# 2002 AUTOMATIC TRANSMISSIONS

## Servicing - Saturn Vue (AF33-5)

# APPLICATION

### TRANSAXLE APPLICATION

| Application | Transaxle Model (RPO Code) |
|---|---|
| 3.0L (AWD) | AF33-5 (M45) |

# LUBRICATION

### SERVICE INTERVALS

**WARNING: Saturn ATF (P/N 21005966 and 21019223), and DEXRON-III ATF are not compatible with this transaxle. This transaxle uses T-IV Fluid (P/N 22689186) only.**

#### Transaxle

It is not necessary to check transmission fluid. A transmission fluid leak is the only reason to check transmission fluid level. Transmission fluid should not be changed under normal operating conditions. Under continuous extreme operating conditions (trailer towing, heavy city traffic with ambient temperature more than 90°F (32°C) or delivery service), replace fluid and filter every 50,000 miles.

#### Power Transfer Unit

It is not necessary to check power transfer unit fluid. A power transfer unit fluid leak is the only reason for fluid loss. Power transfer unit fluid should not need to be changed.

#### Rear Drive Module

It is not necessary to check rear drive module fluid. A rear drive module fluid leak is the only reason for fluid loss. Rear drive module fluid should not need to be changed.

### CHECKING FLUID LEVELS

**WARNING: Saturn ATF (P/N 21005966 and 21019223), and DEXRON-III ATF are not compatible with this transaxle. This transaxle uses T-IV Fluid (P/N 22689186) only.**

1. Park vehicle on level ground.
2. Start engine and operate vehicle until transmission fluid temperature reaches 158-176°F (70-80°C).
3. Depress brake pedal and move shift lever slowly through all gear ranges from Park to L (Low). Return shift lever to Park range at idle condition.

 

4. Pull level gauge out, wipe off fluid with a clean cloth and reinsert.
5. Pull level gauge out again and check if fluid level is within the HOT range.
6. Check condition of transmission fluid. Refer to check fluid color.
7. If fluid is not within the correct level, adjust accordingly. If fluid is below the HOT range, add enough fluid to bring it up to correct level. If fluid is above the HOT range, drain excess fluid. If check is necessary at a low oil temperature 86-104°F (30°-40°C), perform check using the COLD range on level gauge. However, the fluid must be re-checked at the proper fluid temperature.

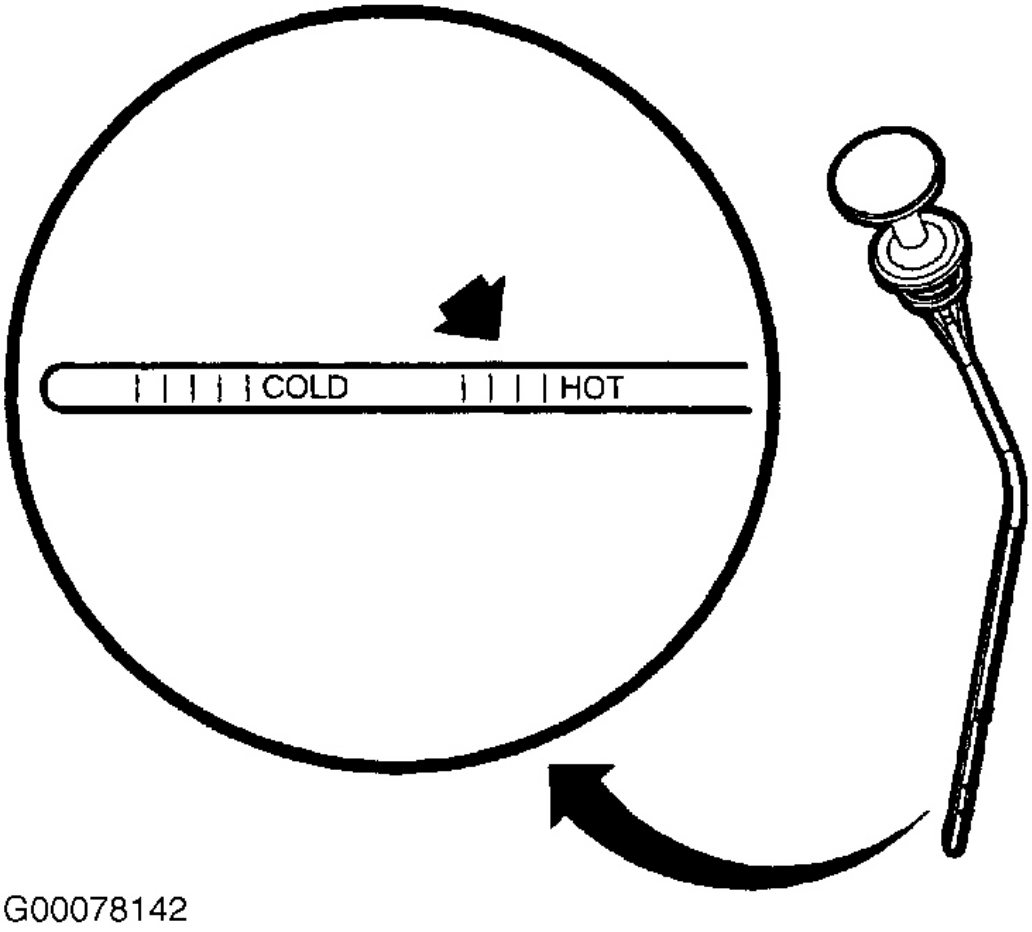


**Fig. 1: Identifying Dipstick Marks**
**Courtesy of GENERAL MOTORS CORP.**

**FLUID DIAGNOSIS**

**Red Or Light Brown**

 

This is the normal color for automatic transmission fluid. Make sure transmission fluid is at the proper level. See **CHECKING FLUID LEVELS** .

**Foaming Fluid**

The following could be possible causes of this condition:

- Degraded transmission fluid.
- Contaminated transmission fluid.
- Transaxle is overfilled.
- Transaxle cooler lines plugged.
- Transaxle oil filter clogged or cracked.
- Oil filter seal leaking.
- Side cover seal damaged.
- Oil level control valve damaged or loose
- Engine overheating or vehicle overloading.

**Dark Brown**

Drain fluid to determine source of possible contamination. If fluid contains metal or other debris, possible transaxle damage may have occurred. If fluid does not contain metal or other debris, fluid may have been overheated.

## RECOMMENDED FLUIDS

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Manufacturer recommends T-IV Fluid (P/N 22689186) only. Fill transaxle with appropriate quantity. See **FLUID CAPACITIES** .

## FLUID CAPACITIES

### TRANSAXLE FLUID CAPACITIES

| Application | (1) Drain & Refill - Qts. (L) | Overhaul - Qts. (L) |
|---|---|---|
| AF33-5 | 4.2 (4) | 7.5 (7.1) |
| (1) Drain and refill capacity does not include torque converter. | | |

## DRAINING & REFILLING

**WARNING: Make sure vehicle is properly supported and squarely positioned on hoist. To help avoid personal injury when a vehicle is on a hoist, provide**

**additional support for vehicle on opposite end from which components are being removed.**

**WARNING: Saturn ATF (P/N 21005966 and 21019223), and DEXRON-III ATF are not compatible with this transaxle. This transaxle uses T-IV Fluid (P/N 22689186) only.**

1. Position vehicle on a hoist and raise vehicle. Remove drain plug and drain fluid. Allow at least 5 minutes for fluid to drain completely.
2. Remove gasket from drain plug and discard. Install a new gasket onto drain plug. See **Fig. 2** .
3. Install drain plug. Tighten drain plug to specification. See **TORQUE SPECIFICATIONS** . Lower vehicle.
4. Add approximately 4.2 Qts. (4L) of T-IV Fluid (P/N 22689186) to unit. Make sure vehicle is on level ground.
5. Start engine and operate vehicle until transmission fluid temperature reaches 158°F-176°F (70-80°C). Apply parking brake.
6. Depress brake pedal and move shift lever slowly through all gear ranges from Park to L (Low). Return shift lever to Park range at idle condition. Pull level gauge out, wipe off fluid with a clean cloth and reinsert.
7. Pull level gauge out again and check if fluid level is within the HOT range. See **Fig. 1** . If fluid is not within the correct level, adjust accordingly. If fluid is below the HOT range, add enough to bring it up to the correct level. If fluid is above HOT range, drain excess fluid. If the check is necessary at a low oil temperature 86-104°F (30-40°C), perform check using the COLD range on the level gauge. However, the fluid must be re-checked at the proper fluid temperature.

 

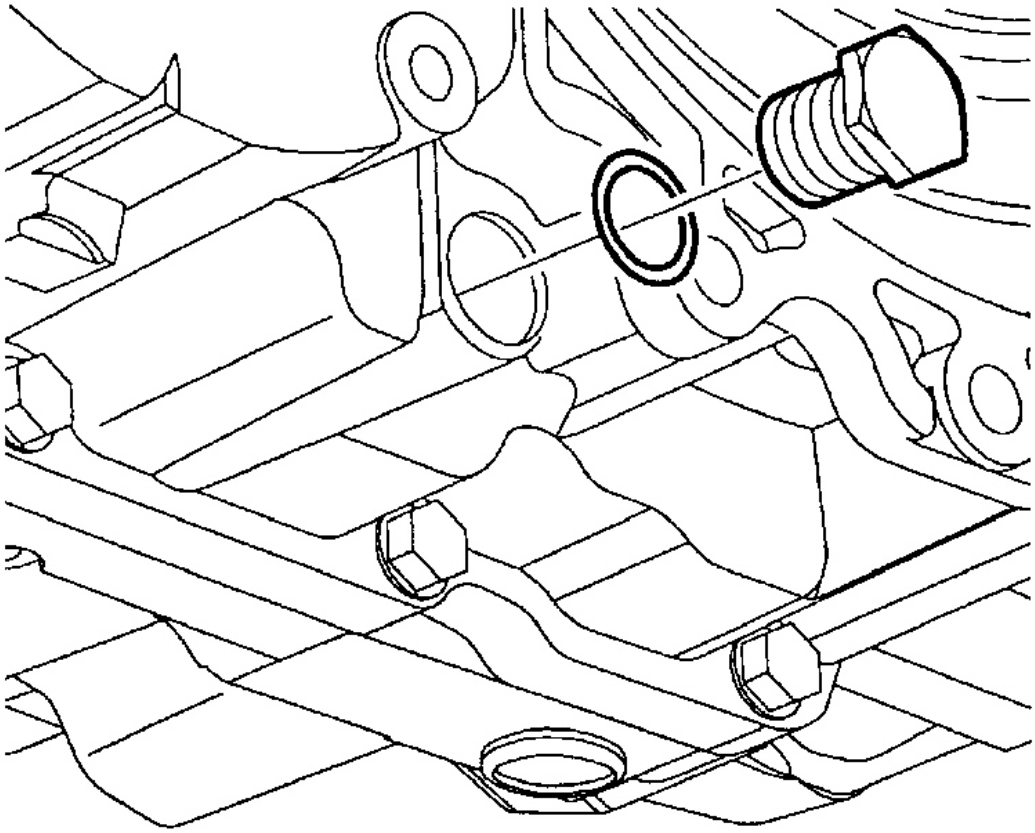


**Fig. 2: Removing & Installing Transaxle Drain Plug**
**Courtesy of GENERAL MOTORS CORP.**

**OIL COOLER FLUSHING**

1. Oil Line Cooler Flusher (SA9165T) should be used when flushing of transaxle oil cooler in radiator assembly is required. Follow instructions provided with the tool when performing flushing procedure.
2. Cooler Flusher Adapter (J35944-440) is used in combination with flushing tool and allows you to attach cooler flusher to transaxle oil cooler line assembly and flush cooler and cooler lines at the same time.
3. The transaxle oil cooler and lines should be flushed in any of the following situations:
   - Performing a transaxle replacement.
   - Oil cooler lines should be flushed after oil cooler replacement.
   - Any internal transaxle failure that caused debris (clutch plate material, metal shavings, etc.) to enter the transaxle oil cooler and oil cooler lines.

## ON-VEHICLE REPAIRS

 

**NOTE: Various components may be serviced without transaxle removal. For servicing of these components, see appropriate component under ADJUSTMENTS and/or REMOVAL & INSTALLATION . For additional information on servicing electrical-type components, see appropriate DIAGNOSIS article in AUTOMATIC TRANSMISSIONS.**

# ADJUSTMENTS

**WARNING: Vehicles are 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 AIR BAG DEACTIVATION PROCEDURES article in GENERAL INFORMATION.**

## CONTROL CABLE

**CAUTION: Control cable must be disconnected from transaxle range switch lever prior to disconnecting it from control cable bracket. Otherwise damage to manual shift shaft may result, requiring transaxle disassembly.**

1. Move control assembly into Neutral position. Using Fascia Retainer Remover tool (J36346), disconnect control cable from transaxle range switch lever.
2. Disconnect control cable from control cable bracket by depressing control cable retainer clip tabs and pulling up. Release control cable assembly adjustment lock. Slide Black tab back. Insert screwdriver into slot under White tab and pull up on White tab. See **Fig. 3** and **Fig. 4** .
3. Install control cable into control cable bracket. Secure with control cable retainer clip. An audible snap will be heard when properly installed. Snap cable end fitting onto ball stud of transaxle range switch lever. An audible snap will be heard when properly installed.
4. Lock control cable adjustment tab. Push down on White tab to secure in place. Slide Black tab over White tab to lock in place. Verify proper operation.

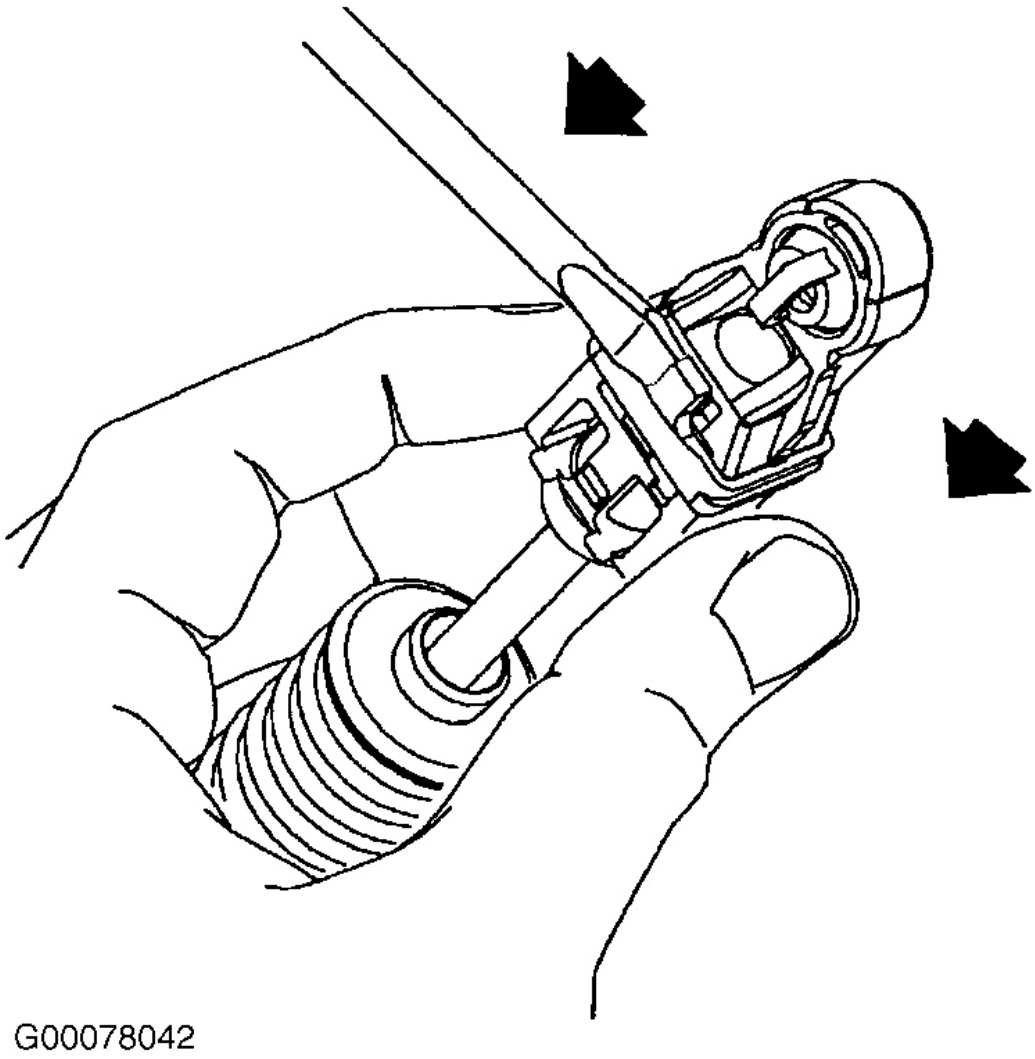


**Fig. 3: Releasing Control Cable Adjustment Lock (1 Of 2)**
**Courtesy of GENERAL MOTORS CORP.**

 

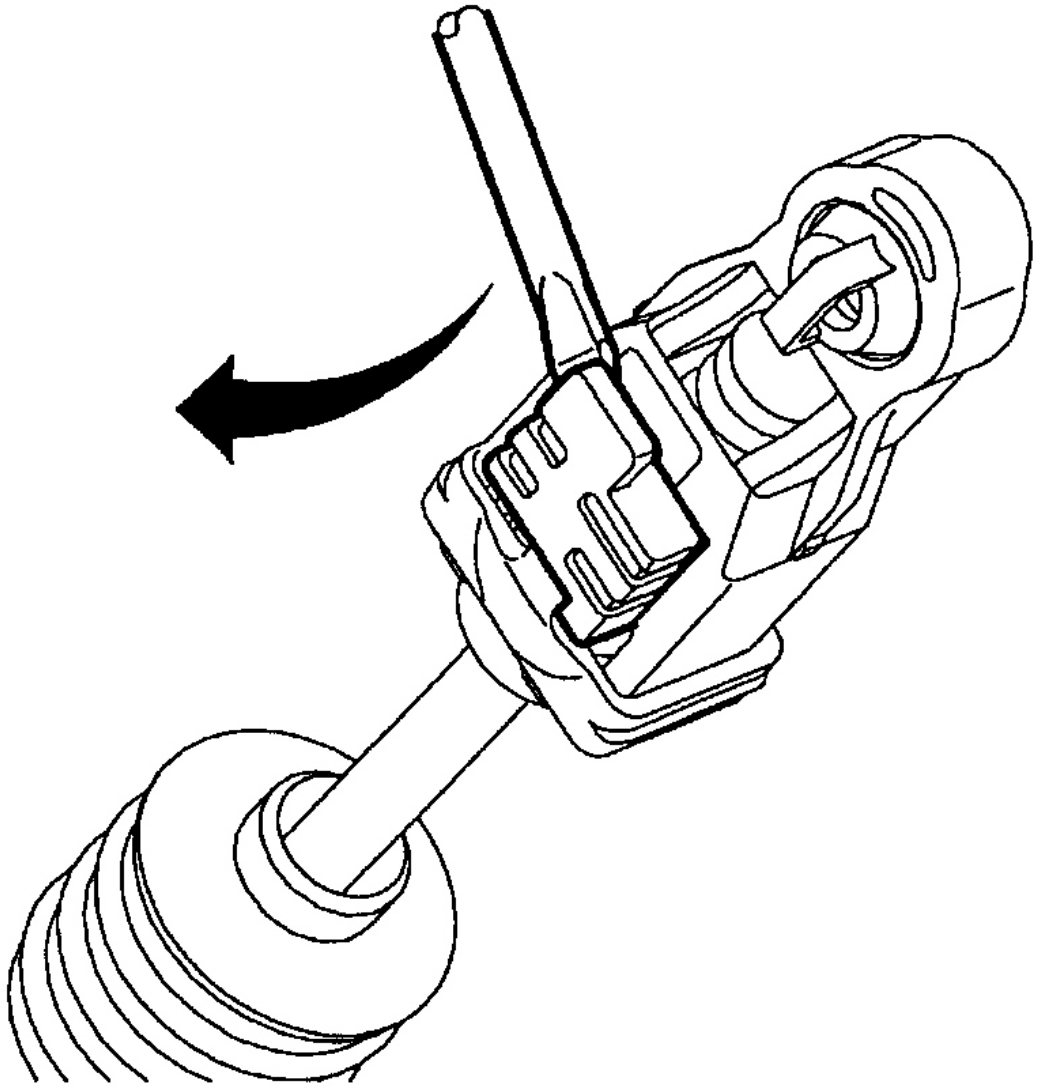


**Fig. 4: Releasing Control Cable Adjustment Lock (2 Of 2)**
**Courtesy of GENERAL MOTORS CORP.**

**TRANSAXLE RANGE SWITCH**

1. Remove control cable assembly from transaxle range switch lever. See **Fig. 5** . Loosen transaxle range switch bolts. See **Fig. 7** . Remove control cable assembly from transaxle range switch lever. Loosen transaxle range switch bolts.
2. Install Transaxle Range Switch Alignment tool (J45404) and align the Transaxle Range Switch Alignment tool pointer to the neutral basic line. See **Fig. 6** . Install transaxle range switch lever and nut,

 

then tighten to specification. See **TORQUE SPECIFICATIONS** .

3. Remove alignment tool. Tighten transaxle range switch bolts to specification. After adjusting switch, verify engine only starts in Park or Neutral. If engine starts in any other position, readjust switch.

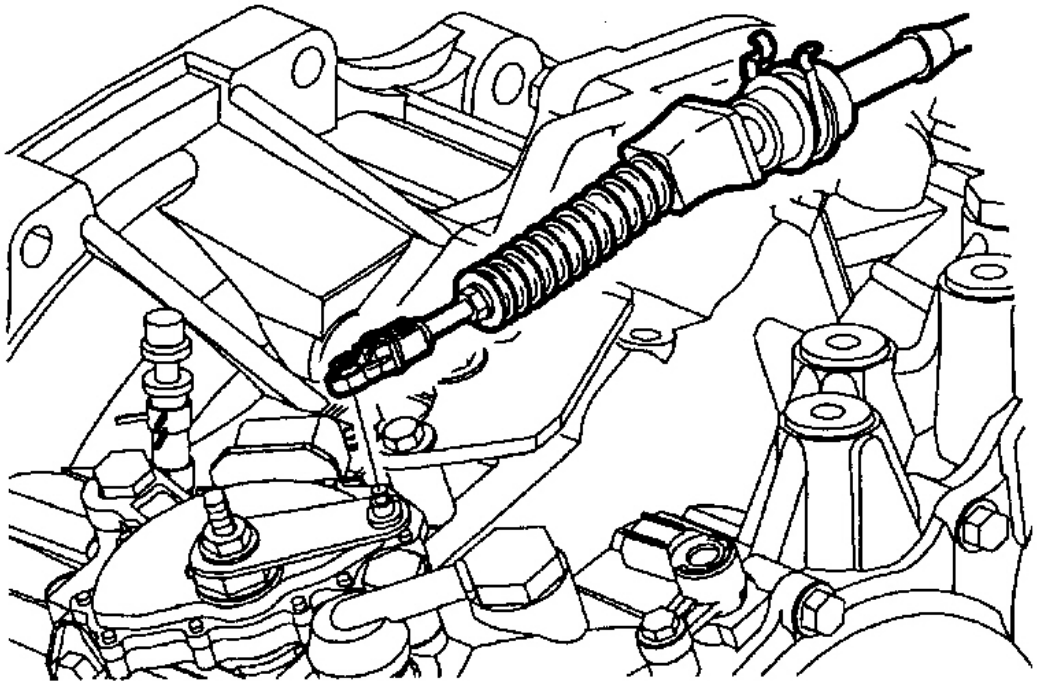

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**Fig. 5: Removing & Installing Control Cable**
**Courtesy of GENERAL MOTORS CORP.**

 

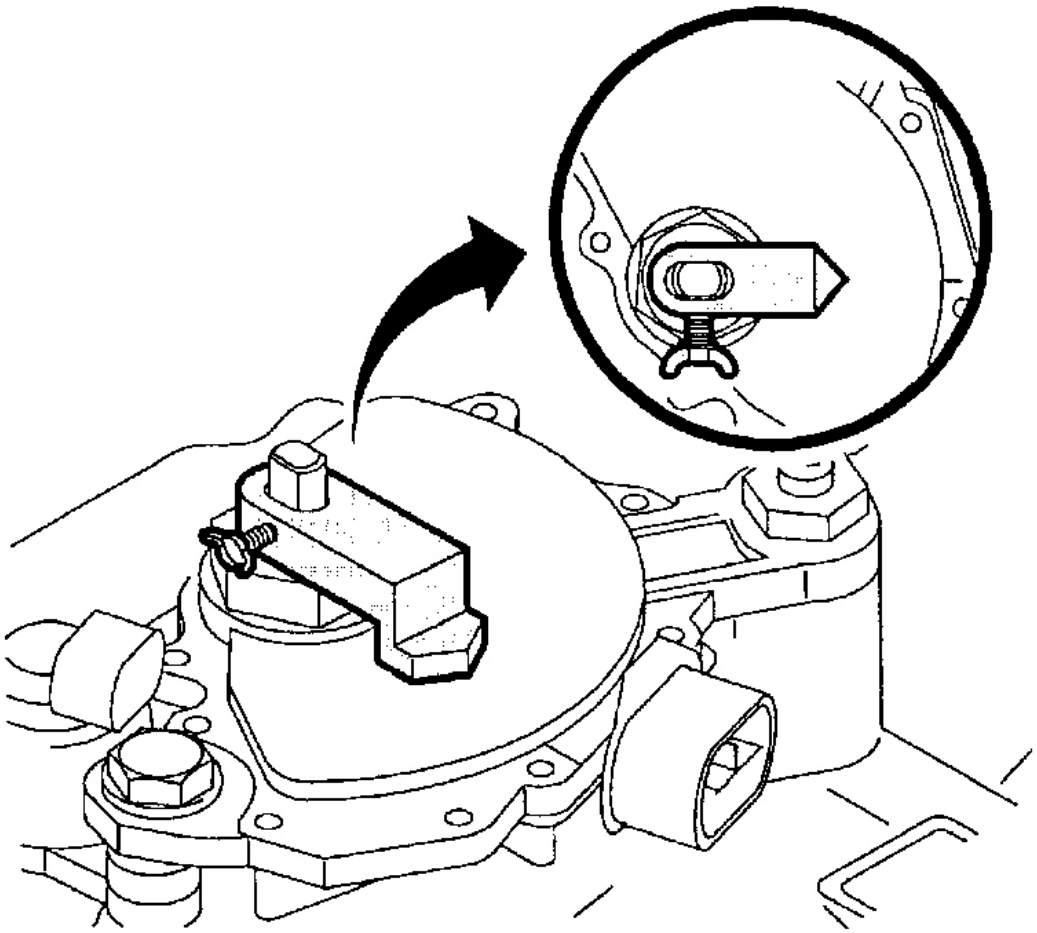


**Fig. 6: Identifying Transaxle Range Switch Alignment Tool**
**Courtesy of GENERAL MOTORS CORP.**

 

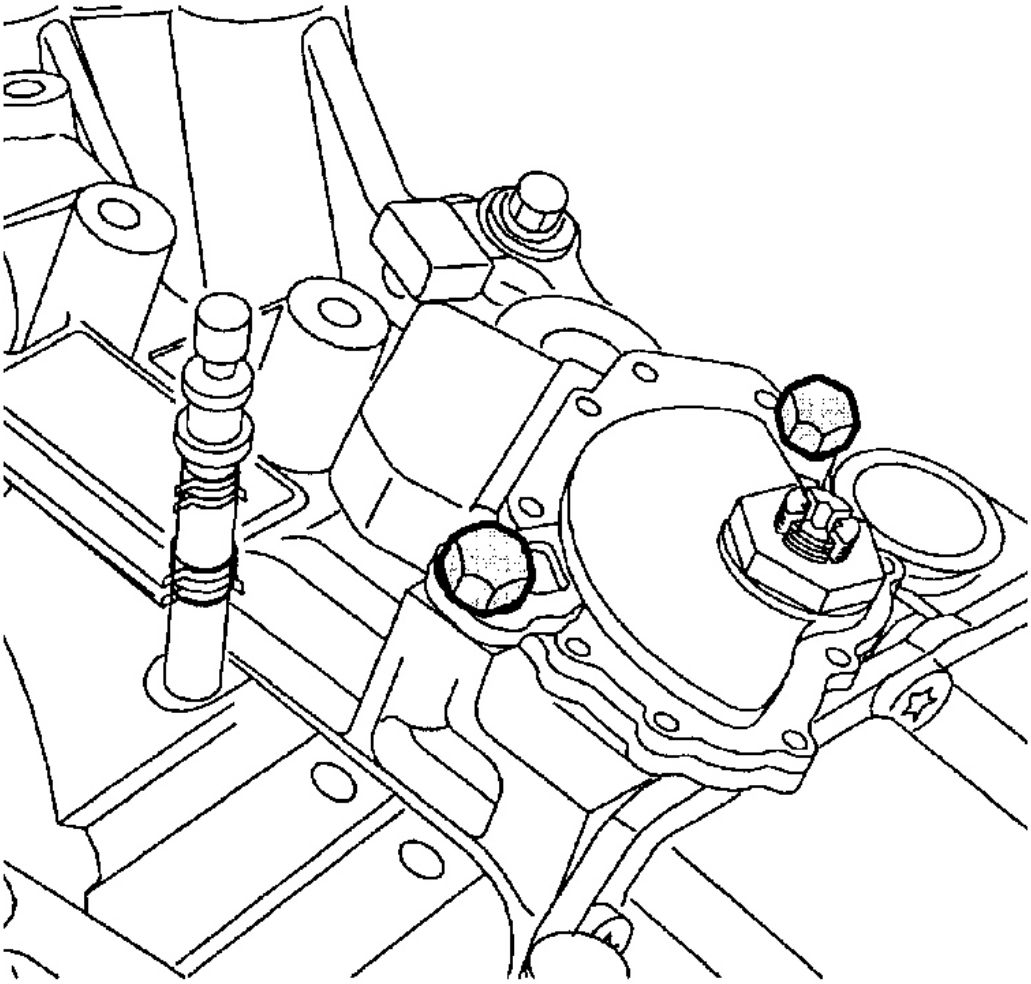

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**Fig. 7: Identifying Transaxle Range Switch Bolts**
**Courtesy of GENERAL MOTORS CORP.**

## REMOVAL & INSTALLATION

**WARNING: Vehicles are 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 AIR BAG DEACTIVATION PROCEDURES article in GENERAL**

 

**INFORMATION.**

**WARNING: Make sure vehicle is properly supported and squarely positioned on hoist. To help avoid personal injury when a vehicle is on a hoist, provide additional support for vehicle on opposite end from which components are being removed.**

**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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.**

## BATTERY COOLING BOX

### Removal

**CAUTION: DO NOT tip battery over 45 degree angle or acid could spill.**

**NOTE: Record all pre-set radio stations prior to disconnecting battery and reprogram pre-set stations after repair.**

1. Remove battery cover. Disconnect negative battery cable. Disconnect positive battery cable. Loosen battery hold-down screw and remove battery. See **Fig. 8** . Remove underhood fuse box cover. Remove positive battery cable and EPS wire from positive battery terminal at underhood fuse box. Open all retainer clips and remove all cables, lines and harnesses from battery cooling box.

   **CAUTION: Protect disconnected harness from contamination during service.**

2. Loosen underhood fuse box connector retaining screws. Unfasten underhood fuse box from its housing and disconnect forward lamp harness. See **Fig. 9** . Remove battery cooling box screws. Remove battery cooling box side support screw. Pull inlet duct away from battery cooling box. Rotate underhood fuse box out of way and remove battery cooling box.

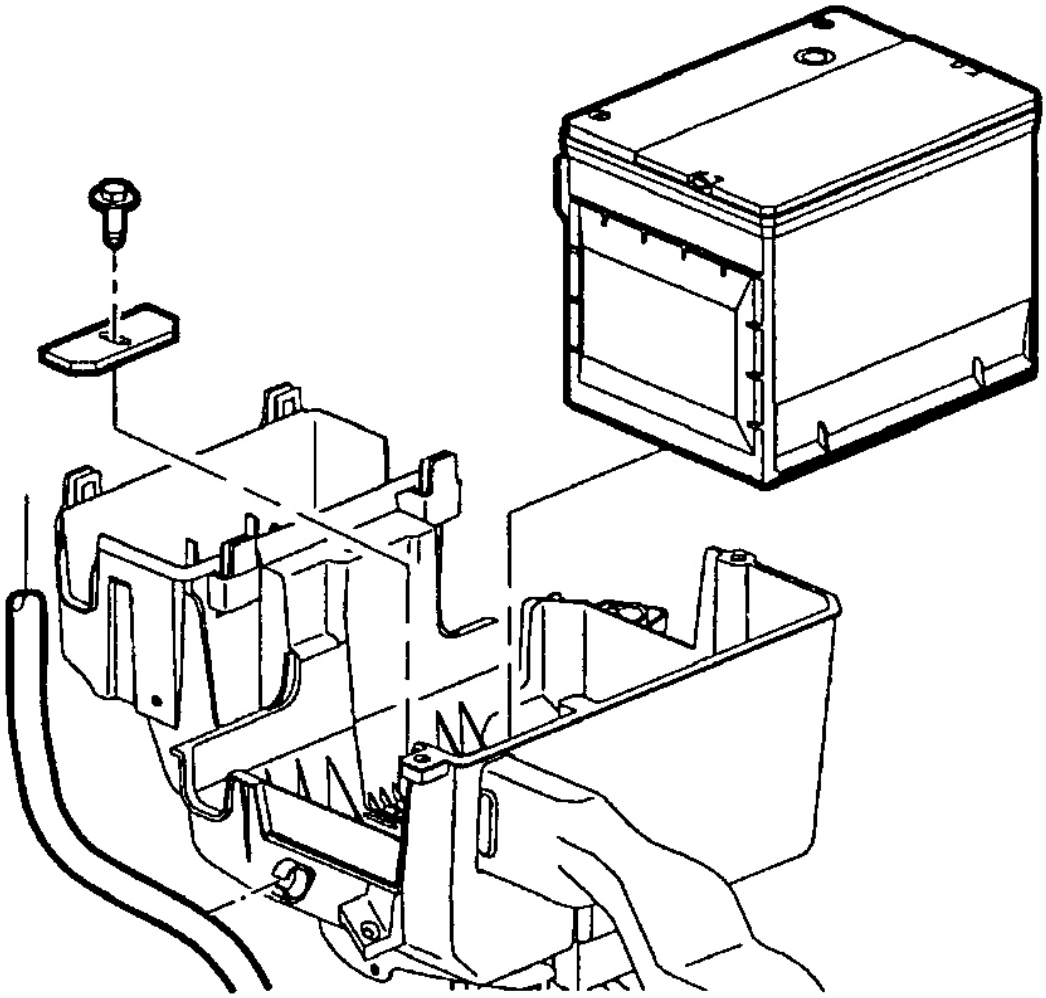

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**Fig. 8: Removing & Installing Battery Hold Down Screw**
**Courtesy of GENERAL MOTORS CORP.**

 

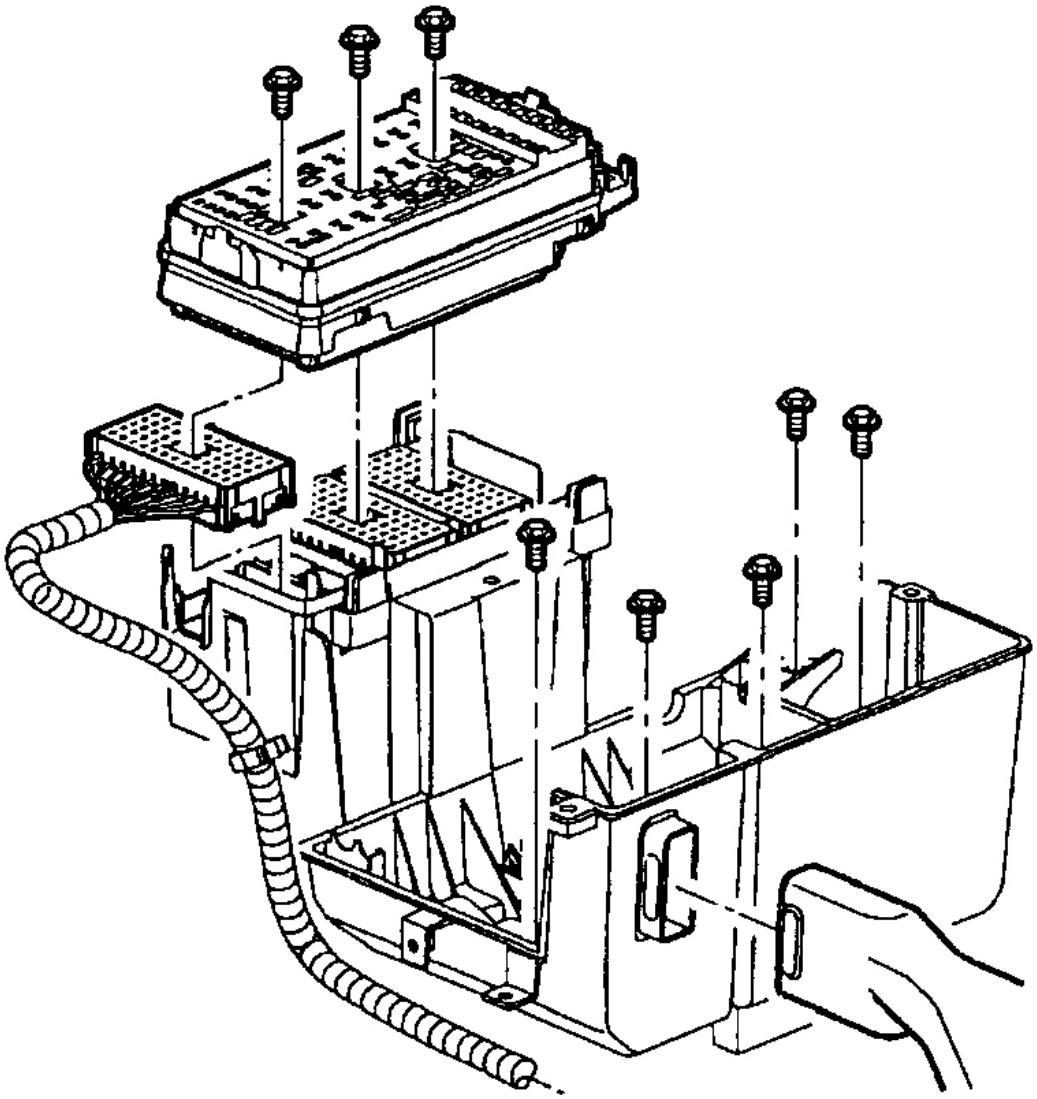


**Fig. 9: Removing & Installing Underhood Fuse Box**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

**NOTE: Alignment of inlet and outlet ducts with battery cooling box, is critical to ensure proper airflow to battery.**

**CAUTION: Over-tightening battery cooling box screws will break/crack plastic.**

 

1. Position battery cooling box on tray so that inlet and outlet ducts are properly aligned. Install battery cooling box screws and tighten to specification. Install battery cooling box side support screw and tighten to specification. See **TORQUE SPECIFICATIONS** .
2. Connect forward lamp harness to underhood fuse box and attach underhood fuse box into housing. See **Fig. 9** . Tighten underhood fuse box connector retaining screws to specification. Secure all cables, lines and harnesses into retaining clips.
3. Attach positive battery cable and EPS wire to positive battery terminal at underhood fuse box and tighten nut to specification. Insert battery and tighten battery hold-down screw to specification. See **Fig. 8** . See **TORQUE SPECIFICATIONS** . Connect positive battery cable to battery and tighten to specification.
4. Connect negative battery cable to battery and tighten to specification. Install fuse box cover. Install battery cooling box cover and tighten screws to specification.

## CONSOLE

### Removal

1. Disable Supplemental Inflatable Restraint (SIR) system. See AIR BAG DEACTIVATION PROCEDURES article in GENERAL INFORMATION. Move shifter to Neutral position. Pull up at rear edge of shifter bezel, disengaging retention clips. See **Fig. 10** . Disconnect window switches, mirror switch and cigar lighter and remove shifter bezel.
2. Move front seats to forward-most position. Remove front floor console assembly-to-floor pan screws. Lift console from rear and disconnect power outlet harness connector. Move front seats to rearward-most position and put seat backs down. Remove console by pulling up at rear first, then twisting counterclockwise to remove.
3. Remove screws and pull rearward at clip locations to remove knee bolster. See **Fig. 11** . Open glove box and turn door stops 1/4 turn and remove door stops. See **Fig. 12** . Push center pin portion of glove box door pins toward center of instrument panel compartment and remove glove box assembly.
4. Pull rearward at clip locations to remove center trim panel. See **Fig. 13** . Remove front screws holding left and right console trim panels. Remove panel-to-HVAC module push pins and trim panel-to-instrument panel retainer screws and remove panels. See **Fig. 14** .

 

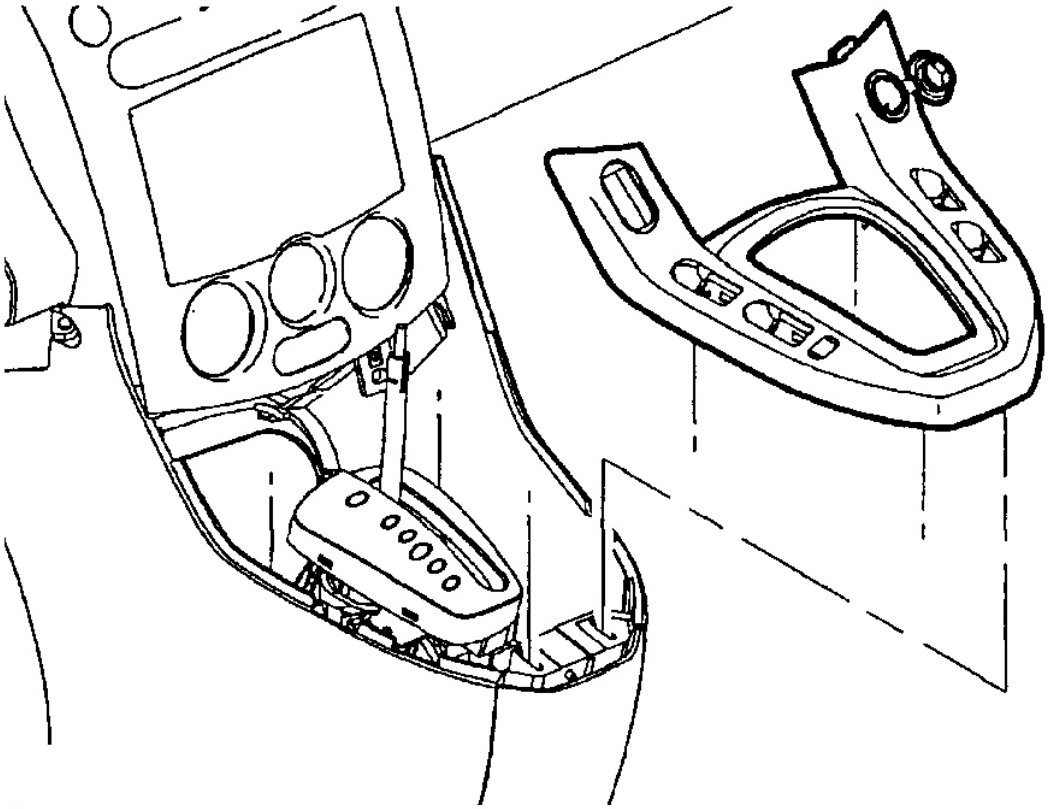


**Fig. 10: Removing & Installing Shifter Bezel**
**Courtesy of GENERAL MOTORS CORP.**

 

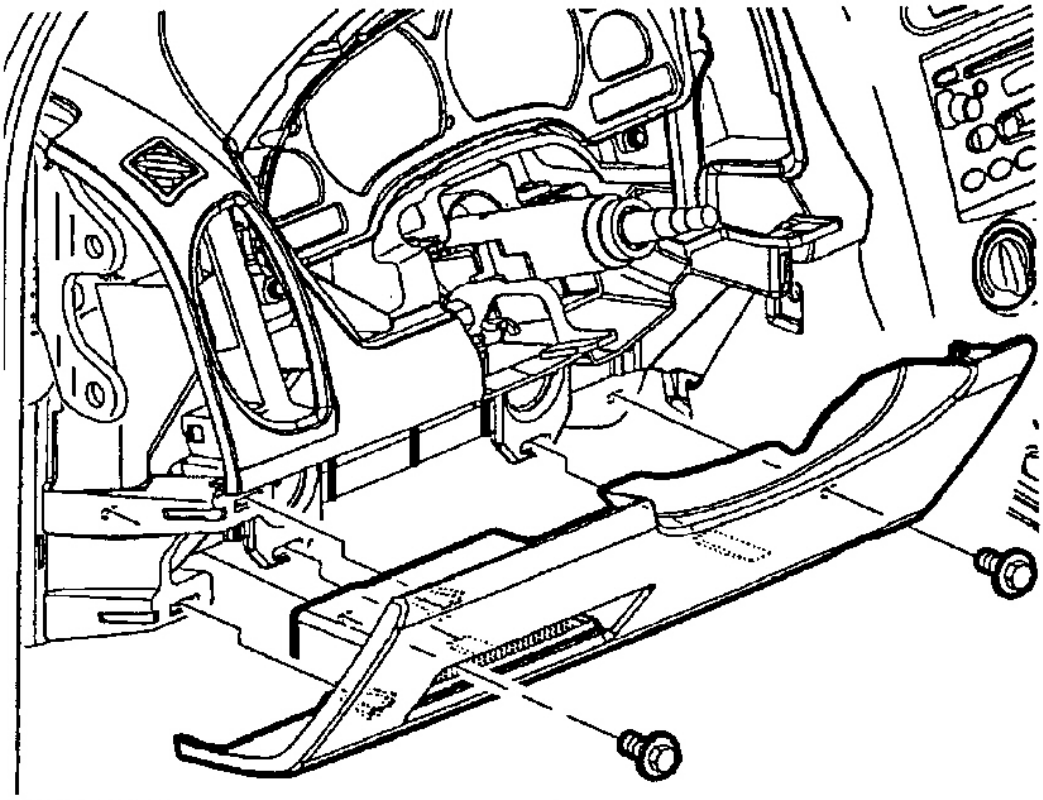


**Fig. 11: Removing & Installing Knee Bolster**
**Courtesy of GENERAL MOTORS CORP.**

 

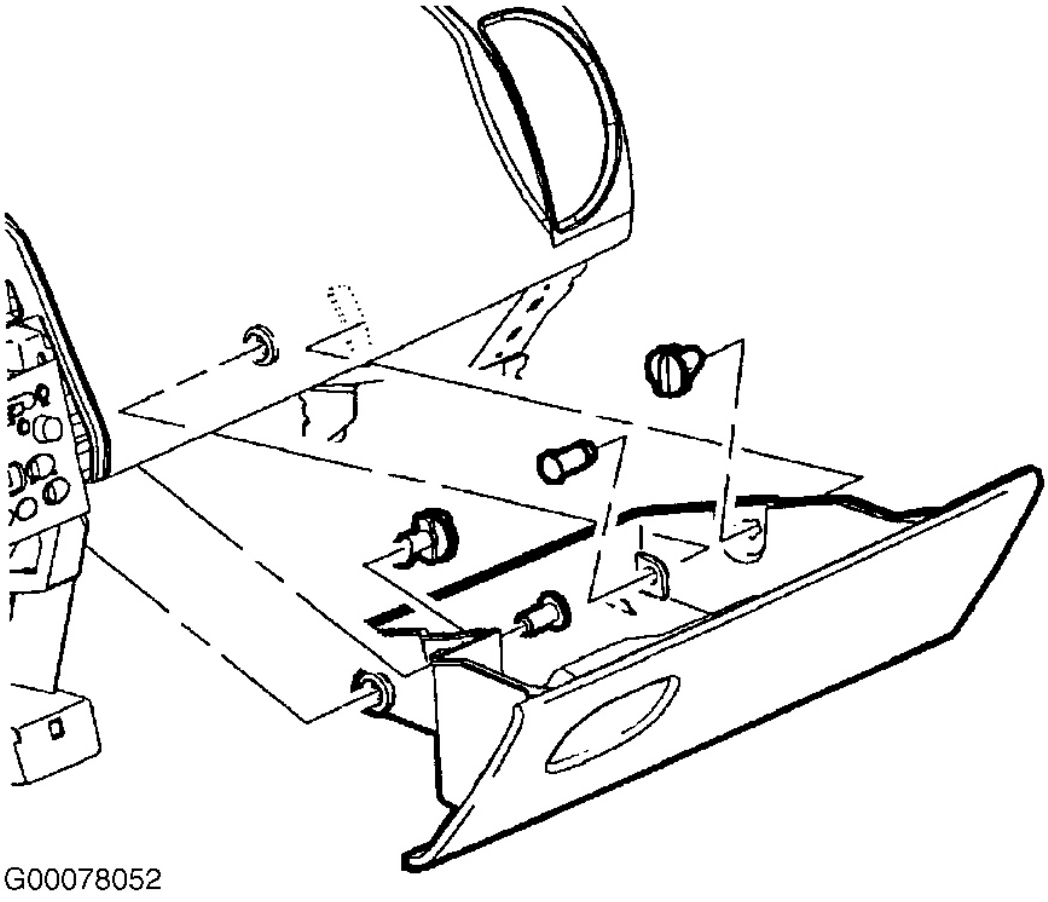


**Fig. 12: Removing & Installing Glove Box Door**
**Courtesy of GENERAL MOTORS CORP.**

 

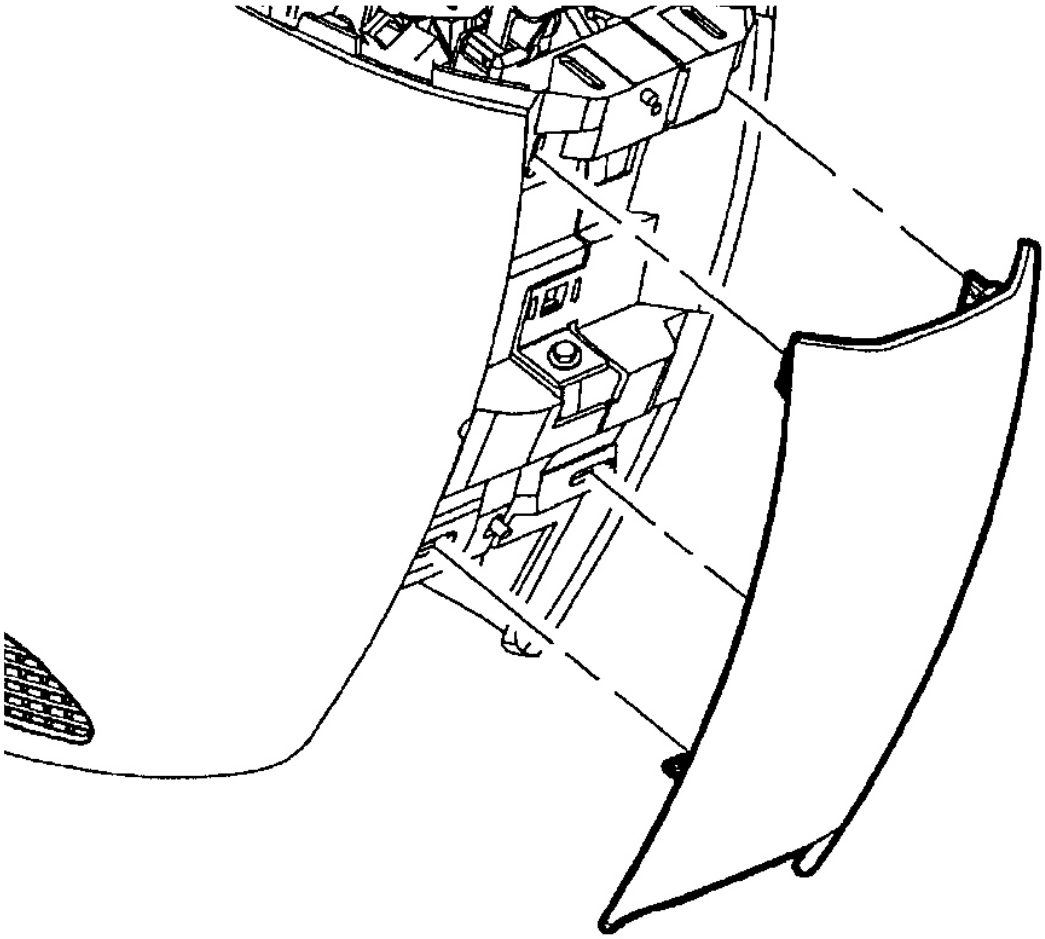


**Fig. 13: Removing & Installing Center Trim Panel**
**Courtesy of GENERAL MOTORS CORP.**

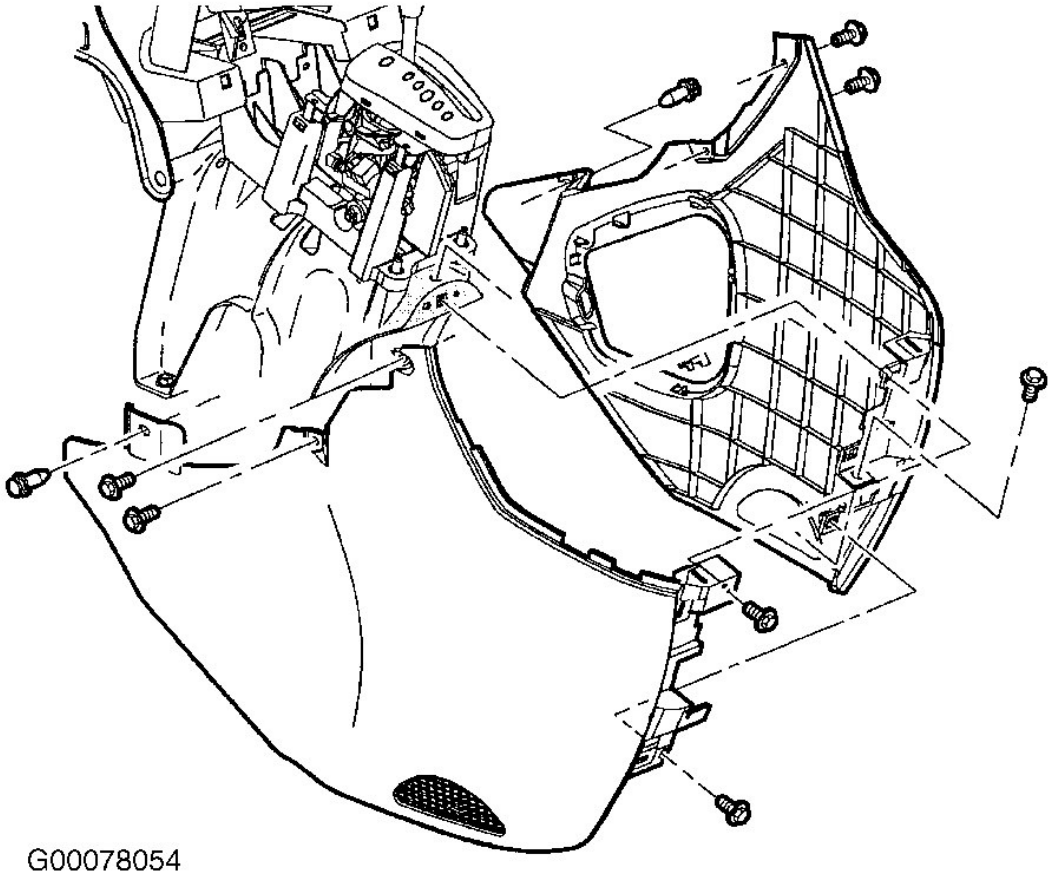


**Fig. 14: Removing & Installing Console Trim Panels**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

1. Install right trim panel and align left trim panel over alignment pins in right trim panel and install screws. See **Fig. 14** . Install panel-to-HVAC module push pins and trim panel-to-instrument panel retainer screws. Align retention clips with slots in side trim panels and press center trim panel forward at clip locations to snap into place. See Fig. 13 . Position glove box door to instrument panel retainer assembly and install door pins. See **Fig. 12** .
2. Install instrument panel glove box door stops by inserting with 1/4 turn to lock into position. Install instrument panel knee bolster by aligning retention clips with corresponding slots in retainer and snapping into place by applying light force at clip locations. See **Fig. 11** . Install screws and tighten. Connect power outlet harness connector. Connect wiring harnesses to window switches, mirror switch and cigar lighter.
3. Move shifter to Neutral position. Install front edge of horseshoe bezel, making sure to engage alignment pins and front edge tabs with corresponding slots at bottom of radio bezel. Lower back edge by pressing down and snapping into place. Put shifter in Park position. Enable SIR system. See AIR BAG DEACTIVATION PROCEDURES article in GENERAL INFORMATION.

 

## CONTROL CABLE

**Removal**

**CAUTION: DO NOT tip battery over 45 degree angle or acid could spill.**

**NOTE: Record all pre-set radio stations prior to disconnecting battery and reprogram pre-set stations after repair.**

1. Move control assembly into Neutral position. Remove battery cover. Disconnect negative battery cable. Disconnect positive battery cable. Loosen battery hold-down screw and remove battery. See **Fig. 8** . Remove battery cooling box. See **BATTERY COOLING BOX** .
2. Loosen battery tray bracket screws and remove bracket. See **Fig. 15** . Remove console. See **CONSOLE** . Using Fascia Retainer Remover Tool (J36346), disconnect control cable from control assembly lever. Depress control cable retainer clip tabs and remove cable from control assembly. See **Fig. 16** .

**CAUTION: Control cable must be disconnected from transaxle range switch lever prior to disconnecting it from control cable bracket. Otherwise damage to manual shift shaft may result, requiring transaxle disassembly.**

3. Using fascia retainer remover, disconnect control cable from transaxle range switch lever. Depress control cable retainer clip tabs and remove cable from control cable bracket.
4. Position vehicle on hoist and raise vehicle. Remove control cable from cable-to-steering gear assembly retaining clip. Lower vehicle. Remove control cable grommet from dash panel. See **Fig. 17** . Remove control cable from vehicle.

 

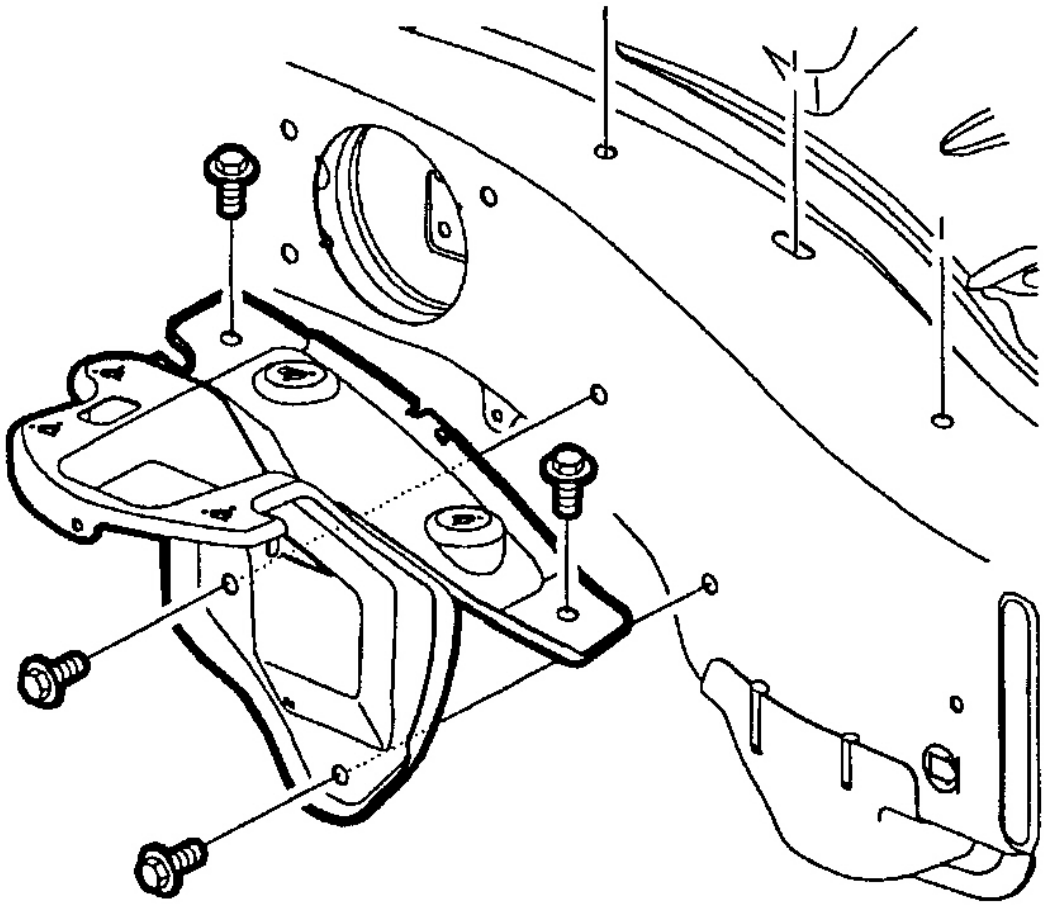


**Fig. 15: Removing & Installing Battery Tray Bracket**
**Courtesy of GENERAL MOTORS CORP.**

 

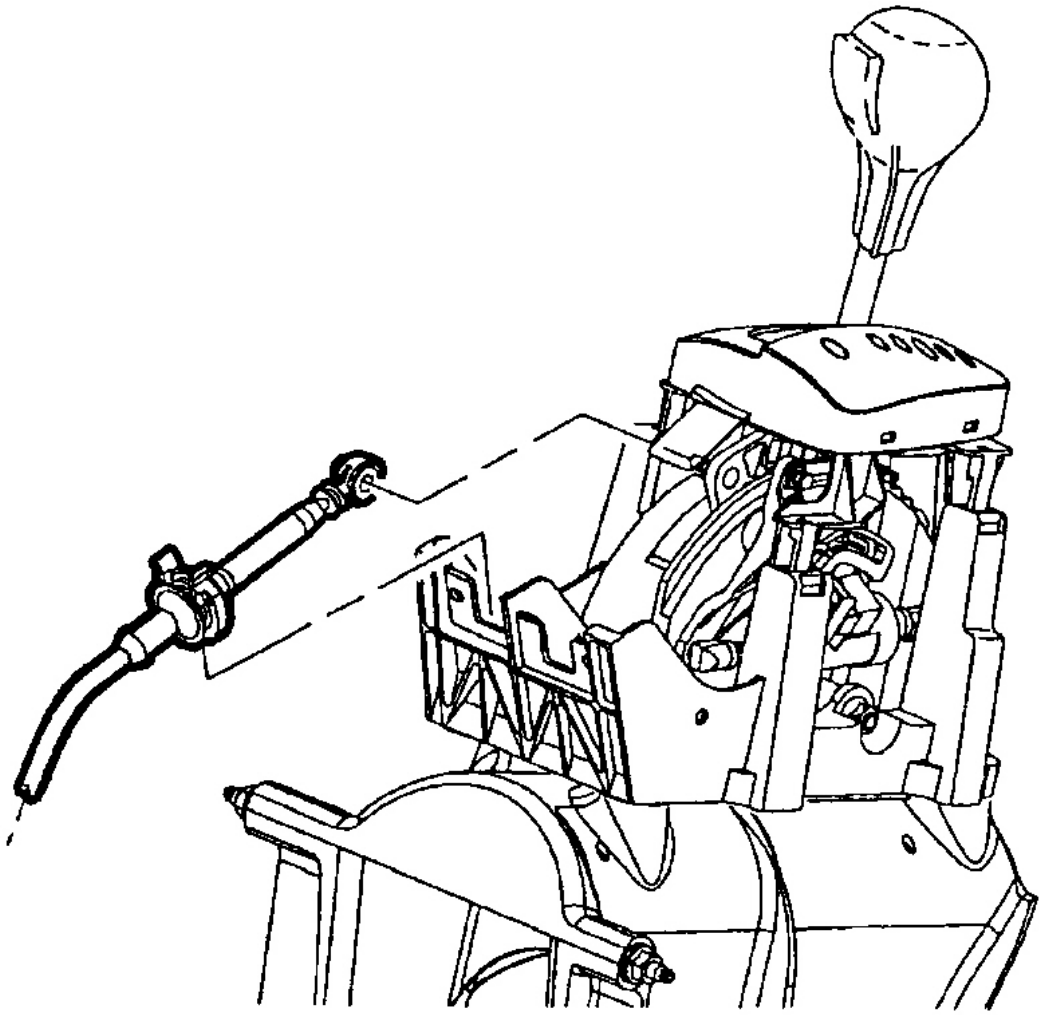


**Fig. 16: Removing & Installing Control Cable At Shift Controller**
**Courtesy of GENERAL MOTORS CORP.**

 

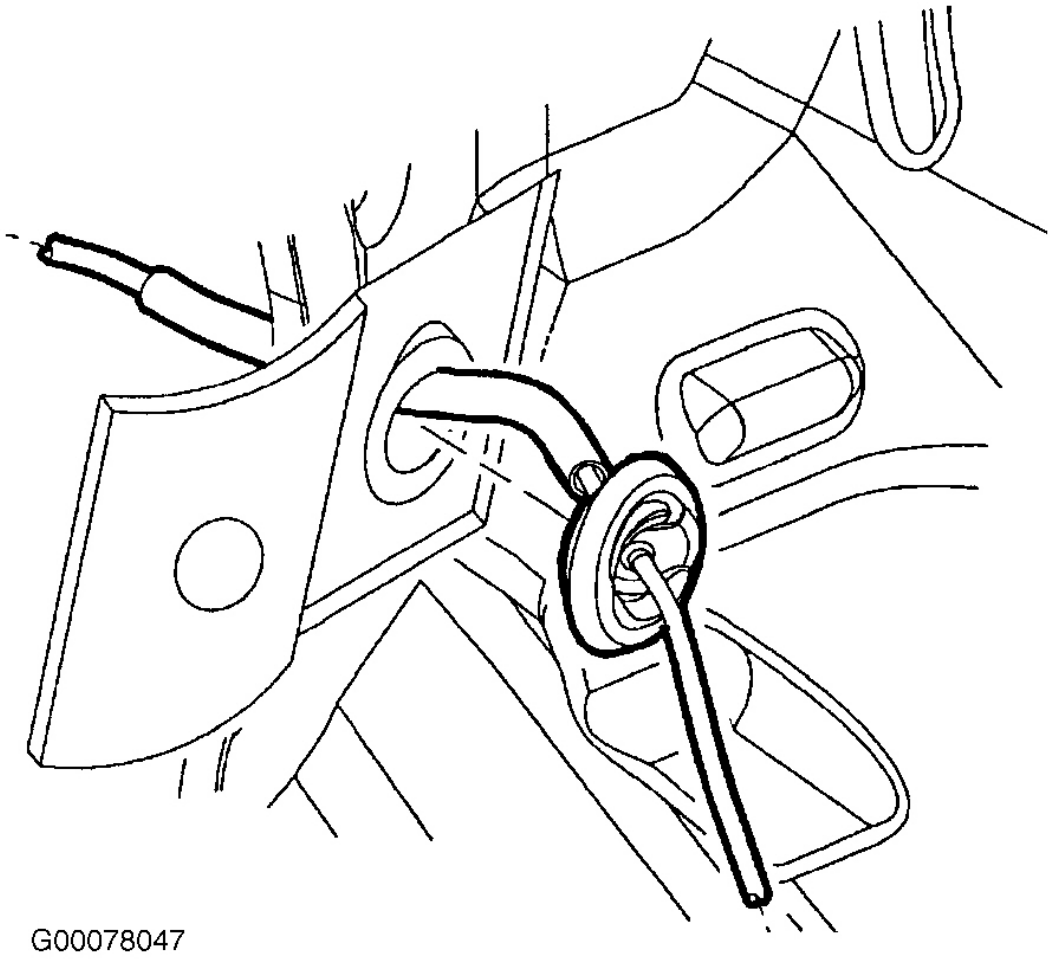


**Fig. 17: Removing & Installing Control Cable Grommet**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

1. Route control cable through cable bracket. Secure cable to bracket with control cable retainer clip. An audible snap will be heard when properly installed. With transaxle range switch lever located in Neutral, snap cable end fitting onto ball stud of lever. An audible snap will be heard when properly installed.
2. Position vehicle on hoist and raise vehicle. Route cable along steering gear assembly into clip and up into dash panel. Lower vehicle. Secure control cable grommet by pressing cable into pass-through hole in dash panel. See **Fig. 17** . Make sure control assembly is in Neutral position.
3. Connect control cable to control assembly. Secure with control cable retainer clip. Install control cable onto control assembly lever. See **Fig. 16** . Adjust control cable assembly. See **CONTROL CABLE** under ADJUSTMENTS. Install console. See **CONSOLE** .
4. Position battery tray bracket and tighten screws to specification. See **Fig. 15** . See **TORQUE SPECIFICATIONS** . Install battery cooling box. See **BATTERY COOLING BOX** .

5. Insert battery and tighten battery hold-down screw to specification. See **Fig. 8** . Connect positive battery cable to battery and tighten to specification. Connect negative battery cable to battery and tighten to specification. Install battery cooling box cover and tighten screws to specification. See **TORQUE SPECIFICATIONS** .

## CONTROL VALVE BODY

### Removal

1. Position vehicle on hoist and raise vehicle. Remove left wheel and tire assembly. Remove left splash shield. See **Fig. 18** .
2. Remove front pitch restrictor-to-transaxle bolts. See **Fig. 19** . Remove front pitch restrictor through-bolt and pitch restrictor. See **Fig. 20** .
3. Remove transaxle oil cooler lines from transaxle. See **TRANSAXLE OIL COOLER LINE ASSEMBLY** . Place drain pan or suitable container under vehicle. Remove transaxle oil cooler line assembly nut from transaxle. See **Fig. 21** . Remove transaxle oil cooler lines from vehicle.
4. Remove Torx(R) bolts and washers from the control valve body cover and discard. Ensure not to damage transaxle control valve body cover, case or sealing surfaces. Remove control valve body cover. See **Fig. 22** .

**NOTE: Do not bend solenoid wire connector pins.**

5. Disconnect solenoid wire connectors. See **Fig. 23** . Remove fluid temperature sensor bolt. Remove fluid temperature sensor clamp. Remove fluid temperature sensor. Remove O-ring and discard. See **Fig. 24** .

**NOTE: Do not break wiring harness connectors or fluid temperature sensor.**

6. Remove wiring harness from clamps. With a twisting motion remove wiring harness assembly. See **Fig. 25** .

**NOTE: Place transaxle in (N) Neutral position.**

7. Remove bolts, control valve body fluid passage cover and gasket. Discard fluid passage cover and fluid passage cover gasket. See **Fig. 26** . Remove valve body assembly-to-transaxle case bolts. See **Fig. 27** .
8. While holding the valve body assembly, disconnect manual shift detent lever assembly from manual valve link. See **Fig. 28** .
9. Move detent lever assembly clockwise for ease of removing manual valve. Remove valve body assembly. Remove case fluid passage seals and discard. See **Fig. 29** .

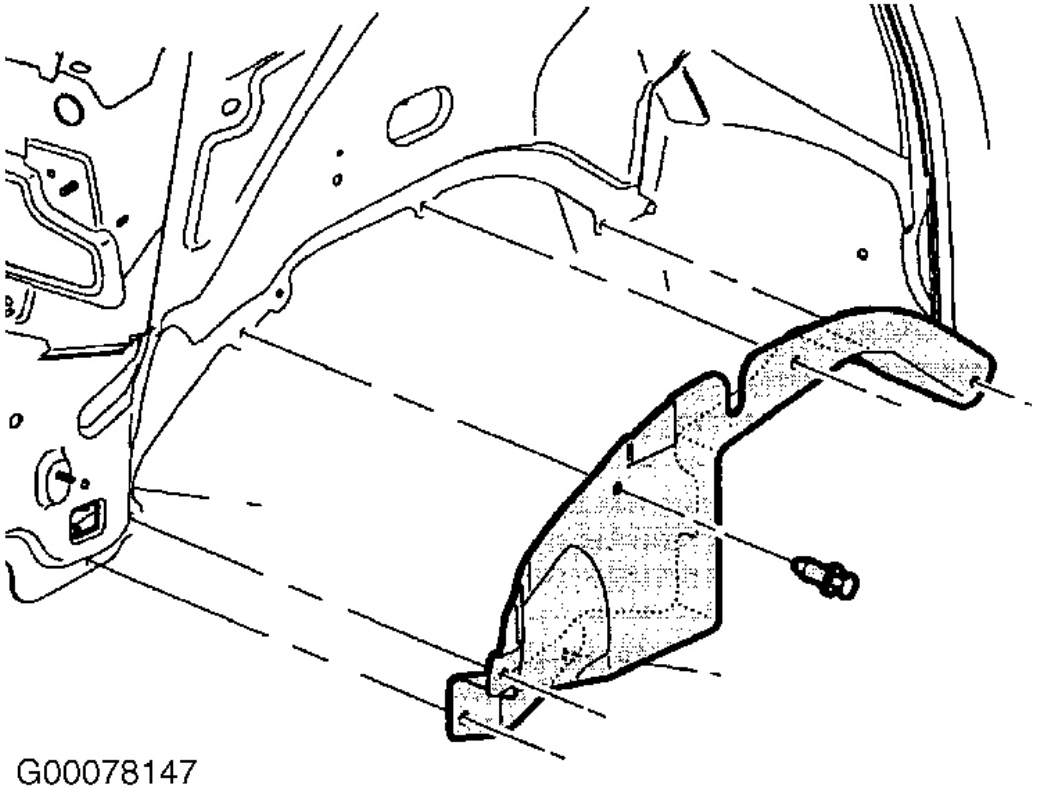


**Fig. 18: Removing & Installing Left Front Splash Shield**
**Courtesy of GENERAL MOTORS CORP.**

 

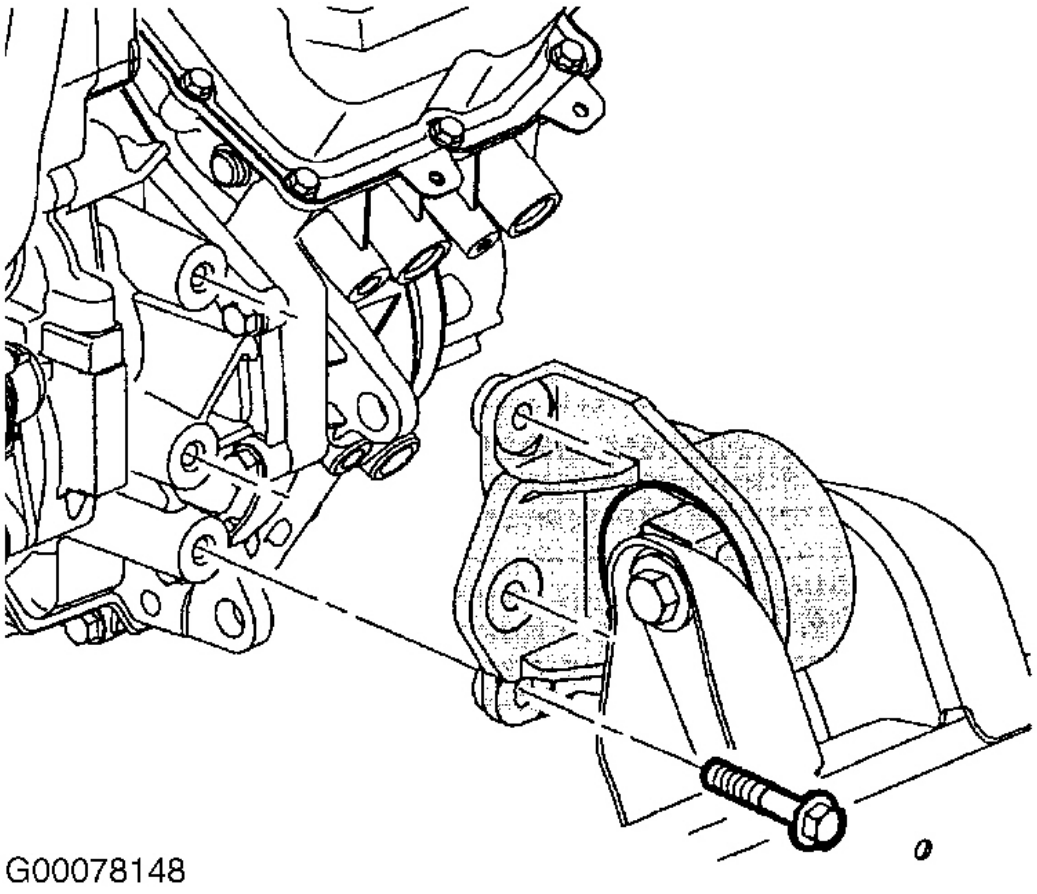


**Fig. 19: Removing & Installing Front Pitch Restrictor-To-Transaxle Bolts**
**Courtesy of GENERAL MOTORS CORP.**

 

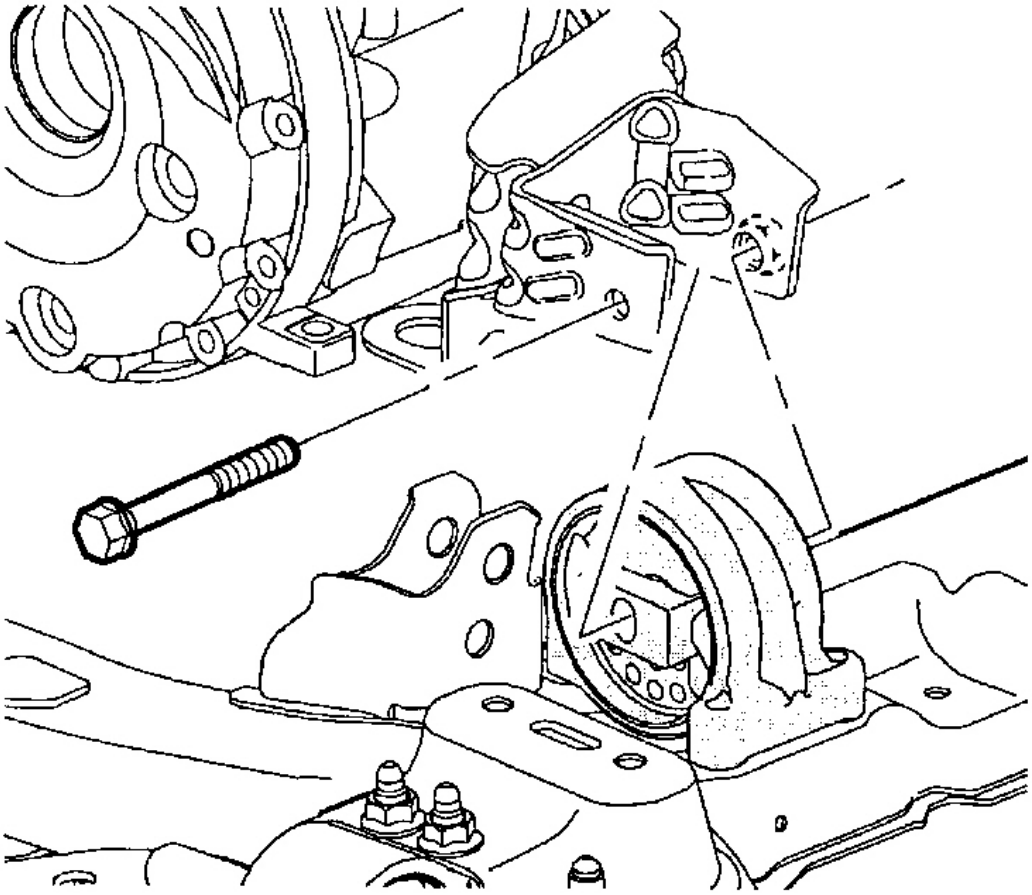


**Fig. 20: Removing & Installing Front Pitch Restrictor**
**Courtesy of GENERAL MOTORS CORP.**

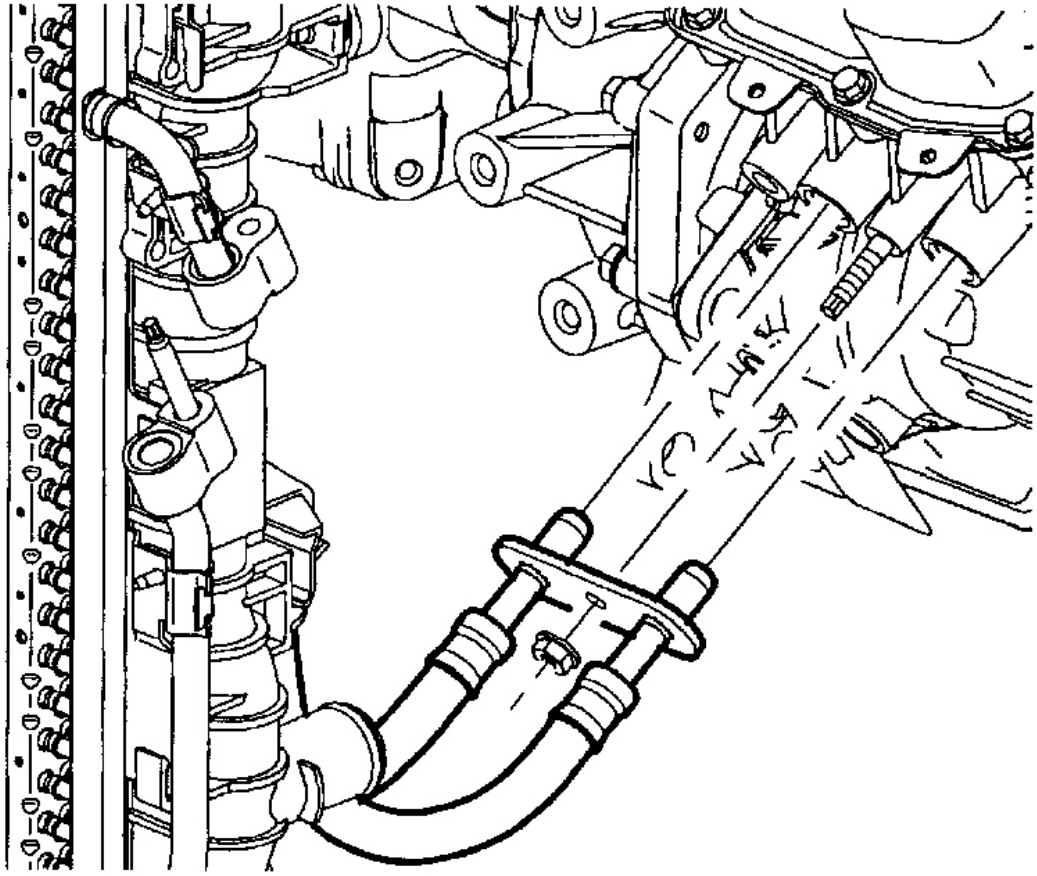

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**Fig. 21: Removing & Installing Transaxle Oil Cooler Lines From Transaxle**
**Courtesy of GENERAL MOTORS CORP.**

 

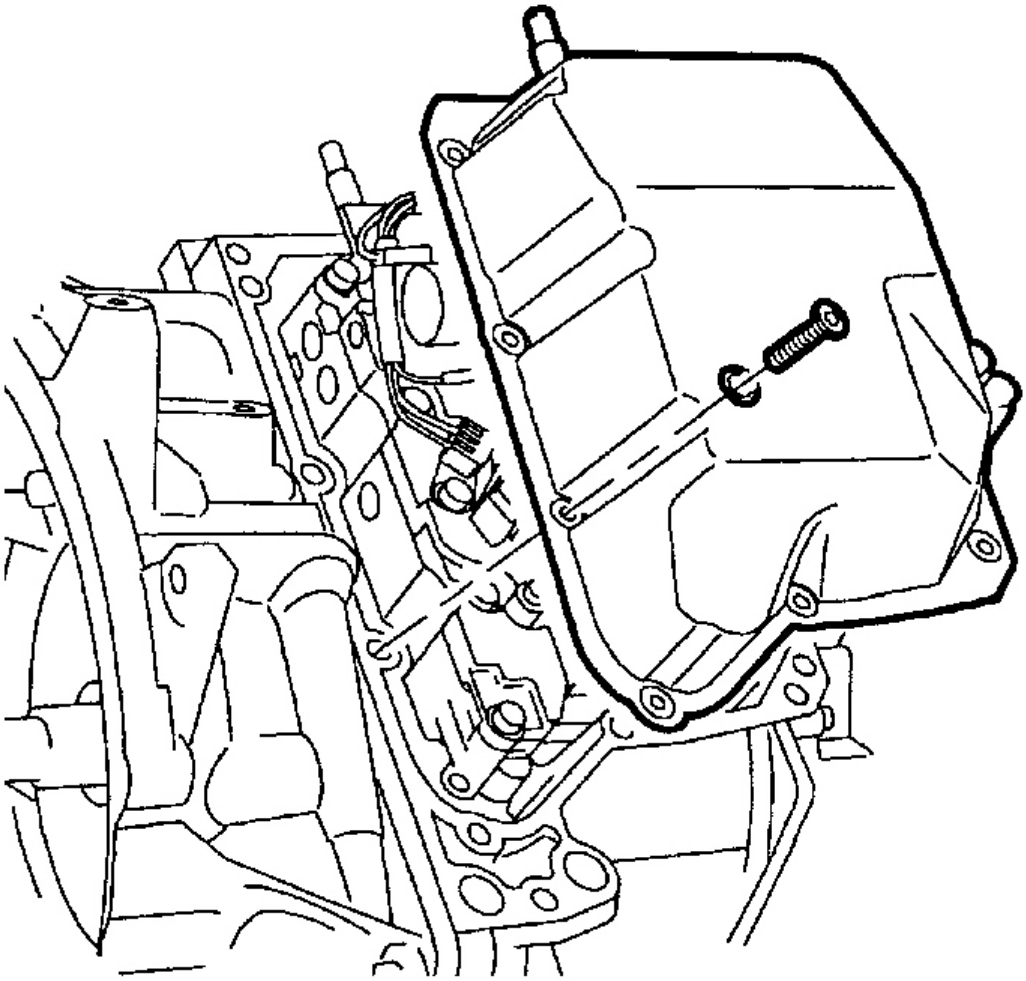

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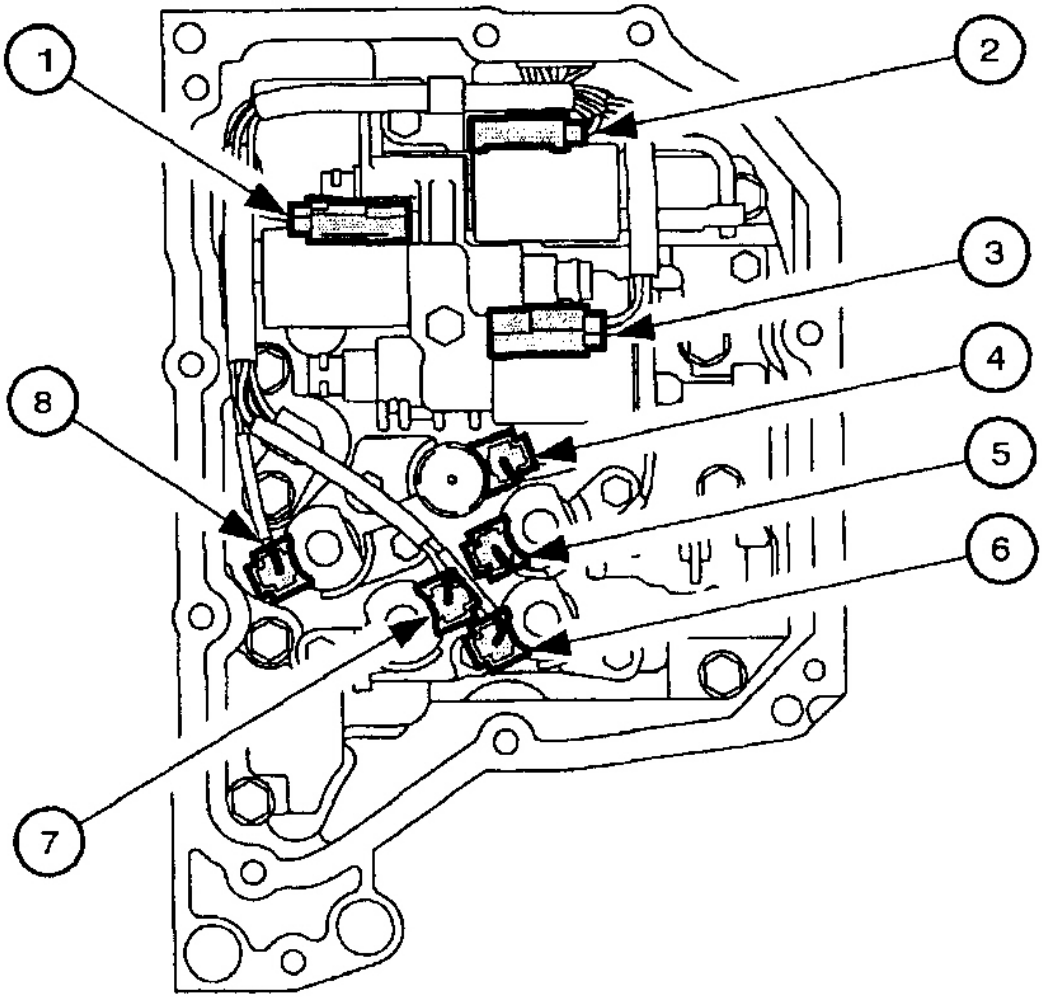
**Fig. 22: Removing & Installing Control Valve Body Cover**
**Courtesy of GENERAL MOTORS CORP.**




(1) Blue
(2) Black
(3) Green
(4) Black
(5) Blue
(6) Gray
(7) Green
(8) Gray

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**Fig. 23: Removing & Installing Harness Connectors For Solenoids**
**Courtesy of GENERAL MOTORS CORP.**

 

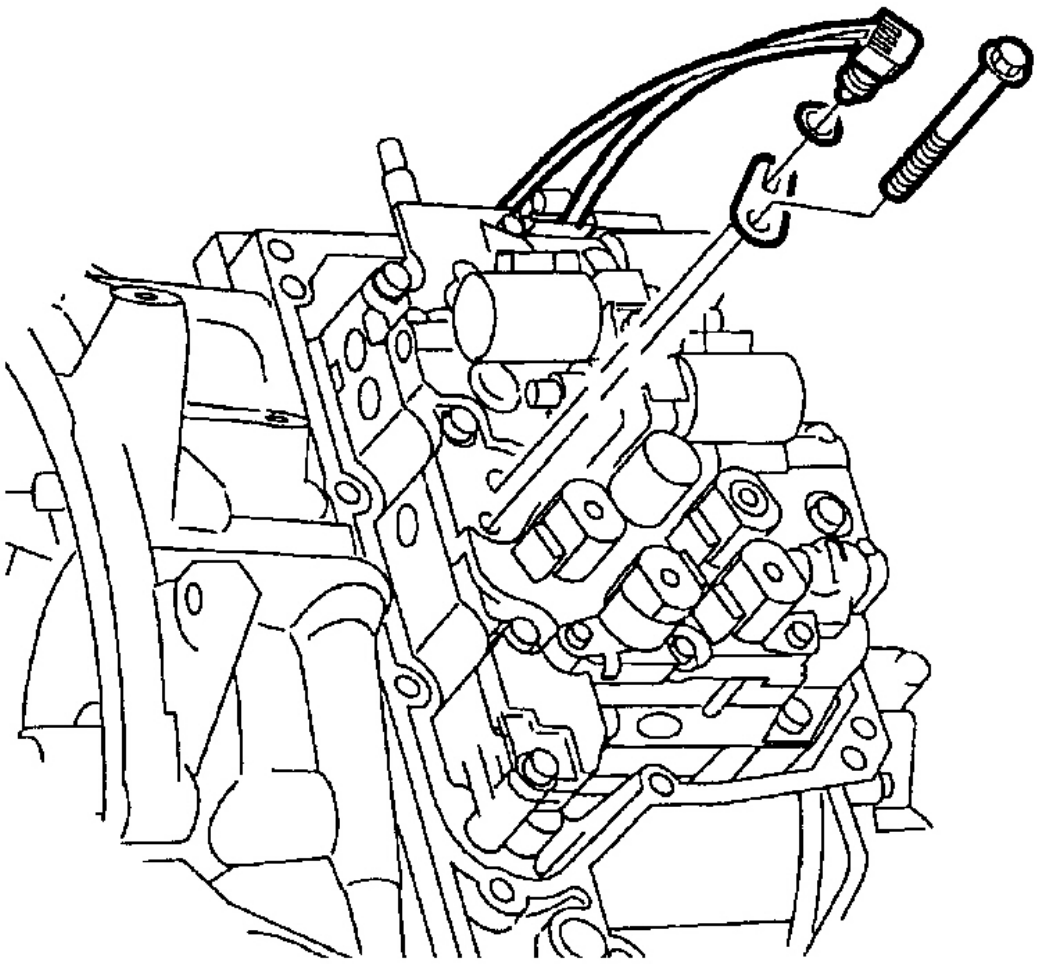


**Fig. 24: Removing & Installing Fluid Temperature Sensor**
**Courtesy of GENERAL MOTORS CORP.**

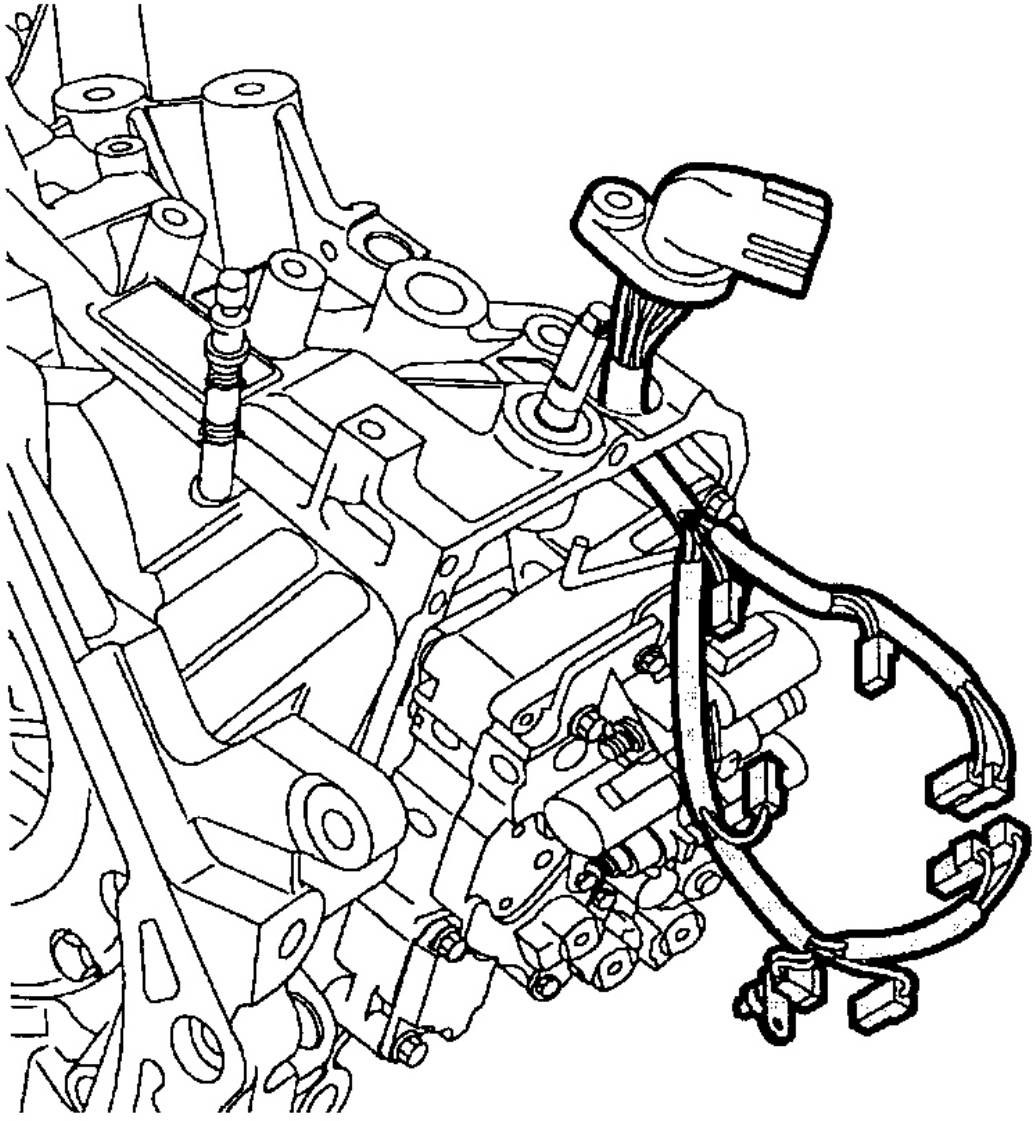

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**Fig. 25: Removing & Installing Wiring Harness Assembly**
**Courtesy of GENERAL MOTORS CORP.**

 

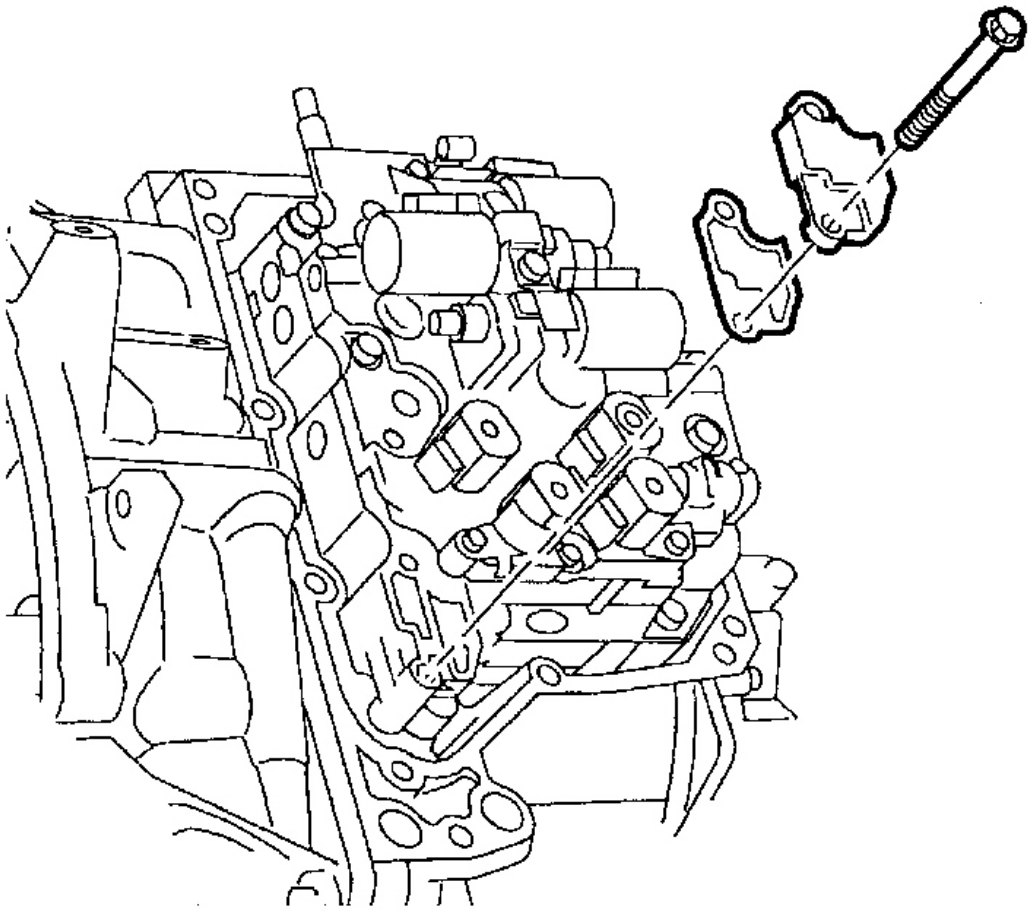


**Fig. 26: Removing & Installing Fluid Passage Cover & Fluid Passage Cover Gasket**
**Courtesy of GENERAL MOTORS CORP.**

 

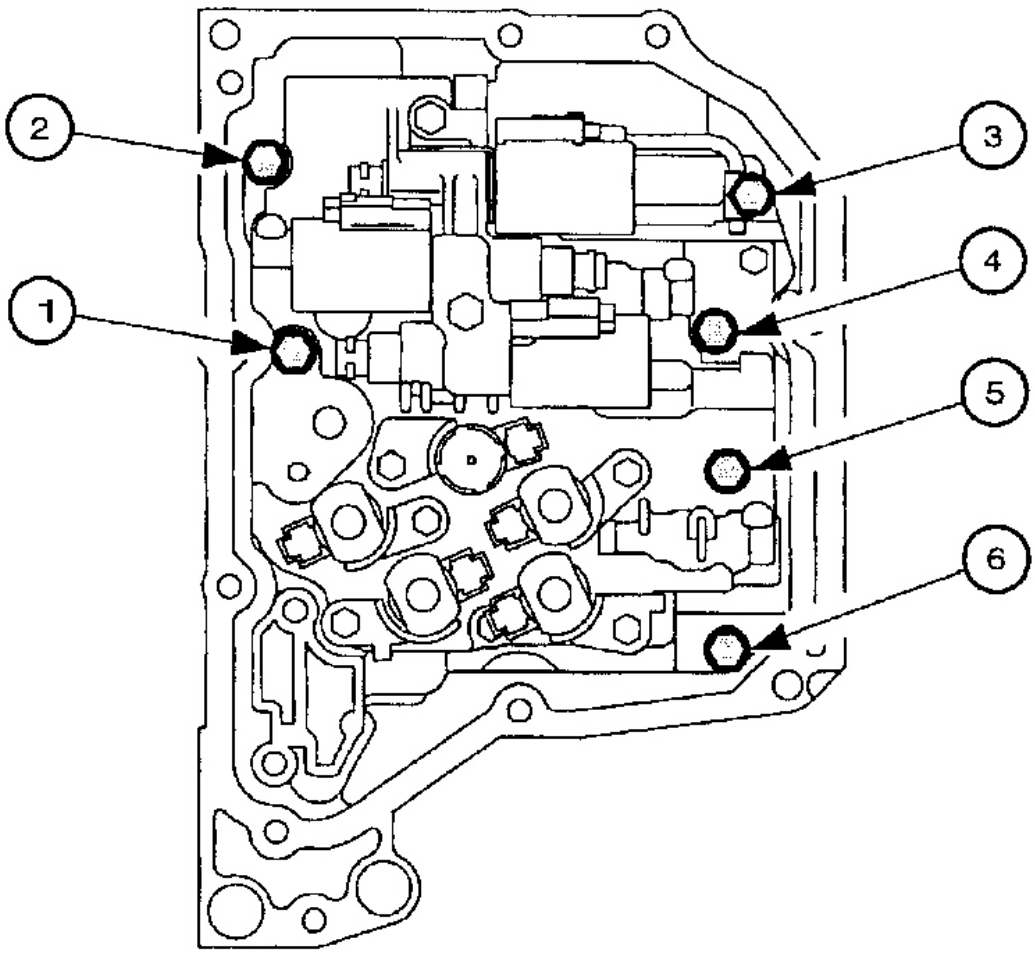


**Fig. 27: Removing & Installing Valve Body Assembly-To-Transaxle Case Bolts**
**Courtesy of GENERAL MOTORS CORP.**

 

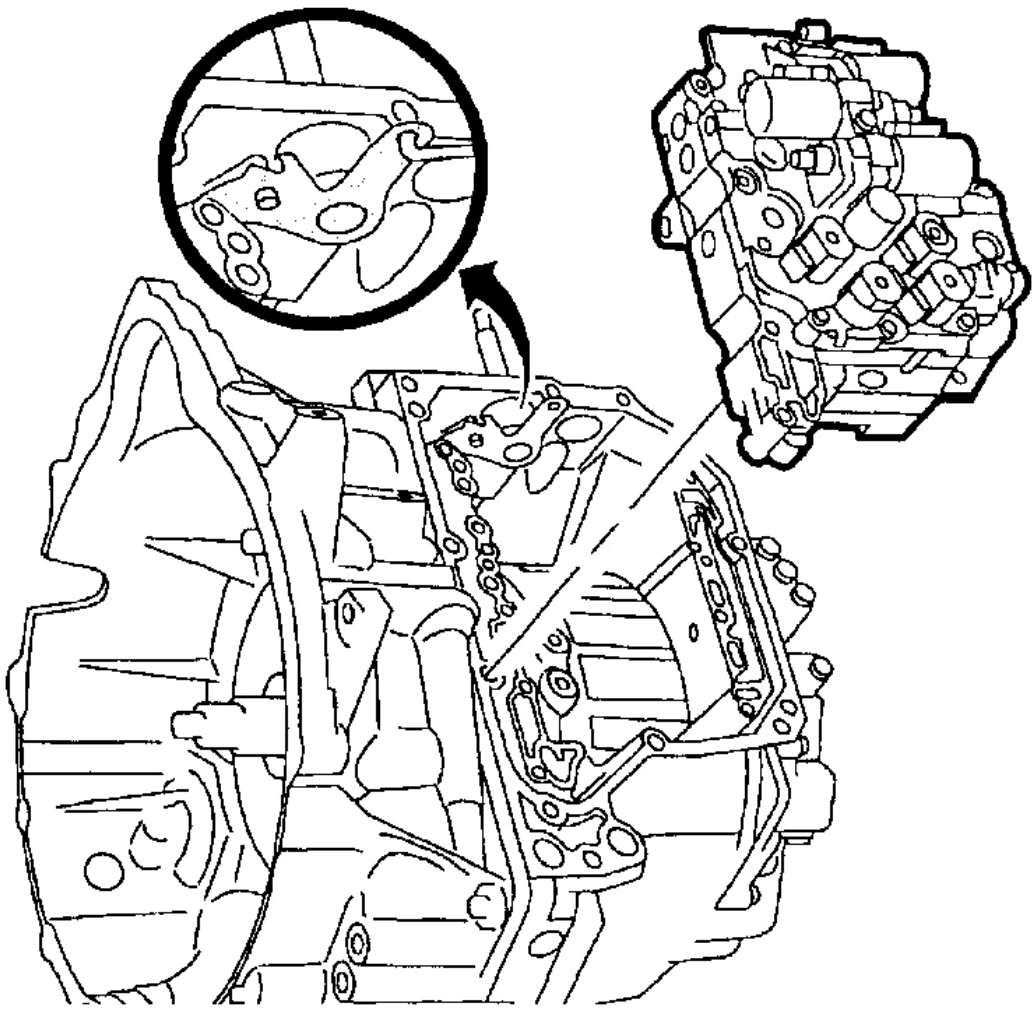

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**Fig. 28: Removing & Installing Manual Shift Detent Lever Assembly**
**Courtesy of GENERAL MOTORS CORP.**

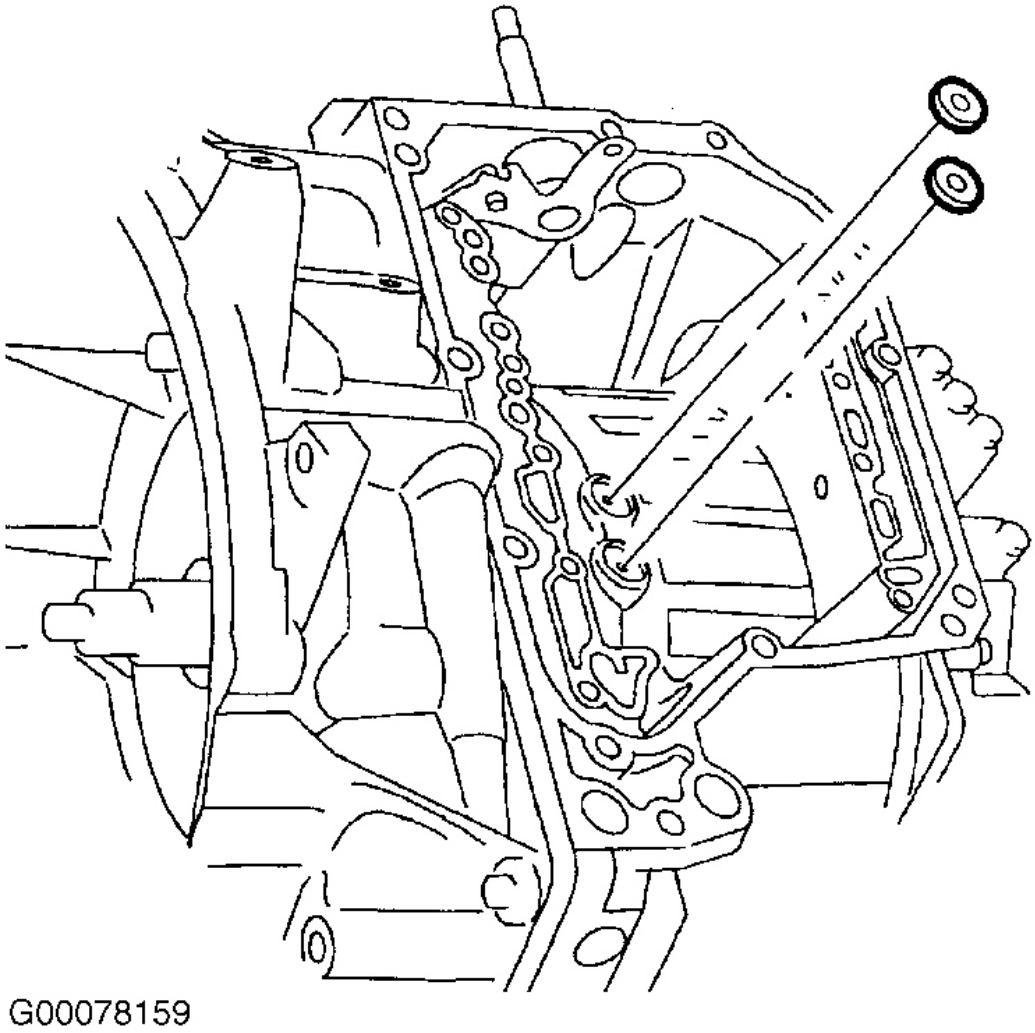



**Fig. 29: Removing & Installing Case Fluid Passage Seals**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

1. Install new case fluid passage seals onto transaxle case. See **Fig. 29** . Shift transaxle into Neutral position. While holding valve body assembly, connect manual valve link to manual shift detent lever assembly. See **Fig. 28** .
2. Install valve body assembly-to-transaxle case bolts, (34) M6 X 16 mm, (35) M6 X 50 mm and (47) M6 X 55 mm, and hand tighten. See **Fig. 31** . Tighten valve body assembly-to-transaxle case bolts to specification in sequence shown. See **Fig. 27** and **TORQUE SPECIFICATIONS** .
3. Install new control valve body fluid passage cover gasket. Install new control valve body fluid passage cover. See **Fig. 26** . Install M6 X 1.0 X 50 mm control valve body bolts and tighten to specification. See

**TORQUE SPECIFICATIONS** .

4. Apply transmission fluid to the new wiring harness O-ring. Install new O-ring seal onto wiring harness. Install wiring harness. See **Fig. 25** . Apply transmission fluid to new O-ring Install new O-ring into groove of fluid temperature sensor and install fluid temperature sensor clamp. See **Fig. 24** . Install fluid temperature sensor bolt and tighten to specification. See **TORQUE SPECIFICATIONS** .

**NOTE: Do not bend solenoid wire connector pins.**

5. Connect solenoid wire harness connectors as follows: (1) Blue, (2) Black, (3) Green, (4) Black, (5) Blue, (6) Gray, (7) Green and (8) Gray. See **Fig. 23** .
6. Clean any gasket material from valve body cover and inspect gasket mounting surface. Install valve body cover onto transaxle case using new bolts and washers. Tighten valve body cover bolts to specification, in sequence shown. See **Fig. 30** and **TORQUE SPECIFICATIONS** .
7. Install transaxle oil cooler line assembly nut. See **Fig. 21** . Torque transaxle oil cooler line nut to specification. Install front pitch restrictor and through bolt. See **Fig. 20** . Torque front pitch restrictor through bolt to specification. See **TORQUE SPECIFICATIONS** .
8. Install front pitch restrictor-to-transaxle bolts. See **Fig. 19** . Torque front pitch restrictor bolts to specification. See **TORQUE SPECIFICATIONS** .

**WARNING: Saturn ATF (P/N 21005966 and 21019223), and DEXRON-III ATF are not compatible with this transaxle. This transaxle uses T-IV Fluid (P/N 22689186) only.**

9. Install left-hand splash shield. See **Fig. 18** . Install splash shield push pins. Lower vehicle. Add fluid to transaxle. See **CHECKING FLUID LEVELS** .

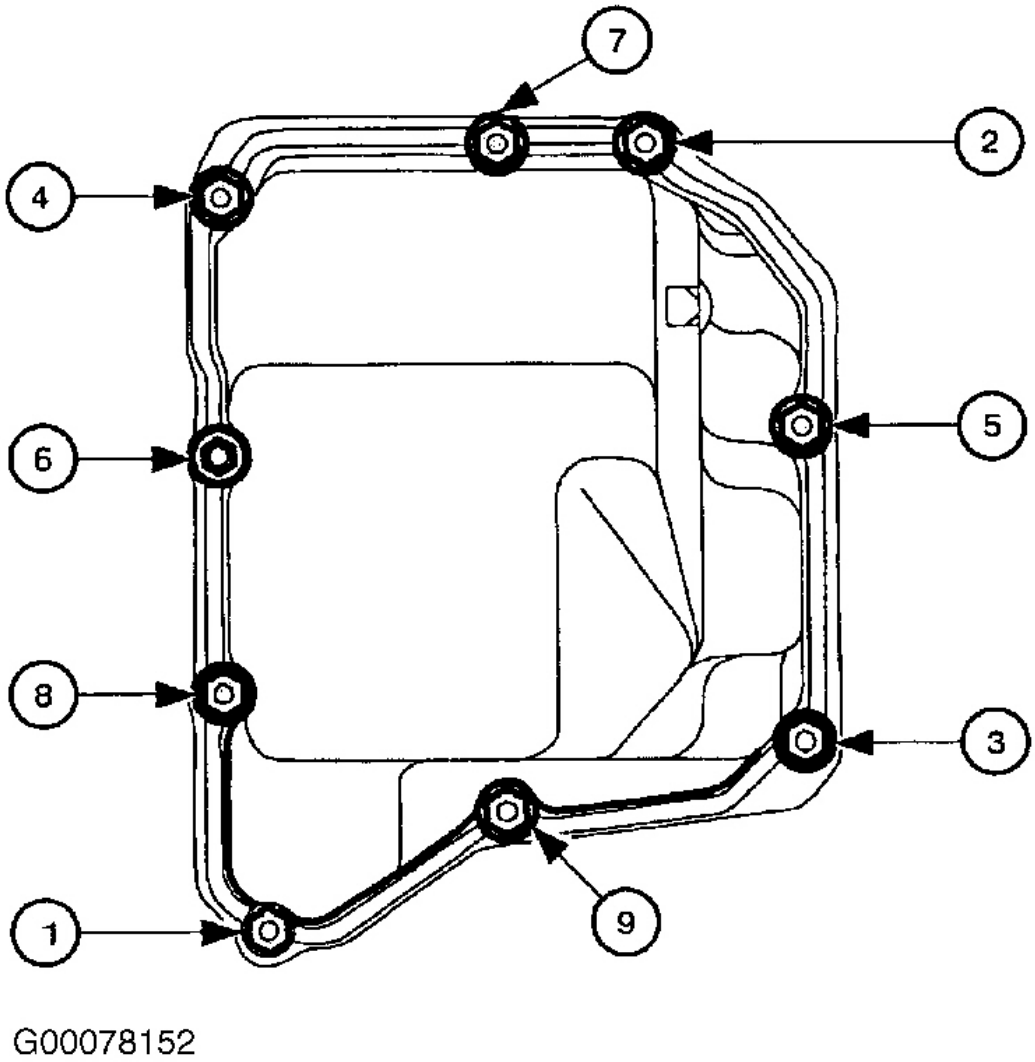
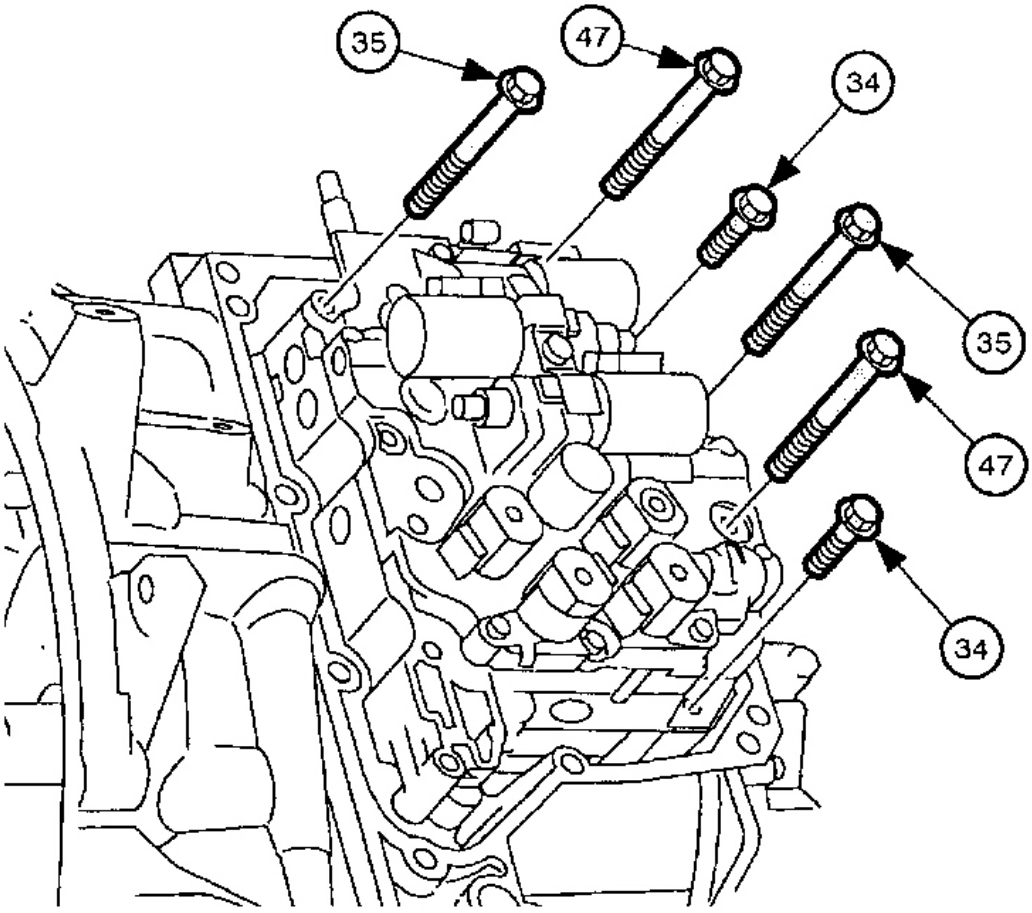



**Fig. 30: Valve Body Cover Torque Sequence**
**Courtesy of GENERAL MOTORS CORP.**




(34) M6 X 16 mm

(35) M6 X 50 mm

(47) M6 X 55 mm

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**Fig. 31: Identifying Valve Body-To-Transaxle Case Bolts**
**Courtesy of GENERAL MOTORS CORP.**

**CONTROL VALVE BODY COVER**

 

**Removal**

1. Position vehicle on hoist and raise vehicle. Remove left wheel and tire assembly. Remove left splash shield. See **Fig. 18** .
2. Remove front pitch restrictor-to-transaxle bolts. See **Fig. 19** . Remove front pitch restrictor through-bolt and pitch restrictor. See **Fig. 20** .
3. Remove transaxle oil cooler lines from transaxle. See **TRANSAXLE OIL COOLER LINE ASSEMBLY** . Place drain pan or suitable container under vehicle. Remove transaxle oil cooler line assembly nut from transaxle. See **Fig. 21** . Remove transaxle oil cooler lines from vehicle.
4. Remove Torx bolts and washers from the control valve body cover and discard. Ensure not to damage transaxle control valve body cover, case or sealing surfaces. Remove control valve body cover. See **Fig. 22** .

**Installation**

**WARNING: Saturn ATF (P/N 21005966 and 21019223), and DEXRON-III ATF are not compatible with this transaxle. This transaxle uses T-IV Fluid (P/N 22689186) only.**

1. Clean any gasket material from valve body cover and inspect gasket mounting surface. Install valve body cover onto transaxle case using new bolts and washers. See **Fig. 22** .
2. Tighten valve body cover bolts to specification in sequence shown. See **Fig. 30** . See **TORQUE SPECIFICATIONS** . Install transaxle oil cooler line assembly to transaxle.
3. Install transaxle oil cooler line assembly nut. See **Fig. 21** . Torque transaxle oil cooler line nut to specification. Install front pitch restrictor and through bolt. See **Fig. 20** . Torque front pitch restrictor through bolt to specification. See **TORQUE SPECIFICATIONS** .
4. Install front pitch restrictor-to-transaxle bolts. See **Fig. 19** . Torque front pitch restrictor bolts to specification. See **TORQUE SPECIFICATIONS** . Install left-hand splash shield. See **Fig. 18** .
5. Install left wheel and tire assembly. Install wheel nuts and tighten in a criss-cross pattern. Torque wheel nuts to specification. See **TORQUE SPECIFICATIONS** .
6. Lower vehicle. Add fluid to transaxle. See **DRAINING & REFILLING** .

## FRONT FASCIA

**Removal**

1. Remove front fascia-to-structure bolt. See **Fig. 32** . Remove sidemarker-to-body pushpin fastener.
2. Lift side marker, up and out of fascia to free lower attaching tabs. Rotate side marker bulb socket and remove socket assembly from housing.
3. Remove headlight bracket-to-structure bolt. Carefully lift headlight assembly up. Rotate headlight bulb sockets to remove them from housing.
4. Lift headlight out to remove. Disconnect foglight harness connector, (if equipped) by reaching through headlight housing.
5. Remove pushpins from front wheelhouse-liner-to fascia. Remove fascia-to-lower front fender bracket bolt. Remove front air deflector-to-cradle pushpins. See **Fig. 33** .

 

6. Remove fascia-to-body pushpins. Separate fascia from front fenders. Remove fascia-to-fascia support pushpins. See **Fig. 32** . Remove front fascia.

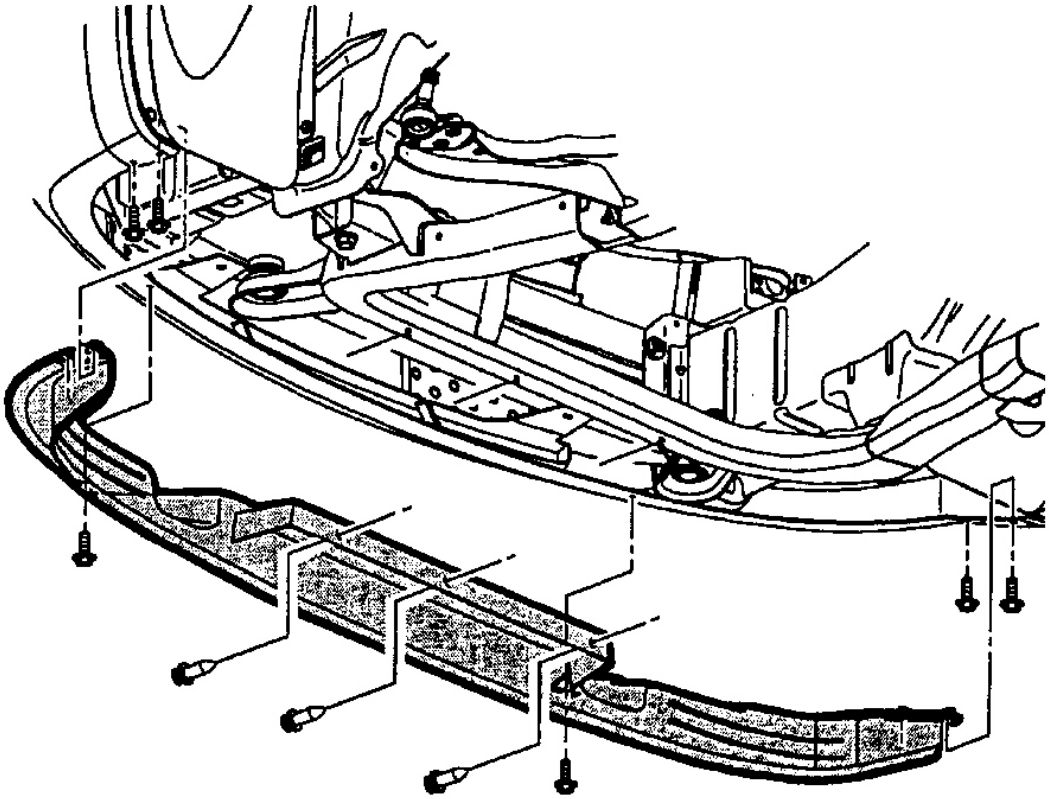


**Fig. 32: Removing & Installing Front Fascia**
**Courtesy of GENERAL MOTORS CORP.**

 

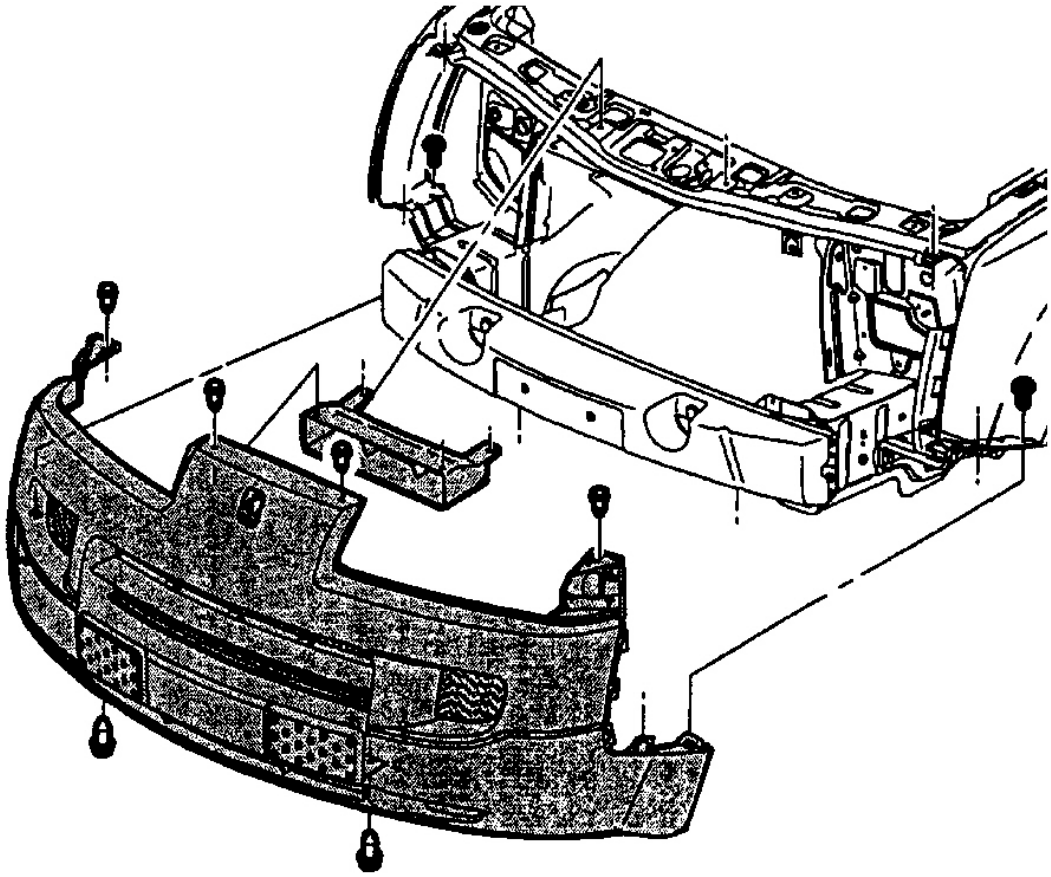


**Fig. 33: Removing & Installing Front Air Deflector**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

1. Install fascia-to-fascia support pushpins. See **Fig. 32** . Install fascia tabs to front fenders. Install fasica-to-body pushpins.
2. Install front fascia-to-lower front fender bracket bolt and tighten to specification. See **TORQUE SPECIFICATIONS** .
3. Install Wheelhouse liner-to-fascia pushpins. Connect foglight harness connectors (if equipped). Install headlight bulb sockets.
4. Carefully lower headlight into position, making sure headlight housing bracket lower arm fits into bracket located on vehicle structure.
5. Install headlight bracket-to-structure bolt and tighten to specification. See **TORQUE SPECIFICATIONS** .
6. Connect sidemarker bulb socket. Install sidemarker to fascia, making sure lower sidemarker housing tabs

 

are engaging fascia.

7. Install sidemarker-to-body pushpin fastener. Install front fascia-to-structure bolt and tighten to specification. See **TORQUE SPECIFICATIONS** . See **Fig. 32** . Install front air deflector-to-cradle postpone. See **Fig. 33** .

## INPUT SPEED SENSOR

### Removal

**WARNING: Do not tip battery over 45 degree angle or acid could spill.**

1. Record preset radio stations. Remove battery. Remove battery cover. Disconnect negative battery cable. Disconnect positive battery cable.
2. Loosen battery hold-down screw and remove battery. Remove battery cooling box. See **BATTERY COOLING BOX** .
3. Remove battery tray bracket. Loosen battery tray bracket screws and remove bracket. See **Fig. 15** .
4. Remove input speed sensor. Remove input speed sensor O-ring and discard. **Fig. 34** .

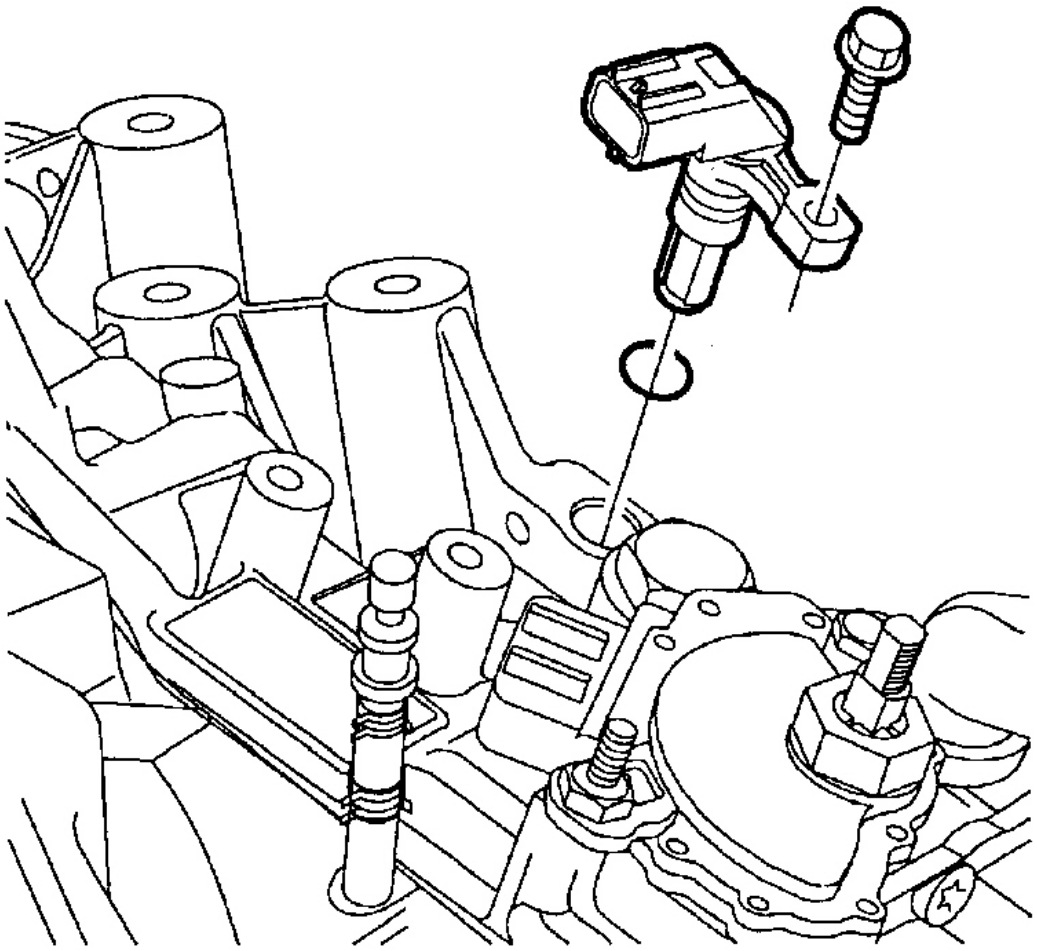


**Fig. 34: Removing & Installing Input Speed Sensor**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

1. Apply transmission fluid to new O-ring. Install new O-ring onto input speed sensor. Install input speed sensor onto transaxle. See **Fig. 34** . Connect wiring harness to input speed sensor. Install new input speed sensor bolt and tighten to specification. See **TORQUE SPECIFICATIONS** .
2. Install battery tray bracket and tighten bolts to specification. See **Fig. 15** . See **TORQUE SPECIFICATIONS** . Install battery cooling box. See **BATTERY COOLING BOX** .
3. Insert battery and tighten battery hold-down screw to specification. Connect positive battery cable to battery and tighten screws to specification. See **TORQUE SPECIFICATIONS** .
4. Connect negative battery cable to battery and tighten screws to specification. Install battery cooling box

 

cover and tighten screws to specification. See **TORQUE SPECIFICATIONS** . Reprogram radio stations.

## OUTPUT SPEED SENSOR

### Removal

**WARNING: Do not tip battery over 45 degree angle or acid could spill.**

1. Record preset radio stations. Remove battery. Remove battery cover. Disconnect negative battery cable. Disconnect positive battery cable.
2. Loosen battery hold-down screw and remove battery. Remove battery cooling box. See **BATTERY COOLING BOX** .
3. Remove battery tray bracket. Loosen battery tray bracket screws and remove bracket. See **Fig. 15** .
4. Remove output speed sensor. Remove output speed sensor O-ring and discard. See **Fig. 35** .

 

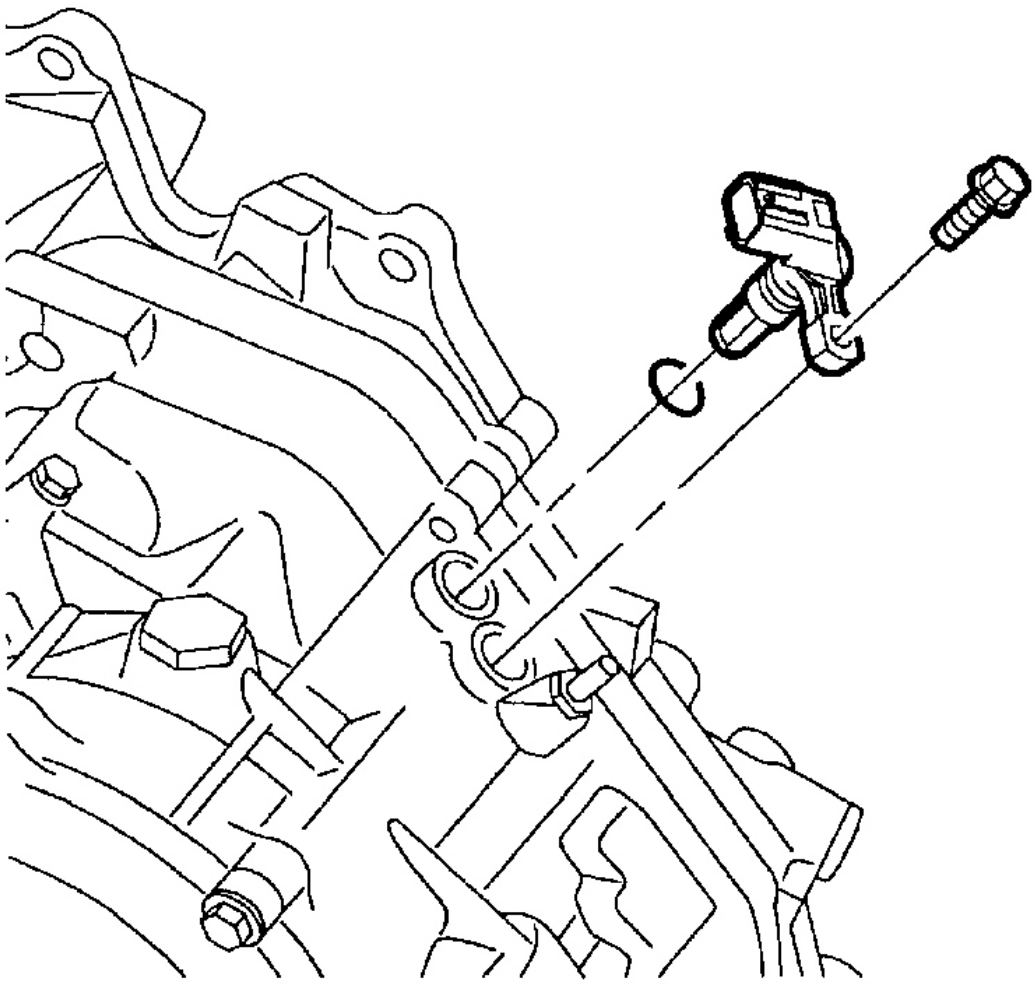


**Fig. 35: Removing & Installing Output Speed Sensor**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

1. Apply transmission fluid to new O-ring. Install new O-ring onto output speed sensor. Install output speed sensor onto transaxle. See **Fig. 35** . Connect wiring harness to output speed sensor. Install new output speed sensor bolt and tighten to specification. See **TORQUE SPECIFICATIONS** .
2. Install battery tray bracket and tighten bolts to specification. See **Fig. 15** . See **TORQUE SPECIFICATIONS** . Install battery cooling box. See **BATTERY COOLING BOX** .
3. Insert battery and tighten battery hold-down screw to specification. Connect positive battery cable to battery and tighten screws to specification. See **TORQUE SPECIFICATIONS** .

 

4. Connect negative battery cable to battery and tighten screws to specification. Install battery cooling box cover and tighten screws to specification. See **TORQUE SPECIFICATIONS** . Reprogram radio stations.

## TRANSAXLE FLUID LEVEL INDICATOR ASSEMBLY

### Removal & Installation

Remove transmission fluid level indicator assembly fastener from transaxle. Remove transmission fluid level indicator assembly from vehicle. See **Fig. 36** . Wipe away any excess fluid from transaxle. To install, install transmission fluid level indicator assembly onto vehicle. Install transmission fluid level indicator fastener onto transaxle and tighten to specification. See **TORQUE SPECIFICATIONS** .

 

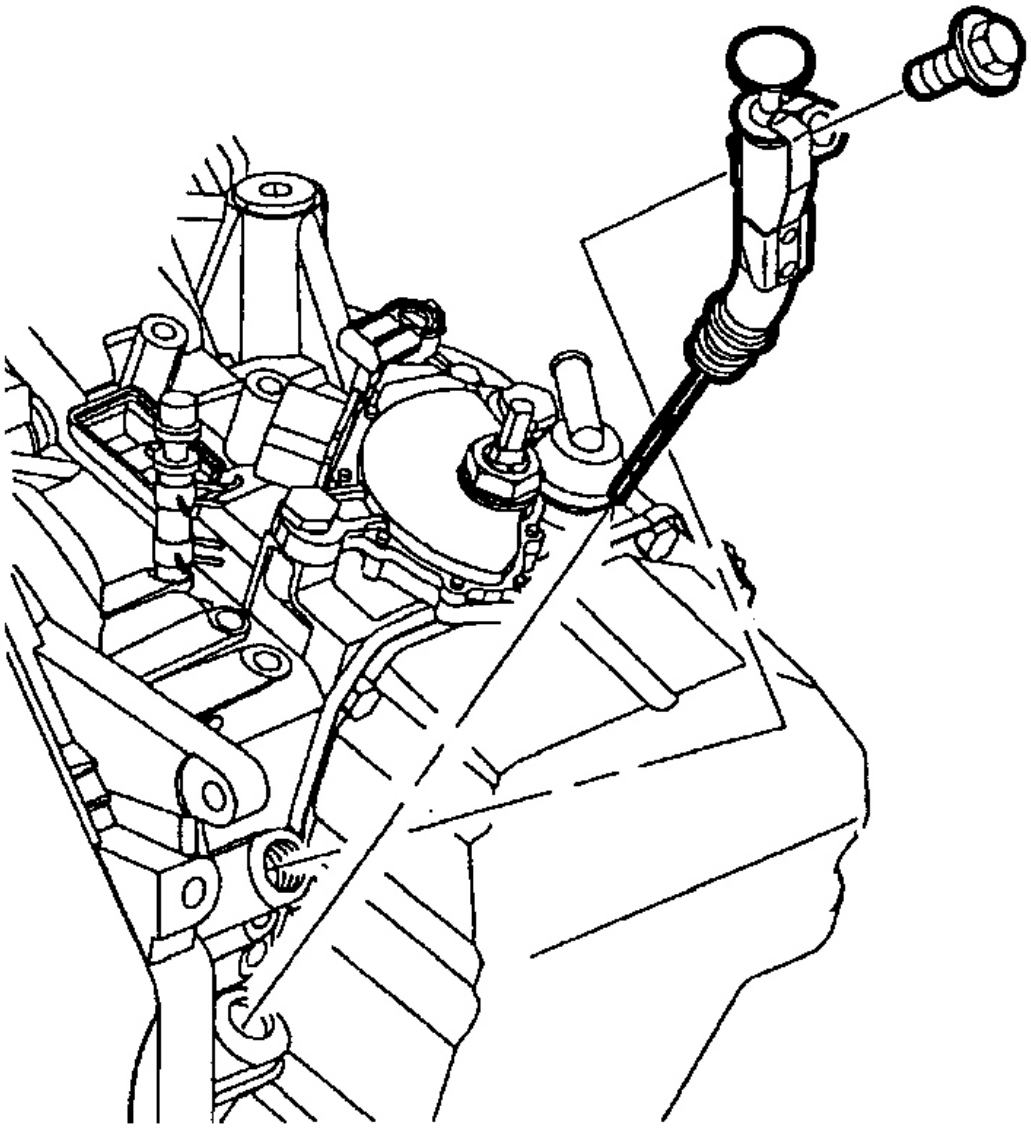

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**Fig. 36: Removing & Installing Fluid Level Indicator**
**Courtesy of GENERAL MOTORS CORP.**

## TRANSAXLE OIL COOLER

### Removal

1. Remove front fascia. See **FRONT FASCIA** . Separate transaxle oil cooler lines from radiator. Remove oil cooler line-to-radiator bracket bolt. Remove battery box inlet air duct. See **Fig. 37** .

 

2. Remove condenser splash shield. See **Fig. 38** . Remove upper Condenser Radiator Fan Module (CRFM) bracket assemblies. See **Fig. 39** . Unclip condenser from radiator. See **Fig. 40** . Unclip transaxle oil cooler from radiator and remove transaxle oil cooler.

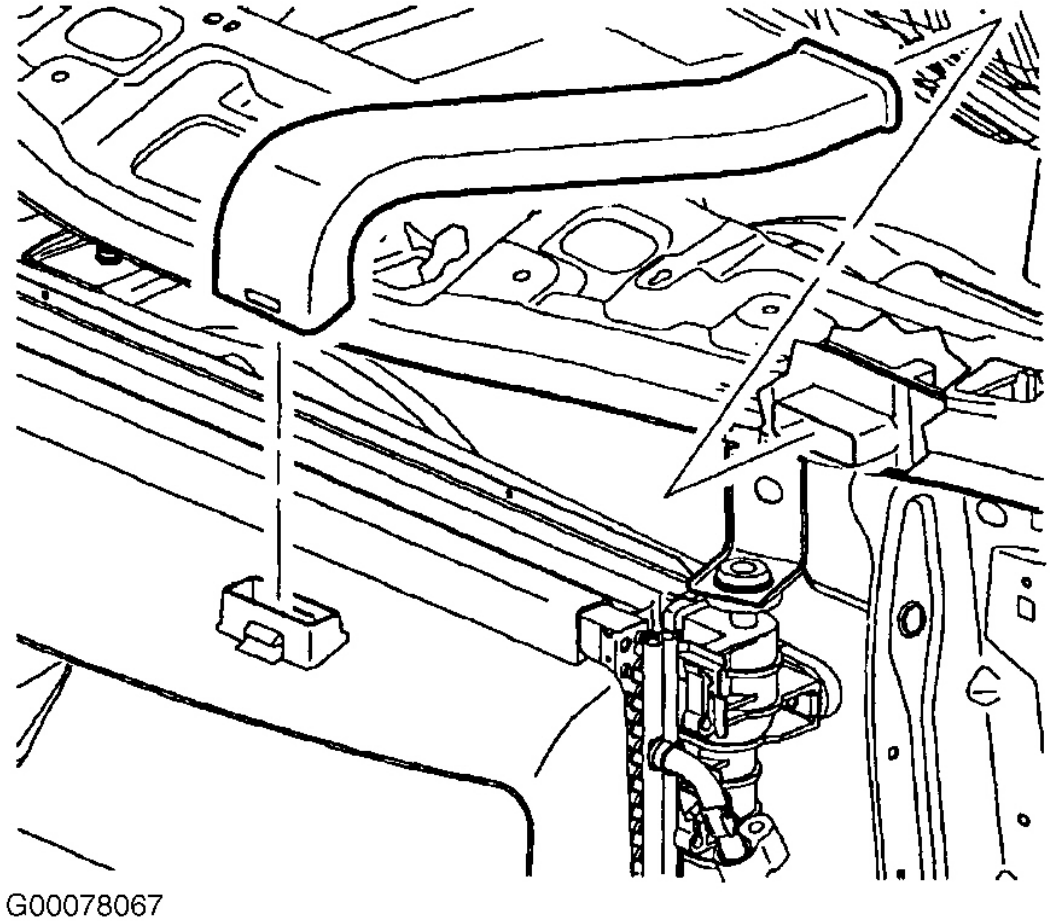


**Fig. 37: Removing & Installing Air Inlet**
**Courtesy of GENERAL MOTORS CORP.**

 

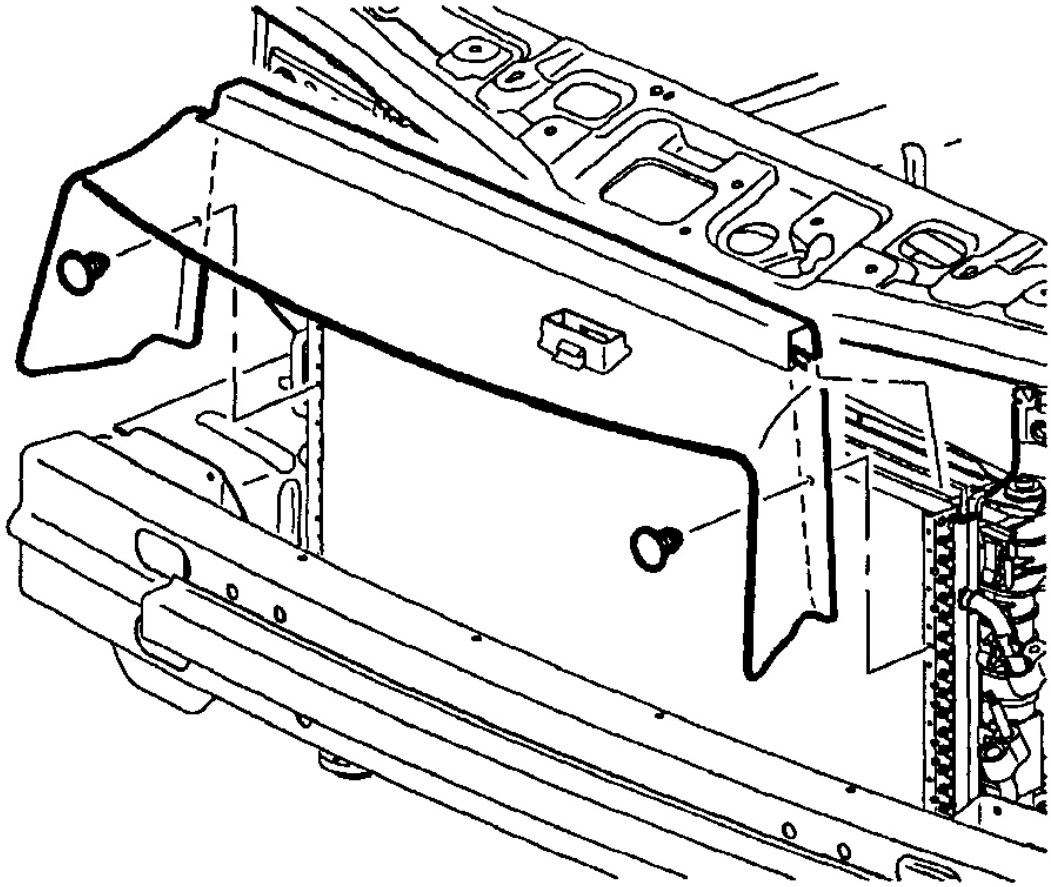


**Fig. 38: Removing & Installing Condenser Splash Shield**
**Courtesy of GENERAL MOTORS CORP.**

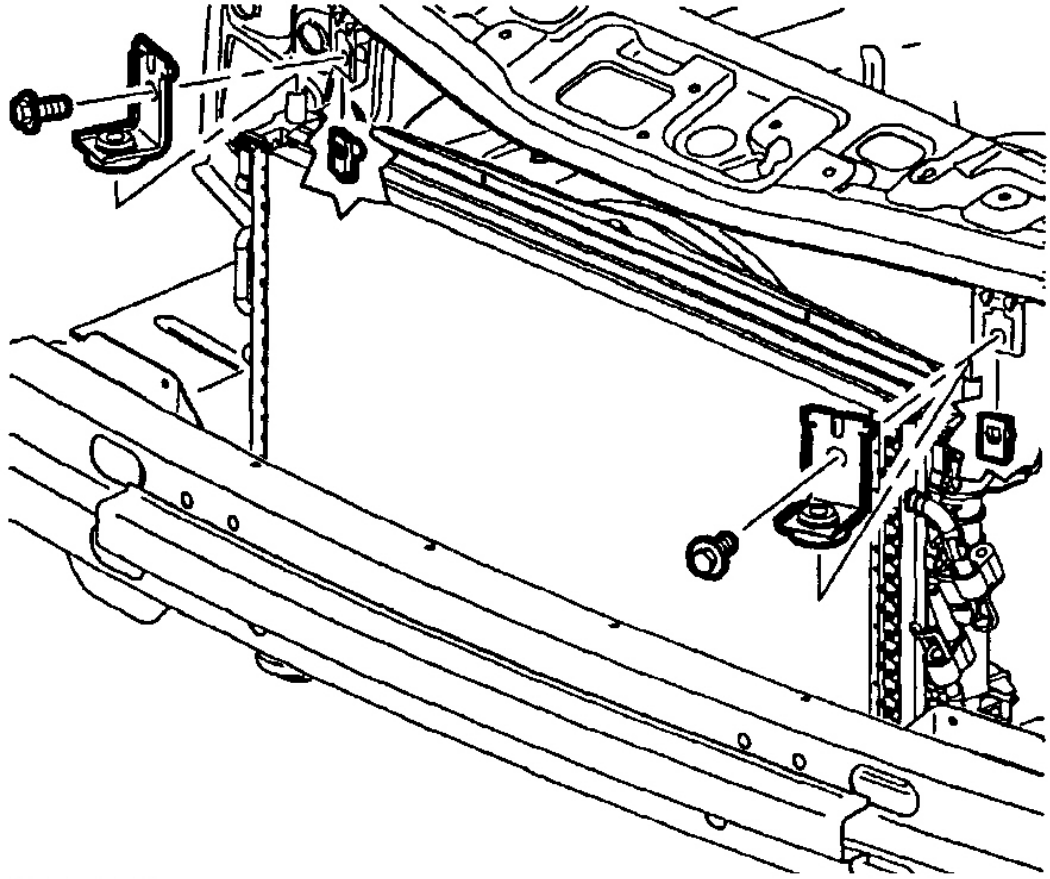


**Fig. 39: Removing & Installing Condenser Radiator Fan Module Bracket Assemblies**
**Courtesy of GENERAL MOTORS CORP.**

 

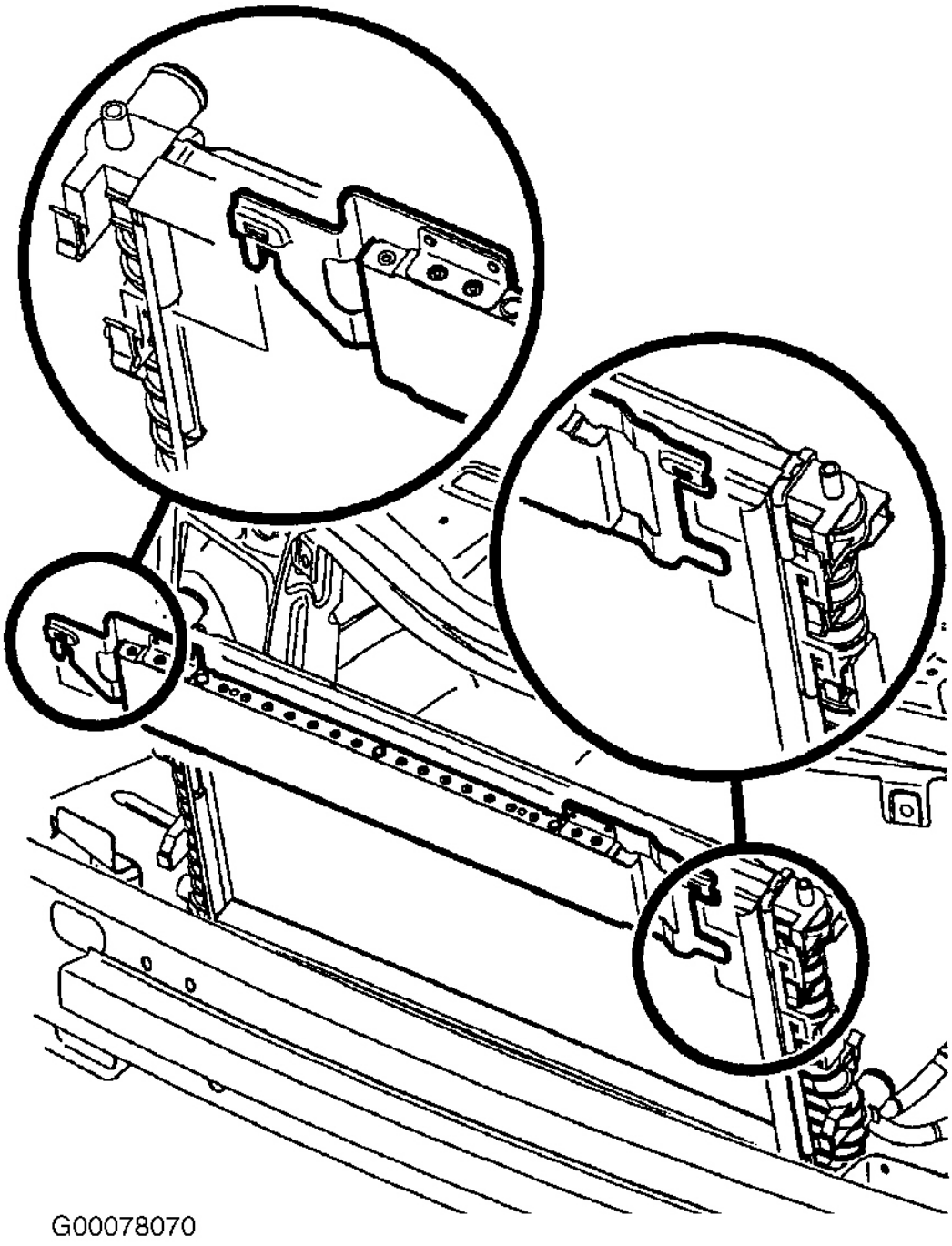


**Fig. 40: Identifying Transaxle Oil Cooler Retaining Clips**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

 

1. Clip transaxle oil cooler to radiator. See **Fig. 40** . Clip condenser to radiator. Install upper CRFM bracket assemblies. See **Fig. 39** . Install condenser splash shield. See **Fig. 38** . Install battery box inlet air duct. See **Fig. 37** . Install oil cooler line-to-radiator bracket bolt. Connect transaxle oil cooler lines to radiator.
2. Install front fascia. See **FRONT FASCIA** . Check transmission fluid level. See **CHECKING FLUID LEVELS** under LUBRICATION. If necessary, fill transaxle to proper level.

## TRANSAXLE OIL COOLER LINE ASSEMBLY

### Removal

Place drain pan or suitable container under vehicle. Position vehicle on a hoist. Remove transaxle oil cooler lines from radiator. Raise vehicle. Remove transaxle cooler line assembly nut from transaxle. See **Fig. 21** . Remove transaxle oil cooler lines from vehicle.

### Installation

Install transaxle oil cooler line assembly to transaxle. Install transaxle oil cooler line nut and tighten to specification. See **TORQUE SPECIFICATIONS** . Lower vehicle. Install transaxle oil cooler lines to radiator and tighten to specification. Add fluid to transaxle. See **CHECKING FLUID LEVELS** under LUBRICATION. Start engine and check for leaks.

## TRANSAXLE OIL COOLER LINE SEALS

### Removal

**CAUTION: Avoid spinning seal in case bore. Damage to case bore may result. Do not collapse seal more than 1/8". Removal tool requires two undeformed opposing edges to work.**

1. Place drain pan or suitable container under vehicle. Position vehicle on a hoist. Raise vehicle. Remove transaxle oil cooler line assembly nut from transaxle. Remove transaxle oil cooler lines from transaxle. See **TRANSAXLE OIL COOLER LINE ASSEMBLY** .
2. Use a long chisel with a 1/4" blade to partially collapse seal in one place only. See **Fig. 41** . Clamp Cooler Line Seal Remover/Installer (J41239) onto transaxle cooler line seal on outside of the case bore. See **Fig. 42** . Remove transaxle cooler line seal by prying and rotating seal out of case with attached tool.

 

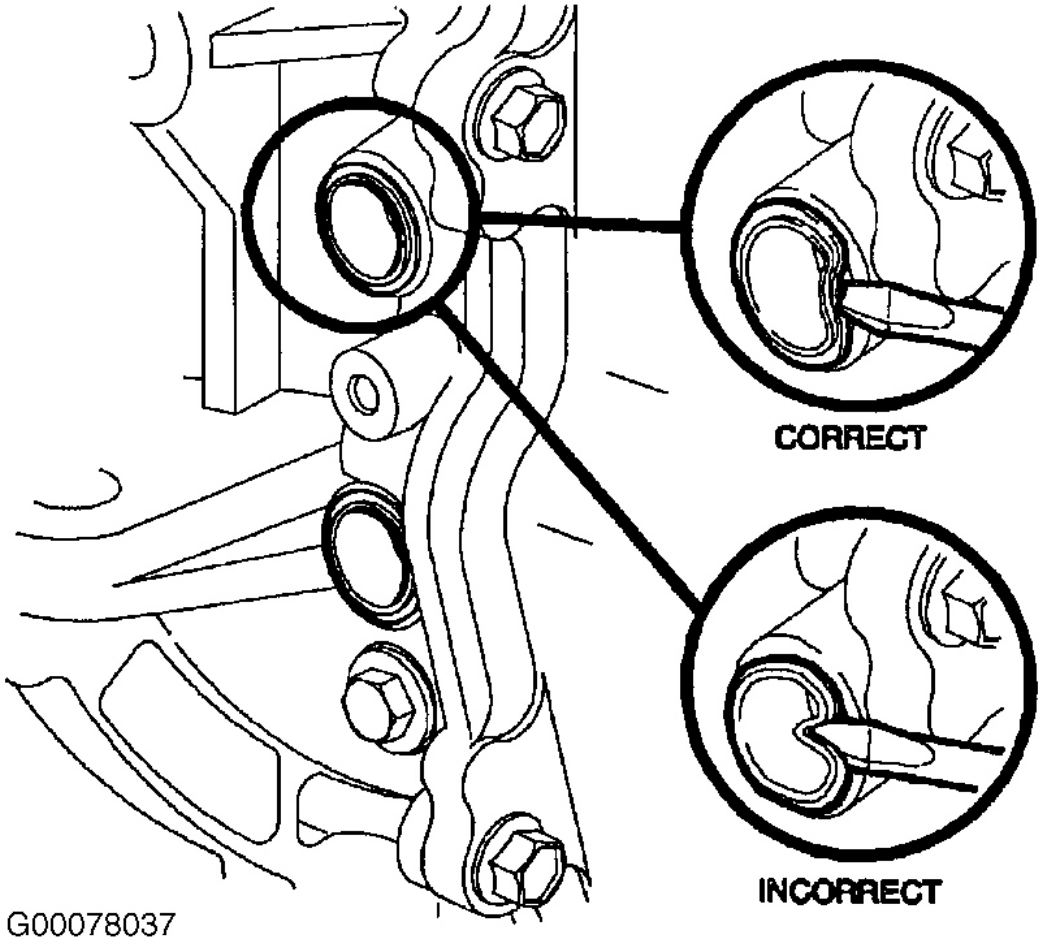


**Fig. 41: Removing Transaxle Oil Cooler Seals**
**Courtesy of GENERAL MOTORS CORP.**

 

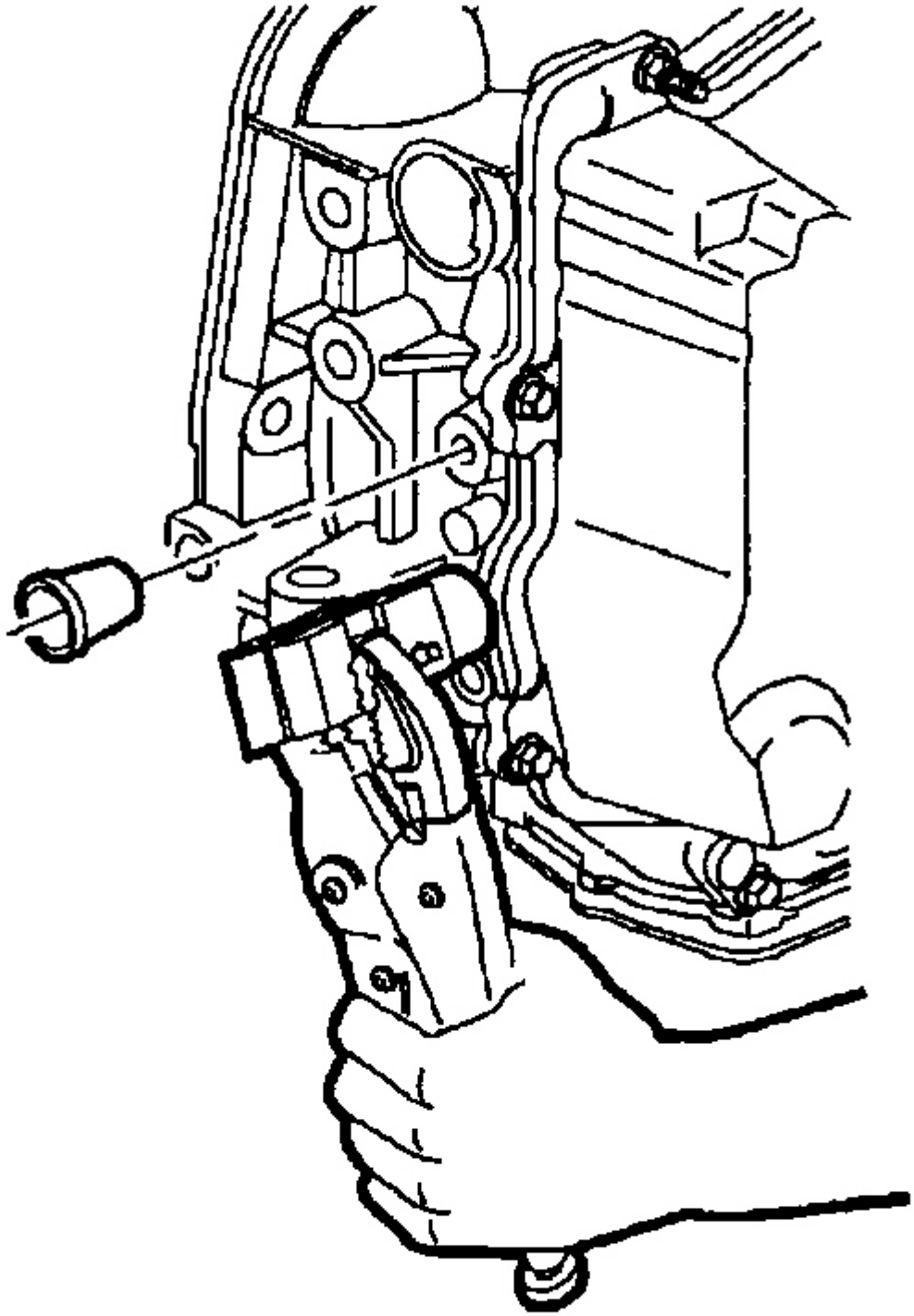

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**Fig. 42: Identifying Cooler Line Seal Remover**
**Courtesy of GENERAL MOTORS CORP.**

**Installation**

1. Place a new transaxle cooler line seal in case bore. Remove nub from Cooler Line Seal Installer (J-41239). Install nub of cooler line seal installer on transaxle cooler line seal. See **Fig. 43** . Tap in a new transaxle cooler line seal into case bore. Install transaxle oil cooler line assembly to transaxle.
2. Install transaxle oil cooler line assembly nut and tighten to specification. See **TORQUE SPECIFICATIONS** . Lower vehicle. Add fluid to transaxle. See **CHECKING FLUID LEVELS** under LUBRICATION. Start engine and check for leaks.

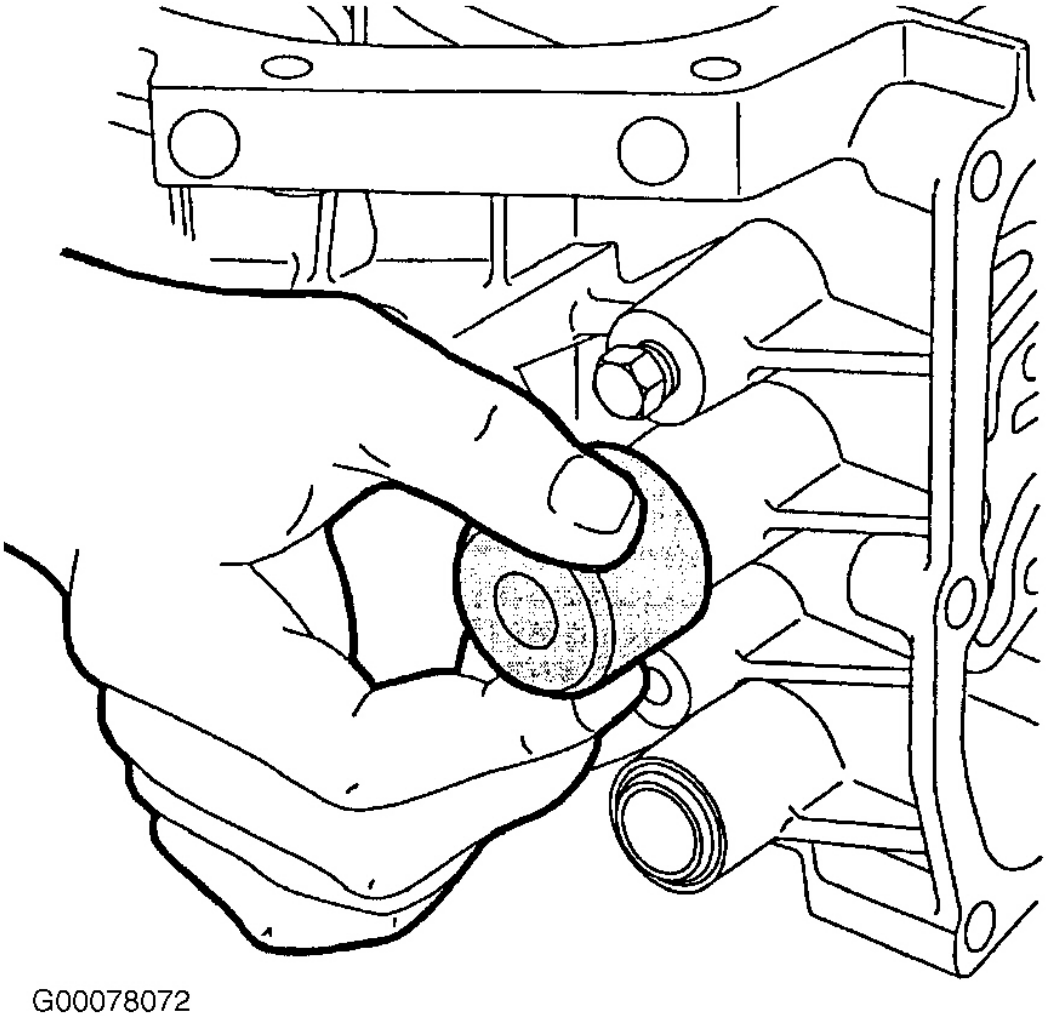


**Fig. 43: Installing Transaxle Cooler Line Seal**
**Courtesy of GENERAL MOTORS CORP.**

 

## TRANSAXLE RANGE SWITCH

**Removal**

**CAUTION: DO NOT tip battery over 45 degree angle or acid could spill.**

**NOTE: Record all pre-set radio stations prior to disconnecting battery and reprogram pre-set stations after repair.**

1. Remove battery cover. Disconnect negative battery cable. Disconnect positive battery cable. Loosen battery hold-down screw and remove battery. See **Fig. 8** .
2. Remove battery cooling box. See **BATTERY COOLING BOX** . Remove battery tray bracket. Loosen battery tray bracket screws and remove bracket. See **Fig. 15** .
3. Apply parking brake and place control shift lever in Neutral position. Using Fascia Retainer Remover (J36346) remove control cable assembly from transaxle range switch lever.
4. Disconnect harness connectors from transaxle range switch. Remove transaxle range switch lever nut and lever. Using a screwdriver, bend lock washer tabs on manual shaft nut retainer down. Remove nut, lock tab washer and flat washer. Remove transaxle range switch bolt stud and flat washers. Remove transaxle range switch.

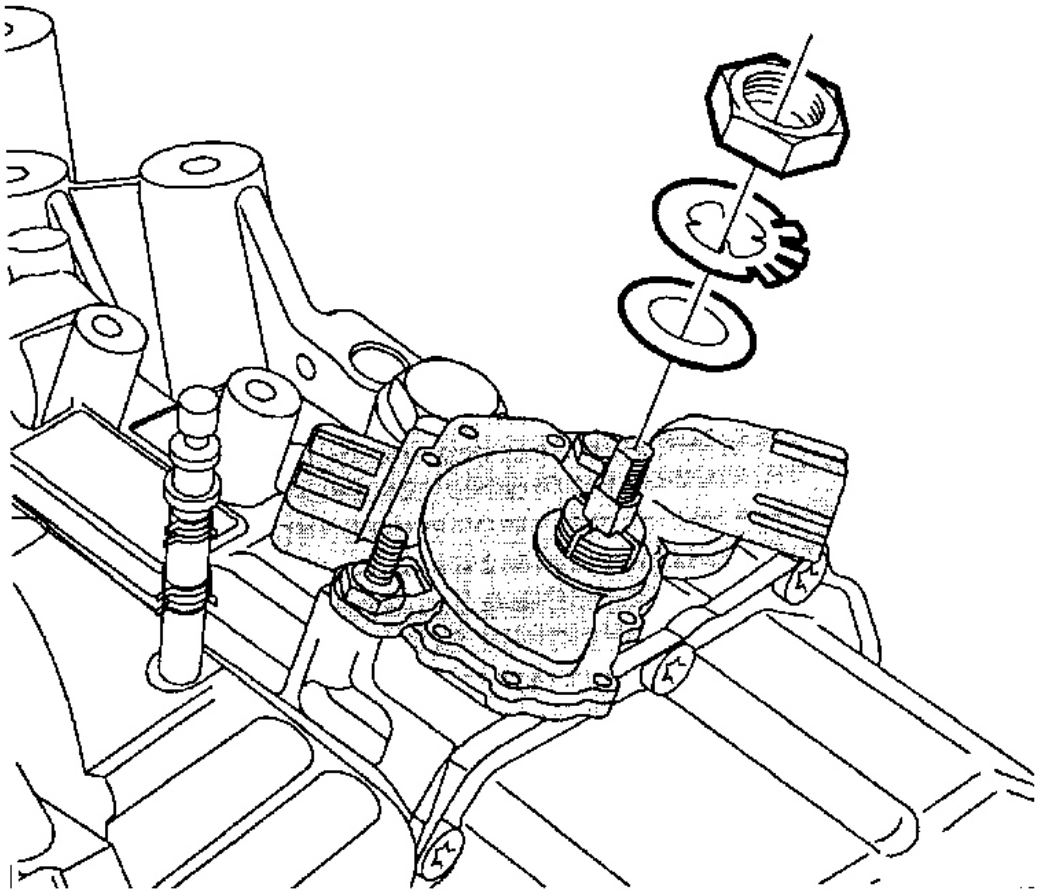

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**Fig. 44: Removing & Installing Transaxle Range Switch Nut**
**Courtesy of GENERAL MOTORS CORP.**

**Installation (Using Old Switch)**

1. Install transaxle range switch to the manual valve lever. Install transaxle range switch bolts, then hand tighten. Install flat washer, lock tab washer and nut, then tighten to specification. See **Fig. 44** . Place the manual valve lever in Neutral position.
2. Install Transaxle Range Switch Alignment Tool (J45404) and align tool pointer to the neutral basic line. See **Fig. 7** . Remove alignment tool. Tighten the transaxle range switch bolts to specification. See **TORQUE SPECIFICATIONS** .
3. Move lock washer into place by bending tabs up with pliers. Connect electrical harness to transaxle range switch. Install transaxle range switch lever and nut. Tighten transaxle range switch nut to specification. Install control cable assembly to transaxle range switch lever.
4. Install battery tray bracket. Position battery tray bracket and tighten screws to specification. Install battery

cooling box. See **BATTERY COOLING BOX** .

5. Install battery. Insert battery and tighten battery hold-down screw to specifications. Connect positive battery cable to battery and tighten to specification. Connect negative battery cable to battery and tighten to specification. Install battery cooling box cover and tighten screws to specification.
6. Reprogram radio stations. Adjust transaxle range switch. See **TRANSAXLE RANGE SWITCH** under ADJUSTMENTS. After adjusting switch, verify engine starts only in Park or Neutral position. If engine starts in any other position, readjust switch.

**Installation (Using New Switch)**

1. Make sure transaxle manual shaft is in Neutral position. Install transaxle range switch to the manual valve lever. Align flats on transaxle shift shaft with flats on transaxle range switch and install switch. Tighten transaxle range switch bolts to specification. See **TORQUE SPECIFICATIONS** . Install flat washer, lock tab washer and nut and tighten to specification. See **Fig. 44** . Move lock tab washer into place by bending tabs up with pliers.
2. Connect harness connector to transaxle range switch. Install transaxle range switch lever and nut. Tighten transaxle range switch lever nut to specification. Install control cable assembly to transaxle range switch lever. Install battery tray bracket. Position battery tray bracket and tighten screws to specification. See **TORQUE SPECIFICATIONS** . Install battery cooling box. See **BATTERY COOLING BOX** .
3. Insert battery and tighten battery hold-down screw to specification. Connect positive battery cable to battery and tighten screws to specification. Connect negative battery cable to battery and tighten screws to specification. Install battery cooling box cover and tighten screws to specification. See **TORQUE SPECIFICATIONS** .
4. Reprogram radio stations. Adjust transaxle range switch. See **TRANSAXLE RANGE SWITCH** under ADJUSTMENTS. After adjusting switch, verify engine starts only in Park or Neutral position. If engine starts in any other position, readjust switch.

# TORQUE SPECIFICATIONS

**TORQUE SPECIFICATIONS**

| Application | Ft. Lbs. (N.m) |
|---|---|
| Battery Hold-Down Screw | 11 (15) |
| Battery Terminal Bolt | 13 (17) |
| Battery Tray Bracket Screw | 12 (16) |
| Front Pitch Restrictor Bolt | 37 (50) |
| Front Pitch Restrictor Through Bolt | 81 (110) |
| Transaxle Cooler Line Fitting | 12 (16) |
| Transaxle Drain Plug | 30 (40) |
| Transaxle Lower Tube Assembly | 12 (16) |
| Transaxle Range Switch Lever Nut | 12 (16) |
| Transaxle Range Switch Bolt | 18 (25) |
| Wheel Nut | 92 (125) |
| | **INCH Lbs. (N.m)** |
| Battery Cooling Box Cover Screw | 18 (2) |

| | |
|---|---|
| Battery Cooling Box Side Support Screw | 89 (10) |
| Control Valve Body Bolt | 115 (13) |
| Fluid Passage Cover Bolt | 89 (10) |
| Fluid Temperature Sensor Bolt | 89 (10) |
| Front Fascia-To-Lower Front Fender Bolt | 80 (9) |
| Input Speed Sensor Bolt | 53 (6) |
| Output Speed Sensor Bolt | 53 (6) |
| Transaxle Fluid Level Indicator Bolt | 106 (12) |
| Transaxle Oil Cooler Line Nut | 71 (8) |
| Transaxle Range Switch Nut | 62 (7) |
| Valve Body-To-Transaxle Case Bolt | 89 (10) |

# 2002 AUTOMATIC TRANSMISSIONS

## AF33-5 Diagnosis

## APPLICATION

**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 AIR BAG DEACTIVATION PROCEDURES article in GENERAL INFORMATION.**

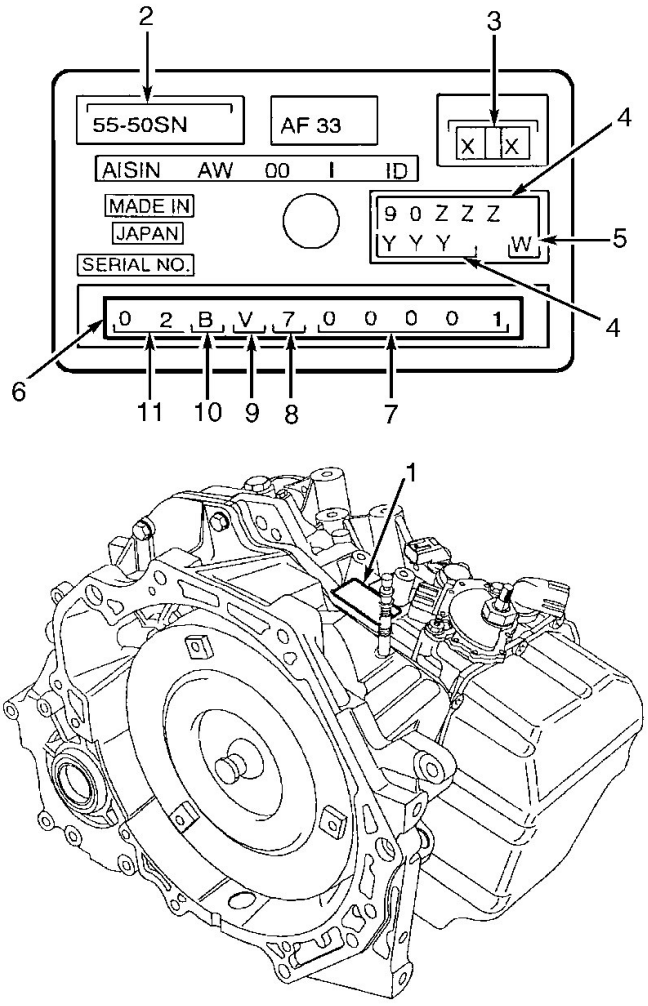
**TRANSAXLE APPLICATION**

| Application | Transaxle Model |
|---|---|
| Saturn Vue (AWD) | Aisin Warner AF33-5 |

## IDENTIFICATION

### TRANSAXLE

Transaxle has a metal identification plate attached to top of transaxle case. See **Fig. 1** . The RPO code for the AF33-5 transaxle is M45.




1. Transaxle Identification Plate
2. Model Number
3. GM Identification Code
4. GM Part Number
5. Calibration Code
6. Aisin-Warner Production Unit Number
7. Serial Number (during month of manufacture)
8. Assembly Line Code
9. Transaxle Mode
10. Month Of Manufacture
11. Year Of Manufacture

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**Fig. 1: Locating Transaxle Identification Information**
**Courtesy of GENERAL MOTORS CORP.**

# DESCRIPTION & OPERATION

## INTRODUCTION

The AF33-5 transaxle incorporates electronic controls that utilize the Transaxle Control Module (TCM) to control shift points (through shift solenoids), Torque Converter Clutch (TCC) apply and release (through the lock-up Pressure Control (PC) solenoid) and line pressure (through the line PC solenoid and the shift PC solenoid). Electrical signals from various sensors provide information to the TCM about vehicle speed, throttle position, engine coolant temperature, transmission fluid temperature, gearshift lever position, engine speed, converter turbine speed, engine load braking and operating mode. The TCM uses this information to determine the precise moment to upshift or downshift, apply or release the TCC and what fluid pressure is needed to apply the clutches. This type of control provides consistent and precise shift points and shift quality based on the operating conditions of the vehicle.

## ELECTRONIC COMPONENTS

**NOTE: For transaxle electronic component locations, refer to illustration. See Fig. 2 .**

### Transmission Fluid Temperature Sensor

The Transmission Fluid Temperature (TFT) sensor is part of the transaxle wiring harness assembly. The TFT sensor is a resistor, or thermistor, which changes value based on temperature. The sensor has a negative-temperature coefficient. This means that as the temperature increases, the resistance decreases, and as the temperature decreases the resistance increases. The TCM supplies a 5-volt reference signal to the sensor and measures the voltage drop in the circuit. When the transmission fluid is cold, the sensor resistance is high and the TCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The TCM uses this information to maintain shift quality and TCC apply quality over the operating temperature range.

### Output Speed Sensor

The Output Speed Sensor (OSS) is a 2-wire hall-effect sensor, located in the top of the transaxle case. This sensor is mounted in the case opposite the parking lock gear that is splined to the underdrive planetary gear assembly shaft. The OSS consists of a permanent magnet, a hall element, and integrated circuits. As the parking lock gear rotates, a square wave DC voltage signal is produced when the teeth on the gear pass by the hall element. Whenever the vehicle is moving, the OSS sensor produces a square wave DC voltage signal with a frequency proportional to vehicle speed. This signal is sent to the TCM. The TCM uses the output speed to help determine line pressure, transaxle shift patterns, TCC apply pressure, gear ratios and TCC slippage for diagnostic purposes. The TCM also sends a vehicle speed signal to other controllers, based on the OSS signal.

### Input Speed Sensor

The Input Speed Sensor (ISS) operates identically to the OSS except it uses the stamped teeth on the forward and direct clutch housing and input shaft assembly as the rotor (reluctor). Remember that the forward and direct clutch housing and input shaft assembly is driven at converter turbine speed. The TCM uses transaxle input speed to help determine line pressure, transaxle shift patterns, TCC apply pressure, gear ratios, and TCC slippage for diagnostic purposes.

### Transaxle Range Switch

The Transaxle Range (TR) switch assembly is a sliding contact switch attached to the manual shift shaft and detent lever assembly outside the transaxle case. The five inputs to the TCM from the TR switch assembly indicate which position is selected by the gearshift lever. This information is used for engine controls as well as determining the transaxle shift patterns. The state of each input is available for display on the scan tool.

**Shift Solenoid "1"**

The shift solenoid "1" is a normally open, on/off type solenoid controlled by the TCM. When the shift solenoid "1" is energized (on), shift solenoid "1" signal fluid is blocked from exhausting through the solenoid, thereby creating shift solenoid "1" signal fluid pressure. Shift solenoid "1" signal fluid pressure acts on the U1 shift valve and the M1 shift valve. When the shift solenoid "1" is de-energized (off), any existing shift solenoid "1" signal fluid pressure exhausts through the solenoid.

**Shift Solenoid "2"**

The shift solenoid "2" is a normally open, on/off type solenoid controlled by the TCM. When the shift solenoid "2" is energized (on), shift solenoid "2" signal fluid is blocked from exhausting through the solenoid, thereby creating shift solenoid "2" signal fluid pressure. Shift solenoid "2" signal fluid pressure acts on the M2 shift valve, against spring force, to move the valve into the applied position. When the shift solenoid "2" is de-energized (off), any existing shift solenoid "2" signal fluid pressure exhausts through the solenoid.

**Shift Solenoid "3"**

The shift solenoid "3" is a normally closed, on/off type solenoid controlled by the TCM. When the shift solenoid "3" is energized (on), shift solenoid "3" signal fluid is allowed to exhaust through the solenoid, thereby exhausting any shift solenoid "3" signal fluid pressure present in the circuit. When the shift solenoid "3" is de-energized (off), shift solenoid "3" signal fluid is blocked from exhausting through the solenoid, thereby creating shift solenoid "3" signal fluid pressure. Shift solenoid "3" signal fluid pressure acts on the U2 shift valve, against spring force, to move it into the applied position.

**Shift Solenoid "4"**

The shift solenoid "4" is a normally open, on/off type solenoid controlled by the TCM. When the shift solenoid "4" is energized (on), shift solenoid "4" signal fluid is blocked from exhausting through the solenoid, thereby creating shift solenoid "4" signal fluid pressure. Shift solenoid "4" signal fluid pressure acts on the U2 shift valve and the U1 shift valve. When the shift solenoid "4" is de-energized (off), any existing shift solenoid "4" signal fluid pressure exhausts through the solenoid.

**Shift Solenoid "5"**

The shift solenoid "5" is a normally closed, on/off type solenoid controlled by the TCM. When the shift solenoid "5" is energized (on), shift solenoid "5" signal fluid is allowed to exhaust through the solenoid thereby exhausting any shift solenoid "5" signal fluid pressure present in the circuit. When the shift solenoid "5" is de-energized (off), shift solenoid "5" signal fluid is blocked from exhausting through the solenoid, thereby creating shift solenoid "5" signal fluid pressure. Shift solenoid "5" signal fluid pressure acts on the shift pressure relay valve, against spring force, to move it into the applied position.

**Line Pressure Control Solenoid**

The line Pressure Control (PC) solenoid (normally high, 3-port linear PC solenoid) is a precision electronic pressure regulator that controls line pressure based on current flow through its coil windings. As current flow is increased, the magnetic field produced by the coil moves the solenoid's plunger further away from the exhaust port. Opening the exhaust port decreases the output fluid pressure regulated by the line PC solenoid, which ultimately decreases line pressure. The TCM controls the line PC solenoid based on various inputs including throttle position, transmission fluid temperature and gear state.

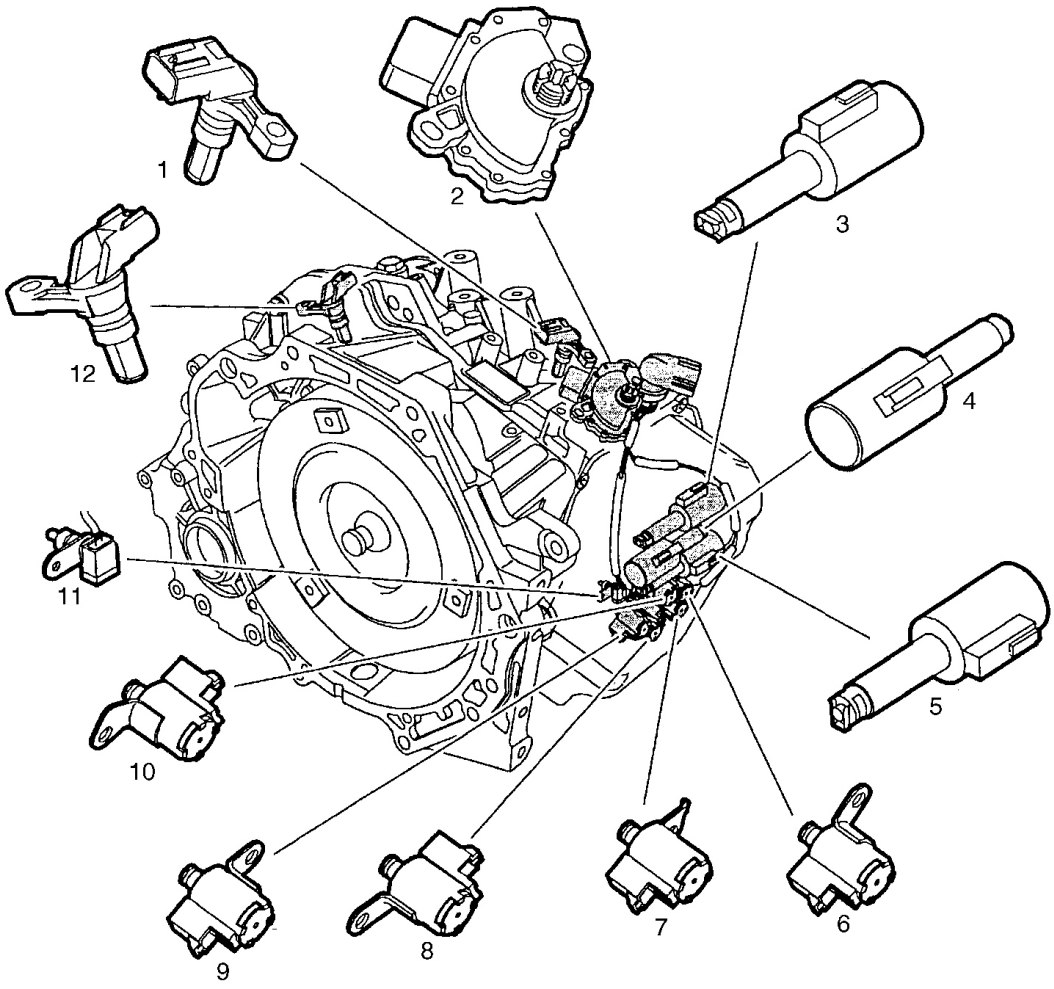
**TCC Lock-Up Pressure Control Solenoid**

The TCC lock-up Pressure Control (PC) solenoid is a normally low, 3-port linear PC solenoid used to control the apply and release of the forward and reverse clutches, and the TCC. The TCM operates the solenoid with a negative duty cycle at a fixed frequency of 32 Hz to control the rate of clutch apply/release. The solenoid's ability to ramp the clutch apply and release pressures results in a smoother clutch operation.

**Shift Pressure Control Solenoid**

The shift Pressure Control (PC) solenoid (normally high, 3-port linear PC solenoid) is a precision electronic pressure regulator that controls clutch apply pressure based on current flow through its coil windings. As current flow is increased, the magnetic field produced by the coil moves the solenoid's plunger further away from the exhaust port. Opening the exhaust port decreases the output fluid pressure regulated by the shift PC solenoid, which ultimately decreases clutch apply pressure. The TCM controls the shift PC solenoid based on various inputs including throttle position, transmission fluid temperature and gear state.




1. Input Speed Sensor
2. Transaxle Range Switch
3. TCC Lock-Up Pressure Control Solenoid (Black)
4. Line Pressure Control Solenoid (Blue)
5. Shift Pressure Control Solenoid (Green)
6. Shift Solenoid "4" (Blue)
7. Shift Solenoid "3" (Dark Gray)
8. Shift Solenoid "5" (Green)
9. Shift Solenoid "2" (Light Gray)
10. Shift Solenoid "1" (Black)
11. Transmission Fluid Temperature Sensor
12. Output Speed Sensor

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**Fig. 2: Locating Transaxle Electronic Components**
**Courtesy of GENERAL MOTORS CORP.**

**ECM & TCM**

The ECM is mounted on the rear of engine, below battery box. The TCM is located in front of the right front strut tower. See **Fig. 6** . ECM and TCM control ignition, fuel and emission devices related to engine and transaxle upshifts and downshifts.

The TCM receives electronic signals from sensors and switches. These signals help TCM determine when to

 

operate various relays and solenoids related to engine and transaxle control.

### ELECTRONIC CONTROL SYSTEM

The TCM constantly monitors all transaxle electrical circuits. If the TCM detects circuit problems or sensors out of range, it will record a Diagnostic Trouble Code (DTC). If problem continues for a predetermined time, Malfunction Indicator Light (MIL) will light.

If MIL is on all the time, DTC(s) are currently being detected. If MIL is off, but TCM had detected a circuit or sensor problem, DTC(s) will be stored in computer memory.

Stored DTCs may be retrieved from TCM memory using a scan tool. DTCs CANNOT be retrieved by grounding 16-pin Data Link Connector (DLC).

**NOTE: Faulty engine sensors and actuators may cause transaxle-related DTCs or driveability problems. Engine faults and related DTCs must be diagnosed and repaired before transaxle DTCs are repaired. For additional information on diagnosing and repairing engine-related DTCs, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.**

### TRANSAXLE PROTECTION MODE

Transaxle Protection Mode occurs if a failure is detected. Only certain gears will be available when the transaxle is in protection mode. Cycle the ignition key off and on to bring the transaxle out of protection mode, until the failure is detected again. Vehicle should not be driven for extended periods in protection mode.

### SHIFT INTERLOCK SYSTEM

**NOTE: For system operation, diagnosis and repair, see appropriate SHIFT INTERLOCK SYSTEMS article.**

## TROUBLE SHOOTING

**NOTE: Any diagnosis should begin with confirming the customer's complaint. If possible, road test vehicle first, and note transaxle performance for future reference during diagnosis.**

### PRELIMINARY INSPECTION

Transaxle malfunctions may be caused by poor engine performance, improper adjustments or failure of hydraulic, mechanical or electronic components. Prior to diagnosing transaxle concerns, always begin by checking fluid level, fluid condition and shift cable adjustment. Ensure engine starts with gearshift lever in Park and Neutral to ensure proper adjustment of park/neutral position switch. Ensure all system-related fuses are okay. Check wire harnesses for proper routing. Verify all harness and component connections are clean and tight. See **WIRING DIAGRAMS** . If area of fault cannot be located or repaired during preliminary inspection, check self-diagnostic system. See **SELF-DIAGNOSTIC SYSTEM** . Repair as necessary.

Perform road test to determine if problem has been corrected. See **ROAD TEST** under PERFORMANCE TESTS. If problem still exists, diagnose by symptom. See **SYMPTOM DIAGNOSIS** .

## SYMPTOM DIAGNOSIS

### Transaxle Overheats

The following are possible causes and corrections for this condition:

- Fluid filter is restricted - diagnose the cause for the filter restriction and repair as necessary.
- Fluid filter is restricted - replace fluid filter and fluid.
- Restricted oil cooler line(s) - diagnose the cause of restriction and repair as necessary. Replace fluid.
- Internal oil cooler restriction - replace radiator assembly and fluid.
- Case assembly oil inlet filter/screen - remove inlet cooler line seal from case assembly. Inspect for foreign material trapped by the case inlet filter/screen. Clean passage to remove the foreign material from case inlet screen. If unable to remove the foreign material, screen will have to be removed from the case assembly and cleared manually outside the case assembly.

### No Forward Or Reverse

The following are possible causes and corrections for this condition:

- No fluid or fluid level low - inspect fluid level and color. Perform a fluid level inspection and make sure that the fluid does not smell burnt. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with correct fluid and retest. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Torque converter assembly - torque converter is not physically connected to the engine flex-plate due to mounting bolts not installed or physical damage to torque converter mounting lugs due to mounting bolts being too short in length. Perform a physical inspection of the torque converter mounting bolts to verify correct length and size. Seizure or breaking of the torque converter sleeve or fluid pump assembly internal bushing, due to misalignment of the torque converter pilot in to the engine crankshaft pilot hole. Inspect the torque converter sleeve and fluid pump bushing for signs of physical damage. If damage is present, inspect crankshaft pilot hole and correct as necessary before installing a new torque converter assembly.

  Torque converter to flex plate mounting bolt(s) length too long, thus causing internal damage to the torque converter (projection into the front cover) which in turn peels off the internal friction material from the torque converter's apply plate. Replace torque converter assembly and install the correct torque converter to flex-plate mounting bolts.

  Torque converter internal lock-up friction material peeled off the apply plate due to an attempted thread repair on one of more of the converter mounting lug pads. Re-tapping of the mounting lug pad(s) threads causes projection of the front cover which in turn peels off the lock-up clutches friction material. Replace torque converter assembly and torque converter-to-flex plate mounting bolts if necessary.

- Physical damage to fluid pump assembly due to improper torque converter installation - inspect fluid pump drive gear for physical damage. Replace fluid pump assembly if there is damage to the gear(s).

 

- Line PC solenoid - verify the line PC solenoid electrically responds. If there is no response, perform an electrical diagnosis. If there is no electrical concern(s), remove the solenoid, inspect the "O" ring seal and bore for signs of damage and/or missing seal. If solenoid responded electrically and there is no bore or seal concern, replace line PC solenoid due to possible internal mechanical concern and retest. If a concern is still present after replacing the line PC solenoid, then replace control valve body assembly.

**No Movement Or Slips In Drive**

The following are possible causes and corrections for this condition:

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and retest. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Low system line pressure caused by:
  A. Fluid low - perform fluid level check and correct as necessary.
  B. Fluid pump - internal fluid pump concern, diagnose fluid pump assembly and repair or replace assembly as necessary.
  C. Torque converter - internal concern, diagnose the cause of the concern and repair as necessary. Replace torque converter assembly.
  D. Fluid filter - fluid filter restricted. Diagnose the cause of restriction, repair as necessary and replace filter assembly.
  E. Internal transaxle concern - internal fluid leak, perform system air checks and repair as necessary.
- External valve body assembly (line PC solenoid) - verify the line PC solenoid electrically responds. If there is no response, perform electrical diagnosis. If there is no electrical concerns, remove the solenoid assembly, inspect the "O" ring seal and bore for signs of damage and/or missing seal. If solenoid responded electrically and there is no bore or seal concern, replace line PC solenoid due to possible internal mechanical concern and retest. If a concern is still present after replacing the line PC solenoid, replace the control valve body assembly.
- Internal valve body assembly (primary regulator valve check valve, manual valve, line PC accumulator piston) - remove valve body assembly to inspect the items listed. Inspect internal bores and valves for signs of wear, damage and/or contamination. If unable to verify a repairable concern, replace the control valve body assembly.
- 1-2 reverse clutch assembly - remove the transaxle rear case cover and 1-2 reverse clutch assembly and inspect all clutch components and operation. Repair as necessary.
- Forward clutch - remove the transaxle rear case cover, 1-2 reverse clutch assembly and the forward and direct clutch assembly to inspect all forward clutch components and operation. Repair as necessary.
- Front internal gear and low clutch sprag assembly - remove the transaxle rear case cover, 1-2 reverse clutch assembly, forward and direct clutch assembly, front internal carrier sun gear assembly, and the front internal gear and low clutch sprag assembly to inspect all its components and operation. Repair as necessary.

**No Movement Or Slips In Reverse**

The following are possible causes and corrections for this condition:

 

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt, and shows no sign of coolant cross-contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with correct fluid and retest. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Fluid pump - internal fluid pump concern, diagnose fluid pump assembly and repair or replace assembly as necessary.
- Torque converter - internal concern, diagnose the cause of the concern and replace torque converter assembly.
- Fluid filter - fluid filter restricted. Diagnose the cause of restriction and repair as necessary and replace filter assembly.
- Internal transaxle concerns - internal fluid leak, perform system air checks and repair as necessary.
- External valve body assembly (line PC solenoid, shift solenoid "1", shift solenoid "2", line PC accumulator piston) - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there is no electrical concern, remove the solenoid assembly, and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoid responded electrically and there is no bore or seal concerns, replace assembly due to a possible internal mechanical concern and retest. If after replacing the solenoid assembly in question, a concern is still present, replace the control valve body assembly.
- Internal valve body assembly (primary regulator valve, check valve, manual valve, M1 shift valve, M2 shift valve, U1 shift valve) - remove valve body assembly to inspect the items listed. Inspect internal bores and valves for signs of wear, damage and/or contamination. If unable to verify a repairable concern, replace the complete valve body assembly.
- Forward clutch assembly - remove the transaxle rear case cover and 1-2 reverse clutch assembly, forward and direct clutch assembly to inspect all forward clutch components and operation. Repair as necessary.
- Low and reverse clutch piston assembly - remove the transaxle rear case cover, 1-2 reverse clutch assembly, forward and direct clutch assembly, front gear and low clutch sprag assembly, and low and reverse clutch plates and disc assembly to inspect the low and reverse clutch piston related components for proper operation. Repair as necessary.
- 1-2 reverse clutch assembly - remove the transaxle rear case cover and 1-2 reverse clutch assembly and then inspect all clutch components and operation. Repair as necessary.

**Delayed Engagement From Neutral To Drive**

The following are possible causes and corrections for this condition:

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt, and shows no sign of coolant cross contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and retest. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- ISS - inspect ISS for loose electrical connection and/or signs of physical damage that could cause erratic output. Magnetic end of sensor should be free of any metal shavings/particles (heavy friction material build-up). If metal or heavy friction material is found, diagnose the cause and repair as necessary.
- Internal valve body assembly (forward clutch control valve) - remove valve body assembly to inspect the

 

items listed. Inspect internal bores and valves for signs of wear, damage and/or internal contamination. If unable to verify a repairable concern, replace the complete valve body assembly.

- Forward clutch assembly - remove the transaxle rear case cover, 1-2 reverse clutch assembly, forward and direct clutch assembly to inspect all forward clutch components and operation. Repair as necessary.

**Delayed Engagement From Neutral To Reverse**

The following are possible causes and corrections for this condition:

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt, and shows no sign of coolant cross contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and retest. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- ISS - inspect ISS for loose electrical connection and/or signs of physical damage that could cause erratic output. Magnetic end of sensor should be free of any metal shavings/particles (heavy friction material build-up). If metal or heavy friction material is found, diagnose the cause and repair as necessary.
- External valve body assembly (shift solenoid "5") - verify the solenoid responds electrically. If there is no response, perform electrical diagnosis. If there is no electrical concerns, remove the solenoid assembly, and inspect the solenoid "O" ring seal, and bore for signs of damage and/or missing seal. If solenoid responded electrically and there is no bore or seal concerns, replace assembly due to a possible internal mechanical concern and retest. If after replacing the solenoid assembly in question, a concern is still present, replace the control valve body assembly.
- Internal valve body assembly (shift pressure relay valve, shift PC valve) - remove valve body assembly to inspect the items listed. Inspect internal bores and valves for signs of wear and/or damage to include internal contamination. If unable to verify a repairable concern, replace the complete valve body assembly.
- Forward and direct clutch assembly and/or low and reverse clutch plates and disc assembly - remove the transaxle rear case cover and 1-2 reverse clutch assembly, forward and direct clutch assembly, front carrier sun gear and low clutch sprag assembly, and low and reverse clutch plates and disc assembly. Inspect all related components for proper operation. Repair as necessary.

**Engine Stalls Upon Transaxle Engagement**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "4", shift solenoid "5", TCC lock-up PC solenoid - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly and retest. If after replacing the solenoid assembly in question and a fault still exists, replace control valve body assembly.
- Internal valve body assembly Ul shift valve, lock-up relay valve, shift pressure relay valve - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly as necessary.

**Slips On Acceleration**

 

The following are possible causes and corrections for this condition:

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt and shows no sign of coolant cross contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and retest. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Fluid pump - internal fluid pump concern. Diagnose fluid pump assembly and repair or replace assembly as necessary.
- Torque converter - internal concerns. Diagnose the cause of the concern and replace torque converter assembly.
- Fluid filter - fluid filter restricted. Diagnose the cause of the restriction and repair as necessary and replace filter assembly.
- Internal concern - internal fluid leak. Perform system air checks and repair as necessary.
- External valve body assembly (line PC solenoid, lock-up PC solenoid, shift solenoid "1", shift solenoid "2", shift solenoid "5" - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly as required, due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the valve assembly, replace the control valve body assembly.
- Internal valve body assembly (M2 shift valve, Neutral relay valve, shift pressure relay valve, shift PC valve, forward clutch accumulator) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.
- TR switch - See **DTC P0705: TR SWITCH CIRCUIT** .
- Forward clutch assembly - remove the transaxle rear case cover and 1-2 reverse clutch assembly, forward and direct clutch assembly, front carrier sun gear and low clutch sprag assembly, and low and reverse clutch plates and disc assembly. Inspect all related components for proper operation. Repair as necessary.

**No 1-2 Upshift**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "1", shift solenoid "2", shift solenoid "4") - verify all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U2 shift valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.
- 2nd coast clutch, 2nd clutch hub, and 2nd clutch sprag assembly - remove torque converter assembly and the fluid pump assembly to inspect the 2nd coast clutch, 2nd clutch hub, and 2nd clutch sprag assembly.

 

Inspect all related parts and repair as necessary.

**No 2-3 Upshift**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "4") - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoid responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U2 shift valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign material and/or contamination. Replace control valve body assembly if necessary.
- 4-5 clutch assembly - inspect the 3rd gear band servo piston assembly for signs of binding, contamination, and/or missing parts. If assembly was found to be binding in the bore, possible damage to the 4-5 brake band assembly might have occurred and band should be checked to verify proper operation.
- 3rd gear band assembly - remove the transaxle rear case cover, 1-2 reverse clutch assembly and 1-2 reverse carrier gear assembly to inspect the 3rd gear brake band assembly. Inspect all related components for proper operation. Repair as necessary.
- TR Switch - See **DTC P0705: TR SWITCH CIRCUIT** .

**No 3-4 Upshift**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "4") - verify that all solenoids respond electrically. If there is no response, perform an electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoid responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U2 shift valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace complete valve body assembly if necessary.
- 4-5 clutch assembly - remove transaxle rear case cover and 1-2 reverse clutch assembly, 1-2 reverse carrier gear assembly, 3rd gear band, and the 4-5 clutch assembly. Inspect all related components for proper operation. Repair as necessary.
- TR switch - See **DTC P0705: TR SWITCH CIRCUIT** .

**No 4-5 Upshift**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "5") - verify that all

 

solenoids respond electrically. If there is no response, perform an electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoid responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.

- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U2 shift valve) - shift pressure relay valve. Remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.
- Direct clutch - remove the transaxle rear case cover and 1-2 reverse clutch assembly, forward and direct clutch assembly to inspect all direct clutch components and operation. Repair as necessary.

**No 5-4 Downshift**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "5") - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U2 shift valve, shift pressure relay valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.
- 2nd coast clutch, 2nd clutch hub and 2nd clutch sprag assembly - remove torque converter assembly, fluid pump assembly, 2nd coast clutch, 2nd clutch hub and 2nd clutch sprag assembly. Inspect all related parts and repair as necessary.

**No 4-3 Downshift**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "4") - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U2 shift valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.

**No 3-2 Downshift**

The following are possible causes and corrections for this condition:

- External valve body (shift solenoid "2", shift solenoid "3", shift solenoid "4", line PC solenoid) - verify

 

that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If concern is still present after replacing the solenoid assembly, replace the control valve body assembly.

- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U2 shift valve - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.
- 1-2 reverse clutch assembly - remove transaxle rear case cover and 1-2 reverse clutch assembly and then inspect all clutch components and operation. Repair as necessary.

**No 2-1 Downshift**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "1", shift solenoid "2", shift solenoid "3", shift solenoid "4") - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids, "O" ring seals bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (M1 shift valve, M2 shift valve, U1 shift valve, U1 shift valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.

**TCC Stuck On Or Off**

The following are possible causes and corrections for this condition:

- External valve body assembly, (shift solenoid "3", shift solenoid "4", TCC lock-up PC solenoid) - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (secondary regulator valve, U2 shift valve, solenoid relay valve, lock-up relay valve, lock-up control valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.
- Torque converter assembly - perform an electrical performance test. If no concern was verified electrically, inspect torque converter assembly for signs of internal damage caused by an external issue such as mounting bolts too long in length or thread repair. Replace torque converter assembly making sure the correct flex-plate mounting bolts are used.

**No 4th Gear Engine Braking**

The following are possible causes and corrections for this condition:

 

- External valve body assembly (shift solenoid "5") - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (Ml shift valve, shift pressure relay valve, shift PC valve, control valve body assembly) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace complete valve body assembly if necessary.

**No 3rd Gear Engine Braking**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "5") - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (Ml shift valve, shift pressure relay valve, shift PC valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace complete valve body assembly if necessary.

**No 2nd Gear Engine Braking**

The following are possible causes and corrections for this condition:

- External valve body assembly (shift solenoid "5") - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (Ml shift valve, shift pressure relay valve, shift PC valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace complete valve body assembly if necessary.

**Gearshift Lever Moves Freely & Transaxle Does Not Respond To Selected Gearshift Lever Position**

The following are possible causes and corrections for this condition:

- Gearshift lever assembly - gearshift lever assembly mechanically broken or not connected to cable assembly.
- Gearshift lever cable - cable not connected to the gearshift lever assembly or to the manual shift shaft and detent lever assembly. Cable broken.

 

- Manual shift detent lever assembly - not installed or shaft physically broken.
- Manual shift detent lever spring - not installed. Mechanically broken or mounting bolts not installed or loose.

**Transaxle Does Not Respond To Gearshift Lever Position, & Gearshift Lever Response Feels Normal**

The following are possible causes and corrections for this condition:

- Manual valve link - not connected to the manual shift detent lever assembly or not installed.

**Transaxle Attempts To Move, But Acts Physically Locked Up Internally**

The following are possible causes and corrections for this condition:

- Park pawl actuator rod assembly - not installed correctly inside transaxle assembly or not installed.

**Oil Leaks**

The following are possible causes and corrections for this condition:

- From the vent assembly area - transaxle overfilled with fluid. Vent not installed, damaged or restricted. Vent hose not secure, not installed, restricted or damaged. Vent pipe not secure, not installed, restricted or damaged. Vent hose clips not installed.
- Between engine and transaxle assembly - engine rear main seal concern. Engine oil pan and/or gasket concern. Engine intake manifold or gasket concern. Engine valve cover concern. Torque converter weld or seam issue. Transaxle fluid pump "O" ring seal not installed or damaged during installation. Front differential carrier seal assembly not installed, worn and/or damaged. Front differential carrier seal to torque converter housing internal bore concern.
- Manual shift detent lever assembly - manual shift detent lever seal not installed or sealing surface damaged. Manual shift detent lever to transaxle case assembly internal bore concern.
- ISS and/or OSS assembly - sensor "O" ring seal not installed or sealing surface damaged. Sensor to transaxle case assembly internal bore concern.
- Torque converter housing assembly to transaxle case assembly - lack of sealant torque converter housing assembly sealing surface damaged. Transaxle case assembly sealing surface damaged. Mounting bolts not torqued to the correct specification, cross-threaded or missing.
- Transaxle side cover to transaxle case assembly - lack of sealant transaxle side cover sealing surface damaged transaxle case assembly sealing surface damaged. Mounting bolts not torqued to the correct specification, cross-threaded or missing.
- Transaxle rear case cover and 1-2 reverse clutch assembly to transaxle case assembly - lack of sealant. Transaxle rear case cover and 1-2 reverse clutch assembly sealing surface damaged. Transaxle case assembly sealing surface damaged. Mounting bolts not torqued to the correct specification, cross-threaded or missing.
- Torque converter housing assembly - porous casting or damaged. Replace housing assembly.
- Transaxle case assembly - porous casting or damaged. Replace housing assembly.
- Rear case cover assembly - porous casting or damaged. Replace housing assembly.

 

- Transaxle wiring connector "O" ring seal - transaxle wiring connector "O" ring seal not installed or sealing surface damaged. Transaxle case assembly wiring connector internal bore either damaged or oversize.
- Oil cooler line seals - oil cooler lines not fully seated into seals. Oil cooler line retainer mounting bolts not torqued to the correct specification, cross-threaded or missing. Internal bore concern, damaged or oversize within the transaxle case assembly oil cooler line seal bore.

**Harsh Neutral To Drive Engagement**

The following are possible causes and corrections for this condition:

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt and shows no sign of coolant cross-contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and re-test. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Calibration - using a scan tool, verify the current calibration level downloaded into the TCM is correct for this platform. Check to verify that both engine and transaxle calibrations are the most current up-to-date level.
- ISS - inspect ISS for loose electrical connection and/or signs of physical damage that could cause erratic output. Magnetic end of sensor should be free of any metal shavings/particles (heavy friction material build-up). If metal or heavy friction material is found, diagnose the cause and repair as necessary.
- External valve body assembly (shift solenoid "1", shift solenoid "2", line PC solenoid - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Transmission fluid temperature sensor - using a scan tool, verify that the fluid temperature is correct. If temperature is not correct, diagnose and correct as necessary.
- Internal valve body assembly (M1 shift valve, M2 shift valve, neutral relay valve, solenoid modulator valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.

**Harsh Neutral To Reverse Engagement**

The following are possible causes and corrections for this condition:

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt and shows no sign of coolant cross-contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and re-test. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Calibration - using a scan tool, verify that the current calibration level downloaded into the TCM is correct for this platform. Check any service information to verify that both engine and transaxle calibrations are the most current up-to-date level.

 

- ISS - inspect ISS for loose electrical connection and/or signs of physical damage that could cause erratic output. Magnetic end of sensor should be free of any metal shavings/particles (heavy friction material build-up). If metal or heavy friction material is found, diagnose the cause and repair as necessary.
- Fluid temperature sensor - using a scan tool, verify the fluid temperature is correct. If temperature is not correct, diagnose and correct as necessary.
- External valve body assembly (shift solenoid "5", shift PC solenoid) - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly and inspect the solenoids "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there is no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (shift pressure relay valve, solenoid modulator valve, shift PC valve, forward clutch control valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.

**Harsh Upshifts**

The following are possible causes and corrections for this condition:

- Customer driving habits - road test in an attempt to duplicate the concern. If unable to duplicate concern, scan system to verify there is no other concern present, perform a bulletin search, and verify calibration level.
- Fluid level low or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure that the fluid does not smell burnt, and shows no sign of coolant cross-contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and retest. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Calibration - using a scan tool, verify that the current calibration level downloaded into the TCM is correct for this platform. Check any service information to verify that both engine and transaxle calibrations are the most current up-to-date level.
- ISS - inspect ISS for loose electrical connection and/or signs of physical damage that could cause erratic output. Magnetic end of sensor should be free of any metal shavings/particles (heavy friction material build-up). If metal or heavy friction material is found, diagnose the cause and repair as necessary.
- TFT sensor - using a scan tool, verify the fluid temperature is correct. If temperature is not correct, diagnose and correct as necessary.
- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "4", shift solenoid "5", line PC solenoid, shift PC solenoid, TCC lock-up PC solenoid - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (Ml shift valve, M2 shift valve, neutral relay valve, U2 shift valve, solenoid relay valve, 4-5 clutch release valve, shift pressure relay valve, solenoid modulator valve, shift PC valve, 2nd coast clutch control valve, 2nd clutch control valve, 3rd gear control valve, rear underdrive clutch

 

control valve) - remove valve body assembly and inspect listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.

**Harsh Shift On Coastdown**

The following are possible causes and corrections for this condition:

- Fluid level low and/or contaminated or unit filled with the wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt and shows no sign of coolant cross-contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and re-test. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Calibration - using a scan tool, verify that the current calibration level downloaded into the TCM is correct for this platform. Check any service information to verify that both engine and transaxle calibrations are the most current up-to-date level.
- ISS - inspect ISS for loose electrical connection and/or signs of physical damage that could cause erratic output. Magnetic end of sensor should be free of any metal shavings/particles (heavy friction material build-up). If metal or heavy friction material is found, diagnose the cause and repair as necessary.
- TFT sensor - using a scan tool, verify the fluid temperature is correct. If temperature is not correct, diagnose and correct as necessary.
- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "4", shift solenoid "5", line PC solenoid, shift PC solenoid, TCC lock-up PC solenoid) - verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly, and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.
- Internal valve body assembly (solenoid relay valve, M1 shift valve, M2 shift valve, neutral relay valve, U2 shift valve, solenoid modulator valve, 4-5 clutch release valve, shift pressure relay valve, solenoid modulator valve, shift PC valve, 2nd coast clutch control valve, 2nd clutch control valve, 3rd gear control valve) - remove valve body assembly and inspect all listed valves and/or bores for wear, scoring, foreign objects and/or contamination. Replace control valve body assembly if necessary.

**Harsh Forced Downshift**

The following are possible causes and corrections for this condition:

- Customer driving habits road test in an attempt to duplicate the concern. If unable to duplicate concern, scan system to verify there is no other concern present, perform a bulletin search, and verify calibration level.
- Fluid level low and/or contaminated or unit filled with wrong type of fluid - inspect fluid level and color. Perform a fluid level inspection and make sure the fluid does not smell burnt and shows no sign of coolant cross-contamination. If unable to determine if the transaxle has the correct type of fluid, drain the unit and refill with the correct fluid and re-test. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
- Calibration - Using a scan tool, verify that the current calibration level downloaded into the TCM is

 

correct for this platform. Check any service information to verify that both engine and transaxle calibrations are the most current up-to-date level.

- ISS - Inspect ISS for loose electrical connection and/or signs of physical damage that could cause erratic output. Magnetic end of sensor should be free of any metal shavings/particles (heavy friction material build-up). If metal or heavy friction material is found, diagnose the cause and repair as necessary.
- TFT sensor - Using a scan tool, verify the fluid temperature is correct. If temperature is not correct, diagnose and correct as necessary.
- External valve body assembly (shift solenoid "2", shift solenoid "3", shift solenoid "4", shift solenoid "5", line PC solenoid, shift PC solenoid, TCC lock-up PC solenoid) - Verify that all solenoids respond electrically. If there is no response, perform electrical diagnosis. If there are no electrical concerns, remove the solenoid assembly and inspect the solenoids, "O" ring seals and bores for signs of damage and/or missing seals. If solenoids responded electrically and there are no bore or seal concerns, replace assembly due to a possible internal mechanical concern, and retest. If a concern is still present after replacing the solenoid assembly, replace the control valve body assembly.

## SHIFT SOLENOID SYMPTOM DIAGNOSIS

#### Shift Solenoid "1" Stuck Open

The following symptoms occur if shift solenoid "1" is stuck open:

- 2.89:1 ratio in 1st gear.
- 2.22:1 ratio in 1st manual low.
- 0.98:1 ratio in 4th gear.
- DTCs P0730 and/or P0731 may set.

#### Shift Solenoid "1" Stuck Closed

The following symptoms occur if shift solenoid "1" is stuck closed:

- Slips in 2nd, 3rd, 4th and 5th gears.
- DTCs P0732, P0733, P0734 and/or P0735 may set.

#### Shift Solenoid "2" Stuck Open

The following symptoms occur if shift solenoid "2" is stuck open:

- 2.22:1 ratio in 2nd gear.
- 1.45:1 ratio in 3rd gear.
- 0.98:1 ratio in 4th gear.
- DTCs P0732, P0733, and/or P0734 may set.

#### Shift Solenoid "2" Stuck Closed

The following symptoms occur if shift solenoid "2" is stuck closed:

 

- Transaxle input speed is the same as engine RPM when idling in Drive.
- 2.89:1 ratio in 1st gear.
- Harsh 1-2 upshift.
- 1.28:1 ratio in 5th gear.
- DTCs P0722, P0730, P0731 P0735 and/or P1719 may set.

**Shift Solenoid "3" Stuck Open**

The following symptoms occur if shift solenoid "3" is stuck open:

- Harsh 3-4 upshift.
- 1.89:1 ratio in 4th gear.
- 1.45:1 ratio in 5th gear.
- DTCs P0734, P0735, P0762 and/or P1719 may set.

**Shift Solenoid "3" Stuck Closed**

The following symptoms occur if shift solenoid "3" is stuck closed:

- Engine stalls in 1st gear manual low.
- 0.98:1 ratio in 1st gear.
- 1.28:1 ratio in 2nd and 3rd gears.
- DTCs P0731, P0732 and/or P0733 may set.

**Shift Solenoid "4" Stuck Open**

The following symptoms occur if shift solenoid "4" is stuck open:

- 2.89:1 ratio in 3rd gear.
- TCC slips in 3rd, 4th and 5th gears.
- DTCs P0733 and/or P0741 may set.

**Shift Solenoid "4" Stuck Closed**

The following symptoms occur if shift solenoid "4" is stuck closed:

- Shudders in 1st manual low.
- 1.45:1 ratio in 1st gear.
- Slips in Reverse.
- TCC stalls engine in 2nd gear.
- DTCs P0730, P0731 and/or P0736 may set.

**Shift Solenoid "5" Stuck Open**

 

The following symptoms occur if shift solenoid "5" is stuck open:

- Harsh 1-2 upshift.
- DTC P1719 may set.

**Shift Solenoid "5" Stuck Closed**

The following symptoms occur if shift solenoid "5" is stuck closed:

- Harsh 2-3 and 3-4 upshifts.
- DTC P1719 may set.

## CLUTCH & BAND APPLICATIONS

**NOTE: For clutch and band applications, refer to illustration. See Fig. 3 .**

| RANGE | GEAR | SHIFT SOLENOID | | | | | CLUTCH | | | BAND | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | C1 | C2 | C3 | B1 | B2 | B3 | B4 | B5 |
| PARK | | X | | X | | | | | | | | | | X |
| REVERSE | <= 7km/h | | X | X | | X | | X | | | | X | | X |
| | > 7km/h | X | X | | | | | | | | | | | X |
| NEUTRAL | | X | | X | | | | | | | | | | X |
| DRIVE | 1st | X | | X | | | X | | | | | | | X |
| | 1st⟷2nd | | X | X | | | X | | | / | / | | | X |
| | 2nd | | X | X | | | X | | | X | X | | | X |
| | 2nd⟷3rd | | X | X | X | X | X | | | X | X | | / | / |
| | 3rd | | X | X | X | | X | | | X | X | | X | |
| | 3rd⟷4th | | X | | X | X | X | | / | X | X | | / | |
| | 4th | | X | | X | | X | | X | X | X | | | |
| | 4th⟷5th | | | | X | | X | / | X | / | X | | | |
| | 5th | | | | X | | X | X | X | | X | | | |
| INT. | 1st | X | | X | | | X | | | | | | | X |
| | 1st⟷2nd | | X | X | | | X | | | / | / | | | X |
| | 2nd | | X | X | | | X | | | X | X | | | X |
| | 2nd⟷3rd | | X | X | X | X | X | | | X | X | | / | / |
| | 3rd | | X | X | X | | X | | | X | X | | X | |
| LOW | 1st | X | | X | | X | X | | | | | X | | X |
| | 1st⟷2nd | | X | X | | | X | | | / | / | / | | X |
| | 2nd | | X | X | | | X | | | X | X | | | X |

X = Solenoid ON, or clutch or band APPLIED.

/ = Clutch or band in transition between APPLIED and RELEASED.

| | | |
|---|---|---|
| C1 | = | Forward Clutch |
| C2 | = | Direct Clutch |
| C3 | = | 4–5 Clutch |
| | | |
| B1 | = | Second Coast Clutch |
| B2 | = | Second Clutch |
| B3 | = | Low & Reverse Clutch |
| B4 | = | 3rd Gear Band |
| B5 | = | 1–2, Reverse Clutch |

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**Fig. 3: Clutch & Band Applications**
**Courtesy of GENERAL MOTORS CORP.**

# PERFORMANCE TESTS

## ROAD TEST

 

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

**Introduction**

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

- Electrical Function Check
- Garage Shifts
- Upshift Control And TCC Apply
- Part Throttle Detent Downshifts
- Full Throttle Detent Downshifts
- Manual Downshifts
- Manual Gear Range Selection

Before the road test, ensure the following:

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

During the road test:

- Perform the test only when traffic conditions permit.
- Operate the vehicle in a controlled, safe manner.
- Observe all traffic safety regulations.
- View the scan tool data while conducting this test.
- Take along qualified help to operate the vehicle safely.
- Observe any unusual sounds or smells.
- If Transaxle Protection Mode turns on at any time during testing, locate a safe place to stop the vehicle. Cycle the ignition switch off for 10 seconds and then on again before continuing the road test.

After the road test, check the following:

- Transmission fluid level.
- Diagnostic Trouble Codes (DTC) that may have set during the testing.
- Refer to the applicable DTC. See **DIAGNOSTIC TROUBLE CODE DEFINITIONS** under SELF-DIAGNOSTIC SYSTEM.

**Electrical Function Check**

Perform this check first, to ensure the electronic transaxle components are connected and functioning properly.

If these components are not checked, a simple electrical condition could be misdiagnosed.

1. Place transaxle in Park and set the parking brake.
2. Start the engine.
3. Verify the following scan tool data is functioning properly:
    - Transaxle Protection Mode
    - Last Shift Status
    - Accelerator Pedal Position (APP) Angle
    - Engine Torque
    - Engine Speed
    - ISS
    - OSS
    - Vehicle Speed
    - Gear Ratio
    - TR Switch
    - TR Switch A/B/C/P
    - Solenoid Circuit Status
    - Transmission Fluid Temperature
    - Ignition Voltage
    - Transmission Oil Life
    - Brake Switch
    - Engine Coolant Temperature
4. Monitor the brake switch signal while depressing and releasing the brake pedal. The scan tool should display APPLIED when the brake pedal is depressed and RELEASED when the brake pedal is released.
5. Monitor APP angle while increasing and decreasing engine speed with the accelerator pedal. The scan tool throttle angle should increase and decrease with the accelerator pedal position.

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

**Garage Shifts**

Apply the brake pedal and set the parking brake. Observe TR switch with a scan tool. Slowly move the gearshift lever through the following ranges:

- Park to Reverse
- Reverse to Neutral
- Neutral to Drive

Verify TR switch value matches the gear range selected, and the gear engagements are immediate and not too harsh. If TR switch does not match the gear range selected, inspect the shift linkage and Park/Neutral switch adjustment. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. If the gear engagements

are delayed or too harsh, see **SYMPTOM DIAGNOSIS** .

**Upshift Control & TCC Apply**

The TCM calculates the upshift points based primarily on APP angle and vehicle speed. When the TCM determines that conditions are met for a shift to occur, the TCM commands the shift by closing or opening the voltage circuit for the appropriate solenoids. Perform the following steps:

1. Choose an APP angle of 12, 25, or 50 percent. All APP angles shown should be tested to cover the normal driving range. See **SHIFT SPEED SPECIFICATIONS** .
2. Monitor the following scan tool parameters:
   - APP Angle
   - Vehicle Speed
   - Engine Speed
   - ISS
   - OSS
   - Commanded Gear
   - Gear Ratio
   - Shift Solenoids 1-5
   - TCC Slip Speed
3. Place the gearshift lever in Drive.
4. Accelerate the vehicle using the chosen APP angle. Hold the throttle steady.
5. As the transaxle upshifts, note the vehicle speed when the shift occurs for each gear change. There should be a noticeable shift feel or engine speed change within one second of the commanded gear change.
6. Compare the shift speed to the shift speed specifications. See **SHIFT SPEED SPECIFICATIONS** . Shift speeds may vary slightly due to transmission fluid temperature.
7. Repeat steps 1 -6 to complete all 3 APP angles.
8. Check for TCC apply in 3rd, 4th, and 5th gears.

**Part Throttle Detent Downshift**

1. Place the gearshift lever in Drive.
2. Accelerate the vehicle to 45 MPH in 5th gear.
3. Quickly increase the APP angle to about 50 percent.
4. Verify that the TCC releases, and the transaxle downshifts to 4th gear.

**Full Throttle Detent Downshift**

1. Place the gearshift lever in Drive.
2. Accelerate the vehicle to 45 MPH in 5th gear.
3. Quickly increase the APP angle to about 100 percent.
4. Verify that the TCC releases, and the transaxle downshifts to 3rd gear.

 

**Manual 5-3 Downshift**

**NOTE: Shifts between all forward gears are controlled by the shift solenoids, not the manual valve. Manual downshifts are accomplished by the TCM, based on the TR switch input.**

1. Place the gearshift lever in Drive.
2. Accelerate the vehicle to 45 MPH in 5th gear.
3. Release the accelerator pedal while moving gearshift lever to Intermediate.
4. Verify the TCC releases, the transaxle downshifts immediately to 3rd gear and the engine slows the vehicle.

**Manual 5-2 Downshift**

1. Place the gearshift lever in Drive.
2. Accelerate the vehicle to 45 MPH in 5th gear.
3. Release accelerator pedal while moving gearshift lever to Low.
4. Verify the TCC releases, the transaxle downshifts immediately to 2nd gear and the engine slows the vehicle.

**Manual Gear Range Selection**

Perform the following tests using 10-15 percent APP angle.

**Reverse**

1. With the vehicle stopped, move the gearshift lever to Reverse.
2. Slowly accelerate the vehicle.
3. Verify that there is no noticeable slip, noise, or vibration.

**Manual Low**

1. With the vehicle stopped, move the gearshift lever to Low.
2. Accelerate the vehicle to 20 MPH.
3. Verify the 1-2 shift occurs, the 2-3 shift does not occur and there is no noticeable slip, noise, or vibration.

**Manual Intermediate**

1. With the vehicle stopped, move gearshift lever to Intermediate.
2. Accelerate vehicle to 35 MPH.
3. Verify the 1-2 shift occurs, the 2-3 shift occurs, the 3-4 shift does not occur and there is no noticeable slip, noise, or vibration.

**Manual Drive**

 

1. With the vehicle stopped, move the gearshift lever to Drive.
2. Accelerate the vehicle to 55 MPH.
3. Verify all upshifts occur, the TCC applies and there is no noticeable slip, noise, or vibration.

**SHIFT SPEED SPECIFICATIONS**

**SHIFT SPEED SPECIFICATIONS**

| Operating Condition | Shift Speed MPH |
|---|---|
| Accelerator Pedal Position Angle = 12% | |
| 1-2 | 12 |
| 2-3 | 19 |
| 3-4 | 28 |
| 4-5 | 47 |
| 5-4 | 43 |
| 4-3 | 21 |
| 3-2 | 14 |
| 2-1 | 6 |
| Accelerator Pedal Position Angle = 25% | |
| 1-2 | 19 |
| 2-3 | 31 |
| 3-4 | 47 |
| 4-5 | 70 |
| 5-4 | 47 |
| 4-3 | 21 |
| 3-2 | 15 |
| 2-1 | 6 |
| Accelerator Pedal Position Angle = 50% | |
| 1-2 | 30 |
| 2-3 | 52 |
| 3-4 | 84 |
| 4-5 | ..... |
| 5-4 | 47 |
| 4-3 | 29 |
| 3-2 | 19 |
| 2-1 | 7 |

**HYDRAULIC PRESSURE TESTS**

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

**NOTE: The transaxle must be in Park or Neutral, with the vehicle stopped, for the scan tool to be able to command the line pressure lower than normal. This protects transaxle clutches from extremely low pressure in Drive or Reverse. Before performing a line pressure check, verify the line PC solenoid is receiving the correct electrical signal from the TCM.**

**Line Pressure**

1. Turn front wheels to the left.
2. Raise vehicle.
3. Remove left front splash shield.
4. Remove the "B5" fluid pressure test hole plug and install pressure gauge to the "B5" port. See **Fig. 4** .
5. Connect a scan tool.
6. Place transaxle in Park and apply parking brake.
7. Start engine and allow to idle.
8. Select FUNCTIONAL LINE PC SOLENOID TEST from scan tool OUTPUT CONTROLS menu.
9. Increase and decrease line pressure solenoid reference current. Record the corresponding line pressure shown on pressure gauge.
10. Exit the FUNCTIONAL LINE PC SOLENOID TEST on scan tool.
11. Firmly depress brake pedal, and place transaxle in Drive. Allow engine to idle.
12. Record the line pressure shown on the pressure gauge.

**CAUTION: Do not run the 2450 RPM stall test longer than 5 seconds continuously. Allow 2 minutes between stall tests for the oil to cool. Otherwise, transaxle damage may result.**

13. Increase engine speed to 2450 RPM.
14. Record line pressure shown on pressure gauge.
15. Allow engine to idle, and place transaxle in Reverse.
16. Record line pressure shown on pressure gauge.
17. Increase engine speed to 2450 RPM.
18. Record line pressure shown on pressure gauge.
19. Compare data to the appropriate line pressure table.

**LINE PRESSURE SPECIFICATIONS (PARK)**

| Line PC Solenoid Current (Amp) | Line Pressure - psi (kPa) |
|---|---|
| .43 | 166-180 (1144-1241) |
| .49 | 154-165 1062-1138) |
| .55 | 144-153 (993-1055) |
| .60 | 133-143 (917-986) |
| .64 | 121-132 (834-910) |
| | |

| | |
|---|---|
| .68 | 110-120 (758-827) |
| .72 | 99-109 (683-752) |
| .78 | 87-98 (600-676) |
| .84 | 76-86 (524-593) |
| .90 | 65-75 (448-517) |
| .98 | 55-64 (379-441) |

**LINE PRESSURE SPECIFICATIONS (DRIVE)**

| Engine Speed (RPM) | Line Pressure - psi (kPa) |
|---|---|
| 685 | 48-57 (331-393) |
| 2450 | 186-206 (1282-1420) |

**LINE PRESSURE SPECIFICATIONS (REVERSE)**

| Engine Speed (RPM) | Line Pressure - psi (kPa) |
|---|---|
| 685 | 73-89 (503-614) |
| 2450 | 248-287 (1710-1979) |

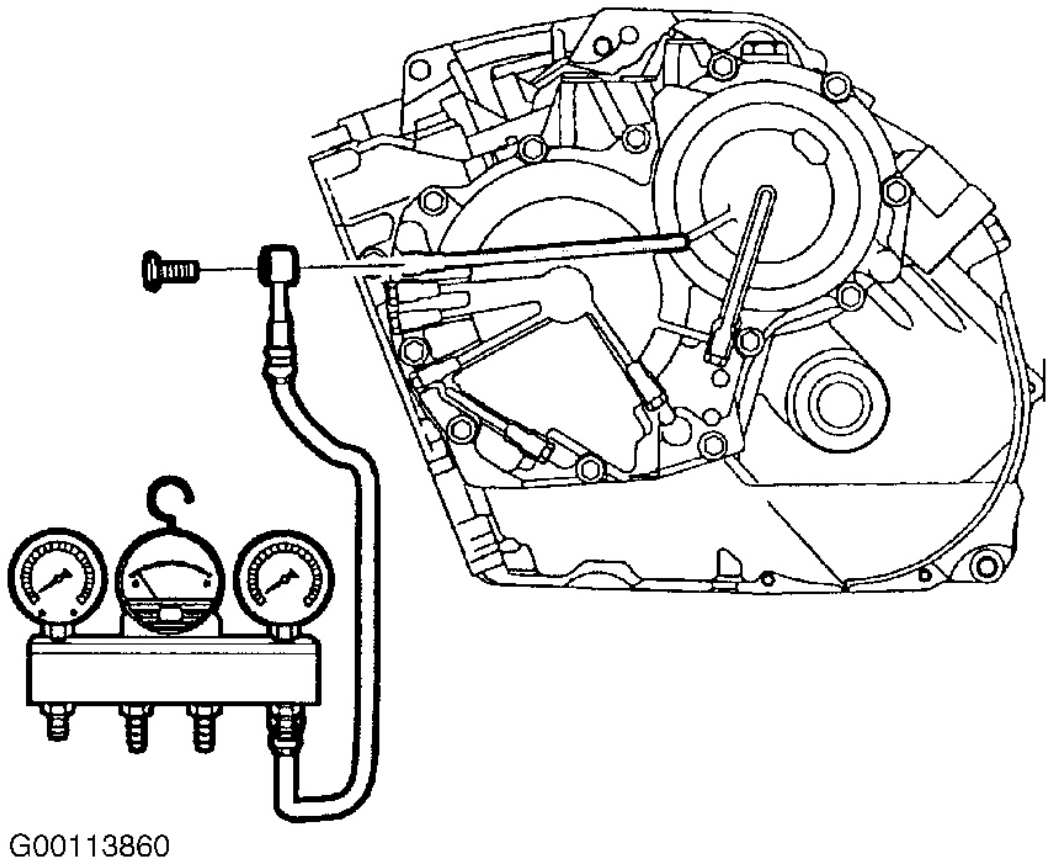


**Fig. 4: Installing Oil Pressure Gauge**
**Courtesy of GENERAL MOTORS CORP.**

### CLUTCH & SERVO AIR CHECKS

**NOTE: For additional information, refer to overhaul procedures. See appropriate OVERHAUL article.**

## SELF-DIAGNOSTIC SYSTEM

### DIAGNOSTIC SYSTEM CHECK

After performing a visual and physical underhood inspection, the diagnostic system check is the starting point for all diagnostic procedures or finding the cause of an emissions test failure.

The correct procedure to diagnose a problem is to follow three basic steps:

**NOTE: Scan serial data transmitted by the TCM. This involves reading the**

 

**information available on the serial data stream with one of the scan tools available for that purpose.**

1. Are the on-vehicle diagnostics working? If not, see appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT. This is determined by performing the diagnostic system check. Since this is the starting point for the diagnostic procedures or finding the cause of an emissions test failure, always begin here. Go to next step.
2. Is there a DTC stored? If a DTC is stored, see **DIAGNOSTIC TROUBLE CODE DEFINITIONS** . This will determine if the fault is still present. If no DTC is stored, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.

## DIAGNOSTIC TROUBLE CODE DEFINITIONS

**NOTE: Only transaxle related DTCs are listed. See DIAGNOSTIC TROUBLE CODE DEFINITIONS table. For engine-related DTC definitions and diagnosis, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE. These DTCs pertain to engine performance and must be repaired first, as engine performance and related component signals will affect transaxle operation and diagnosis.**

There are 4 types of DTC categories:

- **Type "A"** - Emissions related. Illuminates MIL the first time DTC sets.
- **Type "B"** - Emissions related. Illuminates MIL if fault is active for 2 consecutive driving cycles.
- **Type "C"** - Non-emissions related. Does not illuminate MIL, but may illuminate SERVICE light.
- **Type "D"** - Non-emissions related. Does not illuminate MIL or SERVICE light.

## DIAGNOSTIC TROUBLE CODE DEFINITIONS

| DTC | Circuit & Fault Definitions |
|---|---|
| **P0562** | System Voltage Low |
| **P0563** | System Voltage High |
| **P0601** | TCM Read Only Memory |
| **P0602** | TCM Not Programmed |
| **P0603** | TCM Long Term Memory |
| **P0604** | TCM Random Access Memory |
| **P0703** | Brake Switch Circuit |
| **P0705** | TR Switch Circuit |
| **P0711** | TFT Sensor Performance |
| **P0712** | TFT Sensor Low Voltage |
| **P0713** | TFT Sensor High Voltage |
| **P0717** | ISS Low Voltage |
| **P0722** | OSS Low Voltage |
| **P0727** | Engine Speed No Signal |
| | |

| | |
|---|---|
| **P0730** | Incorrect 1st Low Gear Ratio |
| **P0731** | Incorrect 1st Gear Ratio |
| **P0732** | Incorrect 2nd Gear Ratio |
| **P0733** | Incorrect 3rd Gear Ratio |
| **P0734** | Incorrect 4th Gear Ratio |
| **P0735** | Incorrect 5th Gear Ratio |
| **P0736** | Incorrect Reverse Ratio |
| **P0741** | TCC System - Stuck Off |
| **P0744** | TCC System Intermittent |
| **P0762** | Shift Solenoid "3" Stuck Open |
| **P0962** | Line PC Solenoid Low Current |
| **P0963** | Line PC Solenoid High Current |
| **P0966** | TCC Lock-Up PC Solenoid Low Current |
| **P0967** | TCC Lock-Up PC Solenoid High Current |
| **P0970** | Shift PC Solenoid Low Current |
| **P0971** | Shift PC Solenoid High Current |
| **P0973** | Shift Solenoid "1" Control Circuit Low Voltage |
| **P0974** | Shift Solenoid "1" Control Circuit High Voltage |
| **P0976** | Shift Solenoid "2" Control Circuit Low Voltage |
| **P0977** | Shift Solenoid "2" Control Circuit High Voltage |
| **P0979** | Shift Solenoid "3" Control Circuit Low Voltage |
| **P0980** | Shift Solenoid "3" Control Circuit High Voltage |
| **P0982** | Shift Solenoid "4" Control Circuit Low Voltage |
| **P0983** | Shift Solenoid "4" Control Circuit High Voltage |
| **P0985** | Shift Solenoid "5" Control Circuit Low Voltage |
| **P0986** | Shift Solenoid "5" Control Circuit High Voltage |
| **P1719** | Incorrect Shifting Detected |
| **P1779** | Torque Delivered Signal |
| **P1780** | Torque Reduction Signal |
| **P1781** | Engine Torque Circuit |
| **P1791** | Pedal Position Circuit |
| **P1792** | Engine Coolant Signal |
| **P1868** | Transmission Fluid Life |

**CLEARING DIAGNOSTIC TROUBLE CODES**

Using scan tool, clear DTCs following scan tool manufacturer's instructions. Do not clear DTCs unless instructed to do so.

**SUMMARY**

If no hard DTCs are present, and driveability symptoms or intermittent DTCs exist, attempt diagnosis by

 

symptom, or by testing individual components related to system fault. See **TROUBLE SHOOTING** . If no problem is found, verify proper electronic control system circuit operation.

**NOTE: Always clear DTCs once repairs are complete. See CLEARING DIAGNOSTIC TROUBLE CODES . Road test vehicle and retrieve DTCs to determine if complaint or DTC is repaired.**

# DIAGNOSTIC TESTS

## INTRODUCTION

### Diagnostic Procedures

The following diagnostic procedures are DTC specific. Perform **DIAGNOSTIC SYSTEM CHECK** under SELF-DIAGNOSTIC SYSTEM prior to performing any diagnostic procedure. For engine related DTCs, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

### Repair Verification

After making a repair to the transaxle it is important the repair is verified before returning the vehicle to the customer. The vehicle must be driven so that each upshift and downshift is accomplished at least twice, and then the PCM must be checked for DTCs. Not all faults will illuminate an indicator lamp and the memory must be checked using a scan tool.

### Diagnostic Aids

Diagnostic aids, located at end of each diagnostic test, are additional tips used to help diagnose DTCs when diagnostic procedures do not find a problem.

## DTC P0562: SYSTEM VOLTAGE LOW

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

### Circuit Description

Ignition voltage supplies power to operate the TCM and transaxle solenoids. The TCM monitors ignition voltage on both ignition "1" circuits. DTC P0562 sets when the TCM detects low ignition voltage when the engine is running.

### Conditions For Setting DTC

DTC P0562 will set if the TCM detects ignition voltage less than 8.68 volts when:

- Engine speed is greater than 800 RPM.
- Transaxle Protection Mode is off.

- The condition exists for 20 seconds.
- The TCM will command Transaxle Protection Mode on if this DTC is active.
- This DTC will pass if ignition voltage remains 9-18 volts for 20 seconds.
- DTC P0562 is a type "A" DTC.

**Diagnostic Procedure**

1. Start engine and allow to idle. Using scan tool, monitor ignition voltage. Is ignition voltage less than 12 volts? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Using DVOM, measure battery voltage. Is ignition voltage displayed on the scan tool near measured battery voltage? If so, see appropriate GENERATORS & REGULATORS article in STARTING & CHARGING SYSTEMS. If not, go to next step.
3. Inspect the following and repair as necessary:
    - Ignition "1" circuits (639) between PWRTRN fuse (10-amp) and TCM harness connector J1 terminals No. 22 and 31 for open or high resistance.
    - Ground circuits (451) between TCM harness connector J1 terminals No. 23 and 32 and ground.
    - Poor terminal connections.
    - Faulty TCM.

**Diagnostic Aids**

Test the charging system. A weak generator or battery may cause DTC P0562 to set. If the TCM has low voltage, the Daytime Running Lamp (DRL) indicator lamp may flicker. To locate an intermittent problem, use a scan tool to monitor ignition voltage with ignition on, engine off. Wiggling wires while watching for a change on ignition voltage may locate the area where an open or high resistance in the wiring could lie. Clear DTCs in the TCM after repair is made to the charging system or wiring.

## DTC P0563: SYSTEM VOLTAGE HIGH

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Ignition voltage supplies power to operate the TCM and transaxle solenoids. The TCM monitors ignition voltage. DTC P0563 sets when the TCM detects high ignition voltage when the engine is running.

**Conditions For Setting DTC**

DTC P0563 will set if the TCM detects ignition voltage greater than 18 volts when:

- Engine speed is greater than 800 RPM.
- Transaxle Protection Mode is off.
- The condition exists for 20 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. This DTC will pass if ignition voltage remains 9-18 volts for 20 seconds. DTC P0563 is a type "A" DTC.

**Diagnostic Procedure**

Start engine and run above 1500 RPM. Using scan tool, monitor ignition voltage. Is ignition voltage greater than 18 volts? If so, test charging system. See appropriate GENERATORS & REGULATORS article in STARTING & CHARGING SYSTEMS. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .

**Diagnostic Aids**

DTC P0563 may set if the vehicle is jump started. Test the charging system. See appropriate GENERATORS & REGULATORS article in STARTING & CHARGING SYSTEMS. Clear DTCs in the TCM after repair is made to the charging system.

## DTC P0601: TCM READ ONLY MEMORY

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Conditions For Setting DTC**

This DTC will set when the TCM determines that TCM ROM checksum failure has occurred. DTC P0601 is a type "A" DTC.

**Diagnostic Procedure**

Record all TCM DTCs and include with repair information. Replace and reprogram the TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

New service TCMs contain DTC P0602. When TCM is reprogrammed with the correct software and calibrations, DTC P0602 will be erased.

## DTC P0602: TCM NOT PROGRAMMED

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Conditions For Setting DTC**

This DTC will set if the TCM is not programmed, or if the Vehicle Identification Number (VIN) is not stored in the TCM after 255 ignition cycles. DTC P0602 is a type "C" DTC.

**Diagnostic Procedure**

Record all TCM DTCs and include with repair information. Reprogram the TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

New service TCMs contain DTC P0602. When TCM is reprogrammed with the correct software and calibrations, DTC P0602 will be erased.

## DTC P0603: TCM LONG TERM MEMORY

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Conditions For Setting DTC**

This DTC will set when the TCM determines that a non-volatile memory checksum failure has occurred. DTC P0603 is a type "C" DTC.

**Diagnostic Procedure**

Record all TCM DTCs and include with repair information. Replace and reprogram the TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

New service TCMs contain DTC P0602. When TCM is reprogrammed with the correct software and calibrations, DTC P0602 will be erased.

## DTC P0604: TCM RANDOM ACCESS MEMORY

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Conditions For Setting DTC**

This DTC will set when the TCM determines that its random access memory in inoperable. DTC P0604 is a type "A" DTC.

**Diagnostic Procedure**

Record all TCM DTCs and include with repair information. Replace and reprogram the TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

New service TCMs contain DTC P0602. When TCM is reprogrammed with the correct software and calibrations, DTC P0602 will be erased.

## DTC P0703: BRAKE SWITCH CIRCUIT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The ECM monitors the cruise brake switch. The ECM sends brake pedal information to the TCM via the Controller Area Network (CAN) bus. The ECM also determines if the brake pedal information is reliable or not, and sends that information to the TCM.

**Conditions For Setting DTC**

DTC P0703 sets when the TCM receives a message from the ECM that the brake pedal message is unreliable and:

- The ignition has been on for at least 3 seconds.
- The TCM and ECM are communicating.
- Transaxle Protection Mode is off.
- The condition exists for 4 seconds.

DTC P0703 diagnostic runs continuously when the above conditions have been met. DTC P0703 is a type "C" DTC.

**Diagnostic Aids**

This DTC does not indicate a problem with the transaxle or with the TCM. It does indicate that the ECM is not sending the required information to the TCM. Check for and diagnose any DTCs stored in the ECM and the Electronic Brake Traction Control Module (EBTCM) related to the brake switch circuits. Clear DTCs in the TCM after repair is made.

## DTC P0705: TR SWITCH CIRCUIT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TR switch is a part of the Park/Neutral position switch assembly. The TR switch determines which gear position has been manually selected. The TCM determines this gear selection by detecting a combination of opens and voltages at the four switch inputs of the TR switch. When the switch is open the TCM input is low. When a switch is closed, the TCM input is high. The specific combinations of lows and highs for the four inputs at the TCM denote which gear position has been selected. Only one combination is possible for each manual gear selected. See**TRANSAXLE RANGE SWITCH LOGIC** table. DTC P0705 sets when the TCM input combination is not valid.

**TRANSAXLE RANGE SWITCH LOGIC (1)**

| Gearshift Lever Position | Signal "A" | Signal "B" | Signal "C" | Signal "P" |
|---|---|---|---|---|
| Park | HI | LOW | LOW | HI |
| Reverse | HI | HI | LOW | LOW |
| Neutral | LOW | HI | LOW | HI |
| Drive | LOW | HI | HI | LOW |
| Intermediate | HI | HI | HI | HI |
| Low | HI | LOW | HI | LOW |
| (1) HI = ignition voltage; LOW = zero volts. | | | | |

**Conditions For Setting DTC**

DTC P0705 will set if the TCM has detected an invalid input combination when:

- The engine is running.
- Ignition voltage is 9-16 volts.
- Condition exists for longer than 5 seconds.

DTC P0705 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on, and allow only 5th gear and Reverse, if this DTC is active. DTC P0705 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, monitor the TR switch. Move gearshift lever through all positions while checking each position. Is the scan tool reading correct for each gearshift lever position? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Is the scan tool TR switch reading always blank? If so, go to step 11 . If not, go to next step.
3. Place the gearshift lever in Park. Does the scan tool display PARK? If so, go to next step. If not, go to step 14 .
4. Place gearshift lever in Reverse. Does the scan tool display REVERSE? If so, go to next step. If not, go to step 21 .
5. Place gearshift lever in Neutral. Does the scan tool display NEUTRAL? If so, go to next step. If not, go to step 9 .
6. Disconnect the PNP switch. Connect 3-amp fused jumper wire, between PNP switch harness connector terminals No. 5 and 9. Using scan tool, monitor TR switch A/B/C/P position "C". Does position "C" indicate HI? If so, go to next step. If not, go to step 8 .
7. Inspect for loose terminal connections. If okay, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
8. Inspect TR switch signal "C" circuit (773) for an open or loose terminal connection. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

9. Disconnect the PNP switch. Using scan tool, monitor TR switch A/B/C/P position "A". Does position "A" indicate HI? If so, go to next step. If not, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
10. Inspect TR switch signal "A" circuit (771) for a short to voltage. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
11. Disconnect the PNP switch. Measure voltage between PNP switch harness connector terminal No. 9 and ground. Does battery voltage exist? If so, go to next step. If not, go to step 13 .
12. Inspect for loose terminal connections. If okay, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
13. Inspect ignition "1" circuit (639) for an open or loose terminal connection between PWRTRN fuse (10-amp) and PNP switch harness connector terminal No. 9. Repair as necessary. If circuit is okay, replace underhood fuse block.
14. Place gearshift lever in Reverse. Does the scan tool display REVERSE? If so, go to next step. If not, go to step 27 .
15. Place gearshift lever in Neutral. Does the scan tool display NEUTRAL? If so, go to next step If not, go to step 18 .
16. Disconnect the PNP switch. Using scan tool, monitor TR switch A/B/C/P position "B". Is position "B" indicate HI? If so, go to next step. If not, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
17. Inspect TR switch signal "B" circuit (772) for a short to voltage. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
18. Disconnect the PNP switch. Connect 3-amp fused jumper wire, between PNP switch harness connector terminals No. 8 and 9. Using scan tool, monitor TR switch A/B/C/P position "P". Does position "P" indicate HI? If so, go to next step. If not, go to step 20 .
19. Inspect for loose terminal connections. If okay, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
20. Inspect TR switch signal "P" circuit (776) for an open or loose terminal connection. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
21. Place gearshift lever in Neutral. Does the scan tool display NEUTRAL? If so, go to next step If not, go to step 24 .
22. Disconnect the PNP switch. Using scan tool, monitor TR switch A/B/C/P position "P". Does position "P" indicate HI? If so, go to next step. If not, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
23. Inspect TR switch signal "P" circuit (776) for a short to voltage. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
24. Disconnect the PNP switch. Connect 3-amp fused jumper wire, between PNP switch harness connector terminals No. 6 and 9. Using scan tool, monitor TR switch A/B/C/P position "B". Does position "B" indicate HI? If so, go to next step. If not, go to step 26 .
25. Inspect for loose terminal connections. If okay, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
26. Inspect TR switch signal "B" circuit (772) for an open or loose terminal connection. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL &

INSTALLATION.

27. Place gearshift lever in Neutral. Does the scan tool display NEUTRAL? If so, go to next step If not, go to step 31 .
28. Disconnect the PNP switch. Connect 3-amp fused jumper wire, between PNP switch harness connector terminals No. 9 and 10. Using scan tool, monitor TR switch A/B/C/P position "A". Does position "A" indicate HI? If so, go to next step. If not, go to step 30 .
29. Inspect for loose terminal connections. If okay, replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
30. Inspect TR switch signal "A" circuit (771) for an open. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
31. Disconnect PNP switch. Using scan tool, monitor TR switch A/B/C/P position "C". Does scan tool indicate position "C" HI? If so, go to next step. If not, go to step 33 .
32. Replace PNP switch. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
33. Inspect TR switch signal "C" circuit for a short to voltage. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

DTC P0705 can not be set due to a misadjusted shift cable or park/neutral switch assembly.

## DTC P0711: TFT SENSOR PERFORMANCE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TFT sensor is a thermistor that varies resistance according to changes in transmission fluid temperature. The TCM supplies a 5-volt reference through pull up resistor to the sensor, which is connected to ground. When the sensor is cold it has high resistance. As the sensor temperature increases, its resistance decreases. The TCM uses the signal voltage to determine transmission fluid temperature. This diagnostic detects a stuck value, indicating poor sensor circuit performances. DTC P0711 is a rational check of the TFT sensor.

**Conditions For Setting DTC**

DTC P0711 will set if the TFT sensor temperature has not changed more than 9°F (5°C) 15 minutes after start up when the following conditions have been met:

- The engine is running.
- Transmission fluid temperature is not greater than 32°F (0°C).
- The transaxle is not in Park or Neutral.
- Transaxle Protection Mode is off.
- The condition exits for 15 minutes.

DTC P0711 is a type "A" DTC.

**Diagnostic Procedure**

1. Operate the vehicle until the engine coolant temperature is at least 122°F (50°C). Turn ignition on, engine off. Using scan tool, monitor transmission fluid temperature. Is the transmission fluid temperature less than 32°F (0°C)? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect the transaxle harness connector J1. Connect Decade Box (SA9205Z) set to one k/ohms or a one k/ohms resistor between transaxle harness connector J1 terminals No. 1 and 8. Using scan tool, monitor transmission fluid temperature. Is the transmission fluid temperature near 141°F (61°C)? If so, go to next step. If not, go to step 4 .
3. Inspect for loose terminal connections. Inspect internal harness for a high resistance. Repair as necessary. If okay, replace TFT sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect for loose terminal connections. Inspect TFT sensor high (585) and low (586) signal circuits for high resistance. Repair as necessary. If circuits are okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

A short to voltage on TFT sensor high signal circuit (585) may damage the TFT sensor. Check for correct resistance versus temperature after repair has been made. See **TRANSMISSION FLUID TEMPERATURE SENSOR RESISTANCE** table under ELECTRONIC COMPONENT SPECIFICATIONS. To locate an intermittent problem, use a scan tool to monitor transmission fluid temperature with ignition on, engine off. Wiggling wires while watching for a change on transmission fluid temperature may locate the area where a high resistance in the wiring could lie.

## DTC P0712: TFT SENSOR LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TFT sensor is a thermistor that varies according to changes in transmission fluid temperature. The TCM supplies 5-volt reference through a pull up resistor to the sensor, which is connected to ground. When the sensor is cold it has high resistance. As the sensor temperature increases, its resistance decreases. The TCM uses the signal voltage to determine transmission fluid temperature. DTC P0712 sets when the TFT sensor signal voltage at the TCM is below the calibrated voltage value.

**Conditions For Setting DTC**

DTC P0712 will set if transmission fluid temperature is over 302°F (150°C) when:

- The engine is running.
- Transaxle Protection Mode is off.
- Condition exists for longer than 5 minutes.

DTC P0712 diagnostic runs continuously when the above conditions have been met. DTC P0712 is a type "A"

DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, monitor transmission fluid temperature. Is the transmission fluid temperature more than 302°F (150°C)? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect the transaxle harness connector J1. Is the transmission fluid temperature less than -35°F (-37° C)? If so, replace TFT sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. If not, go to next step.
3. Turn ignition off. Disconnect the TCM harness connector J2. Check continuity between TCM harness connector J2 terminal No. 21 and ground, then between terminals No. 21 and 31. Does continuity exist? If so, go to next step. If not, go to step 5 .
4. Inspect TFT high signal circuit (585) for a short to ground or a short to TFT low signal circuit (586). Repair as necessary.
5. Replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor transmission fluid temperature with ignition on, engine off. Wiggling wires while watching for a change on transmission fluid temperature may locate the area where a short to ground in the wiring could lie. See **TRANSMISSION FLUID TEMPERATURE SENSOR RESISTANCE** table under ELECTRONIC COMPONENT SPECIFICATIONS.

## DTC P0713: TFT SENSOR HIGH VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TFT sensor is a thermistor that varies resistance according to changes in transmission fluid temperature. The TCM supplies 5-volt reference through a pull resistor to the sensor, which is connected to ground. When the sensor is cold it has high resistance. As the sensor temperature increases, its resistance decreases. The TCM uses the signal voltage to determine transmission fluid temperature. DTC P0713 sets when the TFT sensor signal voltage at the TCM is above the calibrated voltage value.

**Conditions For Setting DTC**

DTC P0713 will set if TFT temperature is below 32°F (0°C) when:

- No engine coolant temperature DTCs are set.
- Transaxle Protection Mode is off.
- The vehicle has been driven for at least 15 minutes.
- Engine coolant temperature is at least 122°F (50°C).
- Condition exists for greater than 12 seconds.

DTC P0713 diagnostic runs continuously when the above conditions have been met. DTC P0713 is a type "A" DTC.

**Diagnostic Procedure**

1. Operate the vehicle until the engine coolant temperature is at least 122°F (50°C). Turn ignition on, engine off. Using scan tool, monitor transmission fluid temperature. Is the transmission fluid temperature less than 32°F (0°C)? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect the transaxle harness connector J1. Connect Decade Box (SA9205Z) set to one k/ohms or a one k/ohms resistor between transaxle harness connector J1 terminals No. 1 and 8. Using scan tool, monitor transmission fluid temperature. Is the transmission fluid temperature 141°F (61°C)? If so, go to step 4 . If not, go to next step.
3. Inspect for loose terminal connections. Inspect the internal transaxle harness for an open or high resistance. Repair as necessary. If okay, replace TFT sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Disconnect TCM harness connector J2. Check for continuity between TCM harness connector J2 terminals No. 21 and 31. Does continuity exist? If so, go to step 6 . If not, go to next step.
5. Inspect TFT sensor high (585) and low (586) signal circuits for an open. Repair as necessary.
6. Measure voltage between TCM harness connector J2 terminals No. 21 and 31. Does voltage exist. If so, go to next step. If not, go to step 8 .
7. Inspect TFT sensor high (585) and low (586) signal circuits for a short to voltage. Repair as necessary.
8. Inspect for loose terminal connections. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

A short to voltage on TFT high signal circuit (585) may damage the TFT sensor. Check for correct resistance versus temperature after repair has been made. See **TRANSMISSION FLUID TEMPERATURE SENSOR RESISTANCE** under ELECTRONIC COMPONENT SPECIFICATIONS. To locate an intermittent problem, use a scan tool to monitor transmission fluid temperature with ignition on, engine off. Wiggling wires while watching for a change in transmission fluid temperature may locate the area where an open or short to voltage in the wiring could lie.

## DTC P0717: ISS LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The ISS is a 2-wire hall-effect speed sensor. The ISS uses 12 machined notches on the forward clutch drum to produce different squarewave voltage signals. The ISS changes the voltage signal on ISS low signal circuit (1231) to different frequencies depending on velocity of the input shaft. The ISS signal is sent to the TCM, which is used to determine input shaft RPM. DTC P0717 sets when the TCM does not detect an ISS signal for a certain length of time.

**Conditions For Setting DTC**

DTC P0717 will set if no ISS signal is detected when:

- A forward gear is selected.
- Transmission fluid temperature is greater than 68°F (20°C).
- Transaxle Protection Mode is off.
- Ignition voltage is 9-16 volts.
- Engine speed is more than 400 RPM.
- TCM detects at least 6 pulses from the OSS sensor.
- Condition exists for longer than 10 seconds.

DTC P0717 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0717 is a type "A" DTC.

**Diagnostic Procedure**

1. Start engine. Using scan tool, monitor ISS. Is there a ISS signal reading on scan tool? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Turn ignition on, engine off. Disconnect ISS harness connector. Measure voltage between ISS harness connector terminals. Is 9-12 volts present? If so, go to next step. If not, go to step 4 .
3. Inspect for loose terminal connections. If okay, replace ISS. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Turn ignition off. Disconnect TCM harness connector J2. Check continuity of ISS high signal circuit (1230). Does continuity exist? If so, go to next step. If not, repair open in ISS high signal circuit (1230).
5. Check continuity of ISS low signal circuit (1231). Does continuity exist? If so, go to next step. If not, repair open in ISS low signal circuit (1231).
6. Inspect for loose terminal connections. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor ISS with the engine running. Wiggling wires while watching for a change in input speed may locate the area where an open or high resistance may lie. Check the ISS mounting bolt for tightness.

## DTC P0722: OSS LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The OSS is a 2-wire hall-effect speed sensor. The OSS uses the machined notches on the parking gear to produce different squarewave voltage signals. The OSS changes the signal on OSS low signal circuit (401)

voltage to different frequencies depending on velocity of the output shaft. The OSS signal is sent to the TCM, which is used to determine output shaft RPM. DTC P0722 sets when the TCM does not detect an OSS signal when other speed signals register vehicle movement.

**Conditions For Setting DTC**

DTC P0722 will set if no OSS signal is detected when:

- A forward gear is selected.
- Transmission fluid temperature is greater than 68°F (20°C).
- Transaxle Protection Mode is off.
- Ignition voltage is 9-16 volts.
- TCM detects at least 12 pulses from the ISS.
- Condition exists for 10 seconds.

DTC P0722 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0722 is a type "A" DTC.

**Diagnostic Procedure**

1. Raise and support vehicle. Start engine and rotate wheels greater than 3 MPH. Using scan tool, monitor OSS. Is there a OSS signal reading on the scan tool? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Turn ignition on, engine off. Disconnect the OSS harness connector. Measure voltage between OSS harness connector terminals. Is 9-12 volts present? If so, go to next step. If not, go to step 4 .
3. Inspect for loose terminal connections. If okay, replace OSS. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Turn ignition off. Disconnect the TCM harness connector J2. Check continuity of ISS high signal circuit (400). Does continuity exist? If so, go to next step. If not, repair open in ISS high signal circuit (400).
5. Check continuity of ISS low signal circuit (401). Does continuity exist? If so, go to next step. If not, repair open in ISS low signal circuit (401).
6. Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor OSS with the engine running. Wiggling wires while watching for a change in output speed may locate the area where an open or high resistance may lie. Check the OSS mounting bolt for tightness. Check shift solenoid "2" for a stuck closed or restricted condition. If shift solenoid "2" is plugged or stuck closed, DTC P0722 may set when idling in Drive.

**DTC P0727: ENGINE SPEED NO SIGNAL**

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

 

**Circuit Description**

The ECM sends engine RPM information to the TCM via the CAN bus. The ECM also determines if the engine RPM information is reliable or not, and sends that information to the TCM. DTC P0727 sets when the TCM receives an invalid engine RPM signal from ECM.

**Conditions For Setting DTC**

DTC P0727 will set if the TCM receives an invalid engine RPM signal from the ECM when:

- The ignition has been on for at least 3 seconds.
- The TCM has not lost communication with ECM.
- Transaxle Protection Mode is off.
- Condition exists for 4 seconds.

DTC P0727 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0727 is a type "A" DTC.

**Diagnostic Aids**

This DTC does not indicate a problem with the TCM or the transaxle. It does indicate the ECM is not sending the required information to the TCM. Check for and diagnose any DTCs stored in the ECM related to the Crankshaft Position (CKP) sensor circuit. Clear DTCs in the TCM after repairs are made.

## DTC P0730: INCORRECT 1ST LOW GEAR RATIO

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCM uses the ISS and OSS to determine input speed and output speed. These sensor readings are used to determine the current gear ratio. The TCM uses this information to determine if the commanded gear matches the actual gear. DTC P0730 sets if 1st low gear is commanded and the TCM detects there is no engine braking.

**Conditions For Setting DTC**

DTC P0730 sets if 1st low gear is commanded and the TCM detects an actual gear ratio other than 1st gear when:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.
- Transaxle has been in a forward gear for at least 8 seconds.
- Accelerator pedal position angle is zero percent.
- Output speed is 500-1260 RPM.
- Transmission fluid temperature is at least 68°F (20°C).

- Condition exists for 12 seconds.

DTC P0730 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0730 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0717, P0721, P0722, P0963, P0973, P0974, P0976, P0977, P0979, P0980, P0982, or P0983 is set, diagnose that DTC first.**

1. Operate the vehicle in 1st low gear. Release the accelerator pedal. Using scan tool, observe gear ratio. Is gear ratio near 4.60:1? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Using scan tool, monitor ISS and OSS. Do the ISS and OSS read correctly? If so, go to next step. If not, replace affected speed sensor.

   **NOTE: Shift solenoid "1" produces an audible click noise when commanded on, but may not when commanded off.**

3. Ignition on, engine off. Using scan tool, command shift solenoids "1" and "5" on and off. Listen for audible clicks from the solenoids. Does shift solenoid "1" or "5" have a muffled (low tone) or stuck (no tone)? If so, replace affected shift solenoid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. If not, go to next step.
4. Does the vehicle have the symptoms of stuck shift solenoid "2" or "4"? See **SHIFT SOLENOID SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING. If so, remove and test affected shift solenoid. Replace as necessary. If not, go to next step.
5. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
6. Inspect for the following and repair as necessary:
   - Damaged forward clutch.
   - Damaged 1-2, reverse clutch.
   - Worn front internal gear and low clutch sprag.
   - Inoperable valve body.

**Diagnostic Aids**

Monitor ISS and OSS with a scan tool. Compare with a known-good vehicle to determine if the speed sensors are reading correctly. Shift solenoids "2" and "4" do not produce any audible click noises when turned on or off. Shift solenoids "2" and "4" can not be tested by listening for audible click noises. To determine if shift solenoids "2" or "4" may be stuck open or closed. See **SHIFT SOLENOID SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING. Shift solenoid "1" produces an audible click noise when turned on, but not when turned off. Do not replace shift solenoid "1" because it does not click off. Possible causes of incorrect 1st gear ratio:

- Shift solenoid "1" stuck open.

- Shift solenoid "2" stuck closed.
- Shift solenoid "4" stuck closed.
- Shift solenoid "5" stuck closed.
- Line PC solenoid stuck closed.
- TCC lock-up PC solenoid stuck closed.
- Damaged valve body.
- Damaged forward clutch.
- Damaged 1-2, reverse clutch.
- Damaged front internal gear sprag.
- Inaccurate speed sensors.
- Faulty TCM.

1st low gear ratio is 4.602:1 with engine braking.

**DTC P0731: INCORRECT 1ST GEAR RATIO**

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCM uses the ISS and OSS to determine input shaft speed and output shaft speed. These sensor readings are used to determine the current gear ratio. The TCM uses this information to determine if the commanded gear matches the actual gear. DTC P0731 sets if 1st gear is commanded and The TCM detects an actual gear ratio other than 1st gear.

**Conditions For Setting DTC**

DTC P0731 sets if 1st gear is commanded and the TCM detects an actual gear ratio other than 1st gear when:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.
- Transaxle has been in a forward gear for at least 8 seconds.
- Accelerator pedal position angle is at least 40 percent.
- Output speed is 500-1260 RPM.
- Condition exists for 5 seconds.

DTC P0731 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0731 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0716, P0717, P0721, P0722, P0963, P0973, P0974, P0976, P0977, P0979,**

**P0980, P0982, or P0983 is set, diagnose that DTC first.**

1. Operate the vehicle in 1st gear. Using scan tool, observe gear ratio. Is the gear ratio near 4.60:1.? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Using scan tool, monitor ISS and OSS. Do the ISS and OSS read correctly? If so, go to next step. If not, replace affected speed sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**NOTE: Shift solenoid "1" produces an audible click noise when commanded on, but may not when commanded off. Shift solenoid "3" may produce a louder click noise when commanded off than it does when commanded on.**

3. Turn ignition on, engine off. Using scan tool, command shift solenoids "1" and "3" on and off. Listen for audible clicks from the solenoids. Does shift solenoid "1" or "3" have a muffled (low tone) or stuck (no tone)? If so, go to next step. If not, replace affected shift solenoid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Does the vehicle have the symptoms of stuck shift solenoid "2" or "4"? See **SHIFT SOLENOID SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING. If so, remove and test affected shift solenoid. Replace as necessary. If not, go to next step.
5. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
6. Inspect for the following and repair as necessary:
   - Damaged forward clutch.
   - Damaged 1-2 reverse clutch.
   - Worn front internal gear and low clutch sprag.
   - Inoperable valve body.

**Diagnostic Aids**

Monitor ISS and OSS with a scan tool. Compare with a known-good vehicle to determine if the speed sensors are reading correctly. Shift solenoids "2" and "4" do not produce any audible click noises when turned on or off. Shift solenoids "2" and "4" may not be tested by listening for audible click noises. Shift solenoid "1" produces an audible click noise when turned on, but may not when turned off. Do not replace shift solenoid "1" because it does not click off. Possible causes of incorrect 1st gear ratio:

- Shift solenoid "1" stuck open.
- Shift solenoid "2" stuck closed.
- Shift solenoid "3" stuck closed.
- Shift solenoid "4" stuck closed.
- Line PC solenoid stuck closed.
- Damaged valve body.
- Damaged forward clutch.

- Damaged 1-2, reverse clutch.
- Damaged front internal gear sprag.
- Inaccurate speed sensors.
- Faulty TCM.

The 1st gear ratio is 4.602:1 without engine braking.

**DTC P0732: INCORRECT 2ND GEAR RATIO**

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCM uses the ISS and OSS to determine input shaft speed and output shaft speed. These sensor readings are used to determine the current gear ratio. The TCM uses this information to determine if the commanded gear matches the actual gear. DTC P0732 sets if 2nd gear is commanded and The TCM detects an actual gear ratio other than 2nd gear.

**Conditions For Setting DTC**

DTC P0732 sets if 2nd gear is commanded and the TCM detects an actual gear ratio other than 2nd gear when:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.
- Transaxle has been in a forward gear for at least 8 seconds.
- Accelerator pedal position angle is at least 10 percent.
- Output speed is at least 500 RPM.
- Condition exists for 12 seconds.

DTC P0732 diagnostic runs continuously when the above conditions have been met. DTC P0732 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0717, P0722, P0963, P0973, P0974, P0976, P0977, P0979, or P0980 is set, diagnose that DTC first.**

1. Operate the vehicle in 2nd gear. Using scan tool, monitor gear ratio. Is gear ratio near 2.89:1? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Using scan tool, monitor ISS and OSS. Do the ISS and OSS read correctly? If so, go to next step. If not, replace affected speed sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**NOTE: Shift solenoid "1" produces an audible click noise when commanded on,**

**but may not when commanded off. Shift solenoid "3" may produce a louder click noise when commanded off than it does when commanded on.**

3. Using scan tool, command shift solenoids "1" and "3" on and off. Listen for audible clicks from the solenoids. Does shift solenoid "1" or "3" have a muffled (low tone) or stuck (no tone)? If so, replace affected shift solenoid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. If not, go to next step.
4. Does the vehicle have 2.22:1 gear ratio in 2nd gear, 1.45:1 ratio in 3rd gear, and 0.98:1 ratio in 4th gear? If so, remove and test shift solenoid "2". See **SHIFT SOLENOID TEST** under COMPONENT TESTS. Replace if necessary. If not, go to next step.
5. Perform line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
6. Inspect for the following and repair as necessary:
    - Worn forward clutch.
    - Worn 1-2 reverse clutch.
    - Damaged valve body.

**Diagnostic Aids**

Using scan tool, monitor ISS and OSS. Compare with a known-good vehicle to determine if the speed sensors are reading correctly.

Shift solenoid "2" may not produce any audible click noises when turned on or off. Shift solenoid "2" can not be tested by listening for audible click noises. Shift solenoid "2" may be stuck open if the vehicle has all of the following symptoms:

- 2.22:1 gear ratio when in 2nd gear.
- 1.45:1 gear ratio when in 3rd gear.
- 0.98:1 gear ratio when in 4th gear.

Shift solenoid "1" produces an audible click noise when turned on, but may not when turned off. Do not replace shift solenoid "1" because it does not click off. Possible causes of incorrect 2nd gear ratio:

- Shift solenoid "1" stuck closed.
- Shift solenoid "2" stuck open.
- Shift solenoid "3" stuck closed.
- Line pressure solenoid stuck closed.
- Damaged valve body.
- Worn forward clutch.
- Worn 1-2 reverse clutch.
- Inaccurate speed sensors.

 

- Faulty TCM.

The 2nd gear ratio is 2.890:1.

**DTC P0733: INCORRECT 3RD GEAR RATIO**

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCM uses the ISS and OSS to determine input shaft speed and output shaft speed. These sensor readings are used to determine the current gear ratio. The TCM uses this information to determine if the commanded gear matches the actual gear. DTC P0733 sets if 3rd gear is commanded and the TCM detects an actual gear ratio other than 3rd gear.

**Conditions For Setting DTC**

DTC P0733 sets if 3rd gear is commanded and the TCM detects an actual gear ratio other than 3rd gear when:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.
- Transaxle has been in a forward gear for at least 8 seconds.
- Accelerator pedal position angle is at least 10 percent.
- Output speed is at least 500 RPM.
- Condition exists for 12 seconds.

DTC P0733 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0733 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0716, P0717, P0721, P0722, P0963, P0973, P0974, P0976, P0977, P0979, P0980, P0982, P0983, P0985, or P0986 is set, diagnose that DTC first.**

1. Operate the vehicle in 3rd gear. Using scan tool, monitor gear ratio. Is gear ratio near 1.89:1? If so, problem intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Using scan tool, monitor ISS and OSS. Do the ISS and OSS read correctly? If so, go to next step. If not, replace affected speed sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**NOTE: Shift solenoid "1" produces an audible click noise when commanded on, but may not when commanded off. Shift solenoid "3" may produce a louder click noise when commanded off than it does when commanded on.**

3. Using scan tool, command shift solenoids "1", "3", and "5" on and off. Listen for audible clicks from the solenoids. Does shift solenoid "1", "3", or "5" have a muffled (low tone) or stuck (no tone)? If so, replace affected shift solenoid. Does the vehicle have all of the symptoms of shift solenoids "2" or "4" stuck open? If so, remove and test affected shift solenoid. See **SHIFT SOLENOID TEST** under COMPONENT TESTS. Replace if necessary. If not, go to next step.
4. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
5. Inspect for the following and repair as necessary:
    - Worn forward clutch.
    - Worn 3rd gear band.
    - Inoperable valve body.

**Diagnostic Aids**

Using scan tool, monitor ISS and OSS. Compare with a known-good vehicle to determine if the speed sensors are reading correctly. Shift solenoid "2" and "4" do not produce any audible click noises when turned on or off. Shift solenoids "2" and "4" may not be tested by listening for audible click noises. To determine if shift solenoids "2" or "4" may be stuck open or closed. See **SHIFT SOLENOID SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING. Shift solenoid "1" produces an audible click noise when turned on, but may not when turned off. Shift solenoid "3" may produce a louder click noise when turned off than when turned on. This is normal, and is not a reason to replace shift solenoids "1" or "3". Possible causes of incorrect 3rd gear ratio:

- Shift solenoid "1" stuck closed.
- Shift solenoid "2" stuck open.
- Shift solenoid "3" stuck closed.
- Shift solenoid "4" stuck open.
- Shift solenoid "5" stuck open.
- Line PC solenoid stuck closed.
- Stuck valves in valve body.
- Forward clutch worn.
- 3rd gear band worn.
- Inaccurate speed sensors.
- Faulty TCM.

The 3rd gear ratio is 1.889:1.

## DTC P0734: INCORRECT 4TH GEAR RATIO

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCM uses the ISS and OSS to determine input shaft speed and output shaft speed. These sensor readings are used to determine the current gear ratio. The TCM uses this information to determine if the commanded gear matches the actual gear. DTC P0734 sets if 4th gear is commanded and The TCM detects an actual gear ratio other than 4th gear.

**Conditions For Setting DTC**

DTC P0734 sets if 4th gear is commanded and the TCM detects an actual gear ratio other than 4th gear when:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.
- Transaxle has been in a forward gear for at least 8 seconds.
- Accelerator pedal position angle is at least 10 percent.
- Output speed is at least 500 RPM.
- Condition exists for 12 seconds.

DTC P0734 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0734 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0717, P0722, P0762, P0963, P0973, P0974, P0976, P0977, P0979, or P0980 is set, diagnose that DTC first.**

1. Operate the vehicle in 4th gear. Using scan tool, monitor gear ratio. Is gear ratio near 1.28:1? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Using scan tool, monitor ISS and OSS. Does ISS and OSS read correctly? If so, go to next step. If not, replace affected speed sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

   **NOTE: Shift solenoid "1" produces an audible click noise when commanded on, but may not when commanded off. Shift solenoid "3" may produce a louder click noise when commanded off than it does when commanded on.**

3. Turn ignition on, engine off. Using scan tool, command shift solenoids "1" and "3" on and off. Listen for the audible clicks from the solenoids. Does shift solenoid "1" or "3" have a muffled (low tone) or stuck (no tone)? If so, replace affected shift solenoid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. If not, go to next step.
4. Does the vehicle have 2.22:1 gear ratio in 2nd gear, 1.45:1 ratio in 3rd gear, and 0.98:1 ratio in 4th gear? If so, remove and test shift solenoid "2". See **SHIFT SOLENOID TEST** under COMPONENT TESTS. Replace if necessary. If not, go to next step.
5. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
6. Inspect for the following and repair as necessary:

- Worn forward clutch.
- Worn 4-5 clutch.
- Inoperable valve body.

**Diagnostic Aids**

Using scan tool, monitor ISS and OSS. Compare with a known-good vehicle to determine if the speed sensors are reading correctly. Shift solenoid "2" may not produce any audible click noises when turned on or off. Shift solenoid "2" cannot be tested by listening for audible click noises. Shift solenoid "2" may be stuck open if the vehicle has all of the following symptoms:

- 2.22:1 gear ratio when in 2nd gear.
- 1.45:1 gear ratio when in 3rd gear.
- 0.98:1 gear ratio when in 4th gear.

Shift solenoid "1" produces an audible click noise when turned on, but may not when turned off. Do not replace shift solenoid "1" because it does not click off. Possible causes of incorrect 4th gear ratio:

- Shift solenoid "1" stuck closed.
- Shift solenoid "2" stuck open.
- Shift solenoid "3" stuck closed.
- Line PC solenoid stuck closed.
- Valve body faulty.
- Forward clutch worn.
- 4-5 clutch worn.
- Inaccurate speed sensors.

The 4th gear ratio is 1.278:1.

## DTC P0735: INCORRECT 5TH GEAR RATIO

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCM uses the ISS and OSS to determine input shaft speed and output shaft speed. These sensor readings are used to determine the current gear ratio. The TCM uses this information to determine if the commanded gear matches the actual gear. DTC P0735 sets if 5th gear is commanded and the TCM detects an actual gear ratio other than 5th gear.

**Conditions For Setting DTC**

DTC P0735 sets if 5th gear is commanded and the TCM detects an actual gear ratio other than 5th gear when:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.
- Transaxle has been in a forward gear for at least 8 seconds.
- Accelerator pedal position angle is at least 10 percent.
- Output speed is at least 500 RPM.
- Condition exists for 12 seconds.

DTC P0735 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0735 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0717, P0722, P0762 P0963, P0973, P0974, P0976, P0977, P0979, or P0980 is set, diagnose that DTC first.**

1. Operate the vehicle in 5th gear. Using scan tool, monitor gear ratio. Is gear ratio near 0.98:1? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Using scan tool, monitor ISS and OSS. Do the ISS and OSS read correctly? If so, go to next step. If not, replace affected speed sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**NOTE: Shift solenoid "1" produces an audible click noise when commanded on, but may not when commanded off. Shift solenoid "3" may produce a louder click noise when commanded off than it does when commanded on.**

3. Turn ignition on, engine off. Using scan tool, command shift solenoids "1", "2", and "3" on and off. Listen for audible clicks from the solenoids. Does shift solenoid "1", "2", or "3" have a muffed (low tone) or stuck (no tone)? If so, replace affected solenoid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. If not, go to next step.
4. Does the vehicle have 2.89:1 ratio in 1st gear, harsh 1-2 upshifts, and 1.28:1 ratio in 5th gear? If so, remove and test shift solenoid "2". See **SHIFT SOLENOID TEST** under COMPONENT TESTS. Replace if necessary. If not, go to next step.
5. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
6. Inspect for the following and repair as necessary:
   - Stuck shift PC solenoid.
   - Worn forward clutch.
   - Worn direct clutch.
   - Worn 4-5 clutch.
   - Inoperable valve body.

**Diagnostic Aids**

Using scan tool, monitor ISS and OSS. Compare with a known-good vehicle to determine if the speed sensors are reading correctly. Shift solenoid "2" may not produce any audible click noises when turned on or off. Shift solenoid "2" cannot be tested by listening for audible click noises. Shift solenoid "2" may be stuck open if the vehicle has all of the following symptoms:

- 2.89:1 gear ratio when 1st gear.
- Harsh 1-2 upshift.
- 1.28:1 gear ratio when in 5th gear.

Shift solenoid "1" produces an audible click noise when turned on, but may not when turned off. Do not replace shift solenoid "1" because it does not click off. Possible causes of incorrect 5th gear ratio:

- Shift solenoid "1" stuck closed.
- Shift solenoid "2" stuck open.
- Shift solenoid "3" stuck closed.
- Line PC solenoid stuck closed.
- Shift PC solenoid stuck closed.
- Stuck valves in valve body.
- Forward clutch worn.
- Direct clutch worn.
- 4-5 clutch worn.
- Faulty TCM.
- Inaccurate speed sensors.

The 5th gear ratio is 0.982:1.

## DTC P0736: INCORRECT REVERSE RATIO

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

### Circuit Description

The TCM uses the ISS and OSS to determine input shaft speed and output shaft speed. These sensor readings are used to determine the current gear ratio. The TCM uses this information to determine if the commanded gear matches the actual gear. DTC P0736 sets if Reverse is commanded and the TCM detects an actual gear ratio other than Reverse.

### Conditions For Setting DTC

DTC P0736 sets if Reverse is commanded and the TCM detects an actual gear ratio other than Reverse when:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.

- Transaxle has been in Reverse for at least 8 seconds.
- Output speed is at least 500 RPM.
- Condition exists for 12 seconds.

DTC P0736 diagnostic runs continuously when the above conditions have been met. The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0736 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0717, P0722, P0963, P0982, or P0983 is set, diagnose that DTC first.**

1. Operate the vehicle in Reverse. Using scan tool, monitor gear ratio. Is the gear ratio near 3.1.2:1? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Using scan tool, monitor ISS and OSS. Do the ISS and OSS read correctly? If so, go to next step. If not, replace affected speed sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
3. Does the vehicle have 1.45:1 ratio in 1st gear, stall in 2nd gear, and slip in Reverse? If so, remove and test shift solenoid "4". See **SHIFT SOLENOID TEST** under COMPONENT TESTS. Replace if necessary. If not, go to next step.
4. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
5. Inspect for the following and repair as necessary:
    - Worn direct clutch.
    - Worn low and reverse clutch.
    - Worn 1-2 reverse clutch.
    - Inoperable valve body.

**Diagnostic Aids**

Using scan tool, monitor ISS and OSS. Compare with a known-good vehicle to determine if the speed sensors are reading correctly. Shift solenoid "4" may not produce any audible click noises when turned on or off. Shift solenoid "4" cannot be tested by listening for audible click noises. Shift solenoid "4" may be stuck closed if the vehicle has all of the following symptoms:

- 1.45:1 gear ratio in 1st gear.
- TCC stalls engine in 2nd gear.
- Slips in Reverse.

Possible causes of incorrect Reverse gear ratio:

- Shift solenoid "4" stuck closed.
- Line PC solenoid stuck closed.
- Stuck valves in valve body.

- Direct clutch worn.
- Low and reverse clutch worn.
- 1-2, reverse clutch worn.
- Faulty TCM.
- Inaccurate speed sensors.

The Reverse gear ratio is 3.121:1.

**DTC P0741: TCC SYSTEM - STUCK OFF**

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCC lock-up PC solenoid is used to apply and release the TCC. The TCC can be applied in 3rd, 4th and 5th gears. The TCC lock-up PC solenoid is normally closed. The TCM controls TCC by pulse width modulating an internal driver that pulls the solenoid circuit to ground. The TCM uses engine RPM and ISS to calculate the TCC slip speed. DTC P0741 sets when the TCC is commanded on, and the TCC slip speed is greater than 100 RPM.

**Conditions For Setting DTC**

DTC P0741 sets if TCC is commanded on, and the TCC slip speed is greater than 100 RPM when:

- Ignition voltage is at least 10.5 volts.
- Transaxle is in a forward gear.
- Accelerator pedal position angle is a least 20 percent.
- Engine Speed is not more than 4000 RPM.
- Condition exits for 12 seconds.

DTC P0741 diagnostic runs continuously when the above conditions have been met. DTC P0741 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0717, P0727, P0963, or P0966 is set, diagnose that DTC first.**

1. Operate the vehicle in 3rd, 4th, and 5th gear, with the TCC commanded on. Using scan tool, monitor TCC slip. Is TCC slipping more that 100 RPM? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Using scan tool, monitor engine RPM and transaxle ISS. Does the engine RPM and transaxle ISS read correctly? If so, go to next step. If not, replace affected speed sensor.
3. Does the vehicle have a 2.89:1 ratio in 3rd gear, and TCC slip in 3rd, 4th, and 5th gears? If so, remove

and test shift solenoid "4". See **SHIFT SOLENOID TEST** under COMPONENT TESTS. Replace if necessary. If not, go to next step.

4. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
5. Inspect for the following and repair as necessary:
   - Hydraulic leaks.
   - Inoperable valve body.
   - Worn torque converter.

**Diagnostic Aids**

Using scan tool, monitor engine RPM and transaxle ISS. Compare with a known-good vehicle to determine if the speed sensors are reading correctly. Possible causes of TCC stuck off:

- Shift solenoid "4" stuck open.
- TCC lock-up PC solenoid stuck closed.
- Stuck valves in valve body.
- Faulty torque converter.
- Faulty TCM.

If the TCC lock-up PC solenoid is stuck closed, harsh 1-2, 2-1, and 3-2 shifts, and flare on 2-3 shift will result.

## DTC P0744: TCC SYSTEM INTERMITTENT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The torque converter has an Electronically Controlled Capacity Clutch (ECCC). In the ECCC system, the pressure plate does not always fully lock to the torque cover. At certain speeds, the TCC lock-up PC solenoid is precisely controlled to maintain a small amount of slippage between the engine and the transaxle, reducing driveline torsional disturbances. The TCM uses information from the OSS to determine if shudder is present by calculation of OSS frequency variance. The TCM monitors the OSS to detect shudder while the TCC is partially applied. If too much shudder is detected with the TCC partially applied, the TCM will then release the TCC, and monitor the OSS again for shudder. This allows the TCM to determine if the shudder is caused by the TCC system or by a rough road. DTC P0744 sets when the OSS indicates too much TCC shudder with the TCC partially applied, and no shudder with the TCC, released.

**Conditions For Setting DTC**

DTC P0744 set if the OSS indicates TCC shudder. DTC P0744 is a type "D" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0722, P0727, P0733, P0966, P0967, or P0982 is set, diagnose that DTC first.**

1. Operate the vehicle in on smooth road in 3rd, 4th, and 5th gears. Using scan tool, monitor DTC P0744. Does DTC P0744 fail this ignition? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Using scan tool, monitor OSS. Compare with a known-good vehicle. Does OSS read correctly? If so, go to next step. If not, inspect OSS mounting bolt for tightness. Inspect for high current carrying wiring routed near OSS wiring. Repair as necessary. If okay, replace OSS. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
3. Does the vehicle have a 2.89:1 ratio in 3rd gear, and TCC slip in 3rd, 4th, and 5th gears? If so, remove and test shift solenoid "4". See **SHIFT SOLENOID TEST** under COMPONENT TESTS. Replace if necessary. If not, go to next step.
4. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
5. Inspect for the following and repair as necessary:
   - Old transmission fluid.
   - Incorrect transmission fluid type.
   - Contaminated transmission fluid.
   - Stuck TCC lock-up PC solenoid.
   - Worn torque converter.

**Diagnostic Aids**

Use a scan tool to monitor OSS while wiggling wires. DTC P0744 can set due to:

- Old transmission fluid.
- Incorrect transmission fluid level.
- Incorrect transmission fluid type.
- Contaminated transmission fluid.
- Intermittent open anywhere in the OSS circuit.
- Loose or damaged OSS.
- Electromagnetic Interference (EMI) cause by high current carrying wiring routed near OSS sensor wiring.
- Shift solenoid "4" leaking or stuck open.
- TCC lock-up PC solenoid stuck.
- Torque converter faulty.

If Shift solenoid "4" stuck open, a 2.89:1 gear ratio in 3rd gear will result. If the TCC lock-up PC solenoid is stuck, harsh shifts between 1st, 2nd, and 3rd gears will result.

**DTC P0762: SHIFT SOLENOID "3" STUCK OPEN**

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "3" is turned electrically on and hydraulically open during 1st, 2nd, 3rd, and Reverse operation. Shift solenoid "3" is turned electrically off and hydraulically closed during 4th and 5th gear operation. The TCM controls shift solenoid "3" by controlling an internal driver that pulls the solenoid circuit to voltage. During normal 4th gear shift operation, the TCM will turn off shift solenoid "3" and keep it off until downshift to 3rd or lower gear occurs. The TCM will turn off shift solenoid "3" and keep it off until a downshift to 3rd or lower gear occurs. The TCM monitors the actual gear ratio for each gear commanded. DTC P0762 sets when the gear ratio when 4th gear is commanded is 1.89:1, or the gear ratio when 5th is commanded is 1.45:1, indicating that shift solenoid "3" is stuck open, or that the U2 shift valve is stuck in the valve body.

**Conditions For Setting DTC**

DTC P0761 will set if 5th gear is selected, and current gear ratio, is 20 percent less than expected gear ratio or 4th gear is selected, and current gear ratio is the same as 3rd gear and:

- Ignition voltage is at least 10.5 volts.
- Engine speed is at least 400 RPM.
- Transmission fluid temperature is greater than 68°F (20°C).
- A forward gear has been selected for at least 8 seconds.
- Condition exists for 12 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0762 is a type "A" DTC.

**Diagnostic Procedure**

**NOTE: If DTC P0717, P0722, or P0979 is set, diagnose that DTC first.**

1. Operate the vehicle in 4th, and 5th gears. Using scan tool, monitor gear ratio. Is the gear ratio near 1.89:1 in 4th gear and 1.45 in 5th gear? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .

   **NOTE: Shift solenoid "3" may produce a louder click noise when commanded off than it does when commanded on.**

2. Using scan tool, command shift solenoid "3" on and off. Listen for audible clicks from solenoid "3". Does shift solenoid "3" have a muffled (low tone) when it is turned off, or stuck (no tone)? If so, replace shift solenoid "3". See appropriate AUTOMATIC article in TRANSMISSION SERVICING. If not, go to next step.
3. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.

4. Inspect for the following and repair as necessary:
    - Faulty valve body.
    - Skewed ISS.
    - Skewed OSS.
    - Faulty TCM.

**Diagnostic Aids**

Shift solenoid "3" may produce a louder click noise when turned off than when turned on. This is normal, and is not reason to replace shift solenoid "3". If shift solenoid "3" is stuck open, or if the U2 shift valve is stuck outward, harsh 3-4 upshifts, 1.89:1 ratio in 4th gear, and 1.45:1 ratio in 5th gear may result. DTCs P0734, P0735, and P1719 may also set.

## DTC P0962: LINE PC SOLENOID LOW CURRENT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The line PC solenoid is used to control main line pressure to the transaxle hydraulic system. The line PC solenoid is pulse with modulated by the TCM whenever the engine is running. The TCM controls the line PC solenoid by pulse with modulating an internal driver that pulls the solenoid circuit to voltage. When the line PC solenoid is commanded off, main line pressure is highest. During normal shift operation, the TCM will pulse with modulate the line PC solenoid to prevent clutch slip and harsh shifts. The line PC solenoid ground circuit is monitored for current flow. DTC P0962 sets if the TCM detects low current flow through the line PC solenoid.

**Conditions For Setting DTC**

DTC P0962 sets if low current detected through the line PC solenoid and:

- The engine is running.
- Transaxle Protection Mode is off.
- Condition exists for at least 12.5 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0962 is a type "A" DTC.

**Diagnostic Procedure**

1. Start engine. Using scan tool, command the line PC solenoid reference current to about 0.23 amp. Observe line PC solenoid actual current. Is the line PC solenoid actual current less than 0.10 amp? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect the transaxle harness connector. Connect a test light between transaxle harness connector J1 terminal No. 11 and ground. Using scan tool, command the line PC solenoid reference current to about 0.86 amp. Does the test light turn on? If so, go to step 4 . If not, go to next step.

 

3. Inspect line PC solenoid circuit (1994) for an open. Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
4. Connect a test light between transaxle harness connector J1 terminals No. 4 and 11. Does the test light illuminate? If so, go to next step. If not, go to step 6 .
5. Inspect line PC solenoid circuit (5510) for an open and/or short-to-ground. Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
6. Replace valve body. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor line PC solenoid actual current with ignition on, engine off. Wiggling wires watching for a change on line PC solenoid actual current may locate the area where an open or high resistance in the wiring could lie. Line PC solenoid current is 92-1356 milliamps.

## DTC P0963: LINE PC SOLENOID HIGH CURRENT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The line PC solenoid is used to control main line pressure to the transaxle hydraulic system. The line PC solenoid is pulse width modulated by the TCM whenever the engine is running. The TCM controls the line PC solenoid with an internal driver that pulls the solenoid circuit voltage. When the line PC solenoid is commanded off, main line pressure is highest. During normal shift operation, the TCM will pulse width modulate the line PC solenoid to prevent clutch slip and harsh shifts. The line PC solenoid ground circuit is monitored for current flow. DTC P0963 sets if the TCM detects high current flow through the line PC solenoid.

**Conditions For Setting DTC**

DTC P0963 sets if low current detected through the line PC solenoid and:

- The engine is running.
- Transaxle Protection Mode is off.
- Condition exists for at least 2 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0963 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command the line PC solenoid reference current to about 0.86 amp. Using scan tool, monitor line PC solenoid actual current. Is the line PC solenoid actual current more than 1.356 amps? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect transaxle harness connector J1. Connect a test light between transaxle harness connector J1

terminal No. 4 and ground. Does the test light turn on? If so, go to next step. If not, go to step 4

3. Inspect line PC solenoid circuit (5510) for a short to voltage. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
4. Replace valve body. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor line PC solenoid actual current with ignition on, engine off. Wiggling wires watching for a change on line PC solenoid actual current may locate the area where an open or high resistance in the wiring could lie. Line PC solenoid current is 92-1356 milliamps.

## DTC P0966: TCC LOCK-UP PC SOLENOID LOW CURRENT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCC lock-up PC solenoid is used to apply and release the TCC. The TCC can be applied in 3rd, 4th, and 5th gear. The TCC solenoid also controls shift pressure while in 1st and 2nd gears. The TCC solenoid is pulse width modulated by the TCM whenever the engine is running. The TCM controls the TCC solenoid by pulse width modulating an internal driver that pulls the solenoid circuit voltage. When shift solenoid "4" is on, and the TCC lock-up PC solenoid is commanded on, the TCC is applied. The TCC solenoid ground circuit is monitored for current flow. DTC P0966 sets if the TCM detects low current flow through the TCC lock-up PC solenoid.

**Conditions For Setting DTC**

DTC P0966 sets if low current is detected through the TCC lock-up PC solenoid and:

- The engine is running.
- Transaxle Protection Mode is off.
- Condition exists for at least 12.5 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0966 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command TCC lock-up PC solenoid reference current to about 0.23 amp. Using scan tool, monitor TCC lock-up PC solenoid actual current. Is the TCC lock-up PC solenoid actual current less than 0.10 amp? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 10 and ground. Using scan tool, command the TCC lock-up PC solenoid reference current to about 0.86 amp. Does the test light illuminate? If so, go to next step. If not, inspect TCC lock-up PC solenoid circuit (5511) for an open. Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

3. Connect test light between transaxle harness connector J1 terminals No. 3 and 10. Does the test light illuminate? If so, go to next step. If not, inspect TCC lock-up PC solenoid circuit (5509) for an open or short to ground. Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
4. Replace valve body. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor TCC lock-up PC solenoid actual current and with the ignition on, engine off. Wiggling wires while watching for a change on TCC lock-up PC solenoid actual current and line PC solenoid circuit status may locate the area where an open or high resistance in the wiring could lie. TCC lock-up PC solenoid current is 92-1356 milliamps.

## DTC P0967: TCC LOCK-UP PC SOLENOID HIGH CURRENT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCC lock-up PC solenoid is used to apply and release the TCC. The TCC can be applied in 3rd, 4th, and 5th gears. The TCC solenoid also controls shift pressure while in 1st and 2nd gears. The TCC solenoid is pulse width modulated by the TCM whenever the engine is running. The TCM controls the TCC solenoid by pulse width modulating an internal driver that pulls the solenoid circuit voltage. When shift solenoid "4" is on, and the TCC solenoid is commanded on, the TCC is applied. The TCC solenoid ground circuit is monitored for current flow. DTC P0967 sets if the TCM detects high current flow through the TCC lock-up PC solenoid.

**Conditions For Setting DTC**

DTC P0967 sets if low current is detected through the TCC lock-up PC solenoid and:

- The engine is running.
- Transaxle Protection Mode is off.
- Condition exists for at least 2 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0967 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command TCC PC solenoid reference current to about 0.86 amp. Monitor TCC PC solenoid actual current. Is the TCC PC solenoid actual current more than 1.356 amps? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 3 and ground. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Inspect TCC PC solenoid circuit (5509) for a short to voltage. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

 

4. Replace valve body. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor TCC PC solenoid actual current with the ignition on, engine off. Wiggling wires while watching for a change on TCC PC solenoid actual current may locate the area where an open or high resistance in the wiring could lie. TCC lock-up PC solenoid current is 92-1356 milliamps.

## DTC P0970: SHIFT PC SOLENOID LOW CURRENT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The shift PC solenoid is used to control pressure to the 2nd coast clutch when in 2nd, 3rd, and 4th gears. The shift PC solenoid also controls the direct clutch when in 5th gear and Reverse. The shift PC solenoid is pulse width modulated by the TCM whenever the engine is running. The TCM controls the shift PC solenoid by pulse width modulating an internal driver that pulls the solenoid circuit voltage. When shift PC solenoid is commanded on, pressure to 2nd coast clutch and direct clutch is lowest. The shift PC solenoid ground circuit is monitored for current flow. DTC P0970 sets if the TCM detects low current flow through the shift PC solenoid.

**Conditions For Setting DTC**

DTC P0970 sets if low current is detected through the shift PC solenoid and:

- The engine is running.
- Transaxle Protection Mode is off.
- Condition exists for at least 12.5 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0970 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift PC solenoid reference current to about 0.23 amp. Observe shift PC solenoid actual current. Is the shift PC solenoid actual current less than 0.10 amp? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect the transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 9 and ground. Command shift PC solenoid current to about 0.86 amp. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Inspect shift PC solenoid circuit (2880) for an open. Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
4. Replace valve body. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

 

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift PC solenoid actual current with the ignition on, engine off. Wiggling wires while watching for a change on shift PC solenoid actual current may locate the area where an open or high resistance in the wiring could lie. Shift PC solenoid current is 92-1356 milliamps.

## DTC P0971: SHIFT PC SOLENOID HIGH CURRENT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The shift PC solenoid is used to control pressure to the 2nd coast clutch when in 2nd, 3rd, and 4th gears. The shift PC solenoid also controls the direct clutch when in 5th gear and Reverse. The shift PC solenoid is pulse width modulated by the TCM whenever the engine is running. The TCM controls the shift PC solenoid by pulse width modulating an internal driver that pulls the solenoid circuit voltage. When shift PC solenoid is commanded on, pressure to 2nd coast clutch and direct clutch is lowest. The shift PC solenoid ground circuit is monitored for current flow. DTC P0971 sets if the TCM detects high current flow through the shift PC solenoid.

**Conditions For Setting DTC**

DTC P0971 sets if low current is detected through the shift PC solenoid and:

- The engine is running.
- Transaxle Protection Mode is off.
- Condition exists for at least 2 seconds.

The TCM will command Transaxle Protection Mode on if this DTC is active.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift PC solenoid reference current to about 0.86 amp. Monitor shift PC solenoid actual current. Is the shift PC solenoid actual current more than 1.35 amps? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Disconnect the transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 2 and ground. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Inspect shift PC solenoid circuit (5508) for a short to voltage. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
4. Replace valve body. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift PC solenoid actual current with the ignition on, engine off. Wiggling wires while watching for a change on shift PC solenoid actual current and shift PC solenoid circuit status may locate the area where an open or high resistance in the wiring could lie. Shift PC

solenoid current is 92-1356 milliamps.

## DTC P0973: SHIFT SOLENOID "1" CONTROL CIRCUIT LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

### Circuit Description

Shift solenoid "1" is turned electrically on and hydraulically closed, applying pressure to the M1 shift valve, during 1st gear operation. The TCM controls shift solenoid "1" by controlling an internal driver that pulls the solenoid circuit to voltage. During normal 1st and 2nd gear shift operation, the TCM will turn shift solenoid "1" off and keep it off until a downshift to lst gear occurs. Shift solenoid "1" circuit (1222) is monitored for low and high voltage feedback. DTC P0973 sets if shift solenoid "1" is commanded on and the feedback voltage at the TCM is low.

### Conditions For Setting DTC

DTC P0973 sets if low voltage is detected on the shift solenoid "1" control circuit and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "1" commanded on.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0973 is a type "A" DTC.

### Diagnostic Procedure

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "1" on, and observe shift solenoid "1" circuit status. Is shift solenoid "1" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 14 and ground. Using scan tool, command shift solenoid "1" on. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Replace shift solenoid "1". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "1" circuit (1222) for a short to ground. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

### Diagnostic Aids

To locate an intermittent problem, use a scan tool to monitor shift solenoid "1" circuit status with solenoid "1" commanded on. Wiggling wires while watching for a change on shift solenoid "1" circuit status may locate the area where a short to ground in the wiring could lie.

## DTC P0974: SHIFT SOLENOID "1" CONTROL CIRCUIT HIGH VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "1" is turned electrically on and hydraulically closed, applying pressure to the M1 shift valve, during 1st gear operation. The TCM controls shift solenoid "1" by controlling an internal driver that pulls the solenoid circuit to voltage. During normal 1st, 2nd gear shift operation, the TCM will turn shift solenoid "1" off and keep it off until a downshift to 1st gear occurs. Shift solenoid "1" circuit (1222) is monitored for low and high voltage feedback. DTC P0974 sets if shift solenoid "1" is commanded on and the feedback voltage at the TCM is high.

**Conditions For Setting DTC**

DTC P0974 sets if high voltage is detected on the shift solenoid "1" control circuit and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "1" commanded off.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0974 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "1" off and observe shift solenoid "1" circuit status. Is shift solenoid "1" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle case connector J1. Connect test light between transaxle case connector J1 terminal No. 14 and ground. Command shift solenoid "1" on and off. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Inspect shift solenoid "1" circuit (1222) for an open or short to voltage. Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.
4. Inspect for loose terminal connections. If okay, replace shift solenoid "1". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "1" circuit status with ignition on, engine off. Wiggling wires while watching for a change on shift solenoid "1" circuit status may locate the area where an open or short to voltage in the wiring could lie.

## DTC P0976: SHIFT SOLENOID "2" CONTROL CIRCUIT LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING**

**DIAGRAMS .**

**Circuit Description**

Shift solenoid "2" is turned electrically on and hydraulically closed, applying pressure to the M2 shift valve, during 2nd, 3rd, and 4th gear operation. The TCM controls shift solenoid "2" by controlling an internal driver that pulls the solenoid circuit to voltage. During normal 1st-2nd gear shift operation, the TCM will turn shift solenoid "2" on and keep it on until a downshift to 1st gear or an upshift to 5th gear occurs. Shift solenoid "2" circuit (1223) is monitored for low and high voltage feedback. DTC P0976 sets if shift solenoid "2" is commanded electrically on and the feedback voltage at the TCM is low.

**Conditions For Setting DTC**

DTC P0976 sets when shift solenoid "2" is commanded on and the feedback voltage at the TCM is low and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "2" commanded on.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0976 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "2" on and observe shift solenoid "2" circuit status. Is shift solenoid "2" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 7 and ground. Using scan tool, command shift solenoid "2" on. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Replace shift solenoid "2". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "2" circuit (1223) for a short to ground. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "2" circuit status with solenoid "2" commanded on. Wiggling wires while watching for a change on shift solenoid "2" circuit status may locate the area where a short to ground in the wiring could lie.

## DTC P0977: SHIFT SOLENOID "2" CONTROL CIRCUIT HIGH VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "2" is turned electrically on and hydraulically closed, applying pressure to the M2 shift valve, during 2nd, 3rd, and 4th gear operation. The TCM controls shift solenoid "2" by controlling an internal driver that pulls the solenoid circuit to voltage. During normal 1st-2nd gear shift operation, the TCM will turn shift solenoid "2" on and keep it on until a downshift to 1st gear or an upshift to 5th gear occurs. Shift solenoid "2" circuit (1223) is monitored for low and high voltage feedback. DTC P0977 sets if shift solenoid "2" is commanded electrically off and the feedback voltage at the TCM is low.

**Conditions For Setting DTC**

DTC P0977 will set if high voltage is detected on the shift solenoid "2" control circuit and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "2" commanded is off.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0977 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "2" off and observe shift solenoid "2" circuit status. Is shift solenoid "2" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect a test light between transaxle harness connector J1 terminal No 7 and ground. Using scan tool, command shift solenoid "2" on and off. Does the test light turn on and off? If so, go to next step. If not, go to step 4 .
3. Inspect for loose terminal connections. If okay, replace shift solenoid "2". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "2" circuit (1223) for an open or short to voltage. Inspect for loose terminal connections. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "2" circuit status with solenoid "2" commanded off. Wiggling wires while watching for a change on shift solenoid "2" circuit status may locate the area where an open or short to voltage in the wiring could lie.

## DTC P0979: SHIFT SOLENOID "3" CONTROL CIRCUIT LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "3" is turned electrically on and hydraulically open, relieving pressure from the M3 shift valve,

 

during 1st, 2nd, 3rd, and Reverse gear operation. Shift solenoid "3" is turned electrically off and hydraulic closed, applying pressure to M3 shift valve, during 3rd and 5th gear operation. The TCM controls shift solenoid "3" by controlling an internal driver that pulls the solenoid circuit to voltage. During normal 3rd-4th gear shift operation, the TCM will turn off shift solenoid "3" and keep it off until a downshift to 3rd or lower gear occurs. Shift solenoid "3" circuit (898) is monitored for low and high voltage feedback. DTC P0979 sets when shift solenoid "3" is commanded electrically on and the feedback voltage at the TCM is low.

**Conditions For Setting DTC**

DTC P0979 sets when shift solenoid "3" is commanded on and the feedback voltage at the TCM is low and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "3" commanded on.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0979 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "3" on and observe shift solenoid "3" circuit status. Is shift solenoid "3" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 13 and ground. Using scan tool, command shift solenoid "3" on. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Replace shift solenoid "3". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "3" circuit (898) for a short to ground. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "3" circuit status with shift solenoid "3" commanded on. Wiggling wires while watching for a change on shift solenoid "3" circuit status may locate the area where a short to ground in the wiring could lie.

## DTC P0980: SHIFT SOLENOID "3" CONTROL CIRCUIT HIGH VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "3" is turned electrically on and hydraulically open, relieving pressure from the M3 shift valve, during 1st, 2nd, and 3rd and Reverse gear operation. Shift solenoid "3" is turned electrically off and hydraulically closed, applying pressure to the M3 shift valve, during 4th-5th gear operation. The TCM controls

 

shift solenoid "3" by controlling an internal driver that pulls the solenoid circuit to voltage. During normal 3rd-4th gear shift operation, the TCM will turn off shift solenoid until downshift to 3rd or lower occurs. Shift solenoid "3" circuit (898) is monitored for low and high voltage feedback. DTC P0980 sets when shift solenoid "3" is commanded electrically off and the feedback voltage at the TCM is high.

**Conditions For Setting DTC**

DTC P0980 will set if high voltage is detected on the shift solenoid "3" control circuit and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "3" commanded is off.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0980 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "3" off and observe shift solenoid "3" circuit status. Is shift solenoid "3" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 13 and ground. Using scan tool, command shift solenoid "3" on and off. Does test light turn on and off? If so, go to next step. If not, go to step 4 .
3. Inspect for loose terminal connections. If okay, replace shift solenoid "3". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "3" circuit (898) for an open or short to voltage. Inspect for loose terminal connections. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "3" circuit status with the ignition on, engine off. Wiggling wires while watching for a change on shift solenoid "3" circuit status may locate the area where an open or short to voltage in the wiring could lie.

## DTC P0982: SHIFT SOLENOID "4" CONTROL CIRCUIT LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "4" is turned electrically on and hydraulically closed during 3rd, 4th and 5th gear operation. Shift solenoid "4" is turned electrically off and hydraulic open during 1st, 2nd, and Reverse gear operation. During normal 2nd-3rd gear shift operation, the TCM will turn shift solenoid "4" on and keep it on until a downshift to

 

2nd gear occurs. Shift solenoid "4" circuit (2879) is monitored for low and high voltage feedback. DTC P0982 sets when shift solenoid "4" is commanded electrically on and the feedback voltage at the TCM is low.

**Conditions For Setting DTC**

DTC P0982 sets when shift solenoid "4" is commanded on and the feedback voltage at the TCM is low and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "4" commanded on.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0982 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "4" on and observe shift solenoid "4" circuit status. Is shift solenoid "4" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 14 and ground. Using scan tool, command shift solenoid "4" on. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Replace shift solenoid "4". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "4" solenoid circuit (2879) for a short to ground. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "4" circuit status with shift solenoid "4" commanded on. Wiggling wires while watching for a change on shift solenoid "4" circuit status may locate the area where a short to ground in the wiring could lie.

## DTC P0983: SHIFT SOLENOID "4" CONTROL CIRCUIT HIGH VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "4" is turned electrically on and hydraulically closed during 3rd, 4th and 5th gear operation. Shift solenoid "4" is turned electrically off and hydraulic open during 1st, 2nd, and Reverse gear operation. During normal 2nd-3rd gear shift operation, the TCM will turn shift solenoid "4" on and keep it on until a downshift to 2nd gear occurs. Shift solenoid "4" circuit (2879) is monitored for low and high voltage feedback. DTC P0983 sets when shift solenoid "4" is commanded electrically off and the feedback voltage at the TCM is high.

**Conditions For Setting DTC**

DTC P0983 will set if the high voltage is detected on the shift solenoid "4" control circuit and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "4" is commanded off.
- Condition exists for at least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0983 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "4" off and observe shift solenoid "4" circuit status. Is shift solenoid "4" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 6 and ground. Using scan tool, command shift solenoid "4" on and off. Does the test light turn on and off? If so, go to next step. If not, go to step 4 .
3. Inspect for loose terminal connections. If okay, replace shift solenoid "4". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "4" circuit (2879). Inspect for loose terminal connections. Repair as necessary. If okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "4" circuit status with ignition on, engine off. Wiggling wires while watching for a change on shift solenoid "4" circuit status may locate the area where an open or short to voltage in the wiring could lie.

## DTC P0985: SHIFT SOLENOID "5" CONTROL CIRCUIT LOW VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "5" is used to affect shift pressure. Shift solenoid "5" is turned electrically on and hydraulically open, relieving pressure from the M3 shift valve, during 2-3, and 3-4 shifts. The TCM controls shift solenoid "5" by controlling an internal driver that pulls the solenoid circuit to voltage. Shift solenoid "5" circuit (2527) is monitored for low and high voltage feedback. DTC P0985 sets when shift solenoid "5" is commanded electrically on and the feedback voltage at the TCM is low.

**Conditions For Setting DTC**

DTC P0985 sets when shift solenoid "5" is commanded on and the feedback voltage at the TCM is low and:

- The engine is running.
- Transaxle Protection Mode is off.
- Shift solenoid "5" commanded on.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0985 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "5" on and observe shift solenoid "5" circuit status. Is shift solenoid "5" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 12 and ground. Using scan tool, command shift solenoid "5" on. Does the test light illuminate? If so, go to next step. If not, go to step 4 .
3. Replace shift solenoid "5". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "5" circuit (2527) for a short to ground. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "5" circuit status with solenoid "5" commanded on. Wiggling wires while watching for a change on shift solenoid "5" circuit status may locate the area where a short to ground in the wiring could lie.

## DTC P0986: SHIFT SOLENOID "5" CONTROL CIRCUIT HIGH VOLTAGE

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

Shift solenoid "5" is used to affect shift pressure. Shift solenoid "5" is turned electrically on and hydraulically open during Reverse operation and during 2-3, and 3-4 shifts. The TCM controls shift solenoid "5" by controlling an internal driver that pulls the solenoid circuit to voltage. Shift solenoid "5" circuit (2527) is monitored for low and high voltage feedback. DTC P0986 sets when shift solenoid "5" is commanded electrically off and the feedback voltage at the TCM is high.

**Conditions For Setting DTC**

DTC P0986 will set if high voltage is detected on the shift solenoid "5" control circuit and:

- The engine is running.
- Transaxle Protection Mode is off.

- Shift solenoid "5" is commanded off.
- Condition exists for a least 500 milliseconds.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P0986 is a type "A" DTC.

**Diagnostic Procedure**

1. Turn ignition on, engine off. Using scan tool, command shift solenoid "5" off and observe shift solenoid "5" circuit status. Is shift solenoid "5" circuit status okay? If so, problem is intermittent. See **DIAGNOSTIC AIDS** . If not, go to next step.
2. Disconnect transaxle harness connector J1. Connect test light between transaxle harness connector J1 terminal No. 12 and ground. Using scan tool, command shift solenoid "5" on and off. Does the test light turn on and off? If so, go to next step. If not, go to step 4 .
3. Inspect for loose terminal connections. If okay, replace shift solenoid "5". See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
4. Inspect shift solenoid "5" circuit (2527) for an open or a short to voltage. Inspect for loose terminal connections. Repair as necessary. If circuit is okay, replace TCM. See **TRANSAXLE CONTROL MODULE** under REMOVAL & INSTALLATION.

**Diagnostic Aids**

To locate an intermittent problem, use a scan tool to monitor shift solenoid "5" circuit status with ignition on, engine off. Wiggling wires while watching for a change on shift solenoid "5" circuit status may locate the area where an open or short to voltage in the wiring could lie.

## DTC P1719: INCORRECT SHIFTING DETECTED

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The TCM uses the ISS and OSS to determine input shaft speed and output shaft speed. These sensor readings are used to determine the current gear ratio. The TCM measures the amount of time between the moment that a gear shift is commanded and the moment that a gear shift has taken place. DTC P1719 sets if shift times are too long or too short, indicating a malfunction.

**Conditions For Setting DTC**

DTC P1719 will set if the TCM detects shift time too long or too short, or engine flare when shifting and:

- A forward gear is selected.
- Transmission fluid temperature is at least 140°F (60°C).
- The condition exists 5 times.

The TCM will command Transaxle Protection Mode on if this DTC is active. DTC P1719 is a type "A" DTC.

 

**Diagnostic Procedure**

**NOTE: If any other DTC is set, diagnose that DTC first.**

1. Operate the vehicle. Using scan tool, observe LAST SHIFT STATUS. Does LAST SHIFT STATUS indicate flare, tie-up, short, or long for any shift? If so, go to next step. If not, problem is intermittent. See **DIAGNOSTIC AIDS** .
2. Using scan too, monitor TFT sensor, ISS and OSS. Does the TFT sensor, ISS, and OSS read correctly? If so, go to next step. If not, replace affected sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
3. Inspect transmission fluid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. Is the transmission fluid level and quality okay? If so, go to next step. If not, add or replace fluid as necessary.

   **NOTE: Shift solenoid "1" produces an audible click noise when commanded on, but may not when commanded off. Shift solenoid "3" may produce a louder click noise when commanded off than it does when commanded on.**

4. Using scan tool, command shift solenoids "1", "3", and "5" on and off. Listen for audible clicks from the solenoids. Does shift solenoid "1", "3", and "5" have a muffed (low tone) or stuck (no tone), or does the vehicle have all of the symptoms of a stuck shift solenoid "2" or "4"? See **SHIFT SOLENOID SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING. If so, go to next step. If not, go to step 6 .
5. Replace affected solenoid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
6. Perform a line pressure test. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. Is line pressure within specification? If so, go to next step. If not, **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
7. Inspect for the following and repair as necessary:
   - Sticking PC solenoids.
   - Inoperable valve body.
   - Mechanical failure.
   - Terminal tightness.

**Diagnostic Aids**

The following are possible causes of incorrect shifting:

- Low transmission fluid level.
- Incorrect transmission fluid type.
- Contaminated transmission fluid.
- Poor electrical connections.
- Inaccurate TFT sensor.
- Inaccurate speed sensors.

 

- Valve body faulty.
- Mechanical failure.

## DTC P1779: TORQUE DELIVERED SIGNAL

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

### Circuit Description

The ECM sends serial data to the TCM via the CAN bus. DTC 1779 does not indicate a problem with the transaxle or with the TCM. It does indicate that the ECM is not sending the required information to the TCM. Check for any related DTCs stored in the ECM and the Electronic Brake Traction Control Module (EBTCM). Clear DTCs in the TCM after a repair is made to the engine or anti-lock brake system.

### Conditions For Setting DTC

DTC will set under the following conditions:

- The ignition is on for 3 seconds.
- The condition exists for 4 seconds.
- TCM receives an invalid torque delivered signal from the ECM.

DTC P1779 is a type "A" DTC.

### Diagnostic Procedure

Check for any DTCs stored in the ECM and EBTCM related to the torque reduction/request circuit. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

## DTC P1780: TORQUE REDUCTION SIGNAL

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

### Circuit Description

The ECM sends serial data to the TCM via the CAN bus. DTC 1780 does not indicate a problem with the transaxle or with the TCM. It does indicate that the ECM is not sending the required information to the TCM. Check for any related DTCs stored in the ECM and the Electronic Brake Traction Control Module (EBTCM). Clear DTCs in the TCM after a repair is made to the engine or anti-lock brake system.

### Conditions For Setting DTC

DTC will set under the following conditions:

- The ignition is on for 3 seconds.
- The condition exists for 4 seconds.
- TCM receives an invalid torque delivered signal from the ECM.
- The TCM will inhibit adaptive learning if DTC P1780 is active.

DTC P1780 is a type "A" DTC.

**Diagnostic Procedure**

Check for any DTCs stored in the ECM and EBTCM related to the torque reduction/request circuit. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

## DTC P1781: ENGINE TORQUE CIRCUIT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The ECM sends serial data to the TCM via the CAN bus. DTC 1781 does not indicate a problem with the transaxle or with the TCM. It does indicate that the ECM is not sending the required information to the TCM. Check for any related DTCs stored in the ECM and the Electronic Brake Traction Control Module (EBTCM). Clear DTCs in the TCM after a repair is made to the engine or anti-lock brake system.

**Conditions For Setting DTC**

DTC will set under the following conditions:

- The ignition is on for 3 seconds.
- The condition exists for 4 seconds.
- TCM receives an invalid torque delivered signal from the ECM.
- The TCM will command Transaxle Protection Mode on if DTC P1781 is active.

DTC P1781 is a type "A" DTC.

**Diagnostic Procedure**

Check for any DTCs stored in the ECM and EBTCM related to the torque reduction/request circuit. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

## DTC P1791: PEDAL POSITION CIRCUIT

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The ECM sends serial data to the TCM via the CAN bus. DTC 1791 does not indicate a problem with the transaxle or with the TCM. It does indicate that the ECM is not sending the required information to the TCM. Check for any related DTCs stored in the ECM and the Electronic Brake Traction Control Module (EBTCM). Clear DTCs in the TCM after a repair is made to the engine or anti-lock brake system.

**Conditions For Setting DTC**

DTC will set under the following conditions:

- The ignition is on for 3 seconds.
- The condition exists for 4 seconds.
- TCM receives an invalid accelerator pedal position signal from the ECM.
- The TCM will command Transaxle Protection Mode on if DTC P1791 is active.

DTC P1791 is a type "A" DTC.

**Diagnostic Procedure**

Check for any DTCs stored in the ECM and EBTCM related to the torque reduction/request circuit. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

## DTC P1792: ENGINE COOLANT SIGNAL

**NOTE: For circuit identification, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .**

**Circuit Description**

The ECM sends serial data to the TCM via the CAN bus. DTC 1792 does not indicate a problem with the transaxle or with the TCM. It does indicate that the ECM is not sending the required information to the TCM. Check for any related DTCs stored in the ECM and the Electronic Brake Traction Control Module (EBTCM). Clear DTCs in the TCM after a repair is made to the engine or anti-lock brake system.

**Conditions For Setting DTC**

DTC will set under the following conditions:

- The ignition is on for 3 seconds.
- The condition exists for 4 seconds.
- TCM receives an invalid engine coolant signal from the ECM.
- The TCM will command Transaxle Protection Mode on if DTC P1781 is active.

DTC P1792 is a type "A" DTC.

**Diagnostic Procedure**

Check for any DTCs stored in the ECM and EBTCM related to the torque reduction/request circuit. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

### DTC P1868: TRANSMISSION FLUID LIFE

**Circuit Description**

The TCM contains a program to keep track of remaining transmission fluid life. The TCM slowly decrements transmission fluid life left when transmission fluid temperature is greater than 212°F (100°C). The program uses run time and transmission fluid temperature to determine the remaining fluid life. DTC P1868 sets if transmission fluid life = zero percent, and transmission fluid temperature is greater than 212°F (100°C).

**Conditions For Setting DTC**

DTC will set under the following condition:

- Transmission fluid life equals zero percent, and transmission fluid temperature is greater than 212°F (100°C).

DTC P1808 is a type "C" DTC.

**Diagnostic Procedure**

1. Replace the transmission fluid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.
2. Reset the transmission fluid life to 100 percent with a scan tool.
3. Record and clear DTCs.

## COMPONENT TESTS

### SHIFT SOLENOID TEST

Shift solenoids "l", "3", and "5" produce audible clicks when they are opened and/or closed. Shift solenoids "2" and "4" may not produce any audible sound. Do not assume that shift solenoids "2" and "4" are inoperable if they do not click. If the vehicle has the symptoms of a stuck solenoid, use the following procedure to determine if a shift solenoid is inoperable.

1. Using scan tool, command each shift solenoid on and off.
2. Listen for audible clicks from the solenoids. The use of chassis ears or a stethoscope will aid in this step.
3. Compare the results of the click test. See **SHIFT SOLENOID AUDIBLE CLICK** table.
4. If any shift solenoid does not click as expected, there may be an electrical condition, or the solenoid may be stuck.

Use the following procedure to isolate an electrical condition for a shift solenoid.

 

1. Disconnect the transaxle harness connector.
2. Connect a test light to the shift solenoid control circuit in the harness connector, and a good ground.
3. Command the shift solenoid on and off.
4. If the test light does not turn on and off, the circuit may be open, or the TCM may be inoperable.
5. Connect the Jumper Harness (J-45188) to the transaxle.
6. Measure the resistance of each shift solenoid. See **COMPONENT RESISTANCE** under ELECTRONIC COMPONENT SPECIFICATIONS.
7. If the resistance of any shift solenoid is not within the specification, check the internal harness for an open or high resistance. If okay, replace the shift solenoid.

Use the following procedure to determine if a shift solenoid is stuck.

1. Remove the shift solenoid. See appropriate AUTOMATIC article in TRANSMISSION SERVICING.

**NOTE: Do not leave 12 volts connected to the shift solenoid for more than 10 seconds continuously. Leaving 12 volts connected for a greater time will cause the solenoid to overheat.**

2. Repeatedly connect and disconnect 12 volts to the shift solenoid. See **Fig. 5** .
3. Observe the shift solenoid pintle.
4. If the shift solenoid pintle does not move, replace the shift solenoid.

**SHIFT SOLENOID AUDIBLE CLICK**

| Shift Solenoid | On | Off |
|---|---|---|
| 1 | (1) X | (2) (3) x or O |
| 2 | O | O |
| 3 | X or x | X |
| 4 | O | O |
| 5 | X | X |

(1) X = loud click sound.

(2) x = soft click sound.

(3) O = no click sound.

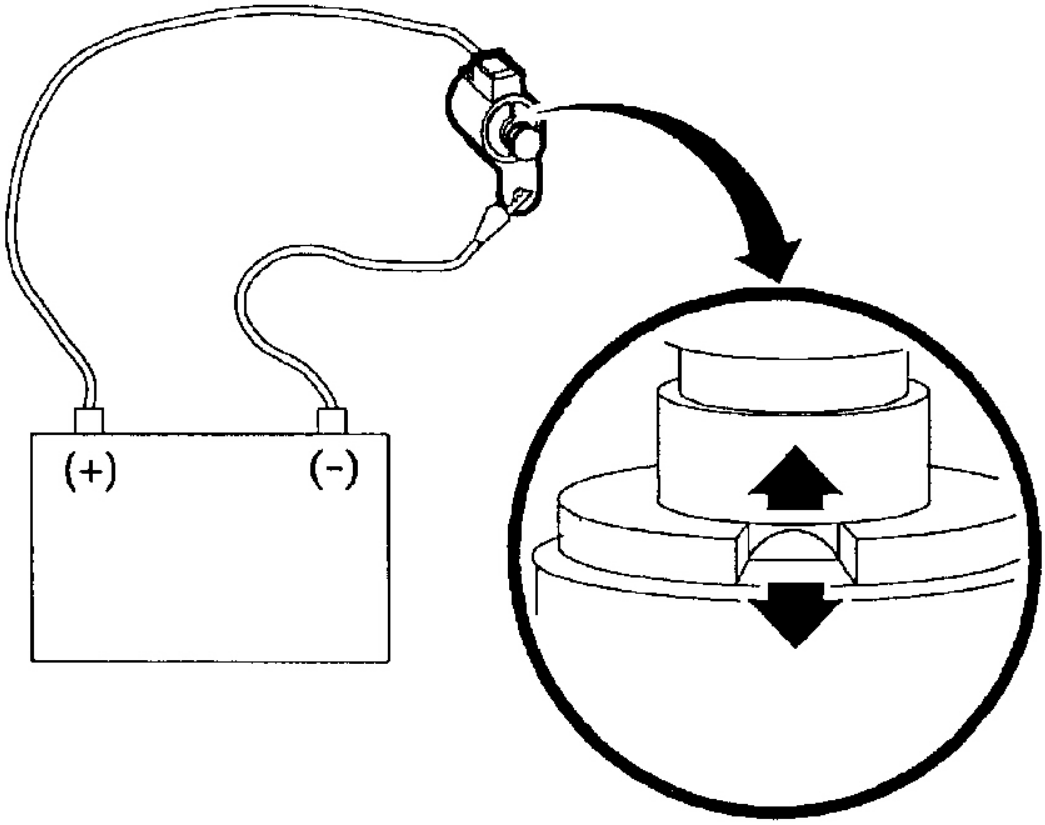


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**Fig. 5: Testing Shift Solenoid**
**Courtesy of GENERAL MOTORS CORP.**

## 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 AIR BAG DEACTIVATION PROCEDURES article in GENERAL INFORMATION.**

**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. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting**

 

**battery.**

## TRANSAXLE CONTROL MODULE

**NOTE: When replacing TCM with a NEW unit, TCM must be reprogrammed. After replacing TCM or if program needs to be updated, refer to latest Techline information on PCM reprogramming.**

**Removal**

Turn ignition off. Pull retaining tang from the TCM and rotate the TCM up. Remove the TCM from bracket. Disconnect TCM harness connectors. See **Fig. 6** .

**Installation**

**NOTE: DTC P0602 is set with new service TCM. When the TCM is reprogrammed with the correct software and calibrations, DTC P0602 will be erased.**

Connect the TCM harness connectors. Install the TCM into bracket. Reprogram the TCM with the correct calibration.

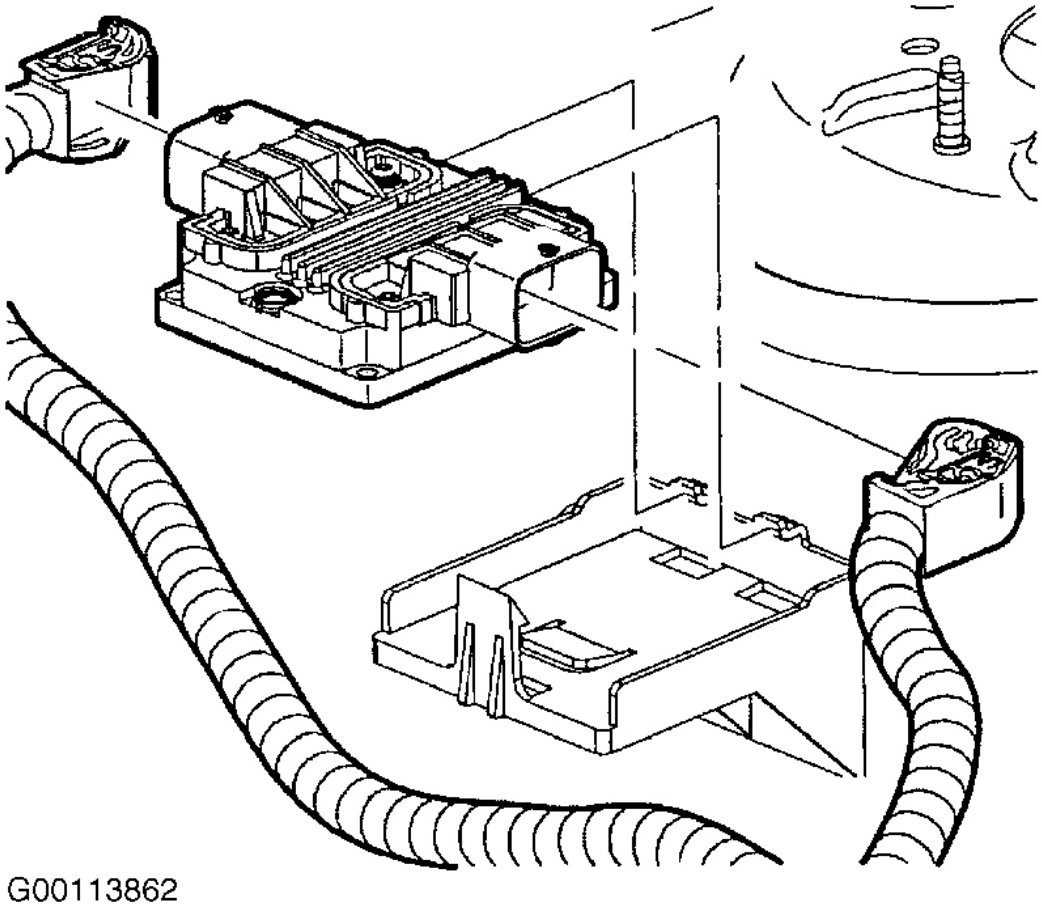


**Fig. 6: Removing & Installing TCM**
**Courtesy of GENERAL MOTORS CORP.**

## ELECTRONIC COMPONENT SPECIFICATIONS

### COMPONENT RESISTANCE

Connect DVOM between specified terminals at component or at transaxle connector. See **Fig. 12** . Measure individual component resistance at specified temperature. See **COMPONENT RESISTANCE SPECIFICATIONS** table. If resistance is not as specified, replace appropriate component.

### COMPONENT RESISTANCE SPECIFICATIONS

| Component | Pins (1) | Ohms (2) | Ohms (3) | Resistance To Ground (Case) |
|---|---|---|---|---|
| ISS | 1 & 2 (4) | Open | Open | Open |
| OSS | 1 & 2 (4) | Open | Open | Open |

| | | | | |
|---|---|---|---|---|
| Line PC Solenoid | 4-10 | 5.0-5.6 | 6.6-7.8 | Open |
| TCC Lock-Up PC Solenoid | 3-10 | 5.0-5.6 | 6.6-7.8 | Open |
| Shift PC Solenoid | 2-9 | 5.0-5.6 | 6.6-7.8 | Open |
| TFT Sensor (5) | 1-8 | 5.80-7.09 | .213-.263 | Open |
| Shift Solenoid "1" | 1-14 | 11-16 | 15-22 | Same |
| Shift Solenoid "2" | 1-7 | 11-16 | 15-22 | Same |
| Shift Solenoid "3" | 1-13 | 11-16 | 15-22 | Same |
| Shift Solenoid "4" | 1-6 | 11-16 | 15-22 | Same |
| Shift Solenoid "5" | 1-12 | 11-16 | 15-22 | Same |

(1) Resistance is measured between specified terminals at component or at transaxle harness connector.

(2) Resistance is measured at 68°F (20°C).

(3) Resistance is measured at 212°F (100°C).

(4) Resistance is measured at speed sensor.

(5) The resistance of this device is necessarily temperature dependent and will therefore vary far more than any other device. See **TRANSMISSION FLUID TEMPERATURE SENSOR RESISTANCE** table.

**TRANSMISSION FLUID TEMPERATURE SENSOR RESISTANCE**

| Temperature - °F (°C) | Ohms |
|---|---|
| 68 (20) | 4280 |
| 86 (30) | 2960 |
| 104 (40) | 2055 |
| 122 (50) | 1428 |
| 140 (60) | 1040 |
| 158 (70) | 751 |
| 176 (80) | 570 |
| 194 (90) | 425 |
| 212 (100) | 325 |
| 238 (110) | 254 |
| 293 (120) | 196 |

## CONNECTOR IDENTIFICATION

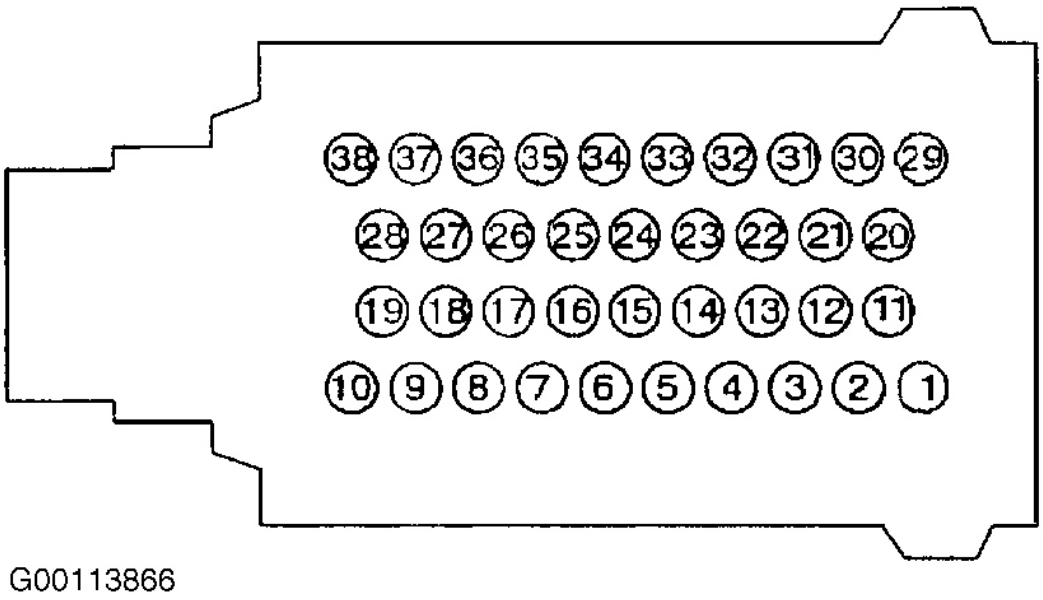


**Fig. 7: Identifying Transaxle Control Module "J1" & "J2" (Black) 38-Way Harness Connector Terminals**
**Courtesy of GENERAL MOTORS CORP.**

 

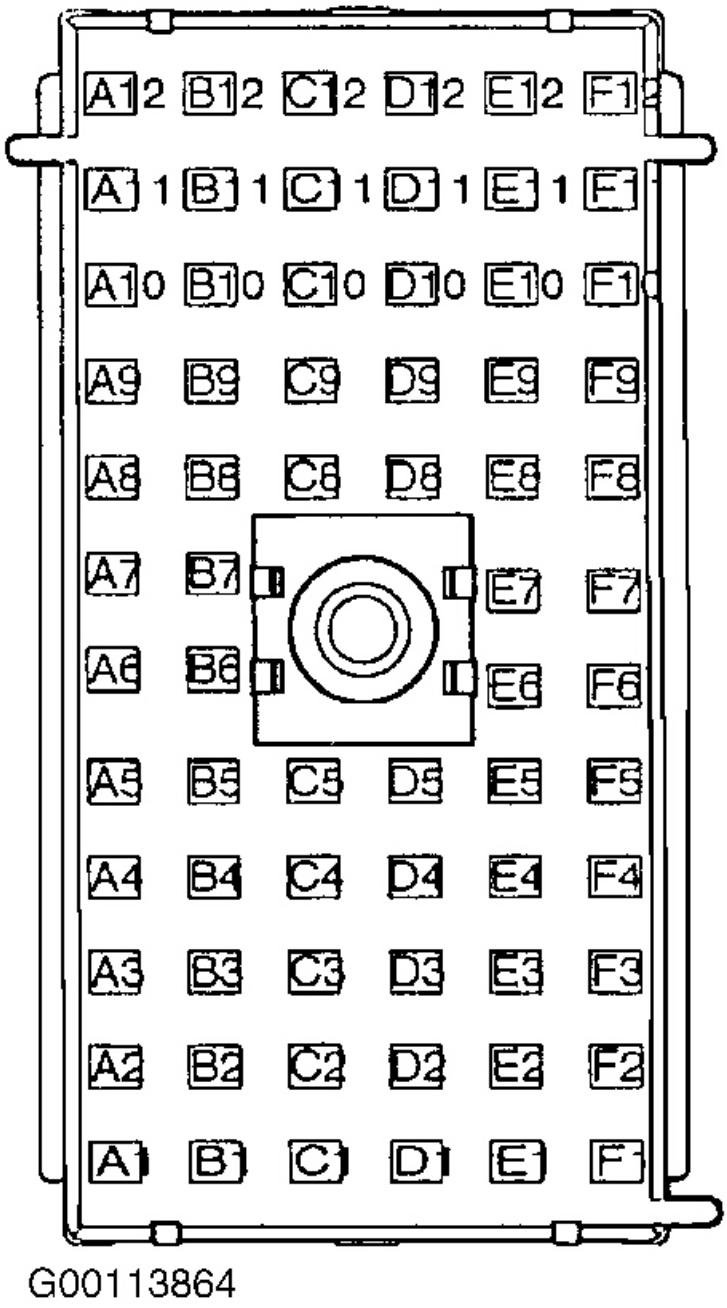


**Fig. 8: Identifying Underhood Fuse Block "J2" (Gray) 68-Way Harness Connector Terminals**
**Courtesy of GENERAL MOTORS CORP.**

 

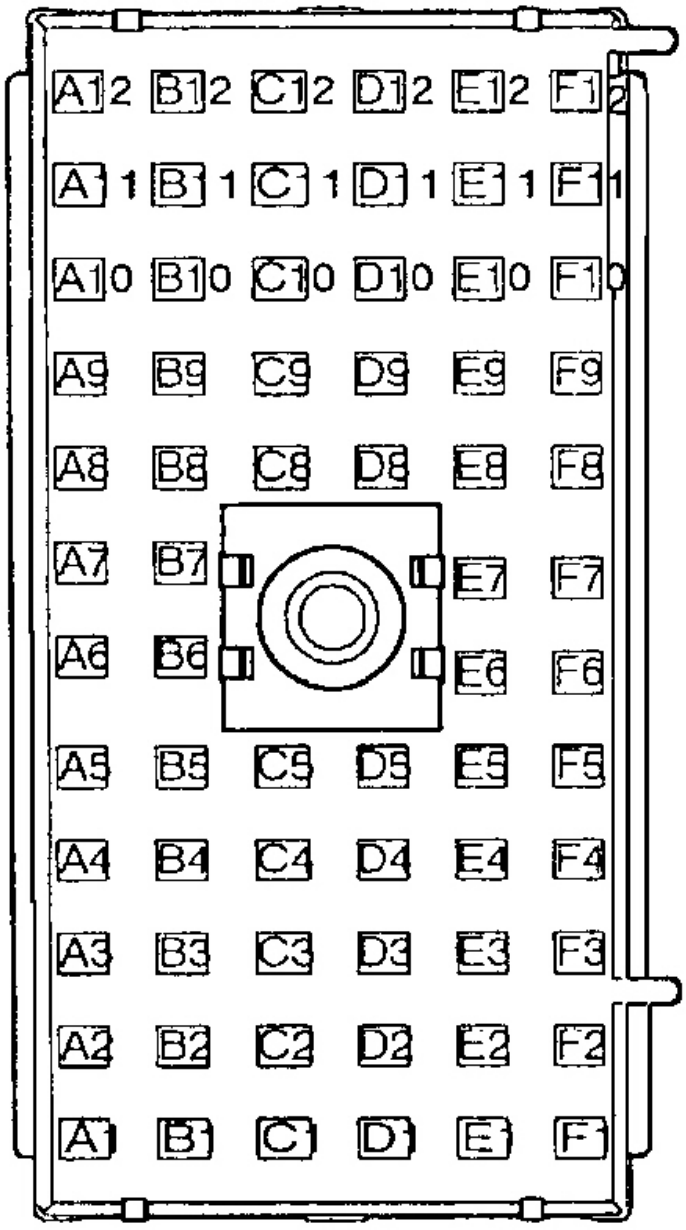


**Fig. 9: Identifying Underhood Fuse Block "J3" (Black) 68-Way Harness Connector Terminals**
**Courtesy of GENERAL MOTORS CORP.**

 

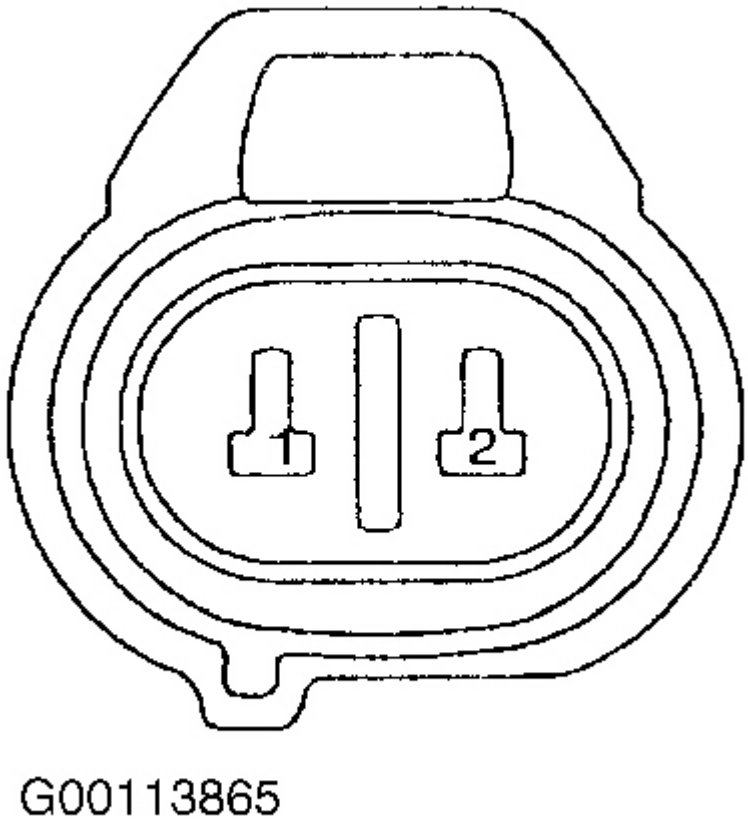


**Fig. 10: Identifying Input & Output Speed Sensor (Blue) 2-Way Harness Connector Terminals**
**Courtesy of GENERAL MOTORS CORP.**

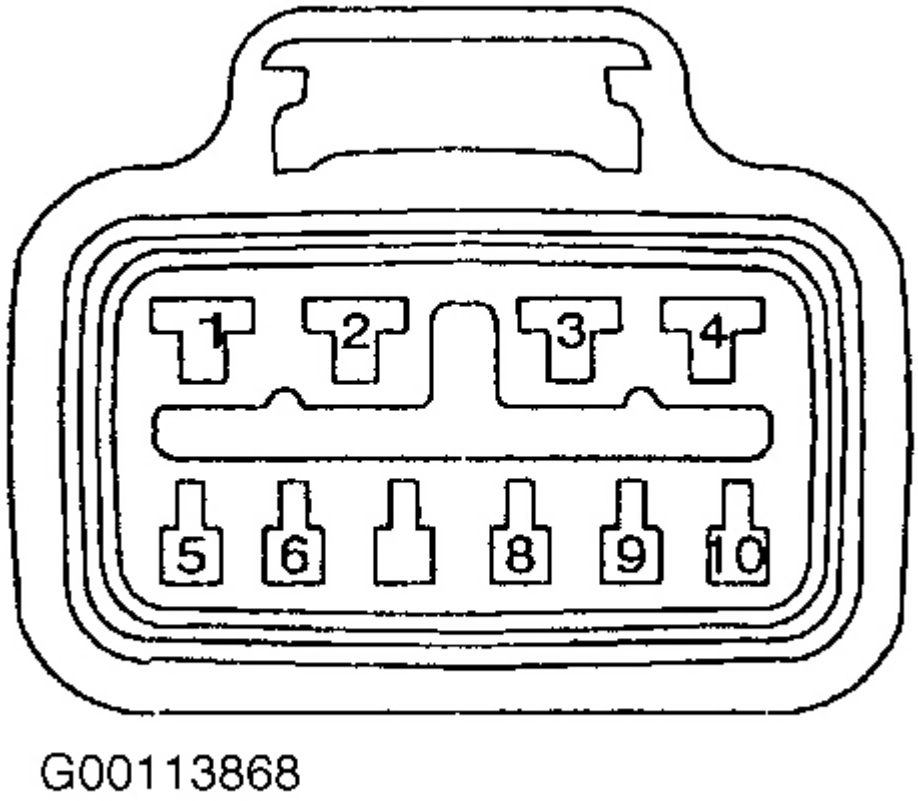


**Fig. 11: Identifying Transaxle Range Switch (Black) 10-Way Harness Connector Terminals**
**Courtesy of GENERAL MOTORS CORP.**

 

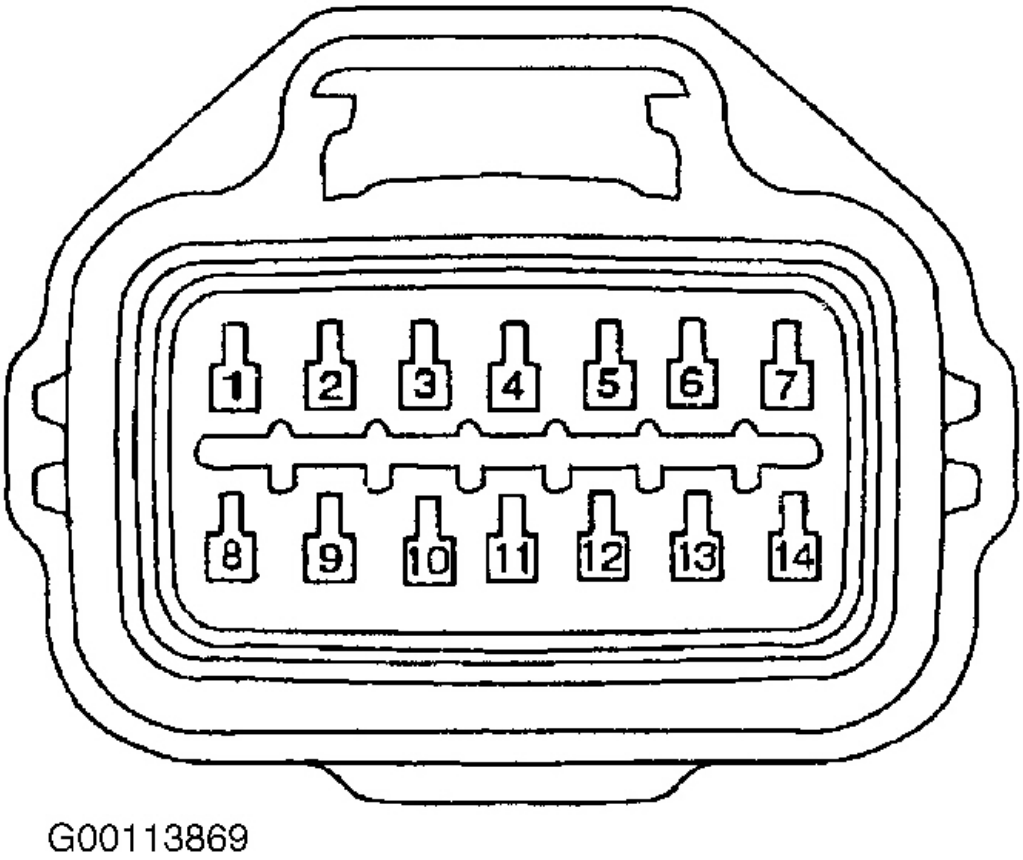


**Fig. 12: Identifying Transaxle "J1" (Gray) 14-Way Harness Connector Terminals**
**Courtesy of GENERAL MOTORS CORP.**

## WIRING DIAGRAMS

 

**Fig. 13: Transaxle Electronic Control System Wiring Diagram (Saturn Vue - 3.0L)**