2008 TRANSMISSION

Automatic Transmission - Allison - Cab & Chassis Sierra, Cab & Chassis Silverado, Sierra & Silverado

SYMPTOMS - AUTOMATIC TRANSMISSION

The following table consists of six diagnostic categories that are located in the left-hand column. Using this column, choose the appropriate category based on the operating conditions of the vehicle or transmission. After selecting a category, use the right-hand column to locate the specific symptom diagnostic information.

Diagnostic Category	Diagnostic Information
IMPORTANT: **The Functional Test Procedure should be performed before beginning any diagnosis. If this procedure has not already been performed, refer to Functional Test.**	
Fluid Diagnosis: This category contains the following topics: • Fluid condition - appearance, contaminants, smell, overheating • Line pressure - high or low • Low lubrication pressure • Fluid leaks	• Refer to **Transmission Fluid Check**. • Refer to **Transmission Overheats**. • Refer to **Low Main Line Pressure in All Ranges**. • Refer to **Low Main Line Pressure in Specific Ranges, Normal Pressure in Other Ranges**. • Refer to **Low Lubrication Pressure**. • Refer to **Fluid Leak Diagnosis**. • Refer to **Fluid Leaks from Fluid Fill Tube and/or Vent**. • Refer to **Fluid Leaks from Transmission Input**. • Refer to **Fluid Leaks from Transmission Output**. • Refer to **Contaminated Transmission Fluid**. • Refer to **Intermittent Buzzing Noise**.
Noise and Vibration Diagnosis: This category contains the following topics:	• Refer to **Noise and Vibration Analysis**.

• Noise - drive gear, final drive, whine, growl, rattle, buzz, popping • Vibration	• Refer to **Flexplate/Torque Converter Vibration Test**.
Range Performance Diagnosis: This category contains the following topics: • Drives in Neutral • Excessive creep • Will not shift to Forward or Reverse • Will not stay in Forward or Reverse • Will not make a specific shift	• Refer to **Abnormal Activities or Responses**. • Refer to **Transmission Will Not Shift to Forward or Reverse**. • Refer to **Transmission Will Not Stay in Forward or Reverse**. • Refer to **Transmission Will Not Make a Specific Shift**.
Shift Quality - Feel Diagnosis: This category contains the following topics: • Erratic shifts • Harsh, soft, delayed or slipping shifts • Harsh, soft, or delayed engagement	• Refer to **Transmission Does Not Shift Properly**. • Refer to **Excessive Slippage and Clutch Chatter**. • Refer to **Excessive Flare - Engine Overspeed on Wide-Open Throttle**.
Shift Speed Diagnosis: This category contains the following topic: Inaccurate or inconsistent shift points	Refer to **Transmission Does Not Shift Properly**.
Torque Converter Diagnosis: This category contains the following topics: • Poor performance • Noise during converter operation • TCC shudder • Shudder after TCC apply • Vibration during converter operation	• Refer to **Torque Converter Diagnosis**. • Refer to **Flexplate/Torque Converter Vibration Test**.

FUNCTIONAL TEST

Step	Action	Yes	No
The Functional Test Procedure is the first step in diagnosing mechanical or hydraulic transmission conditions. The Functional Test Procedure provides procedures and references to the symptom diagnosis table for specific diagnostic information.			

1	**IMPORTANT:** **Engine performance can strongly affect transmission performance. Ensure the condition is not the result of poor engine performance before continuing.** Verify the customer concern.Has the customer concern been verified?	Go to **Step 2**	-
2	**IMPORTANT:** **Many transmissions have default actions that take place once a DTC fault is detected. These actions may appear to be transmission concerns.** Perform the **Diagnostic System Check - Vehicle** .Did you perform the Diagnostic System Check - Vehicle?	Go to **Step 3**	Go to **Diagnostic System Check - Vehicle**
3	Inspect for the following conditions: • Vehicle damage • Transmission oil pan damage Refer to **Oil Pan Replacement**. • Transmission range selector cable damaged or out of adjustment Refer to **Range Selector Lever Cable Adjustment** or **Range Selector Lever Cable Replacement**. • Inspect for the following loose, worn, damaged, or missing components: o Mounts or struts o Brackets o Mounting hardware Refer to **Transmission Replacement** . • Transmission cooler or cooler line		

	restrictions Refer to **Transmission Fluid Cooler Flushing and Flow Test**. • Fluid leaks Refer to **Fluid Leak Diagnosis**. Did you find a condition?	Go to the appropriate repair or diagnosis section	Go to **Step 4**
4	Perform the **Transmission Fluid Check**. Did you perform the **Transmission Fluid Check** ?	Go to **Step 5**	Go to **Transmission Fluid Check**
5	Perform the **Road Test**. Did the vehicle exhibit any objectionable performance condition?	Go to **Step 6**	Go to **Step 1**
6	Did the vehicle exhibit objectionable torque converter operation?	Go to **Step 15**	Go to **Step 7**
7	Did the vehicle produce any objectionable noise condition?	Go to **Symptoms - Automatic Transmission**	Go to **Step 8**
8	Did the vehicle exhibit a vibration condition?	Go to **Step 9**	Go to **Step 10**
9	Did the vibration occur only during torque converter clutch (TCC) apply or release?	Go to **Step 15**	Go to **Symptoms - Automatic Transmission**
10	Did the vehicle exhibit a shift speed condition, such as low or high shift speeds?	Go to **Symptoms - Automatic Transmission**	Go to **Step 11**
11	Inspect for the following unacceptable shift qualities: • Harsh, soft, delayed, or no engagement • Harsh, soft, or delayed shifts • Shift shudder, flare, or tie-up Did the vehicle exhibit any of these shift quality conditions?	Go to **Step 12**	Go to **Step 13**

12	Perform the **Line Pressure Check**. Is the line pressure within specification?	Go to **Symptoms - Automatic Transmission**	Go to **Symptoms - Automatic Transmission**
13	Inspect for the following unacceptable shift pattern conditions: • No upshift or downshift • Only 1 or 2 forward ranges • No first range, second range, third range, fourth range, or fifth range • Slipping • Non first range start Did the vehicle exhibit any of these shift pattern conditions?	Go to **Symptoms - Automatic Transmission**	Go to **Step 14**
14	Inspect for the following unacceptable range performance conditions: • No PARK, REVERSE, or DRIVE • No engine braking • No gear selection • Incorrect gear selection Did the vehicle exhibit any of these range performance conditions?	Go to **Symptoms - Automatic Transmission**	System OK
15	Inspect for the following specific torque converter conditions or TCC conditions: • Stuck ON or Stuck OFF • Early or late engagement • Incorrect apply or release • Soft or harsh apply • Clunk or shudder • No torque multiplication • Excessive slip		

	• Poor acceleration • Engine stalls Did the vehicle exhibit any of these torque converter or TCC conditions?	Go to **Torque Converter Diagnosis**	System OK

TRANSMISSION FLUID CHECK

COLD FLUID CHECK

The purpose of the cold check is to determine if the transmission has enough fluid to be operated safely until a hot check can be made.

IMPORTANT: The fluid level rises as fluid temperature increases. DO NOT fill above the COLD CHECK band if the transmission fluid is below normal operating temperatures.

1. Bring the vehicle to a complete stop on a level surface using the service brakes.
2. Ensure that the engine is at low idle RPM (500-800 RPM).
3. With the service brakes applied, put the transmission in the P, PARK, position.
4. Engage the park pawl by slowly releasing the service brakes. The vehicle may move slightly as the pawl engages.
5. Apply the parking brake and ensure it is properly engaged.
6. Run the engine for at least one minute. Apply the service brakes and shift to D, DRIVE, then to N, NEUTRAL, and then shift to R, REVERSE, in order to fill the hydraulic system.
7. Ensure that the engine is at low idle RPM (500-800 RPM).
8. With the service brakes applied, put the transmission in the P, PARK, position.
9. Engage the park pawl by slowly releasing the service brakes. The vehicle may move slightly as the pawl engages.
10. With the engine running, remove the fluid level indicator from the fill tube and wipe the indicator clean.

IMPORTANT:

- **If the fluid level is within the COLD CHECK band, the transmission may be operated until the fluid is hot enough to perform a HOT RUN check. If the fluid level is not within the COLD CHECK band, add or drain as**

necessary to bring it to the middle of the COLD CHECK band.

- **Always check the fluid level at least twice using the procedure described above. Consistent readings are important in order to maintaining proper fluid level. If inconsistent readings persist, inspect the transmission vent assembly to be sure that it is clean and unclogged. If readings are still inconsistent, contact your nearest Allison distribution or dealer.**

11. Insert the fluid level indicator into the fill tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.
12. Perform a hot check at the first opportunity after the normal operating sump temperature of 71-93°C (160-200°F) is reached.

HOT FLUID CHECK

IMPORTANT: The fluid must be hot to ensure an accurate check. The fluid level rises as temperature increases.

1. Operate the transmission in D, DRIVE, range until normal operating temperature is reached. Normal operating temperature is any of the following:
   - Sump temperature 71-93°C (160-200°F)
   - Converter-out temperature 82-104°C (180-220°F)
   - If a transmission temperature gage is not present, check the fluid level when the engine water temperature gage has stabilized and the transmission has been operated under load for at least one hour.
2. Bring the vehicle to a complete stop on a level surface using the service brake.
3. Ensure that the engine is at low idle RPM, 500-800 RPM.
4. With the service brakes applied, place the transmission in the P, PARK, position.
5. Engage the park pawl by slowly releasing the service brakes. The vehicle may move slightly as the pawl engages.
6. Apply the parking brake and ensure it is properly engaged.
7. With the engine running, remove the fluid level indicator from the fill tube and wipe the indicator clean.

IMPORTANT: Always check the fluid level at least twice using the

procedure described above. Consistent readings are important to maintaining proper fluid level. If inconsistent readings persist, inspect the transmission vent assembly to be sure it is clean and unclogged. If readings are still inconsistent, contact your nearest Allison distribution or dealer.

8. Insert the fluid level indicator into fill the tube and remove. Check fluid level reading. Repeat the check procedure to verify the reading.

IMPORTANT: Safe operating level is within the HOT RUN band on the fluid level indicator. The width of the HOT RUN band represents approximately 1.0 liter (1.06 quarts) of fluid at normal operating sump temperature.

9. If the fluid level is not within the HOT RUN band, add or drain as necessary to bring the fluid level to within the HOT RUN band.

FLUID INSPECTION

IMPORTANT: Transmission fluid must be changed whenever there is evidence of dirt or a high temperature condition. High temperature causes the transmission fluid to be discolored or to have a strong odor. Local conditions, severity of operation, or duty cycle may require more or less frequent fluid or filter change intervals.

1. Examine the drained fluid for evidence of dirt.

IMPORTANT: Cooler water may be contaminated by engine oil if an engine oil cooler is present; be sure to locate the correct source of cooler water contamination.

2. Examine the drained fluid for evidence of water. Obvious water contamination of the transmission fluid or transmission fluid in the cooling water from the heat exchanger indicates a leak between the water and fluid areas of the cooler. Inspect and pressure test the cooler to confirm the leak. Replace leaking coolers.

NOTE: Engine coolant in the transmission hydraulic system requires

immediate action. Failure to clean or replace all contaminated components may result in premature transmission failure.

3. Examine the drained fluid for evidence of engine coolant.
4. Examine the drained fluid for evidence of metal. Metal particles in the fluid, other than minute particles normally trapped in the oil filter, indicate internal transmission damage. When this occurs, inspect the inside of the oil pan for excessive metal particles. Refer to **Oil Pan Replacement**.
5. Metal contamination requires complete transmission disassembly.

NOTE: Flush the transmission cooling system and inspect for restrictions following a transmission failure. Failure to repair or replace restricted oil cooling system components may result in premature transmission failure.

6. Clean all internal and external hydraulic circuits, cooler, and all other areas where the particles could lodge. Refer to **Transmission Fluid Cooler Flushing and Flow Test**.

LINE PRESSURE CHECK

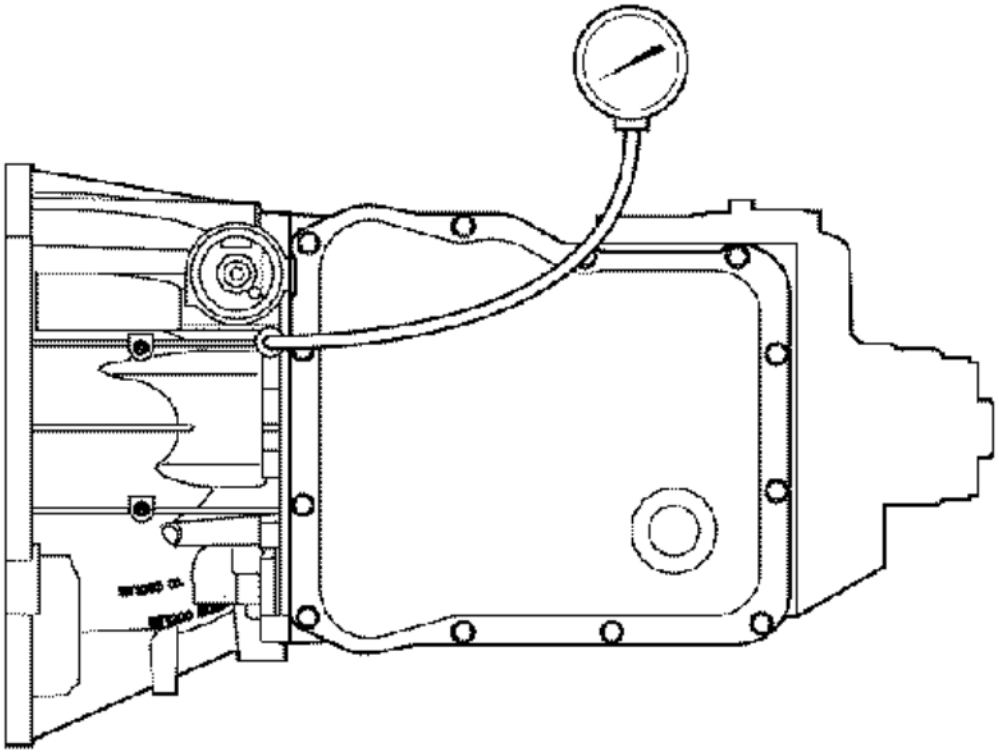


Fig. 1: Transmission Pressure Gage
Courtesy of GENERAL MOTORS CORP.

Checking main line pressure helps to determine if a transmission malfunction is due to a mechanical or an electrical condition. Properly making these pressure checks requires transmission and vehicle, or test stand, preparation, recording of data, and comparing recorded data against specifications provided.

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. Remove the oil pressure tap plug. Refer to **Automatic Transmission Fluid Pressure Test Hole Plug Replacement**.
2. Install **J 45056** pressure test adapter fitting prior to connecting the oil pressure gage.

3. All transmission fluid level and pressure checks must be made at normal operating temperatures 71-93°C (160-200°F) sump; 82-104°C (180-220°F) converter-out. Check the transmission fluid level.
4. Connect a 0-2070 kPa (0-300 PSI) oil pressure gage to the pressure test adapter fitting. Use the scan tool to check the engine RPM. Refer to **Line Pressure** for pressure level specifications.
5. With the brakes applied, record the line pressure values at 600 RPM engine speed in NEUTRAL and REVERSE range. The transmission will be in converter mode, torque converter clutch not applied.
6. With the brakes applied, record the line pressure values with the engine running at 2,100 RPM in NEUTRAL. The transmission will be in converter mode, torque converter clutch not applied.
7. With the brakes applied, use the following scan tool settings to check pressures in FIRST through FIFTH gear ranges at 600 RPM. The transmission will be in converter mode, torque converter clutch not applied, at 600 RPM.
    1. Select F0: Diagnostics and press ENTER.
    2. Select Model Year.
    3. Select LDTrk, MPV, Incomplete.
    4. Select F0: Powertrain, press ENTER.
    5. Select Engine size, press ENTER.
    6. Select 6 Speed Automatic, press ENTER.
    7. Select F2: Special Functions, press ENTER.
    8. Select F1: Transmission Output Controls.
    9. Select Shift transmission. This will allow the technician to shift the transmission and check line pressure in each forward gear range.
8. Compare the data recorded to the line pressure specifications. Refer to **Line Pressure** .
9. Disconnect the oil pressure gage and remove the **J 45056** pressure test adapter fitting.
10. Install the oil pressure tap plug again. Refer to **Automatic Transmission Fluid Pressure Test Hole Plug Replacement**.

OBTAINING DIAGNOSTIC TROUBLE CODES

A microcomputer controls the transmission by receiving and processing signals from various switches and sensors. The microcomputer determines shift sequences, shift timing, and clutch apply and release characteristics. The microcomputer is an independent controller and is referred to as a transmission control module (TCM). The pressure switch manifold (PSM) and the

park/neutral position (PNP) switch provide operator input to the TCM. Other data sent to the TCM include throttle position, engine, turbine, and output speeds, and sump temperature. Any active special function, such as anti-lock brakes or power take-off, is also an input to the TCM. The TCM processes this data to determine proper shift points, to monitor the current range, to perform ratio tests, and to compile diagnostic data. The TCM is programmed to protect the transmission and other vehicle driveline components by inhibiting actions, such as full-throttle NEUTRAL-to-range shifts and high-speed direction changes. The TCM determines if a system malfunction exists and stores diagnostic codes related to the malfunction. The codes accessed by the service technician are used in diagnosing persistent or intermittent trouble in the system.

To obtain transmission diagnostic trouble codes (DTCs), install the scan tool and follow the menu selections listed below:

1. From the title screen, press ENTER.
2. Select F0: Diagnostics. Press ENTER.
3. Select Model Year. Press ENTER.
4. Select LDTrk, MPV, Incomplete. Press ENTER.
5. Select Product Make, i.e. (C) Chevrolet Truck, (T) GMC Truck. Press ENTER.
6. Select Product Line, i.e. (C) or (K). Press ENTER.
7. Select F0: Powertrain. Press ENTER.
8. Select Engine size. Press ENTER.
9. Select 6 Speed Automatic. Press ENTER.
10. Select F0: Diagnostic Trouble Codes (DTC). Press ENTER.
11. Select F1: DTC (s) (Transmission). Press ENTER.
12. Select F0: DTC Information. Press ENTER.
13. Select F0: DTC Info. Press ENTER.

IMPORTANT: Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.

CLUTCH TEST

Clutch Test allows a technician to manually select each of the 6 forward ranges with the vehicle stopped. The intent of this procedure is to verify the ability of all 5 clutches to transmit torque without slipping. Refer to the table in **Adapt Function**, which shows the clutches applied in each gear range.

CLUTCH TEST

Use the scan tool in order to perform the clutch test. Select the following information when setting up the tool for running the test. Use the Shift Transmission feature on the scan tool to complete the clutch test.

1. Select F0: Diagnostics and press ENTER.
2. Select Model Year.
3. Select LDTrk, MPV, Incomplete.
4. Select F0: Powertrain, press ENTER.
5. Select Engine size, press ENTER.
6. Select 6 Speed Automatic, press ENTER.
7. Select F2: Special Functions, press ENTER.
8. Select F1: Transmission Output Controls.
9. Select Shift Transmission. This allows the technician to shift the transmission and observe the integrity of each clutch/range in the transmission.

Attach the transmission pressure gage as described in the Line Pressure Check Procedure. Refer to **Line Pressure Check**. Apply the parking brake. Hold the service brakes with your left foot and move the gear selector to DRIVE. Increase engine speed to 1,400 RPM with your right foot. With soft keys, select UPSHIFT and shift the transmission from FIRST gear to SIXTH gear while observing turbine speed. Turbine speed should increase momentarily and then drop to 0 RPM when each gear is attained. Line pressure should drop momentarily, then gain pressure again when each gear is attained.

Maintain 1,400 RPM and select the DOWNSHIFT soft key. Downshift the transmission from SIXTH gear sequentially to FIRST gear while observing turbine speed. Turbine speed should increase momentarily and then drop to 0 RPM when each gear is attained.

To further investigate a suspected leak in a clutch circuit, the clutch test should be repeated, keeping the engine at idle speed. While performing the clutch test at 600 RPM, main pressure should drop momentarily, then gain pressure again when each gear range is attained. If main pressure remains low, suspect damaged seal in that range. If low pressure is in FIRST range only, suspect Low and Reverse piston seal damage.

FASTLEARN PROCEDURE

OVERVIEW

In general, FastLearn is a procedure for Allison 1000 Series 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, FastLearn translates it to the adaptive data cells, which the TCM uses for clutch control during range shifts. FastLearn is used at GM assembly plants, and allows the vehicle to be driven out of the assembly plant in a near-fully-adapted state to minimize any customer shift concerns. The scan tool version of FastLearn is intended to provide the same benefit following transmission repair or replacement at GM Dealerships.

FastLearn must be used when one of the following repairs have been made to the vehicle:

- Transmission replacement or internal service/overhaul
- Valve body repair or replacement, including replacement of the pressure control solenoids
- TCM replacement
- TCM software/calibration update
- Any service in response to a shift quality concern

The scan tool is used to initiate FastLearn by selecting the following commands:

- F3: Special Functions
- F1: Transmission Output Controls
- FastLearn

IMPORTANT: When performing FastLearn, the following conditions must be met:

- Block the drive wheels.
- Apply the parking brake.
- Apply the service brake during DRIVE and REVERSE.
- 0 percent throttle and engine at idle RPM
- Transmission sump temperature is between 40-100°C (104-212°F) - Ref temp bargraph on screen.
- If equipped, 4WD transfer case in 2WD

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

Three steps are required to successfully complete the FastLearn procedure:

1. PARK Mode
2. DRIVE Mode
3. REVERSE Mode

PARK MODE

While the transmission is in PARK, with the engine idling, FastLearn will cycle through a series of tests where the 3rd, 5th and reverse clutch and the 2nd clutch is repeatedly applied to learn their clutch characteristics. During the 3rd, 5th and reverse clutch and 2-6 clutch apply/release procedure, FastLearn is able to characterize the pressure control solenoid 1 (PCS1) and pressure control solenoid 2 (PCS2) pressures corresponding to clutch return springs, and is also able to learn the volumes for the 3rd, 5th and reverse clutch and 2-6 clutch packs. In addition, the low and reverse clutch is repeatedly applied and released in PARK to purge out air for later learning of the clutch volume.

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 all of the PARK test data have converged, the scan tool instructs the driver to select DRIVE. Once DRIVE is selected, the TCM engages the 1-2-3-4 clutch to obtain DRIVE and learn 1-2-3-4 clutch volume. The TCM repeats this test until the volume learned for the 1-2-3-4 clutch has converged. The TCM then engages 4-5-6 clutch until the volume is learned and 4-5-6 clutch has converged.

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. Once REVERSE is selected, the TCM engages the low and reverse clutch to obtain REVERSE and to learn the low and reverse clutch volume. The TCM repeats this test until the volume learned for the low and reverse clutch

has converged.

IMPORTANT: All shifts will be left in fast adaptive mode at this point.

After learning the 1-2-3-4 and the low and reverse clutch volume, FastLearn updates the adaptive volume data for all shifts with either the 1-2-3-4 or the low and reverse on-coming clutch.

TROUBLESHOOTING

If FastLearn will not run and the above stated conditions have been met, ensure the following:

- Transmission fluid temperature is between 40-100°C (104-212°F).
- Closed throttle and engine at warm idle RPM
- No active DTCs
- All speed sensors are connected and functioning properly.
- Internal mode switch is functioning properly
- Main pressure is within specification.
- TCC slip speed less than 100 RPM at idle in PARK/NEUTRAL

LIMP HOME MODE

PRINCIPLE OF OPERATION

The Allison transmission incorporates control logic that enables the transmission to revert to a limited total hydraulic operation. The hydraulic system provides a Limp Home Mode, allowing the operator to drive the vehicle to a service location. If power is interrupted while the transmission is operating in R, REVERSE, or N, NEUTRAL, the transmission defaults to or continues NEUTRAL operations. The operator may turn off the engine and start the engine again. The shift selector provides REVERSE/NEUTRAL/DRIVE capability regardless of the range where the failure occurred. In this state, pressure control solenoid 1 (PCS1), de-energized, allows the 3rd, 5th and reverse clutch to be applied. If the selector valve is moved to the REVERSE position, main pressure is routed to the low and reverse clutch, allowing REVERSE operation. If the selector valve is moved to the DRIVE position, main pressure is routed to the 1-2-3-4 clutch, allowing THIRD range operation.

TEST PROCEDURE

If a No Forward, No REVERSE, or Will Not Move condition occurs:

1. Set the parking brake.

2. With the ignition OFF, disconnect the 80-way connector at the transmission control module (TCM).
3. Using a fused jumper wire, connect terminal R of the automatic transmission inline 20-way connector to a known good ground.
4. Start the engine and move the range selector to REVERSE position.

   The transmission should engage REVERSE range.

5. Move the range selector to the D position.

   The transmission should engage THIRD range.

If REVERSE and THIRD range are available in Limp Home Mode, an electrical failure may be indicated. If only 1 of the 2 ranges, or neither, was obtainable, this may indicate an internal hydraulic failure such as one of the following:

- Failed clutch
- Stuck valve
- Solenoid failure

The clutches that could possibly have an indicated failure in Limp Home are the 1-2-3-4 clutch, the 3rd, 5th and reverse clutch, and the low and reverse clutch.

ROAD TEST

IMPORTANT: The Road Test Procedure should be performed only as part of the Functional Test Procedure. Refer to Functional Test.

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

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

- Manual Range Selection
  - REVERSE
  - Manual FIRST

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

Before the road test, ensure the following conditions are met:

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

During the road test:

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

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

- Observe any unusual sounds or smells.

After the road test, inspect the following conditions:

- Transmission fluid level

  Refer to **Transmission Fluid Check**.

- Diagnostic trouble codes (DTCs) that may have set during the testing

  Refer to the applicable DTC.

- Scan tool data for any abnormal readings or data

ELECTRICAL FUNCTION CHECK

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

could be mis-diagnosed.

1. Install the scan tool.
2. Ensure the shift 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 **Scan Tool Data List** for typical data values. Data that is questionable may indicate a concern.
    - Engine speed
    - Transmission input speed
    - Transmission turbine speed
    - Transmission output speed
    - Vehicle speed
    - TFP 1, 2, 3 and TFP 4 pressure switch states
    - C, D, E and REVERSE pressure switch states
    - Transmission range, engine list
    - 4WD low
    - Commanded range, current range
    - PCS1 and PCS2 solenoid reference current
    - PCS1 and PCS2 solenoid actual current
    - PCS1 and PCS2 solenoid duty cycle
    - Brake switch
    - Engine coolant temperature
    - Transmission fluid temperature
    - Throttle angle
    - Ignition voltage
    - Shift solenoid 1
    - Shift solenoid 2
    - Shift solenoid 3
    - Modulated main G solenoid
    - TCC solenoid duty cycle
    - TCC slip speed
5. Monitor the brake switch signal while depressing and releasing the brake pedal. The scan

tool should display the following:

- Closed when the brake pedal is released
- Open when the brake pedal is depressed

6. Check the garage shifts.
    1. Apply the brake pedal and ensure the parking brake is set.
    2. Move the shift 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 selector position.

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

- **High idle speed**

  Compare engine idle speed to desired idle speed.

- **Commanded low PCS1 or PCS2 solenoid current**

  Compare PCS1 and PCS2 solenoid reference current to PCS1 and PCS2 solenoid actual current.

- **A default condition caused by certain DTCs that result in maximum full throttle shift points**
- **Shift is not fully adapted**

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**
- **Cold transmission fluid**

  Inspect for low transmission fluid temperature.

4. Verify the range engagements are immediate and not harsh.

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

If any of the above checks do not perform properly, record the result for reference after the completion of the Road Test Procedure.

UPSHIFT CONTROL AND TORQUE CONVERTER CLUTCH (TCC) APPLY

The transmission control module (TCM) calculates the upshift points based on the throttle angle and the engine, turbine and output speed. When the TCM determines that conditions are met for a shift to occur, the TCM commands the shift, and controls PCS1 and PCS2 solenoid current to proper control clutch pressures during the shift.

Perform the following steps:

1. Choose a throttle position of 10 percent, 25 percent or 50 percent. All throttle angles shown should be tested to cover the normal driving range.
2. Monitor the following scan tool parameters:
    - Throttle angle
    - Vehicle speed
    - Engine speed
    - Turbine speed
    - Output shaft speed
    - Commanded range
    - Slip speed

- Solenoid states

3. Place the shift selector in DRIVE.
4. Using the chosen throttle angle, accelerate the vehicle. Hold the throttle steady.
5. As the transmission upshifts, note the vehicle speed when the shift occurs for each range change. There should be a noticeable shift feel or engine speed change within 1 to 2 seconds of the commanded range change.
6. Shift speeds may vary slightly due to transmission fluid temperature or hydraulic delays in responding to the electronic controls.
   - Note any harsh, soft or delayed shifts or slipping.
   - Note any noise or vibration.
7. Repeat steps 1-6 to complete all throttle angles.

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

8. Inspect for TCC apply in SECOND, THIRD, FOURTH, FIFTH and SIXTH range.
   - Note the TCC apply point. When the TCC applies there should be a noticeable drop in engine speed and a drop in slip speed to below 100 RPM. If the TCC apply can not be detected inspect for DTCs. Refer to **Torque Converter Diagnosis**.
   - Lightly tap and release the brake pedal. The TCC will release on most applications.

PART THROTTLE DETENT DOWNSHIFT

1. Place the shift selector in DRIVE.
2. Accelerate the vehicle to a speed just above the FIFTH to SIXTH shift point, using less than 50 percent throttle.
3. Quickly increase throttle angle to greater than 63 percent.
4. Verify the following conditions:
   - The TCC releases.
   - The transmission downshifts immediately to FIFTH range.

MANUAL DOWNSHIFTS

1. Place the shift selector in DRIVE.
2. Accelerate the vehicle to obtain SIXTH range.

3. Place the shift selector in RANGE SELECTION MODE (M).
4. By pressing the "+/-" button on the shift selector select the desired preselect range.
5. Release the throttle.
6. Verify the following conditions:
    - The TCC releases.
    - The transmission downshifts immediately to the preselected range. Downshifts will occur in sequence to the preselect range.
    - The engine slows the vehicle.

MANUAL 2-1 DOWNSHIFT

1. Place the shift selector in DRIVE.
2. Accelerate the vehicle until the 1-2 shift occurs.
3. Go to 8 km/h (5 mph) above the 1-2 shift point.
4. Release the throttle while moving the shift selector to FIRST.
5. Verify the following conditions:
    - The TCC releases.
    - The transmission immediately downshifts to FIRST range.
    - The engine slows the vehicle.

COASTING DOWNSHIFTS

1. Place the shift selector in DRIVE.
2. Accelerate the vehicle to SIXTH range with the TCC applied.
3. Release the throttle and lightly apply the brakes.
4. Verify the following conditions:
    - The TCC releases.
    - Downshifts occur in normal sequence and the transmission returns to FIRST range before the vehicle comes to a stop.

MANUAL RANGE SELECTION

The shift solenoids control the upshifts in the manual ranges.

Perform the following tests, using 10-15 percent throttle angle.

REVERSE

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

TORQUE CONVERTER DIAGNOSIS

The torque converter clutch (TCC) is applied by fluid pressure, which is controlled through the converter flow valve by the TCC variable bleed solenoid. The converter flow valve and the TCC variable bleed solenoid are located inside the automatic transmission assembly.

TORQUE CONVERTER STATOR

The torque converter stator assembly 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 car tends to have poor acceleration from a standstill. At speeds above 50-55 km/h (30-35 mph), the car may perform normally. For poor acceleration, you should first determine that the exhaust system is not blocked, and the transmission is in FIRST range when starting out.

If the engine freely accelerates to a high RPM in NEUTRAL, you can assume that the engine and the exhaust system are normal. Inspect for poor performance in DRIVE and REVERSE in order 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 caused by overheating.

You should be able to turn the race clockwise, but should have difficulty in moving the race counterclockwise, or you may be unable to move the race at all.

WHINE NOISE

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

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

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

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

1. Bring the vehicle to a complete stop using the service brake.
2. Ensure that the engine is at low idle RPM.
3. Put the transmission in P, PARK.
4. Engage the P, PARK, range by slowly releasing the service brake.
5. Apply the emergency brake and/or parking brake, if present, and ensure it is properly engaged.
6. If the vehicle will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.
7. Place your foot on the brake.
8. Place the range selector in DRIVE.

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

9. Depress the accelerator to approximately 1,200 RPM for no greater than 6 seconds. Listen for torque converter noise. A torque converter noise will increase under this load.

TORQUE CONVERTER CLUTCH SHUDDER

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

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

If the shudder occurs while the TCC is applying, the condition could 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 may be causing the conditions to occur:

- Leaking turbine shaft seal rings
- A restricted release orifice
- Defective friction material on the TCC piston

IF SHUDDER OCCURS AFTER THE TCC HAS APPLIED

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

As mentioned above, the TCC is not likely to slip after the TCC has been applied. Engine conditions 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 the 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 also avoids 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 ozone dust or a black carbon substance present, the wires are bad. Also, inspect for a white discoloration of the wire. This indicates arcing during hard acceleration.

- Coil

  Inspect for 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 the correct amount of fuel. The mixture may run rich or lean depending on where the leak occurs.

- Exhaust gas recirculation (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.

- Manifold absolute pressure (MAP) or mass air flow (MAF) sensor - possibly a vacuum leak

  The engine will not receive 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 far enough to let the proper fuel/air mixture into the cylinders.

- Oxygen sensor

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

- Fuel pressure

  Fuel pressure may be too low.

- Engine mounts

  Vibration of the mounts can be multiplied by TCC engagement.

- Axle joints

  Inspect for vibration.

- Throttle position (TP) sensor

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

- Cylinder balance

  Malfunctioning piston rings or poorly sealed valves can cause low power in a cylinder.

- Fuel contamination

  Fuel contamination causes poor engine performance.

TORQUE CONVERTER EVALUATION AND DIAGNOSIS

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

- External leaks appear in the hub weld area
- The converter hub is scored or damaged
- The converter pilot is broken, damaged, or fits poorly into the crankshaft
- You discover steel particles after flushing the cooler and the cooler lines
- The pump is damaged, or you discover steel particles in the converter
- The vehicle has TCC shudder and/or no TCC apply

  Replace the torque converter only after all hydraulic and electrical diagnoses have been made. The converter clutch material may be glazed.

- The converter has an imbalance which cannot be corrected

  Refer to **Flexplate/Torque Converter Vibration Test**.

- The converter is contaminated with engine coolant which contains antifreeze
- An internal failure occurs in the stator race
- Overheating produces heavy debris in the clutch
- You discover steel particles or clutch lining material in the control main filter or suction filter, or on the magnets, 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 holes are damaged

  Correct the condition with a new thread insert.

- Transmission failure did not display evidence of damaged or worn internal parts, steel particles or clutch plate lining material in the unit and in the control main filter or suction filter

FLEXPLATE/TORQUE CONVERTER VIBRATION TEST

To determine and correct a torque converter vibration, use the following general procedure to achieve the best possible torque converter-to-flywheel balance. Refer to **Transmission Replacement** for detailed procedure steps as appropriate.

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

1. Disconnect the battery.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the starter motor bolts and position the starter motor aside. 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)** .

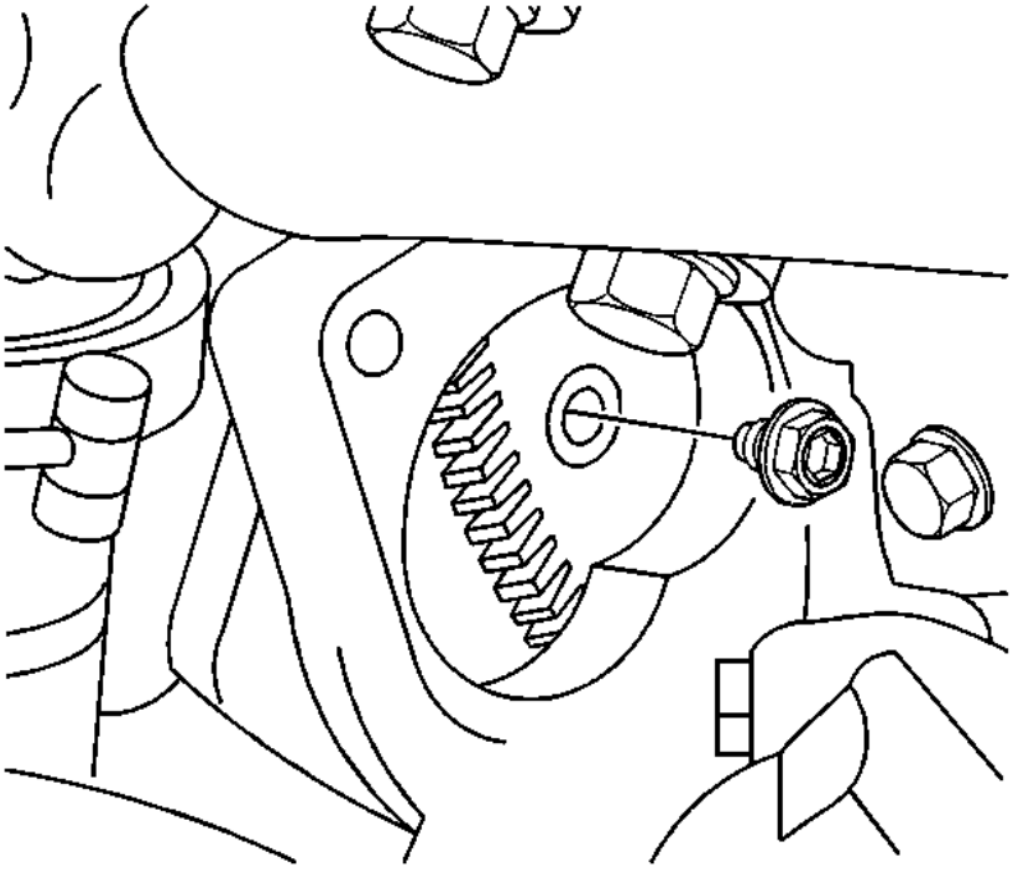


Fig. 2: View Of Torque Convertor Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the torque converter bolts.

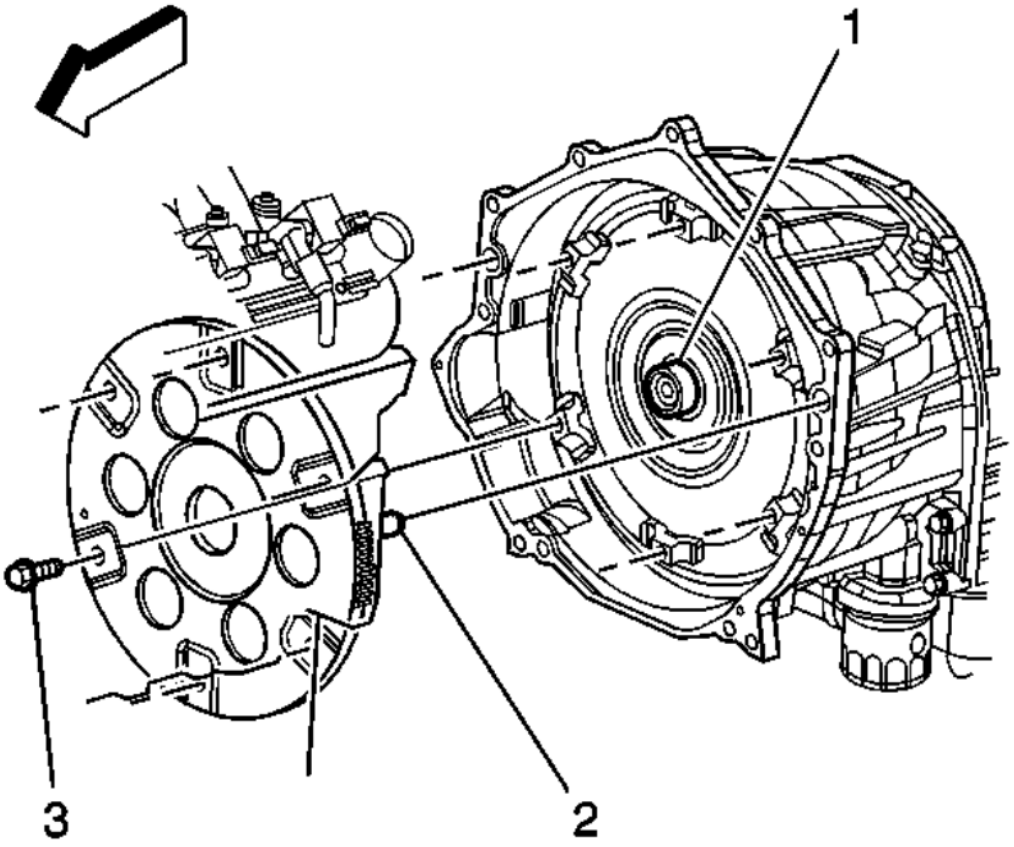


Fig. 3: Accessing Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

5. Rotate the torque converter one bolt position.

NOTE: **Refer to Fastener Notice .**

6. Install the torque converter bolts.

Tighten: Tighten the bolts to 60 N.m (44 lb ft).

7. Install the starter motor and starter motor bolts. 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)** .

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

8. Connect the battery.
9. Start the vehicle and test for vibration again. If vibration is still present, repeat the testing procedure. Repeat this procedure until you obtain the best possible balance.

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 condition may be caused by unsatisfactory engine performance.

- Inspect the tires for the following conditions:
  - Uneven wear

    Refer to **Tire Diagnosis - Irregular or Premature Wear** .

  - Imbalance
  - Mixed sizes
  - Mixed radial and bias ply
- Inspect the suspension components for the following conditions:
  - Alignment and wear
  - Loose fasteners

    Refer to **Fastener Tightening Specifications** .

- 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

FLUID LEAK DIAGNOSIS

Tools Required

- **J 28431-6** Fluorescent Oil Dye - 6 1 oz
- **J 42220** Universal 12V Leak Detection Lamp

DYE AND BLACK LIGHT METHOD

Use the **J 42220** and the **J 28431-6** to isolate the leak point. Fluid dye and black light kits are also available from various tool manufacturers. All transmissions that are diagnosed, that require replacement due to leakage, must be diagnosed with the leak dye and black light method.

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.

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.

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

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. Ensure the area to be repaired is fully covered.
4. Allow the epoxy cement to cure for 3 hours before starting the engine.
5. Repeat the fluid leak diagnosis procedures.

TRANSMISSION FLUID COOLER FLUSHING AND FLOW TEST

IMPORTANT: The J 45096 - Automatic Transmission Oil Cooler Flush and Flow Test Tool can be used to flush the transmission oil cooler system on an Allison equipped vehicle, but the flow meter should not be utilized.

GM studies indicate that plugged or restricted transmission oil coolers and pipes cause insufficient transmission lubrication and elevated operating temperatures which can lead to premature transmission wear-out. Many cases could have been prevented by following published procedures for transmission oil cooler flushing and flow checking. This procedure includes flushing and flow checking the auxiliary transmission oil cooler, if equipped. GM requires that transmission oil cooler flushing and flow checking be performed whenever a transmission is removed from the vehicle for service within warranty, including:

- Goodwrench SRTA
- Major overhaul
- Torque converter replacement
- Oil pump replacement

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

Tools Required

- **J 35944-A** Transmission Oil Cooler and Line Flusher
- **J 35944-22** Transmission Oil Cooler Flushing Fluid
- **J-44835-1** Transmission Oil Cooler Flusher Adapters
- Measuring cup
- Funnel
- Water supply - hot water recommended
- Water hose at least 16 mm (5/8 in) ID
- Shop air supply - with water/oil filters, regulator and pressure gage
- Air chuck with clip, if available
- Oil drain container
- Minimum 19 L (5 gallon) pail or similar container with lid
- Eye protection
- Rubber gloves

PREPARATION

1. After the repair or replacement transmission is installed in the vehicle, do not connect the oil cooler pipes again.

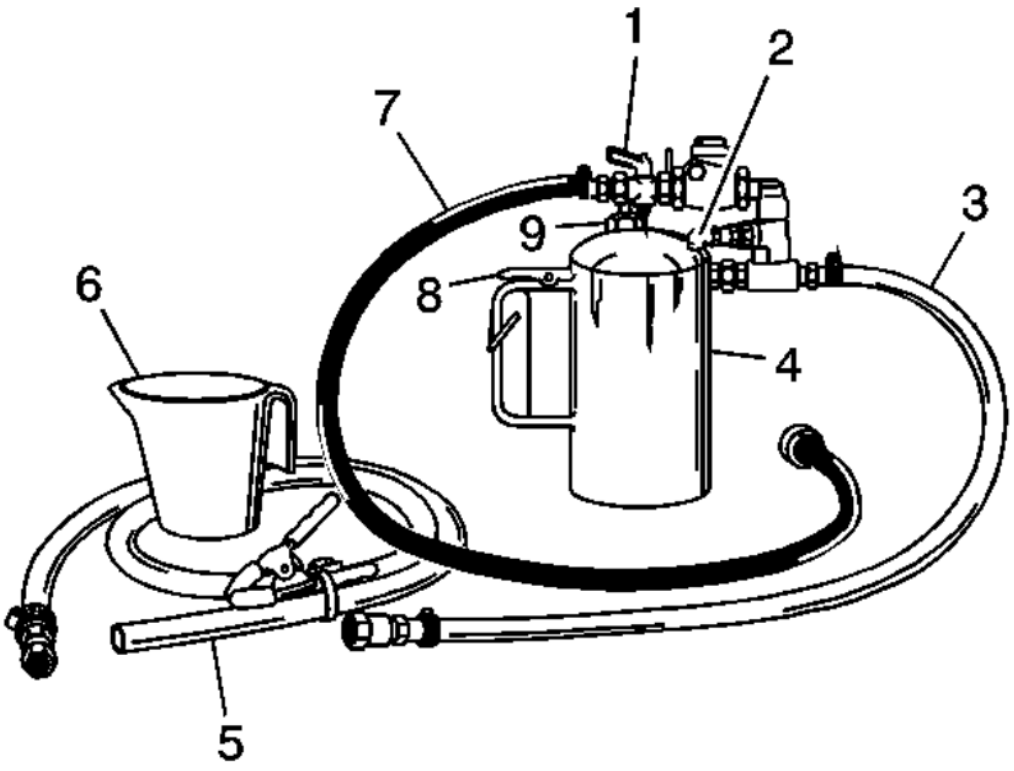


Fig. 4: Identifying Flusher Tank & Components
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Do not substitute with solutions that contain alcohol or glycol. Use of solutions that contain alcohol or glycol may damage the J 35944-A , oil cooler components or transmission components.**
- **The J 35944-22 flushing fluid is environmentally safe, yet powerful enough to cut through transmission fluid to dislodge any contaminants from the cooler. The safety precautions on the label regarding potential skin and eye irritations associated with prolonged exposure, are typical precautions that apply to many similar cleaning solutions. It should be noted that according to GM, use of other non-approved fluids for cooler flushing can have**

an adverse reaction to the seals inside the transmission.

2. Remove the fill cap (9) on the **J 35944-A** and fill the flusher tank (4) with 0.6 L (20-21 oz) of **J 35944-22** flushing solution using the measuring cup (6). Do not overfill.
3. Install the fill cap (9) on the **J 35944-A** and pressurize the flusher tank (4) to 550-700 kPa (80-100 psi), using the shop air supply at the tank air valve (9).

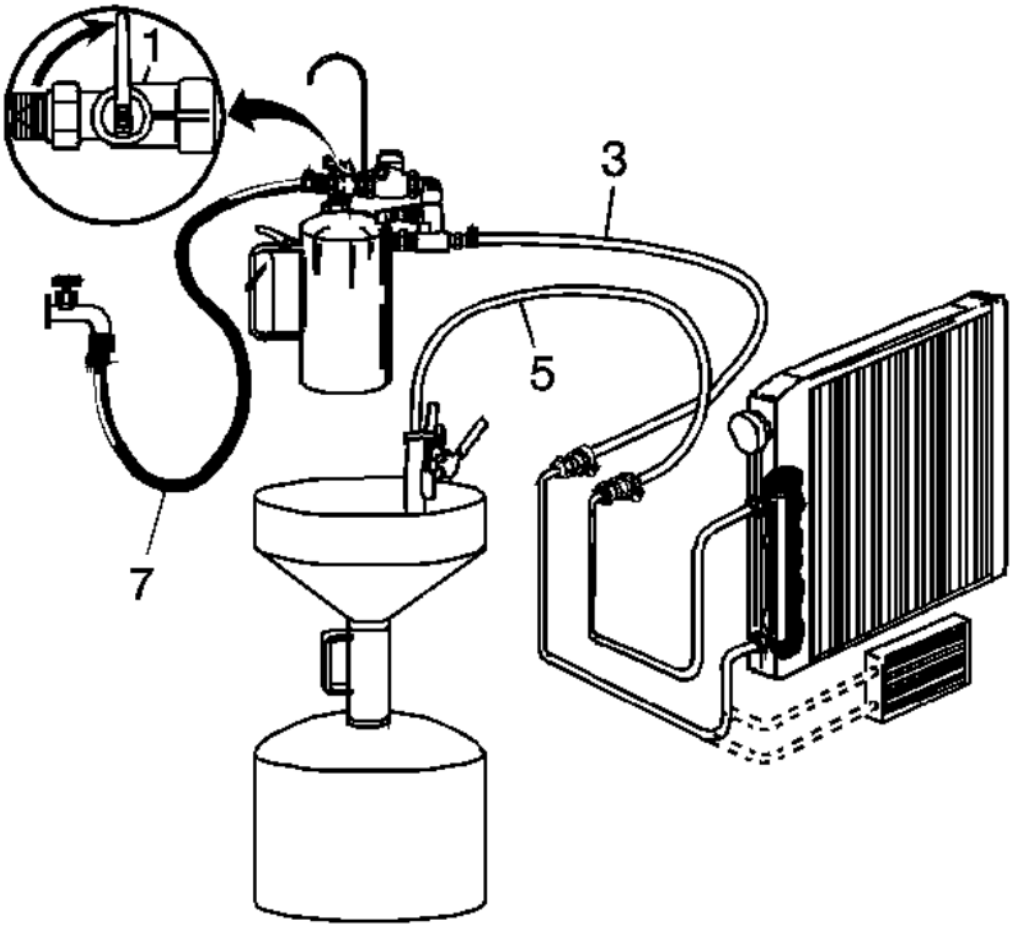


Fig. 5: Flushing Transmission Oil Cooler Using J 35944
Courtesy of GENERAL MOTORS CORP.

4. Connect the **J-44835-1** adapters to the transmission oil cooler lines.

5. Connect the **J 35944-A** discharge hose (5) to the oil cooler return pipe, top connector.
6. Clip the discharge hose (5) onto the oil drain container.
7. Attach the **J 35944-A** to the undercarriage of the vehicle with the hook provided and connect the flushing system feed supply hose (3) from the **J 35944-A** to the oil cooler feed pipe, bottom connector.
8. With the water supply valve (1) on the **J 35944-A** in the OFF position, connect the water supply hose from the **J 35944-A** to the water supply at the faucet.
9. Turn ON the water supply at the faucet.

INITIAL FLUSH

1. Turn the **J 35944-A** water supply valve (1) to the ON position and allow water to flow through the oil cooler and pipes for 10 seconds in order to remove any remaining transmission fluid. If water does not flow through the oil cooler and pipes, the cause of the blockage must be diagnosed and the plugged component must be repaired or replaced. Continue with the cooler flushing and flow check procedure once the blockage is corrected.
2. Turn the **J 35944-A** water supply valve (1) to the OFF position and clip the discharge hose (5) onto a suitable container, preferably with a lid, to avoid splashback.

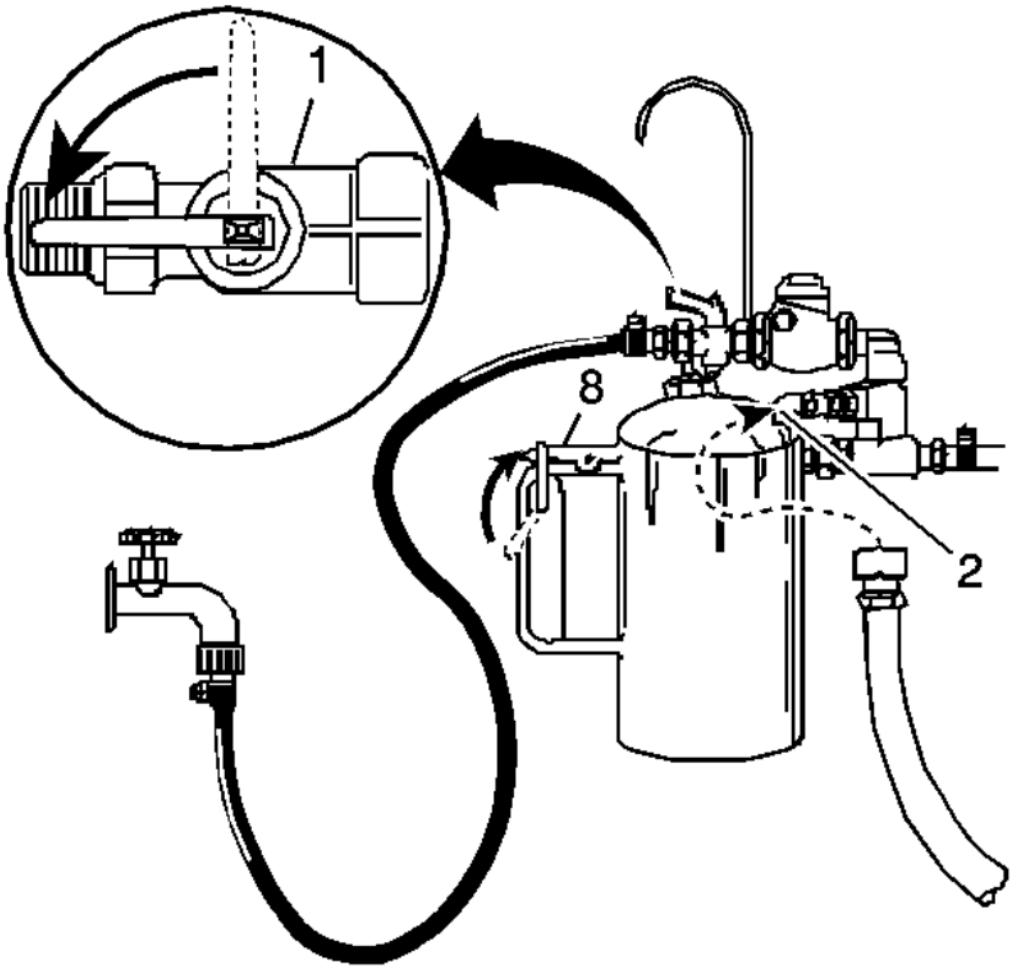


Fig. 6: Turning J 35944-A Water Supply Valve To On Position
Courtesy of GENERAL MOTORS CORP.

3. Turn the **J 35944-A** water supply valve (1) to the ON position and depress the trigger (8) to mix cooler flushing solution into the water flow. Use the clip provided on the handle to hold the trigger (8) down. The discharge will foam vigorously when the solution is introduced into the water stream.

IMPORTANT: Flushing for approximately 2 minutes in each cooler line direction will result in a total of about 31-38 L (8-10 gallons) of waste fluid. This mixture of water and flushing fluid is to

be captured in a suitable container, preferably with a lid.

4. Flush the oil cooler and pipes with water and solution for 2 minutes. During this flush, attach the shop air supply 825 kPa (120 psi) to the flushing system feed air valve (2) located on the **J 35944-A** for 3-5 seconds at the end of every 15-20 second interval to create a surging action.
5. Release the trigger (8) and turn the **J 35944-A** water supply valve (1) to the OFF position.

BACK FLUSH

1. Disconnect both hoses from the oil cooler pipes and then connect them to the opposite oil cooler pipe. This will allow the oil cooler and pipes to be back flushed.
2. Repeat steps 3 and 4 of the INITIAL FLUSH procedure.
3. Release the trigger (8) of the **J 35944-A** and allow water only to rinse the oil cooler and pipes for 1 minute.
4. Turn the **J 35944-A** water supply valve (1) to the OFF position and turn OFF the water supply at the faucet.
5. Attach the shop air supply to the flushing system feed air valve (2) on the **J 35944-A** and blow out the water from the oil cooler and pipes. Continue until no water comes out of the discharge hose (5).

FLOW CHECK

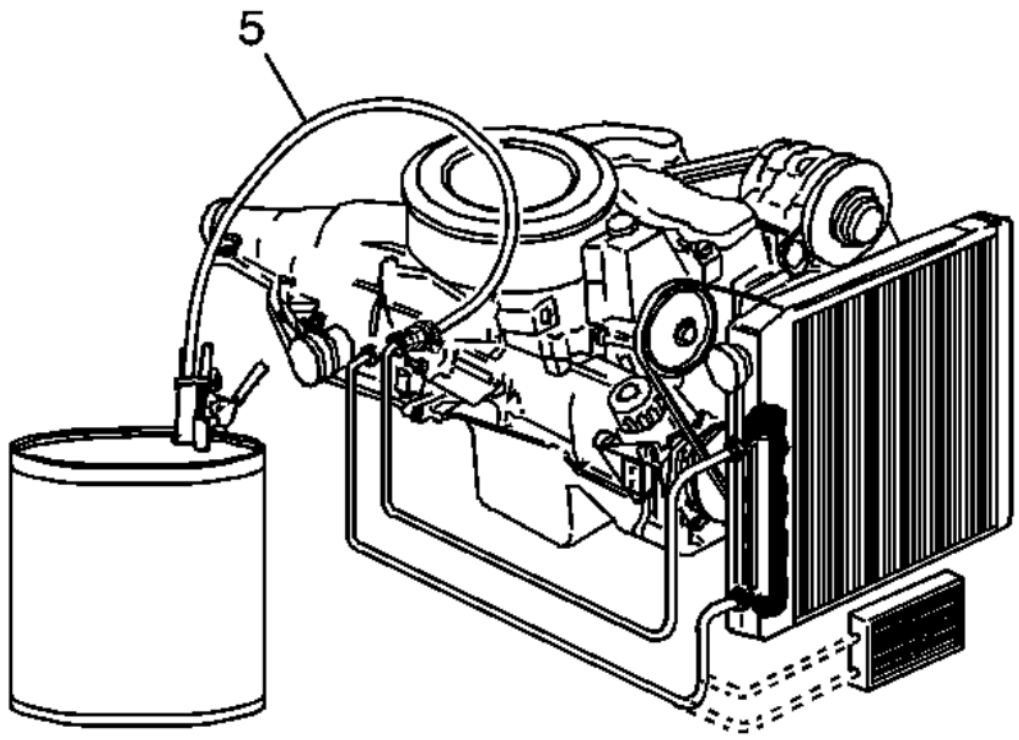


Fig. 7: Connecting Return Pipe, Top Connector, To Discharge Hose
Courtesy of GENERAL MOTORS CORP.

1. Disconnect both hoses from the oil cooler pipes. Connect the oil cooler feed pipe, bottom connector, to the transmission. Connect the return pipe, top connector, to the discharge hose (5). This will require the use of **J-44835-1** . Clip the discharge hose (5) onto an empty oil drain container.
2. Confirm the transmission is filled with automatic transmission fluid.
3. Start the engine with the transmission in PARK range and run for 5 seconds at 2,400 RPM. A minimum of 2.2 L (2.3 quarts) must be discharged during this 5 second run time.
   - If fluid flow is greater than 2.2 L (2.3 quarts) in 5 seconds at 2,400 RPM, go to step 4.
   - If fluid flow is less than 2.2 L (2.3 quarts) in 5 seconds at 2,400 RPM, perform the following diagnosis:

     Disconnect the oil cooler feed line at the radiator. Connect the discharge hose (5) to the cooler feed line. Clip the discharge hose (5) to the empty oil drain container. Start

the engine with the transmission in PARK range and run for 5 seconds at 2,400 RPM. A minimum of 2.2 L (2.3 quarts) must be discharged during this 5 second run time at 2,400 RPM. Do the following according to the flow rate:

- Insufficient feed flow: Inspect the transmission.
- Sufficient feed flow: Inspect the oil cooler return pipe, the oil cooler located in the radiator, and the auxiliary oil cooler.

4. Remove the discharge hose (5), connect the cooler feed and return pipes to the transmission and fill the unit to the proper fluid level. Inspect the transmission oil cooler pipe connections at the radiator, the auxiliary cooler and the transmission for leaks.

CLEAN-UP

1. Disconnect the water supply hose (7) from the **J 35944-A** and bleed any remaining air pressure from the flusher tank (4).
2. Remove the fill cap (9) from the **J 35944-A** and return any unused flushing solution to its container. Rinse the **J 35944-A** with water. Do not store the **J 35944-A** with flushing solution in it.
3. After every third use, clean the **J 35944-A** as described in the instructions included with the tool.
4. Dispose of any waste water/solution and transmission fluid in accordance with local regulations.

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

EXCESSIVE SLIPPAGE AND CLUTCH CHATTER

Condition	Action
Incorrect speed sensor readings	See speed sensor DTCs.
Incorrect fluid level	Correct the fluid level. Refer to **Transmission Fluid Check**.
Main pressure low	Repair the transmission.
TCC clutch not applied	Inspect the torque converter clutch system wiring, pressure, and controls. Repair as necessary.
Ranges 1, 2, 3, 4 Only	
1-2-3-4 clutch slipping, leaks at rotating clutch seals, leaks at piston seals, 1-2-3-4 clutch plates worn	Inspect the 1-2-3-4 clutch plates, and piston and rotating seals. Replace/rebuild as necessary.
Ranges 4, 5, 6 Only	
4-5-6 clutch slipping, leaks at rotating clutch seals, leaks at piston seals, 4-5-6 clutch plates worn	Inspect the 4-5-6 clutch plates, and piston and rotating seals. Replace/rebuild as necessary.
Ranges 3, 5, R Only	
3rd, 5th and Reverse clutch slipping, leaks at piston seals, 3rd, 5th and Reverse clutch plates worn	Inspect the 3rd, 5th and Reverse clutch plates and piston seals. Replace/rebuild as necessary.
Range 2, 6 Only	
2-6 clutch slipping, leaks at piston seals, 2nd clutch plates worn	Inspect the 2-6 clutch plates and piston seals. Replace/rebuild as necessary.
Ranges 1, R Only	

Low and Reverse clutch slipping, leaks at piston seals, Low and Reverse clutch plates worn	Inspect the Low and Reverse clutch plates and piston seals. Replace/rebuild as necessary.

FLUID LEAKS FROM FLUID FILL TUBE AND/OR VENT

Condition	Action
Dipstick loose	Tighten the cap. Replace the cap if necessary.
Fluid level too high	Drain the fluid to the proper level. Refer to **Transmission Fluid Check**.
Fluid level too low	Add fluid to the proper level. Refer to **Transmission Fluid Check**.
Breather stopped up - clogged	Clean or replace the breather.
Dipstick or fill tube seal worn	Replace the seals or dipstick.
Incorrect dipstick marking	Calibrate the dipstick.
Fluid contaminated with engine coolant or water	Drain and replace fluid. Locate and fix source of additional fluid. Refer to **Transmission Fluid Check** and **Automatic Transmission Fluid and Filter Replacement**.

FLUID LEAKS FROM TRANSMISSION INPUT

Condition	Action
Torque converter seal leaks	Replace the torque converter seal. Refer to **Torque Converter Fluid Seal Replacement**.
Front support bolt seals leaking	Replace the bolt seals. Refer to **Torque Converter Housing Bolt Seal Replacement**.
Converter leaks	Inspect the converter seals, cracked converter pump tangs, converter cover, or converter housing porosity. Replace the parts as required.
Spin-on filter leaking	Replace the filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
Main pressure plug leak	Replace or torque the main pressure plug. Refer to **Automatic Transmission Fluid Pressure Test Hole Plug Replacement**.

Pump bushing shows excessive wear	Rebuild and repair the pump.

FLUID LEAKS FROM TRANSMISSION OUTPUT

Condition	Action
Faulty or missing seal at output flange/yoke	Install a new seal assembly in the transmission rear cover. Refer to **Rear Propshaft Shaft Seal Replacement**.
Machine lead on output flange/yoke seal surface	Replace the flange/yoke. Refer to **Output Flange/Yoke Replacement**.
Rear cover porosity	Repair or replace the cover.
Flange/yoke worn at seal surface	Replace the flange/yoke. Refer to **Output Flange/Yoke Replacement**.
Insufficient sealant around seal OD	Install a new seal assembly in the transmission rear cover. Refer to **Rear Propshaft Shaft Seal Replacement**.
Damaged or missing output bolt washer seal	Replace the output bolt sealing washer. Refer to **Output Flange/Yoke Replacement**.
Damaged, missing, or loose output flange bolt	Replace and/or torque the output flange bolt. Refer to **Output Flange/Yoke Replacement**.

INTERMITTENT BUZZING NOISE

Condition	Action
Low fluid level	Add fluid to the proper level. Refer to **Transmission Fluid Check**.
Air leak in oil suction filter canister	Replace the oil suction filter. Refer to **Oil Pan Replacement**.
Clogged suction filter	Replace the filter. Refer to **Oil Pan Replacement**.
Aerated fluid causes noisy pump	Correct the fluid level. Refer to **Transmission Fluid Check**.
Low main pressure causes main regulator valve to oscillate	Refer to **Low Main Line Pressure in All Ranges** and **Low Main Line Pressure in Specific Ranges, Normal Pressure in Other Ranges**.

LOW MAIN LINE PRESSURE IN ALL RANGES

Condition	Action
Incorrect fluid level	Correct the fluid level. Refer to **Transmission Fluid Check**.
Plugged or faulty suction filter	Clean or replace the oil suction filter element. Refer to **Oil Pan Replacement**.
Main pressure regulator valve sticking	Overhaul the control module assembly.
Leaking solenoids in control valve body assembly	Replace the solenoids. Refer to **Control Valve Solenoid Replacement (SS1, SS2, SS3, TCC, and MAIN MOD)** or **Control Valve Solenoid Replacement (PCS1 and PCS2)**.
Main pressure regulator valve spring weak, broken, or missing	Inspect the spring and replace, if necessary.
Control module body leakage - separator plate not flat, loose control valve body bolts	Replace or rebuild the control module assembly. Care should be taken when removing and labeling shift springs.
Faulty or incorrect fluid pressure gage	Repair or replace the gage.
Oil pump worn or damaged	Replace or rebuild the oil pump.
Leak in suction circuit	Inspect the suction circuit for leaking seal, gasket, or mating surface.

LOW MAIN LINE PRESSURE IN SPECIFIC RANGES, NORMAL PRESSURE IN OTHER RANGES

Condition	Action
Seal leak	Replace the seals that are causing low pressure in a particular range.

LOW LUBRICATION PRESSURE

Condition	Action
Incorrect fluid level	Correct the fluid level. Refer to **Transmission Fluid Check**.
Plugged suction filter	Clean or replace the oil suction filter. Refer to **Oil Pan Replacement**.

Plugged control main filter	Replace the filter.
Excessive internal fluid leakage	• Inspect other pressures. Refer to **Low Main Line Pressure in All Ranges** and **Low Main Line Pressure in Specific Ranges, Normal Pressure in Other Ranges**. • Inspect the control module mounting bolts. • Inspect the lubrication valve and spring. • Inspect the converter housing to separator plate gasket.
Cooler lines restricted or leaking	Inspect for kinks and leakage. Reroute or replace lines as necessary.
Lubrication regulator valve sticking	Clean or replace the regulator valve.
Converter relief valve sticking	Clean or replace the converter relief valve.
Cooler plugged	Clean or replace the cooler.
Faulty gage	Repair or replace the gage.

CONTAMINATED TRANSMISSION FLUID

Condition	Action
Failure to change fluid and filters	Change the fluid and install new filters. Refer to **Automatic Transmission Fluid and Filter Replacement**.
Excessive heat	Inspect the cooling system for restrictions and proper capacity.
Substandard fluid	Use recommended fluid. Refer to **Transmission General Specifications** .
Clutch/transmission failure	Overhaul the transmission.

EXCESSIVE FLARE - ENGINE OVERSPEED ON WIDE-OPEN THROTTLE

Condition	Action
Incorrect fluid level	Add fluid to the proper level. Refer to **Transmission Fluid Check**.
Sticking valves in control valve body assembly	Rebuild the control valve body assembly. Refer to **Control Valve Body Replacement**.

Low main pressure	Refer to **Low Main Line Pressure in All Ranges** and **Low Main Line Pressure in Specific Ranges, Normal Pressure in Other Ranges**.
Leaking pressure control solenoids	Repair or replace the pressure control solenoids. Refer to **Control Valve Solenoid Replacement (SS1, SS2, SS3, TCC, and MAIN MOD)** or **Control Valve Solenoid Replacement (PCS1 and PCS2)**.
Erratic speed sensor signal	Refer to the speed sensor DTCs.
Piston seals leaking or clutch plates slipping in range involved	Overhaul the transmission.

HIGH STALL SPEEDS (STALL IN RANGES 1-6)

Condition	Action
Not in gear	Select D, DRIVE.
Low fluid level, aerated fluid	Add fluid to the proper level. Refer to **Transmission Fluid Check**.
Faulty torque converter	Replace the torque converter. Refer to **Torque Converter Replacement**.
Incorrect torque converter	Replace the torque converter. Refer to **Torque Converter Replacement**.
Clutch pressure low	Refer to **Low Main Line Pressure in Specific Ranges, Normal Pressure in Other Ranges**.
1-2-3-4 clutch or Low and Reverse clutch or 2-6 clutch slipping Use the diagnostic tool to measure turbine speed.	Rebuild the 1-2-3-4 clutch or the Low and Reverse clutch or the 2-6 clutch.
Higher power engine	Confirm proper engine match.

LOW STALL SPEEDS (STALL IN RANGES 1-6)

Condition	Action
Engine not performing efficiently • Plugged or restricted injectors	Refer to appropriate engine article. The following specific sections should be helpful in defining the condition:

• High altitude conditions • Dirty air filters • Incorrect fuel/valve timing • Throttle linkage broken or not adjusted correctly • Electronic engine controls condition	• Refer to **Diagnostic System Check - Vehicle** . • Refer to **Symptoms - Engine Mechanical** .
Stall speeds of 33% of normal implies freewheeling stator	Replace the converter assembly. Refer to **Torque Converter Replacement**.
Engine smoke controls	Compare lugback vs. static stall speed.
Incorrect torque converter	Install the correct torque converter. Refer to **Torque Converter Replacement**.

TRANSMISSION WILL NOT MAKE A SPECIFIC SHIFT

Condition	Action
Low engine power	Correct the engine condition.
Extreme fluid temperature	Inspect the cooling system and fluid level. Refer to **Transmission Fluid Check**.
Faulty speed sensor/circuit	Repair the circuit or replace the speed sensor or sensors. Refer to **Speed Sensor Replacement**.
Faulty temperature sensor/circuit	Inspect for a temperature reading which inhibits shifts.
Faulty or misadjusted shift selector	Repair the shift selector.

TRANSMISSION WILL NOT STAY IN FORWARD OR REVERSE

Condition	Action
Low fluid	Adjust the fluid level. Refer to **Transmission Fluid Check**.
Leaking at solenoid assembly	Replace the solenoid assembly. Refer to **Control Valve Solenoid Replacement (SS1, SS2, SS3, TCC, and MAIN MOD)** or **Control Valve Solenoid Replacement (PCS1 and PCS2)**.
Low pressure	Repair the transmission.

Faulty solenoid - leaking	Replace the solenoid. Refer to **Control Valve Solenoid Replacement (SS1, SS2, SS3, TCC, and MAIN MOD)** or **Control Valve Solenoid Replacement (PCS1 and PCS2)**.

TRANSMISSION WILL NOT SHIFT TO FORWARD OR REVERSE

Condition	Action
Engine RPM too high	Reduce the engine RPM. It may be necessary to select NEUTRAL, and then D or R again.
Low fluid level	Add fluid to the proper level. Refer to **Transmission Fluid Check**.
Faulty throttle signal from engine	Correct the engine throttle signal.
Shift selector is not functioning properly	Repair the shift selector.
Speed sensor or sensors not functioning properly	Repair or replace the speed sensor or sensors or circuitry. Refer to **Speed Sensor Replacement**.
Mechanical failure to Low and Reverse clutch	Repair the transmission.
Mechanical failure in transmission torque converter, shafts, or planetaries	Repair the transmission.
Low pressure	Repair the transmission.
Faulty wiring in transmission control module (TCM) input/output function circuits	Correct the circuit wiring.

TRANSMISSION OVERHEATS

Condition	Action
Aerated fluid - incorrect fluid level	• Adjust fluid to the proper level. Refer to **Transmission Fluid Check**. • Inspect for a defective pump.
Air flow to cooler obstructed	Remove the air flow obstruction.
Engine overheat	Correct the overheating condition. Refer to **Symptoms - Engine Cooling** in Engine Cooling.
Inaccurate temperature gauge or sending	Replace the gauge and/or sending unit.

unit	
Inaccurate sump temperature sensor	Replace the pressure switch manifold (PSM) or internal harness. Refer to **Pressure Switch Manifold Replacement** or **Wiring Harness Replacement**.
Excessive cooler circuit pressure drop	Inspect for plugged cooler, lines too small, collapsed hose, too many elbows in circuit.
Transmission cooler lines reversed	Connect the cooler lines properly. Oil and water should flow in opposite directions.
Fluid cooler lines restricted	Remove restrictions and clean or replace the lines. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement**.
Torque converter - wrong converter, no torque converter clutch, stuck stator, or slipping stator	Replace or repair the converter assembly. Refer to **Torque Converter Replacement**. A stuck stator will not allow cool down in Neutral.
Cooler flow loss due to internal transmission leakage	Overhaul the transmission.

TRANSMISSION DOES NOT SHIFT PROPERLY

Condition	Action
Engine idle speed too fast during NEUTRAL to range shift	Adjust to correct idle speed.
Faulty throttle sensor/circuit	Repair or replace the sensor or circuit.
Faulty or sticking bleed ball in 1-2-3-4 clutch piston housing	Repair the transmission.
Excessive clutch running clearance	Rebuild the transmission and adjust clearances.
Shift adaptives not converged	Refer to **FastLearn Procedure**.
Instrument panel tachometer incorrect	Repair or replace the tachometer.
Incorrectly calibrated electronic speedometer	Calibrate the electronic speedometer.
Faulty speed sensor/circuit	Repair the circuit or replace the speed sensor. Refer to the speed sensor DTCs.
Loose speed sensor	Tighten the speed sensor retaining bracket bolt. Refer to **Speed Sensor Replacement**.
Degraded fluid	Change the transmission fluid and filter. Refer

	to **Automatic Transmission Fluid and Filter Replacement**.
Incorrect fluid level	Correct the fluid level. Refer to **Transmission Fluid Check**.
Low main pressure	Repair the transmission.
Intermittent conditions	Inspect the wiring harnesses and connectors.
Loose or damaged speed gear	Tighten the output flange bolt or replace the speed gear.
Sticking valves in the control valve body	Overhaul the control valve body assembly.
Leaking pressure control solenoids	Repair or replace the pressure control solenoids.

ABNORMAL ACTIVITIES OR RESPONSES

Condition	Action
Excessive Creep in First and Reverse Gears	
Engine idle speed too high	Adjust to the correct idle speed.
Vehicle Moves Forward in Neutral	
1-2-3-4 clutch failed or not released	Rebuild the 1-2-3-4 clutch.
Vehicle Moves Backward in Neutral	
3rd, 5th and reverse clutch failed or not released	Rebuild the 3rd, 5th and reverse clutch assembly.

ON-VEHICLE REPAIR INFORMATION

TRANSMISSION CONTROL MODULE REPLACEMENT

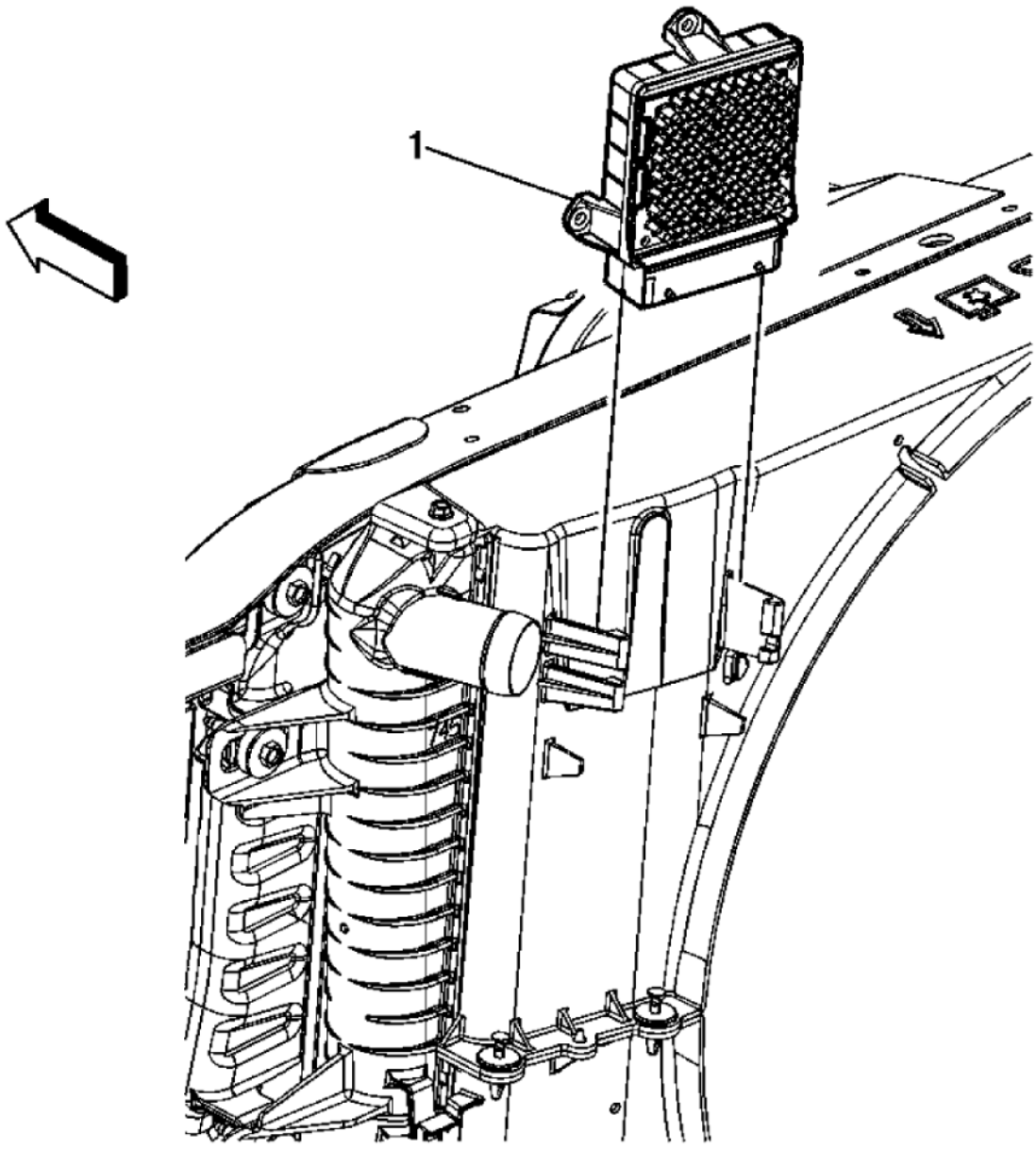


Fig. 8: Transmission Control Module Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
	Transmission Control Module (TCM) **Procedure** 1. Disconnect the TCM electrical connector.

1	2. A new TCM requires programming. Refer to **Control Module References** . **Tip:** Twisting or tilting of the transmission control module electrical connector while disconnecting may result in bent or misaligned electrical terminal pins.

CONTROL VALVE SOLENOID REPLACEMENT (SS1, SS2, SS3, TCC, AND MAIN MOD)

Removal Procedure

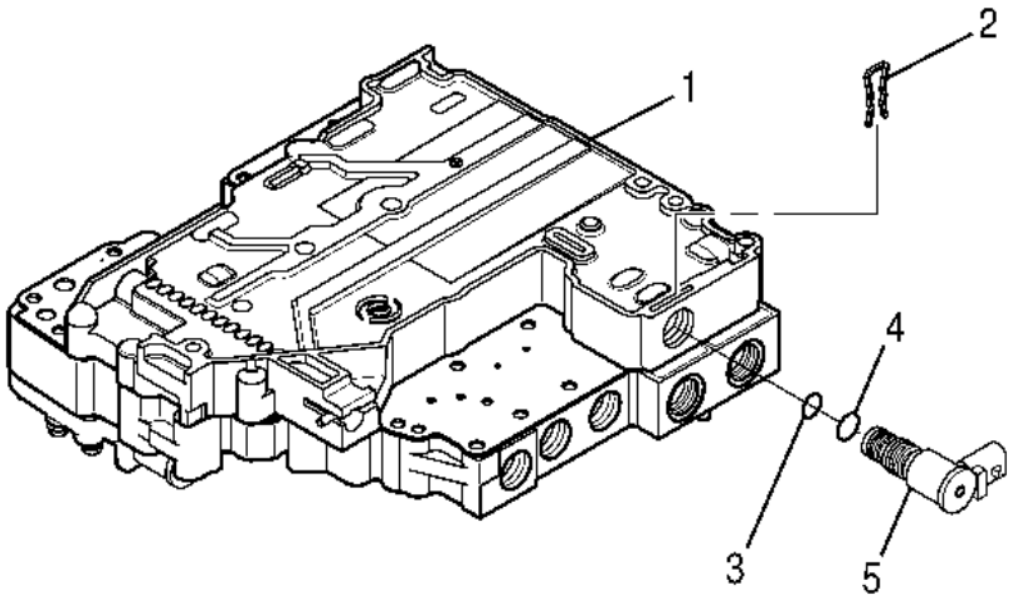


Fig. 9: Locating Shift Solenoid
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pan and the transmission internal oil filter. Refer to **Oil Pan Replacement**.
2. Disconnect the internal wiring harness from the solenoid being changed.
3. Remove the solenoid retainer (2) for shift solenoid 1 (SS1) (5). Note the position of the solenoid connector and pull the solenoid (5) out of the bore in the control valve assembly (1). The O-rings (3 and 4) provide the resistance felt during removal.

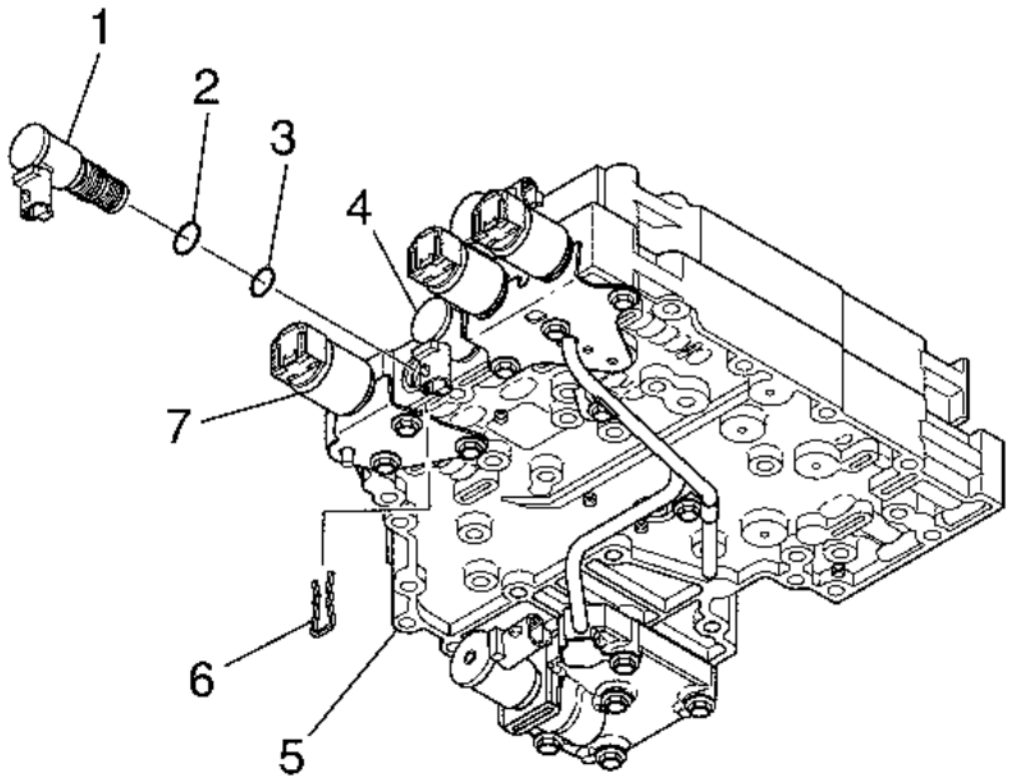


Fig. 10: Identifying Control Valve Solenoids
Courtesy of GENERAL MOTORS CORP.

4. Remove the solenoid retainer (6) for shift solenoid 2 (SS2) (1) or shift solenoid 3 (SS3) (4), whichever is being replaced.
5. Note the position of the solenoid connector and pull the solenoid out of the bore in the control valve assembly. The O-rings (2 and 3) provide the resistance felt during removal.

IMPORTANT: The TCC pressure control solenoid (PCS) retaining bracket must not be modified. Note that the angle between the 2 bracket surfaces is less than 90 degrees. Replace the bracket if the angle is 90 degrees or greater.

6. Remove the TCC PCS retaining bolt and retaining bracket.
7. Remove the TCC PCS (7).

Installation Procedure

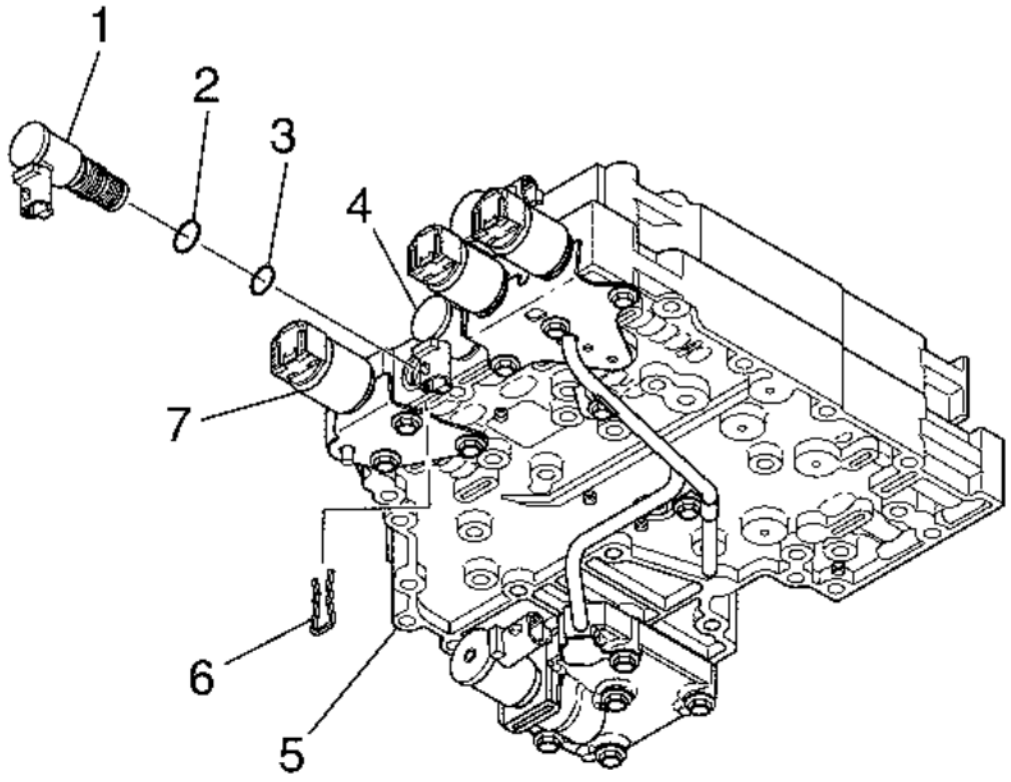


Fig. 11: Identifying Control Valve Solenoids
Courtesy of GENERAL MOTORS CORP.

1. Obtain a new SS 2 (1), SS 3 (4), TCC PCS (7), or modulated main pressure solenoid. Install O-rings (2 and 3) and lubricate with clean transmission fluid. Push the new solenoid into the control valve assembly (5) with the wiring harness connector in the correct position.
2. Install the solenoid retainer (6). Connect the internal wiring harness to the solenoids replaced.
3. For a new TCC PCS (7), install O-rings and lubricate with clean transmission fluid. Push the new TCC PCS (7) into the control valve assembly with the wiring harness connector in the correct position.
4. Install the TCC PCS retainer and bolt.

Tighten: Tighten the bolt to 12 N.m (108 lb in).

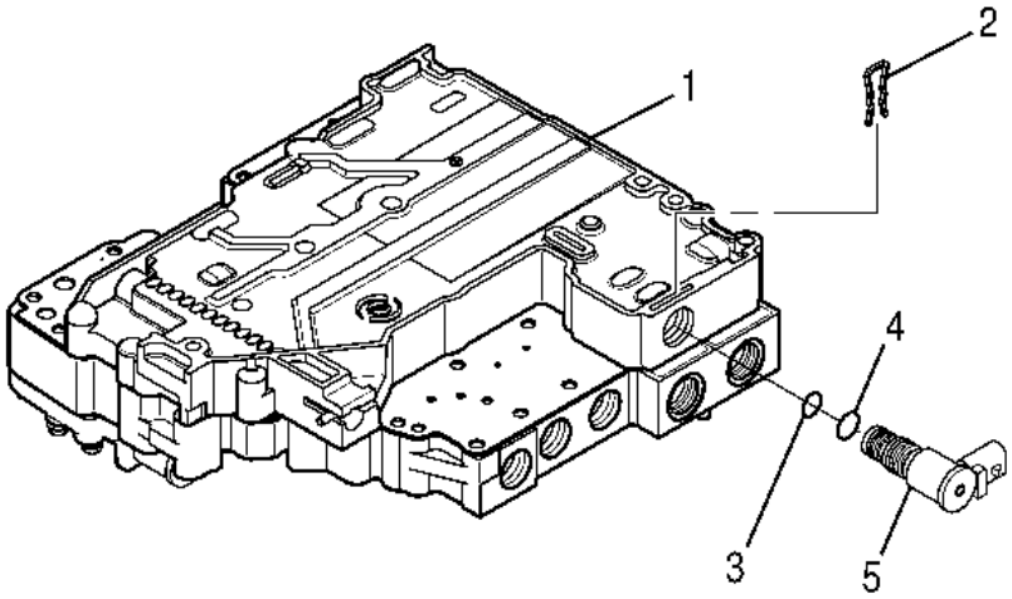


Fig. 12: Locating Shift Solenoid
Courtesy of GENERAL MOTORS CORP.

5. For a new SS 1 (5), install O-rings (3 and 4) and lubricate with clean transmission fluid. Push the new SS 1 (5) into the control valve assembly with the wiring harness connector in the correct position. Install the solenoid retainer (2).
6. Install the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.

IMPORTANT: The FastLearn, adapt, procedure must be performed. This can be done in 1 step using a scan tool. If this procedure is not done, the TCM adaptive values will be at the settings that it learned for the old components and will be in slow adaptive mode. Under these conditions, it will take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

7. Perform the FastLearn procedure. Refer to **FastLearn Procedure**.

CONTROL VALVE SOLENOID REPLACEMENT (PCS1 AND PCS2)

Removal Procedure

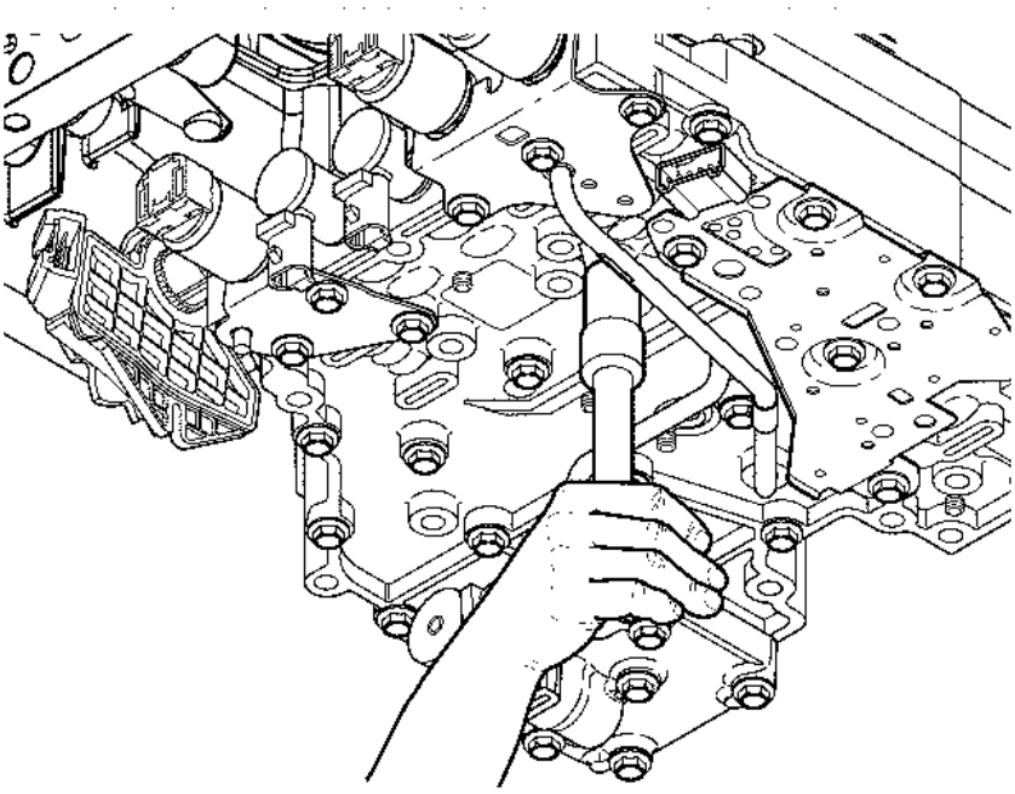


Fig. 13: Reverse Signal Pipe Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.
2. Disconnect the internal wiring harness from the solenoid being changed.
3. Remove the 2 bolts that fasten reverse signal pipe to the control valve assembly. Remove the reverse signal pipe.

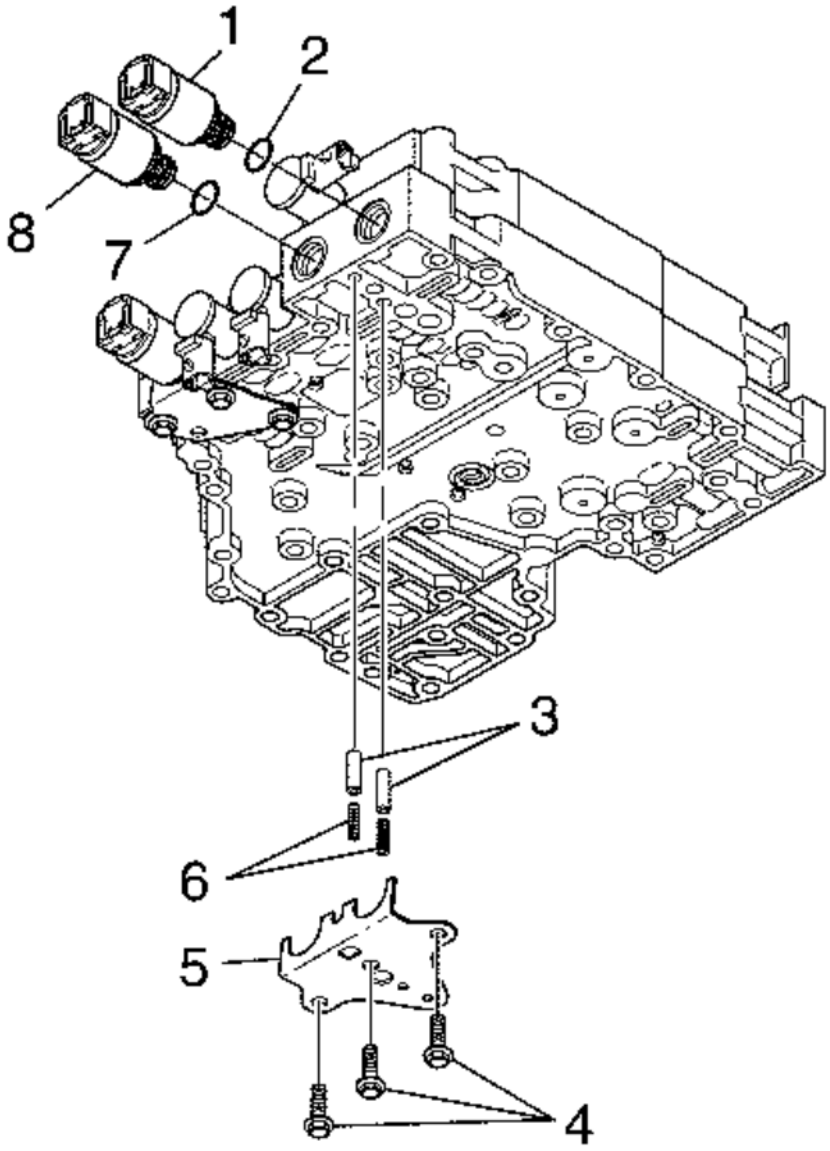


Fig. 14: Exploded View Of PCS1 and PCS2 Components
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **When the pressure control valve retaining bracket (5) is removed, there are 2 sets of accumulators (3) and**

springs (6) which may fall from the bores. Be sure to catch the accumulators and springs so as to prevent damage to these parts.

- **The pressure control valve retaining bracket (5) must not be modified. Note that the angle between the 2 bracket surfaces is less than 90 degrees. Replace the bracket if the angle is 90 degrees or more.**

4. To remove the pressure control solenoid 1 (PCS1) or PCS2, remove three bolts (4) and the pressure control valve retaining bracket (5). Remove accumulators (3) and springs (6) if they do not fall out when the bracket (5) is removed.
5. Note the position of the solenoid connector and pull the solenoid (1) or (8) out of the bore in the control valve assembly. The O-ring on the solenoid provides the resistance felt during removal.

Installation Procedure

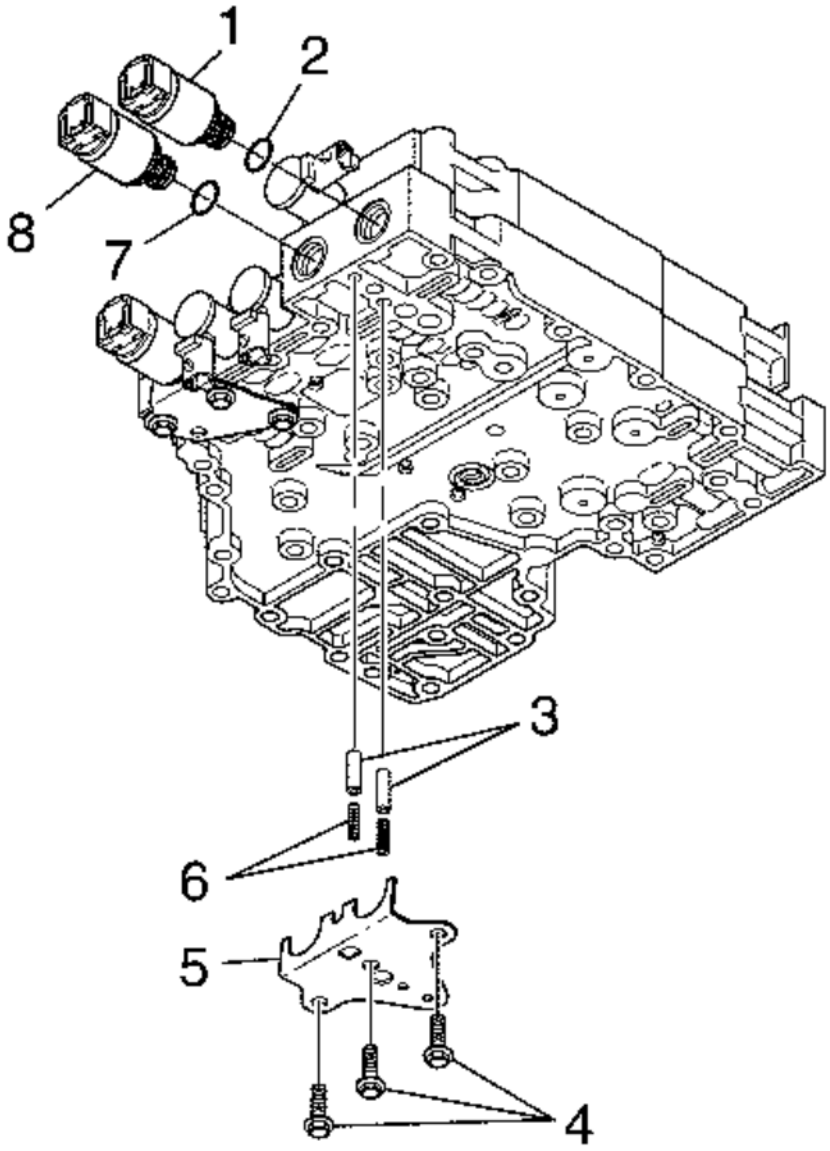


Fig. 15: Exploded View Of PCS1 and PCS2 Components
Courtesy of GENERAL MOTORS CORP.

1. Obtain the new solenoid (1) or (8). Lubricate new O-ring (2) or (7) with clean transmission fluid. Install the O-ring and push the new solenoid into the control valve body bore with the wiring harness connector in the correct position.

2. Install the 2 accumulators (3) and springs (6) before installing the pressure control valve retaining bracket (5). The valve (3) goes in the bore first with the hollow end facing outward, followed by the spring (6) which goes inside the hollow portion of the valve.

NOTE: Refer to Fastener Notice .

3. Install the pressure control valve retaining bracket (5), and install the 3 bolts (4).

Tighten: Tighten the bolts to 12 N.m (108 lb in).

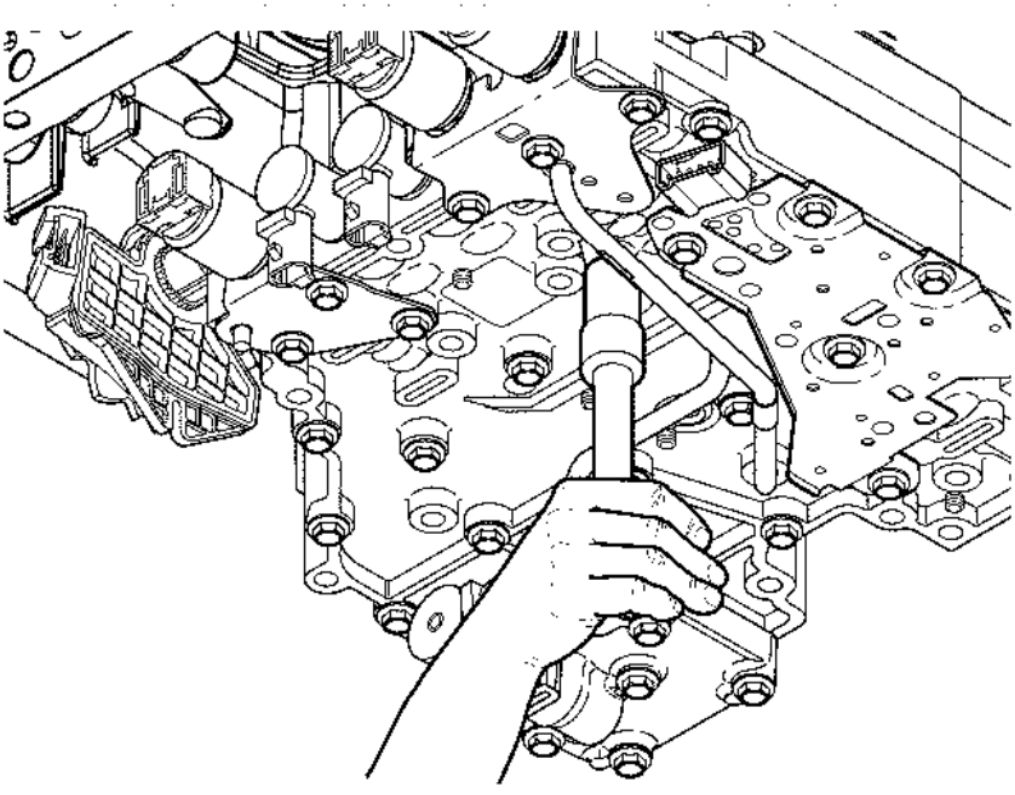


Fig. 16: Reverse Signal Pipe Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the reverse signal pipe. Install the 2 bolts that fasten reverse signal pipe to the control valve assembly.

Tighten: Tighten the bolts to 12 N.m (108 lb in).

5. Reconnect the internal wiring harness to the solenoid.
6. Install the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.

IMPORTANT: The FastLearn, adapt, procedure must be performed. This can be done in 1 step using a scan tool. If this procedure is not done, the TCM adaptive values will be at the settings that it learned for the old components and will be in slow adaptive mode. Under these conditions, it will take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

7. Perform the FastLearn procedure. Refer to **FastLearn Procedure**.

OUTPUT FLANGE/YOKE REPLACEMENT

Removal Procedure

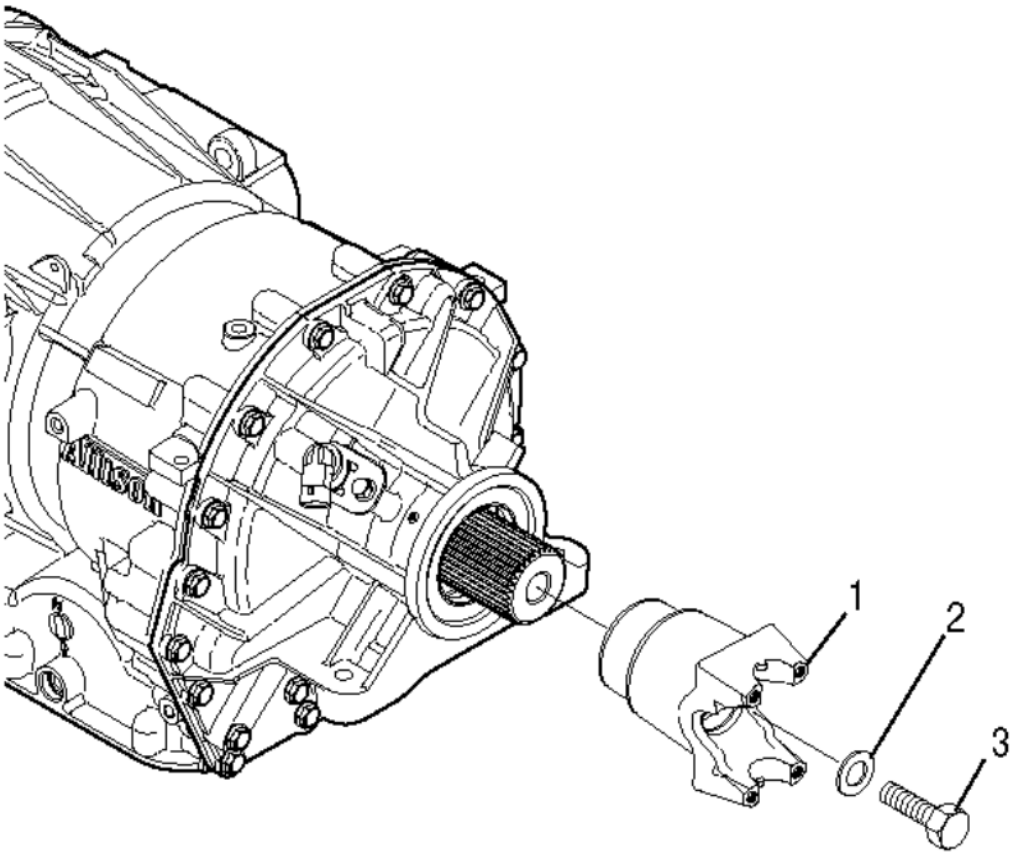


Fig. 17: Yoke Assembly
Courtesy of GENERAL MOTORS CORP.

1. Place the transmission in the Park (P) selector position.

CAUTION: Apply the parking brake and block the drive wheels before performing this procedure in order to prevent bodily injury.

2. Apply the parking brake and chock the wheels to prevent vehicle movement.
3. Remove the vehicle driveline from the transmission yoke assembly (1). Refer to **Transmission Replacement**.

Remove the bolt (3) and seal-ring washer (2).

4. Remove the yoke assembly (1).

IMPORTANT: Do the following prior to installation of the yoke assembly:

- **Be sure the yoke, output shaft and retaining hardware are clean.**
- **Verify the output seal is free of tears or cuts.**
- **DO NOT attempt to remove scratches from the output seal journal on the yoke assembly. Repair may produce machine lead and leakage.**

5. Inspect the yoke assembly and replace it whenever there are nicks or scratches on the seal journal or on the lead-in chamfer just ahead of the seal journal.

Installation Procedure

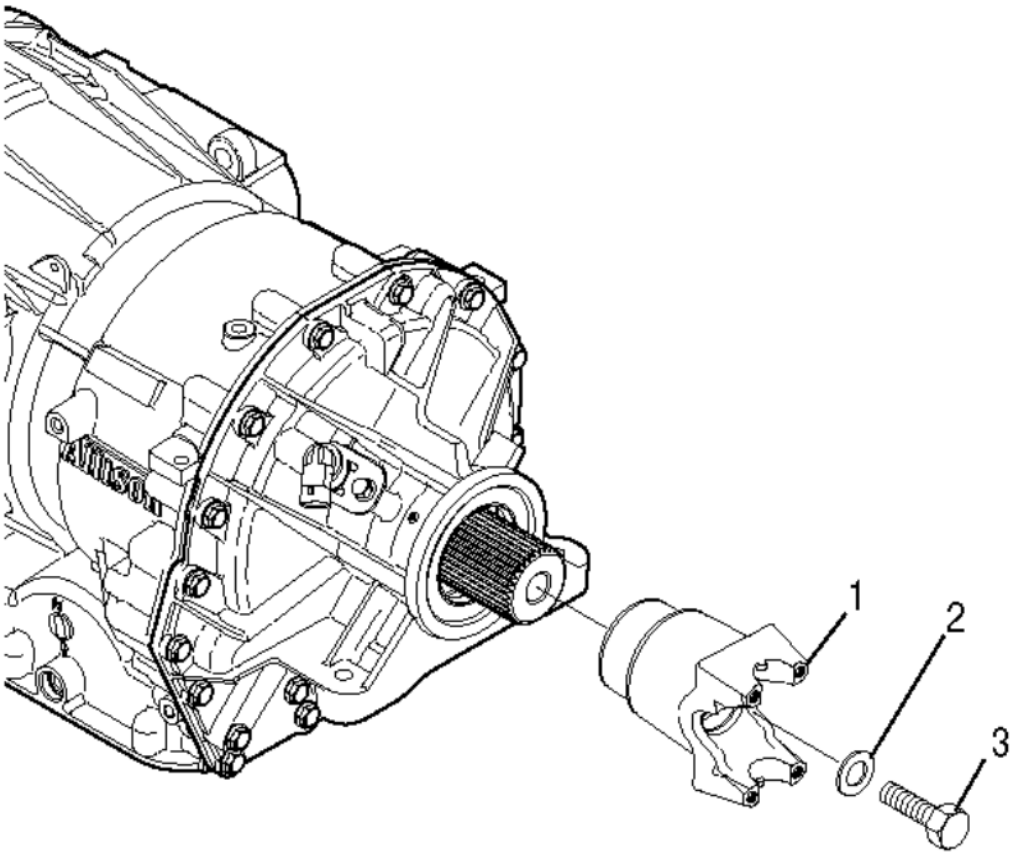


Fig. 18: Yoke Assembly
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the internal splines and the rear seal journal of the yoke assembly with clean transmission fluid.
2. Install the yoke assembly (1) onto the transmission output shaft.

NOTE: **Refer to Fastener Notice .**

3. Install the bolt (3) and seal-ring washer (2).

   Tighten: Tighten the bolt to 123 N.m (91 lb ft).

4. Attach the vehicle driveline to the transmission yoke assembly. Refer to **Transmission**

Replacement.

5. Be sure the selector is in the Park (P) position.
6. Remove the wheel chocks before continuing operation of the vehicle.

TORQUE CONVERTER REPLACEMENT

Tools Required

- **J 21366** Converter Holding Strap
- **J 46409** Torque Converter Lifting Handles. See **Special Tools**.
- **J 44723** Transmission/Stand Adaptor Plate

Removal Procedure

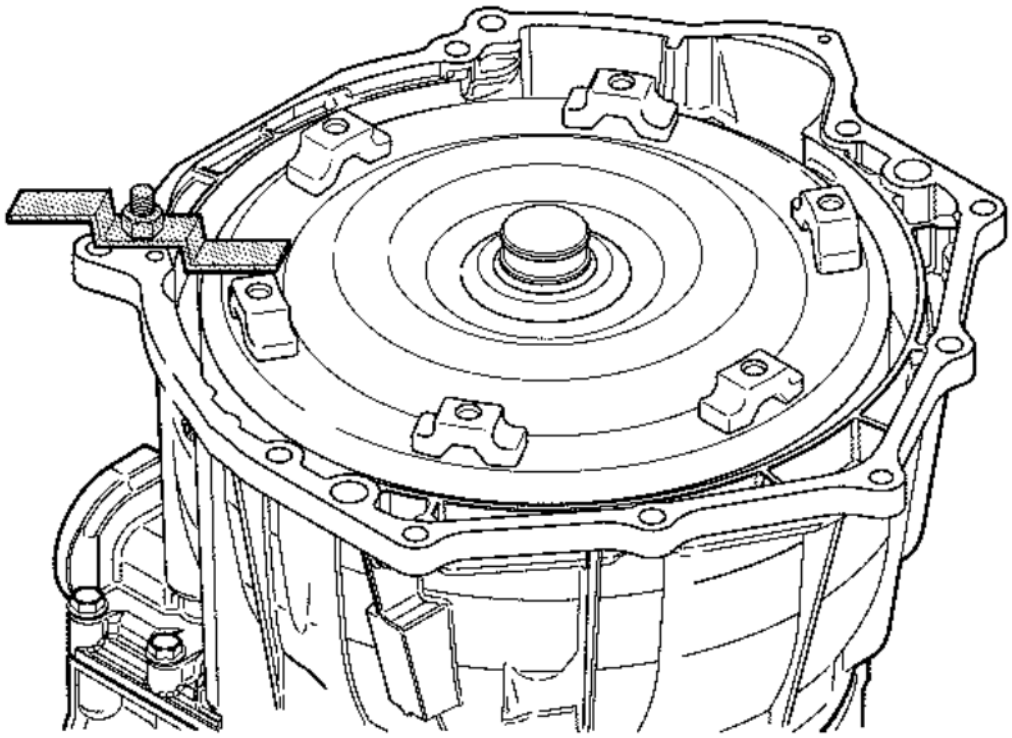


Fig. 19: Torque Converter Restraining Device
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission from the vehicle. Refer to **Transmission Replacement**.
2. Install **J 21366** to restrain the torque converter.
3. Install **J 44723** . Refer to **Holding Fixture Installation**.
4. Position the transmission vertically with the torque converter end up.
5. Remove **J 21366** torque converter retaining bracket.

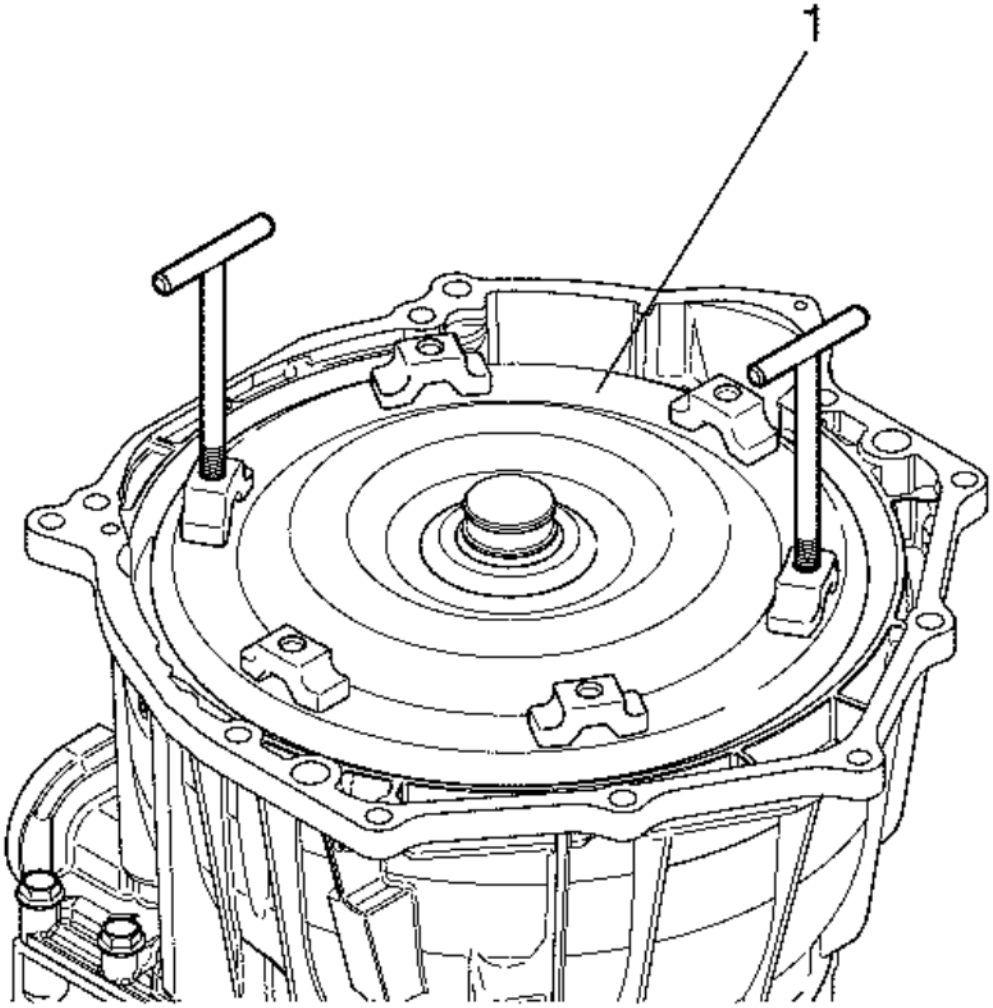


Fig. 20: Installing J 46409 Into Torque Converter Lugs
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The distance from the torque converter mounting lugs to the transmission mounting face is an important measurement. It is required to check correct reassembly of the torque converter.

6. Measure from the mounting lugs to the transmission mounting face.
7. Install **J 46409** 180 degrees apart into 2 lugs on the front of the torque converter. See **Special Tools**.

CAUTION: Avoid personal injury or property damage when removing or installing the torque converter by seeking an assistant to help lift the torque converter.

8. Lift the torque converter free of the transmission and place it on the work table.
9. Remove the lifting handles.

Installation Procedure

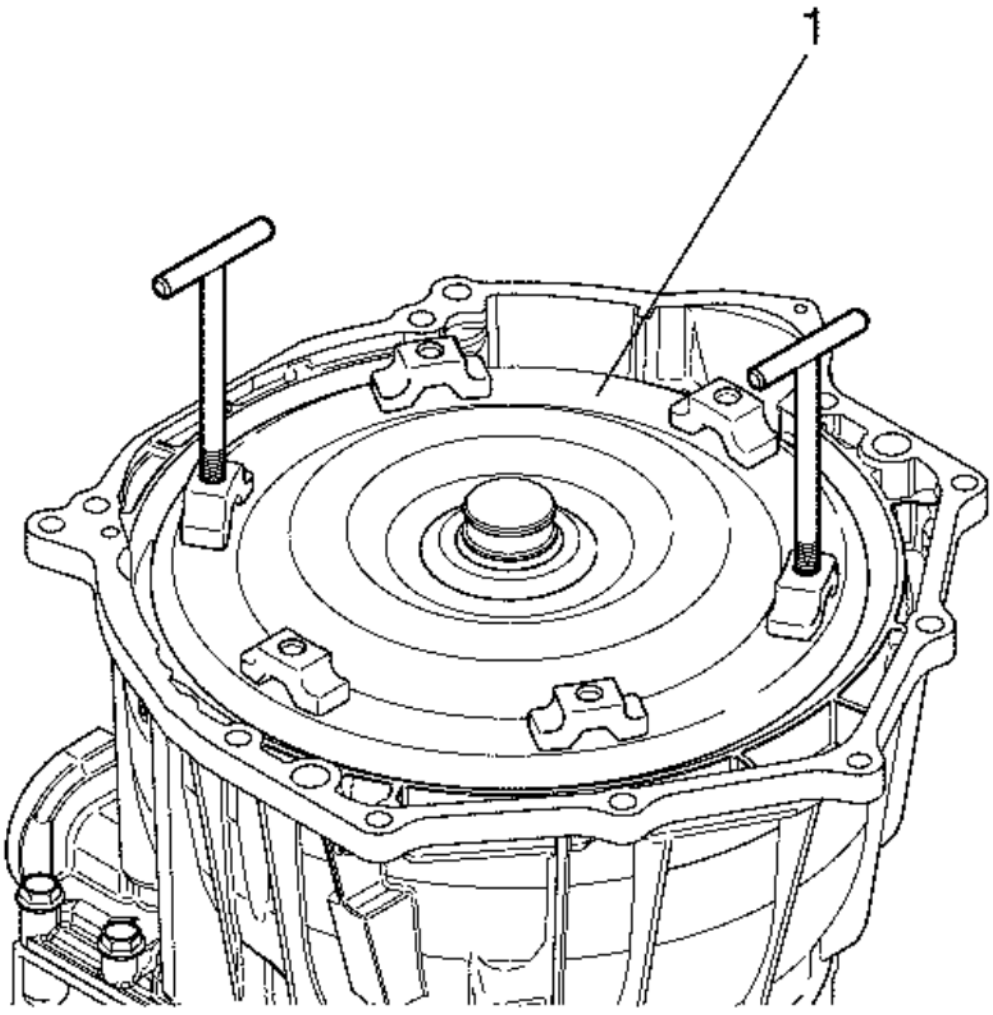


Fig. 21: Installing J 46409 Into Torque Converter Lugs
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the converter pump hub OD and the torque converter seal with clean transmission fluid.
2. Install **J 46409** 180 degrees apart into 2 lugs on the front of the torque converter. See **Special Tools**.

CAUTION: Avoid personal injury or property damage when removing

or installing the torque converter by seeking an assistant to help lift the torque converter.

3. Lift the torque converter into the transmission.
4. Spin the torque converter to engage the turbine shaft splines in the torque converter hub, the stator shaft splines in the stator race and to engage the drive flats on the converter pump hub with the oil pump drive gear.
5. The torque converter is correctly installed when the distance from the lugs to the mounting face is the same as when measured before removing the torque converter.

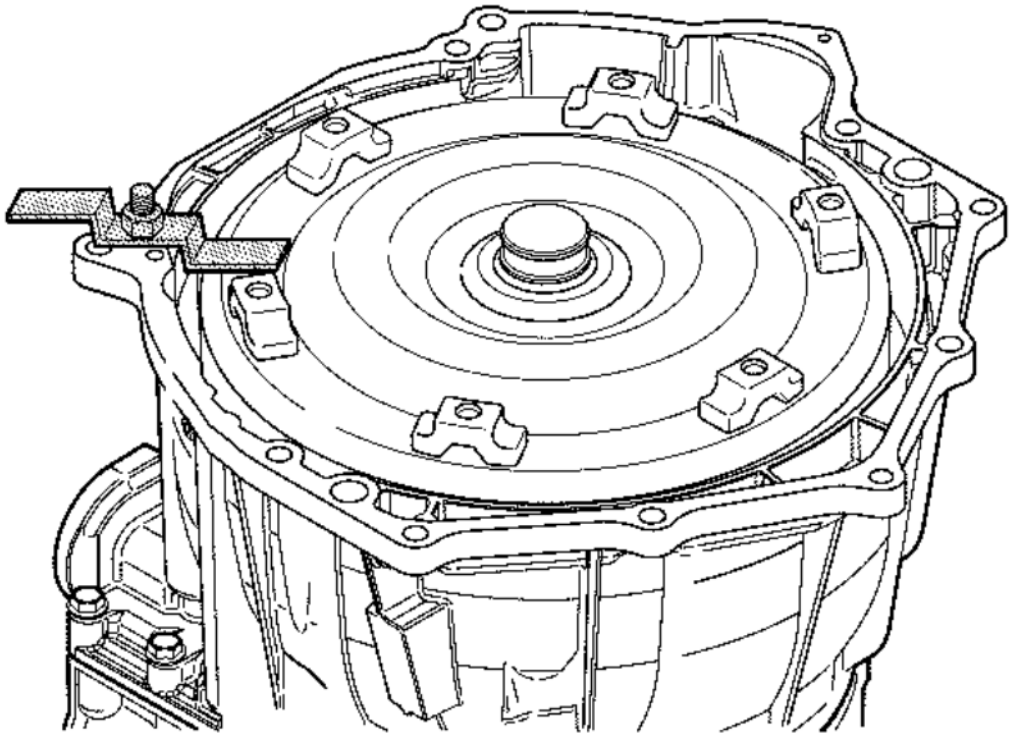


Fig. 22: Torque Converter Restraining Device
Courtesy of GENERAL MOTORS CORP.

6. Install **J 21366** .
7. Reinstall the transmission into the vehicle. Refer to **Transmission Replacement**.

IMPORTANT: The FastLearn (adapt) procedure must be performed. This can be done in one step using a scan tool. If this procedure is not done, the TCM's adaptive values will be at the settings that it learned for the old components. and will be in slow adaptive mode. Under these conditions, it would take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

8. Perform the FastLearn procedure. Refer to **FastLearn Procedure**.

PRESSURE SWITCH MANIFOLD REPLACEMENT

Removal Procedure

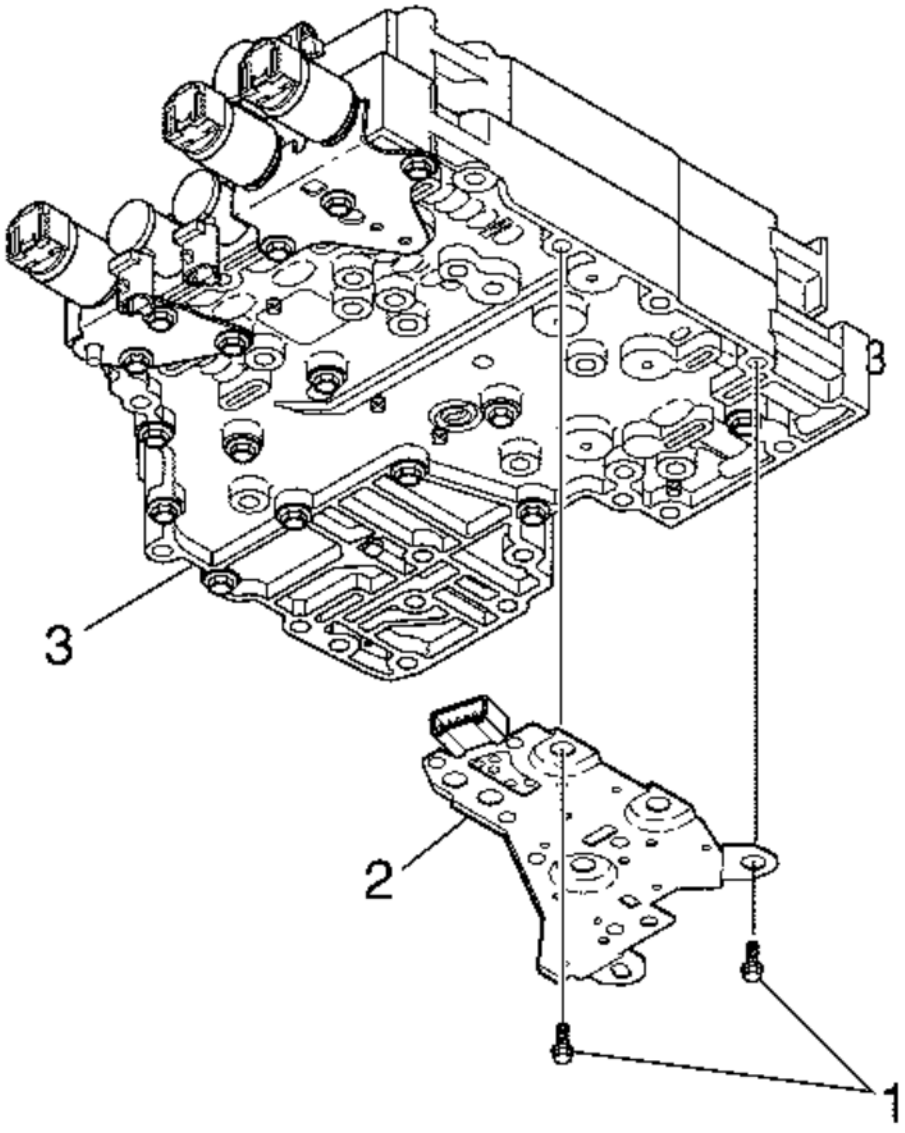


Fig. 23: TFP Switch
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Individual pressure switches cannot be replaced. When any pressure switch needs replacing, the entire assembly must be replaced.

IMPORTANT: The modulated main pressure (MAIN MOD) solenoid has been removed for clarity.

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

1. Remove the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.
2. Disconnect the internal wiring harness connector from the transmission fluid pressure (TFP) switch (2).
3. Remove six bolts (1). Remove the TFP switch (2).

Installation Procedure

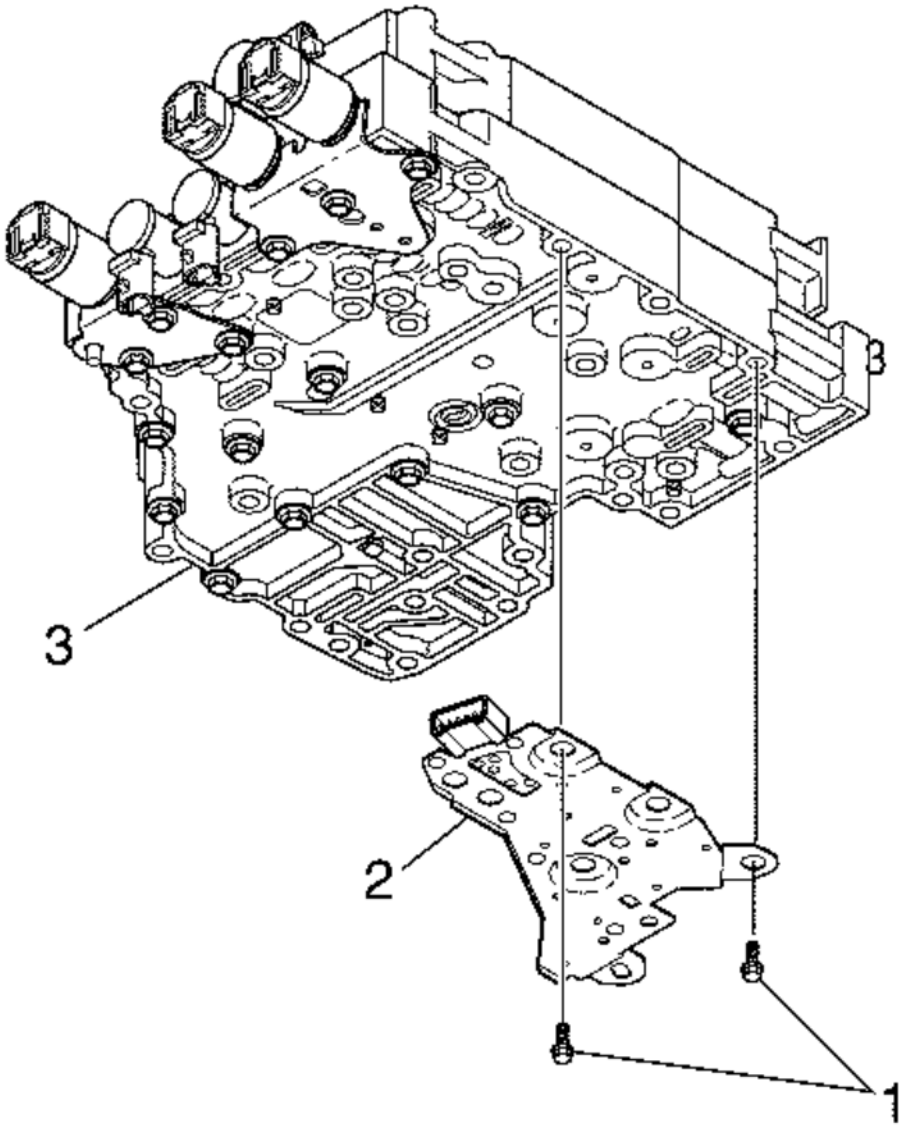


Fig. 24: TFP Switch
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Place the new TFP manifold assembly (2) in position and install one bolt (1) in a recessed

location to hold in position. Start the remaining five bolts (1) in recessed locations and tighten the bolts by hand.

Tighten: Torque the bolts to 12 N.m (108 lb in).

2. Connect the internal wiring harness connector to the TFP switch.
3. Install the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.

IMPORTANT: The FastLearn, adapt, procedure must be performed. This can be done in 1 step using a scan tool. If this procedure is not done, the TCM adaptive values will be at the settings that it learned for the old components and will be in slow adaptive mode. Under these conditions, it will take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

4. Perform the FastLearn procedure. Refer to **FastLearn Procedure**.

POWER TAKE-OFF COVER GASKET REPLACEMENT

Removal Procedure

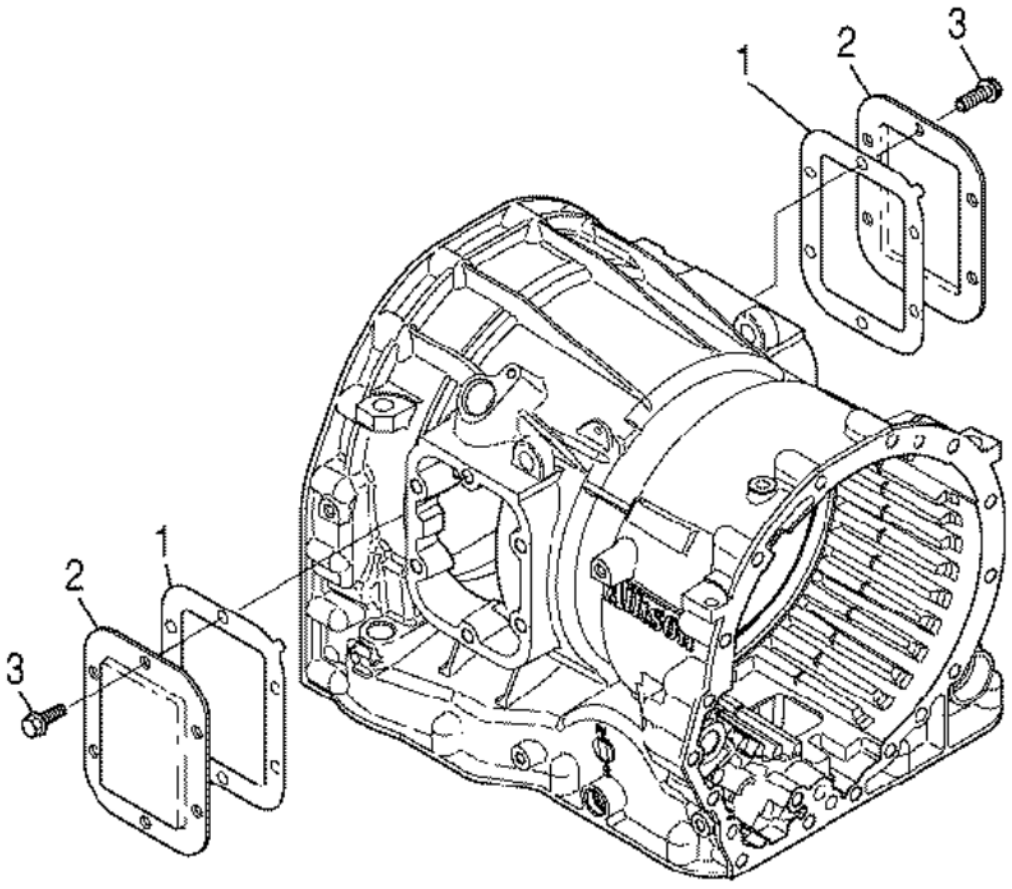


Fig. 25: Power Take-Off (PTO) Cover And Gasket
Courtesy of GENERAL MOTORS CORP.

1. Remove 6 bolts (3).
2. Remove the power take-off (PTO) cover (2) and gasket (1). Discard the used gasket.
3. Ensure the PTO gasket face on the transmission case is free of all foreign material, nicks, and scratches.

Installation Procedure

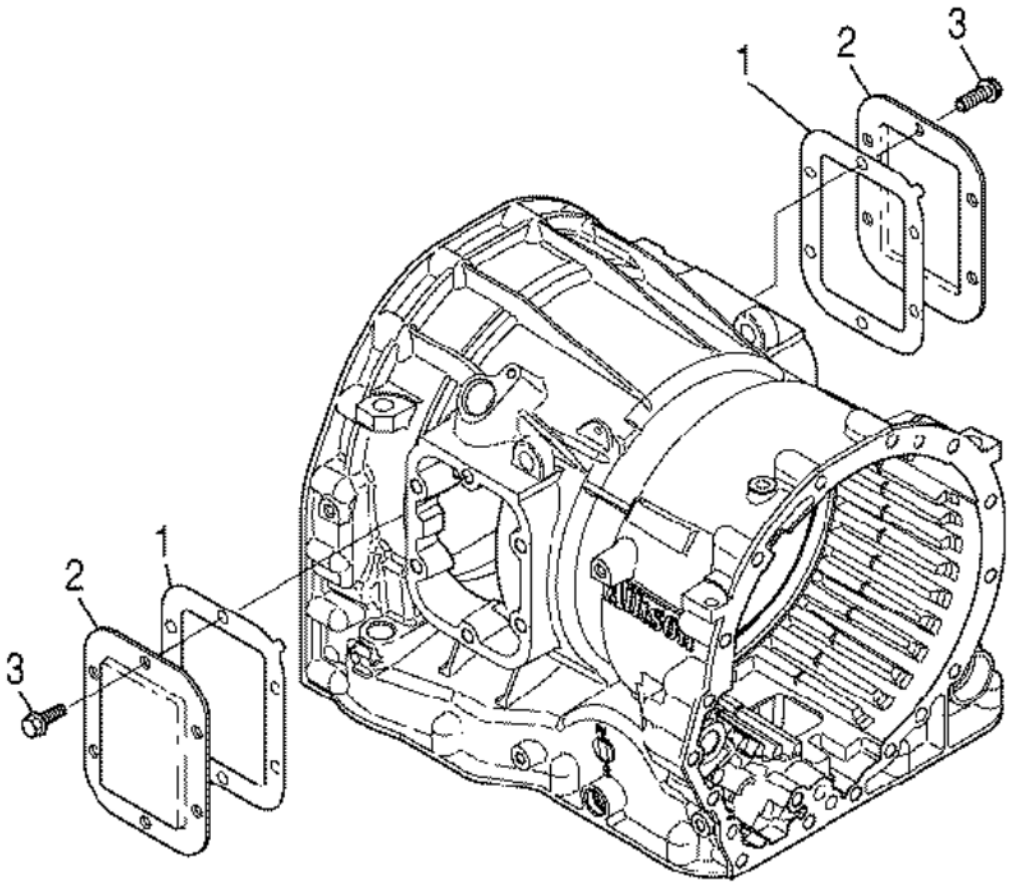


Fig. 26: Power Take-Off (PTO) Cover And Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install the new PTO cover gasket (1) and cover (2).

NOTE: Refer to Fastener Notice .

2. Start the top-center bolt (3) first. Install the other 5 bolts.

Tighten: Tighten all bolts to 43 N.m (32 lb ft).

RANGE SELECTOR LEVER CABLE ADJUSTMENT

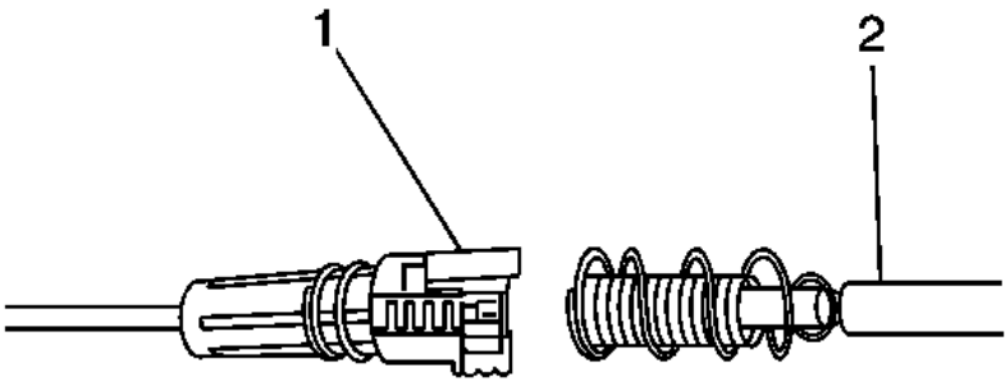


Fig. 27: Aligning Outside Diameter Of Transmission End With Inside Diameter Of Shifter End
Courtesy of GENERAL MOTORS CORP.

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).

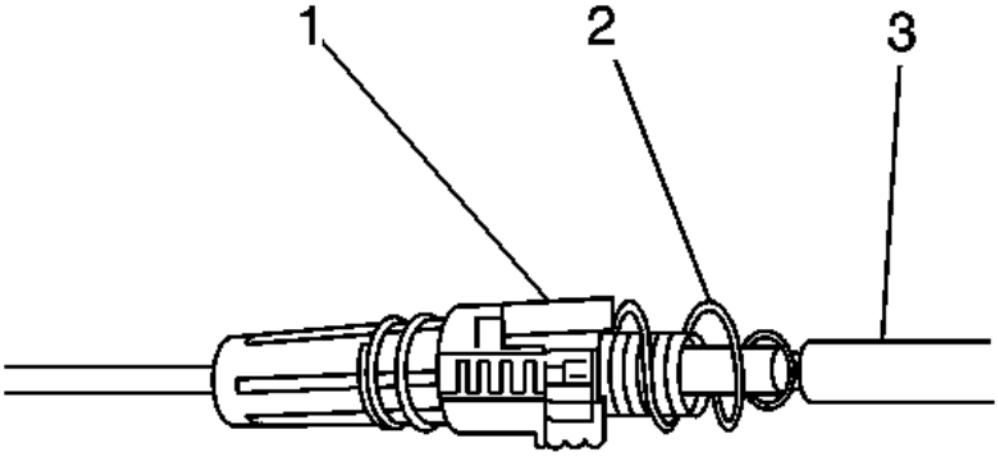


Fig. 28: Engaging Inner Wire And Lock Both Wires Together
Courtesy of GENERAL MOTORS CORP.

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.

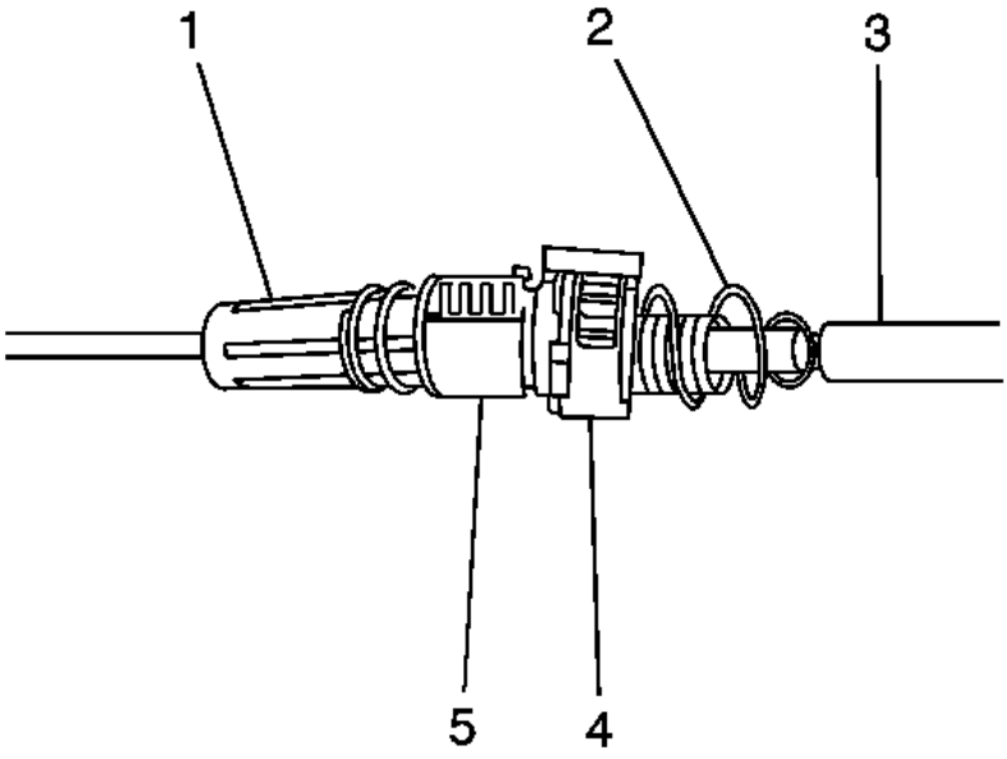


Fig. 29: Tension/Adjust Cable System
Courtesy of GENERAL MOTORS CORP.

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).

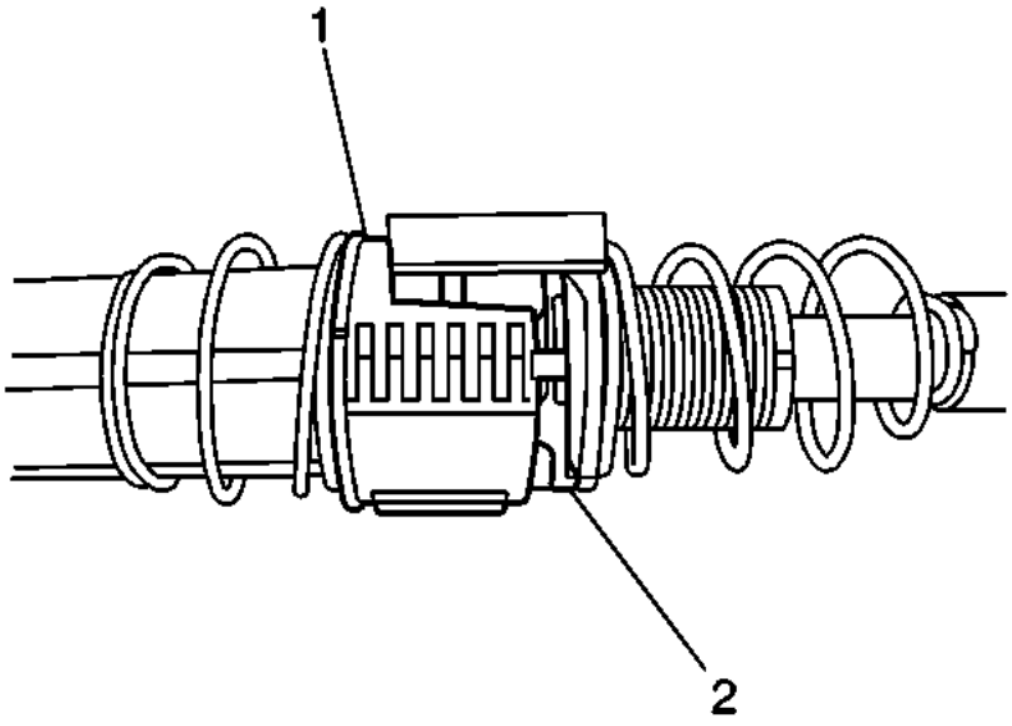


Fig. 30: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

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

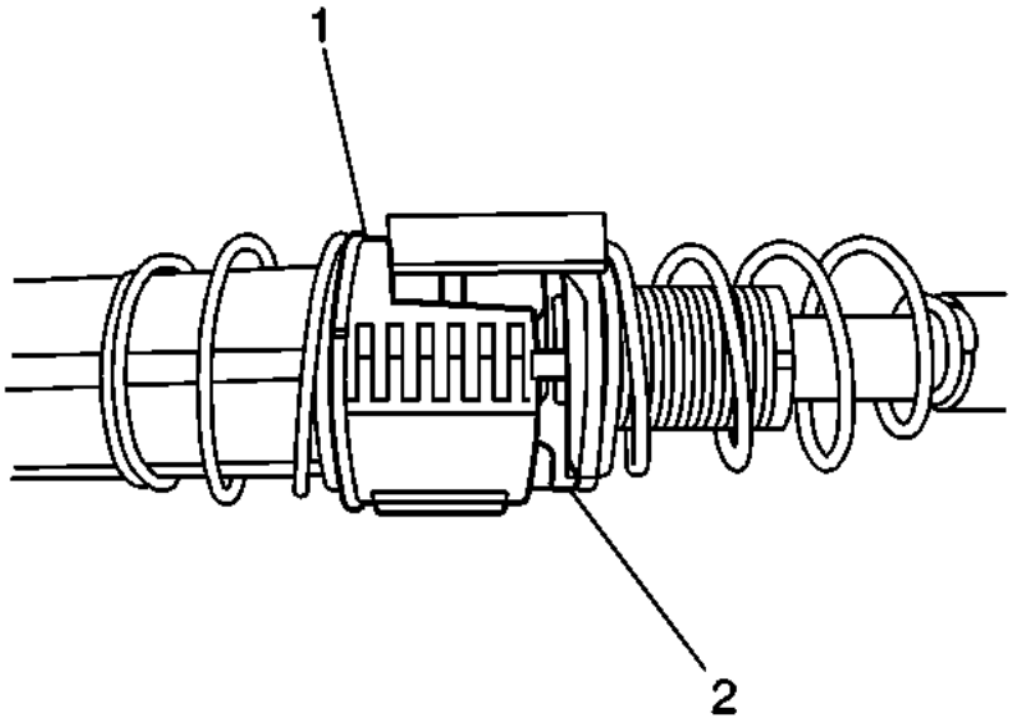


Fig. 31: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

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.

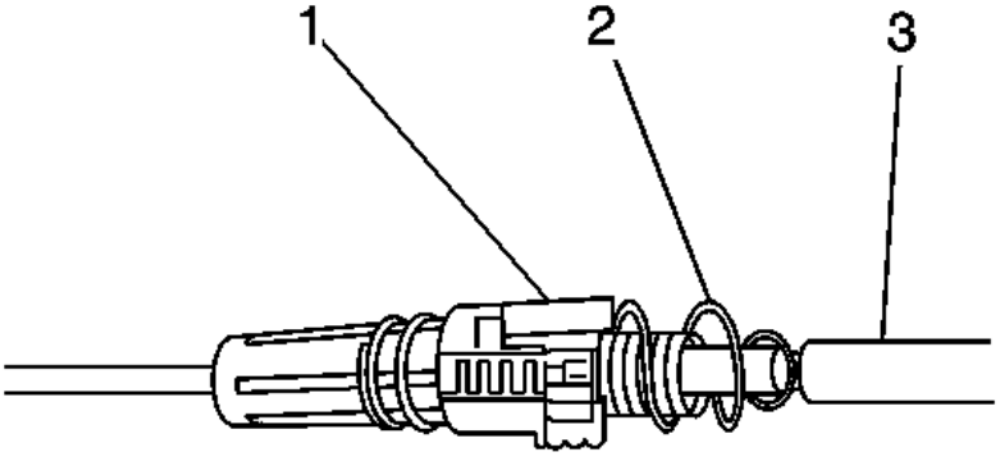


Fig. 32: Engaging Inner Wire And Lock Both Wires Together
Courtesy of GENERAL MOTORS CORP.

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.

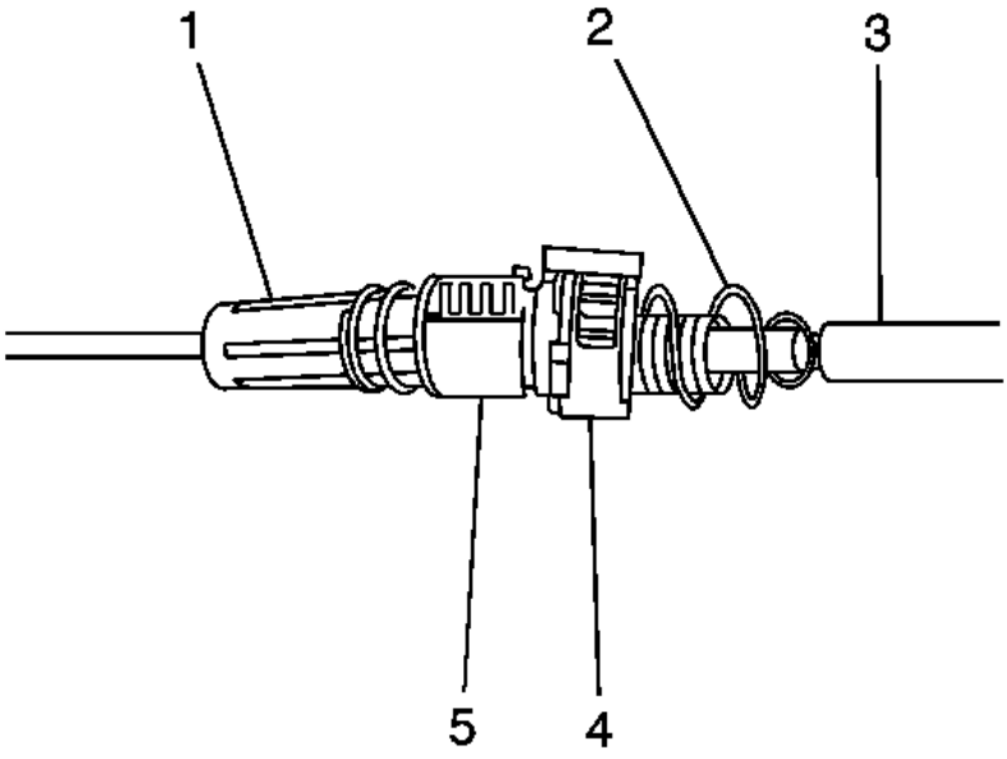


Fig. 33: Tension/Adjust Cable System
Courtesy of GENERAL MOTORS CORP.

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).

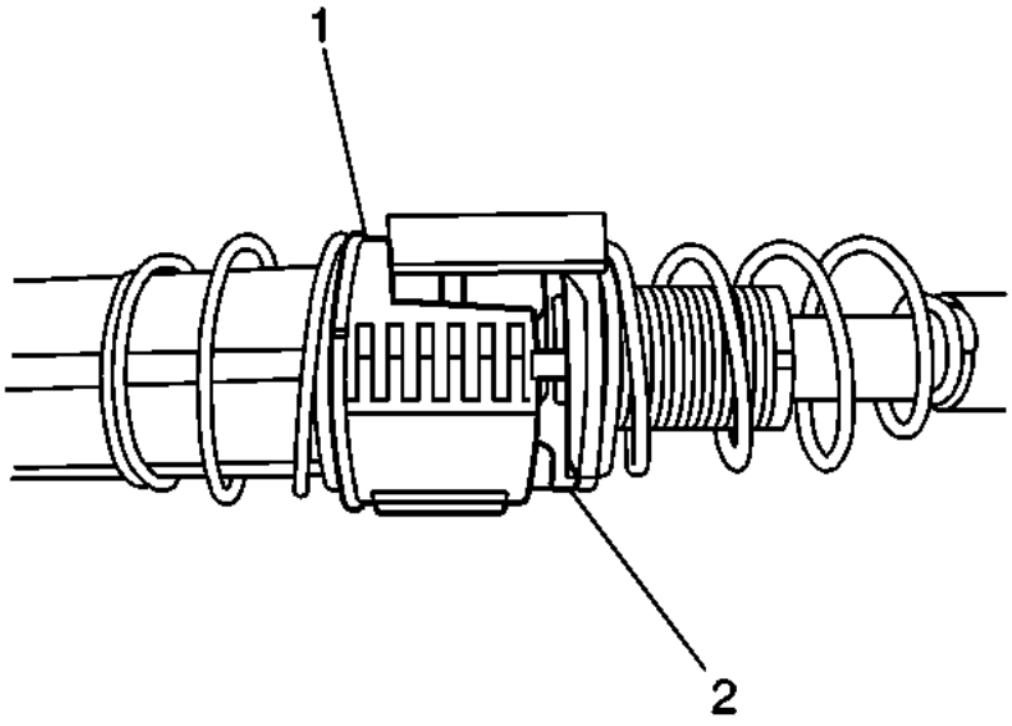


Fig. 34: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

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

MANUAL SHIFT SHAFT, DETENT LEVER, AND POSITION SWITCH ASSEMBLY REPLACEMENT

Removal Procedure

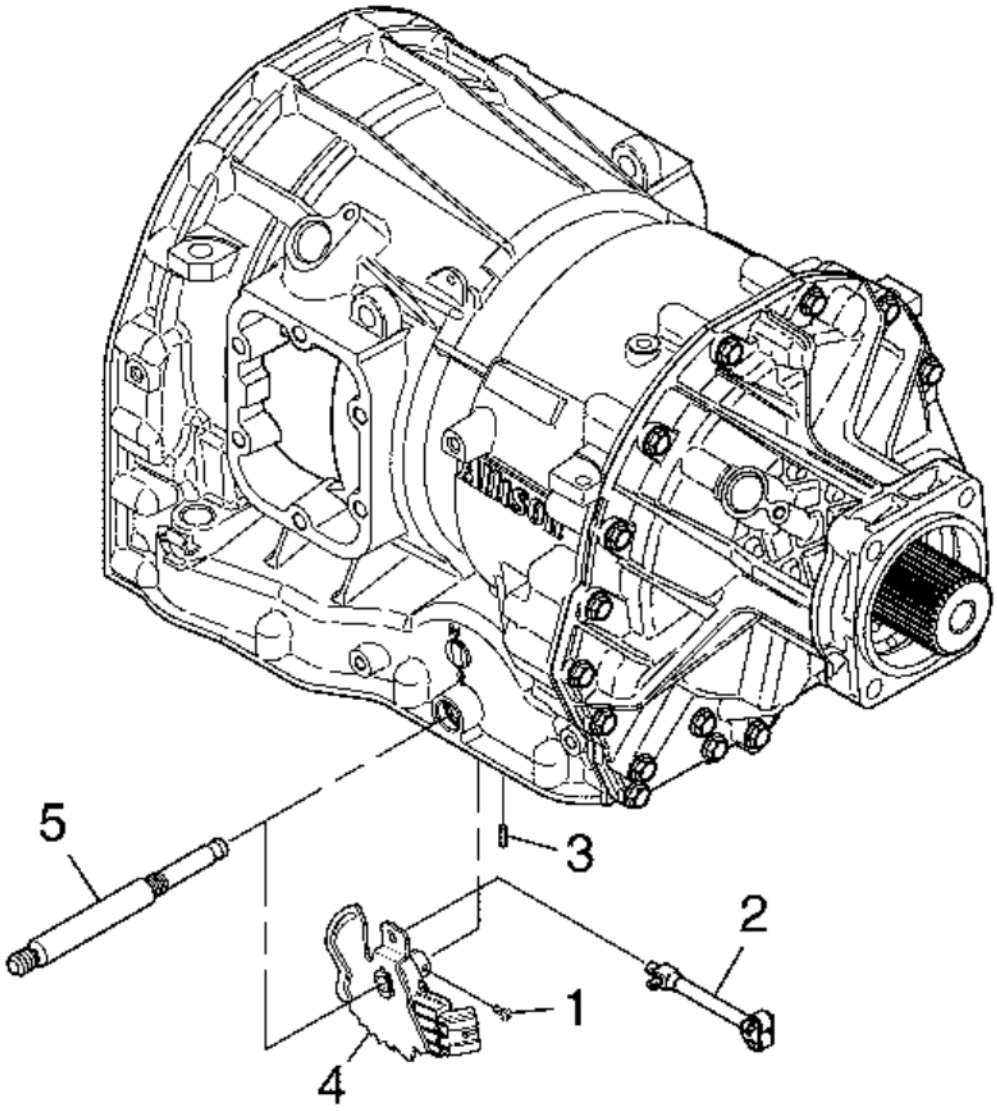


Fig. 35: Detent Lever/IMS Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the control valve assembly from the transmission. Refer to **Control Valve Body Replacement**.

IMPORTANT: The detent lever/IMS retaining bolt contains patch lock

material on the threads. Do not reuse the retaining bolt.

2. Remove the detent lever/IMS retaining bolt (1) using a T27 TORX® bit and discard the retaining bolt.

NOTE: DO NOT mar the transmission case surface around the spherical pin when removing or installing the spherical pin. An unmarred surface is required to maintain the seal between the control valve assembly and the transmission case.

NOTE: DO NOT twist the spherical pin when removing the pin from the transmission case. Damage to the transmission case can occur.

3. Place a protective plate on the transmission case surface around the spherical pin (3). Remove the spherical pin (3) from the transmission case.
4. Slide the manual shift shaft (5) through the detent lever/IMS assembly (4) and through the manual shift shaft seal.
5. Rotate the detent lever/IMS assembly to disengage the park pawl apply assembly (2). Remove the detent lever/IMS assembly (4).

Installation Procedure

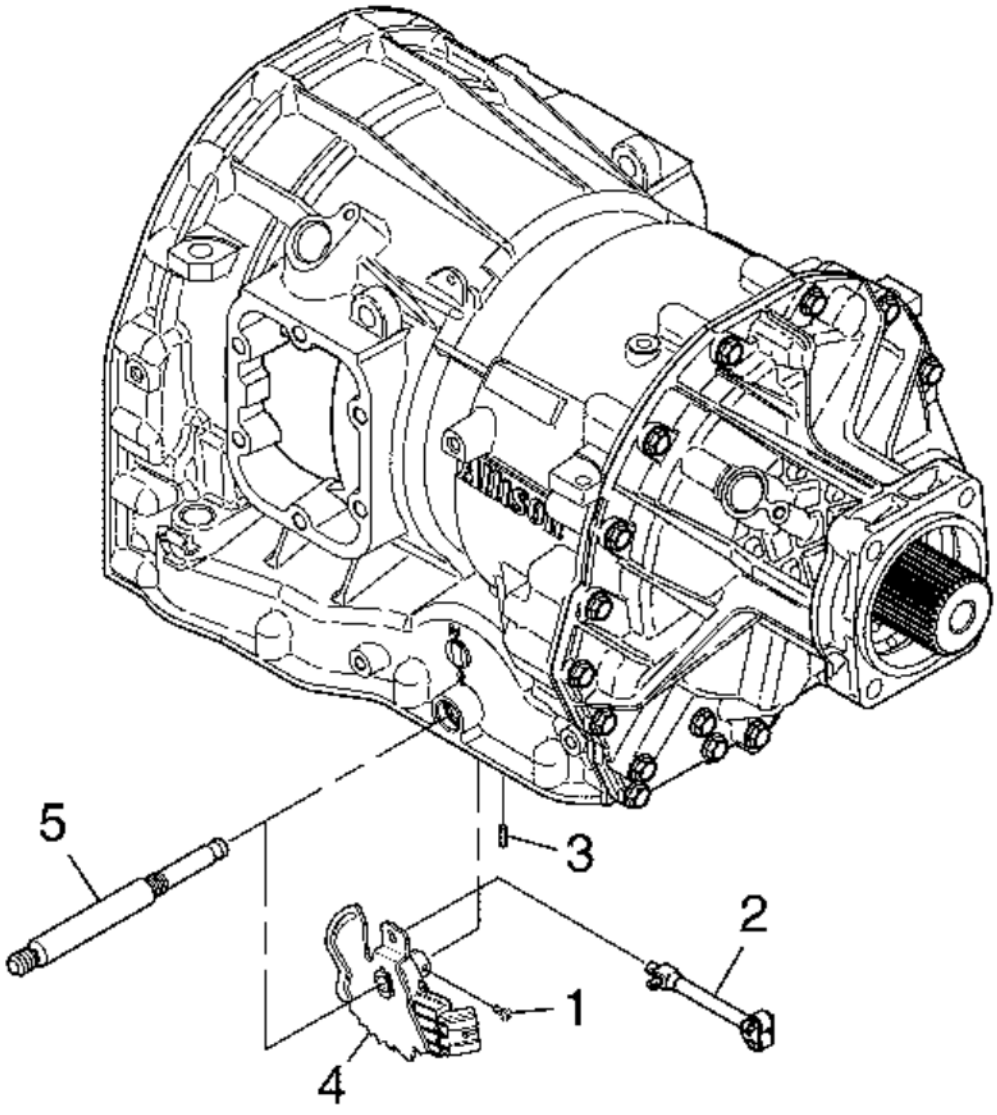


Fig. 36: Detent Lever/IMS Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

1. Place the new detent lever/IMS assembly (4) in position in the transmission case. Rotate the detent lever/IMS assembly to engage the park pawl apply assembly (2). Reinstall the manual shift shaft (5) through the manual shift shaft seal and through the detent lever/IMS assembly (4).

NOTE: Refer to Fastener Notice .

2. Push the manual shift shaft (5) into the final position in the transmission case.
3. Install the spherical pin (3) into the transmission case that retains the manual shift shaft.
4. Install the detent lever/IMS retaining bolt (1) using a T27 TORX® bit.

   Tighten: Tighten the bolt (1) to 10 N.m (92 lb in).

5. Install the control valve assembly. Refer to **Control Valve Body Replacement**.

IMPORTANT: The FastLearn, adapt, procedure must be performed. This can be done in 1 step using a scan tool. If this procedure is not done, the TCM adaptive values will be at the settings that it learned for the old components and will be in slow adaptive mode. Under these conditions, it will take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

6. Perform the FastLearn procedure. Refer to **FastLearn Procedure**.

TORQUE CONVERTER HOUSING BOLT SEAL REPLACEMENT

Removal Procedure

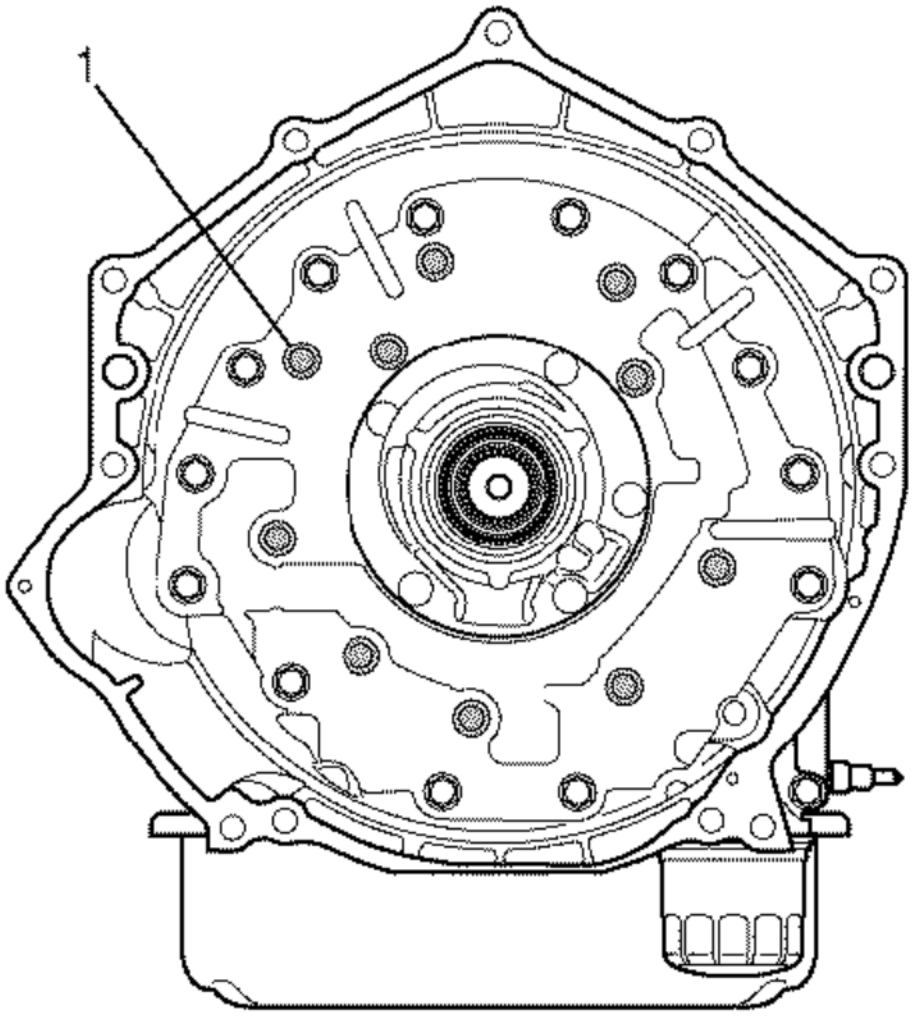


Fig. 37: Torque Converter Housing Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the torque converter from the transmission. Refer to **Torque Converter Replacement**.
2. Remove any of the 10 bolts (1), bolt heads shaded, where leakage at the bolt head is suspected.

IMPORTANT: The bolts (1) have a removable seal under the flanged head.

3. Remove and discard seals from bolts removed.

Installation Procedure

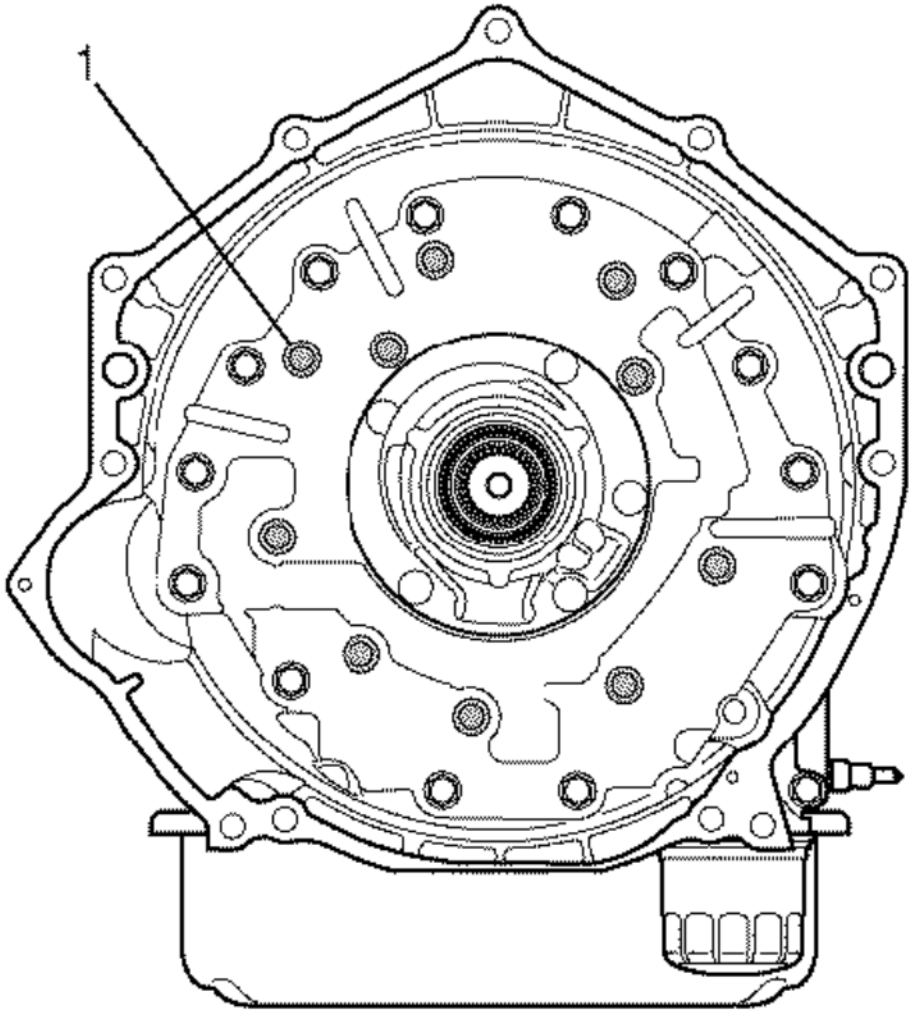


Fig. 38: Torque Converter Housing Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install new seals on any removed bolts (1).

NOTE: Refer to Fastener Notice .

2. Install any bolts (1) removed.

   Tighten: Tighten bolts to 56 N.m (41 lb ft).

3. Install the torque converter into the transmission. Refer to **Torque Converter Replacement**.

TRANSMISSION FLUID FILTER ADAPTER REPLACEMENT

Removal Procedure

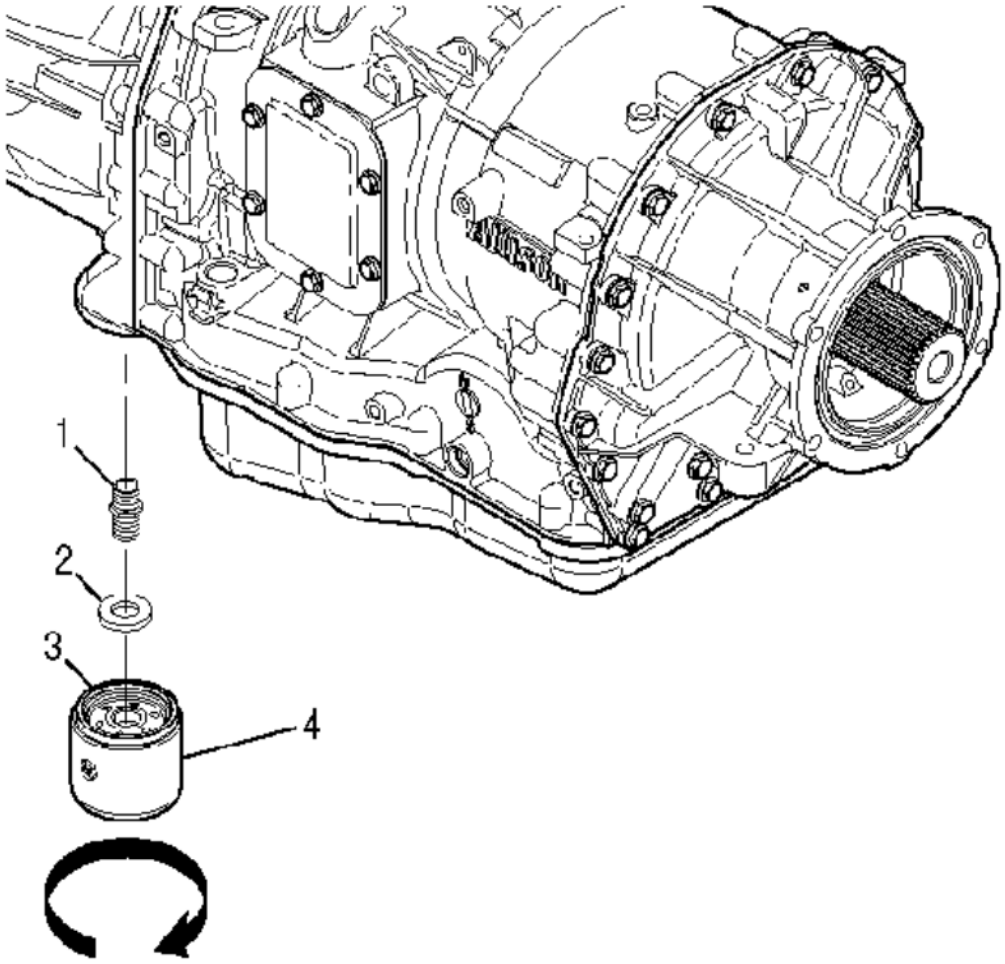


Fig. 39: Transmission External Oil Filter Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **DO NOT drain the fluid if only the transmission external oil filter adapter is being replaced.**
- **Use a standard strap-type filter wrench to remove or install the transmission external oil filter.**

1. Remove the transmission external oil filter (4) by rotating in the counterclockwise direction.
2. Remove the magnet (2) from the transmission external oil filter adapter (1) in the converter

housing or from the filter element.

3. Clean any metal debris from the magnet. Presence of any metal pieces larger than dust may indicate that transmission replacement or overhaul is required.
4. Remove the filter adapter (1) from the converter housing.

Installation Procedure

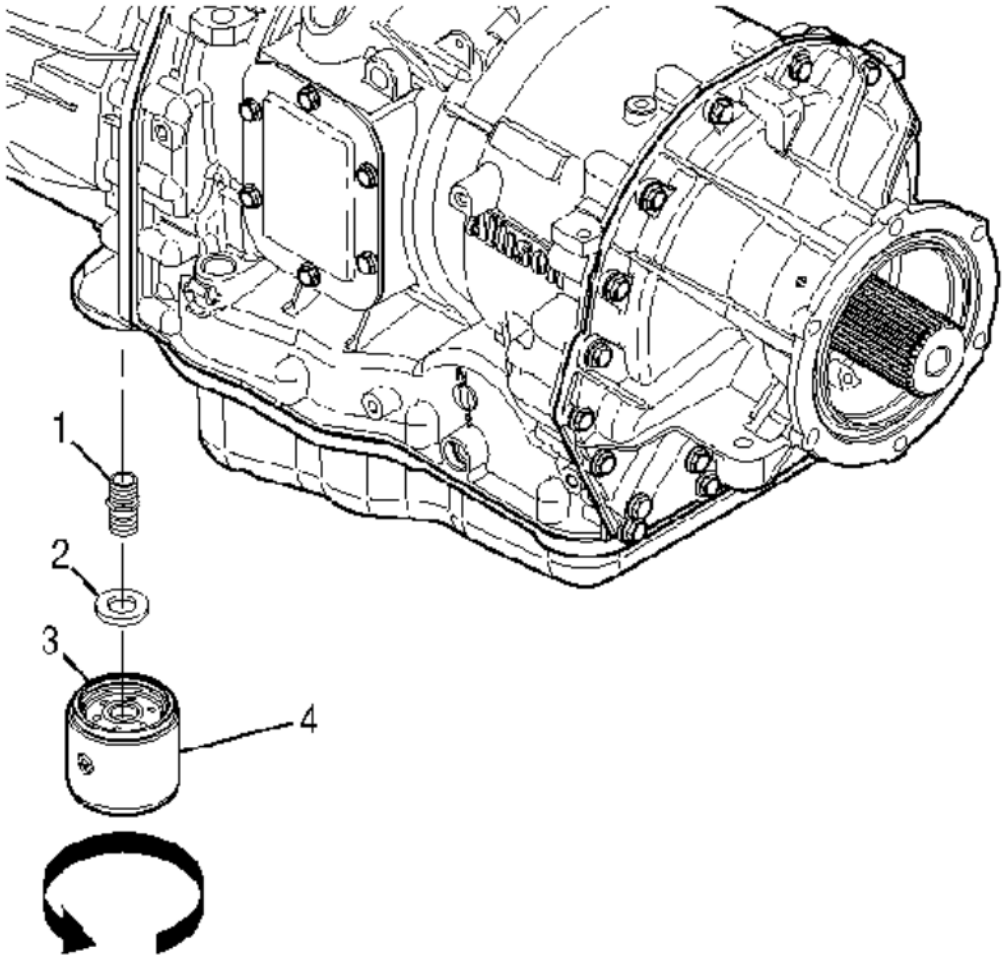


Fig. 40: Transmission External Oil Filter Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the transmission external oil filter adapter (1).

   Tighten: Tighten the adapter to 30 N.m (22 lb ft).

2. Reinstall the magnet (2) onto the filter adapter (1).
3. Lubricate the gasket (3) on the transmission external oil filter with transmission fluid.
4. Install, by hand, the transmission external oil filter (4) until the gasket on the filter touches the converter housing.

NOTE: Turning the transmission external oil filter more than ONE FULL TURN after gasket contact will damage the filter and may cause fluid leakage.

5. Turn the filter ONE FULL TURN ONLY after gasket contact.

NOTE: Use only clean and approved transmission fluid.

6. Check the transmission fluid level. Refer to **Transmission Fluid Check**.

RANGE SELECTOR LEVER CABLE REPLACEMENT

Removal Procedure

1. Position the steering column shift lever to the park position.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

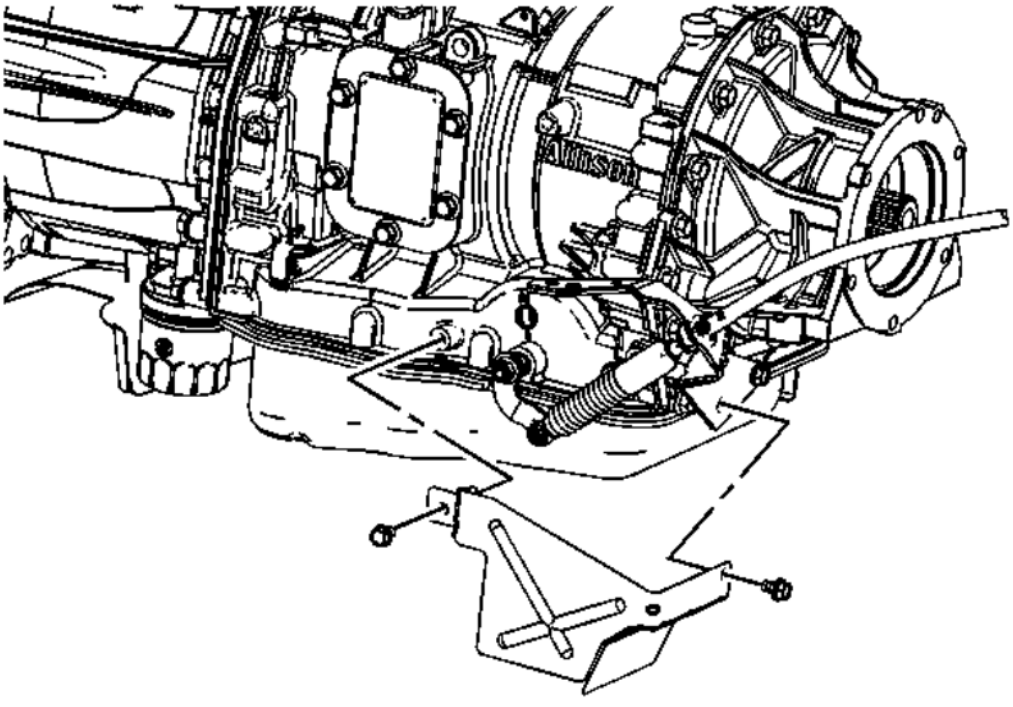


Fig. 41: Range Selector Cable Heat Shield
Courtesy of GENERAL MOTORS CORP.

3. Remove the range selector cable heat shield bolts.
4. Remove the range selector cable heat shield.

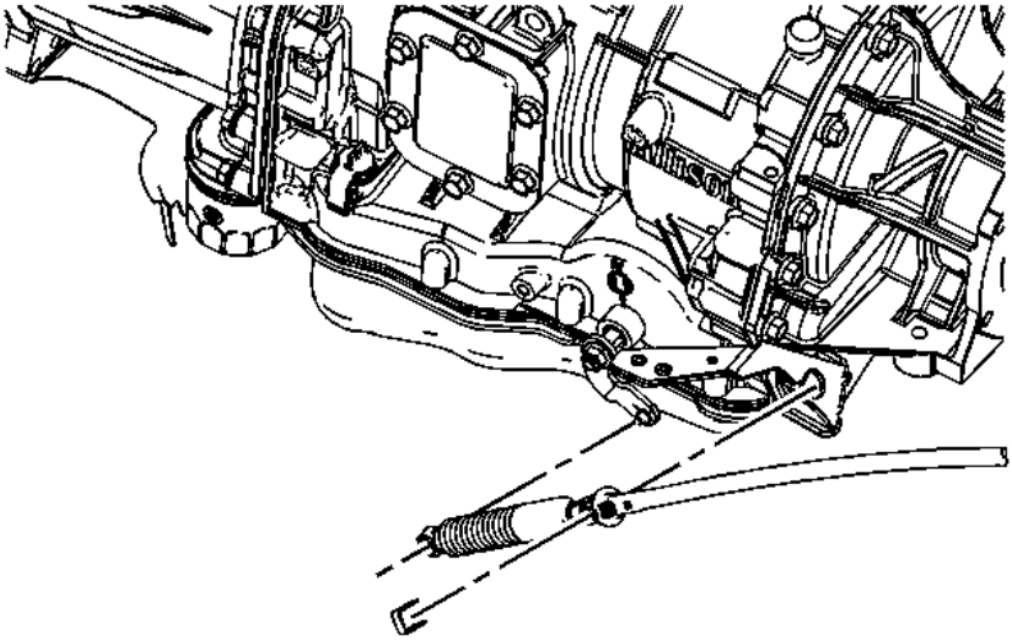


Fig. 42: Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

5. Ensure the transmission manual shaft is positioned in mechanical park.
6. Remove the range selector cable end from the transmission range selector lever stud.
7. Remove the retainer securing the range selector cable to the bracket.
8. Depress the tangs and remove the cable from the range selector cable bracket.

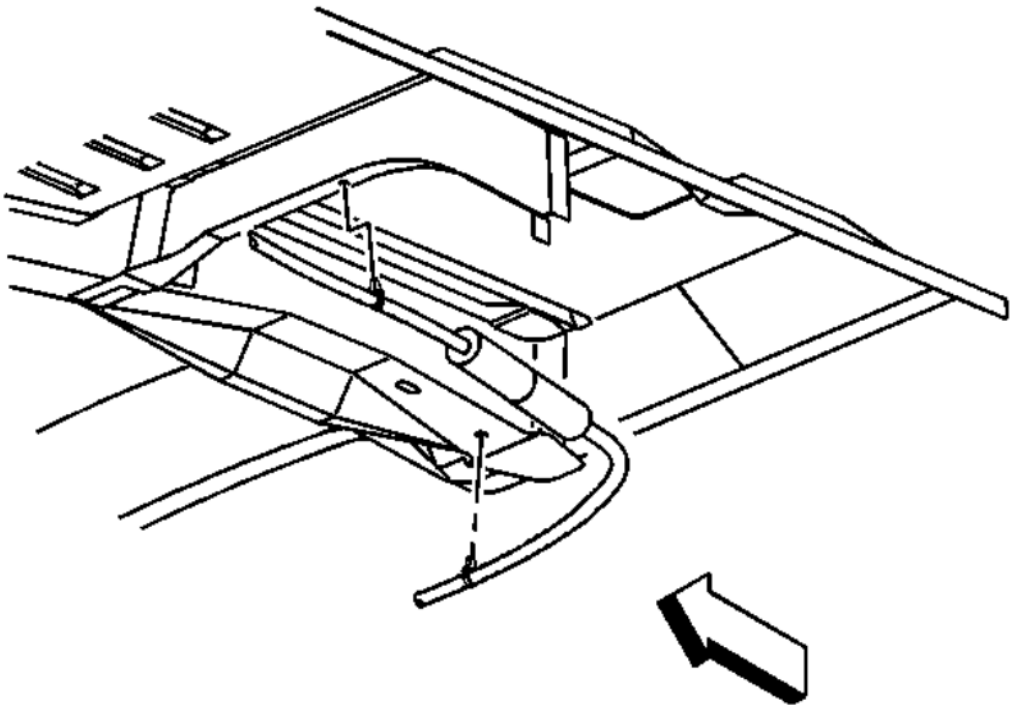


Fig. 43: View Of Cable Clips At Floor Panel Reinforcement
Courtesy of GENERAL MOTORS CORP.

9. Remove the cable clips from the floor panel reinforcement.

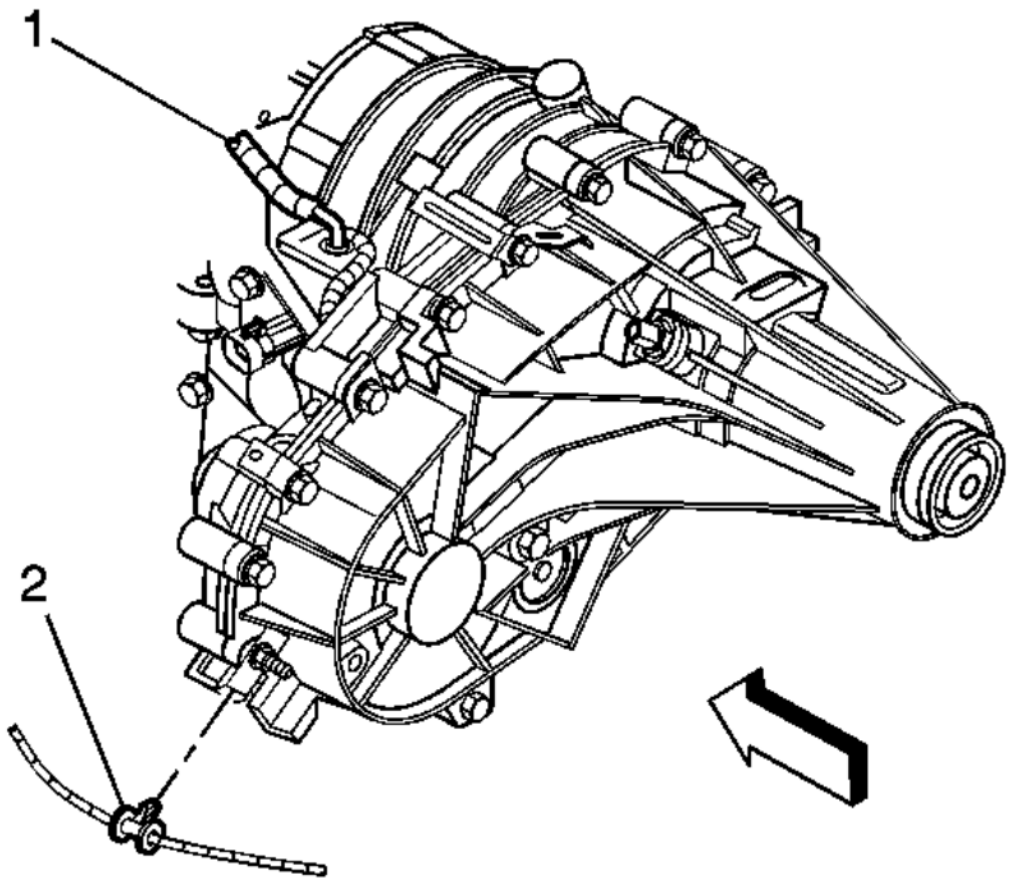


Fig. 44: Cable Clips & Transfer Case, If Equipped
Courtesy of GENERAL MOTORS CORP.

10. Remove the cable clips (2) from the transfer case, if equipped.
11. Lower the vehicle.
12. Ensure that the steering column shift lever is still in the park position.
13. Pull back the carpet and insulation around the driver's area.
14. Remove the instrument panel knee bolster. Refer to **Knee Bolster Replacement (with RPO SLT)** or **Knee Bolster Replacement (without RPO SLT)** .

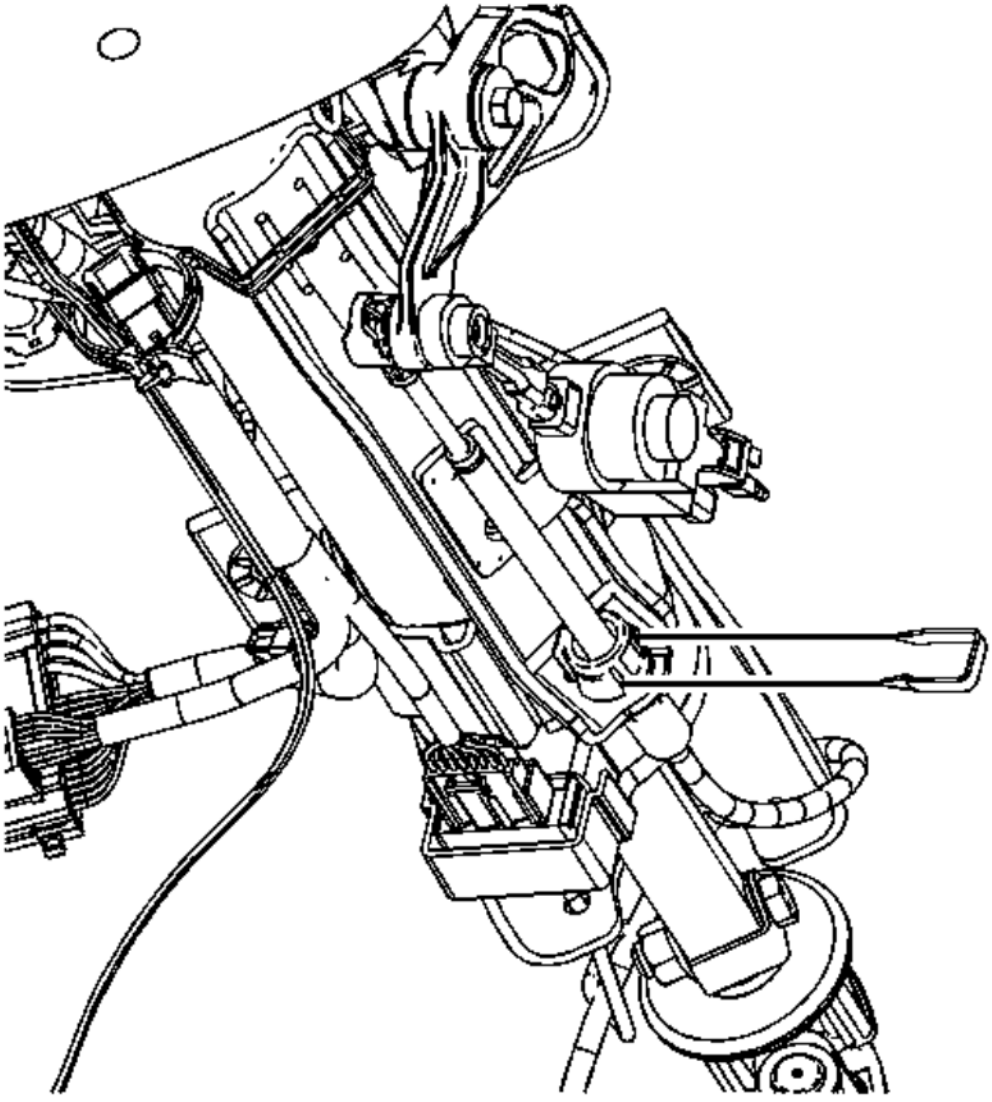


Fig. 45: View Of Steering Cable Retainer On Steering Column
Courtesy of GENERAL MOTORS CORP.

15. Remove the retainer securing the cable to the steering column.

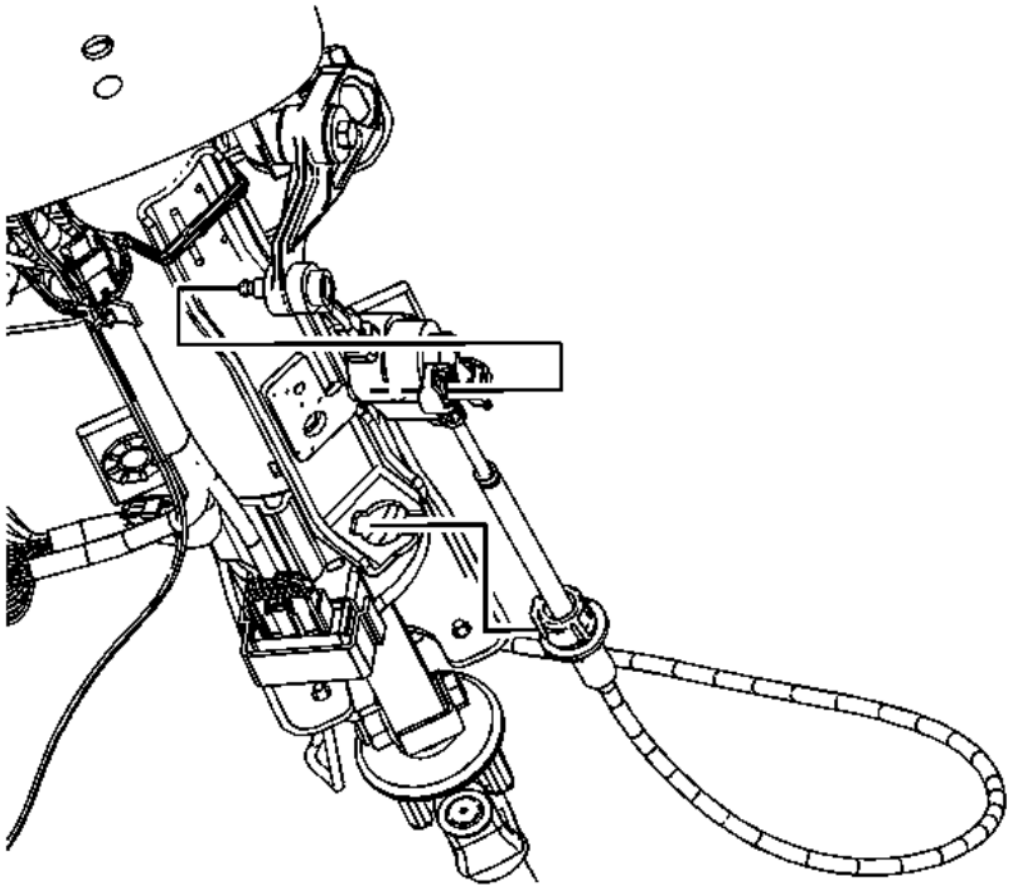


Fig. 46: View Of Cable, Steering Column Ball Stud & Steering Column Bracket
Courtesy of GENERAL MOTORS CORP.

16. Remove the cable end from the steering column ball stud.
17. Depress the tangs and remove the cable from the steering column bracket.

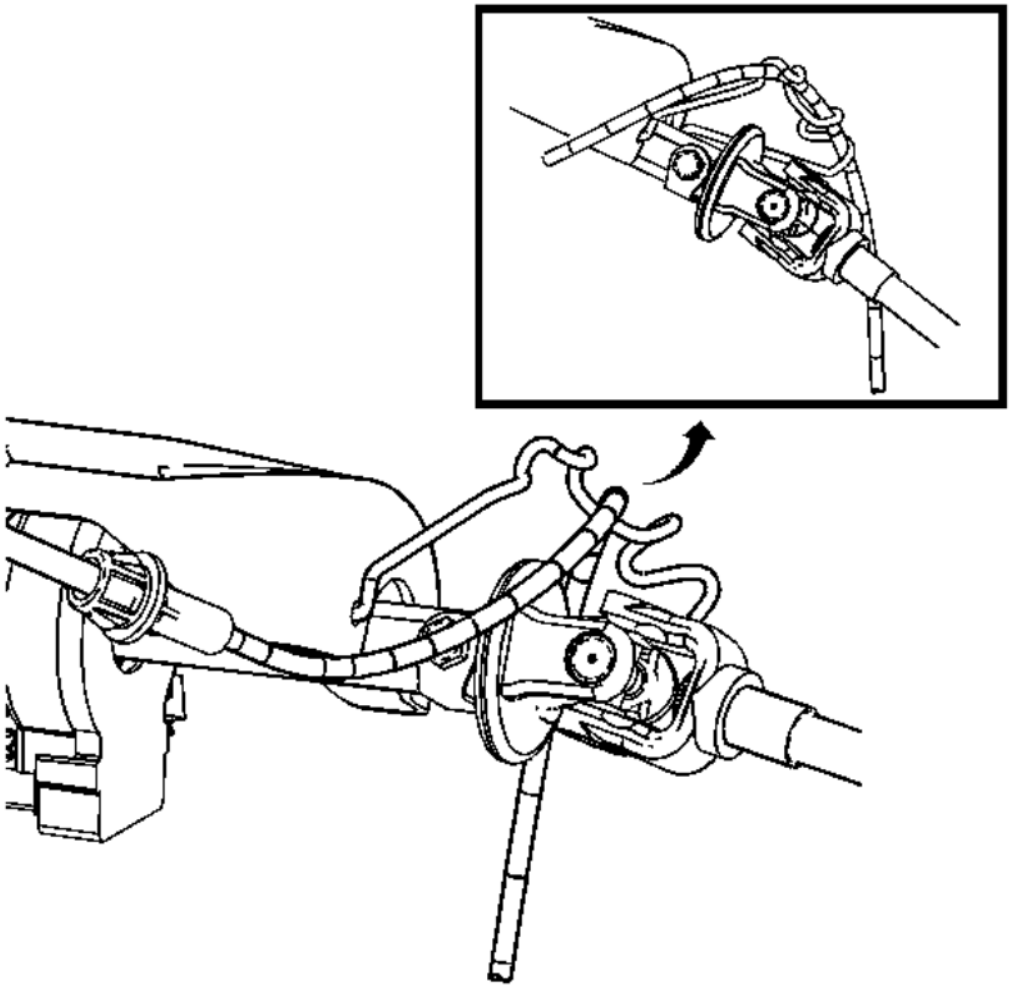


Fig. 47: View Of Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

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

18. Remove the range selector cable from the support.

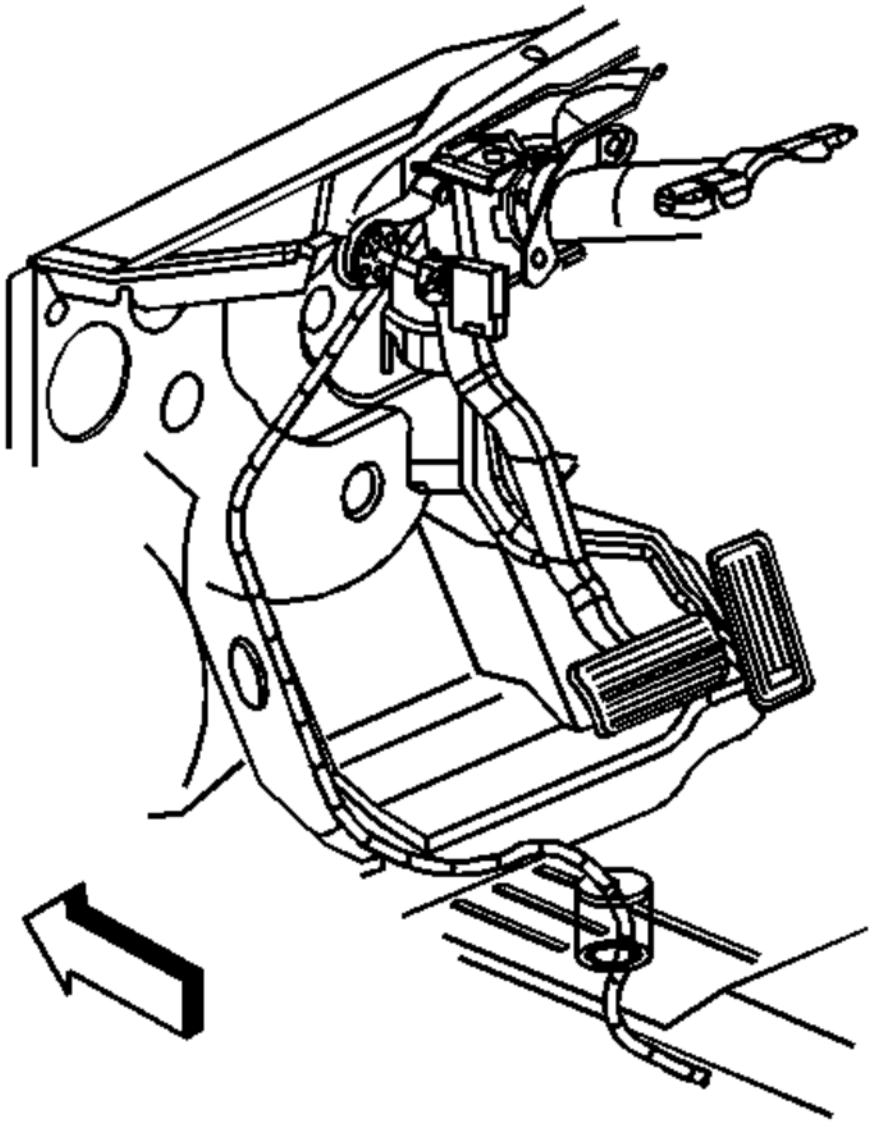


Fig. 48: View Of Cable Grommet At Floor Panel
Courtesy of GENERAL MOTORS CORP.

19. Remove the cable grommet from the floor panel.
20. Remove the cable from the vehicle.

Installation Procedure

1. Install the cable to the vehicle.

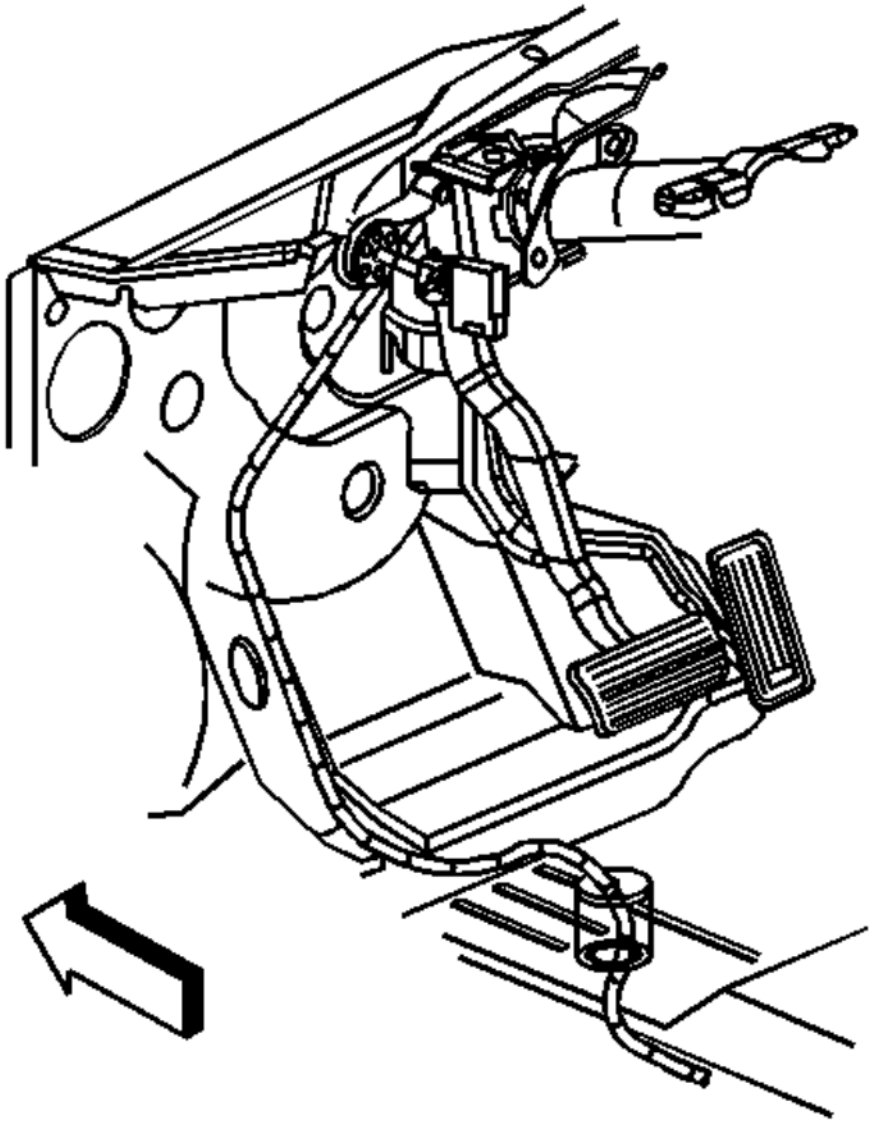


Fig. 49: View Of Cable Grommet At Floor Panel
Courtesy of GENERAL MOTORS CORP.

2. Install the cable grommet to the floor panel.

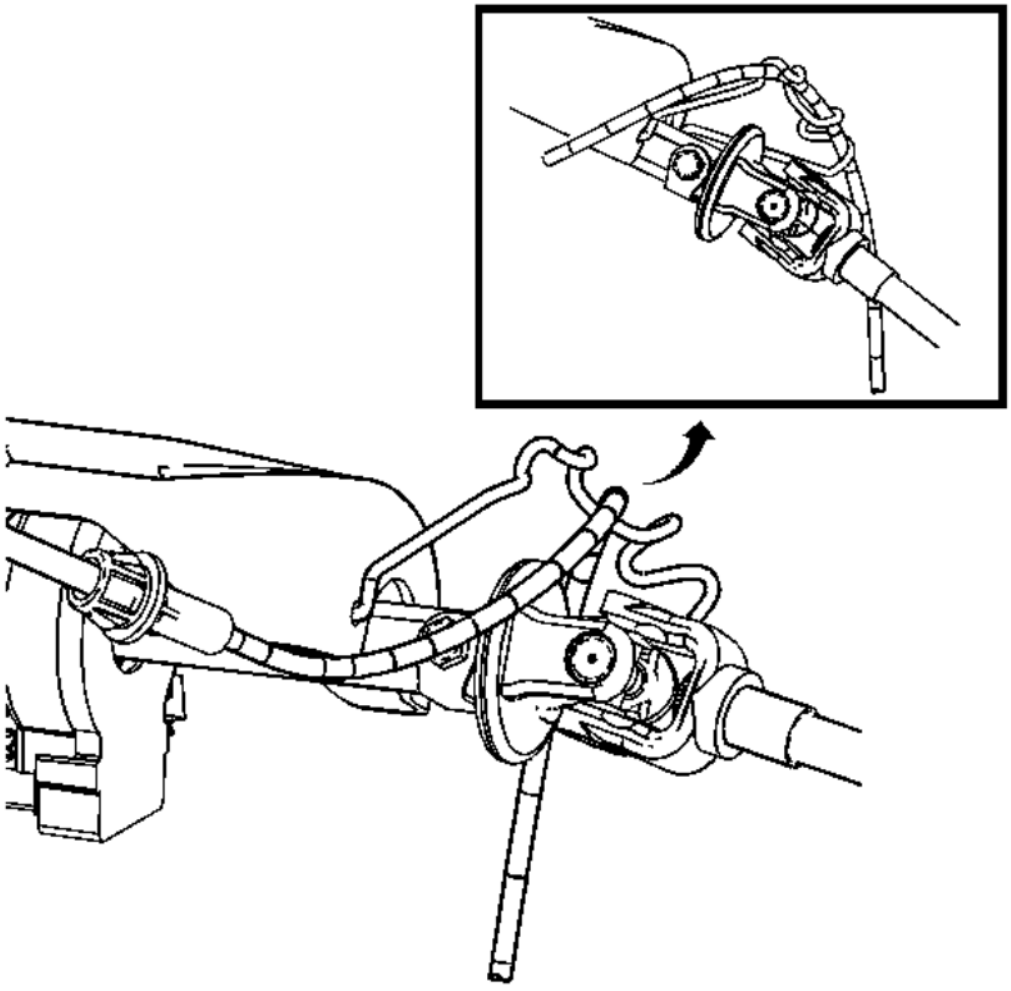


Fig. 50: View Of Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

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

3. Install the range selector cable to the support.
4. Ensure that the transmission manual shaft lever is in the mechanical park position.

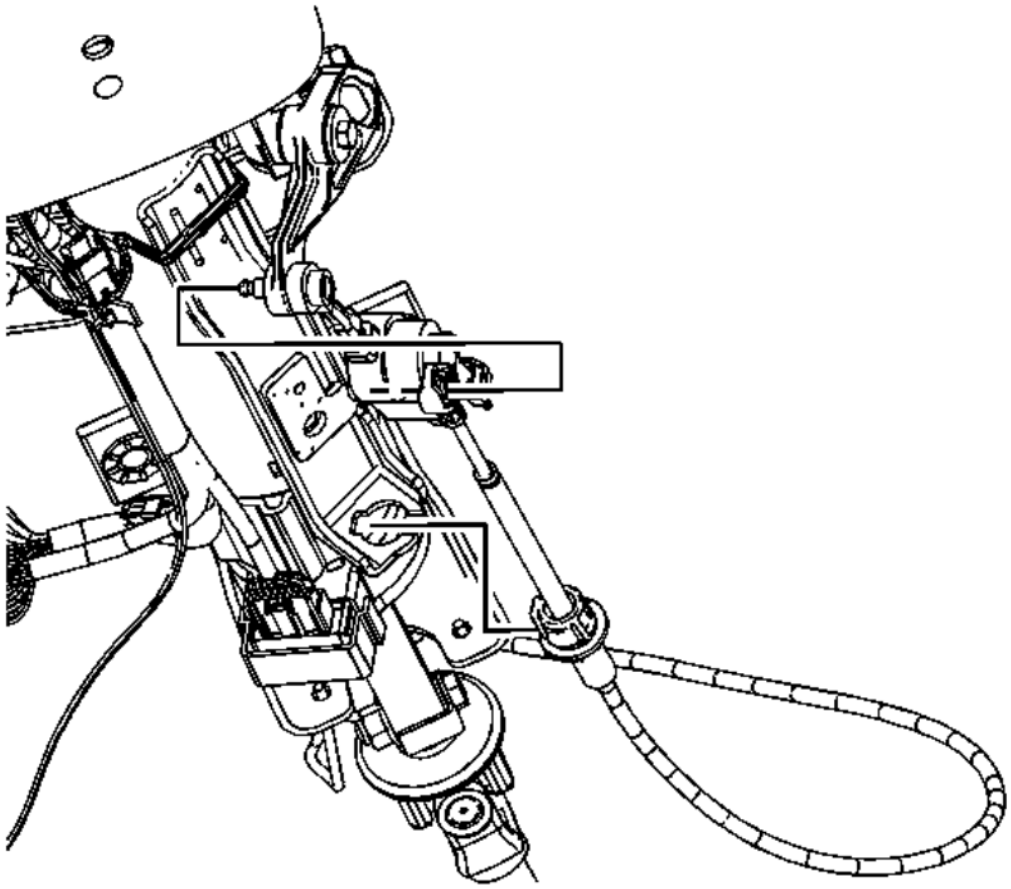


Fig. 51: View Of Cable, Steering Column Ball Stud & Steering Column Bracket
Courtesy of GENERAL MOTORS CORP.

5. Install the cable to the steering column bracket.
6. Ensure the tangs fully seat (snap) into the steering column bracket.
7. Install the cable end to the steering column ball stud.

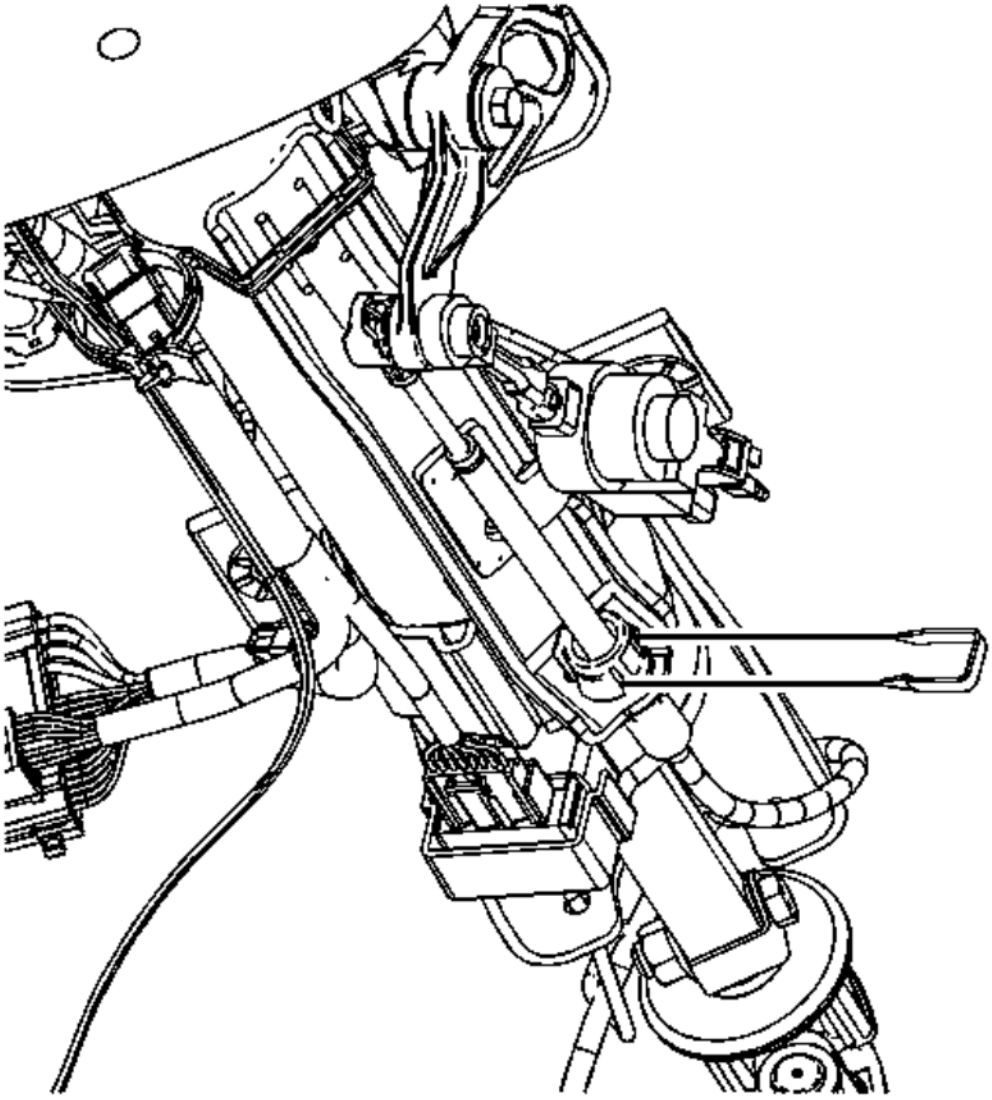


Fig. 52: View Of Steering Cable Retainer On Steering Column
Courtesy of GENERAL MOTORS CORP.

8. Install the retainer securing the cable to the steering column.
9. Position the carpet and insulation around the driver's area.
10. Install the instrument panel knee bolster. Refer to **Knee Bolster Replacement (with RPO SLT)** or **Knee Bolster Replacement (without RPO SLT)** .

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

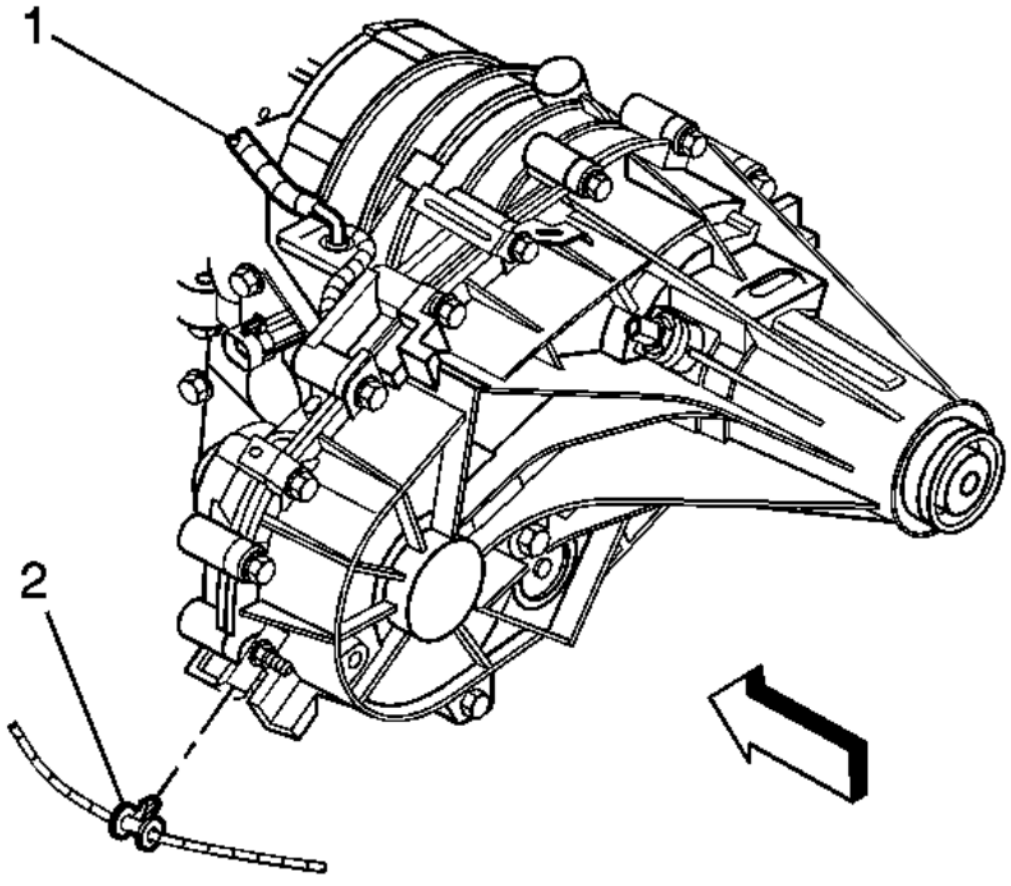


Fig. 53: Cable Clips & Transfer Case, If Equipped
Courtesy of GENERAL MOTORS CORP.

12. Install the cable clips (2) to the transfer case, if equipped.

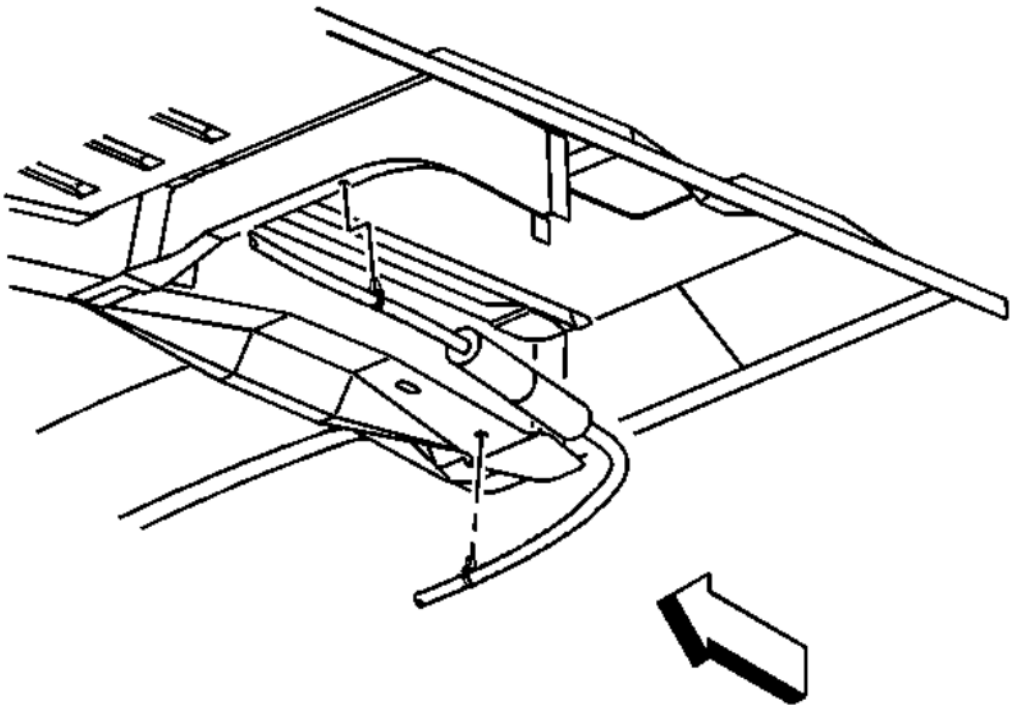


Fig. 54: View Of Cable Clips At Floor Panel Reinforcement
Courtesy of GENERAL MOTORS CORP.

13. Install the cable clips to the floor panel reinforcement.

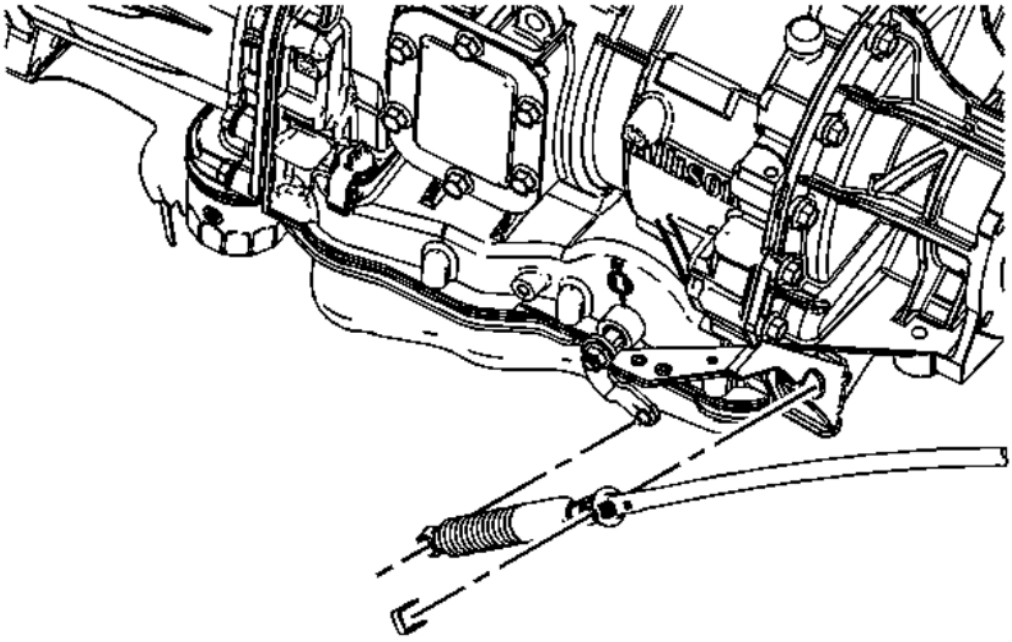


Fig. 55: Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

14. Ensure the transmission manual shaft is positioned in mechanical park.
15. Install the range selector cable to the range selector cable bracket.
16. Install the retainer securing the range selector cable to the bracket.
17. Install the range selector cable end to the transmission range selector lever stud.

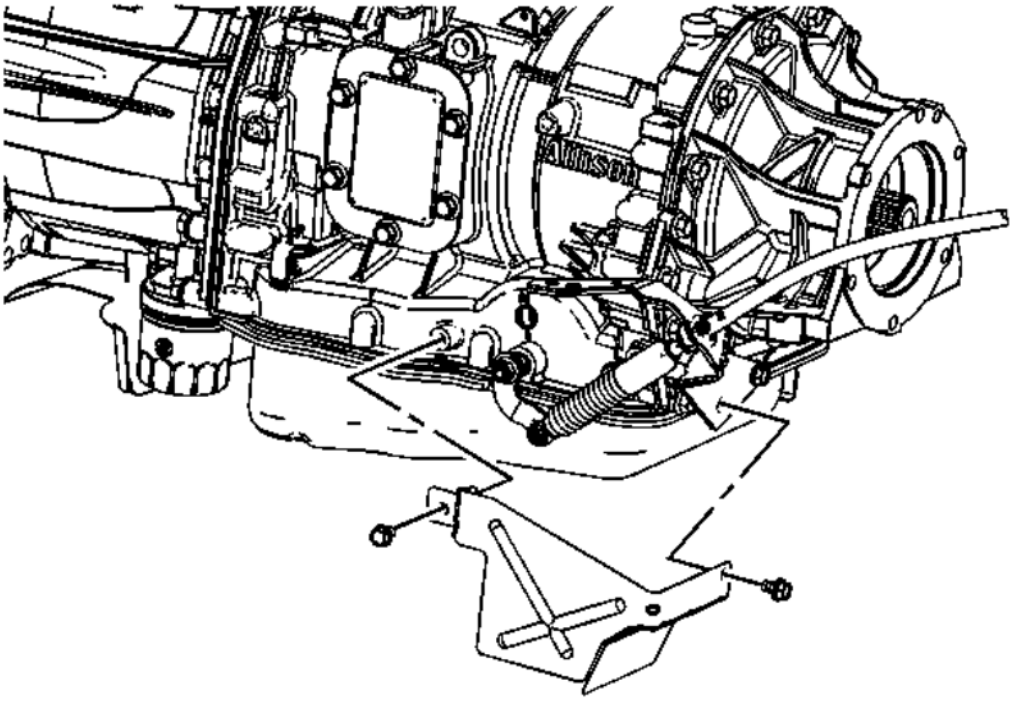


Fig. 56: Range Selector Cable Heat Shield
Courtesy of GENERAL MOTORS CORP.

18. Install the range selector cable heat shield.

NOTE: **Refer to Fastener Notice .**

IMPORTANT: Install bolts by hand then mechanically tighten the front bolt first and the rear bolt last. Failure to tighten the bolts in the specified order will result in misalignment of the heat shield.

19. Install the range selector cable heat shield bolts.
    1. **Tighten:** Tighten the front bolt to 25 N.m (18 lb ft).
    2. **Tighten:** Tighten the rear bolt to 25 N.m (18 lb ft).
20. Lower the vehicle.

21. Test the transmission for proper shift operation.
22. If all of the gear positions cannot be achieved, adjust the cable. Refer to **Range Selector Lever Cable Adjustment**.

TRANSMISSION FLUID COOLER HOSE/PIPE CONNECTOR REPLACEMENT

Removal Procedure

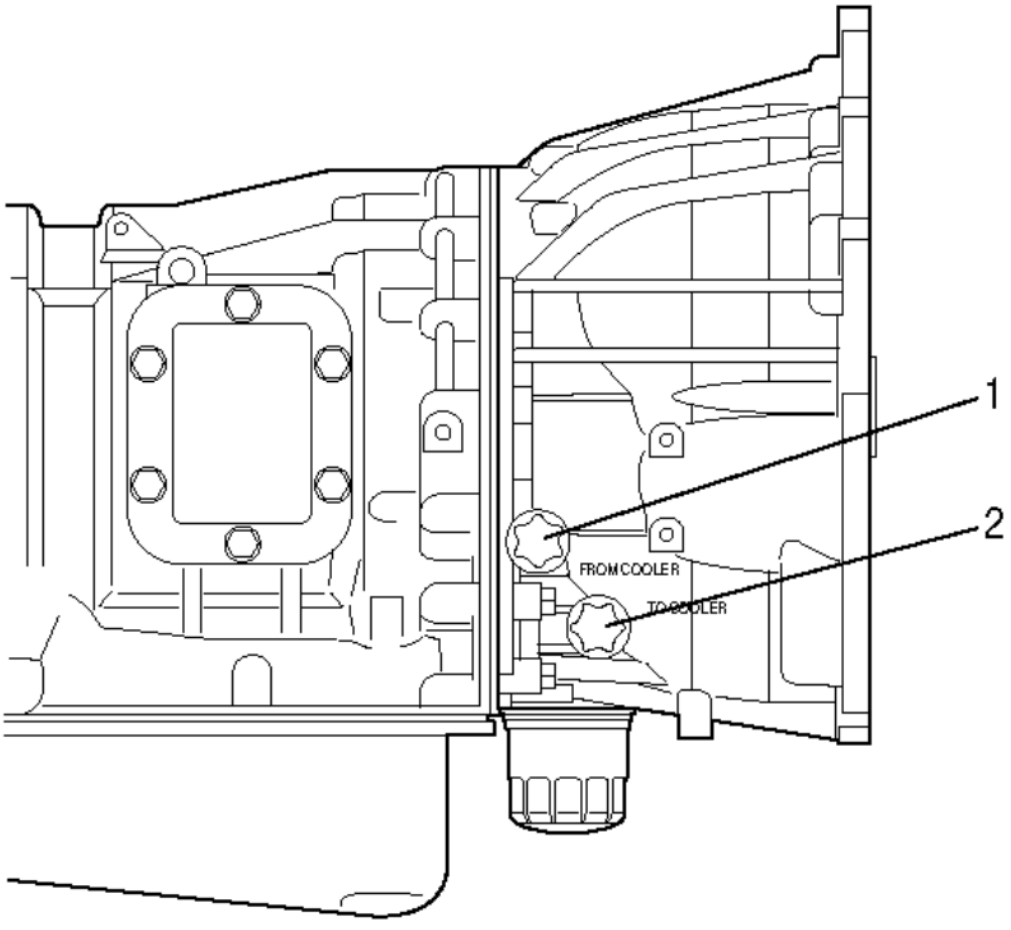


Fig. 57: Transmission Oil Cooler Pipe Connectors
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the hose from the transmission oil cooler pipe connector being replaced.

2. Remove the transmission oil cooler pipe connectors (1) and (2).

Installation Procedure

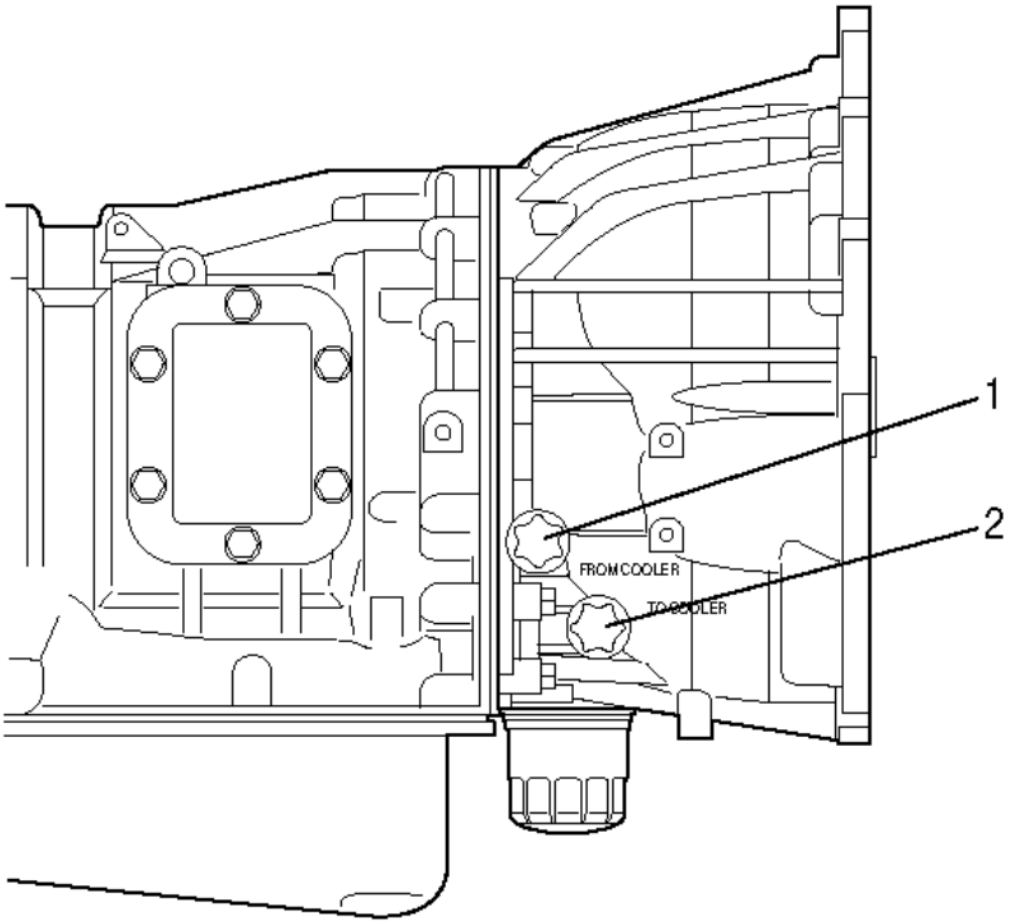


Fig. 58: Transmission Oil Cooler Pipe Connectors
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install new transmission oil cooler pipe connectors (1 and 2).

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

2. Connect the hose to the transmission oil cooler pipe connectors.

TRANSMISSION INTERNAL MODE SWITCH REPLACEMENT

IMPORTANT: The Internal Mode Switch (IMS) is mounted to the manual shift shaft detent lever as an assembly. The components of the detent lever/IMS assembly cannot be individually serviced. When the IMS needs replacing, the entire assembly must be replaced.

Replace the IMS. Refer to **Manual Shift Shaft, Detent Lever, and Position Switch Assembly Replacement**.

AUTOMATIC TRANSMISSION FLUID AND FILTER REPLACEMENT

Removal Procedure

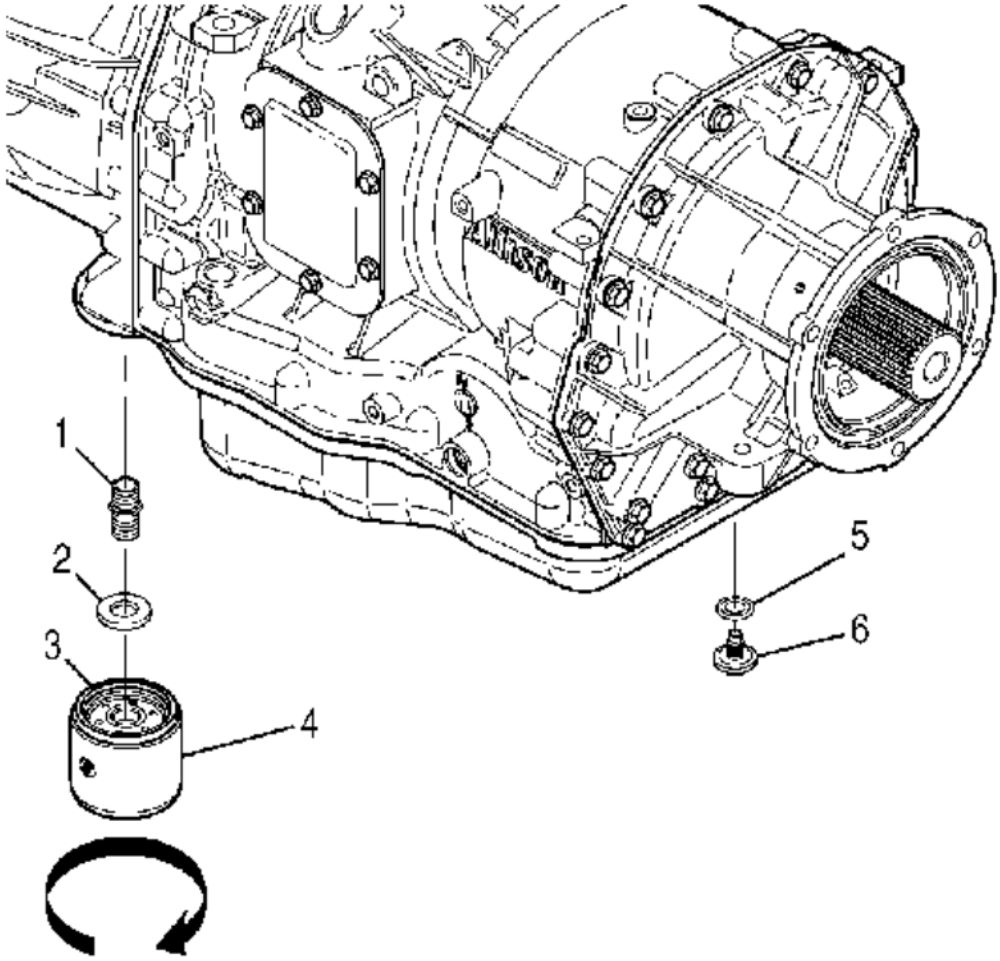


Fig. 59: View Of Magnet, Filter & Adapter, Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT drain the fluid if only the transmission external oil filter is being replaced.

1. Remove the drain plug (6) and drain plug seal (5). Drain the transmission fluid into a suitable container.
2. Inspect the drained fluid. Refer to **Transmission Fluid Check**.

IMPORTANT: Use a standard strap-type filter wrench to remove the transmission external oil filter.

3. Remove the filter (4) by rotating in the counterclockwise direction.
4. Remove the magnet (2) from the filter adapter (1) in the converter housing or from the top of the transmission external oil filter (3).
5. Clean any metal debris from the magnet. Presence of any metal pieces larger than dust may indicate that transmission replacement or overhaul is required.

Installation Procedure

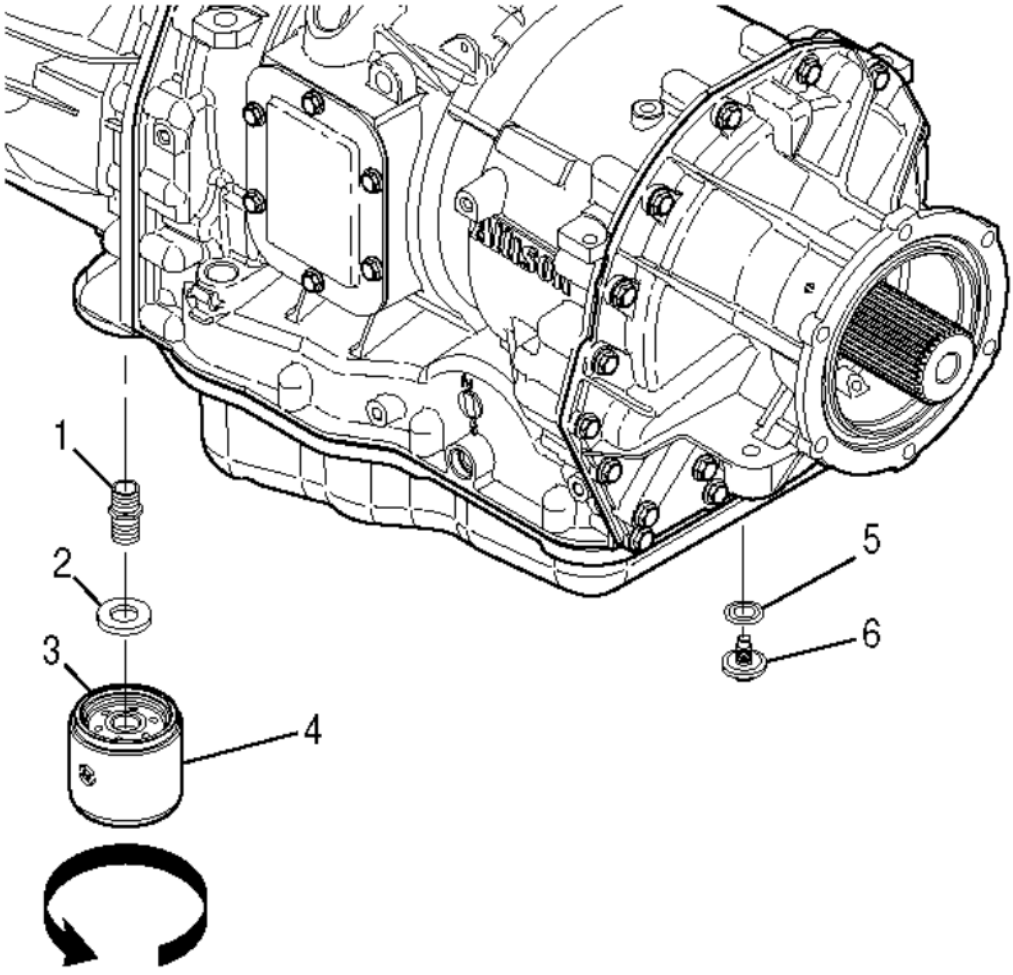


Fig. 60: View Of Magnet, Filter & Adapter, Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

1. Install the magnet (2) onto the filter adapter (1) which is in the converter housing.
2. Lubricate the gasket (3) on the transmission external oil filter with transmission fluid.
3. Install, by hand, the transmission external oil filter (4) until the gasket on the filter touches the converter housing.

NOTE: Turning the transmission external oil filter more than ONE FULL TURN after gasket contact will damage the filter and may cause fluid leakage.

4. Turn the filter ONE FULL TURN ONLY after gasket contact.

NOTE: Refer to Fastener Notice .

5. Install the drain plug (6) and drain plug seal (5).

Tighten: Tighten the drain plug to 35 N.m (26 lb ft).

6. Refill Transmission with DEXRON®VI Automatic Transmission Fluid. Refer to **Fluid Capacity Specifications** .

IMPORTANT: DTC P0701 may often set following fluid service. Cycling the ignition clears the code and allows Drive or Reverse range to be attained.

7. Cycle the ignition until Drive or Reverse range is attained.

IMPORTANT: Fluid remains in the external circuits and transmission cavities after draining the transmission.

8. Check the transmission fluid level. Refer to **Transmission Fluid Check**.

OIL PAN REPLACEMENT

Removal Procedure

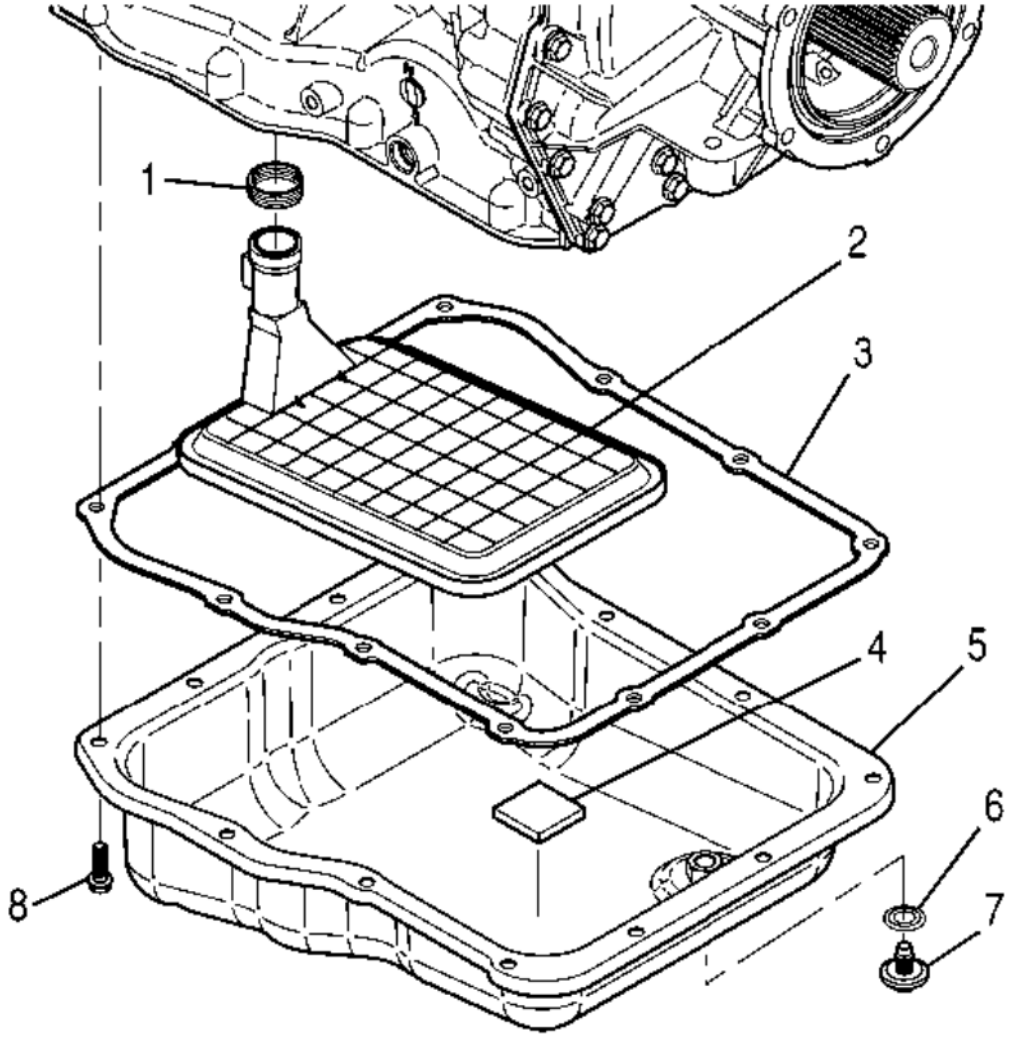


Fig. 61: Drain Plug, Drain Plug Seal, Filter & Oil Pan
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: It would be helpful to record the amount of transmission fluid lost during this procedure. Fluid in good condition, drained into a clean container, may be reused.

2. Remove the drain plug (7) and drain plug seal (6) from the oil pan (5). Allow the fluid to drain into a suitable container.
3. Inspect the drained fluid. Refer to **Transmission Fluid Check**
4. Remove 12 bolts (8). Hold the oil pan in position as the last bolt is removed.
5. Remove oil pan (5) and gasket (3).
6. Inspect magnet (4). Excessive metallic particles or large metallic particles may indicate need for overhaul or replacement of the transmission.

IMPORTANT: DO NOT remove the transmission internal oil filter or seal if only replacing the oil pan or oil pan gasket.

7. Remove the transmission internal oil filter (2) by pulling straight down where the suction tube is seated in the transmission case.
8. Remove the transmission internal oil filter seal (1) from the filter or from the seal bore in the transmission case. Discard the old seal. Discard the filter, if the filter is being replaced.

Installation Procedure

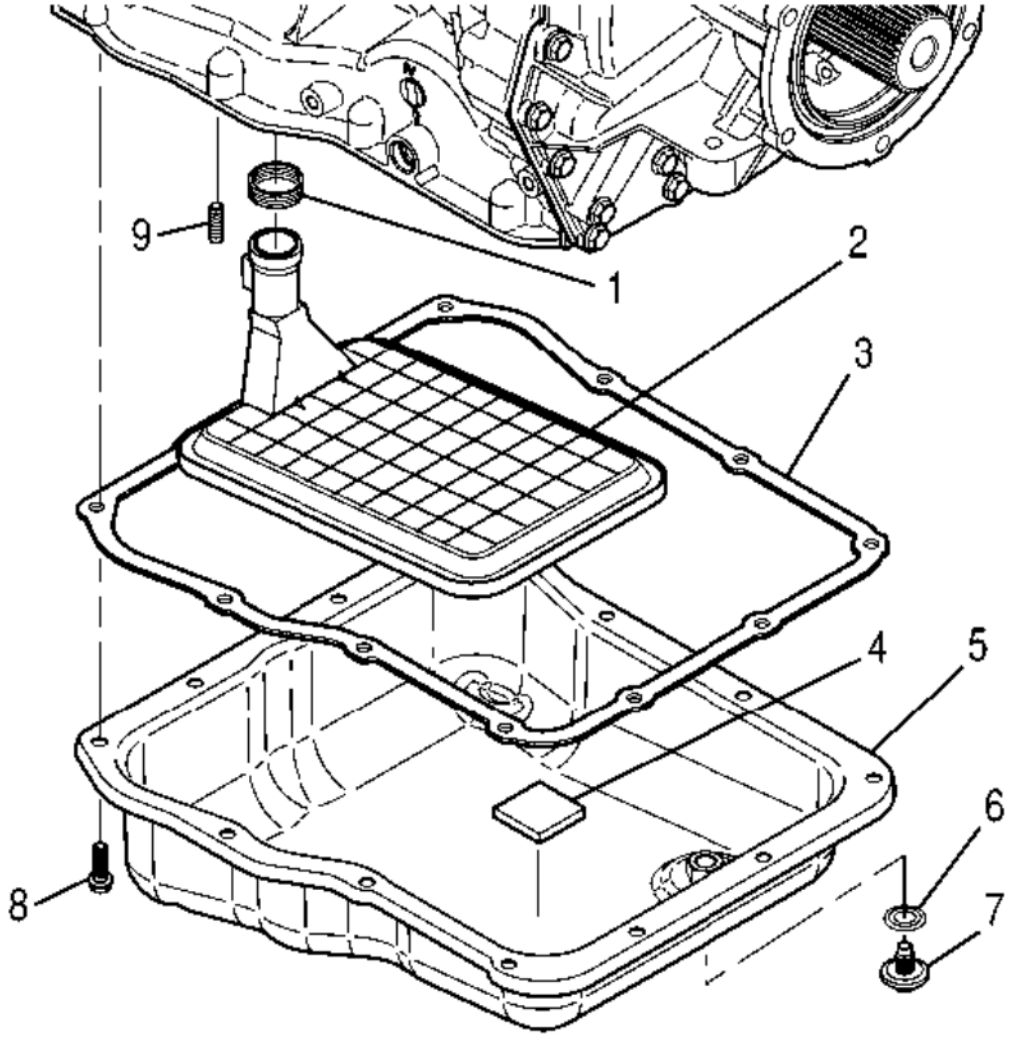


Fig. 62: Drain Plug, Drain Plug Seal, Filter & Oil Pan
Courtesy of GENERAL MOTORS CORP.

1. Remove all gasket material from the transmission case. Remove any scratches from the transmission case that would cause a split-line leak.
2. Place a new seal (1) on the tube of the transmission internal oil filter (2), if the filter was removed. Be sure the seal locates against the shoulder on the internal oil filter tube.
3. Push the filter (2) and seal (1) into the seal bore in the transmission case. Position the transmission internal oil filter properly.

4. Install 2 headless guide bolts (9), M8 x 1.25, into opposite corners of the oil pan mounting face on the transmission case.
5. Place a gasket (3) on the oil pan and align the bolt holes.
6. Slide the gasket (3) and oil pan (5) over the guide bolts and hold them in place while installing 2 bolts (8) to hold the parts in place.

NOTE: Refer to Fastener Notice .

7. Remove the guide bolts.
8. Install the 10 remaining oil pan bolts (8).

Tighten: Tighten the bolts to 27 N.m (20 lb ft).

NOTE: Refer to Component Fastener Tightening Notice .

9. Install the drain plug (7) and drain plug seal (6).

Tighten: Tighten the drain plug to 35 N.m (26 lb ft).

10. Lower the vehicle.

NOTE: Use only clean and approved transmission fluid.

11. Refill the transmission with DEXRON®VI Automatic Transmission Fluid. Refer to **Fluid Capacity Specifications** .

IMPORTANT: Remember fluid remains in the external circuits and transmission cavities after draining the transmission.

12. Check the transmission fluid level. Refer to **Transmission Fluid Check**.

TRANSMISSION FLUID FILLER TUBE AND SEAL REPLACEMENT

Removal Procedure

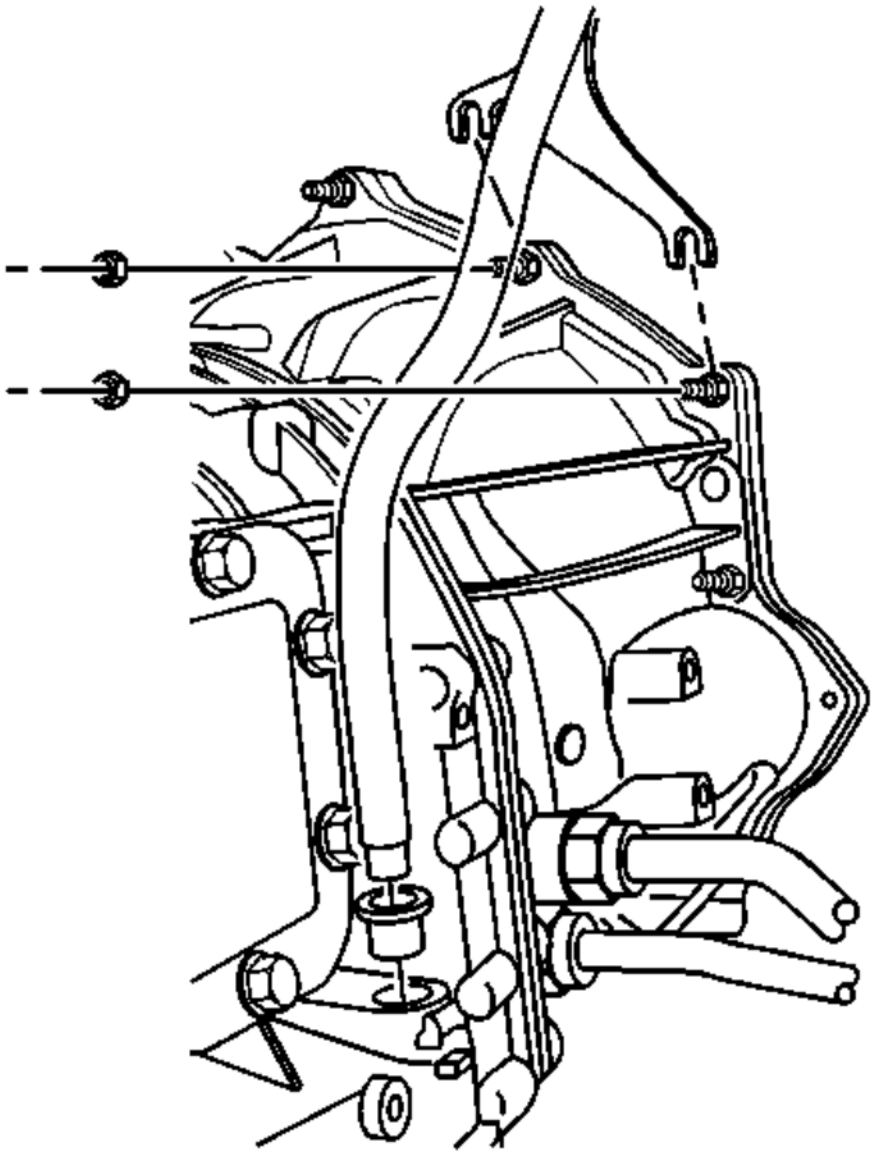


Fig. 63: Fill Tube Nuts
Courtesy of GENERAL MOTORS CORP.

1. The transmission case has provisions that enable the fill tube to be installed on either the right or left side of the transmission. Proceed to step 9 if servicing the plug and/or seal opposite the fill tube.

2. If the vehicle is equipped with a diesel engine, the transmission must be removed to service the fill tube and/or seal. Refer to **Transmission Replacement**.
3. Remove the transmission fluid level indicator.
4. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Remove the heat shield. Refer to **Transmission Heat Shield Replacement**.
6. Remove the fill tube nuts.
7. Place a drain pan under the transmission to catch any dripping fluid.
8. Loosen the fill tube from the transmission.
9. Remove the fill tube and seal from the vehicle.

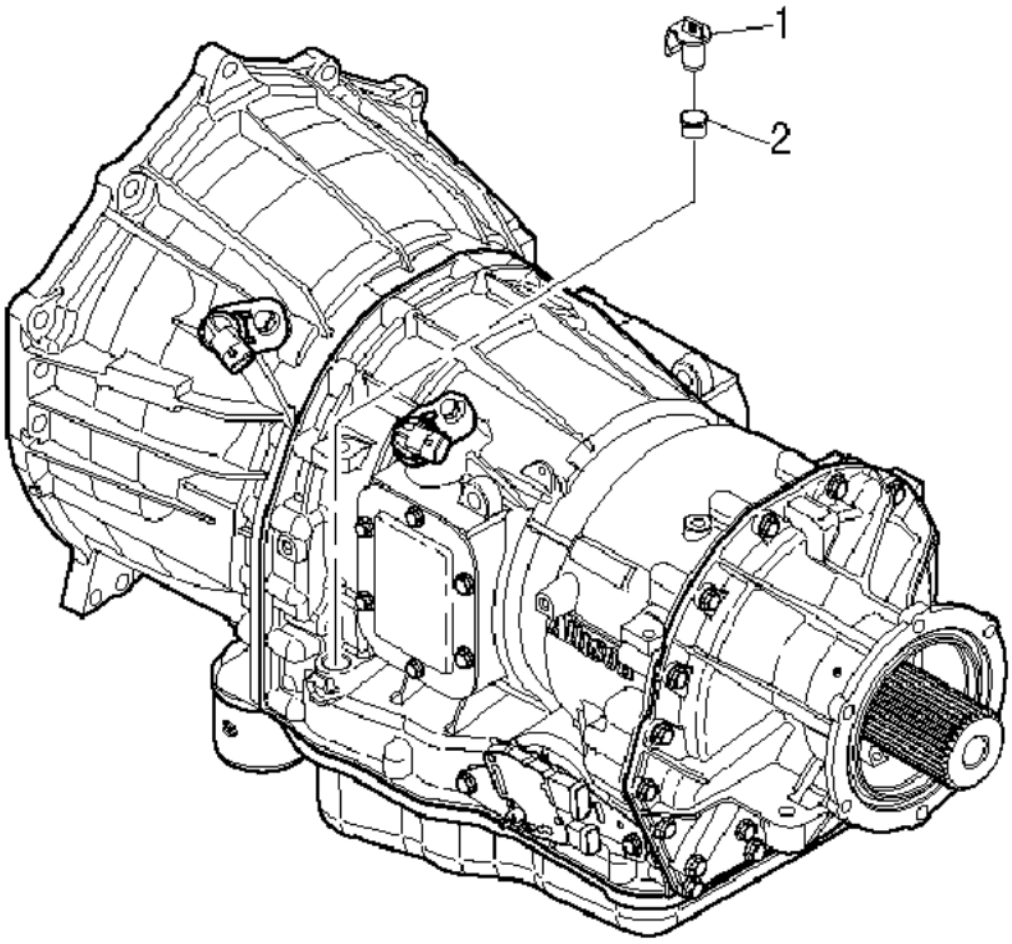


Fig. 64: Fill Tube Plug & Seal
Courtesy of GENERAL MOTORS CORP.

10. Remove the fill tube plug (1).
11. Remove the fill tube plug seal (2).

Installation Procedure

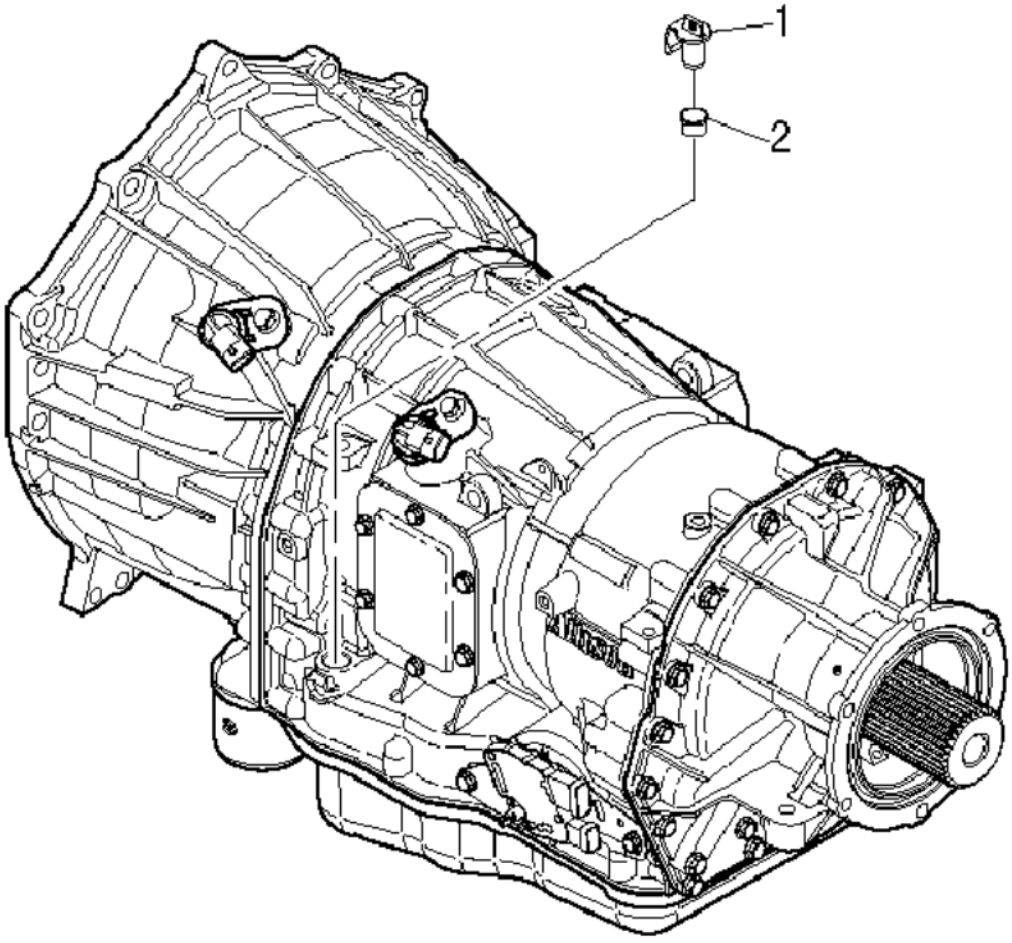


Fig. 65: Fill Tube Plug & Seal
Courtesy of GENERAL MOTORS CORP.

1. Install a new fill tube plug seal (2) into the main housing.

2. Align the tab on the fill tube plug (1) with the tang on the main housing.
3. Install the fill tube plug (1). Press the plug into the seal (2) until the tab on the fill tube plug locks into place in the notch on the main housing.

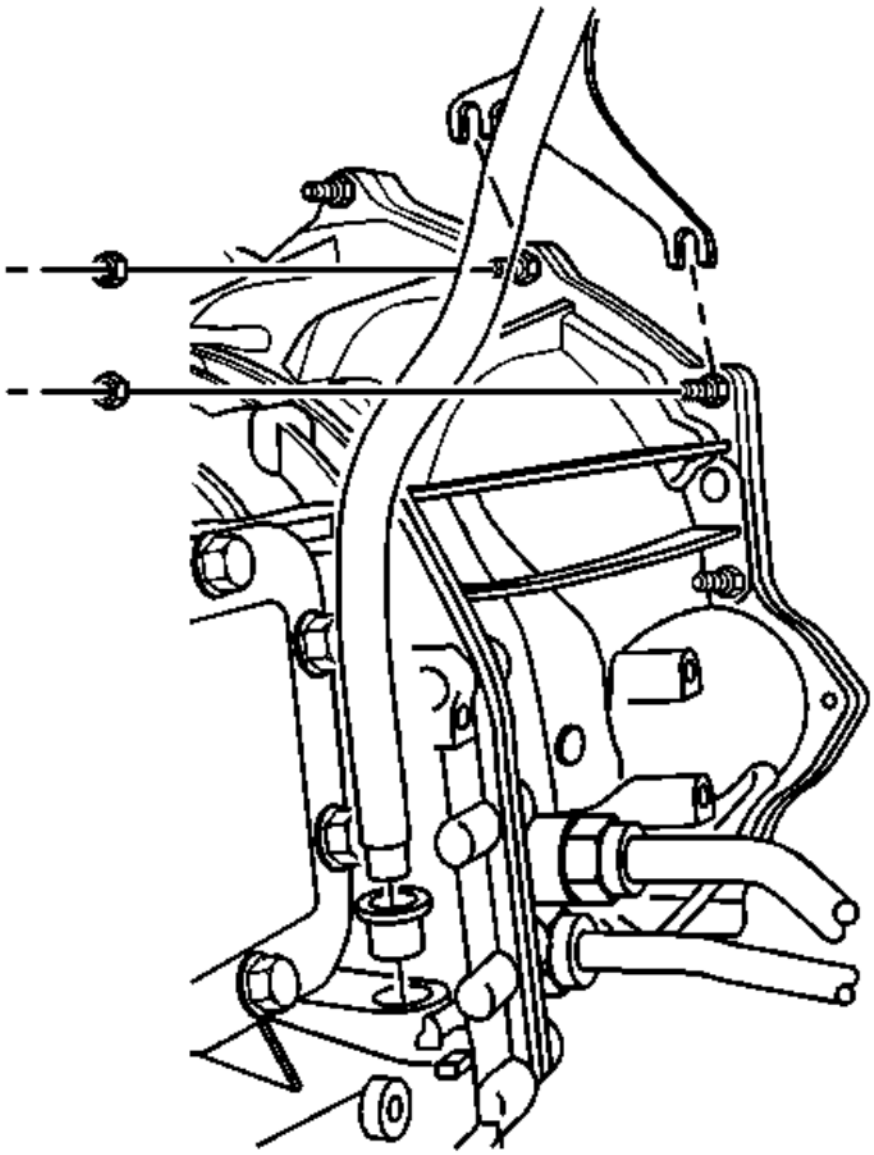


Fig. 66: Fill Tube Nuts

Courtesy of GENERAL MOTORS CORP.

4. Install a NEW fill tube seal.
5. Install the fill tube. Ensure that the fill tube bracket is positioned properly on the studs.

NOTE: Refer to Fastener Notice .

6. Install the fill tube nuts.

   Tighten: Tighten the nuts to 18 N.m (13 lb ft).

7. Install the heat shield. Refer to **Transmission Heat Shield Replacement**.
8. Lower the vehicle.
9. Fill the transmission to the proper level with approved fluid.

SPEED SENSOR REPLACEMENT

Removal Procedure

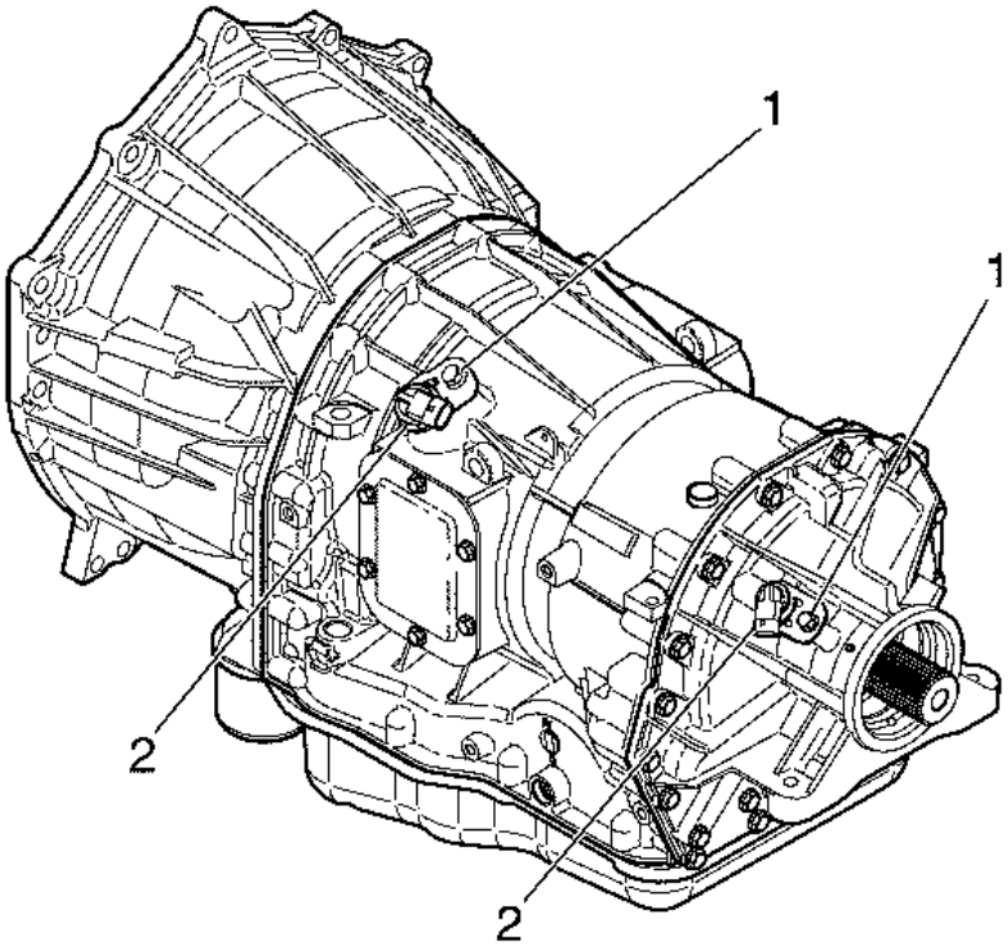


Fig. 67: Identifying Speed Sensors
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

1. Be sure the vehicle ignition is turned off.
2. Disconnect the external wiring harness from the speed sensor.
3. Remove the bolt (1) from the speed sensor and carefully remove the speed sensor (2).

Installation Procedure

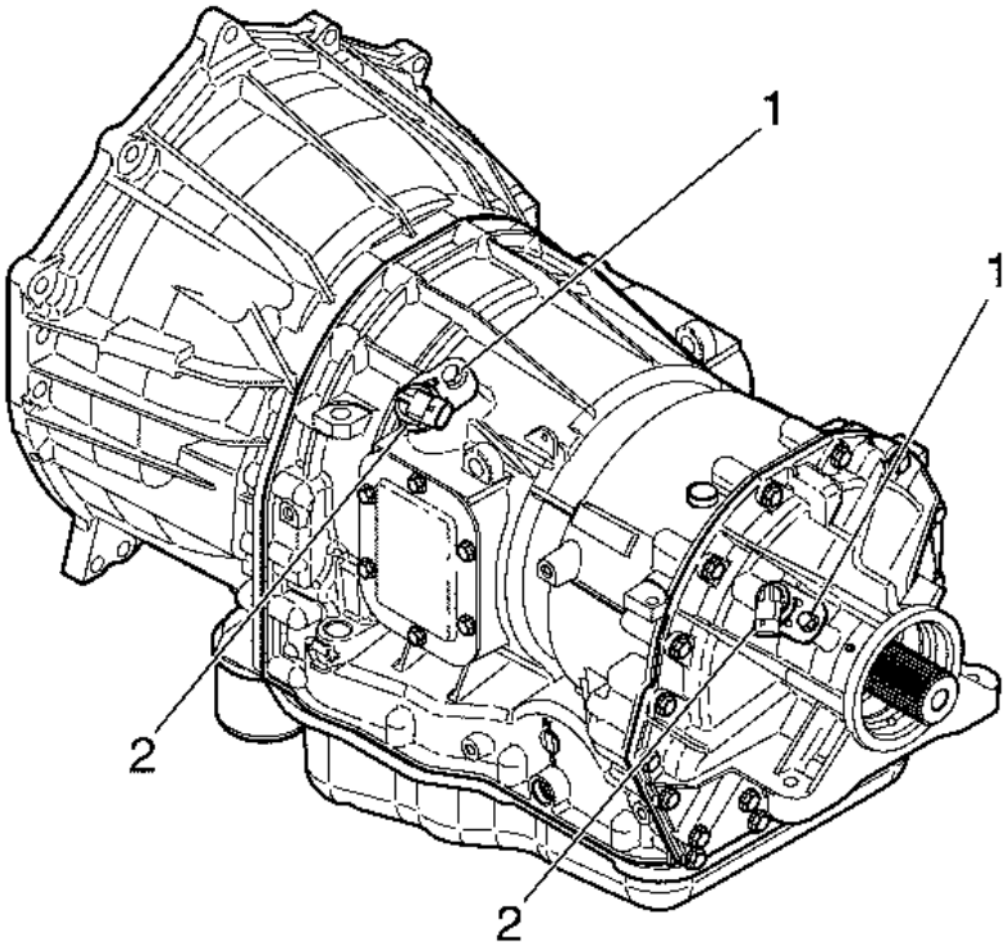


Fig. 68: Identifying Speed Sensors
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not rotate the sensor in its retaining bracket. Changing the sensor/bracket orientation may cause improper operation.

1. Install a new a O-ring on the speed sensor (2). Lubricate the O-ring with clean transmission fluid.
2. Install the new speed sensor (2) into the speed sensor bore. Align the hole in the retaining bracket with the bolt hole in the speed sensor boss.

NOTE: Refer to Fastener Notice .

3. Install the speed sensor bolt (1).

   Tighten: Tighten bolt to 12 N.m (108 lb in).

4. Reconnect the external wiring harness to the speed sensor.

TRANSMISSION FLUID COOLER HOSE/PIPE REPLACEMENT

Removal Procedure

1. Remove the radiator grille. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .

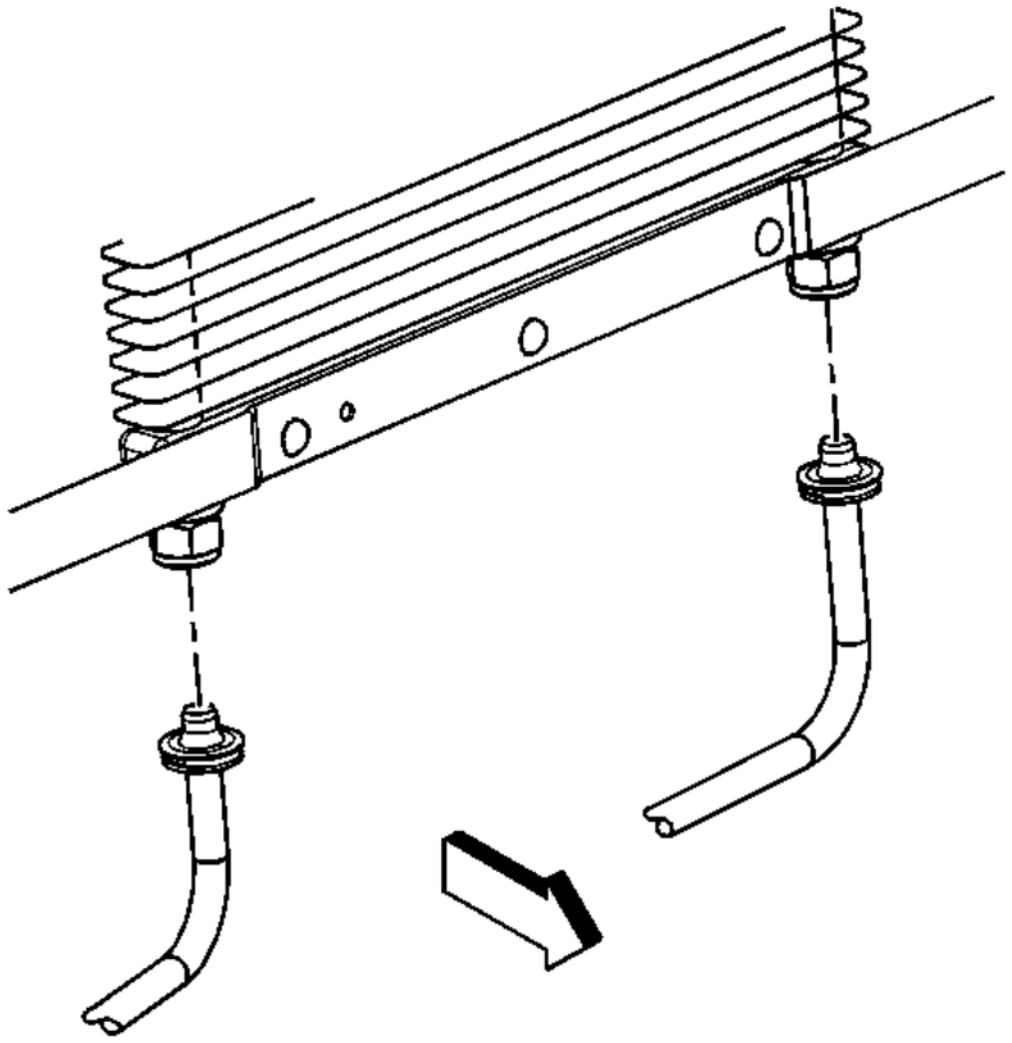


Fig. 69: View Of Transmission Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

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** .

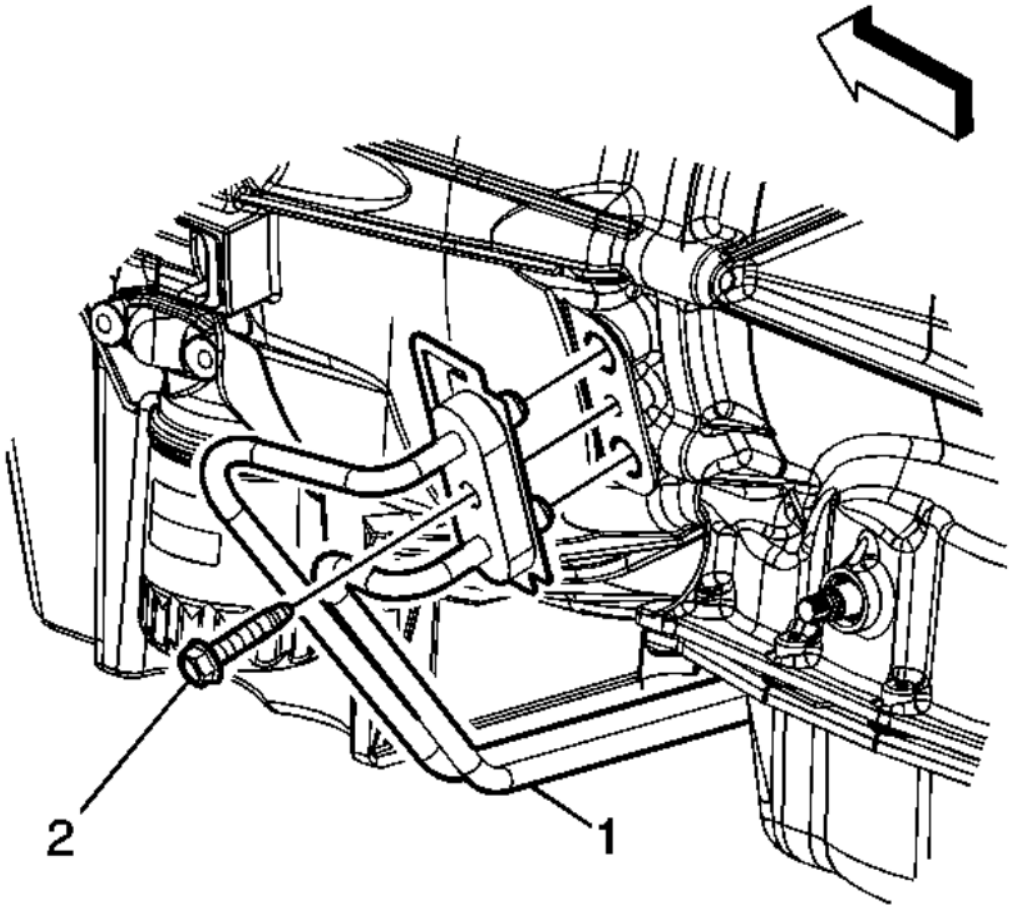


Fig. 70: View Of Oil Cooling Lines & Bolt
Courtesy of GENERAL MOTORS CORP.

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

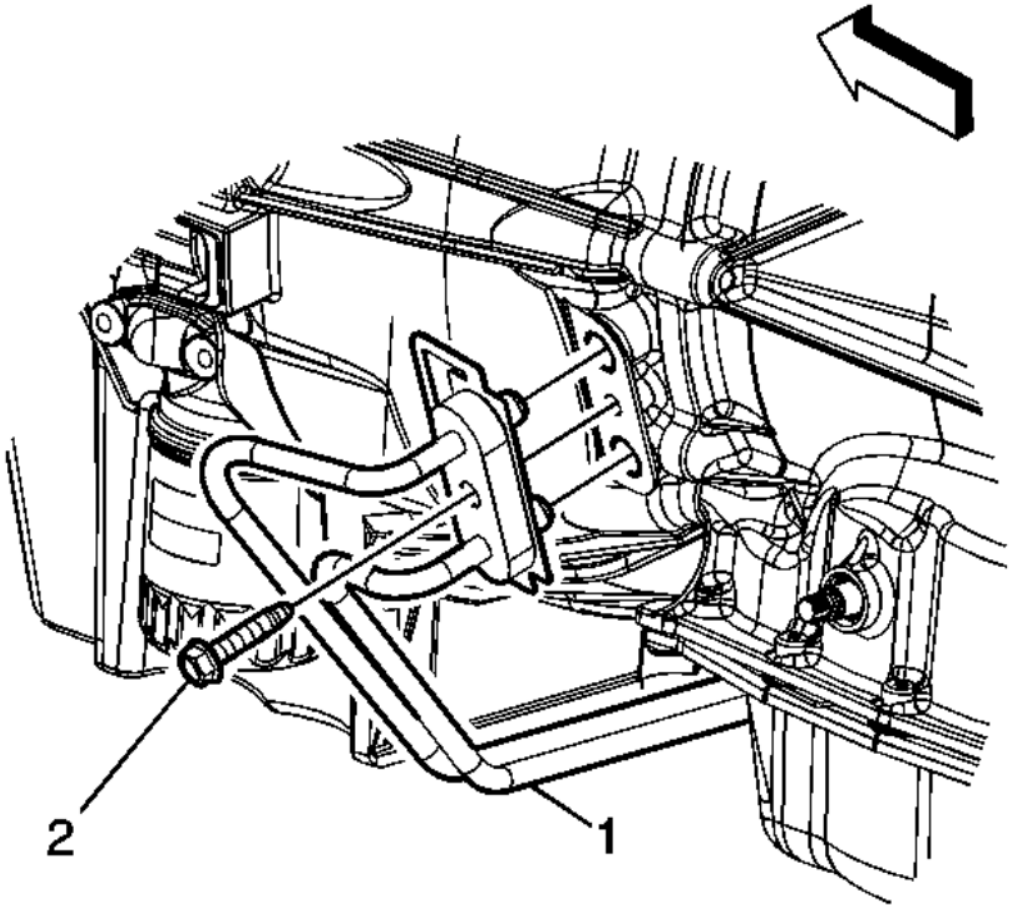


Fig. 71: View Of Oil Cooling Lines & Bolt
Courtesy of GENERAL MOTORS CORP.

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** .

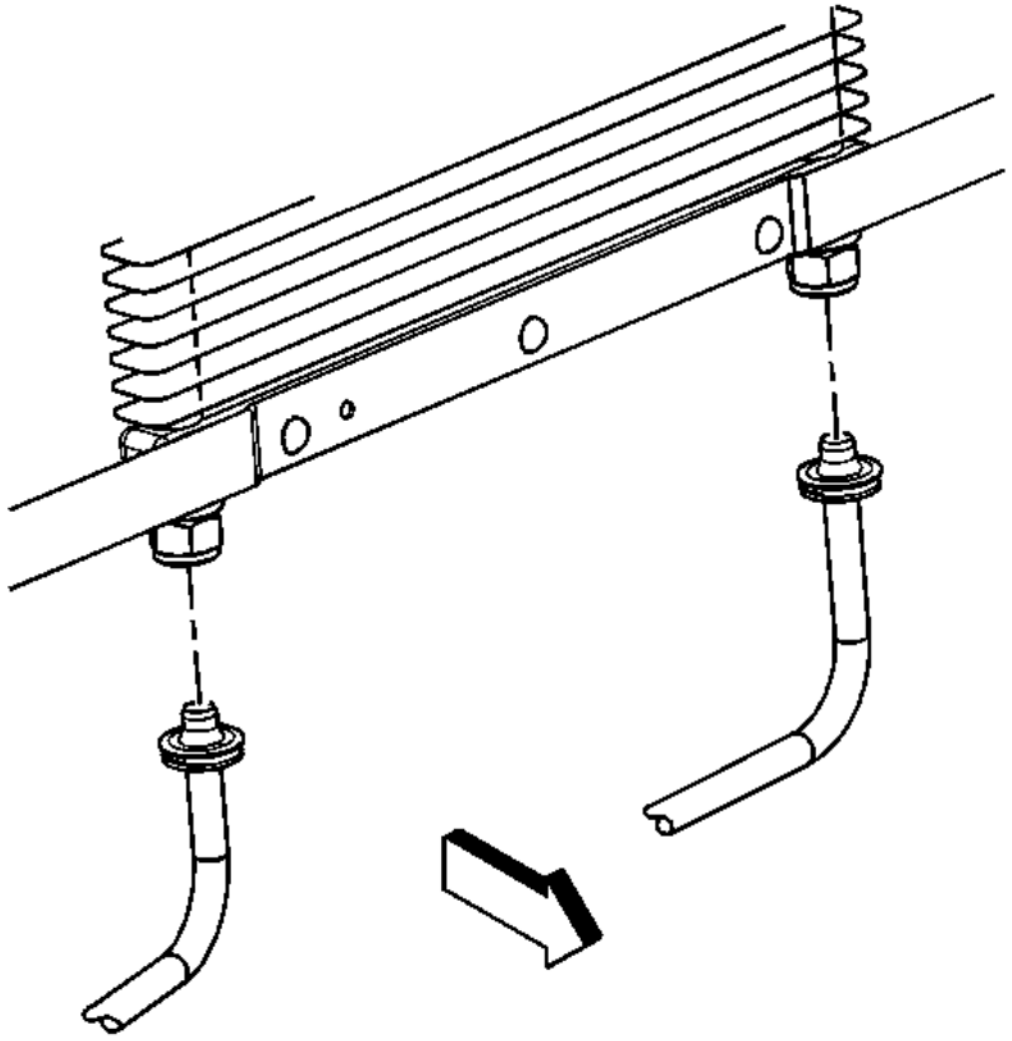


Fig. 72: View Of Transmission Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

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 radiator grille. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .

TRANSMISSION FLUID AUXILIARY COOLER REPLACEMENT

Removal Procedure

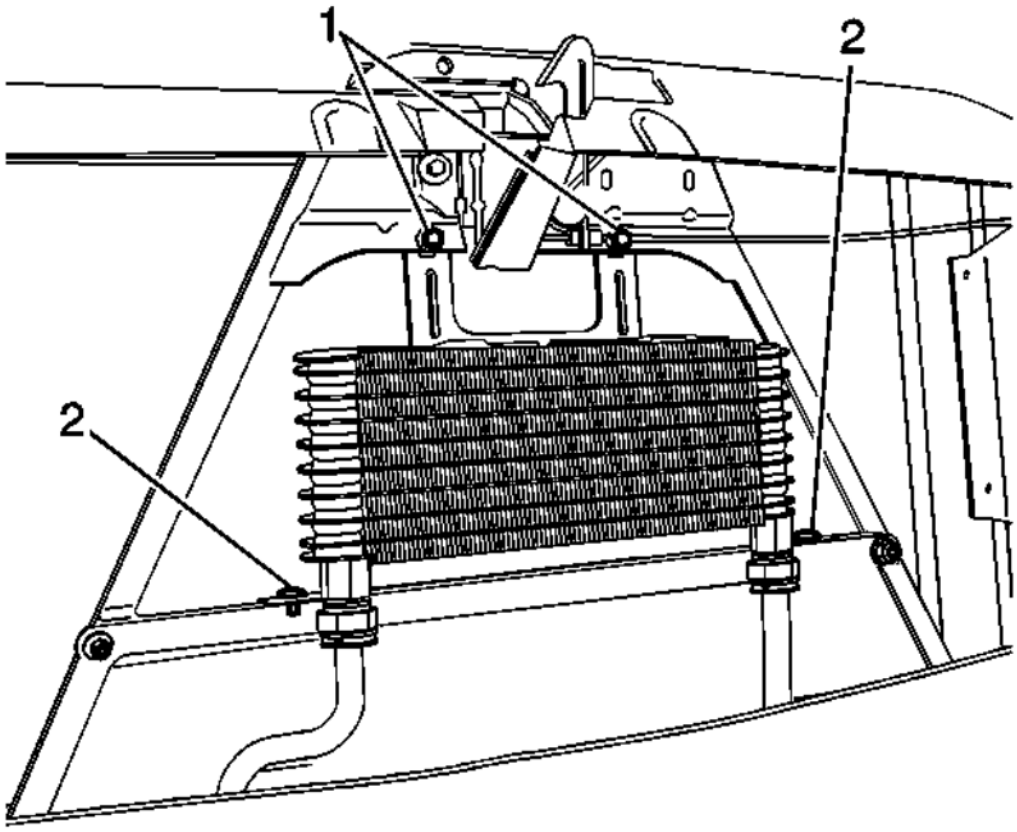


Fig. 73: View Of Auxiliary Oil Cooler, Bolts & Push Pins
Courtesy of GENERAL MOTORS CORP.

1. Remove the radiator grille. 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 Replacement**.
4. Remove the auxiliary oil cooler bolts (1) and push pins (2).
5. Remove the auxiliary oil cooler from the vehicle.

Installation Procedure

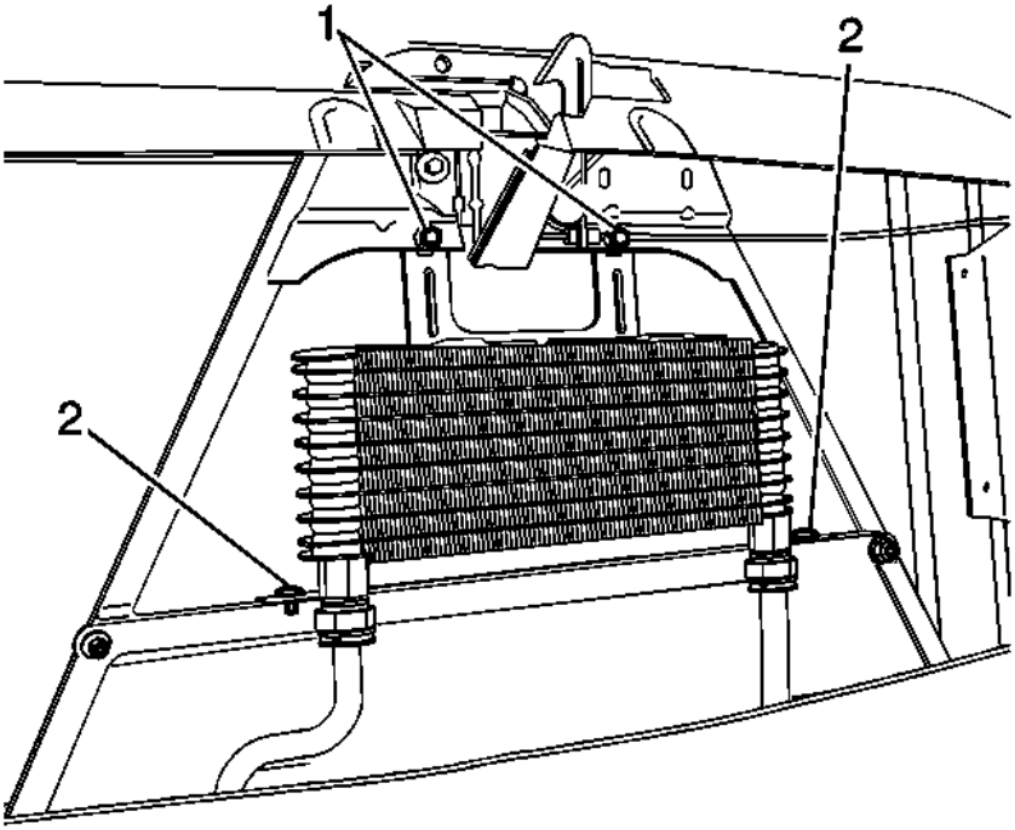


Fig. 74: View Of Auxiliary Oil Cooler, Bolts & Push Pins
Courtesy of GENERAL MOTORS CORP.

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 (106 lb in).

3. Connect the transmission oil cooler lines to the auxiliary cooler. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement**.
4. Install the radiator grille. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .
5. Check and add transmission fluid as necessary.

TRANSMISSION HEAT SHIELD REPLACEMENT

Removal Procedure

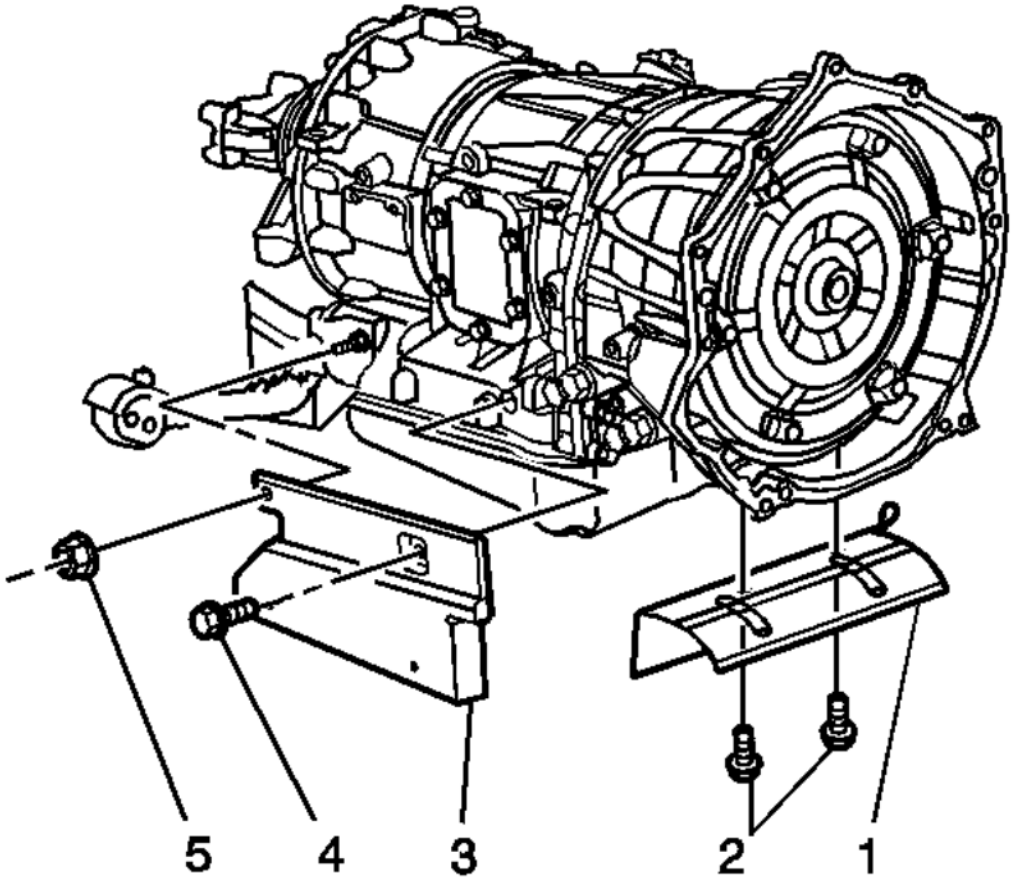


Fig. 75: Heat Shields
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the front heat shield bolts (2).
3. Remove the front heat shield (1).
4. Remove the side heat shield bolt (4) and nut (5).
5. Remove the side heat shield (3).

Installation Procedure

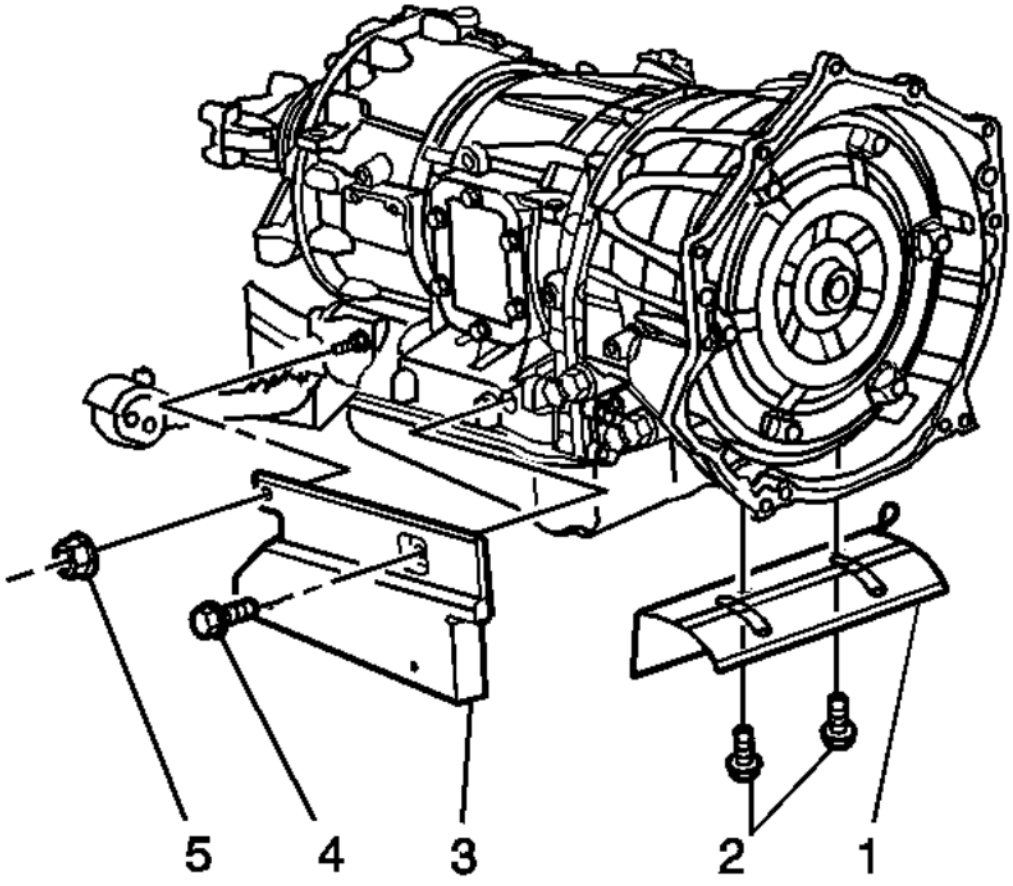


Fig. 76: Heat Shields
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the side heat shield (3).
2. Install the side heat shield bolt (4) and nut (5).

Tighten:

- Tighten the bolt (4) to 17 N.m (13 lb ft).
- Tighten the nut (5) to 25 N.m (18 lb ft).

3. Install the front heat shield (1).

4. Install the front heat shield bolts (2).

   Tighten: Tighten the bolts (2) to 17 N.m (13 lb ft).

5. Lower the vehicle.

CONTROL VALVE BODY REPLACEMENT

Tools Required

- **J 44247** Internal Wiring Harness Installer. See **Special Tools**.
- **J 44257** Main Wiring Harness Connector Remover

Removal Procedure

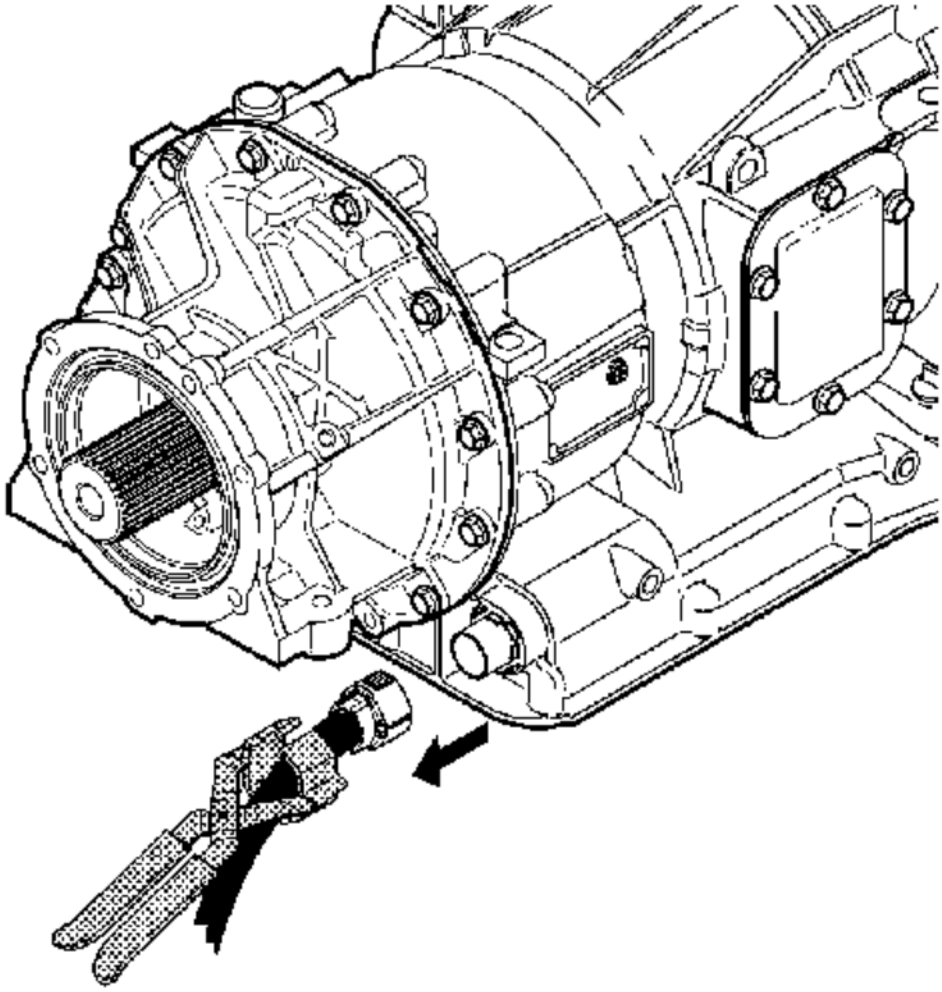


Fig. 77: Transmission Rear Electrical Connector
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

1. Disconnect the external wiring harness from the transmission main connector. Use **J 44257** if the connector is not easily accessible.
2. Remove the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.

IMPORTANT: The transmission main connector is actually one end of the internal harness that protrudes through the transmission case.

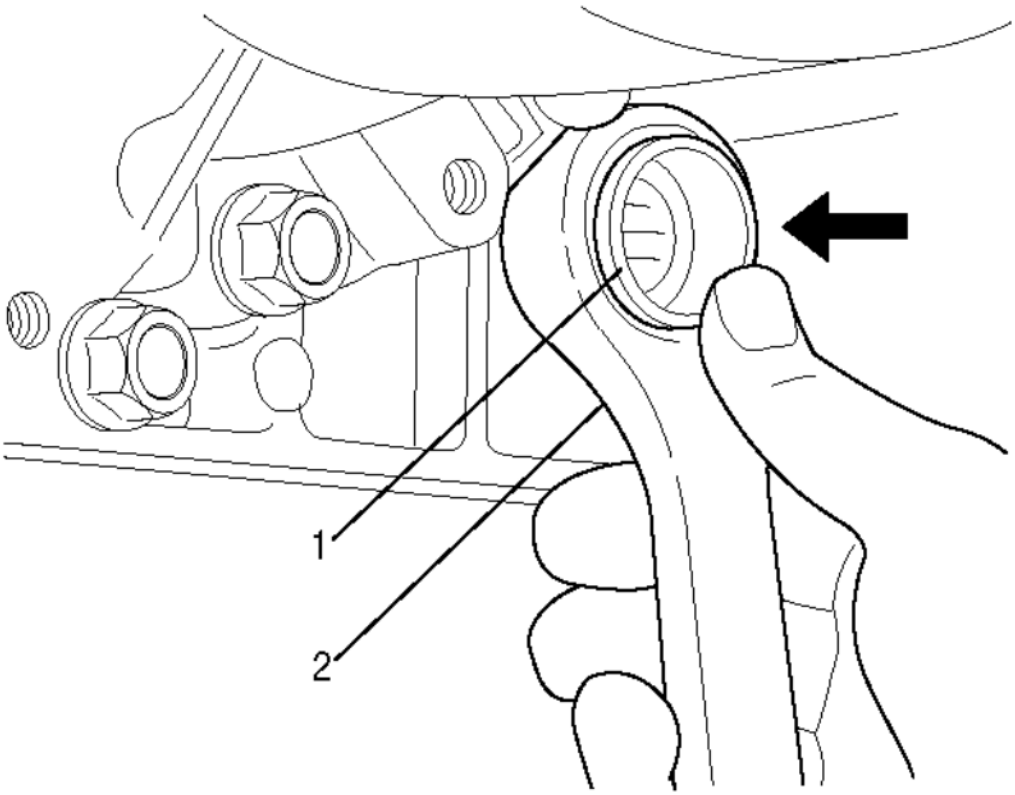


Fig. 78: Placing 30 mm 12-Point Deep Socket Or Box-End Over Connector
Courtesy of GENERAL MOTORS CORP.

3. Place a 30 mm (1 3/16 in) 12-point deep socket or box-end (2) over the connector (1).
4. Push inward on the socket or wrench to release the retainer feet that attach the connector (1) to the transmission case.
5. Remove the wrench. Push inward on the electrical connector to separate it from the transmission case. This allows the internal wiring harness to remain with the control valve assembly when removed.

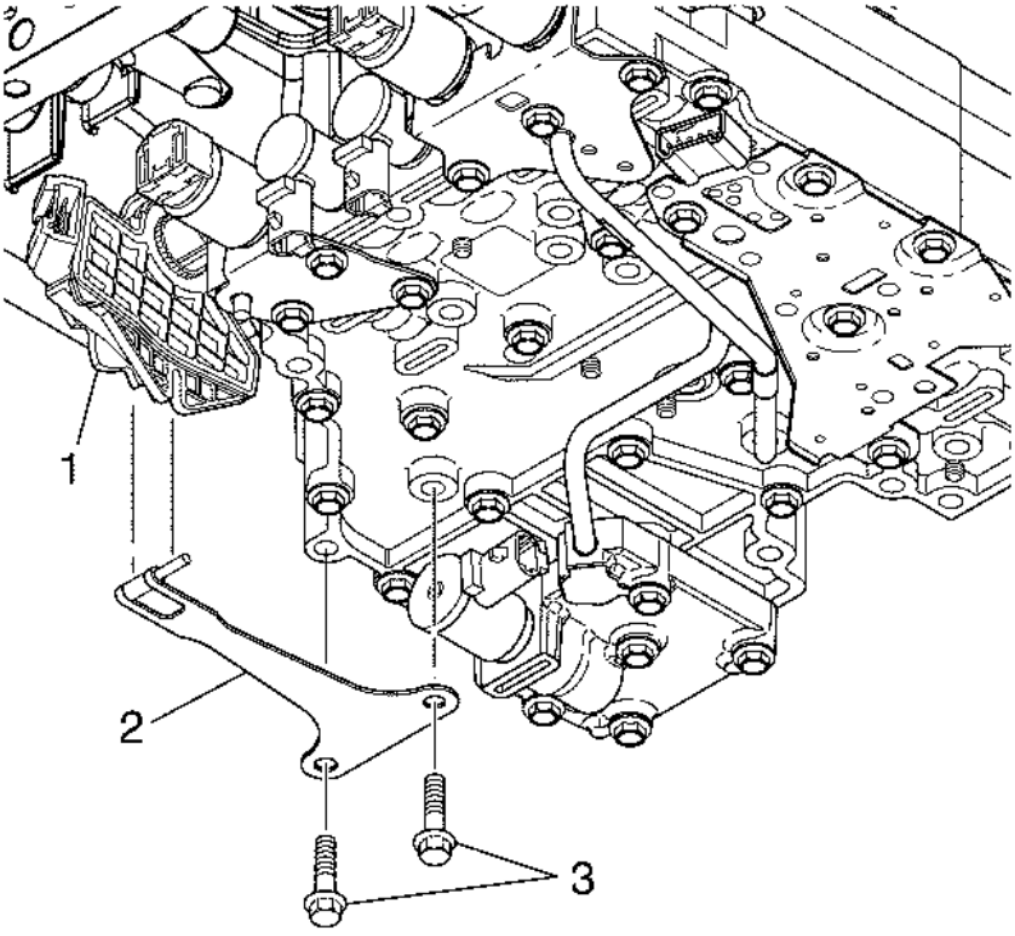


Fig. 79: Detent Spring Assembly
Courtesy of GENERAL MOTORS CORP.

6. Remove the 2 detent spring bolts (3). Remove the detent spring assembly (2).
7. Disconnect the internal wiring harness from the detent lever/IMS assembly.

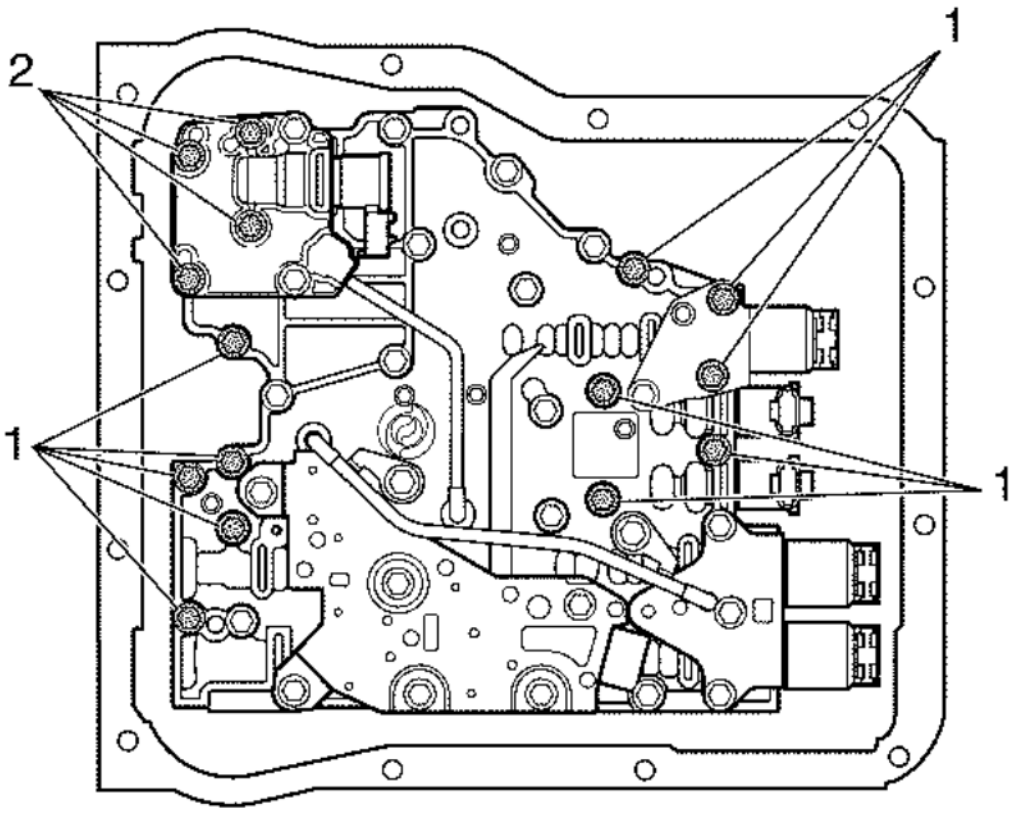


Fig. 80: Control Valve Assembly Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: As the control valve assembly is removed, be careful not to lose the manual selector valve pin or allow the manual selector valve to slide out of the control valve assembly.

8. Remove 10 bolts at locations marked (1) and 4 bolts at locations marked (2). Support the control valve assembly, about 10 pounds, and remove the last bolt marked (1).

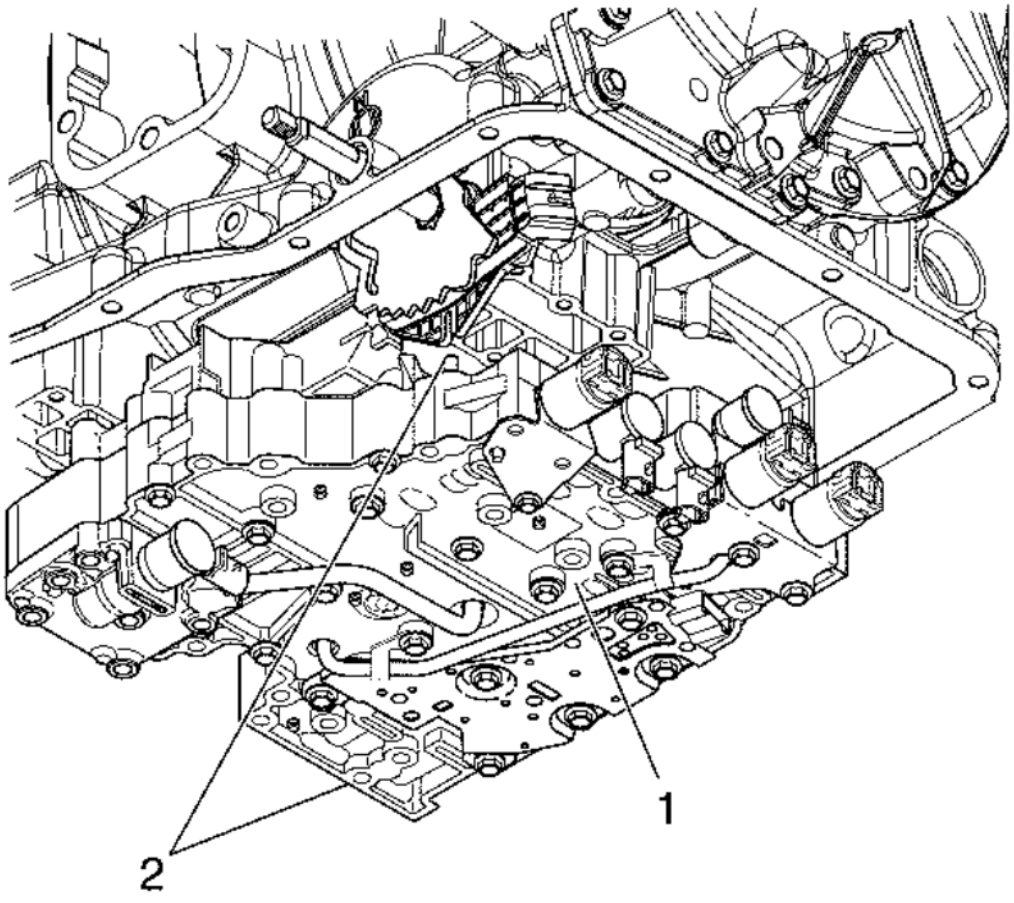


Fig. 81: View Of Control Valve Assembly & Locating Pins
Courtesy of GENERAL MOTORS CORP.

9. Lower the control valve assembly (1) to clear the locating pins (2) in the transmission case.

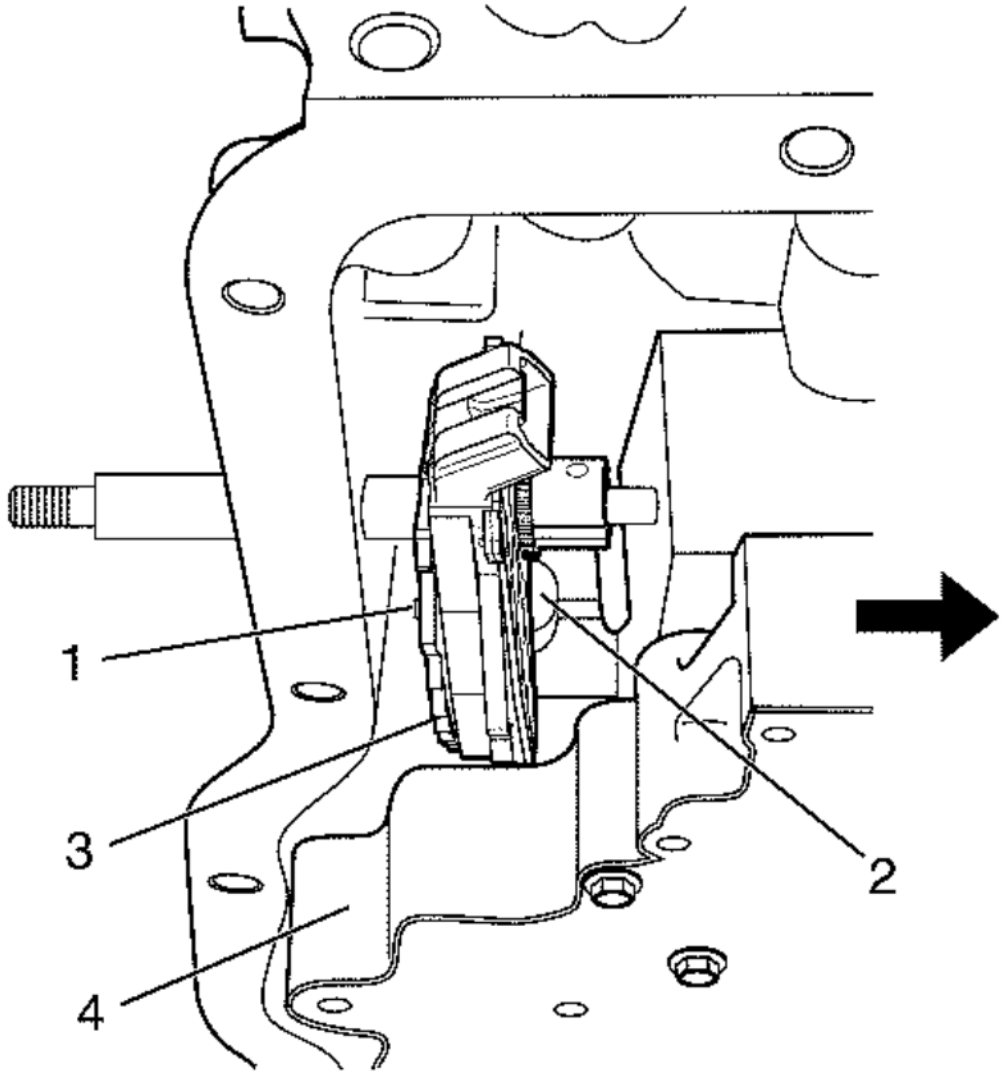


Fig. 82: Moving Control Valve Assembly Sideways To Clear Manual Selector Valve
Courtesy of GENERAL MOTORS CORP.

10. Move the control valve assembly (4) sideways to disengage pin (1) in the manual selector valve (2) from the slot in detent lever (3). Remove the control valve assembly (4).

Installation Procedure

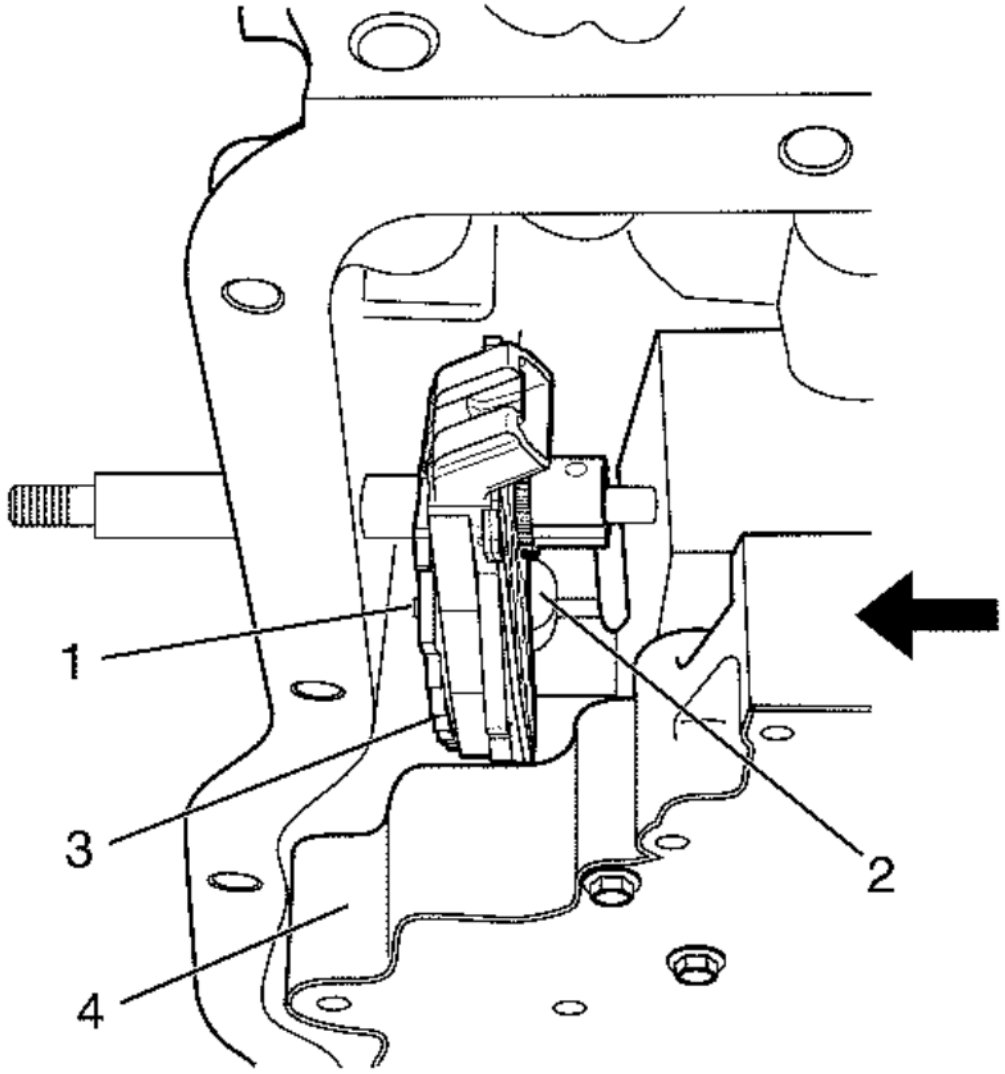


Fig. 83: Positioning Control Valve Assembly To Engage Manual Selector Valve Pin
Courtesy of GENERAL MOTORS CORP.

1. Move the control valve assembly (4) into position under the transmission case. Engage the pin (1) in the manual selector valve (2) into the slot in the detent lever (3).

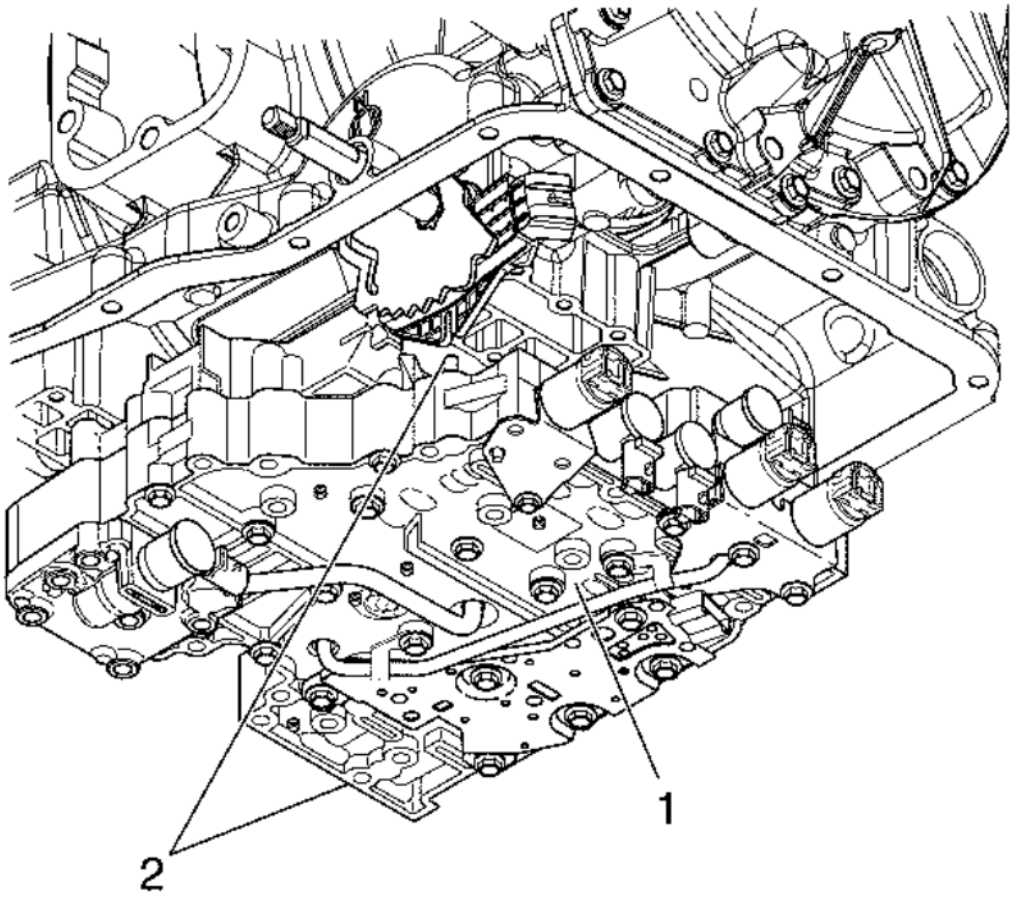


Fig. 84: View Of Control Valve Assembly & Locating Pins
Courtesy of GENERAL MOTORS CORP.

2. Align control valve assembly (1) with the locating pins (2) in the transmission case. Seat the control valve assembly against the transmission case and hold the position.

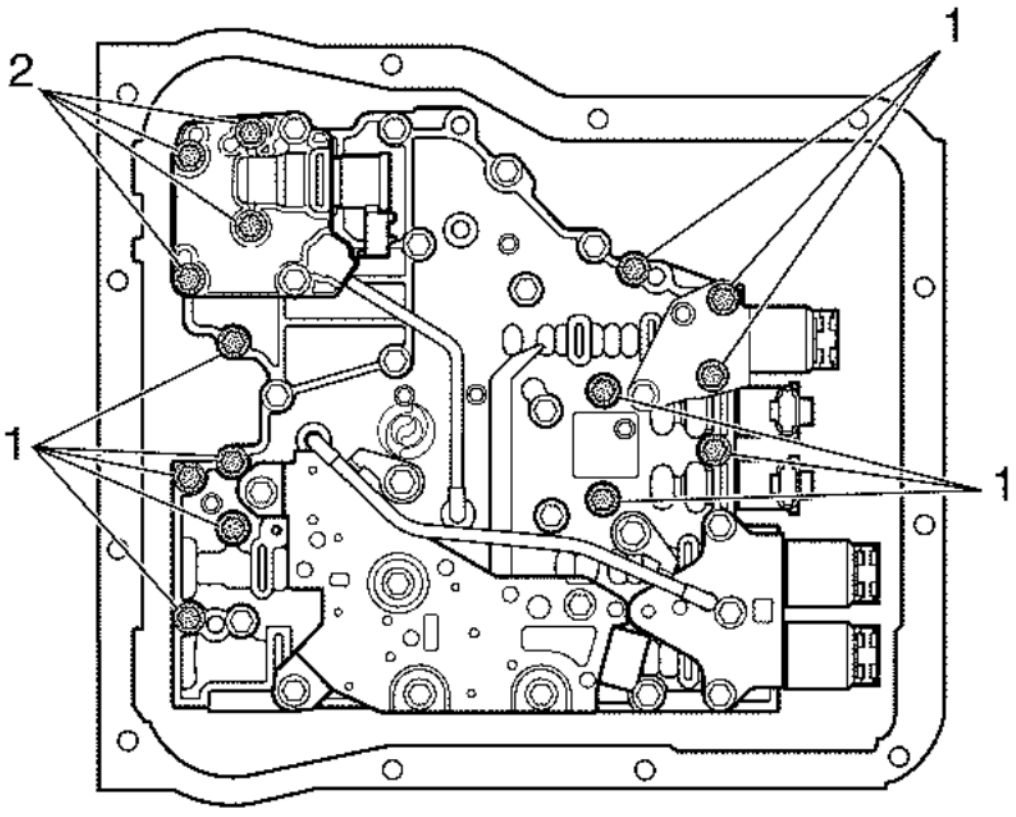


Fig. 85: Control Valve Assembly Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install one bolt marked (1) to hold the control valve assembly in place.

NOTE: **Refer to Fastener Notice .**

4. Reinstall the remaining 10 bolts marked (1) and 4 bolts marked (2) that fasten the control valve assembly to the transmission case.

Tighten: Tighten the bolts to 12 N.m (108 lb in).

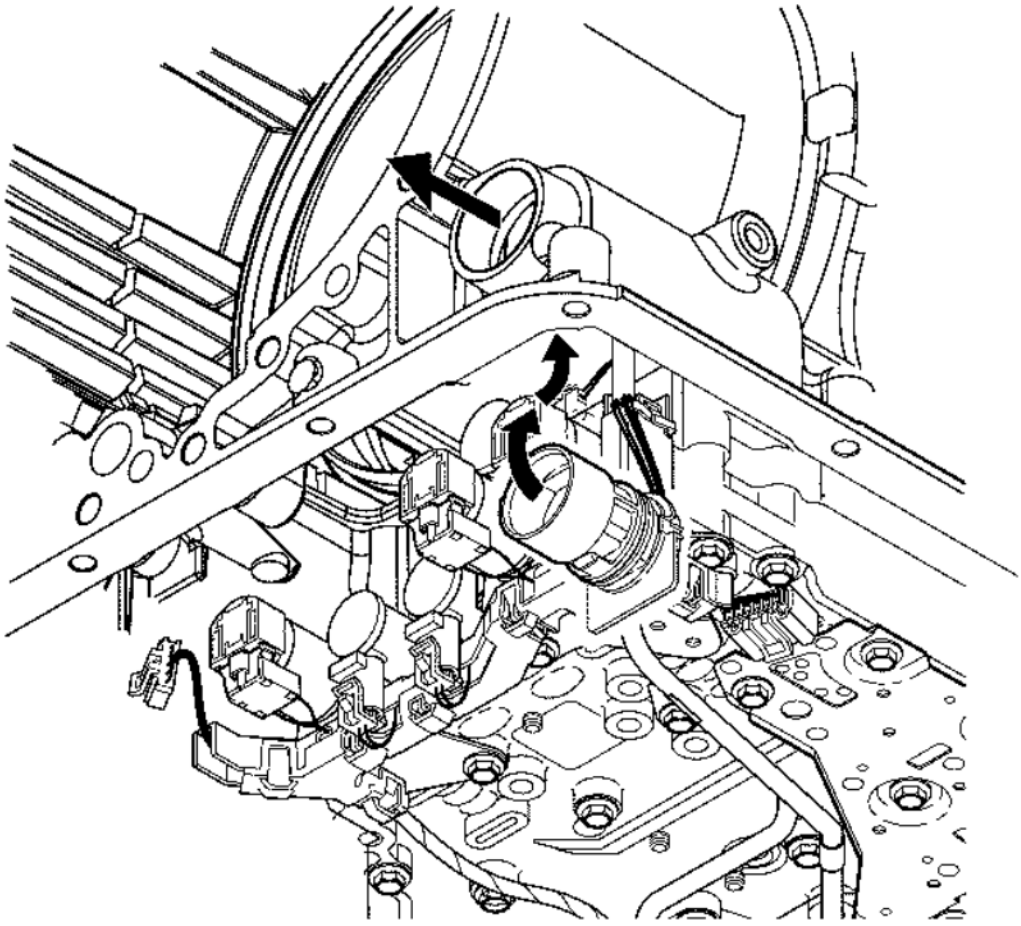


Fig. 86: Identifying Main Transmission Connector
Courtesy of GENERAL MOTORS CORP.

5. Push the transmission main connector outward through the hole in the transmission case until the retaining feet on the connector are nearing the locked position.

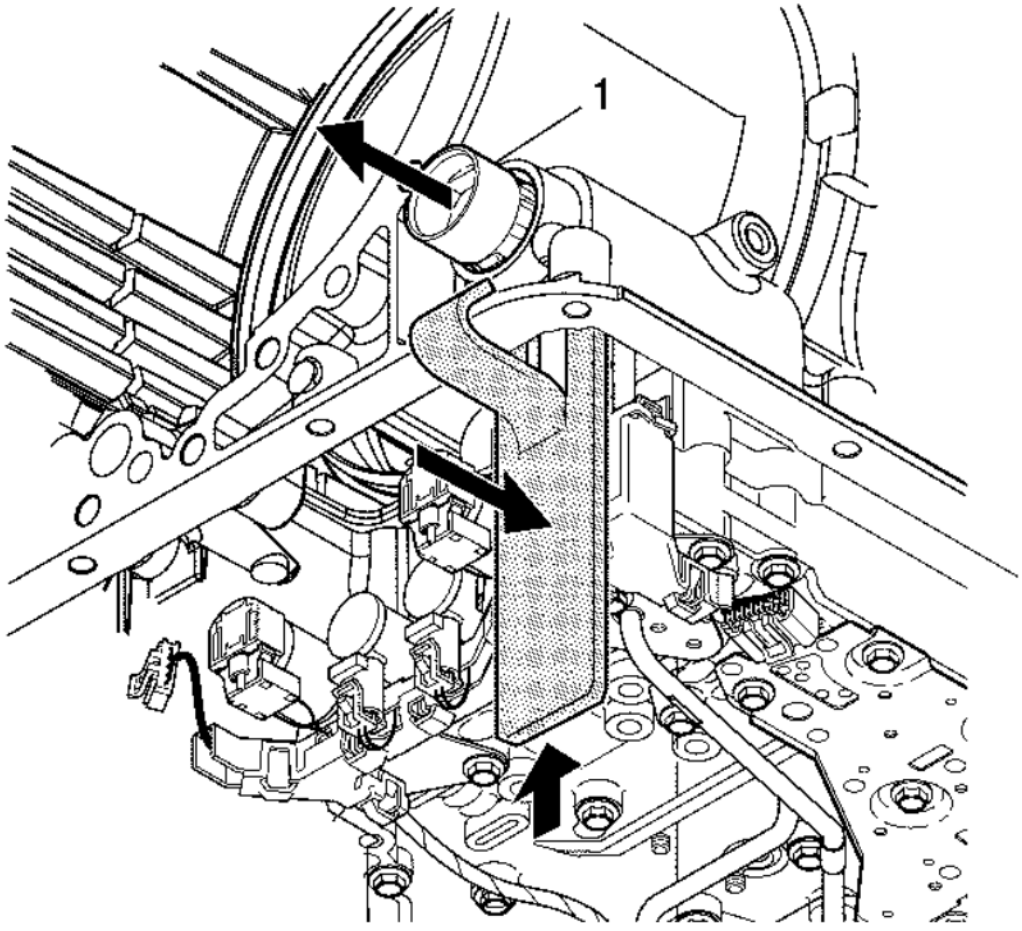


Fig. 87: Using J 44247 To Seat Transmission Connector
Courtesy of GENERAL MOTORS CORP.

6. Use the **J 44247** to complete the seating of the retaining feet that lock the connector (1) into the transmission case. See **Special Tools**.

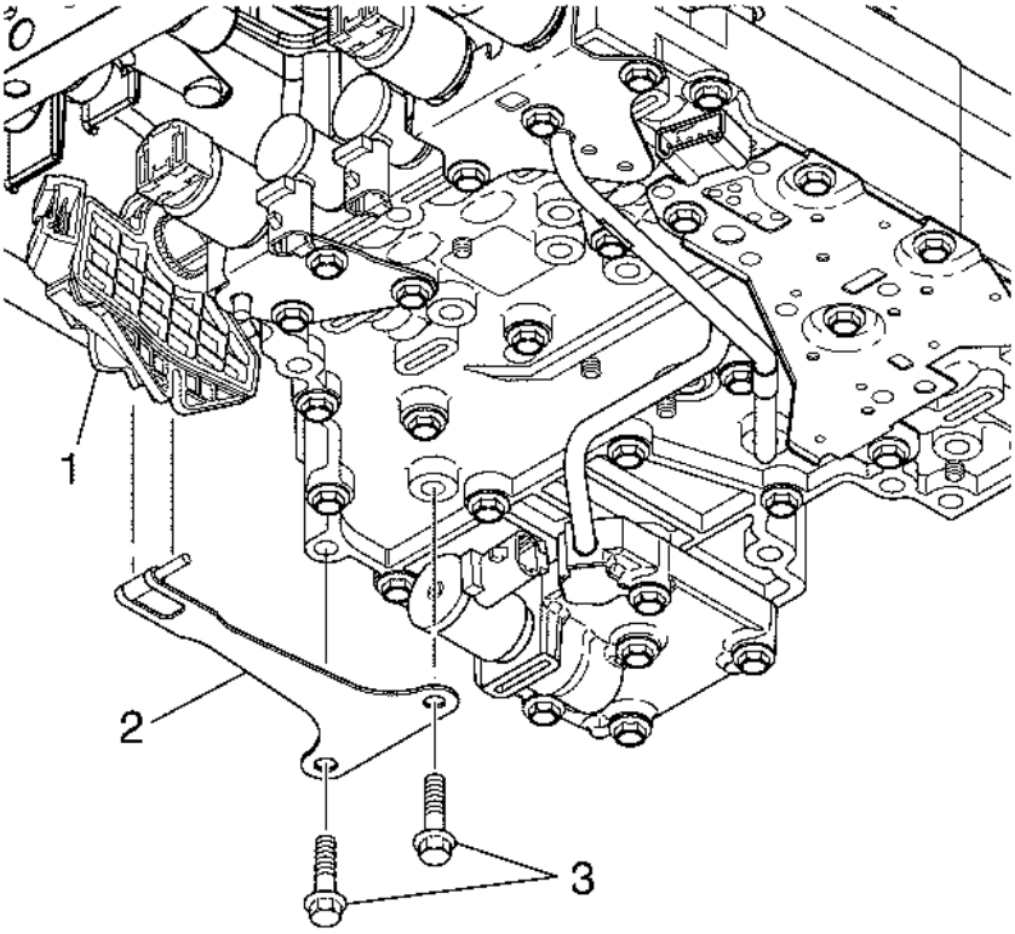


Fig. 88: Detent Spring Assembly
Courtesy of GENERAL MOTORS CORP.

7. Install the detent spring assembly (2) onto the control valve assembly. Confirm that the roller of the detent spring assembly rests on the detent lever (1).
8. Attach the IMS connector on the internal harness to the IMS.
9. Install 2 detent spring bolts (3).

   Tighten: Tighten the bolts to 12 N.m (108 lb in).

10. Install the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.
11. Connect the external wiring harness to the transmission main connector.

IMPORTANT: The FastLearn, adapt, procedure must be performed. This can be done in 1 step using a scan tool. If this procedure is not done, the TCM adaptive values will be at the settings that it learned for the old components and will be in slow adaptive mode. Under these conditions, it will take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

12. Perform the FastLearn procedure. Refer to **FastLearn Procedure**.

TORQUE CONVERTER FLUID SEAL REPLACEMENT

Tools Required

- **J 24171-A** Seal and Dust Shield Remover
- **J 43772** Torque Converter Seal Installer. See **Special Tools**.

Removal Procedure

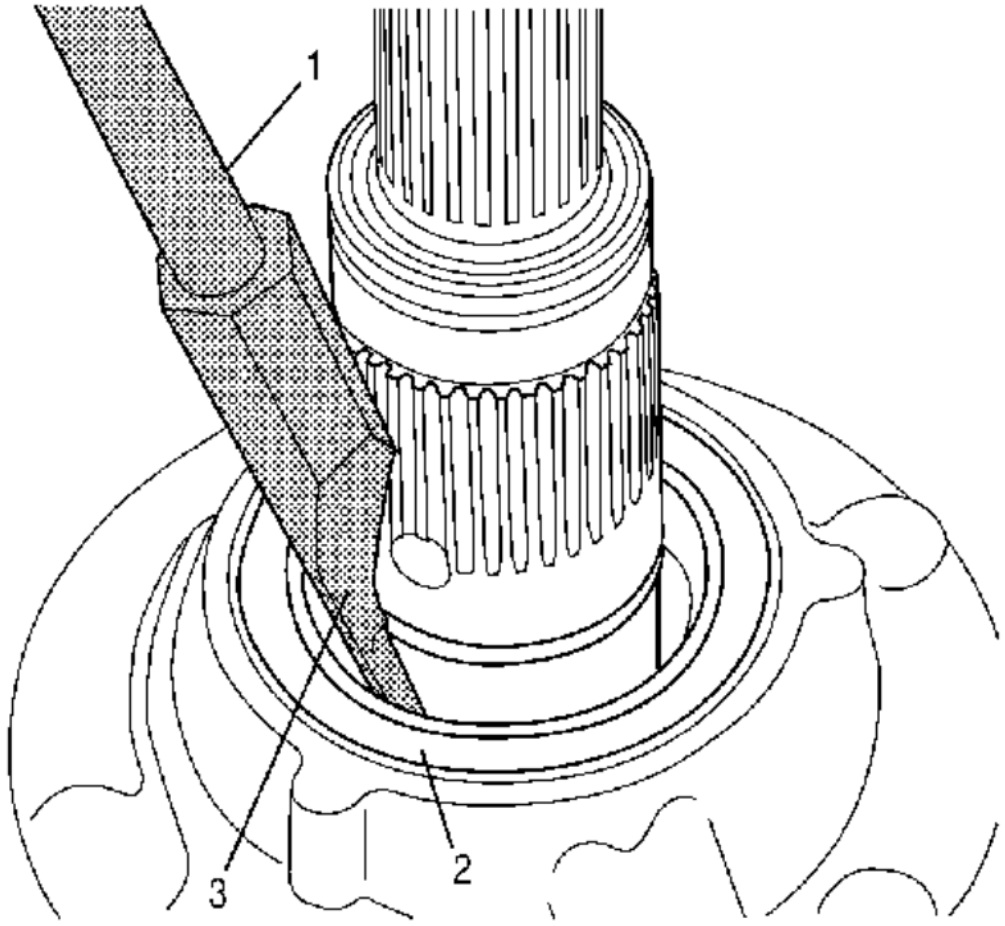


Fig. 89: Removing Torque Converter Seal Using J 24171-A
Courtesy of GENERAL MOTORS CORP.

1. Remove the torque converter from the transmission. Refer to **Torque Converter Replacement**.
2. Obtain **J 24171-A** and install the tip (3) with a 90 degree hook onto the end of the slide-hammer (1).
3. Position the 90 degree hook behind the rear face of the seal outer case (2). Remove the torque converter seal using the slide-hammer.
4. Inspect the seal bore for scratches. Remove any scratches in the seal bore using crocus cloth.

Installation Procedure

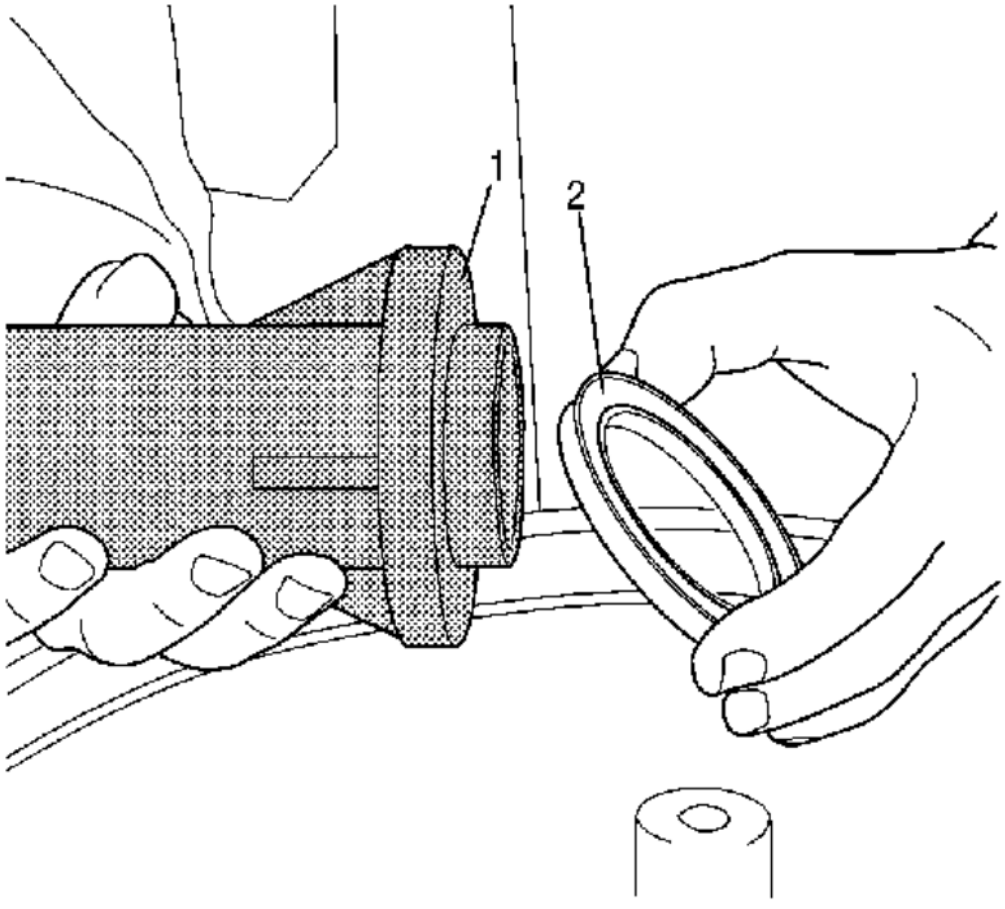


Fig. 90: Installing New Seal Onto J 43772
Courtesy of GENERAL MOTORS CORP.

1. Install the new seal (2) onto the **J 43772** . See **Special Tools**. Position the seal so the seal lip is outward and the face of the steel case is against the driving face (1) on the tool.

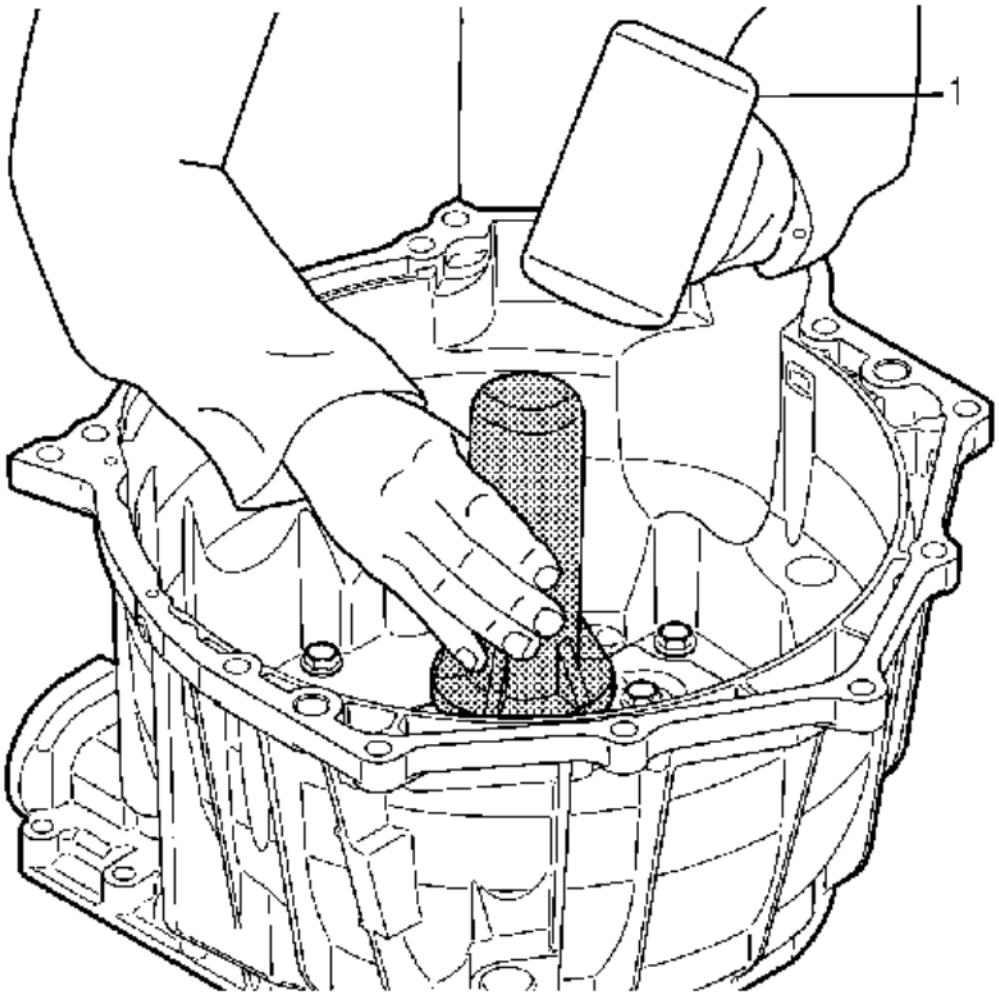


Fig. 91: Driving Seal Into Seal Bore
Courtesy of GENERAL MOTORS CORP.

2. Slide **J 43772** over the turbine shaft and the stator shaft until the seal starts into the seal bore. See **Special Tools**. Strike the **J 43772** with a mallet (1) to drive the seal into the seal bore. See **Special Tools**. The seal is installed correctly when the shoulder of the **J 43772** squarely contacts the outer surface of the oil pump. See **Special Tools**.
3. Install the torque converter into the transmission. Refer to **Torque Converter Replacement**.

REAR PROPSHAFT SHAFT SEAL REPLACEMENT

Tools Required

- **J 24171-A** Seal and Dust Shield Remover
- **J 43782** Rear Seal Installer. See **Special Tools**.

Removal Procedure

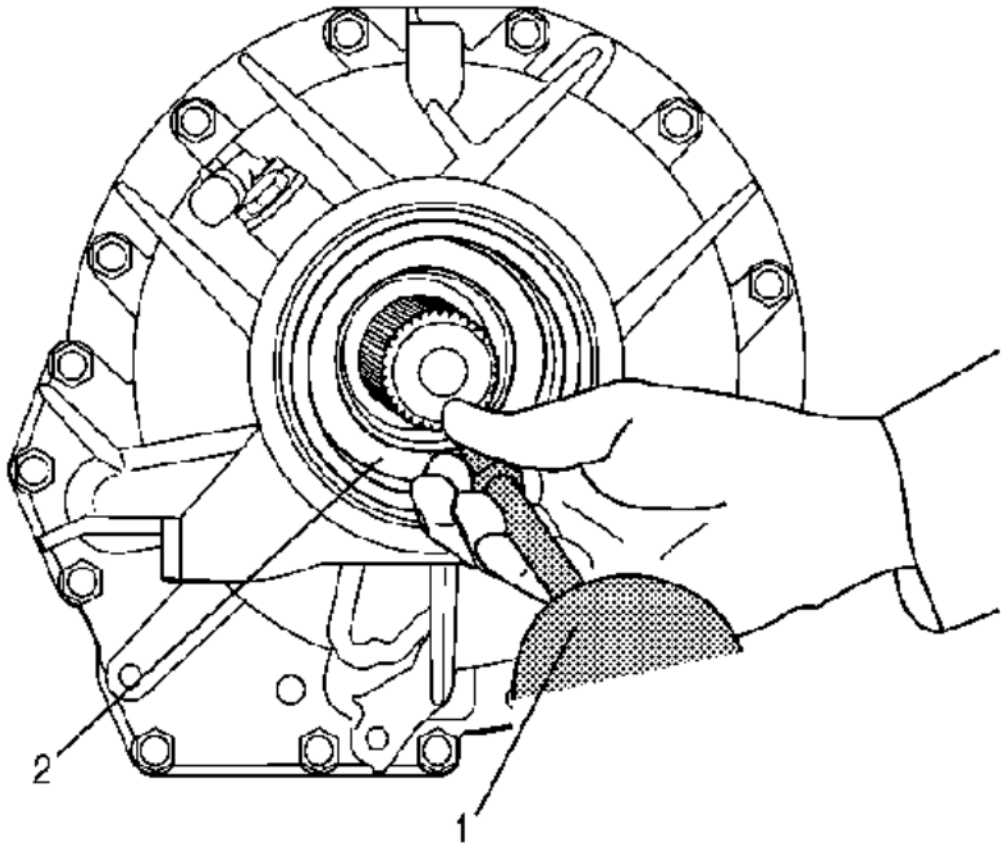


Fig. 92: Removing Rear Seal Using The Slide-Hammer
Courtesy of GENERAL MOTORS CORP.

1. Remove the yoke assembly from the transmission. Refer to **Output Flange/Yoke Replacement**.

2. Obtain **J 24171-A** and install a 90 degree hook onto the end of the slide-hammer (1).
3. Position the 90 degree hook behind the rear face of the seal's outer case (2).
4. Remove the rear seal using the slide-hammer.
5. Inspect the seal bore for scratches. Remove any scratches in the seal bore using crocus cloth.

Installation Procedure

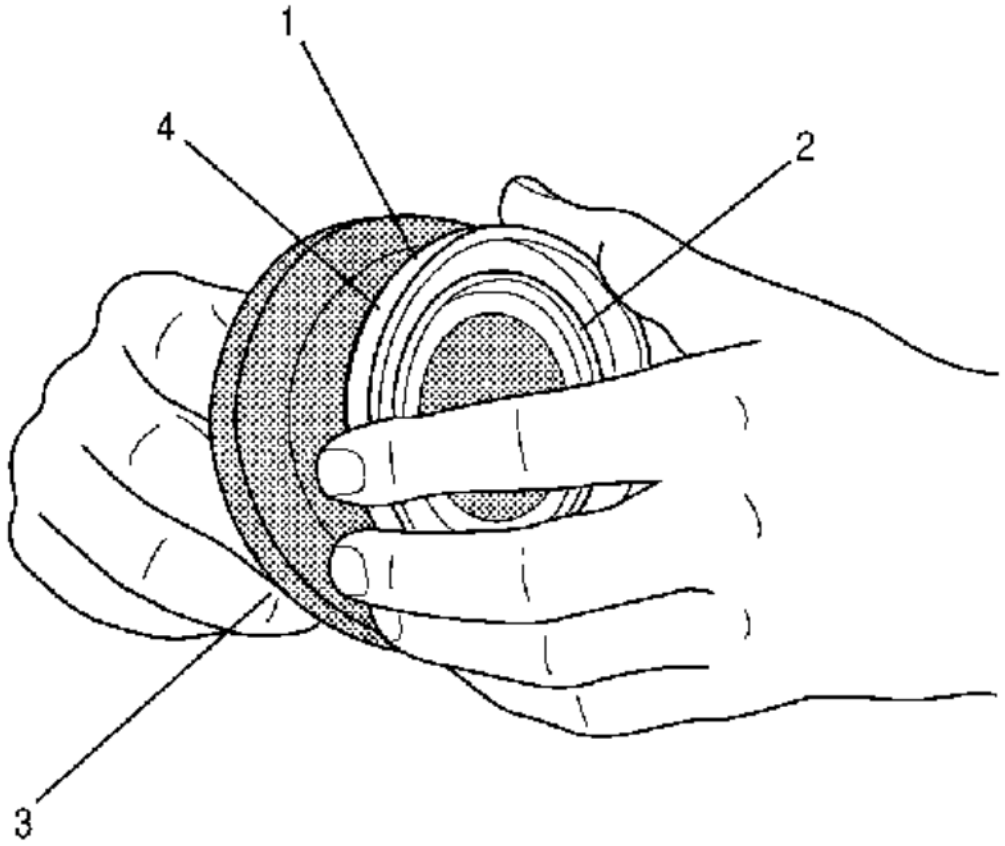


Fig. 93: Aligning Rear Propshaft Seal Lip Outward Onto J 43782
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Be sure the new seal has blue sealant coating the OD (4). This identifies the seal for use in the 1000 Series transmissions. The blue sealant identification is important

because the 1000 Series transmissions have an overdrive ratio in fifth range and there is a potential for high output shaft speeds and resultant high seal temperature.

1. Align the seal so the seal lip (2) is outward and the face of the steel case (1) will be against the driving face (3) of the tool. Install the new seal onto **J 43782** . See **Special Tools**.

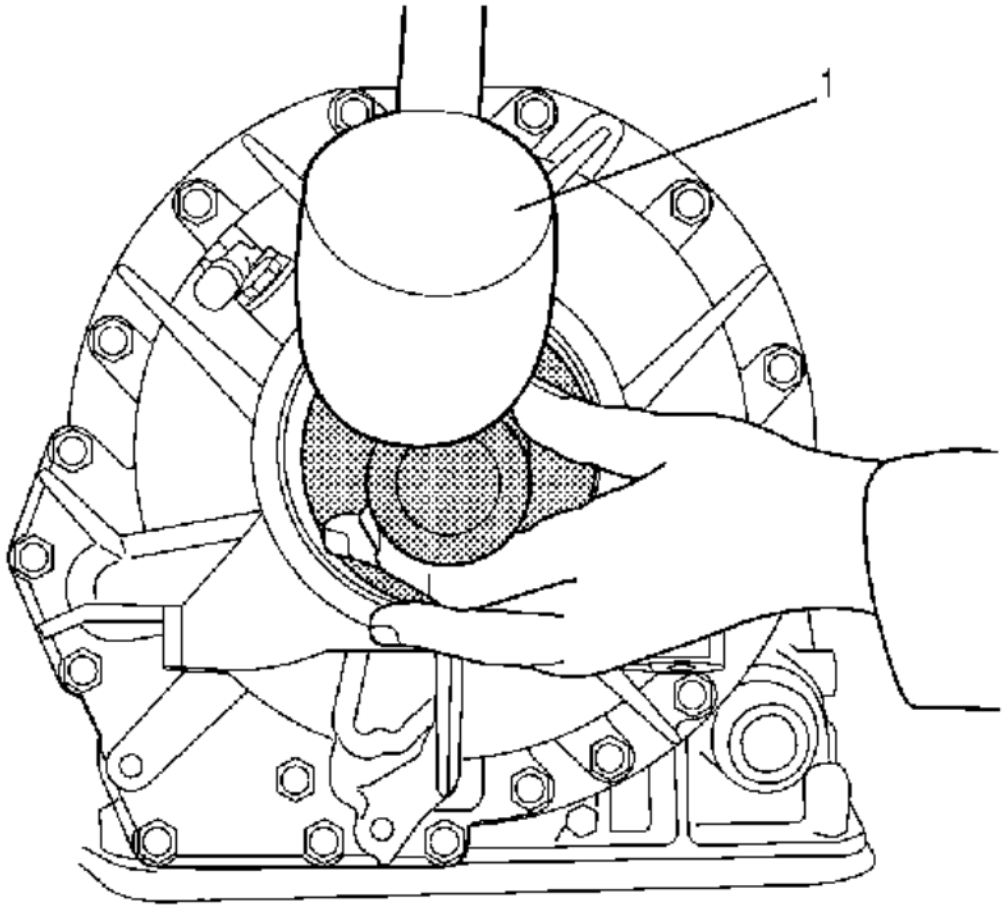


Fig. 94: Installing Rear Propshaft Seal
Courtesy of GENERAL MOTORS CORP.

2. Slide **J 43782** over the output shaft until the seal enters the seal bore. See **Special Tools**. Strike **J 43782** with a mallet (1) to drive the seal into the seal bore. See **Special Tools**. The

seal is installed correctly when the shoulder of **J 43782** squarely contacts the outer surface of the rear cover. See **Special Tools**.

3. Install the yoke assembly onto the transmission. Refer to **Output Flange/Yoke Replacement**.

MANUAL SHIFT SHAFT SEAL REPLACEMENT

Tools Required

- **J 43911** Manual Shift Shaft Seal Remover
- **J 43909** Manual Shift Shaft Seal Installer

Removal Procedure

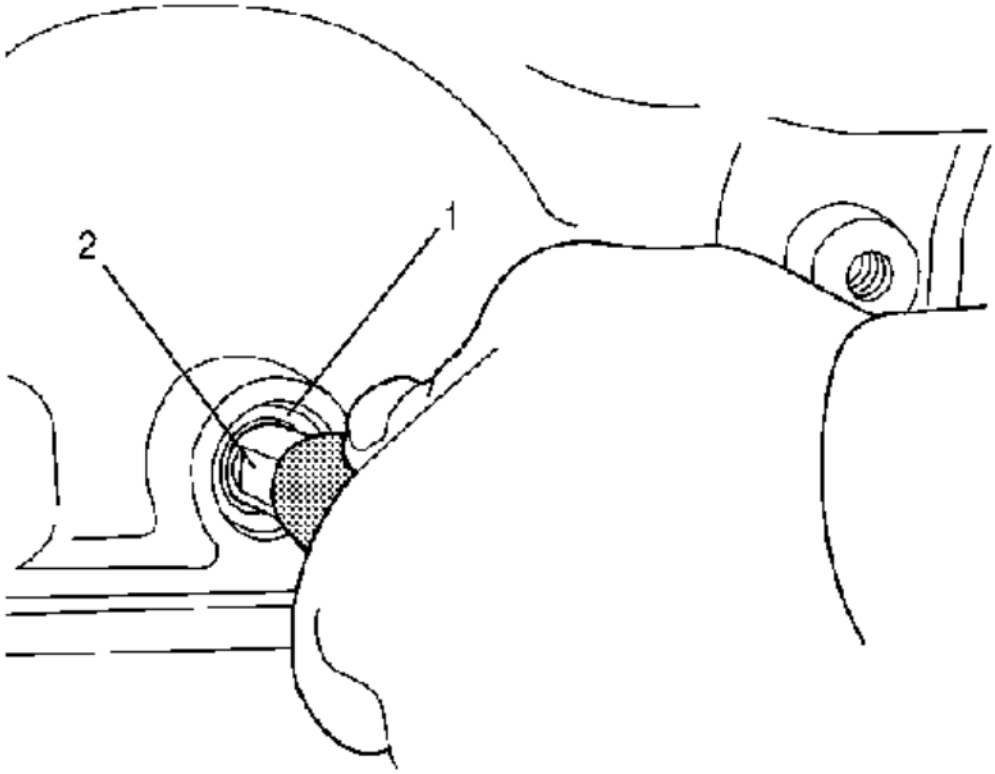


Fig. 95: Sliding Seal Remover Tool Over Selector Shaft

Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

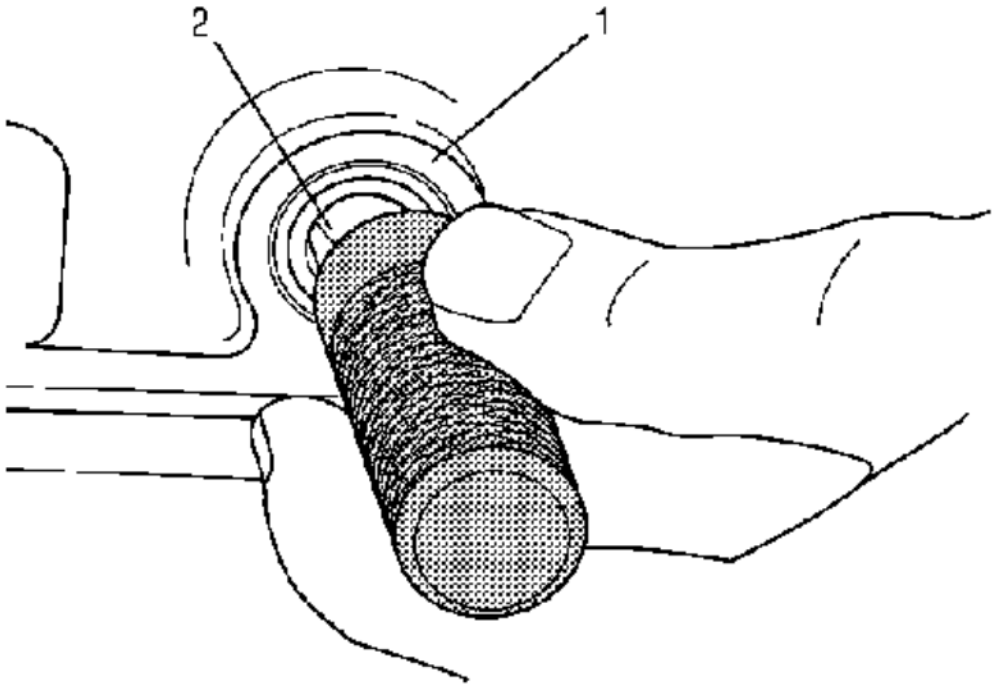


Fig. 96: Sliding New Selector Shaft Seal Over Selector Shaft
Courtesy of GENERAL MOTORS CORP.

1. Carefully slide a new manual shift shaft seal (1) over the manual shift shaft (2) with the wide face of the steel case facing outward. Position so that the seal is starting to enter the seal

bore.

2. Obtain **J 43909** and remove the inner sleeve so that the tool will slide over the manual shift shaft.
3. Slide the **J 43909** into position so that the end of the tool contacts the seal being installed. Use a mallet to strike the **J 43909** and drive the new seal into the seal bore until the seal is seated at the bottom of the bore.

WIRING HARNESS REPLACEMENT

Tools Required

- **J 44247** Internal Wiring Harness Installer. See **Special Tools**.
- **J 44257** Main Wiring Harness Connector Remover

Removal Procedure

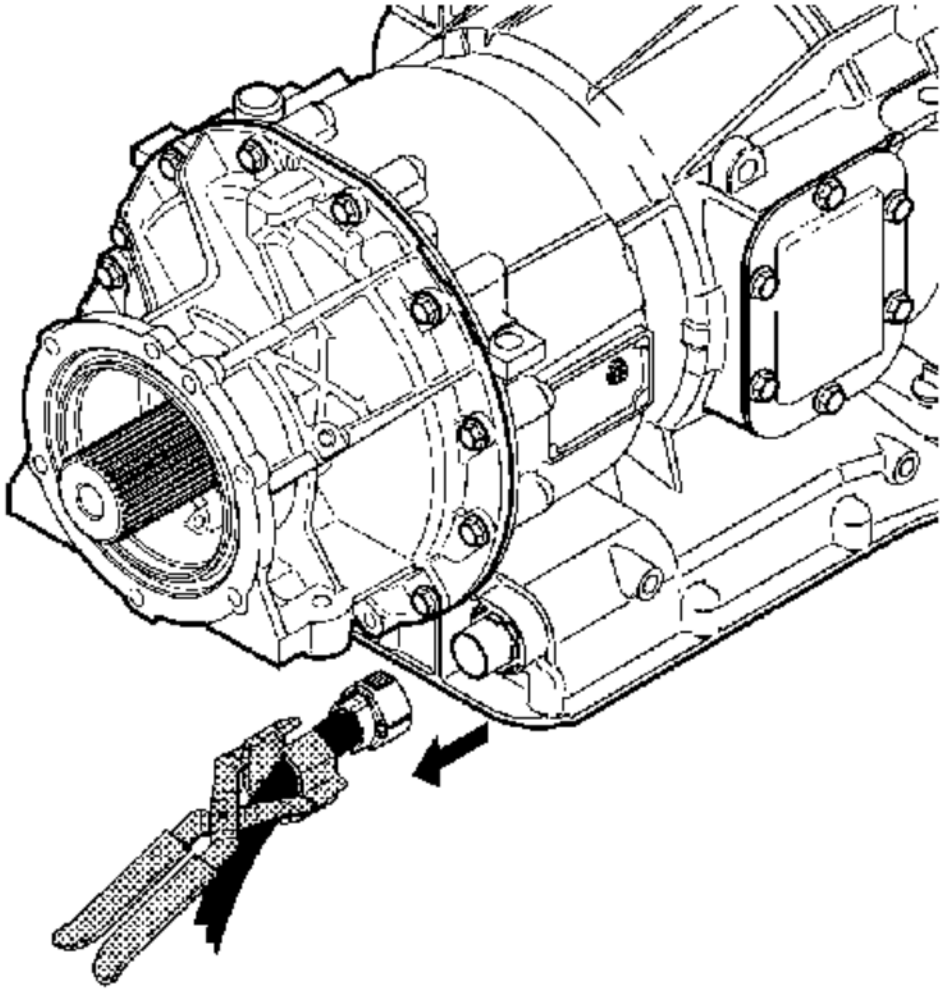


Fig. 97: Transmission Rear Electrical Connector
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to BATTERY DISCONNECT CAUTION .

1. Remove the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.
2. Disconnect the external wiring harness from the main transmission connector. Use **J 44257** , if connector is not easily accessible.

IMPORTANT: The main transmission connector is actually one end of the internal wiring harness that protrudes through the transmission case.

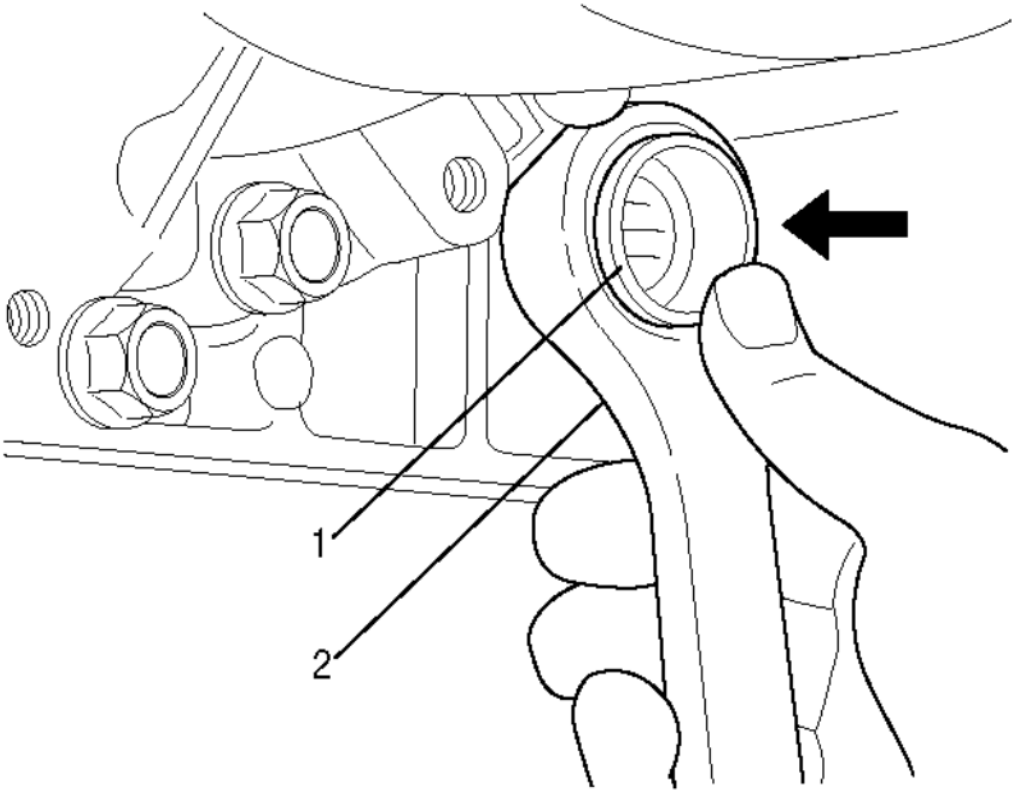


Fig. 98: Placing 30 mm 12-Point Deep Socket Or Box-End Over Connector
Courtesy of GENERAL MOTORS CORP.

3. Place a 30 mm or 1 3/16 inch 12-point deep socket or box-end wrench (2) over the main transmission connector (1).
4. Push inward on the socket or wrench to release the retaining feet that attach the connector (1) to the transmission case.
5. Remove the wrench. Push inward on the electrical connector to separate from the transmission case.

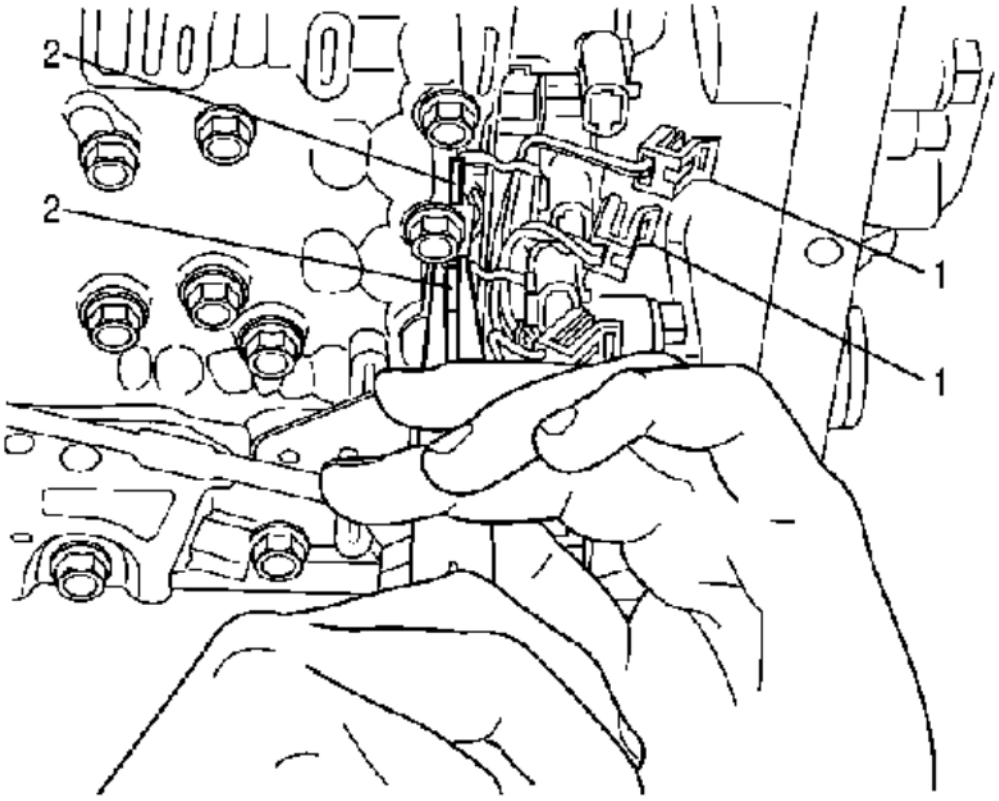


Fig. 99: Identifying Internal Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the internal wiring harness connectors (1) from the solenoids, the internal mode switch (IMS), and from the transmission fluid pressure (TFP) switch.

IMPORTANT: The solenoid retainers for shift solenoid 3 (SS3) and shift solenoid 2 (SS2) also retain tabs on the wiring harness U-channel. The solenoids will remain in position even after the solenoid retainers are removed.

7. Remove the solenoid retainers (2) for SS3 and SS2.
8. Remove the internal wiring harness from the transmission.

Installation Procedure

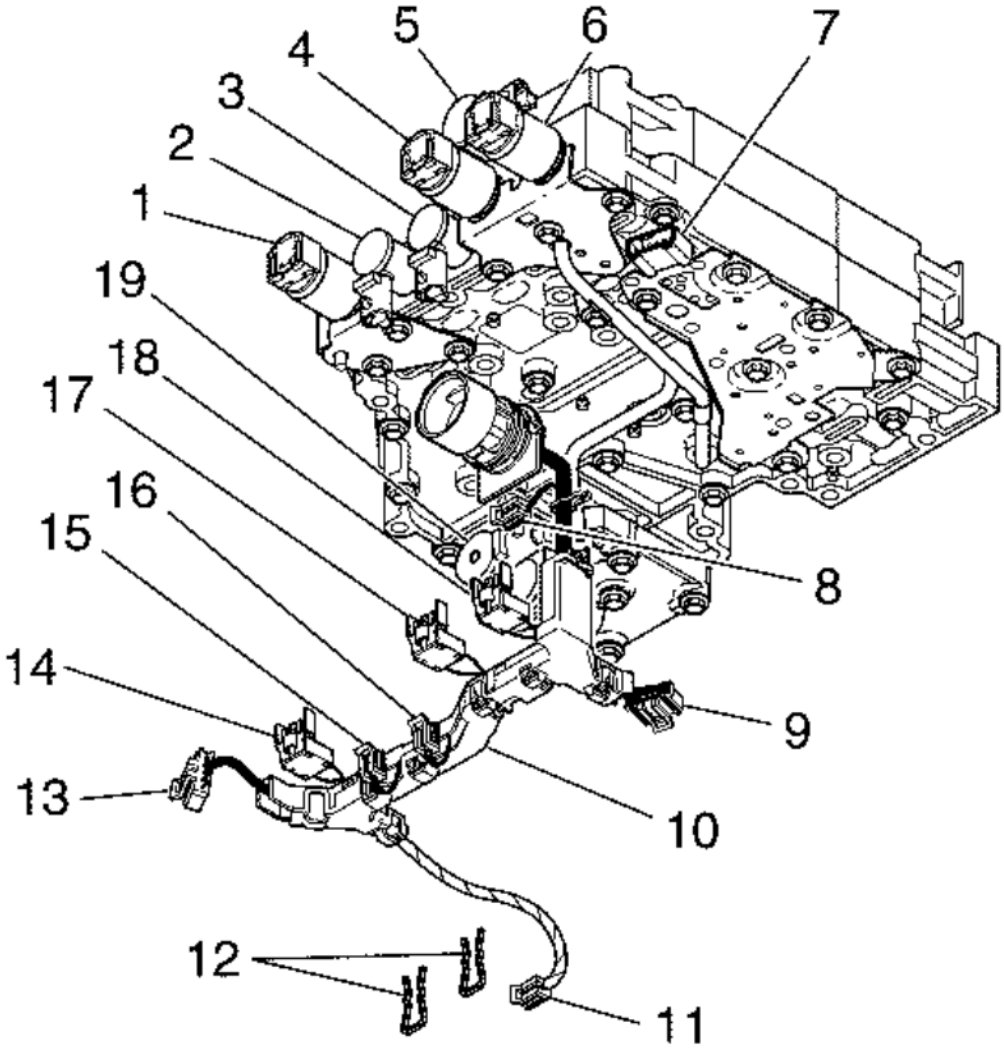


Fig. 100: Identifying Internal Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

1. Align the tabs on the new wiring harness (10) U-channel with the solenoid retainer slots for SS3 (3) and SS2 (2) on the control valve assembly. Install the solenoid retainers (12) for the SS3 (3) and SS2 (2) solenoids.

IMPORTANT: The internal wiring harness connectors should be in the correct position for installation because of their pre-assembled position in the U-channel.

2. Attach the internal wiring harness (10) connectors to the solenoids, the IMS, and the TFP switch.
   - Connector (8) goes to SS1 (5)
   - Connector (9) goes to the TFP switch (7)
   - Connector (11) goes to the MAIN MOD solenoid (19)
   - Connector (13) goes to the IMS
   - Connector (14) goes to the TCC PCS (1)
   - Connector (15) goes to SS2 (2)
   - Connector (16) goes to SS3 (3)
   - Connector (17) goes to PCS1 (4)
   - Connector (18) goes to PCS2 (6)

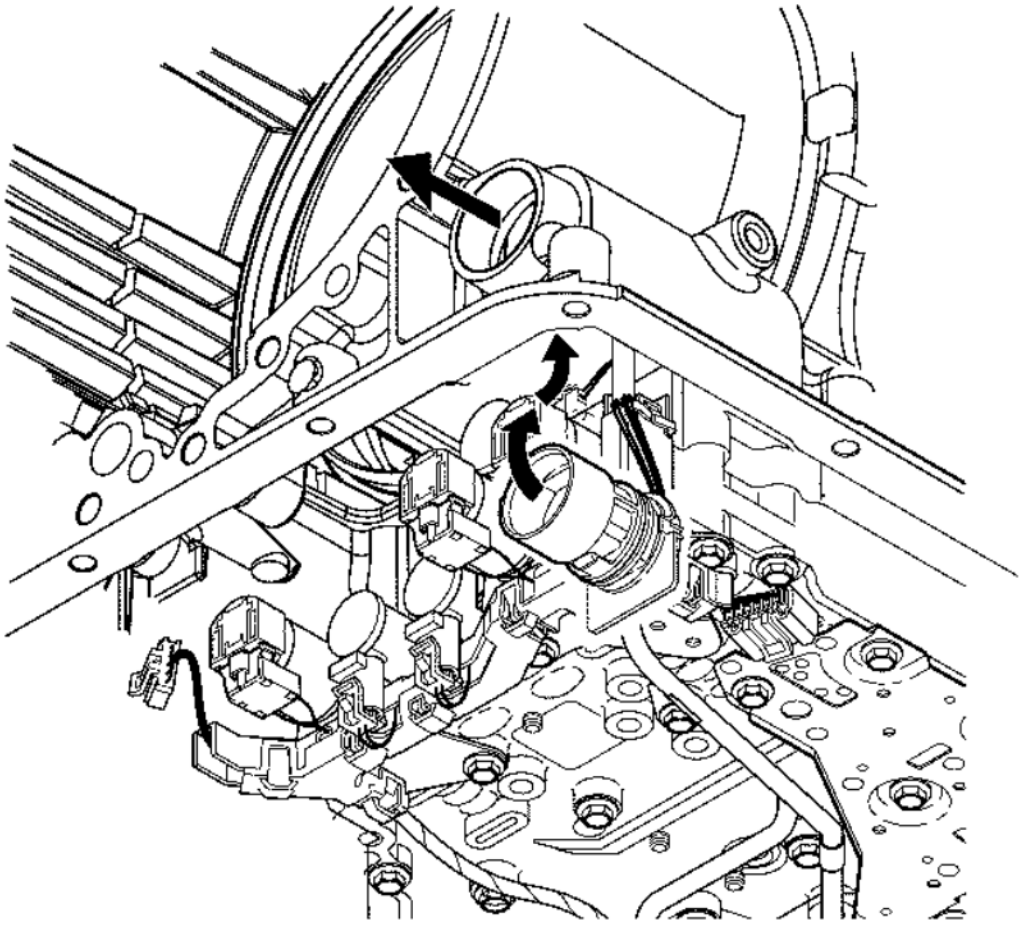


Fig. 101: Identifying Main Transmission Connector
Courtesy of GENERAL MOTORS CORP.

3. Push the main transmission connector (2) outward through hole (1) in the transmission case until the retaining feet on the connector are near the locked position.

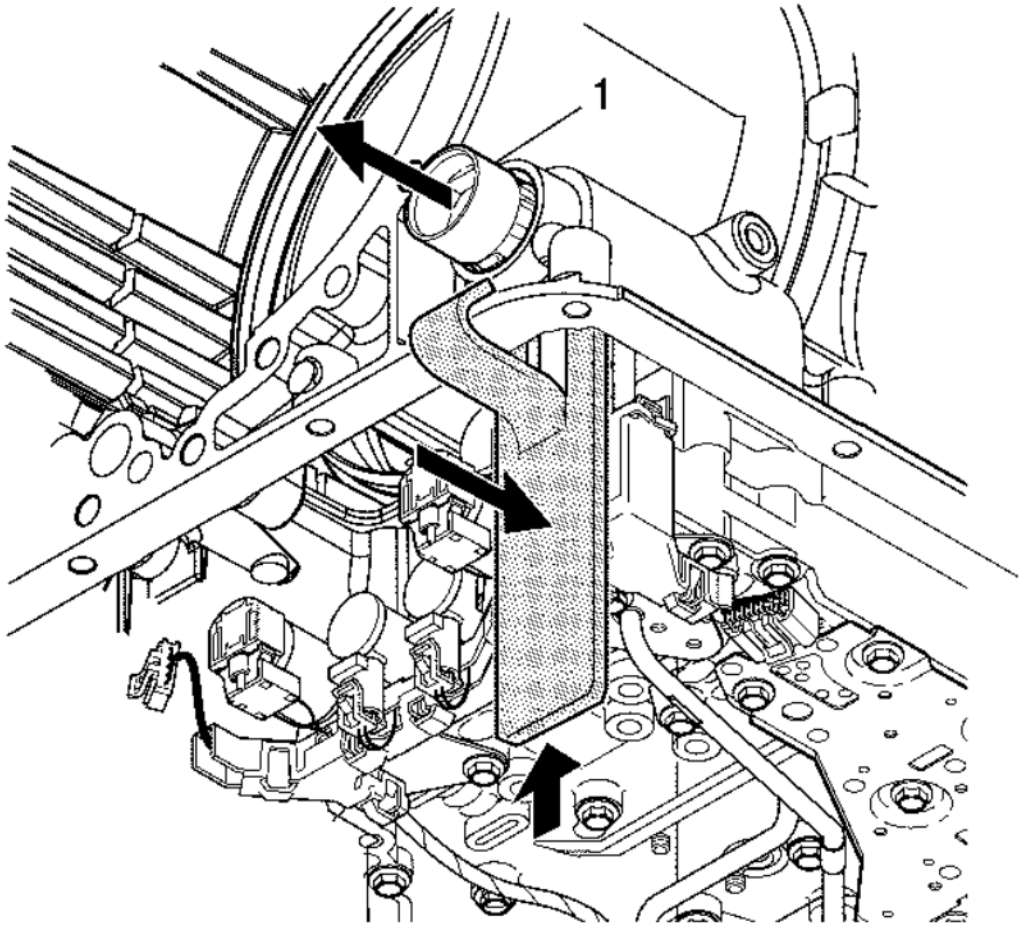


Fig. 102: Using J 44247 To Seat Transmission Connector
Courtesy of GENERAL MOTORS CORP.

4. Use **J 44247** to seat the retaining feet on transmission connector (1). See **Special Tools**.
5. Install the oil pan and transmission internal oil filter. Refer to **Oil Pan Replacement**.
6. Connect the external wiring harness to the main transmission connector.

IMPORTANT: The FastLearn, adapt, procedure must be performed. This can be done in 1 step using a scan tool. If this procedure is not done, the TCM adaptive values will be at the settings that it learned for the old components and will be in slow adaptive mode. Under these conditions, it will take an

unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

7. Perform the FastLearn procedure. Refer to **FastLearn Procedure**.

AUTOMATIC TRANSMISSION FLUID PRESSURE TEST HOLE PLUG REPLACEMENT

Removal Procedure

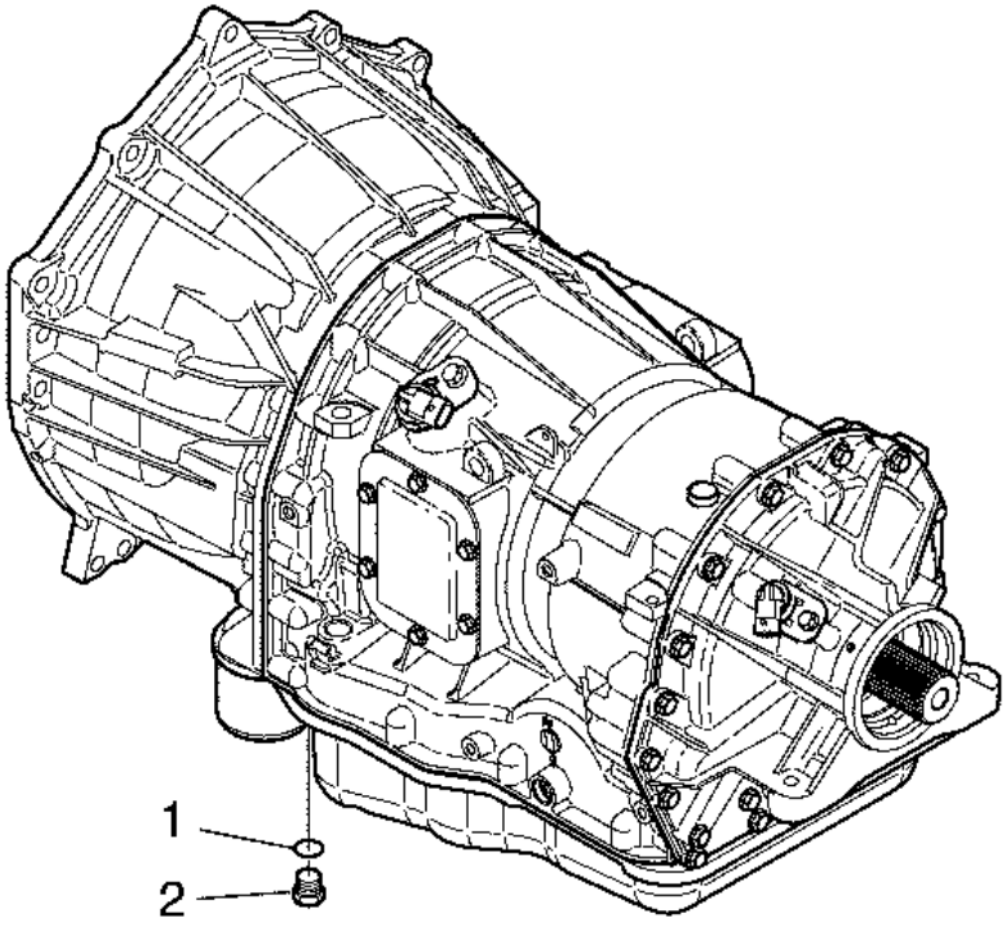


Fig. 103: View Of Pressure Tap Plug And O-Ring
Courtesy of GENERAL MOTORS CORP.

1. Remove the pressure tap plug (2) and O-ring (1) on the bottom of the converter housing near the transmission external oil filter.
2. Remove the O-ring from the plug and discard it.

Installation Procedure

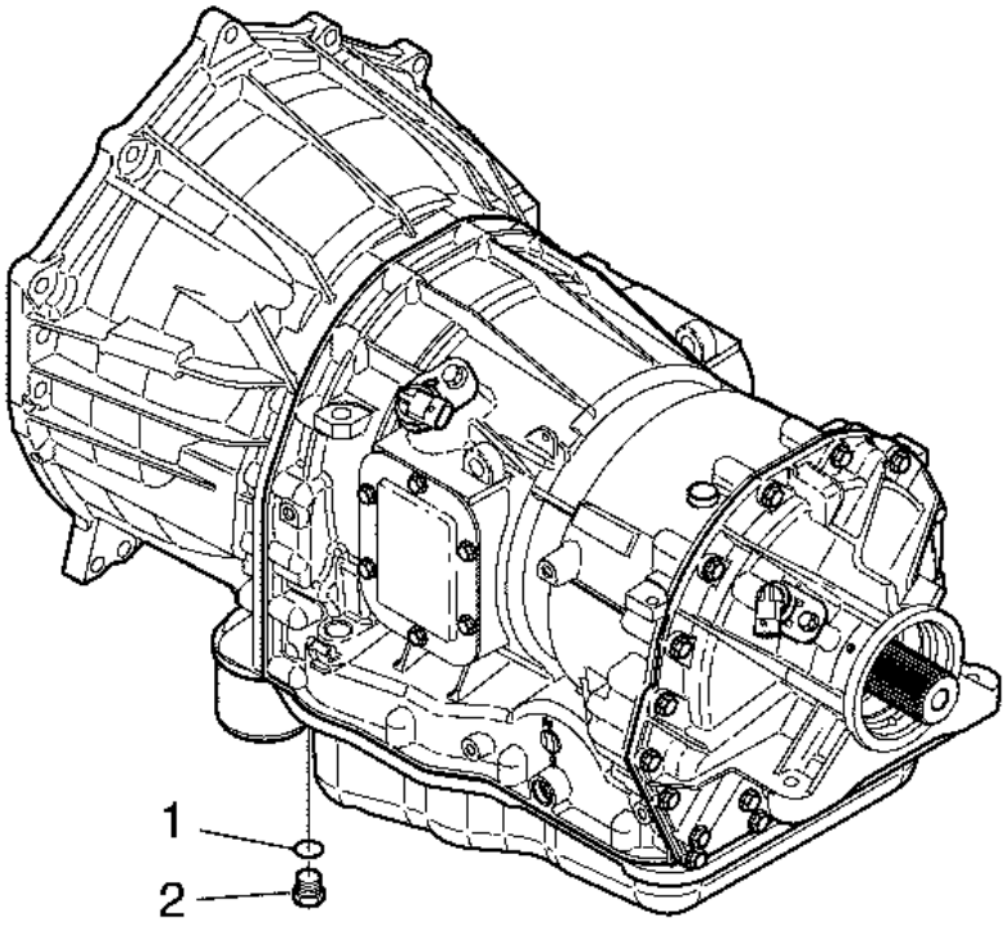


Fig. 104: View Of Pressure Tap Plug And O-Ring
Courtesy of GENERAL MOTORS CORP.

1. Install a new O-ring (1) on the pressure tap plug (2).

NOTE: **Refer to Fastener Notice .**

2. Install the plug and O-ring into the converter housing.

   Tighten: Tighten the plug to 12 N.m (108 lb in).

TRANSMISSION MOUNT REPLACEMENT

Removal Procedure

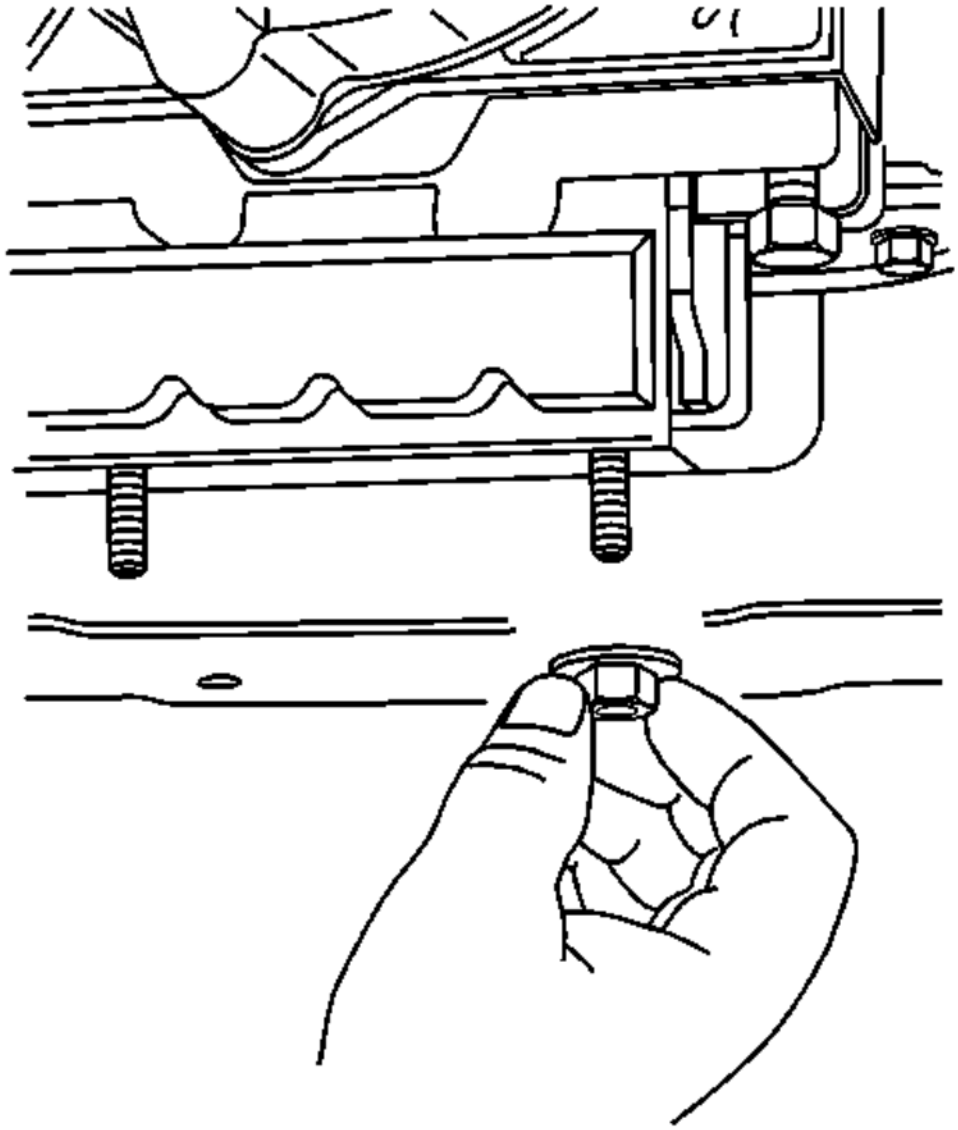


Fig. 105: Identifying Transmission Mount Nuts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Support the transmission with a transmission jack.
3. Remove the transmission mount to the transmission support retaining nut or nuts.

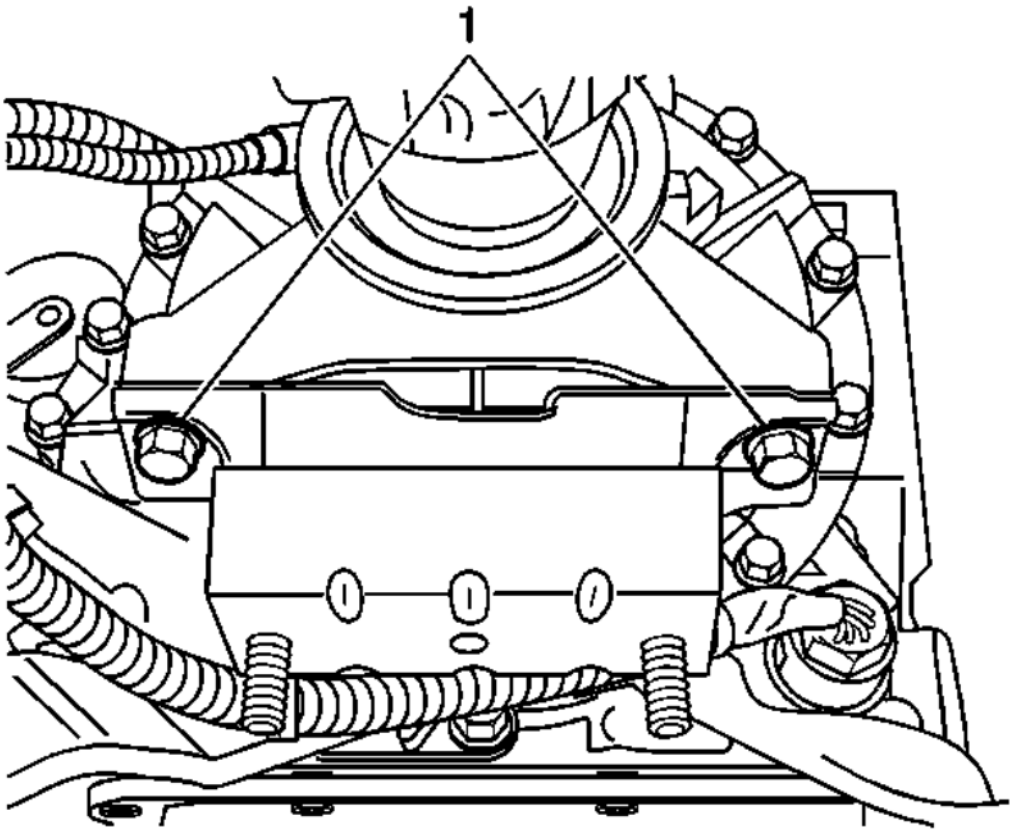


Fig. 106: Locating Transmission Mount Bolts
Courtesy of GENERAL MOTORS CORP.

4. Raise the transmission to take the weight off of the mount.
5. Remove the transmission mount to the transmission or transfer case adapter mounting bolts (1).
6. Raise the transmission just enough to remove the transmission mount.
7. Remove the transmission mount from the vehicle.

Installation Procedure

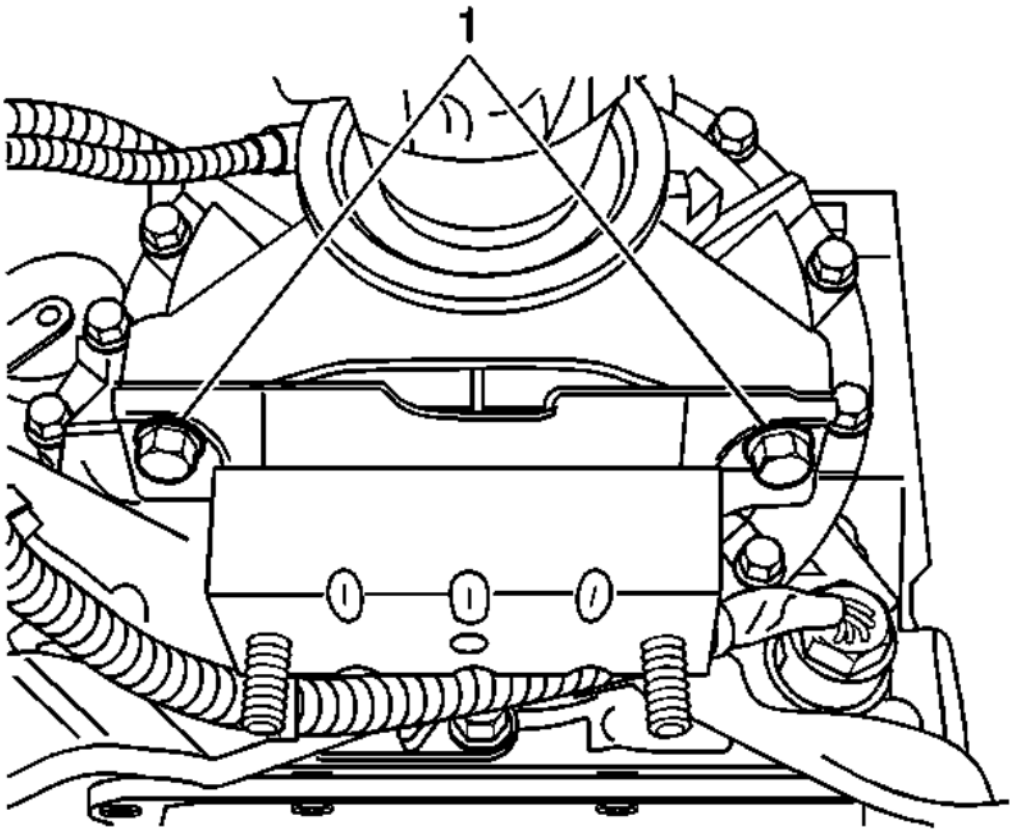


Fig. 107: Locating Transmission Mount Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission mount to the vehicle.

NOTE: **Refer to Fastener Notice .**

2. Install the transmission mount to the transmission or transfer case adapter mounting bolts (1).

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

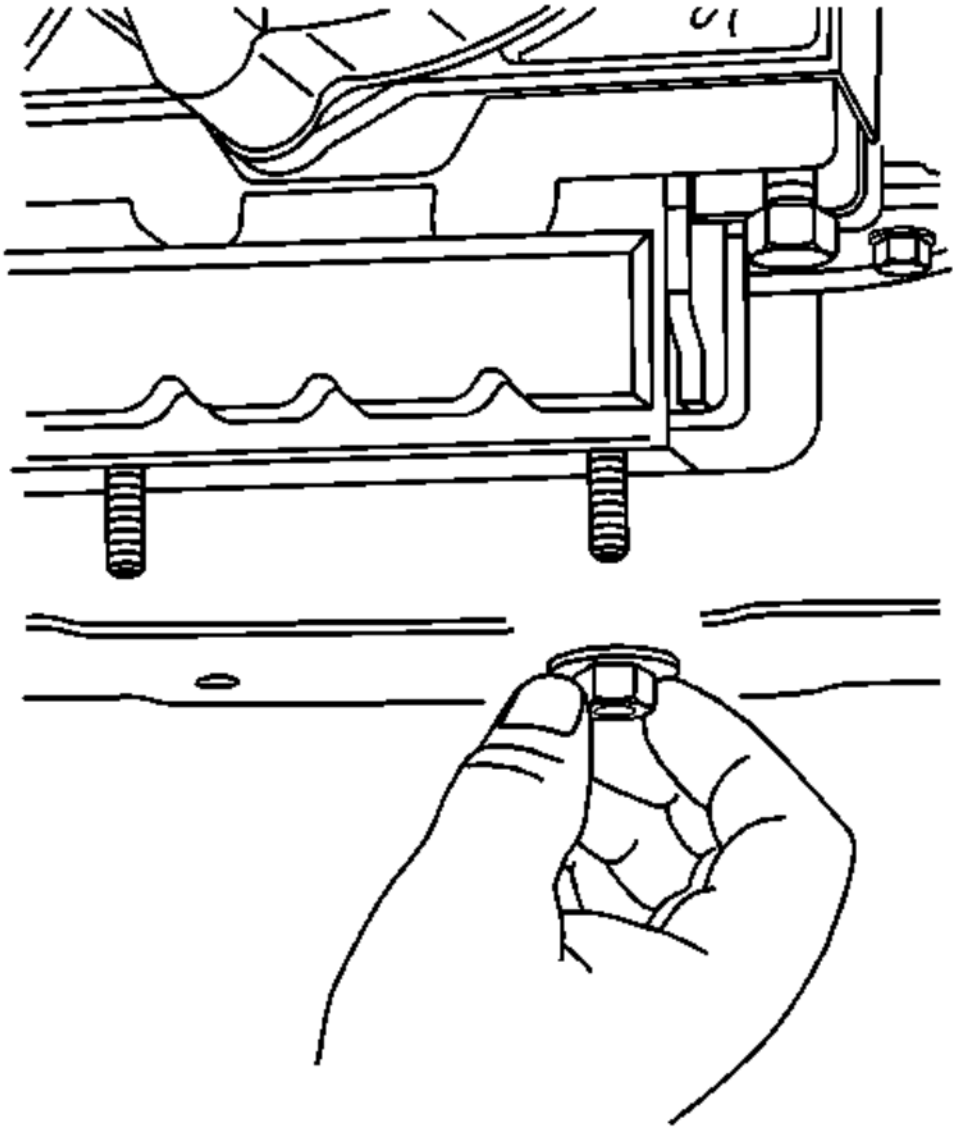


Fig. 108: Identifying Transmission Mount Nuts
Courtesy of GENERAL MOTORS CORP.

3. Lower the transmission.
4. Install the transmission mount to the transmission support retaining nut or nuts.

Tighten: Tighten the nut or nuts to 50 N.m (37 lb ft).

5. Remove the transmission jack.
6. Lower the vehicle.

TRANSMISSION REPLACEMENT

Tools Required

- **J 21366** Converter Holding Strap
- **J 44257** Connector Removal Tool

Removal Procedure

IMPORTANT: If replacing a failed transmission, the "FastLearn" (adapt) procedure must be performed. This can be done in one step using a scan tool. If this procedure is not done, the transmission control module's (TCM's) adaptive values will still be at the settings that it learned for the old transmission, and will be in slow adaptive mode. Under these conditions, it would take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

1. Remove the transmission fluid level indicator.
2. 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)** .

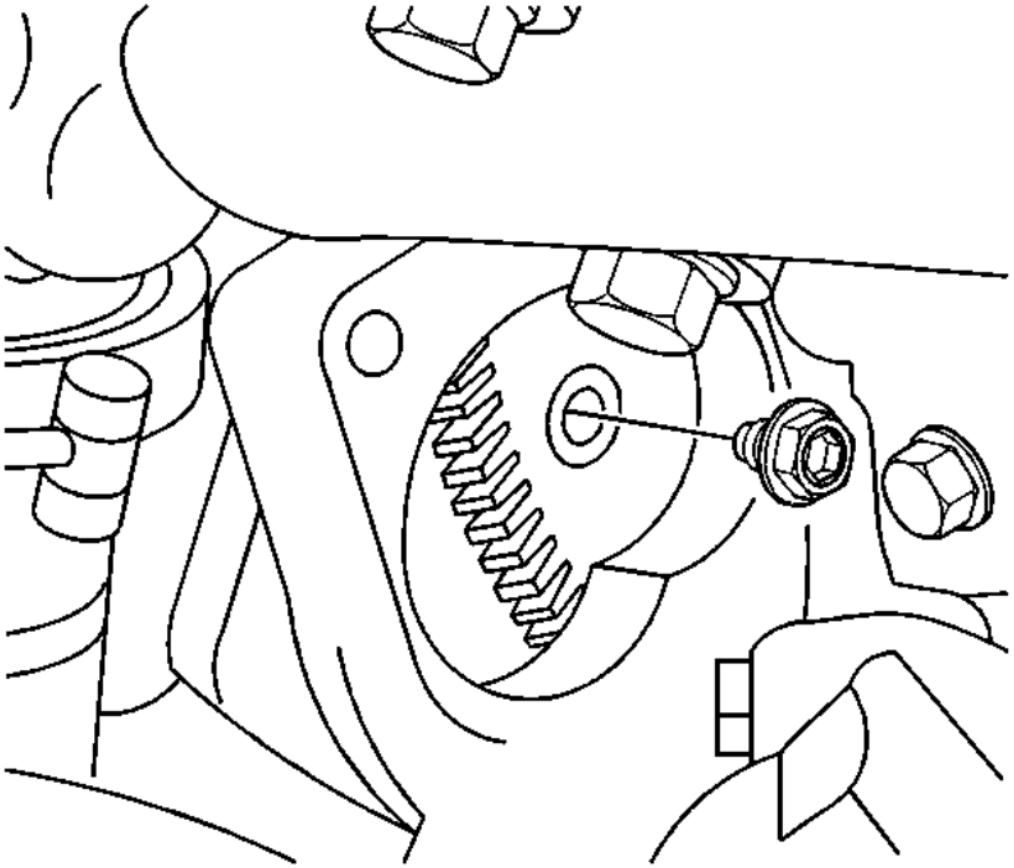


Fig. 109: View Of Torque Convertor Bolt
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Rotate the engine clockwise ONLY, rotating the engine counterclockwise may loosen the crankshaft balancer bolt.

3. Rotate the engine clockwise, using the crankshaft bolt in order to access the torque converter bolts through the starter opening. Have an assistant rotate the engine while aligning the bolts.
4. Remove the torque converter bolts.
5. Completely raise the vehicle.
6. Drain the transmission fluid.

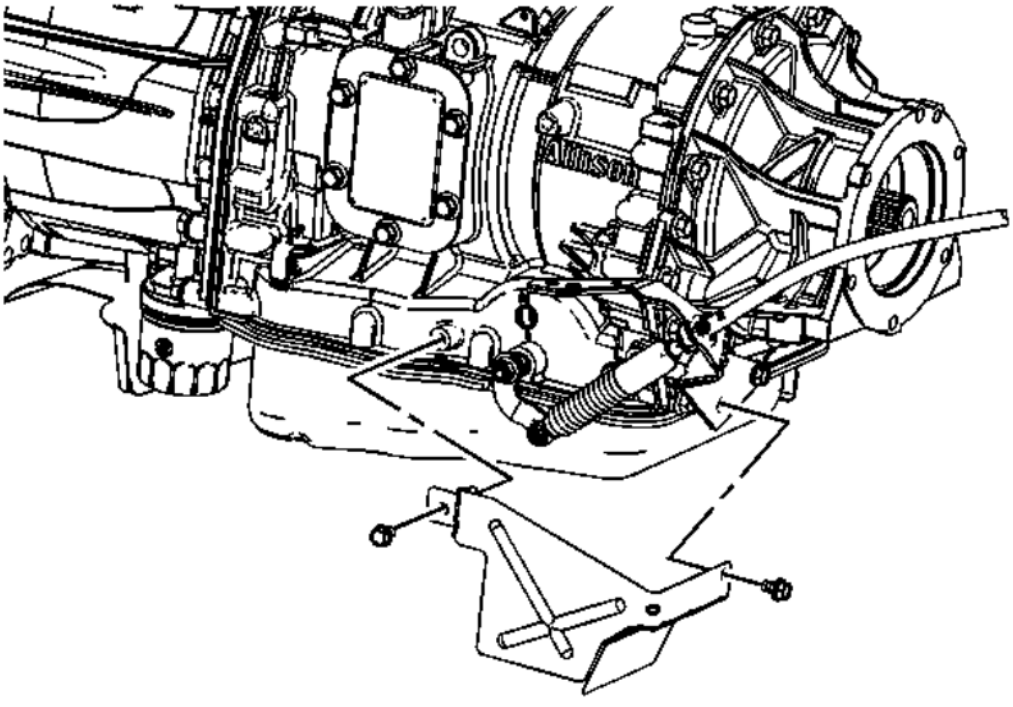


Fig. 110: Range Selector Cable Heat Shield
Courtesy of GENERAL MOTORS CORP.

7. Remove the range selector cable heat shield bolts.
8. Remove the range selector cable heat shield.

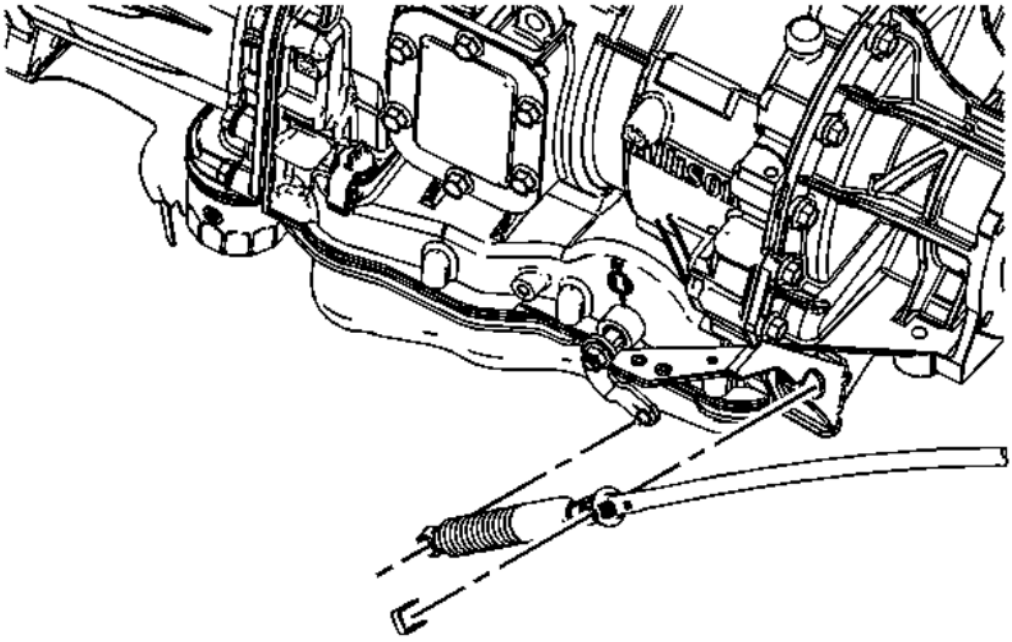


Fig. 111: Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

9. Remove the range selector cable end from the transmission range selector lever stud.

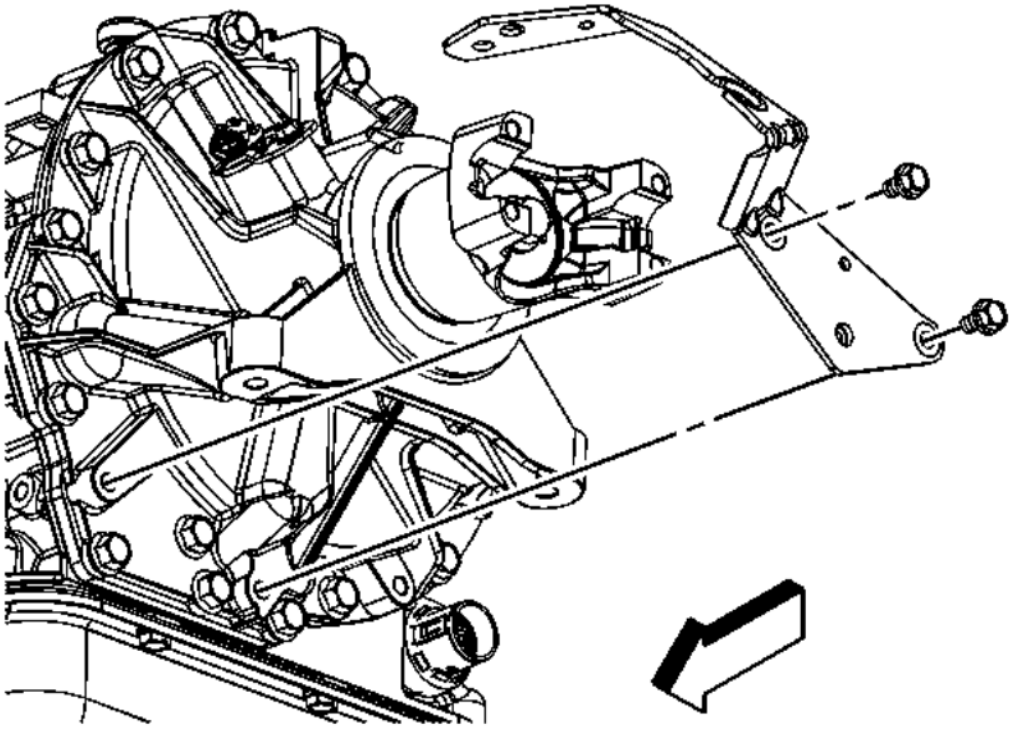


Fig. 112: View Of Shift Cable Bracket And Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the shift cable bracket bolts and bracket from the transmission.
11. Position the bracket with the cable attached out of the way.

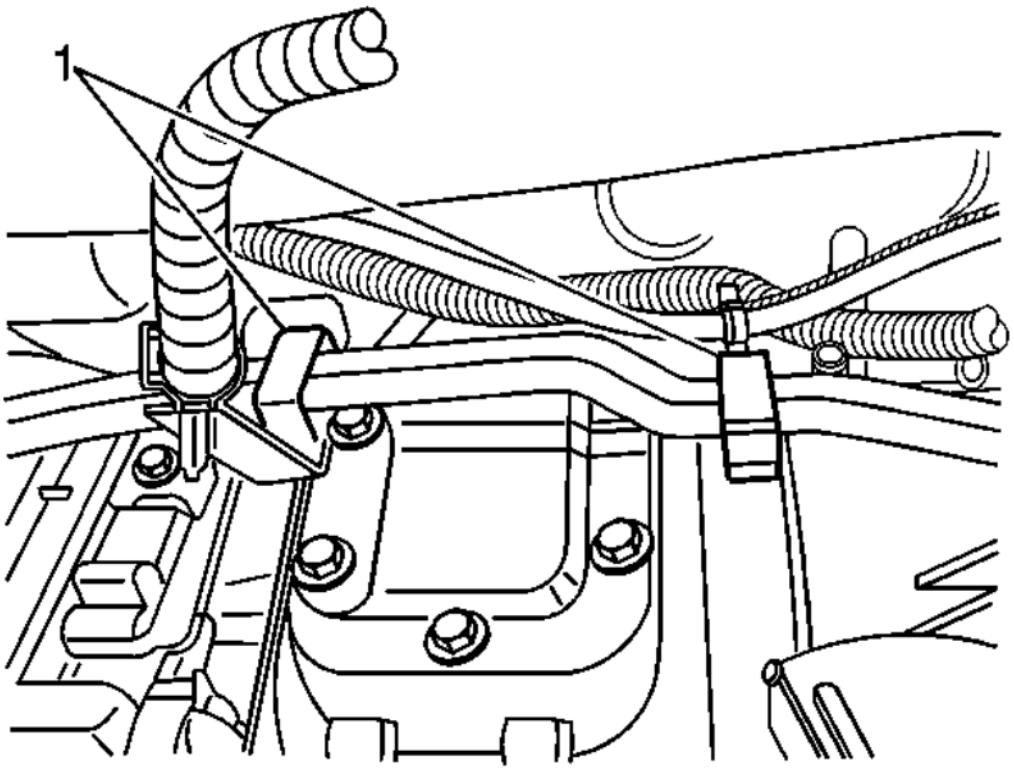


Fig. 113: Identifying Fuel Line Retainer Bolts
Courtesy of GENERAL MOTORS CORP.

12. Remove the fuel line retainer (1) bolts on the left side of the transmission.

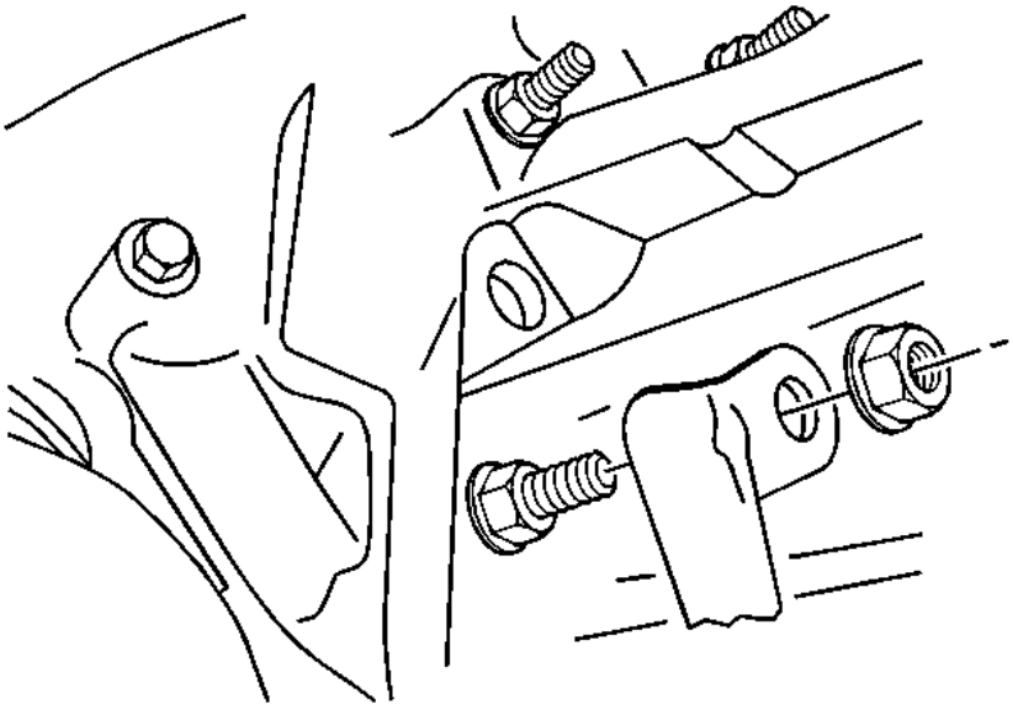


Fig. 114: Identifying Fuel Line Bracket
Courtesy of GENERAL MOTORS CORP.

13. Remove the fuel line bracket nut from the converter housing stud.

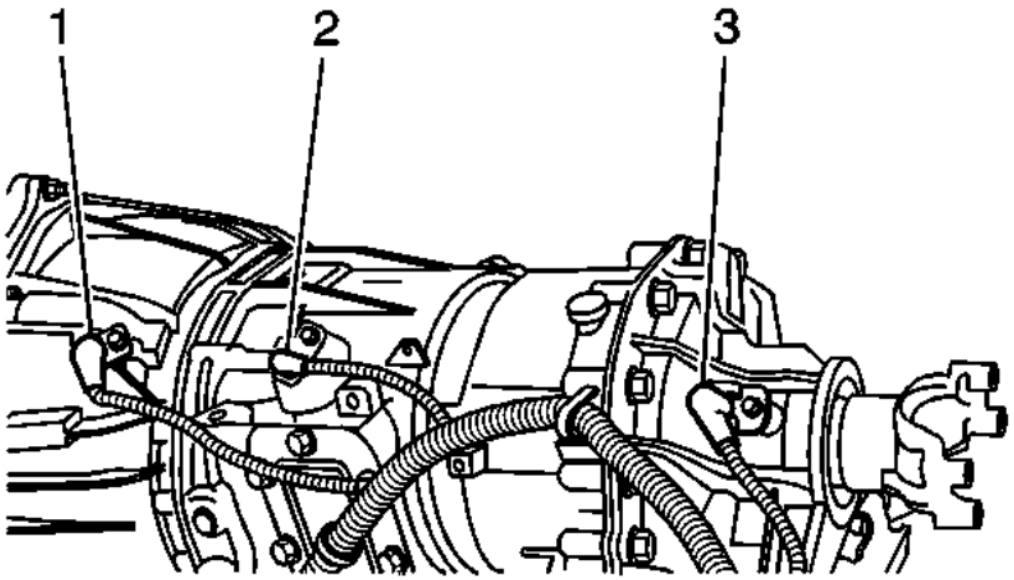


Fig. 115: Identifying Electrical Connectors And Sensors
Courtesy of GENERAL MOTORS CORP.

14. Two wheel drive vehicles disconnect the turbine speed sensor (1), input speed sensor (2) and output speed sensor (3).
15. Four wheel drive vehicles disconnect the electrical connectors to the turbine speed sensor (1), the input speed sensor (2) and any electrical connectors on the transfer case.

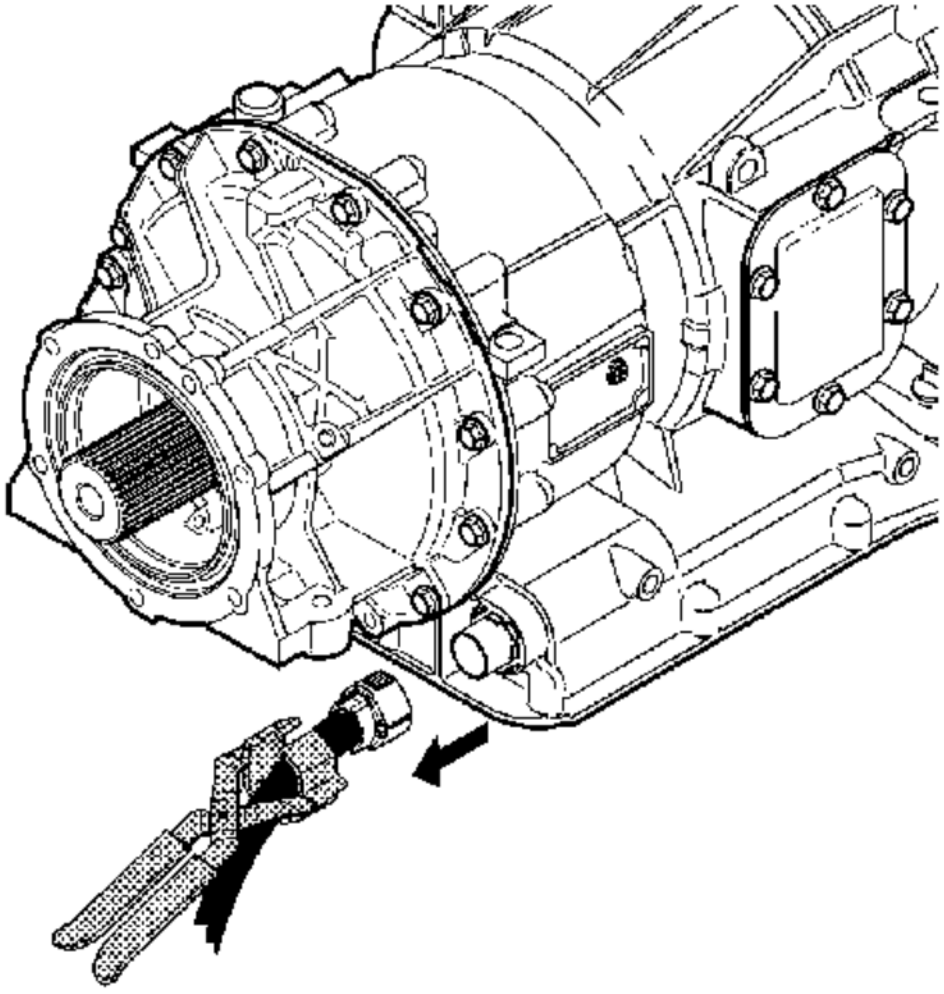


Fig. 116: Transmission Rear Electrical Connector
Courtesy of GENERAL MOTORS CORP.

16. Disconnect the transmission main electrical connector. **J 44257** may be used, but is not required.
17. Remove the transmission heat shield. Refer to **Transmission Heat Shield Replacement**.

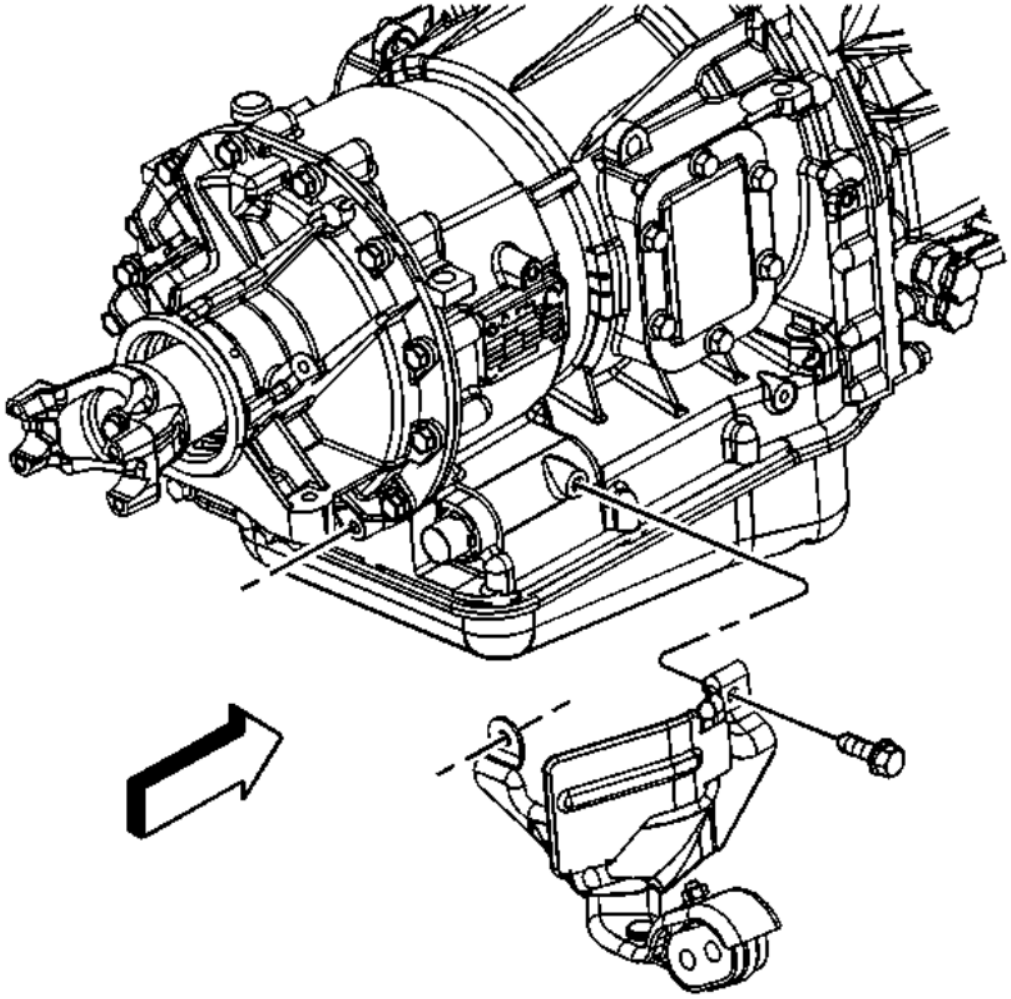


Fig. 117: Exhaust Pipe Hanger Bracket
Courtesy of GENERAL MOTORS CORP.

18. Remove the exhaust hanger bolts and reposition the hanger.
19. Support the transmission with a transmission jack.
20. Two wheel drive vehicles remove the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .
21. Two wheel drive vehicles, remove the transmission support. 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)** .

22. Two wheel drive vehicles, remove the transmission mount from the transmission. Refer to **Transmission Mount Replacement**.
23. Four wheel drive vehicles, remove the transfer case. Refer to the appropriate procedure:
    - If equipped with a NQG, refer to **Transfer Case Assembly Replacement** .
    - If equipped with a NQF, refer to **Transfer Case Assembly Replacement** .
24. Reposition any wiring harness branches out of the way.

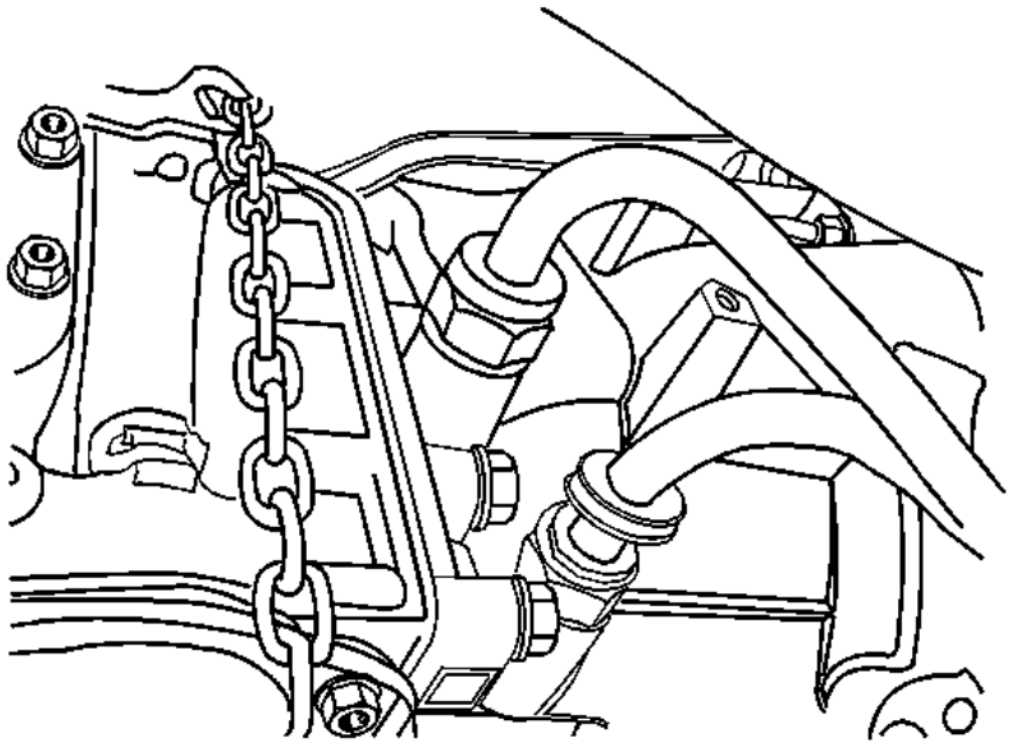


Fig. 118: Securing Safety Chain Around Transmission
Courtesy of GENERAL MOTORS CORP.

25. Secure a safety chain around the transmission. Use care not to overlap any wiring, fuel lines, or other related components.

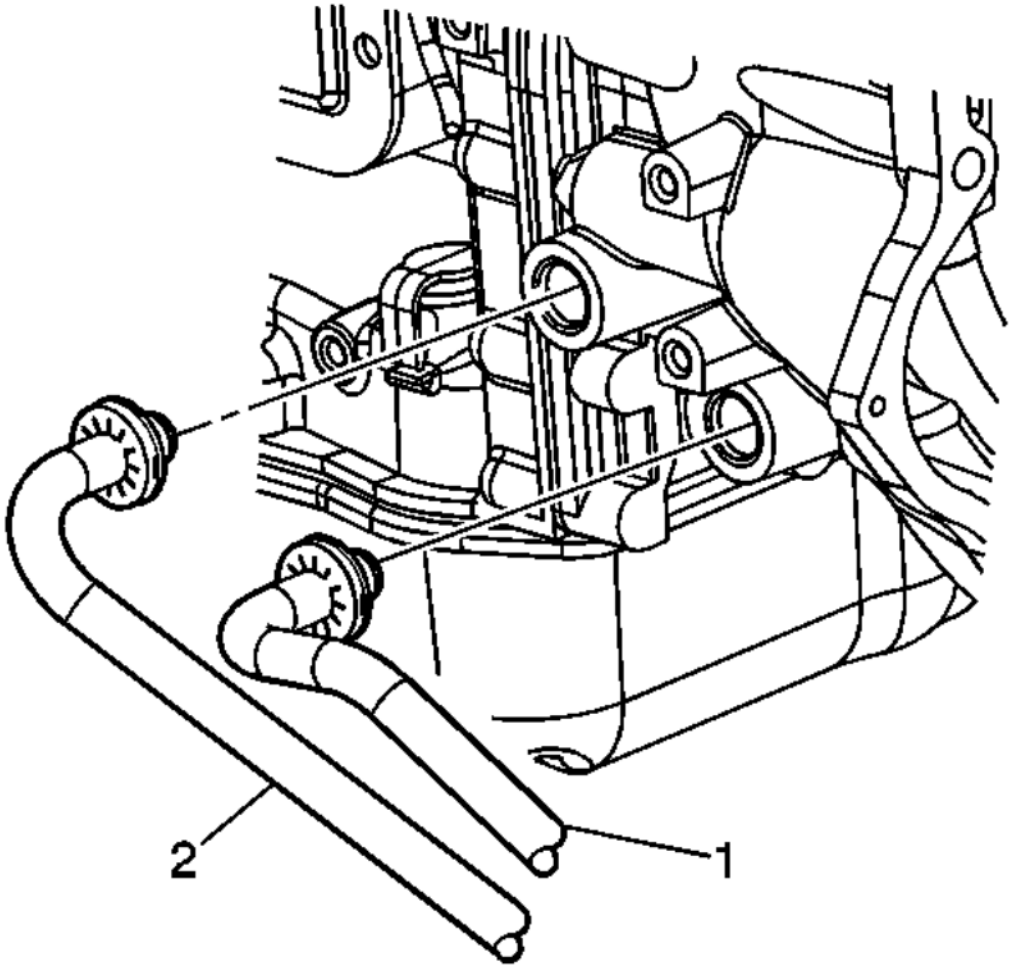


Fig. 119: View Of Transmission Oil Cooler Lines At Transmission
Courtesy of GENERAL MOTORS CORP.

26. Disconnect the transmission oil cooler lines (1, 2) from the transmission.
27. Plug the transmission oil cooler line fittings in the transmission case, if necessary.
28. If the vehicle is equipped with a power take off (PTO) unit, disconnect and/or remove any necessary components to facilitate transmission removal.

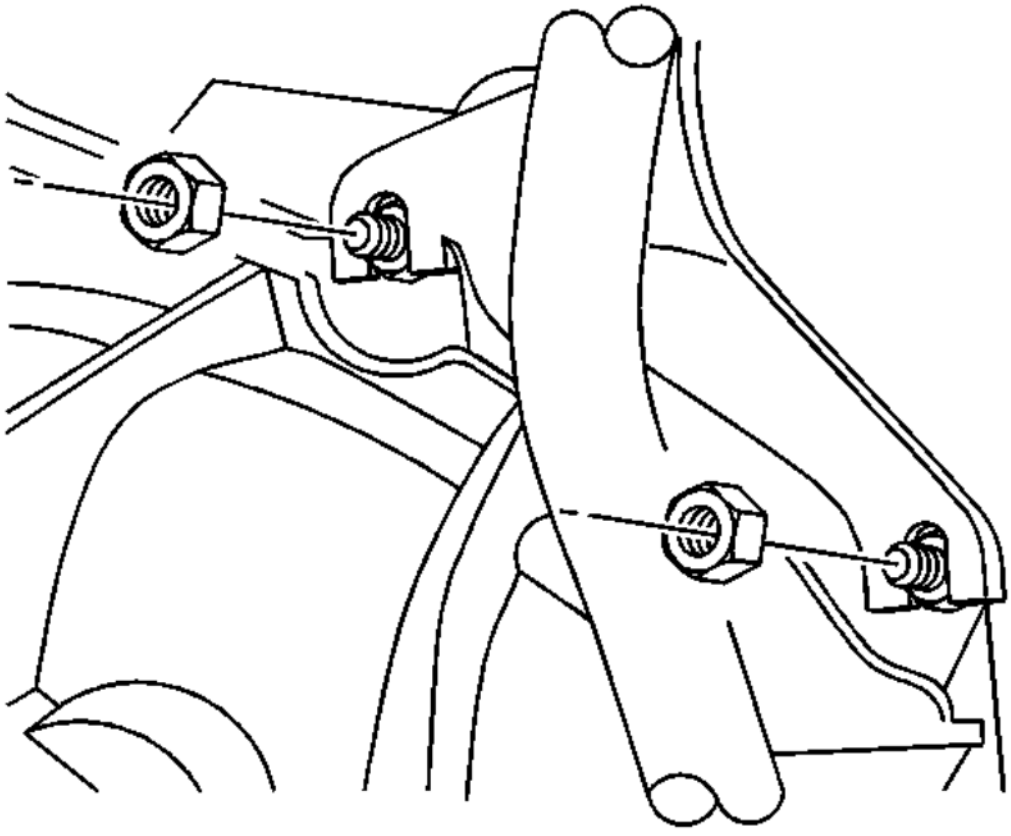


Fig. 120: View Of Fill Tube To Bellhousing Nuts
Courtesy of GENERAL MOTORS CORP.

29. Remove the transmission fill tube nuts from the converter housing studs.

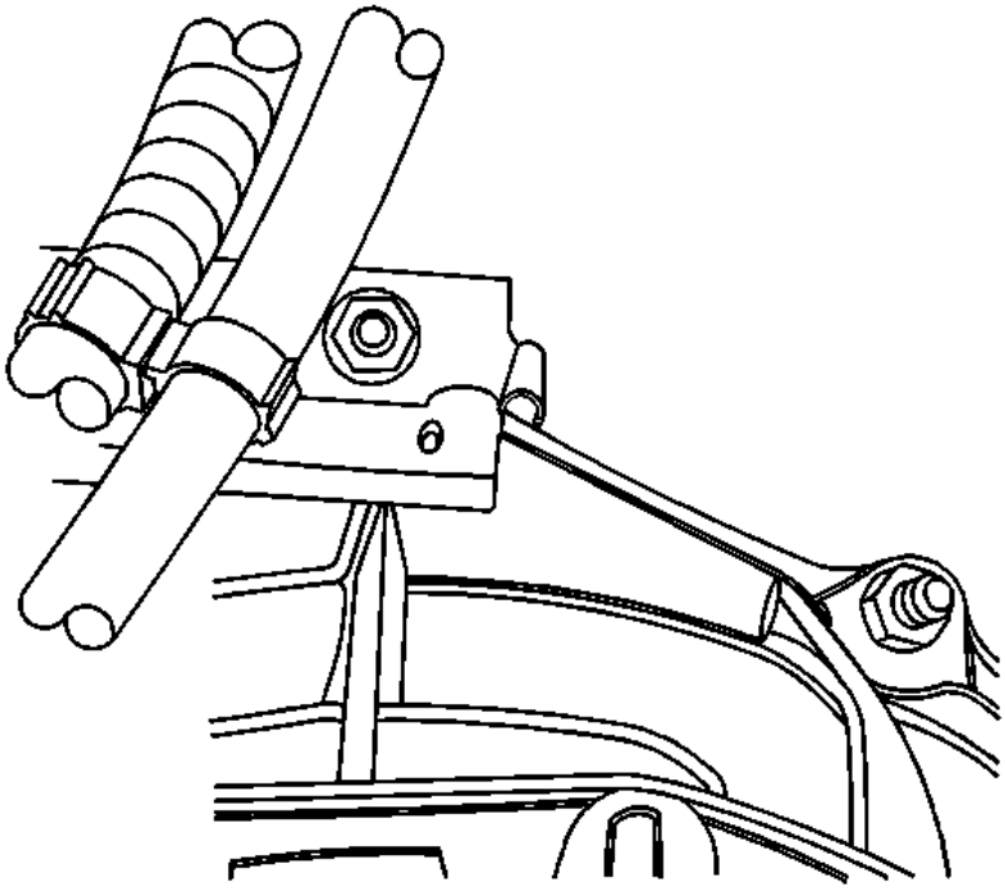


Fig. 121: Wire Harness/Vent Tube Bracket Nut & Converter Housing Stud
Courtesy of GENERAL MOTORS CORP.

30. Remove the wire harness/vent tube bracket nut from the converter housing stud and reposition the bracket.

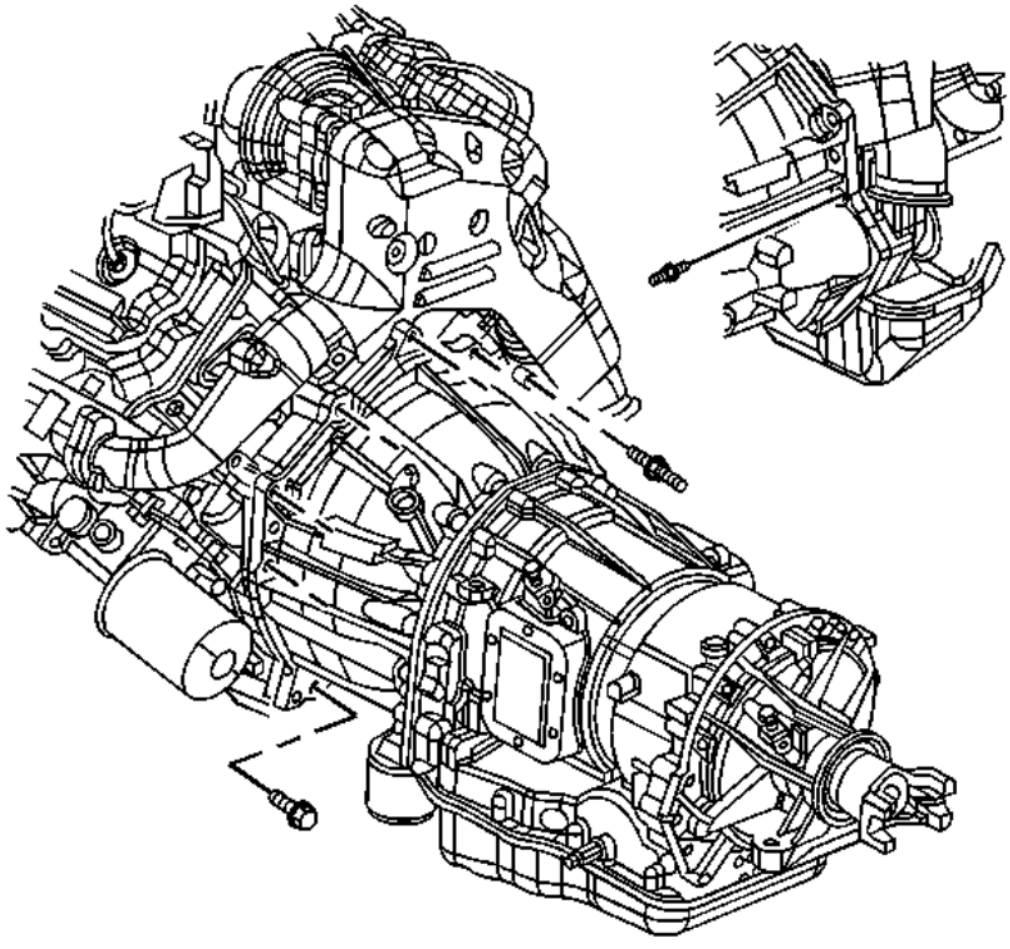


Fig. 122: View of Transmission To Engine Stud & Bolts
Courtesy of GENERAL MOTORS CORP.

31. Remove the remaining converter housing bolts and studs.
32. Separate the transmission from the engine.

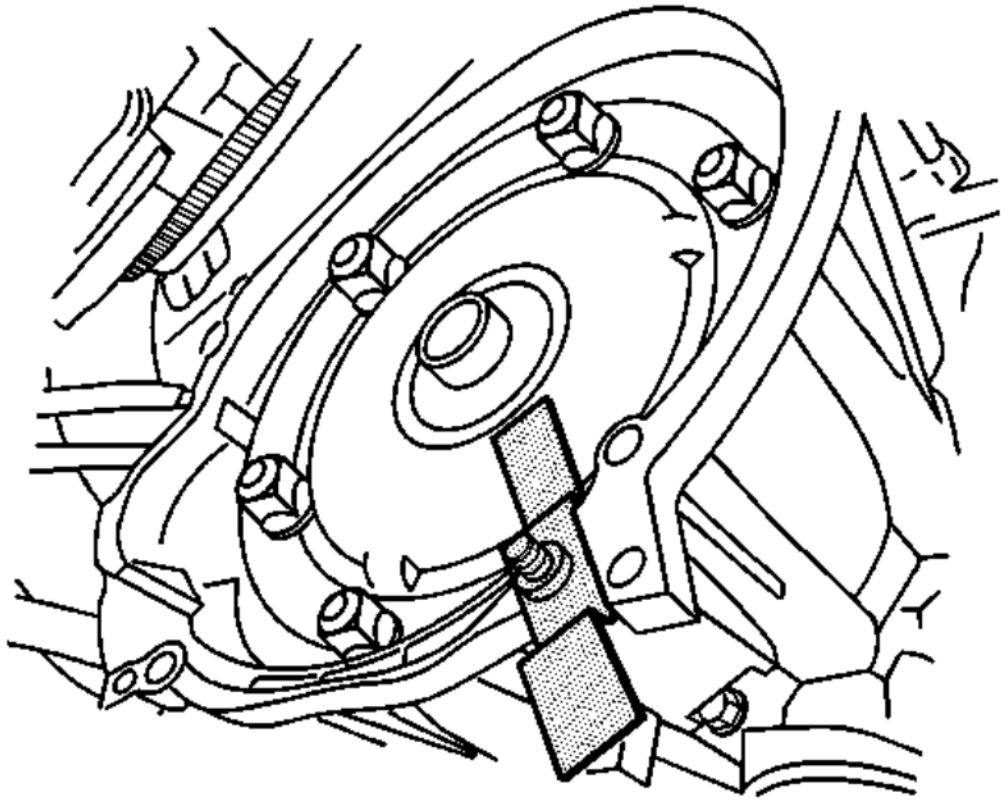


Fig. 123: Installing J 21366 To Converter Housing
Courtesy of GENERAL MOTORS CORP.

33. Install **J 21366** to the converter housing in order to keep the torque converter from sliding off of the turbine shaft.
34. Carefully lower the transmission from the vehicle while simultaneously removing the fill tube.
35. Remove the **J 21366** .

Installation Procedure

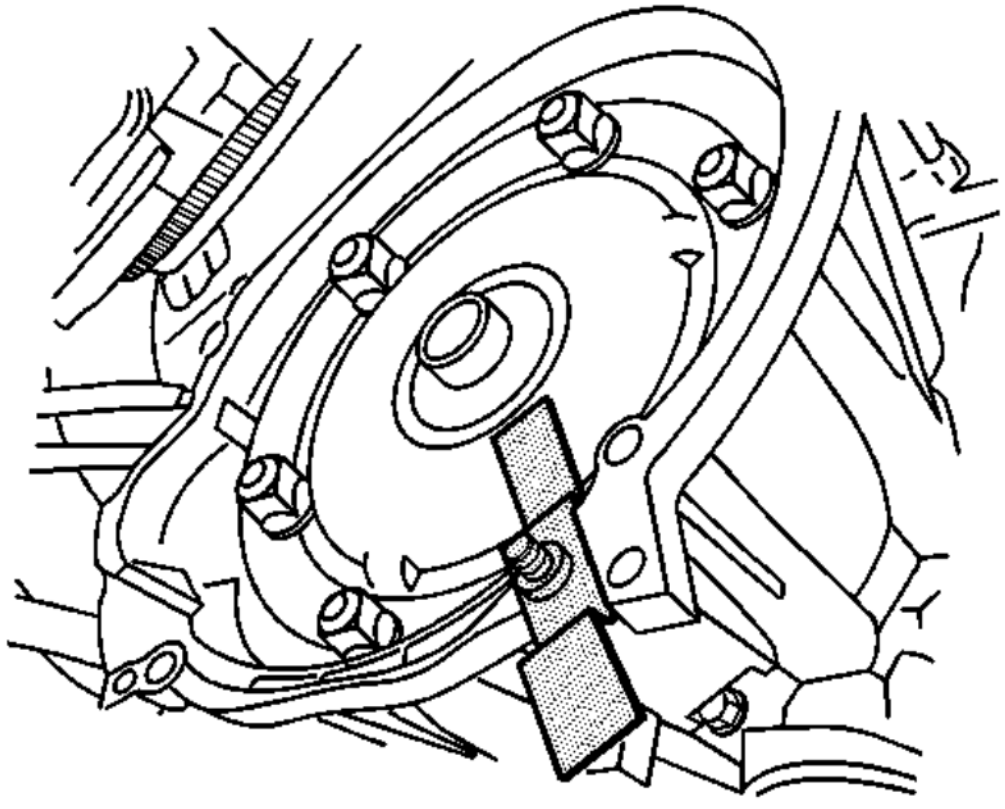


Fig. 124: Installing J 21366 To Converter Housing
Courtesy of GENERAL MOTORS CORP.

1. Install **J 21366** to the converter housing in order to keep the torque converter from sliding off of the turbine shaft.
2. Raise the transmission into place while simultaneously installing the transmission fill tube.
3. Remove the **J 21366**

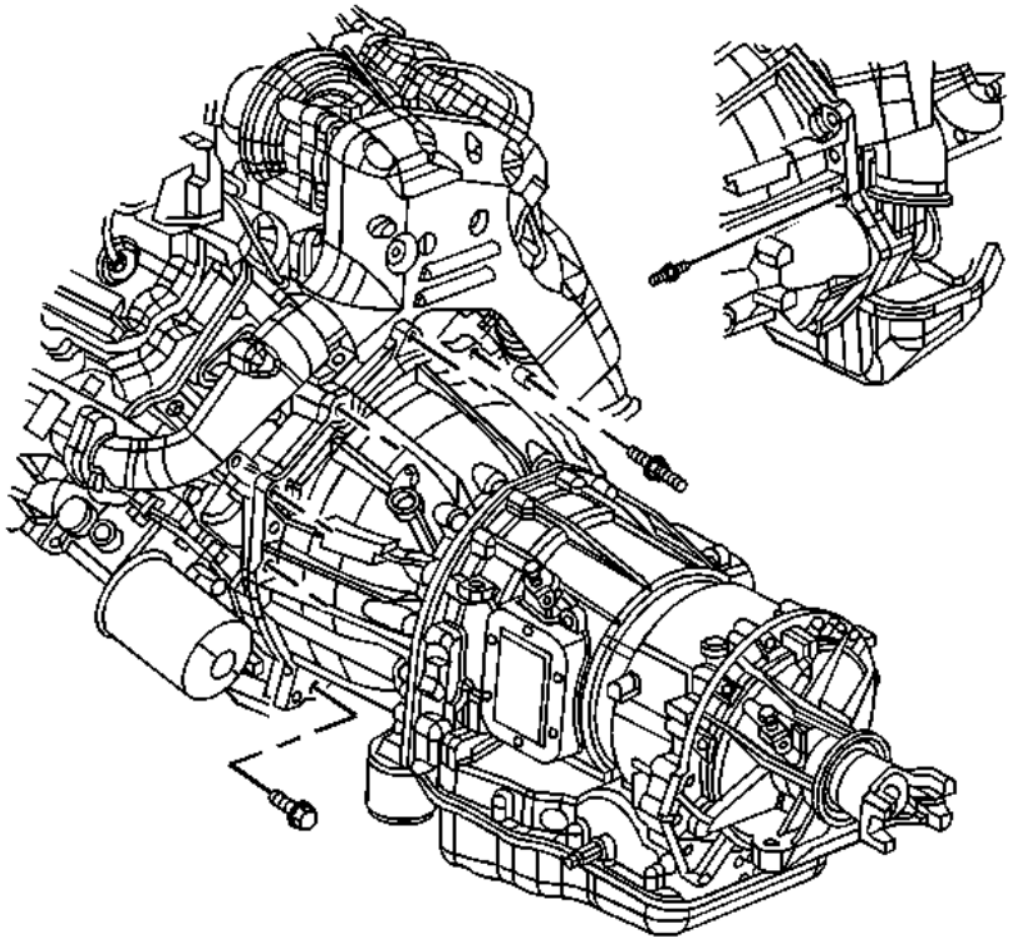


Fig. 125: View of Transmission To Engine Stud & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not install the transmission by drawing it to the engine using the studs and bolts.

4. Align the transmission with the engine using the alignment dowels located at the rear of the engine.

NOTE: Refer to Fastener Notice .

IMPORTANT: Ensure that the torque converter can be rotated before tightening the bolts and studs.

5. Install the converter housing bolts and studs.

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

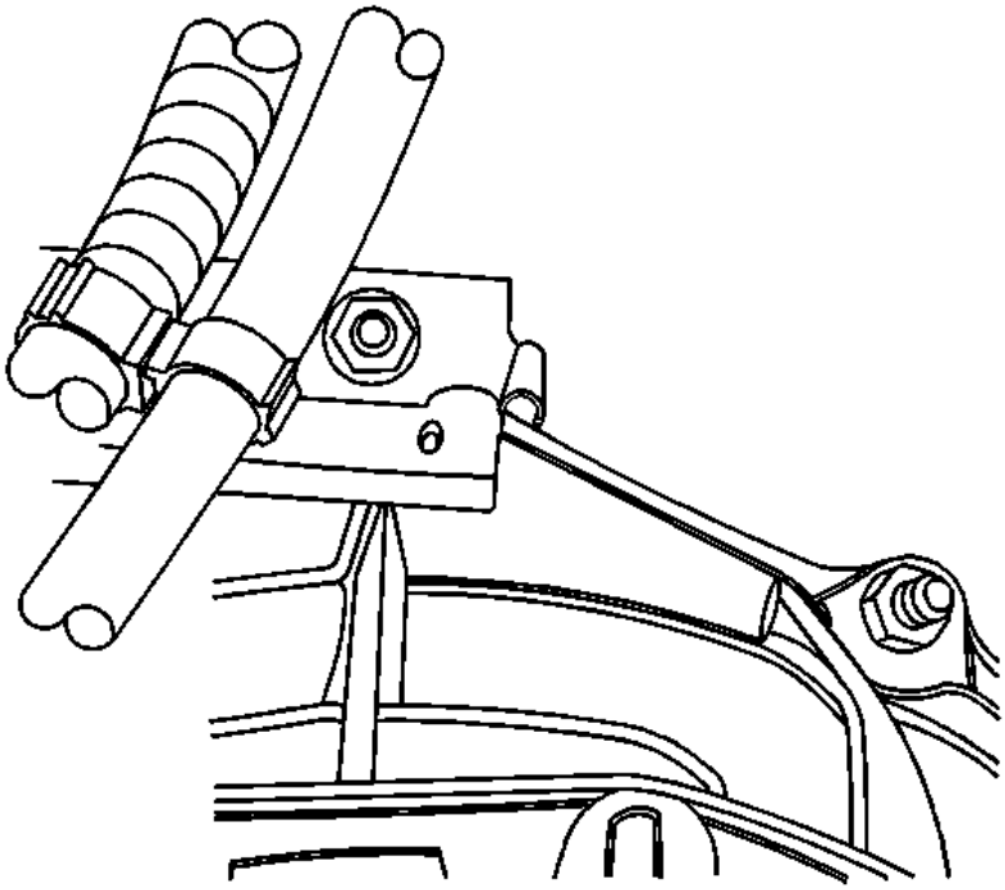


Fig. 126: Wire Harness/Vent Tube Bracket Nut & Converter Housing Stud
Courtesy of GENERAL MOTORS CORP.

6. Install the wire harness/vent tube bracket and nut to the converter housing stud.

   Tighten: Tighten the nut to 18 N.m (13 lb ft).

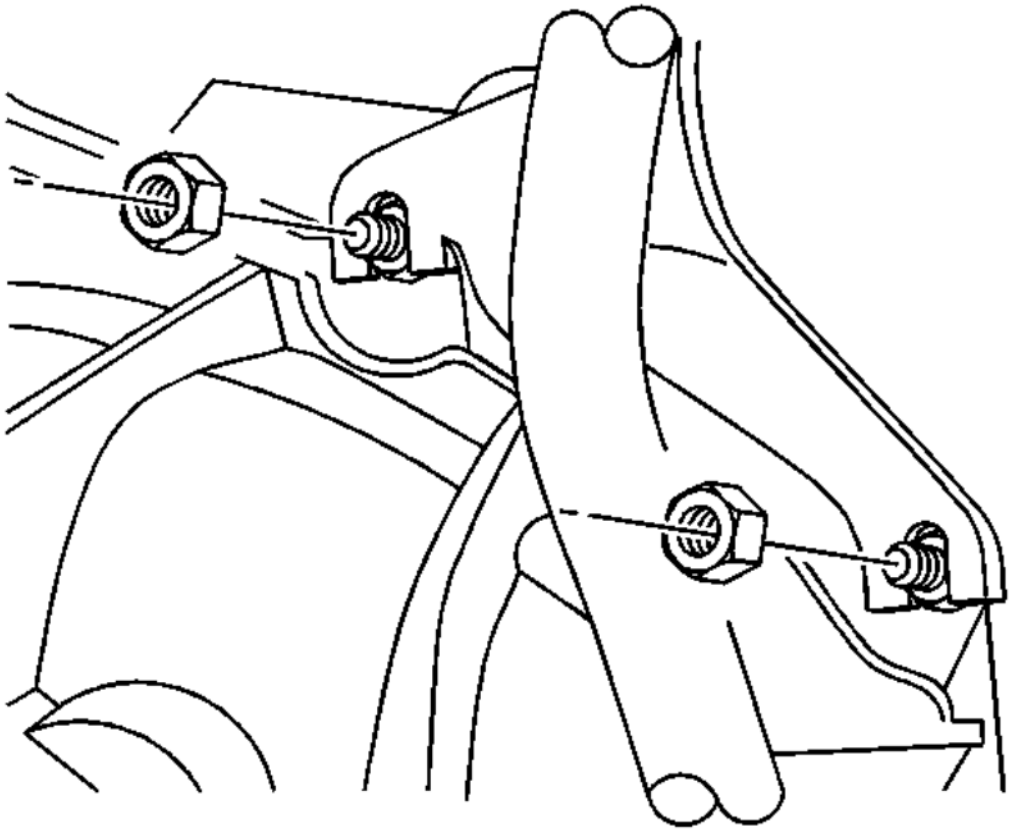


Fig. 127: View Of Fill Tube To Bellhousing Nuts
Courtesy of GENERAL MOTORS CORP.

7. Install the transmission fill tube and nuts to the converter housing studs.

   Tighten: Tighten the nuts to 18 N.m (13 lb ft).

8. If the vehicle is equipped with a PTO unit, connect and/or install the components at this time.

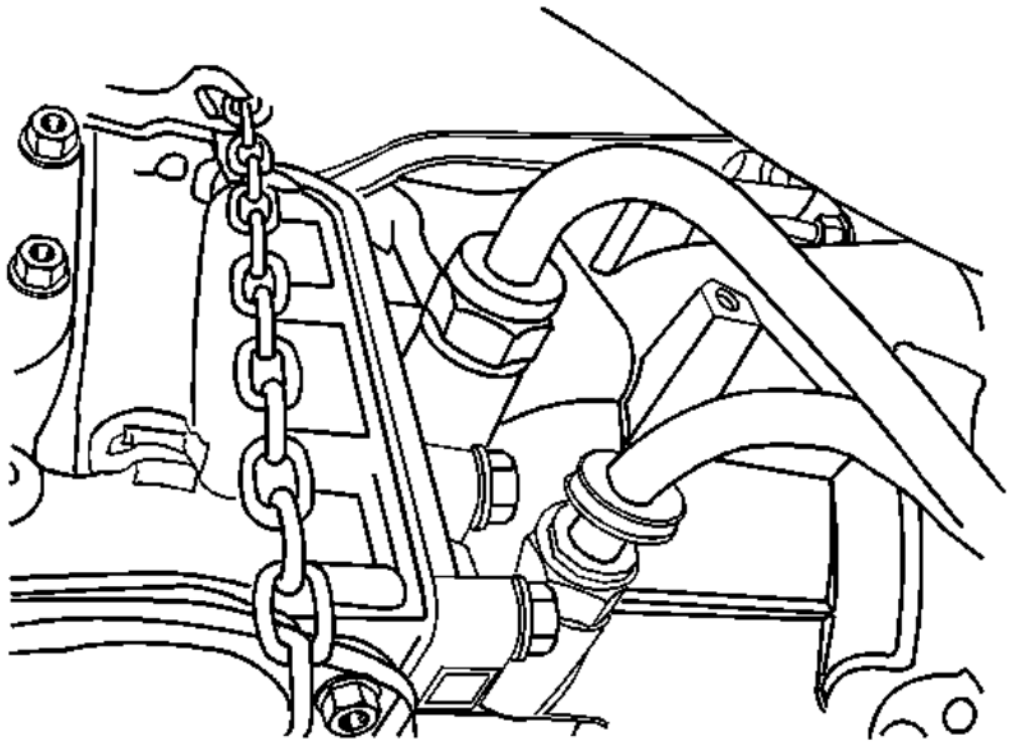


Fig. 128: Securing Safety Chain Around Transmission
Courtesy of GENERAL MOTORS CORP.

9. Remove the safety chain from around the transmission.
10. Four wheel drive vehicles install the transfer case, transmission support and propeller shafts. Refer to the appropriate procedure:
    - If equipped with a NQG, refer to **Transfer Case Assembly Replacement** .
    - If equipped with a NQF, refer to **Transfer Case Assembly Replacement** .
11. Two wheel drive vehicles, install the transmission mount to the transmission. Refer to **Transmission Mount Replacement**.
12. Two wheel drive vehicles, install the transmission support. 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)** .

13. Two wheel drive vehicles, install the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .

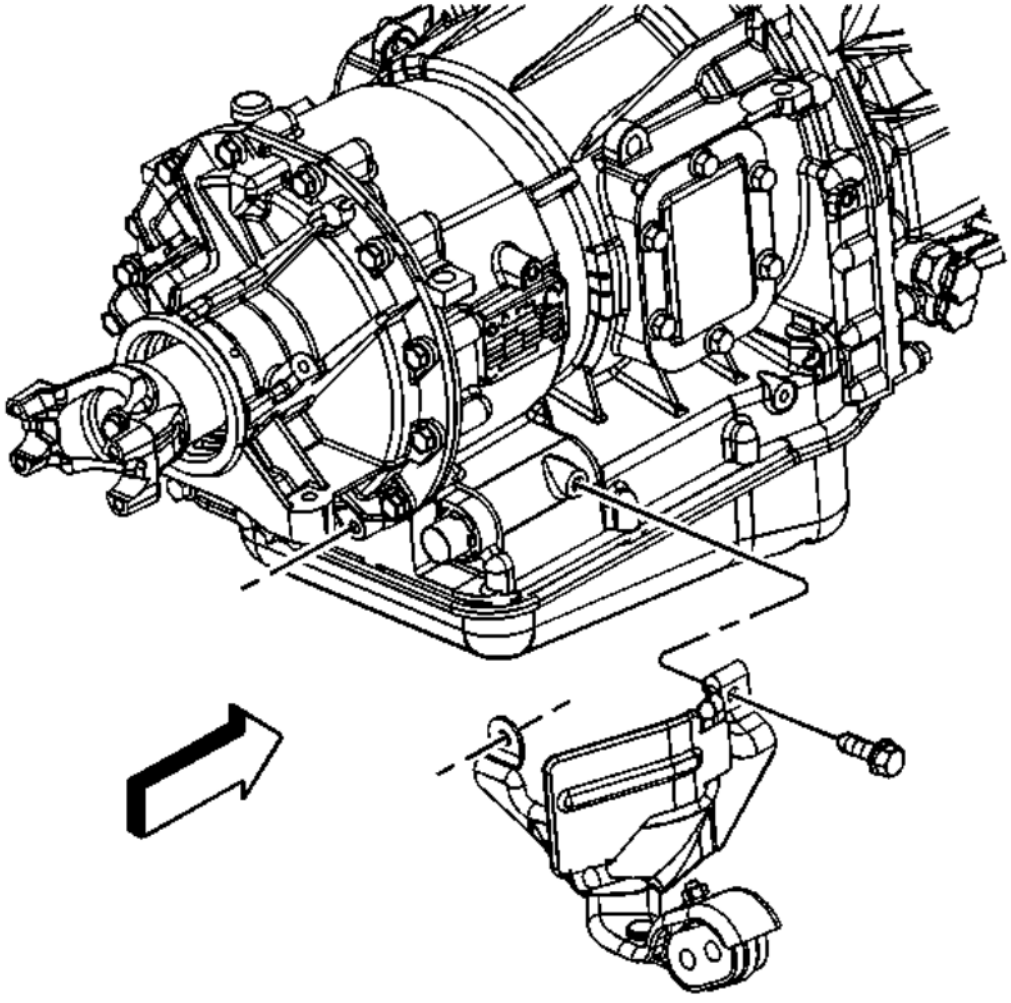


Fig. 129: Exhaust Pipe Hanger Bracket
Courtesy of GENERAL MOTORS CORP.

14. Position the exhaust hanger and install the bolts.

Tighten: Tighten the bolts to 12 N.m (106 lb in).

15. Install the transmission heat shield. Refer to **Transmission Heat Shield Replacement**.
16. Position the wiring harness branches.

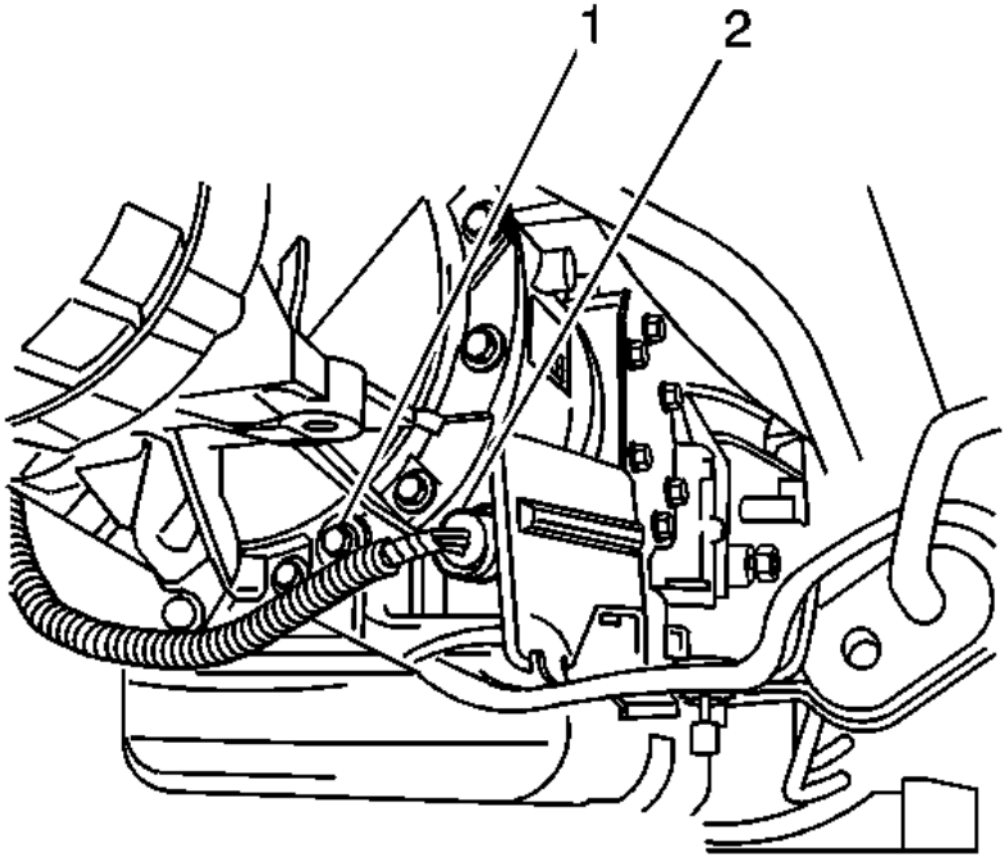


Fig. 130: Identifying Transmission Main Electrical Connector
Courtesy of GENERAL MOTORS CORP.

17. Connect the transmission main electrical connector (2).

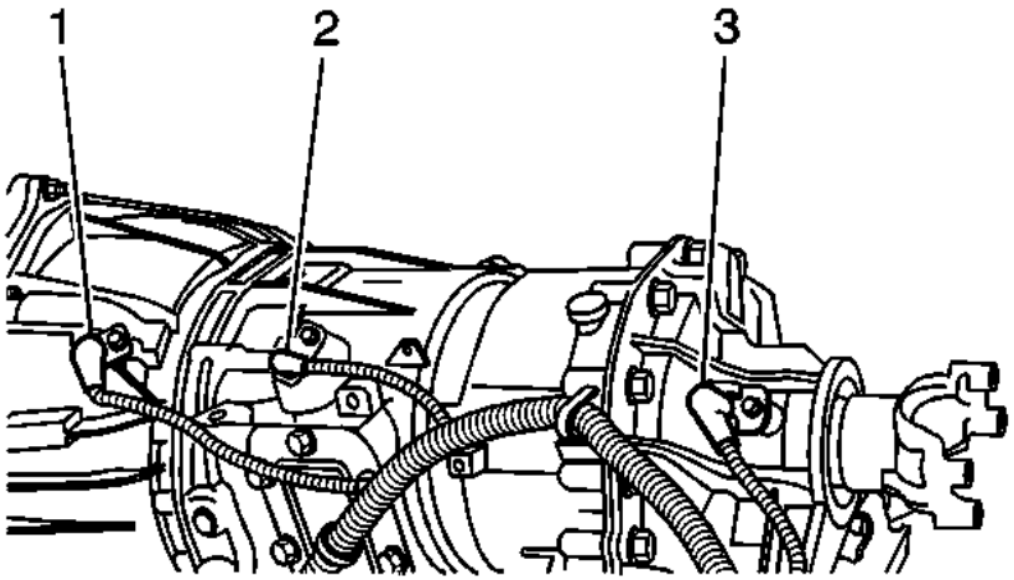


Fig. 131: Identifying Electrical Connectors And Sensors
Courtesy of GENERAL MOTORS CORP.

18. Two wheel drive vehicles, connect the electrical connectors to the output speed sensor (3), turbine speed sensor (1), and the input speed sensor (2).
19. Four wheel drive vehicles, connect the electrical connectors to the turbine speed sensor (1), the input speed sensor (2) and any remaining electrical connectors on the transfer case.

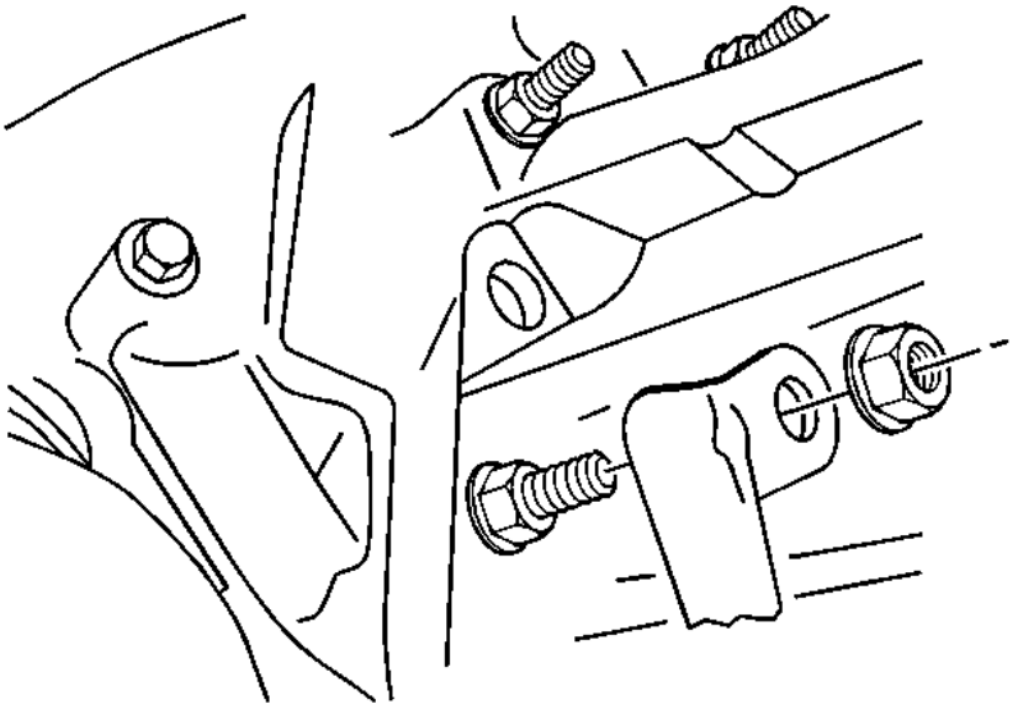


Fig. 132: Identifying Fuel Line Bracket
Courtesy of GENERAL MOTORS CORP.

20. Install the fuel line bracket and nut to the transmission converter housing stud.

    Tighten: Tighten the nut to 18 N.m (13 lb ft).

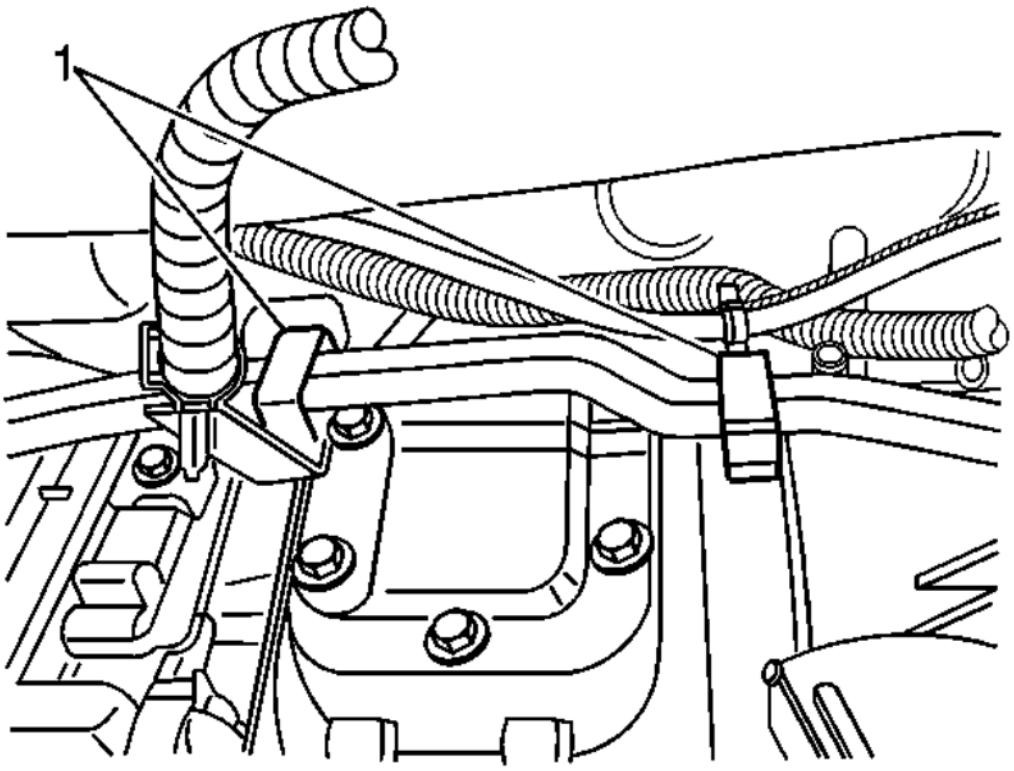


Fig. 133: Identifying Fuel Line Retainer Bolts
Courtesy of GENERAL MOTORS CORP.

21. Install the fuel line retainer (1) and bolts to the left side of the transmission.

    Tighten: Tighten the bolts to 2.5 N.m (22 lb in).

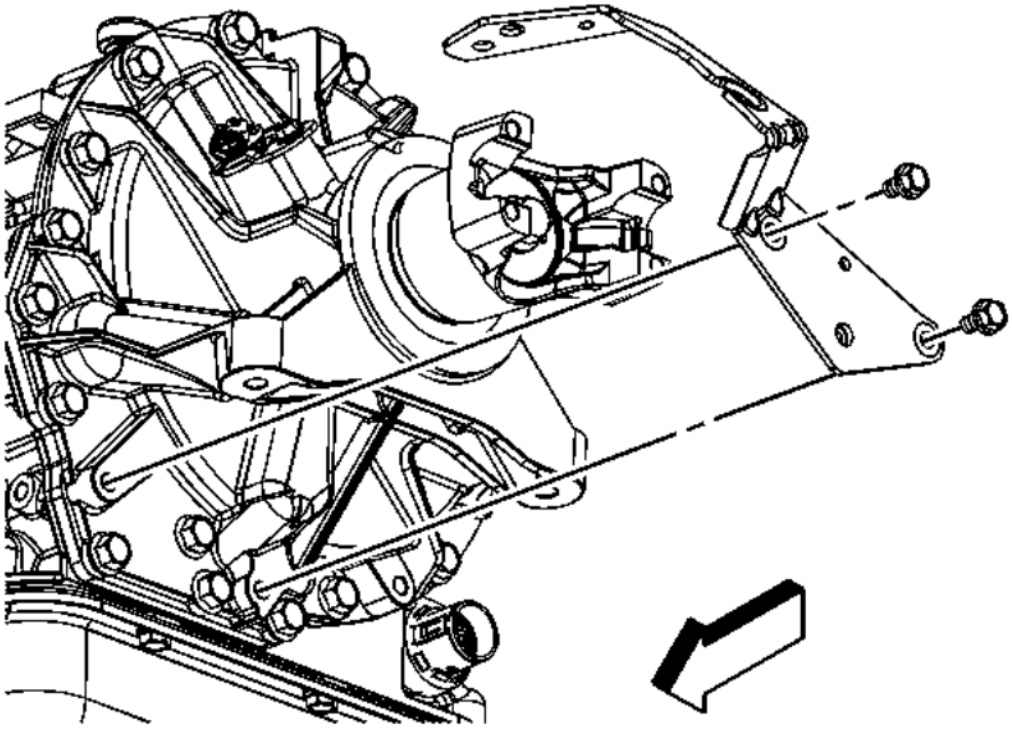


Fig. 134: View Of Shift Cable Bracket And Bolts
Courtesy of GENERAL MOTORS CORP.

22. Install the shift cable bracket and bolts to the transmission.

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

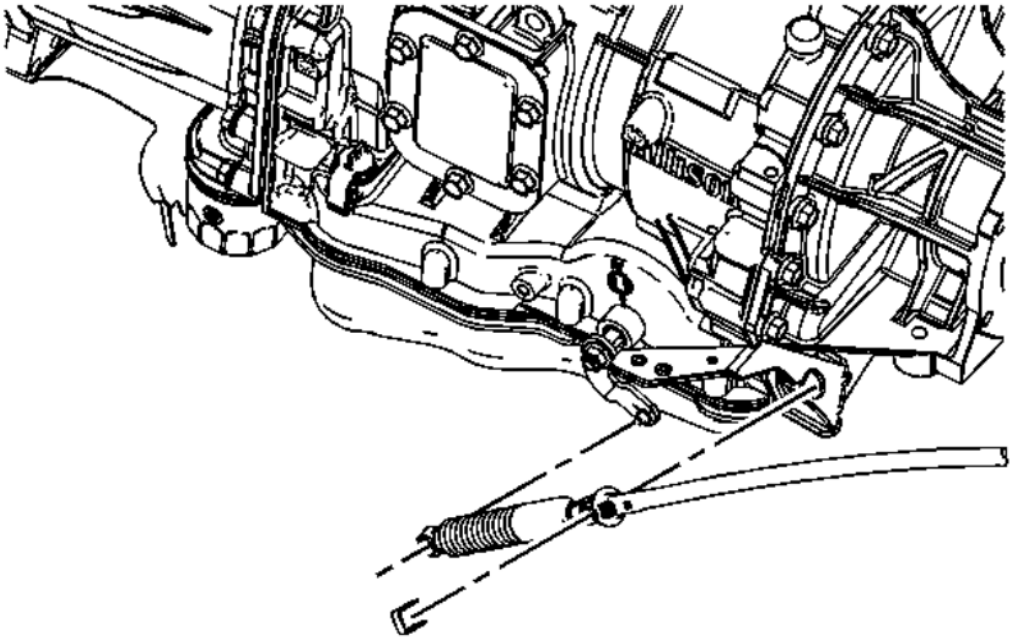


Fig. 135: Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

23. Install the range selector cable end to the transmission range selector lever stud.

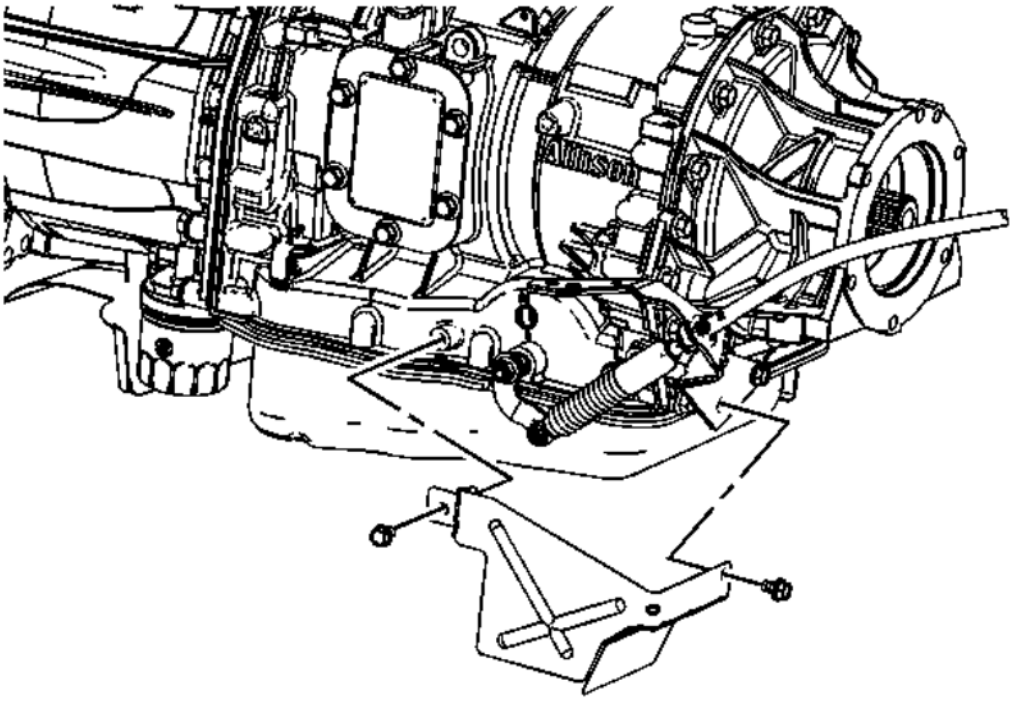


Fig. 136: Range Selector Cable Heat Shield
Courtesy of GENERAL MOTORS CORP.

24. Install the range selector cable heat shield.

IMPORTANT: Install bolts by hand then mechanically tighten the front bolt first and the rear bolt last. Failure to tighten the bolts in the specified order will result in misalignment of the heat shield.

25. Install the range selector cable heat shield bolts.
    1. **Tighten:** Tighten the front bolt to 25 N.m (18 lb ft).
    2. **Tighten:** Tighten the rear bolt to 25 N.m (18 lb ft).

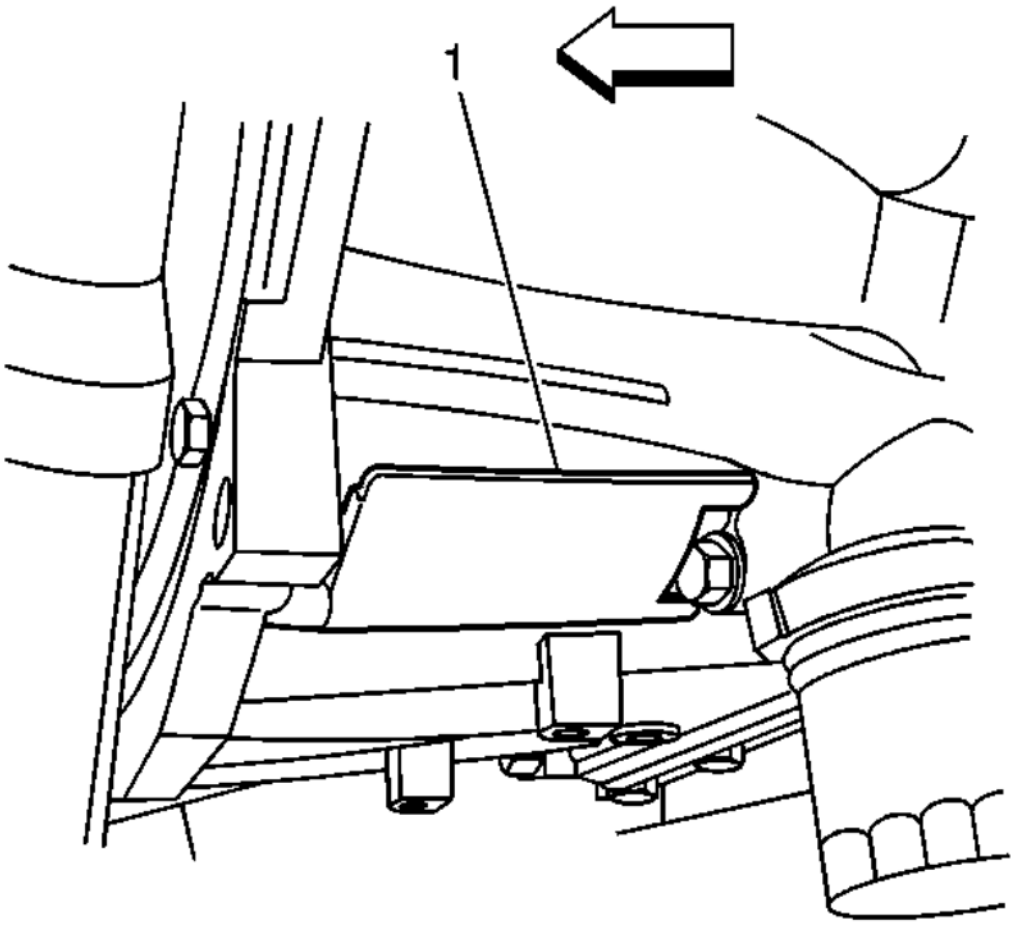


Fig. 137: Identifying Converter Housing Access Hole Cover
Courtesy of GENERAL MOTORS CORP.

26. Remove the access hole cover (1) on the converter housing in order to rotate the converter and align the first torque converter bolt.

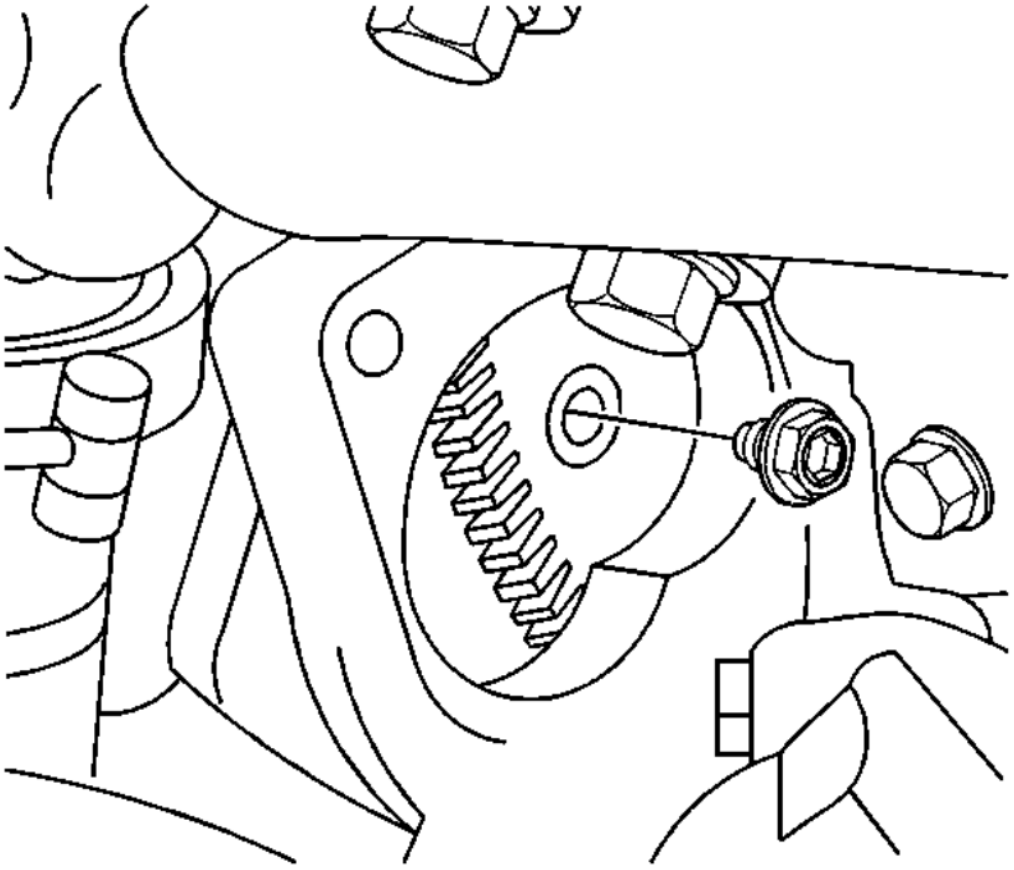


Fig. 138: View Of Torque Convertor Bolt
Courtesy of GENERAL MOTORS CORP.

27. 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.
28. Install the torque converter bolts.

    Tighten: Tighten the bolts to 60 N.m (44 lb ft).

29. Install the converter housing access hole cover.
30. 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)** .

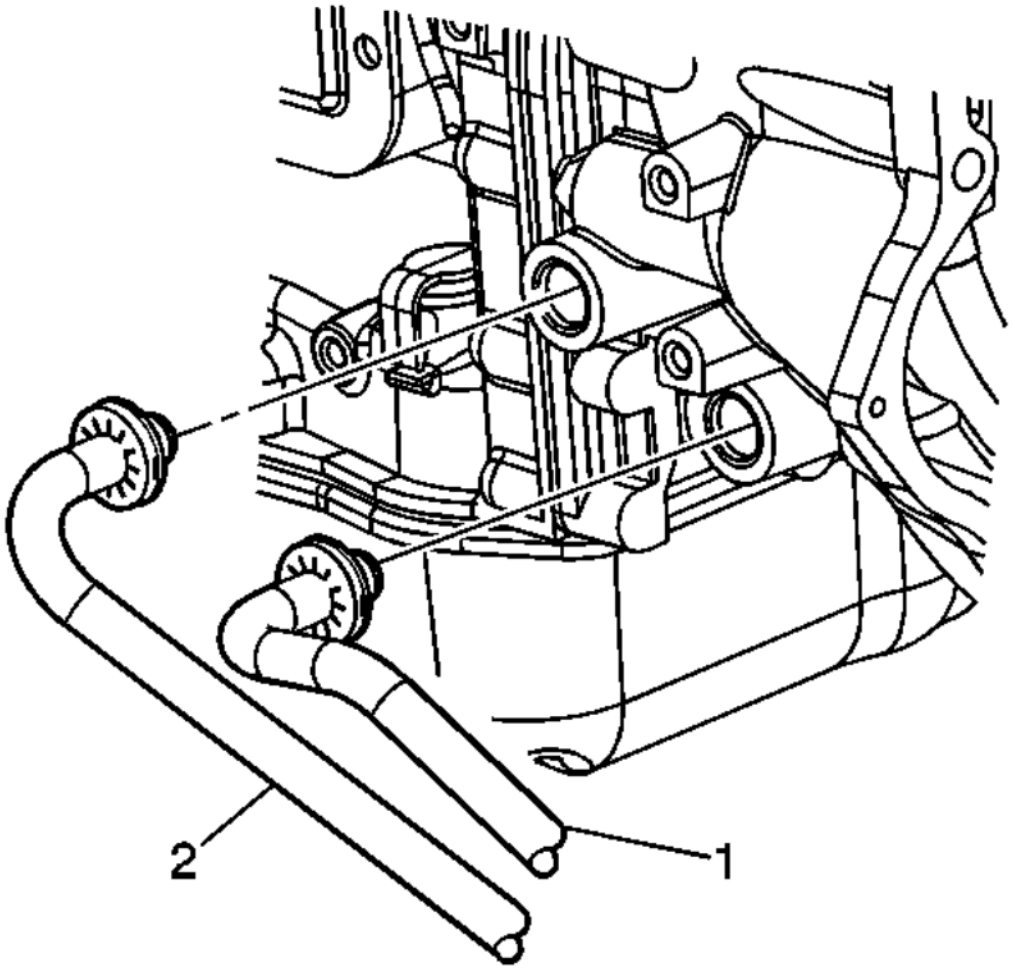


Fig. 139: View Of Transmission Oil Cooler Lines At Transmission
Courtesy of GENERAL MOTORS CORP.

31. Remove the plugs from the transmission oil cooler line fittings in the transmission case, if necessary.
32. Flush the transmission oil cooler and lines, if necessary. Refer to **Transmission Fluid Cooler Flushing and Flow Test**.
33. Connect the transmission oil cooler lines (1, 2) to the transmission.
34. Lower the vehicle.
35. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement (Non-**

HP2) .

36. Connect both negative battery cables. 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)** .
37. Fill the transmission with new transmission fluid.
38. Install the transmission fluid level indicator.
39. If a replacement transmission was installed, perform the "FastLearn" procedure using a scan tool. Refer to **FastLearn Procedure**.

OFF-VEHICLE REPAIR INFORMATION

HOLDING FIXTURE INSTALLATION

Tools Required

J 44723 Transmission/Stand Adapter Plate. See **Special Tools**.

Installation

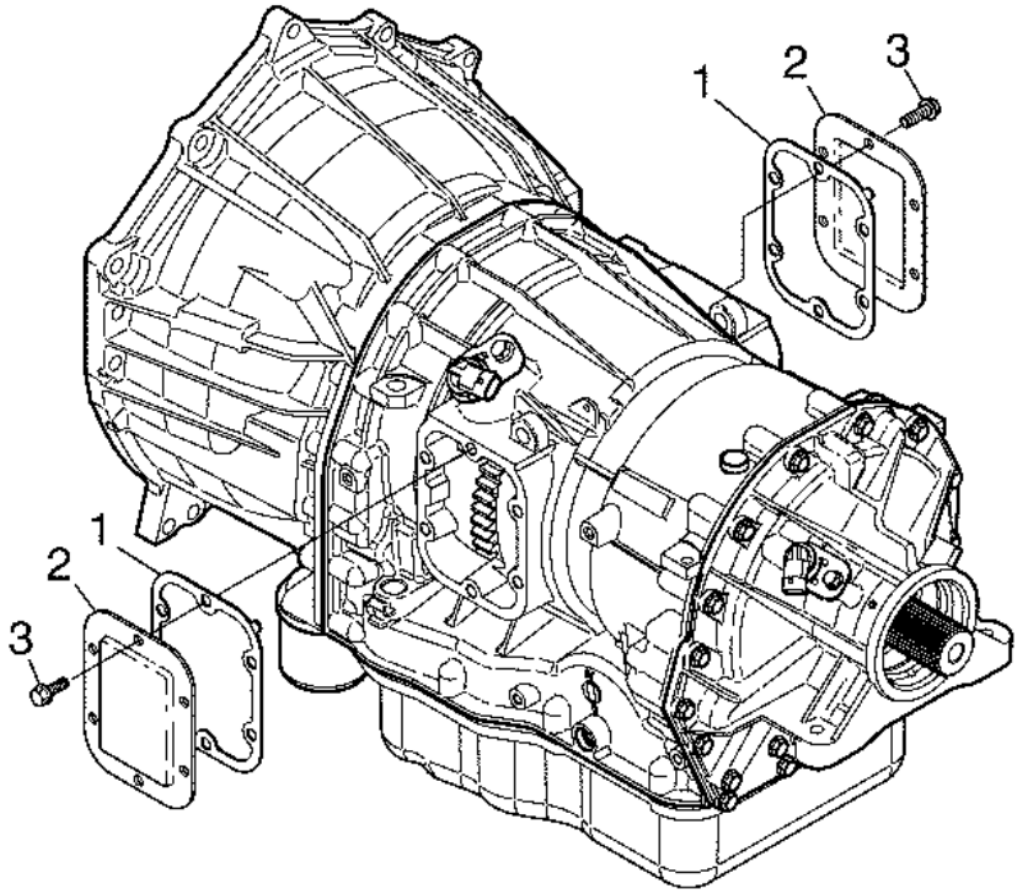


Fig. 140: PTO Cover, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

CAUTION: The torque converter must be held to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage.

CAUTION: The 1000 Series™ transmission dry weight is approximately 150 kg (330 lb). To help avoid personal

injury and/or property damage: Use caution when installing, removing, or moving the transmission. Get help when lifting the transmission. Assistance from a hoist or another person may be required. Ensure that lifting equipment can properly support the transmission.

1. Position the transmission on the work table so that the transmission is resting on the oil pan.
2. Remove 12 power take-off (PTO) cover bolts (3)
3. Remove 2 PTO covers (2).
4. Remove the PTO gaskets (1).

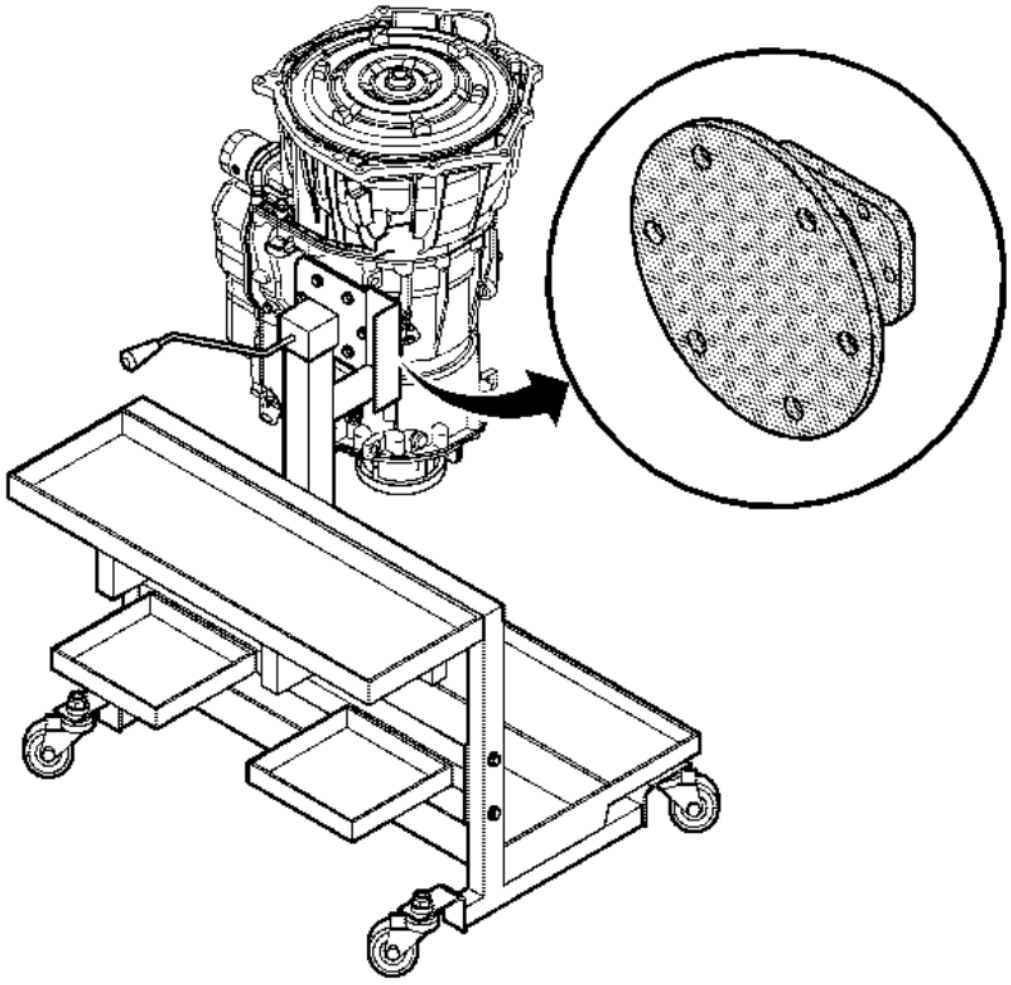


Fig. 141: Transmission Mounted On Holding Fixture
Courtesy of GENERAL MOTORS CORP.

5. Install **J 44723** onto the repair stand. See **Special Tools**.
6. Attach a sling to the transmission.
7. Attach a hoist to the sling.
8. Raise the transmission to adapter plate **J 44723** . See **Special Tools**.

CAUTION: If the transmission is not secured properly to the adapter plate, the transmission could fall. To help avoid personal

injury and/or property damage: Use at least 5 bolts to support the transmission. Use M10 x 1.5 bolts with 19-25 mm (3/4-1 inch) thread engagement. If the proper bolt is not used, the PTO bolt holes may be damaged.

9. Secure the transmission to **J 44723** using either of the PTO mounting pads as the attachment point. See **Special Tools**.
10. Remove the sling from the transmission.

TURBINE SPEED SENSOR REMOVAL

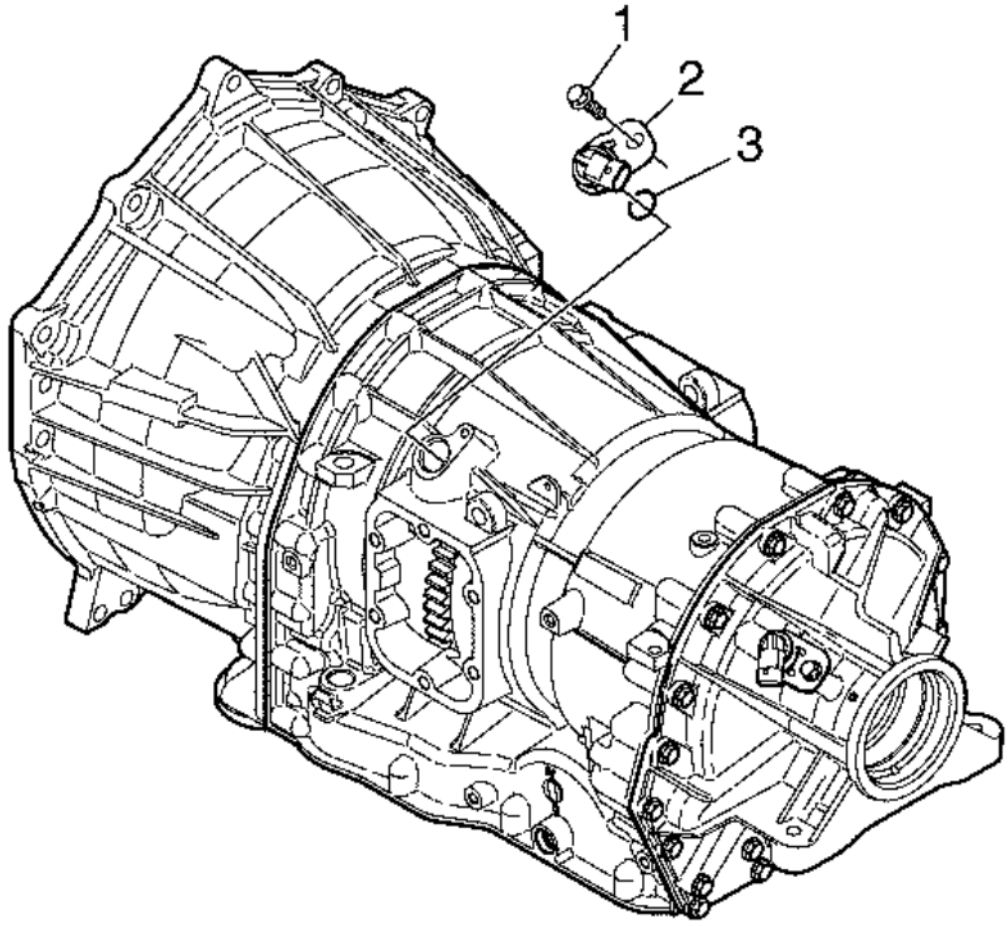


Fig. 142: VSS And Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the vehicle speed sensor bolt (1) that retains the turbine speed sensor (2) to the transmission case.
2. Remove the turbine speed sensor (2).
3. Remove the vehicle speed sensor O-ring (3) from the turbine speed sensor.

1-2-3-4-5-6 CLUTCH PISTON HOUSING ASSEMBLY REMOVAL

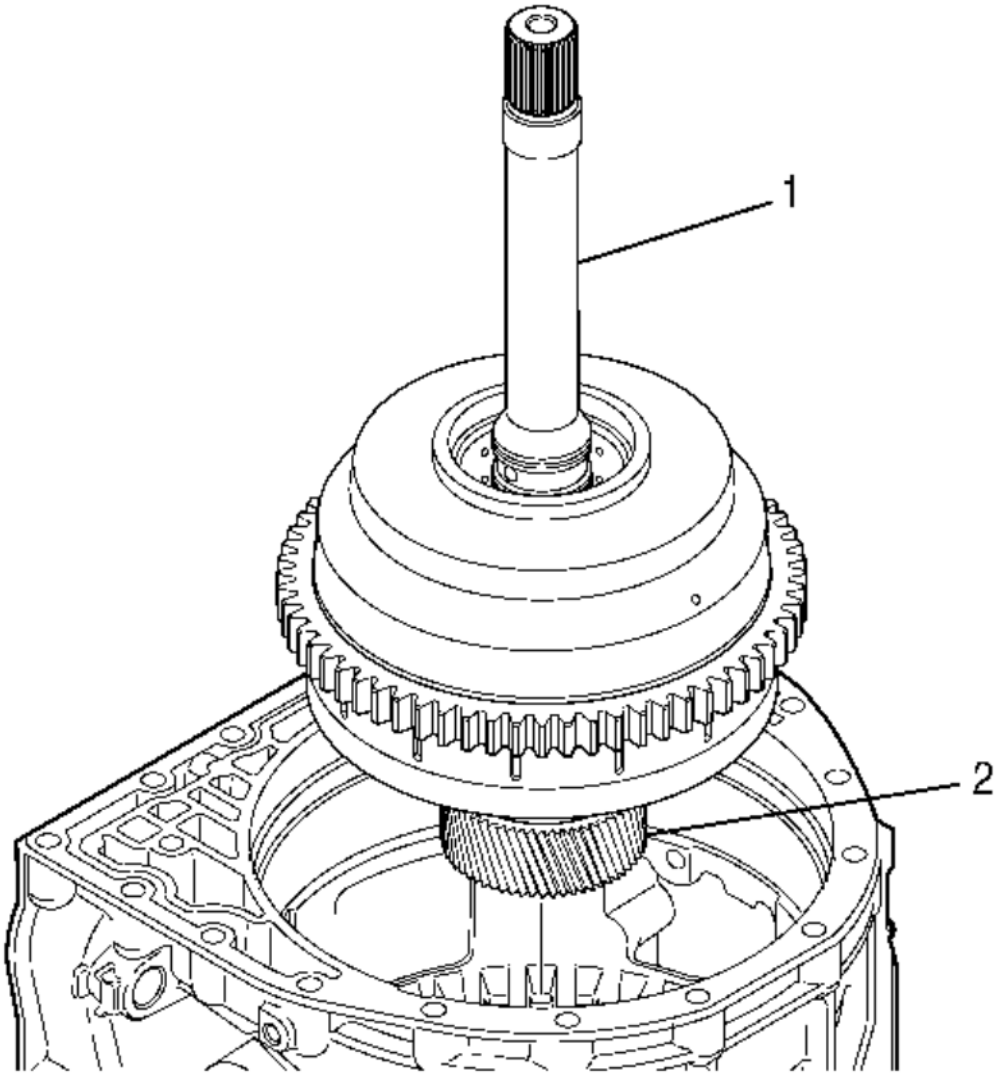


Fig. 143: Identifying 1-2-3-4, 4-5-6 Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

1. Lift and remove the 1-2-3-4, 4-5-6 clutch piston assembly (1).

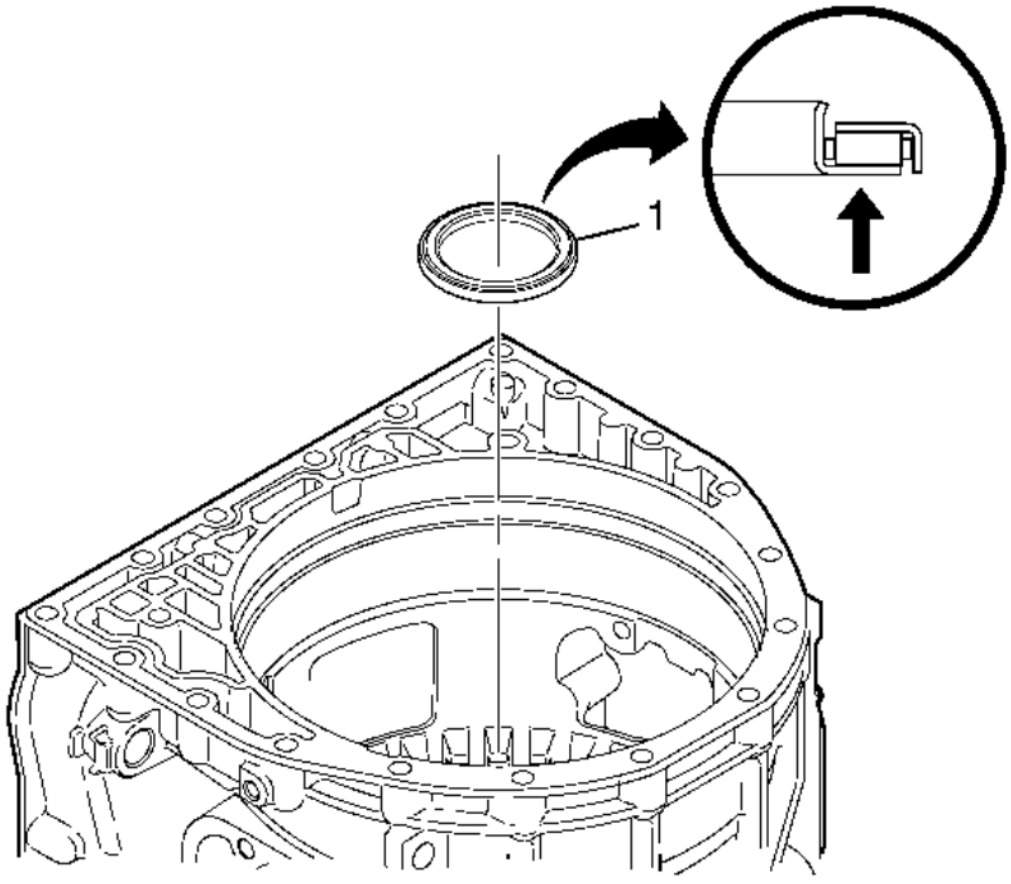


Fig. 144: Locating Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The thrust bearing assembly may stick to the 1-2-3-4, 4-5-6 clutch piston assembly or the input carrier assembly.

2. Remove thrust bearing assembly (1) from the 1-2-3-4, 4-5-6 clutch piston assembly or the input carrier assembly.

OUTPUT SPEED SENSOR REMOVAL (2WD)

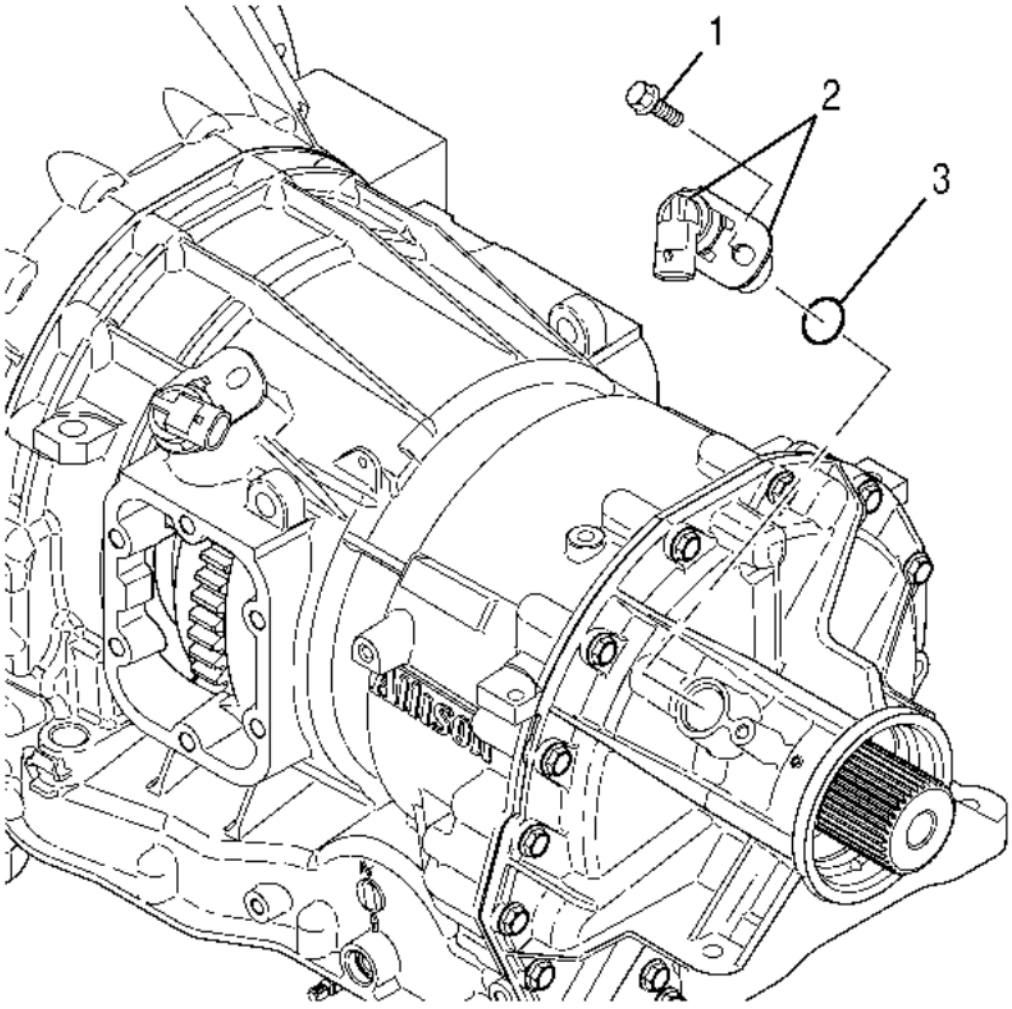


Fig. 145: Output Speed Sensor & Vehicle Speed Sensor Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the vehicle speed sensor bolt (1) that retains the output speed sensor (2) to the low and reverse clutch housing - 2WD.
2. Remove the output speed sensor (2).
3. Remove the vehicle speed sensor O-ring (3) from the output speed sensor.

TRANSMISSION VENT REMOVAL

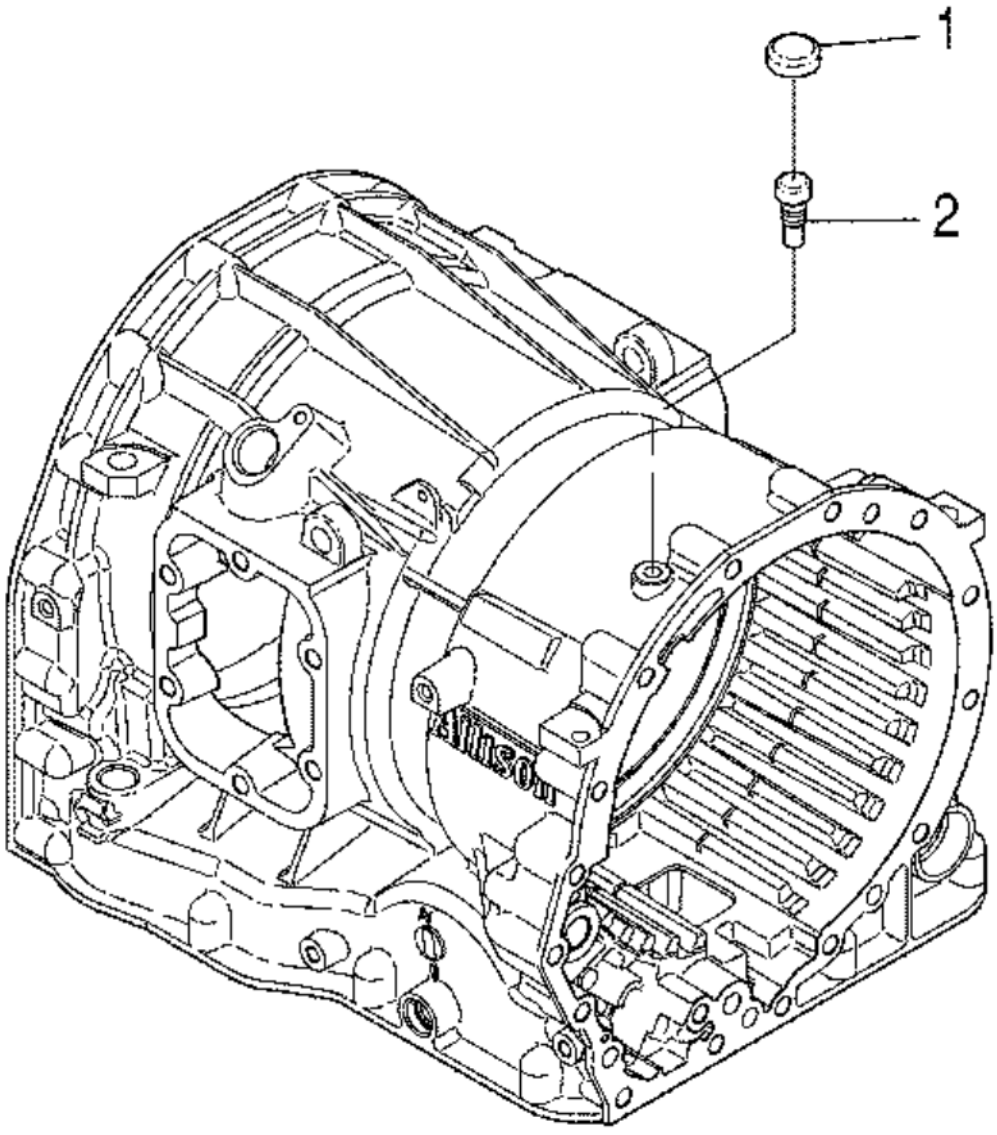


Fig. 146: View Of Transmission Case Vent
Courtesy of GENERAL MOTORS CORP.

1. Gently pry the vent (2) from the transmission case.
2. If the vent cap (1) comes off, gently pry the stem from the transmission case.

TORQUE CONVERTER ASSEMBLY REMOVAL

Tools Required

J 46409 Torque Converter Lifting Handles. See **Special Tools**.

Removal Procedure

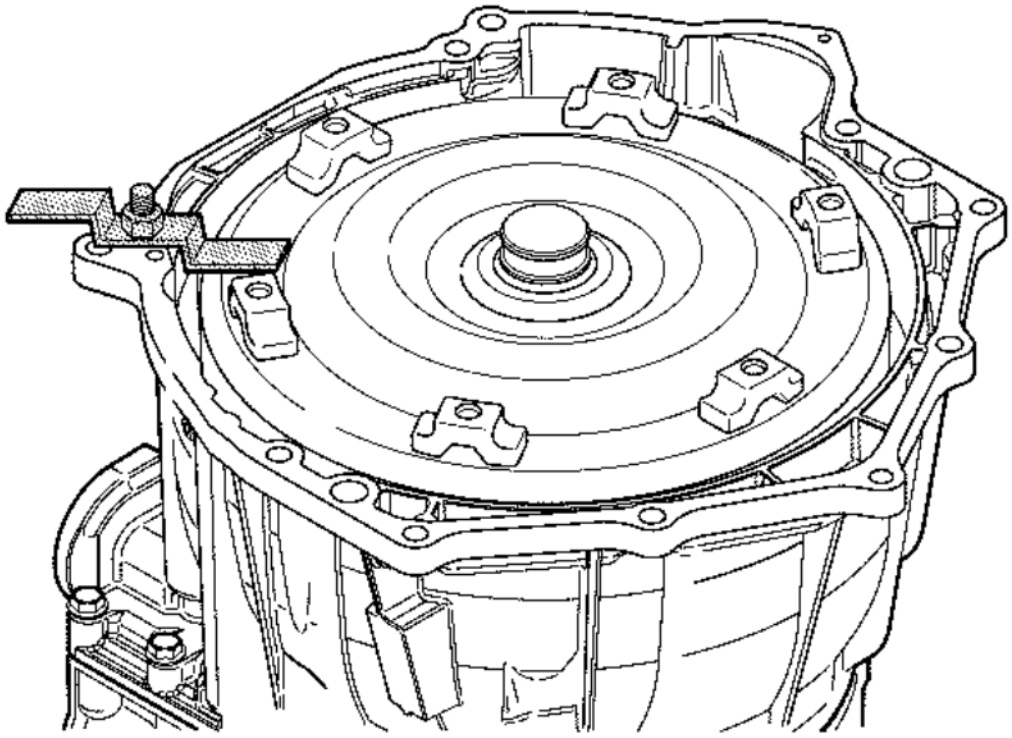


Fig. 147: Torque Converter Restraining Device
Courtesy of GENERAL MOTORS CORP.

CAUTION: The torque converter dry weight is approximately 29 kg (63 lb). To help avoid personal injury and/or property damage:

- **Use caution when installing, removing, or moving the torque converter.**
- **Get help when lifting the torque converter. Assistance from a hoist or another person is**

required.

- **Make sure J 46409 T-handles are installed securely and that any lifting equipment used can properly support the torque converter.**

1. Position the transmission so that the front of the torque converter is facing up.
2. If used, remove 4 bolts and 2 shipping brackets, or remove any other torque converter restraining device.

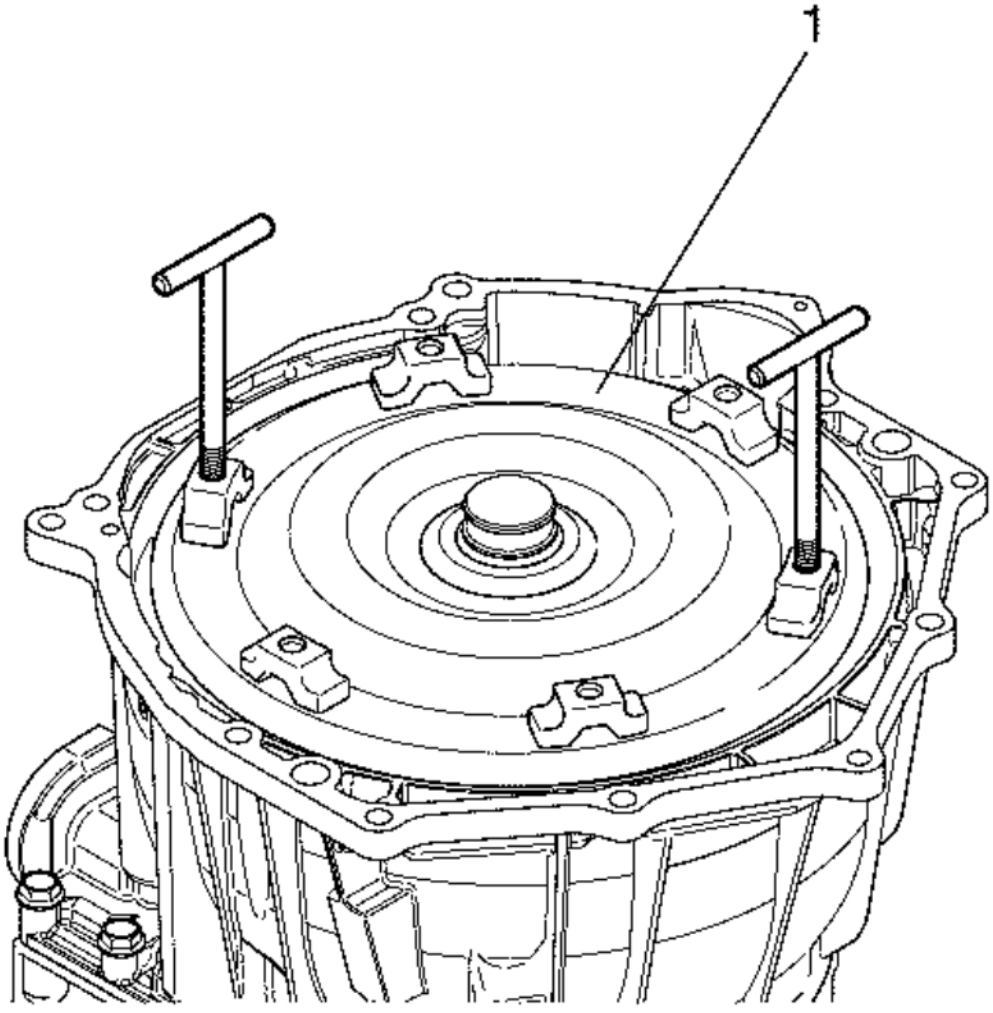


Fig. 148: Installing J 46409 Into Torque Converter Lugs
Courtesy of GENERAL MOTORS CORP.

3. Install 1 **J 46409** T-handle into a boss on the front of the torque converter. See **Special Tools**.
4. Install the other **J 46409** T-handle into a boss on the front of the torque converter 180 degrees away from the first T-handle. See **Special Tools**.

CAUTION: Avoid personal injury or property damage when removing or installing the torque converter by seeking an assistant to help lift the torque converter.

5. Remove the torque converter from the converter housing.
6. Place the torque converter on the work table.

TORQUE CONVERTER LEAK TEST

Tools Required

- **J 43763** Torque Converter Leak Test Plug. See **Special Tools**.
- **J 21369-F** Torque Converter Leak Test Fixture. See **Special Tools**.

Test

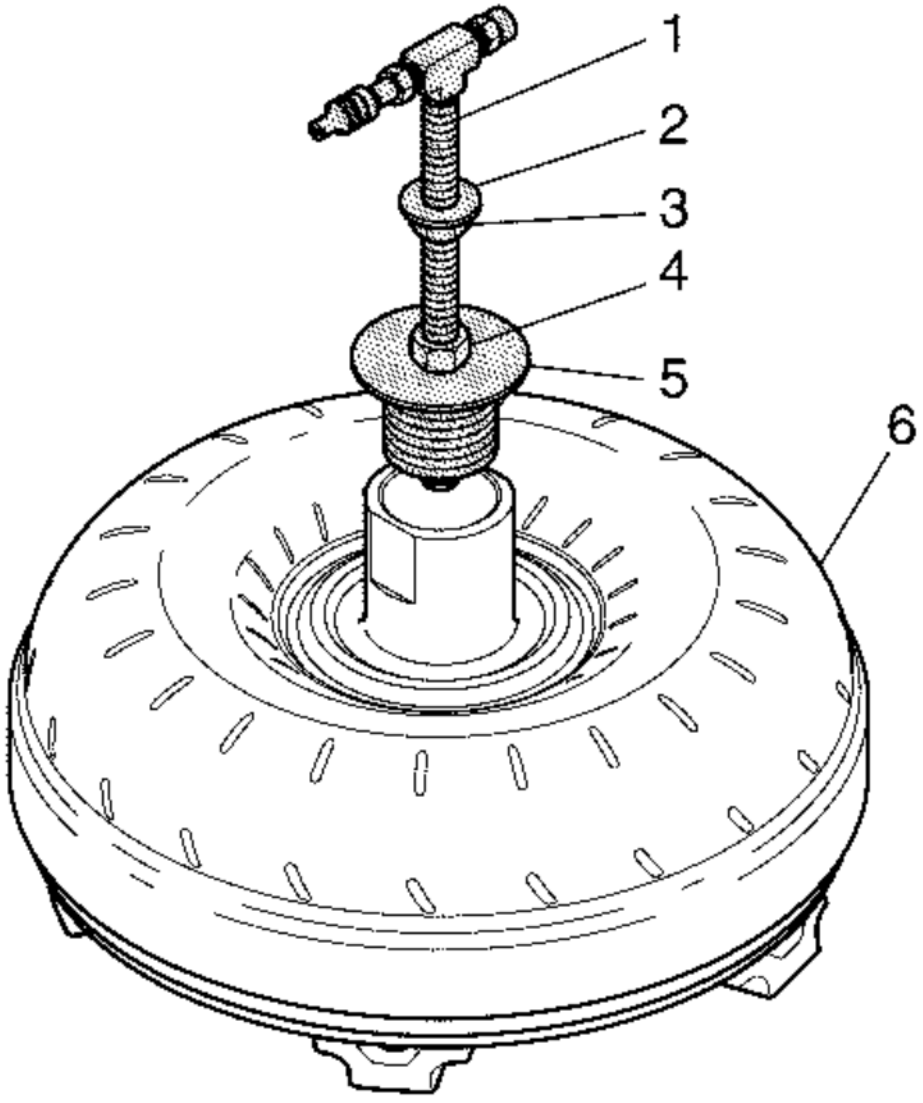


Fig. 149: Installing Test Equipment To Check Torque Converter For Leaks
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The torque converter leak test requires a large container of water in order to submerge the torque converter.

1. Position the torque converter (6) on the work table so that the pump hub is facing up.

2. Move the nut (3) to the middle of the center body (1) of **J 43763** . See **Special Tools**.
3. Install **J 43763** into the torque converter hub. See **Special Tools**.

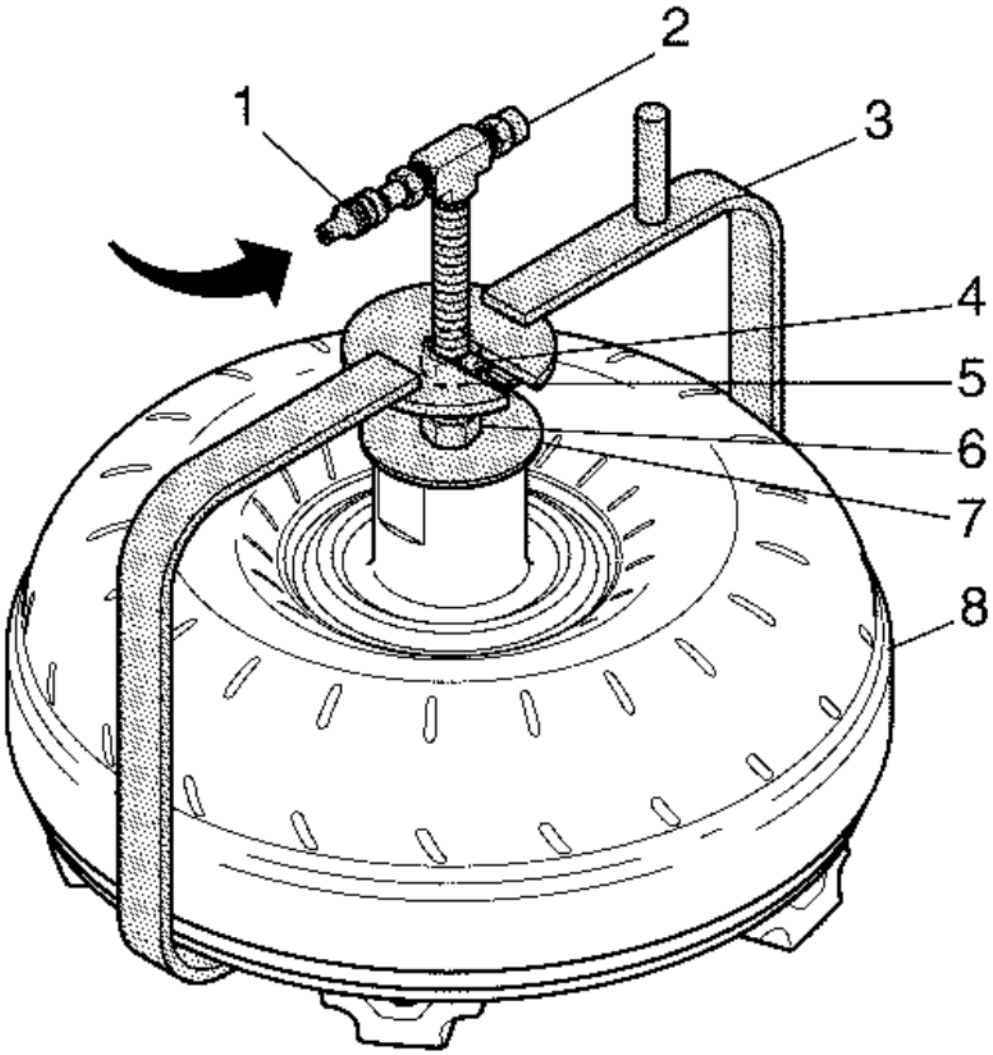


Fig. 150: Using Compressed Air To Leak Test Converter
Courtesy of GENERAL MOTORS CORP.

4. Install **J 21369-F** (3) onto the torque converter (8) and onto **J 43763** (4). See **Special Tools**.

5. Firmly tighten the nut (6) in order to seal J 43763 into the torque converter.
6. Firmly tighten the nut (5) in order to securely attach the torque converter to **J 21369-F** (3). See **Special Tools**. Connect an air hose to the air fitting (1) of **J 43763** . See **Special Tools**.
7. Pressurize the converter to 517 kPa (75 psi) maximum.
8. Disconnect the air hose. Submerge the torque converter in water.
9. Closely observe the torque converter for bubbles that indicate leakage. If the torque converter leaks, replace the torque converter.

CAUTION: All pressure from the torque converter must be exhausted before loosening the test fixture nut. Failure to relieve the pressure could cause personal injury and/or property damage.

10. Push on the pressure relief valve (2) of **J 43763** and release the air from the torque converter. See **Special Tools**.
11. Remove the J tools from the torque converter.

TORQUE CONVERTER INSPECTION

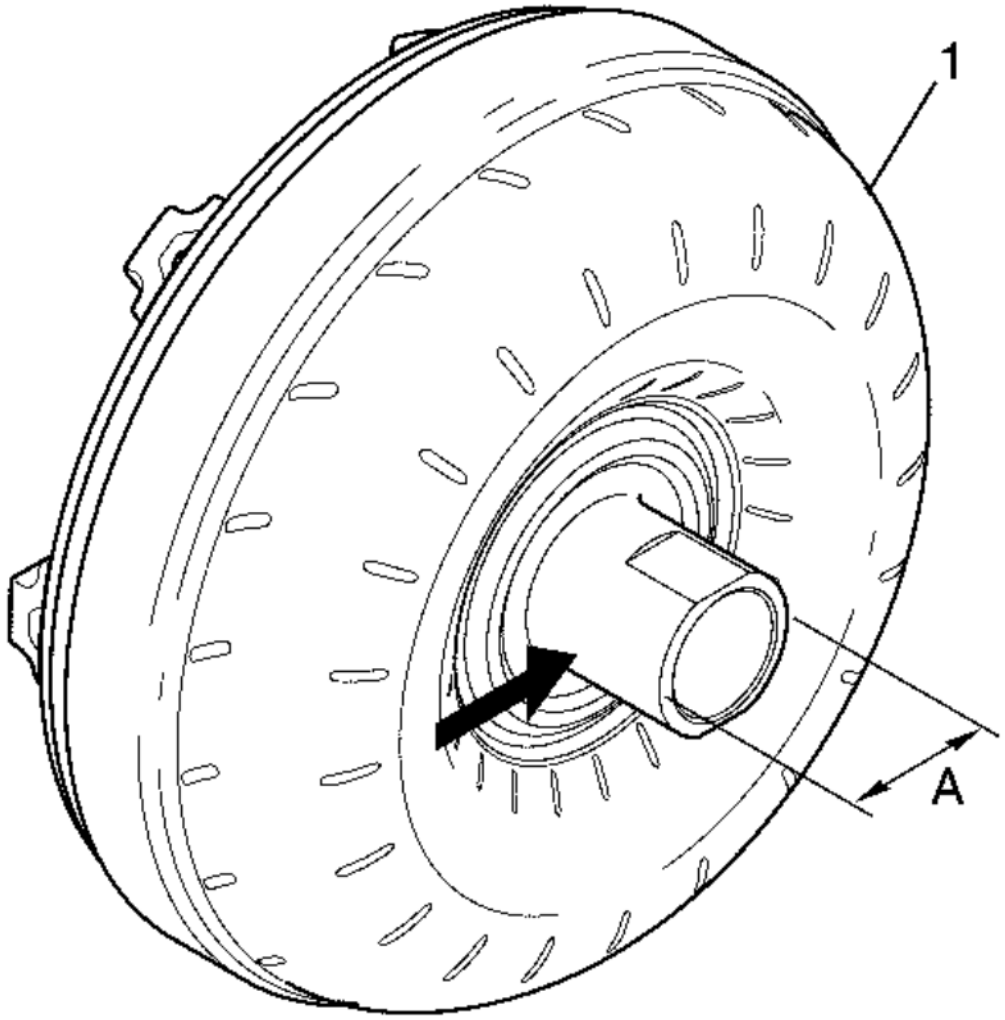


Fig. 151: Checking Torque Converter Hub For Bushing Wear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Replace the torque converter if it does not meet specifications.

1. Measure the OD of torque converter hub (1) at dimension A, the bushing wear area.

   Torque Converter Hub OD: Dimension A must equal or exceed 58.250 mm (2.293 in).

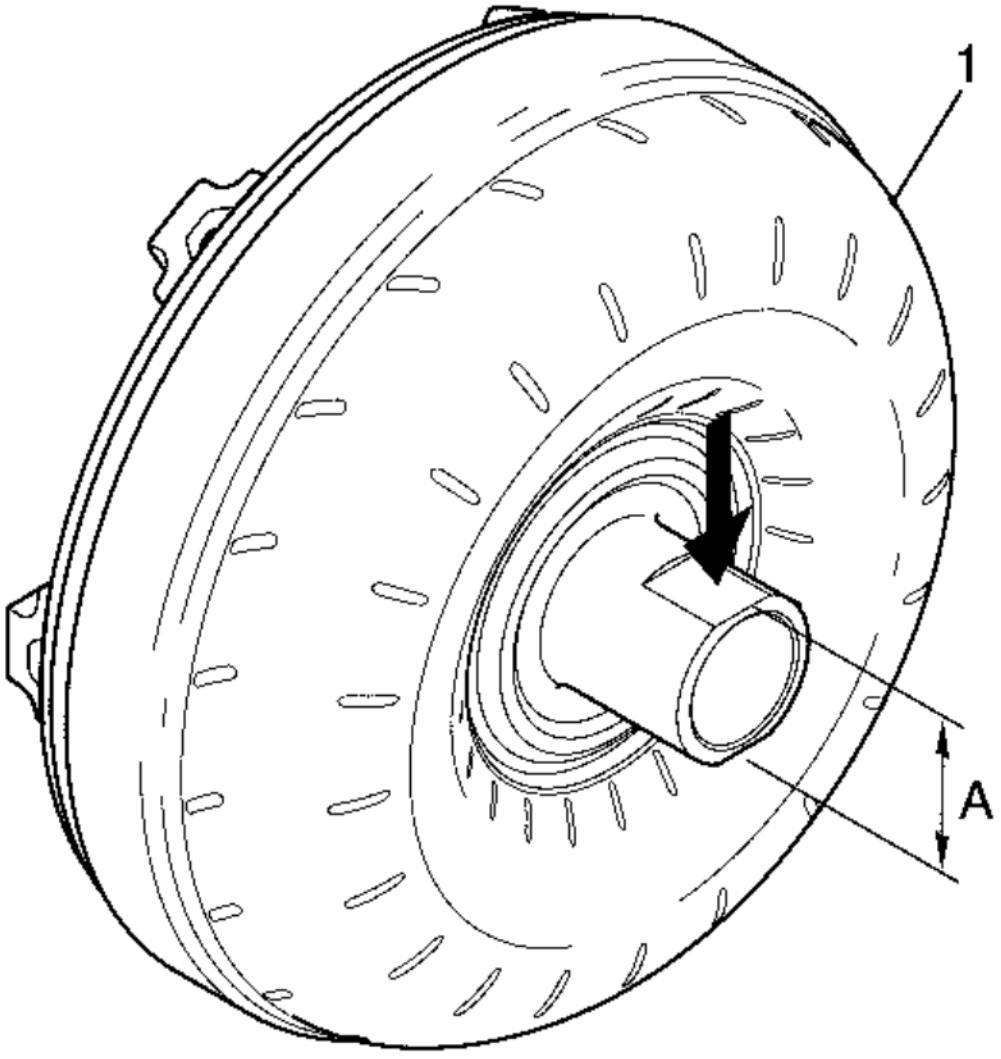


Fig. 152: Measuring Flats On Torque Converter Hub
Courtesy of GENERAL MOTORS CORP.

2. Measure the distance between the flats of the torque converter hub at dimension A.

   Torque Converter Hub Flats: Dimension A must equal or exceed 51.816 mm (2.040 in).

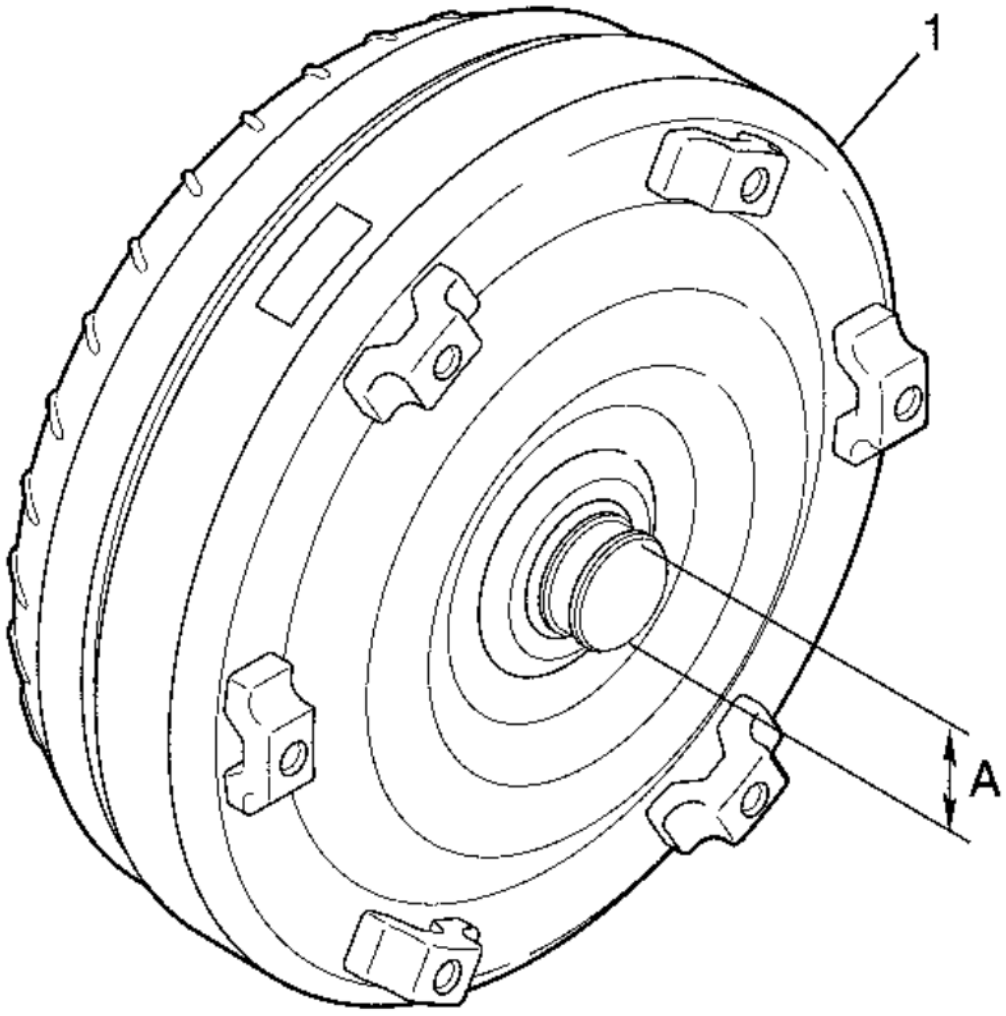


Fig. 153: Measuring Torque Converter Cover Pilot
Courtesy of GENERAL MOTORS CORP.

3. Measure the OD of the torque converter cover pilot at dimension A.

Torque Converter Pilot: Dimension A must equal or exceed 43.080 mm (1.696 in).

TRANSMISSION FLUID INSPECTION

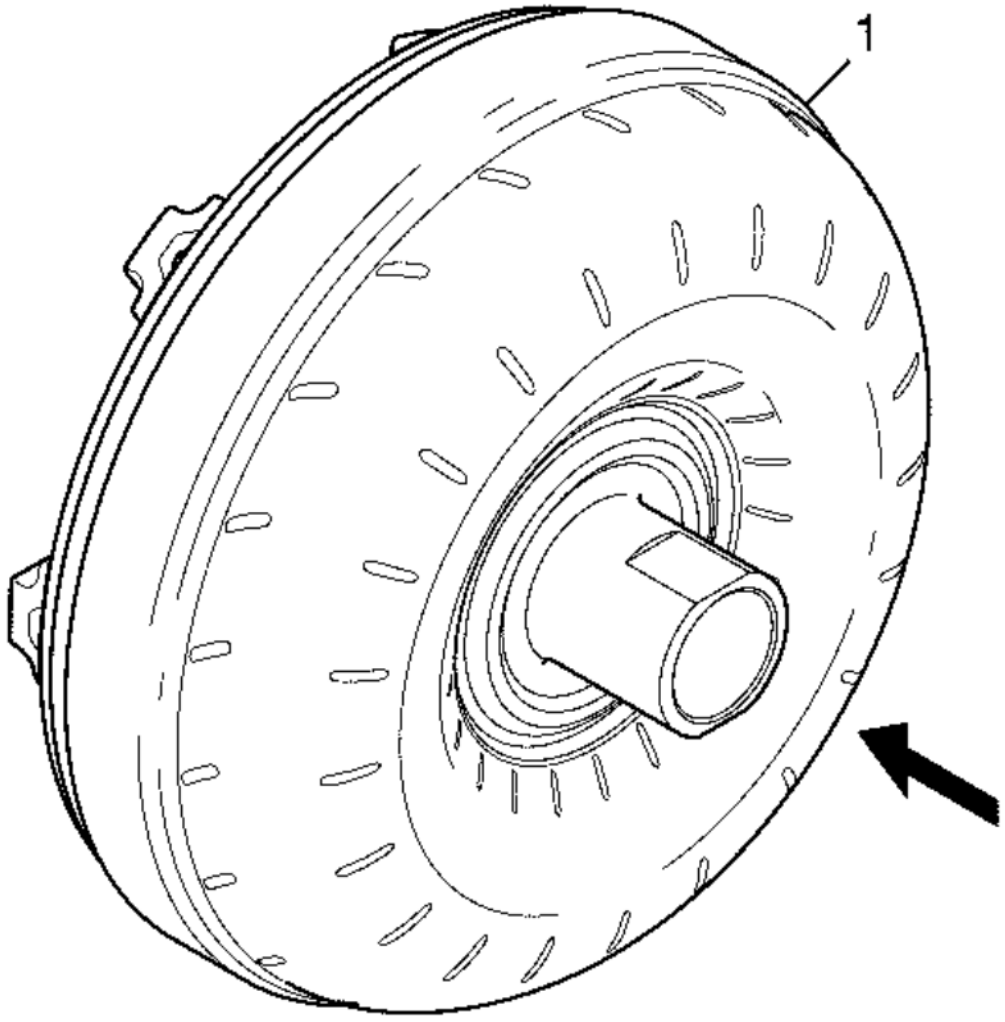


Fig. 154: Torque Converter
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission fluid from torque converter (1).
2. Examine the transmission fluid for the following.
    - Evidence of foreign matter
    - Metal particles
    - Other contaminates

3. If the torque converter is damaged, replace the torque converter.

TORQUE CONVERTER END PLAY INSPECTION

Tools Required

- **J 43764** Torque Converter End Play Gauge. See **Special Tools**.
- **J 5959** Dial Indicator Clamp and Adjuster. See **Special Tools**.
- **J 7872** Magnetic Base Dial Indicator

Inspection

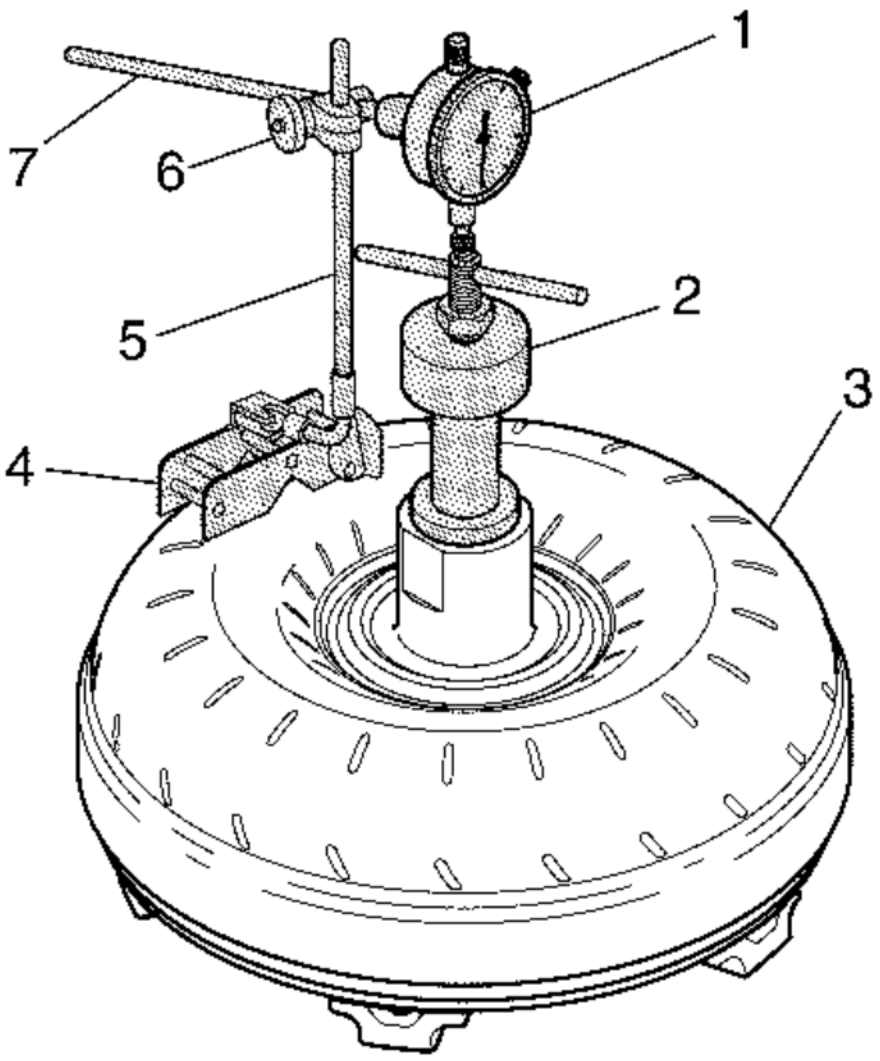


Fig. 155: Measuring Torque Converter End Play
Courtesy of GENERAL MOTORS CORP.

1. Position the torque converter (3) on the work table so that the pump hub is facing up.
2. Install **J 43764** (2) into the torque converter hub. See **Special Tools**.
3. Hold **J 43764** (2) in the converter hub and rotate the center screw until **J 43764** is locked into the converter hub. See **Special Tools**. Do not over tighten **J 43764** . See **Special**

Tools.

4. Assemble the following tools and install the tools onto the torque converter as shown:
   - **J 5959** (1). See **Special Tools**.
   - Extension rod (7)
   - Clamp (6)
   - **J 7872** (4)
   - Adaptor rod (5)
5. Adjust the clamp (6) so that the dial indicator (1) firmly contacts the top of **J 43764** (2). See **Special Tools**.
6. Set the **J 5959** (1) to read zero. See **Special Tools**.
7. Lift **J 43764** (2) upward as far as possible. See **Special Tools**.
8. Read the **J 5959** (1) to determine torque converter end play. See **Special Tools**.
9. Compare the measured end play with the torque converter end play specifications. Refer to **End Play Specifications** .
10. If the measured torque converter end play exceeds the value listed, replace the torque converter.
11. Remove the J tools from the converter housing.

TORQUE CONVERTER HOUSING WITH FLUID PUMP ASSEMBLY REMOVAL

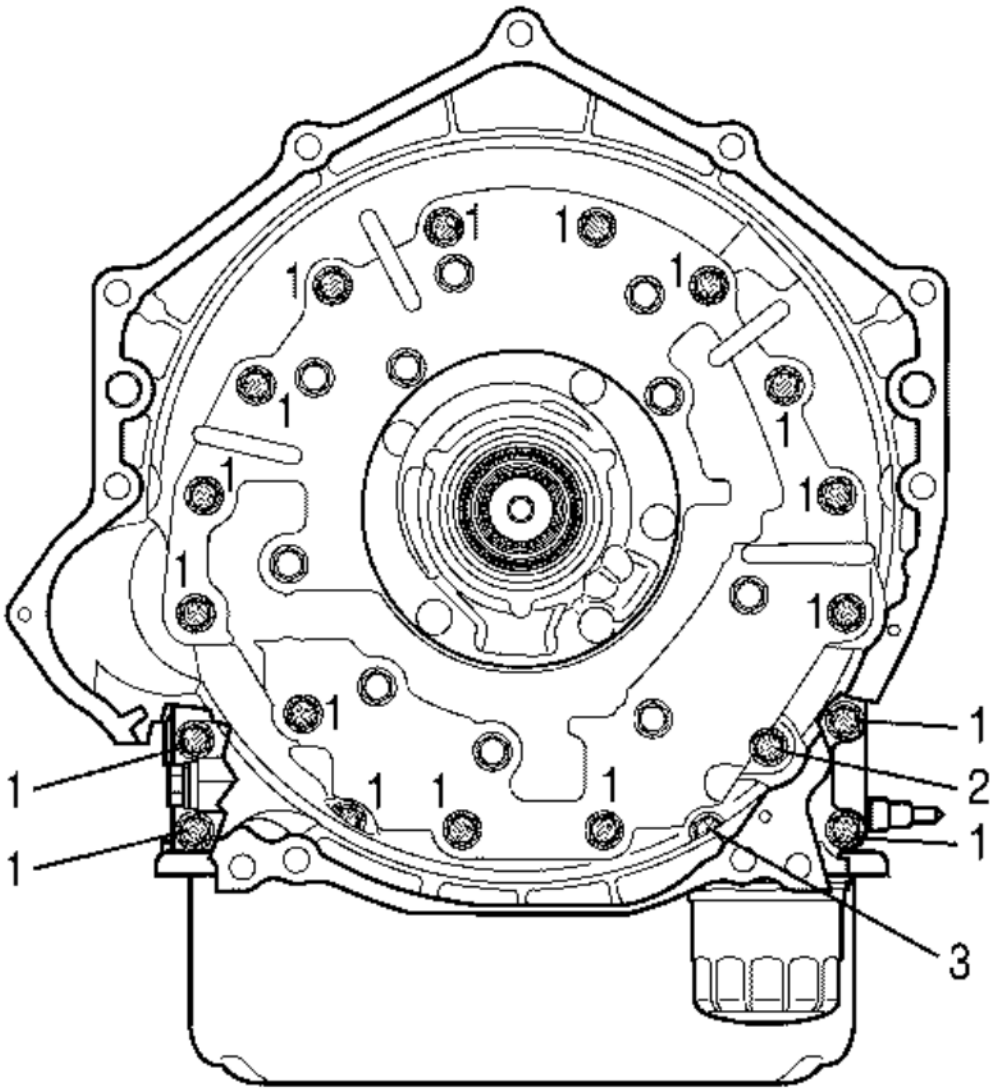


Fig. 156: Locating Transmission Case Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Converter Housing/Low and Reverse Clutch Housing Bolt Size Notice .

1. Remove 18 bolts (1), one bolt (2), and one bolt (3).

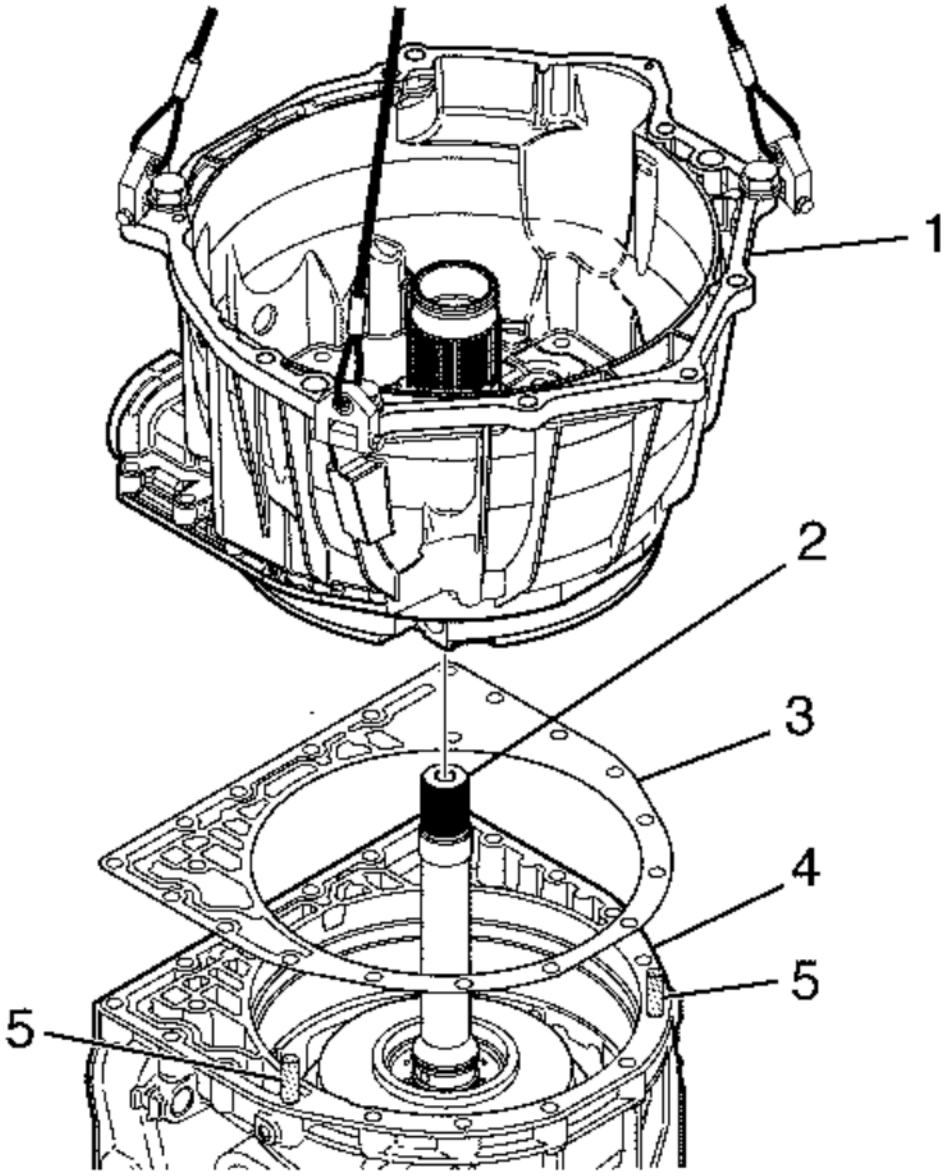


Fig. 157: View Of Torque Converter Housing with Fluid Pump Assembly
Courtesy of GENERAL MOTORS CORP.

CAUTION: The torque converter housing/oil pump cover assembly dry weights are approximately 27 kg (60 lb). To help avoid

personal injury and/or property damage:

- **Use caution when installing, removing, or moving the converter housing/oil pump cover assembly.**
- **Get help when lifting the converter housing/oil pump cover assembly.**
- **Assistance from a hoist or another person may be required.**
- **Make sure lifting equipment can properly support the converter housing/oil pump cover assembly.**

2. Attach a sling to the converter housing (1).
3. Attach a hoist to the sling.
4. Remove the converter housing/oil pump cover assembly (1) from the transmission case (4) and the turbine shaft (2).
5. Place the converter housing/oil pump cover assembly on the work table.
6. Remove the sling.
7. Remove and discard the main housing/separator plate gasket (3).

TRANSMISSION FLUID PAN AND FILTER ASSEMBLY REMOVAL

Tools Required

J 44587 Main Shaft Holder. See **Special Tools**.

Removal

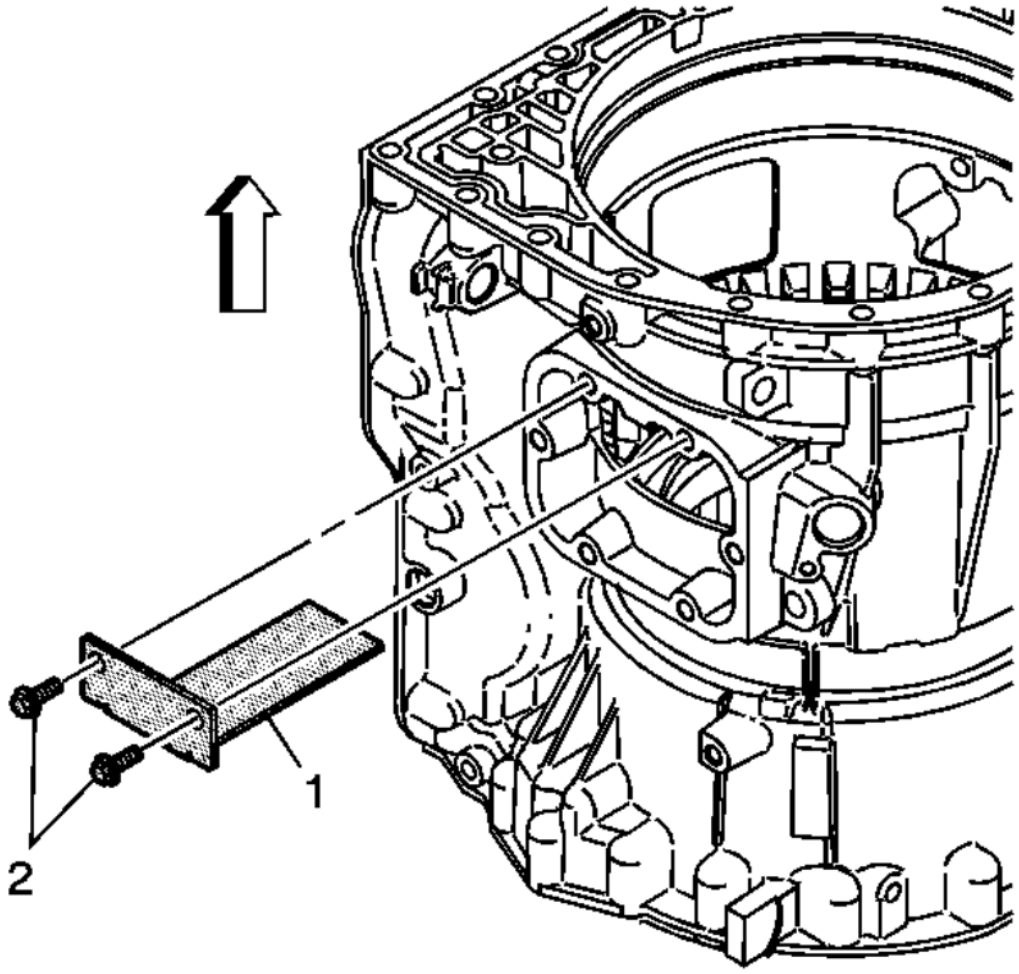


Fig. 158: Identifying J 44587
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not rotate the transmission from the nose-up position without installing J 44587. Failure to install J 44587 and rotating the transmission will cause clearance issues during assembly and possible damage to the transmission.

1. Align **J 44587** with the power take-off (PTO) access as follows:. See **Special Tools**.
   - The tongue of **J 44587** is facing toward the PTO access. See **Special Tools**.

- The bolts holes of **J 44587** are aligned with the 2 front bolt holes of the PTO access. See **Special Tools**.

2. Install **J 44587** into the PTO access. See **Special Tools**.
3. Install 2 bolts into **J 44587** and tighten the bolts snugly. See **Special Tools**.

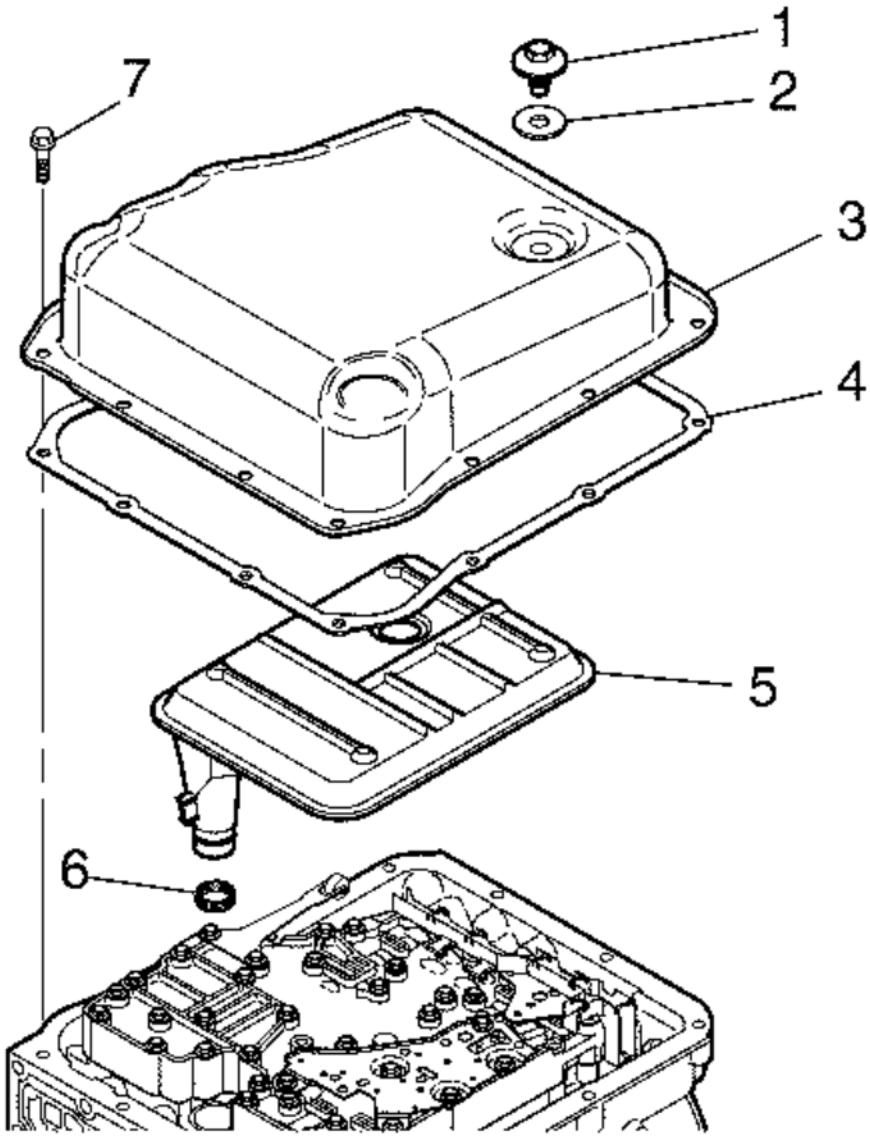


Fig. 159: Identifying Pan And Filter Assembly
Courtesy of GENERAL MOTORS CORP.

4. Position the main housing so that the oil pan is facing up.
5. Remove the drain plug (1).
6. Remove the drain plug seal (2) from the drain plug (1).
7. Remove 12 oil pan bolts (7). Remove the oil pan (3).
8. Remove the oil pan gasket (4).
9. Remove the transmission internal oil filter (5).
10. Remove the transmission internal oil filter seal (6).

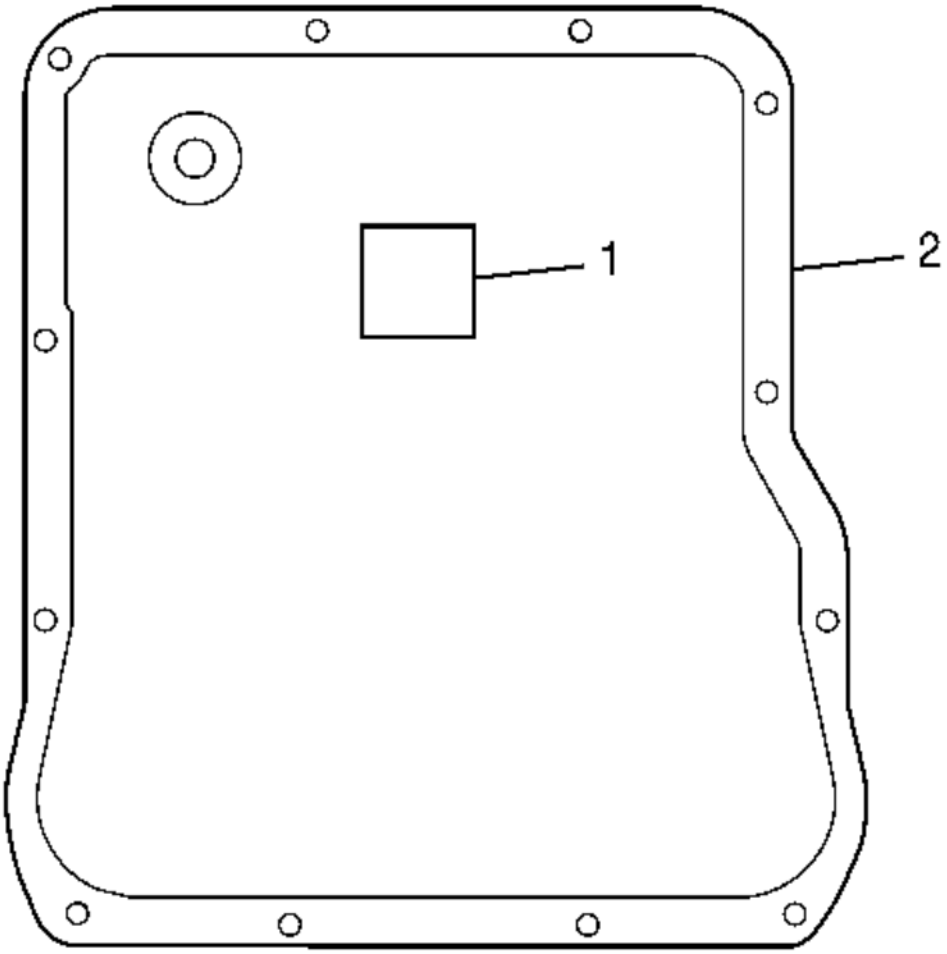


Fig. 160: View Of Transmission Oil Pan Magnet
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The magnet cannot be removed from the oil pan.

11. Inspect and clean the transmission oil pan magnet (1) in the oil pan (2).

WIRING HARNESS REMOVAL

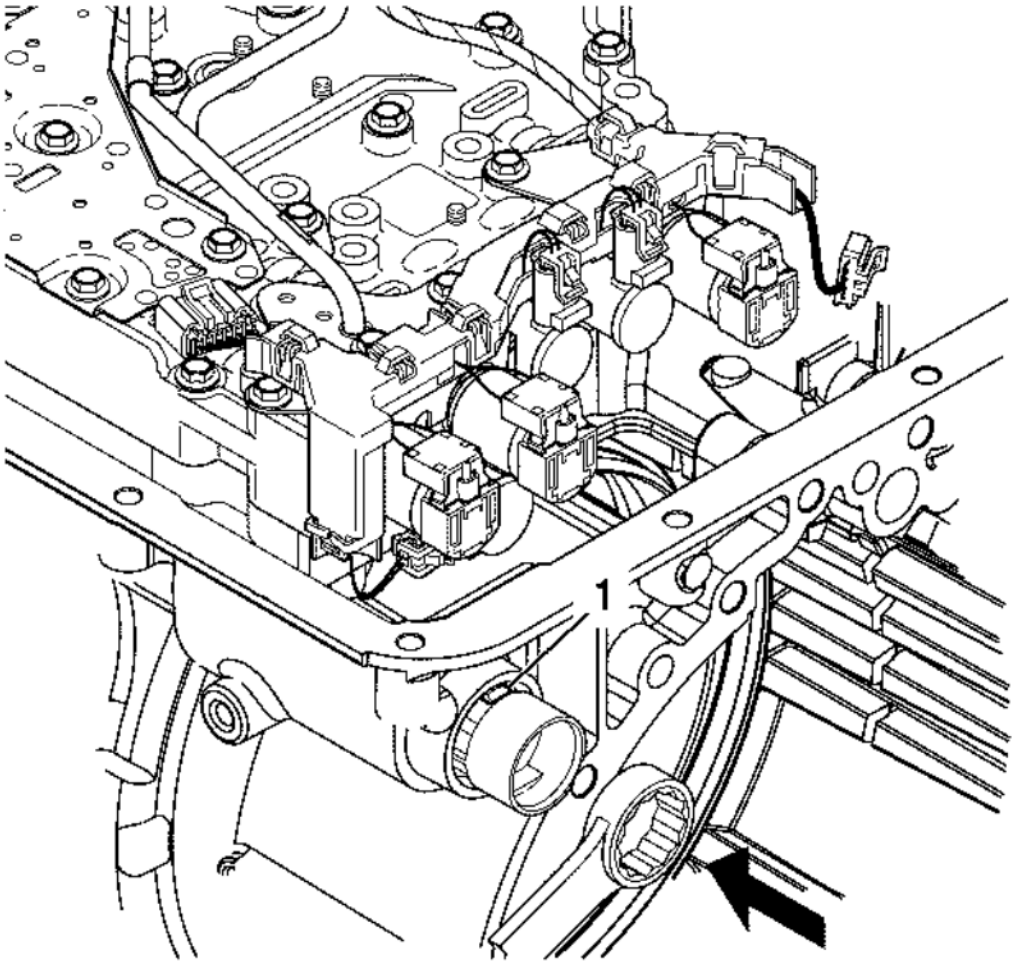


Fig. 161: Depressing 4 Tabs On Internal Wiring Harness Connector
Courtesy of GENERAL MOTORS CORP.

1. Using a 30-32 mm (1 3/16 in) deep well socket or box end wrench, depress the 4 tabs on internal wiring harness connector (1). With the tabs depressed, gently pop the connector into and through the transmission case with the palm of the hand.

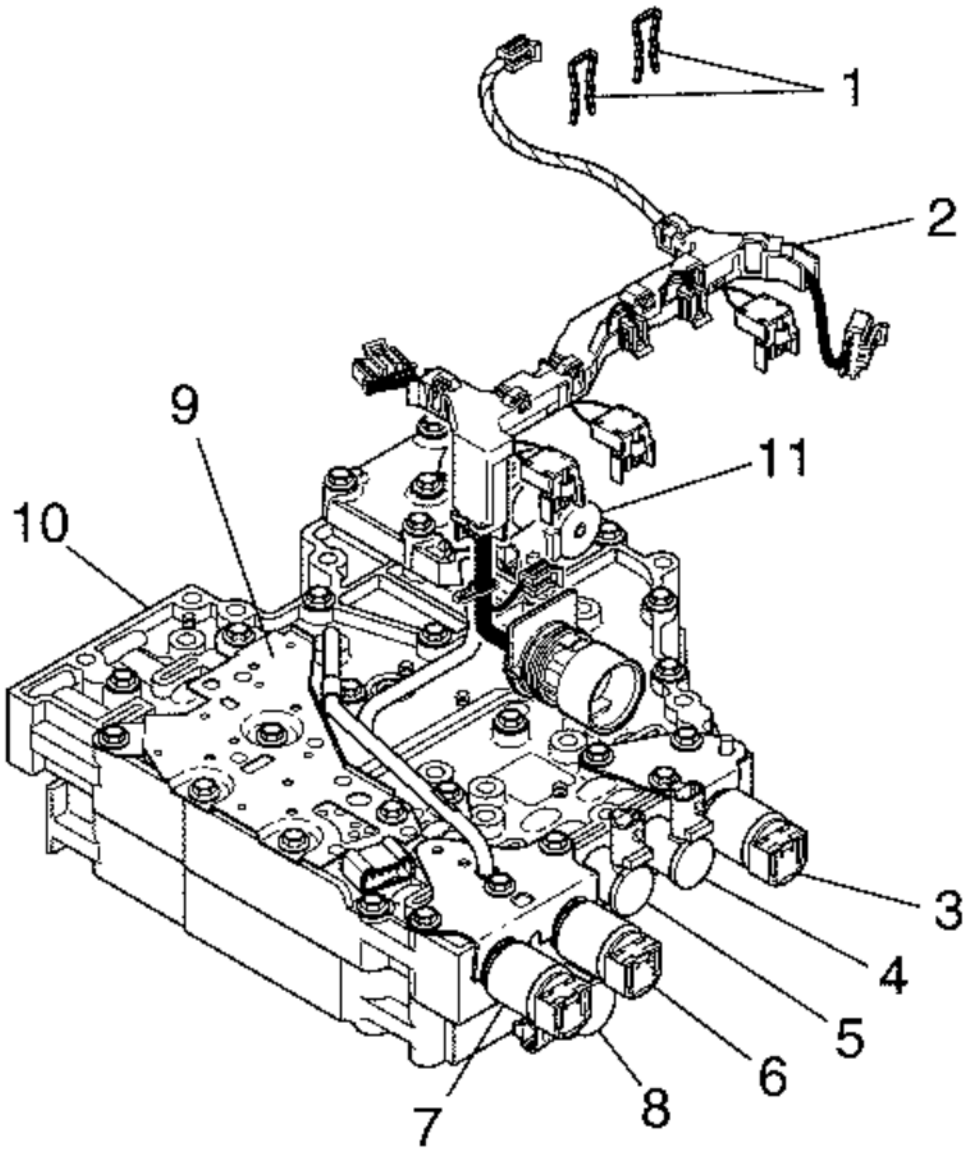


Fig. 162: Identifying Main valve Body Solenoids, Switches & Harness
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the internal wiring harness (2) from the following components:
   - Pressure control solenoid 1 (PCS1) (7)

- PCS2 (6)
- Shift solenoid 3 (SS3) (5)
- SS2 (4)
- Torque converter clutch (TCC) PCS (3)
- SS1 (8).
- Transmission fluid pressure (TFP) switch (9)
- Modulated main pressure solenoid (11)
- Transmission internal mode switch (IMS)

3. Remove the solenoid retainers (1) from SS2 (4) and SS3 (5).
4. Remove the internal wiring harness (2) from main valve body (10).
5. Install the solenoid retainers (1).

CONTROL VALVE ASSEMBLY REMOVAL

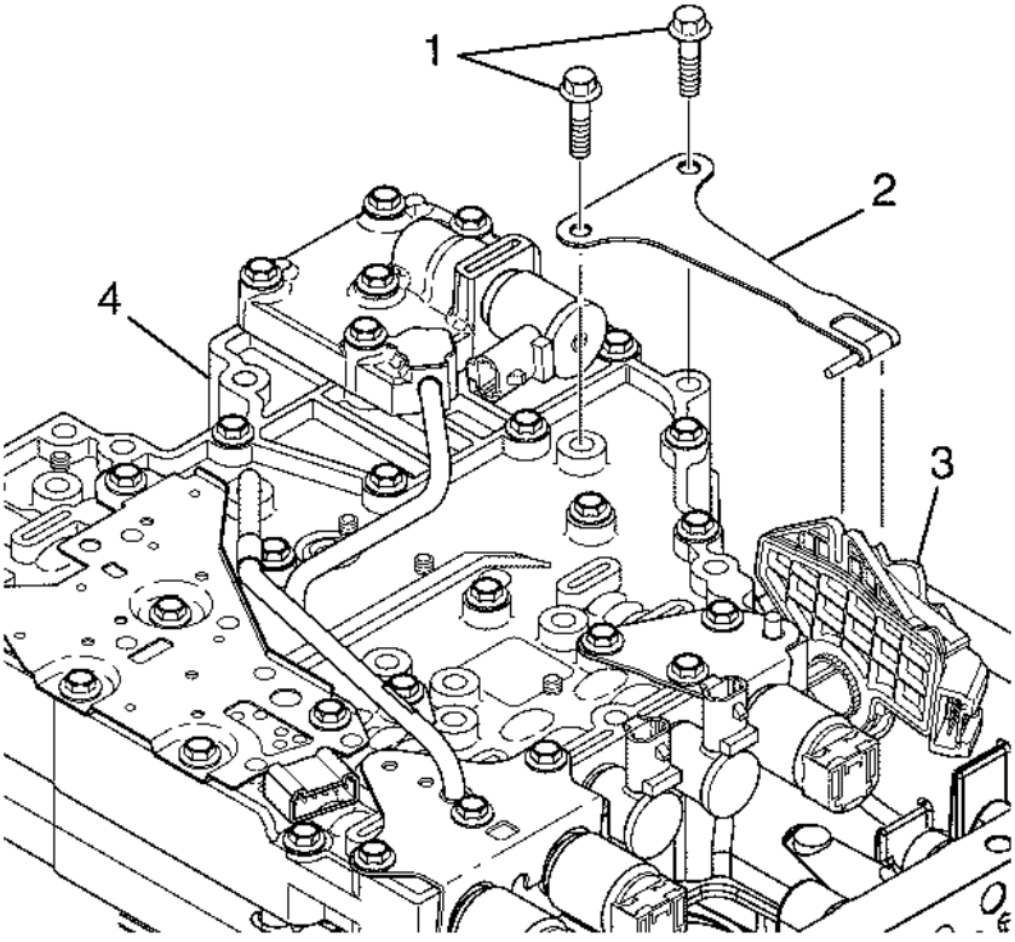


Fig. 163: Manual Shift Shaft Detent Spring
Courtesy of GENERAL MOTORS CORP.

1. Remove 2 detent spring bolts (1).
2. Remove the manual shift shaft detent spring (2).

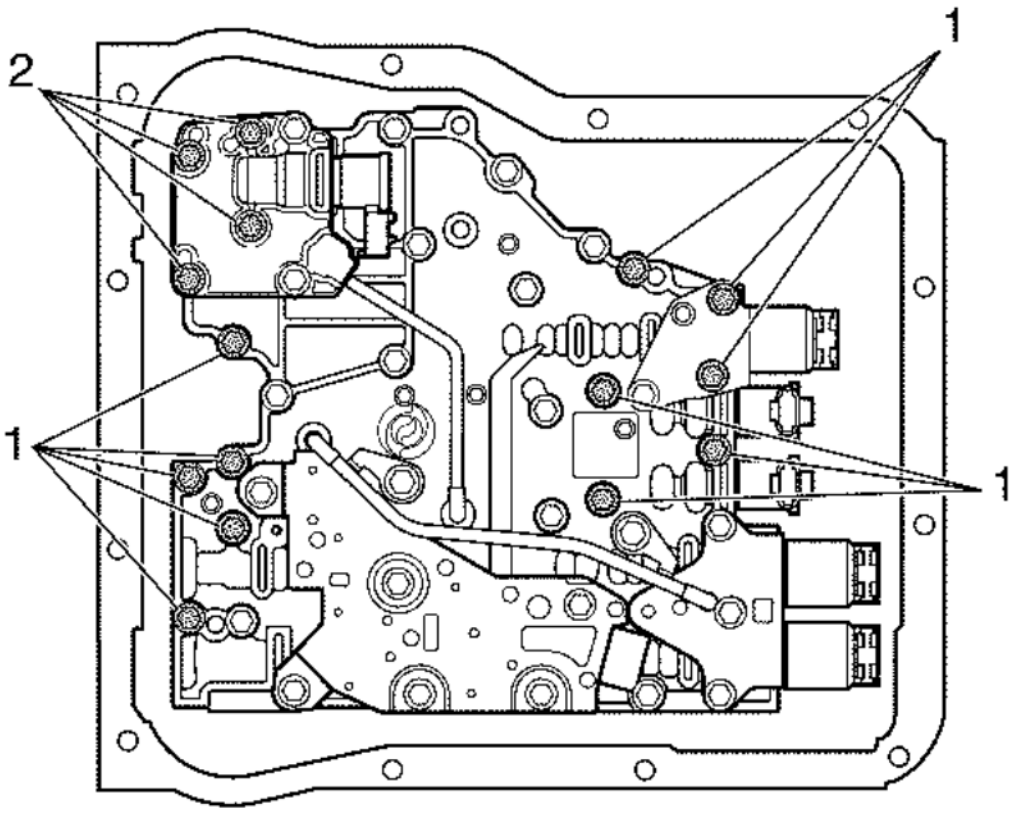


Fig. 164: Control Valve Assembly Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Six gold colored bolts retain the modulated main valve body. Four of these bolts assist in retaining the control valve body. The modulated main valve body is removed as part of the control valve assembly disassemble procedure.

3. Remove 11 control valve body assembly bolts (1).
4. Remove 4 bolts (2) from the modulated main valve body and control valve body.

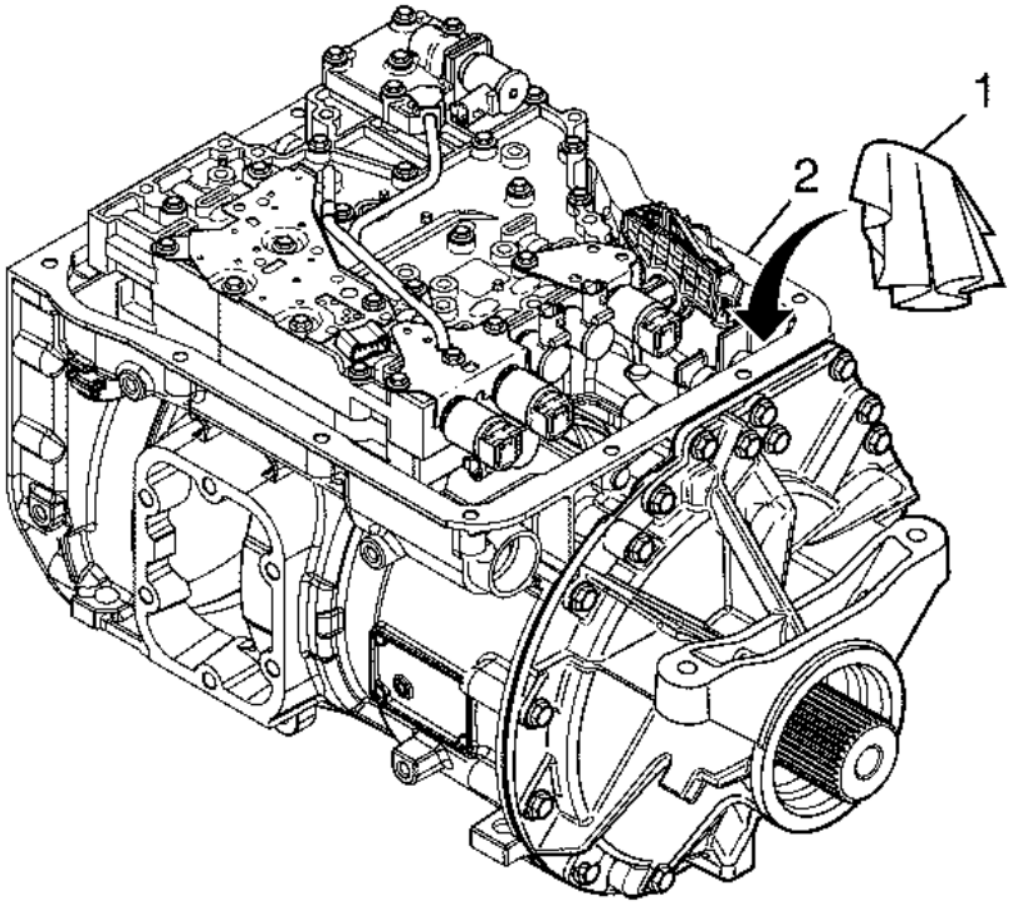


Fig. 165: Installing Cloth In Park Pawl Apply Assembly Guide Hole
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Installing a lint-free cloth into the park pawl apply assembly guide hole prevents the manual valve pin from falling into the transmission.

5. Install a lint-free cloth (1) in the park pawl apply assembly guide hole in the transmission case (2).

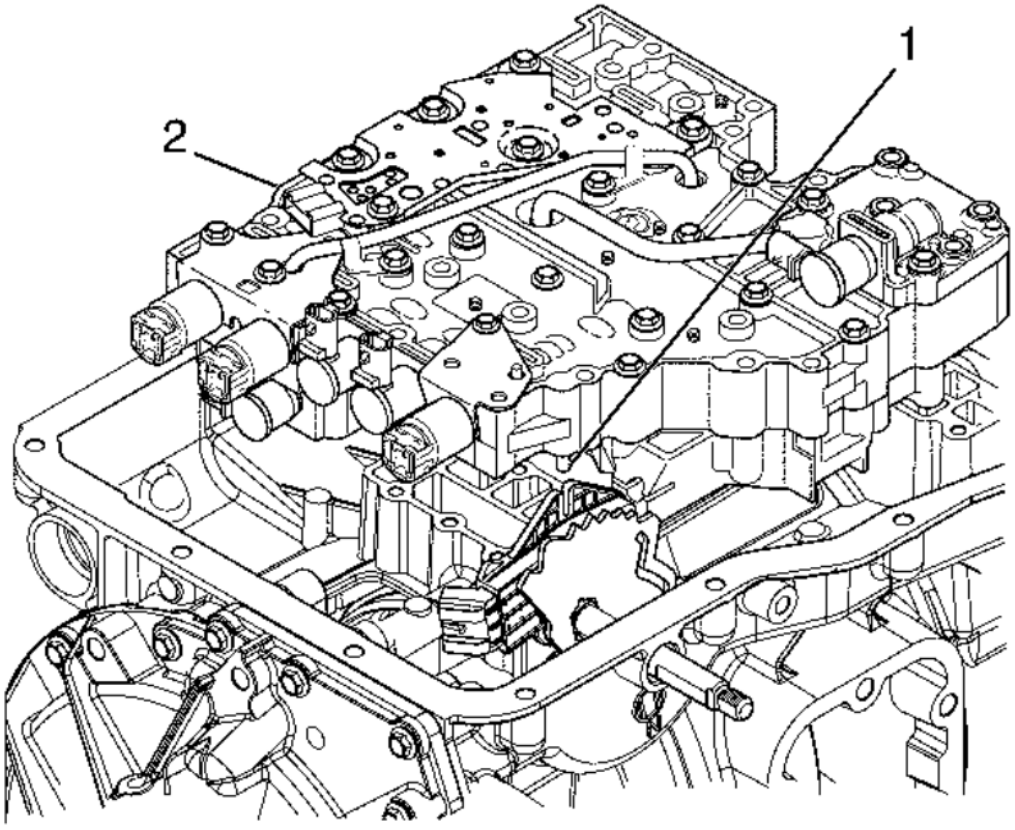


Fig. 166: Control Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not drop the manual valve when removing or installing the control valve body assembly onto or from the transmission case.
Placing a finger over the end of the manual valve hole when removing the control valve body assembly from the transmission case prevents the manual valve from falling free of the bore.

6. Lift the control valve body assembly (2) until the 2 locating pins (1) of the control valve body assembly are disengaged from the transmission case.

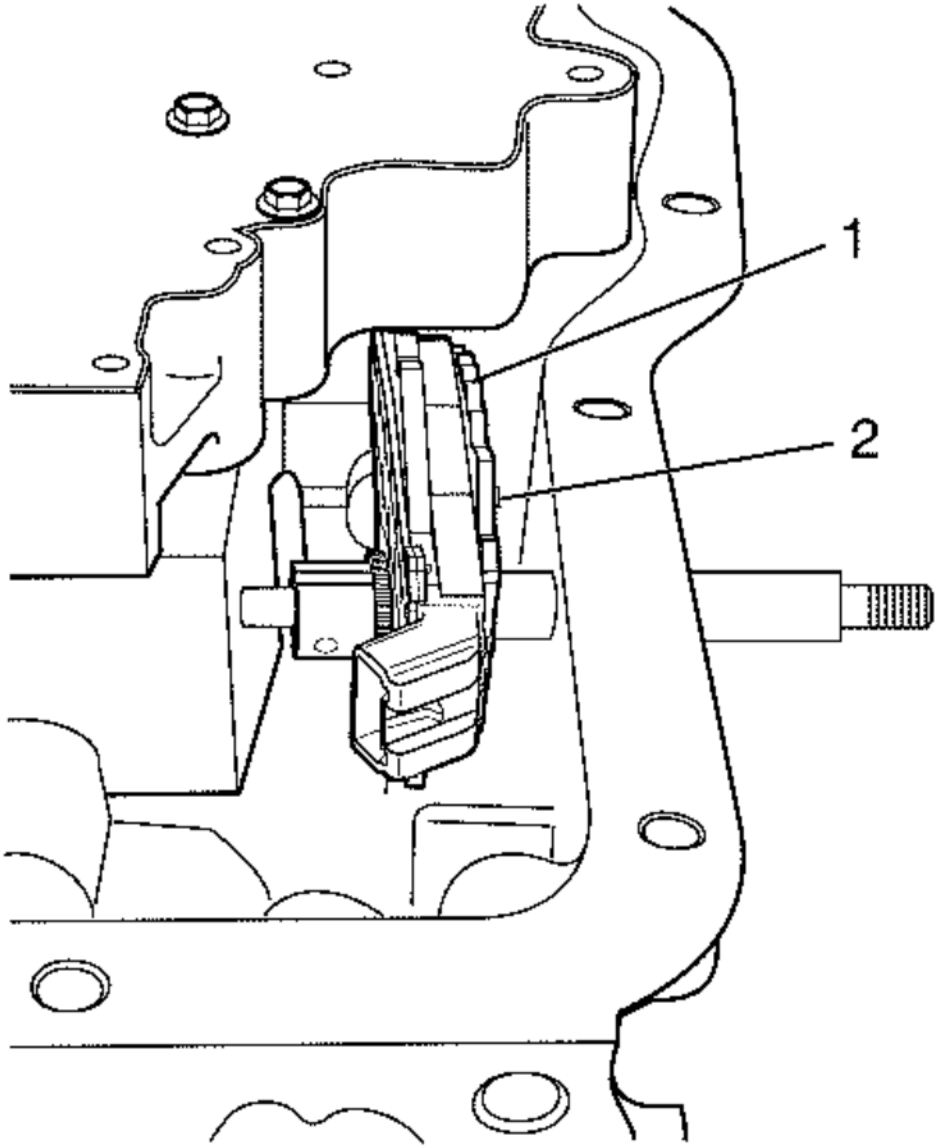


Fig. 167: Detent Lever/IMS Assembly
Courtesy of GENERAL MOTORS CORP.

7. Slide the control valve body assembly to the side and disengage the manual valve pin (2) from the manual shift shaft detent lever/IMS assembly (1).
8. Remove the control valve body assembly from the transmission case.

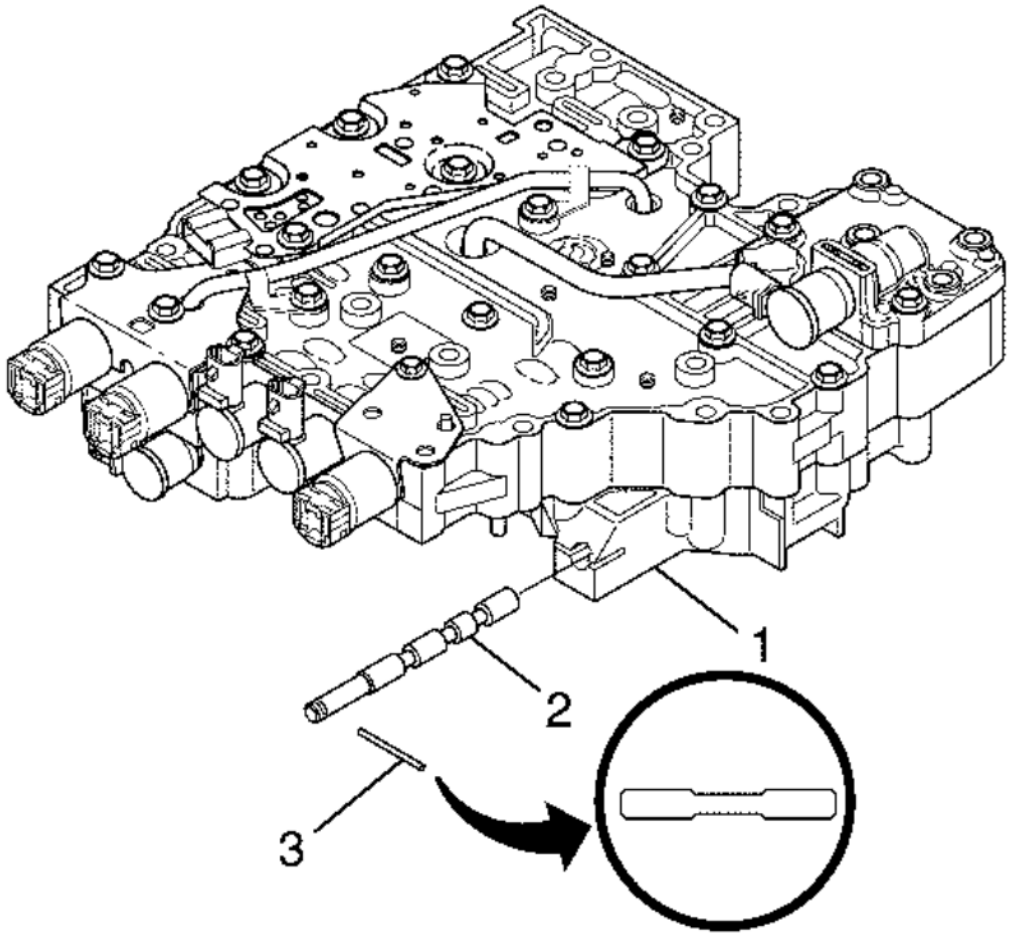


Fig. 168: Manual Valve And Pin
Courtesy of GENERAL MOTORS CORP.

9. Remove, as a unit, the manual valve (2) and the manual valve pin (3) from the shift valve body assembly (1).
10. Remove the manual valve pin (3) from the manual valve (2).

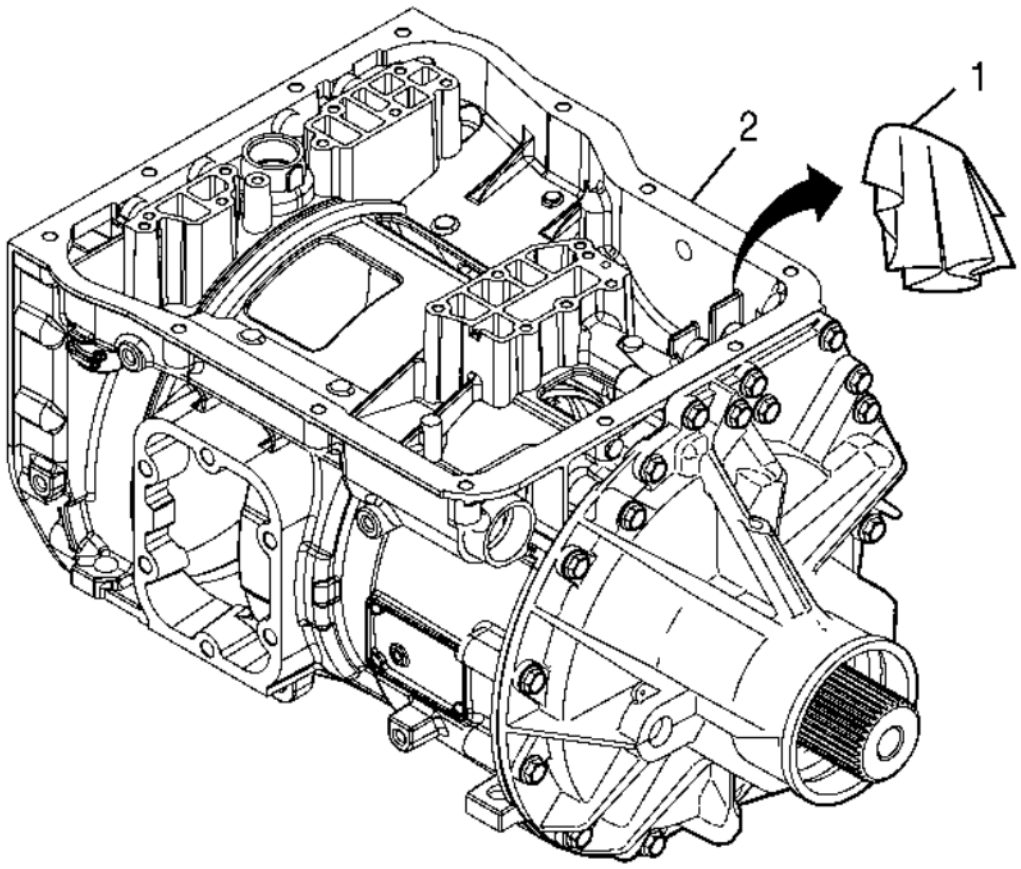


Fig. 169: Lint Free Cloth For Park Pawl Apply Assembly Guide Hole
Courtesy of GENERAL MOTORS CORP.

11. Remove the lint free cloth (1) from the park pawl apply assembly guide hole in the transmission case (2).

REAR BALL BEARING REMOVAL

Tools Required

- **J 43910** Output Shaft Bearing Puller Leg Set. See **Special Tools**.
- **J 24420-B** Universal Puller. See **Special Tools**.
- **J 43769** Spanner Nut Wrench - 4WD. See **Special Tools**.

Removal

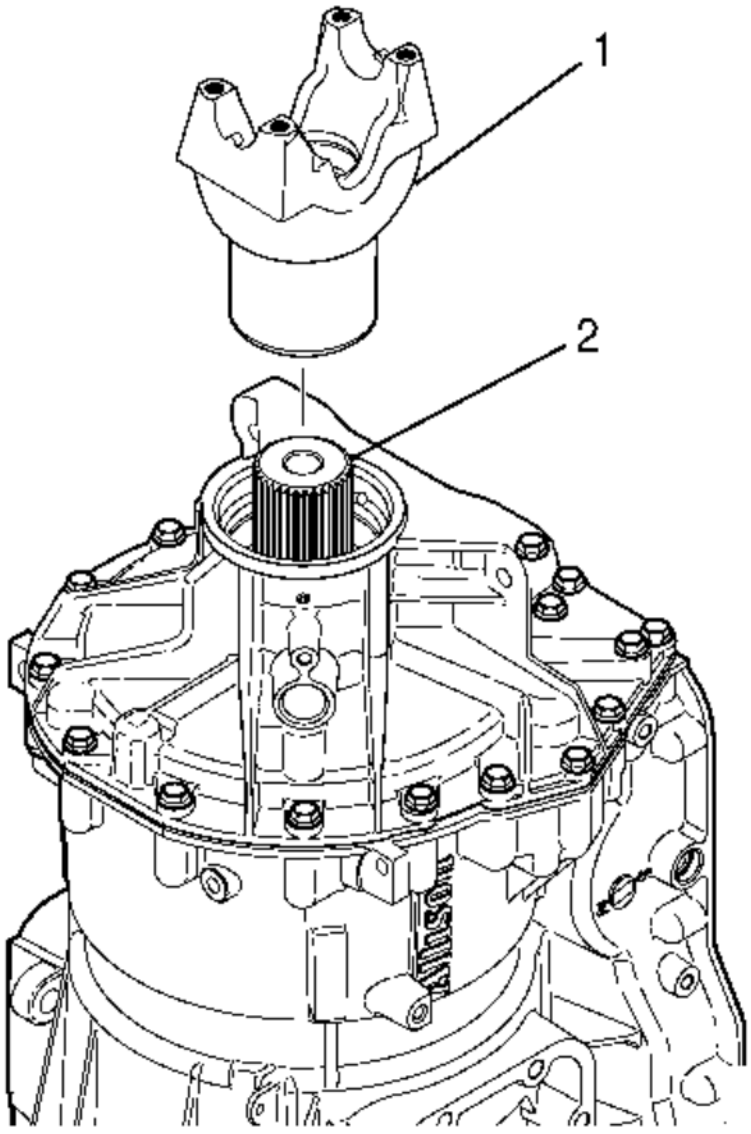


Fig. 170: View Of Yoke From Output Shaft
Courtesy of GENERAL MOTORS CORP.

1. Position the transmission so that the rear of the transmission is facing up.

2. Remove the flange or yoke (1) from the output shaft (2).
3. If present, remove the oil seal assembly.

IMPORTANT: The fullest clockwise position of the manual shift shaft is park (P), which engages the park pawl.

4. On 4WD transmissions only, use a wrench on the manual shift shaft flats to rotate the manual shift shaft to the fullest clockwise position.

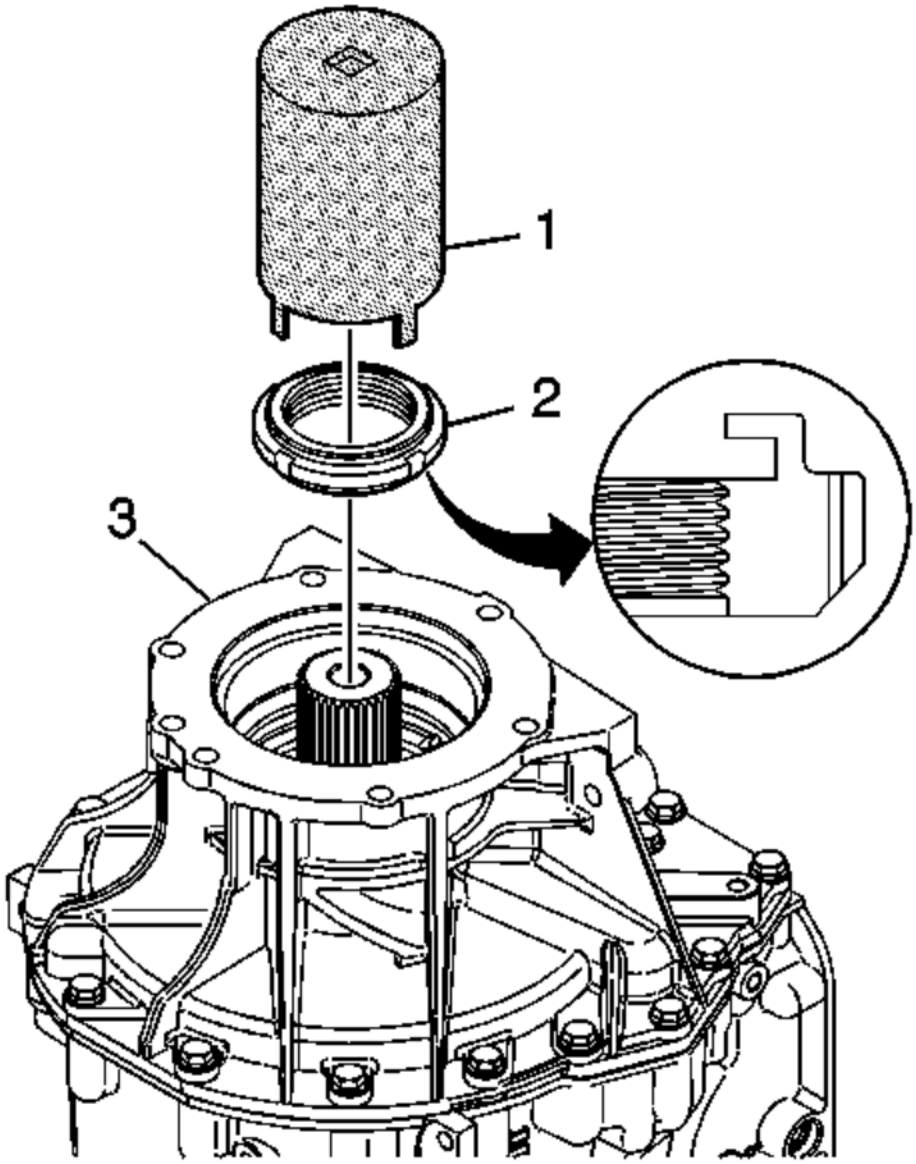


Fig. 171: Output Nut (4WD)
Courtesy of GENERAL MOTORS CORP.

5. On 4WD transmissions only, perform the following steps:
    1. Install **J 43769** (1) onto the output nut (2). See **Special Tools**.

2. Remove the output nut (2).

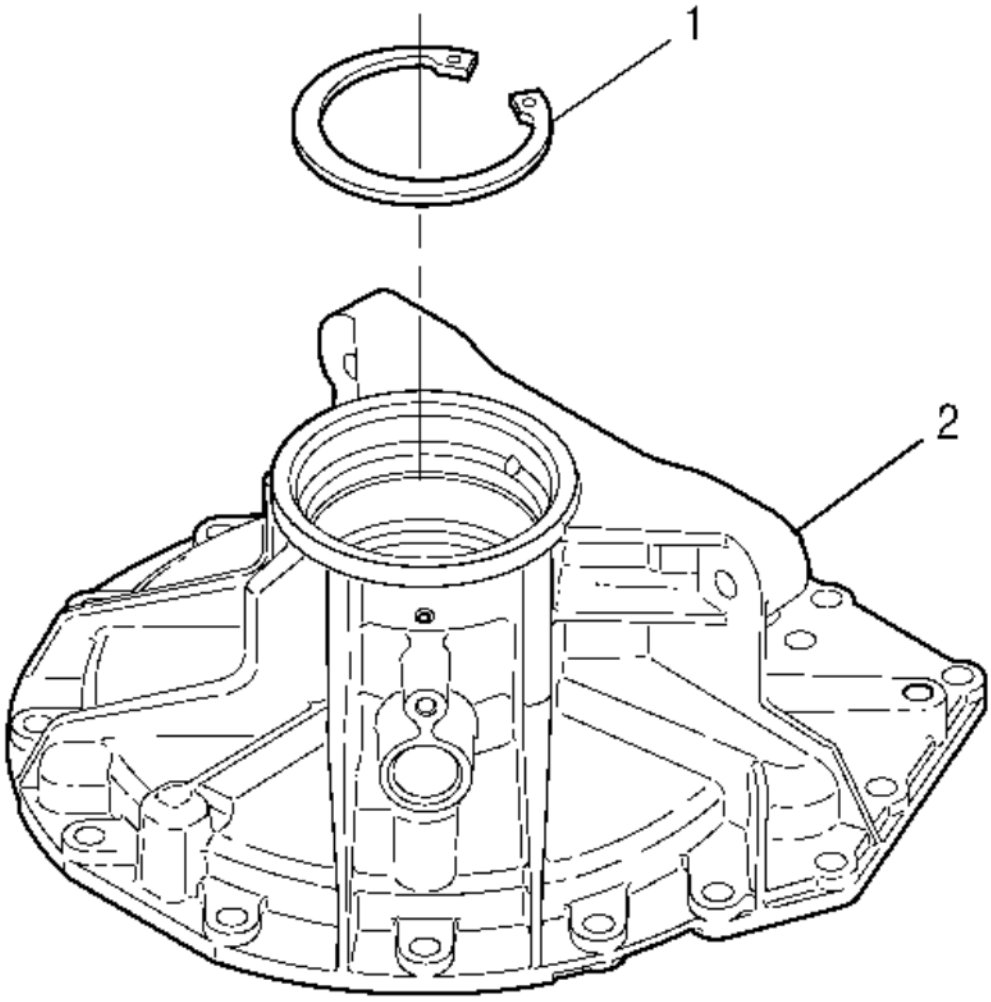


Fig. 172: Locating Retaining Ring From Low And Reverse Clutch Housing
Courtesy of GENERAL MOTORS CORP.

6. Remove the retaining ring (1) from the low and reverse clutch housing (2)

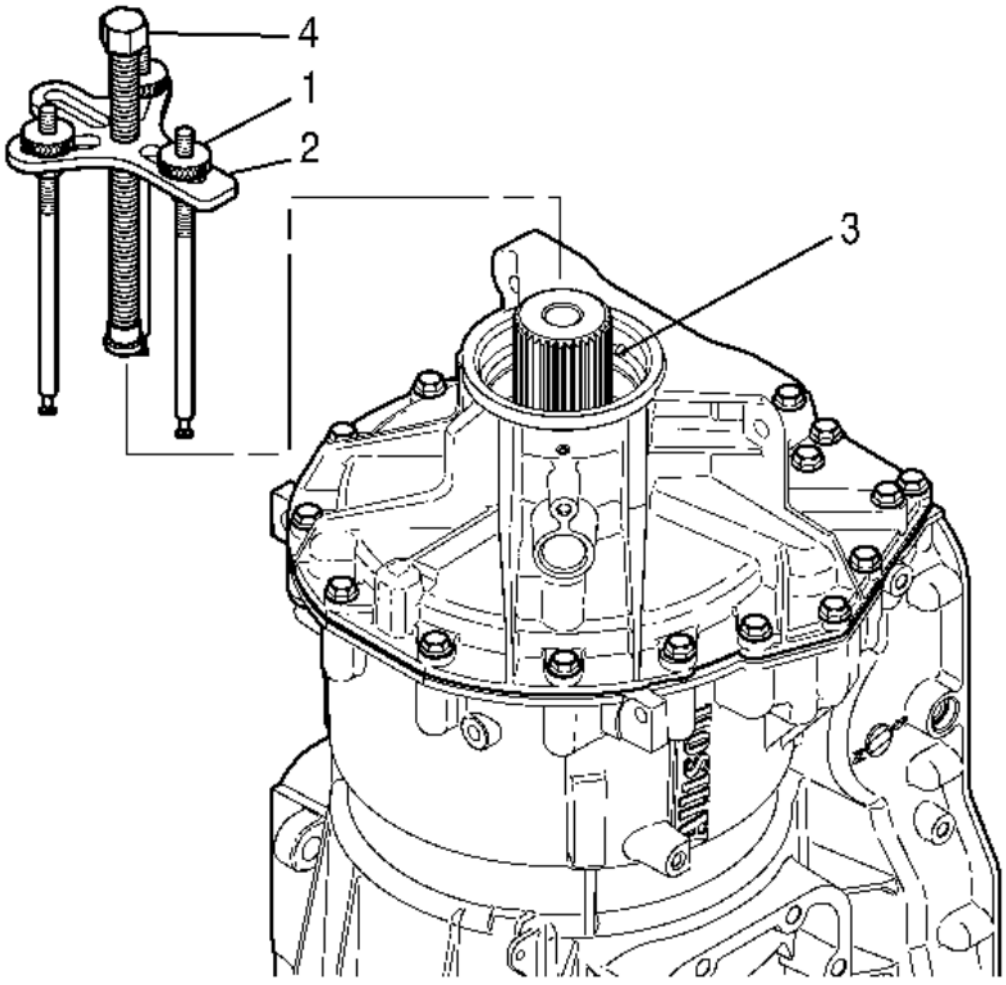


Fig. 173: Identifying J 43910 & J 24420-B
Courtesy of GENERAL MOTORS CORP.

7. Assemble 3 **J 43910** to **J 24420-B** . See **Special Tools**.
8. Place the foot of each leg between the 2 bearing balls.
9. Twist each leg until the foot of the leg is forced under the bearing races.
10. Adjust the center screw (4) and each leg nut (1) until the body of **J 24420-B** is perpendicular to the rear face of the transmission case. See **Special Tools**.
11. Tighten the center screw (4) until ball bearing assembly (3) is dislodged.

12. Remove **J 43910** , **J 24420-B** , and **J 43769** from the ball bearing assembly. See **Special Tools**.

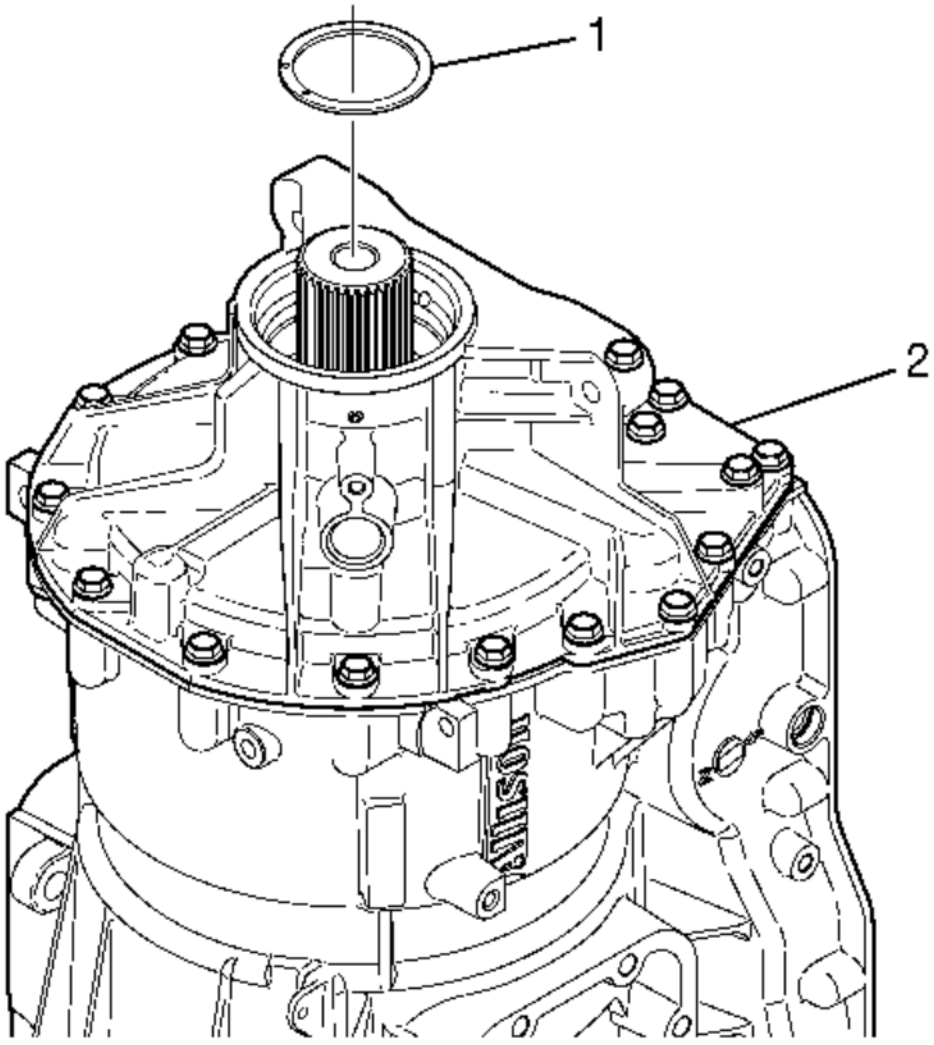


Fig. 174: Transmission Selective Spacer
Courtesy of GENERAL MOTORS CORP.

13. For both transmissions, remove the selective spacer (1).

LOW AND REVERSE CLUTCH PISTON AND OUTPUT CARRIER ASSEMBLY REMOVAL

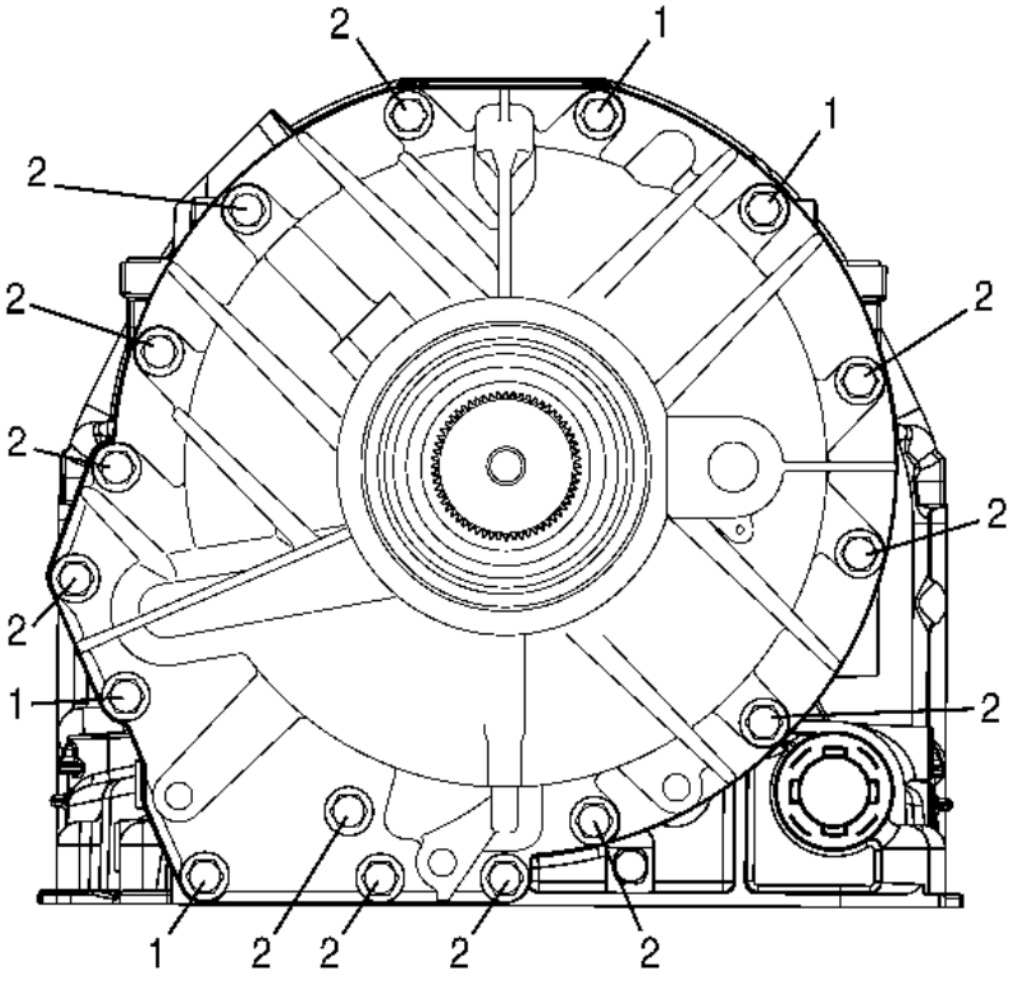


Fig. 175: Identifying Low And Reverse Clutch Housing Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Torque Converter Housing/Low and Reverse Clutch Housing Bolt Size Notice .**

IMPORTANT: Remove the low and reverse clutch housing - 4WD using the same procedure as when removing a low and reverse clutch

housing - 2WD.

1. Remove 4 bolts (1).
2. Remove 12 bolts (2).

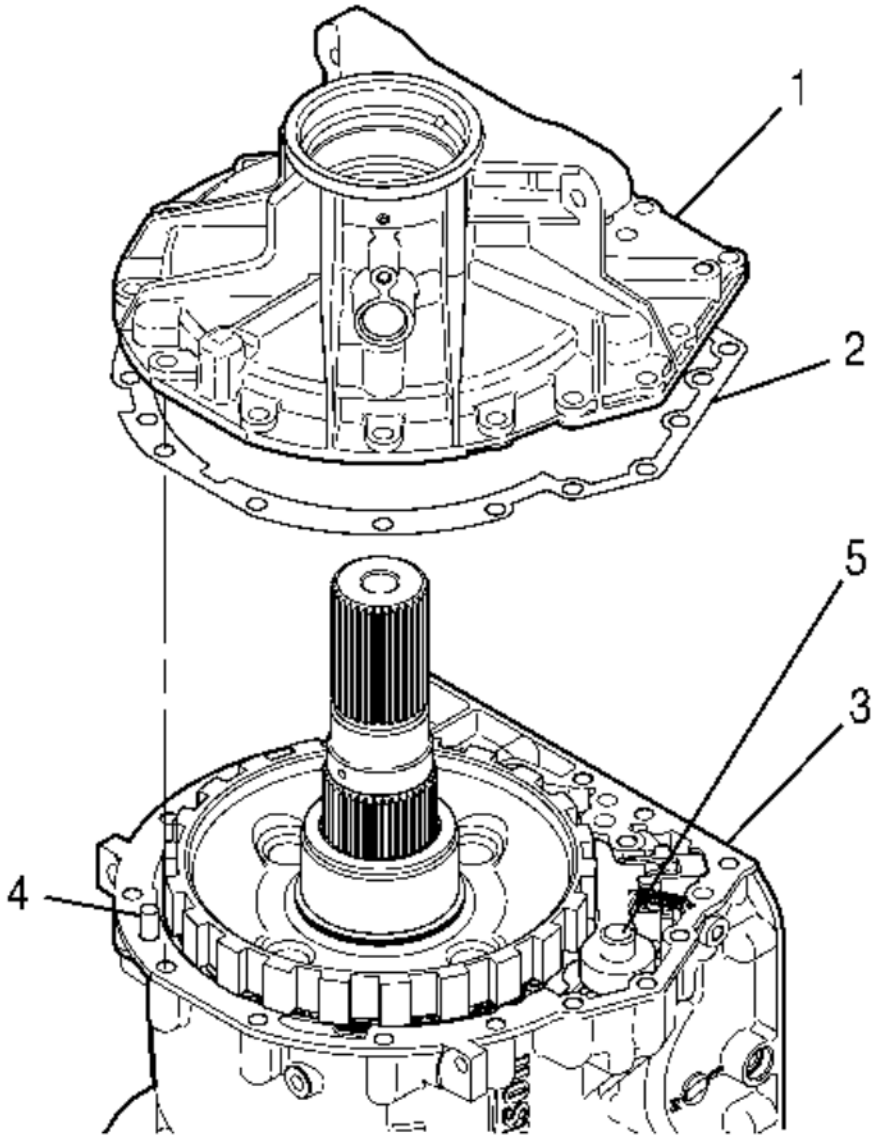


Fig. 176: View Of Low And Reverse Clutch Housing Gasket

Courtesy of GENERAL MOTORS CORP.

NOTE: To help avoid damaging the park pawl return spring, make sure the park pawl support pin is not retained in and removed with the low and reverse clutch housing.

3. Disengage the low and reverse clutch housing (1) from main housing locating pin (4) and pawl support pin (5).
4. Remove the low and reverse clutch housing (1).
5. Remove and discard the gasket (2).

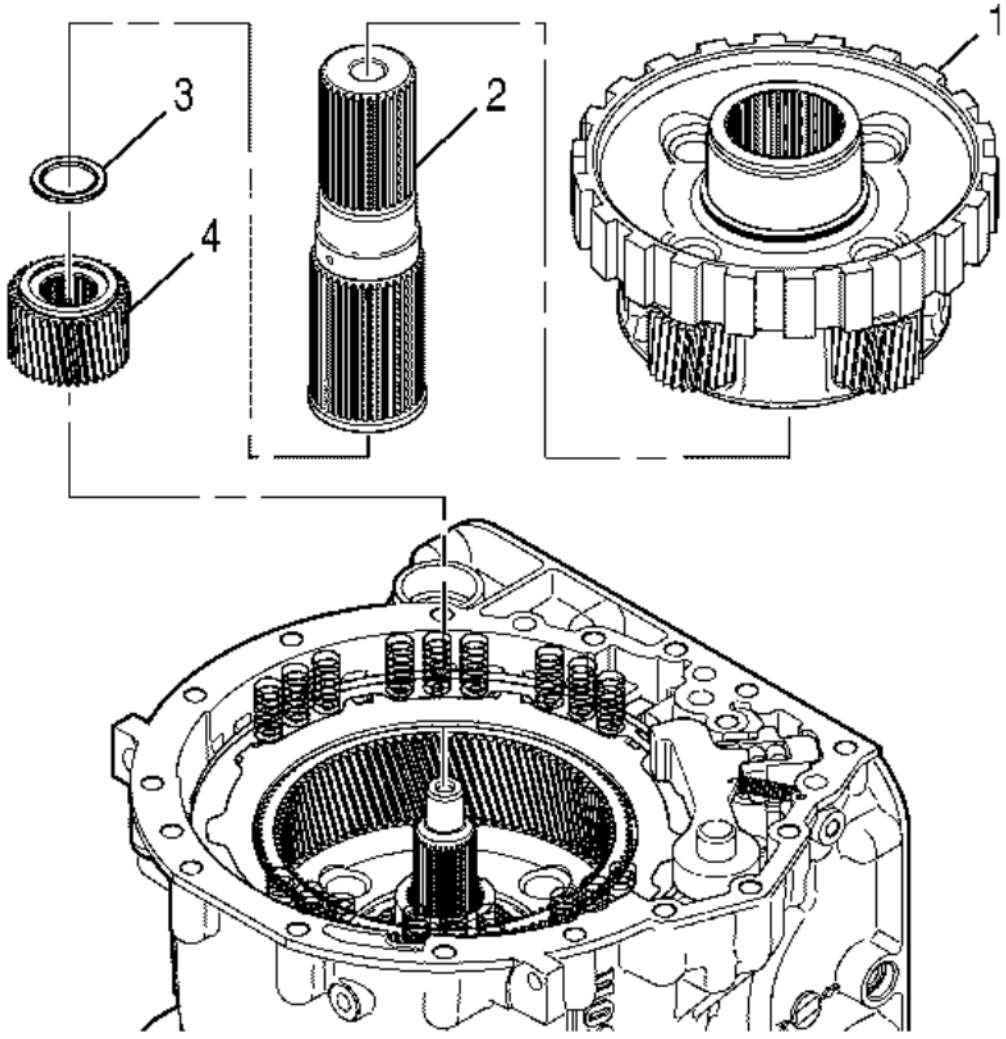


Fig. 177: View Of Output Carrier Assembly Components
Courtesy of GENERAL MOTORS CORP.

CAUTION: Always remove or install the output carrier assembly by holding onto the output shaft. Holding onto the output carrier assembly instead of the output shaft may allow the output shaft to fall causing personal injury and/or property damage.

6. Remove, as a unit, the output shaft (2) and the output carrier assembly (1).
7. Remove the output shaft (2) from the output carrier assembly (1).
8. Remove the output sun gear (4).

IMPORTANT: The thrust bearing assembly may stick to the output shaft or the output sun gear.

9. Remove the thrust bearing (3) from the output shaft (2) or the output sun gear (4).

Park Pawl Removal

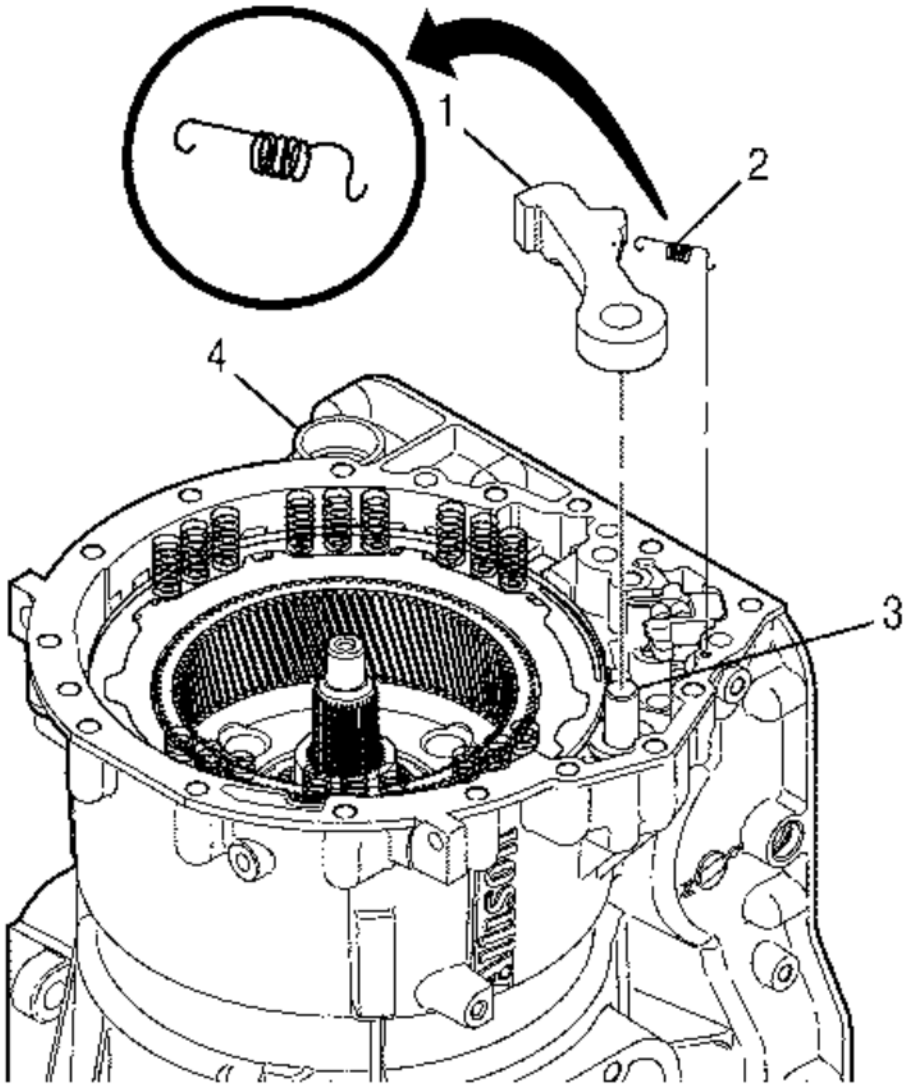


Fig. 178: Exploded View Of Park Pawl & Return Spring
Courtesy of GENERAL MOTORS CORP.

1. Disengage the park pawl return spring (2) from the transmission case (4).
2. Remove, as a unit, the park pawl (1) and the park pawl return spring (2) from the park pawl support pin (3).
3. Remove the park pawl return spring from the park pawl.

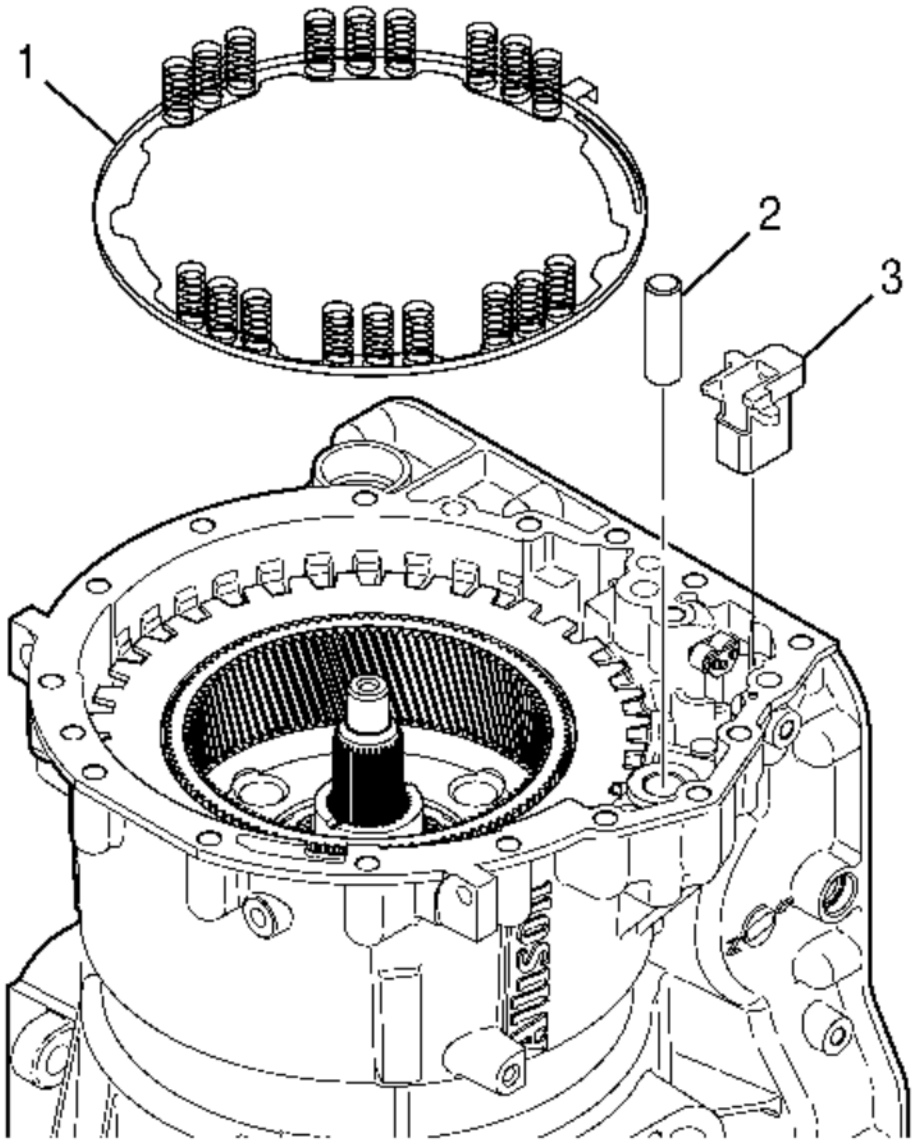


Fig. 179: View Of Park Pawl Support Pin & Cam Guide
Courtesy of GENERAL MOTORS CORP.

4. Remove the park pawl support pin (2) from the transmission case.
5. If present, remove the park pawl cam guide (3).
6. Remove the low and reverse clutch piston return spring assembly (1).

INTERMEDIATE CARRIER AND MAIN SHAFT REMOVAL

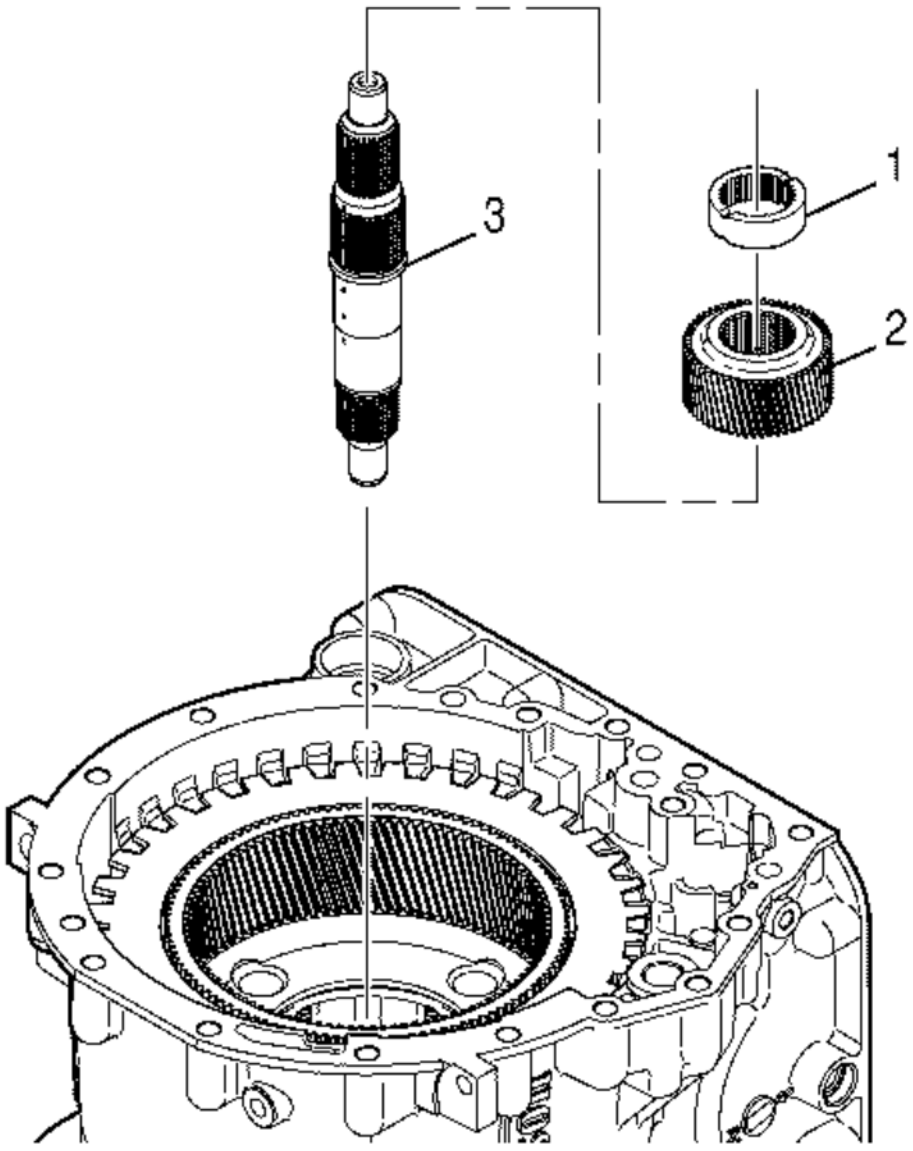


Fig. 180: Main Shaft Components
Courtesy of GENERAL MOTORS CORP.

1. Remove, as a unit, the main shaft (3), the intermediate sun gear (2), and the sun gear spacer

(1).

2. Remove the sun gear spacer (1) and the intermediate sun gear (2) from the main shaft.

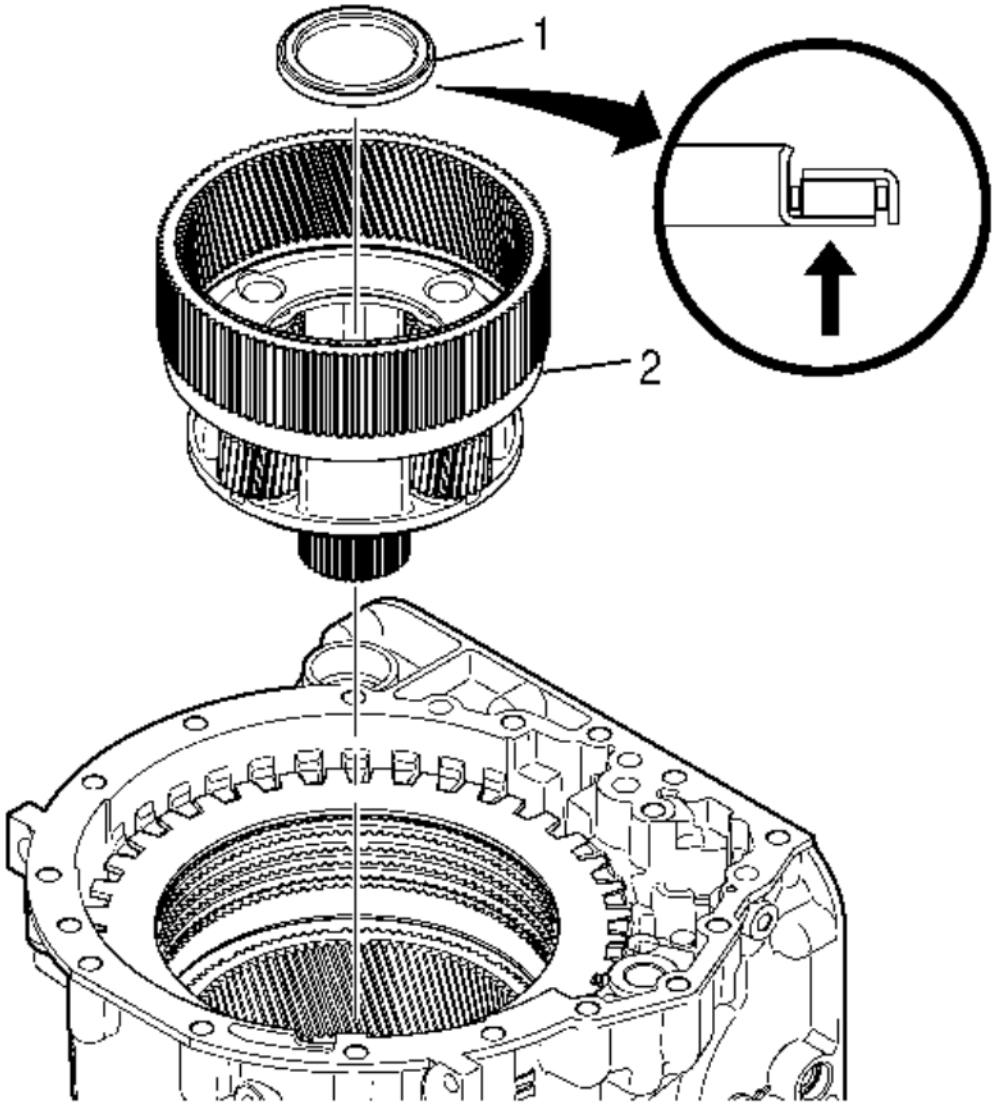


Fig. 181: Identifying Intermediate Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove the intermediate carrier assembly (2).

IMPORTANT: The thrust bearing assembly may adhere to the intermediate carrier assembly (2) or the intermediate sun gear.

4. Remove the thrust bearing assembly (1) from the intermediate carrier assembly (2) or the intermediate sun gear.

LOW AND REVERSE CLUTCH REMOVAL

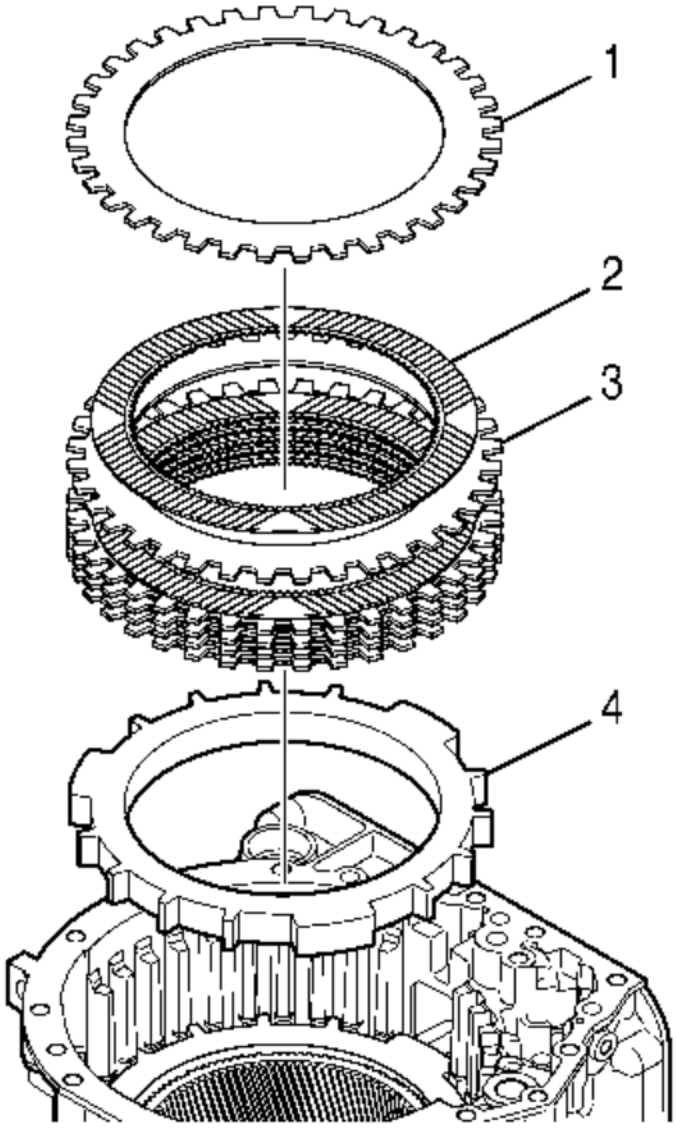


Fig. 182: Identifying Low And Reverse Clutch Plates
Courtesy of GENERAL MOTORS CORP.

1. Remove the low and reverse clutch selective steel plate (1).
2. Remove 6 low and reverse clutch fiber plates (2) and 5 low and reverse clutch steel plates (3).

3. Remove the low and reverse clutch backing plate (4).

INPUT CARRIER REMOVAL

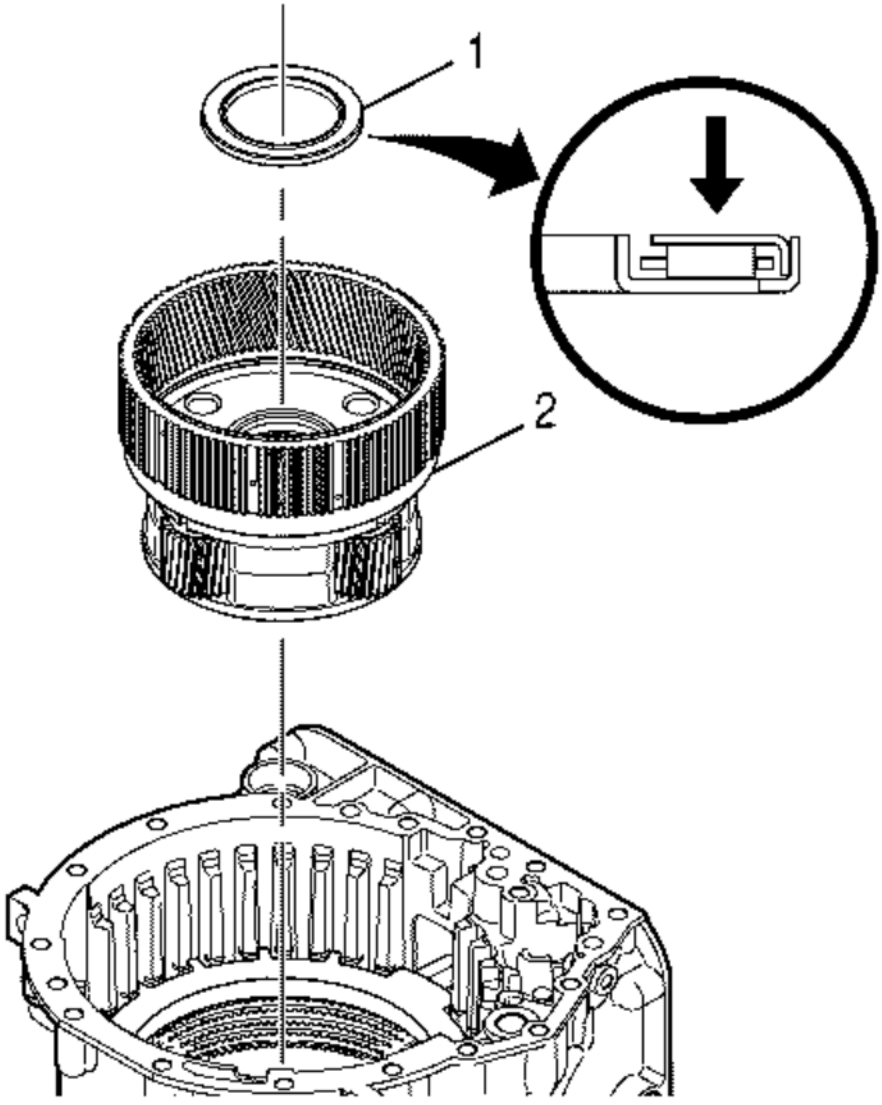


Fig. 183: View Of Input Carrier & Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the input carrier assembly (2).

IMPORTANT: The thrust bearing assembly may stick to the input carrier assembly or the intermediate carrier assembly.

2. Remove thrust bearing assembly (1) from input carrier assembly (2) or intermediate carrier assembly.

2-6 CLUTCH REMOVAL

Tools Required

- **J 24204-2** Bar and Stud Assembly. See **Special Tools**.
- **J 44530** Clutch Piston Spring Compressor. See **Special Tools**.

Removal

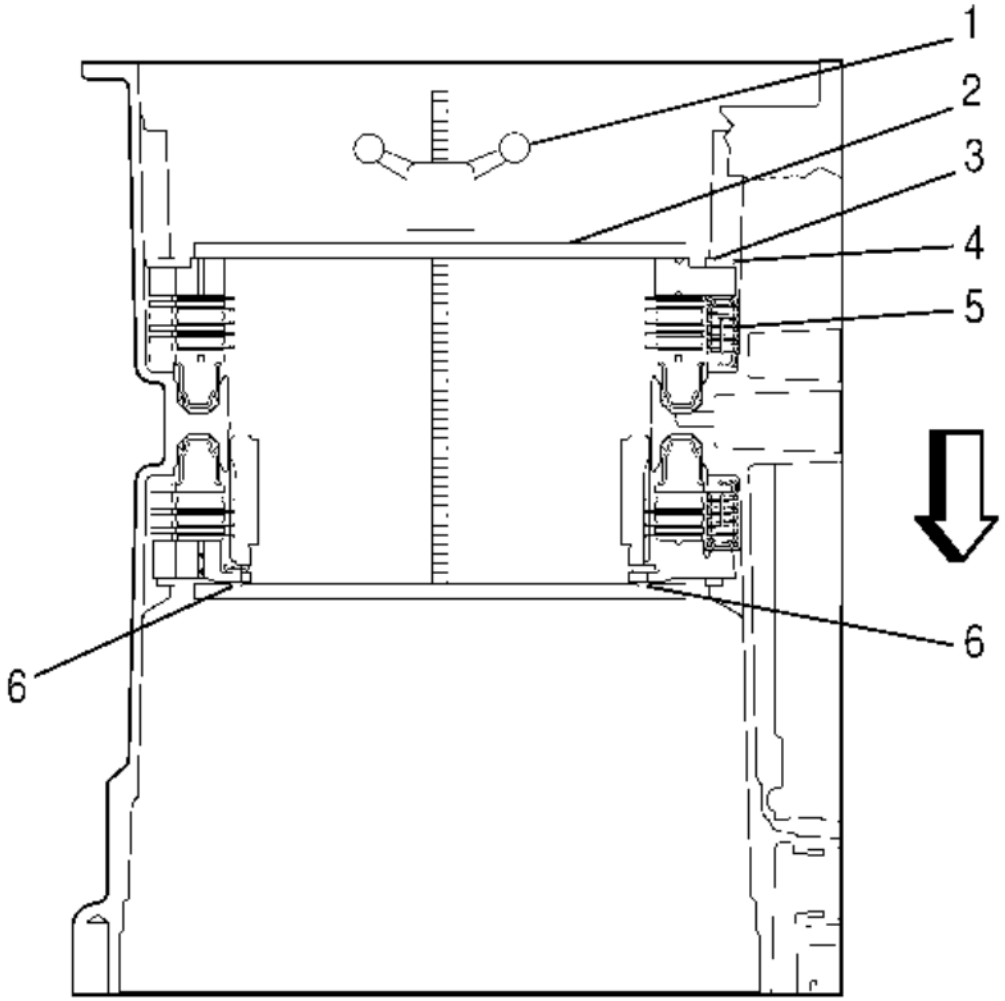


Fig. 184: View Of J 24204-2 & J 44530 Installed In Transmission Case
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to 3-5 Reverse Clutch Backing Plate Rivet Damage Notice .**

1. Install **J 24204-2** (1) and **J 44530** (2) into the transmission case. See **Special Tools**. Make sure that **J 24204-2** does not touch the gear thrust plate rivets (6) on the 3rd, 5th, and reverse clutch backing plate assembly. See **Special Tools**.

2. Compress the piston return spring assemblies (5) until a gap is visible below the retaining rings (3 and 4).

IMPORTANT: The outer 2-6 clutch retaining ring is thinner and larger in circumference compared to the inner low and reverse clutch retaining ring.

3. Remove the low and reverse clutch retaining ring (3).
4. Remove the 2-6 clutch retaining ring (4).
5. Remove **J 24204-2** (1) and **J 44530** (2) from the transmission case. See **Special Tools**.

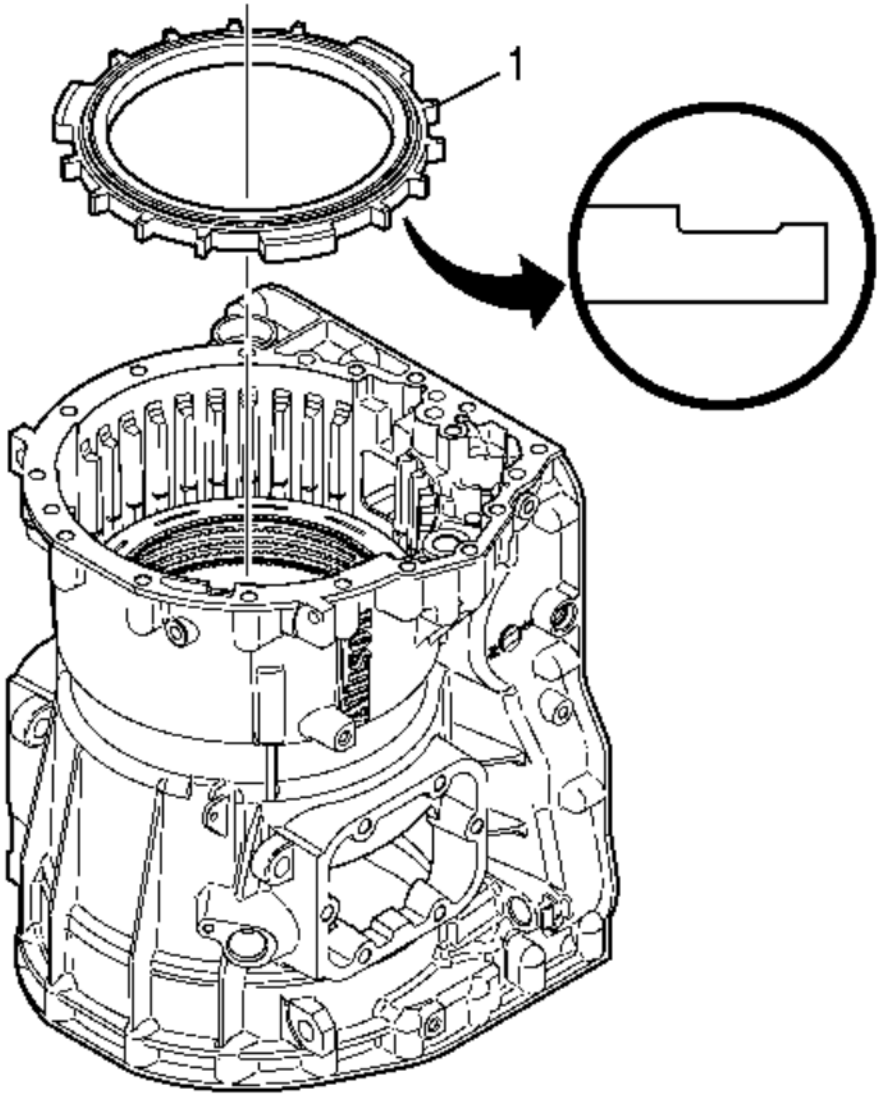


Fig. 185: Identifying Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

6. Remove the 2-6 clutch backing plate (1).

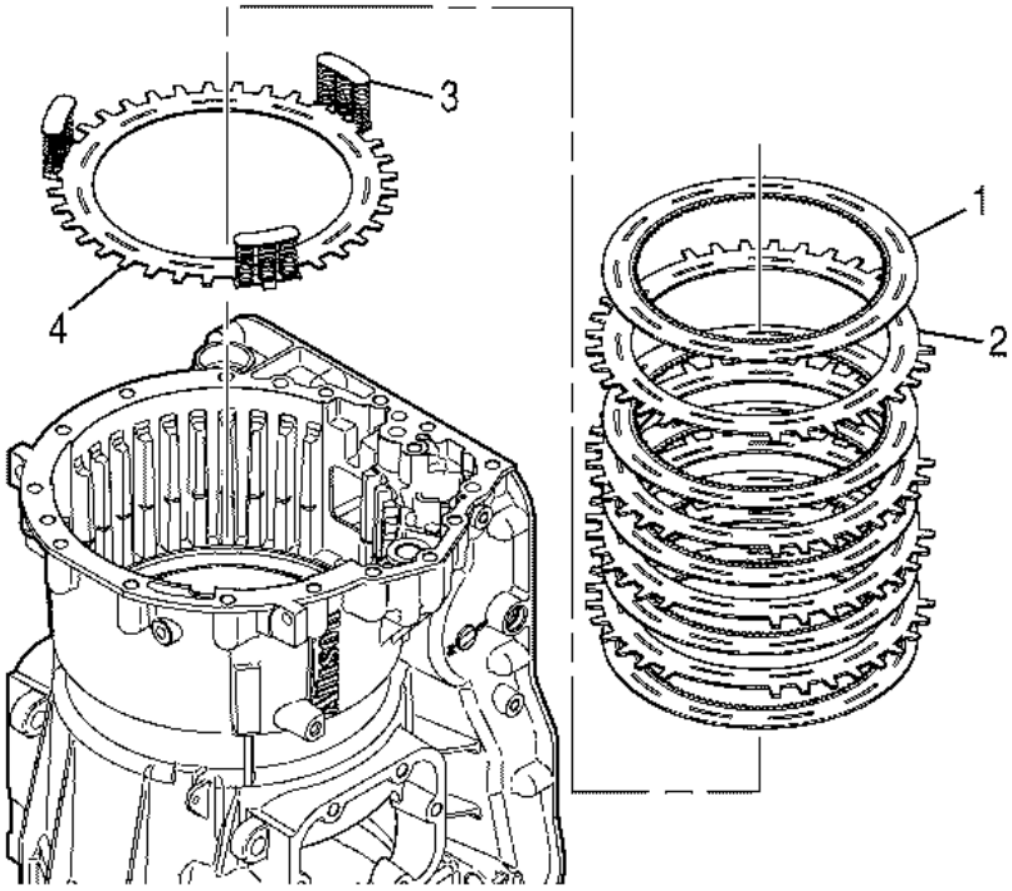


Fig. 186: View Of Clutch Plates & Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

7. Remove five 2-6 clutch fiber plates (1) and four 2-6 clutch steel plates (2).
8. Remove, as a unit, the 2-6 clutch spring plate (4) and 3 piston return spring assemblies (3).

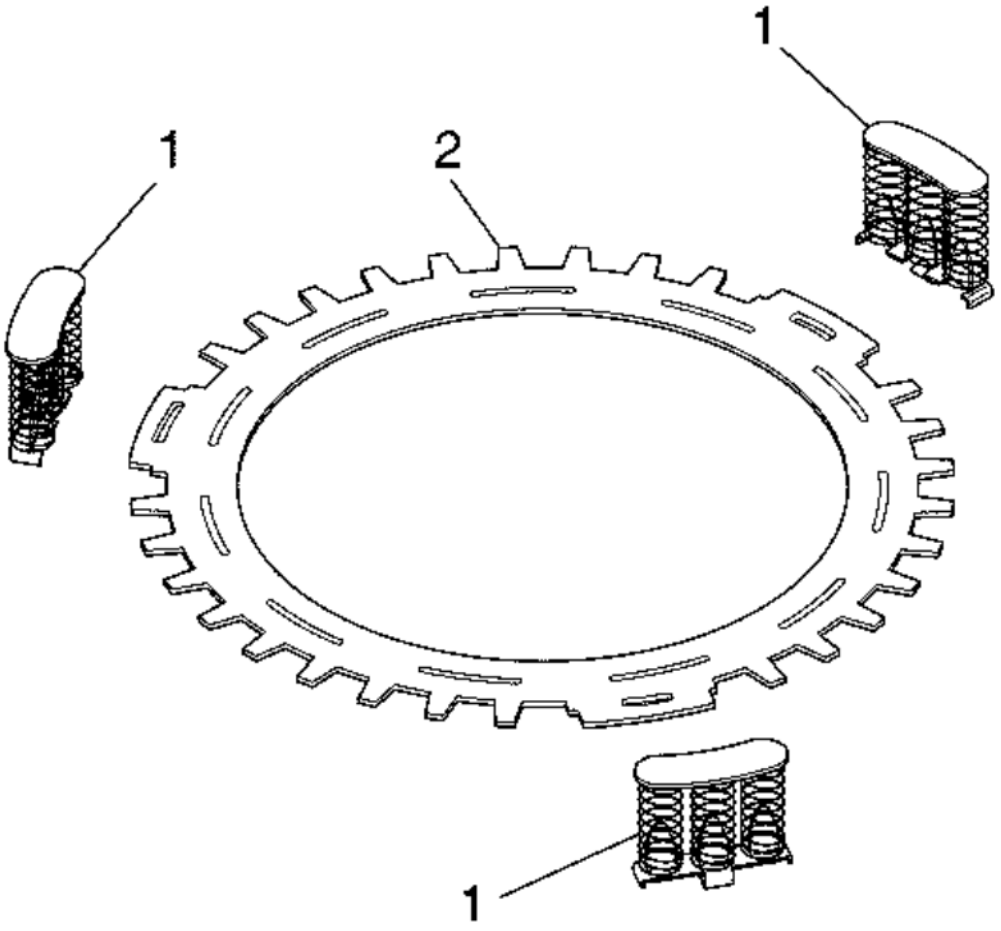


Fig. 187: Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The piston return spring assemblies snap off.

9. Remove 3 piston return spring assemblies (1) from the 2-6 clutch spring plate (2).

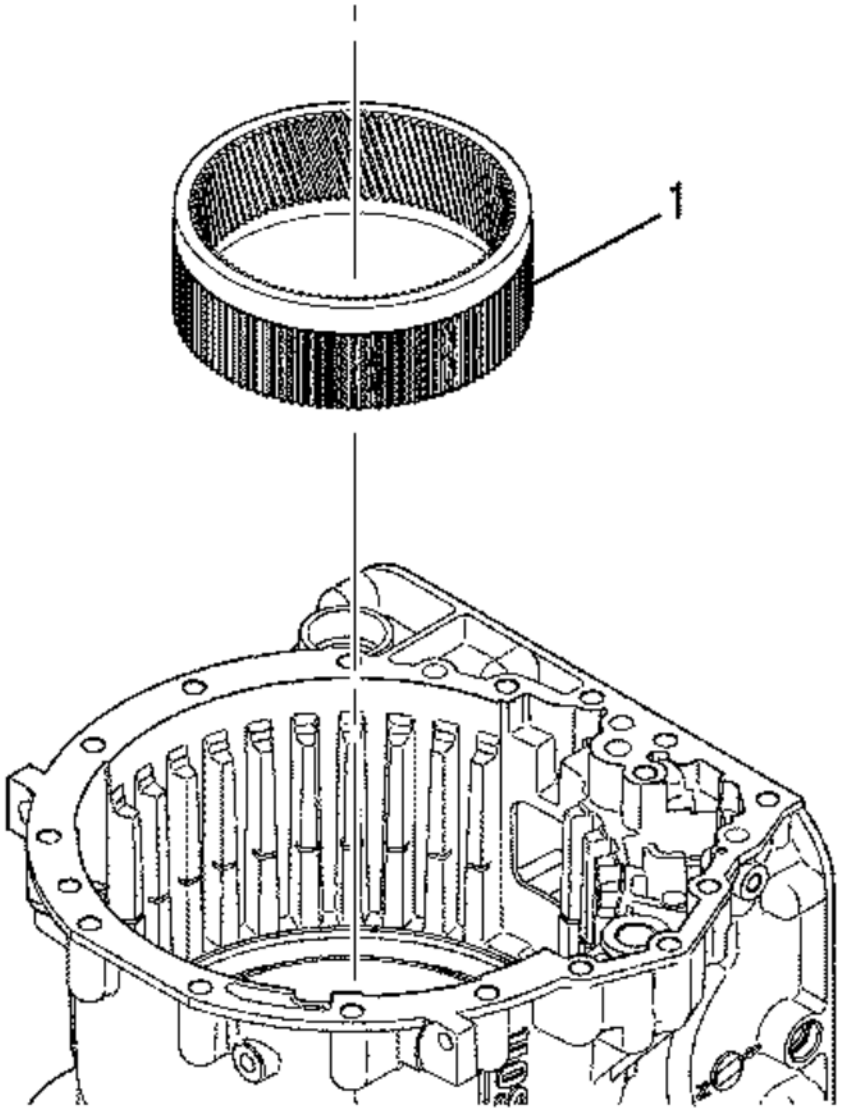


Fig. 188: View Of Input Internal Ring Gear
Courtesy of GENERAL MOTORS CORP.

10. Remove the input internal ring gear (1).

2-6 CLUTCH PISTON REMOVAL

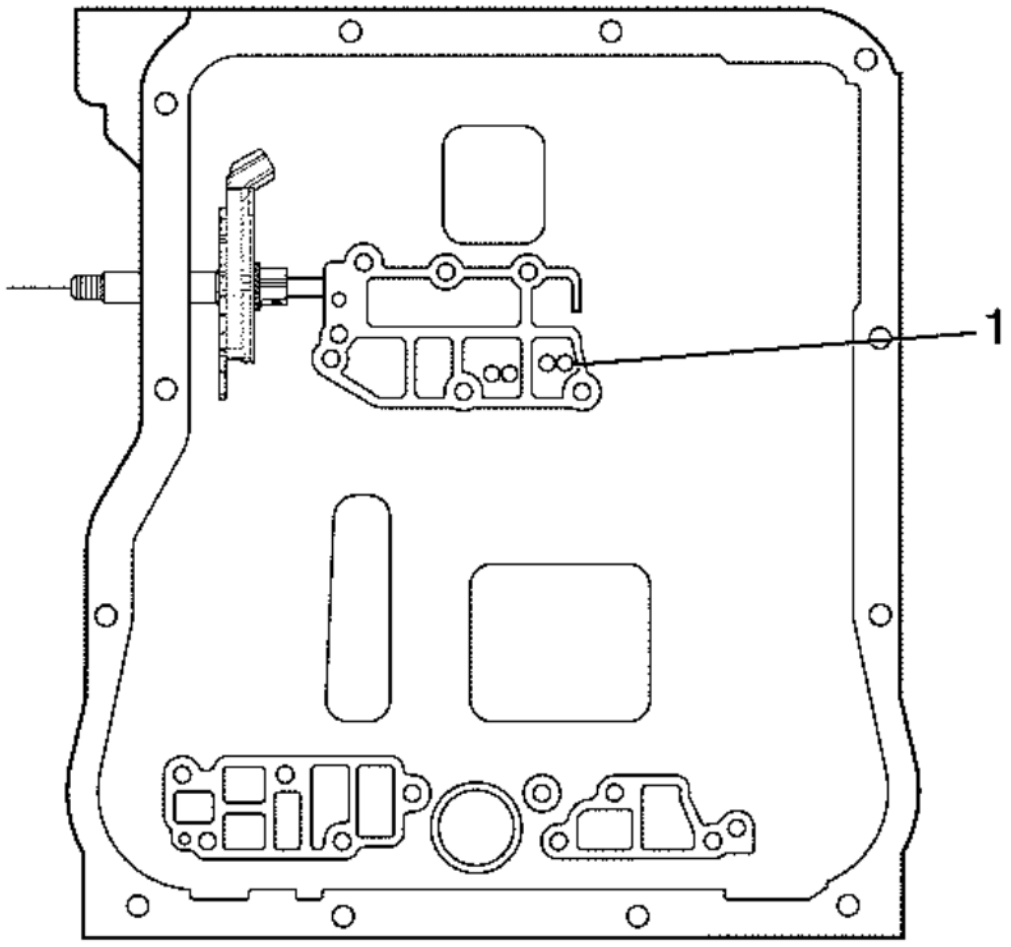


Fig. 189: Locating 2-6 Clutch Annulus Holes
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The preferred method of dislodging the 2-6 clutch piston is with compressed air. If compressed air is not available, remove the 2-6 clutch piston assembly using pliers. If compressed air is used, note the following. Use a 9.5 mm (3/8 in) rubber hose on the air connection to reach into the 2-6 clutch annulus port. When shooting air into the annulus port, ensure that the rubber hose covers both of the 2-6 clutch annulus port holes.

1. Position the rubber hose so that the hose covers both 2-6 clutch annulus holes (1).

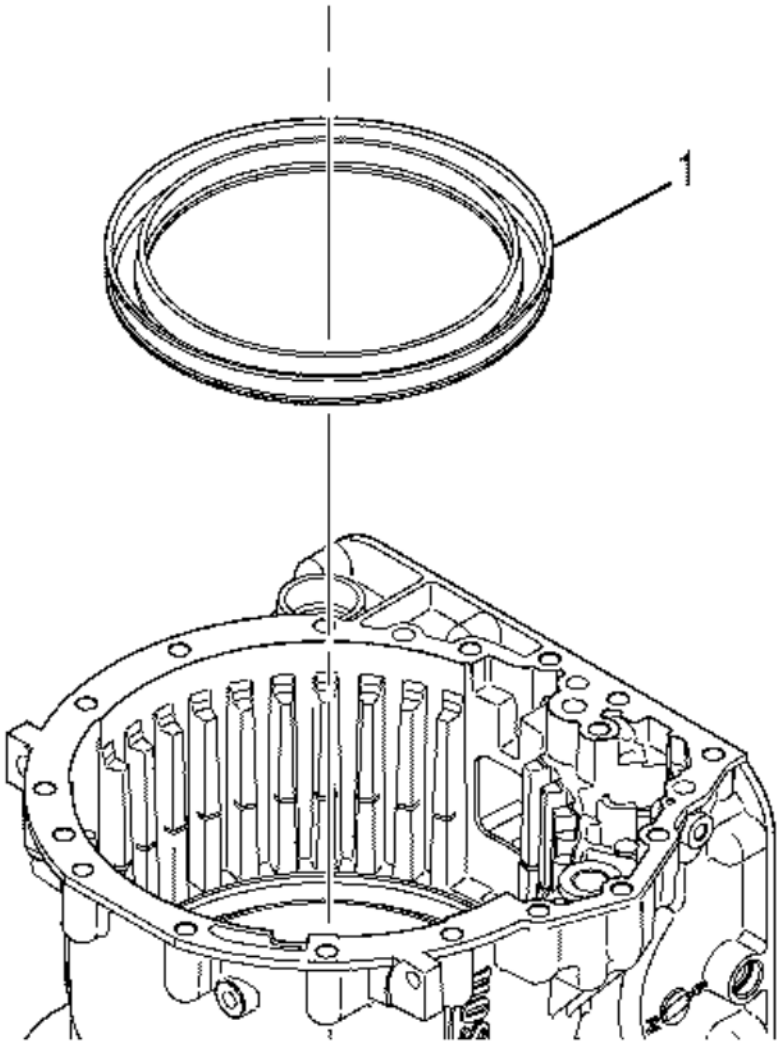


Fig. 190: Locating Clutch Piston Assembly
Courtesy of GENERAL MOTORS CORP.

2. Shoot air into the 2-6 clutch annulus port until the 2-6 clutch piston assembly (1) is dislodged.
3. Remove the 2-6 clutch piston assembly (1).

3RD, 5TH AND REVERSE CLUTCH REMOVAL

Tools Required

- **J 24204-2** Bar and Stud Assembly. See **Special Tools**.
- **J 44530** Clutch Piston Spring Compressor. See **Special Tools**.

Removal

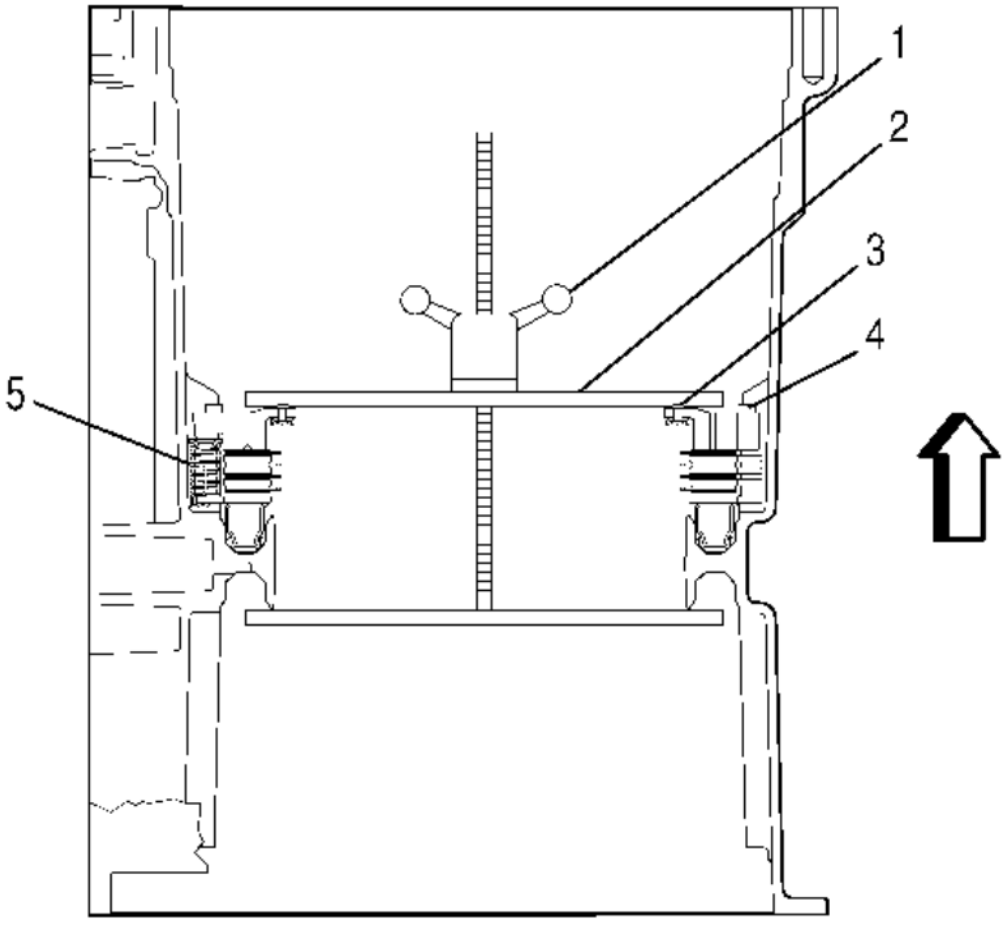


Fig. 191: Compressing 3rd, 5th, And Reverse Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

1. Position the transmission case so that the front of the transmission case is facing up.

NOTE: **Refer to 3-5 Reverse Clutch Backing Plate Rivet Damage Notice .**

2. Install **J 24204-2** (1) and **J 44530** (2) into the transmission case. See **Special Tools**. Make sure that **J 44530** does not touch the gear thrust plate rivets (3) on the 3rd, 5th, and reverse clutch backing plate assembly. See **Special Tools**.
3. Compress the piston return spring assemblies (5) until a gap is visible below the retaining ring (4).
4. Remove the retaining ring (4).
5. Remove **J 24204-2** and **J 44530** from the transmission case. See **Special Tools**.

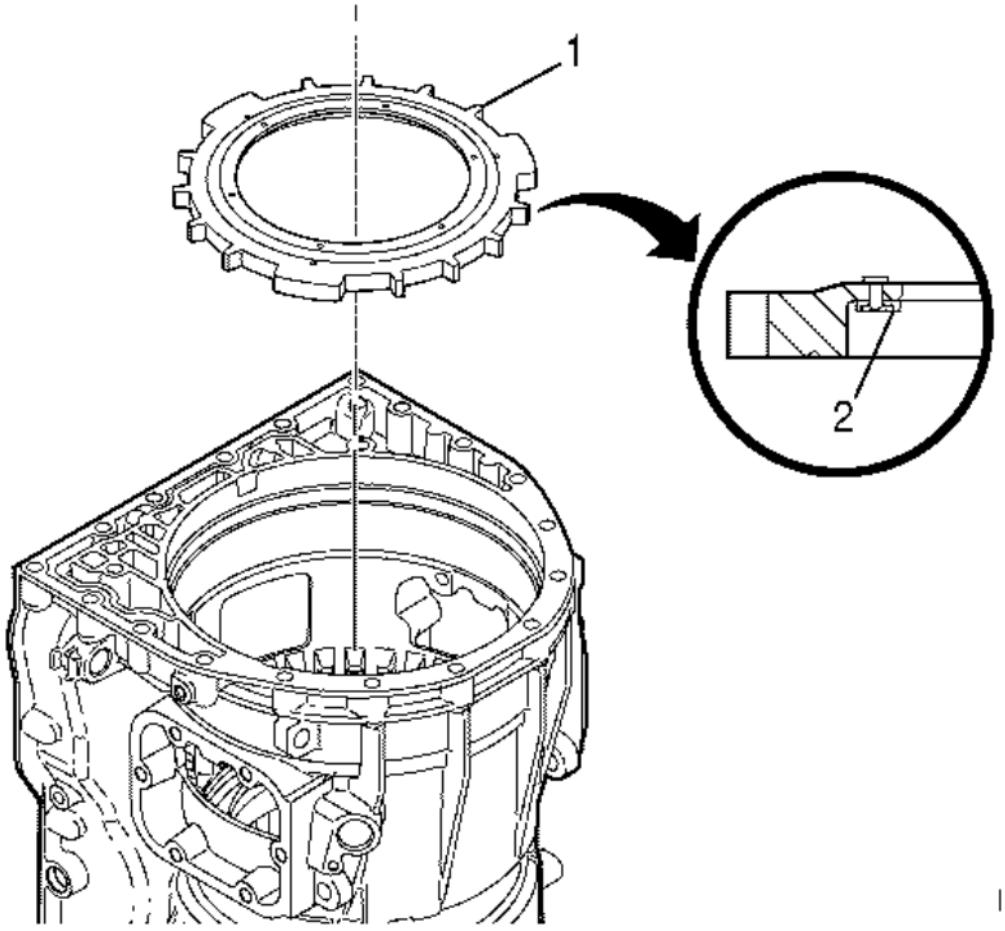


Fig. 192: Aligning 3rd, 5th, And Reverse Clutch Backing Plate Assembly
Courtesy of GENERAL MOTORS CORP.

6. Remove the 3rd, 5th, and reverse clutch backing plate assembly (1).

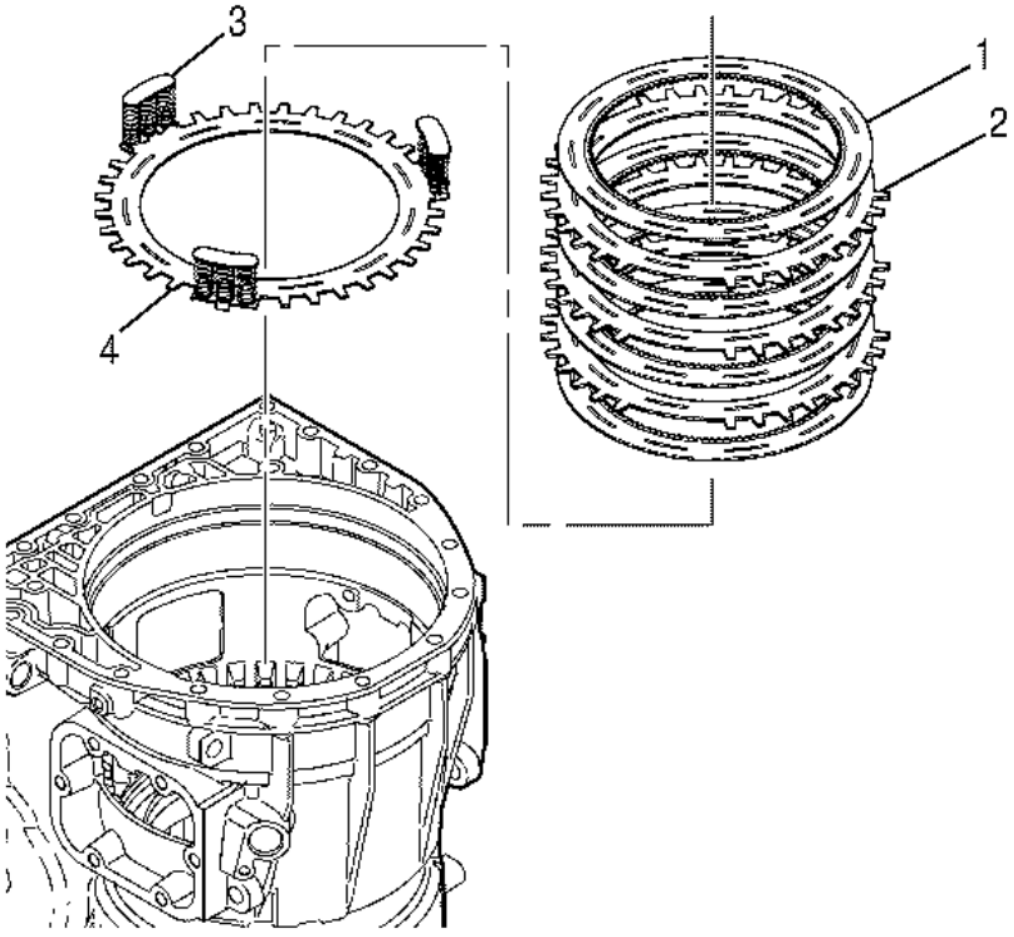


Fig. 193: View Of 3rd, 5th And Reverse Spring Plates, Steel Plates & Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

7. Remove four 3rd, 5th, and reverse clutch fiber plates (1) and three 3rd, 5th, and reverse clutch steel plates (2).
8. Remove, as a unit, 3rd, 5th, and reverse spring plate (4) and 3 piston return spring assemblies (3).

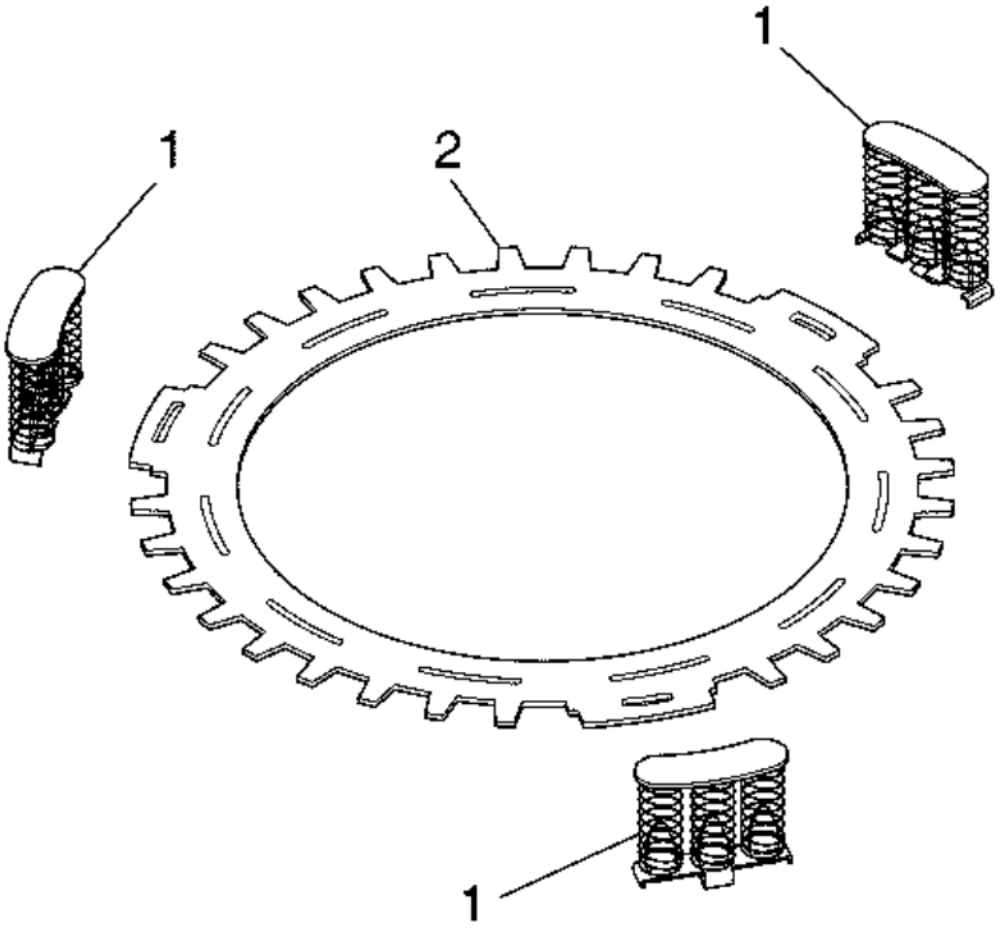


Fig. 194: Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The piston return spring assemblies snap off.

9. Remove 3 piston return spring assemblies (1) from the 3rd, 5th, and reverse spring plate (2).

3-5-REVERSE CLUTCH PISTON REMOVAL

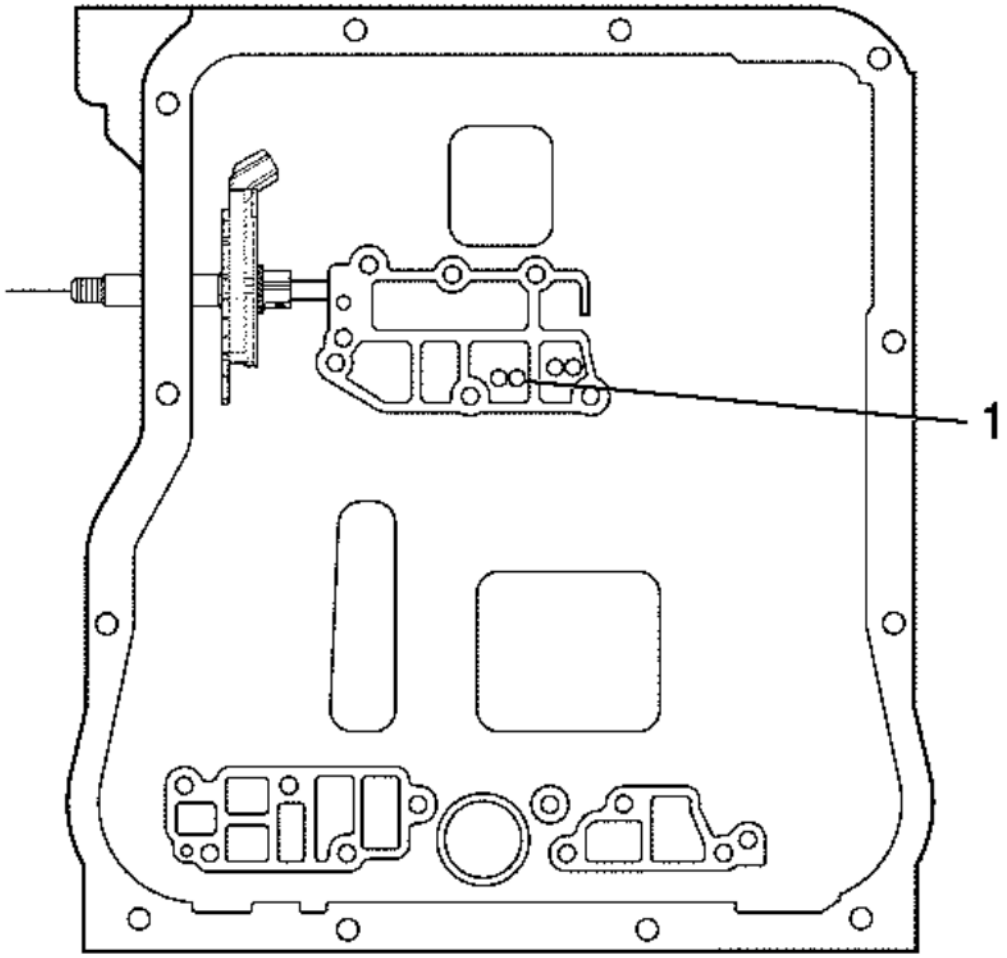


Fig. 195: Locating 3rd, 5th And Reverse Clutch Annulus Holes
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The preferred method of dislodging the 3rd, 5th, and reverse clutch piston is with compressed air. Use a 9.5 mm (3/8 in) rubber hose on the air connection to reach into the 3rd, 5th, and reverse clutch annulus port. When shooting air into the annulus port, ensure that the rubber hose covers both of the 3rd, 5th, and reverse clutch annulus port holes. If compressed air is not available, remove the 3rd, 5th, and

reverse clutch piston assembly using pliers.

1. Position the air hose so that the hose covers both 3rd, 5th, and reverse clutch annulus holes (1).

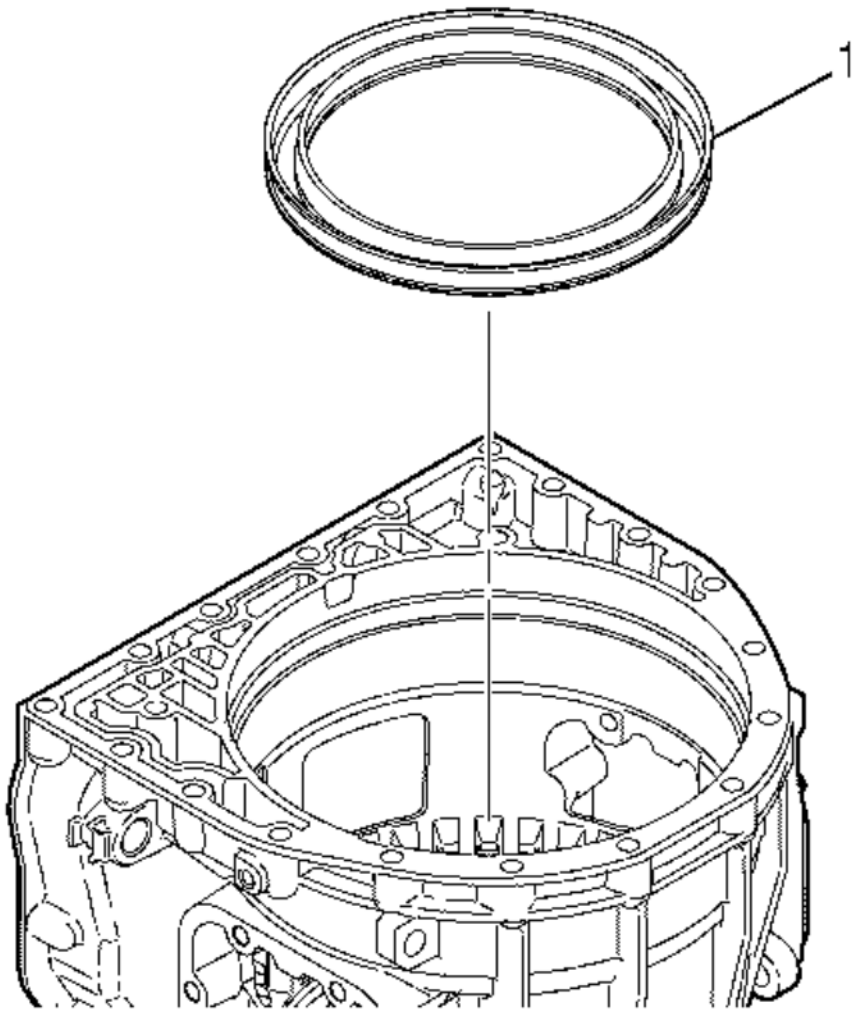


Fig. 196: View Of 3rd, 5th, And Reverse Clutch Piston Assembly
Courtesy of GENERAL MOTORS CORP.

2. Shoot air into the 3rd, 5th, and reverse clutch annulus port until the 3rd, 5th, and reverse

clutch piston assembly (1) is dislodged.

3. Remove the 3rd, 5th, and reverse clutch piston assembly (1).

TORQUE CONVERTER HOUSING FROM PUMP ASSEMBLY DISASSEMBLE

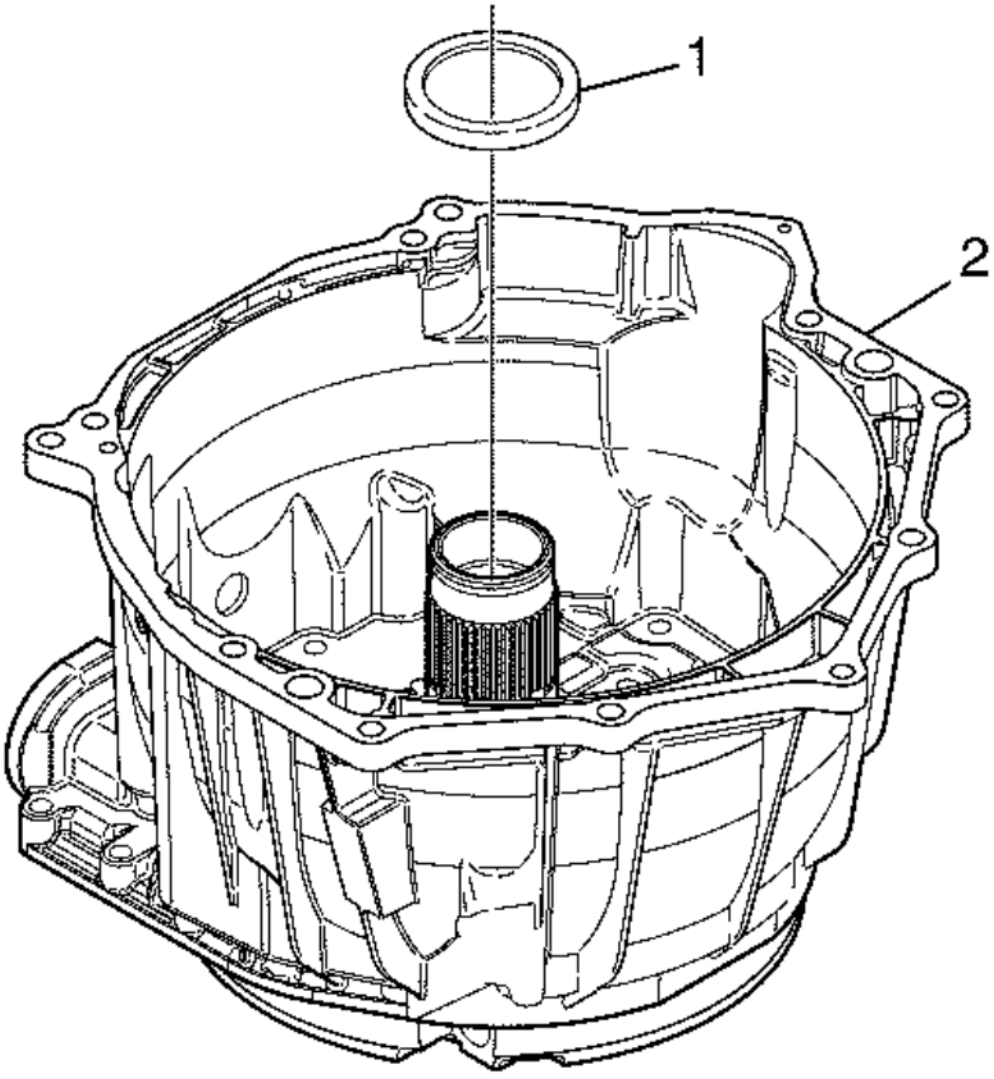


Fig. 197: View Of Converter Housing/Oil Pump Cover Module And Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Position the converter housing/oil pump cover module (2) on the work table so that the torque converter housing is facing up.
2. Remove the oil seal assembly (1).

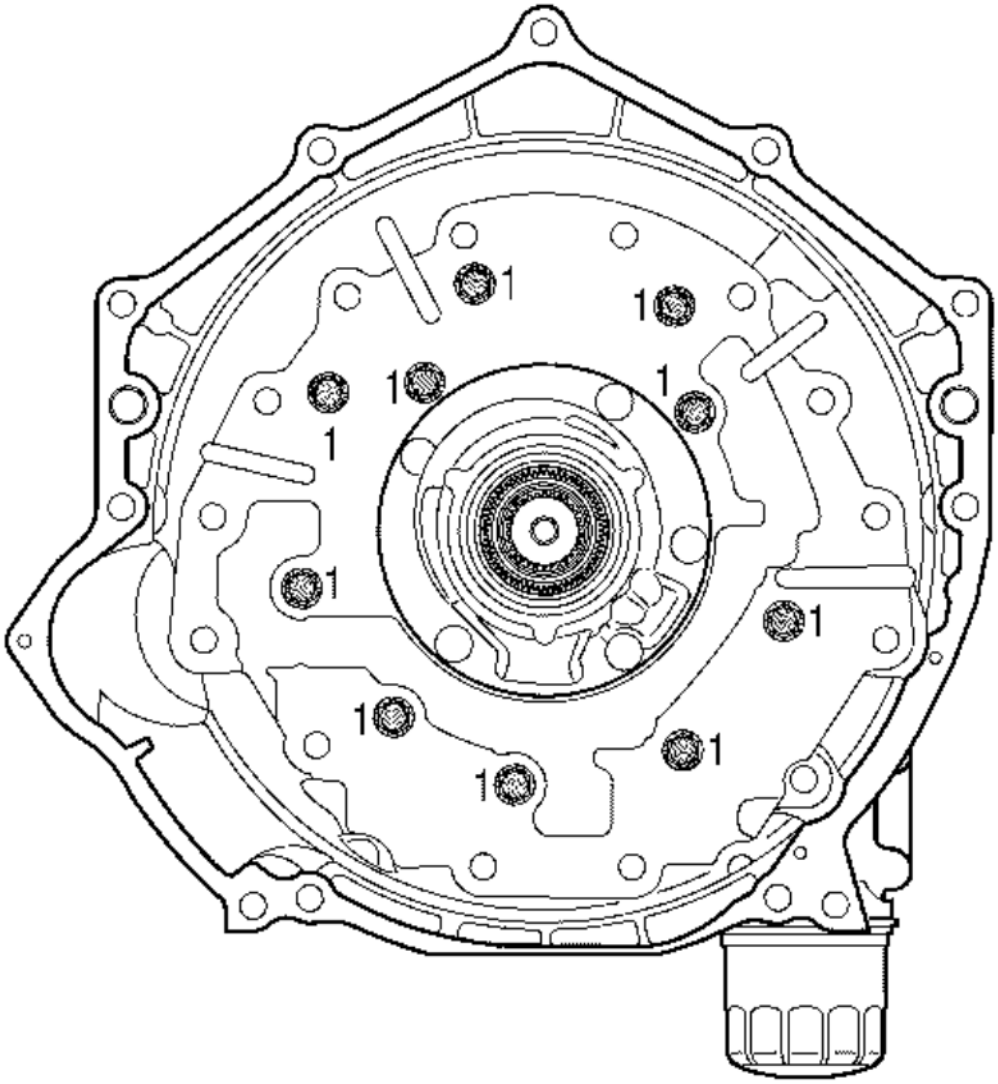


Fig. 198: View Of Oil Seal Assembly Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove 10 bolts (1).

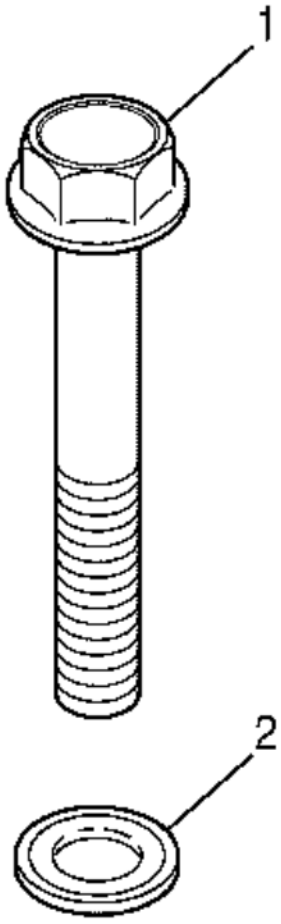


Fig. 199: Identifying Bolt Seals
Courtesy of GENERAL MOTORS CORP.

4. Remove the seals (2) from the bolts (1).

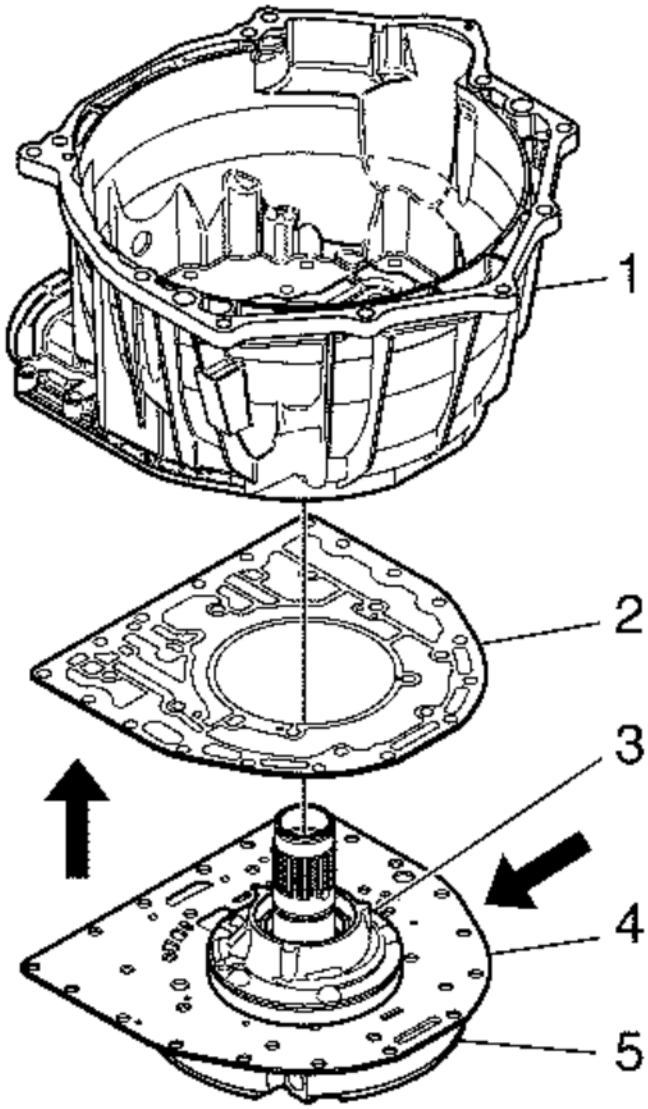


Fig. 200: Converter Housing, Oil Pump Cover Module, Channel Plate And Gasket
Courtesy of GENERAL MOTORS CORP.

5. Remove the converter housing (1) from the oil pump cover module (3).

IMPORTANT: Do not damage the torque converter housing to case channel plate when separating the torque converter housing from the

oil pump cover module.

6. Remove the torque converter housing to case channel plate gasket (2) from the torque converter housing to case channel plate (4).

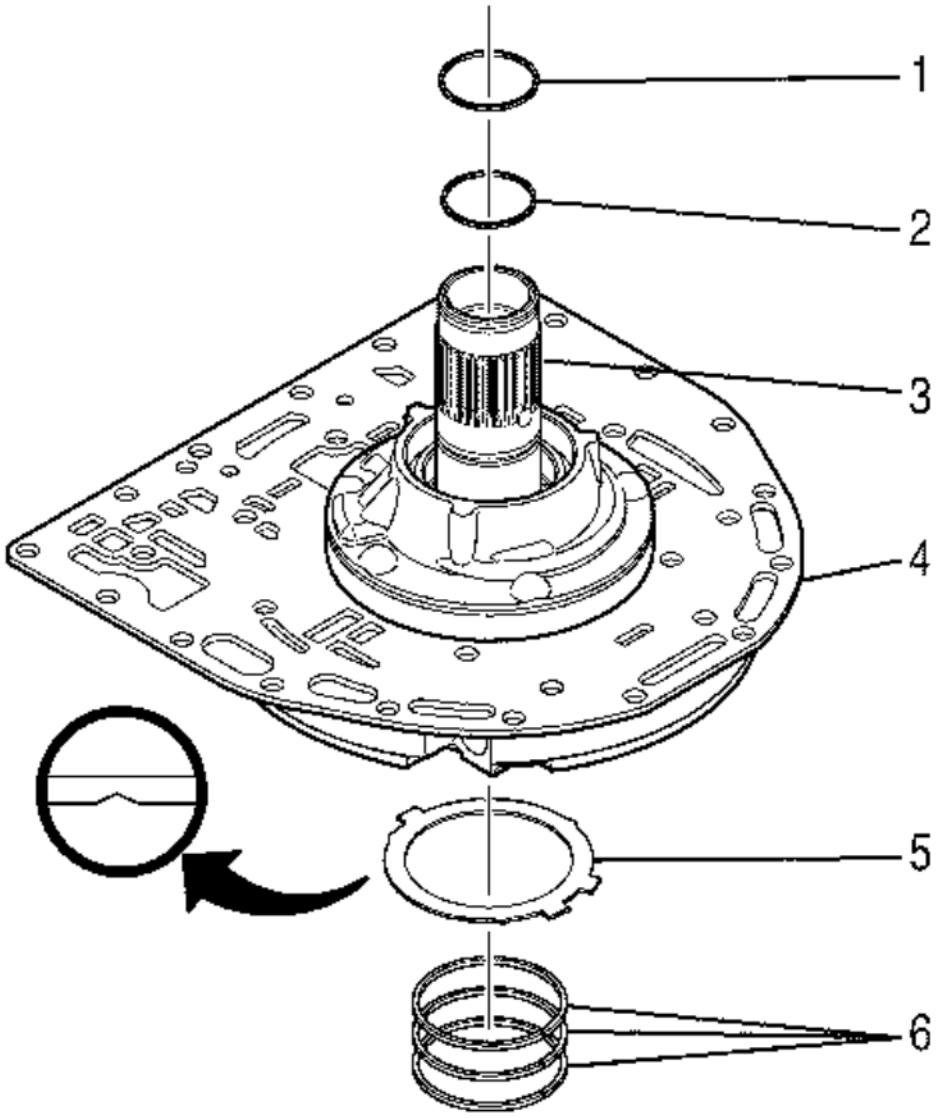


Fig. 201: Identifying Overlap Seal Rings, Stator Shaft, Rear Hub and Thrust

Washer
Courtesy of GENERAL MOTORS CORP.

7. Remove 3 overlap seal rings (6) from the rear hub of the oil pump cover module.
8. Remove 2 overlap seal rings (1, 2) from the stator shaft (3).
9. Remove the thrust washer (5).

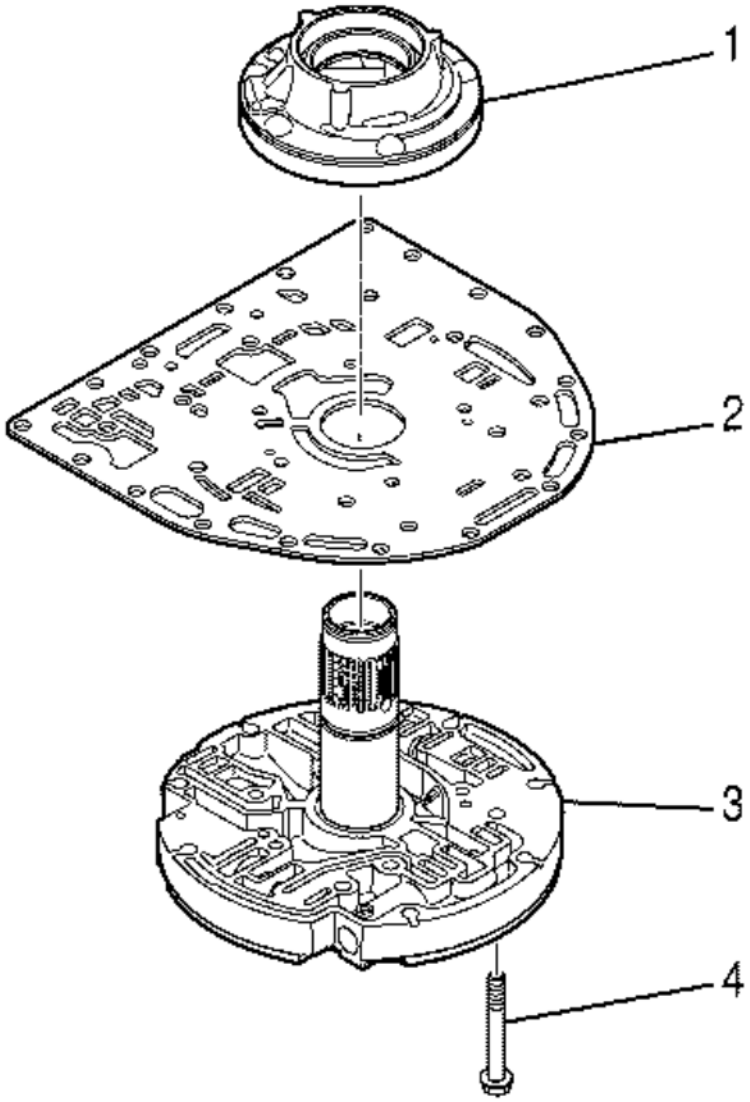


Fig. 202: Locating Oil Pump Assembly Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove 5 bolts (4) retaining the oil pump assembly (1) to the oil pump cover assembly (3).

IMPORTANT: Do not damage the torque converter housing to case channel plate when separating the oil pump cover assembly, torque converter housing to case channel plate, and oil pump assembly.

11. Separate the oil pump cover assembly (3), the torque converter housing to case channel plate (2), and the oil pump assembly (1).

TRANSMISSION FLUID PRESSURE TEST HOLE PLUG, EXTERNAL FILTER, AND FLUID COOLER PIPE RETAINER REMOVAL

Tools Required

J 45023 Control Main Filter Wrench. See **Special Tools**.

Removal

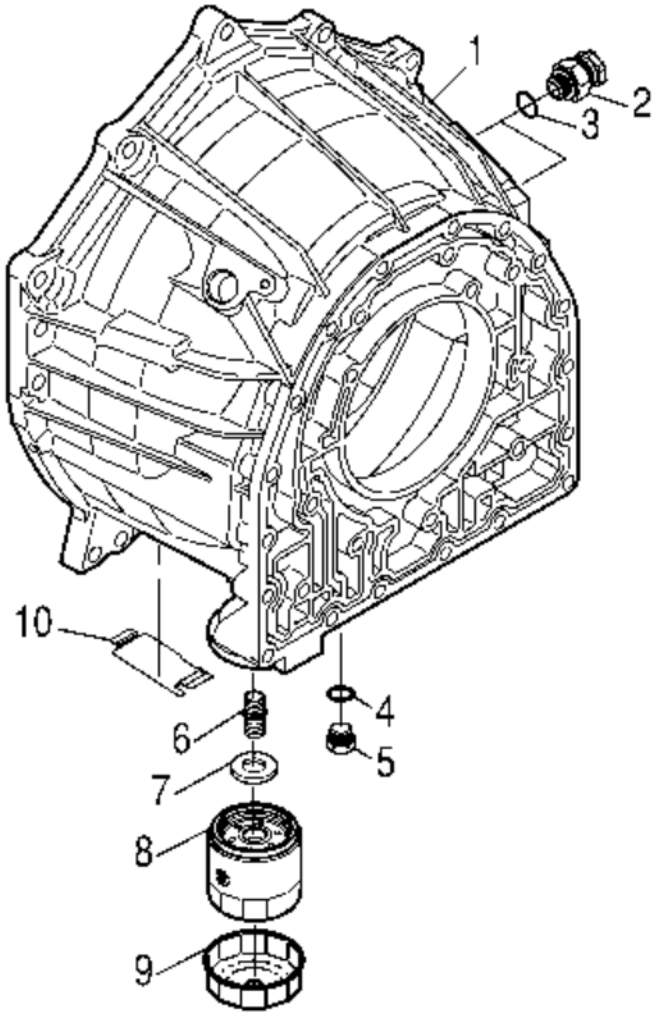


Fig. 203: Locating Transmission External Oil Filter & Adapter
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission line pressure test hole plug (5).
2. Remove the O-ring (4) from the pressure test hole plug (5).
3. Using **J 45023** (9) or a filter strap wrench, remove the transmission external oil filter (8). See **Special Tools**.
4. Remove the magnet (7) from the transmission external oil filter adapter (6) or from the

external oil filter (8).

5. Remove the transmission external oil filter adapter (6).
6. If present, remove both transmission oil cooler pipe connector hydraulic assemblies (2).
7. Remove the O-rings (3) from the hydraulic assemblies.

OIL PUMP DISASSEMBLE

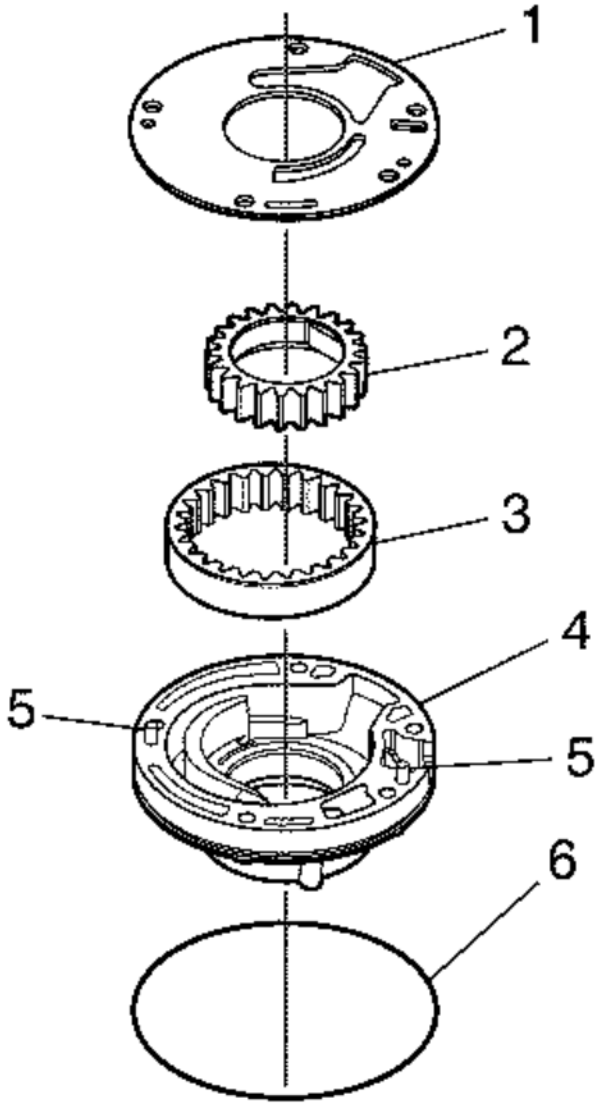


Fig. 204: Exploded View Of Oil Pump
Courtesy of GENERAL MOTORS CORP.

1. Remove the wear plate (1).

IMPORTANT: The oil pump drive gear and driven gear have a punch mark on one side. Before the gears are removed from the oil pump, the presence or absence of the punch marks on the gears must be noted so that the gears can be reinstalled in the original orientation.

2. Note the presence or absence of punch marks on the drive gear and driven gear.
3. If not punch-marked, mark the gears so as to be able to reinstall them in their original positions.
4. Remove the drive gear (2) and driven gear (3) from the oil pump body (4).
5. Remove the O-ring (6).

OIL PUMP INSPECTION

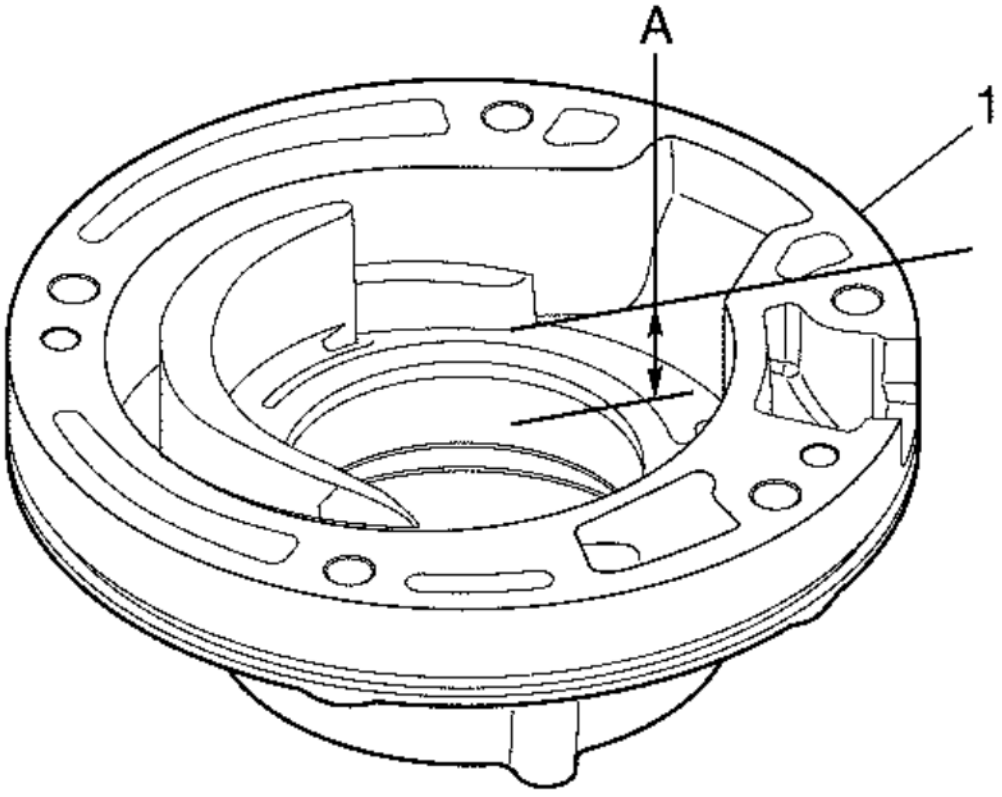


Fig. 205: Measuring Depth Of Oil Pump Body Gear Cavity
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Make the following measurements described below at several locations.**
- **Replace the oil pump body, driven gear and drive gear if any of the following specifications are not met.**

1. Measure the depth of the oil pump body gear cavity at dimension A.

   Specification: The gear cavity maximum depth is 24.940 mm (0.9819 in).

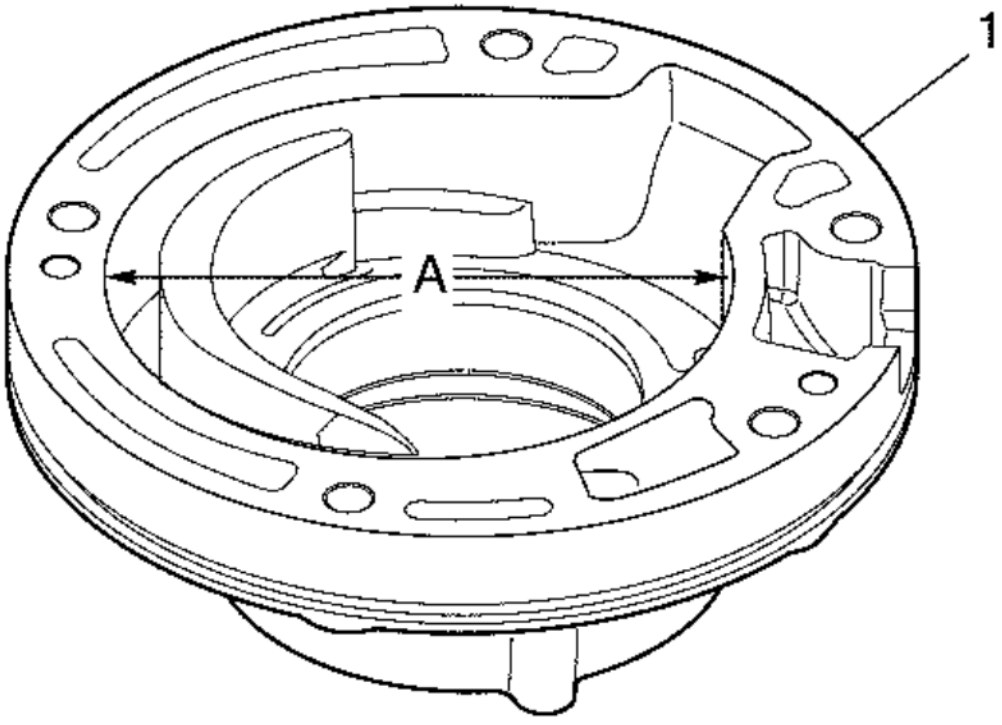


Fig. 206: Measuring Inside Diameter Of Oil Pump Body Gear Cavity
Courtesy of GENERAL MOTORS CORP.

2. Measure the ID of the oil pump body gear cavity at dimension A.

   Specification: The gear cavity maximum ID is 109.191 mm (4.2989 in).

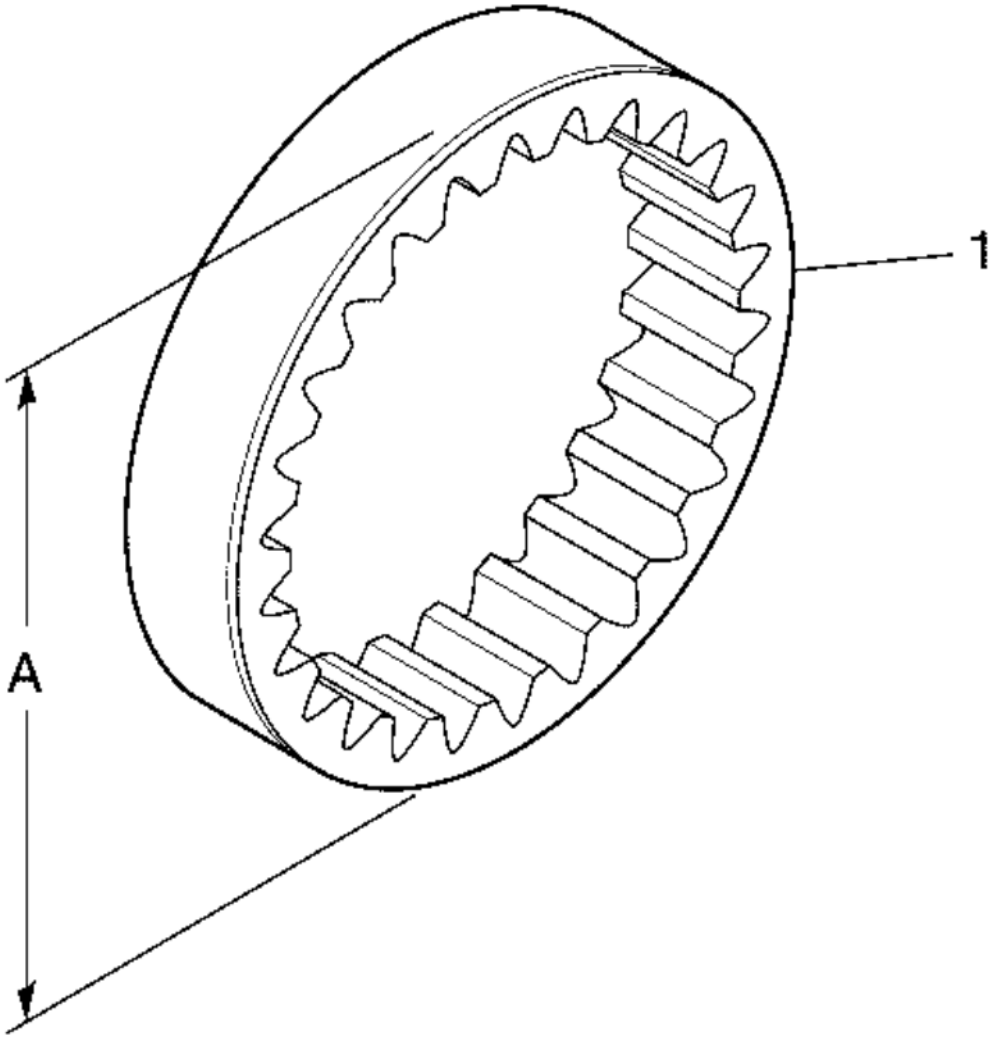


Fig. 207: Measuring Outside Diameter Of Oil Pump Driver Gear
Courtesy of GENERAL MOTORS CORP.

3. Measure the OD of the driven gear at dimension A.

Specification: The driven gear minimum OD is 108.987 mm (4.2908 in).

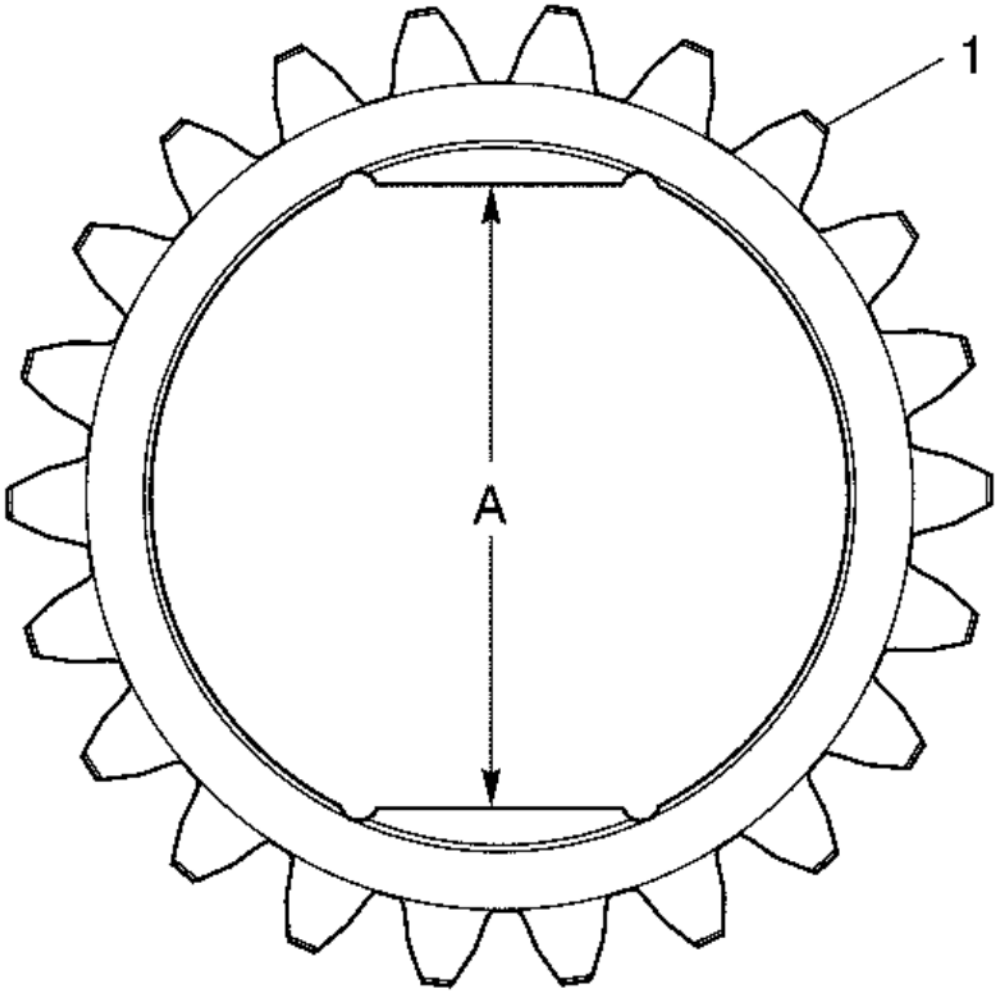


Fig. 208: Measuring Distance Between Flats Of Drive Gear
Courtesy of GENERAL MOTORS CORP.

4. Measure the distance between the flats of the drive gear at dimension A.

   Specification: The maximum distance between the flats is 52.165 mm (2.0537 in).

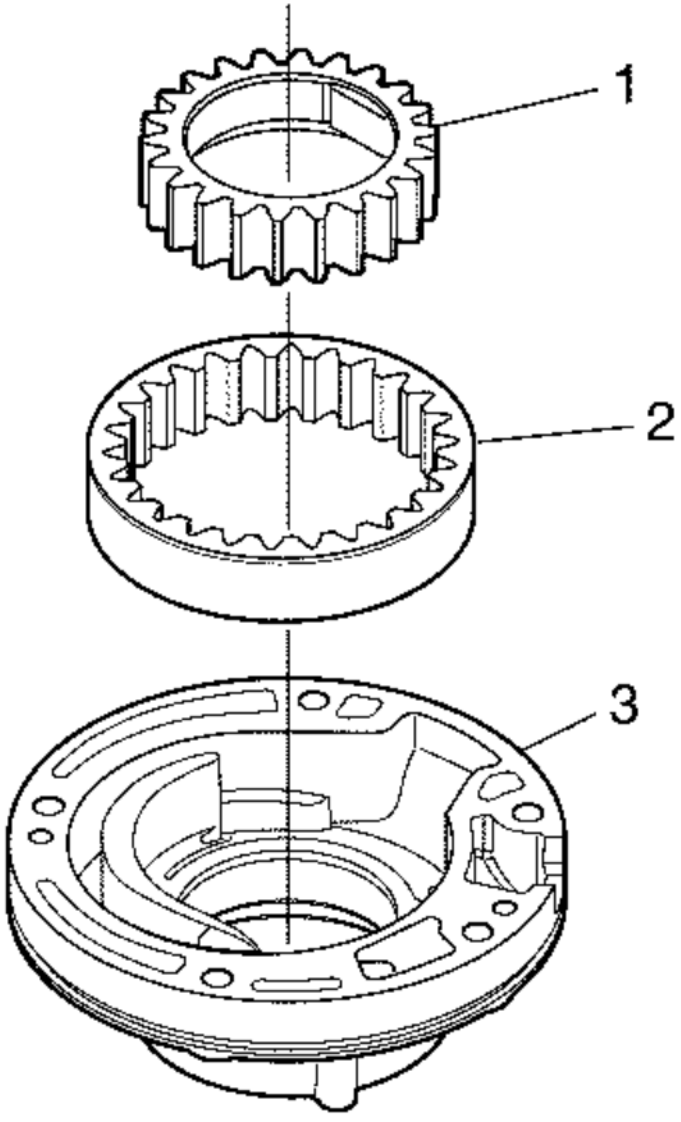


Fig. 209: Drive Gear & Driven Gears
Courtesy of GENERAL MOTORS CORP.

5. Align the drive gear (1) and driven gear (2) with the oil pump so that their punch marks are in the same position as when they were originally removed.
6. Install the gears into the oil pump body (3).

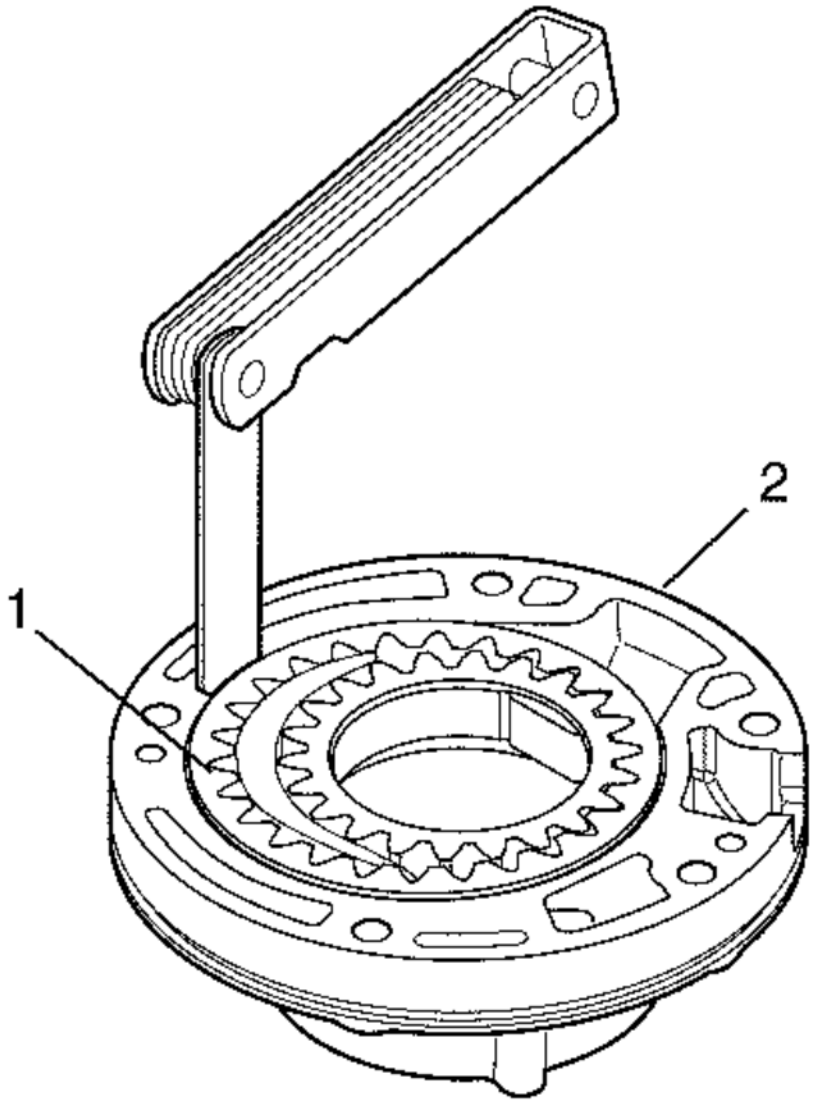


Fig. 210: Measuring Driven Gear To Oil Pump Body Clearance
Courtesy of GENERAL MOTORS CORP.

7. Measure the clearance between the driven gear (1) and the oil pump body (2), driven gear diametrical clearance.

Specification: The driven gear maximum diametrical clearance is 0.20 mm (0.0080 in).

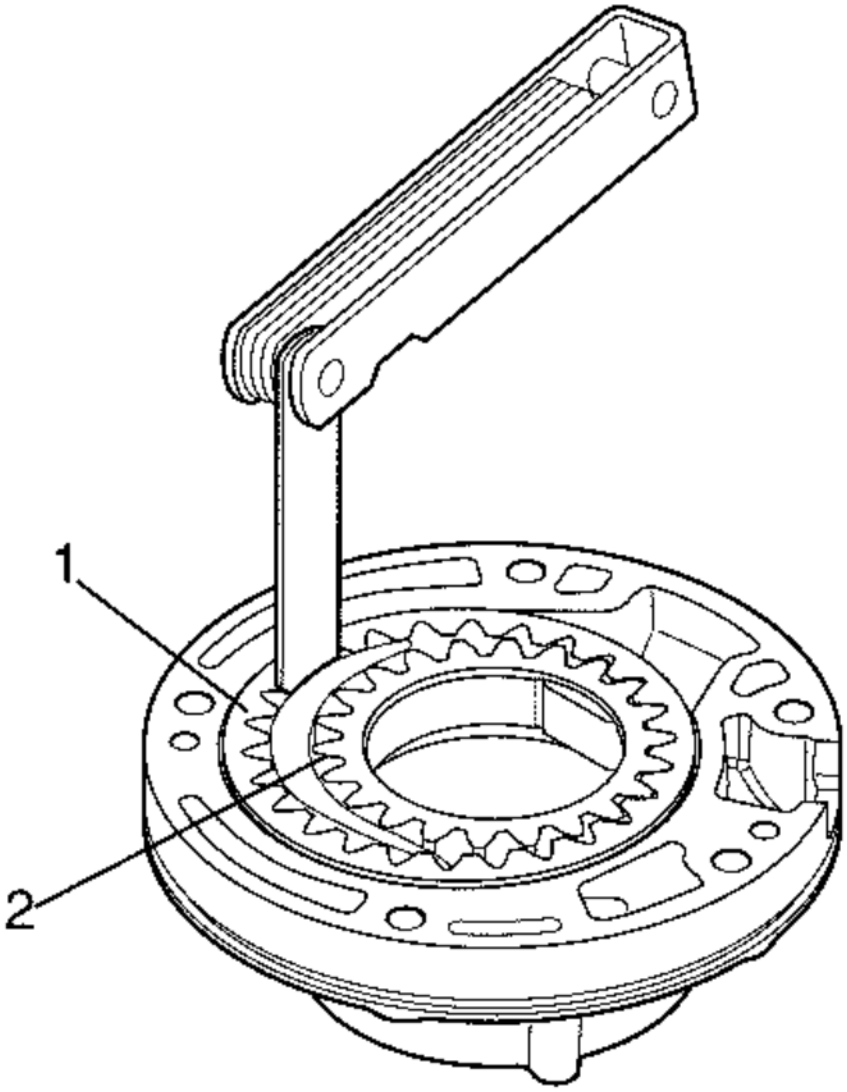


Fig. 211: Measuring Driven Gear To Oil Pump Body Crescent Clearance
Courtesy of GENERAL MOTORS CORP.

8. Measure the clearance between the driven gear (1) and the oil pump body crescent (2).

   Specification: The driven gear/crescent maximum clearance is 0.455 mm (0.0179 in).

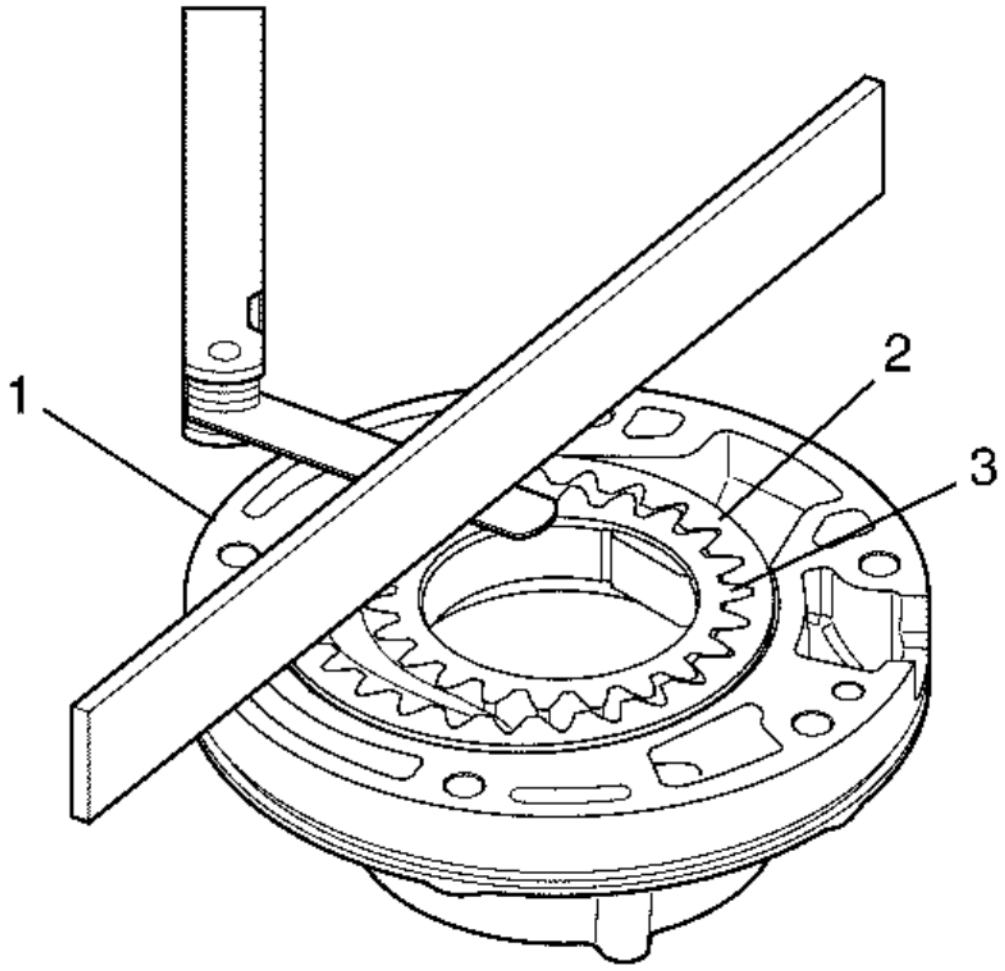


Fig. 212: Measuring Drive Gear Side Clearance
Courtesy of GENERAL MOTORS CORP.

9. Hold a straight edge across the oil pump body (1) and the drive gear (3). Measure the clearance between the drive gear and the straight edge. This is the drive gear side clearance.

   Specification: The drive gear maximum side clearance is 0.066 mm (0.0026 in).

10. Hold a straight edge across the oil pump body (1) and the driven gear (2). Measure the clearance between the driven gear and the straight edge.

Specification: The driven gear maximum side clearance is 0.050 mm (0.0022 in).

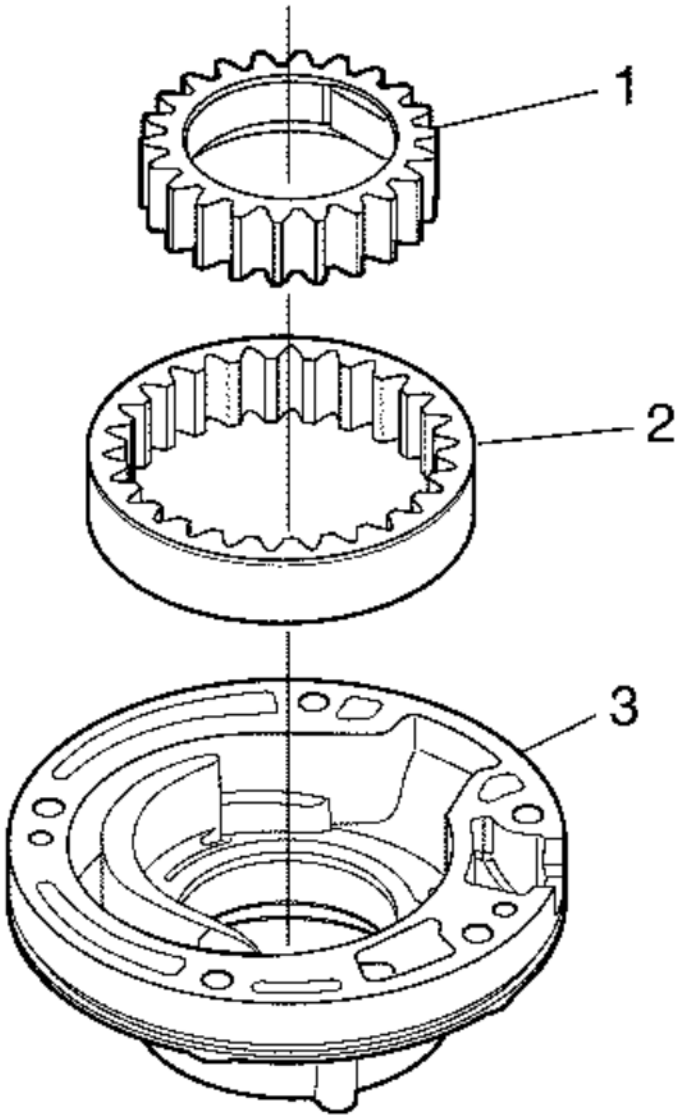


Fig. 213: Drive Gear & Driven Gears
Courtesy of GENERAL MOTORS CORP.

11. Remove the drive gear (1) and driven gear (2) from the oil pump body (3).

Oil Pump Wear Plate Inspection

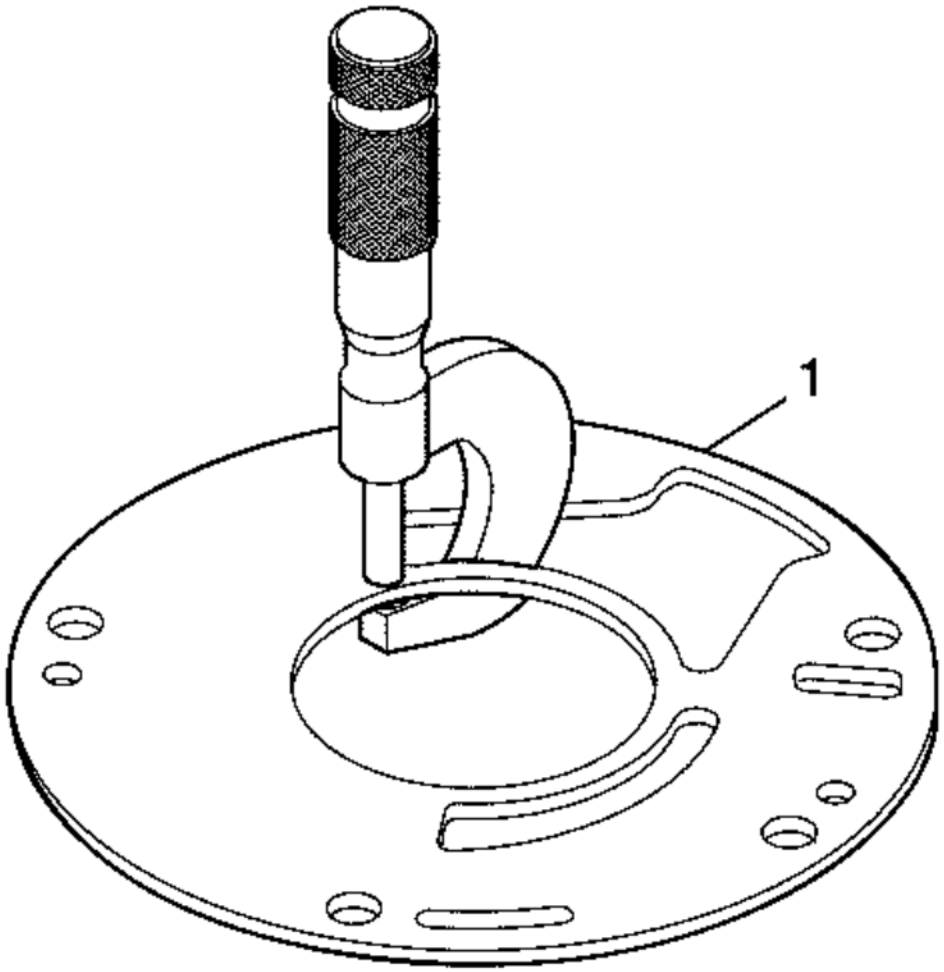


Fig. 214: Checking Wear Plate Thickness
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Replace the oil pump wear plate if specifications are not met.

1. Inspect the wear plate (1) for damage. The wear plate must not be scored, nicked, or grooved.
2. Measure the thickness of the wear plate in the gear wear area.

Specification: The thickness of the wear plate must not be less than 2.950 mm (0.116 in).

OIL PUMP BODY BUSHING REPLACEMENT

Tools Required

- **J 43771** Pump Bushing Removal and Installation Tool. See **Special Tools**.
- **J 8092** Universal Driver

Replacement

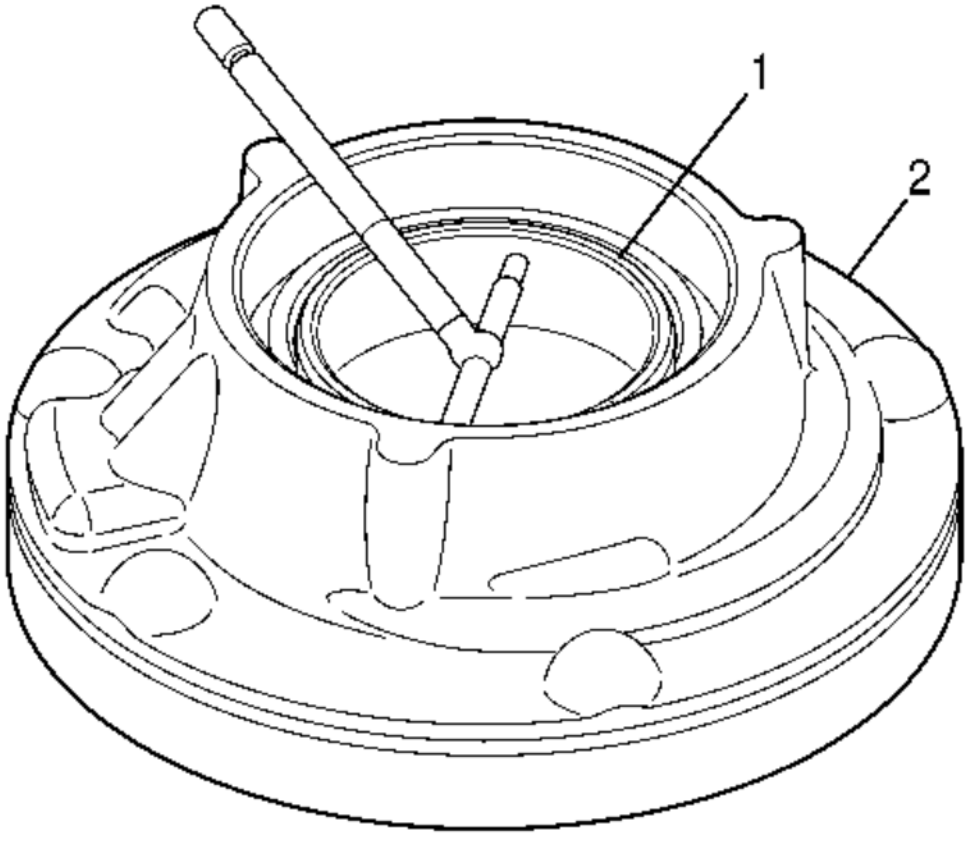


Fig. 215: Inspecting Oil Pump Bushing Diameter
Courtesy of GENERAL MOTORS CORP.

1. Inspect the bushing for damage and wear. The bushing must not be damaged or worn.
2. Measure the ID of the bushing. Replace the pump bushing if the ID exceeds specifications.

Specification: The bushing maximum ID is 58.458 mm (2.3015 in).

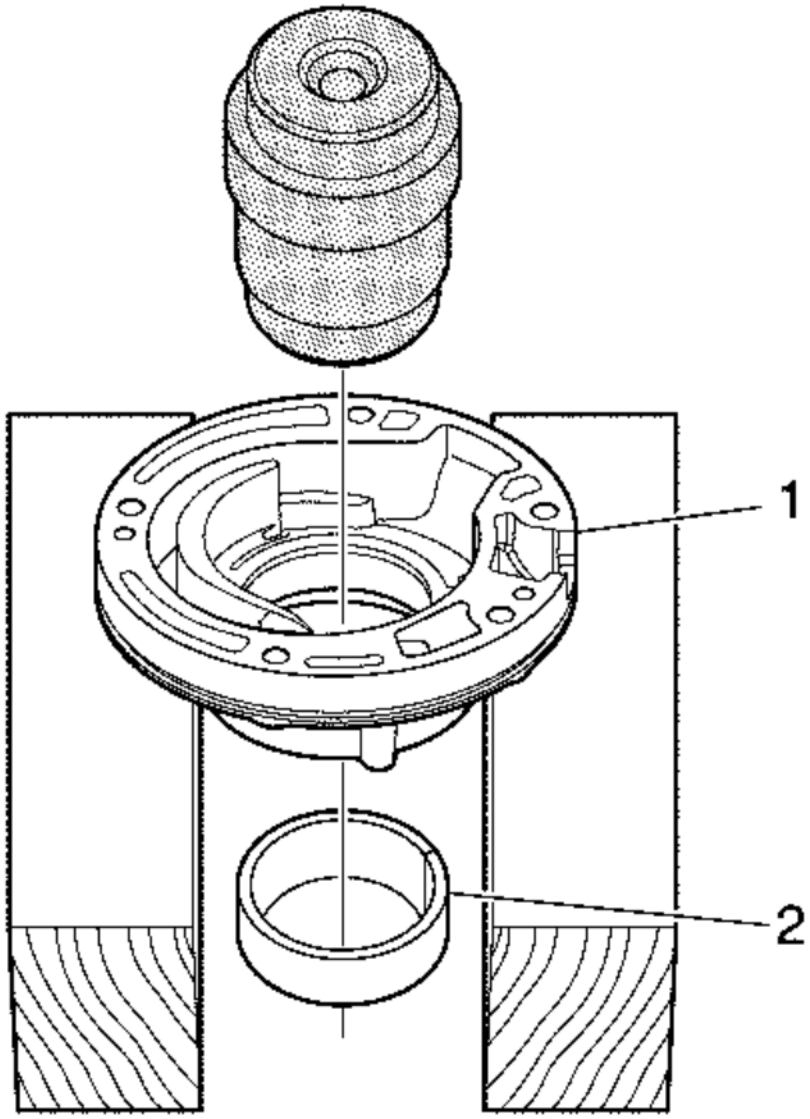


Fig. 216: Driving Bushing From Pump Body

Courtesy of GENERAL MOTORS CORP.

3. Remove all gears from the pump body (1).

IMPORTANT: The preferred method of removing or installing the bushing is with tool J 43771 and a press. See Special Tools. If a press is not available use J 43771 and. See Special Tools.J 8092 .

4. Support the pump body (1), machined surface up, on 2 wooden blocks so that the bushing (2) can be removed from the back of the pump body.
5. Install the longer end of **J 43771** into the bushing. See **Special Tools**.
6. Press or drive the bushing (2) from the pump body (1).
7. Clean the bushing bore of all residue. All of the parts must be dry before installing the bushing.

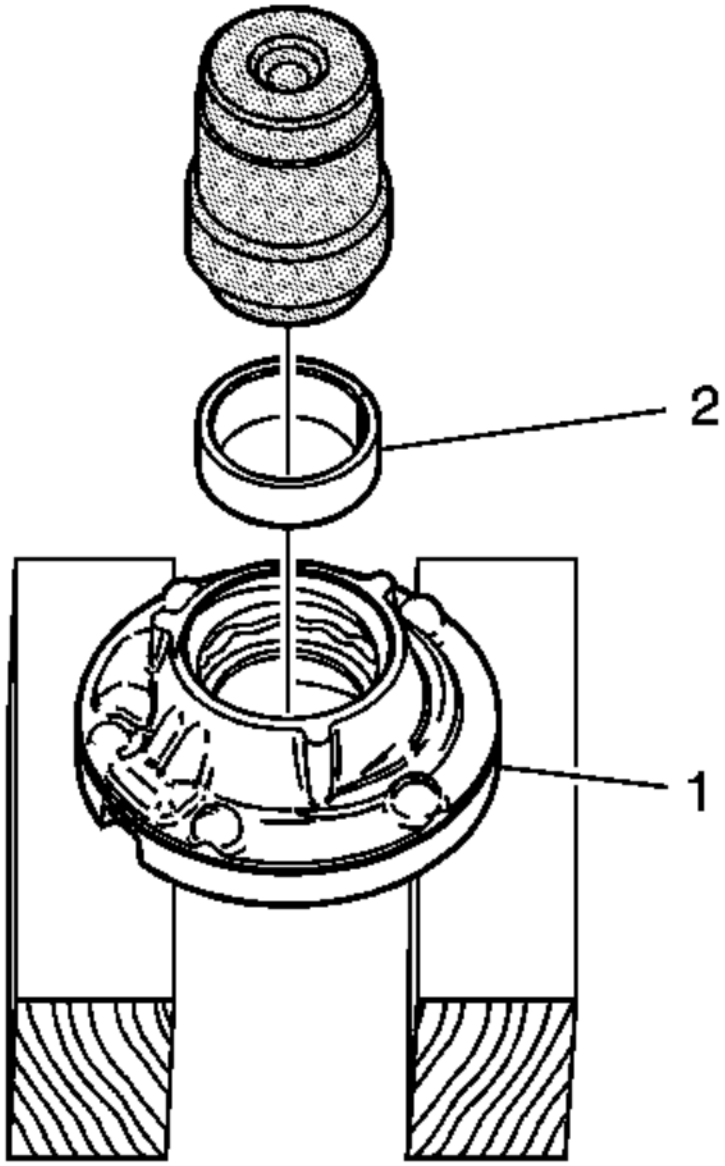


Fig. 217: Locating Oil Pump Body & Bushing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The bushing may be orientated in any position, but the preferred orientation is with the bushing split joint aligned

with the casting numbers and the centerline of the boss opposite the numbers. Position the split joint away from the boss.

8. Support the pump body (1), machined surface down, on 2 wooden blocks.
9. Install the bushing (2) onto the shorter end of **J 43771** . See **Special Tools**.
10. Apply Loctite® #620, or equivalent, to the bushing bore.
11. Using **J 43771** , press or drive the bushing into the pump body until **J 43771** seats. See **Special Tools**.

OIL PUMP LOCATING PIN REPLACEMENT

Tools Required

J 43779 Locating Pin Installer. See **Special Tools**.

Replacement

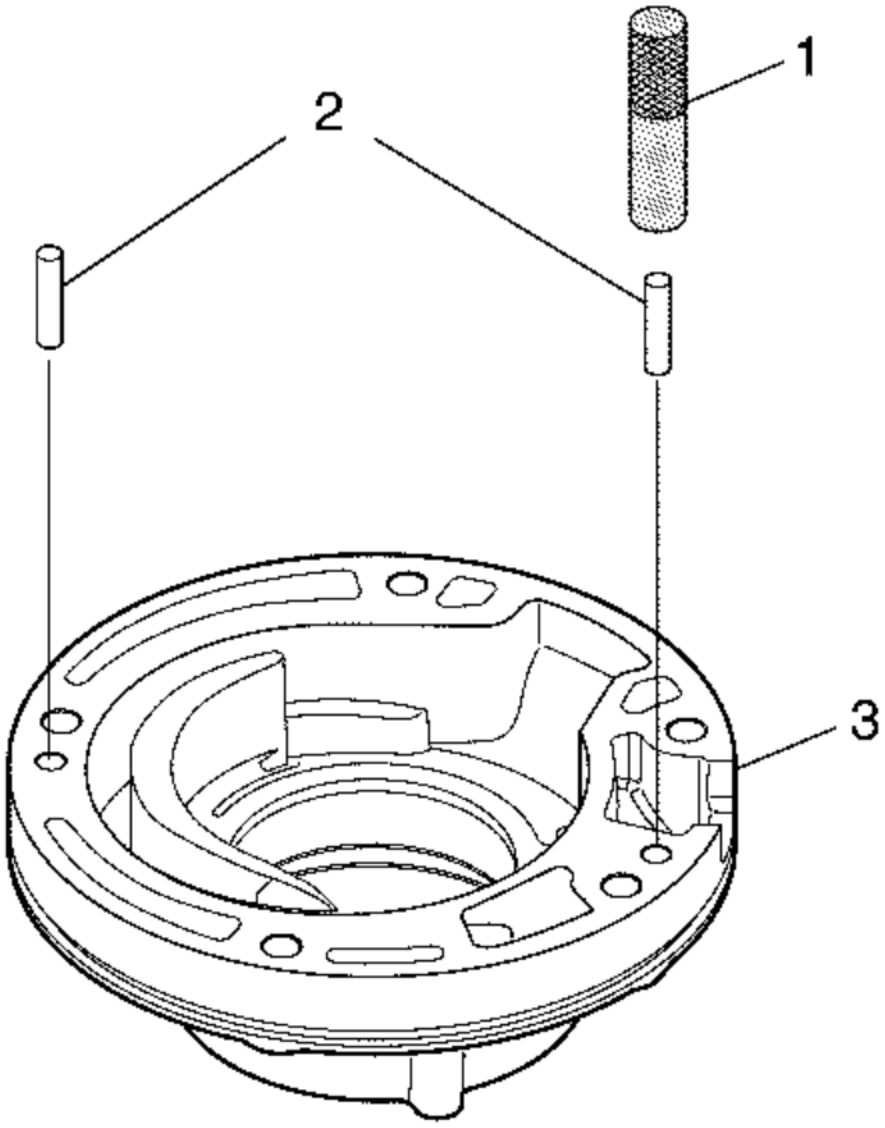


Fig. 218: Using J 43779 To Install Locating Pins To Specified Height
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not replace the oil pump locating pin or pins unless the pin or pins are damaged.

1. Remove the locating pin (2) from the oil pump body (3).

NOTE: DO NOT mar the oil pump body surface when installing the locating pin(s). Tap gently on the locating pin installer tool. Heavy or continued hammering will damage the oil pump body surface.

2. Using **J 43779** (1), install the locating pin (2) to the specified height. See **Special Tools**.

   Specification: The locating pin installed height measurement is 10.7-11.3 mm (0.42-0.44 in) above the oil pump body surface.

OIL PUMP ASSEMBLE

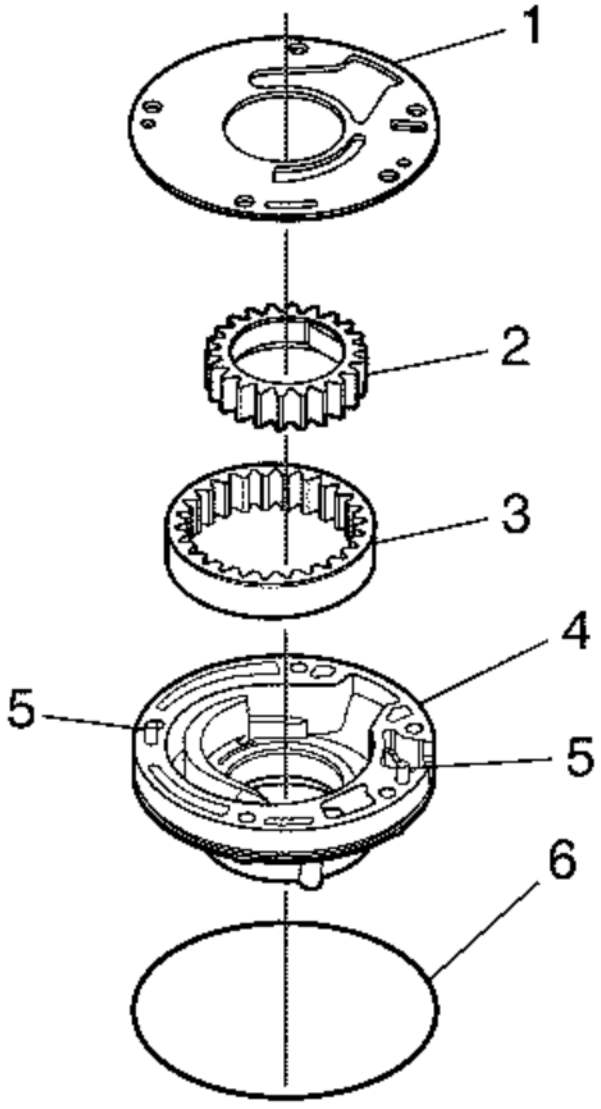


Fig. 219: Exploded View Of Oil Pump
Courtesy of GENERAL MOTORS CORP.

1. Install the O-ring (6) onto the oil pump body (4).
2. Position the oil pump body (4) on the work table so that the oil pump body hub is facing down.

3. Lubricate the oil pump drive gear (2) and driven gear (3).

NOTE: When the drive gear and driven gear are installed into the oil pump, the gears must be installed in their original orientation by having their punch marks in the same position as when they were originally removed. Failure to install the drive and driven gears in their original orientation may damage the transmission.

4. Align the drive gear (2) and driven gear (3) with the oil pump so that the punch marks are in the same position as when they were originally removed.
5. Install the gears into the oil pump body (4).
6. Align the locating pin holes in the wear plate (1) with the locating pins (5) in the oil pump body. Ensure the bolt holes in the pump wear plate (1) align with the bolt holes on the oil pump body (4).
7. Install the wear plate (1) onto the locating pins (5) and the oil pump body (4).

TRANSMISSION FLUID PUMP COVER DISASSEMBLE

Tools Required

- **J 24459-5** Spring Compressor Adapter. See **Special Tools**.
- **J 43770** Main Lube, Converter Relief Valve Spring Compressor. See **Special Tools**.
- **J 43773** Valve Spring Compressor. See **Special Tools**.

Disassemble

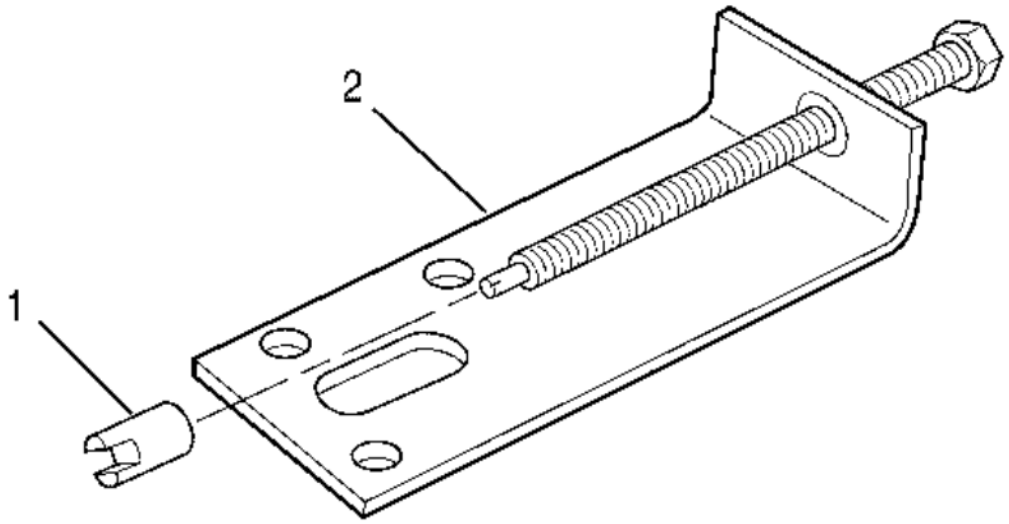


Fig. 220: View Of J 24459-5 & J 43770
Courtesy of GENERAL MOTORS CORP.

1. Install **J 24459-5** (1) onto **J 43770** (2). See **Special Tools**.

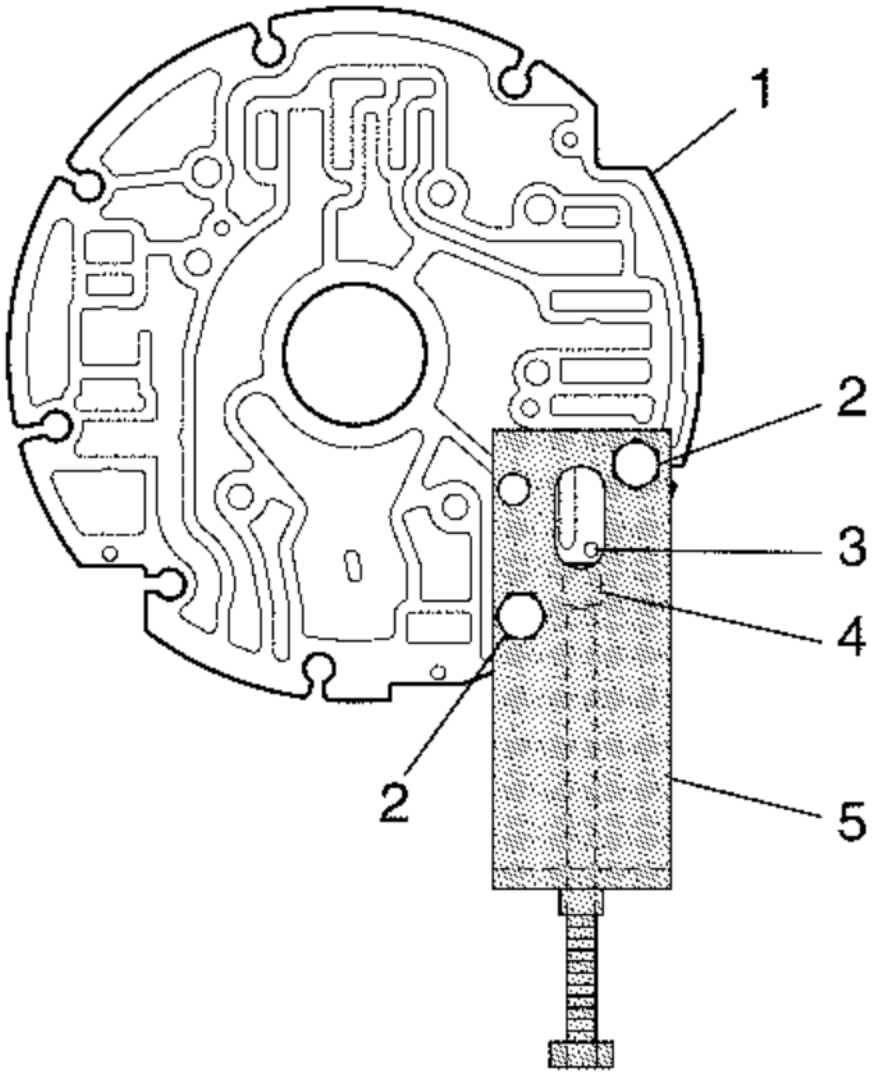


Fig. 221: J 43770, J 24459-5 & Oil Pump Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

2. Position the oil pump cover assembly (1) on the work table so that the rear of the oil pump cover assembly is facing down.
3. Align **J 43770** (5) and **J 24459-5** (4) with the oil pump cover so that:. See **Special Tools**.
   - The threaded rod of **J 43770** is facing down. See **Special Tools**.

- Two bolt holes of **J 43770** align with the bolt holes of the oil pump cover. See **Special Tools**.

4. Install **J 43770** (5) onto the oil pump cover assembly. See **Special Tools**.
5. Install 2 oil pump cover retaining bolts (2).
6. Align the slot of **J 24459-5** (4) with the retainer pin (3). See **Special Tools**.
7. Using **J 24459-5** (4) and **J 43770** (5), compress the main regulator valve spring until the retainer pin (3) is loose. See **Special Tools**.
8. Turn the oil pump cover so that the pin (3) is accessible.
9. Using a pick, push the pin through the oil pump cover (1).
10. Relieve the main regulator valve spring tension.
11. Remove tools **J 43770** and **J 24459-5** . See **Special Tools**.

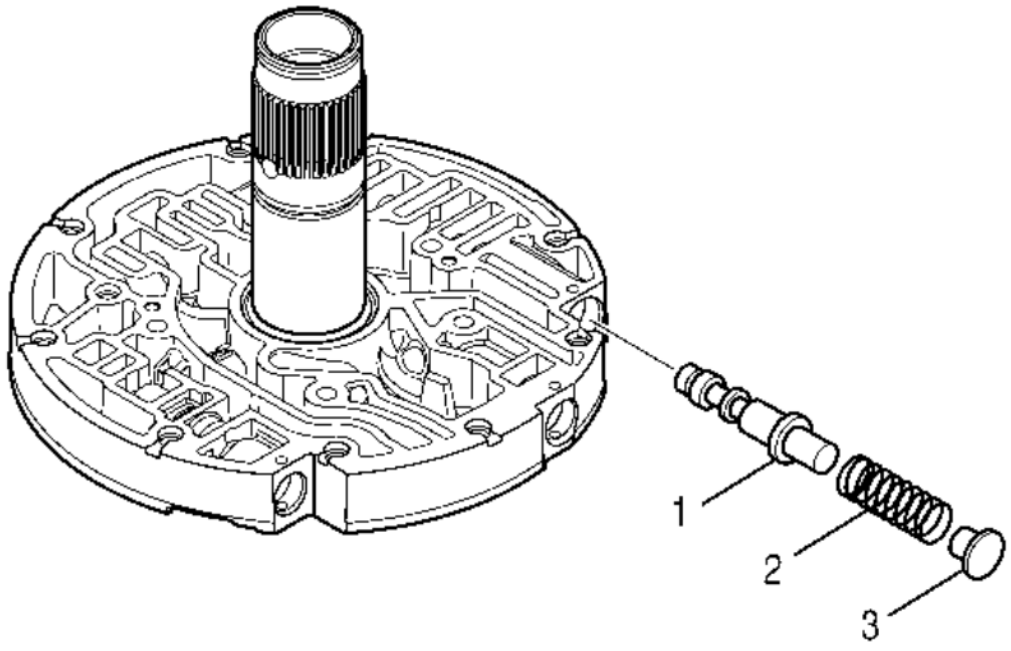


Fig. 222: View Of Stop, Spring & Main Regulator Valve
Courtesy of GENERAL MOTORS CORP.

12. Remove the stop (3), the spring (2), and the main regulator valve (1).

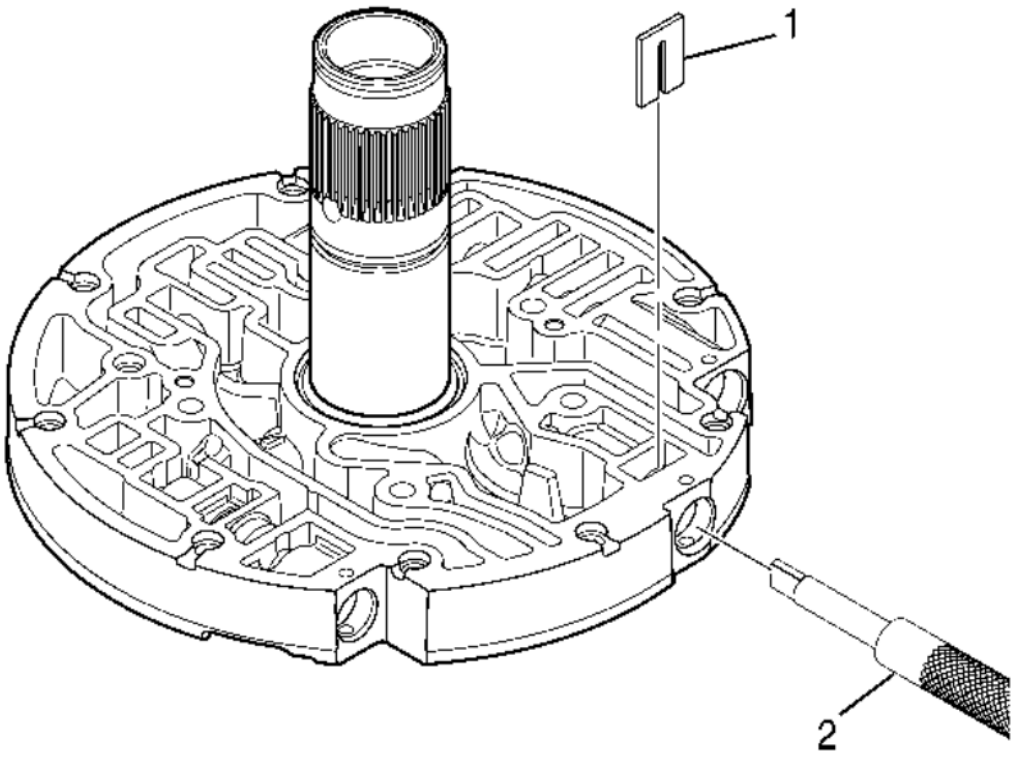


Fig. 223: 1-2-3-4 Clutch Backfill Valve Spring Retaining Clip & J 43773
Courtesy of GENERAL MOTORS CORP.

13. Using **J 43773** (2), compress the 1-2-3-4 clutch backfill valve spring until the retaining clip (1) is loose. See **Special Tools**.
14. Remove the clip.

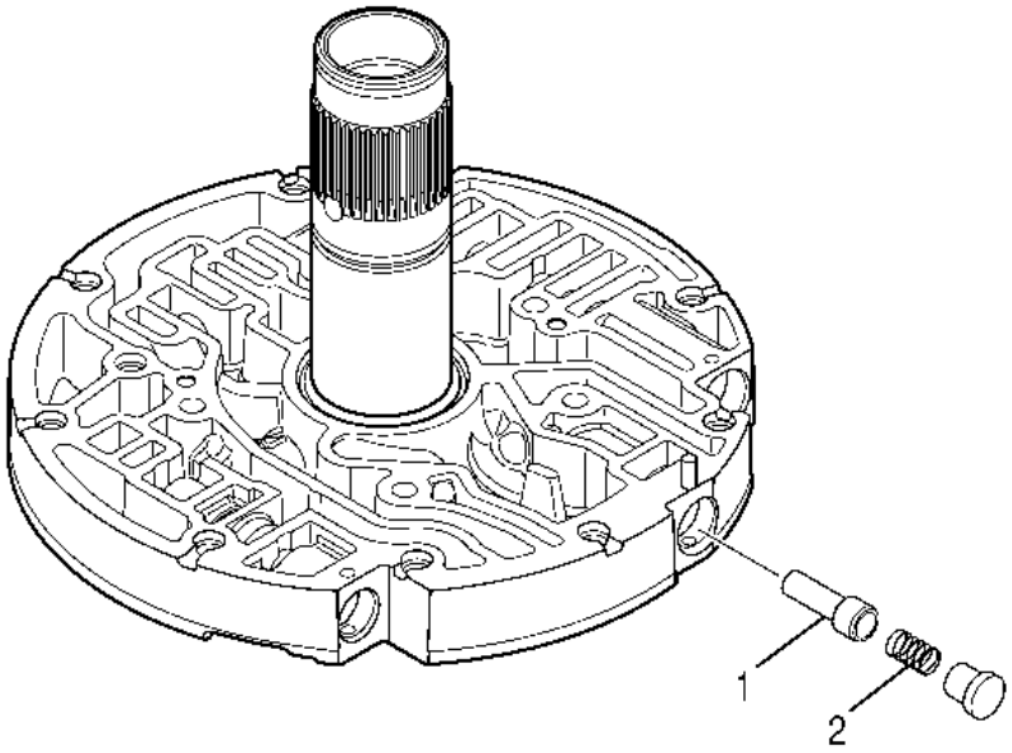


Fig. 224: View Of 1-2-3-4 Clutch Backfill Valve & Spring
Courtesy of GENERAL MOTORS CORP.

15. Remove the spring (2) and the 1-2-3-4 clutch backfill valve (1).

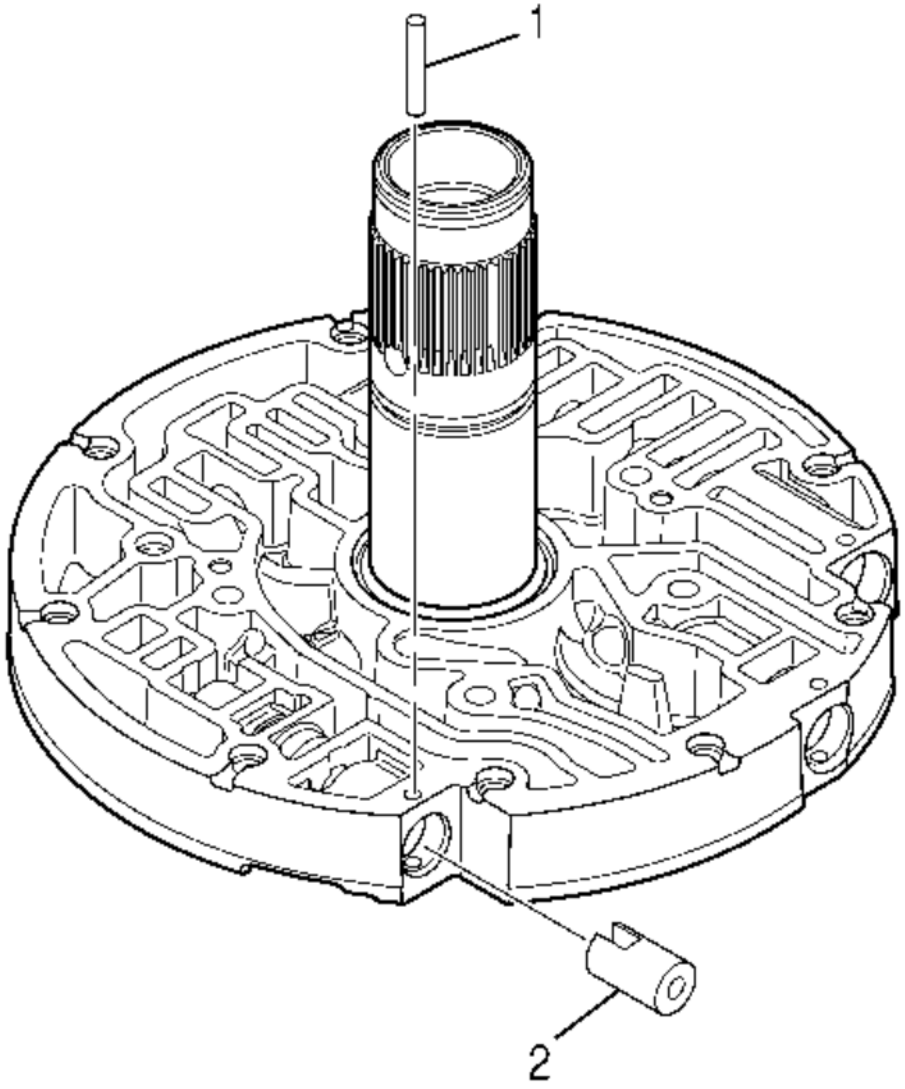


Fig. 225: Using J 24459-5 To Compress Oil Pump Lube Regulator Valve Spring
Courtesy of GENERAL MOTORS CORP.

16. Align the slot of **J 24459-5** (2) with the retainer pin (1). See **Special Tools**.
17. Using **J 24459-5** (2), compress the lube regulator valve spring until the retainer pin (1) is loose. See **Special Tools**.
18. Remove the pin.

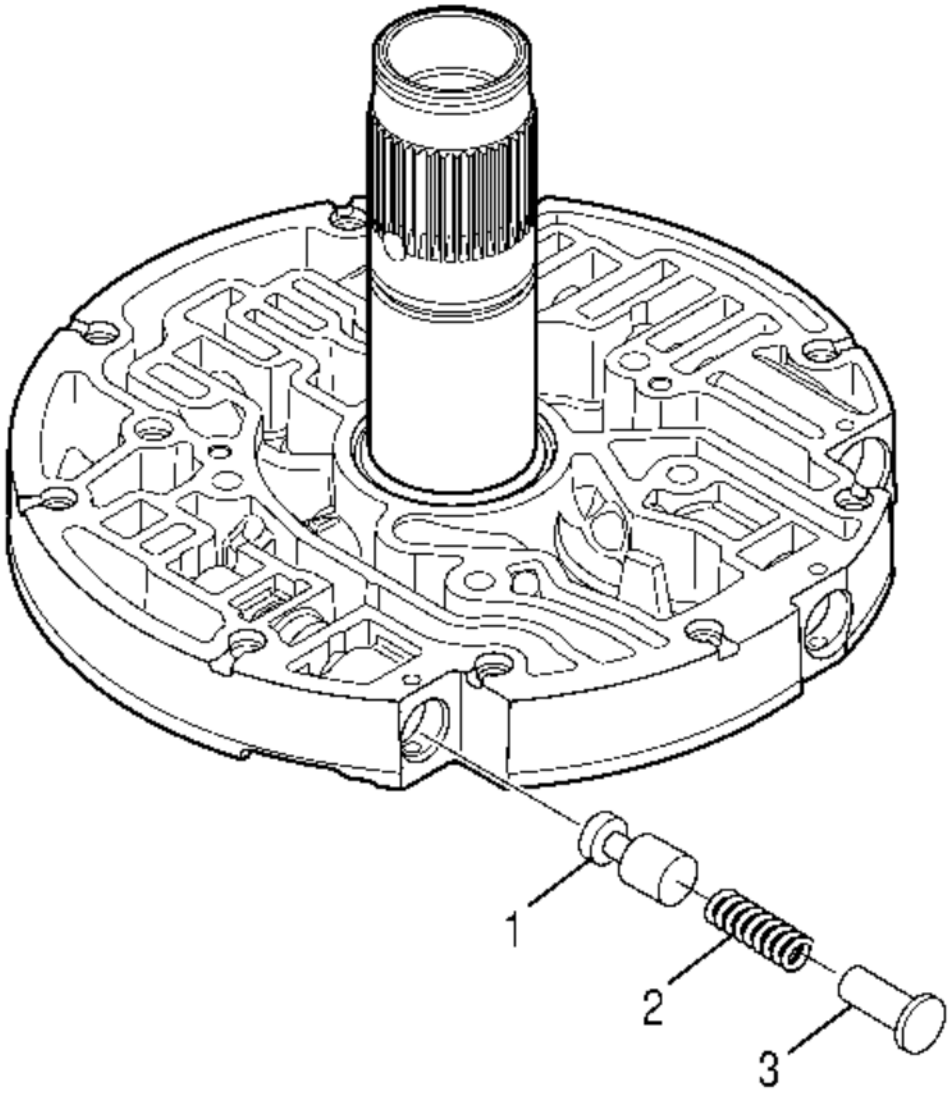


Fig. 226: View Of Lube Regulator Valve, Stop & Spring
Courtesy of GENERAL MOTORS CORP.

19. Remove the stop (3), the spring (2) and the lube regulator valve (1).

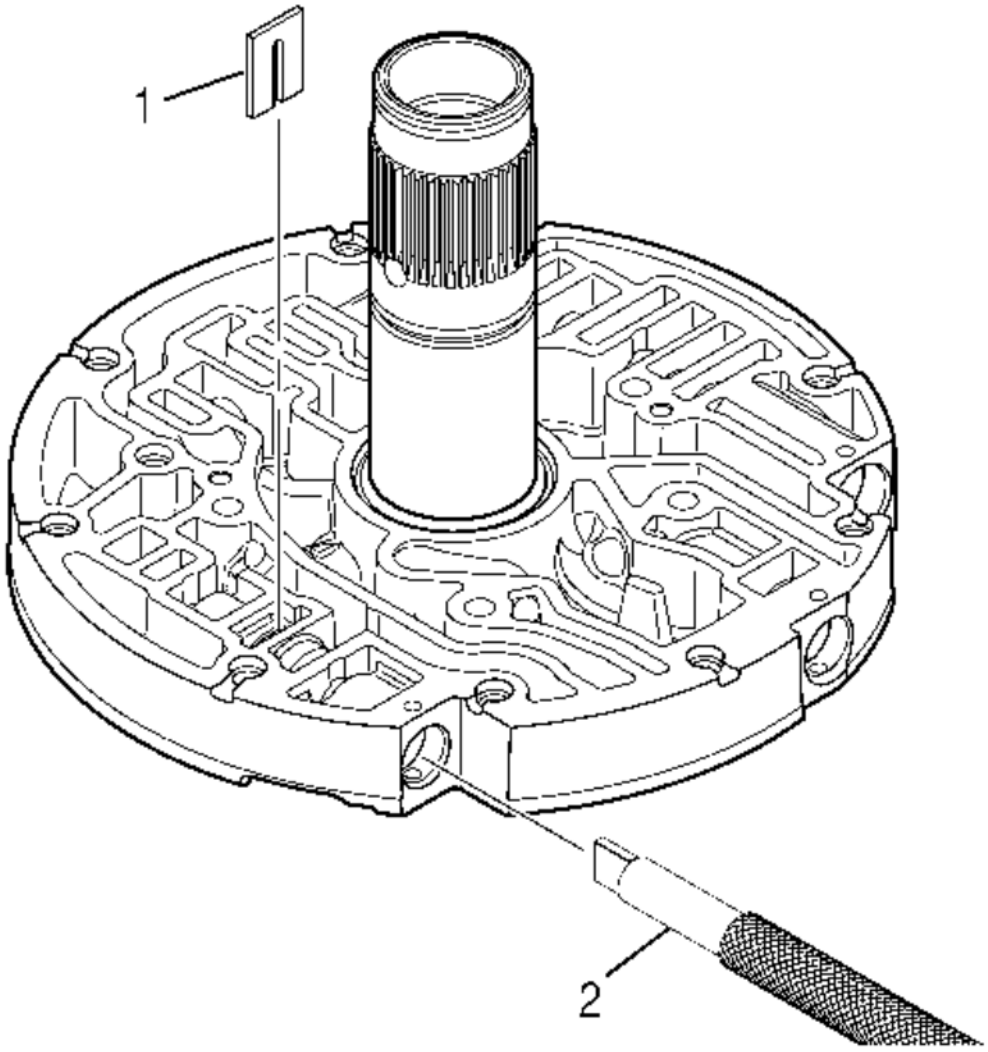


Fig. 227: Converter Relief Valve Spring Retaining Clip & J 43773
Courtesy of GENERAL MOTORS CORP.

20. Using **J 43773** (2), compress the converter relief valve spring until the retaining clip (1) is loose. See **Special Tools**.
21. Remove the clip.

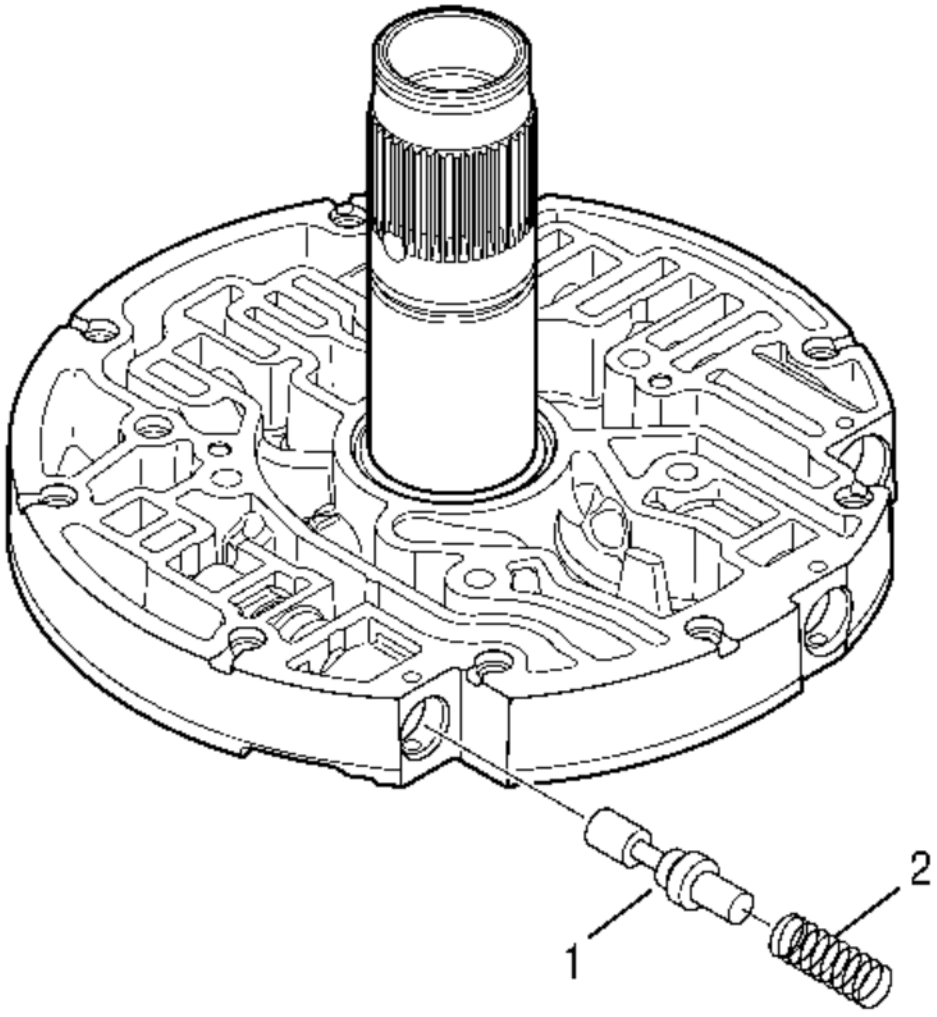


Fig. 228: View Of Converter Relief Valve & Spring
Courtesy of GENERAL MOTORS CORP.

22. Remove the spring (2) and the converter relief valve (1).

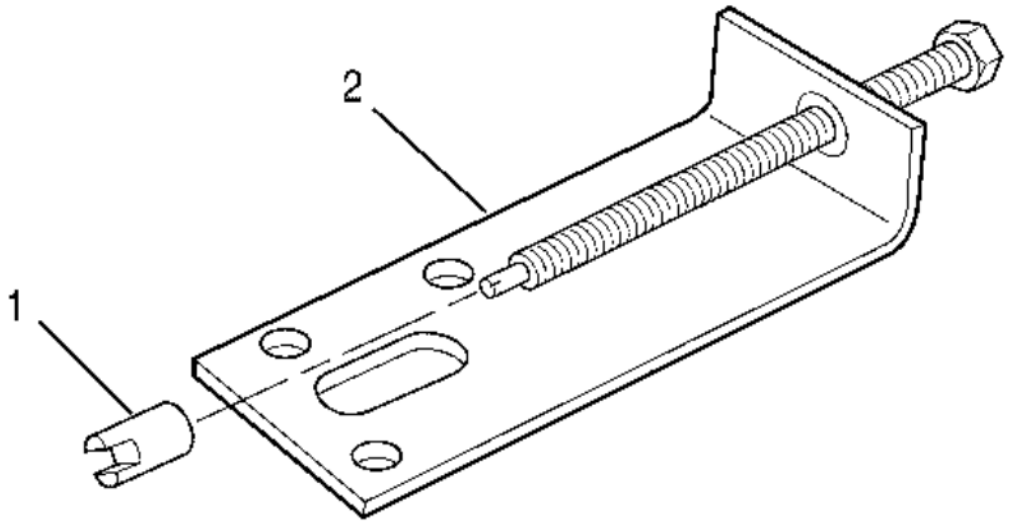


Fig. 229: View Of J 24459-5 & J 43770
Courtesy of GENERAL MOTORS CORP.

23. Install **J 24459-5** (1) onto **J 43770** (2). See **Special Tools**.

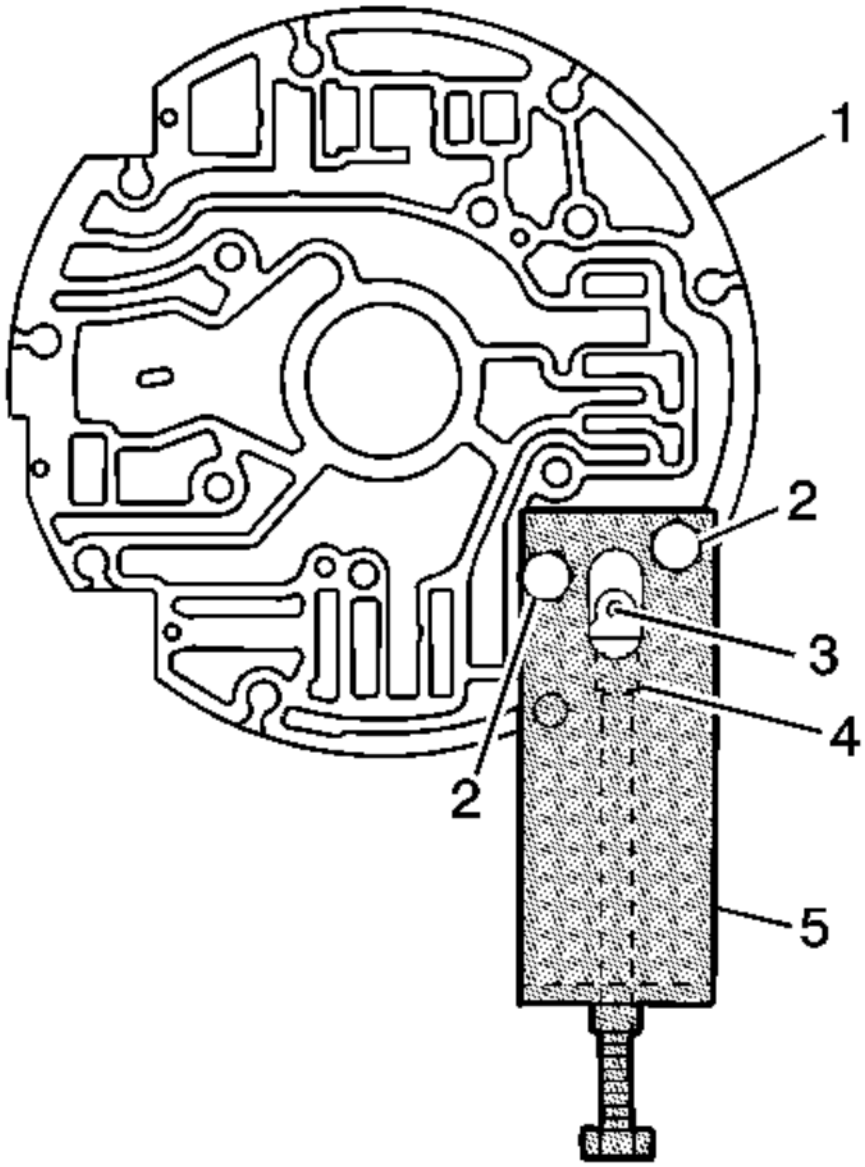


Fig. 230: Using J 24459-5 And J 43770 To Compress Converter Flow Valve Spring
Courtesy of GENERAL MOTORS CORP.

24. Align **J 43770** (5) and **J 24459-5** (4) with the oil pump cover so that the following conditions are met:. See **Special Tools**.

- The threaded rod of **J 43770** is facing down. See **Special Tools**.
- Two **J 43770** bolt holes align with 2 bolt holes in the oil pump cover. See **Special Tools**.

25. Install **J 43770** (5) onto the oil pump cover assembly (1). See **Special Tools**.
26. Install 2 oil pump cover retaining bolts (2).
27. Align the slot in **J 24459-5** (4) with the retainer pin (3). See **Special Tools**.
28. Using **J 24459-5** (4) and **J 43770** (5), compress the torque converter clutch (TCC) valve spring until the retainer pin (3) is loose. See **Special Tools**.
29. Using a pick, push the pin through the oil pump cover (1).
30. Turn the oil pump cover so that the retaining pin is accessible.
31. Relieve the TCC valve spring tension.
32. Remove tools **J 43770** (5) and **J 24459-5** (4). See **Special Tools**.

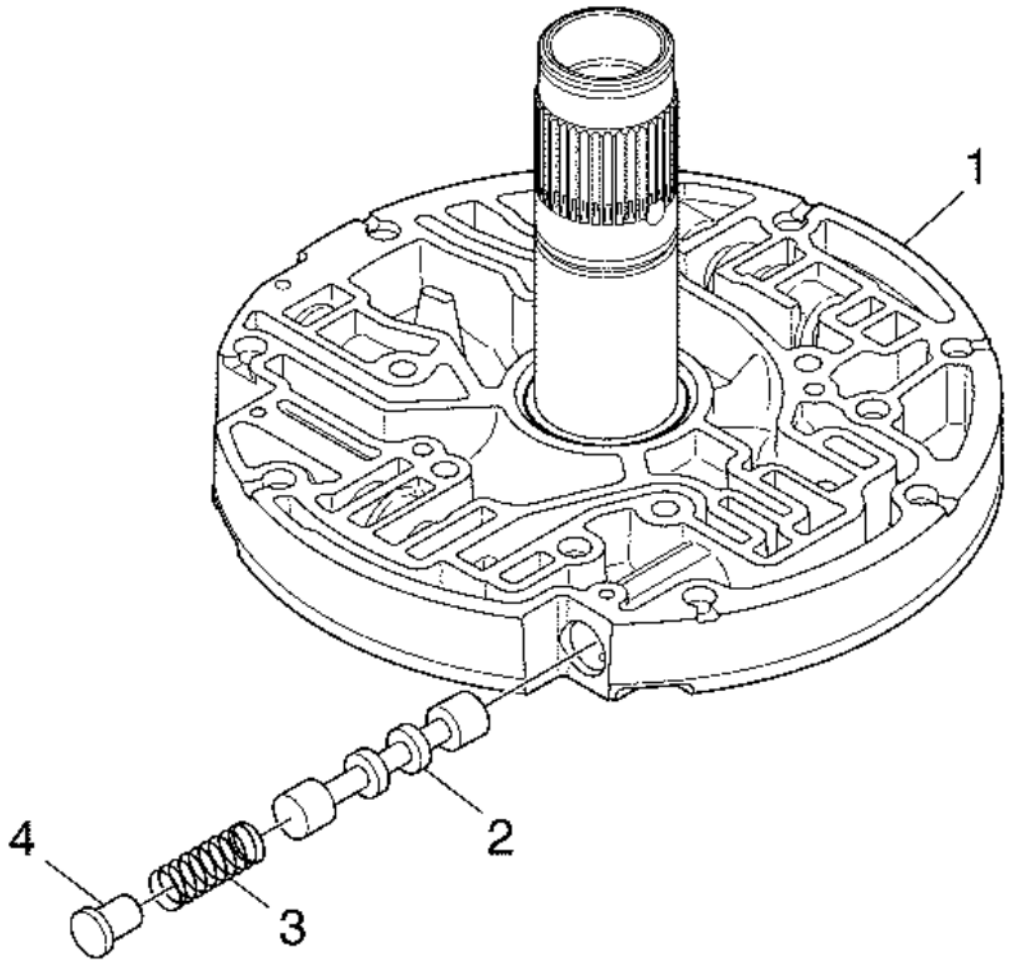


Fig. 231: View Of Converter Flow Valve, Stop & Spring
Courtesy of GENERAL MOTORS CORP.

33. Remove the stop (4), the spring (3), and the TCC valve (2).

STATOR SHAFT INSPECTION

IMPORTANT:
- **Replace the needle bearing if the bearing is damaged.**
- **The only time the stator shaft is pressed from the oil pump cover assembly is to replace the stator shaft.**

- **The new stator shaft comes with a pre-installed bushing.**
- **The bearing must be removed to replace the stator shaft. If the stator shaft and the bearing both need replacing, replace the stator shaft first.**

Replace the stator shaft if the specifications are not met.

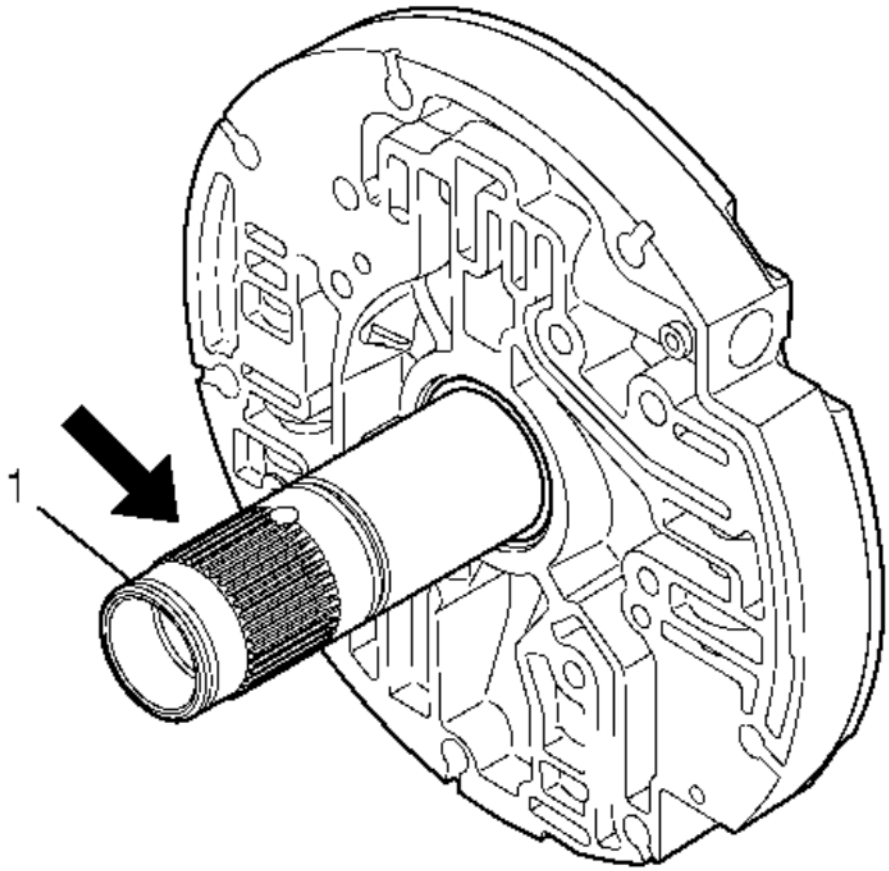


Fig. 232: Identifying Inspection Areas On Stator Shaft
Courtesy of GENERAL MOTORS CORP.

1. Inspect the splines of the stator shaft (1) for damage and wear. Replace the stator shaft if there is any visible wear.

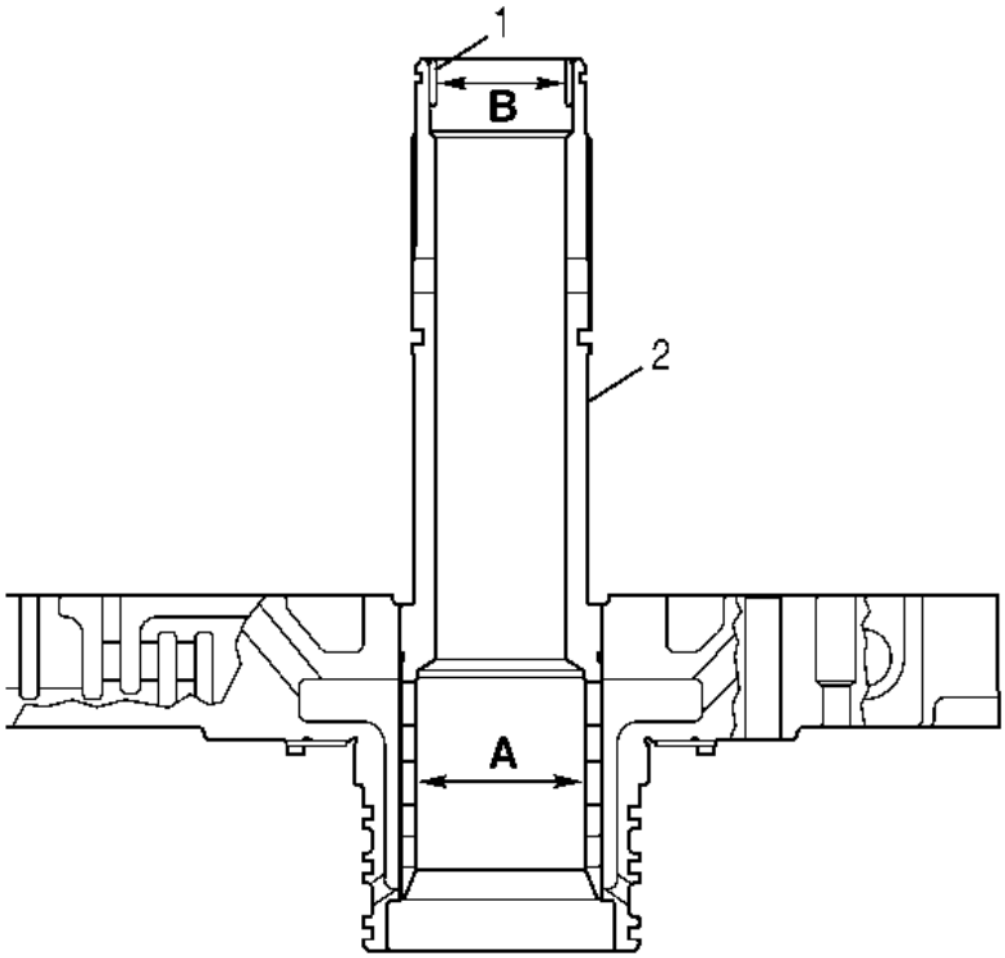


Fig. 233: Illustrating Stator Shaft Measurement Points
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **The stator shaft bushing and bearing are replaced with the stator shaft installed in the oil pump cover assembly.**
- **Replace the stator shaft if the stator shaft splines or seal ring bore specification is not met.**

2. Measure the inside diameter (ID) of the stator shaft (2) at dimension A, the turbine shaft seal ring bore.

Specification: Stator shaft maximum ID is 45.450 mm (1.789 in).

IMPORTANT: Replace the bushing if the bushing is damaged or the ID specification is not met.

3. Measure the ID of the stator shaft bushing (1) at dimension B.

Specification: Stator shaft bushing maximum ID is 33.820 mm (1.3315 in).

STATOR SHAFT REPLACEMENT

Tools Required

J 43765 Stator Shaft Installer/Remover. See **Special Tools**.

Removal Procedure

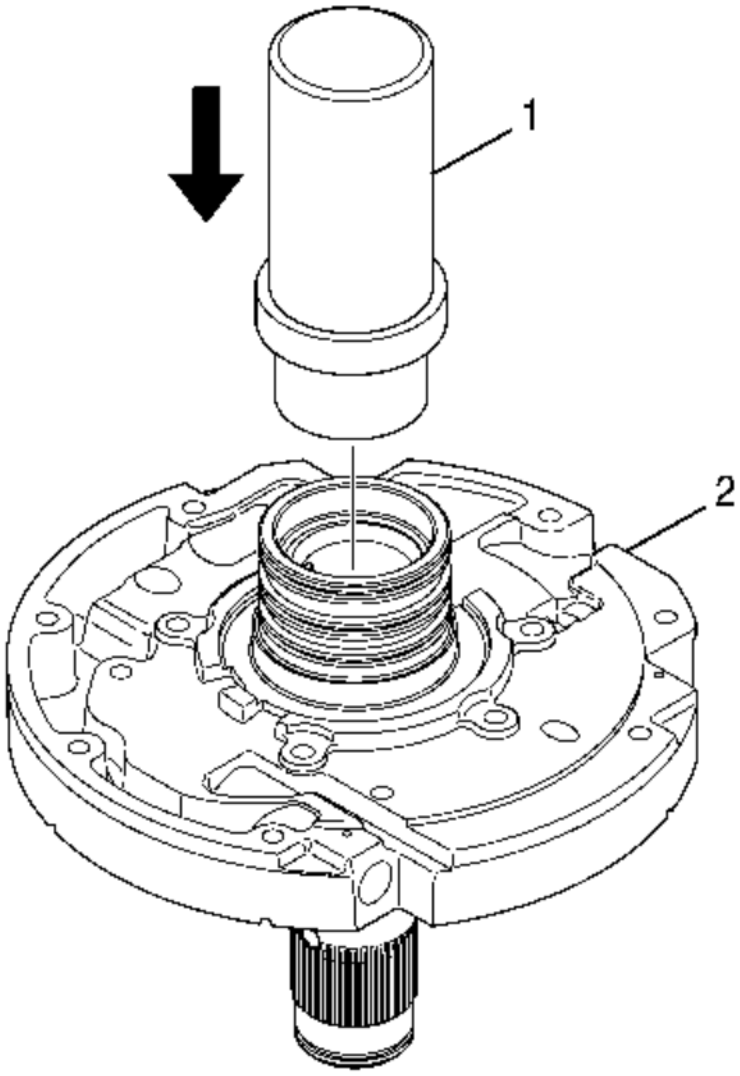


Fig. 234: Removing/Installing Stator Shaft
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Remove the needle bearing only if replacing both the bearing and the stator shaft.

1. Position the oil pump cover assembly (2) on a press bed so that the assembly is supported by

wooden blocks and the stator shaft is facing down.

2. Install the short end of J 43765-2 remover (1) into the rear of the oil pump cover assembly.
3. Press the stator shaft from the oil pump cover assembly (2).

Installation Procedure

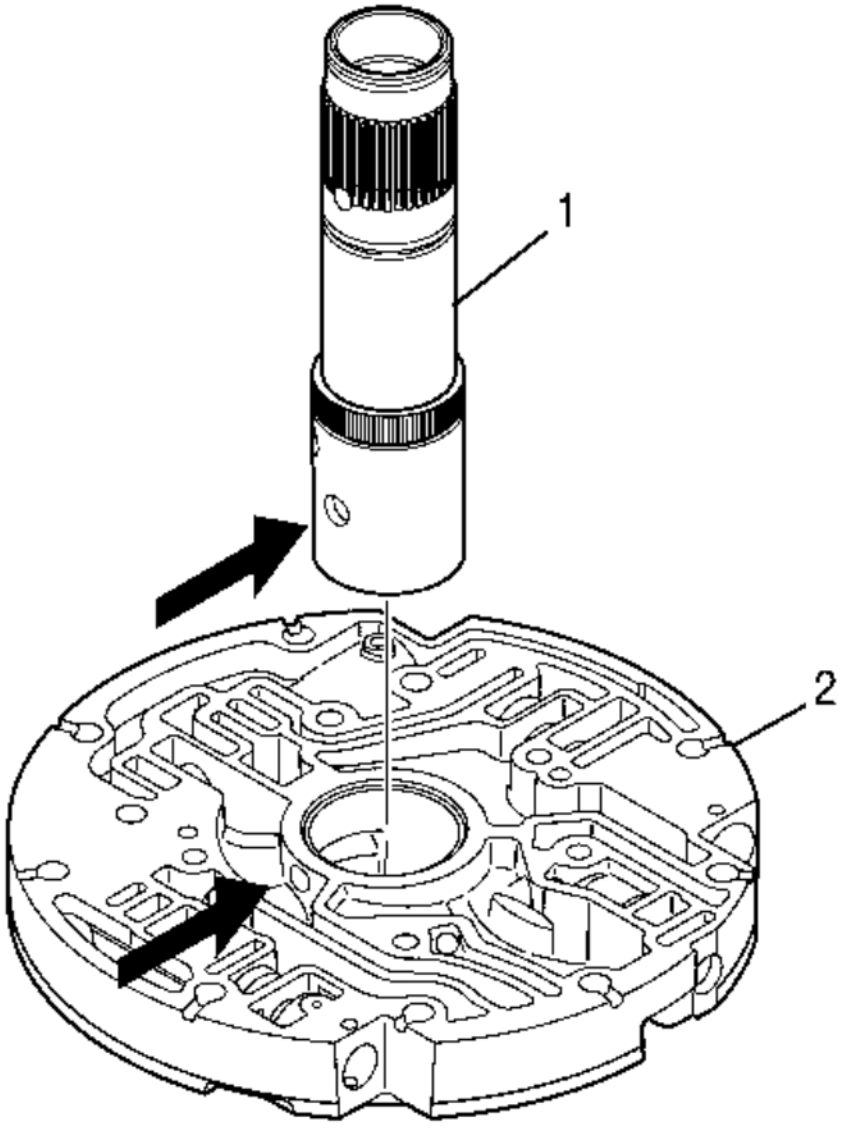


Fig. 235: View Of Oil Pump Cover
Courtesy of GENERAL MOTORS CORP.

1. Position the oil pump cover (2) on the work table so that the rear hub is facing down.
2. Align the stator shaft with the oil pump cover so that the stator shaft is centered over the oil pump cover and the rear of the stator shaft is facing down.

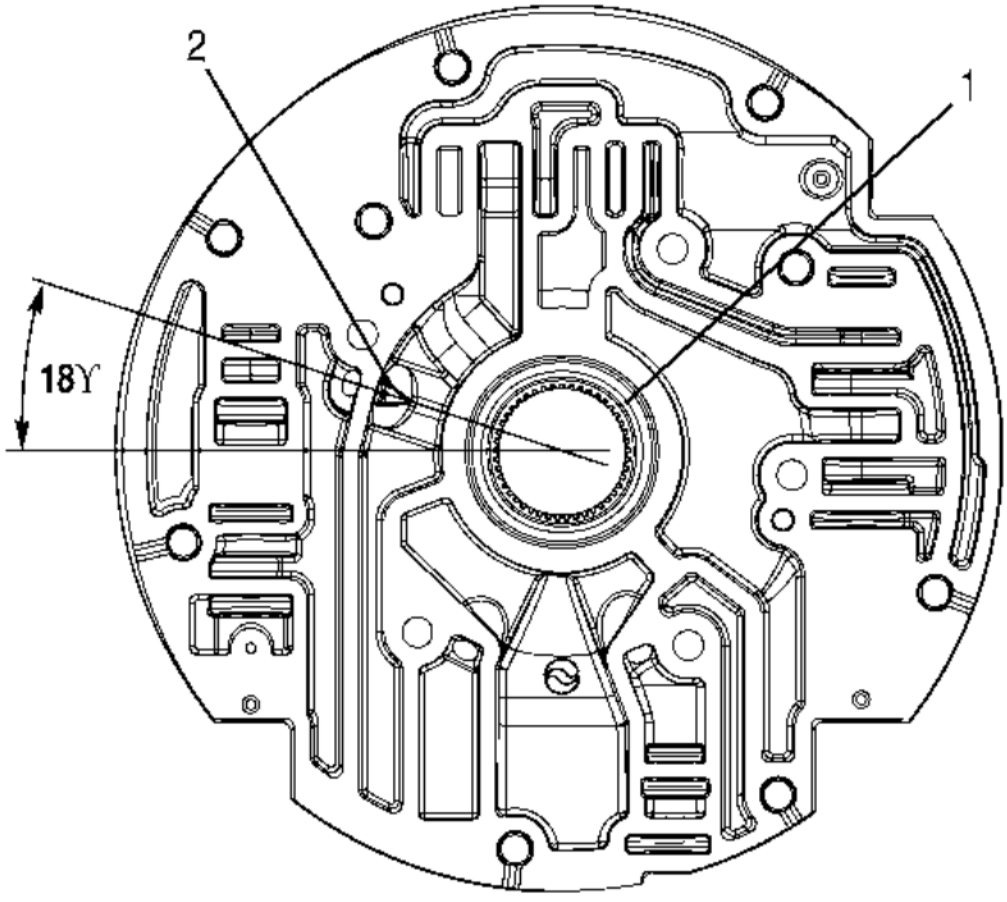


Fig. 236: Aligning Stator Shaft Holes With Fluid Passage
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The arrows on the drawing indicate the holes that must be aligned.

3. Rotate the stator shaft (1) until the lowest and smallest hole in the stator shaft is aligned with the fluid passage (2).
4. Gently tap the stator shaft into the oil pump cover until the oil pump cover holds the ground sleeve in a vertical position.

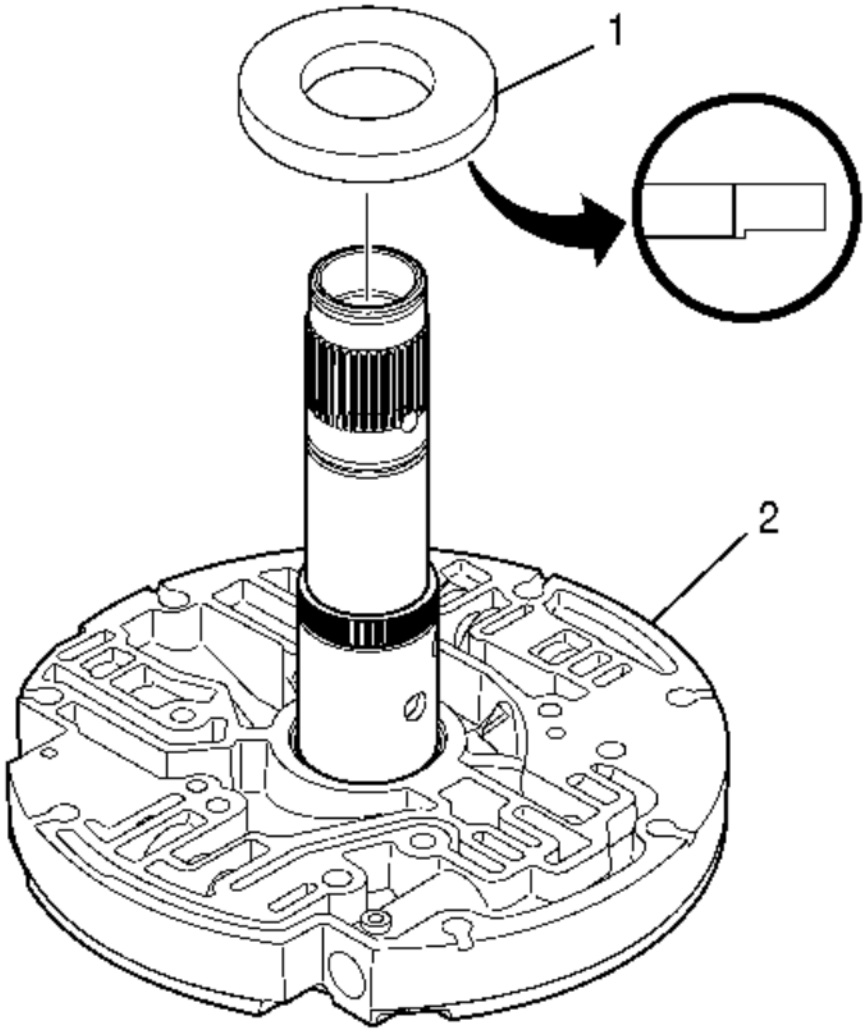


Fig. 237: Installing J 43765-1 Onto Stator Shaft
Courtesy of GENERAL MOTORS CORP.

5. Align J 43765-1 protector (1) so that the lip of the tool is downward.
6. Install J 43765-1 protector (1) onto the stator shaft.

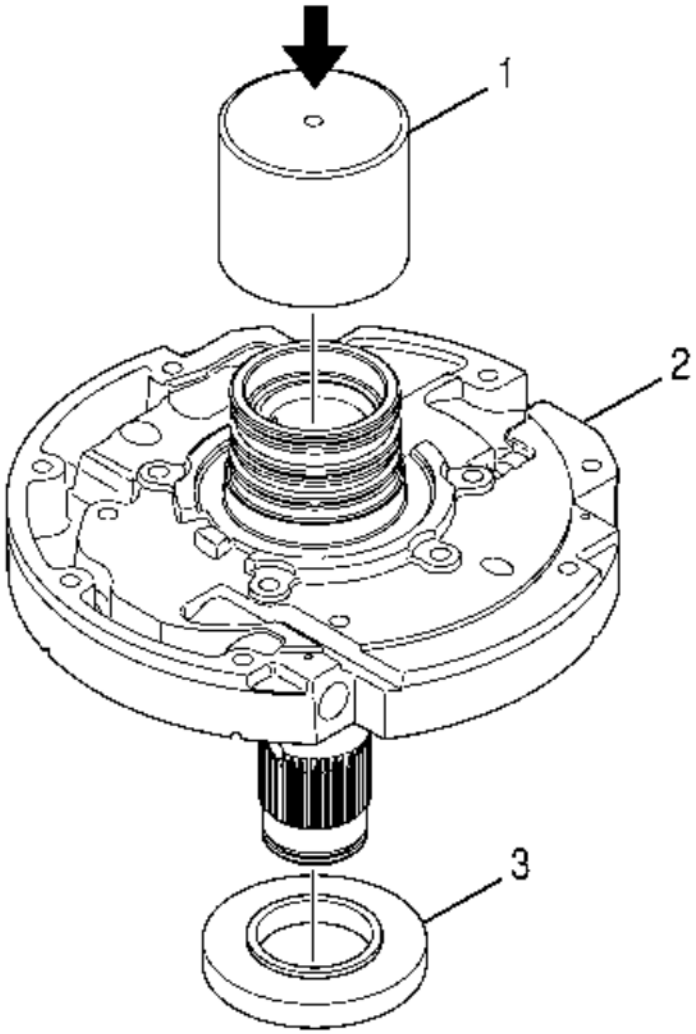


Fig. 238: Locating J 43765-3 Into Rear Hub Of Oil Pump Cover Assembly
Courtesy of GENERAL MOTORS CORP.

7. While holding J 43765-1 protector (3) in place, turn over the oil pump cover assembly (2) and place J 43765-1 on a press.

8. Install J 43765-3 installer (1) into the rear hub of the oil pump cover assembly (2).
9. Press on J 43765-3 installer (1) until the stator shaft seats.

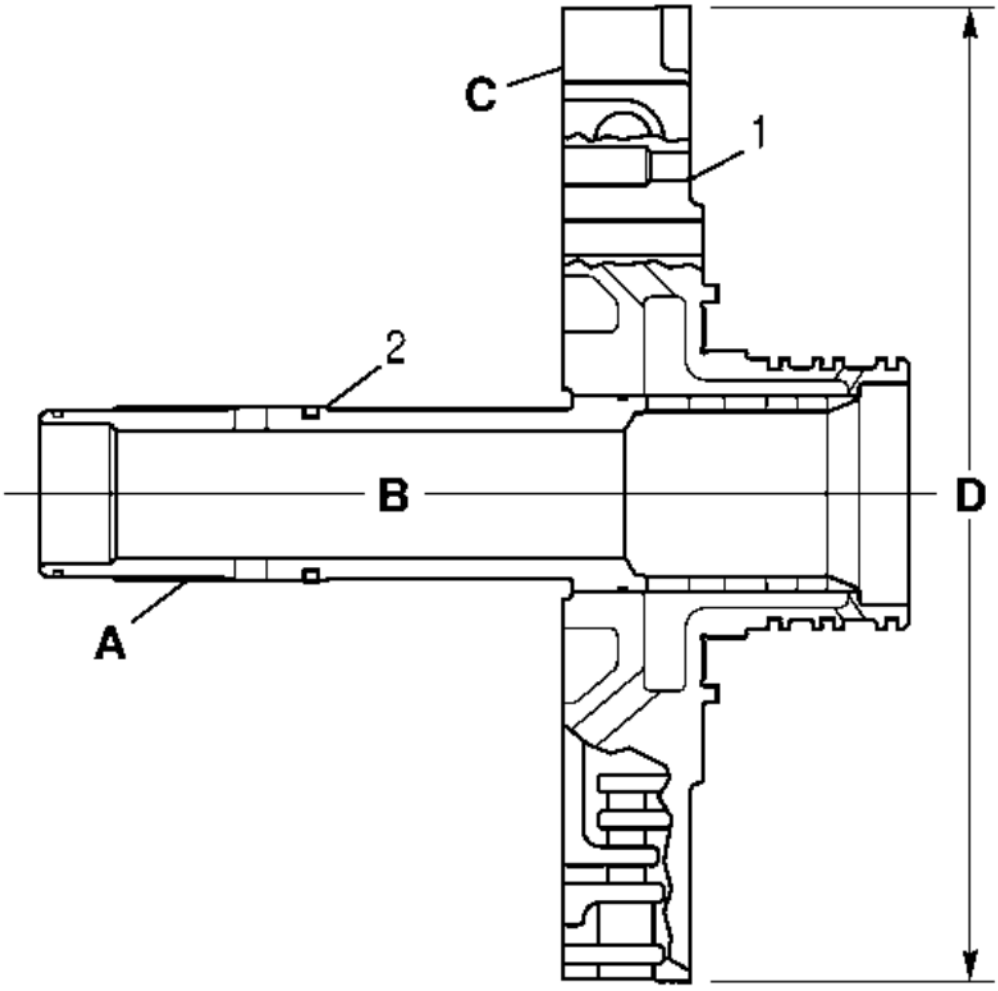


Fig. 239: Checking Total Indicated Runout (TIR) Of Stator Shaft
Courtesy of GENERAL MOTORS CORP.

10. Check the total indicated runout (TIR) of the stator shaft as follows:
    1. Install the oil pump cover assembly (1) in a lathe, clamping on dimension D.
    2. Use a dial indicator, to make sure the oil pump cover surface C is square with the

dimension D.

3. Check the TIR along the stator shaft axis B at the stator shaft pitch diameter A.

   Specification: The TIR must not exceed 0.20 mm (0.008 in).

4. Remove the oil pump cover assembly from the lathe.

STATOR SHAFT NEEDLE BEARING REPLACEMENT

Tools Required

- **J 26941** Oil Pump Cover Needle Bearing Remover. See **Special Tools**.
- **J 8092** Universal Driver
- **J 43775** Oil Pump Cover Needle Bearing Installer. See **Special Tools**.

Replacement

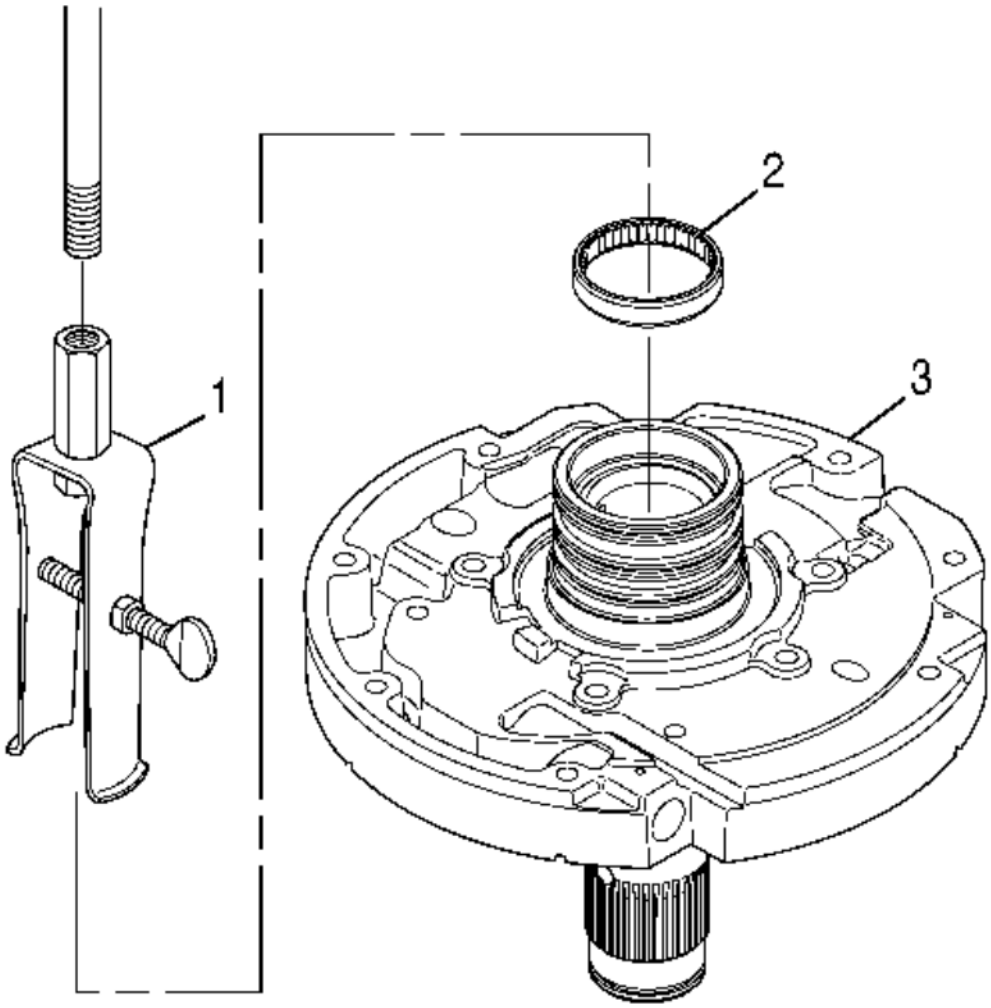


Fig. 240: Installing J 26941 (1) Into Bearing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use this procedure if replacing only the stator shaft needle bearing.

1. Install **J 26941** (1) into the bearing (2) so that the lips of the tool engage the bottom lip of the needle bearing race. See **Special Tools**.
2. Tighten the screw of **J 26941** finger tight. See **Special Tools**.

3. Install a slide hammer onto the end of **J 26941** . See **Special Tools**.
4. Remove the needle bearing (2).

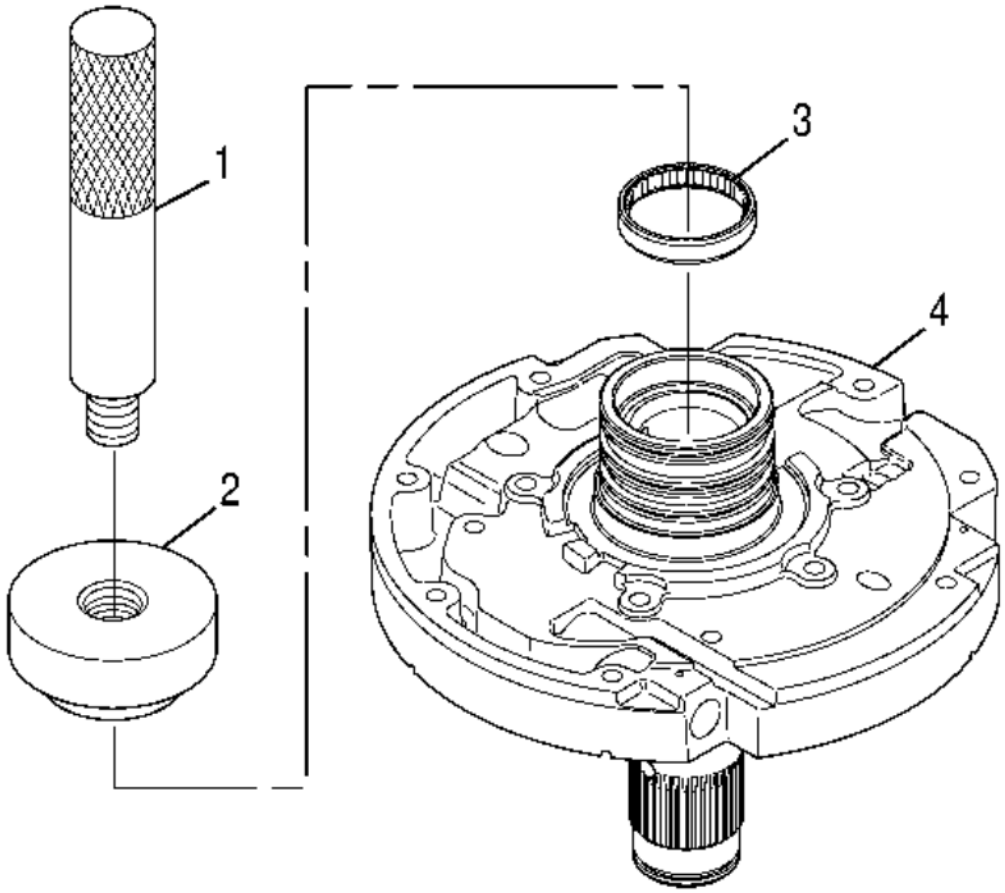


Fig. 241: Installing Oil Pump Cover Assembly Needle Bearing Using J 8092
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The needle bearing may be installed with either end up.

5. Install the large end of **J 43775** (2) onto **J 8092** (1). See **Special Tools**.
6. Drive the needle bearing (3) into the oil pump cover assembly (4) until **J 43775** sets. See **Special Tools**.

7. Ensure the bearing is installed below the stator shaft surface.

   Specification: The needle bearing installed depth measurement is flush to 0.25 mm (0.010 in) below the stator shaft surface

STATOR SHAFT BUSHING REPLACEMENT

Tools Required

- **J 44529** Stator Shaft Bushing Remover. See **Special Tools**.
- **J 8092** Universal Driver
- **J 43774** Stator Shaft Bushing Installer. See **Special Tools**.

Replacement

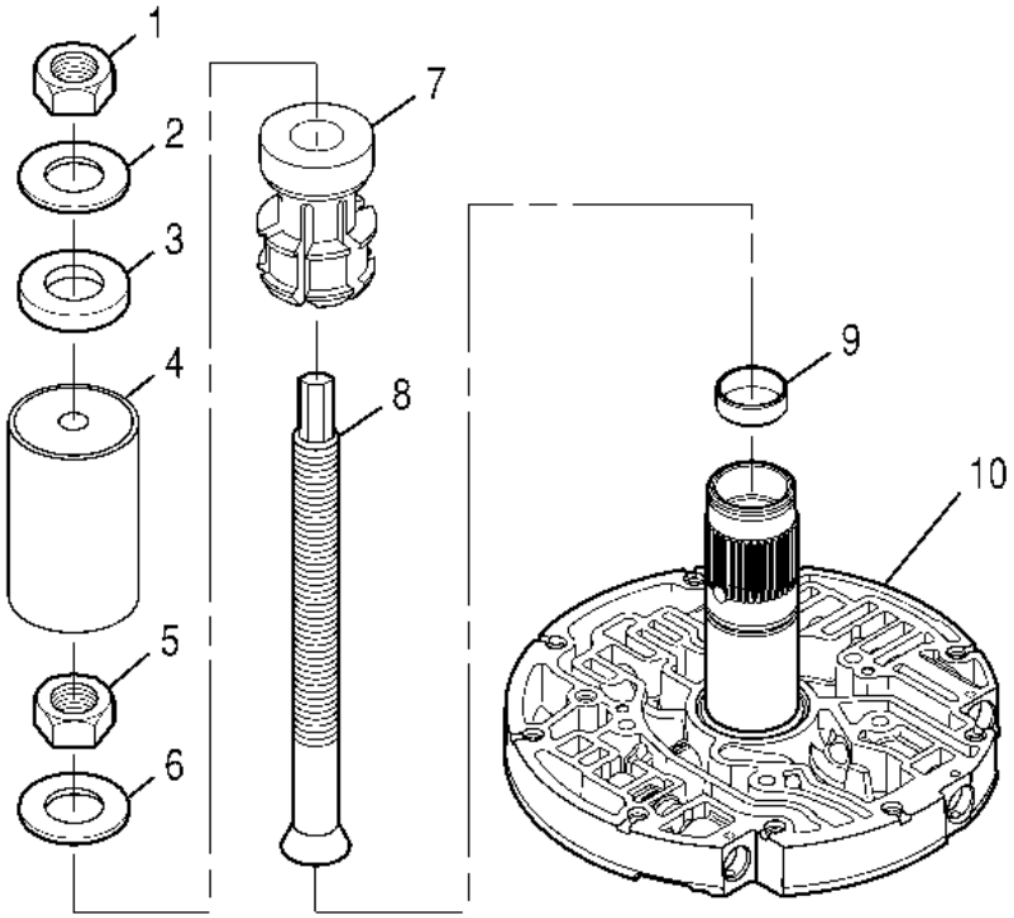


Fig. 242: Removing/Installing Stator Shaft Bushing With J Tools
Courtesy of GENERAL MOTORS CORP.

NOTE: Always use J 44529 when removing the stator shaft bushing to help avoid damage to the stator shaft sealing surface.

1. Position the oil pump cover assembly (10) supported by wooden blocks with the stator shaft facing up.
2. Install J 44529 -2 bolt (8) into J 44529 -1 extractor (7).
3. Install J 44529 -2 bolt (8) and J 44529 -1 extractor (7) into the bushing (9).
4. Install washer (6) and nut (5) onto J 44529 -2 bolt (8).

5. Hold the top of J 44529 -2 bolt (8) with a wrench and tighten nut (5) until J 44529 -1 extractor (7) engages the bushing (9).
6. Install J 44529 -3 protector (4) onto J 44529 -2 bolt (8).
7. Install bearing (3), washer (2), and nut (1) onto J 44529-2 bolt (8).
8. Hold the top of J 44529 -2 bolt (8) with a wrench and tighten nut (1) until the bushing is dislodged.
9. Remove the J tools from the stator shaft.
10. Remove the bushing from the J tools.

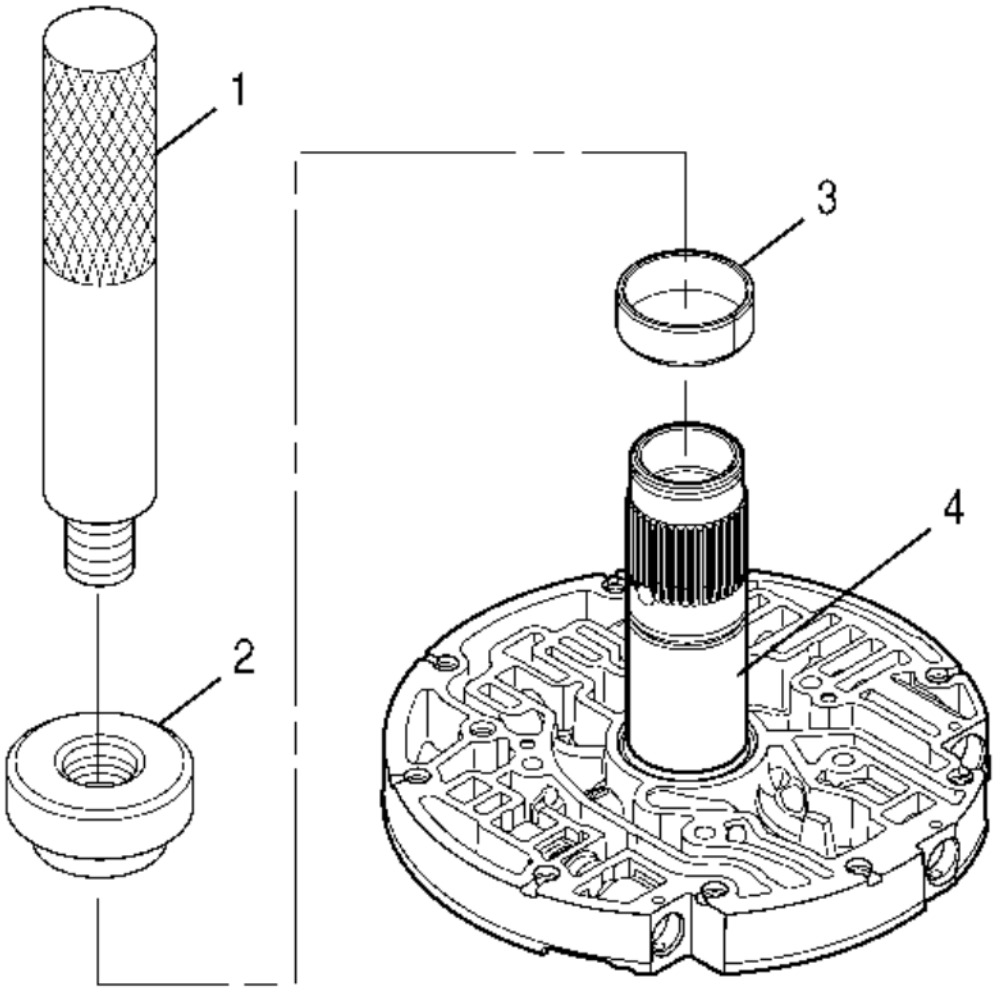


Fig. 243: View Of Stator Shaft Bushing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The preferred method for installing the stator shaft bushing is to use J 43774 and a press. See Special Tools. If a press is not available, use J 43774 and J 8092 universal driver. If the bushing will be installed without a press, install the large end of J 43774 (2) onto J 8092 (1). See Special Tools.

11. Install a new bushing (3) onto **J 43774** . See **Special Tools**.
12. Drive the bushing into the stator shaft (4) until the bushing is seated.

Specification: The bushing installed depth measurement is flush to 0.25 mm (0.010 in) below the stator shaft surface.

OIL PUMP COVER THRUST WASHER INSPECTION

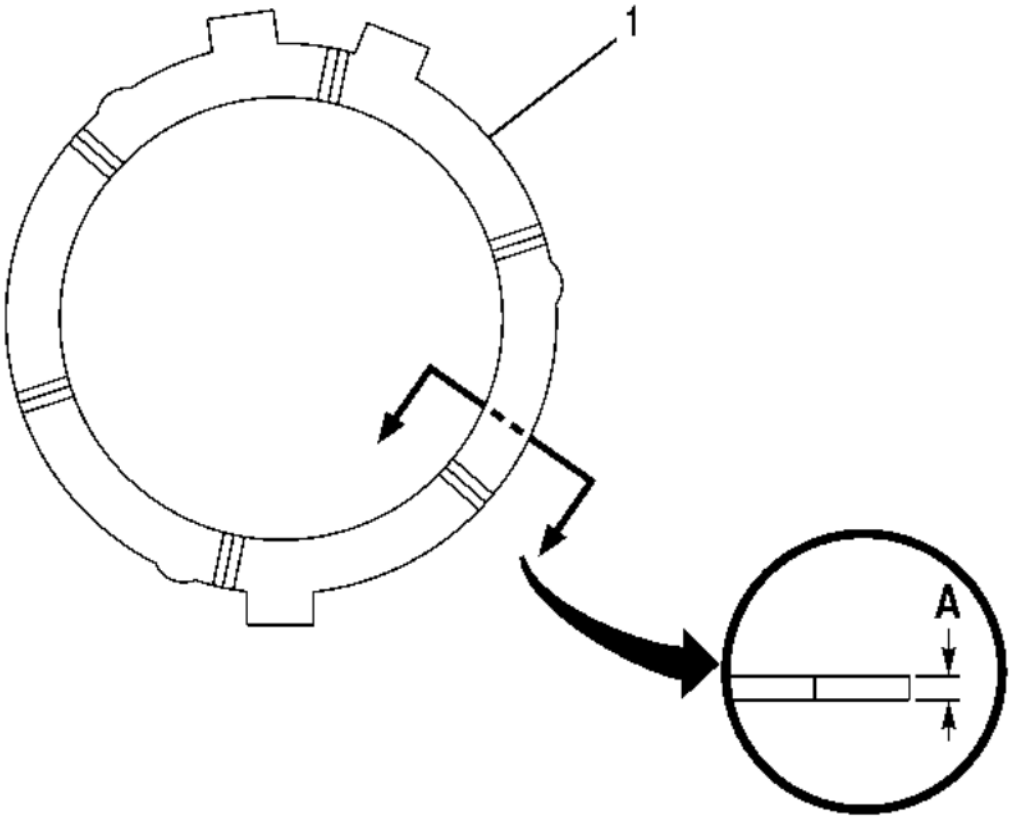


Fig. 244: Measuring Thickness Of Thrust Washer
Courtesy of GENERAL MOTORS CORP.

1. Measure the thickness of thrust washer (1) at dimension A.

   Specification: The minimum thrust washer thickness is 1.49 mm (0.059 in).

2. Replace the thrust washer if the thickness does not meet specifications.

TRANSMISSION FLUID PUMP COVER ASSEMBLE

Tools Required

- **J 24459-5** Spring Compressor Adapter. See **Special Tools**.
- **J 36850** Transjel®. See **Special Tools**.

- **J 43770** Main Lube Converter Relief Valve Spring Compressor. See **Special Tools**.
- **J 43772** Torque Converter Seal Installer. See **Special Tools**.
- **J 43773** Valve Spring Compressor. See **Special Tools**.

Assemble

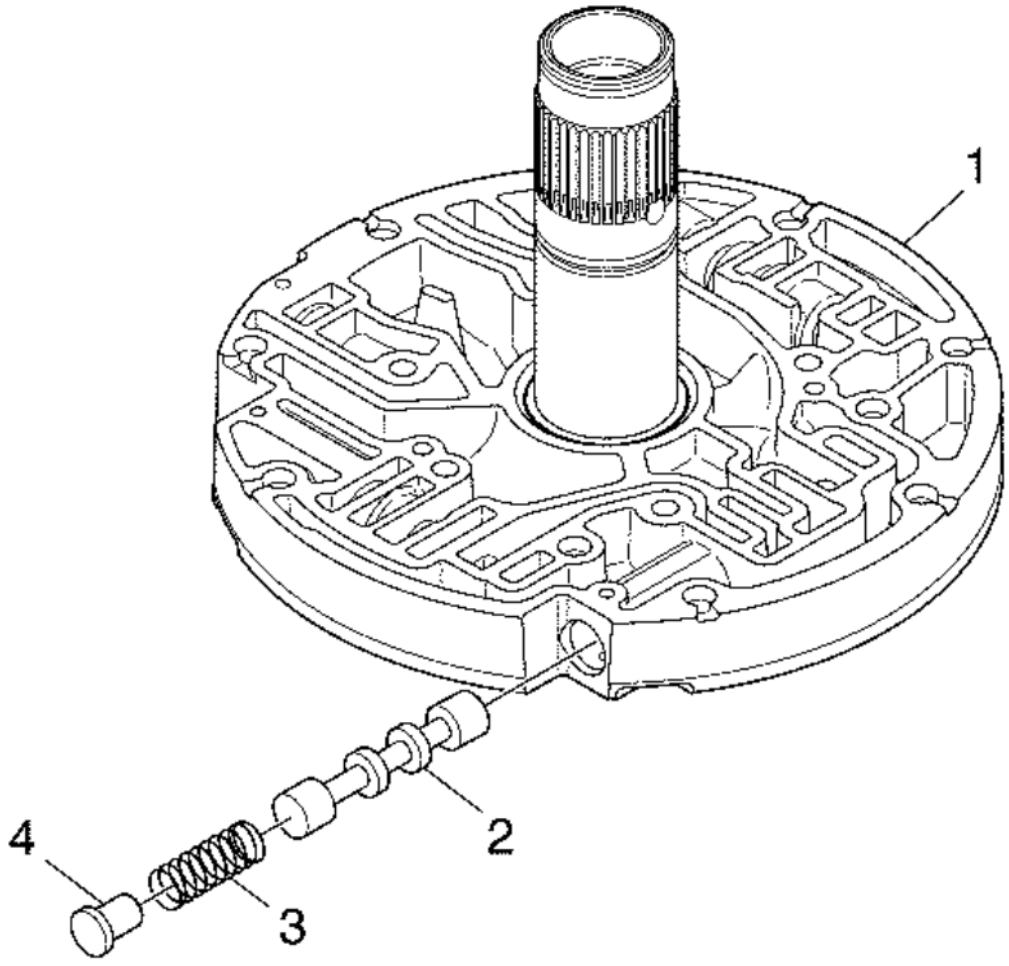


Fig. 245: View Of Converter Flow Valve, Stop & Spring
Courtesy of GENERAL MOTORS CORP.

1. Position the oil pump cover assembly (1) so that the rear of the assembly is facing down.

2. Install the torque converter clutch (TCC) valve (2).
3. Install the TCC valve spring (3) and stop (4).

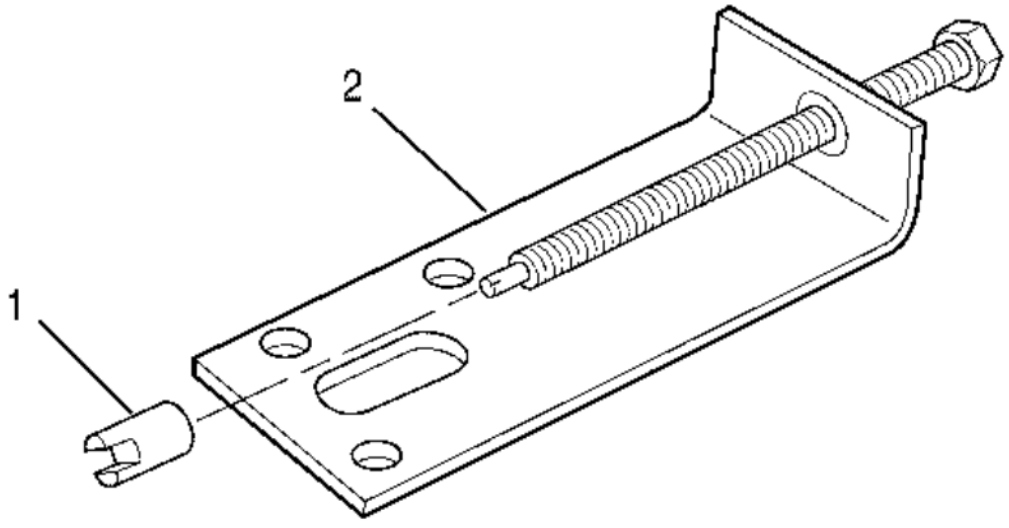


Fig. 246: View Of J 24459-5 & J 43770
Courtesy of GENERAL MOTORS CORP.

4. Install **J 24459-5** (1) onto **J 43770** (2). See **Special Tools**.

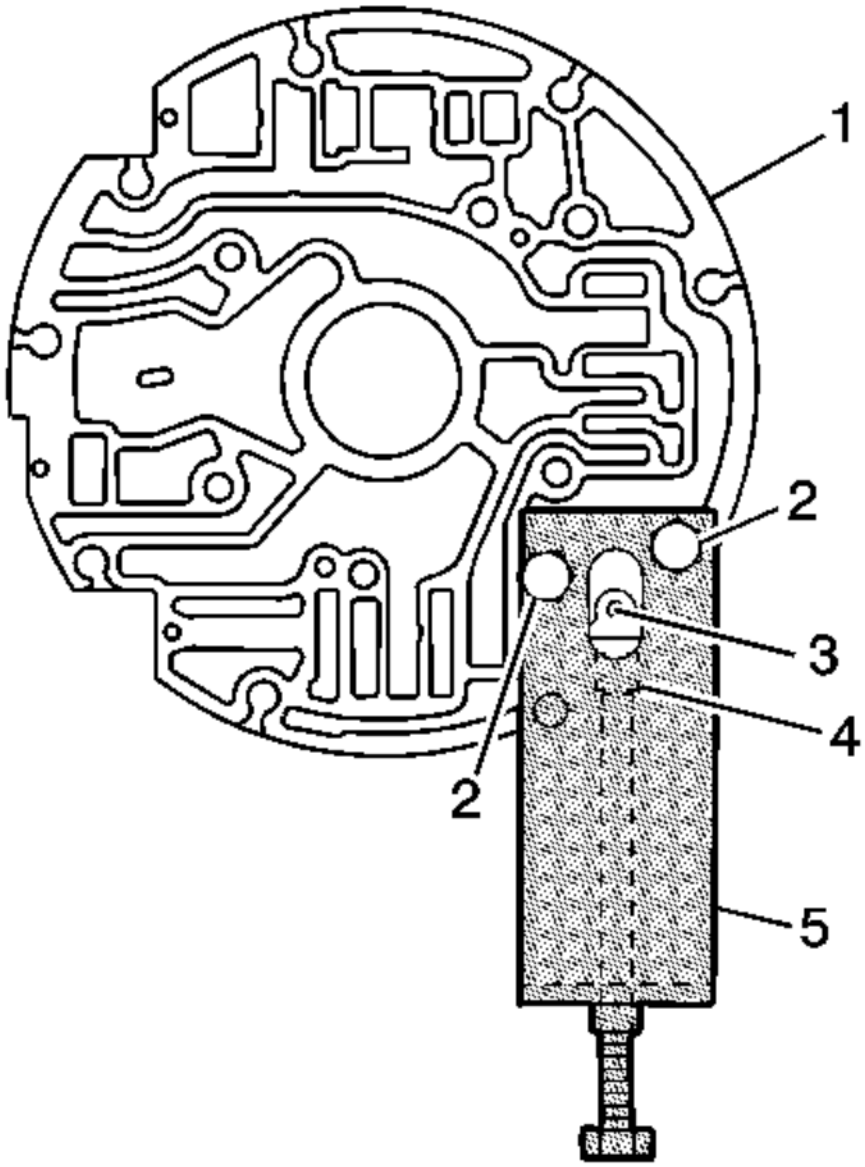


Fig. 247: Using J 24459-5 And J 43770 To Compress Converter Flow Valve Spring
Courtesy of GENERAL MOTORS CORP.

5. Align **J 43770** (5) and **J 24459-5** (4) with the oil pump cover so that the following conditions are met:. See **Special Tools**.

- The threaded rod is facing down.
- Two bolt holes align with 2 bolt holes in the oil pump cover.

6. Install **J 43770** (5) onto the oil pump cover assembly (1). See **Special Tools**.
7. Install 2 oil pump cover retaining bolts (2).
8. Align the slot in **J 24459-5** (4) to allow installing the retainer pin (3). See **Special Tools**.
9. Using **J 24459-5** (4) and **J 43770** (5), compress the TCC valve spring until the retainer pin (3) can be installed. See **Special Tools**.
10. Install the pin through oil pump cover (1). Make sure the pin is below the oil pump cover surface.
11. Relieve the TCC valve spring tension.
12. Remove **J 24459-5** (4) and **J 43770** (5). See **Special Tools**.

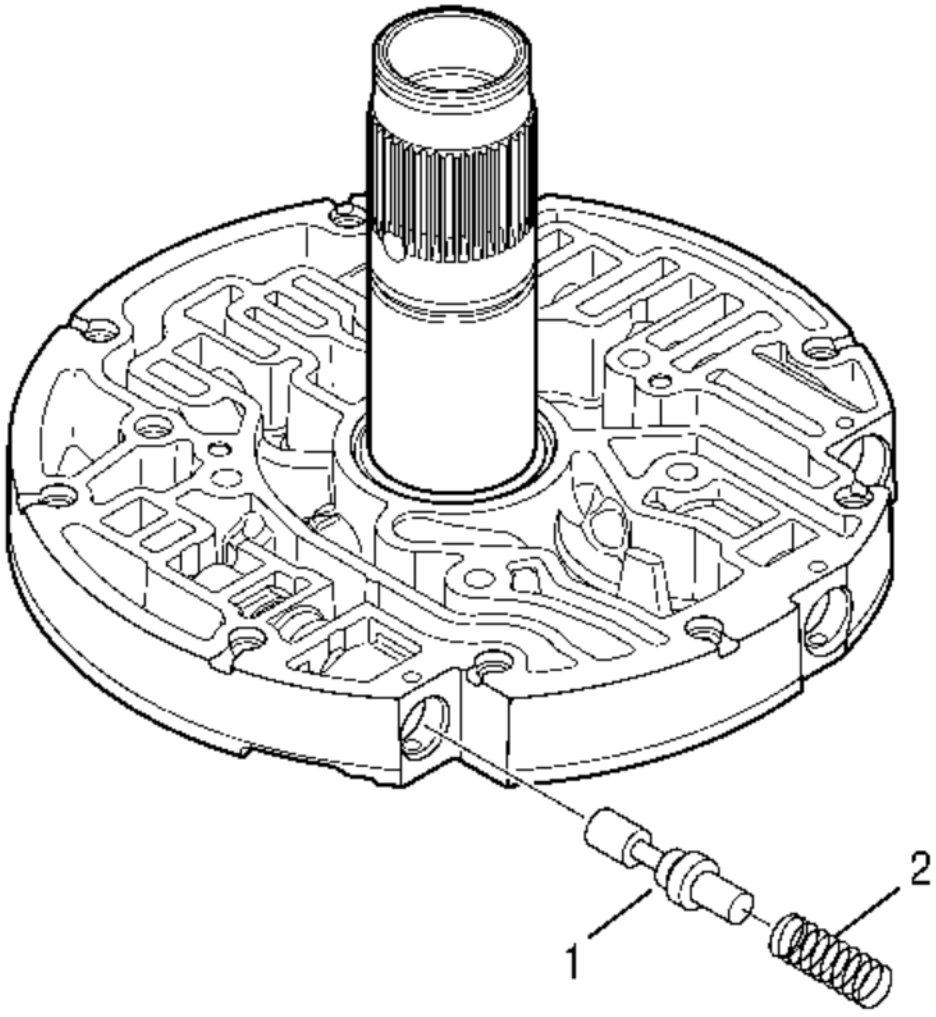


Fig. 248: View Of Converter Relief Valve & Spring
Courtesy of GENERAL MOTORS CORP.

13. Install the TCC relief valve (1) and spring (2).

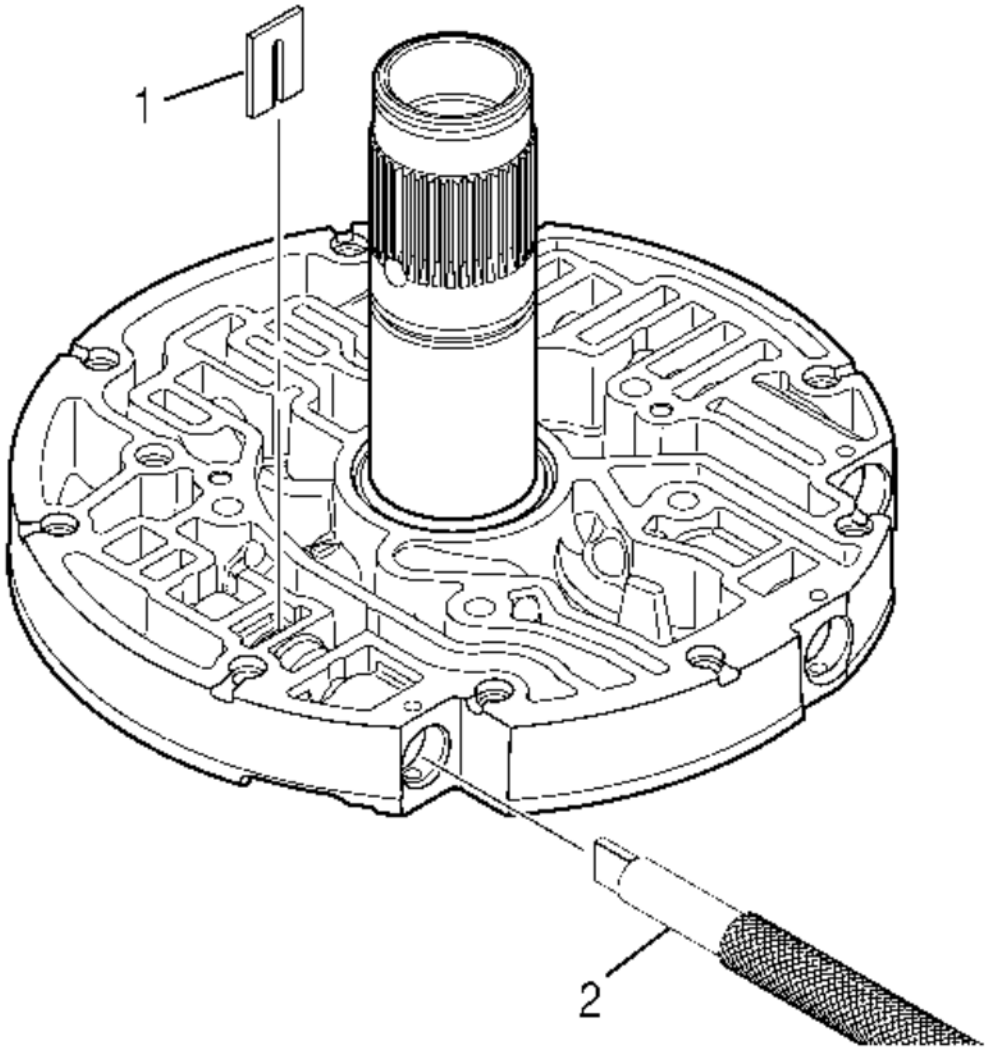


Fig. 249: Converter Relief Valve Spring Retaining Clip & J 43773
Courtesy of GENERAL MOTORS CORP.

14. Using **J 43773** (2), compress the TCC relief valve spring until the retaining clip (1) can be installed. See **Special Tools**.
15. Install the clip. Make sure the retaining clip is below the surface of the oil pump cover.

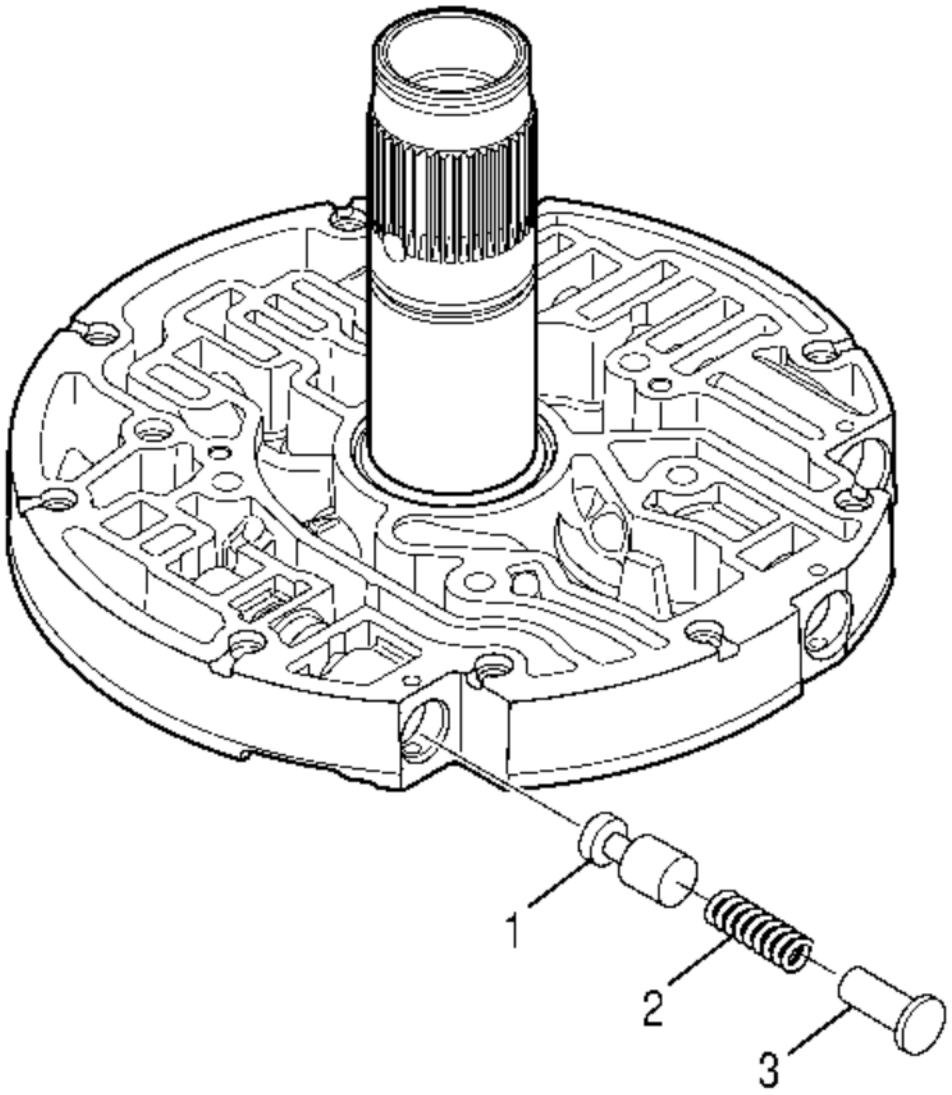


Fig. 250: View Of Lube Regulator Valve, Stop & Spring
Courtesy of GENERAL MOTORS CORP.

16. Install the oil pump lube regulator valve (1).
17. Install the oil pump lube regulator valve spring (2).
18. Install the oil pump lube regulator valve stop (3).

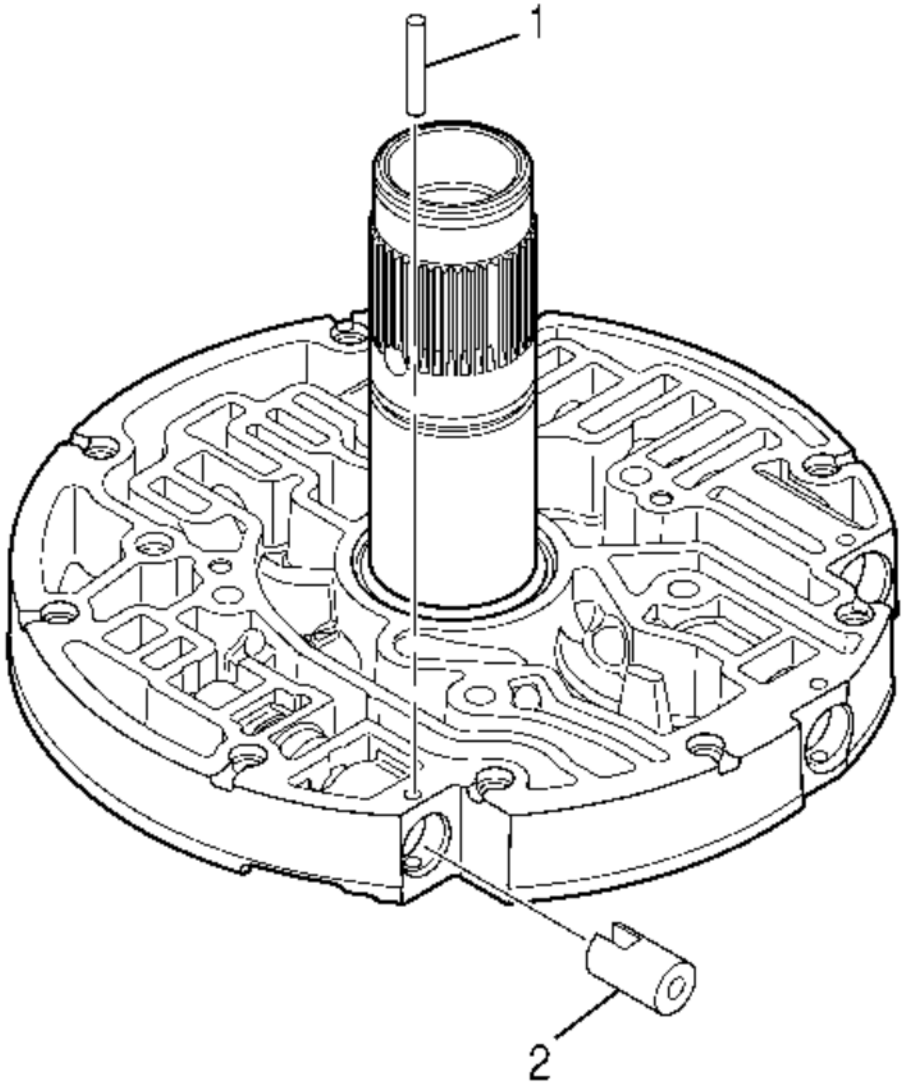


Fig. 251: Using J 24459-5 To Compress Oil Pump Lube Regulator Valve Spring
Courtesy of GENERAL MOTORS CORP.

19. Align the slot of **J 24459-5** (2) with retainer pin (1) hole. See **Special Tools**.
20. Using **J 24459-5** (2), compress the oil pump lube regulator valve spring until the retainer pin (1) can be installed. See **Special Tools**.
21. Install the retainer pin (1). Make sure the pin is below the surface of the oil pump cover.

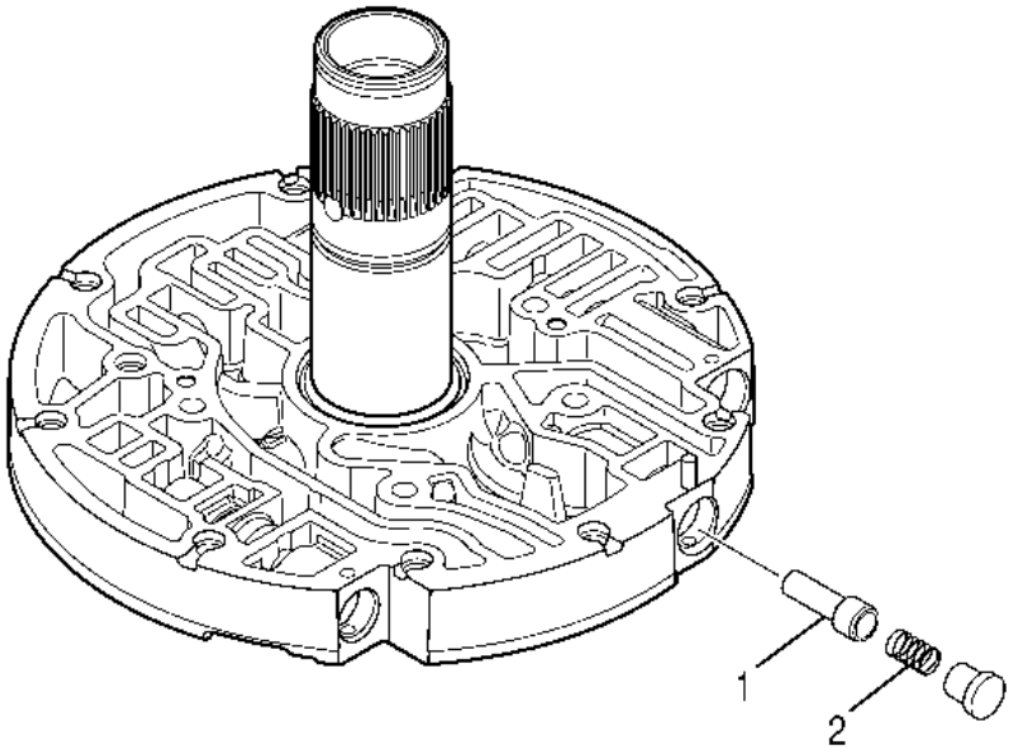


Fig. 252: View Of 1-2-3-4 Clutch Backfill Valve & Spring
Courtesy of GENERAL MOTORS CORP.

22. Install the 1-2-3-4 clutch backfill valve (1).
23. Install the 1-2-3-4 clutch backfill valve spring (2).

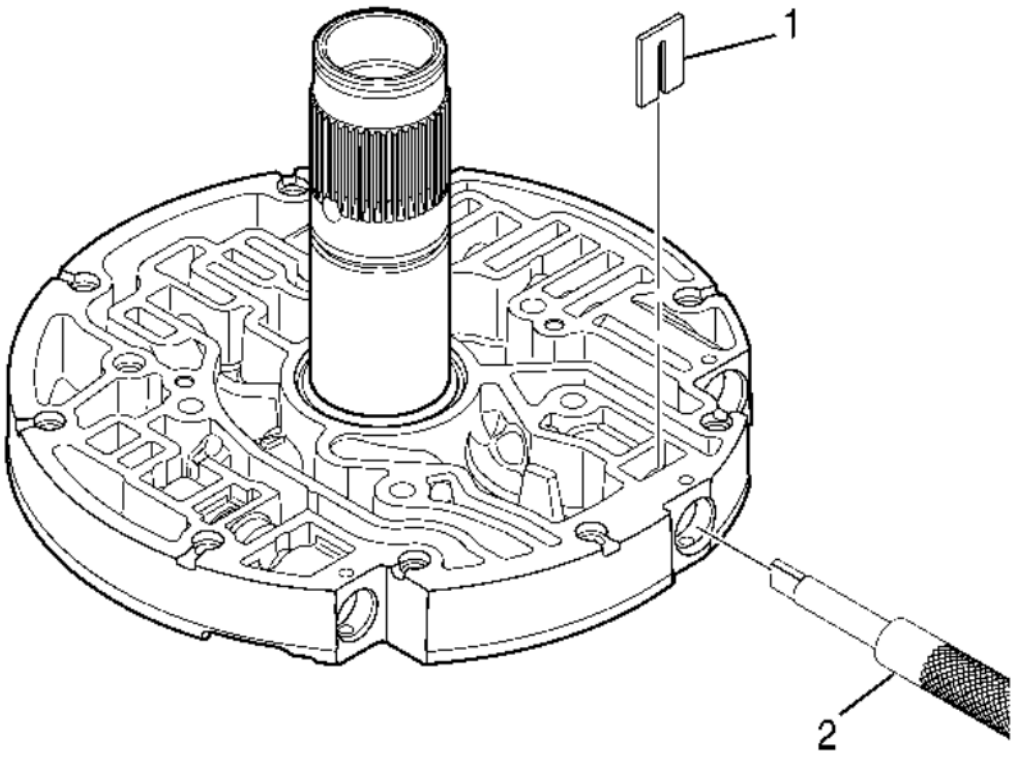


Fig. 253: 1-2-3-4 Clutch Backfill Valve Spring Retaining Clip & J 43773
Courtesy of GENERAL MOTORS CORP.

24. Using **J 43773** (2), compress the 1-2-3-4 clutch backfill valve spring until the retaining clip (1) can be installed. See **Special Tools**.
25. Install the retaining clip (1). Make sure the retaining clip is below the surface of the oil pump cover.

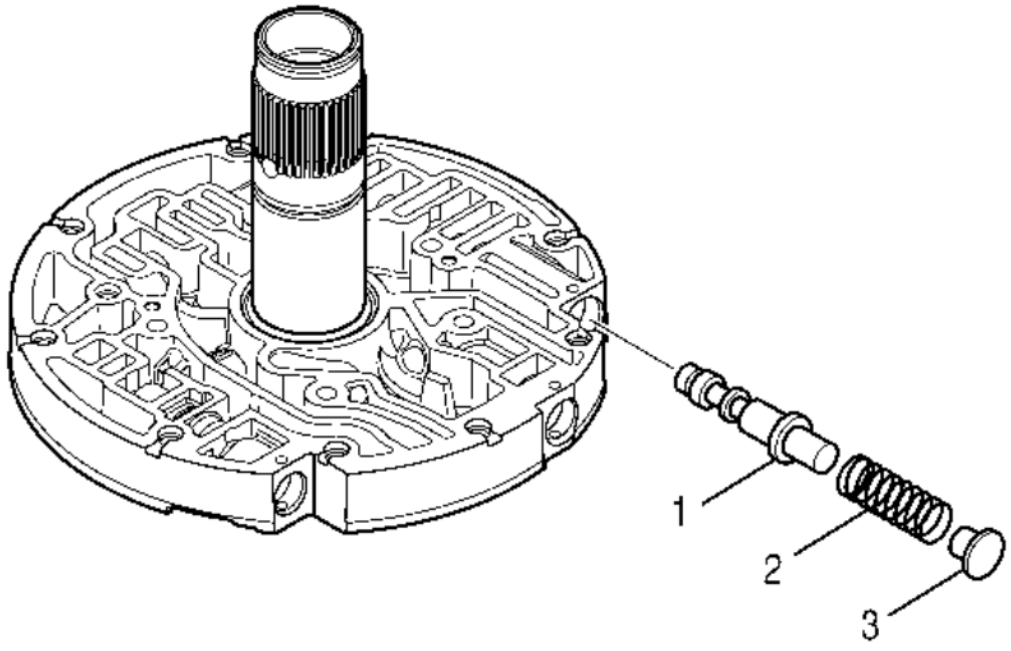


Fig. 254: View Of Stop, Spring & Main Regulator Valve
Courtesy of GENERAL MOTORS CORP.

26. Install the pressure regulator valve (1).
27. Install the pressure regulator valve spring (2) and stop (3).

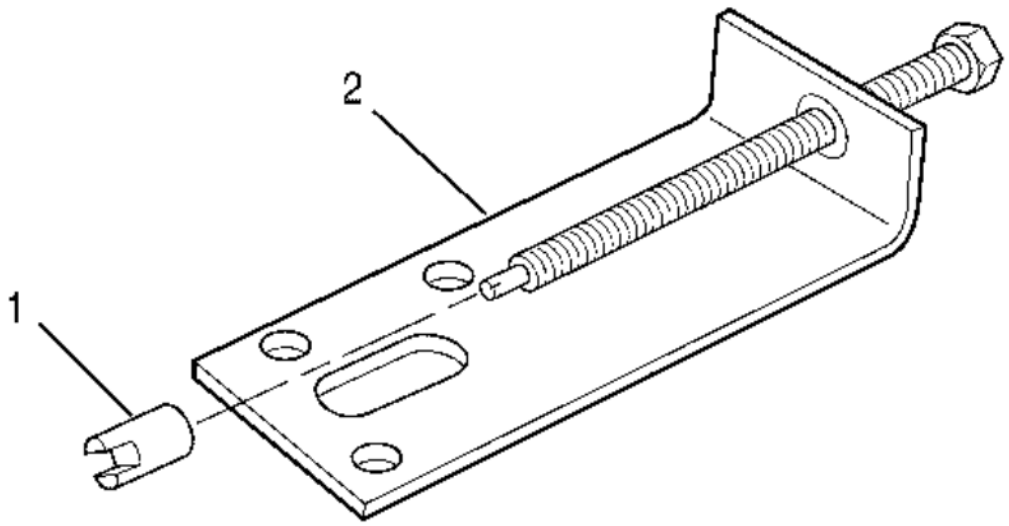


Fig. 255: View Of J 24459-5 & J 43770
Courtesy of GENERAL MOTORS CORP.

28. Install **J 24459-5** (1) onto **J 43770** (2). See **Special Tools**.

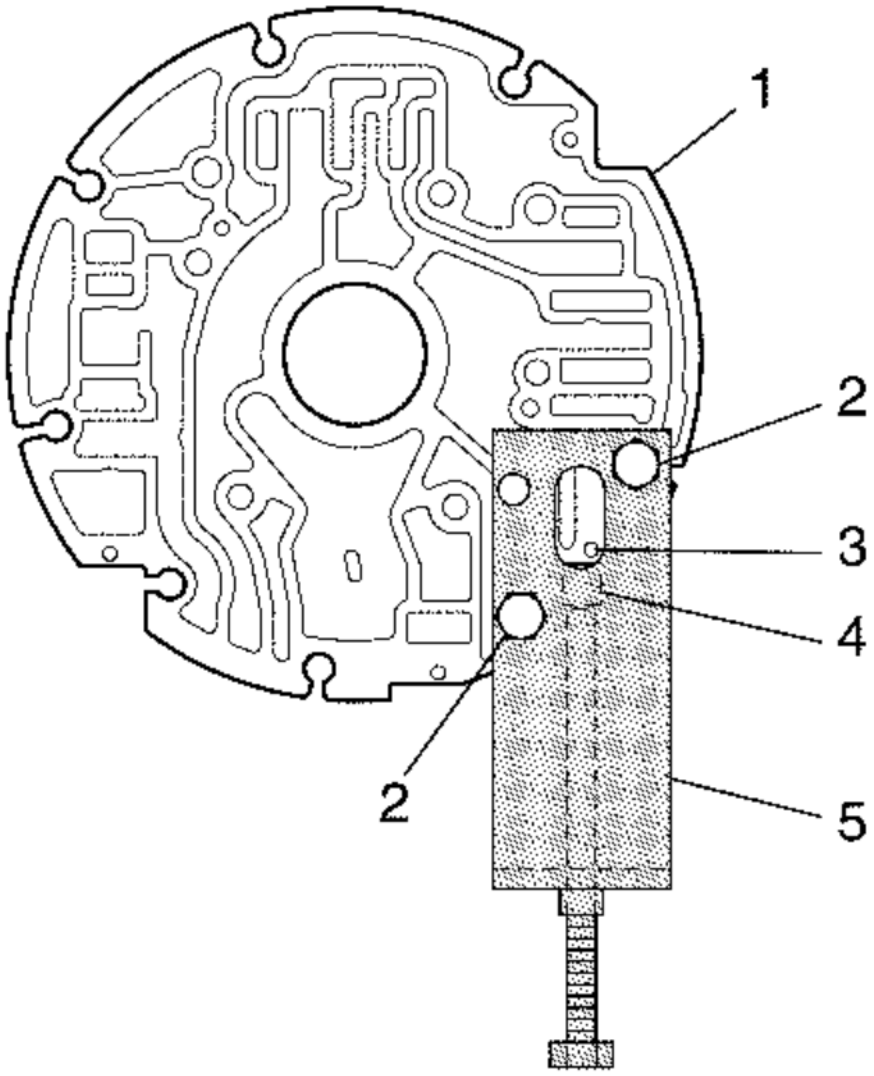


Fig. 256: J 43770, J 24459-5 & Oil Pump Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

29. Install **J 43770** (5) onto the oil pump cover assembly. See **Special Tools**.
30. Install 2 bolts (2).
31. Align **J 24459-5** (4) slot with the retainer pin (3). See **Special Tools**.
32. Using **J 43770** and **J 24459-5** , compress the pressure regulator valve spring until the stop is

past the pin hole. See **Special Tools**.

33. Install the retainer pin (3). Make sure the pin is below the surface of the oil pump cover.
34. Relieve the spring pressure.
35. Remove **J 24459-5** and **J 43770** . See **Special Tools**.

Converter Housing/Oil Pump Cover Assembly

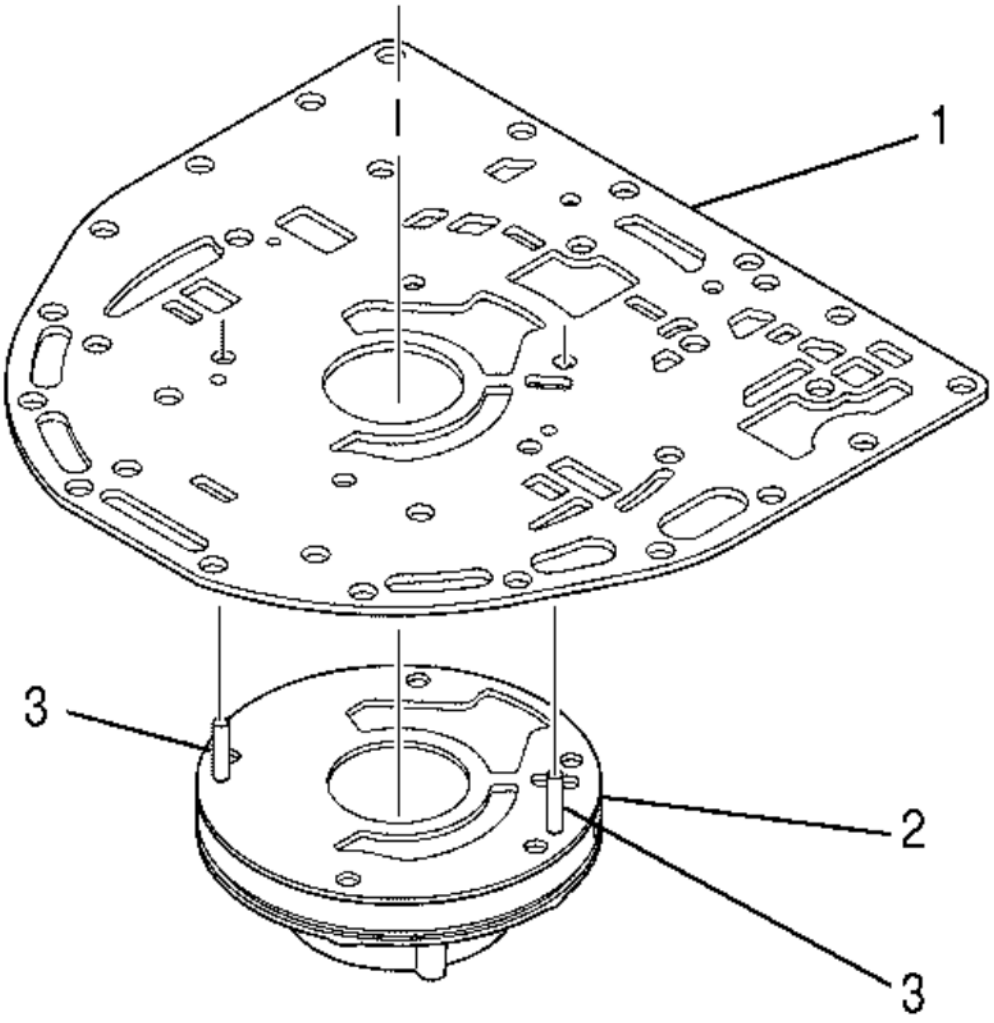


Fig. 257: Aligning Locating Pins In Pump Body With Pin Holes
Courtesy of GENERAL MOTORS CORP.

1. Position the oil pump assembly (2) on the work table so that the rear of the pump is facing up.
2. Align the locating pin holes in the torque converter housing to case channel plate (1) with the locating pins (3) in the oil pump assembly (2).
3. Make sure the bolt holes in the torque converter housing to case channel plate (1) align with the bolt holes in the oil pump assembly (2).
4. Install the torque converter housing to case channel plate (1) onto the oil pump assembly (2).

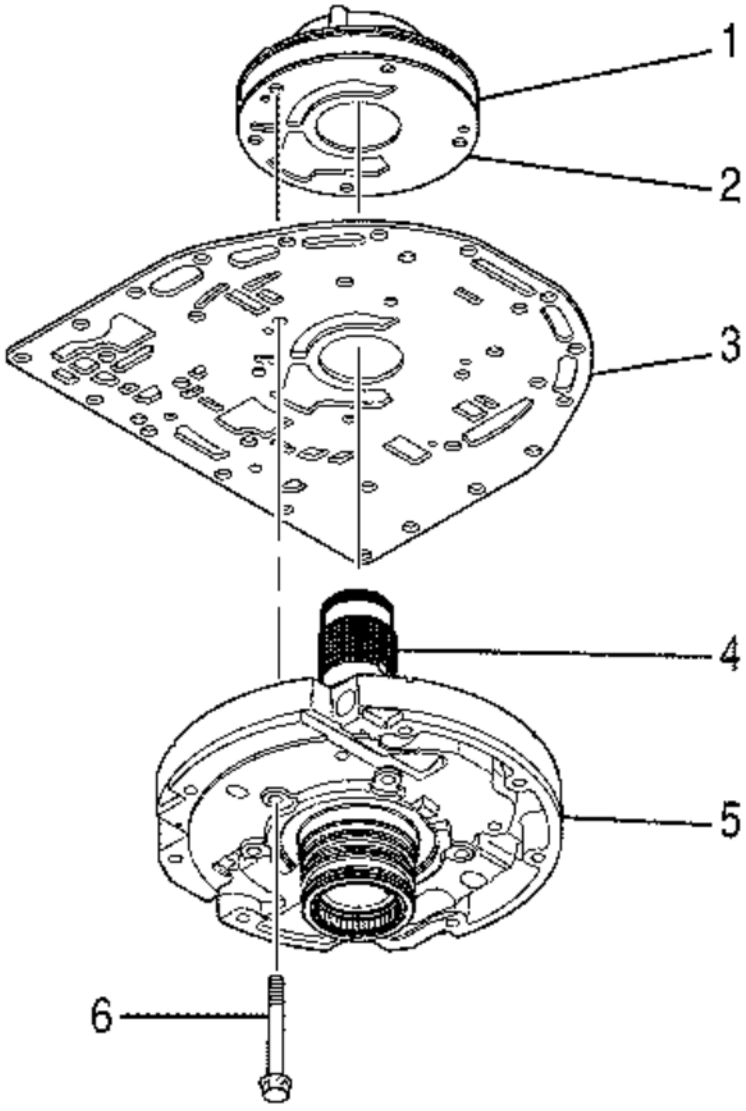


Fig. 258: Locating Oil Pump Cover Assembly Components
Courtesy of GENERAL MOTORS CORP.

5. Position the oil pump cover assembly (5) on the work table so that the stator shaft (4) is facing up.
6. Align, as a unit, the oil pump assembly (1) and the torque converter housing to case channel plate (3) so that the following conditions are met:

- Oil pump locating pins (2) align with the holes in the oil pump cover assembly (5).
- The oil pump assembly bolt holes align with the bolt holes of the oil pump cover assembly.

7. Install, as a unit, the oil pump assembly (1) and the torque converter housing to case channel plate (2) onto the oil pump cover assembly (5).

NOTE: Refer to Fastener Notice .

8. Install 5 bolts (6).

Tighten: Tighten the bolts to 27 N.m (20 lb ft)

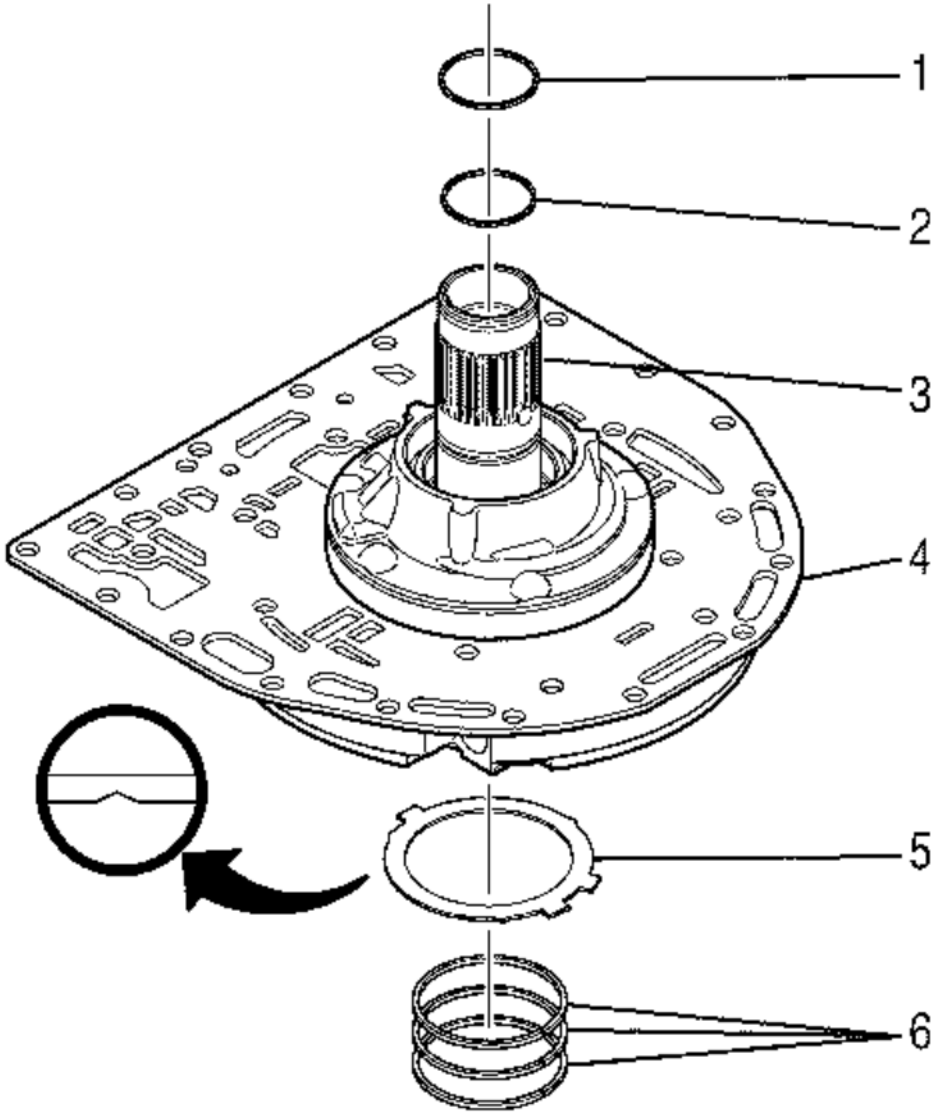


Fig. 259: Identifying Overlap Seal Rings, Stator Shaft, Rear Hub and Thrust Washer
Courtesy of GENERAL MOTORS CORP.

9. Align the tangs of the thrust washer (5) with the slots at the base of the oil pump cover assembly rear hub.

10. Install the thrust washer (5) onto the oil pump cover assembly. The thrust washer snaps into place.
11. Install 3 new overlap seal rings (6) onto the oil pump cover assembly rear hub.
12. Install a new overlap seal ring (2) onto the middle of the stator shaft (3).
13. Install a new overlap seal ring (1) onto the front of the stator shaft (3).

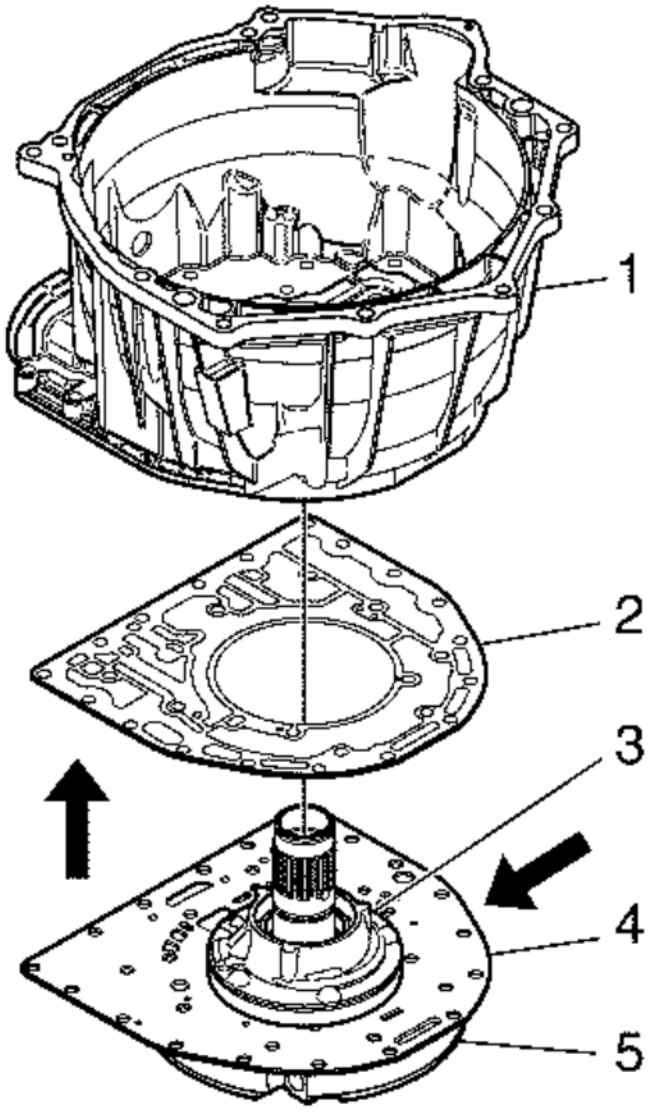


Fig. 260: Converter Housing, Oil Pump Cover Module, Channel Plate And Gasket
Courtesy of GENERAL MOTORS CORP.

14. Position the oil pump cover module (5) on the work table so that the stator shaft is facing up.
15. Align the bolt holes of the torque converter housing to case channel plate gasket (2) with the bolt holes in the torque converter housing to case channel plate (4).
16. Apply **J 36850** or an equivalent lubricant to the gasket face nearest the torque converter housing to case channel plate. See **Special Tools**.
17. Install the gasket onto the torque converter housing to case channel plate.
18. Apply **J 36850** or an equivalent lubricant onto the outside diameter (OD) of the oil pump assembly (3). See **Special Tools**.

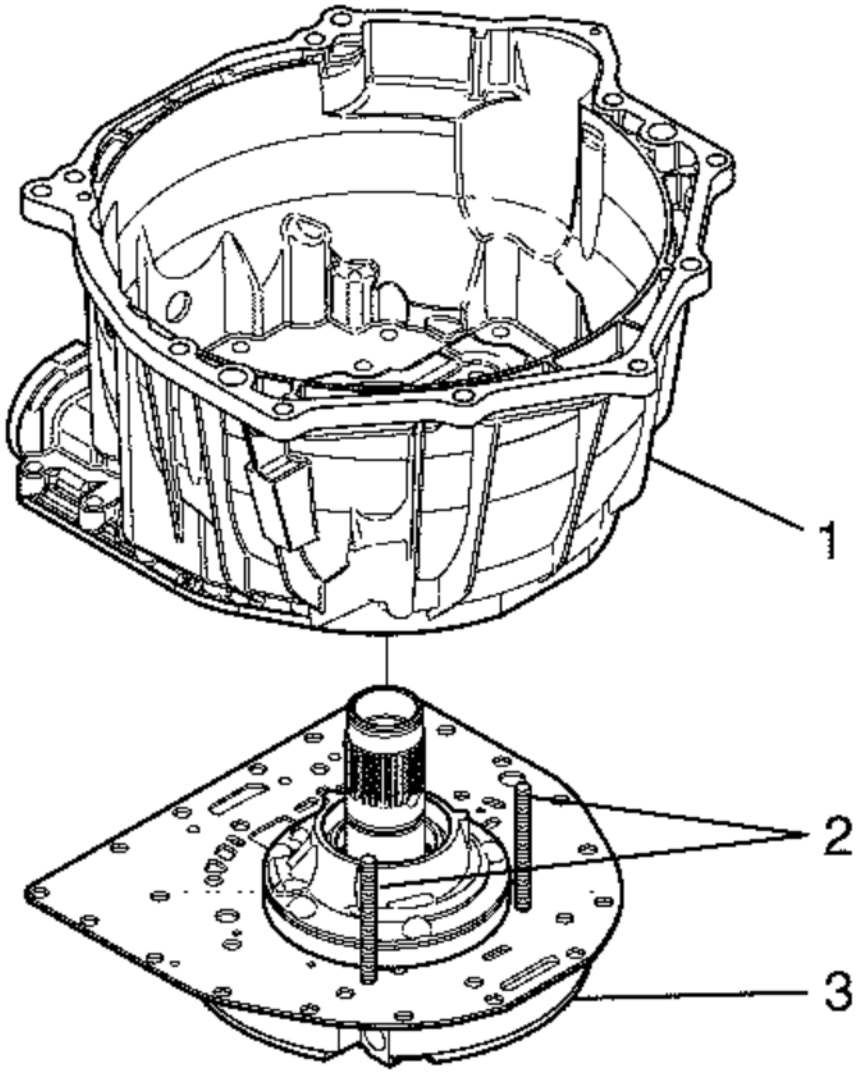


Fig. 261: View Of Guide Bolts And Oil Pump Cover Module
Courtesy of GENERAL MOTORS CORP.

19. Install 2 M10 x 1.5 guide bolts (2) into the oil pump cover module (3).
20. Align the converter housing bolt holes with the bolt holes in the oil pump cover module.
21. Install the converter housing onto the guide bolts and onto the oil pump cover module.
22. Remove the guide bolts from the oil pump cover module.

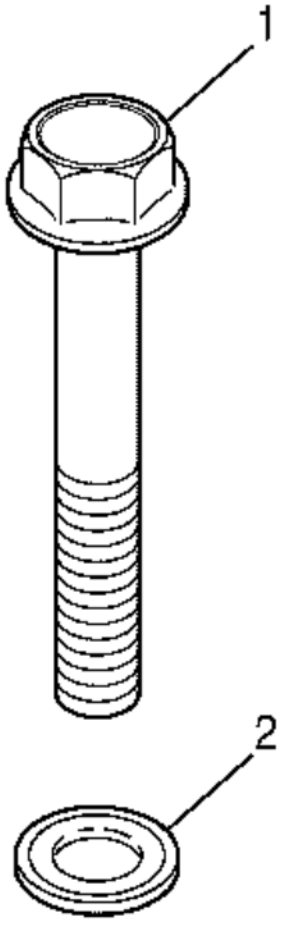


Fig. 262: Identifying Bolt Seals
Courtesy of GENERAL MOTORS CORP.

23. Inspect the bolt seals (2) for nicks or other damage. Replace damaged seals.
24. Install seals (2) onto 10 bolts (1).

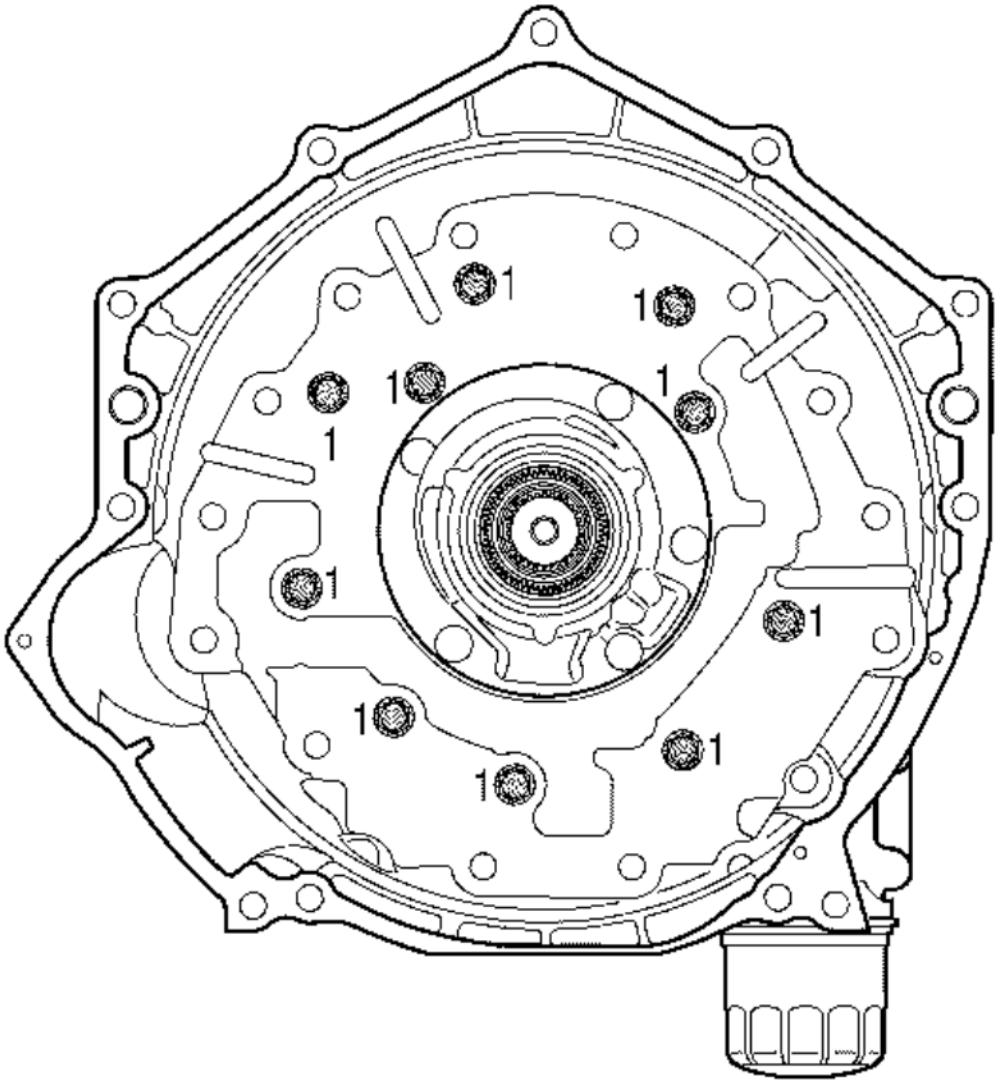


Fig. 263: View Of Oil Seal Assembly Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

25. Install 10 bolts (1) into the converter housing to retain the oil pump cover module.

    Tighten: In a criss-cross pattern, tighten the bolts to 56 N.m (42 lb ft).

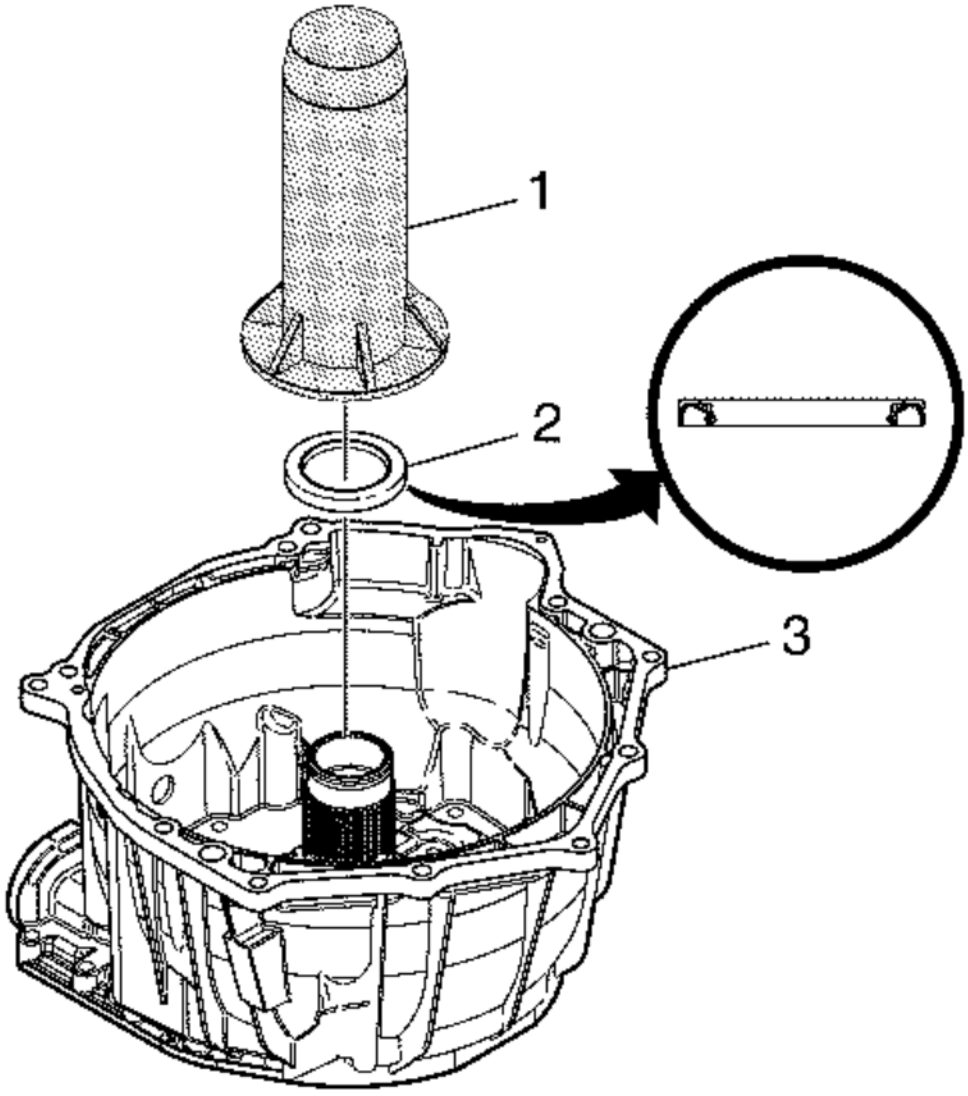


Fig. 264: Installing Pump Body Hub Oil Seal Assembly
Courtesy of GENERAL MOTORS CORP.

26. Align the oil seal assembly (2) with the oil pump body so that the double edges face the pump body hub.
27. Using **J 43772** , install the oil seal assembly into the pump body hub. See **Special Tools**.

Specification: The seal installed depth measurement is flush to 0.25 mm (0.010 in) below the oil pump body surface.

1-2-3-4-5-6 CLUTCH PISTON HOUSING DISASSEMBLE

Tools Required

- **J 24204-2** Bar and Stud Assembly. See **Special Tools**.
- **J 43772** Torque Converter Seal Installer. See **Special Tools**.
- **J-47339-1** Piston Return Spring Compressor. See **Special Tools**.
- **J-47339-2** Seal Area Protector. See **Special Tools**.

Disassemble

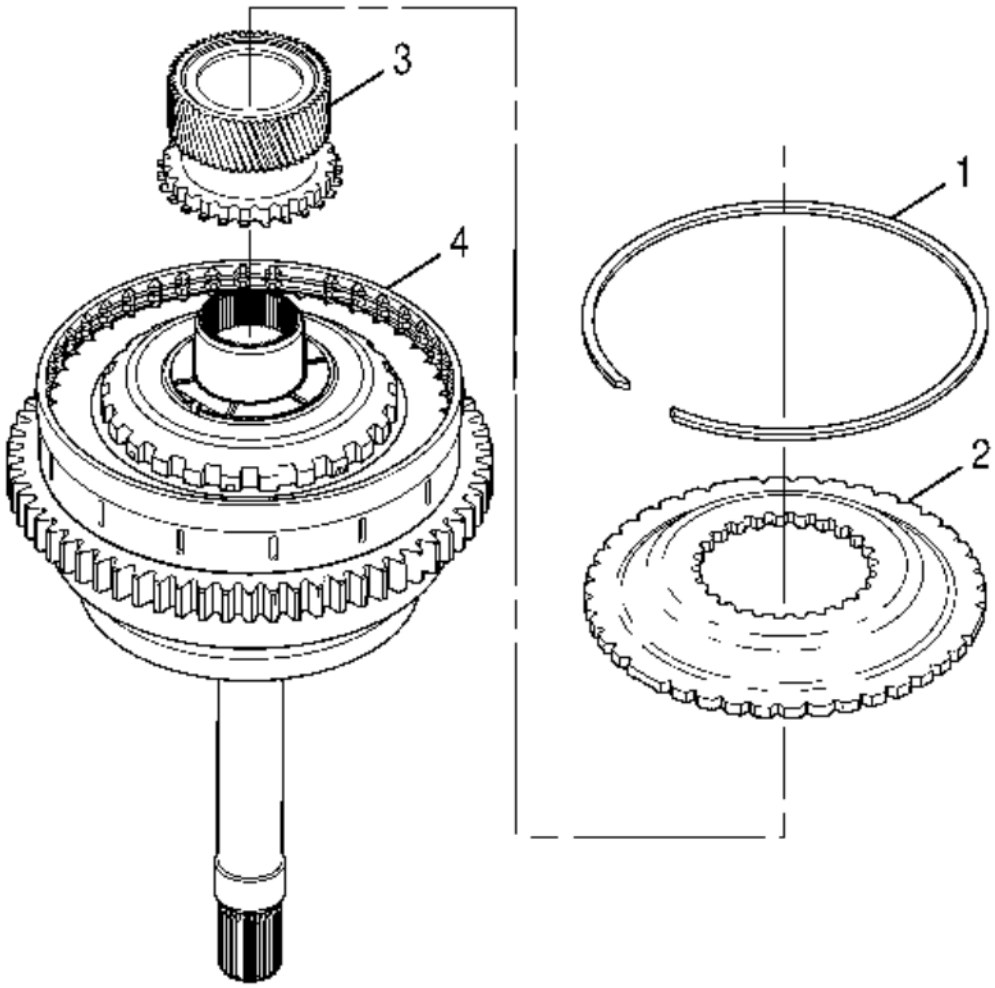


Fig. 265: View Of 1-2-3-4, 4-5 Clutch Housing Components
Courtesy of GENERAL MOTORS CORP.

1. Position the 1-2-3-4, 4-5-6 clutch assembly (4) on the work table so that the rear of the assembly is up.
2. Remove the retaining ring (1) from the 1-2-3-4, 4-5-6 clutch assembly.
3. Remove the input sun gear (3) with the input drive flange (2) attached.
4. Remove the input sun gear from the drive flange.

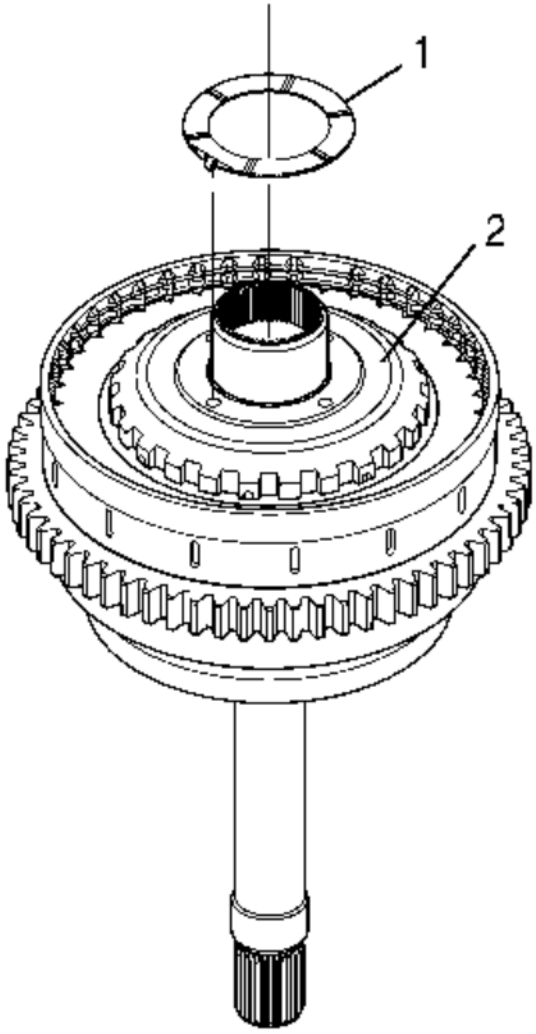


Fig. 266: Identifying Bronze Thrust Washer With Holes
Courtesy of GENERAL MOTORS CORP.

5. Remove the bronze thrust washer (1) from the 4-5-6 drive hub (2).

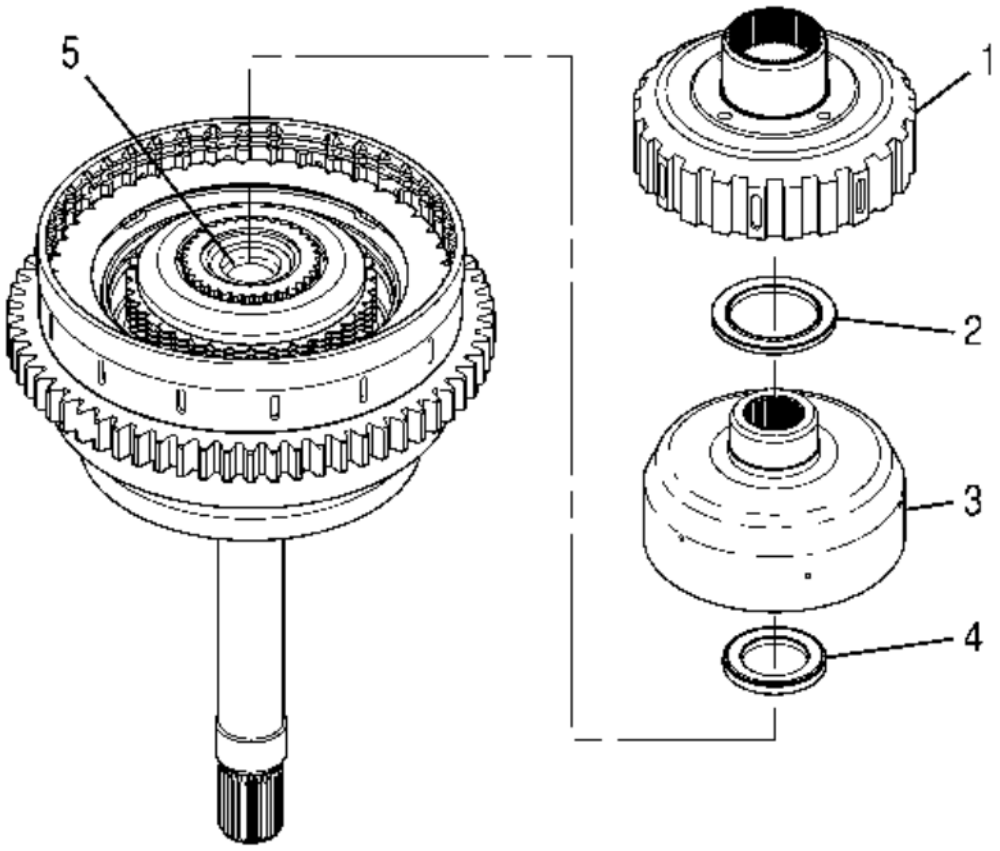


Fig. 267: Identifying 4-5 Drive Hub, Thrust Bearing Assembly & Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

6. Remove the 4-5-6 drive hub (1).

IMPORTANT: The thrust bearing assembly may stick to the 1-2-3-4 clutch drive hub or the 4-5-6 clutch drive hub.

7. Remove the thrust bearing assembly (2) from the rear of the 1-2-3-4 clutch drive hub (3) or the front of the 4-5-6 clutch drive hub (1).
8. Remove the 1-2-3-4 clutch drive hub (3).

IMPORTANT: The thrust bearing assembly may stick to the rear of the

turbine shaft or the front of the 1-2-3-4 clutch drive hub.

9. Remove the thrust bearing assembly (4) from the rear of the turbine shaft (5) or the front of the 1-2-3-4 clutch drive hub (3).

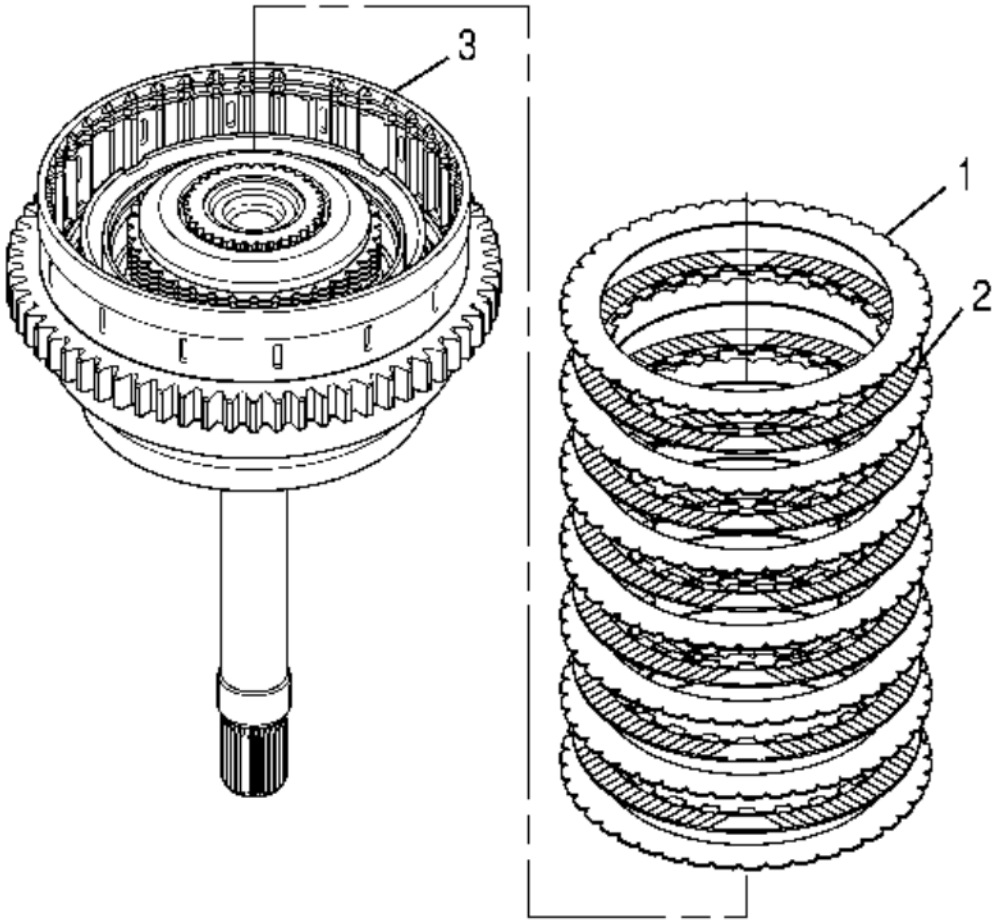


Fig. 268: Identifying Clutch Plate Stacking Sequence
Courtesy of GENERAL MOTORS CORP.

10. Remove seven 4-5-6 clutch steel plates (1) and six 4-5-6 clutch fiber plates (2) from the 1-2-3-4, 4-5-6 clutch housing (3).

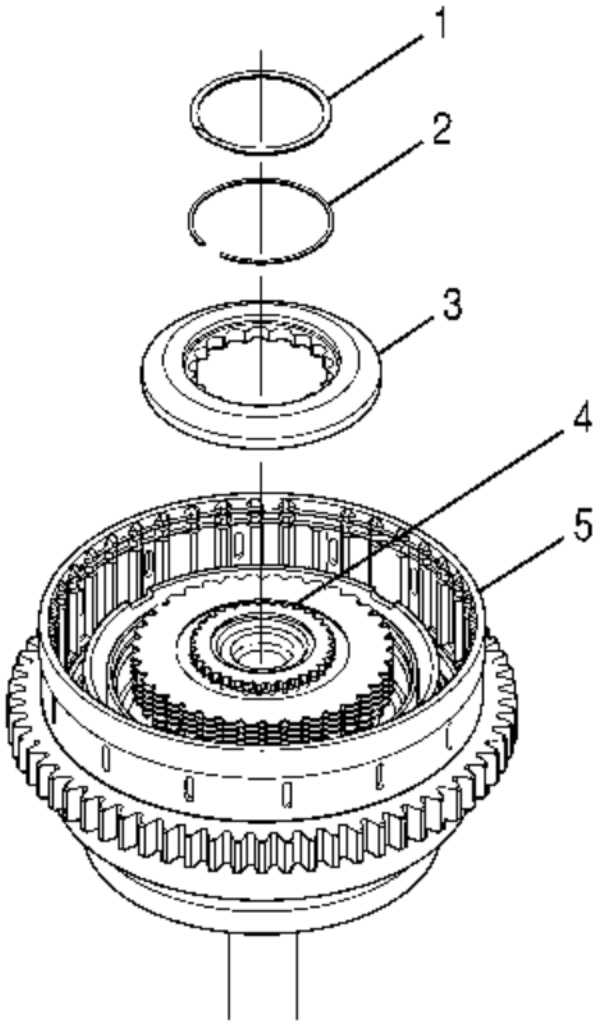


Fig. 269: View Of 1-2-3-4 Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

11. Remove the internal spiral retaining ring (1) from the 1-2-3-4 clutch backing plate (3).
12. Remove the retaining ring (2) from the turbine shaft (4).
13. Remove the 1-2-3-4 clutch backing plate (3) from the turbine shaft (4).

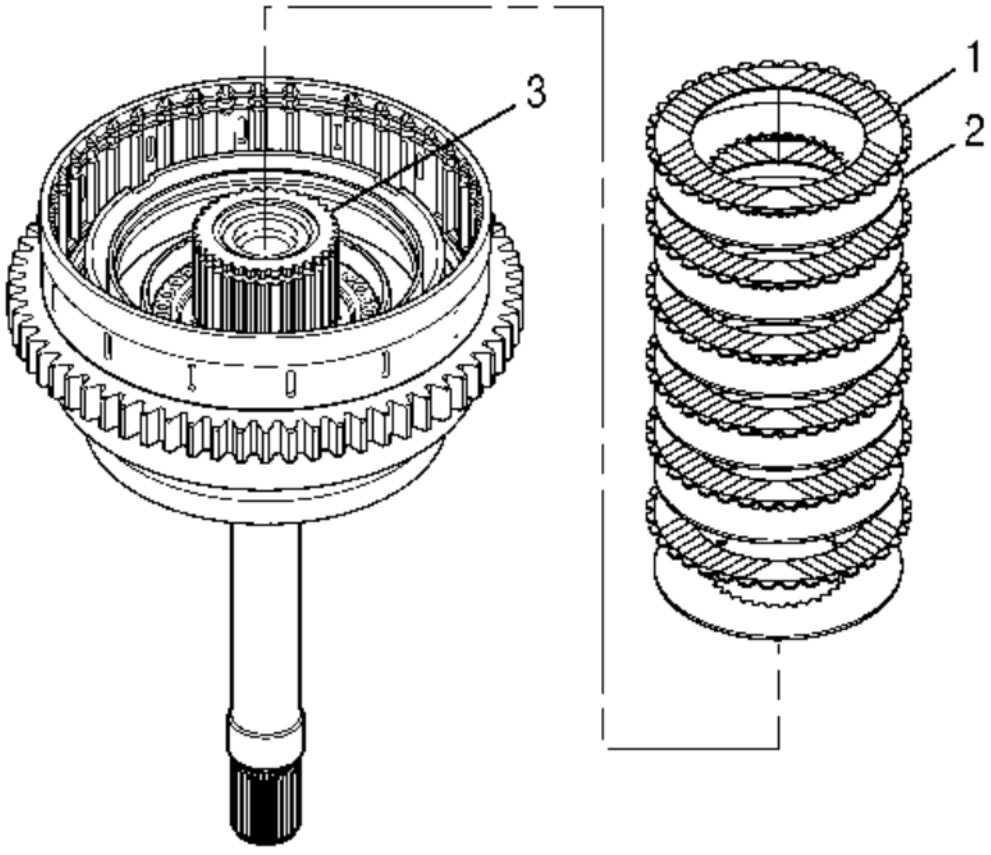


Fig. 270: Identifying Stacking Sequence Of Clutch Plates
Courtesy of GENERAL MOTORS CORP.

14. Remove six 1-2-3-4 clutch fiber plates (1) and six 1-2-3-4 clutch steel plates (2) from the turbine shaft (3).

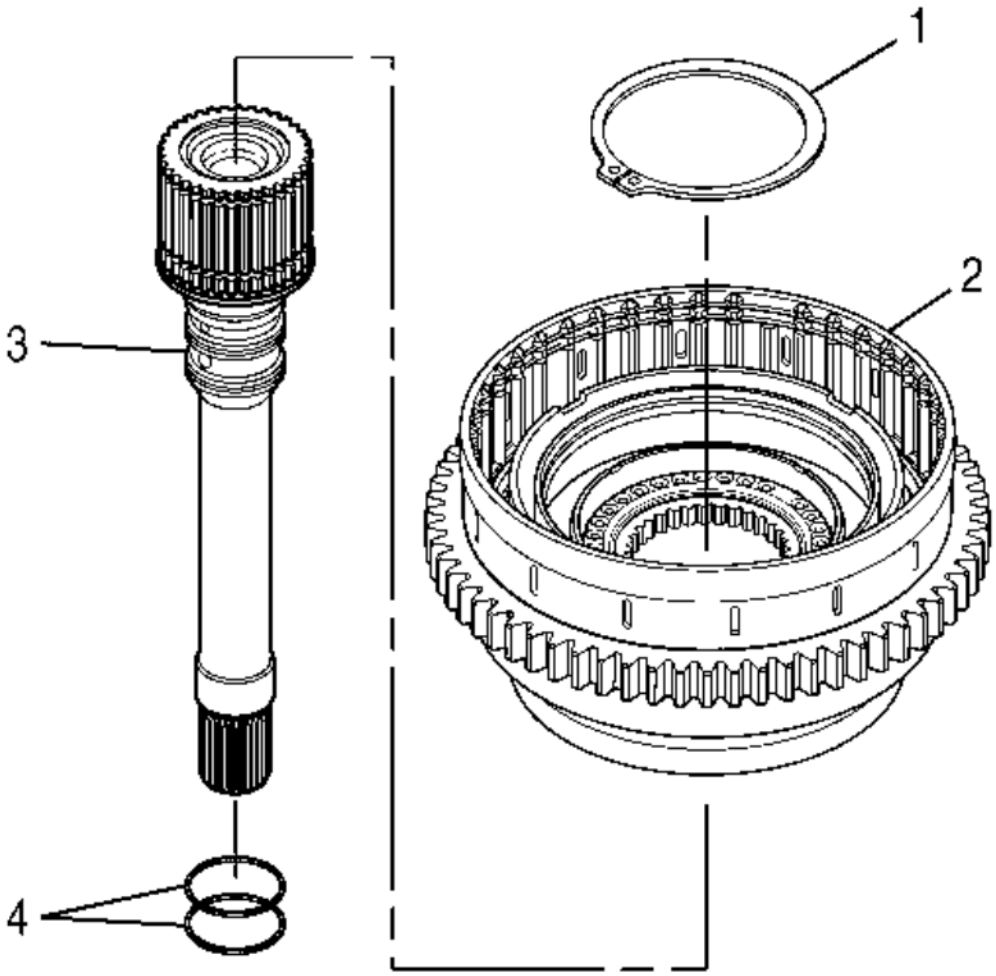


Fig. 271: Locating Turbine Shaft & Overlap Seal Rings
Courtesy of GENERAL MOTORS CORP.

CAUTION: Personal injury and/or property damage may result from the movement of the 1-2-3-4, 4-5-6 clutch housing or the turbine shaft. The 1-2-3-4, 4-5-6 clutch housing and turbine shaft are held together by a retaining ring. Removing the retaining ring allows the turbine shaft and the 1-2-3-4, 4-5-6 clutch housing to move freely. When removing the retaining ring, make sure the 1-2-3-4, 4-5-6

clutch housing and the turbine shaft are restrained from moving.

15. Remove the retaining ring (1) from the turbine shaft (3).
16. Remove the 1-2-3-4, 4-5-6 clutch housing (2) from the rear of the turbine shaft.
17. Remove 2 overlap seal rings (4) from the turbine shaft.

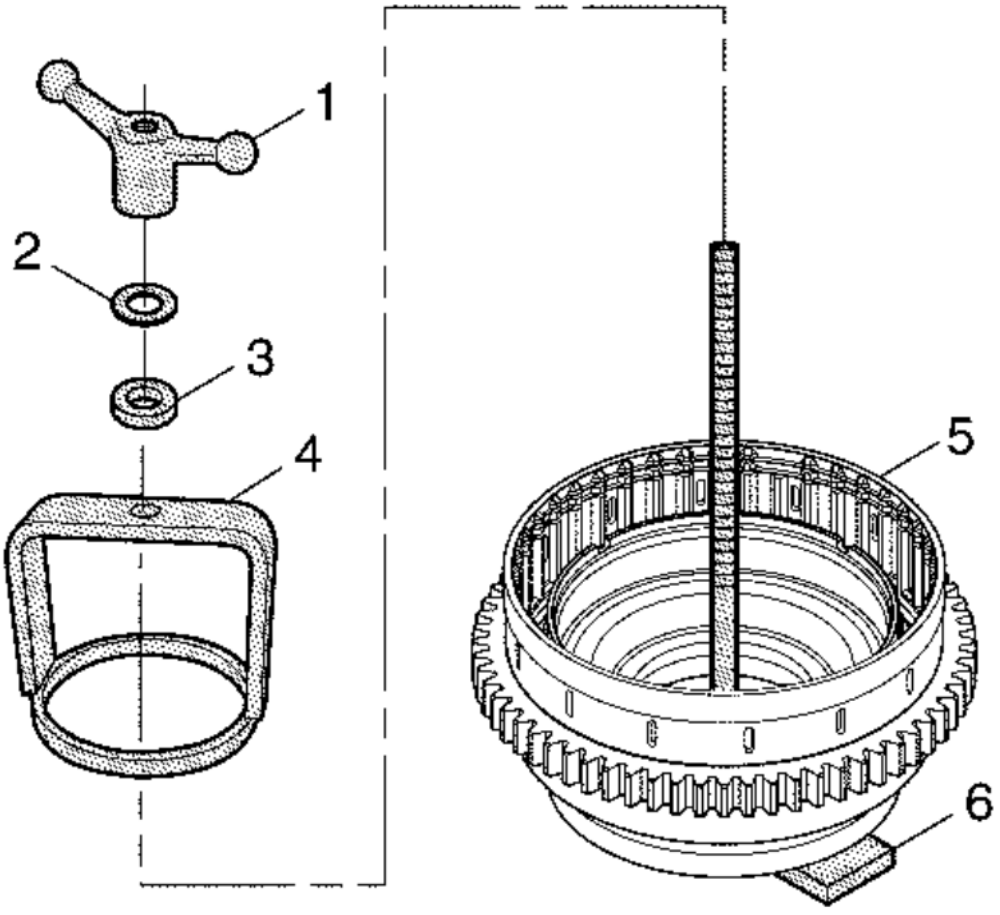


Fig. 272: Positioning 1-2-3-4, 4-5-6 Clutch Housing On Base Of J 24204-2
Courtesy of GENERAL MOTORS CORP.

18. Position the 1-2-3-4, 4-5-6 clutch housing (5) on the base of **J 24204-2** (6) so that the rear

of the housing is facing up. See **Special Tools**.

19. Install **J-47339-1** (4) onto the 1-2-3-4 clutch balance piston. See **Special Tools**.
20. Install the **J 24204-2** ball bearing (3) and washer (2) onto the shaft of **J 24204-2** . See **Special Tools**.
21. Install the **J 24204-2** wing nut (1) onto the shaft of **J 24204-2** (6). See **Special Tools**.

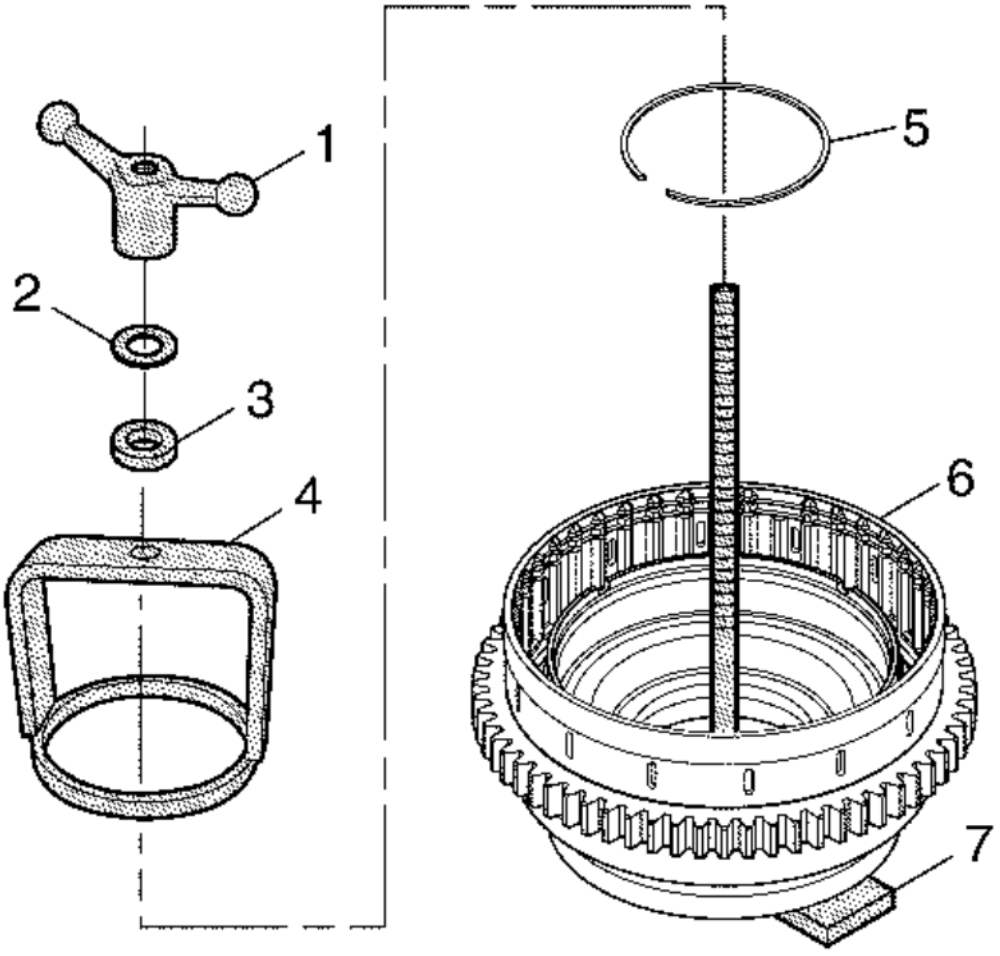


Fig. 273: 1-2-3-4-, 4-5-6 Clutch Housing & J 24204-2
Courtesy of GENERAL MOTORS CORP.

22. Compress the 1-2-3-4 clutch balance piston return spring assembly until the retaining ring

(5) can be removed.

23. Remove the retaining ring (5) from the groove in the 1-2-3-4 clutch housing.
24. Remove the retaining ring (5).
25. Remove all J tools.

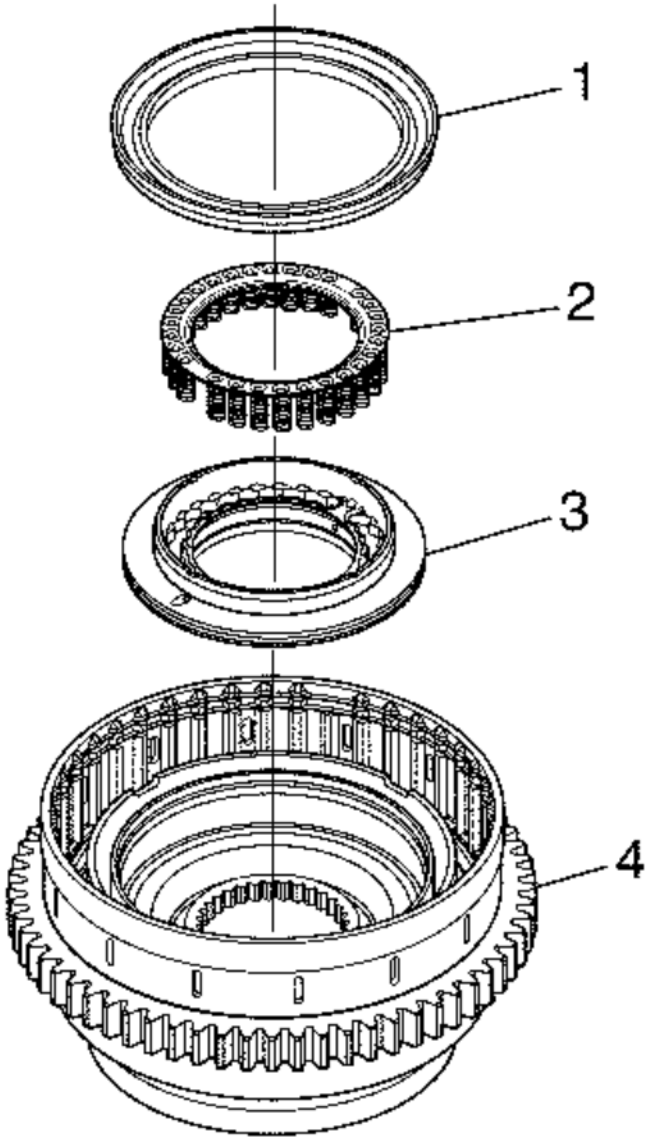


Fig. 274: 1-2-3-4 Clutch Piston Housing Components
Courtesy of GENERAL MOTORS CORP.

26. Remove the 1-2-3-4 clutch balance piston (1) from the 1-2-3-4 clutch housing (4).
27. Remove the 1-2-3-4 clutch piston return spring assembly (2) from the 1-2-3-4 clutch housing (4).
28. Remove the 1-2-3-4 clutch piston (3) from the 1-2-3-4 clutch housing (4).

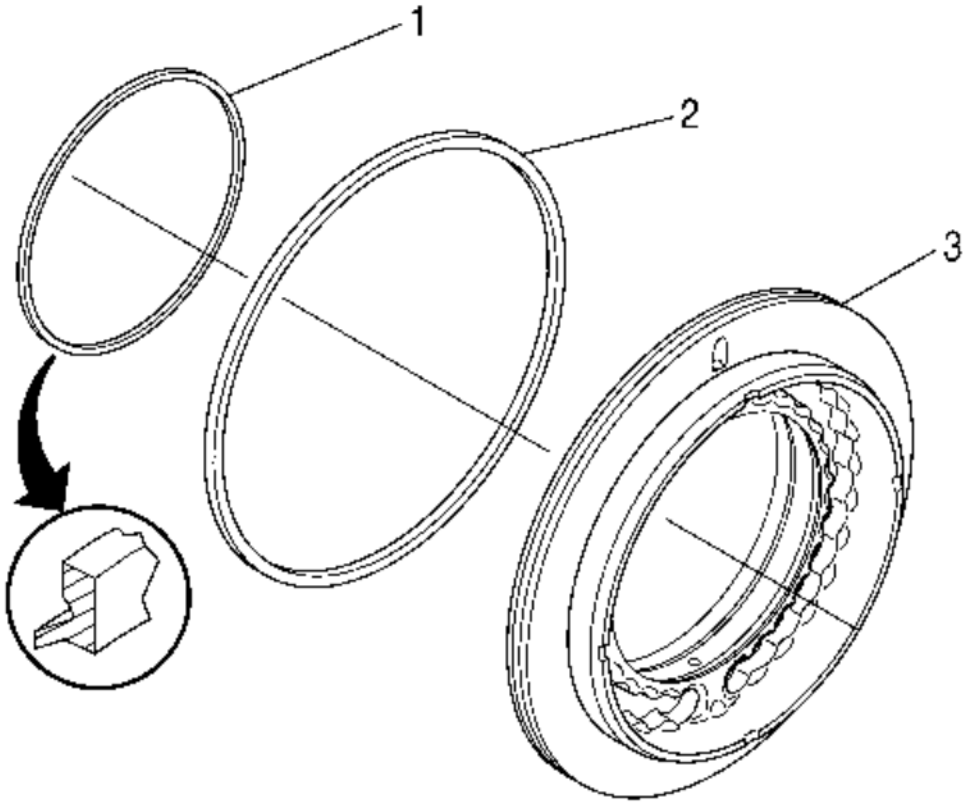


Fig. 275: Locating Clutch Piston Seal Rings
Courtesy of GENERAL MOTORS CORP.

29. Remove the seal rings (1 and 2) from the 1-2-3-4 clutch piston (3).

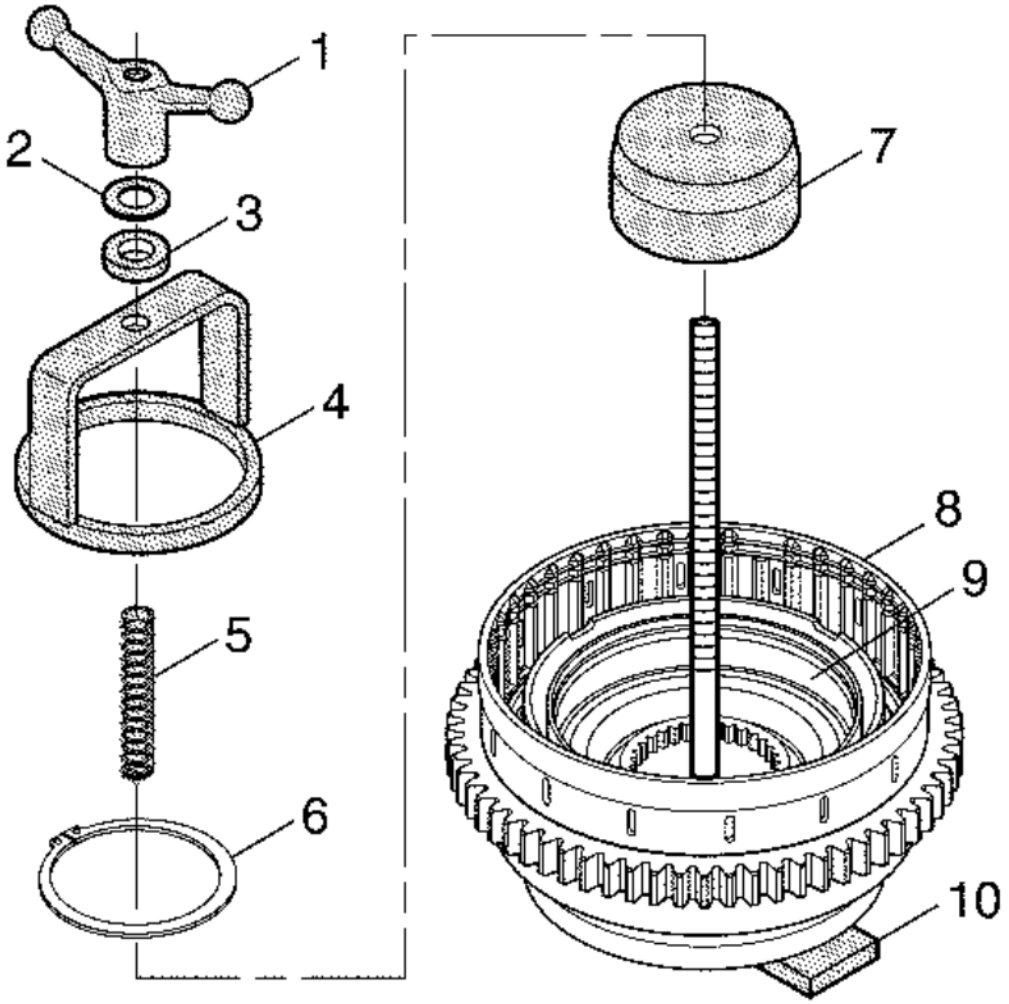


Fig. 276: 1-2-3-4-, 4-5-6 Clutch Housing & J 24204-2
Courtesy of GENERAL MOTORS CORP.

30. Position the 1-2-3-4, 4-5-6 clutch housing (8) on the base of **J 24204-2** (10) so that the rear of the housing is facing up. See **Special Tools**.
31. Align **J-47339-2** (7) so that the bowl is facing down. See **Special Tools**.
32. Install **J-47339-2** (7) onto the shaft of **J 24204-2** and onto the inner hub of the 1-2-3-4, 4-5-6 clutch housing (9). See **Special Tools**. Make sure the rim of **J-47339-2** (7) almost touches the retaining ring. See **Special Tools**.

33. Install the spring (5) of **J-47339-1** onto the shaft of **J 24204-2** . See **Special Tools**.
34. Install **J-47339-1** (4) onto the shaft of **J 24204-2** . See **Special Tools**.
35. Install the **J 24204-2** ball bearing (3) and washer (2) onto the shaft of **J 24204-2** . See **Special Tools**.
36. Install the **J 24204-2** wing nut (1) onto the shaft of **J 24204-2** . See **Special Tools**.
37. Compress the 4-5-6 clutch piston return spring assembly until the retaining ring (6) can be removed.
38. Remove the retaining ring (6) from the groove in the 1-2-3-4, 4-5-6 clutch housing inner hub and move the retaining ring over the top of **J-47339-2** (7). See **Special Tools**.
39. Remove all J tools from the 1-2-3-4, 4-5-6 clutch housing.
40. Remove the retaining ring (6) from the 1-2-3-4, 4-5-6 clutch housing.

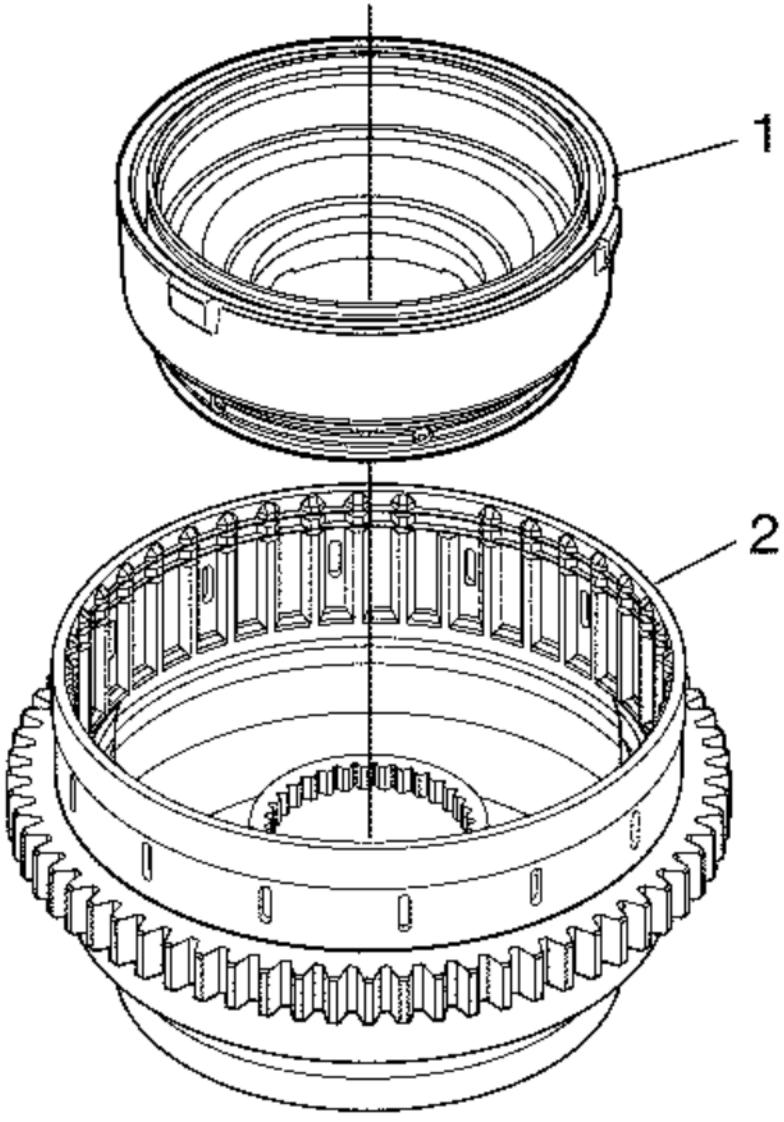


Fig. 277: Viewe Of Clutch Piston & Clutch Housing
Courtesy of GENERAL MOTORS CORP.

41. Remove the 1-2-3-4 clutch piston housing, the 4-5-6 piston return spring assembly, and the 4-5-6 clutch piston, as an assembly (1), from the 1-2-3-4, 4-5-6 clutch housing (3).

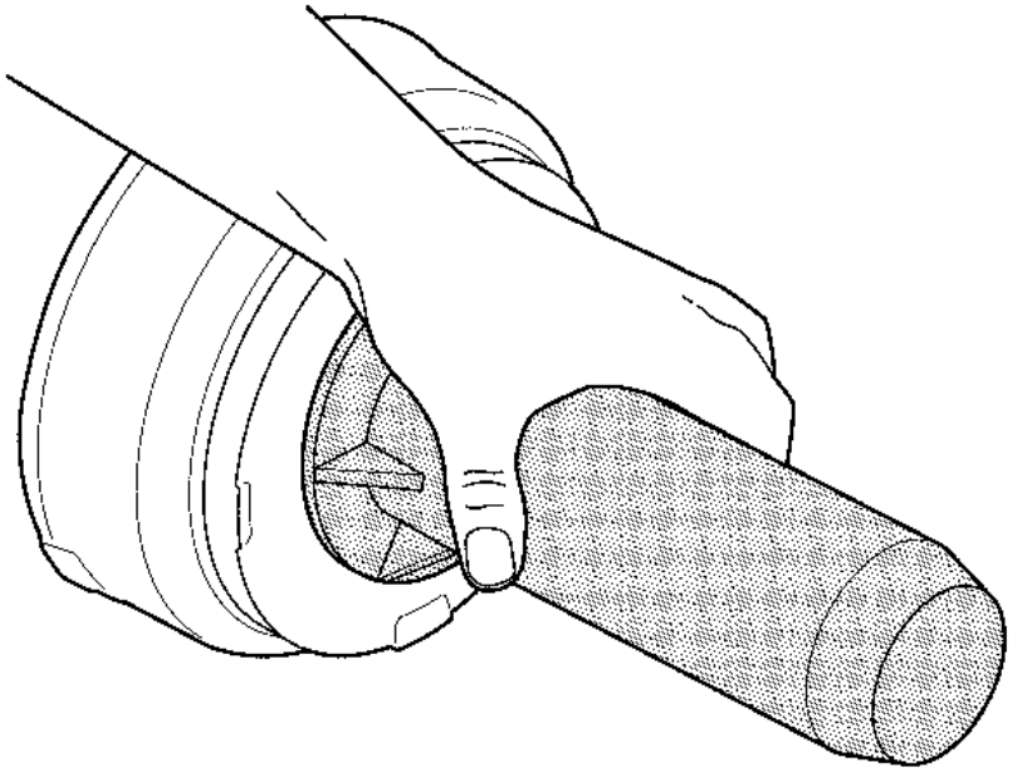


Fig. 278: Using J 43772 To Remove 1-2-3-4 Clutch Housing From 4-5-6 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

42. Position the 4-5-6 piston and 1-2-3-4 clutch housing horizontally on a work table.
43. Hold the 4-5-6 piston and 1-2-3-4 clutch housing, and place **J 43772** against the 1-2-3-4 clutch housing. See **Special Tools**.
44. Using a rubber mallet, gently tap on **J 43772** to remove the 1-2-3-4 clutch housing from the 4-5-6 clutch piston. See **Special Tools**.

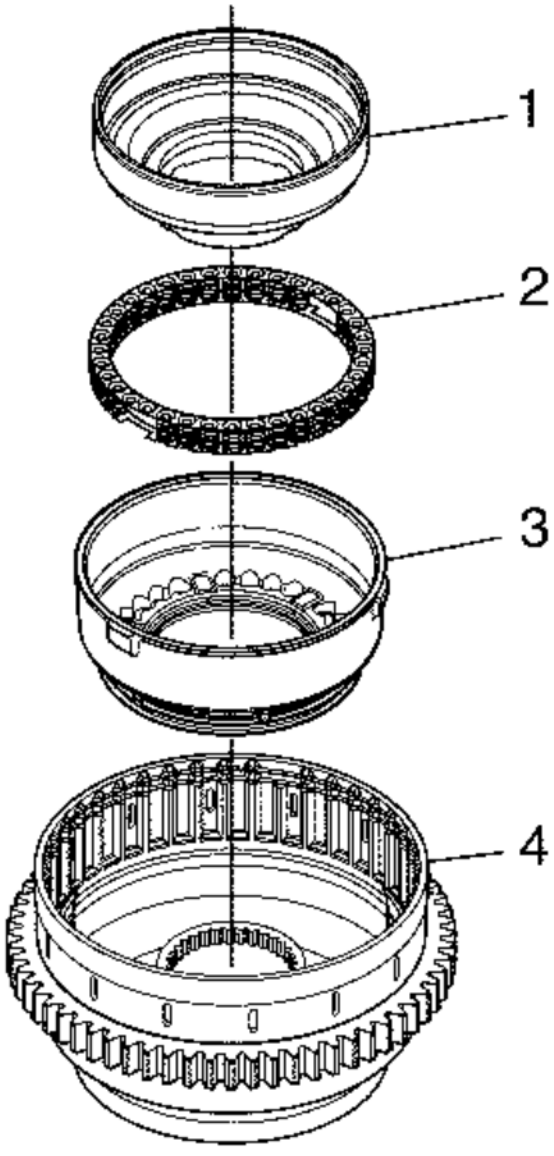


Fig. 279: 4-5-6 Clutch Piston Return Springs
Courtesy of GENERAL MOTORS CORP.

45. Remove the 4-5-6 clutch piston return springs (2) from the 4-5-6 clutch piston (3).

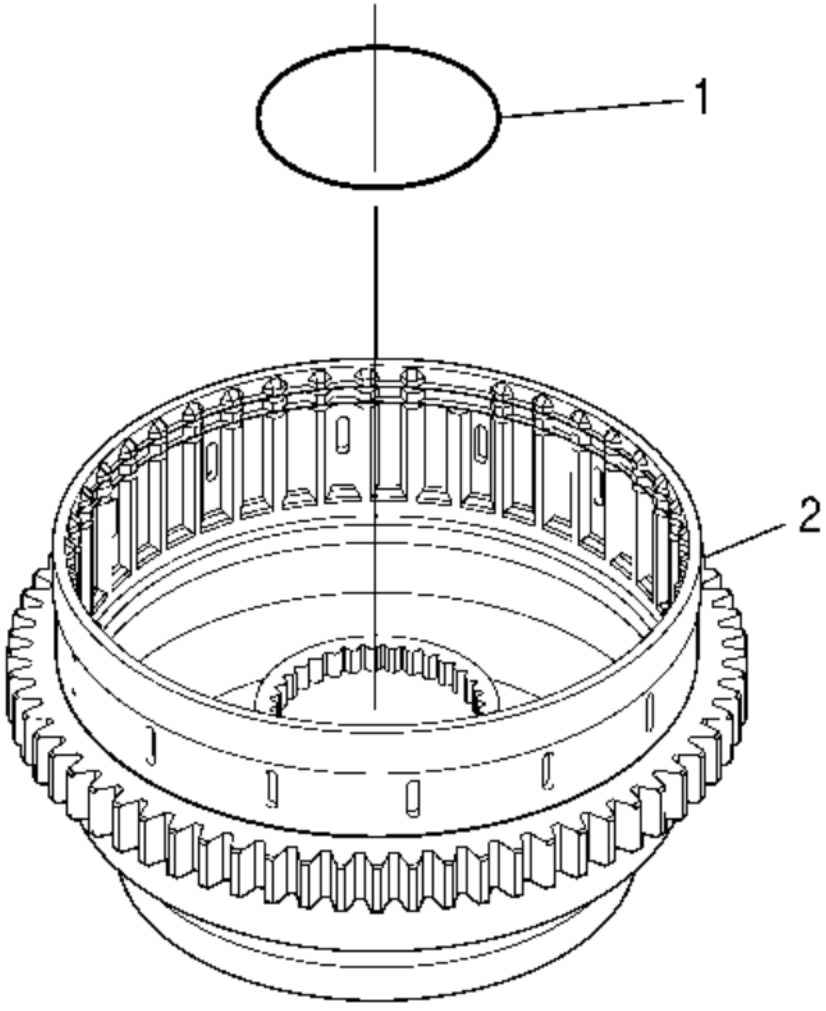


Fig. 280: View Of 1-2-3-4, 4-5 Clutch Housing Inner Hub O-Ring
Courtesy of GENERAL MOTORS CORP.

46. Remove the O-ring (1) from the inner hub of the 1-2-3-4, 4-5-6 clutch housing (2).

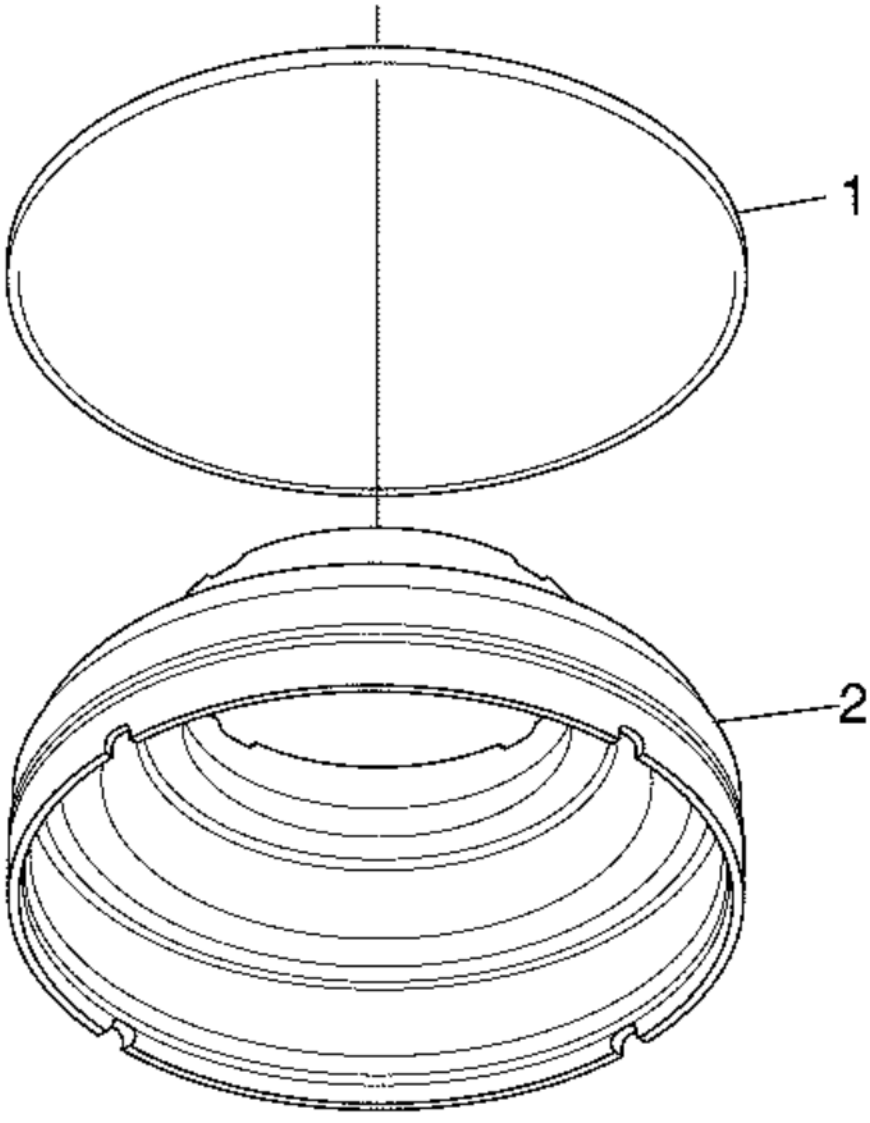


Fig. 281: 1-2-3-4 Clutch Piston Housing Seal Ring
Courtesy of GENERAL MOTORS CORP.

47. Remove the seal ring (1) from the 1-2-3-4 clutch housing (2).

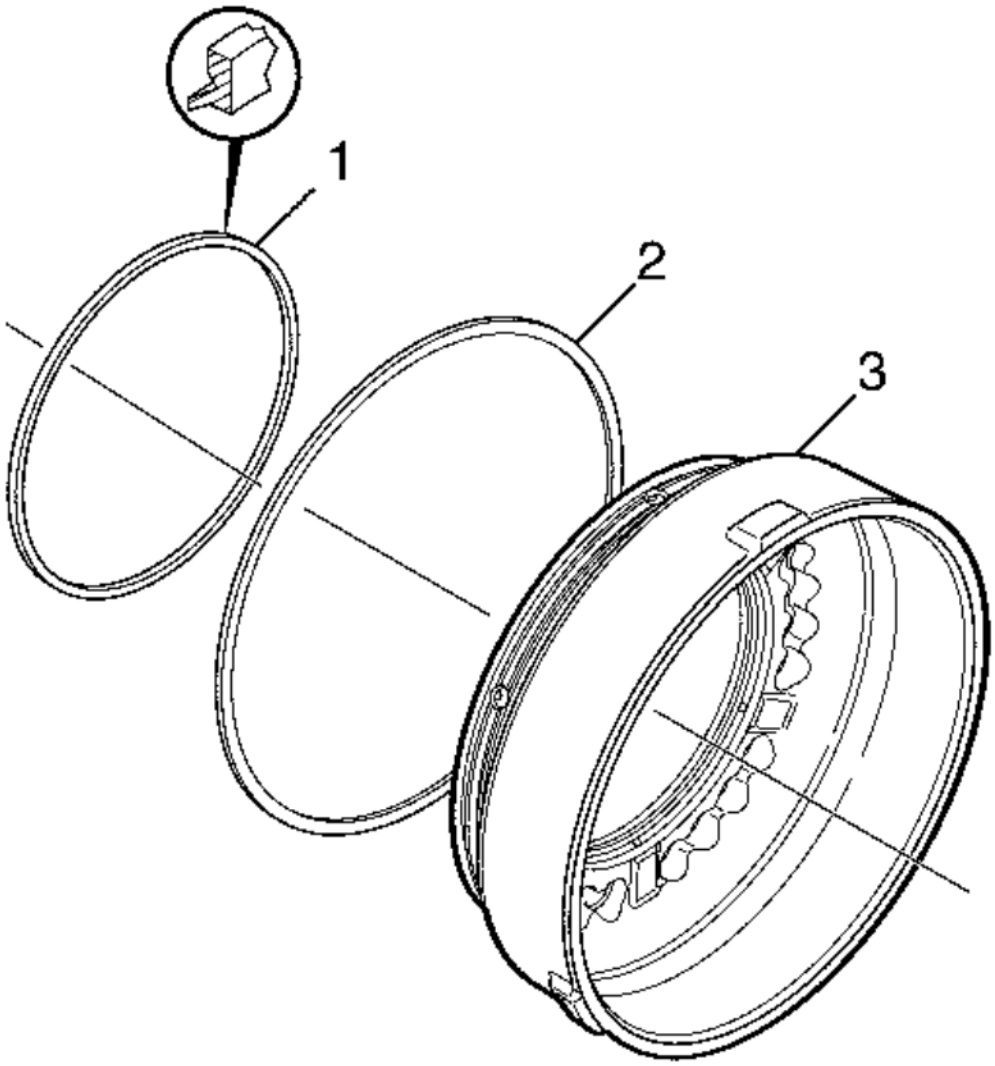


Fig. 282: Piston Seal Rings
Courtesy of GENERAL MOTORS CORP.

48. Remove the piston seal rings (1 and 2) from the 4-5-6 clutch piston (3).

TURBINE SHAFT BUSHING INSPECTION

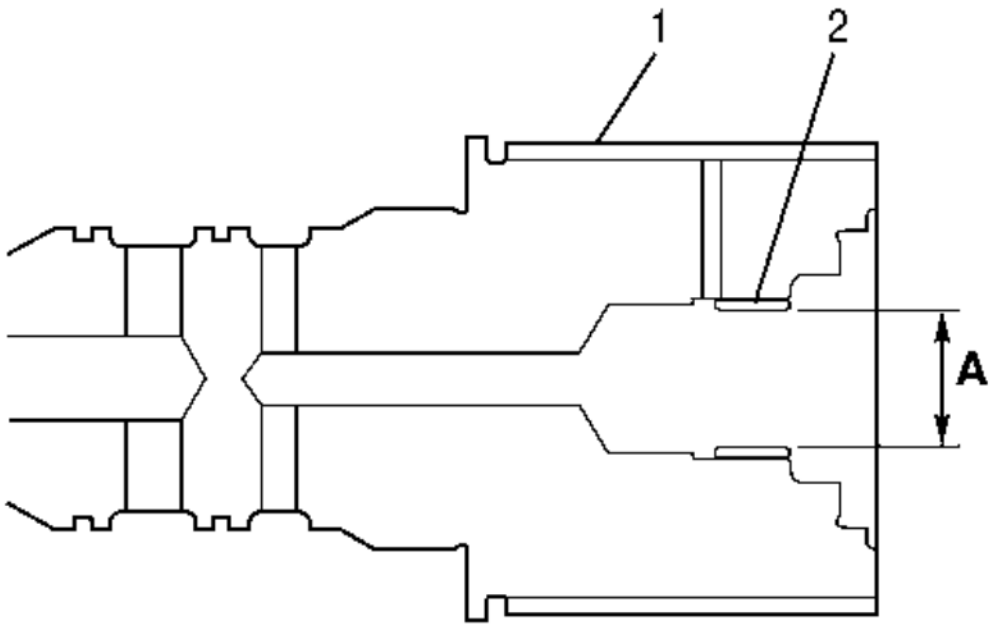


Fig. 283: View Of Turbine Shaft Bushing Measurements
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Replace the turbine shaft bushing if specifications are not met.

1. Inspect the bushing (2) inside the end of the turbine shaft (1) for damage.
2. Measure the inside diameter of the turbine shaft bushing at dimension A.

Specification: The maximum turbine shaft bushing ID is 20.117 mm (0.7920 in).

TURBINE SHAFT BUSHING REPLACEMENT

Tools Required

- **J 44526** Output/Turbine Shaft Bushing Remover. See **Special Tools**.
- **J 43791** Output/Turbine Shaft Bushing Installer. See **Special Tools**.

Removal Procedure

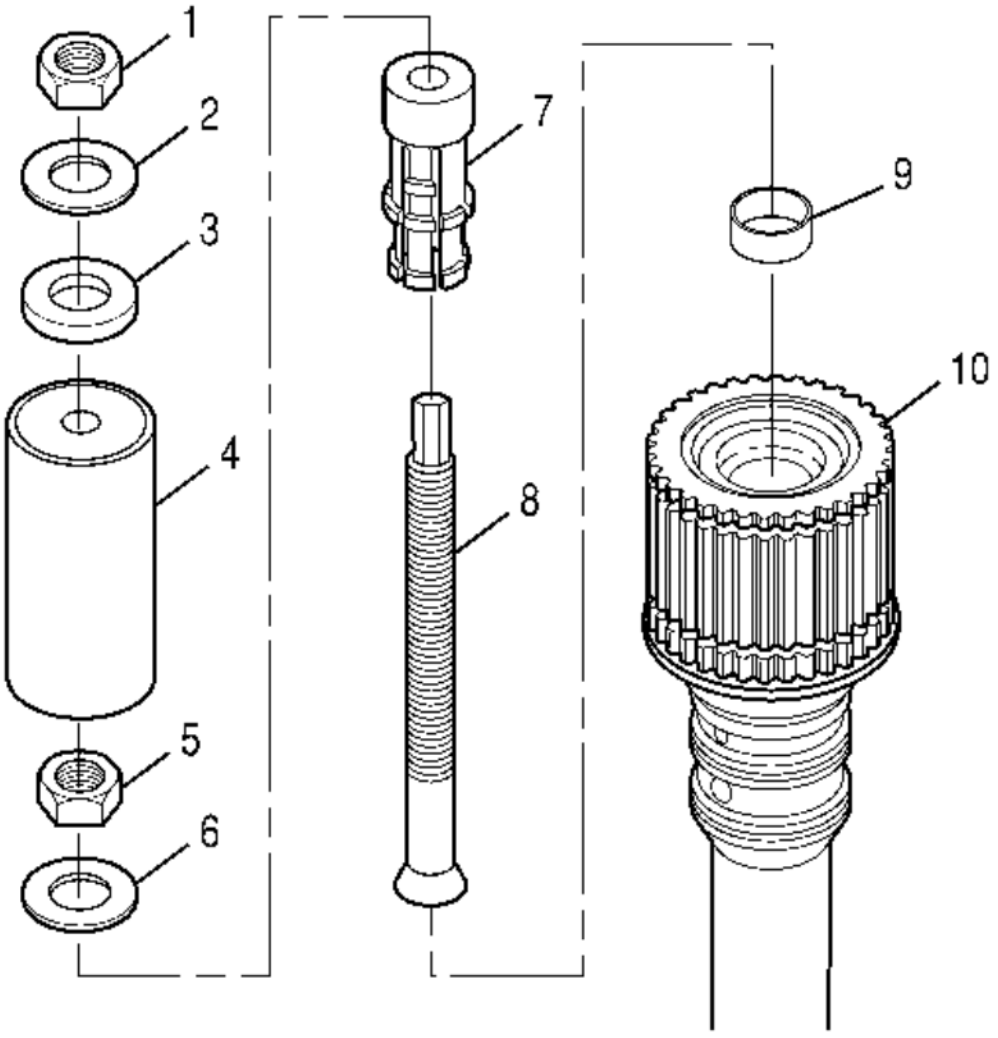


Fig. 284: Identifying Output/Turbine Shaft Bushing Remover Components
Courtesy of GENERAL MOTORS CORP.

1. Install J 44526-2 bolt (8) into J 44526-1 extractor (7).
2. Install J 44526-2 bolt (8) and J 44526-1 extractor (7) into the bushing (9).
3. Install the washer (6) and the nut (5) onto J 44526-2 bolt (8).

4. Hold the top of J 44526-2 bolt (8) with a wrench and tighten nut (5) until J 44526-1 extractor (7) engages the bushing (9).
5. Install J 44526-3 protector (4) onto J 44526-2 bolt (8).
6. Install bearing (3), washer (2), and nut (1) onto J 44526-2 bolt (8).
7. Hold the top of J 44526-2 bolt (8) with a wrench and tighten nut (1) until the bushing is dislodged.
8. Remove **J 44526** from the turbine shaft. See **Special Tools**.

Installation Procedure

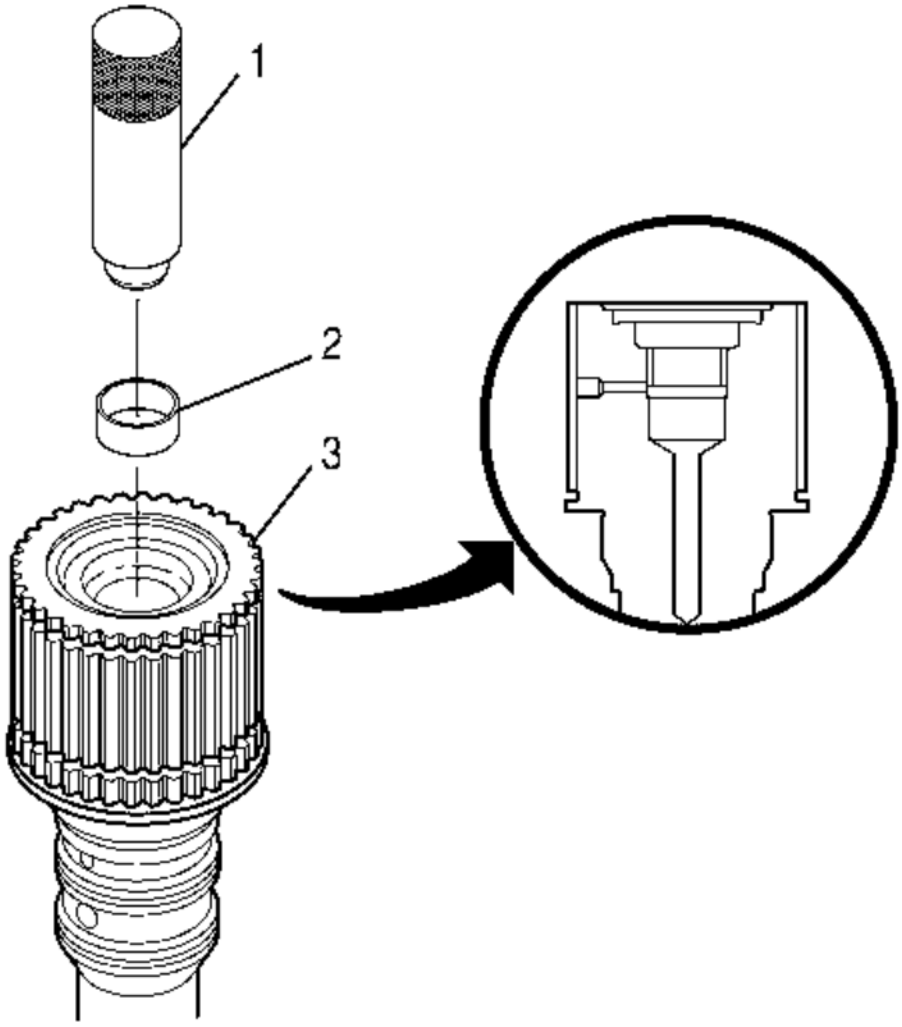


Fig. 285: Cross Sectional View Of Proper Turbine Shaft Bushing Installation
Courtesy of GENERAL MOTORS CORP.

1. Install a new bushing (2) onto **J 43791** (1). See **Special Tools**.
2. Drive the bushing into turbine shaft (3) until the bushing is seated to specifications.

Specification: The bushing installed depth measurement is flush to 0.25 mm (0.010 in) below the inner turbine shaft surface.

1-2-3-4-5-6 CLUTCH PISTON HOUSING INSPECTION

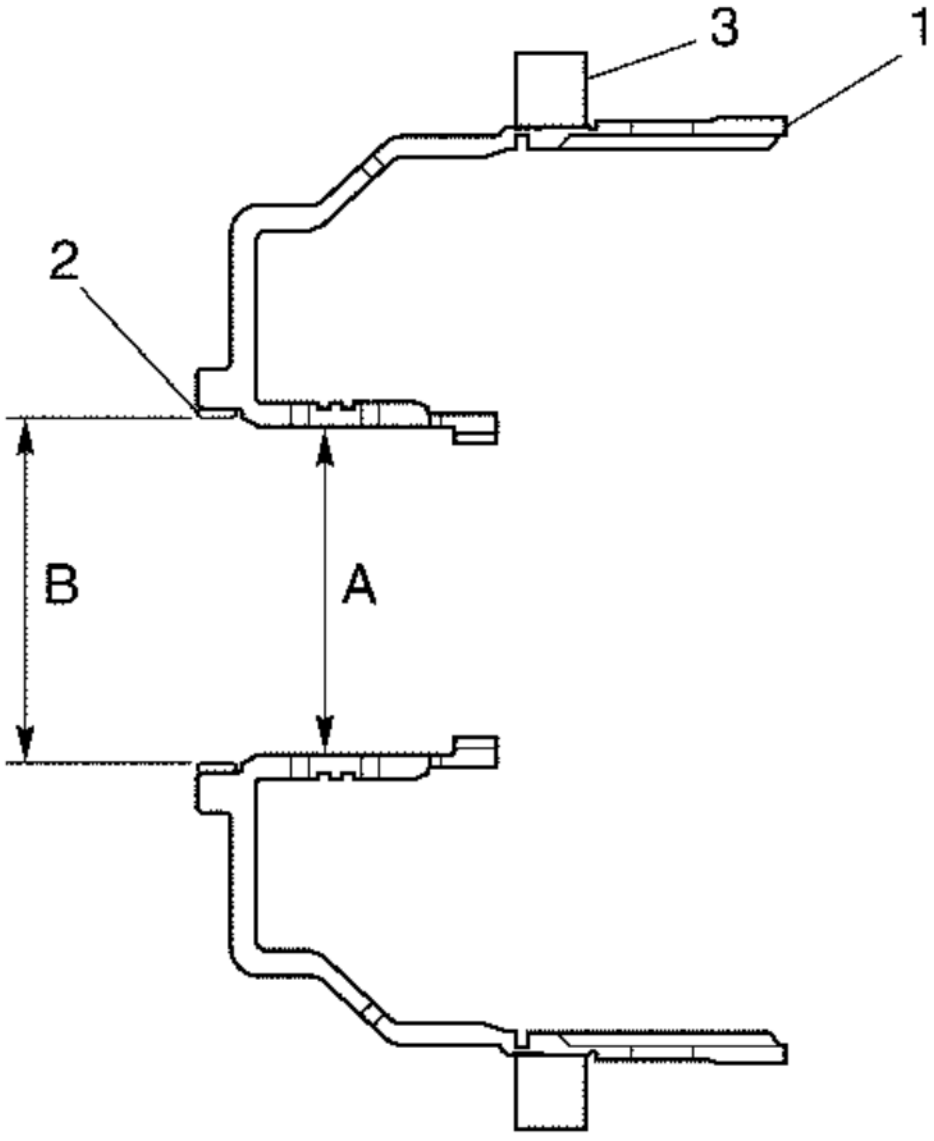


Fig. 286: Measuring Inside Diameter Of 1-2-3-4, 4-5-6 Clutch Seal Bore
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The power take-off (PTO) gears are permanently staked to the

1-2-3-4, 4-5-6 clutch housing and are not serviceable. Turbine tone wheels are serviceable.
Inspect the turbine tone wheel or PTO gear (3) for damage. Make sure a tone wheel is not dented or out-of-round.

1. If the PTO gear is damaged, replace the 1-2-3-4, 4-5-6 clutch housing. If the tone wheel is damaged, replace the tone wheel.
2. Measure the inside diameter (ID) of the 1-2-3-4, 4-5-6 clutch seal bore in the 1-2-3-4, 4-5-6 clutch housing (1) at dimension A.

   Replace the 1-2-3-4, 4-5-6 clutch housing (1) if the measurement exceeds the specification.

   Specification: The 1-2-3-4, 4-5-6 clutch seal bore maximum ID is 74.05 mm (2.9154 in)

IMPORTANT: Replace the 1-2-3-4, 4-5-6 clutch housing bushing if the bushing is damaged or the specifications are not met.

3. Inspect the bushing (2) inside the front of the 1-2-3-4, 4-5-6 clutch housing (1) for damage.
4. Measure the ID of the bushing at dimension B.

   Replace the bushing if the measurement exceeds the specification.

   Specification: The 1-2-3-4, 4-5-6 clutch housing bushing maximum ID is 78.17 mm (3.0776 in).

1-2-3-4 AND 4-5-6 CLUTCH HOUSING BUSHING REPLACEMENT

Tools Required

- **J 43778** Clutch Bushing Installer. See **Special Tools**.
- **J 8092** Universal Driver

Removal Procedure

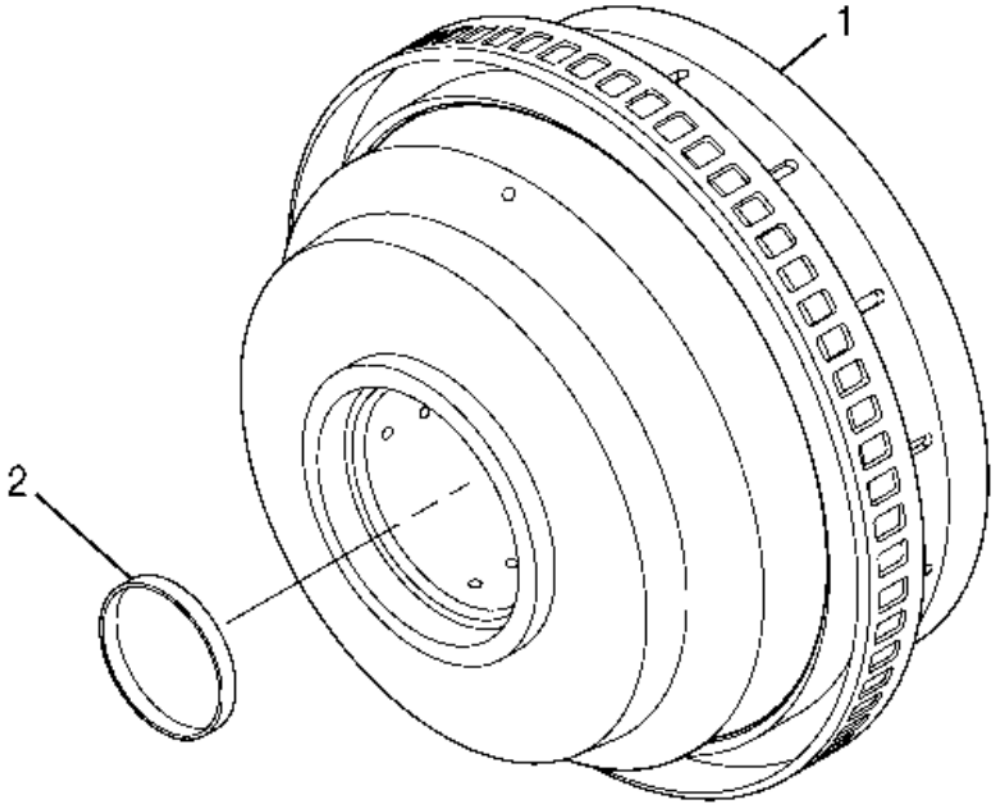


Fig. 287: View Of 1-2-3-4, 4-5 Clutch Housing Bushing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT score the 1-2-3-4, 4-5-6 clutch housing bore when removing the clutch housing bushing.

1. Gently tap the bushing through the inside of the 1-2-3-4, 4-5-6 clutch housing until the bushing becomes dislodged.
2. Remove the bushing (2) from the 1-2-3-4, 4-5-6 clutch housing (1).
3. Remove any nicks or burrs with a crocus cloth.

Installation Procedure

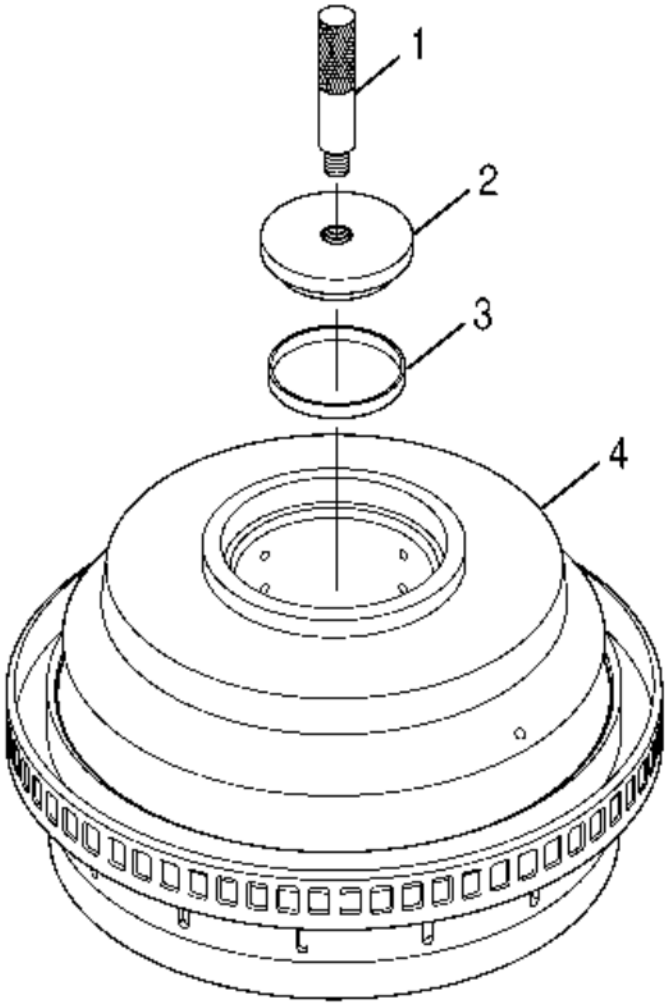


Fig. 288: Installing 1-2-3-4, 4-5 Clutch Housing Bushing
Courtesy of GENERAL MOTORS CORP.

1. Position the 1-2-3-4, 4-5-6 clutch housing (4) on a press so that the front of the housing is facing up.

IMPORTANT: The preferred method for installing the 1-2-3-4, 4-5-6 clutch housing bushing is to use the J 43778 and a press. See Special Tools. If a press is not available, use the J 43778 and

the J 8092 . See Special Tools.

2. If the bushing will be installed without a press, install the large end of **J 43778** (2) onto **J 8092** (1). See **Special Tools**.
3. Install a new bushing (3) onto **J 43778** (2). See **Special Tools**.
4. Using **J 8092** , press or drive the new bushing into the clutch housing.

   Specification: The bushing depth measurement is flush to 0.25 mm (0.01 in) below the 1-2-3-4, 4-5-6 clutch housing surface.

1-2-3-4 AND 4-5-6 CLUTCH HOUSING RELUCTOR WHEEL REPLACEMENT

Tools Required

- **J 43767** Tone Wheel Staker. See **Special Tools**.
- **J 43768** Tone Wheel Driver. See **Special Tools**.

Removal Procedure

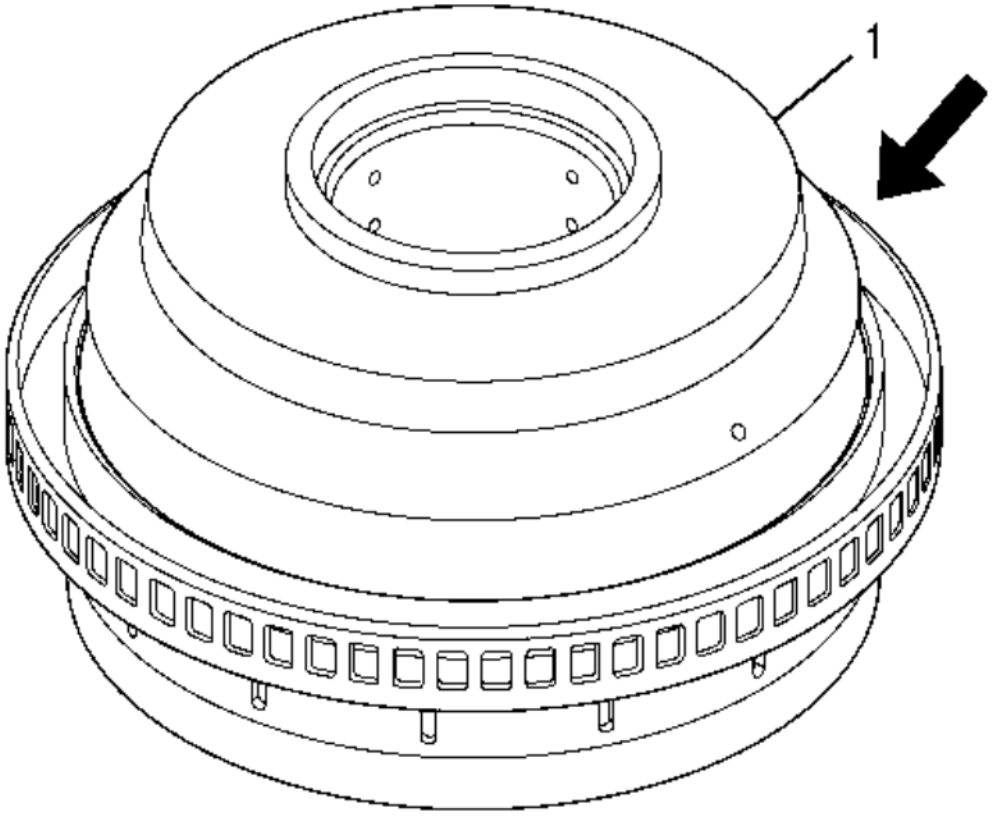


Fig. 289: Identifying Stakes On 1-2-3-4, 4-5 Clutch Housing
Courtesy of GENERAL MOTORS CORP.

1. Grind the stakes from the 1-2-3-4, 4-5-6 clutch housing (1).

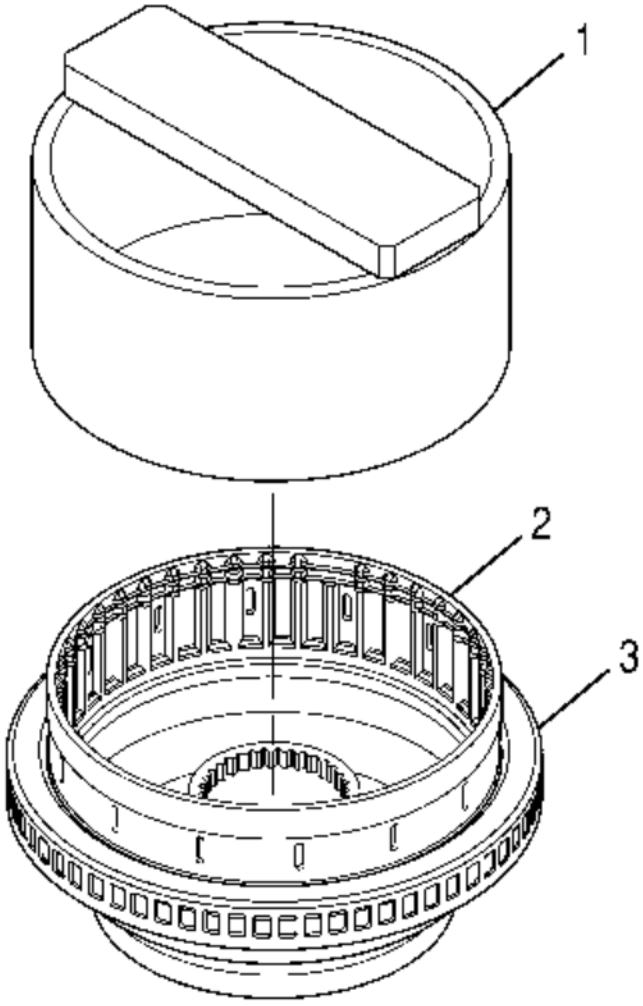


Fig. 290: Removing 1-2-3-4, 4-5 Clutch Housing Tone Wheel
Courtesy of GENERAL MOTORS CORP.

2. Position the 1-2-3-4, 4-5-6 clutch housing (2) on a press so that the front of the housing is down.
3. Install **J 43768** (1) onto the tone wheel (3). See **Special Tools**.
4. Using **J 43768** (1), press the tone wheel (3) from the 1-2-3-4, 4-5-6 clutch housing (2). See **Special Tools**.

Installation Procedure

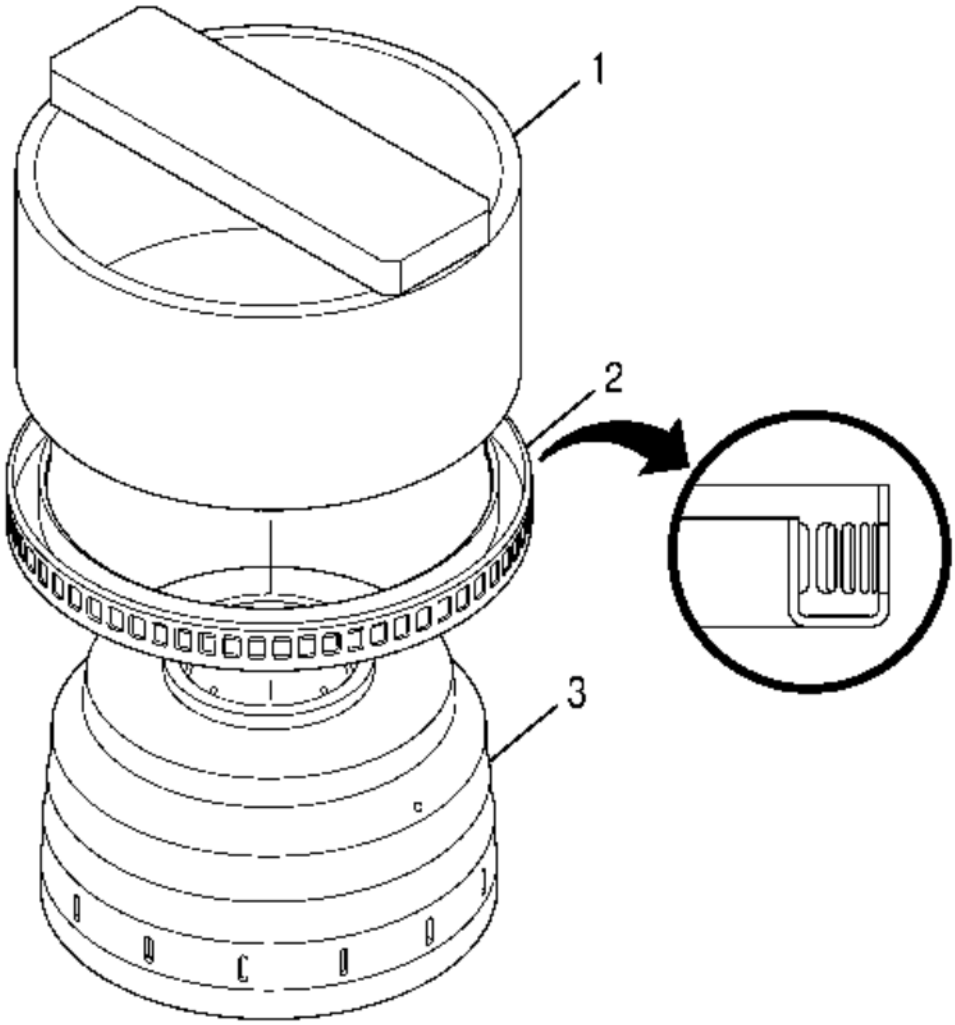


Fig. 291: Installing Tone Wheel Onto 1-2-3-4, 4-5 Clutch Housing
Courtesy of GENERAL MOTORS CORP.

1. Position the 1-2-3-4, 4-5-6 clutch housing (3) on a press so that the front of the housing is facing up.
2. Align the tone wheel (2) so that the outside edge is facing up.
3. Install the tone wheel (2) onto the 1-2-3-4, 4-5-6 clutch housing.

4. Install **J 43768** (1) onto the tone wheel. See **Special Tools**.
5. Using **J 43768** (1), press the tone wheel onto the 1-2-3-4, 4-5-6 clutch housing. See **Special Tools**.

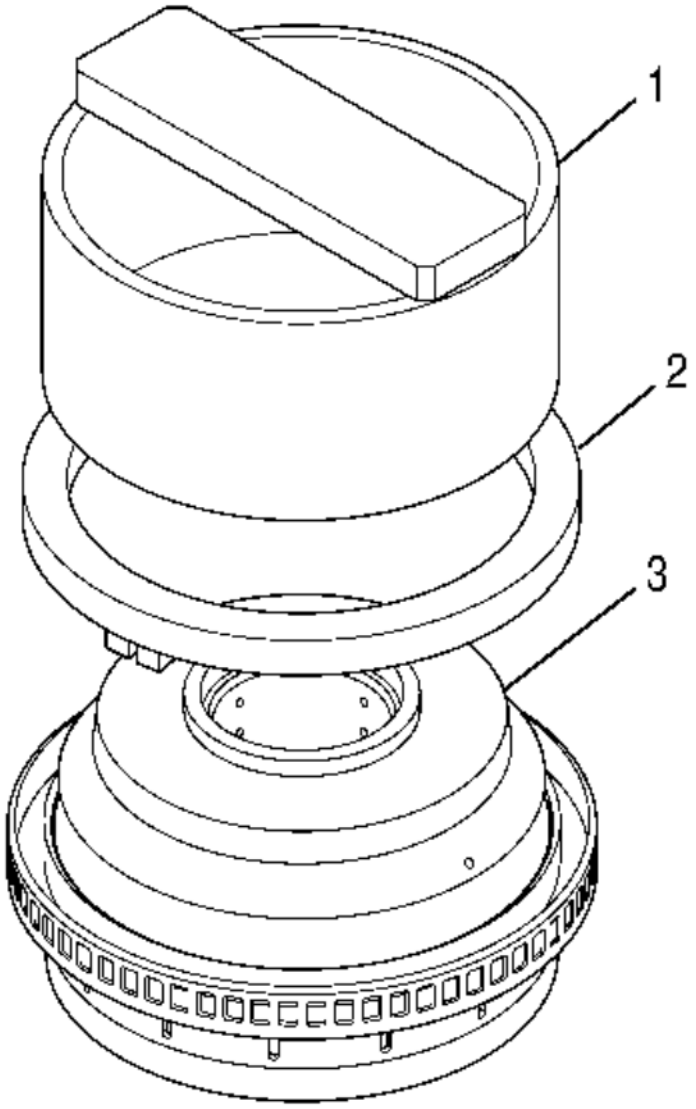


Fig. 292: Staking 1-2-3-4, 4-5 Clutch Housing
Courtesy of GENERAL MOTORS CORP.

6. Locate 4 positions on the 1-2-3-4, 4-5-6 clutch housing (3), 90 degrees apart from each other, that have not been previously staked.
7. Install **J 43767** onto the 1-2-3-4, 4-5-6 clutch housing with the 2 staking prongs at 2 of the 4 staking positions. See **Special Tools**.
8. Install **J 43768** (1) onto **J 43767** (2). See **Special Tools**.

NOTE: Stake the tone wheel to 9 tons. The accuracy of the pressure gauges on presses varies. Start at a lower pressure and increase to 9 tons. Too great a pressure will distort the tone wheel. Too little pressure will result in stakes that will not hold.

9. Stake the tone wheel to the 1-2-3-4, 4-5-6 clutch housing.

IMPORTANT: If necessary, tap J 43768 and J 43767 to remove the tools from the 1-2-3-4, 4-5-6 clutch housing. See Special Tools.

10. Remove the J tools and repeat steps 7-9 at the remaining 2 staking positions.
11. Remove the J tools.

1-2-3-4 CLUTCH FIBER PLATE INSPECTION

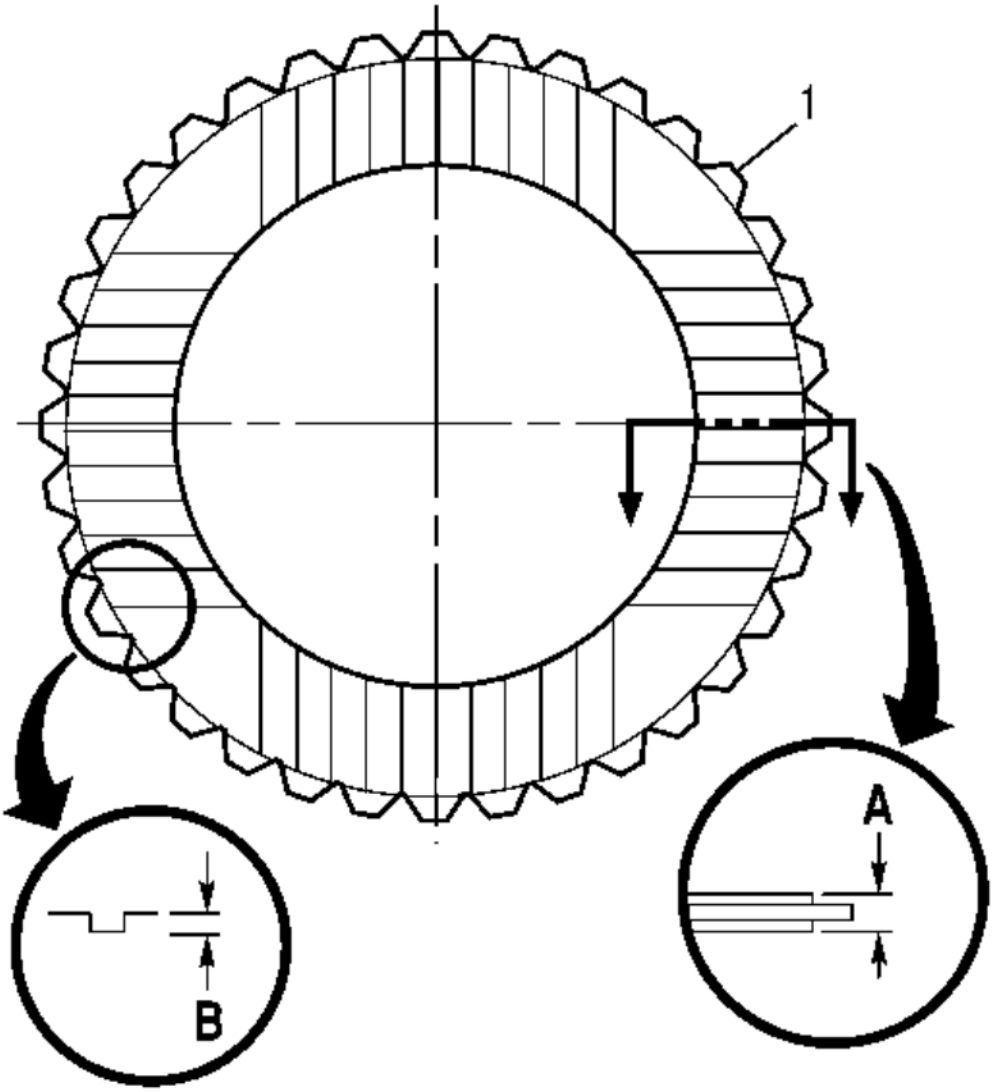


Fig. 293: Checking Thickness & Oil Groove Depth On 1-2-3-4 Clutch Fiber Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Measure as described below at a minimum of 3 locations.**
- **Replace any 1-2-3-4 clutch fiber plate that does not meet specifications.**

1. Measure the thickness of each 1-2-3-4 clutch fiber plate (1) at dimension A.

   Specification: The 1-2-3-4 clutch friction plate minimum thickness is 2.375 mm (0.093 in).

2. Measure the oil groove depth of each plate at dimension B.

   Specification: The oil groove minimum depth is 0.200 mm (0.0079 in).

IMPORTANT: Check the plates for coning on a level surface.

3. Measure the cone of each plate (1) at dimension A.

   Friction Plate Cone: The fiber plate maximum cone is 0.255 mm (0.010 in).

1-2-3-4 CLUTCH STEEL PLATE INSPECTION

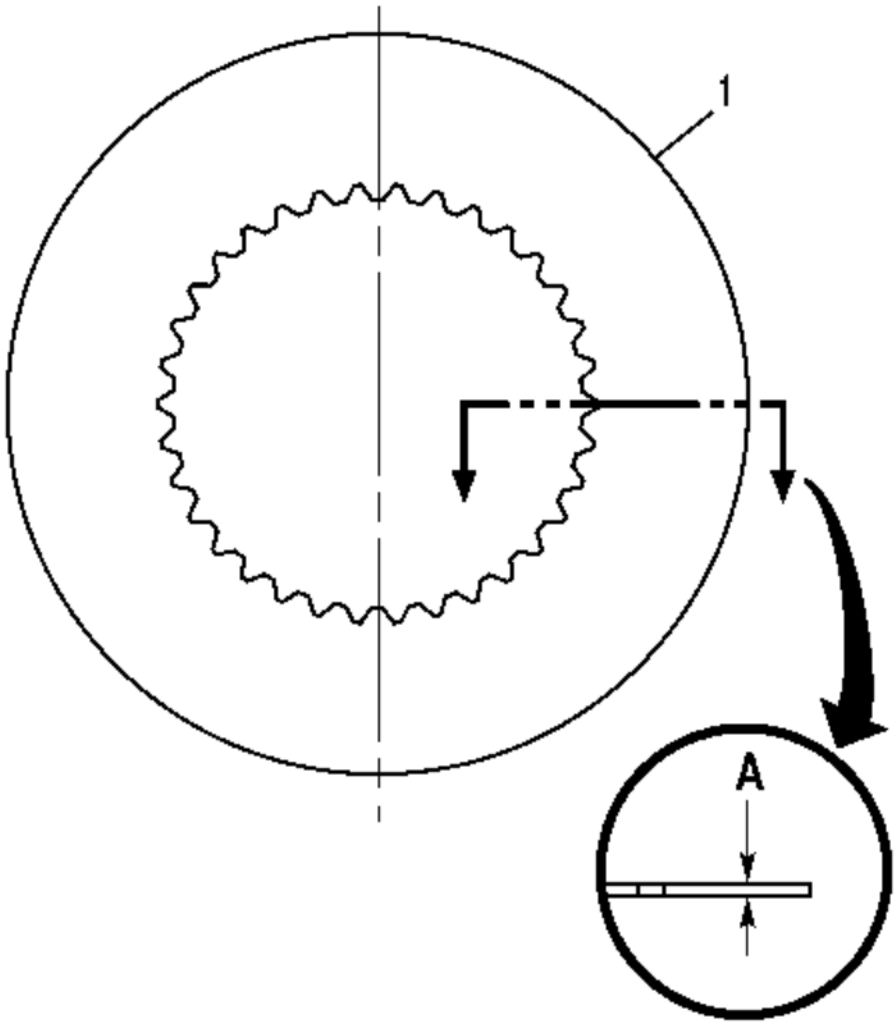


Fig. 294: Inspecting Thickness Of 1-2-3-4 Steel Clutch Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Measure as described below at a minimum of 3 locations.**
- **Replace any 1-2-3-4 clutch steel plate that does not meet specifications.**

1. Measure the thickness of each 1-2-3-4 clutch steel plate (1) at dimension A.

   Specification: The 1-2-3-4 clutch steel plate minimum thickness is 2.135 mm (0.084 in).

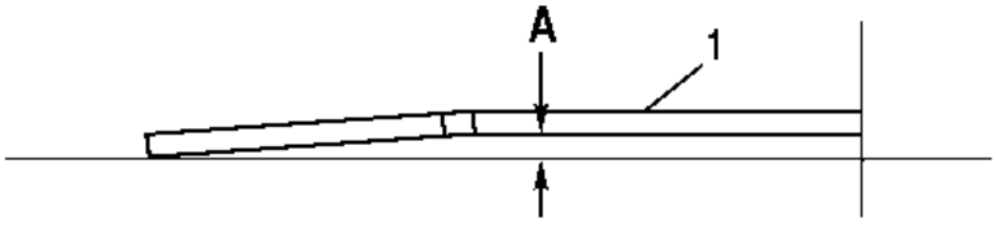


Fig. 295: Checking Cone On Steel Clutch Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Check the plates for coning on a level surface.

2. Measure the cone of each plate (1) at dimension A.

   Specification: The 1-2-3-4 clutch steel plate maximum cone is 0.200 mm (0.0079 in).

1-2-3-4 CLUTCH BACKING PLATE INSPECTION

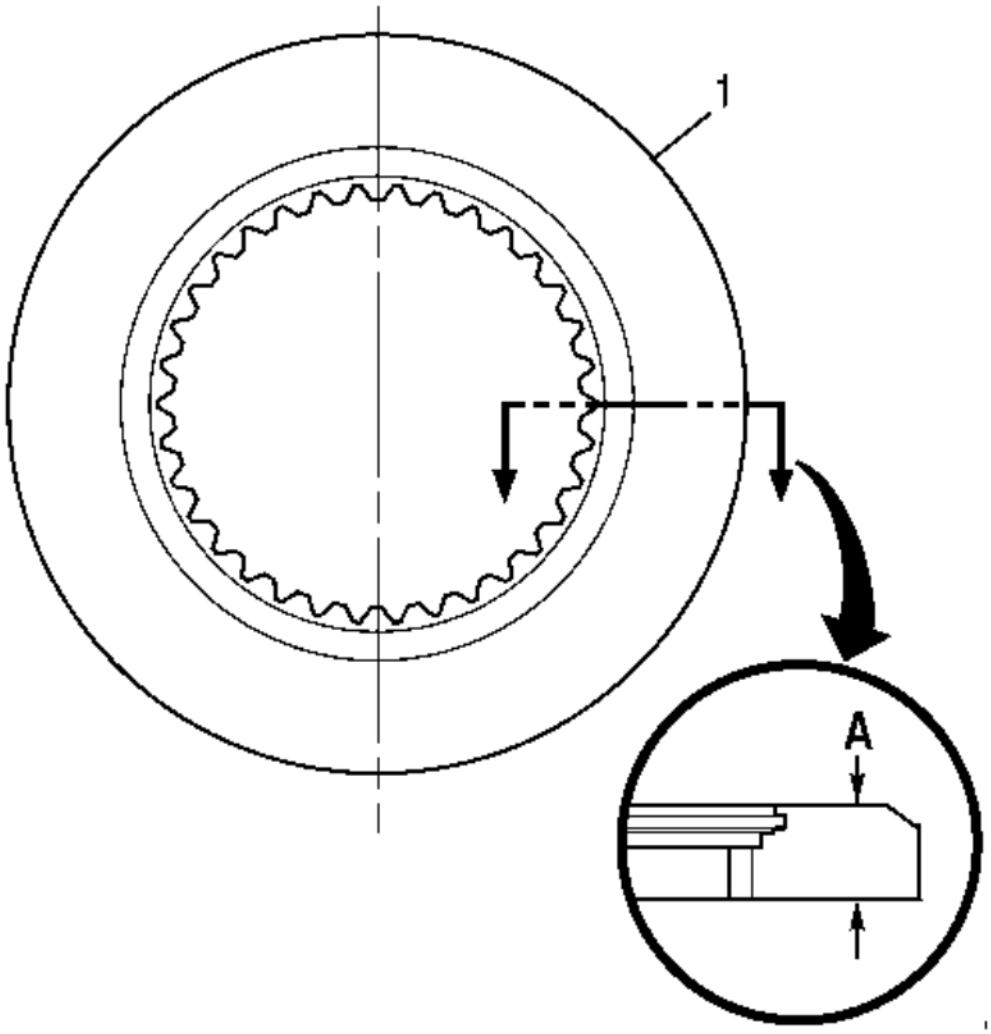


Fig. 296: Measuring Wear Surface Thickness On 1-2-3-4 Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Measure as described below at a minimum of 3 locations. Replace the 1-2-3-4 clutch backing plate if the specifications are not met.

1. Measure the wear surface thickness of the 1-2-3-4 clutch backing plate (1) at dimension A

for minimum thickness.

2. Refer to the 1-2-3-4 clutch backing plate table in **Selective Components Specifications** for the correct size backing plate.

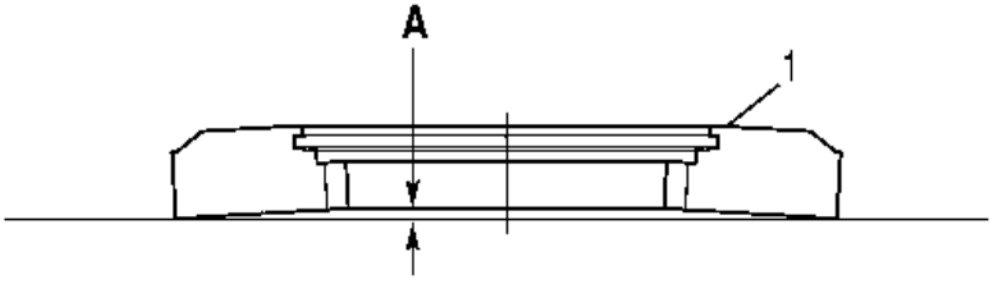


Fig. 297: Measuring Cone Of 1-2-3-4 Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Check the backing plate for coning on a level surface.

3. Measure the cone of the 1-2-3-4 clutch backing plate (1) at dimension A.
4. Replace the backing plate (1) if any cone is measured.

1-2-3-4 CLUTCH PISTON INSPECTION

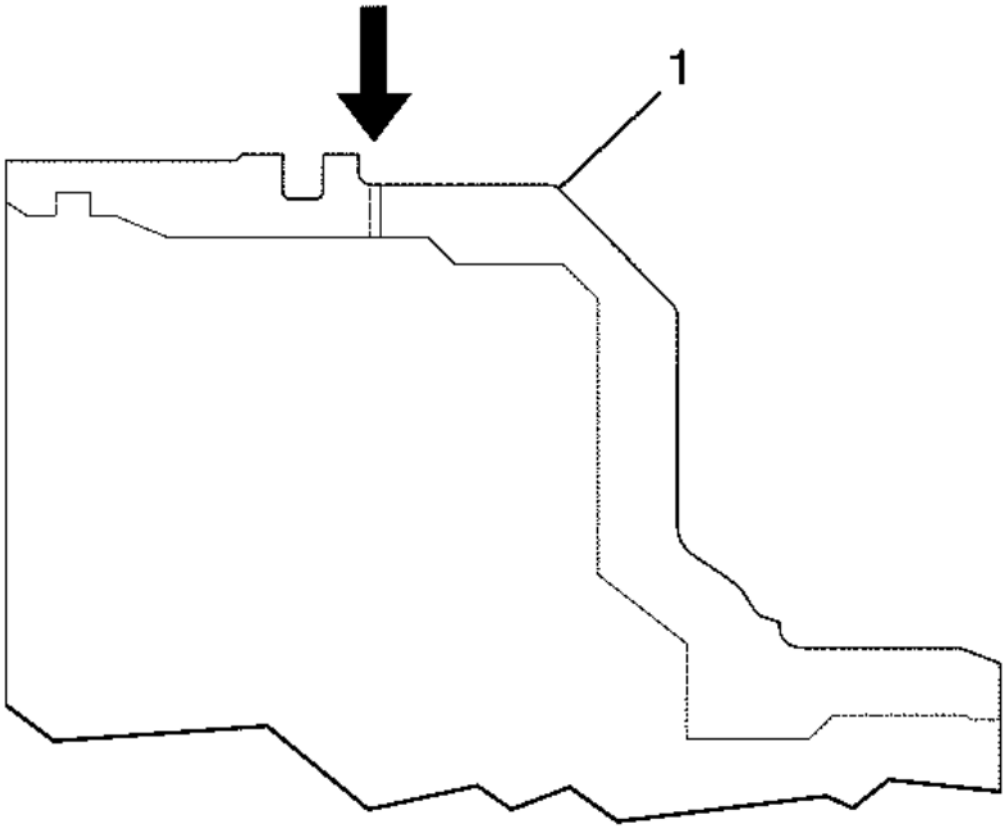


Fig. 298: Locating Orifice
Courtesy of GENERAL MOTORS CORP.

1. Inspect 1-2-3-4 clutch piston (1) for damage. Replace the piston if damage is present.
2. Make sure that the orifice in the 1-2-3-4 clutch piston is not restricted. Clean any debris that is restricting the orifice.
3. Measure the orifice in the 1-2-3-4 clutch piston for the specified size. Replace the piston if the specification is not met.

Specification: The 1-2-3-4 clutch piston orifice size is 0.85-1.15 mm (0.033-0.045 in).

1-2-3-4 CLUTCH PISTON HOUSING INSPECTION

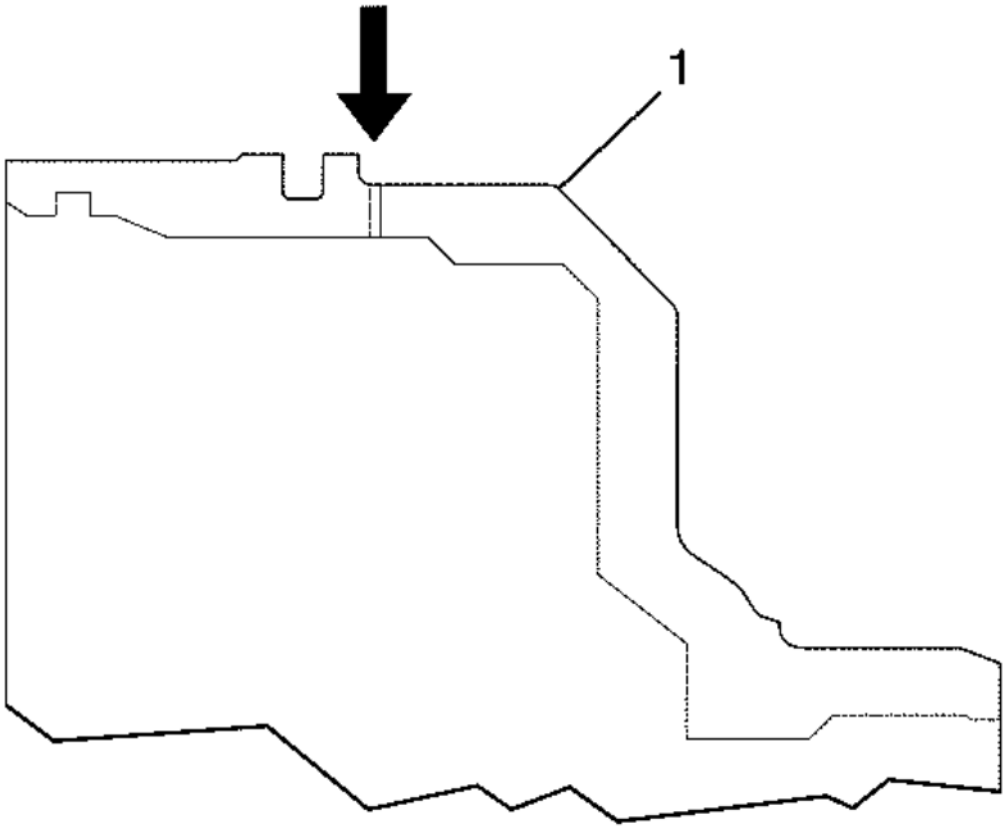


Fig. 299: Locating Orifice
Courtesy of GENERAL MOTORS CORP.

1. Inspect the 1-2-3-4 clutch housing (1) for damage. Replace the housing if damage is present.
2. Make sure that the orifice in the 1-2-3-4 clutch housing is not restricted. Clean any debris that is restricting the orifice.
3. Measure the orifice in the 1-2-3-4 clutch housing for the specified size. Replace the housing if the specification is not met.

Specification: The 1-2-3-4 clutch housing orifice size is 0.85-1.15 mm (0.033-0.045 in).

FIBER 4-5-6 CLUTCH PLATE INSPECTION

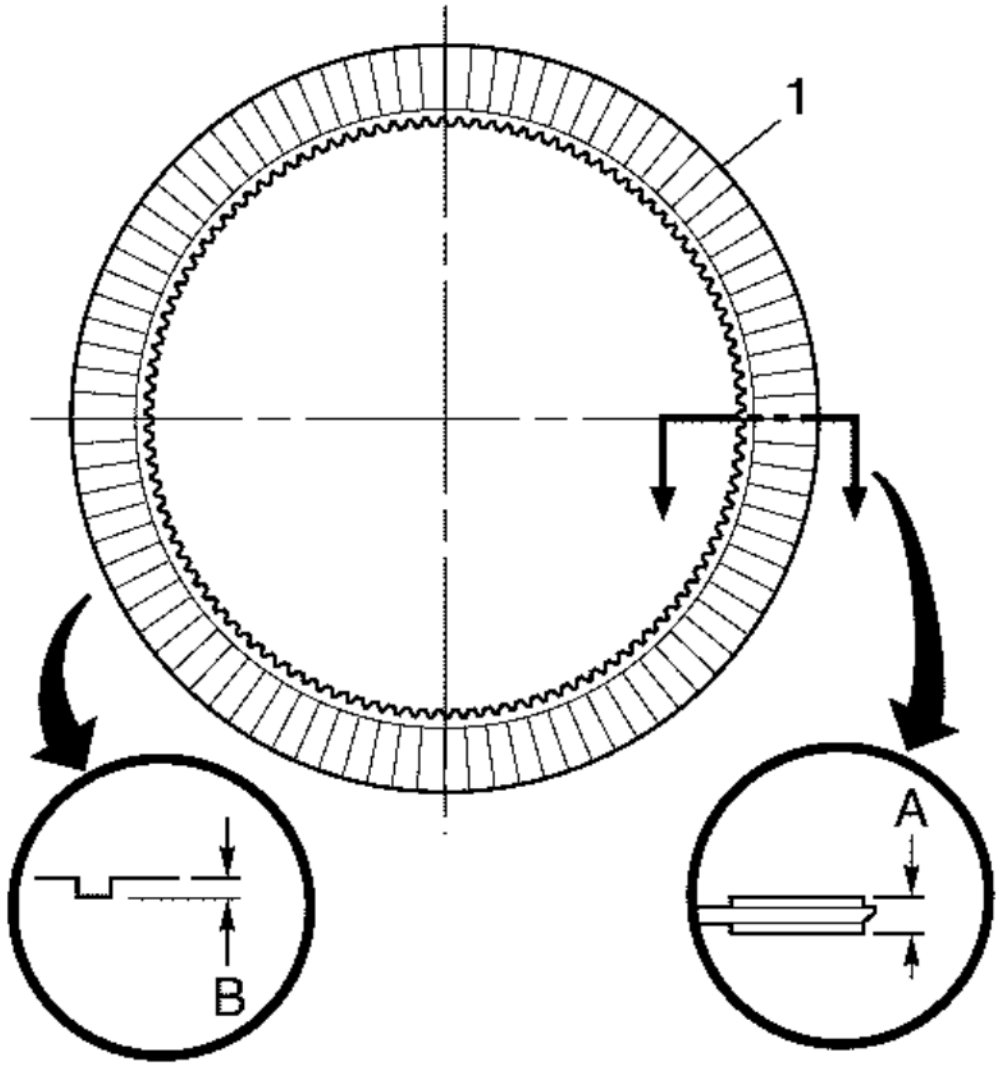


Fig. 300: Identifying Fiber Clutch Plate Measurement Locations
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Measure as described below at a minimum of 3 locations.**
- **Replace any 4-5-6 clutch fiber plate that does not meet specifications.**

1. Measure the thickness of each 4-5-6 clutch fiber plate (1) at dimension A.

   Specification: The 4-5-6 clutch fiber plate minimum thickness is 2.375 mm (0.0935 in).

2. Measure the 4-5-6 clutch fiber plate oil groove depth of each plate at dimension B.

   Specification: The 4-5-6 clutch fiber plate minimum groove depth is 0.200 mm (0.0079 in).

STEEL 4-5-6 CLUTCH PLATE INSPECTION

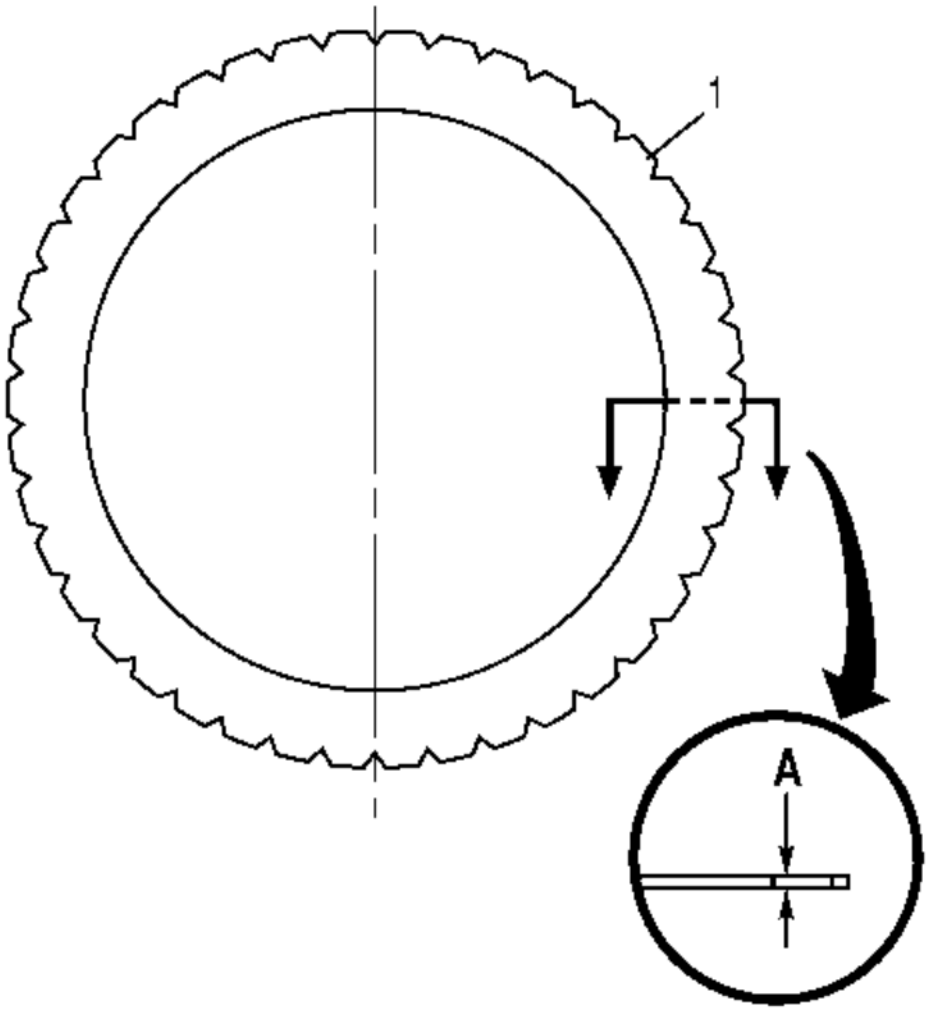


Fig. 301: Measuring Thickness Of 4-5 Clutch Steel Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Measure as described below at a minimum of 3 locations.**
- **Replace any 4-5-6 clutch steel plate that does not meet specifications.**

1. Measure the thickness of each 4-5-6 clutch steel plate (1) at dimension A.

   Specification: The 4-5-6 clutch steel plate minimum thickness is 2.135 mm (0.0841 in).

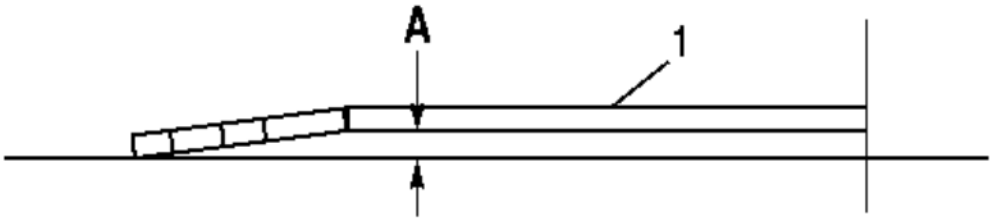


Fig. 302: Measuring Cone Of Clutch Steel Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Check the steel plates for coning on a level surface.

2. Measure the cone of each 4-5-6 clutch steel plate (1) at dimension A.

   Specification: The 4-5-6 clutch steel plate maximum cone is 0.240 mm (0.0094 in).

1-2-3-4-5-6 CLUTCH PISTON HOUSING ASSEMBLE

Tools Required

- **J 24204-2** Bar and Stud Assembly. See **Special Tools**.
- **J 36850** Transjel® Lubricant. See **Special Tools**.
- **J 44525** Clutch Backing Plate Selector. See **Special Tools**.
- **J-47339-1** Piston Return Spring Compressor. See **Special Tools**.
- **J-47339-2** Seal Area Protector. See **Special Tools**.

Assemble

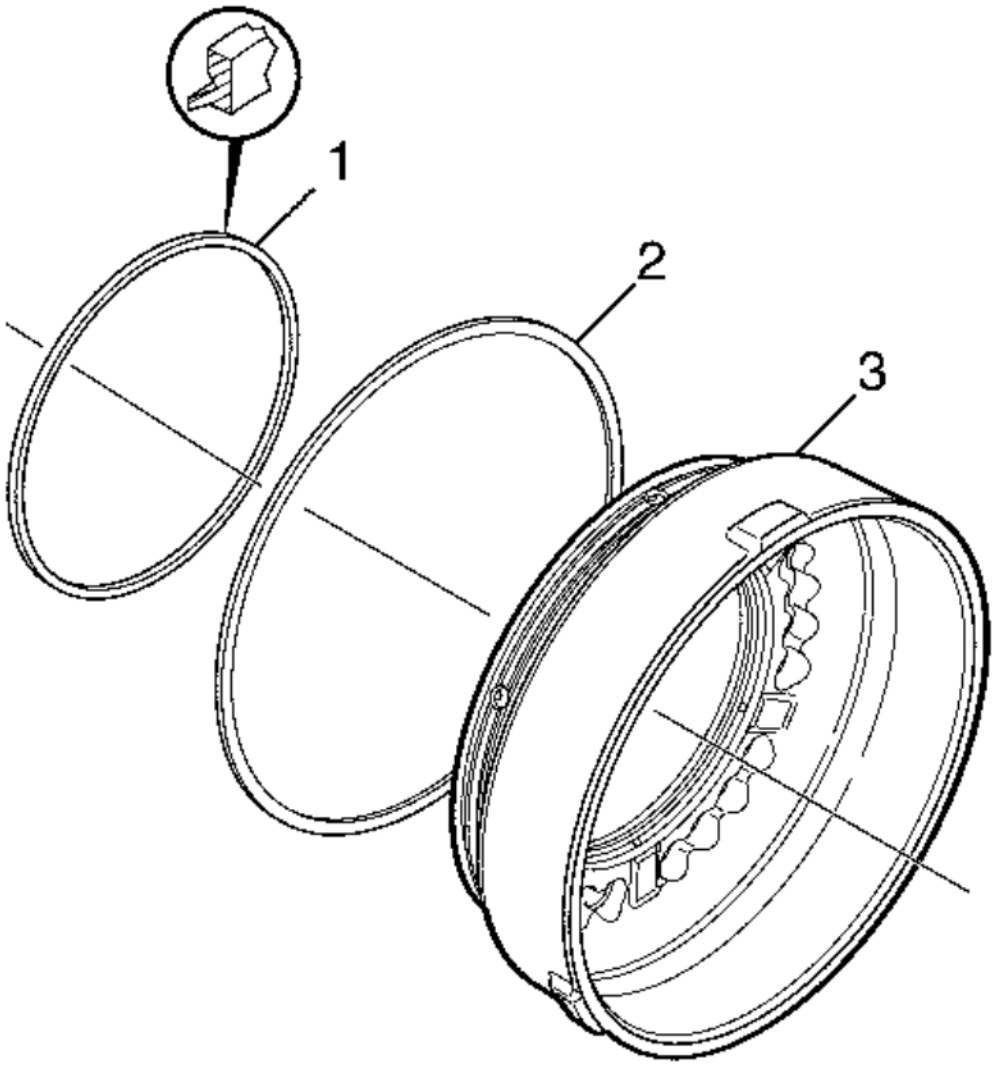


Fig. 303: Piston Seal Rings
Courtesy of GENERAL MOTORS CORP.

1. Install the piston seal rings (1, 2) onto the 4-5-6 clutch piston (3).
2. Lubricate the 4-5-6 clutch piston ID and OD seal rings (1, 2) with **J 36850** . See **Special Tools**.

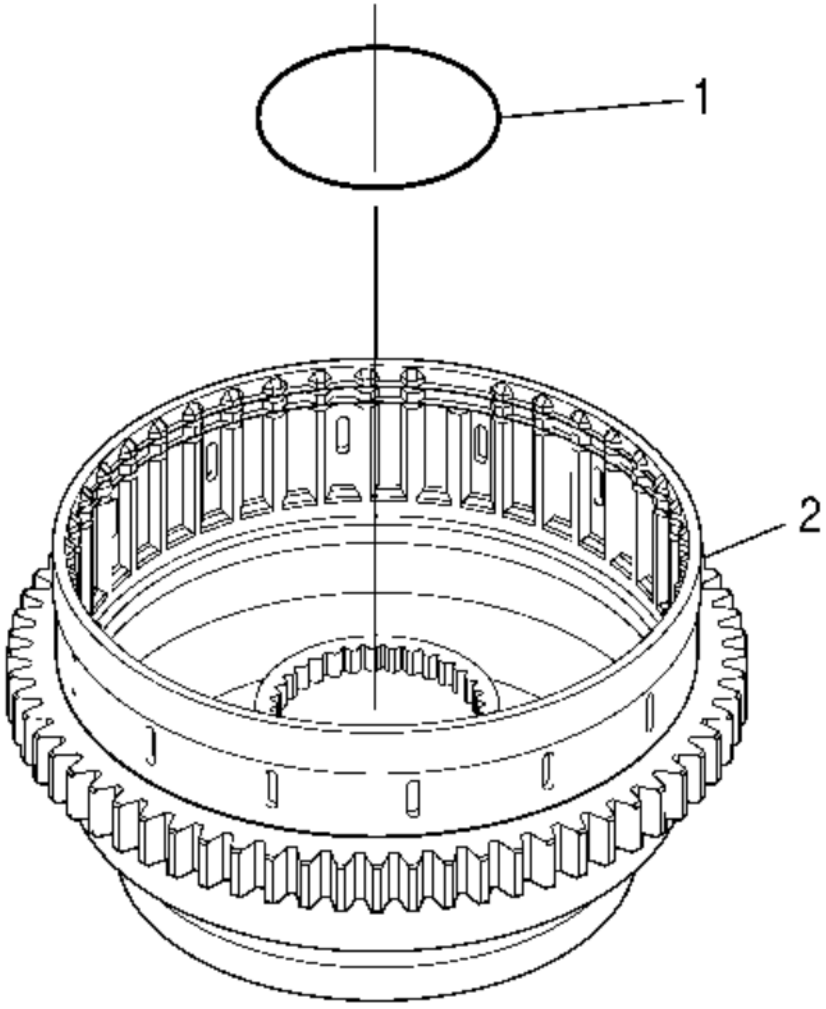


Fig. 304: View Of 1-2-3-4, 4-5 Clutch Housing Inner Hub O-Ring
Courtesy of GENERAL MOTORS CORP.

3. Position the 1-2-3-4, 4-5-6 clutch housing (2) on the work table so that the rear of the housing is facing up.
4. Install the O-ring (1) into the bottom groove on the inner hub of the 1-2-3-4, 4-5-6 clutch housing (2).

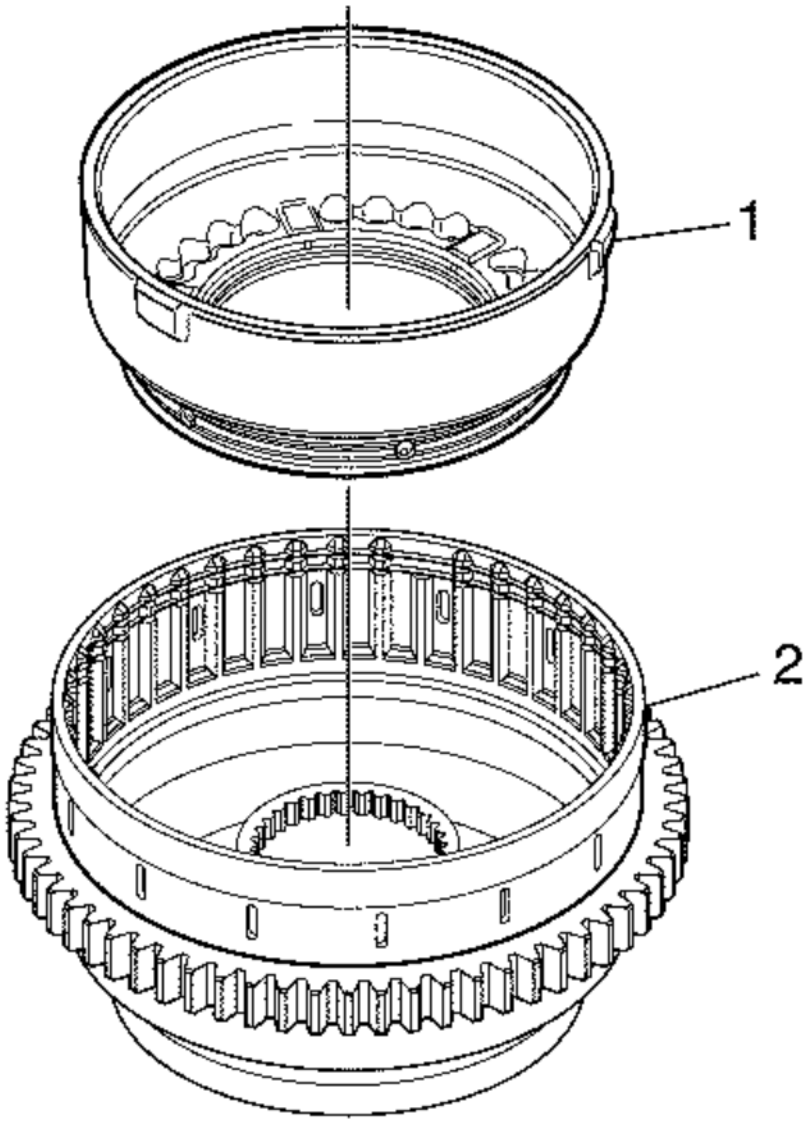


Fig. 305: 4-5-6 Clutch Piston & Housing
Courtesy of GENERAL MOTORS CORP.

5. Position the 4-5-6 clutch piston (1) on the work table so that the rear of the piston is facing up.
6. Install the 4-5-6 clutch piston (1) into the 1-2-3-4, 4-5-6 clutch housing (2).

7. Make sure the 4-5-6 clutch piston (1) is seated on the 1-2-3-4, 4-5-6 clutch housing (2).

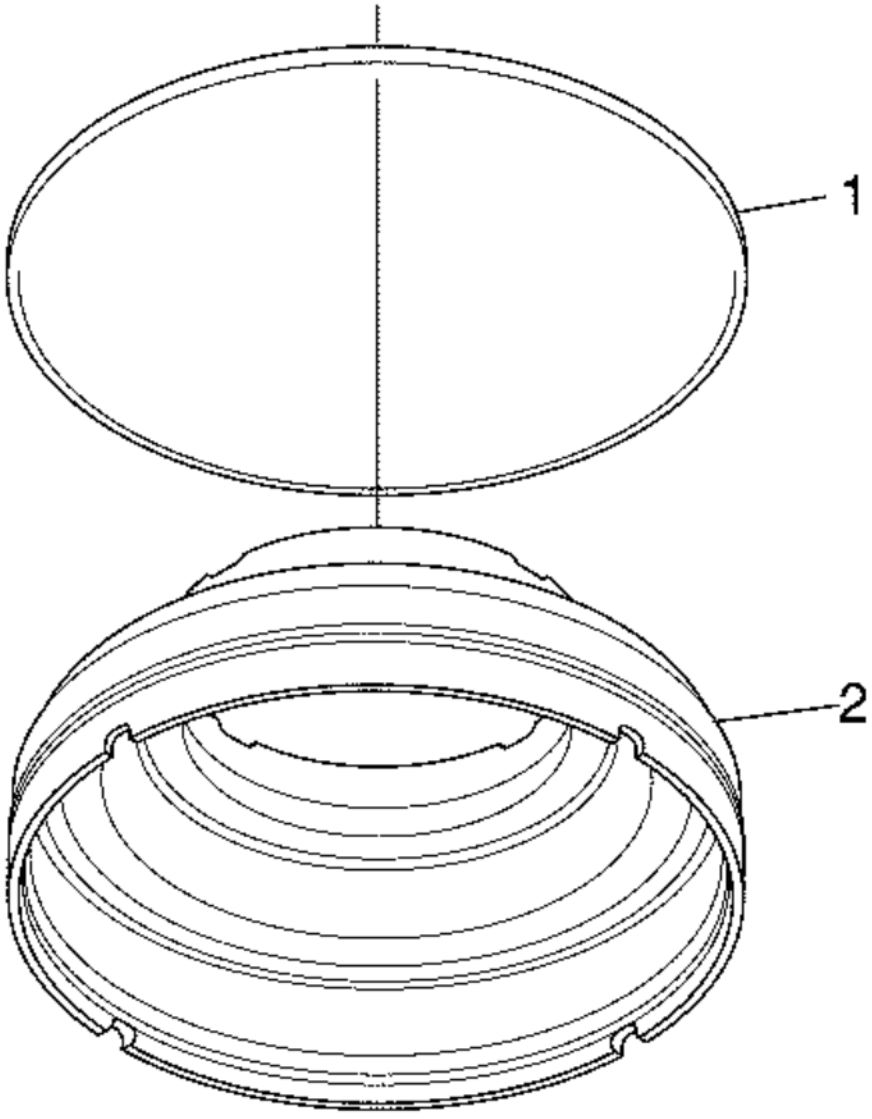


Fig. 306: 1-2-3-4 Clutch Piston Housing Seal Ring
Courtesy of GENERAL MOTORS CORP.

8. Install the seal ring (1) onto the 1-2-3-4 clutch piston housing (2).

9. Lubricate the 1-2-3-4 clutch piston housing seal (1) with **J 36850** . See **Special Tools**.

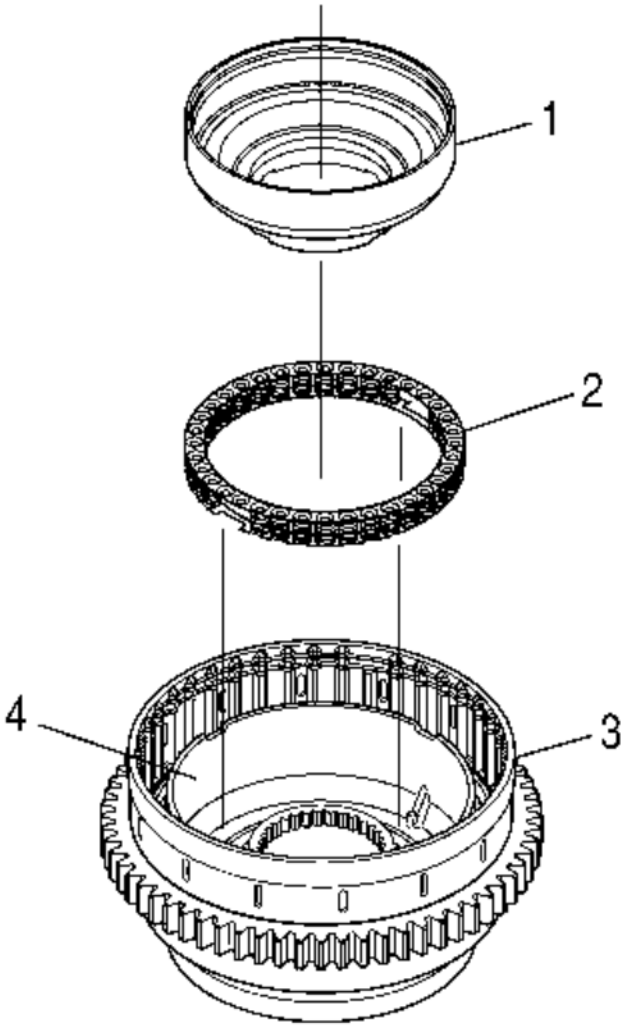


Fig. 307: View Of 1-2-3-4 Clutch Piston Housing & 1-2-3-4, 4-5 Clutch Housing
Courtesy of GENERAL MOTORS CORP.

10. Align the 4-5-6 clutch piston return spring assembly (2) so that the notches of the spring assemblies are facing and aligned with the tangs of the 4-5-6 clutch piston (4).
11. Install the 4-5-6 clutch piston return spring assembly (2) into the 4-5-6 clutch piston (4).

12. Align the 1-2-3-4 clutch piston housing (1) so that the rear of the housing is facing up.
13. Install the 1-2-3-4 clutch piston housing (1) into the 4-5-6 clutch piston (4).

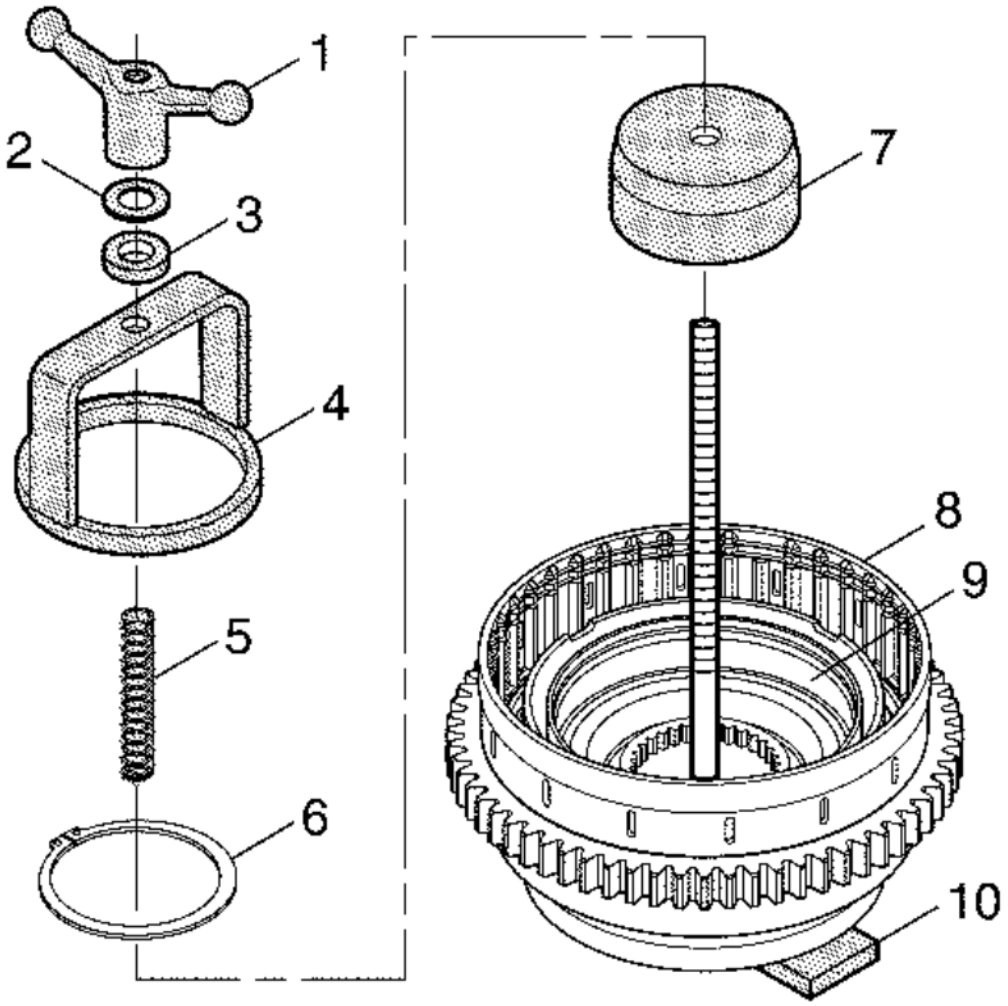


Fig. 308: 1-2-3-4-, 4-5-6 Clutch Housing & J 24204-2
Courtesy of GENERAL MOTORS CORP.

14. Position the 1-2-3-4, 4-5-6 clutch housing (8) on the base of **J 24204-2** (10) so that the rear of the housing is facing up. See **Special Tools**.
15. Install **J-47339-2** (7) onto the shaft of **J 24204-2** with the bowl down. See **Special Tools**.

16. Install the retaining ring (6) onto the surface of **J-47339-2** (7). See **Special Tools**.
17. Install the spring (5) of **J-47339-2** onto the shaft of **J 24204-2** . See **Special Tools**.
18. Install **J-47339-1** (4) onto the shaft of **J 24204-2** . See **Special Tools**.
19. Install the **J 24204-2** ball bearing (3) and washer (2) onto the shaft of **J 24204-2** . See **Special Tools**.
20. Install the **J 24204-2** wing nut (1) onto the shaft of **J 24204-2** . See **Special Tools**.
21. Compress the 4-5-6 clutch piston return spring assembly until the retaining ring groove on the inner hub of the 1-2-3-4, 4-5-6 clutch housing (8) is visible.
22. Install the retaining ring (6) into the 1-2-3-4, 4-5-6 clutch housing inner hub.
23. Make sure the retaining ring (6) is seated all around the clutch housing (8).
24. Remove all J tools.

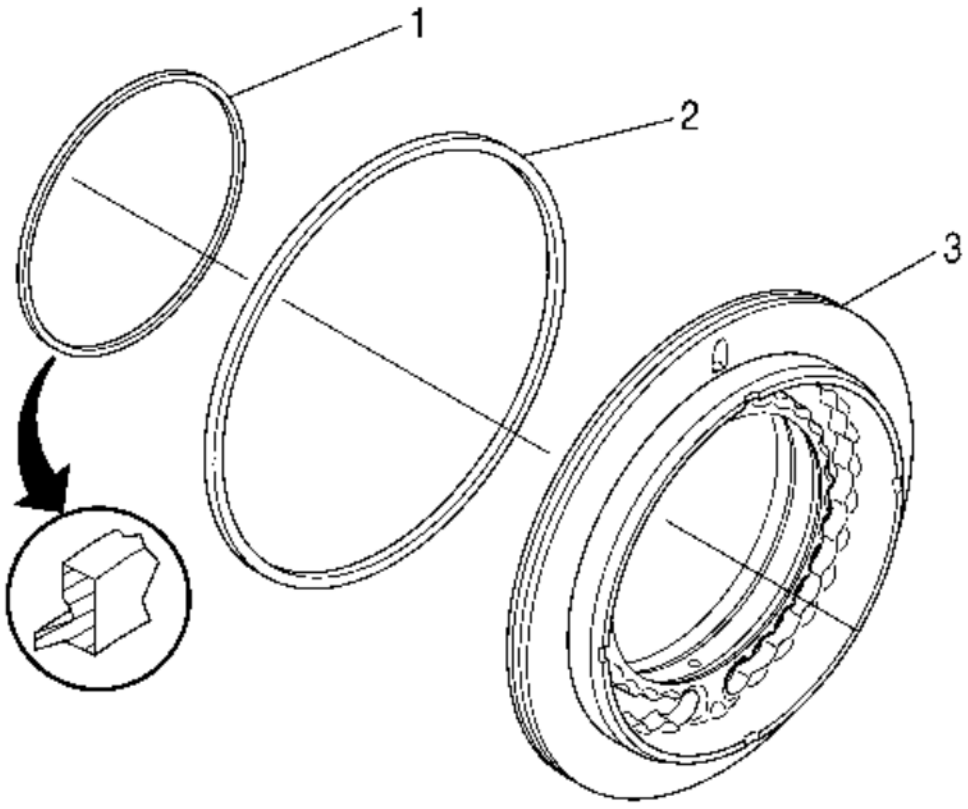


Fig. 309: Locating Clutch Piston Seal Rings
Courtesy of GENERAL MOTORS CORP.

25. Install the 1-2-3-4 clutch piston ID seal ring (1) and the 1-2-3-4 clutch piston OD seal ring (2) onto the 1-2-3-4 clutch piston (3).
26. Lubricate the seal rings with **J 36850** . See **Special Tools**.

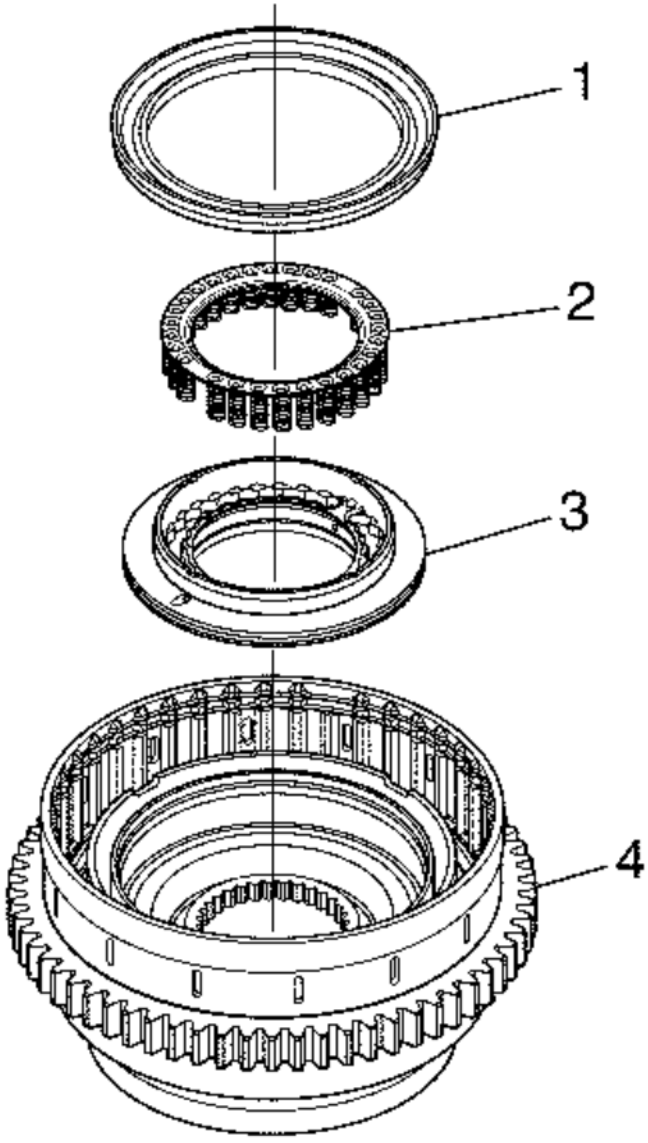


Fig. 310: 1-2-3-4 Clutch Piston Housing Components
Courtesy of GENERAL MOTORS CORP.

27. Position the 1-2-3-4, 4-5-6 clutch housing (4) on the work table so that the rear of the housing is facing up.
28. Align the 1-2-3-4 clutch piston (3) so that the spring indents are facing up.

29. Install the 1-2-3-4 clutch piston (3) into the 1-2-3-4 clutch piston housing (4).
30. Make sure the 1-2-3-4 clutch piston (3) is seated in the 1-2-3-4 clutch piston housing (4).
31. Align the 1-2-3-4 clutch piston return spring assembly (2) so that the springs are facing and aligned with the spring pockets of 1-2-3-4 clutch piston (3).
32. Install the 1-2-3-4 clutch piston return spring assembly (2) into the 1-2-3-4 clutch piston (3).
33. Lubricate the 1-2-3-4 clutch balance piston ID and OD seal area with **J 36850** . See **Special Tools**.
34. Align the 1-2-3-4 clutch balance piston (1) and position so that the rubber seal is facing down.

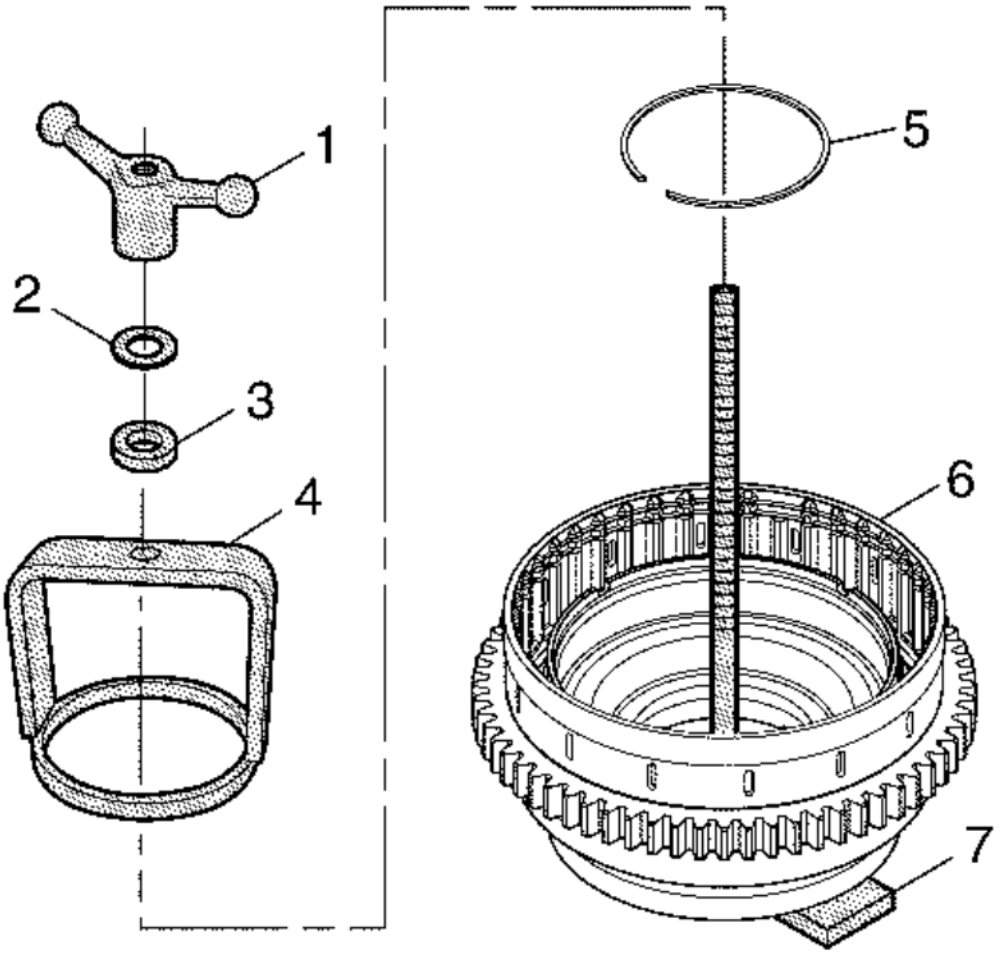


Fig. 311: 1-2-3-4-, 4-5-6 Clutch Housing & J 24204-2
Courtesy of GENERAL MOTORS CORP.

35. Position the 1-2-3-4, 4-5-6 clutch housing (6) on the base of **J 24204-2** (7) so that the rear of the housing is facing up. See **Special Tools**.
36. Install **J-47339-1** (4) onto the shaft of **J 24204-2** (7). See **Special Tools**.
37. Center **J-47339-1** (4) on the 1-2-3-4 clutch balance piston. See **Special Tools**.
38. Install the **J 24204-2** ball bearing (3) and washer (2) onto the shaft of **J 24204-2** . See **Special Tools**.
39. Install the **J 24204-2** wing nut (1) on the shaft of **J 24204-2** . See **Special Tools**.
40. Compress the 1-2-3-4 clutch piston return spring assembly until the retaining ring groove on the 1-2-3-4 clutch housing is visible.
41. Install the retaining ring (5) into the 1-2-3-4 clutch housing.
42. Remove all of the J tools.

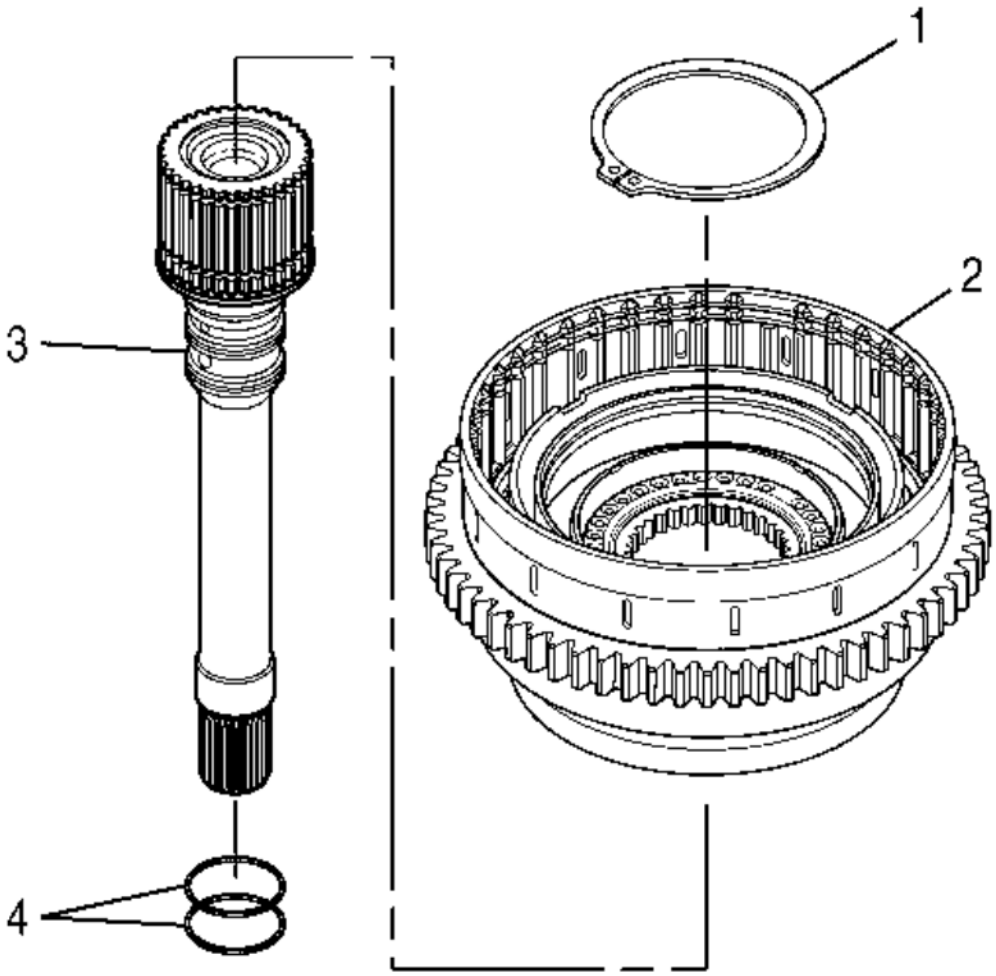


Fig. 312: Locating Turbine Shaft & Overlap Seal Rings
Courtesy of GENERAL MOTORS CORP.

43. Install 2 overlap seal rings (4) onto the turbine shaft (3).
44. Position the turbine shaft (3) on the work table so that the rear of the shaft is facing up.
45. Align the 1-2-3-4, 4-5-6 clutch housing (2) with the rear of the turbine shaft (3) so that the rear of the clutch housing is facing up.
46. Install the 1-2-3-4, 4-5-6 clutch housing (2) onto the rear of turbine shaft (3).
47. Install the retaining ring (1) onto the turbine shaft (3).

48. Make sure the retaining ring (1) is seated completely around the turbine shaft (3).

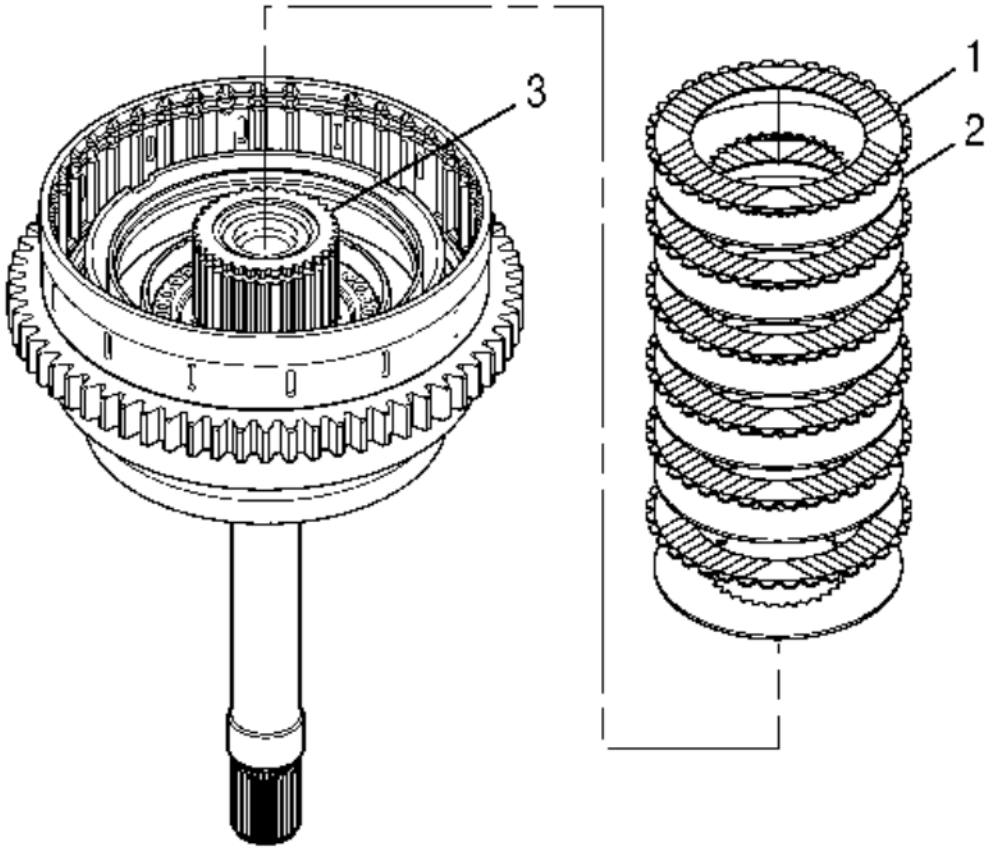


Fig. 313: Identifying Stacking Sequence Of Clutch Plates
Courtesy of GENERAL MOTORS CORP.

49. Starting with a 1-2-3-4 clutch steel plate, alternately install 6 1-2-3-4 clutch steel plates (2) and 6 1-2-3-4 clutch fiber plates (1) onto the turbine shaft (3).

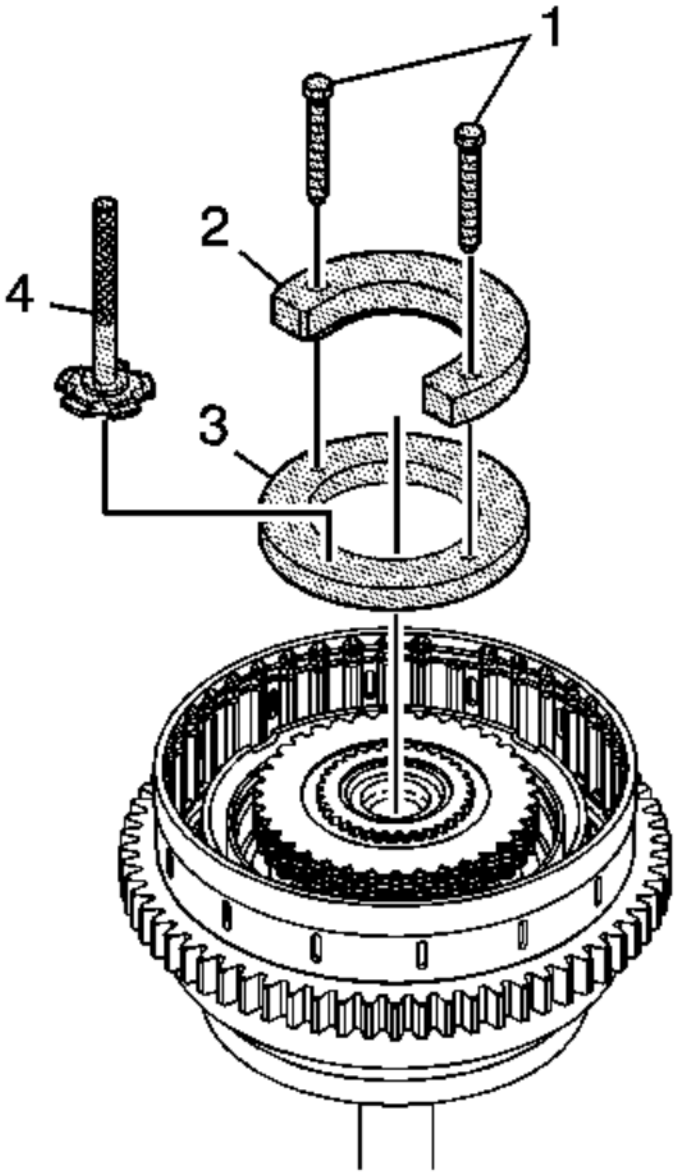


Fig. 314: Installing J44525 Onto Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Special tools J 44525-4 selector tool (4) and J 44525-5 pressure plate (3) are silver plated for easy identification. Do

not use the pressure plate and selector tool from the J 44525 set if they are not matched in color. See Special Tools.

50. Align J 44525-5 pressure plate (3) with the turbine shaft so that the countersunk holes of J 44525-5 pressure plate (3) are facing up.
51. Install J 44525-5 pressure plate (3) onto the turbine shaft.
52. Align J 44525-1 compressor (2) with the turbine shaft so that the inner ridge of J 44525-1 compressor (2) is facing down.
53. Slide the inner ridge of J 44525-1 compressor (2) into the turbine shaft retaining ring groove.
54. Align the holes in J 44525-1 compressor (2) with the countersunk holes of J 44525-5 pressure plate (3).

NOTE: Refer to Fastener Notice .

55. Hand install 2 bolts (1) of **J 44525** into the holes of J 44525-1 compressor (2). See **Special Tools**.

Tighten: Tighten the bolts to 1.8 N.m (16 lb in).

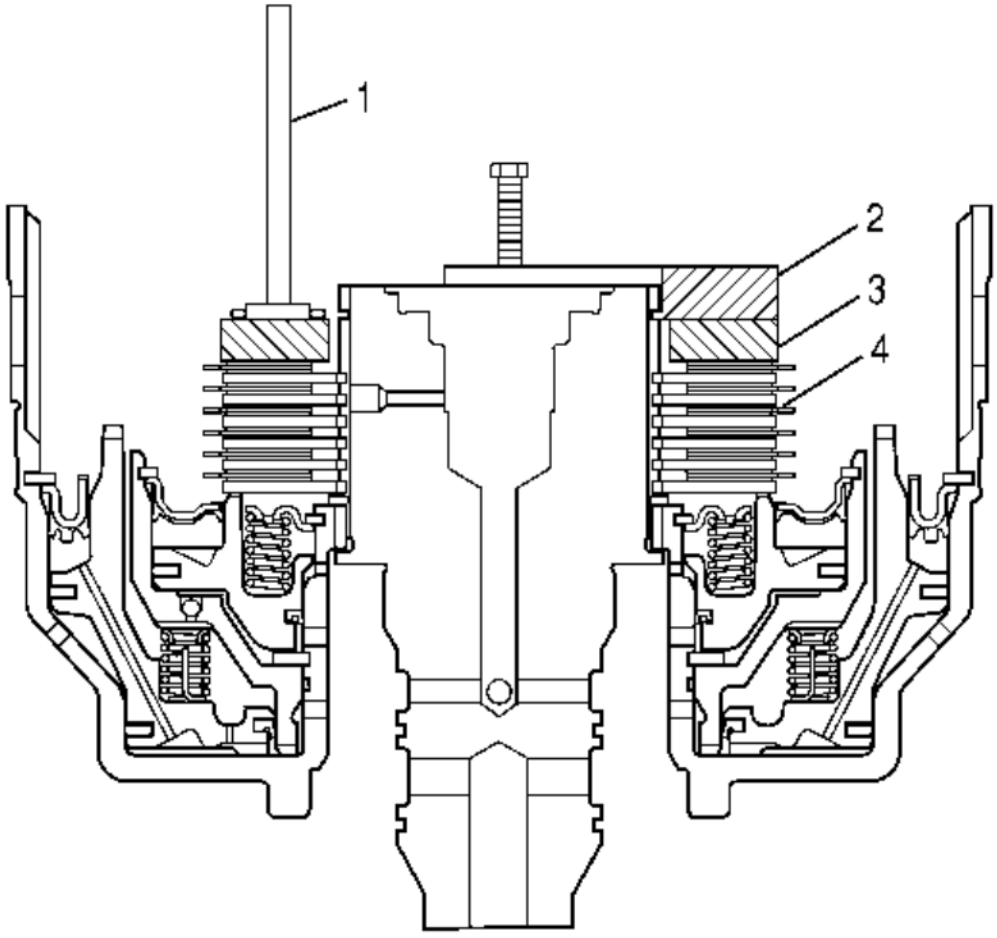


Fig. 315: Using J 44525 To Select Correct 1-2-3-4 Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The shift quality of the transmission depends heavily upon selecting the correct 1-2-3-4 clutch backing plate.

56. Perform the following procedure for each tab of J 44525-4 selector tool (1):
    1. Place the flat surface, tabbed end of J 44525-4 selector tool (1) onto the top surface of J 44525-5 pressure plate (3).

IMPORTANT: At most, 2 of the different tabs will fit into the retaining ring groove.

2. Try to slide the tabbed end of J 44525-4 selector tool (1) into the retaining ring groove on the turbine shaft.
3. If a tab fits into the retaining ring groove, record the 4-digit ID number located on the tab of J 44525-4 selector tool (1). Refer to **Selective Components Specifications** to determine the correct backing plate.

57. Select a 1-2-3-4 clutch backing plate as follows:
    - If no tab of J 44525-4 selector tool (1) fits into the retaining ring groove, select the 1-2-3-4 clutch backing plate with ID No. 2420.
    - If one or more tabs of J 44525-4 selector tool (1) fit into the retaining ring groove, select the 1-2-3-4 clutch backing plate with an ID No. corresponding to the highest number recorded in the previous step.
58. Remove **J 44525** from the turbine shaft. See **Special Tools**.

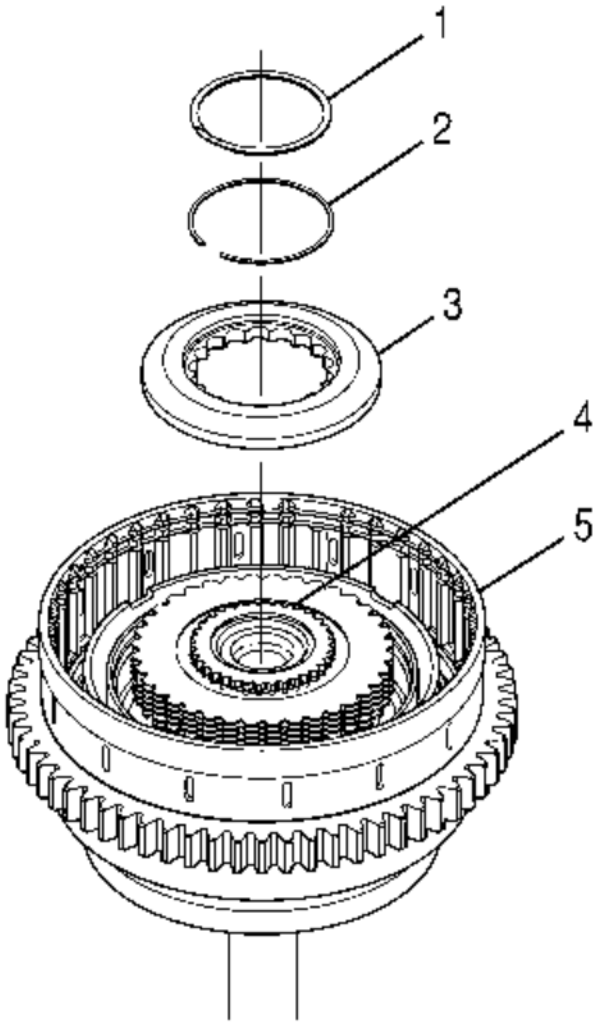


Fig. 316: View Of 1-2-3-4 Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

59. Align the selected 1-2-3-4 clutch backing plate (3) so that the beveled edge of the backing plate is facing up.
60. Install the 1-2-3-4 clutch backing plate (3) onto the turbine shaft (4).
61. Install the retaining ring (2) onto the turbine shaft (4).
62. Lift the 1-2-3-4 clutch backing plate (3) and install the spiral retaining ring (1) into the 1-2-

3-4 clutch backing plate (3).

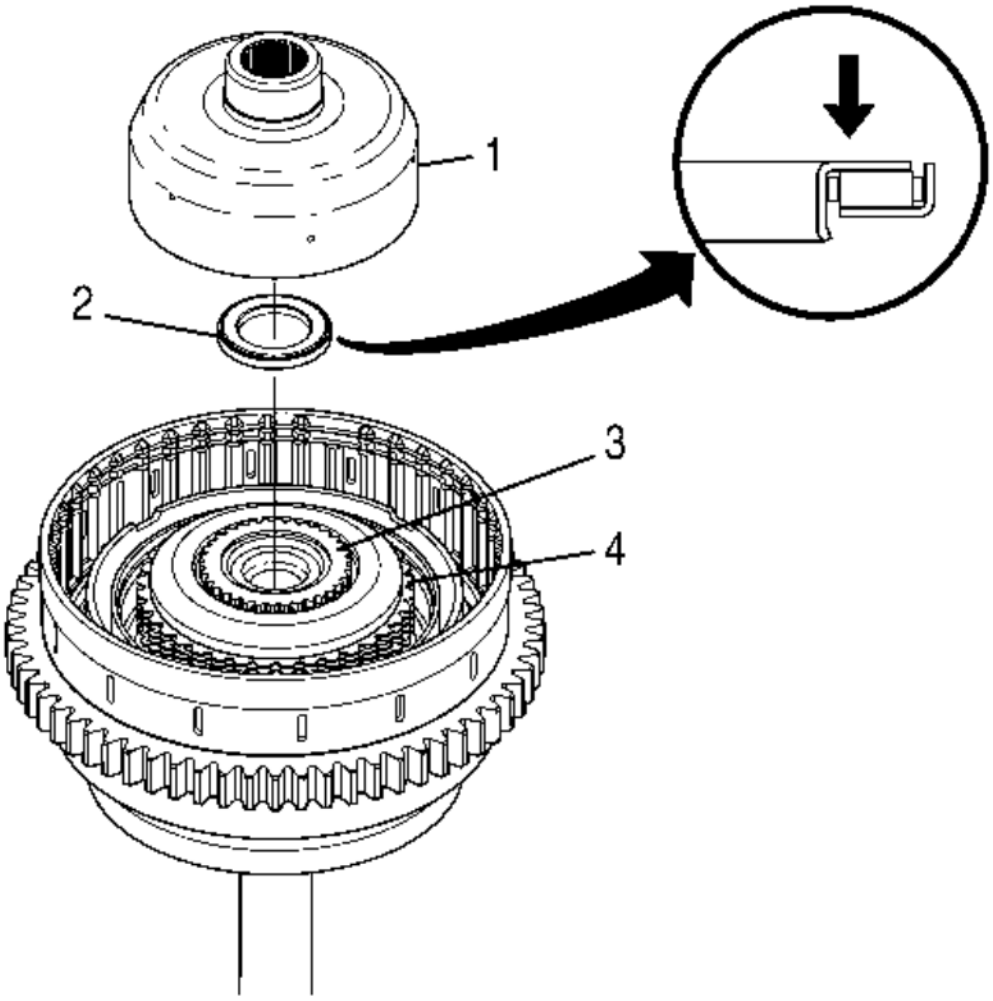


Fig. 317: Locating 1-2-3-4 Clutch Thrust Bearing Assembly & Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

NOTE: Installing the thrust bearing assembly onto the rear of the turbine shaft in the wrong direction may cause permanent damage to the transmission. The blue stripe must be visible.

63. Align thrust bearing assembly (2) so that the blue stripe on the thrust bearing assembly is facing away from turbine shaft (3).
64. Install the thrust bearing assembly (2) into the turbine shaft (3).
65. Make sure the blue stripe on the thrust bearing assembly is visible.
66. Center the 1-2-3-4 clutch plates (4).
67. Install the 1-2-3-4 clutch drive hub (1) over the 1-2-3-4 clutch plates (4).
68. Make sure the 1-2-3-4 clutch drive hub (1) has seated on the thrust bearing assembly (2).

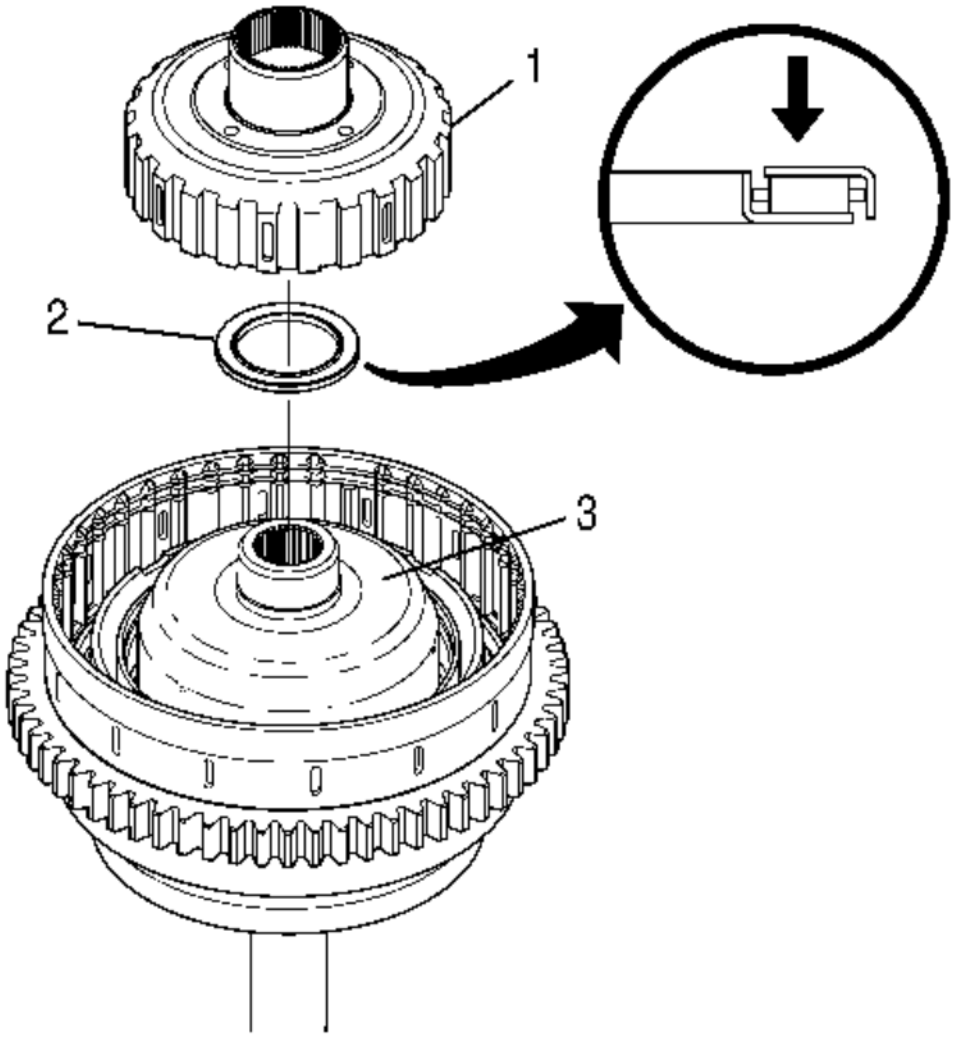


Fig. 318: Correct Installation Position Of 1-2-3-4 Clutch Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: Installing the thrust bearing assembly onto the rear of the 1-2-3-4 drive hub in the wrong direction may cause permanent damage to the transmission. The blue stripe must be visible.

69. Align the thrust bearing assembly (2) so that the blue stripe on the thrust bearing assembly is

facing away from the 1-2-3-4 clutch drive hub (3).

70. Install the thrust bearing assembly (2) onto the rear of the 1-2-3-4 clutch drive hub (3).
71. Make sure the blue stripe on the thrust bearing assembly is visible.
72. Align the 4-5-6 clutch drive hub (1) so that the smaller end is facing up.
73. Install the 4-5-6 clutch drive hub (1).

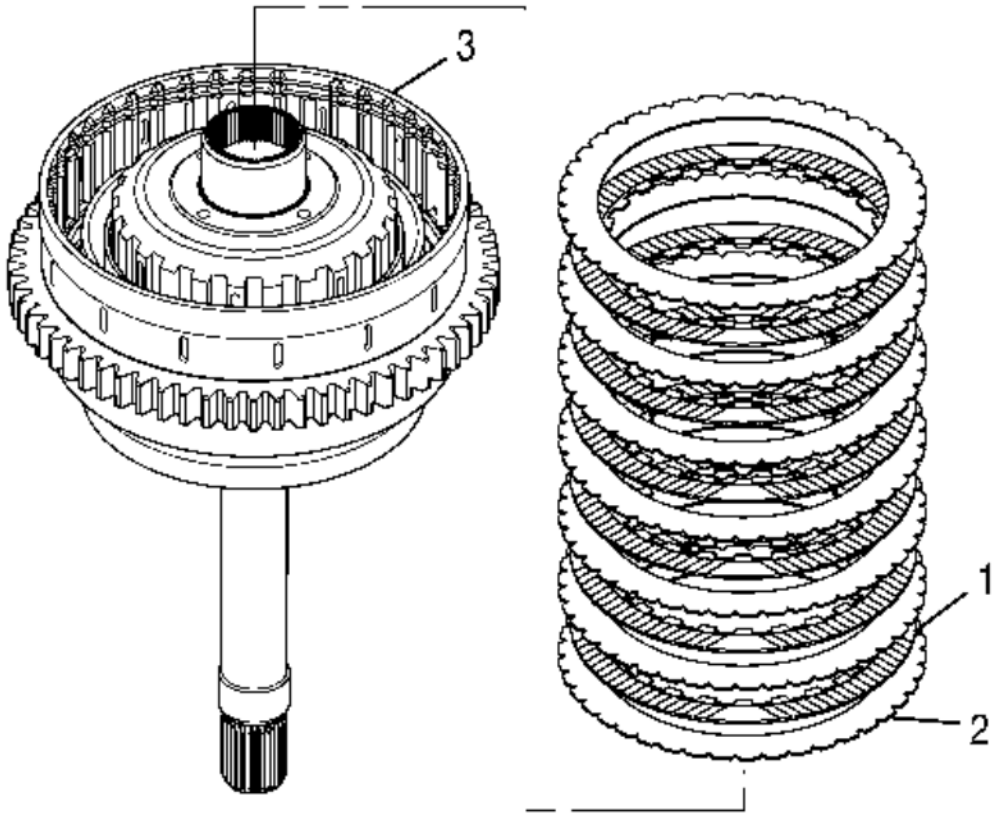


Fig. 319: Illustrating Stacking Sequence Of 4-5 Clutch Steel & Fiber Plates
Courtesy of GENERAL MOTORS CORP.

74. Starting with a 4-5-6 clutch steel plate, alternately install seven 4-5-6 clutch steel plates (2) and six 4-5-6 clutch fiber plates (1) into the 1-2-3-4, 4-5-6 clutch housing.

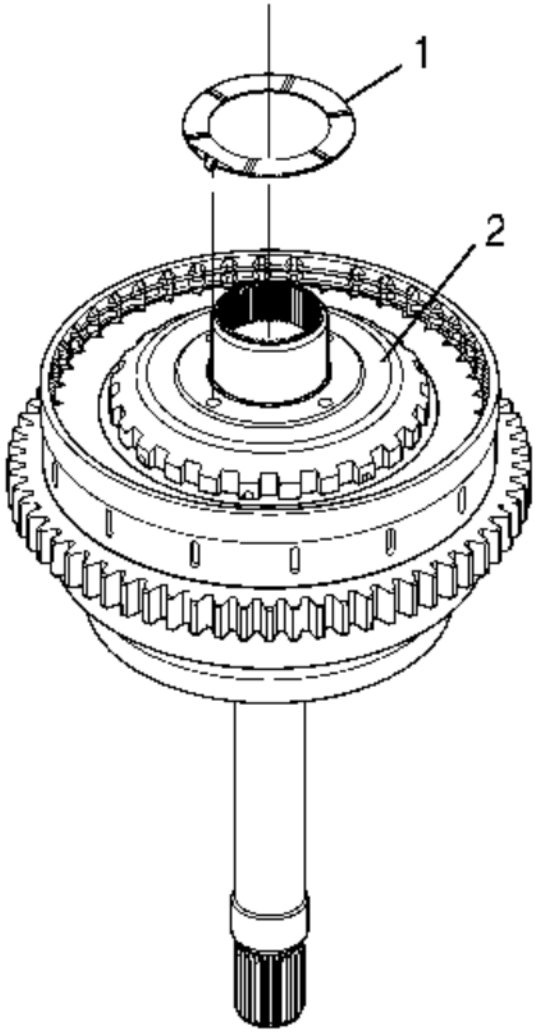


Fig. 320: Identifying Bronze Thrust Washer With Holes
Courtesy of GENERAL MOTORS CORP.

75. Align the tangs of the bronze thrust washer (1) with the holes in the 4-5-6 clutch drive hub (2).
76. Install the bronze thrust washer (1) onto the 4-5-6 clutch drive hub (2).

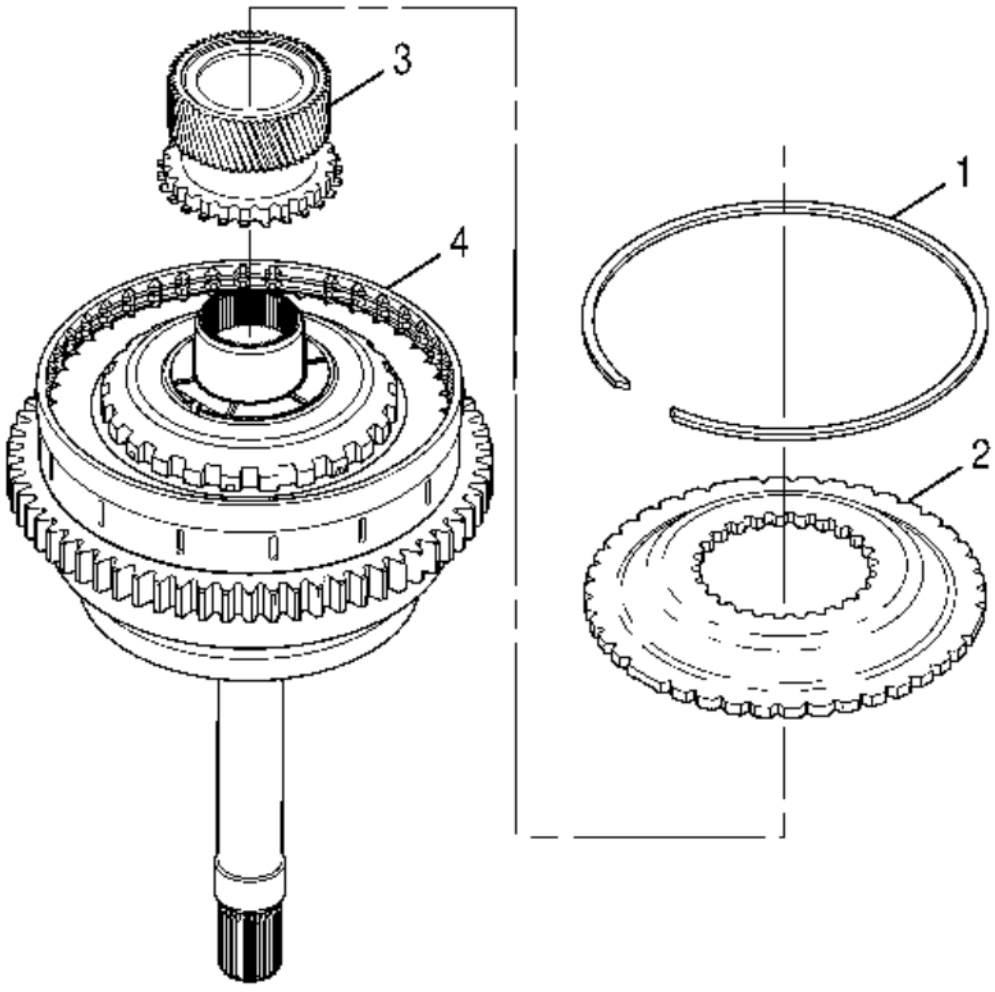


Fig. 321: View Of 1-2-3-4, 4-5 Clutch Housing Components
Courtesy of GENERAL MOTORS CORP.

77. Align the input sun gear (3) so that the gear teeth of the sun gear face the concave face of the input sun gear flange (2).
78. Install the input sun gear (3) into the input sun gear flange (2).
79. Make sure the splines are engaged.
80. Hold the sun gear and align the double wide splines of the input sun gear flange (2) with the double wide spaces on the 1-2-3-4, 4-5-6 clutch housing (4).

81. Install the input sun gear (3) with the input sun gear flange (2) into the 1-2-3-4, 4-5-6 clutch housing (4).
82. Install the input sun gear external retaining ring (1) into the 1-2-3-4, 4-5-6 clutch housing (4).
83. Make sure the retaining ring is seated all the way around the 1-2-3-4, 4-5-6 clutch housing.
84. Remove tools **J 24204-2** and **J 43777** . See **Special Tools**.

INPUT SUN GEAR THRUST WASHER INSPECTION

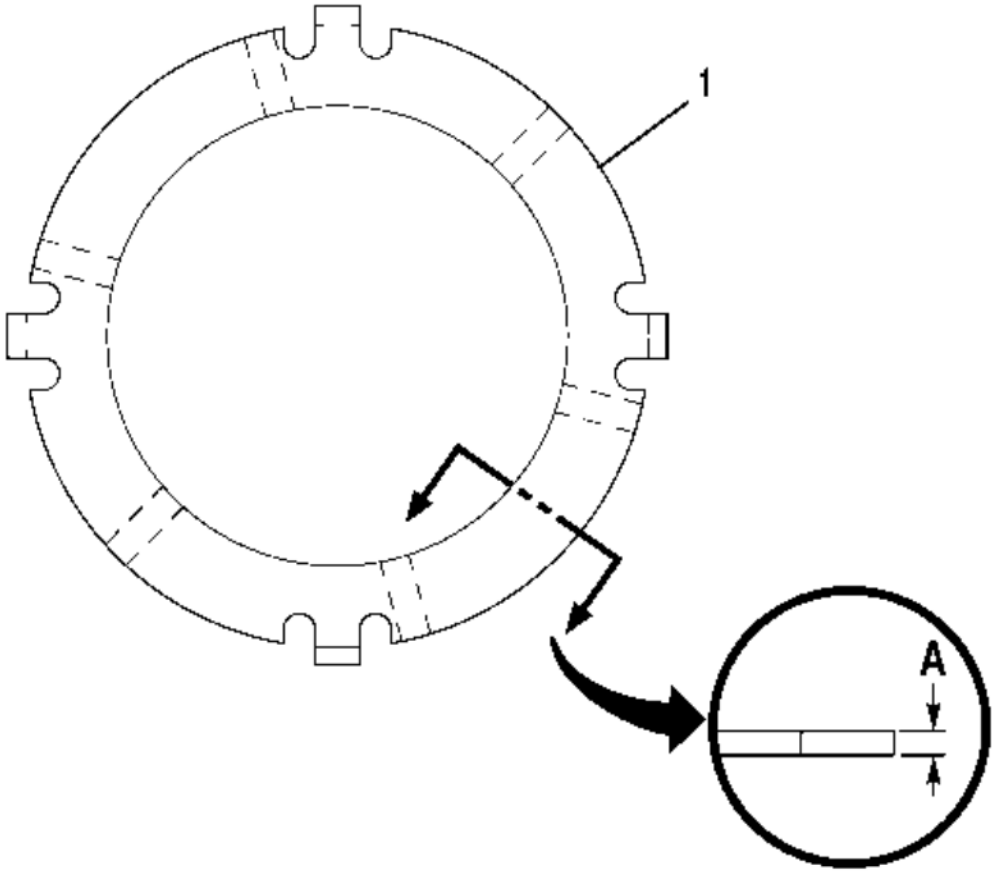


Fig. 322: Measuring Thickness Of Input Sun Gear Thrust Washer
Courtesy of GENERAL MOTORS CORP.

1. Measure the thickness of the 1-2-3-4, 4-5-6 clutch thrust washer (1) at dimension A.

   Specification: The thrust washer minimum thickness is 2.59 mm (0.102 in).

2. Replace the thrust washer if the specifications are not met.

TRANSMISSION FLUID FILLER TUBE PLUG AND TRANSMISSION CASE LOCATING PIN REPLACEMENT

Tools Required

J 43780 Transmission Case Locating Pin Installer. See **Special Tools**.

Transmission Case Fill Plug Replacement

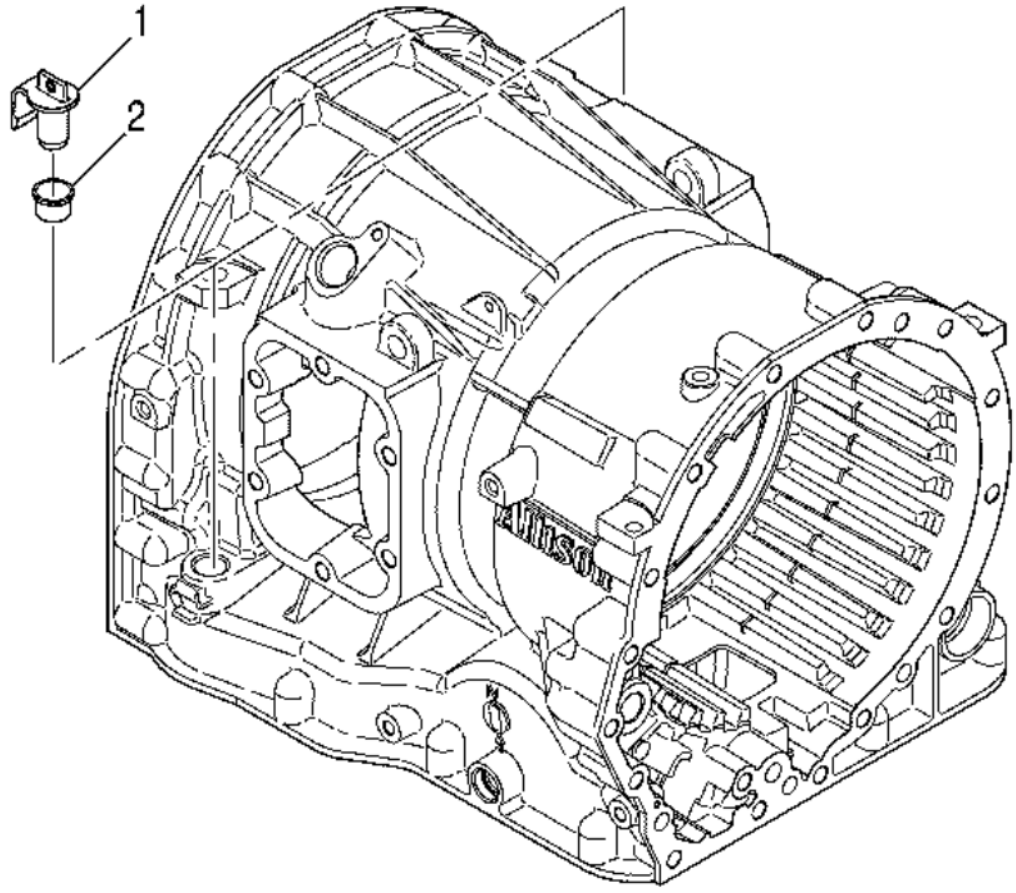


Fig. 323: Identifying Transmission Fill Tube Seal & Plug
Courtesy of GENERAL MOTORS CORP.

1. Remove the fill tube plug (1).
2. Remove the fill tube seal (2).
3. Install the fill tube seal (2) into the transmission case.
4. Align the tab on the fill plug (1) with the tang on the transmission case.

IMPORTANT: The fill plug retaining tab snaps into place over a tang on the transmission case.

5. Install the fill plug (1) into the fill tube seal (2).

6. Press the fill plug down until the retaining tab locks into place.

Transmission Case Locating Pin Replacement

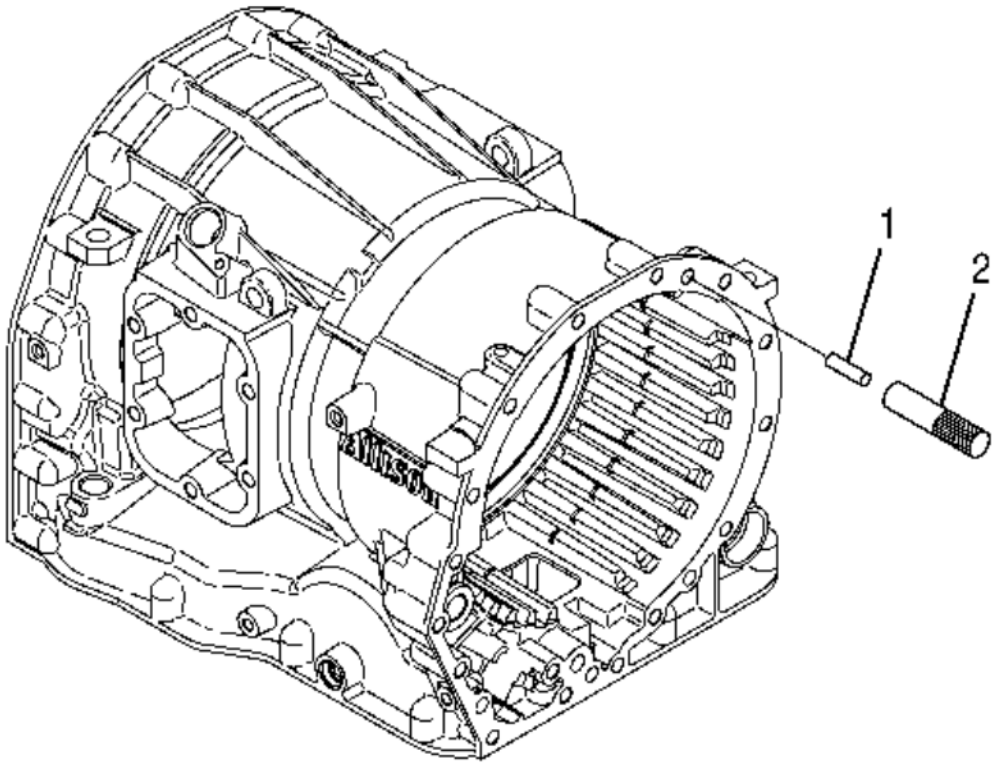


Fig. 324: View Of Transmission Case Locating Pin
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT mar the transmission case surface when removing the locating pin. An unmarred surface is required to maintain the seal between the low and reverse clutch housing assembly and the transmission case.

IMPORTANT: Do not replace the transmission case locating pin unless the locating pin is damaged.

1. Remove the locating pin (1) from the rear surface of the transmission case.
2. Install a new locating pin (1) into **J 43780** (2). See **Special Tools**.
3. Using **J 43780** (2), drive the locating pin until seated. See **Special Tools**.

   Locating Pin Installed Height: Make sure the locating pin is installed to a height of 20.80-21.20 mm (0.819-0.835 in) above the transmission case rear surface.

MANUAL SHIFT SHAFT, DETENT LEVER, AND POSITION SWITCH ASSEMBLY DISAS DISASSEMBLE

Tools Required

J 43911 Manual Shift Shaft Seal Remover

Disassemble

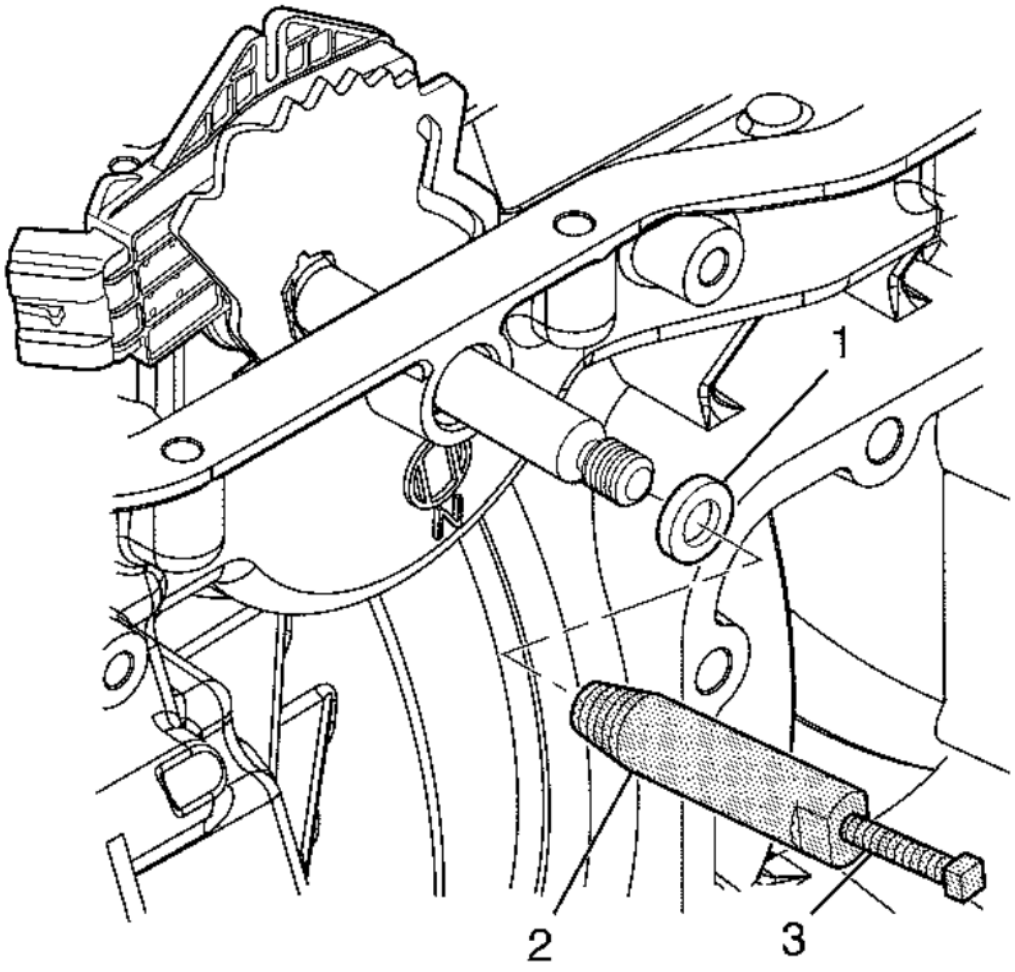


Fig. 325: Using J 43911 To Remove Shift Shaft Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not remove the manual shift shaft unless replacing one or more of the following:

- **Manual shift shaft**
- **Detent lever/internal mode switch (IMS) assembly**
- **Park pawl assembly**

1. Position the transmission so that the valve body face of the transmission case is facing up.

2. Remove the screw (3) from the body of **J 43911** (2).
3. Screw the body of **J 43911** into the manual shift shaft seal (1).
4. Install the screw (3) into the body of **J 43911** (2).
5. Tighten the screw (3) against the manual shift shaft until the manual shift shaft seal (1) becomes dislodged.
6. Remove the manual shift shaft seal (1) from **J 43911** (2).

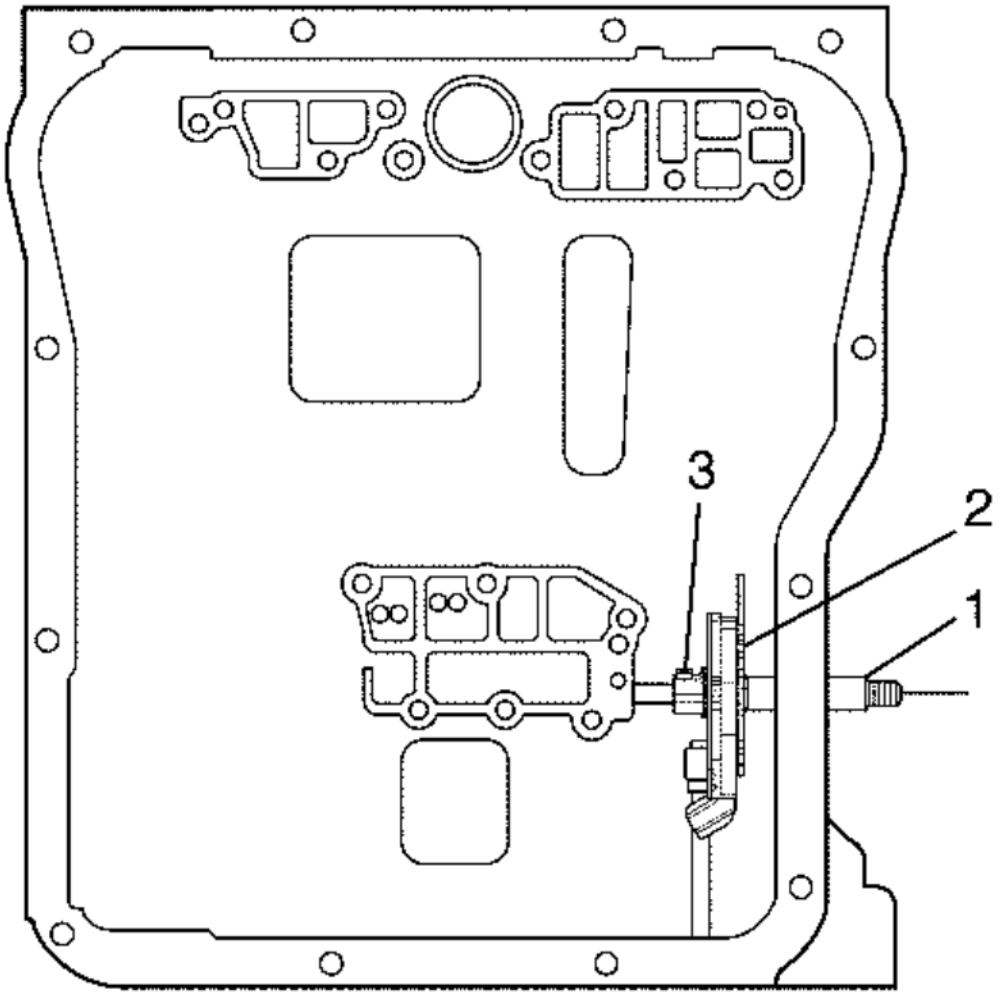


Fig. 326: Detent Lever/IMS Assembly Retaining Bolt

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The detent lever/IMS assembly retaining bolt contains patch lock material on the threads. Do not reuse the detent lever/IMS assembly retaining bolt.

7. Remove the detent lever/IMS assembly retaining bolt (3) using a T27 Torx® bit and discard the bolt.

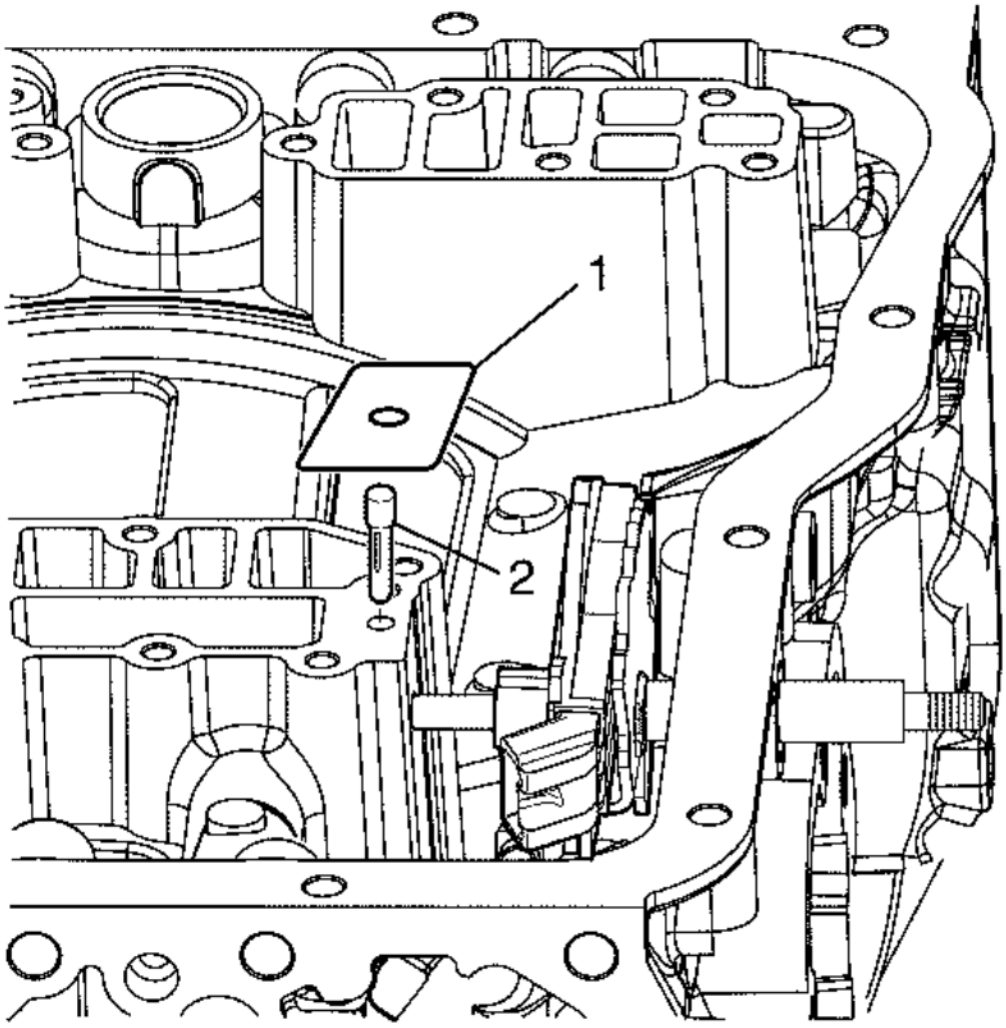


Fig. 327: Placing Protective Plate On Transmission Case Surface
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT mar the transmission case surface around the spherical pin when removing or installing the spherical pin. An unmarred surface is required to maintain the seal between the control valve assembly and the transmission case.

8. Place a protective plate (1) on the transmission case surface around the spherical pin (2).

NOTE: DO NOT twist the spherical pin when removing the pin from the transmission case. Damage to the transmission case can occur.

9. Remove the spherical tip pin (2) from the transmission case.

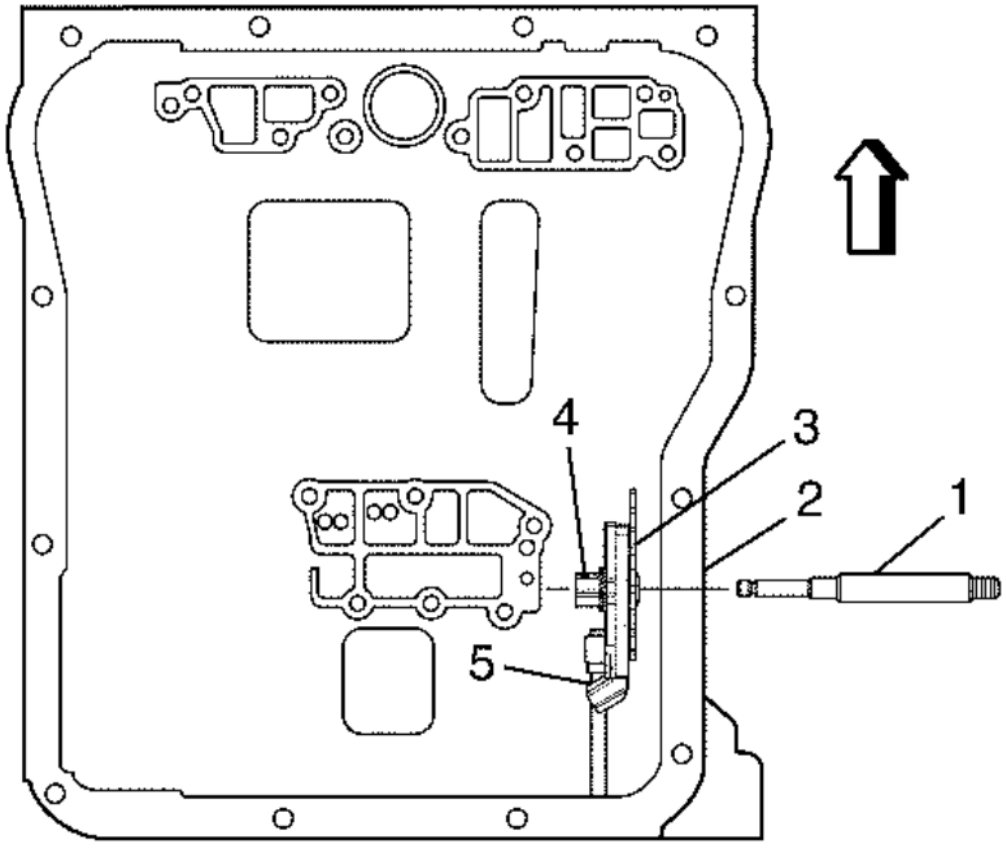


Fig. 328: Manual Shift Shaft
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Burrs or raised metal where the manual shift shaft detent lever seats against the manual shift shaft may prevent the manual shift shaft from sliding from the transmission case. Use a file to remove burrs or raised metal from the manual shift shaft.

10. While holding the detent lever/IMS assembly (3), carefully slide the manual shift shaft (1) through the following:
    - Detent lever/IMS assembly (3)
    - Manual shift shaft seal hole (2)

11. Remove the detent lever/IMS assembly (3) and the park pawl assembly (5) from the transmission case.

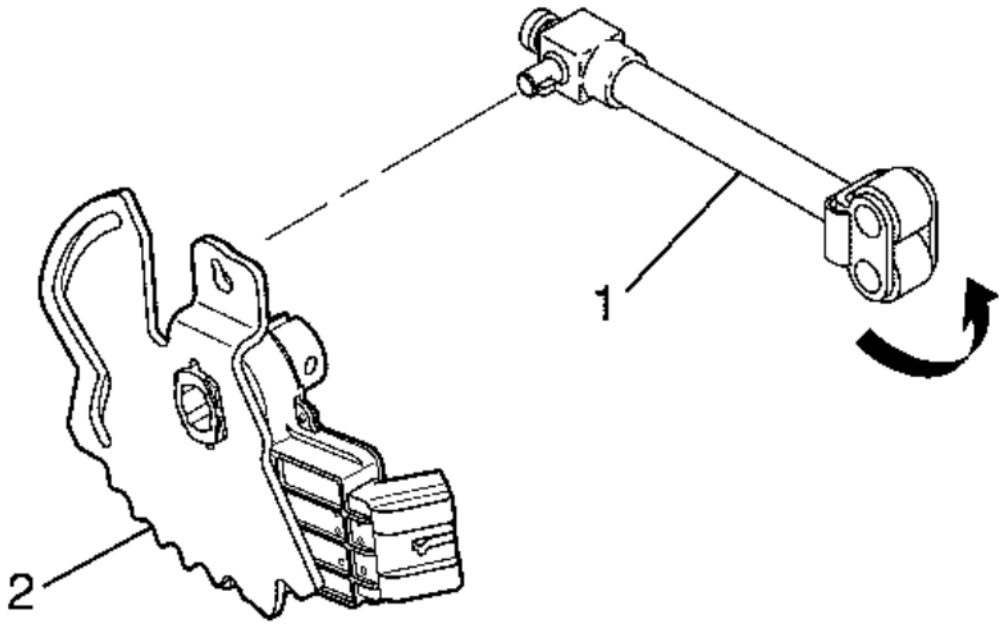


Fig. 329: View Of Park Pawl Assembly And Detent Lever/IMS Assembly
Courtesy of GENERAL MOTORS CORP.

12. Rotate the park pawl assembly (1) 180 degrees.
13. Remove the nib of the park pawl assembly through the keyhole in the detent lever/IMS assembly (2).

MANUAL SHIFT SHAFT, DETENT LEVER, AND POSITION SWITCH ASSEMBLY ASSEM ASSEMBLE

Tools Required

J 43909 Manual Shift Shaft Seal Installer

Assemble

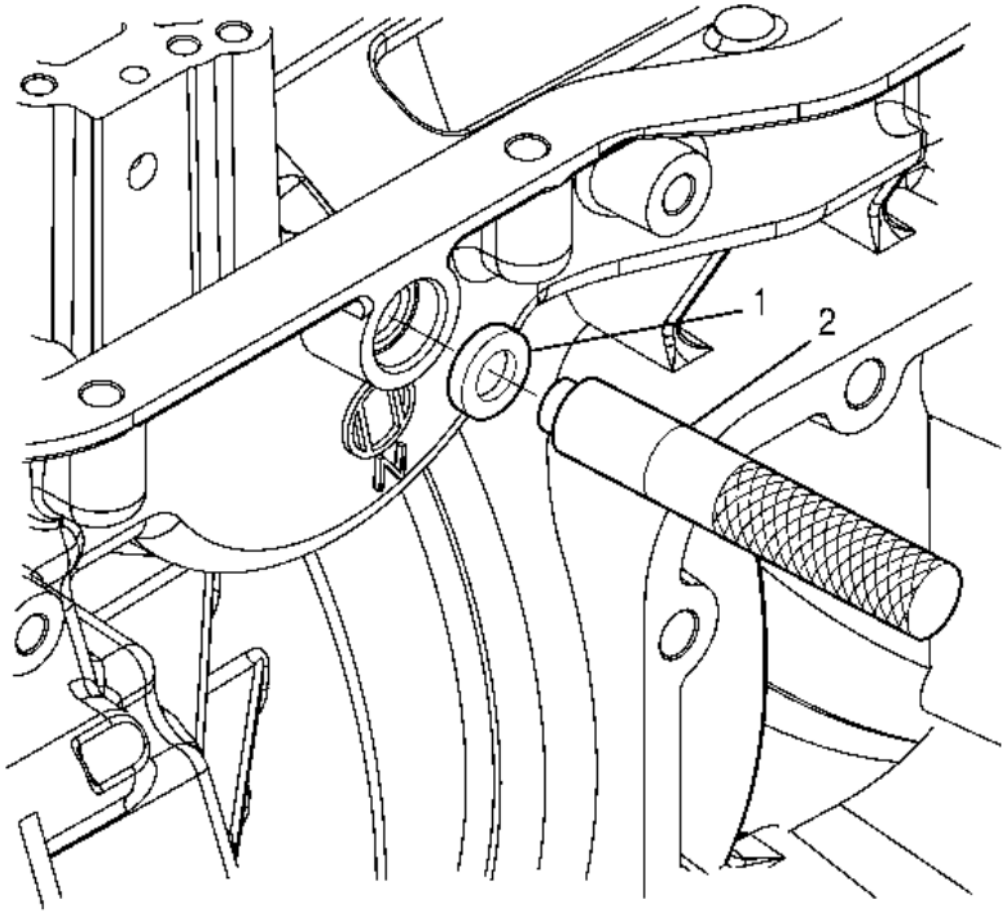


Fig. 330: Installing A New Manual Shift Shaft Seal Using J 43909
Courtesy of GENERAL MOTORS CORP.

1. Install a new manual shift shaft seal (1) onto **J 43909** (2).
2. Using **J 43909** (2), drive the manual shift shaft seal (1) into the transmission case.
3. Make sure the manual shift shaft seal is seated on the bottom of the bore.

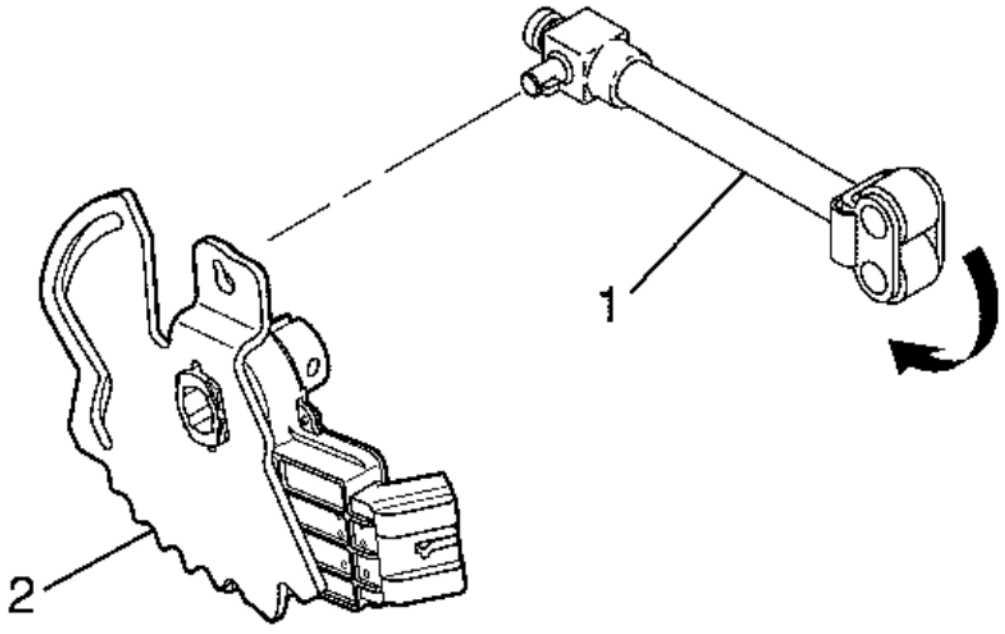


Fig. 331: View of Detent Lever/IMS Assembly And Park Pawl Assembly
Courtesy of GENERAL MOTORS CORP.

4. Install the nib of the park pawl assembly (1) through the keyhole in the detent lever/internal mode switch (IMS) assembly (2).
5. Rotate the park pawl assembly 180 degrees.

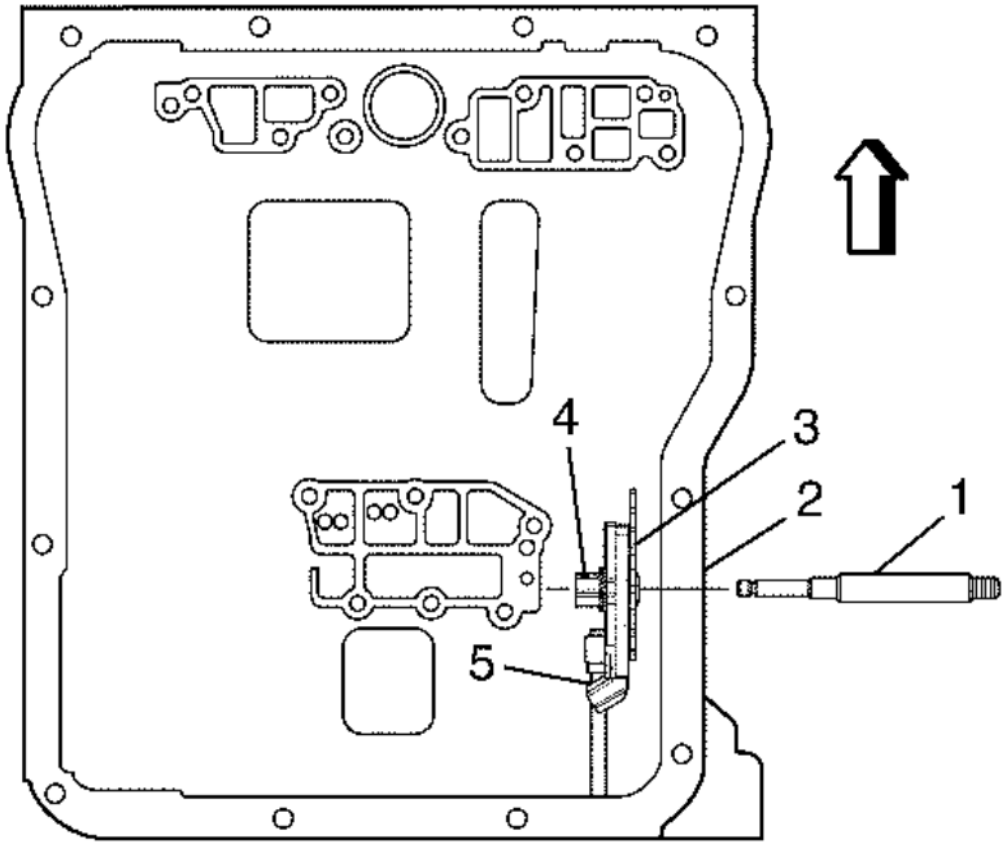


Fig. 332: Manual Shift Shaft
Courtesy of GENERAL MOTORS CORP.

6. Place the roller end of the park pawl assembly (5) into the transmission case.
7. Align the detent lever/IMS assembly (3) so that:
   - The detent notches of the detent lever are facing up.
   - The IMS connector is facing towards the rear of the transmission.
   - The guide hole for the manual valve pin is facing forward.
   - The manual shift shaft hole in the detent lever is aligned with the manual shift shaft seal (2).
8. Slide the manual shift shaft (1) through the following components:
   - Transmission case

- Manual shift shaft seal (2)
- Detent lever/IMS assembly (3)

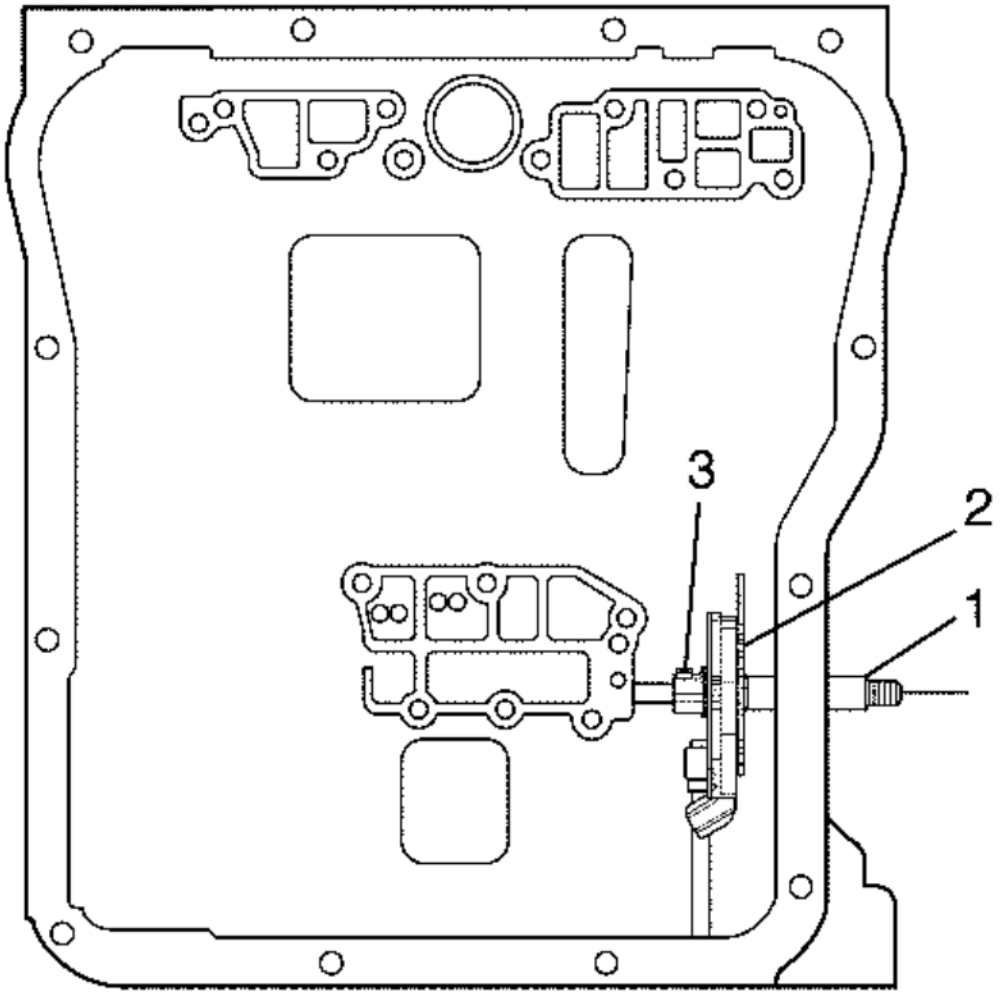


Fig. 333: Detent Lever/IMS Assembly Retaining Bolt
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The detent lever/IMS assembly retaining bolt contains patch lock material on the threads. Do not reuse the retaining bolt.

9. Install the detent lever/IMS assembly (2) onto the manual shift shaft (1).
10. Install the detent lever/IMS assembly retaining bolt (3).

NOTE: Refer to Fastener Notice .

11. Using a T27 Torx® bit, tighten the detent lever/IMS assembly retaining bolt (3).

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

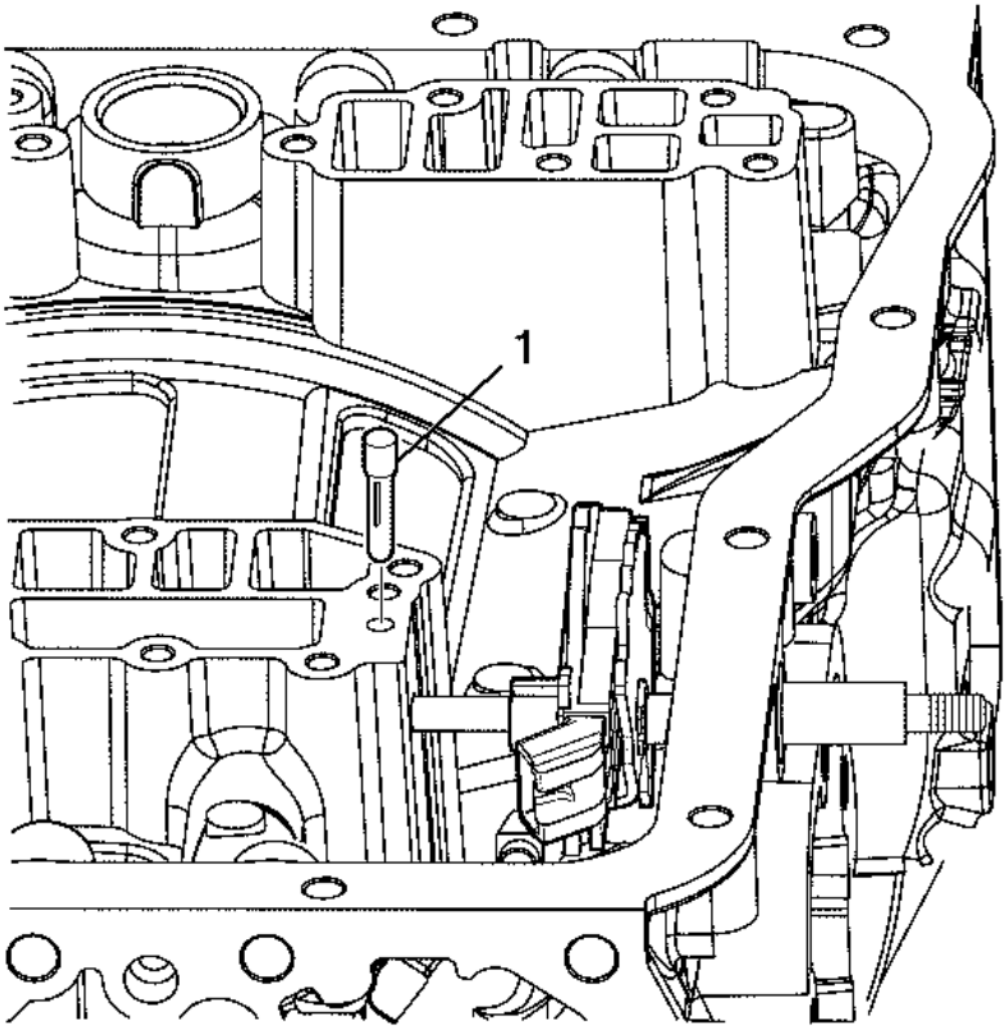


Fig. 334: Locating Spherical Pin At Transmission Case
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT mar the transmission case surface around the spherical pin when removing or installing the spherical pin. An unmarred surface is required to maintain the seal between the control valve assembly and the transmission case.

12. Install the spherical pin (1) into the transmission case.
13. Lightly tap the spherical pin (1) into position until the head of the pin (1) is seated against the transmission case.

EMBLEM/NAMEPLATE REPLACEMENT

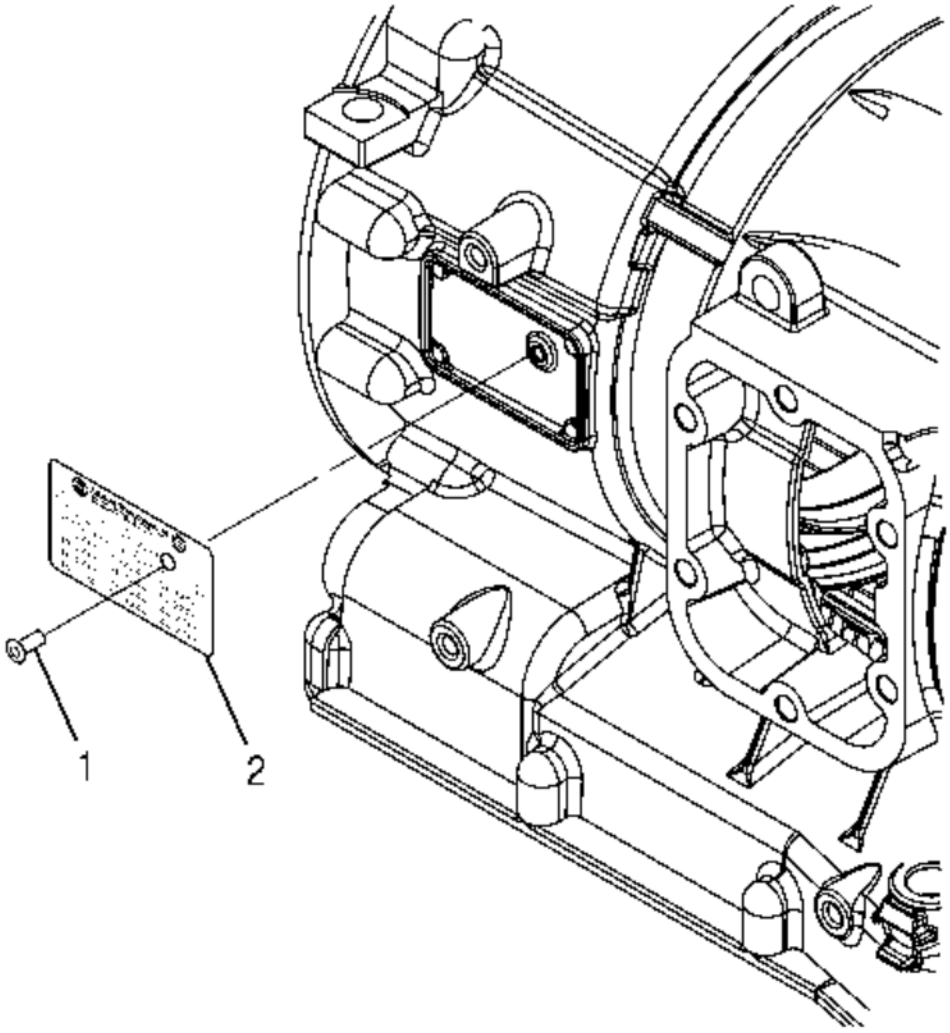


Fig. 335: Locating Nameplate On Transmission Case
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When replacing a nameplate, keep the original nameplate. Stamp the information from the original nameplate onto the replacement nameplate.

1. Using a 0.004 mm (3/16 in) drill bit, drill through the rivet fastening the nameplate to the

transmission case.

2. Remove the nameplate and rivet.
3. Using a new rivet (1) and a pop rivet gun, rivet the new nameplate (2) onto the transmission case.

3RD, 5TH AND REVERSE CLUTCH PLATE INSPECTION

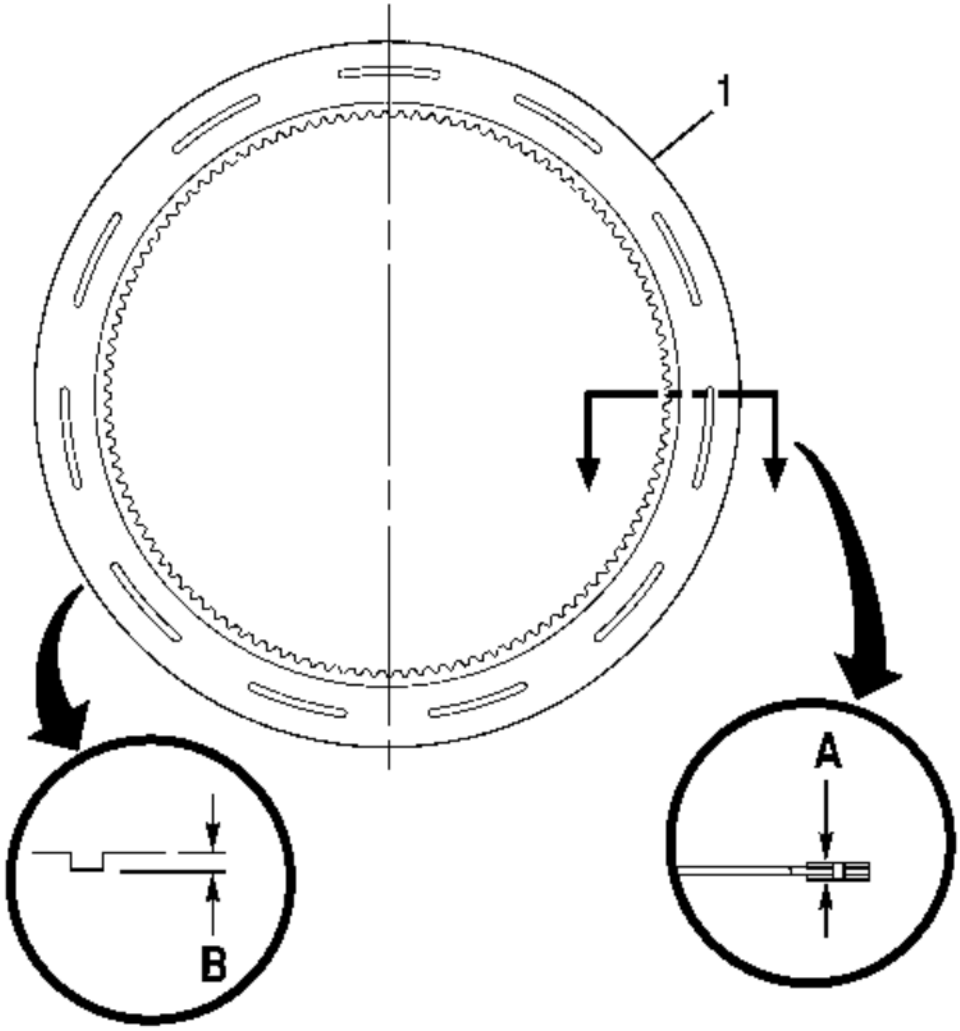


Fig. 336: Measuring Clutch Oil Groove Depth & Fiber Plate Thickness

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Make the following measurements at 3 or more locations. Replace any parts not meeting specifications.

1. Measure the thickness of each 3rd, 5th, and reverse clutch fiber plate (1) at dimension A.

   Specification: The 3rd, 5th, and reverse clutch fiber plate minimum thickness is 2.375 mm (0.093 in).

2. Measure the oil groove depth of each 3rd, 5th, and reverse clutch fiber plate at dimension B.

   Specification: The 3rd, 5th, and reverse clutch fiber plate minimum groove depth is 0.200 mm (0.0079 in).

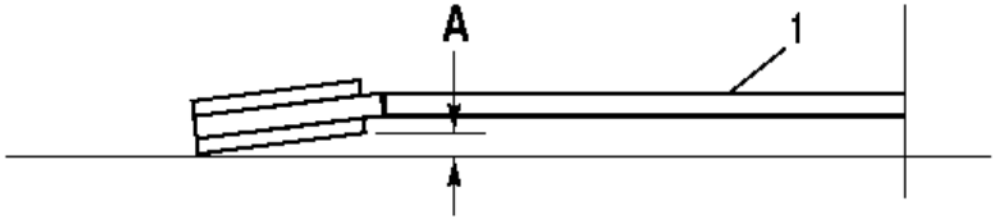


Fig. 337: Measuring Cone Of Clutch Fiber Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Check the plates for coning on a level surface.

3. Measure the cone of each 3rd, 5th, and reverse clutch fiber plate (1).

   Specification: The 3rd, 5th, and reverse clutch fiber plate maximum cone is 0.225 mm (0.0089 in).

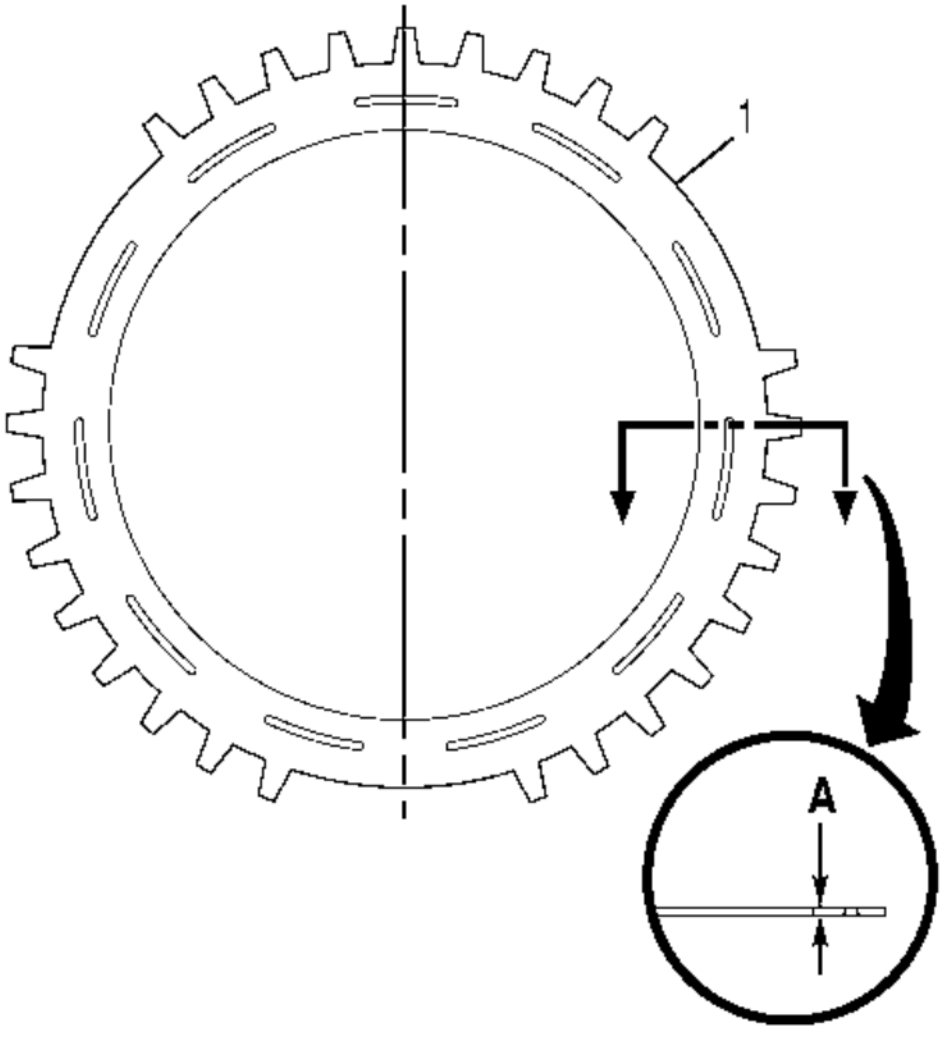


Fig. 338: Measuring Thickness Of Clutch Steel Plate
Courtesy of GENERAL MOTORS CORP.

4. Measure the thickness of each 3rd, 5th, and reverse clutch steel plate (1) at dimension A.

   Specification: The 3rd, 5th, and reverse clutch steel plate minimum thickness is 2.440 mm (0.096 in).

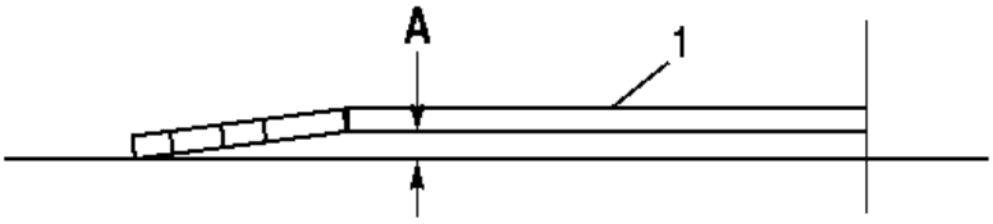


Fig. 339: Measuring Cone Of Clutch Steel Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Check the plates for coning on a level surface.

5. Measure the cone of each 3rd, 5th, and reverse clutch steel plate (1) at dimension A.

   Specification: The 3rd, 5th, and reverse clutch steel plate maximum cone is 0.400 mm (0.015 in).

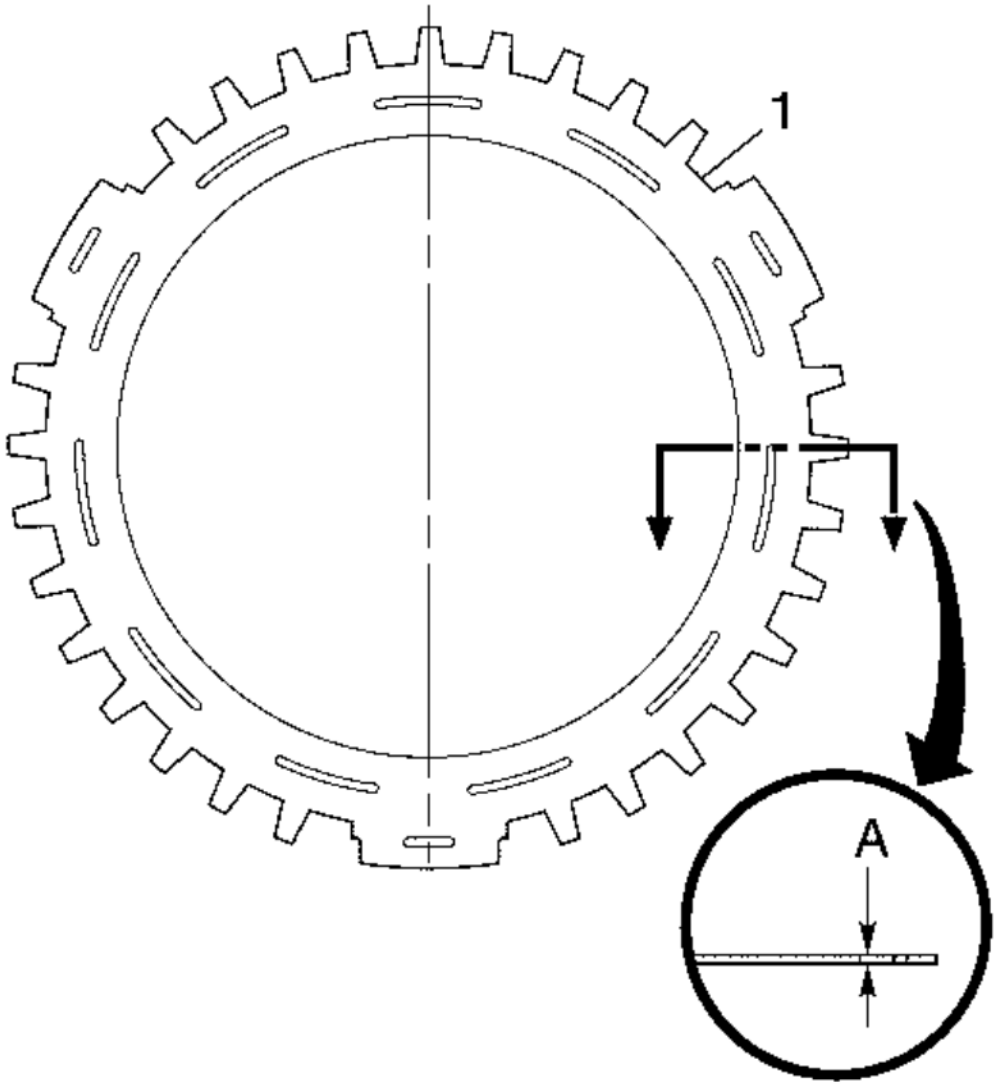


Fig. 340: Measuring Thickness Of Clutch Spring Plate
Courtesy of GENERAL MOTORS CORP.

6. Measure the thickness of the 3rd, 5th, and reverse clutch spring plate (1) at dimension A.

   Specification: The 3rd, 5th, and reverse clutch spring plate minimum thickness is 3.110 mm (0.1224 in).

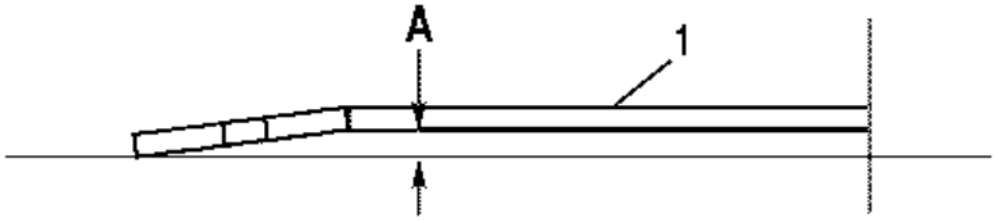


Fig. 341: Measuring Cone Of Clutch Spring Plate
Courtesy of GENERAL MOTORS CORP.

7. Measure the cone of the 3rd, 5th, and reverse clutch spring plate (1) at dimension A.

   Specification: The 3rd, 5th, and reverse clutch spring plate maximum cone is 0.400 mm (0.0157 in).

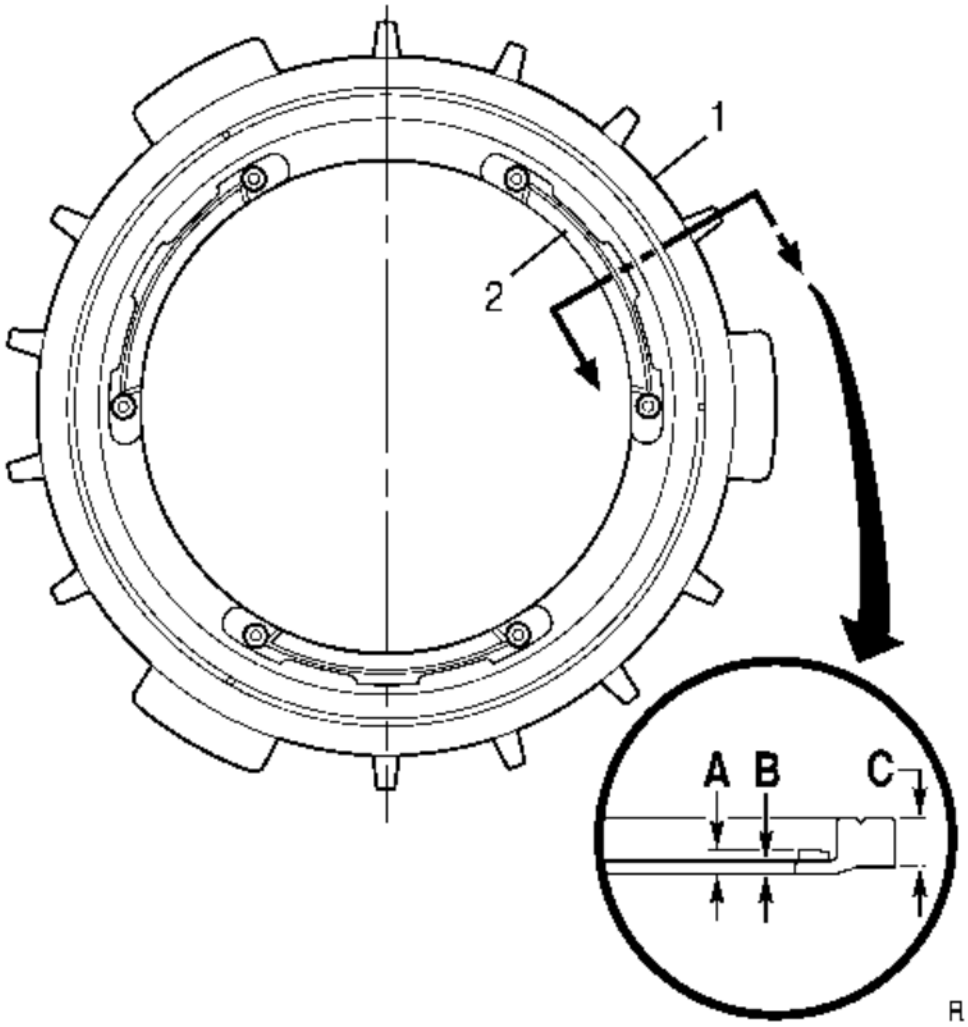


Fig. 342: Measuring Thickness Of Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

8. Measure the thickness of the 3rd, 5th, and reverse clutch backing plate (1) at dimension C.

   Specification: The 3rd, 5th, and reverse clutch backing plate minimum thickness is 15.325 mm (0.6033 in).

9. Measure the distance from the top of the thrust plate (2) to the bottom of the 3rd, 5th, and

reverse clutch plate inner rim at dimension A.

10. Measure the thickness of the 3rd, 5th, and reverse clutch plate inner rim at dimension B.
11. Calculate the thickness of the thrust plate by subtracting Dimension B from Dimension A.

Specification: The thrust plate minimum thickness is 3.000 mm (0.1181 in).

IMPORTANT: Check the plates for coning on a level surface.

12. Measure the cone of the 3rd, 5th, and reverse clutch backing plate (1).
13. Replace the backing plate if any cone is present.

2-6 CLUTCH PLATE INSPECTION

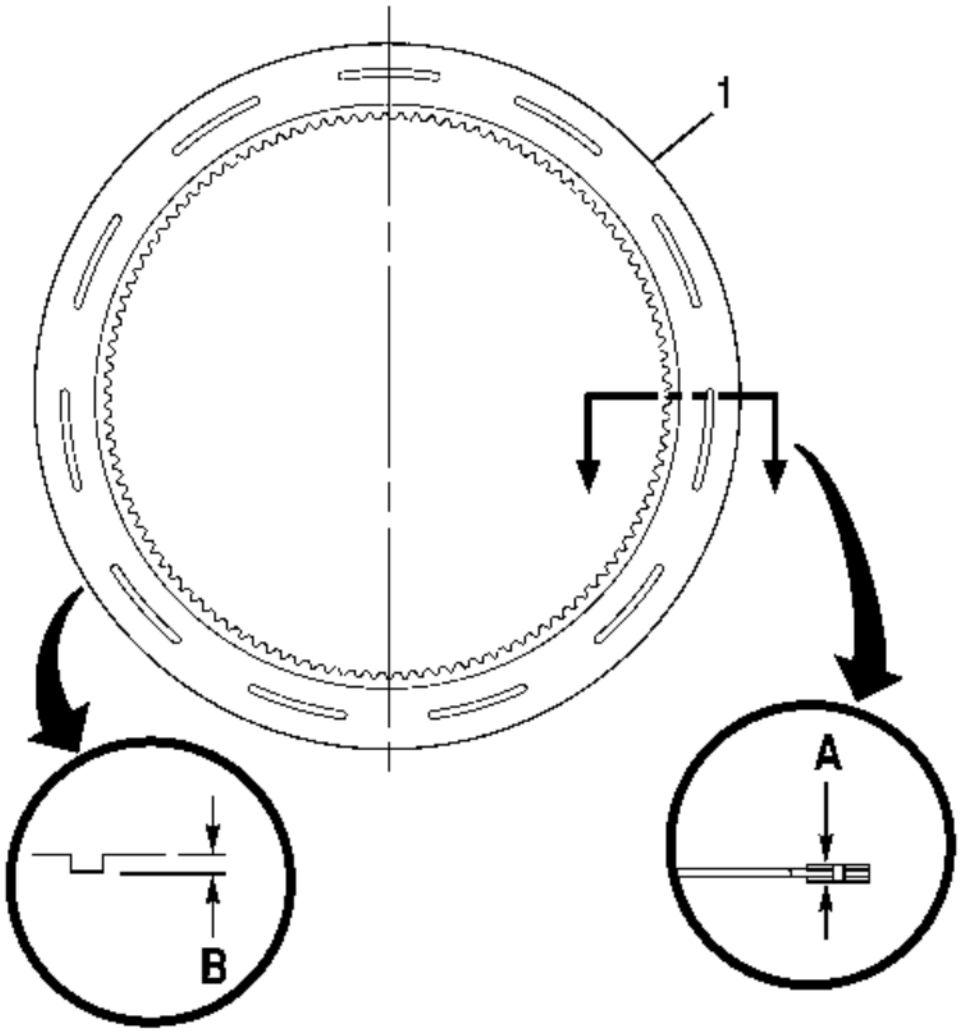


Fig. 343: Measuring Clutch Oil Groove Depth & Fiber Plate Thickness
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Perform the following measurements at 3 or more locations.**
- **Check the plates for coning on a level surface.**
- **Replace any parts not meeting specifications.**

1. Measure the thickness of each 2-6 clutch fiber plate (1) at dimension A.

   Specification: The 2-6 clutch fiber plate minimum thickness is 2.375 mm (0.0935 in).

2. Measure the oil groove depth of each 2-6 clutch fiber plate (1) at dimension B.

   Specification: The 2-6 clutch fiber plate oil groove minimum depth is 0.2 mm (0.0079 in).

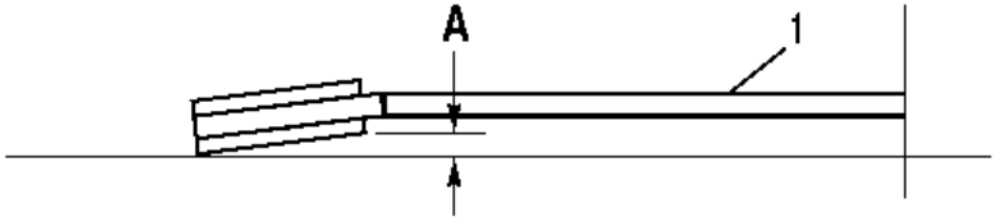


Fig. 344: Measuring Cone Of Clutch Fiber Plate
Courtesy of GENERAL MOTORS CORP.

3. Measure the cone of each 2-6 clutch fiber plate (1) at dimension A.

   Specification: The 2-6 clutch fiber plate maximum cone is 0.225 mm (0.0089 in).

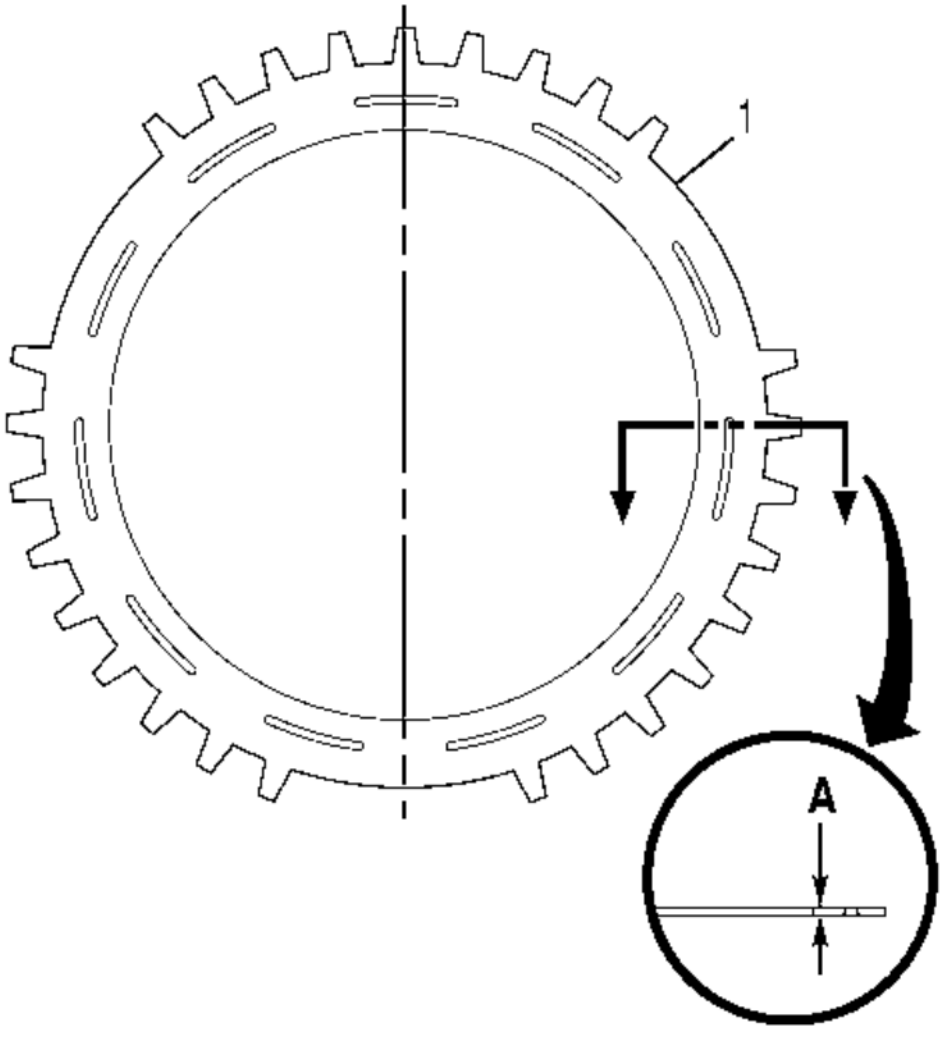


Fig. 345: Measuring Thickness Of Clutch Steel Plate
Courtesy of GENERAL MOTORS CORP.

4. Measure the thickness of each 2-6 clutch steel plate (1) at dimension A.

   Specification: The 2-6 clutch steel plate minimum thickness is 2.44 mm (0.096 in).

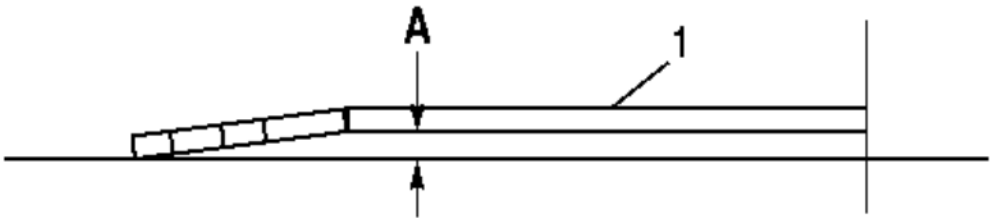


Fig. 346: Measuring Cone Of Clutch Steel Plate
Courtesy of GENERAL MOTORS CORP.

5. Measure the cone of each 2-6 clutch steel plate (1) at dimension A.

   Specification: The 2-6 clutch steel plate maximum cone is 0.4 mm (0.0157 in).

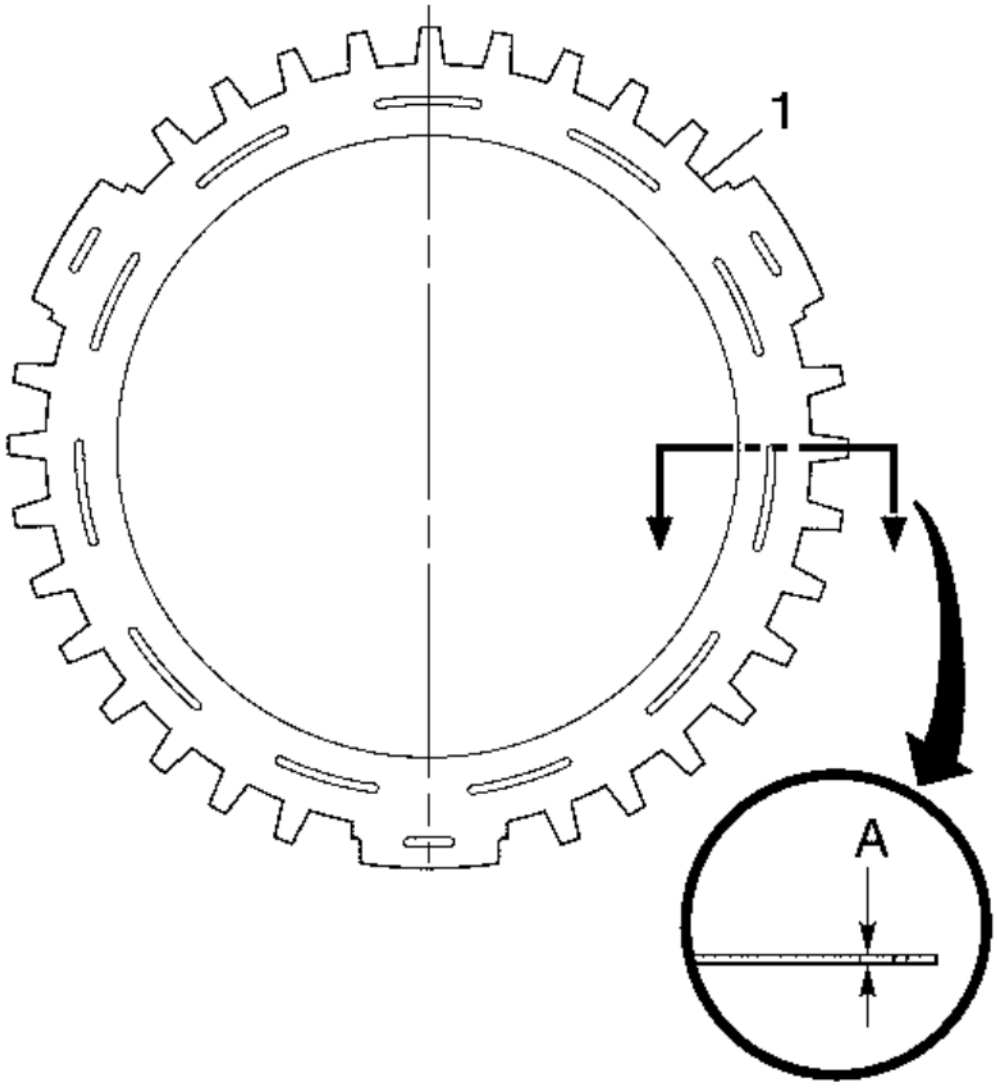


Fig. 347: Measuring Thickness Of Clutch Spring Plate
Courtesy of GENERAL MOTORS CORP.

6. Measure the thickness of the 2-6 clutch spring plate (1) at dimension A.

Specification: The 2-6 clutch spring plate minimum thickness is 3.11 mm (0.1224 in).

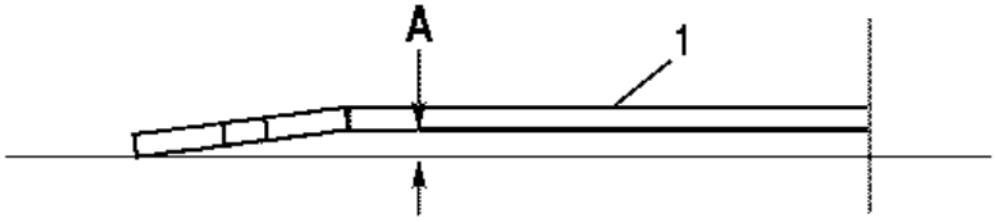


Fig. 348: Measuring Cone Of Clutch Spring Plate
Courtesy of GENERAL MOTORS CORP.

7. Measure the cone of the 2-6 clutch spring plate (1) at dimension A.

   Specification: The 2-6 clutch spring plate maximum cone is 0.4 mm (0.0157 in).

2-6 CLUTCH BACKING PLATE INSPECTION

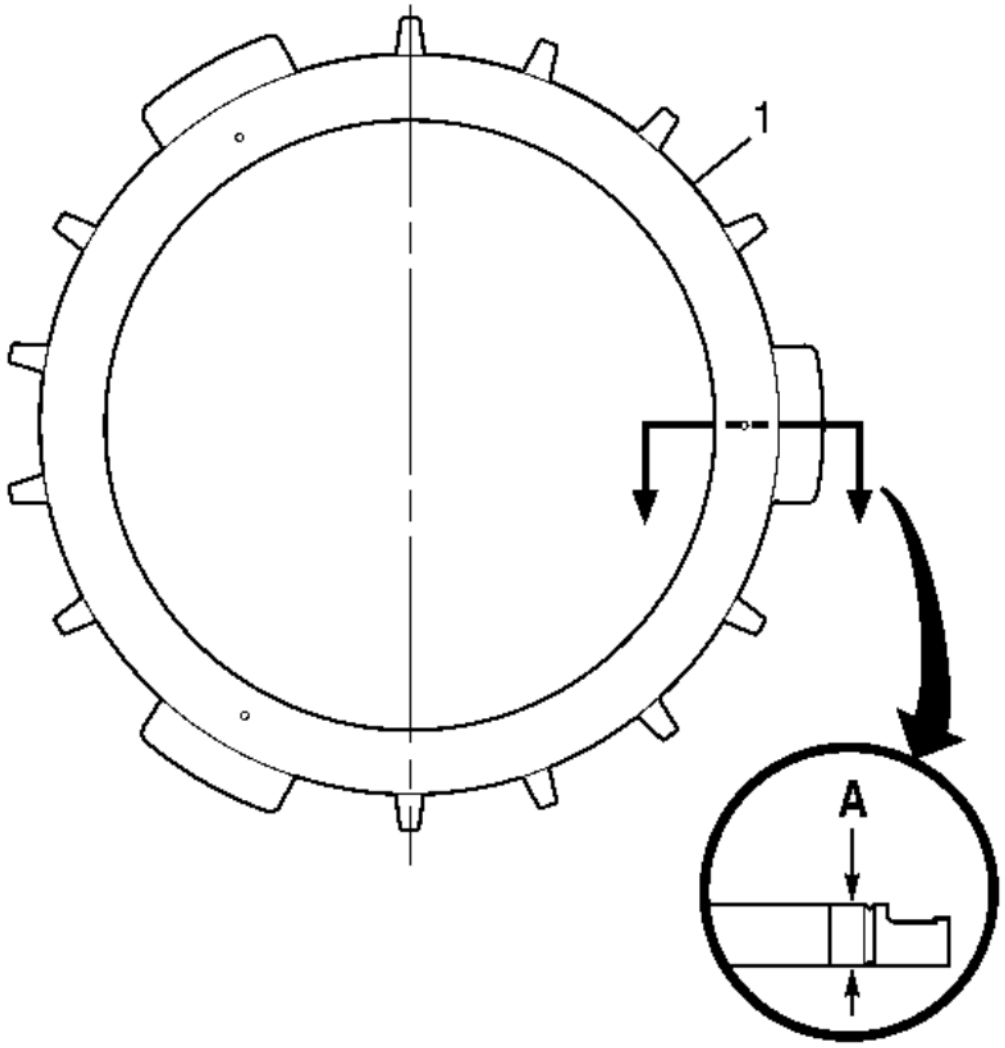


Fig. 349: Measuring Clutch Backing Plate Dimension
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform the following measurements at 3 or more locations.

1. Measure the thickness of the 2-6 clutch backing plate at dimension A.

   Specification: The 2-6 clutch backing plate minimum thickness is 15.400 mm (0.6063 in).

2. Measure the cone of the 2-6 clutch backing plate.
3. Replace the backing plate (1) if any cone is present.

LOW AND REVERSE CLUTCH PLATE INSPECTION

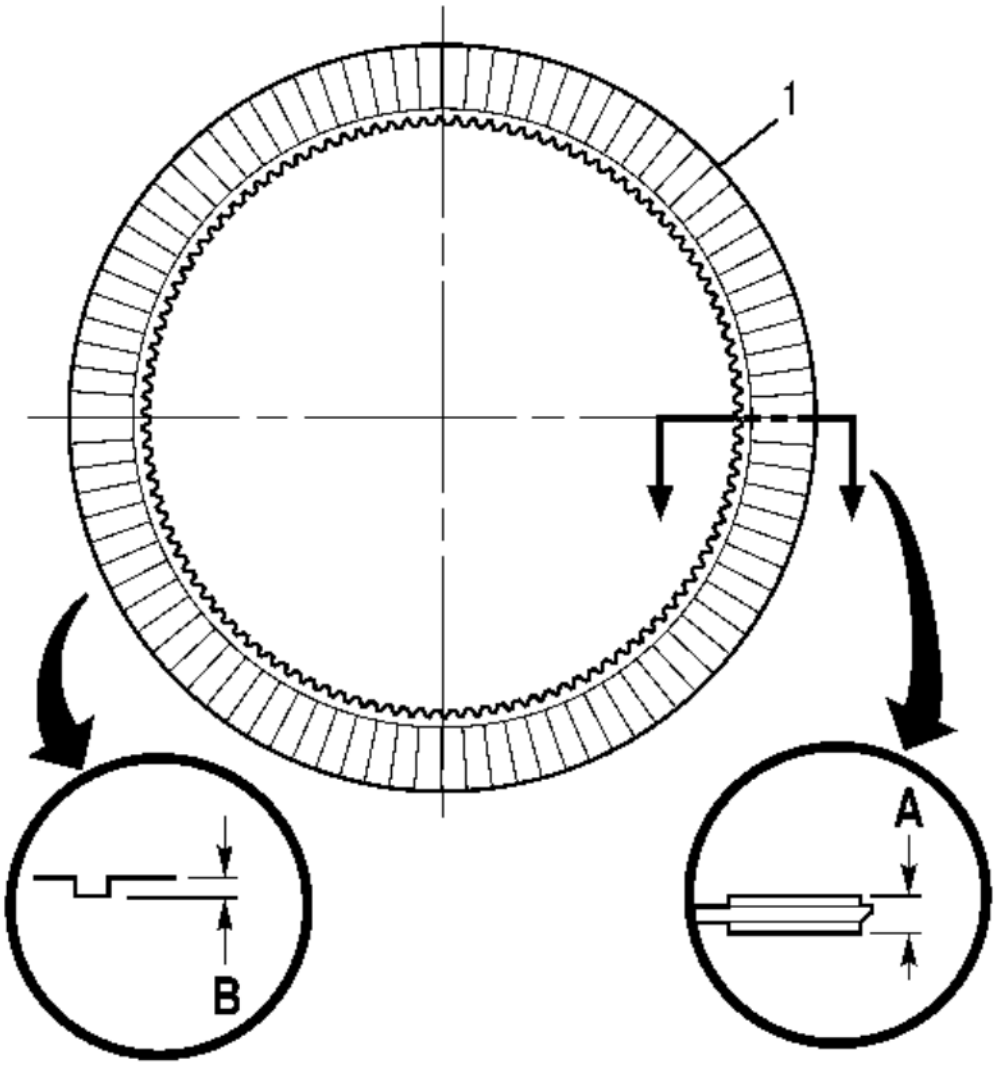


Fig. 350: Low and Reverse Clutch Plate Measurements
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Perform the following measurements at 3 or more locations.**
- **Check the plates for coning on a level surface.**
- **Replace any parts not meeting specifications.**

1. Measure the thickness of each low and reverse clutch fiber plate (1) at dimension A.

   Specification: The low and reverse clutch fiber plate minimum thickness is 2.375 mm (0.0935 in).

2. Measure the oil groove depth of each low and reverse clutch fiber plate (1) at dimension B.

   Specification: The low and reverse clutch fiber plate minimum groove depth is 0.200 mm (0.0079 in).

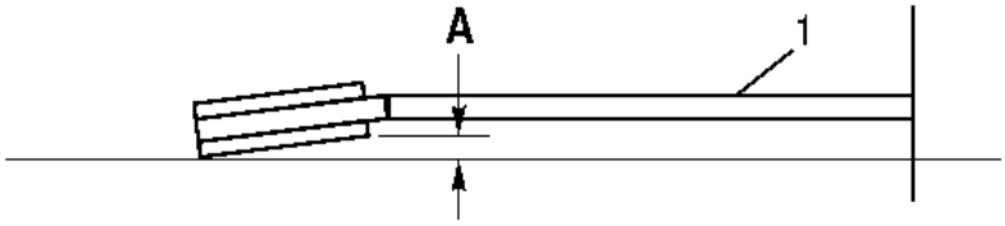


Fig. 351: Checking Low And Reverse Clutch Fiber Plate Cone
Courtesy of GENERAL MOTORS CORP.

3. Measure the cone of each low and reverse clutch fiber plate (1) at dimension A.

   Specification: The low and reverse clutch fiber plate maximum cone is 0.225 mm (0.0089 in).

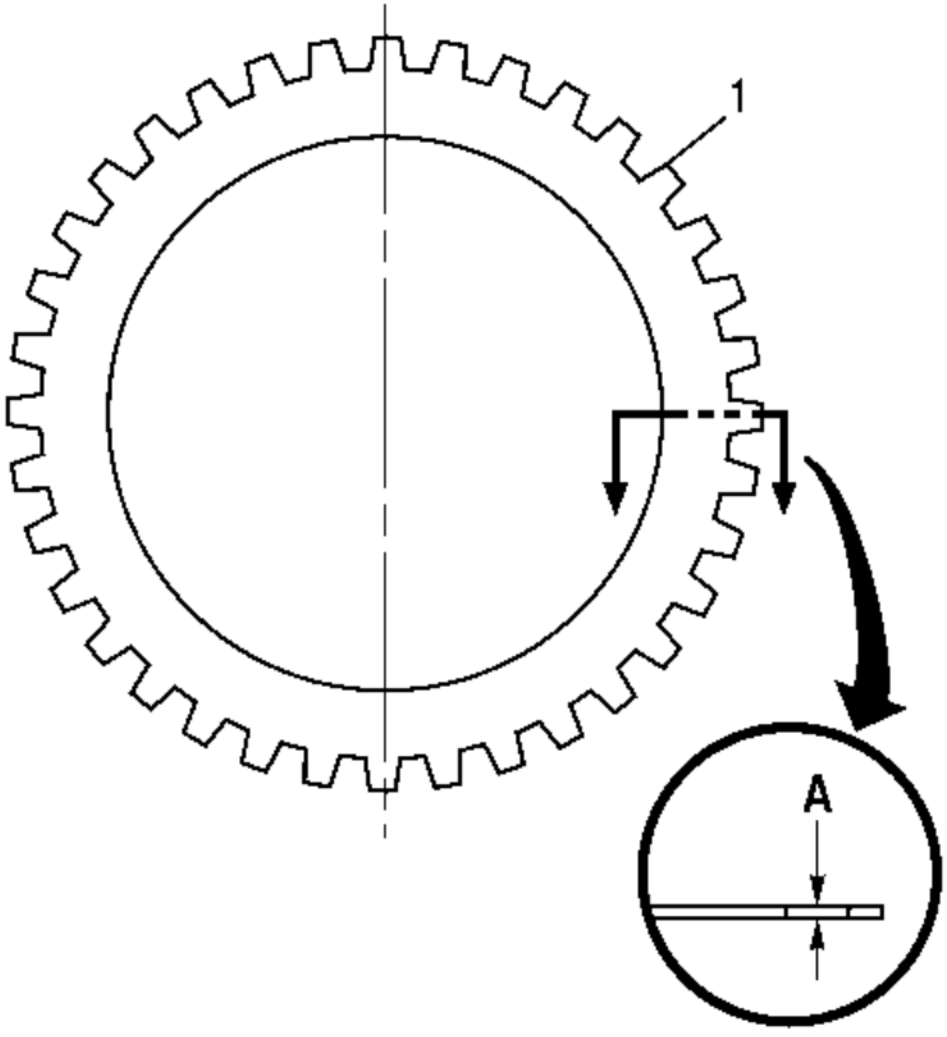


Fig. 352: Measuring Low And Reverse Clutch Steel Plate Thickness
Courtesy of GENERAL MOTORS CORP.

4. Measure the thickness of each low and reverse clutch steel plate (1) at dimension A.
5. The minimum thickness is listed in **Selective Components Specifications** .

LOW AND REVERSE CLUTCH BACKING PLATE INSPECTION

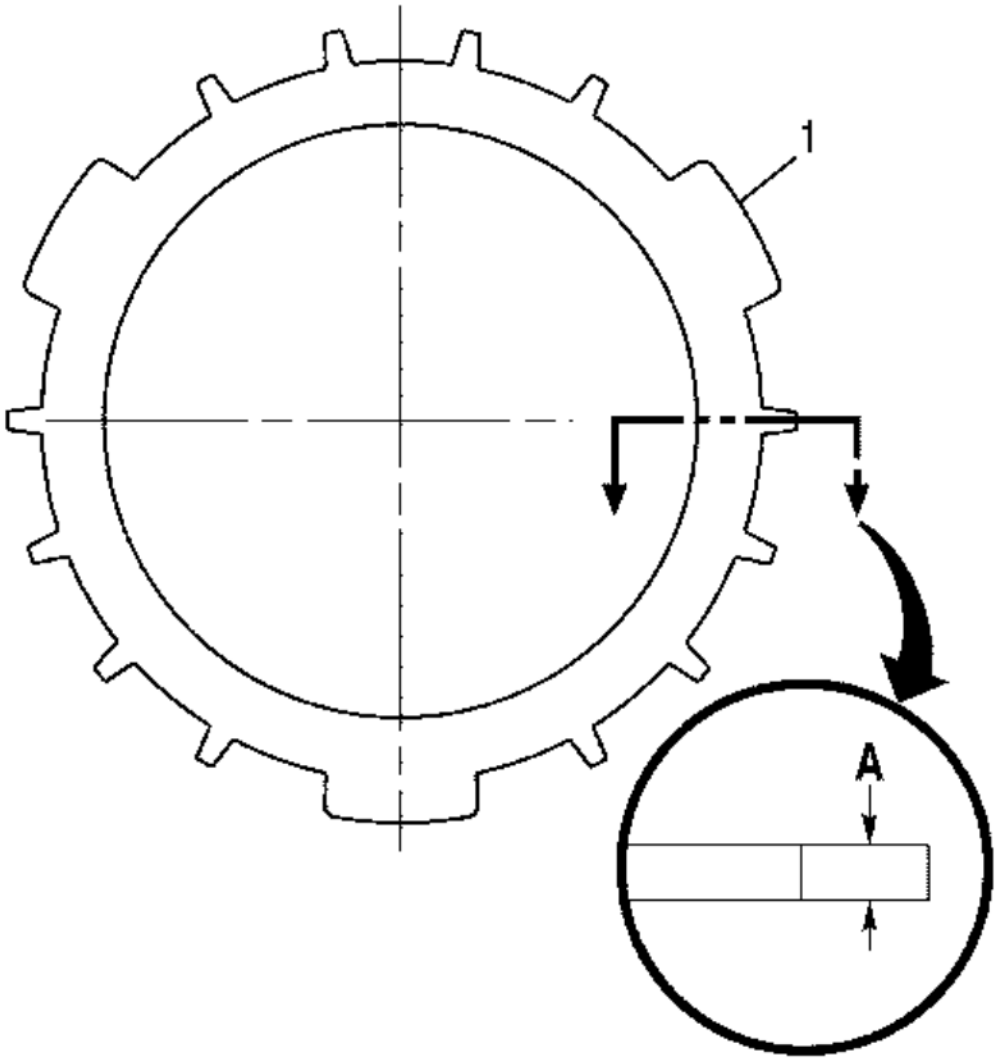


Fig. 353: Locating Low And Reverse Clutch Backing Plate Inspection Areas
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform the following measurements at 3 or more locations.

1. Measure the thickness of each low and reverse clutch backing plate (1) at dimension A.

   Specification: The low and reverse clutch backing plate minimum thickness is 17.900 mm

(0.7047 in).

2. Measure the cone of the low and reverse clutch backing plate (1).
3. Replace the low and reverse clutch backing plate (1) if any cone is present.

INPUT INTERNAL RING GEAR INSPECTION

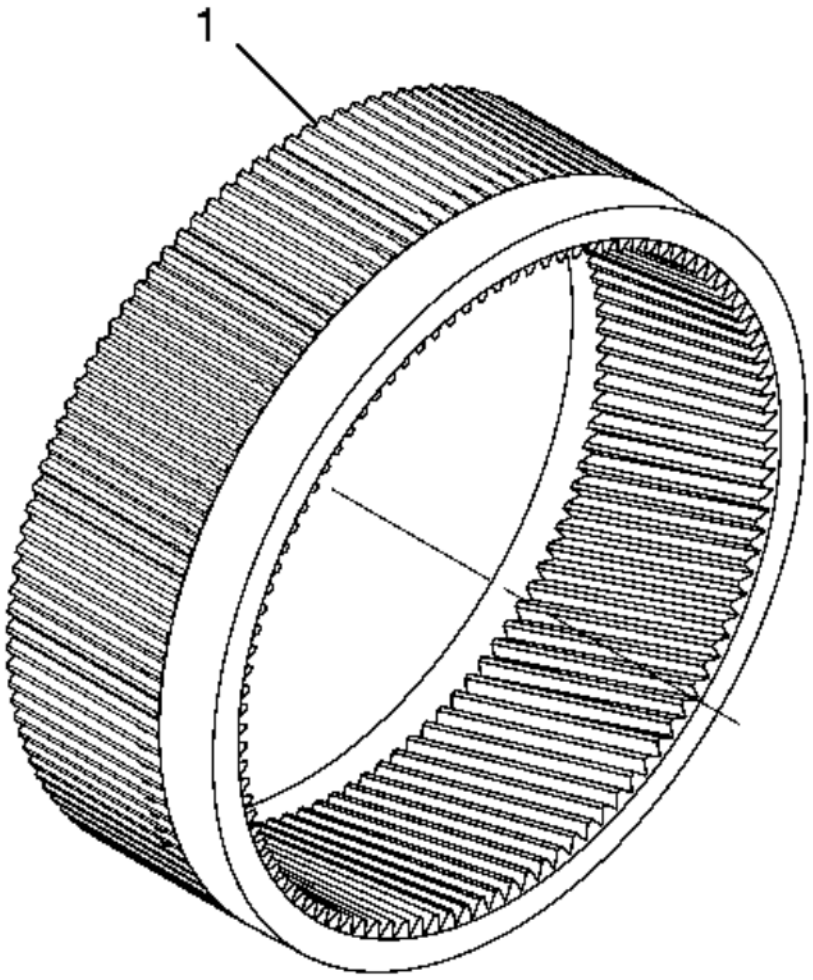


Fig. 354: Input Internal Ring Gear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Clutch plate movement can cause notching on the external splines of the input internal ring gear.

1. Inspect the external splines of the input internal ring gear (1) for notching.
2. Replace the ring gear if detectable notching has occurred.

MAIN SHAFT CLEANING AND INSPECTION

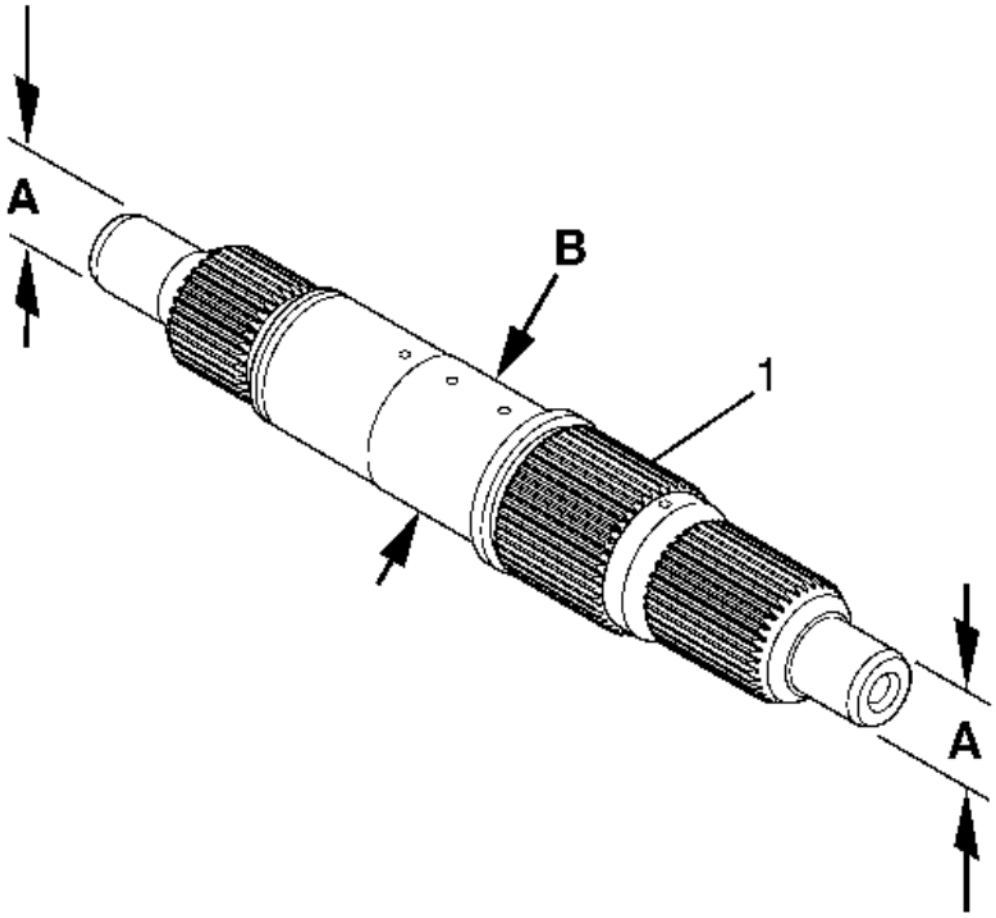


Fig. 355: Inspection Areas On Main Shaft
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Replace the main shaft if the specifications are not met.

1. Inspect the main shaft pilots for damage.
2. Measure the main shaft pilots at dimension A.

   Specification: The main shaft pilot minimum outside diameter is 19.987 mm (0.7869 in).

3. Inspect the main shaft journal contact area for damage.
4. Measure the main shaft journal contact area at dimension B.

   Specification: The main shaft journal minimum diameter is 36.405 mm (1.4333 in).

INPUT CARRIER ASSEMBLY DISASSEMBLE

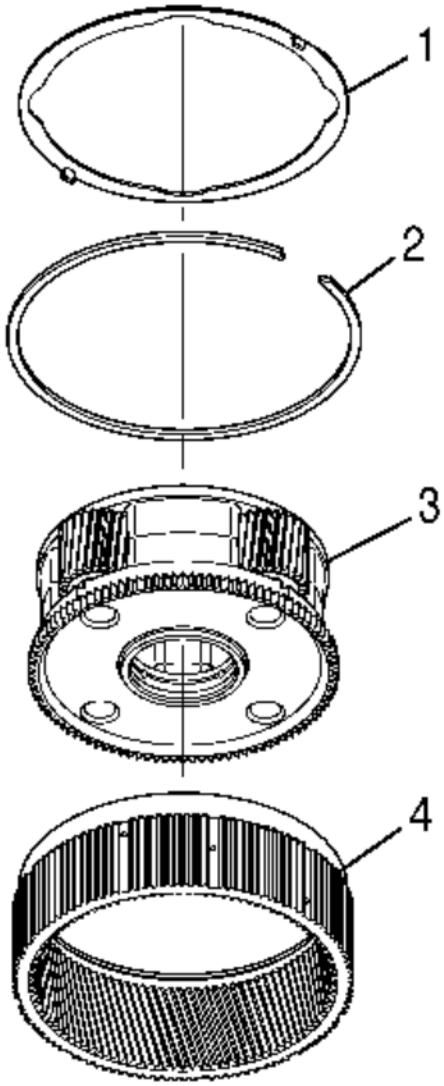


Fig. 356: Exploded View Of Input Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the thrust washer (1) from the intermediate internal gear (4).
2. Remove the retaining ring (2) from the intermediate internal gear (4).
3. Separate the input carrier assembly (3) from the intermediate internal gear (4).

INPUT CARRIER ASSEMBLY INSPECTION

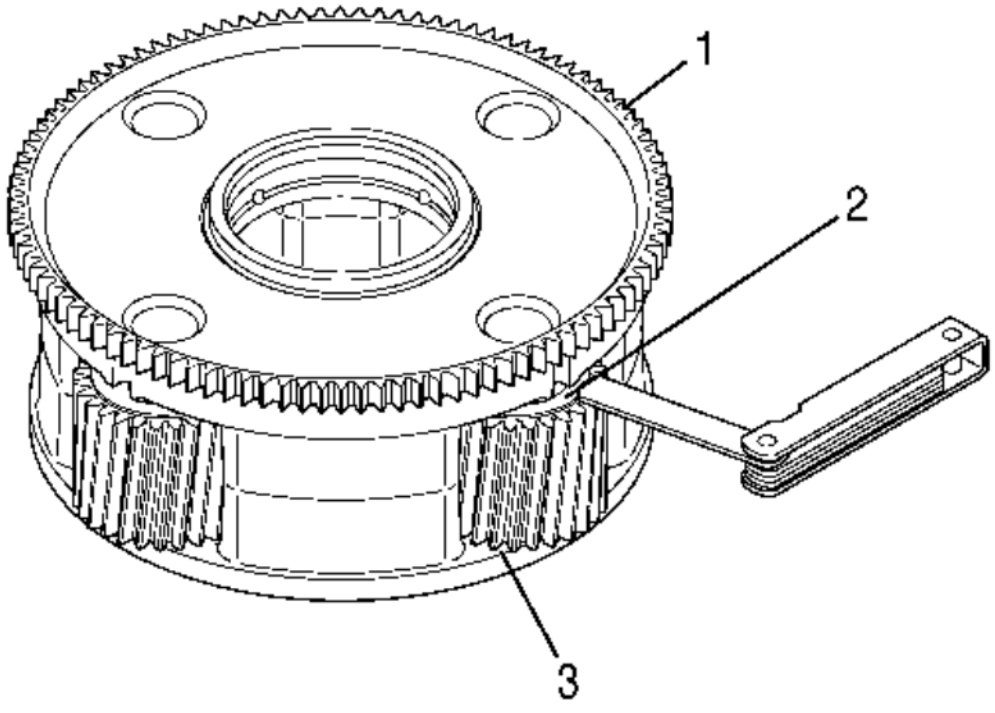


Fig. 357: Checking Input Carrier End Play With Feeler Gage
Courtesy of GENERAL MOTORS CORP.

1. Check the end play between the input carrier (1) and the thrust washer (2) at each pinion gear (3).
2. Replace the input carrier assembly if the end play exceeds specifications.

Specification: Replace the input carrier assembly if the end play exceeds 1.01 mm (0.040 in).

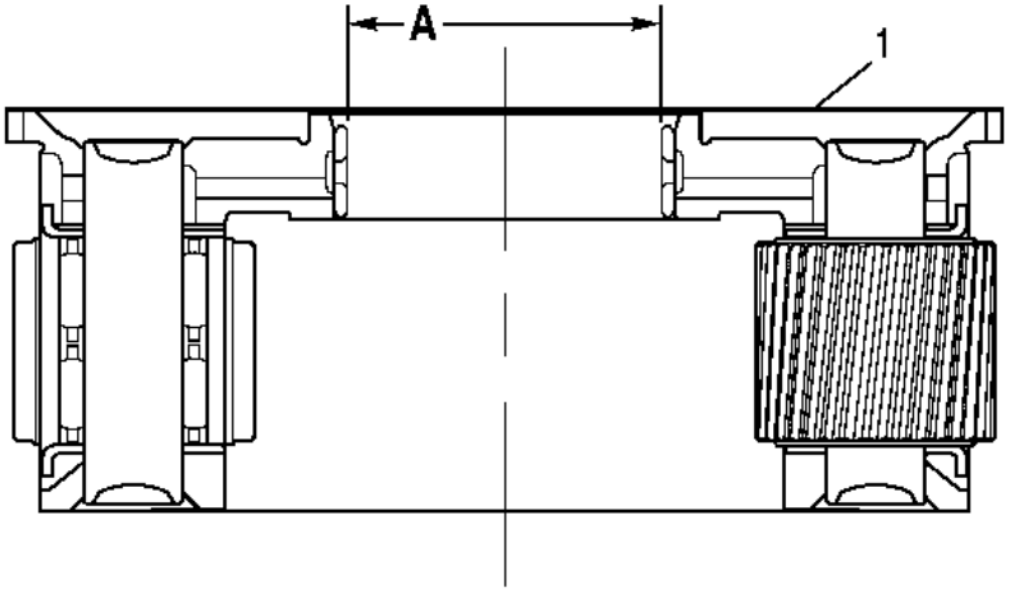


Fig. 358: Inspecting Inside Diameter Of Input Carrier Bushing
Courtesy of GENERAL MOTORS CORP.

3. Inspect the bushing for wear or damage.
4. Measure the ID of the bushing.
5. Replace the bushing if the ID exceeds specification.

Specification: The bushing maximum ID is 50.69 mm (1.9957 in).

INPUT CARRIER BUSHING INSPECTION AND REPLACEMENT

Tools Required

- **J 43781** Input Carrier Bushing Remover/Installer. See **Special Tools**.
- **J 8092** Universal Driver

Inspection and Replacement

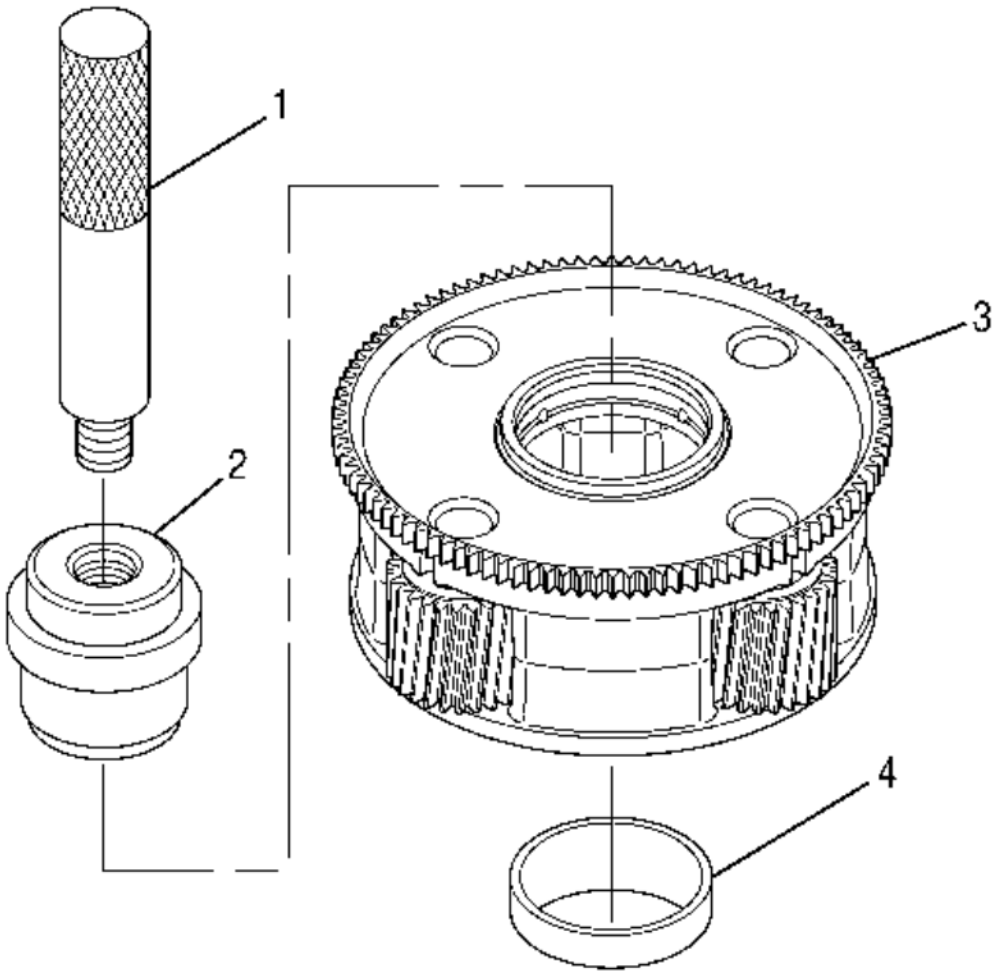


Fig. 359: View Of Input Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The preferred method for removing/installing the input carrier bushing is to use J 43781 and a press. See Special Tools. If a press is not available, use J 43781 and J 8092 universal driver. See Special Tools.

1. Position the input carrier assembly (3) on the press with the external splines facing up.
2. If the bushing will be removed without a press, install the short end of **J 43781** (2) onto **J**

8092 (1). See **Special Tools**.

3. Using **J 43781** , press or drive the bushing (4) out of the carrier. See **Special Tools**.

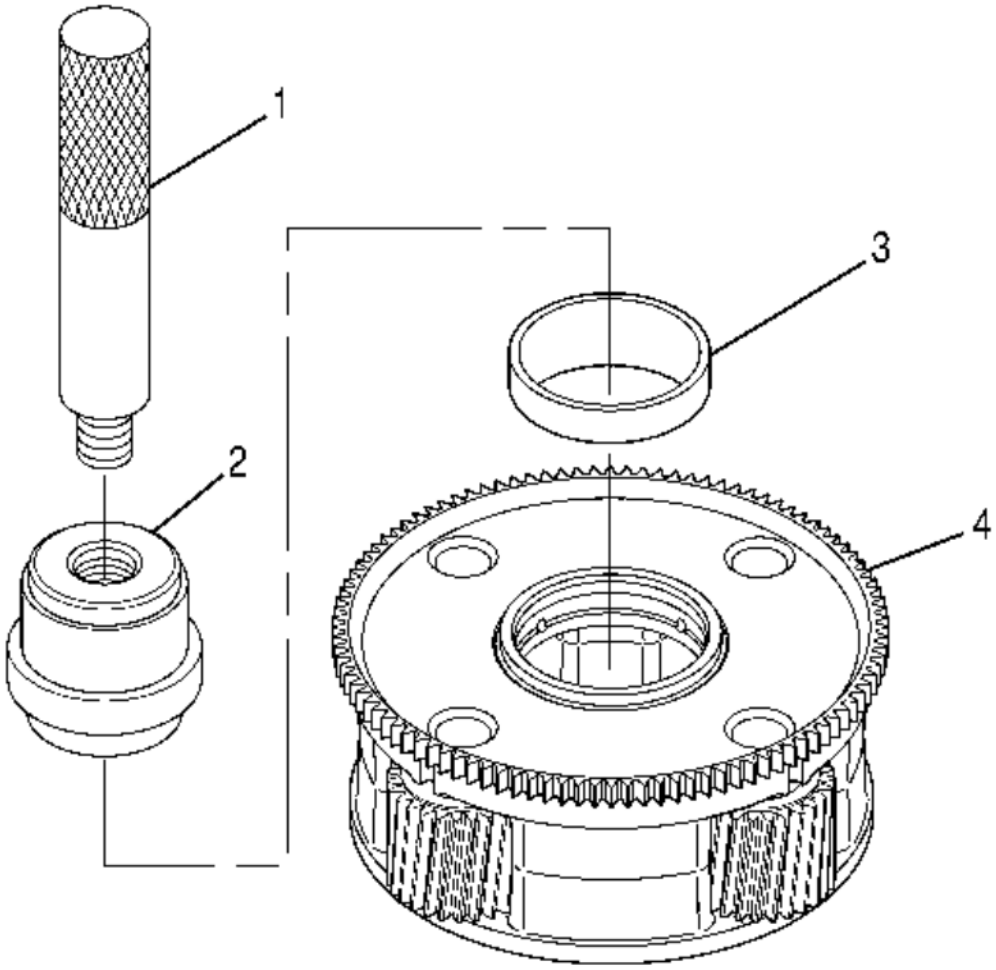


Fig. 360: Installing Input Carrier Assembly Bushing
Courtesy of GENERAL MOTORS CORP.

4. If the bushing will be installed without a press, install the long end of **J 43781** (2) onto **J 8092** (1). See **Special Tools**.
5. Install a new bushing (3) onto **J 43781** (2). See **Special Tools**.

6. Using **J 43781** , press or drive the bushing into the carrier until **J 43781** (2) seats. See **Special Tools**.

INPUT CARRIER THRUST WASHER INSPECTION

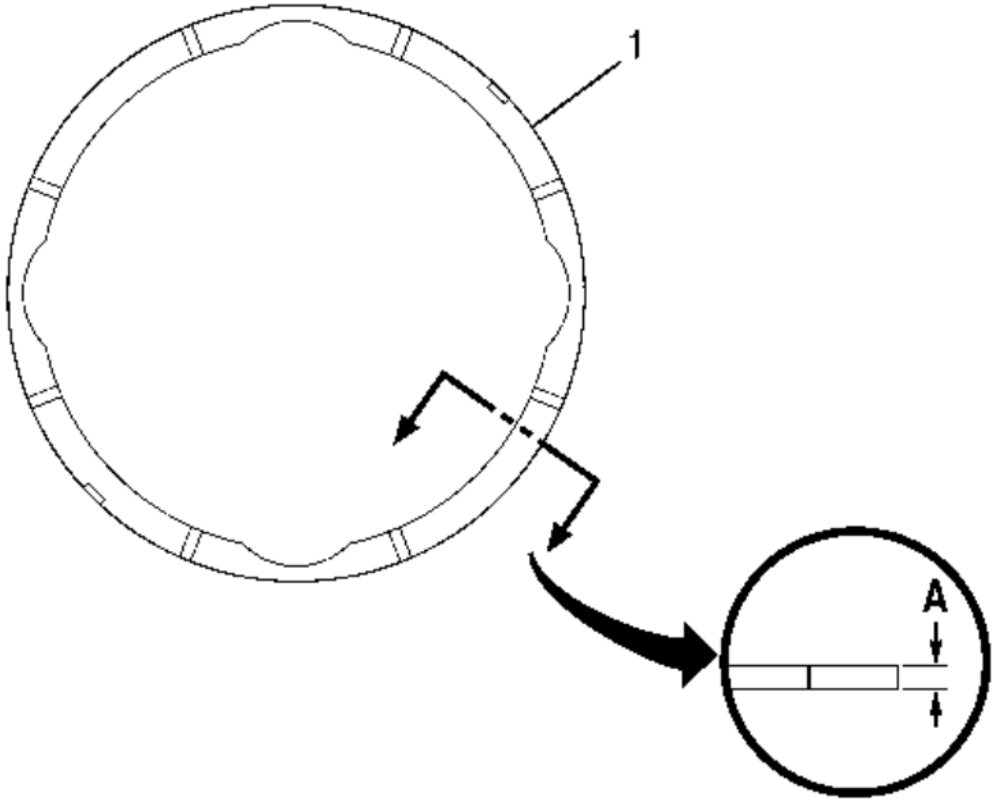


Fig. 361: Illustrating Input Carrier Thrust Washer Measurements
Courtesy of GENERAL MOTORS CORP.

1. Measure the thickness of the thrust washer (1) at dimension A.

   Specification: The minimum thrust washer thickness is 1.49 mm (0.059 in).

2. Replace the thrust washer if specifications are not met.

INPUT CARRIER ASSEMBLY ASSEMBLE

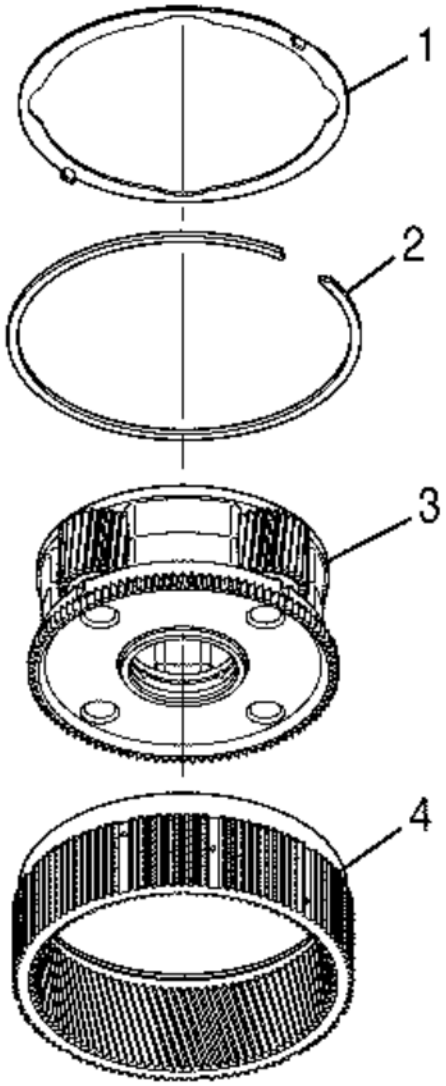


Fig. 362: Exploded View Of Input Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

1. Position the intermediate internal gear (4) on the work table so that the tang holes are facing up.
2. Install the input carrier assembly (3) into the intermediate internal gear (4). Make sure the splines are engaged.

3. Install the retaining ring (2) into the intermediate internal gear so that the input carrier assembly is retained.
4. Align the tangs of the thrust washer (1) with the tang holes in the intermediate internal gear.
5. Install the thrust washer onto the intermediate internal gear.

INTERMEDIATE INTERNAL GEAR INSPECTION

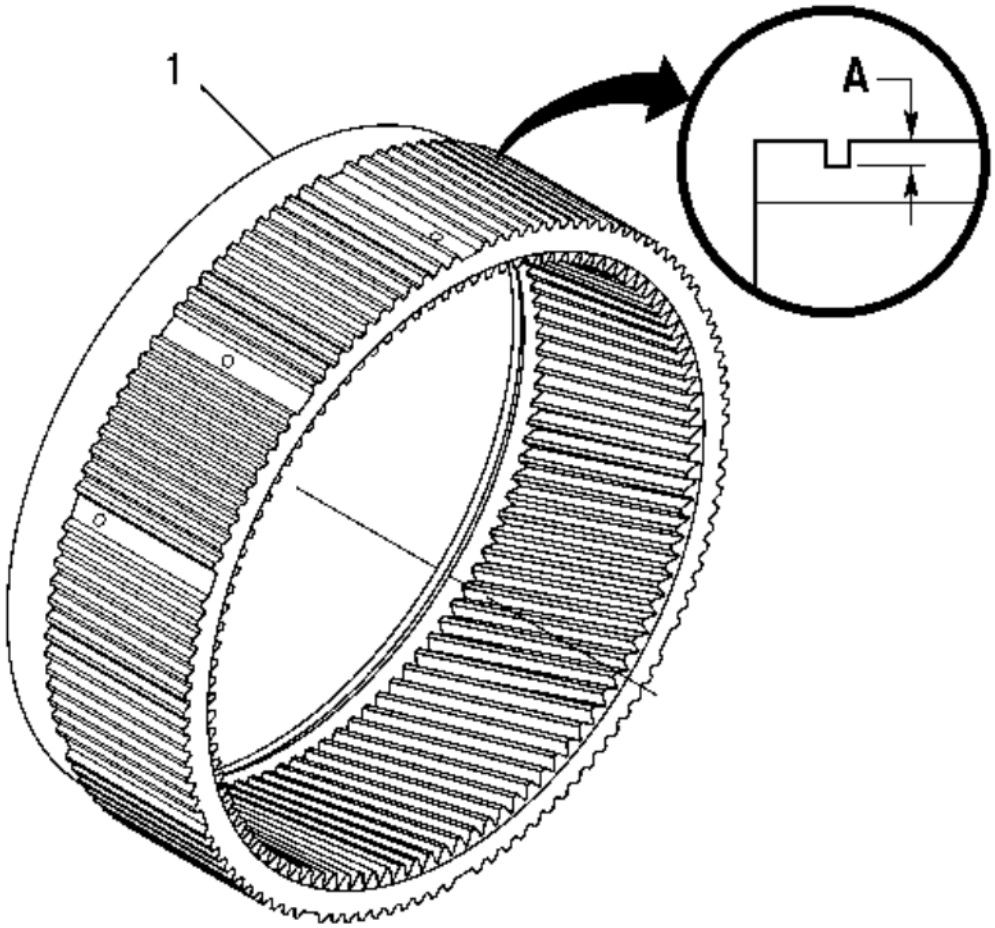


Fig. 363: Intermediate Internal Gear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Clutch plate movement can cause notching on the external

splines of the intermediate internal gear.

1. Inspect the external splines of the intermediate internal gear.
2. Replace the intermediate internal gear if detectable notching has occurred.

INTERMEDIATE CARRIER ASSEMBLY DISASSEMBLE

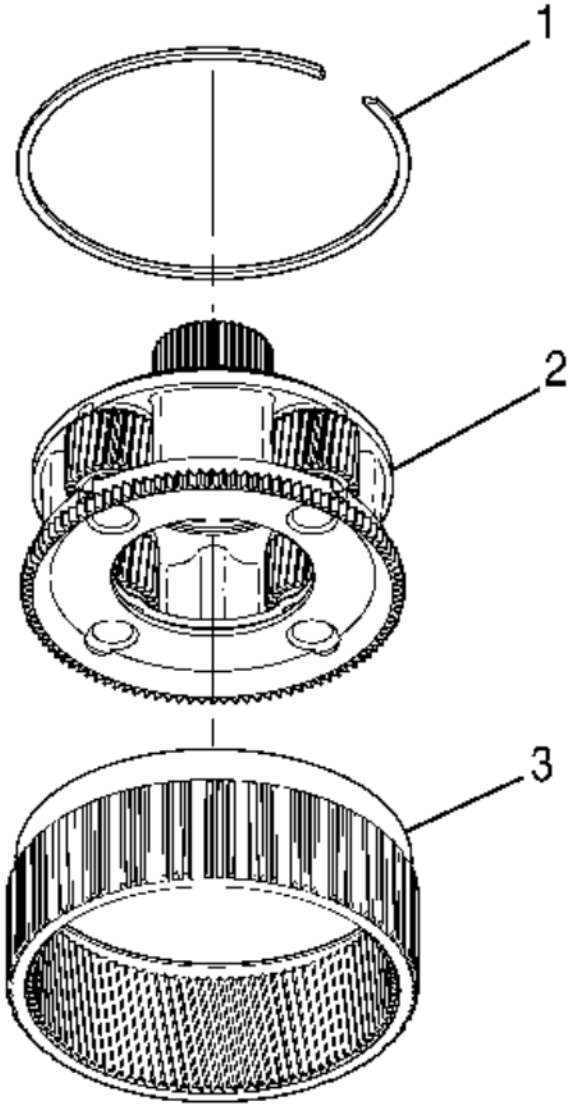


Fig. 364: View Of Intermediate Carrier Assembly & Output Carrier Internal Gear
Courtesy of GENERAL MOTORS CORP.

1. Remove the retaining ring (1) from the output carrier internal gear (3).
2. Separate the intermediate carrier assembly (2) from the output carrier internal gear (3).

INTERMEDIATE CARRIER ASSEMBLY INSPECTION

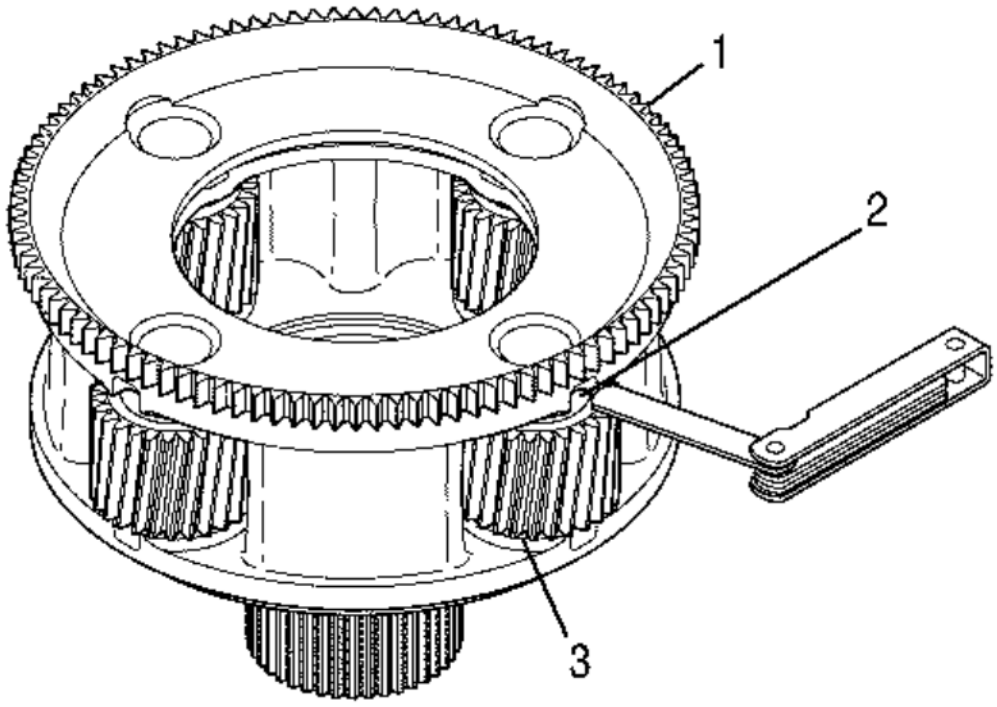


Fig. 365: Checking End Play Between Intermediate Carrier Assembly And Thrust Washer On Intermediate Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

1. Check the end play between the intermediate carrier assembly (1) and the thrust washer (2) at each pinion gear (3).
2. If the end play exceeds specifications replace the intermediate carrier assembly.

Specification: The maximum end play is 1.01 mm (0.040 in).

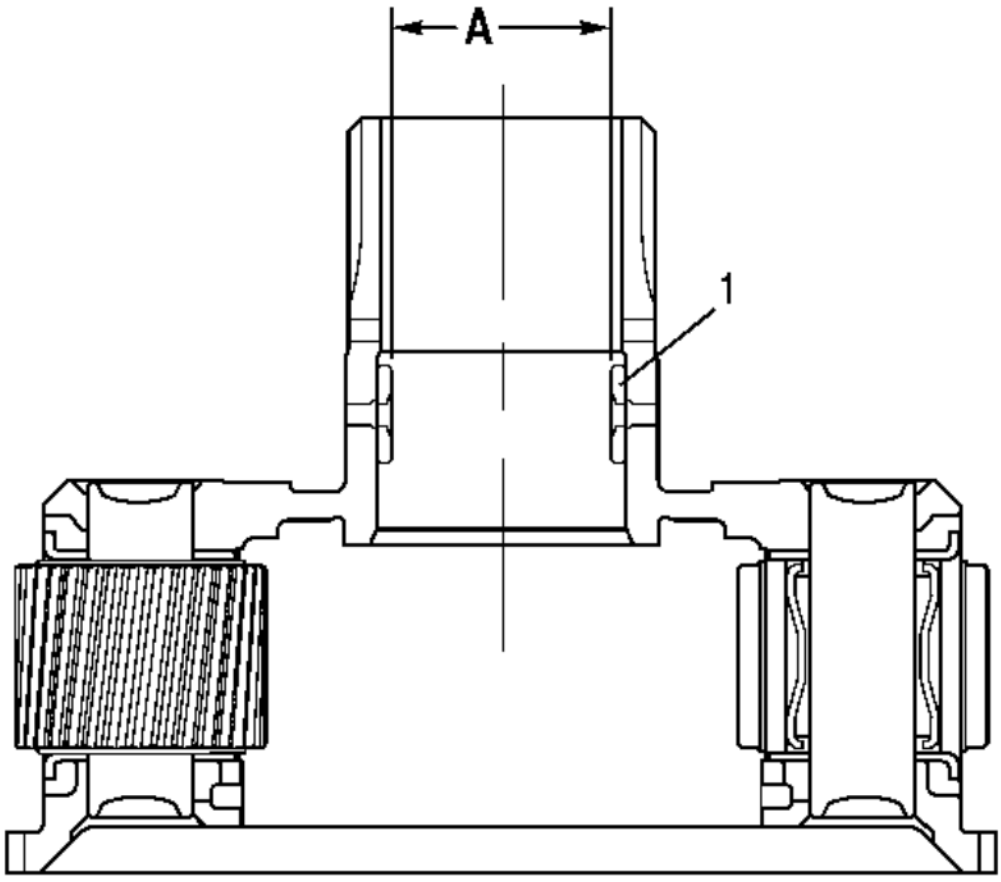


Fig. 366: Measuring Inside Diameter Of Intermediate Carrier Bushing
Courtesy of GENERAL MOTORS CORP.

3. Inspect the bushing (1) for wear and damage.
4. Measure the inside diameter (ID) of the bushing at dimension A.
5. If the bushing ID exceeds specifications, replace the bushing.

Specification: The bushing maximum ID is 36.575 mm (1.4400 in)

INTERMEDIATE CARRIER BUSHING REPLACEMENT

Tools Required

- **J 43785** Intermediate Bushing Remover/Installer. See **Special Tools**.
- **J 8092** Universal Driver

Replacement

IMPORTANT: The preferred method for removing/installing the intermediate carrier bushing is to use J 43785 and a press. See Special Tools. If a press is not available, use J 43785 and universal driver J 8092 . See Special Tools.

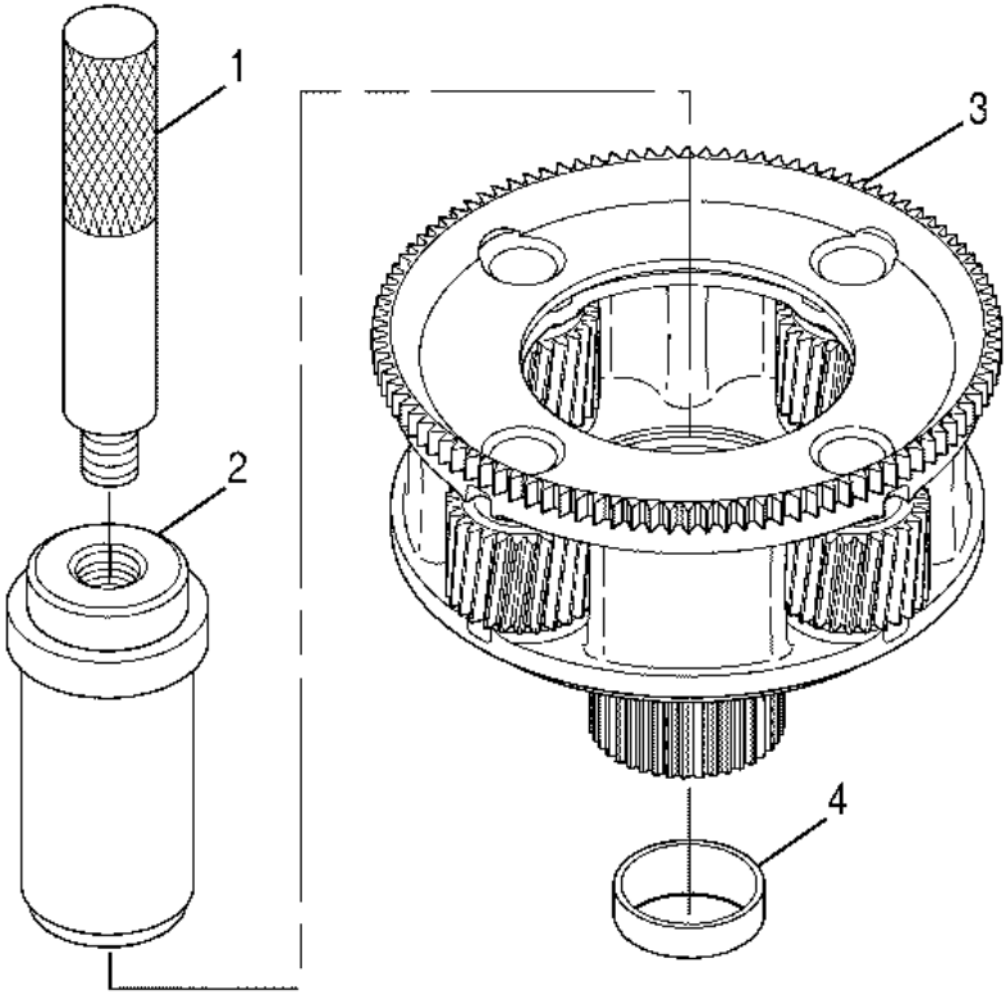


Fig. 367: Removing Intermediate Carrier Bushing Using J 43785 & J 8092
Courtesy of GENERAL MOTORS CORP.

1. Position the intermediate carrier assembly (3) on wooden blocks on the press with the external splines facing up.
2. If the bushing will be removed with out a press, install the short end of **J 43785** (2) onto **J 8092** (1). See **Special Tools**.
3. Using **J 43785** (2), press or drive the bushing (4) out of the carrier (3). See **Special Tools**.

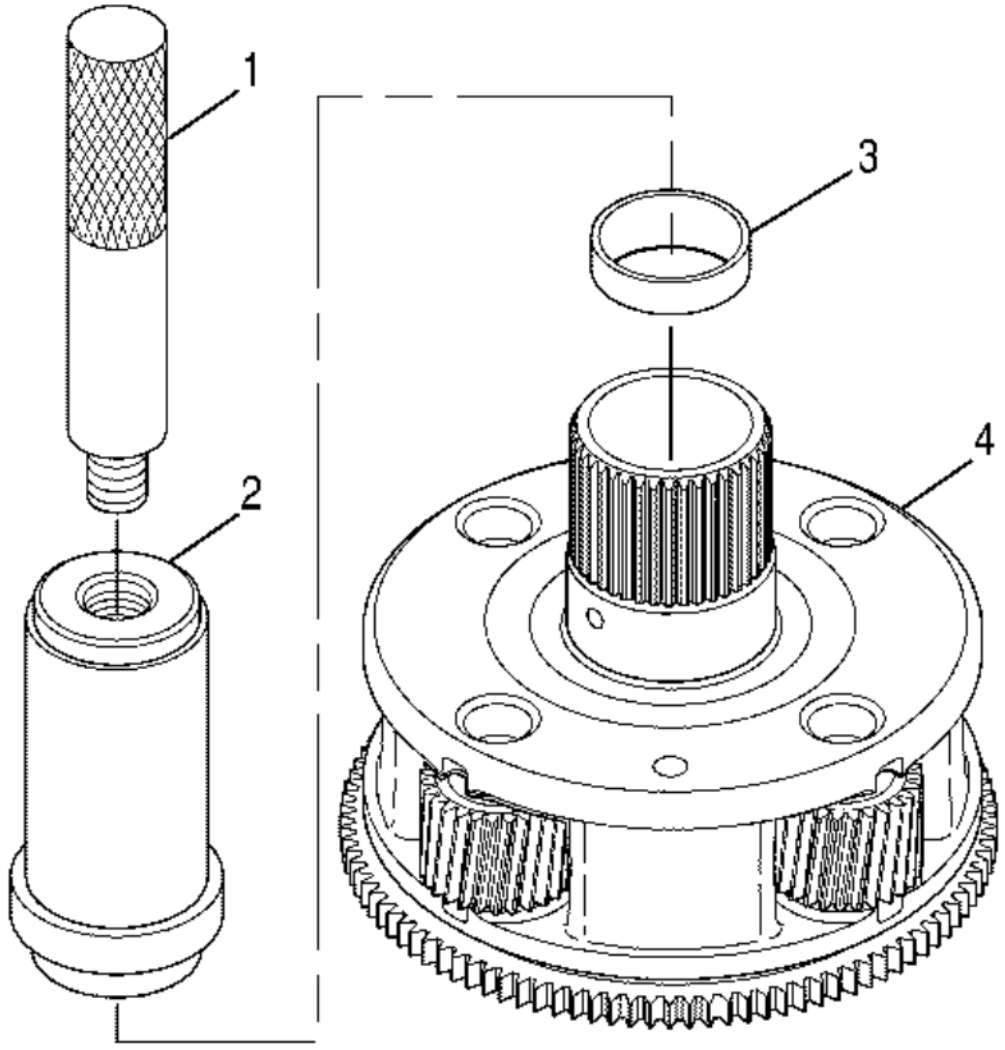


Fig. 368: Intermediate Carrier Bushing
Courtesy of GENERAL MOTORS CORP.

4. Position the intermediate carrier assembly (4) on wooden blocks on the press with the external splines facing down.
5. If the bushing will be installed without a press, install the long end of **J 43785** (2) onto **J 8092** (1). See **Special Tools**.
6. Install a new bushing (3) onto **J 43785** (2). See **Special Tools**.

7. Using **J 43785** (2), press or drive the bushing into of the carrier until **J 43785** (2) seats. See **Special Tools**.

INTERMEDIATE CARRIER ASSEMBLY ASSEMBLE

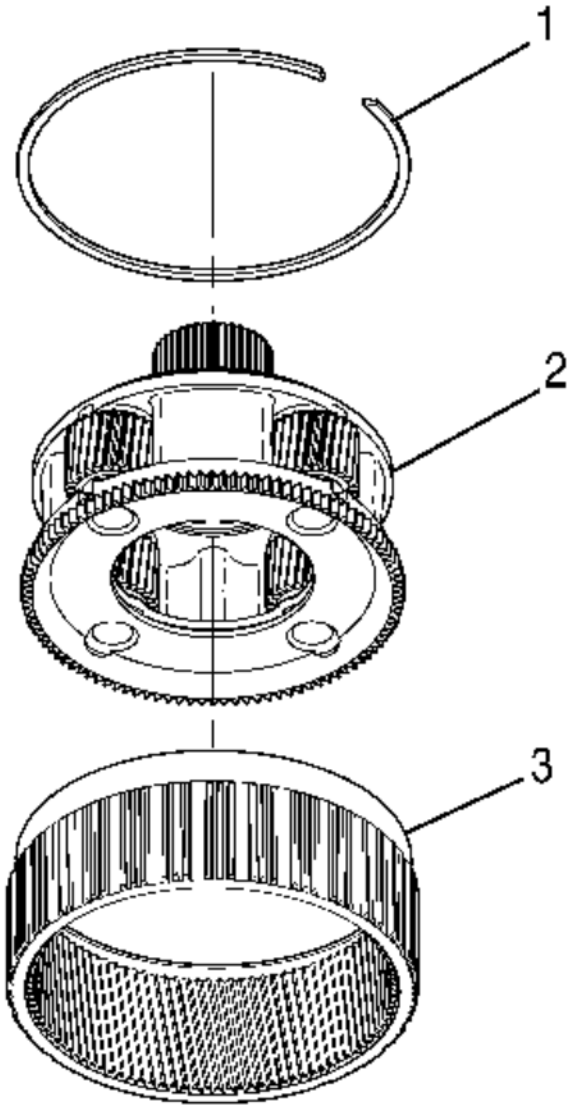


Fig. 369: View Of Intermediate Carrier Assembly & Output Carrier Internal Gear
Courtesy of GENERAL MOTORS CORP.

1. Position the output carrier internal gear (3) on the work table so that the outer splines are facing down.
2. Install the intermediate carrier assembly (2) into the output carrier internal gear (3). Make sure the splines are engaged.
3. Install the retaining ring (1) into the output carrier internal gear (3) so that the intermediate carrier assembly is retained.

OUTPUT CARRIER INTERNAL GEAR INSPECTION

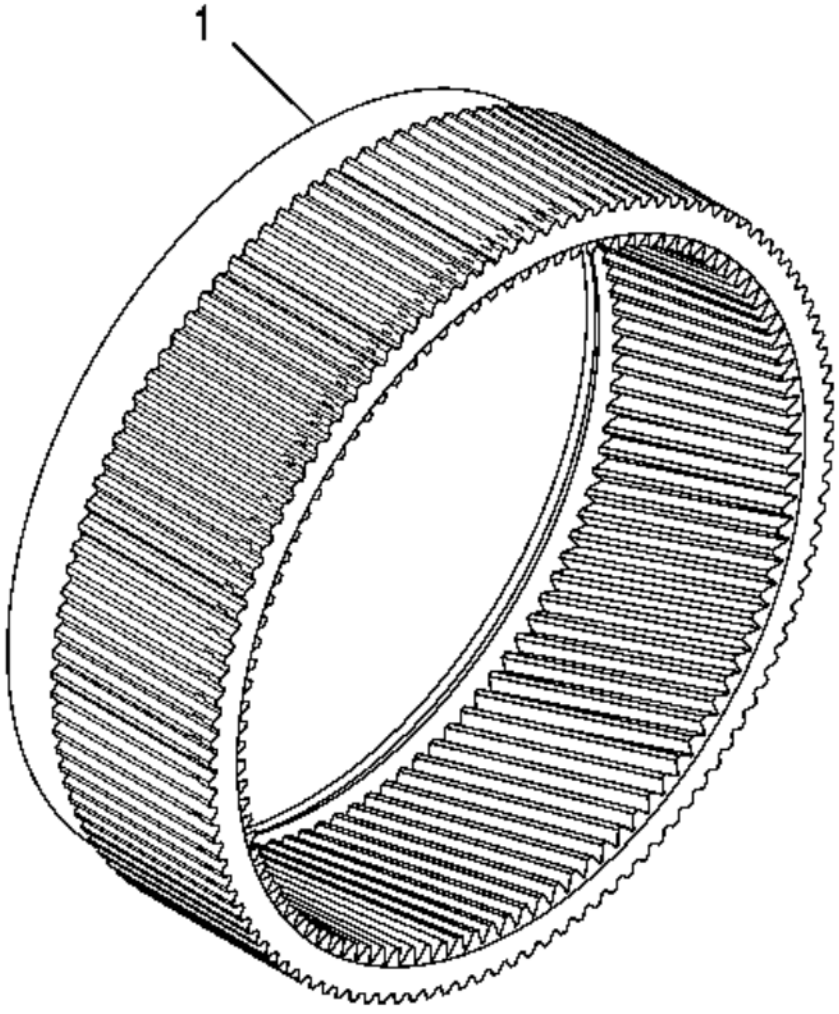


Fig. 370: Identifying Output Carrier Internal Gear
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **Clutch plate movement can cause notching on the external splines if the output carrier internal gear.**
- **Replace the output carrier internal gear if the specifications are not met.**

1. Inspect the external splines of the output carrier internal gear (1).
2. Replace the gear if detectable notching has occurred.

OUTPUT CARRIER INSPECTION

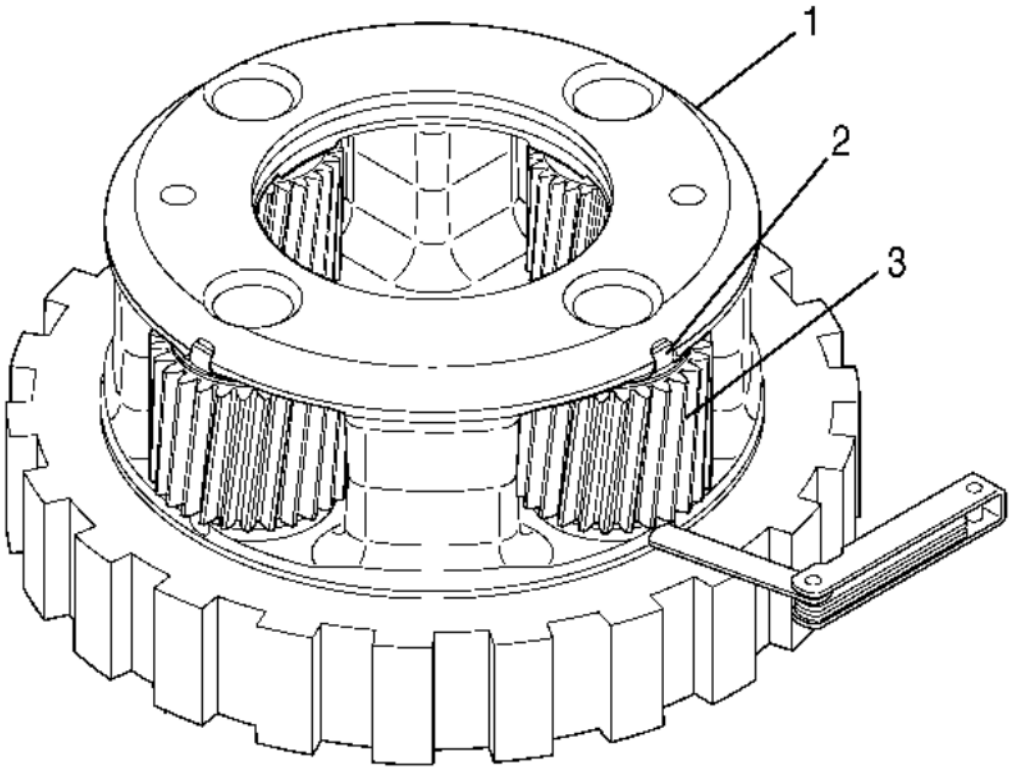


Fig. 371: Measuring End Play Between Output Carrier And Thrust Washer
Courtesy of GENERAL MOTORS CORP.

1. Measure the end play between the output carrier (1) and the thrust washer (2) at each pinion gear (3).
2. Replace the output carrier assembly if the end play exceeds specifications.

   Specification: The maximum pinion end play is 1.010 mm (0.040 in).

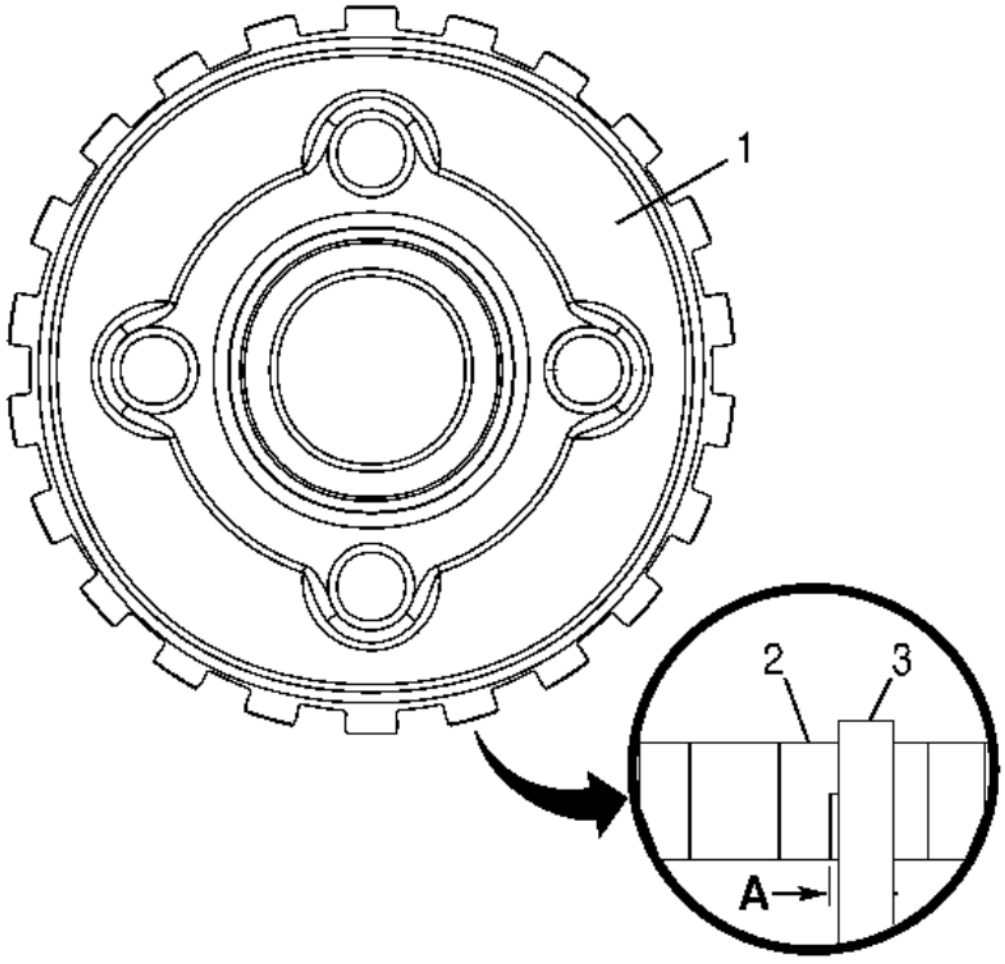


Fig. 372: Checking Output Carrier Assembly Teeth For Wear
Courtesy of GENERAL MOTORS CORP.

3. Inspect the wear of each output carrier assembly tooth by placing a straight edge (3) against the side of each carrier assembly tooth (2).

4. Observe the wear on the carrier assembly tooth at dimension A.
5. If detectable notching has occurred, replace the output planetary carrier assembly.

OUTPUT CARRIER BEARING RACE REPLACEMENT

Tools Required

- **J 44528** Output Carrier Bearing Race Remover. See **Special Tools**.
- **J 43797** Output Carrier Bearing Race Installer. See **Special Tools**.

Removal Procedure

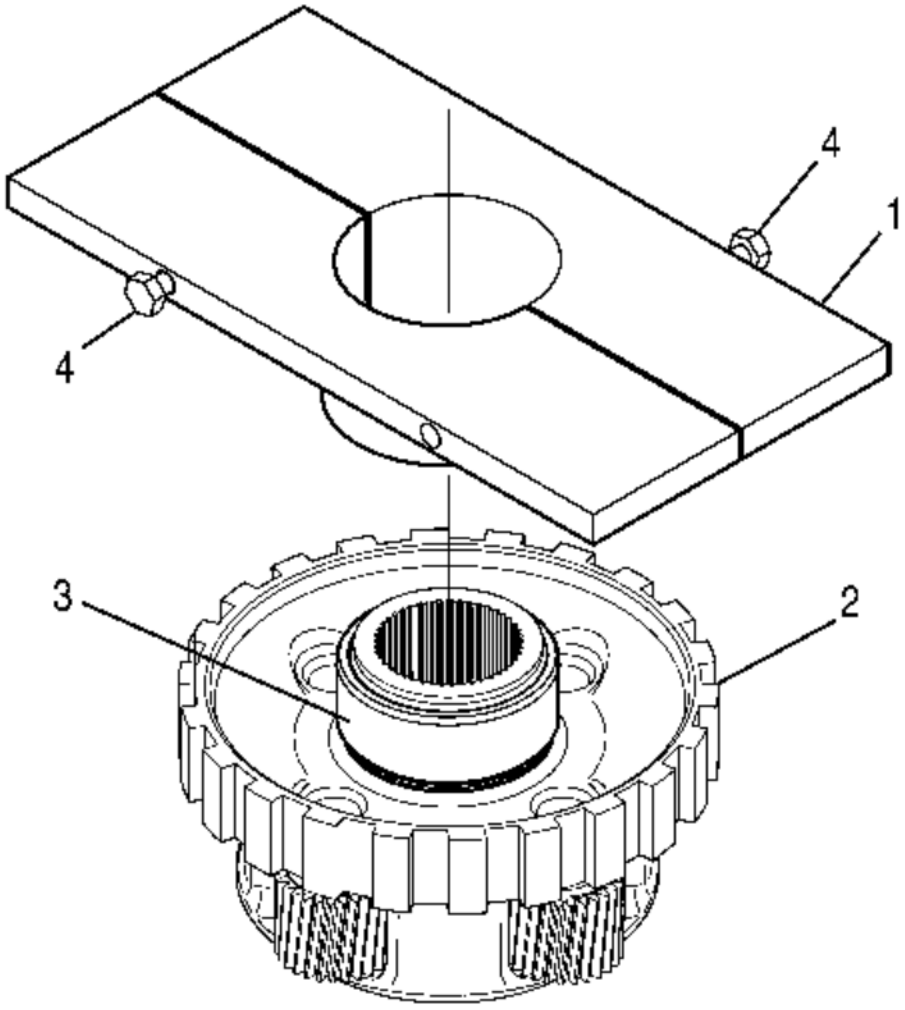


Fig. 373: Identifying Output Carrier Assembly & J 44528-1
Courtesy of GENERAL MOTORS CORP.

1. Position the output carrier assembly (2) on the work table so that the rear of the carrier is facing up.
2. Install J 44528-1 remover (1) over the hub of the carrier and onto the bearing race (3).
3. Tighten the J 44528-1 remover screws (4) wrench tight.

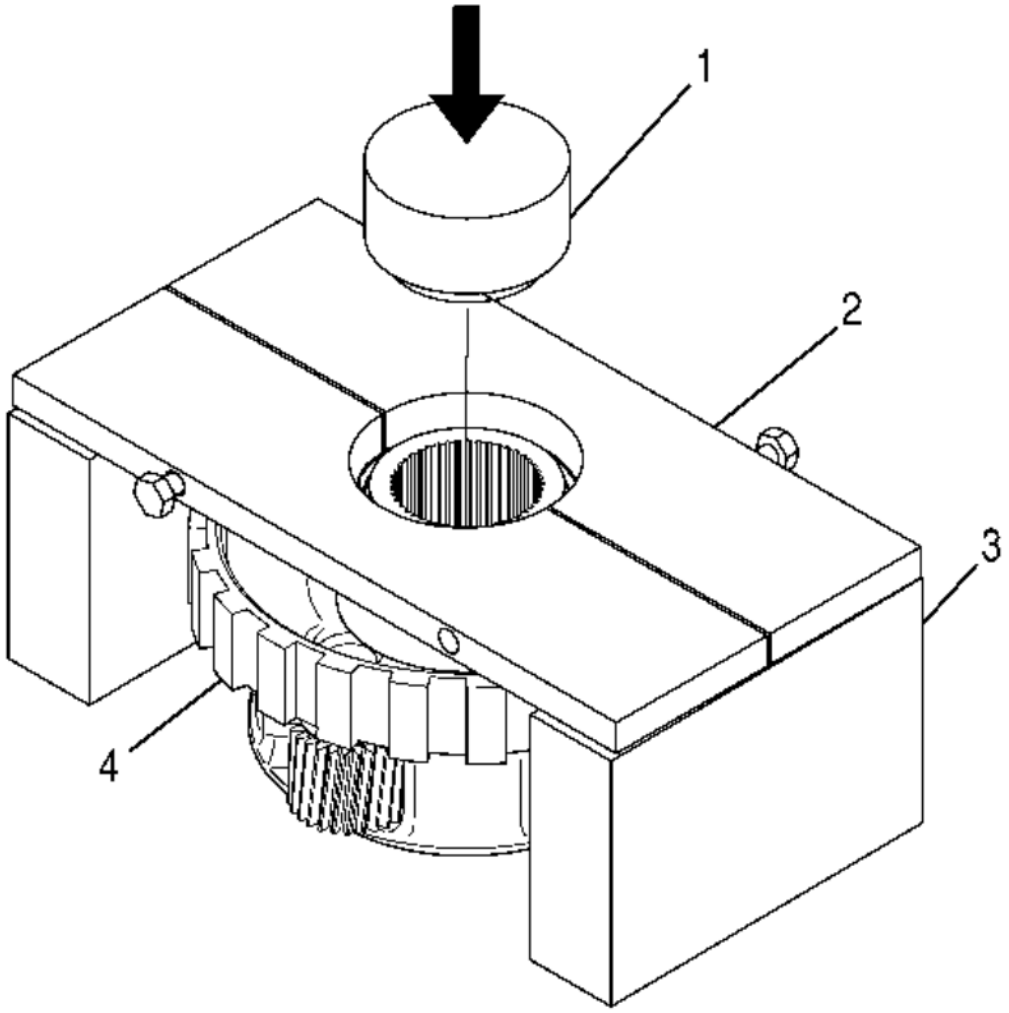


Fig. 374: Supporting Output Carrier Assembly On Wood Blocks
Courtesy of GENERAL MOTORS CORP.

4. Place 2 wooden blocks (3) on the press. Install J 44528-2 remover/installer (1) into the output carrier assembly.
5. Position the output carrier assembly (4) so that J 44528-1 remover (2) spans the wooden blocks and the front of the carrier is facing down.

CAUTION: Pressing the output planetary carrier from the bearing

race causes the output carrier to fall from the bearing race. Make sure the output carrier is safely caught when freed from the bearing race. An uncontrolled output carrier could cause personal injury and/or property damage.

6. Using J 44528-2 remover/installer (1), press the output carrier assembly (4) from J 44528-1 remover (2).
7. Remove the bearing race from J 44528-1 remover.
8. Remove J 44528-2 remover/installer (1) from the output carrier assembly.

Installation Procedure

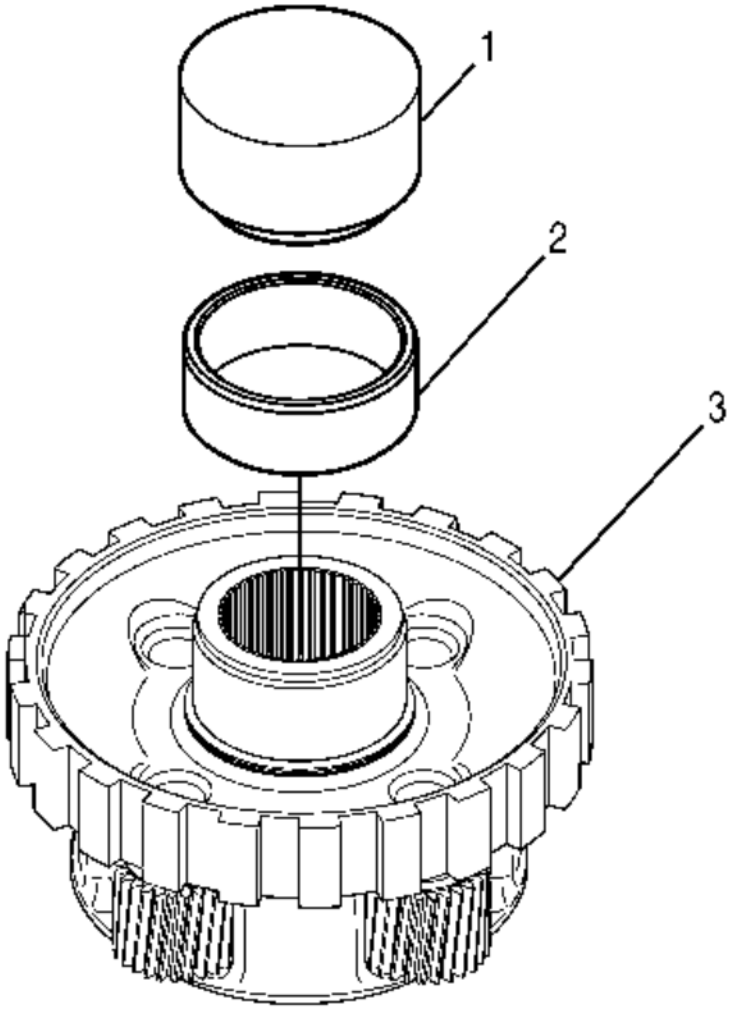


Fig. 375: Installing Output Carrier Assembly Bearing Race
Courtesy of GENERAL MOTORS CORP.

1. Position the output carrier assembly (3) on the press so that the rear of the carrier is facing up.
2. Install a new bearing race into **J 43797** (1). See **Special Tools**.
3. Using **J 43797** (1), press the bearing race (2) onto the output carrier assembly (3) until **J 43797** seats. See **Special Tools**.

LOW AND REVERSE CLUTCH HOUSING ASSEMBLY DISASSEMBLE

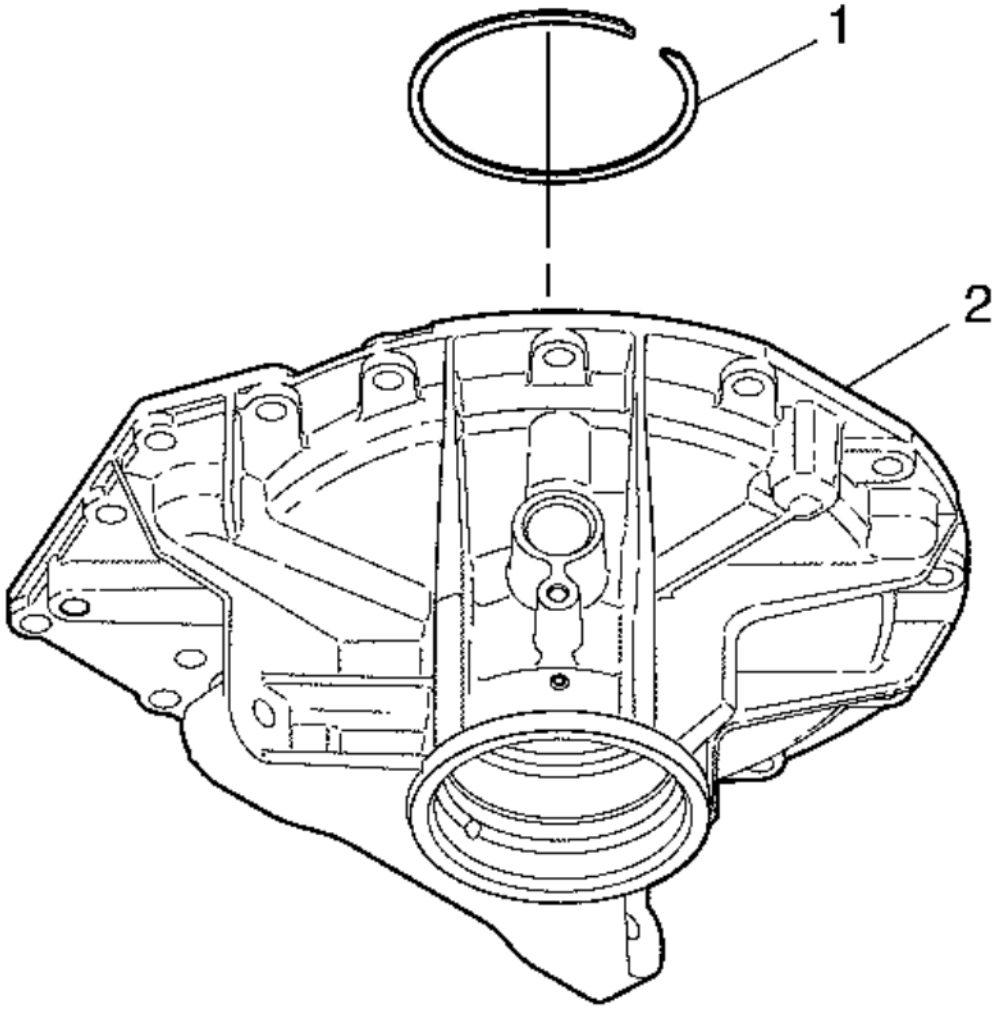


Fig. 376: Locating Low and Reverse Clutch Housing Retaining Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The low and reverse clutch housing, 2WD and the low and reverse clutch housing, 4WD are disassembled using the same procedures except as indicated.

1. Remove the retaining ring (1).

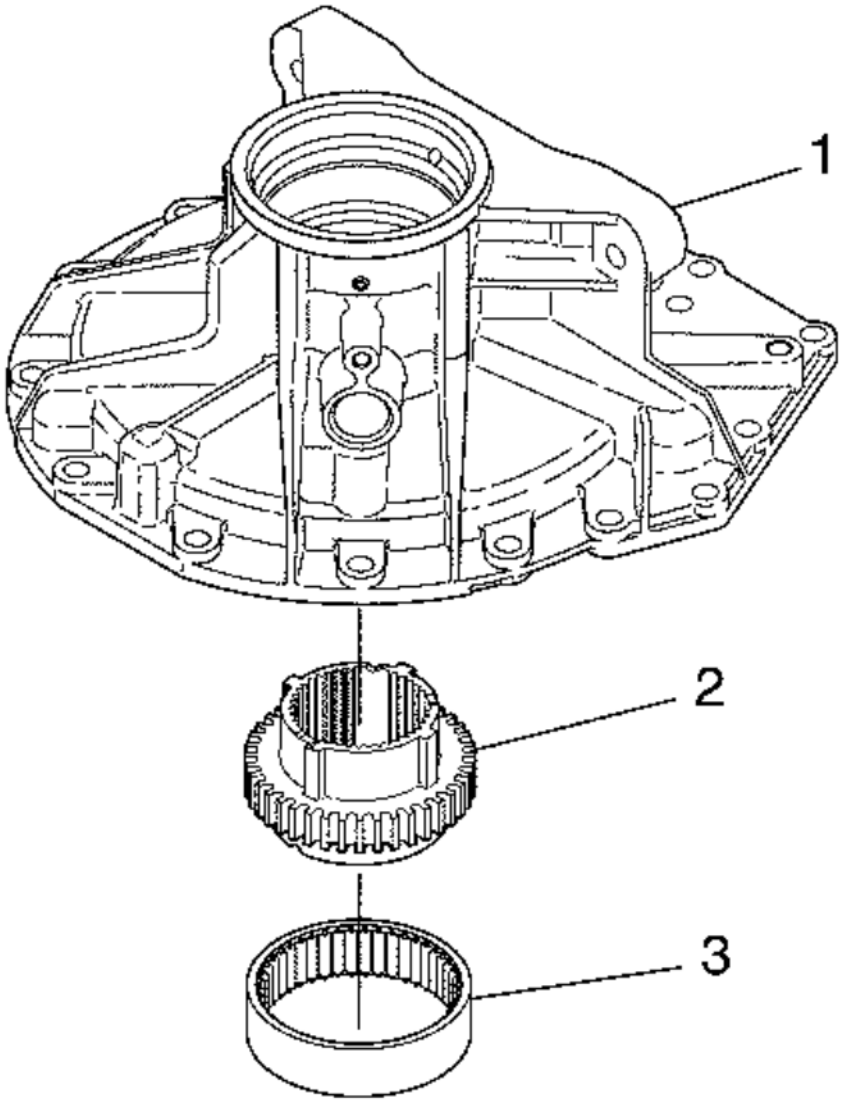


Fig. 377: View Of OSS Reluctor Wheel & Output Carrier Support Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

2. To remove the output carrier support bearing assembly from the low and reverse clutch

housing, 2WD on a 2WD transmission, perform the following procedure:

1. Position the low and reverse clutch housing, 2WD (1) on the press so that the inside of the housing is facing down.
2. Press the output speed sensor (OSS) reluctor wheel (2) and the output carrier support bearing assembly (3) from the low and reverse clutch housing, 2WD.

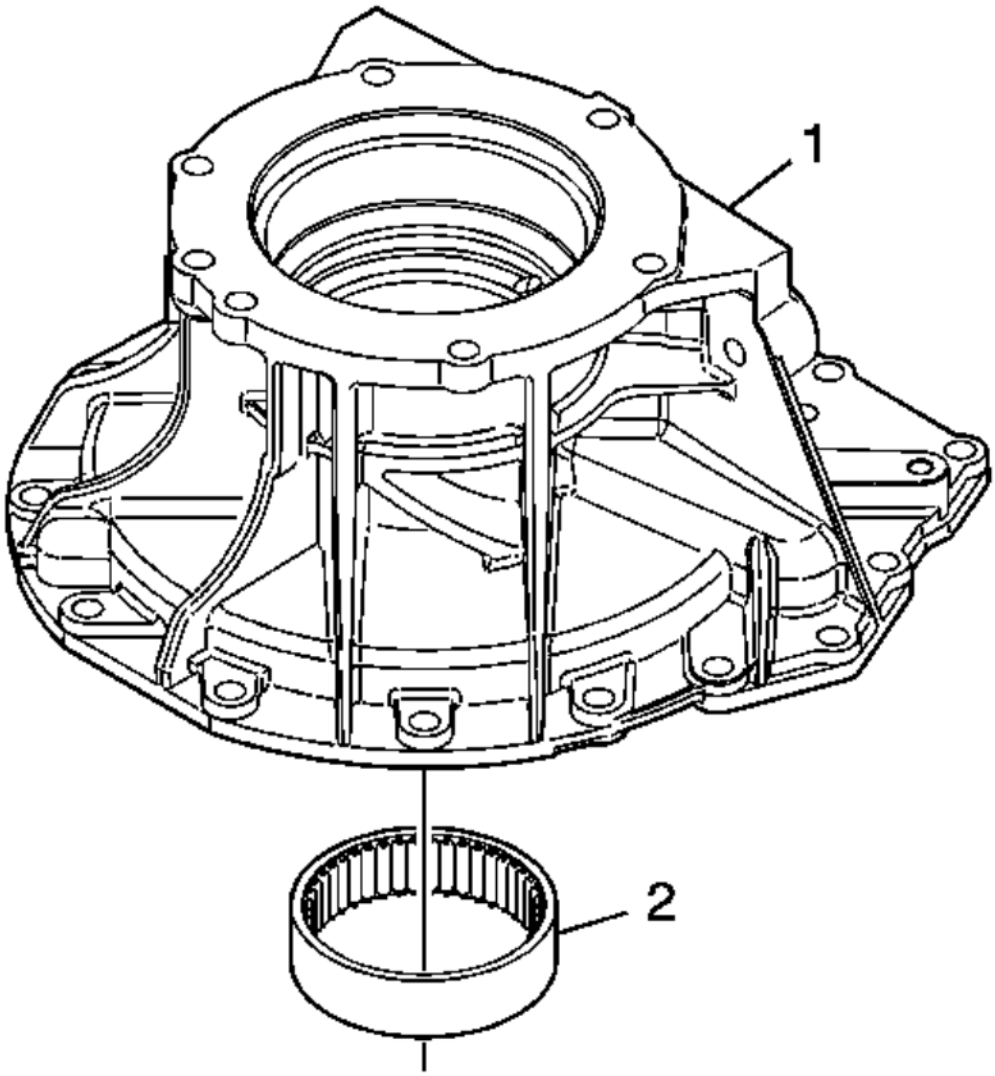


Fig. 378: View Of Output Carrier Support Bearing And Low And Reverse Clutch

Housing (4WD)
Courtesy of GENERAL MOTORS CORP.

3. To remove the output carrier support bearing from the low and reverse clutch housing, 4WD on a 1000 Series™ 4WD transmission, perform the following procedure:
    1. Position the low and reverse clutch housing, 4WD (1) on the worktable with the inside of the housing facing down.
    2. Using a drift, tap the output carrier support bearing (2) from the low and reverse clutch housing, 4WD.

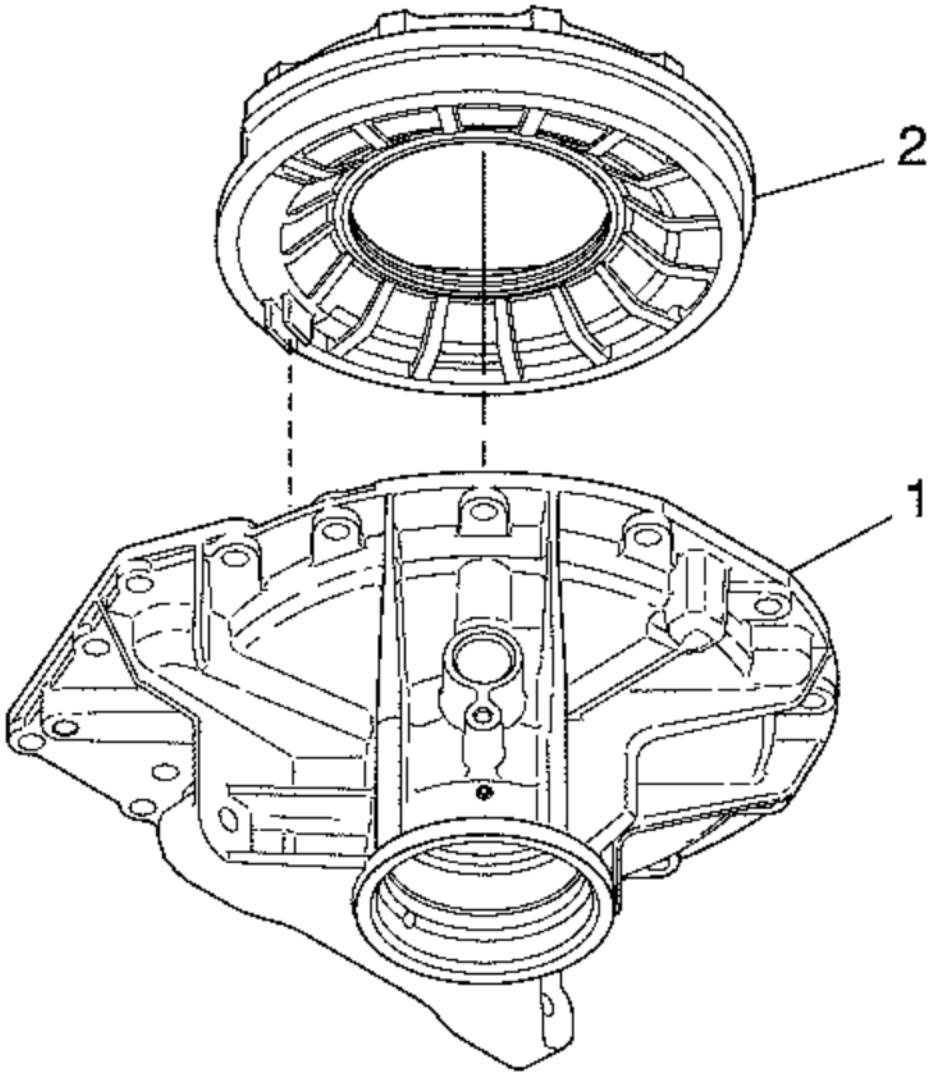


Fig. 379: Aligning Low And Reverse Clutch Piston Tang
Courtesy of GENERAL MOTORS CORP.

4. Position the low and reverse clutch housing (1) on the work table so that the inside of the housing is facing up.
5. Gently pry the low and reverse clutch piston (2) from the low and reverse clutch housing (1).

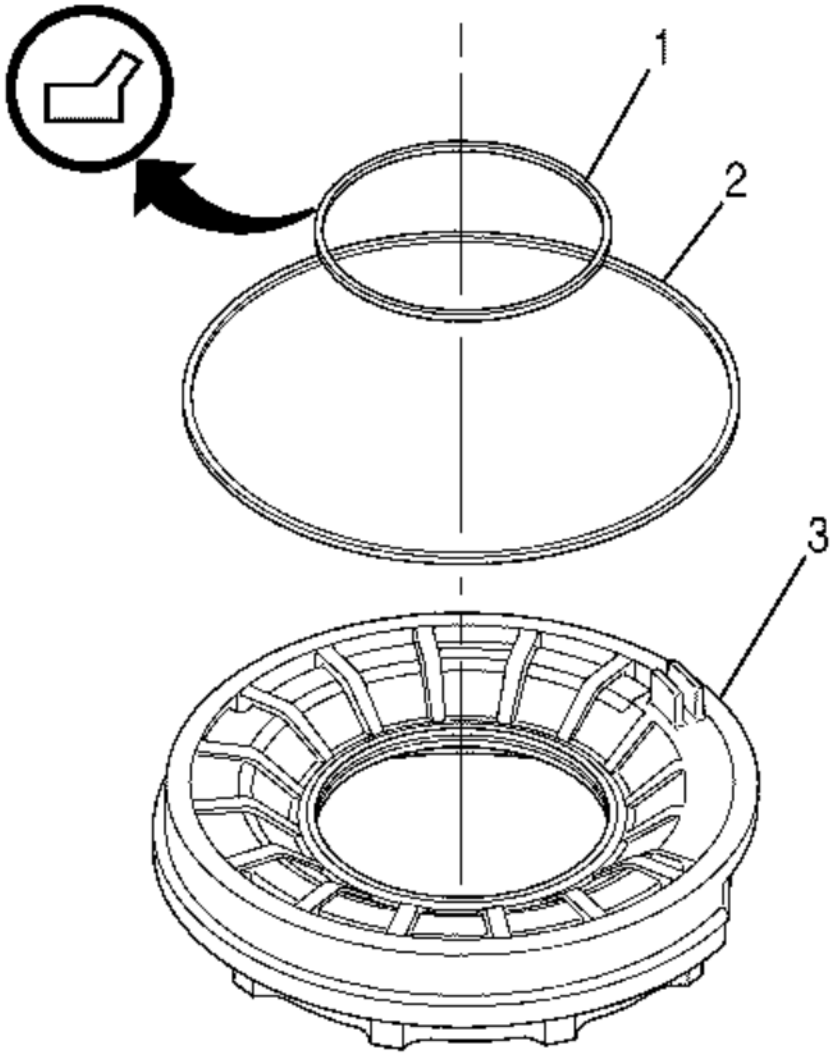


Fig. 380: View Of Low And Reverse Clutch Piston, Seal & Seal Ring
Courtesy of GENERAL MOTORS CORP.

6. Remove seal ring (1) and seal ring (2) from the low and reverse clutch piston (3).

LOW AND REVERSE CLUTCH HOUSING RETAINING RING REPLACEMENT

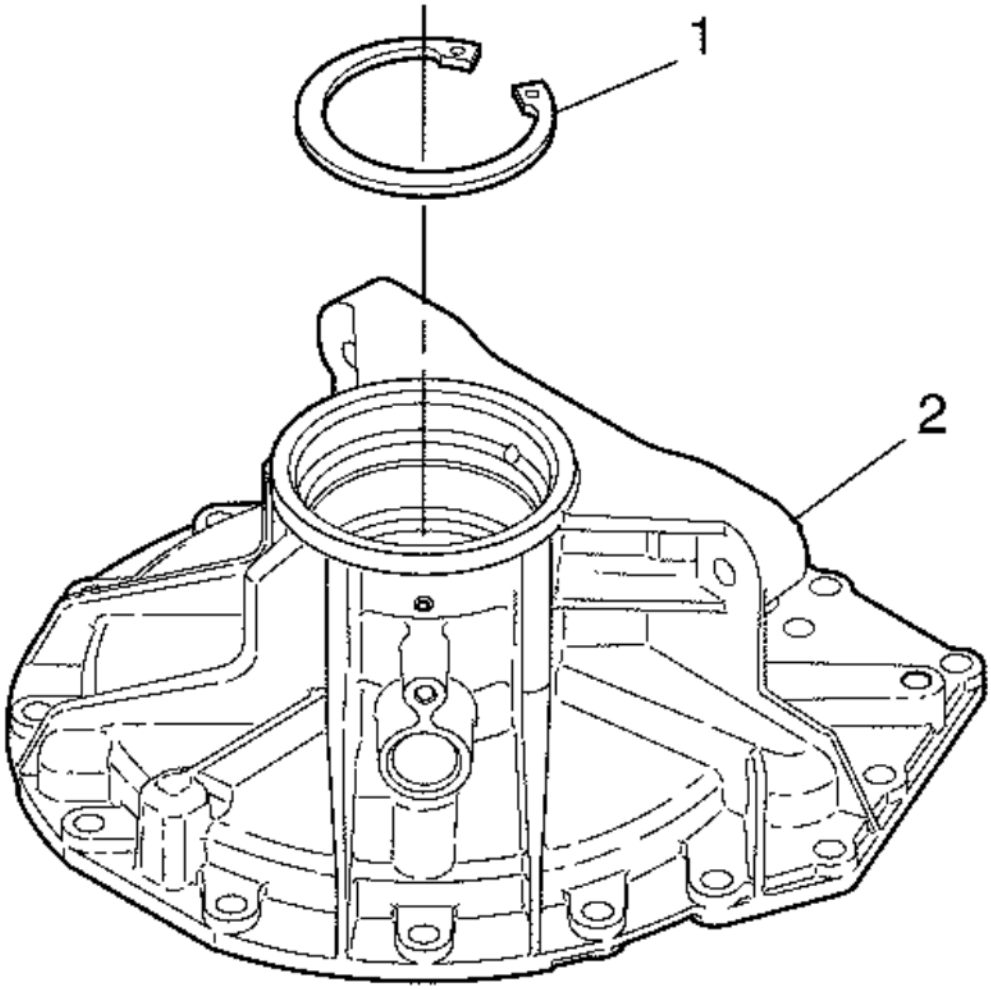


Fig. 381: Low and Reverse Clutch Housing Retaining Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT replace the retaining ring in the low and reverse clutch housing unless:

- **The retaining ring is damaged.**
- **The low and reverse clutch housing is to be replaced.**

1. Position the low and reverse clutch housing (2) on the worktable so that the inside of the cover is facing down.
2. Remove retaining ring (1).
3. Install a new retaining ring (1).
4. Make sure the retaining ring is seated.

TWO-WHEEL-DRIVE OUTPUT SHAFT BUSHING INSPECTION

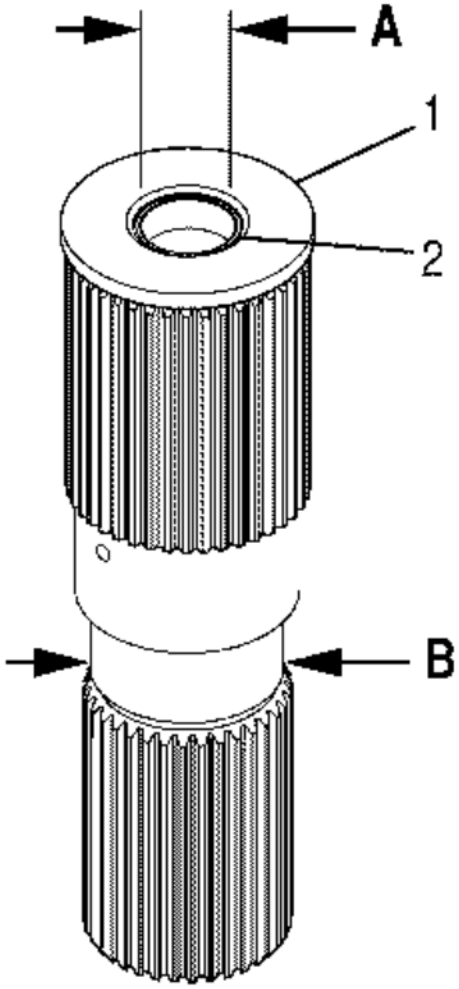


Fig. 382: Inspection Areas On Output Shaft Bushing - 2WD

Courtesy of GENERAL MOTORS CORP.

1. Inspect the output shaft bushing (2) for wear or damage.
2. Measure the inside diameter (ID) of the bushing (2) at dimension A. Replace the bushing If the ID of the bushing exceeds specification.

   Specification: The bushing maximum ID is 20.070 mm (0.7940 in).

3. Measure the outside diameter (OD) of the bearing surface at dimension B. Replace the output shaft If the OD of the bearing surface exceeds specification

   Specification: The bearing minimum OD is 44.978 mm (1.7708 in)

FOUR-WHEEL-DRIVE OUTPUT SHAFT BUSHING INSPECTION

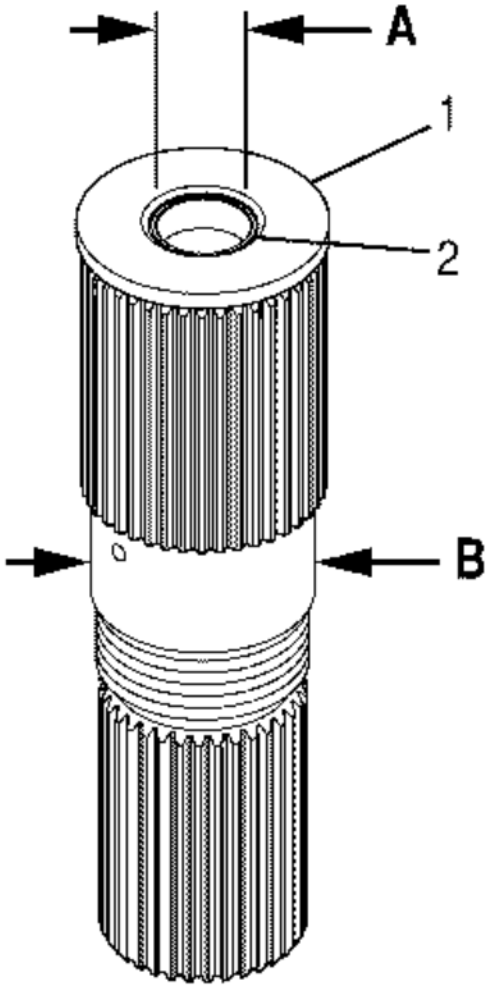


Fig. 383: Output Shaft Bushing Inspection Areas - 4WD
Courtesy of GENERAL MOTORS CORP.

1. Inspect the output shaft bushing (2) for wear or damage.
2. Measure the inside diameter (ID) of the bushing (2) at dimension A.
3. Replace the bushing If the ID of the bushing exceeds specifications.

Specification: The bushing maximum ID is 20.07 mm (0.794 in).

4. Measure the outside diameter (OD) of the bearing surface at dimension B.
5. Replace the output shaft if the OD of the bearing surface is less than specifications.

Specification: The bearing surface minimum OD is 44.978 mm (1.77 in).

OUTPUT SHAFT BUSHING REPLACEMENT

Tools Required

- **J 43791** Output/Turbine Shaft Bushing Installer. See **Special Tools**.
- **J 44526** Output/Turbine Shaft Bushing Remover. See **Special Tools**.

Removal Procedure

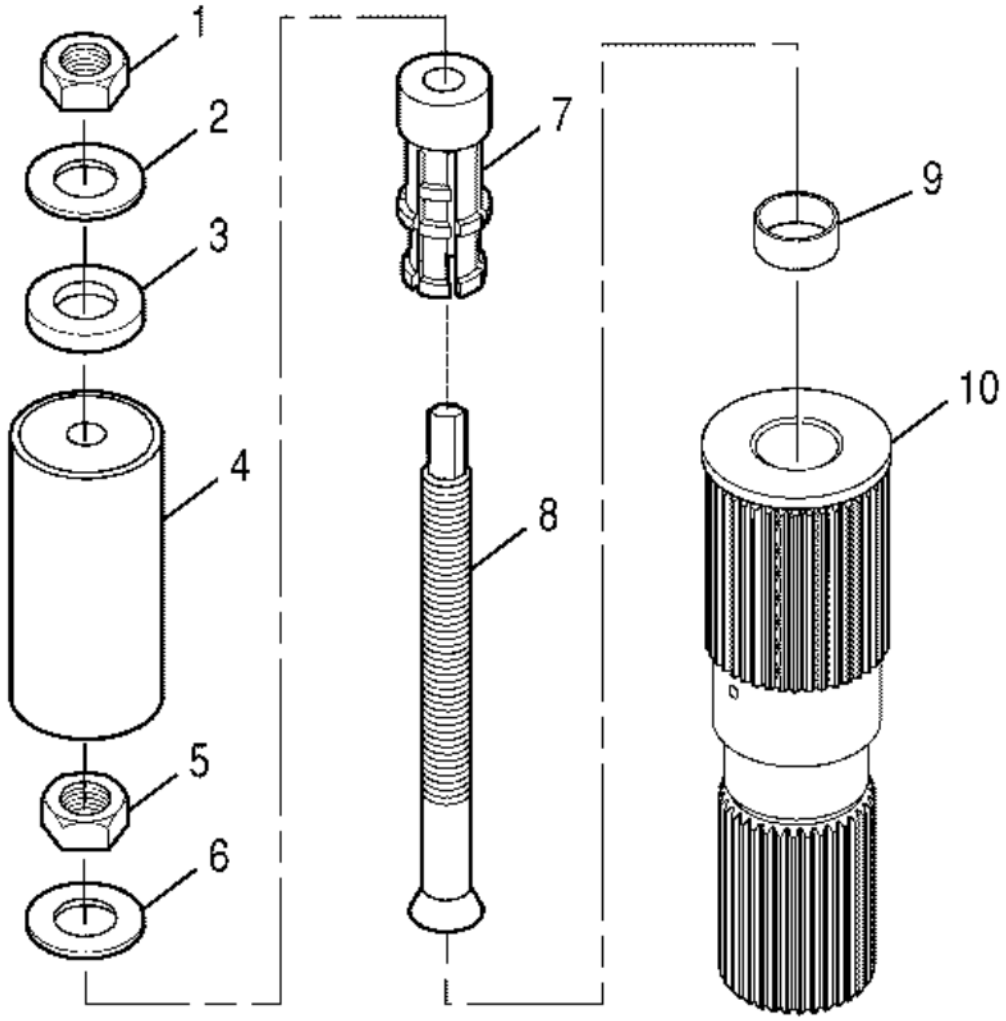


Fig. 384: Using J Tools To Remove Output Shaft Bushing
Courtesy of GENERAL MOTORS CORP.

1. Install J 44526-2 bolt (8) and J 44526-1 extractor (7) into the bushing (9).
2. Install J 44526-2 bolt (8) into J 44526-1 extractor (7).
3. Install the washer (6) and nut (5) onto J 44526-2 bolt (8).
4. Hold the top of J 44526-2 bolt (8) with a wrench and tighten the nut (5) until J 44526-1 extractor (7) engages the bushing (9).

5. Install the bearing (3), washer (2), and nut (1) onto J 44526-2 bolt (8).
6. Install J 44526-3 protector (4) onto J 44526-2 bolt (8).
7. Hold the top of J 44526-2 bolt (8) with a wrench and tighten the nut (1) until the bushing is dislodged.
8. Remove the J tools.
9. Remove the bushing from **J 44526** . See **Special Tools**.

Installation Procedure

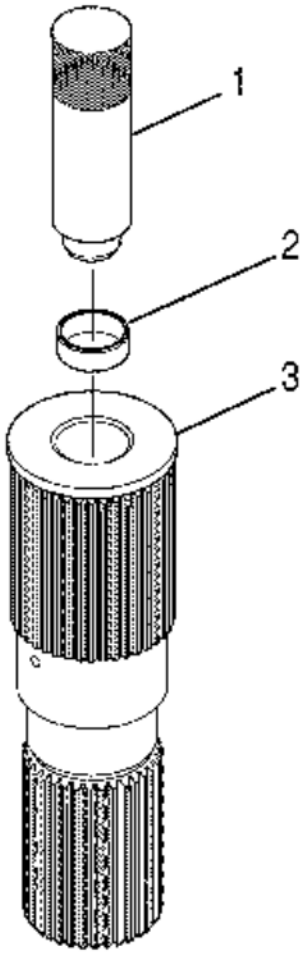


Fig. 385: Installing Output Shaft Bushing

Courtesy of GENERAL MOTORS CORP.

1. Install a new output shaft bushing (2) onto **J 43791** (1). See **Special Tools**.
2. Using **J 43791** , drive the bushing into the output shaft (3) until **J 43791** (1) is seated to specification. See **Special Tools**.

   Specification: Make sure the bushing is pressed flush to 0.25 mm (0.01 in) below the output shaft surface.

LOW AND REVERSE CLUTCH HOUSING ASSEMBLY ASSEMBLE

Tools Required

J 36850 Transjel® Lubricant. See **Special Tools**.

Assemble

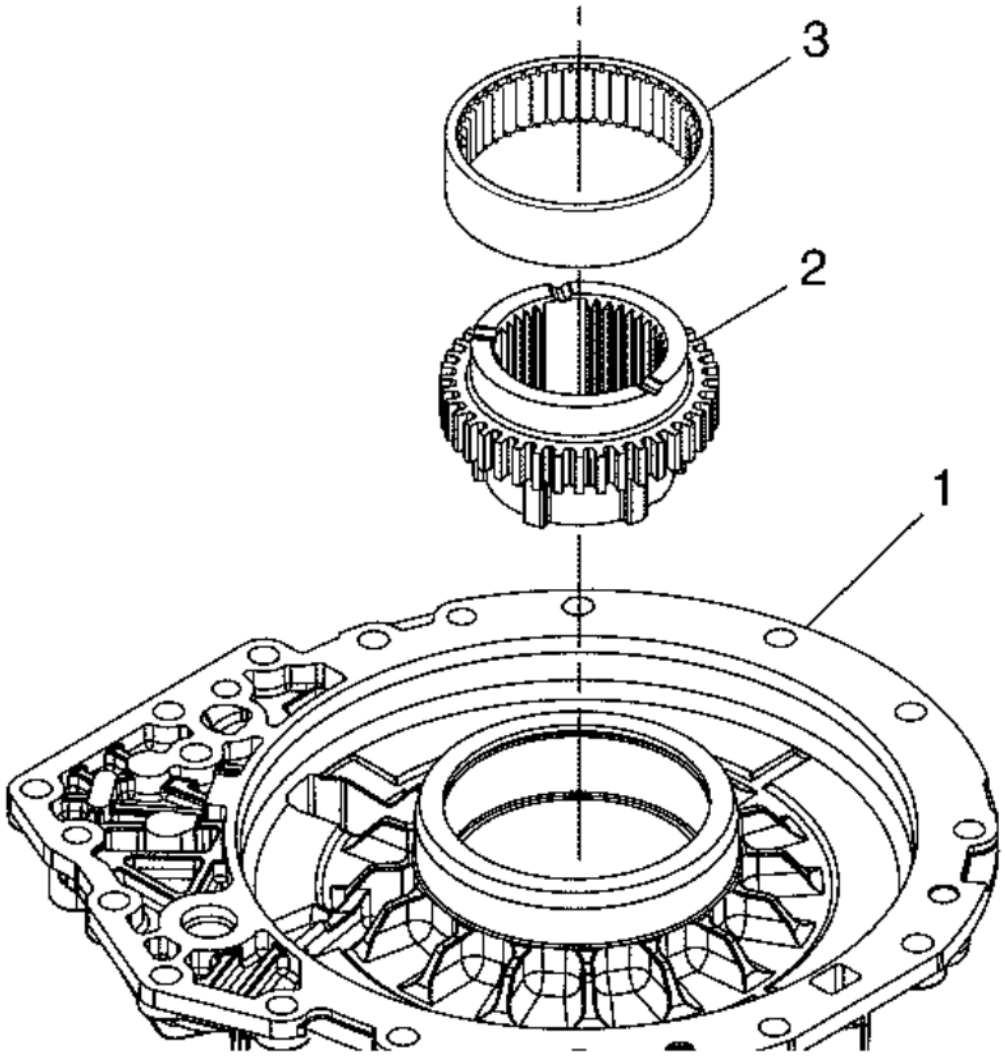


Fig. 386: View Of OSS Reluctor Wheel & Output Carrier Support Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Position the low and reverse clutch housing so that the outside of the housing is facing down.

IMPORTANT: The low and reverse clutch housing, 4WD does not contain

an output speed sensor (OSS) reluctor wheel.

2. For 2WD transmissions, install the OSS reluctor wheel (2).
3. Gently tap the output carrier support bearing assembly (3) into the low and reverse clutch housing.

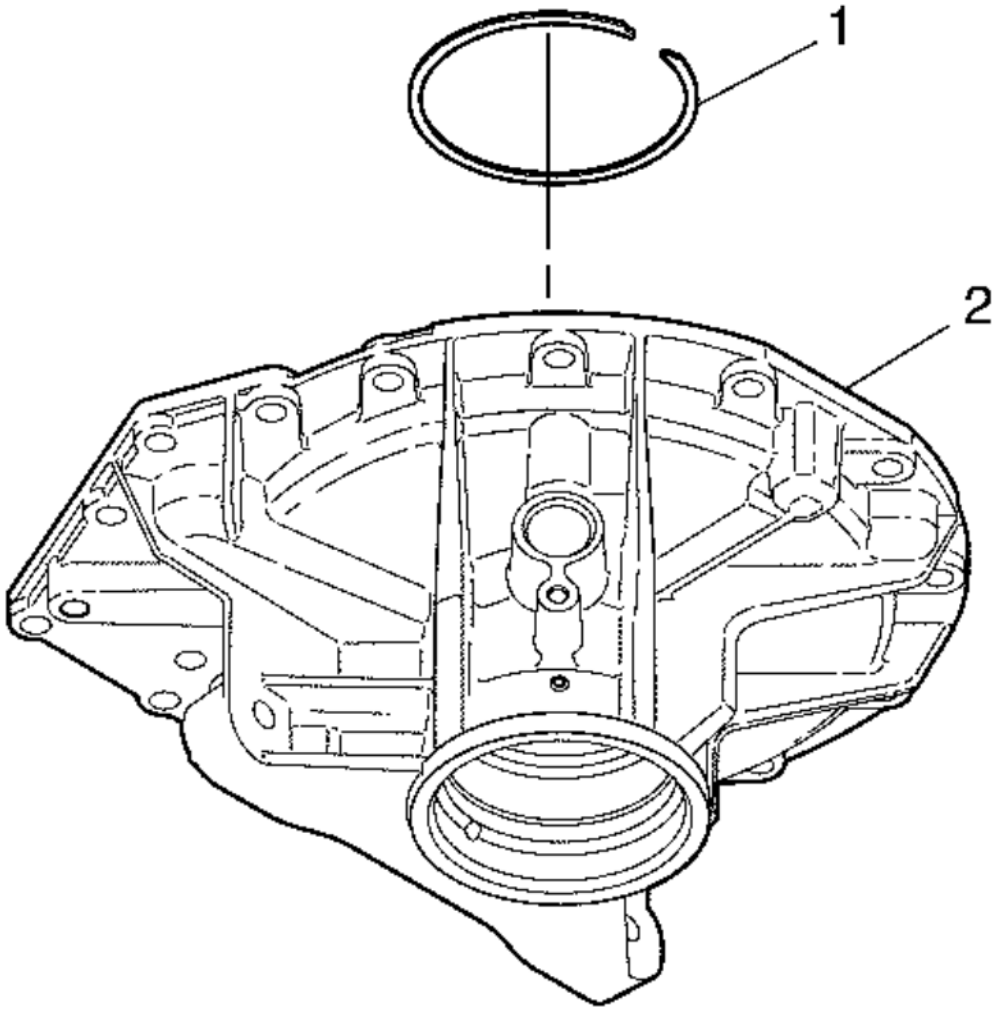


Fig. 387: Locating Low and Reverse Clutch Housing Retaining Ring
Courtesy of GENERAL MOTORS CORP.

4. Install the retaining ring (1).

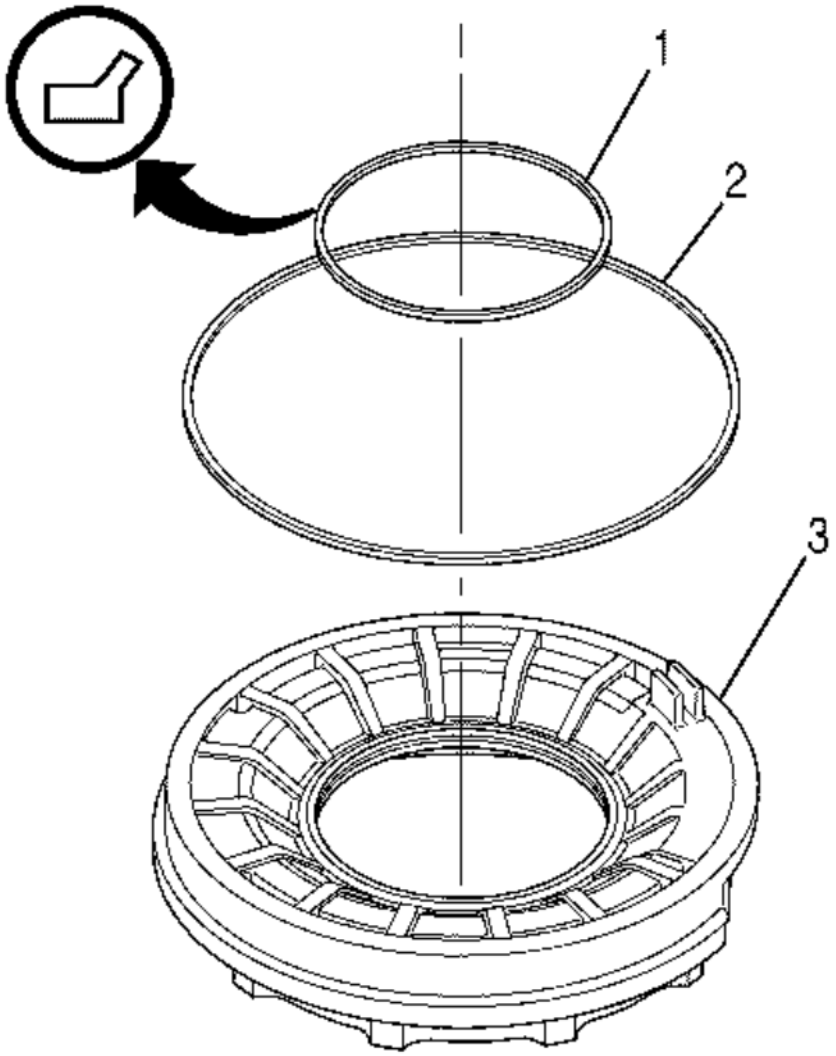


Fig. 388: View Of Low And Reverse Clutch Piston, Seal & Seal Ring
Courtesy of GENERAL MOTORS CORP.

5. Install seal ring (1) and seal ring (2) onto the low and reverse clutch piston (3). Lubricate the seal rings with **J 36850** or an equivalent lubricant. See **Special Tools**.

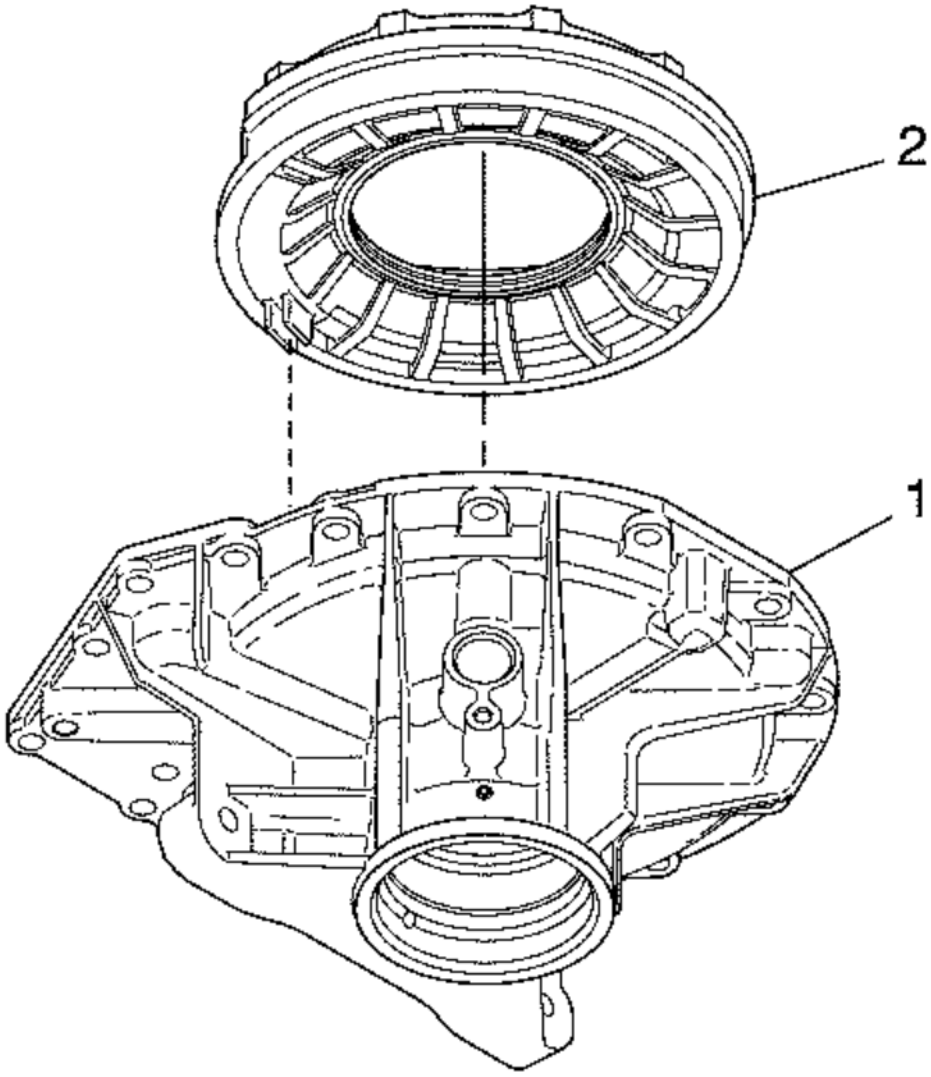


Fig. 389: Aligning Low And Reverse Clutch Piston Tang
Courtesy of GENERAL MOTORS CORP.

6. Position the low and reverse clutch housing so that the outside of the cover is facing down.
7. Align the tang on the low and reverse clutch piston (2) with the tang hole in low and reverse clutch housing (1).
8. Install the low and reverse clutch piston.

OUTPUT YOKE INSPECTION

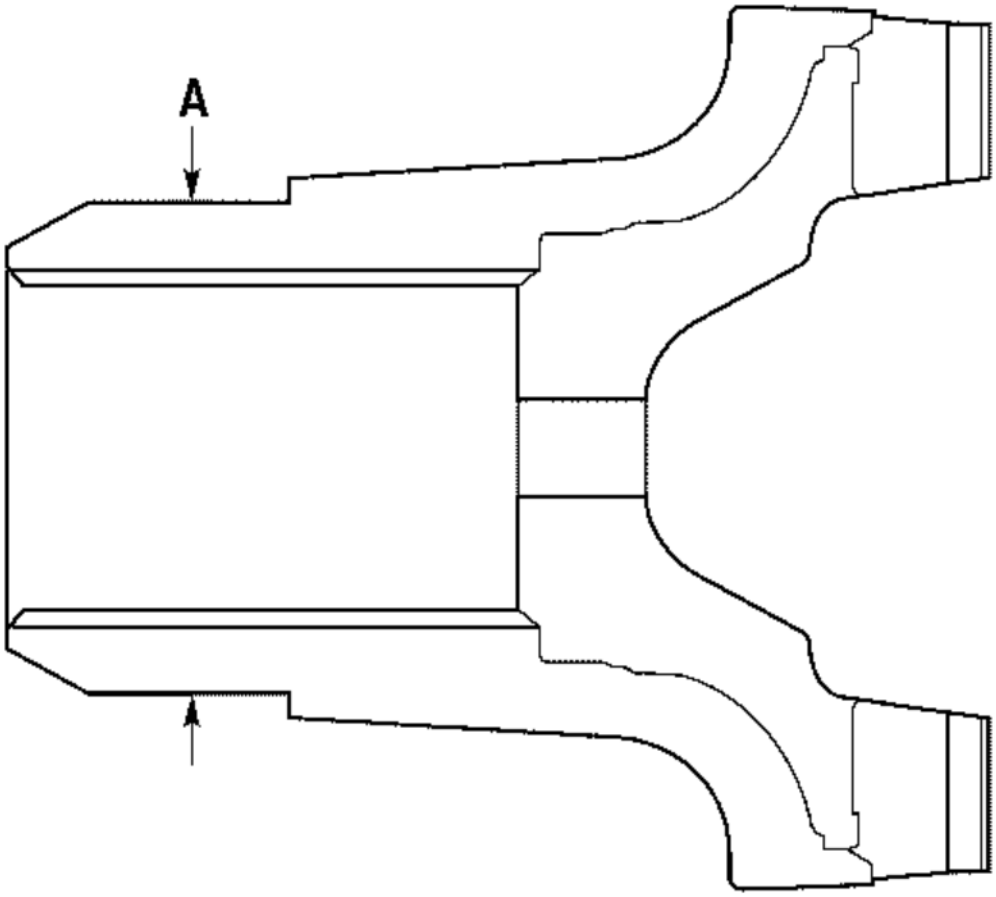


Fig. 390: Measuring Outside Diameter (OD) Of Output Yoke Oil Seal Surface
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:
- **Measure as described below at 3 or more locations.**
- **Replace the output yoke if the specifications are not met.**

1. Inspect the output yoke (1) for damage.
2. Measure the outside diameter (OD) of the output yoke oil seal surface.

Specification: The oil seal surface minimum OD is 65.08 mm (2.5622 in).

CONTROL VALVE BODY ASSEMBLY DISASSEMBLE

Tools Required

J 33163 Valve Tray Set. See **Special Tools**.

Disassemble

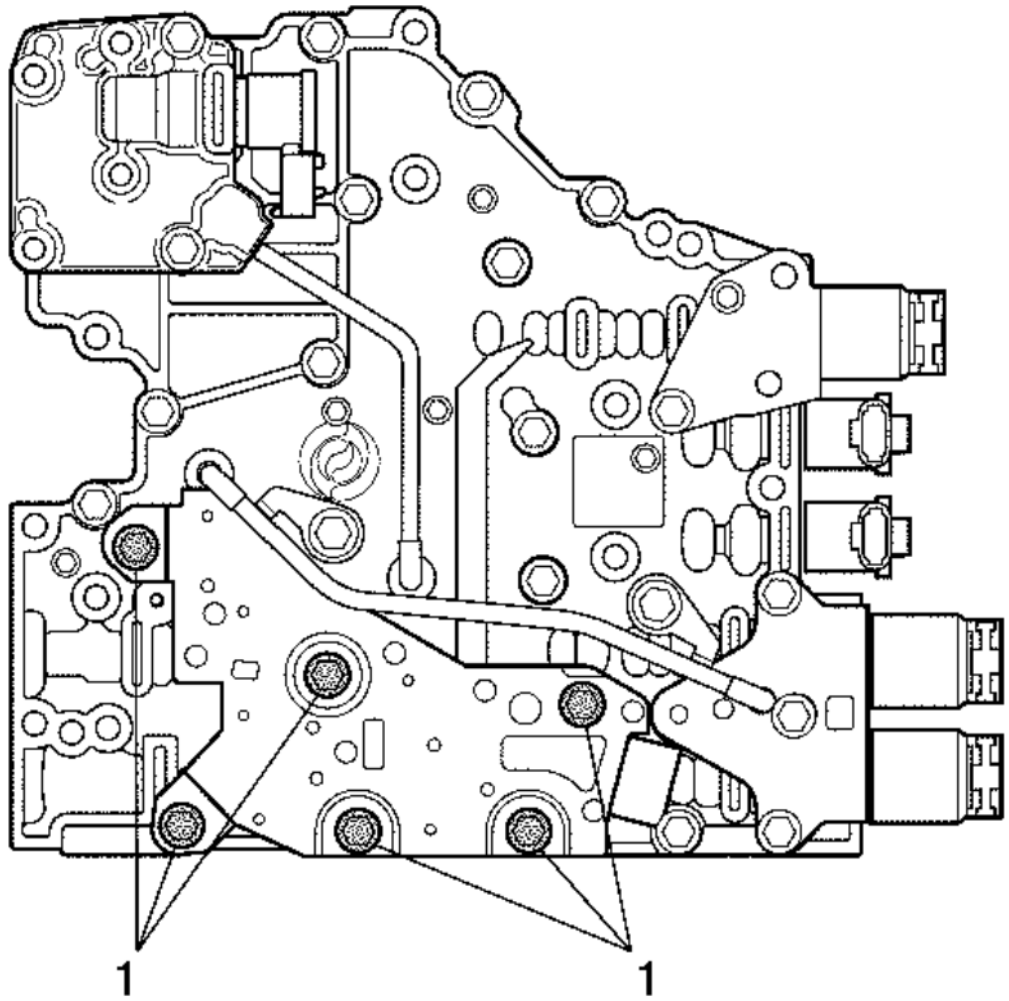


Fig. 391: Identifying TFP Switch Retaining Bolts

Courtesy of GENERAL MOTORS CORP.

1. Position the control valve assembly on the work table so that the main valve body assembly is facing up.
2. Remove 6 bolts (1) retaining the transmission fluid pressure (TFP) switch to the main valve body.

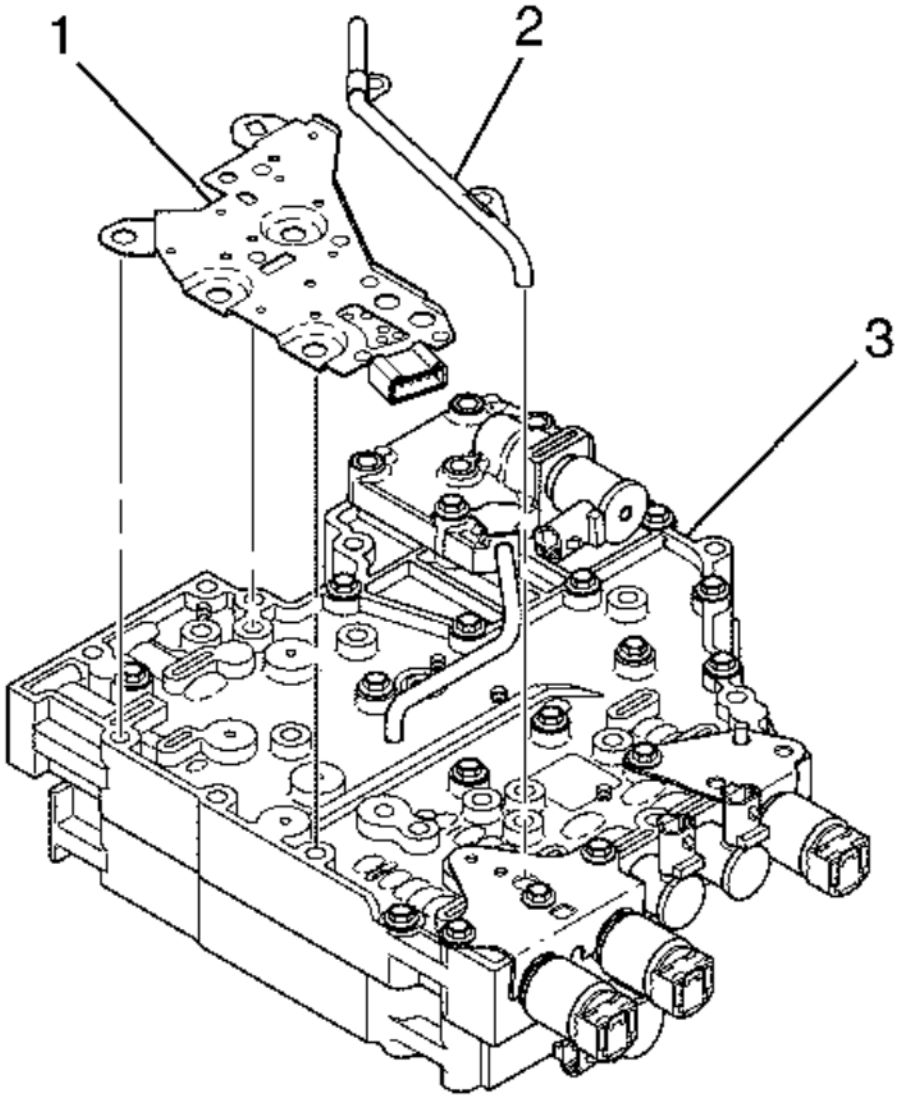


Fig. 392: TFP Switch And Reverse Signal Pipe
Courtesy of GENERAL MOTORS CORP.

3. Remove the TFP switch (1) from the main valve body (3).
4. Remove 2 bolts retaining the reverse signal pipe (2) to the main valve body (3).
5. Remove the reverse signal pipe (2) from the main valve body (3).

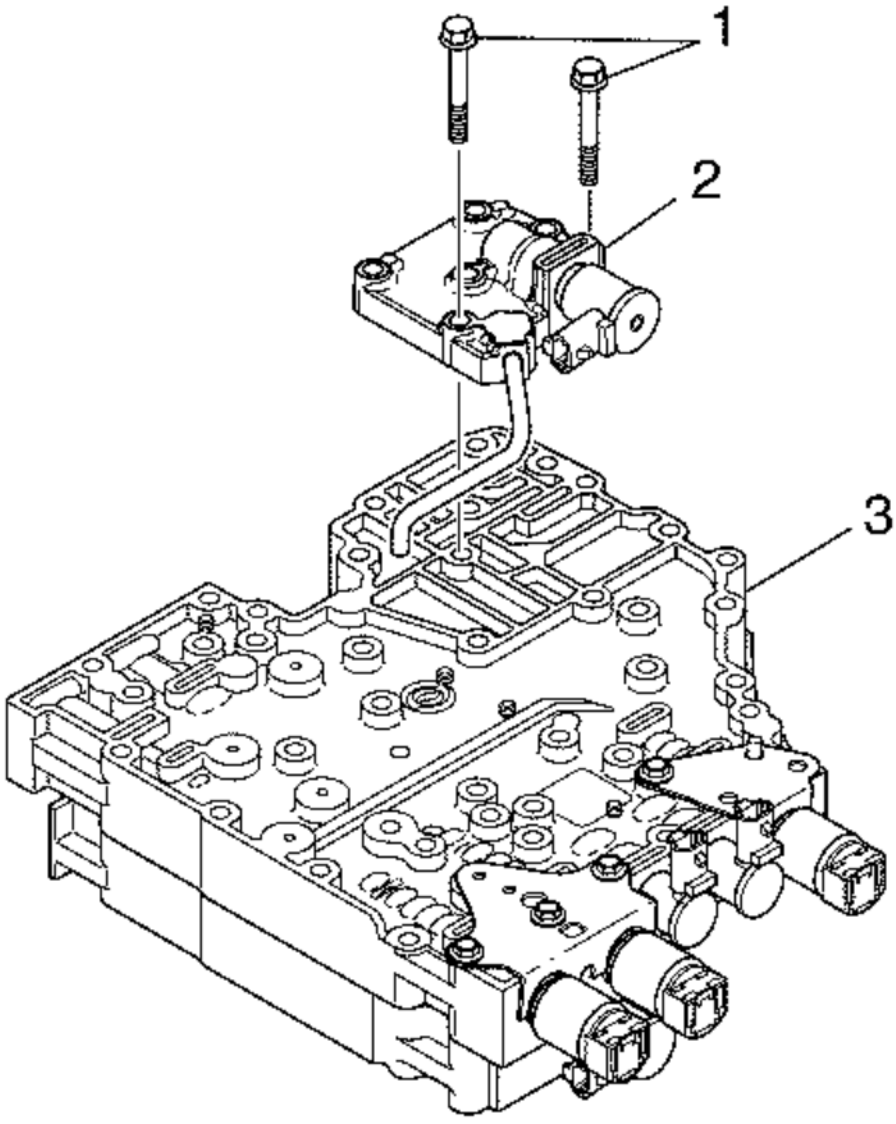


Fig. 393: Modulated Main Pressure Solenoid Valve Body
Courtesy of GENERAL MOTORS CORP.

6. Remove 2 bolts (1) retaining the modulated main pressure solenoid valve body to the main valve body (3).

IMPORTANT: To help prevent confusing parts on assembly, use J 33163 to store the removed control valve assembly valves, springs, and stops. See Special Tools.

7. Remove the modulated main pressure solenoid valve body (2) and six speed tube.
8. Remove the modulated main pressure (MAIN MOD) solenoid retainer (5) from the bottom of the valve body.
9. Remove the MAIN MOD solenoid (3).
10. Remove 2 O-rings (4) from the MAIN MOD solenoid (3).

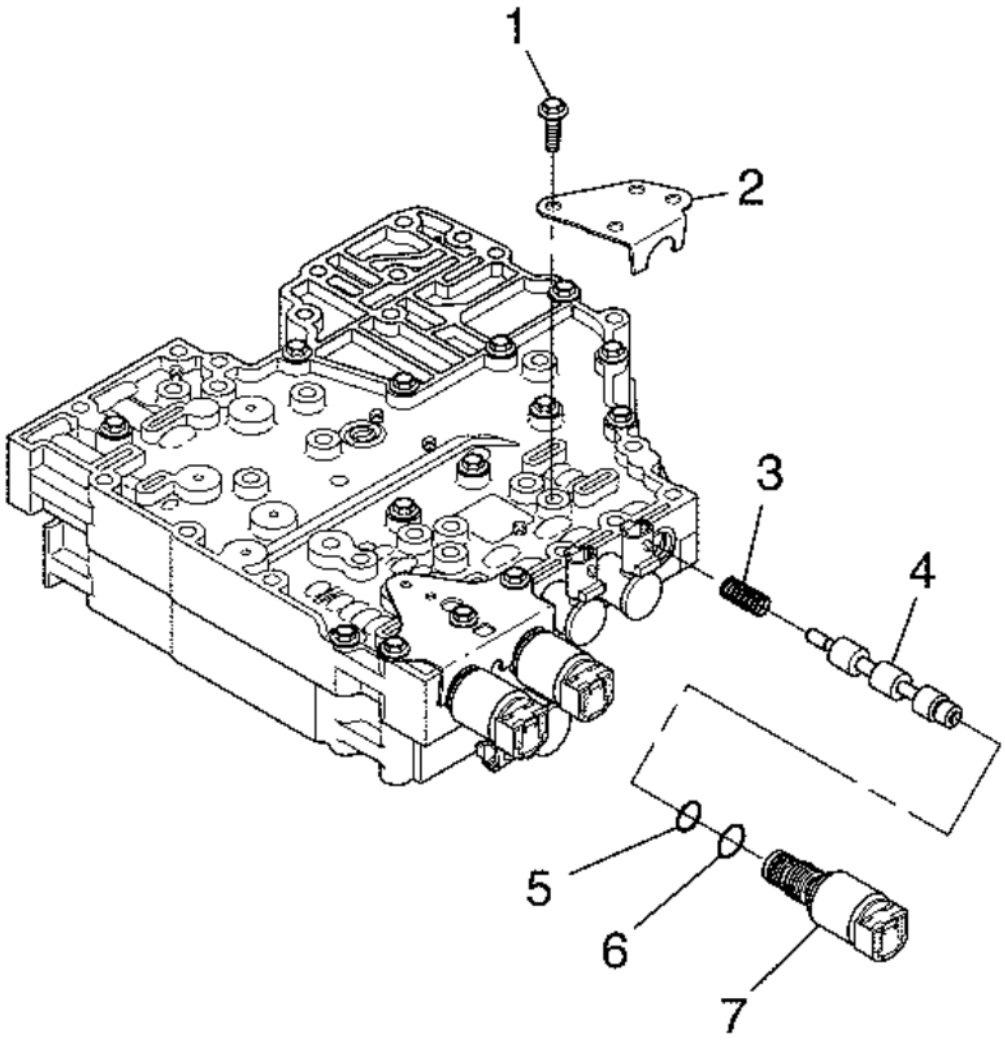


Fig. 394: TCC PCS And Components
Courtesy of GENERAL MOTORS CORP.

11. Remove 1 bolt (1) retaining the torque converter clutch pressure control solenoid (TCC PCS) bracket to the main valve body.
12. Remove the TCC PCS bracket (2).
13. Remove the TCC PCS (7), valve (4), and spring (3).
14. Remove the O-rings (5, 6) from the TCC PCS (7).

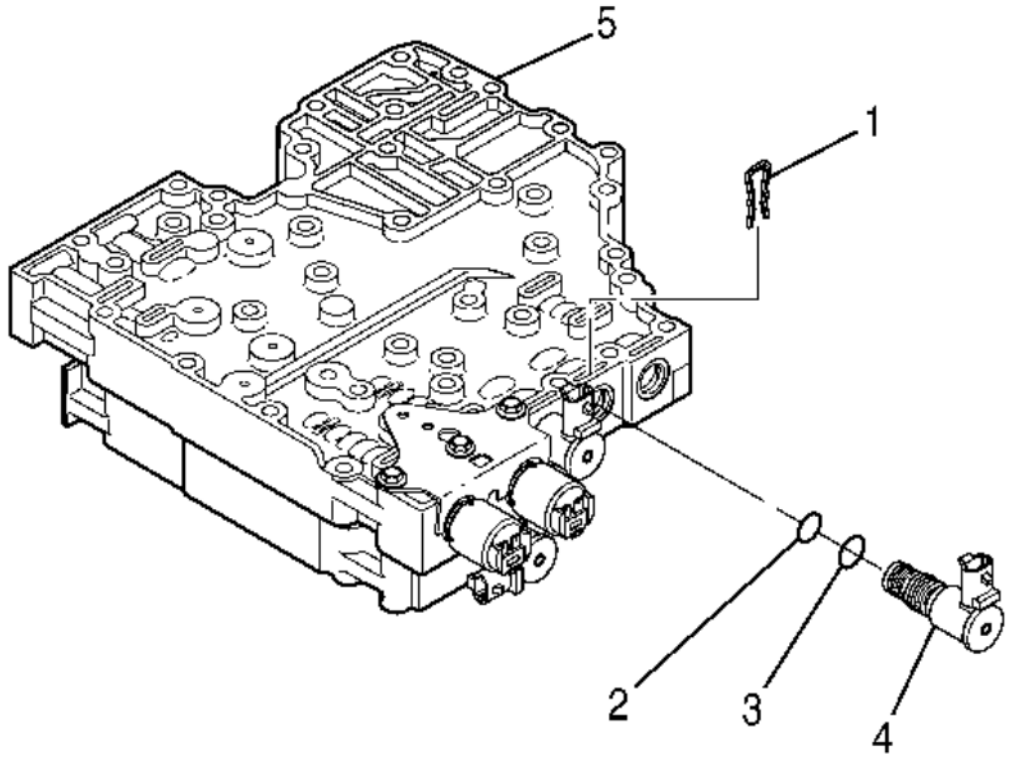


Fig. 395: Shift Solenoid Assembly
Courtesy of GENERAL MOTORS CORP.

15. Remove the shift solenoid 2 (SS2) retainer (1).
16. Remove the SS2 (4).
17. Remove the O-rings (2, 3) from the SS2 (4).

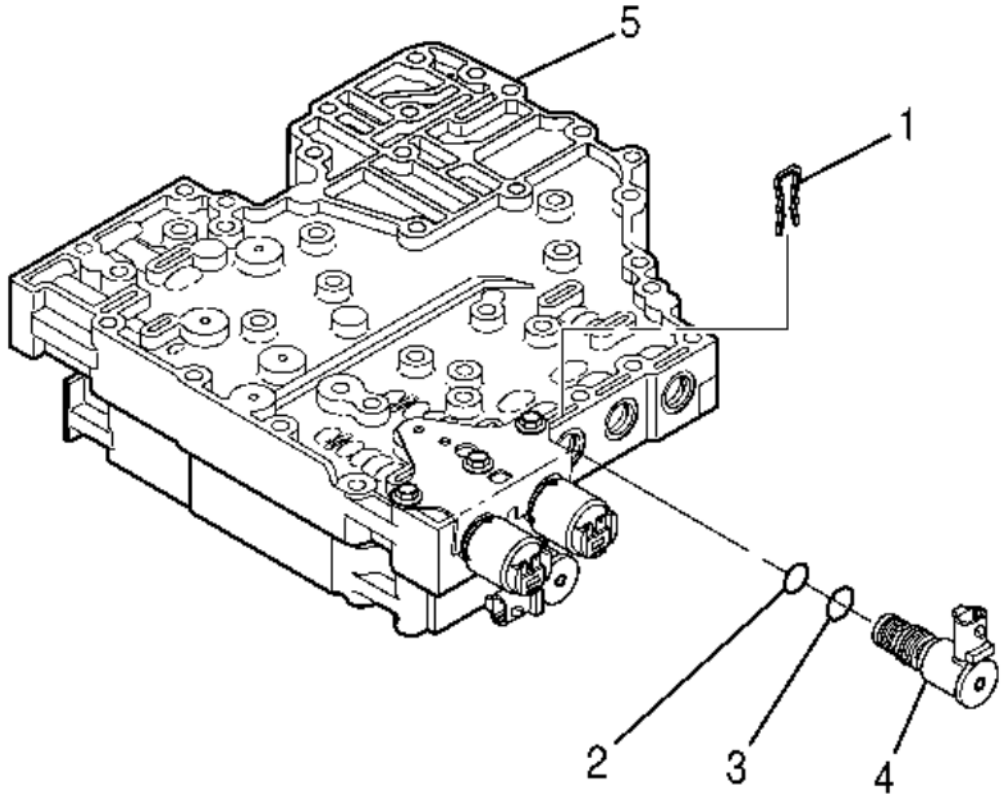


Fig. 396: Identifying Shift Solenoid Assembly
Courtesy of GENERAL MOTORS CORP.

18. Remove the shift solenoid 3 (SS3) retainer (1).
19. Remove the SS3 (4).
20. Remove the O-rings (2, 3) from SS3 (4).

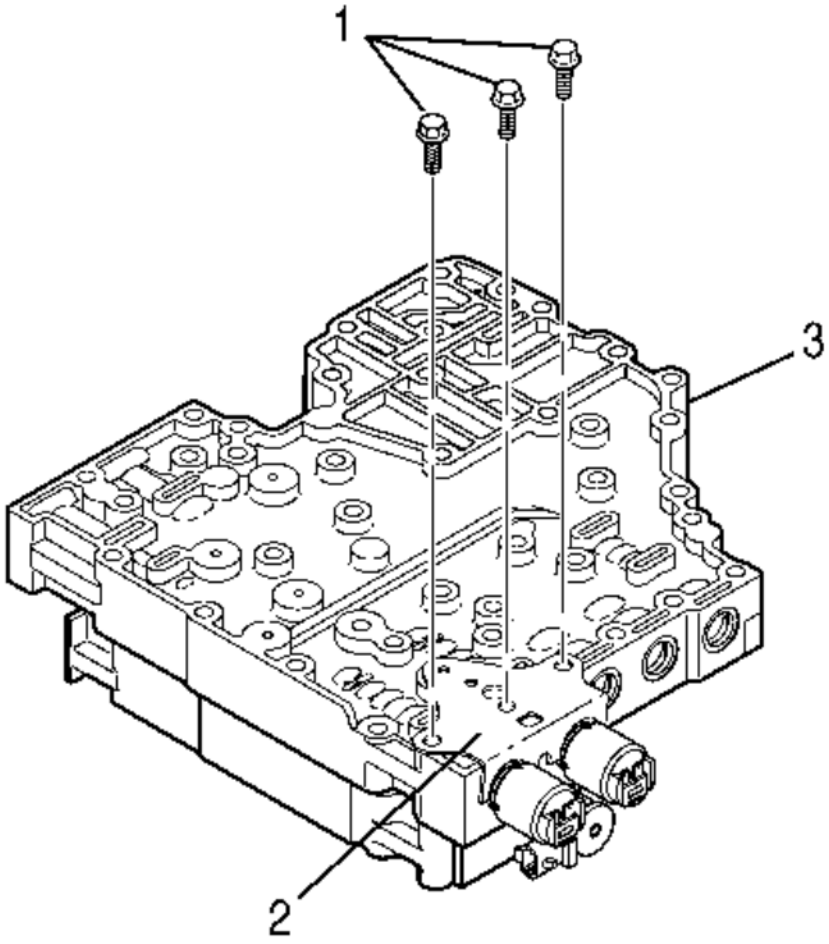


Fig. 397: View Of Pressure Control Valve Retaining Bracket Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

21. Remove 3 bolts (1) that retain the PCS1 and PCS2 retaining bracket (2) to the main valve body (3).

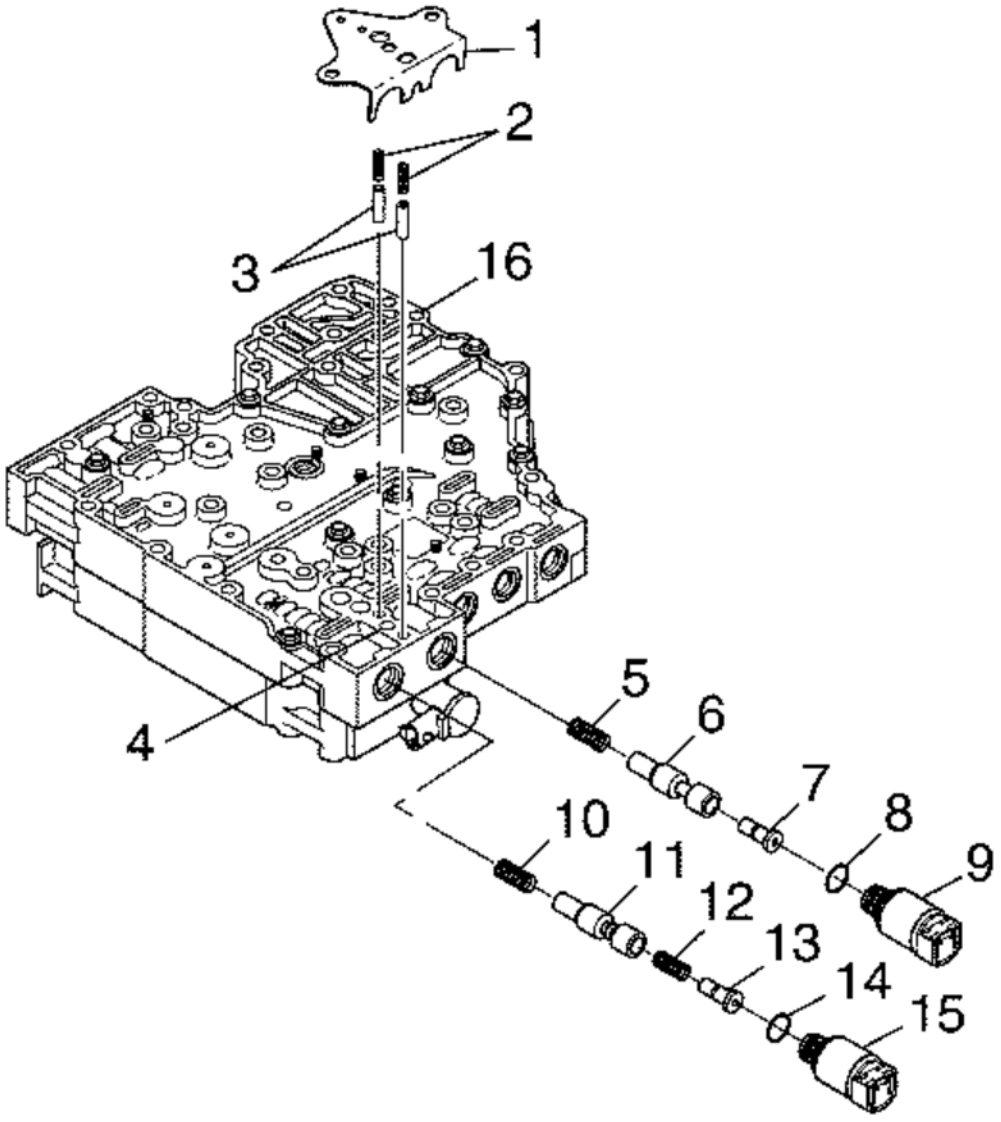


Fig. 398: Pressure Control Solenoid Components
Courtesy of GENERAL MOTORS CORP.

22. Remove the PCS1 and PCS2 retaining bracket (1), 2 accumulator springs (2), and 2 accumulator plugs (3).
23. Remove the PCS1 (15), valve (13), spring (12), valve (11), and spring (10).

24. Remove the PCS2 (9), valve (7), valve (6), and spring (5).
25. Remove the O-ring (14) from the PCS1 (15).
26. Remove the O-ring (8) from the PCS2 (9).

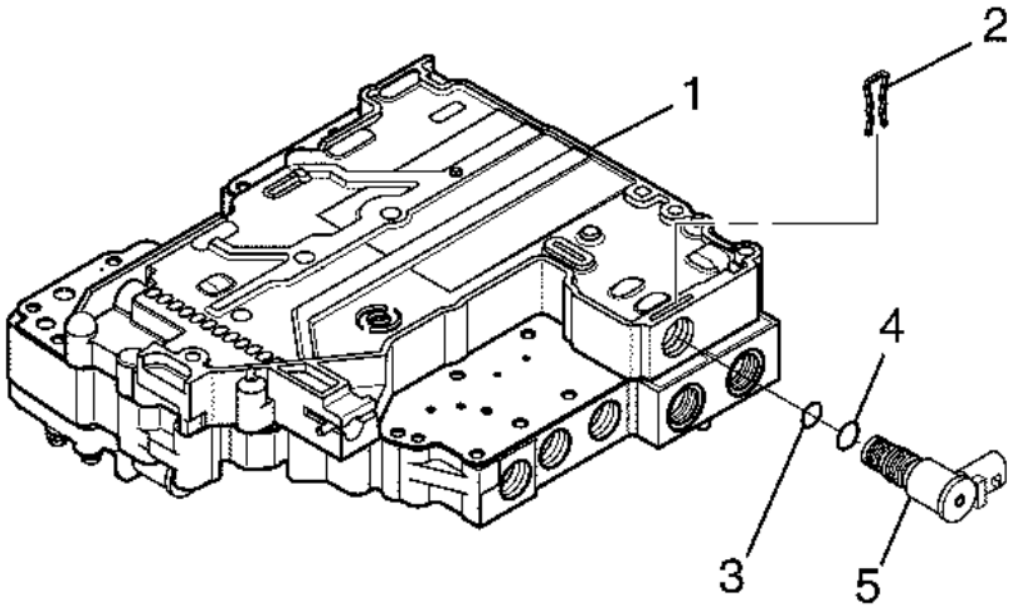


Fig. 399: Shift Solenoid
Courtesy of GENERAL MOTORS CORP.

27. Position the control valve body on the work table so that the shift valve body (1) is facing up.
28. Remove the shift solenoid 1 (SS1) retainer (2).
29. Remove the SS1 (5).
30. Remove the O-rings (3, 4) from SS1 (5).

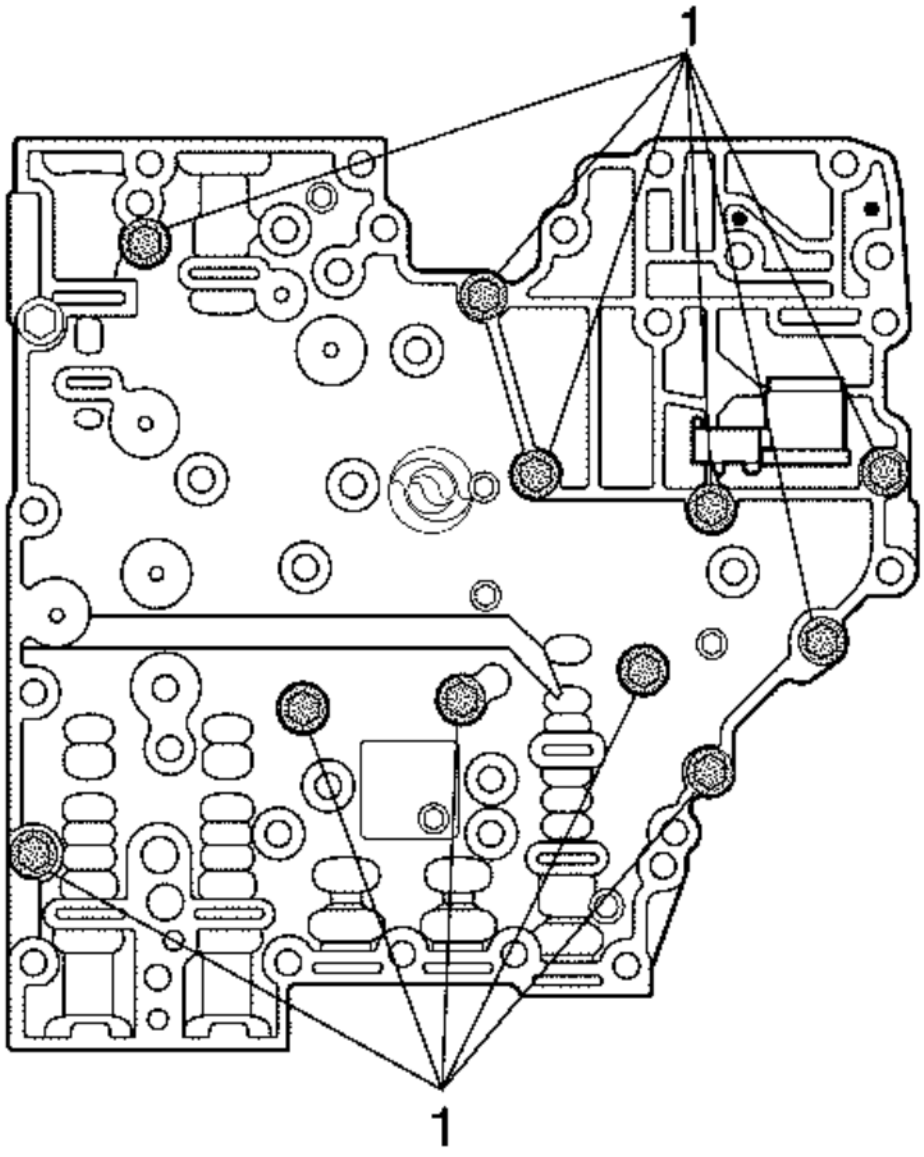


Fig. 400: Shift Valve Body Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT damage the solenoids when turning over the control valve assembly.

31. Position the control valve assembly on the work table so that the main valve body is facing up.

    Remove 11 bolts (1) retaining the shift valve body and the main valve body together.

32. Position the control valve body assembly on the work table so that the main valve body is on edge, sideways.
33. Reinstall 4 bolts (1) so that the bolts are partially threaded into the shift valve body and protrude from the main valve body.
34. Gently tap the bolts until the assembly separates.

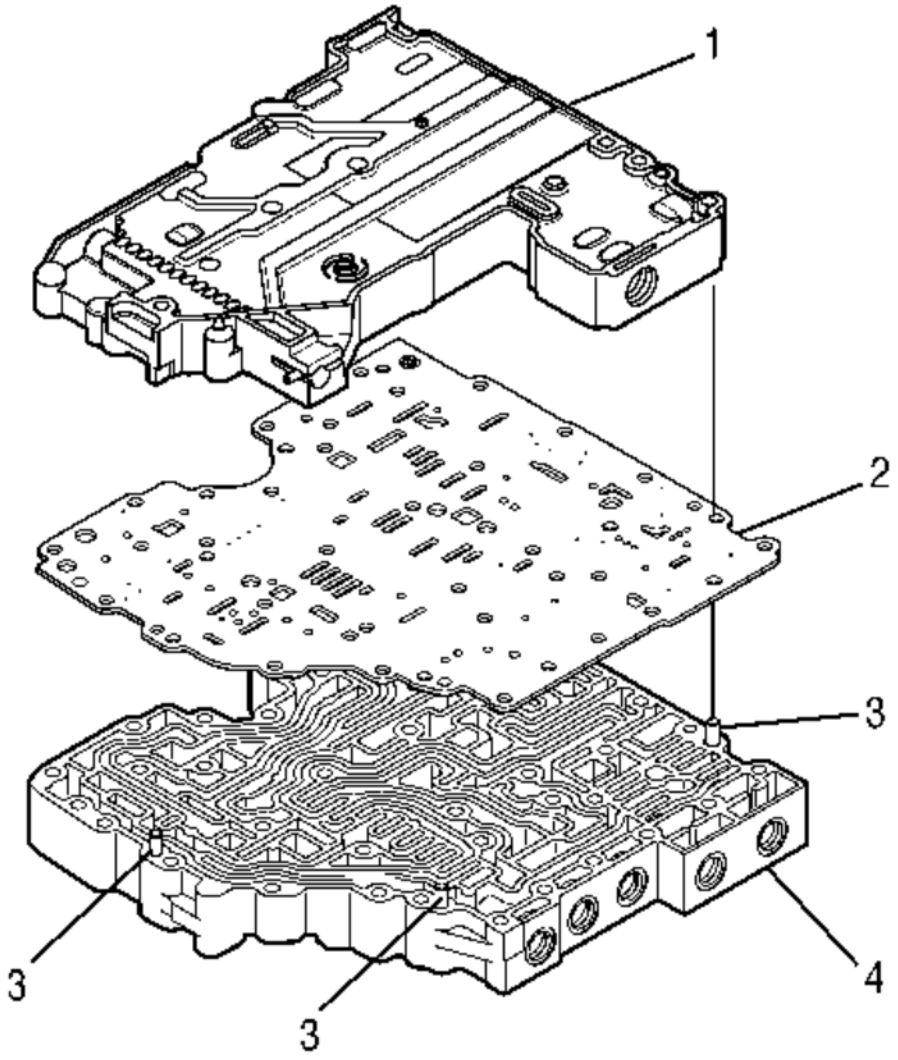


Fig. 401: Separating Shift Valve Body Assembly, Separator Plate, And Main Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

35. Position the control valve assembly on the work table so that the shift valve body (1) is facing up.
36. Separate the shift valve body assembly (1), the separator plate (2), and the main valve body assembly (4).

CONTROL VALVE BODY CLEANING AND INSPECTION

Clean and Inspect

NOTE: Refer to Transmission Control Valve Body Overhaul Notice .

1. Clean all removed parts with volatile mineral spirits or other similar cleaning agent.
2. Clean fluid passages by working a piece of soft wire through the passage and flushing with mineral spirits. Dry the passages with compressed air.
3. Inspect valves for wear, nicks, or scratches. Remove minor imperfections with a soft stone or crocus cloth. Replace any damaged valves.
4. Inspect springs for signs of overheating, permanent set, or wear. Replace suspect springs.
5. Inspect mating surfaces for nicks, burrs, scratches, or foreign matter. Remove any defects with crocus cloth or a soft stone. Replace damaged parts.
6. Inspect bores for wear, scratches, and grooves. Remove scratches and burrs with crocus cloth. Replace deeply grooved or scratched parts.
7. Inspect threaded parts for burred or damaged threads. Remove burrs with a soft stone or fine file.
8. Inspect threaded openings for damaged threads. Correct damaged threads with a correctly sized tap.

Pressure Control Solenoid 1 (PCS1)/PSC2 and the Torque Converter Clutch (TCC) PCS Retaining Bracket Inspection Inspection

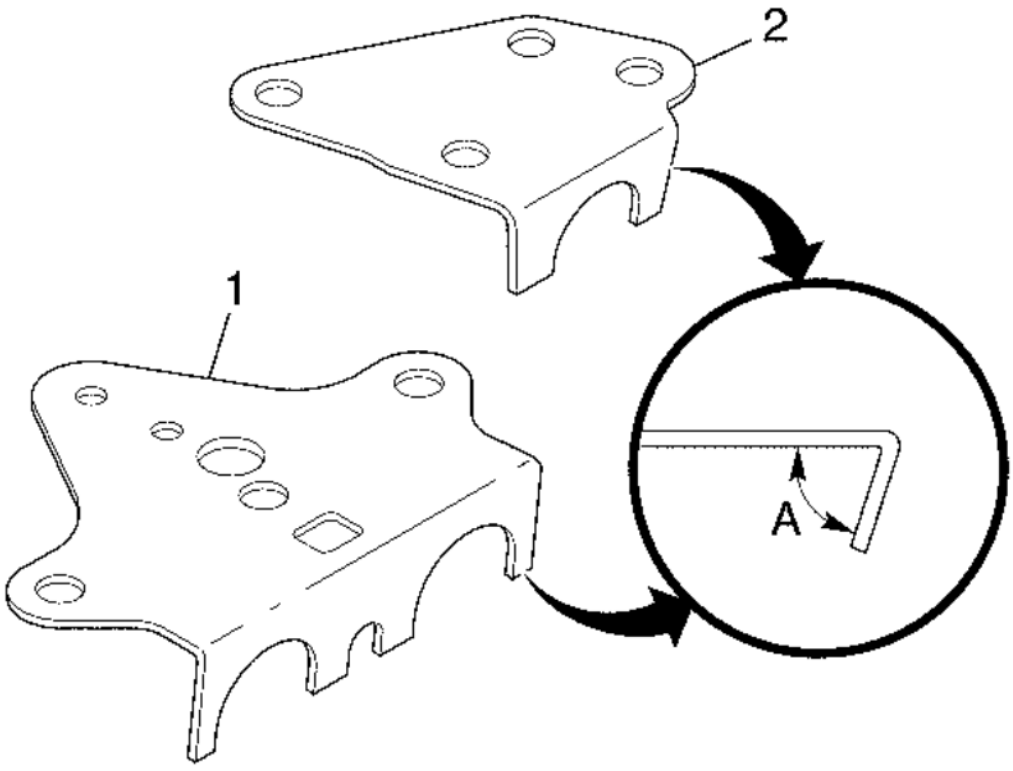


Fig. 402: Inspecting Retaining Bracket Angles
Courtesy of GENERAL MOTORS CORP.

1. Measure the angle between the surfaces of the PCS1/PCS2 retaining bracket (1), and the TCC PCS retaining bracket (2), as shown in insert, angle A.
2. Adjust the bracket surfaces until the angle between the surfaces is 82.84 degrees.

SHIFT SOLENOID VALVE DISASSEMBLE

Tools Required

- **J 33163** Valve Tray Set. See **Special Tools**.
- **J 43773** Valve Spring Compressor. See **Special Tools**.

Disassemble

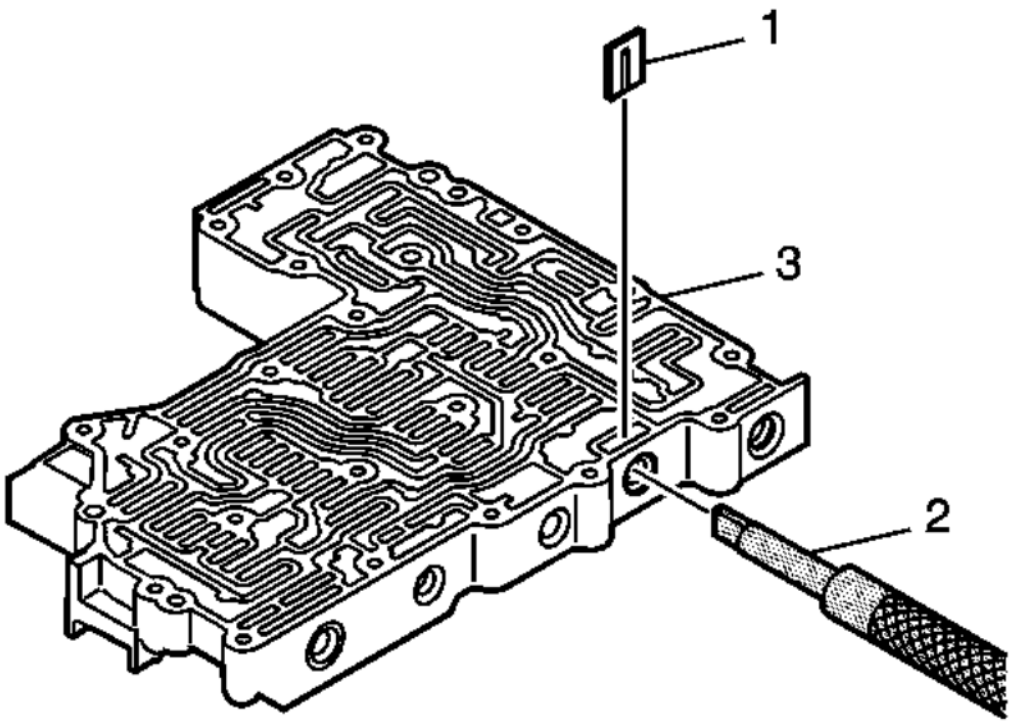


Fig. 403: Compressing Shift Solenoid Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: To help prevent confusing parts on reassembly, use J 33163 to store the removed shift valve body assembly valves, springs, and stops. See Special Tools.

1. Using **J 43773** (2), compress the shift valve 1 (SV1) spring until the retaining clip (1) is loose. See **Special Tools**.
2. Remove the clip.

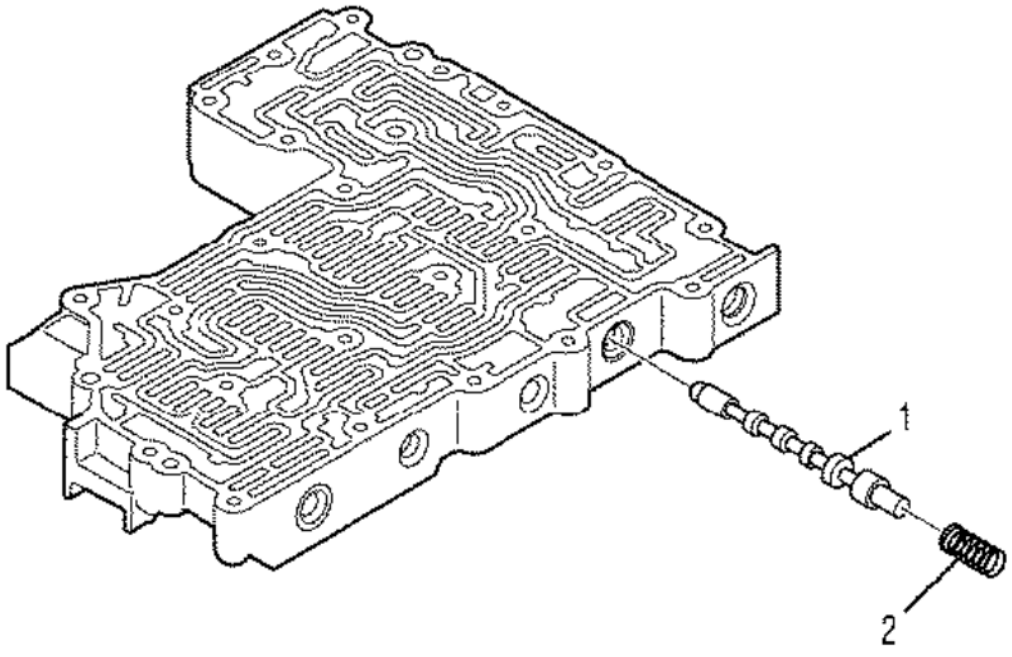


Fig. 404: Spring And Shift Valve
Courtesy of GENERAL MOTORS CORP.

3. Remove the spring (2) and SV1 (1).

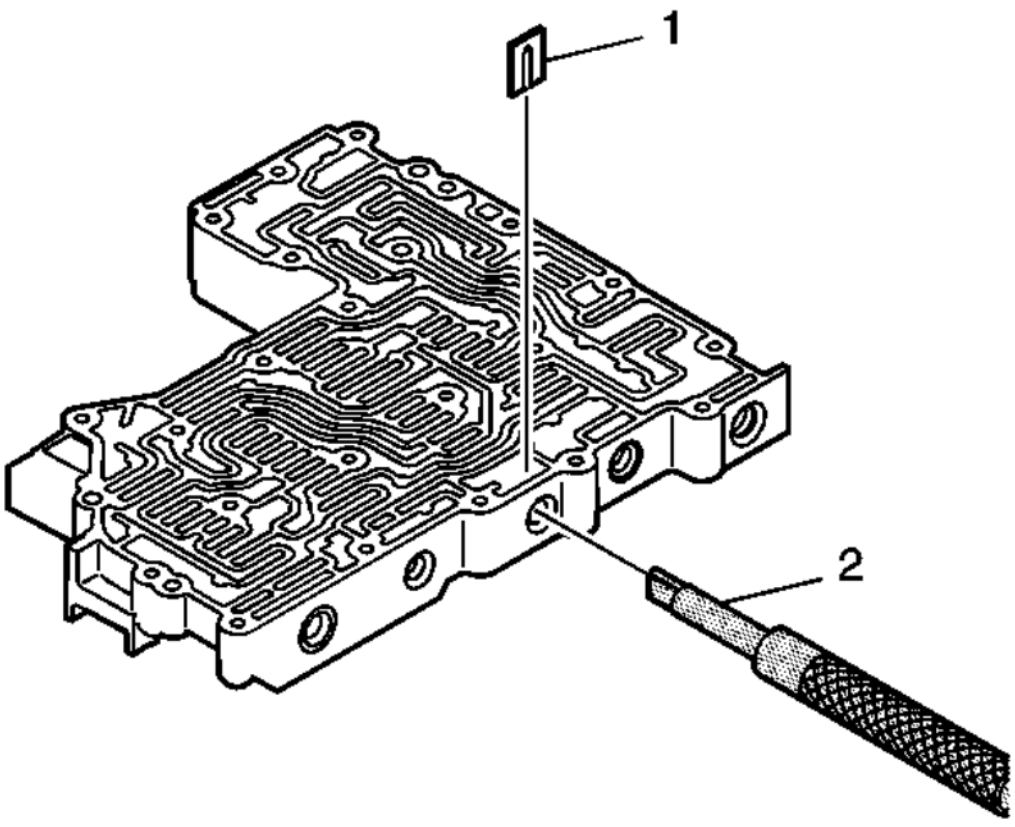


Fig. 405: Compressing Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

4. Using **J 43773** (2), compress the shift valve 3 (SV3) spring until the retaining clip (1) is loose. See **Special Tools**.
5. Remove the clip.

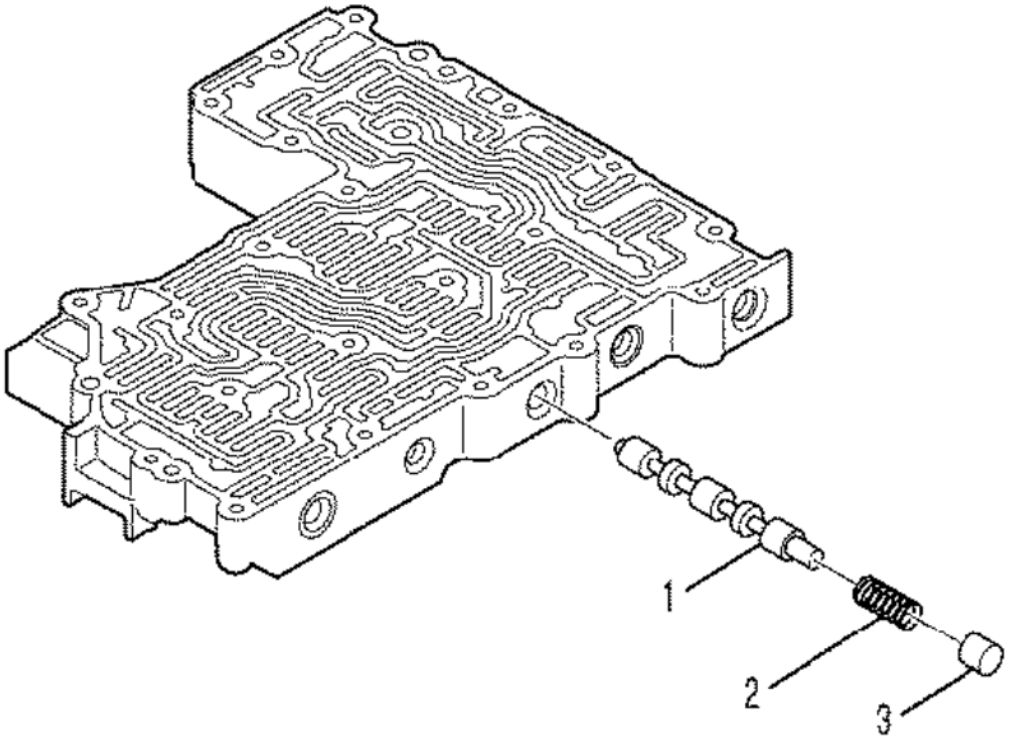


Fig. 406: View Of Plug, Spring, And Shift Valve
Courtesy of GENERAL MOTORS CORP.

6. Remove the plug (3), spring (2), and SV3 (1).

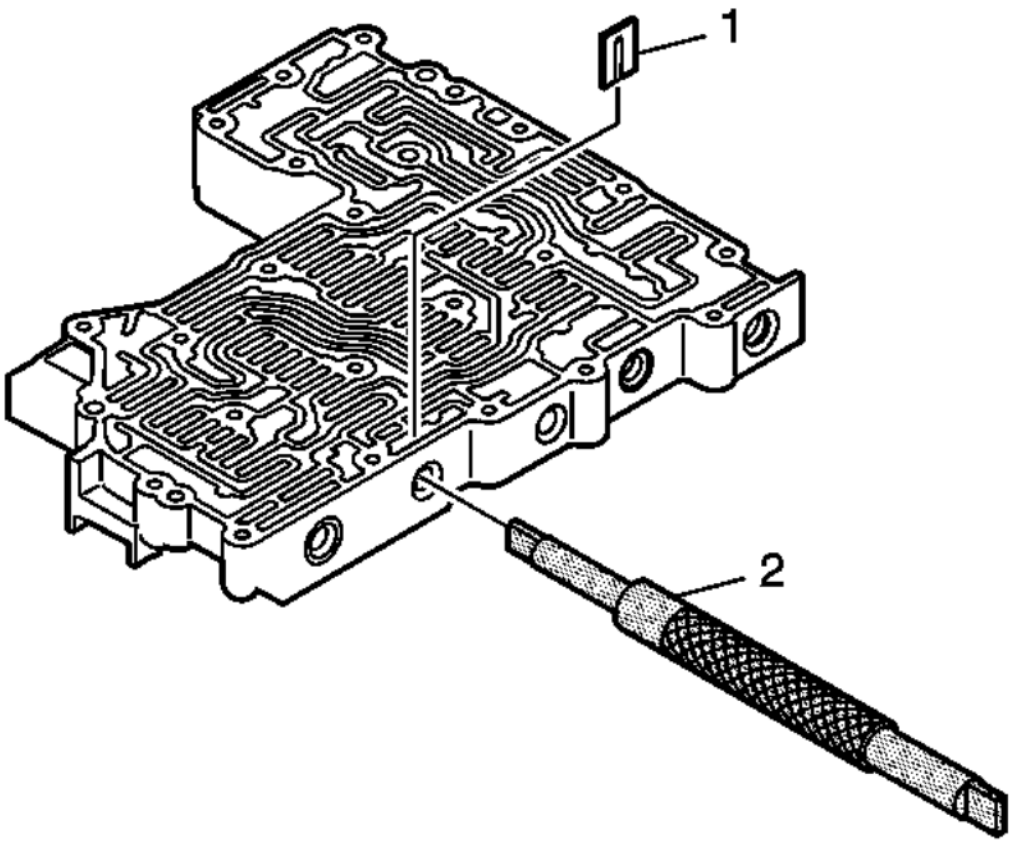


Fig. 407: Compressing Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

7. Using **J 43773** (2), compress the shift valve 2 (SV2) spring until the retaining clip (1) is loose. See **Special Tools**.
8. Remove the clip.

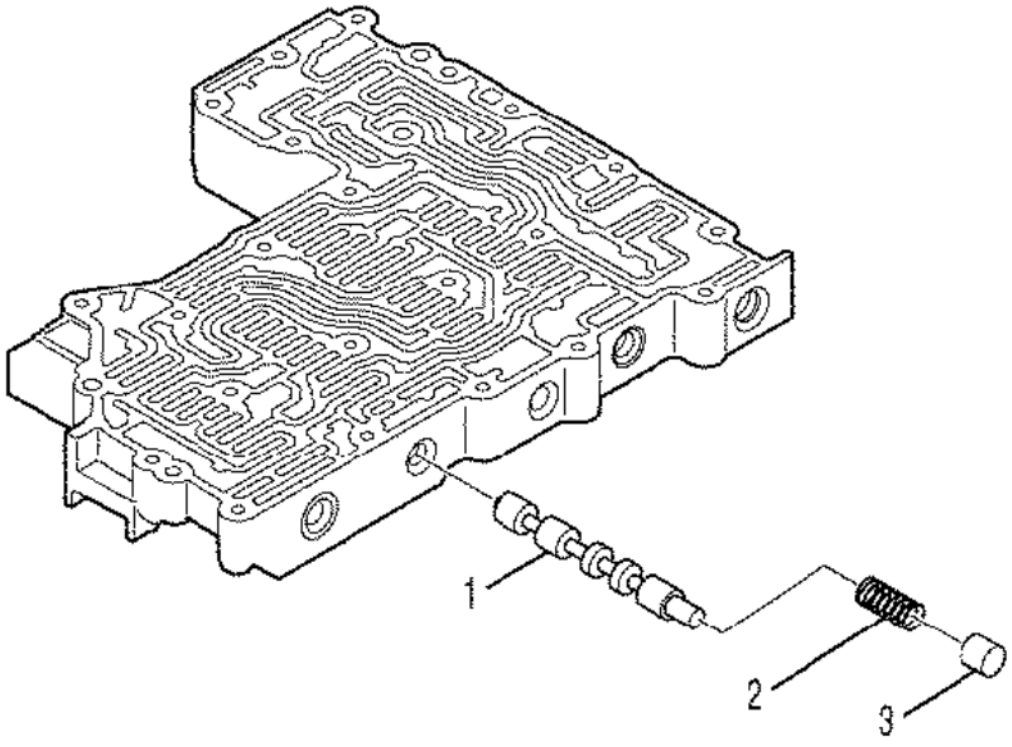


Fig. 408: View Of Plug, Spring, And Shift Valve
Courtesy of GENERAL MOTORS CORP.

9. Remove the plug (3), spring (2), and SV2 (1).

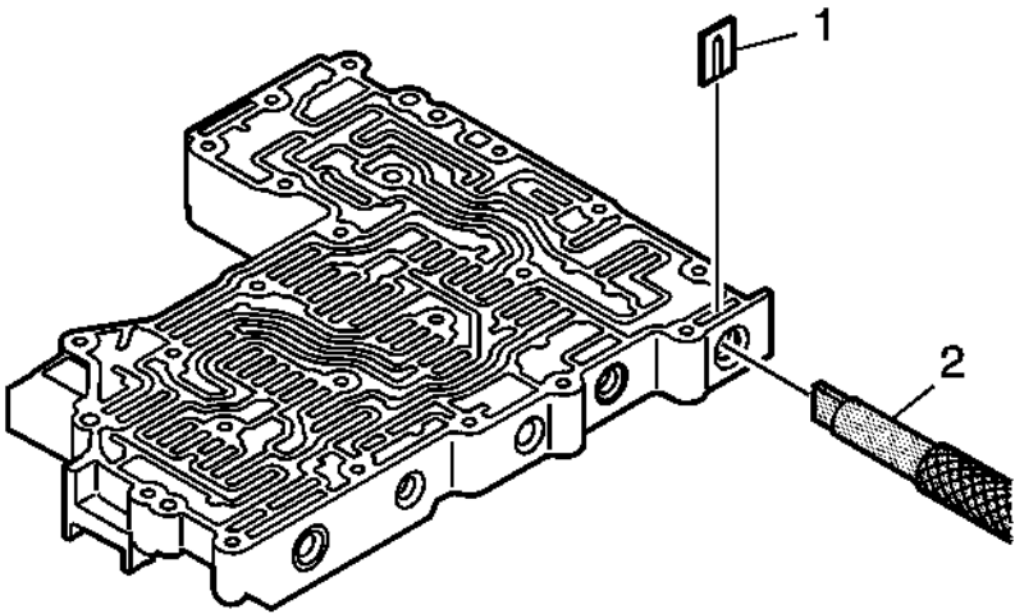


Fig. 409: Compressing Control Main Valve Spring
Courtesy of GENERAL MOTORS CORP.

10. Using **J 43773** (2), compress the control main valve spring until retaining clip (1) is loose. See **Special Tools**.
11. Remove the clip.

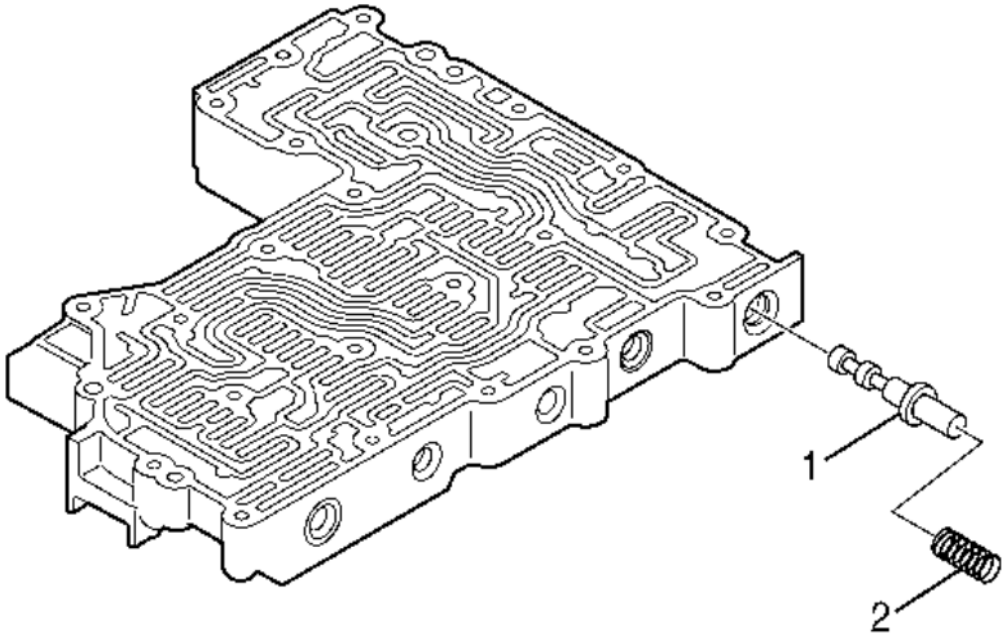


Fig. 410: Spring And Control Main Valve
Courtesy of GENERAL MOTORS CORP.

12. Remove the spring (2) and the control main valve (1).

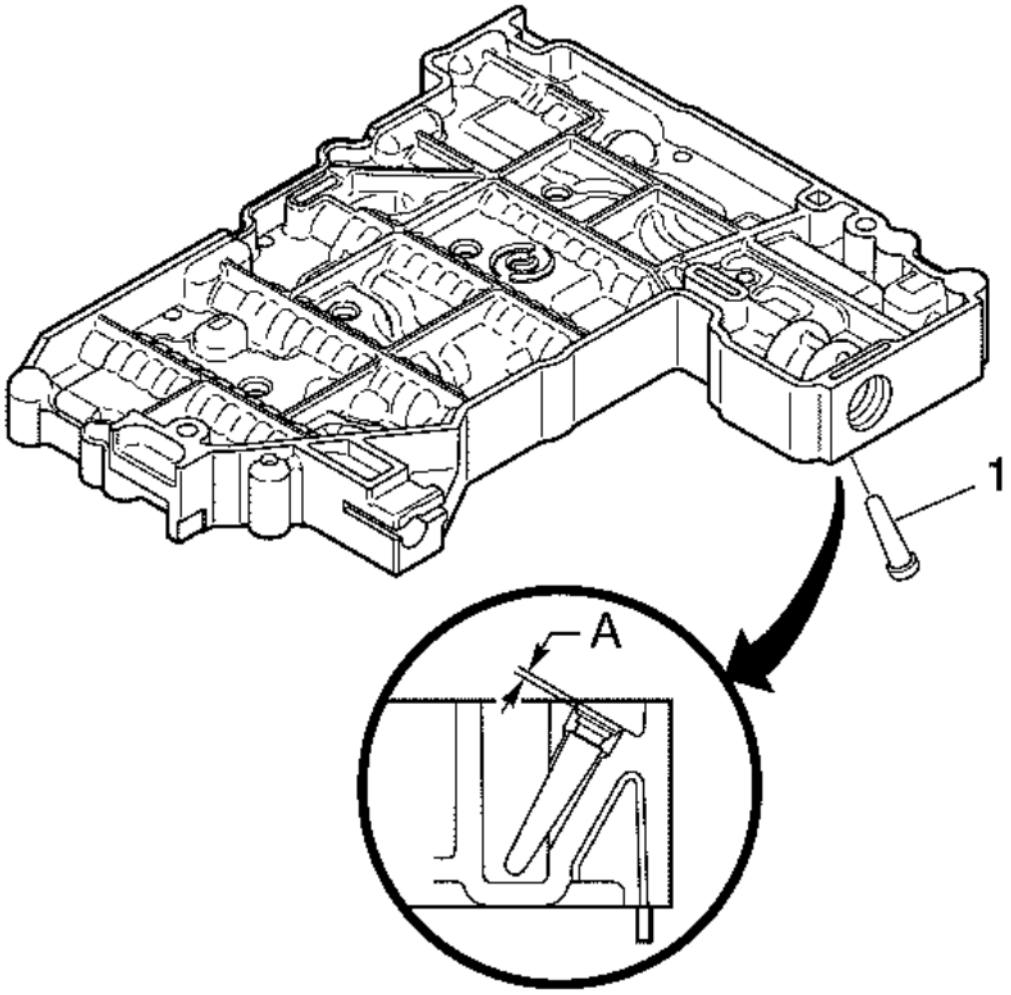


Fig. 411: Shift Solenoid Screen
Courtesy of GENERAL MOTORS CORP.

13. Remove the shift solenoid screen (1).

SHIFT SOLENOID VALVE ASSEMBLE

Tools Required

- **J 33163** Valve Tray Set. See **Special Tools**.

- **J 43773** Valve Spring Compressor. See **Special Tools**.

Assemble

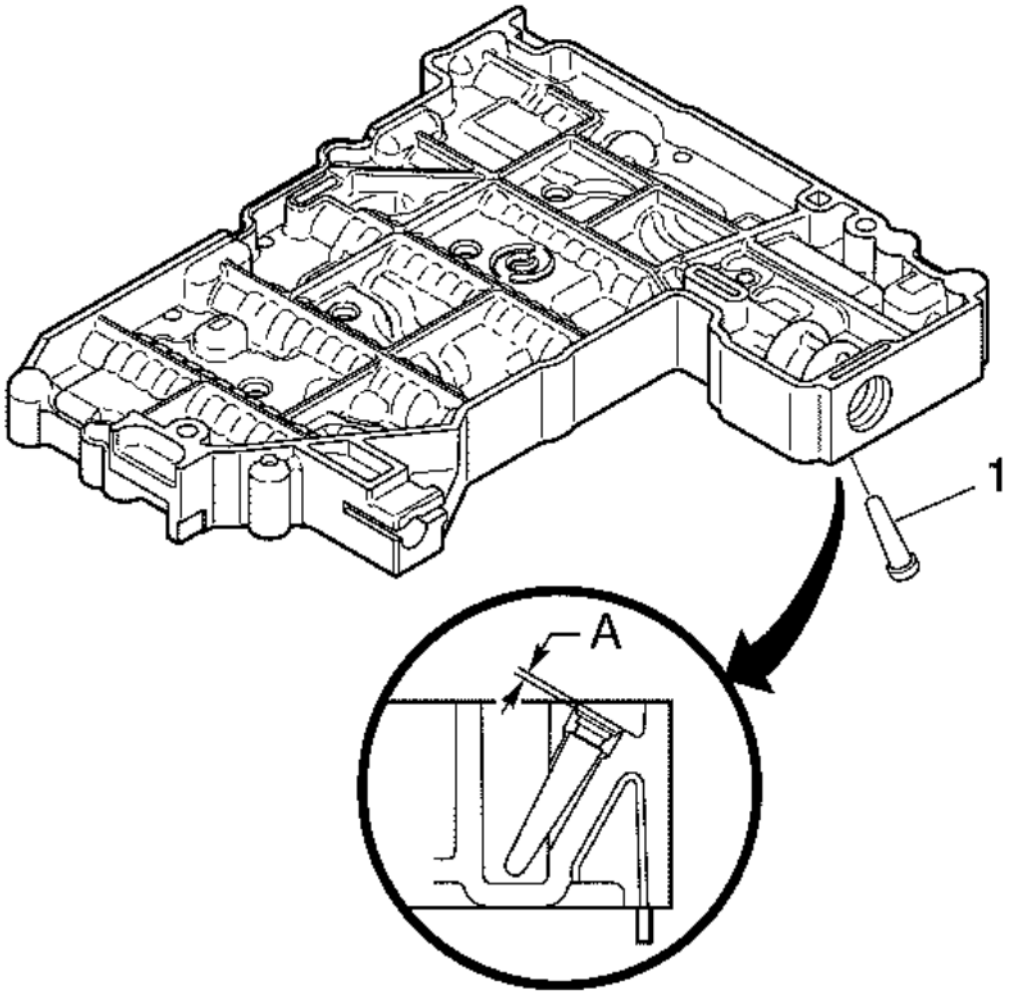


Fig. 412: Shift Solenoid Screen
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: To help prevent confusing parts on assembly, J 33163 has been used during the disassemble procedure in order to store the removed valves, springs, and stops. See Special

Tools.

1. Install the shift solenoid screen (1).
2. Measure the screen installation depth at dimension A.

   Specification: The screen installed depth is 0.50-1.0 mm (0.020-0.039 in) below the shift valve body surface as shown.

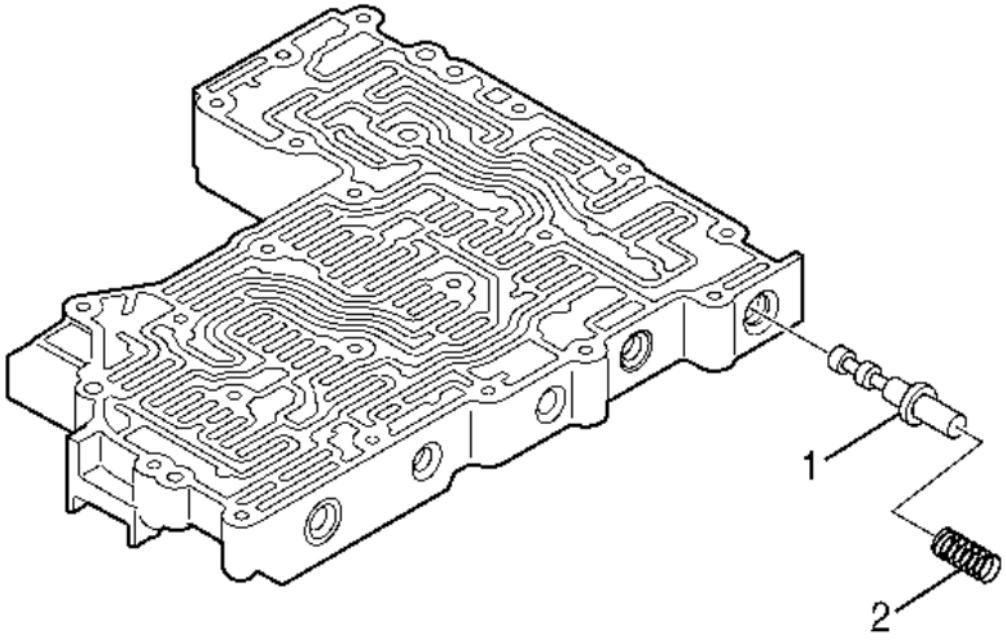


Fig. 413: Spring And Control Main Valve
Courtesy of GENERAL MOTORS CORP.

3. Install the control main valve (1) and the control main spring (2).

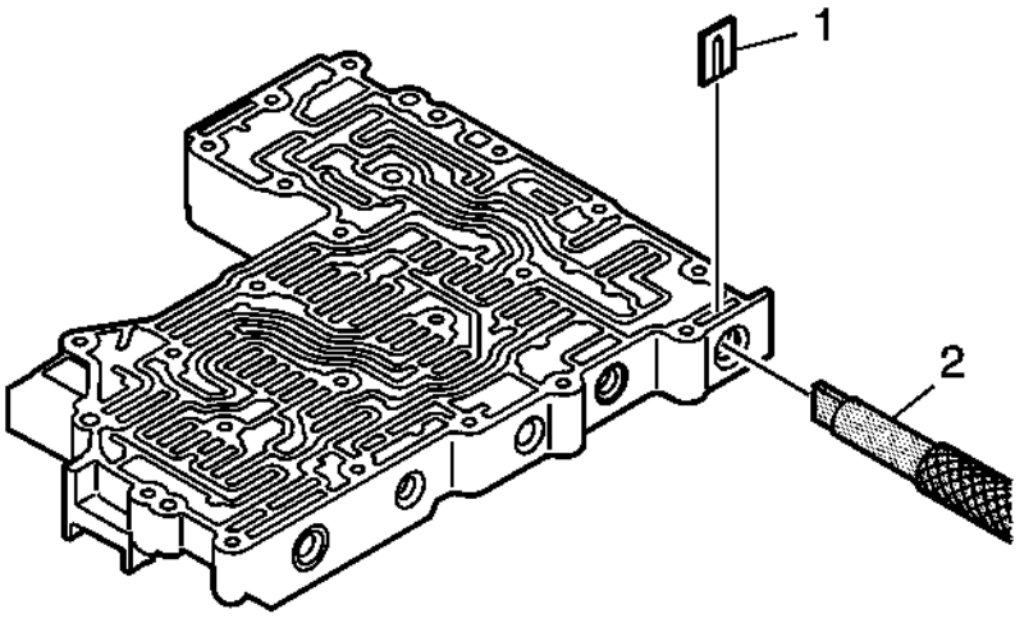


Fig. 414: Compressing Control Main Valve Spring
Courtesy of GENERAL MOTORS CORP.

4. Compress the spring with **J 43773** (2). See **Special Tools**.
5. Install the retaining clip (1).
6. Make sure the retaining clip is below the valve body surface.

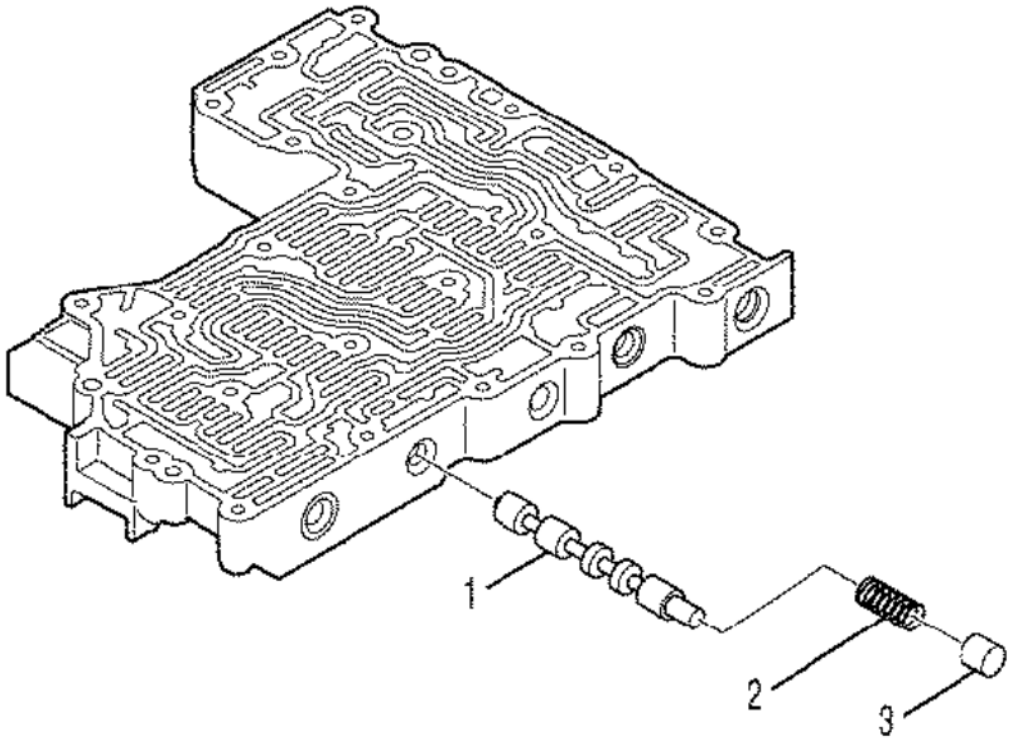


Fig. 415: View Of Plug, Spring, And Shift Valve
Courtesy of GENERAL MOTORS CORP.

7. Install shift valve 2 (SV2) (1), spring (2), and plug (3).

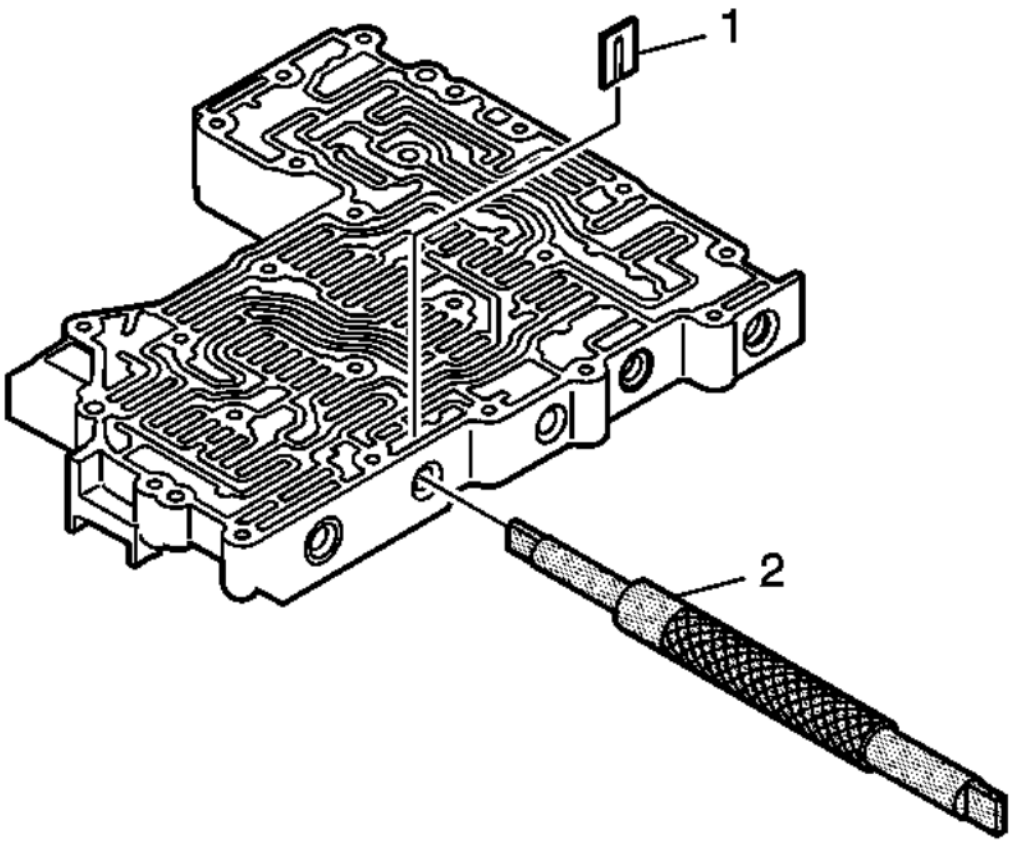


Fig. 416: Compressing Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

8. Compress the spring with **J 43773** (2). See **Special Tools**.

   Install the retaining clip (1).

9. Make sure the retaining clip is below the valve body surface.

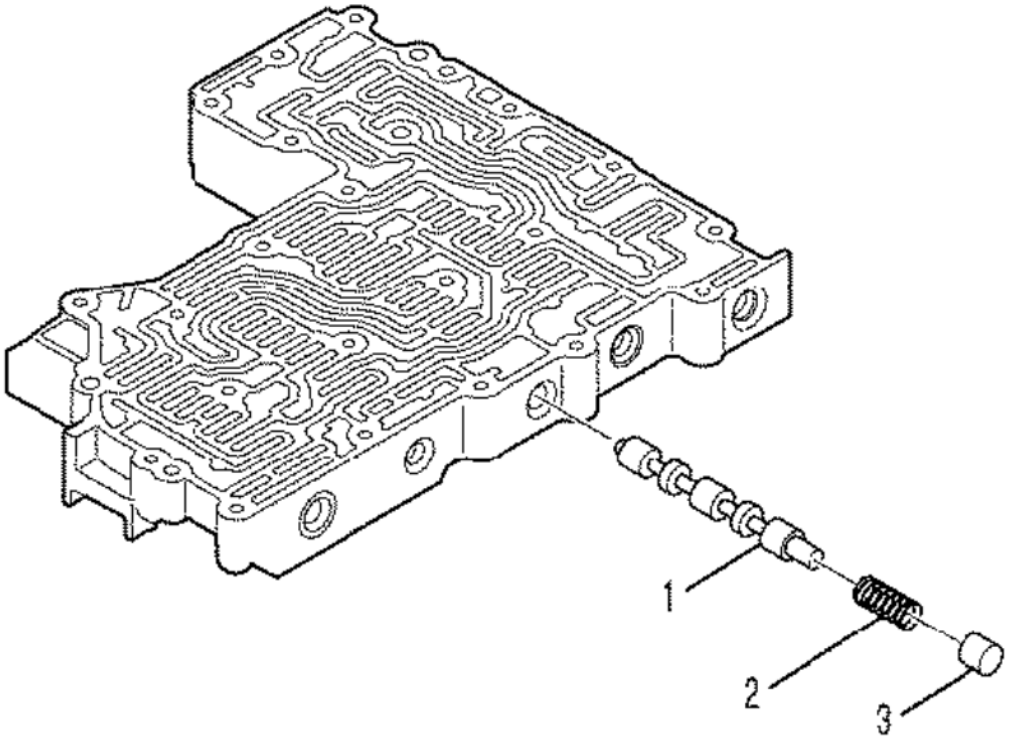


Fig. 417: View Of Plug, Spring, And Shift Valve
Courtesy of GENERAL MOTORS CORP.

10. Install shift valve 3 (SV3) (1), the spring (2), and plug (3).

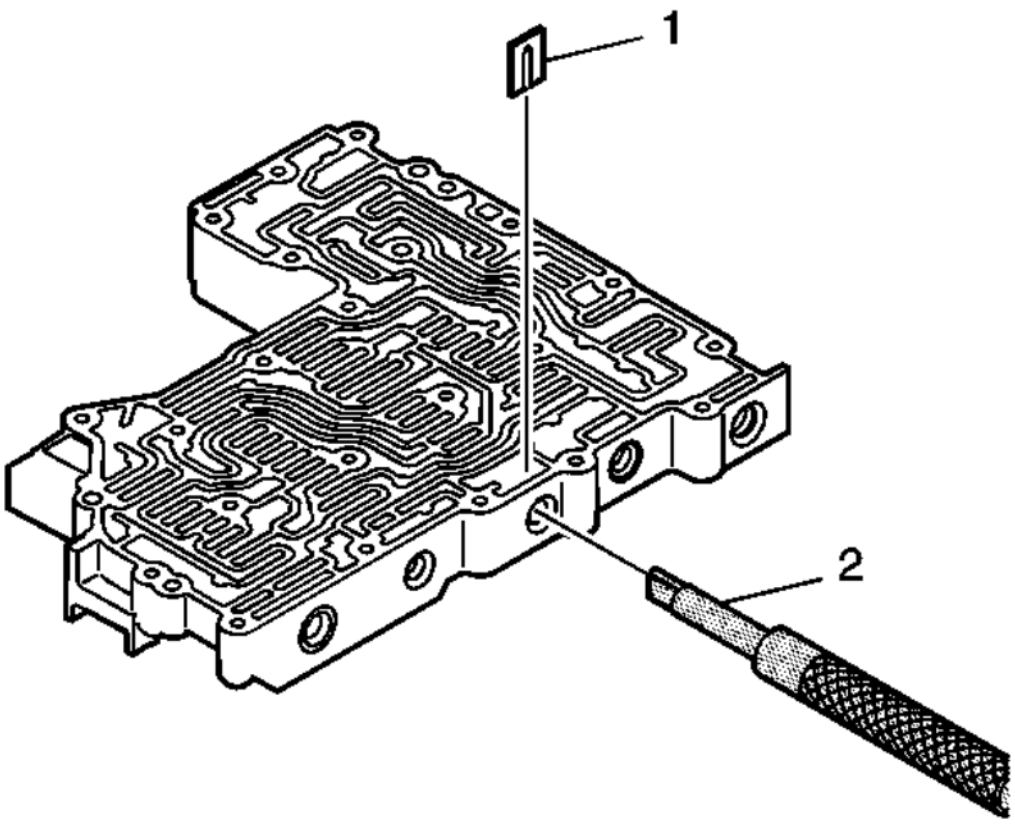


Fig. 418: Compressing Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

11. Compress the spring with **J 43773** (2). See **Special Tools**.
12. Install the retaining clip (1).
13. Make sure the retaining clip is below the valve body surface.

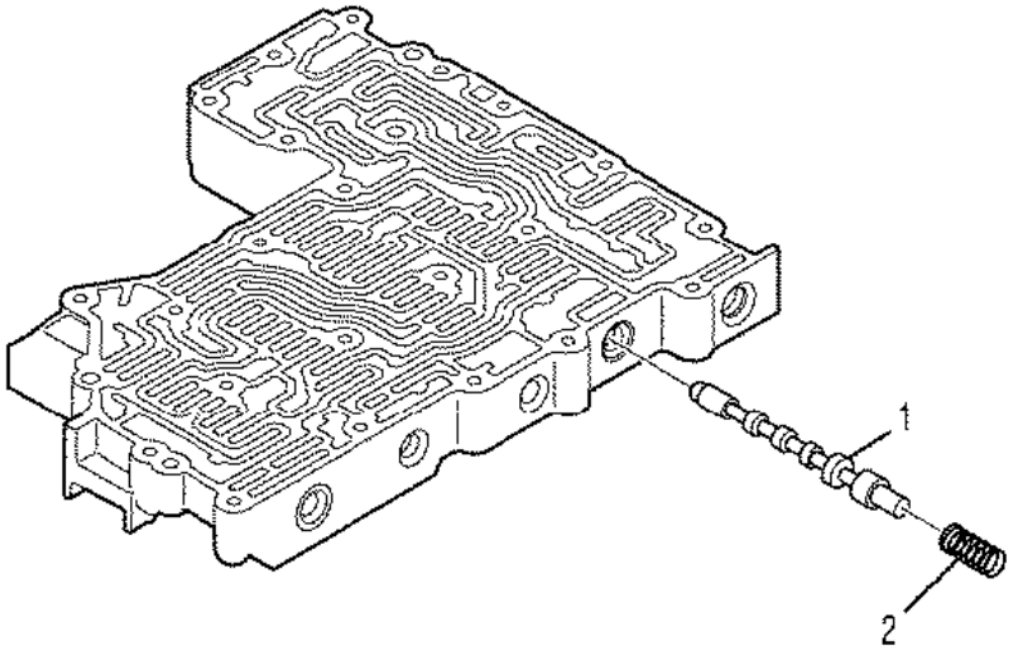


Fig. 419: Spring And Shift Valve
Courtesy of GENERAL MOTORS CORP.

14. Install shift valve 1 (SV1) (1) and spring (2).

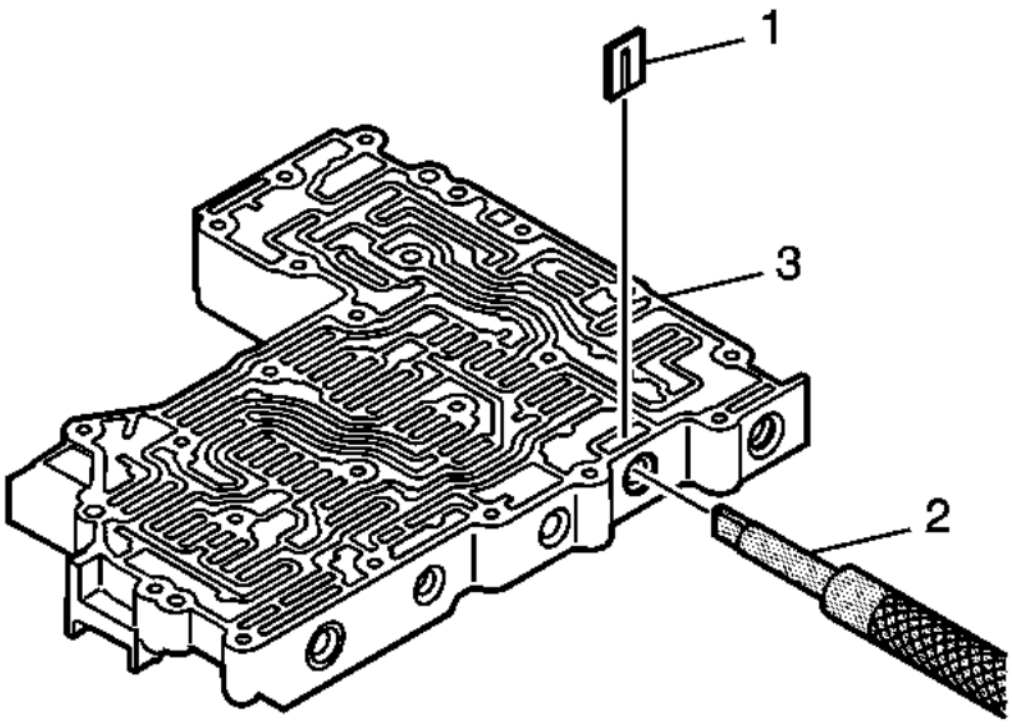


Fig. 420: Compressing Shift Solenoid Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

15. Compress the spring with **J 43773** (2). See **Special Tools**.
16. Install the retaining clip (1).
17. Make sure the retaining clip is below the valve body surface.

MAIN VALVE BODY DISASSEMBLE

Tools Required

- **J 33163** Valve Tray Set. See **Special Tools**.
- **J 43773** Valve Spring Compressor. See **Special Tools**.

Disassemble

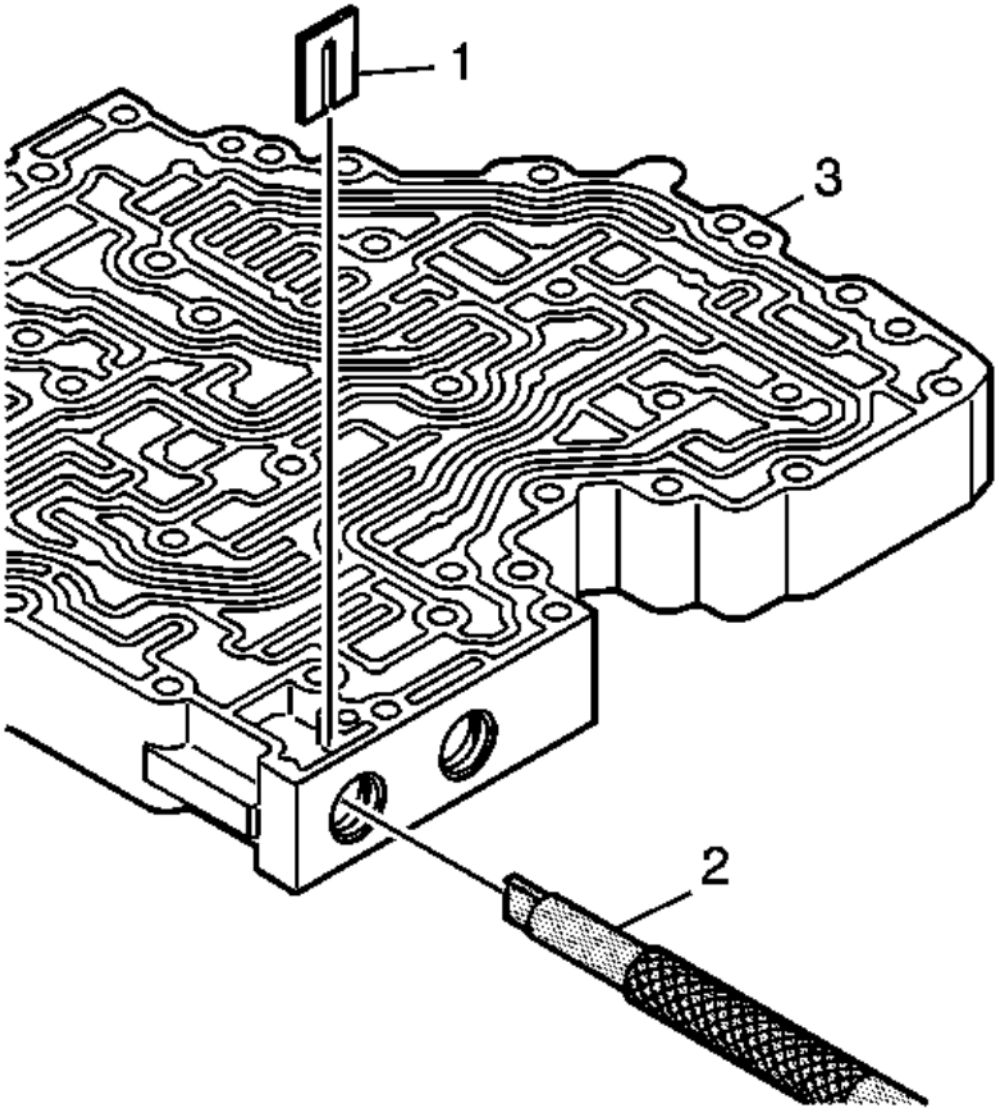


Fig. 421: Compressing Control Relief Valve Spring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: To prevent confusing parts during assembly, use J 33163 to store the removed valves, springs, and stops. See Special Tools.

1. Using **J 43773** (2), compress the control relief spring until the retaining clip (1) is loose. See **Special Tools**.
2. Remove the clip.

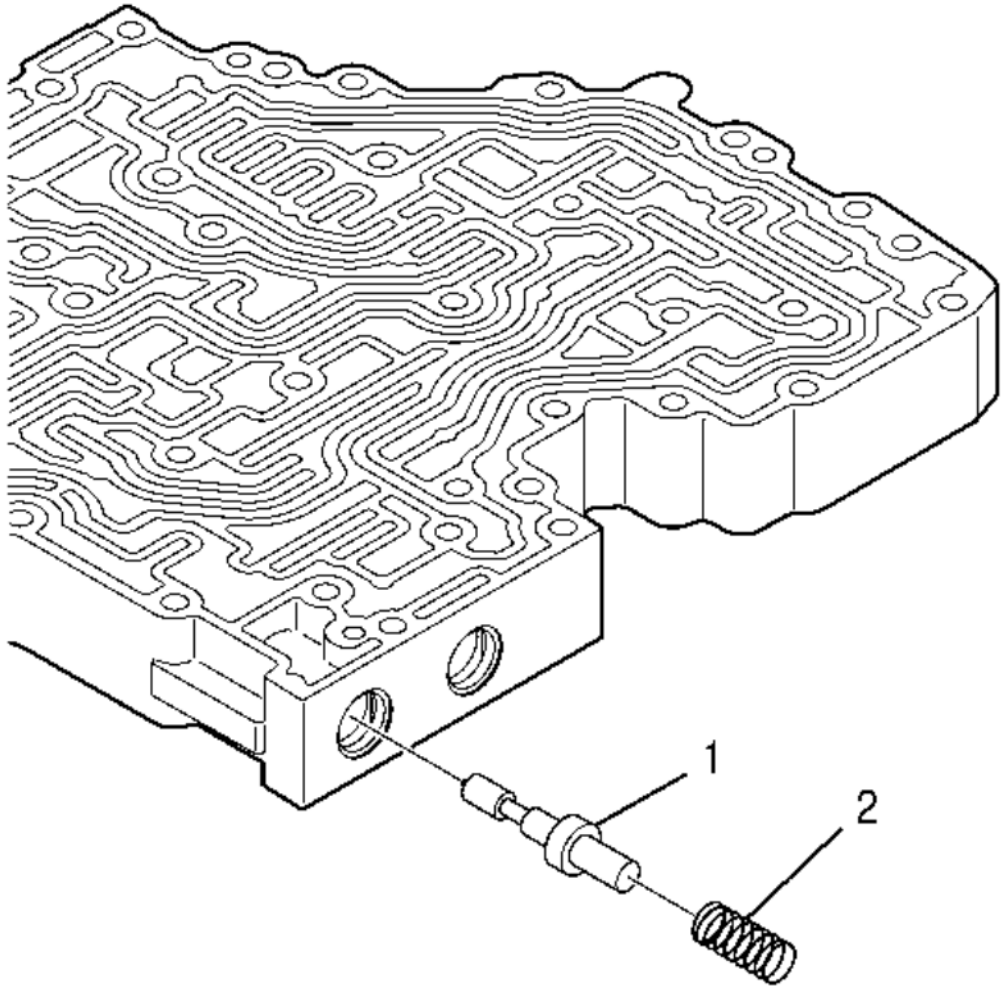


Fig. 422: Identifying Control Relief Spring & Control Relief Valve
Courtesy of GENERAL MOTORS CORP.

3. Remove the control relief spring (2) and the control relief valve (1).

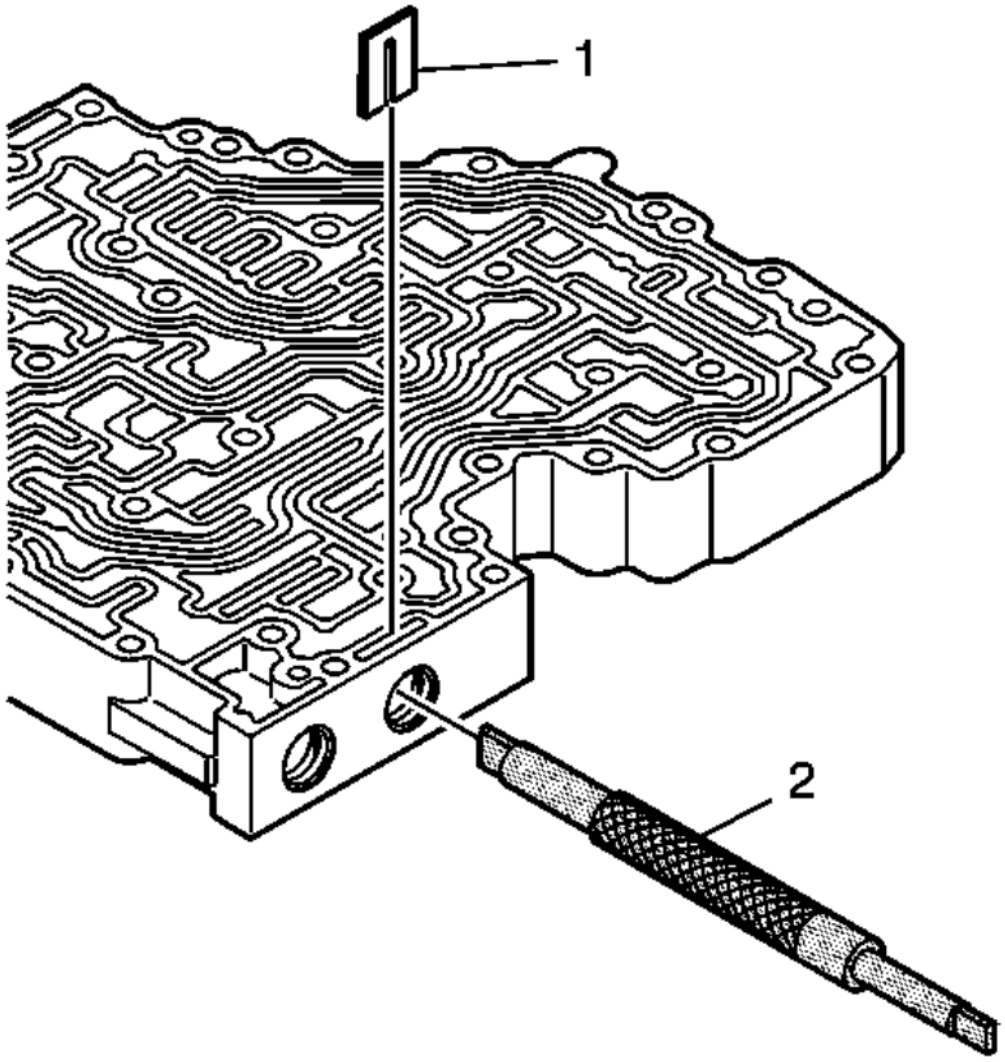


Fig. 423: Compressing Exhaust Pressure Regulator Valve Spring
Courtesy of GENERAL MOTORS CORP.

4. Using **J 43773** (2), compress the exhaust pressure regulator valve spring until the retaining clip (1) is loose. See **Special Tools**.
5. Remove the clip.

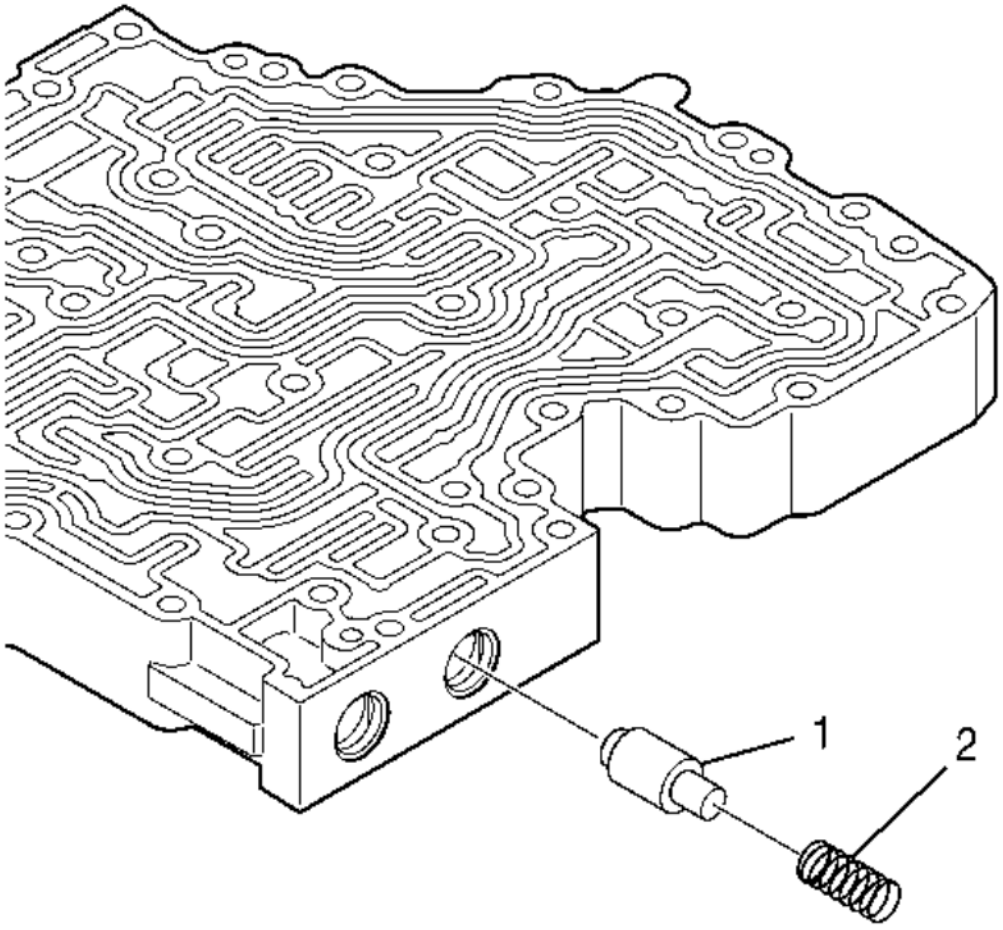


Fig. 424: Locating Exhaust Pressure Regulator Valve & Spring
Courtesy of GENERAL MOTORS CORP.

6. Remove exhaust pressure regulator valve spring (2) and exhaust pressure regulator valve (1).

CONTROL VALVE BODY LOCATION PIN REPLACEMENT

Tools Required

J 43779 Locating Pin Installer. See **Special Tools**.

Replacement

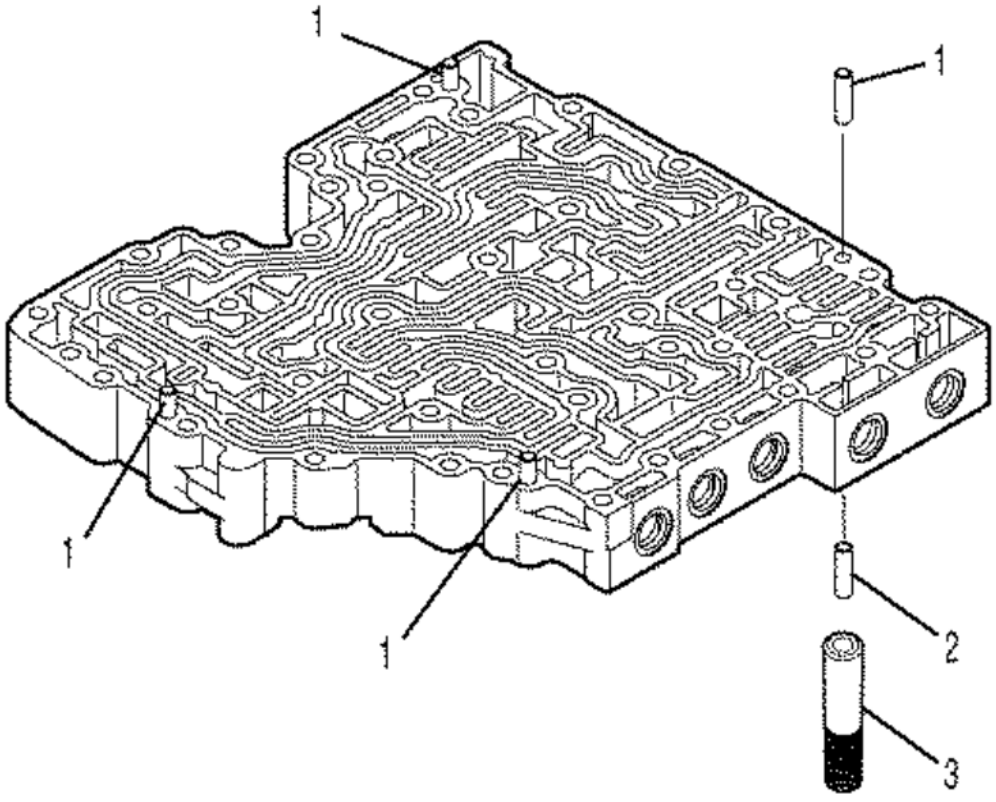


Fig. 425: View Of Main Valve Body Locating Pins
Courtesy of GENERAL MOTORS CORP.

NOTE: DO NOT mar the main valve body surface when installing the locating pin(s). Tap gently on the locating pin installer tool. Heavy or continued hammering will damage the transmission case surface.

IMPORTANT: The main valve body has 5 locating pins that can be replaced. Do not replace a locating pin unless the pin is damaged.

1. Remove the locating pin from the main valve body.
2. Place a new locating pin into **J 43779** (3). See **Special Tools**.

3. Install **J 43779** with the locating pin into the locating pin hole. See **Special Tools**.
4. Gently tap **J 43779** until. See **Special Tools**.**J 43779** touches the main housing surface. See **Special Tools**.

   Specification: The locating pin installed height is 10.7-11.3 mm (0.42-0.44 in) above the main valve body surface.

MAIN VALVE BODY ASSEMBLE

Tools Required

- **J 33163** Valve Tray Set. See **Special Tools**.
- **J 43773** Valve Spring Compressor. See **Special Tools**.

Assemble

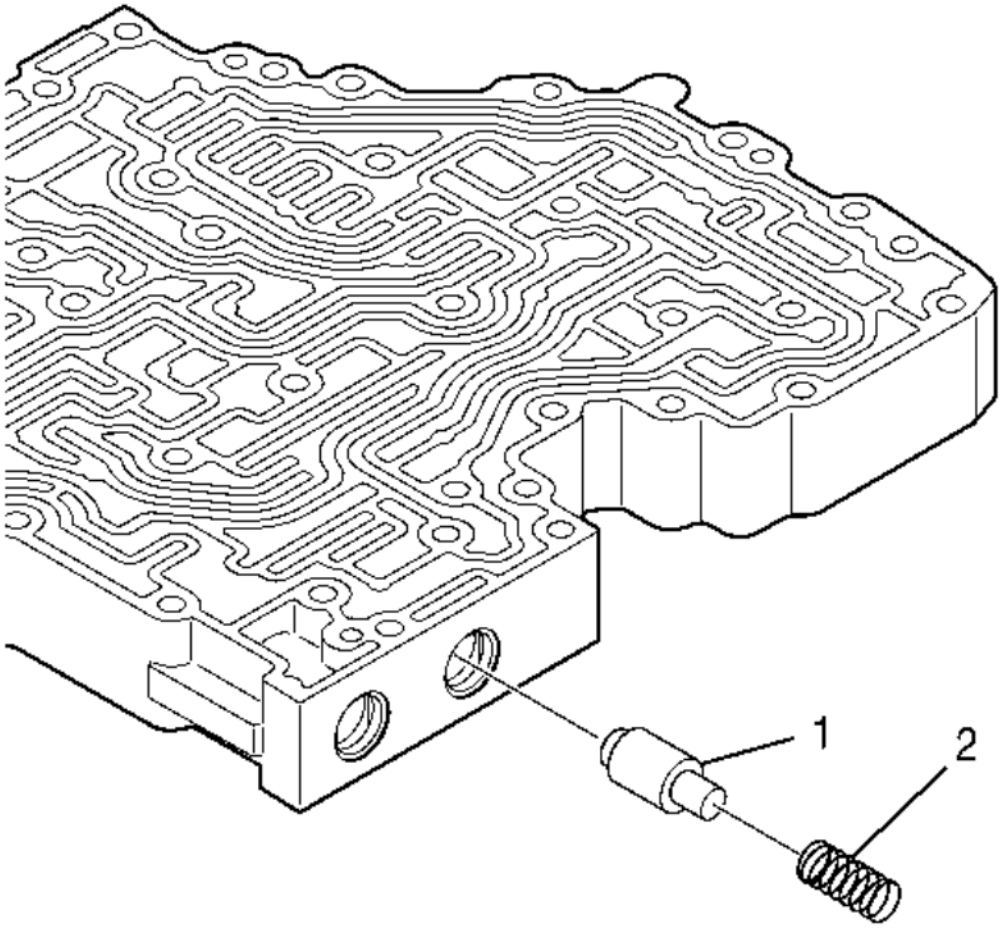


Fig. 426: Locating Exhaust Pressure Regulator Valve & Spring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: To prevent confusing parts during assembly, the removed valves, springs, and stops are stored in J 33163 . See Special Tools.

1. Install the exhaust pressure regulator valve (1) and spring (2).

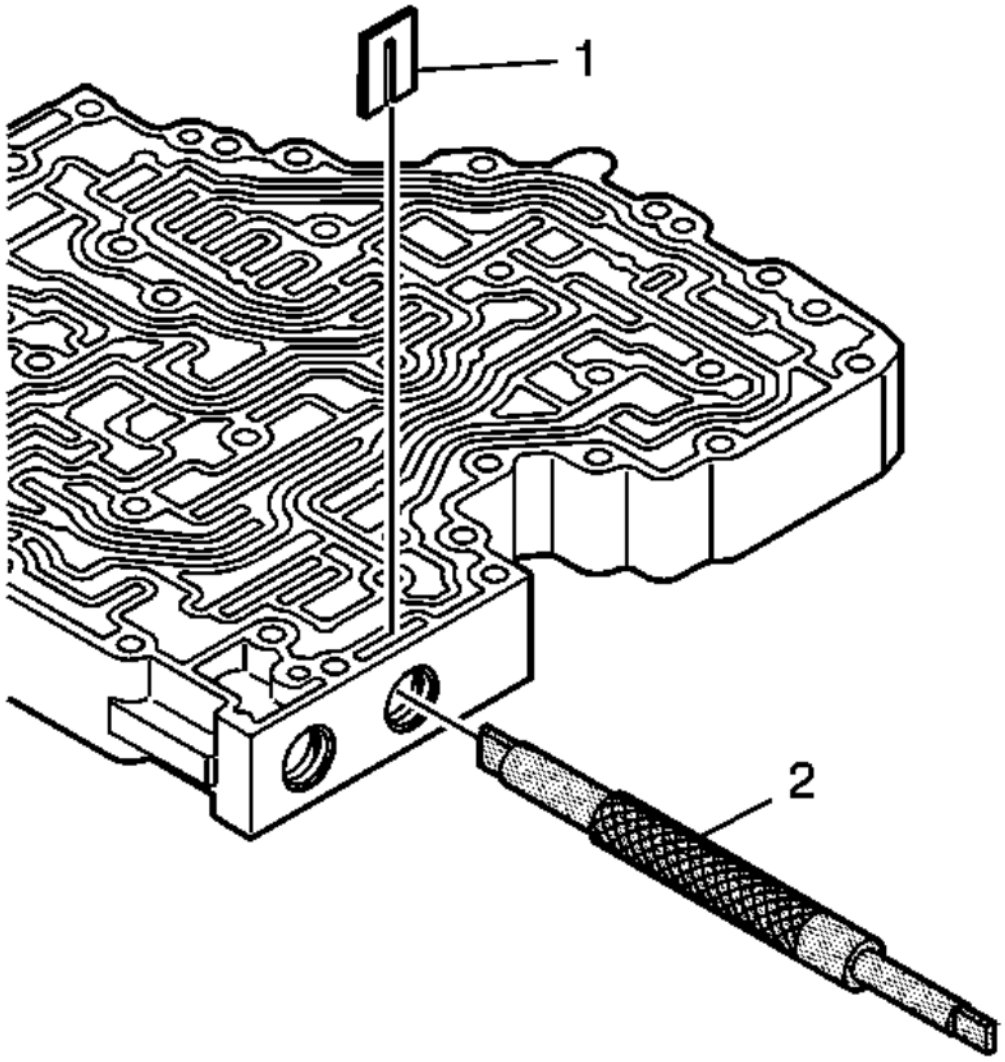


Fig. 427: Compressing Exhaust Pressure Regulator Valve Spring
Courtesy of GENERAL MOTORS CORP.

2. Compress the spring with **J 43773** (2). See **Special Tools**.
3. Install the retaining clip (1).
4. Make sure the retaining clip is below the valve body surface.

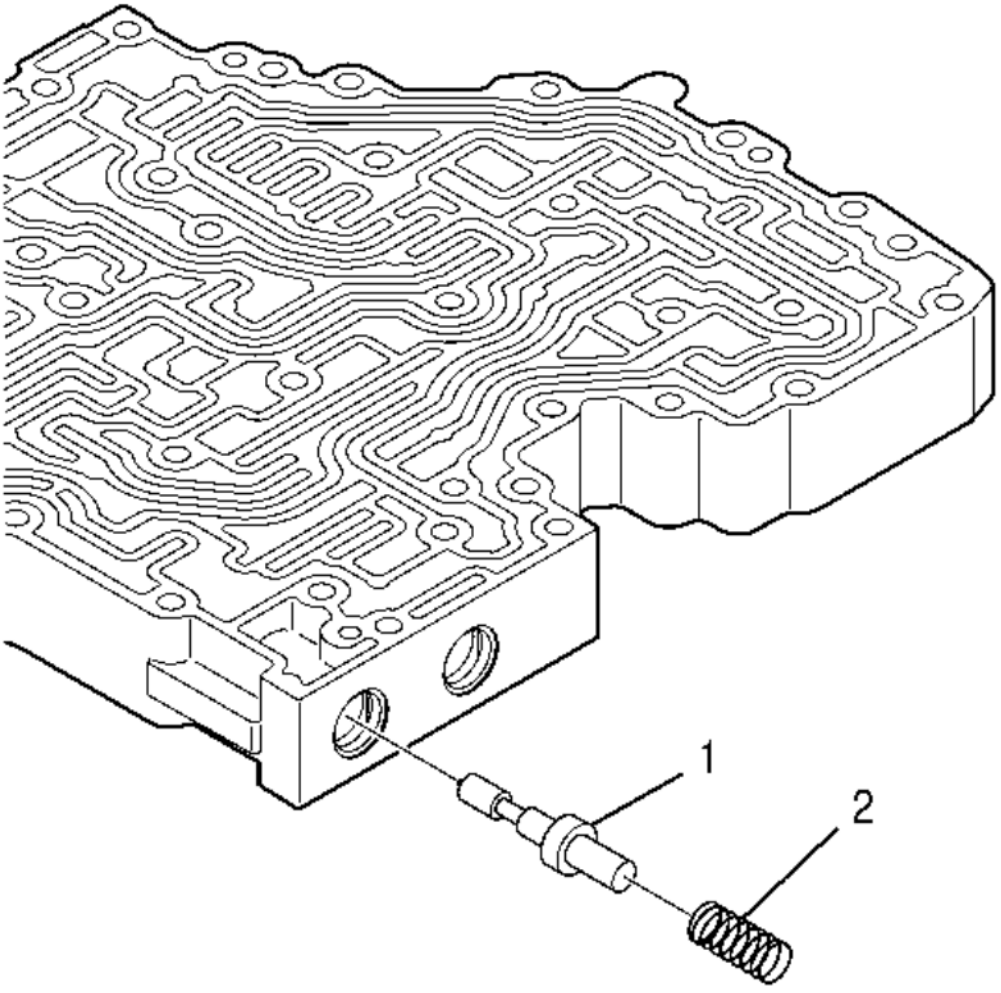


Fig. 428: Identifying Control Relief Spring & Control Relief Valve
Courtesy of GENERAL MOTORS CORP.

5. Install the control relief valve (1) and spring (2).

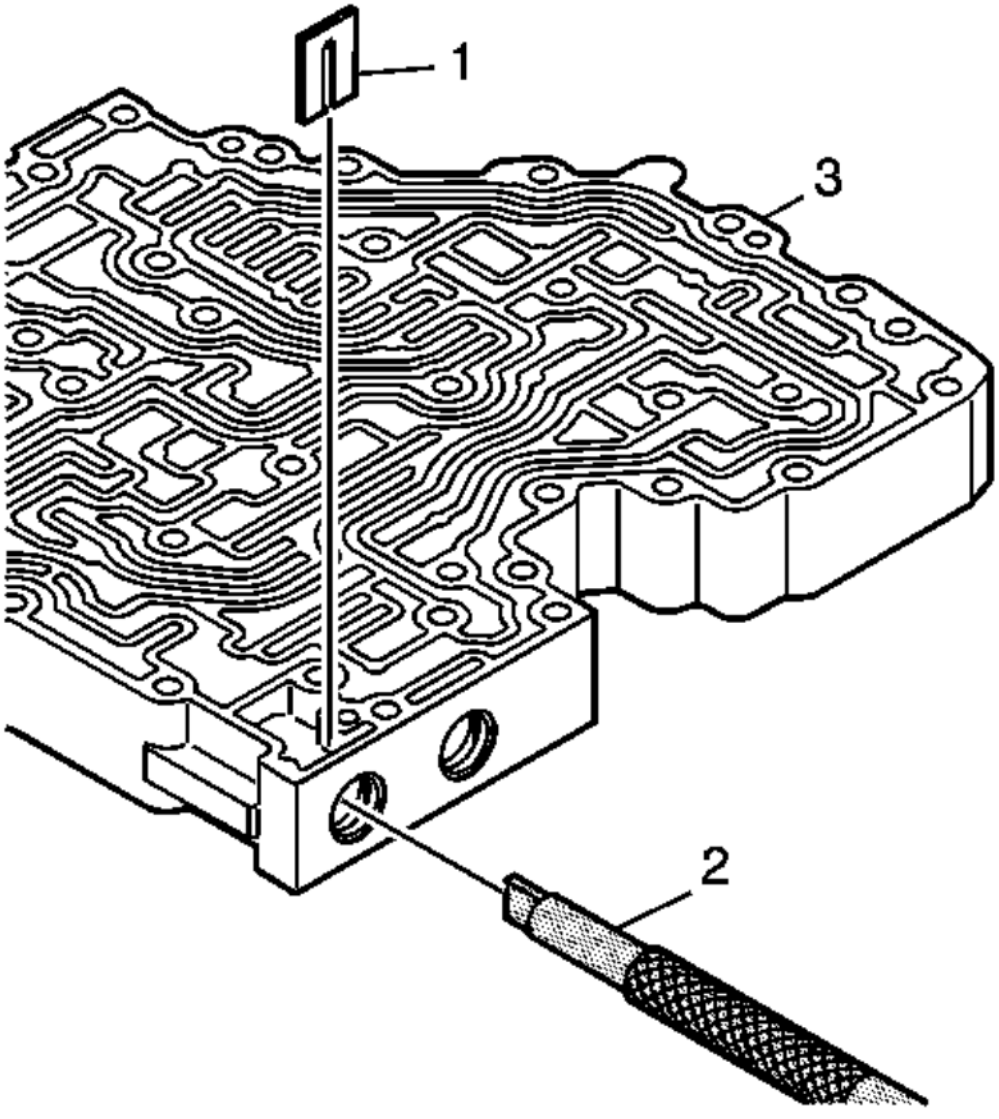


Fig. 429: Compressing Control Relief Valve Spring
Courtesy of GENERAL MOTORS CORP.

6. Compress the spring with **J 43773** (2). See **Special Tools**.
7. Install the retaining clip (1).
8. Make sure the retaining clip is below the valve body surface.

CONTROL VALVE BODY ASSEMBLE

Tools Required

- **J 33163** Valve Tray Set. See **Special Tools**.
- **J 43773** Valve Spring Compressor. See **Special Tools**.

Main Valve Body Assemble

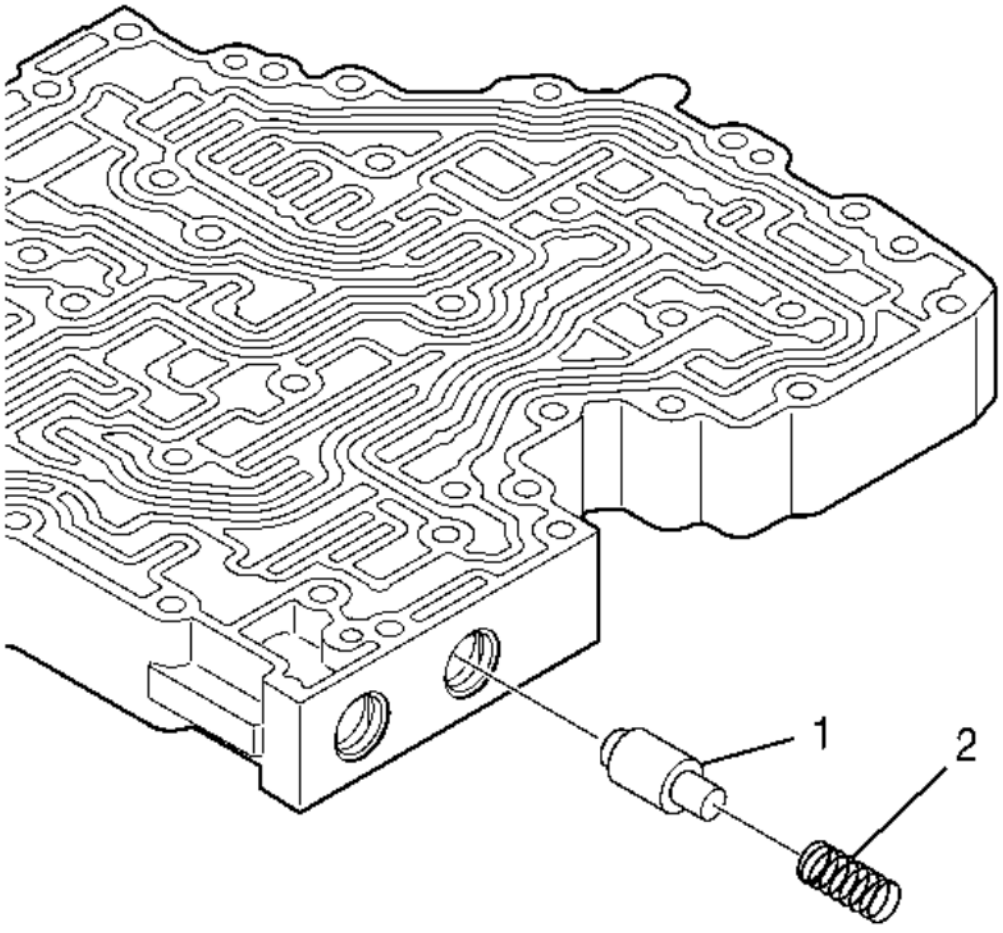


Fig. 430: Locating Exhaust Pressure Regulator Valve & Spring
Courtesy of GENERAL MOTORS CORP.

1. Install the exhaust backfill valve (1) and the spring (2).

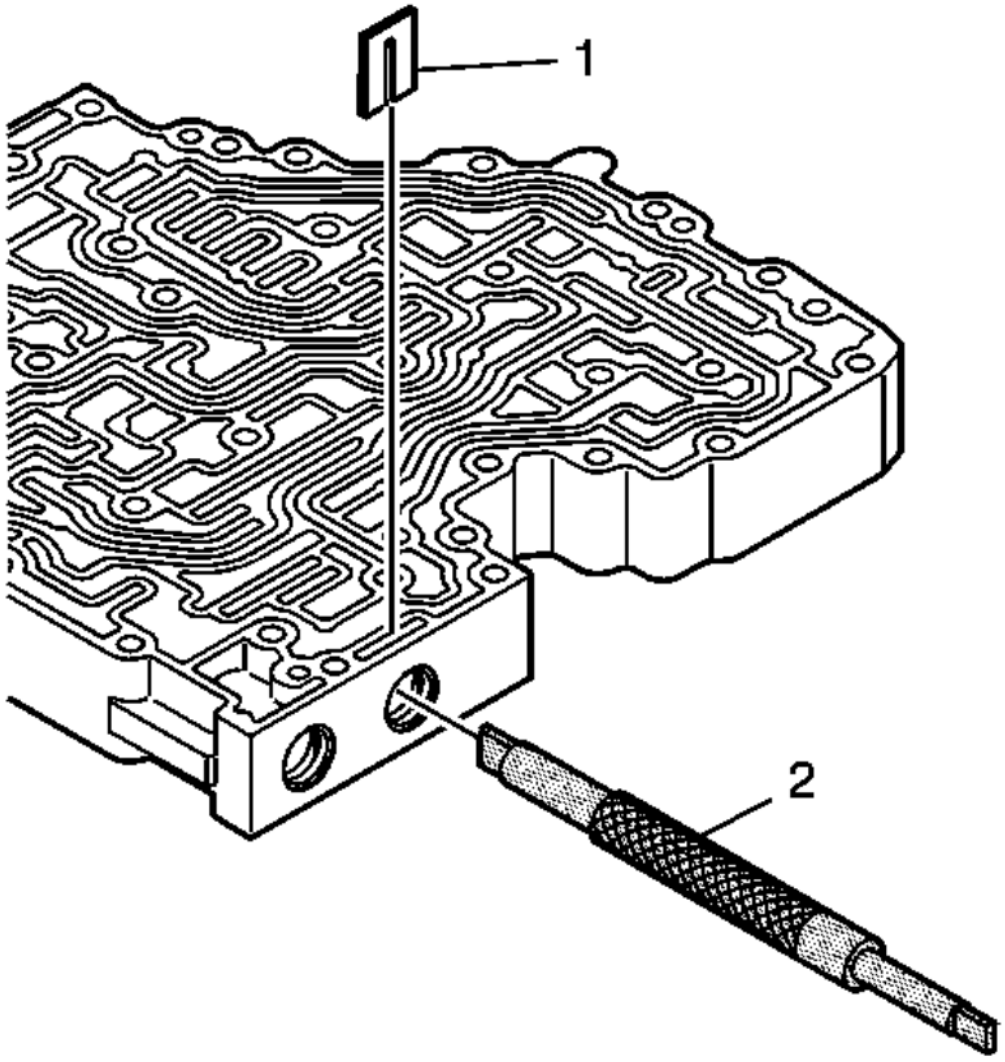


Fig. 431: Compressing Exhaust Pressure Regulator Valve Spring
Courtesy of GENERAL MOTORS CORP.

2. Compress the exhaust backfill spring with **J 43773** (2). See **Special Tools**.
3. Install the retaining clip (1). Ensure the retaining clip (1) is below the valve body surface.

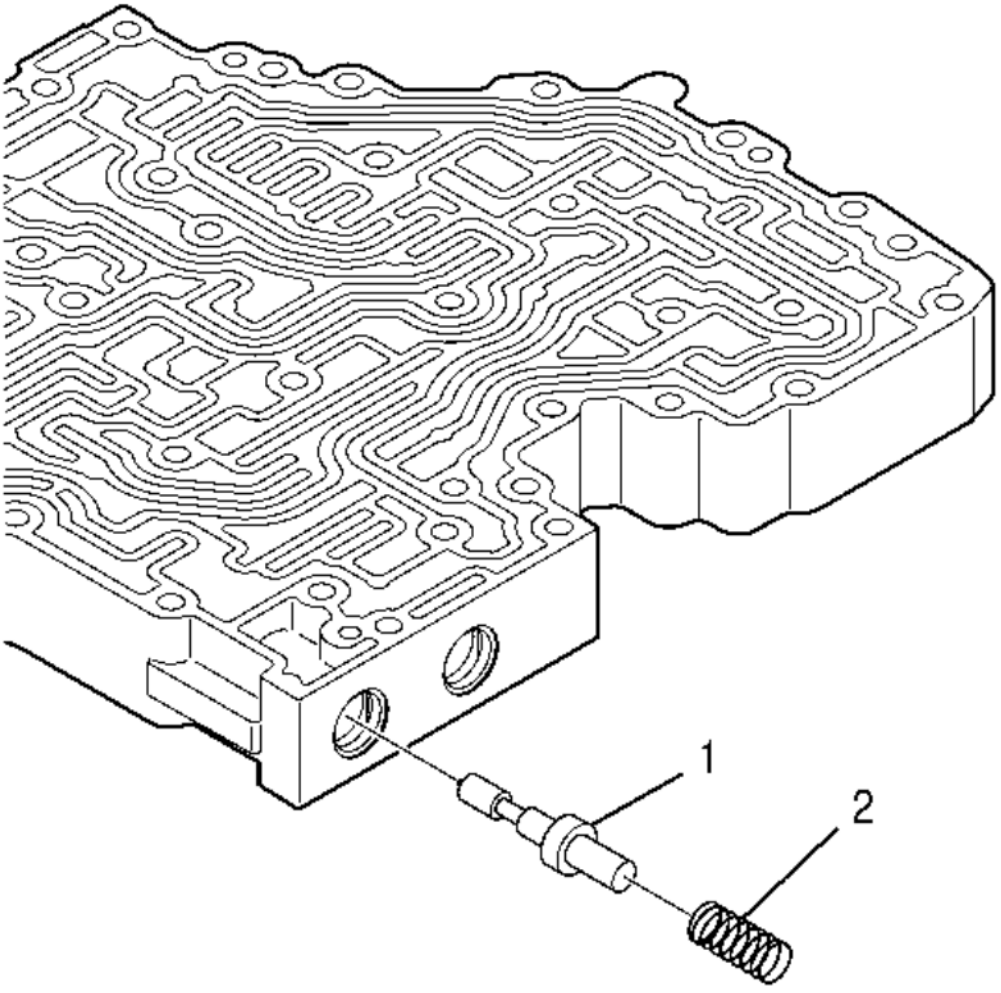


Fig. 432: Identifying Control Relief Spring & Control Relief Valve
Courtesy of GENERAL MOTORS CORP.

4. Install the control relief valve (1) and spring (2).

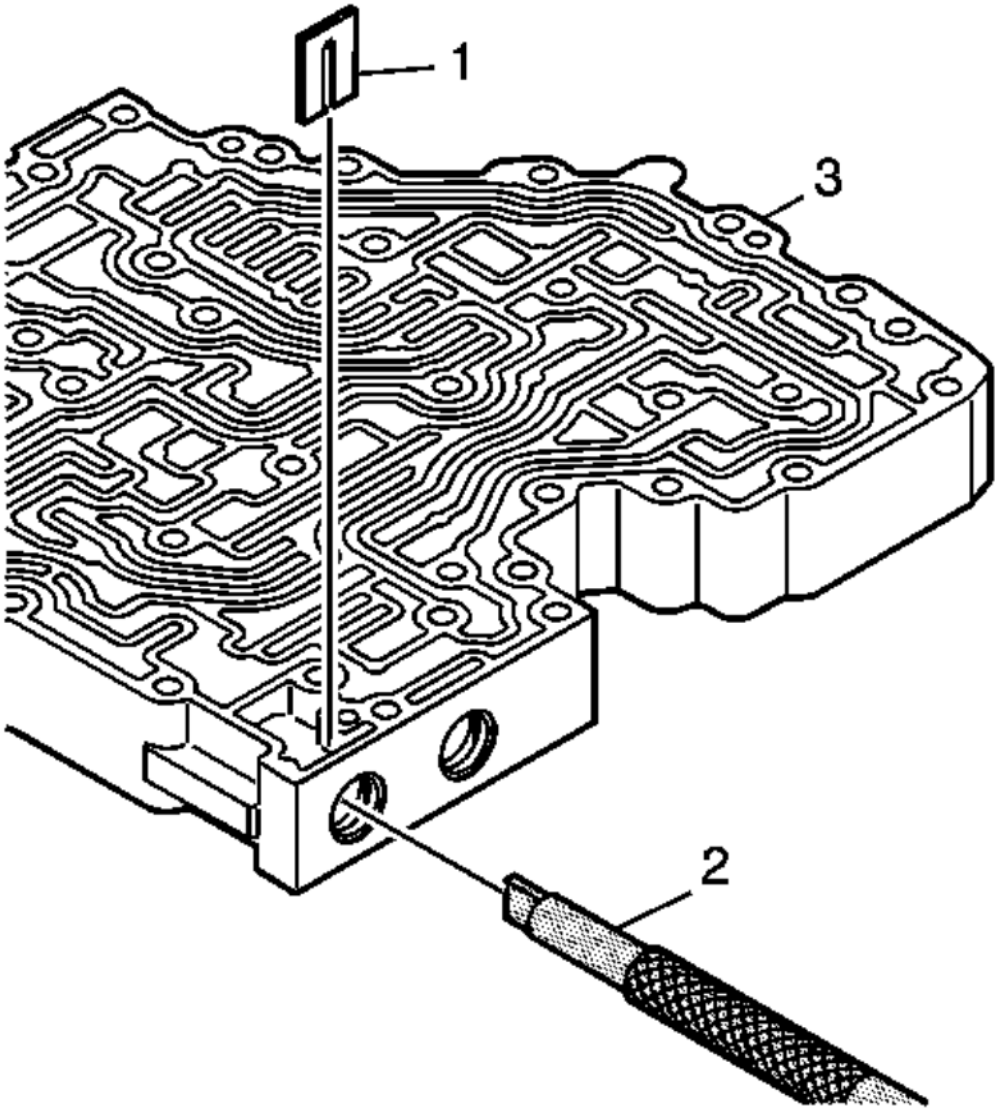


Fig. 433: Compressing Control Relief Valve Spring
Courtesy of GENERAL MOTORS CORP.

5. Compress the control relief spring with **J 43773** (2). See **Special Tools**.
6. Install the retaining clip (1). Ensure the retaining clip (1) is below the valve body surface.

Shift Valve Body Assemble

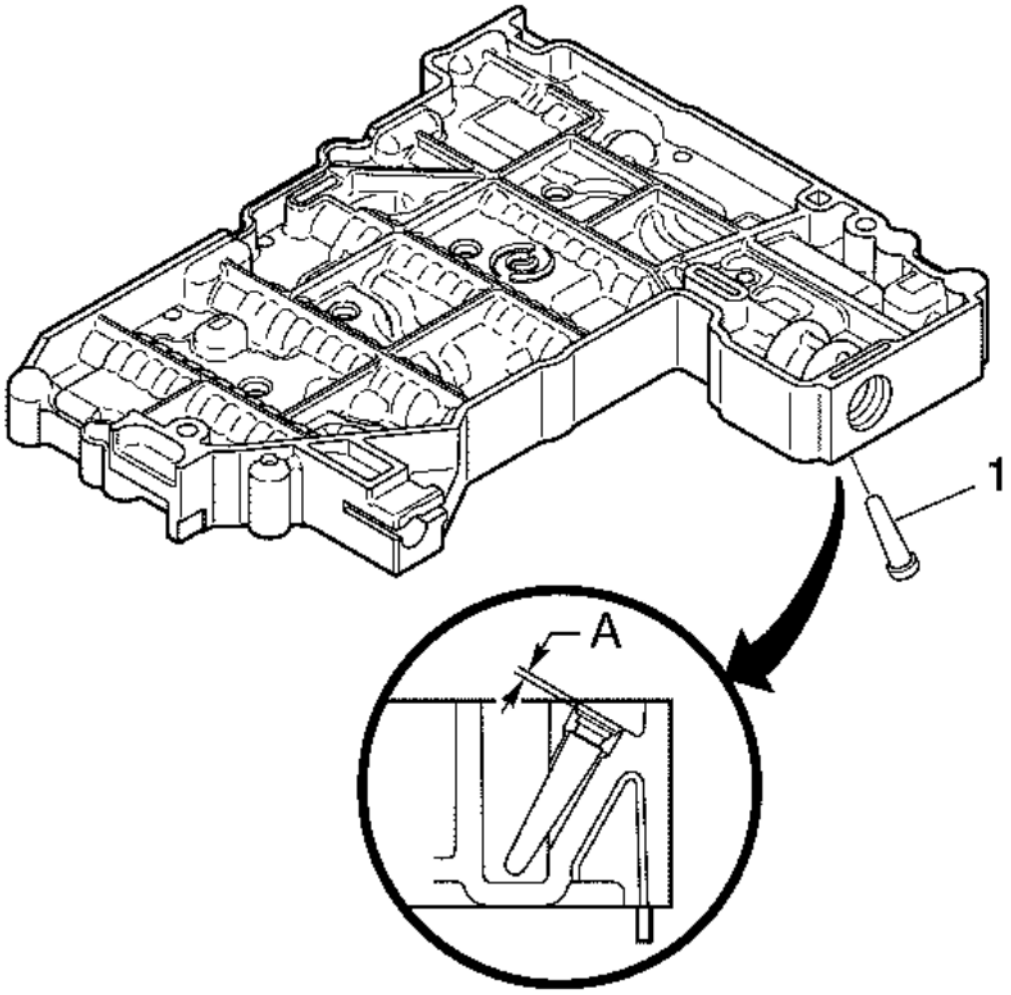


Fig. 434: Shift Solenoid Screen
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Transmission Control Valve Body Overhaul Notice .

1. Install the solenoid screen (1).

Solenoid screen installed depth: Ensure the solenoid screen (1) is installed to a depth of 0.50-1.00 mm (0.20-0.039 in) below the shift valve body surface, as shown in the insert, dimension A.

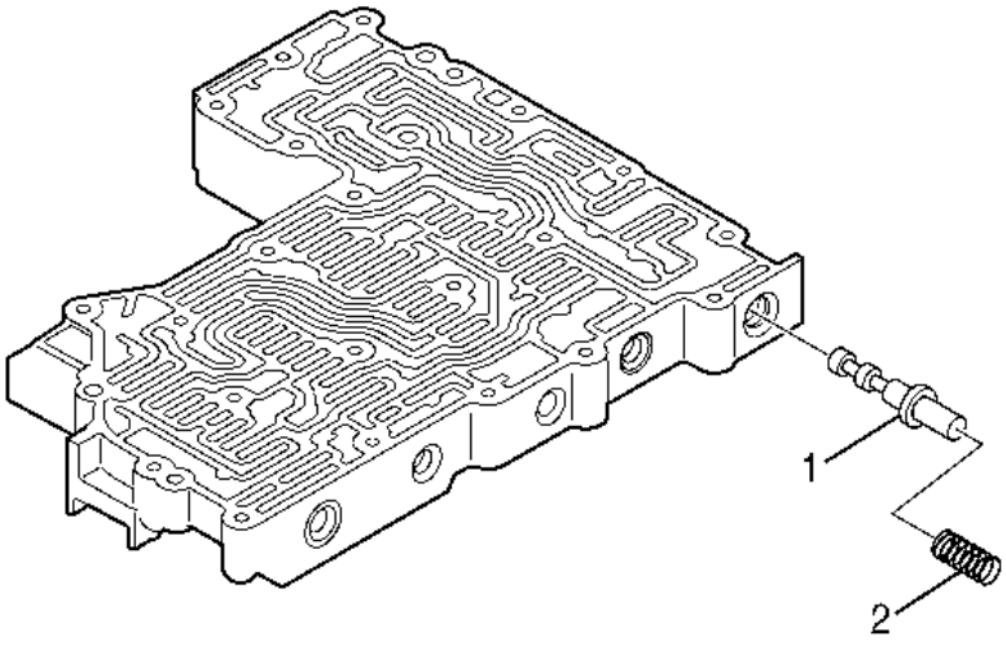


Fig. 435: Spring And Control Main Valve
Courtesy of GENERAL MOTORS CORP.

2. Install control main valve (1) and spring (2).

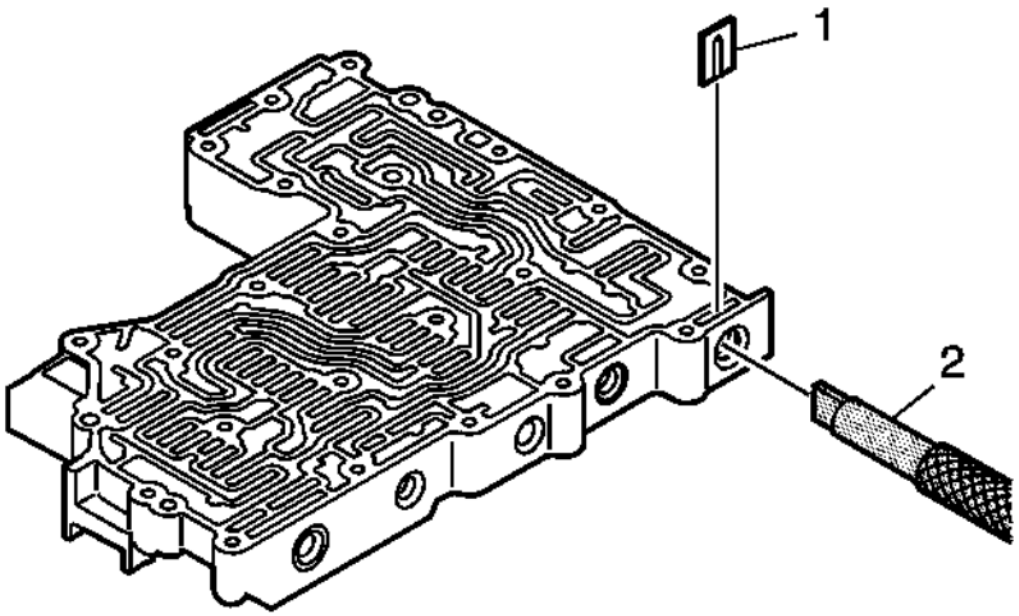


Fig. 436: Compressing Control Main Valve Spring
Courtesy of GENERAL MOTORS CORP.

3. Using **J 43773** (2), compress the valve spring. See **Special Tools**.
4. Install retaining clip (1). Ensure the retaining clip (1) is below the valve body surface.

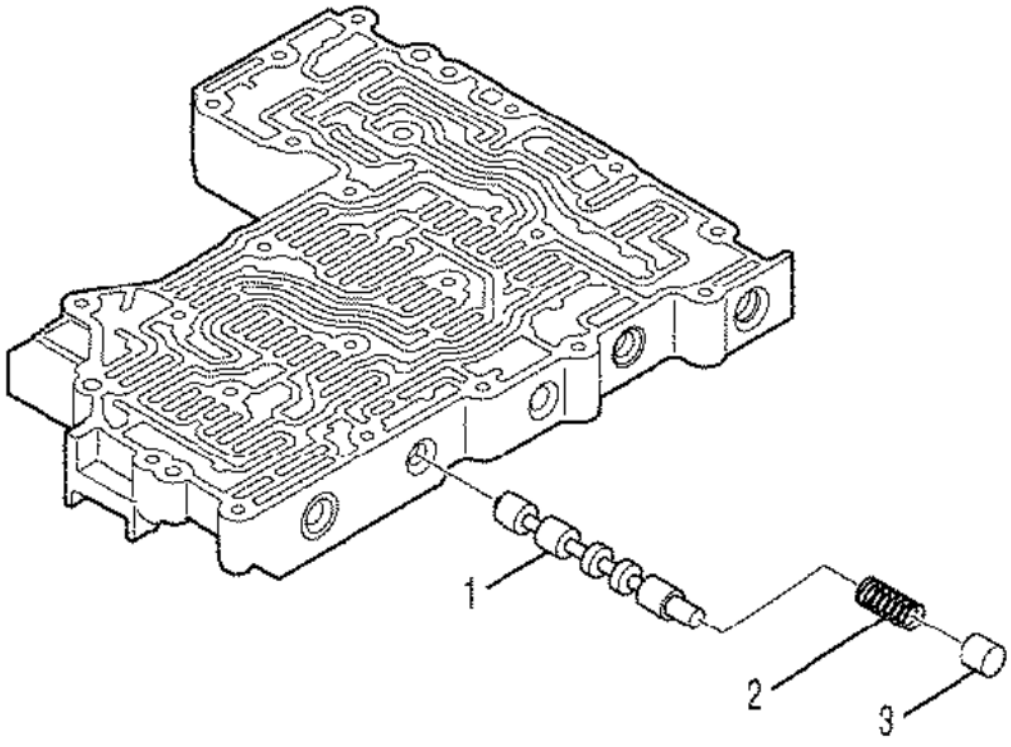


Fig. 437: View Of Plug, Spring, And Shift Valve
Courtesy of GENERAL MOTORS CORP.

5. Install shift valve 2 (1), spring (2), and plug (3).

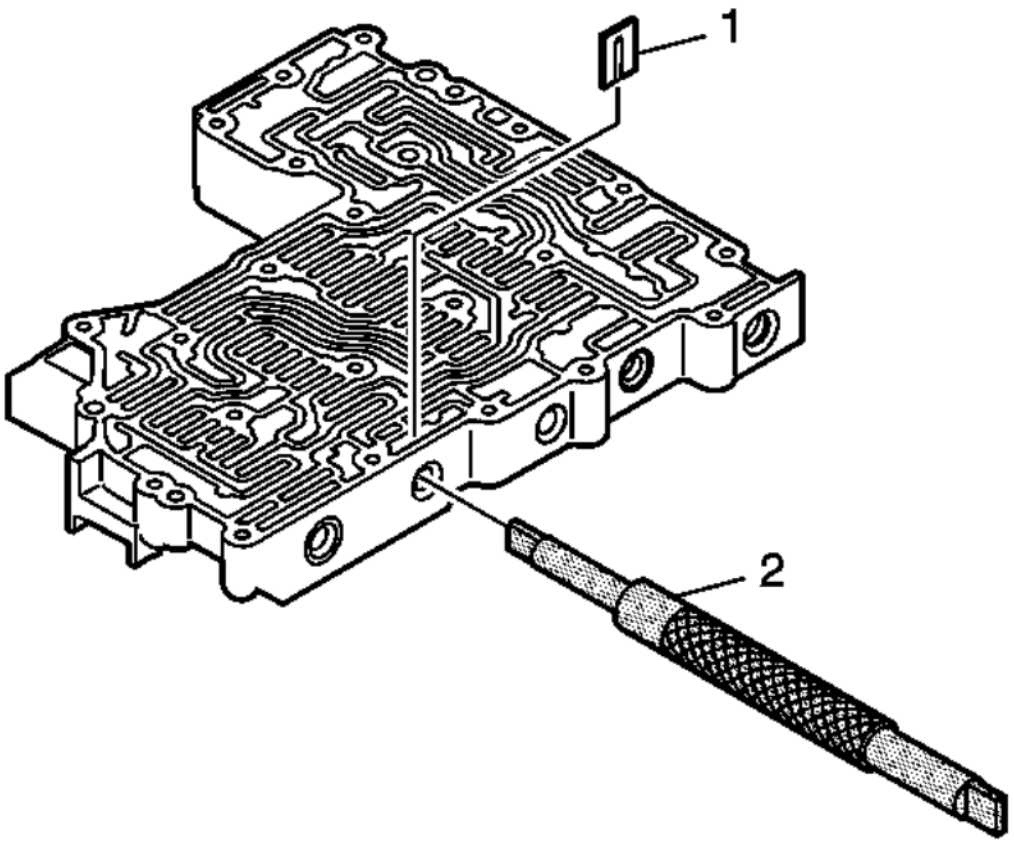


Fig. 438: Compressing Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

6. Using **J 43773** (2), compress the valve spring. See **Special Tools**.
7. Install retaining clip (1). Ensure the retaining clip is below the valve body surface.

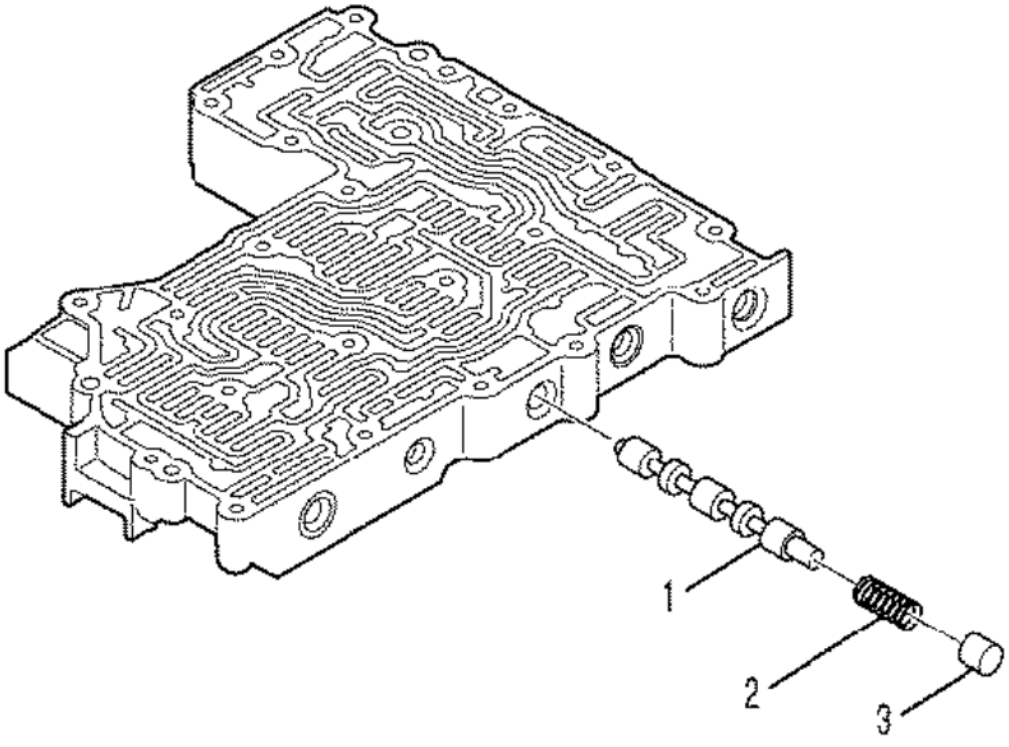


Fig. 439: View Of Plug, Spring, And Shift Valve
Courtesy of GENERAL MOTORS CORP.

8. Install shift valve 3 (1), spring (2), and plug (3).

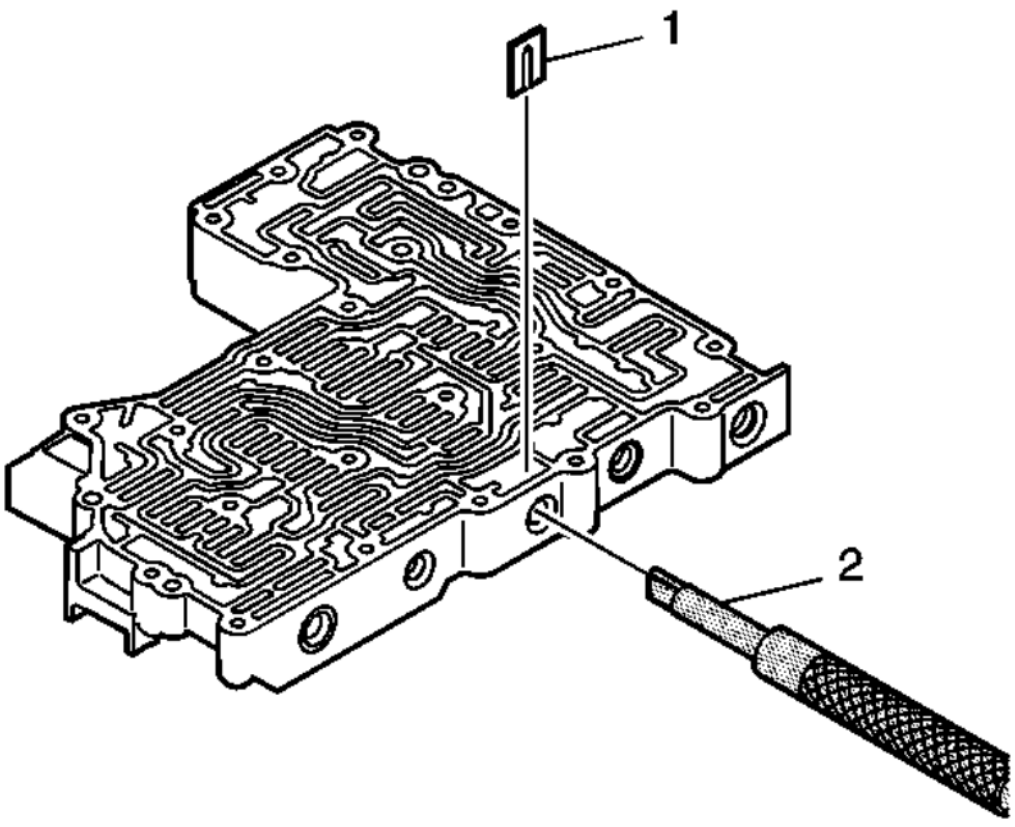


Fig. 440: Compressing Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

9. Using **J 43773** (2), compress the valve spring. See **Special Tools**.
10. Install retaining clip (1). Make sure the retaining clip is below the valve body surface.

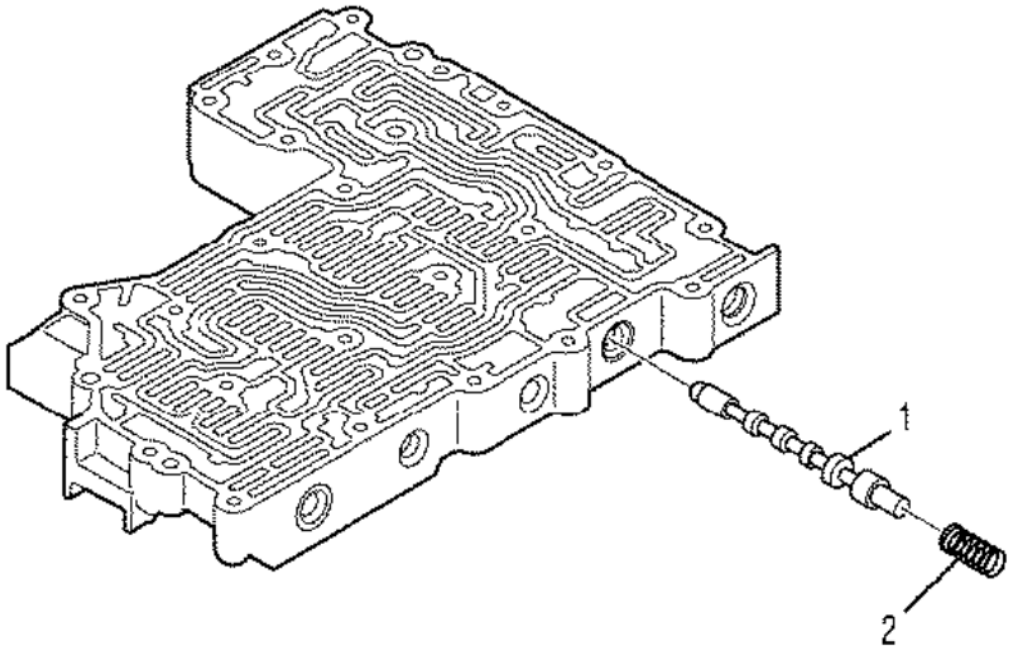


Fig. 441: Spring And Shift Valve
Courtesy of GENERAL MOTORS CORP.

11. Install shift valve 1 (1), spring (2), and plug.

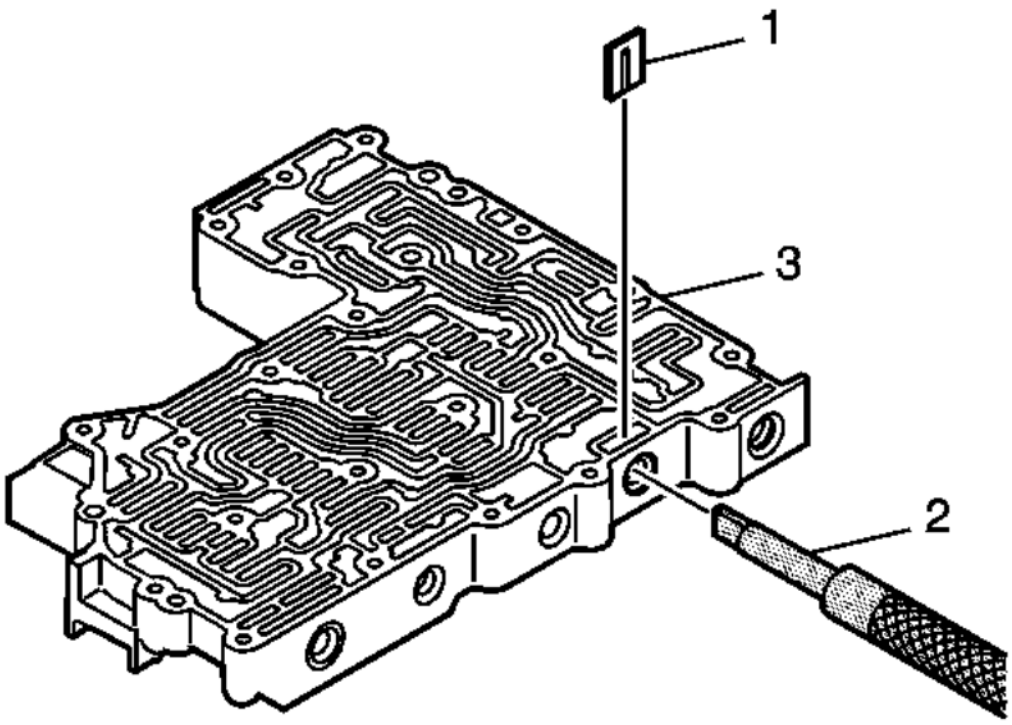


Fig. 442: Compressing Shift Solenoid Shift Valve Spring
Courtesy of GENERAL MOTORS CORP.

12. Using **J 43773** (2), compress the valve spring. See **Special Tools**.
13. Install retaining clip (1). Ensure the retaining clip is below the valve body surface.

Control Valve Body Assembly

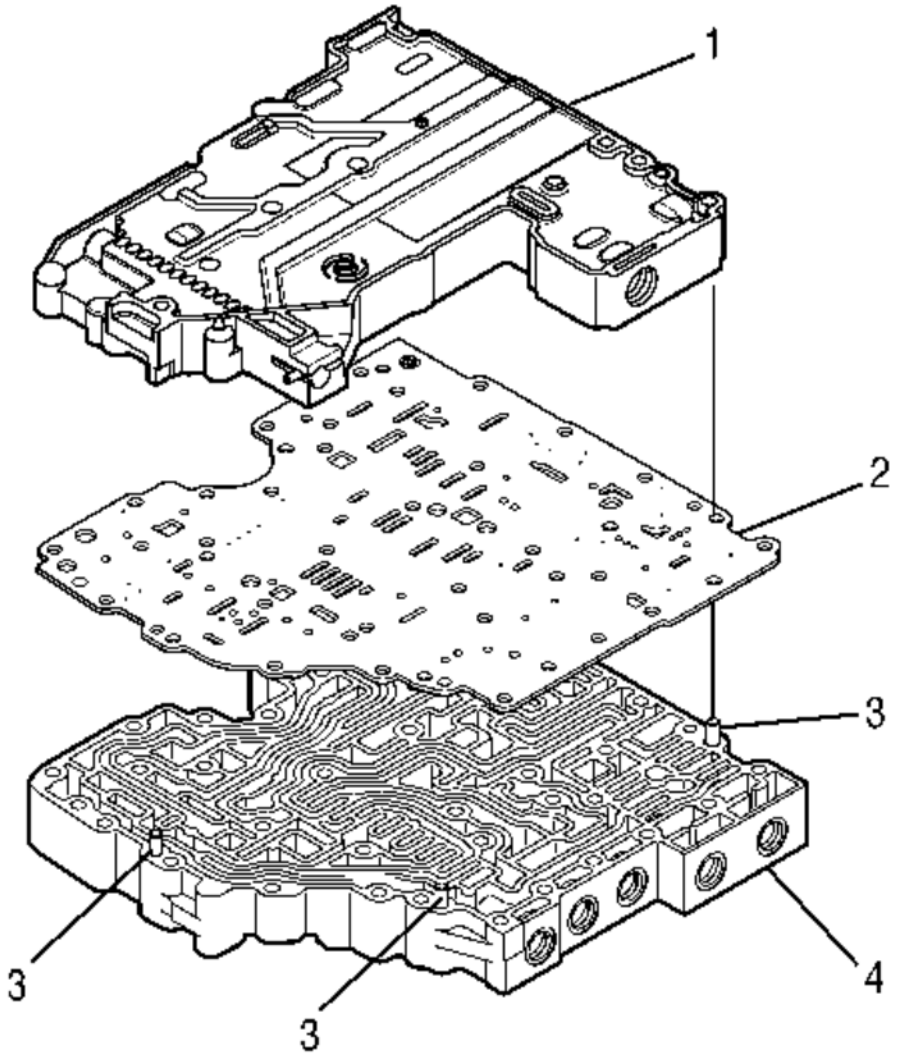


Fig. 443: Separating Shift Valve Body Assembly, Separator Plate, And Main Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

1. Position main valve body assembly (4) on the work table so that the worm-track side is up.
2. Align separator plate (2) with main valve body locating pins (3).
3. Install separator plate (2).

4. Align shift valve body assembly (1) with main valve body locating pins (3).
5. Install the shift valve body assembly onto the separator plate.

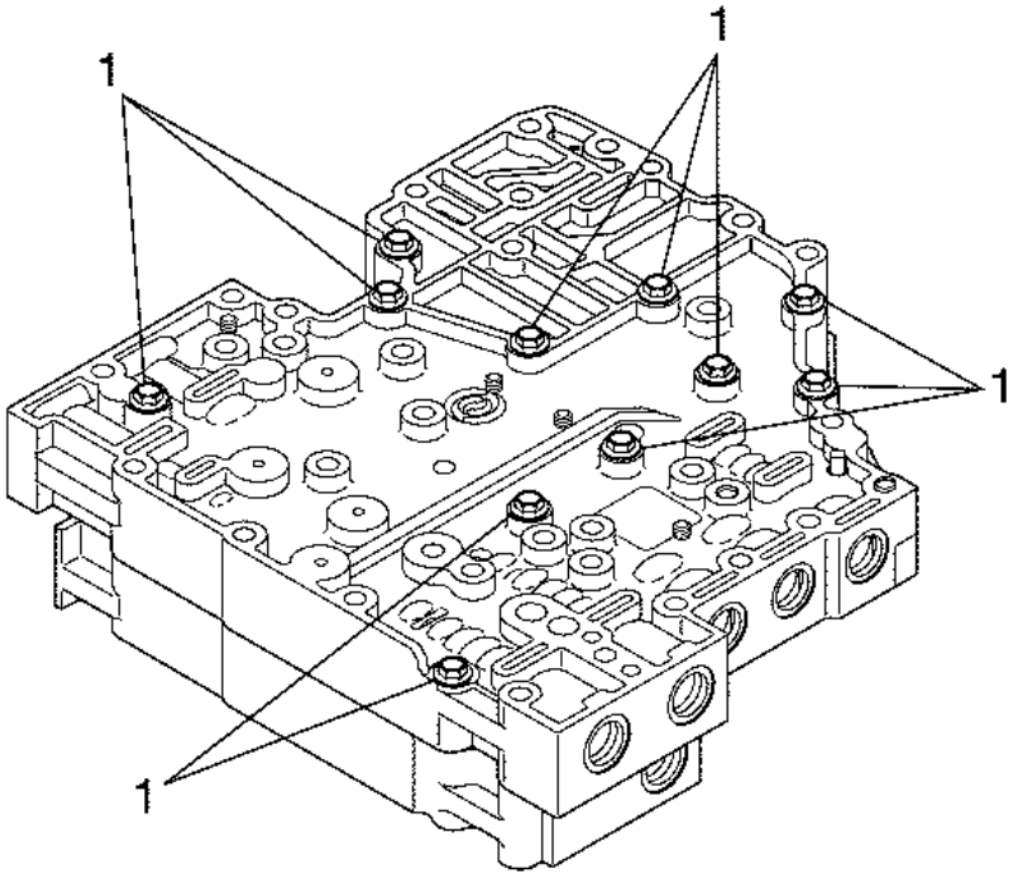


Fig. 444: Shift Valve Body Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

6. Position the control valve assembly on the work table so that the main valve body is facing up.

NOTE: Refer to Fastener Notice .

7. Install 11 bolts (1) retaining the valve bodies together.

Tighten: Tighten the bolts to 12 N.m (108 lb in).

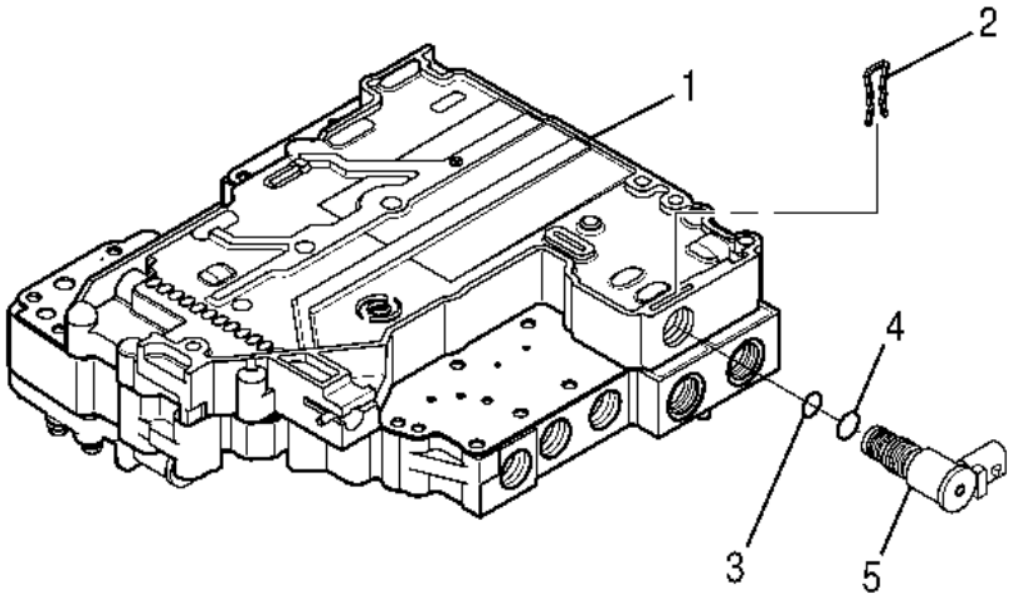


Fig. 445: Locating Shift Solenoid
Courtesy of GENERAL MOTORS CORP.

8. Position the control valve assembly on the work table so that the shift valve body is up.

IMPORTANT:
- **O-ring (4) is slightly larger than O-ring (3).**
- **P/N 29536833 is printed on the shift solenoid 1 (SS1) (5).**

9. Install the solenoid O-ring (4) onto the SS1 (5).
10. Install the solenoid O-ring (3) onto the SS1 (5).
11. Align the SS1 (5) so that the electrical connector points away from the nearest locating pin and is parallel to the separator plate as shown.
12. Install the solenoid retainer (2).

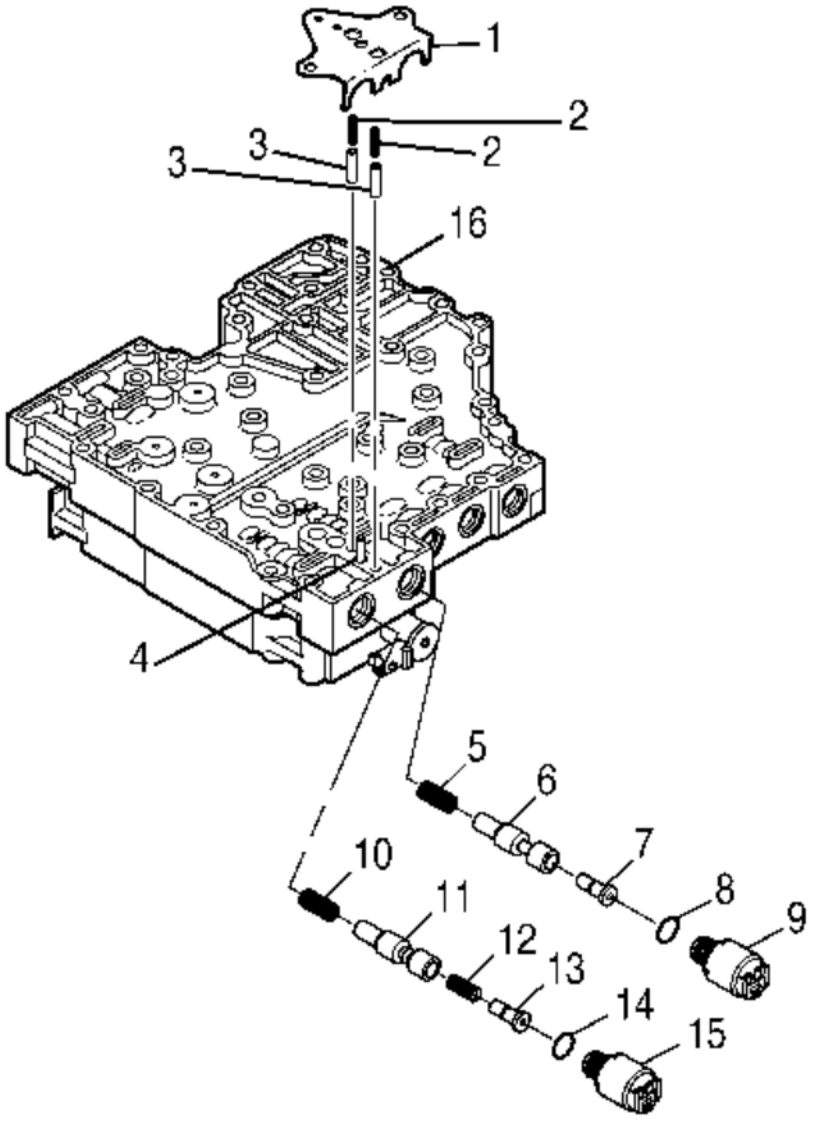


Fig. 446: Identifying Pressure Control Solenoids
Courtesy of GENERAL MOTORS CORP.

13. Position the control valve assembly on the work table so that main valve body (16) is facing up.

IMPORTANT: P/N 29541895 is printed on the pressure control solenoid 1 (PCS1).

14. Install the solenoid O-ring (14) onto the PCS1 (15).

IMPORTANT: P/N 29541896 is printed on the pressure control solenoid 2 (PCS2).

15. Install the solenoid O-ring (8) onto the PCS2 (9).
16. Install the spring (10), PCS1 trim valve (11), spring (12), and trim gain valve (13).
17. Install the spring (5), PCS2 trim valve (6) and trim gain valve (7).
18. Install PCS1 (15) so that the electrical connection faces up. Do not seat the solenoid.
19. Install PCS2 (9) so the electrical connection faces up. Do not seat the solenoid.
20. Align 2 accumulator plugs (3) so that the spring bores face up.
21. Install 2 accumulator plugs (3) and 2 accumulator springs (2).
22. Push PCS1 and PCS2 into the bores until the solenoids seat.
23. Align the PCS retaining bracket (1) with main valve body locating pin (4).
24. Install the PCS retaining bracket (1) so that PCS1 and PCS2, the accumulator plugs, and the accumulator springs are retained against the valve body.

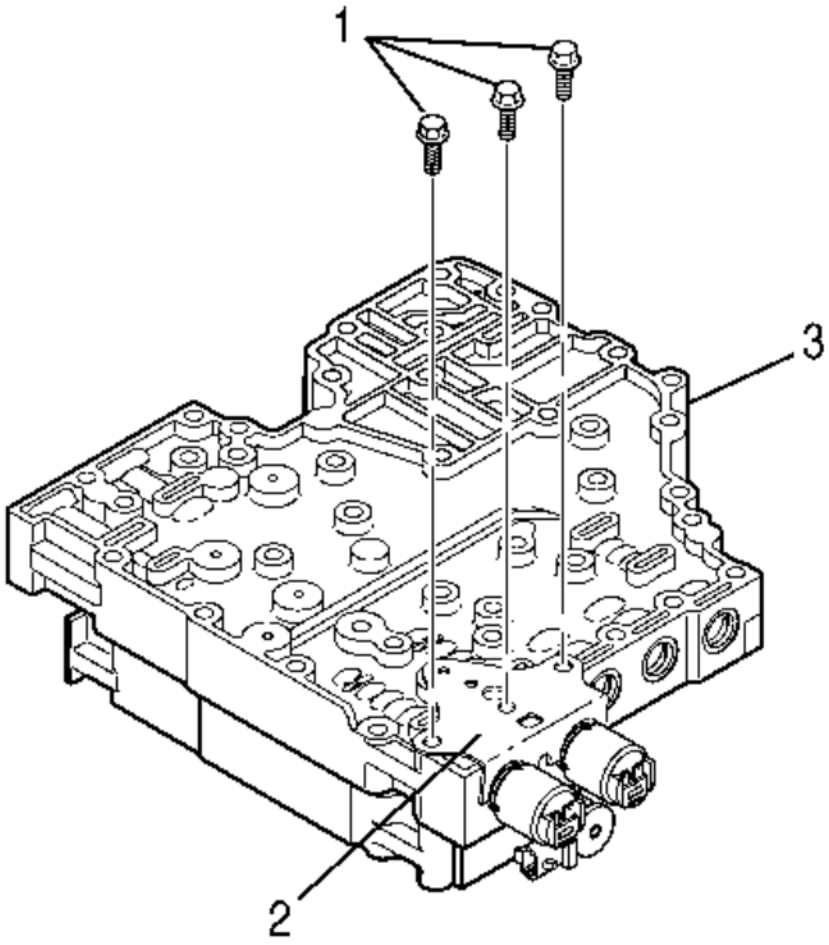


Fig. 447: View Of Pressure Control Valve Retaining Bracket Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

25. Install 3 bolts (1) retaining the PCS retaining bracket (2).

    Tighten: Tighten bolts (1) to 12 N.m (108 lb in).

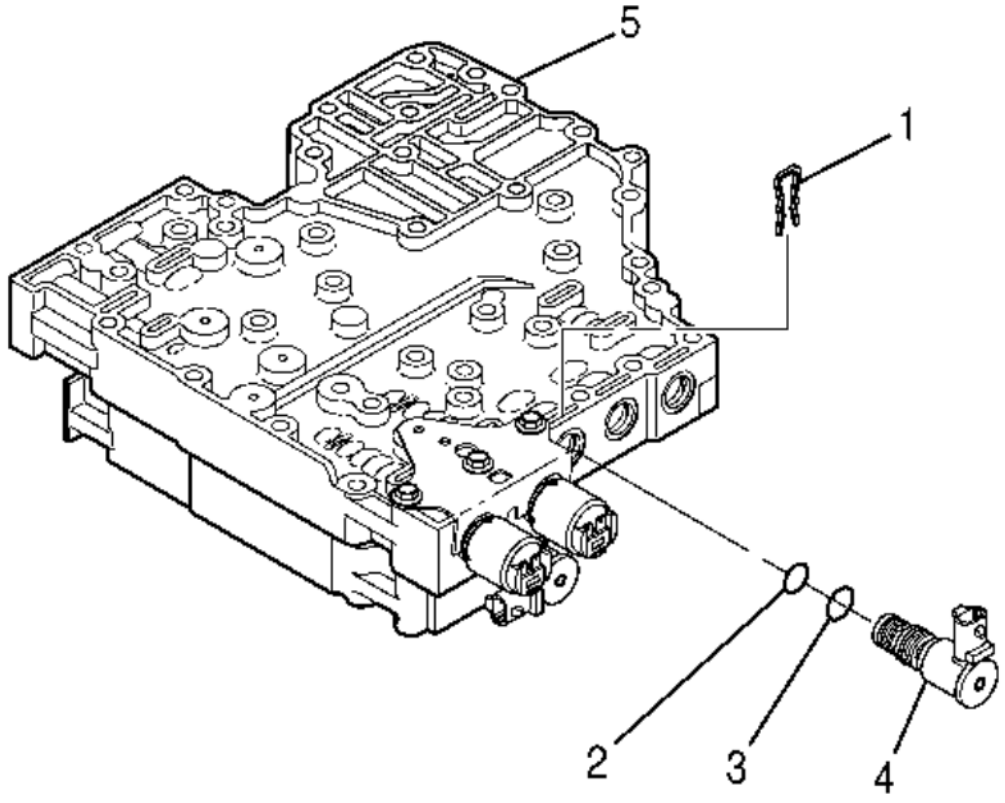


Fig. 448: Identifying Shift Solenoid Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **The solenoid O-rings are blue and white.**
- **O-ring (3) is slightly larger than O-ring (2).**
- **P/N 29536833 is printed on the shift solenoid 3 (SS3).**

26. Install the solenoid O-ring (3) onto the SS3 (4).
27. Install the solenoid O-ring (2) onto the SS3 (4).
28. Install the SS3 (4) so that the electrical connection faces up. seat the solenoid.
29. Install the solenoid retainer (1).

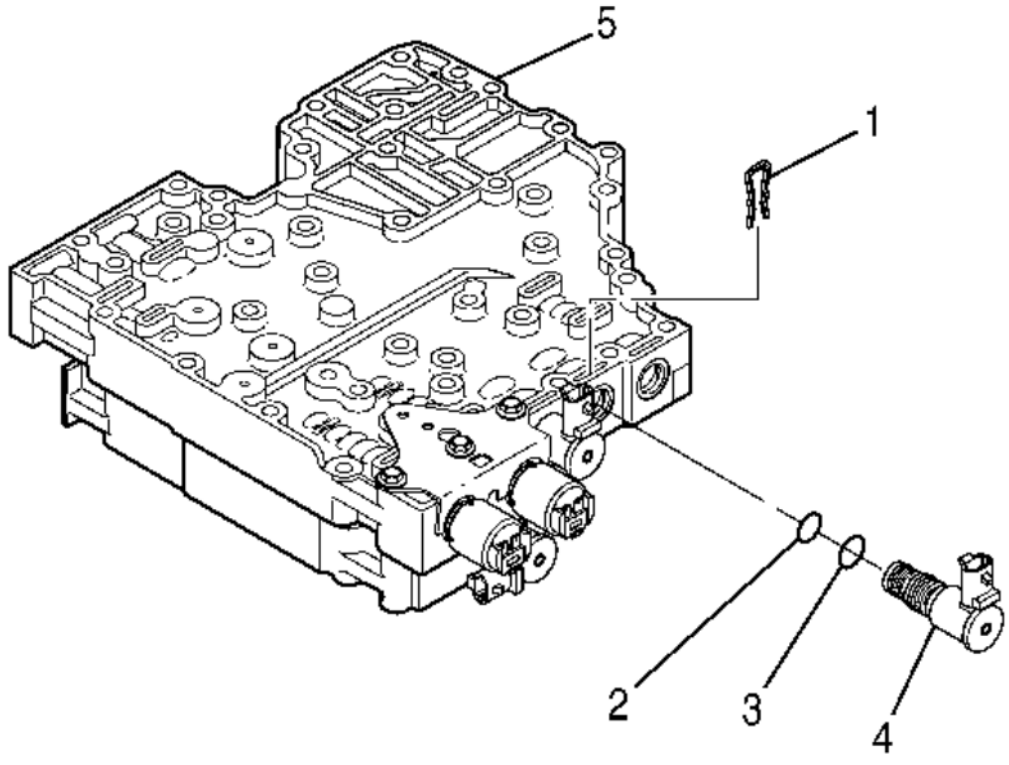


Fig. 449: Shift Solenoid Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **The solenoid O-rings are blue and white.**
- **O-ring (3) is slightly larger than O-ring (2).**
- **P/N 29536833 is printed on shift solenoid 2 (SS2).**

30. Install the solenoid O-ring (3) onto the SS2 (4).
31. Install the solenoid O-ring (2) onto the SS2 (4).
32. Install the SS2 (4) so that the electrical connection faces up. seat the solenoid.
33. Install the solenoid retainer (1).

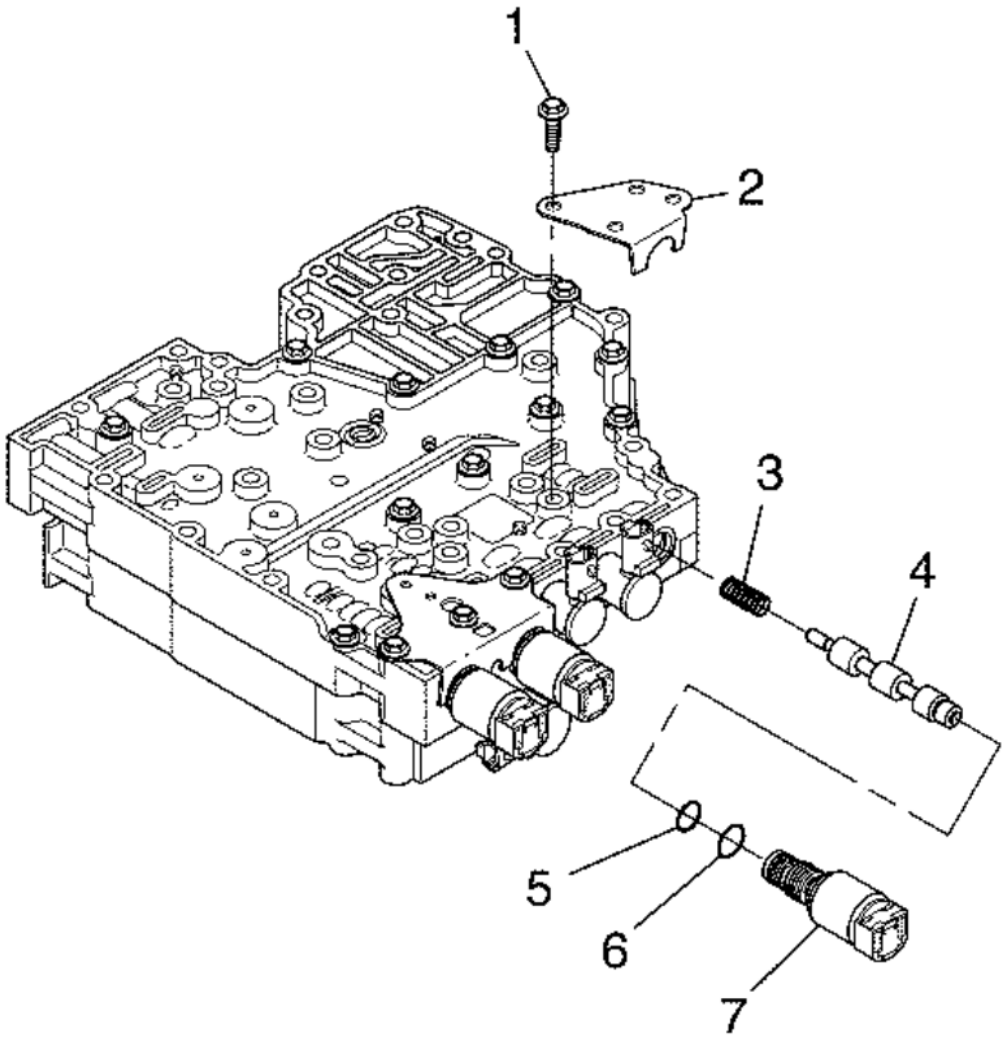


Fig. 450: TCC PCS And Components
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **P/N 29541898 is printed on the torque converter clutch pressure control solenoid (TCC PCS).**
- **The solenoid O-rings are green.**
- **O-ring (6) is slightly larger than O-ring (5).**

34. Install the solenoid O-ring (6) onto the TCC PCS (7).
35. Install the solenoid O-ring (5) onto the TCC PCS (7).
36. Install the TCC PCS spring (3).
37. Install the TCC PCS valve (4)
38. Align the TCC PCS (7) so that the electrical connection faces up.
39. Install the TCC PCS. Seat the solenoid.
40. Align the PCS retaining bracket (2) with the main valve body locating pin.
41. Install the PCS retaining bracket (2) so that the TCC PCS is against the valve body.
42. Install the bolt (1) retaining the PCS retaining bracket (2).

Tighten: Tighten the bolt to 12 N.m (108 lb in).

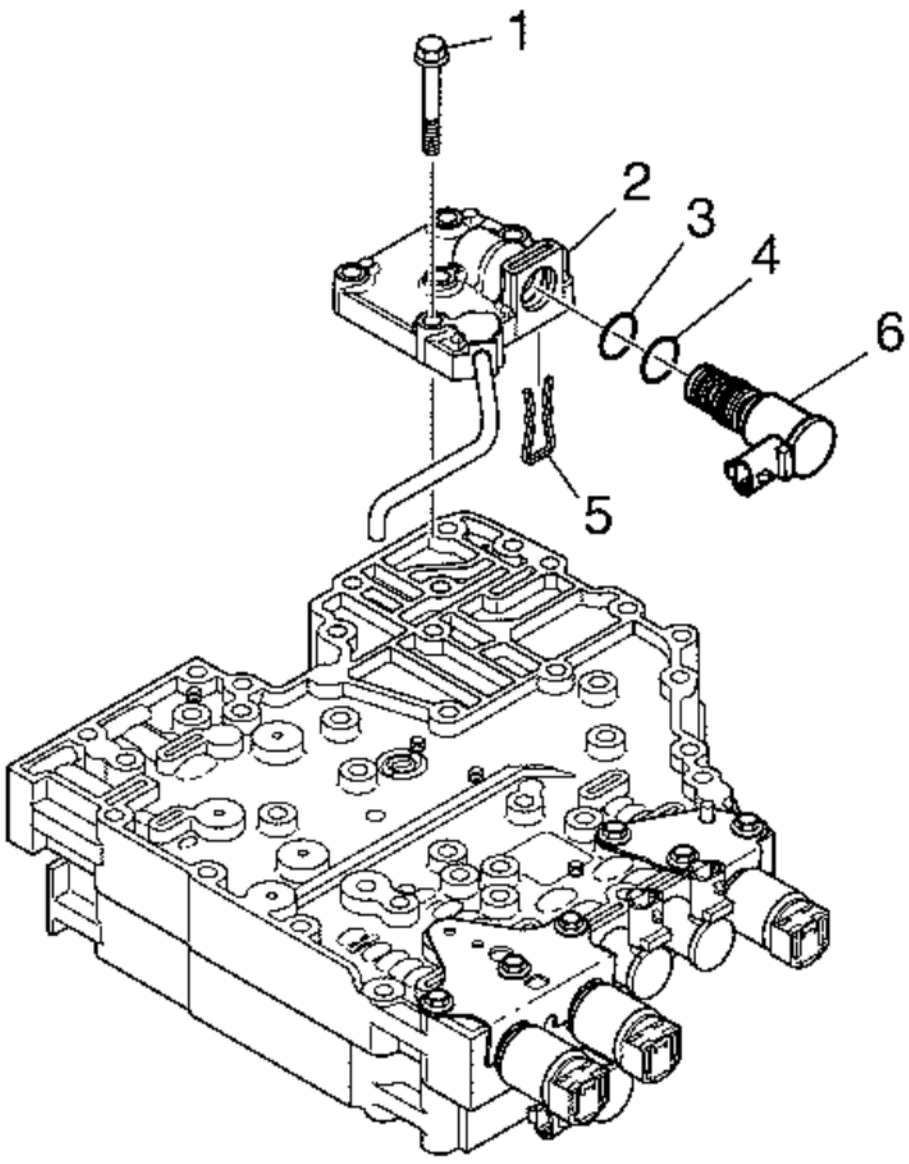


Fig. 451: Main Mod Solenoid And Body Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **The solenoid O-rings are blue and white.**
- **O-ring (3) is slightly larger than O-ring (2)**

- **P/N 29536833 is printed on the modulated main pressure (MAIN MOD) solenoid.**

43. Install the O-rings (3 and 4) onto the MAIN MOD solenoid (6).
44. Install the MAIN MOD solenoid (6).
45. Install the MAIN MOD solenoid retainer (5) into the bottom of the valve body.
46. Install the MAIN MOD solenoid body assembly (2).

IMPORTANT: Four bolts pass through the MAIN MOD solenoid valve body to retain the control valve body assembly to the transmission case. Install these bolts when installing the control valve body assembly.

47. Install the 2 bolts (1) retaining the MAIN MOD solenoid valve body and the shift valve body to the main valve body.

    Tighten: Tighten bolts to 12 N.m (108 lb in).

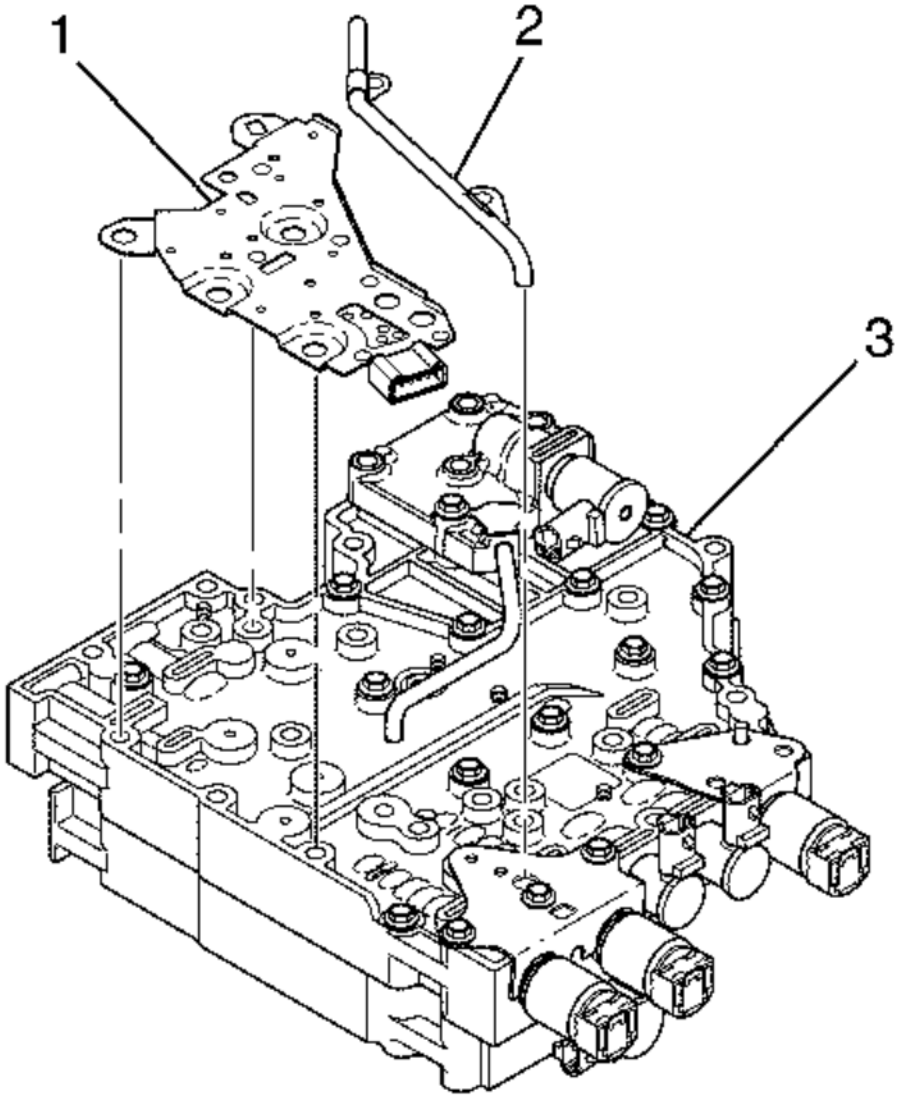


Fig. 452: TFP Switch And Reverse Signal Pipe
Courtesy of GENERAL MOTORS CORP.

48. Align the bolts holes and alignment tabs of the transmission fluid pressure (TFP) switch (1) with the TFP switch holes in main valve body (3).
49. Install TFP switch (1) onto main valve body (3).

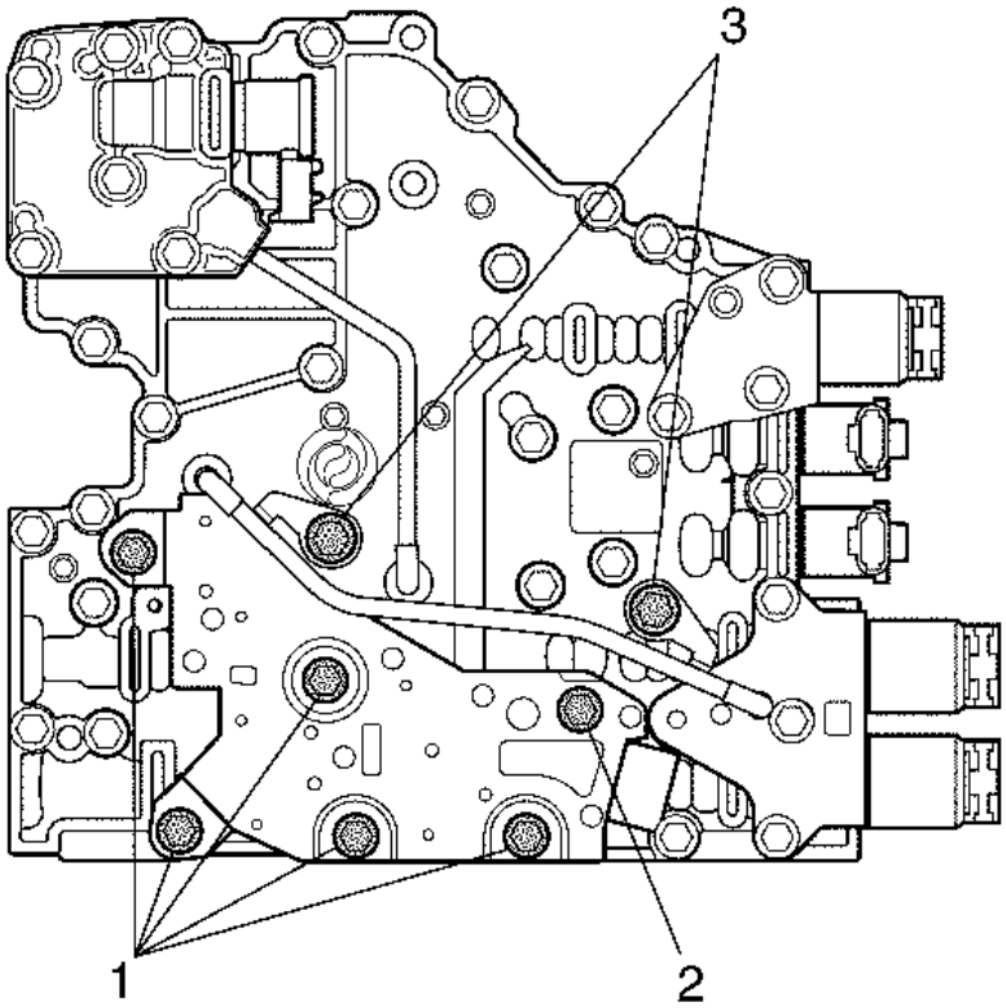


Fig. 453: TFP Switch And Reverse Signal Pipe Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:
- **Bolt (2) is slightly longer than the other bolts (1).**
- **The TFP switch is retained by five bolts (1) and by bolt (2).**

50. Install five bolts (1) and one bolt (2) retaining the TFP switch to the main valve body.

Tighten: Tighten the bolts to 12 N.m (108 lb in).

51. Install the reverse signal pipe (2) onto the main valve body.
52. Install two bolts (3) retaining the reverse signal pipe and the shift valve body to the main valve body.

Tighten: Tighten the bolts to 12 N.m (108 lb in).

3RD, 5TH AND REVERSE CLUTCH INSTALLATION

Tools Required

- **J 24204-2** Bar and Stud Assembly. See **Special Tools**.
- **J 36850** Transjel® Lubricant. See **Special Tools**.
- **J 44530** Piston Spring Compressor. See **Special Tools**.

Installation

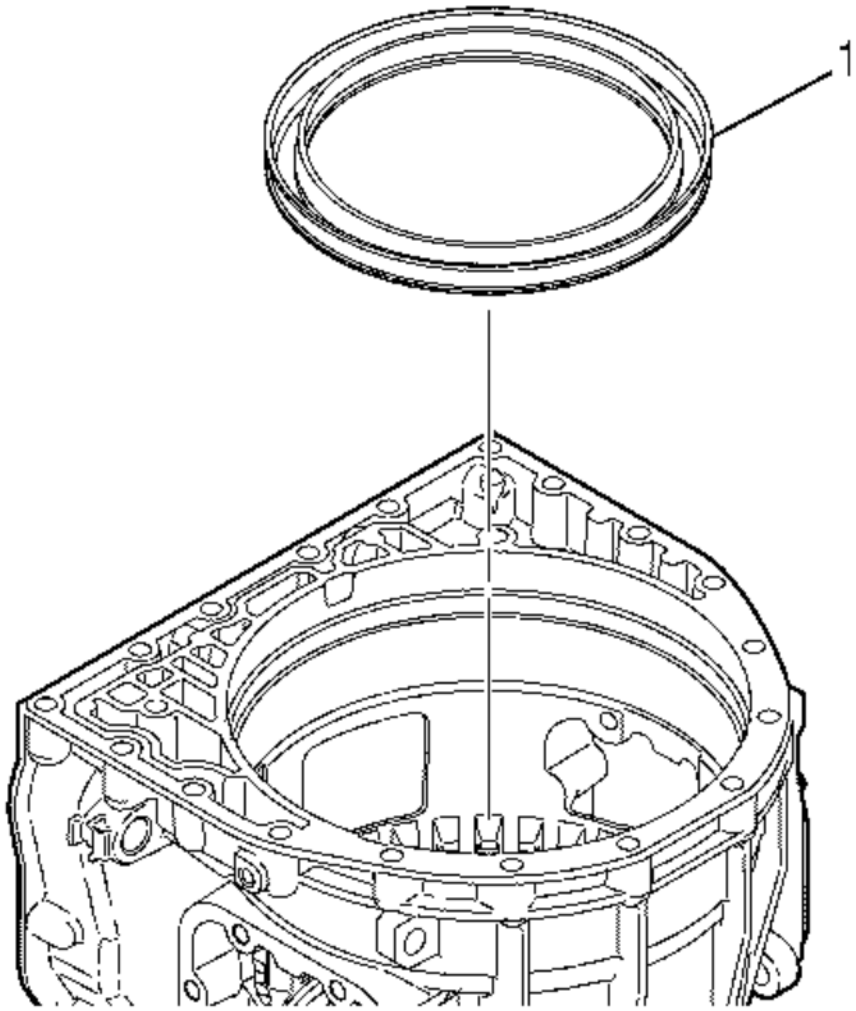


Fig. 454: View Of 3rd, 5th, And Reverse Clutch Piston Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not reuse the old 3rd, 5th, and reverse clutch piston assembly. Install a new 3rd, 5th, and reverse clutch piston assembly.

1. Position the transmission case so that the front of the case is facing up.
2. Apply **J 36850** to the inside diameter and outside diameter of the new 3rd, 5th, and reverse

clutch piston assembly (1). See **Special Tools**.

3. Align the new 3rd, 5th, and reverse clutch piston assembly (1) with the transmission case so that the seal is facing down and the 1.016 mm (0.040 in) lubrication/cooling orifice is at the top of the transmission case.
4. Install the 3rd, 5th, and reverse clutch piston assembly.
5. Gently tap the piston until the piston seats.

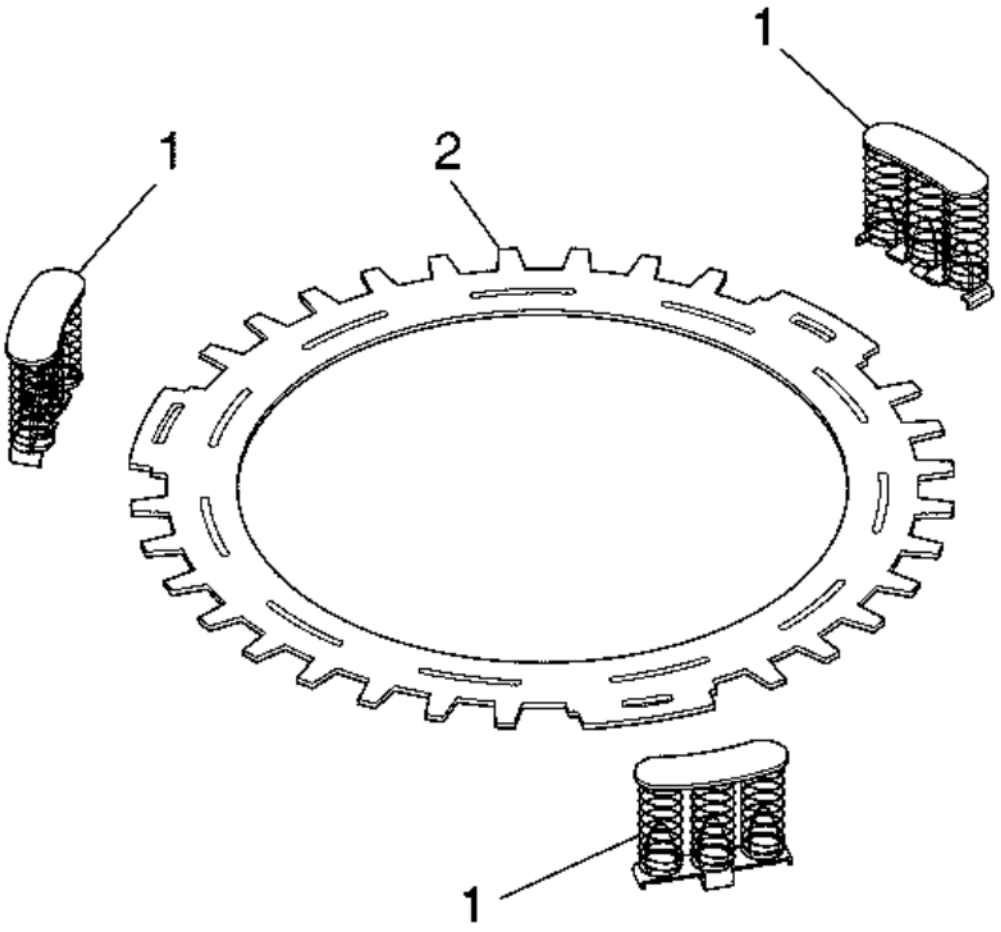


Fig. 455: Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The spring assemblies can be reused. If required, squeeze

the spring assembly tabs with pliers to make sure the spring assemblies are retained to the spring plate. When correctly adjusted, the piston return spring assemblies snap into place.

6. Install 3 piston return spring assemblies (1) onto the 3rd, 5th, and reverse spring plate (2).

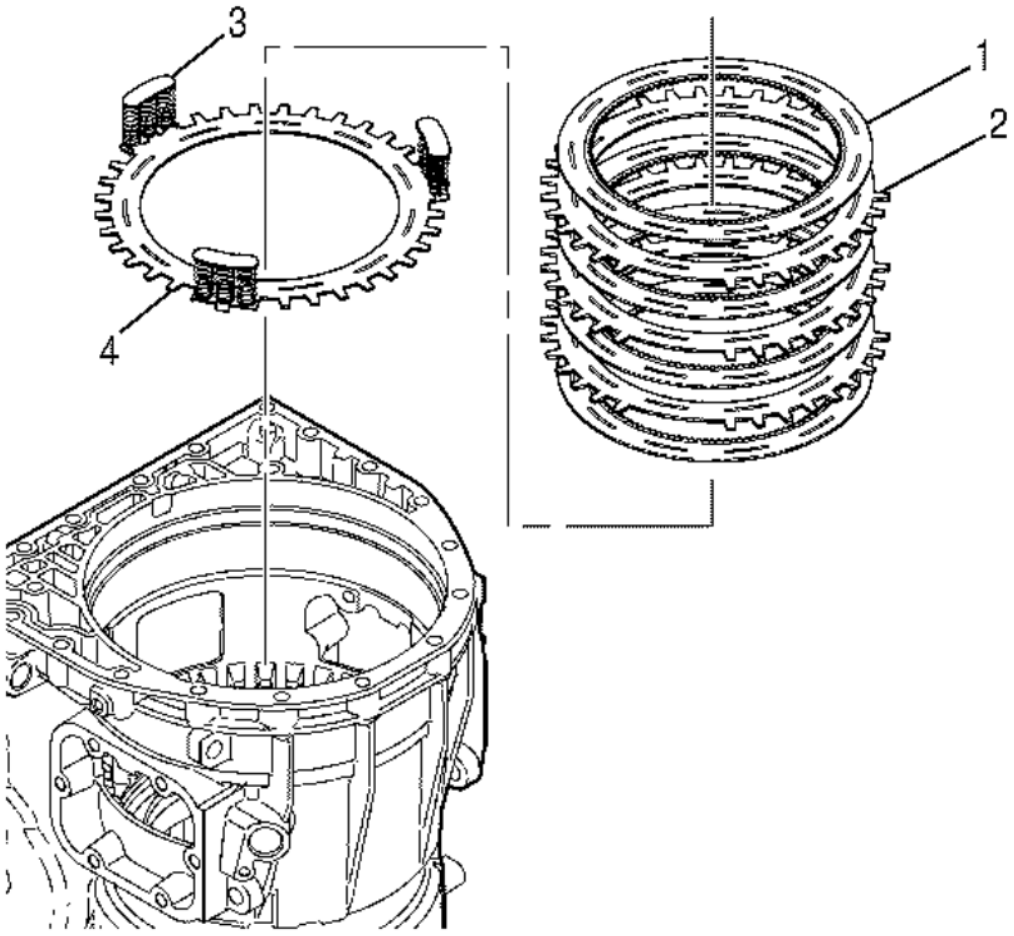


Fig. 456: View Of 3rd, 5th And Reverse Spring Plates, Steel Plates & Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

7. Align the 3rd, 5th and reverse spring plate (4) and piston return spring assemblies (3) so that

the spring assemblies face up.

8. Install the spring plate (4) into the transmission case.
9. Starting with a 3rd, 5th, and reverse clutch fiber plate, alternately install four 3rd, 5th, and reverse clutch fiber plates (1) and three 3rd, 5th, and reverse clutch steel plates (2) into the transmission case.

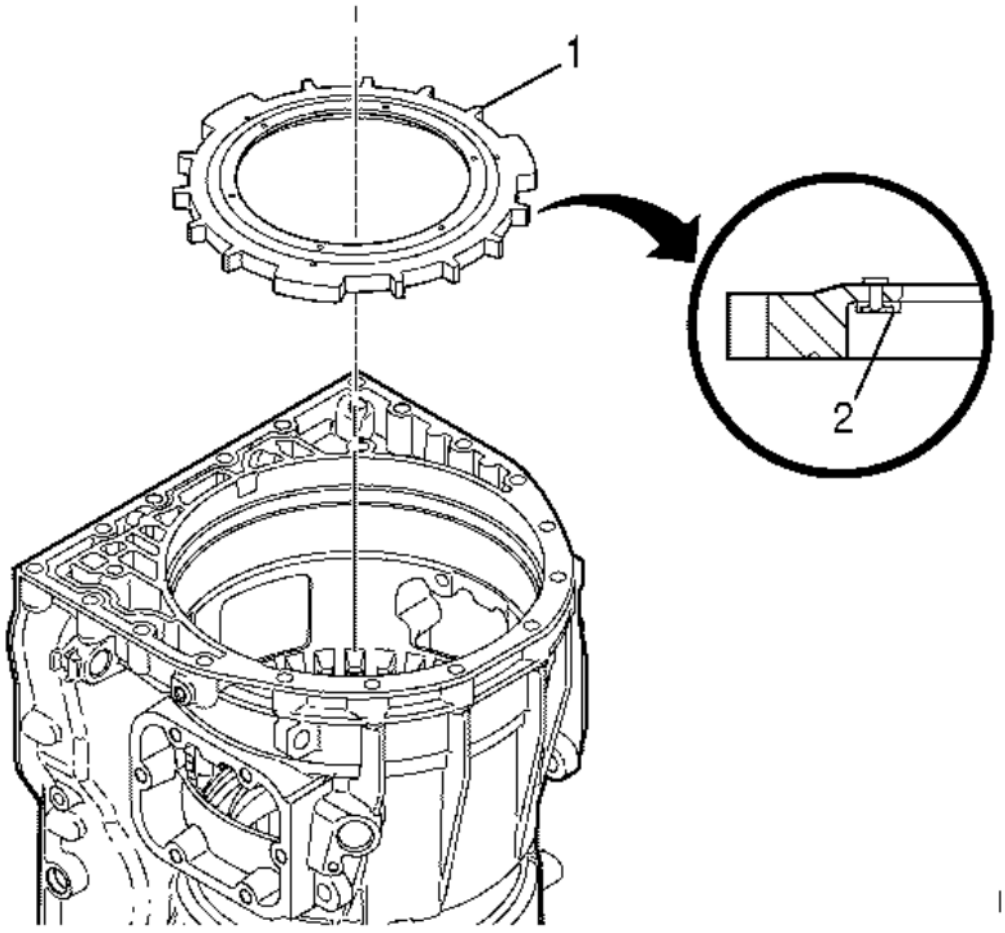


Fig. 457: Aligning 3rd, 5th, And Reverse Clutch Backing Plate Assembly
Courtesy of GENERAL MOTORS CORP.

10. Align the 3rd, 5th, and reverse clutch backing plate assembly (1) with gear thrust plates (2) down.

11. Install the 3rd, 5th, and reverse clutch backing plate assembly (1) into the transmission case.

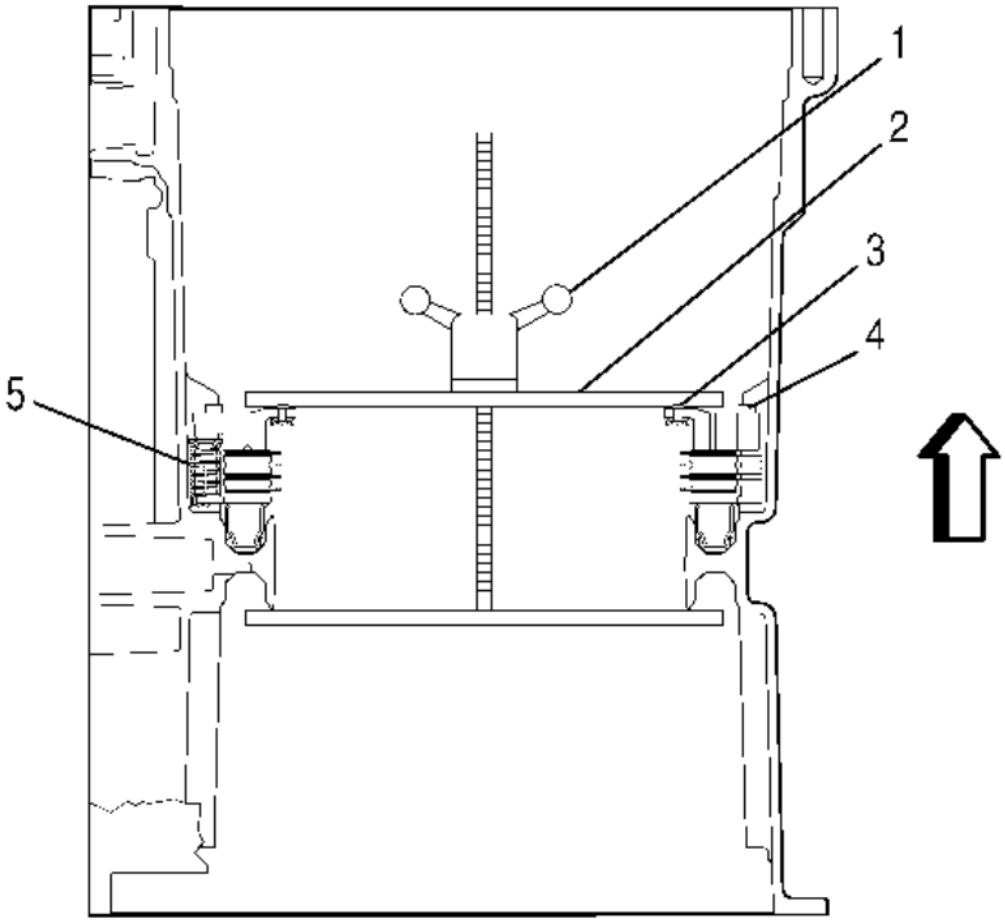


Fig. 458: Compressing 3rd, 5th, And Reverse Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to 3-5 Reverse Clutch Backing Plate Rivet Damage Notice .**

12. Install **J 24204-2** (1) and **J 44530** (2) into the transmission case. See **Special Tools**. Make sure **J 44530** does not touch the gear thrust plate rivets (3) on the 3rd, 5th, and reverse clutch backing plate assembly. See **Special Tools**.

13. Compress the 3rd, 5th, and reverse piston return spring assemblies (5) until the retaining ring groove is visible.
14. Install the retaining ring (4).
15. Make sure the retaining ring is seated.
16. Remove **J 24204-2** and **J 44530** . See **Special Tools**.

INPUT CARRIER ASSEMBLY AND 2-6 CLUTCH INSTALLATION

Tools Required

- **J 24204-2** Bar and Stud Assembly. See **Special Tools**.
- **J 36850** Transjel® Lubricant. See **Special Tools**.
- **J 44530** Clutch Piston Spring Compressor. See **Special Tools**.

Installation

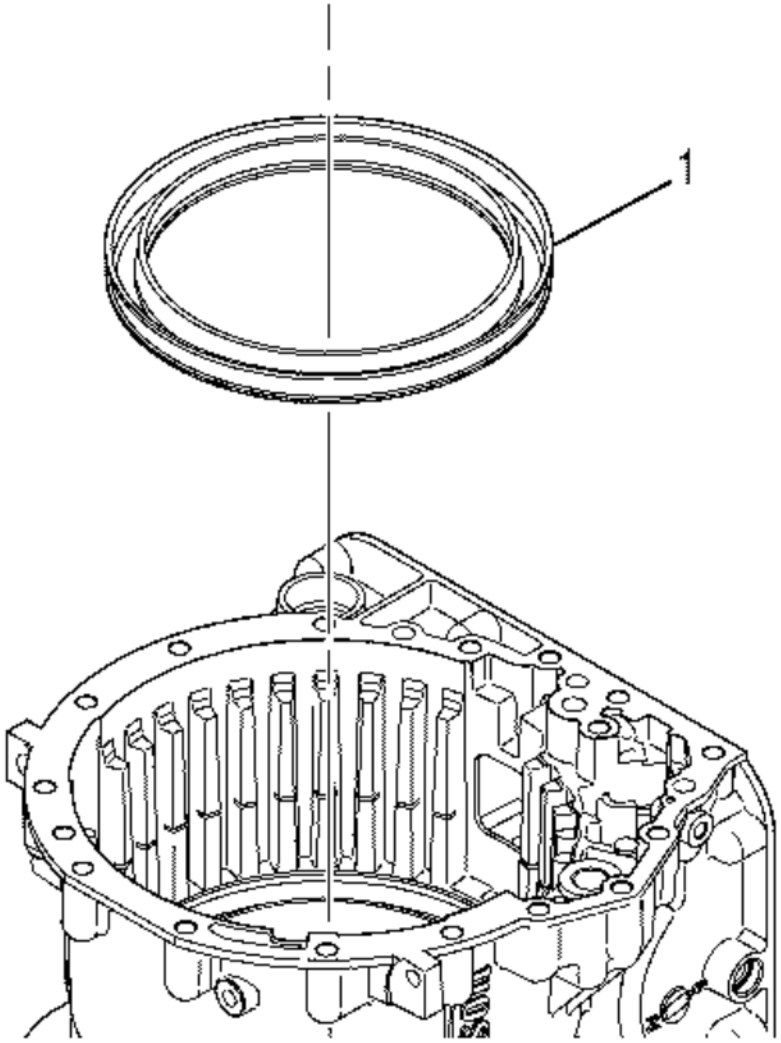


Fig. 459: Locating Clutch Piston Assembly
Courtesy of GENERAL MOTORS CORP.

1. Position the transmission case so that the rear of the case is facing up.
2. Apply **J 36850** or an equivalent lubricant to the inside and outside diameters of the new 2-6 clutch piston assembly (1). See **Special Tools**.
3. Align the new 2-6 clutch piston assembly (1) so that the seal is facing down and the 1.016 mm (0.040 in) lubrication/cooling orifice is positioned at the top of the transmission case.

4. Install the 2-6 clutch piston assembly (1).
5. Gently tap the piston until the piston seats.

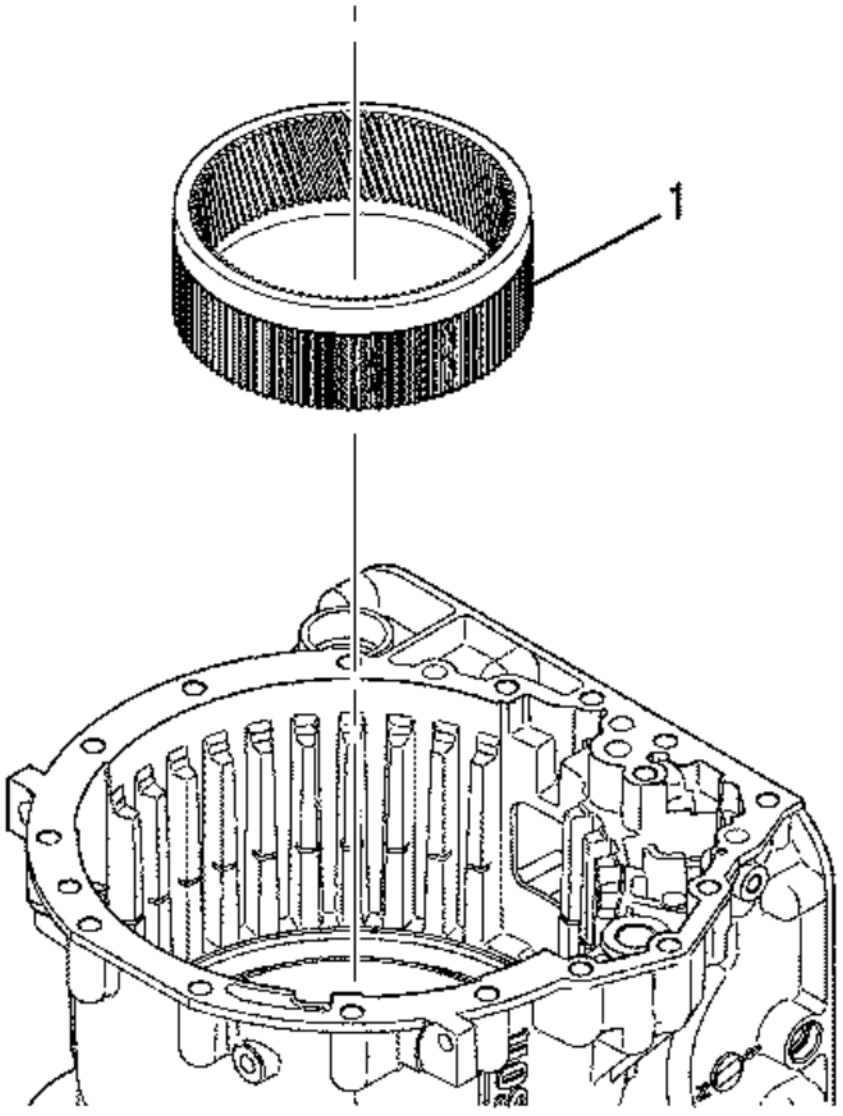


Fig. 460: View Of Input Internal Ring Gear
Courtesy of GENERAL MOTORS CORP.

6. Align the input internal ring gear (1) so that the outside splines are facing down.
7. Install the input internal ring gear (1).
8. Rotate the ring gear until the 3rd, 5th, and reverse fiber plates are engaged.
9. Make sure the input internal ring gear (1) is seated against the thrust plates of the 3rd, 5th, and reverse clutch backing plate assembly.

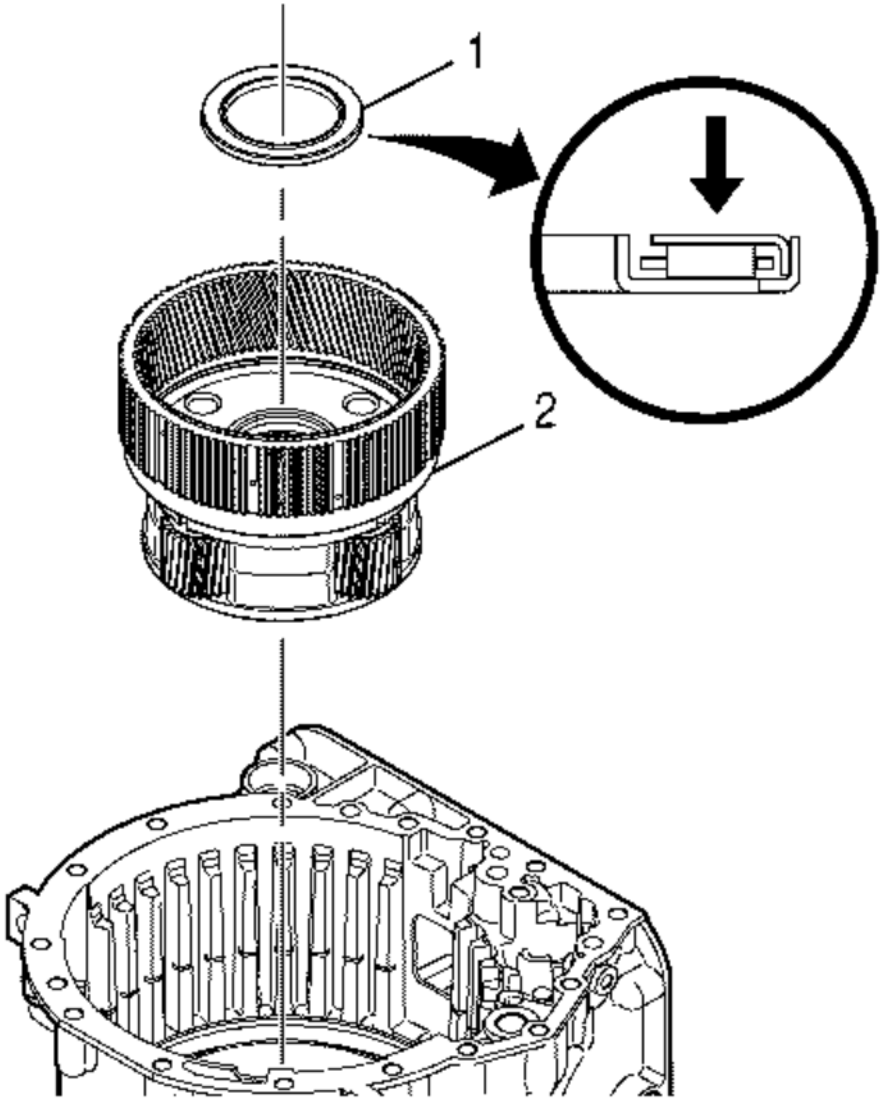


Fig. 461: Locating Input Carrier Module & Thrust Bearing
Courtesy of GENERAL MOTORS CORP.

10. Install the input carrier module (2).
11. Rotate the input carrier module until the module drops into place.

NOTE: Installing the thrust bearing incorrectly may cause permanent damage to the transmission.

12. Align the thrust bearing (1) so that the blue stripe on the thrust bearing is facing away from the input carrier module (2).
13. Install the thrust bearing (1) onto the input carrier module (2).

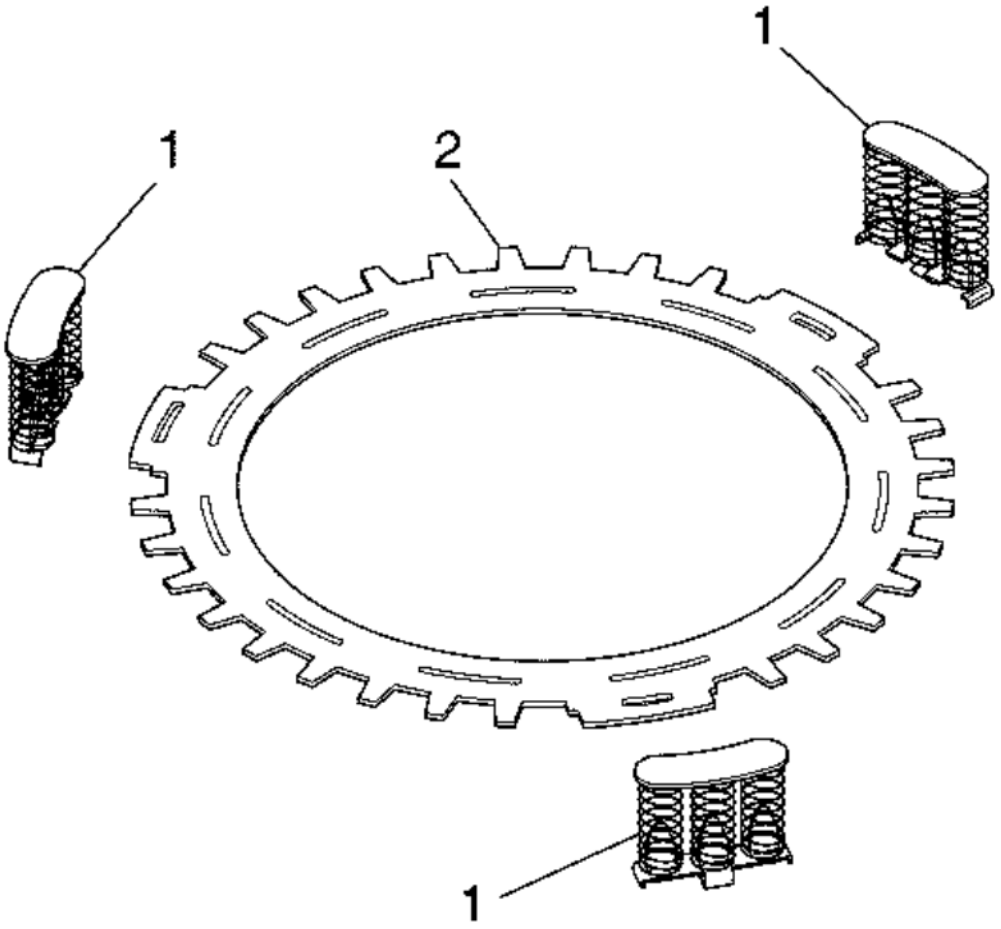


Fig. 462: Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The spring assemblies can be reused. If necessary, squeeze the spring assembly tabs with pliers to make sure the spring assemblies snap onto the 2-6 clutch spring plate.

14. Install 3 piston return spring assemblies (1) onto the 2-6 spring plate (2).

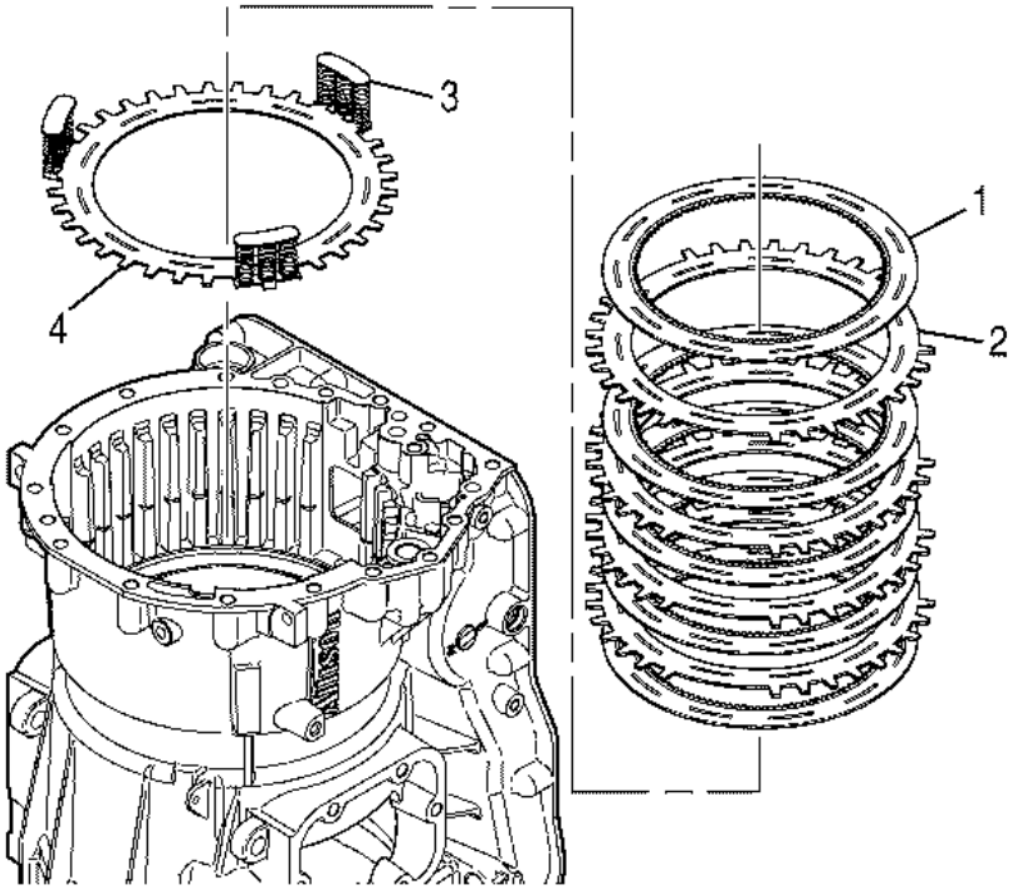


Fig. 463: View Of Clutch Plates & Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

15. Align the 2-6 clutch spring plate (4) and the piston return spring assemblies (3) with the spring assemblies up.
16. Install the spring plate (4) into the transmission case.
17. Starting with a 2-6 clutch fiber plate, alternately install five 2-6 clutch fiber plates (1) and four 2-6 clutch steel plates (2).

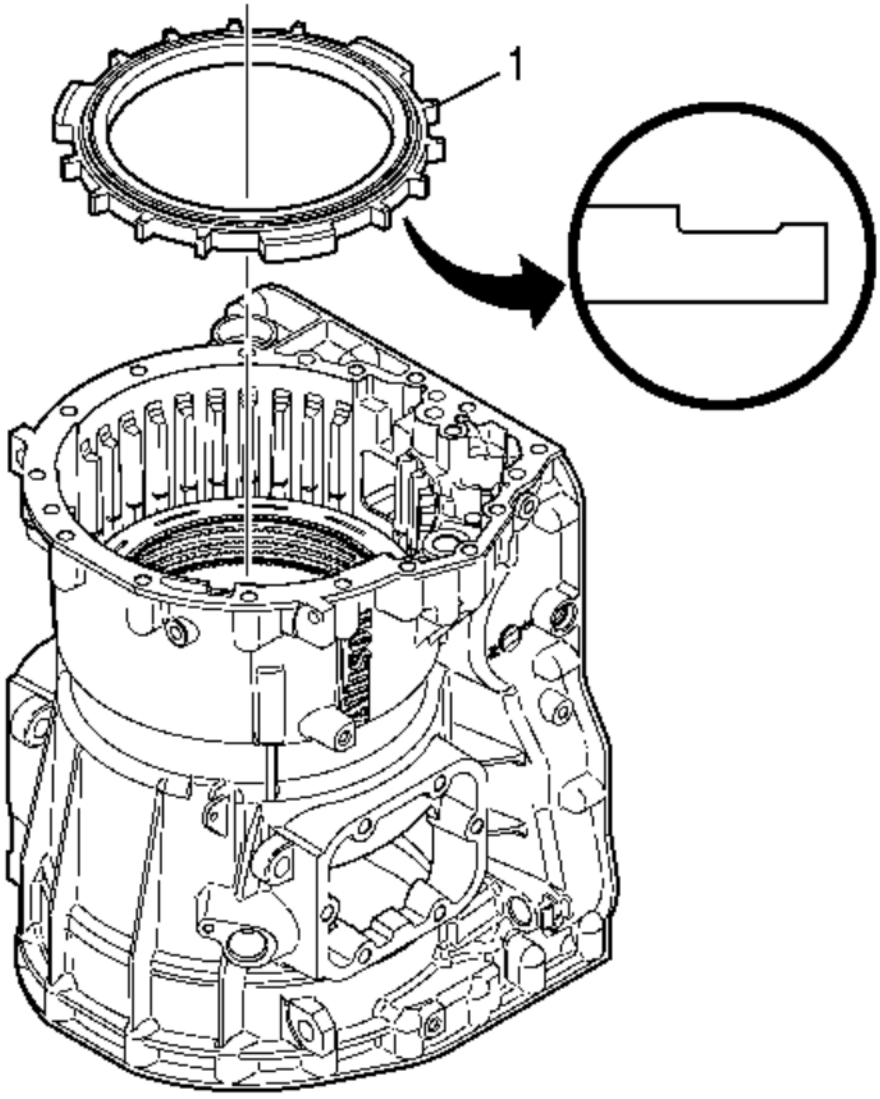


Fig. 464: Identifying Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

18. Install the 2-6 clutch backing plate (1).

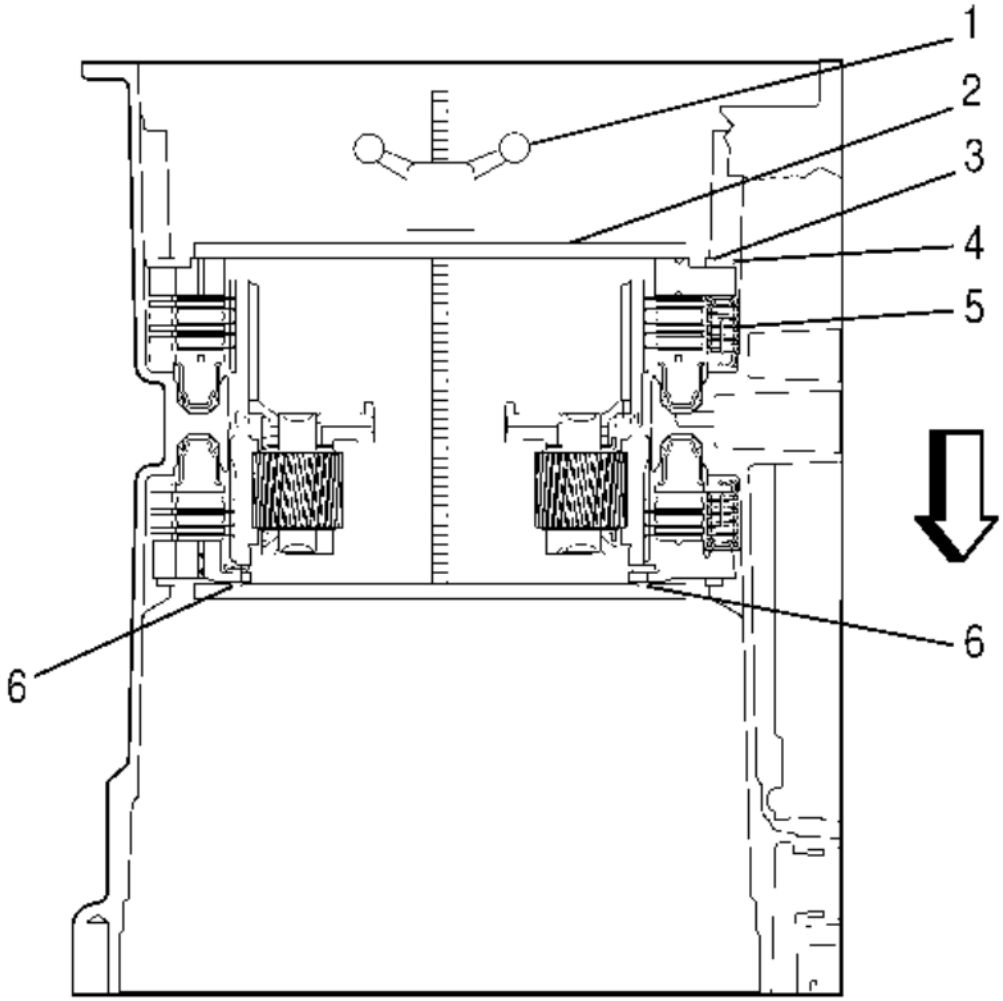


Fig. 465: Compressing Clutch Piston Return Spring Assemblies
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to 3-5 Reverse Clutch Backing Plate Rivet Damage Notice .

19. The threaded rod of **J 24204-2** must pass through but not touch the bushing. See **Special Tools**.
20. Install **J 24204-2** (1) and **J 44530** (2) into the transmission case. See **Special Tools**.

21. Make sure **J 24204-2** does not touch the gear thrust plate rivets (6) on the 3rd, 5th, and reverse clutch backing plate assembly. See **Special Tools**.
22. Compress the piston return spring assemblies (5) until the retaining ring groove is visible.

IMPORTANT: The outer 2-6 clutch retaining ring is thinner and larger in circumference compared to the inner low and reverse clutch retaining ring.

23. Install the 2-6 clutch retaining ring (4).

IMPORTANT: Position the 2-6 clutch and the low and reverse clutch retaining ring gaps 180 degrees apart.

24. Install the low and reverse clutch retaining ring (3) with the retaining ring gap 180 degrees from the 2-6 clutch retaining ring gap.

IMPORTANT: DO NOT damage the input carrier bushing when removing J 24204-2 from the transmission case. The threaded rod of J 24204-2 must pass through but not touch the bushing.

25. Remove **J 24204-2** and **J 44530** from the transmission case. See **Special Tools**.

LOW AND REVERSE CLUTCH STEEL PLATE SELECTION

Tools Required

- **J 24204-2** Bar and Stud Assembly. See **Special Tools**.
- **J 44530** Clutch Piston Spring Compressor. See **Special Tools**.

Selection

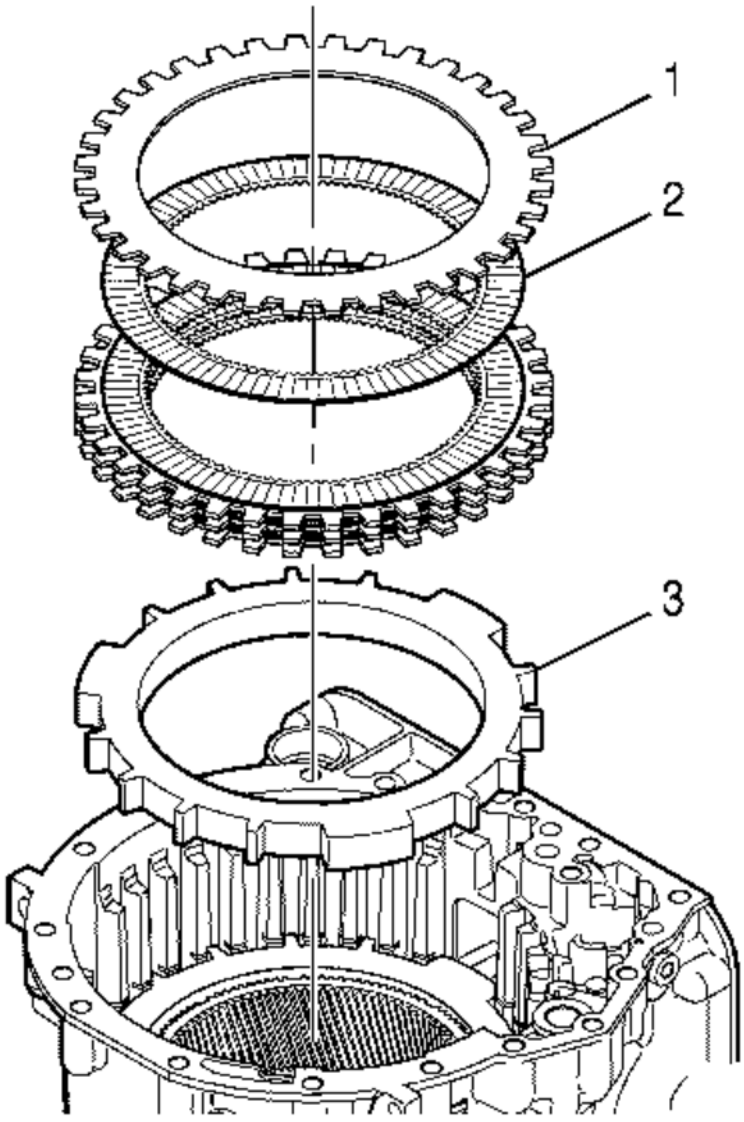


Fig. 466: View Of Low And Reverse Clutch Backing Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The low and reverse clutch backing plate installs in either direction. The plate may have no grooves, one side grooved, or both sides grooved.

1. Install the low and reverse clutch backing plate (3).

IMPORTANT: The low and reverse clutch pack uses a single selective steel plate. The low and reverse clutch pack is stacked out of order to allow determining the required selective steel plate part number. When properly stacked, the top plate is a steel plate and the next 2 plates are fiber plates. The selective steel plate is not stacked. Steel plates have an ID number stamped on a tang. The identification number that does not match the other identification numbers is the selective steel plate.

2. Starting with a low and reverse clutch fiber plate, alternately install the remaining 5 low and reverse clutch fiber plates (2) and the low and reverse clutch steel plates (1).

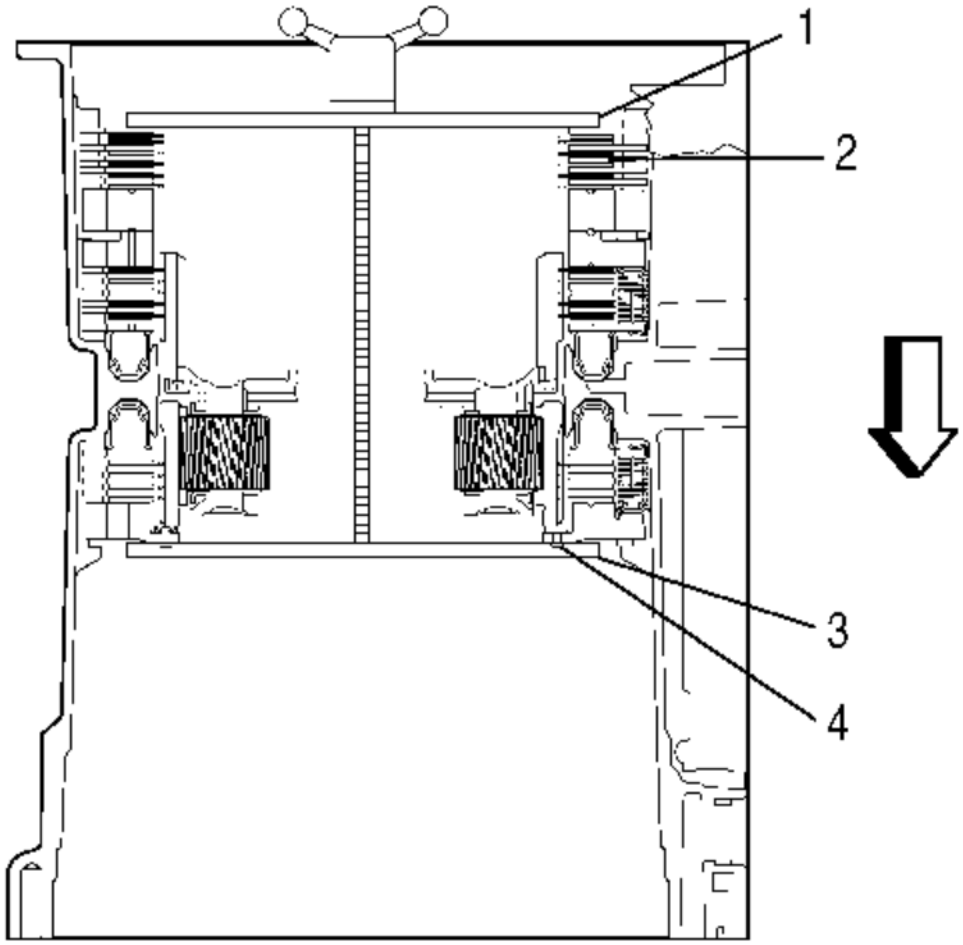


Fig. 467: Cross Sectional View Of Low And Reverse Clutch Stack
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to 3-5 Reverse Clutch Backing Plate Rivet Damage Notice .**

3. Install **J 24204-2** (3) and **J 44530** (1) into the transmission case. See **Special Tools**.
4. Make sure **J 24204-2** does not damage the gear thrust plate rivets (4) on the 3rd, 5th, and reverse clutch backing plate assembly. See **Special Tools**.

IMPORTANT: The low and reverse clutch plates need to be compressed enough to remove the coning from the plates. Hand tightening the wing nut of J 24204-2 should be sufficient to remove the coning. See Special Tools.

5. Using the **J 24204-2** wing nut, compress the low and reverse clutch plates (2) until hand tight. See **Special Tools**.

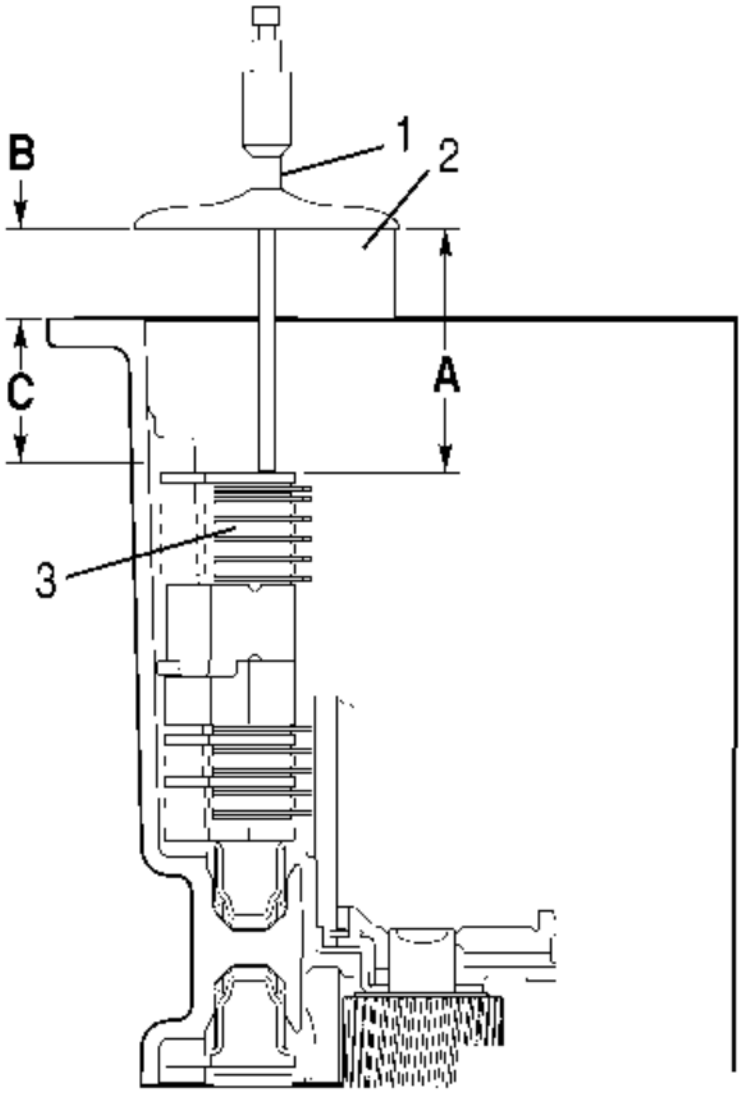


Fig. 468: Measuring Low And Reverse Clutch Stack For Steel Plate Selection
Courtesy of GENERAL MOTORS CORP.

6. Place a 25 mm (1 in) gage bar (2) on the rear surface of the transmission case at a location near **J 44530** . See **Special Tools**.
7. Measure the distance from the top of the gage bar to the top of the low and reverse clutch stack (3) (Dimension A).

8. Subtract dimension B, the width of the gage bar; from dimension A.
9. Dimension C is the result of the subtraction.
10. Select a low and reverse clutch steel plate based upon Dimension C. Refer to **Selective Components Specifications** .

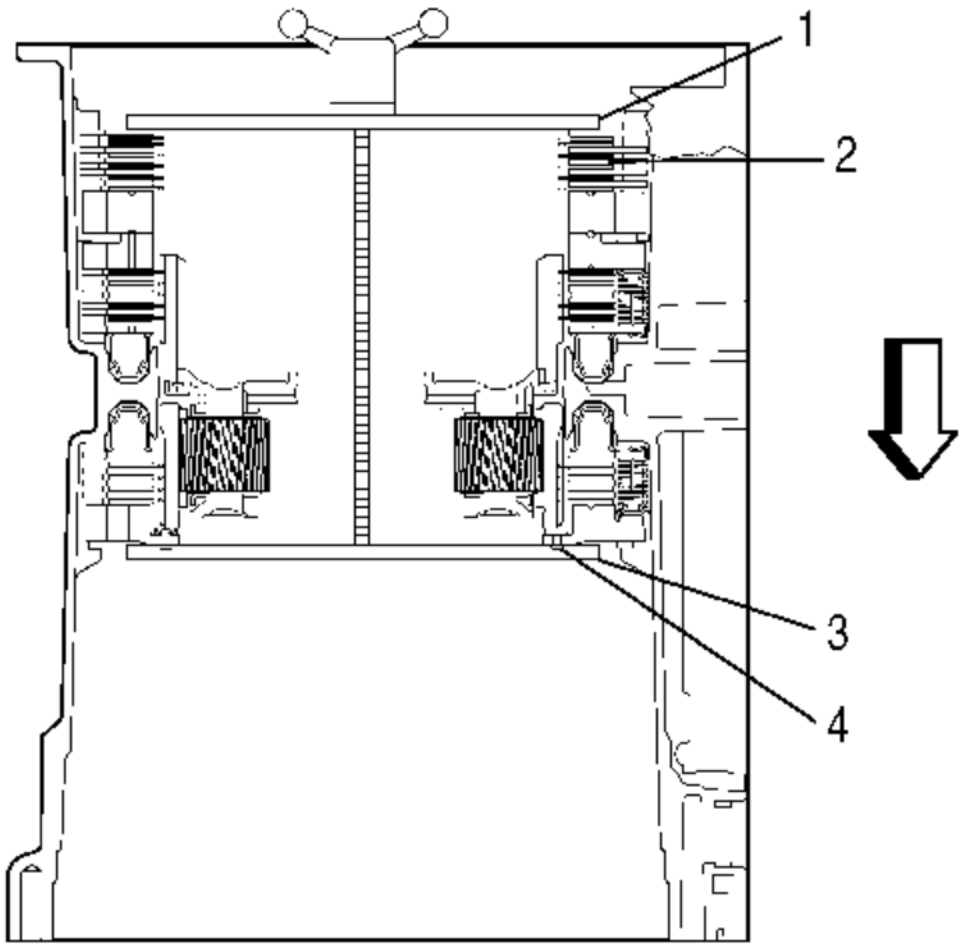


Fig. 469: Cross Sectional View Of Low And Reverse Clutch Stack
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT damage the input carrier bushing when removing J 24204-2 from the transmission case. The threaded rod of J

24204-2 must pass through but not touch the bushing.

11. Remove **J 24204-2** (3) and **J 44530** (1). See **Special Tools**.

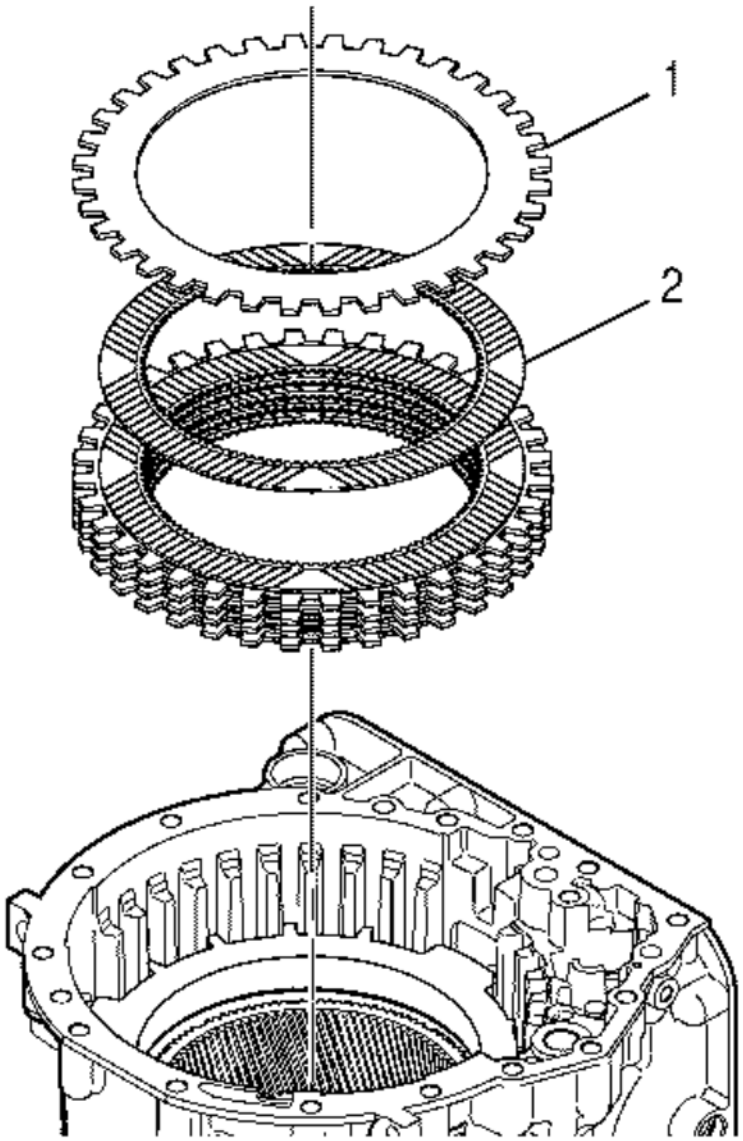


Fig. 470: View Of Low And Reverse Clutch Fiber & Steel Plates
Courtesy of GENERAL MOTORS CORP.

12. Remove 6 low and reverse clutch fiber plates (2) and 5 low and reverse clutch steel plates (1).

INTERMEDIATE CARRIER ASSEMBLY AND MAIN SHAFT INSTALLATION

Tools Required

J 44587 Main Shaft Holder. See **Special Tools**.

Installation

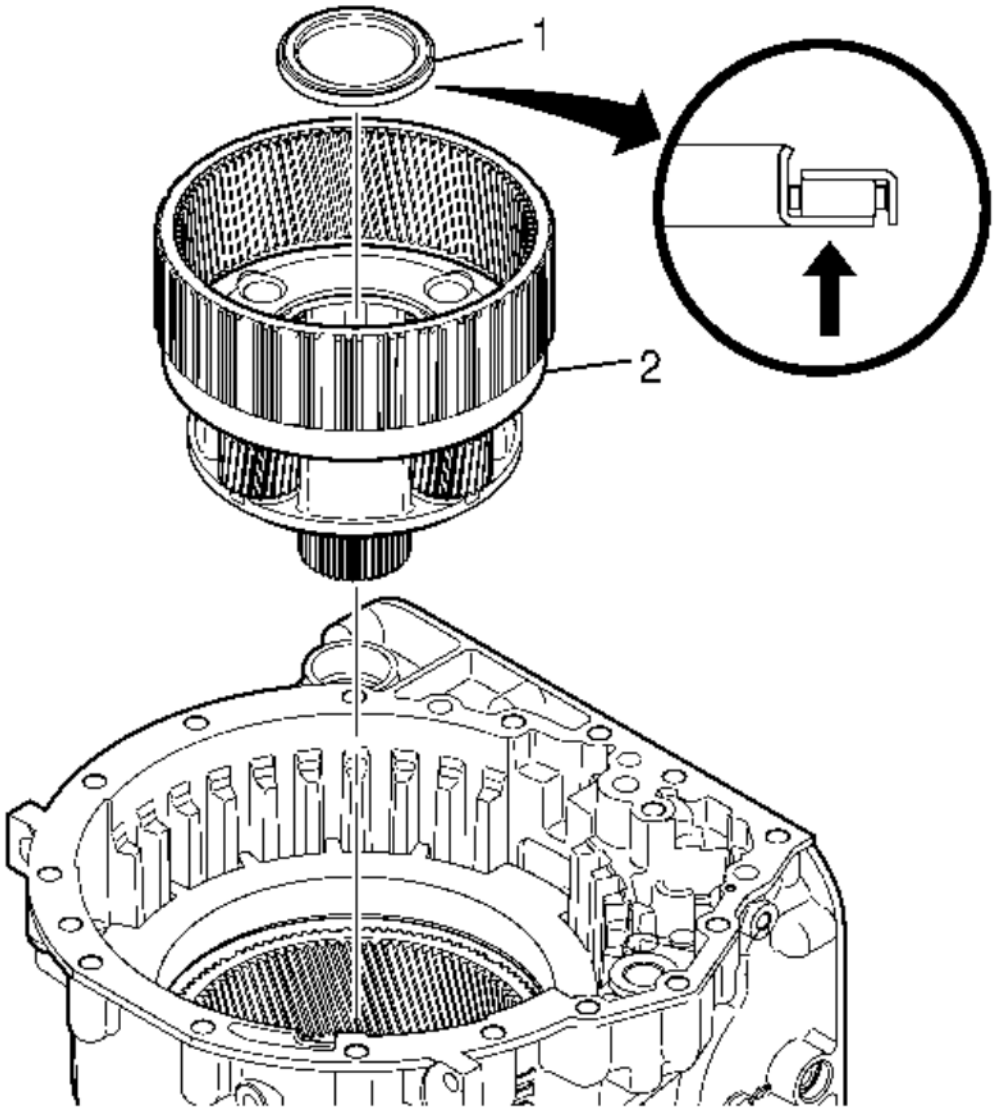


Fig. 471: Locating Intermediate Carrier Module & Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the intermediate carrier module (2).
2. Rotate the intermediate carrier module (2) until the module drops into place.

NOTE: Installing the thrust bearing incorrectly may cause permanent

damage to the transmission.

3. Align thrust bearing assembly (1) so that the blue stripe on the thrust bearing assembly is facing towards the intermediate carrier module (2).
4. Install the thrust bearing assembly (1) onto the intermediate carrier module (2).

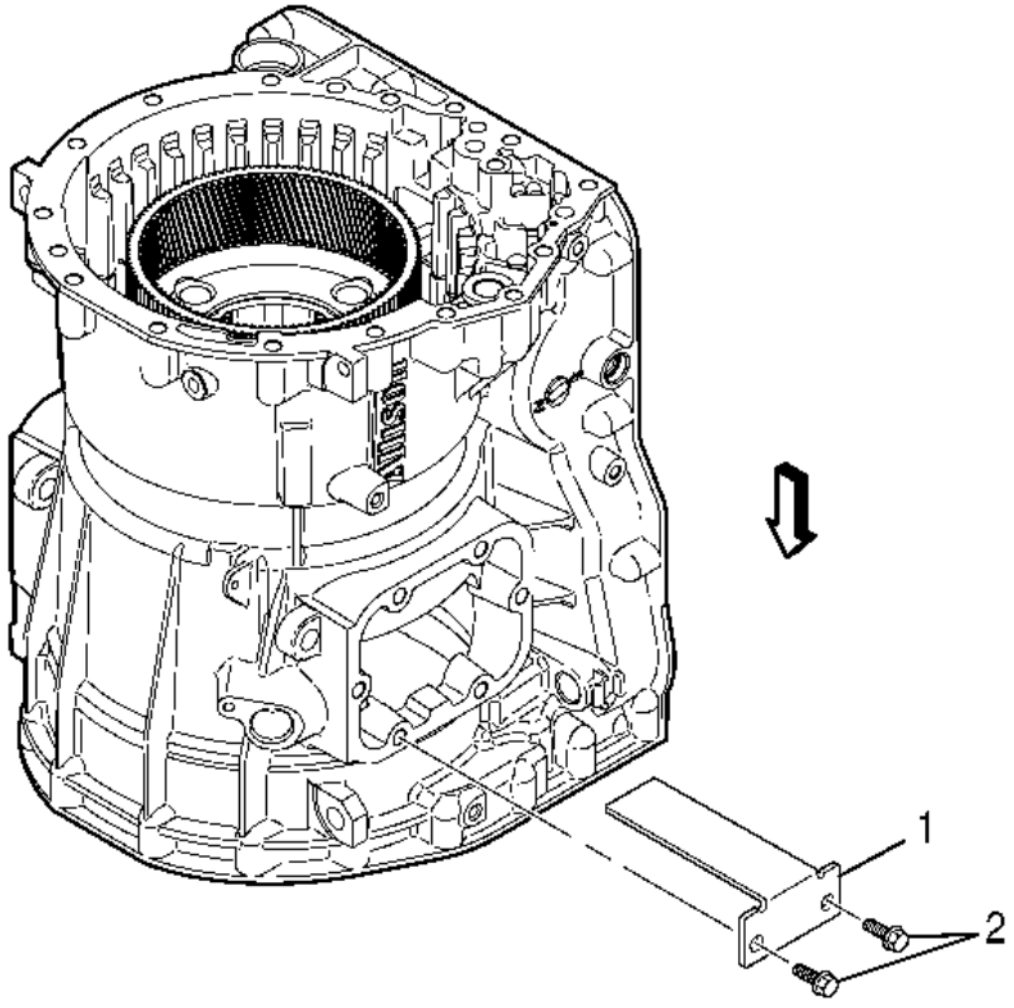


Fig. 472: Identifying J 44587
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not rotate the transmission from the nose-up position without installing J 44587. Failure to install J 44587 and rotating the transmission will cause clearance issues during assembly and possible damage to the transmission.

5. Align **J 44587** (1) with the power takeoff (PTO) access as follows:. See **Special Tools**.
   - The tongue of **J 44587** is facing toward the PTO access. See **Special Tools**.
   - The bolts holes of **J 44587** are aligned with the 2 front bolt holes of the PTO access. See **Special Tools**.
6. Install **J 44587** (1) into the PTO access. See **Special Tools**.
7. Install 2 bolts (2) into **J 44587** (1) and tighten the bolts snugly. See **Special Tools**.

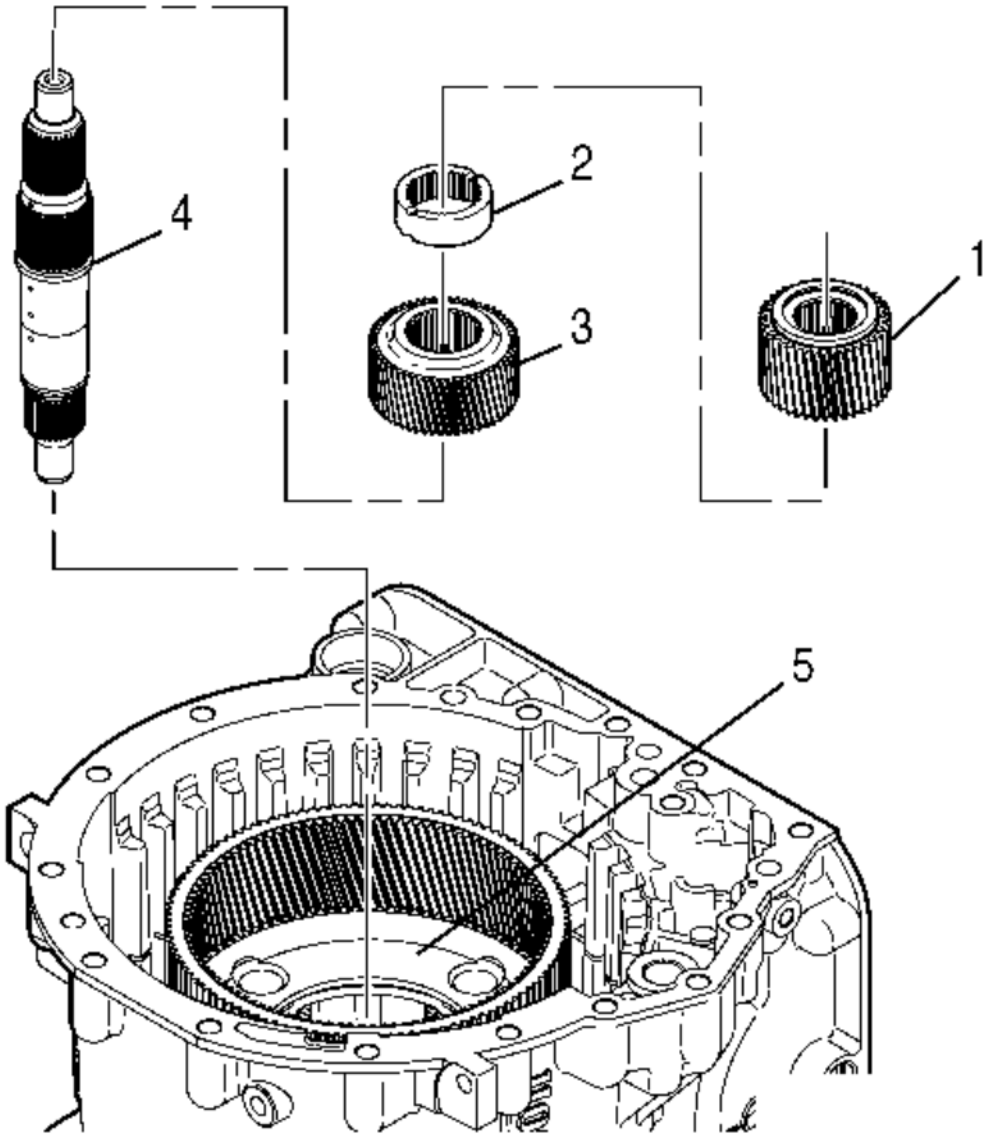


Fig. 473: Locating Intermediate Sun Gear, Sun Gear Spacer & Main Shaft
Courtesy of GENERAL MOTORS CORP.

8. Install the intermediate sun gear (3) and the sun gear spacer (2) onto the main shaft (4).
9. As a unit, install the main shaft (4), the intermediate sun gear (3), and the sun gear spacer (2) into the intermediate planetary carrier module (5).

10. Align the output sun gear (1) so that the flat side of the sun gear is facing the sun gear spacer.
11. Install the output sun gear (1) onto the main shaft (4).
12. Make sure the output sun gear and sun gear spacer splines are engaged.

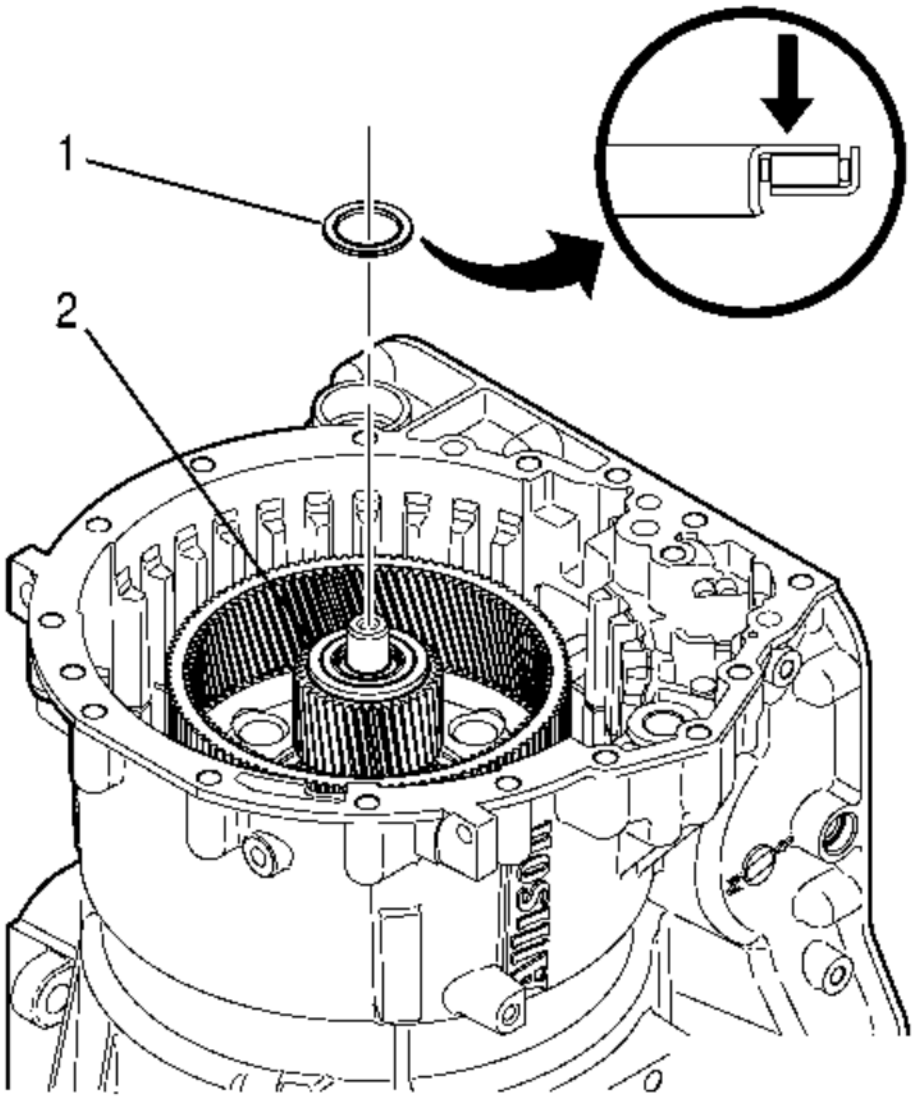


Fig. 474: Aligning Thrust Bearing Assembly

Courtesy of GENERAL MOTORS CORP.

NOTE: Installing the thrust bearing incorrectly may cause permanent damage to the transmission.

13. Align the thrust bearing assembly (1) so that the blue stripe on the thrust bearing assembly is facing away from the output sun gear (2).
14. Install the thrust bearing assembly (1) into the output sun gear (2).

LOW AND REVERSE CLUTCH INSTALLATION

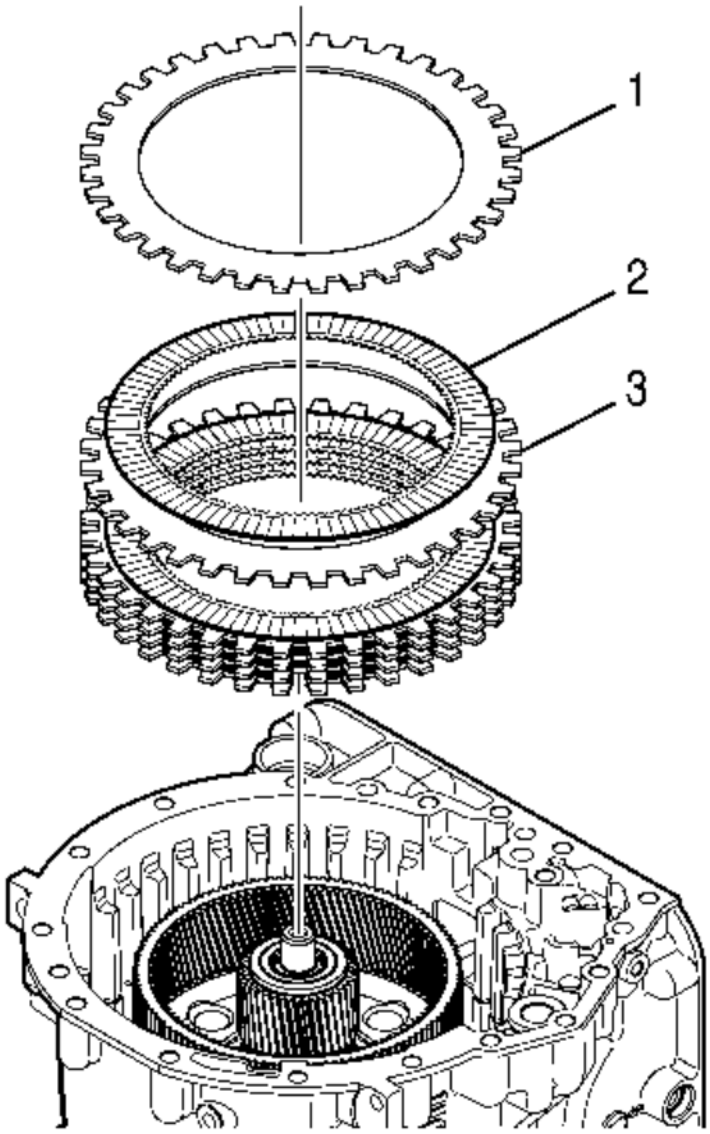


Fig. 475: View Of Low & Reverse Clutch Plates
Courtesy of GENERAL MOTORS CORP.

1. Starting with a low and reverse clutch fiber plate, alternately install 6 low and reverse clutch fiber plates (2) and 5 low and reverse clutch steel plates (3).
2. Install the correct selective low and reverse clutch steel plate (1).

PARK PAWL INSTALLATION

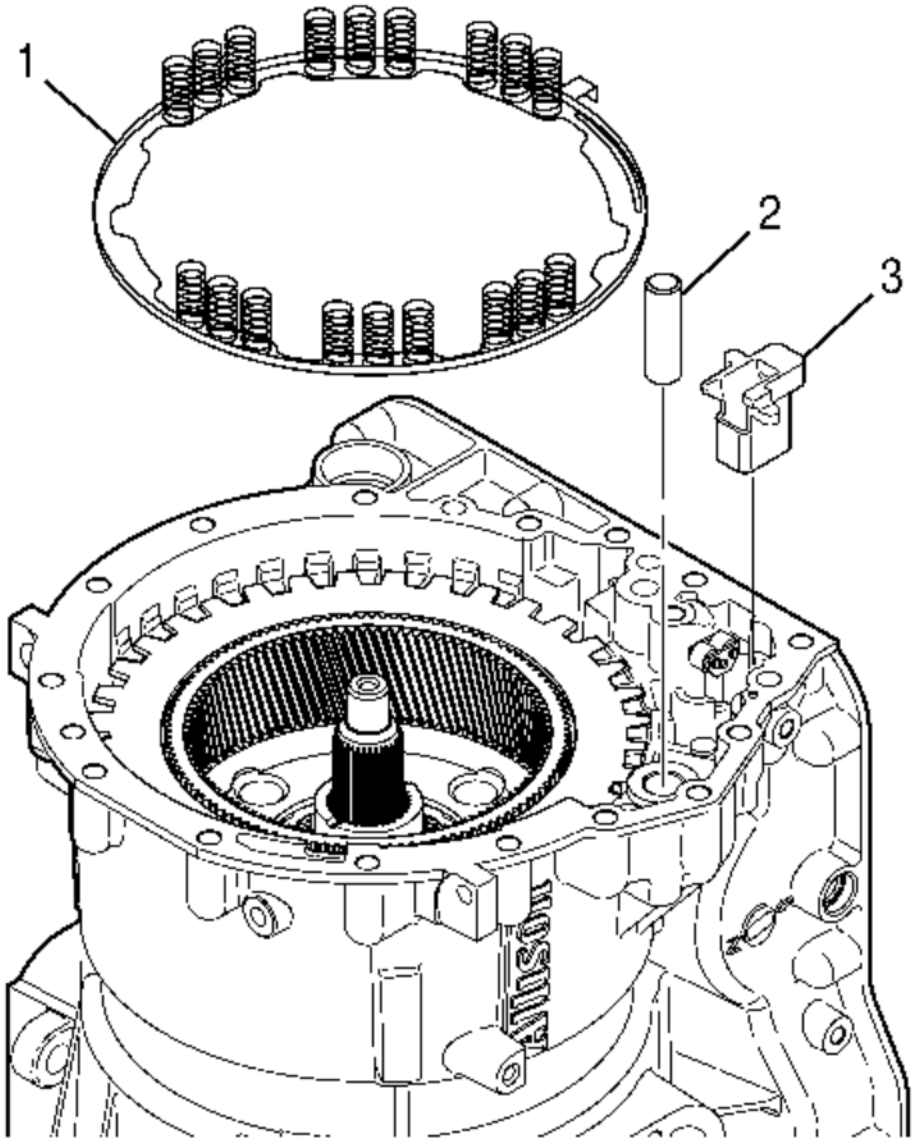


Fig. 476: View Of Park Pawl Support Pin & Cam Guide
Courtesy of GENERAL MOTORS CORP.

1. Align the tang in the low and reverse clutch return spring assembly (1) with the notch in the

transmission case.

2. Install the low and reverse clutch piston return spring assembly (1).
3. Install the park pawl cam guide (3).
4. Install the park pawl support pin (2) into the transmission case.

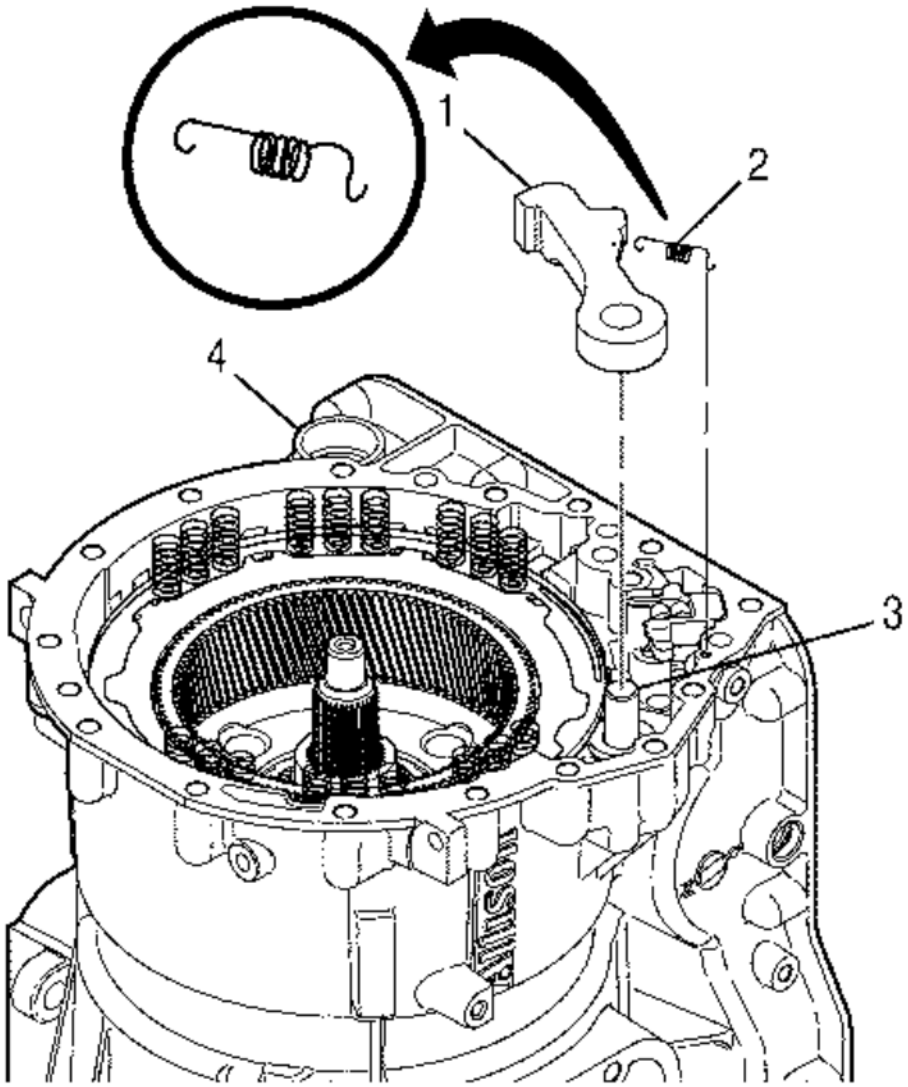


Fig. 477: Exploded View Of Park Pawl & Return Spring
Courtesy of GENERAL MOTORS CORP.

5. Install the park pawl return spring (2) onto the park pawl (1).
6. Align the park pawl and the park pawl return spring toward the rear, with the park pawl support pin (3).
7. Install the park pawl (1) onto the park pawl support pin (3).
8. Connect the park pawl return spring (2) to the transmission case.

OUTPUT SHAFT AND OUTPUT CARRIER ASSEMBLY INSTALLATION

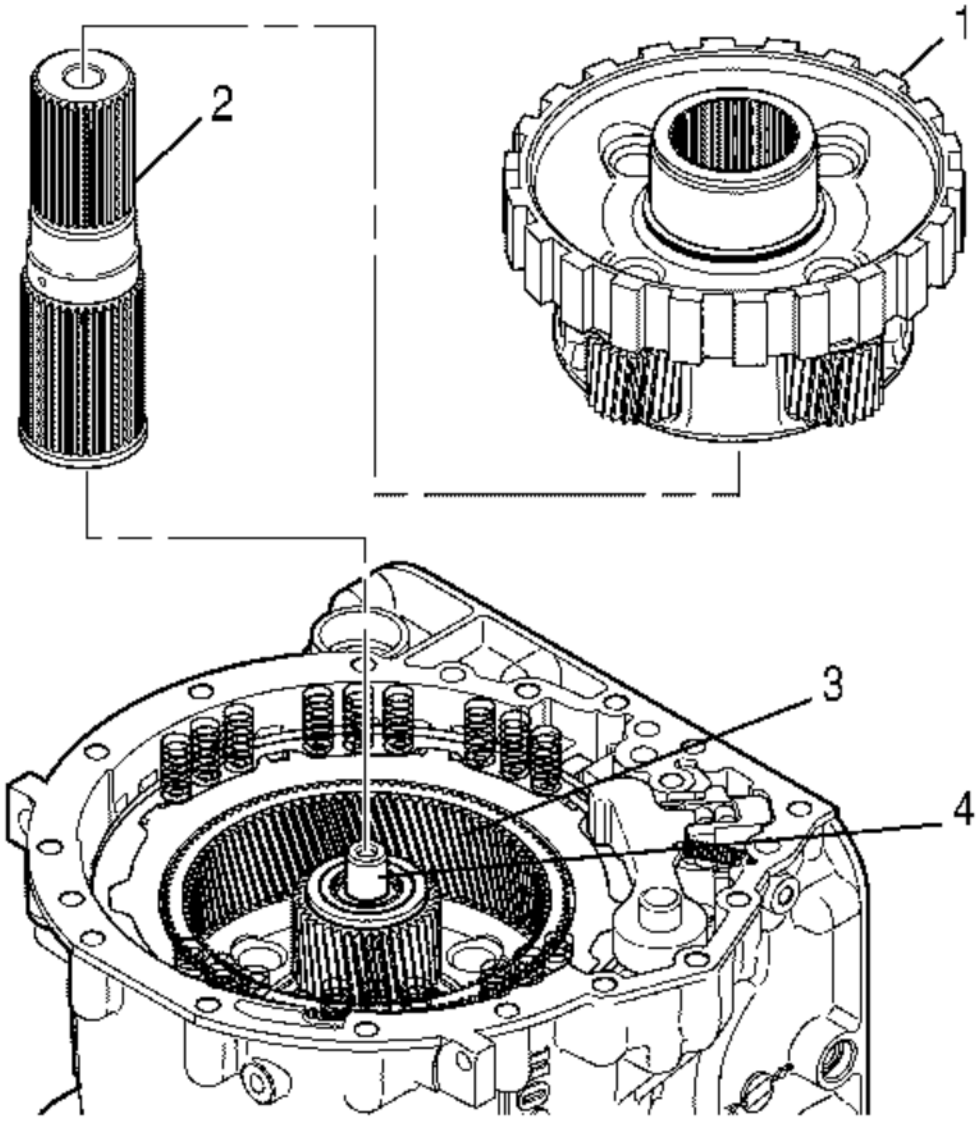


Fig. 478: Output Shaft And Output Carrier
Courtesy of GENERAL MOTORS CORP.

1. Install the output shaft (2) into the output carrier assembly (1).
2. While holding the output shaft (2), place the output carrier assembly (1) into the top of the output ring gear (3).

3. Move/rotate the output shaft until the carrier assembly drops into the output ring gear (3).
4. Gently place the output shaft onto the main shaft (4).
5. Rotate the carrier assembly until the carrier assembly seats.

LOW AND REVERSE CLUTCH PISTON HOUSING INSTALLATION

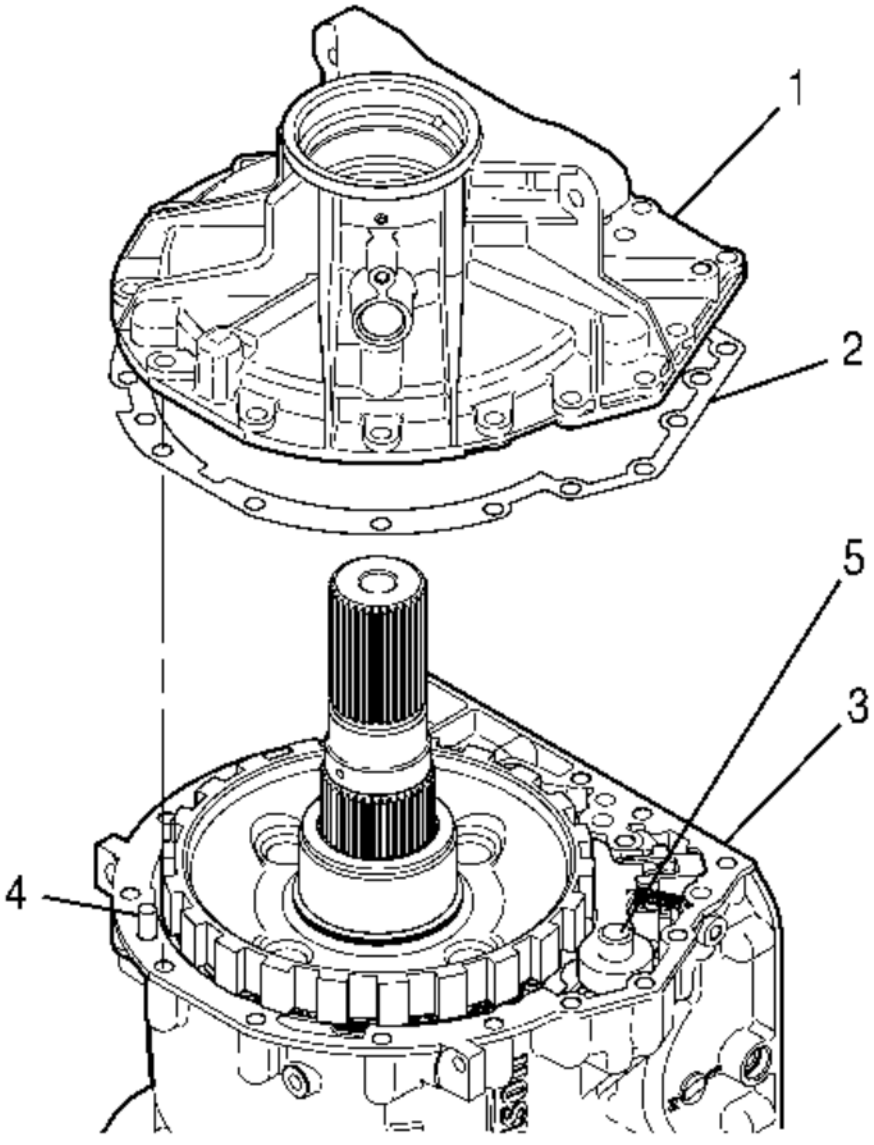


Fig. 479: View Of Low And Reverse Clutch Housing Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Except as noted, a low and reverse clutch housing, 4WD is installed using the same procedures as used when installing a low and reverse clutch housing, 2WD.

1. Install a new gasket (2) onto the transmission case (3).
2. For a 2WD transmission, make sure the output shaft turns with the output speed sensor (OSS) reluctor wheel. For a 4WD transmission, install the output shaft bearing spacer.
3. Align the low and reverse clutch housing with the transmission case locating pin (4) and park pawl pin (5).
4. Install the low and reverse clutch housing.
5. For a 2WD transmission, turn the OSS reluctor wheel through the OSS hole to make sure the output shaft turns with the reluctor wheel.

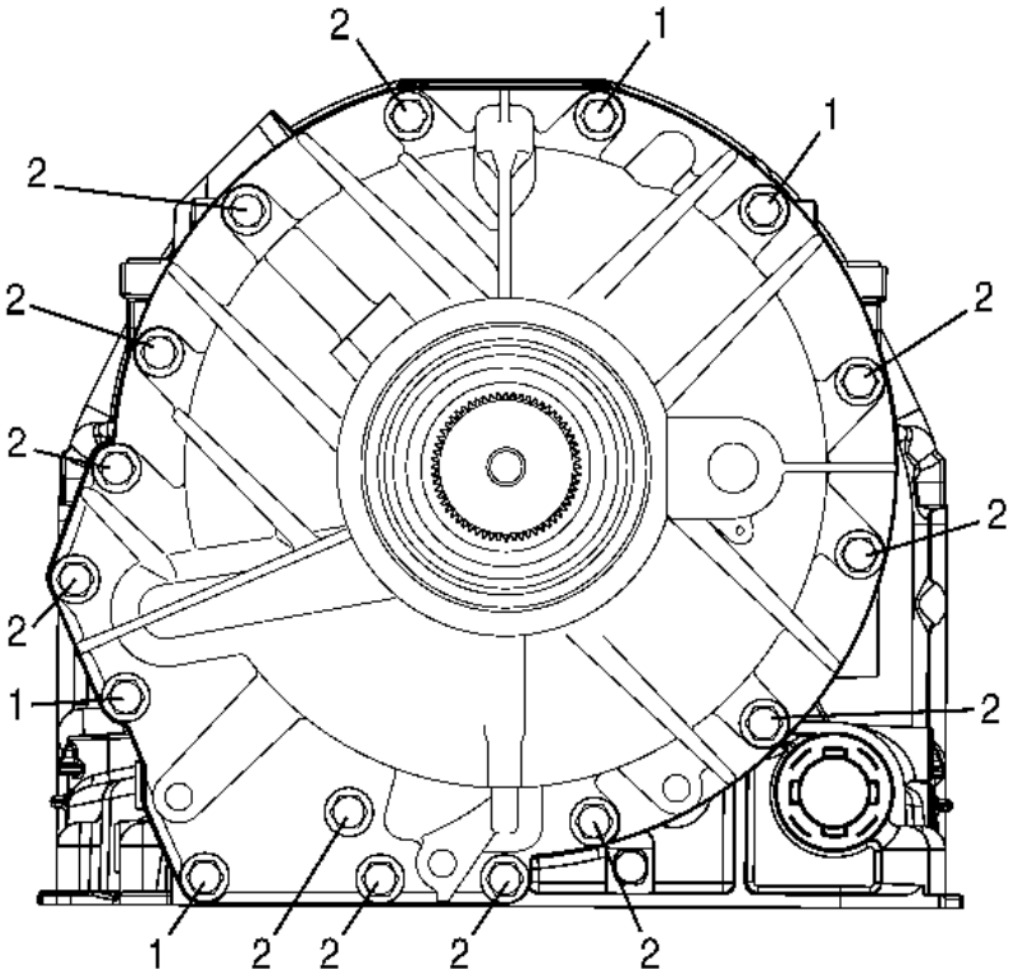


Fig. 480: Identifying Low And Reverse Clutch Housing Bolts
Courtesy of GENERAL MOTORS CORP.

6. Hand install 4 bolts (1).
7. Evenly draw down bolts (1) until the low and reverse clutch housing seats on the transmission case.
8. Hand install 12 bolts (2).

NOTE: Refer to Fastener Notice .

9. Tighten the bolts (1) and bolts (2).

   Tighten: Tighten bolts to 56 N.m (42 lb ft).

CONTROL VALVE BODY ASSEMBLY INSTALLATION

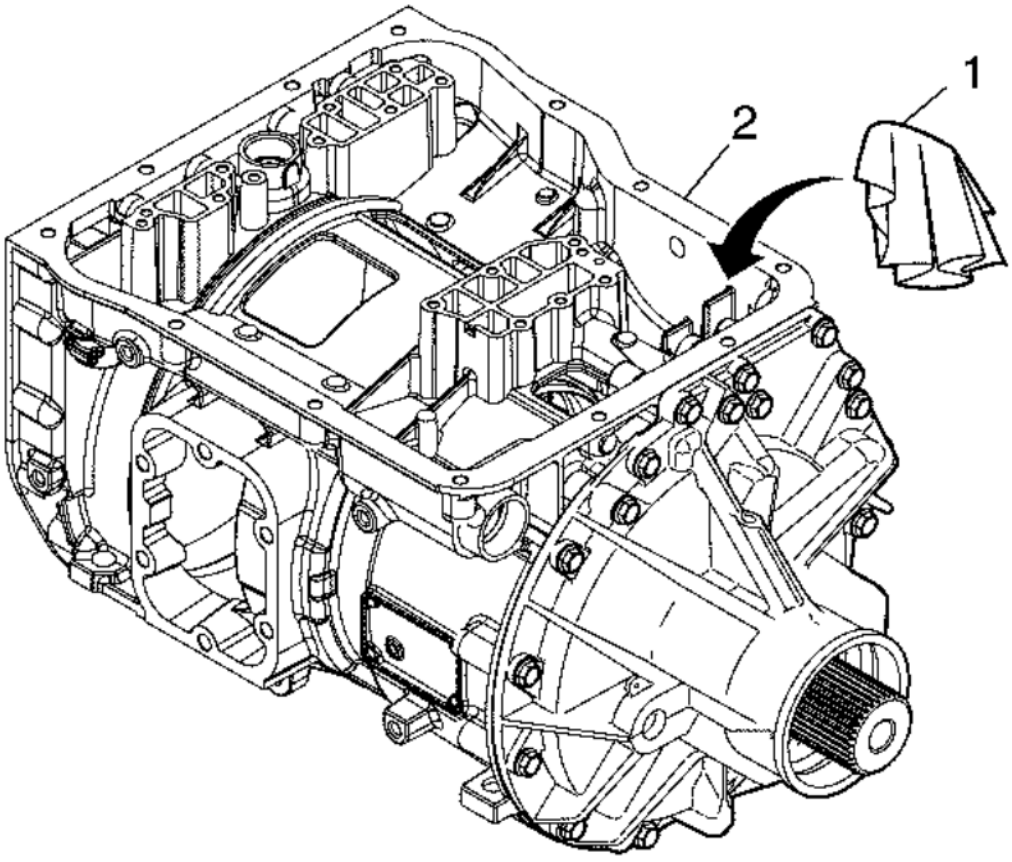


Fig. 481: Park Pawl Cam Guide Hole
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Installing a lint-free cloth into the park pawl cam guide hole prevents the manual valve pin from falling into the transmission.

1. Install a lint-free cloth (1) in the park pawl cam guide hole in the transmission case (2).

2. Position the transmission case so that the valve body face of the transmission case is facing up.

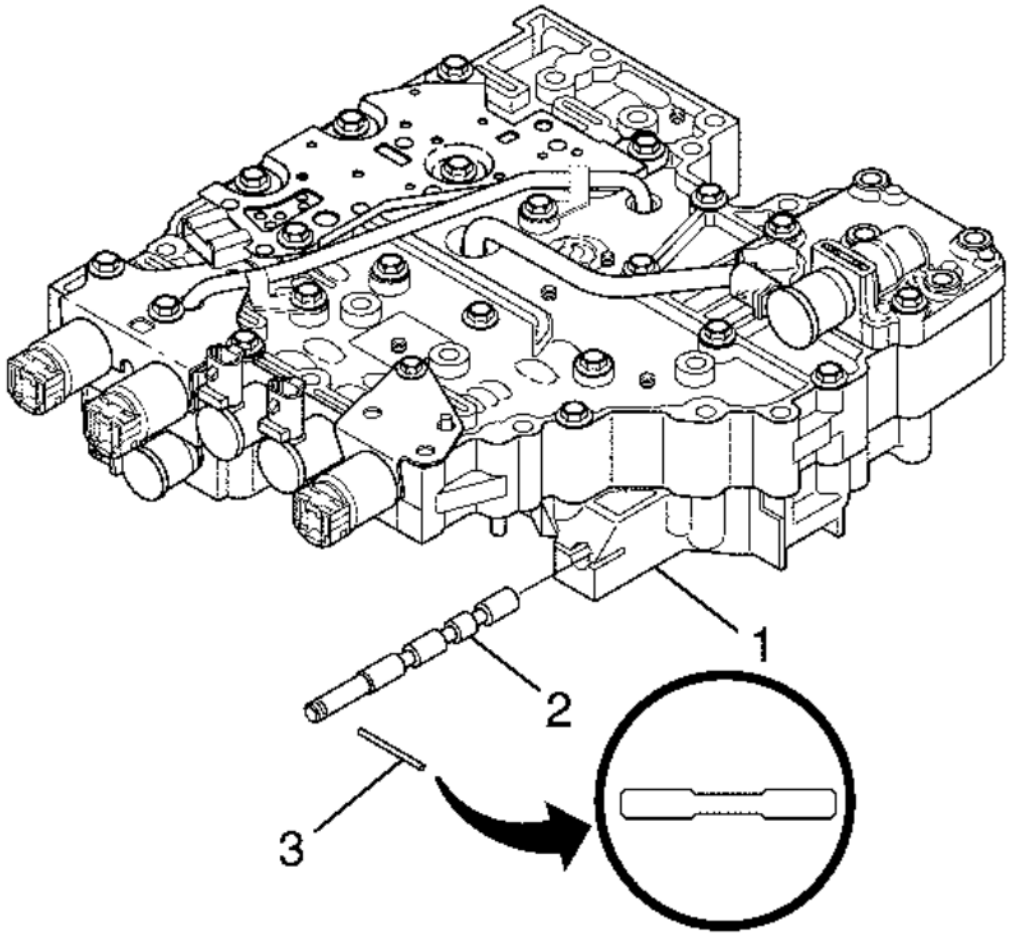


Fig. 482: Manual Valve And Pin
Courtesy of GENERAL MOTORS CORP.

3. Align the manual valve pin (3) with the manual selector valve (2).
4. Rotate the manual valve pin (3) until the pin can be installed into the manual selector valve.
5. Install the manual valve pin (3) into the manual selector valve (2).
6. Install the manual selector valve into shift valve body (1).

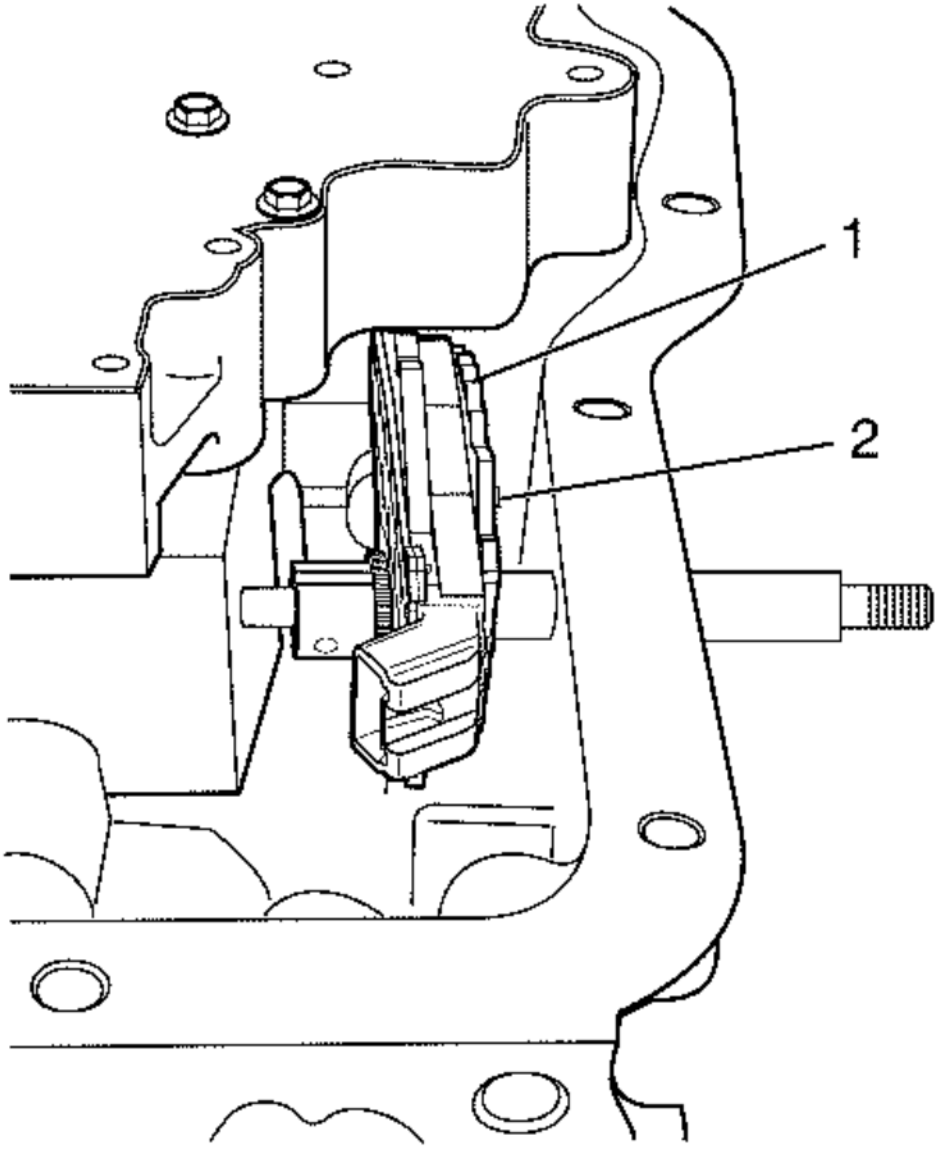


Fig. 483: Detent Lever/IMS Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not drop the manual valve when removing or installing the control valve assembly onto or from the transmission case.

7. Rotate the detent lever/internal mode switch (IMS) assembly to the fullest counter-clockwise position.
8. Align the control valve assembly with the transmission case while installing the manual valve pin (2) into the detent lever/IMS assembly (1).

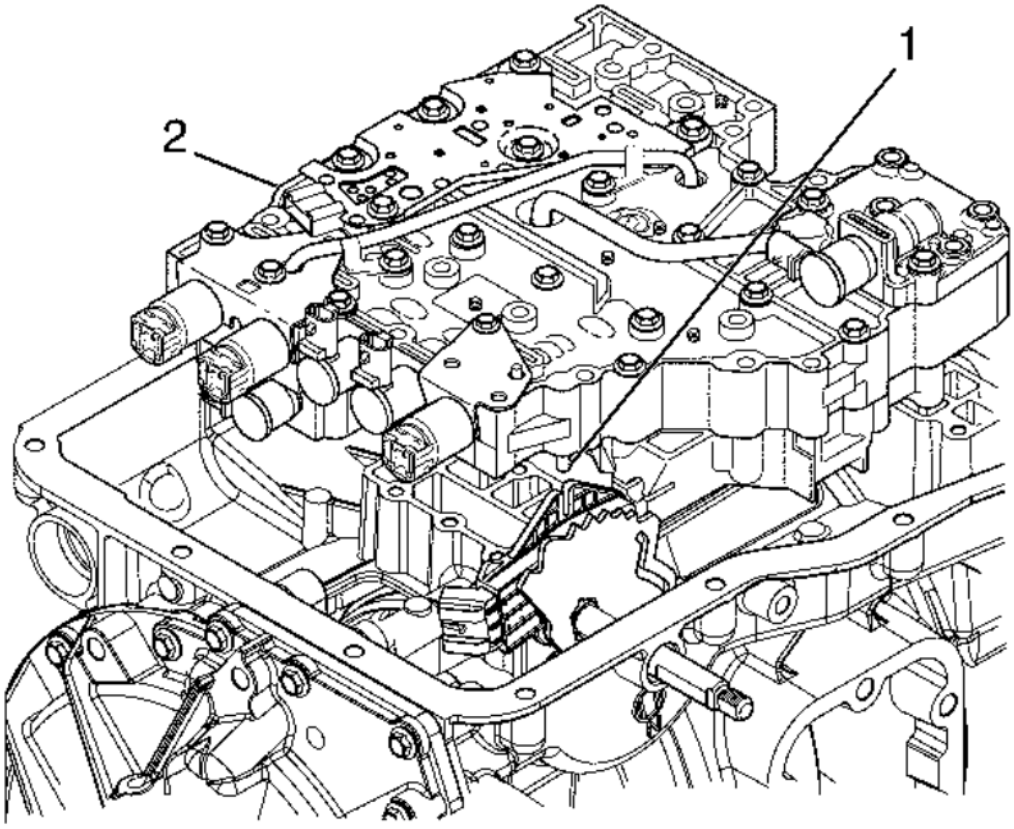


Fig. 484: Control Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

9. Align 2 control valve assembly locating pins (1) with the locating pin holes in the transmission case.
10. Install the control valve body assembly (2) onto the transmission case.

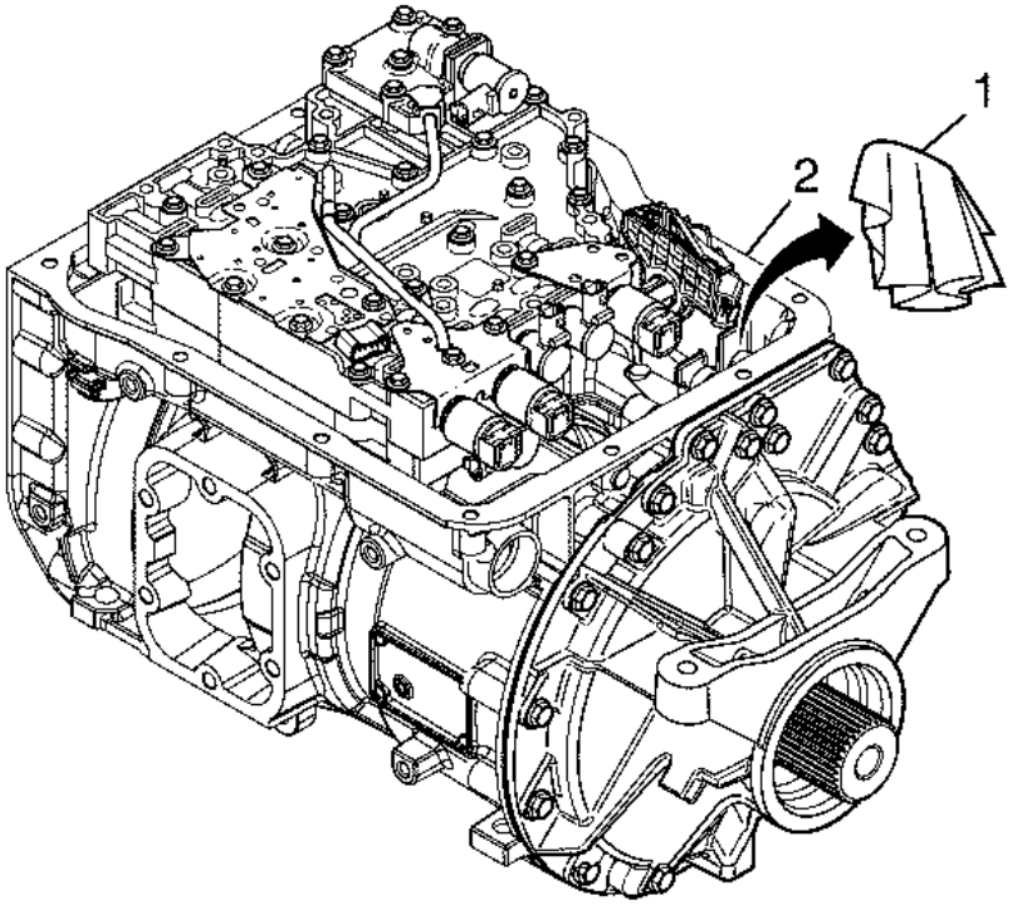


Fig. 485: Park Pawl Cam Guide Hole
Courtesy of GENERAL MOTORS CORP.

11. Remove the lint-free cloth (1) from the park pawl cam guide hole.

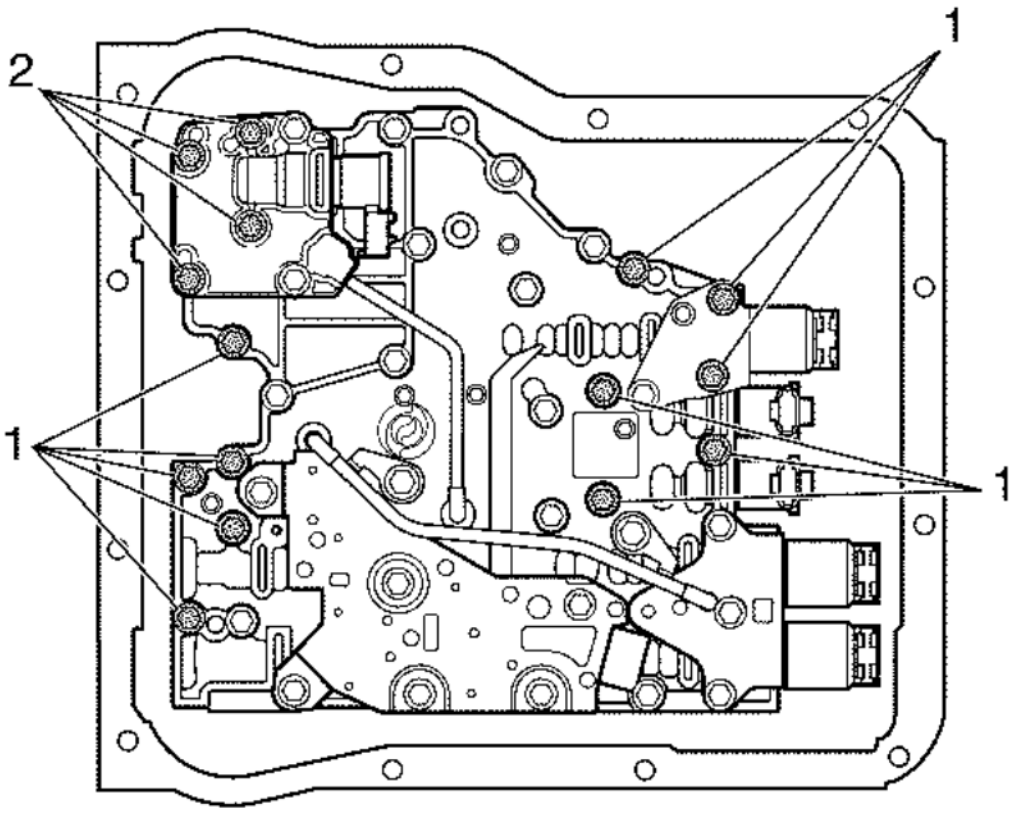


Fig. 486: Control Valve Assembly Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

12. Install 11 control valve assembly bolts (1) and 4 control valve assembly bolts (2).

    Tighten: Tighten the bolts to 12 N.m (108 lb in).

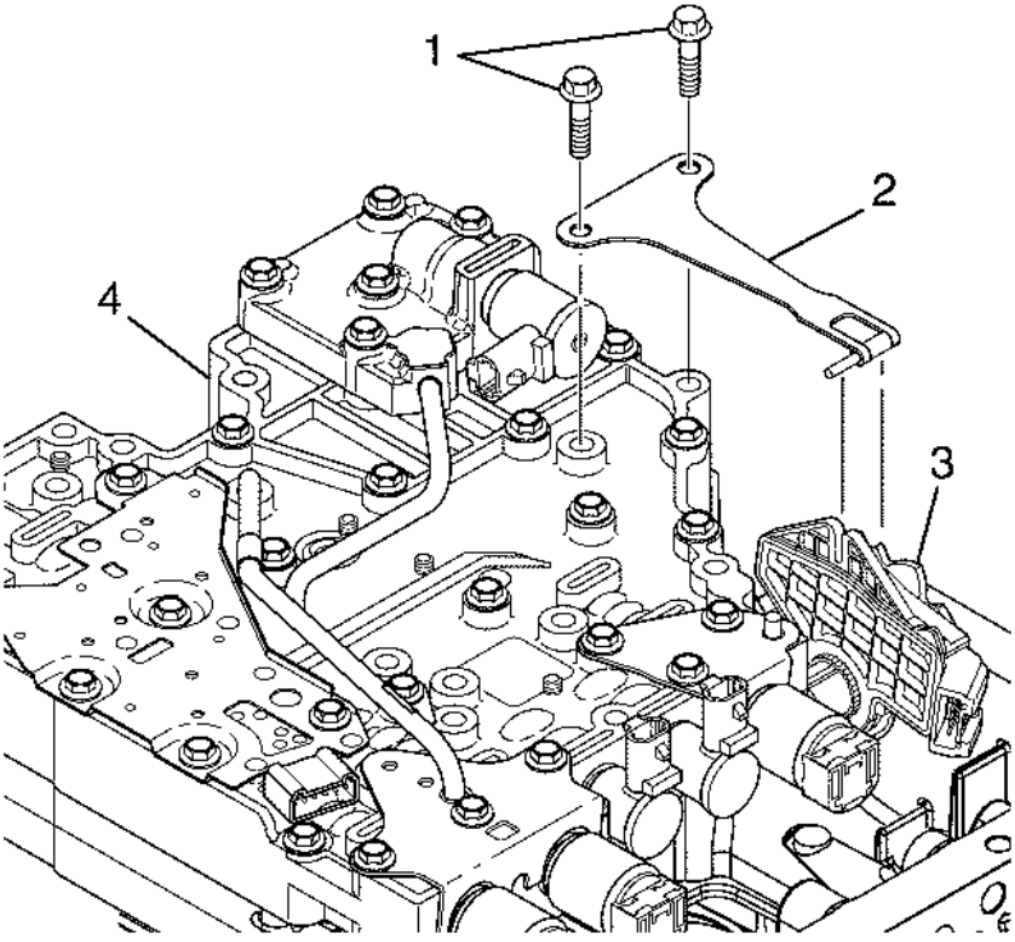


Fig. 487: Manual Shift Shaft Detent Spring
Courtesy of GENERAL MOTORS CORP.

13. Install the manual shift shaft detent spring (2) onto the main valve body (4).
14. Make sure the pin of the manual shift shaft detent spring (2) engages the slot of the IMS and the detent spring roller rests on the detent lever (3).
15. Install 2 manual shift shaft detent spring bolts (1).

Tighten: Tighten the bolts to 12 N.m (108 lb in).

WIRING HARNESS INSTALLATION

Tools Required

J 44247 Internal Wiring Harness Installer. See **Special Tools**.

Installation

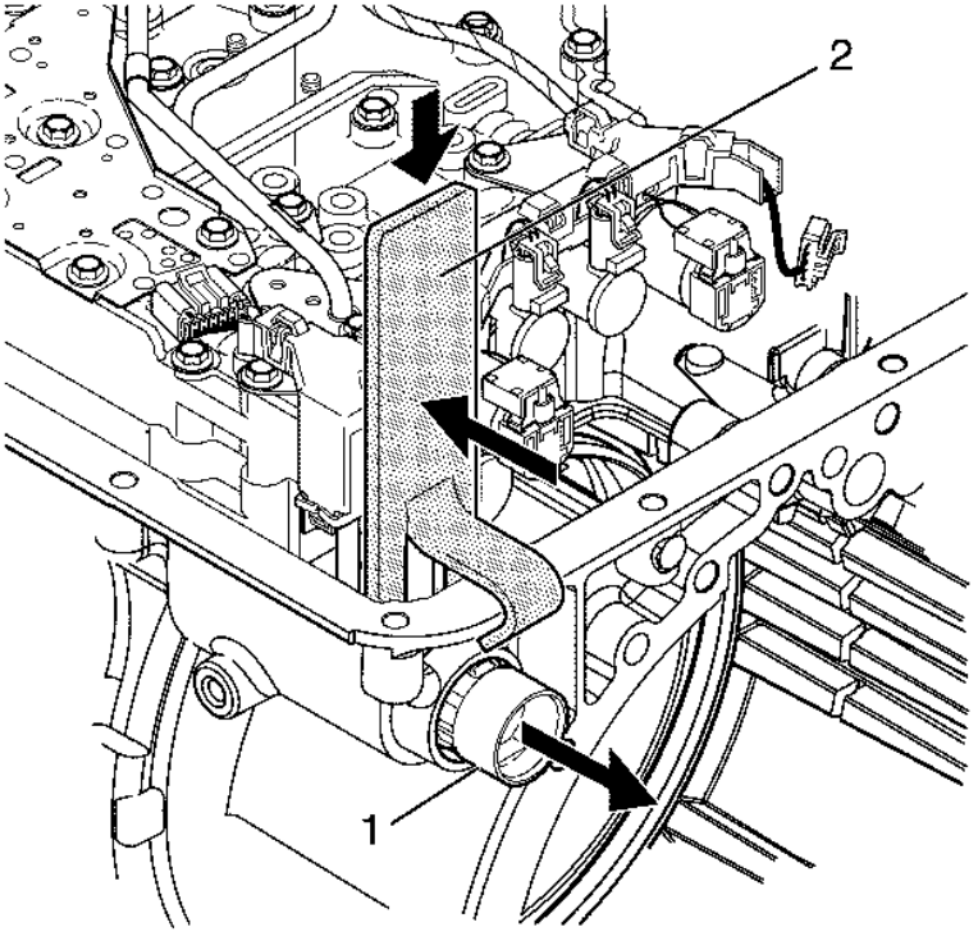


Fig. 488: Using J44247 To Install Internal Wiring Harness Connector
Courtesy of GENERAL MOTORS CORP.

1. Install the internal wiring harness connector by hand into the transmission case.
2. Using **J 44247** (2), install the connector of the internal wiring harness (1) into the transmission case. See **Special Tools**. The 4 tabs on the wiring harness connector should

snap into place.

3. Make sure the wiring harness connector is securely in place.

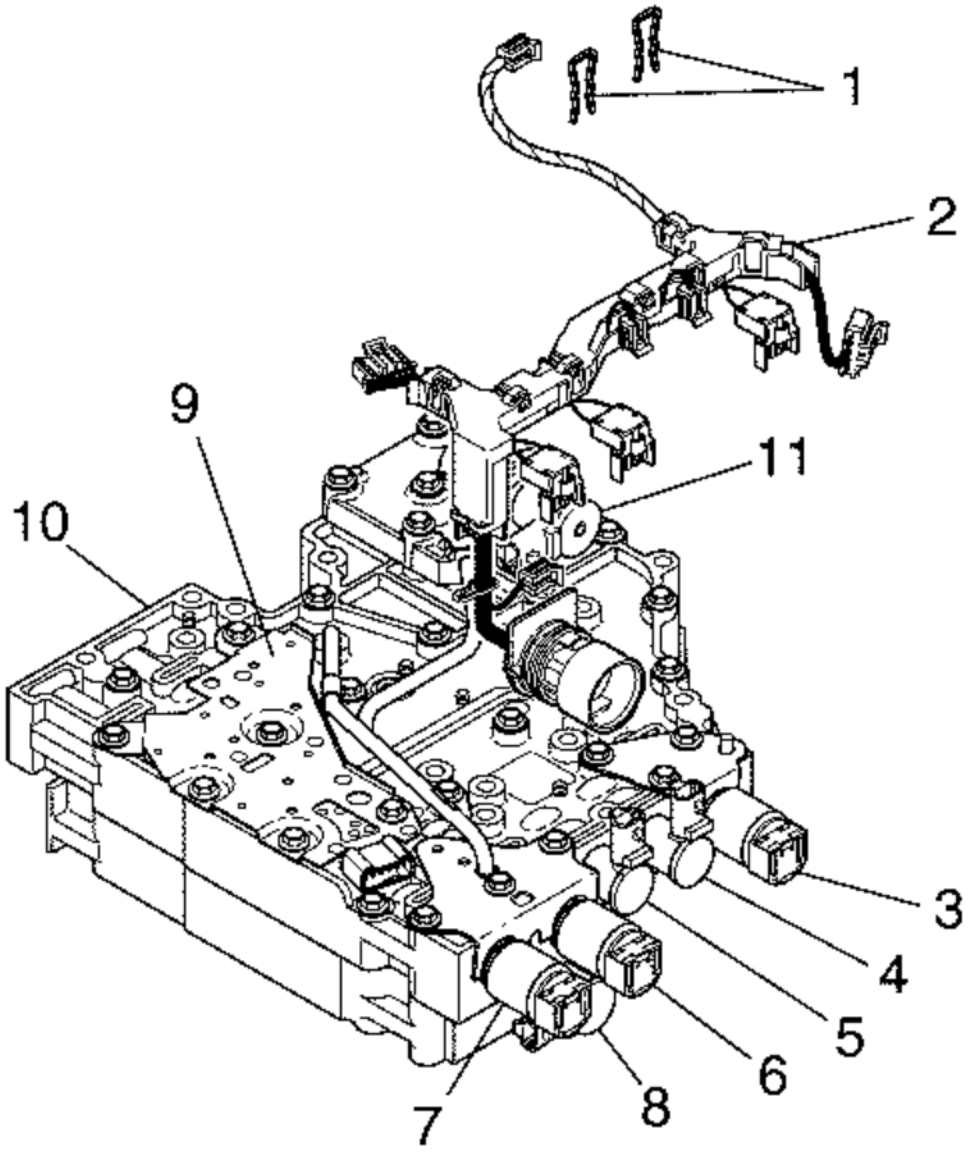


Fig. 489: Identifying Main valve Body Solenoids, Switches & Harness
Courtesy of GENERAL MOTORS CORP.

4. Remove the shift solenoid retainers (1) from shift solenoid 2 (SS2) (4) and SS3 (5).
5. Install the internal wiring harness (2) onto the main valve body (10).
6. Install the shift solenoid retainers (1) over the wiring harness tabs.
7. Connect internal wiring harness (2) to the following components:
    - Transmission fluid pressure (TFP) switch (9)
    - Transmission internal mode switch (IMS)
    - SS1 (8)
    - Torque converter clutch pressure control solenoid (TCC PCS) (3)
    - SS2 (4)
    - SS3 (5)
    - PCS2 (6)
    - PCS1 (7)
    - Modulated main pressure (MAIN MOD) solenoid (11)

TRANSMISSION FLUID PAN AND FILTER ASSEMBLY INSTALLATION

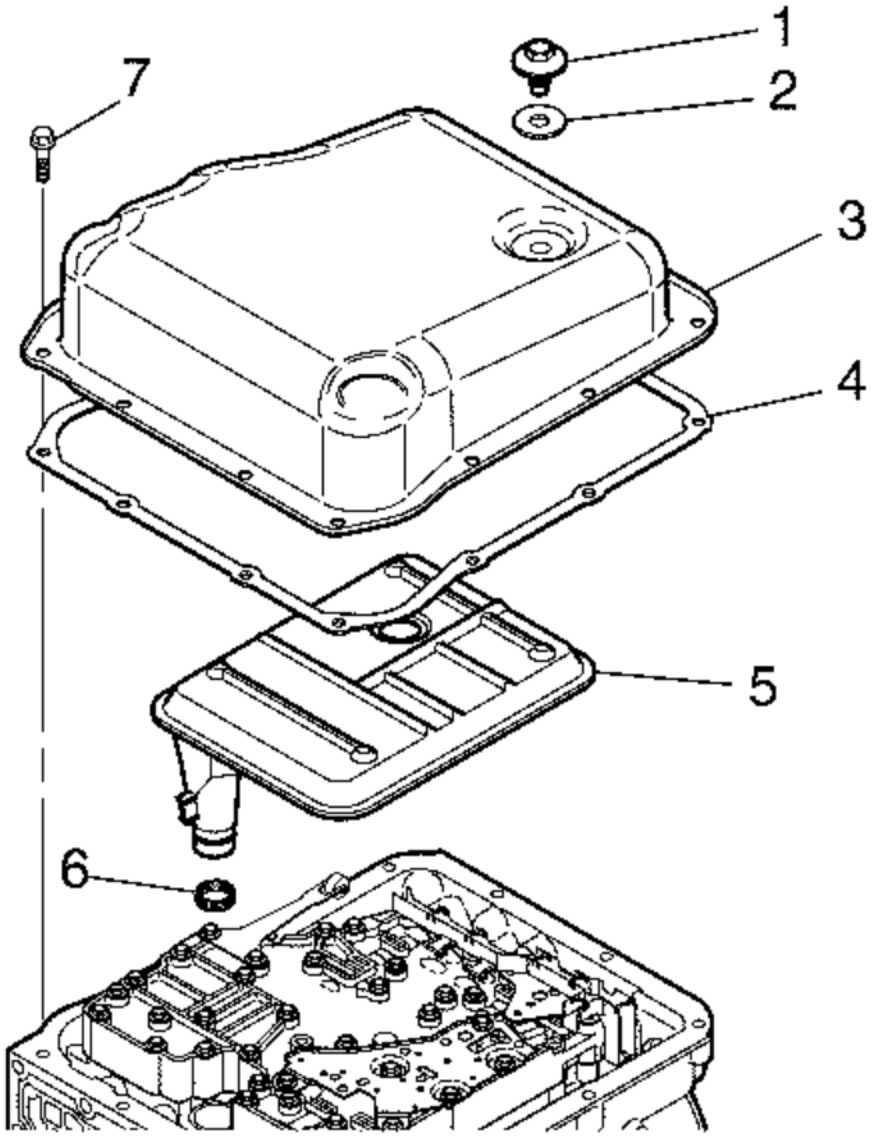


Fig. 490: Identifying Pan And Filter Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission internal oil filter seal (6) onto the transmission internal oil filter (5).
2. Align the neck of the transmission internal oil filter (5) with the filter hole in the transmission case.

3. Install the transmission internal oil filter (5).
4. Make sure the filter is seated.
5. Install a new oil pan gasket (4) onto the transmission case.
6. Install the oil pan (3) onto the transmission case.

NOTE: Refer to Fastener Notice .

7. Install 12 oil pan bolts (7).

   Tighten: Tighten the bolts to 27 N.m (20 lb ft).

8. Install the drain plug seal (2) onto the drain plug (1).

NOTE: Refer to Component Fastener Tightening Notice .

9. Install the drain plug (1).

   Tighten: Tighten the plug to 35 N.m (26 lb ft).

1-2-3-4-5-6 CLUTCH PISTON HOUSING ASSEMBLY INSTALLATION

Tools Required

- **J 36850** Transjel® Lubricant. See **Special Tools**.
- **J 44587** Main Shaft Holder. See **Special Tools**.

Installation

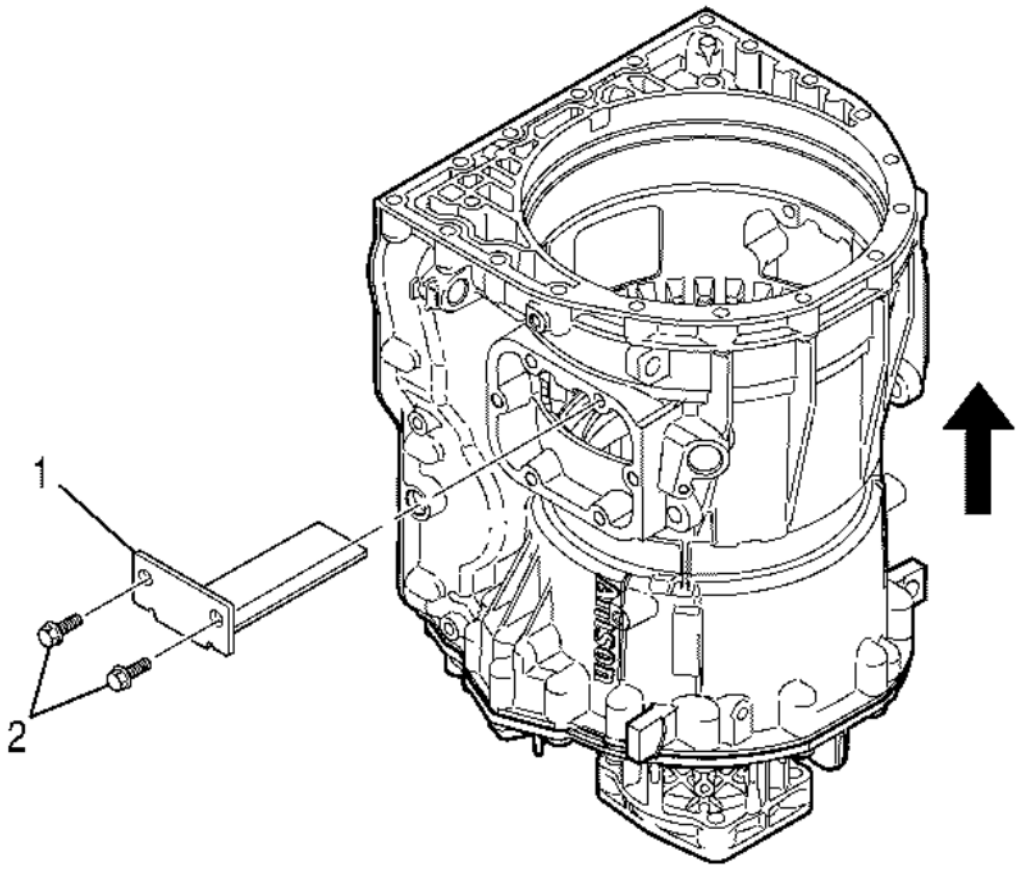


Fig. 491: View Of Main Shaft Holder & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the transmission case so that the front of the case is facing up.
2. Remove 2 bolts (2) from **J 44587** (1). See **Special Tools**.
3. Remove **J 44587** from the power take-off (PTO) access. See **Special Tools**.

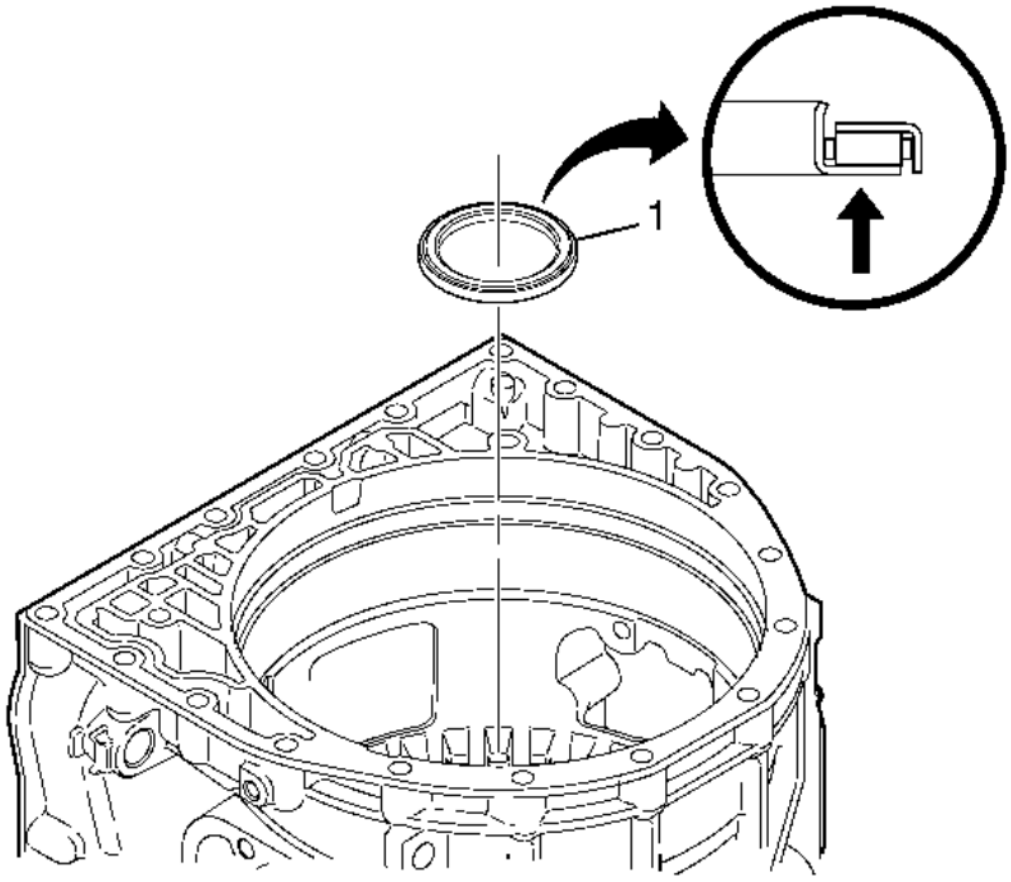


Fig. 492: Locating Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

4. Apply **J 36850** or equivalent lubricant to the thrust bearing assembly (1). See **Special Tools**.

NOTE: Installing the thrust bearing incorrectly may cause permanent damage to the transmission.

5. Align the thrust bearing (1) so that the blue stripe on the thrust bearing is facing towards the input carrier assembly.
6. Install the thrust bearing (1) into the input carrier assembly.

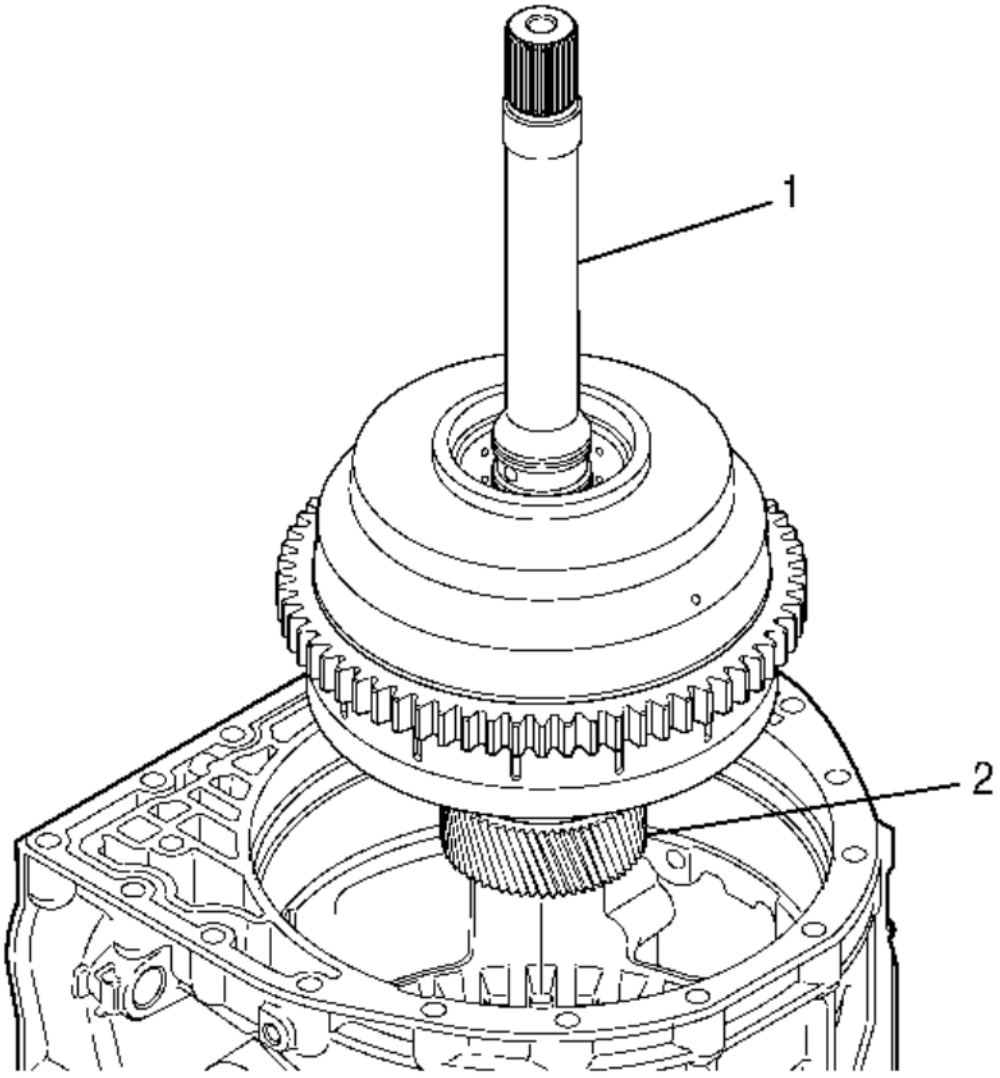


Fig. 493: Identifying 1-2-3-4, 4-5-6 Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

7. Install the 1-2-3-4, 4-5-6 clutch assembly (1).
8. Rotate the clutch assembly until the assembly seats.
9. Make sure one of the following is visible through the turbine speed sensor hole in the transmission case:

- The teeth of the PTO gear
- The teeth of the turbine tone wheel

TORQUE CONVERTER HOUSING WITH FLUID PUMP ASSEMBLY INSTALLATION

Tools Required

- **J 36850** Transjel® Lubricant. See **Special Tools**.
- **J 45023** Control Main Filter Wrench. See **Special Tools**.

Installation

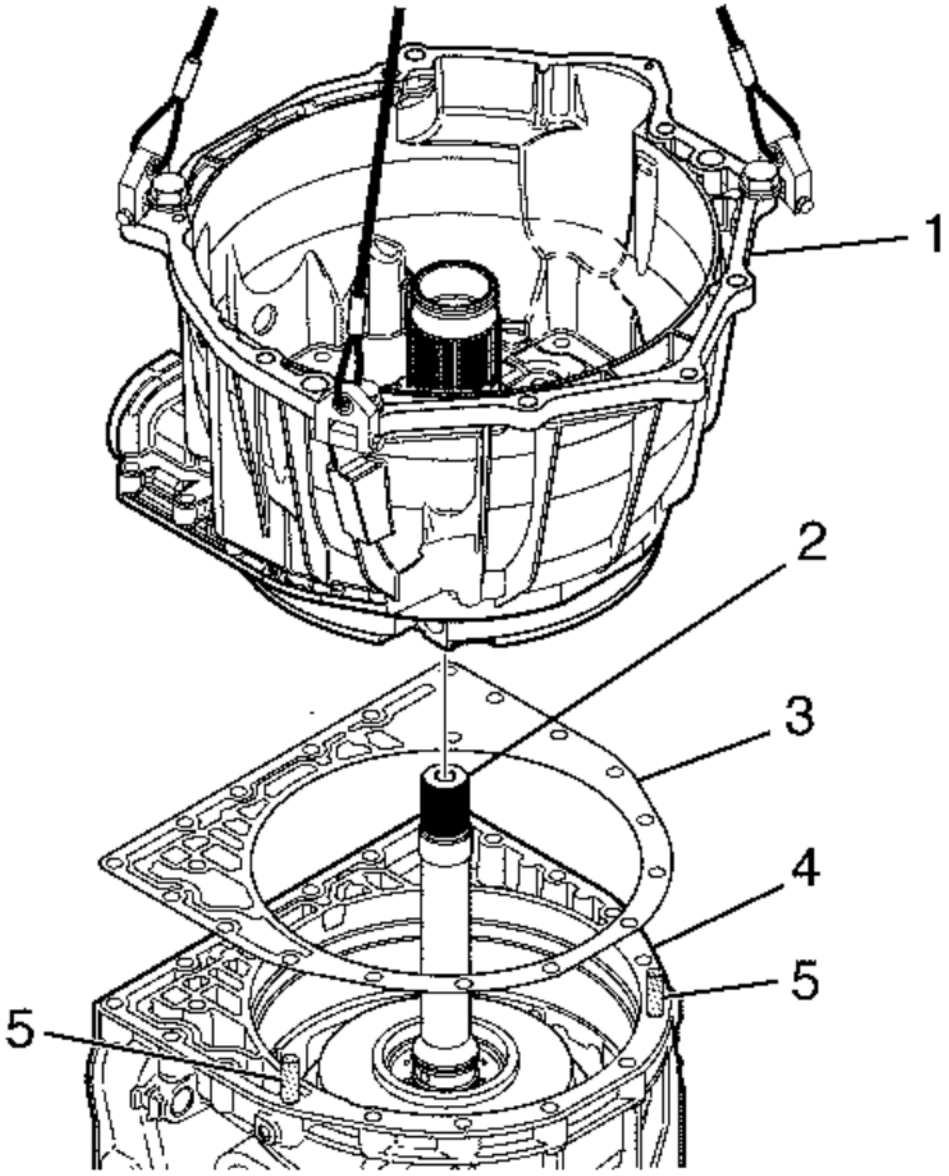


Fig. 494: View Of Torque Converter Housing with Fluid Pump Assembly
Courtesy of GENERAL MOTORS CORP.

CAUTION: The torque converter housing/oil pump cover assembly dry weights are approximately 27 kg (60 lb). To help avoid

personal injury and/or property damage:

- **Use caution when installing, removing, or moving the converter housing/oil pump cover assembly.**
- **Get help when lifting the converter housing/oil pump cover assembly.**
- **Assistance from a hoist or another person may be required.**
- **Make sure lifting equipment can properly support the converter housing/oil pump cover assembly.**

1. Install 2 M10 x 1.5 guide bolts (5) into the transmission case (4).
2. Install a new torque converter housing to case gasket (3) onto the transmission case.
3. Attach a sling to the converter housing (1).
4. Attach a hoist to the sling.
5. Align the converter housing (1) with the guide bolts (5).
6. Apply **J 36850** or equivalent lubrication to the 3 seal rings on the rear of the oil pump cover assembly. See **Special Tools**.
7. Lower the converter housing/oil pump cover assembly (1) over the turbine shaft (2) and onto the transmission case (4).

NOTE: **Transmission damage may occur if the torque converter housing is forced into position. If tapping does not cause the torque converter housing to drop into place, then one or more of the following components may be misaligned:**

- **Output sun gear**
- **Output sun gear spacer**
- **Seal ring**

8. Tap the converter housing until the converter housing seats on the transmission case.
9. Remove the sling.
10. Remove 2 guide bolts (5) from the transmission case.

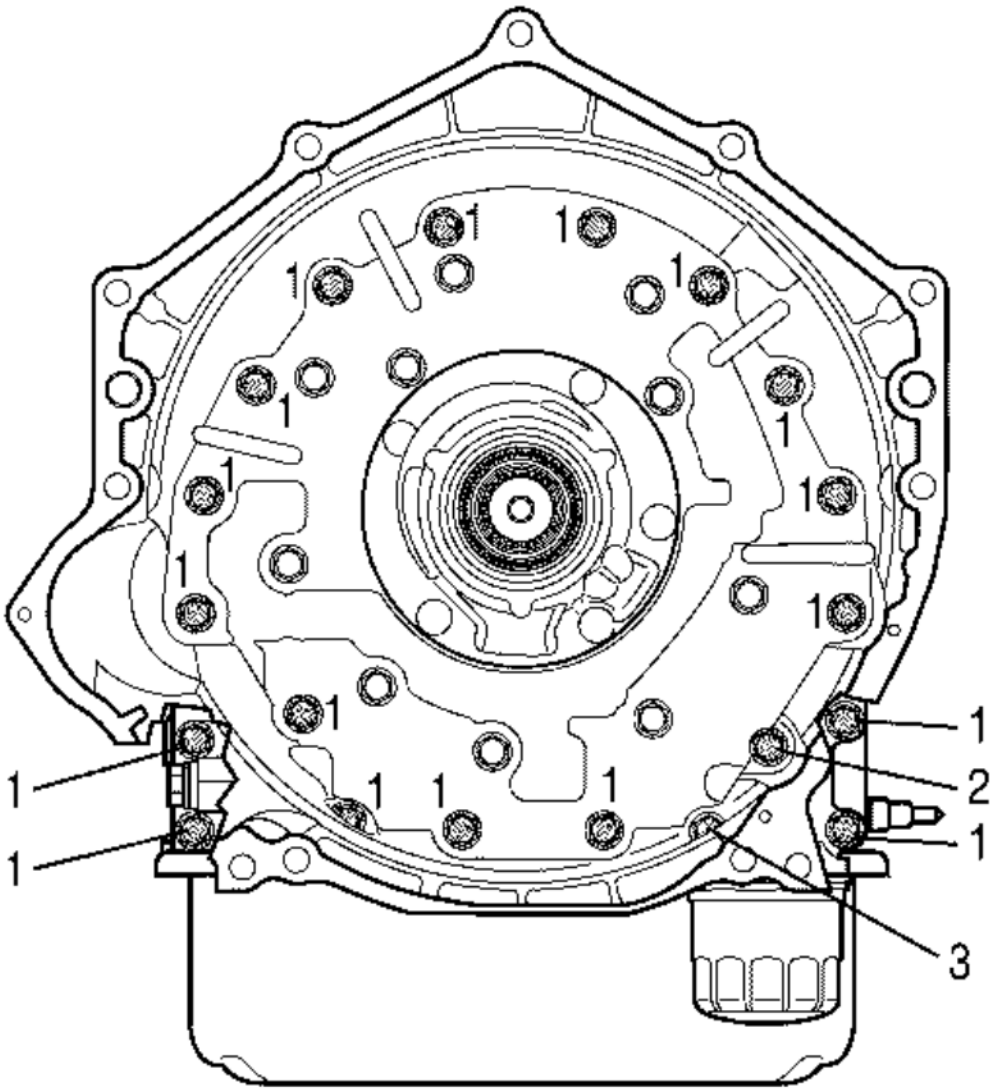


Fig. 495: Locating Transmission Case Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Converter Housing/Low and Reverse Clutch Housing Bolt Size Notice .

11. Install 18 bolts (1).

12. Install 1 bolt (2).

NOTE: Refer to Fastener Notice .

13. Install 1 bolt (3).

Tighten: Tighten bolts (1, 2, 3) to 56 N.m (42 lb ft).

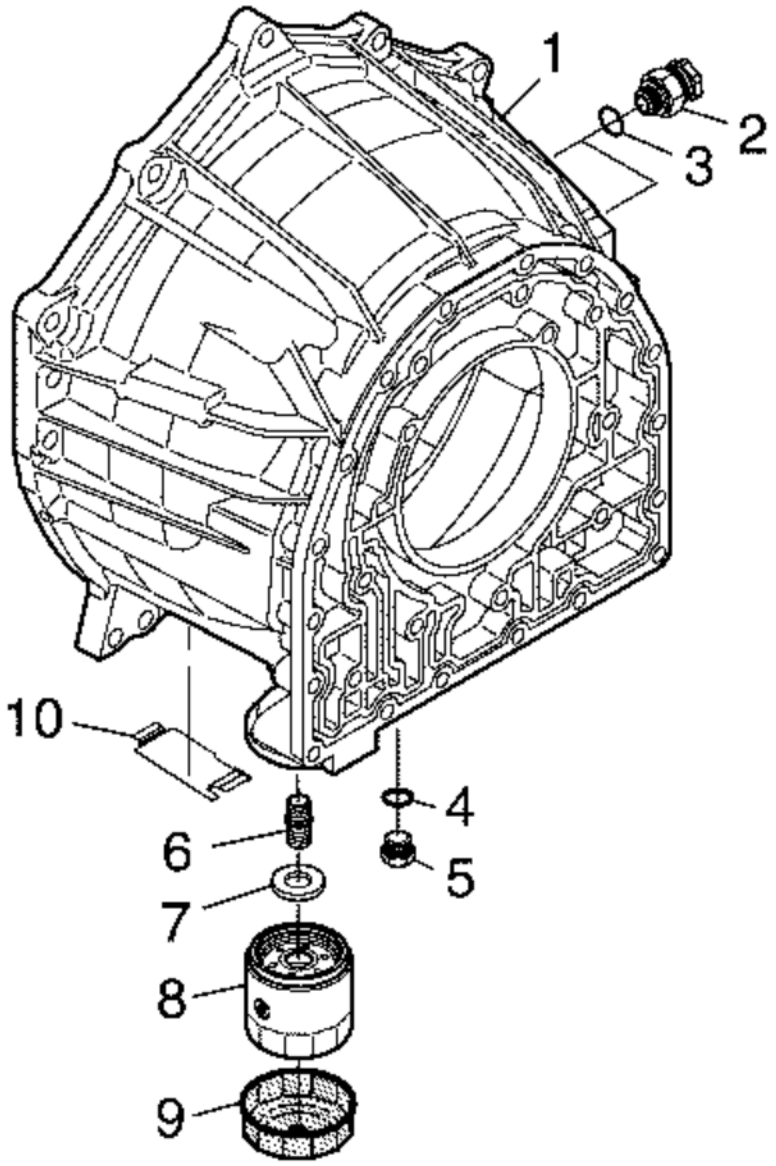


Fig. 496: Identifying Converter Housing Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Install the short-threaded end of the transmission external oil filter adapter into the converter housing. If the long-threaded

end of the filter adapter is installed, the threads of the converter housing will be damaged.

NOTE: Refer to Component Fastener Tightening Notice .

14. Install the short-threaded end of the transmission external oil filter adapter (6) into the converter housing by hand.

    Tighten: Tighten the adapter to 30 N.m (22 lb ft.)

15. Install the magnet (7) onto the transmission external oil filter adapter.
16. Lubricate the gasket on the transmission external oil filter (8) with transmission fluid.

NOTE: Turning the transmission external oil filter more than ONE FULL TURN after gasket contact will damage the filter.

17. Install the transmission external oil filter by hand until the gasket on the filter touches the converter housing.
18. Using **J 45023** (9) or by hand, turn the filter ONE FULL TURN ONLY. See **Special Tools**.
19. Install the line pressure test hole plug O-ring (4) onto the line pressure test hole plug (5).
20. Install the plug.

    Tighten: Tighten the plug to 12 N.m (108 lb in).

21. Install the torque converter housing access hole cover (10).
22. If present, install the O-rings (3) onto the transmission oil cooler pipe connectors (2).
23. Install 2 transmission oil cooler pipe connectors (2).

    Tighten: Tighten the connectors to 25 N.m (19 lb ft).

TWO-WHEEL-DRIVE LOW AND REVERSE CLUTCH HOUSING SPACER MEASUREMENT

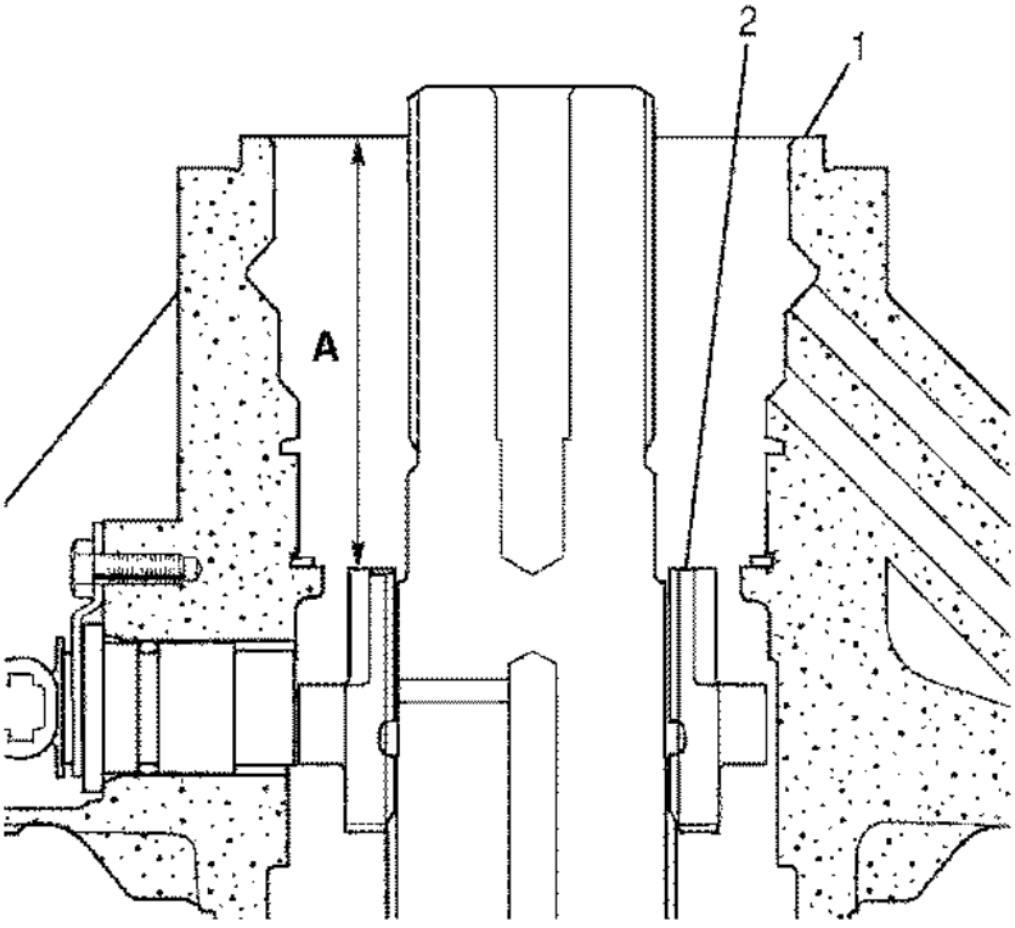


Fig. 497: Dimension A
Courtesy of GENERAL MOTORS CORP.

1. Position the transmission case so that the rear of the case is facing up.
2. At dimension A, measure the distance from the rear face of the low and reverse clutch housing (1) to the rear face of output speed sensor (OSS) reluctor wheel (2).

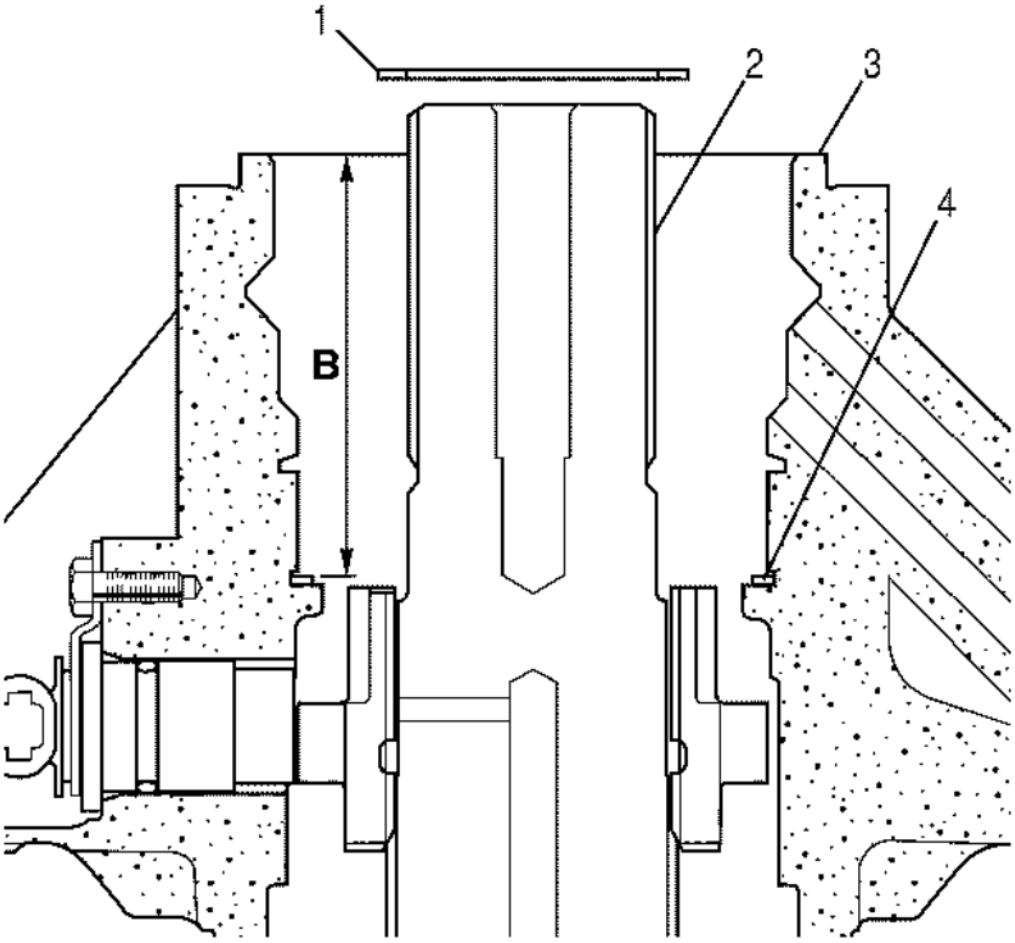


Fig. 498: Dimension B
Courtesy of GENERAL MOTORS CORP.

3. At dimension B, measure the distance from the rear face of the low and reverse clutch housing (3) to the rear face of the retaining ring (4).
4. Calculate Dimension C by subtracting Dimension B from Dimension A.
5. Select the appropriate selective spacer (1) based upon Dimension C. Refer to **Selective Components Specifications** .
6. Install the selective spacer (1) onto the output shaft (2).

FOUR-WHEEL-DRIVE LOW AND REVERSE CLUTCH HOUSING SPACER MEASUREMENT

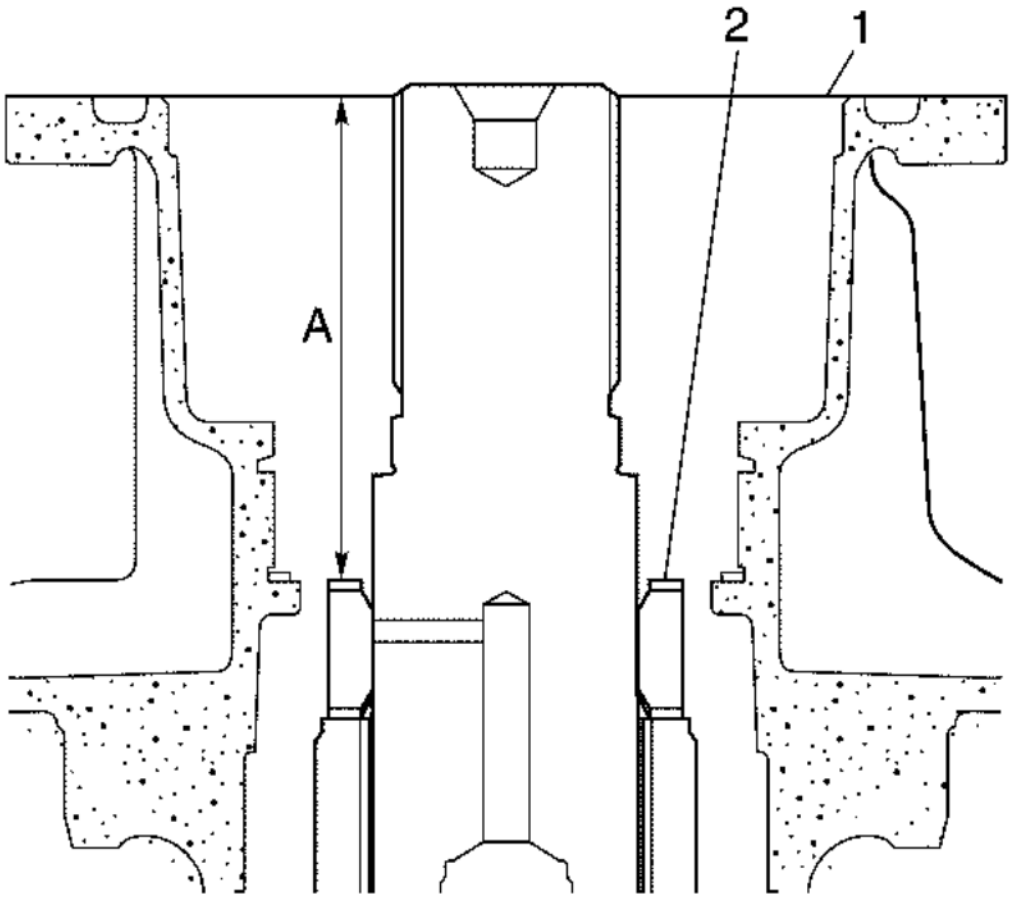


Fig. 499: Identifying Selective Spacer Dimension A - 4WD
Courtesy of GENERAL MOTORS CORP.

1. Position the transmission case so that the rear of the case is facing up.
2. At dimension A, measure the distance from the rear face of the low and reverse clutch housing (1) to the rear face of the bearing spacer (2).

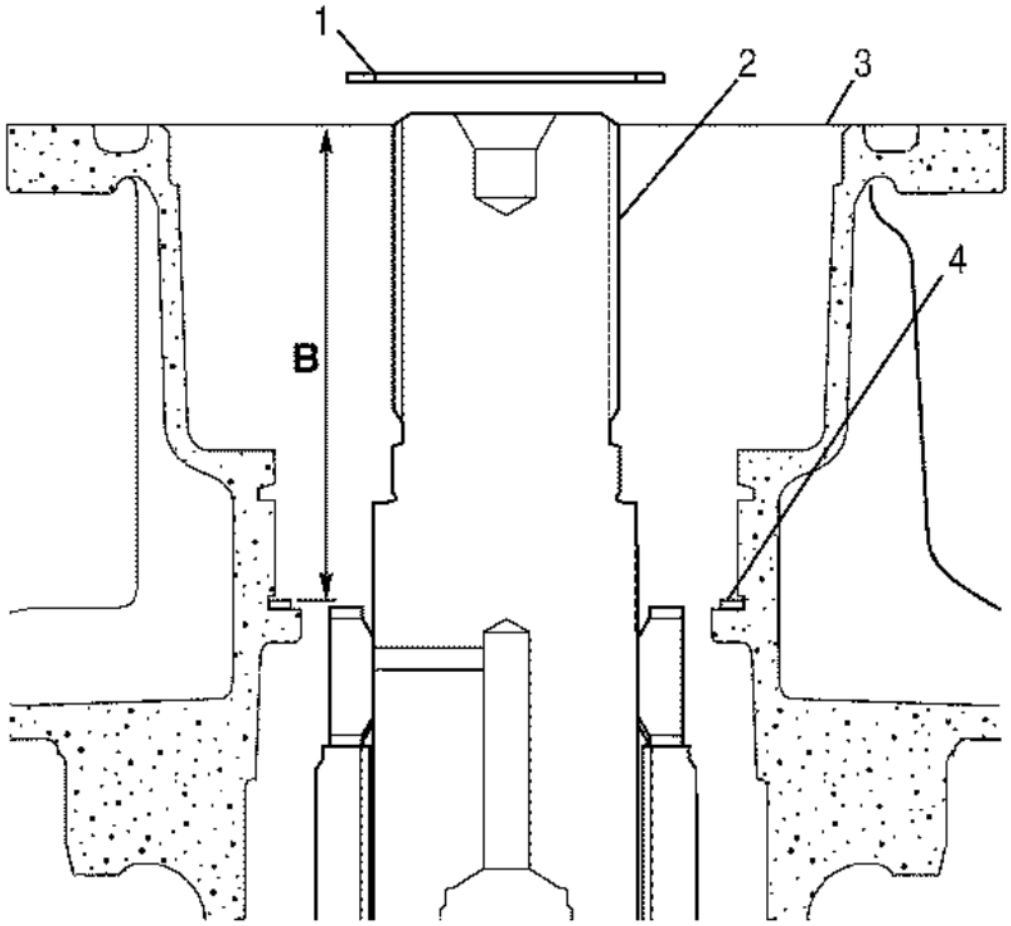


Fig. 500: Identifying Selective Spacer Dimension B - 4WD
Courtesy of GENERAL MOTORS CORP.

3. At dimension B, measure the distance from the rear face of the low and reverse clutch housing (3) to the rear face of the retaining ring (4).
4. Calculate Dimension C by subtracting Dimension B from Dimension A.
5. Select the appropriate selective spacer (1) based upon Dimension C. Refer to **Selective Components Specifications** .
6. Install the selective spacer (1) onto the output shaft (2).

TRANSMISSION END PLAY MEASUREMENT

Tools Required

- **J 24446** Rear Bearing Installer. See **Special Tools**.
- **J 5959** Dial Indicator Set. See **Special Tools**.

Measurement

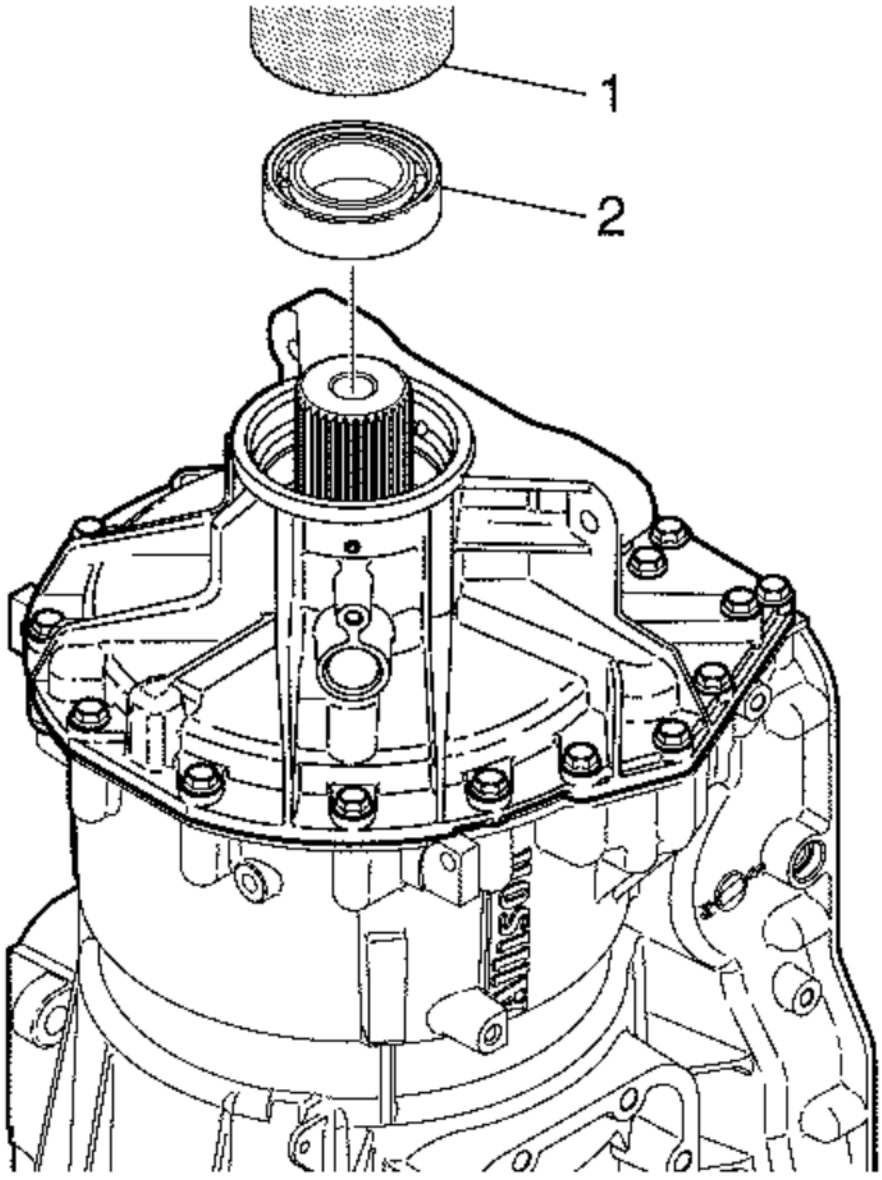


Fig. 501: Identifying Rear Bearing
Courtesy of GENERAL MOTORS CORP.

1. Using **J 24446** (1), install the ball bearing (2) until the bearing seats. See **Special Tools**.

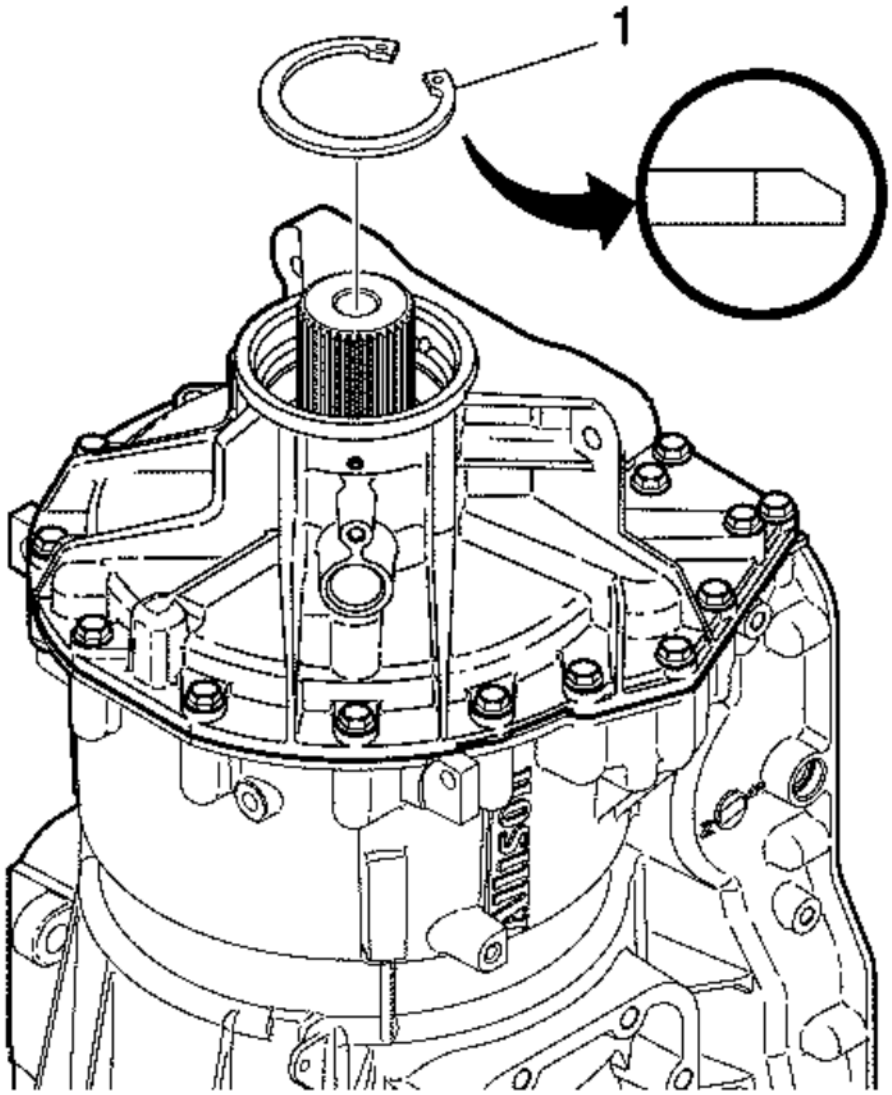


Fig. 502: Locating Transmission Retaining Ring
Courtesy of GENERAL MOTORS CORP.

2. Align the retaining ring (1) so that the beveled edge is facing up.
3. Install the retaining ring (1).

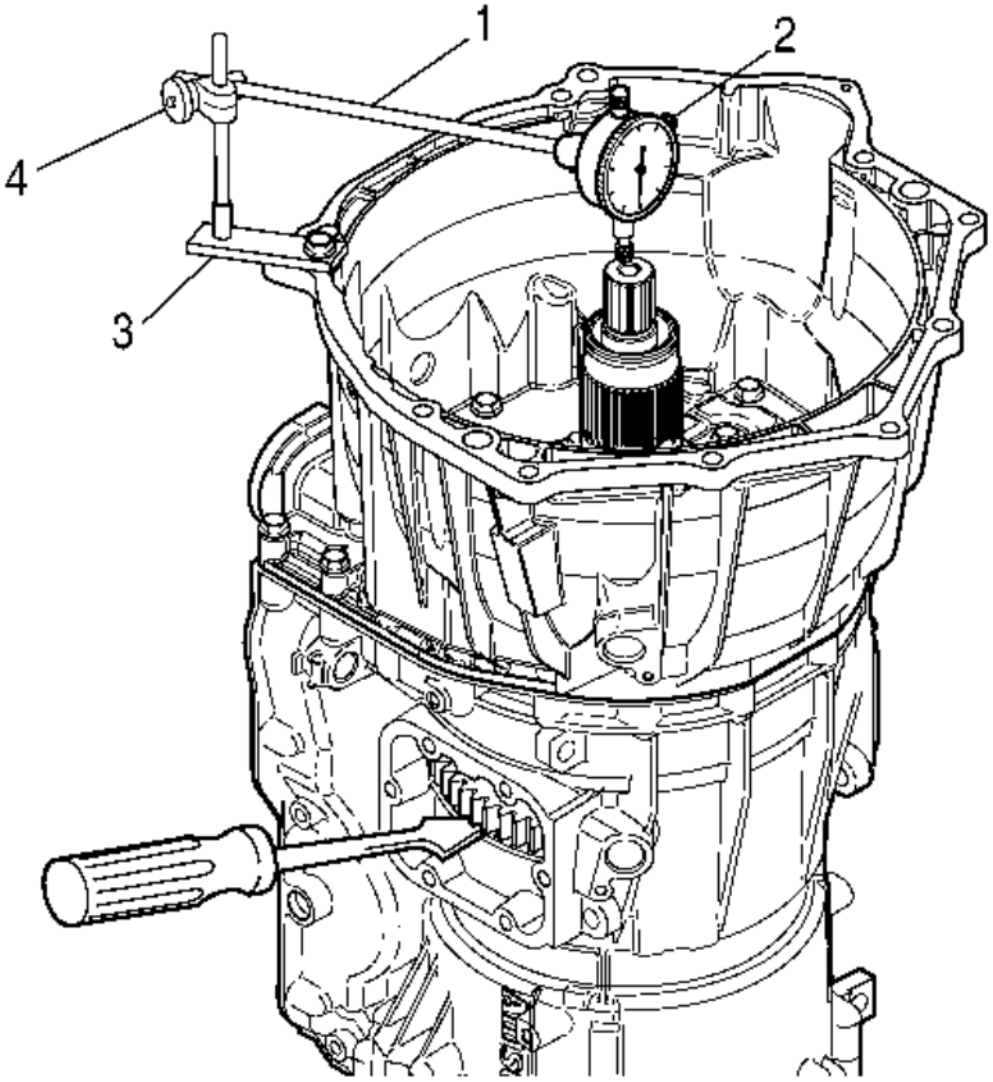


Fig. 503: View Of Dial Indicator Set On Transmission Case
Courtesy of GENERAL MOTORS CORP.

4. Position the transmission case so that the front is facing up.
5. Assemble the following tools and install them onto the torque converter housing as shown.
   - J 5959-3 extension (1)
   - J 5959-1 dial indicator (2)

- J 5959-2 base (3)
- J 5959-7 clamp (4)

6. Zero the dial indicator (2).
7. Lift the rear of the 1-2-3-4, 4-5-6 clutch housing with a screwdriver through the power take-off (PTO) hole in the transmission case.
8. Note the end play measured on the dial indicator.

   Specification: The transmission end play must be 0.279-1.549 mm (0.011-0.061 in).

9. If the end play is not within the specification, a different selective spacer must be installed.
10. Remove the special tools from the transmission.
11. Remove the retaining ring and the ball bearing assembly.
12. Repeat the measurement and calculation to determine the correct selective spacer.

TORQUE CONVERTER ASSEMBLY INSTALLATION

Tools Required

- **J 46409** Torque Converter Lifting Handles. See **Special Tools**.
- **J 21366** Torque Converter Retaining Strap

Installation

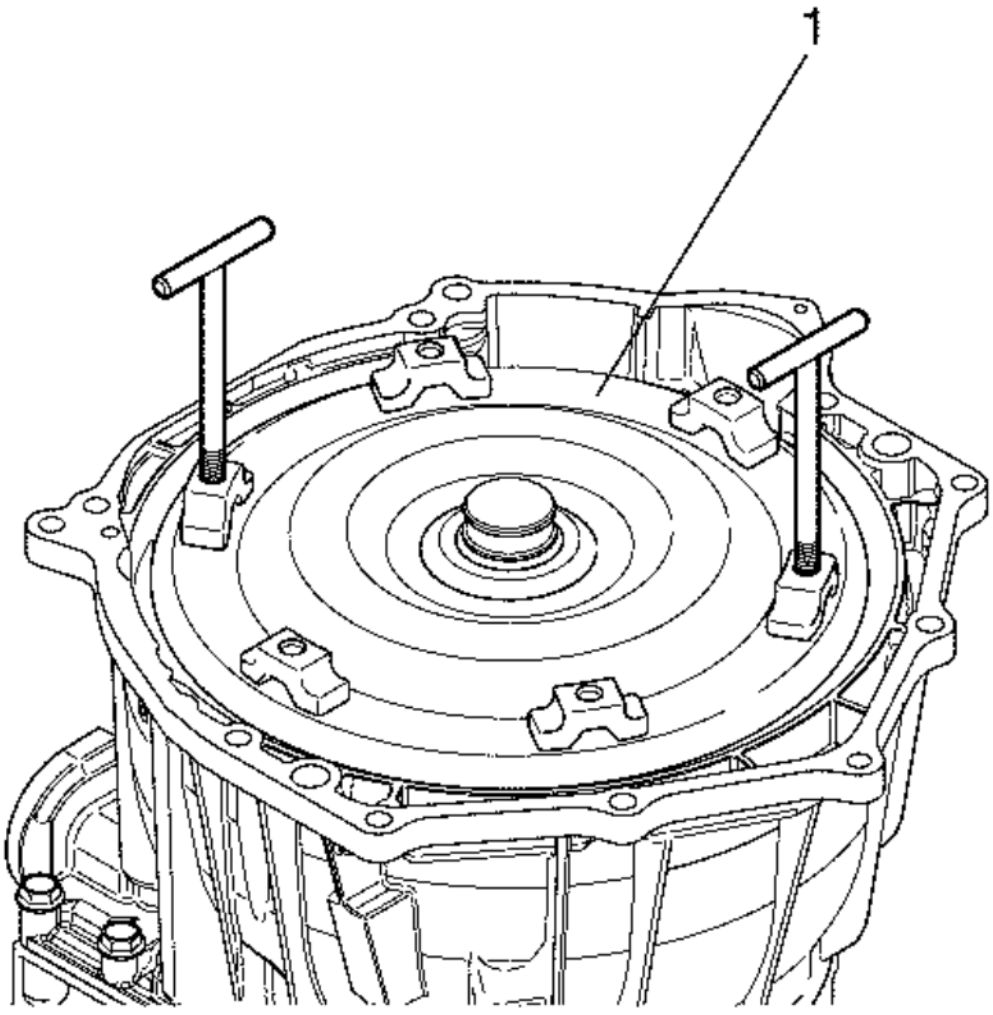


Fig. 504: Installing J 46409 Into Torque Converter Lugs
Courtesy of GENERAL MOTORS CORP.

CAUTION: The torque converter dry weight is approximately 29 kg (63 lb). To help avoid personal injury and/or property damage:

- **Use caution when installing, removing, or moving the torque converter.**

- **Get help when lifting the torque converter. Assistance from a hoist or another person is required.**
- **Make sure J 46409 T-handles are installed securely and that any lifting equipment used can properly support the torque converter.**

1. If not installed, install **J 46409** , positioned 180 degrees apart, into 2 threaded bosses on the torque converter (1). See **Special Tools**.
2. Raise the torque converter (1) over the torque converter housing.
3. Lower the torque converter (1) over the turbine shaft and the stator shaft and into the oil pump assembly.
4. Make sure the torque converter is seated in the oil pump assembly.
5. Remove the **J 46409** . See **Special Tools**.

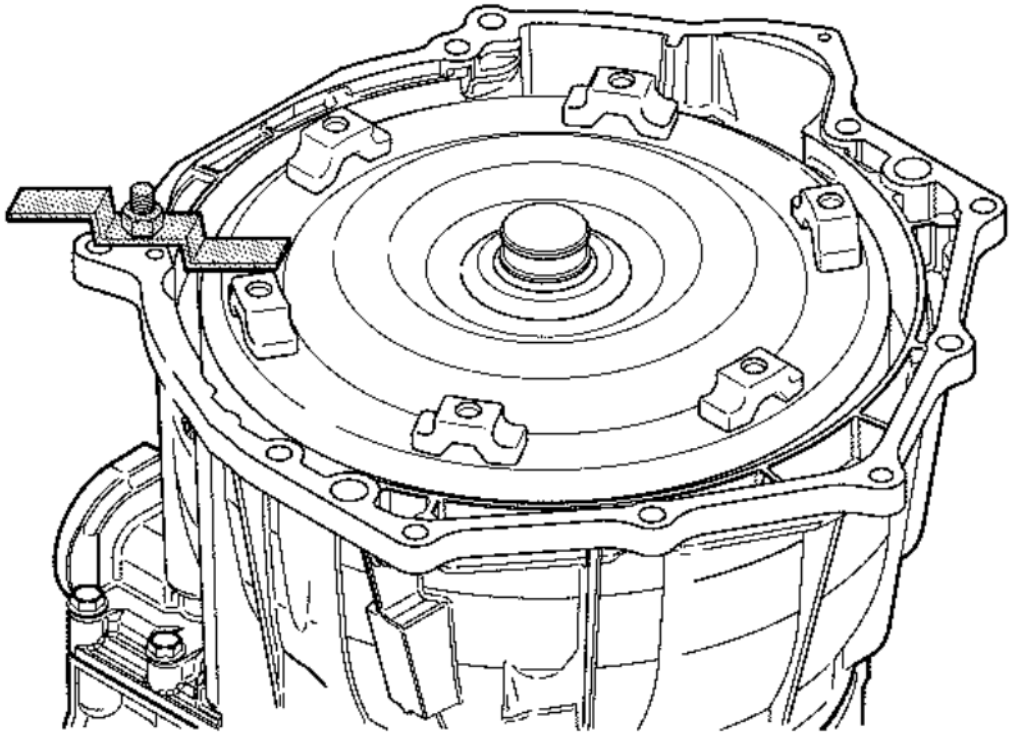


Fig. 505: Torque Converter Restraining Device
Courtesy of GENERAL MOTORS CORP.

CAUTION: The torque converter must be held to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage.

IMPORTANT: The torque converter may not be seated if the J 21366 retaining device cannot be installed.

6. Install the **J 21366** to retain the torque converter to the transmission.

REAR OIL SEAL INSTALLATION (2WD)

Tools Required

J 43782 Rear Seal Installer. See **Special Tools**.

Installation

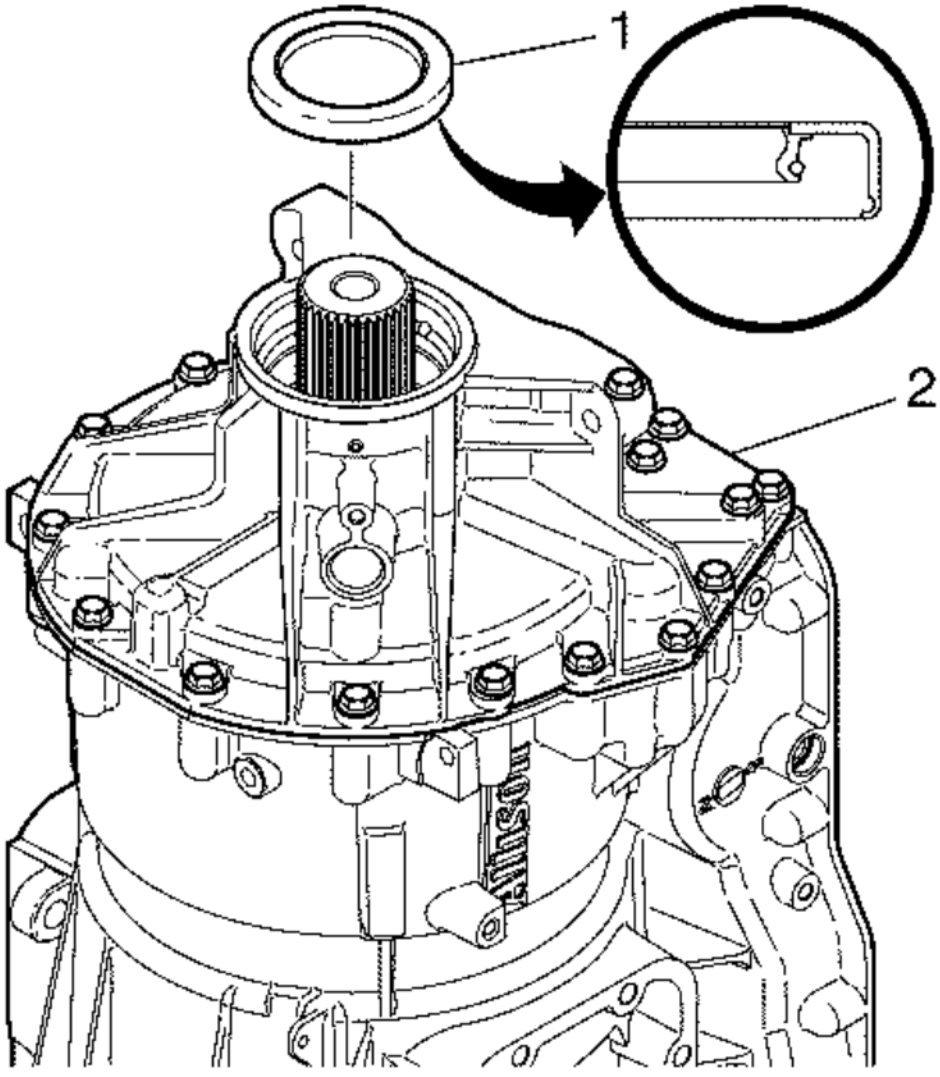


Fig. 506: View Of Prop Shaft Front Slip Yoke Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Using **J 43782** install the prop shaft front slip yoke oil seal (1). See **Special Tools**.
2. Make sure the oil seal is installed to the correct depth below the rear face of the low and reverse clutch housing, 2WD (2).

Specification: The rear seal installed depth is 4.55-5.35 mm (0.179-0.211 in) below the rear face of the low and reverse clutch housing, 2WD.

FOUR-WHEEL-DRIVE OUTPUT SHAFT RETAINING NUT INSTALLATION

Tools Required

J 43769 Spanner Nut Wrench - 4WD. See **Special Tools**.

Installation

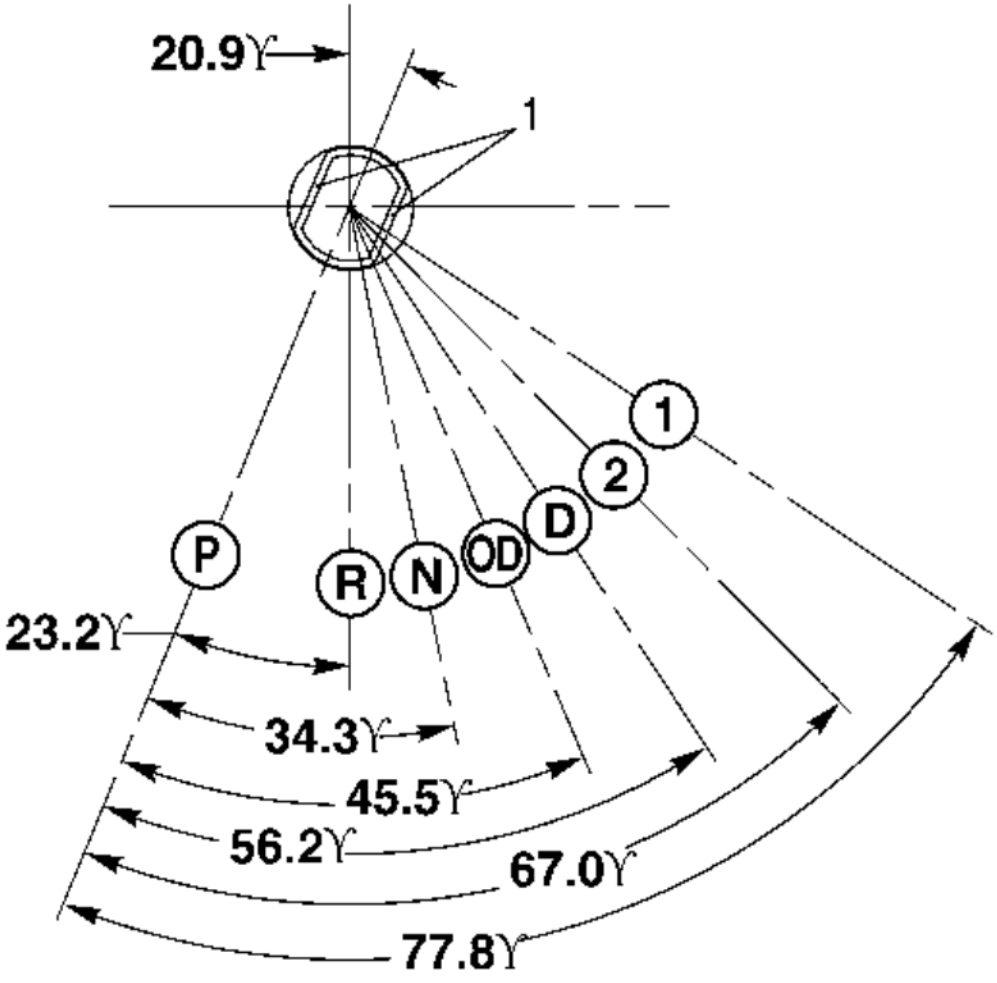


Fig. 507: Park/Neutral Position Switch Gear Positions
Courtesy of GENERAL MOTORS CORP.

1. The fullest clockwise position of the manual shift shaft is Park (P), which engages the park pawl.
2. Using a wrench on the manual shift shaft flats (1), rotate the shaft to the fullest clockwise position.

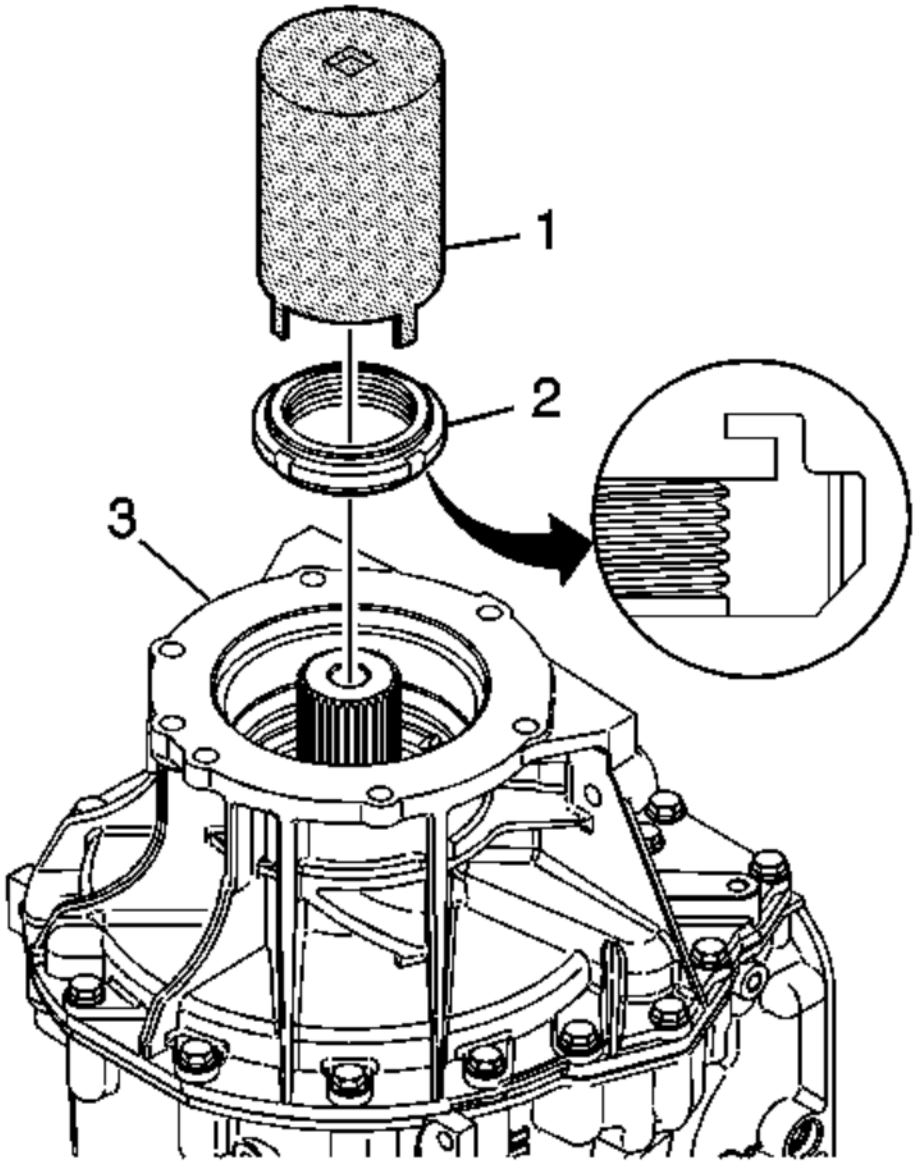


Fig. 508: Output Nut (4WD)
Courtesy of GENERAL MOTORS CORP.

3. Ensure the park pawl is engaged.
4. Install the **J 43769** (1) onto the output shaft retaining nut, 4WD (2). See **Special Tools**.

NOTE: Refer to Component Fastener Tightening Notice .

5. Using the **J 43769** (1), install a new output shaft retaining nut, 4WD (2) onto the output shaft (3). See **Special Tools**.

   Tighten: Tighten the nut to 61 N.m (45 lb ft).

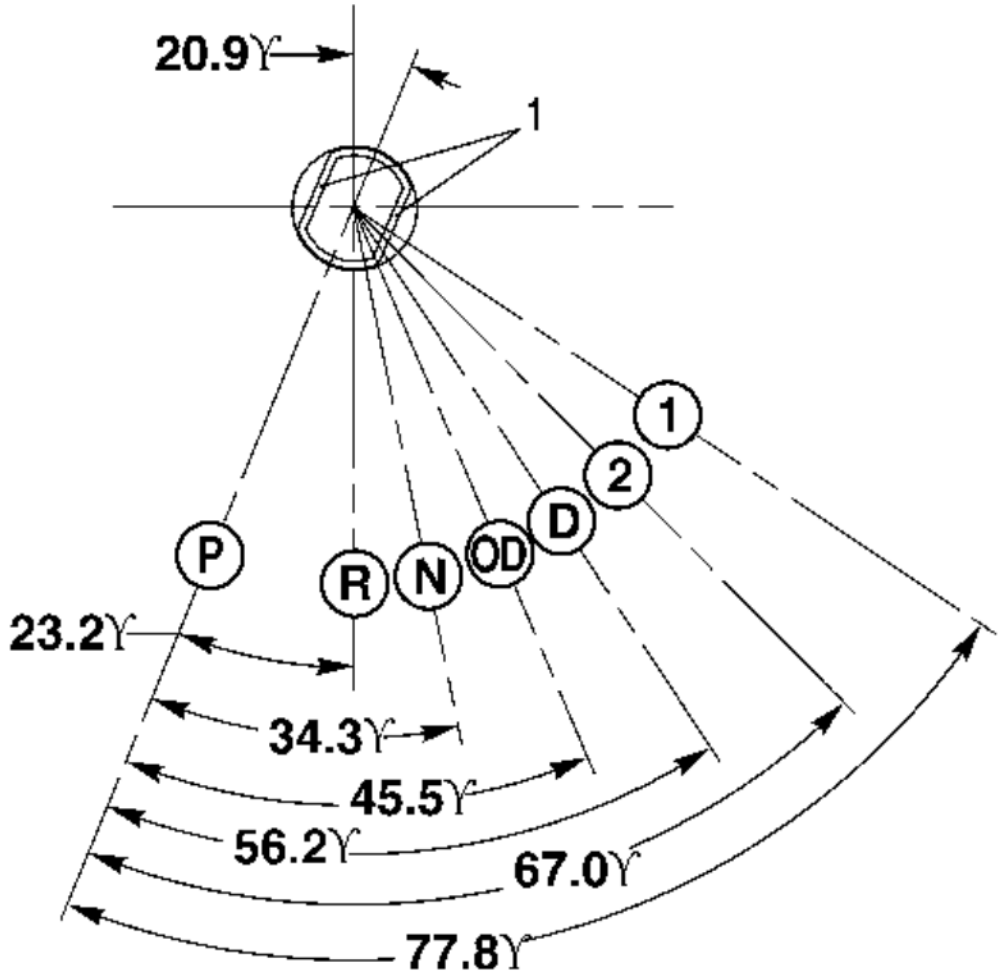


Fig. 509: Park/Neutral Position Switch Gear Positions
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The Neutral (N) position of the manual shift shaft is 2 detent positions counterclockwise from the fullest clockwise position.

6. Using a wrench on the manual shift shaft flats (1), rotate the shaft to the fullest clockwise position.
7. Rotate the manual shift shaft counterclockwise 2 detent positions.
8. Make sure the park pawl is disengaged.

TRANSMISSION VENT INSTALLATION

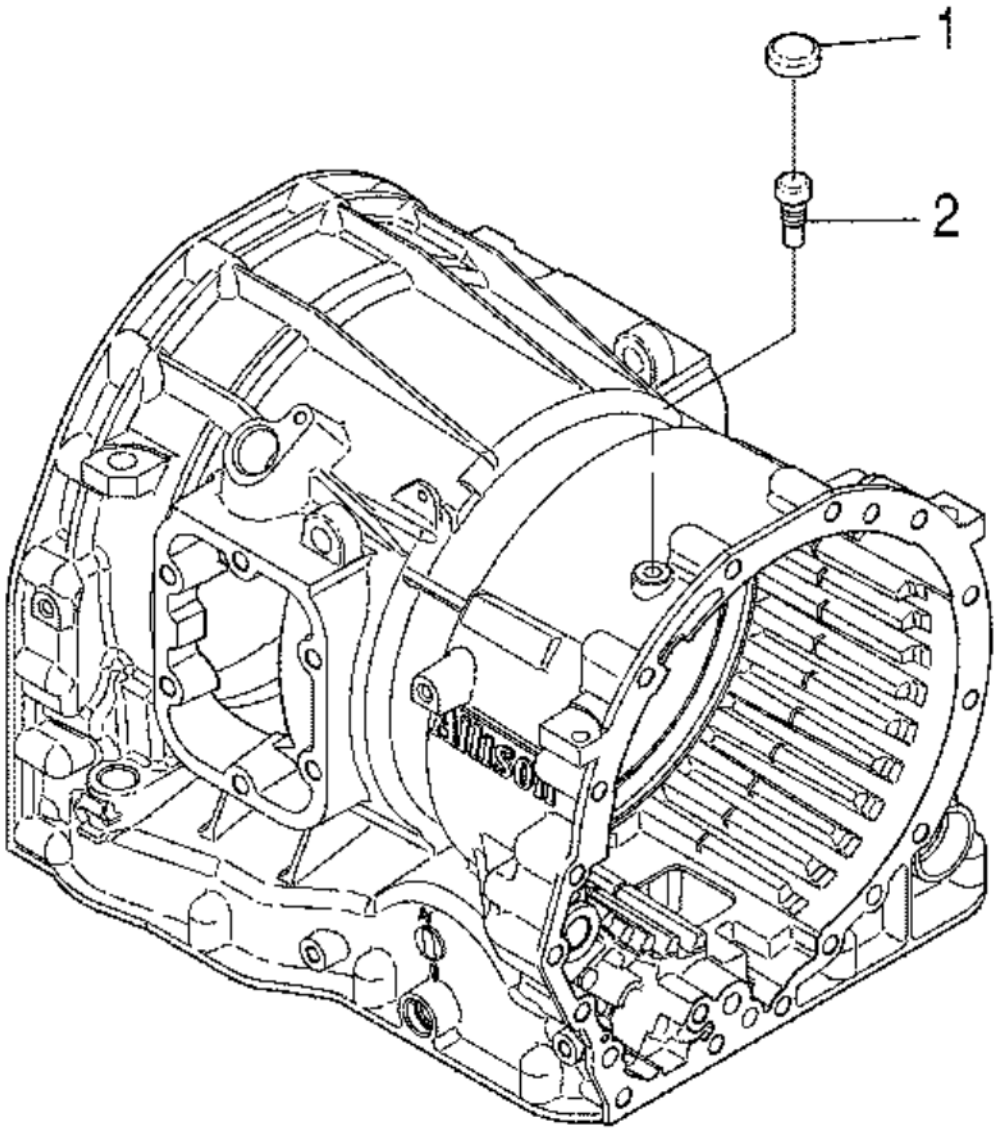


Fig. 510: View Of Transmission Case Vent
Courtesy of GENERAL MOTORS CORP.

1. Install the vent (1).
2. Gently tap the vent until seated.

TURBINE SPEED SENSOR INSTALLATION

Tools Required

J 36850 Transjel® Lubricant. See **Special Tools**.

Installation

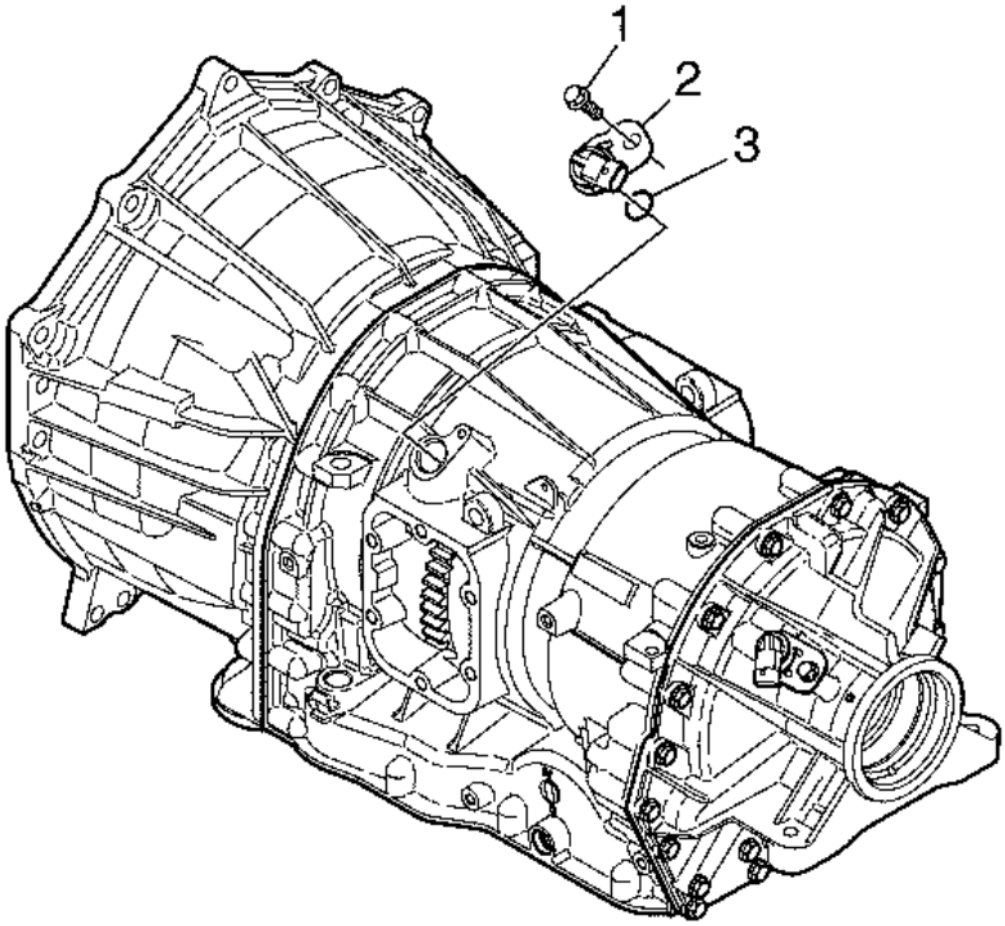


Fig. 511: VSS And Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the vehicle speed sensor O-ring (3) onto the turbine speed sensor (2).
2. Apply **J 36850** to the O-ring (3). See **Special Tools**.
3. Install the turbine speed sensor (2) into the transmission case.

4. Install the vehicle speed sensor bolt (1) into the transmission case.

NOTE: Refer to Fastener Notice .

Tighten: Tighten the bolt to 12 N.m (108 lb in).

OUTPUT SPEED SENSOR INSTALLATION (2WD)

Tools Required

J 36850 Transjel® Lubricant. See **Special Tools**.

Installation

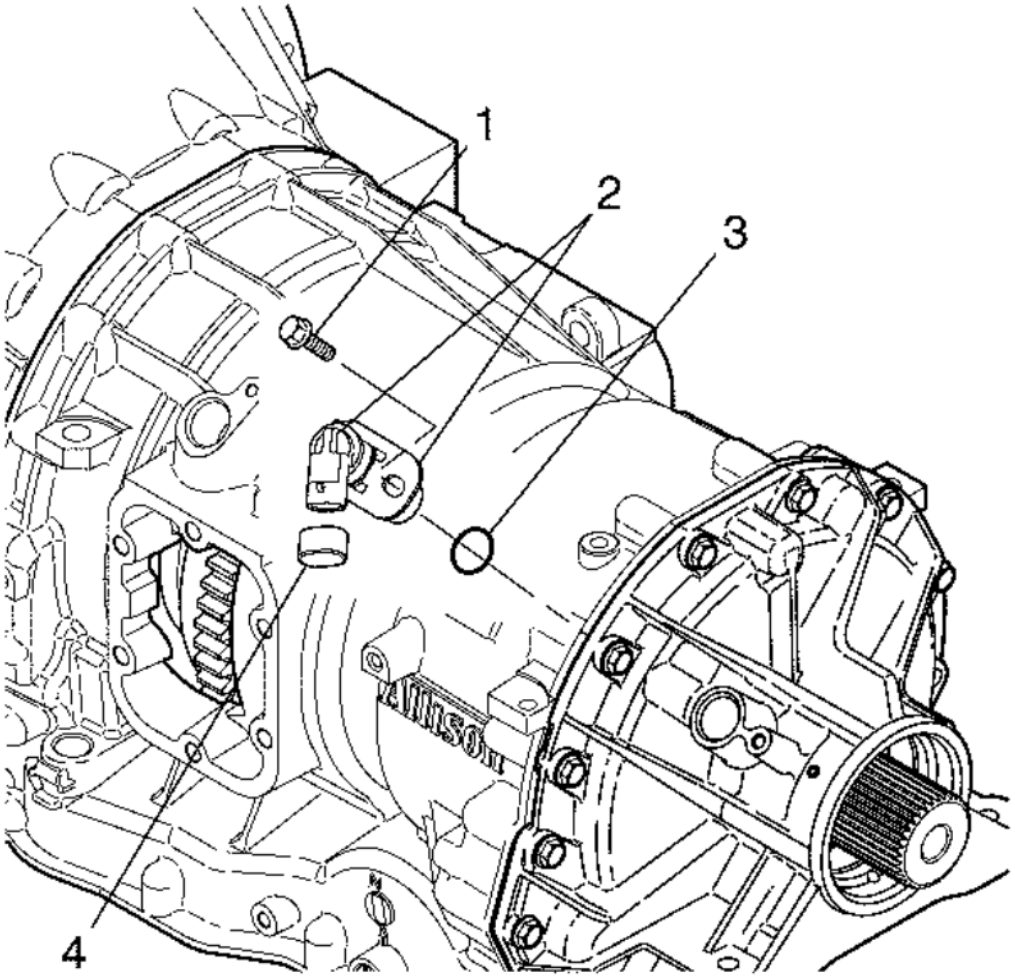


Fig. 512: Locating Output Speed Sensor (OSS)
Courtesy of GENERAL MOTORS CORP.

1. Install the vehicle speed sensor O-ring (3) onto the output speed sensor (OSS) (2).
2. Apply **J 36850** to the O-ring (3). See **Special Tools**.
3. Install the OSS (2) into the low and reverse clutch housing, 2WD.

NOTE: Refer to Fastener Notice .

4. Install the vehicle speed sensor bolt (1) into the low and reverse clutch housing, 2WD.

Tighten: Tighten the bolt to 12 N.m (108 lb in).

HOLDING FIXTURE REMOVAL

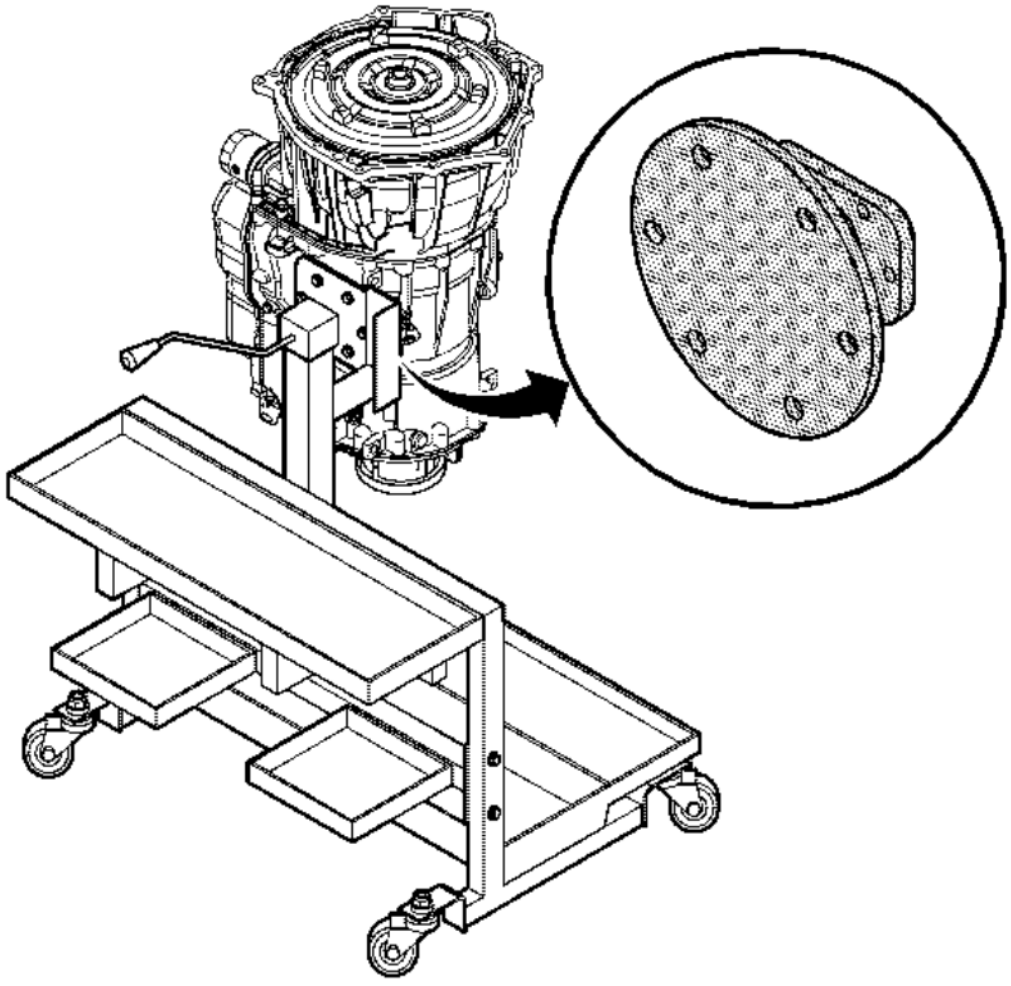


Fig. 513: Transmission Mounted On Holding Fixture
Courtesy of GENERAL MOTORS CORP.

CAUTION: The 1000 Series™ transmission dry weight is approximately 150 kg (330 lb). To help avoid personal injury and/or property damage: Use caution when installing, removing, or moving the transmission. Get

help when lifting the transmission. Assistance from a hoist or another person may be required. Ensure that lifting equipment can properly support the transmission.

1. Attach a sling to the transmission.
2. Attach a hoist to the sling.
3. Put moderate lift tension on the hoist.
4. Disconnect and remove the transmission from the repair stand.
5. Place the transmission on the work table with the oil pan facing down.

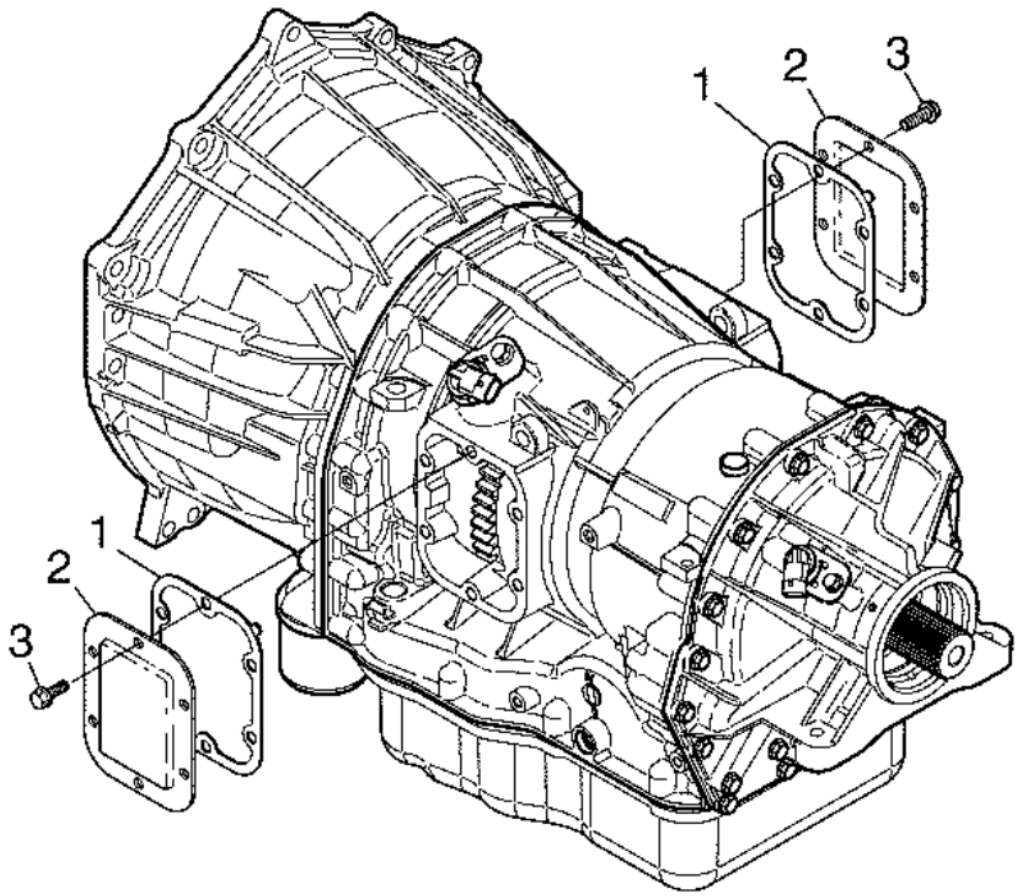


Fig. 514: PTO Cover, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

6. Install the power take-off (PTO) cover gaskets (1)
7. Install 2 PTO covers (2).

NOTE: Refer to Fastener Notice .

8. Install 12 PTO cover bolts (3).

Tighten: Tighten the bolts to 43 N.m (31 lb ft).

DESCRIPTION & OPERATION

TRANSMISSION GENERAL INFORMATION

When attempting to diagnose a suspected 1000 Series transmission problem, always begin by conducting the Functional Test Procedure. Refer to **Functional Test**. This procedure indicates the proper path for diagnosing the transmission by making basic checks. This procedure will refer you to the locations of specific checks. After you have determined the cause of a condition, you either take corrective action or install a replacement transmission. Refer to **Transmission Replacement**.

IMPORTANT: DO NOT, under any circumstances, attempt to diagnose a powertrain condition without basic knowledge of this powertrain. If you perform diagnostic procedures without this basic knowledge, you may incorrectly diagnose the condition or damage the powertrain components.

You must be familiar with some basic electronics in order to use this section of the manual. You should be able to use the following special tools:

- A Digital Multimeter (DMM)
- A circuit tester
- Jumper wires or leads
- A line pressure gauge set

The functional test procedures verify the correct operation of electronic components in the transmission. These procedures eliminate the unnecessary removal of transmission components.

IMPORTANT: If you probe a wire with a sharp instrument and do not properly seal the wire afterward, the wire corrodes and an open circuit

results.

Diagnostic test probes are now available that allow you to probe individual wires without leaving the wire open to the environment. These probe devices are inexpensive, easy to install and they permanently seal the wire from corrosion.

DEFINITIONS AND ABBREVIATIONS

Throttle Position Definitions

Heavy Throttle

Approximately 75% of accelerator pedal travel

Light Throttle

Approximately 25% of accelerator pedal travel

Medium Throttle

Approximately 50% of accelerator pedal travel

Wide-Open Throttle (WOT)

Full travel of the accelerator pedal, 100% throttle

Closed Throttle

Foot is off the accelerator pedal or pedal is not depressed, 0% throttle

Throttle-Related Shift Condition Definitions

Closed Throttle Manual Downshift

A condition where the engine is used to slow the vehicle by manually downshifting during a closed throttle coast down

Closed Throttle Coast Down

A full release of the accelerator pedal while the transmission remains in DRIVE range, allowing the transmission to downshift as vehicle speed reduces

WOT Detent Downshift

Quick apply of the accelerator pedal to its full travel, forcing a downshift

WOT Upshifts/Downshifts

Accelerator pedal is fully depressed and transmission shifts sequentially through ranges as dictated by load and grade

Shift Condition Definitions

Bump

A sudden and forceful apply of a clutch

Delayed

A shift was expected but did not occur for several seconds, as during a manual downshift or WOT detent downshift - may also be defined as Late or Extended

Double Bump

Two bumps felt during a clutch apply

Early

Shift occurs at lower speed than expected, often accompanied by engine laboring after an upshift

End Bump

A firmer feel at the end of a shift than at the start of a shift

Firm

A noticeably quick apply of a clutch at medium or heavy throttle conditions - DO NOT confuse with Harsh or Rough

Flare

A quick increase in engine speed along with a momentary loss of torque during a shift transition - also defined as Slipping

Harsh - Rough

More noticeable clutch apply than Firm - considered unacceptable at any throttle position

Hunting

A repeating quick series of upshifts and downshifts that cause a noticeable change in engine speed, such as 4-3-4, etc. - sometimes defined as Cycling

Initial Feel

A distinctly firmer feel at the start of a shift than at the finish of a shift

Late

A shift that occurs at a higher speed than normal for a given throttle position

Shudder

Multiple, rapid jerks usually associated with an oncoming clutch

Slipping

A noticeable increase in engine speed without an increase in vehicle speed - usually occurring just after the initial application of a clutch

Soft

A slow, almost unnoticeable, clutch apply

Surge

A repeating engine-related condition of acceleration and deceleration that is less intense than Shudder

Tie-up

A condition where 2 opposing clutches, usually 1 oncoming and 1 offgoing, are applied at the same time - giving a braking sensation and/or loss of engine speed

Noise Conditions

Planetary Gear Noise

A whine related to engine speed and noticeable in a particular transmission range - may be less noticeable or disappear following a transmission upshift

Pump Noise

A high pitched whine that increases in intensity with increasing engine speed - may occur in any transmission range and with the vehicle moving or stationary

Torque Converter Noise

A whine usually noticed when the vehicle is stopped and the transmission is in D, DRIVE, or R, REVERSE

Thermostatic Fan Noise

A normal noise that occurs while climbing a grade under load, caused by the engaging/disengaging of the engine cooling fan thermostatic clutch

Transmission Abbreviations

AC

Alternating Current

DC

Direct Current

DLC

Diagnostic Link Connector

DMM

Digital Multimeter

DTC

Diagnostic Trouble Code

ECM

Engine Control Module

ECT

Engine Coolant Temperature

EMI

Electromagnetic Interference

IGN

Ignition

IMS

Internal Mode Switch

MIL

Malfunction Indicator Lamp

NC

Normally Closed

NO

Normally Open

OBD

On Board Diagnostic

PCS

Pressure Control Solenoid

PS

Pressure Switch

PTO

Power Take-Off

RPM

Revolutions Per Minute

SS

Shift Solenoid

TCC

Torque Converter Clutch

TCM

Transmission Control Module

TFT

Transmission Fluid Temperature

TP

Throttle Position

TPS

Throttle Position Sensor

VBS

Variable Bleed Solenoid

WOT

Wide-Open Throttle

2WD

Two-Wheel Drive

4WD

Four-Wheel Drive

TRANSMISSION IDENTIFICATION INFORMATION

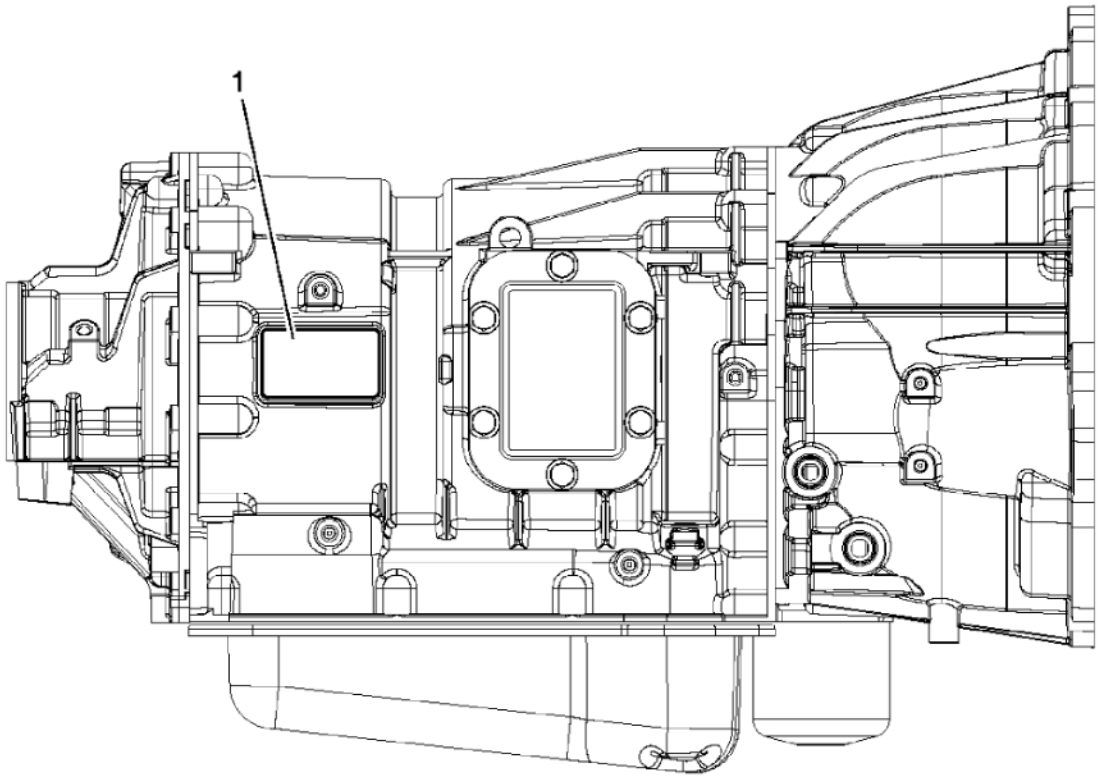


Fig. 515: Nameplate Location
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Nameplate

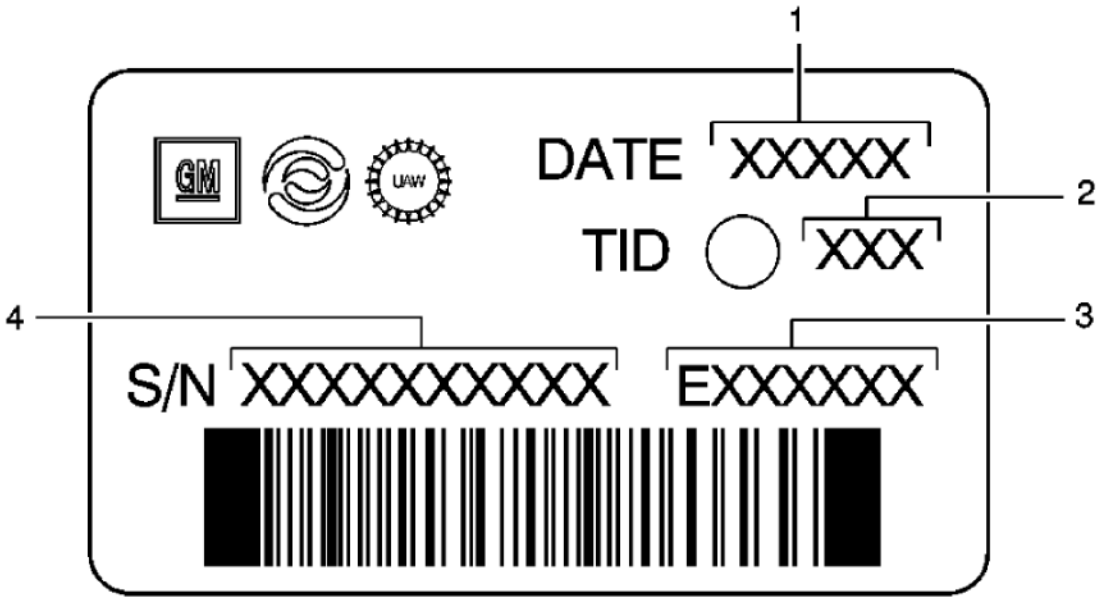


Fig. 516: Nameplate Components
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Date of Manufacture
2	Transmission Identification Number
3	Engineering Feature Configuration Number
4	Serial Number

EXTERNALLY GENERATED ELECTRONIC INTERFERENCE (SPEED SENSOR SIGNALS)

Use the following procedures in order to determine if speed sensor signals, generated by a source external to the transmission or wiring harness, are present:

1. Turn the ignition ON.
2. Keep the engine OFF.
3. If the transmission control module (TCM) is ON, install the scan tool.

IMPORTANT: If false speed signals were present at the previous shutdown, the TCM might still be ON, even though the ignition is OFF. The scan tool is powered by ignition power. The ignition must be ON in order to use the scan tool to read the speed signals.

4. Read the speed sensor signals.
5. If a speed sensor signal is something other than one (1), there is a short to another circuit that is carrying an AC or pulse width modulated (PWM) signal.
6. Measure the resistance of the sensor.
7. Inspect for shorts to other circuits within the harness or transmission connector.
8. Inspect to ensure there is no conductive material inside the connector.
9. Inspect to ensure the speed sensor circuit wires are a twisted pair.
10. Inspect to ensure a properly grounded drain wire.
11. Inspect for the presence of a strong external AC signal.
12. Repair or replace parts as required.

TRANSMISSION GENERAL DESCRIPTION

Allison 1000 Series transmissions are torque converter driven, fully automatic, transmission systems. The 1000 Series transmissions have 6 forward speeds, NEUTRAL, and REVERSE. The fifth and sixth range has overdrive gear ratio. The 1000 Series incorporates a variety of standard and optional design features. These design features include the following:

- Direct mount to engine block
- Flexplate drive
- Torque converter with a torque converter clutch (TCC) and integral vibration damper
- 3 constant-mesh planetary gear sets with helical gears
- 5 multiple disk clutches - 2 rotating and 3 stationary
- Common hydraulic system for all transmission functions
- 2 transmission fluid filtration systems
- Electrohydraulic control valve assembly
- Electronically controlled automatic gear selection and clutch apply
- Fill tube/dipstick provision on both sides of transmission
- Parking pawl
- Power takeoff (PTO) provision on both sides of transmission

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

Engine/Transmission Connection

The converter housing of 1000 Series transmissions mates directly to the engine block. Flexplate

drive is used for engine-to-transmission torque transfer.

Torque Converter

Several torque converters are available to match the transmissions to a wide variety of diesel and gasoline engines. The torque converter is a single-stage, polyphase, and 3-element unit, consisting of a pump, stator, and turbine. At lower output speeds, the torque converter multiplies torque and provides a fluid coupling to the engine. At higher speeds, the torque converter clutch (TCC) is automatically engaged to provide direct drive from the engine to the transmission. Hydraulic fluid for converter charging pressure comes from the sump and is supplied by the input pump. The TCC is applied or released by changing direction of fluid in the torque converter. An integral converter damper minimizes the need for additional engine vibration control.

Gear Sets

The planetary gear train includes 3 constant-mesh planetary gear sets containing high-helix gears. By the engagement of the clutches in various combinations, the planetary sets act singly or together to provide 6 forward ranges, NEUTRAL, and REVERSE.

Clutches

5 clutches, 2 rotating and 3 stationary, direct the flow of torque through the transmission. All range clutches are hydraulically actuated and spring-released, with automatic wear compensation. The transmission fluid cools the clutches. The transmission control module (TCM) signals solenoid valves to apply and release clutches based on speed and power combinations and the range selected by the operator.

Hydraulic System

A common hydraulic system serves the torque converter and the transmission. Transmission fluid for all hydraulic operations, lubrication, and cooling comes from the sump and is supplied by the charging pump.

Transmission Fluid Filtration

Fluid filtration is provided by 2 filter systems. A suction filter, located in the sump, provides general protection to the entire hydraulic system by filtering large particulates. A spin-on filter provides full-time protection for the control solenoids and multipass protection for the entire system. The spin-on filter is externally located on the converter housing at the lower left front of the transmission.

Electrohydraulic Control Valve Assembly

The control valve assembly consists of 2 components. The main valve body contains the pressure control valves, the TCC valve, the exhaust backfill valve, and the control main relief valve. The shift valve body contains the shift valves, the control main pressure valve, and the manual selector valve. The control valve assembly attaches to the bottom of the main case module and is enclosed by the oil pan.

Remote Oil Cooler Provision

Ports for remote-mount oil cooler lines are located on the right side of the converter housing near the converter housing/main housing splitline. Remote oil-to-water coolers require plumbing for transmission fluid and engine-cooling water. Remote oil-to-air coolers may also be used and only transmission fluid lines need to be provided. Heat is transferred from the transmission fluid to either water or air depending upon the cooler type used.

Fill Tube/Dipstick Provision

All 1000 Series models have a fill tube/dipstick provision on both sides of the transmission. A plug is installed in the unused location.

Park Pawl

All 1000 Series transmissions have a park pawl. The internal parking pawl is engaged by selection of the PARK position on the shift selector.

Power Take-Off (PTO) Provision

The 1000 Series transmissions have a provision to mount and drive a PTO unit on the left and/or right side of the transmission housing. The torque converter turbine drives the optional PTO drive gear. The PTO reflects engine and torque converter characteristics.

TOW/HAUL MODE

Tow/Haul mode significantly changes the transmission shift pattern to reduce shift cycling and to deliver better performance, control, and cooling when towing or hauling heavy loads. For instance:

- Upshift points are raised at light to mid throttle position to use more of the available engine power for acceleration. Downshift points are raised to enhance engine braking to help slow the vehicle.
- During deceleration, the torque converter clutch (TCC) remains applied at closed throttle at lower speeds to significantly improve the effect of engine braking.
- During acceleration, the TCC is applied in 2nd range and remains applied in 3rd, 4th, 5th

and 6th. This improves the drivetrain efficiency and significantly lowers transmission sump temperature when towing heavy loads. In Normal mode, the TCC generally applies only in higher ranges and is dependent on throttle position.

- Tow/haul is designed to be most effective when the vehicle and trailer combined weight is at least 75 percent of the gross combined weight rating (GCWR) of the vehicle.
- Operation of tow/haul in a lightly loaded or non-loaded vehicle will not cause damage. However, there is no benefit to the selection of tow/haul when the vehicle is unloaded. This situation will cause a firm shift. The tow/haul switch is not a performance switch.
- Selection of tow/haul when unloaded may result in unpleasant engine and transmission driving characteristics and reduced fuel economy. Tow/haul is recommended only when pulling a heavy trailer or a large or heavy load.

Activation

- Tow/Haul is selected or de-selected via a switch on the end of the transmission shift lever. A lamp on the instrument panel will illuminate to indicate that tow/haul has been selected.
- Tow/Haul must be selected again, every time the vehicle is started, if desired.

ADAPT FUNCTION

The transmission control module (TCM) produces excellent shift quality by applying closed loop control that constantly adjusts shift characteristics for changes in operating conditions. These adjustments are based on vehicle conditions, such as grade, load, and engine power.

The learning process of comparing and adjusting shift parameters is referred to as adaptive control. Adaptive control establishes initial conditions for shifts and makes during shift adjustments. The TCM constantly monitors operating conditions, such as battery voltage and transmission sump temperature, and adjusts shift parameters accordingly. After a shift is completed, the TCM compares the shift to a target shift profile in the TCM calibration and makes adjustments before the next shift of the same kind is made.

The Allison 1000 Series transmission consists of 5 clutches. A combination of 2 clutches is required to be engaged, in order to attain a torque path from the input to the output of the transmission. The following table indicates the clutch combinations for each gear range.

Gear Range	1-2-3-4 Clutch	4-5-6 Clutch	3rd, 5th and Reverse Clutch	2-6 Clutch	Low and Reverse Clutch	TCC
PARK/NEUTRAL	-	-	-	-	X	-

REVERSE	-	-	X	-	X	-
First	X	-	-	-	X	-
Second	X	-	-	X	-	X
Third	X	-	X	-	-	X
Fourth	X	X	-	-	-	X
Fifth	-	X	X	-	-	X
Sixth	-	X	-	X	-	X

The Allison 1000 Series transmission utilizes clutch-to-clutch shift control to achieve range changes. In every case, except shifts to or from NEUTRAL, 1 clutch is exhausted and another applied in order to make a range shift. The hand-off between exhausting and applying clutches is precisely controlled by the use of 2 pressure control solenoids (PCS). These solenoids are labeled PCS1 and PCS2 in the transmission. For example, to make a 1-2 shift, PCS1 is used to trim pressure off the low and reverse clutch, and PCS2 is used to trim pressure on the 2-6 clutch. The TCM modulates the current to both PCS1 and PCS2, which translates to a proportional level of pressure to the clutch. In order to make a shift, the TCM uses software and calibration settings of several program parameters in order to determine the level of current sent to the respective PCS. These parameters are referred to as adaptive values. With a new transmission and TCM calibration, the adaptive values are set to base calibration level. The transmission uses the base calibration to perform the first of each type of shift. However, once the transmission has performed a shift, the TCM evaluates the actual shift and compares it to an ideal shift in the TCM memory. Based on that comparison, the TCM changes the settings of the adaptive values to a level that it believes will result in a shift closer to the ideal shift the next time it makes that type of shift. This is referred to as adaptive shifting. When the transmission/TCM calibration is new, the TCM is in fast adaptive mode. The TCM is allowed to make large changes in the adaptive values after each shift. Once the TCM determines that a given shift is close to the ideal level, it switches to slow adaptive mode. In slow adaptive, the TCM still is evaluating shifts and changing adaptive values, but is only allowed to do so in smaller increments. When a shift switches from fast to slow adaptive mode, it is described as converged. The TCM is programmed in order to switch from fast to slow adaptive mode in as many as 15-20 shifts. It is important to understand that there are many different distinct shifts recognized by the TCM, and each of these shifts has its own adaptive values. There are upshifts and downshifts to and from each range, as well as unique adaptive values for several different throttle regions for each upshift and downshift. It may take a significant amount of time before most of the shifts converge from fast to slow adaptive, and thus it is not unusual to experience somewhat harsh or unpleasant shift quality until these shifts are adapted.

TCC engagement is accomplished by a separate PCS. There are adaptive values for this as well, and thus it will also require some driving for TCC engagement to converge.

If you are experiencing harsh shifts, it is important to verify whether the particular shift is converged. Use the scan tool in order to determine if the shift is converged.

- If the shift is not converged, the TCM is learning how to adapt that shift, and needs to be driven more, with the intention of performing more of the particular type of shift.
- If a particular shift is converged, but still objectionable, it is good troubleshooting practice to reset the adaptive values for that shift back to base calibration level. This will automatically reset the TCM to fast adaptive mode. The vehicle should then be driven in order to allow the TCM to relearn the shift. Many times this will correct the condition. It is possible to reset individual shifts without affecting the other shifts.

IMPORTANT: WHEN REPLACING A FAILED TRANSMISSION WITH A REPLACEMENT UNIT, IT IS IMPORTANT TO RESET THE TCM IN ORDER TO BASE CALIBRATION AND FAST ADAPTIVE FOR ALL SHIFTS. This can be done in 1 step with FastLearn. If this is not done, the TCM adaptive values will be at the settings that it learned for the old transmission, and will be in slow adaptive mode. Under these conditions, it would take an unacceptably long time for the adaptive values to converge to levels suitable for the new transmission.

TRANSMISSION INDICATORS AND MESSAGES

NORMAL Inhibits Which Result in a Blinking PRNDL

High engine speed NEUTRAL to Range shifts

When a NEUTRAL to DRIVE or NEUTRAL to REVERSE shift is made, when engine RPM is high, the shift is inhibited to NEUTRAL. The TCM has torque management capability and attempts to slow the engine to a point where it makes the requested shift.

High Throttle or Torque Direction Change Shifts

REVERSE to DRIVE, DRIVE to REVERSE, NEUTRAL to DRIVE, and NEUTRAL to REVERSE shifts, where throttle position is greater than 25 percent, are inhibited to NEUTRAL. The TCM has torque management capability and attempts to slow the engine to a point where it makes the requested shift.

Four-Wheel Drive Transfer Case in NEUTRAL

If the four-wheel drive transfer case is shifted into NEUTRAL while the transmission is in

DRIVE or REVERSE, the transmission continues to the commanded range until output speed is low, at which point NEUTRAL is commanded. If the driver attempts to shift the transmission from NEUTRAL to DRIVE or NEUTRAL to REVERSE, with the transfer case in NEUTRAL, the PRNDL display blinks immediately.

High Output Speed Direction Change Shifts

REVERSE to DRIVE, DRIVE to REVERSE, and NEUTRAL to REVERSE shifts, initiated above 300 RPM output speed are inhibited to NEUTRAL.

Low Automatic Transmission Fluid (ATF) Level Low

Low ATF level is caused by insufficient transmission fluid and lack of initial pump prime, caused by refilling the transmission.

Extremely Low ATF temperature

A shift out of NEUTRAL when the ATF temperature is below -45°C (-49°F) may be inhibited.

MALFUNCTIONS Which May Cause a Blinking PRNDL

Failure to detect turbine speed pull-down during a shift may occur under the following conditions:

- A clutch is failed and the transmission cannot attain the requested range.
- Invalid gear ratio
- Pressure control solenoid failure
- Turbine or output speed sensor failure
- Lack of pressure at startup

Conditions Which May Cause a BLANK PRNDL

The PRNDL display may be blank because of failure of the internal mode switch circuits A, B, C, or P.

The transmission will command the most appropriate range, based on reverse pressure switch and the remaining internal mode switch inputs.

ELECTRONIC COMPONENT DESCRIPTION

Transmission Control Module

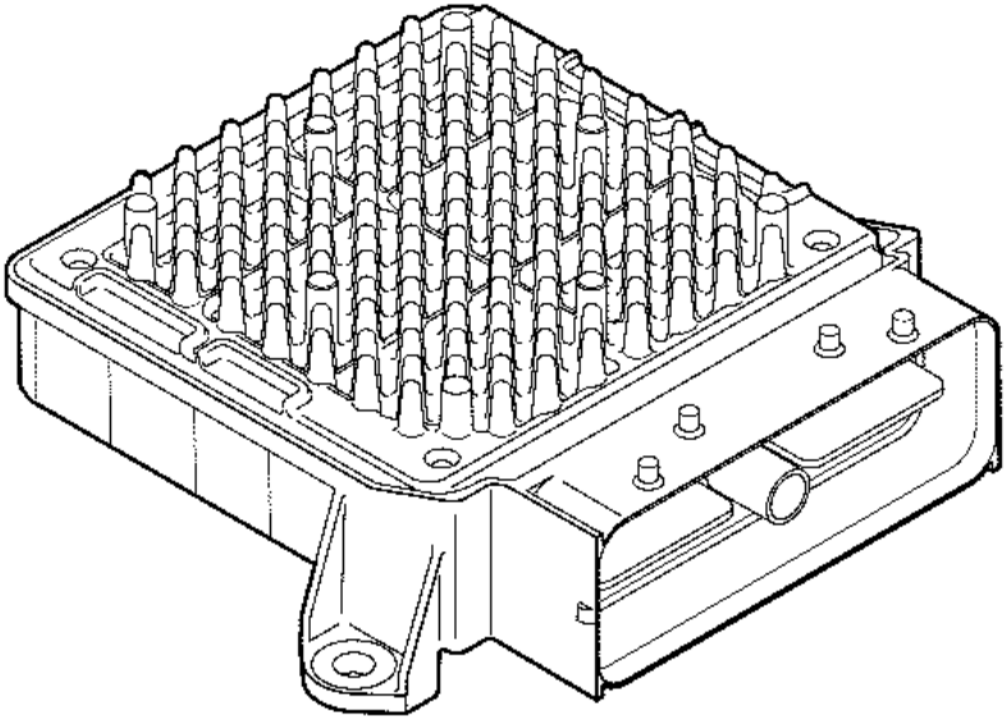


Fig. 517: Transmission Control Module
Courtesy of GENERAL MOTORS CORP.

A microcomputer controls the transmission by receiving and processing signals from various switches and sensors. The microcomputer determines shift sequences, shift timing, and clutch apply and release characteristics. The microcomputer is an independent controller and is referred to as a transmission control module (TCM). The pressure switch manifold (PSM) and the internal mode switch (IMS) provide operator input to the TCM. Other data sent to the TCM include throttle position, engine, turbine, and output speeds, and sump temperature. Any active special function, such as anti-lock brakes or power take-off, is also an input to the TCM. The TCM processes this data to determine proper shift points, to monitor the current range, to perform ratio tests, and to compile diagnostic data. The TCM is programmed to protect the transmission and other vehicle driveline components by inhibiting actions, such as full-throttle NEUTRAL-to-range shifts and high speed direction changes. The TCM determines if a system malfunction exists and stores diagnostic codes related to the malfunction. The codes, accessed by the service

technician, are used in diagnosing persistent or intermittent trouble in the system.

Throttle Position/Torque Management

The TCM receives input on throttle position/torque management from a signal transmitted by the engine control module (ECM).

The ECM communicates directly to the transmission electronic controls over an SAE J1850 or J1939 serial communication interface (SCI) data link. The TCM must be calibrated to receive these signals.

Speed Sensors

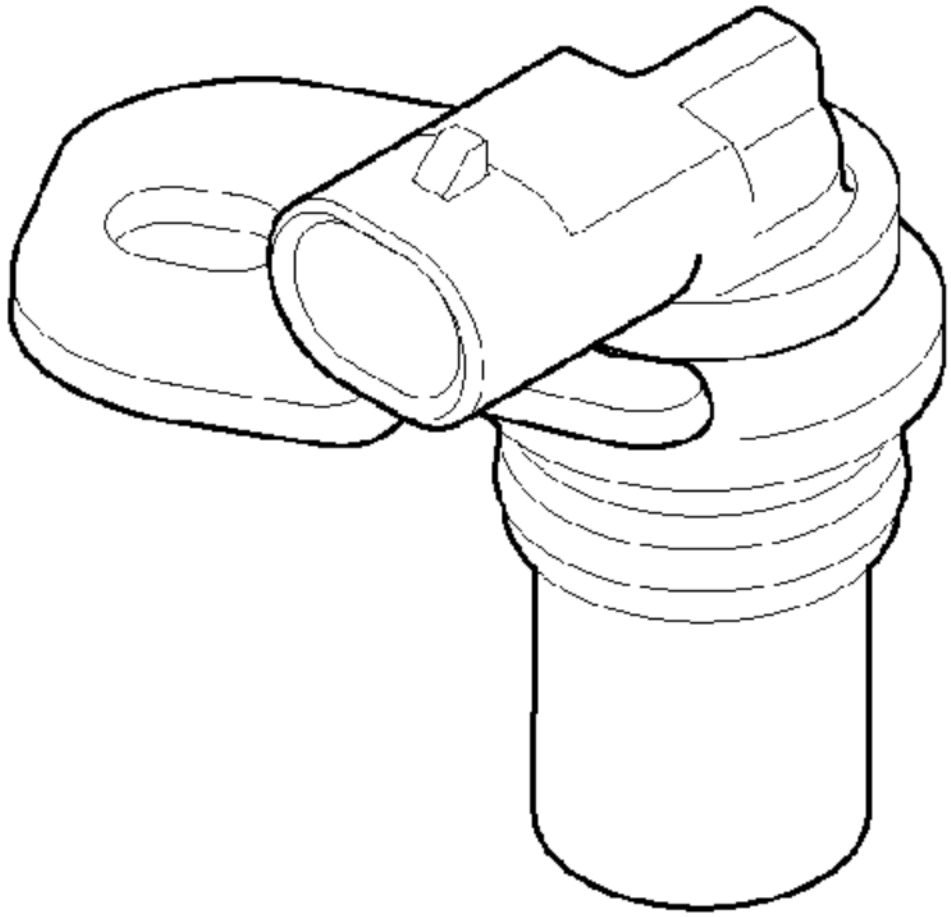


Fig. 518: Speed Sensors
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not rotate the sensor in the retaining bracket. Changing the sensor/bracket orientation may cause improper operation.

There are 3 speed sensors typically required for use with 1000 Series transmissions. They include the engine speed sensor, the turbine speed sensor, and the output speed sensor. The speed sensors provide revolutions per minute (RPM) information to the TCM. The speed ratios between the various sensors allow the TCM to determine the transmission operating range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the best

possible shift quality. Hydraulic conditions are detected by comparing the speed sensor information for the current range, to the range of the speed sensor information stored in TCM memory. The speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member.

Shift Selector

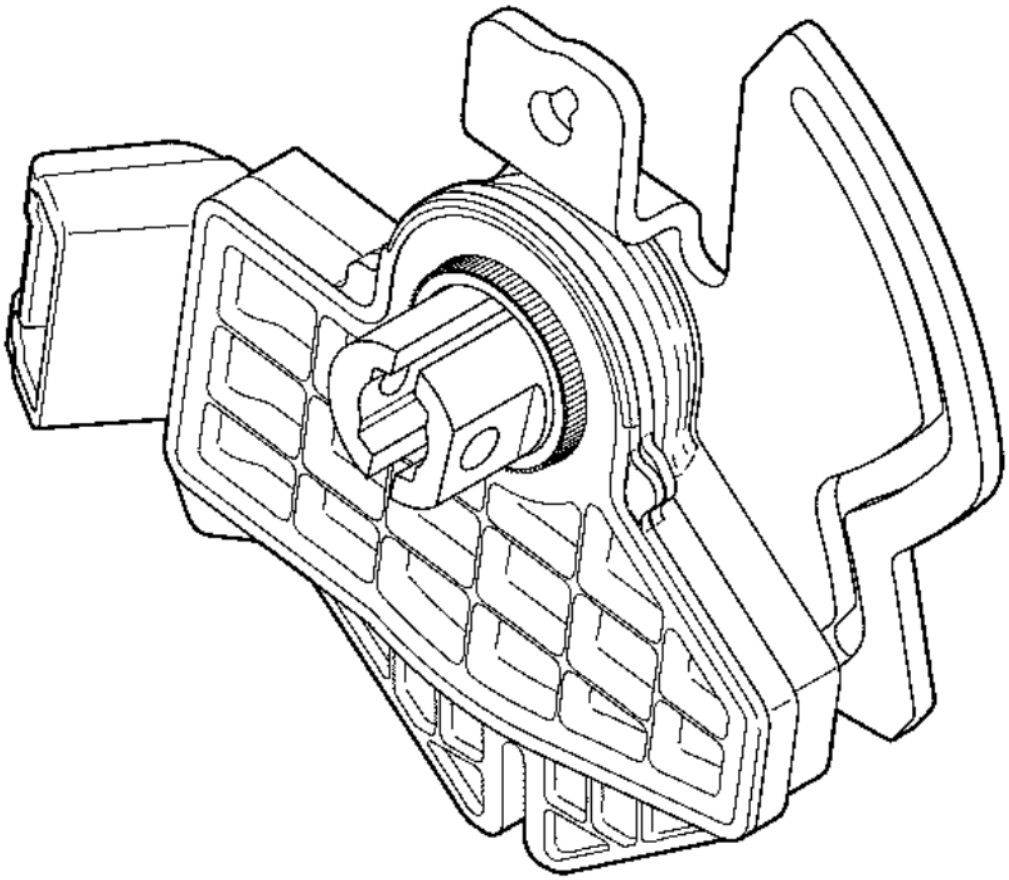


Fig. 519: Internal Mode Switch
Courtesy of GENERAL MOTORS CORP.

The vehicle is equipped with a column type shift selector. In addition to the column shifter, another component associated with the shift selector is the internal mode switch (IMS), which is

mounted internally on the selector shaft. The IMS transmits selector position information to the TCM. The IMS detects the angular position of the shift selector shaft. This position is communicated to the TCM so that certain vehicle control functions can be coordinated with the position of the shift controls. The IMS has redundant circuitry to alert the TCM in the event of a single wire or switch failure. The neutral signal output of the IMS is typically used as confirmation that the transmission is in NEUTRAL before the engine starter is engaged. The IMS is interfaced to the starter circuit.

The operator chooses the transmission range by moving the selector lever to the appropriate gate position. When properly adjusted, the shifter gates prevent inadvertent shifting between ranges, and corresponds to the internal transmission detent positions. A positive detent is provided in the transmission in order to maintain the selector shaft in the selected position.

The TCM shift calibration determines the available forward ranges for each selector position. Although specific installations vary, typical selector positions for the 1000 Series include the following:

P - PARK

The parking pawl is engaged. The transmission is in NEUTRAL.

R - REVERSE

REVERSE is selected in order to move the vehicle backward.

N - NEUTRAL

NEUTRAL may be used when starting the engine and for stationary operations. The TCM disables the starter switch if a range other than NEUTRAL or PARK is selected before starting the vehicle.

D - DRIVE

DRIVE is the highest forward range used for normal driving. The transmission shifts to first range for starting, then automatically upshifts through the ranges, as operating conditions permit, until the highest range is attained.

M - Manual

Manual selection of ranges is provided by moving the selector to the M - MANUAL position. A driver shift request switch has been added to the column shift lever. The driver

information center (DIC) then shows the 6 available ranges with the current range bracketed. The bracketed range is the highest attainable range with all gears below accessible, for example, when 4th range is selected, ranges 1st through 4th are available. By using the +/- buttons on the gear select lever, the driver can select the range of gears desired for their current driving conditions.

1 - Manual LOW

Manual LOW provides first gear operation only.

Internal Components

Several components of the 1000 Series electrical control system are located within the transmission as part of the main control valve body. These components include 3 types of solenoids for controlling the hydraulic action of the valves. They include the PSM and an internal wiring harness that links the internal components with the TCM.

Solenoids

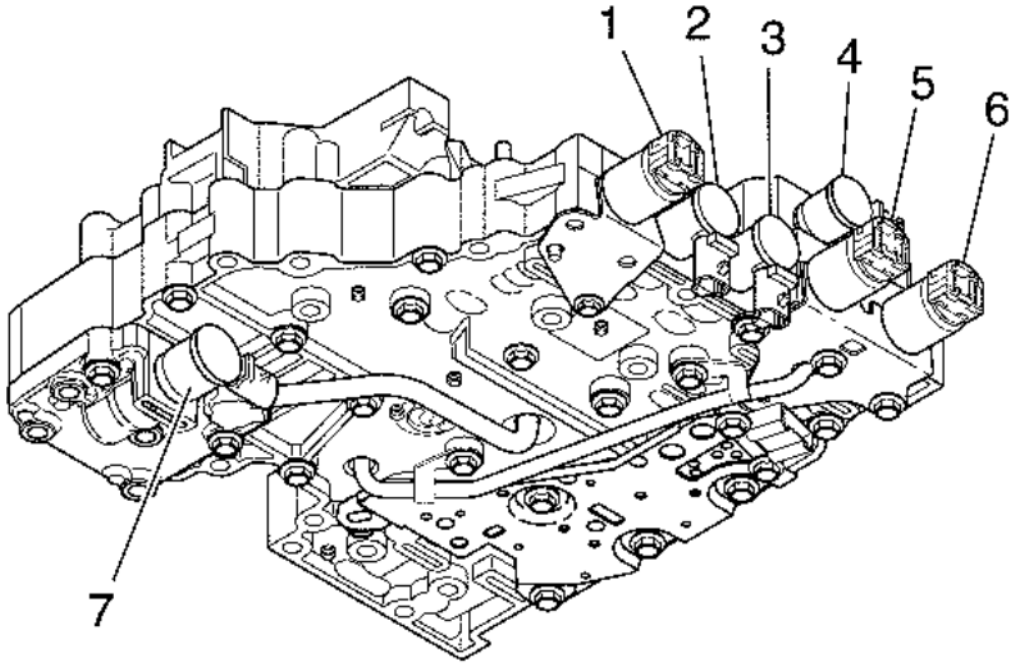


Fig. 520: Solenoid Valves
Courtesy of GENERAL MOTORS CORP.

The 1000 Series control valve body contains both normally closed (N/C) and normally open (N/O) solenoids. A N/C solenoid remains closed until a signal from the TCM energizes the solenoid. A N/O solenoid remains open until the TCM energizes the solenoid. When a solenoid valve is in the closed position, the valve blocks the flow. When a solenoid valve is in the open position, flow is permitted through the valve. Shift solenoid 1 (SS1) (4), shift solenoid 2 (SS2) (2) and shift solenoid 3 (SS3) (3) are N/C. Both solenoid types have an orifice, electrical windings, an iron core, and a steel check ball.

Shift solenoids provide the necessary logic to distribute fluid to the correct clutches. The shift solenoids provide either full control main pressure or exhaust to the head of each of the corresponding shift valves. Since the valve states, stroked or unstroked, are critical to providing the correct transmission range, each shift valve has a pressure switch, located in the PSM, which provides feedback to the computer regarding the position of the valve.

Modulated main pressure solenoid (7) is a N/C solenoid used to modulate the transmission main pressure. Under specific conditions, such as low throttle setting, low engine torque, low engine speed, and low transmission output speeds, the TCM commands the solenoid ON. When the solenoid is applied, fluid is routed to the main pressure regulator valve; this in turn reduces the main pressure schedule and improves the volume of oil through the overage circuit. By modulating main pressure, the cooler flow at idle can be increased, allowing improved cooling and reducing transmission pump noise.

Pressure control solenoid 1 (PCS1) (6), pressure control solenoid 2 (PCS2) (4), and the torque converter clutch (TCC) (1) are used to control on-coming, off-going, and holding pressure to the 5 clutches and the TCC. These solenoids are referred to as variable bleed solenoids, since the output hydraulic pressure supplied by these solenoids is proportional to the controlled current command.

Pressure Switch Manifold

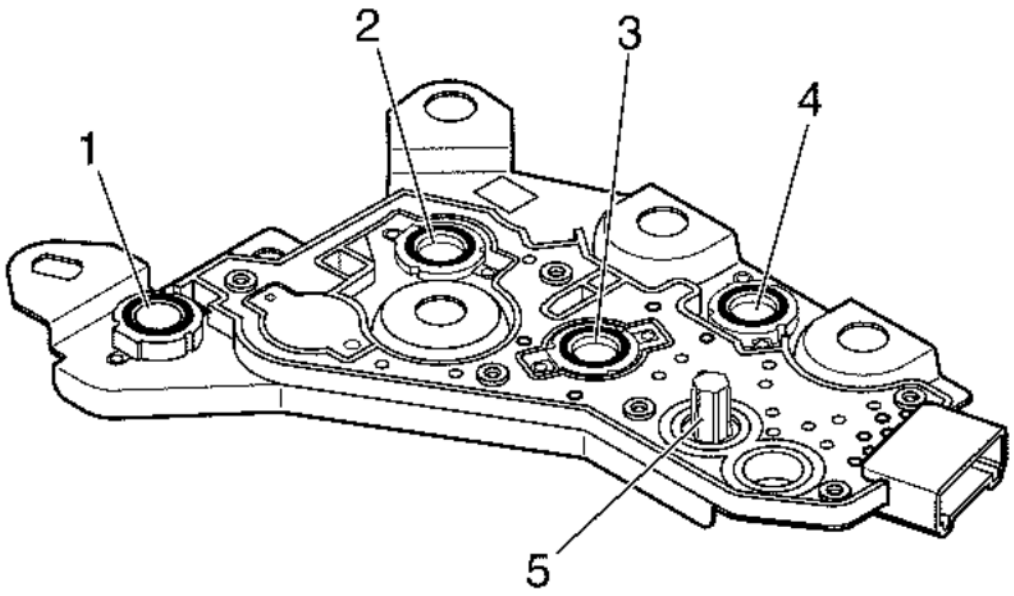


Fig. 521: Pressure Switch Manifold
Courtesy of GENERAL MOTORS CORP.

The PSM is a multiple-switch assembly made up of 3 N/O pressure switches, PS1 (4), PS2 (3), and PS3 (2) and 1 N/C pressure switch. N/O pressure switches, PS1, PS2, and PS3, correspond to shift valves SS1, SS2, and SS3. Fluid pressures are fed from shift valves SS1, SS2, and SS3 to the manual selector valve and to the pressure switches based on the positions of the valves and shift selector. The shift valve fluid pressures reflect the logic condition at the corresponding solenoids. This logic indicates the current transmission operating range to the TCM.

The 3 fluid pressure switches corresponding to the shift valves are N/O, contacts not touching, when no fluid pressure is present, so that electrical current is stopped at the switch. When fluid pressure is routed to the switch, it moves the diaphragm and upper contact so that the contact element touches both the positive and ground contacts. This closes the circuit and allows current to flow from the positive contact and through the switch.

Pressure switch 4 (PS4) (1) corresponding to REVERSE is N/C, since fluid pressure is always present unless the selector valve is moved to REVERSE. The PSM also contains a transmission fluid temperature (TFT) sensor thermistor (5) for sump temperature. Changes in sump fluid temperature are indicated by changes in sensor resistance. Increasing temperature causes

decreased sensor resistance. The resistance value is then relayed to the TCM as an input for shift control.

Internal Wiring Harness

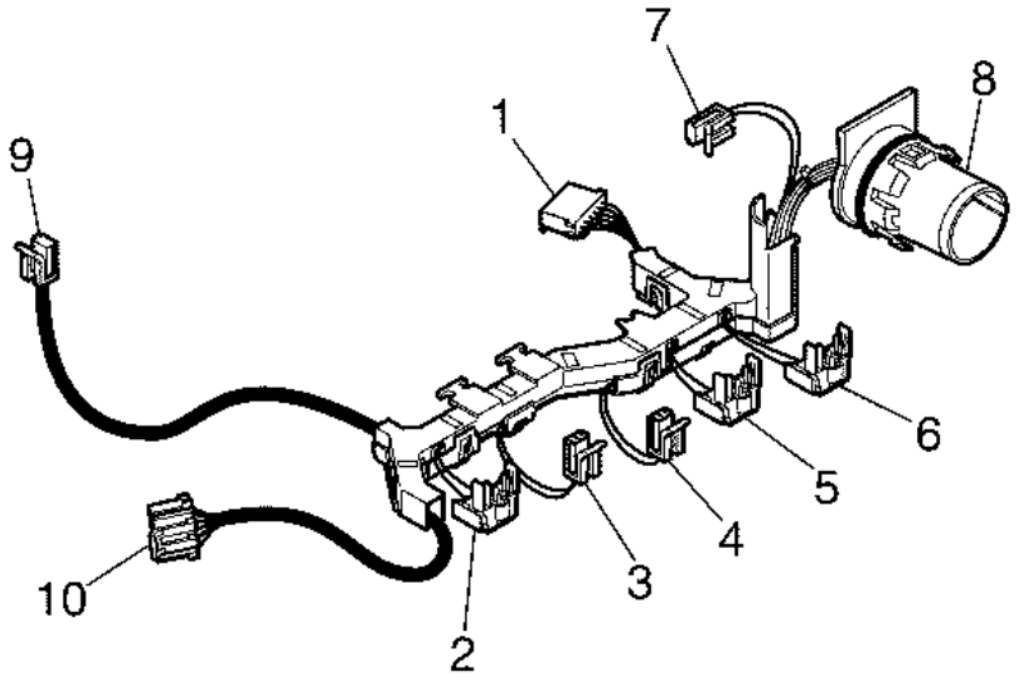


Fig. 522: Internal Wiring Harness
Courtesy of GENERAL MOTORS CORP.

The internal wiring harness has connectors for shift solenoids SS1 (7), SS2 (3) and SS3 (4), PCS1 (6) and PCS2 (5), TCC pressure control solenoid (TCC PCS) (2), and the PSM (1). There is also a connector for the modulated main (MOD MAIN) pressure solenoid (9) and the IMS (10). All of these connectors go to the main electrical connector (8). The transmission main electrical connector transports signals from these connectors to the TCM via the external harness.

NEUTRAL - ENGINE RUNNING

In Neutral (N), pressure control solenoid 1 (PCS1) is in the normally closed state (de-energized), PCS2 is in the normally open state (de-energized), shift solenoid 1 (SS1), SS2, and SS3 are energized, and the torque converter clutch pressure control solenoid (TCC PCS) remains de-

energized.

SS1, SS2, and SS3 supply control main pressure to the top of shift valve 1, shift valve 2, and shift valve 3, stroking the valves against spring force.

With shift valve 1 stroked, control main pressure is directed through shift valve 1 to pressure switch 1, turning the switch on. With shift valve 2 stroked, the exhaust path is blocked for the control main pressure being supplied through an orifice to pressure switch 2, and the pressure raises to control main and pressure switch 2 turns on. With shift valve 3 stroked, the exhaust path is blocked for the control main pressure being supplied through an orifice to pressure switch 3, and the pressure raises to control main and pressure switch 3 turns ON. With pressure switch 1, pressure switch 2, and pressure switch 3 ON, feedback is provided to the transmission control module (TCM) that shift valve 1, shift valve 2, and shift valve 3 are stroked.

Normally closed PCS1 blocks the exhaust of the PCS1 signal pressure, raising the signal pressure. PCS1 signal pressure strokes pressure control valve 1, raising the PCS1 pressure which is directed to shift valve 2. In the stroked position, shift valve 2 routes fluid to the low and reverse clutch, applying the clutch. All other clutches are exhausted.

With only one clutch applied, the transmission is in Neutral (N).

If electrical power is interrupted while Neutral (N) is selected, SS1, SS2, and SS3 are de-energized and shift valve 1 de-strokes. Due to valve timing, when power is lost, shift valve 1 strokes faster than shift valve 3. When shift valve 1 de-strokes, control main pressure is fed through shift valve 1 to the top of shift valve 3, keeping the valve stroked. Normally closed PCS1 continues to block the exhaust of the solenoid signal pressure (solenoid signal remains control main). The solenoid signal pressure on top of pressure control valve 1 produces maximum pressure, which is routed to shift valve 2. Shift valve 2 stays stroked due to the "latching" effect of the low and reverse clutch pressure acting on two different diameter lands. In the stroked position, pressure continues to be routed to the low and reverse clutch, keeping the clutch applied. Since only one clutch is applied, the transmission remains in Neutral (N).

If electrical power is interrupted with the transmission in Neutral (N) and the manual selector valve is moved to a forward range or reverse, the transmission stays in neutral because shift valve 3 stays de-stroked and main pressure is blocked from reaching the manual selector valve.

If the engine is shutdown and restarted with the electrical power interrupted to the TCM, shift valve 1, shift valve 2, and shift valve 3 remain de-stroked. Normally closed PCS1 blocks the exhaust of the PCS1 signal pressure (signal pressure becomes control main). The solenoid signal pressure on top of PCV1 produces maximum pressure, which is routed to shift valve 2. In the de-stroked position, shift valve 2 routes fluid to the 3rd, 5th, and reverse clutch. All other clutches

are exhausted, so the transmission remains in Neutral (N). When shift valve 3 is de-stroked, main pressure is routed through shift valve 3 to the manual selector valve. If a forward range is selected, the manual selector valve routes fluid to the 1-2-3-4 clutch. 3rd, 5th, and reverse clutch remains on with the 1-2-3-4 clutch, resulting in third range being attained for limp home capability. If Reverse (R) is selected, the selector valve directs fluid through the TCC valve and shift valve 2 to low and reverse clutch. 3rd, 5th, and reverse clutch remains on with low and reverse clutch, resulting in Reverse (R) range being attained.

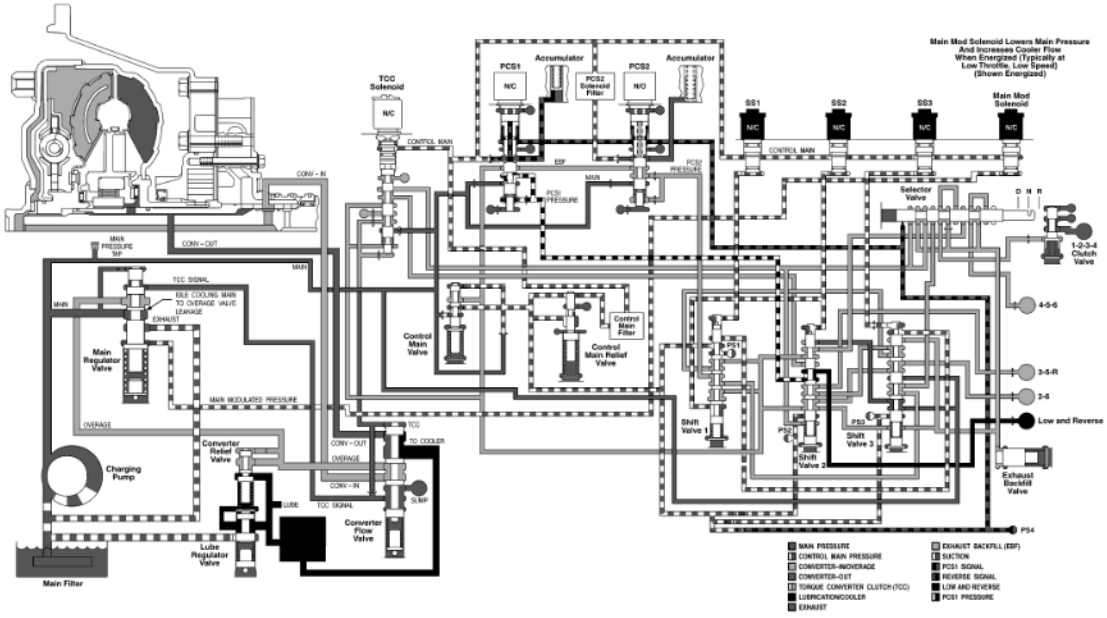


Fig. 523: Identifying Hydraulic Circuits Used In Neutral
Courtesy of GENERAL MOTORS CORP.

FIRST RANGE

When the selector lever is moved from Neutral (N) to Drive (D), the transmission shifts from neutral to first range operation. Shift solenoid 1 (SS1), SS2, and SS3 remain energized. Pressure control solenoid 1 (PCS1) and the torque converter clutch (TCC) solenoid remain de-energized.

Shift valve 1, shift valve 2, and shift valve 3 stay in the stroked position. With normally closed PCS1 de-energized, pressure control valve 1 continues to supply full control pressure through shift valve 2 to the low and reverse clutch, keeping the clutch applied. During the shift, PCS2 energizes, blocking the exhaust of the PCS2 signal pressure, causing the pressure to rise. The PCS2 signal pressure strokes pressure control valve 2, opening the pressure control valve 2

pressure port to main pressure. PCS2 pressure is directed through shift valve 1, shift valve 3, and the manual selector valve to the 1-2-3-4 clutch, applying the 1-2-3-4 clutch. The transmission control module (TCM) provides current to PCS2, which controls the rate of pressure buildup of the 1-2-3-4 clutch, assuring a smooth transition to first range. The combination of the 1-2-3-4 clutch and the low and reverse clutch application produces first range operation.

After the shift to first range is complete, SS3 is de-energized followed closely by SS1 (timed to prevent SS3 from becoming "latched" down), allowing both valves to de-stroke. PCS2 is also de-energized, exhausting PCS2 signal pressure, allowing the pressure control valve 2 to de-stroke which exhausts PCS2 pressure. In the de-stroked position, shift valve 3 routes main pressure to the manual selector valve which directs the main pressure to the 1-2-3-4 clutch, keeping the 1-2-3-4 clutch applied. With the 1-2-3-4 clutch and the low and reverse clutch applied, the transmission stays in first range.

Control main pressure exhaust for pressure switch 2 is blocked by shift valve 2, keeping the switch turned on and providing feedback to the TCM that shift valve 2 is stroked. With shift valve 1 in the de-stroked position, the pressure feed to pressure switch 1 is eliminated and with the pressure exhausted, the pressure switch turns off, providing feedback that shift valve 1 is in the de-stroked position. With shift valve 3 de-stroked, the control main pressure to pressure switch 3 is exhausted and pressure switch 3 turns off, providing feedback that shift valve 3 is in the de-stroked position.

If electrical power is interrupted while the transmission is in first range, SS2 is de-energized. Normally closed PCS1 continues to block the exhaust of PCS1 signal pressure (signal pressure remains control main) which results in maximum PCS1 pressure being maintained. PCS1 pressure continues to be directed to shift valve 2, which stays stroked due to the "latching" effect of pressure on two different diameter lands and fluid continues to be directed to the low and reverse clutch, keeping the low and reverse clutch applied. Main pressure continues to be directed through shift valve 3 and the manual selector valve to the 1-2-3-4 clutch, keeping the 1-2-3-4 clutch applied. The combination of the 1-2-3-4 clutch and the low and reverse clutch application allows the transmission to stay in first range for limp home capability.

If electrical power is interrupted while the transmission is in first range, moving the manual selector valve to Neutral (N) will cut off main pressure to the 1-2-3-4 clutch and the clutch will be exhausted. The low and reverse clutch remains applied. Because only one clutch is applied, the transmission goes to neutral.

If electrical power is interrupted while the transmission is in first range, moving the manual selector valve to Reverse (R) cuts off main pressure to the 1-2-3-4 clutch, exhausting the 1-2-3-4 clutch. The manual selector valve directs main pressure through the TCC valve to the bottom of shift valve 2, de-stroking the valve and opening the path for main pressure to feed the low and

reverse clutch, keeping the clutch applied. PCS1 control pressure is then directed to the 3rd, 5th, and reverse clutch, applying the clutch. The combination of the 3rd, 5th, and reverse clutch and the low and reverse clutch application produces Reverse (R) range operation, for limp home capability.

IMPORTANT: If the manual selector valve is put back in a forward range after reverse has been attained, the selector valve will direct fluid to the 1-2-3-4 clutch and shift valve 2 will stay de-stroked, directing fluid to the 3rd, 5th, and reverse clutch, resulting in third range operation.

If electrical power is interrupted while the transmission is in first range, resulting in only first, neutral, and reverse operation, the engine may be shut down and restarted to attain neutral, third, and reverse operation.

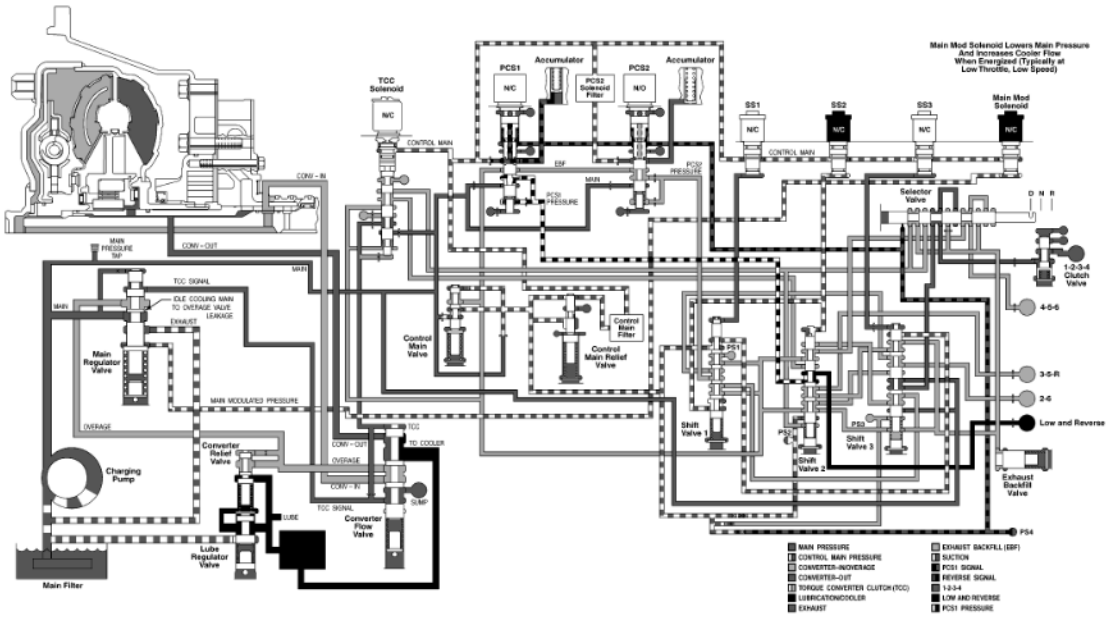


Fig. 524: Identifying Hydraulic Circuits Used In First Range
Courtesy of GENERAL MOTORS CORP.

SECOND RANGE (WITHOUT TCC APPLIED)

Before shifting from first to second range, the transmission control module (TCM) makes certain

shift valve 1, shift valve 2, and shift valve 3 are in the correct position with shift valve 1 and shift valve 2 de-stroked and shift valve 3 stroked.

Pressure control solenoid 1 (PCS1) is energized, opening PCS1 signal pressure to exhaust and allowing pressure control valve 1 to de-stroke, exhausting the low and reverse clutch pressure. PCS2 is energized, raising PCS2 signal and PCS2 pressures. The PCS2 pressure is directed through shift valve 1 and shift valve 3 to the 2-6 clutch. The TCM provides current to PCS2, which controls the rate at which the pressure control valve 2 supplies pressure to the 2-6 clutch, and current to PCS1, which controls the rate at which the low and reverse clutch is exhausted, assuring a smooth transition to second range. Main pressure continues to feed through shift valve 3 and the manual selector valve, keeping the 1-2-3-4 clutch applied.

The combination of the 1-2-3-4 and the 2-6 clutch application produces second range operation.

After the shift to second range is complete, SS2 is de-energized allowing shift valve 2 to de-stroke. The low and reverse clutch feed, which was exhausted through shift valve 2 and the PCS1, now exhausts through exhaust backfill, keeping the low and reverse clutch released. The 3rd, 5th, and reverse clutch has an exhaust path through shift valve 2 to the pressure control valve 1, keeping the 3rd, 5th, and reverse clutch released.

Pressure switch 1, pressure switch 2, and pressure switch 3 turn off, providing feedback that the valves are in the de-stroked position.

If electrical power is interrupted while the transmission is in second range, PCS1 and PCS2 de-energize. Normally open PCS2 exhausts the PCS2 signal pressure, allowing pressure control valve 2 to de-stroke, exhausting the 2-6 clutch. Normally closed PCS1 blocks the exhaust of the pressure control valve 1 signal pressure, allowing the PCS1 signal and PCS1 pressures to rise. Pressure control valve 1 directs full pressure through shift valve 2 to the 3rd, 5th, and reverse clutch, applying the clutch. The 1-2-3-4 clutch continues to be applied with main pressure through shift valve 3 and the manual selector valve. The combination of the 1-2-3-4 clutch and the 3rd, 5th, and reverse clutch applied produces third range converter operation for limp home capability.

If the torque converter clutch was applied during the power interrupt, the TCC solenoid is de-energized and the transmission returns to converter operation.

If electrical power is interrupted while the transmission is in second range and subsequent third range operation, moving the manual selector valve to Neutral (N) will cut off main pressure to the 1-2-3-4 clutch and the clutch will be exhausted. The 3rd, 5th, and reverse clutch remains applied. Because only one clutch is applied, the transmission goes to neutral.

If electrical power is interrupted while the transmission is in second range with subsequent third range operation, moving the manual selector valve to reverse will cut off main pressure to the 1-2-3-4 clutch, exhausting the 1-2-3-4 clutch. The manual selector directs main pressure through the TCC valve and shift valve 2 to the low and reverse clutch, applying the clutch. The 3rd, 5th and reverse clutch remains applied. The combination of the 3rd, 5th, and reverse clutch and the low and reverse clutch application produces reverse range operation for limp home capability.

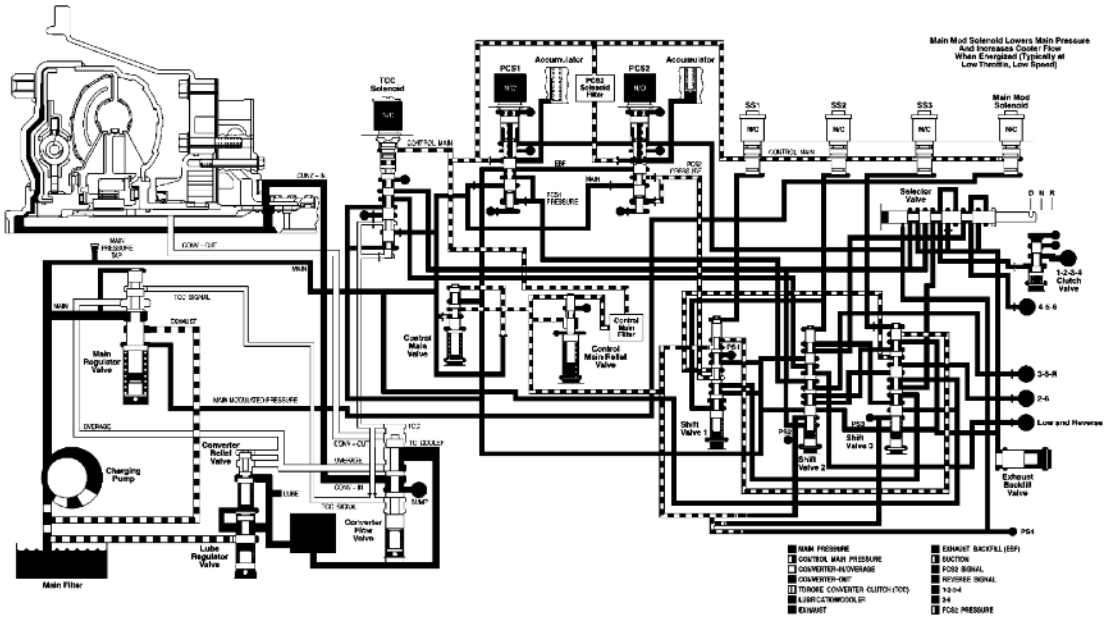


Fig. 525: Identifying Hydraulic Circuits Used In Second Range
Courtesy of GENERAL MOTORS CORP.

SECOND RANGE (WITH TCC APPLIED (TOW-HAUL))

Energizing the torque converter clutch (TCC) solenoid strokes the TCC valve against the stop, allowing main pressure to flow to the top of the converter flow valve. The converter flow valve is stroked, exhausting converter-in pressure to sump, and eliminating the separating force between the TCC piston and the converter cover. At the same time, the converter flow valve opens the passage supplying TCC-apply pressure to the converter-out circuit. The pressure differential across the TCC piston applies the torque converter clutch.

Depending upon the calibration, TCC solenoid could be energized in ranges 2-6. The calibrations can also apply the TCC for special applications such as power take-off (PTO) operation controlled directly by engine speed with transmission in neutral or TCC operation in first hold.

THIRD RANGE

Before making the shift from second to third range, the transmission control module (TCM) makes certain all of the shift valves are in the correct position with shift valve 1, shift valve 2, and shift valve 3 de-stroked.

Pressure control solenoid 2 (PCS2) is de-energized, exhausting PCS2 signal pressure which allows the pressure control valve 2 to de-stroke, exhausting the 2-6 clutch. PCS1 is de-energized, raising PCS1 signal and PCS1 pressures. The PCS1 pressure is directed through shift valve 2 to the 3rd, 5th, and reverse clutch. The TCM reduces current to PCS1, which controls the rate at which the pressure control valve 1 supplies pressure to the 3rd, 5th, and reverse clutch, and reduces current to PCS2, which controls the rate at which pressure control valve 2 exhausts the 2-6 clutch, assuring a smooth transition to third range. Main pressure continues to flow through shift solenoid 3 (SS3) and the manual selector valve to the 1-2-3-4 clutch, keeping the clutch applied.

The combination of the 1-2-3-4 clutch and the 3rd, 5th, and reverse clutch application produces third range operation.

After the shift into third range is complete, SS1 is energized and directs control main pressure to the top of shift valve 1, stroking the valve. With shift valve 1 in the stroked position, the 2-6 clutch feed is exhausted through shift valve 1 to exhaust backfill keeping the 2-6 clutch released and the 4-5-6 clutch has an exhaust path through shift valve 1 to pressure control valve 2, keeping the 4-5-6 clutch released.

Pressure switch 1 turns ON, providing feedback that shift valve 1 is stroked. Pressure switch 2 and pressure switch 3 remain OFF, providing feedback that shift valve 2 and shift valve 3 are in the de-stroked position.

If electrical power is interrupted while the transmission is in third range, SS1 and the torque converter clutch (TCC) solenoid (if TCC is applied) are de-energized. Shift valve 1 de-strokes, changing the exhaust path of the 4-5-6 clutch to exhaust backfill and the exhaust path of the 2-6 clutch to pressure control valve 2. Normally closed PCS1 continues to block the exhaust of the PCS1 signal pressure (signal remains control main). The signal pressure on top of pressure control valve 1 produces maximum PCS1 pressure, which is routed through shift valve 2 to the 3rd, 5th, and reverse clutch, keeping the clutch applied. With the manual selector valve in a forward position, main pressure continues to feed the 1-2-3-4 clutch through shift valve 3 and the manual selector valve. The combination of the 1-2-3-4 clutch and the 3rd, 5th, and reverse clutch applied keeps the transmission in third range for limp home capability. If the TCC is applied, the TCC solenoid de-energizes, causing the TCC valve to de-stroke, exhausting pressure from the top of the converter flow valve. The converter flow valve de-strokes, redirecting main overage to converter in and converter out to the cooler. The TCC is now released.

If electrical power is interrupted while the transmission is in third range, and the manual selector valve is moved to Neutral (N), the 1-2-3-4 clutch exhausts through the manual selector valve to exhaust backfill. The 3rd, 5th, and reverse clutch remains applied. With only one clutch applied, the transmission goes to Neutral (N).

If electrical power is interrupted while the transmission is in third range and the manual selector valve is moved to the Reverse (R) position, the 1-2-3-4 clutch exhausts through the manual selector valve which releases the clutch. Main pressure goes through shift valve 3, the manual selector valve and shift valve 2 to the low and reverse clutch, applying the clutch. The combination of the 3rd, 5th, and reverse clutch and the low and reverse clutch application produces Reverse (R) range for limp home capability.

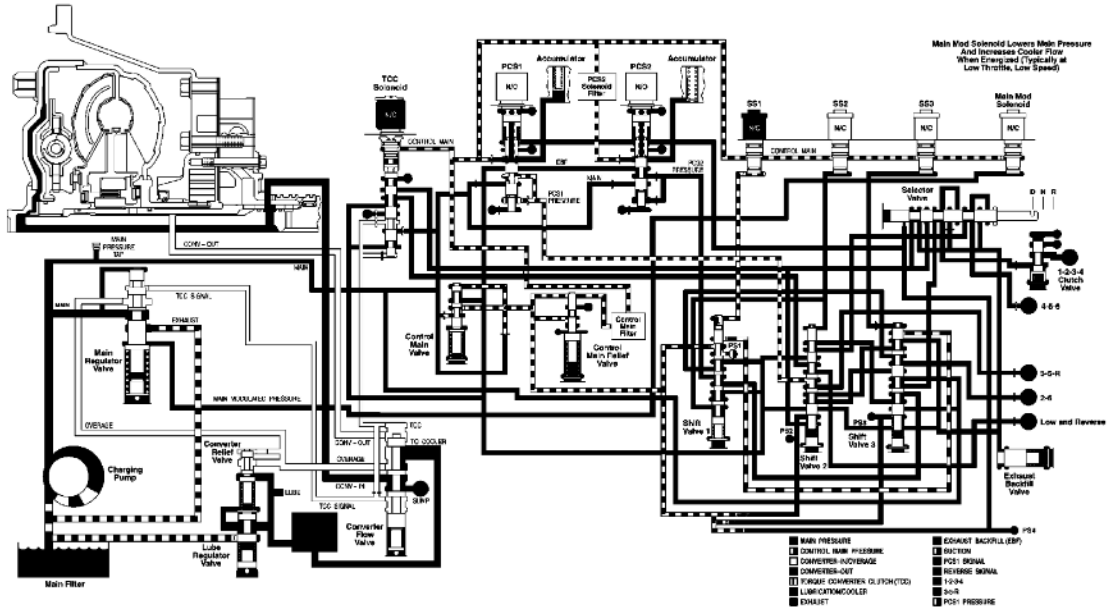


Fig. 526: Identifying Hydraulic Circuits Used In Third Range
Courtesy of GENERAL MOTORS CORP.

FOURTH RANGE

Before making the shift from third to fourth range, the transmission control module (TCM) makes certain all of the shift valves are in the correct position, with shift valve 1 stroked and shift valve 2 and shift valve 3 de-stroked.

Pressure control solenoid 1 (PCS1) is energized, opening the PCS1 signal pressure to exhaust

which allows the pressure control valve 1 to de-stroke and the 3rd, 5th, and reverse clutch pressure is exhausted. PCS2 is energized, raising the PCS2 signal and PCS2 pressures. The PCS2 pressure is directed through shift valve 1, shift valve 3, shift valve 2, and the manual selector valve to the 4-5-6 clutch, applying the clutch. Main pressure continues to flow through shift valve 3 and the manual selector valve to the 1-2-3-4 clutch, keeping the 1-2-3-4 clutch applied. The TCM supplies current to PCS2, which controls the rate at which pressure control valve 2 supplies pressure to the 4-5-6 clutch, and current to PCS1, which controls the rate at which pressure control valve 1 exhausts the 3rd, 5th, and reverse clutch, assuring a smooth transition to fourth range.

The combination of the 1-2-3-4 clutch and the 4-5-6 clutch application produces fourth range operation.

After the shift to fourth range is completed, SS3 is energized, directing control main pressure to the top of shift valve 3, stroking the valve. In the stroked position, main pressure is redirected through shift valve 2 and the manual selector valve to the 4-5-6 clutch, keeping the 4-5-6 clutch applied. The flow from pressure control valve 2 to shift valve 3 is directed through the manual selector valve to the 1-2-3-4 clutch, keeping the 1-2-3-4 clutch applied.

Pressure switch 3 turns ON and pressure switch 1 remains ON, providing feedback that the valves are stroked. Pressure switch 2 remains OFF, providing feedback that shift valve 2 is in the de-stroked position.

If electrical power is interrupted while the transmission is in fourth range, PCS1, PCS2, the torque converter clutch (TCC) solenoid, SS1, and SS3 are de-energized. Main pressure continues to flow through shift valve 3 and shift valve 2 and the manual selector valve to the 4-5-6 clutch, keeping the 4-5-6 clutch applied. When de-energized, normally open PCS2 exhausts the PCS2 signal pressure, allowing pressure control valve 2 to de-stroke and the 1-2-3-4 clutch exhausts. After shift valve 1 de-strokes, the 1-2-3-4 clutch exhausts to exhaust backfill. Normally closed PCS1 blocks the exhaust of PCS1 signal pressure, allowing the PCS1 signal and PCS1 pressures to rise. Pressure control valve 1 directs full pressure through shift valve 2 to the 3rd, 5th, and reverse clutch, applying the clutch. The combination of the 4-5-6 clutch and the 3rd, 5th, and reverse clutch applied produces fifth range operation for a limp home capability. If the TCC is applied, de-energizing the TCC solenoid causes the TCC valve to de-stroke, exhausting pressure from the top of the converter flow valve. The converter flow valve de-strokes, redirecting main overage to converter in and converter out to the cooler. The TCC is now released.

If electrical power is interrupted while the transmission is in fourth range (causing fifth range converter operation) and the manual selector valve is moved to Neutral (N), the 4-5-6 clutch exhausts through the manual selector valve to exhaust backfill, releasing the 4-5-6 clutch. The 3rd, 5th, and reverse clutch remains applied. With only one clutch applied, the transmission goes

to neutral.

If electrical power is interrupted while the transmission is in fourth range (causing fifth range converter operation) and the manual selector valve is moved to Reverse (R), the 4-5-6 clutch exhausts through the manual selector valve, releasing the clutch. The 3rd, 5th, and reverse clutch remains applied. With only one clutch applied, the transmission goes to neutral.

If electrical power is interrupted with the transmission in fourth range, resulting in only fifth range and neutral operation, the engine may be shut down and restarted to attain neutral, third, and reverse operation.

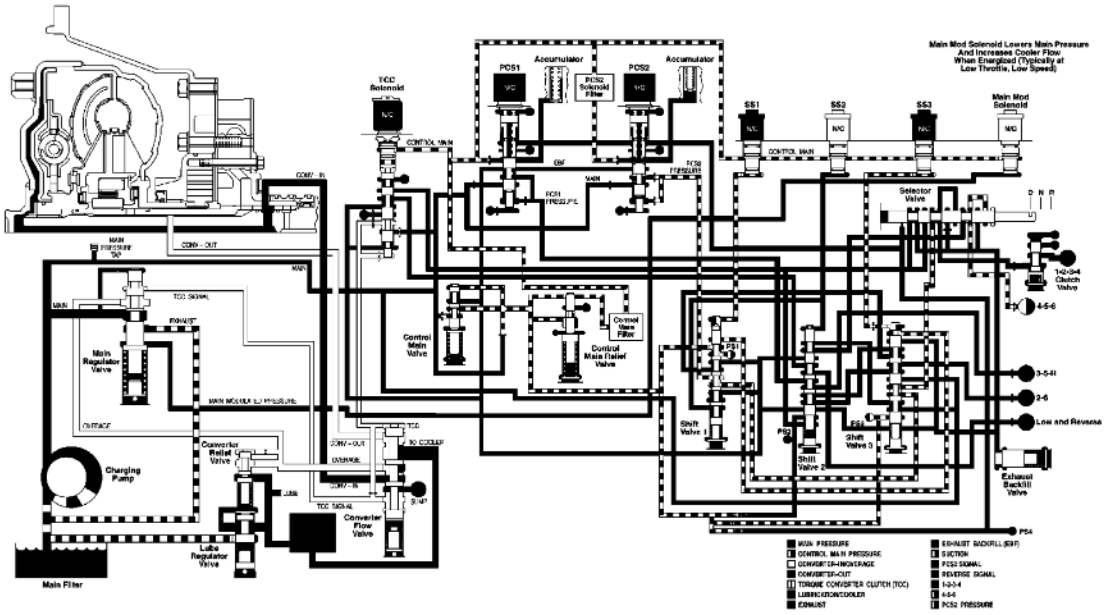


Fig. 527: Identifying Hydraulic Circuits Used In Fourth Range
Courtesy of GENERAL MOTORS CORP.

FIFTH RANGE

Before making a shift from fourth to fifth range, the transmission control module (TCM) makes certain all of the shift valves are in the correct position with shift valve 1 and shift valve 3 stroked and shift valve 2 de-stroked.

Pressure control solenoid 2 (PCS2) is de-energized, exhausting PCS2 signal pressure and pressure control valve 2 de-strokes, which allows the 1-2-3-4 clutch to exhaust through the manual selector

valve, shift valve 3 and shift valve 1, and pressure control valve 2. PCS1 is de-energized, raising the PCS1 signal and pressure control valve 1 pressures. PCS1 pressure is directed through shift valve 2 to the 3rd, 5th, and reverse clutch, applying the clutch. The TCM reduces the current to PCS1, which controls the rate at which pressure control valve 1 supplies pressure to the 3rd, 5th, and reverse clutch, and reduces the current to PCS2, which controls the rate at which pressure control valve 2 exhausts the 1-2-3-4 clutch, assuring a smooth transition from fourth to fifth range. The 4-5-6 clutch continues to be applied by main pressure flowing through shift valve 3, shift valve 2, and the manual selector valve.

The combination of the 4-5-6 clutch and the 3rd, 5th, and reverse clutch application produces fifth range operation.

Pressure switch 1 and pressure switch 2 are turned OFF, providing feedback that shift valve 1 and shift valve 2 are in the de-stroked position, and pressure switch 3 remains ON, providing feedback that shift valve 3 is in the stroked position.

If electrical power is interrupted while the transmission is in fifth range, PCS2, shift solenoid 3 (SS3), and the torque converter clutch (TCC) solenoid (if TCC is applied) de-energize. Although SS3 no longer supplies control main pressure to the top of shift valve 3, control main pressure flows through shift valve 1 to the top of shift valve 3, keeping the valve stroked. Normally closed PCS1 continues to block the exhaust of the signal pressure (signal remains control main). The signal pressure on top of pressure control valve 1 produces maximum control pressure, which is routed through shift valve 2 to the 3rd, 5th, and reverse clutch, keeping the clutch applied. Main pressure feeds through shift valve 3 and shift valve 2 and the manual selector valve to the 4-5-6 clutch, keeping the clutch applied.

The combination of the 4-5-6 clutch and the 3rd, 5th, and reverse clutch application produces fifth range operation for limp home capability.

If the TCC is applied, the TCC solenoid de-energizes, causing the TCC pressure control valve to de-stroke, exhausting pressure from the top of the converter flow valve. The converter flow valve de-strokes, redirecting main overage to converter in and converter out flow to the cooler. The TCC is now released.

If electrical power is interrupted while the transmission is in fifth range (causing fifth range converter operation) and the manual selector valve is moved to Neutral (N), the 4-5-6 clutch exhausts through the manual selector valve to exhaust backfill, releasing the 4-5-6 clutch. The 3rd, 5th, and reverse clutch remains applied. With only one clutch applied, the transmission goes to neutral.

If electrical power is interrupted while the transmission is in fifth range, (fifth range converter

operation) and the manual selector valve is moved to Reverse (R), the 4-5-6 clutch exhausts through the manual selector valve, releasing the clutch. The 3rd, 5th, and reverse clutch remains applied. With only one clutch applied, the transmission goes to neutral.

If electrical power is interrupted while the transmission is in fifth range, resulting in only fifth and neutral operation, the engine may be shut down and restarted to attain neutral, third and reverse operation.

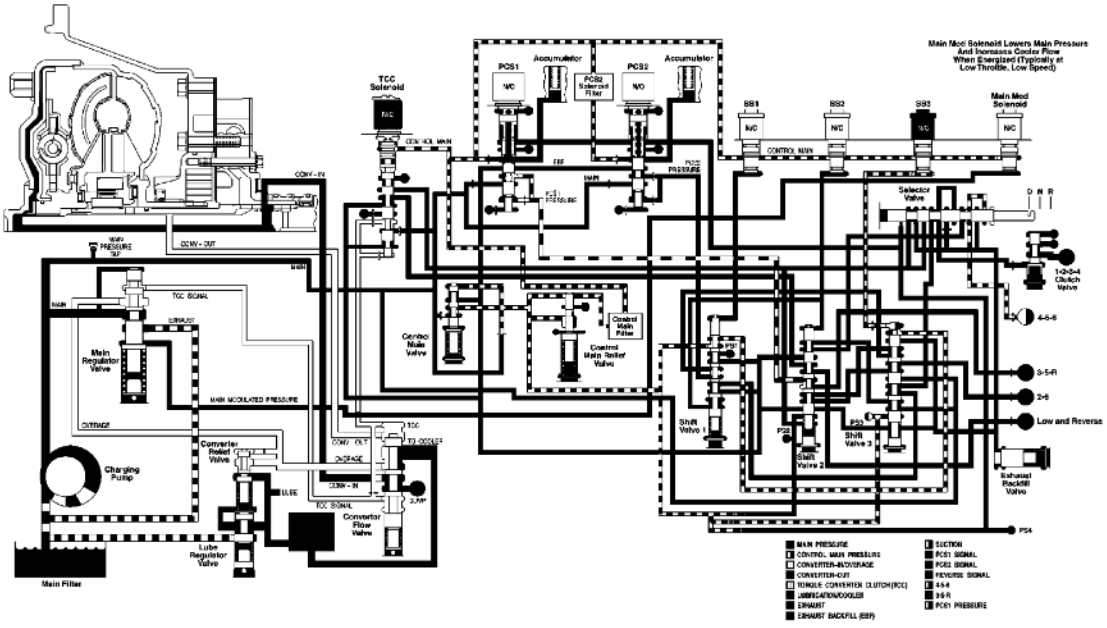


Fig. 528: Identifying Hydraulic Circuits Used In Fifth Range
Courtesy of GENERAL MOTORS CORP.

SIXTH RANGE

Before making a shift from fifth to sixth range, the transmission control module (TCM) makes certain that all shift valves are in the correct position. Shift solenoid 1 (SS1) and SS2 are electrically off and shift valve 1 and shift valve 2 are in the de-stroked position. SS3 is electrically on and shift valve 3 is in the stroked position.

Pressure control solenoid 1 (PCS1) is energized, opening PCS1 pressure to exhaust, which allows pressure control valve 3 to de-stroke, exhausting the 3rd, 5th, and reverse clutch pressure and releasing the 3rd, 5th, and reverse clutch. PCS2 is energized, raising the PCS2 signal and PCS2 pressure. PCS2 pressure is directed through shift valve 1, shift valve 3, shift valve 2, and again

through shift valve 3 to the 2-6 clutch, applying the clutch. Main pressure continues to flow through shift valve 3, shift valve 2, and the manual selector valve to the 4-5-6 clutch, keeping the 4-5-6 clutch applied. The TCM supplies current to the PCS2, which controls the rate at which the pressure control valve 2 supplies pressure to the 2-6 clutch, and current to PCS1, which controls the rate at which the pressure control valve 1 exhausts the 3rd, 5th, and reverse clutch, assuring a smooth transition to sixth range.

The combined application of the 4-5-6 clutch and the 2-6 clutch produces sixth range operation.

Pressure switch 1 and pressure switch 2 remain open (OFF) providing feedback that shift valve 1 and shift valve 2 remain in the de-stroked position, and pressure switch 3 remains closed (ON) providing feedback that shift valve 3 remains in the stroked position.

If electrical power is interrupted while the transmission is in sixth range, PCS1 and PCS2, SS3 and the torque converter clutch (TCC) solenoid (if TCC is applied) are de-energized. Although SS3 supplies control main pressure to the top of shift valve 3, control main pressure flows through shift valve 1 to the top of shift valve 3, keeping the valve in the stroked position. Normally open PCS2 exhausts PCS2 signal pressure, allowing the pressure control valve 2 to de-stroke, exhausting the 2-6 clutch. Normally closed PCS1 blocks exhausting of PCS1 signal pressure, allowing PCS1 signal and PCS1 pressure to rise.

PCS1 pressure is directed through shift valve 2 to the 3rd, 5th, and reverse clutch, applying the clutch. Main pressure continues to flow through shift valve 3, shift valve 2, and the manual selector valve to the 4-5-6 clutch, keeping the 4-5-6 clutch applied. The combination of 4-5-6 clutch and 3rd, 5th, and reverse clutch application produces fifth range operation for limp home capability.

If the TCC is applied, the TCC solenoid de-energizes, causing the TCC valve to de-stroke, exhausting pressure form the top of the converter flow valve. De-stroking the converter flow valve redirects main overage pressure to "converter in" path, then to "converter out" proceeding on to the transmission oil cooler. The TCC is now released.

If electrical power is interrupted while the transmission is in sixth range (causing sixth range converter operation [TCC OFF]) and the manual selector valve is moved to Neutral (N), the 4-5-6 clutch exhausts through the manual selector valve to exhaust backfill pressure, releasing the 4-5-6 clutch. The 3rd, 5th, and reverse clutch remains applied. With only one clutch applied the transmission shifts to neutral

If electrical power is interrupted while the transmission is in sixth range (causing fifth range converter operation [TCC OFF]) and the manual selector valve is moved to Reverse (R), the 4-5-6 clutch exhausts through the manual selector valve to exhaust backfill pressure, releasing the 4-5-

6 clutch. The 3rd, 5th, and reverse clutch remains applied. With only one clutch applied, the transmission shifts to neutral.

If electrical power is interrupted while the transmission is in sixth range, resulting in only fifth range and neutral operation, the engine may be shut down and restarted to attain neutral, drive, and reverse operation.

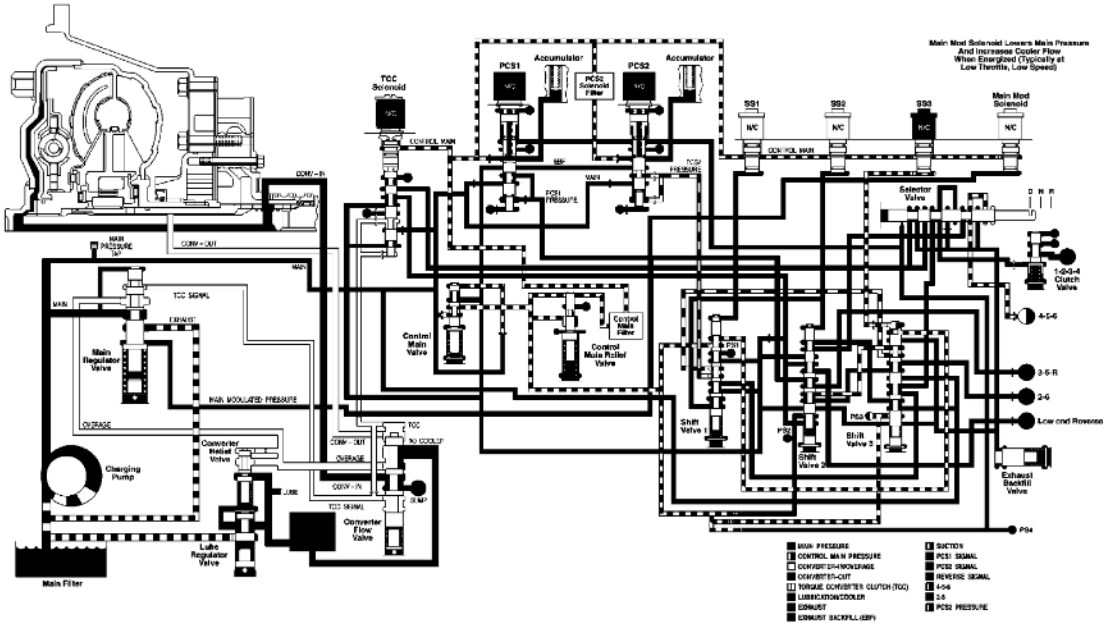


Fig. 529: Identifying Hydraulic Circuits Used In Sixth Range
Courtesy of GENERAL MOTORS CORP.

REVERSE

When the manual selector valve is moved from Neutral (N) to Reverse (R), shift solenoid 1 (SS1) de-energizes, turning OFF pressure switch 1. SS2 and SS3 remain energized, keeping pressure switch 2 and pressure switch 3 on. Reverse signal pressure is exhausted, removing pressure from pressure switch 4, turning on the normally closed pressure switch 4.

The transmission control module (TCM) energizes pressure control solenoid 2 (PCS2) to control the rate at which PCS2 pressure supplies oil to the oncoming 3rd, 5th, and reverse clutch, assuring a smooth transition to reverse. As PCS2 is energized, PCS2 signal pressure increases. Initially, the pressure control valve 2 gain valve spring keeps the gain valve away from pressure control valve 2, so that only PCS2 signal pressure acts on pressure control valve 2. As PCS2

signal pressure increases, the PCS2 pressure increases. The PCS2 signal pressure also acts on the gain valve, stroking the valve and compressing the gain valve spring. When the gain valve spring is compressed sufficiently, the gain valve contacts pressure control valve 2. The gain valve spring allows the 3rd, 5th, and reverse clutch initial apply to be controlled at a lower gain rate, improving control of the oncoming 3rd, 5th, and reverse clutch. Once the gain valve makes contact with pressure control valve 2, PCS2 pressure increases at a higher gain rate, PCS2 pressure flows through shift valve 1 to shift valve 3 and on to apply the 3rd, 5th, and reverse clutch. When the shift to reverse is complete, PCS2 fully energizes and PCS2 pressure fully applies the 3rd, 5th, and reverse clutch. PCS1 supplies full pressure to the low and reverse clutch.

The application of the 3rd, 5th, and reverse clutch and the low and reverse clutch produces reverse range operation.

If electrical power is interrupted with the transmission operating in reverse range, PCS2, SS2, and SS3 de-energize. When PCS2 de-energizes, the normally open solenoid exhausts PCS2 signal pressure, causing pressure control valve 2 to de-stroke, exhausting and releasing the 3rd, 5th, and reverse clutch. Shift valve 1 remains in the stroked position. Control main pressure goes through shift valve 1 to the top of shift valve 3 keeping shift valve 3 stroked. Normally closed PCS1 blocks the exhaust of PCS1 signal pressure, and PCS1 pressure is maintained. PCS1 pressure continues to be directed through shift valve 2, which stays down due to the "latching" effect of pressure on two different diameter lands, to the low and reverse clutch, keeping the low and reverse clutch applied. Because only one clutch is applied, the transmission shifts to neutral range.

If electrical power is interrupted with the transmission operating in reverse range, resulting in neutral operation, main pressure is directed through shift valve 3 to shift valve 2. Because shift valve 2 stays stroked due to the "latching" effect of pressure on two different diameter lands, main pressure is blocked from reaching the manual selector valve. If the manual selector valve is moved to Neutral (N) or a forward range, the transmission remains in neutral.

If electrical power is interrupted with the transmission operating in reverse range, resulting in neutral operation, the engine may be shut down and restarted to attain neutral, third and reverse operation.

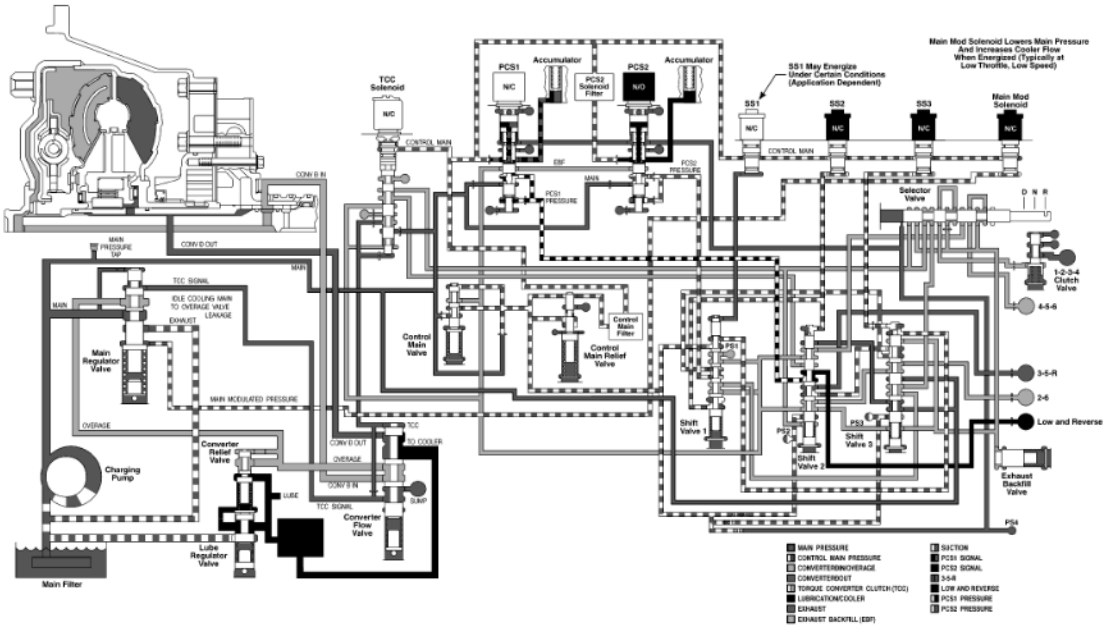


Fig. 530: Identifying Hydraulic Circuits Used In Reverse Range
Courtesy of GENERAL MOTORS CORP.

DEFAULT REVERSE - LIMP HOME

If electrical power is interrupted with the transmission operating in reverse range, resulting in neutral operation, main pressure is directed through shift valve 3 to shift valve 2. Because shift valve 2 stays stroked due to the "latching" effect of pressure on two different diameter lands, main pressure is blocked from reaching the manual selector valve. If the manual selector valve is moved to Neutral (N) or a forward range, the transmission remains in neutral.

If electrical power is interrupted with the transmission operating in reverse range, resulting in neutral operation, the engine may be shut down and restarted to attain neutral, third and reverse operation.

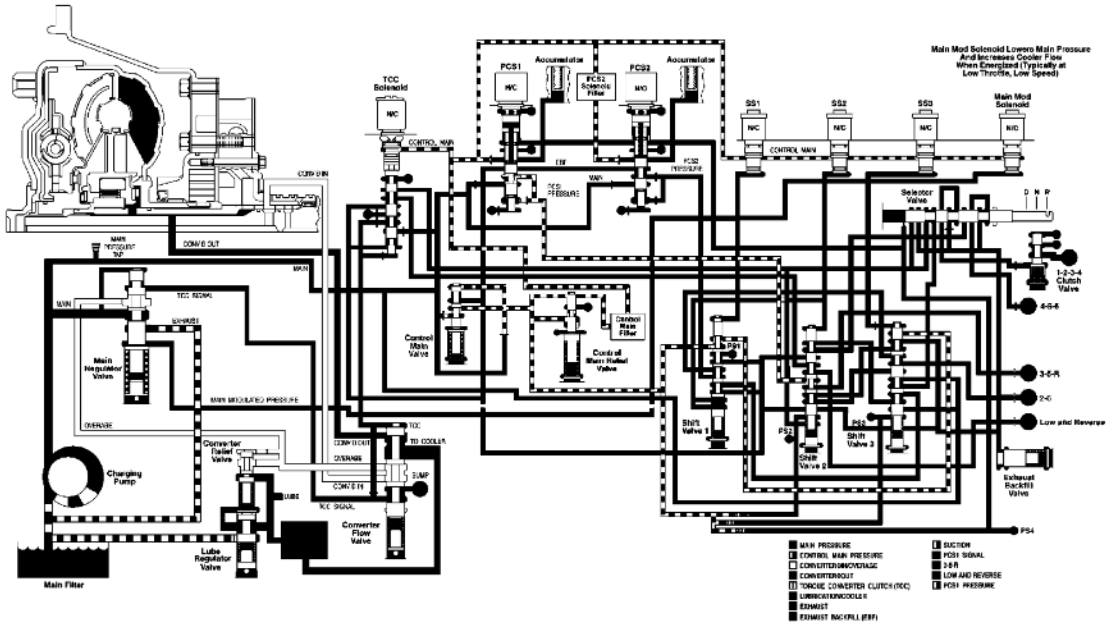


Fig. 531: Identifying Hydraulic Circuits Used In Default Reverse - Limp Home
Courtesy of GENERAL MOTORS CORP.

DEFAULT FORWARD - 3RD RANGE LIMP HOME

If electrical power is interrupted while the transmission is in third range, SS1 and the torque converter clutch (TCC) solenoid (if TCC is applied) are de-energized. Shift valve 1 de-strokes, changing the exhaust path of the 4-5-6 clutch to exhaust backfill and the exhaust path of the 2-6 clutch to pressure control valve 2. Normally closed PCS1 continues to block the exhaust of the PCS1 signal pressure (signal remains control main). The signal pressure on top of pressure control valve 1 produces maximum PCS1 pressure, which is routed through shift valve 2 to the 3rd, 5th, and reverse clutch, keeping the clutch applied. With the manual selector valve in a forward position, main pressure continues to feed the 1-2-3-4 clutch through shift valve 3 and the manual selector valve. The combination of the 1-2-3-4 clutch and the 3rd, 5th, and reverse clutch applied keeps the transmission in third range for limp home capability. If the TCC is applied, the TCC solenoid de-energizes, causing the TCC valve to de-stroke, exhausting pressure from the top of the converter flow valve. The converter flow valve de-strokes, redirecting main overage to converter in and converter out to the cooler. The TCC is now released.

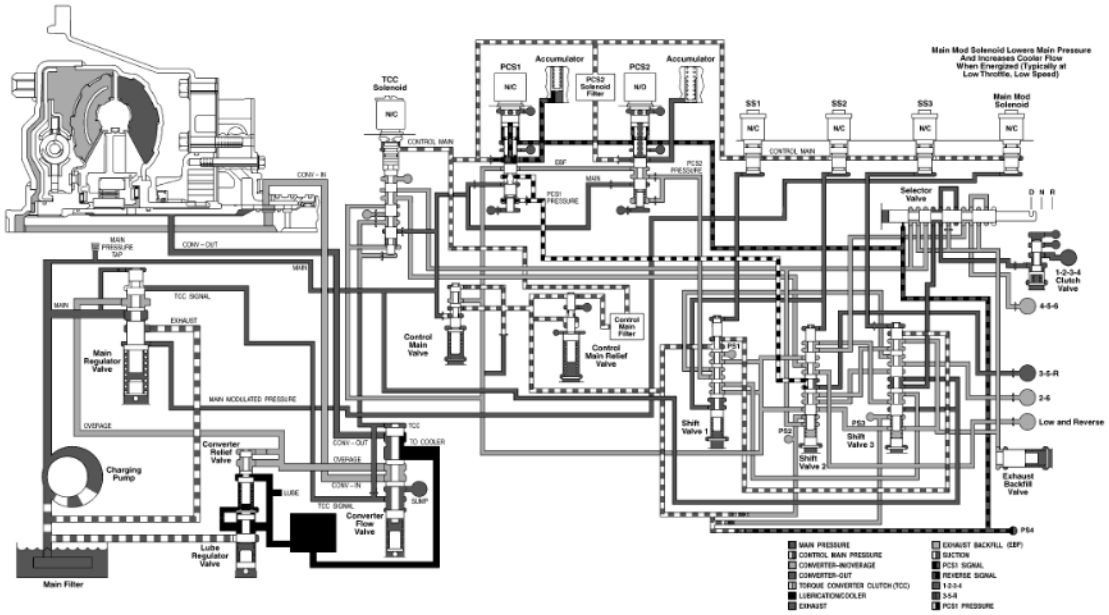


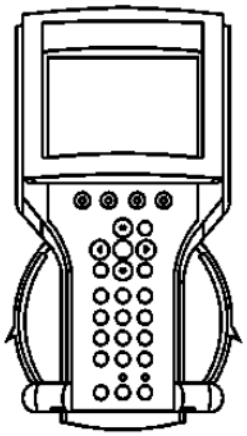
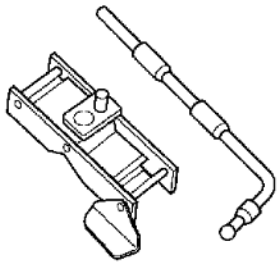
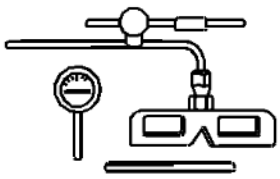
Fig. 532: Identifying Hydraulic Circuits Used In Default Forward - Third Range Limp Home

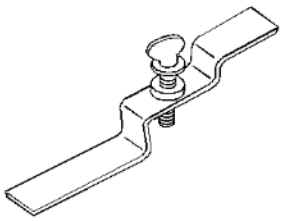
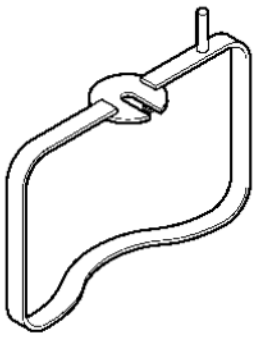
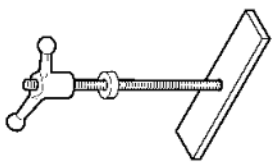
Courtesy of GENERAL MOTORS CORP.

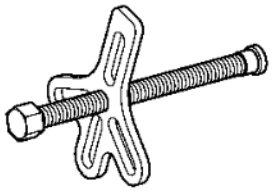
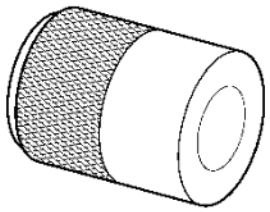
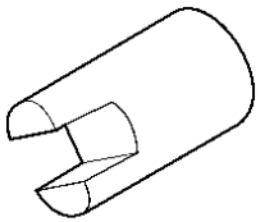
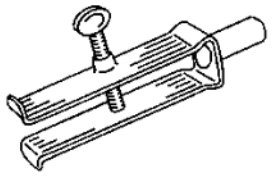
SPECIAL TOOLS AND EQUIPMENT

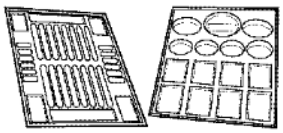
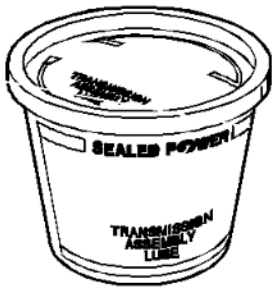
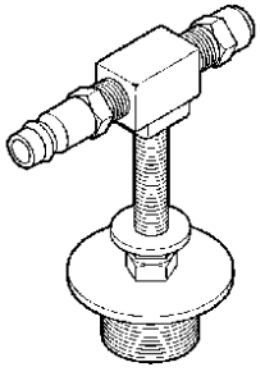
SPECIAL TOOLS

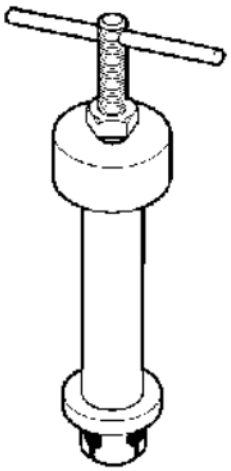
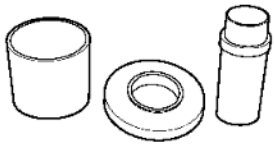
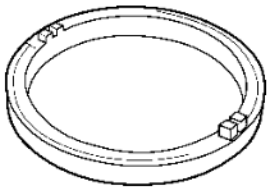
Illustration	Tool Number/ Description
	Scan Tool

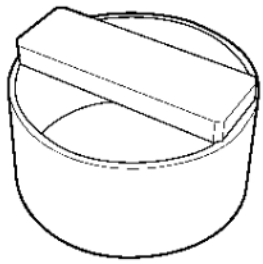
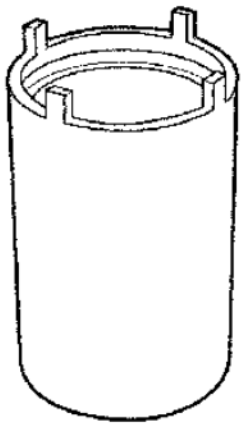
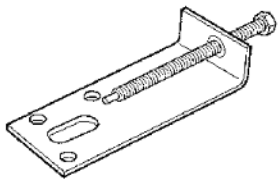
	
	J 5959 Dial Indicator Clamp and Adjuster
	J 7872 Magnetic Base Dial Indicator
	J 8092 Universal Driver Handle - 3/4 in - 10

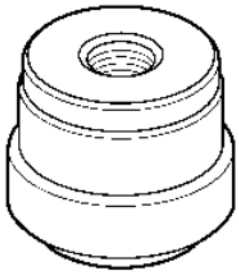
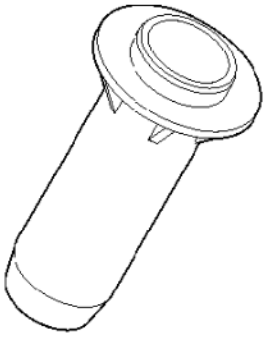
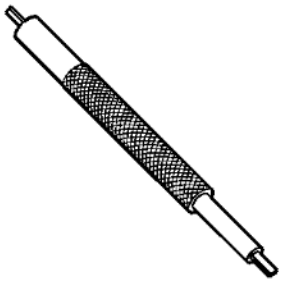
	
	J 21366 Torque Converter Retaining Strap
	J 21369-F Torque Converter Leak Test Fixture
	J 24204-2 Bar and Stud Assembly

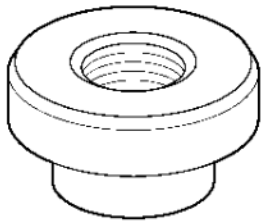
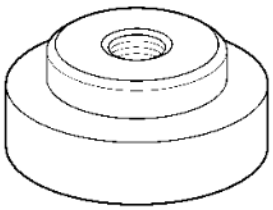
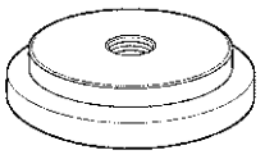
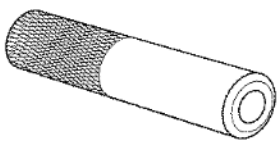
	J 24420-B Universal Puller
	J 24446 Rear Bearing Installer
	J 24459-5 Spring Compressor Adapter
	J 26941 Bushing and Bearing Remover 3-4 in
	J 33163 Valve Tray Set

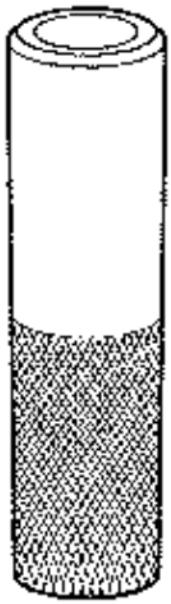
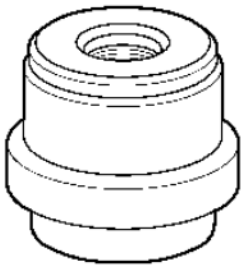
	
	J 36850 Transjel® Lubricant
	J 39200 Digital Multimeter (DMM)
	J 43763 Torque Converter Leak Test Plug

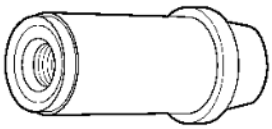
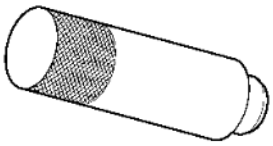
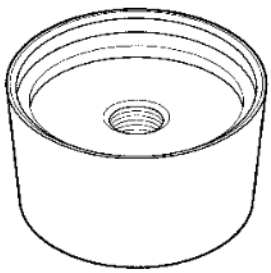
	J 43764 Torque Converter End Play Gage
	J 43765 Stator Shaft Installer/Remover
	J 43767 Tone Wheel Staker
	J 43768 Tone Wheel Driver

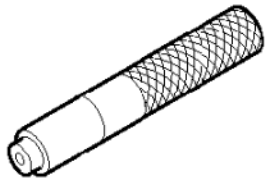
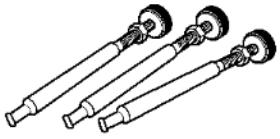
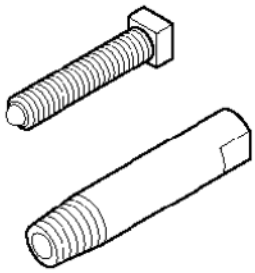
	
	J 43769 Spanner Nut Wrench - 4WD
	J 43770 Main Lube, Converter Relief Valve Spring Compressor
	J 43771 Pump Bushing Removal and Installation Tool

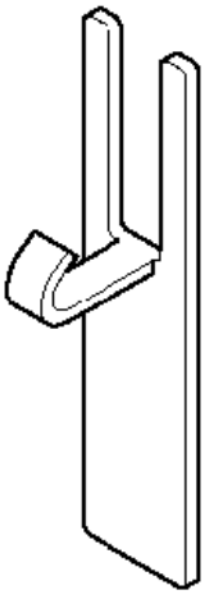
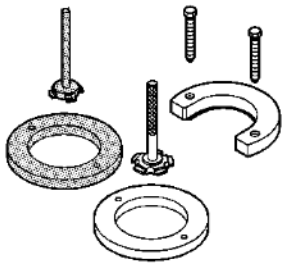
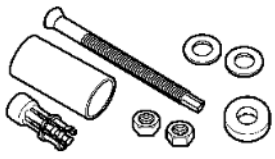
	
	J 43772 Torque Converter Seal Installer
	J 43773 Valve Spring Compressor
	J 43774 Stator Shaft Bushing Installer

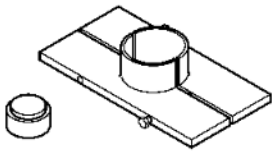
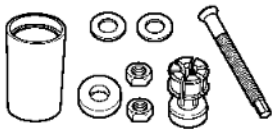
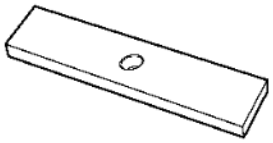
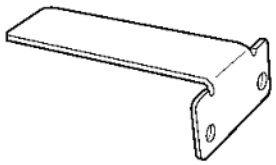
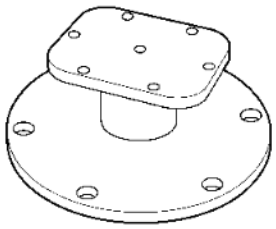
	
	J 43775 Oil Pump Cover Needle Bearing Installer
	J 43778 Clutch Bushing Installer
	J 43779 Locating Pin Installer

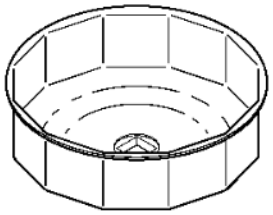
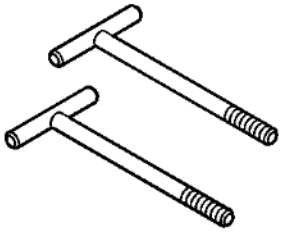
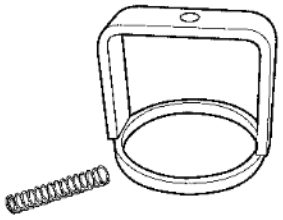
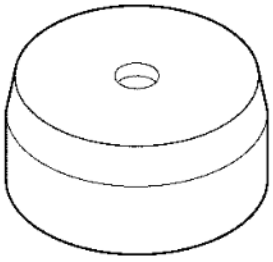
	J 43780 Transmission Case Locating Pin Installer
	J 43781 Input Carrier Bushing Remover/Installer
	J 43782

	Rear Seal Installer
	J 43785 Intermediate Bushing Remover/Installer
	J 43791 Output/Turbine Shaft Bushing Installer
	J 43797 Output Carrier Bearing Race Installer
	J 43909 Manual Shift Shaft Seal Installer

	
	J 43910 Output Bearing Puller Leg Set
	J 43911 Manual Shift Shaft Seal Remover
	J 44247 Internal Wiring Harness Installer

	
	J 44525 Clutch Backing Plate Selector
	J 44526 Output/Turbine Shaft Bushing Remover

	J 44528 Output Carrier Bearing Race Remover
	J 44529 Stator Shaft Bushing Remover
	J 44530 Clutch Piston Spring Compressor
	J 44587 Main Shaft Holder
	J 44723 Transmission/Stand Adapter Plate

	J 45023 Control Main Filter Wrench
	J 46409 Torque Converter Lifting Handles
	J 47339-1 Piston Return Spring Compressor
	J 47339-2 Seal Area Protector