

2006 Chevrolet HHR LT

2006 TRANSMISSION Manual Transmission - Getrag 5 Speed - HHR

2006 TRANSMISSION

Manual Transmission - Getrag 5 Speed - HHR

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Drain Plugs	38 N.m	28 lb ft
Front Transmission Mount Bolts	50 N.m	37 lb ft
Front Transmission Mount Through Bolt	100 N.m	74 lb ft
Heat Shield to Engine Block Bolt	30 N.m	22 lb ft
Heat Shield to Transmission Mount Bolt	10 N.m	89 lb in
Intermediate Shaft Bolt	100 N.m	74 lb ft
Rear Cover Bolts	25 N.m	18 lb ft
Rear Transmission Mount Bracket to Transmission Bolts	60 N.m	44 lb ft
Rear Transmission Mount Through Bolt	100 N.m	74 lb ft
Rear Transmission Mount to Frame Bolts	60 N.m	44 lb ft
Reverse Lockout Bolt	6 N.m	53 lb in
Reverse Switch	18 N.m	13 lb ft
Ring Gear	90 N.m	66 lb ft
Side Transmission Mount Bolts	45 N.m	33 lb ft
Side Transmission Mount to Mid-Rail Bolts	34 N.m	25 lb ft
Shaft Bolts	100 N.m	74 lb ft
Shift Cable Attachment Nut	10 N.m	89 lb in
Shift Control Nuts	25 N.m	18 lb ft
Shifter Guide Bolt	25 N.m	18 lb ft
Shifter Retaining Bolts	25 N.m	18 lb ft
Speed Sensor	12 N.m	106 lb in
Transmission Housing Bolts	27 N.m	20 lb ft
UBEC Bracket Bolts	25 N.m	18 lb ft
UBEC Bracket Nuts	10 N.m	89 lb in
UBEC Positive Post	10 N.m	89 lb in

SEALERS, ADHESIVES, AND LUBRICANTS

Sealers, Adhesives, and Lubricants

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Application	Type of Material	Part Number
Case Halves	Sealant	12378516
Differential Ring Gear Bolt	Threadlocker	21005994
Drain Plugs	Sealant	21485278
Input Shaft Bolt	Threadlocker	21005994
Intermediate Shaft Bolt	Threadlocker	21005994
Output Shaft Bolt	Threadlocker	21005994
Rear Cover	Sealant	21019581
Reverse Lockout Lever Bolt	Threadlocker	21485277
Backup Lamp Switch	Sealant	21019581
Shifter Cover	Sealant	12378516
Shifter Guide Bolt	Sealant	21485278
Transmission Fluid	DEXRON® III	21019223
Vehicle Speed Sensor Bolt	Threadlocker	21485277

LUBRICATION SPECIFICATIONS**Lubrication Specifications**

Application	Specification	
	Metric	English
DEXRON®III	1.7 liters	1.8 quarts

SHIM SIZE SPECIFICATIONS**Shim Size Specifications**

Shim Thickness	
Metric	English
0.5 mm	0.0197 in
0.55 mm	0.0217 in
0.6 mm	0.0236 in
0.65 mm	0.0256 in
0.7 mm	0.0276 in
0.75 mm	0.0295 in
0.8 mm	0.0315 in
0.85 mm	0.0335 in
0.9 mm	0.0354 in
0.95 mm	0.0374 in
1.00 mm	0.0394 in
1.05 mm	0.0413 in

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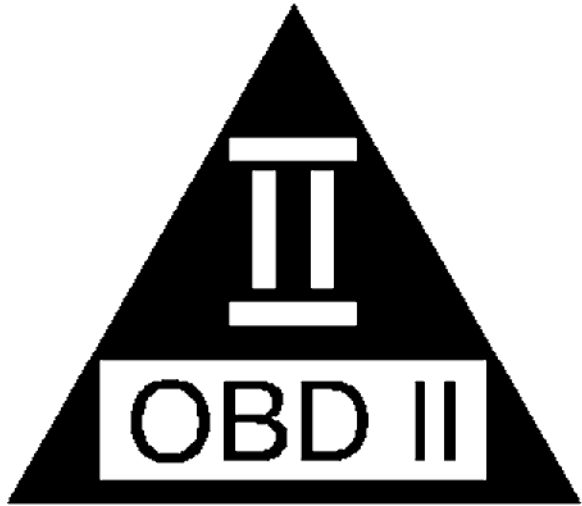
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1.1 mm	0.0433 in
1.15 mm	0.0453 in
1.2 mm	0.0473 in
1.25 mm	0.0493 in
1.3 mm	0.0512 in
1.35 mm	0.0531 in

SCHEMATIC AND ROUTING DIAGRAMS

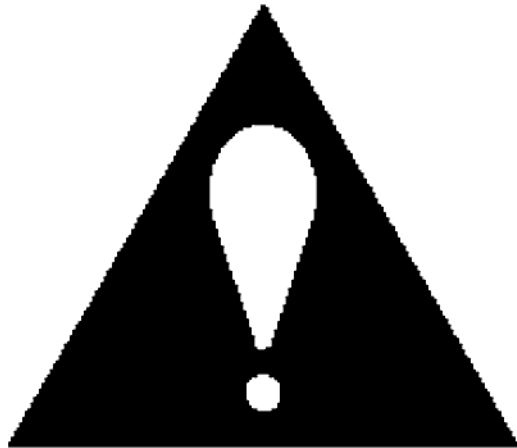
MANUAL TRANSMISSION SCHEMATIC ICONS

Manual Transmission Schematic Icons

Icon	Icon Definition
	NOTE: The OBD II symbol is used on the circuit diagrams in order to alert the technician that the circuit is essential for proper OBD II emission control circuit operation. Any circuit which fails and causes the malfunction indicator lamp (MIL) to turn ON, or causes emissions-related component damage, is identified as an OBD II circuit.
	IMPORTANT: Twisted-pair wires provide an effective "shield" that helps protect sensitive electronic components from electrical interference. If the wires were covered with shielding, install new shielding. In order to prevent electrical interference from degrading the performance of the connected components, you must maintain the proper specification when making any repairs to the twisted-pair wires shown : • The wires must be twisted a

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minimum of 9 turns per 31 cm (12 in) as measured anywhere along the length of the wires

- The outside diameter of the twisted wires must not exceed 6.0 mm

Refer to **Splicing Twisted or Shielded Cable** in Wiring Systems.

MANUAL TRANSMISSION SCHEMATICS

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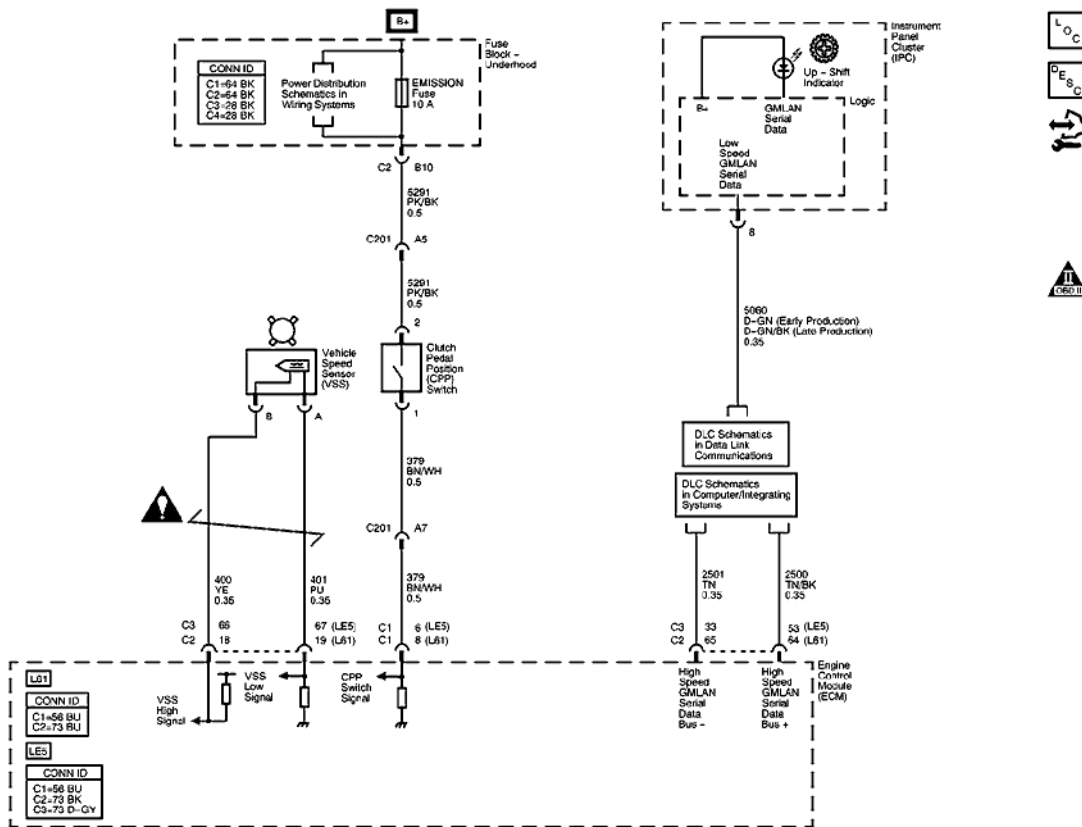


Fig. 1: Manual Transmission Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

MANUAL TRANSMISSION COMPONENT VIEWS

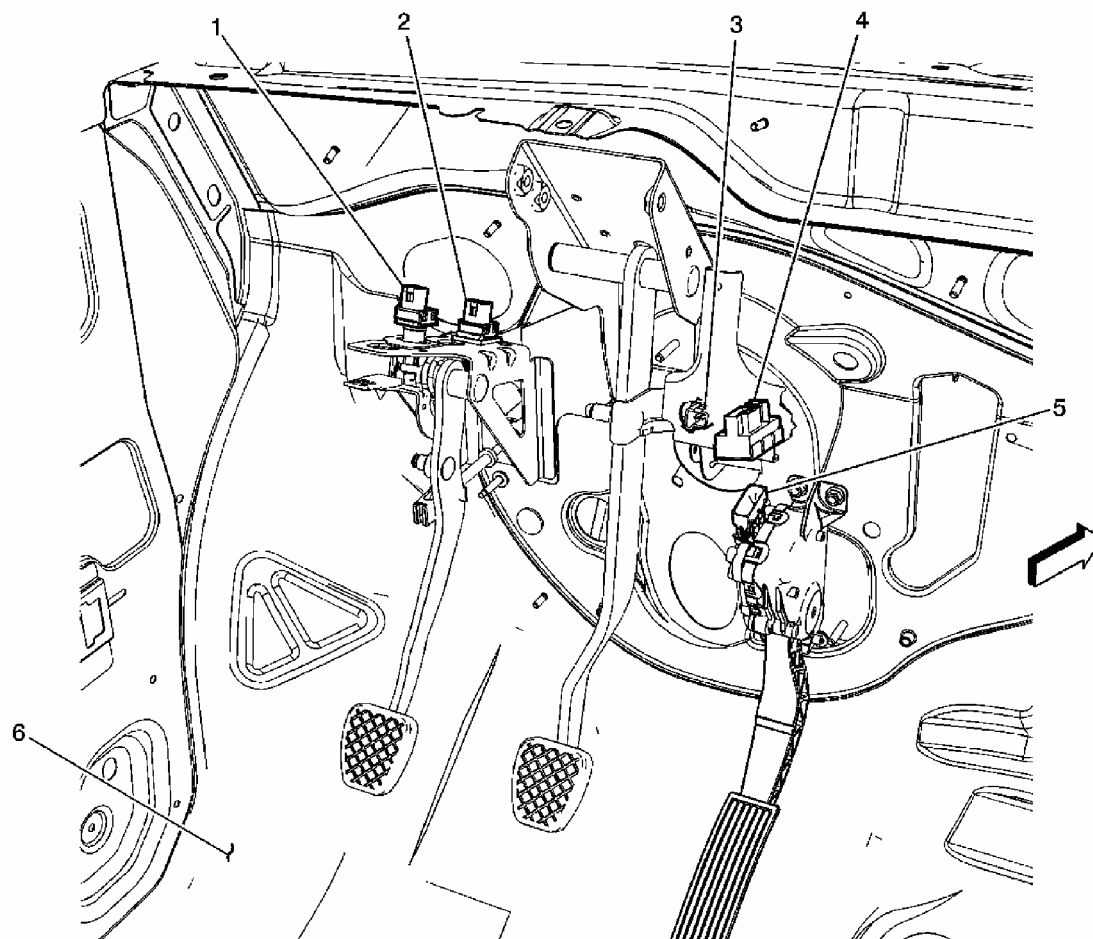


Fig. 2: Pedal Assemblies

Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

Callout	Component Name
1	Clutch Pedal Position (CPP) Switch (M86)
2	Clutch Start Switch (M86)
3	Stop Lamp Switch
4	Stop Lamp / Torque Converter Clutch (TCC) Switch / Cruise Release Switch
5	Accelerator Pedal Position (APP) Sensor
6	Floor Panel

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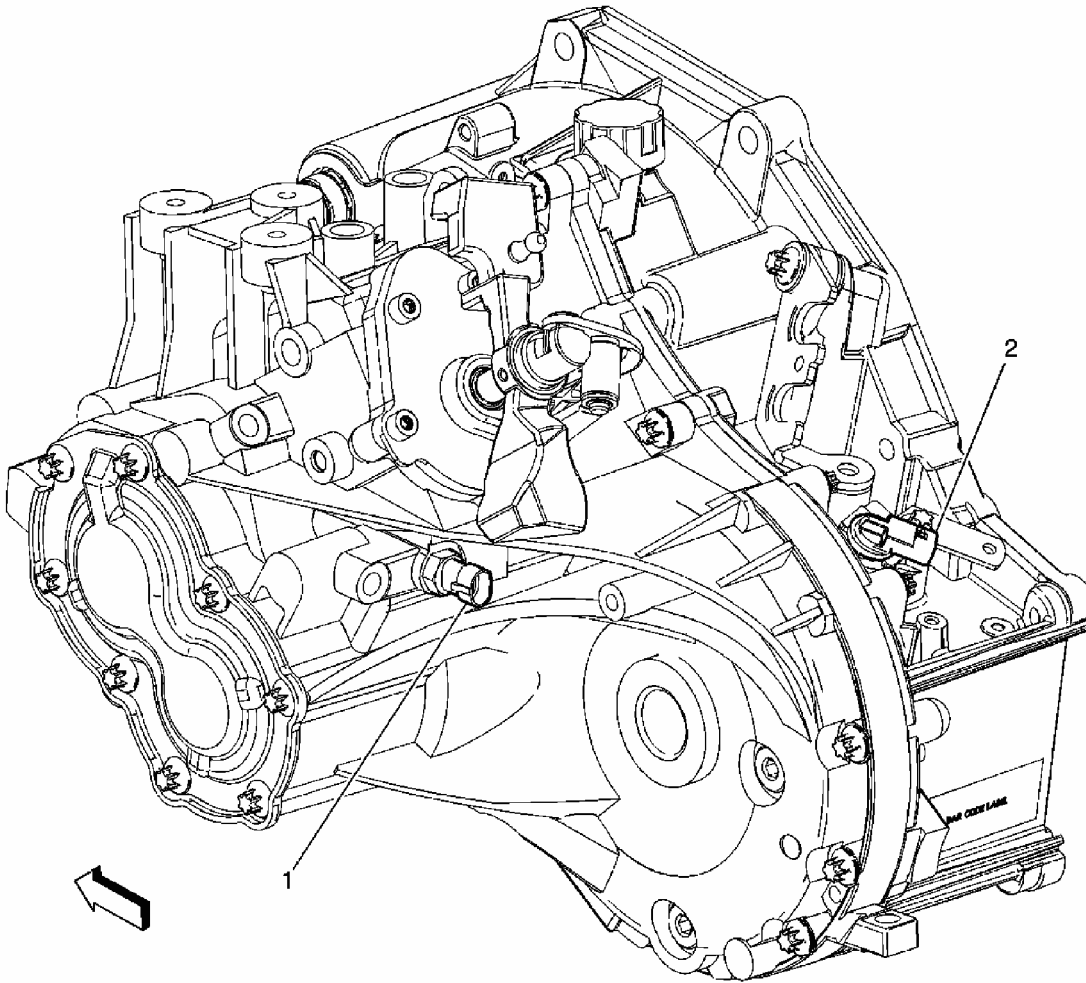


Fig. 3: Manual Transmission (M86)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 3

Callout	Component Name
1	Backup Lamp Switch
2	Vehicle Speed Sensor

MANUAL TRANSMISSION CONNECTOR END VIEWS

Clutch Pedal Position (CPP) Sensor

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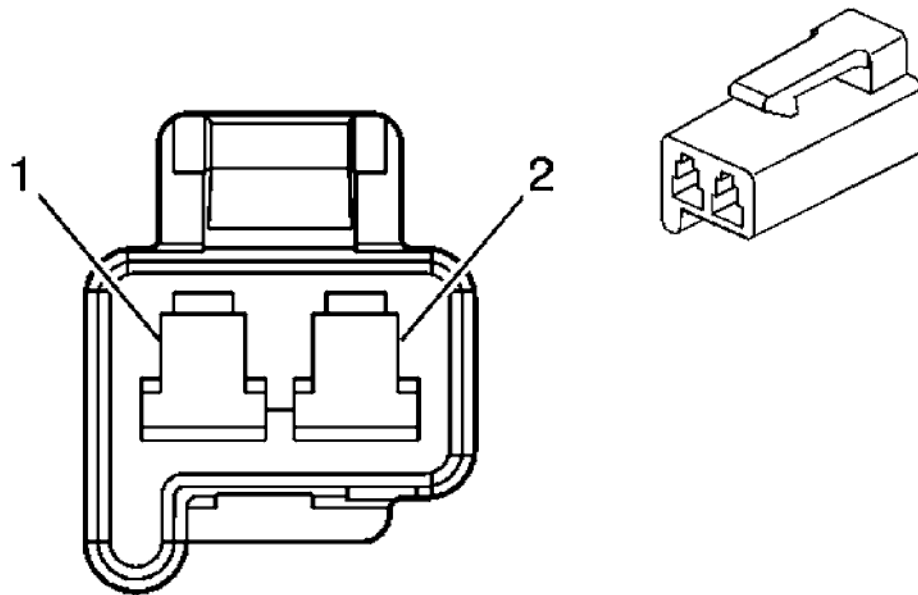


Fig. 4: Clutch Pedal Position (CPP) Sensor Connector
Courtesy of GENERAL MOTORS CORP.

Manual Transmission Connector End Views

Connector Part Information

- OEM:
- Service:
- Description: 2-Way F Micro-Pack 280 Series Delphi Packard (L-GY)

Terminal Part Information

- Terminal/Tray:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

Clutch Pedal Position (CPP) Sensor

Pin	Wire Color	Circuit No.	Function
1	BN/WH	379	CPP Switch Signal
2	PK/BK	5291	Ignition 1 Voltage

Vehicle Speed Sensor (VSS)

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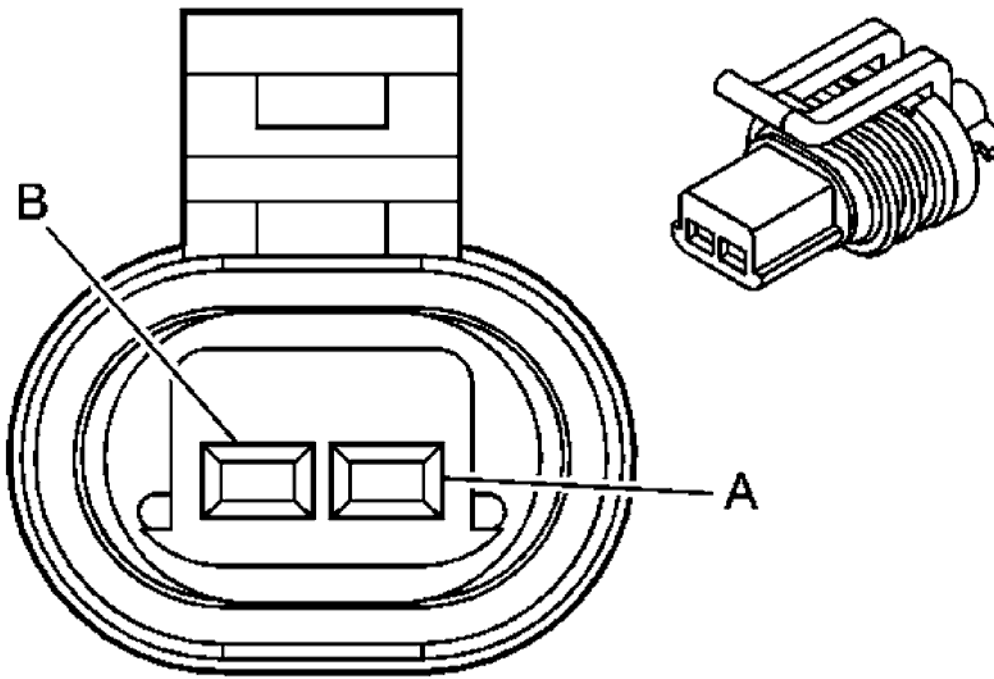


Fig. 5: Vehicle Speed Sensor (VSS) Connector
Courtesy of GENERAL MOTORS CORP.

Manual Transmission Connector End Views

Connector Part Information

- OEM: 15336024
- Service:
- Description: 2-Way F GT 150 Series Sealed Delphi Packard (BK)

Terminal Part Information

- Terminal/Tray:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

Vehicle Speed Sensor (VSS)

Pin	Wire Color	Circuit No.	Function
A	PU	401	VSS Low Signal
B	YE	400	VSS High Signal

DISASSEMBLED VIEWS

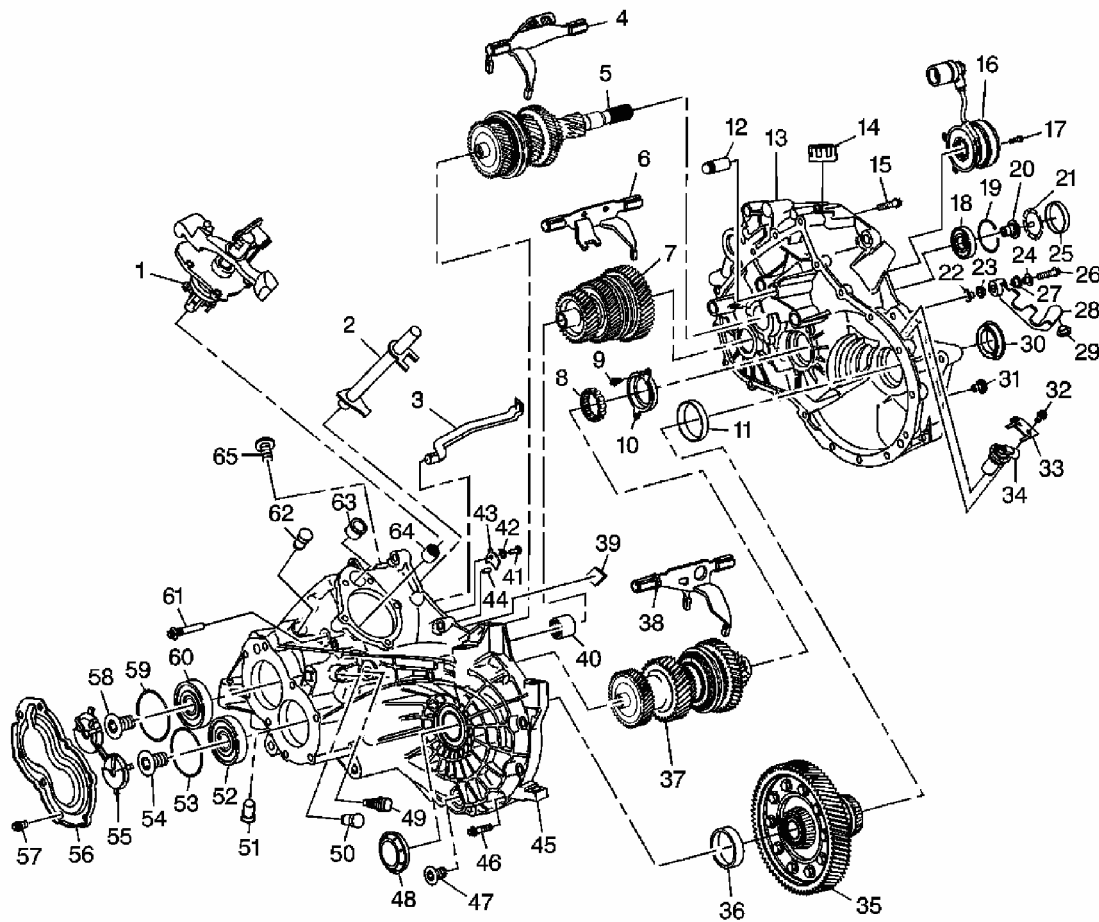


Fig. 6: Case Components
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	Shifter
2	Shift Rod
3	Oil Tube
4	3rd/4th Gear Shift Fork
5	Input Shaft Assembly
6	1st/2nd Gear Shift Fork
7	Intermediate Shaft Assembly
8	Output Shaft Roller Bearing
9	Output Shaft Bearing Race Bolt
10	Output Shaft Bearing Race
11	Clutch Housing Differential Bearing Race

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12	Shifter Detent
13	Clutch Housing
14	Fill Cap
15	Clutch Housing to Transaxle Case Bolt
16	Actuator
17	Actuator Bolt
18	Intermediate Shaft Roller Bearing
19	Intermediate Shaft Bearing Snap Ring
20	Intermediate Shaft Bolt
21	Oil Guide
22	Shift Cable Bracket Spacer
23	Shift Cable Bracket Isolators
24	Shift Cable Bracket Spacer
25	Intermediate Shaft Seal
26	Shift Cable Bracket Bolt
27	Shift Cable Bracket Isolators
28	Shift Cable Bracket
29	Shift Cable Bracket Isolators
30	Clutch Housing Differential Output Shaft Seal
31	Lubricant Check Plug
32	Vehicle Speed Sensor Bolt
33	Vehicle Speed Sensor Retaining Bracket
34	Vehicle Speed Sensor
35	Differential Assembly
36	Transaxle Case Differential Bearing Race
37	Output Shaft Assembly
38	5th/Reverse Gear Shift Fork
39	Magnet
40	Intermediate Shaft Needle Bearing
41	Bolt, if equipped
42	Spring, if equipped
43	Lever, if equipped
44	Alignment Pin
45	Transaxle Case
46	Transaxle Case to Clutch Housing Bolt
47	Lubricant Drain Plug
48	Transaxle Case Differential Output Shaft Seal
49	Reverse Lamp Switch
50	

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	Shift Shaft Detents
51	Shift Shaft Detents
52	Bearing
53	Output Shaft Bearing Snap Ring
54	Output Shaft Bolt
55	Oil Guide
56	Rear Cover
57	Rear Cover Bolts
58	Input Shaft Bolt
59	Input Shaft Bearing Snap Ring
60	Bearing
61	Shifter Guide Bolt
62	Shift Shaft Detents
63	Shift Rod Bushing
64	Shifter Bearing
65	Fill Plug

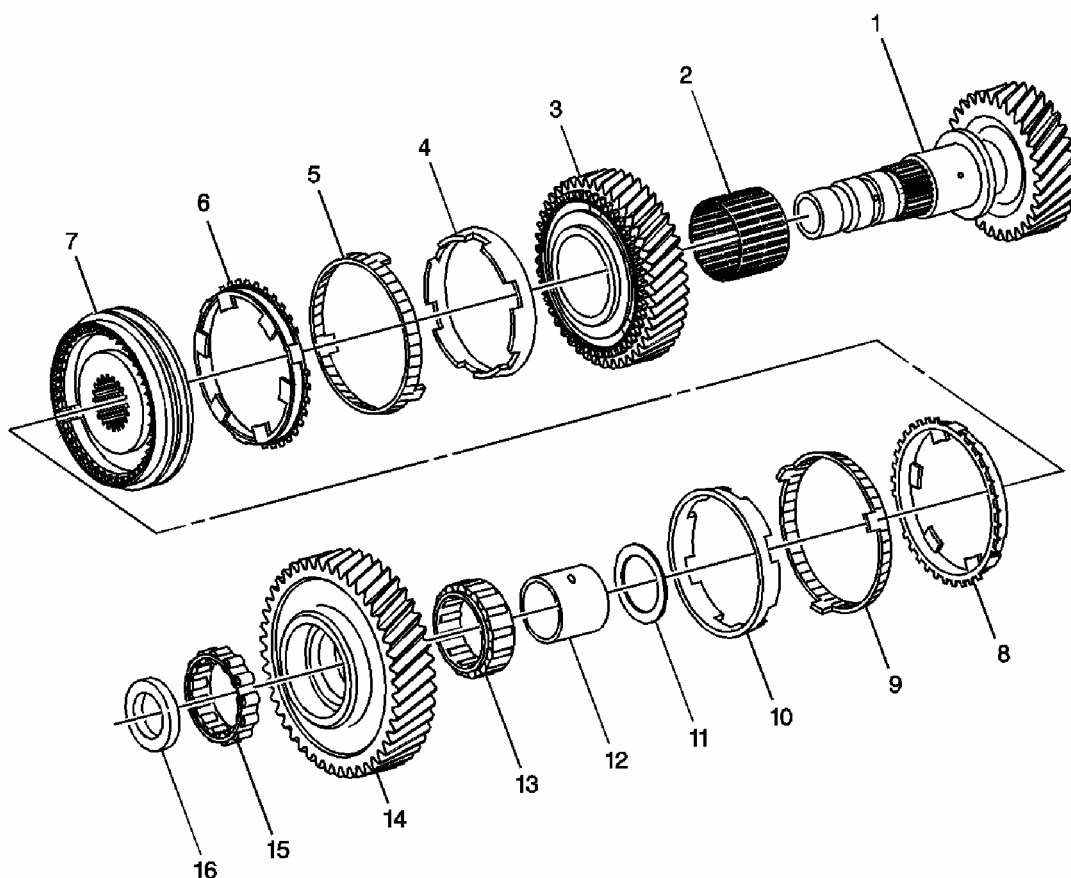


Fig. 7: Intermediate Shaft Components

Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
1	Intermediate Shaft
2	Caged Needle Bearings
3	2nd Gear
4	2nd Gear Inner Cone
5	2nd Gear Blocking Ring
6	2nd Gear Outer Cone
7	1st/2nd Synchronizer Assembly
8	1st Gear Outer Cone
9	1st Gear Blocking Ring
10	1st Gear Inner Cone
11	Thrust Washer
12	Bearing Collar
13	Roller Bearing
14	1st Gear
15	Roller Bearing
16	Thrust Washer

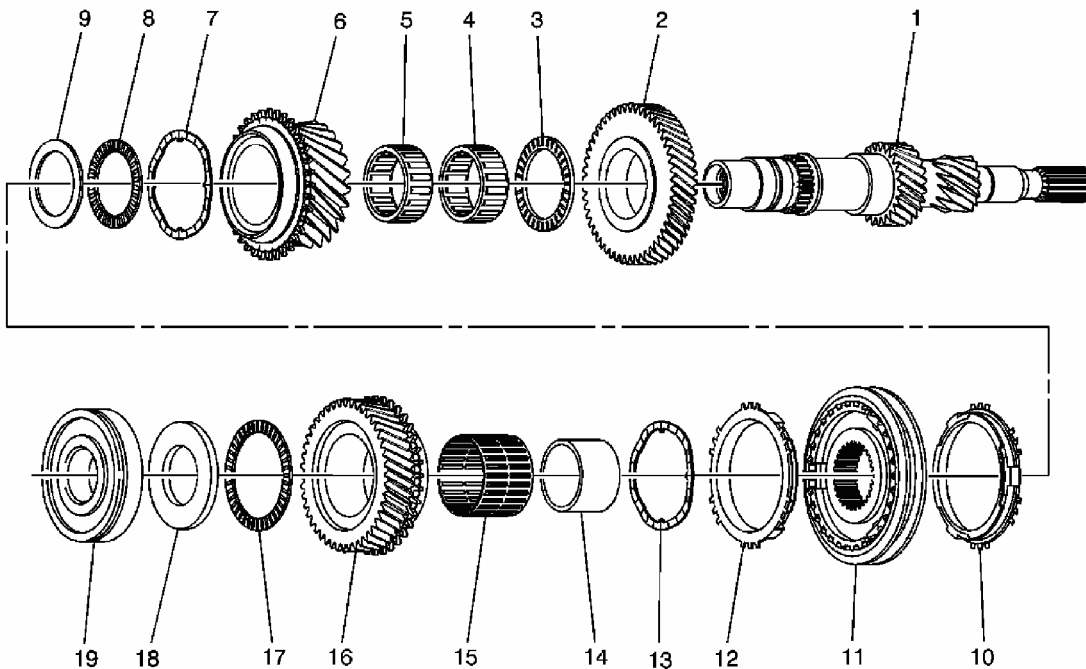


Fig. 8: Input Shaft Components
Courtesy of GENERAL MOTORS CORP.

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Callouts For Fig. 8

Callout	Component Name
1	Input Shaft
2	5th Drive Gear
3	Thrust Bearing
4	Caged Needle Bearing
5	Caged Needle Bearing
6	3rd Drive Gear
7	Wavy Washer
8	Thrust Bearing
9	Thrust Washer
10	3rd Gear Blocking Ring
11	3rd/4th Synchronizer Assembly
12	4th Gear Blocking Ring
13	Wavy Washer
14	Bearing Collar
15	Caged Needle Bearing
16	4th Drive Gear
17	Thrust Bearing
18	Thrust Washer
19	Input Shaft Bearing

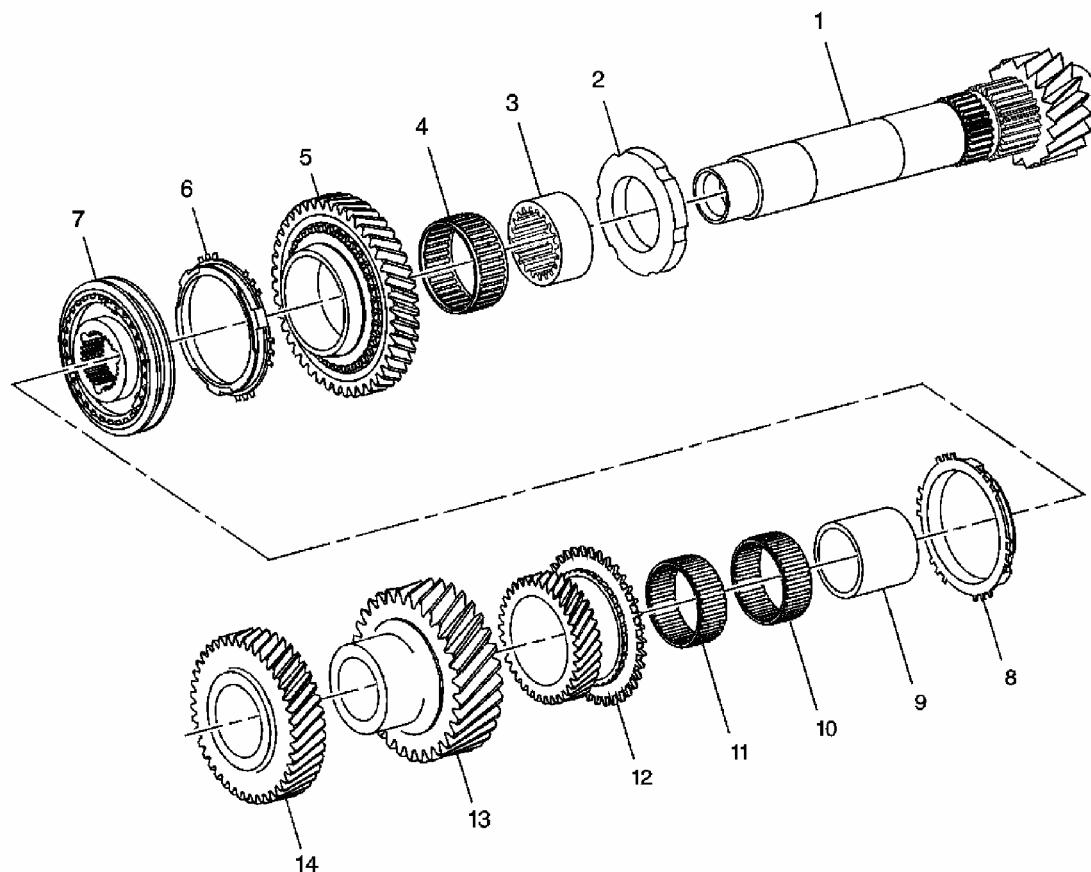


Fig. 9: Output Shaft Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 9

Callout	Component Name
1	Output Shaft
2	Thrust Washer
3	Bearing Collar
4	Caged Needle Bearing
5	Reverse Gear
6	Reverse Blocking Ring
7	5th/Reverse Synchronizer Assembly
8	5th Gear Blocking Ring
9	Bearing Collar
10	Caged Needle Bearing
11	Caged Needle Bearing
12	5th Driven Gear
13	3rd Driven Gear
14	4th Driven Gear

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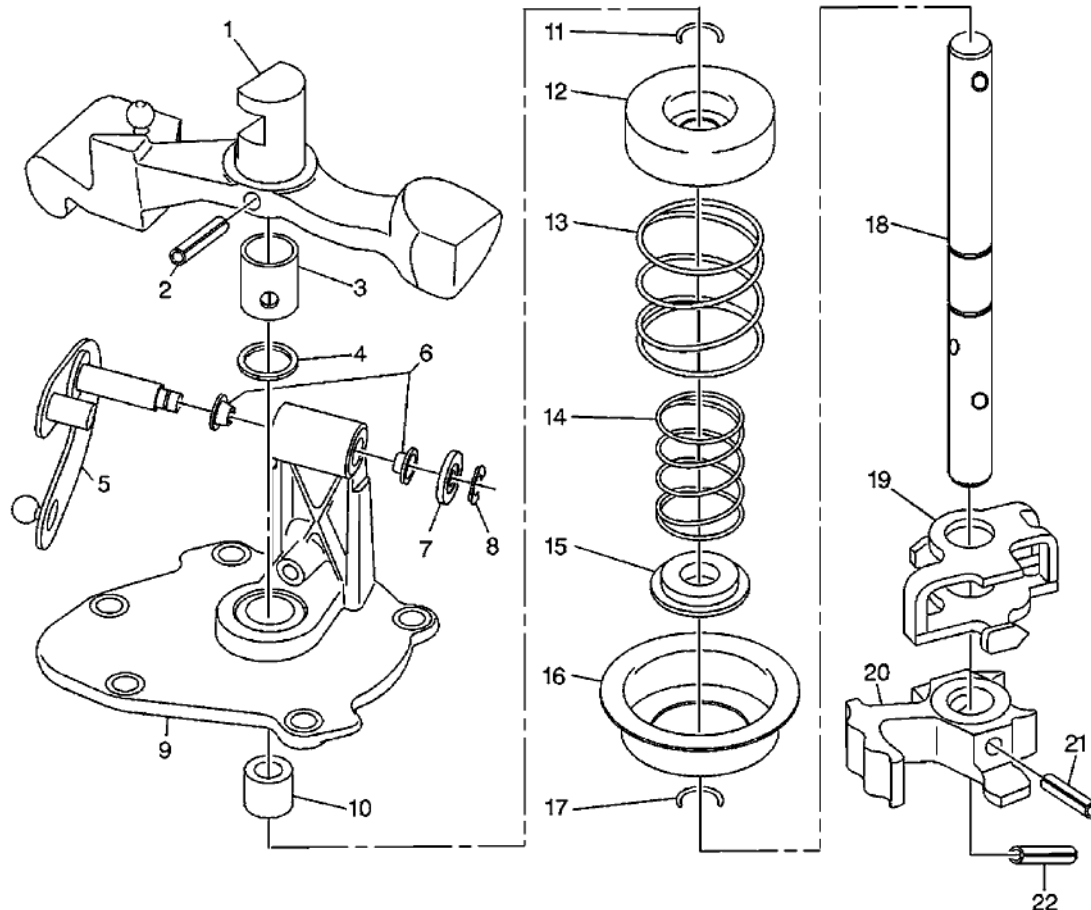


Fig. 10: Shifter Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 10

Callout	Component Name
1	Shift Lever
2	Roll Pin
3	Cover Bushing
4	Seal
5	Select Lever
6	Bushing
7	Washer
8	Retainer
9	Shift Cover
10	Bushing
11	Retainer
12	Outer Spring Seat
13	Outer Spring
14	Inner Spring
15	Inner Spring Seat
16	Shift Fork
17	Shift Fork Retainer
18	Shift Fork Shaft
19	Shift Fork
20	Shift Fork Retainer
21	Shift Fork Pin
22	Shift Fork Pin Retainer

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14	Inner Spring
15	Inner Spring Seat
16	End Cap
17	Retainer
18	Shift Shaft
19	Outer Control Lever
20	Inner Control Lever
21	Roll Pin
22	Reverse Inhibit Roll Pin

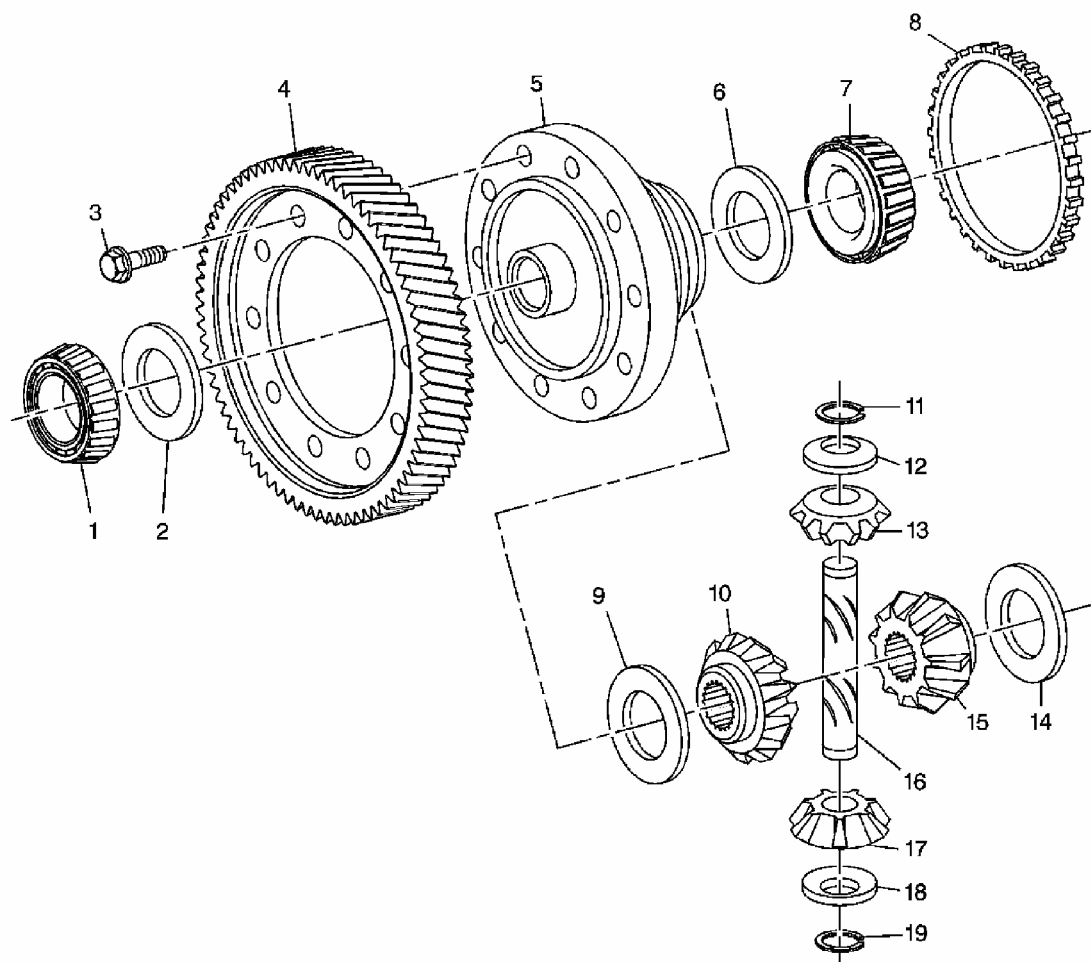


Fig. 11: Differential Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 11

Callout	Component Name
1	Left Differential Side Bearing
2	Left Differential Shim

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3	Differential Ring Gear Bolts
4	Differential Ring Gear
5	Differential Case
6	Right Differential Shim
7	Right Differential Side Bearing
8	Vehicle Speed Sensor (VSS) Ring
9	Side Gear Thrust Washer
10	Side Gear
11	Pinion Shaft Snap Ring
12	Pinion Gear Thrust Washer
13	Pinion Gear
14	Side Gear Thrust Washer
15	Side Gear
16	Pinion Shaft
17	Pinion Gear
18	Pinion Gear Thrust Washer
19	Pinion Shaft Snap Ring

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC P0502	Vehicle Speed Sensor (VSS) Circuit Low Voltage
DTC P0503	Vehicle Speed Sensor (VSS) Circuit Intermittent
DTC P0833	Clutch Pedal Switch 2 Circuit

DIAGNOSTIC STARTING POINT - MANUAL TRANSMISSION

Begin the system diagnosis with **Diagnostic System Check - Vehicle** . The Diagnostic System Check will provide the following information:

- The identification of the control module or modules which command the system.
- The ability of the control module or modules to communicate through the serial data circuit.
- The identification of any stored DTCs and the status of the codes.

Use the **Diagnostic System Check - Vehicle** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

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SCAN TOOL DATA LIST

Use the scan tool data values under the following conditions:

- The **Diagnostic System Check - Vehicle** is complete.
- The On-Board Diagnostics are functioning properly.
- There are no diagnostic trouble codes (DTCs) present.

The values below represent a typical display recorded from a properly functioning system.

IMPORTANT: Do not use a scan tool that displays faulty data. Report the condition to the scan tool manufacturer. The use of a faulty scan tool can result in misdiagnosis and the unnecessary replacement of parts.

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by General Motors for use in diagnosis.

Scan tool values below were recorded under the following conditions:

- Engine at idle
- Upper radiator hose hot
- Closed throttle
- Transmission in Neutral
- Closed Loop operation
- Accessories OFF
- Brake pedal not applied

Engine Data List 2.2L (L61)

Scan Tool Parameter	*Data List	Units Displayed	Typical Data Value
CPP Switch (If Equipped)	1	APPLIED/RELEASED	RELEASED
Vehicle Speed Sensor	1, 2, 3, 4, 5, 6, 7, 8, 10, 11	km/h (mph)	0

*Data List Legend

- Engine Data (1)
- EVAP Data (2)
- Fuel Trim Data (3)

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- H02S Data (4)
- Ignition Data (5)
- Misfire Data (6)
- HVAC Data (7)
- Cruise Control Data (8)
- Electrical/Theft Data (9)
- IPC Data (10)
- I/M Data (11)

Engine Data List 2.4L (LE5)

Scan Tool Parameter	*Data List	Units Displayed	Typical Data Value
CPP Switch (If Equipped)	F0, F8	APPLIED/RELEASED	RELEASED
Vehicle Speed Sensor	ALL	km/h (mph)	0

*Data List Legend

- Engine Data (F0)
- CMP Actuator Data (F1)
- EVAP Data (F2)
- Fuel Trim Data (F3)
- H02S Data (F4)
- Ignition Data (F5)
- Induction Data (F6)
- Misfire Data (F7)
- TAC Data (F8)

SCAN TOOL DATA DEFINITIONS

The Transmission Scan Tool Data Definitions contain a brief description of all manual transmission related parameters available on the scan tool. The list is in alphabetical order.

CPP Switch

This parameter displays the state of the clutch pedal switch circuit input. The scan tool will display APPLIED when the clutch pedal is depressed, and RELEASED when the clutch pedal is released.

Vehicle Speed Sensor

This parameter displays the speed at which the vehicle is traveling. The scan tool displays vehicle speed as kilometers per hour (km/h), miles per hour (mph). The vehicle speed is calculated based on the input signal from the vehicle speed sensor.

DIAGNOSTIC TROUBLE CODE (DTC) TYPE DEFINITIONS

Diagnostic trouble codes (DTCs) are categorized into emissions and non-emissions related types. If a DTC is set, the malfunction indicator lamp (MIL) and failure data are utilized by the control module diagnostic executive according to the DTC type. Each DTC is set based upon the individual DTCs running and setting criteria. Read the Action Taken When the DTC Sets and Conditions for Clearing the MIL/DTC in the supporting text for taking appropriate action to each DTC. All DTCs can be cleared with a scan tool. Only clear DTCs when instructed to do so in the diagnostic table.

Emissions Related DTCs

Type A

The following actions occur at the time of the first failure:

- The MIL is turned ON.
- A DTC is stored in memory.
- The Freeze Frame/Failure Record data is stored.
- The Failure Records are updated after the first failure of each ignition cycle.

Some Type A DTCs will not perform the above actions when the DTC first detects a failure. Two consecutive failures are required. This allows systems, such as evaporative emission (EVAP), to accurately identify what failure exists before setting a DTC and requesting MIL illumination.

Type B

The following actions occur at one of the following times:

- First failure:
 - The MIL is not turned ON.
 - A DTC is stored in memory as a Failed Last Test.
 - The Failure Record data is stored.
- Second consecutive drive cycle with a failure:
 - The MIL is turned ON.
 - A DTC is stored in memory as a history DTC.
 - The Freeze Frame data is stored.
 - The Failure Record data is stored.

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- Second non-consecutive drive cycle with a failure:
 - The MIL is not turned ON.
 - A DTC is stored in memory as a Failed Last Test.
 - The Failure Record data is stored.

Non-Emissions Related DTCs

Type C

The following actions occur at the time of a failure:

- The MIL does not turn ON.
- The driver information center will display SERVICE VEHICLE.
- A DTC is stored in memory as a history DTC.
- The Failure Record data is stored.
- The Failure Records are updated after the first failure of each ignition cycle.

Type D

The following actions occur at the time of a failure:

- The MIL does not turn ON.
- The driver information center will not display SERVICE VEHICLE.
- A DTC is stored in memory as a history DTC.
- The Failure Record data is stored.
- The Failure Records are updated after the first failure of each ignition cycle.

DIAGNOSTIC TROUBLE CODE (DTC) LIST/TYPE

Diagnostic Trouble Code (DTC) List/Type

Diagnostic Trouble Code (DTC)	Type
DTC P0502	B
DTC P0503	B
DTC P0833	B

DTC P0502

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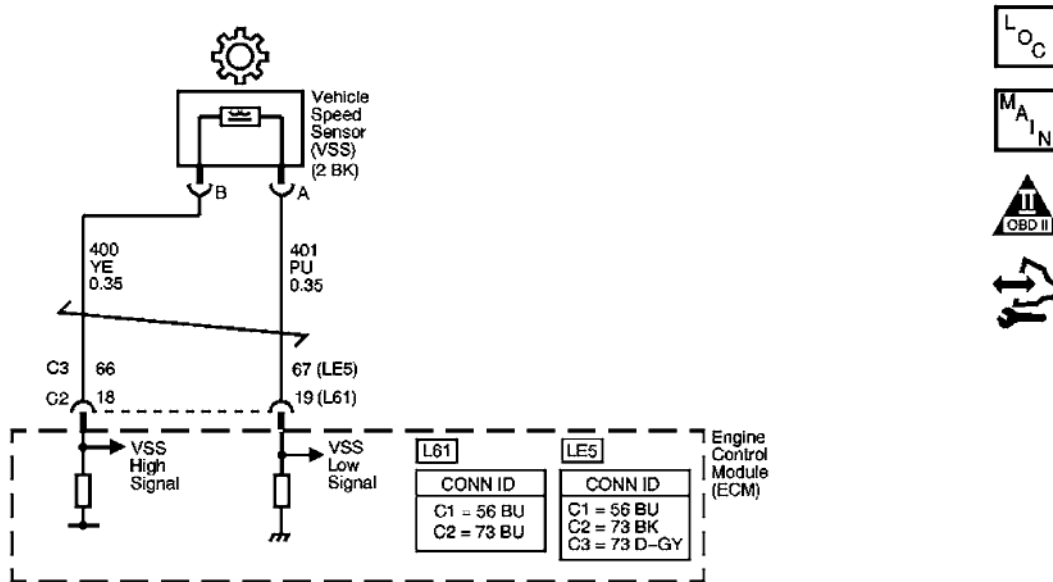


Fig. 12: DTC P0502 Schematic
Courtesy of GENERAL MOTORS CORP.

Circuit Description

Vehicle speed information is provided to the engine control module (ECM) by the vehicle speed sensor (VSS). The VSS is a permanent magnet generator that is mounted on the transaxle and produces a pulsing voltage when vehicle speed is over 5 km/h (3 mph). The AC voltage amplitude and frequency increases with vehicle speed. The ECM converts the pulsing voltage into km/h (mph). The ECM supplies the necessary signal to the instrument panel for speedometer, odometer operation and to the cruise control module.

If the ECM detects no vehicle speed for a specified length of time while other sensors indicate that the vehicle is moving, DTC P0502 sets. DTC P0502 is a type B DTC.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0502 Vehicle Speed Sensor (VSS) Circuit Low Voltage

Conditions for Running the DTC

- No Vehicle Speed Sensor Codes P0503.
- Engine speed is between 1,000-5,000 RPM.
- Throttle position is 15 percent or more.
- Engine vacuum is less than 22.89 kPa (3.320 psi).

- No throttle position codes.

Conditions for Setting the DTC

Vehicle speed is greater than 5 km/h (3 mph) for 5 seconds.

Action Taken When the DTC Sets

- The ECM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- PWR-STR message displays on the driver information center (DIC).
- The ECM disables Cruise Control.
- The ECM commands the coolant fan ON.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The ECM stores DTC P0502 in ECM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL during the third consecutive trip in which the diagnostic runs and passes.
- A scan tool can clear the MIL/DTC.
- The ECM clears the DTC from ECM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The ECM cancels the DTC default actions when the fault no longer exists and the DTC passes.

Diagnostic Aids

Ensure the VSS is correctly torqued to the transmission housing.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests the ability of the VSS to produce an AC voltage. This step also verifies the integrity of the wiring to the ECM.

4: This step tests the VSS circuit for correct resistance.

DTC P0502

Step	Action	Value(s)	Yes	No
Schematic Reference: <u>Manual Transmission Schematics</u>				
Connector End View Reference: <u>Manual Transmission Connector End Views</u>				

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1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. IMPORTANT: Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the ECM. 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Raise and support the drive wheels. 6. Start and idle the engine. 7. Engage the transmission in 2nd gear. 8. Select Vehicle Speed Sensor on the scan tool. With the drive wheels rotating, does Vehicle Speed Sensor increase when the wheel speed increases?	-	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the ECM connector C2 (L61) or C3 (LE5). 3. Using the J 35616 GM terminal test kit, connect the DMM between the vehicle speed sensor (VSS) high signal circuit and the VSS low signal circuit at the ECM connector. 4. Select AC volts on the DMM. 5. Turn ON the ignition, with the	0.5 V AC		

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	engine OFF. 6. Rotate the right front drive wheel by hand. 7. Observe the DMM display. Can a voltage greater than the specified value be obtained?		Go to Step 14	Go to Step 4
4	1. Leave the DMM test leads connected. 2. Measure circuit resistance. Is the circuit resistance within the specified range?	977-2,354 ohms	Go to Step 8	Go to Step 5
5	Is the circuit resistance greater than the specified value?	2,354 ohms	Go to Step 11	Go to Step 6
6	1. Leave the DMM test leads connected. 2. Disconnect the VSS connector at the transmission. Is the circuit resistance less than the specified value?	977 ohms	Go to Step 7	Go to Step 13
7	Test the high signal circuit and the low signal circuit of the VSS for being shorted together. Refer to Circuit Testing and Wiring Repairs. Did you find and correct the condition?	-	Go to Step 15	-
8	Test the high signal circuit of the VSS for a short to ground. Refer to Testing for Short to Ground and Wiring Repairs. Did you find and correct the condition?	-	Go to Step 15	Go to Step 9
9	1. Connect ECM connector C2 (L61) or C3 (LE5) 2. Select DC volts on the DMM. 3. Using the J 35616, connect the DMM test leads to the VSS high signal circuit and the VSS low signal circuit of the VSS wiring	-		

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	harness connector. 4. Turn ON the ignition, with the engine OFF. Does the DMM display system voltage?		Go to Step 10	Go to Step 12
10	Test the high signal circuit of the VSS for a short to voltage. Refer to Testing for a Short to Voltage and Wiring Repairs. Did you find and correct the condition?	-	Go to Step 15	-
11	Test the high signal circuit and the low signal circuit of the VSS for an open. Refer to Testing for Continuity and Wiring Repairs. Did you find and correct a condition?	-	Go to Step 15	Go to Step 13
12	1. Remove the VSS. Refer to Vehicle Speed Sensor (VSS) Replacement. 2. Inspect the VSS and the transmission for the following conditions: • Incorrect VSS • VSS damage • Excessive VSS to speed sensor rotor gap • Incorrect speed sensor rotor alignment • Speed sensor rotor damage 3. Repair any of the above conditions as necessary. Did you complete the repair?	-	Go to Step 15	-
13	Replace the VSS. Refer to Vehicle Speed Sensor (VSS) Replacement. Did you complete the repairs?	-	Go to Step 15	-
14	Replace the ECM. Refer to Control Module References for replacement, setup, and programming. Did you complete the repairs?	-	Go to Step 15	-

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15	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Test drive the vehicle. 4. Select Specific DTC. 5. Enter DTC P0502.	-		
	Has the test run and passed?		Go to Step 16	Go to Step 2
16	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P0503

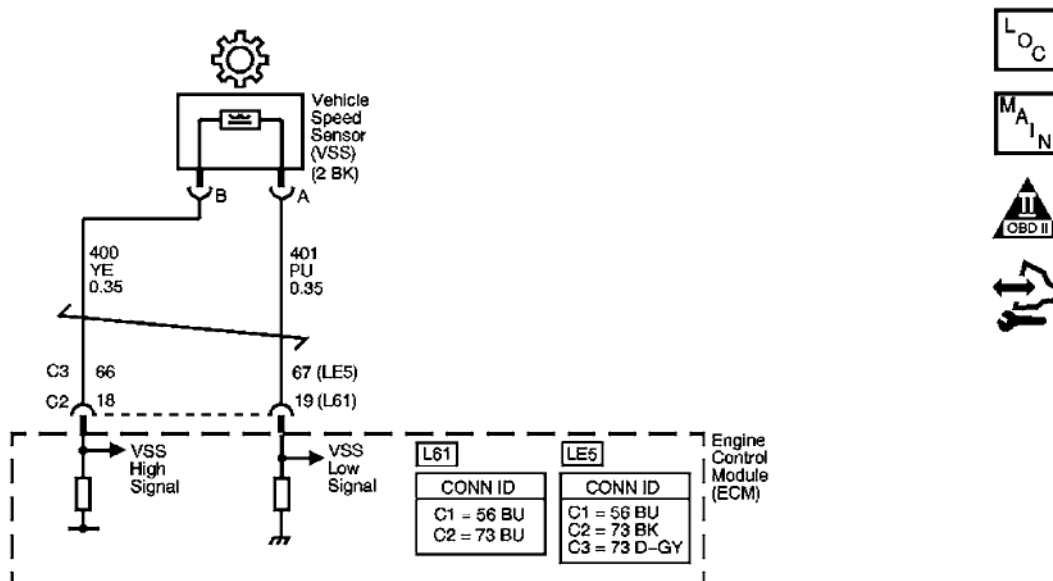


Fig. 13: DTC P0503 Schematic
Courtesy of GENERAL MOTORS CORP.

Circuit Description

Vehicle speed information is provided to the engine control module (ECM) by the vehicle speed sensor (VSS). The VSS is a permanent magnet generator that is mounted on the

transaxle and produces a pulsing voltage when vehicle speed is over 5 km/h (3 mph). The AC voltage amplitude and frequency increases with vehicle speed. The ECM converts the pulsing voltage into km/h (mph). The ECM supplies the necessary signal to the instrument panel for speedometer, odometer operation and to the cruise control module.

If the ECM detects no vehicle speed for a specified length of time while other sensors indicate that the vehicle is moving, DTC P0503 sets. DTC P0503 is a type B DTC.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0503 Vehicle Speed Sensor (VSS) Circuit Intermittent**Conditions for Running the DTC**

- Engine speed is between 1,000-5,000 RPM.
- Engine vacuum is less than 22.89 kPa (3.320 psi).

Conditions for Setting the DTC

Vehicle speed is less than 5 km/h (3 mph) for 6.2 seconds.

Action Taken When the DTC Sets

- The ECM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- PWR-STR message displays on the driver information center (DIC).
- The ECM disables Cruise Control.
- The ECM commands the coolant fan ON.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The ECM stores DTC P0503 in ECM history during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL during the third consecutive trip in which the diagnostic runs and passes.
- A scan tool can clear the MIL/DTC.
- The ECM clears the DTC from ECM history if the vehicle completes 40 warm-up cycles without an emission related diagnostic fault occurring.
- The ECM cancels the DTC default actions when the fault no longer exists and the DTC passes.

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Diagnostic Aids

Ensure the VSS is correctly torqued to the transmission housing.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests the ability of the VSS to produce an AC voltage. This step also verifies the integrity of the wiring to the ECM.

4: This step tests the VSS circuit for correct resistance.

DTC P0503

Step	Action	Value(s)	Yes	No
Schematic Reference: Manual Transmission Schematics				
Connector End View Reference: Manual Transmission Connector End Views				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. IMPORTANT: Before clearing the DTC, use the scan tool in order to record the Freeze Frame and Failure Records. Using the Clear Info function erases the Freeze Frame and Failure Records from the ECM. 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Raise and support the drive wheels. 6. Start and idle the engine. 7. Engage the transmission in 2nd gear. 8. Select Vehicle Speed Sensor on the scan tool.	-	Go to <u>Testing for Intermittent</u>	

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	With the drive wheels rotating, does Vehicle Speed Sensor increase when the wheel speed increases?		Conditions and Poor Connections	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the ECM connector C2 (L61) or C3 (LE5). 3. Using the J 35616 GM terminal test kit, connect the DMM between the vehicle speed sensor (VSS) high signal circuit and the VSS low signal circuit at the ECM connector. 4. Select AC volts on the DMM. 5. Turn ON the ignition, with the engine OFF. 6. Rotate the right front drive wheel by hand. 7. Observe the DMM display. Can a voltage greater than the specified value be obtained?	0.5 V AC		
			Go to Step 14	Go to Step 4
4	1. Leave the DMM test leads connected. 2. Measure circuit resistance. Is the circuit resistance within the specified range?	977-2,354 ohms		
			Go to Step 8	Go to Step 5
5	Is the circuit resistance greater than the specified value?	2,354 ohms	Go to Step 11	Go to Step 6
6	1. Leave the DMM test leads connected. 2. Disconnect the VSS connector at the transmission. Is the circuit resistance less than the specified value?	977 ohms		
			Go to Step 7	Go to Step 13
7	Test the high signal circuit and the low signal circuit of the VSS for being shorted together. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the	-		-

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	condition?		Go to Step 15	
8	Test the high signal circuit of the VSS for a short to ground. Refer to Testing for Short to Ground and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 15	Go to Step 9
9	1. Connect ECM connector C2 (L61) or C3 (LE5). 2. Select DC volts on the DMM. 3. Using the J 35616 , connect the DMM test leads to the VSS high signal circuit and the VSS low signal circuit of the VSS wiring harness connector. 4. Turn ON the ignition, with the engine OFF. Does the DMM display system voltage?	-	Go to Step 10	Go to Step 12
10	Test the high signal circuit of the VSS for a short to voltage. Refer to Testing for a Short to Voltage and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 15	-
11	Test the high signal circuit and the low signal circuit of the VSS for an open. Refer to Testing for Continuity and Wiring Repairs . Did you find and correct a condition?	-	Go to Step 15	Go to Step 13
12	1. Remove the VSS. Refer to Vehicle Speed Sensor (VSS) Replacement. 2. Inspect the VSS and the transmission for the following conditions: • Incorrect VSS • VSS damage • Excessive VSS to speed sensor rotor gap	-		-

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	• Incorrect speed sensor rotor alignment • Speed sensor rotor damage 3. Repair any of the above conditions as necessary. Did you complete the repair?		Go to Step 15	
13	Replace the VSS. Refer to Vehicle Speed Sensor (VSS) Replacement. Did you complete the repairs?	-	Go to Step 15	-
14	Replace the ECM. Refer to Control Module References for replacement, setup, and programming. Did you complete the repairs?	-	Go to Step 15	-
15	Perform the following procedure in order to verify the repair: 1. Select DTC. 2. Select Clear Info. 3. Test drive the vehicle. 4. Select Specific DTC. 5. Enter DTC P0503. Has the test run and passed?	-	Go to Step 16	Go to Step 2
16	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P0833

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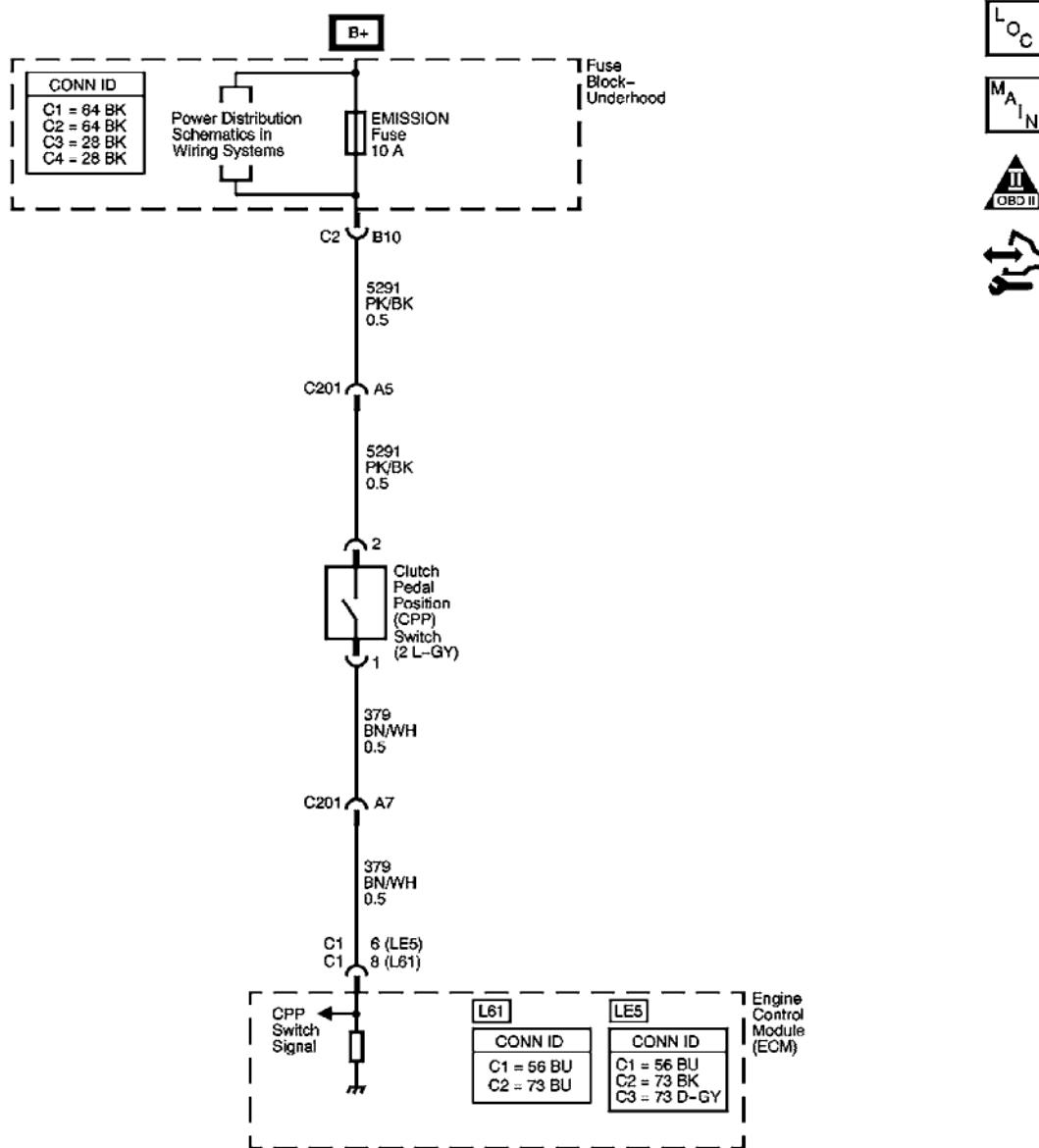


Fig. 14: DTC P0833 Schematic
Courtesy of GENERAL MOTORS CORP.

Circuit Description

The clutch switch is a normally closed switch, clutch pedal released. The engine control module (ECM) detects an ignition voltage on the clutch switch circuit when the clutch switch is closed. The ECM detects 0 volts on the clutch switch circuit when the clutch switch is open, clutch pedal depressed.

When the ECM detects a large number of gear changes without detecting a clutch switch transition, DTC P0833 sets. DTC P0833 is a type B DTC.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0833 Clutch Pedal Switch 2 Circuit**Conditions for Running the DTC**

- No VSS DTCs P0502 or P0503.
- The vehicle speed is greater than 15 km/h (9 mph).
- The brake switch remains released.

Conditions for Setting the DTC

- The ECM must detect 20 or more gear changes with less than 6 clutch pedal transitions.
- Time between gear changes must be 4 seconds or greater.

Action Taken When the DTC Sets

- The ECM illuminates the malfunction indicator lamp (MIL) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- The ECM disables Cruise Control.
- The ECM records the operating conditions when the Conditions for Setting the DTC are met. The ECM stores this information as Freeze Frame and Failure Records.
- The ECM stores DTC P0833 in ECM History during the second consecutive trip in which the Conditions for Setting the DTC are met.

Conditions for Clearing the MIL/DTC

- The ECM turns OFF the MIL during the third consecutive trip in which the diagnostic runs and passes.
- A scan tool can clear the MIL/DTC.
- The ECM clears the DTC from ECM history if the vehicle completes 40 warm-up cycles without an emission-related diagnostic fault occurring.
- The ECM cancels the DTC default actions when the ignition switch is OFF long enough in order to power down the ECM.

Test Description

The number below refers to the step number on the diagnostic table.

- 2:** This test confirms if the scan tool is receiving a clutch switch position signal.
- 3:** This step inspects the clutch pedal connector and adjustment.

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DTC P0833

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. IMPORTANT: Before clearing the DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data. 3. Use the scan tool to monitor the clutch pedal position switch parameter. 4. Apply and release the clutch pedal several times. Does the scan tool indicate a change in state when the clutch pedal is either applied or released?	-	Refer to <u>Testing for Intermittent Conditions and Poor Connections</u>	Go to Step 3
3	Inspect the clutch pedal position switch and the connector. Does the clutch switch or the connector require service?	-	Go to Step 11	Go to Step 4
4	Inspect the EMISSION fuse for an open. Refer to <u>Circuit Protection - Fuses</u> . Is the EMISSION fuse open?	-	Go to Step 9	Go to Step 5
5	Using a DMM, measure voltage at the EMISSION fuse. Does the DMM indicate the specified value?	B+	Go to Step 6	Go to Step 12
	1. Turn OFF the ignition. 2. Disconnect the clutch pedal position switch connector. 3. Turn ON the ignition with the			

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6	engine OFF. 4. Using a DMM, measure the voltage at the ignition 1 voltage circuit at the switch connector. Does the DMM indicate the specified value?	B+	Go to Step 7	Go to Step 13
7	1. Clear all DTCs. 2. Use the scan tool to monitor the clutch pedal position switch parameter. 3. Use a fused jumper wire to repeatedly connect and disconnect pin 1 and pin 2 of the clutch pedal position switch electrical connector. Does the scan tool display that the clutch is applying and releasing?	-	Go to Step 15	Go to Step 8
8	1. Turn the ignition switch OFF. 2. Disconnect C1 at the ECM. 3. Using the DMM, test for continuity and a short to voltage on the clutch pedal position switch signal circuit. Did you find a short to voltage, high resistance or an open on the clutch pedal position switch signal circuit?	-	Go to Step 14	Go to Step 16
9	1. Turn the ignition switch OFF. 2. Remove the EMISSION fuse. 3. Disconnect the clutch pedal position switch connector and C2 at the ECM. 4. Using a DMM, test for a short to ground on the ignition 1 voltage circuit at the switch connector. Is the ignition 1 voltage circuit grounded?	-	Go to Step 13	Go to Step 10
	Using a DMM, test for a short to			

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10	ground on the clutch pedal position switch signal circuit at the switch connector. Is the clutch pedal position switch signal circuit grounded?	-	Go to Step 14	Go to Step 15
11	Replace the clutch pedal position switch, or repair the connector, as necessary. Refer to Clutch Pedal Position Switch Replacement or Connector Repairs . Did you complete the repair?	-	Go to Step 17	-
12	Repair the power distribution circuit to the EMISSION fuse. Did you complete the repair?	-	Go to Step 17	-
13	Repair the open, high resistance or short to ground in the ignition 1 voltage circuit or a parallel circuit that uses the brake fuse. Refer to Wiring Repairs . Did you complete the repair?	-	Go to Step 17	-
14	Repair the open, high resistance, short to ground or short to voltage in the clutch pedal position switch signal circuit. Refer to Wiring Repairs . Did you complete the repair?	-	Go to Step 17	-
15	Replace the clutch pedal position switch. Refer to Clutch Pedal Position Switch Replacement . Is the action complete?	-	Go to Step 17	-
16	Replace the ECM. Refer to Control Module References for replacement, setup, and programming. Is the action complete?	-	Go to Step 17	-
17	1. Select the DTC. 2. Select Clear Info. 3. Operate the vehicle from 0 km/h (0 mph) to above 38 km/h (24 mph) then back to 0 km/h (0 mph) 7 times.	-		

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	4. Select Specific DTC. 5. Enter DTC P0833.			
	Has the test run and passed?		Go to Step 18	Go to Step 2
18	With the scan tool, observe the stored information, capture info and DTC info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

SYMPTOMS - MANUAL TRANSMISSION

Strategy Based Diagnostics

Review the system operations in order to familiarize yourself with the system functions. Refer to **Transmission System Description and Operation**.

Visual/Physical Inspection

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the manual transaxle for the correct fluid level.
- Inspect the manual transaxle for fluid leaks.
- Inspect the manual transaxle for broken or loose transaxle mounts.

Intermittent

Test the vehicle under the same conditions that the customer reported in order to verify the system is operating properly.

Symptom List

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

- **Transmission Shifts Hard**
- **Transmission Gear Clash When Shifting Gears**
- **Transmission Noisy**
- **Transmission Does Not Shift into One Gear**
- **Transmission Jumps Out of Gear**
- **Transmission Locked in One Gear**
- **Transmission Clunk on Acceleration or Deceleration**

TRANSMISSION SHIFTS HARD**Diagnostic Aids**

An intermittent hard shift may be caused by an intermittent clutch condition.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: A static shift test is performed by shifting into all of the gear positions with the engine not operating. While performing the test one should note how the shift lever movement is felt. Also while shifting from one gear to the other feel for binding in the shift rails. You should be able to feel the detent plungers operating when coming out of a gear and going into a gear.

6: A dynamic shift test is performed by shifting into the gear positions with the engine operating. Test for the correct mesh of the synchronizers and for the clutch releasing correctly. When shifting into and out of a gear, feel for the shift detent plungers and for the synchronizers sleeve for moving freely.

8: The transaxle uses a synthetic transaxle fluid that allows proper synchronizer operation. The incorrect fluid may cause hard shifting by varnish build-up, or not enough lubrication for proper synchronizer operation.

Transmission Shifts Hard

Step	Action	Yes	No
DEFINITION: The transaxle does not shift smoothly, or without difficulty, from one gear to the other.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect the clutch system for proper operation. Refer to Clutch System Description and Operation in Clutch. Did you find or repair the condition?	Go to Step 12	Go to Step 3
3	1. Perform a static shift test on the transaxle. 2. Test for the following: • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Binding in the shift lever		

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	• Detent plungers or shift rails binding • Shift cable binding • Shift cable proper adjustment		
	Are you able to shift into all gears?	Go to Step 6	Go to Step 4
4	1. Remove the floor console. Refer to Console Replacement - Front Floor in Instrument Panel, Gages, and Console. 2. Inspect for the following: • Loose mounting • Foreign debris		
	Did you find and repair the condition?	Go to Step 12	Go to Step 5
5	Inspect for proper shift cable adjustment. Refer to Shift Cable Adjustment . Did you find and repair the condition?	Go to Step 12	Go to Step 6
6	1. Perform a dynamic shift test on the transaxle. 2. Test for the following: • Detent plungers or shift rails binding • Synchronizer sleeve binding • Gear clash into only one gear • Gear clash into all gears		
	Did the transaxle shift hard into all gears?	Go to Step 7	Go to Step 11
7	Inspect the transaxle for the correct fluid level and type of the transaxle fluid. Refer to Transmission Fluid Checking Procedure . Is the transaxle at the correct level and the proper fluid being used?	Go to Step 9	Go to Step 8
8	Drain and refill the transaxle with the correct type fluid. Refer to Transmission Fluid Checking Procedure . Did you find and repair the condition?	Go to Step 12	Go to Step 9
	1. Remove the transaxle. Refer to Transmission Replacement. 2. Inspect the clutch pressure plate and/or		

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9	clutch driven plate. Is the clutch pressure plate and/or clutch driven plate worn or faulty?	Go to Step 10	Go to Step 11
10	Replace the clutch assembly. Refer to <u>Clutch Drive Plate and Clutch Driven Plate</u> in Clutch. Did you find and repair the condition?	Go to Step 12	Go to Step 11
11	1. Disassemble the transaxle. Refer to Transaxle Case Disassemble in the Transmission Unit Repair Manual. 2. Inspect the following components for being faulty, in the gear that is hard to shift or clashing: • Excessive synchronizers blocking ring to gear clearance • Synchronizer hub external splines worn or damaged • Excessive axial clearance in the speed gear • Mainshaft to speed gear bearing or journal worn • Shift rail and the internal shift control lever components for wear or damage 3. Replace worn or damaged components as necessary. Did you find and repair the condition?	Go to Step 12	Go to Diagnostic Aids
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION GEAR CLASH WHEN SHIFTING GEARS**Diagnostic Aids**

Gear clashing may be caused by shifting at too high of an engine RPM or by rushing the shift. If gear clashing is occurring in more than one gear, the clutch may not be releasing properly for proper synchronizer operation.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step tests for the proper releasing of the clutch. If the clutch reserve is not proper, the mainshaft gears may still be turning causing the gear clashing.

5: This step inspects for the proper transaxle fluid. A special fluid is required for the correct lubrication of the synchronizers.

7: A static shift test is performed by shifting into all of the gear positions with the engine not operating. While performing the test, you should note how the shift lever movement is felt. Also, while shifting from one gear to another, feel for binding in the shift rails. You should be able to feel the detent plungers operating when coming out of a gear and going into a gear. Excessive play in the gear shift lever may prevent the shift forks from fully engaging the synchronizer.

10: A dynamic shift test is performed by shifting into all of the gear positions with the engine operating. Test for the correct mesh of the synchronizers, and for the clutch releasing correctly. Move the shift lever and feel for the synchronizer sleeve to just release from the gear, then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage that gear again. If it shifts back into the gear without clashing, the clutch is releasing correctly and the synchronizer is working. If clashing occurs, test on another gear. If all gears clash, the clutch is not releasing correctly.

Transmission Gear Clash When Shifting Gears

Step	Action	Yes	No
DEFINITION: Noise from the transaxle when shifting gears. A grinding or grating sound, when the synchronizer sleeve is engaging with the selector teeth on the speed gear. A suspected internal transaxle condition, if the noise only occurs in one gear.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	With the engine operating, does the transaxle shift from neutral to any gear, without the vehicle lurching or gear clashing?	Go to Step 5	Go to Step 3
3	Inspect for proper clutch operation. Refer to Clutch System Description and Operation in Clutch. Does the clutch operate properly?	Go to Step 5	Go to Step 4
4	Repair the clutch system. Refer to Symptoms - Clutch in Clutch. Did you find and repair the condition?	Go to Step 11	Go to Step 5
5	Inspect for the correct transaxle fluid level and the proper fluid. Refer to Transmission Fluid Checking		

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	Procedure. Is the transaxle fluid level correct and at the proper level?	Go to Step 7	Go to Step 6
6	Fill the transaxle to the correct level, or change the transaxle fluid if it is not the correct type. Does the transaxle still have gear clash?	Go to Step 7	Go to Step 11
7	1. Perform a static shift test on the transaxle. 2. Test for the following: • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Binding in the shift lever • Detent plungers or shift rails binding • Shift cable binding • Shift cable proper adjustment Did the transaxle shift smoothly into the gear that is clashing?	Go to Step 10	Go to Step 8
8	Remove the floor console. Refer to Console Replacement - Front Floor in Instrument Panel, Gages, and Console. Inspect for the following: • Loose mounting • Foreign debris Did you find and repair the condition?	Go to Step 12	Go to Step 10
9	Inspect for proper shift cable adjustment. Refer to Shift Cable Adjustment . Did you find and repair the condition?	Go to Step 12	Go to Step 10
10	1. Perform a dynamic shift test on the transaxle. 2. Test for the following: • Detent plungers or shift rails binding		

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	• Synchronizer sleeve binding • Gear clashing in more than the suspected gear	Go to <u>Transmission Shifts Hard</u>	Go to Step 11
	Is the transaxle hard to shift into all gears?		
11	1. Disassemble the transaxle. Refer to Transaxle Case Disassemble in the Transmission Unit Repair Manual. 2. Inspect the following transaxle components for the gear that is clashing: • Excessive synchronizer blocking ring to gear clearance • Synchronizer sleeve to hub clearance excessive • Excessive axial clearance in the speed gear • Mainshaft to speed gear bearing or journal worn • Shift fork worn or damaged • Internal shift control worn or damaged • Mainshaft bearing worn or damaged • Input gear bearing or pilot bearing worn		
	Did you find and repair the condition?	Go to Step 12	Go to Diagnostic Aids
12	Operate the system and verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION NOISY

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step inspects for vibration causing a noise. If the vehicle is carrying a certain load, the driveline axle may not be correct, and could cause a vibration. The vibration maybe resonating into the transaxle, causing a noise.

6: This step inspects for the correct transaxle fluid level. If the transaxle fluid level is

excessively low, damage may have occurred to the transaxle components.

8: This step inspects for the correct type of transaxle fluid. The transaxle uses a special fluid. If the incorrect fluid was used, there may have been an overheating problem. Overheating may cause damage to the transaxle components.

10: This step inspects for noise coming into the driver compartment. Improper sealing of the shift tower may be allowing normal transaxle noise to be heard by the driver.

14: This step tests to determine if clutch components are making the noise. Depress the clutch pedal slowly and listen for the change in noise. If the noise changes while pressing the pedal, it may be a faulty clutch component. If the noise does not change until the clutch is completely disengaged, the transaxle component is faulty.

Transmission Noisy

Step	Action	Yes	No
DEFINITION: The transaxle is making a noise. The different noises may be a whine or a growl from faulty bearings or gears. The noise may also be caused from a faulty component causing a vibration noise or rattle.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Is the noise present at a certain road speed, or with a certain load?	Go to Step 3	Go to Step 4
3	Inspect for the correct driveline angle. Refer to Diagnostic Starting Point - Vibration Diagnosis and Correction in Vibration Diagnosis and Correction. Did you find and repair the condition?	Go to Step 17	Go to Step 4
4	Is the noise present in all gears?	Go to Step 6	Go to Step 5
5	Is the noise present in just one gear?	Go to Step 16	Go to Step 6
6	Inspect the transaxle fluid level. Is the fluid level correct?	Go to Step 8	Go to Step 7
7	Add transaxle fluid. Refer to Transmission Fluid Checking Procedure . Did you find and repair the condition?	Go to Step 17	Go to Step 8
8	Inspect the transaxle for the correct fluid type. Refer to Lubrication Specifications . Is the transaxle fluid the correct type?	Go to Step 10	Go to Step 9
9	Drain and refill the transaxle with the correct type fluid. Refer to Transmission Fluid Checking Procedure . Did you find and repair the condition?	Go to Step 17	Go to Step 10
10	Inspect the shift tower boot. Is the closeout boot loose or damaged?	Go to Step 11	Go to Step 12

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11	Position and tighten the shift tower boot to specifications. Refer to <u>Shift Control Replacement</u> . Did you find and repair the condition?	Go to Step 17	Go to Step 12
12	1. Inspect for engine to transaxle alignment. 2. Inspect for loose transaxle mounting bolts. Are there any loose transaxle mounting bolts?	Go to Step 13	Go to Step 14
13	Replace and tighten the transaxle mounting bolts. Refer to <u>Transmission Replacement</u> . Is the noise still present?	Go to Step 14	Go to Step 17
14	With the engine operating, depress the clutch pedal. Is the noise still present?	Go to Step 15	Go to Step 16
15	1. Remove the clutch. Refer to <u>Clutch Drive Plate and Clutch Driven Plate</u> in Clutch. 2. Inspect the following components for being the cause of the noise. • The release bearing • The pilot bearing • The pressure plate • The clutch disc • The input shaft bearing • The engine crankshaft end play Did you find and repair the condition?	Go to Step 17	Go to Step 16
16	1. Remove the transaxle. Refer to <u>Transmission Replacement</u> . 2. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> in the Transmission Unit Repair Manual. Use the information in the Cleaning and Inspection section to determine if any of the transaxle components are faulty. Did you find and repair the condition?	Go to Step 17	-

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17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1
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TRANSMISSION DOES NOT SHIFT INTO ONE GEAR**Diagnostic Aids**

If the transaxle shifts into gear and then jumps out of gear, refer to **Transmission Jumps Out of Gear**. If it is an intermittent condition, other driveline components may be faulty.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step is to confirm that the clutch is not slipping. During certain conditions, the clutch may slip, and feel as though the transaxle is not in gear.

3: A static shift test is performed by shifting into all gears with the engine not operating. While performing the test, you should note how the shift lever movement feels. Also, feel for the shift rails moving freely, the detent plungers operating when coming out of a gear and going in the next gear, and the synchronizer sleeve movement.

6: A dynamic shift test is performed by shifting into all gears with the engine operating. Test for the correct mesh of the synchronizers sleeve and the speed gear selector teeth. Move the shift lever and feel for the synchronizer sleeve to just release from the gear, then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage that gear again, to ensure full travel of the shift components.

Transmission Does Not Shift into One Gear

Step	Action	Yes	No
DEFINITION: The shift lever will not move into a particular gear position, or when it is in a gear position, power is not delivered through the transaxle.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect the clutch system for slipping. Refer to Clutch Slipping in Clutch. Is the clutch working properly?	Go to Step 3	Go to Clutch Drive Plate and Clutch Driven Plate in Clutch
	1. Perform a static shift test on the transaxle. 2. Test for the following: • Blockage preventing full shift		

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3	lever movement • Excessive movement in the shift lever • Binding in the shift lever • Detent plungers or shift rails binding • Synchronizer sleeve moving on the hub and pressure pieces • Shift cable binding • Shift cable proper adjustment Were you able to shift into the gear position that has the concern?	Go to Step 6	Go to Step 4
4	Remove the floor console. Refer to Console Replacement - Front Floor in Instrument Panel, Gages, and Console. Inspect for the following: • Loose mounting • Foreign debris Did you find and repair the condition?	Go to Step 9	Go to Step 6
5	Inspect for proper shift cable adjustment. Refer to Shift Cable Adjustment. Did you find and repair the condition?	Go to Step 9	Go to Step 6
6	1. Perform a dynamic shift test on the transaxle. 2. Test for the following: • Detent plungers or shift rails binding • Synchronizer sleeve binding • Synchronizer sleeve engaging on the speed gear selector teeth Were you able to shift into the gear position that has the concern?	Go to Step 8	Go to Step 7
	1. Remove the transaxle. Refer to Transmission Replacement. 2. Disassemble the transaxle. Refer to		

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7	Transaxle Case Disassemble in the Transmission Unit Repair Manual. 3. Inspect the following transaxle internal components for wear or damage: • The shift forks • The internal shift control lever		
	Did you find and repair the condition?	Go to Step 9	Go to Step 8
8	1. Remove the transaxle. Refer to Transmission Replacement. 2. Disassemble the transaxle. Refer to Transaxle Case Disassemble in the Transmission Unit Repair Manual. 3. Inspect the following transaxle internal components for wear or damage: • The synchronizer sleeve selector teeth • The speed gear selector teeth • The speed gear axial clearance for being excessive • The speed gear to mainshaft bearings and journals • The countershaft for being broken • The mainshaft for being broken • The countershaft gear for being stripped • The mainshaft gear for being stripped		
	Did you find and repair the condition?	Go to Step 9	Go to Diagnostic Aids
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION JUMPS OUT OF GEAR**Diagnostic Aids**

If the transaxle jumps out of gear during deceleration, inspect the components that may allow for the gears or shafts to tip. If the gears or shafts tip, the synchronizer sleeve can disengage from the selector teeth on the speed gear. If the transaxle jumps out of gear during

acceleration, inspect the components that may not allow full engagement of the synchronizer sleeve to the selector teeth on the speed gear. Insufficient engagement of the selector teeth under torque may cause the transaxle to jump out of gear.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: A static shift test is performed by shifting into all gear positions with the engine not operating. While performing the test, slowly move the shift lever. Feel for proper movement of the shift lever and transaxle internal shift components.

4: A dynamic shift test is performed by shifting into all gear positions with the engine operating. Test for the correct mesh of the synchronizers sleeve and the speed gear selector teeth. Move the shift lever, and feel for the synchronizer sleeve to release from the gear, and then let up on the clutch pedal. Depress the clutch pedal and move the shift lever to engage the gear again, to ensure full travel of the shift components.

5: This step inspects for worn or damaged transaxle or engine mounts. Loose mounts may cause a shock on the transaxle allowing for gear disengagement.

6: This step inspects for the misalignment of the clutch to transaxle. Misalignment may put a bind on the input shaft, allowing for the input shaft or the mainshaft to tip.

8: This step inspects the pilot bearing and the pilot bearing journal on the input shaft. A worn pilot bearing or input shaft may allow the input shaft to tip, causing gear disengagement.

Transmission Jumps Out of Gear

Step	Action	Yes	No
DEFINITION: Gear disengagement occurs during acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	1. Perform a static shift test. 2. Test for the following: • Blockage preventing full shift lever movement • Excessive movement in the shift lever • Detent plungers engaging in the shift rails • Synchronizer pressure pieces on the synchronizer sleeves Did the transaxle shift completely into all		

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	gears?	Go to Step 4	Go to Step 3
3	Remove the shift tower and inspect for worn or faulty components. Refer to <u>Shift Control Replacement</u> . Did you find and repair the condition?	Go to Step 10	Go to Step 4
4	1. Perform a dynamic shift test on the transaxle. 2. Test for the following: • Synchronizer sleeve engagement to the speed gear selector teeth • Detent plungers engaging in the shift rails Did the transaxle shift completely into all gears?	Go to Step 5	Go to Step 8
5	Inspect the engine and/or transaxle mounts. Refer to <u>Engine Mount Inspection</u> in Engine Mechanical - 2.2L and <u>Transmission Mount Replacement - Rear</u> or <u>Transmission Mount Replacement - Left</u> . Did you find and repair the condition?	Go to Step 10	Go to Step 6
6	Inspect the clutch housing for loose bolts or misalignment. Are there any loose bolts or misalignment?	Go to Step 7	Go to Step 8
7	1. Align the housing, if required. 2. Tighten any loose housing bolts. Refer to <u>Fastener Tightening Specifications</u>. Did you find and repair the condition?	Go to Step 10	Go to Step 8
8	1. Remove the transaxle. Refer to <u>Transmission Replacement</u>. 2. Remove the clutch assembly. Refer to <u>Clutch Drive Plate and Clutch Driven Plate</u> in Clutch. 3. Inspect the pilot bearing for being faulty. 4. Inspect the input shaft for excessive wear at the pilot bearing.		

	Did you find and repair the condition?	Go to Step 10	Go to Step 9
9	1. Disassemble the transaxle. Refer to Transaxle Case Disassemble in the Transmission Unit Repair Manual. 2. Inspect the following components for wear or damage: • The shift rails • The detent plungers and springs • The shift forks • The synchronizer sleeve and speed gear selector teeth • The mainshaft to input shaft bearing and journals • The speed gear bearings and journals • The speed gear axial clearance • The mainshaft center and rear bearings		
	Did you find and repair the condition?	Go to Step 10	Go to Diagnostic Aids
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION LOCKED IN ONE GEAR

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step is to ensure the use of the proper transaxle fluid. A special fluid is used to ensure proper synchronizer operation, and for sufficient lubrication. Improper fluid may cause the synchronizers to stick or the transaxle components to overheat.

4: A static shift test is performed by shifting into all gears with the engine not operating. By confirming that the transaxle can be shifted into all positions, ensures that the shift lever is not excessively worn or damaged.

6: A dynamic shift test is performed by shifting into all of the gear positions with the engine operating. Test to ensure that the internal shift components are functioning properly.

Transmission Locked in One Gear

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Step	Action	Yes	No
DEFINITION: The transaxle cannot be shifted out of a gear, or the vehicle will not move because the transaxle is locked.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect for the correct type of transaxle fluid. Is the correct type transaxle fluid being used?	Go to Step 4	Go to Step 3
3	Drain the transaxle, and refill with the correct type of fluid. Refer to Transmission Fluid Checking Procedure . Did you find and repair the condition?	Go to Step 9	Go to Step 4
4	1. Perform a static shift test on the transaxle. 2. Test for the shift lever moving to all positions. Were you able to shift into all positions?	Go to Step 6	Go to Step 5
5	1. Remove the shift lever. 2. Inspect for worn or faulty components. Refer to Shift Control Replacement . Did you find and repair the conditions?	Go to Step 9	Go to Step 6
6	1. Perform a dynamic shift test on the transaxle. 2. Test for being able to shift in and out of the gear with the concern. Were you able to shift the transaxle correctly?	Go to Step 7	Go to Step 8
7	1. Remove the transaxle. Refer to Transmission Replacement . 2. Inspect the clutch system for the clutch not releasing properly. Refer to Clutch System Description and Operation in Clutch. Did you find and repair the condition?	Go to Step 9	Go to Step 8
	1. Disassemble the transaxle. Refer to		

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8	Transaxle Case Disassemble in Transmission Overhaul article. 2. Inspect the following transaxle internal components for wear or damage: • The shift rail • The internal shift control lever • The synchronizer components for being broken or faulty • The speed gears for being seized to the mainshaft		
	Did you find and repair the conditions?	Go to Step 9	-
9	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION CLUNK ON ACCELERATION OR DECELERATION**Diagnostic Aids**

All manual transaxles have gear play that might cause a clunk. If the transaxle is suspected of causing the clunk, compare it with a similar vehicle. An internal clunk in the transaxle is usually caused by wear between two components, or from improper assembly, which would also cause other symptoms.

Test Description

The number below refers to the step number on the diagnostic table.

5: This step inspects the driveline components that may be the cause of the clunk noise. The noise may resonate to the transaxle.

Transmission Clunk on Acceleration or Deceleration

Step	Action	Yes	No
DEFINITION: A clunk is heard and/or felt on acceleration or deceleration.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	Inspect the engine mounts for being loose or damaged. Refer to Engine Mount Inspection in Engine Mechanical - 2.2L. Did you find and repair the condition?	Go to Step 7	Go to Step 3

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3	Inspect the transaxle mounts for being loose or damaged. Refer to <u>Transmission Mount Replacement - Rear</u> or <u>Transmission Mount Replacement - Left</u> . Did you find and repair the condition?	Go to Step 7	Go to Step 4
4	Inspect the transaxle to engine fasteners for being loose or missing. Refer to <u>Fastener Tightening Specifications</u> . Did you find and repair the condition?	Go to Step 7	Go to Step 5
5	Inspect the driveline for causing the clunk. Refer to <u>Clunk When Accelerating from Coast</u> in Wheel Drive Shafts. Did you find and repair the condition?	Go to Step 7	Go to Step 6
6	1. Remove the transaxle. Refer to <u>Transmission Replacement</u>. 2. Disassemble the transaxle. Refer to <u>Transaxle Case Disassemble</u> in the Transmission Unit Repair Manual. 3. Inspect the following transaxle components that maybe causing the clunk: • Faulty mainshaft bearings • Faulty countershaft bearings • Worn speed gear teeth • Worn countershaft gear teeth • Worn synchronizer sleeve to hub • Worn thrust washers and thrust surfaces on the speed gears or mainshaft Did you find and repair the condition?	Go to Step 7	Go to Diagnostic Aids
7	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

TRANSMISSION FLUID LEAK DIAGNOSIS**Diagnostic Aids**

Using the incorrect type of transaxle fluid may affect the sealing ability of the seals. Ensure the use of the correct type of transaxle fluid. The incorrect type of sealer may not be compatible with the transaxle fluid or may not have the correct characteristics for sealing the

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affected components. Ensure the use of the correct type of sealers. Refer to **Sealers, Adhesives, and Lubricants** in the Transmission Unit Repair Manual.

Test Description

The number below refers to the step number on the diagnostic table.

5: Use an approved method to clean the transaxle to ensure the leak location is correctly identified. If using a powder method or dye method, ensure the products are compatible with the transaxle fluid.

Transmission Fluid Leak Diagnosis

Step	Action	Yes	No
DEFINITION: Visible sign of the transaxle fluid leaking from the transaxle.			
1	Did you review the Symptoms - Manual Transmission and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Manual Transmission
2	1. Inspect for the transaxle fluid level higher than the recommended level. Refer to Transmission Fluid Checking Procedure. 2. Adjust the transaxle level if incorrect. Was the transaxle fluid level too high?	Go to Step 24	Go to Step 3
3	Inspect the transaxle vent for a blockage. Is the transaxle vent blocked?	Go to Step 4	Go to Step 5
4	Repair or replace the transaxle vent. Did you find and repair the condition?	Go to Step 24	Go to Step 5
5	Verify the location of the leak. 1. Clean the transaxle assembly. 2. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached. 3. Visual inspect or use the powder method or dye and black light method to locate the leak. Is the leak occurring at the drain or fill plug?	Go to Step 6	Go to Step 7
6	Replace the drain or fill plug. Refer to Transmission Fluid Checking Procedure . Did you find and repair the condition?	Go to Step 24	Go to Diagnostic Aids

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7	Is the leak at the transaxle output shaft seal?	Go to Step 8	Go to Step 9
8	Remove the output shaft seal and inspect for the following. Refer to <u>Axle Shaft Oil Seal Replacement</u>. • Damaged or worn seal • Damaged seal bore • Improper installation • Cracks in the component • Loose or worn bearing causing excessive seal wear Did you find and repair the condition?	Go to Step 24	Go to Diagnostic Aids
9	Is the leak at the shift lever area?	Go to Step 10	Go to Step 11
10	1. Inspect the shift control lever lower boot for damage. 2. Inspect for loose shift control lever mounting bolts. 3. Remove the shift control lever. Refer to <u>Shift Control Replacement</u>. 4. Replace the shift control lever lower boot if damaged. 5. Inspect the shift control lever sealing surfaces for scratched, nicked or damaged. Did you find and repair the condition?	Go to Step 24	Go to Diagnostic Aids
11	Is the leak at the front of the transaxle?	Go to Step 12	Go to Step 15
12	1. Remove the transaxle. Refer to <u>Transmission Replacement</u>. 2. Inspect the input shaft retainer for leaking. 3. Remove the input shaft bearing retainer. Refer to <u>Axle Shaft Oil Seal Replacement</u>. Replace the seal. Did you find and repair the condition?	Go to Step 24	Go to Step 13
	1. Inspect for the leak at the input shaft seal.		

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13	2. Inspect for the following if the input shaft seal is leaking: • Damaged or worn seal • Damaged seal bore • Improper installation • Cracks in the component • Input shaft sealing surface is scratched, nicked, damaged or worn • Loose or worn bearing causing excessive seal wear 3. Replace the input shaft seal if leaking. Refer to <u>Axle Shaft Oil Seal Replacement</u>.		
	Did you find and repair the condition?	Go to Step 24	Go to Step 14
14	1. Inspect the case for cracks or porosity. 2. Replace the transaxle case or clutch housing if it is faulty. Refer to Transaxle Case Disassemble in the Transmission Unit Repair Manual.		
	Did you find and repair the condition?	Go to Step 24	Go to Diagnostic Aids
15	Is the leak at the vehicle speed sensor (VSS)?	Go to Step 16	Go to Step 17
16	1. Remove the VSS. Refer to <u>Vehicle Speed Sensor (VSS) Replacement</u>. 2. Inspect for the following: • Cut or damaged O-ring seal • VSS over-tightened causing deformation in the VSS • VSS bore scratched or damaged		
	Did you find and repair the condition?	Go to Step 24	Go to Step 1
17	Is the leak at the backup light switch?	Go to Step 18	Go to Step 20
	1. Remove the backup light switch. Refer to <u>Backup Lamp Switch Replacement</u>. 2. Inspect for the following:		

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18	• Cross threaded or damaged threads • Insufficient sealant • Leaking switch • Improper installation		
	Did you find and repair the condition?	Go to Step 24	Go to Step 1
19	1. Remove the shift shaft detent sleeve. Refer to Transaxle Case Disassemble and Transaxle Case Assembly in the Transmission Unit Repair Manual. 2. Inspect for the following: • Cross threaded or damaged threads • Insufficient sealant • Cracked sleeve or case • Improper installation		
	Did you find and repair the condition?	Go to Step 24	Go to Step 1
20	Is the leak at the sealing flanges of the transaxle case?	Go to Step 21	Go to Step 22
21	1. Remove the transaxle. Refer to Transmission Replacement. 2. Disassemble the transaxle. Refer to Transaxle Case Disassemble in the Transmission Unit Repair Manual. 3. Inspect the sealing surfaces. Refer to Clutch and Differential Housing Cleaning and Inspection in the Transmission Unit Repair Manual.		
	Did you find and repair the condition?	Go to Step 24	Go to Step 22
22	Is the leak coming from a crack or porosity in the transaxle case?	Go to Step 23	Go to Diagnostic Aids
23	1. Remove the transaxle. Refer to Transmission Replacement. 2. Disassemble the transaxle. Refer to Transaxle Case Disassemble in the Transmission Unit Repair Manual.		

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	3. Replace the faulty transaxle case or clutch housing. Refer to Transaxle Case Assembly in the Transmission Unit Repair Manual.		
	Did you find and repair the condition?	Go to Step 24	Go to Diagnostic Aids
24	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 1

REPAIR INSTRUCTIONS

TRANSMISSION MOUNT INSPECTION

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

IMPORTANT: Before replacing any transmission mount due to a suspected fluid loss, verify that the source of the fluid is the mount.

1. Raise the transmission/transaxle in order to relieve tension in the mount.
2. Observe the mount while raising the transmission/transaxle. Raising the transmission/transaxle removes the weight from the mount.
3. Replace the mount if it exhibits any of the following conditions:
 - The hard rubber surface is covered with heat check cracks.
 - The rubber is separated from the outer metal sleeve of the mount.
 - The rubber is split through the center of the transmission mount.
 - The mount is leaking fluid.
4. When replacing the transmission mounts or brackets, refer to the following procedures:
 - Transmission Mount Replacement - Front
 - Transmission Mount Replacement - Rear
 - Transmission Mount Bracket Replacement - Rear
 - Transmission Mount Replacement - Left

TRANSMISSION MOUNT REPLACEMENT - FRONT

Removal Procedure

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

Information.

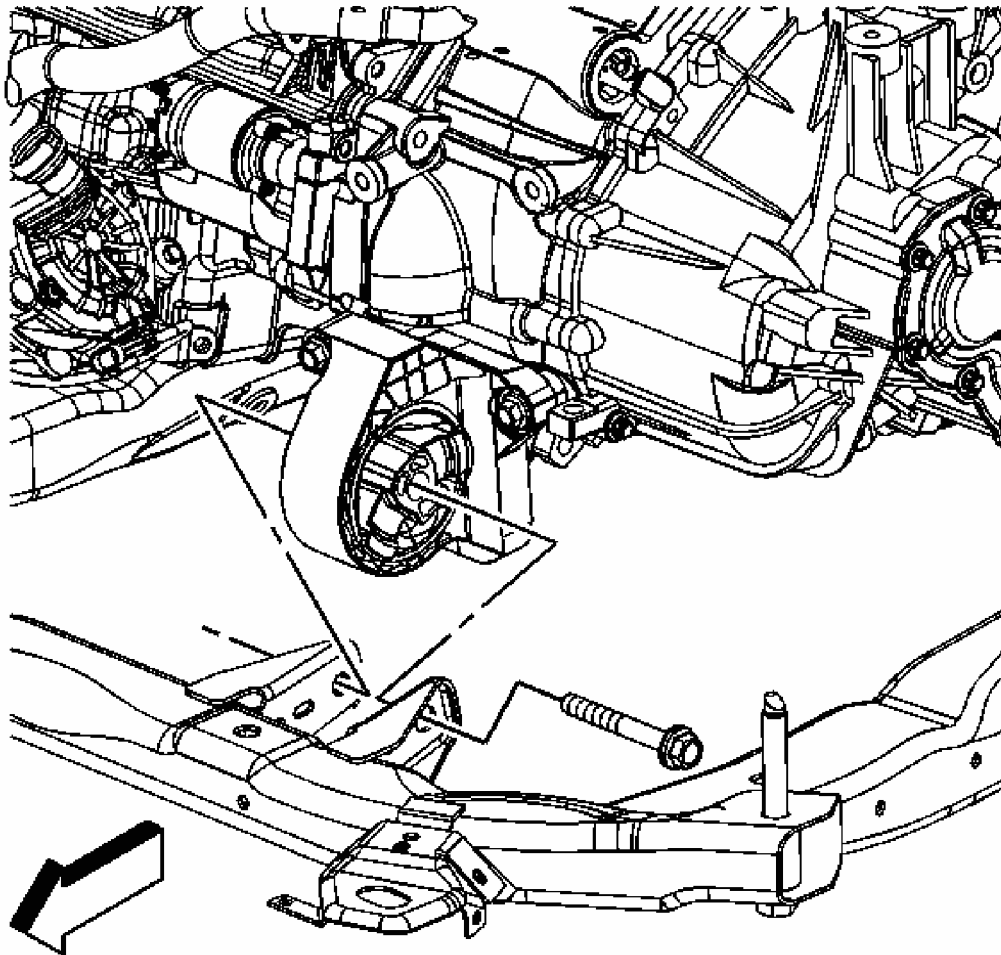


Fig. 15: View Of Front Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the front transaxle mount thru bolt.

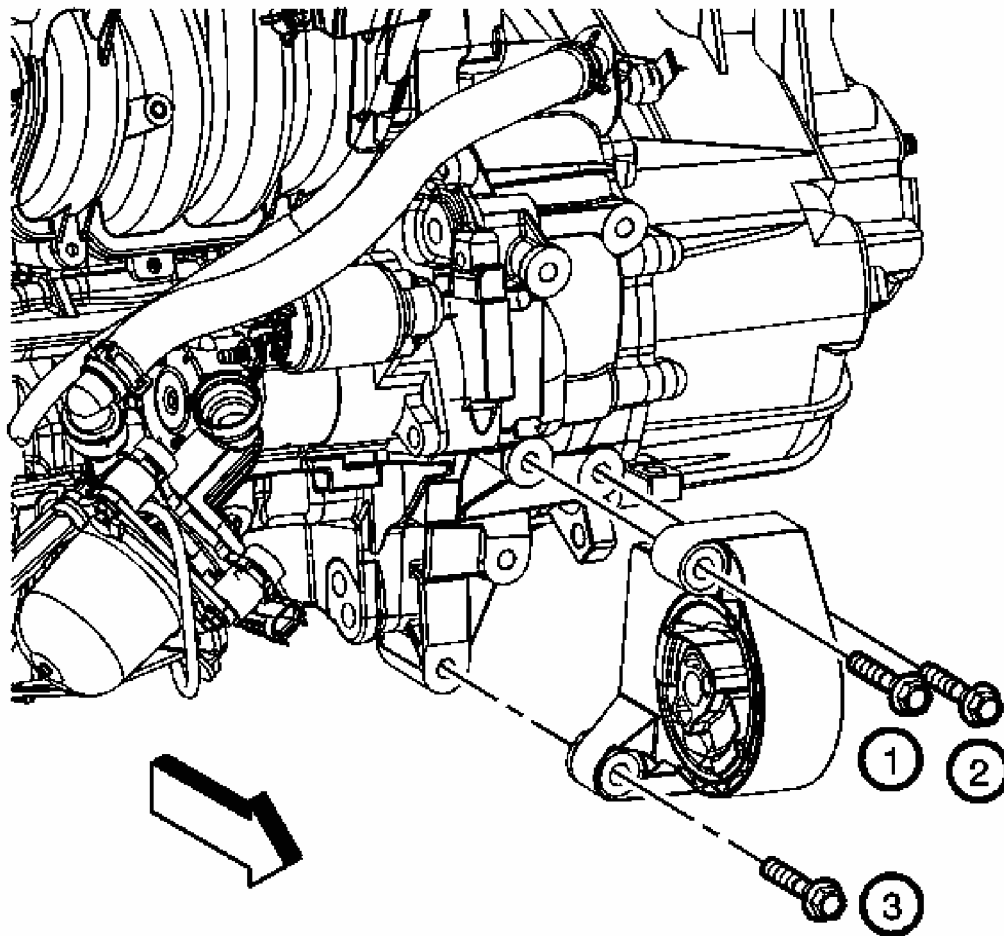


Fig. 16: View Of Front Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

3. Remove the front transaxle mount to transaxle bolts.
4. Remove the front transaxle mount from the vehicle.

Installation Procedure

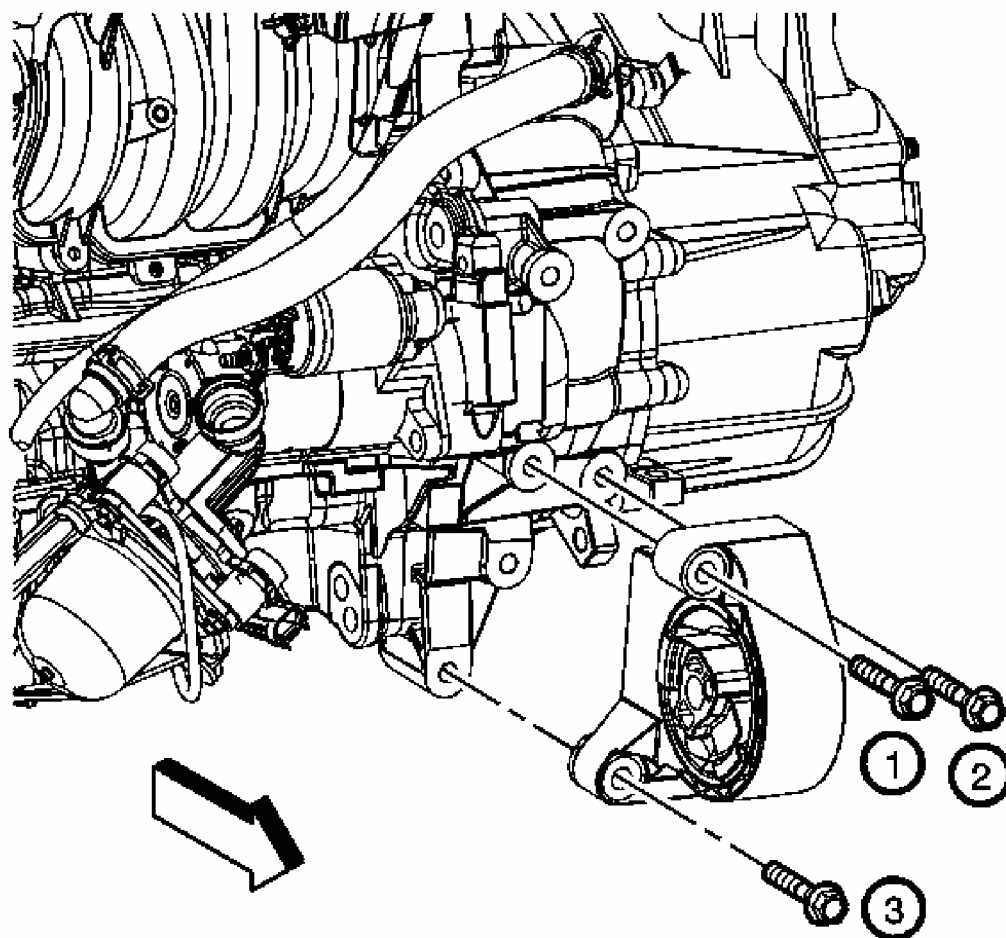


Fig. 17: View Of Front Transaxle Mount
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The transaxle bolts must be torqued in a mandatory sequence as shown.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the front transaxle mount and transaxle bolts.

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

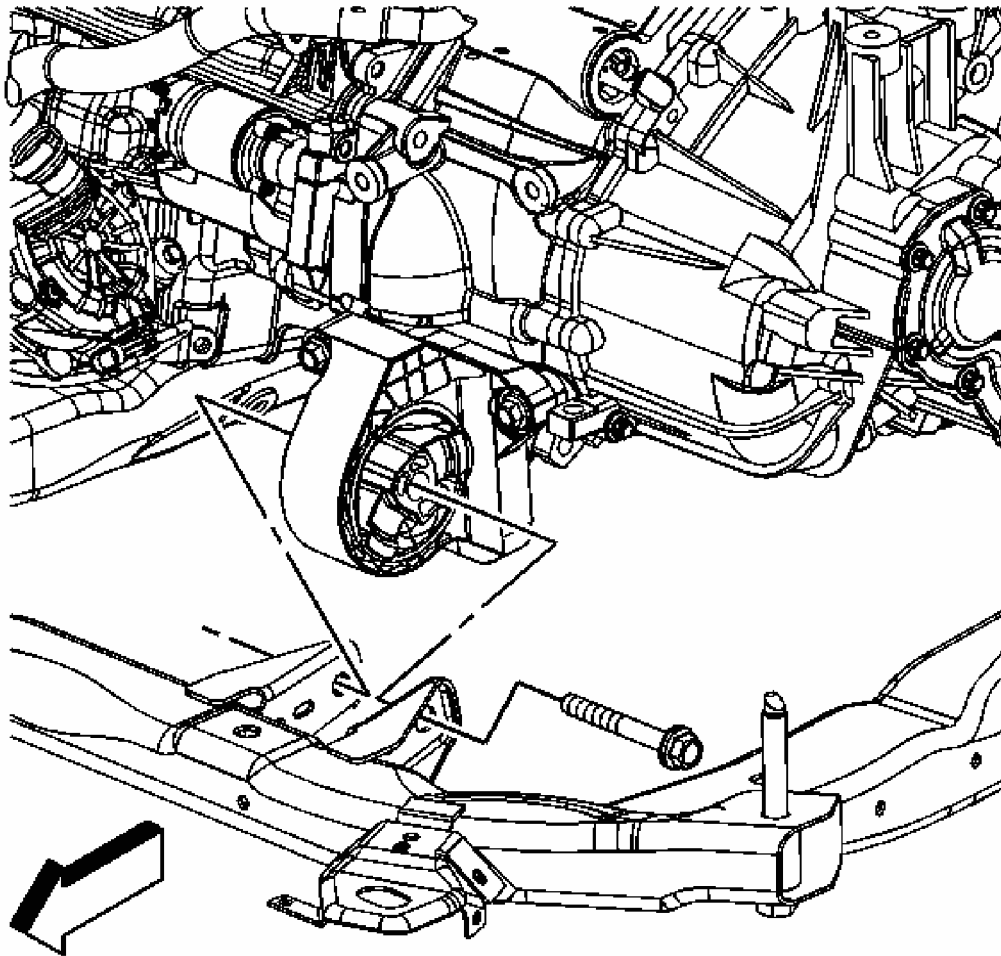


Fig. 18: View Of Front Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Hand start the front transaxle mount through bolt.

IMPORTANT: The front and rear transaxle mounts must be allowed to settle with the through bolts loosened.

3. Loosen the rear transaxle mount through bolt.
4. Tighten the transaxle mount through bolts in the following order:

Tighten:

1. Tighten the rear bolt to 100 N.m (74 lb ft).
2. Tighten the front bolt to 100 N.m (74 lb ft).

5. Lower the vehicle.

TRANSMISSION MOUNT REPLACEMENT - REAR

Removal Procedure

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

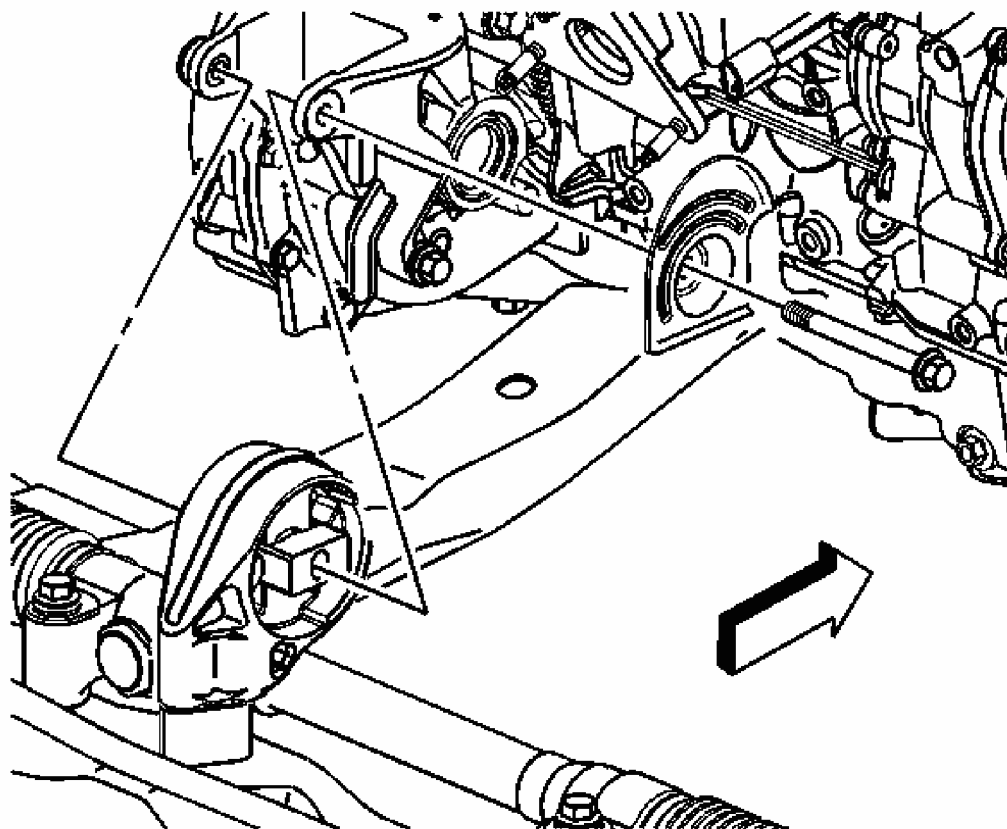


Fig. 19: View Of Rear Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the rear transaxle mount through bolt and heat shield.

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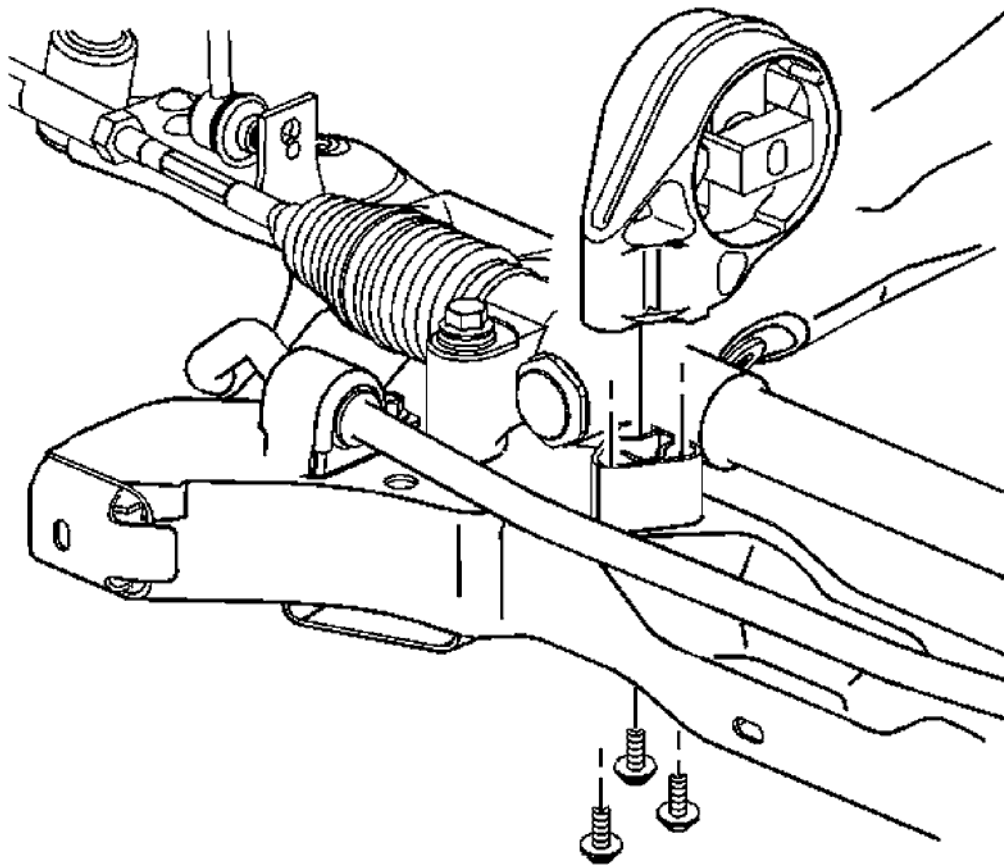


Fig. 20: View Of Rear Transaxle Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the rear transaxle mount to frame bolts.
4. Remove the rear transaxle mount.

Installation Procedure

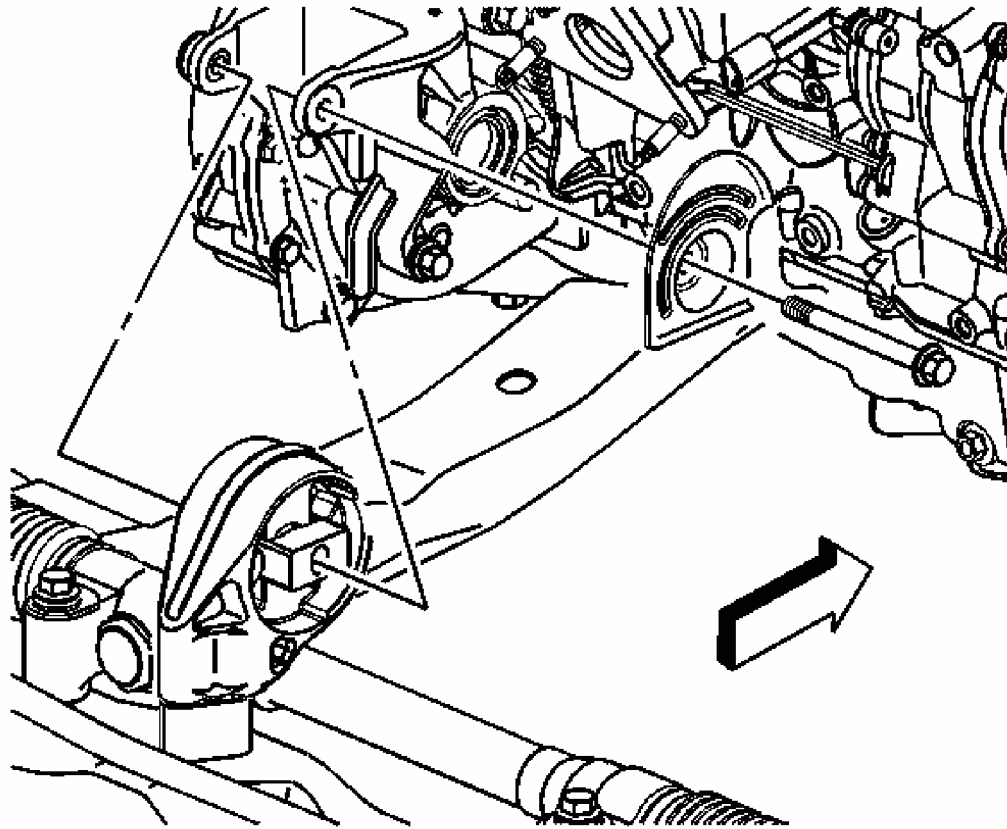


Fig. 21: View Of Rear Transaxle Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the rear transaxle mount and heat shield. Hand start the bolts.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Tighten the rear transaxle mount to frame bolts.

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

IMPORTANT: Rotate the rear transaxle mount heat shield clockwise until the tab is seated on the mount bracket.

3. Hand start the rear transaxle mount through bolt.

IMPORTANT: The front and rear transmission mounts must be allowed

to settle with the through bolts loosened.

4. Loosen the front trans mount through bolt.
5. Tighten the transmission mount through bolts in the following order:

Tighten:

1. Tighten the rear bolt to 100 N.m (74 lb ft).
 2. Tighten the front bolt to 100 N.m (74 lb ft).
6. Lower the vehicle.

TRANSMISSION MOUNT REPLACEMENT - LEFT

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.
2. Remove the underhood electrical center cover.

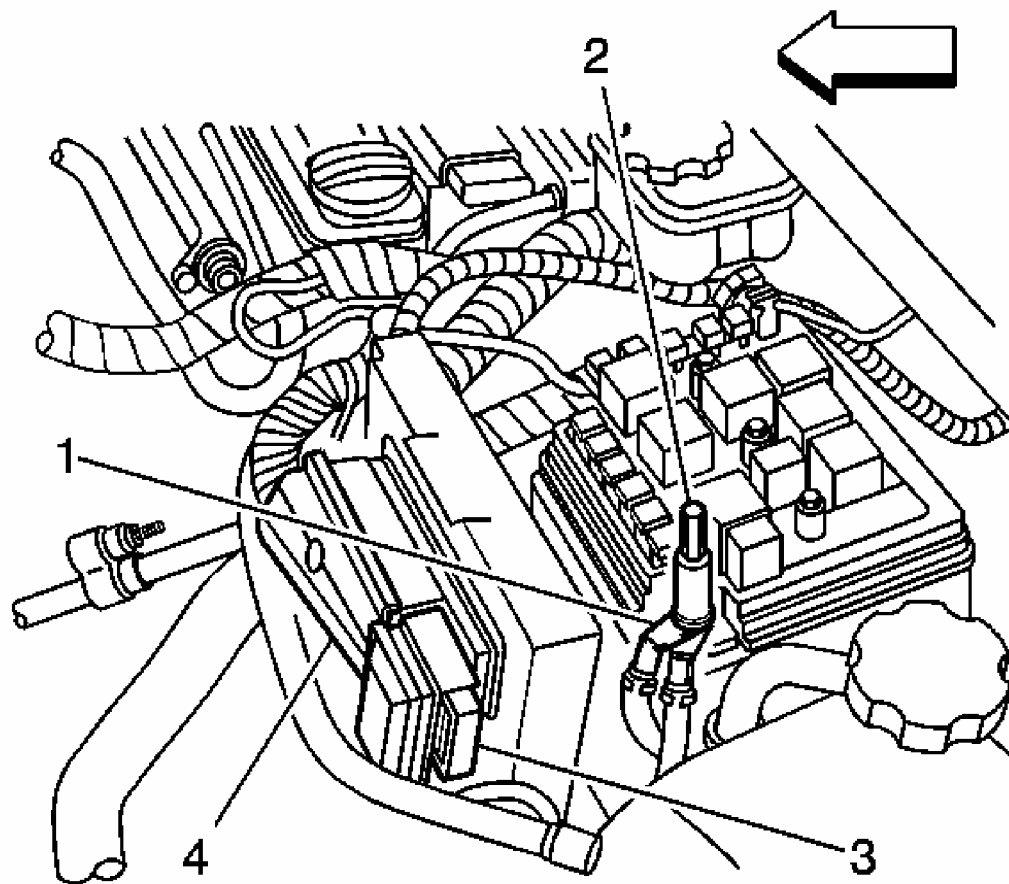


Fig. 22: View Of Engine Electrical Center
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the engine control module (ECM) harness connector (3, 4).
4. Disconnect the positive battery cables (1) from the underhood electrical center.

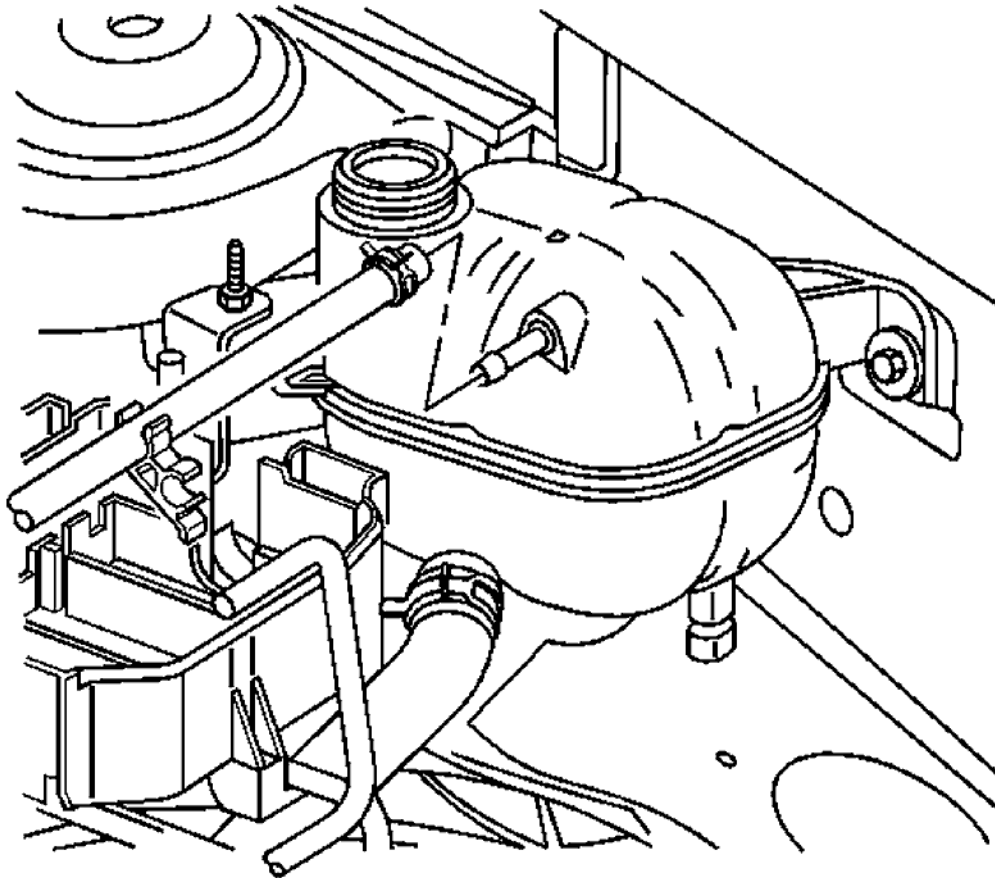


Fig. 23: View Of Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the surge tank inlet hose from the surge tank.

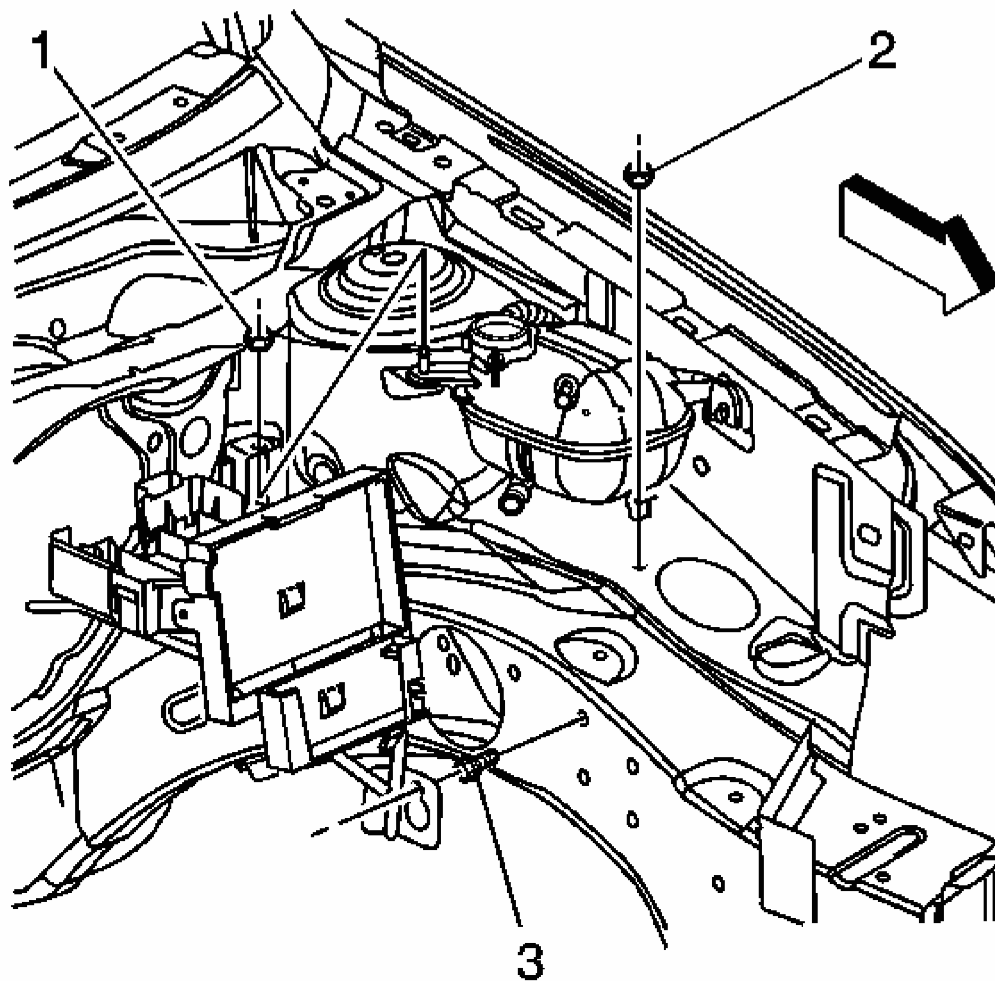


Fig. 24: View Of Engine Compartment Component Locations
Courtesy of GENERAL MOTORS CORP.

6. Remove the underhood electrical center tray bracket nuts (1, 2) and bolt (3).
7. Disconnect the wiring harness retainer from the tray bracket.

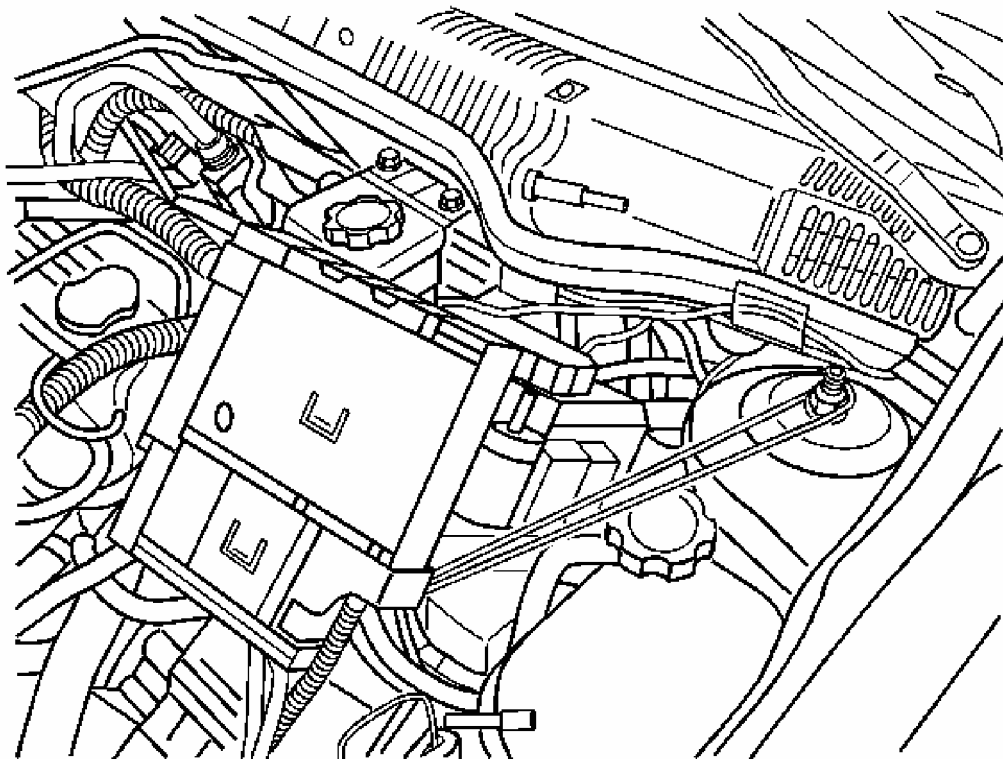


Fig. 25: View Of Underhood Junction Block
Courtesy of GENERAL MOTORS CORP.

8. Lift the electrical center up and swing it back and out of the way.

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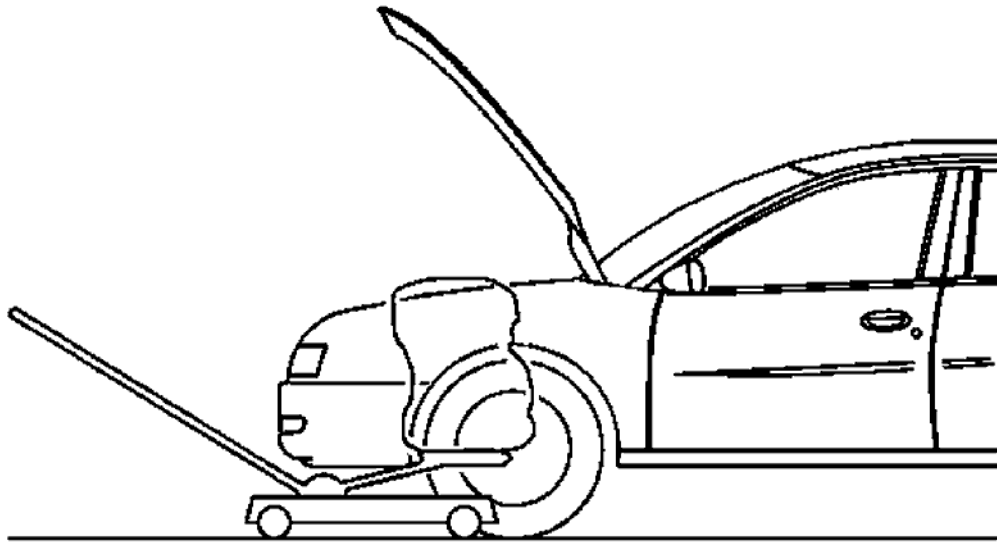


Fig. 26: Supporting Engine/Transmission With Hydraulic Floor Jack
Courtesy of GENERAL MOTORS CORP.

9. Support the transmission with a floor jack. Use a piece of wood between the jack and the transmission.

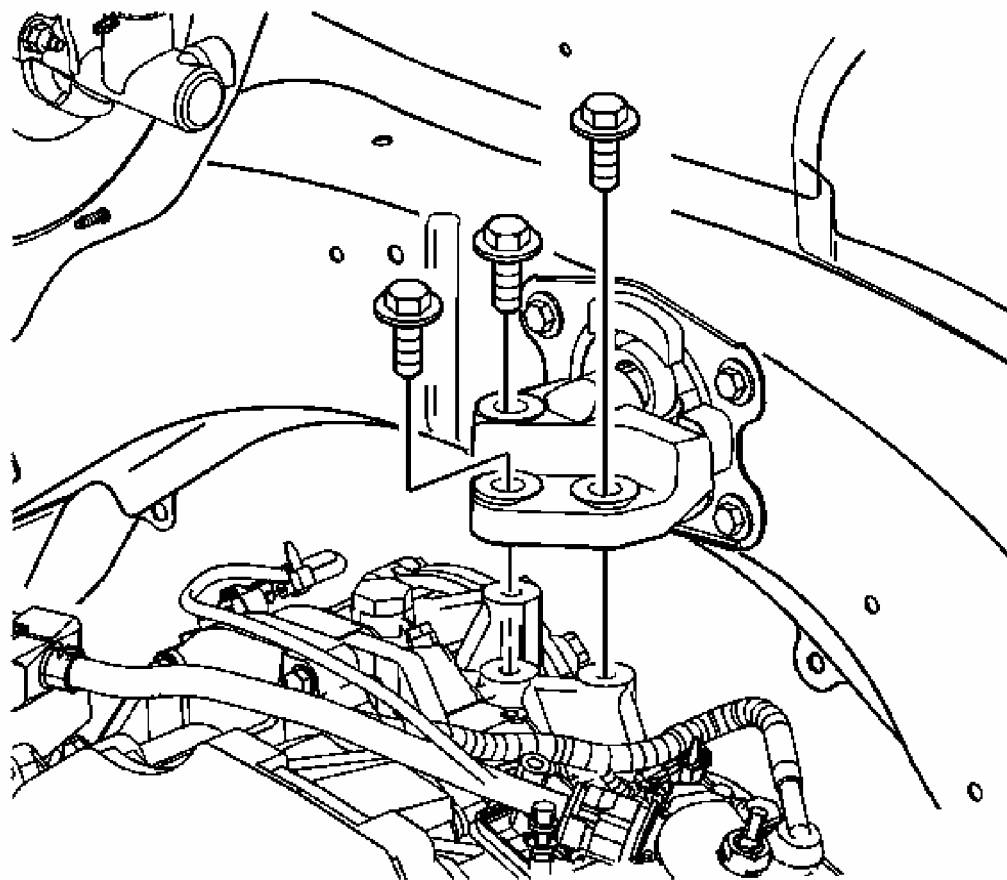


Fig. 27: View Of Transmission Mount-To-Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the transmission mount to transmission bolts.

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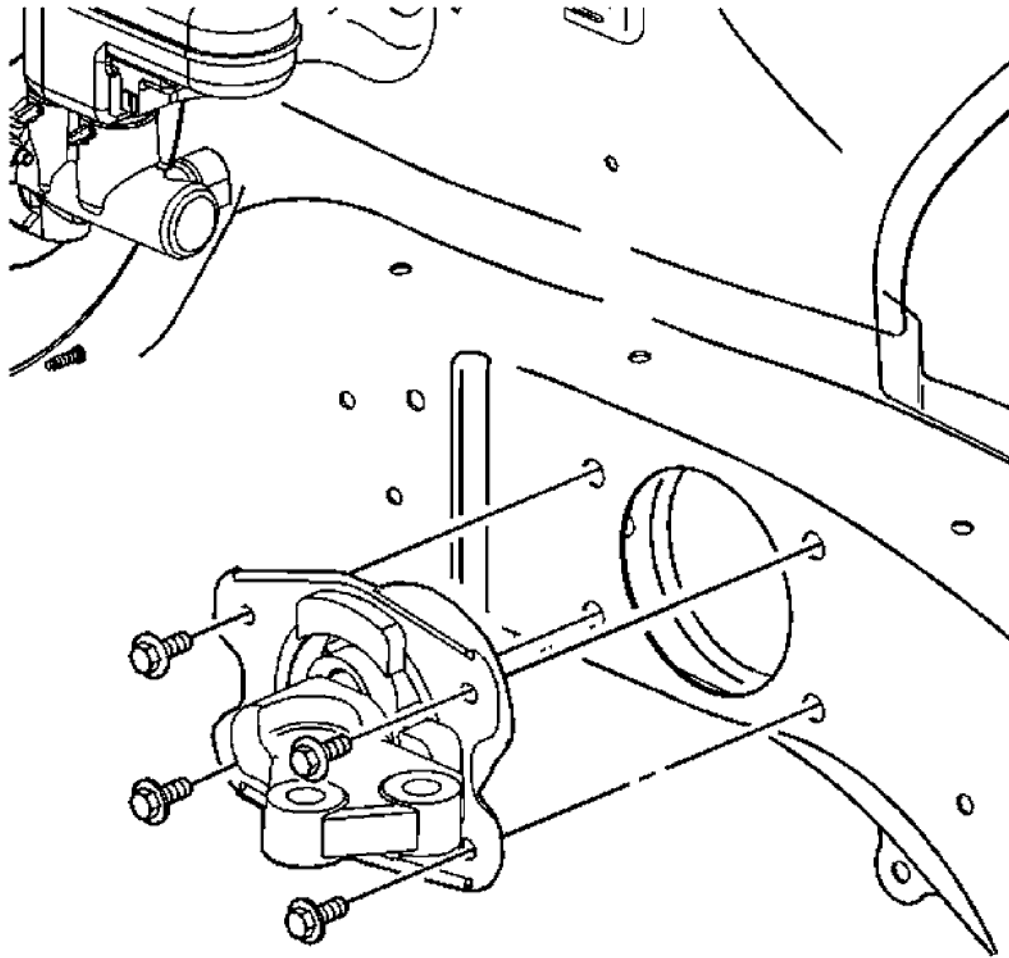


Fig. 28: View Of Transmission Mount-To-Mid-rail Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the transmission mount to mid-rail bolts.

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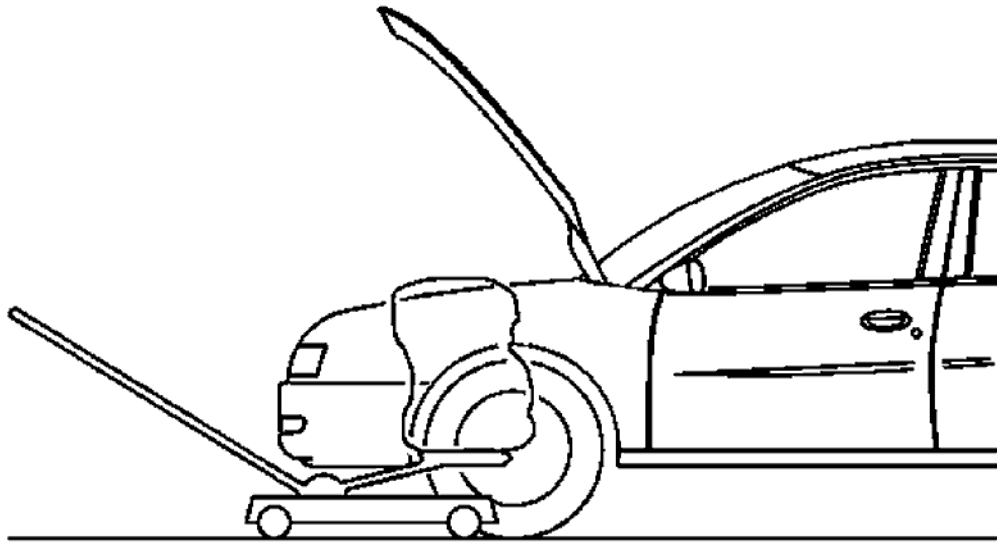


Fig. 29: Supporting Engine/Transmission With Hydraulic Floor Jack
Courtesy of GENERAL MOTORS CORP.

12. Using a floor jack, slowly lower the transmission enough to remove the transmission mount from the vehicle.

Installation Procedure

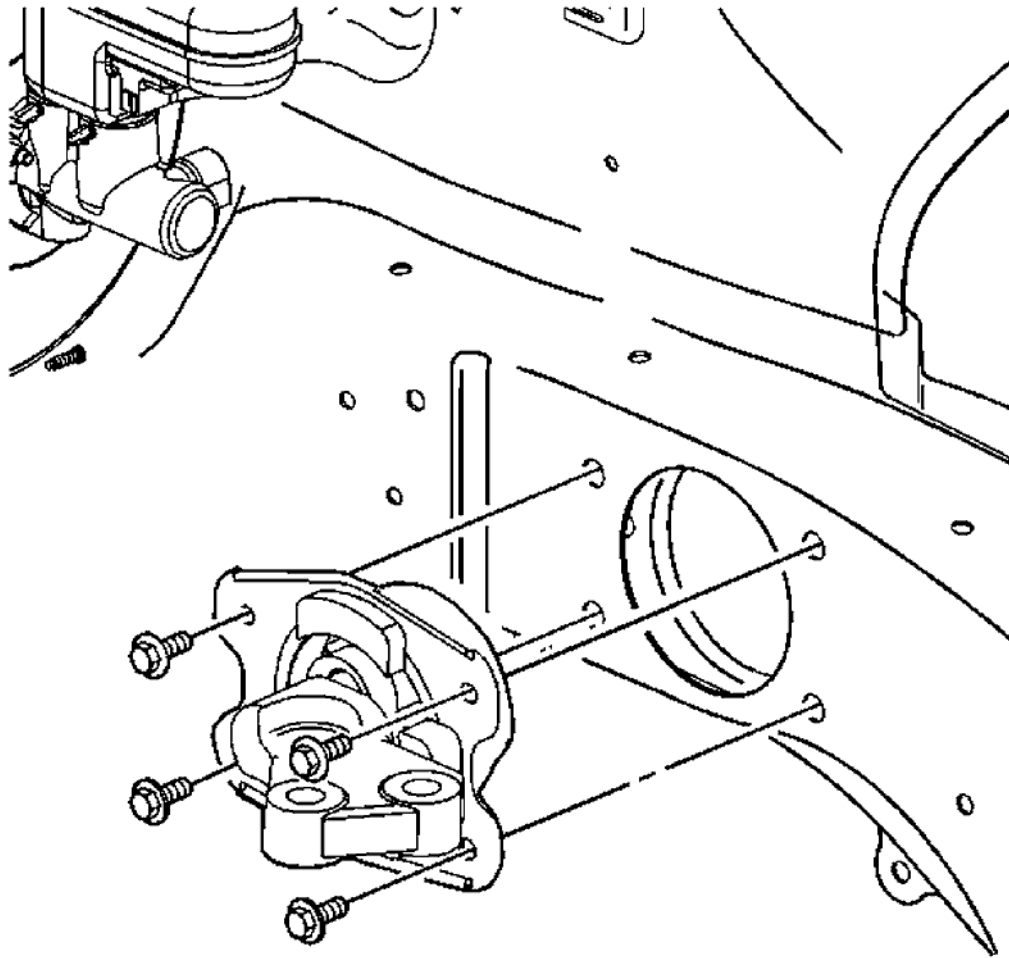


Fig. 30: View Of Transmission Mount-To-Mid-rail Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission mount to the mid-rail.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Hand start the transmission mount to mid-rail bolts.

Tighten: Tighten the bolts to 34 N.m (25 lb ft).

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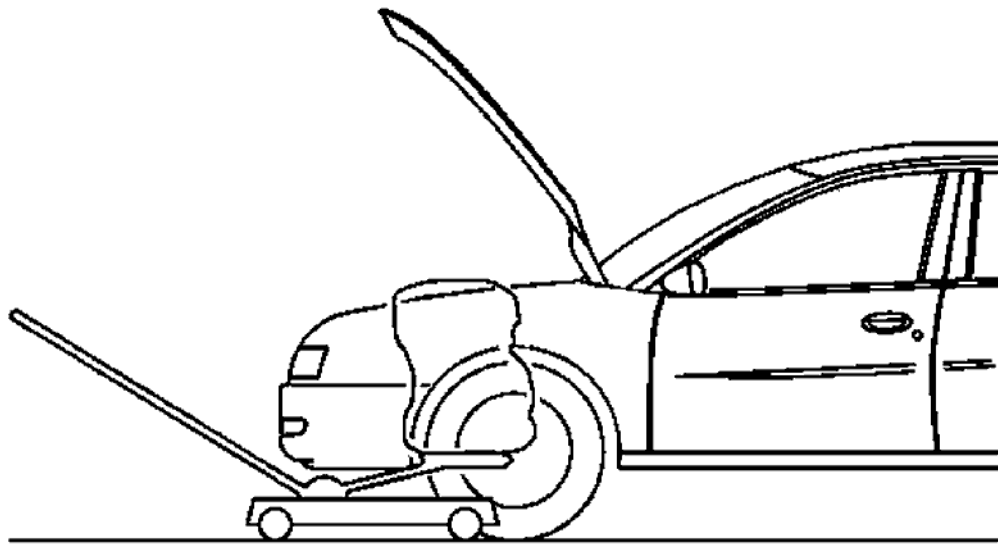


Fig. 31: Supporting Engine/Transmission With Hydraulic Floor Jack
Courtesy of GENERAL MOTORS CORP.

3. Using a floor jack, raise the transmission until it contacts the transmission mount.

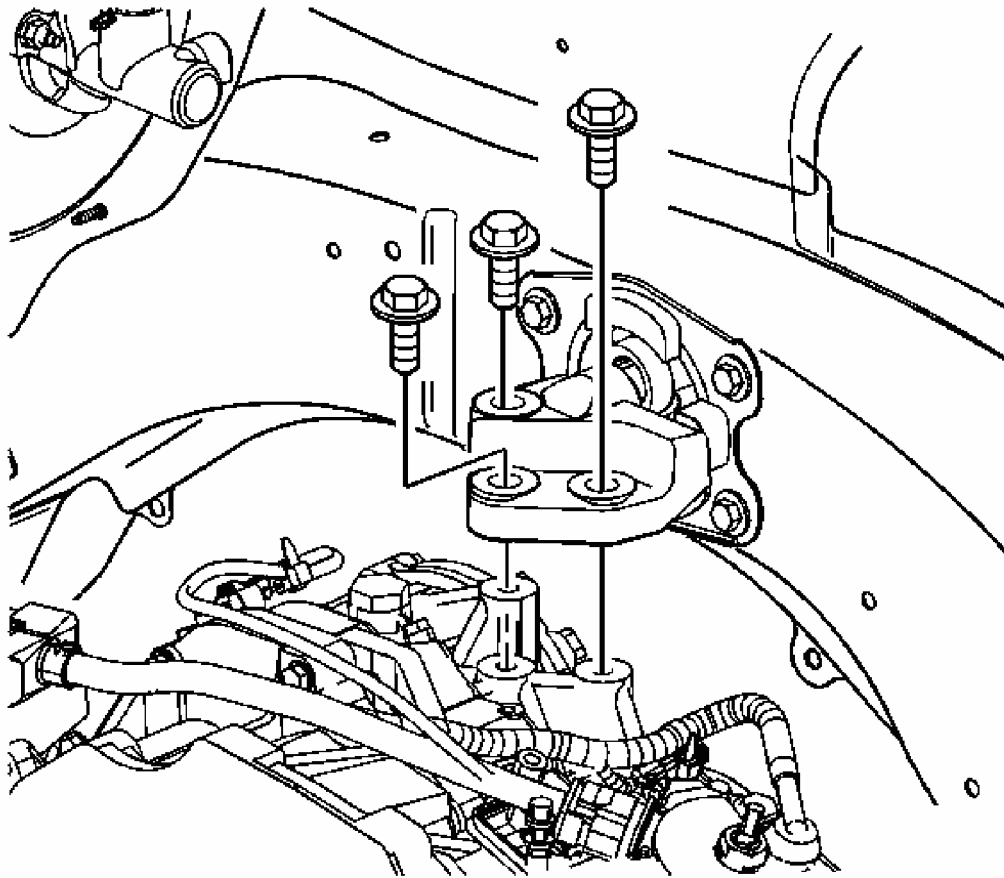


Fig. 32: View Of Transmission Mount-To-Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The transmission mount to transmission bolts must be hand started. Do not pry the transmission or mount to align the holes.

4. Hand start the transmission mount to transmission bolts using the following sequence:
 1. Rear bolt
 2. Middle bolt
 3. Front bolt
5. Using the previous sequence, tighten the transmission mount bolts.

Tighten: Tighten the bolts to 45 N.m (33 lb ft).

6. Reposition the underhood electrical center.

7. Connect the wiring harness to the tray bracket.

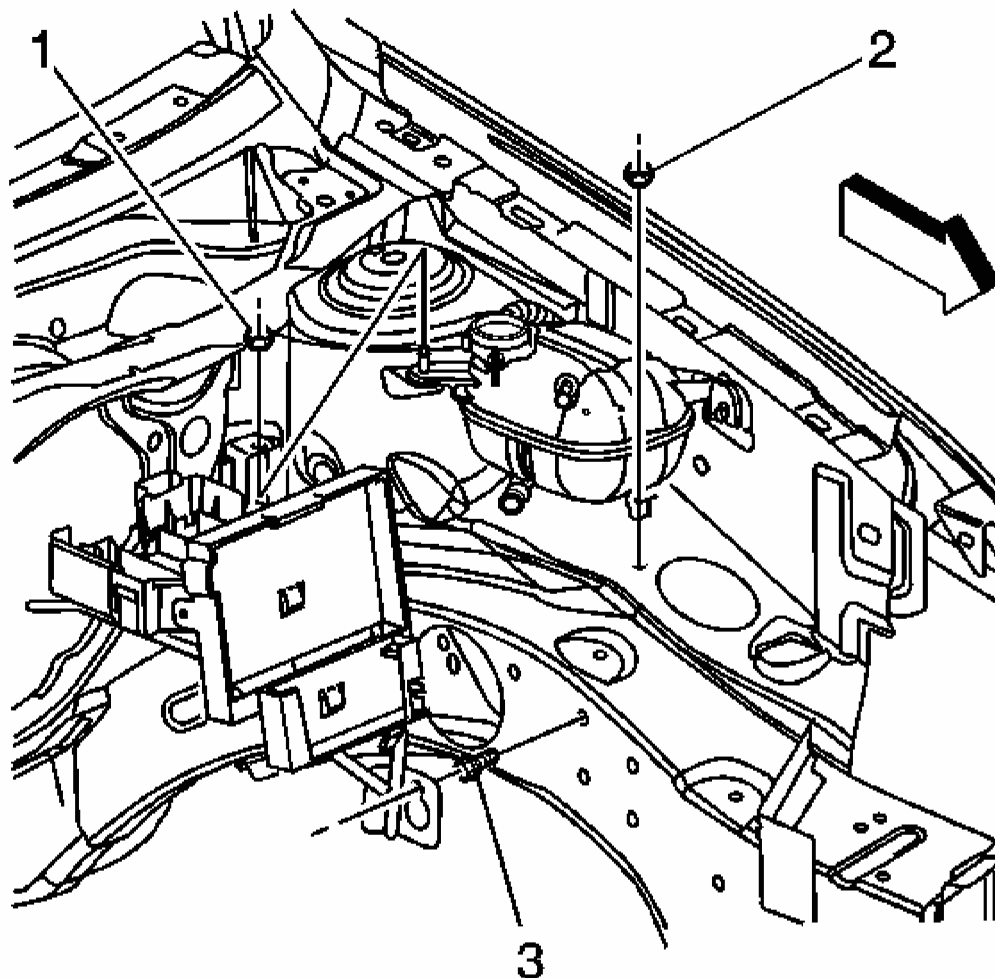


Fig. 33: View Of Engine Compartment Component Locations
Courtesy of GENERAL MOTORS CORP.

8. Install the electrical center nuts (1, 2) and bolt (3).

Tighten:

- Tighten the nuts to 10 N.m (89 lb in).
- Tighten the bolt to 25 N.m (18 lb ft).

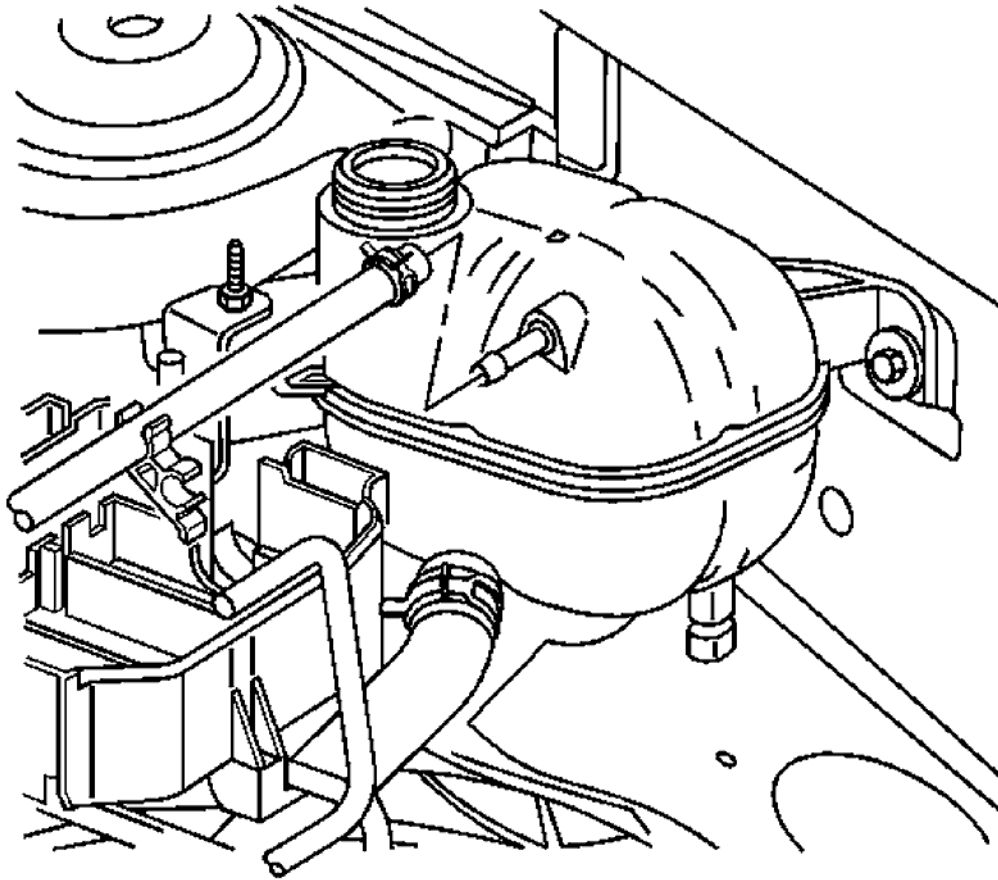


Fig. 34: View Of Surge Tank Inlet Hose
Courtesy of GENERAL MOTORS CORP.

9. Connect the surge tank inlet hose to the surge tank.

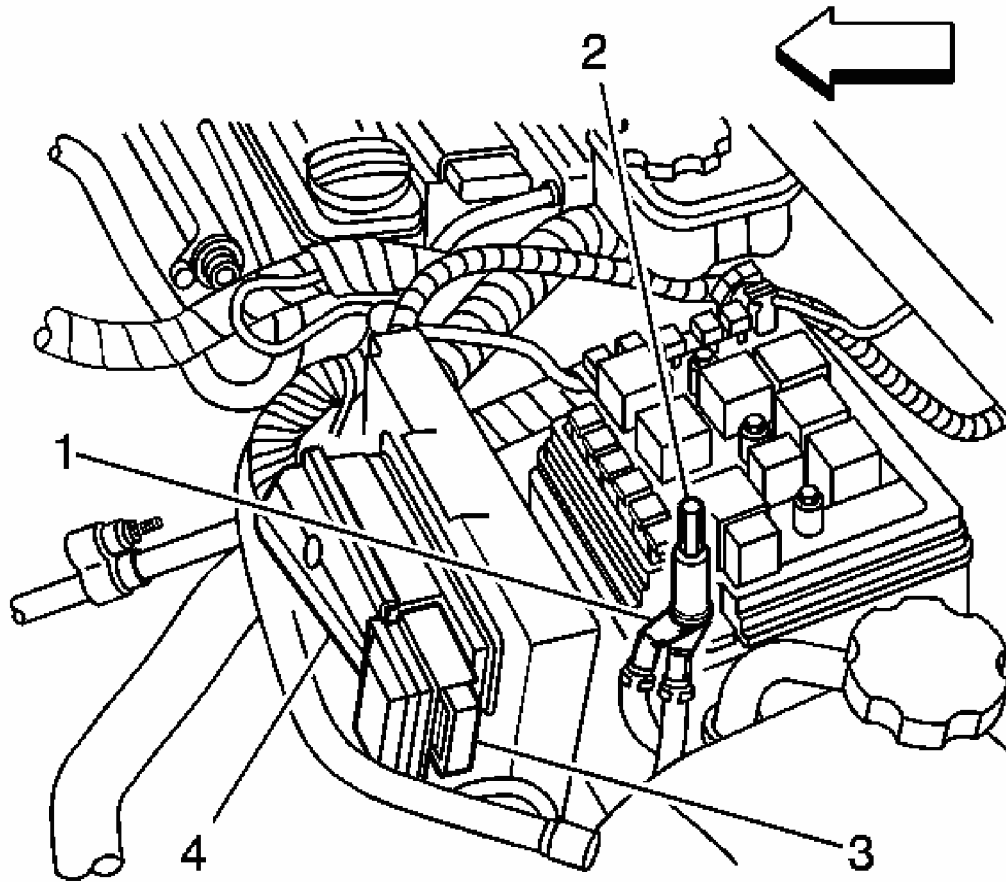


Fig. 35: View Of Engine Electrical Center
Courtesy of GENERAL MOTORS CORP.

10. Install the positive battery cables (1) to the underhood electrical center.

Tighten: Tighten the positive cable nut to 15 N.m (11 lb ft).

11. Connect the engine control module harness connectors (3, 4).
12. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.
13. Install the underhood electrical center cover.

TRANSMISSION MOUNT BRACKET REPLACEMENT - REAR

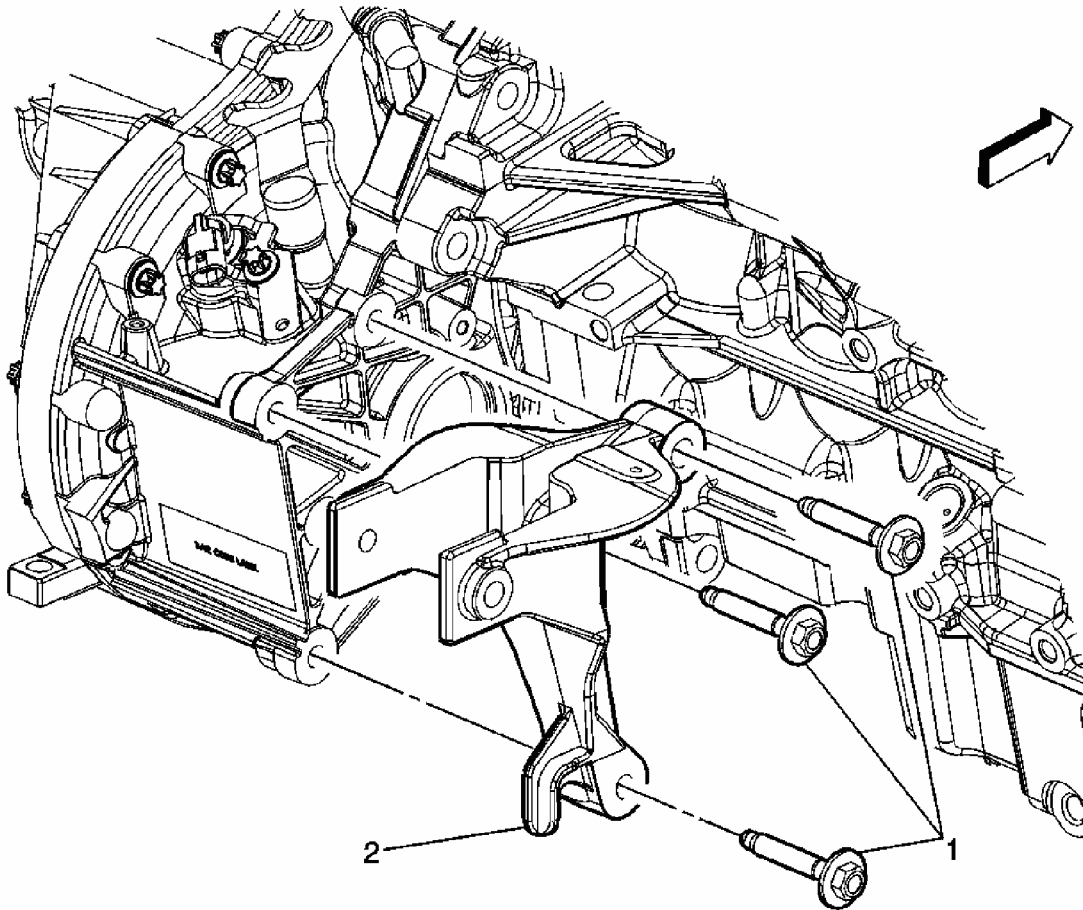


Fig. 36: Transmission Mount Bracket Replacement - Rear
Courtesy of GENERAL MOTORS CORP.

Transmission Mount Bracket Replacement - Rear

Callout	Component Name
NOTE: Refer to Fastener Notice in Cautions and Notices.	
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications . Preliminary Procedure: Remove the rear transmission mount. Refer to Transmission Mount Replacement - Rear .	
1	Transaxle Mount Bracket Bolt (Qty: 3) Tighten: 50 N.m (37 lb ft). Tip: Tighten bolts in specified sequence.
2	Transaxle Bracket

TRANSMISSION FLUID CHECKING PROCEDURE

1. Remove the left front wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

IMPORTANT: Inspect the fluid level only when the engine is off. Ensure the vehicle is level. The transaxle must be cold.

2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.

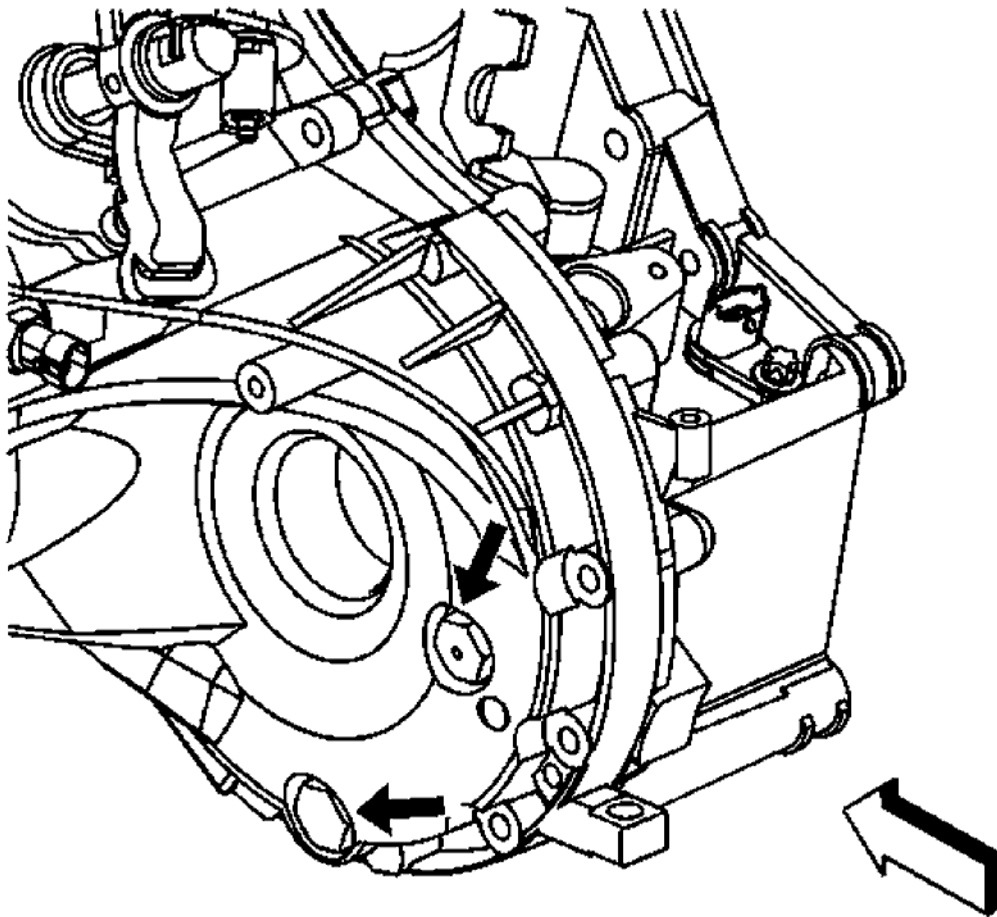


Fig. 37: Locating Fluid Level Check Plugs
Courtesy of GENERAL MOTORS CORP.

3. Remove the level check plug.

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4. Verify that the fluid is up to the opening.
5. If no fluid is visible, add Dexron III P/N 21019223 Transmission Fluid, or equivalent until the level check opening begins to leak fluid.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the fluid level check plug.

Tighten: Tighten the fluid level check plug to 38 N.m (28 lb ft).

7. Install the left front wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

TRANSMISSION FLUID REPLACEMENT

Draining Procedure

1. Remove the left front wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

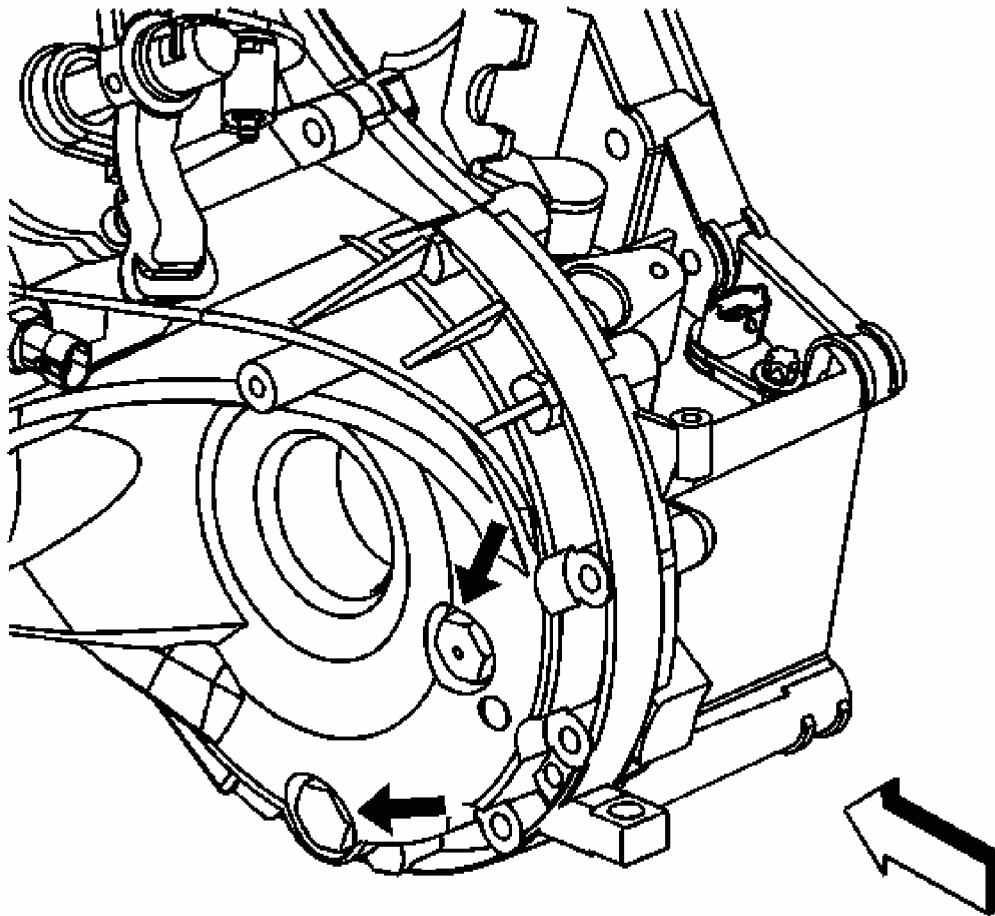


Fig. 38: Locating Fluid Level Check Plugs
Courtesy of GENERAL MOTORS CORP.

2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Clean away all dirt and debris from the transmission fluid drain plug area.
4. Remove the drain plug.
5. Allow the system to drain.

NOTE: Refer to **Fastener Notice** in Cautions and Notices.

6. Install the transmission fluid drain plug, using pipe sealant Saturn P/N 21485278 or equivalent on the plug threads.

Tighten: Tighten the transmission fluid drain plug to 38 N.m (28 lb ft).

Filling Procedure

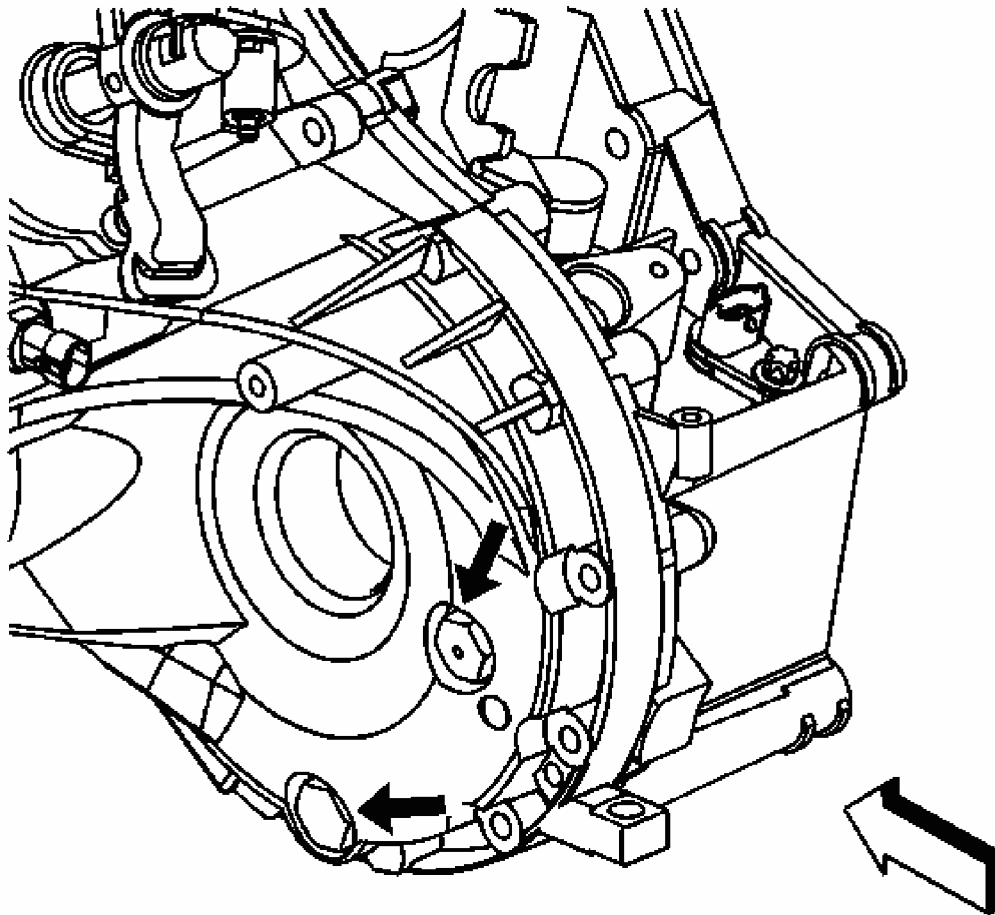


Fig. 39: Locating Fluid Level Check Plugs
Courtesy of GENERAL MOTORS CORP.

1. Clean away all dirt and debris from the transmission fluid fill plug area.
2. Remove the transmission fluid level check plug.
3. Fill the transmission with DEXRON®-III transmission fluid Saturn P/N 21019223, until even with the bottom of the fill plug hole.
4. Install the level check plug.

Tighten: Tighten the level check plug to 38 N.m (28 lb ft).

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5. Install the left front wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

FRONT WHEEL DRIVE SHAFT OIL SEAL REPLACEMENT

Tools Required

- **J 44385** Differential Bearing Race and Seal Installer
- **J 7079-2** Non-threaded Driver Handle
- **SA9133T** Axle Seal Puller

Removal Procedure

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the front wheel and tire assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the wheel driveshaft. Refer to **Wheel Drive Shaft Replacement** in Wheel Drive Shafts.

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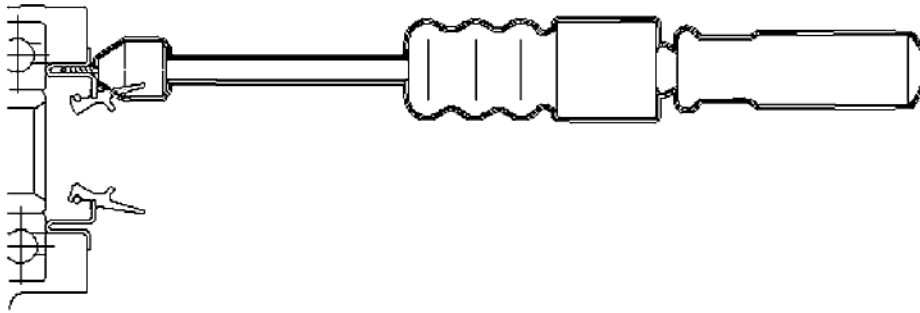


Fig. 40: Removing Front Wheel Drive Shaft Oil Seal
Courtesy of GENERAL MOTORS CORP.

4. Use the **SA9133T** in order to remove the seal.
5. Inspect the seal bore for nicks or for burrs. Clean the bore with a fine grade sandpaper, if necessary.

Installation Procedure

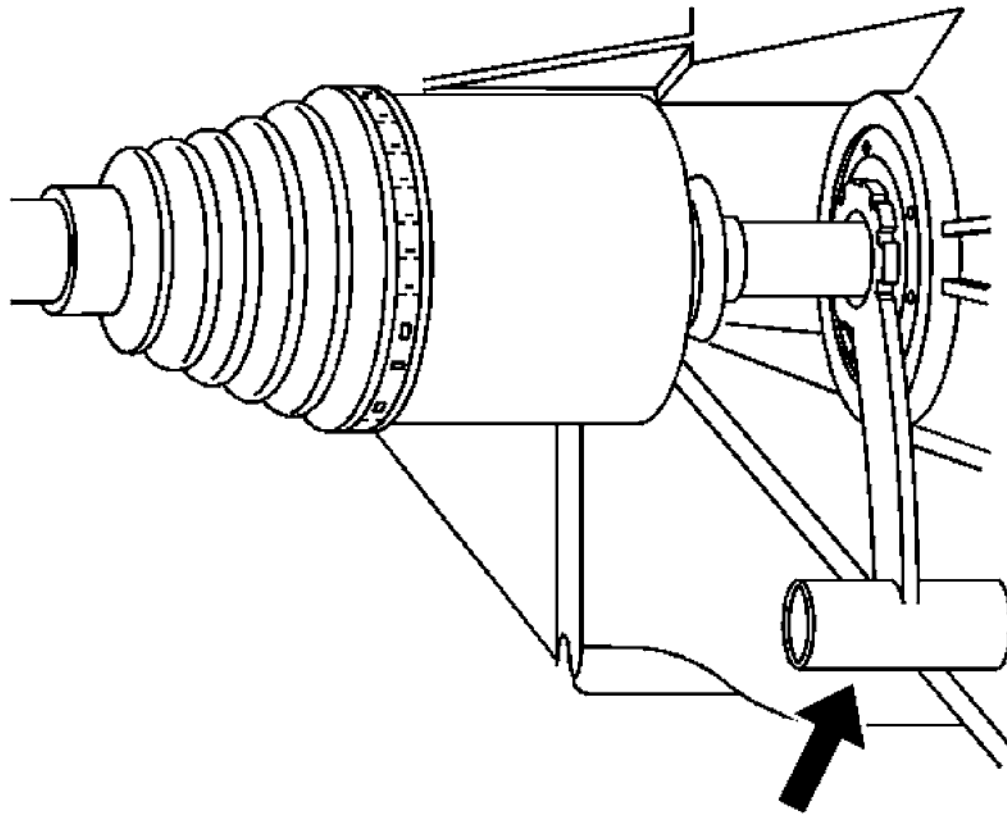


Fig. 41: Installing Wheel Drive Shaft Into Transaxle Through J 44394
Courtesy of GENERAL MOTORS CORP.

1. Use the **J 44385** and the **J 7079-2** in order to install a new seal. Ensure that the seal is seated flush to the outer bore area.
2. Lubricate the seal with Dexron®-III transmission fluid Saturn P/N 21019223.
3. Install the wheel driveshaft. Refer to **Wheel Drive Shaft Replacement** in Wheel Drive Shafts.
4. Install the front tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
5. Lower the vehicle.

AXLE SHAFT OIL SEAL REPLACEMENT

Tools Required

- **J 44385** Differential Bearing Race and Seal Installer

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- **J 7079-2** Non-threaded Driver Handle
- **SA9133T** Axle Seal Puller

Removal Procedure

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the front wheel and tire assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove the wheel driveshaft. Refer to **Wheel Drive Shaft Replacement** in Wheel Drive Shafts.

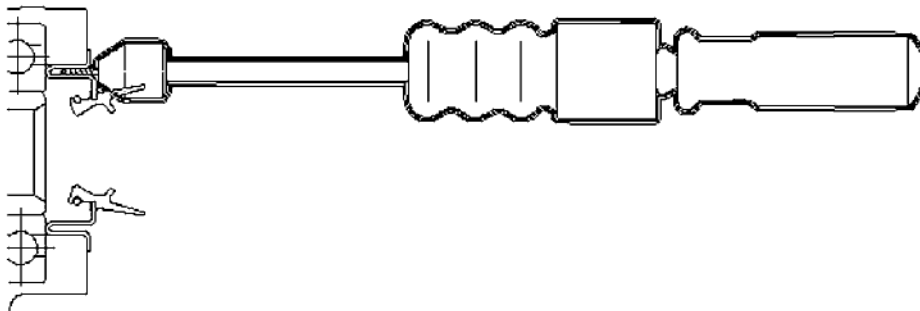


Fig. 42: Removing Front Wheel Drive Shaft Oil Seal
Courtesy of GENERAL MOTORS CORP.

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4. Use the **SA9133T** in order to remove the seal.
5. Inspect the seal bore for nicks or for burrs. Clean the bore with a fine grade sandpaper, if necessary.

Installation Procedure

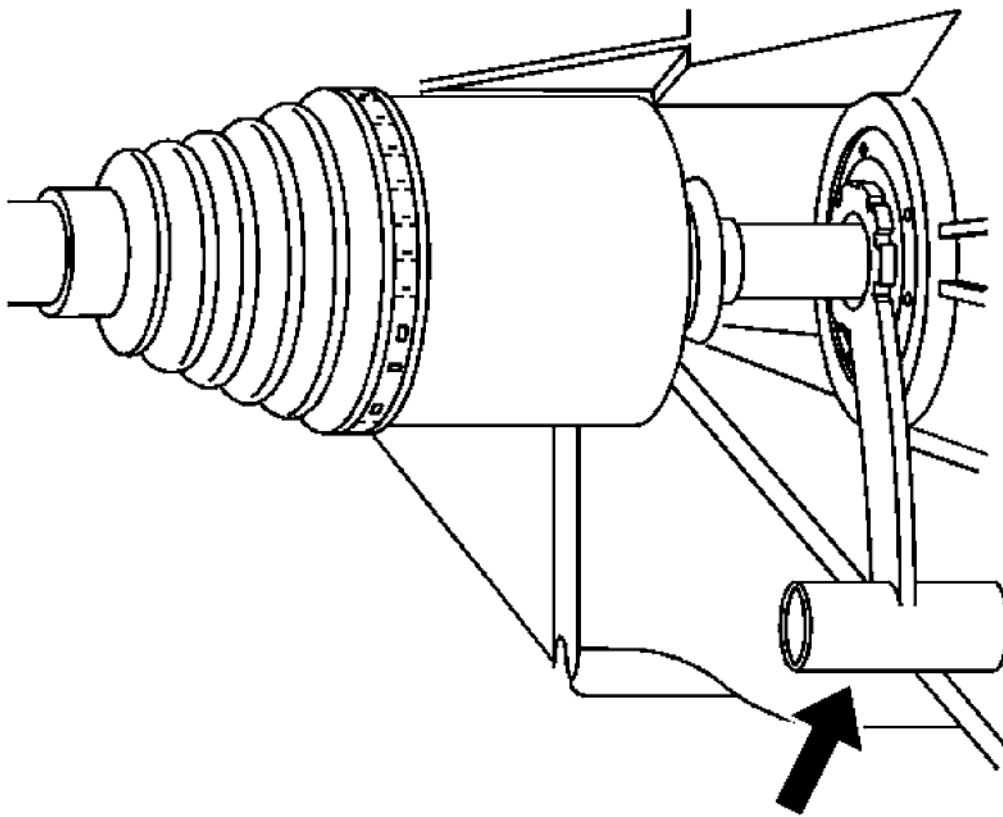


Fig. 43: Installing Wheel Drive Shaft Into Transaxle Through J 44394
Courtesy of GENERAL MOTORS CORP.

1. Use the **J 44385** and the **J 7079-2** in order to install a new seal. Ensure that the seal is seated flush to the outer bore area.
2. Lubricate the seal with Dexron®-III transmission fluid Saturn P/N 21019223.
3. Install the wheel driveshaft. Refer to **Wheel Drive Shaft Replacement** in Wheel Drive Shafts.
4. Install the front tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
5. Lower the vehicle.

FRONT WHEEL SPEED SENSOR REPLACEMENT

Removal Procedure

1. Remove the left front wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

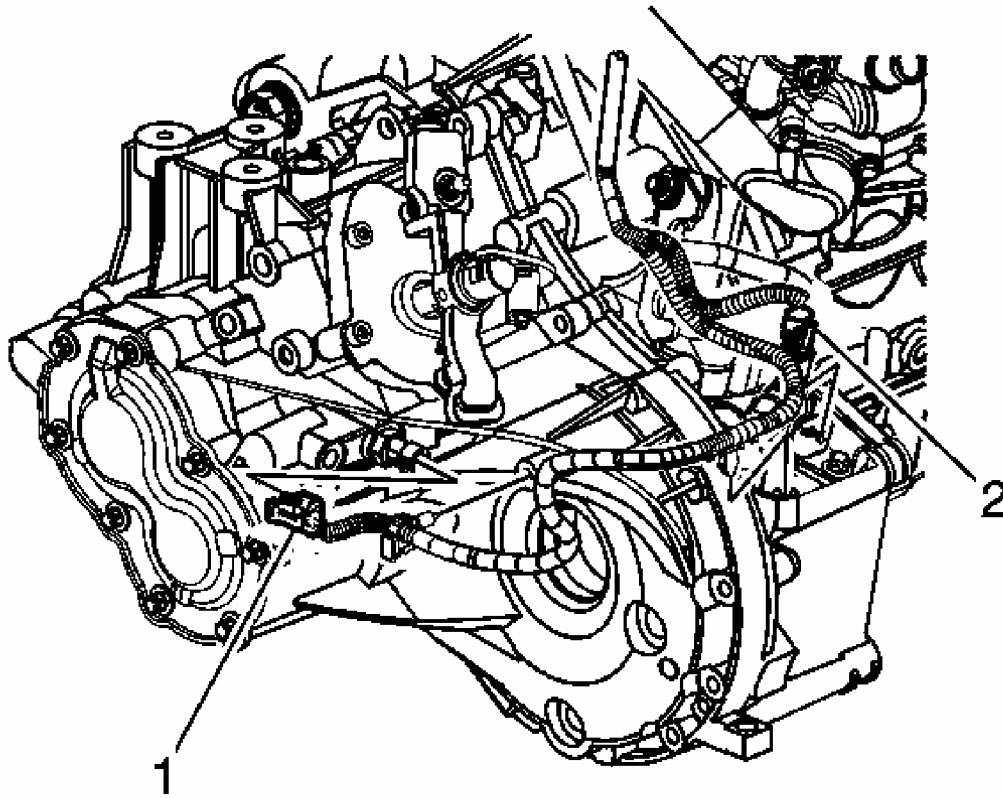


Fig. 44: Locating Backup Light Connector & VSS Connector
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the vehicle speed sensor (VSS) electrical connector (2).

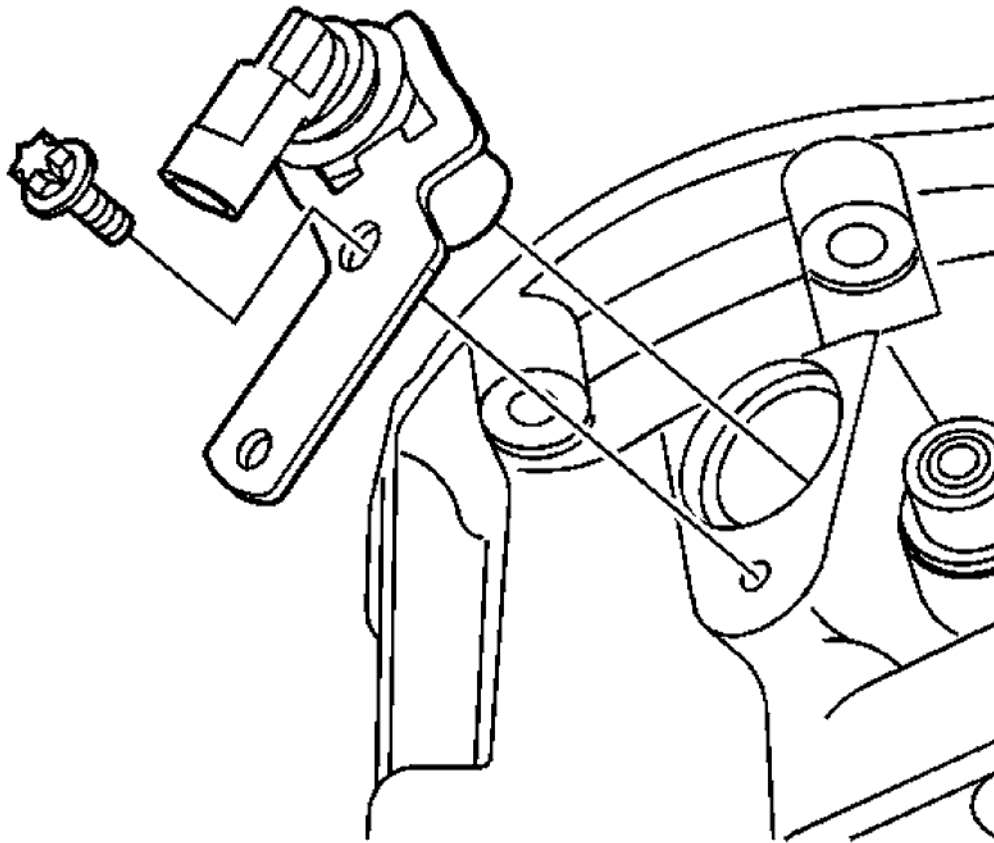


Fig. 45: View Of Vehicle Speed Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Remove the retainer bolt.
4. Remove the retainer.
5. Remove the VSS.
6. Remove and discard the O-ring.

Installation Procedure

1. Lubricate a new O-ring with DEXRON III transmission fluid Saturn P/N 121019223.
2. Install the new O-ring.

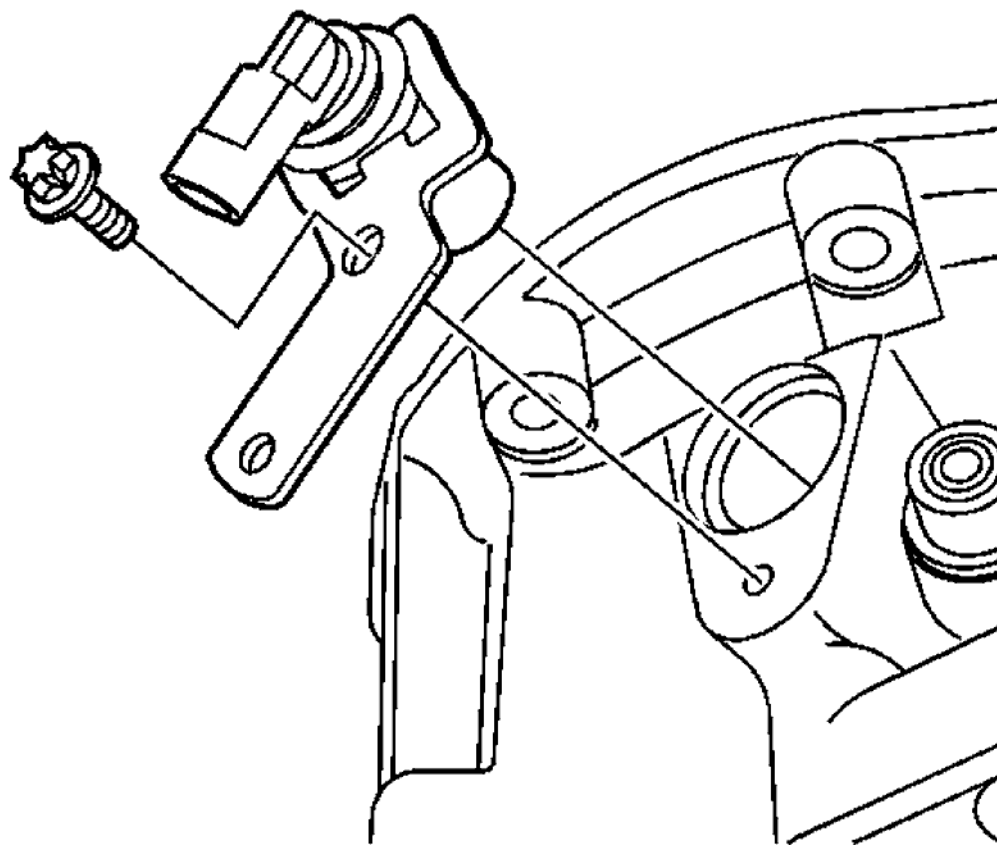


Fig. 46: View Of Vehicle Speed Sensor & Bolt
Courtesy of GENERAL MOTORS CORP.

3. Install the VSS assembly.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the VSS retainer bolt.

Tighten: Tighten the bolt to 9 N.m (80 lb in).

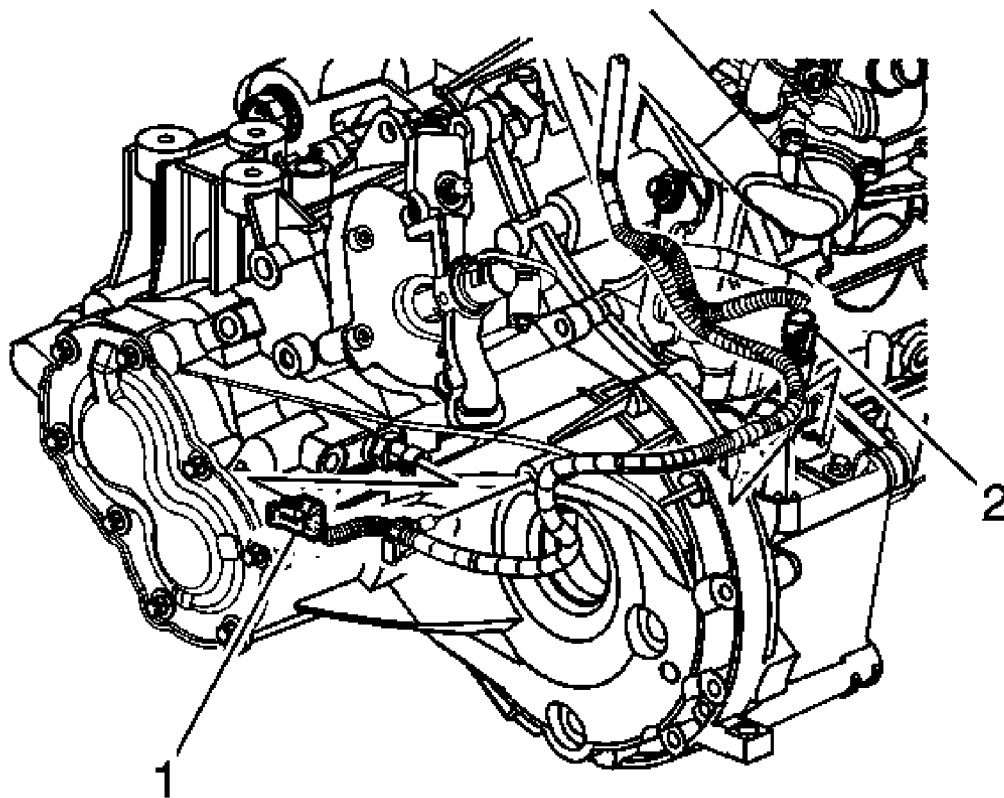


Fig. 47: Locating Backup Light Connector & VSS Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the VSS connector to the VSS (2).
6. Install the left front wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

VEHICLE SPEED SENSOR (VSS) REPLACEMENT

Removal Procedure

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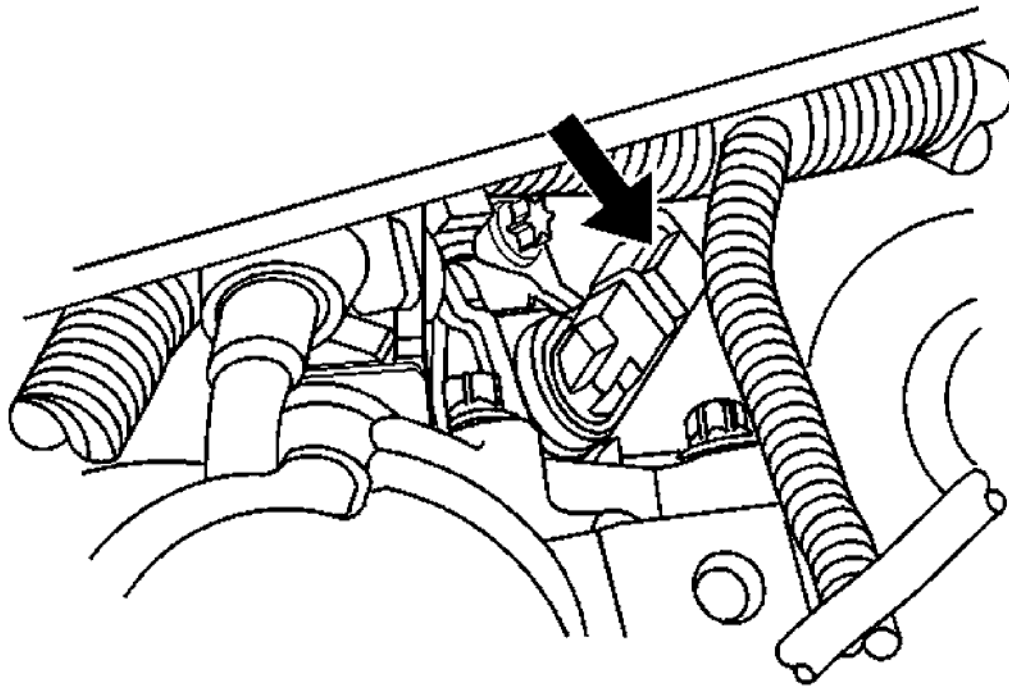


Fig. 48: Locating Vehicle Speed Sensor (VSS)
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the vehicle speed sensor (VSS) electrical connector.

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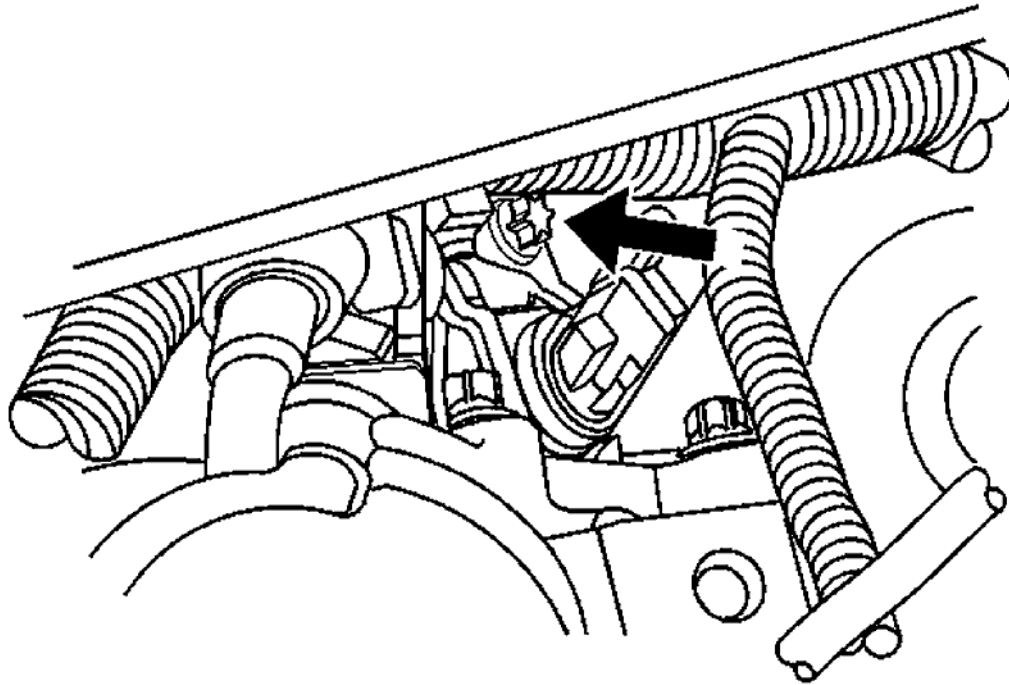


Fig. 49: View Of VSS Retainer Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the retainer bolt.

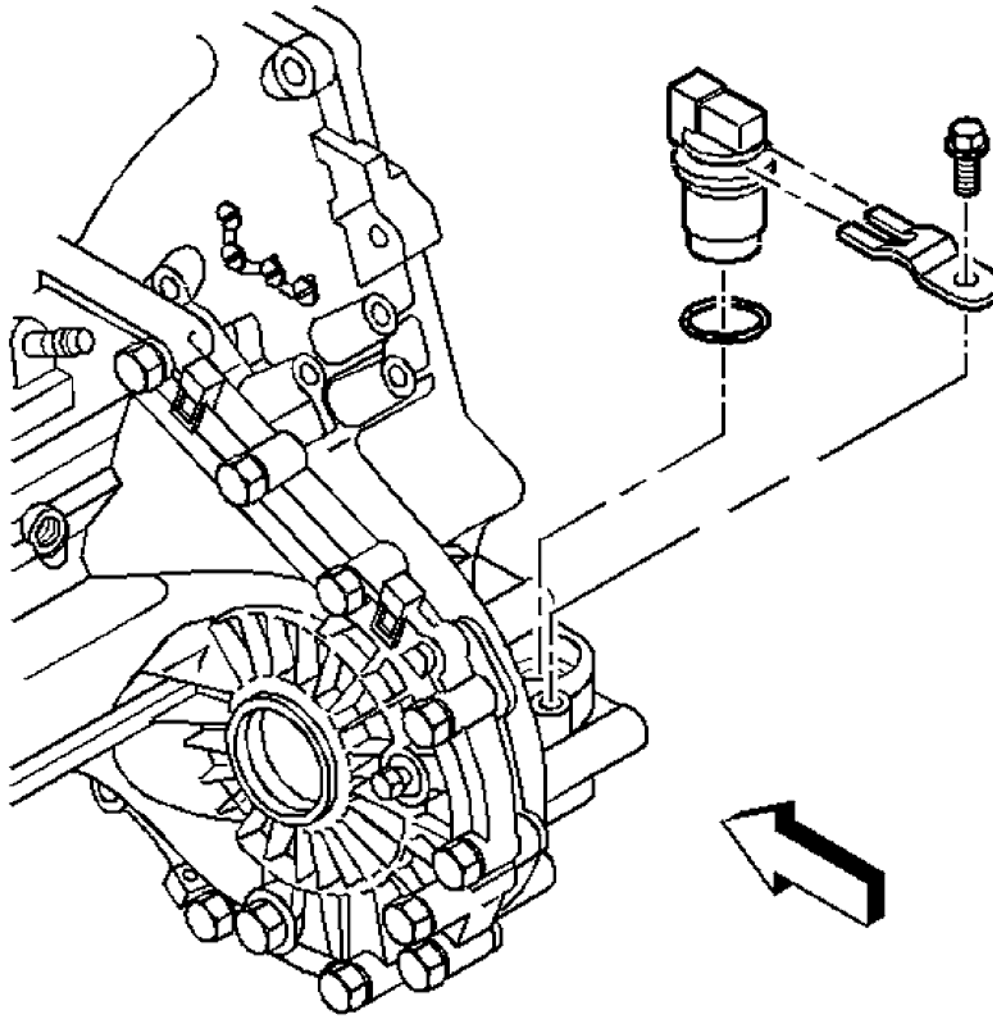


Fig. 50: Identifying VSS Retainer
Courtesy of GENERAL MOTORS CORP.

3. Remove the retainer.
4. Pull up on the VSS in order to remove the VSS from the transaxle.
5. Remove the O-ring.

Installation Procedure

1. Lubricate a new O-ring with DEXRON III transmission fluid.
2. Install the new O-ring.

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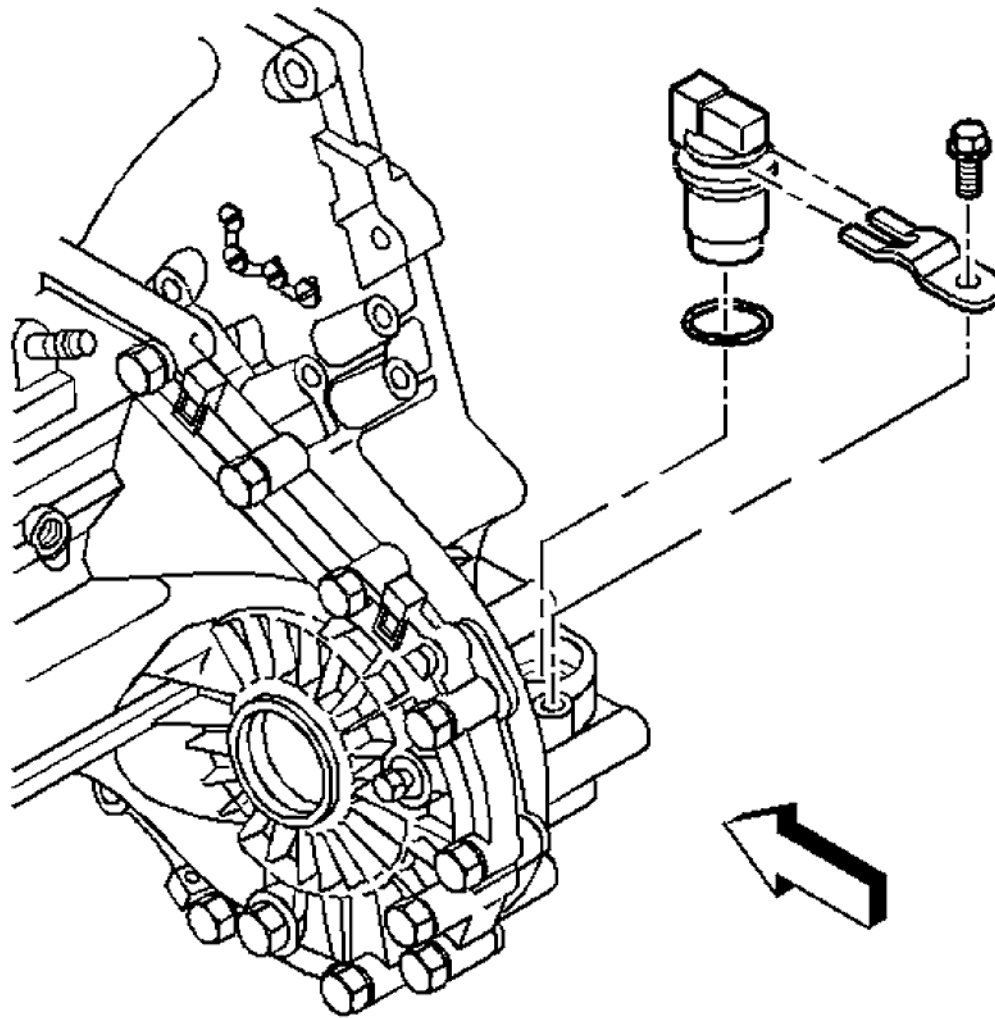


Fig. 51: Identifying VSS Retainer
Courtesy of GENERAL MOTORS CORP.

3. Install the VSS assembly.
4. Install the VSS retainer.

NOTE: Refer to Fastener Notice in Cautions and Notices.

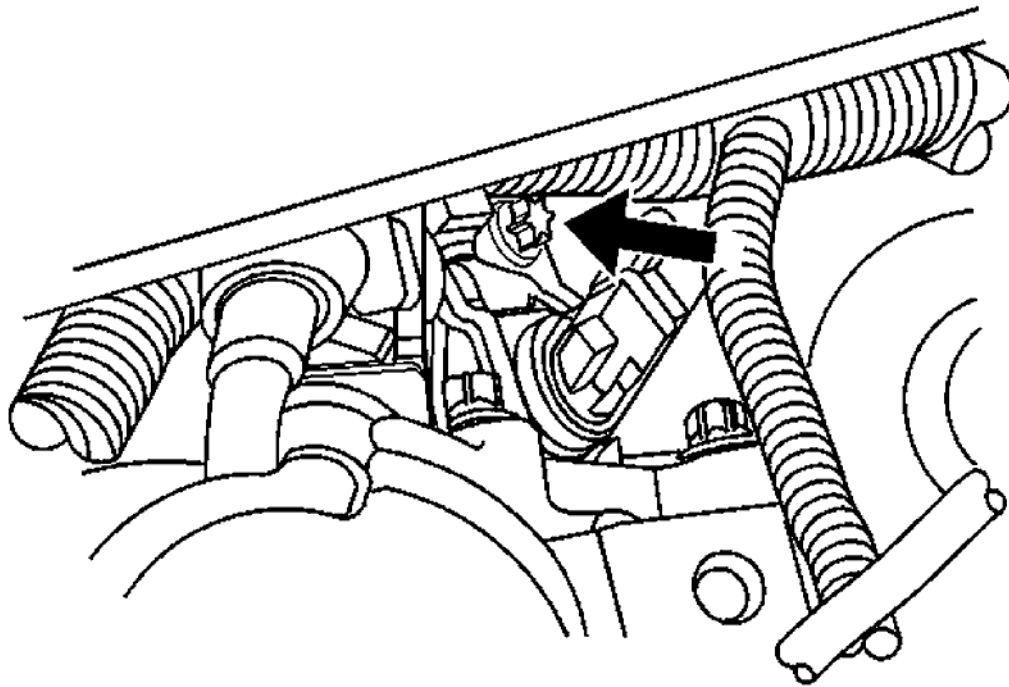


Fig. 52: View Of VSS Retainer Bolt
Courtesy of GENERAL MOTORS CORP.

5. Install the VSS retainer bolt.

Tighten: Tighten the bolt to 12 N.m (8 lb ft).

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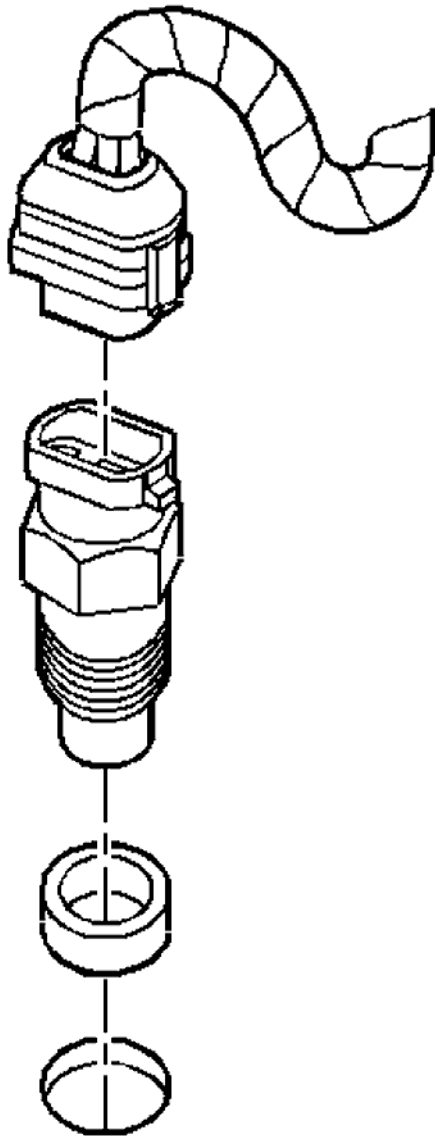


Fig. 53: Connecting VSS Connector To VSS
Courtesy of GENERAL MOTORS CORP.

6. Connect the VSS connector to the VSS.
7. Lower the vehicle.

SHIFT CABLE REPLACEMENT

Removal Procedure

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1. Apply the parking brake.
2. Shift the transmission to neutral (N).
3. Remove the console. Refer to **Console Replacement - Front Floor** in Instrument Panel, Gages and Console.

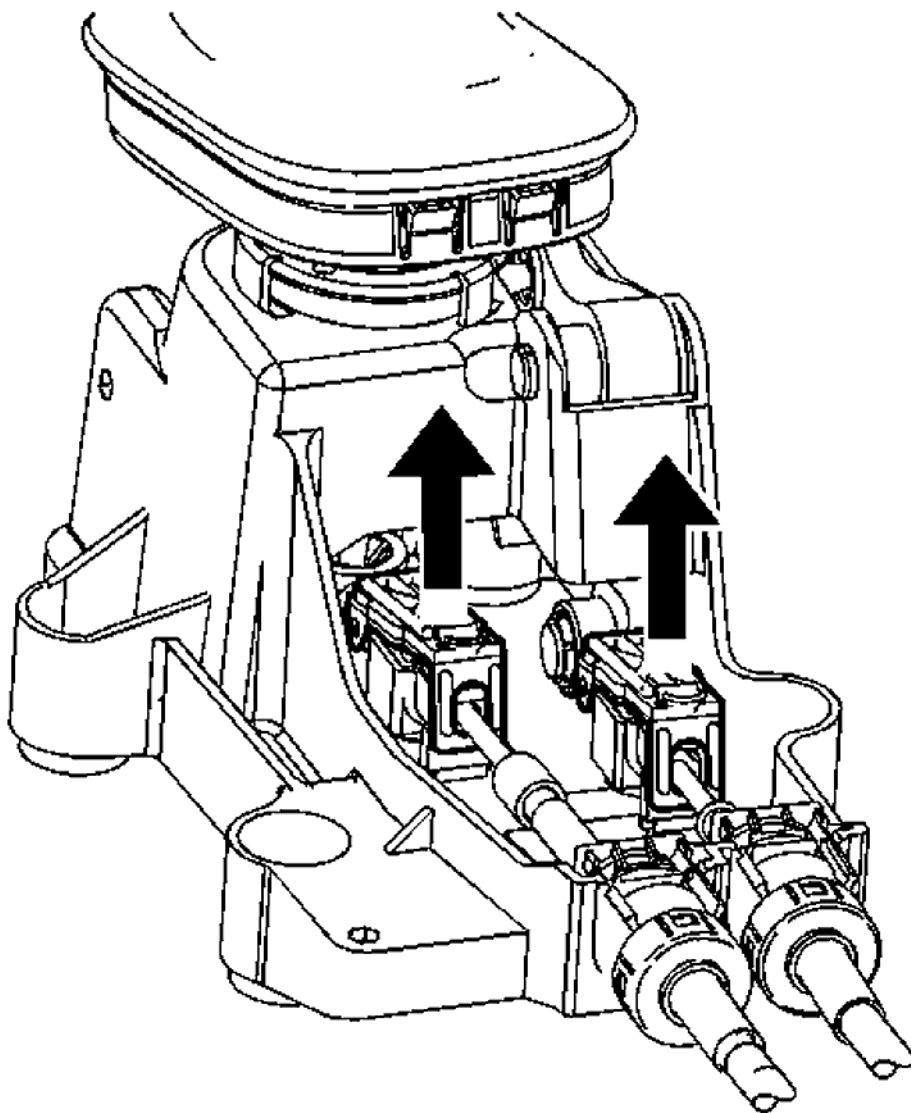


Fig. 54: Cable Retainers
Courtesy of GENERAL MOTORS CORP.

4. Lift up the cable retainers.

5. Disconnect cable ends from the shift control assembly, noting the location for assembly.

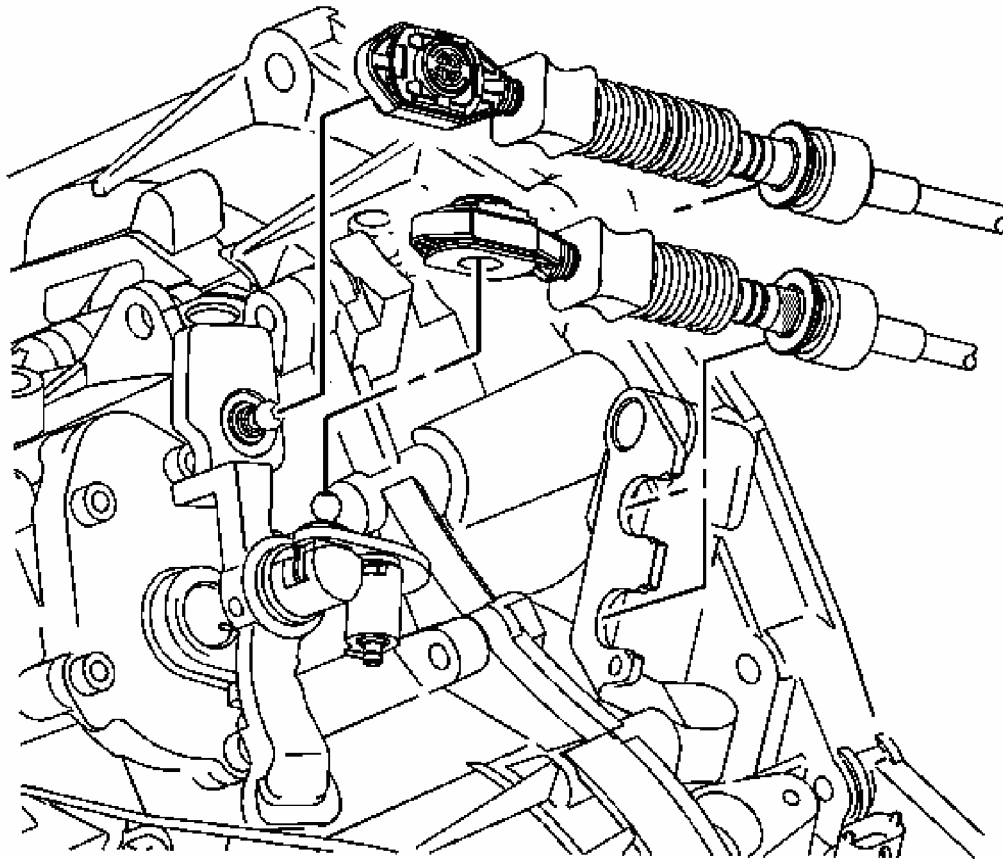


Fig. 55: View Of Shift Cables, Cable Connections & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the cable ends from the transmission shift levers, noting the location for assembly.
7. Remove the shift cable from the transmission cable bracket.
8. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
9. Remove the shift cable attachment nut from the underbody.
10. Lower the vehicle.
11. Remove the left instrument panel closeout panel. Refer to **Extension Replacement - Floor Console - Side** in Instrument Panel, Gages and Console.

12. Position the drivers side front carpet aside. Refer to **Carpet Replacement** in Interior Trim.

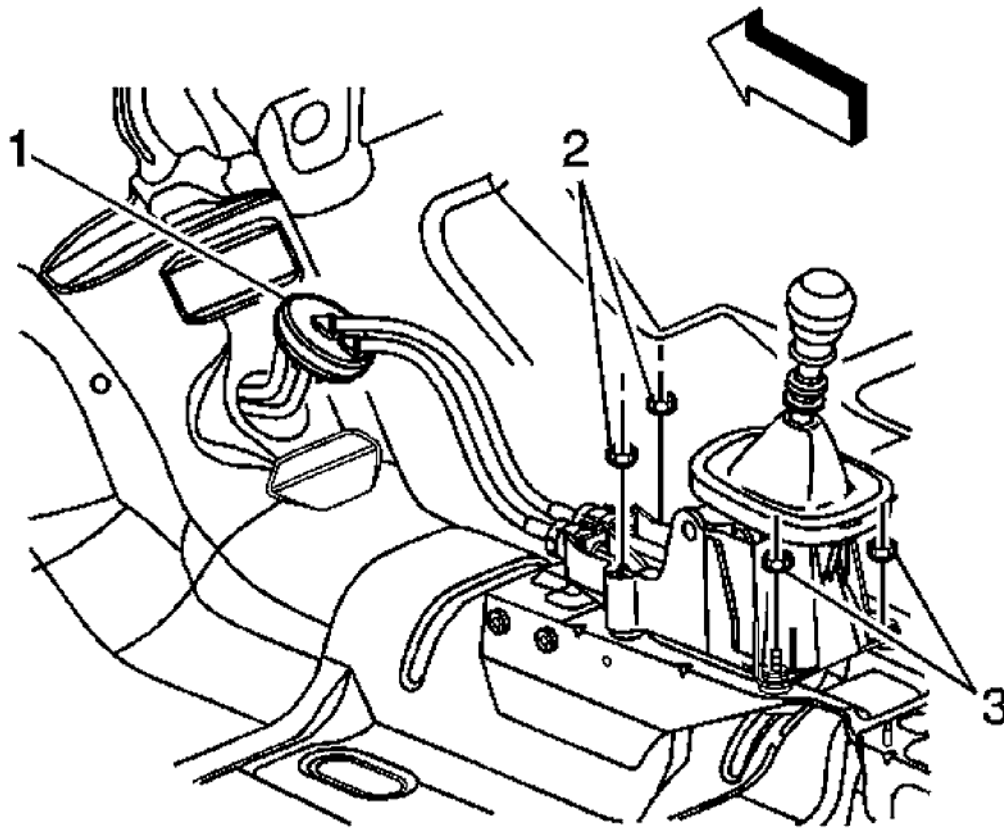


Fig. 56: Locating Floor Pan Grommet & Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

13. Separate the grommet (1) from the floor pan.
14. Remove the cable from the vehicle by pulling the cables through the drivers floor opening.

Installation Procedure

1. Feed the cable assembly through the drivers floor opening.

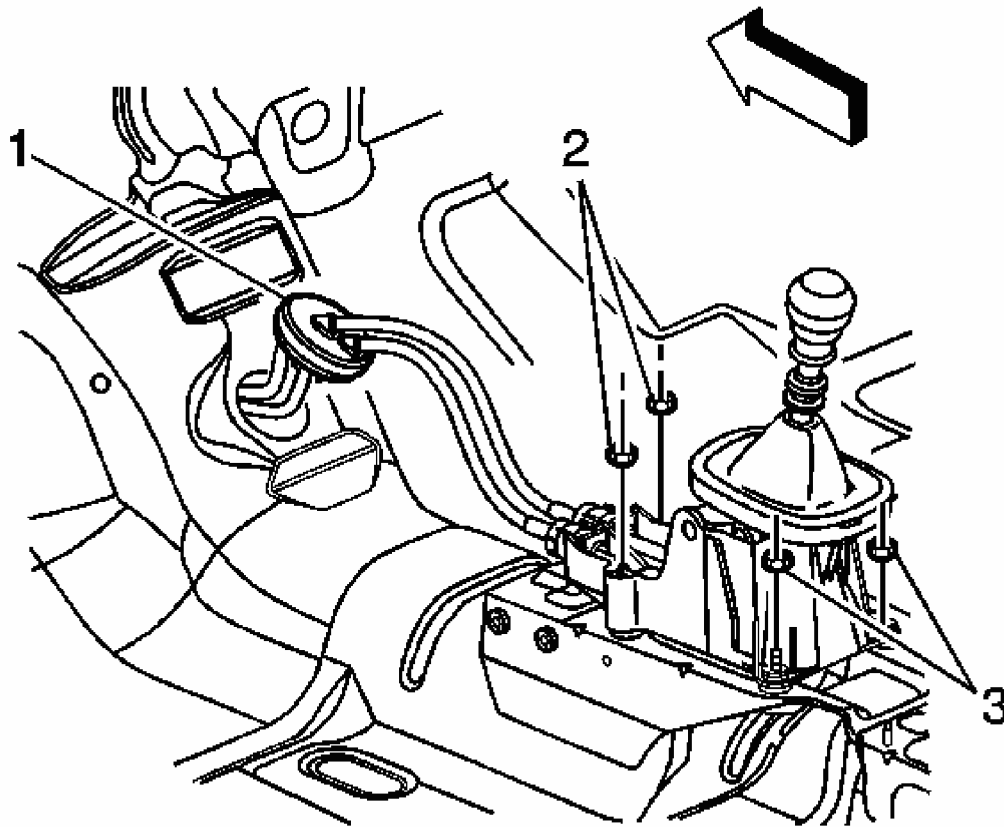


Fig. 57: Locating Floor Pan Grommet & Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

2. Install the grommet (1) flush with the floor opening.
3. Install the drivers side front carpet. Refer to **Carpet Replacement** in Interior Trim.
4. Install the left instrument panel closeout panel. Refer to **Extension Replacement - Floor Console - Side** in Instrument Panel, Gages and Console.
5. Raise the vehicle.

NOTE: Refer to **Fastener Notice** in Cautions and Notices.

6. Install the shift cable attachment nut to the underbody.

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

7. Lower the vehicle.

8. Install the shift cables to the transmission cable bracket.

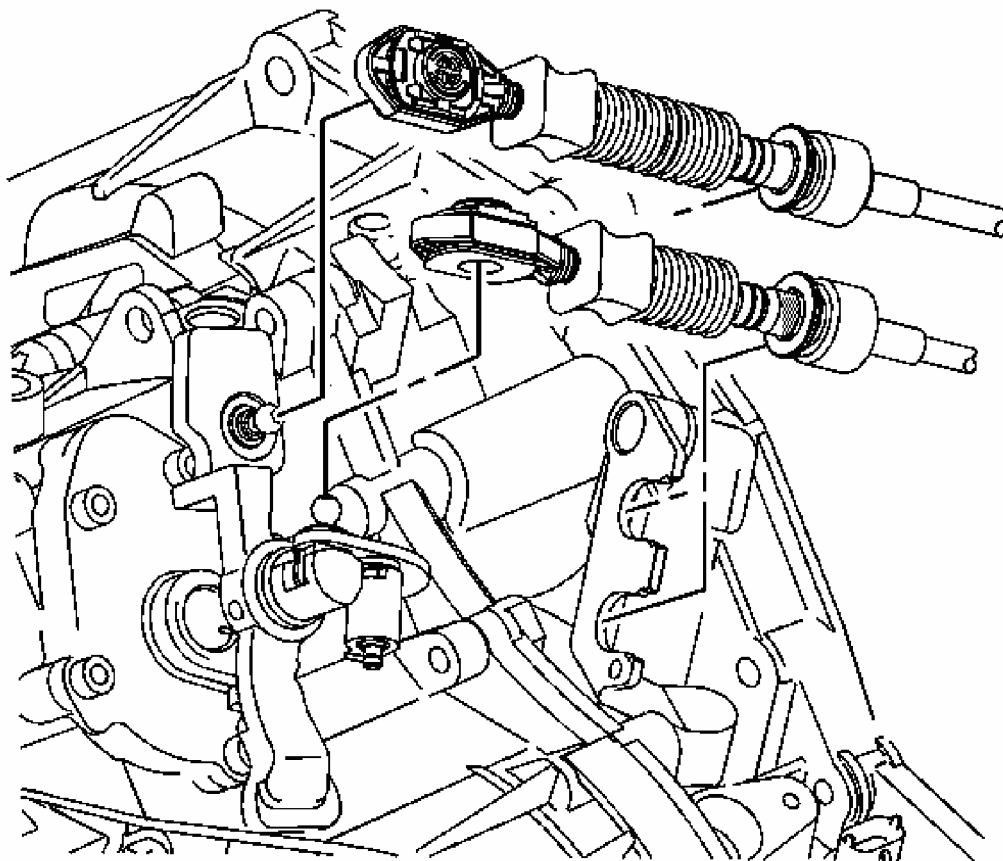


Fig. 58: View Of Shift Cables, Cable Connections & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

9. Connect the shift cable ends to the transmission shift levers as noted during disassembly.
10. Connect the shift cable to the shift control assembly as noted during disassembly.

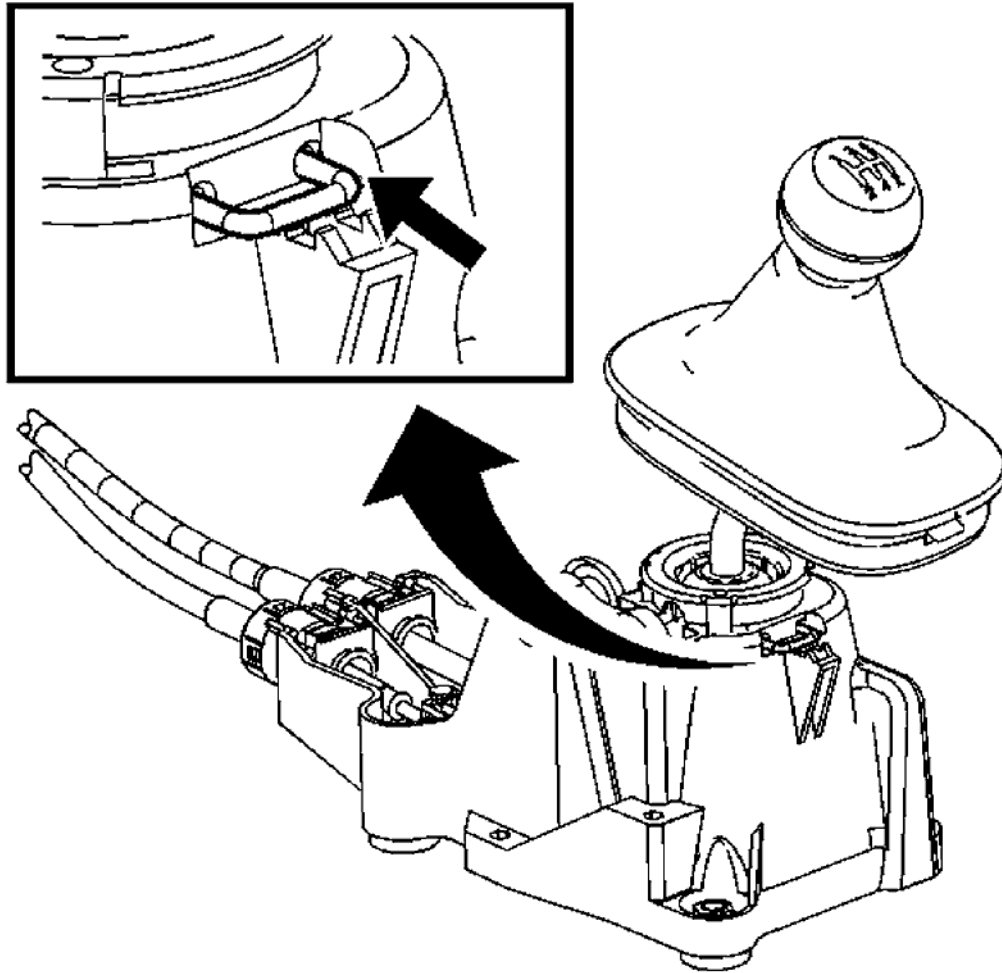


Fig. 59: Shifter Neutral Lock Clip
Courtesy of GENERAL MOTORS CORP.

11. Push the shifter neutral lock clip. Move the shifter slightly in order to center the lock clip.
12. Ensure that the transmission is in neutral.

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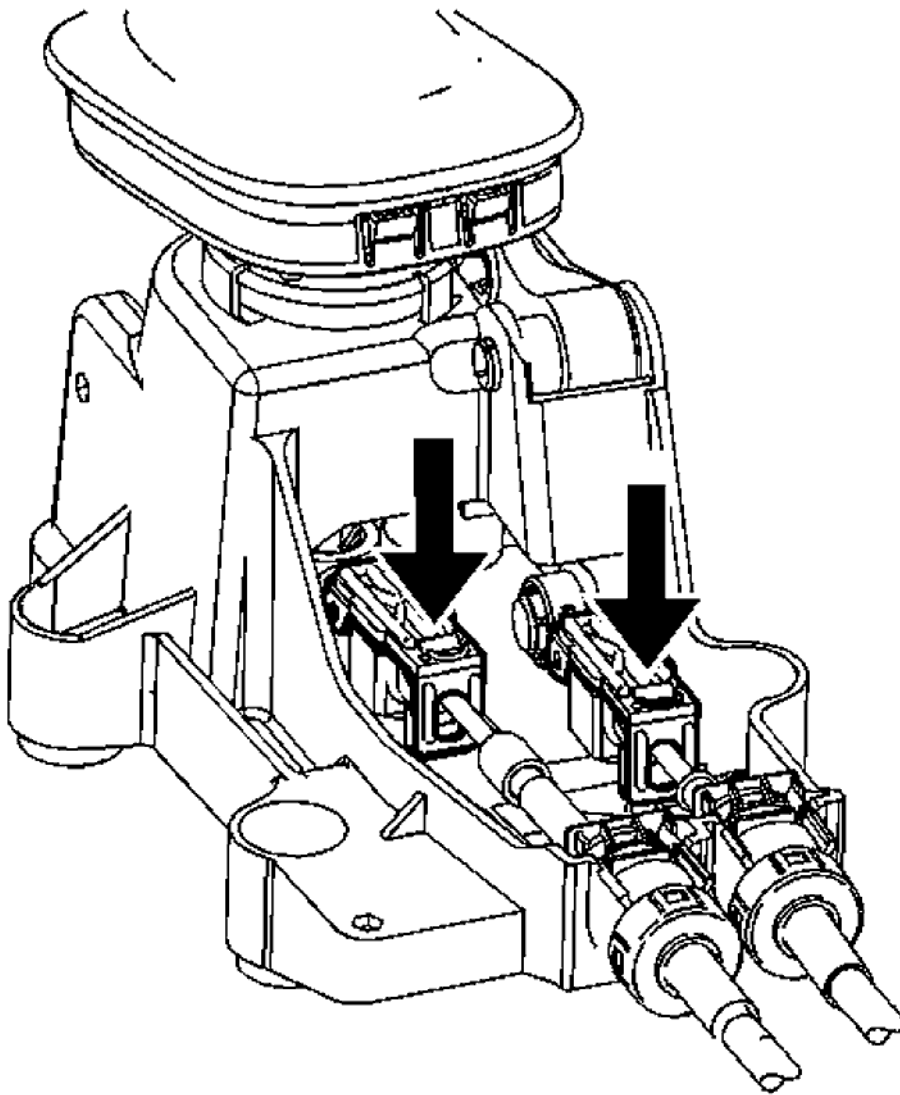


Fig. 60: Locking Tabs
Courtesy of GENERAL MOTORS CORP.

13. Press down on the locking tabs.

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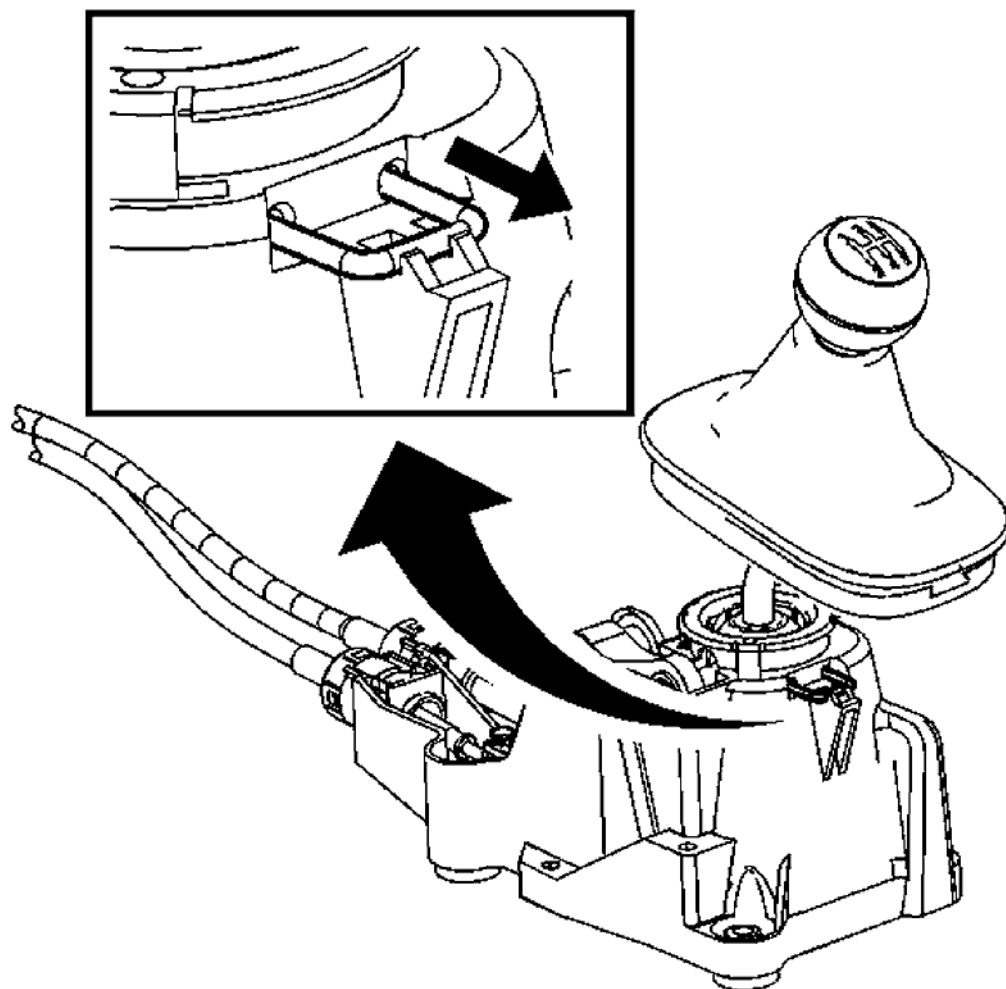


Fig. 61: Shifter Neutral Lock Clip
Courtesy of GENERAL MOTORS CORP.

14. Pull the shifter neutral lock clip to its original position.
15. Install the console. Refer to **Console Replacement - Front Floor** in Instrument Panel, Gages and Console.

SHIFT CONTROL REPLACEMENT

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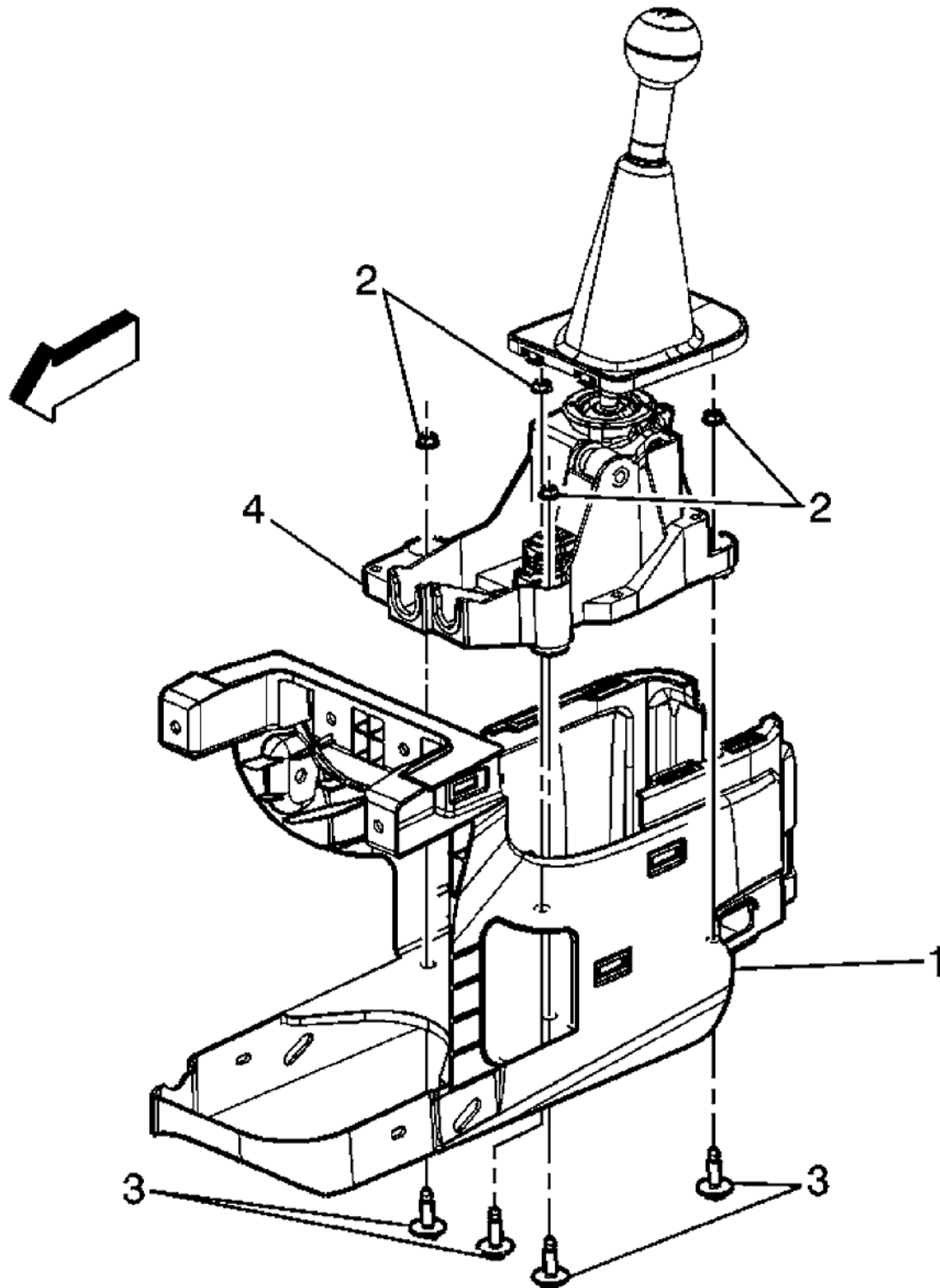


Fig. 62: Shift Control Replacement
Courtesy of GENERAL MOTORS CORP.

Shift Control Replacement

Callout	Component Name

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NOTE:

Refer to **Fastener Notice** in Cautions and Notices.

Fastener Tightening Specifications: Refer to **Fastener Tightening Specifications**. **Preliminary Procedure:** Disconnect the shift cables from the shift control. Refer to **Shift Cable Replacement**.

1	Instrument Panel Center Support Bracket. Refer to Bracket Replacement - Instrument Panel (I/P) Center Support
2	Shift Control Nut (Qty: 4) Tighten: 10 N.m (89 lb in)
3	Shift Control Bolt (Qty: 4)
4	Shift Control

SHIFT CONTROL KNOB REPLACEMENT

Removal Procedure

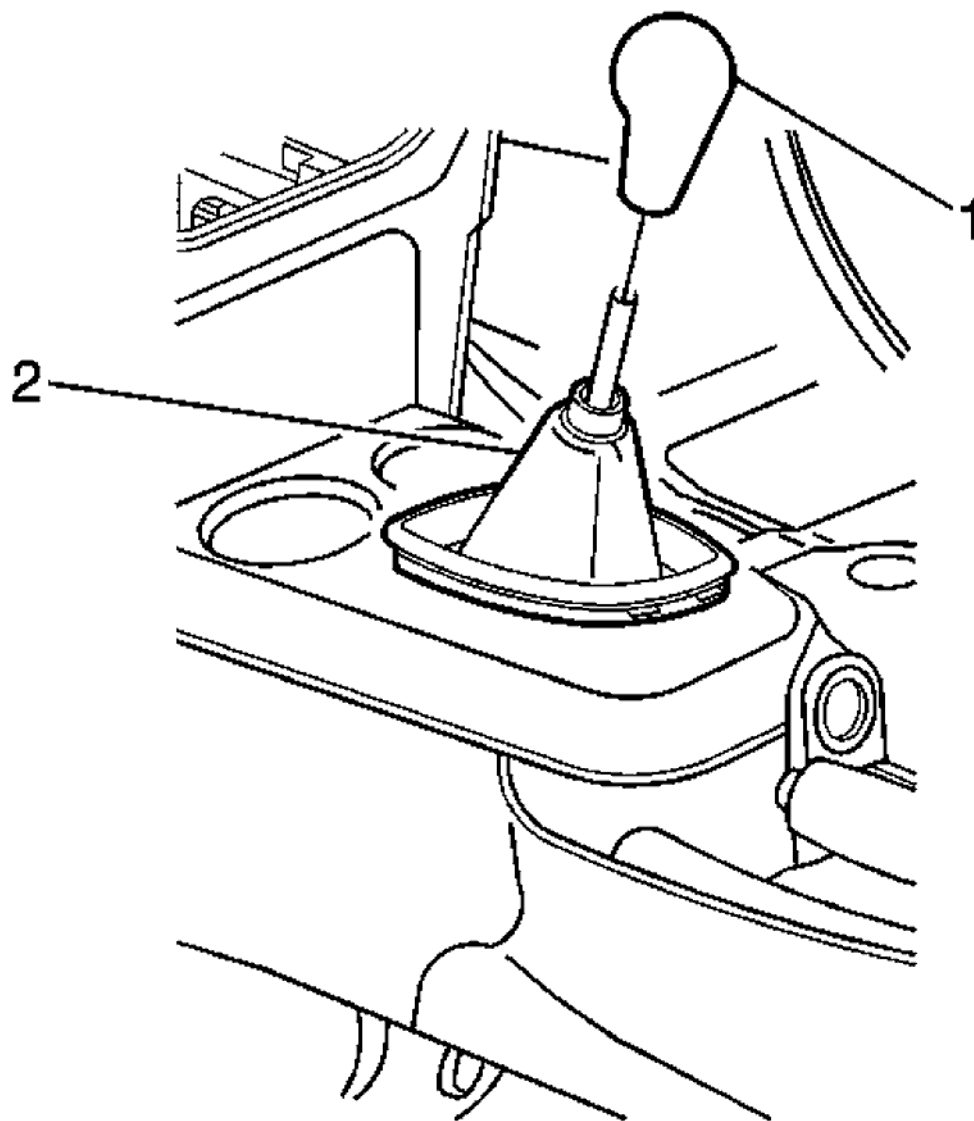


Fig. 63: View Of Shift Control Knob & Boot
Courtesy of GENERAL MOTORS CORP.

1. Twist the shift control boot collar 1/4 turn and disconnect from the shift control boot (2).
2. Remove the shift control knob (1) upward from the shift control assembly.

Installation Procedure

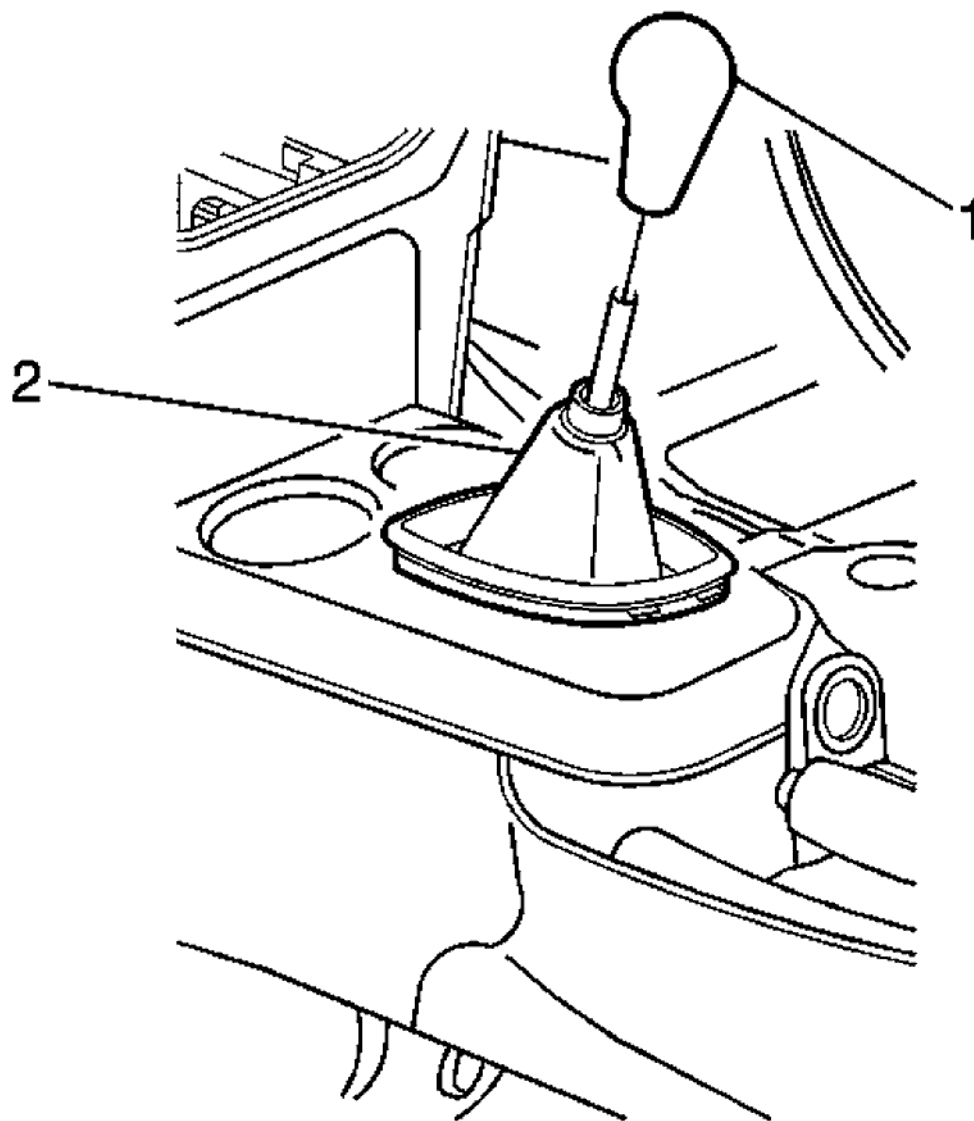


Fig. 64: View Of Shift Control Knob & Boot
Courtesy of GENERAL MOTORS CORP.

1. Install the shift control knob (1) to the shift control assembly.
2. Install the shift control boot collar (2) to the shift control knob (1) and twist 1/4 turn to lock.

SHIFT CONTROL BOOT REPLACEMENT

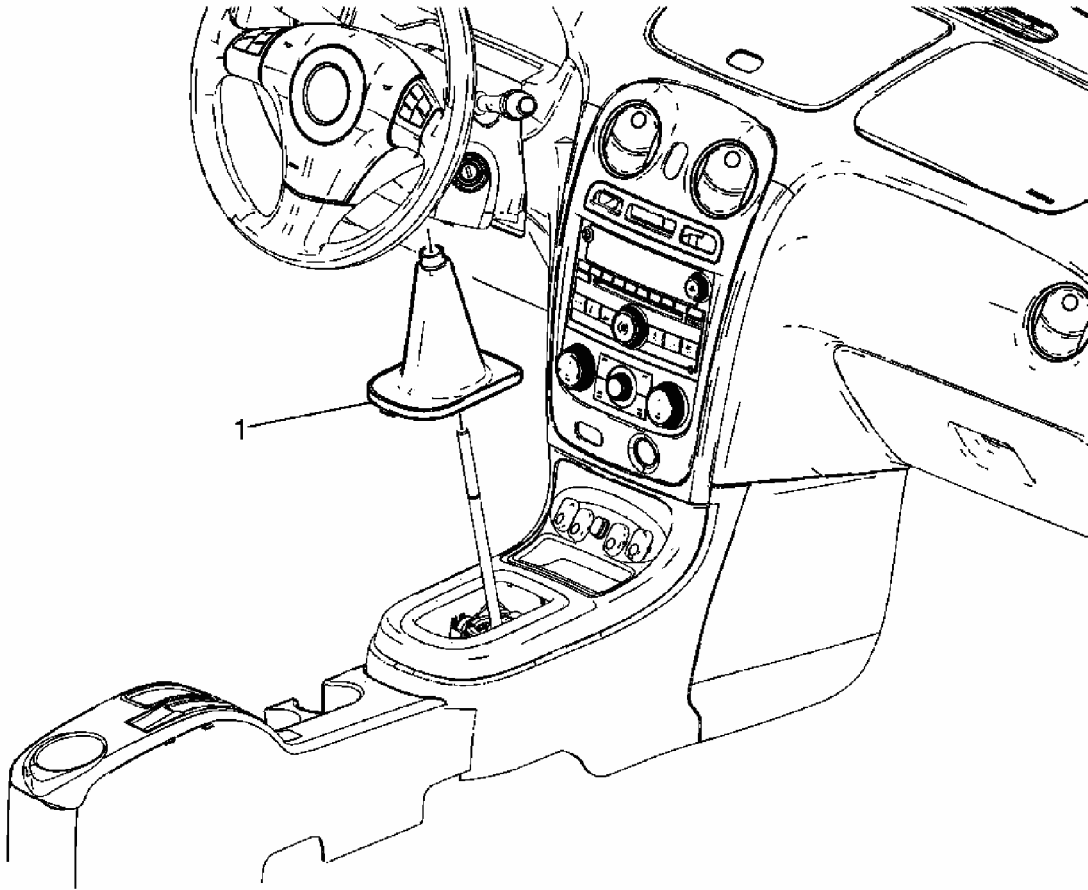


Fig. 65: Shift Control Boot Replacement
Courtesy of GENERAL MOTORS CORP.

Shift Control Boot Replacement

Callout	Component Name
NOTE: Refer to Fastener Notice in Cautions and Notices.	
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications . Preliminary Procedure: Remove the shift control knob. Refer to Shift Control Knob Replacement .	
1	Shift Control Boot

BACKUP LAMP SWITCH REPLACEMENT

Removal Procedure

NOTE: When removing or installing the backup lamp switch, do not use an open end wrench. Use only a socket in order to avoid damage to the switch assembly.

1. Remove the left front wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
2. Disconnect the backup lamp connector (1).

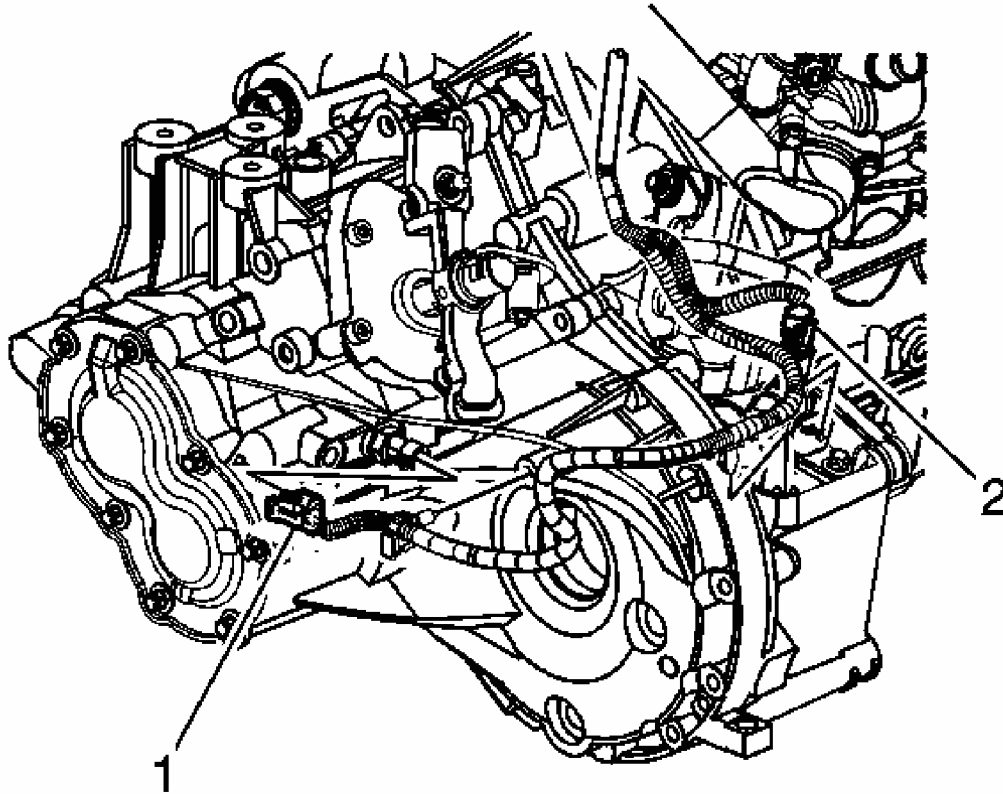


Fig. 66: Locating Backup Light Connector & VSS Connector
Courtesy of GENERAL MOTORS CORP.

3. Remove the backup lamp switch assembly.

Installation Procedure

NOTE: When removing or installing the backup lamp switch, do not use an open end wrench. Use only a socket in order to avoid damage to the switch assembly.

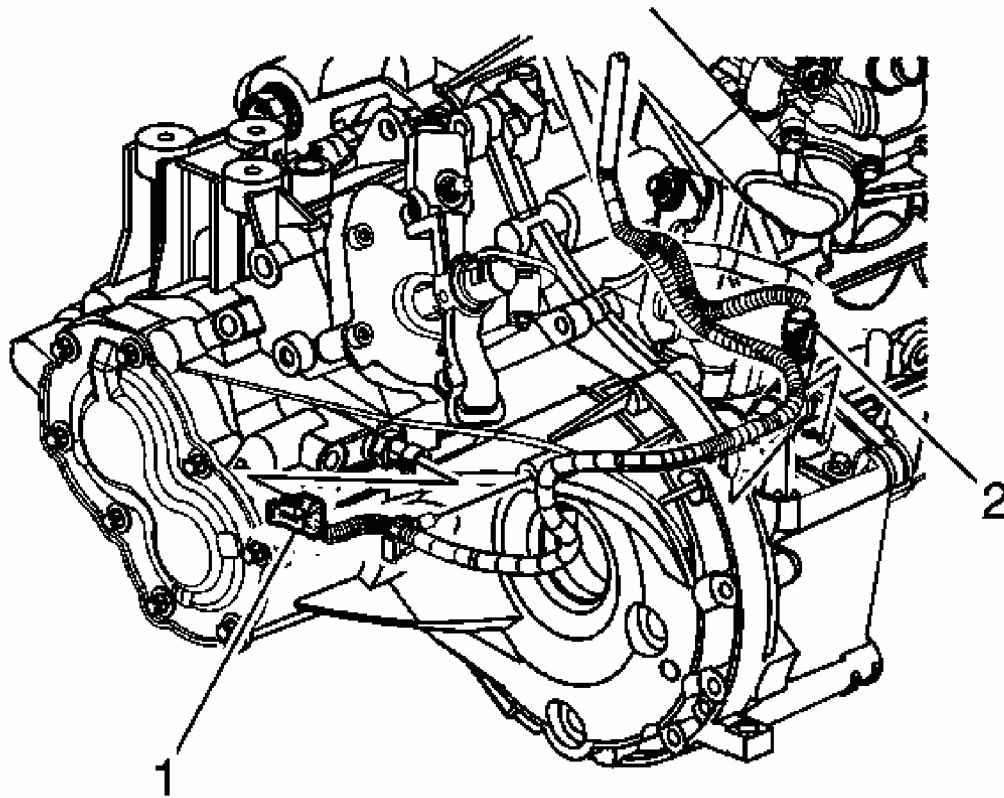


Fig. 67: Locating Backup Light Connector & VSS Connector
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the backup lamp switch. using pipe sealant Saturn P/N 21485278 or equivalent.

Tighten: Tighten the switch to 33 N.m (24 lb ft).

2. Connect the backup lamp connector (1).
3. Install the left front wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

REAR COVER REPLACEMENT

Removal Procedure

1. Remove the left front wheel. Refer to Tire and Wheel Removal and Installation in

Tires and Wheels

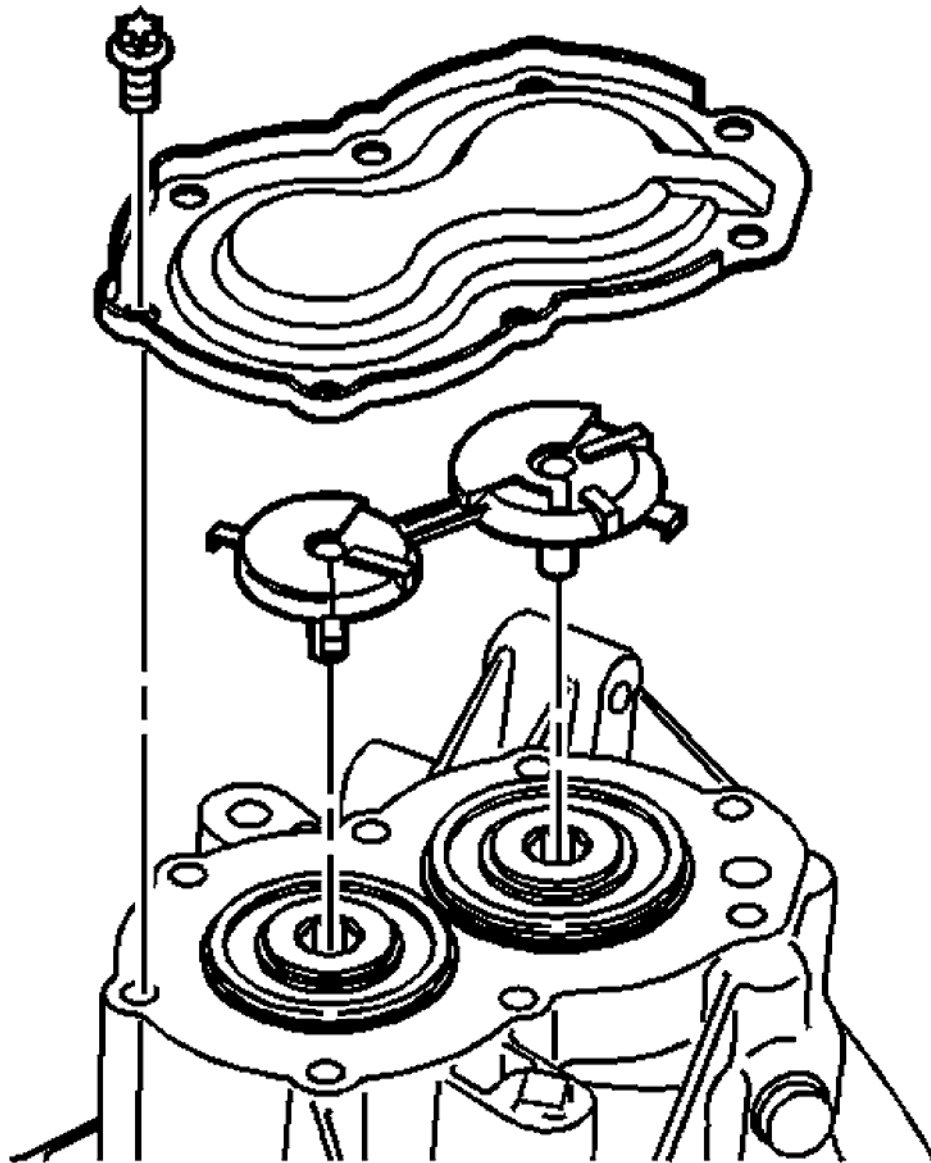


Fig. 68: View Of Rear Cover
Courtesy of GENERAL MOTORS CORP.

2. Remove the rear cover bolts.
3. Remove the rear cover.
4. Inspect the oil guide for damage and replace as necessary.

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Installation Procedure

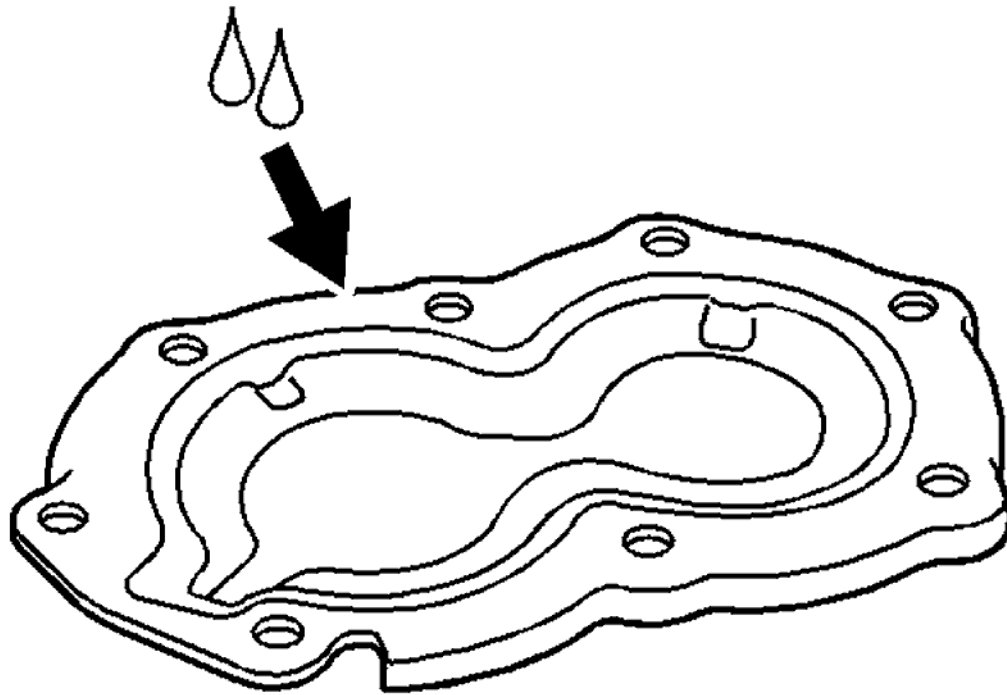


Fig. 69: Installing Sealant To Rear Cover
Courtesy of GENERAL MOTORS CORP.

1. Install sealant Saturn P/N 21019581 to the rear cover.

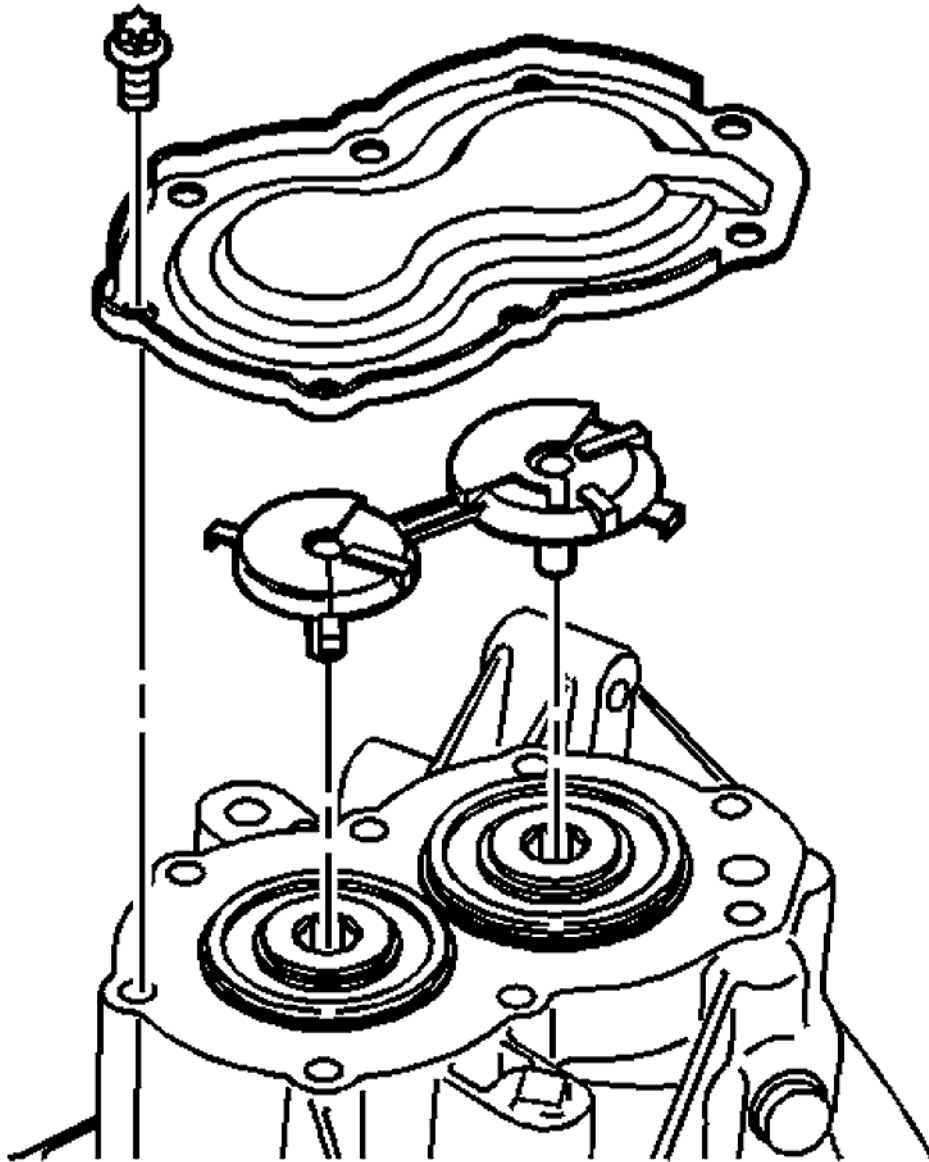


Fig. 70: View Of Rear Cover

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The oil guide only installs in one direction. Ensure the oil guide is completely seated in the gear shafts.

2. Install the oil guide.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the rear cover.

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

4. Install the left front wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

SHIFT CONTROL ASSEMBLY REPLACEMENT

Removal Procedure

1. Remove the left front wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.

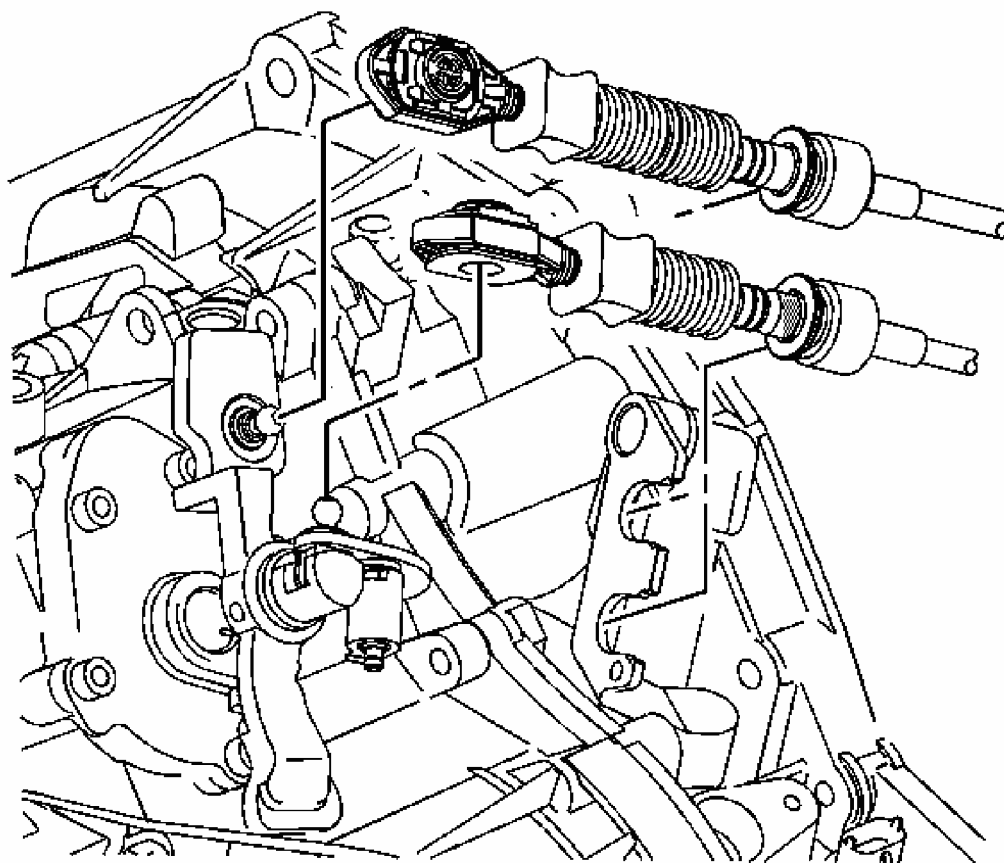


Fig. 71: View Of Shift Cables, Cable Connections & Shift Cable Bracket

Courtesy of GENERAL MOTORS CORP.

2. Disconnect the shift cables from the transmission.

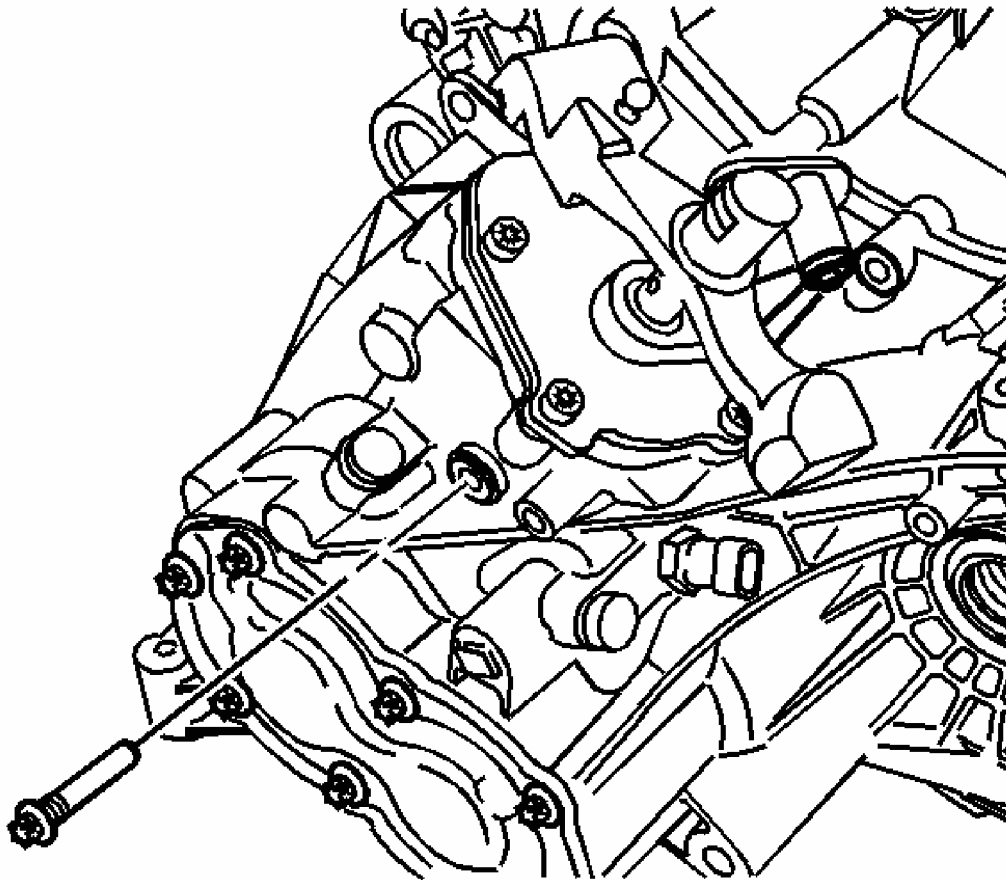


Fig. 72: View Of Shifter Guide Bolt
Courtesy of GENERAL MOTORS CORP.

3. Shift the transmission into neutral.
4. Remove the shifter guide bolt.

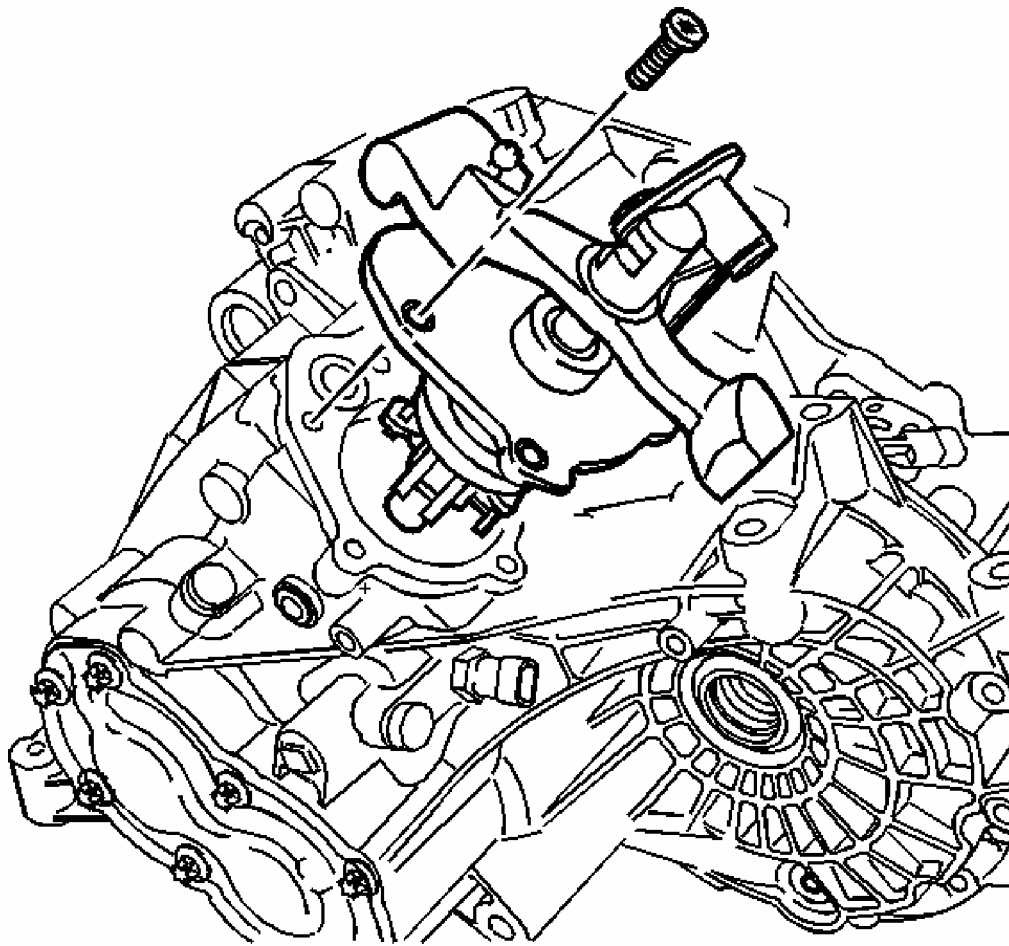


Fig. 73: View Of Shifter And Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the 5 shifter retaining bolts.
6. Remove the shifter assembly from the vehicle.

Installation Procedure

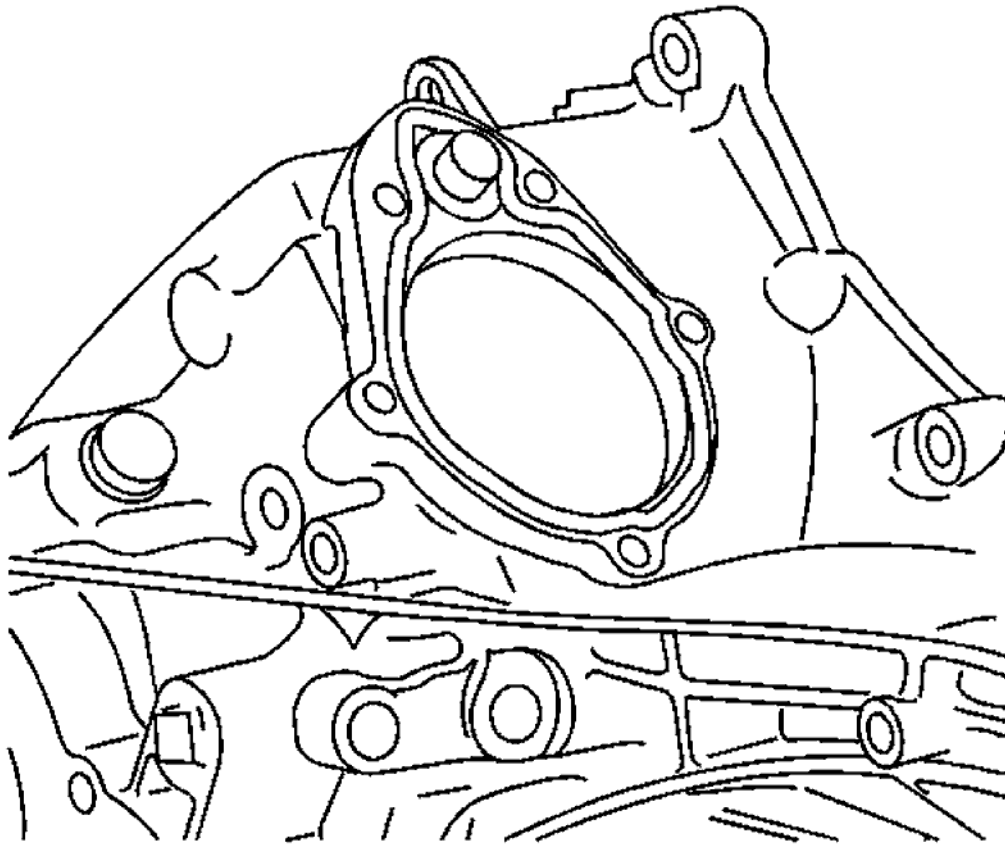


Fig. 74: View Of Transmission Case-To-Shifter Cover Mating Surface
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use only the approved sealer for the transmission case to shifter cover mating surface.

1. Apply sealer P/N 12378516 to the transmission case to shifter cover mating surface.

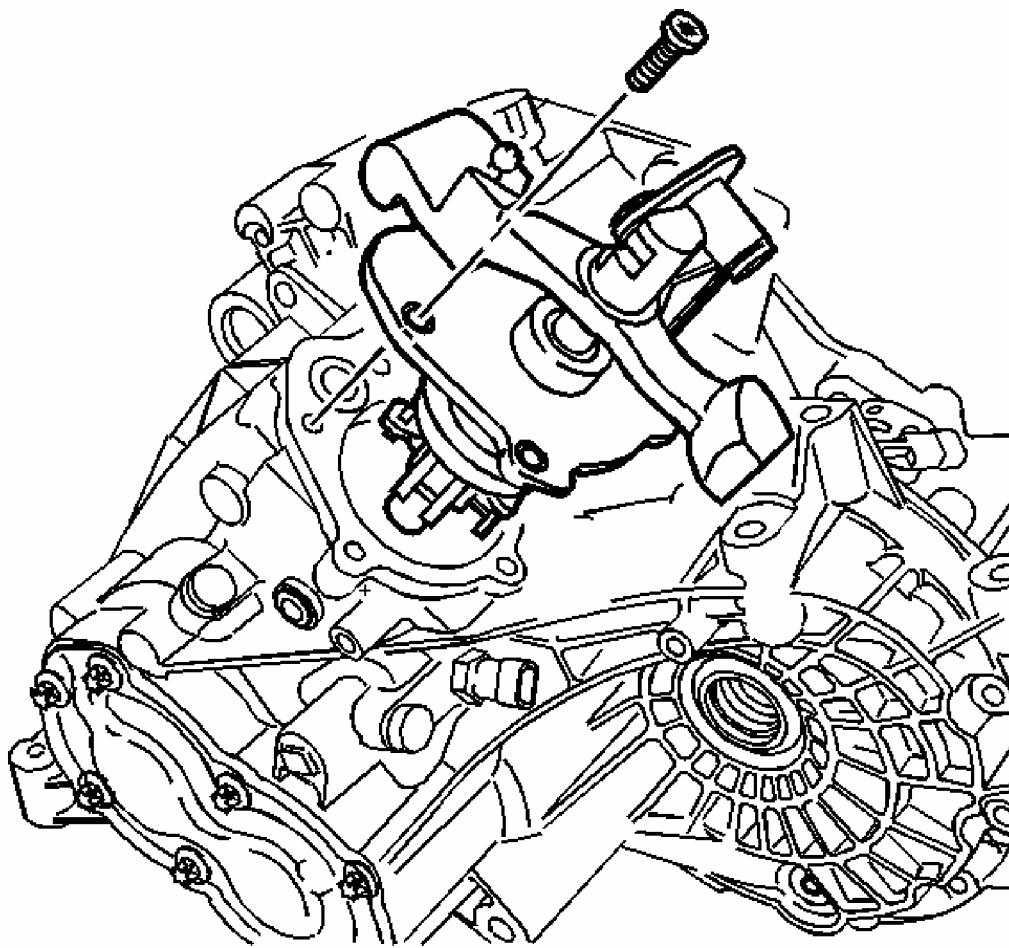


Fig. 75: View Of Shifter And Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

2. Install the shifter.

IMPORTANT: It will be necessary to move the shifter lever when installing and tightening the bolts.

3. Hand start all the shifter bolts.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Tighten the Shifter bolts.

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

5. Verify that the transmission is still in neutral position.

IMPORTANT: To avoid damage to the shifter guide bolt, hand start the bolt.

6. Apply P/N 21485278 to the shifter guide bolt and install the shifter guide bolt. Hand tighten only.
7. Tighten the shifter guide bolt.

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

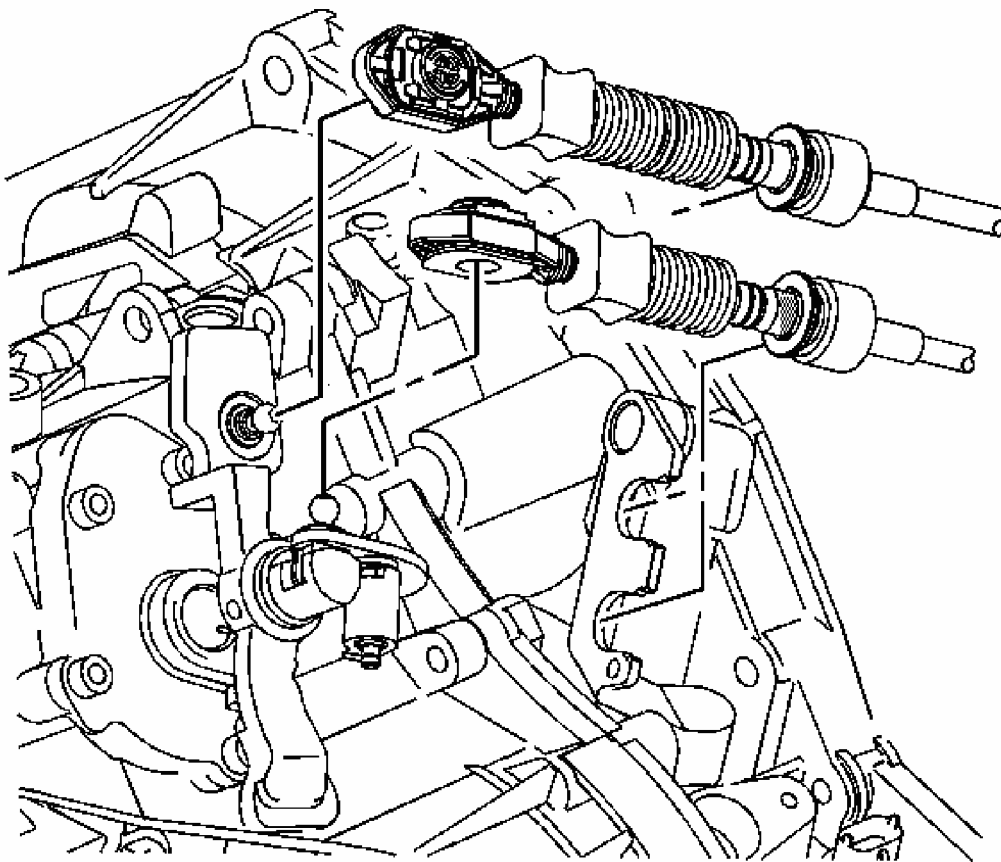


Fig. 76: View Of Shift Cables, Cable Connections & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

8. Connect the shift cables to the transmission.

9. Install the left front wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.

TRANSMISSION REPLACEMENT

Removal Procedure

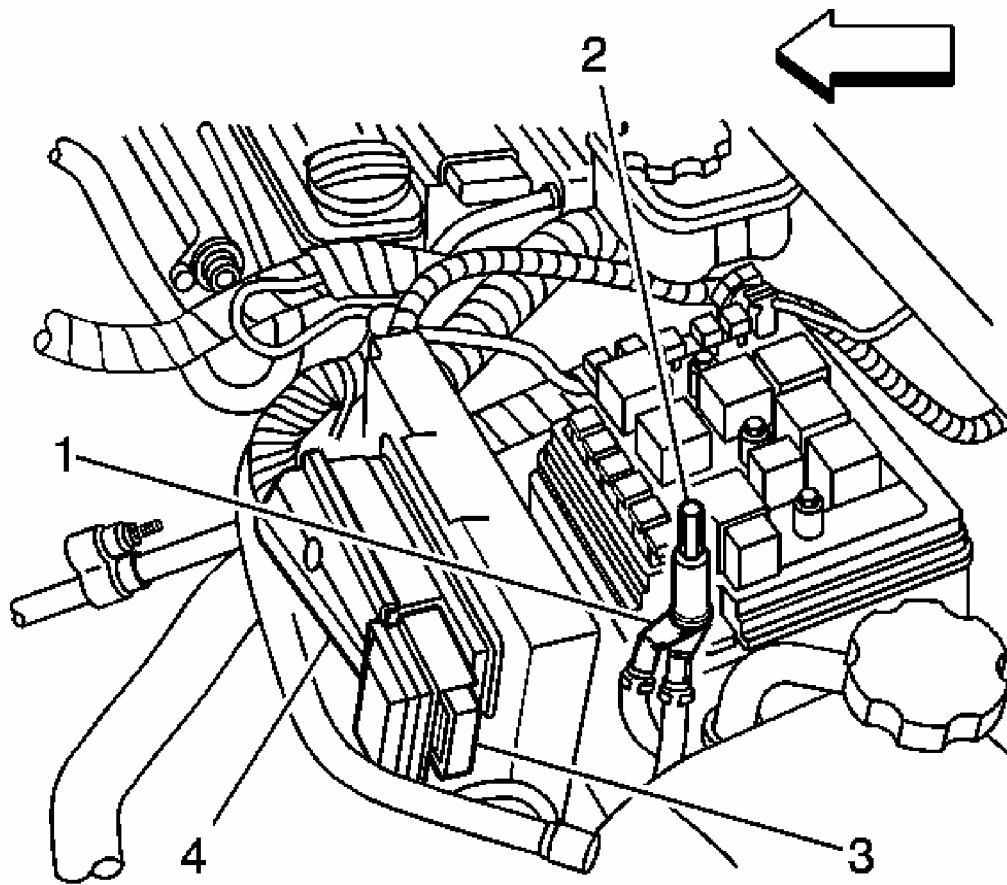


Fig. 77: View Of Engine Electrical Center
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.
2. Remove the positive battery post from the underhood junction block (2).
3. Disconnect the positive cables from the underhood junction block (1).
4. Disconnect the surge tank inlet hose from the surge tank.

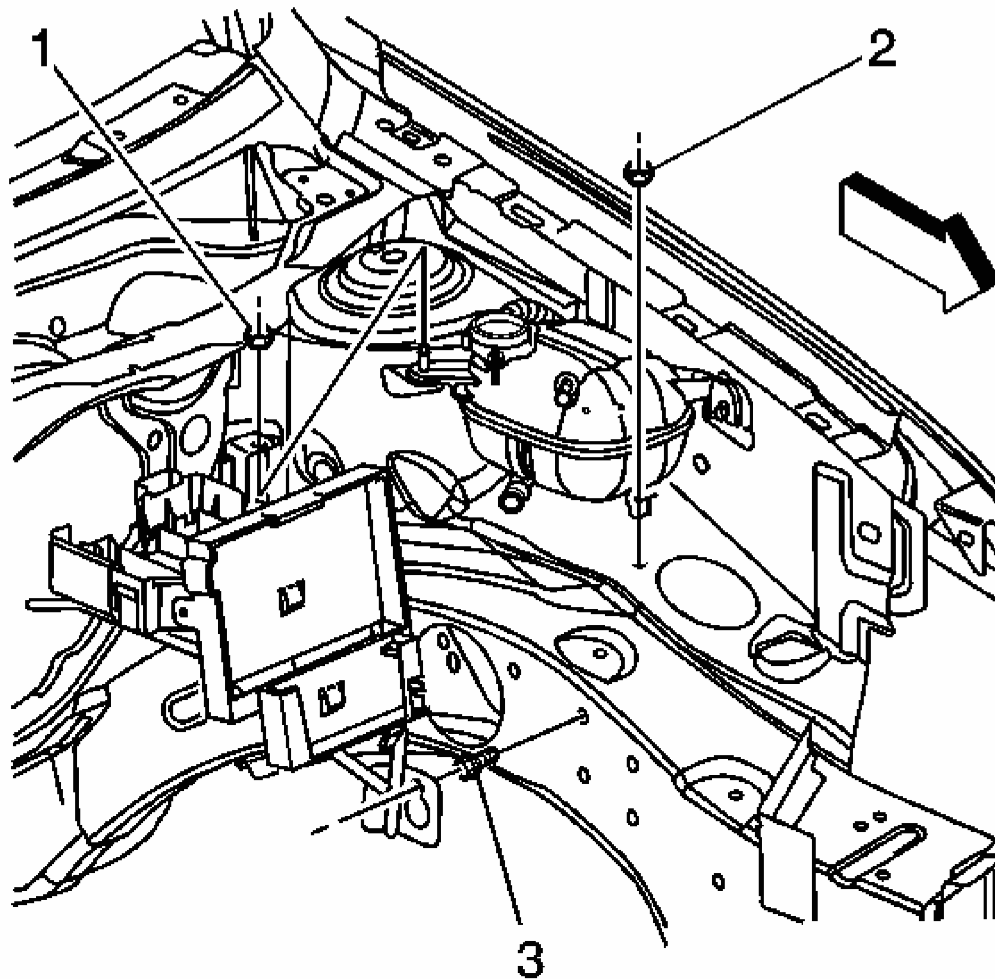


Fig. 78: View Of Engine Compartment Component Locations
Courtesy of GENERAL MOTORS CORP.

5. Remove the underhood junction block bracket nuts (1, 2).
6. Loosen the underhood junction block bracket bolt (3).
7. Disconnect the front wiring harness from the underhood junction block bracket.

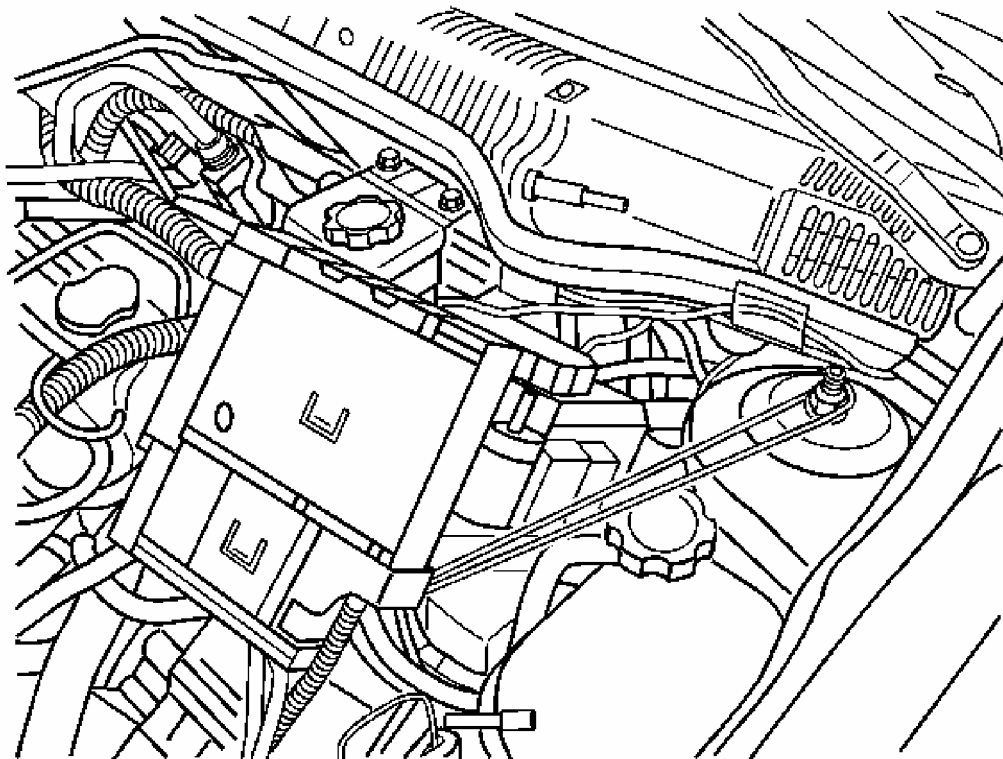


Fig. 79: View Of Underhood Junction Block
Courtesy of GENERAL MOTORS CORP.

8. Reposition the underhood junction block bracket aside.

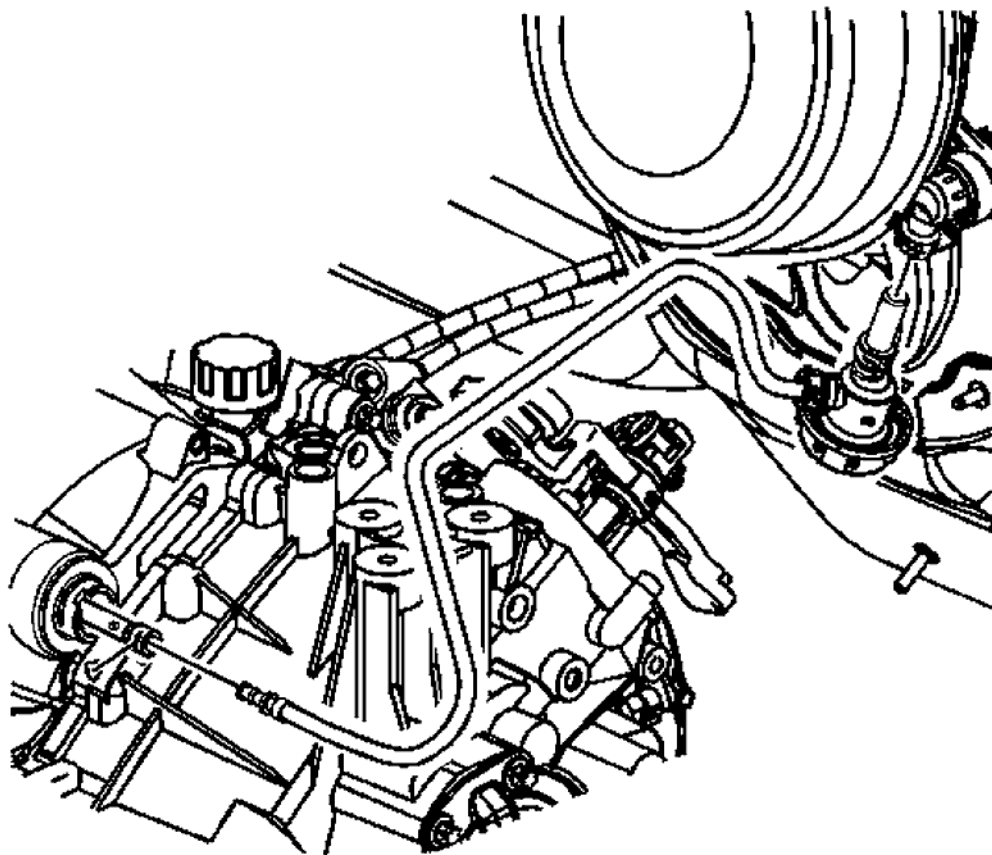


Fig. 80: View Of Hydraulic Clutch Hose
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the hydraulic clutch hose from the clutch actuator cylinder.
10. Install the engine support fixture. Refer to **Engine Support Fixture** in Engine Mechanical - 2.2L (L61).

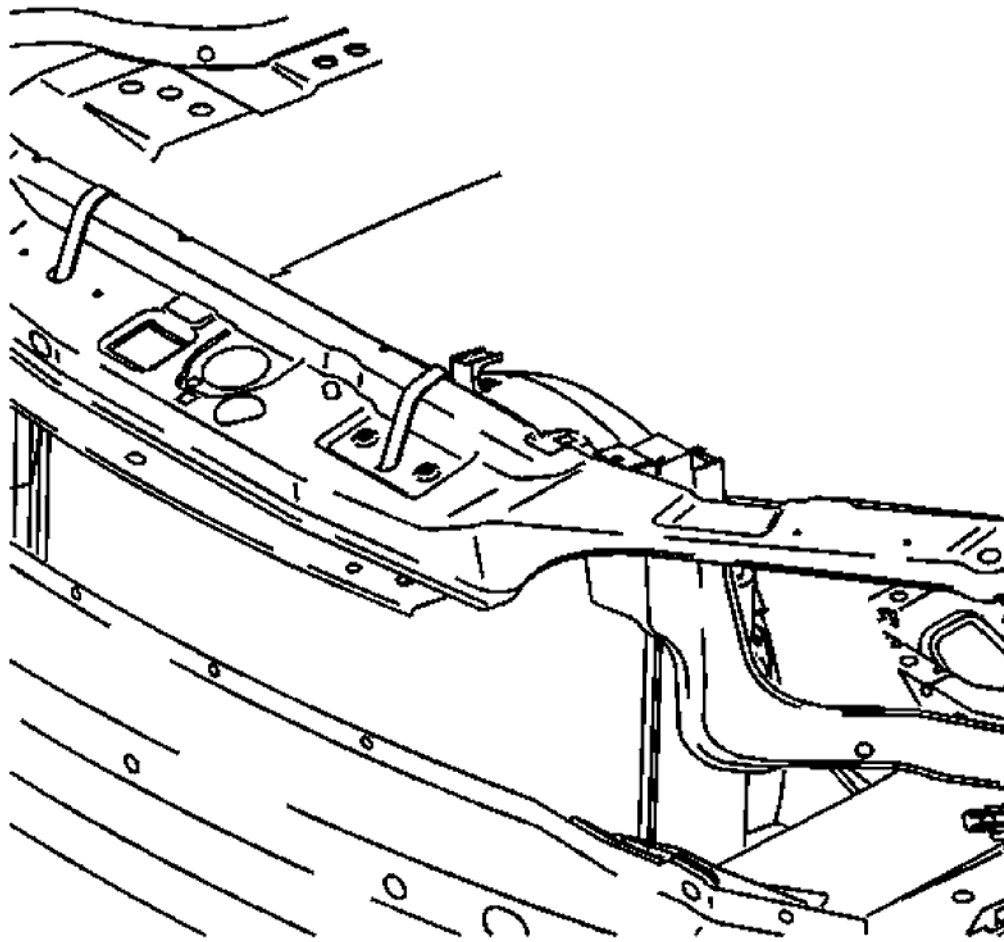


Fig. 81: Cooling Module Secured To Upper Body Structure
Courtesy of GENERAL MOTORS CORP.

11. Secure the cooling module to the upper body structure.

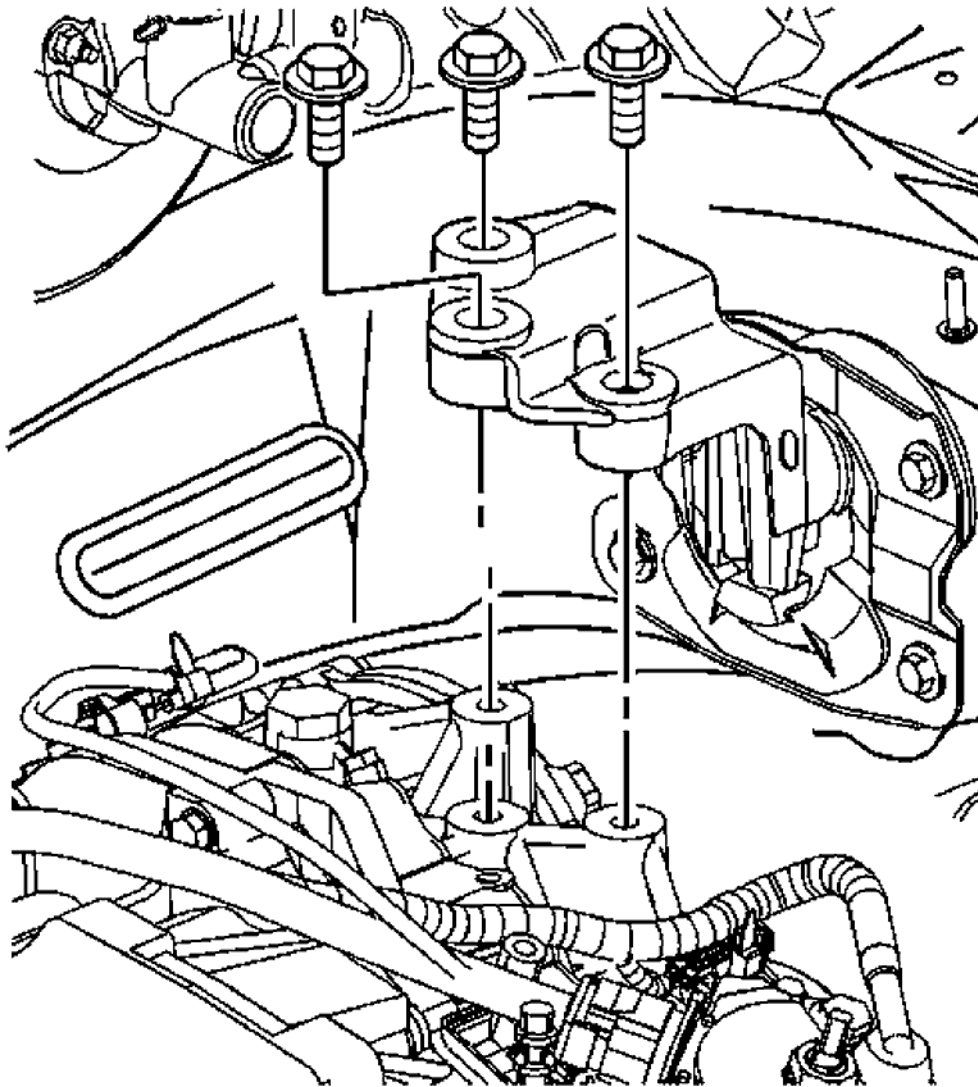


Fig. 82: View Of Side Transmission Mount
Courtesy of GENERAL MOTORS CORP.

12. Remove the upper transmission to mount bolts.
13. Remove the upper transmission to engine bolt.
14. Remove the frame. Refer to **Frame Replacement** in Frame and Underbody.
15. Drain the transaxle. Refer to **Transmission Fluid Replacement**.
16. Disconnect the drive axles from the transmission and secure out of the way. Refer to **Wheel Drive Shaft Replacement** in Wheel Drive Shafts.

17. Remove the starter. Refer to **Starter Motor Replacement** in Engine Electrical.

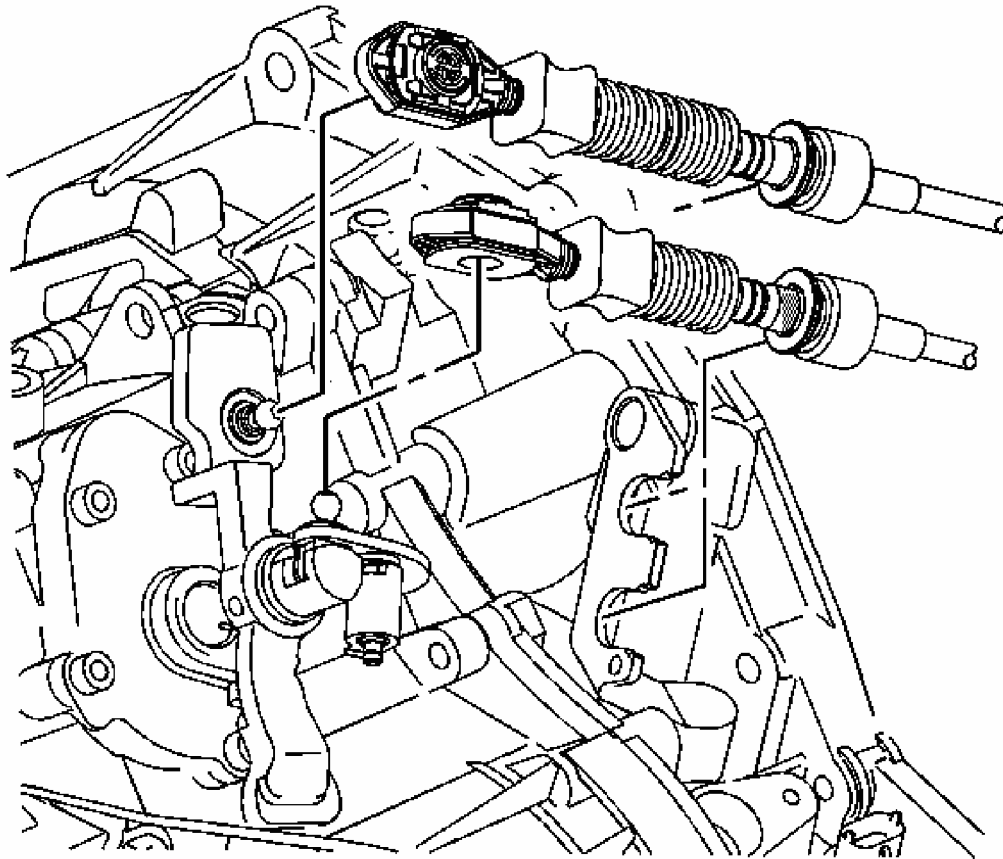


Fig. 83: View Of Shift Cables, Cable Connections & Shift Cable Bracket
Courtesy of GENERAL MOTORS CORP.

18. Disconnect the shift cables from the transmission. Refer to **Shift Cable Replacement**.

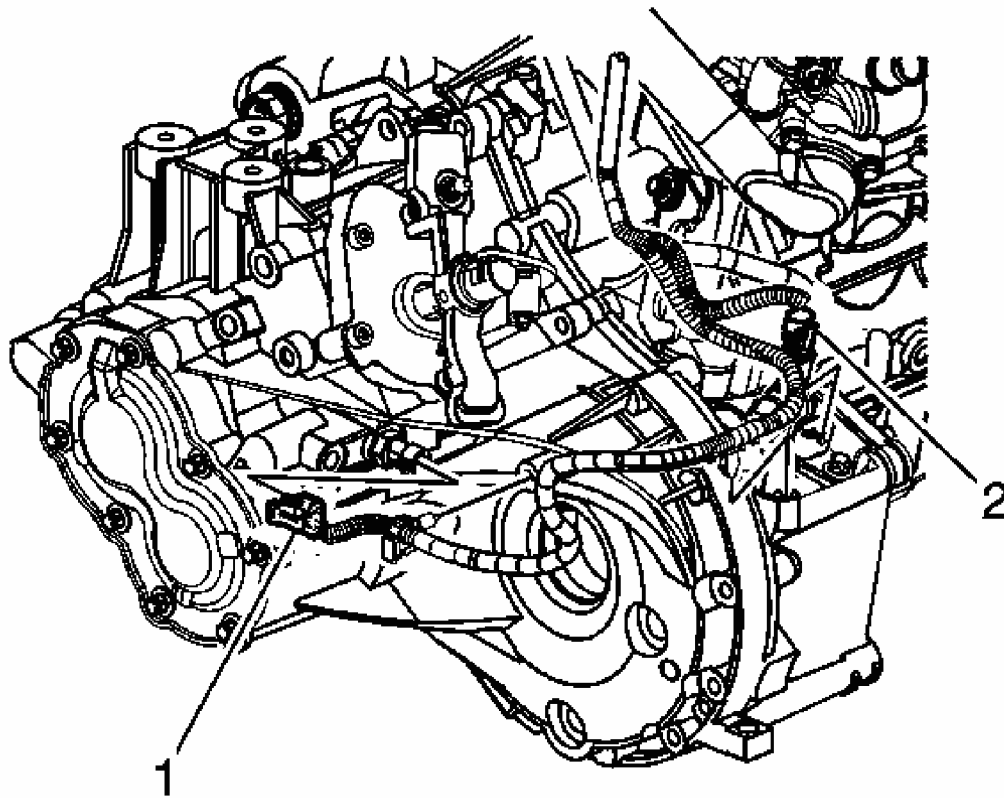


Fig. 84: Locating Backup Light Connector & VSS Connector
Courtesy of GENERAL MOTORS CORP.

19. Disconnect the backup lamp switch harness connector (1).
20. Disconnect the vehicle speed sensor (2).
21. Lower the vehicle.
22. Use the engine support fixture rear hook to lower the powertrain enough to allow clearance between the side rail and powertrain.
23. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
24. Use a transmission jack to secure the transmission, and remove the transmission to engine bolts.
25. Remove the transmission from the vehicle.
26. Remove the front transmission mount from the transmission. Refer to **Transmission Mount Replacement - Front**.
27. Remove the rear transmission mount and bracket from the transmission. Refer to **Transmission Mount Replacement - Rear**.

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Installation Procedure

1. Install the rear transmission mount to the transmission. Refer to **Transmission Mount Replacement - Rear**.
2. Install the front transmission mount to the transmission. Refer to **Transmission Mount Replacement - Front**.
3. Use a transmission jack to position the transmission to the vehicle.

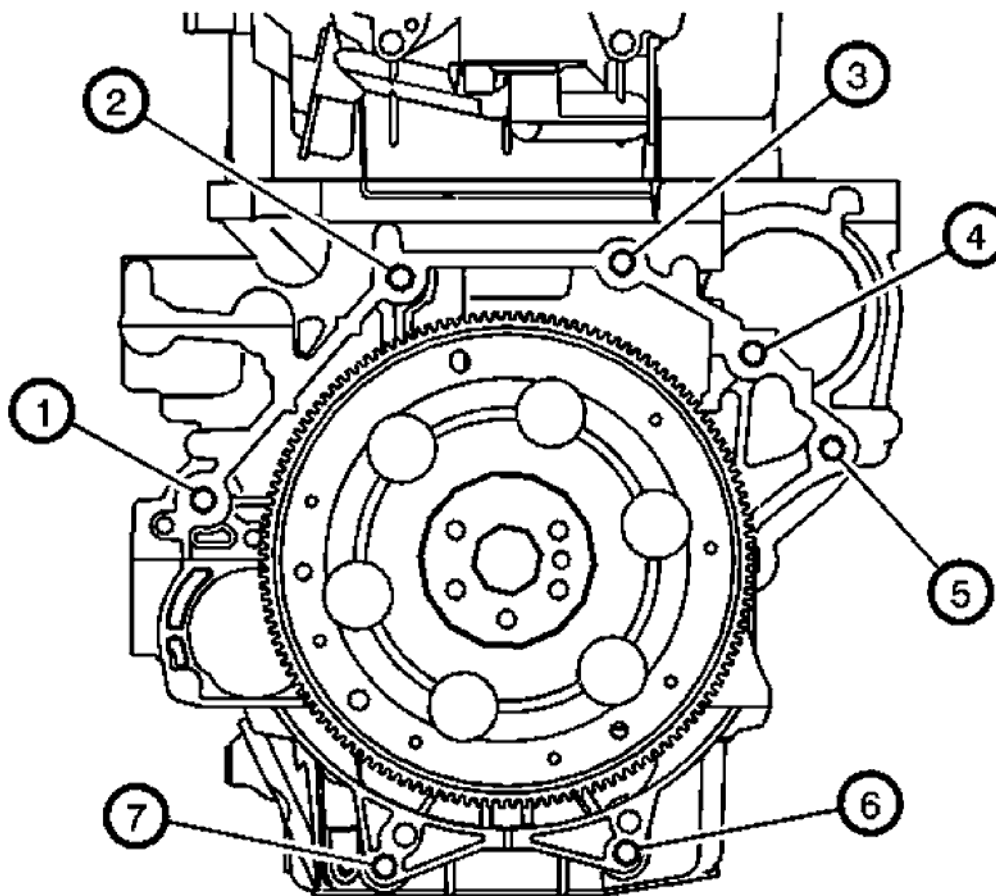


Fig. 85: Securing Engine To Transmission
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to **Fastener Notice** in Cautions and Notices.

IMPORTANT: The number 3 position does not require a bolt.

4. Secure the transmission to the engine.

Tighten: Tighten the bolts to 75 N.m (55 lb ft).

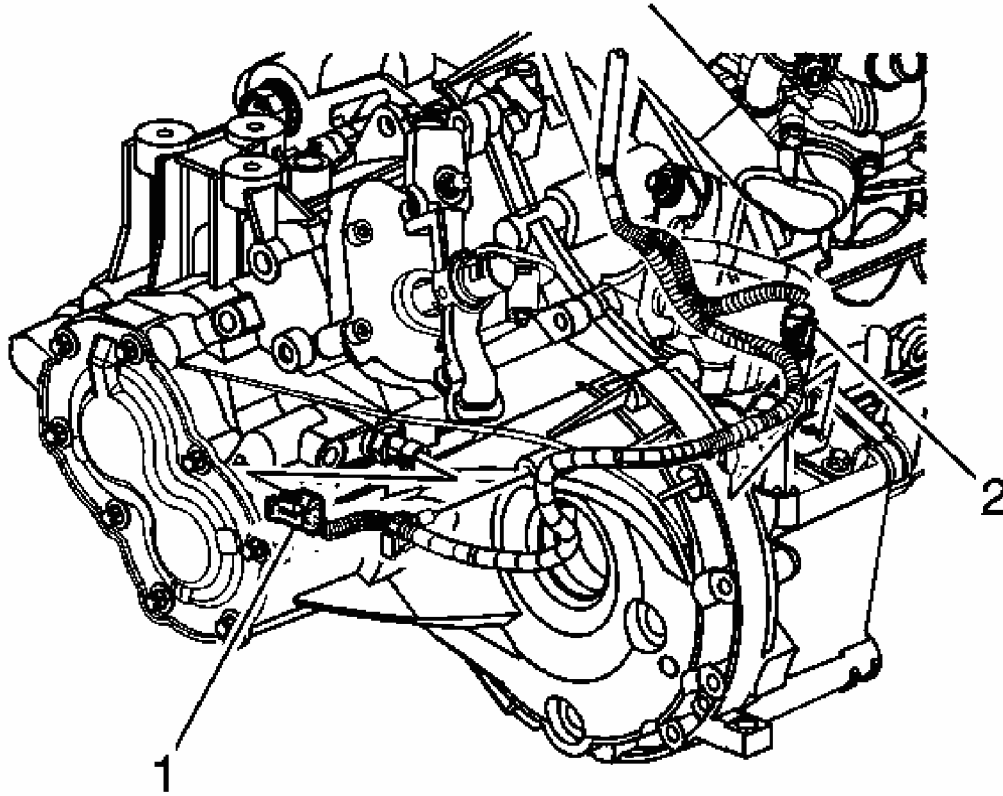


Fig. 86: Locating Backup Light Connector & VSS Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the vehicle speed sensor (2).
6. Connect the backup lamp switch harness connector (1).
7. Connect the shift cable to the transmission. Refer to **Shift Cable Replacement**.
8. Install the starter. Refer to **Starter Motor Replacement** in Engine Electrical.
9. Connect the drive axles to the transmission. Refer to **Wheel Drive Shaft Replacement** in Wheel Drive Shafts.
10. Lower the vehicle.
11. Use the engine support fixture in order to raise the powertrain assembly.
12. Install the transmission side mount. Refer to **Transmission Mount Replacement - Left**.

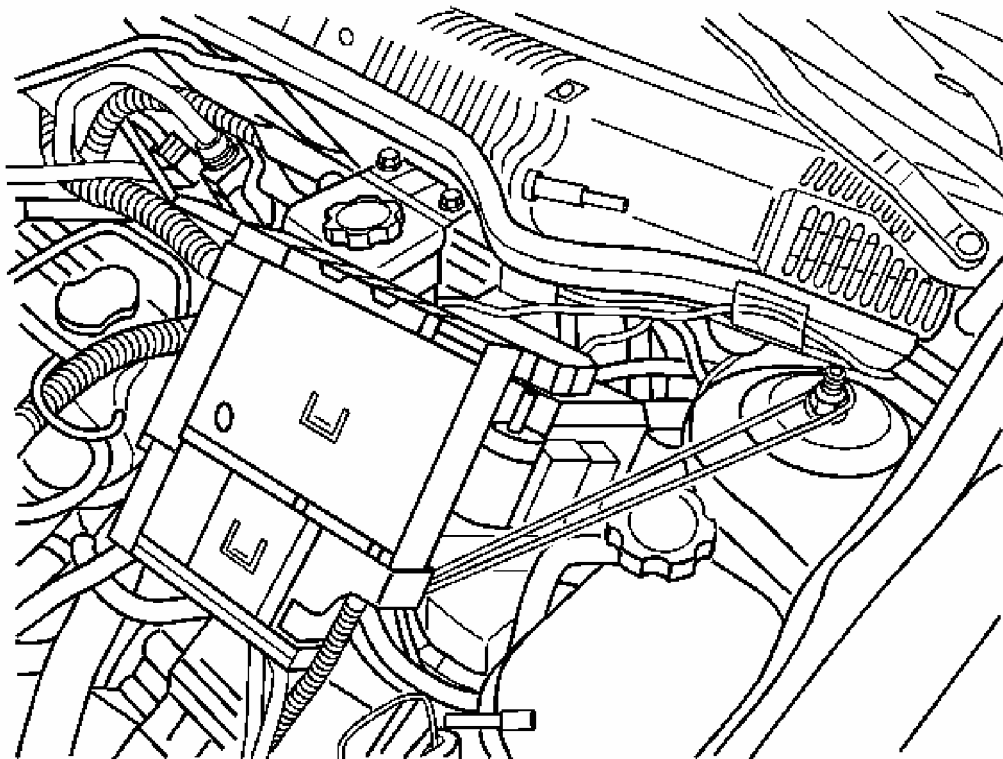


Fig. 87: View Of Underhood Junction Block
Courtesy of GENERAL MOTORS CORP.

13. Position the underhood junction block to the original position.
14. Install the surge tank inlet hose to the surge tank.

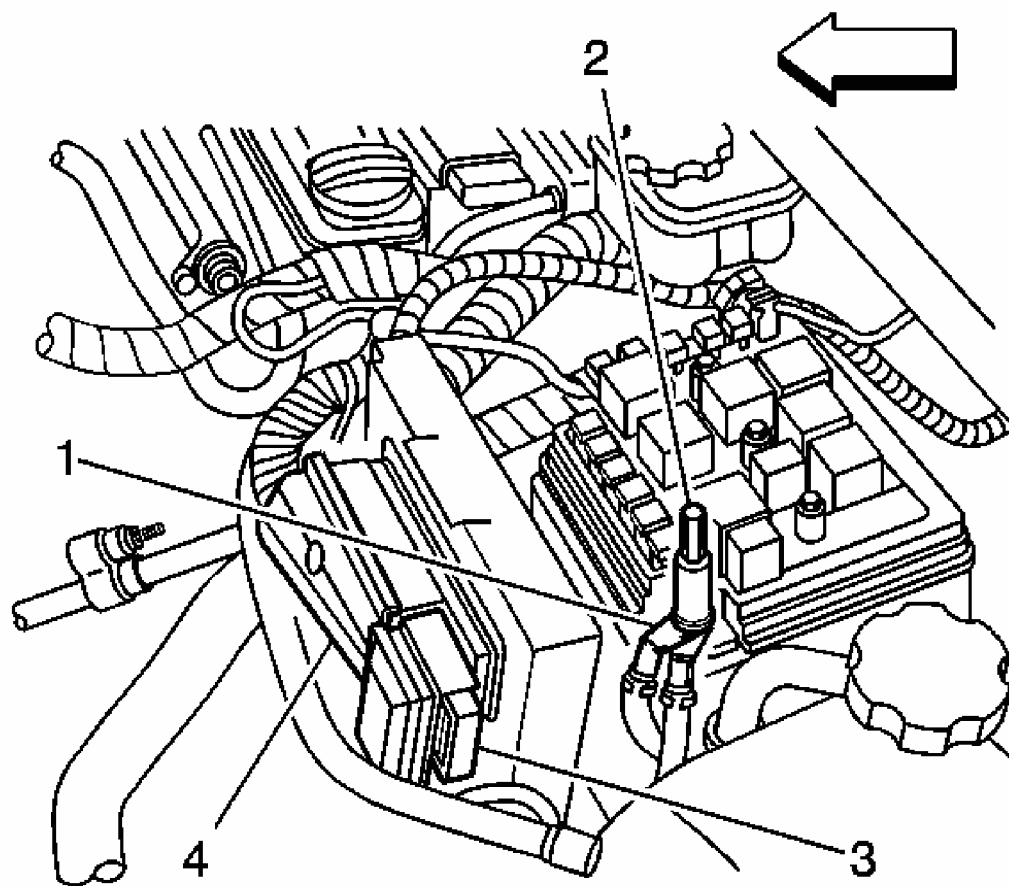


Fig. 88: View Of Engine Electrical Center
Courtesy of GENERAL MOTORS CORP.

15. Install the front wiring harness to the junction block bracket.
16. Connect the positive battery cables to the junction block bracket (1).
17. Install the positive battery post to the junction block bracket (2).

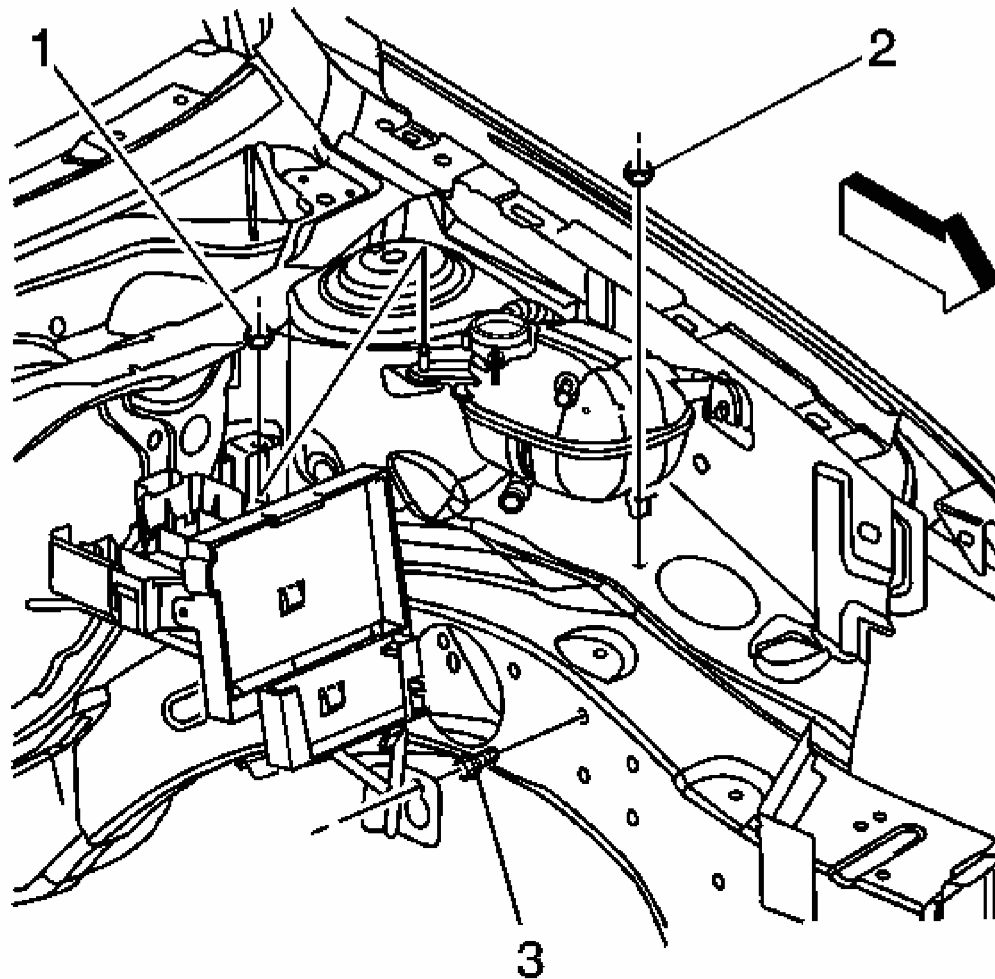


Fig. 89: View Of Engine Compartment Component Locations
Courtesy of GENERAL MOTORS CORP.

18. Install the junction block bracket, bolt (3) and nuts (1,2).

Tighten:

- Tighten the nuts to 10 N.m (89 lb in).
- Tighten the bolt to 25 N.m (18 lb ft).

19. Install the frame. Refer to **Frame Replacement** in Frame and Underbody.

20. Remove the engine support fixture.

21. Install the top engine to transmission bolt.

Tighten: Tighten the bolt to 75 N.m (55 lb ft).

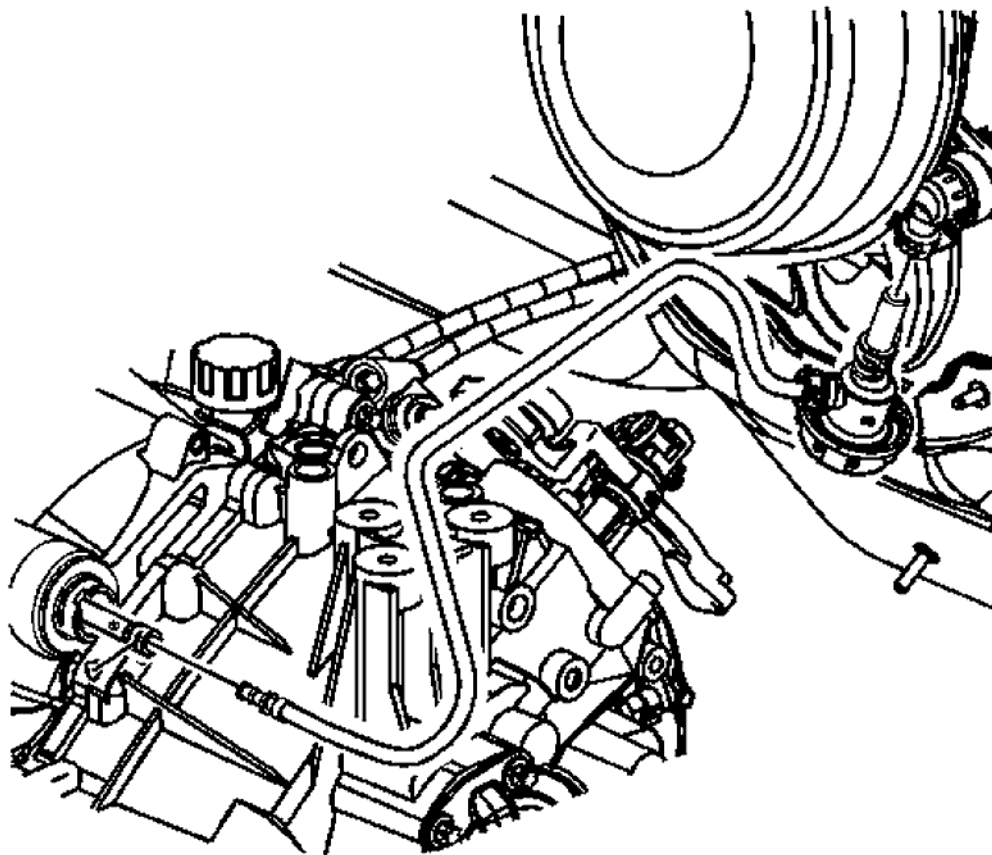


Fig. 90: View Of Hydraulic Clutch Hose
Courtesy of GENERAL MOTORS CORP.

22. Connect the hydraulic clutch hose to the clutch actuator cylinder.
23. Bleed the clutch hydraulic system. Refer to **Hydraulic Clutch Bleeding** in Clutch.

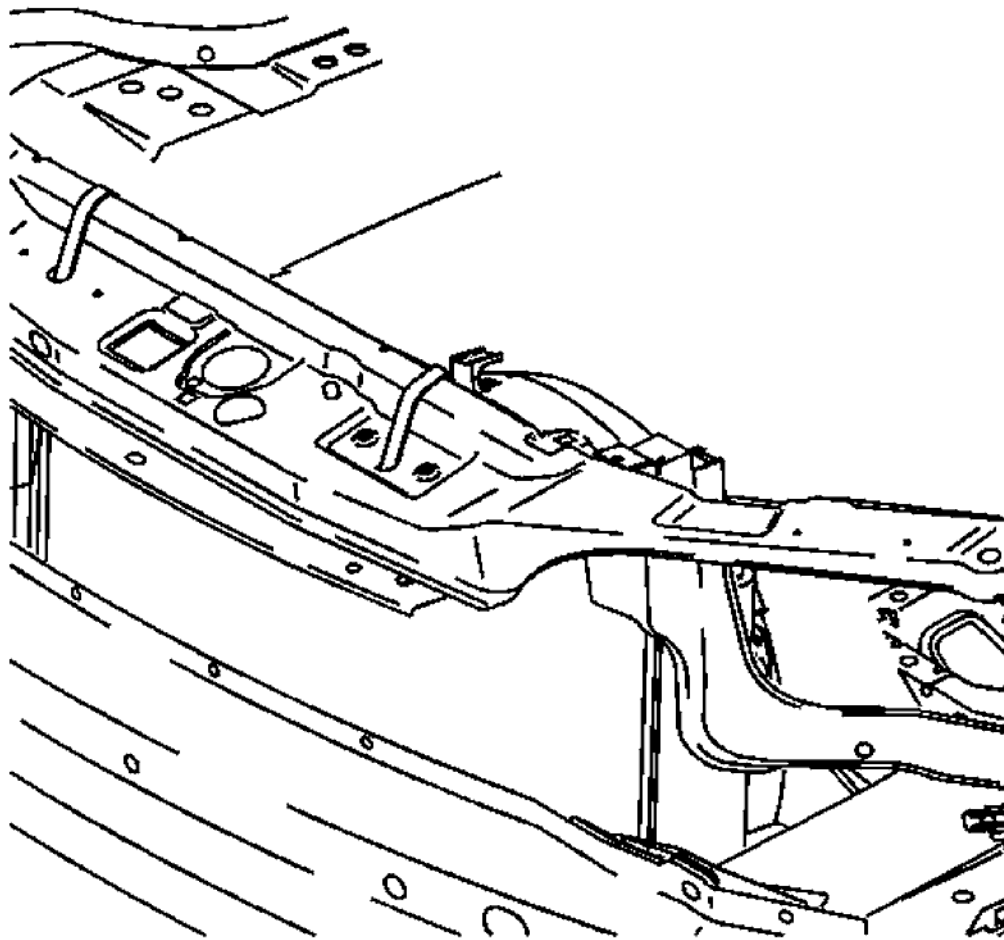


Fig. 91: Cooling Module Secured To Upper Body Structure
Courtesy of GENERAL MOTORS CORP.

24. Release the cooling module from the upper body structure.
25. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure** in Engine Electrical.
26. Fill the transmission to the proper level. Refer to **Transmission Fluid Replacement**.

SHIFT CABLE ADJUSTMENT

1. Set the parking brake.
2. Remove the cup holder. Refer to **Console Replacement - Front Floor** in Instrument Panel, Gages and Console.

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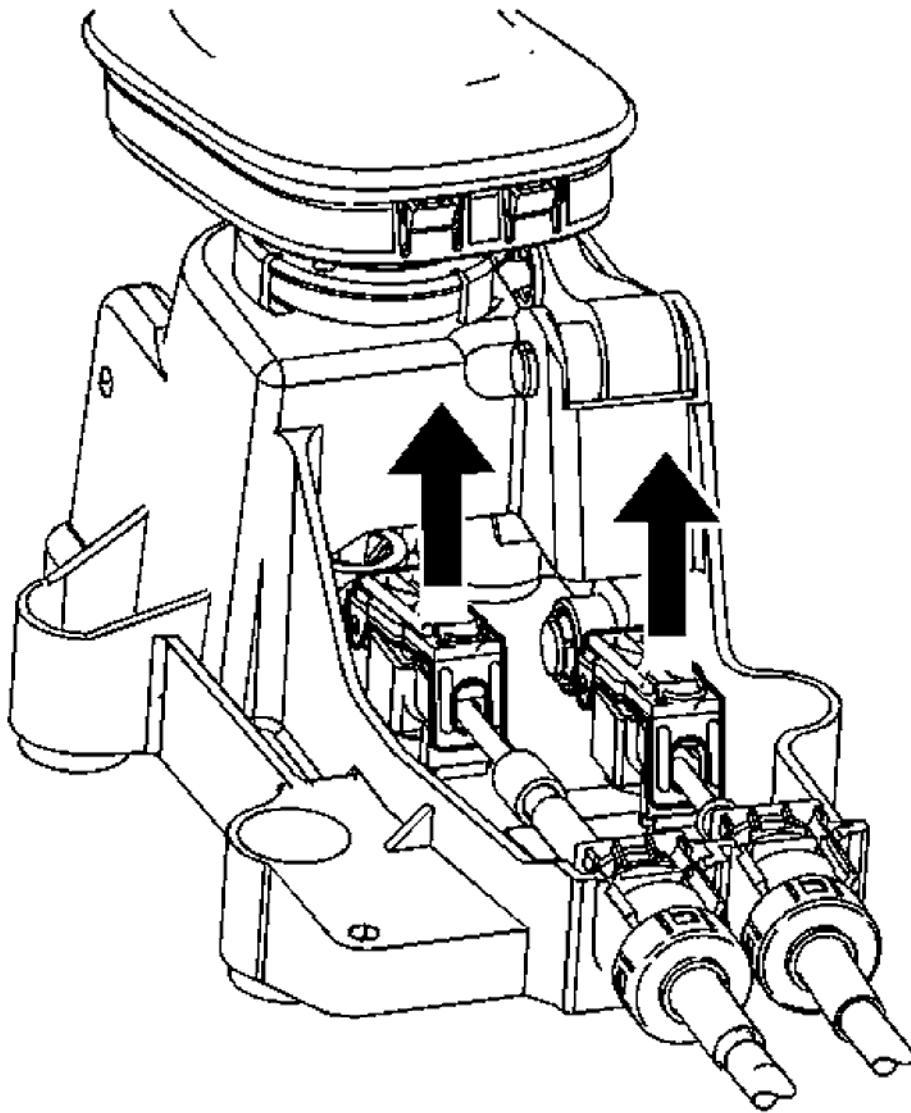


Fig. 92: Shift Cable Retainers
Courtesy of GENERAL MOTORS CORP.

3. Lift and unlock the shift cable retainers.

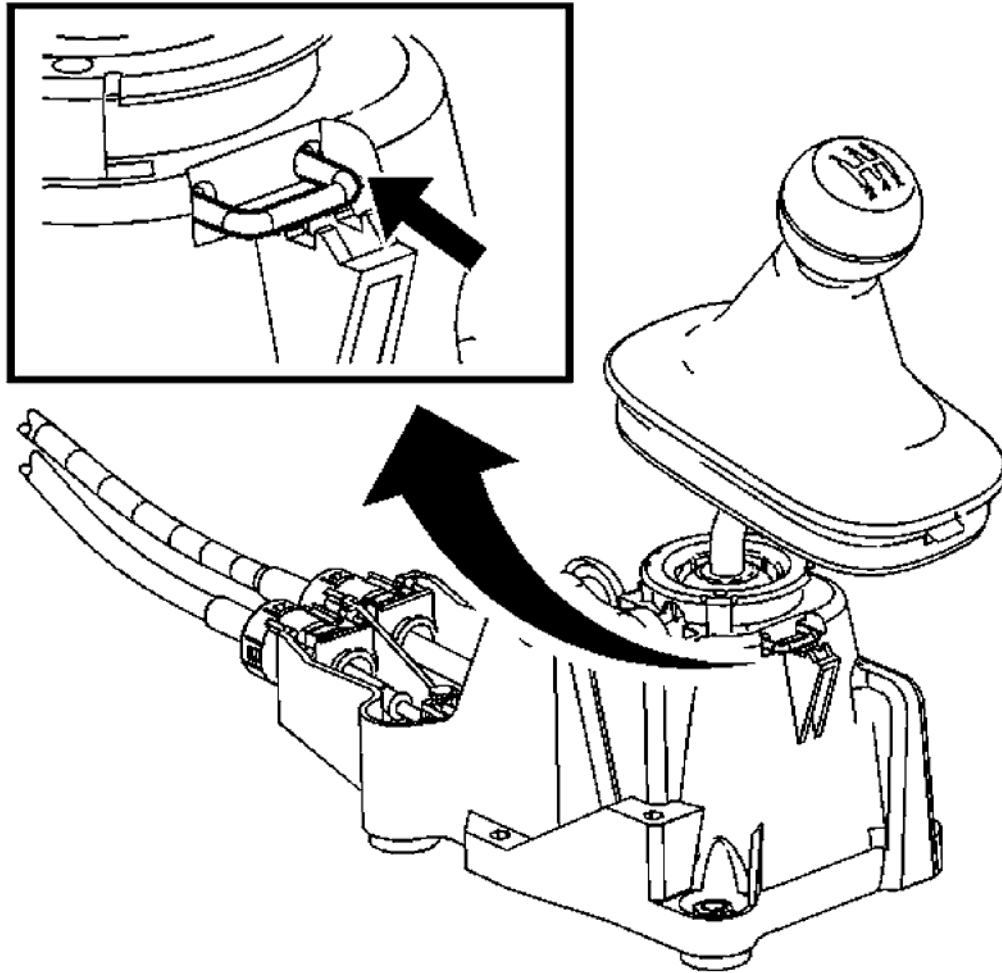


Fig. 93: Shifter Neutral Lock Clip
Courtesy of GENERAL MOTORS CORP.

4. Push the shifter neutral lock clip. Move the shifter slightly in order to center the lock clip.
5. Ensure that the transmission is in neutral.

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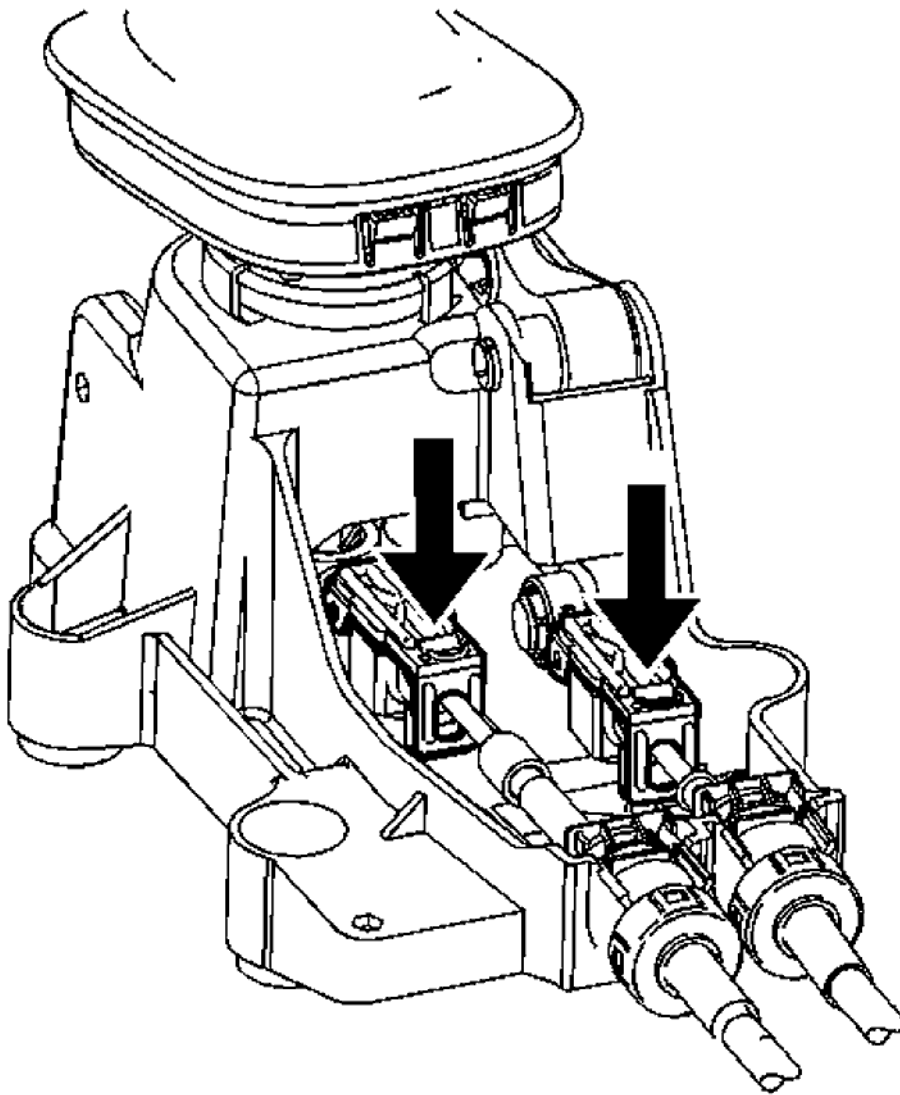


Fig. 94: Shift Cable Retainers
Courtesy of GENERAL MOTORS CORP.

6. Press and lock the shift cable retainers.

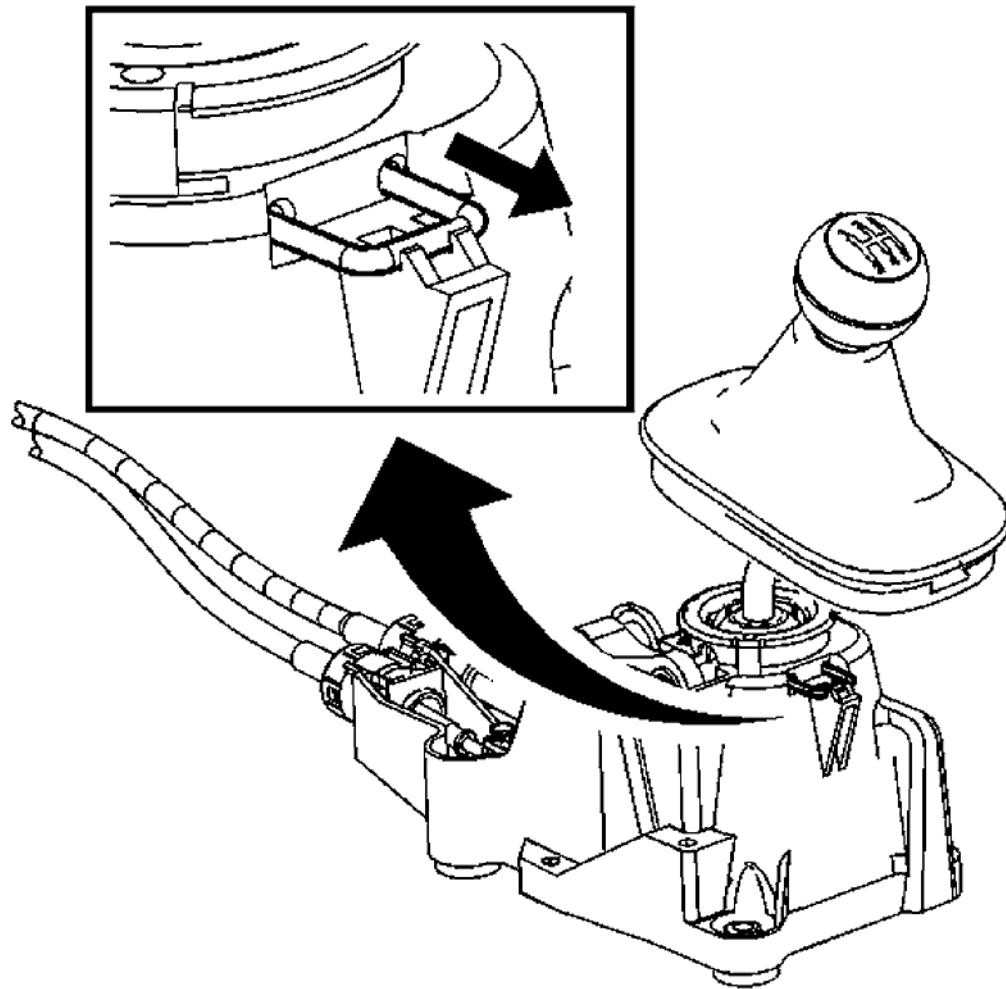


Fig. 95: Shifter Neutral Lock Clip
Courtesy of GENERAL MOTORS CORP.

7. Pull the shifter neutral lock clip to its original position.
8. Install the cup holder. Refer to **Console Replacement - Front Floor** in Instrument Panel, Gages and Console.

DESCRIPTION AND OPERATION

TRANSMISSION SYSTEM DESCRIPTION AND OPERATION

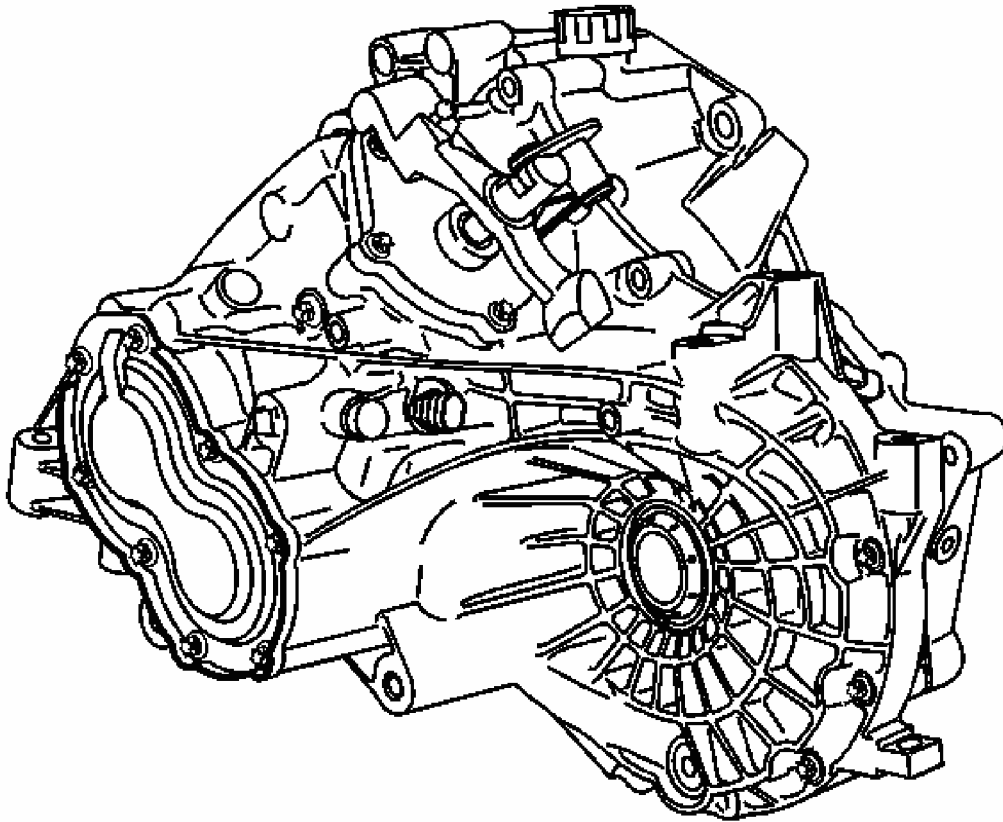


Fig. 96: View Of Transmission System
Courtesy of GENERAL MOTORS CORP.

The Getrag 5 Speed is a 5 speed manual transmission assembly.

IMPORTANT: Use only DEXRON®III Automatic Transmission Lubricant for this manual transmission assembly. Other lubricants or additives may affect the shift performance.

The Getrag 5 Speed manual transmission has the following features:

- First and second gear double coned synchronizer
- Third, fourth, and fifth gear single coned synchronizer
- Reverse synchronized
- Three shaft design consisting of an input shaft, output shaft, and intermediate shaft
- Reverse inhibit feature
- One piece clutch actuator - no bleed screw

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- Transmission venting system is part of the fill cap
- First gear ratio is 3.58
- Second gear ratio is 2.02
- Third gear ratio is 1.35
- Fourth gear ratio is 0.98
- Fifth gear ratio is 0.69
- Reverse gear ratio is 3.31
- Final drive ratio is 3.94
- Vehicle speed sensor (VSS)

The manual transmission shift cables must be adjusted for proper shifter performance.