

Transmission

Automatic Transmission - 6L45 (MYA) or 6L90 (MYD) - Repair Instructions - On Vehicle - CTS
Coupe & Wagon

REPAIR INSTRUCTIONS - ON VEHICLE

TRANSMISSION CONTROL LEVER KNOB REPLACEMENT

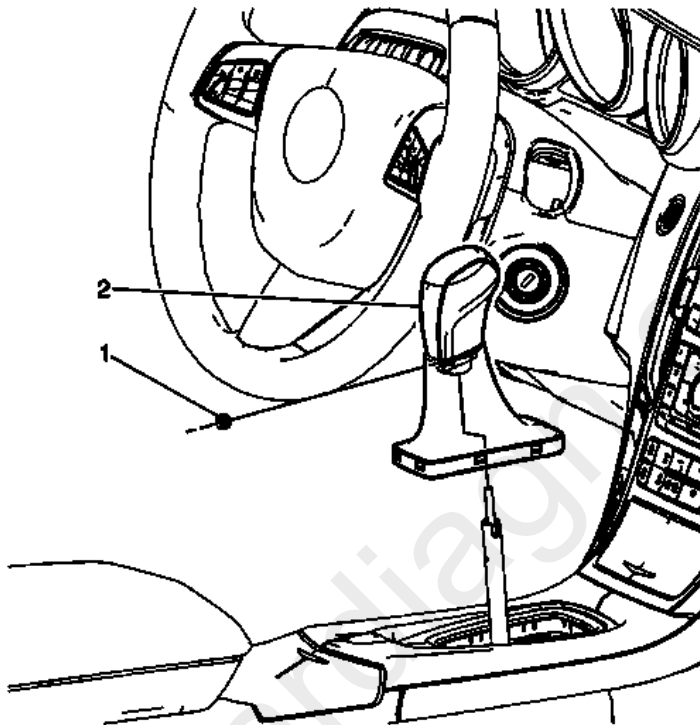


Fig. 1: Transmission Control Lever Knob
Courtesy of GENERAL MOTORS COMPANY

Transmission Control Lever Knob Replacement

Callout	Component Name
	Automatic Transmission Control Lever Knob Screw
	Procedure Insert a flat bladed plastic trim tool between the boot and the knob releasing the retaining tab securing the boot to the knob in order to expose the screw.
1	CAUTION: Refer to <u>Fastener Caution</u> .
	Tighten 3 N.m (27 lb in)

SHIFT CONTROL LINKAGE REPLACEMENT (ALL WHEEL DRIVE)

Removal Procedure

1. Position the shift lever in PARK.
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .

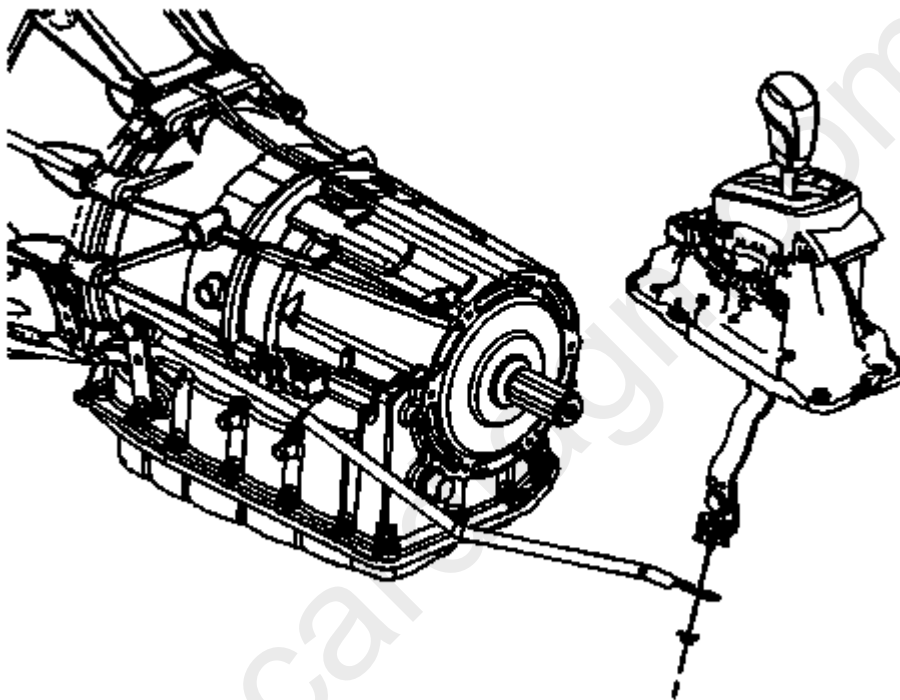


Fig. 2: View Of Shift Control Linkage Rod
Courtesy of GENERAL MOTORS COMPANY

3. Remove the nut from the shift control linkage rod.
4. Disconnect the shift control linkage rod from the shift control assembly.

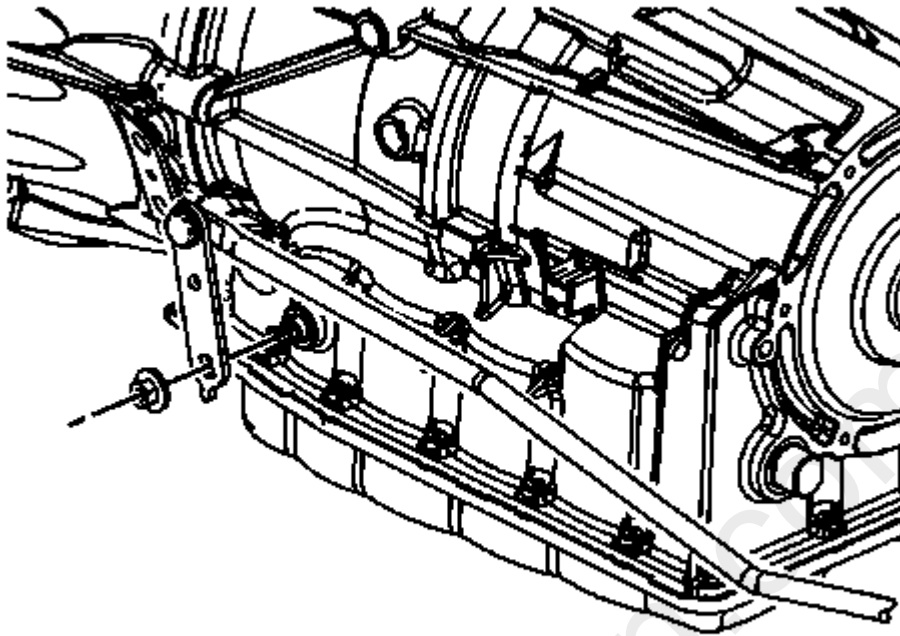


Fig. 3: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

5. Remove the manual shift shaft nut.
6. Remove the shift control linkage from the vehicle.

Installation Procedure

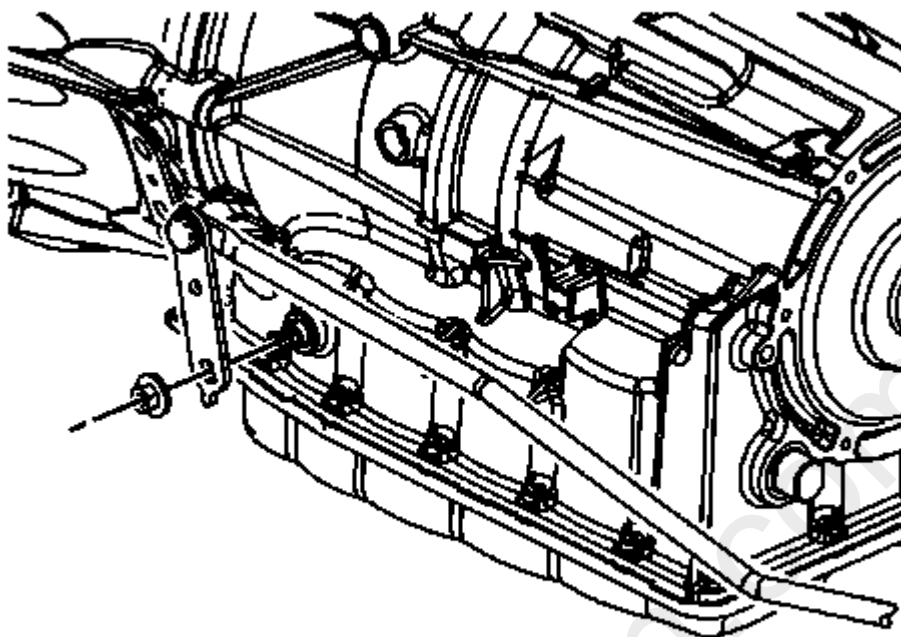


Fig. 4: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

1. Install the shift control linkage to the vehicle.

CAUTION: Refer to Fastener Caution .

2. Install the manual shift shaft nut and tighten to 20 N.m (15 lb ft).

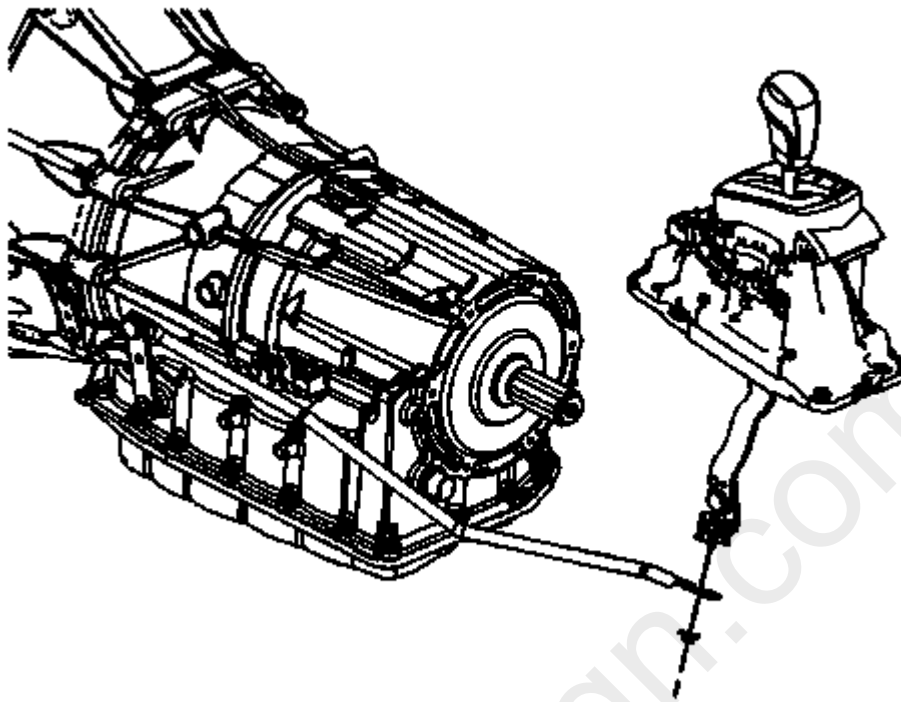


Fig. 5: View Of Shift Control Linkage Rod
Courtesy of GENERAL MOTORS COMPANY

3. Connect the shift control linkage rod to the shift control assembly.
4. Install the nut to the shift control linkage rod.
5. Adjust the shift control linkage. Refer to **Shift Control Linkage Adjustment (All Wheel Drive)**.
6. Lower the vehicle.

SHIFT CONTROL LINKAGE REPLACEMENT (REAR WHEEL DRIVE)

Removal Procedure

1. Position the shift lever in PARK.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

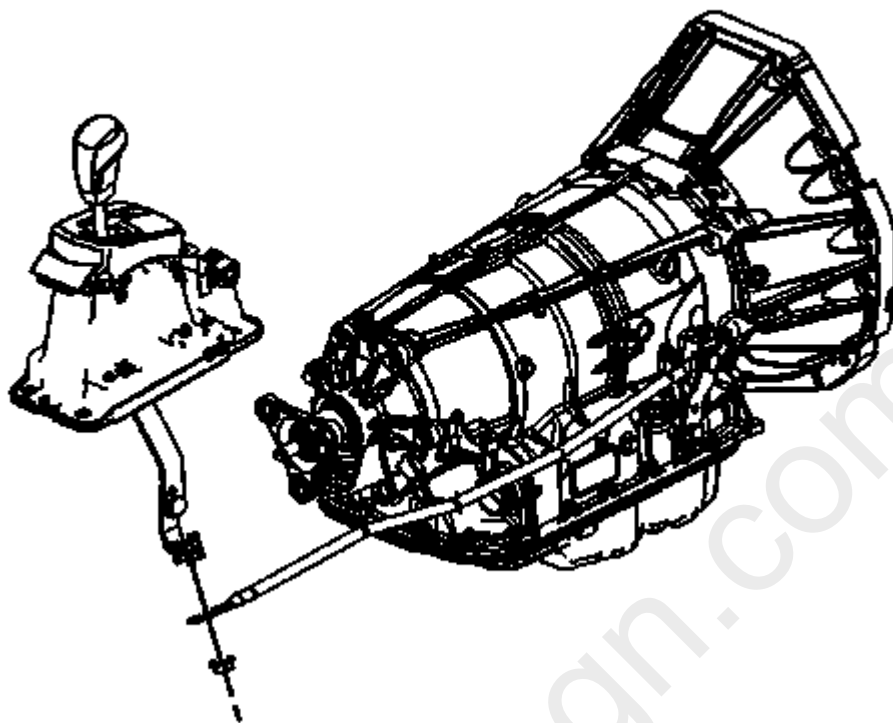


Fig. 6: View Of Shift Control Linkage Rod
Courtesy of GENERAL MOTORS COMPANY

3. Remove the nut from the shift control linkage rod.
4. Disconnect the shift control linkage rod from the shift control assembly.

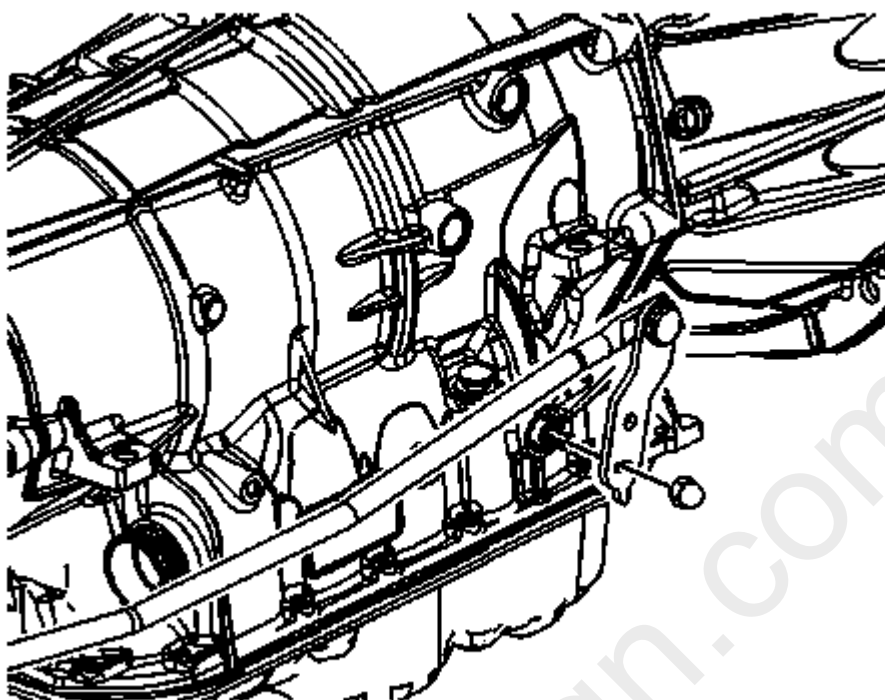


Fig. 7: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

5. Remove the manual shift shaft nut.
6. Remove the shift control linkage from the vehicle.

Installation Procedure

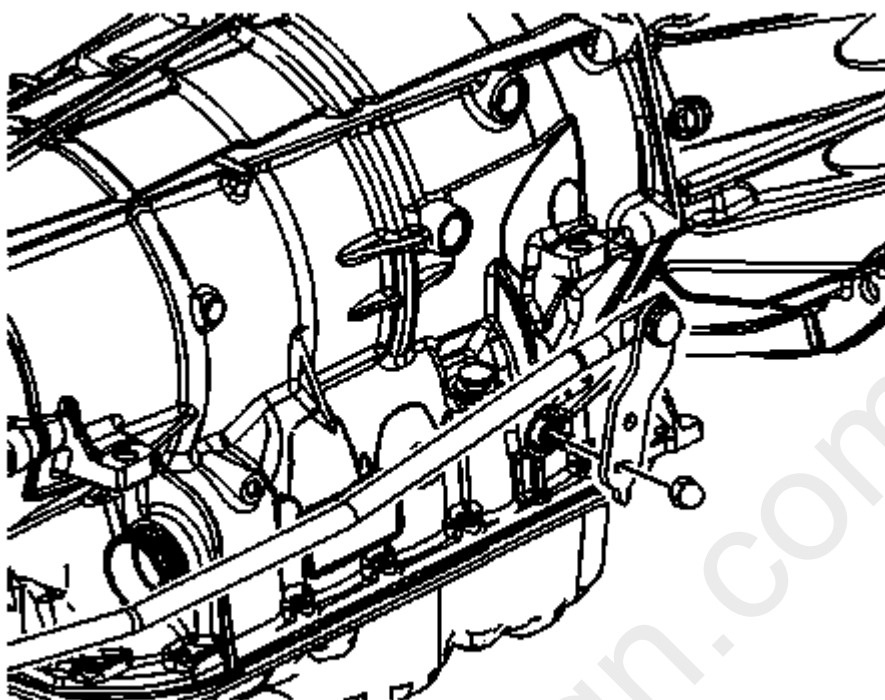


Fig. 8: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

1. Install the shift control linkage to the vehicle.

CAUTION: Refer to Fastener Caution .

2. Install the manual shift shaft nut and tighten to 15 N.m (11 lb ft).

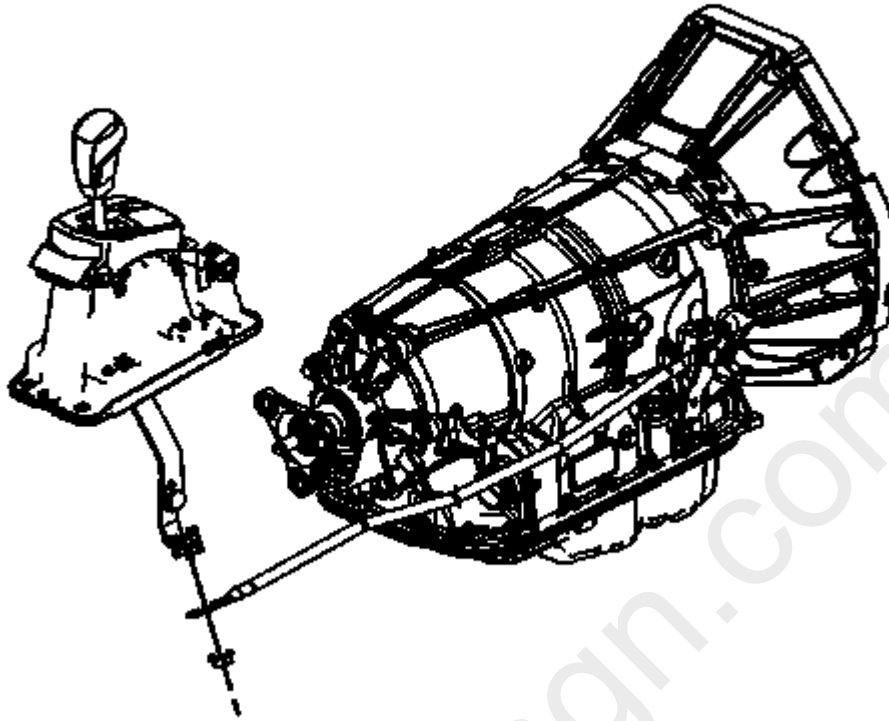


Fig. 9: View Of Shift Control Linkage Rod
Courtesy of GENERAL MOTORS COMPANY

3. Connect the shift control linkage rod to the shift control assembly.
4. Install the nut to the shift control linkage rod.
5. Adjust the shift control linkage. Refer to **Shift Control Linkage Adjustment (Rear Wheel Drive)**.
6. Lower the vehicle.

SHIFT CONTROL LINKAGE ADJUSTMENT (ALL WHEEL DRIVE)

1. Position the shift lever in PARK.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

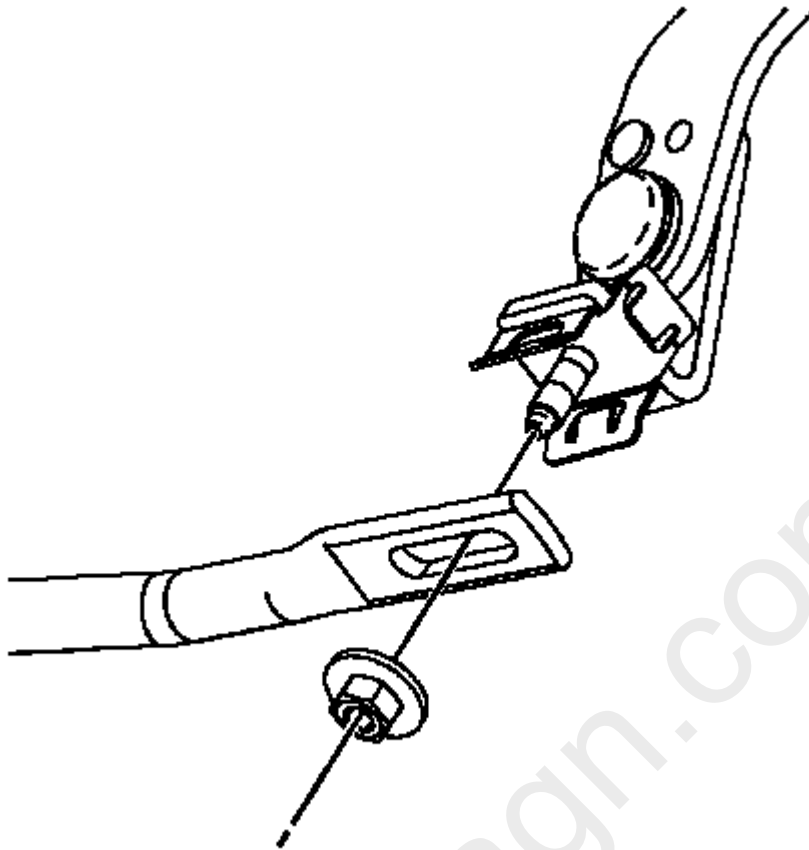


Fig. 10: View Of Shift Control Linkage Adjustment Nut
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Loosen the shift control linkage adjustment nut to allow the adjuster to slide freely.
4. Hold the selector lever on transmission against the rear stop to eliminate any play. Tighten the shift control linkage adjustment nut to 9 N.m (80 lb in).
5. Lower the vehicle.

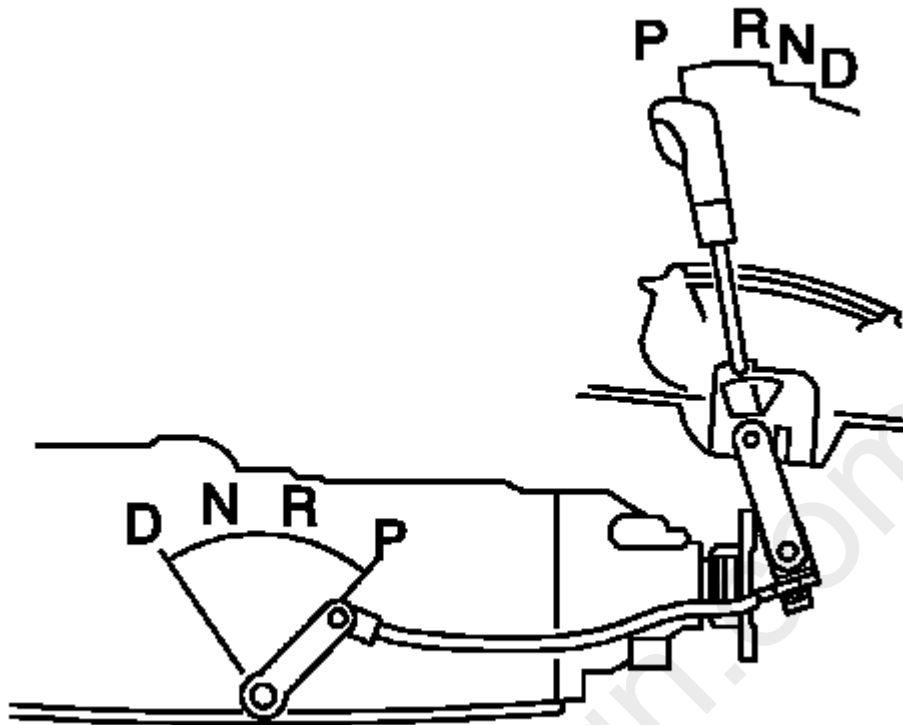


Fig. 11: View Of Shift Lever Positions
Courtesy of GENERAL MOTORS COMPANY

6. Inspect the operation of the starting system with the shift lever in each position. The engine should only crank when the lever is in the PARK or NEUTRAL position.
7. If the key is stuck or hard to remove from the lock cylinder or there is a high button effort, the linkage may not be adjusted properly. Re-adjust as necessary.
8. Ensure that the shifter detentes align with the gear indicators.
9. Return to the PARK position and check for proper engagement. PARK position should feel solid and not spongy. The shift lever should not be bottomed out on the stop bumper when engaging the PARK position. Readjust and retest if necessary.
10. With the ignition on and the engine not running, ensure a smooth transition from position D to tap mode and back. Ensure that the odometer changes to the gear indicator mode. If the odometer does not change to gear indicator mode, or any binding or rough spots are felt, repeat the linkage adjustment procedure and retest the system.

SHIFT CONTROL LINKAGE ADJUSTMENT (REAR WHEEL DRIVE)

1. Position the shift lever in PARK.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

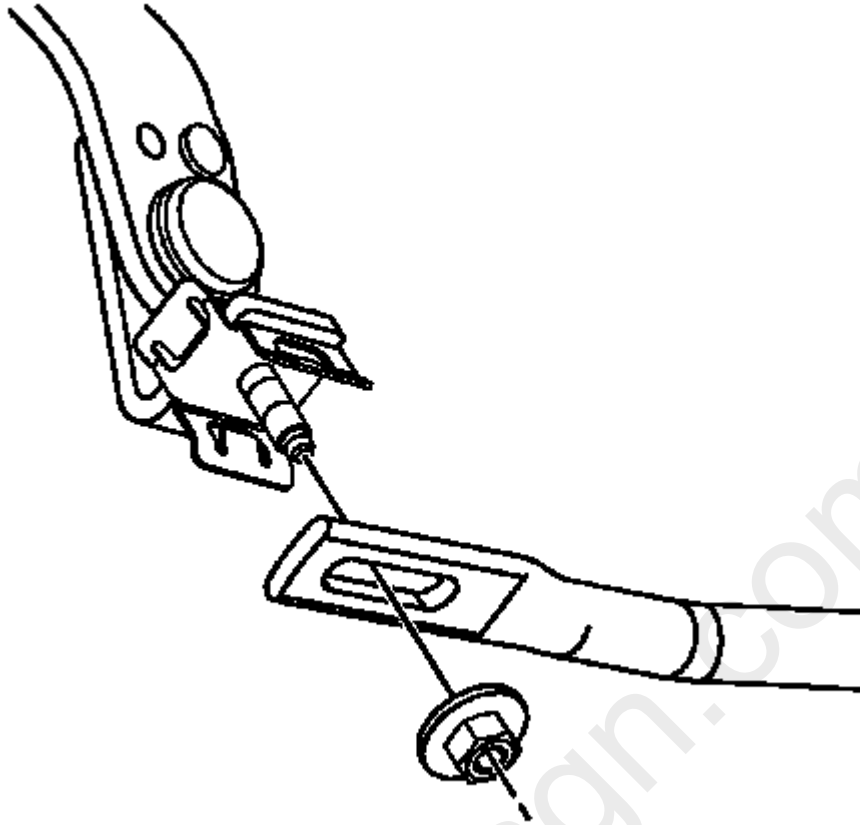


Fig. 12: View Of Shift Control Linkage Adjustment Nut
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Loosen the shift control linkage adjustment nut to allow the adjuster to slide freely.
4. Hold the selector lever on transmission against the rear stop to eliminate any play. Tighten the shift control linkage adjustment nut to 9 N.m (80 lb in).
5. Lower the vehicle.

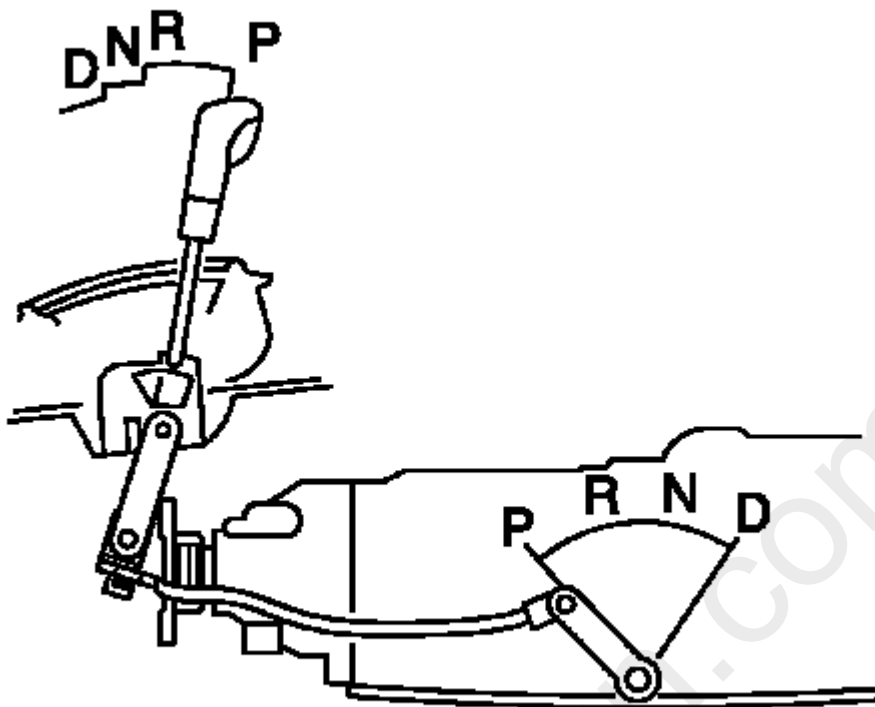


Fig. 13: View Of Shift Lever Positions
Courtesy of GENERAL MOTORS COMPANY

6. Inspect the operation of the starting system with the shift lever in each position. The engine should only crank when the lever is in the PARK or NEUTRAL position.
7. If the key is stuck or hard to remove from the lock cylinder or there is a high button effort, the linkage may not be adjusted properly. Re-adjust as necessary.
8. Ensure that the shifter detents align with the gear indicators.
9. Return to the PARK position and check for proper engagement. PARK position should feel solid and not spongy. The shift lever should not be bottomed out on the stop bumper when engaging the PARK position. Readjust and retest if necessary.
10. With the ignition on and the engine not running, ensure a smooth transition from position D to tap mode and back. Ensure that the odometer changes to the gear indicator mode. If the odometer does not change to gear indicator mode, or any binding or rough spots are felt, repeat the linkage adjustment procedure and retest the system.

TRANSMISSION CONTROL LEVER BOOT REPLACEMENT

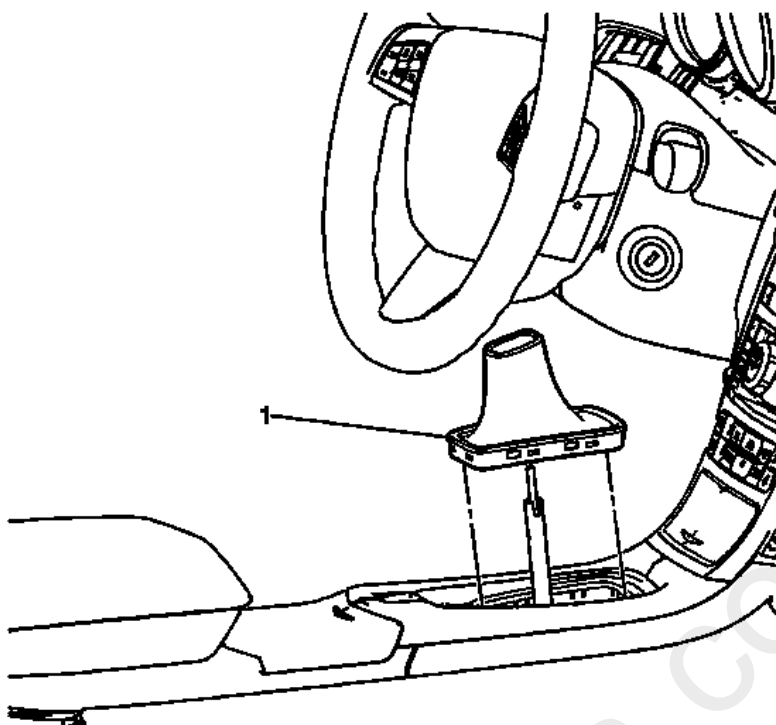


Fig. 14: Transmission Control Lever Boot
 Courtesy of GENERAL MOTORS COMPANY

Transmission Control Lever Boot Replacement

Callout	Component Name
Preliminary Procedure	
Remove the automatic transmission control knob. Refer to <u>Transmission Control Lever Knob.</u>	
1	Automatic Transmission Control Boot Assembly Procedure Use a flat bladed plastic trim tool in order to release the retaining tabs securing the boot assembly to the front floor console transmission shift opening trim plate.

AUTOMATIC TRANSMISSION CONTROL INDICATOR REPLACEMENT

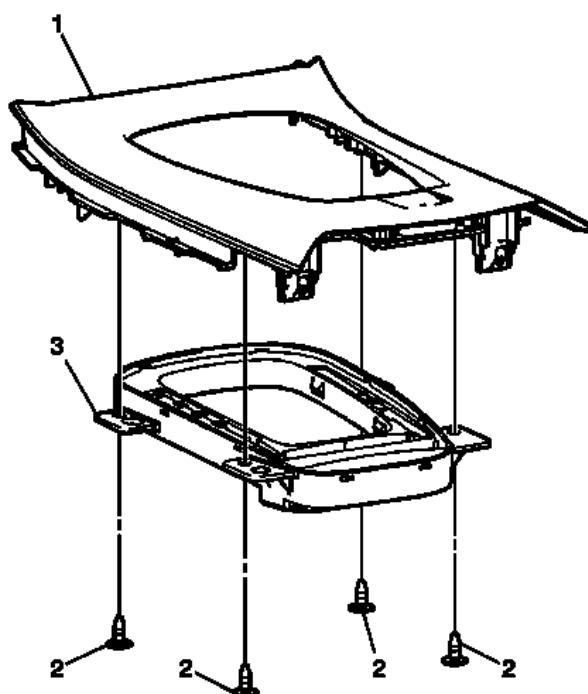


Fig. 15: Automatic Transmission Control Indicator
 Courtesy of GENERAL MOTORS COMPANY

Automatic Transmission Control Indicator Replacement

Callout	Component Name
1	Front Floor Console Transmission Opening Trim Plate Refer to <u>Front Floor Console Transmission Shift Opening Trim Plate Replacement (Right Hand Drive Automatic Trans)</u> , <u>Front Floor Console Transmission Shift Opening Trim Plate Replacement (Right Hand Drive Manual Transmission)</u> , <u>Front Floor Console Transmission Shift Opening Trim Plate Replacement (Left Hand Drive Automatic Trans)</u> , <u>Front Floor Console Transmission Shift Opening Trim Plate Replacement (Left Hand Drive Manual Transmission)</u> .
2	Automatic Transmission Control Indicator Screw (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 2.5 N.m (22 lb in)
3	Automatic Transmission Control Indicator Assembly

TRANSMISSION CONTROL REPLACEMENT

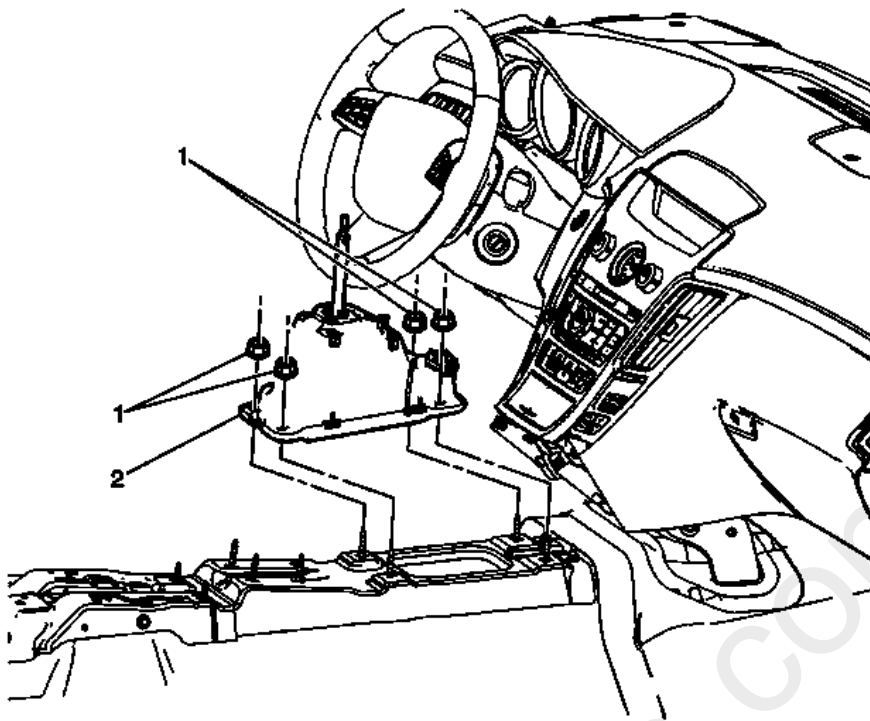


Fig. 16: Transmission Control
Courtesy of GENERAL MOTORS COMPANY

Transmission Control Replacement

Callout	Component Name
Preliminary Procedures	
1. Ensure that the shift control linkage is correctly adjusted before replacing the shift control. Many transmission shift related complaints can be corrected with linkage adjustment. Refer to <u>Shift Control Linkage Adjustment (All Wheel Drive)</u>, <u>Shift Control Linkage Adjustment (Rear Wheel Drive)</u>. 2. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 3. Disconnect the automatic transmission shift control linkage from the automatic transmission shift control assembly. Refer to <u>Shift Control Linkage Replacement (Rear Wheel Drive)</u>, <u>Shift Control Linkage Replacement (All Wheel Drive)</u>. 4. Lower the vehicle. 5. Remove the automatic transmission control boot assembly. Refer to <u>Transmission Control Lever Boot Replacement</u>. 6. Remove the front floor console assembly. Refer to <u>Front Floor Console Replacement (Right Hand Drive)</u> , <u>Front Floor Console Replacement (Left Hand Drive)</u> .	
1	Shift Control Nut (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> .

	Tighten 9 N.m (80 lb in)
2	Automatic Transmission Shift Control Assembly TIP: If replacing the transmission control with a new one, the alignment pin inside the component needs to be sheared by depressing the shift knob release button and shifting from Neutral to Park. Procedure 1. Disconnect the electrical connector from the shift control. 2. Adjust the automatic transmission shift control linkage after installing the automatic transmission shift control assembly. Refer to <u>Shift Control Linkage Adjustment (All Wheel Drive)</u>, <u>Shift Control Linkage Adjustment (Rear Wheel Drive)</u>.

MANUAL SHIFT AUXILIARY POSITION SWITCH REPLACEMENT - STEERING WHEEL

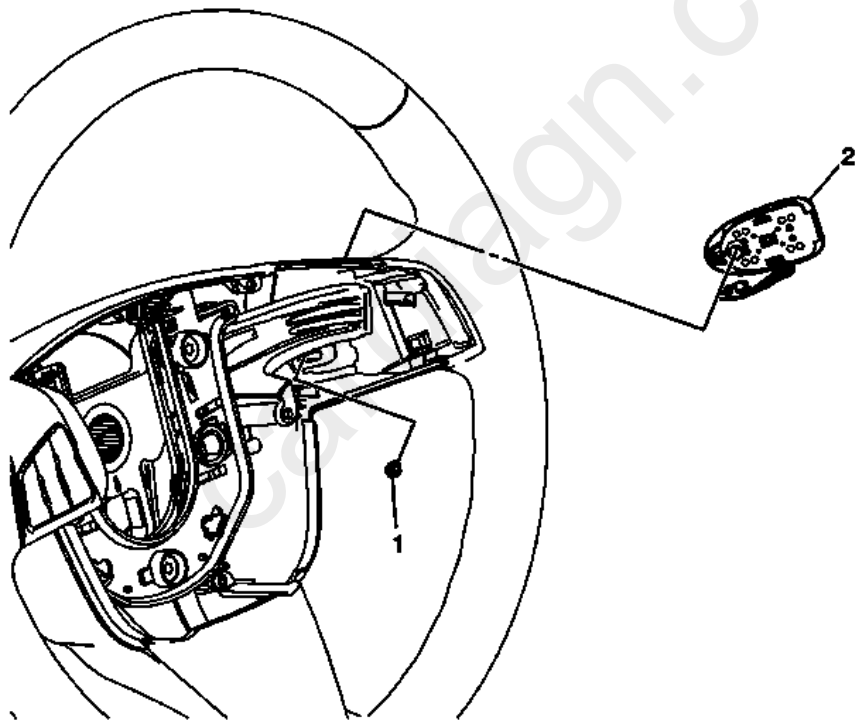


Fig. 17: Identifying Manual Shift Auxiliary Position Switch - Steering Wheel
 Courtesy of GENERAL MOTORS COMPANY

Manual Shift Auxiliary Position Switch Replacement - Steering Wheel

Callout	Component Name
Preliminary Procedure Remove the steering wheel control switch assembly. Refer to <u>Steering Wheel Control Switch Assembly</u>	

Replacement .

1	Steering Wheel Manual Shift Position Switch Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 2 N.m (18 lb in)
2	Steering Wheel Manual Shift Position Switch Procedure 1. Disconnect any electrical connectors as needed. 2. Make sure the steering wheel manual shift position switch is properly seated to the steering wheel during installation.

VENT HOSE REPLACEMENT (ALL WHEEL DRIVE)

Removal Procedure

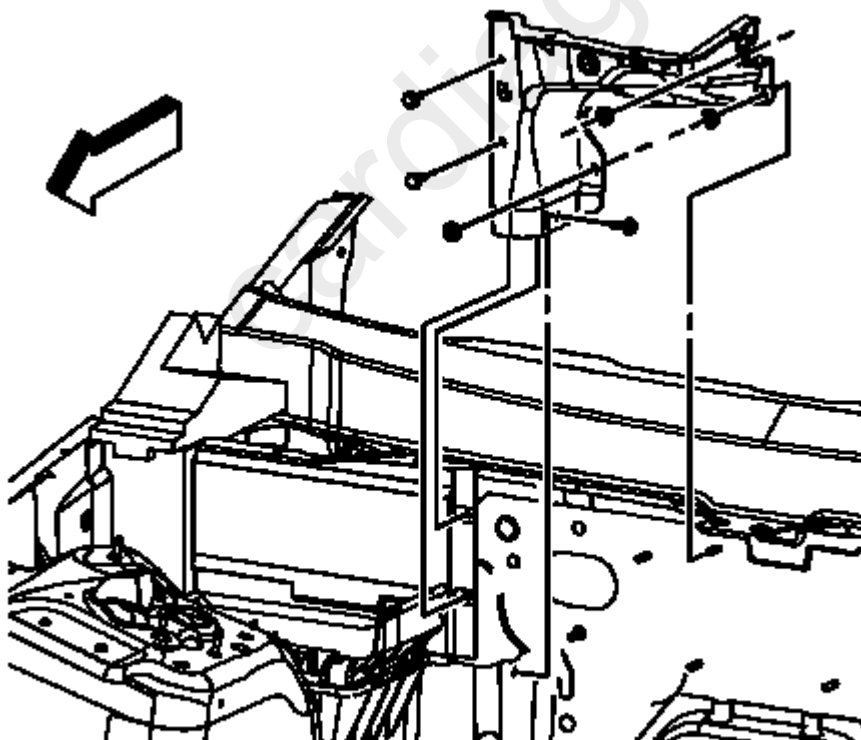


Fig. 18: View Of Air Inlet Housing
Courtesy of GENERAL MOTORS COMPANY

1. Remove the air inlet housing front panel to gain access to the vent hose upper retainer. Refer to **Air Inlet Grille Panel Replacement** .

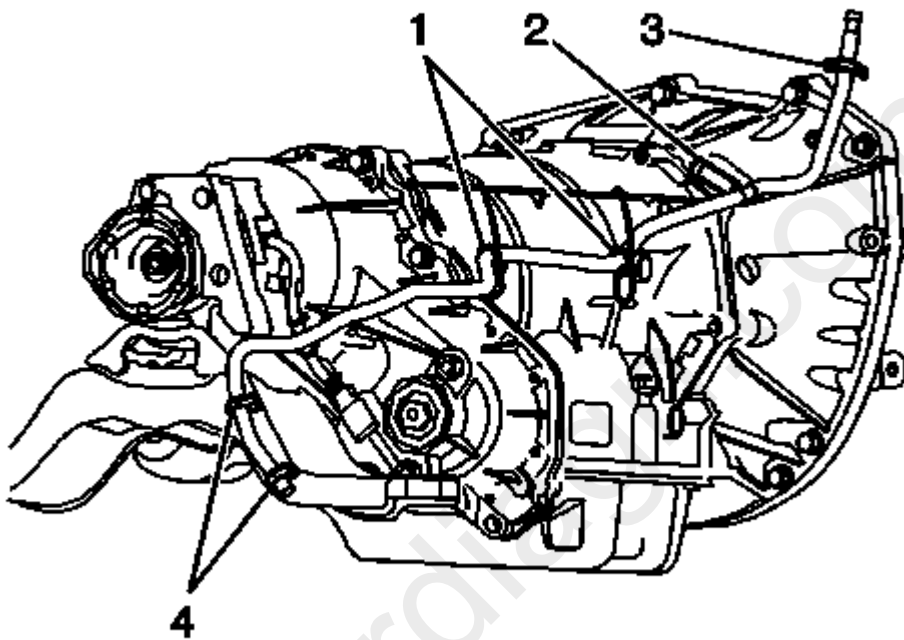


Fig. 19: View of Vent Hose
Courtesy of GENERAL MOTORS COMPANY

2. Remove the vent hose from the retainer (3) located on the rear of the right cylinder head.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the vent hose from the retainers (4) located on the transmission mount assembly.
5. Support the transmission with a suitable jack.
6. Remove the transmission mount assembly. Refer to **Transmission Mount Replacement (Automatic AWD)**.
7. Cut the tie straps (1) that secure the vent hose to the transmission wiring harness.
8. Lower the transmission and remove the vent hose from the vent tube (2).
9. Remove the vent hose assembly from the vehicle.

Installation Procedure

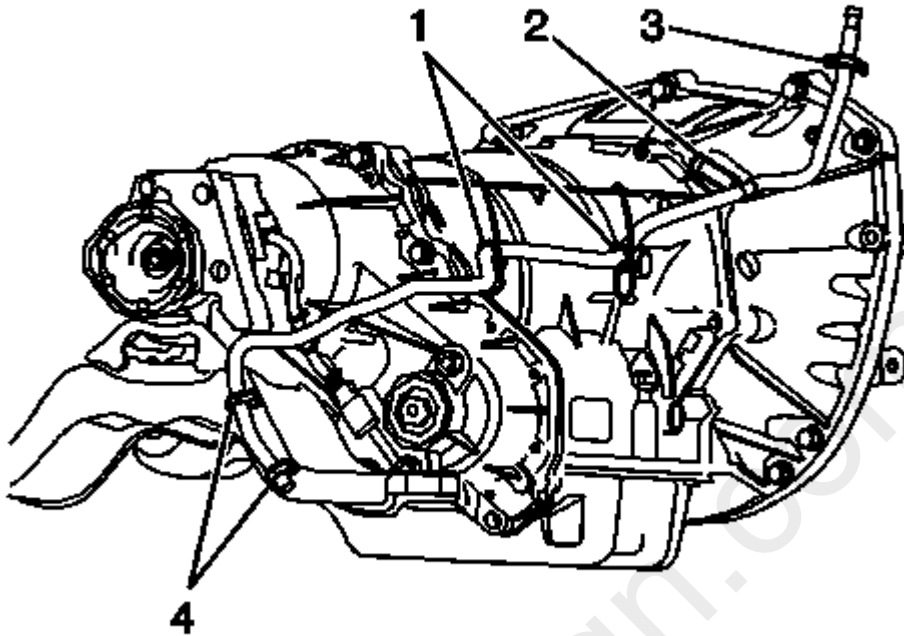


Fig. 20: View of Vent Hose

Courtesy of GENERAL MOTORS COMPANY

1. Install the vent hose assembly to the vehicle.
2. Connect the vent hose to the vent tube (2).
3. Raise the transmission to the installed position.
4. Install new tie straps (1) to secure the vent hose to the transmission wiring harness. Do not collapse the vent hose while tightening the tie straps.
5. Install the transmission mount assembly. Refer to **Transmission Mount Replacement (Automatic AWD)**.
6. Remove the jack.
7. Install the vent hose to the retainers (4) located on the mount assembly.
8. Lower the vehicle.
9. Install the vent hose to the retainer (3) located on the rear of the right cylinder head.

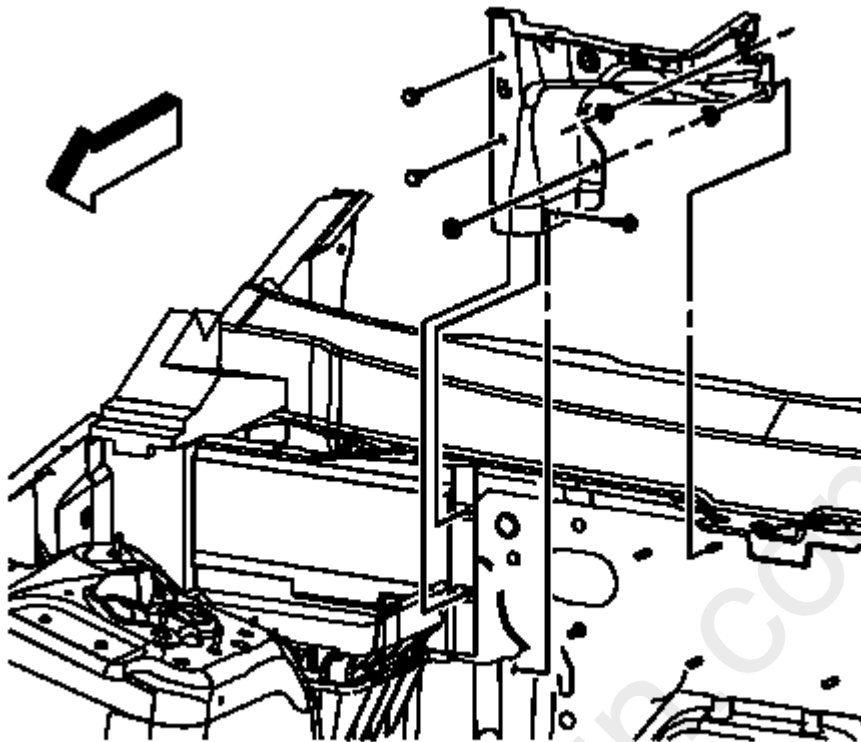


Fig. 21: View Of Air Inlet Housing
Courtesy of GENERAL MOTORS COMPANY

10. Install the air inlet housing front panel. Refer to **Air Inlet Grille Panel Replacement** .

VENT HOSE REPLACEMENT (REAR WHEEL DRIVE)

Removal Procedure

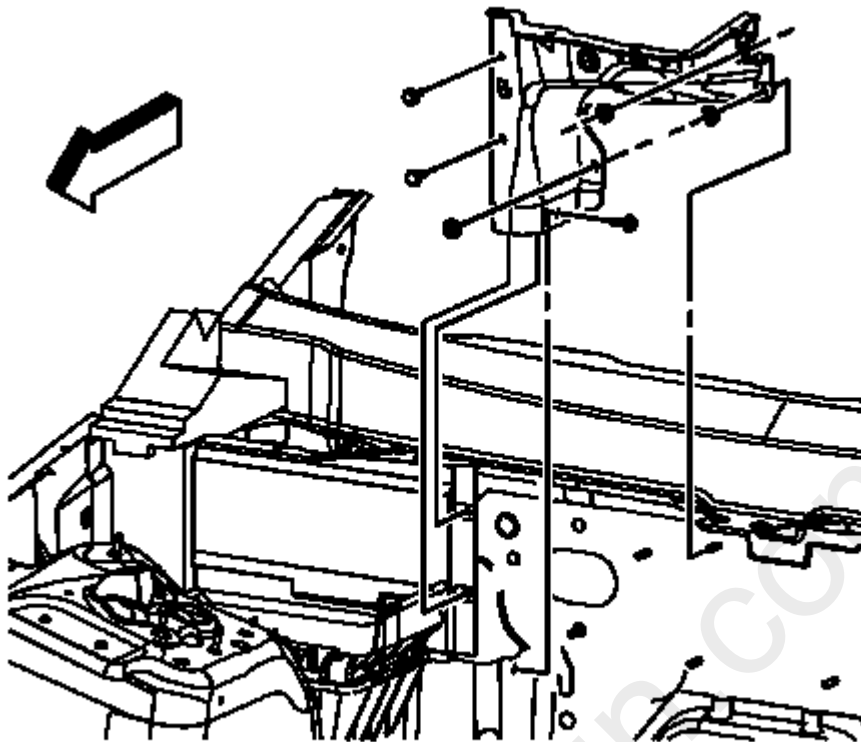


Fig. 22: View Of Air Inlet Housing
Courtesy of GENERAL MOTORS COMPANY

1. Remove the air inlet housing front panel to gain access to the vent hose upper retainer. Refer to **Air Inlet Grille Panel Replacement** .

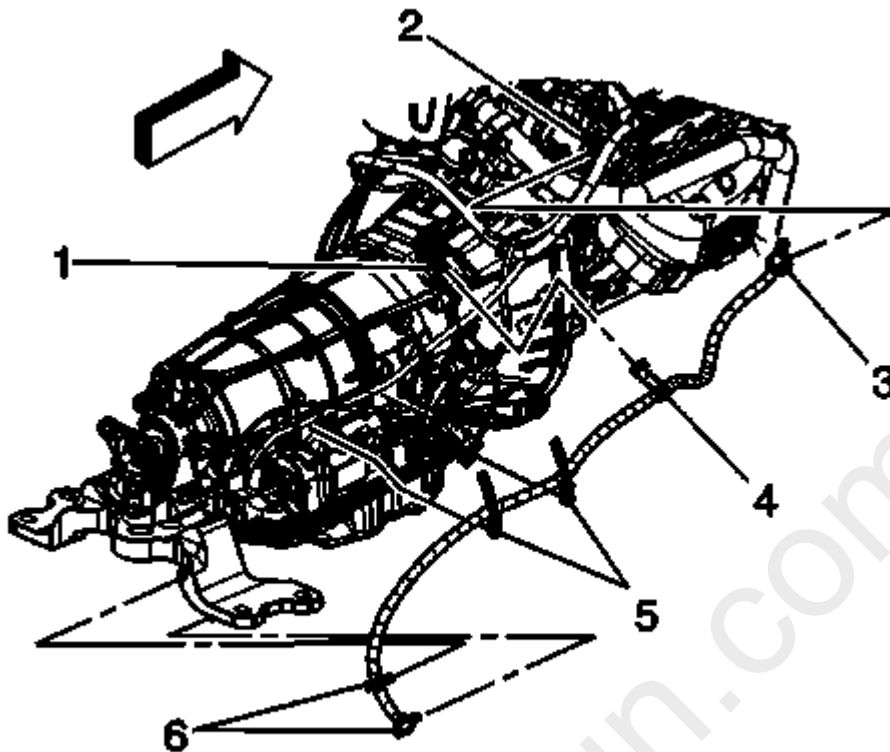


Fig. 23: View Of Vent Hose Assembly
 Courtesy of GENERAL MOTORS COMPANY

2. Remove the vent hose retainer (3) from the rear of the right cylinder head (2).
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the vent hose retainers (6) located on the transmission support.
5. Support the transmission with a suitable jack.
6. Remove the transmission support. Refer to **Transmission Support Replacement (Manual CTS-V)** , **Transmission Support Replacement (Automatic CTS-V)** , **Transmission Support Replacement (Automatic RWD except CTS-V)** , **Transmission Support Replacement (Manual except CTS-V)** .
7. Cut the tie straps (5) that secure the vent hose to the transmission wiring harness.
8. Lower the transmission and remove the vent hose (4) from the vent tube (1).
9. Remove the vent hose assembly from the vehicle.

Installation Procedure

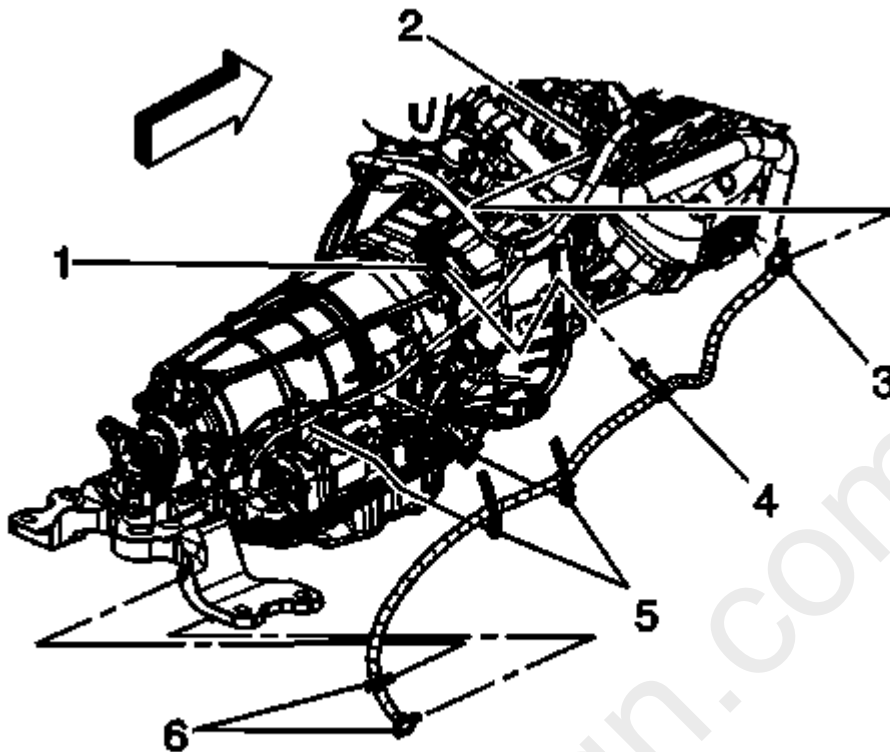


Fig. 24: View Of Vent Hose Assembly
Courtesy of GENERAL MOTORS COMPANY

1. Install the vent hose assembly to the vehicle.
2. Connect the vent hose (4) to the vent tube (1).
3. Raise the transmission to the installed position.
4. Install new tie straps (5) to secure the vent hose to the transmission wiring harness. Do not collapse the vent hose while tightening the tie straps.
5. Install the transmission support. Refer to **Transmission Support Replacement (Manual CTS-V)** , **Transmission Support Replacement (Automatic CTS-V)** , **Transmission Support Replacement (Automatic RWD except CTS-V)** , **Transmission Support Replacement (Manual except CTS-V)** .
6. Remove the jack.
7. Install the vent hose retainers (6) located on the mount assembly.
8. Lower the vehicle.
9. Install the vent hose to the retainer (3) to the rear of the right cylinder head (2).

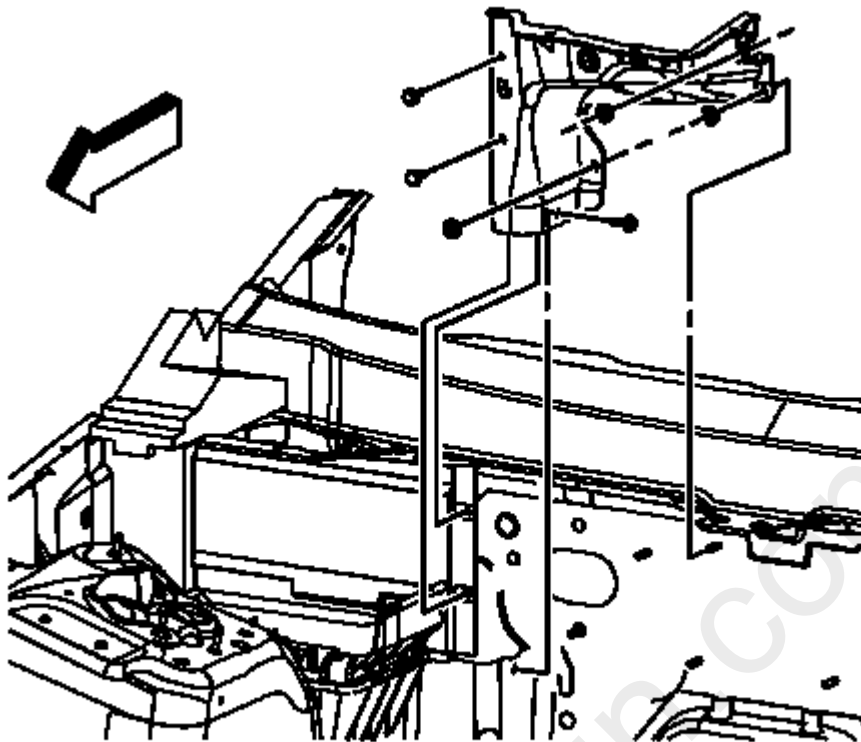


Fig. 25: View Of Air Inlet Housing
Courtesy of GENERAL MOTORS COMPANY

10. Install the air inlet housing front panel. Refer to **Air Inlet Grille Panel Replacement** .

AUTOMATIC TRANSMISSION FLUID PRESSURE TEST HOLE PLUG REPLACEMENT

Removal Procedure

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

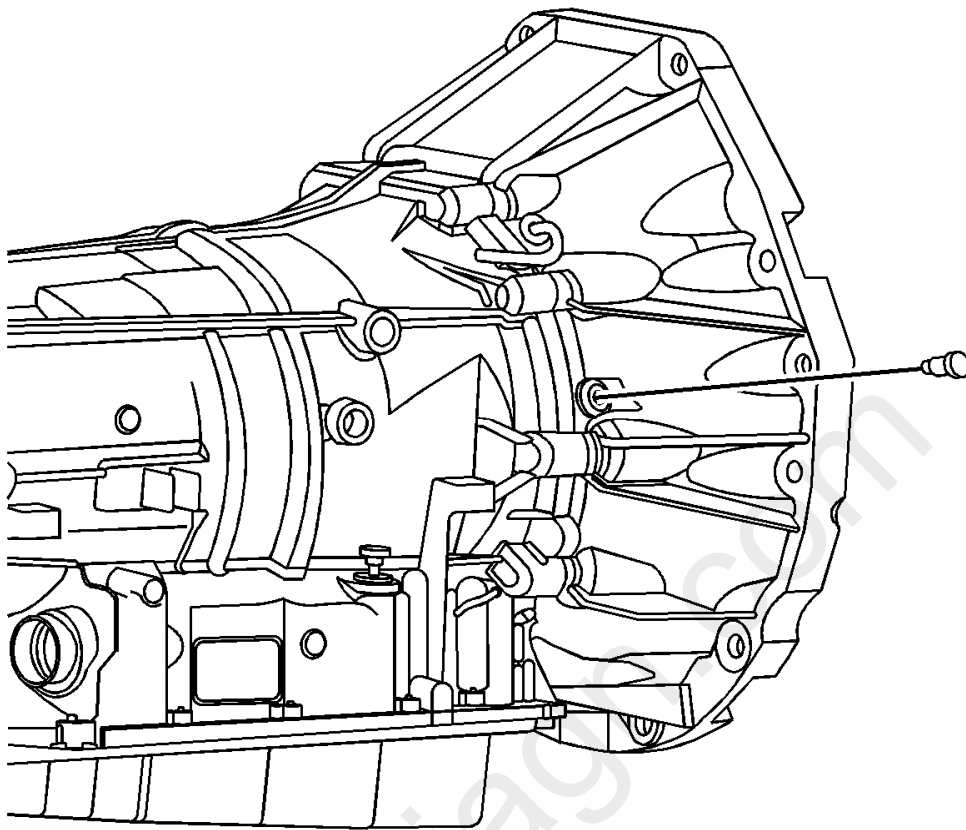


Fig. 26: View Of Oil Pressure Test Plug
Courtesy of GENERAL MOTORS COMPANY

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

Installation Procedure

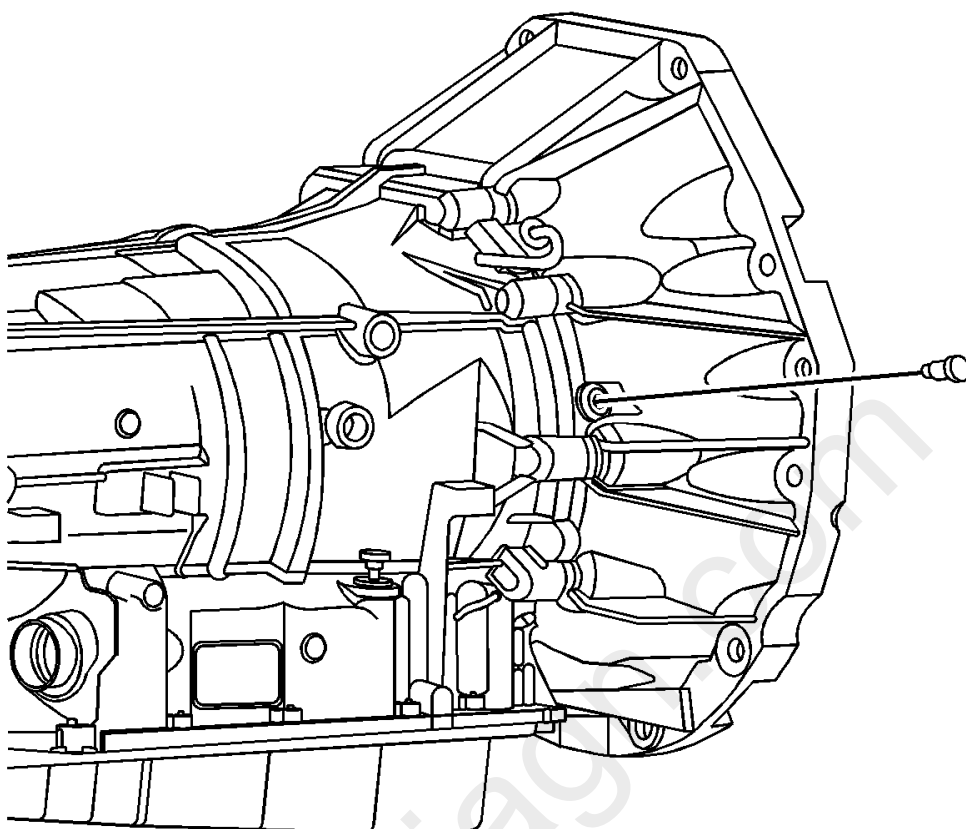


Fig. 27: View Of Oil Pressure Test Plug
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

1. Install the oil pressure test plug and tighten to 11 N.m (97 lb in).
2. Check the transmission fluid level (fill if necessary). Refer to Transmission Fluid Level and Condition Check , and Transmission Fluid Fill Procedure .
3. Lower the vehicle.

AUTOMATIC TRANSMISSION ELECTRICAL CONNECTOR PASSAGE SLEEVE REPLACEMENT

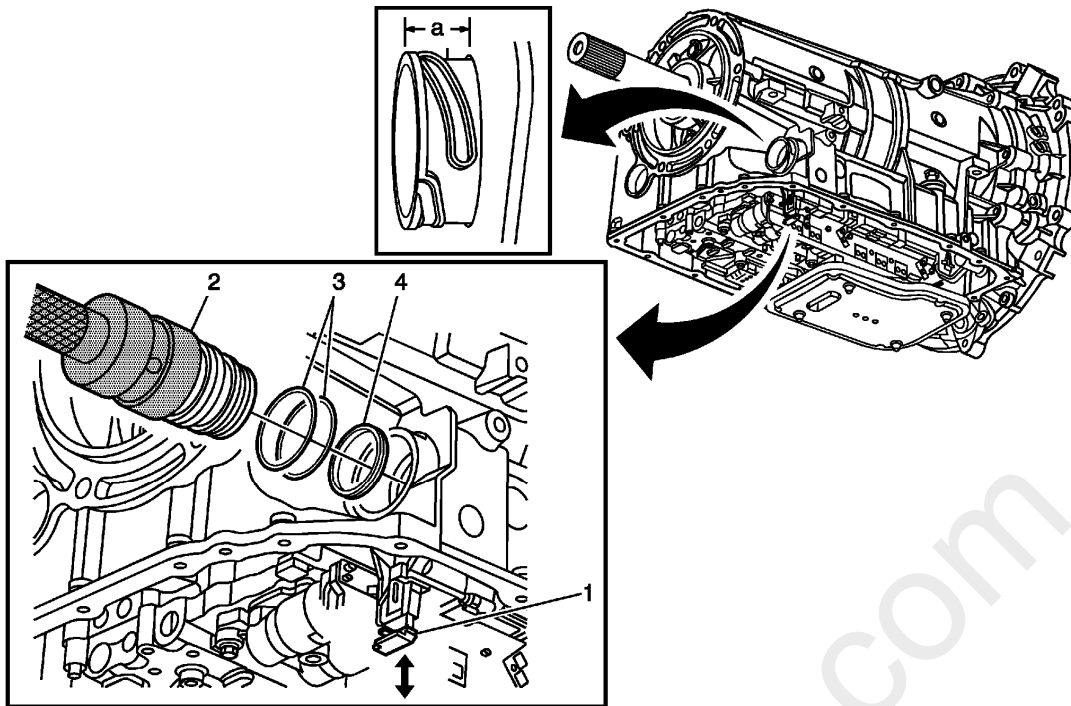


Fig. 28: Automatic Transmission Electrical Connector Passage Sleeve Component View
 Courtesy of GENERAL MOTORS COMPANY

Automatic Transmission Electrical Connector Passage Sleeve Replacement

Callout	Component Name
CAUTION: Orientate the alignment tab inside the passage sleeve with the slot in the electrical connector of the control solenoid valve assembly. Push the sleeve straight into the case bore and connector. Do NOT rotate the sleeve at any time. Ensure the sleeve is fully seated into the case. When the sleeve is properly installed, the distance from the case surface to the end of the sleeve should be 14-16 mm. Even though the correct electrical connections may still be maintained, failure to ensure proper installation of the sleeve may result in a fluid leak around the sleeve lip seal and into the sleeve cavity.	
Preliminary Procedures 1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the transmission oil pan. Refer to <u>Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement</u>. 3. Disconnect the vehicle wire harness electrical connector from the transmission electrical connector passage sleeve.	
1	Electrical Connector Slide Lock TIP: Pull down on the slide lock to remove the sleeve. Push up on the slide lock after sleeve installation.
	Electrical Connector Passage Sleeve

2	• Use the DT 47715 electrical connector passage sleeve remover/installer and J 42183 driver handle to remove and install the electrical connector passage sleeve. • The distance (a) from the case surface to the end of the sleeve should be 14-16 mm. Special Tools • DT 47715 Electrical Connector Passage Sleeve Remover/Installer • J 42183 Driver Handle
3	O-Ring Seal (Qty: 2) TIP: Use a NEW O-ring seal.
4	Lip Seal TIP: Use a NEW lip seal.

TRANSMISSION FLUID FILLER TUBE PLUG REPLACEMENT

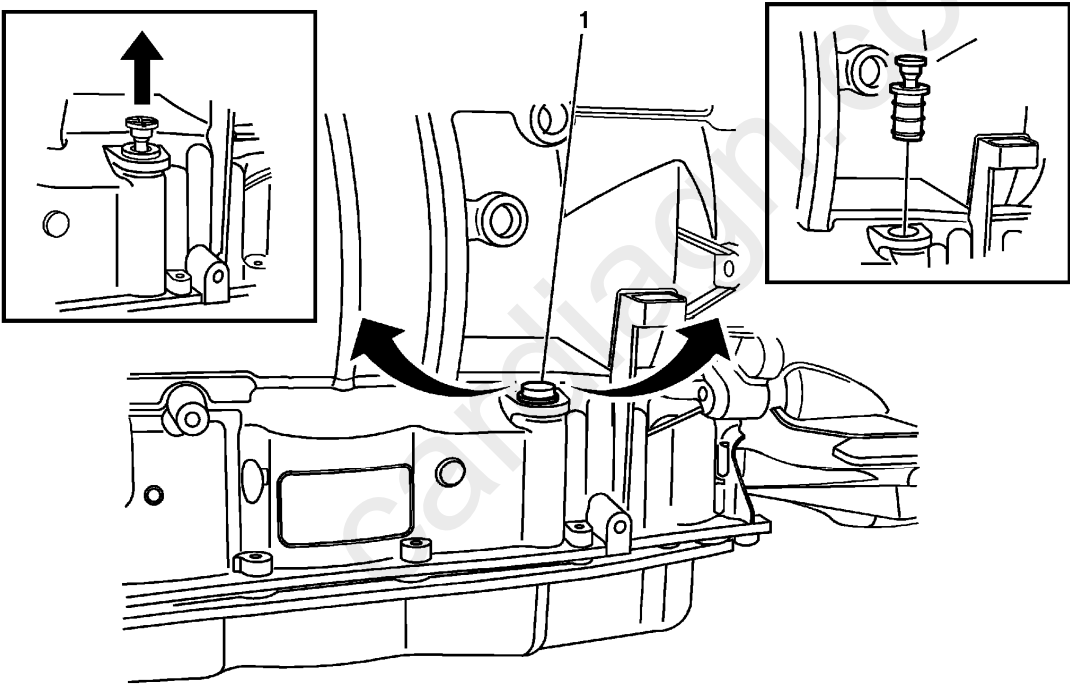


Fig. 29: Transmission Fluid Filler Tube Plug Component View
Courtesy of GENERAL MOTORS COMPANY

Transmission Fluid Filler Tube Plug Replacement

Callout	Component Name
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications (Off Vehicle) , Fastener Tightening Specifications (On Vehicle) .	
Preliminary Procedures Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .	
	Transmission Fluid Filler Tube Plug

1

1. Clean the area around the filler tube plug before removal.
2. Use a door trim tool to release the filler tube plug interlock.

AUTOMATIC TRANSMISSION FLUID, FLUID PAN AND/OR FILTER REPLACEMENT

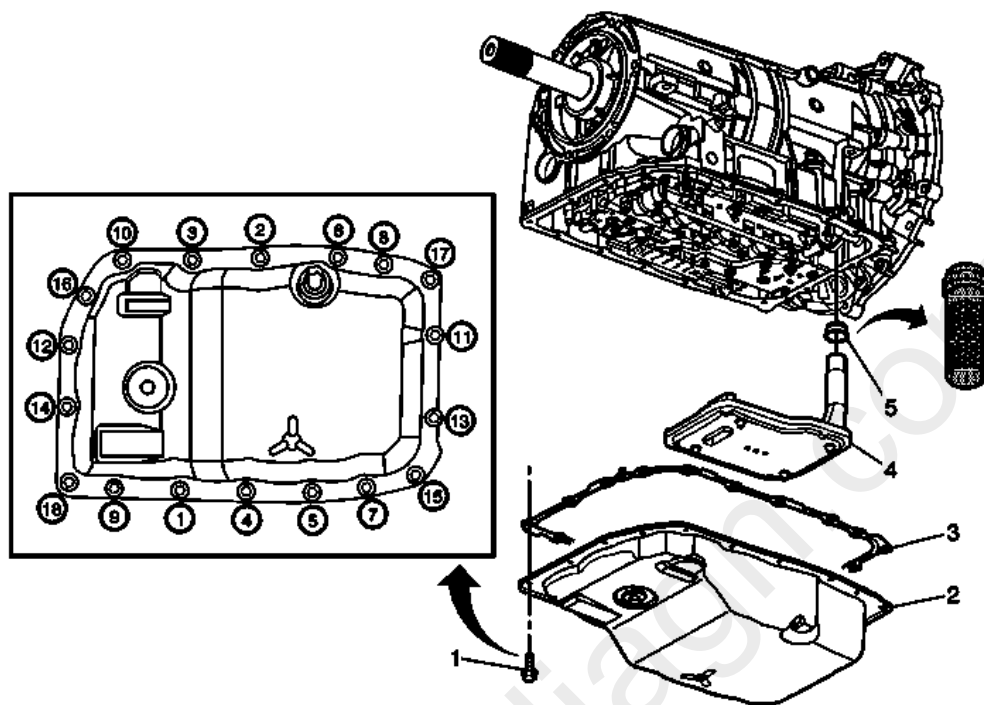


Fig. 30: Fluid, Fluid Pan and/or Filter Component View
Courtesy of GENERAL MOTORS COMPANY

Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement

Callout	Component Name
CAUTION: Use Dexron VI transmission fluid only. Failure to use the proper fluid may result in transmission internal damage.	
Preliminary Procedures 1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Place a suitable drain pan under the transmission.	
1	Transmission Fluid Pan Bolt (Qty: 18) CAUTION: Refer to <u>Fastener Caution</u> .

	TIP: Tighten the bolts in the sequence shown and tighten to 9 (80 lb in).
2	Transmission Fluid Pan Assembly • Check the condition of the draining fluid. Refer to <u>Transmission Fluid Level and Condition Check</u> . • Fill the transmission with the proper fluid. Refer to <u>Transmission General Specifications</u> , and <u>Transmission Fluid Fill Procedure</u> . • Fill the transmission with the proper amount of transmission fluid. Refer to <u>Fluid Capacity Specifications (6L45)</u> , <u>Fluid Capacity Specifications (6L90)</u> , and <u>Transmission Fluid Level and Condition Check</u> .
3	Transmission Fluid Pan Gasket TIP: The fluid pan gasket is reusable. Inspect the gasket to determine if it may be reused.
4	Fluid Filter Assembly • Pull the fluid filter assembly straight out. Do not bend or twist the filter neck. • Use a new fluid filter assembly.
5	Fluid Filter Seal Assembly CAUTION: Do not damage the case sealing surface when removing the filter seal assembly. • Use a screwdriver or snap ring pliers to remove the filter seal. • Use the DT 47848 seal installer and the J 42183 driver handle to install the filter seal. • Use a new fluid filter seal assembly. • Lubricate the filter seal with transmission fluid before installing the filter. Special Tools • DT 47848 Seal Installer • J 42183 Driver Handle

TRANSMISSION MOUNT INSPECTION

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

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

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

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

TRANSMISSION MOUNT REPLACEMENT (CTS-V)

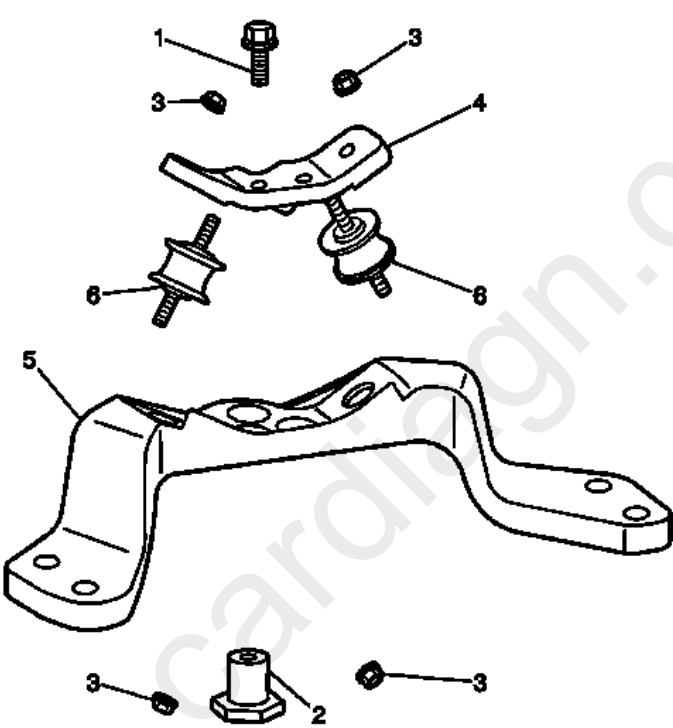


Fig. 31: Identifying Transmission Mount (CTS-V)
Courtesy of GENERAL MOTORS COMPANY

Transmission Mount Replacement (CTS-V)

Callout	Component Name
Preliminary Procedure	
Remove the transmission support. Refer to <u>Transmission Support Replacement (Manual CTS-V)</u> , <u>Transmission Support Replacement (Automatic CTS-V)</u> , <u>Transmission Support Replacement (Automatic RWD except CTS-V)</u> , <u>Transmission Support Replacement (Manual except CTS-V)</u> , <u>Transmission Support Replacement (Automatic AWD)</u> .	
	Transmission Mount Travel Restrictor Bolt

1	CAUTION: Refer to <u>Fastener Caution</u> . Tighten 90 N.m (66 lb ft)
2	Transmission Mount Travel Restrictor
3	Transmission Mount Nut (Qty: 4) Tighten 58 N.m (43 lb ft)
4	Transmission Mount Adaptor
5	Transmission Support
6	Transmission Mount (Qty: 2)

TRANSMISSION MOUNT REPLACEMENT (AUTOMATIC AWD)

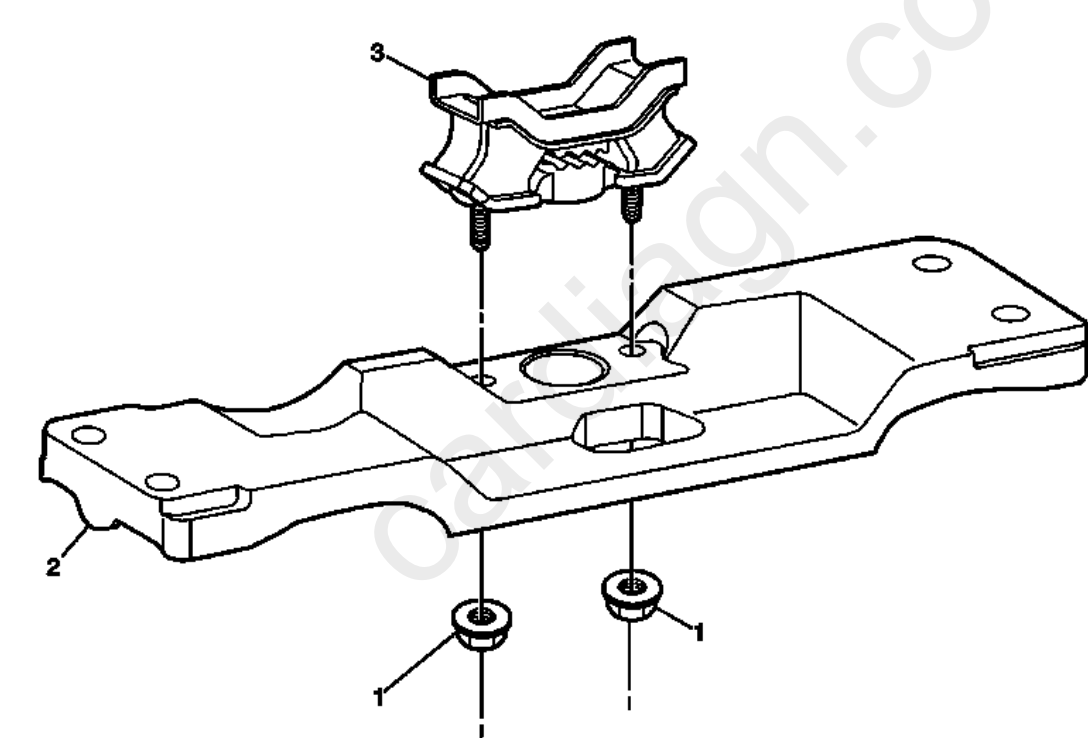


Fig. 32: Transmission Mount (Automatic AWD)
Courtesy of GENERAL MOTORS COMPANY

Transmission Mount Replacement (Automatic AWD)

Callout	Component Name
Preliminary Procedures Remove the transmission support. Refer to , <u>Transmission Support Replacement (Manual except CTS-V)</u> , <u>Transmission Support Replacement (Automatic AWD)</u> .	

1	Transmission Mount Nut (Qty: 2)
	CAUTION: Refer to <u>Fastener Caution</u> .
	Tighten 70 N.m (50 lb ft)
2	Transmission Support
3	Transmission Mount (Qty: 1)

TRANSMISSION MOUNT REPLACEMENT (EXCEPT AWD AND CTS-V)

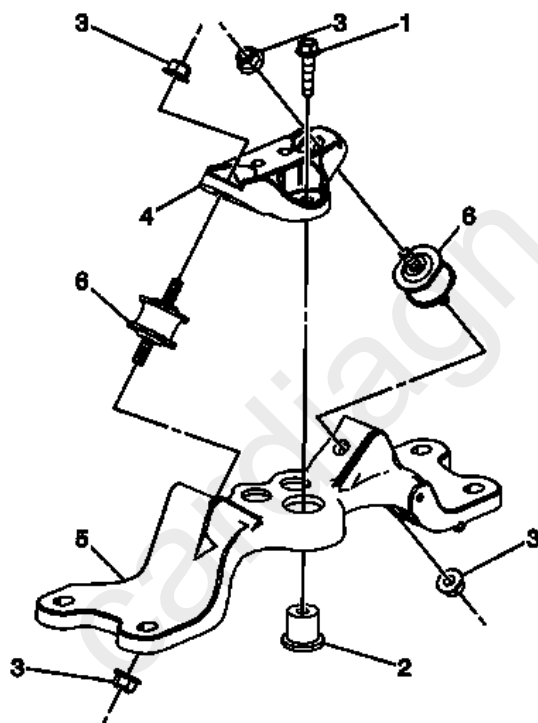


Fig. 33: Transmission Mount Replacement
Courtesy of GENERAL MOTORS COMPANY

Transmission Mount Replacement (Except AWD and CTS-V)

Callout	Component Name
Preliminary Procedures	
Remove the transmission support. Refer to <u>Transmission Support Replacement (Manual CTS-V)</u> , <u>Transmission Support Replacement (Automatic CTS-V)</u> , <u>Transmission Support Replacement (Automatic RWD except CTS-V)</u> , <u>Transmission Support Replacement (Manual except CTS-V)</u> .	
	Transmission Mount Travel Restrictor Bolt

1	CAUTION: Refer to <u>Fastener Caution</u> . Tighten 90 N.m (66 lb ft)
2	Transmission Mount Travel Restrictor
3	Transmission Mount Nut (Qty: 4) Tighten 58 N.m (43 lb ft)
4	Transmission Mount Adaptor
5	Transmission Support
6	Transmission Mount (Qty: 2)

CASE EXTENSION AND GASKET REPLACEMENT (6L45)

Special Tools

J 45012 Holding Fixture

Removal Procedure

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Remove the exhaust system. Refer to Exhaust System Replacement (LSA-Coupe) , Exhaust System Replacement (LSA-Sedan/Wagon) , Exhaust System Replacement (Single Exhaust) , Exhaust System Replacement (LFX/LFW-Coupe) , Exhaust System Replacement (LFX/LFW-Sedan/Wagon) .
3. Remove the drive shaft. Refer to Rear Propeller Shaft Replacement (RPO LSA) , Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO) , Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6) .
4. Support the transmission with a suitable jack.
5. Remove the transmission mount assembly. Refer to Transmission Mount Replacement (Except AWD and CTS-V), Transmission Mount Replacement (Automatic AWD), Transmission Mount Replacement (CTS-V).

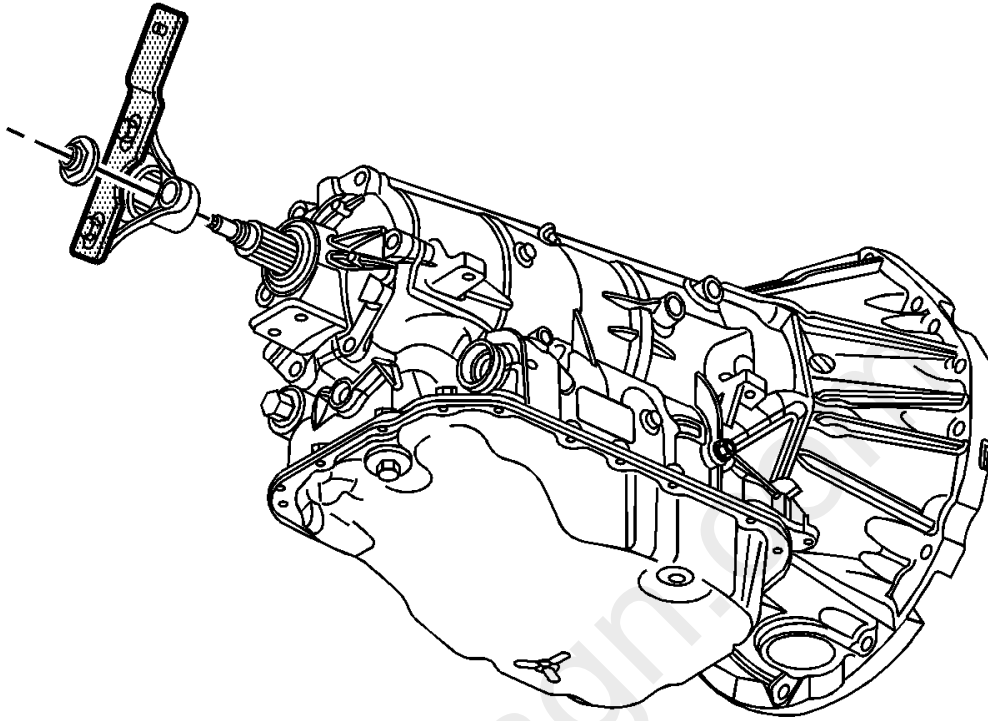


Fig. 34: View Propeller Shaft Flange Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

6. Install the J 45012 propeller shaft flange holding fixture.

CAUTION: Do not reuse the flange nut. Reusing the flange nut may cause damage to the transmission.

7. Remove and discard the propeller shaft flange nut.
8. Remove the propeller shaft flange.

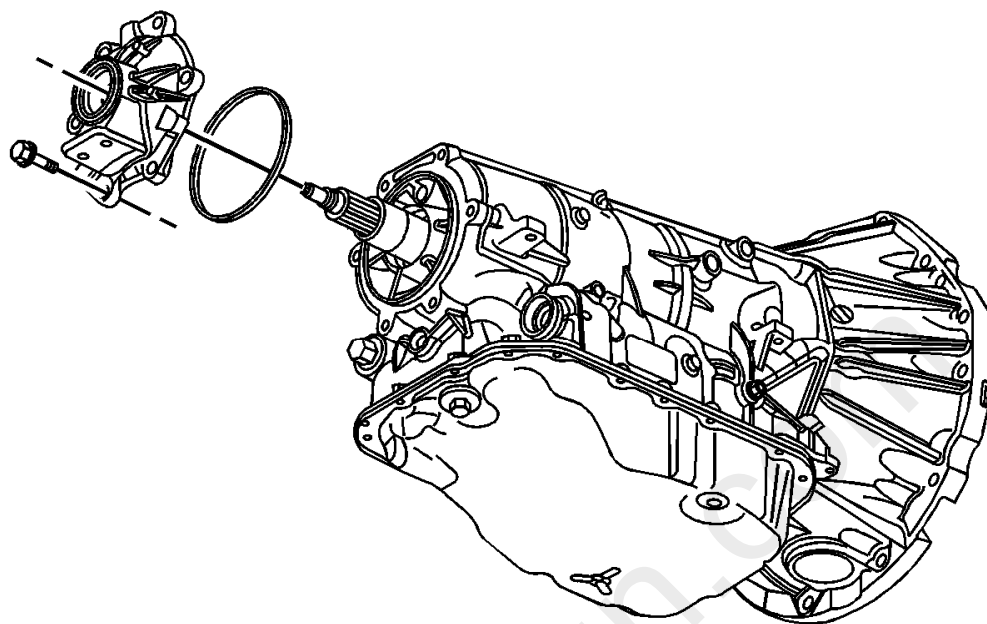


Fig. 35: View Of Case Extension Housing Seal
Courtesy of GENERAL MOTORS COMPANY

9. Remove the case extension housing bolts.
10. Remove the case extension housing.
11. Remove the case extension housing seal.

Installation Procedure

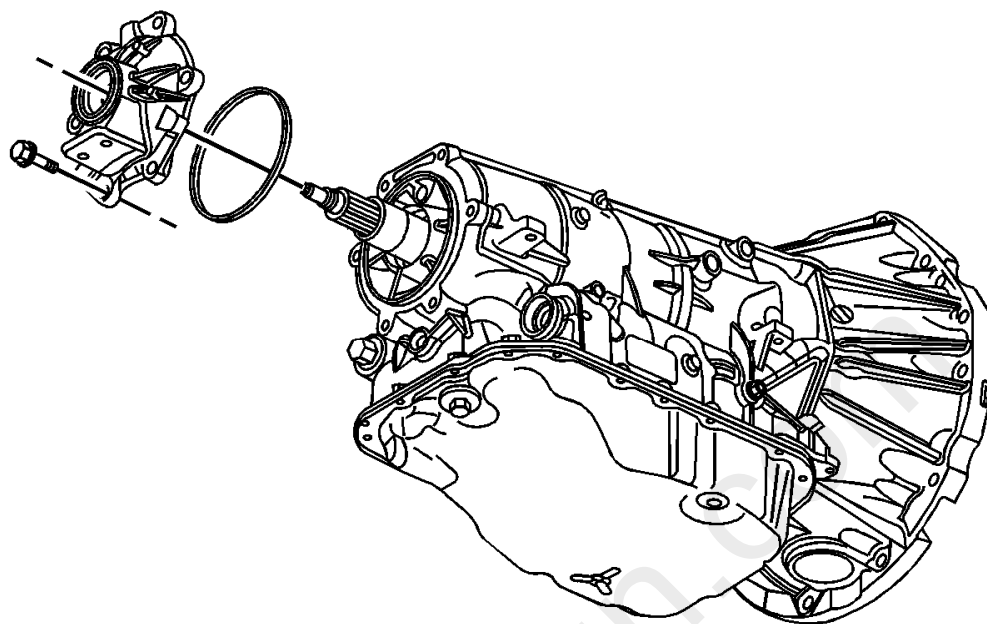


Fig. 36: View Of Case Extension Housing Seal
Courtesy of GENERAL MOTORS COMPANY

1. Install the case extension housing seal.
2. Install the case extension housing.
3. Install by hand the case extension housing bolts.

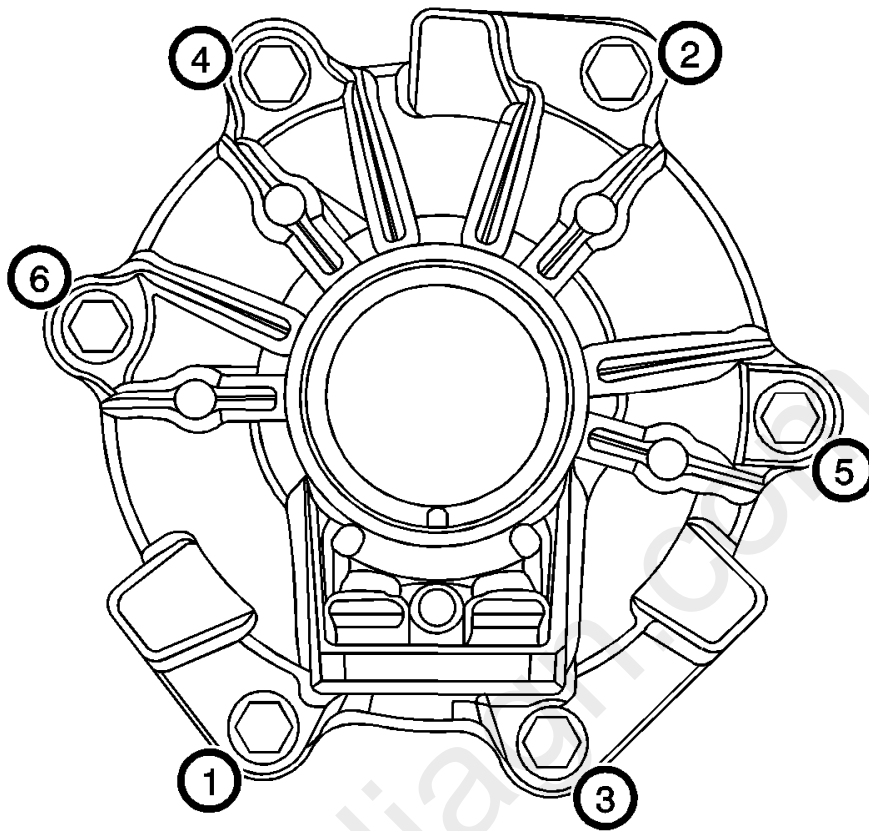


Fig. 37: Case Extension Identifying Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

4. Secure the case extension housing bolts in the specified sequence and tighten to 50 (37 lb ft).

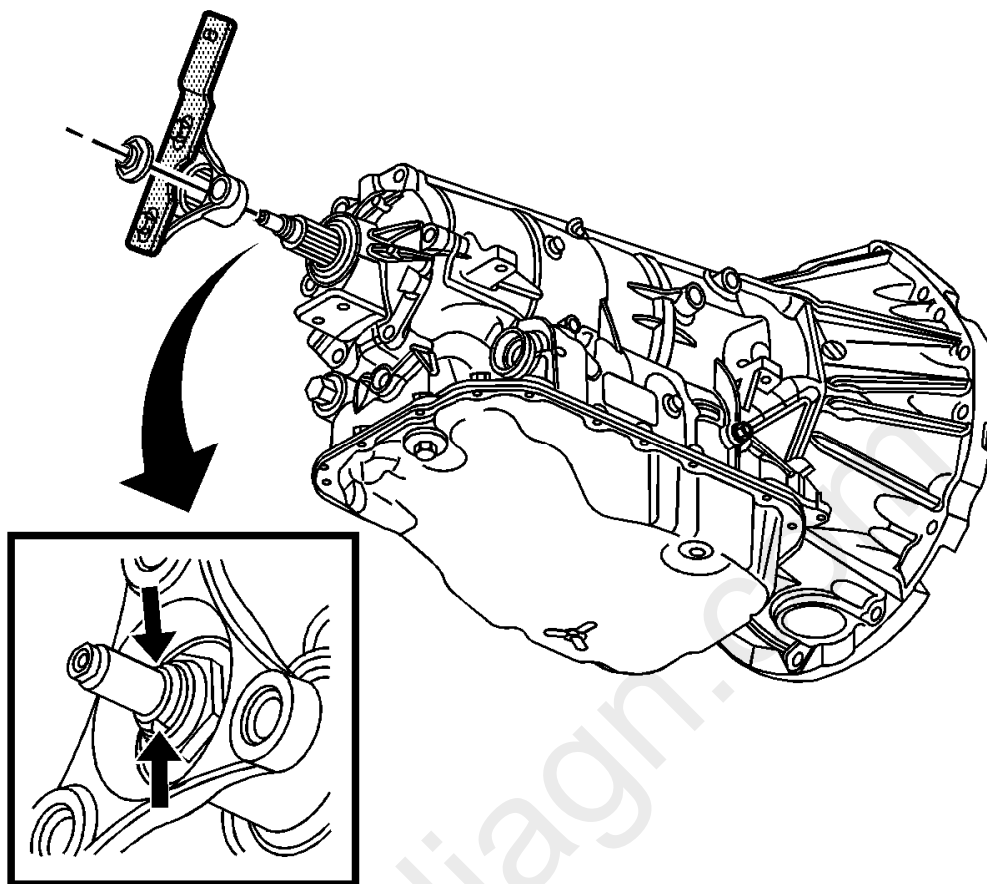


Fig. 38: View Of Propeller Shaft Flange Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

5. Install the prop shaft flange.

CAUTION: Stake the flange nut onto the output shaft. Use the two staking grooves on the shaft to locate the staking points. Failure to stake the flange nut may result in damage to the transmission.

NOTE: Use a NEW propeller shaft flange nut.

6. Install the NEW propeller shaft flange nut and tighten to 105 (77 lb ft).
7. Remove the J 45012 propeller shaft flange holding fixture.
8. Install the transmission mount assembly. Refer to Transmission Mount Replacement (Except AWD and CTS-V), Transmission Mount Replacement (Automatic AWD), Transmission Mount Replacement (CTS-V).
9. Remove the transmission jack.

10. Install the drive shaft. Refer to **Rear Propeller Shaft Replacement (RPO LSA)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)** .
11. Install the exhaust system. Refer to **Exhaust System Replacement (LSA-Coupe)** , **Exhaust System Replacement (LSA-Sedan/Wagon)** , **Exhaust System Replacement (Single Exhaust)** , **Exhaust System Replacement (LFX/LFW-Coupe)** , **Exhaust System Replacement (LFX/LFW-Sedan/Wagon)** .
12. Lower the vehicle.

PROPELLER SHAFT TRANSMISSION FLANGE REPLACEMENT

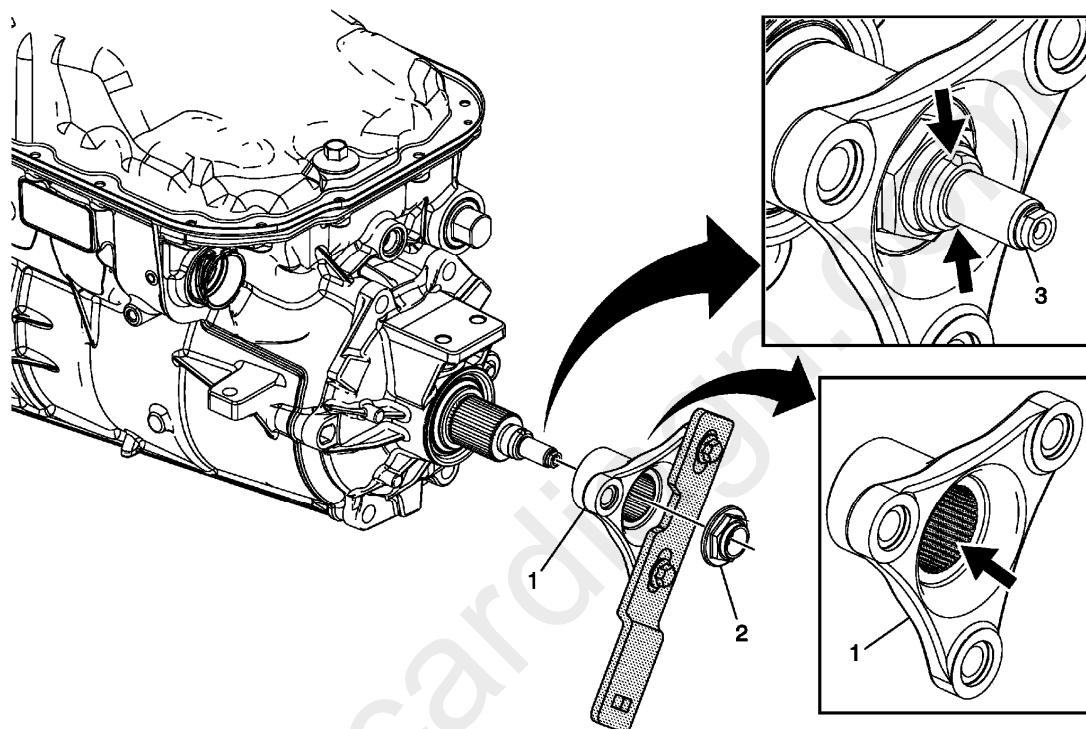


Fig. 39: Propeller Shaft Transmission Flange (6L45/50)
Courtesy of GENERAL MOTORS COMPANY

Propeller Shaft Transmission Flange Replacement

Callout	Component Name
Preliminary Procedure	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the front propeller shaft. Refer to <u>Rear Propeller Shaft Replacement (RPO LSA)</u> , <u>Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)</u> , <u>Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)</u> .	
	Prop Shaft Trans Flange
	Procedure

1	1. The output shaft splines must be thoroughly clean and dry before installing the flange. NOTE: • When repairing low speed and garage shift clunk - except for moving the vehicle from the hoist, do not operate the vehicle above 5 mph at light throttle for 24 hours to allow the adhesive to cure. • If the replacement flange contains a pre-applied adhesive patch, then liquid adhesive is not required and the 24 hour cure time is not necessary. 2. Apply GM P/N 89021297 (Canadian P/N 10953488) across the width of the flange splines, install. However, if the replacement flange contains a pre-applied adhesive patch, then liquid adhesive is not required and the 24 hour cure time is not necessary. 3. Sufficient application of adhesive to every tooth on the flange will leave excess adhesive on the output shaft after installation. If no excess is observed, reapply adhesive.
2	Front Propeller Shaft Flange Nut CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Discard the front propeller shaft flange nut. Install a NEW nut during installation. 2. The output shaft nut threads must be thoroughly clean and dry before installing the nut. 3. Apply GM P/N 89021297 (Canadian P/N 10953488) across the width of the nut threads, prior to tightening and staking. However, if the replacement nut contains a pre-applied adhesive patch, then liquid adhesive is not required. Tighten 55 (41 lb ft) Special Tool J 45012 Holding Fixture For equivalent regional tools, refer to <u>Special Tools</u> .
3	Output Shaft CAUTION: Stake the flange nut onto the output shaft. Use the two staking grooves on the shaft to locate the staking points. Failure to stake the flange nut may result in damage to the transmission.

TRANSMISSION OUTPUT SHAFT SEAL REPLACEMENT (ALL WHEEL DRIVE)

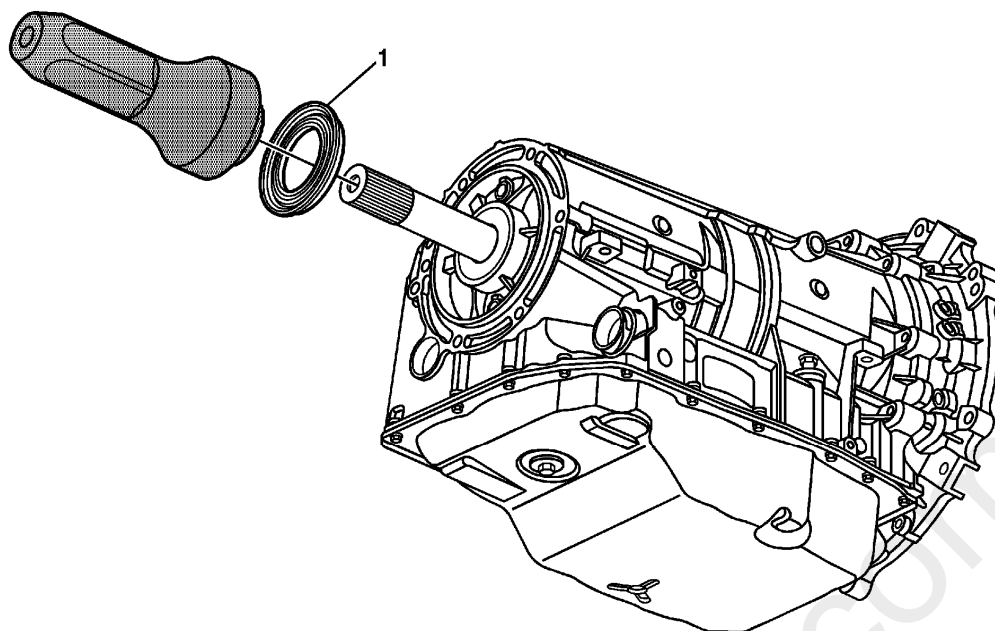


Fig. 40: Transmission Output Shaft Seal Replacement
 Courtesy of GENERAL MOTORS COMPANY

Transmission Output Shaft Seal Replacement (All Wheel Drive)

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the exhaust system. Refer to <u>Exhaust System Replacement (LSA-Coupe)</u> , <u>Exhaust System Replacement (LSA-Sedan/Wagon)</u> , <u>Exhaust System Replacement (Single Exhaust)</u> , <u>Exhaust System Replacement (LFX/LFW-Coupe)</u> , <u>Exhaust System Replacement (LFX/LFW-Sedan/Wagon)</u> . 3. Remove the drive shaft. Refer to <u>Rear Propeller Shaft Replacement (RPO LSA)</u> , <u>Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)</u> , <u>Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)</u> . 4. Support the transmission with a suitable jack. 5. Remove the transmission mount assembly. Refer to <u>Transmission Mount Replacement (Automatic AWD)</u>. 6. Remove the transfer case. Refer to <u>Transfer Case Assembly Replacement</u> .	
	Output Shaft Seal
	Procedure 1. Use the J-6125-B hammer and J-36825-A remover to remove the seal. Use care in order to avoid scraping or gouging the output shaft bushing.

2. Lubricate the seal with clean transmission fluid.
3. Use the **DT-50648** installer to install the seal.

Special Tools

- | | |
|---|--|
| 1 | <ul style="list-style-type: none"> • DT-50648 Case Seal Installer • J-6125-B Slide Hammer with Adaptor • J-36825-A Output Shaft Oil Seal Remover |
|---|--|

For equivalent regional tools, refer to **Special Tools** .

TRANSMISSION OUTPUT SHAFT SEAL REPLACEMENT (REAR WHEEL DRIVE)

Special Tools

- **J 36183** Seal Installer
- **J 45000** Seal Remover
- **J 45012** Holding Fixture

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the exhaust system. Refer to **Exhaust System Replacement (LSA-Coupe)** , **Exhaust System Replacement (LSA-Sedan/Wagon)** , **Exhaust System Replacement (Single Exhaust)** , **Exhaust System Replacement (LFX/LFW-Coupe)** , **Exhaust System Replacement (LFX/LFW-Sedan/Wagon)** .
3. Remove the drive shaft. Refer to **Rear Propeller Shaft Replacement (RPO LSA)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)** .
4. Support the transmission with a suitable jack.
5. Remove the transmission mount assembly. Refer to **Transmission Mount Replacement (Except AWD and CTS-V)**, **Transmission Mount Replacement (CTS-V)**.

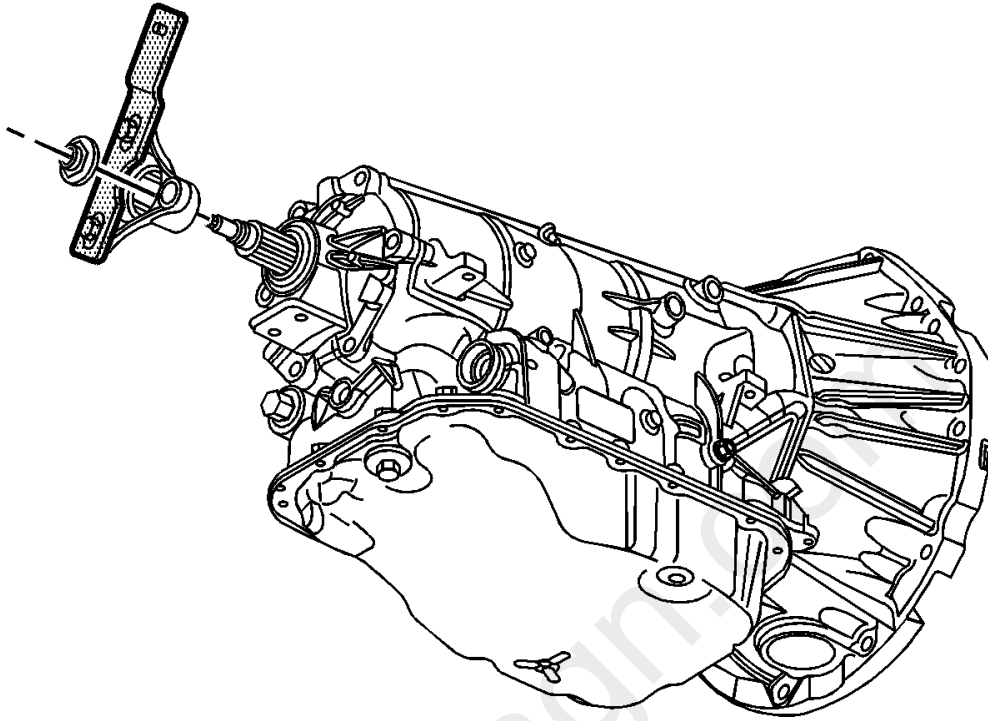


Fig. 41: View Of Propeller Shaft Flange Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

6. Install the J 45012 propeller shaft flange holding fixture using the propeller shaft bolts.

CAUTION: Do not reuse the flange nut. Reusing the flange nut may cause damage to the transmission.

7. Remove and discard the propeller shaft flange nut.
8. Remove the propeller shaft flange.

NOTE: Be careful not to scrape or gouge the case extension housing while removing the output shaft seal.

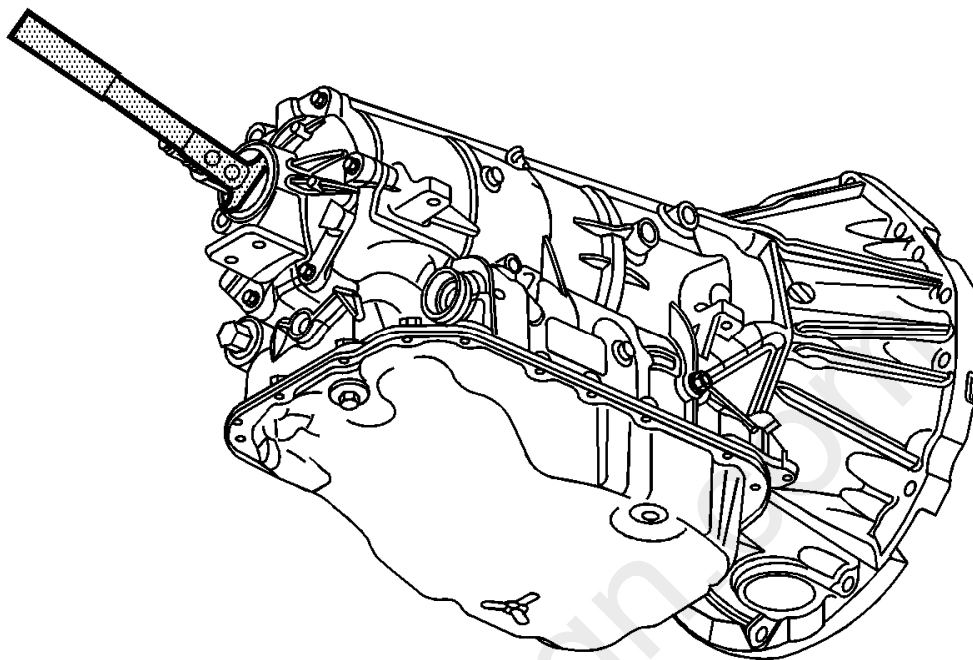


Fig. 42: View Of J 45000
Courtesy of GENERAL MOTORS COMPANY

9. Use the **J 45000** seal remover to remove the output shaft seal from the case extension housing.

Installation Procedure

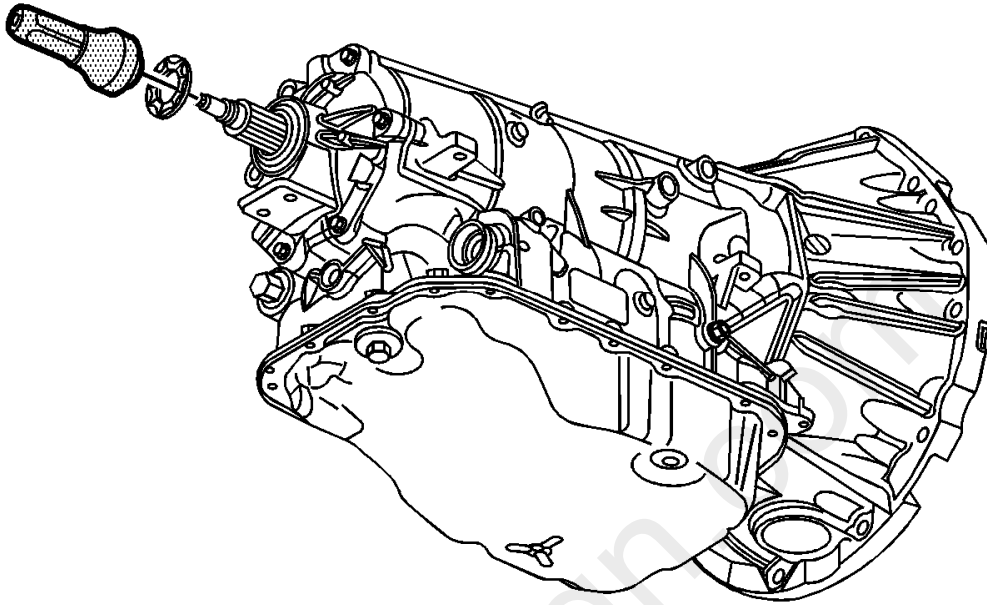


Fig. 43: View Of J 37212
Courtesy of GENERAL MOTORS COMPANY

1. Lubricate the new seal with clean transmission fluid.
2. Use the **J 36183** seal installer to install the output shaft seal to the case extension housing.

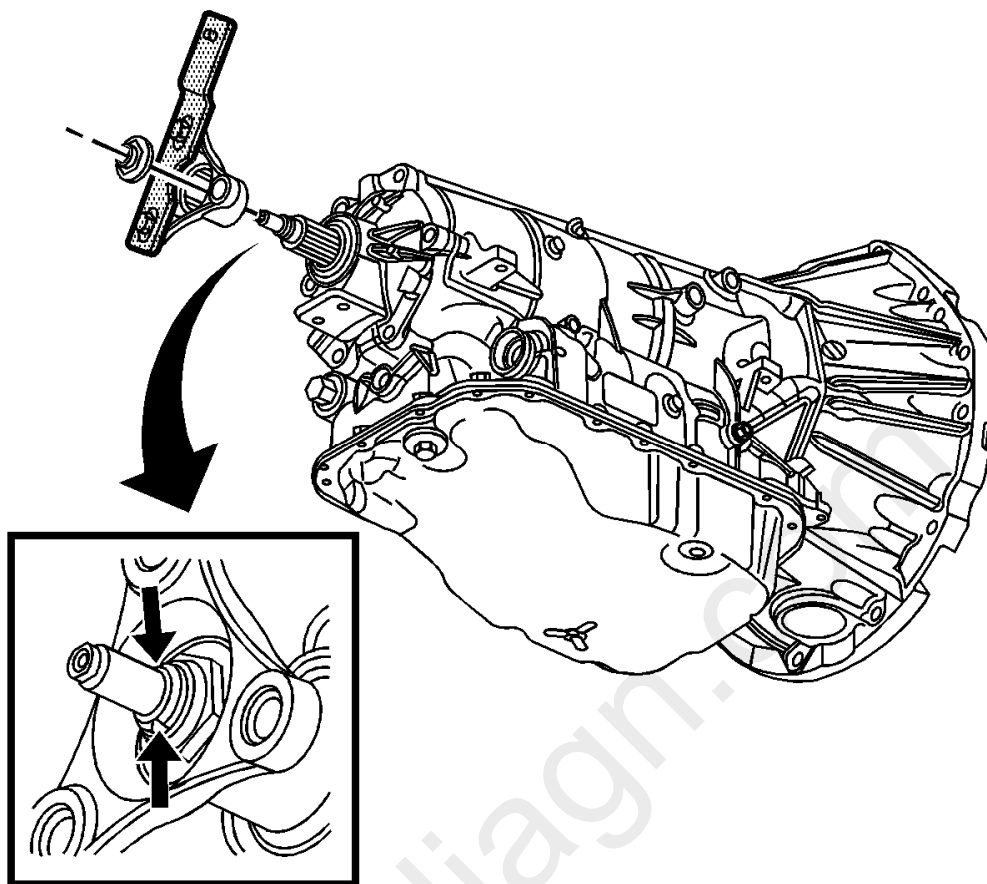


Fig. 44: View Of Propeller Shaft Flange Holding Fixture
Courtesy of GENERAL MOTORS COMPANY

3. Install the prop shaft flange.

CAUTION: Stake the flange nut onto the output shaft. Use the two staking grooves on the shaft to locate the staking points. Failure to stake the flange nut may result in damage to the transmission.

CAUTION: Refer to Fastener Caution .

NOTE: Use a NEW propeller shaft flange nut.

4. Install the NEW propeller shaft flange nut and tighten to 105 (77 lb ft).
5. Remove the **J 45012** propeller shaft flange holding fixture.
6. Install the transmission mount assembly. Refer to Transmission Mount Replacement (Except AWD

and CTS-V), Transmission Mount Replacement (CTS-V).

7. Remove the transmission jack.
8. Install the drive shaft. Refer to **Rear Propeller Shaft Replacement (RPO LSA)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)** .
9. Install the exhaust system. Refer to **Exhaust System Replacement (LSA-Coupe)** , **Exhaust System Replacement (LSA-Sedan/Wagon)** , **Exhaust System Replacement (Single Exhaust)** , **Exhaust System Replacement (LFX/LFW-Coupe)** , **Exhaust System Replacement (LFX/LFW-Sedan/Wagon)** .
10. Lower the vehicle.

MANUAL SHIFT SHAFT AND SEAL REPLACEMENT

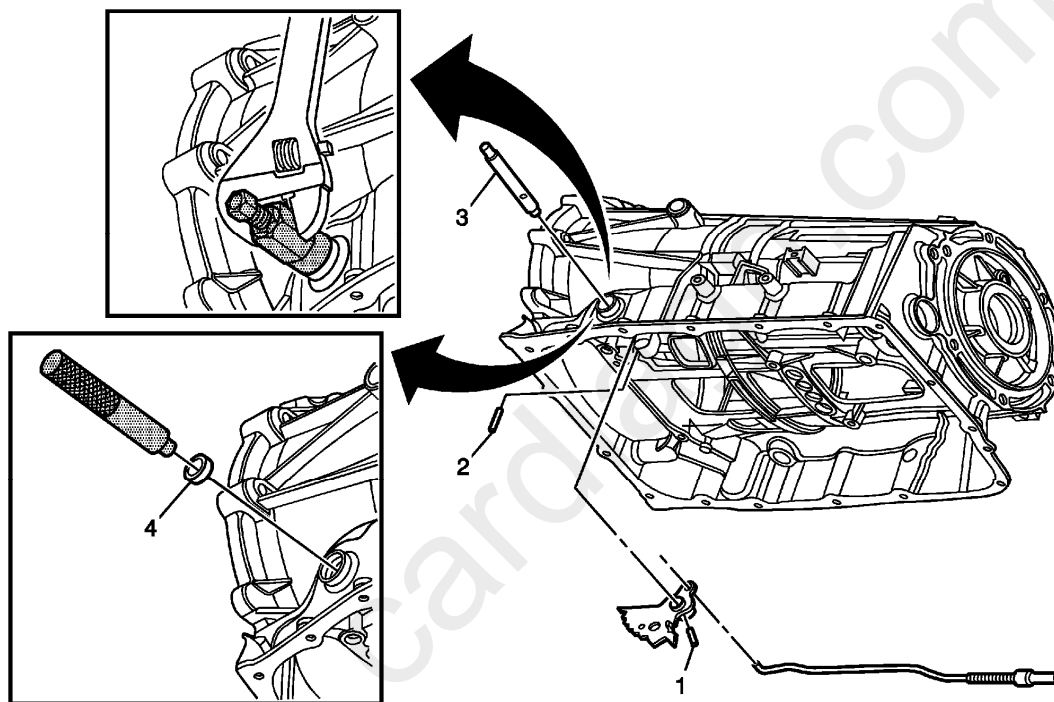


Fig. 45: Manual Shift Shaft and Seal Component View

Courtesy of GENERAL MOTORS COMPANY

Manual Shift Shaft and Seal Replacement

Callout	Component Name
Preliminary Procedures	
1.	Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .
2.	Remove the transmission fluid pan. Refer to <u>Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement</u> .
3.	Remove the manual shift detent assembly roller. Refer to <u>Control Valve Lower Body and Upper Body Replacement</u> .

1	Manual Shaft Detent Lever Hub Pin Procedure 1. Discard the pin. Replace with a NEW pin. 2. "Walk" the pin out using side cutters.
2	Manual Shift Shaft Pin Procedure 1. Discard the pin. Replace with a NEW pin. 2. "Walk" the pin out using side cutters.
3	Manual Shift Shaft
4	Manual Shift Shaft Seal Procedure 1. The manual shaft must be removed to replace the manual shaft seal. 2. Use the J 45201 Cooler Line Seal Remover to remove the seal from the transmission case. 3. Use the DT 47770 Seal Installer to install the seal into the transmission case. Special Tools • DT 47770 Seal Installer • J 45201 Cooler Line Seal Remover

MANUAL SHIFT SHAFT POSITION SWITCH REPLACEMENT

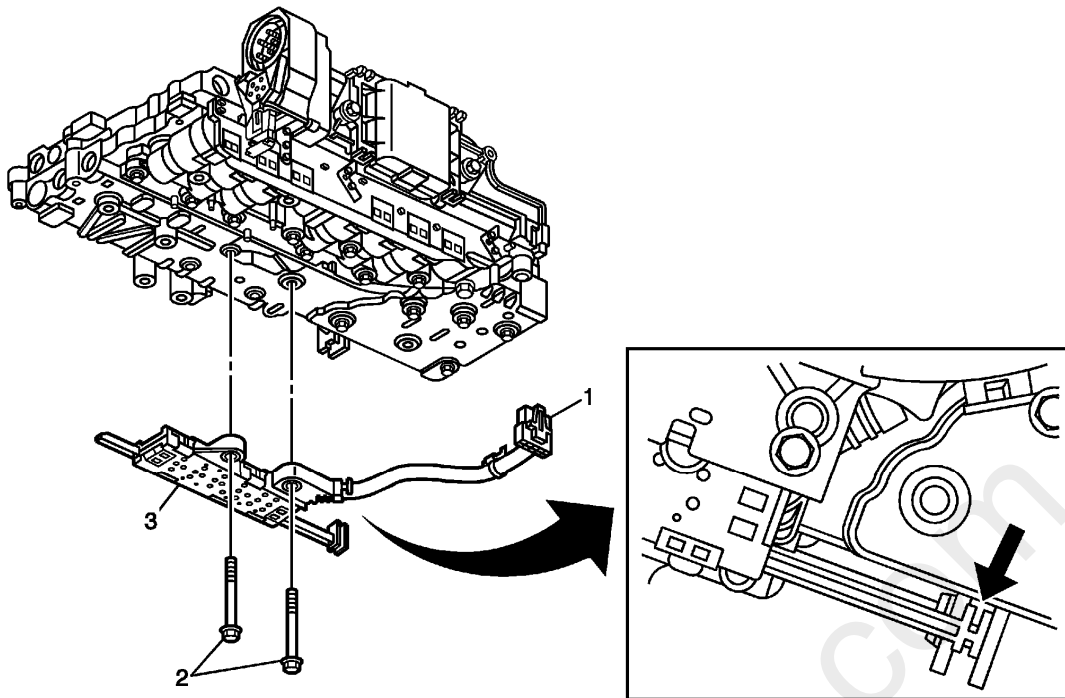


Fig. 46: Manual Shift Shaft Position Switch Component View
 Courtesy of GENERAL MOTORS COMPANY

Manual Shift Shaft Position Switch Replacement

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

	Tighten 12 N.m (106 lb in)
3	Manual Shift Shaft Position Switch Assembly Procedure Align the switch activator slide with the manual valve link.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY REPLACEMENT

Removal Procedure

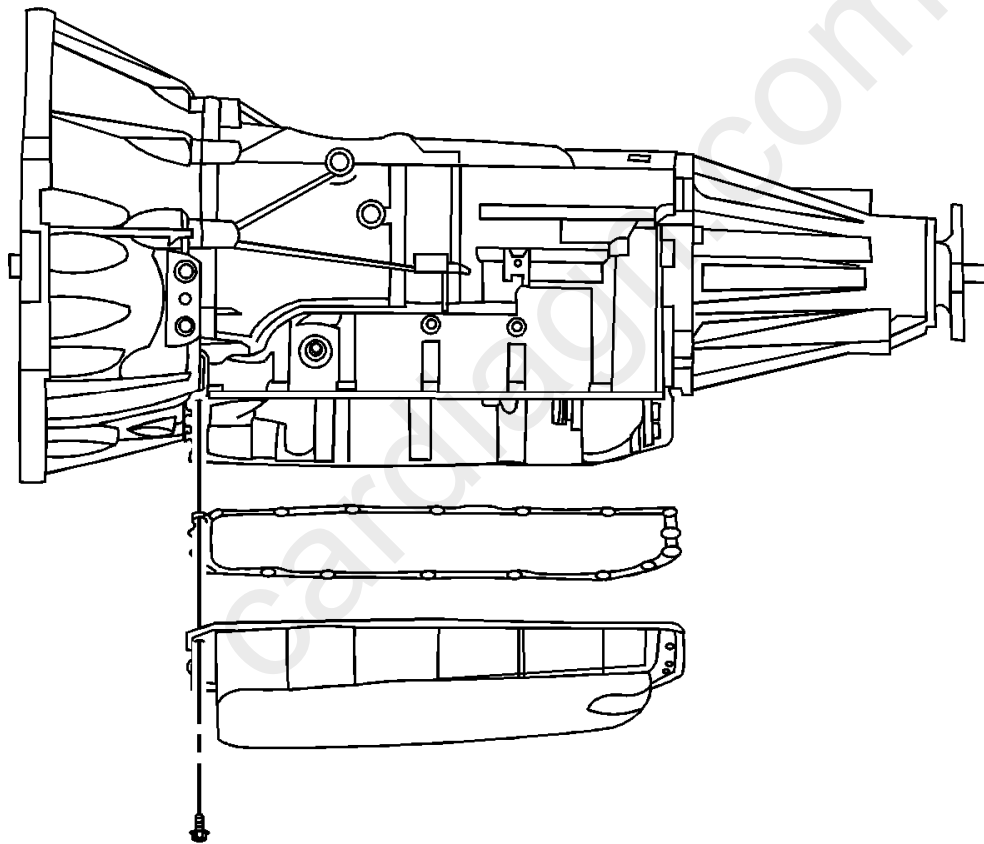


Fig. 47: View Of Transmission Oil Pan And Filter
Courtesy of GENERAL MOTORS COMPANY

NOTE: The valve body must be removed from the transmission to replace the control solenoid valve and transmission control module assembly.

1. Remove the transmission oil pan and filter. Refer to Automatic Transmission Fluid, Fluid Pan and/or

Filter Replacement.

2. Remove the electrical connector passage sleeve. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement.**

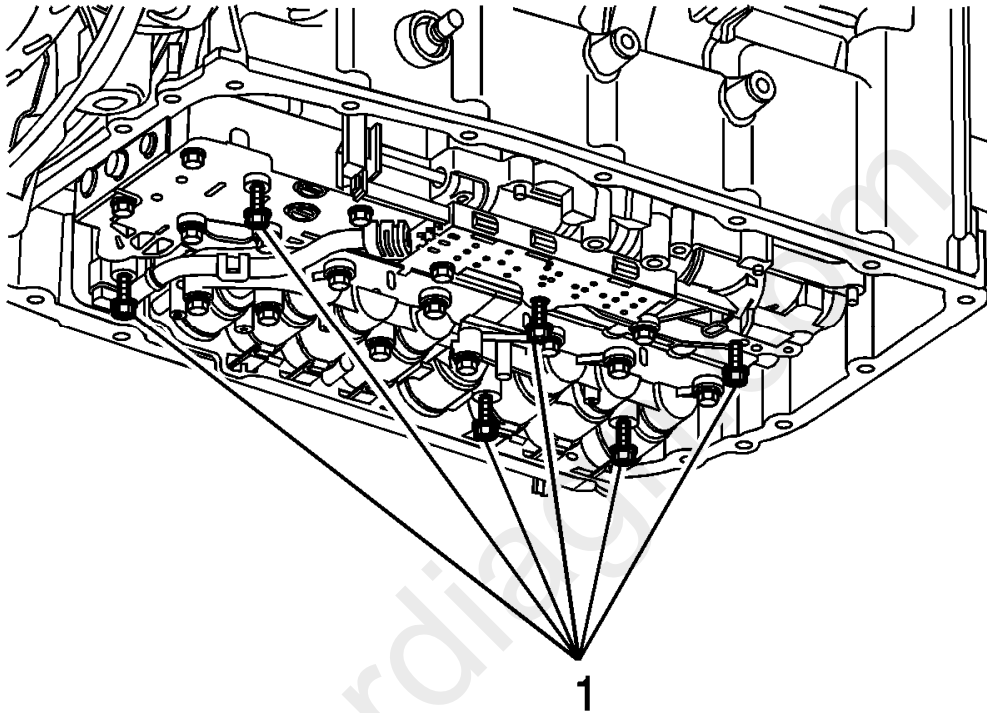


Fig. 48: View Of Valve Body Bolts
Courtesy of GENERAL MOTORS COMPANY

3. Remove the valve body bolts (1).

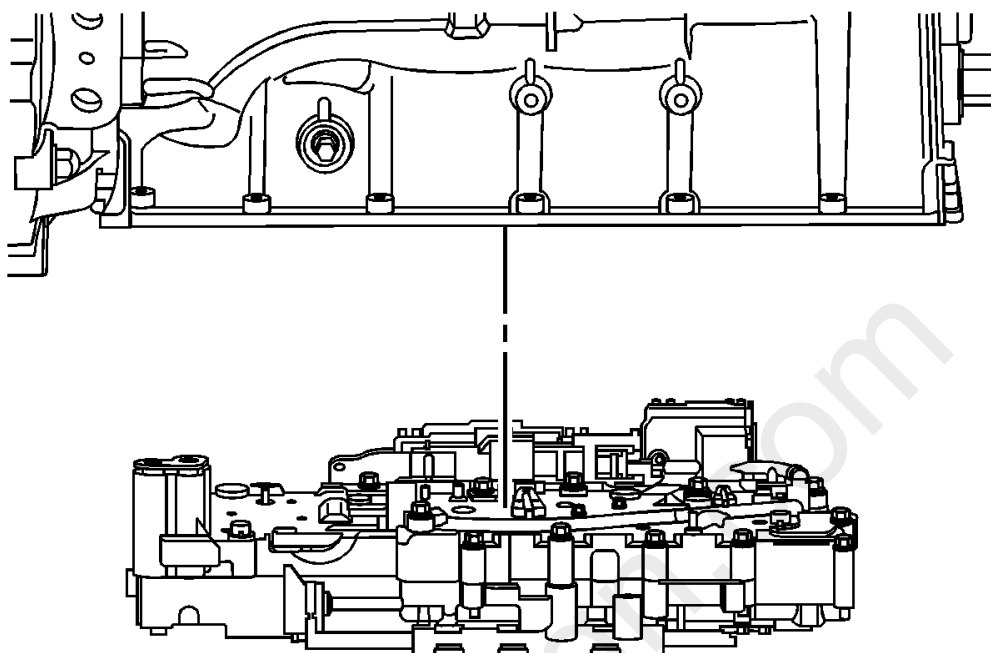


Fig. 49: Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

4. Remove the upper and lower control valve body assembly.

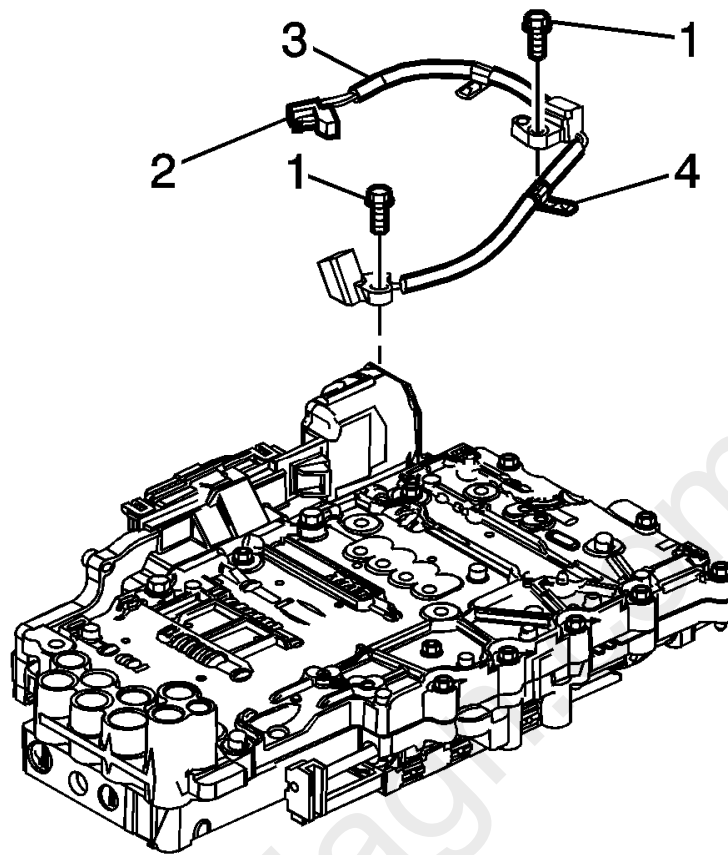


Fig. 50: View Of Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the speed sensor electrical connector (2) from the control solenoid valve assembly.
6. Turn the control valve body assembly over.

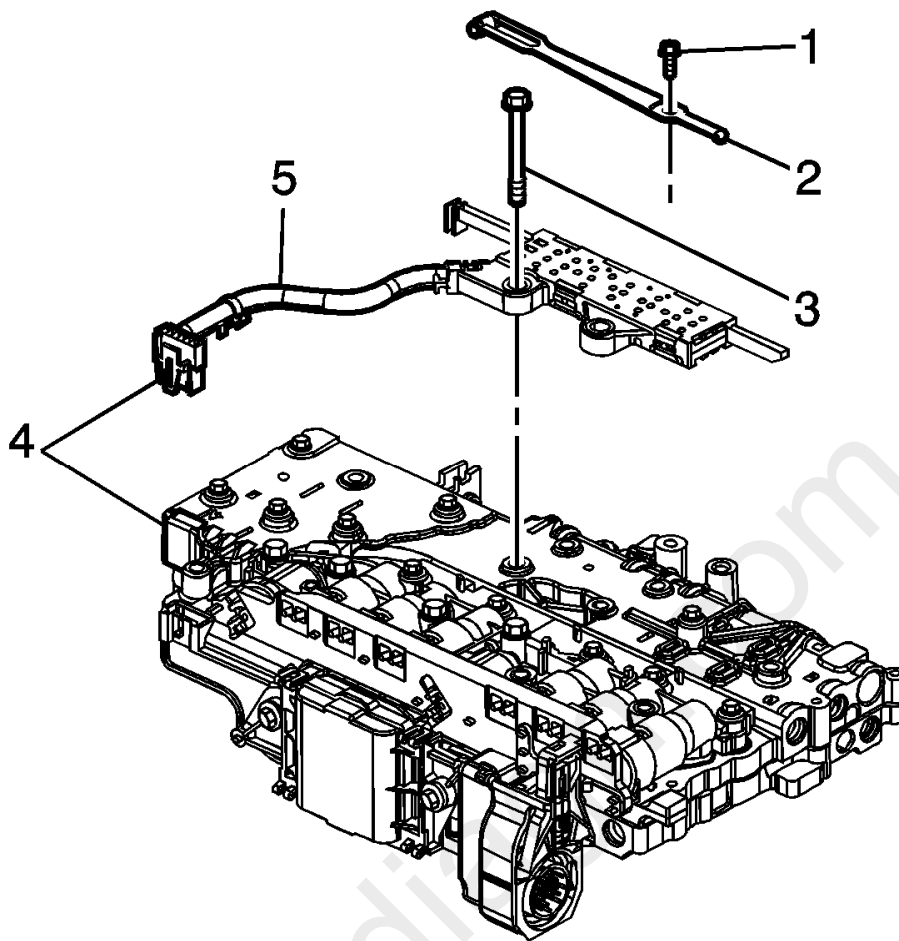


Fig. 51: Manual Shift Shaft Position Switch Connector
Courtesy of GENERAL MOTORS COMPANY

NOTE: Release the connector lock before disconnecting.

7. Disconnect the manual shift shaft position switch connector (4) from the control solenoid valve assembly.
8. Remove the bolt (3) and remove the manual shift shaft position switch assembly.

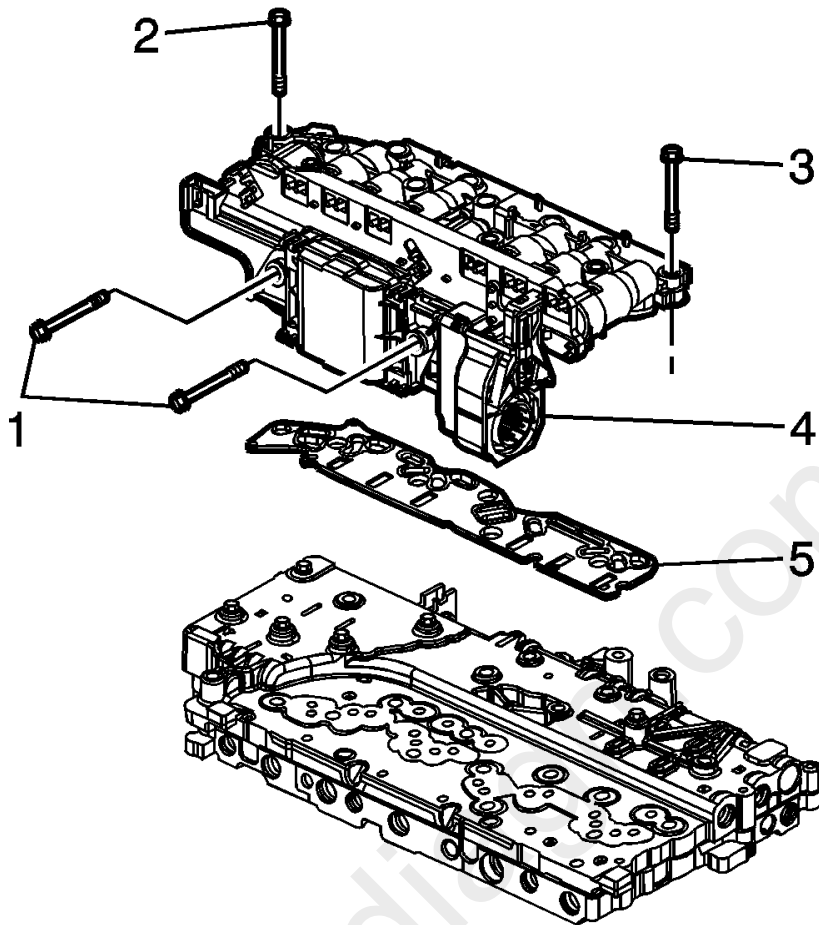


Fig. 52: View Of Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

9. Remove the 2 bolts (1) from the "heat sink" side of the control solenoid valve assembly.

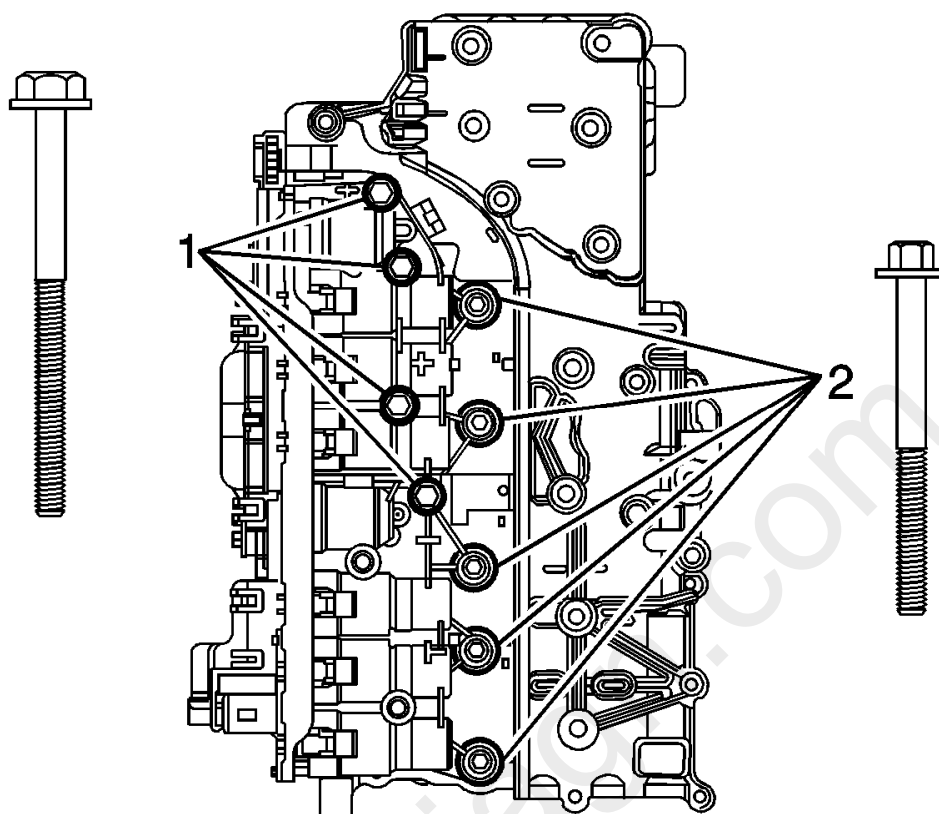


Fig. 53: View Of Bolts

Courtesy of GENERAL MOTORS COMPANY

10. Remove the 5 bolts (2) and the 4 bolts (1) securing the control solenoid valve assembly to the control valve body assembly.

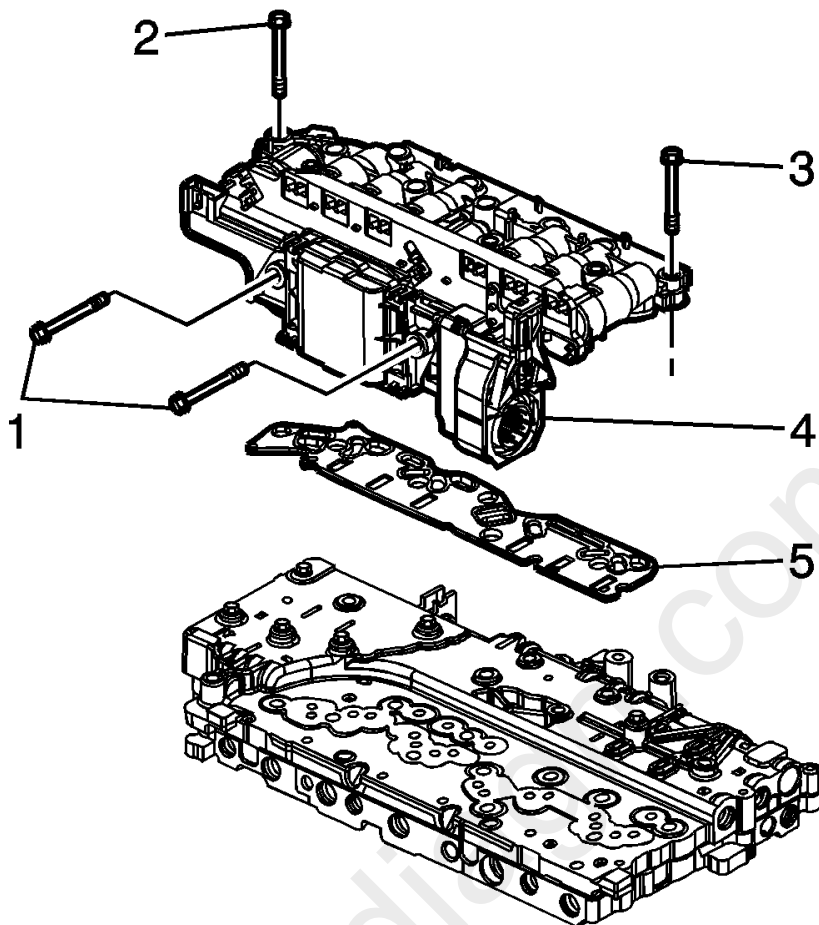


Fig. 54: View Of Control Valve Body Assembly
Courtesy of GENERAL MOTORS COMPANY

11. Remove the control valve body assembly.

CAUTION: Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination.

12. Carefully remove and discard the filter plate assembly (5).

Installation Procedure

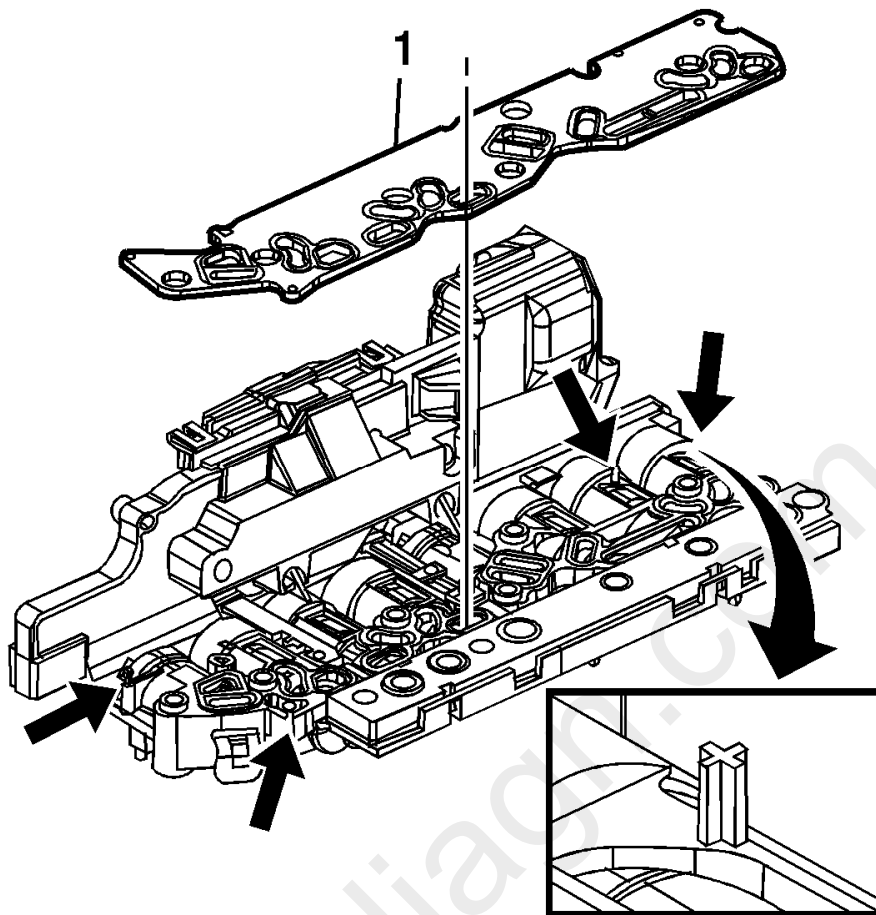


Fig. 55: View Of Filter Plate Assembly
Courtesy of GENERAL MOTORS COMPANY

NOTE: Inspect the 4 filter plate retaining tabs on the control solenoid valve assembly. A broken or missing tab may not adequately secure the filter plate to the control solenoid valve assembly.

1. Install a NEW filter plate assembly (1).

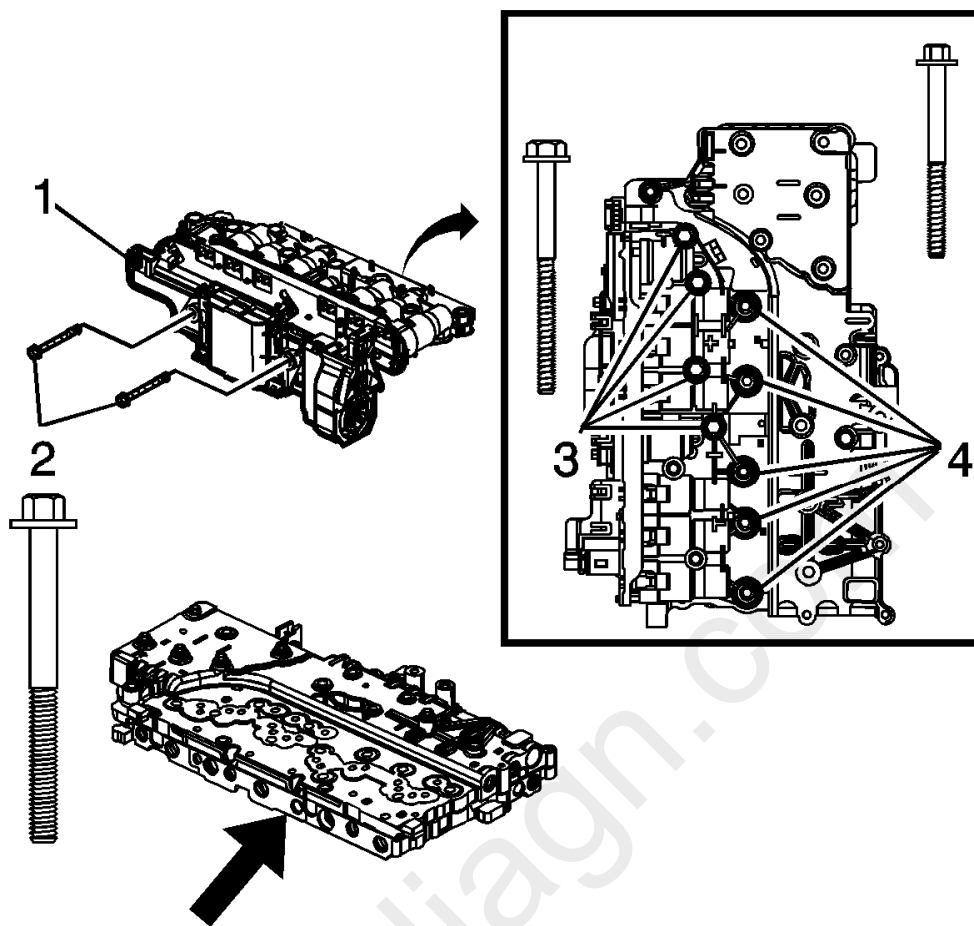


Fig. 56: View Of Control Solenoid Valve Assembly Bolts
Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the locator pin on the control valve lower body assembly.

2. Align the control solenoid valve assembly (1) to the control valve lower body assembly.
3. Install the 2 bolts (2), through the "heat sink" side of the control solenoid valve assembly (1). Hand tighten only.

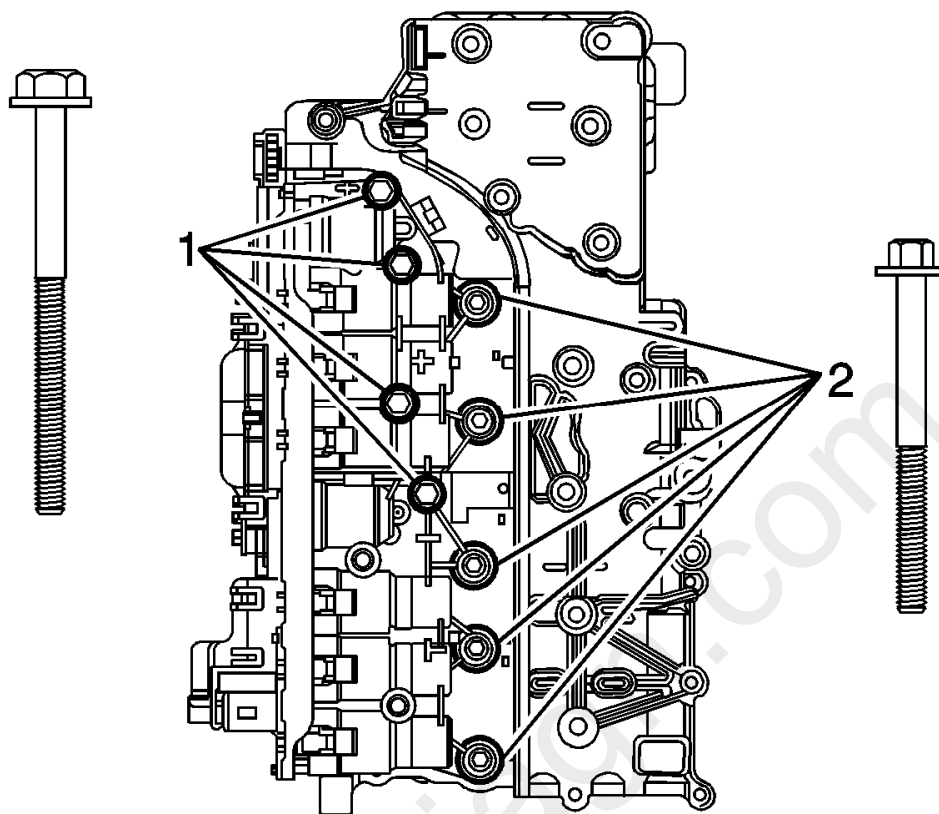


Fig. 57: View Of Bolts

Courtesy of GENERAL MOTORS COMPANY

4. Install the 4 bolts (1) and 5 bolts (2) securing the control solenoid valve assembly to the control valve lower body assembly. Hand tighten only.

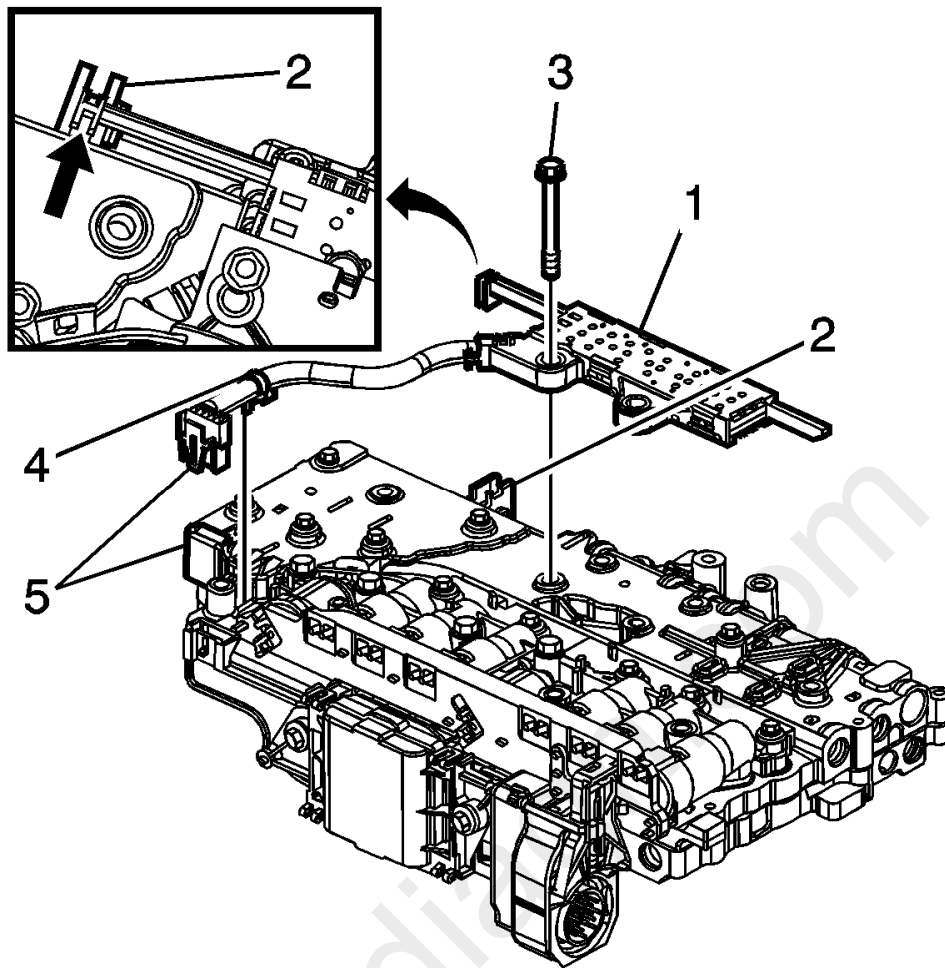


Fig. 58: View Of Manual Shift Shaft Position Switch Assembly
Courtesy of GENERAL MOTORS COMPANY

5. Install the manual shift shaft position switch assembly (1). Align the switch activator slide with the manual valve link. Secure with 1 bolt (3). Hand tighten only.

NOTE: The wiring harness clip (4) on the manual shift shaft position switch does not need to be replaced if damaged or missing. The clip functions only as a manufacturing assembly aid to keep the harness clear during an automated bolt installation process. If the clip is damaged, simply remove and discard.

6. Connect and lock the manual shift shaft position switch electrical connector (5) to the control solenoid valve assembly and attach the wiring harness clip (4).

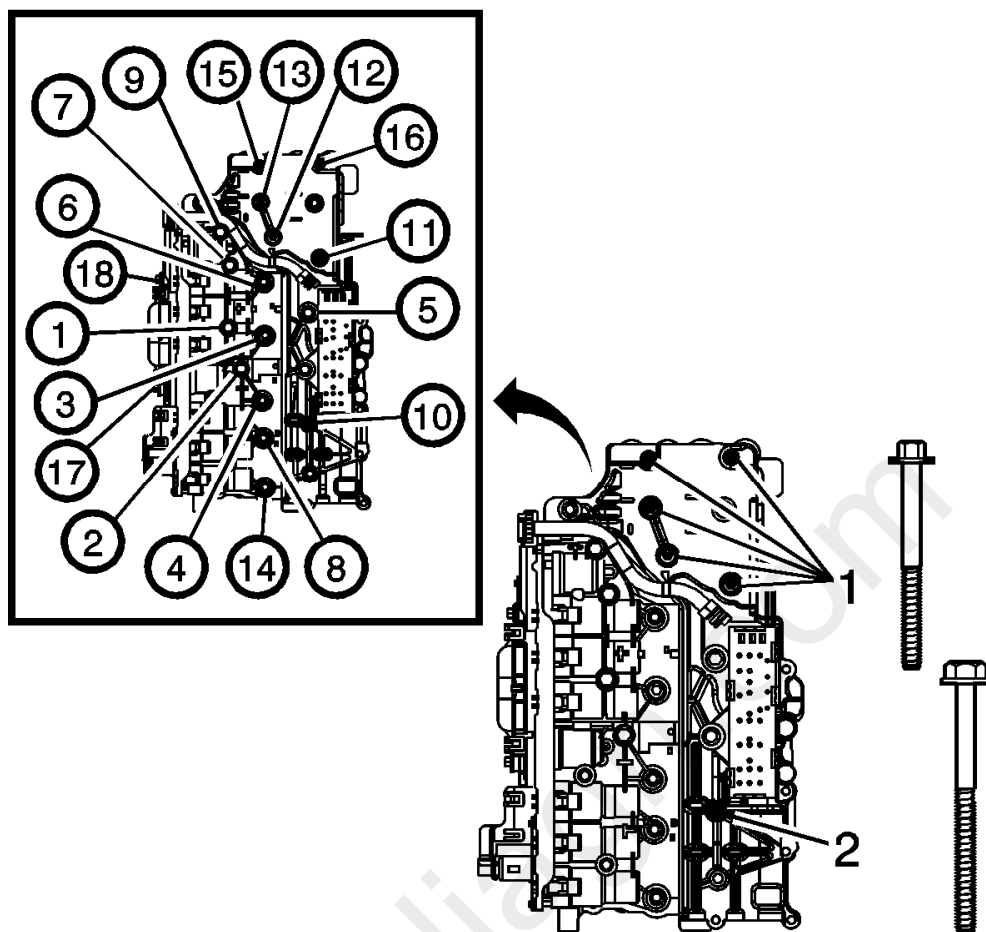


Fig. 59: Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

7. Install the 5 remaining bolts (1) and 1 remaining bolt (2). Hand tighten only.

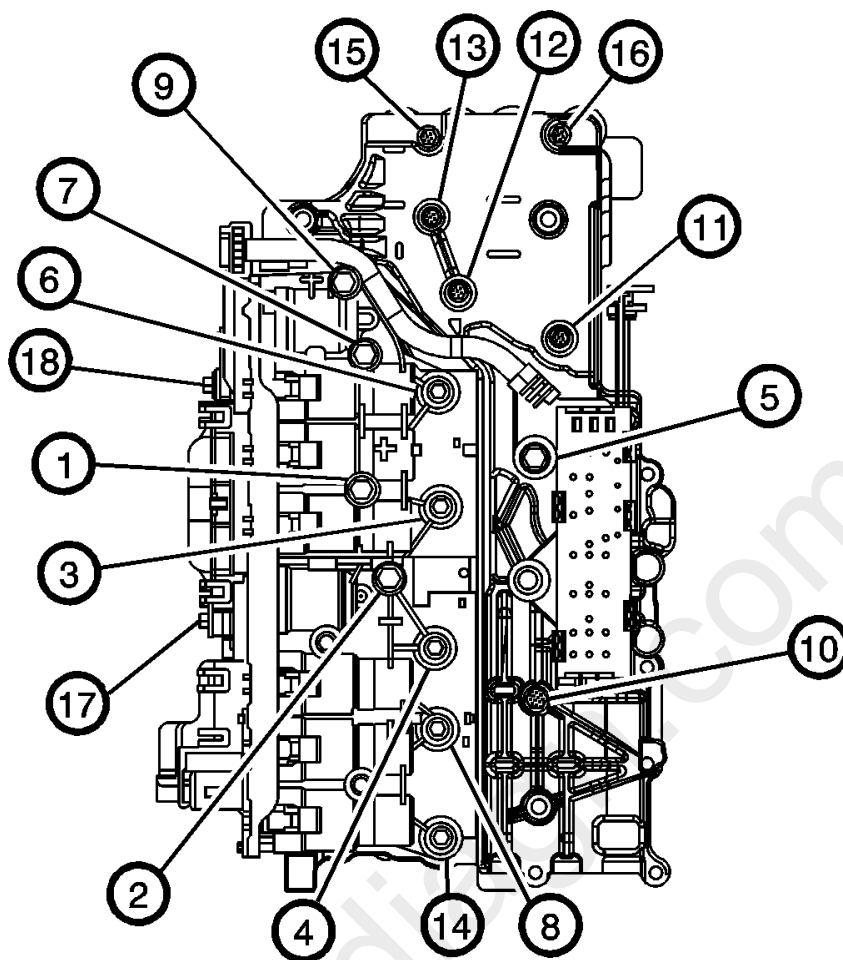


Fig. 60: Bolt Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Bolt torque sequencing is critical to the proper function of the control solenoid valve assembly. Failure to follow the required sequencing may result in transmission malfunction.

CAUTION: Refer to Fastener Caution .

8. Tighten all bolts in the sequence shown. The 2 "heat sink" bolts (17,18) must be tightened last.

Tighten bolts to 8 N.m (6 lb ft).

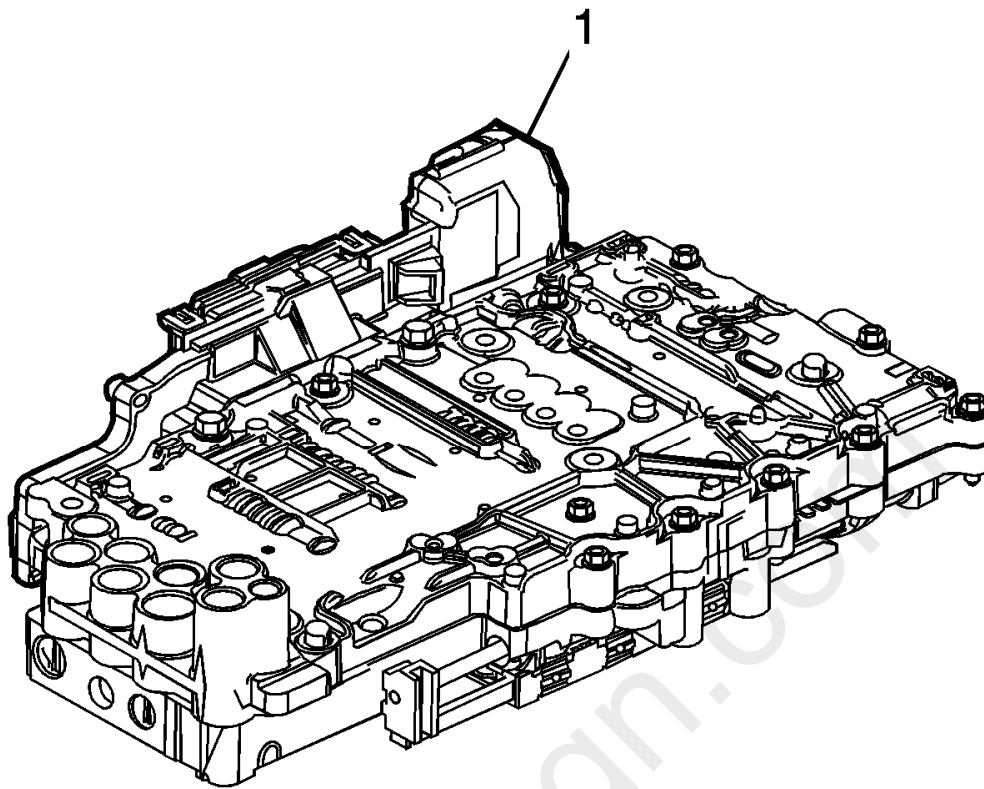


Fig. 61: View Of Control Solenoid Valve Assembly
Courtesy of GENERAL MOTORS COMPANY

9. Inspect the contact area between the "heat sink" area of the control solenoid valve assembly (1) and the valve body. There should be no visible gap. If a gap exists, loosen all 18 bolts and retighten in the sequence shown.

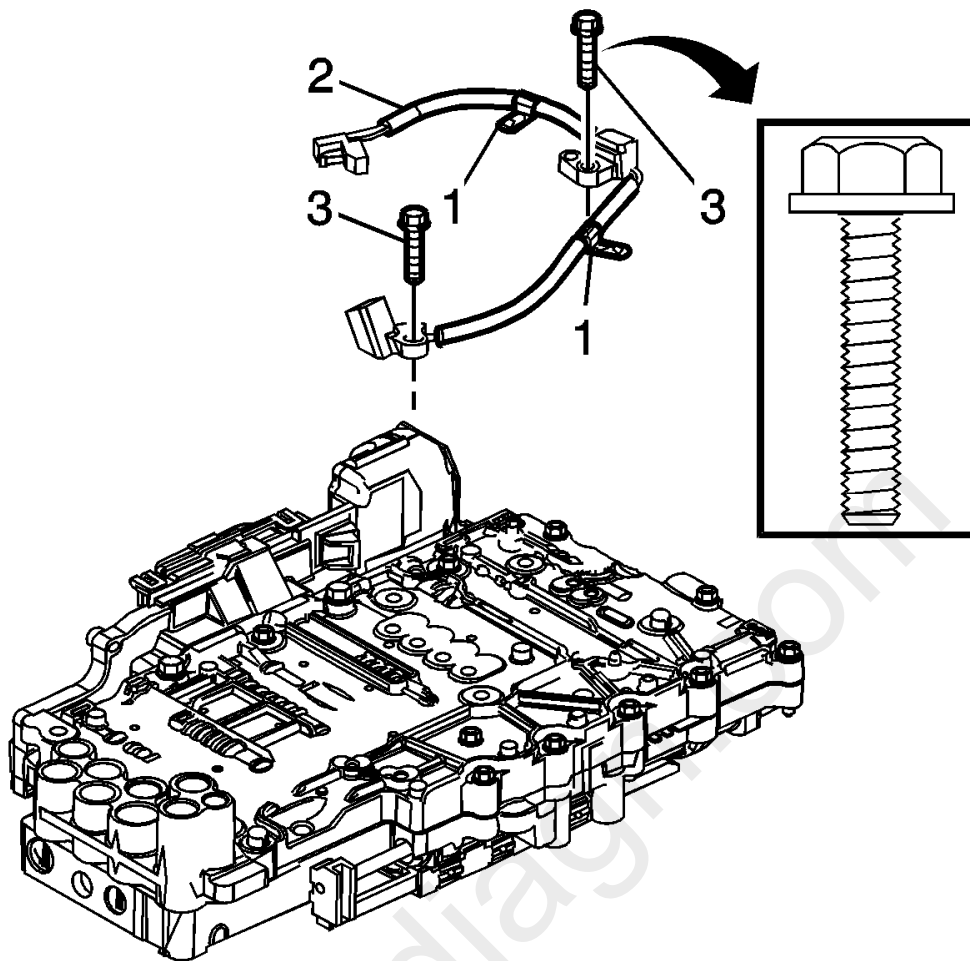


Fig. 62: View Of Output Speed Sensor Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

10. Inspect the 2 input and output speed sensor wiring harness clips (1) for damage. Replace if damaged.

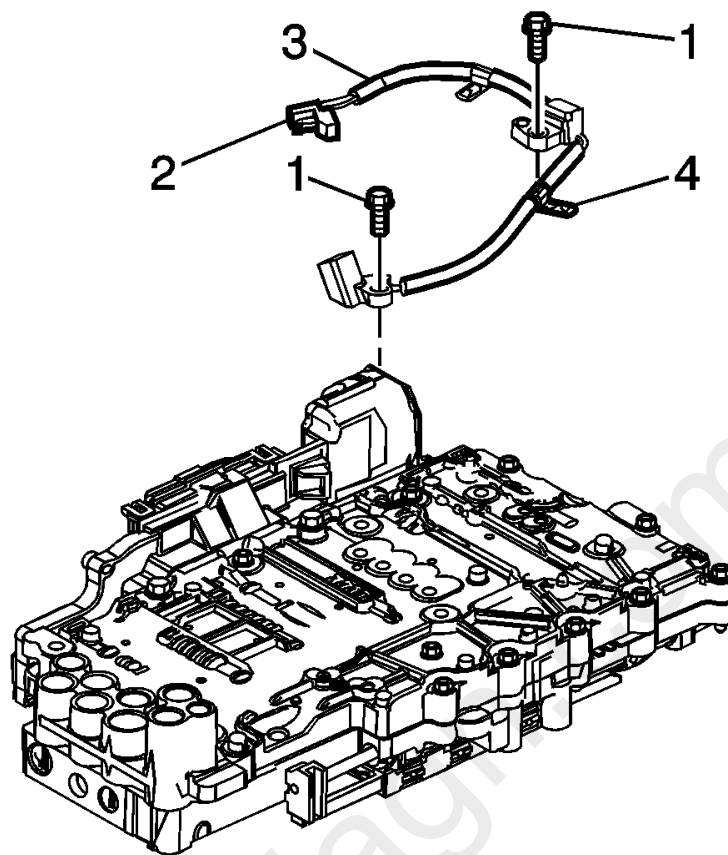


Fig. 63: View Of Speed Sensor Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

11. Connect the speed sensor electrical connector (2) to the control solenoid valve assembly.

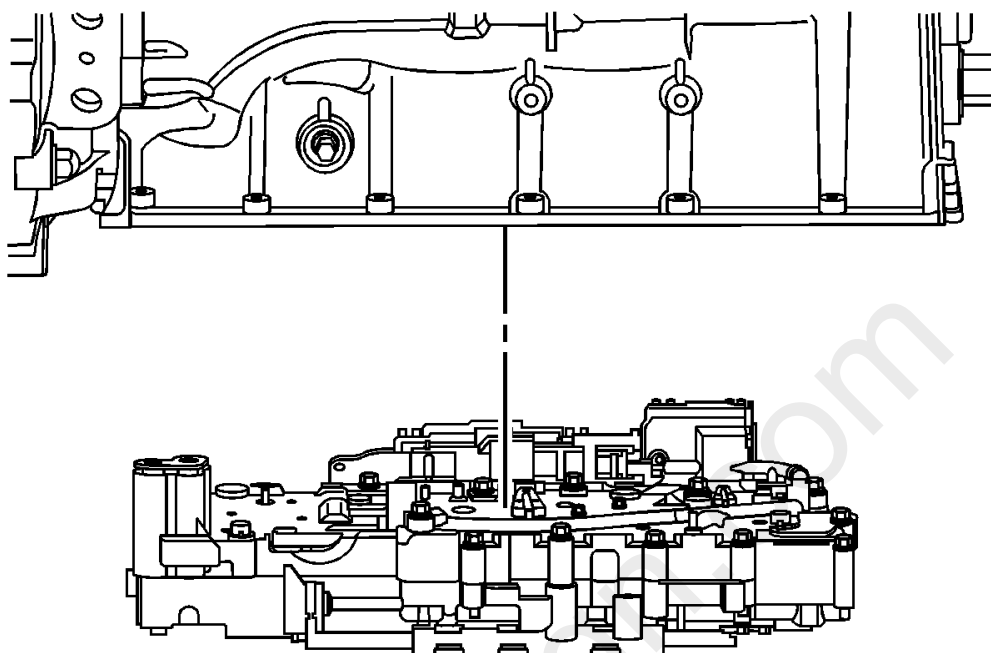


Fig. 64: Valve Body Assembly

Courtesy of GENERAL MOTORS COMPANY

12. Install the upper and lower control valve body assembly. Refer to **Control Valve Lower Body and Upper Body Replacement**.
13. Install the electrical connector passage sleeve. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement**.

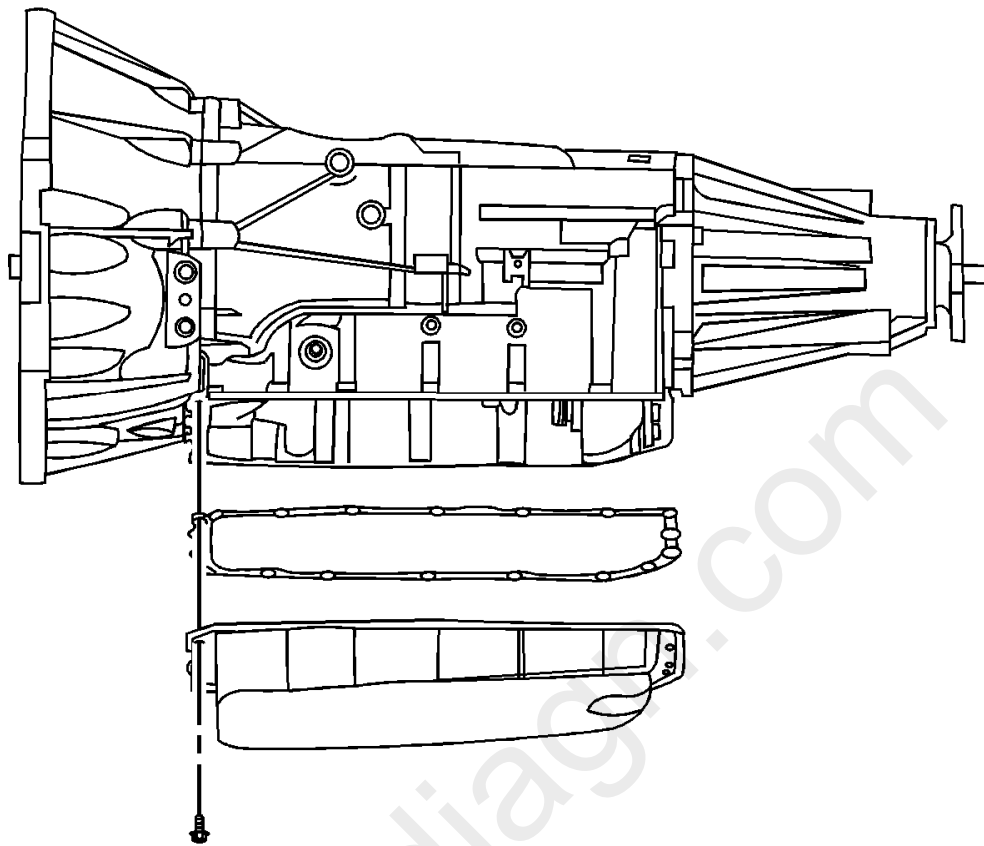


Fig. 65: View Of Transmission Oil Pan And Filter
Courtesy of GENERAL MOTORS COMPANY

14. Install the transmission oil pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.
15. If a NEW TCM has been installed into the vehicle, the NEW module needs to be reprogrammed. Refer to **Service Programming System (SPS)** .

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

- Transmission internal service/overhaul
- Valve body repair or replacement
- Control solenoid valve assembly replacement
- TCM software/calibration update

- Any service in response to a shift quality concern

16. Perform the Reset Transmission Adapts. Refer to Reset Transmission Adapts .

CONTROL VALVE LOWER BODY AND UPPER BODY REPLACEMENT

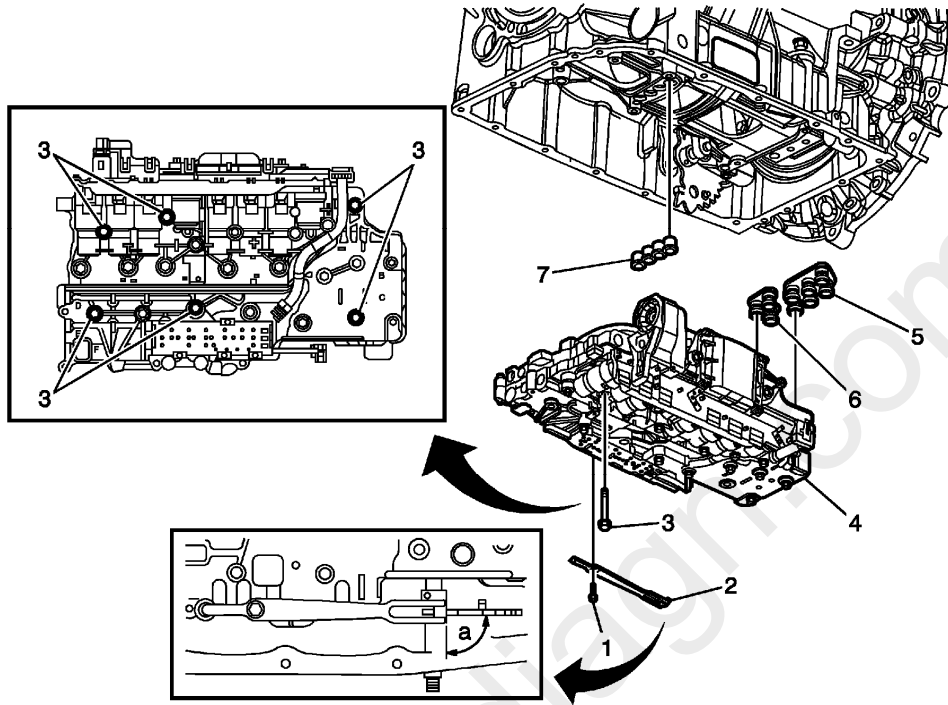


Fig. 66: Control Valve Lower Body and Upper Body Component View
Courtesy of GENERAL MOTORS COMPANY

Control Valve Lower Body and Upper Body Replacement

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the transmission fluid pan, gasket and filter. Refer to <u>Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement</u> . 3. Remove the electrical connector sleeve. Refer to <u>Automatic Transmission Electrical Connector Passage Sleeve Replacement</u> .	
1	Manual Shaft Detent Assembly Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten

	12 N.m (106 lb in)
2	Manual Shaft Detent Assembly TIP: Ensure the manual shaft detent assembly roller is centered (a) over the manual shaft detent lever assembly. Failure to center the roller may cause hard or no shift lever operation.
3	Control Valve Assembly Bolt (Qty: 6) - Do not remove all the bolts in the control valve body assembly. Remove only the bolts indicated. - Tighten the bolts in the proper order. Refer to <u>Control Valve Body Assembly Installation</u> . Tighten 8 N.m (71 lb in)
4	Control Valve Assembly - For control valve body disassembly, refer to <u>Control Valve Body Assembly Disassemble</u> . - For control valve body cleaning and inspection, refer to <u>Control Valve Lower Body Assembly Cleaning and Inspection</u> , and <u>Control Valve Upper Body Assembly Cleaning and Inspection</u> . - For ball check valve locations, refer to <u>Ball Check Valve Locations</u> . - For control valve body assembly, refer to <u>Control Valve Body Assembly Assemble</u> . - Align the manual shift shaft position switch activator slide with the detent lever guide pin during control valve body installation.
5	Fluid Pump Seal Assembly TIP: Do not reuse the seal assembly.
6	Fluid Pump Seal Assembly TIP: Do not reuse the seal assembly.
7	Center Support Fluid Passage Seal Assembly - Do not reuse the seal assembly. - It is recommended that transmission adaptive pressure (TAP) information be reset. Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, the engine control module (ECM), powertrain control module (PCM) or transmission control module (TCM) will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned. Reset the TAP values. Refer to <u>Transmission Adaptive Functions</u> .

INPUT AND OUTPUT SPEED SENSOR REPLACEMENT

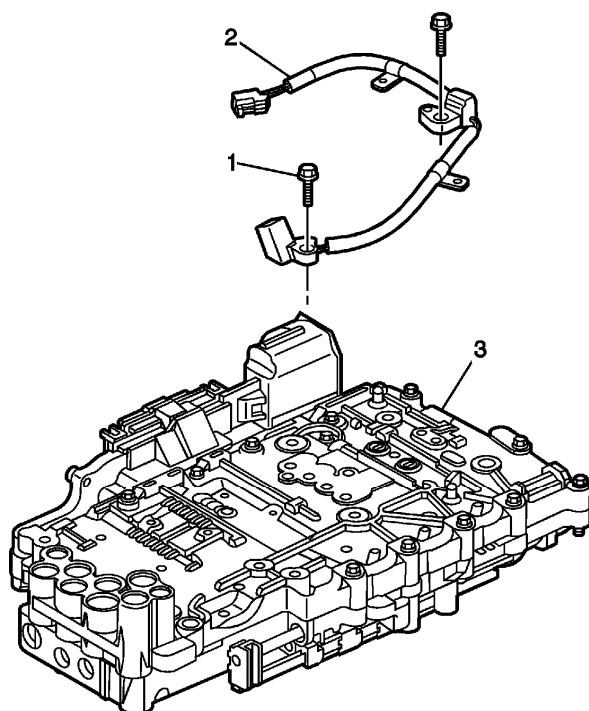


Fig. 67: Input and Output Speed Sensor Component View
 Courtesy of GENERAL MOTORS COMPANY

Input and Output Speed Sensor Replacement

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the transmission fluid pan and filter. Refer to <u>Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement</u>. 3. Remove the upper and lower valve body assembly. Refer to <u>Control Valve Lower Body and Upper Body Replacement</u>. 4. Disconnect the speed sensor electrical connector from the control solenoid valve assembly.	
1	Input and Output Speed Sensor Assembly Bolt (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 12 N.m (106 lb in)
2	Input and Output Speed Sensor Assembly Procedure Disconnect the speed sensor wiring harness clips. Inspect the clips for damage. Replace if damaged.

TRANSMISSION REPLACEMENT (ALL WHEEL DRIVE)

NOTE: NEW cooler pipe O-rings and torque converter bolts will be required each time the transmission is removed and installed.

Removal Procedure

1. Remove the thermostat housing. Refer to **Engine Coolant Thermostat Housing Replacement (LF1,LFW,LLT or LFX)** .
2. Remove the exhaust system. Refer to **Exhaust System Replacement (LSA-Coupe)** , **Exhaust System Replacement (LSA-Sedan/Wagon)** , **Exhaust System Replacement (Single Exhaust)** , **Exhaust System Replacement (LFX/LFW-Coupe)** , **Exhaust System Replacement (LFX/LFW-Sedan/Wagon)** .
3. Remove the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LSA)** , **Catalytic Converter Replacement - Left Side (LFW,LFX)** , and **Catalytic Converter Replacement - Right Side (LFW,LFX)** , **Catalytic Converter Replacement - Right Side (LSA)** .
4. Remove the front and rear propeller shafts. Refer to **Front Propeller Shaft Replacement** , and **Rear Propeller Shaft Replacement (RPO LSA)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)** .

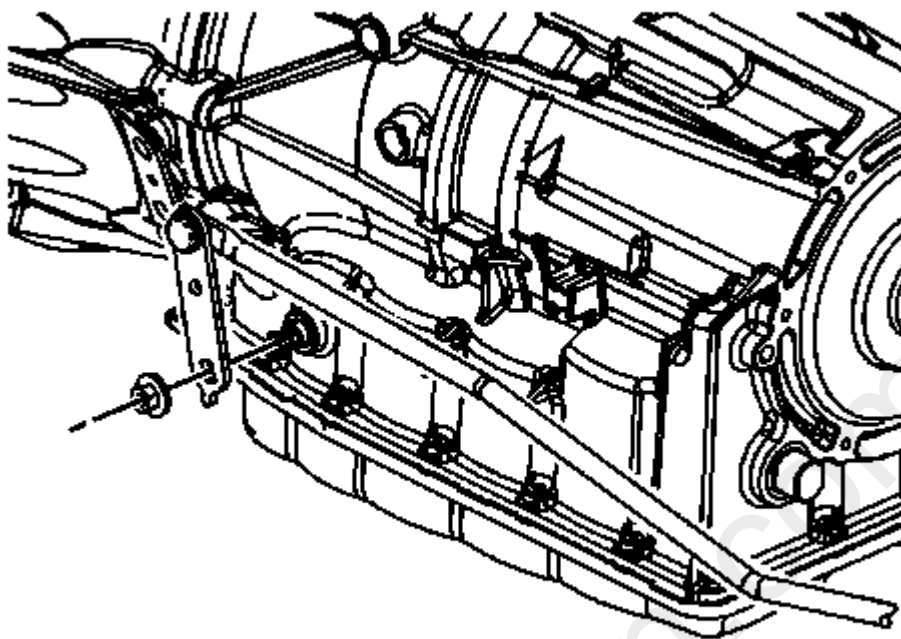


Fig. 68: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect the shift linkage from the transmission.

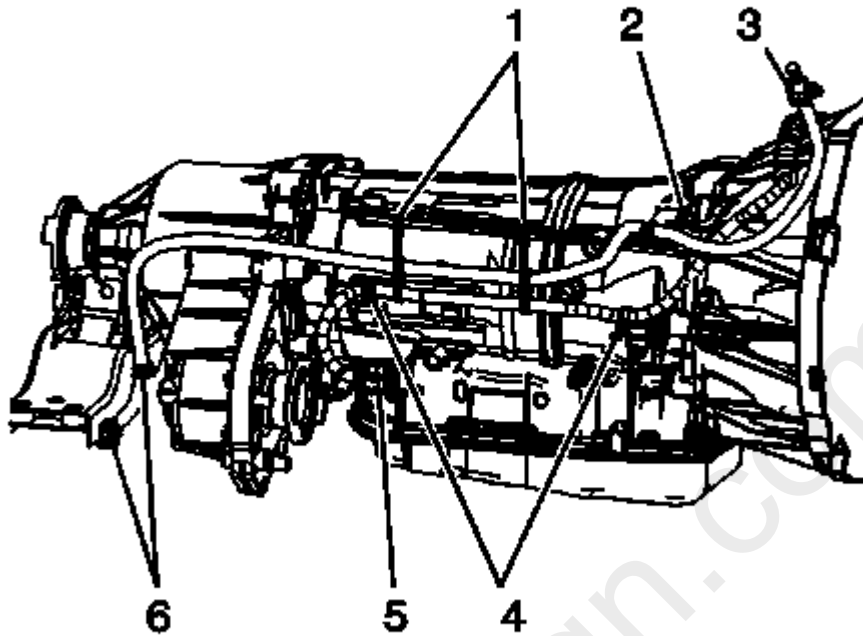


Fig. 69: View Of Retainers

Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the transmission wiring harness connector (5) from the transmission by releasing the locking mechanism and rotating the latch counterclockwise.
7. Disconnect the wiring harness retainers (4) from the transmission.
8. Remove the transmission vent hose from the retaining clips (6) on the transmission mount assembly.
9. Remove the oxygen sensor wiring harness retainer from the transmission.
10. Place an oil drain pan under the transmission fluid cooler pipes.

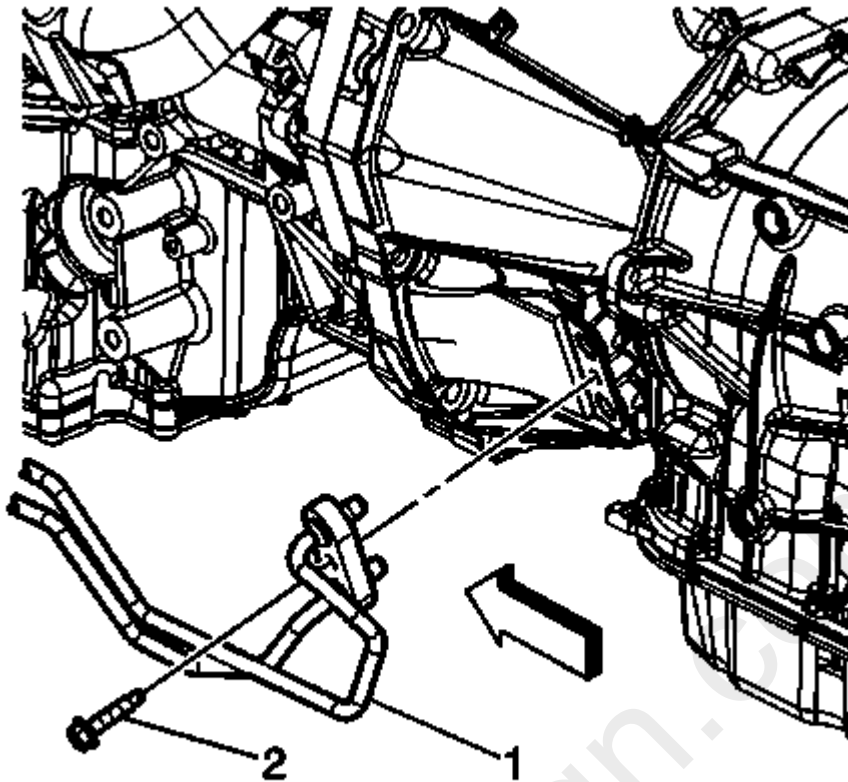


Fig. 70: View of Transmission Fluid Cooler Pipes
Courtesy of GENERAL MOTORS COMPANY

11. Remove the transmission fluid cooler pipes (1) from the transmission, and position aside. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement (With VO3)** , **Transmission Fluid Cooler Hose/Pipe Replacement (Without VO3)** .
12. Remove and discard the O-rings. Do NOT reuse the O-rings.
13. Plug the open outlet ports to prevent fluid loss and contamination.

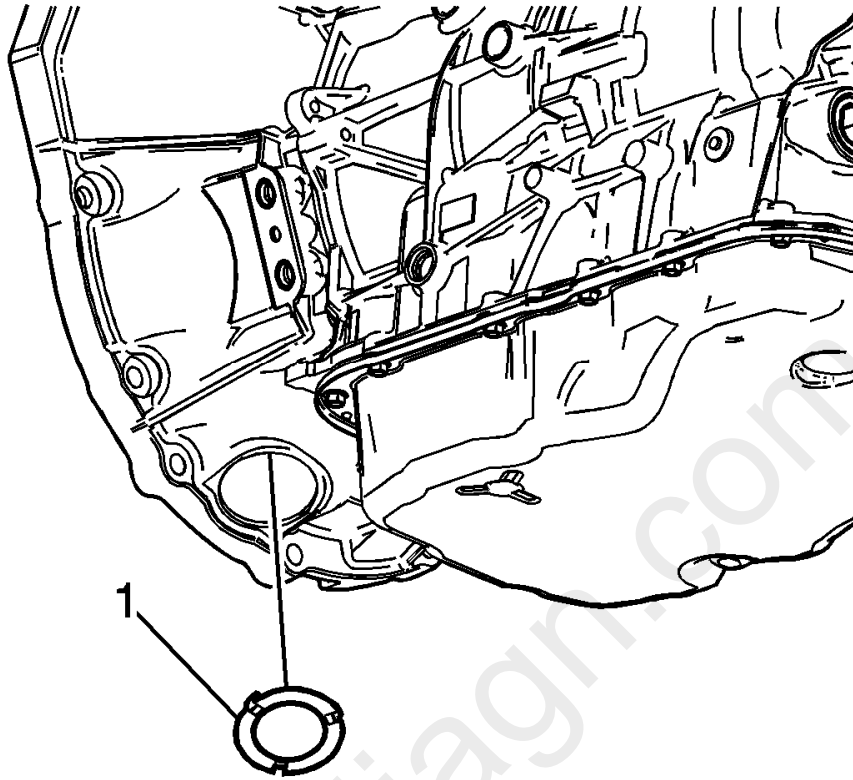


Fig. 71: Identifying Transmission Close Out Plug
Courtesy of GENERAL MOTORS COMPANY

14. Remove the transmission close out plug (1).
15. Mark the torque converter to flexplate/flywheel orientation to ensure proper realignment.
16. Remove the starter motor. Refer to **Starter Replacement (LSA)** , **Starter Replacement (LF1/LLT)** .

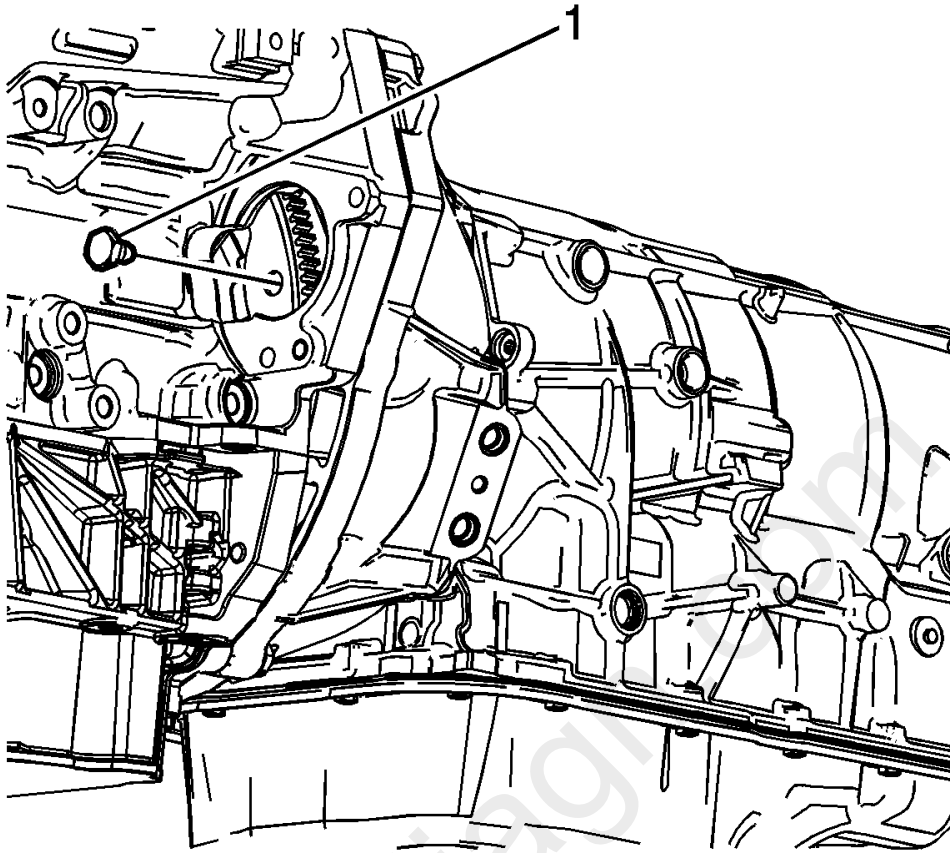


Fig. 72: Identifying Torque Converter Bolts
Courtesy of GENERAL MOTORS COMPANY

17. Repeat the following steps for all torque converter bolts (1):
 1. Rotate the harmonic balancer center bolt clockwise ONLY, in order to align the torque converter bolt with the access hole.
 2. Remove and discard the torque converter bolt.

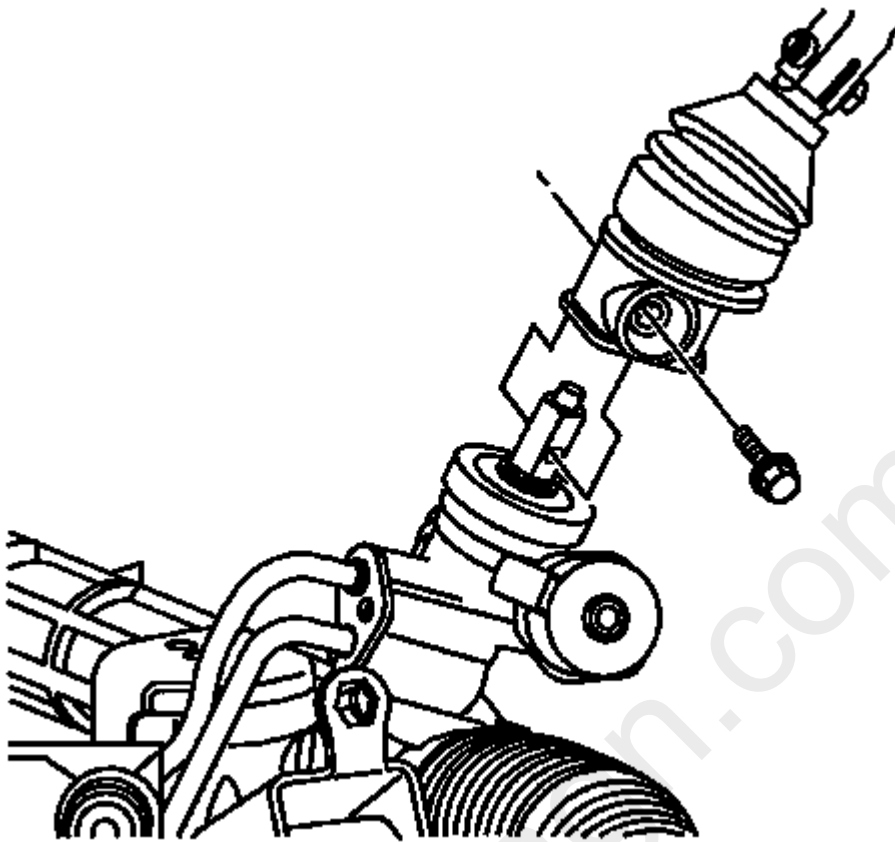


Fig. 73: View Of Intermediate Shaft Lower Pinch Bolt
Courtesy of GENERAL MOTORS COMPANY

18. Disconnect the intermediate shaft from the power steering gear. Refer to **Steering Gear Replacement (LHD With AWD)** .

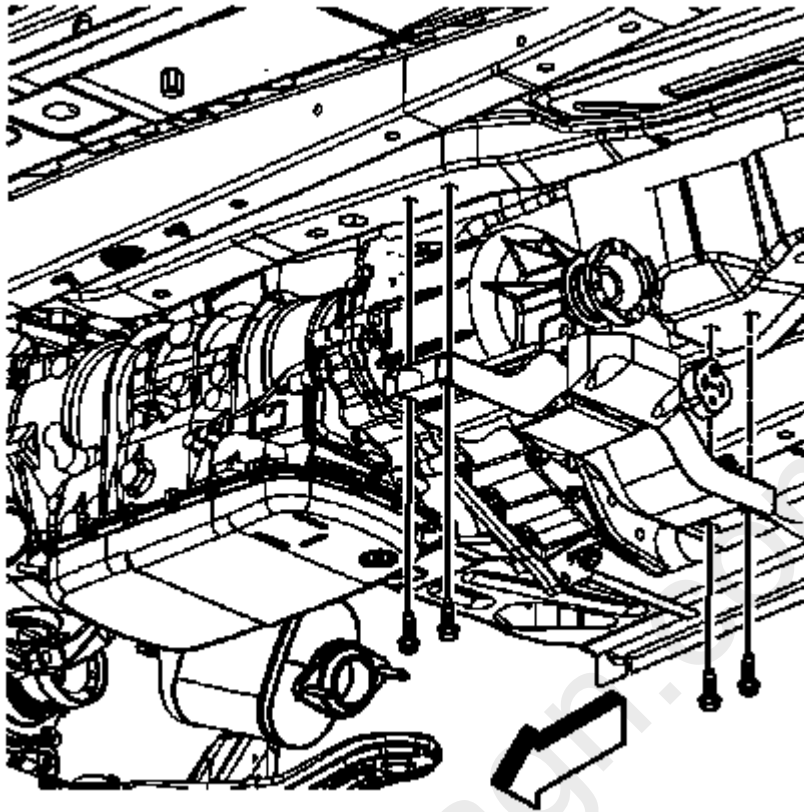


Fig. 74: View Of Body Mounting Bolts
Courtesy of GENERAL MOTORS COMPANY

19. Support the transmission with a suitable transmission jack.
20. Remove the transmission mount assembly. Refer to **Transmission Mount Replacement (Automatic AWD)**.
21. Support the rear of the front frame with adjustable jack stands.
22. Remove the bolts at the rear of the front frame.
23. Loosen the bolts at the front of the front frame two turns but do NOT remove the bolts.
24. Lower the rear of the front frame and the transmission.

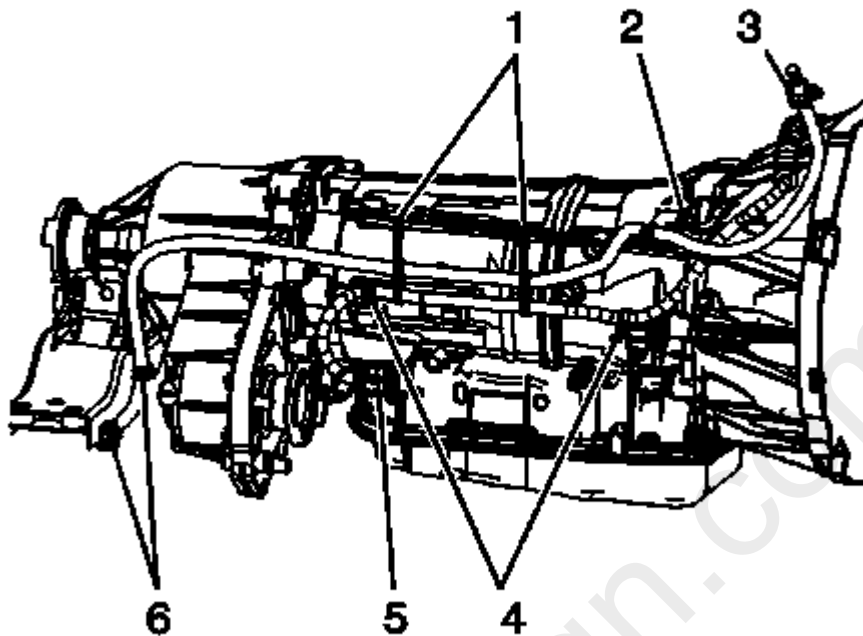


Fig. 75: View Of Retainers

Courtesy of GENERAL MOTORS COMPANY

25. Lower the transmission and remove the vent hose (2) from the vent tube.
26. Position the wire harness and vent tube aside.
27. Remove the transfer case. Refer to **Transfer Case Assembly Replacement** .

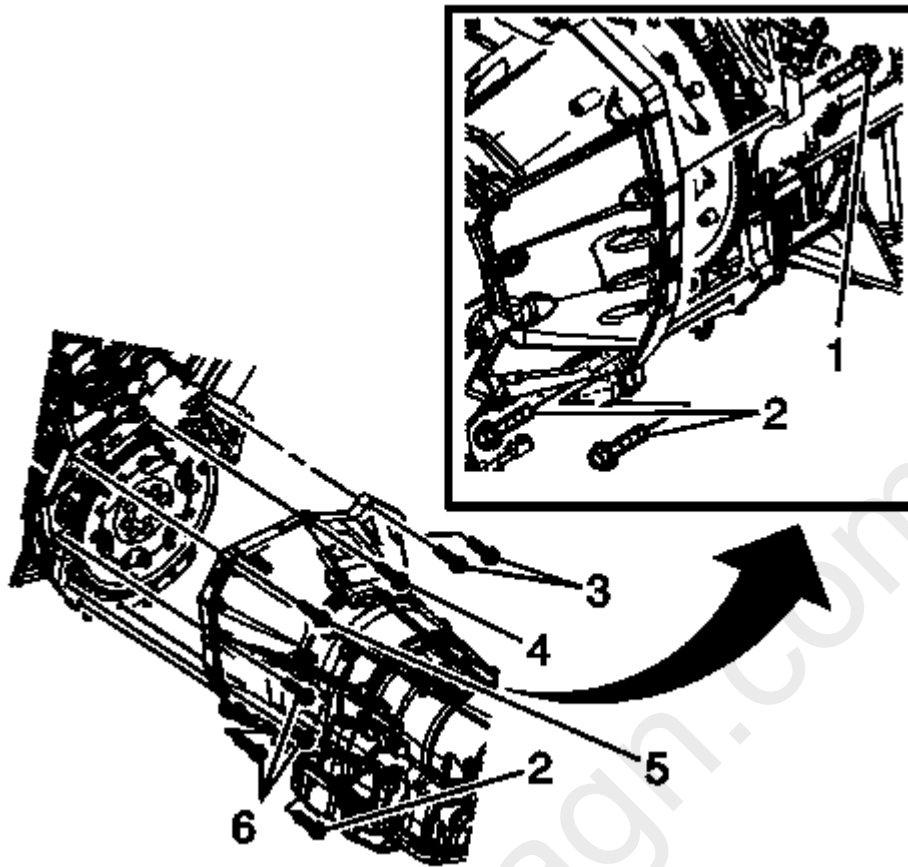


Fig. 76: Transmission Mounting Bolts
Courtesy of GENERAL MOTORS COMPANY

28. Remove the transmission mounting bolts (1-6).
29. Pull the transmission free from the engine dowels.

NOTE: Ensure clearance is maintained between the transmission and the following:

- The wiring harness
- The vent tube
- The cooler pipes

30. Carefully lower the transmission from the vehicle.
31. Flush and flow test the transmission oil cooler and lines. Refer to **Transmission Fluid Cooler Flushing and Flow Test** .

Installation Procedure

NOTE: Ensure clearance is maintained between the transmission and the

following:

- The wiring harness
- The vent tube
- The cooler pipes

1. Using the transmission jack, carefully raise the transmission to the engine.

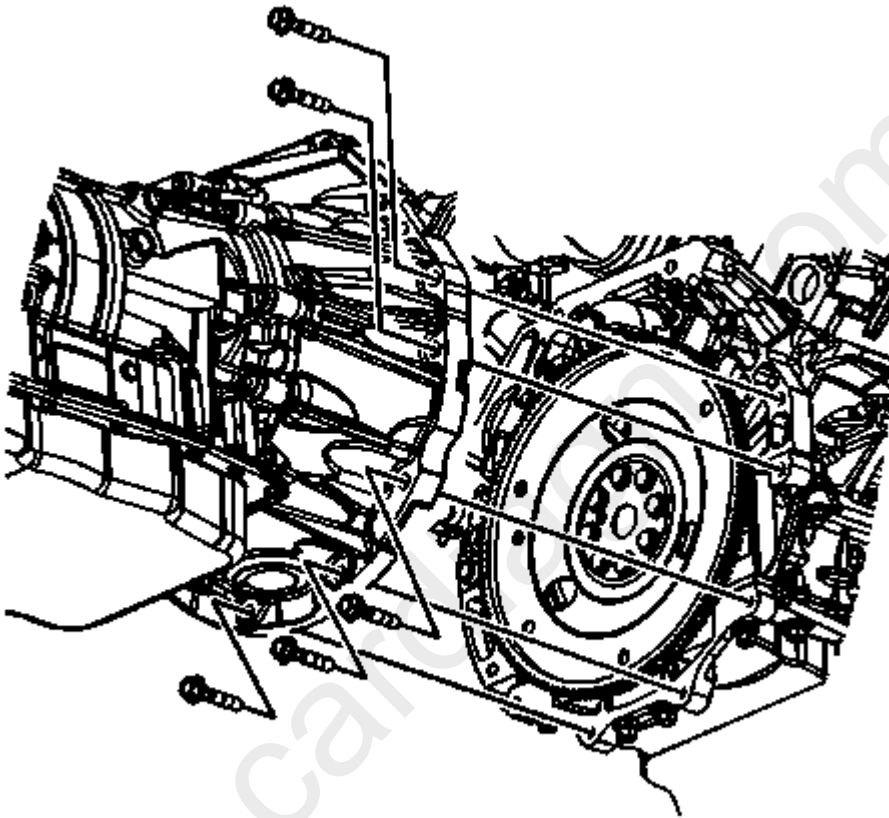


Fig. 77: Identifying Transmission Mounting Bolts
Courtesy of GENERAL MOTORS COMPANY

2. Align the transmission with the engine dowels.

CAUTION: Refer to Fastener Caution .

3. Install the transmission mounting bolts and tighten to 50 (37 lb ft).
4. Install the transfer case. Refer to Transfer Case Assembly Replacement .

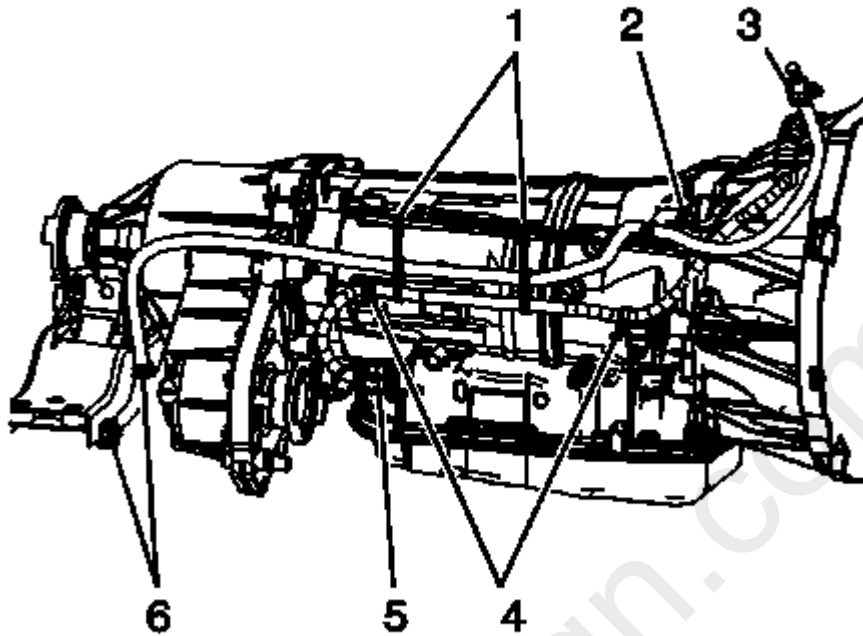


Fig. 78: View Of Retainers

Courtesy of GENERAL MOTORS COMPANY

5. Remove the support stand from under the engine oil pan.
6. Using the transmission jack. Lower the engine and transmission assembly only enough to gain access to the vent hose tube.
7. Install the vent hose (2) to the vent tube.
8. Position the engine wiring harness to the original location.
9. Raise the transmission to the installed position.
10. Install the bolts at the rear of the front frame and properly torque all frame bolts. Refer to **Drivetrain and Front Suspension Frame Replacement (All Wheel Drive)** for proper frame bolt tightening information.

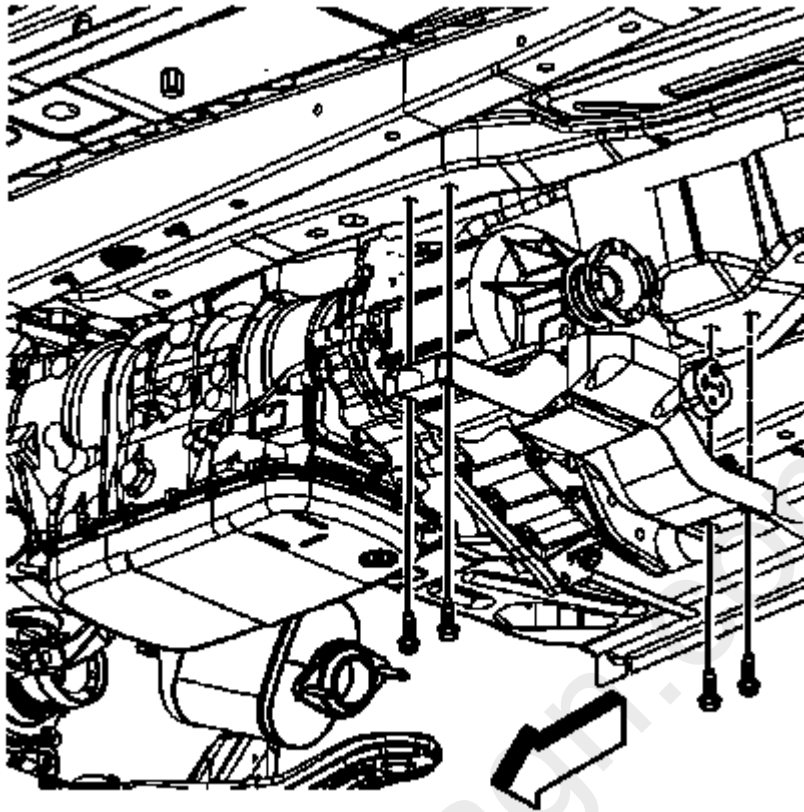


Fig. 79: View Of Body Mounting Bolts
Courtesy of GENERAL MOTORS COMPANY

11. Install the transmission mount assembly. Refer to **Transmission Mount Replacement (Automatic AWD)**.
12. Remove the transmission jack.

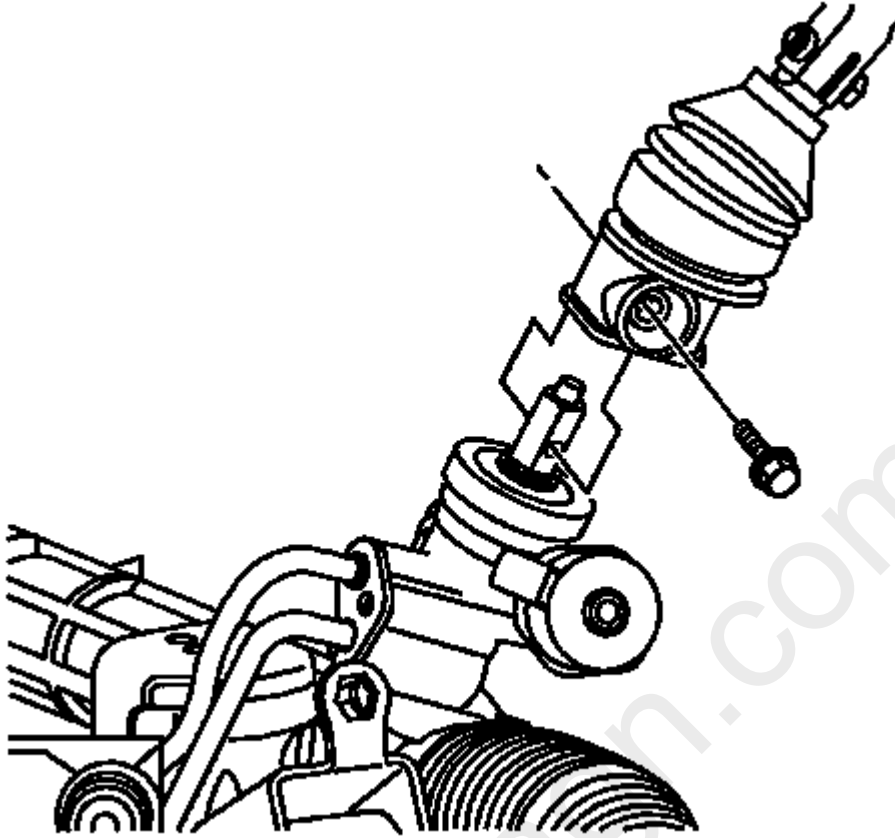


Fig. 80: View Of Intermediate Shaft Lower Pinch Bolt
Courtesy of GENERAL MOTORS COMPANY

13. Connect the intermediate shaft to the power steering gear. Refer to **Steering Gear Replacement (LHD With AWD)** .
14. Align the torque converter to flexplate/flywheel orientation marks made during the removal procedure.

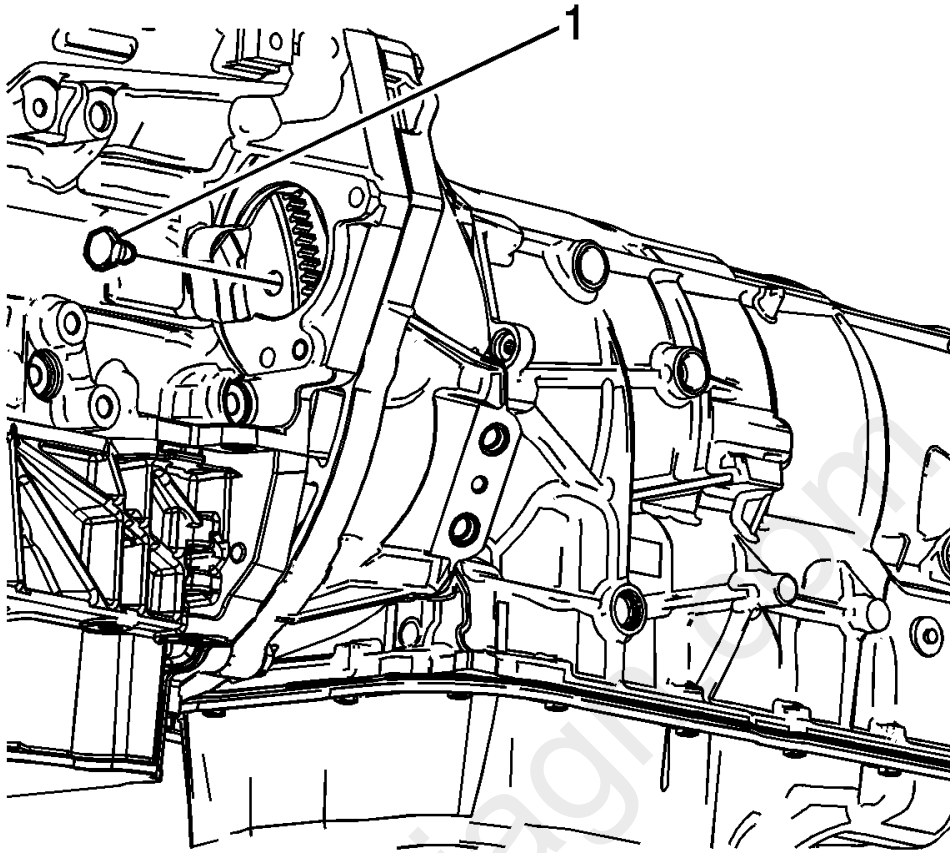


Fig. 81: Identifying Torque Converter Bolts
Courtesy of GENERAL MOTORS COMPANY

NOTE: Torque converter bolts are self locking and must be replaced with NEW torque converter bolts every time the bolts are removed.

15. Complete the following steps for all torque converter bolts (1):
 1. Rotate the harmonic balancer center bolt clockwise ONLY, in order to align the torque converter bolt holes in the flexplate/flywheel with the access hole in the engine block.
 2. To aid in alignment of the torque converter to the flexplate/flywheel. Install all NEW torque converter bolts (1) before fully tightening to 63 (46 lb ft).

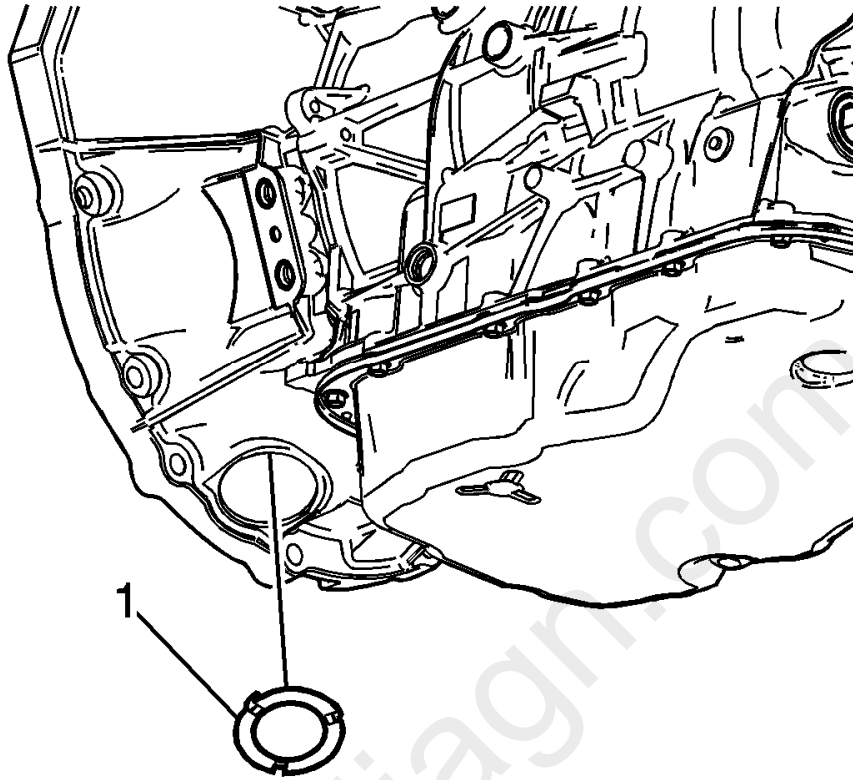


Fig. 82: Identifying Transmission Close Out Plug
Courtesy of GENERAL MOTORS COMPANY

16. Install the transmission close out plug (1).
17. Install the starter motor. Refer to **Starter Replacement (LSA)** , **Starter Replacement (LF1/LLT)** .

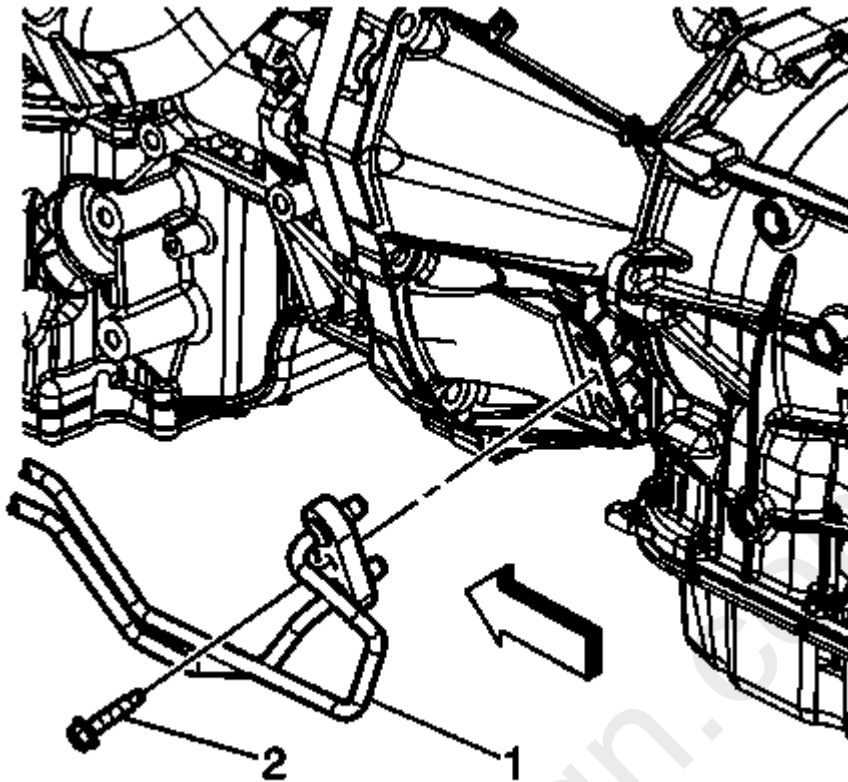


Fig. 83: View of Transmission Fluid Cooler Pipes
Courtesy of GENERAL MOTORS COMPANY

18. Place NEW O-rings over the transmission fluid cooler pipes.
19. Install the transmission fluid cooler pipes (1) to the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement (With VO3)** , **Transmission Fluid Cooler Hose/Pipe Replacement (Without VO3)** .

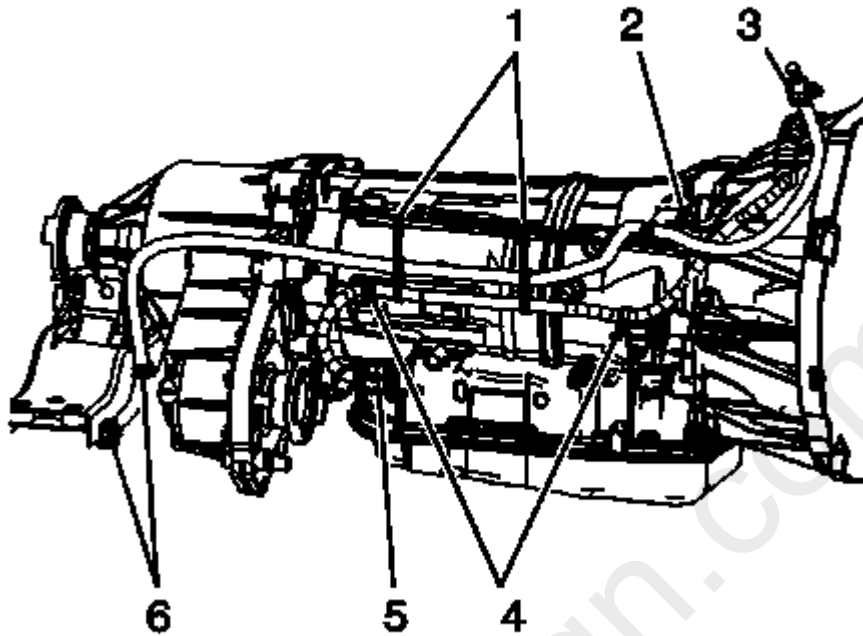


Fig. 84: View Of Retainers

Courtesy of GENERAL MOTORS COMPANY

20. Install the transmission vent hose to the retaining clips (6) on the transmission mount assembly.
21. Install the wiring harness retainers (4) to the transmission.
22. Connect the transmission wiring harness connector (5) to the transmission by rotating the locking latch clockwise.
23. Install the oxygen sensor wiring harness retainer to the transmission.

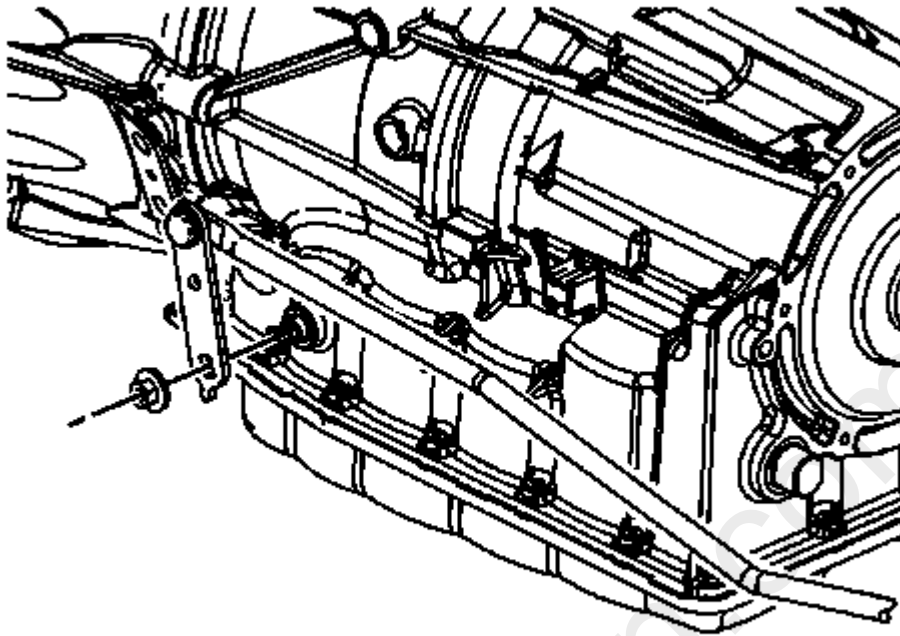


Fig. 85: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

24. Install the shift linkage to the transmission.
25. Install the transmission manual shift shaft nut and tighten to 15 (11 lb ft).
26. Install the front and rear propeller shafts. Refer to **Front Propeller Shaft Replacement** , and **Rear Propeller Shaft Replacement (RPO LSA)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)** .
27. Install the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LSA)** , **Catalytic Converter Replacement - Left Side (LFW,LFX)** , and **Catalytic Converter Replacement - Right Side (LFW,LFX)** , **Catalytic Converter Replacement - Right Side (LSA)** .
28. Install the exhaust system. Refer to **Exhaust System Replacement (LSA-Coupe)** , **Exhaust System Replacement (LSA-Sedan/Wagon)** , **Exhaust System Replacement (Single Exhaust)** , **Exhaust System Replacement (LFX/LFW-Coupe)** , **Exhaust System Replacement (LFX/LFW-Sedan/Wagon)** .
29. Lower the vehicle.
30. Install the thermostat housing. Refer to **Engine Coolant Thermostat Housing Replacement (LF1,LFW,LLT or LFX)** .
31. Check the transmission fluid level and fill if necessary. Refer to **Transmission Fluid Level and Condition Check** .

32. Adjust the shift control linkage. Refer to **Shift Control Linkage Adjustment (All Wheel Drive)**.

Transmission Final Test and Inspection

Complete the following procedure after the transmission is installed in the vehicle:

1. With the ignition OFF or disconnected, crank the engine several times. Listen for any unusual noises or evidence that any parts are binding.
2. Start the engine and listen for abnormal conditions.
3. While the engine continues to idle, raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle**.
4. Inspect for fluid leaks while the engine is idling.
5. Perform a final inspection for the proper fluid level.
6. Lower the vehicle.
7. If a NEW TCM has been installed into the vehicle, the NEW module needs to be reprogrammed. Refer to **Service Programming System (SPS)**.

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

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

8. Perform the Reset Transmission Adapts. Refer to **Reset Transmission Adapts**.
9. Road test the vehicle.

TRANSMISSION REPLACEMENT (REAR WHEEL DRIVE)

NOTE: NEW cooler pipe O-rings and torque converter bolts will be required each time the transmission is removed and installed.

Removal Procedure

1. If equipped with 3.6L engine, Remove the thermostat housing . Refer to **Engine Coolant Thermostat Housing Replacement (LF1,LFW,LLT or LFX)**.
2. Remove the front air deflector. Refer to **Front Air Deflector Replacement**.
3. Remove the exhaust system. Refer to **Exhaust System Replacement (LSA-Coupe)** , **Exhaust System Replacement (LSA-Sedan/Wagon)** , **Exhaust System Replacement (Single Exhaust)** , **Exhaust**

System Replacement (LFX/LFW-Coupe) , Exhaust System Replacement (LFX/LFW-Sedan/Wagon) .

4. Remove the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LSA) , Catalytic Converter Replacement - Left Side (LFW,LFX) , and Catalytic Converter Replacement - Right Side (LFW,LFX) , Catalytic Converter Replacement - Right Side (LSA) .**
5. Remove the propeller shaft. Refer to **Rear Propeller Shaft Replacement (RPO LSA) , Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO) , Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6) .**

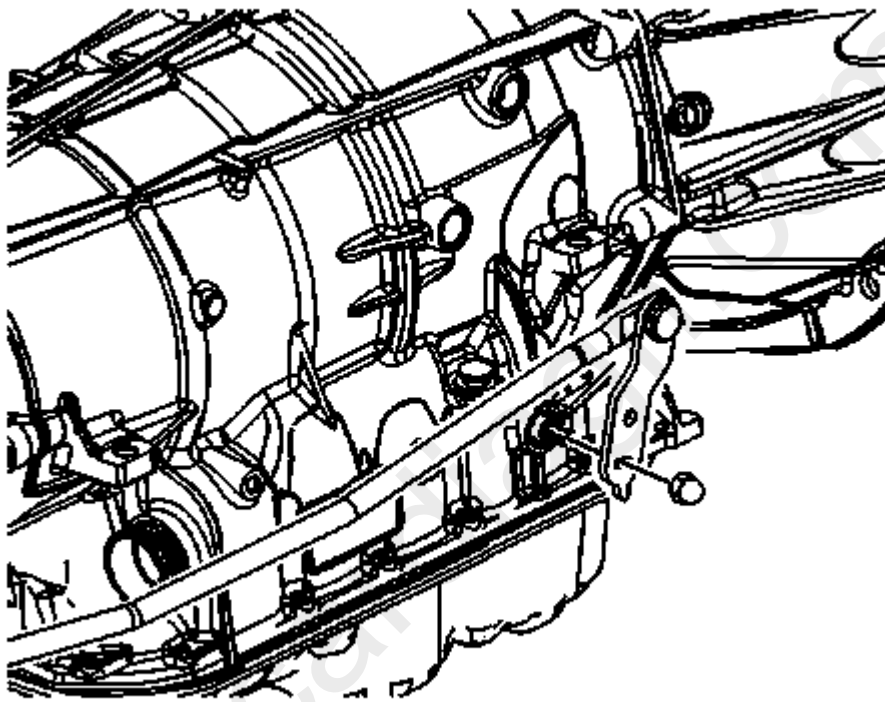


Fig. 86: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the shift linkage from the transmission.

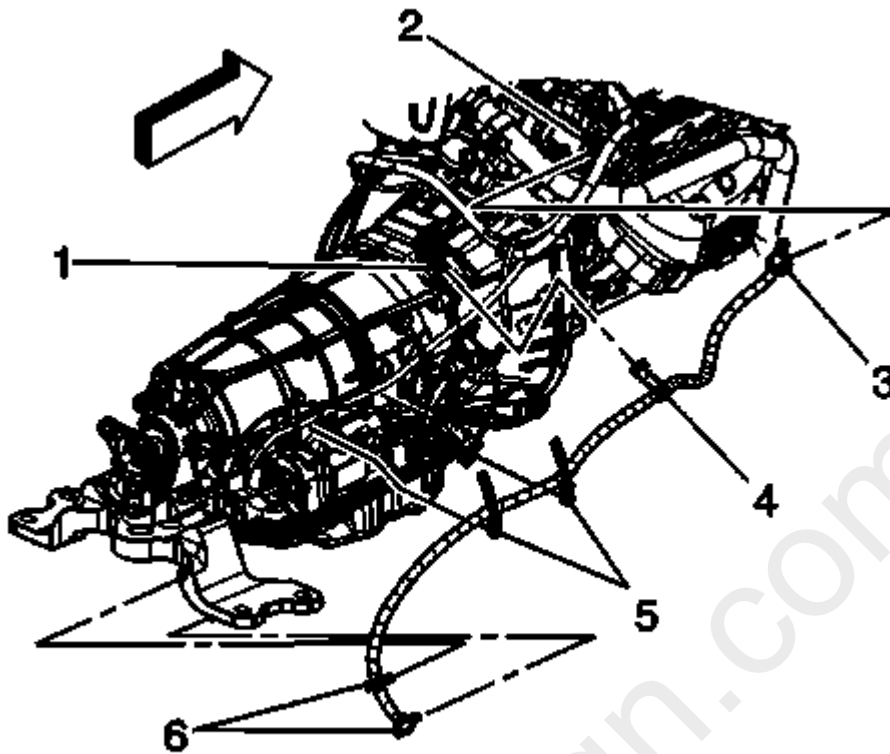


Fig. 87: View Of Vent Hose Assembly
Courtesy of GENERAL MOTORS COMPANY

7. Remove the transmission vent hose from the retaining clips (6) on the transmission support.

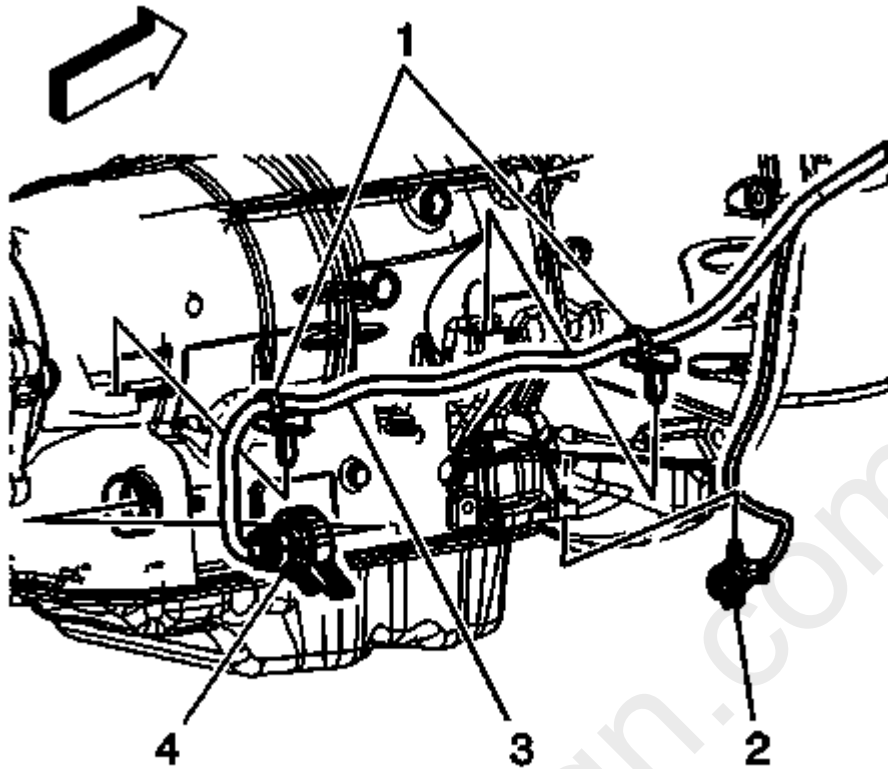


Fig. 88: View Of Oxygen Sensor Wiring Harness Connector, Retainers
Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the transmission wiring harness connector (4) from the transmission by releasing the locking mechanism and rotating the latch counterclockwise.
9. Remove the wiring harness retainers (1) from the transmission.
10. Remove the oxygen sensor wiring harness connector (2) from the transmission.
11. Place an oil drain pan under the transmission fluid cooler pipes.

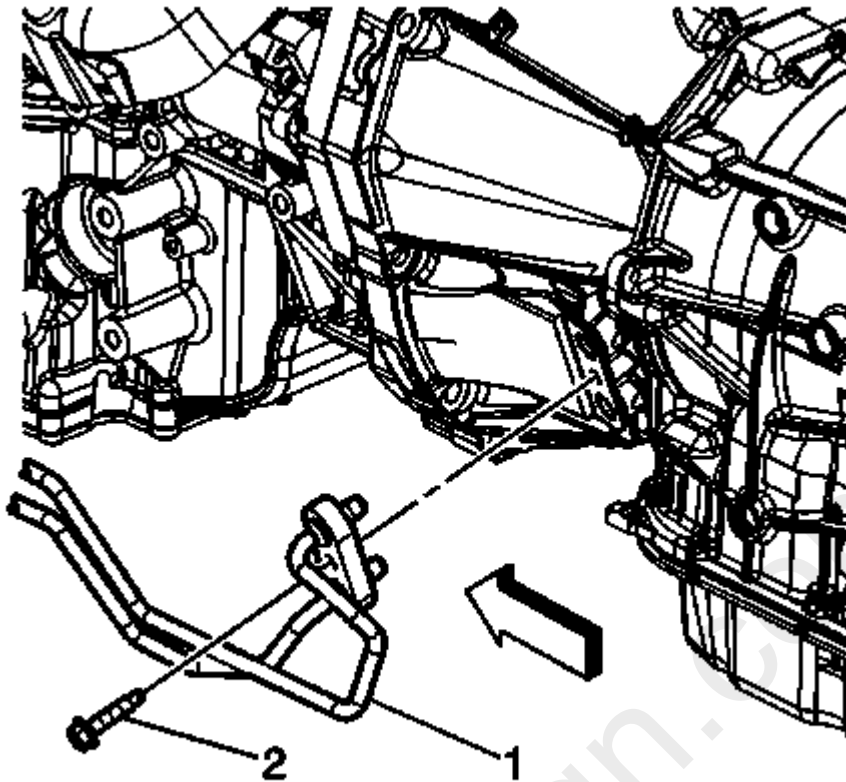


Fig. 89: View of Transmission Fluid Cooler Pipes
Courtesy of GENERAL MOTORS COMPANY

12. Remove the transmission cooler line bracket at right rear of oil pan.
13. Remove the transmission fluid cooler pipes (1) from the transmission, and position aside. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement (With VO3)** , **Transmission Fluid Cooler Hose/Pipe Replacement (Without VO3)** .
14. Remove and discard the O-rings. Do NOT reuse the O-rings.
15. Plug the open outlet ports to prevent fluid loss and contamination.

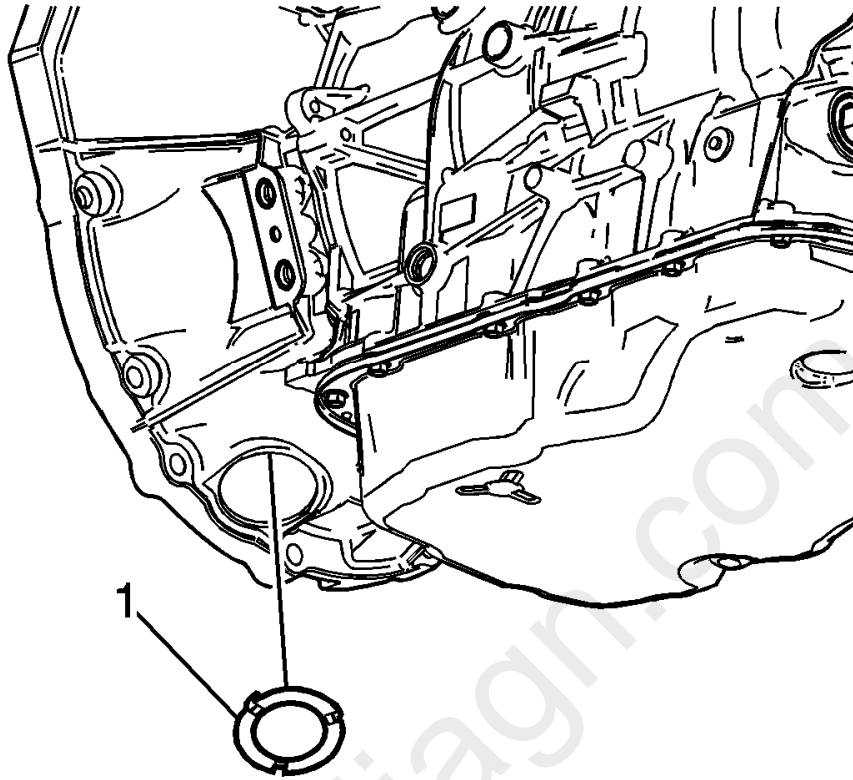


Fig. 90: Identifying Transmission Close Out Plug
Courtesy of GENERAL MOTORS COMPANY

16. Remove the transmission close out plug (1).
17. Mark the torque converter to flexplate/flywheel orientation to ensure proper realignment.
18. Remove the starter motor. Refer to **Starter Replacement (LSA)** , **Starter Replacement (LF1/LLT)** .

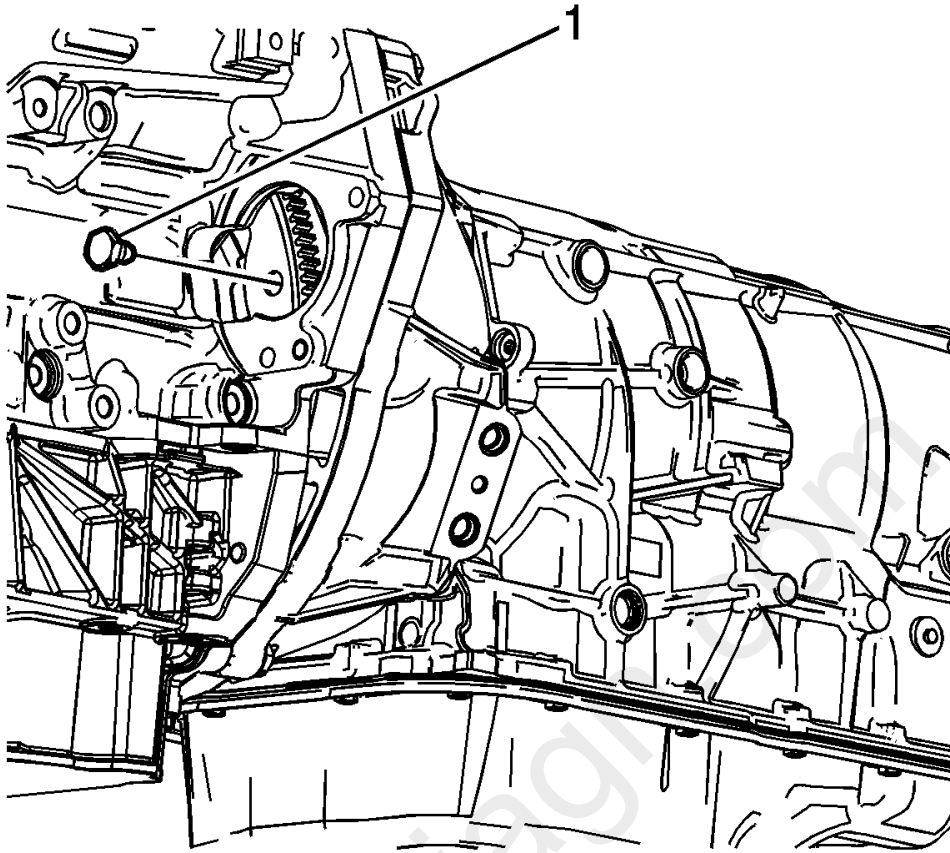


Fig. 91: Identifying Torque Converter Bolts
Courtesy of GENERAL MOTORS COMPANY

19. Remove the flywheel cover mount bolt.
20. Remove the flywheel cover.
21. Repeat the following steps for all torque converter bolts (1):
 1. Rotate the harmonic balancer center bolt clockwise ONLY, in order to align the torque converter bolt with the access hole.
 2. Remove and discard the torque converter bolt.
22. Support the transmission with a suitable transmission jack.
23. Remove the transmission support. Refer to **Transmission Support Replacement (Manual CTS-V)** , **Transmission Support Replacement (Automatic CTS-V)** , **Transmission Support Replacement (Automatic RWD except CTS-V)** , **Transmission Support Replacement (Manual except CTS-V)** .
24. Lower the transmission.

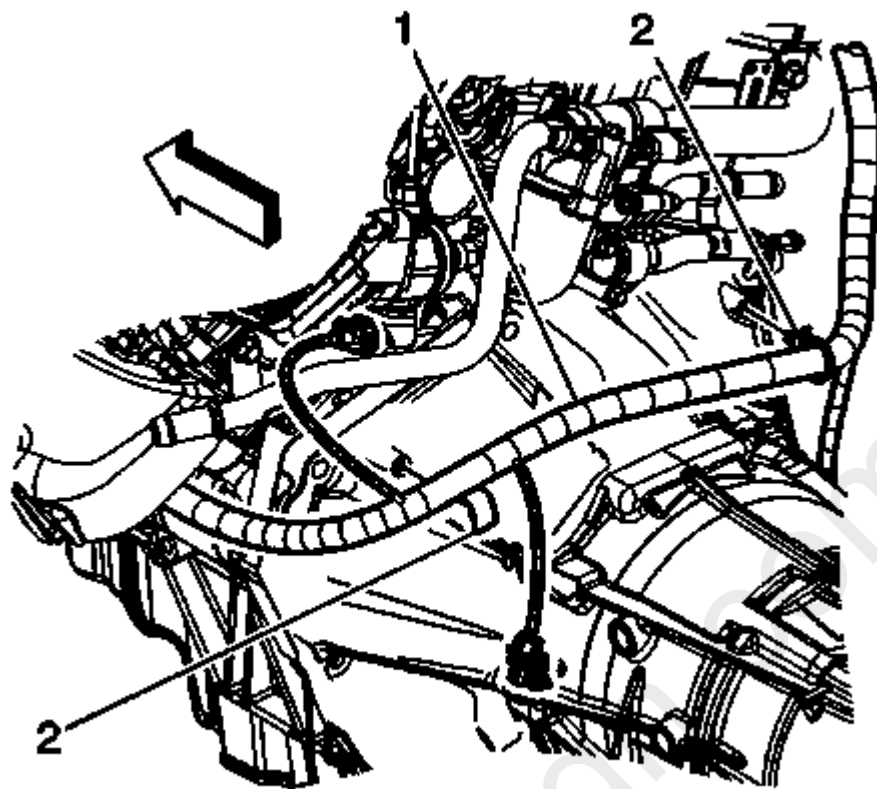


Fig. 93: Wiring Harness Retainers
Courtesy of GENERAL MOTORS COMPANY

26. Remove the wiring harness retainers (2) from the transmission.
27. Position the transmission wiring harness (1) and vent tube out of the way.

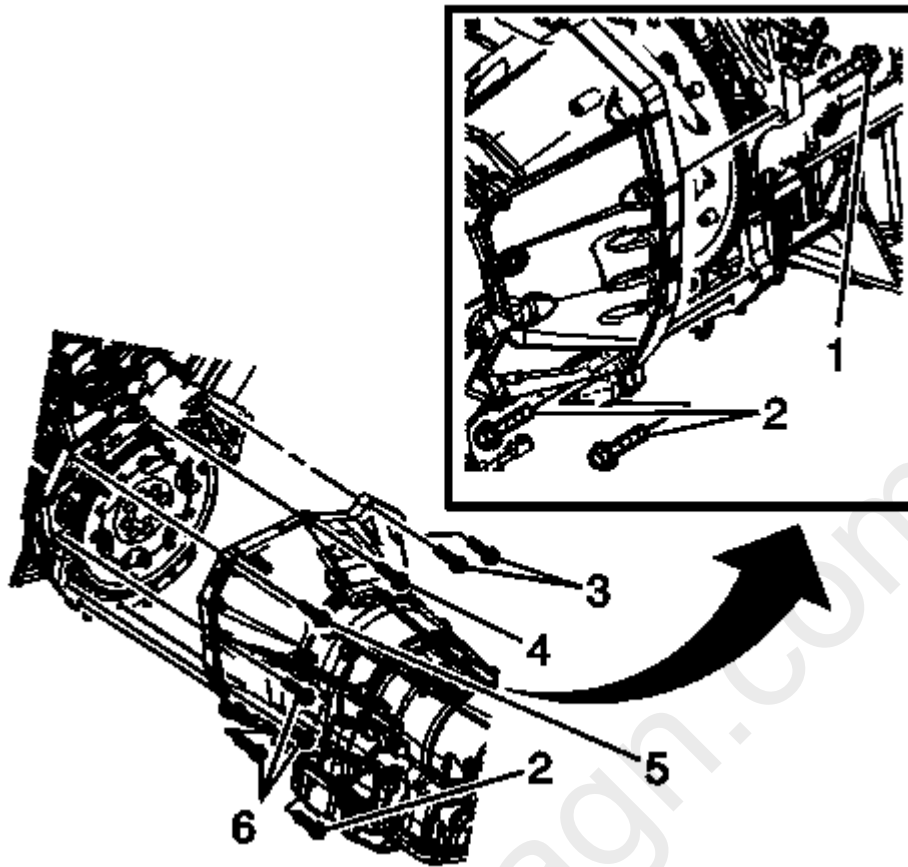


Fig. 94: Transmission Mounting Bolts
Courtesy of GENERAL MOTORS COMPANY

28. Remove the transmission mounting bolts (1-6).
29. Pull the transmission free from the engine dowels.

NOTE: Ensure clearance is maintained between the transmission and the following:

- The wiring harness
- The vent tube
- The cooler pipes

30. Carefully lower the transmission from the vehicle.
31. Flush and flow test the transmission oil cooler and lines. Refer to **Transmission Fluid Cooler Flushing and Flow Test**.

Installation Procedure

NOTE: Ensure clearance is maintained between the transmission and the

following:

- The wiring harness
- The vent tube
- The cooler pipes

1. Using the transmission jack, carefully raise the transmission to the engine.

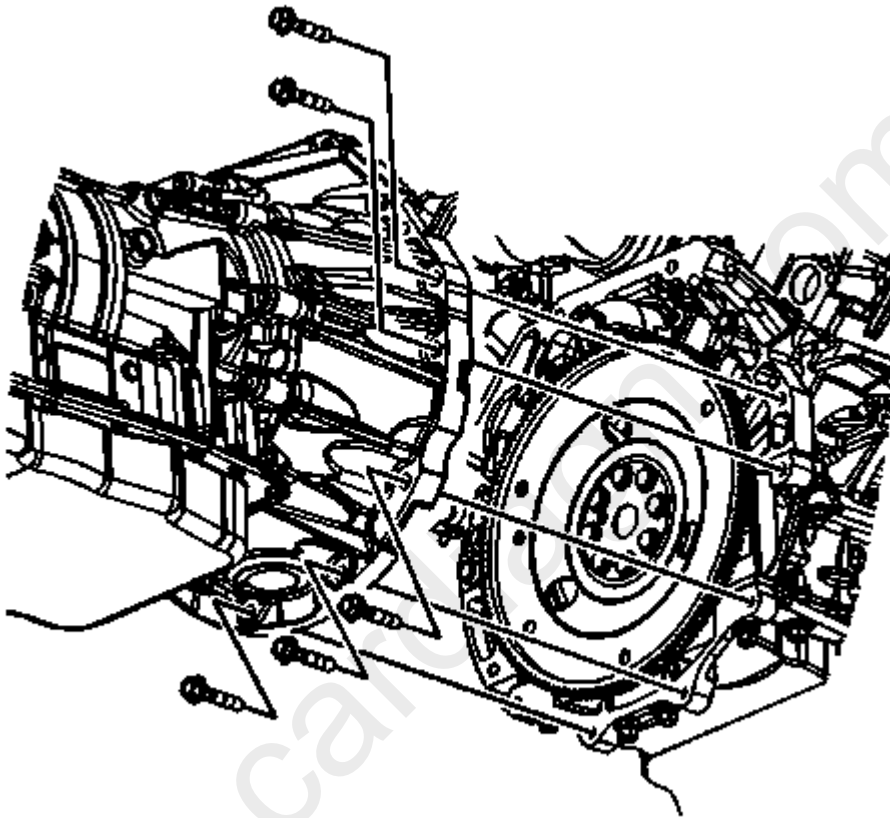


Fig. 95: Identifying Transmission Mounting Bolts
Courtesy of GENERAL MOTORS COMPANY

2. Align the transmission with the engine dowels.

CAUTION: Refer to Fastener Caution .

3. Install the transmission mounting bolts and tighten to 50 (37 lb ft).

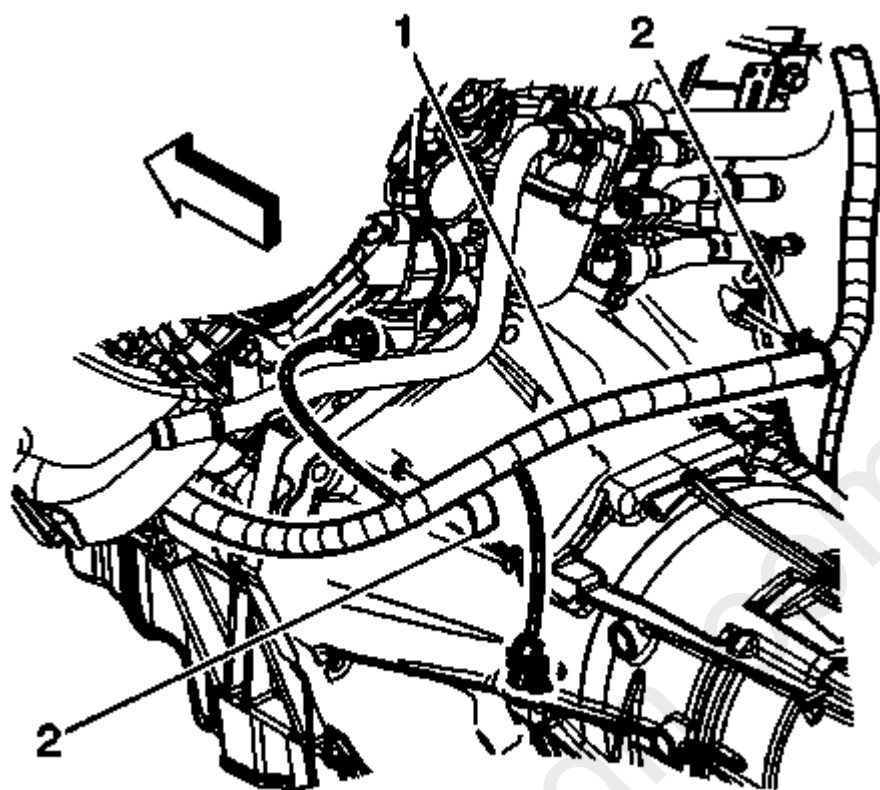


Fig. 96: Wiring Harness Retainers
Courtesy of GENERAL MOTORS COMPANY

4. Position the engine wiring harness (1) to the original location.
5. Install the wiring harness retainers (2) to the transmission.

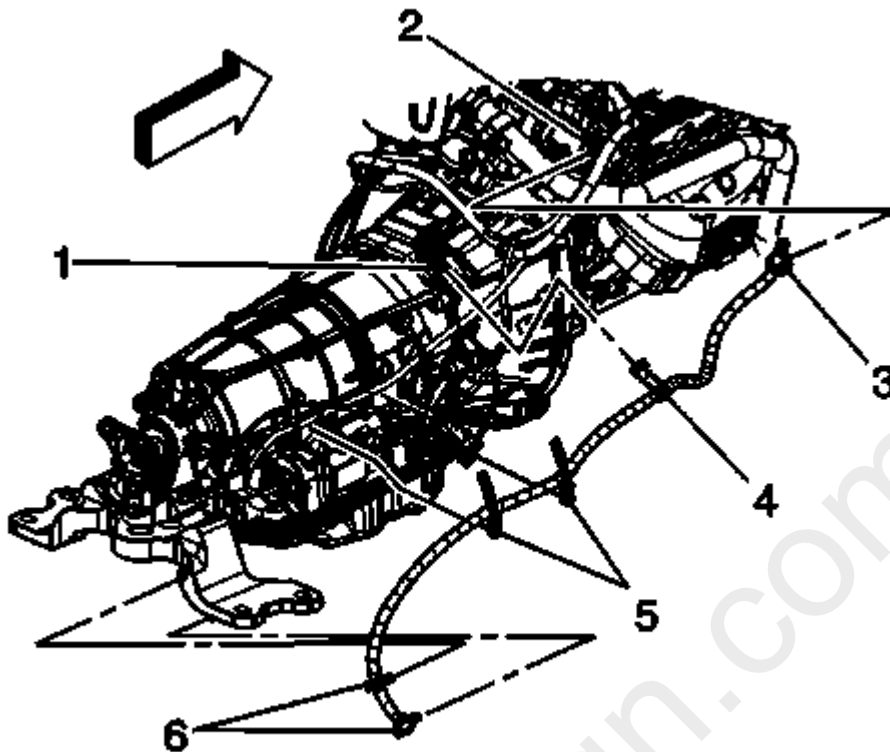


Fig. 97: View Of Vent Hose Assembly
Courtesy of GENERAL MOTORS COMPANY

6. Connect the transmission vent hose (4) to the transmission vent pipe (1).
7. Raise the transmission to the installed position.
8. Install the transmission support. Refer to **Transmission Support Replacement (Manual CTS-V)** , **Transmission Support Replacement (Automatic CTS-V)** , **Transmission Support Replacement (Automatic RWD except CTS-V)** , **Transmission Support Replacement (Manual except CTS-V)** .
9. Remove the jack from under the transmission.
10. Align the torque converter to flexplate/flywheel orientation marks made during the removal procedure.

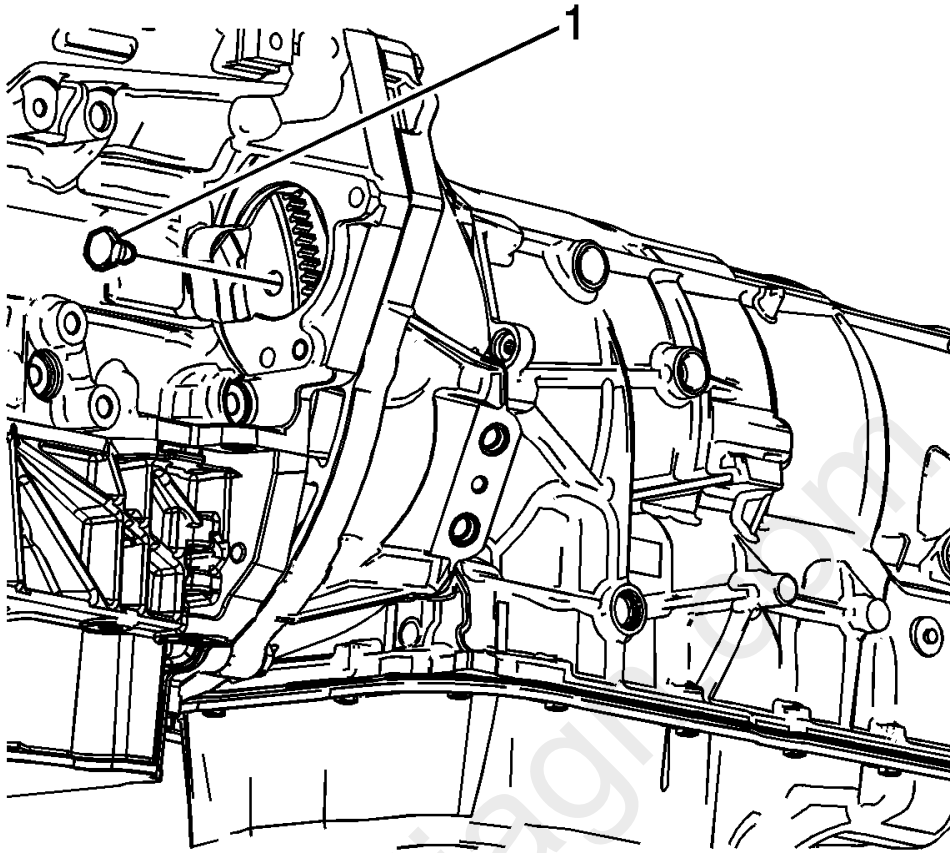


Fig. 98: Identifying Torque Converter Bolts
Courtesy of GENERAL MOTORS COMPANY

NOTE: Torque converter bolts are self locking and must be replaced with NEW torque converter bolts every time the bolts are removed.

11. Complete the following steps for all torque converter bolts (1):
 1. Rotate the harmonic balancer center bolt clockwise ONLY, in order to align the torque converter bolt holes in the flexplate/flywheel with the access hole in the engine block.
 2. To aid in alignment of the torque converter to the flexplate/flywheel. Install all NEW torque converter bolts before fully tightening to 63 (46 lb ft).
12. Install the flywheel cover.
13. Install the starter motor. Refer to **Starter Replacement (LSA)** , **Starter Replacement (LF1/LLT)** .

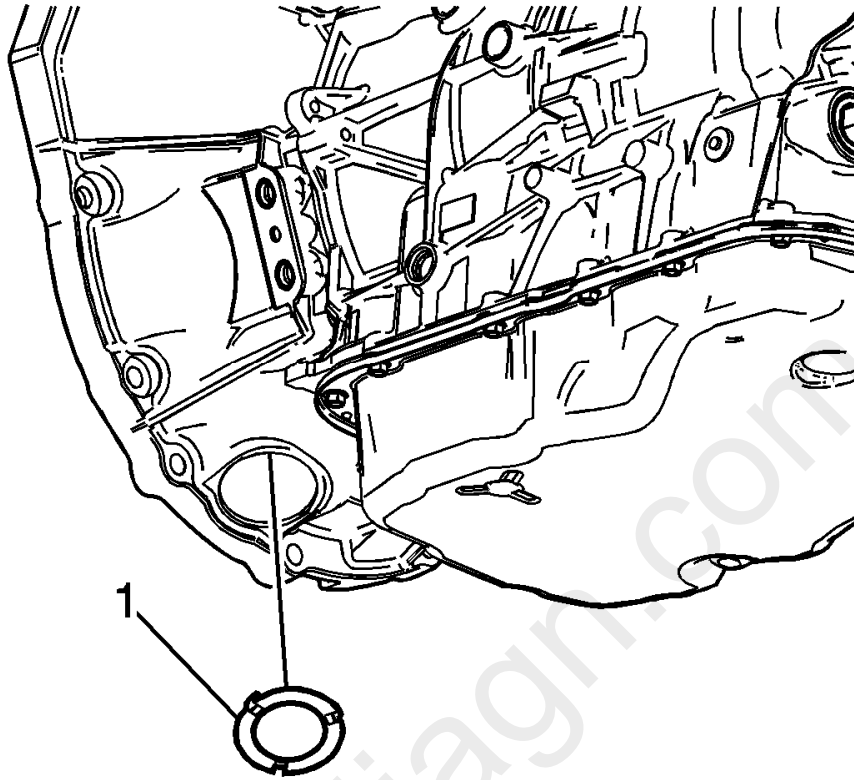


Fig. 99: Identifying Transmission Close Out Plug
Courtesy of GENERAL MOTORS COMPANY

14. Install the transmission close out plug (1).

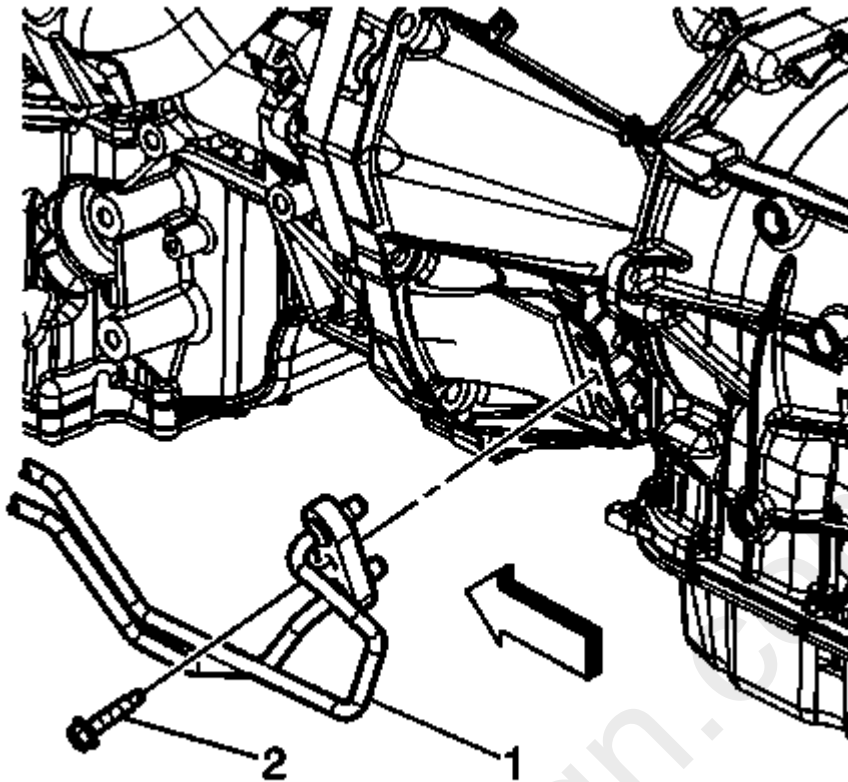


Fig. 100: View of Transmission Fluid Cooler Pipes
Courtesy of GENERAL MOTORS COMPANY

15. Install the transmission cooler line bracket to the right rear of the oil pan.
16. Place NEW O-rings over the transmission fluid cooler pipes.
17. Install the transmission fluid cooler pipes (1) to the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement (With VO3)** , **Transmission Fluid Cooler Hose/Pipe Replacement (Without VO3)** .

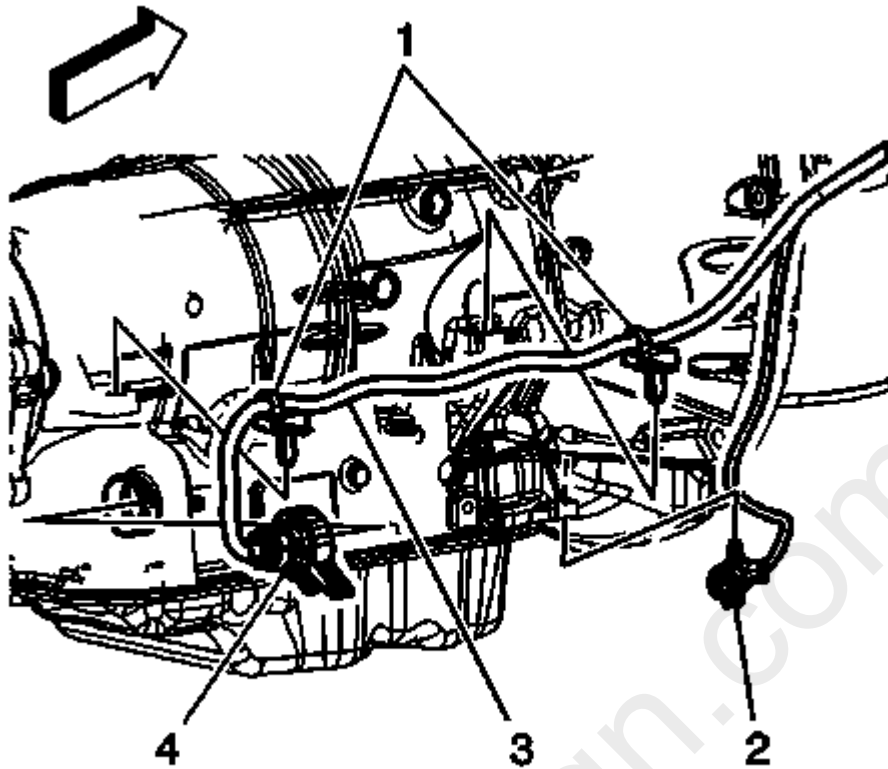


Fig. 101: View Of Oxygen Sensor Wiring Harness Connector, Retainers
Courtesy of GENERAL MOTORS COMPANY

18. Install the oxygen sensor wiring harness connector (2) from the transmission.
19. Install the wiring harness retainers (1) to the transmission.
20. Connect the transmission wiring harness connector (5) to the transmission by rotating the locking latch clockwise.

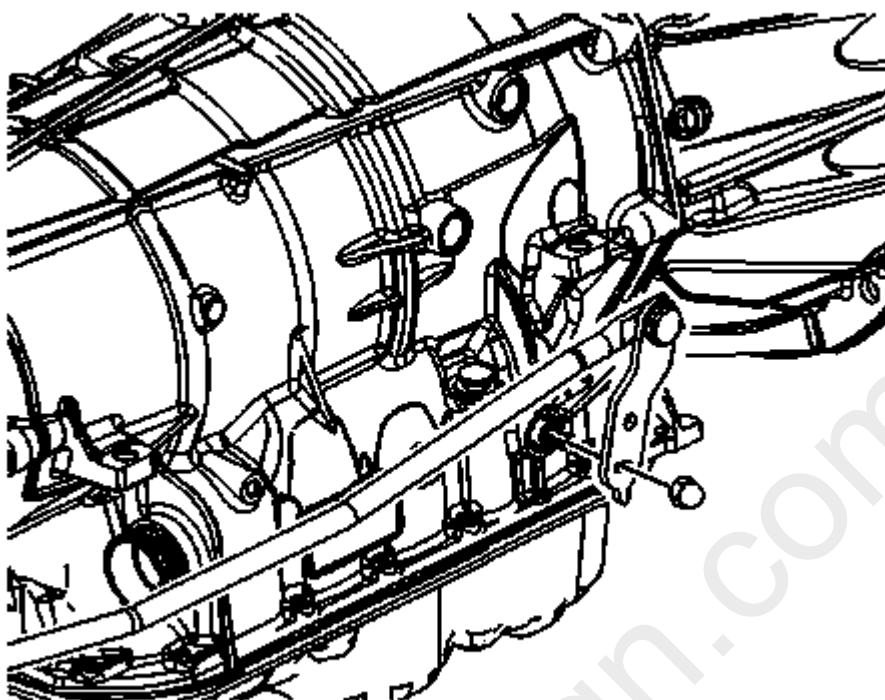


Fig. 103: View Of Manual Shift Shaft Nut
Courtesy of GENERAL MOTORS COMPANY

22. Install the shift linkage to the transmission.
23. Install the transmission manual shift shaft nut and tighten to 15 (11 lb ft).
24. Install the propeller shaft. Refer to **Rear Propeller Shaft Replacement (RPO LSA)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MXO)** , **Rear Propeller Shaft Replacement (RPO LFX or LFW with MX7 or MN6)** .
25. Install the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LSA)** , **Catalytic Converter Replacement - Left Side (LFW,LFX)** , and **Catalytic Converter Replacement - Right Side (LFW,LFX)** , **Catalytic Converter Replacement - Right Side (LSA)** .
26. Install the exhaust system. Refer to **Exhaust System Replacement (LSA-Coupe)** , **Exhaust System Replacement (LSA-Sedan/Wagon)** , **Exhaust System Replacement (Single Exhaust)** , **Exhaust System Replacement (LFX/LFW-Coupe)** , **Exhaust System Replacement (LFX/LFW-Sedan/Wagon)** .
27. Install the front air deflector. Refer to **Front Air Deflector Replacement** .
28. Lower the vehicle.
29. Install the thermostat housing . Refer to **Engine Coolant Thermostat Housing Replacement (LF1,LFW,LLT or LFX)** .
30. Check the transmission fluid level and fill if necessary. Refer to **Transmission Fluid Level and**

Condition Check .

31. Adjust the shift control linkage. Refer to **Shift Control Linkage Adjustment (All Wheel Drive)**, **Shift Control Linkage Adjustment (Rear Wheel Drive)**.

Transmission Final Test and Inspection

Complete the following procedure after the transmission is installed in the vehicle:

1. With the ignition OFF or disconnected, crank the engine several times. Listen for any unusual noises or evidence that any parts are binding.
2. Start the engine and listen for abnormal conditions.
3. While the engine continues to idle, raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Inspect for fluid leaks while the engine is idling.
5. Perform a final inspection for the proper fluid level.
6. Lower the vehicle.
7. If a NEW TCM has been installed into the vehicle, the NEW module needs to be reprogrammed. Refer to **Service Programming System (SPS)** .

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

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

8. Perform the Reset Transmission Adapts. Refer to **Reset Transmission Adapts** .
9. Road test the vehicle.