

2003-04 AUTOMATIC TRANSMISSIONS

Servicing - H2

APPLICATION

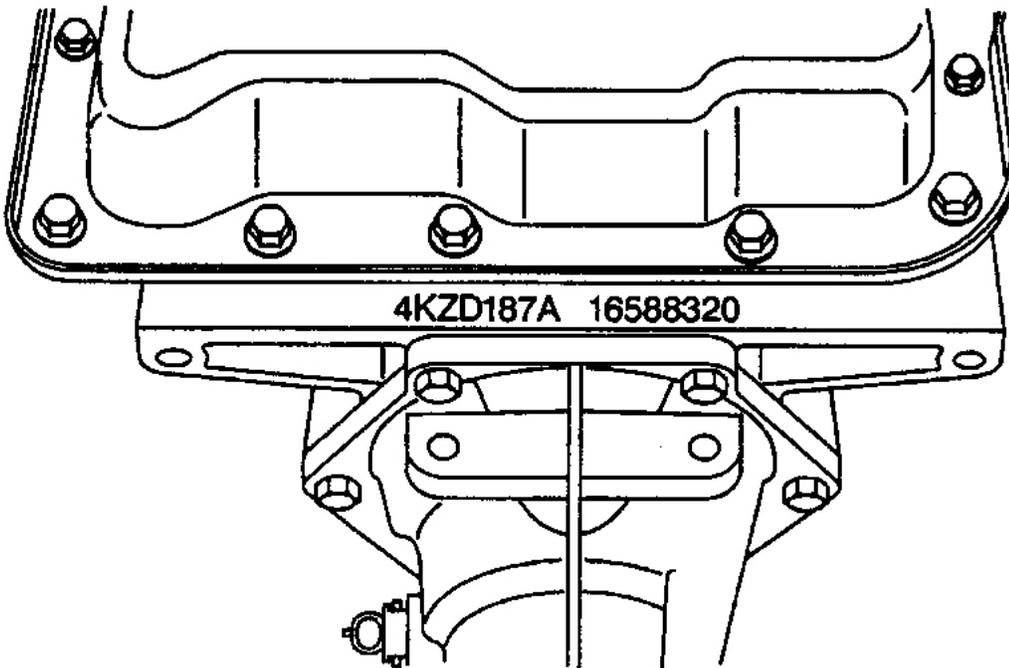
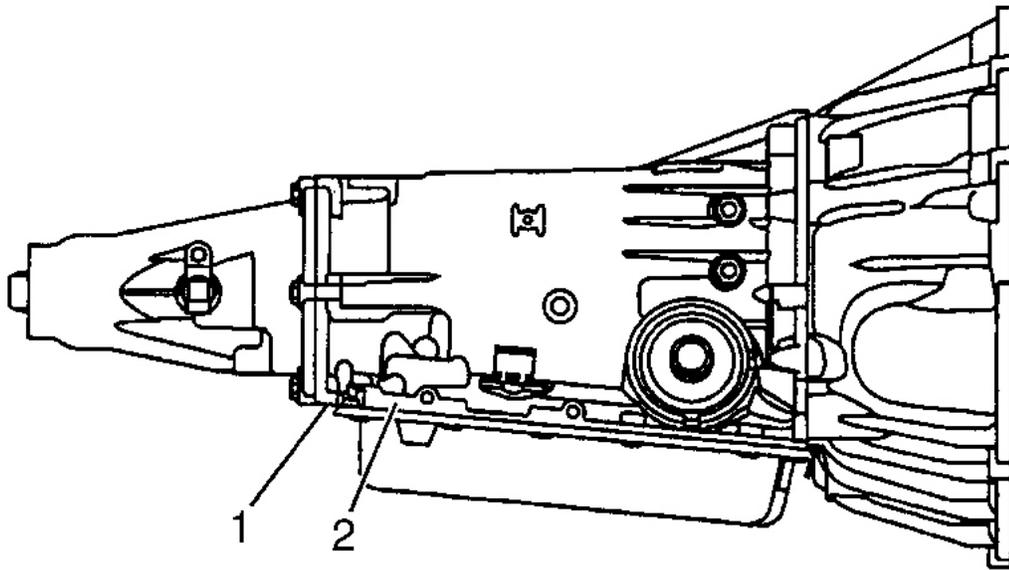
TRANSMISSION APPLICATION

Application	Transmission Model (RPO Code)
H2	4L65-E (M32)

IDENTIFICATION

TRANSMISSION ID NUMBER

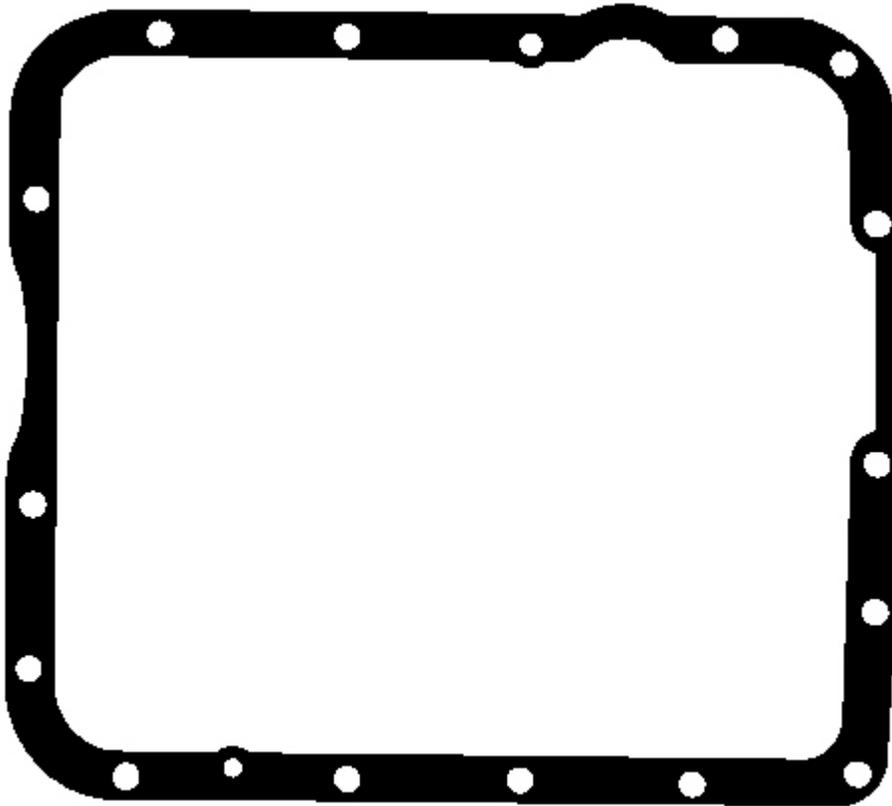
Refer to illustration for main (1) and optional (2) locations of transmission ID number. See **Fig. 1** .



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Fig. 1: Locating Transmission ID Number
Courtesy of GENERAL MOTORS CORP.

TRANSMISSION PAN GASKET



G95J13697

Fig. 2: Identifying Transmission Oil Pan Gasket (Hydra-Matic 4L65-E)
Courtesy of GENERAL MOTORS CORP.

LUBRICATION

SERVICE INTERVALS

Check transmission fluid level at each engine transmission oil change. Change the automatic transmission fluid and the filter every 100,000 miles for normal duty and every 50,000 miles for severe duty. Severe duty applies if the vehicle is mainly driven under one or more of these conditions:

- In heavy city traffic where the outside temperature regularly reaches 90°F (32°C) or higher.

- In hilly or mountainous terrain.
- When doing frequent trailer towing.
- Uses such as found in taxi, police or delivery service.

CHECKING FLUID LEVEL & CONDITION

Checking Fluid Level

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

Checking Fluid Condition

1. Check the fluid color. Is the fluid Red in color? If so, go to step 5 . If not, go to next step.
2. Is the fluid a non transparent Pink in color? If so, go to step 14 . If not, go to next step.
3. Is the fluid a light Brown in color? If so, go to step 5 . If not, go to next step.

NOTE: **Fluid may turn a Dark Brown in color from normal use. This does not always indicate an oxidation or a contamination issue.**

4. Is the fluid Black in color and or have a burnt smell? If so, go to step 14 . If not, go to next step.
5. Does the fluid appear as a solid liquid and not foamy or full of bubbles on transmission fluid level indicator? If so, go to next step. If not, go to step 7 .
6. Check the fluid level. Proper level should be in middle of the "X" pattern, on transmission fluid level indicator. Is the level okay? If so, go to step 19 . If not, go to next step.
7. Is the fluid level high on indicator? If so, go to step 12 . If not, go to next step.
8. Is the fluid level low on indicator? If so, go to step 9 . If not, go to step 4 .
9. Check for any external leak or leaks. Did you find an external leak or leaks? If so, go to next step. If not, go to step 11 .
10. Correct leak or leaks as needed. Are any leak or leaks still present? If so, go to step 9 . If not, go to next step.
11. Add fluid until level is in middle of "X" on the transmission fluid level indicator. Is the level okay? If so, go to step 19 . If not, go to step 6 .

12. Drain fluid until level is in middle of "X" pattern on the transmission fluid level indicator. Is level okay? If so, go to step 19 . If not, go to step 6 .
13. Replace transmission oil cooler and flush lines. See **AUXILIARY TRANSMISSION COOLER** under **REMOVAL & INSTALLATION**. Is the replacement complete? If so, go to step 15 .
14. Drain fluid and remove transmission oil pan to inspect. Is there sign or signs of internal component damage noted in bottom of transmission oil pan? If so, go to step 16 . If not go to step 13 .

NOTE: **A small amount of friction material in pan bottom is a normal condition, but large pieces and or metal particles will require complete transmission overhaul.**

15. Replace the filter and fluid. See **DRAINING & REFILLING** . Is the replacement complete? If so, go to step 6 .
16. Flush transmission oil cooler and lines, and check flow. See **TRANSMISSION COOLER FLUSHING & FLOW CHECK** . Is transmission oil cooler flushing and flow test complete? If so, go to step 17 .
17. Overhaul transmission. See **OVERHAUL** article. Is the overhaul procedure complete? If so, go to next step.
18. Fill transmission with appropriate fluid to proper level. See **RECOMMENDED FLUIDS** and **FLUID CAPACITIES** . Is the procedure complete? If so, go to step 6 .
19. Check the fluid level and correct as necessary. Is the fluid level satisfactory? If so, system is okay. If not, go to step 1 .

RECOMMENDED FLUIDS

Manufacturer recommends Dexron-III ATF.

FLUID CAPACITIES

The following refill capacities given are approximate. Correct fluid level should always be determined by marks on dipstick, rather than amount of fluid added. DO NOT overfill. See **TRANSMISSION FLUID CAPACITIES** table.

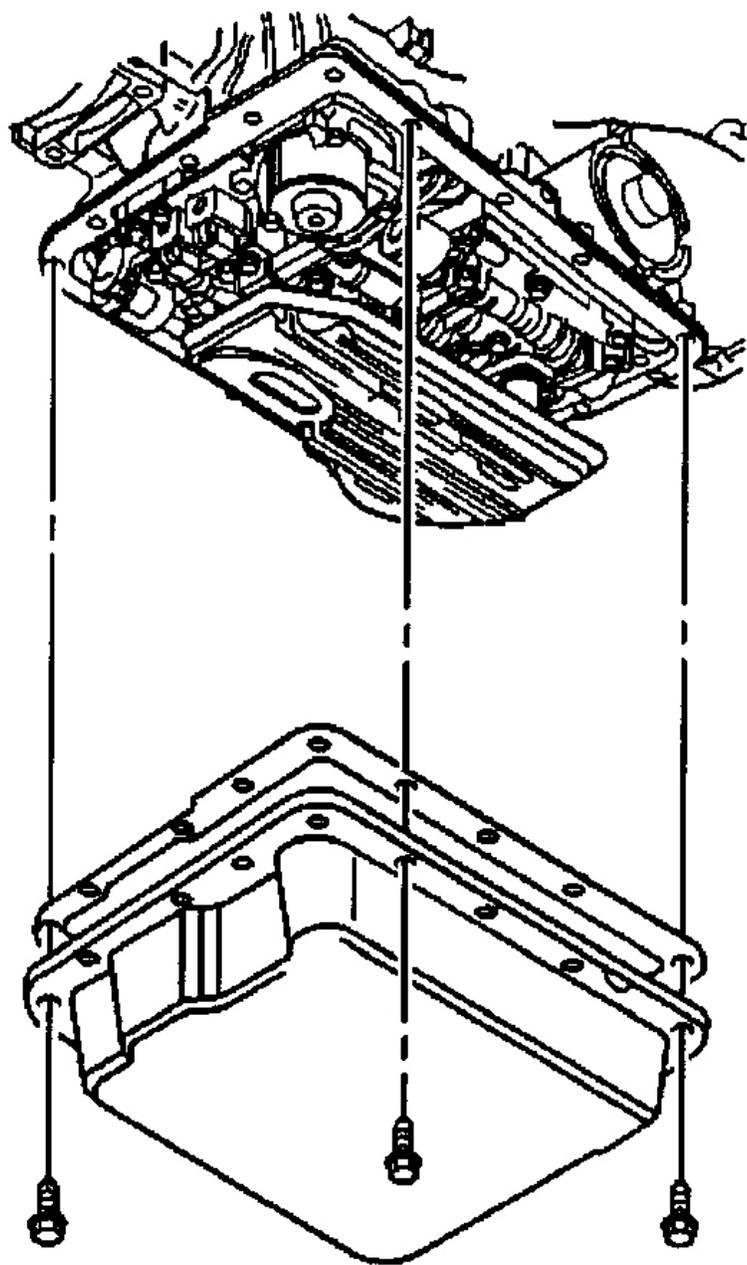
TRANSMISSION FLUID CAPACITIES

Application	Refill - Qts. (L)	Dry Fill - Qts. (L)
4L65-E	5.0 (4.7)	11 (10.6)

DRAINING & REFILLING

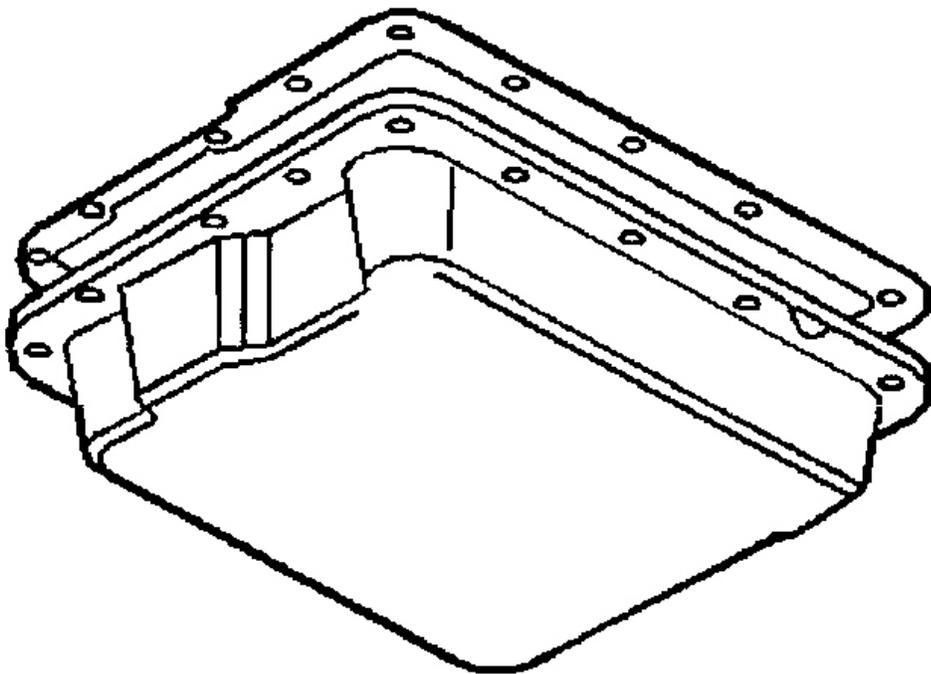
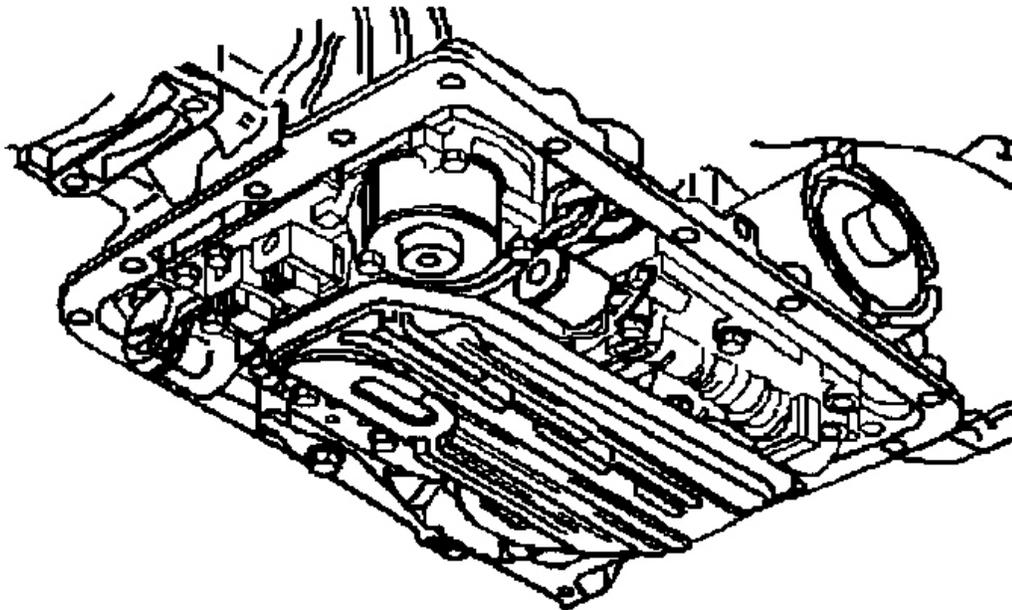
CAUTION: When the transmission is at operating temperatures, take necessary precautions when removing the drain plug, to avoid being burned by draining fluid.

1. Raise and support vehicle.
2. Place a drain pan under the transmission oil pan.
3. Remove transmission oil drain plug, if equipped.
4. If necessary, remove the bolts and position aside the shift cable bracket for clearance while lowering the pan. It is not necessary to remove the cable from the lever or bracket.
5. Remove the transmission oil pan bolts from the front and sides of the pan only.
6. Loosen the rear transmission oil pan bolts approximately 4 turns.
7. Lightly tap the transmission oil pan with a rubber mallet in order to loosen the pan to allow the fluid to drain.
8. Remove the remaining transmission oil pan bolts. See **Fig. 3** .
9. Remove the transmission oil pan and the gasket. See **Fig. 4** .
10. Grasp the filter firmly while pulling down with a twisting motion in order to remove. See **Fig. 5** .
11. Remove and discard the filter seal. The filter seal may be stuck in the pump; if necessary, carefully use pliers or another suitable tool to remove the seal. See **Fig. 6** .
12. Inspect the fluid color.
13. Inspect the filter. Pry the metal crimping away from the top of the filter and pull apart. The filter may contain clutch material, bronze slivers indicating bushing wear or steel particles.
14. Clean the transmission case and the transmission oil pan gasket surfaces with solvent, and air dry. You must remove all traces of the old gasket material.



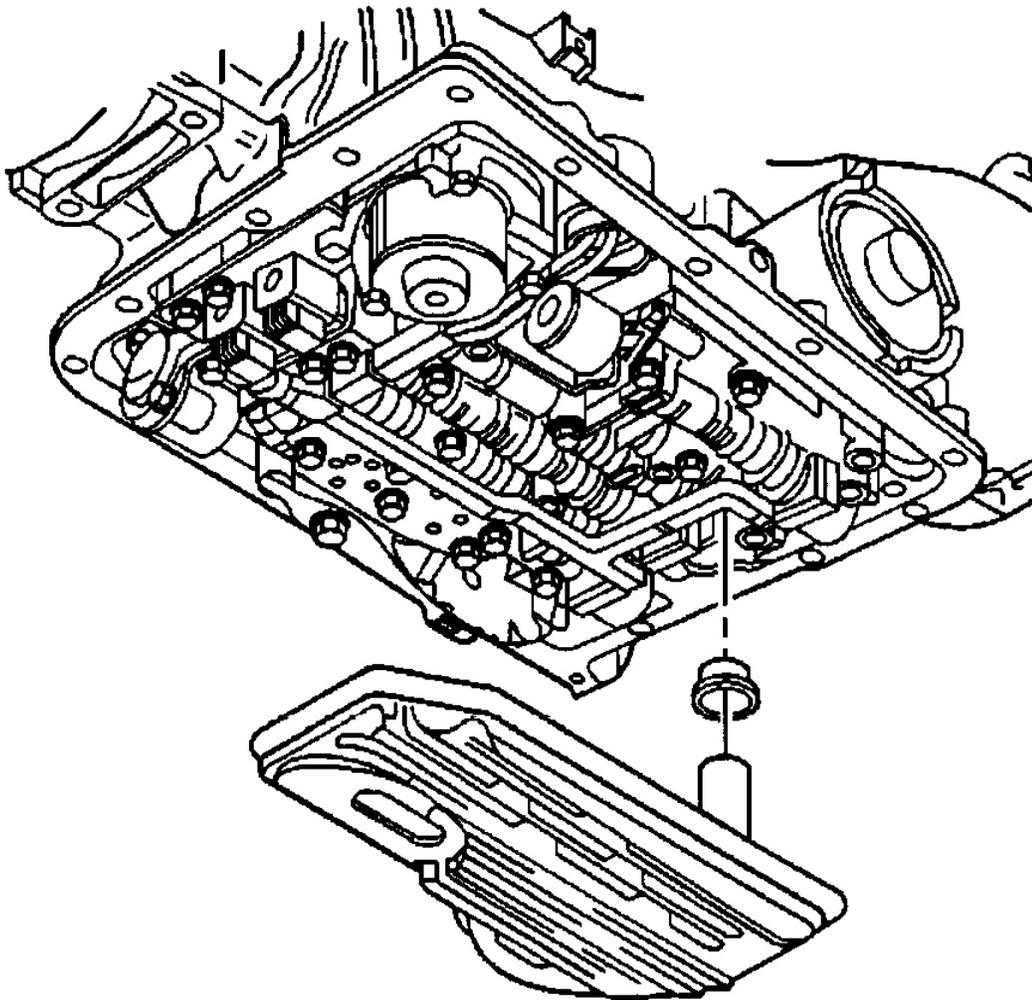
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Fig. 3: Removing Transmission Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.



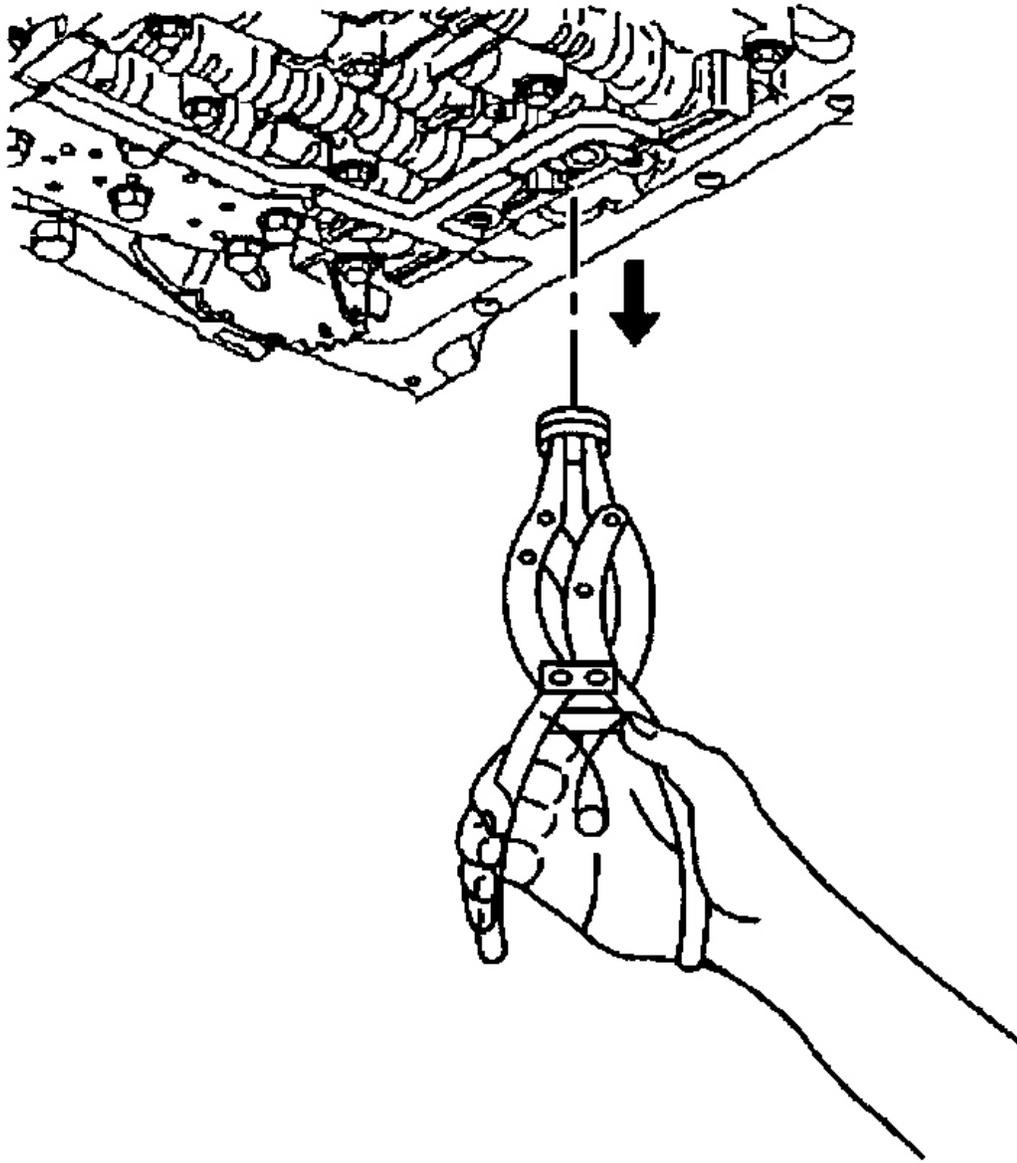
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Fig. 4: Removing Transmission Oil Pan & Gasket
Courtesy of GENERAL MOTORS CORP.



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Fig. 5: Removing & Installing Filter & Seal
Courtesy of GENERAL MOTORS CORP.



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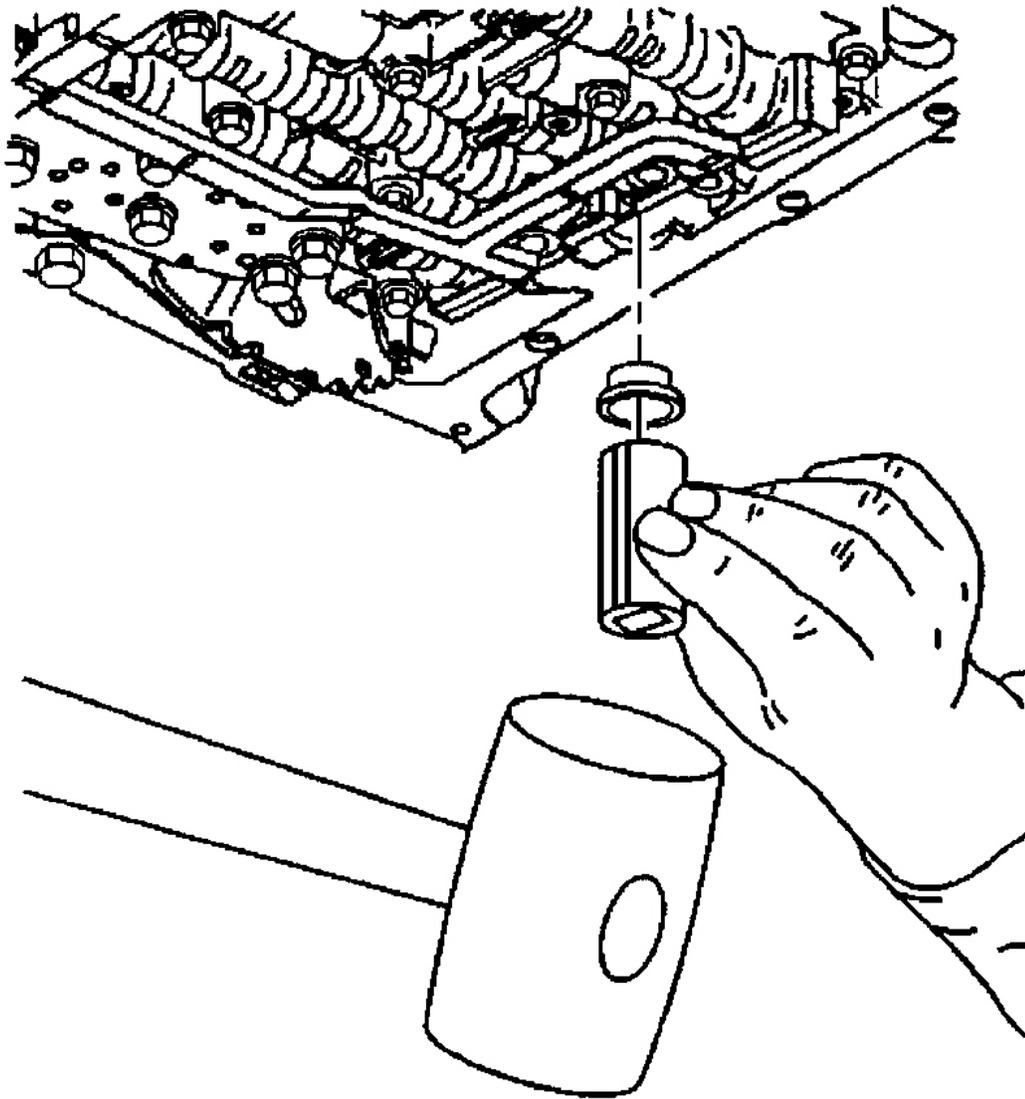
Fig. 6: Removing Seal Using Pliers
Courtesy of GENERAL MOTORS CORP.

Refilling & Inspecting

1. Coat the NEW filter seal with automatic transmission fluid.
2. Install the NEW filter seal into the transmission case. Tap the seal into place using a suitable size socket.

See **Fig. 7** .

3. Install the NEW filter.
4. Install the transmission oil pan and NEW gasket. See **Fig. 4** .
5. Install the transmission oil pan bolts. See **Fig. 3** . Tighten the bolts alternately and evenly to specification. See **TORQUE SPECIFICATIONS** .
6. If previously removed, install the shift cable bracket and bolts. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
7. Apply a small amount of sealant to the threads of the transmission oil pan drain plug, if equipped.
8. Install the transmission oil pan drain plug, if equipped. Tighten the plug to specification. See **TORQUE SPECIFICATIONS** .
9. Lower the vehicle.
10. Fill transmission to proper level with appropriate fluid. See **RECOMMENDED FLUIDS** and **FLUID CAPACITIES** .
11. Check the COLD fluid level reading for initial fill only.
12. Inspect the transmission oil pan gasket for leaks.



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Fig. 7: Installing Filter Seal
Courtesy of GENERAL MOTORS CORP.

TRANSMISSION COOLER FLUSHING & FLOW CHECK

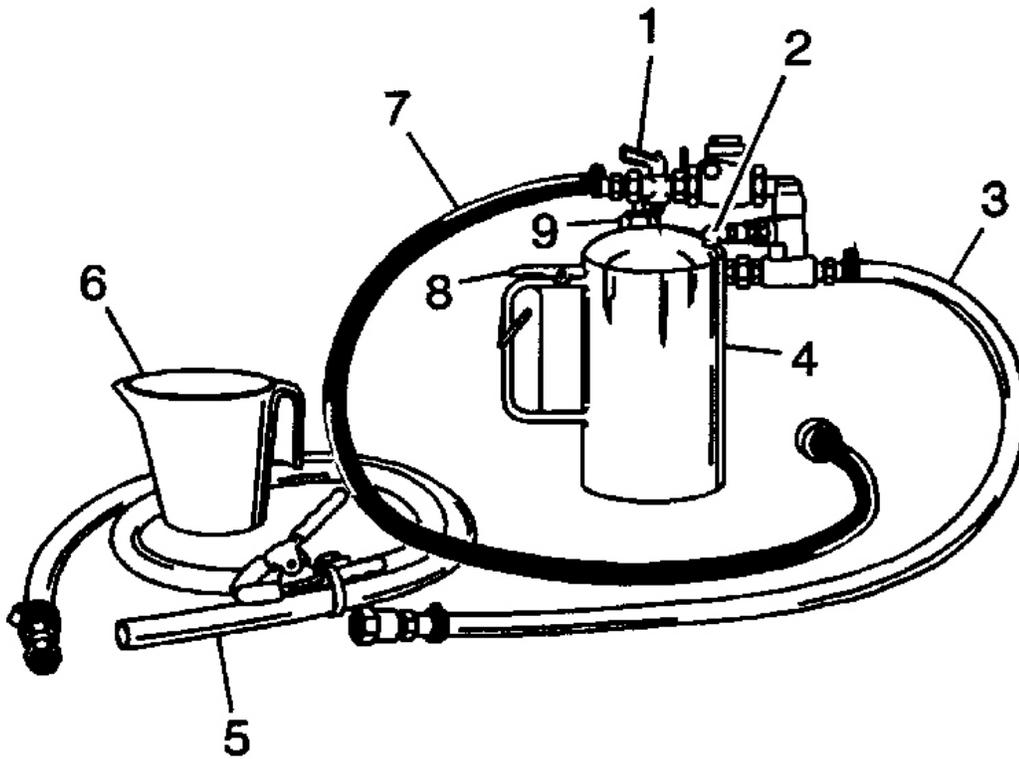
CAUTION: Flushing Solution (J-35944-22) is environmentally safe, yet powerful enough to cut through transmission fluid to dislodge any contaminants from the cooler. The safety precautions on the label regarding potential skin and eye irritations associated with prolonged exposure are typical

precautions that apply to many similar cleaning solutions. It should be noted that according to General Motors, use of other non-approved fluids for cooler flushing can have an adverse reaction to the seals inside the transmission.

NOTE: DO NOT use solutions that contain alcohol or glycol. Use of solutions that contain alcohol or glycol may damage flushing equipment, transmission oil cooler components and/or transmission components.

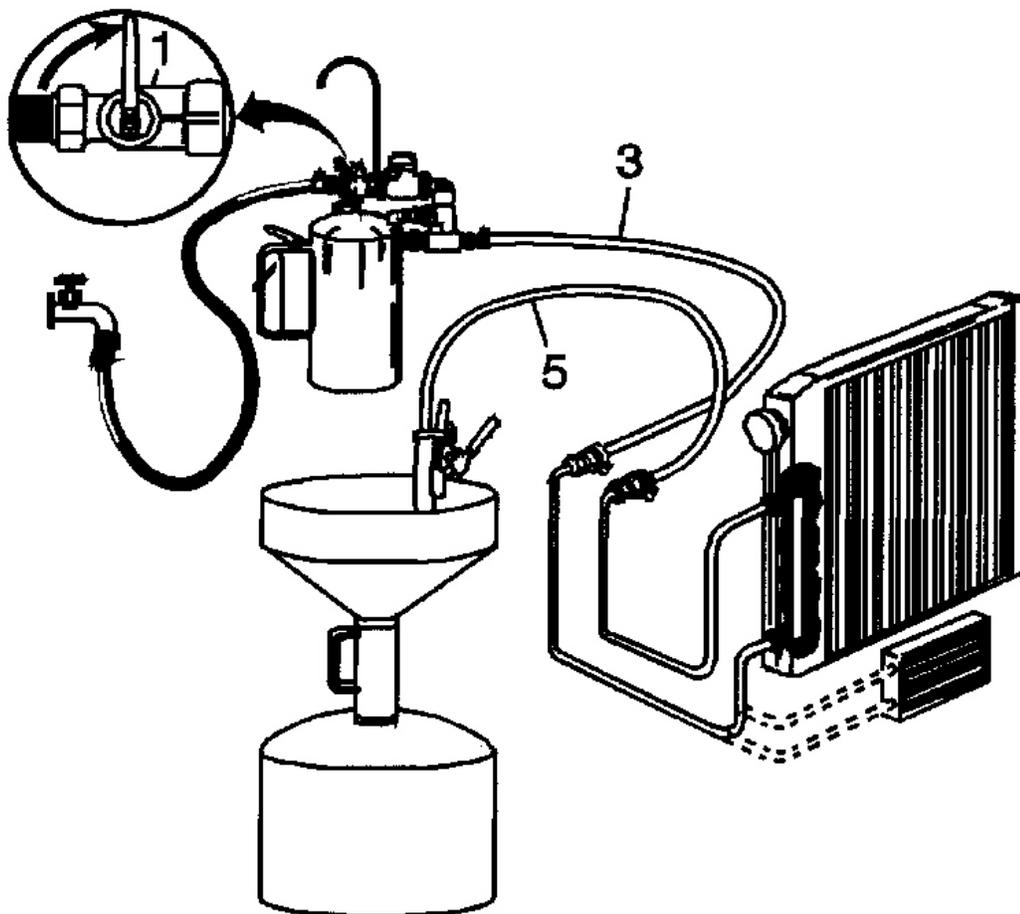
Preparation

1. After the repair or replacement transmission is installed in the vehicle, DO NOT reconnect the transmission oil cooler pipes.
2. Remove the fill cap (9) on the Transmission Oil Cooler and Line Flusher (J-35944-A) and fill the flusher tank (4) with 20-21 oz. (0.6L) of flushing solution using the measuring cup (6). DO NOT overfill.
3. Install the fill cap (9) on the flusher and pressurize the flusher tank (4) to 80-100 psi (550-700 kPa), using the shop air supply at the tank air valve (9). See **Fig. 8**.
4. With the water supply valve (1) on the flusher in the OFF position, connect the water supply hose (7) from the flusher to the water supply at the faucet. See **Fig. 8** and **Fig. 9**.
5. Turn ON the water supply at the faucet.



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Fig. 8: Identifying Flushing Equipment
Courtesy of GENERAL MOTORS CORP.



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Fig. 9: Connecting Flushing Equipment
 Courtesy of GENERAL MOTORS CORP.

Back Flush

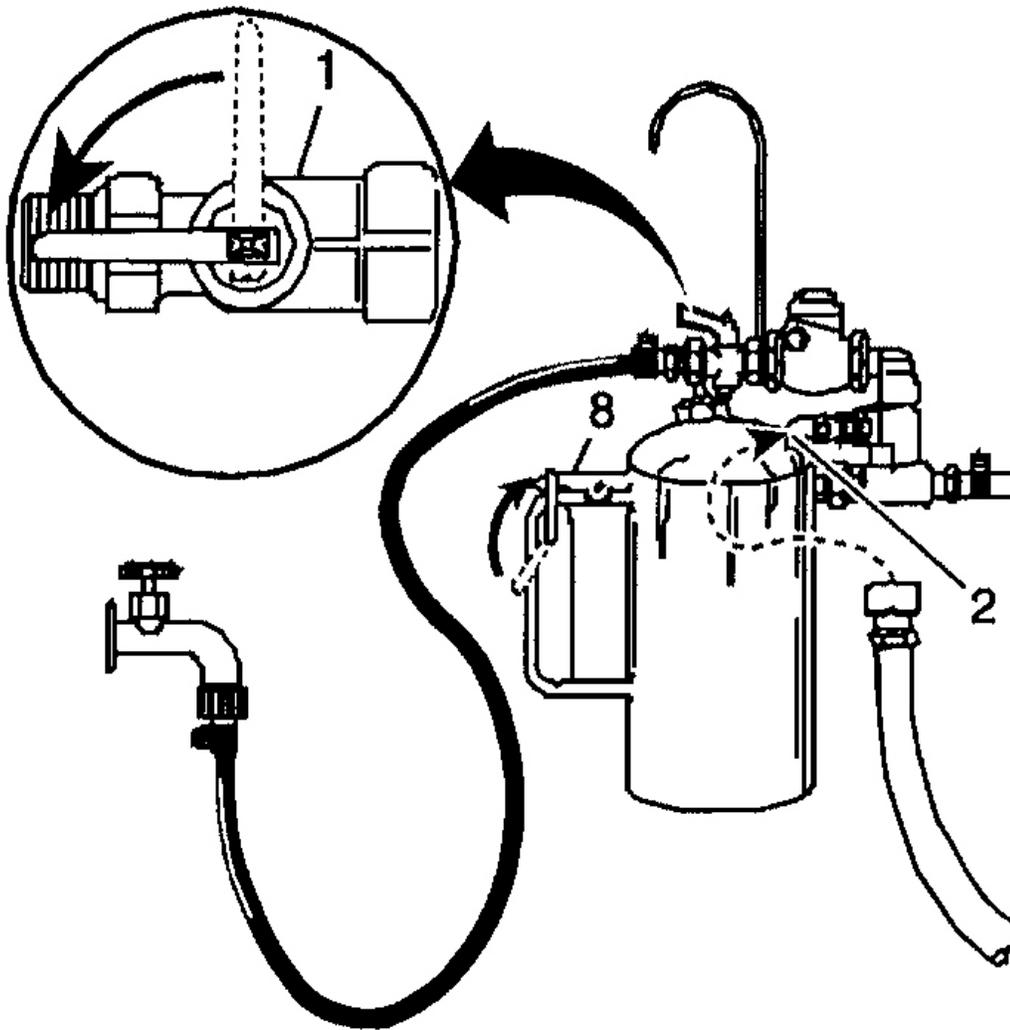
1. Inspect the transmission oil cooler pipes for kinks or damage. Repair as necessary.
2. Connect the transmission oil cooler and line flusher to the transmission oil cooler feed bottom connector. Use the Cooler Flushing Adapter (J 35944-200), if required.
3. Clip the discharge hose (5) onto the transmission drain container. See **Fig. 9**.
4. Attach the flusher to the undercarriage of the vehicle with the hook provided and connect the flushing system feed supply hose (3) from the flusher to the top connector transmission oil cooler return pipe. Use the cooler flushing adapter, if required.
5. Turn the flusher water supply valve (1) to the ON position and allow water to flow through the transmission oil cooler and pipes for 10 seconds to remove any remaining transmission fluid. If water

does not flow through the transmission oil cooler and pipes, the cause of the blockage must be diagnosed and the plugged component must be repaired or replaced. Continue with the cooler flushing and flow check procedure once the blockage is corrected.

6. Turn the flusher water supply valve (1) to the OFF position and clip the discharge hose onto a 5 gallon pail with a lid, to avoid splashback.

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

7. Turn the flusher 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. See **Fig. 10** . The discharge will foam vigorously when the solution is introduced into the water stream.
8. Flush the transmission oil cooler and pipes with water and solution for 2 minutes. During this flush, attach the shop air supply 120 psi (825 kPa) to the flushing system feed air valve (2) located on the flusher, for 3-5 seconds at the end of every 15-20 second interval to create a surging action.
9. Release the trigger (8) and turn the flusher water supply valve (1) to the OFF position.



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Fig. 10: Flushing Transmission Oil Cooling System
 Courtesy of GENERAL MOTORS CORP.

Forward Flush

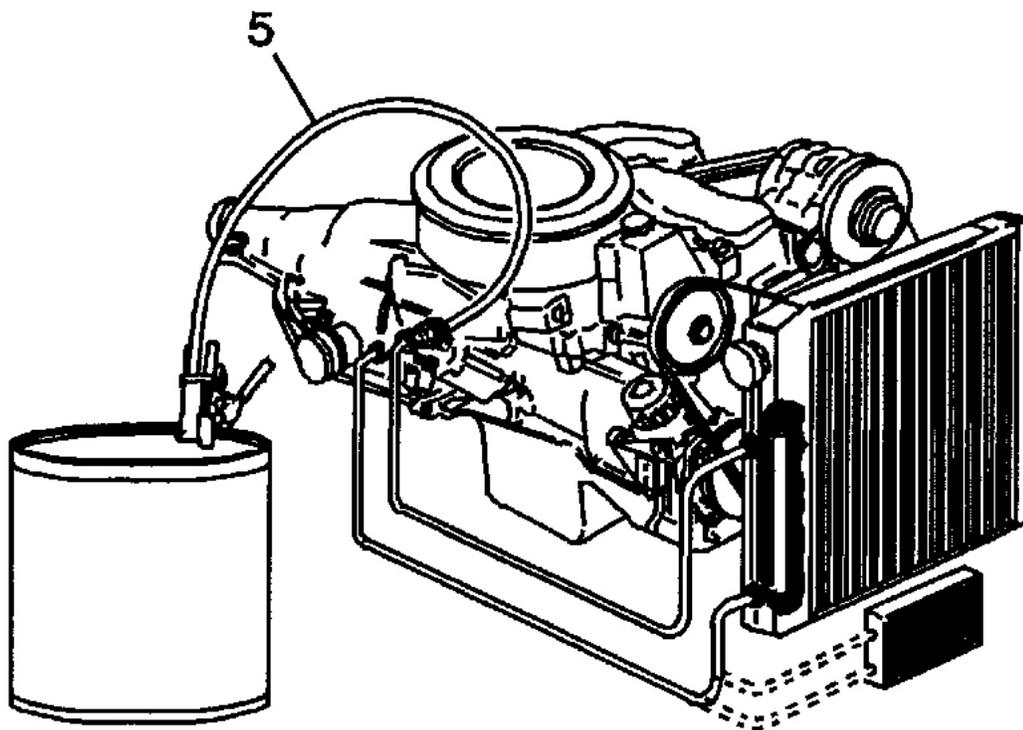
1. Disconnect both hoses (3 and 5) from the transmission oil cooler pipes and connect them to the opposite transmission oil cooler pipe. See **Fig. 9** . This will allow the transmission oil cooler and pipes to be flushed in the normal flow direction.
2. Repeat Steps 6 and 7 of BACK FLUSH procedure.
3. Release the trigger (8) of the transmission oil cooler and line flusher and allow water only to rinse the transmission oil cooler and pipes for one minute. See **Fig. 10** .

4. Turn the flusher 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 flusher and blow out the water from the transmission oil cooler and pipes. Continue, until no water comes out of the discharge hose.

Flow Test

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

1. Disconnect the hose from the transmission oil cooler pipe. Connect the transmission oil cooler feed pipe, bottom connector, to the transmission for normal flow.
2. Clip the discharge hose (1) to an empty transmission container. See **Fig. 11** .
3. Confirm the transmission is filled with automatic transmission fluid. See **FLUID CAPACITIES** for correct fluid capacity.
4. Start the engine with the transmission in Park range and run for 30 seconds after fluid begins to flow from the discharge hose (1). A minimum of 2 qt (1.9 L) must be discharged during this 30 second run time.
5. If the fluid flow meets or exceeds 2 qts (1.9 L) in 30 seconds, connect the transmission oil cooler feed pipe to the bottom connector on the transmission.
6. If fluid flow is less than 2 qt (1.9 L) in 30 seconds, perform the following diagnosis:
 - A. Disconnect the transmission cooler and line flusher discharge hose (1) from the transmission oil cooler return pipe.
 - B. Disconnect the transmission cooler feed pipe at the radiator.
 - C. Connect the flusher discharge hose (1) to the transmission cooler feed pipe, radiator end.
 - D. Clip the discharge hose (1) onto the transmission drain container.
 - E. Start the engine with the transmission in Park range and run for 30 seconds after fluid begins to flow from the discharge hose (1). A minimum of 2 qt (1.9 L) must be discharged during this 30 second run time.
7. If the amount of transmission fluid flow remains less than 2 qt (1.9 L) in 30 seconds, inspect the transmission oil cooler feed pipe, bottom connector, for restrictions or damage. If no condition is found with the feed pipe, bottom connector, inspect the transmission.



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Fig. 11: Capturing Fluid Discharge
Courtesy of GENERAL MOTORS CORP.

Clean-Up

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

ON-VEHICLE REPAIRS

NOTE: Various components may be serviced without transmission removal, depending on application. For servicing of these components, see appropriate component under ADJUSTMENTS and/or REMOVAL & INSTALLATION. For additional information on testing electrical components, see appropriate DIAGNOSIS article.

ADJUSTMENTS

WARNING: Vehicle is equipped with Supplemental Inflatable Restraint (SIR) system. When servicing vehicle, use care to avoid accidental air bag deployment. SIR system-related components are located in various locations throughout interior and exterior of vehicle, depending on application. DO NOT use electrical test equipment on or near these circuits. If necessary, deactivate SIR system before servicing components. See appropriate AIR BAG DEACTIVATION PROCEDURES article in RESTRAINTS.

PARK/NEUTRAL POSITION SWITCH

NOTE: Apply the Park brake. The engine must start in the Park (P) or Neutral (N) positions only. Check the Park/Neutral Position (PNP) switch for proper operation.

1. Place the transmission shifter in the Neutral (N) position.
2. With an assistant in the drivers seat, raise and suitably support the vehicle.
3. Loosen the PNP switch bolts.
4. With the vehicle in the Neutral (N) position, rotate the switch while the assistant attempts to start the engine.
5. Following a successful start, turn the engine OFF.
6. Tighten the PNP switch bolts to specification. See **TORQUE SPECIFICATIONS** .
7. Lower the vehicle.
8. Check the PNP switch for proper operation. The engine must start in the Park (P) or Neutral (N) positions only.
9. Replace the PNP switch if proper operation can not be achieved. See **PARK/NEUTRAL POSITION SWITCH** .

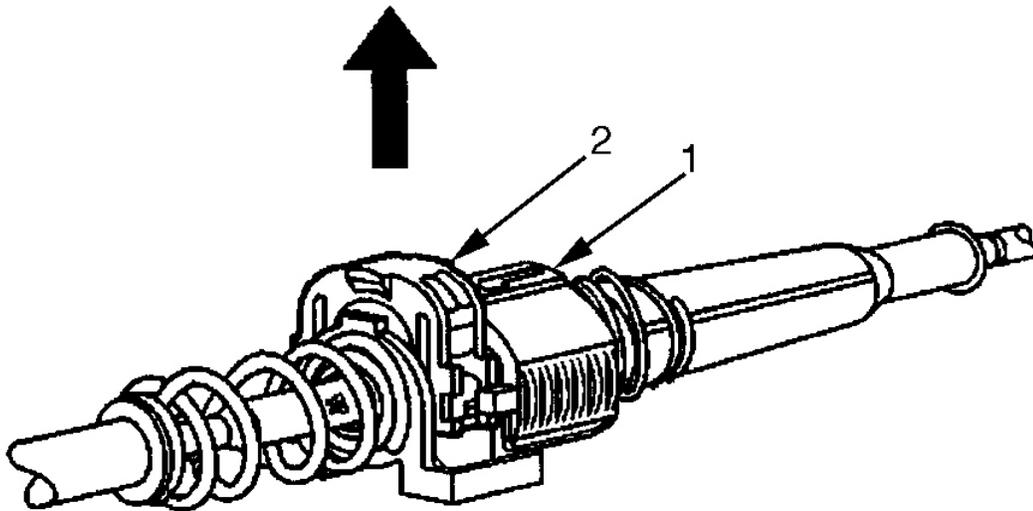
SHIFT CABLE

1. Ensure the steering column shift lever and the transmission manual shaft lever are in the Park (P) position.
2. Raise and suitably support the vehicle.
3. Pull back the white plastic cover (1) on the center connector. See **Fig. 12** . Pull up on the center tabs of the lock button (2).

NOTE: This step must be performed correctly to avoid a misadjusted cable. DO NOT grasp the shift cable end (2) during this procedure.

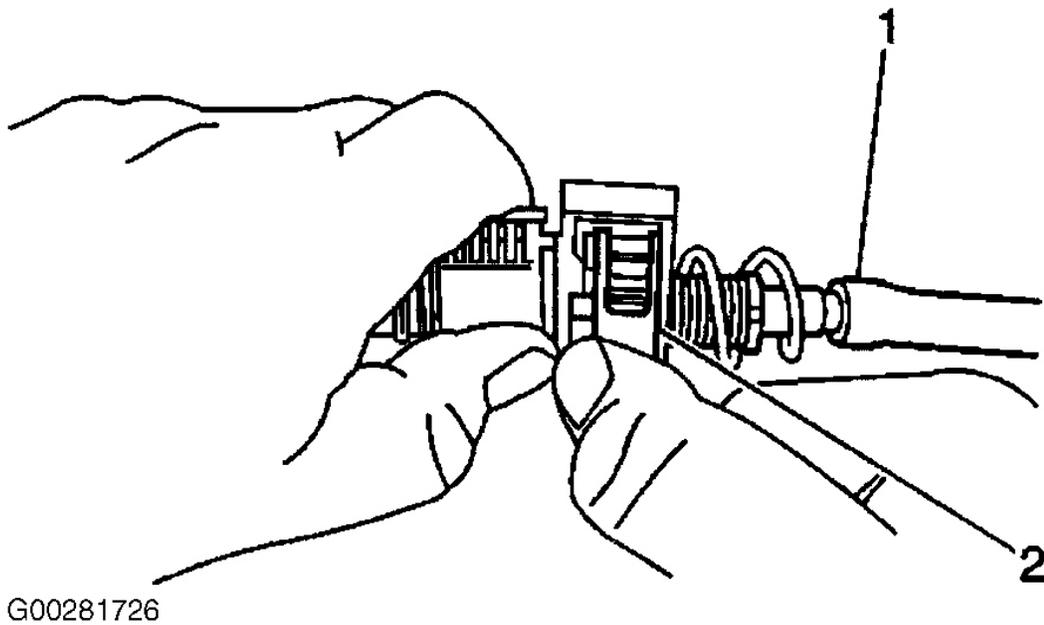
4. Push the natural colored lock button (2) down to engage the locking teeth on the shift cable end (1). See **Fig. 13** .
5. Release the white cover (1). See **Fig. 14** . Verify the white cover (1) conceals the natural colored lock (2).

If the white cover (1) does not conceal the natural colored lock (2), the shift cable must be readjusted. Test the transmission for proper shift operation. If all of the gear positions cannot be achieved, the shift cable must be readjusted.



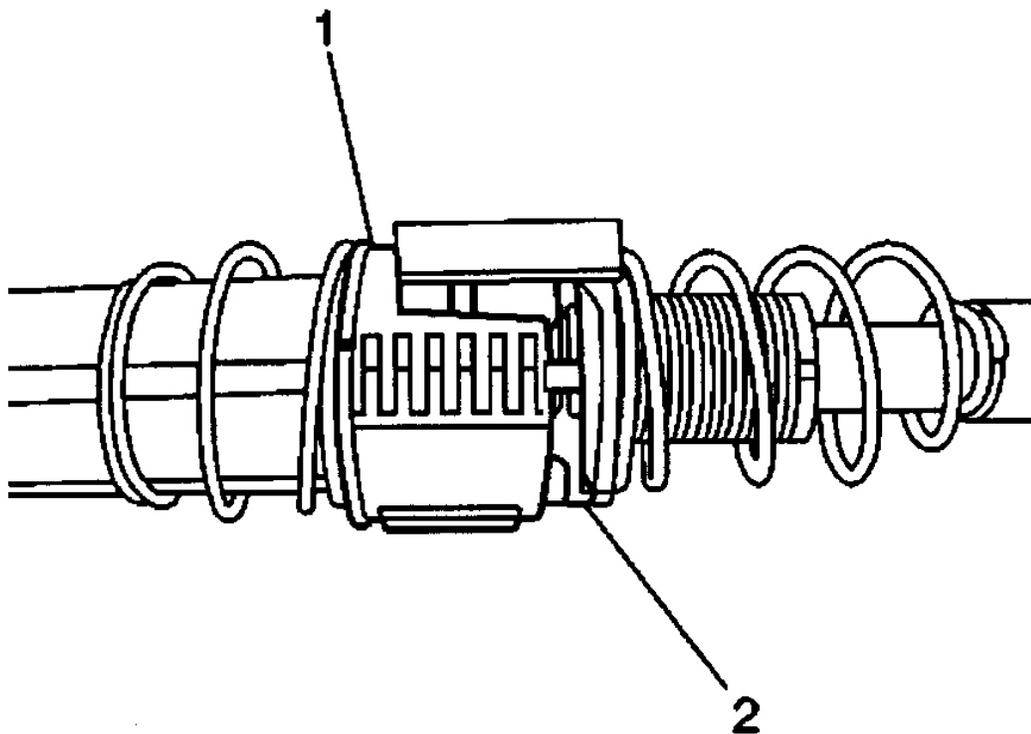
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Fig. 12: Unlocking Shift Cable Adjuster
Courtesy of GENERAL MOTORS CORP.



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Fig. 13: Identifying Shift Cable Lock Button
Courtesy of GENERAL MOTORS CORP.



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Fig. 14: Releasing Shift Cable White Cover
Courtesy of GENERAL MOTORS CORP.

REMOVAL & INSTALLATION

WARNING: Vehicle is equipped with Supplemental Inflatable Restraint (SIR) system. When servicing vehicle, use care to avoid accidental air bag deployment. SIR system-related components are located in various locations throughout interior and exterior of vehicle, depending on application. DO NOT use electrical test equipment on or near these circuits. If necessary, deactivate SIR system before servicing components. See appropriate AIR BAG DEACTIVATION PROCEDURES article in RESTRAINTS.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. Before disconnecting battery, see COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION.

CAUTION: Use the correct fastener in the correct location. Replacement fasteners

must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

ACCUMULATOR ASSEMBLY

NOTE: Tools required: Dial Indicator Post and Guide Pin Set (J-25025-B), and Transjel Lubricant (J-36850).

Removal

1. Remove the control valve body. See VALVE BODY & PRESSURE SWITCH.
2. Remove the accumulator cover bolts. See Fig. 15.
3. Remove the 1-2 accumulator cover.
4. Disassemble the 1-2 accumulator as follows:
 - A. Blow compressed air into the 1-2 accumulator cover in order to remove the 1-2 accumulator piston. See Fig. 16.
 - B. Remove the 1-2 accumulator inner and outer springs.
5. Inspect the 1-2 accumulator inner and outer springs for cracks.
6. Remove the 1-2 accumulator piston seal (1) from the 1-2 accumulator piston. See Fig. 17.
7. Inspect the 1-2 accumulator piston for the following defects:
 - Porosity.
 - Cracks.
 - Scoring.
 - Nicks and scratches.
8. Inspect the 1-2 accumulator cover for the following defects:
 - Porosity.
 - Cracks.
 - Scoring.
 - Nicks and scratches.

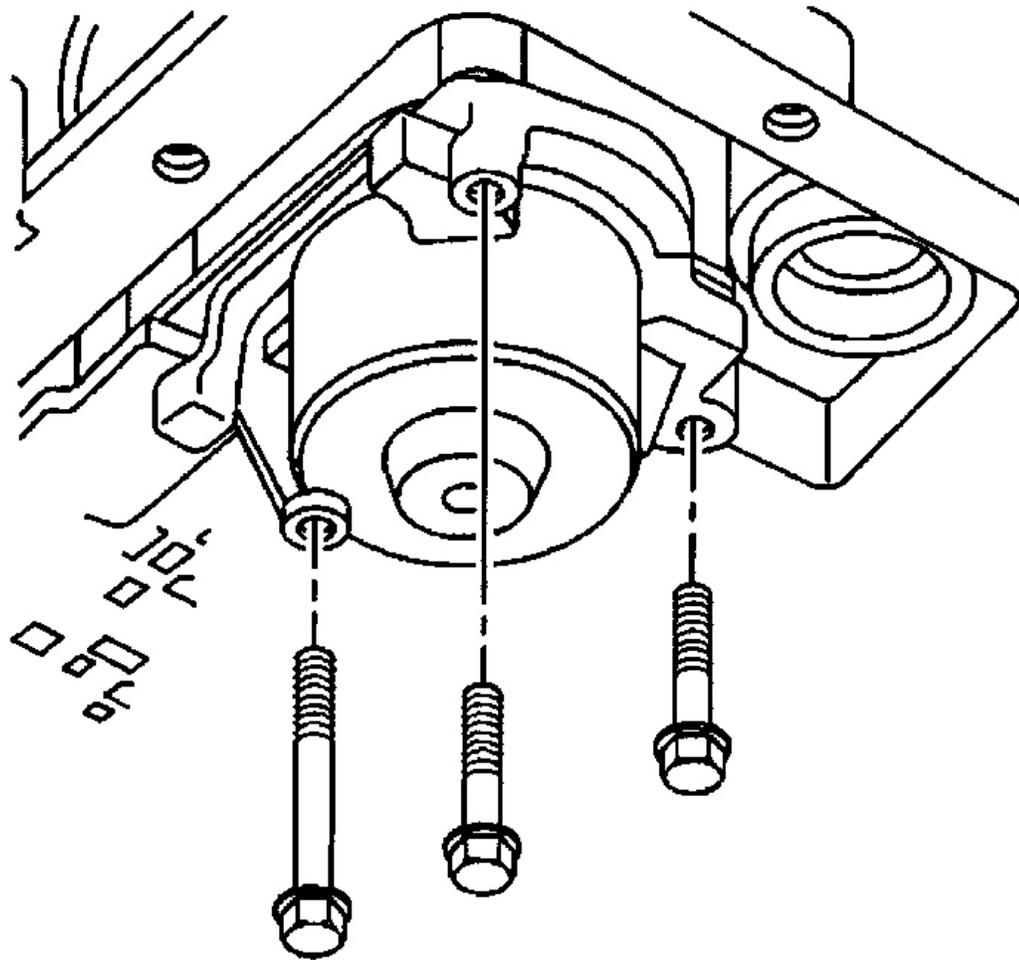
See Fig. 18.

9. Remove the spacer plate support bolts. See Fig. 19.

NOTE: Use care not to drop the number one checkball, the 3-4 accumulator

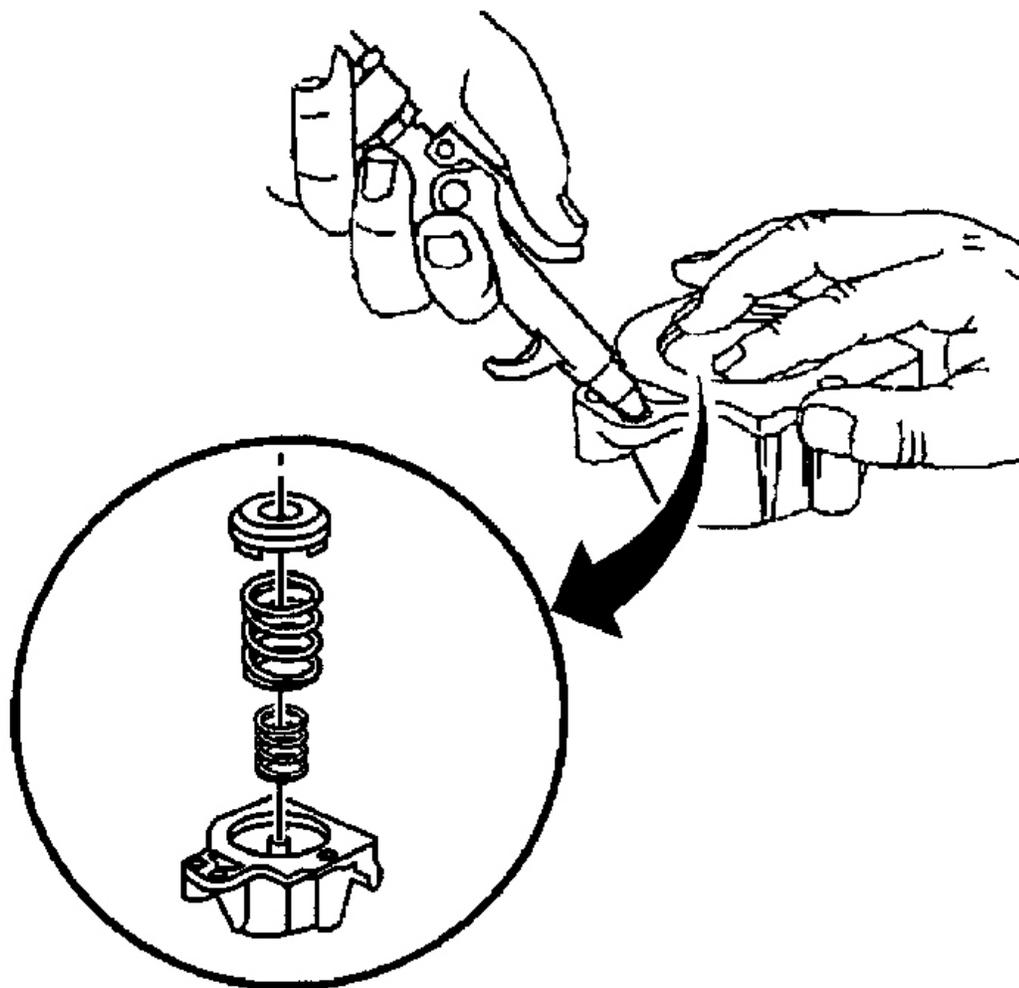
spring and the 3-4 accumulator pin.

10. Remove the spacer plate support.
11. Remove the spacer plate to valve body gasket, the spacer plate and the spacer plate to transmission case gasket. See **Fig. 20** .
12. Remove the 3-4 accumulator piston. See **Fig. 21** .
13. Inspect the 3-4 accumulator spring for cracks.
14. Remove the 3-4 accumulator piston seal (1) from the 3-4 accumulator piston. See **Fig. 17** .
15. Inspect the 3-4 accumulator piston for the following defects:
 - Porosity.
 - Cracks.
 - Scoring.
 - Nicks and scratches.



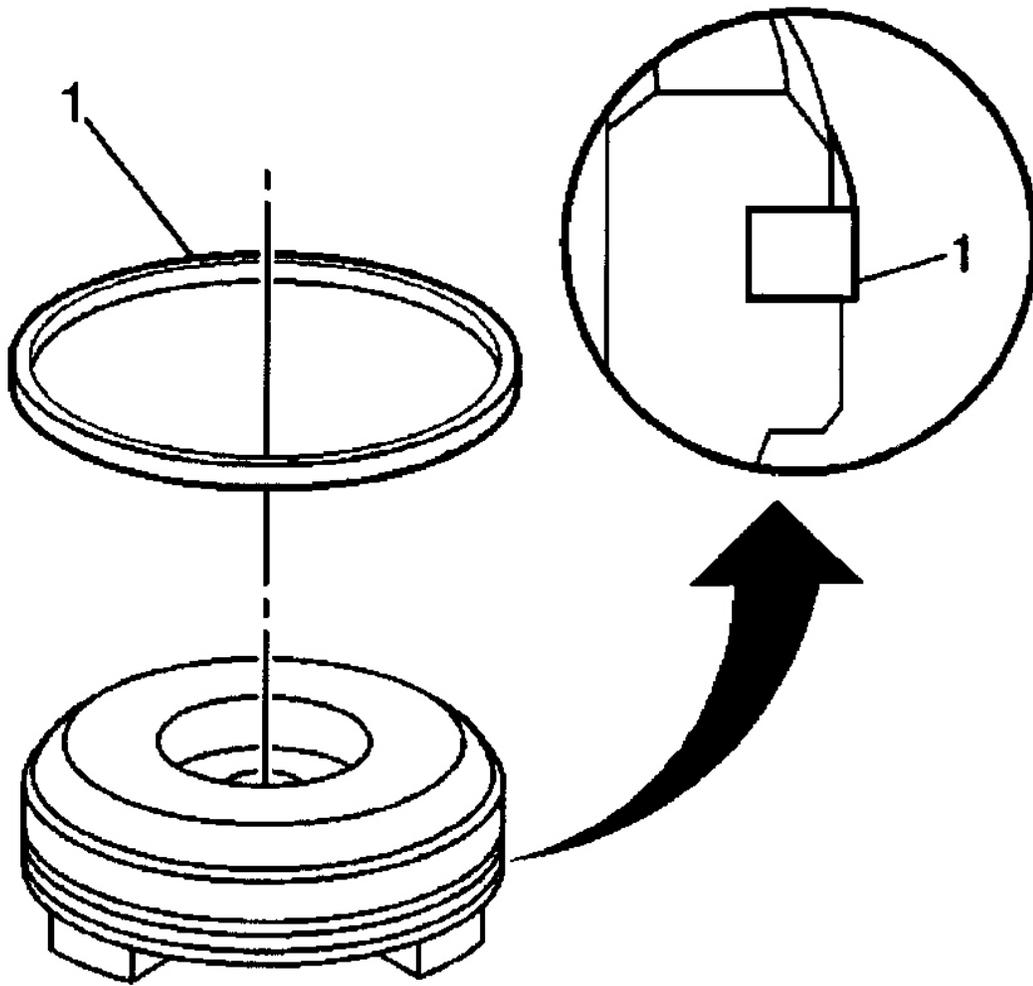
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Fig. 15: Removing Accumulator Assembly Bolts
Courtesy of GENERAL MOTORS CORP.



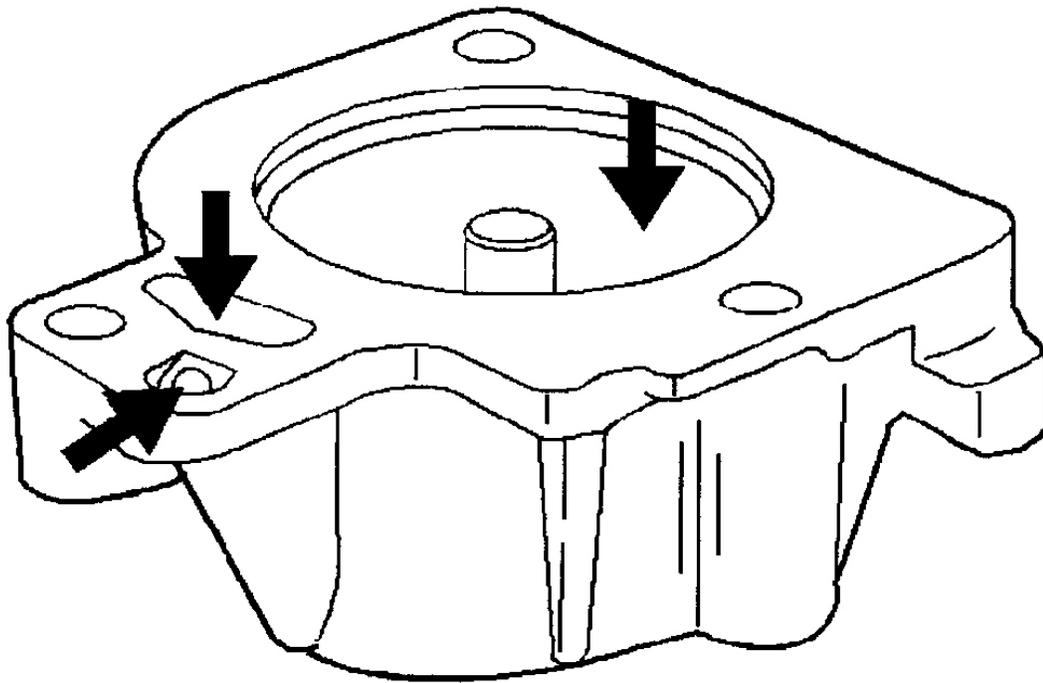
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Fig. 16: Removing & Installing 1-2 Accumulator Assembly
Courtesy of GENERAL MOTORS CORP.



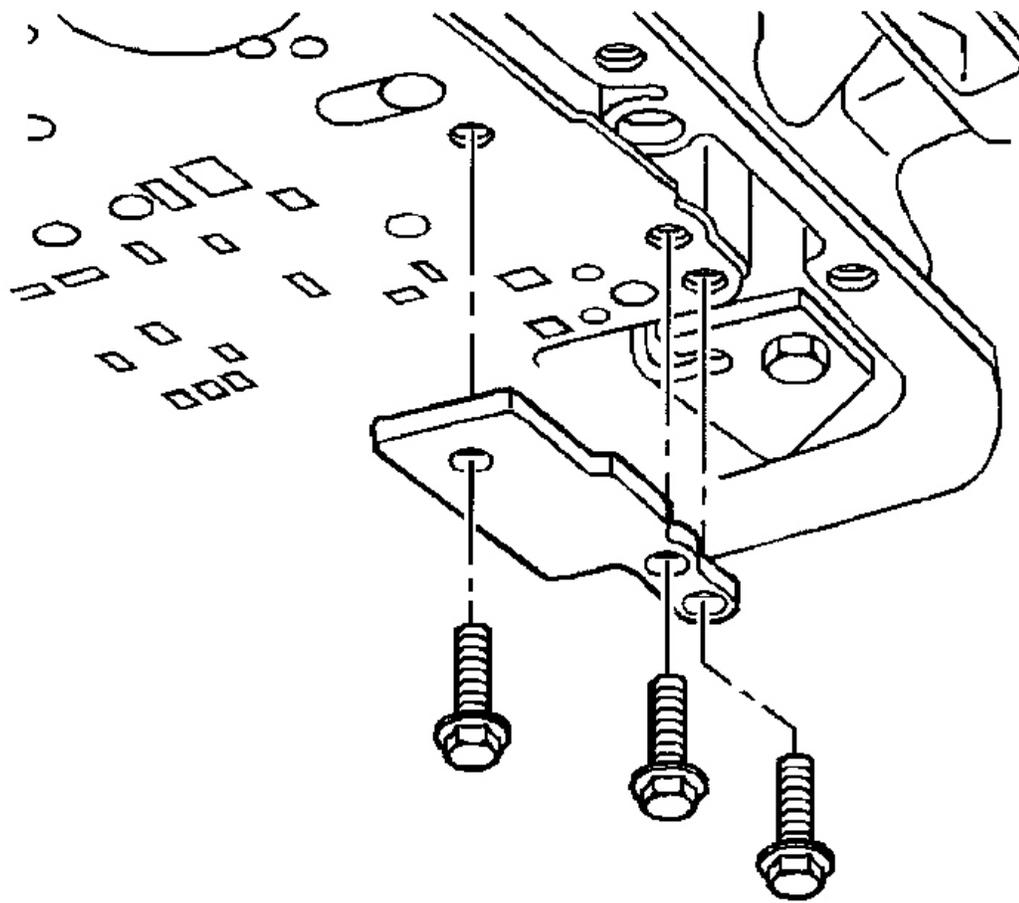
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Fig. 17: Removing 1-2 Accumulator Piston Seal
Courtesy of GENERAL MOTORS CORP.



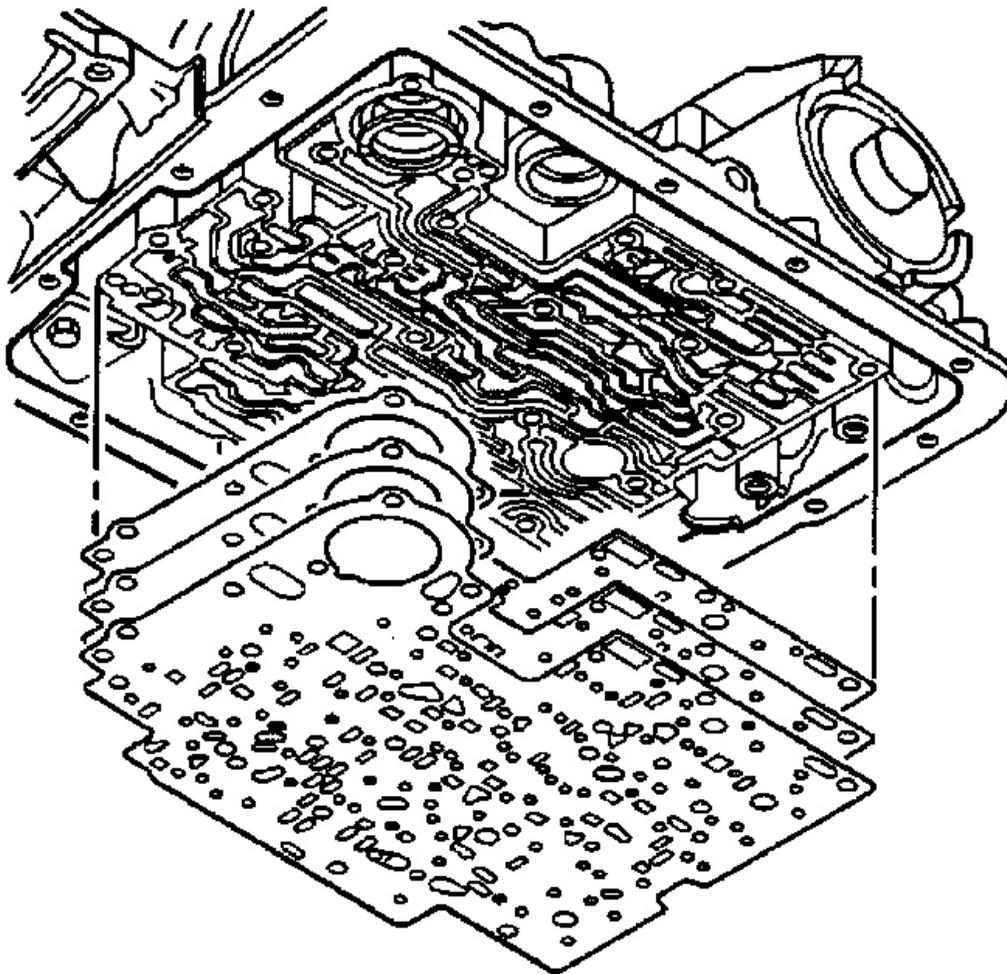
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Fig. 18: Inspecting 1-2 Accumulator Cover
Courtesy of GENERAL MOTORS CORP.



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Fig. 19: Removing & Installing Transmission Pass Cover
Courtesy of GENERAL MOTORS CORP.



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Fig. 20: Removing & Installing Spacer Plates
Courtesy of GENERAL MOTORS CORP.

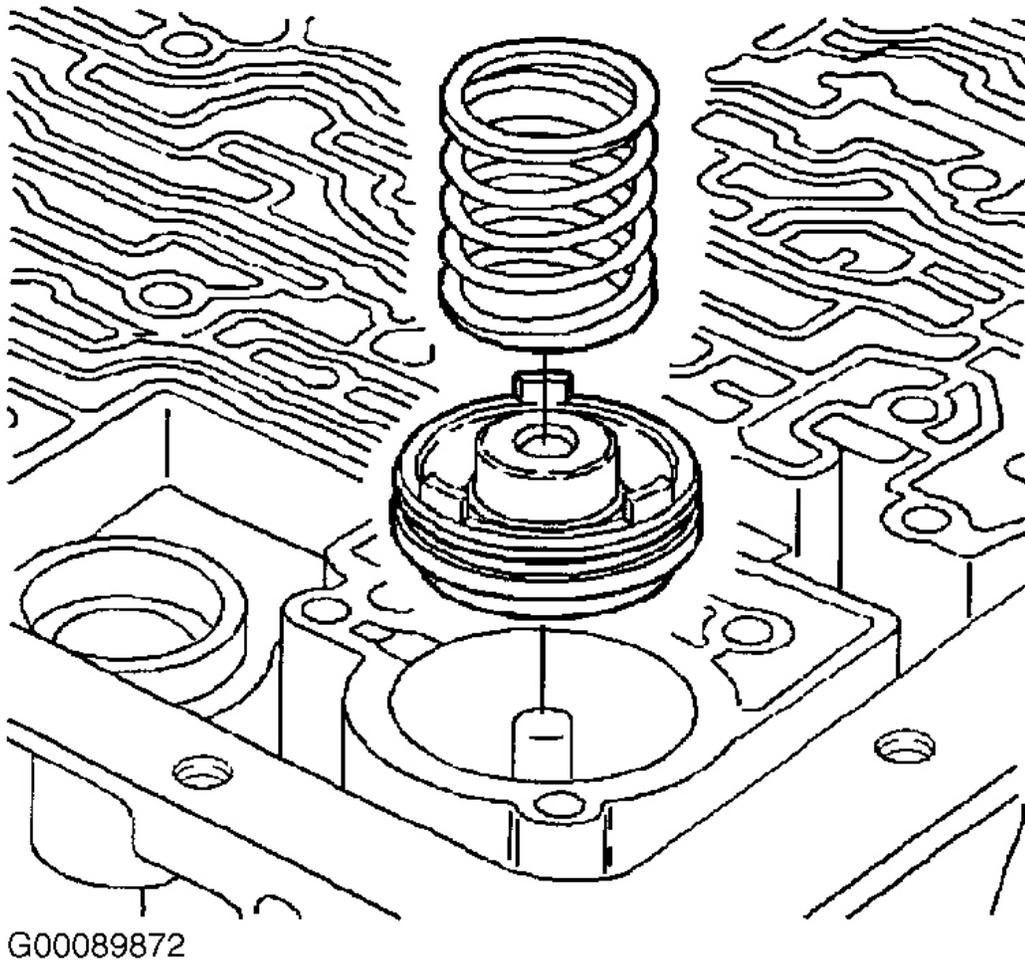


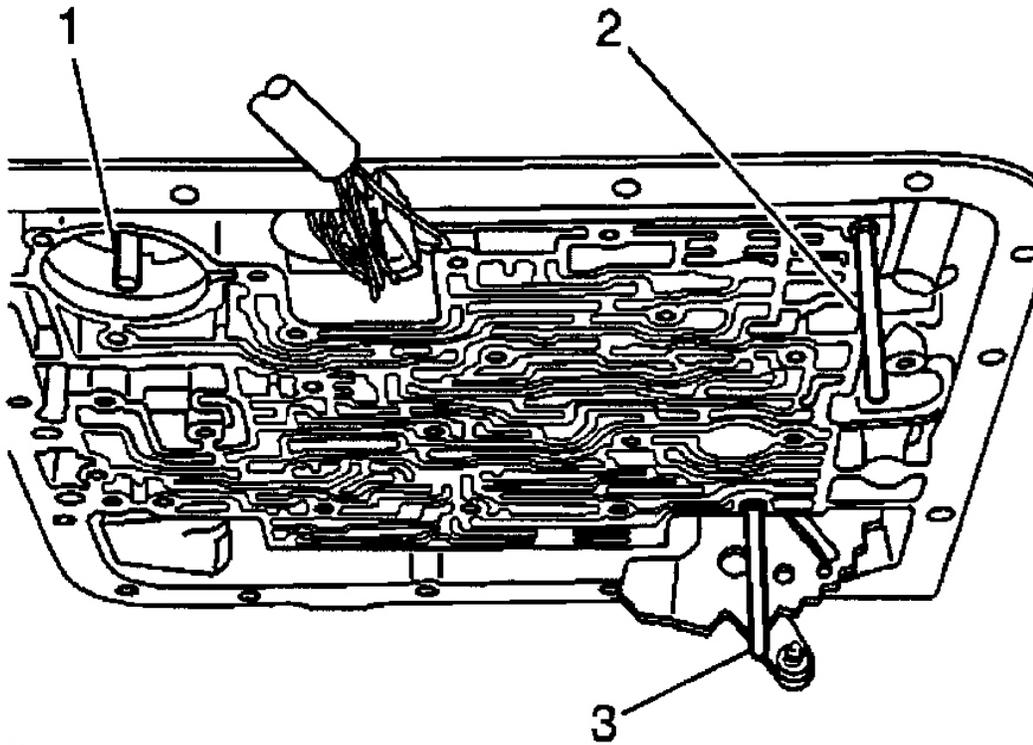
Fig. 21: Removing & Installing 3-4 Accumulator Assembly
 Courtesy of GENERAL MOTORS CORP.

Installation

1. Install a new 3-4 accumulator piston seal (1) to the 3-4 accumulator piston. See **Fig. 17** .
 2. Install the 3-4 accumulator pin (1) into the transmission case and retain the pin with Transjel(R) lubricant. See **Fig. 22** .
 3. Install the 3-4 accumulator piston onto the pin in the transmission case. See **Fig. 21** . Ensure that the 3-4 accumulator piston legs face away from the transmission case.
 4. Install the pump and valve body alignment pin set (2, 3) to the transmission case. See **Fig. 22** .
 5. Install the spacer plate to transmission case gasket and the spacer plate to valve body gasket to the spacer plate; use Transjel(R) lubricant in order to retain the gaskets to the spacer plate. See **Fig. 23** .
- The case gasket is identified by a "C". Be sure to place the case gasket on the transmission case

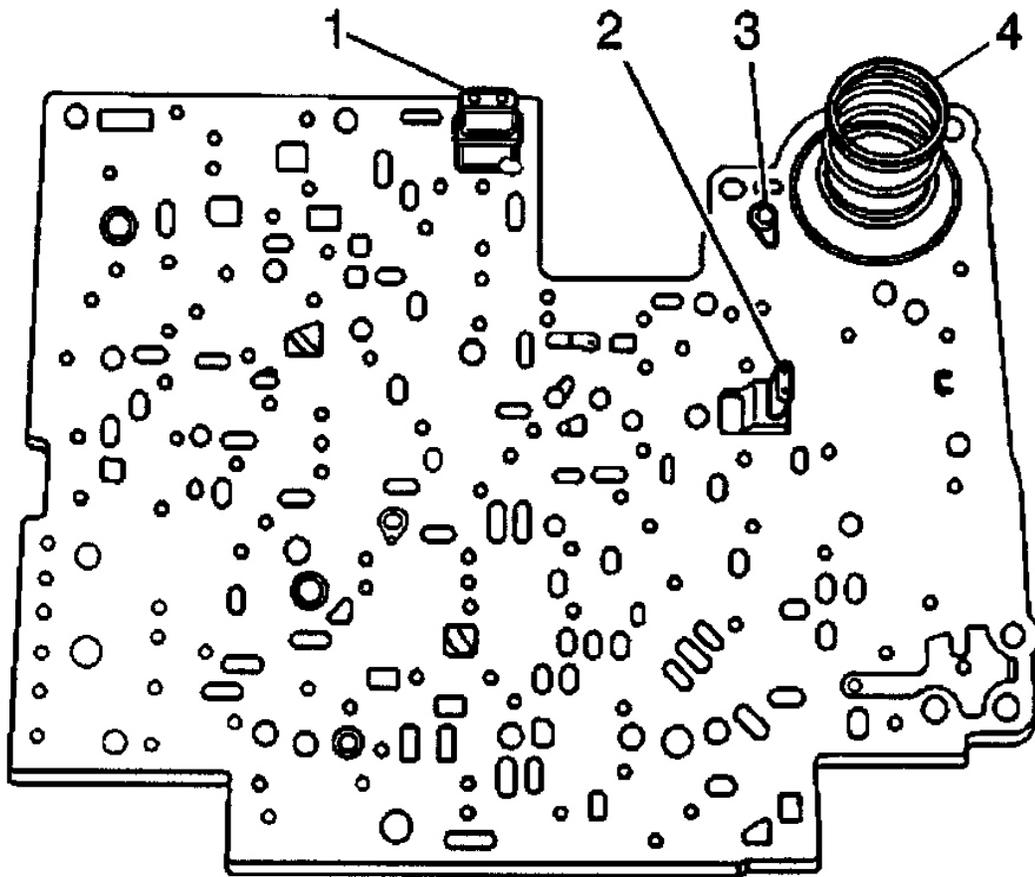
side of the spacer plate.

- The valve body gasket is identified by a "V". Be sure to place the valve body gasket on the valve body side of the spacer plate.
6. Ensure that the solenoid screens (1 and 2) are in place on the spacer plate.
 7. Place the checkball (3) on the spacer plate in the location shown.
 8. Place the 3-4 accumulator spring (4) on the spacer plate.
 9. Install the spacer plate and related components to the transmission.
 10. Install the spacer plate support and the spacer plate support bolts. See **Fig. 19** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
 11. After installing the spacer plate support (2), look through the hole in the spacer plate to ensure that the checkball (1) has remained in the proper location. See **Fig. 24** .
 12. Install a new 1-2 accumulator piston seal (1) to the 1-2 accumulator piston. See **Fig. 17** .
 13. Install the 1-2 accumulator inner and outer springs to the 1-2 accumulator cover. See **Fig. 25** .
 14. Install the 1-2 accumulator piston onto the pin in the 1-2 accumulator cover. Ensure that the piston legs face the accumulator cover.
 15. Install the 1-2 accumulator cover and the accumulator cover bolts. See **Fig. 15** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
 16. Remove the pump and valve body alignment pin set from the transmission case.
 17. Install the valve body. See **VALVE BODY & PRESSURE SWITCH** .
 18. Install the transmission filter.



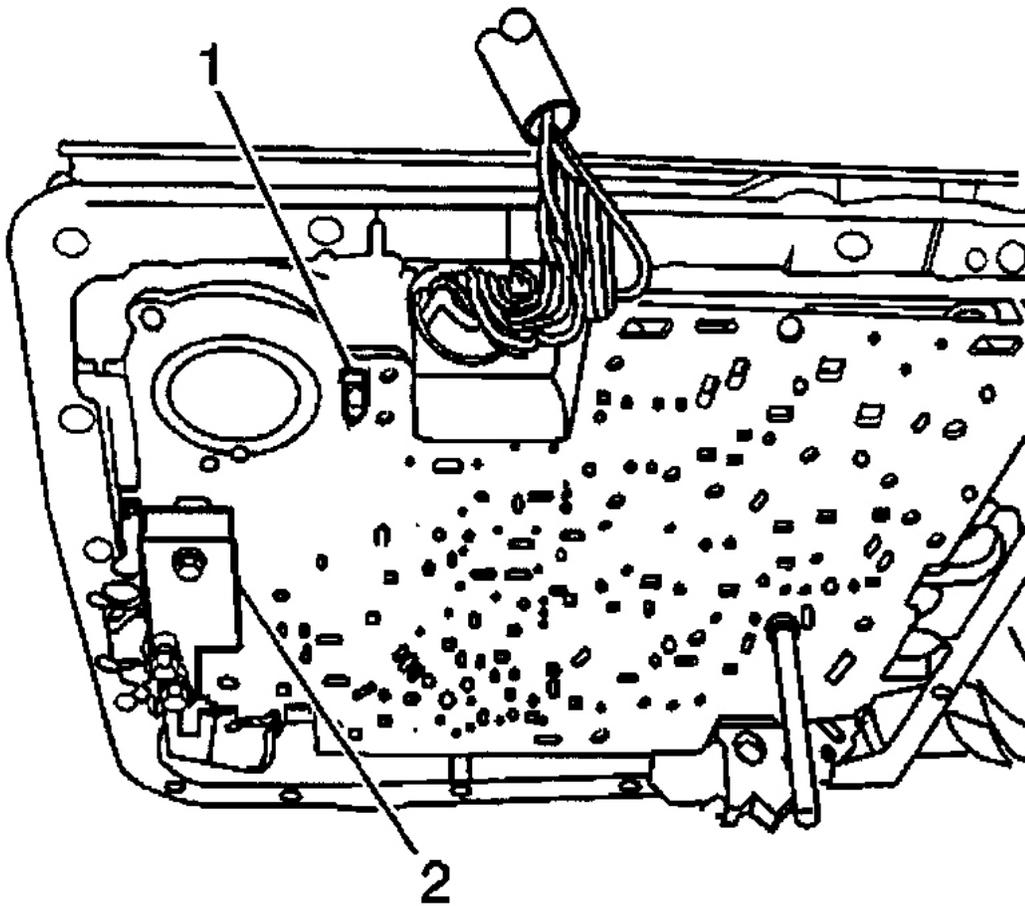
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Fig. 22: Installing 3-4 Accumulator Pin
Courtesy of GENERAL MOTORS CORP.



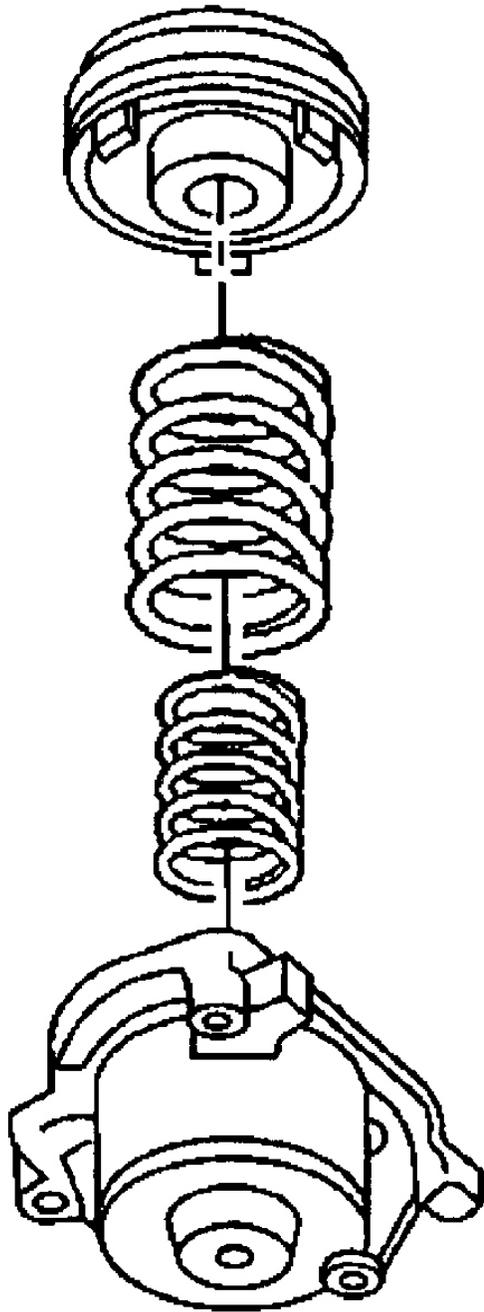
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Fig. 23: Installing Spacer Plate
Courtesy of GENERAL MOTORS CORP.



G00202972

Fig. 24: Installing Spacer Plate Support
Courtesy of GENERAL MOTORS CORP.



G00202973

Fig. 25: Installing 1-2 Accumulator Inner & Outer Springs
Courtesy of GENERAL MOTORS CORP.

AUXILIARY TRANSMISSION OIL COOLER

Removal

1. Open hood. Remove the transmission fluid cooler hoses from the transmission fluid auxiliary cooler. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.
2. Remove the bolts from the auxiliary transmission oil cooler. Remove the auxiliary transmission oil cooler from the vehicle.

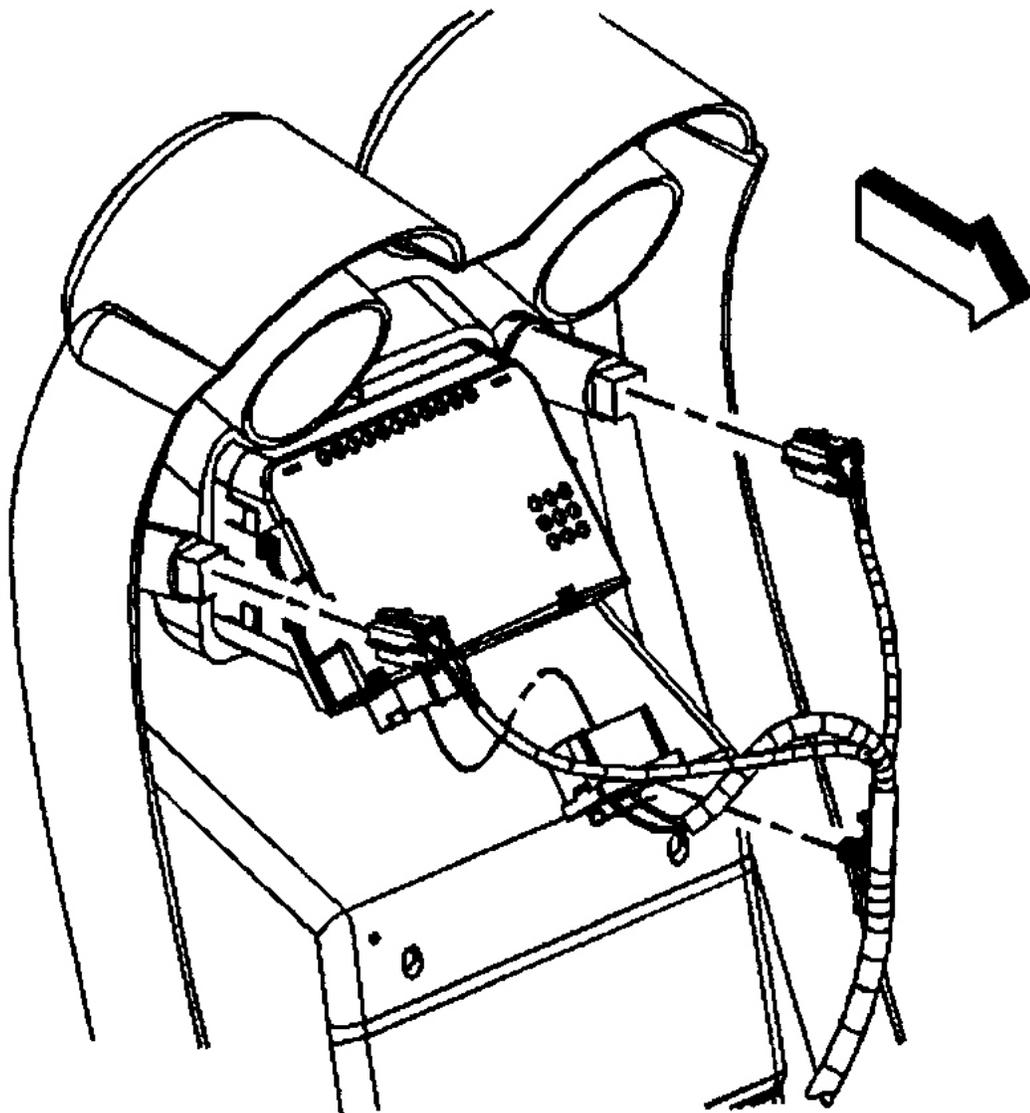
Installation

1. Install the auxiliary transmission oil cooler to the vehicle.
2. Install the bolts to the auxiliary transmission oil cooler. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.
3. Connect the transmission oil cooler lines to the auxiliary cooler. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.

CENTER CONSOLE

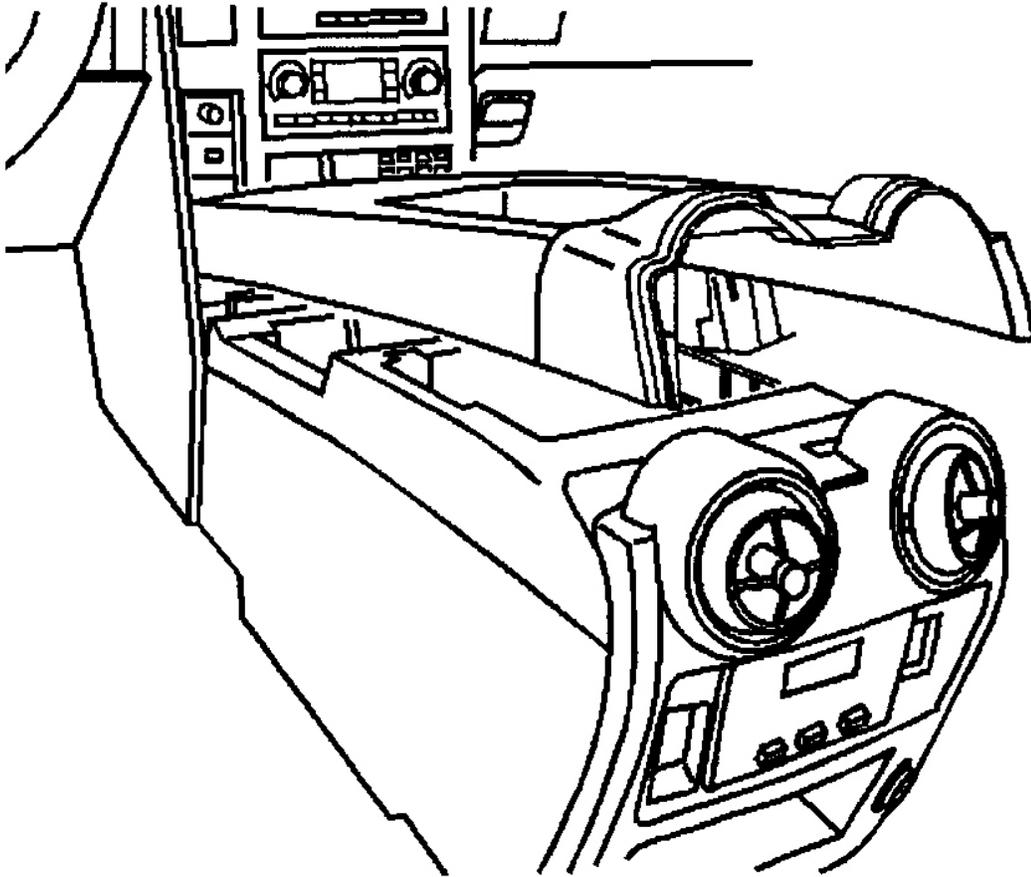
Removal

1. Loosen shift control knob set screw. Pull up to remove the shift control knob (2) from the transmission control assembly.
2. Remove the screws that hold center console storage bin in place. Remove the storage bin from the center console.
3. Using a flat bladed tool, pry up on the cup holder to release the clips. Disconnect the PRNDL lamps from the cup holder. Remove the cup holder.
4. Remove screws that hold end panel to center console. Disconnect electrical connectors to end panel. See **Fig. 26**. Remove console end panel.
5. Pull upwards on the upper console trim panel to release the trim panel clips. See **Fig. 27**. Remove the upper console trim panel.
6. Disconnect the console electrical connector. Remove the bolts holding center console to center console bracket. Remove the center console.



G00281735

Fig. 26: Identifying Center Console End Panel
Courtesy of GENERAL MOTORS CORP.



G00281736

Fig. 27: Identifying Upper Center Console Trim Panel
Courtesy of GENERAL MOTORS CORP.

Installation

NOTE: Make sure HVAC duct is aligned with center console.

1. Align center console to center console bracket and route the electrical wiring through console. Connect the console electrical connector.
2. Install the center console to center console bracket. Install the center console bolts. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS**.
3. Align the upper trim panel with center console. See **Fig. 27**. Push towards the console to engage the trim panel clips.
4. Connect electrical connectors to console end panel. See **Fig. 26**. Install the center console end panel. Install the center console end panel screws. Tighten the screws to specification. See **TORQUE**

SPECIFICATIONS

5. Connect the lamps to the cup holder. Align the cup holder to the center console. Push the cup holder firmly into place to engage the clips.
6. Install shift handle to shifter and fasten in place. Tighten the set screw to specification. See **TORQUE SPECIFICATIONS**.
7. Install the center console storage bin. Install the storage bin screws. Tighten the screws to specification. See **TORQUE SPECIFICATIONS**.

CONTROL & SHIFT SOLENOIDS

NOTE: **Valve body removal is not necessary for the following procedure.**

Removal

1. Remove the transmission oil pan and filter. See **DRAINING & REFILLING** under LUBRICATION.

NOTE: **DO NOT remove the valve body for the following procedures. Removal of the 1-2 accumulator is necessary only if servicing the pressure control solenoid.**

2. Remove the 1-2 accumulator if necessary. See **ACCUMULATOR ASSEMBLY**.
3. Disconnect the internal wiring harness electrical connectors from the following components:
 - Transmission fluid pressure switch. See **Fig. 28**.
 - 1-2 shift control solenoid.
 - 2-3 shift control solenoid.
 - Pressure control solenoid.
 - Torque Converter Clutch Pulse Width Modulation (TCC PWM) solenoid.
 - 3-2 shift control solenoid.
4. Remove the pressure control solenoid retainer. Remove the pressure control solenoid. See **Fig. 29**.
5. Remove the 1-2 and 2-3 shift control solenoid retainers. Remove the 1-2 and 2-3 shift control solenoids. See **Fig. 30**.
6. Remove the 3-2 control solenoid retainer. Remove the 3-2 control solenoid. See **Fig. 31**.

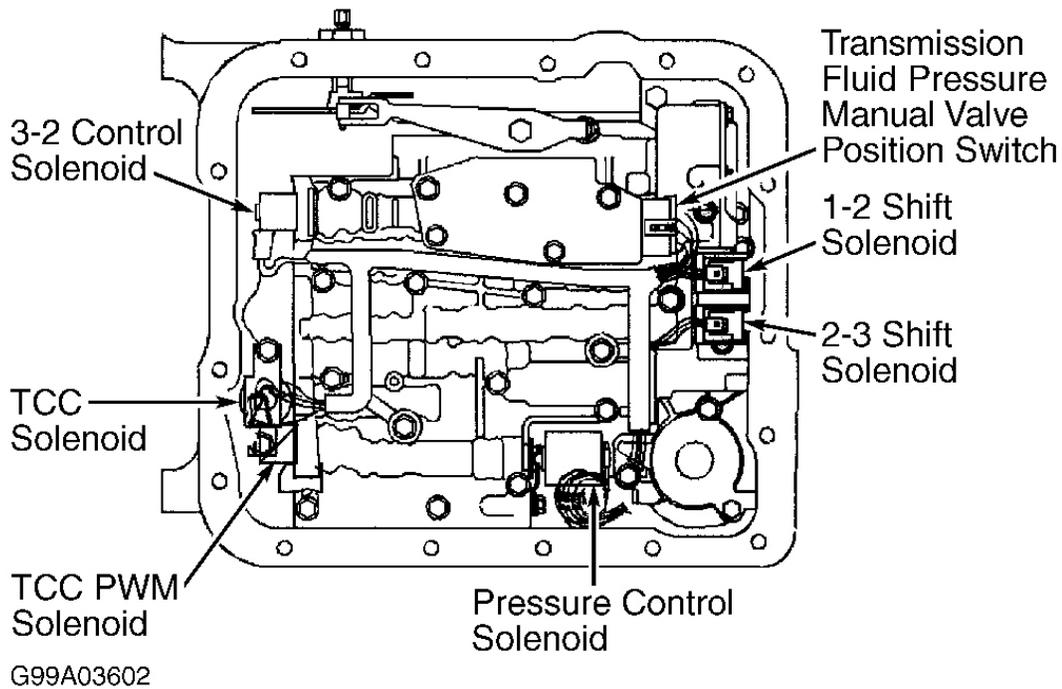
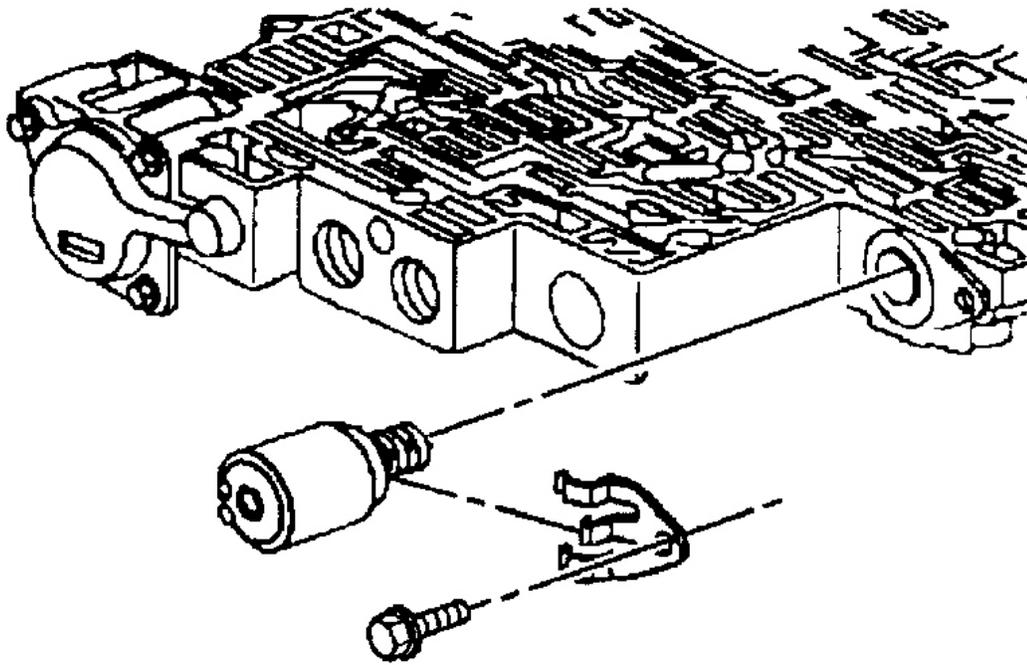
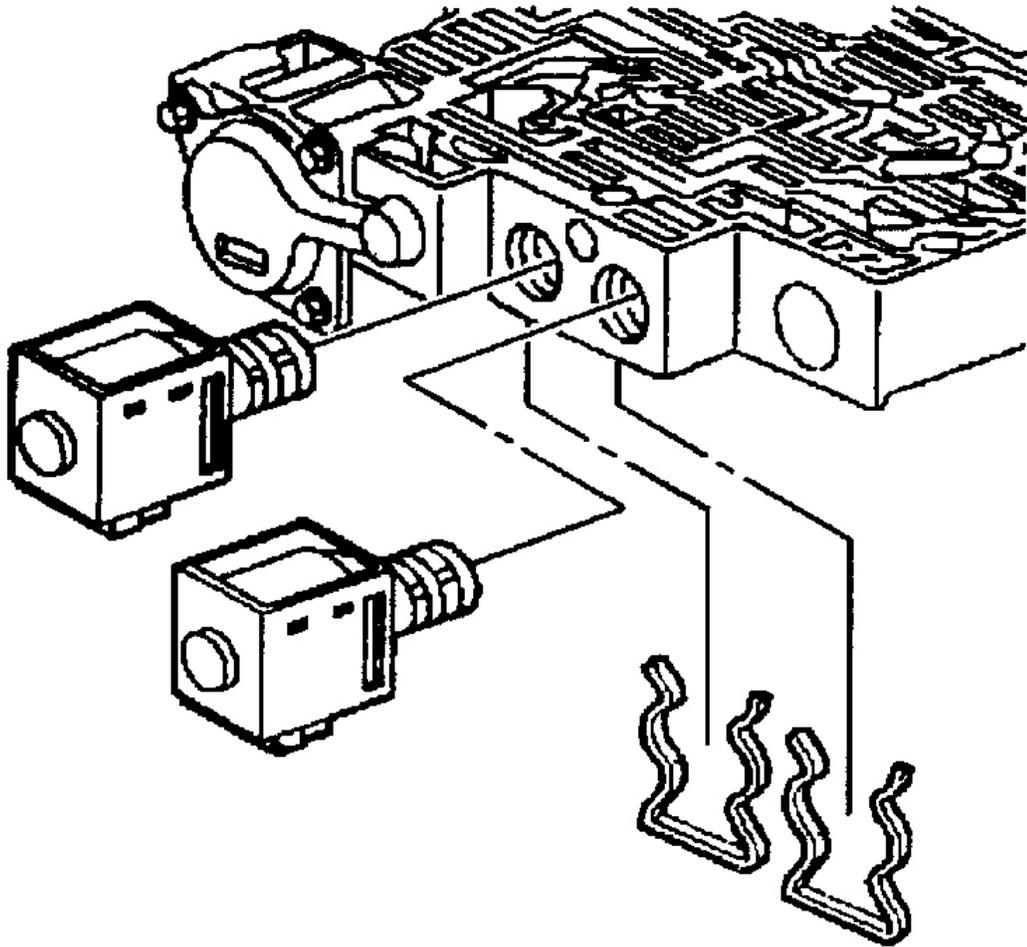


Fig. 28: View Of Control & Shift Control Solenoid Locations
Courtesy of GENERAL MOTORS CORP.



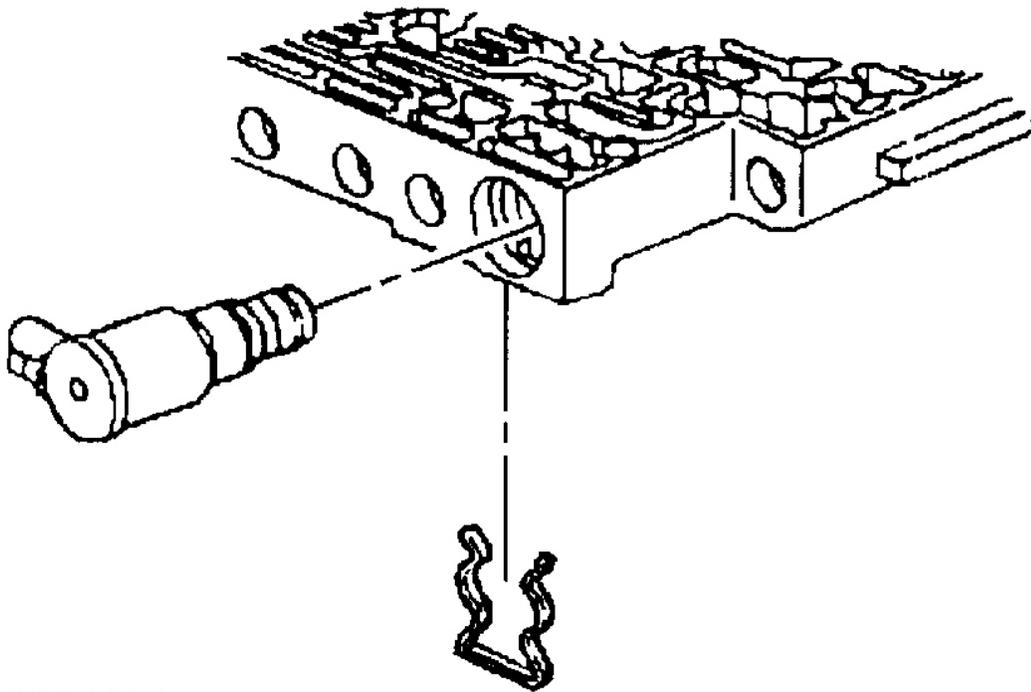
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Fig. 29: Disassembled View Of Pressure Control Solenoid
Courtesy of GENERAL MOTORS CORP.



G00056999

Fig. 30: Disassembled View Of Shift Control Solenoids
Courtesy of GENERAL MOTORS CORP.



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Fig. 31: Removing 3-2 Control Solenoid & Retainer
Courtesy of GENERAL MOTORS CORP.

Installation

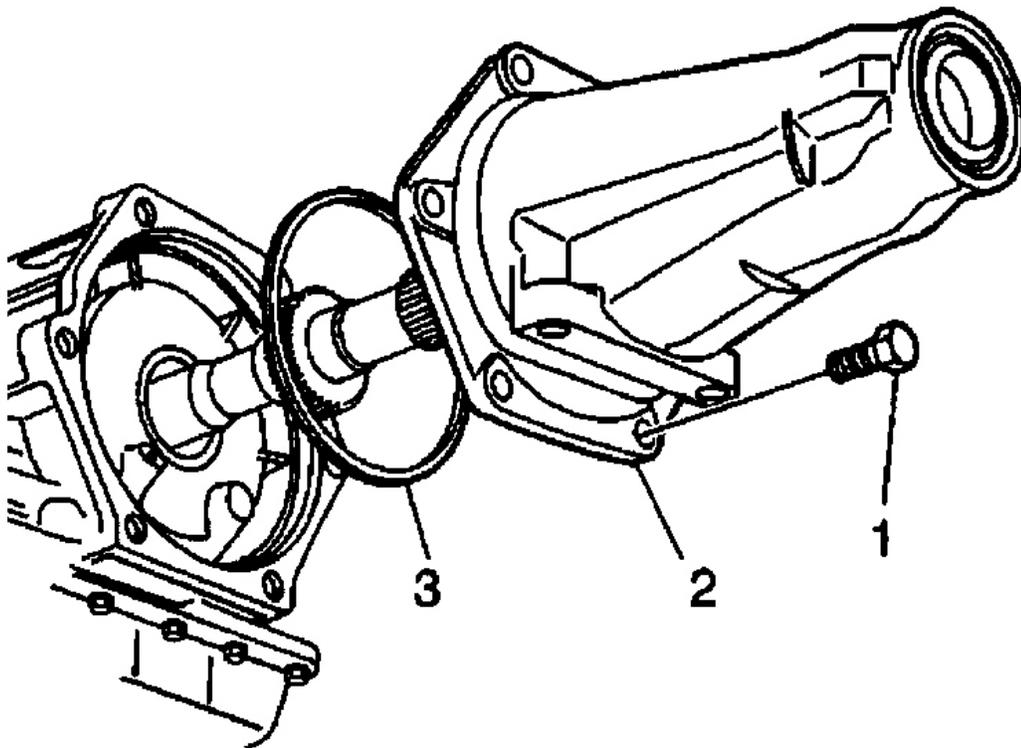
1. Install the 3-2 control solenoid. Install the 3-2 control solenoid retainer. Install the 1-2 and 2-3 shift control solenoids. See **Fig. 31** .
2. Install the 1-2 and 2-3 shift control solenoid retainers. Install the pressure control solenoid. Ensure the electrical tabs are facing outboard. See **Fig. 30** .
3. Install the pressure control solenoid retainer and retaining bolt and tighten to specification. See **TORQUE SPECIFICATIONS** .
4. Connect the internal wiring harness electrical connectors to the following components:
 - Transmission fluid pressure switch. See **Fig. 28** .
 - 1-2 shift control solenoid.
 - 2-3 shift control solenoid.
 - Pressure control solenoid.
 - TCC PWM solenoid.
 - 3-2 control solenoid.
5. Install the 1-2 accumulator. See **ACCUMULATOR ASSEMBLY** .

6. Install the transmission oil pan and filter. See **DRAINING & REFILLING** under LUBRICATION.
7. Fill transmission with appropriate fluid to proper level. See **LUBRICATION**.

EXTENSION HOUSING ASSEMBLY

Removal

1. Remove the drive shaft. See appropriate DRIVE SHAFTS & UNIVERSAL JOINTS article in DRIVELINE/AXLES.
2. Remove the transmission mount. See **TRANSMISSION MOUNT**.
3. Support the transmission with a transmission jack.
4. Place a drain pan under the vehicle.
5. Remove the case extension bolts (1). See **Fig. 32**.
6. Remove the case extension (2).
7. Remove and discard the case extension "O" ring seal (3).



G00087663

Fig. 32: Removing & Installing Extension Housing

Courtesy of GENERAL MOTORS CORP.

Installation

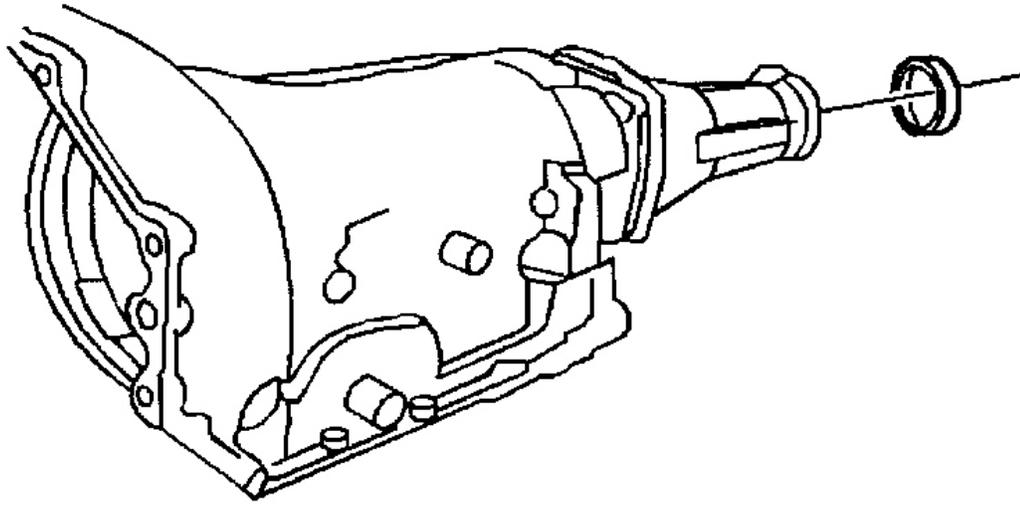
1. Install a new case extension "O" ring seal (3). See **Fig. 32** .
2. Install the case extension (2).
3. Install the case extension bolts (1). Tighten the case extension bolts to specification. See **TORQUE SPECIFICATIONS** .
4. Install the transmission mount. See **TRANSMISSION MOUNT** .
5. Remove the drain pan and the transmission jack.
6. Install the drive shaft. See appropriate DRIVE SHAFTS & UNIVERSAL JOINTS article in DRIVELINE/AXLES.
7. Fill transmission with appropriate fluid to proper level. See **LUBRICATION** .

EXTENSION HOUSING REAR TRANSMISSION SEAL

NOTE: **Tools required: Rear Extension Seal Installer (J-21426), and Transmission Assembly Lubricant (J-36850).**

Removal

1. Place a drain pan under the vehicle.
2. Remove the drive shaft. See appropriate DRIVE SHAFTS & UNIVERSAL JOINTS article in DRIVELINE/AXLES.
3. Remove the rear extension transmission oil seal. See **Fig. 33** .
4. Inspect the case extension housing for damage. Replace the extension housing if necessary.

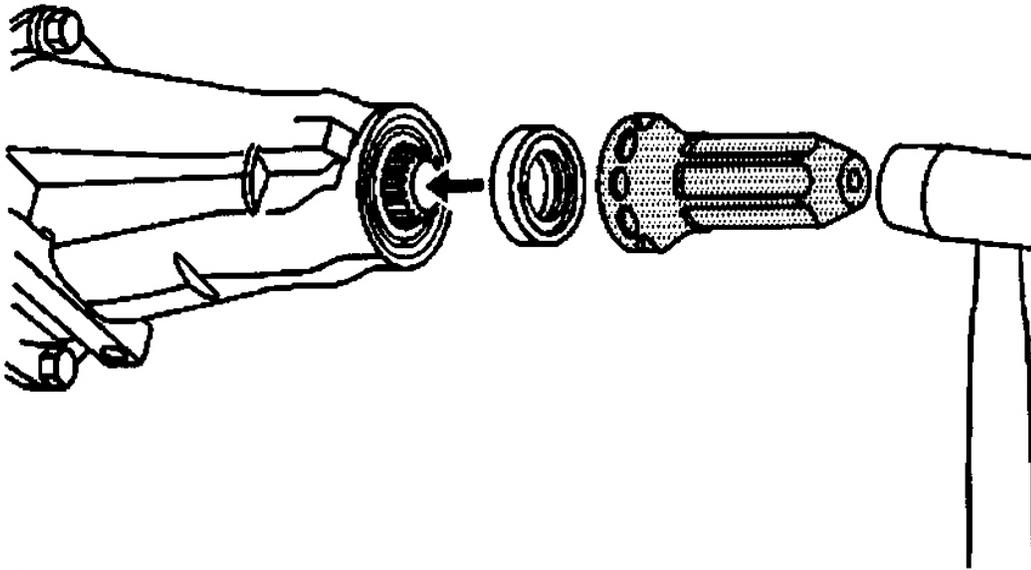


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Fig. 33: Removing Rear Extension Housing Seal
Courtesy of GENERAL MOTORS CORP.

Installation

1. Lubricate the inside diameter of the NEW seal with Transjel(R) lubricant.
2. Install the new seal using rear extension seal installer and a soft faced mallet. See **Fig. 34** .
3. Remove the drain pan.
4. Install the drive shaft. See appropriate DRIVE SHAFTS & UNIVERSAL JOINTS article in DRIVELINE/AXLES.
5. Fill transmission with appropriate fluid to proper level. See **LUBRICATION** .



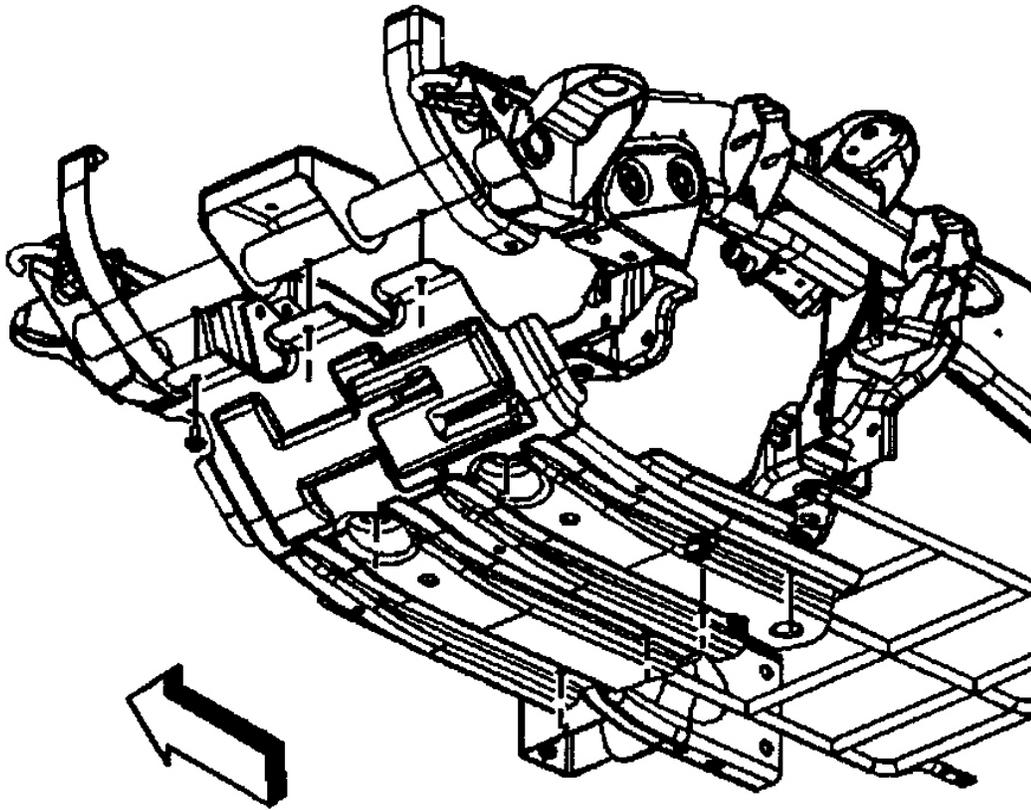
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Fig. 34: Installing Rear Extension Housing Rear Transmission Oil Seal
 Courtesy of GENERAL MOTORS CORP.

FILLER TUBE & SEAL

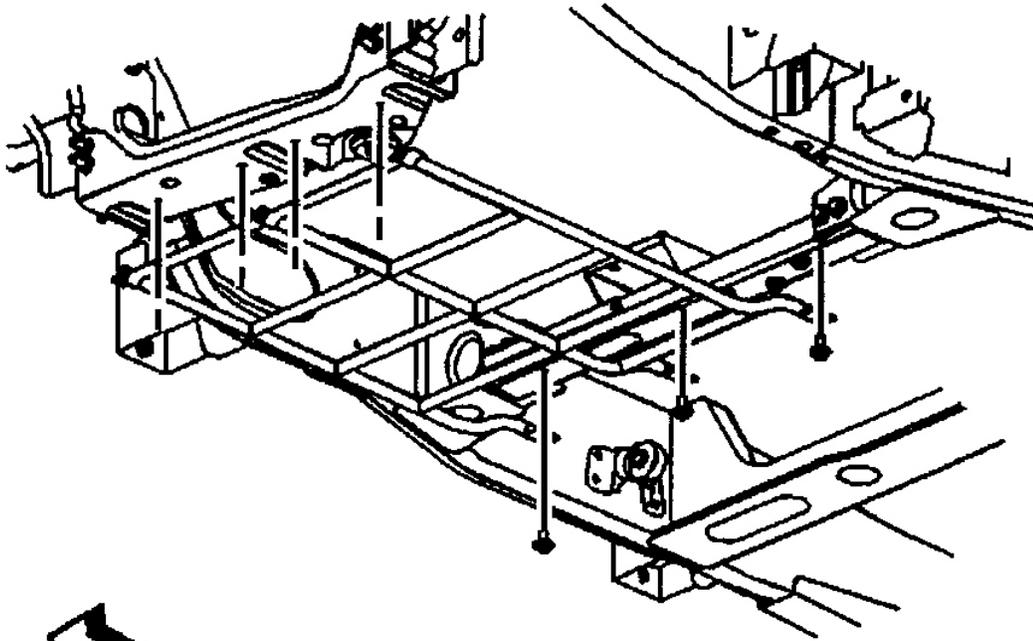
Removal

1. Remove the transmission oil level indicator. Raise and suitably support the vehicle.
2. Remove frame-to-engine protection shield bolts. See **Fig. 35** . Remove engine protection shield. Remove the catalytic converter guard mounting bolts and guard from vehicle. See **Fig. 36** .
3. Disconnect the connector position assurance (CPA) retainers. Disconnect the oxygen sensor electrical connectors (1, 2). See **Fig. 37** .
4. Remove the catalytic converter to muffler flange nuts. Remove the exhaust manifold pipe-to-catalytic converter nuts. Remove the catalytic converter.
5. Remove the transmission heat shield bolt and shield. See **Fig. 38** . Remove the nut securing the transmission oil lever indicator tube to the transmission housing.
6. Place a drain pan under the vehicle. Remove the transmission oil level indicator tube from the transmission case. See **Fig. 39** . Remove the seal from the transmission case.



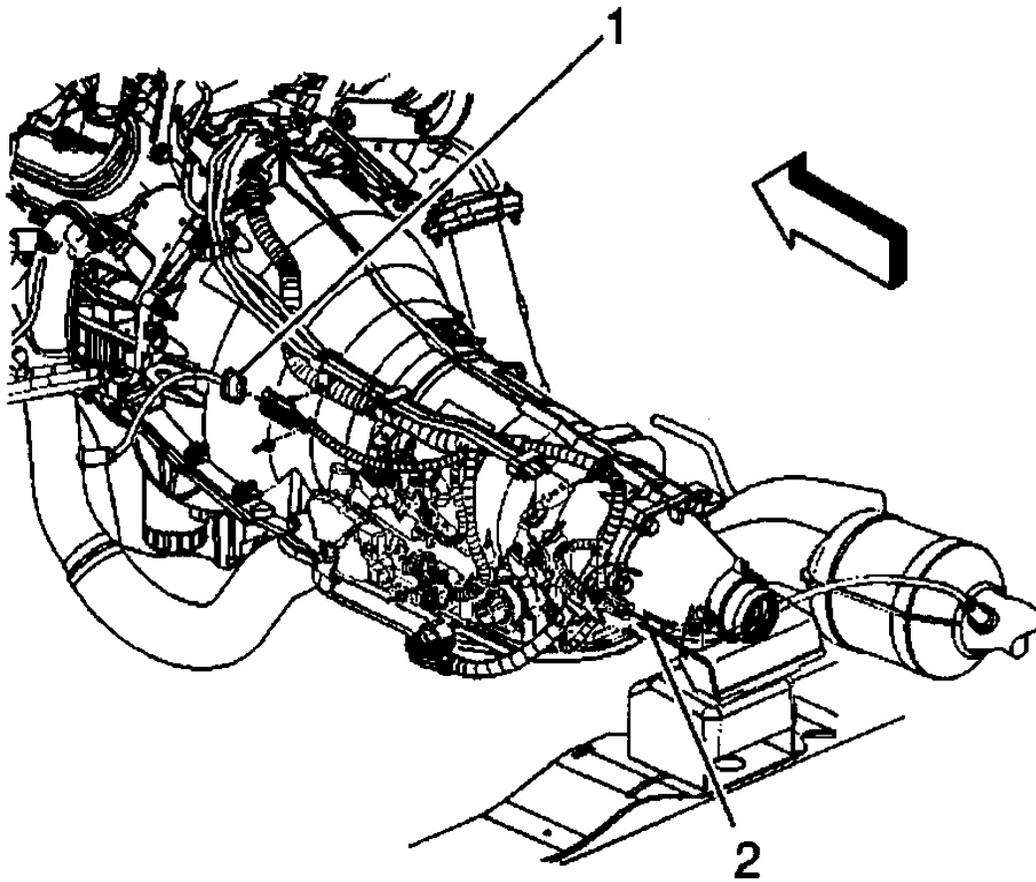
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Fig. 35: Identifying Frame-To-Engine Protection Shield
Courtesy of GENERAL MOTORS CORP.



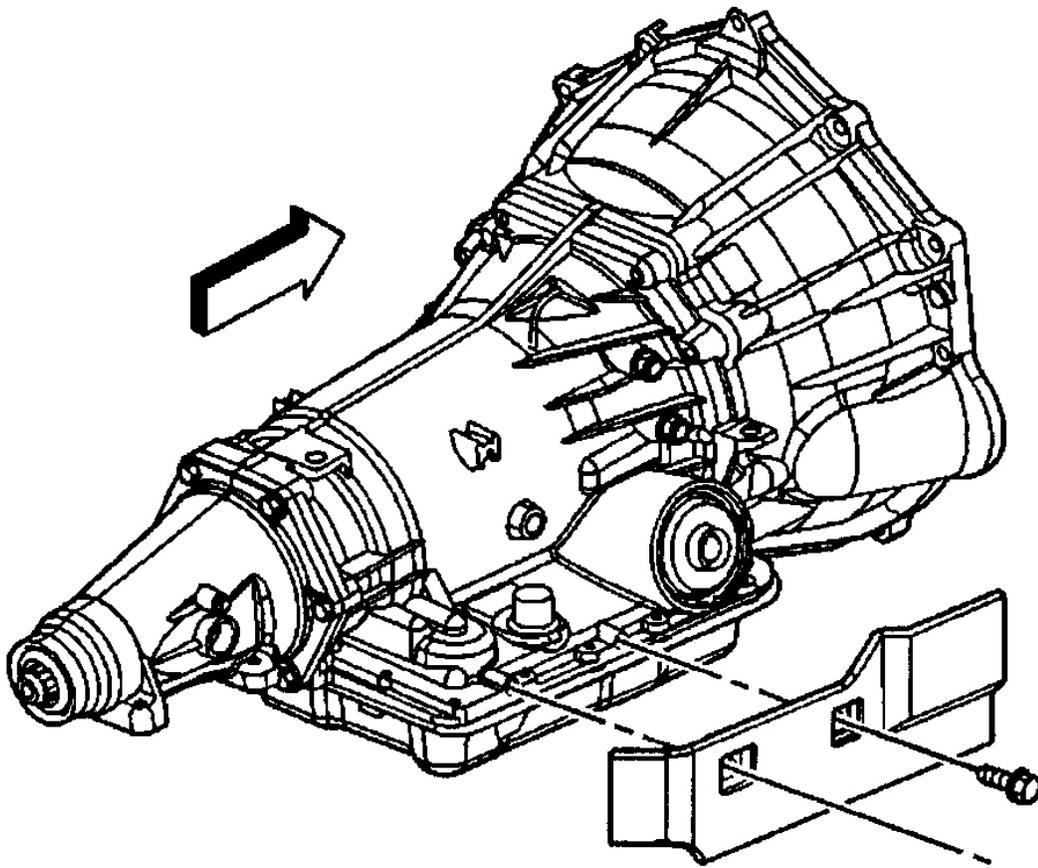
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Fig. 36: Identifying Catalytic Converter Guard
Courtesy of GENERAL MOTORS CORP.



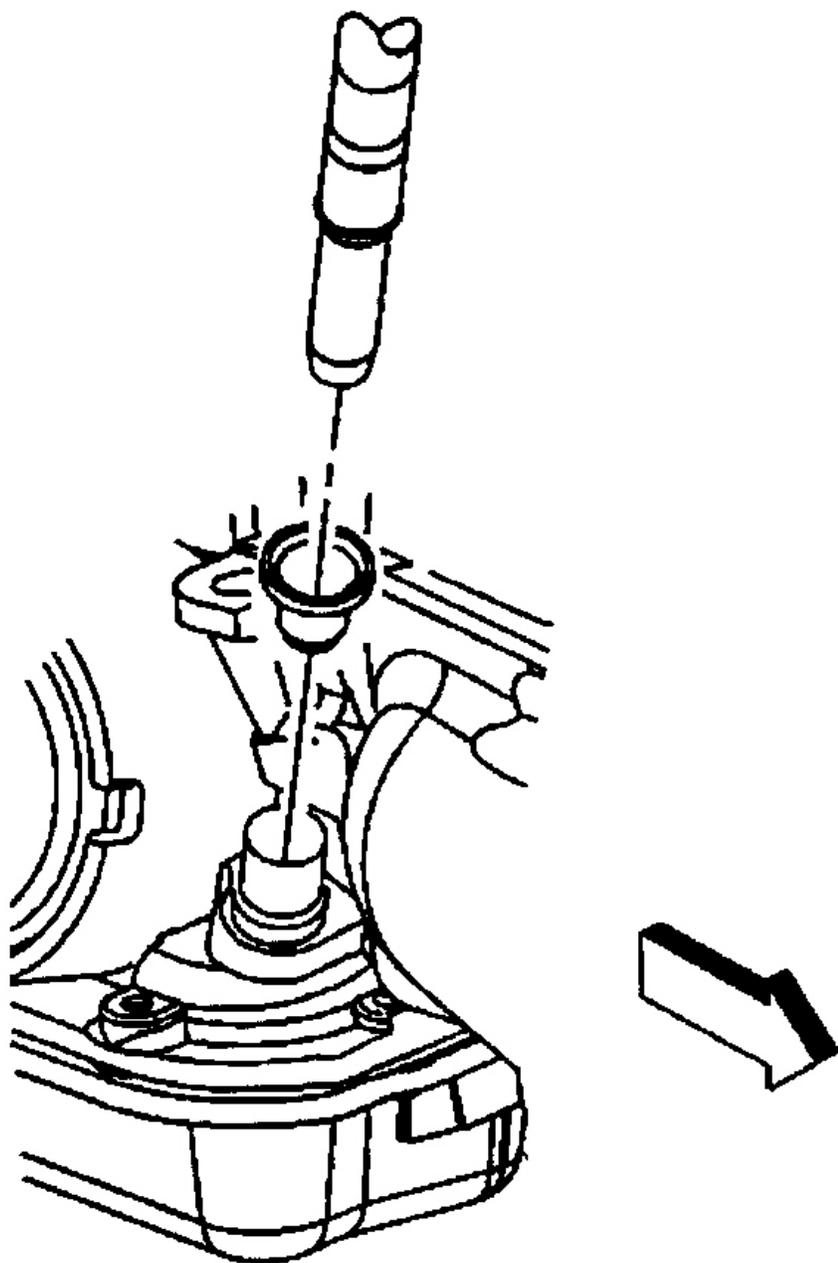
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Fig. 37: Identifying Oxygen Sensor Electrical Connector
Courtesy of GENERAL MOTORS CORP.



G00281733

Fig. 38: Identifying Transmission Heat Shield
Courtesy of GENERAL MOTORS CORP.



G00096144

Fig. 39: Removing & Installing Filler Tube
Courtesy of GENERAL MOTORS CORP.

Installation

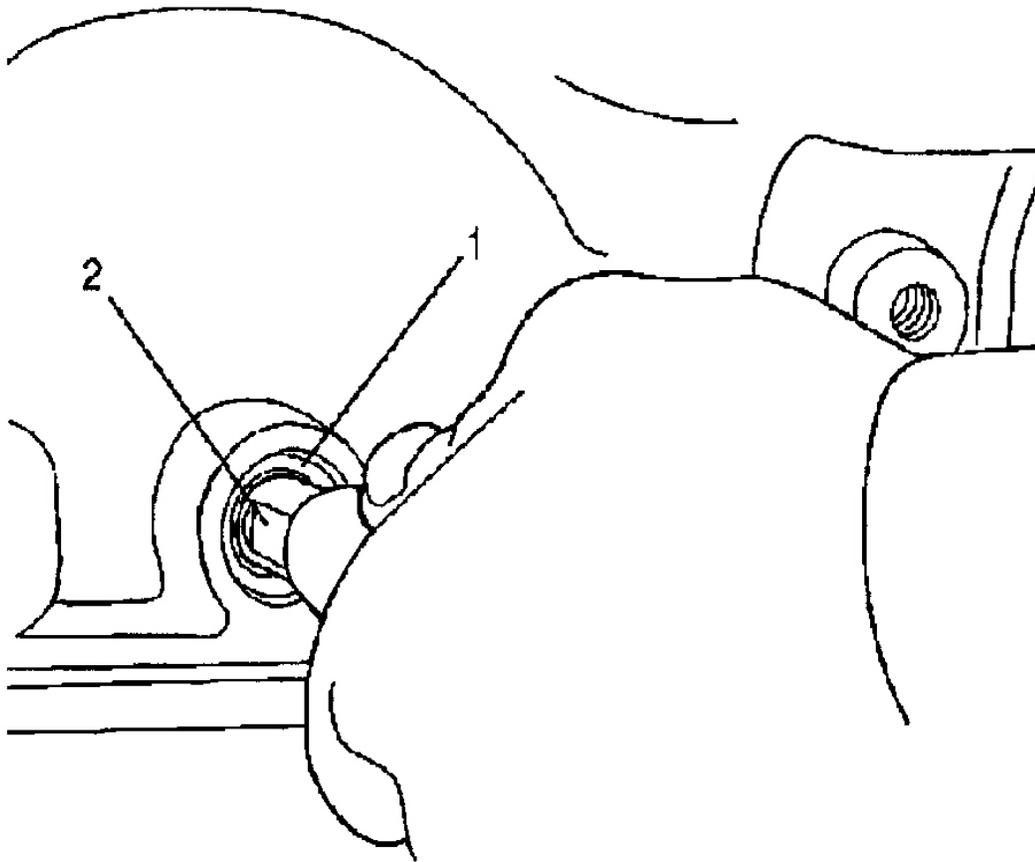
1. Install a NEW seal into transmission case. See **Fig. 39** . Install the transmission oil level indicator tube into seal.
2. Install the transmission level indicator tube nut. Tighten nut to specification. See **TORQUE SPECIFICATIONS** .
3. Install transmission heat shield. Install the 2 bolts retaining the heat shield. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
4. Install right catalytic converter and nuts. Tighten nuts to specification. See **TORQUE SPECIFICATIONS** .
5. Install exhaust manifold pipe-to-catalytic converter nuts. Tighten nuts to specification. See **TORQUE SPECIFICATIONS** .
6. Connect oxygen sensor electrical connectors (1, 2). See **Fig. 37** . Connect the CPA retainers.
7. Install the catalytic converter guard. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . Install frame-to-engine protection shield. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
8. Lower the vehicle. Install the transmission oil level indicator.
9. Fill transmission to proper level with appropriate fluid. See **LUBRICATION** .

MANUAL SHIFT SHAFT SEAL

NOTE: **Tools required: Selector Shaft Seal Remover (J-43911) and Selector Shaft Seal Installer (J-43909).**

Removal

1. Raise the vehicle. Remove the Park/Neutral Position (PNP) Switch. See **PARK/NEUTRAL POSITION SWITCH** .
2. Be sure that the jackscrew for Selector Shaft Seal Remover is backed off and will not interfere with installation of the removal tool. Slide the seal remover tool over the selector shaft (2) with the threaded end of the tool towards the seal. See **Fig. 40** .
3. Rotate the removal tool so that the threads on the end of the tool engage the steel shell (1) of the seal. Use a wrench to be sure that the removal tool is firmly attached to the seal shell.
4. Rotate the jackscrew in the clockwise direction to remove the seal from the bore. Discard the seal that was removed.



G00281734

Fig. 40: Identifying Manual Shaft Seal
Courtesy of **GENERAL MOTORS CORP.**

Installation

1. Carefully slide a new selector shaft seal (1) over the selector shaft (2) with the wide face of the steel case facing outward. See **Fig. 40** . Position the seal so that it is starting to enter the seal bore.
2. Obtain Selector Shaft Seal Installer and remove the inner sleeve so that the tool will slide over the selector shaft.
3. Slide the Seal Installer into position so that the end of the tool contacts the seal being installed. Use a mallet to strike the Seal Installer and drive the new seal into the seal bore until it is seated at the bottom of the bore.
4. Install the PNP Switch. See **PARK/NEUTRAL POSITION SWITCH** . Lower the vehicle.
5. Fill the transmission to the proper level with transmission fluid. See **RECOMMENDED FLUIDS** and **CHECKING FLUID LEVEL & CONDITION** .

PARK/NEUTRAL POSITION SWITCH

NOTE: Tools required: Park/Neutral Position Switch Aligner (J-41364-A).

Removal

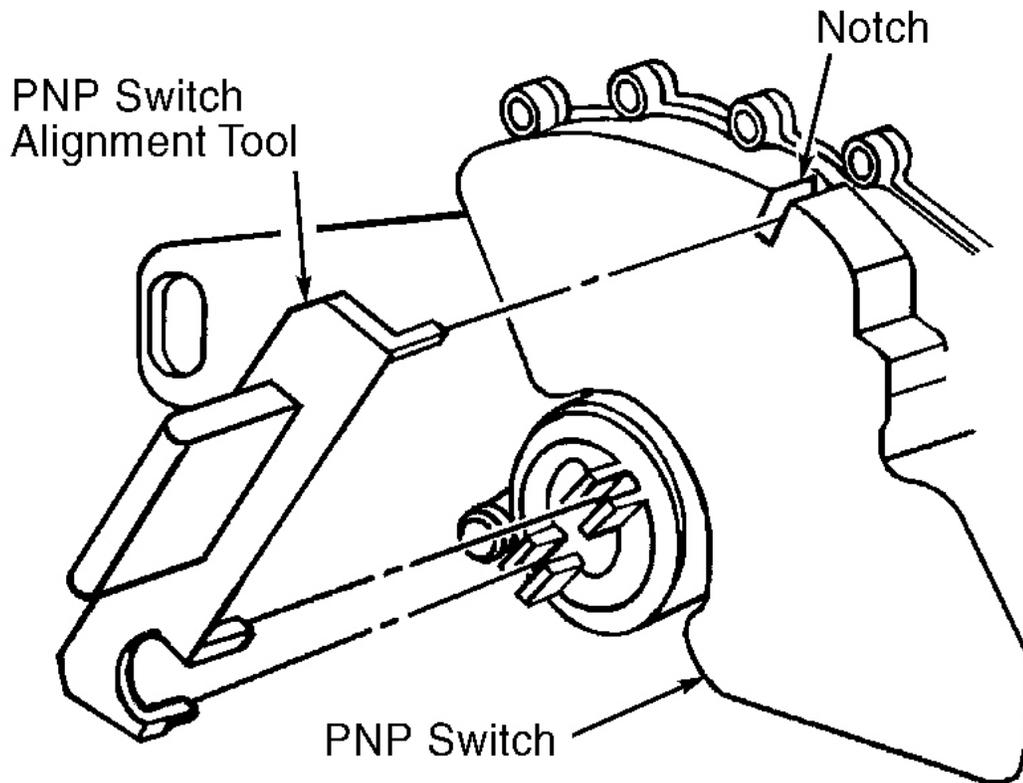
1. Apply the Parking brake. Shift the transmission into Neutral.
2. Raise and suitably support the vehicle.
3. Remove nut securing the transmission control lever to the manual shaft. Remove transmission control lever from manual shaft.
4. Disconnect the Park/Neutral Position (PNP) switch electrical connectors.
5. Remove the PNP switch bolts.
6. Remove the PNP switch from the manual shaft. If the PNP switch did not slide off the manual shaft, file the outer edge of the manual shaft in order to remove any burrs.

Installation

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

NOTE: If a NEW PNP switch is being installed, the switch will come with a positive assurance bracket. The positive assurance bracket aligns the new switch in its proper position for installation and the use of the park neutral switch aligner will not be necessary.

3. Install the PNP switch bolts finger tight.
4. Install park/neutral position switch aligner onto the PNP switch. See **Fig. 41** . Ensure that the two slots on the switch where the manual shaft is inserted are lined up with the lower two tabs on the tool.
5. Rotate the tool until the upper locator pin on the tool is lined up with the slot on the top of the switch. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
6. Remove the park/neutral position switch aligner from the switch. If installing a new switch, remove the positive assurance bracket at this time.
7. Connect the PNP switch electrical connectors.
8. Install the transmission control lever to the manual shaft with the nut. Tighten the nut to specification. See **TORQUE SPECIFICATIONS** .
9. Lower the vehicle.
10. Check the switch for proper operation. The engine must start in the Park (P) or Neutral (N) positions only. If proper operation of the switch can not be obtained, replace the switch.



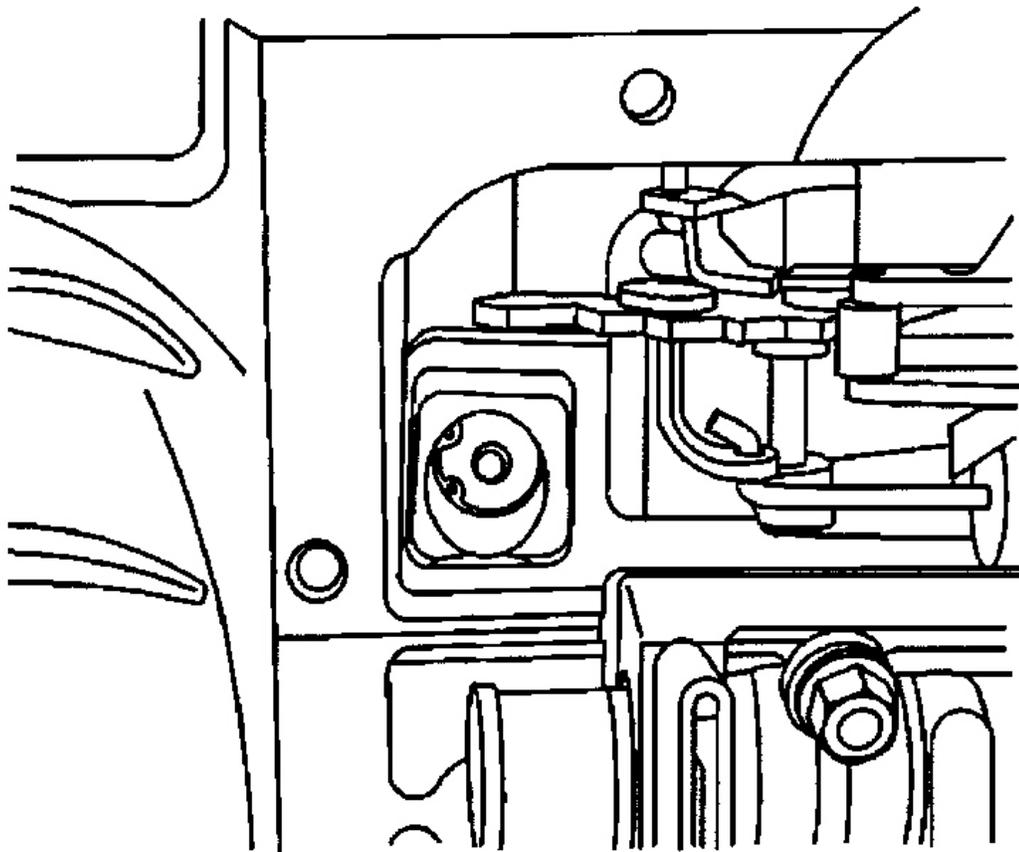
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Fig. 41: Adjusting Park/Neutral Position Switch
 Courtesy of GENERAL MOTORS CORP.

PRESSURE REGULATOR

Removal

1. Remove the transmission oil pan and filter. See **DRAINING & REFILLING** under LUBRICATION.
2. Compress the reverse boost valve sleeve into the bore of the oil pump to release tension on the reverse boost valve retaining ring. See **Fig. 42**.
3. Remove the reverse boost valve retaining ring, then slowly release tension on the reverse boost valve sleeve.
4. Remove the reverse boost valve sleeve (5) and the reverse boost valve (4). See **Fig. 43**.
5. Remove the pressure regulator isolator spring (3) and the pressure regulator valve spring (2). Remove the pressure regulator valve (1).



G00056996

Fig. 42: Installed View Of Pressure Regulator
Courtesy of GENERAL MOTORS CORP.

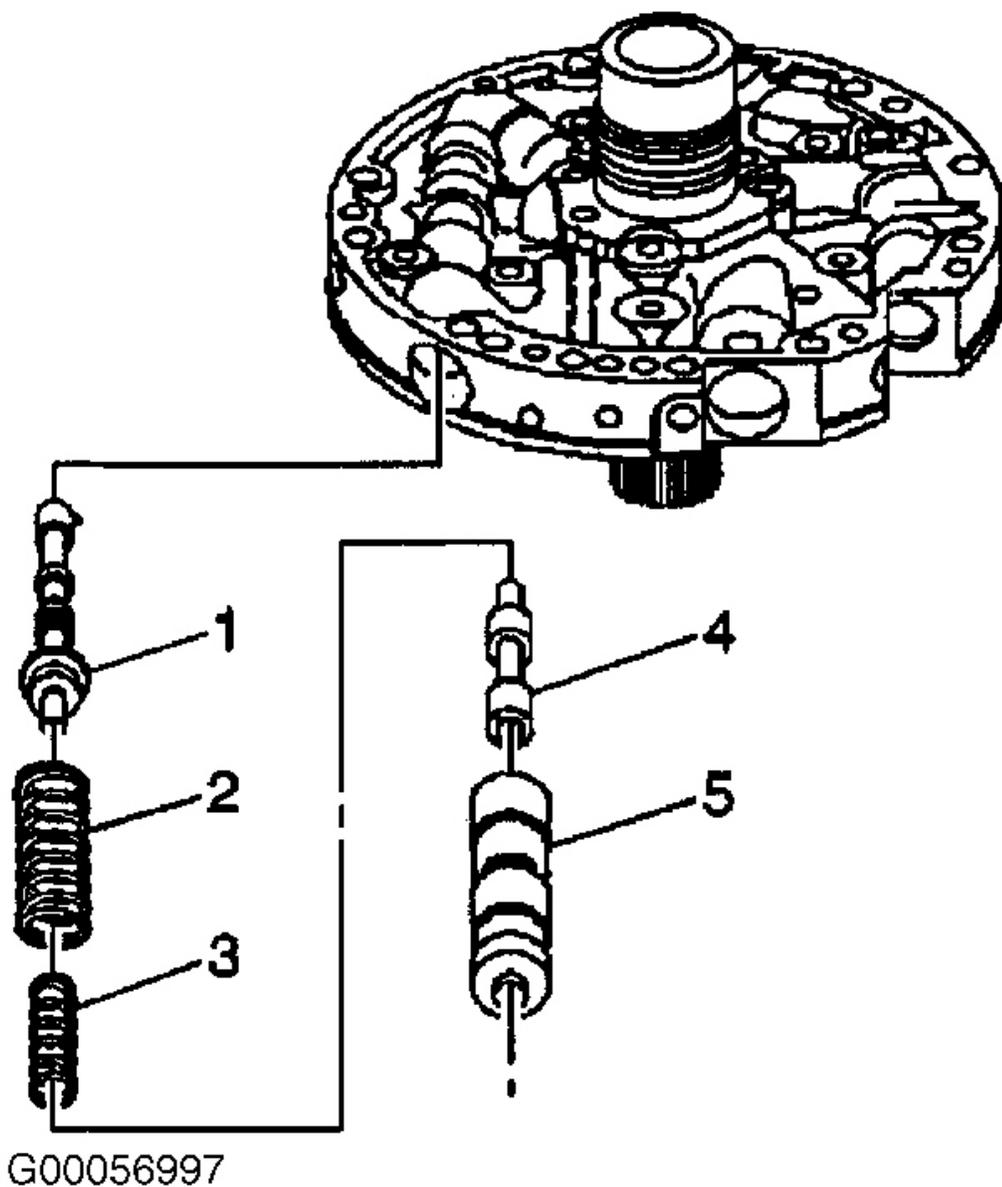


Fig. 43: Exploded View Of Pressure Regulator
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the pressure regulator valve (1). See **Fig. 43** .
2. Install the pressure regulator isolator spring (3) and the pressure regulator valve spring (2).

3. Install the reverse boost valve (4) in the reverse boost valve sleeve (5).
4. Install the reverse boost valve (4) and sleeve (5) in the oil pump cover.
5. Compress the reverse boost valve sleeve into the bore of the oil pump to expose the retaining ring slot.
6. Install the reverse boost valve retaining ring, then slowly release tension on the reverse boost valve sleeve. See **Fig. 42** .
7. Install the transmission oil filter and pan. See **DRAINING & REFILLING** under LUBRICATION.

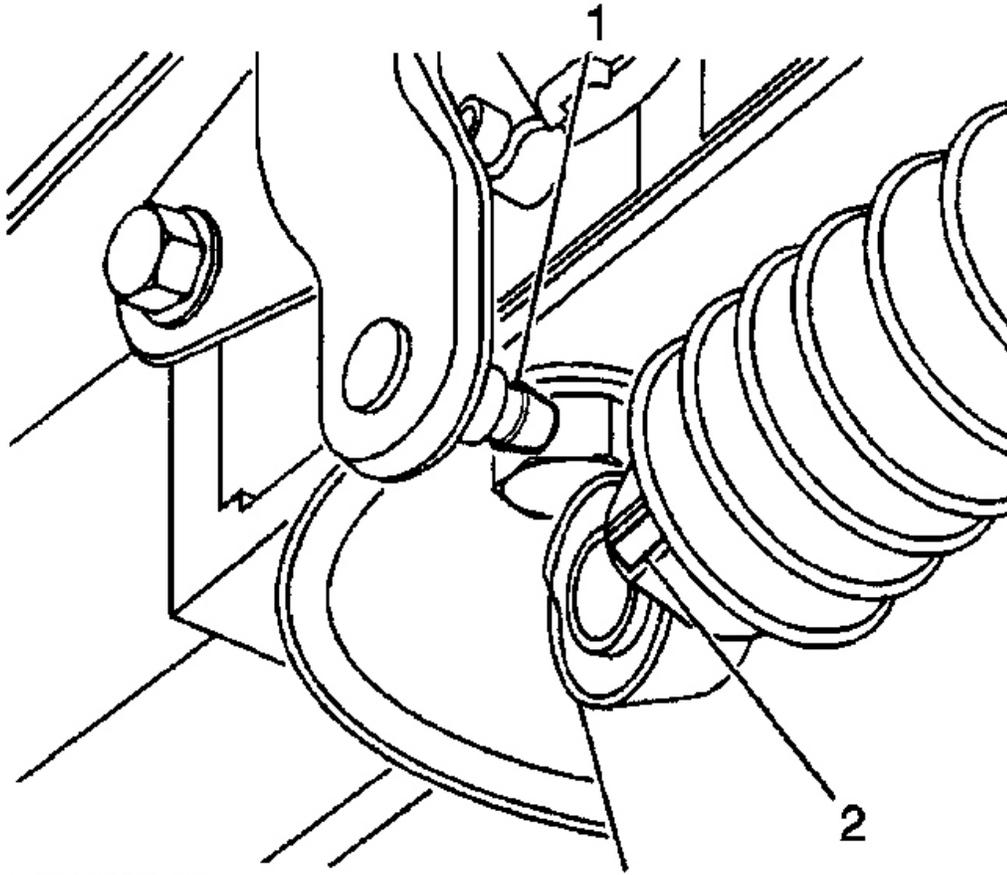
SHIFT CABLE

Removal

1. Position the shift lever to the Park position. Raise the vehicle.

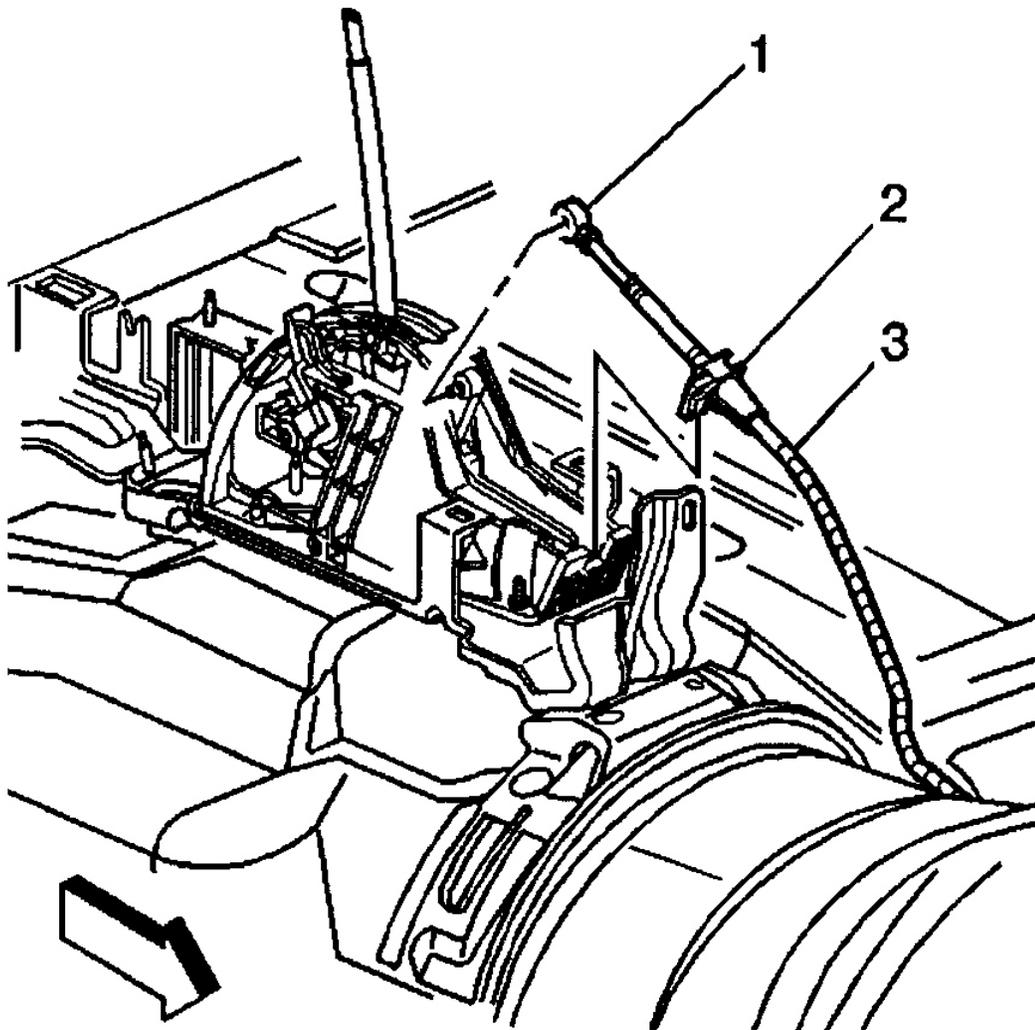
NOTE: **Ensure the transmission manual shaft is positioned to mechanical park.**

2. Remove the shifter retaining clip and then the cable from the bracket at the transmission. Remove the shift cable end (2) from the transmission shift lever ball stud (1). See **Fig. 44** .
3. Lower the vehicle and ensure that the shifter lever is still in the park position.
4. Remove center console. See **CENTER CONSOLE** .
5. Remove the cable end (1) from the floor shift control assembly ball stud. See **Fig. 45** . Remove the shift cable (2) from the floor shifter control assembly.
6. Remove the grommet on the shift cable from the floor panel. Remove the shift cable from the vehicle.



G00092163

Fig. 44: Removing & Installing Shift Cable At Transmission Lever
Courtesy of GENERAL MOTORS CORP.



G00281731

Fig. 45: Identifying Shift Cable Assembly
Courtesy of GENERAL MOTORS CORP.

Installation

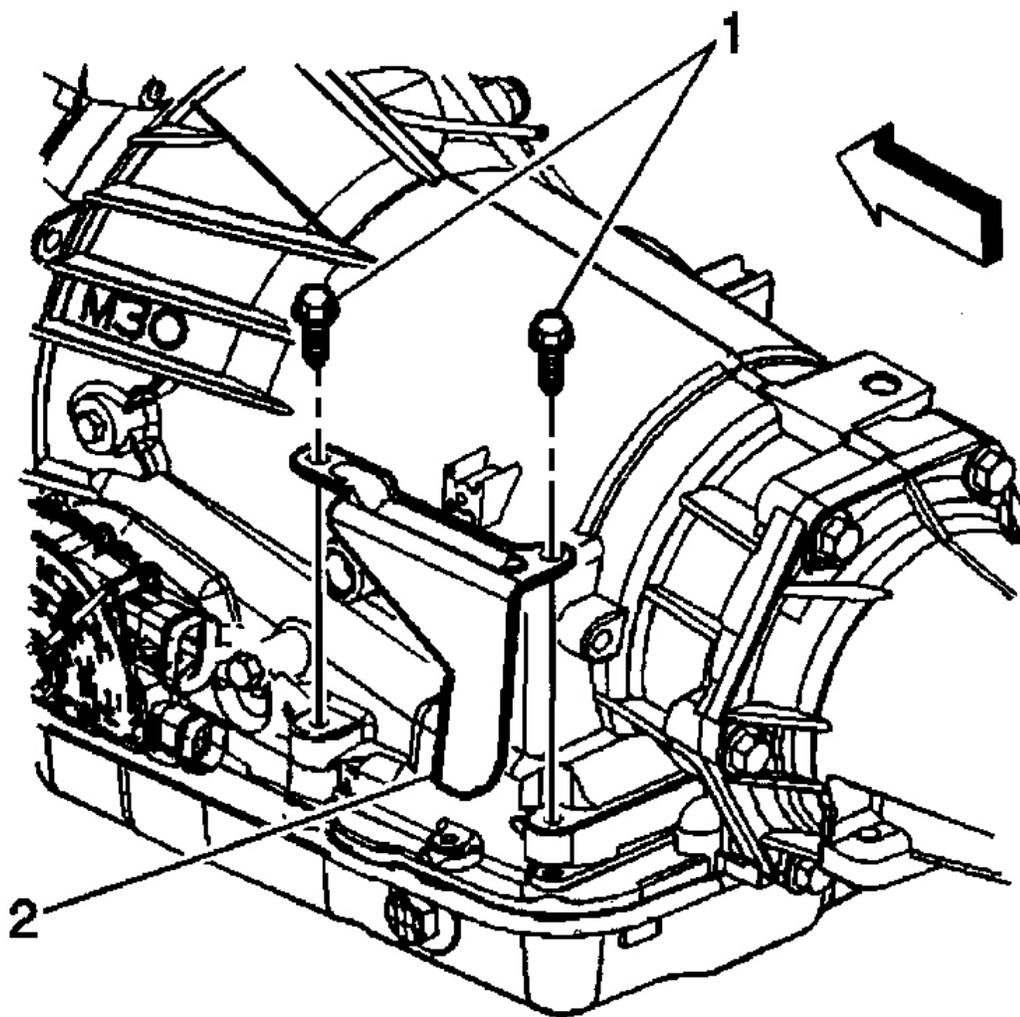
1. Route the cable through the hole in the floor panel. Ensure that the transmission shift lever is in the mechanical Park position.
2. Install the cable grommet to the floor panel. Install the shift cable end (2) to the transmission shift lever ball stud (1). See **Fig. 45**.
3. Install center console. See **CENTER CONSOLE**. Raise the vehicle.
4. Ensure that the transmission manual shaft lever is in the mechanical park position. Install the range selector cable into the bracket at the transmission.

5. Install the cable retaining clip. Install the range selector cable end (2) to the transmission shift lever ball stud (1). See **Fig. 44** . Lower the vehicle.

SHIFT CABLE BRACKET

Removal

1. Apply the Parking brake. Place the transmission into Neutral. Raise and support the vehicle.
2. Disconnect the transmission range selector cable from the shift lever and the bracket (2). See **Fig. 46** and **SHIFT CABLE** .
3. Remove the bolts (1) securing the transmission shift cable bracket (2) to the transmission. Remove the transmission shift cable bracket from vehicle.



G00096160

Fig. 46: Removing & Installing Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

Installation

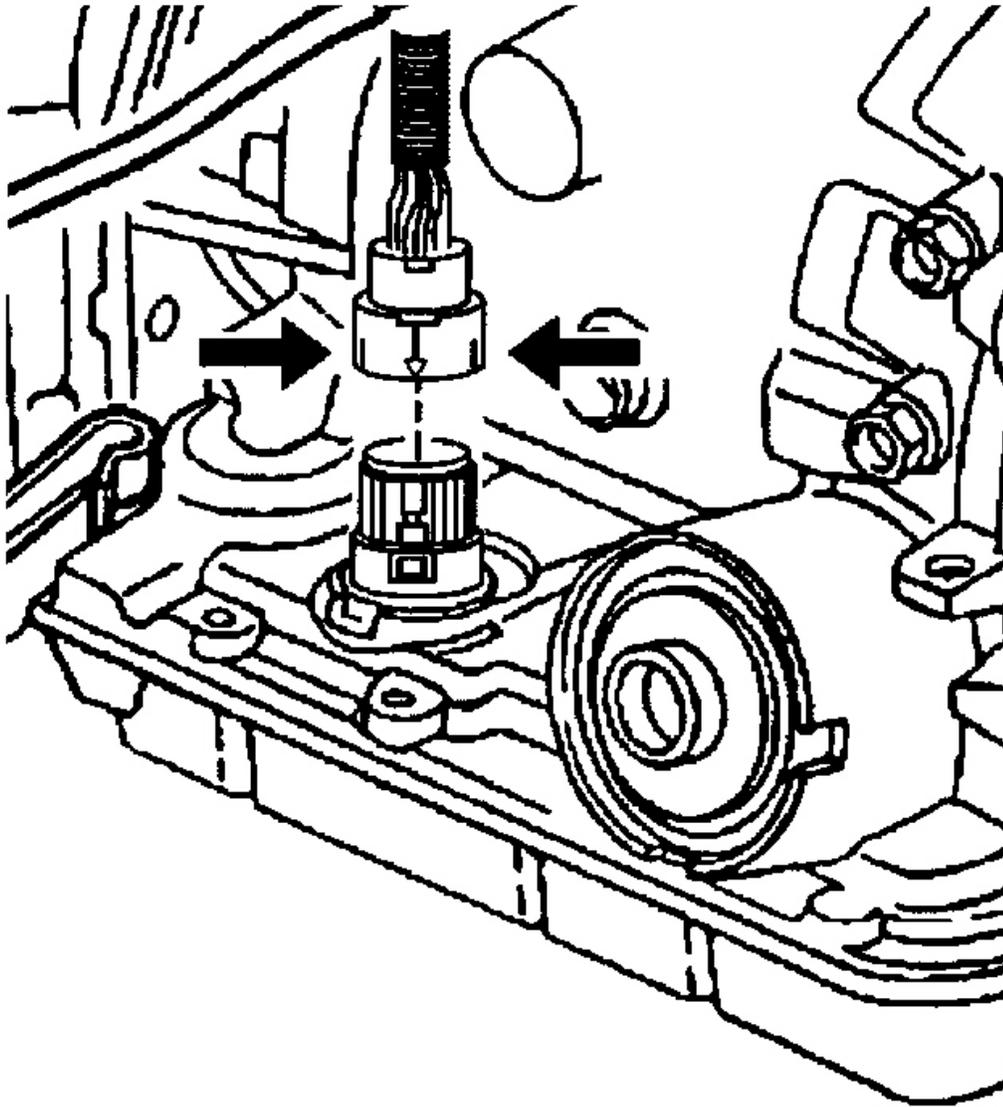
1. Install the shift cable bracket to the vehicle.
2. Install the shift cable bracket bolts (1). See **Fig. 46** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
3. Install the transmission range selector cable to the bracket (2) and the lever. See **SHIFT CABLE** .
4. Lower the vehicle. Check the vehicle for proper operation. If cable adjustment is necessary, see **SHIFT CABLE** under ADJUSTMENTS.

TCC SOLENOID, TCC PWM SOLENOID & WIRING HARNESS

NOTE: Tools required: Seal Protector Retainer Installer (J-28458).

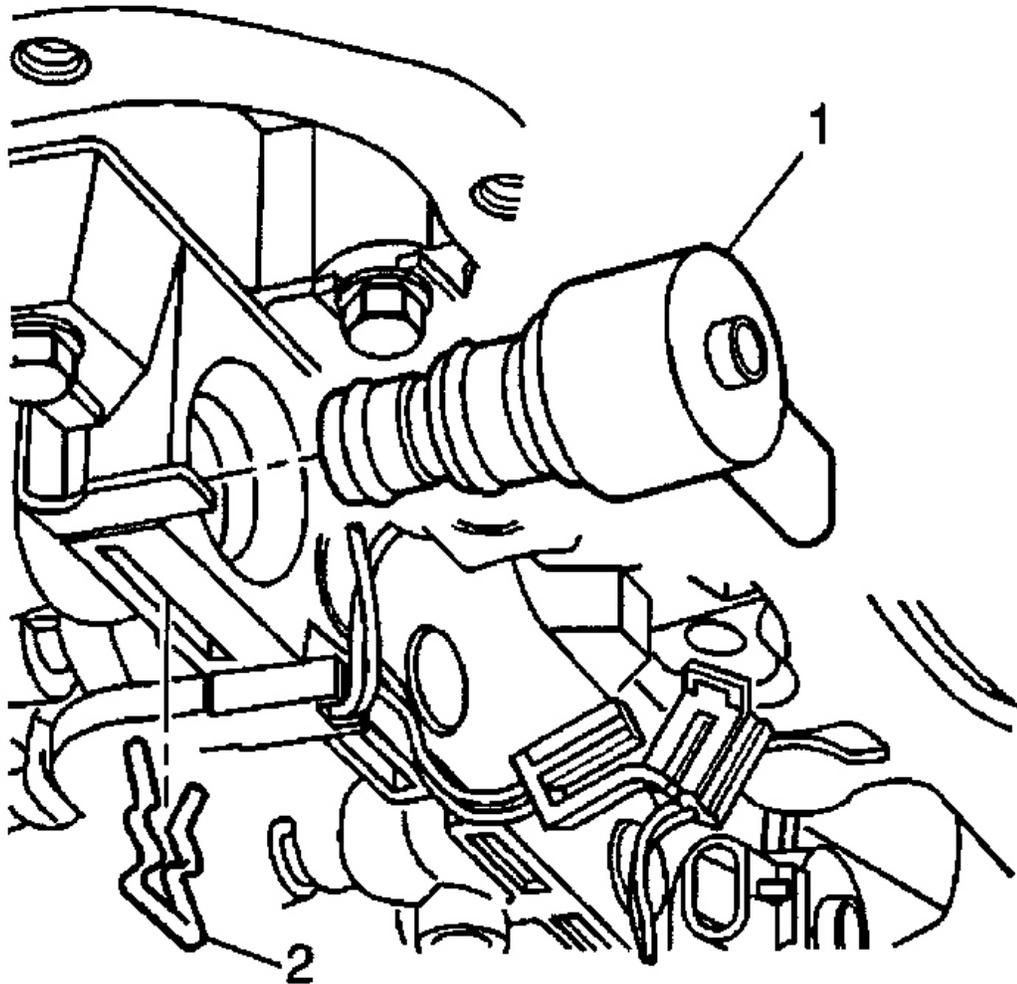
Removal

1. Raise and support the vehicle. Remove the transmission oil pan and the filter. See **DRAINING & REFILLING** under LUBRICATION.
2. Disconnect the transmission harness 20-way connector from the transmission internal harness pass-through connector. See **Fig. 47** . Depress both tabs on the connector and pull straight up, DO NOT pry the connector.
3. Remove the 1-2 accumulator assembly. See **ACCUMULATOR ASSEMBLY** .
4. Disconnect the internal wiring harness electrical connectors from the following components:
 - Transmission fluid pressure switch. See **Fig. 28** .
 - 1-2 shift control solenoid.
 - 2-3 shift control solenoid.
 - Pressure control solenoid.
 - TCC PWM solenoid.
 - 3-2 shift control solenoid.
5. Remove the TCC PWM solenoid retainer. See **Fig. 48** .
6. Remove the TCC PWM solenoid to access one of the TCC solenoid retaining bolts.
7. Remove the pressure control solenoid retainer.
8. Remove the pressure control solenoid. See **Fig. 29** .
9. Remove the TCC solenoid retaining bolts and the valve body bolts which retain the internal wiring harness. See **Fig. 49** .
10. Using the seal protector retainer installer, release the pass-through electrical connector from the transmission case. See **Fig. 50** .
 - A. Use the small end of the seal protector retainer installer over the top of the connector.
 - B. Twist to release the 4 tabs retaining the connector.
 - C. Pull the harness connector down through the transmission case.
11. Remove the TCC solenoid (with "O" ring seal) and wiring harness.
12. Inspect the TCC solenoid and wiring harness assembly for the following defects:
 - Damage. See **Fig. 51** .
 - Cracked connectors.
 - Exposed wires.
 - Loose pins.



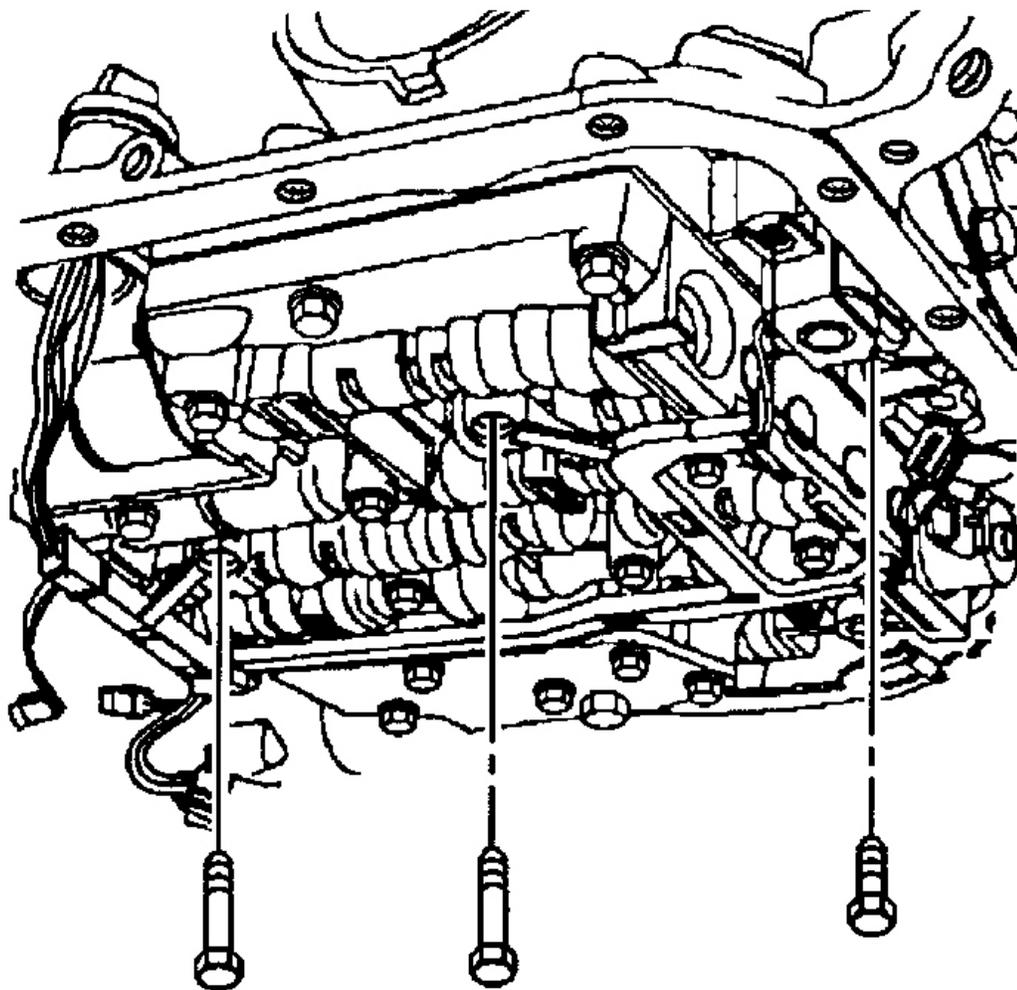
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Fig. 47: Disconnecting & Connecting Transmission Harness Connector
Courtesy of GENERAL MOTORS CORP.



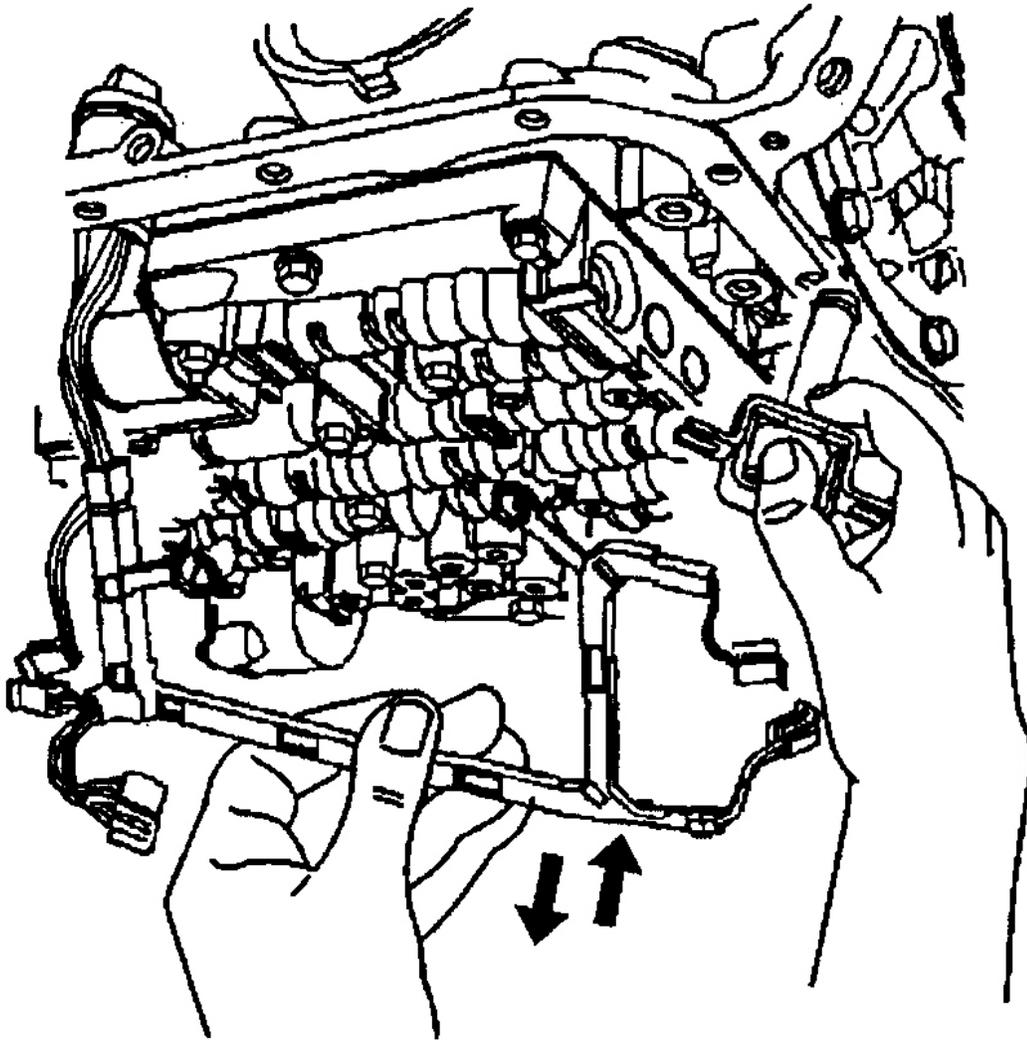
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Fig. 48: Removing & Installing TCC PWM Solenoid
Courtesy of GENERAL MOTORS CORP.



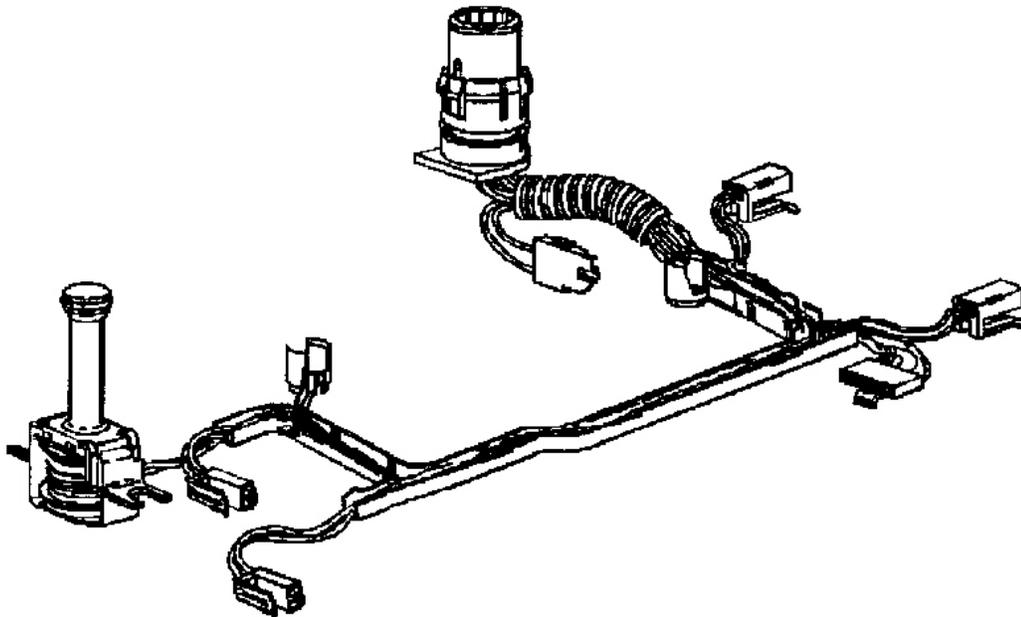
G00057011

Fig. 49: Removing & Installing Valve Body/TCC Solenoid Bolts
Courtesy of GENERAL MOTORS CORP.



G00089850

Fig. 50: Removing & Installing Internal Wiring Harness
Courtesy of GENERAL MOTORS CORP.



G00057012

Fig. 51: Identifying Internal Transmission Wire Harness
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the wiring harness and TCC solenoid assembly with a new "O" ring seal to the transmission. See **Fig. 50** .
2. Install the pass-through electrical connector to the transmission case.
3. Install the valve body bolts which retain the internal wiring harness and install the TCC solenoid retaining bolts. See **Fig. 49** .
 - Tighten the control valve body retaining bolts to specification. See **TORQUE SPECIFICATIONS** .
 - Tighten the TCC solenoid retaining bolts to specification. See **TORQUE SPECIFICATIONS** .
4. Install the pressure control solenoid. See **Fig. 29** . Ensure the electrical tabs are facing outboard.
5. Install the pressure control solenoid retainer and retaining bolt. Tighten the pressure control solenoid retaining bolt to specification. See **TORQUE SPECIFICATIONS** .
6. Install the TCC PWM solenoid to the control valve body. See **Fig. 48** .
7. Install the TCC PWM solenoid retainer.
8. Connect the internal wiring harness electrical connectors to the following components:
 - Transmission fluid pressure switch. See **Fig. 28** .

- 1-2 shift control solenoid.
 - 2-3 shift control solenoid.
 - Pressure control solenoid.
 - TCC PWM solenoid.
 - 3-2 shift control solenoid.
9. Install the 1-2 accumulator. See **ACCUMULATOR ASSEMBLY**.
 10. Connect the transmission harness 20-way connector to the transmission pass through connector. Align the arrows on each half of the connector and insert straight down. See **Fig. 47**.
 11. Install the transmission oil pan and filter. See **DRAINING & REFILLING** under LUBRICATION.

TRANSMISSION COOLER LINES

Removal

1. Remove the air cleaner resonator outlet duct. Remove the transmission fluid cooler hose from the auxiliary transmission oil cooler. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.
2. Remove the bolts from the auxiliary oil cooler. Remove the auxiliary oil cooler from the vehicle. Remove the transmission fluid cooler hose from the auxiliary transmission fluid cooler. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.
3. Remove the transmission fluid cooler hoses from the radiator. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**. Raise and support the vehicle.
4. Remove the bolts from the transmission fluid cooler hose insulator. Remove the transmission fluid cooler hose insulator from the transmission. Remove the cooling lines from the clips.
5. Remove the cooling lines from the transmission. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.

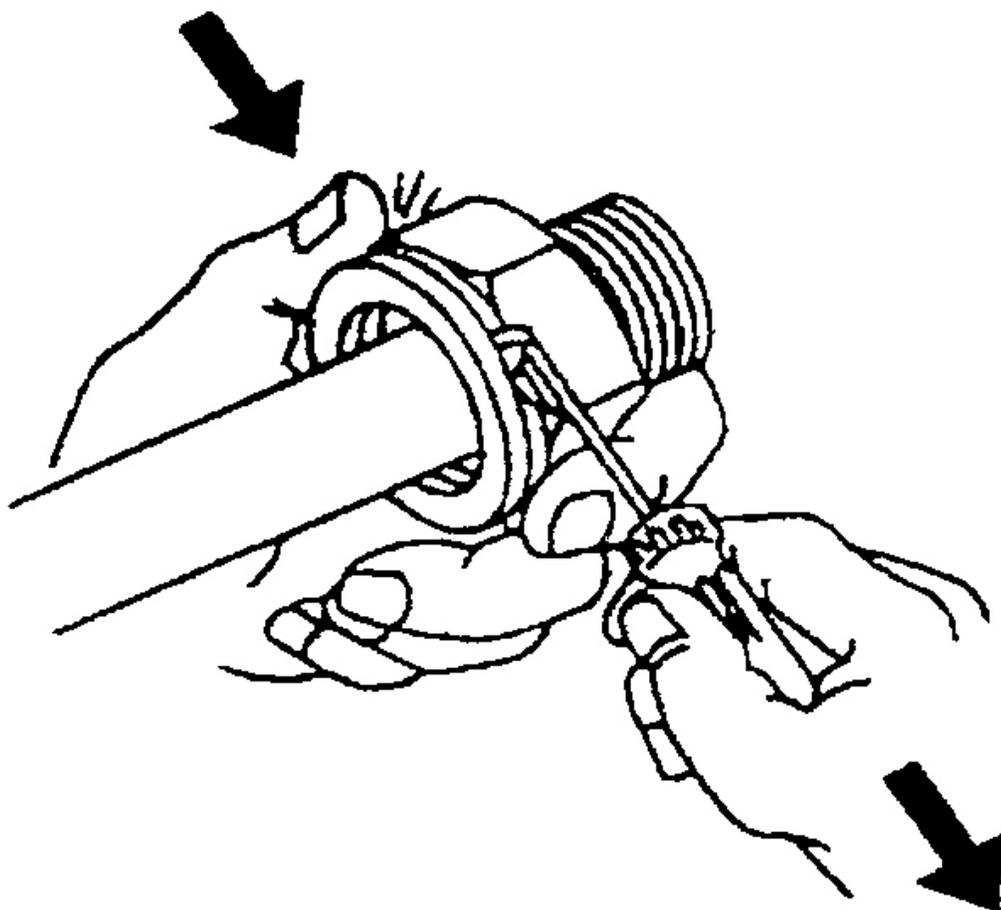
Installation

1. Install the cooling lines to the transmission. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.
2. Install the cooling lines to the clips. Install the transmission fluid cooler hose insulator to the transmission. Install the bolts to the transmission fluid cooler hose insulator. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS**.
3. Lower the vehicle. Install the transmission fluid cooler hose to the radiator. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.
4. Install the auxiliary oil cooler to the vehicle. Install the bolts to the transmission fluid auxiliary cooler. Tighten the bolts to specification. See **TORQUE SPECIFICATIONS**.
5. Install the transmission fluid cooler hose to the Auxiliary transmission oil cooler. See **TRANSMISSION COOLER LINE QUICK CONNECT FITTING**.
6. Install the air cleaner resonator outlet duct.

TRANSMISSION COOLER LINE QUICK CONNECT FITTING

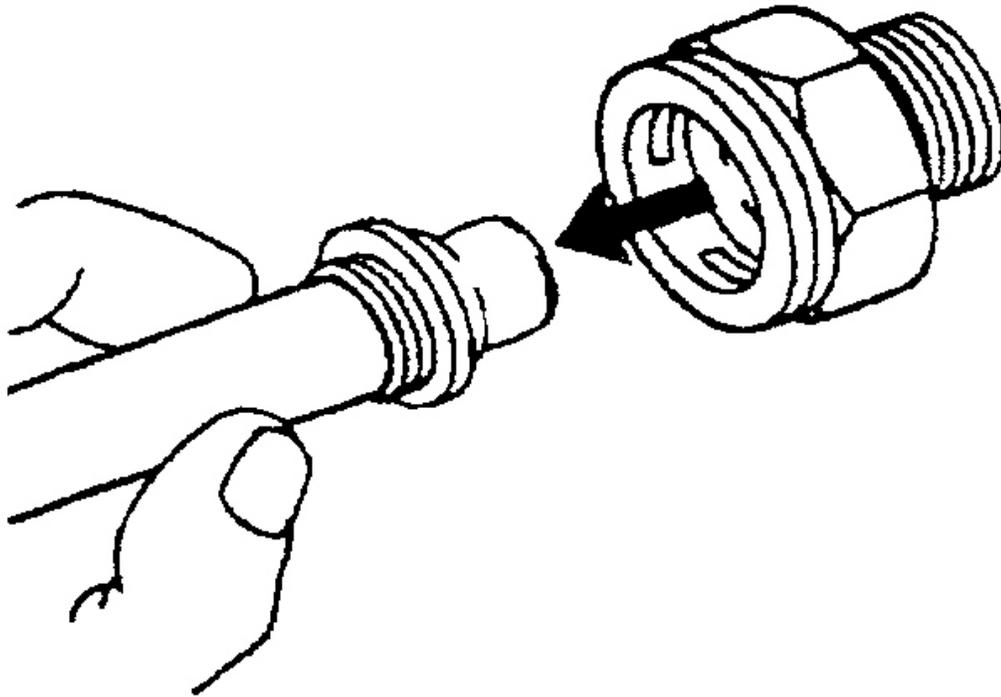
Removal

1. Pull the plastic cap back from the quick connect fitting and down along the cooler line about 2 in (5 cm).
2. Using a bent-tip screwdriver, pull on one of the open ends of the retaining ring in order to rotate the retaining ring around the quick connect fitting until the retaining ring is out of position and can be completely removed. See **Fig. 52** .
3. Remove the retaining ring from the quick connect fitting.
4. Discard the retaining ring.
5. Pull the cooler line straight out from the quick connect fitting. See **Fig. 53** .



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Fig. 52: Removing Retaining Ring
Courtesy of GENERAL MOTORS CORP.



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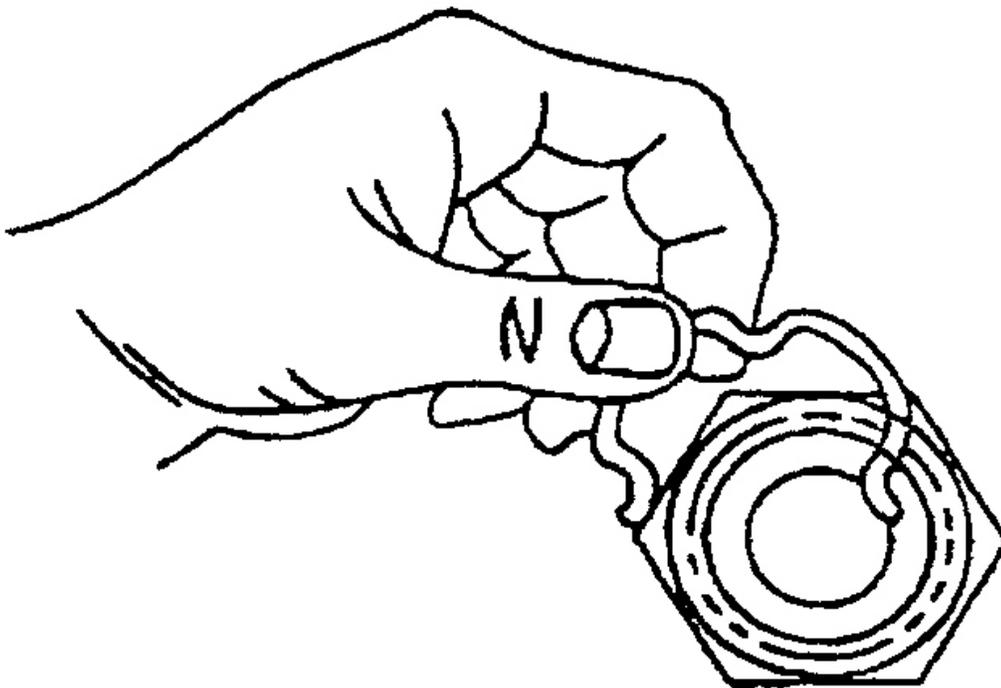
Fig. 53: Removing & Installing Cooler Line From Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

Installation

NOTE: DO NOT reuse any of the existing transmission lines or transmission line fittings if there is excessive corrosion. DO NOT reuse any of the existing retaining rings that were removed from the existing quick connect fittings. Install new retaining rings.

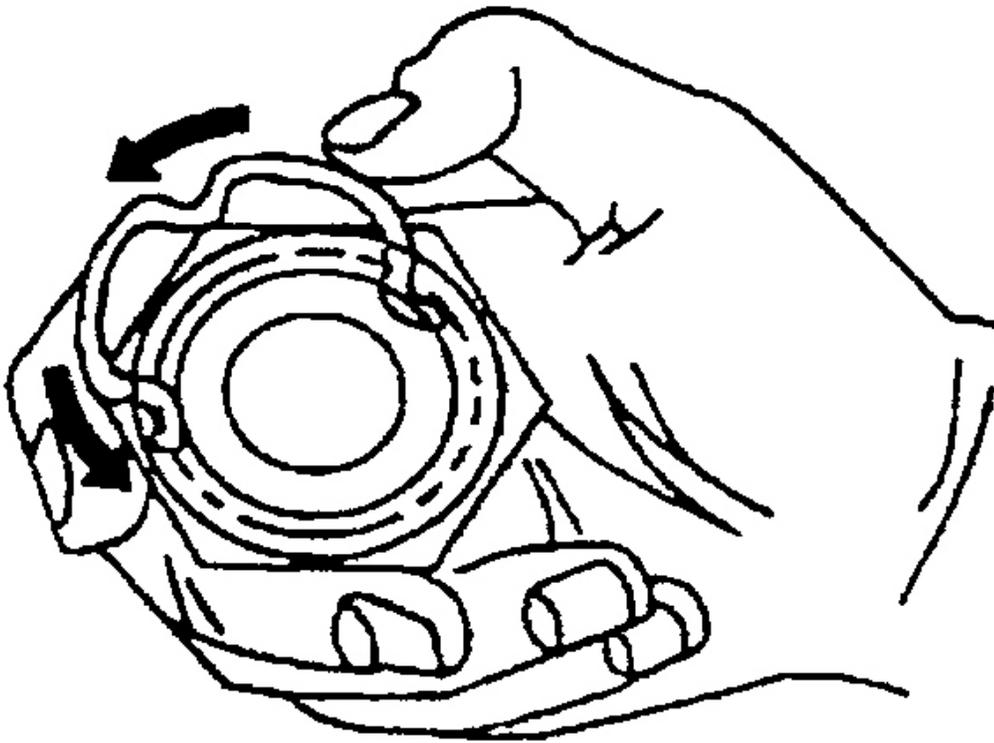
1. Install a new retaining ring into the quick connect fitting using the following procedure:
 - A. Hook one of the open ends of the retaining ring in one of the slots in the quick connect fitting. See **Fig. 54** .
 - B. Rotate the retaining ring around the fitting until the retaining ring is positioned with all three ears through the three slots on the fitting. See **Fig. 55** .
 - C. DO NOT install the new retaining ring onto the fitting by pushing the retaining ring. See **Fig. 56** .
 - D. Ensure that the three retaining ring ears are seen from inside the fitting and that the retaining ring moves freely in the fitting slots. See **Fig. 57** .

2. Install the cooler line into the quick connect fitting. See **Fig. 58** .
3. Insert the cooler line end into the quick connect fitting until a click is either heard or felt.
4. **DO NOT** use the plastic cap on the cooler line in order to install the cooler line into the fitting. See **Fig. 59** .
5. Pull back sharply on the cooler line in order to ensure that the cooler line is fastened into the quick connect fitting.
6. Position (snap) the plastic cap onto the fitting. **DO NOT** manually depress the retaining ring when installing the plastic cap onto the quick connect fitting. See **Fig. 60** .
7. Ensure that the plastic cap is fully seated against the fitting.
8. Ensure that no gap is present between the cap and the fitting. See **Fig. 61** .
9. Ensure that the yellow identification band on the tube is hidden within the quick connect fitting. See **Fig. 60** .
10. A hidden yellow identification band indicates proper joint seating. See **Fig. 62** .
11. Fill transmission to proper level with appropriate fluid. See **LUBRICATION** .



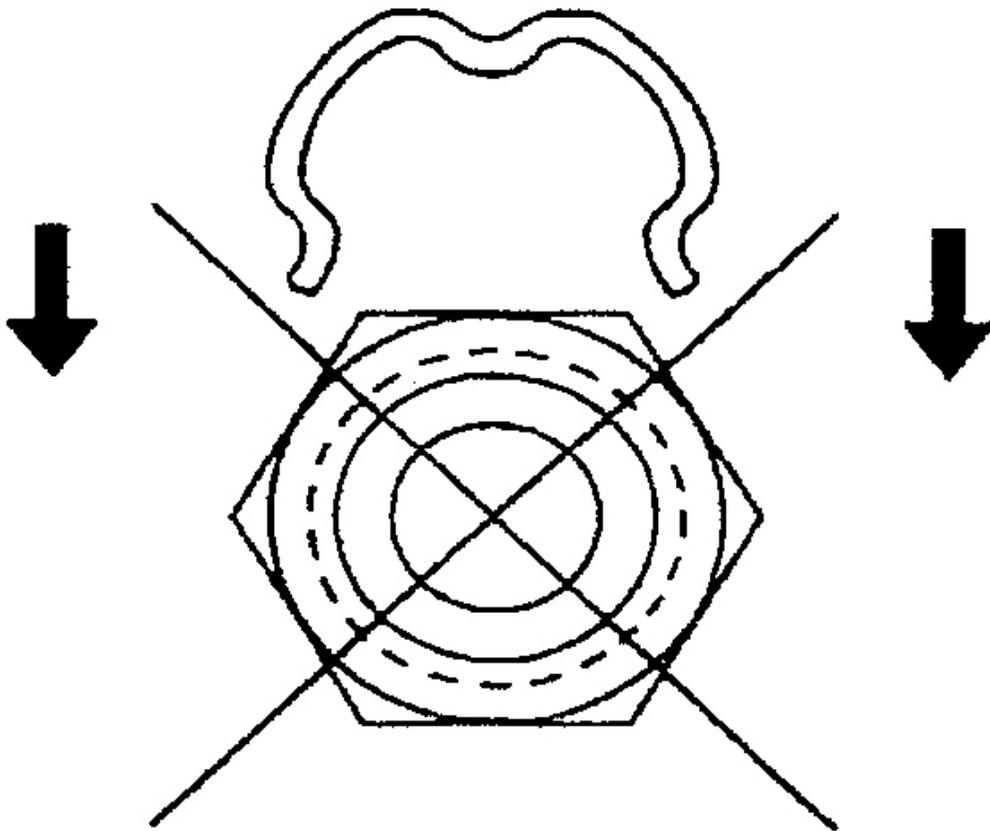
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Fig. 54: Starting Retaining Ring Onto Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.



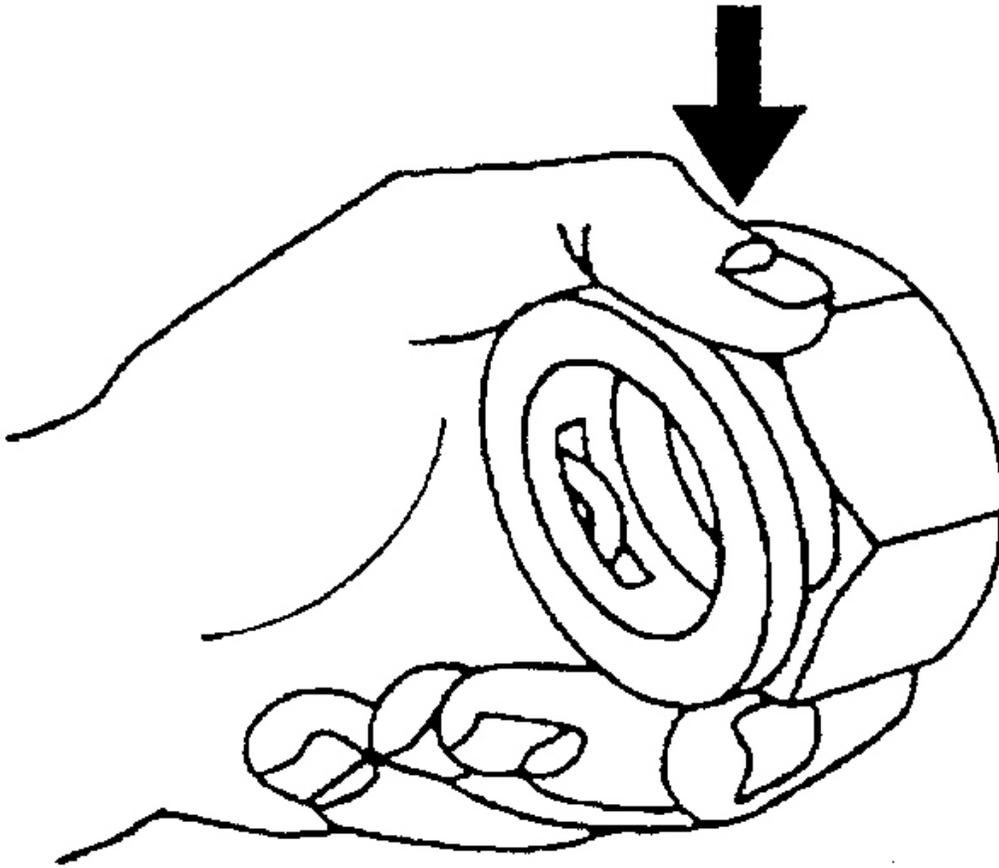
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Fig. 55: Installing Retaining Ring On Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.



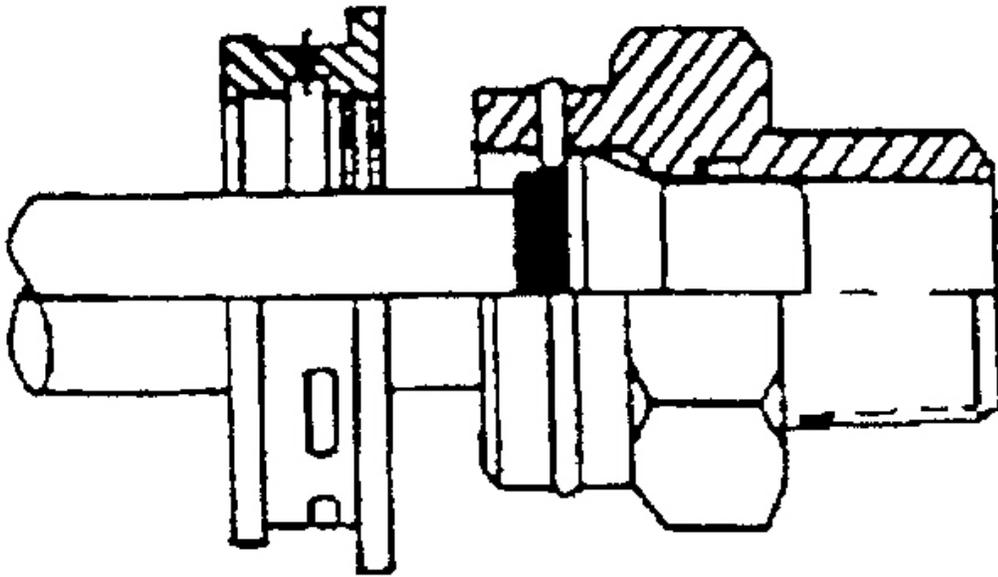
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Fig. 56: Incorrectly Installing Retainer Ring
Courtesy of GENERAL MOTORS CORP.



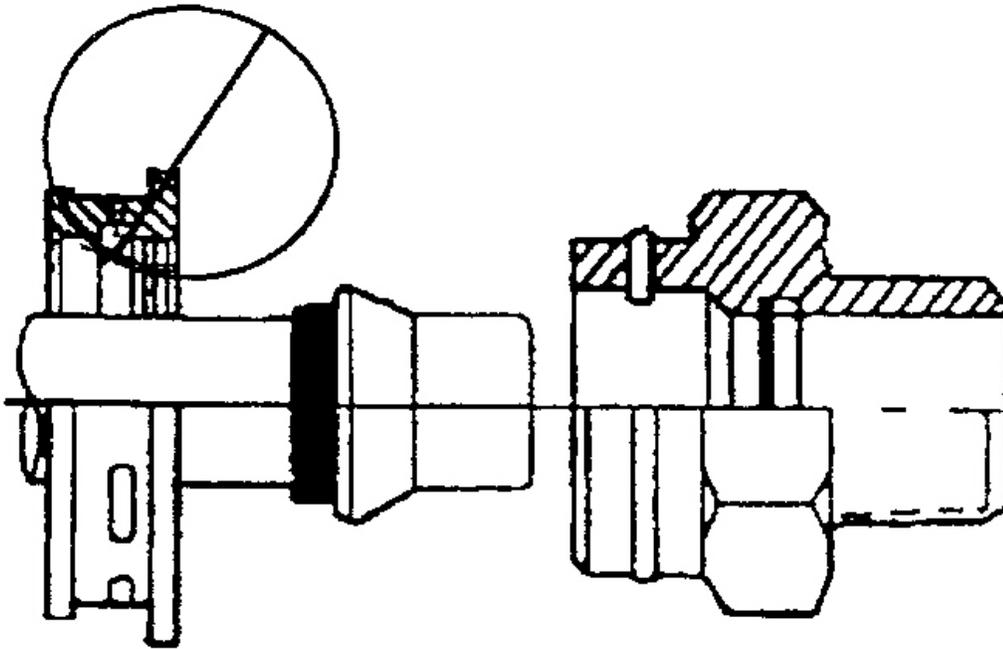
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Fig. 57: Correctly Installing Retainer Ring
Courtesy of GENERAL MOTORS CORP.



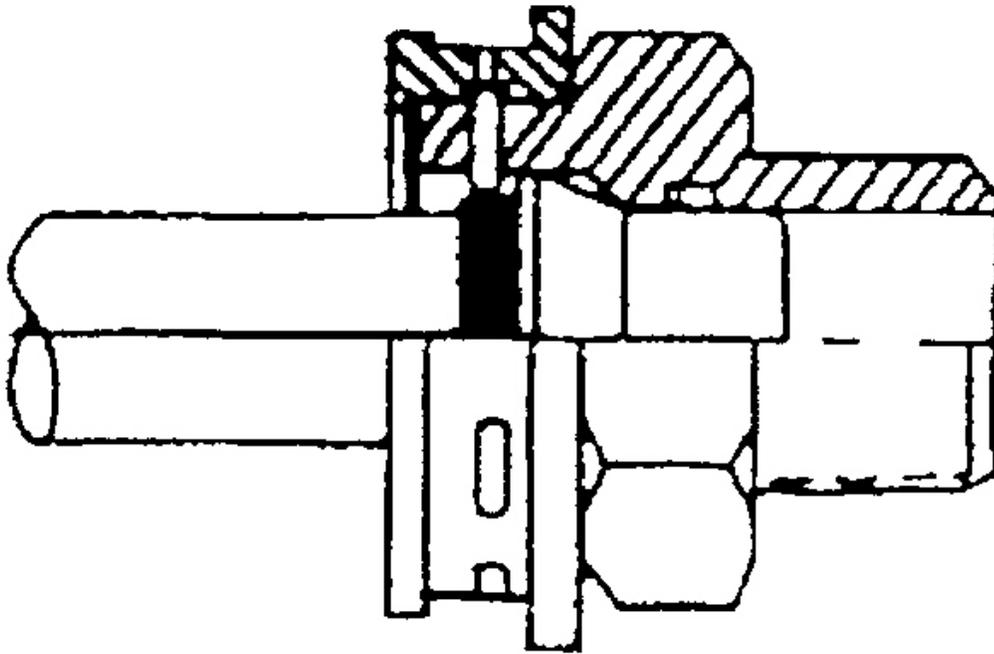
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Fig. 58: Installing Cooler Lines To Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.



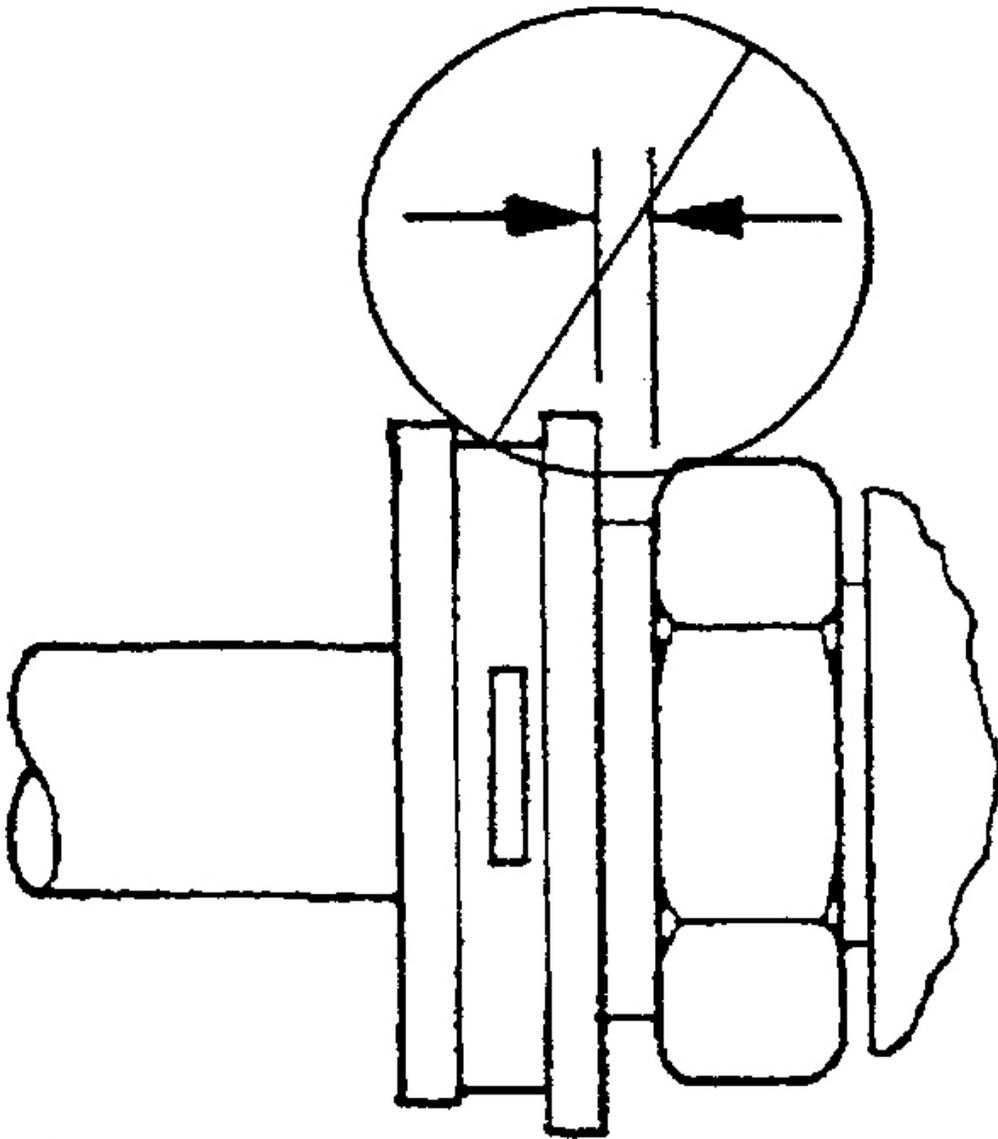
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Fig. 59: Incorrect Installation Method Using Plastic Cap
Courtesy of GENERAL MOTORS CORP.



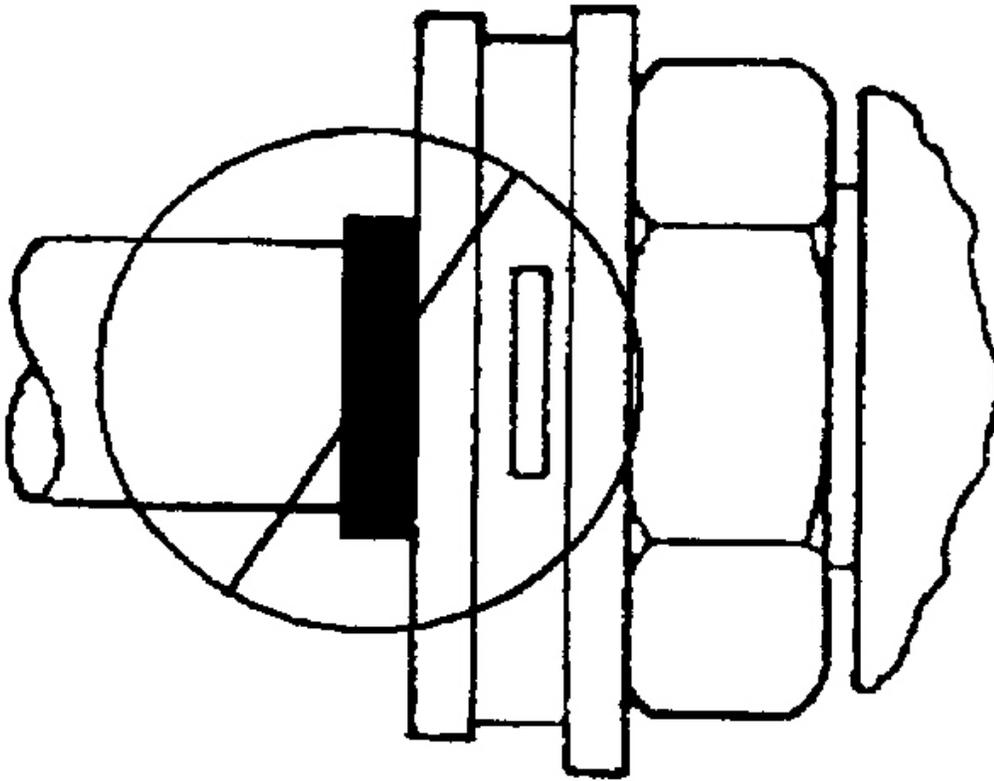
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Fig. 60: Installed View Of Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.



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Fig. 61: Checking For Improper Gap
Courtesy of GENERAL MOTORS CORP.



G00088362

Fig. 62: Checking For Identification Band
Courtesy of GENERAL MOTORS CORP.

TRANSMISSION MOUNT

Removal

1. Raise and support vehicle. Remove frame-to-engine protection shield bolts. See **Fig. 35** . Remove engine protection shield. Remove the catalytic converter guard mounting bolts and guard from vehicle. See **Fig. 36** .
2. Support the transmission with a transmission jack. Remove the two nuts securing the transmission mount to the transmission support. Raise the transmission off of the transmission support. Remove the bolts and transmission mount.

Installation

1. Install the transmission mount to the vehicle. Install the bolts. Tighten the bolts to specification. See

TORQUE SPECIFICATIONS

2. Lower the transmission and install the two nuts securing the transmission mount to the transmission support. Tighten the nuts to specification. See **TORQUE SPECIFICATIONS**.
3. Remove the transmission jack. Install the catalytic converter guard. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Install frame-to-engine protection shield. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.
4. Lower the vehicle.

VALVE BODY & PRESSURE SWITCH

Removal

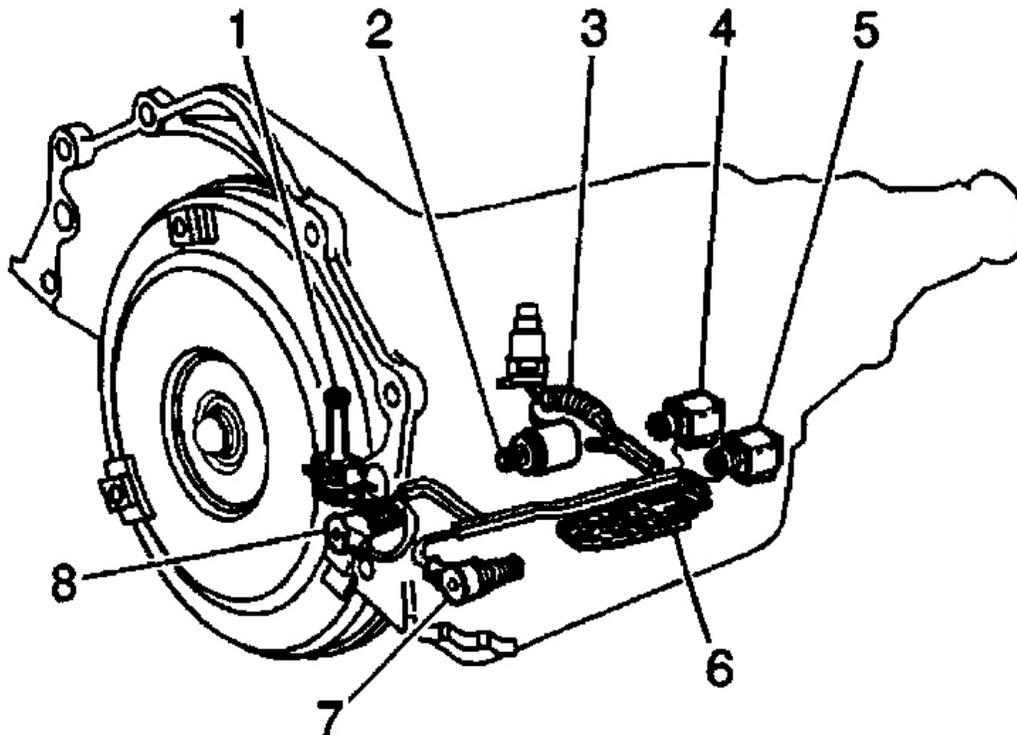
1. Ensure removal of the valve body is necessary before proceeding. The following components can be serviced without removing the valve body from the transmission. See **Fig. 63**.
 - Torque Converter Clutch Solenoid (1)
 - Pressure Control Solenoid (2)
 - Internal Wiring Harness (3)
 - 2-3 Shift Solenoid (4)
 - 1-2 Shift Solenoid (5)
 - Transmission Fluid Pressure Manual Valve Position Switch (6)
 - 3-2 Shift Solenoid (7)
 - Torque Converter Clutch Pulse Width Modulation (TCC PWM) Solenoid (8)
2. Remove the fluid level indicator.
3. Remove the filter. See **DRAINING & REFILLING** under LUBRICATION.
4. Disconnect the internal wiring harness electrical connectors from the following components:
 - Transmission fluid pressure manual valve position switch. See **Fig. 28**.
 - 1-2 shift control solenoid.
 - 2-3 shift control solenoid.
 - Pressure control solenoid.
 - TCC PWM solenoid.
 - 3-2 shift control solenoid.
 - Bracket bolt.
5. Remove the fluid indicator stop bracket bolt (2). See **Fig. 64**. Remove the fluid indicator bracket (1).
6. Remove the TCC PWM solenoid retainer (2) with a small screwdriver. See **Fig. 48**. Rotate the solenoid (1) in the bore, if necessary, until the flat part of the retainer (2) is visible.
7. Remove the TCC PWM solenoid (1) to access the TCC solenoid retaining bolts. Remove the TCC solenoid bolts. See **Fig. 65**.
8. Remove the TCC solenoid (with "O" ring seal) and wiring harness from the control valve body.
9. Reposition the harness to the side of the transmission case. See **Fig. 50**.
10. Remove the control valve body bolts which retain the transmission fluid pressure switch to the control

valve body. See **Fig. 66** .

11. Remove the transmission fluid pressure switch and inspect for damage or debris. See **Fig. 67** .
12. Remove the manual detent spring retaining bolt. Remove the manual detent spring. See **Fig. 68** .
13. Inspect the manual detent spring for cracks or damage.

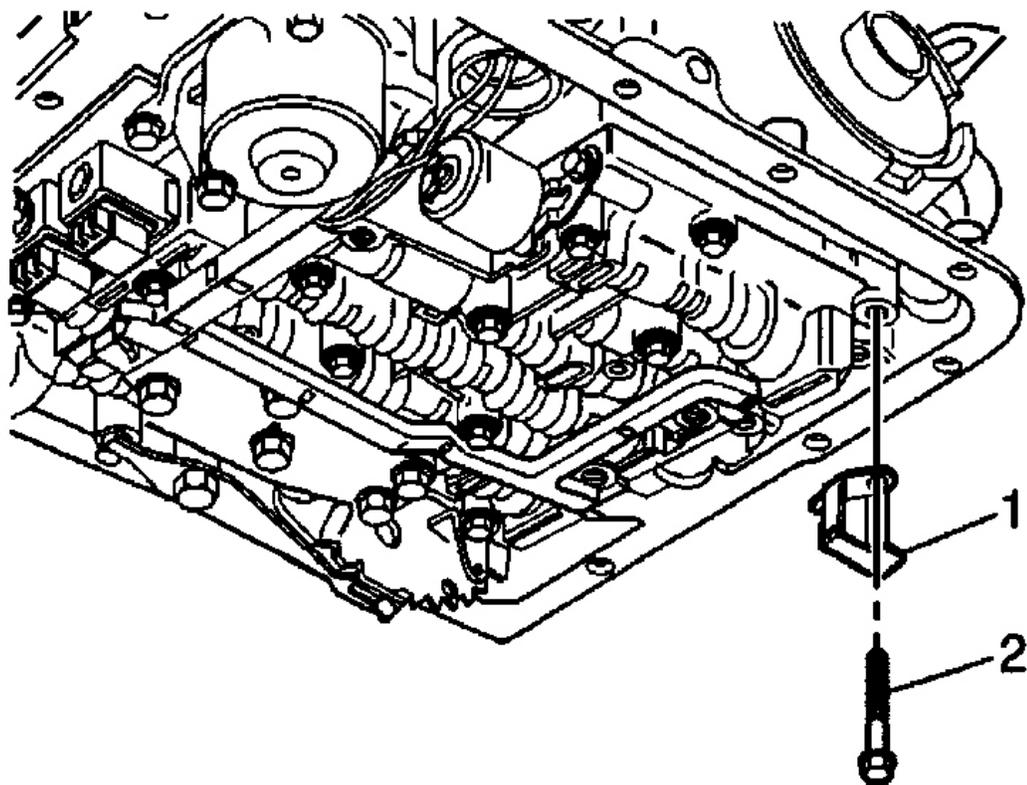
CAUTION: Keep the control valve body level when lowering it from the vehicle. This will prevent the loss of checkballs located in the control valve body passages.

14. Remove the remaining valve body bolts.
15. Carefully begin to lower the control valve body down from the transmission case while simultaneously disconnecting the manual valve link. See **Fig. 69** .



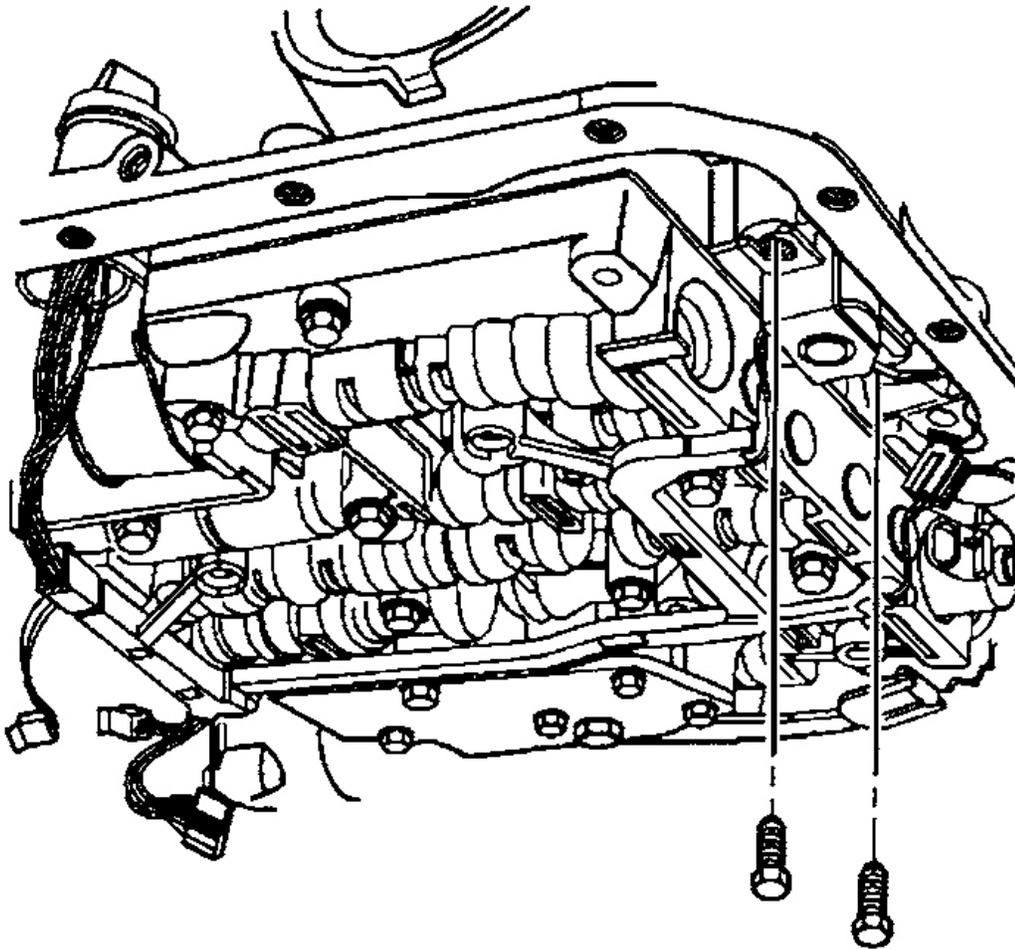
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Fig. 63: Identifying Serviceable Components
Courtesy of GENERAL MOTORS CORP.



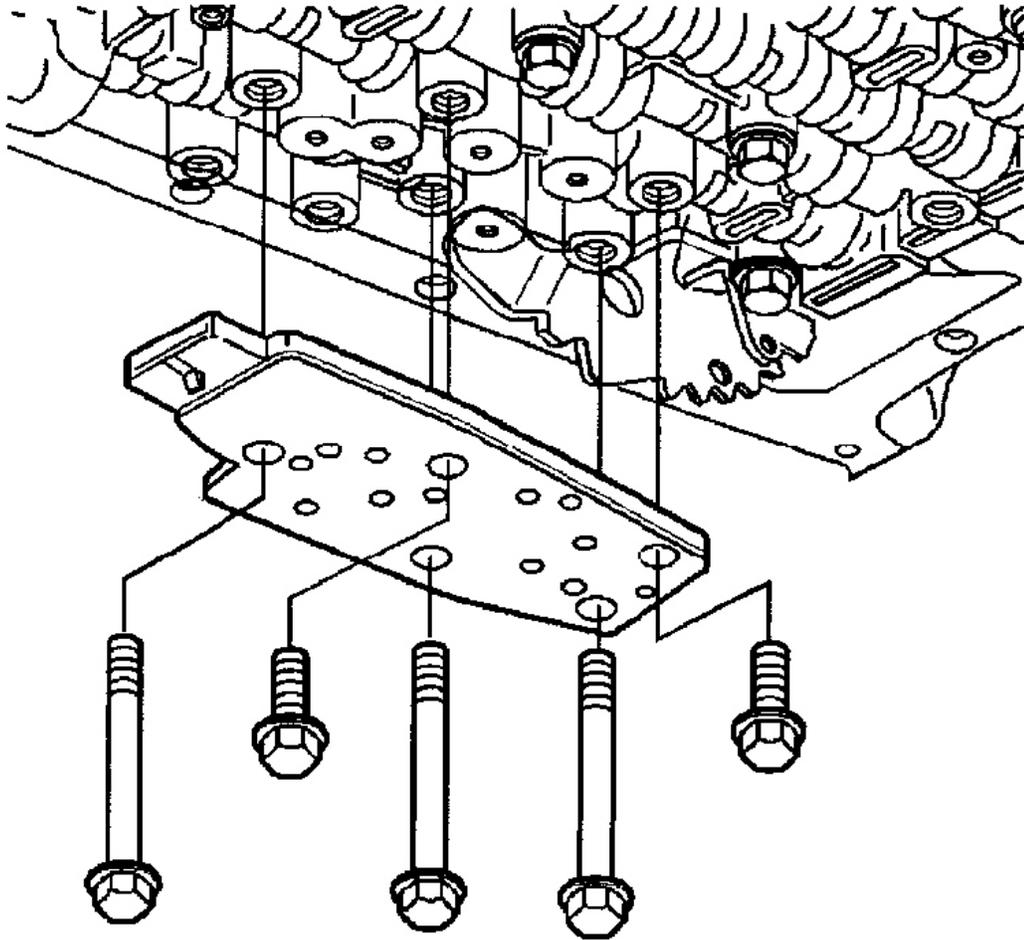
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Fig. 64: Removing & Installing Fluid Indicator Stop Bracket
Courtesy of GENERAL MOTORS CORP.



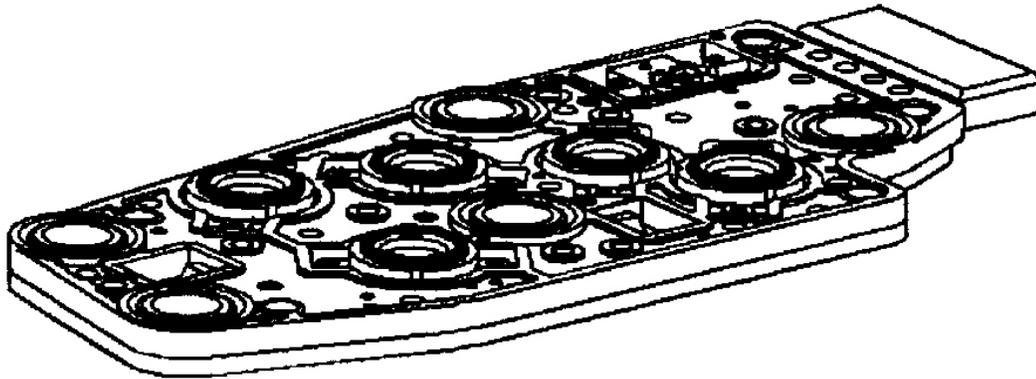
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Fig. 65: Removing & Installing TCC Retainer Bolts
Courtesy of GENERAL MOTORS CORP.



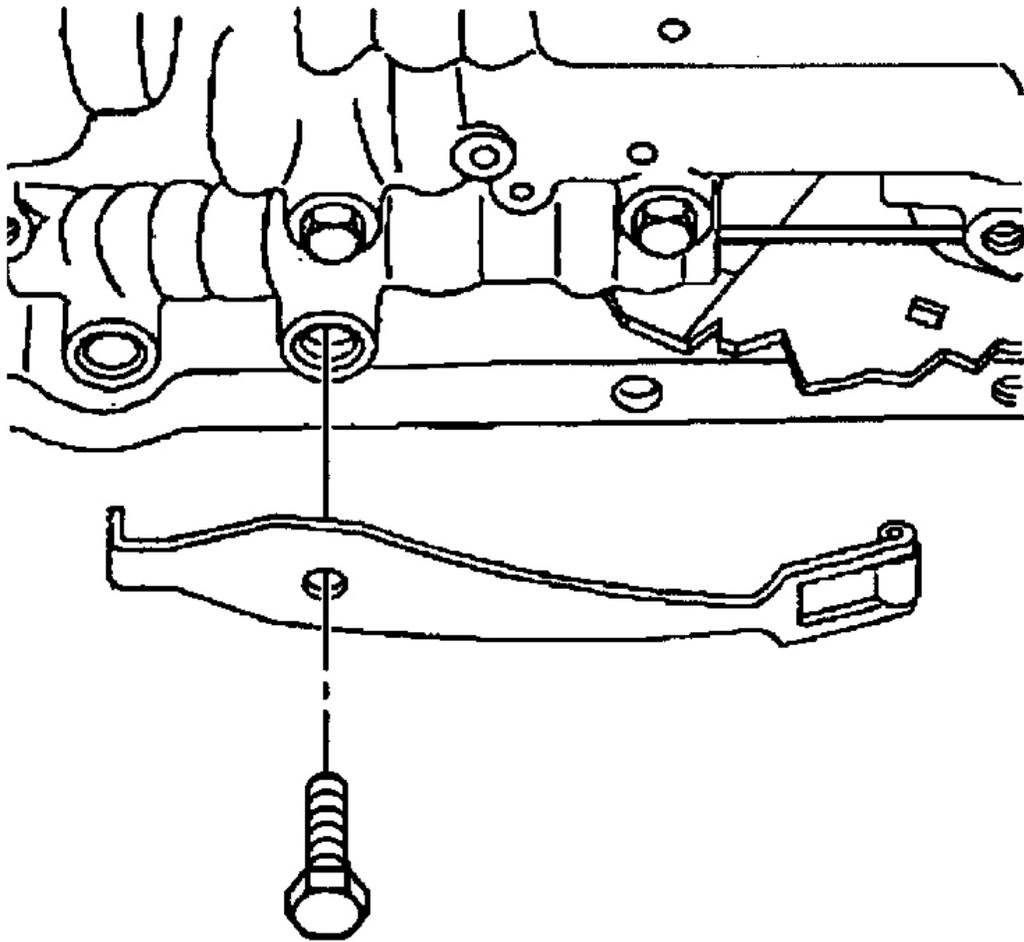
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Fig. 66: Removing & Installing Fluid Pressure Switch Bolts
Courtesy of GENERAL MOTORS CORP.



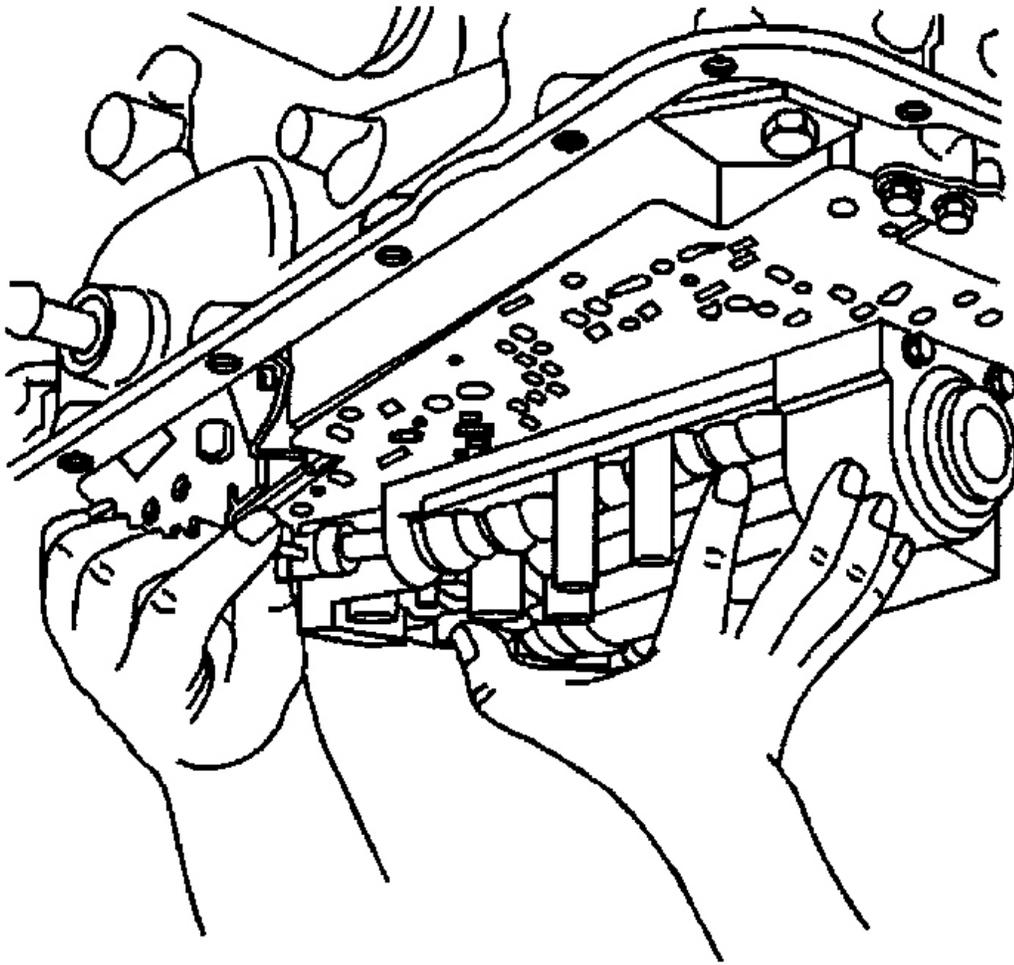
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Fig. 67: Inspecting Fluid Pressure Switch For Damage
Courtesy of GENERAL MOTORS CORP.



G00089857

Fig. 68: Removing & Installing Manual Detent Lever
Courtesy of GENERAL MOTORS CORP.



G00056992

Fig. 69: Lowering & Raising Valve Body
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the 7 checkballs in the valve body. See **Fig. 70** .
2. Install the control valve body to the transmission case while simultaneously connecting the manual valve link to the manual valve. See **Fig. 69** .
3. Verify the manual valve link (3) is installed properly to the inside detent lever (1) and the manual valve (2). See **Fig. 71** .
4. Install one bolt (M6 X 1.0 X 47.5) hand tight in the center (1) of the valve body to hold it in place. See **Fig. 72** .

NOTE: When installing bolts throughout this procedure, be sure to use the correct bolt size and length in the correct location as specified.

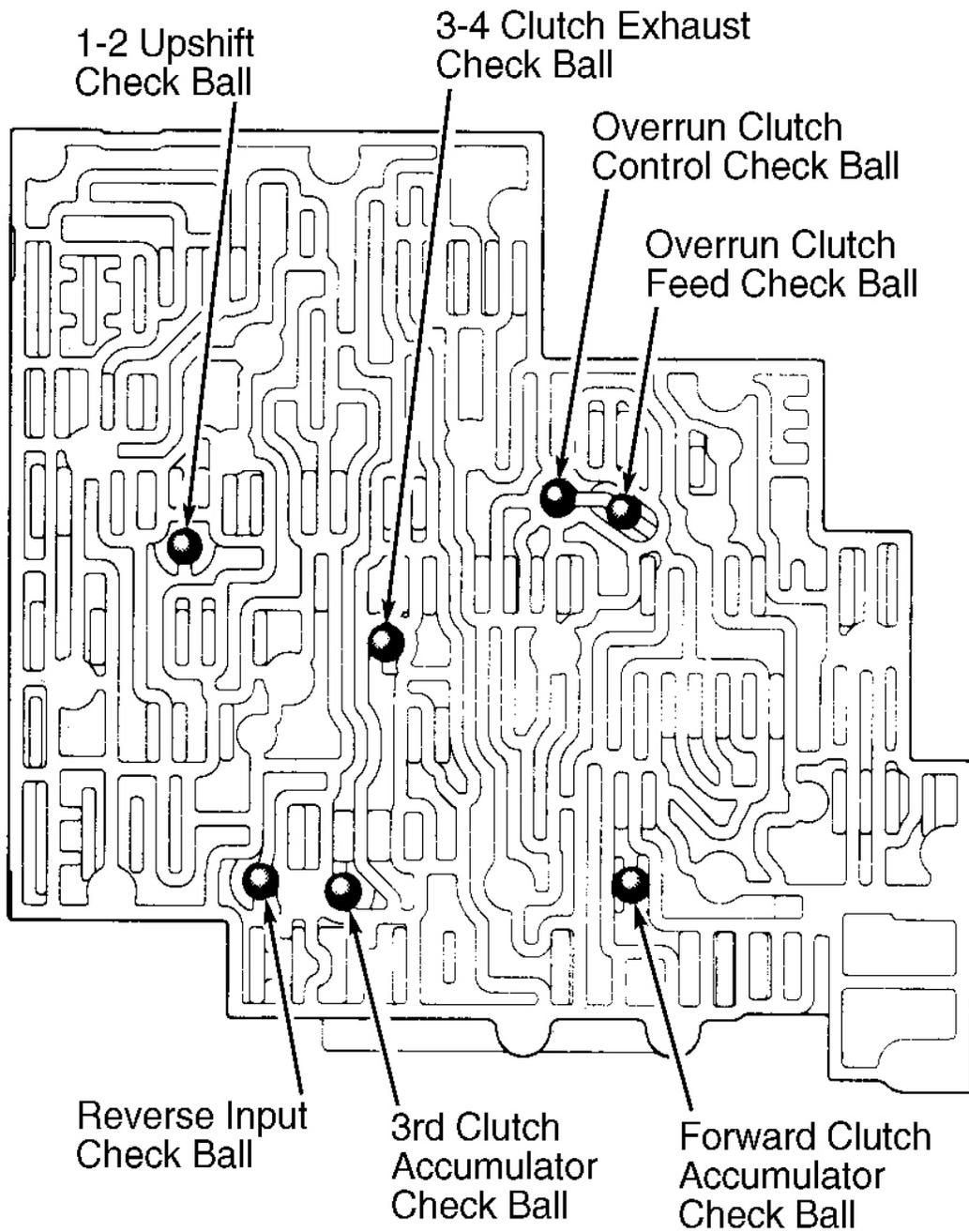
5. DO NOT install the transmission fluid indicator stop bracket and bolt at this time. Install but DO NOT tighten the control valve body bolts which retain only the valve body directly. See **Fig. 73** . Each numbered bolt location corresponds to a specific bolt size and length, as indicated by the following:
 - M6 X 1.0 X 65.0 (1).
 - M6 X 1.0 X 54.4 (2).
 - M6 X 1.0 X 47.5 (3).
 - M6 X 1.0 X 35.0 (4).
 - M8 X 1.0 X 20.0 (5).
 - M6 X 1.0 X 12.0 (6).
 - M6 X 1.0 X 18.0 (7).
6. Install the manual detent spring.
7. Install but DO NOT tighten the manual detent spring retaining bolt. See **Fig. 68** .
8. Install the transmission fluid pressure switch. See **Fig. 66** .
9. Install but DO NOT tighten the control valve body bolts which retain the transmission fluid pressure switch to the control valve body. See **Fig. 66** .

NOTE: Torque valve body bolts in a spiral pattern starting from the center. If the bolts are torqued at random, valve bores may be distorted and inhibit valve operation.

10. Tighten the control valve body bolts in a spiral pattern starting from the center, as indicated by the arrows. See **Fig. 73** . Tighten the control valve body bolts (in sequence) to specification. See **TORQUE SPECIFICATIONS** .
11. Ensure the manual detent spring is aligned properly with the detent lever. Tighten the manual detent spring bolt to specification. See **TORQUE SPECIFICATIONS** .
12. Install the TCC solenoid with a new "O" ring seal to the valve body.
13. Install the TCC solenoid bolts. Tighten the TCC solenoid retaining bolts to specification. See **TORQUE SPECIFICATIONS** .
14. Install the internal wiring harness to the valve body. The internal wiring harness has a tab (1) on the edge of the conduit. See **Fig. 74** .
15. Place the tab between the valve body and the pressure switch in the location shown (2). See . Press the harness into position on the valve body bolt bosses (1, 3). See **Fig. 75** .
16. Install the TCC PWM solenoid (1) to the control valve body. See **Fig. 48** . Install the TCC PWM solenoid retainer (2).
17. Install the transmission fluid indicator stop bracket (1) and bolt (2). See **Fig. 64** . Tighten the transmission fluid indicator stop bracket bolt to specification. See **TORQUE SPECIFICATIONS** .
18. Connect the internal wiring harness electrical connectors to the following components:
 - The transmission fluid pressure manual valve position switch. See **Fig. 28** .

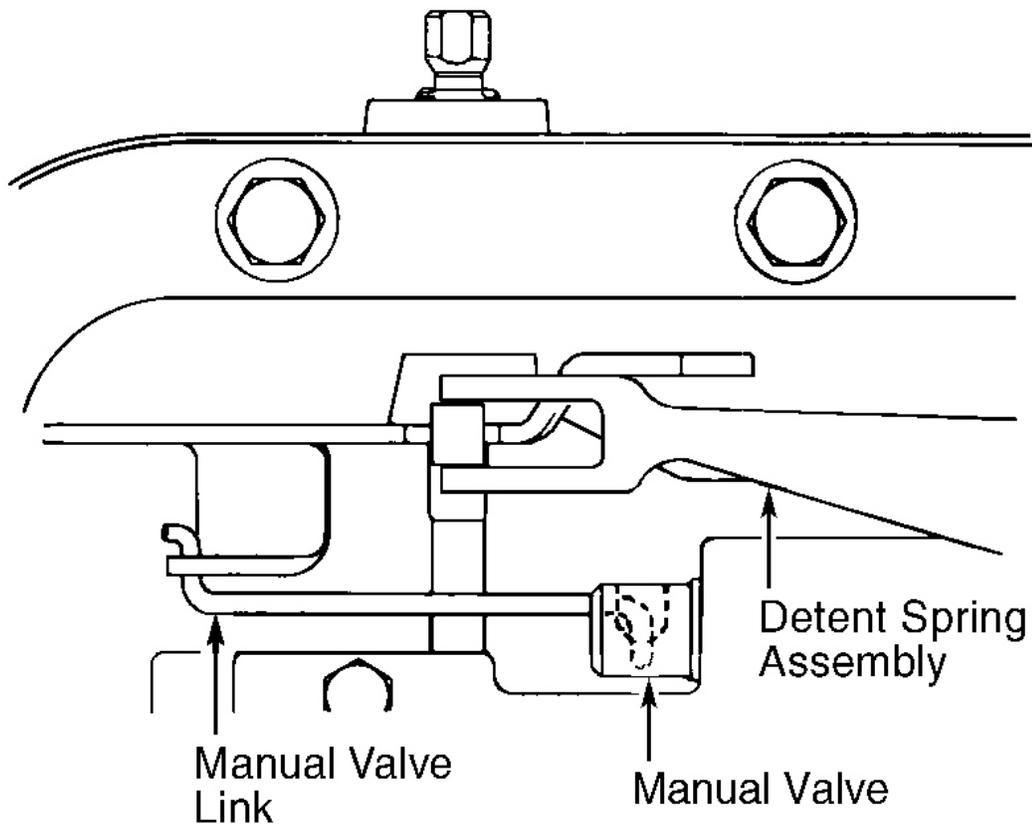
- 1-2 shift control solenoid.
- 2-3 shift control solenoid.
- Pressure control solenoid.
- TCC PWM solenoid.
- 3-2 shift control solenoid.

19. Install the transmission oil pan and filter. See **DRAINING & REFILLING** under LUBRICATION.



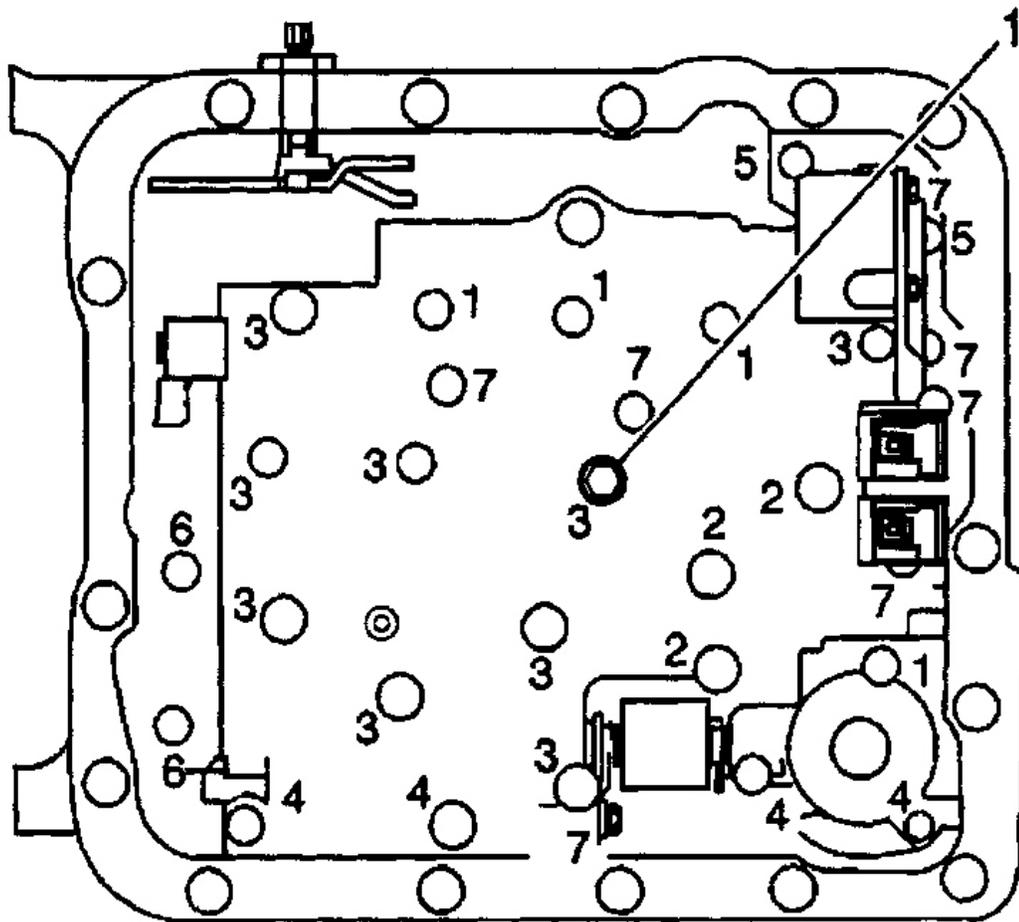
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Fig. 70: Installing Check Balls In Valve Body
 Courtesy of GENERAL MOTORS CORP.



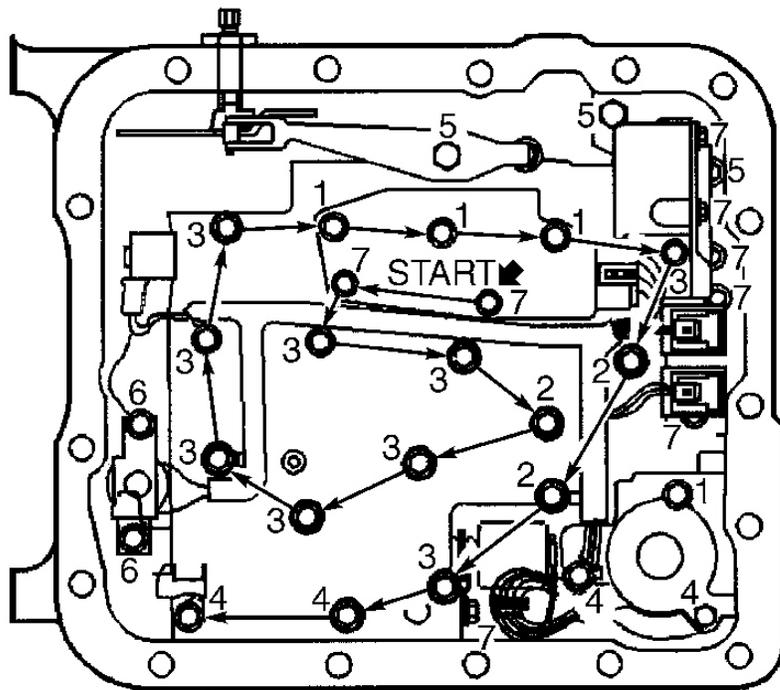
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Fig. 71: Installing Manual Valve To Detent Lever
Courtesy of GENERAL MOTORS CORP.



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Fig. 72: Location Of 1st Bolt To Hold Valve Body In Place
 Courtesy of GENERAL MOTORS CORP.



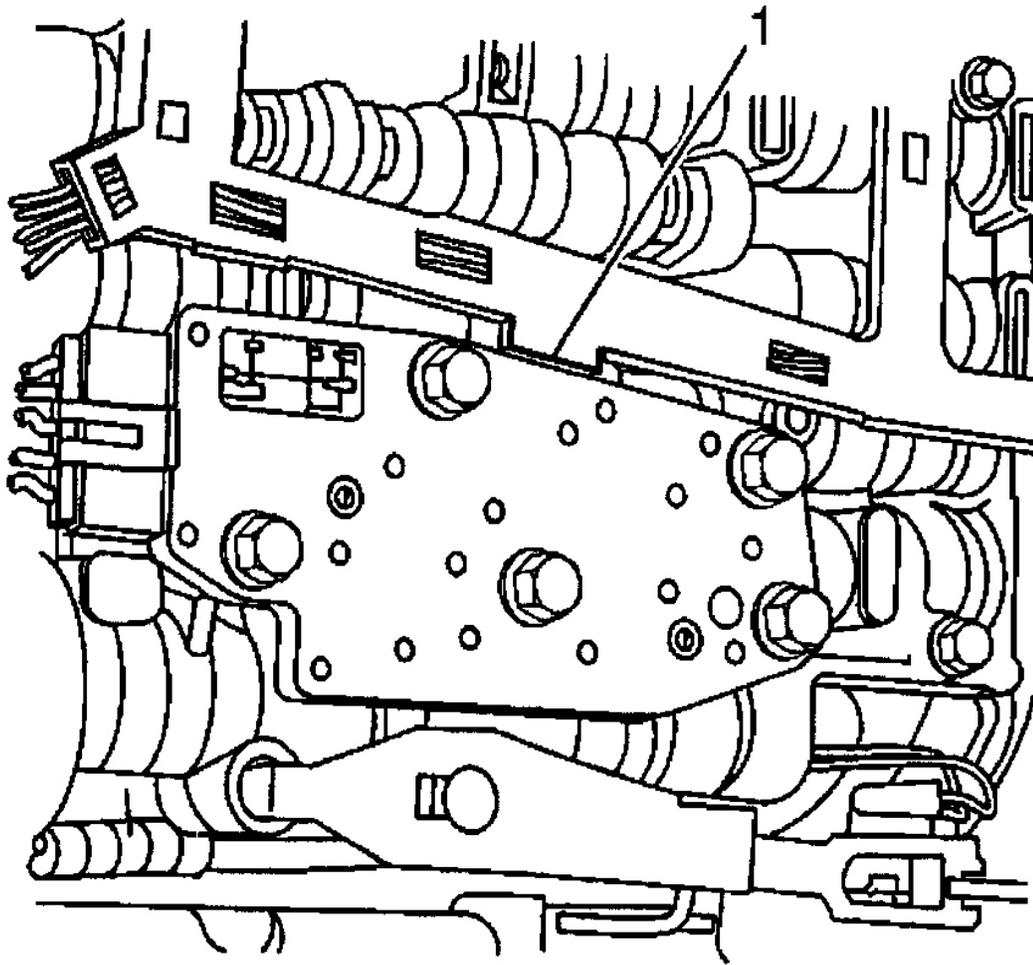
NOTE: Numbers identify bolt length.
Arrows identify tightening sequence.

VALVE BODY BOLT IDENTIFICATION

Bolt No.	Length In. (mm)
1	2.56 (65)
2	2.14 (54.4)
3	1.87 (47.5)
4	1.38 (35)
579 (20)
647 (12)
771 (18)

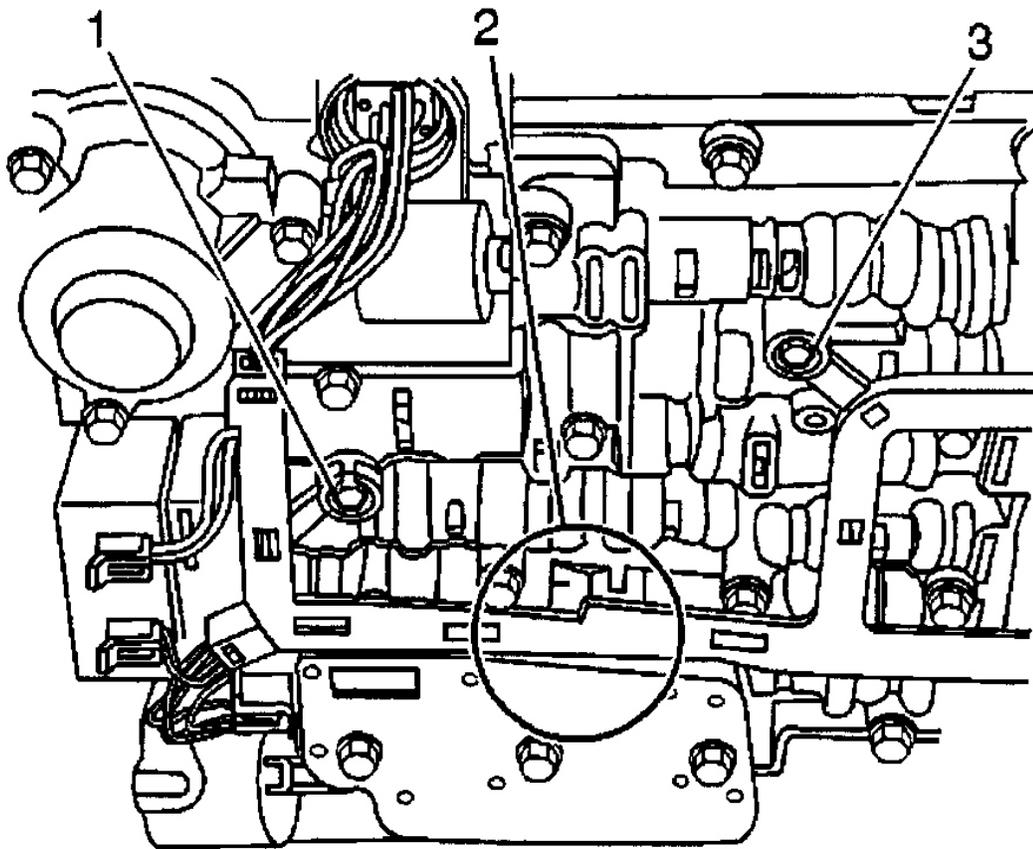
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Fig. 73: Valve Body Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.



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Fig. 74: Installing Internal Wiring Harness To Valve Body
Courtesy of GENERAL MOTORS CORP.



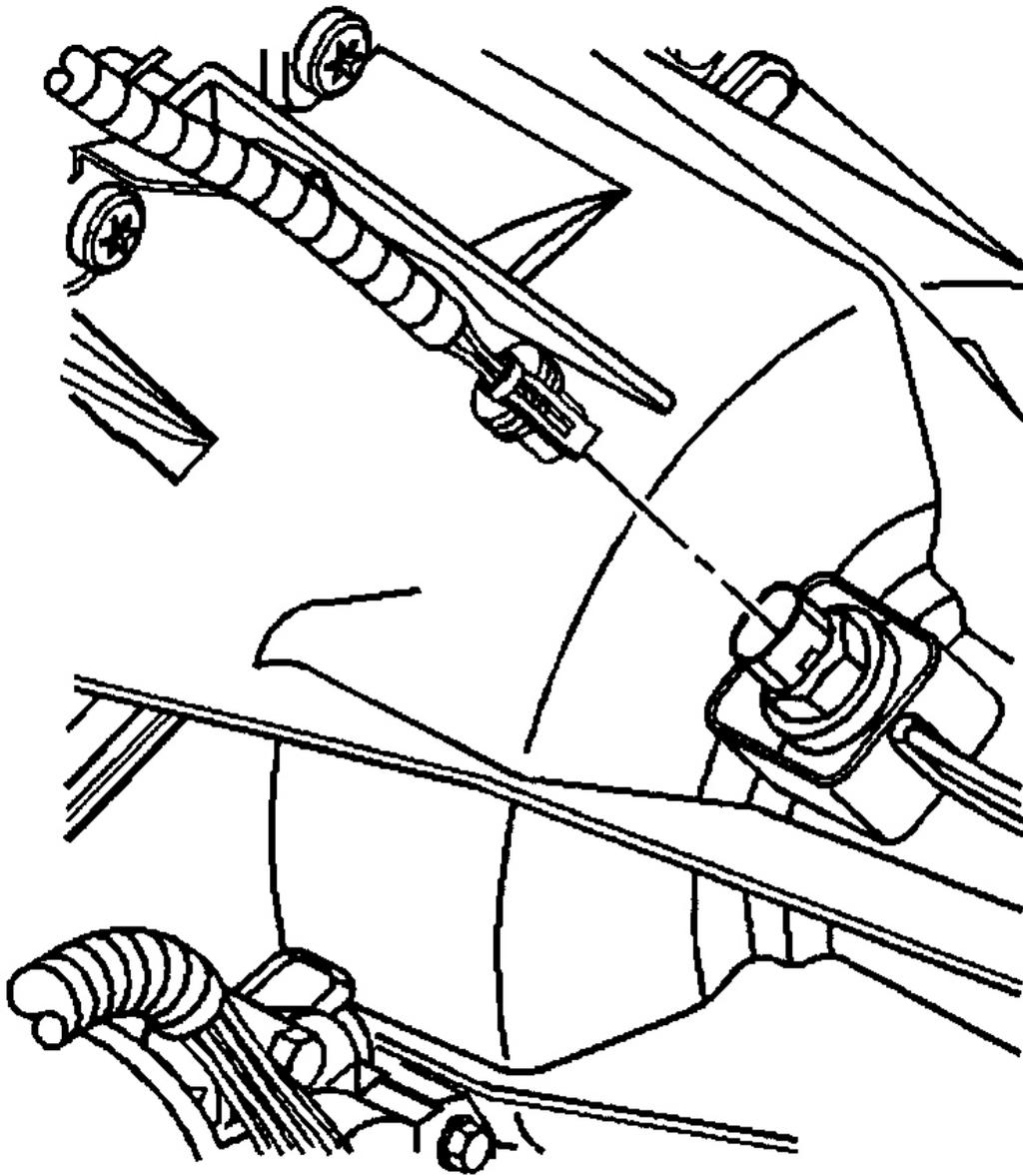
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Fig. 75: Positioning Wiring Harness
Courtesy of GENERAL MOTORS CORP.

VEHICLE SPEED SENSOR

Removal

1. Raise and support the vehicle.
2. Disconnect the Vehicle Speed Sensor (VSS) electrical connector. See **Fig. 76**.
3. Remove the VSS and "O" ring seal from transfer case.



G00281732

Fig. 76: Disconnecting VSS Electrical Connector
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install NEW VSS with a NEW "O" ring seal into the transfer case.
2. Connect the VSS electrical connector (2). See **Fig. 76** .

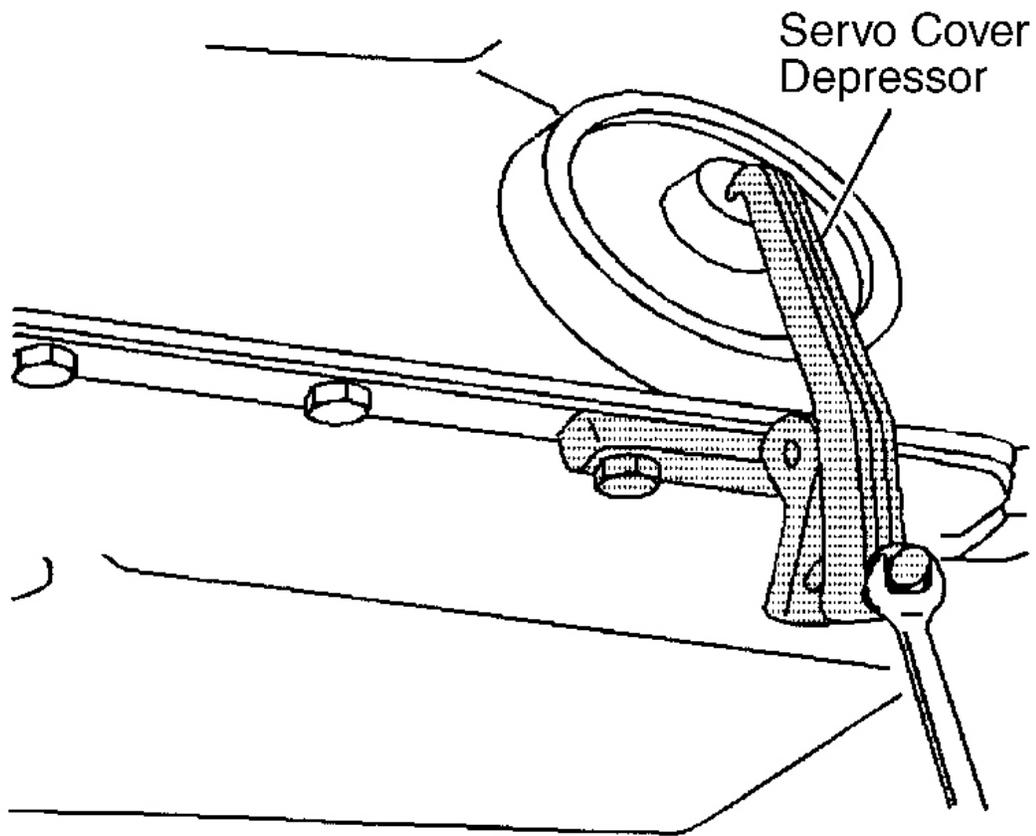
3. Lower the vehicle.
4. Refill the fluid as required. See **LUBRICATION**.

2-4 SERVO

NOTE: **Tools required: Servo Cover Depressor (J-29714-A).**

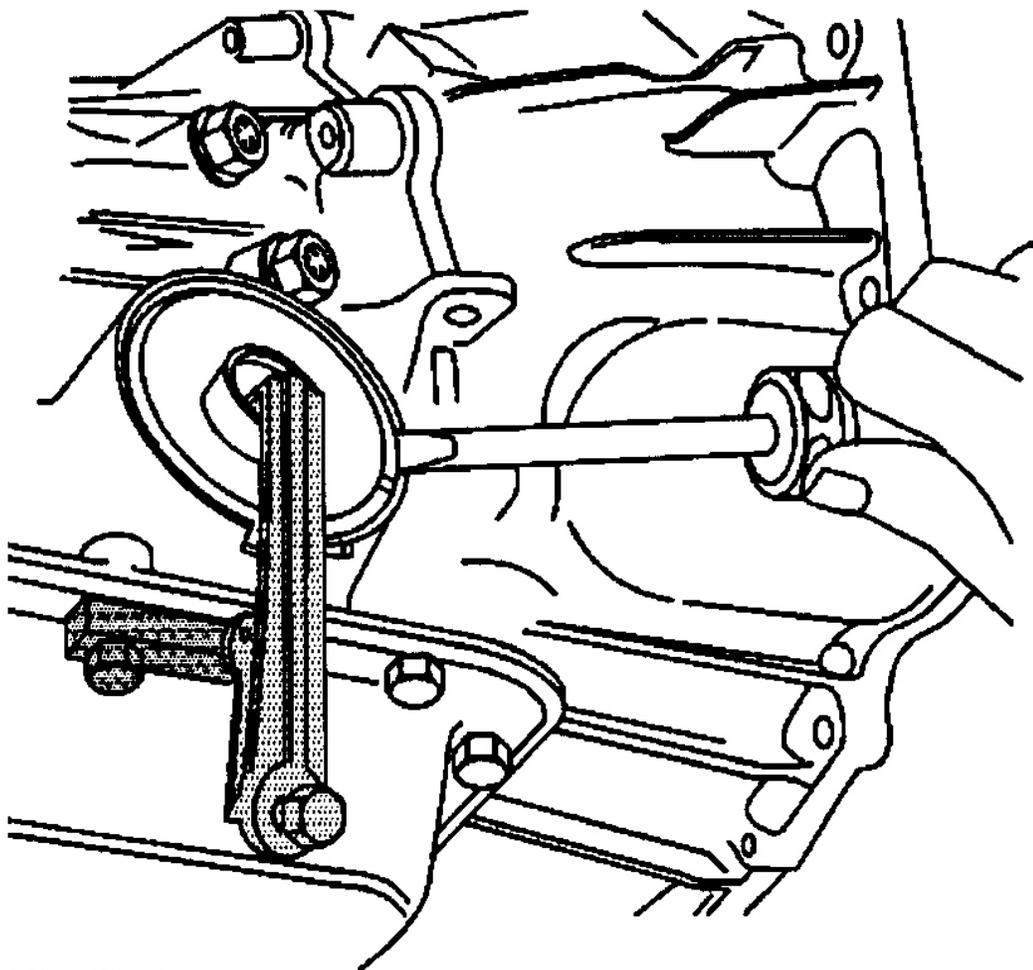
Removal

1. Raise the vehicle. Drain the transmission fluid. See **DRAINING & REFILLING**.
2. Remove frame-to-engine protection shield bolts. See **Fig. 35**. Remove engine protection shield. Remove the catalytic converter guard mounting bolts and guard from vehicle. See **Fig. 36**.
3. Disconnect the connector position assurance (CPA) retainers. Disconnect the oxygen sensor electrical connectors (1, 2). See **Fig. 37**.
4. Remove the catalytic converter to muffler flange nuts. Remove the exhaust manifold pipe-to-catalytic converter nuts. Remove the catalytic converter.
5. Remove the heat shield bolts. See **Fig. 38**. Remove the heat shield.
6. Install the servo cover depressor. See **Fig. 77**.
7. Tighten the bolt on servo cover depressor in order to compress the servo cover.
8. Remove the servo cover ring. See **Fig. 78**.
9. Remove the servo cover depressor.
10. Remove the servo cover and "O" ring seal. If the cover is hung up on the seal, use a pick (2) in order to pull and stretch the seal (1) out of the groove. Cut and remove the "O" ring seal before removing the cover. See **Fig. 79**.
11. Remove the 2-4 servo. See **Fig. 80**.
12. Inspect the 4th apply piston, 2-4 servo converter, 2nd apply piston, and the servo piston inner housing for the following defects:
 - Cracks.
 - Scoring.
 - Burrs and nicks.



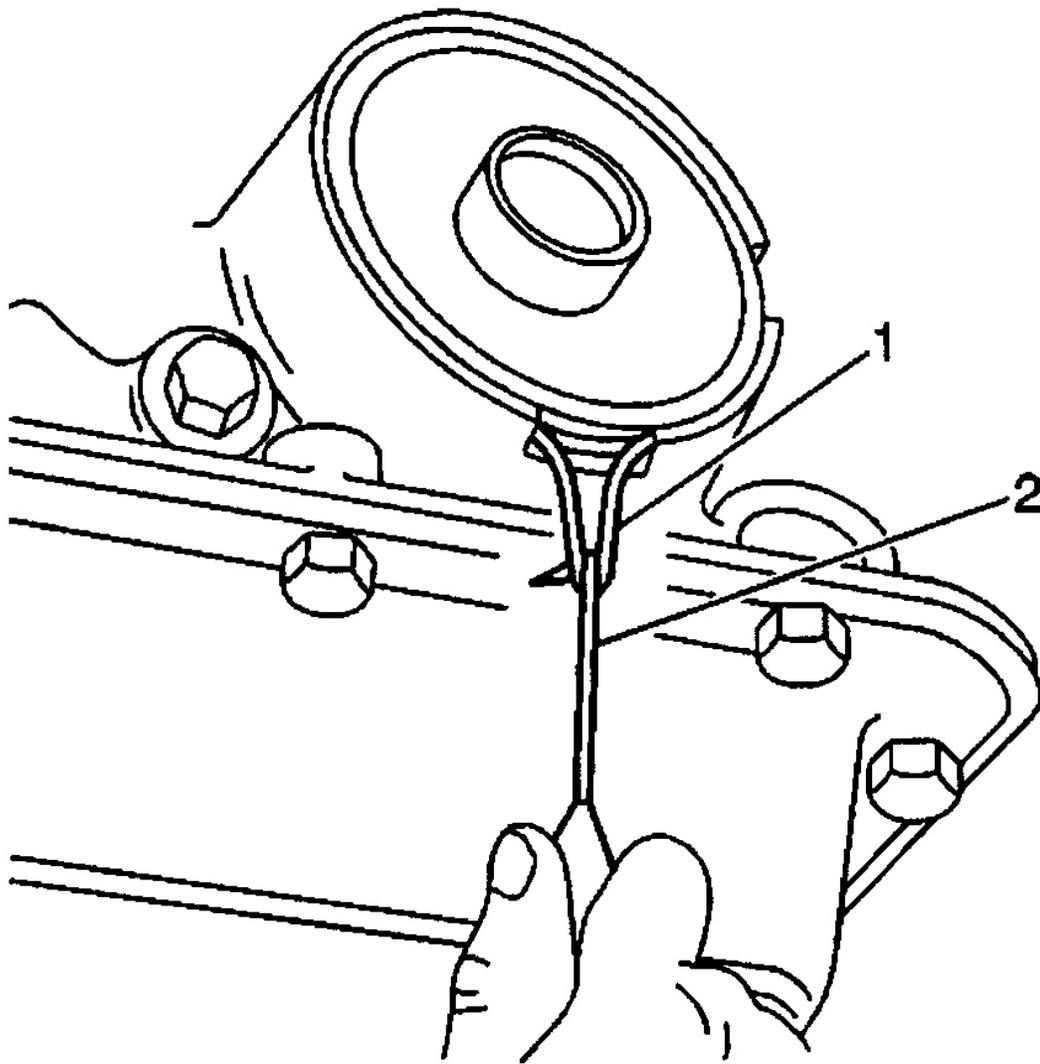
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Fig. 77: Installing Servo Cover Depressor On Transmission
Courtesy of GENERAL MOTORS CORP.



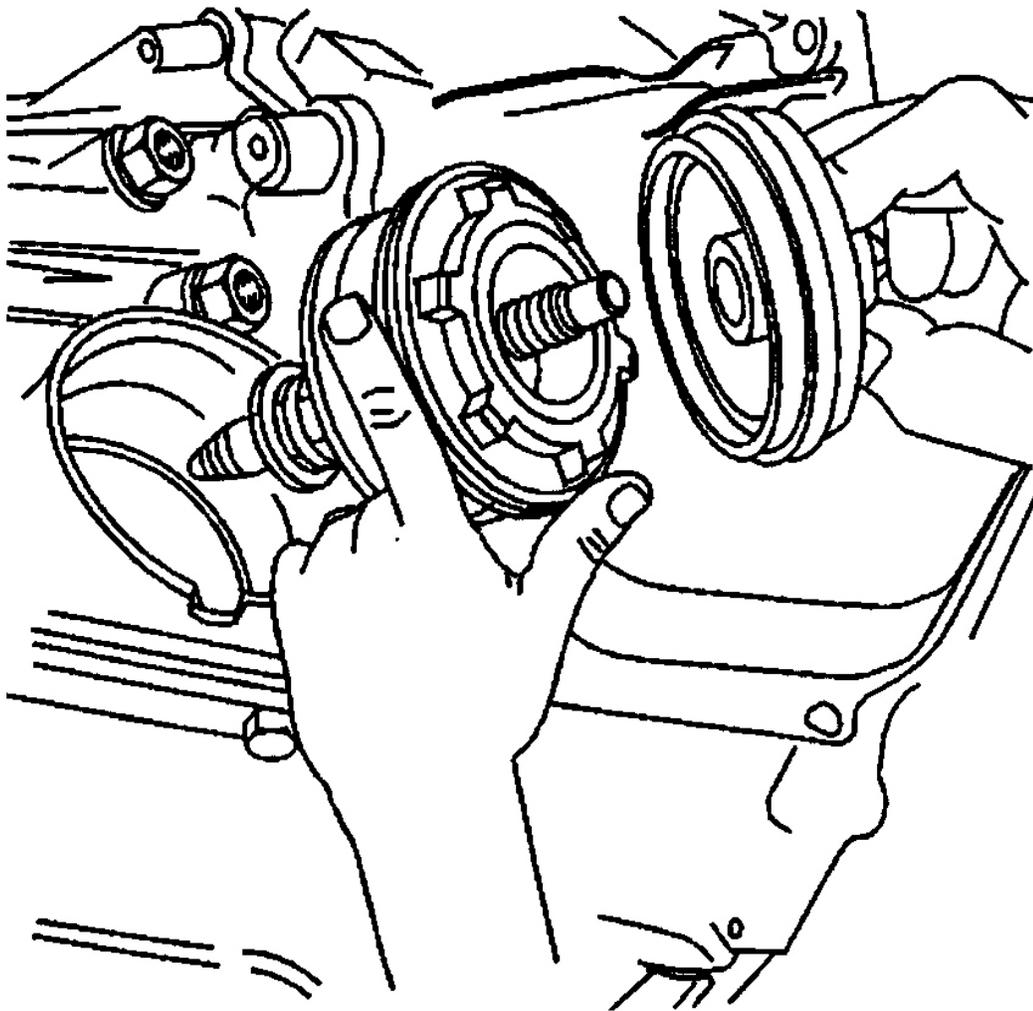
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Fig. 78: Removing Servo Cover Retaining Ring
Courtesy of GENERAL MOTORS CORP.



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Fig. 79: Removing Servo "O" Ring
Courtesy of GENERAL MOTORS CORP.



G00089867

Fig. 80: Inspecting Servo Components For Damage
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install NEW seals onto the servo pistons and the servo cover.
2. Install the 2-4 servo. See **Fig. 80** .
3. Install the servo cover depressor.
4. Tighten the bolt on servo cover depressor in order to compress the servo cover. See **Fig. 77** .
5. Install the servo cover ring.
6. Remove the servo cover depressor.
7. Install the transmission oil pan bolt. Tighten the bolt to specification. See **TORQUE**

SPECIFICATIONS

8. Install the heat shield and bolts. See **Fig. 38** . Tighten the bolts to specification. See **TORQUE SPECIFICATIONS** .
9. Install right catalytic converter and nuts. Tighten nuts to specification. See **TORQUE SPECIFICATIONS** .
10. Install exhaust manifold pipe-to-catalytic converter nuts. Tighten nuts to specification. See **TORQUE SPECIFICATIONS** .
11. Connect oxygen sensor electrical connectors (1, 2). See **Fig. 37** . Connect the CPA retainers.
12. Install the catalytic converter guard. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
Install frame-to-engine protection shield. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
13. Fill transmission to proper level with appropriate fluid. See **LUBRICATION** .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Auxiliary Oil Cooler Support Bolt	12 (16)
Catalytic Converter Guard Bolts	22 (30)
Catalytic Converter Nuts	37 (50)
Engine Protection Shield Bolts	22 (30)
Exhaust Manifold Pipe-To-Catalytic Converter Nuts	37 (50)
Extension Housing Bolts	33 (45)
Heat Shield Bolts	13 (18)
Insulator Nuts	12 (16)
Oil Pan Bolts	12 (16)
Oil Pan Drain Plug	13 (18)
Oxygen Sensor	31 (42)
Park Lock Bracket Bolt	18 (24)
Park/Neutral Position Switch Bolt	18 (24)
Reverse Servo Cover Bolt	18 (24)
Right Exhaust Pipe Nuts	37 (50)
Shift Cable Bracket Bolts	18 (24)
Transmission Control Lever Nut	18 (24)
Transmission Crossmember Bolts & Nuts	70 (95)
Transmission Heat Shield Bolts	13 (18)
Transmission Fluid Cooler Hose Insulator	12 (16)
Transmission Oil Level Indicator Tube Nut	13 (18)
Transmission Mount Bolts	44 (60)
Transmission Mount Nut	30 (40)

	INCH Lbs. (N.m)
Accumulator-To-Case Bolt	97 (11)
Center Console Bolts	80 (9)
Center Console End Panel Screws	14 (1.6)
Center Console Storage Bin Screws	18 (2)
Control Valve Body Bolts	97 (11)
Filler Tube Bolt	53 (6)
Fluid Pressure Switch	97 (11)
Manual Detent Spring Bolt	97 (11)
Oil Pass Cover Bolt	97 (11)
Pressure Control Solenoid Bolt	97 (11)
Shift Cable Brace Bolt	89 (10)
Shift Handle Set Screw	18 (2)
TCC Solenoid Bolts	97 (11)
Transmission Fluid Indicator Stop Bolt	97 (11)
Valve Body-To-Case Bolt ⁽¹⁾	97 (11)
Vent Tube Clamp	89 (10)
VSS Bolt	97 (11)

(1) Tighten valve body bolts in a spiral pattern starting in center of valve body.