2010 ENGINE

Engine Mechanical - 3.5L - Repair Instructions - On Vehicle - G6

INTAKE MANIFOLD COVER REPLACEMENT

REMOVAL PROCEDURE

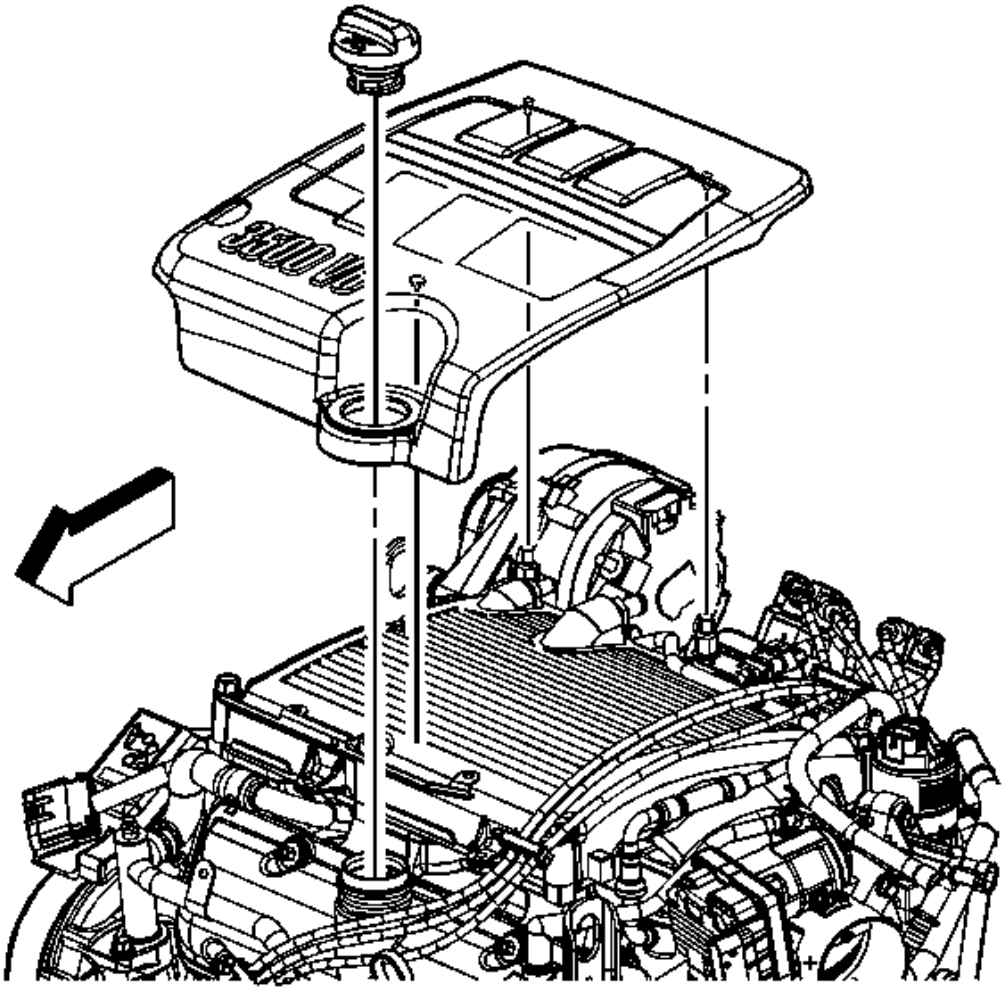

Fig. 1: View Of Intake Manifold Cover
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine oil fill cap.

2. Pull up on the cover in order to disengage the cover from the studs.

INSTALLATION PROCEDURE

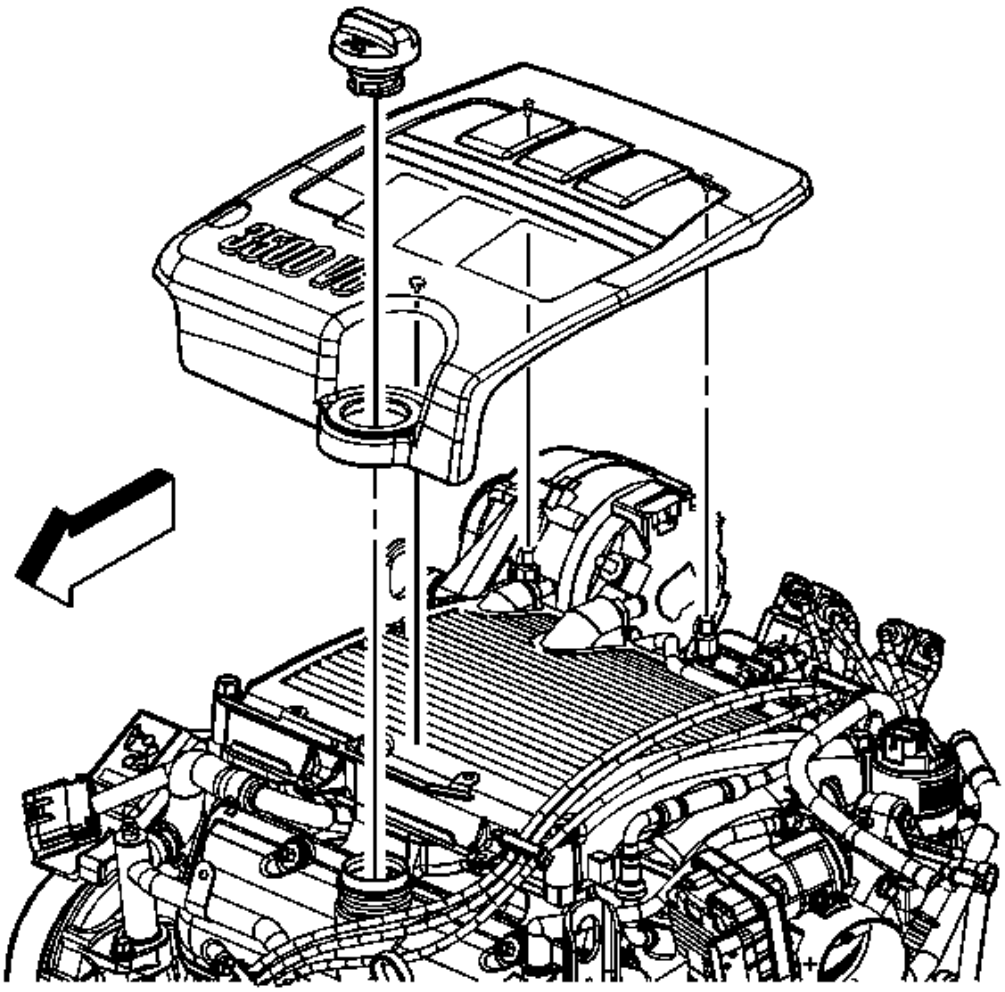

Fig. 2: View Of Intake Manifold Cover
Courtesy of GENERAL MOTORS CORP.

1. Align the cover to the studs on the engine, push down on the cover above the studs in order to engage the cover to the studs.
2. Install the engine oil fill cap.

DRIVE BELT REPLACEMENT

REMOVAL PROCEDURE

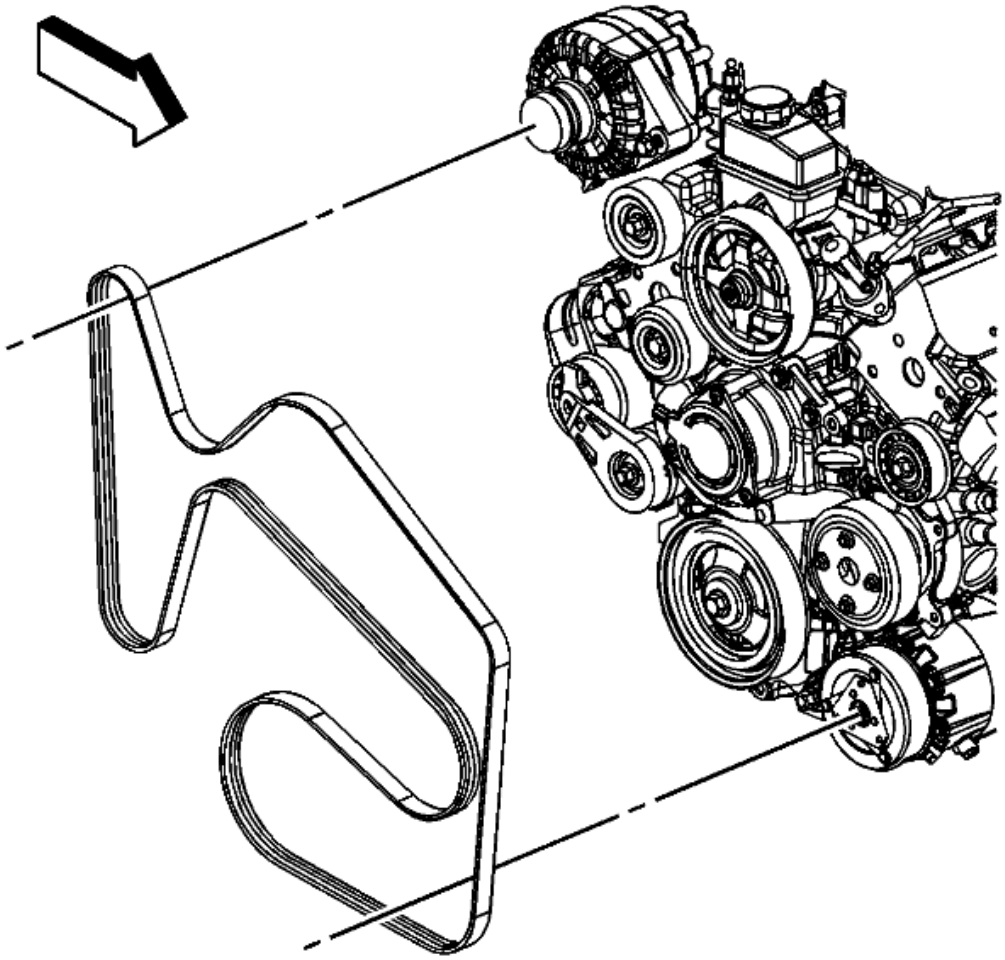

Fig. 3: Drive Belt Routing
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .
2. Remove the engine mount snubber. Refer to **Engine Mount Snubber Replacement**.
3. Install a breaker bar to the drive belt tensioner.
4. Rotate the drive belt tensioner counterclockwise to release the spring tension.

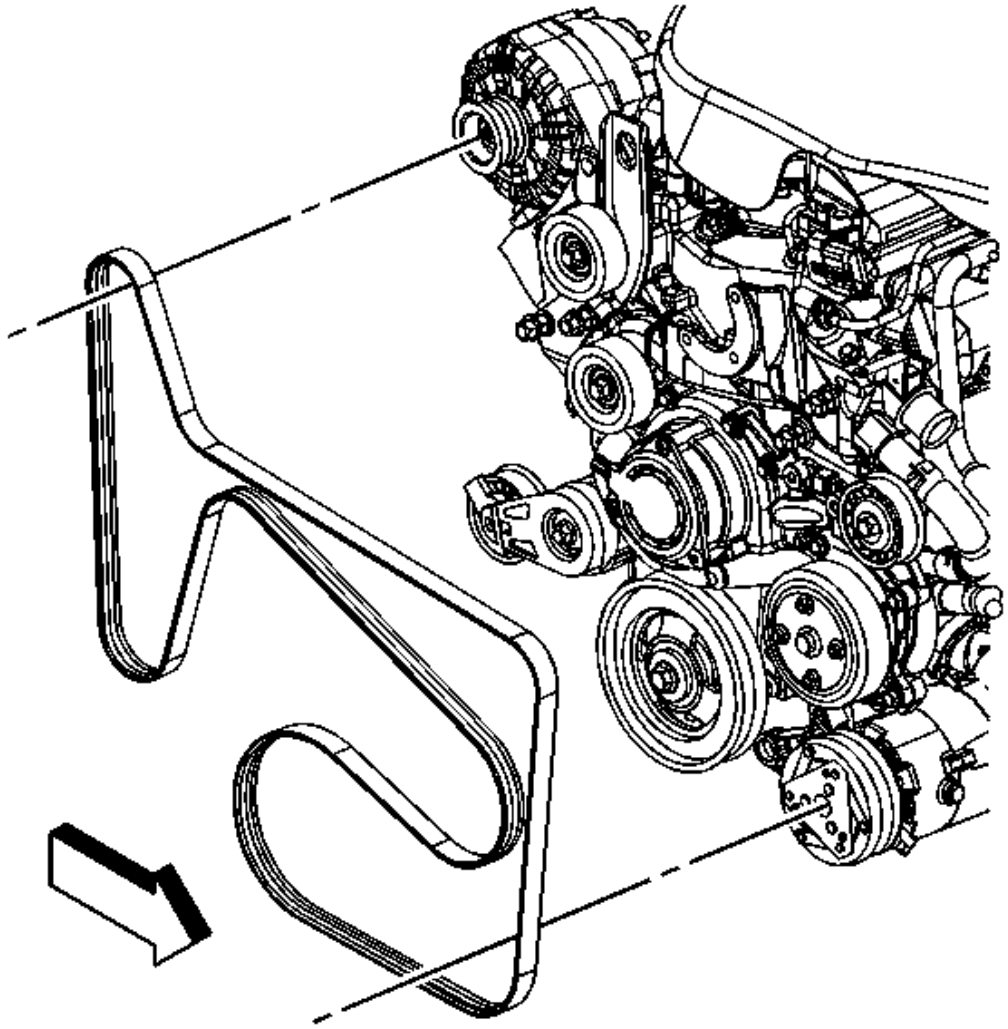

Fig. 4: Drive Belt Routing - With Power Steering
Courtesy of GENERAL MOTORS CORP.

5. Remove the drive belt.

INSTALLATION PROCEDURE

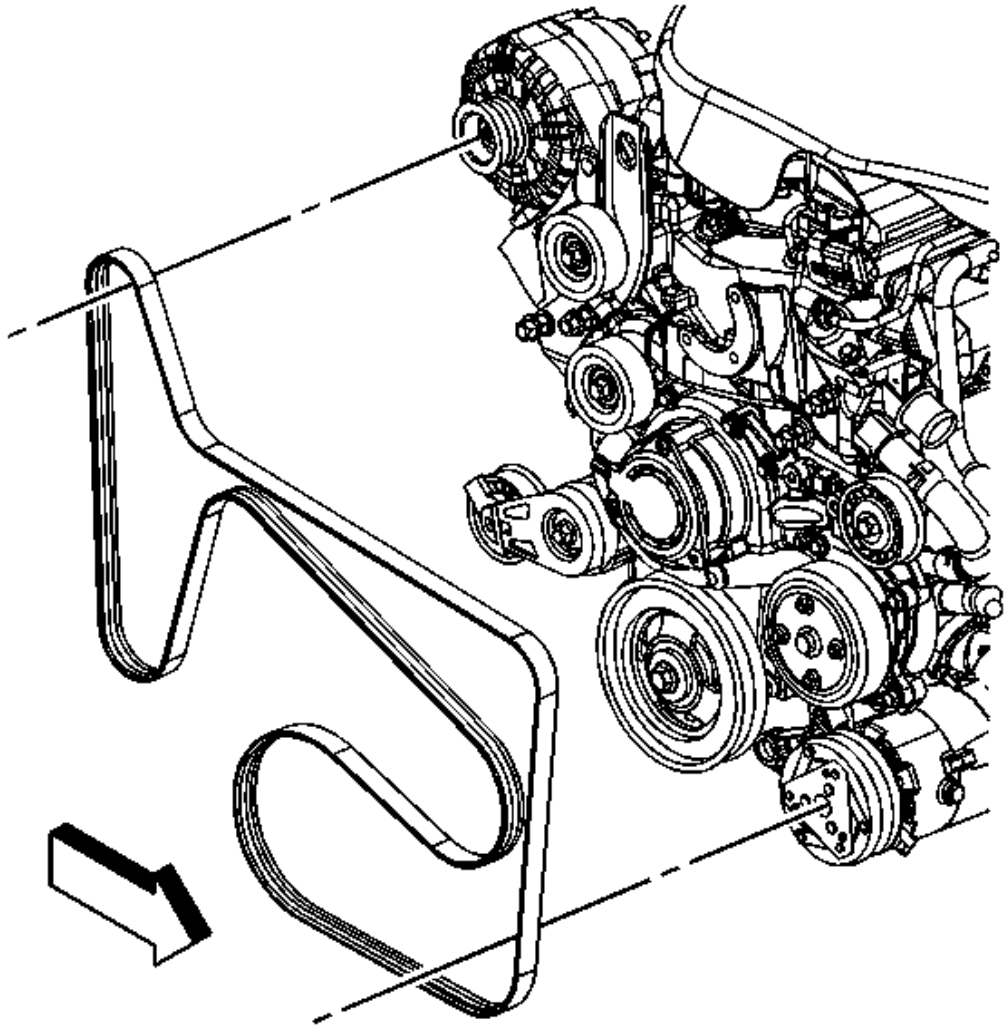

Fig. 5: Drive Belt Routing - With Power Steering
Courtesy of GENERAL MOTORS CORP.

1. Install a breaker bar to the drive belt tensioner.
2. Rotate the drive belt tensioner counterclockwise to release the spring tension.
3. Route and install the drive belt, if equipped with hydraulic power steering.

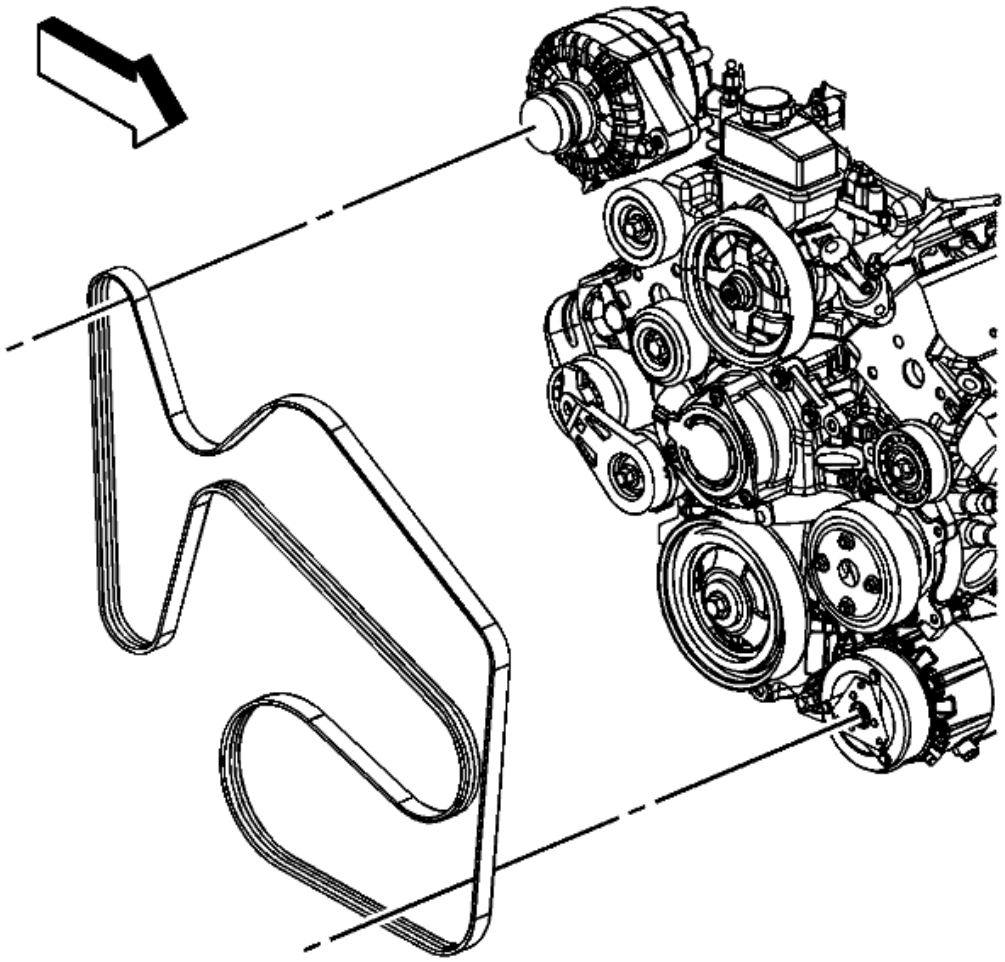

Fig. 6: Drive Belt Routing
Courtesy of GENERAL MOTORS CORP.

4. Route and install the drive belt, if equipped with electric power steering.
5. Install the engine mount snubber. Refer to **Engine Mount Snubber Replacement**.
6. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .

DRIVE BELT IDLER PULLEY REPLACEMENT

REMOVAL PROCEDURE

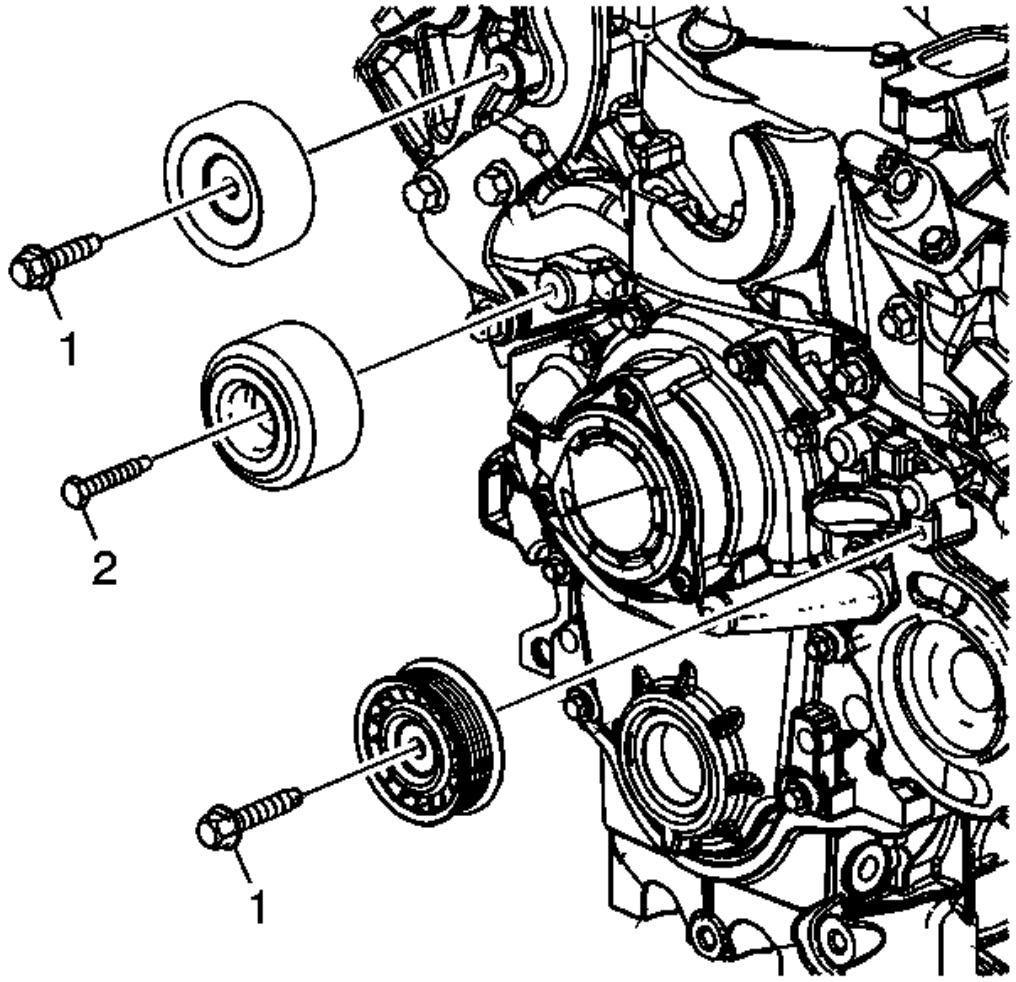

Fig. 7: Identifying Idler Pulley Bolts & Pulleys
Courtesy of GENERAL MOTORS CORP.

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Loosen the appropriate drive belt idler pulley bolt (1, 2).
3. Remove the appropriate drive belt idler pulley.

INSTALLATION PROCEDURE

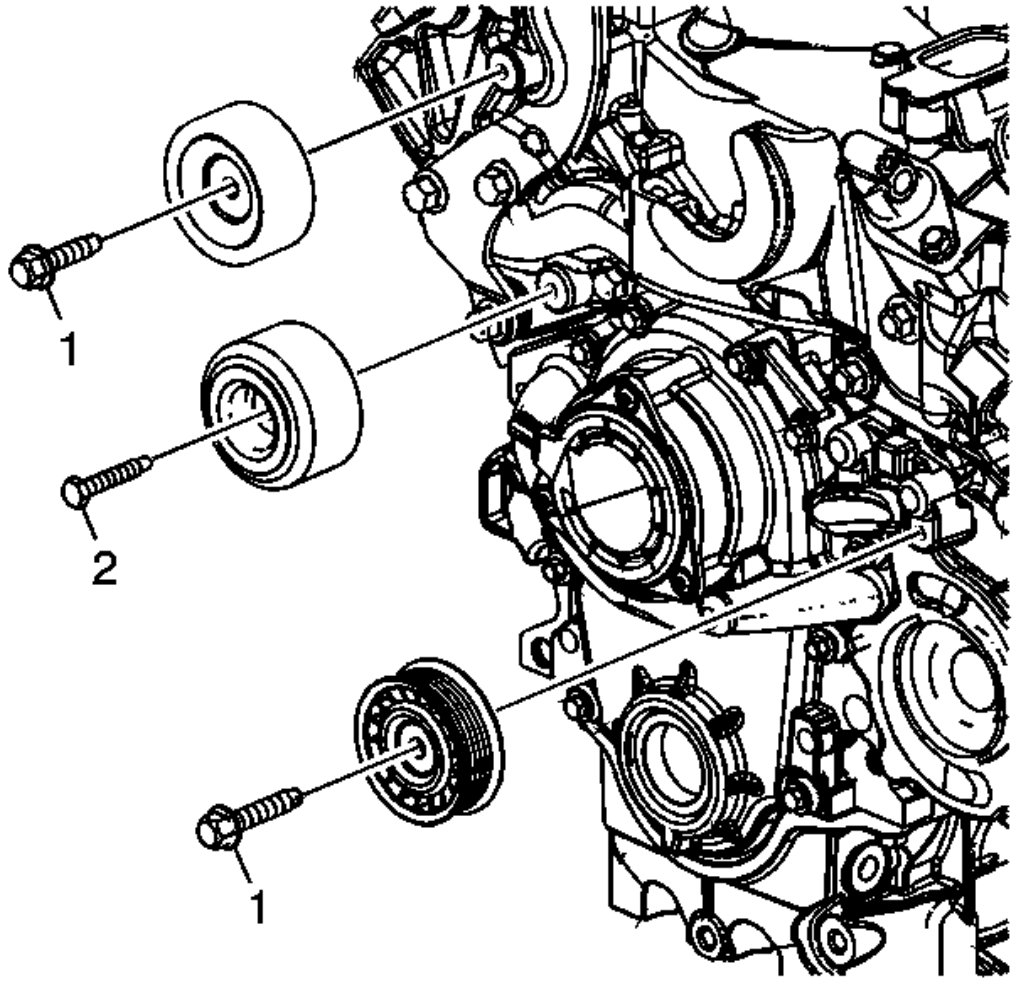

Fig. 8: Identifying Idler Pulley Bolts & Pulleys
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the appropriate drive belt idler pulley.
2. Tighten the appropriate drive belt idler pulley bolt (1, 2).

Tighten:

- Tighten the bolt (1) to 50 N.m (37 lb ft).
- Tighten the bolt (2) to 30 N.m (22 lb ft).

3. Install the drive belt. Refer to **Drive Belt Replacement**.

DRIVE BELT TENSIONER REPLACEMENT

REMOVAL PROCEDURE

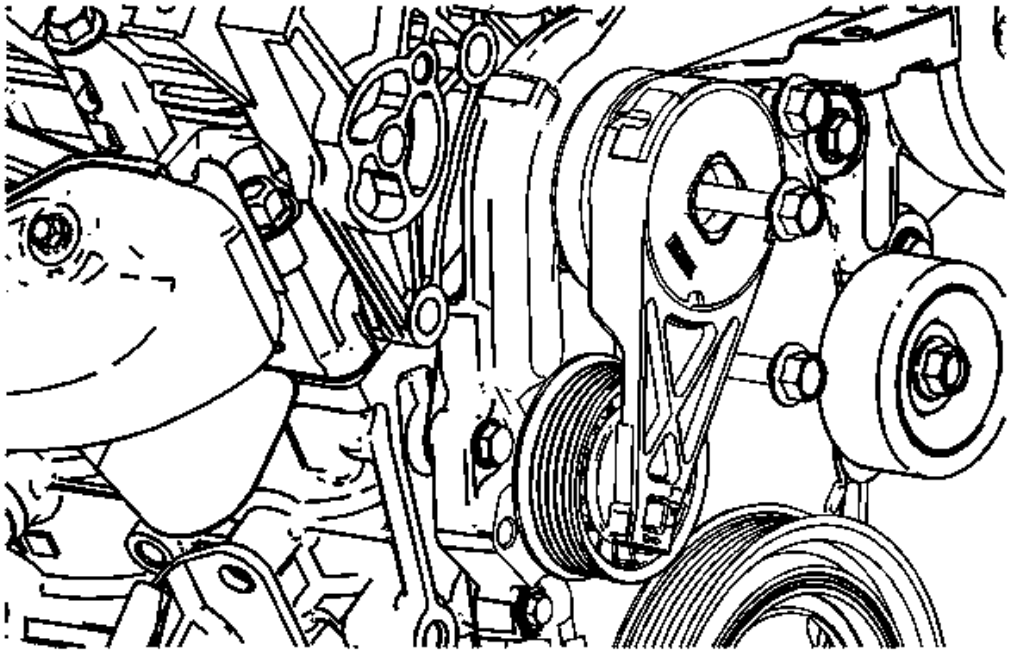

Fig. 9: Identifying Drive Belt Tensioner Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the drive belt tensioner bolt.
3. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Removal** .

INSTALLATION PROCEDURE

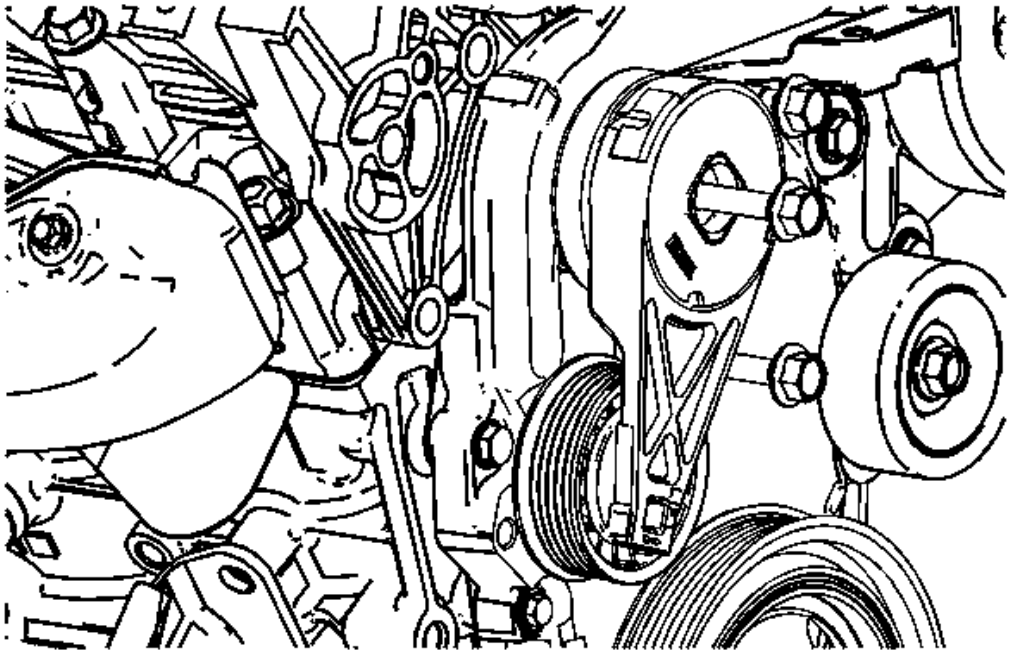

Fig. 10: Identifying Drive Belt Tensioner Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt tensioner. **Drive Belt Tensioner Installation** .

   CAUTION: Refer to Fastener Caution .

2. Install the drive belt tensioner bolt.

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

3. Install the drive belt. Refer to **Drive Belt Replacement**.

ENGINE SUPPORT FIXTURE

SPECIAL TOOLS

- **J 28467-B** Engine Support Fixture
- **J 36462** Engine Support Adapter Leg
- **J 36857**

PROCEDURE

1. Raise the hood.
2. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
3. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.

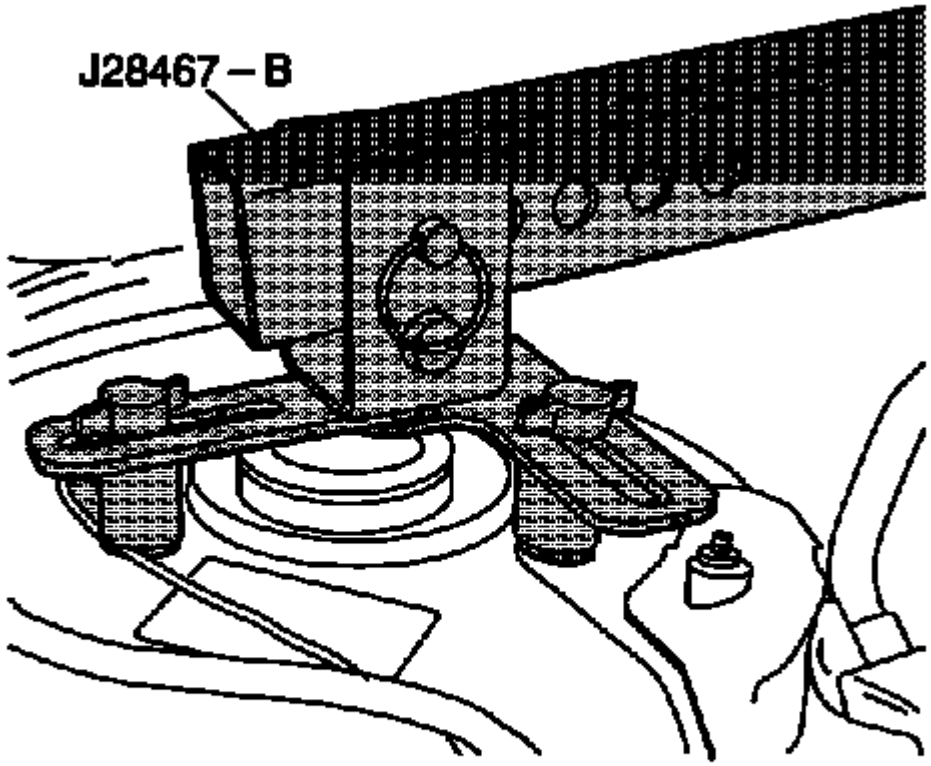

Fig. 11: Identifying Engine Support Fixture (J 28467-B)
Courtesy of GENERAL MOTORS CORP.

4. Install the thread support nuts J 28467-33A onto the strut attaching studs.
5. Install the strut tower support assemblies J 28467-5A over the thread support nuts J 28467-33A.
6. Install the T-bolts J 28467-5 with 5/16 inch washers through the strut tower support assemblies J 28467-5A into the thread support nuts J 28467-33A. Hand tighten the bolts.
7. Install the 2 cross bracket assemblies J 28467-1A over the strut tower tube J 28467-3.
8. Install the strut tower tube J 28467-3 into the strut tower support assemblies J 28467-5A.
9. Install the 1/2 inch x 2.5 inch quick release pin J 28467-10 through the strut tower support assemblies J 28467-5A and the strut tower tube J 28467-3 on one side only.

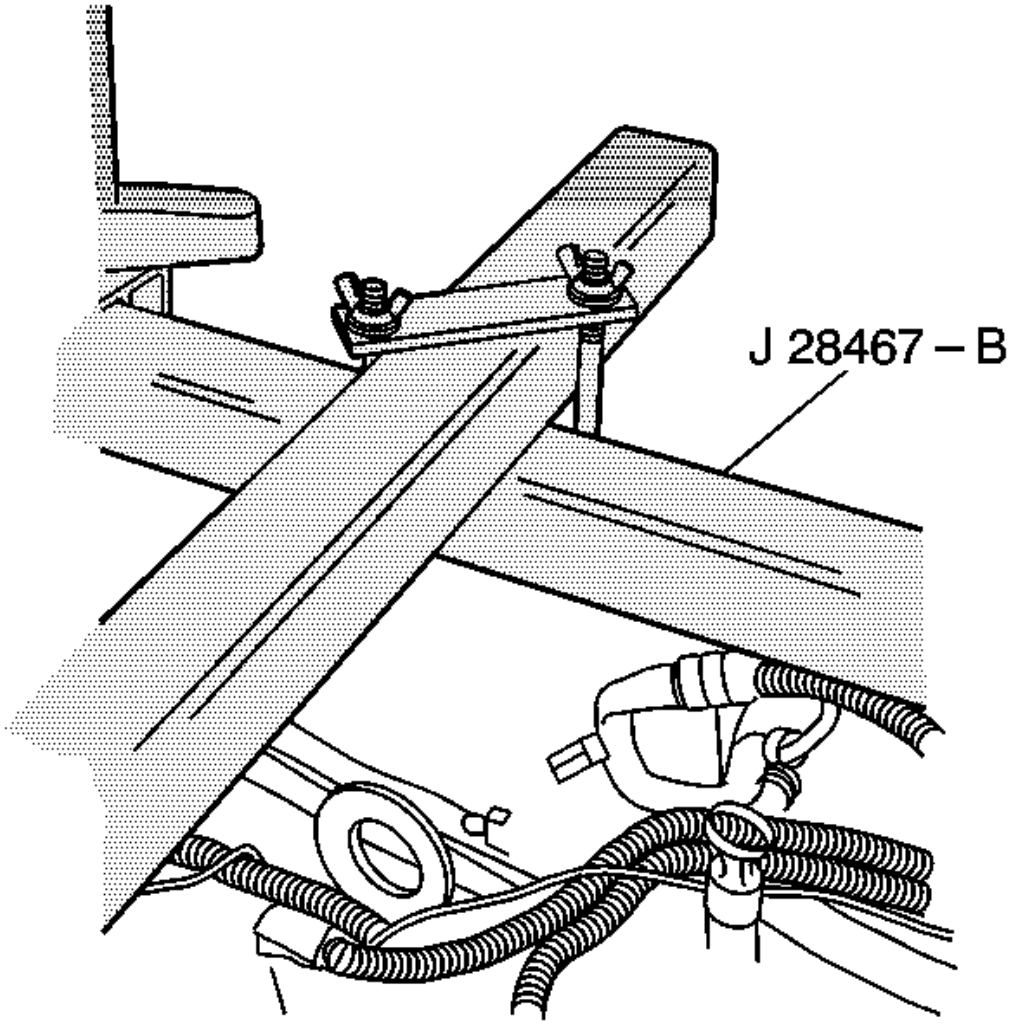

Fig. 12: Identifying Radiator Shelf Tube (J 28467-2A)
Courtesy of GENERAL MOTORS CORP.

10. Install the radiator shelf tube J 28467-2A through the driver side cross bracket assembly J 28467-1A on the top of the strut tower tube J 28467-3.
11. Place the rubber padded foot of the front support assembly J 28467-4A on the vehicle radiator shelf. The foot position used in the front support assembly J 28467-4A depends on the vehicle application.
12. Install the 7/16 inch x 2.0 inch quick release pin J 28467-9 through the hole in the front support assembly J 28467-4A in order to level the radiator shelf tube J 28467-2A. The hole used in the front support assembly J 28467-4A depends on the vehicle application.
13. Install the lift hook J 28467-7A through the lift hook bracket J 28467-6A.

14. Install the 1/2 inch lift hook washer and lift hook wing nut J 28467-34 onto the lift hook J 28467-7A.
15. Install the assembled lift hook bracket J 28467-6A over the radiator shelf tube J 28467-2A.
16. Adjust the radiator shelf tube J 28467-2A and the assemblage lift hook bracket J 28467-6A in order to align the hook with the left (front), rear of engine, lift hook bracket part of the left engine mount strut bracket.
17. Hand tighten the driver side cross bracket assembly J 28467-1A wing nuts.
18. Install the second radiator shelf tube J 28467-2A through the passenger side cross bracket assembly (J 28467-1A) on the top of the strut tower tube J 28467-3.
19. Place the rubber padded foot of the front support assembly J 28467-4A on the vehicle radiator shelf. The foot position used in the front support assembly J 28467-4A depends on the vehicle application.
20. Install the 7/16 inch x 2.0 inch quick release pin J 28467-9 through the hole in the front support assembly J 28467-4A in order to level the radiator shelf tube J 28467-2A. The hole used in the front support assembly J 28467-4A depends on the vehicle application.
21. Install the lift hook J 28467-7A through the lift hook bracket J 28467-6A.
22. Install the 1/2 inch lift hook washer and lift hook wing nut J 28467-34 onto the lift hook J 28467-7A.
23. Install the assemblage lift hook bracket J 28467-6A over the radiator shelf tube J 28467-2A.
24. Adjust the radiator shelf tube J 28467-2A and the assemblage lift hook bracket J 28467-6A in order to align the hook with the right rear and front of engine.

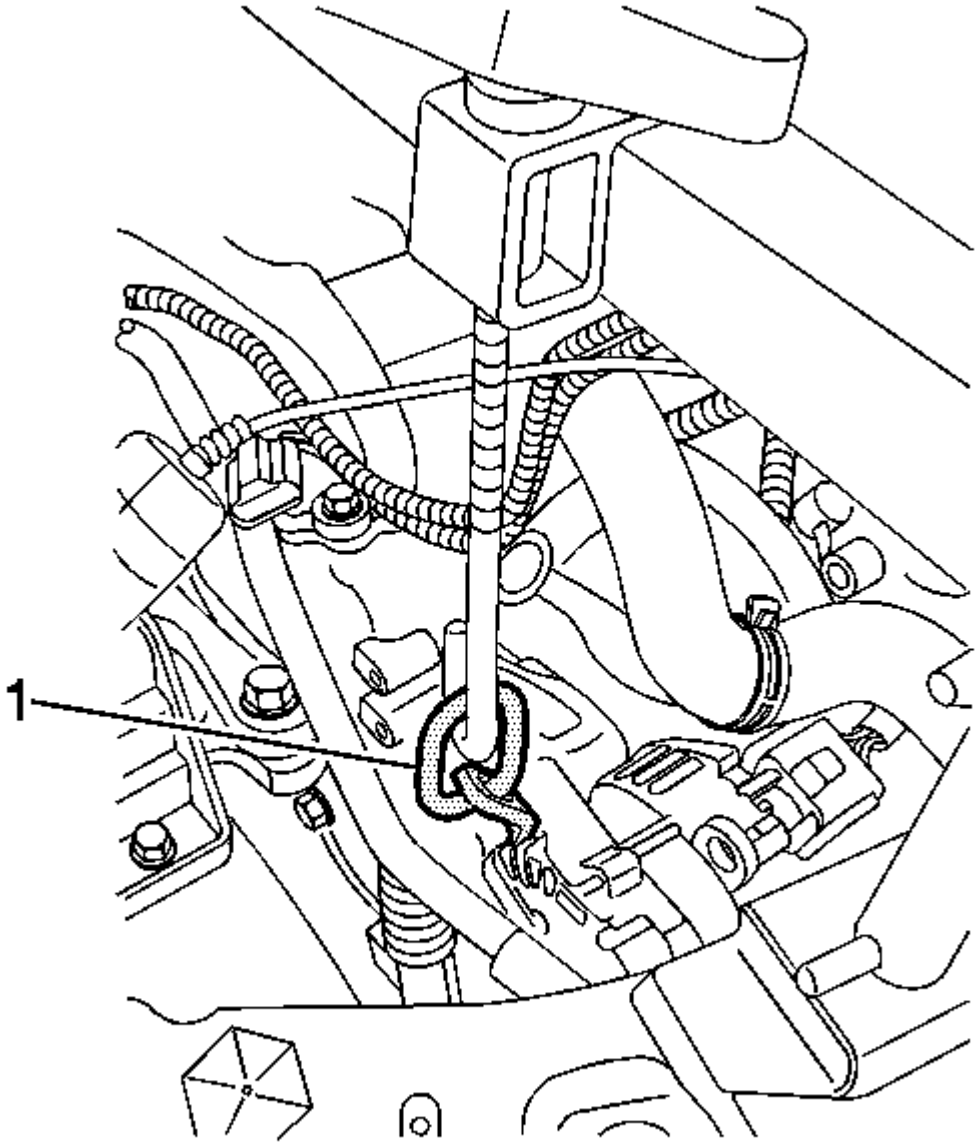

Fig. 13: View Of J 36857 Lift Hook Bracket
Courtesy of GENERAL MOTORS CORP.

25. Install the J 36857lift hook bracket (1).
26. Hand tighten the passenger side cross bracket assembly J 28467-1A wing nuts.
27. Hand tighten the lift hook wing nuts J 28467-34 securely in order to remove all slack from the engine support fixture assembly.

ENGINE MOUNT INSPECTION

IMPORTANT: Before replacing any engine mount due to suspected fluid loss, verify that the source of the fluid is the engine mount, not the engine or accessories.

1. Install the engine support fixture. Refer to **Engine Support Fixture**.
2. Observe the engine mount while raising the engine. Raising the engine removes the weight from the engine mount and creates slight tension on the rubber.
3. Replace the engine mount if the engine mount exhibits any of the following conditions:
   - The hard rubber is covered with heat check cracks.
   - The rubber is separated from the metal plate of the engine mount.
   - The rubber is split through the center of the engine mount.
   - The engine mount itself is leaking fluid.
4. For engine mount replacement. Refer to **Engine Mount Replacement (Coupe)** or **Engine Mount Replacement (Convertible)**.

ENGINE MOUNT REPLACEMENT (COUPE)

REMOVAL PROCEDURE

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** .
3. Remove the engine splash shield. Refer to **Radiator Air Lower Baffle and Deflector Replacement** .

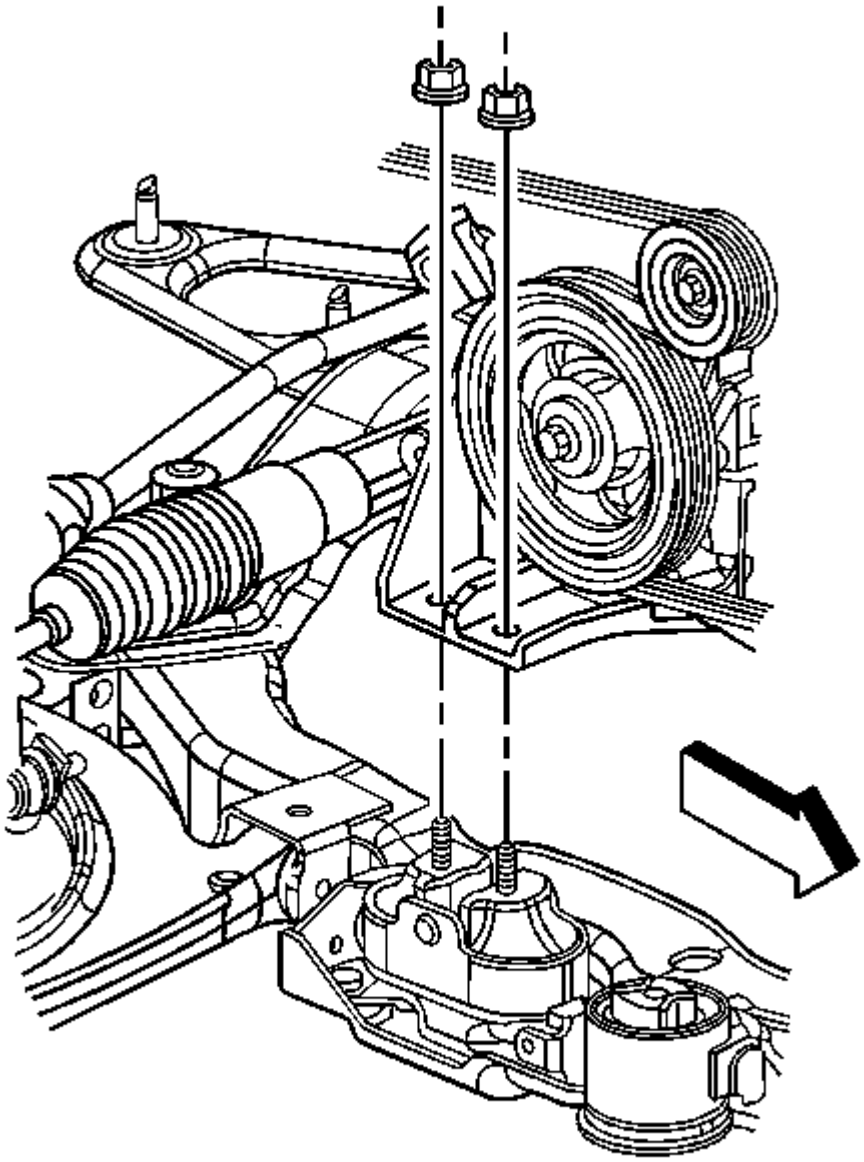

Fig. 14: Identifying Engine Mount To Engine Mount Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

4. Remove the engine mount to engine mount bracket nuts.

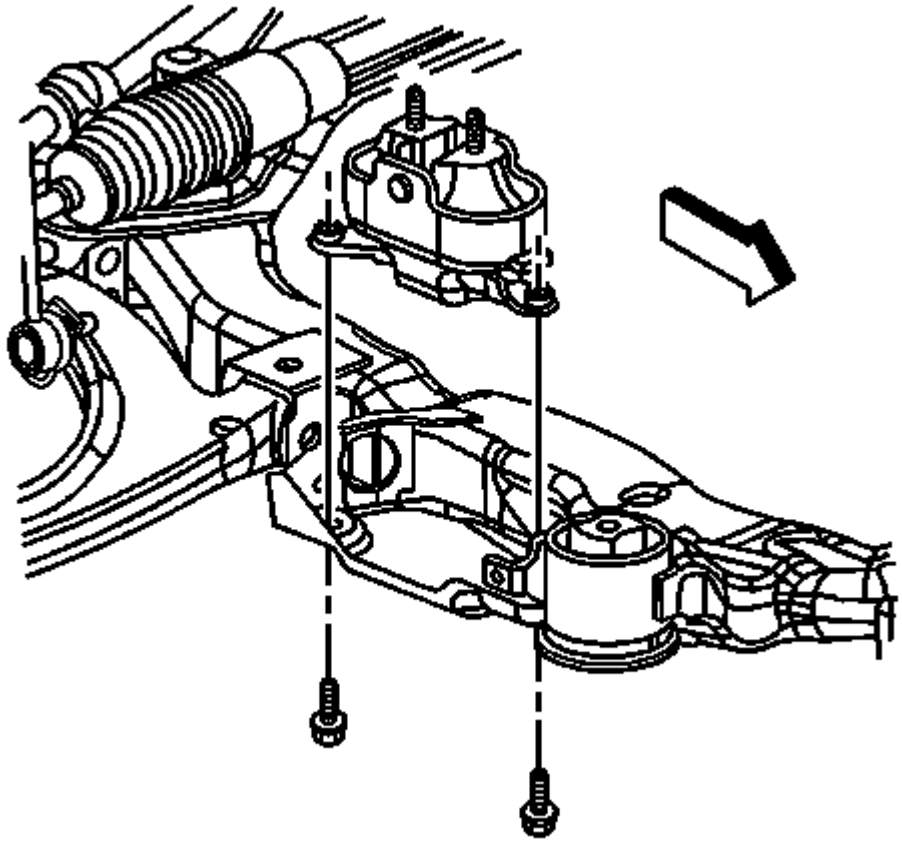

Fig. 15: Identifying Frame & Engine Mount Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the motor mount to frame nuts.
6. Using a suitable jackstand, raise the engine.
7. Remove the motor mount from the vehicle.

INSTALLATION PROCEDURE

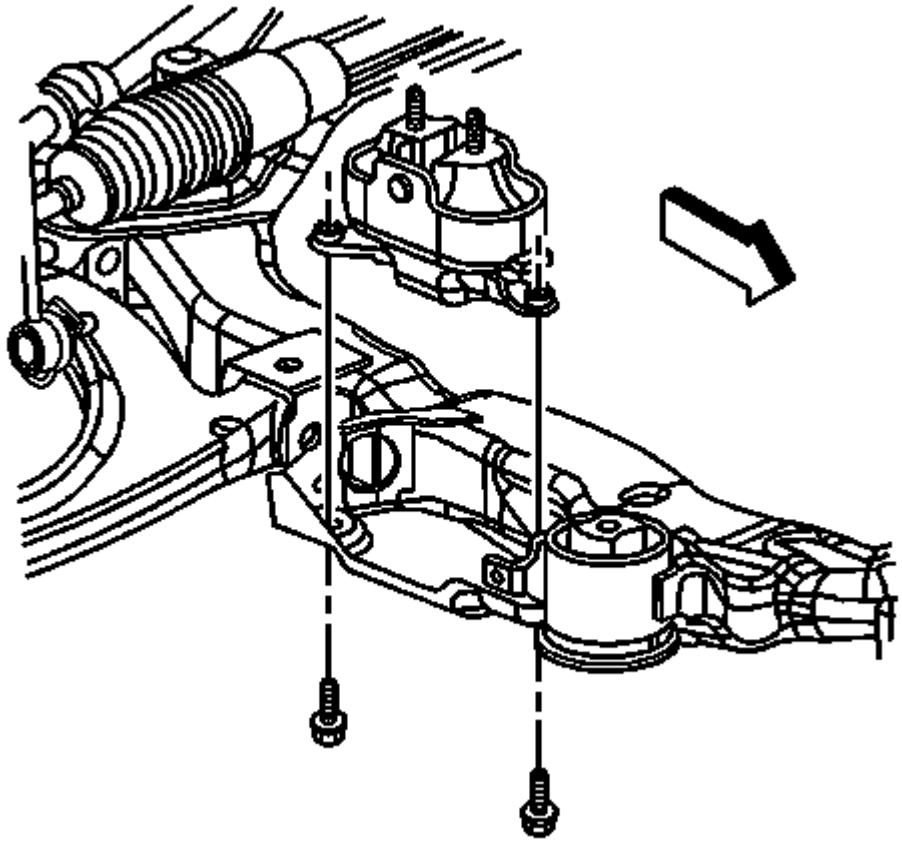

Fig. 16: Identifying Frame & Engine Mount Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the motor mount on the frame.
2. Use the jackstand to lower the engine mount bracket on to the engine mount.

CAUTION: Refer to Fastener Caution .

3. Install the engine mount to frame bolts.

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

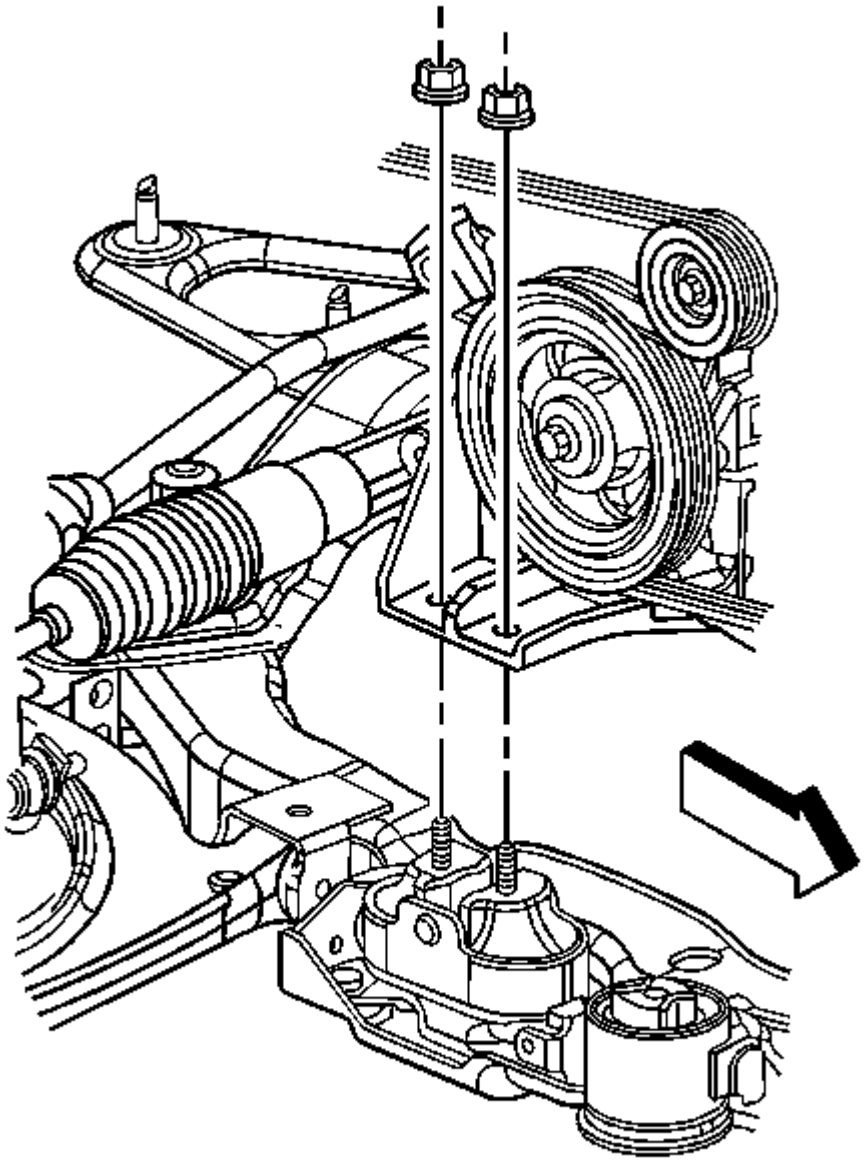

Fig. 17: Identifying Engine Mount To Engine Mount Bracket Nuts
Courtesy of GENERAL MOTORS CORP.

4. Install the motor mount to motor mount bracket nuts.

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

5. Install the engine splash shield. Refer to **Radiator Air Lower Baffle and Deflector Replacement** .
6. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** .
7. Lower the vehicle.

ENGINE MOUNT REPLACEMENT (CONVERTIBLE)

REMOVAL PROCEDURE

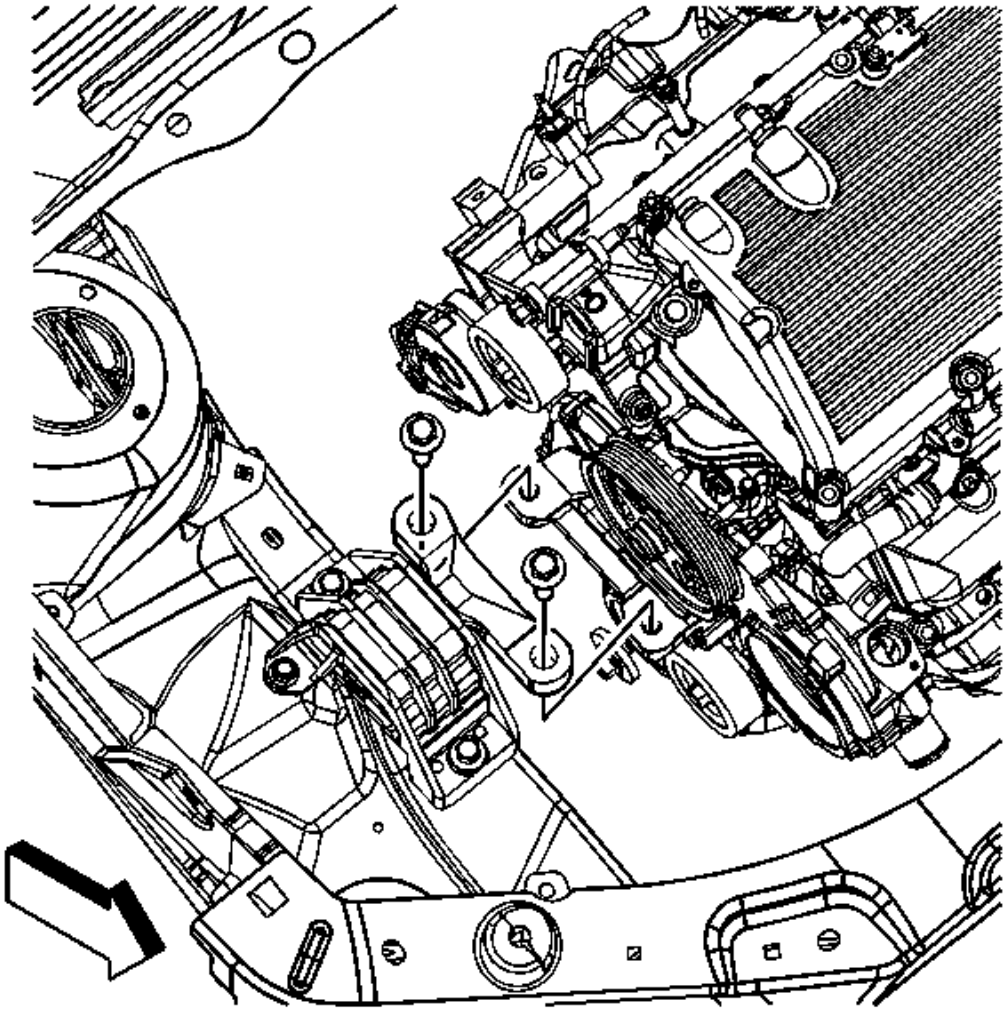

Fig. 18: View Of Engine Mount To Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .
2. Place a block of wood on a adjustable floor jack, and place the jack under the oil pan in order to support the engine.
3. Remove the engine mount to engine mount bracket bolts.

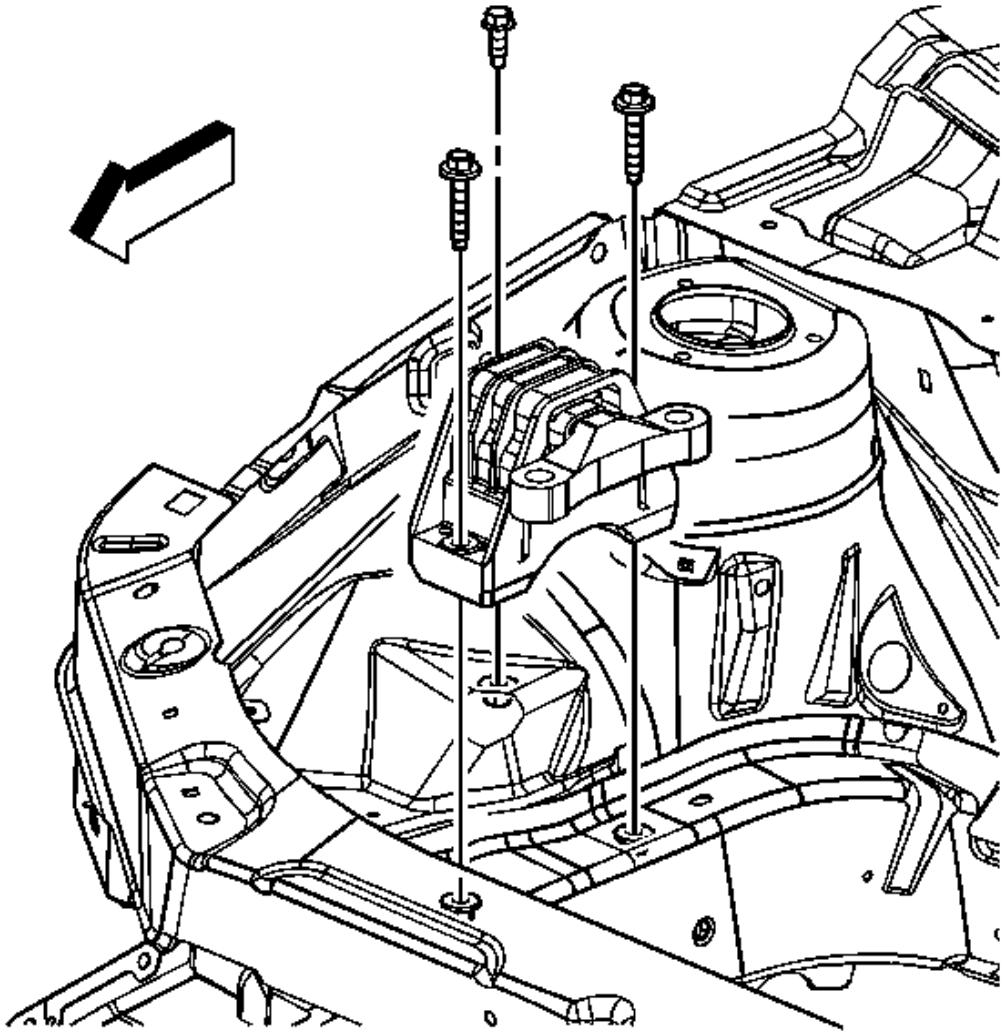

Fig. 19: View Of Engine Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the engine mount bolts.

5. Remove the engine mount.

INSTALLATION PROCEDURE

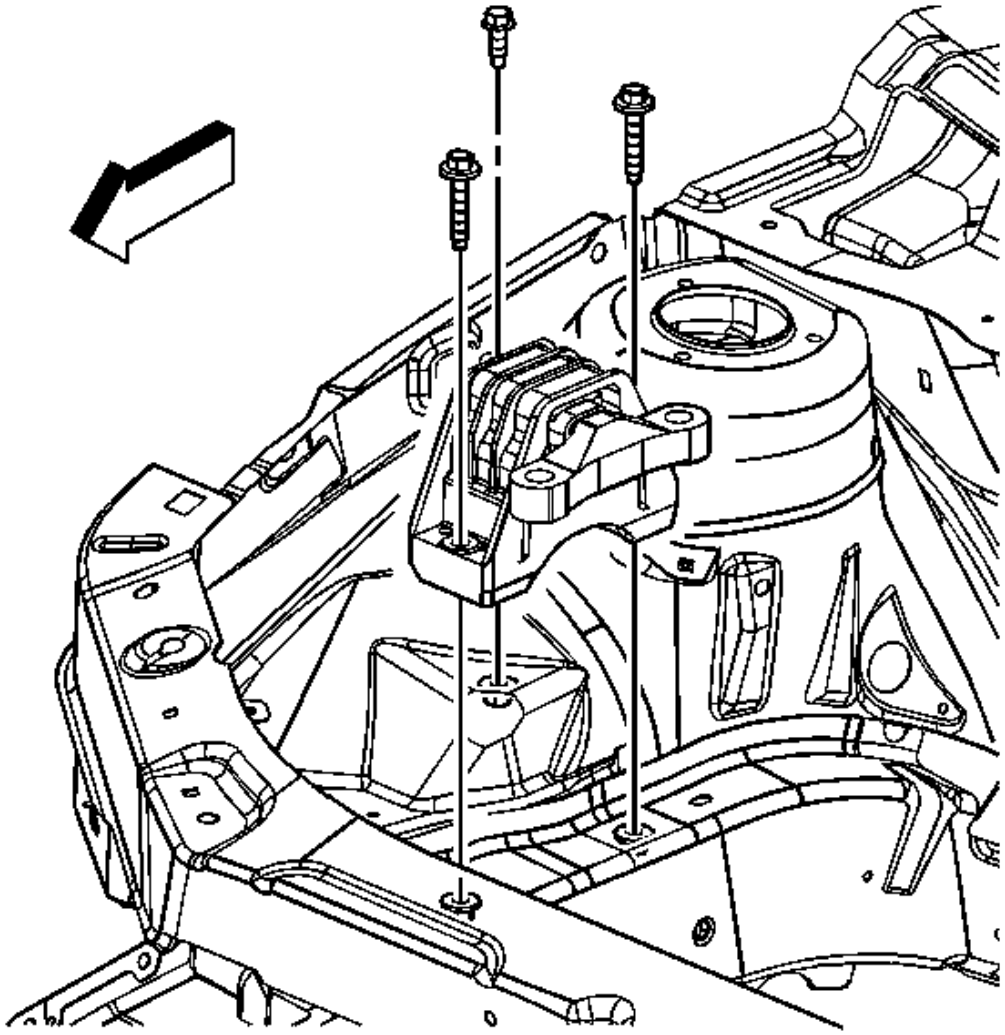

Fig. 20: View Of Engine Mount & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Place the engine mount into position on the engine compartment side rail.

CAUTION: Refer to Fastener Caution .

2. Install the engine mount bolts.

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

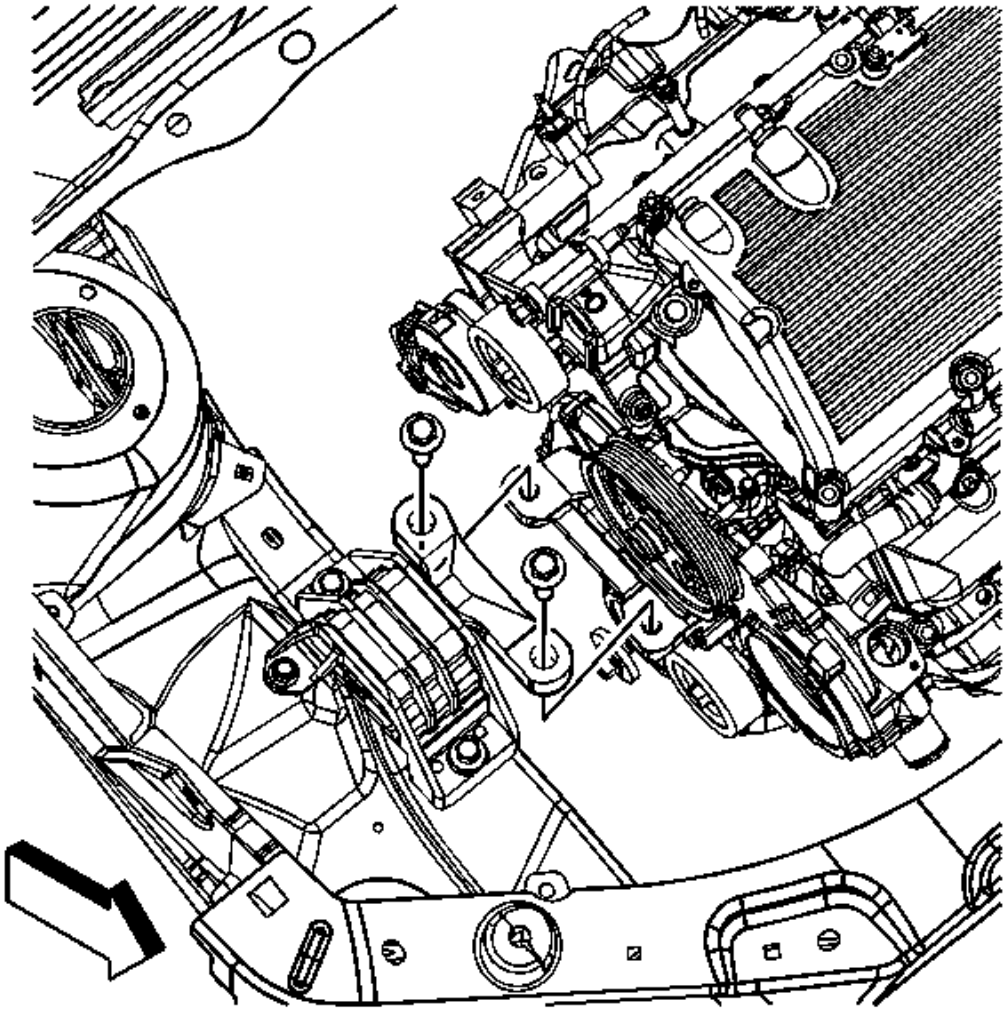

Fig. 21: View Of Engine Mount To Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the engine mount to engine mount bracket bolts.

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

4. Remove the floor jack and block of wood from under the oil pan.
5. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .

ENGINE MOUNT BRACKET REPLACEMENT (CONVERTIBLE)

REMOVAL PROCEDURE

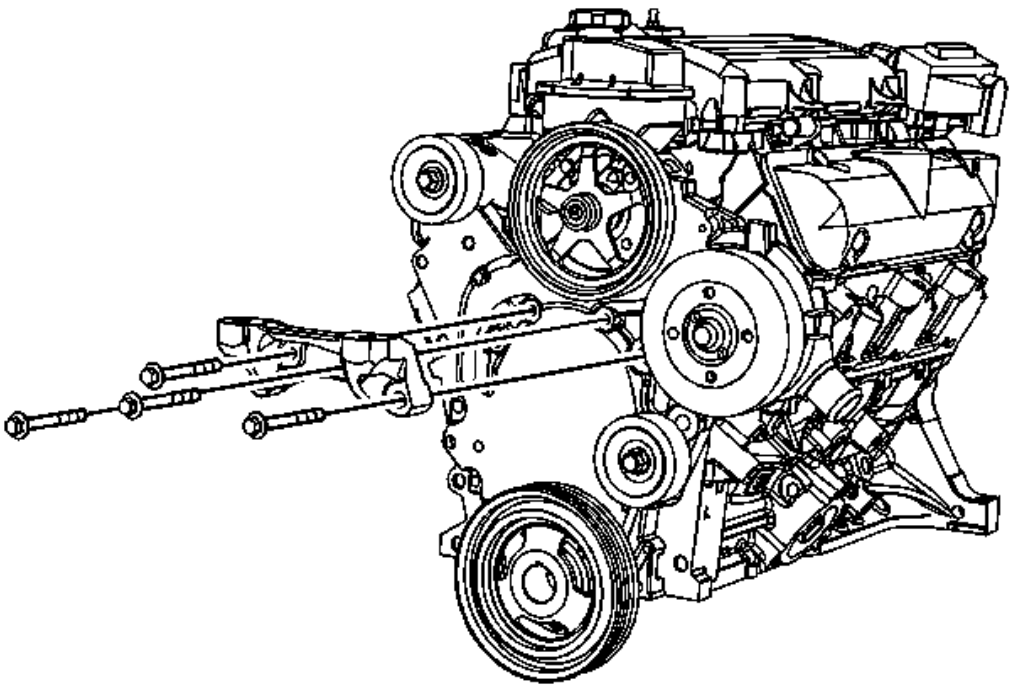

Fig. 22: View Of Engine Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine mount. Refer to **Engine Mount Replacement (Coupe)** or **Engine Mount Replacement (Convertible)**.
2. Remove the engine mount bracket bolts from the engine.
3. Remove the engine mount bracket.

INSTALLATION PROCEDURE

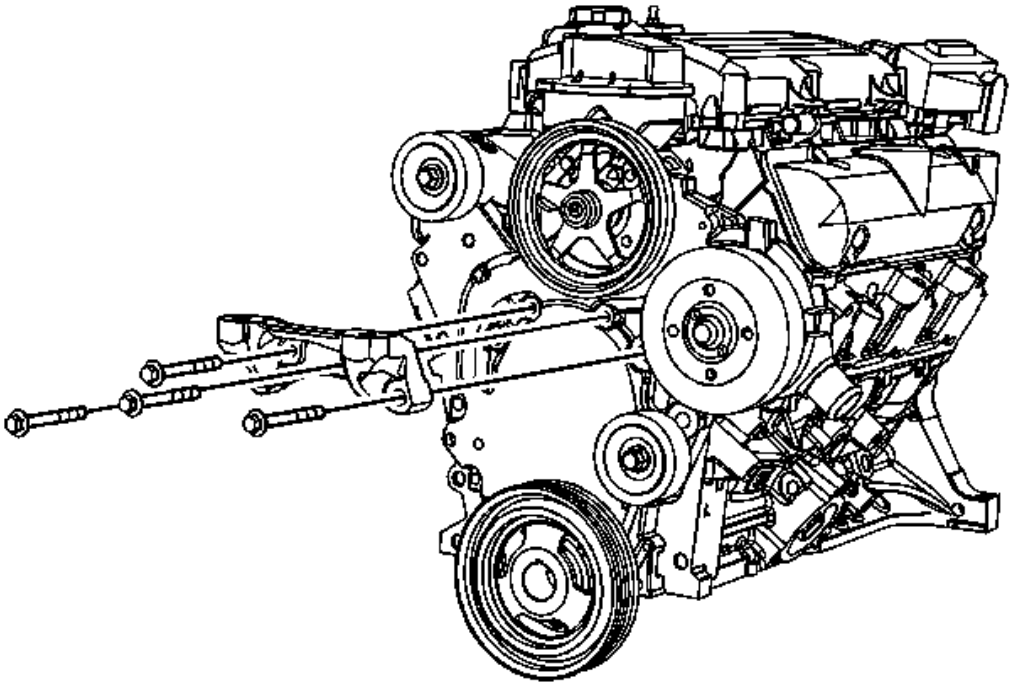

Fig. 23: View Of Engine Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount bracket to the engine front cover.
2. Hold the bracket firmly to the engine front cover and install the engine mount bracket bolts.

CAUTION: Refer to Fastener Caution .

3. Tighten the engine mount bracket bolts.

   Tighten: Tighten the bolts to 90 N.m (66 lb ft).

4. Install the engine mount. Refer to **Engine Mount Replacement (Coupe)** or **Engine Mount Replacement (Convertible)**.

ENGINE MOUNT BRACKET REPLACEMENT (COUPE)

REMOVAL PROCEDURE

1. Remove the engine mount. Refer to **Engine Mount Replacement (Coupe)** or **Engine Mount Replacement (Convertible)**.

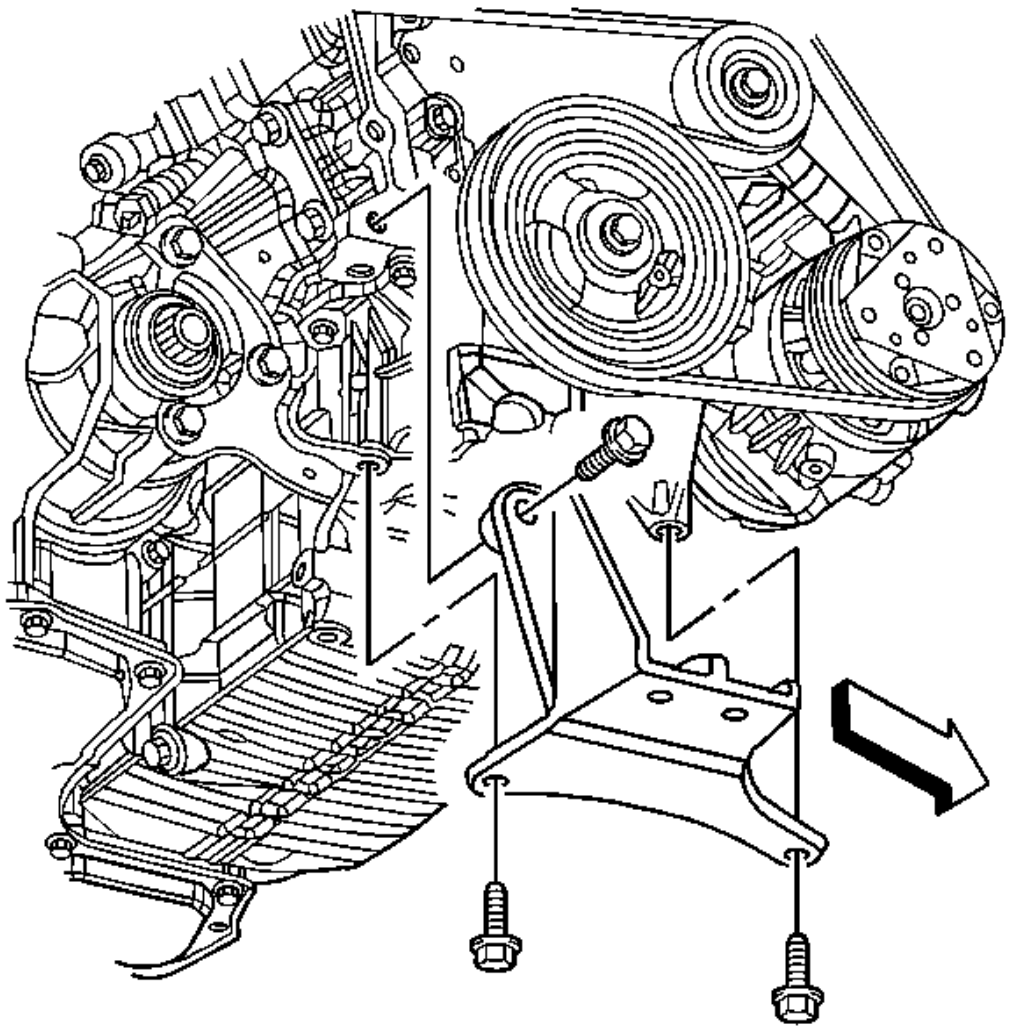

Fig. 24: Identifying Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the engine mount bracket bolts from the engine.
3. Remove the engine mount bracket from the vehicle.

INSTALLATION PROCEDURE

1. Position the engine mount bracket to the engine.

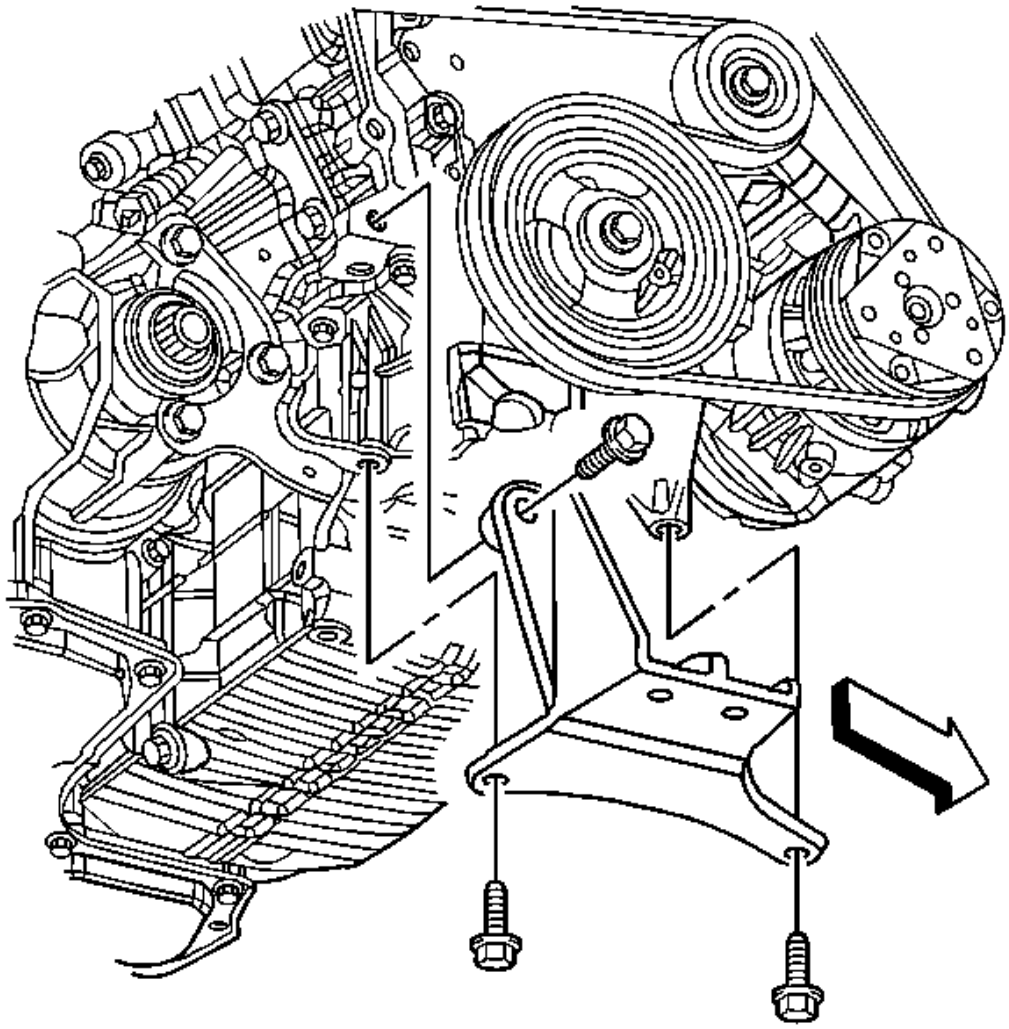

Fig. 25: Identifying Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the front mount bracket bolts to the engine. Hand tighten the bolts at this time.

Tighten:

1. Tighten the upper engine mount bracket bolts to 90 N.m (66 lb ft).
2. Tighten the lower engine mount bracket bolts to 50 N.m (37 lb ft).

3. Install the engine mount. Refer to **Engine Mount Replacement (Coupe)** or **Engine Mount Replacement (Convertible)**.

ENGINE MOUNT SNUBBER REPLACEMENT

REMOVAL PROCEDURE

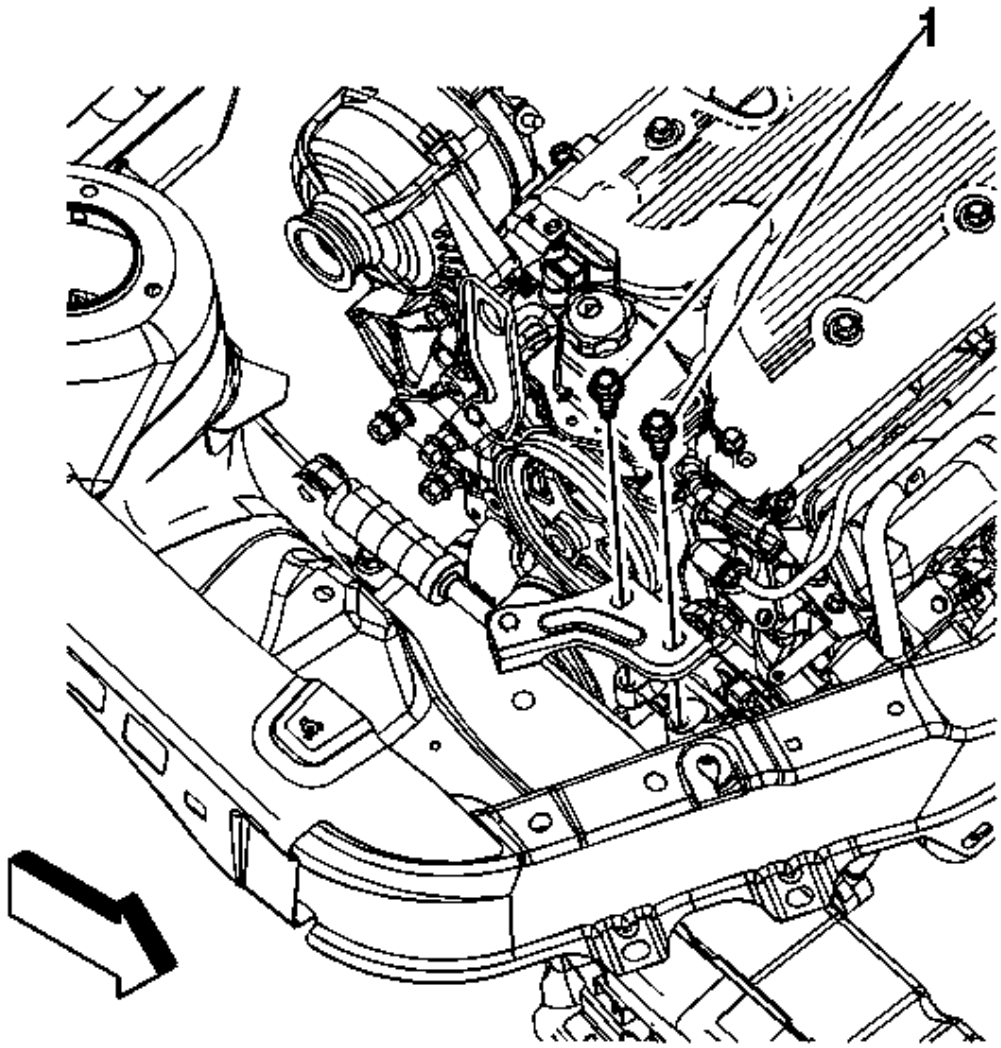

Fig. 26: Identifying Engine Mount Strut To Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .
2. Remove the engine mount snubber to engine mount snubber bracket bolts (1).

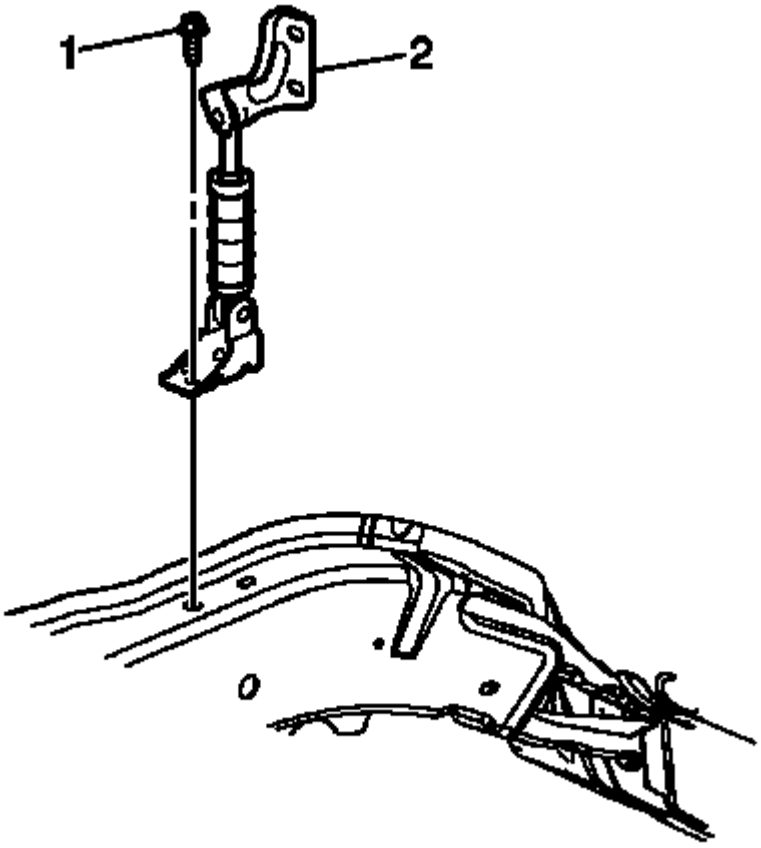

Fig. 27: Identifying Strut & Side Rail Bolts
Courtesy of GENERAL MOTORS CORP.

3. Rotate the engine mount snubber (2) to the vertical position in order to access the lower bolt.
4. Remove the engine mount snubber bolt (1).
5. Remove the engine mount snubber.

INSTALLATION PROCEDURE

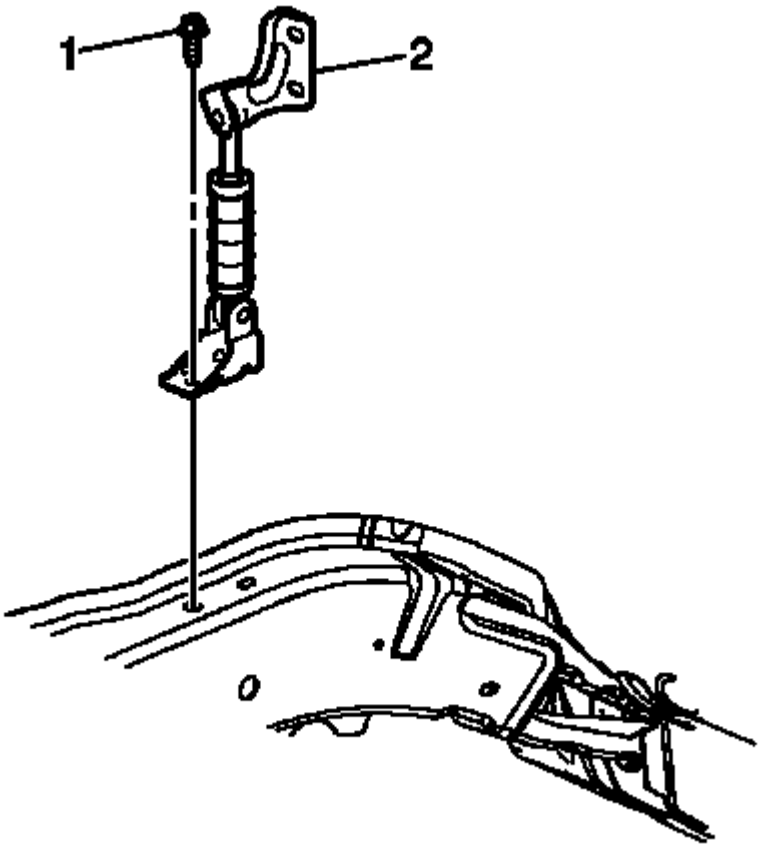

Fig. 28: Identifying Strut & Side Rail Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the engine mount snubber (2) in to the engine compartment side rail. Ensure that the tab on the snubber is inserted into the hole in the side rail.

CAUTION: Refer to Fastener Caution .

2. Install the engine mount snubber bolt (1) and tighten to 50 N.m (37 lb ft).
3. Rotate the engine mount snubber to the horizontal position.

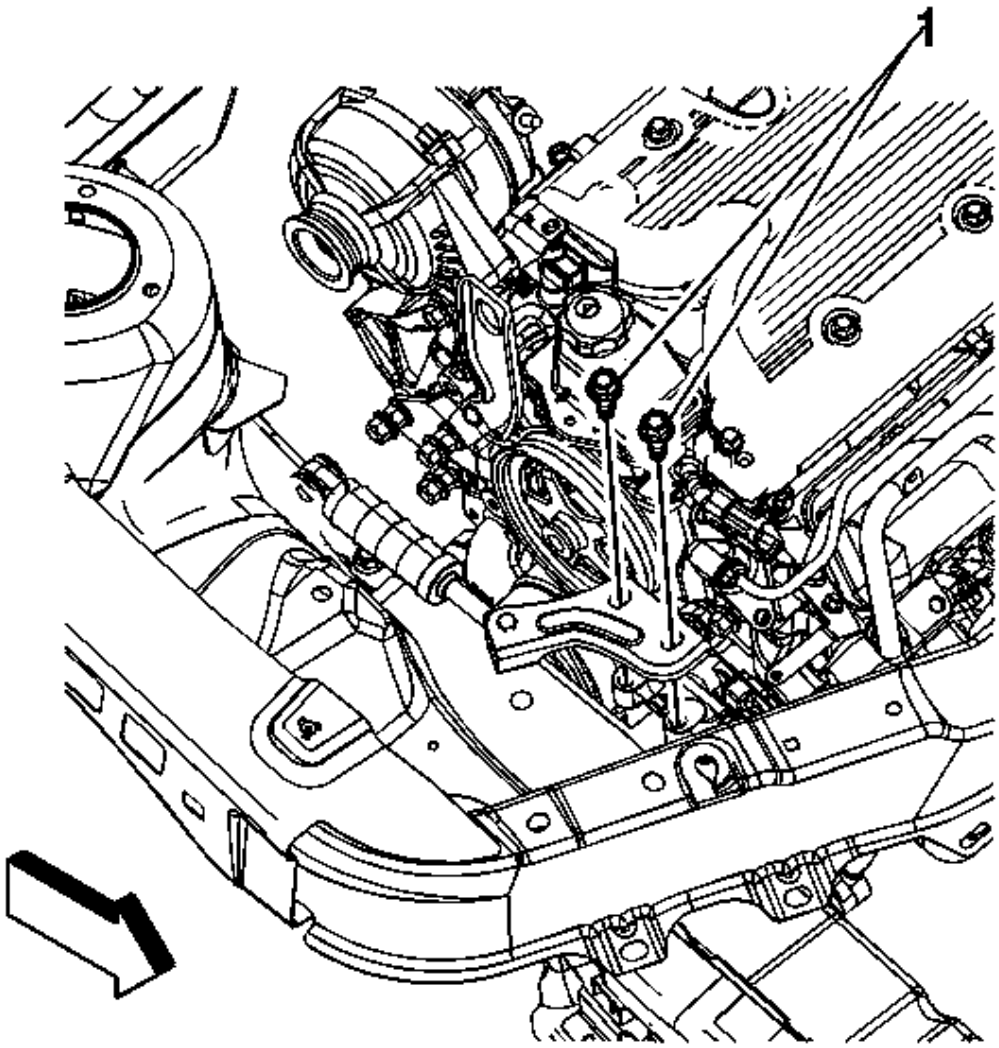

Fig. 29: Identifying Engine Mount Strut To Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the engine mount snubber to engine mount snubber bracket bolts (1) and tighten the bolts to 50 N.m (37 lb ft).
5. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .

ENGINE MOUNT SNUBBER BRACKET REPLACEMENT

REMOVAL PROCEDURE

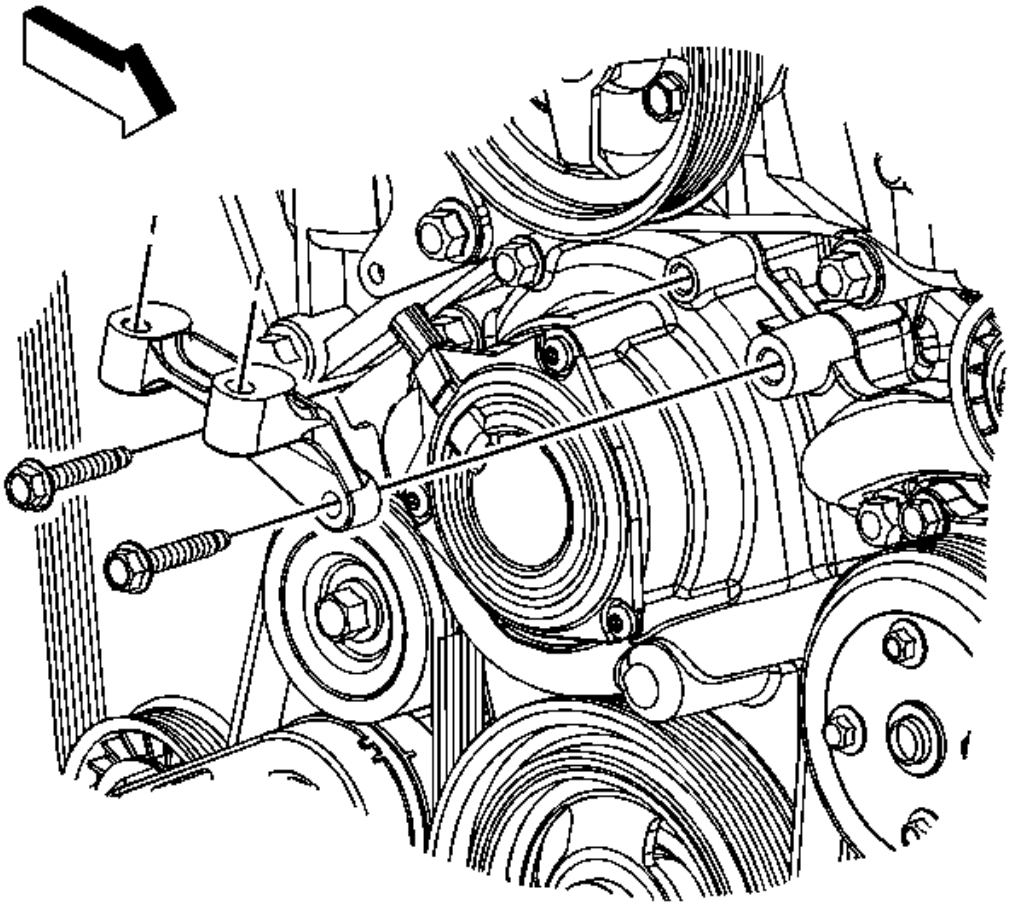

Fig. 30: Identifying Engine Mount Strut Bracket
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine mount snubber. Refer to **Engine Mount Snubber Replacement**.
2. Remove the engine mount snubber bracket to engine bolts.
3. Remove the engine mount snubber bracket.

INSTALLATION PROCEDURE

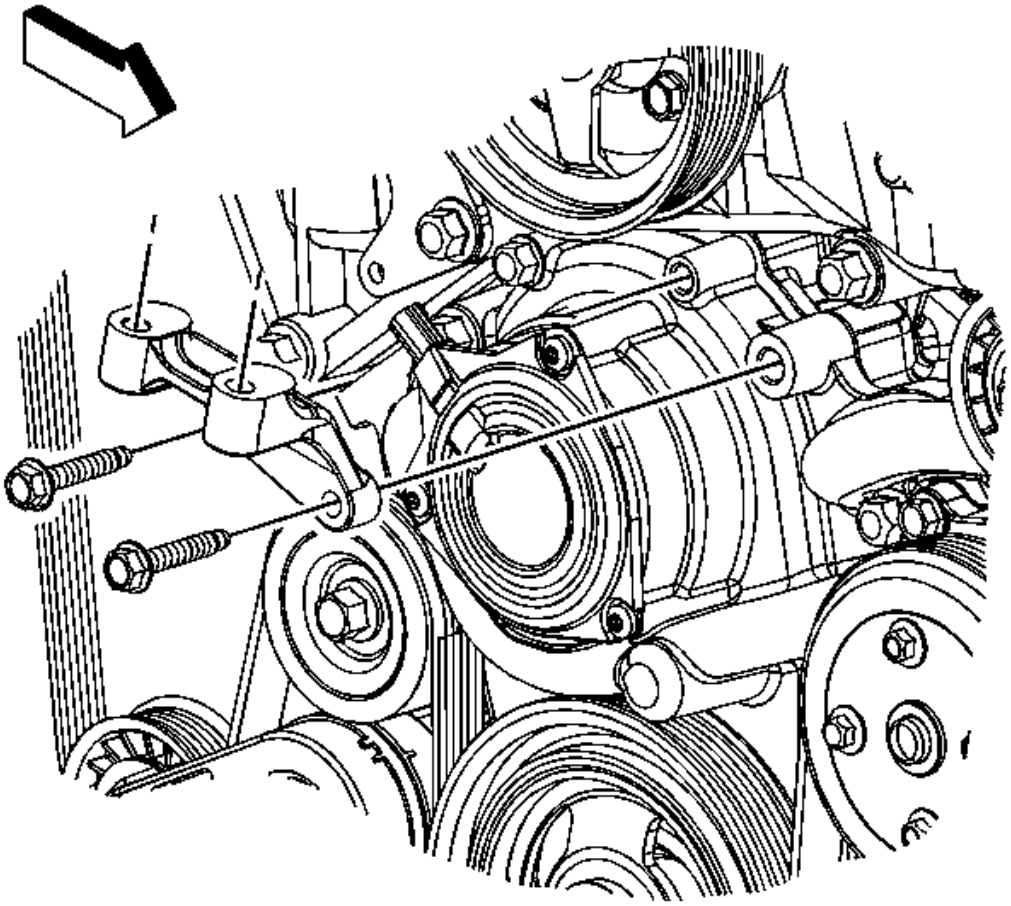

Fig. 31: Identifying Engine Mount Strut Bracket
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Position the engine mount snubber bracket to the engine.

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

2. Install the engine mount snubber. Refer to **Engine Mount Snubber Replacement**.

ENGINE AND TRANSMISSION MOUNT BALANCING - ALL MOUNTS

NOTE: **Follow the balance procedure in the order listed in the following steps. Powertrain mounts must be tightened in sequence.**

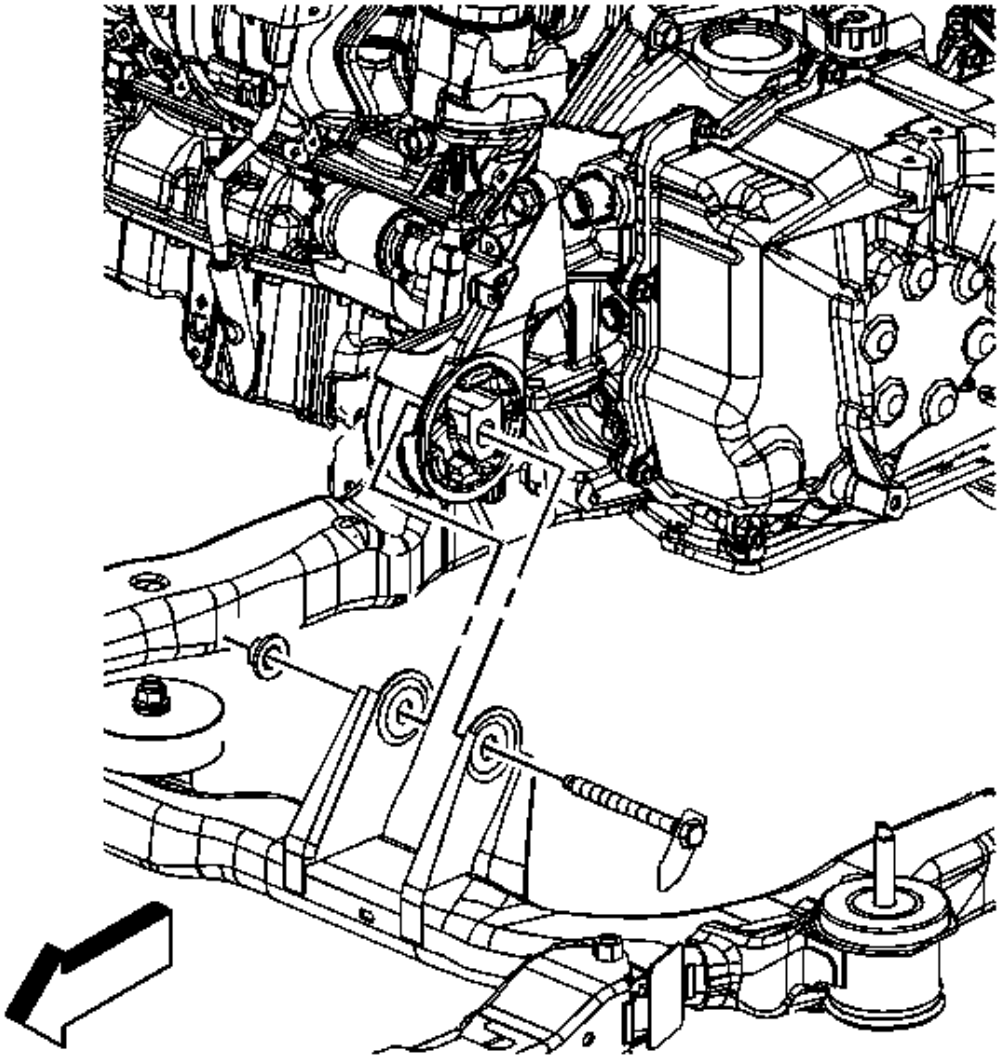

Fig. 32: Identifying Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Loosen, but DO NOT REMOVE the front transmission mount through bolt.

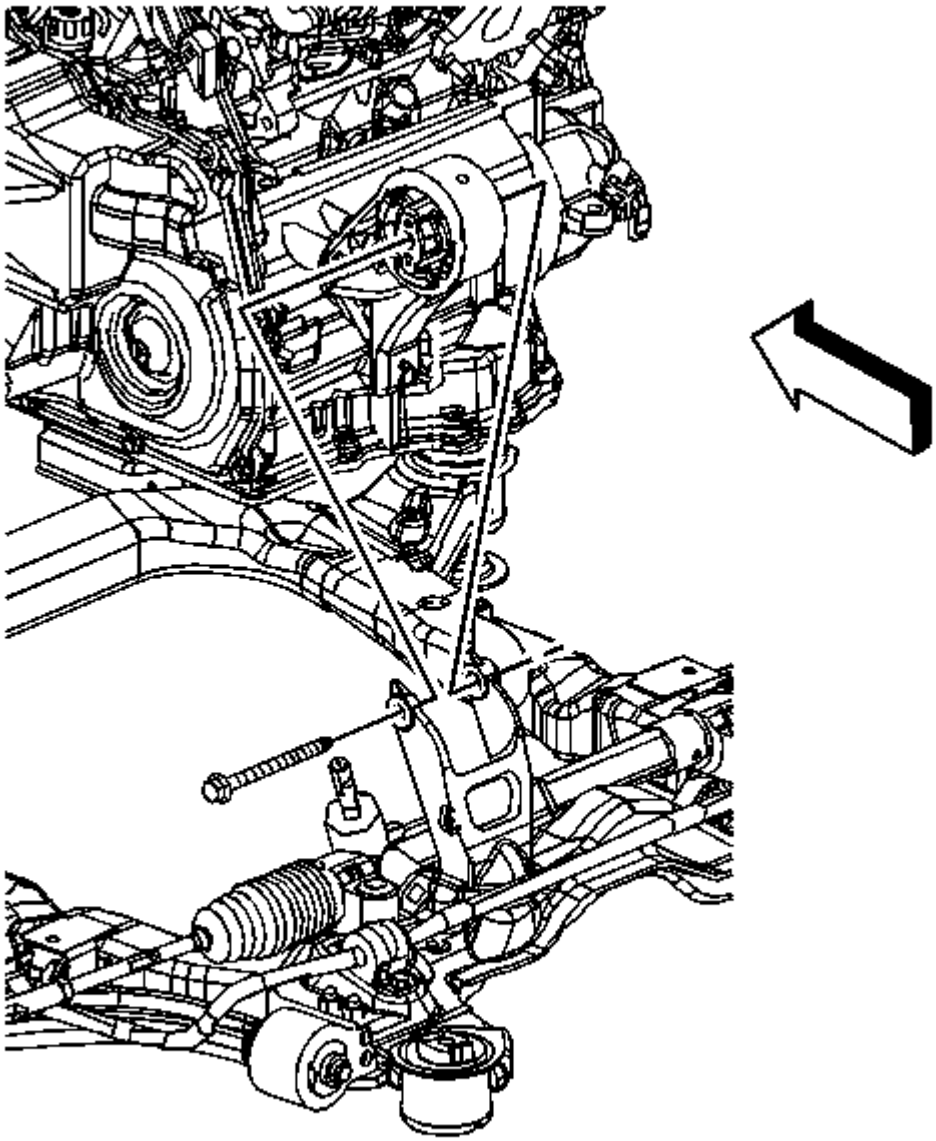

Fig. 33: Identifying Rear Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

3. Loosen, but DO NOT REMOVE the rear transmission mount through bolt.
4. Position 2 floor jacks with wood blocks under the engine and transmission to support the powertrain.

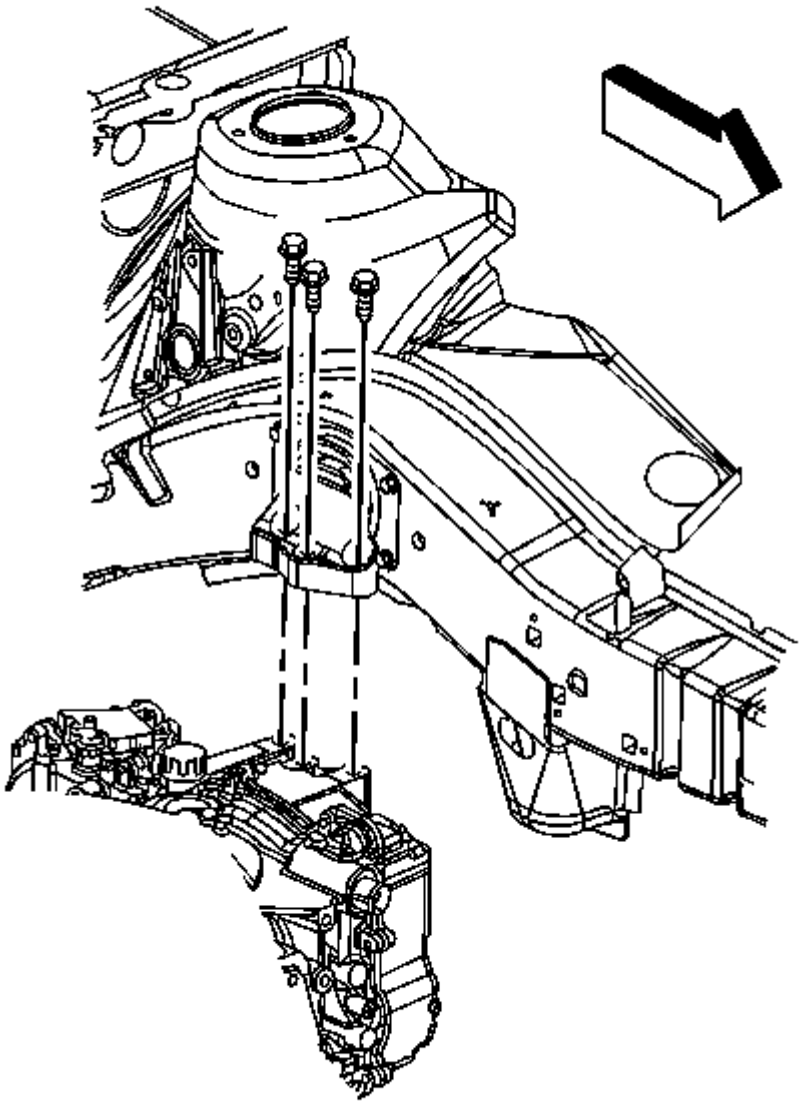

Fig. 34: Identifying Transmission Mount Bracket-To-Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

5. From inside the engine compartment, loosen the transmission mount bracket to transmission bolts.

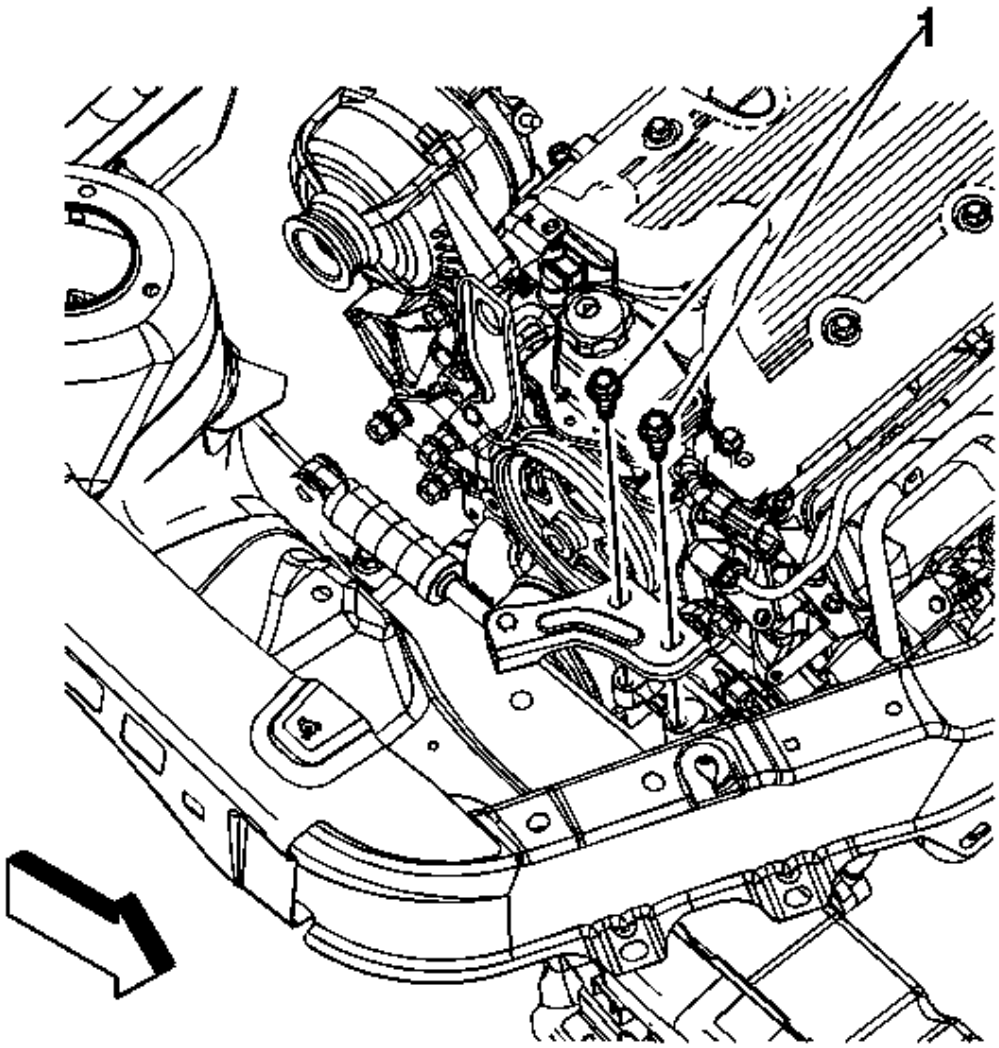

Fig. 35: Identifying Engine Mount Strut To Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

6. Loosen the engine mount strut to engine mount strut bracket bolts (1).
7. Reposition the floor jacks to allow a 1/8 inch gap between the engine mount and engine mount bracket.

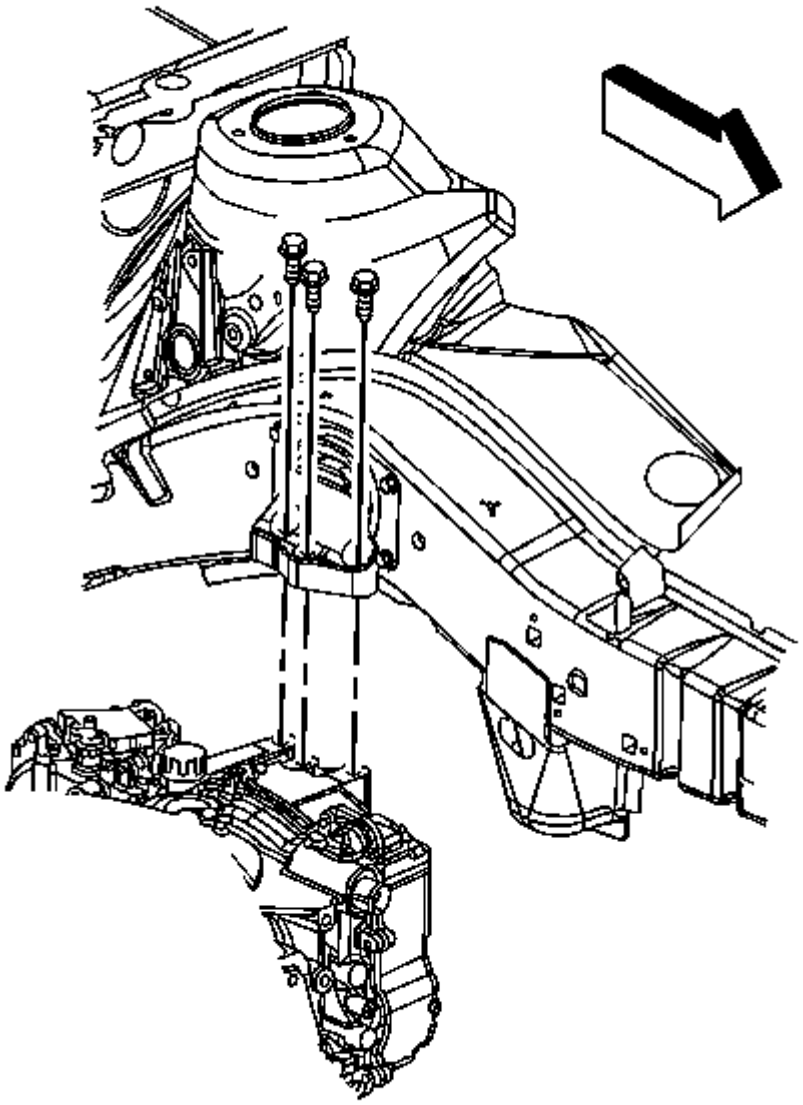

Fig. 36: Identifying Transmission Mount Bracket-To-Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

8. Tighten the transmission mount bracket to transmission bolts using the following sequence:
    1. Rear bolt

2. Middle bolt
3. Front bolt

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

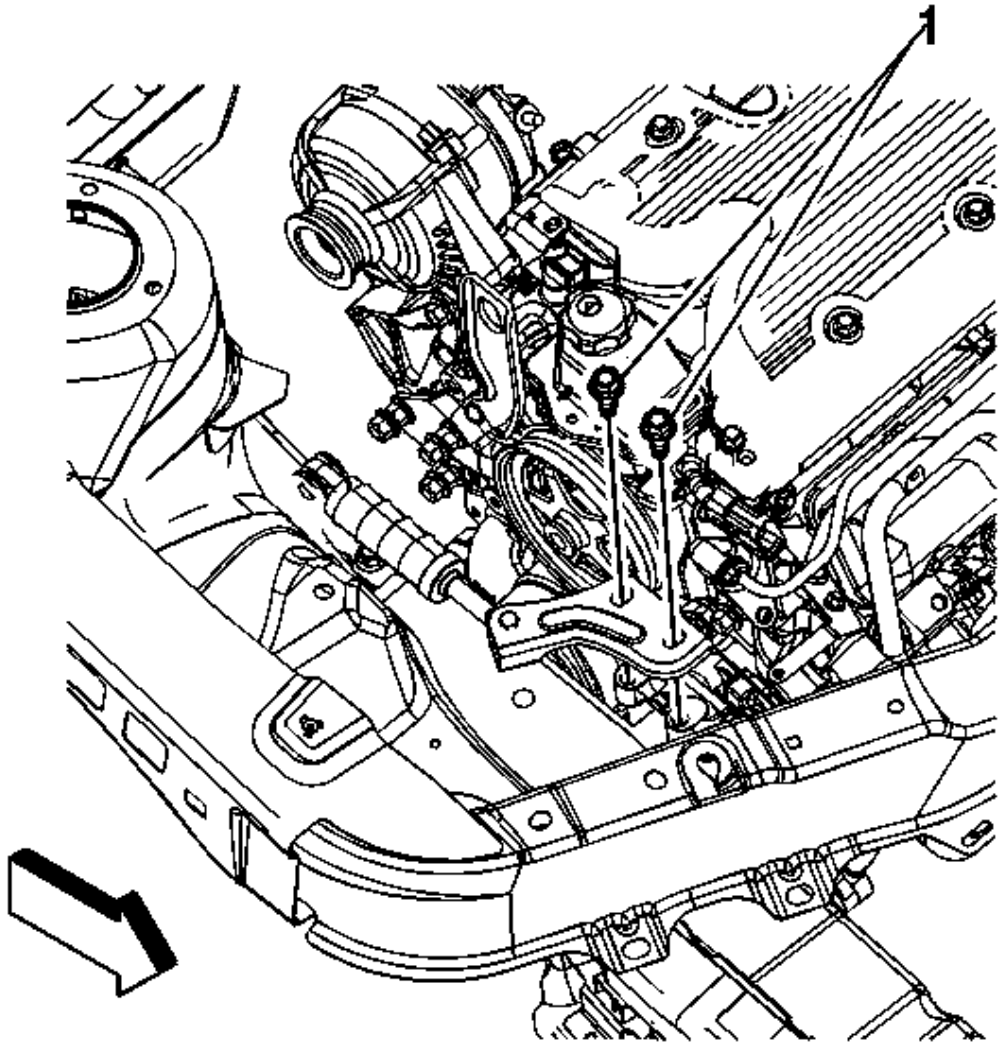

Fig. 37: Identifying Engine Mount Strut To Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

9. Tighten the engine mount strut to engine mount strut bracket bolts (1).

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

10. Remove the floor jacks.
11. Rock the powertrain vigorously from front to rear and allow the powertrain to settle.

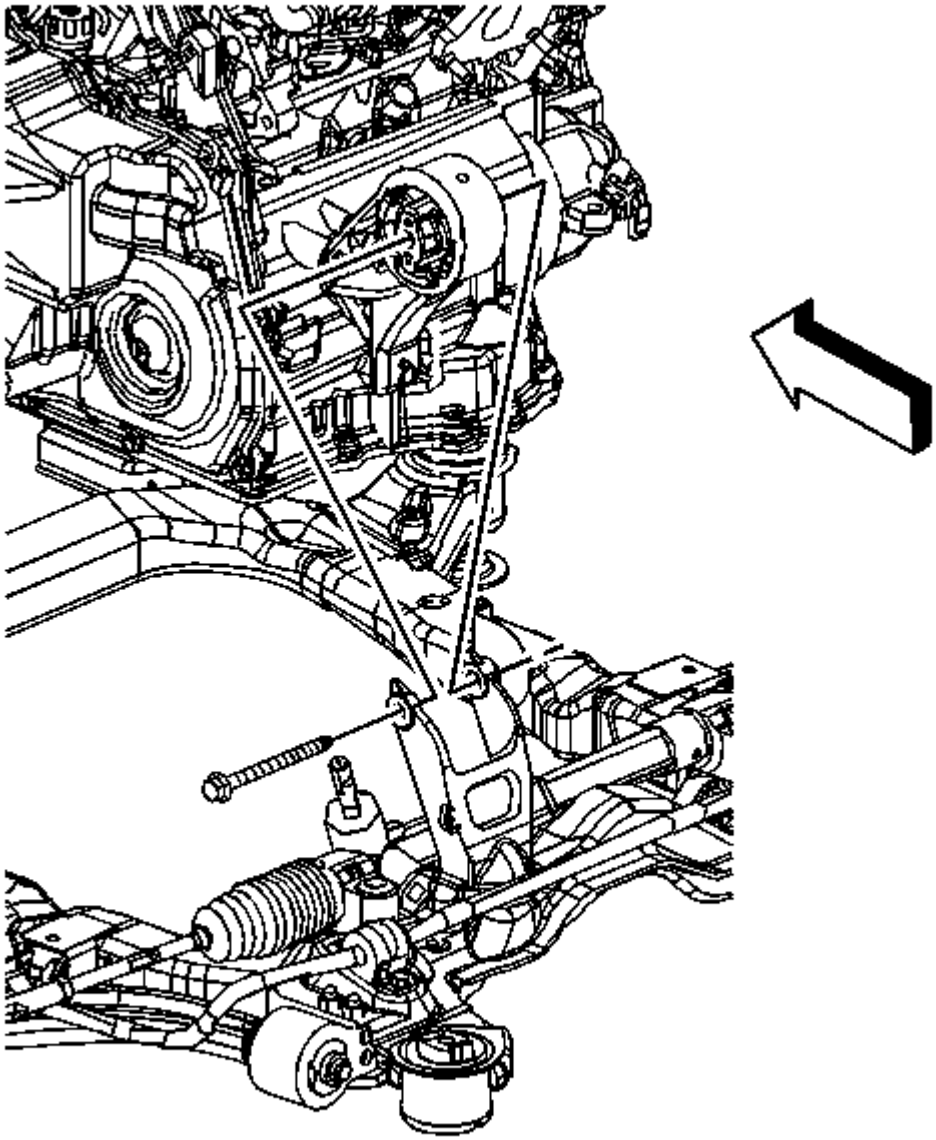

Fig. 38: Identifying Rear Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

12. Tighten the rear transmission mount through bolt.

    Tighten: Tighten the bolt to 90 N.m (66 lb ft).

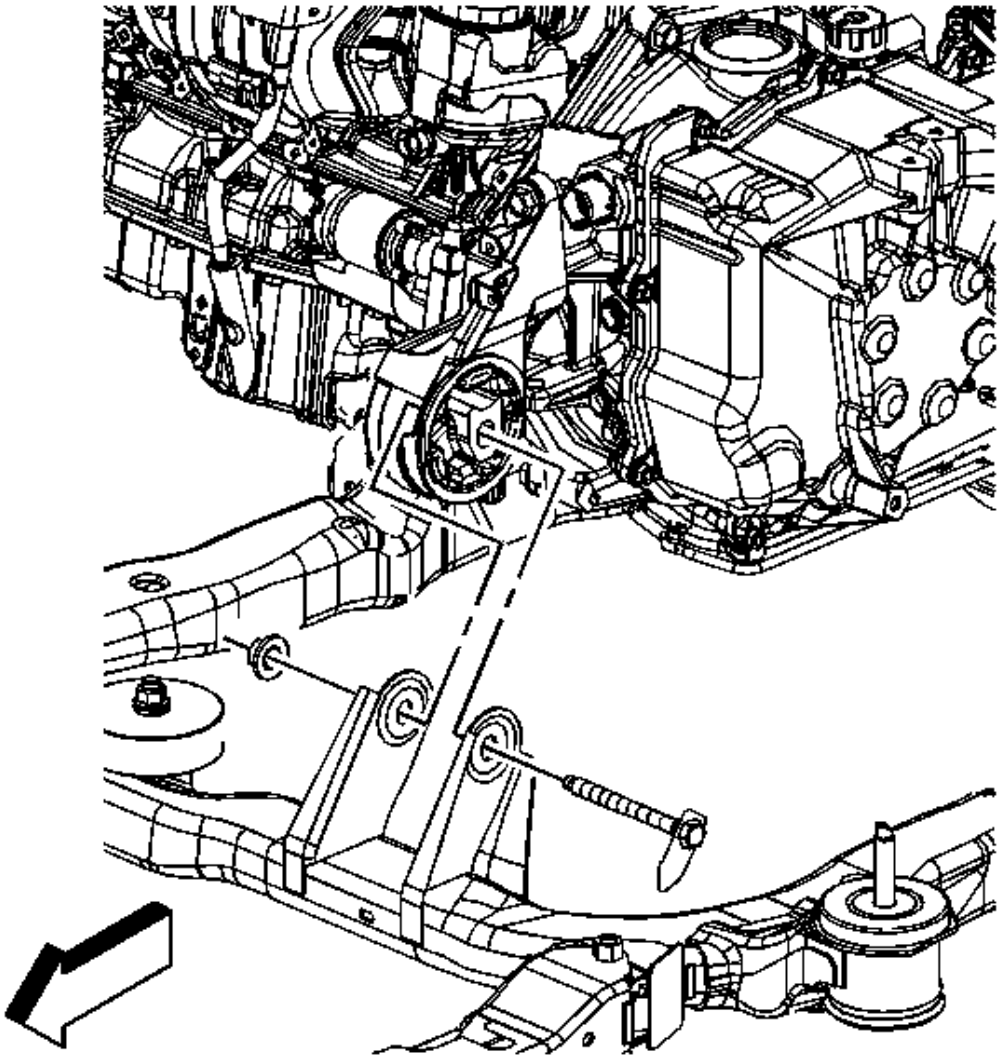

Fig. 39: Identifying Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

13. Tighten the front transmission mount through bolt.

    Tighten: Tighten the bolt to 90 N.m (66 lb ft).

14. Lower the vehicle.

ENGINE MOUNT POSITION ADJUSTMENT

SPECIAL TOOLS

J 23498-A Driveshaft Inclinometer

NOTE: If for some reason there is pressure or preload against the powertrain, it can be put out of design position and this will put stress on the flex coupling in the exhaust system when the vehicle is driven and the out of position powertrain may cause the exhaust downpipe to hit the heat shield in the exhaust tunnel during torque loads.

NOTE: When lifting the vehicle to perform this procedure, the vehicle MUST be lifted using a frame contact hoist, in order for the wheels and suspension to hang free.

POSITION ADJUSTMENT PROCEDURE

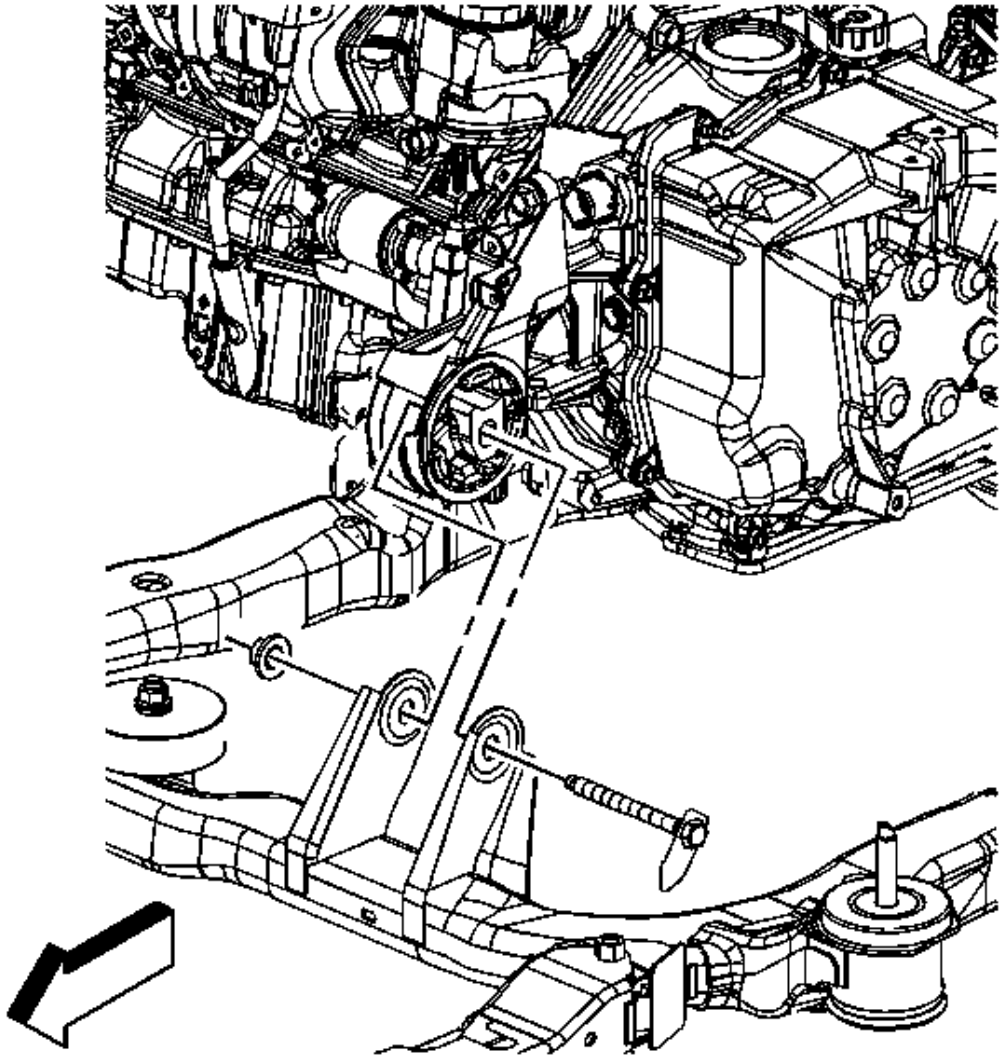

Fig. 40: Identifying Front Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Loosen, but DO NOT REMOVE the front transaxle mount through bolt.

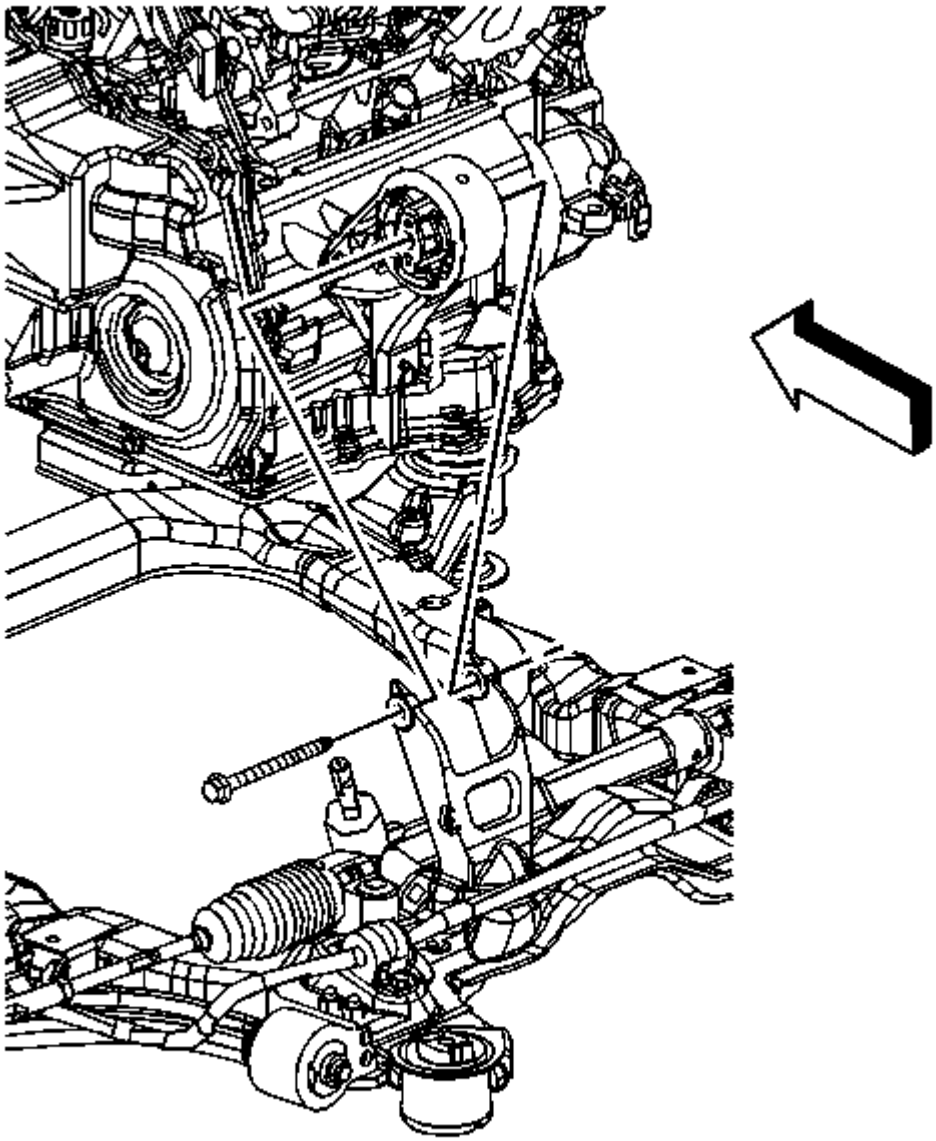

Fig. 41: Identifying Rear Transmission Mount Through Bolt
Courtesy of GENERAL MOTORS CORP.

3. Loosen, but DO NOT REMOVE the rear transaxle mount through bolt.
4. Install the **J 23498-A** on the bottom of the flex coupling of the exhaust pipe.
5. Rock the engine by hand until the **J 23498-A** reading is as close to "0" degrees as possible.

CAUTION: Refer to Fastener Caution .

6. While still holding the powertrain in position, tighten the front through bolt.
7. Tighten the rear through bolt.
8. After the through bolts have been tightened, re-check the angle.
9. There should be no more then "5" degrees of angle in the flex coupling with the powertrain in the static position.
10. If there is no more then "5" degrees of angle, tighten the through bolts to specifications.

    Tighten: Tighten the bolts to 90 N.m (66 lb ft).

11. If there is more then "5" degrees of angle, loosen the through bolts and return to step 5.

OIL FILTER ADAPTER AND BYPASS VALVE ASSEMBLY REPLACEMENT

REMOVAL PROCEDURE

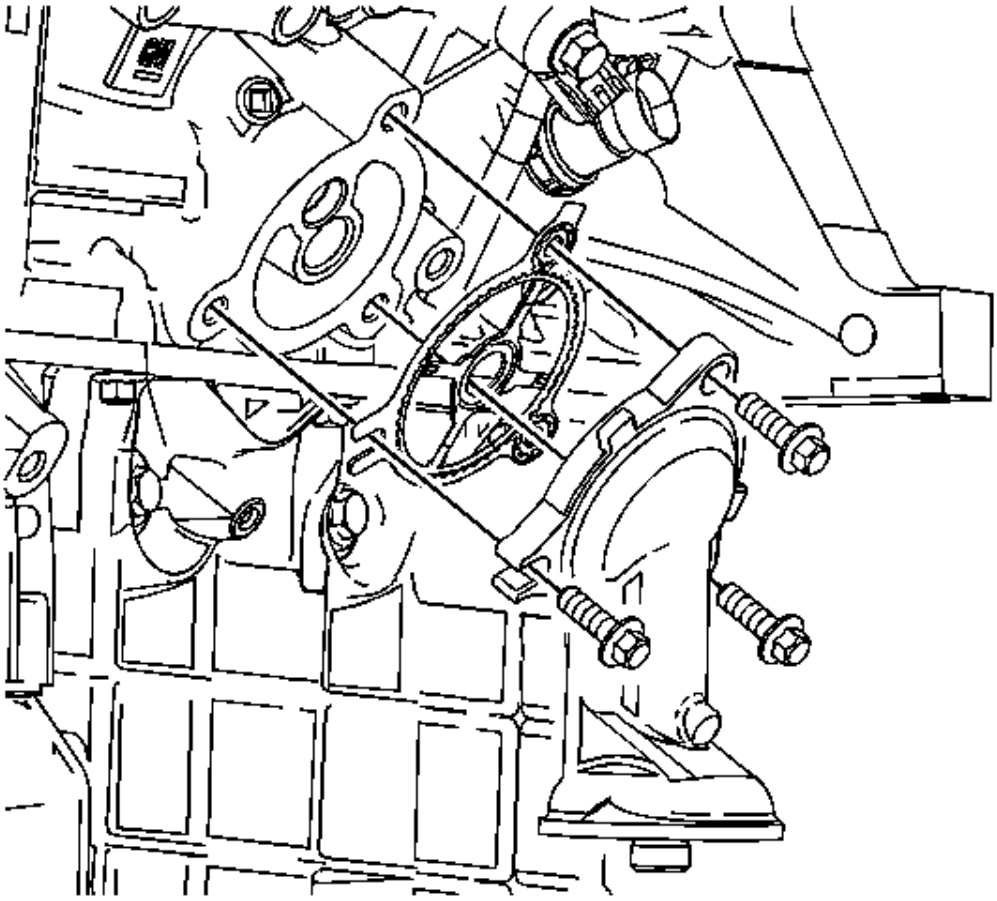

Fig. 42: View Of Oil Filter Adapter & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the oil filter.

NOTE: If the bypass valve does not need to be replaced, the bolt nearest the air conditioning compressor does not need to be fully removed. The hole in the adapter and the gasket are slotted to allow the bolt to be loosened and the adapter and gasket removed without fully removing the bolt.

3. Remove the oil filter adapter and gasket.

NOTE: It is not necessary to evacuate and recharge the air conditioning system, it

is only necessary to remove the belt and the compressor fasteners to reposition the compressor.

4. If the bypass valve hole plug or the bypass valve need to be removed, the air conditioning compressor must be removed and repositioned. Refer to **Air Conditioning Compressor Replacement (LZE, LZ4, LZ9)** .

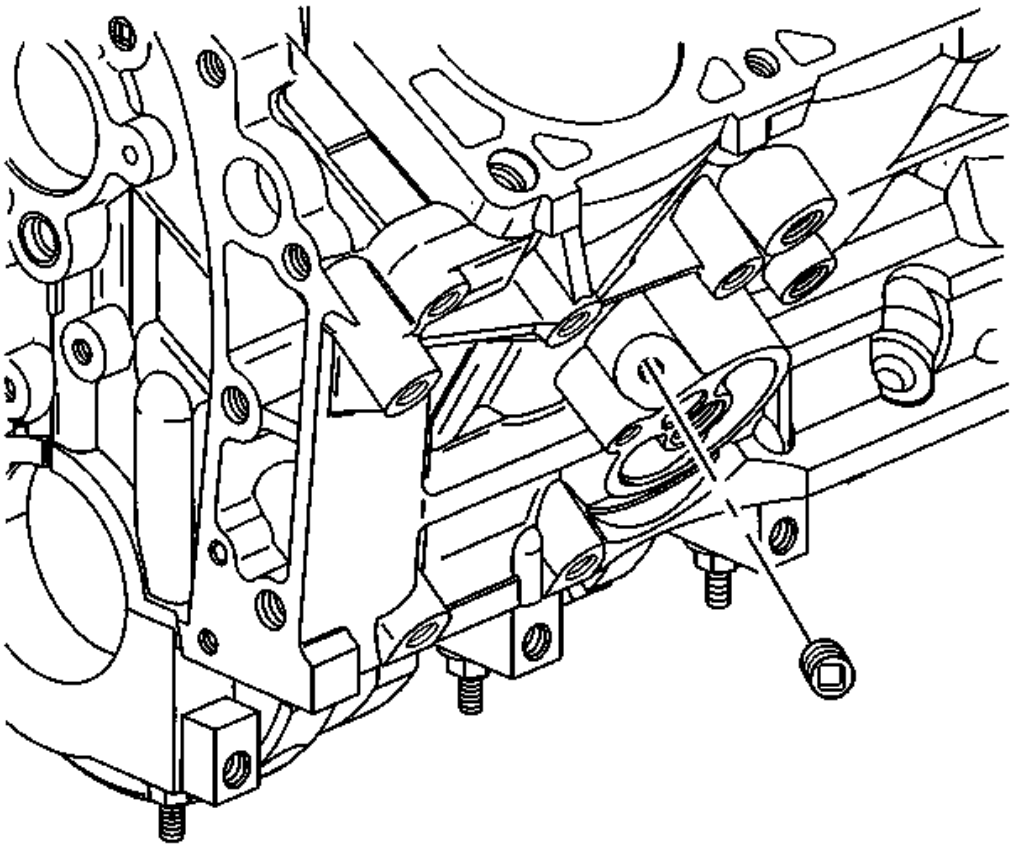

Fig. 43: View Of Oil Filter Bypass Hole Plug
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil filter bypass hole plug.

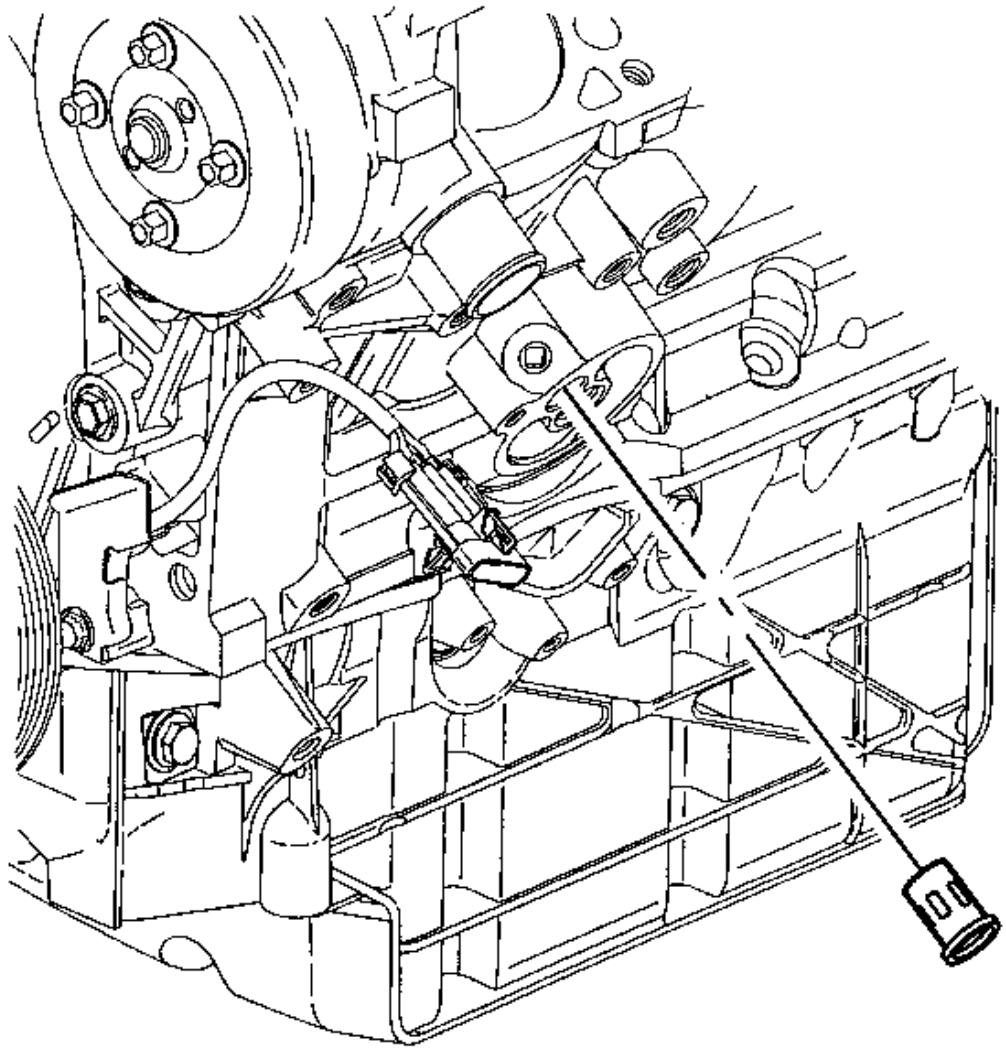

Fig. 44: View Of Oil Filter Bypass Valve
Courtesy of GENERAL MOTORS CORP.

6. Insert a flat-bladed tool into the oil filter bypass hole and remove the bypass valve.

INSTALLATION PROCEDURE

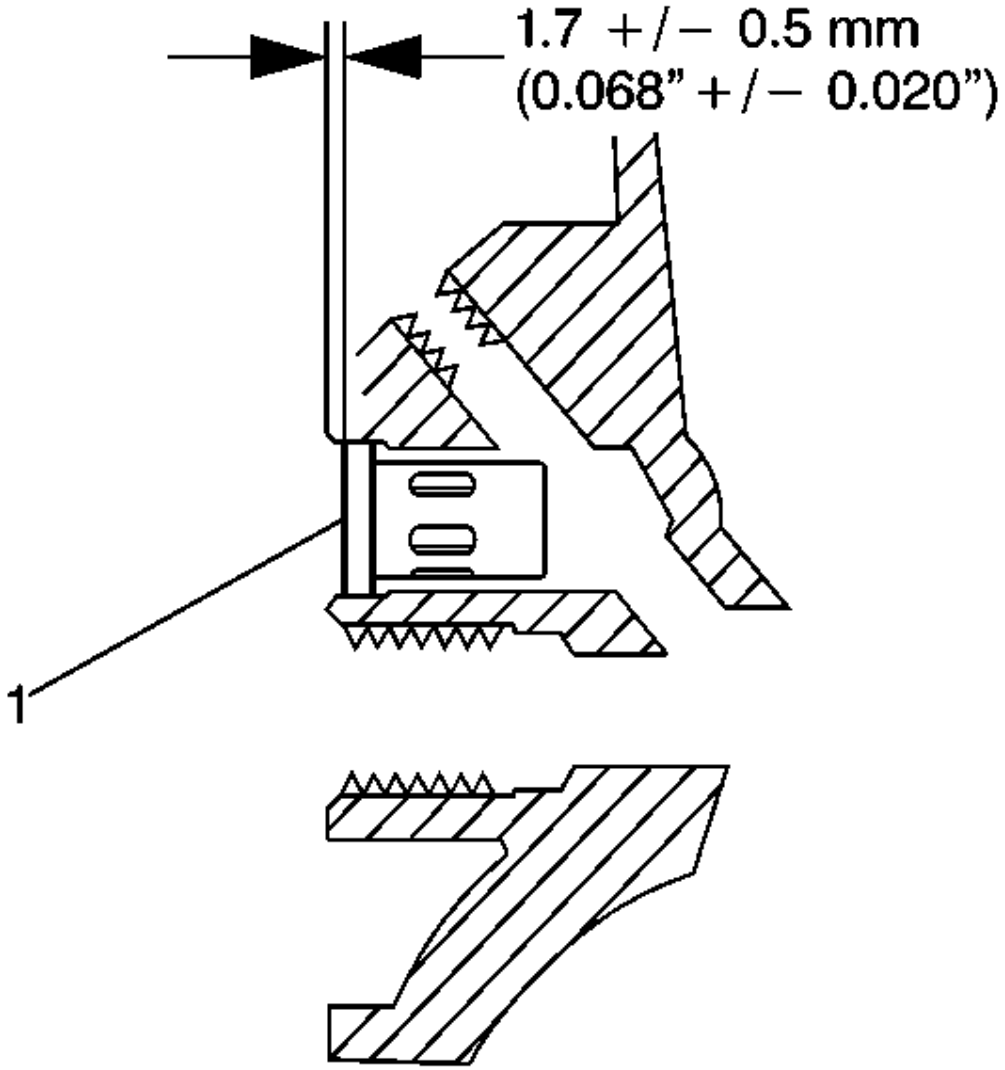

Fig. 45: View Of Oil Filter Bypass Valve
Courtesy of GENERAL MOTORS CORP.

1. Install the oil filter bypass valve (1) to the proper depth.

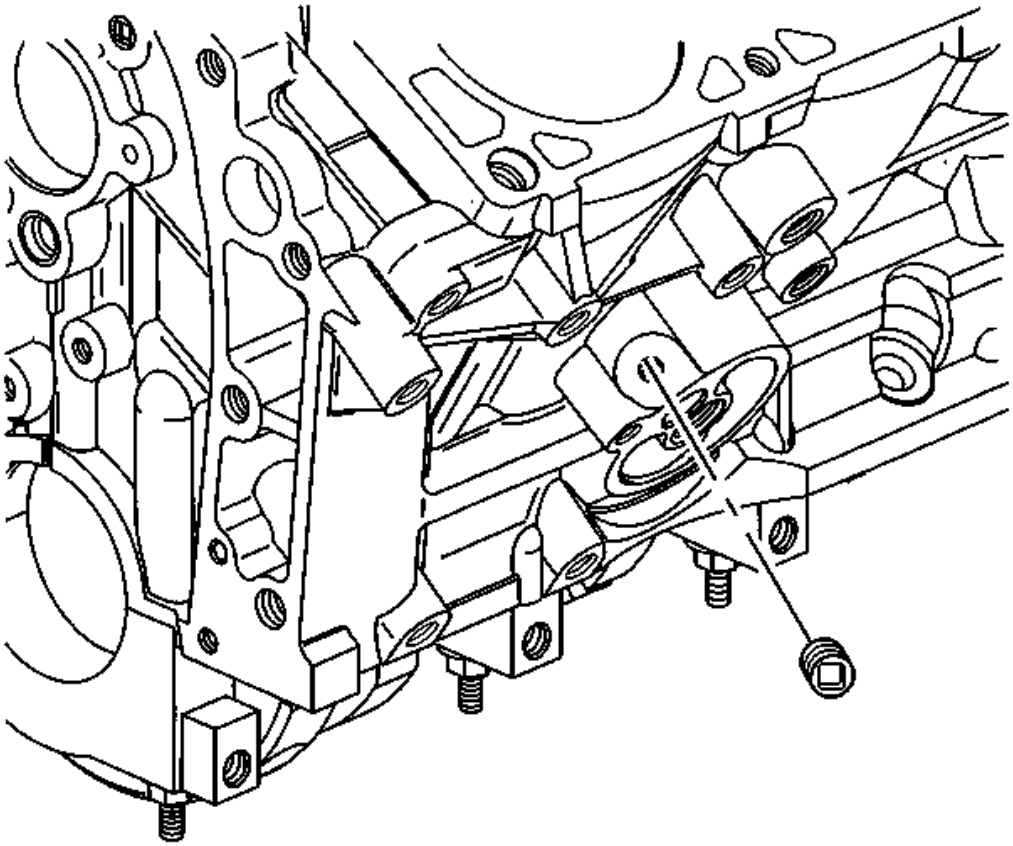

Fig. 46: View Of Oil Filter Bypass Hole Plug
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the oil filter bypass hole plug.

   Tighten: Tighten the plug to 19 N.m (14 lb ft).

3. If the air conditioning compressor has been removed, reinstall the air conditioning compressor. Refer to **Air Conditioning Compressor Replacement (LZE, LZ4, LZ9)** .

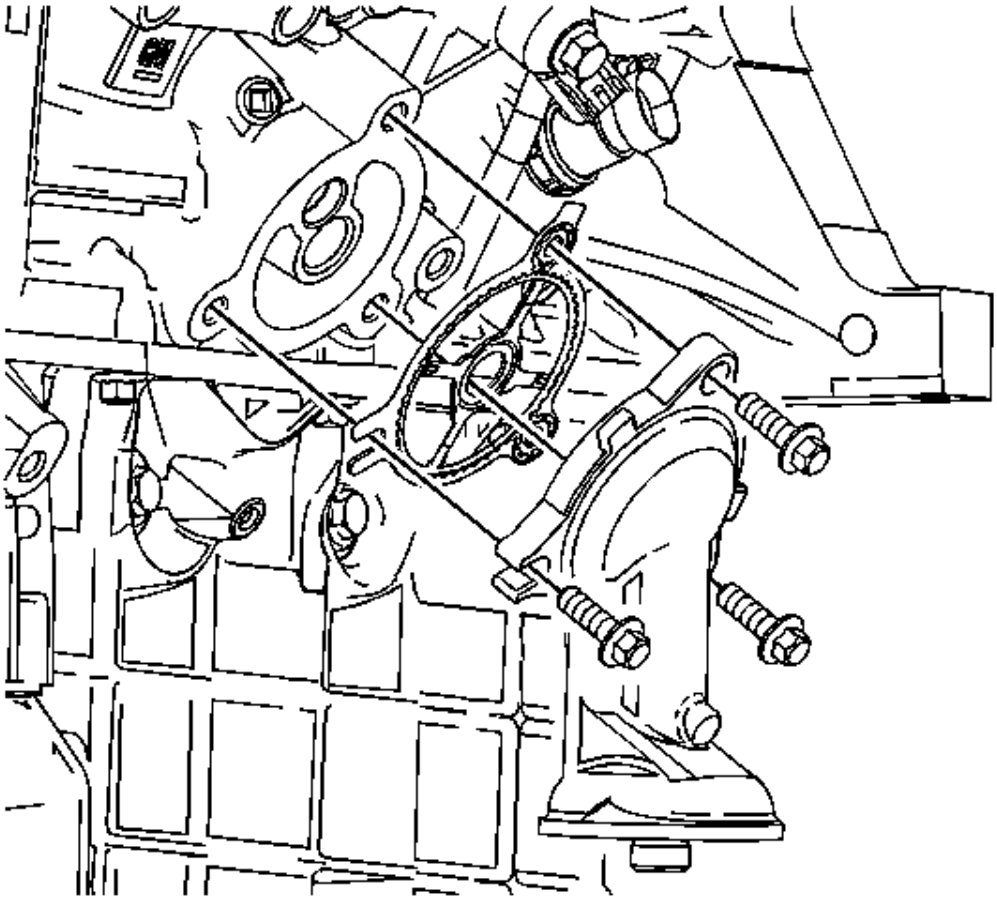

Fig. 47: View Of Oil Filter Adapter & Gasket
Courtesy of GENERAL MOTORS CORP.

4. Install the oil filter and gasket.

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

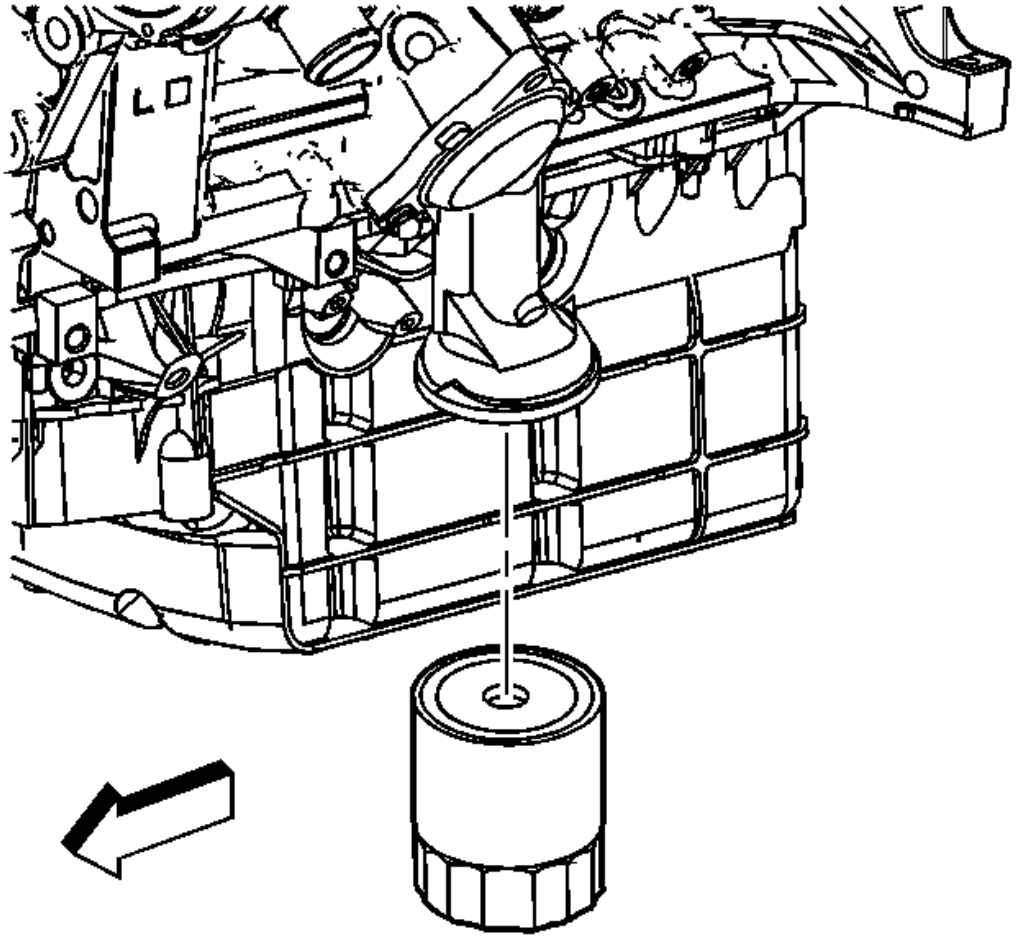

Fig. 48: View Of Oil Filter
Courtesy of GENERAL MOTORS CORP.

5. Install the oil filter.
6. Lower the vehicle.
7. Check and fill the crankcase as necessary.

OIL LEVEL INDICATOR TUBE REPLACEMENT

REMOVAL PROCEDURE

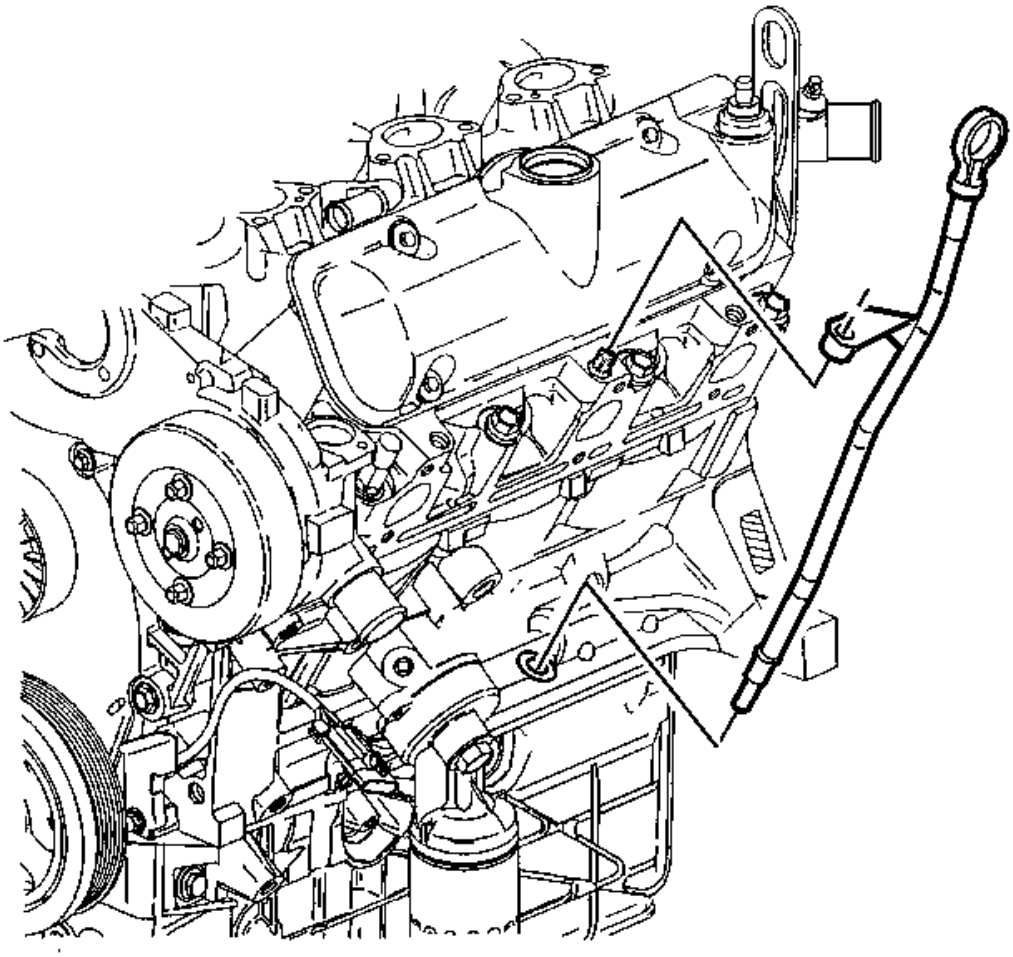

Fig. 49: View Of Oil Level Indicator & Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

1. Remove the spark plug wire from the number 6 cylinder spark plug.
2. Remove the oil level indicator.
3. Remove the oil level indicator tube bracket bolt.
4. Remove the oil level indicator tube.

INSTALLATION PROCEDURE

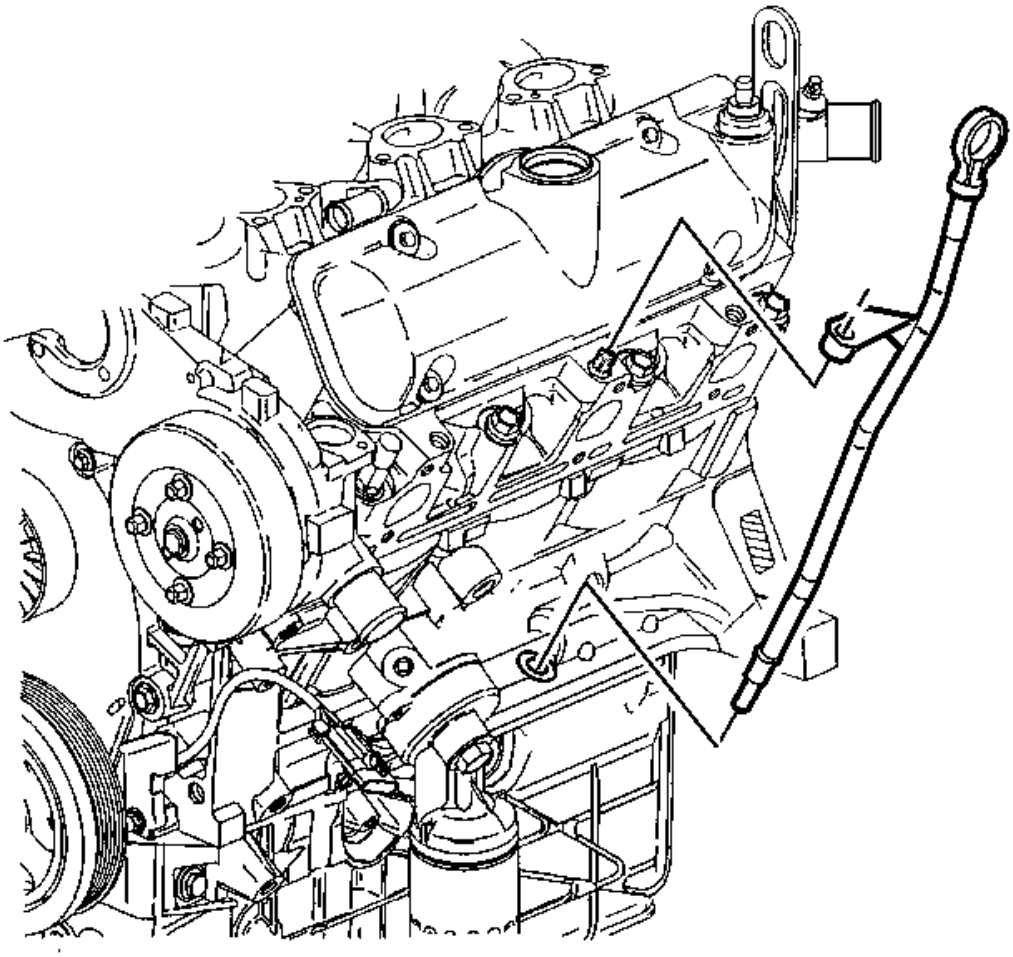

Fig. 50: View Of Oil Level Indicator & Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

1. Clean the oil level indicator tube.
2. Apply sealant around the oil level indicator tube 12.7 mm (0.50 in) below the bead. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
3. Install the oil level indicator tube into the engine block.

CAUTION: Refer to Fastener Caution .

4. Install the oil level indicator tube bracket bolt.

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

5. Install the oil level indicator.
6. Install the spark plug wire to the number 6 cylinder spark plug.

UPPER INTAKE MANIFOLD REPLACEMENT

REMOVAL PROCEDURE

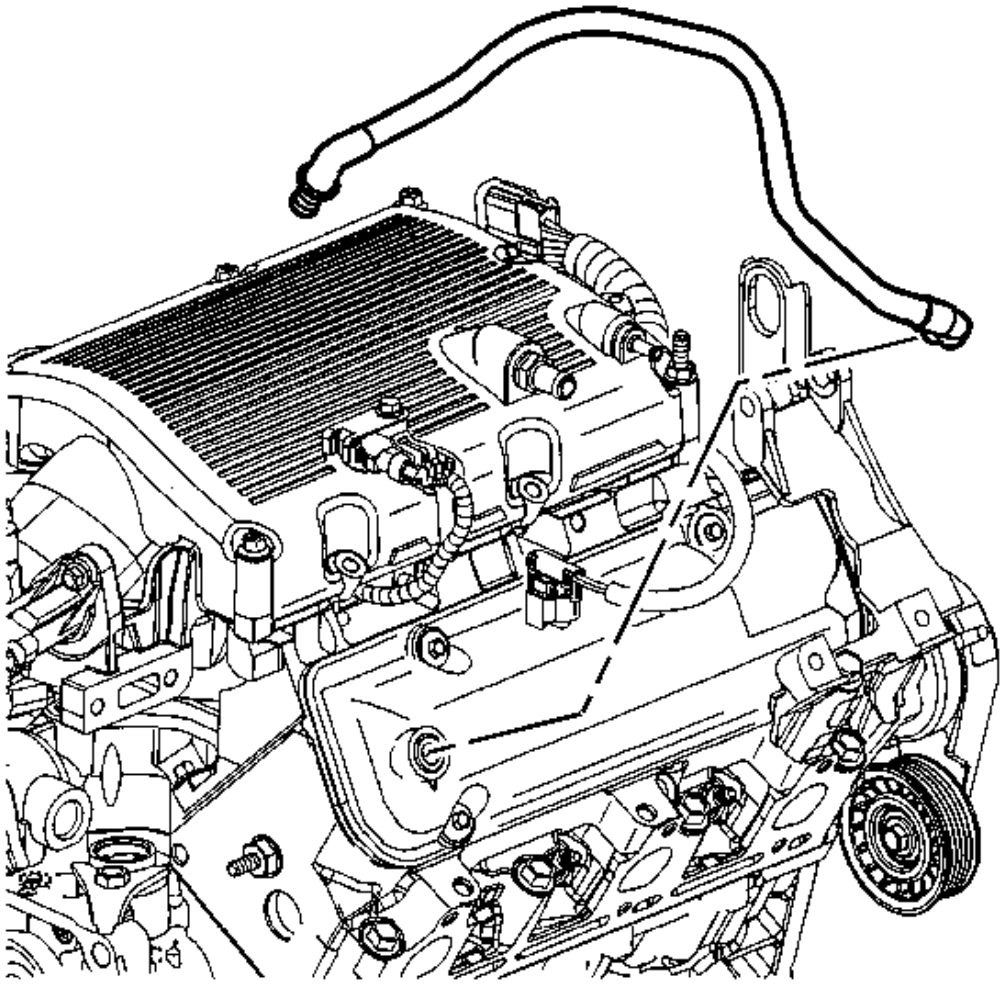

Fig. 51: View Of Vacuum Hoses
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.
3. Remove the vacuum hoses from the following:
    - Evaporative emissions (EVAP) canister purge valve
    - Manifold vacuum source
    - Brake booster
    - Heater and air conditioning (A/C) source
4. Disconnect the electrical connectors from the following:
    - Exhaust gas recirculation (EGR) valve
    - Mass air flow (MAF) sensor
    - Intake air temperature (IAT) sensor
    - Electronic throttle control
    - EVAP canister purge valve
5. Remove the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .
6. Remove the left side spark plug wires from the spark plugs. Refer to **Spark Plug Wire Replacement** .
7. Remove the following wiring harnesses from the retainers:
    - Camshaft position (CMP) sensor wiring harness
    - Left side spark plug wire harness
    - Engine wiring harness

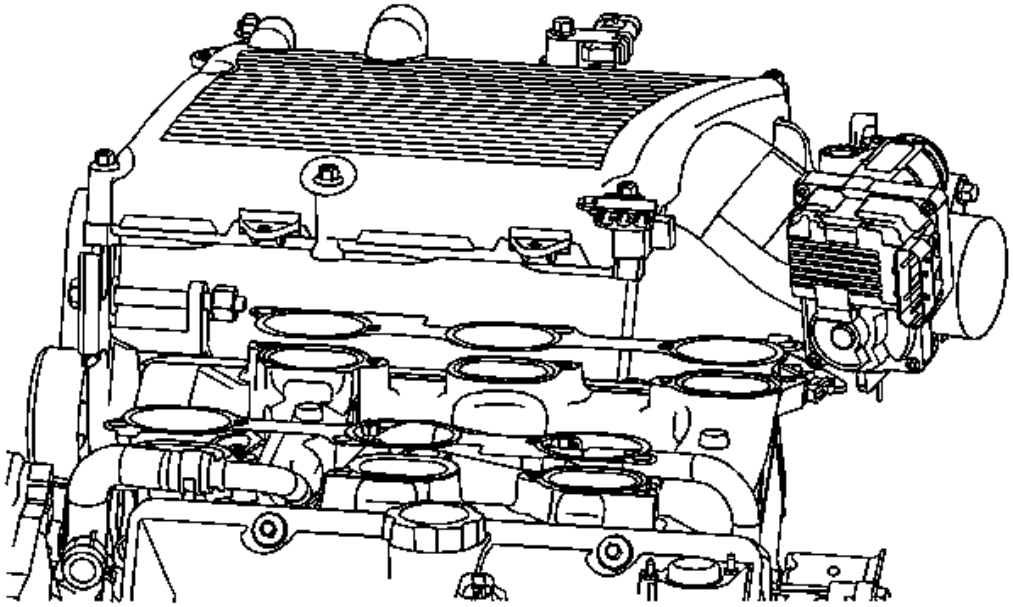

Fig. 52: Identifying Upper Intake Manifold Bolts & Stud
Courtesy of GENERAL MOTORS CORP.

8. Remove the ignition coil bracket with the coils. Refer to **Ignition Control Module Replacement** .
9. Remove the EVAP canister purge solenoid valve. Refer to **Evaporative Emission Canister Purge Solenoid Valve Replacement** .
10. Remove the manifold absolute pressure (MAP) sensor and the bracket. Refer to **Manifold Absolute Pressure Sensor Replacement** .
11. Remove the EGR valve. Refer to **Exhaust Gas Recirculation Valve Replacement** .
12. Remove the upper intake manifold bolts and the stud.
13. Remove the upper intake manifold.
14. Remove the upper intake manifold gaskets.

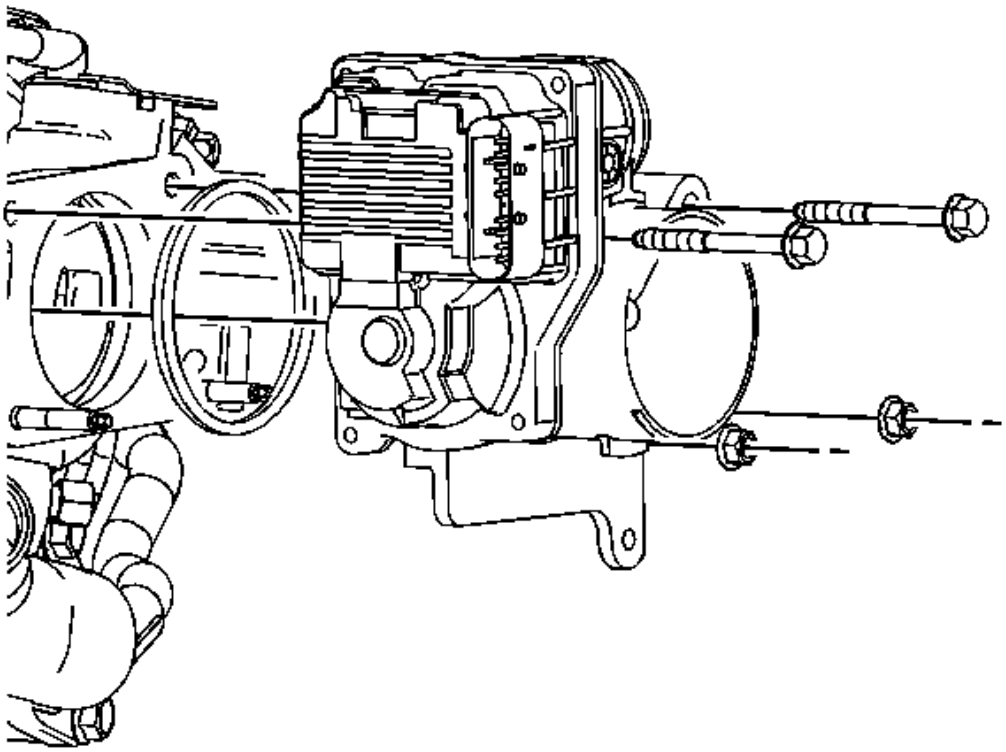

Fig. 53: Identifying Throttle Body
Courtesy of GENERAL MOTORS CORP.

15. If replacing the upper intake manifold, remove the throttle body. Refer to **Throttle Body Assembly Replacement** .
16. Clean the upper intake gasket mating surfaces.

INSTALLATION PROCEDURE

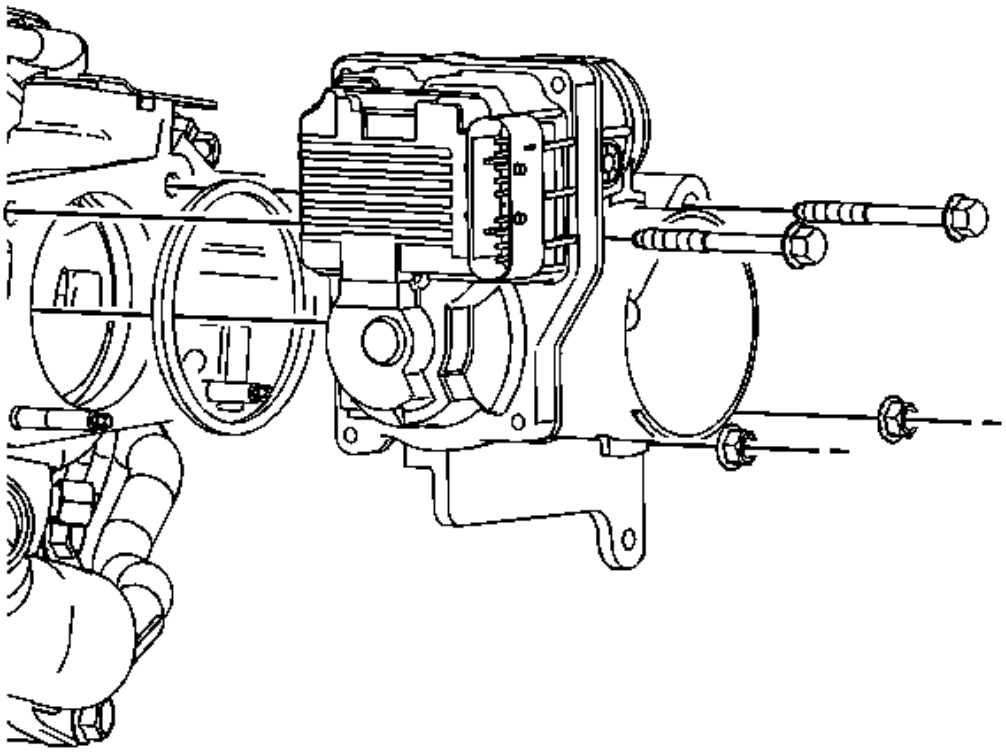

Fig. 54: Identifying Throttle Body
Courtesy of GENERAL MOTORS CORP.

1. If removed, install the throttle body. Refer to **Throttle Body Assembly Replacement** .

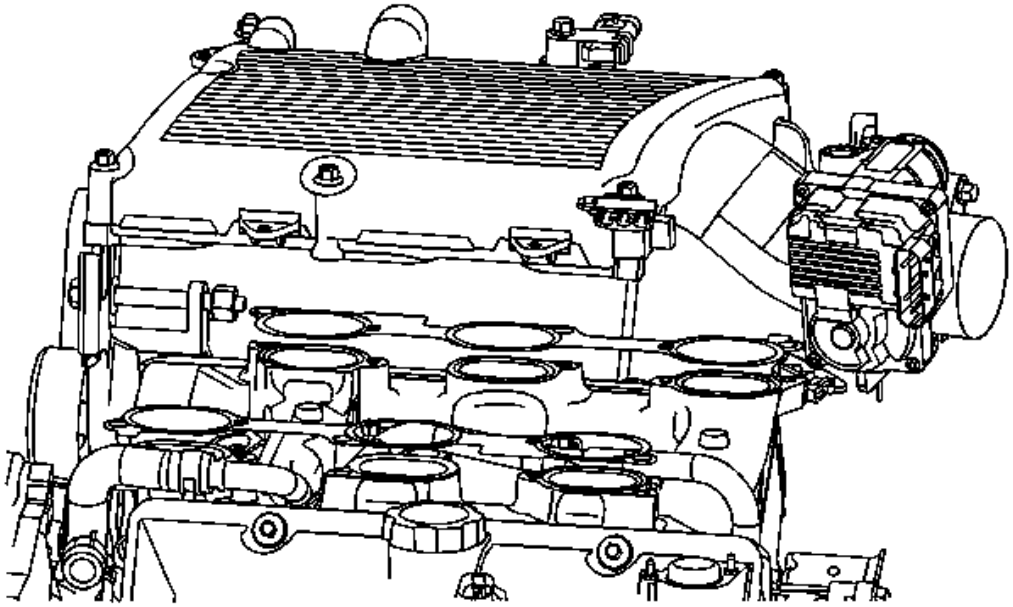

Fig. 55: Identifying Upper Intake Manifold Bolts & Stud
Courtesy of GENERAL MOTORS CORP.

2. Install the upper intake manifold gaskets.
3. Install the upper intake manifold.

CAUTION: Refer to Fastener Caution .

4. Install the right upper intake manifold bolts and the stud.

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

5. Install the EGR valve. Refer to **Exhaust Gas Recirculation Valve Replacement** .
6. Install the MAP sensor bracket and the sensor. Refer to **Manifold Absolute Pressure Sensor Replacement** .
7. Install the EVAP canister purge solenoid valve. Refer to **Evaporative Emission Canister Purge Solenoid Valve Replacement** .
8. Install the ignition coil bracket with the coils. Refer to **Ignition Control Module Replacement** .
9. Install the following wiring harnesses to the retainers:
   - Engine wiring harness

- Left side spark plug wire harness
- CMP sensor wiring harness

10. Install the left side spark plug wires to the spark plugs. Refer to **Spark Plug Wire Replacement** .
11. Install the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .
12. Connect the electrical connectors to the following:
    - EVAP canister purge valve
    - Electronic throttle control
    - IAT sensor
    - MAF sensor
    - EGR valve

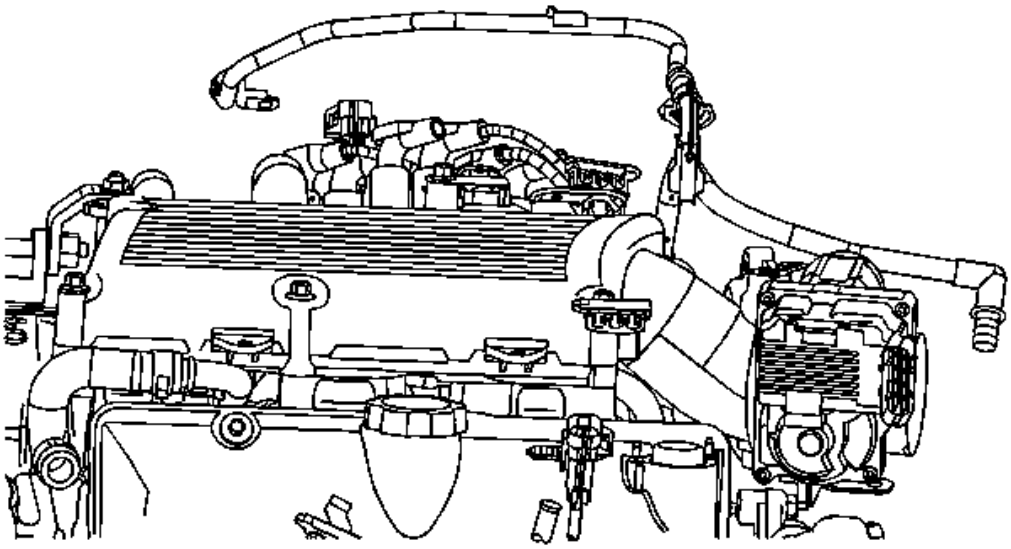

Fig. 56: View Of Vacuum Hoses
Courtesy of GENERAL MOTORS CORP.

13. Install the vacuum hoses to the following:
    - Heater and A/C source
    - Brake booster
    - Manifold vacuum source
    - EVAP canister purge valve
14. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
15. Install the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.

LOWER INTAKE MANIFOLD REPLACEMENT

REMOVAL PROCEDURE

NOTE: This engine uses a sequential multiport fuel injection system. Injector wiring harness connectors must be connected to their appropriate fuel injector or exhaust emissions and engine performance may be seriously affected.

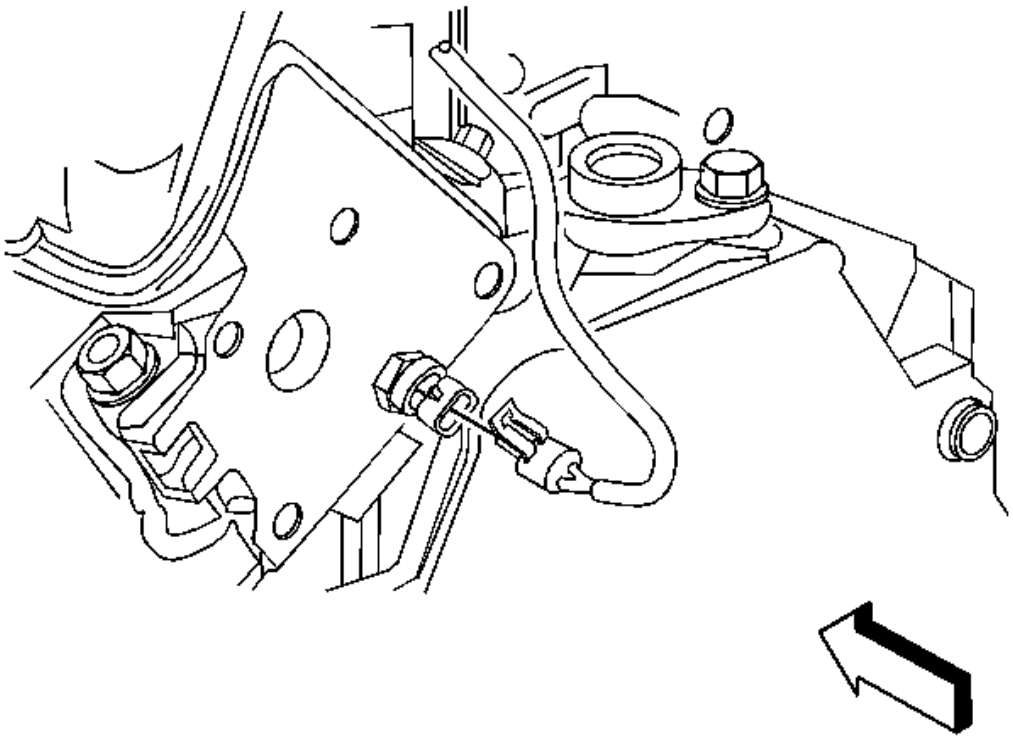

Fig. 57: View Of Upper Intake Manifold
Courtesy of GENERAL MOTORS CORP.

1. Remove the upper intake manifold. Refer to **Upper Intake Manifold Replacement**.
2. Cooling System Draining and Filling. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)**
3. Remove the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Left Side** and **Valve Rocker Arm Cover Replacement - Right Side**.
4. Remove the coolant crossover pipe. Refer to **Engine Coolant Crossover Pipe Replacement (LZE, LZ4)** .

5. Disconnect the fuel injector wiring harness electrical connector from the engine coolant temperature (ECT) sensor.

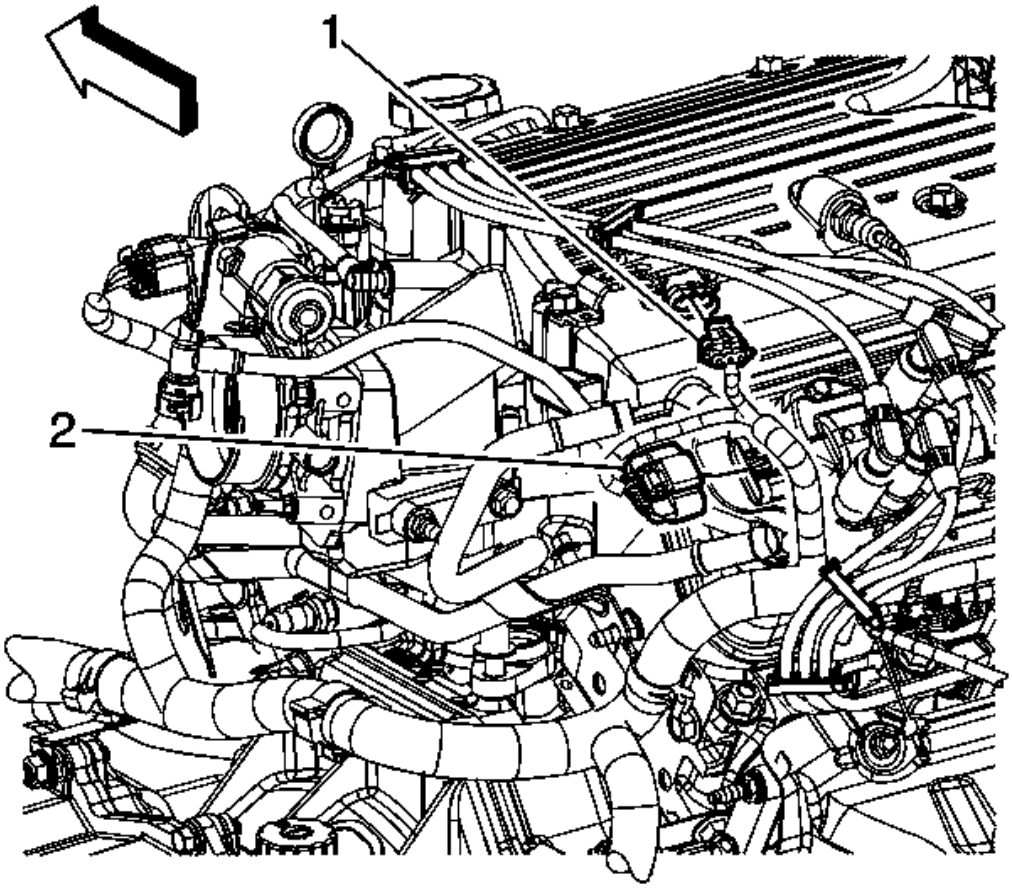

Fig. 58: Identifying Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the engine wiring harness electrical connector (2) from the fuel injector inline electrical connector.

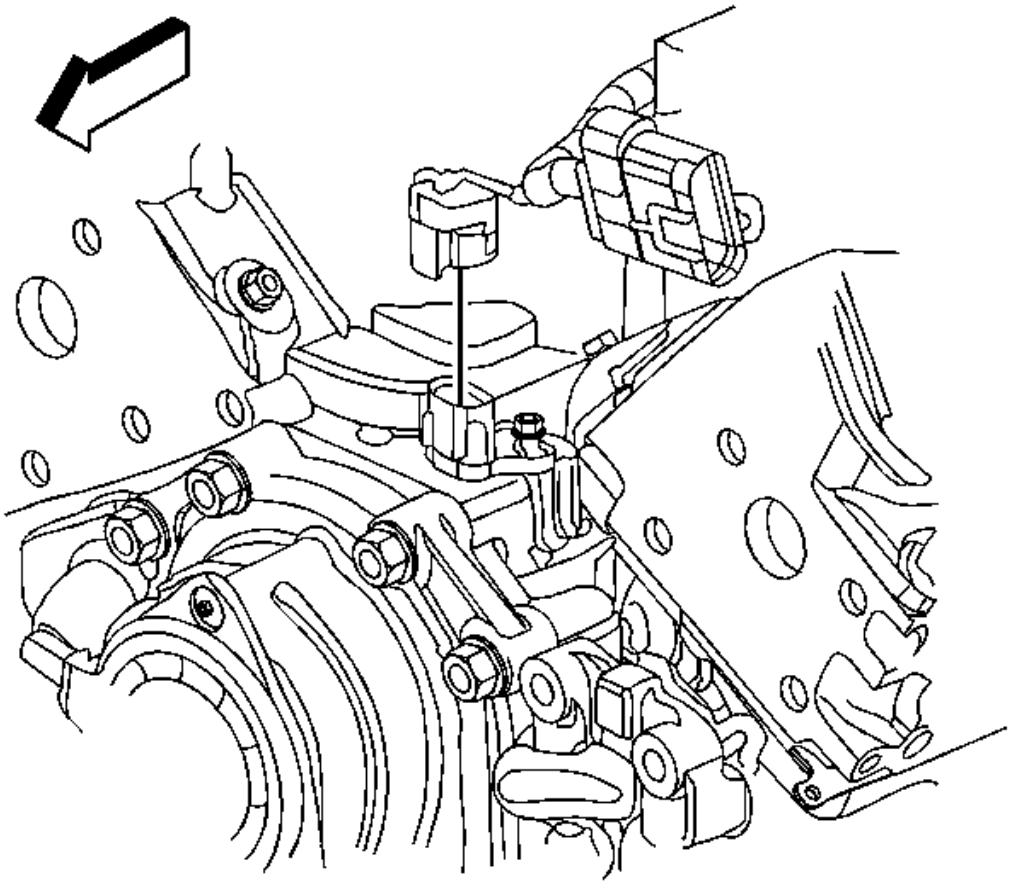

Fig. 59: View Of Fuel Injector Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the fuel injector wiring harness electrical connector from the camshaft position (CMP) sensor.

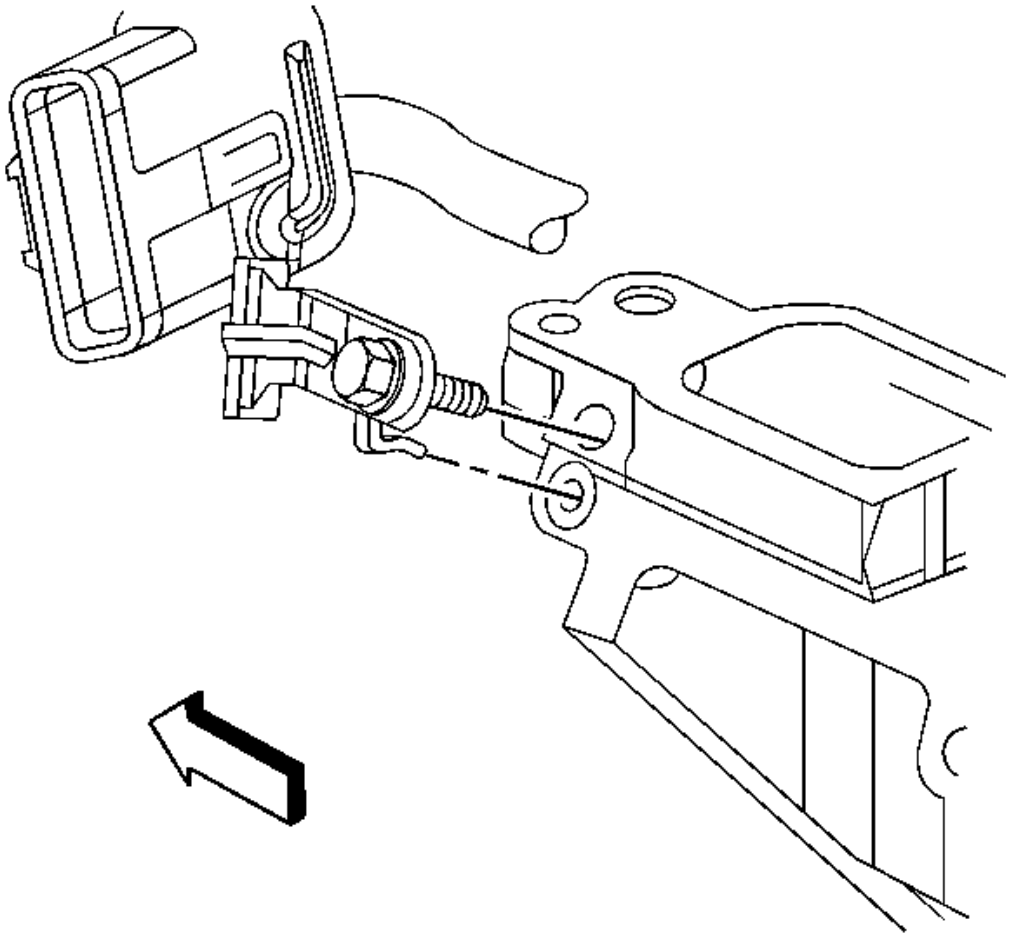

Fig. 60: Identifying Fuel Injector Wiring Harness Connector Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the fuel injector wiring harness connector bracket bolt from the intake manifold.

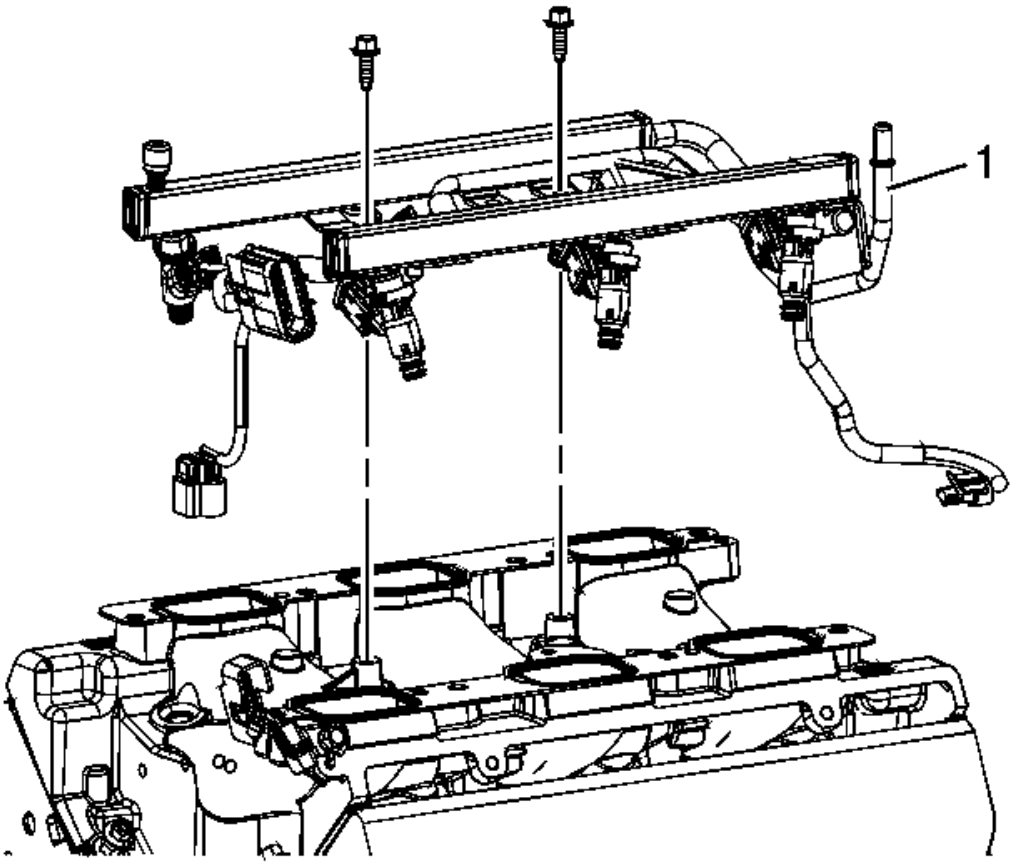

Fig. 61: Identifying Fuel Rail
Courtesy of GENERAL MOTORS CORP.

9. Remove the fuel rail bolts and rail (1).

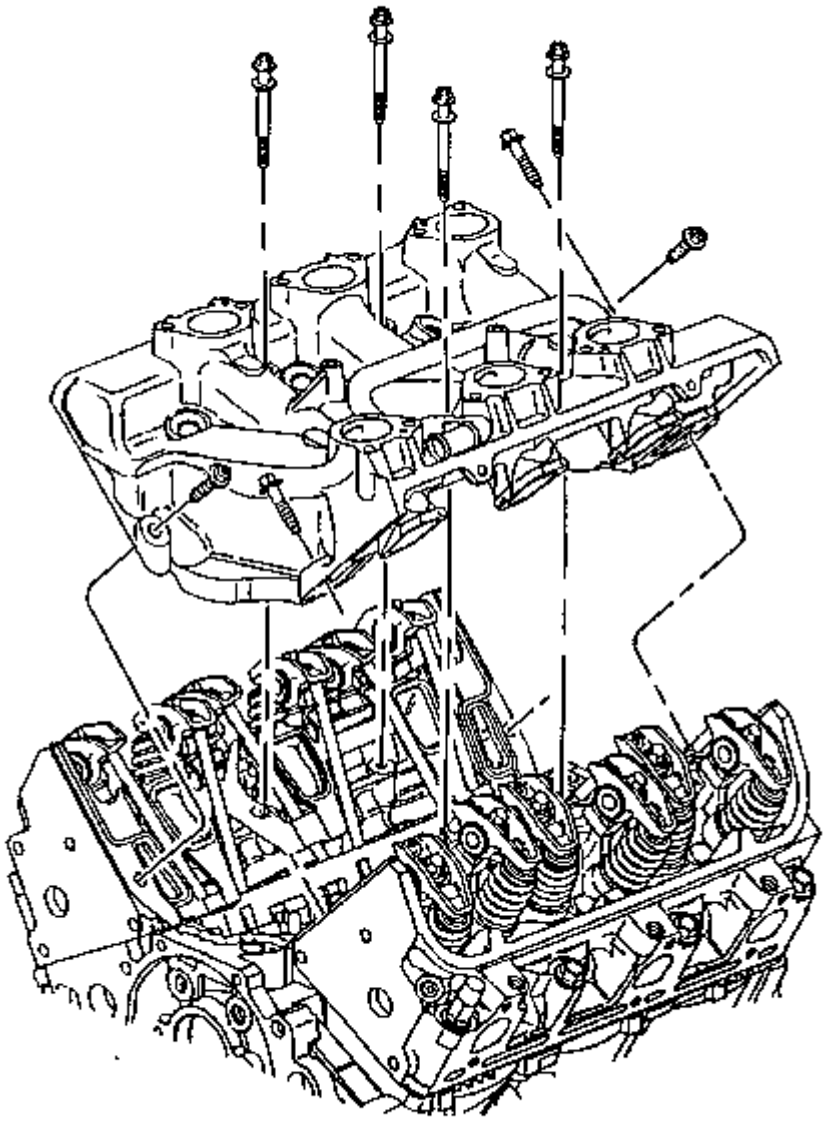

Fig. 62: View Of Lower Intake Manifold & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the lower intake manifold bolts.
11. Remove the lower intake manifold.

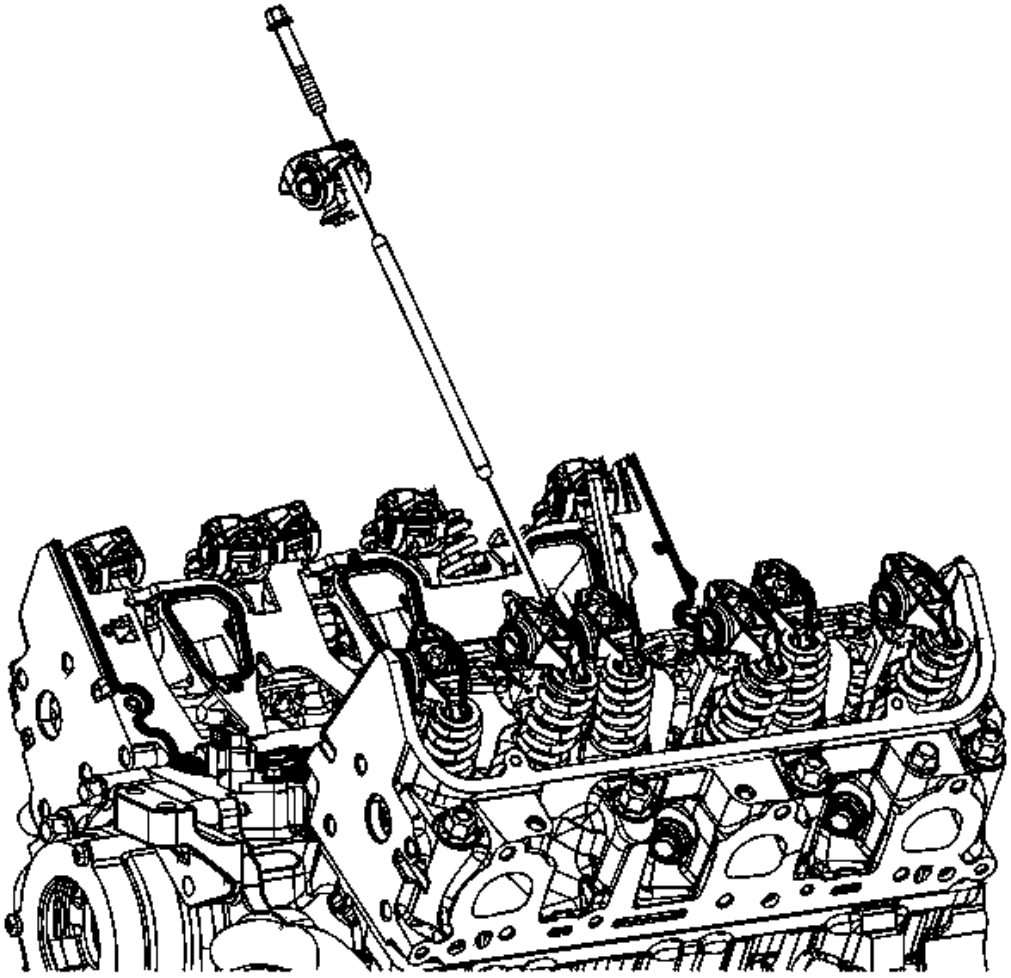

Fig. 63: Identifying Valve Rocker Arm & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Loosen the rocker arm bolts.

NOTE: Place the valve train components in a rack in order to ensure that the components are installed in the same location from which they were removed.

13. Remove the rocker arms.
14. Remove the push rods.
    - The intake push rods measure 147.51 mm (5.81 in).

- The exhaust push rods measure 154.87 mm (6.1 in).

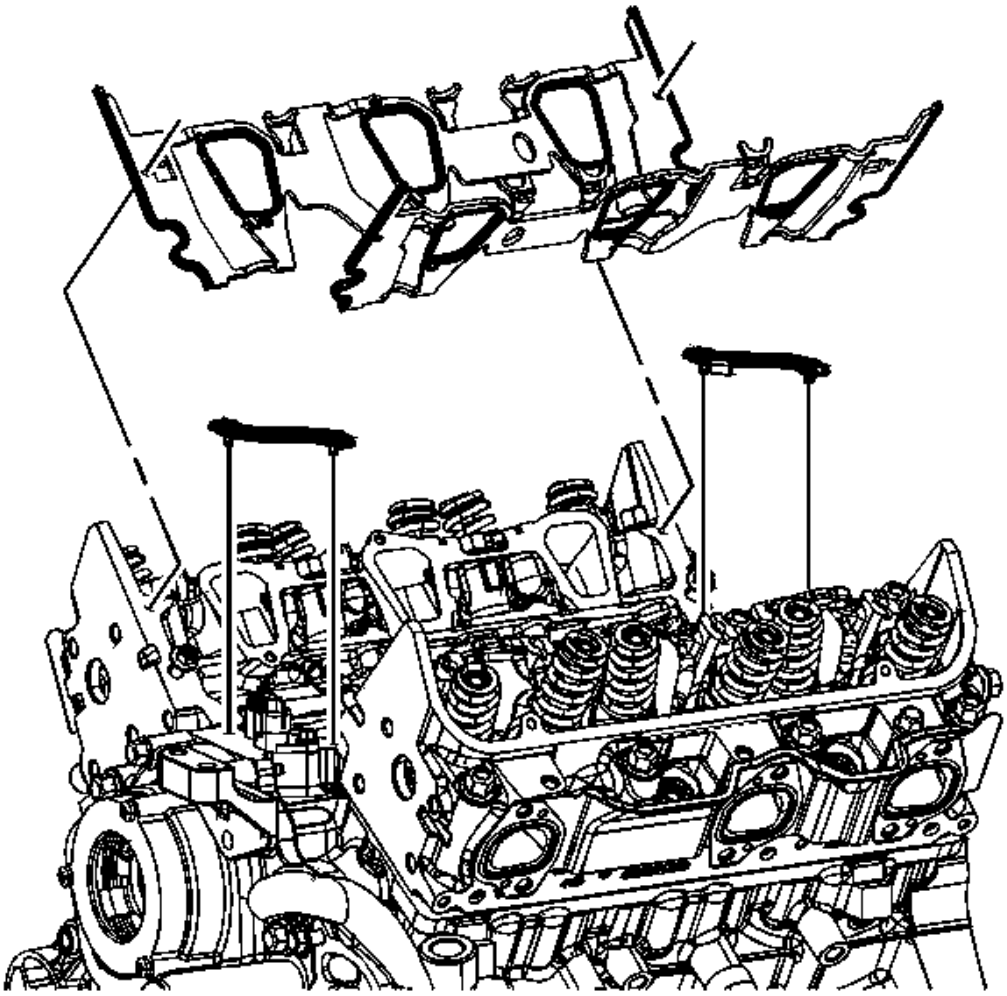

Fig. 64: Identifying Intake Manifold Gaskets & Seals
Courtesy of GENERAL MOTORS CORP.

15. Remove the lower intake manifold gaskets and seals.
16. Clean the lower intake manifold gasket and seal surfaces on the cylinder heads and the engine block.
17. Clean the gasket and seal surfaces on the lower intake manifold with degreaser.
18. Remove all the loose room temperature vulcanizing (RTV) sealer.

INSTALLATION PROCEDURE

NOTE: **All gasket-mating surfaces need to be free of oil and foreign material. Use cleaner to clean the surfaces. Refer to Adhesives, Fluids, Lubricants, and Sealers .**

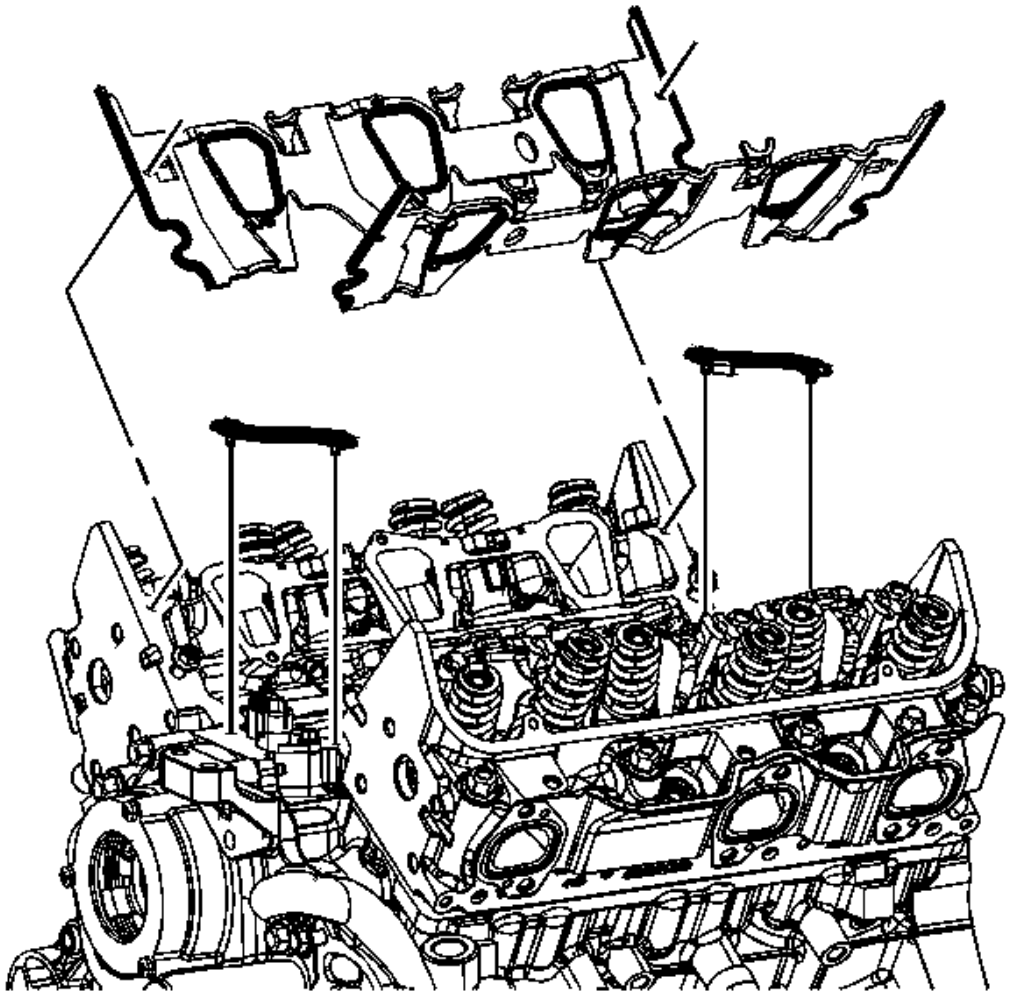

Fig. 65: Identifying Intake Manifold Gaskets & Seals
Courtesy of GENERAL MOTORS CORP.

NOTE: **RTV sealer is NOT to be placed under the lower intake manifold gaskets.**

1. Install the lower intake manifold gaskets and seals.

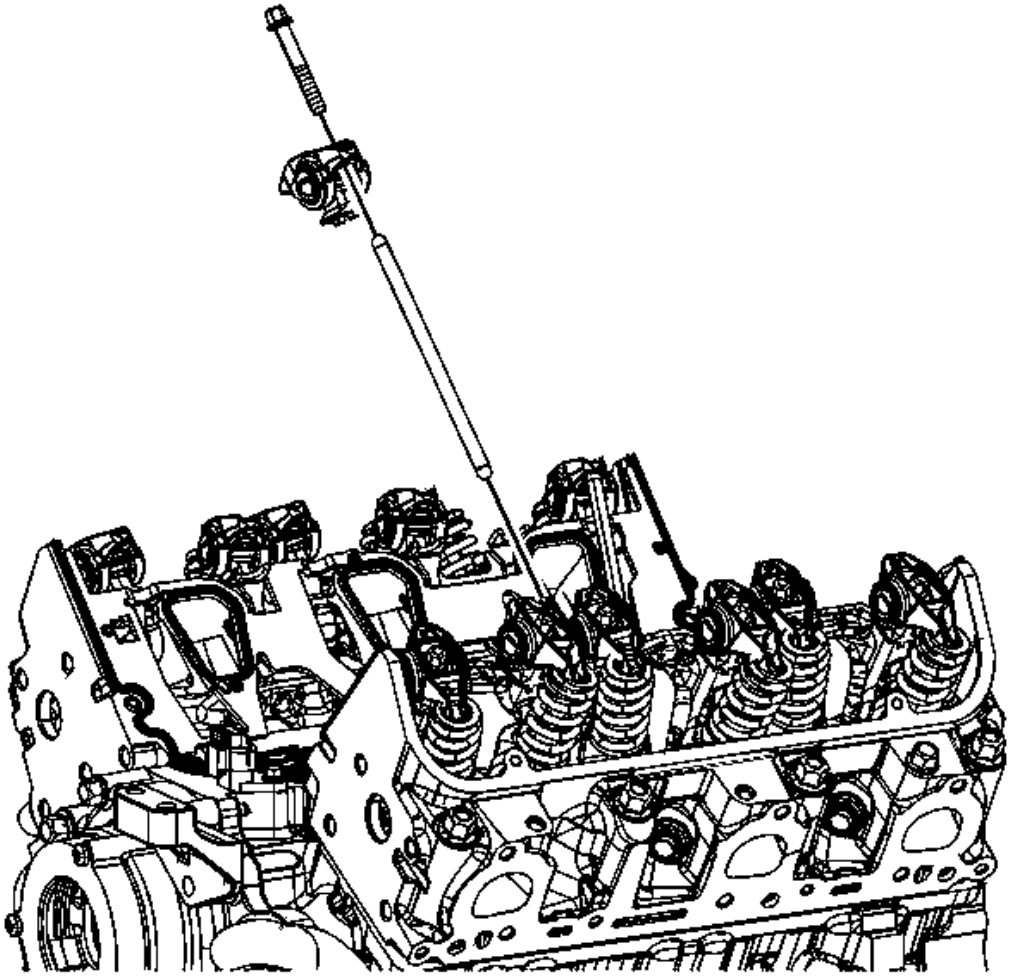

Fig. 66: Identifying Valve Rocker Arm & Bolt
Courtesy of GENERAL MOTORS CORP.

2. Coat the ends of the push rods using prelube. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
3. Install push rods in their original location.
    - The intake pushrods are identified with yellow stripes.
    - The exhaust pushrods are identified with green stripes.
4. Coat the rocker arm friction surfaces using prelube. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

NOTE: Shims (P/N 88894006) may be required under the valve rocker arm pedestals if reconditioning has been performed on the cylinder head or its

components.

5. Install the rocker arms in their original locations.

CAUTION: Refer to Fastener Caution .

6. Install the rocker arm bolts and tighten to 34 N.m (25 lb ft).

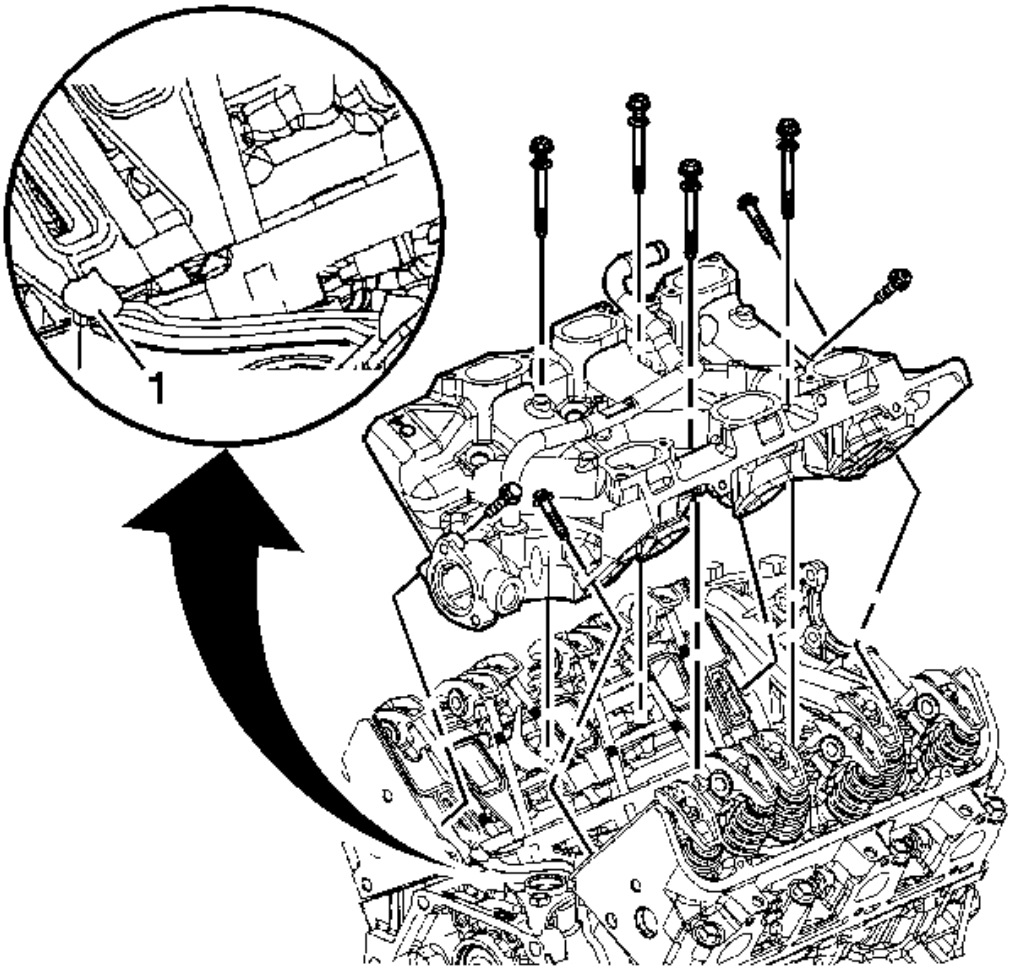

Fig. 67: View Of Lower Intake Manifold
Courtesy of GENERAL MOTORS CORP.

7. With the NEW gaskets and seals in place, apply a small drop, 8-10 mm (0.31-0.39 in) of RTV sealer to the 4 corners of the intake manifold to block joints (1). Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
8. Install the lower intake manifold.

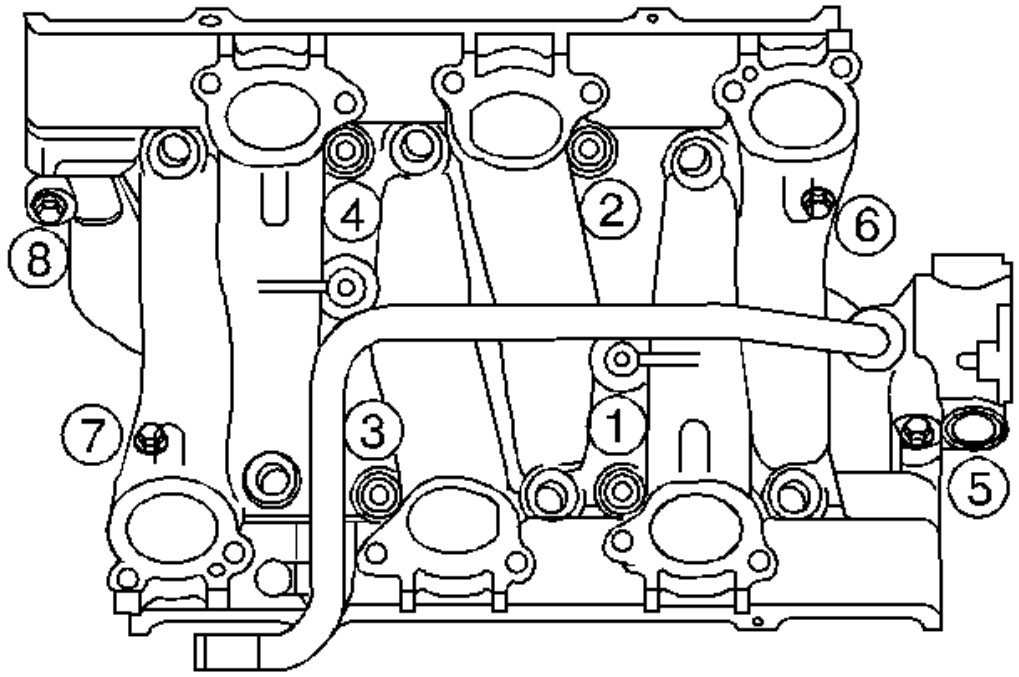

Fig. 68: View Of Lower Intake Manifold Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Maximum gasket performance is achieved when using new fasteners, which contain a thread-locking patch. If the fasteners are not replaced, a thread locking chemical must be applied to the fastener threads. Failure to replace the fasteners or apply a thread-locking chemical MAY reduce gasket sealing capability.

CAUTION: Failure to tighten vertical bolts before the diagonal bolts may cause an oil leak.

9. Apply sealer to the lower intake manifold bolt threads. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
10. Install the lower intake manifold bolts.

11. Tighten the lower intake manifold bolts in the sequence shown.
    1. Tighten the center lower intake manifold bolts (1, 2, 3, 4) in sequence to 20 N.m (15 lb ft).
    2. Tighten the visible corner lower intake manifold bolts (5, 8) to 25 N.m (18 lb ft).
    3. Tighten the hidden corner lower intake manifold bolts (6, 7) to 25 N.m (18 lb ft).

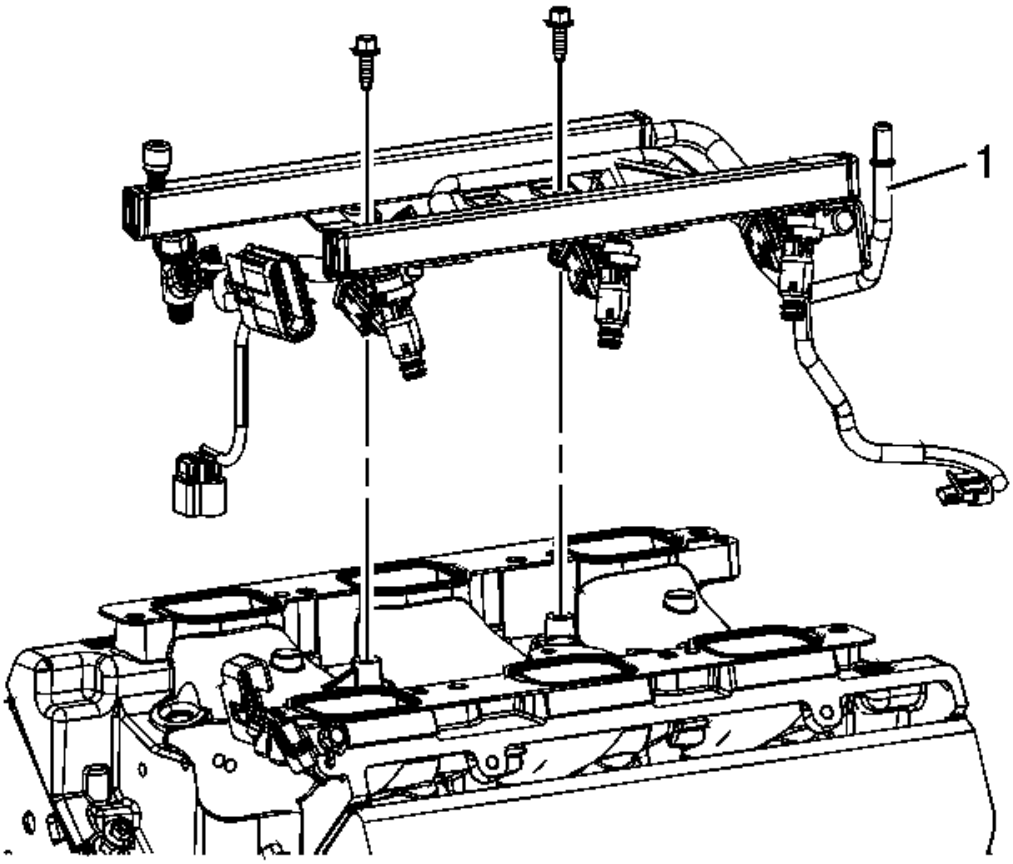

Fig. 69: Identifying Fuel Rail
Courtesy of GENERAL MOTORS CORP.

12. Inspect the fuel rail (1), fuel injectors for damage and replace as necessary.
13. Lubricate and install NEW injector lower O-rings seals onto the injectors. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
14. Install the injector nozzles into the lower intake manifold injector bores.
15. Press on the injector rail using the palms of both hands until the injectors are fully seated.
16. Install the fuel injector rail bolts and tighten to 10 N.m (89 lb in).

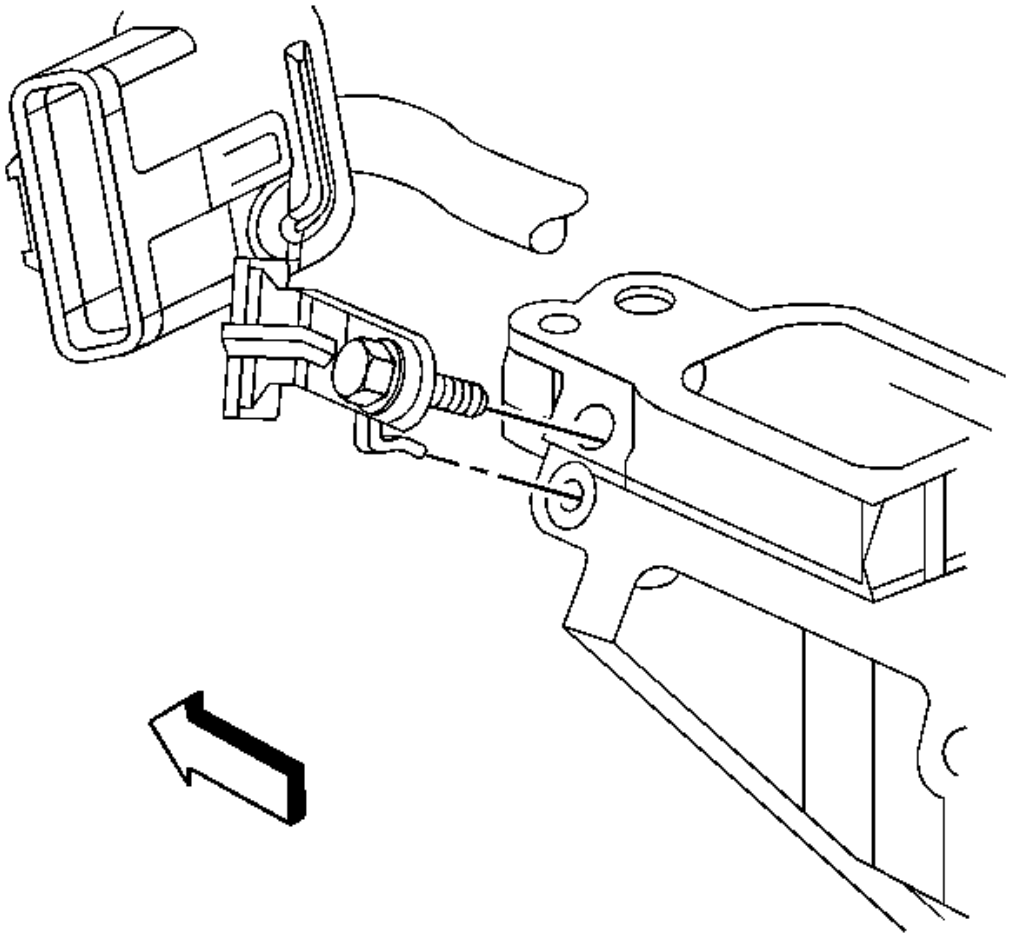

Fig. 70: Identifying Fuel Injector Wiring Harness Connector Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

17. Position the fuel injector wiring harness electrical connector bracket to the intake manifold and install the bolt. Tighten the bolt to 14 N.m (10 lb ft).

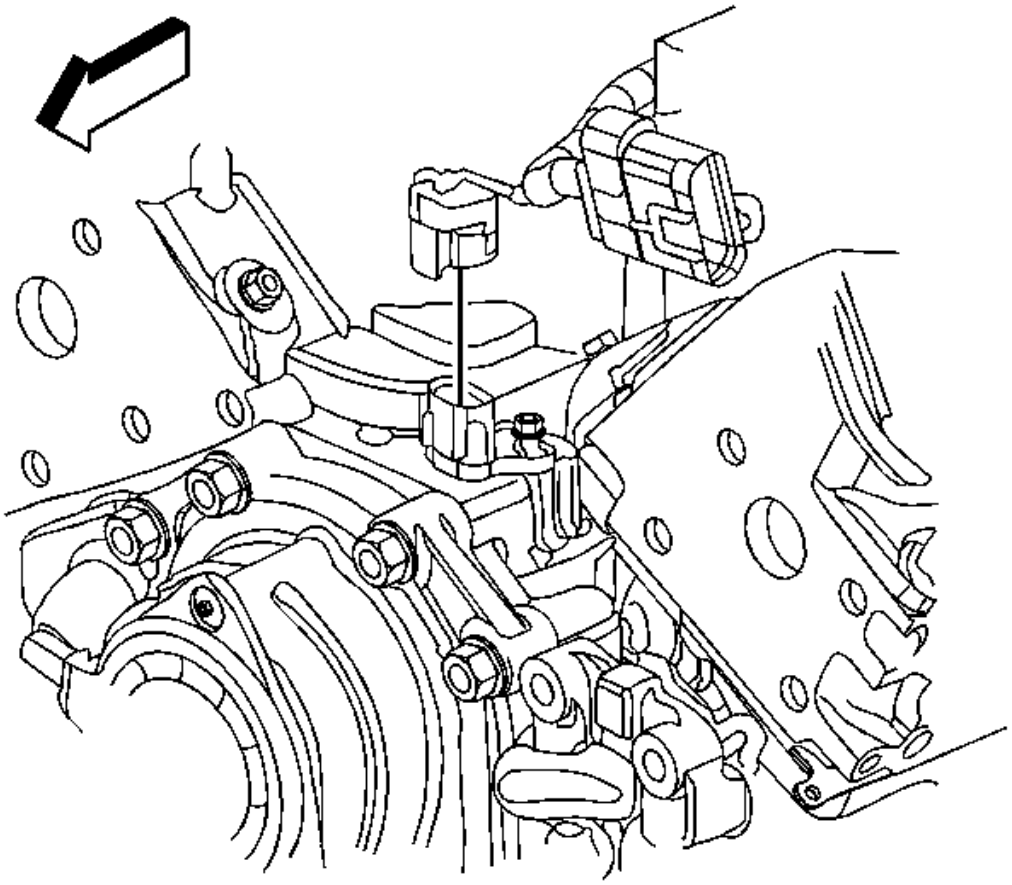

Fig. 71: View Of Fuel Injector Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

18. Connect the fuel injector wiring harness electrical connector to the CMP sensor.

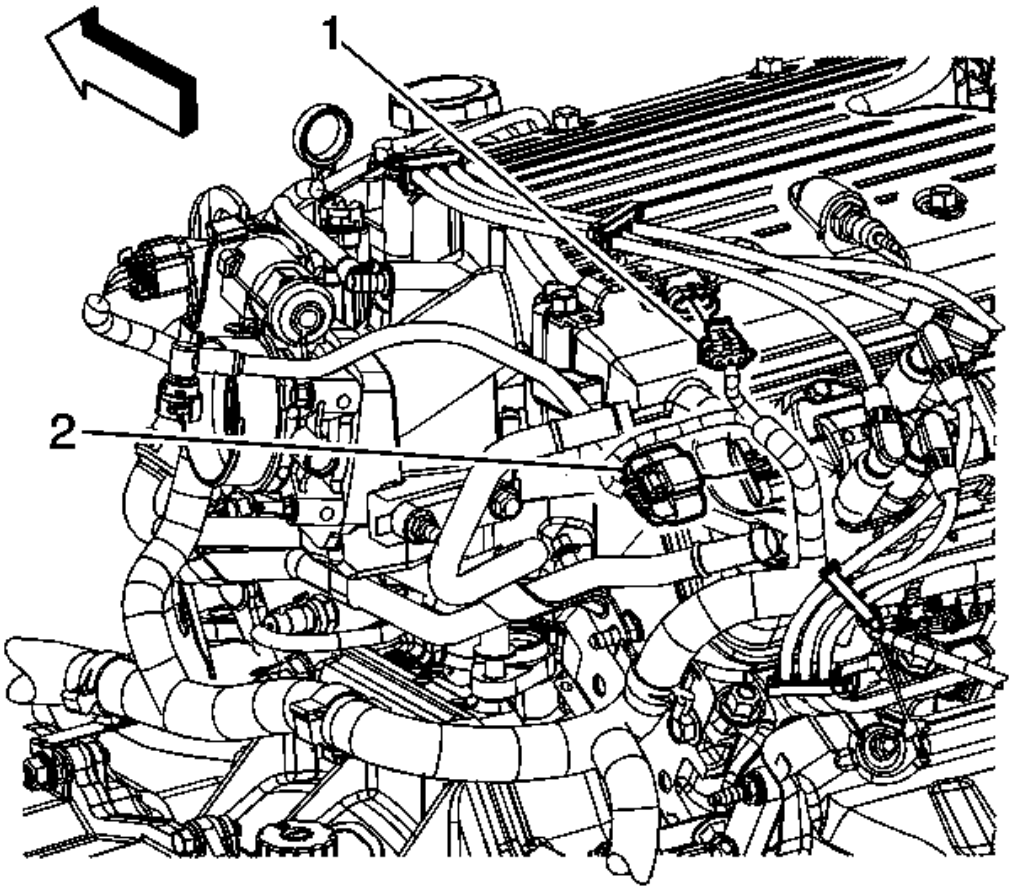

Fig. 72: Identifying Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

19. Connect the engine wiring harness electrical connector (2) to the fuel injector inline electrical connector.

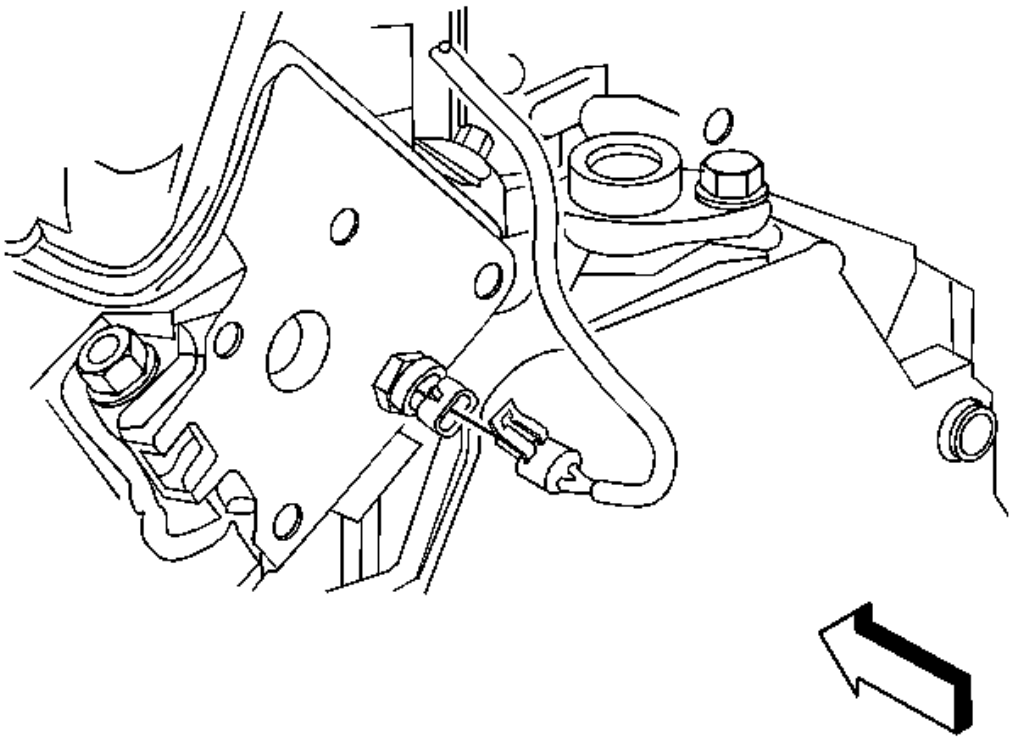

Fig. 73: View Of Upper Intake Manifold
Courtesy of GENERAL MOTORS CORP.

20. Connect the fuel injector wiring harness electrical connector to the ECT sensor.
21. Install the coolant crossover pipe. Refer to **Engine Coolant Crossover Pipe Replacement (LZE, LZ4)** .
22. Install the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Left Side** and **Valve Rocker Arm Cover Replacement - Right Side**.
23. Install the upper intake manifold. Refer to **Upper Intake Manifold Replacement**.
24. Fill the coolant system.refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)**

VALVE ROCKER ARM COVER REPLACEMENT - LEFT SIDE

REMOVAL PROCEDURE

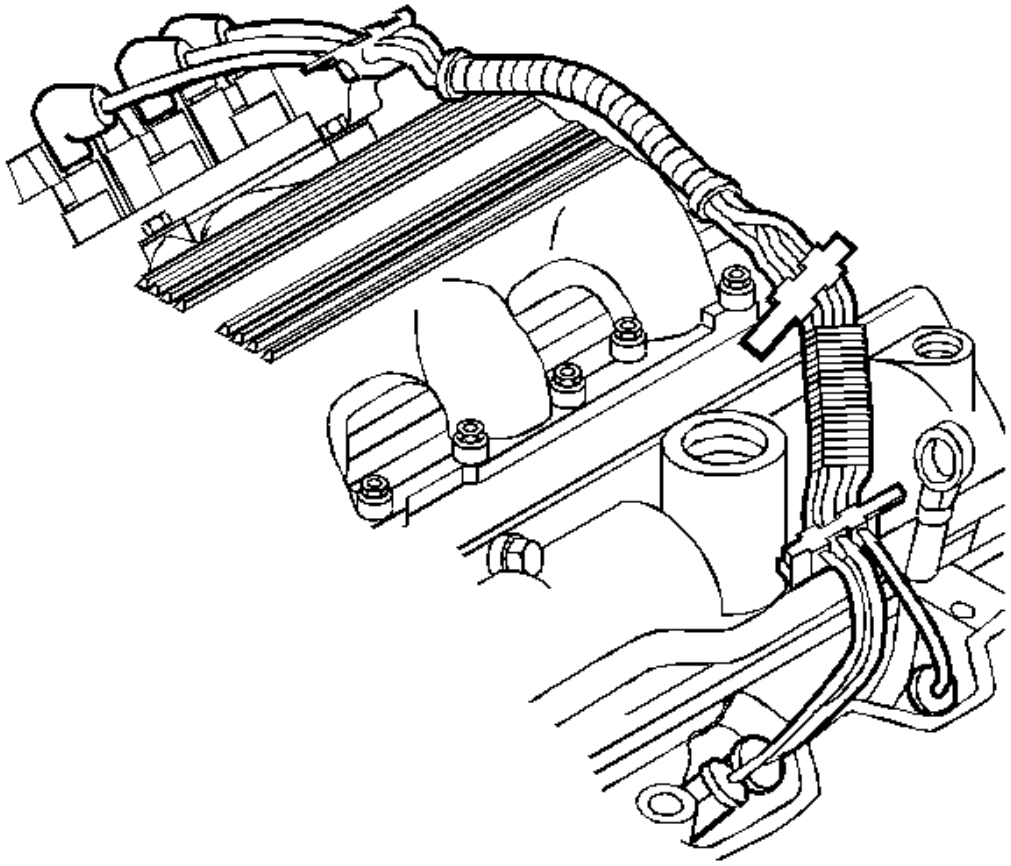

Fig. 74: Identifying Front Ignition Wire Harness
Courtesy of GENERAL MOTORS CORP.

1. Partially drain the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .
2. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.
3. Remove the front ignition wire harness at the upper intake manifold and at the spark plugs.
4. Disconnect the positive crankcase ventilation (PCV) vacuum hose.

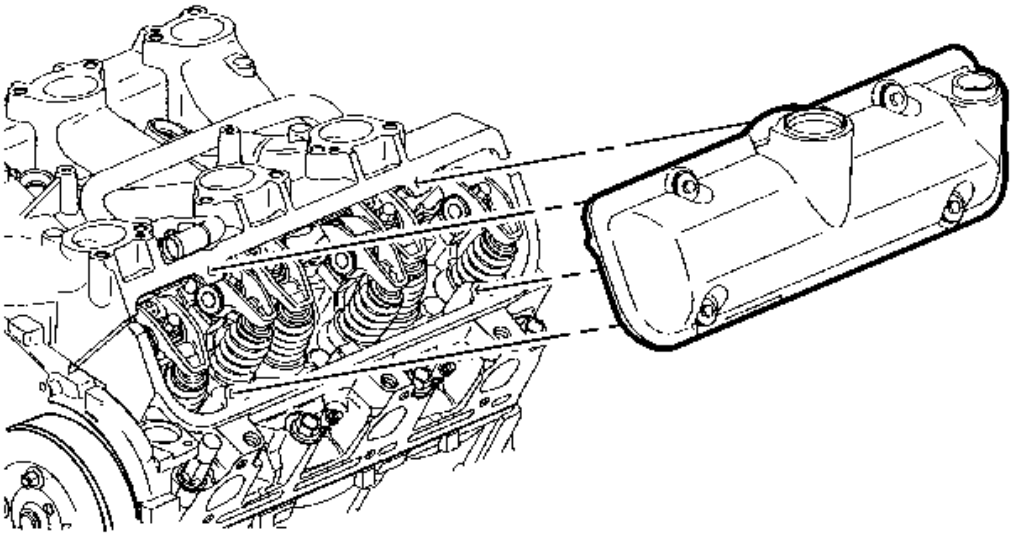

Fig. 75: View Of Valve Rocker Arm Cover - Left
Courtesy of GENERAL MOTORS CORP.

NOTE: The valve rocker arm cover gasket and sealant must be carefully trimmed away from the lower intake manifold gasket. Failure to do so will damage the lower intake manifold gasket, causing a severe oil leak.

5. Remove the valve rocker arm cover bolts.

NOTE: When removing the valve rocker arm cover, ensure the gasket stays in place attached to the cylinder head.

6. Remove the valve rocker arm cover. Bump the end of the valve rocker cover with the palm of your hand or a soft rubber mallet if the cover adheres to the cylinder head.

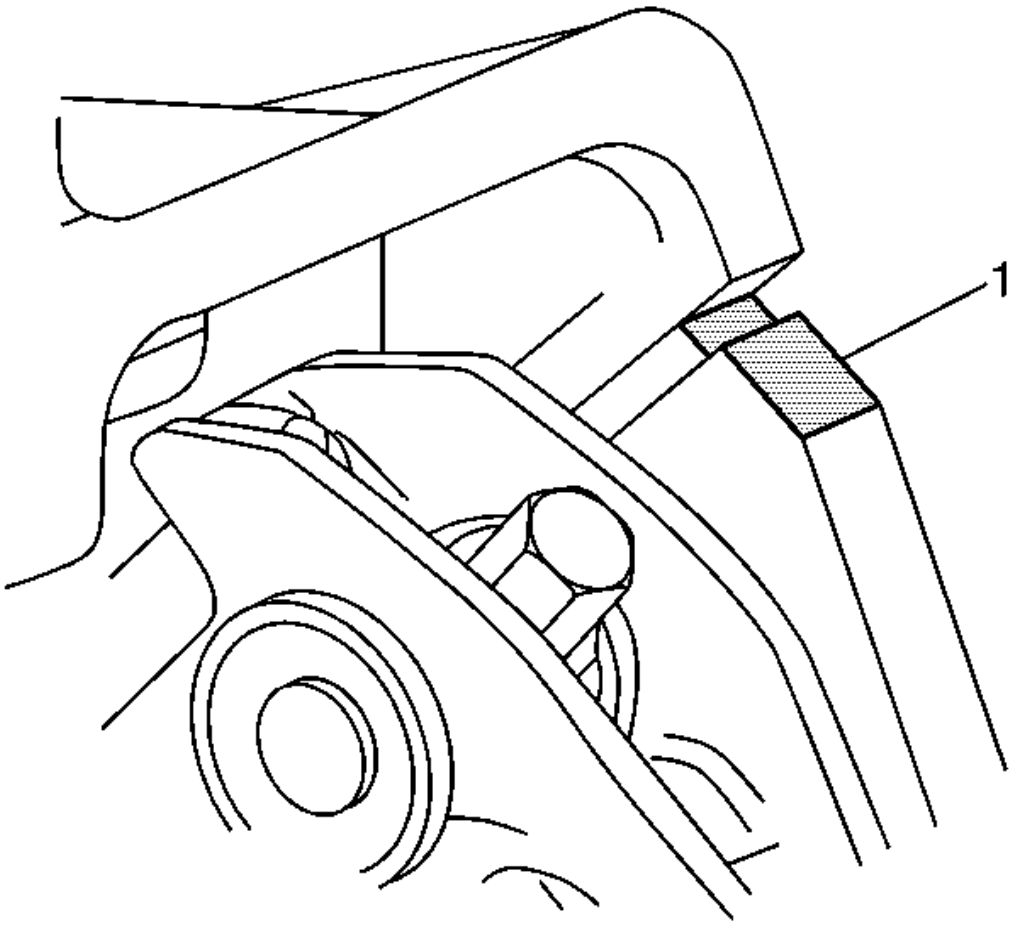

Fig. 76: Identifying Cylinder Head To Lower Intake Manifold Joint
Courtesy of GENERAL MOTORS CORP.

7. Trim the valve cover and sealant away from the lower intake manifold gasket at the cylinder head to the lower intake manifold joints (1).
8. Remove the valve cover gasket.
9. Clean the sealing surface on the cylinder head with degreaser.
10. Clean the valve rocker arm cover. Refer to **Valve Rocker Arm Cover Cleaning and Inspection** .

INSTALLATION PROCEDURE

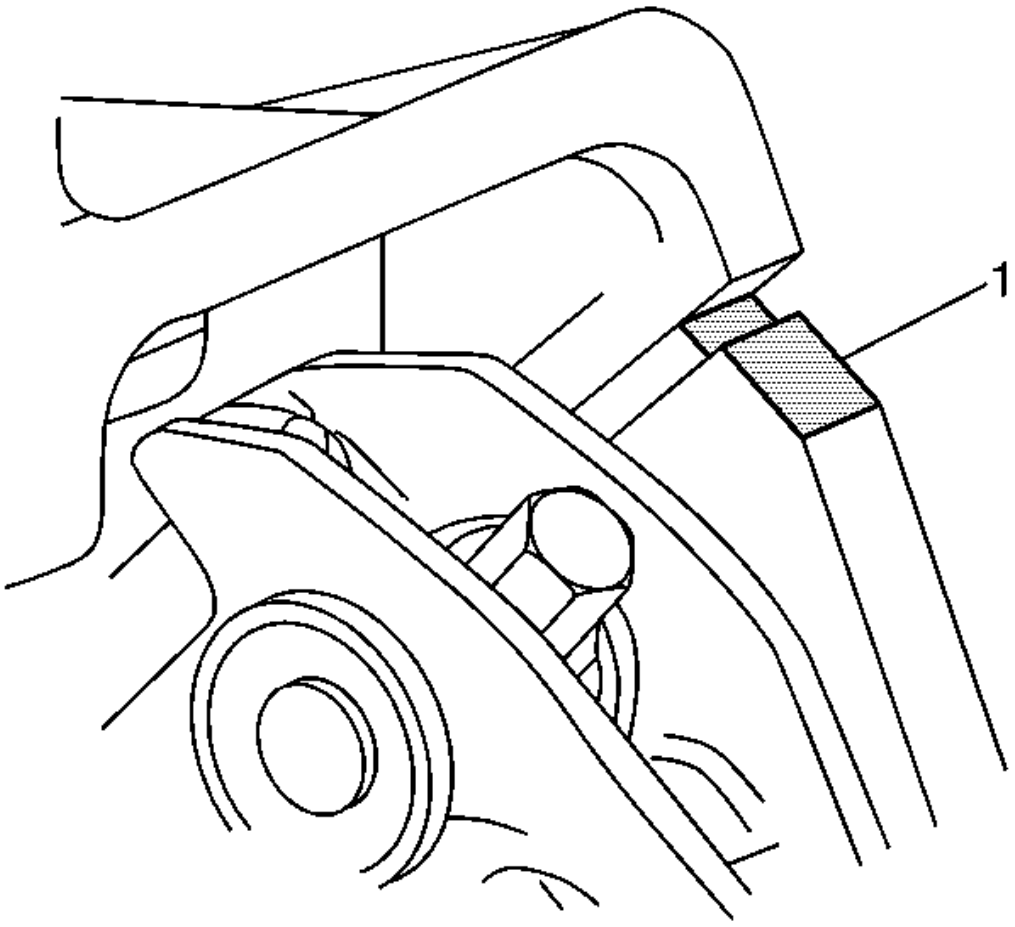

Fig. 77: Identifying Cylinder Head To Lower Intake Manifold Joint
Courtesy of GENERAL MOTORS CORP.

NOTE: Apply sealant at the cylinder head to the lower intake manifold joint. Refer to Adhesives, Fluids, Lubricants, and Sealers for the correct part number.

1. Apply sealant at the cylinder head to the lower intake manifold joints (1).

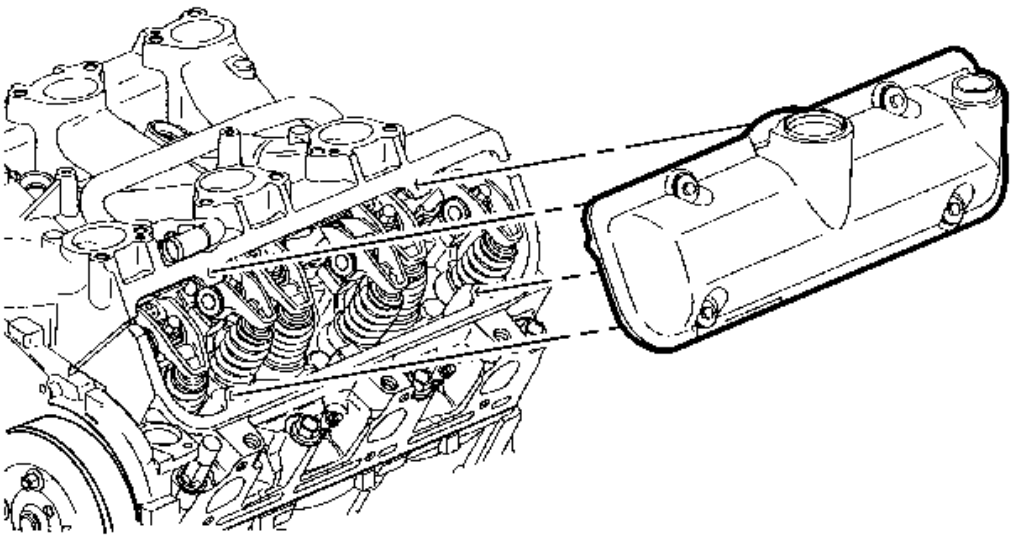

Fig. 78: View Of Valve Rocker Arm Cover - Left
Courtesy of GENERAL MOTORS CORP.

2. Install a new gasket to the valve rocker arm cover. Ensure that the gasket is properly seated in the groove of the valve rocker arm cover.
3. Install the valve rocker cover.
4. Install the valve rocker arm cover bolts. Refer to **Valve Rocker Arm Cover Installation - Left Side** .
5. Connect the PCV valve vacuum line.

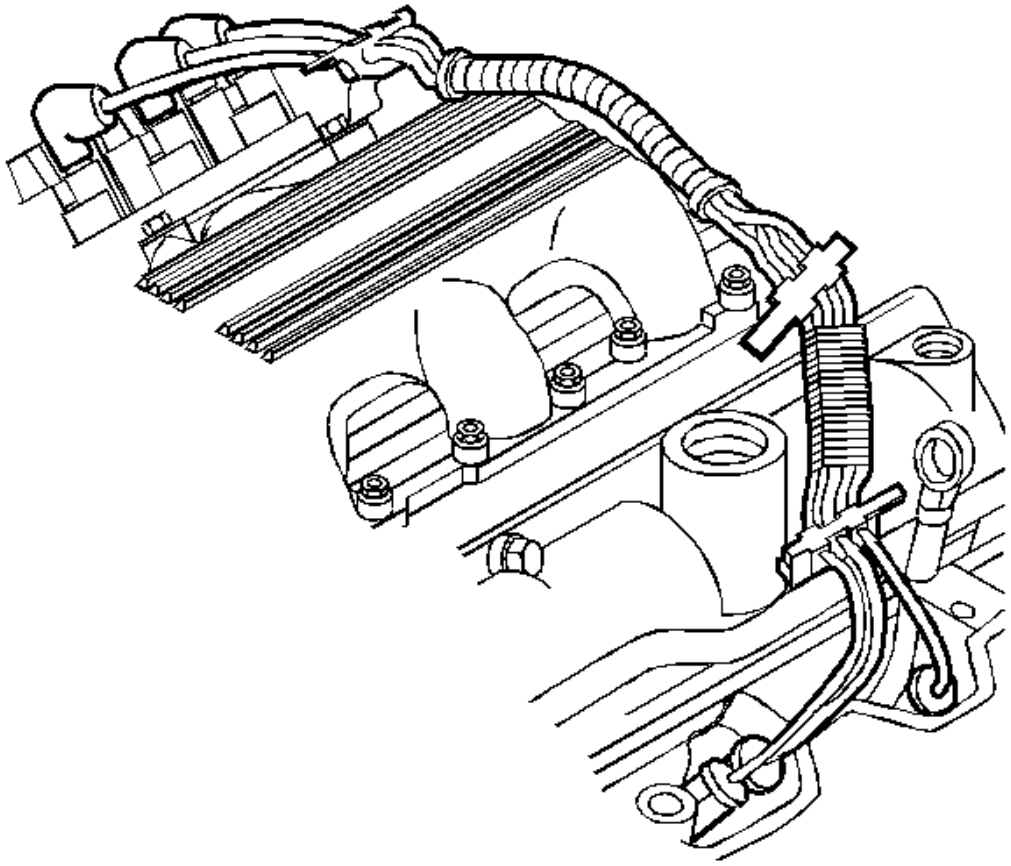

Fig. 79: Identifying Front Ignition Wire Harness
Courtesy of GENERAL MOTORS CORP.

6. Install the front ignition wire harness.
7. Refill the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .
8. Install the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.

VALVE ROCKER ARM COVER REPLACEMENT - RIGHT SIDE

REMOVAL PROCEDURE

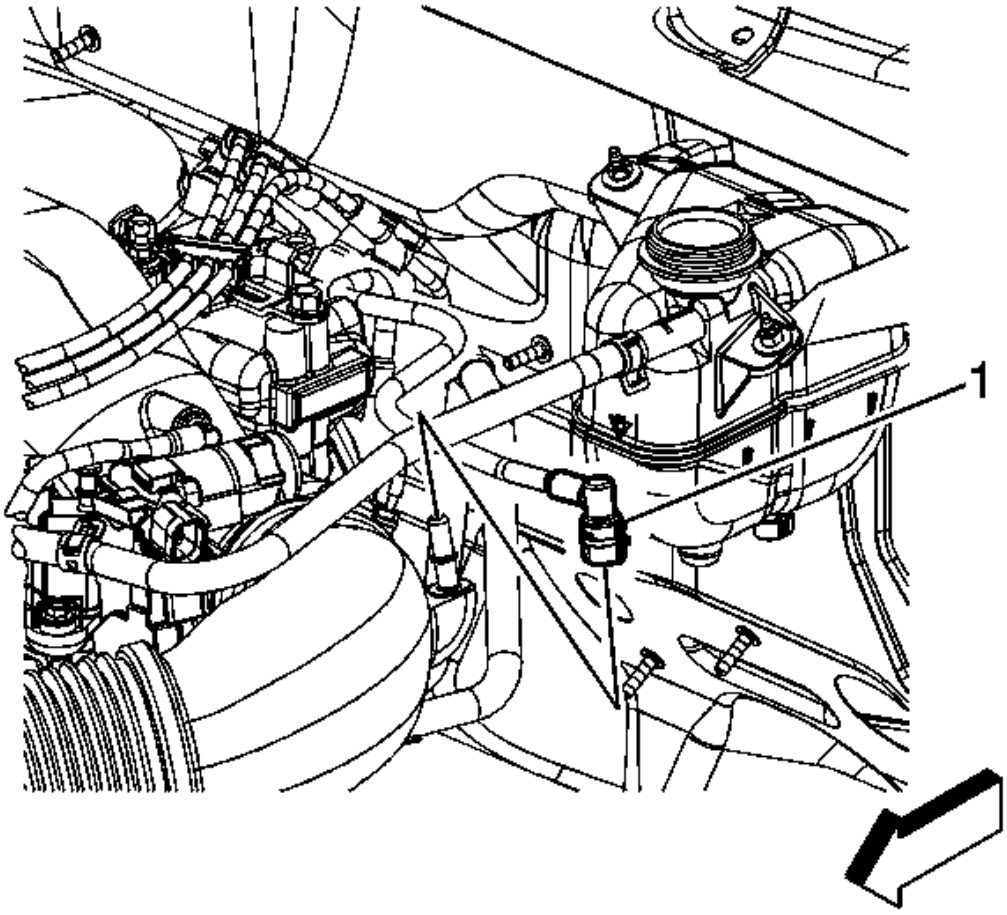

Fig. 80: Identifying PCV Fresh Air Tube (at Air Cleaner Outlet Duct)
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator. Refer to **Generator Replacement (LE5 or LE9)** or **Generator Replacement (LZ4 or LZE)** .
2. Remove the engine coolant crossover pipe. Refer to **Engine Coolant Crossover Pipe Replacement (LZE, LZ4)** .
3. Disconnect the positive crankcase ventilation (PCV) fresh air tube (1) from the air cleaner outlet duct. Refer to **Plastic Collar Quick Connect Fitting Service** .

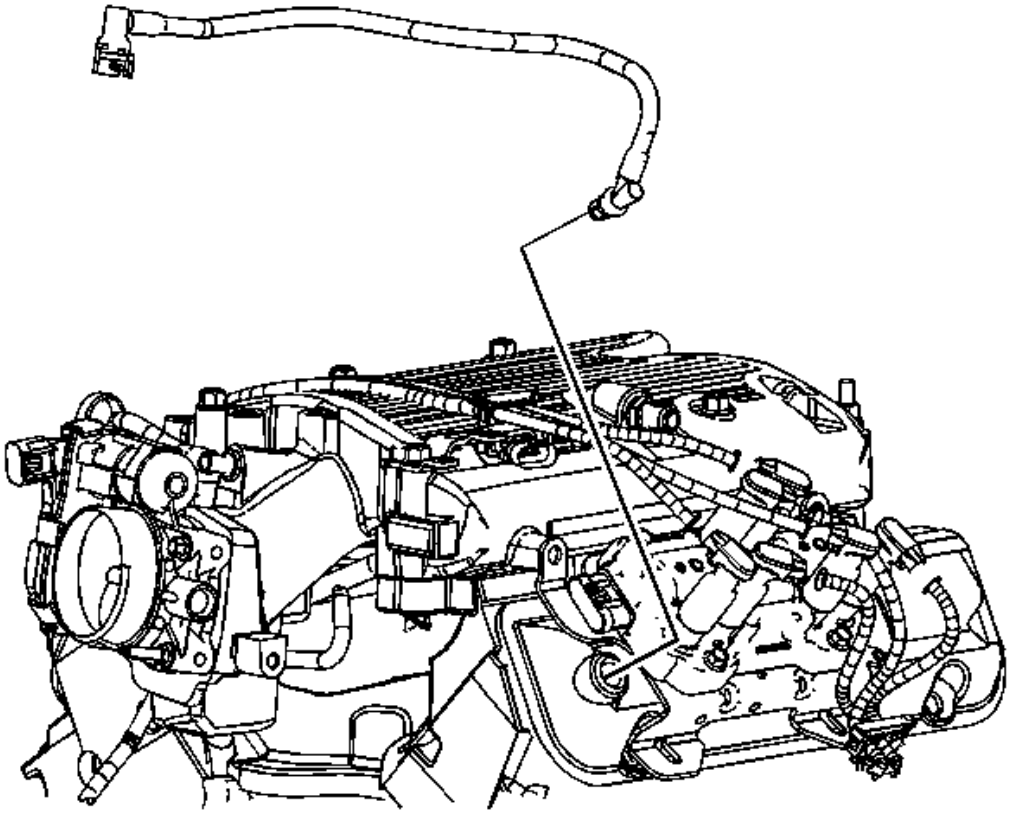

Fig. 81: Identifying Positive Crankcase Ventilation (PCV) Fresh Air Tube
Courtesy of GENERAL MOTORS CORP.

4. Remove the PCV fresh air tube from the right rocker arm cover.

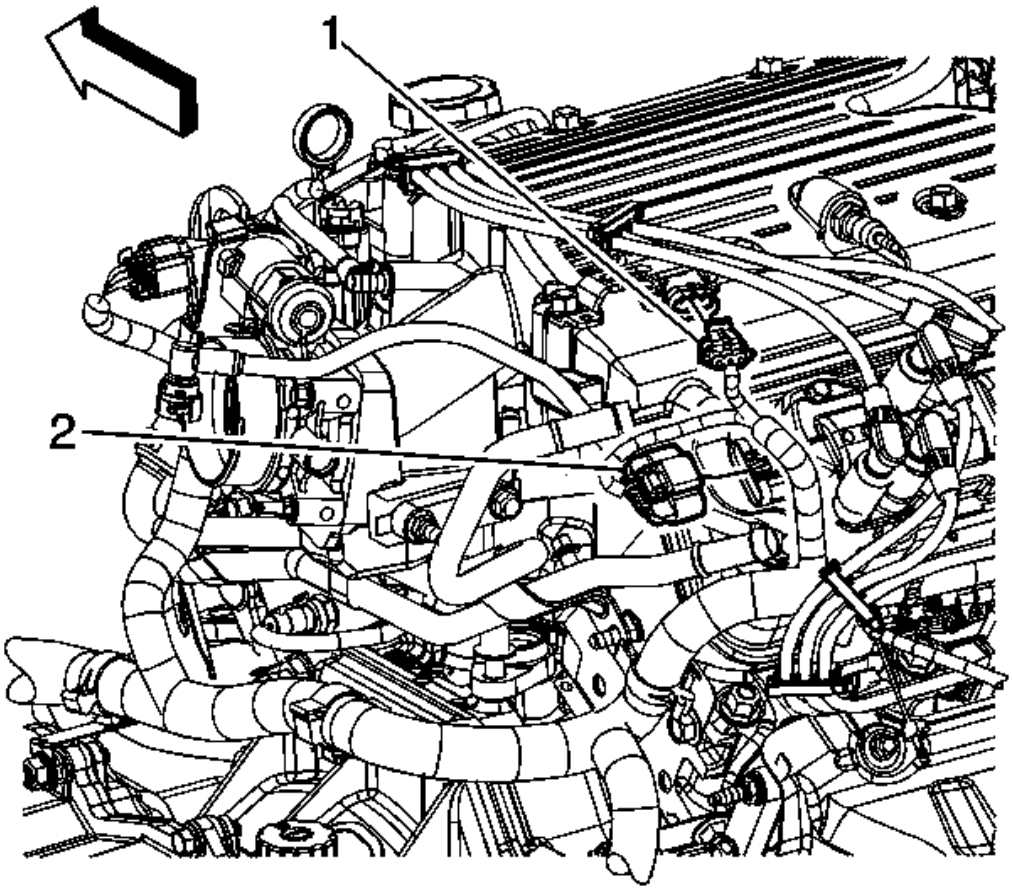

Fig. 82: Identifying Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the engine wiring harness electrical connector (1) from the manifold absolute pressure (MAP) sensor.
6. Disconnect the engine wiring harness electrical connector (2) from the fuel injector wiring harness electrical connector.
7. Remove the ignition coil assembly. Refer to **Ignition Coil Replacement**

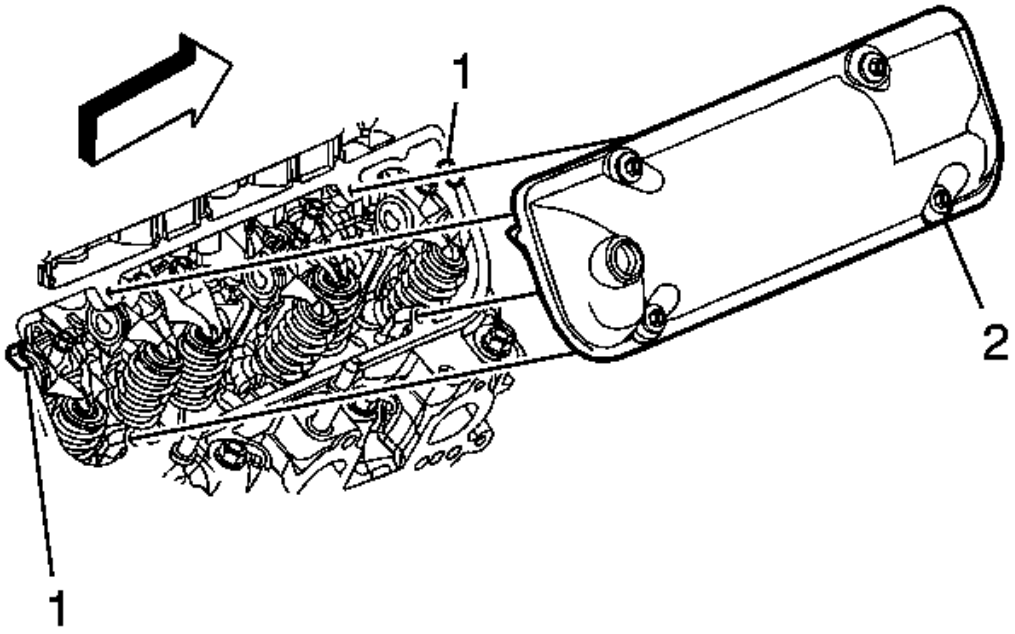

Fig. 83: Identifying Rocker Arm Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Loosen the rocker arm cover bolts.

NOTE: When removing the valve rocker arm cover make sure the gasket stays in place attached to the cylinder head.

9. Remove the rocker arm cover (2). If necessary, bump the end of the cover with the palm of your hand or a soft rubber mallet if the cover adheres to the cylinder head.
10. Cut the room temperature vulcanizing (RTV) sealer in the channel where the intake, cylinder head, and rocker cover meet with a suitable tool.
11. Remove the rocker arm cover gasket.

INSTALLATION PROCEDURE

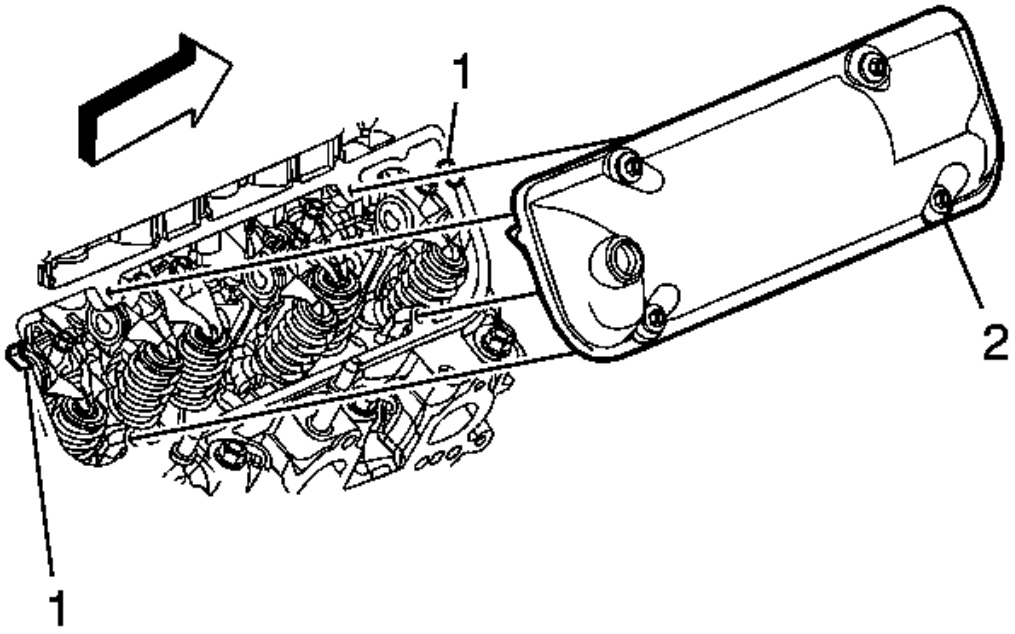

Fig. 84: Identifying Rocker Arm Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

1. All gasket mating surfaces need to be free of oil and foreign material.
2. Install the rocker arm cover gasket into the rocker arm cover.
3. Apply sealer to the surfaces where the cylinder head and the intake manifold meet (1). Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
4. Place the rocker arm cover (2) onto the cylinder head.
5. Install the rocker arm cover bolts. Refer to **Valve Rocker Arm Cover Installation - Right Side** .
6. Install the ignition coil assembly. Refer to **Ignition Coil Replacement** .

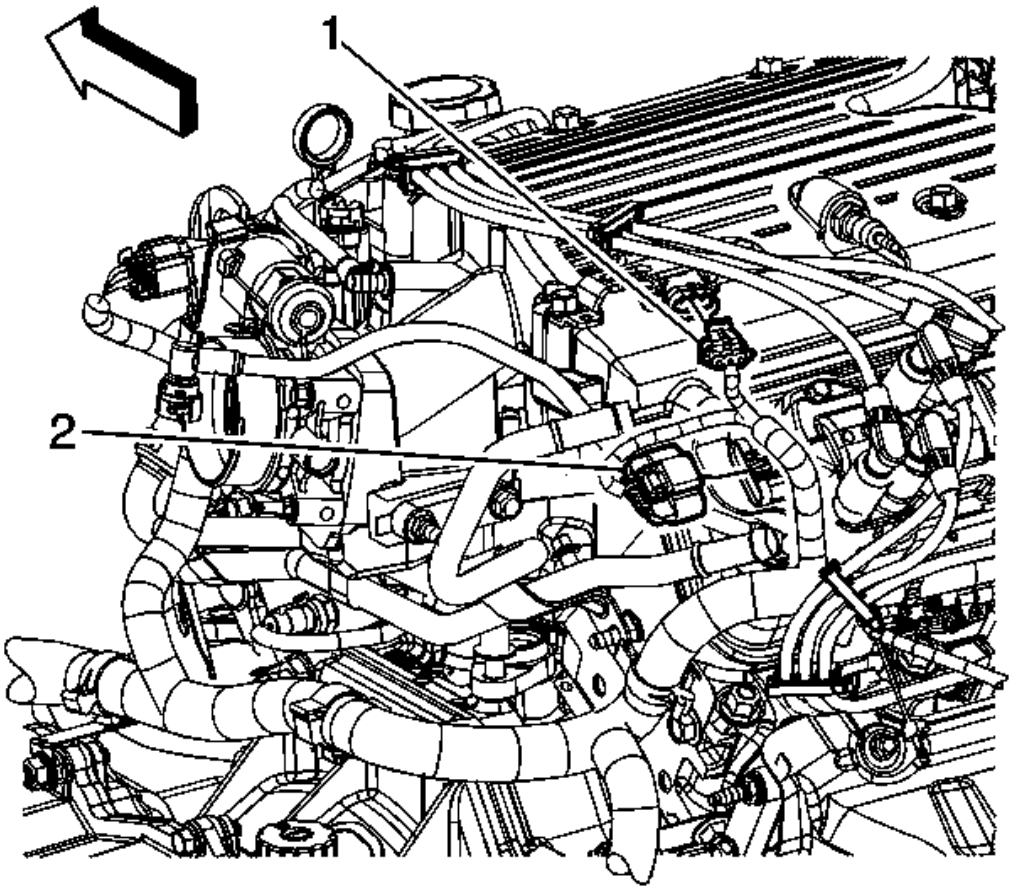

Fig. 85: Identifying Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

7. Connect the engine wiring harness electrical connector (2) to the fuel injector wiring harness electrical connector.
8. Connect the engine wiring harness electrical connector (1) to the MAP sensor.

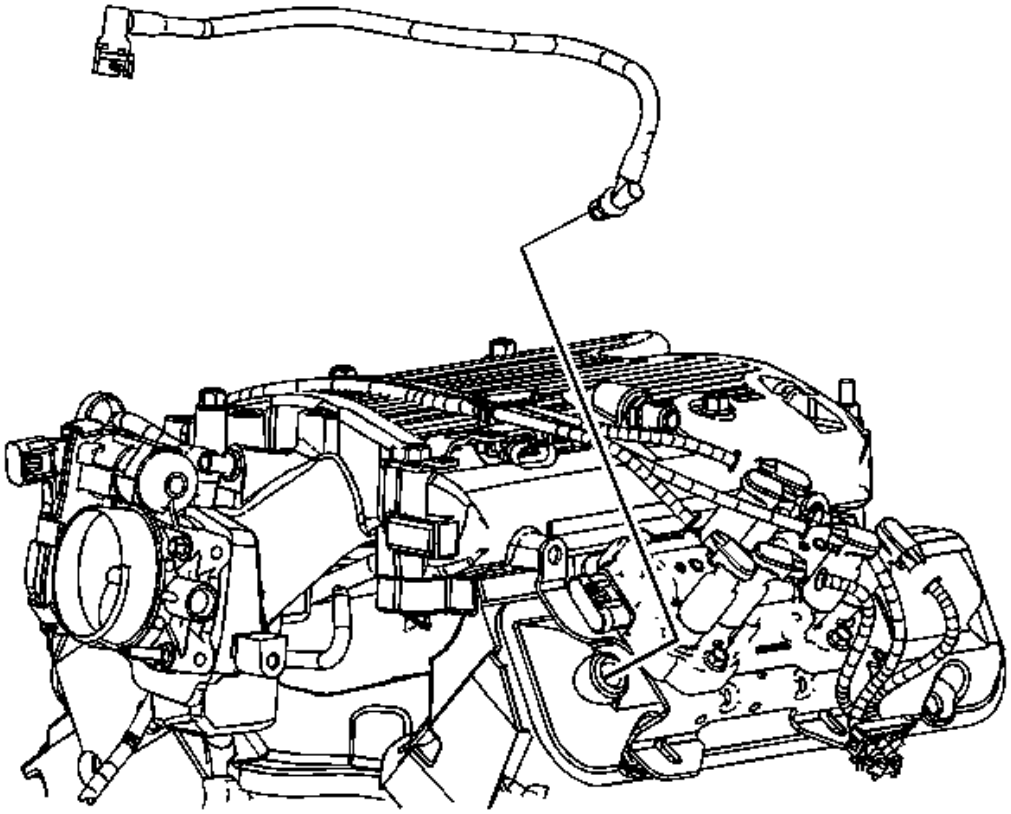

Fig. 86: Identifying Positive Crankcase Ventilation (PCV) Fresh Air Tube
Courtesy of GENERAL MOTORS CORP.

9. Install the PCV fresh air tube to the right rocker arm cover.

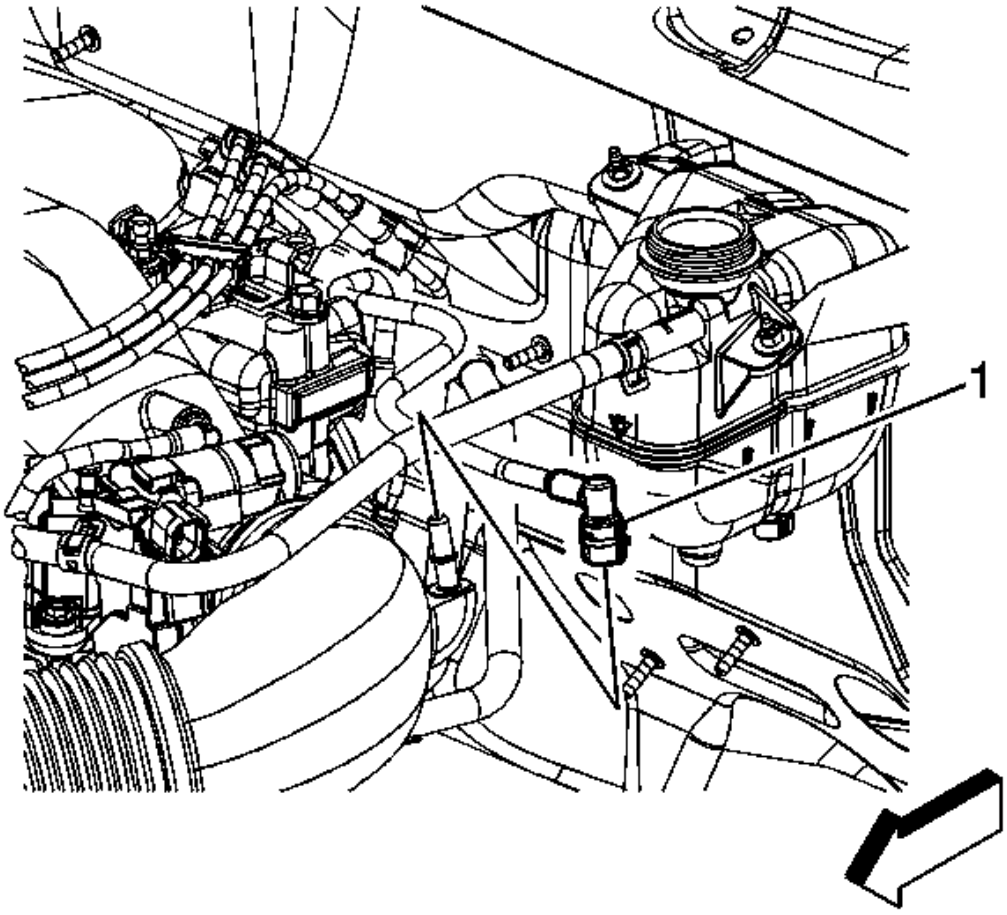

Fig. 87: Identifying PCV Fresh Air Tube (at Air Cleaner Outlet Duct)
Courtesy of GENERAL MOTORS CORP.

10. Connect the PCV fresh air tube (1) to the air cleaner outlet duct. Refer to **Plastic Collar Quick Connect Fitting Service** .
11. Install the engine coolant crossover pipe. Refer to **Engine Coolant Crossover Pipe Replacement (LZE, LZ4)** .
12. Install the generator. Refer to **Generator Replacement (LZ4 or LZE)**

VALVE ROCKER ARM AND PUSH ROD REPLACEMENT

REMOVAL PROCEDURE

1. Remove the valve rocker arm covers. Refer to **Valve Rocker Arm Cover Replacement - Left Side** or

Valve Rocker Arm Cover Replacement - Right Side.

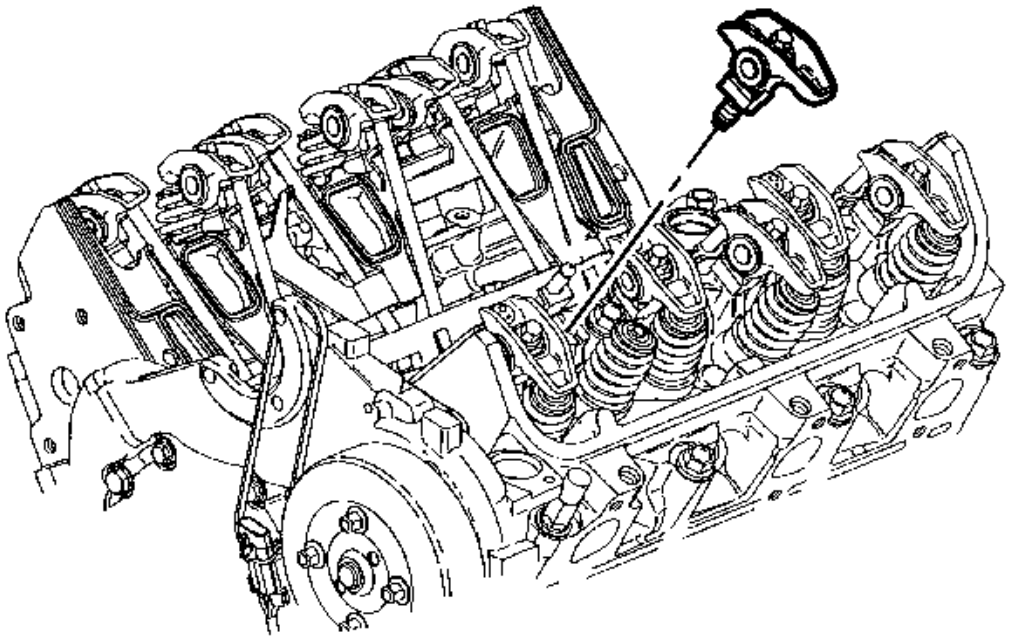

Fig. 88: View Of Valve Rocker Arm
Courtesy of GENERAL MOTORS CORP.

NOTE: Keep the components separated in order to install the components in the same location.

2. Remove the rocker arm bolts.
3. Remove the rocker arms.
4. Remove the pushrods.

INSTALLATION PROCEDURE

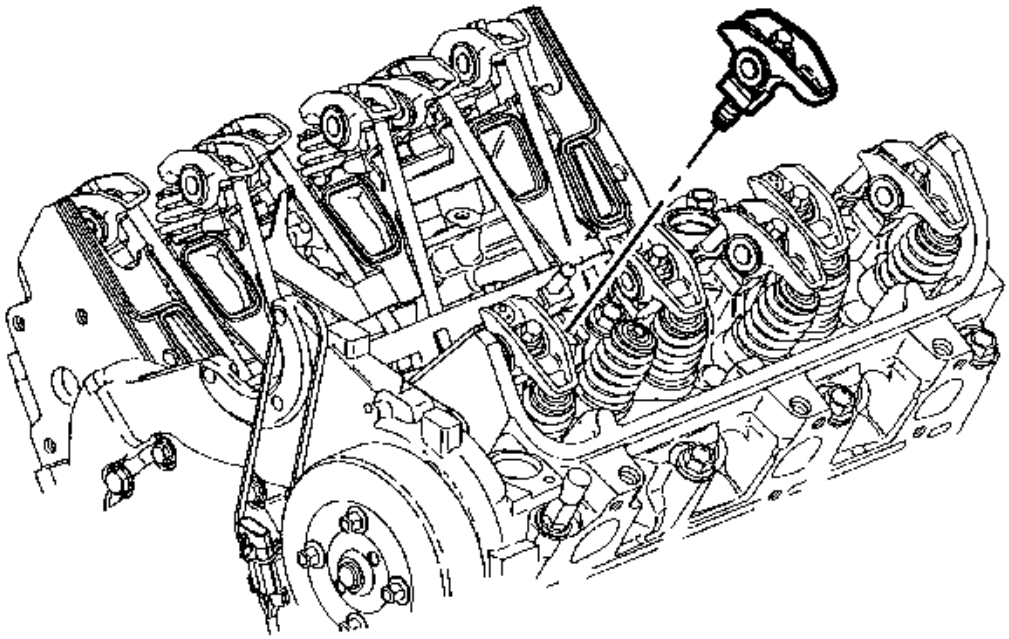

Fig. 89: View Of Valve Rocker Arm
Courtesy of GENERAL MOTORS CORP.

1. Install the pushrods in the original location.
   - Coat the ends of the pushrods with lubricant. Refer to **Adhesives, Fluids, Lubricants, and Sealers** for the 3.5L engine.
   - The intake pushrods are identified with yellow stripes and are 5 3/4 inches long.
   - Exhaust pushrods are identified with green stripes and are 6 inches long.
   - Ensure that the pushrods seat in the lifter.
2. Install the rocker arms.
3. Install the rocker arm bolts. Refer to **Valve Rocker Arm and Push Rod Installation** .
4. Install the valve rocker covers. Refer to **Valve Rocker Arm Cover Replacement - Left Side** or **Valve Rocker Arm Cover Replacement - Right Side**.

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT

SPECIAL TOOLS

- **EN-47823** Valve Spring Compressor Adapter. See **Special Tools** .
- **J 22794** Spark Plug Port Adapter. See **Special Tools** .

- **J 5892-D** Valve Spring Compressor. See **Special Tools** .

REMOVAL PROCEDURE

IMPORTANT:

- **Before removing the valve locks, rotate the engine so that the piston in the cylinder you are working on is at top dead center (TDC). This will eliminate the possibility of the valve accidentally falling inside the cylinder.**
- **Loosen the spark plug, and clean any dirt and/or debris from the spark plug recess area before removing.**

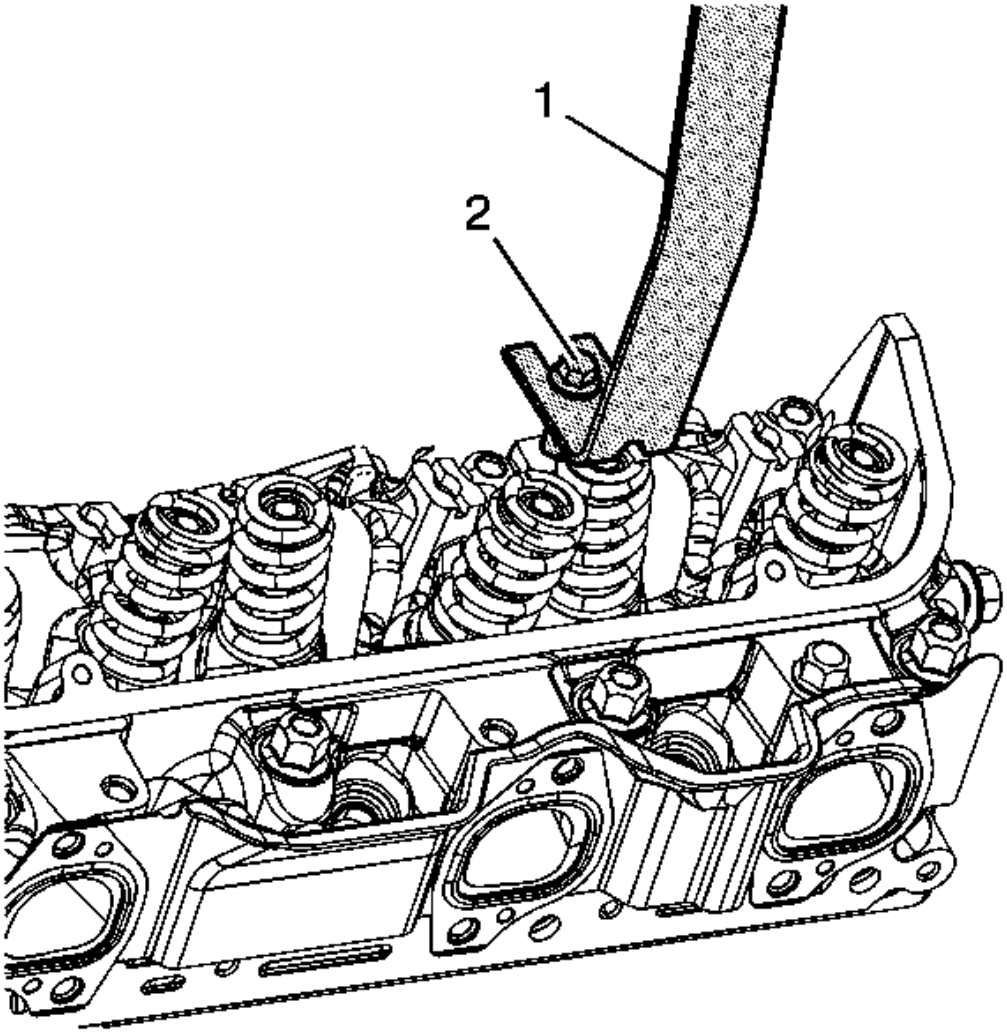

Fig. 90: Identifying Valve Spring Compressing Tools
Courtesy of GENERAL MOTORS CORP.

1. Remove the spark plug. Refer to **Spark Plug Replacement** .
2. Remove the rocker arm. Refer to **Valve Rocker Arm and Push Rod Replacement**.
3. Install the **J 22794** into the spark plug port. Apply compressed air in order to hold the valve in place. See **Special Tools** .
4. Using caution so as not to damage the valve spring or valve spring dampener, compress the valve spring using the **J 5892-D** (1) and the **EN-47823** (2). See **Special Tools** .

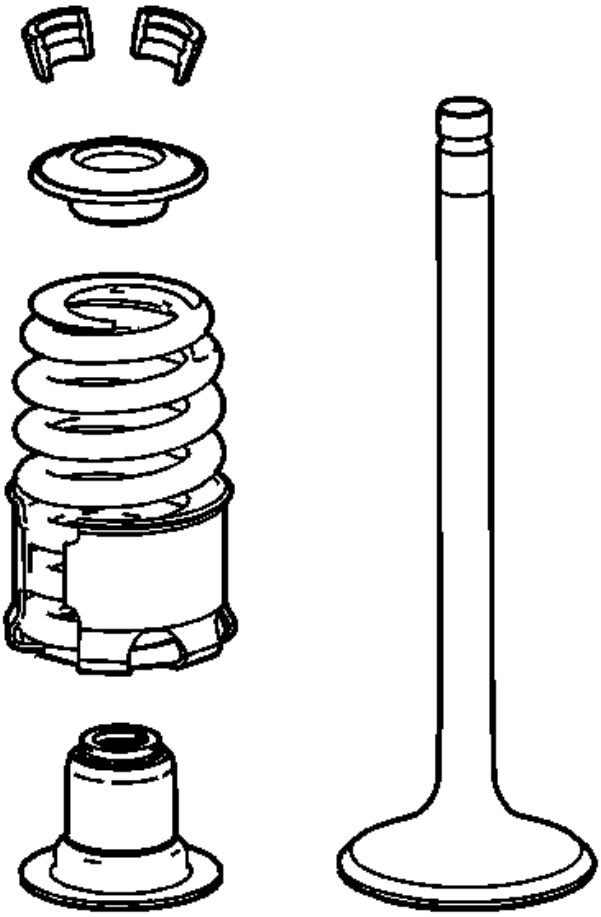

Fig. 91: Identifying Valve Components
Courtesy of GENERAL MOTORS CORP.

5. Remove the valve spring cap keys.
6. Remove the valve cap.
7. Remove the valve spring.
8. Remove the valve stem oil seal.

INSTALLATION PROCEDURE

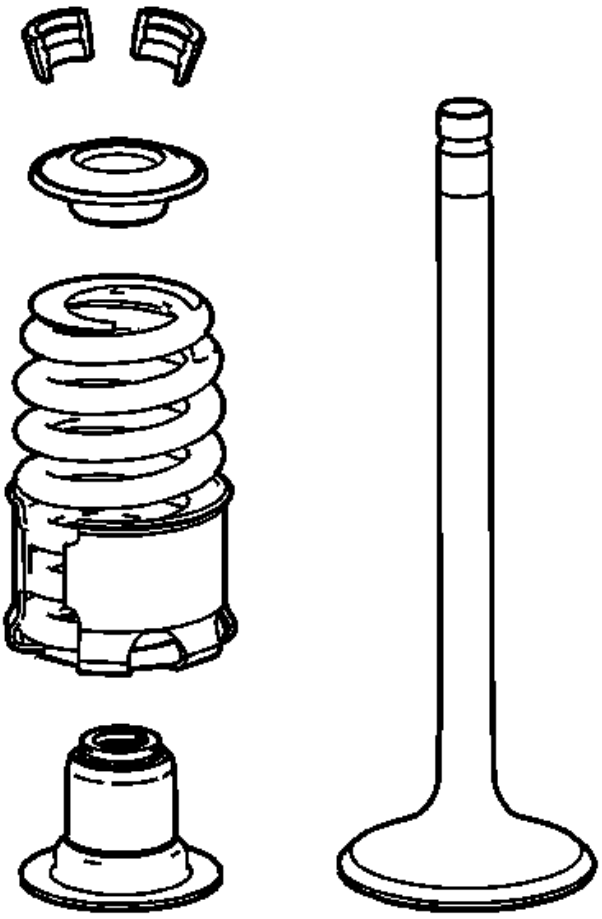

Fig. 92: Identifying Valve Components
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the valve stem with clean engine oil.
2. Install the valve stem oil seal, ensuring the proper seals (intake - black seal and exhaust - brown seal) are installed.
3. Install the valve spring.
4. Install the valve cap.

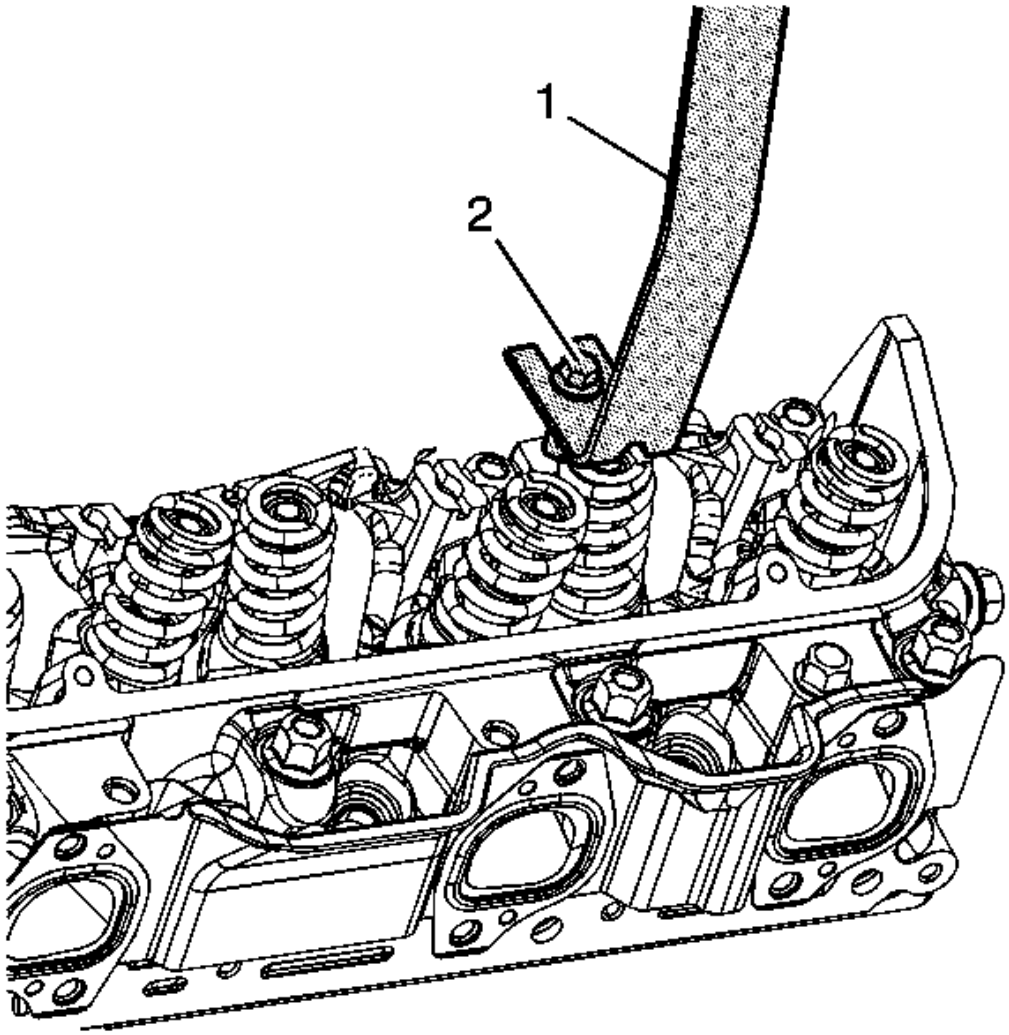

Fig. 93: Identifying Valve Spring Compressing Tools
Courtesy of GENERAL MOTORS CORP.

5. Using caution so as not to damage the valve spring or valve spring dampener, compress the valve spring using the **J 5892-D** (1) and the **EN-47823** (2). See **Special Tools** .
6. Install the valve cap keys. If necessary, use grease in order to hold the valve cap keys in place.
7. Ensure the valve cap keys are seated.
8. Remove the compressed air and remove the **J 22794** from the spark plug port. See **Special Tools** .
9. Install the rocker arm. Refer to **Valve Rocker Arm and Push Rod Replacement**.
10. Install the spark plug. Refer to **Spark Plug Replacement** .

VALVE LIFTER REPLACEMENT

REMOVAL PROCEDURE

1. Remove the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
2. Remove the valve rocker arms and pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.

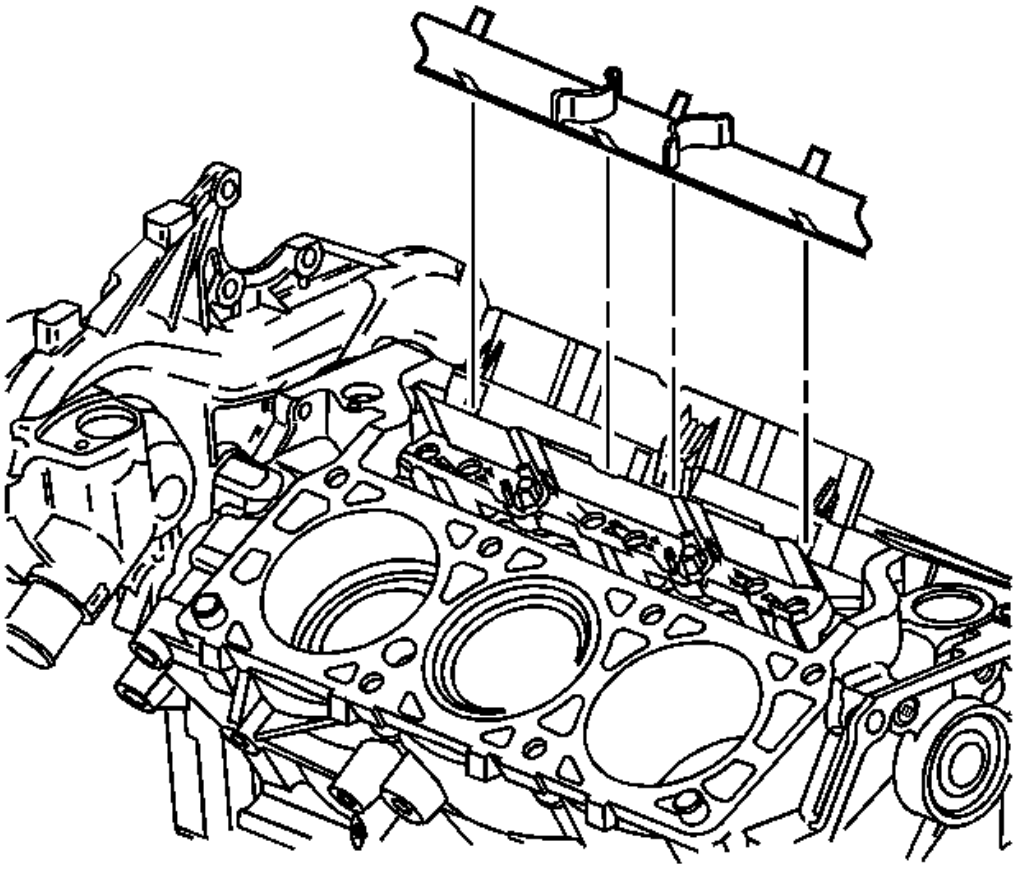

Fig. 94: View Of Intake Manifold Oil Splash Shield
Courtesy of GENERAL MOTORS CORP.

3. Remove the intake manifold oil splash shield.

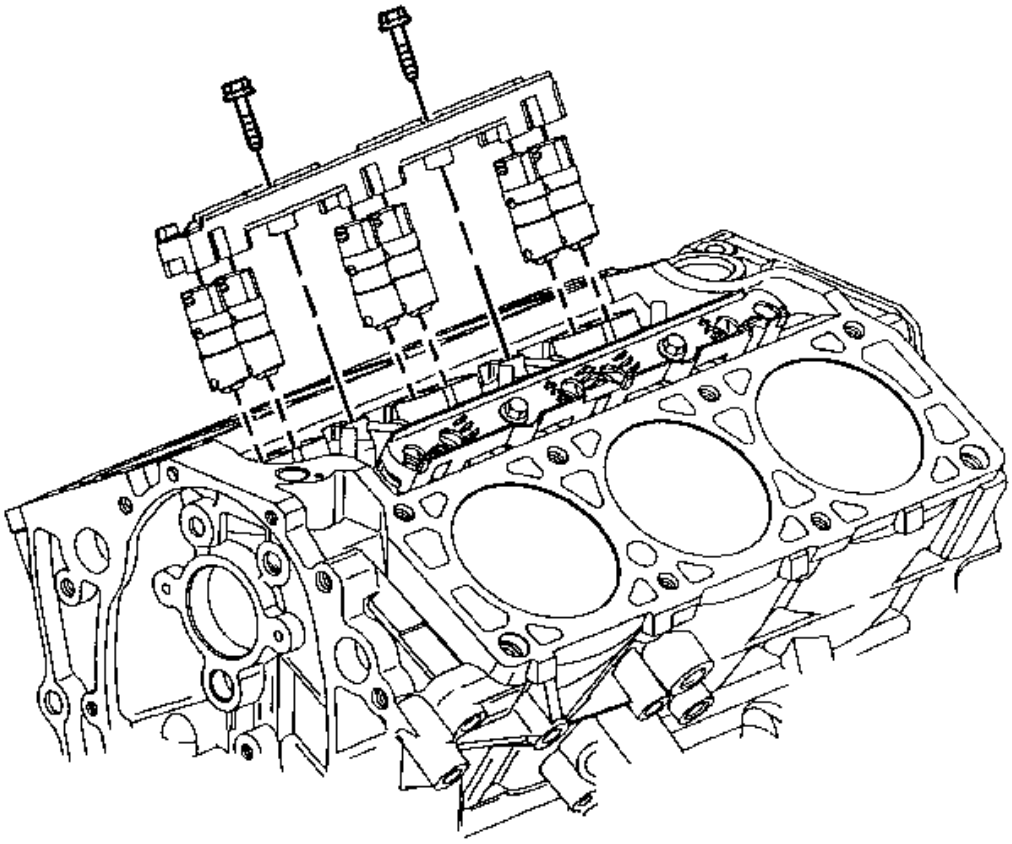

Fig. 95: View Of Lifter Guide
Courtesy of GENERAL MOTORS CORP.

4. Remove the lifter guide bolts.
5. Remove the valve lifter guides.
6. Remove the valve lifters.
7. Clean all gasket surfaces with degreaser.
8. Clean the valve train parts.
9. Inspect the valve lifters and the cam lobes for wear. Refer to **Valve Lifter Cleaning and Inspection** .

INSTALLATION PROCEDURE

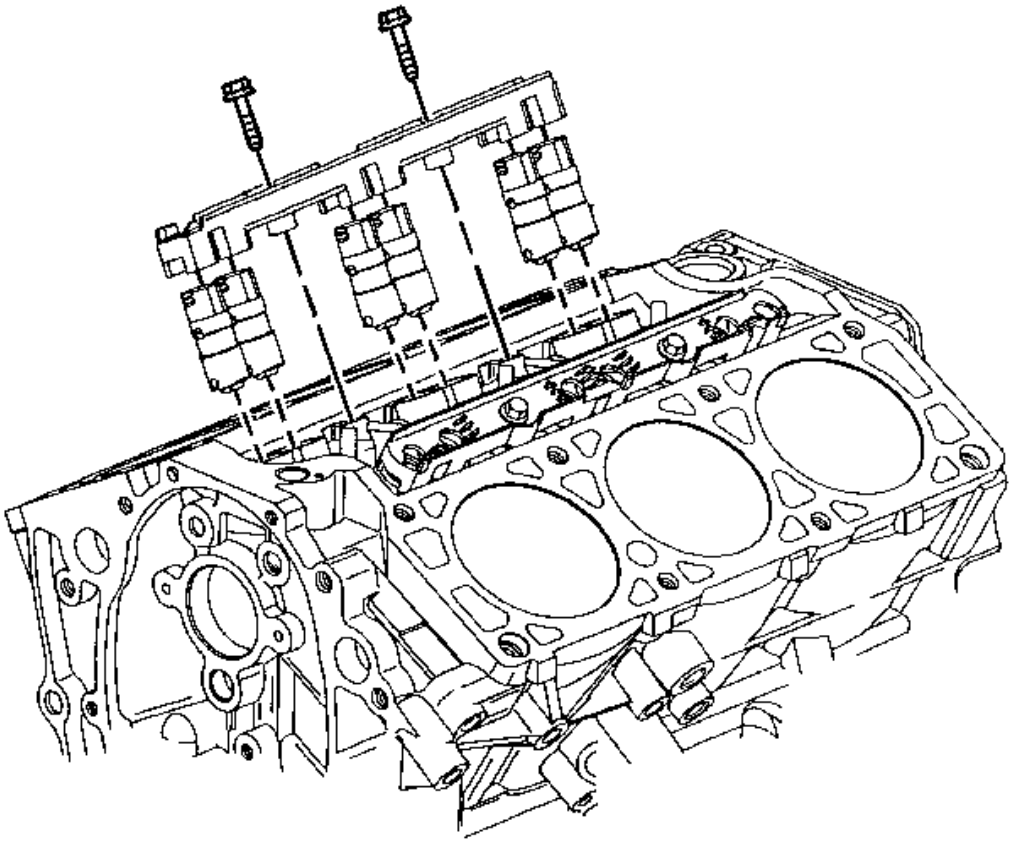

Fig. 96: View Of Lifter Guide
Courtesy of GENERAL MOTORS CORP.

1. Coat the valve lifters with prelube. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
2. Install the valve lifters to the same location from which they were removed.
3. Install the valve lifter guides.

CAUTION: Refer to Fastener Caution .

4. Install the valve lifter guide bolts.

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

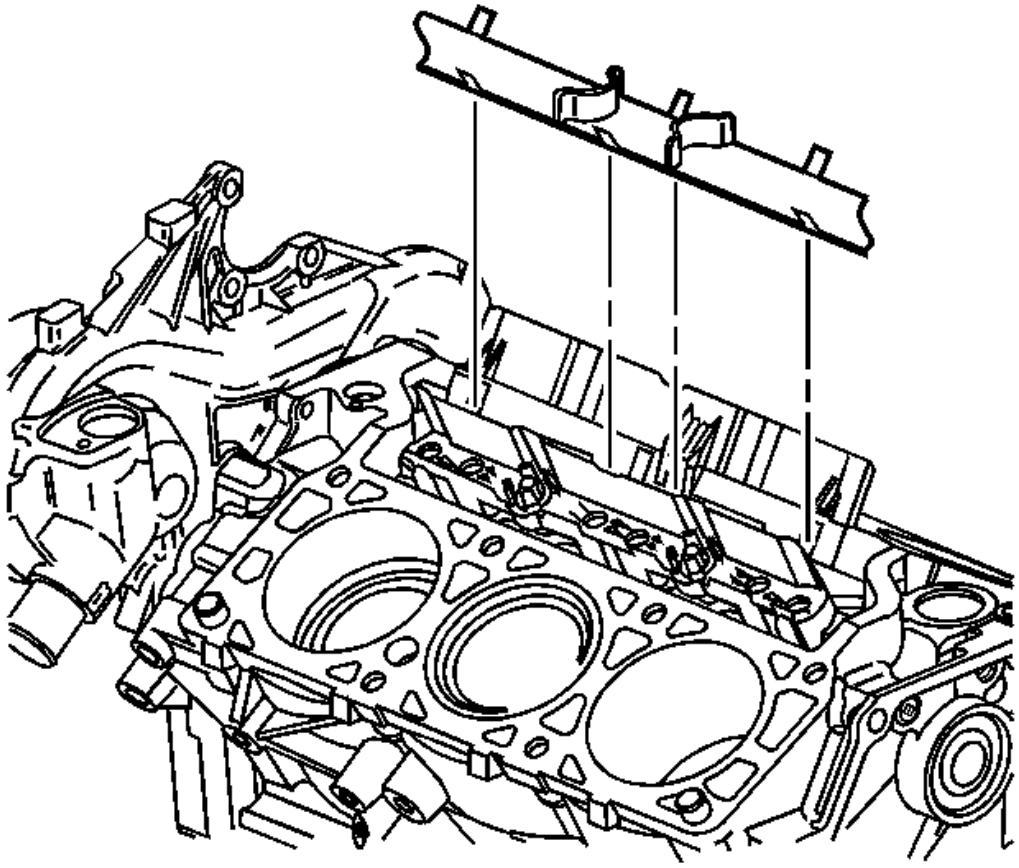

Fig. 97: View Of Intake Manifold Oil Splash Shield
Courtesy of GENERAL MOTORS CORP.

5. Install the intake manifold oil splash shield
6. Install the valve rocker arms and pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
7. Install the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

CRANKSHAFT BALANCER REPLACEMENT

SPECIAL TOOLS

- **J 29113** Balancer and Crank Sprocket Installer. See **Special Tools** .
- **J 37096** Flywheel Holder. See **Special Tools** .
- **J 41816** Crankshaft Balancer Remover. See **Special Tools** .

REMOVAL PROCEDURE

CAUTION: The inertial weight section of the crankshaft balancer is assembled to the hub with a rubber type material. The correct installation procedures (with the proper tool) must be followed or movement of the inertial weight section of the hub will destroy the tuning of the crankshaft balancer.

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the right front tire and wheel. Refer to **Tire and Wheel Removal and Installation** .
4. Remove the right engine splash shield. Refer to **Radiator Air Side Baffle and Deflector Replacement** .
5. Install the jack stands to the frame.
6. Loosen the left frame bolts and remove the right side frame bolts. Refer to **Frame Replacement (Convertible)** **Frame Replacement (Coupe 3.5L, 3.9L)** .
7. Using the jack stands, lower the right side of the frame to access the crankshaft balancer.
8. Remove the torque converter covers.
9. Install the **J 37096** to the flywheel to prevent flywheel rotation. See **Special Tools** .

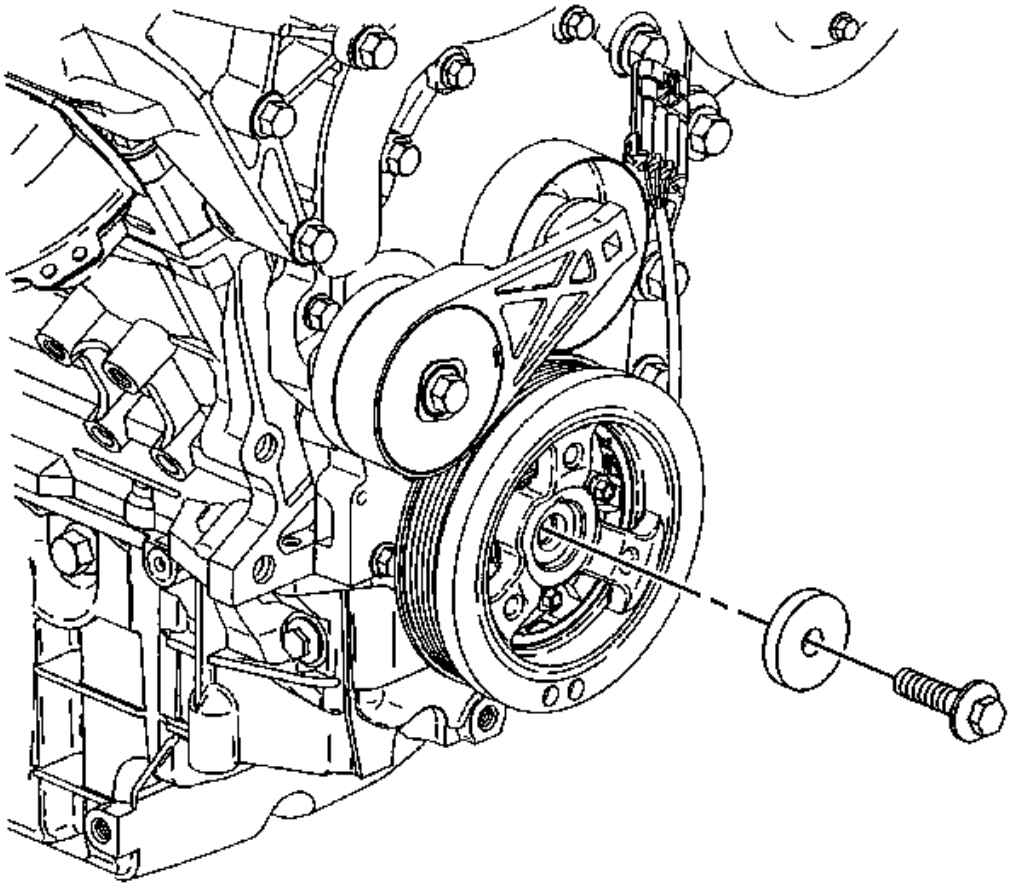

Fig. 98: Identifying Crankshaft Balancer Bolt & Washer
Courtesy of GENERAL MOTORS CORP.

10. Remove the crankshaft balancer bolt and the washer.

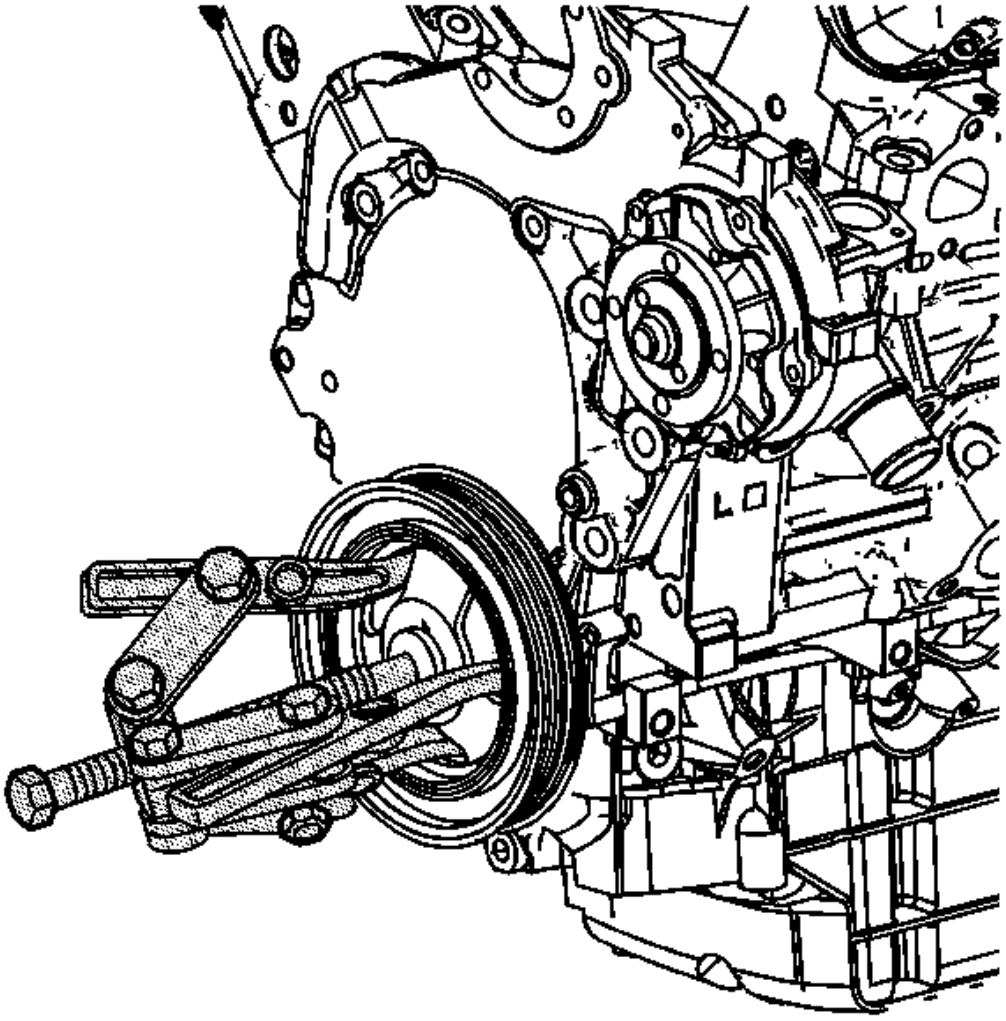

Fig. 99: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

11. Remove the crankshaft balancer. Use the **J 41816** . See **Special Tools** .

INSTALLATION PROCEDURE

1. Apply sealant to the keyway of the balancer. Refer to **Adhesives, Fluids, Lubricants, and Sealers** for the correct part number.

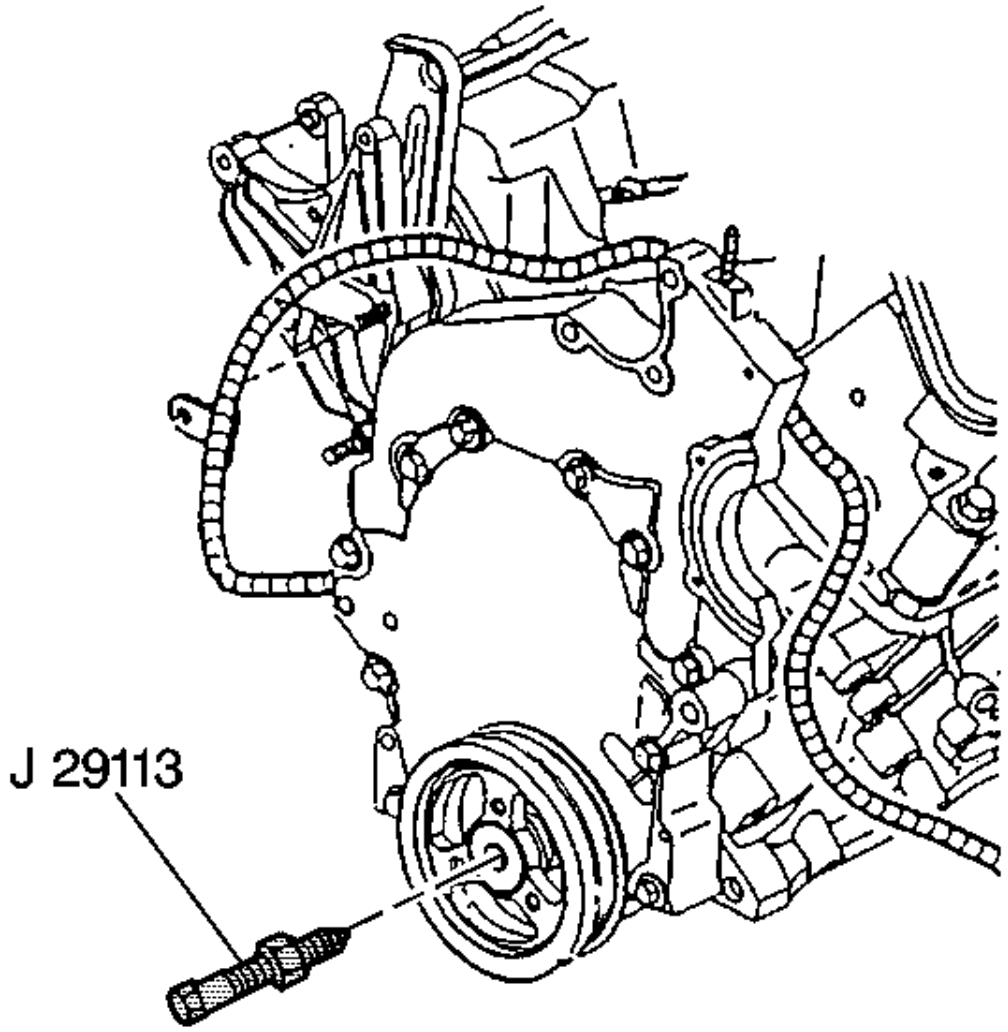

Fig. 100: Identifying Special Tools - J 29113
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do NOT use a power-assisted tool with the special tool in order to remove or install this component. You cannot properly control the alignment of this component using a power-assisted tool, and this can damage the component.

2. Install the crankshaft balancer. Use the **J 29113** . See **Special Tools** .
3. Remove the **J 29113** . See **Special Tools** .

4. Install the **J 37096** to the flywheel to prevent flywheel rotation. See **Special Tools** .

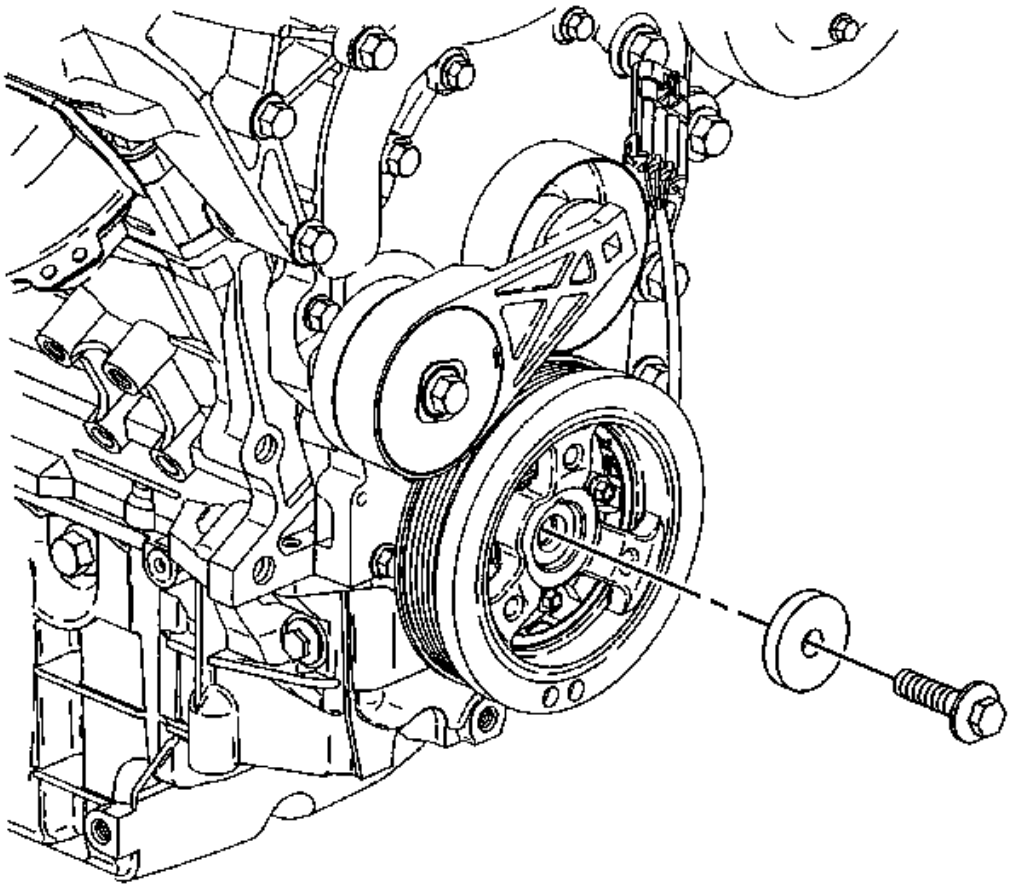

Fig. 101: Identifying Crankshaft Balancer Bolt & Washer
Courtesy of GENERAL MOTORS CORP.

5. Install the crankshaft balancer washer and the bolt.

CAUTION: Refer to Fastener Caution .

6. Install the used crankshaft balancer bolt.

Tighten: Tighten the used crankshaft balancer bolt to 125 N.m (92 lb ft).

7. Remove the used crankshaft balancer bolt.

8. Install the NEW crankshaft balancer bolt.

   Tighten:

   1. Tighten the crankshaft balancer bolt a first pass to 125 N.m (92 lb ft).
   2. Tighten the crankshaft balancer bolt a final pass to 130 degrees using the **J 45059** .

9. Remove the **J 37096** from the flywheel. See **Special Tools** .
10. Install the torque converter covers.
11. Raise the frame to the original position.
12. Install and tighten the frame bolts. Refer to **Frame Replacement (Convertible)** **Frame Replacement (Coupe 3.5L, 3.9L)** .
13. Install the right engine splash shield. Refer to **Radiator Air Side Baffle and Deflector Replacement** .
14. Install the right front tire and wheel. Refer to **Tire and Wheel Removal and Installation** .
15. Lower the vehicle.
16. Install the drive belt. Refer to **Drive Belt Replacement**.

OIL PAN REPLACEMENT

REMOVAL PROCEDURE

NOTE: The vehicle is equipped with a automatic transaxle to oil pan lower brace. The brace boss on the transaxle may interfere with oil pan removal.

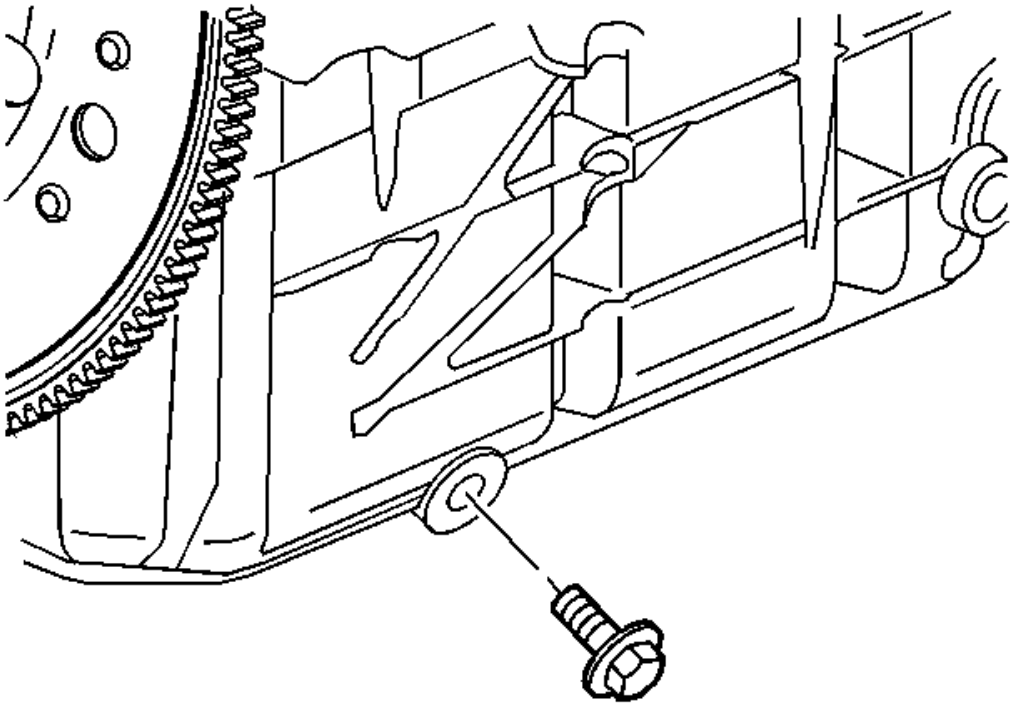

Fig. 102: View Of Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Remove the engine mount snubber and the drive belt. Refer to **Drive Belt Replacement**.
3. Remove the air cleaner inlet duct. Refer to **Air Cleaner Inlet Duct Replacement** .
4. Install the engine support fixture. Refer to **Engine Support Fixture**.
5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
6. Place a suitable drain pan under the oil pan drain plug.
7. Remove the oil pan drain plug and drain the engine oil from the crankcase.

CAUTION: Refer to Fastener Caution .

8. Reinstall the oil pan drain plug and tighten to 26 N.m (19 lb ft).
9. Remove the right front splash shield. Refer to **Engine Splash Shield Replacement - Right Side** .
10. Remove the starter. Refer to **Starter Replacement (LZ4 or LZE)** .

11. Remove the oil filter adapter. Refer to **Oil Filter Adapter and Bypass Valve Assembly Replacement**.

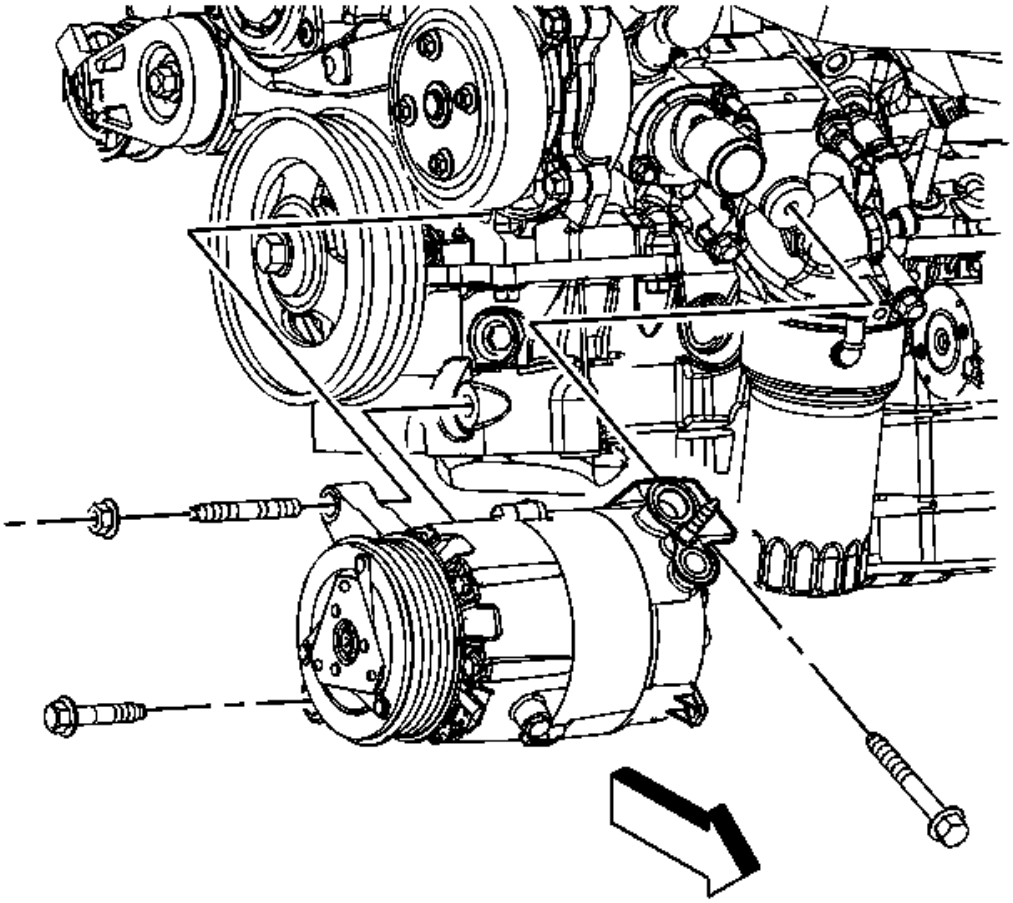

Fig. 103: View Of A/C compressor & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Remove the air conditioning (A/C) compressor bolts/nut and position the compressor aside.
13. Remove the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LZ4)** or **Catalytic Converter Replacement - Right Side (LZ4)** .

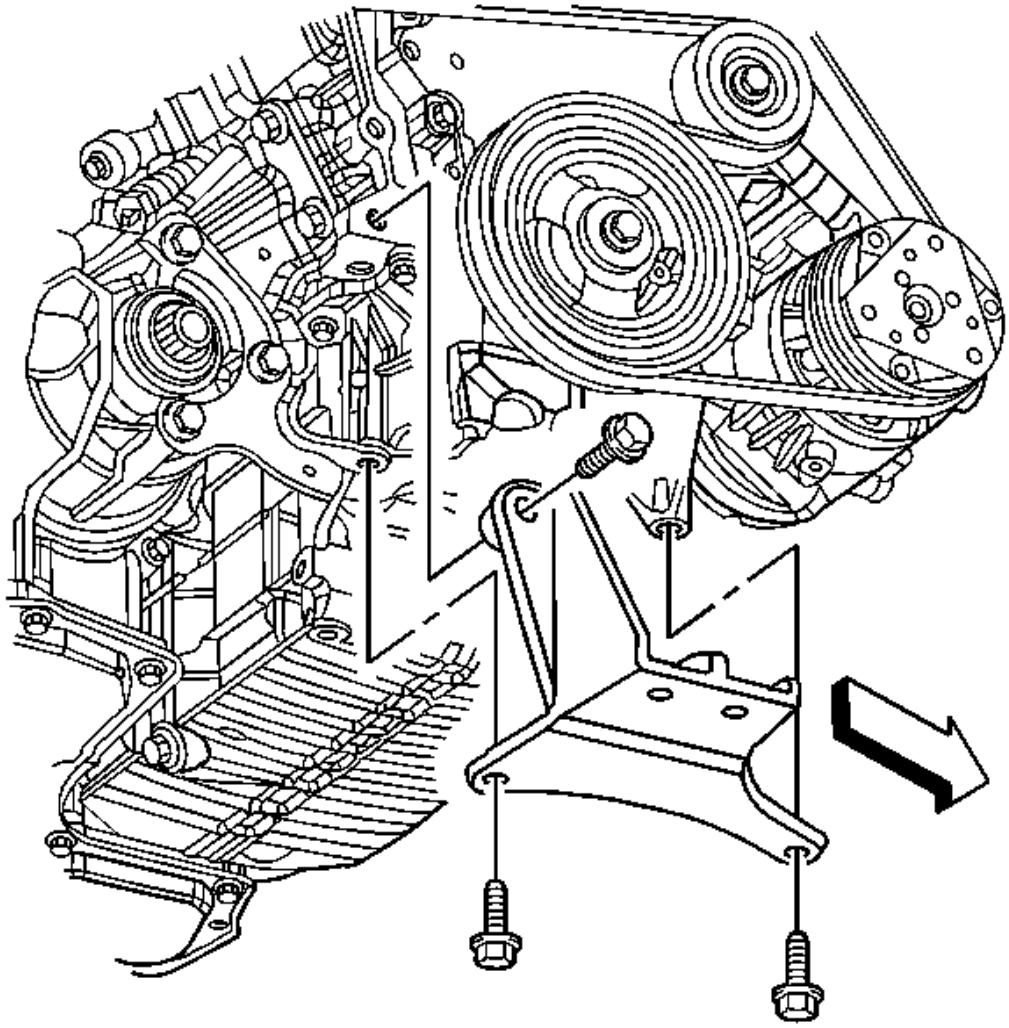

Fig. 104: Identifying Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

14. Remove the engine mount bracket bolts and bracket.

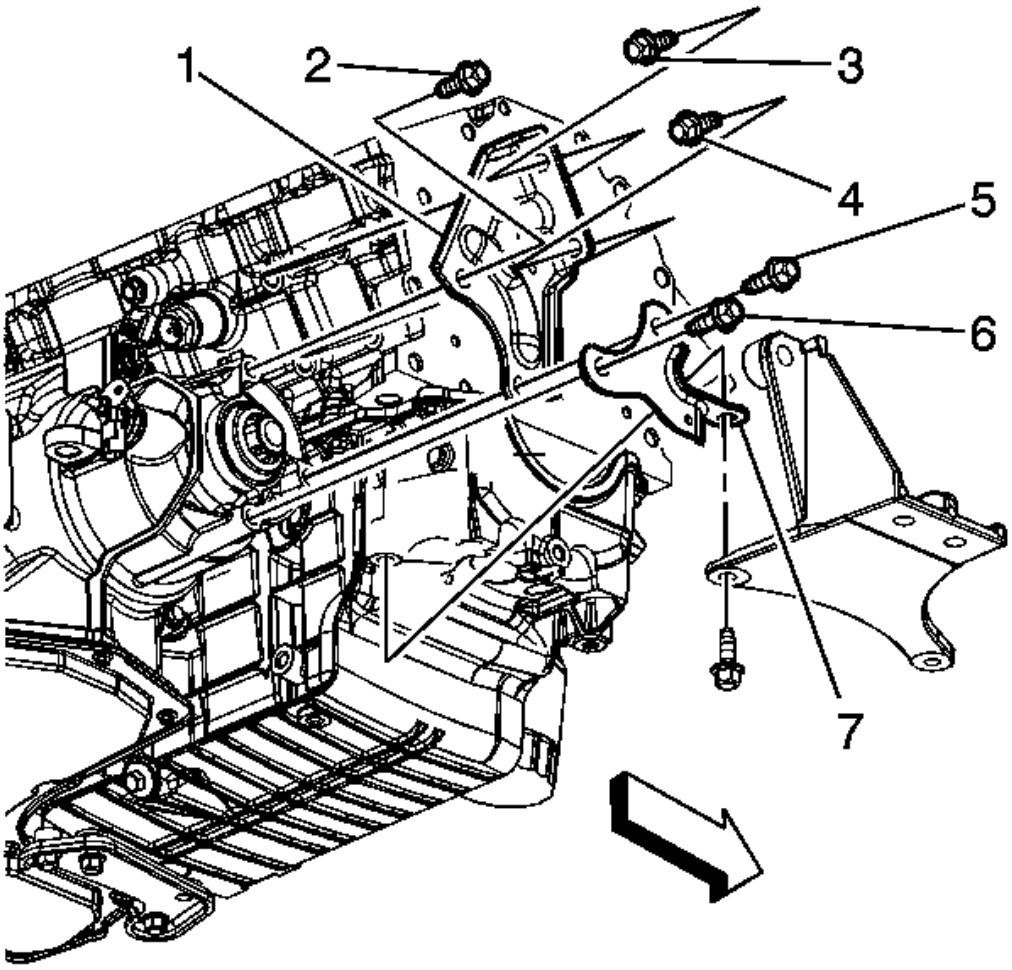

Fig. 105: Identifying Transaxle Brace & Bolts
Courtesy of GENERAL MOTORS CORP.

15. Remove the transaxle brace bolts (5, 6) and remove the brace (7).

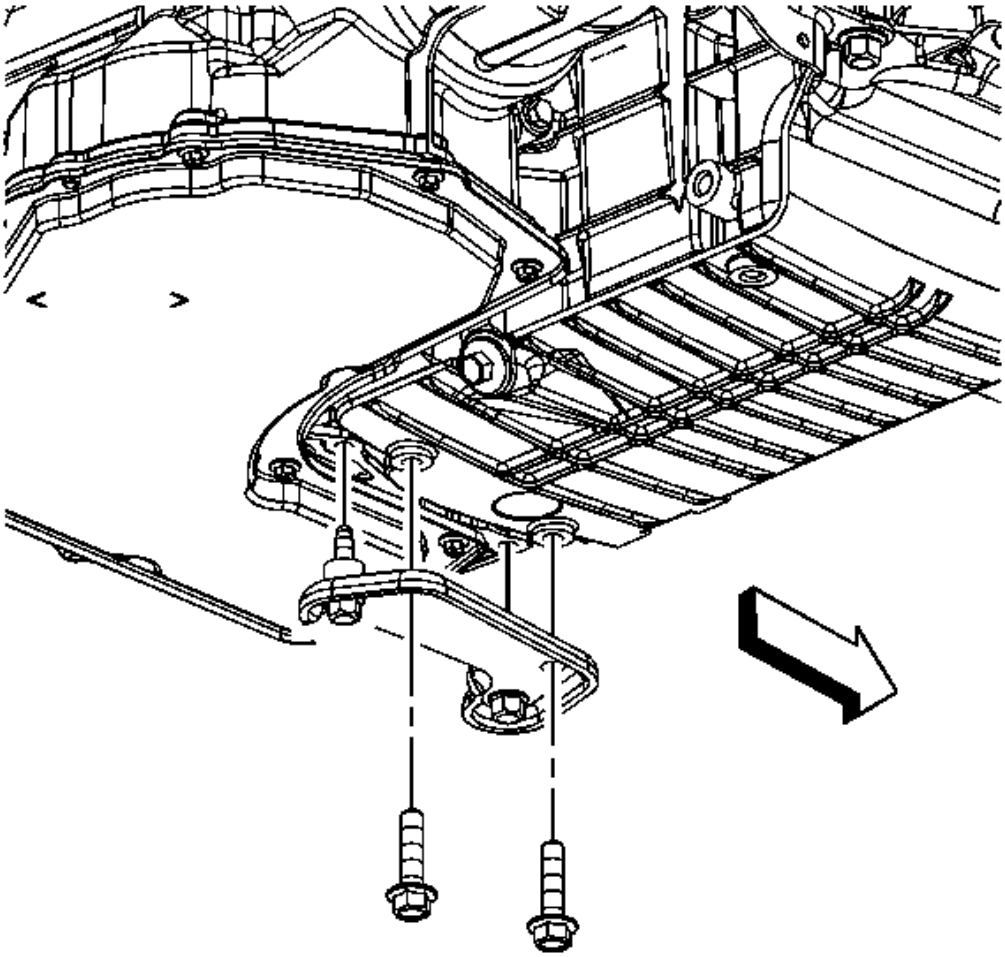

Fig. 106: Identifying Transmission To Engine Brace Bolts
Courtesy of GENERAL MOTORS CORP.

16. Remove the transaxle to oil pan brace bolts and brace.

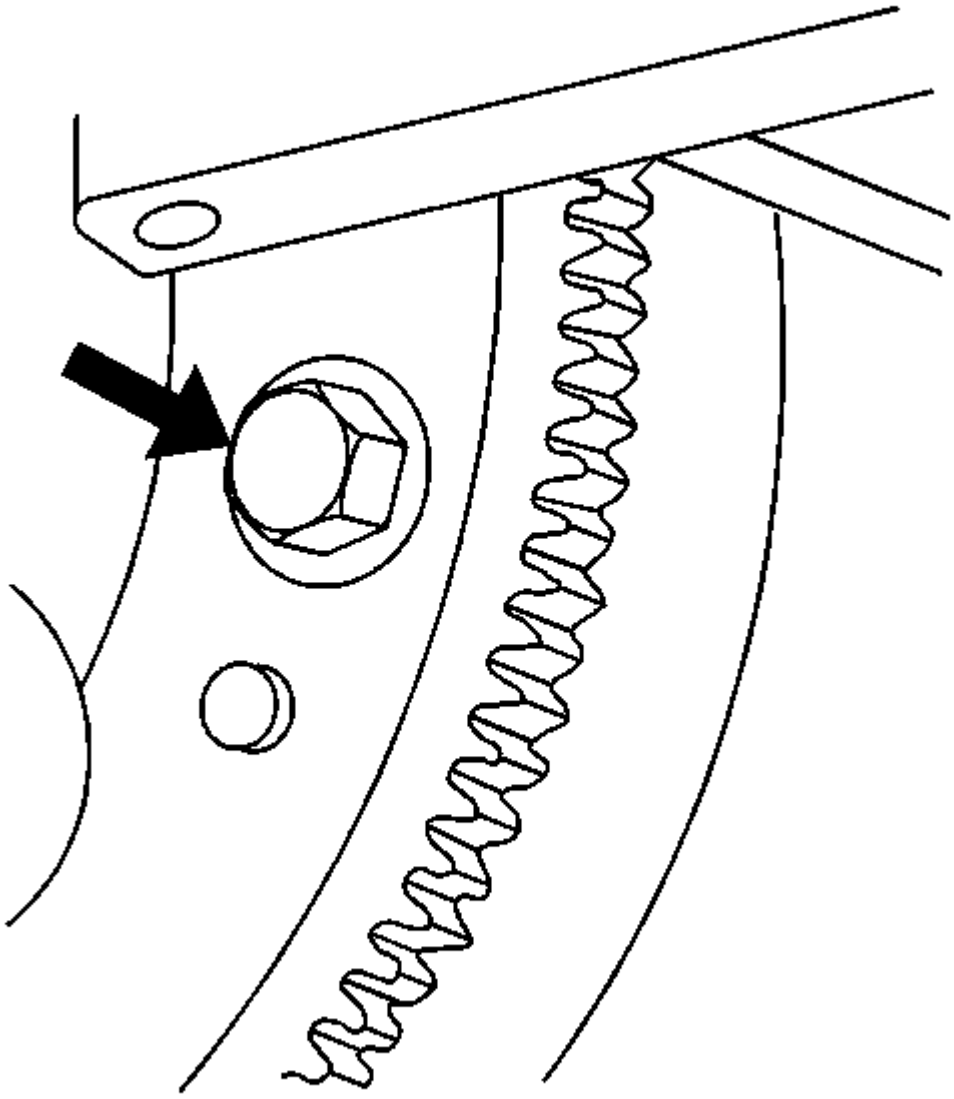

Fig. 107: View Of Flywheel To Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

17. Remove the flexplate to torque converter bolts.
18. Lower the vehicle.

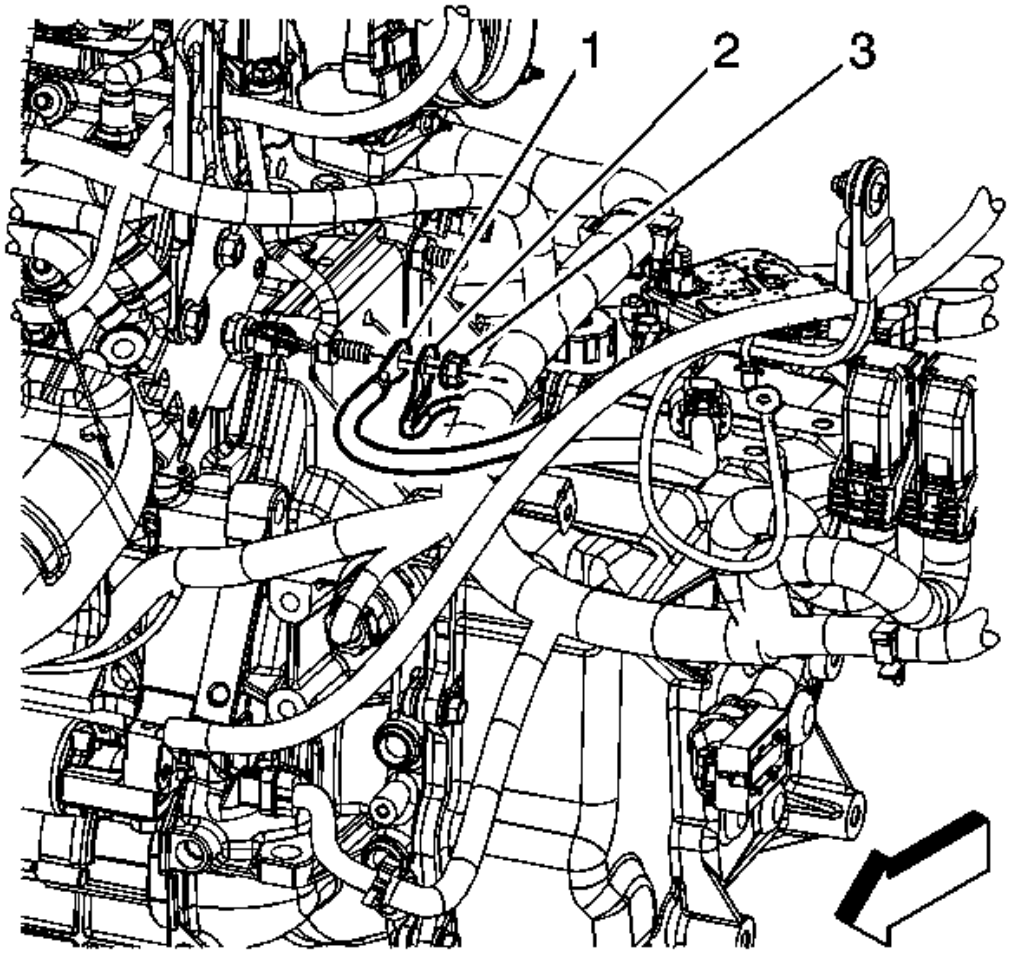

Fig. 108: Identifying Engine Wiring Harness Ground, & Negative Battery Cable Ground & Nut
Courtesy of GENERAL MOTORS CORP.

19. Remove the engine harness ground nut (3) from the transaxle stud.
20. Remove the engine wiring harness ground (2) and the negative battery cable ground (1) from the transaxle stud.

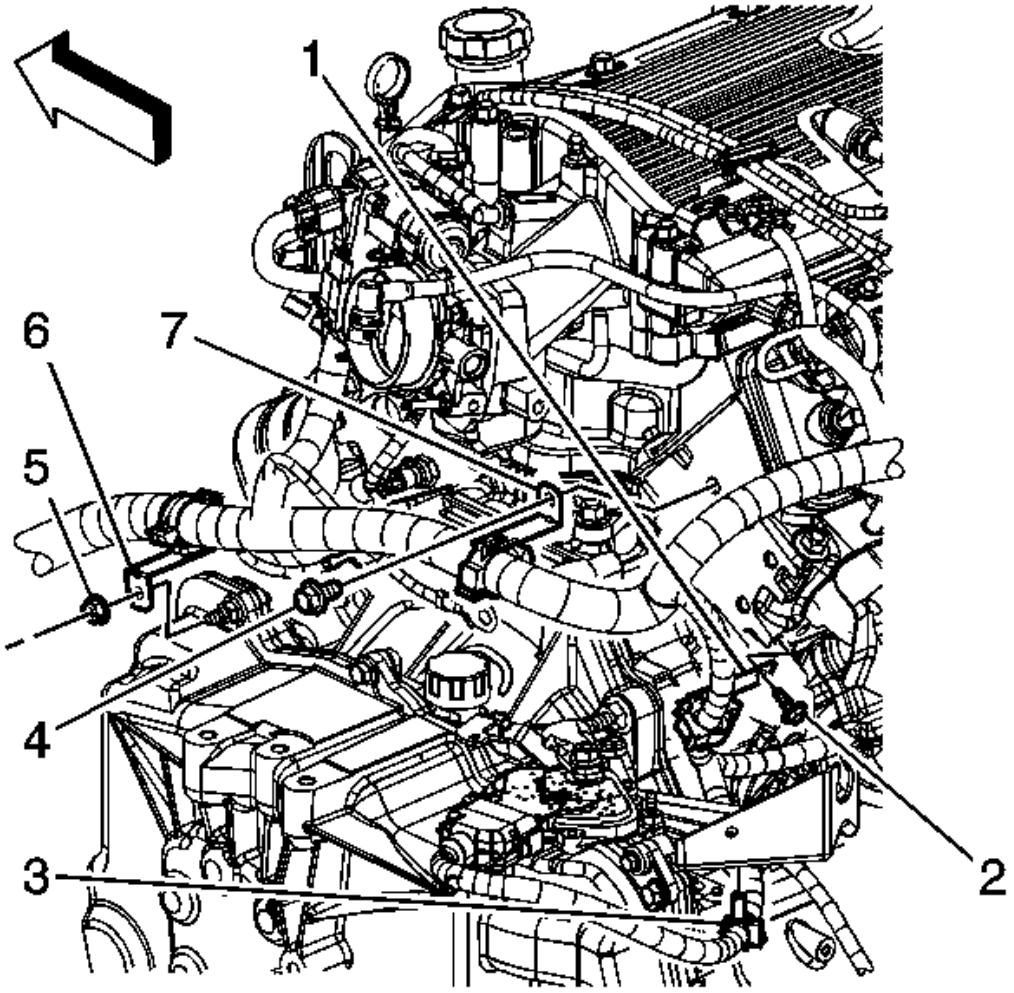

Fig. 109: Identifying Engine Wiring Harness Clips & Bolts
Courtesy of GENERAL MOTORS CORP.

21. Remove the engine wiring harness clip nut (5) from the transaxle stud.
22. Remove the engine wiring harness clip (6) from the transaxle stud.

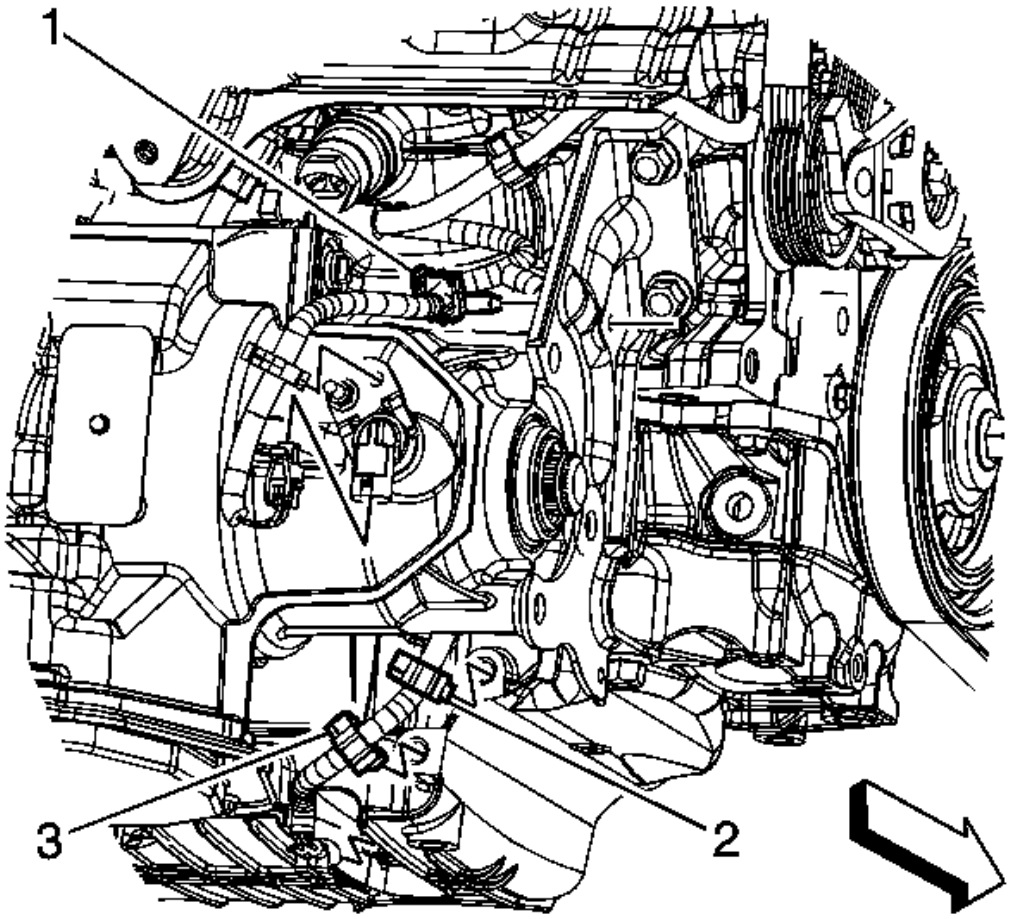

Fig. 110: Identifying Engine Wiring Harness Clip & Nut (At Oil Pan)
Courtesy of GENERAL MOTORS CORP.

23. Remove the engine wiring harness clips (2, 3) from the oil pan.

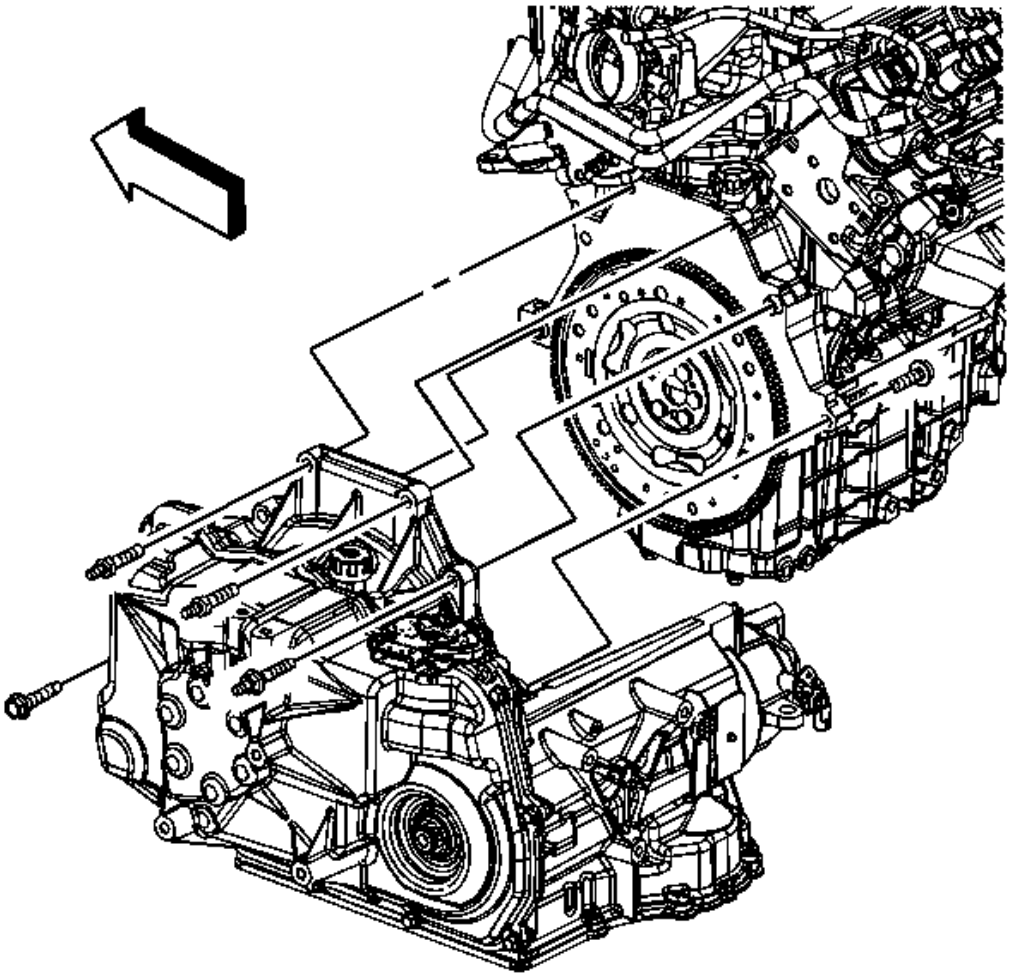

Fig. 111: Identifying Transaxle Studs & Bolts
Courtesy of GENERAL MOTORS CORP.

24. Loosen, DO NOT REMOVE the transaxle studs and bolts.
25. Using the engine support fixture, raise the engine and transaxle slightly.
26. Raise and support the vehicle.

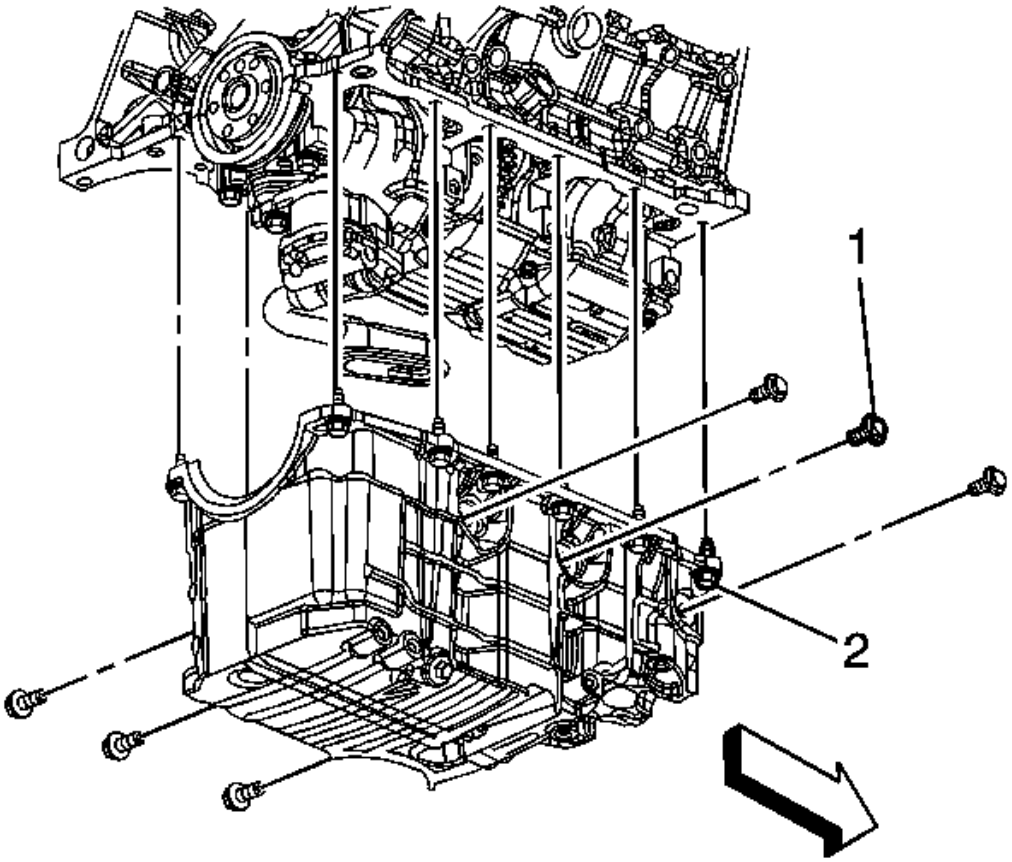

Fig. 112: View Of Oil Pan & Bolts
Courtesy of GENERAL MOTORS CORP.

27. Remove the oil pan bolts (1, 2).
28. Separate the engine and transaxle approximately 13 mm (1/2 inch).

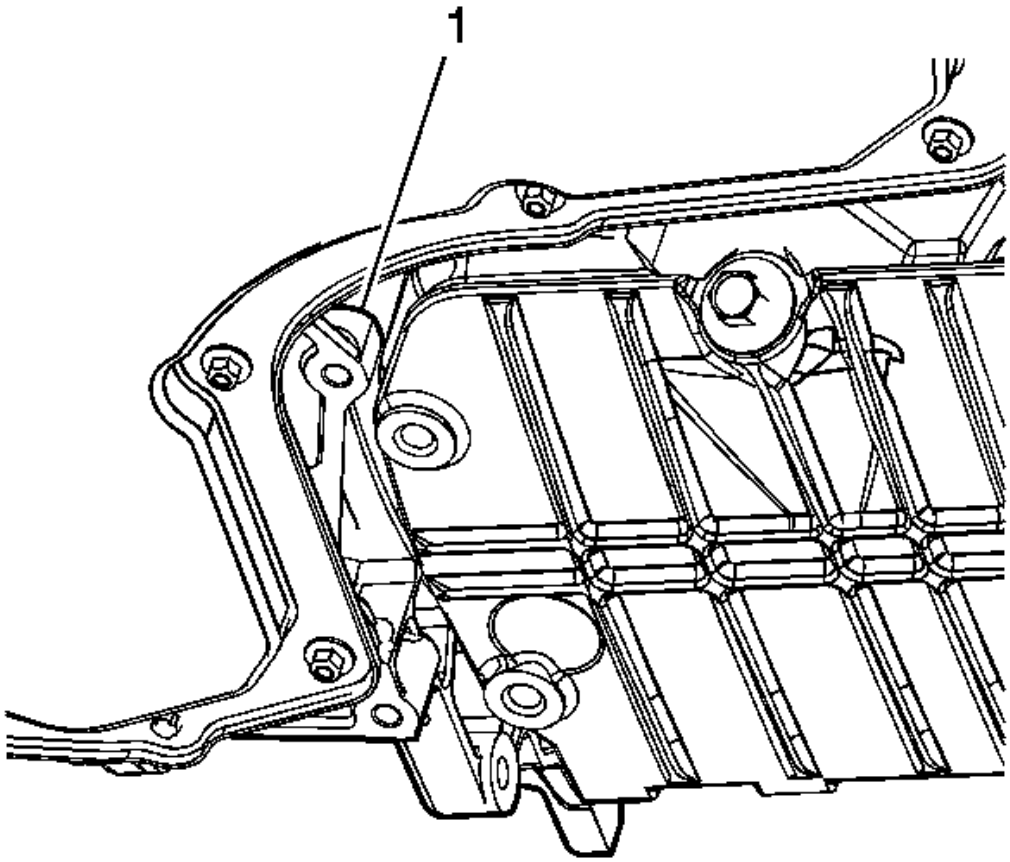

Fig. 113: Identifying Transaxle Boss
Courtesy of GENERAL MOTORS CORP.

29. Ensure that when removing the oil pan, the pan clears the boss (1) on the transaxle.
30. Remove the oil pan. If the oil pan cannot be removed, use the engine support fixture to raise the engine until the pan can be removed.
31. Remove and discard the oil pan gasket.
32. Clean the oil pan sealing surfaces.

INSTALLATION PROCEDURE

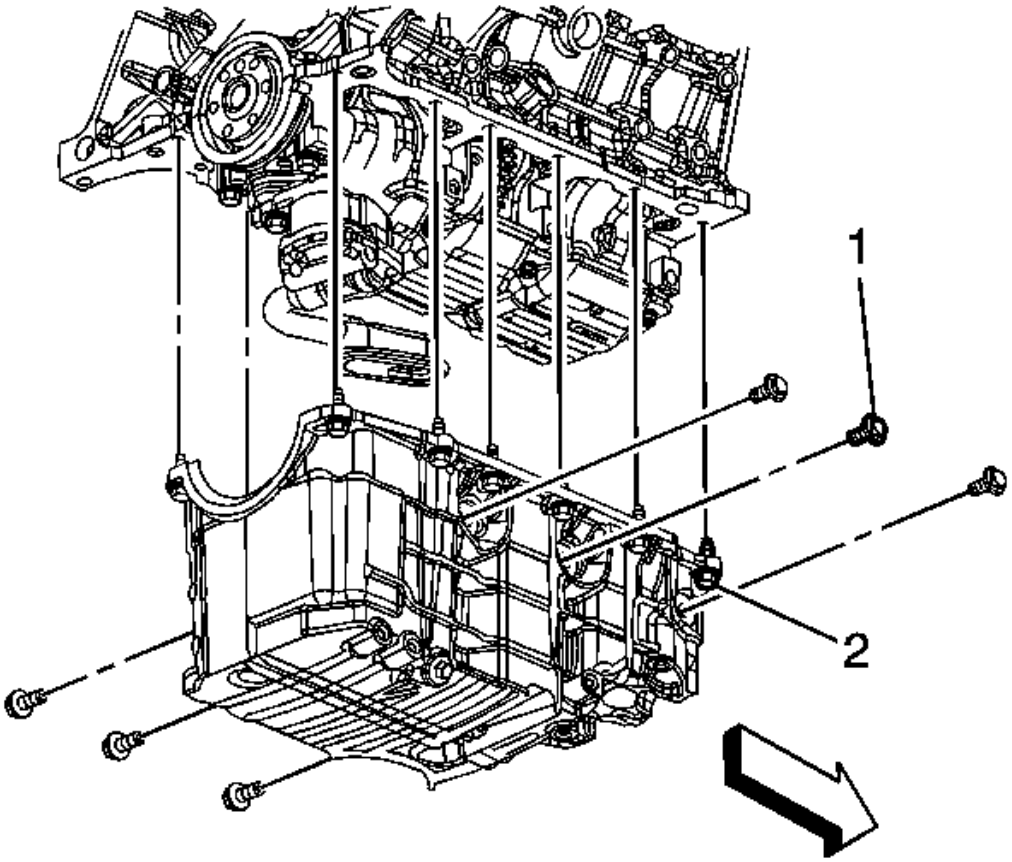

Fig. 114: View Of Oil Pan & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Apply sealer to both sides of the front cover/block mating area. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
2. Apply sealer to both sides of the crankcase rear main bearing cap. Press the sealer into the gap using a putty knife. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
3. Install a NEW oil pan gasket.
4. Install the oil pan.
5. Install the oil pan bolts (1, 2).
    - Tighten the bolts (1) to 50 N.m (37 lb ft) + 50 degrees.
    - Tighten the bolts (2) to 25 N.m (18 lb ft).

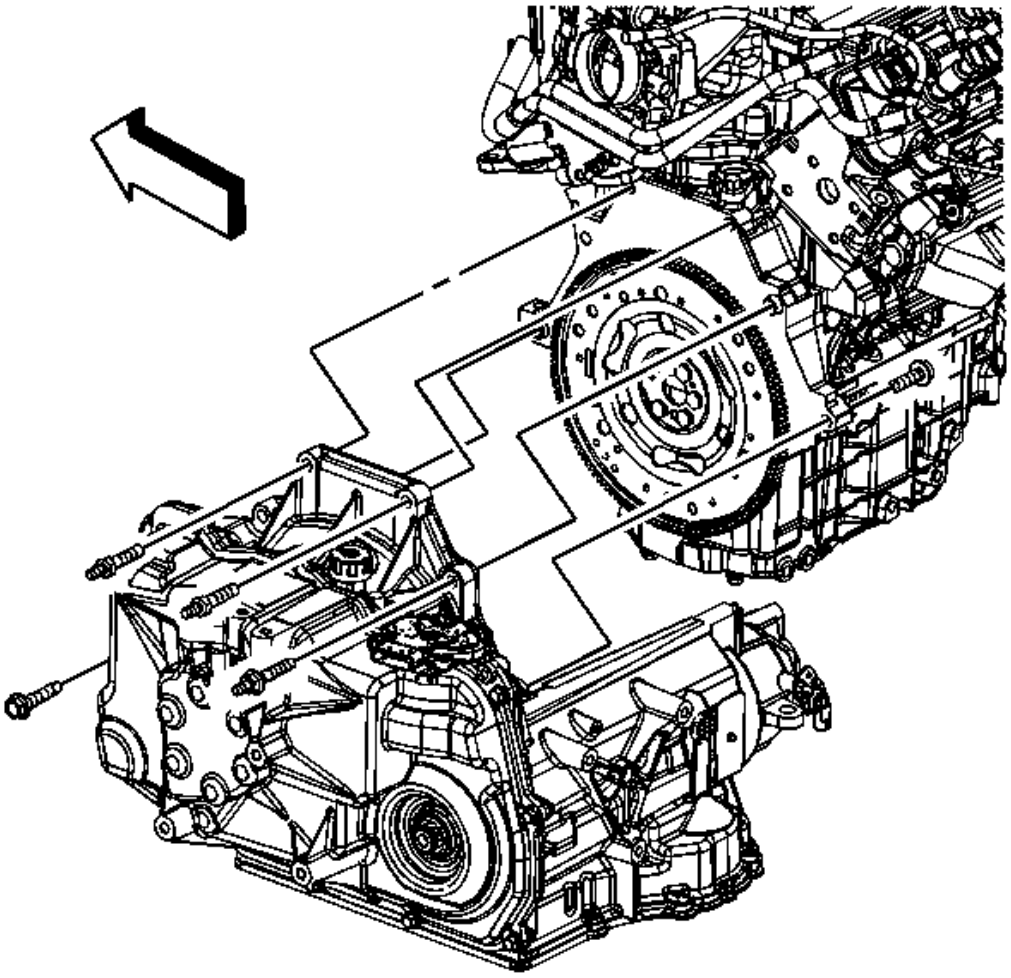

Fig. 115: Identifying Transaxle Studs & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Lower the vehicle.
7. Using the engine support fixture, lower the engine and transaxle.
8. Tighten the transaxle studs and bolts to 75 N.m (55 lb ft).

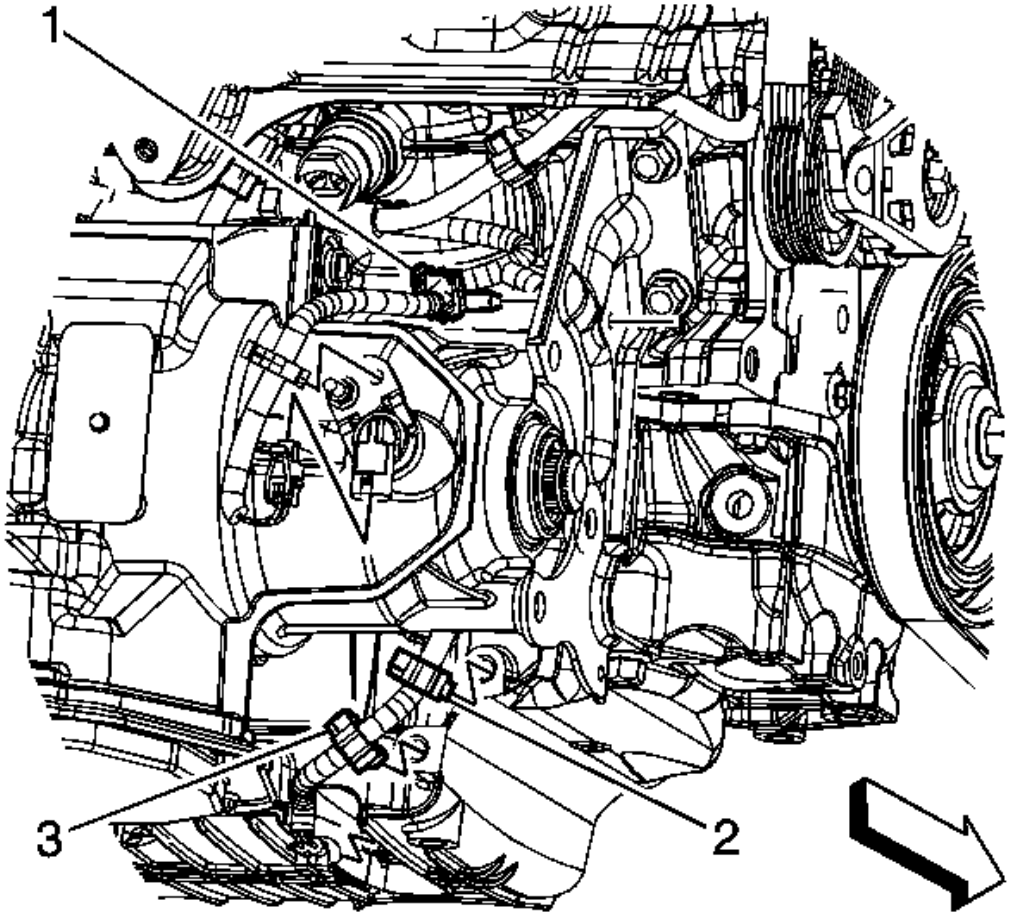

Fig. 116: Identifying Engine Wiring Harness Clip & Nut (At Oil Pan)
Courtesy of GENERAL MOTORS CORP.

9. Install the engine wiring harness clips (2, 3) to the oil pan.

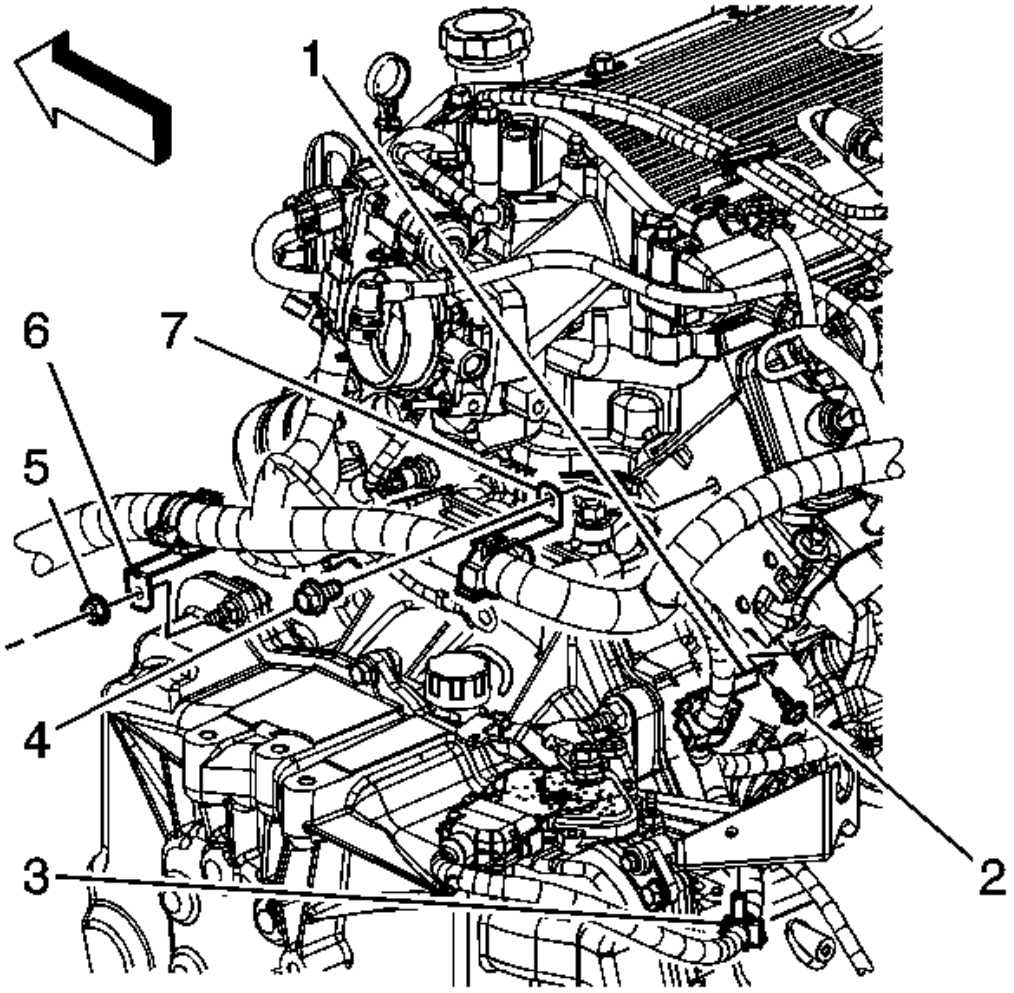

Fig. 117: Identifying Engine Wiring Harness Clips & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Install the engine wiring harness clip (6) to the transaxle stud.
11. Install the engine wiring harness clip nut (5) to the transaxle stud and tighten to 25 N.m (18 lb ft).

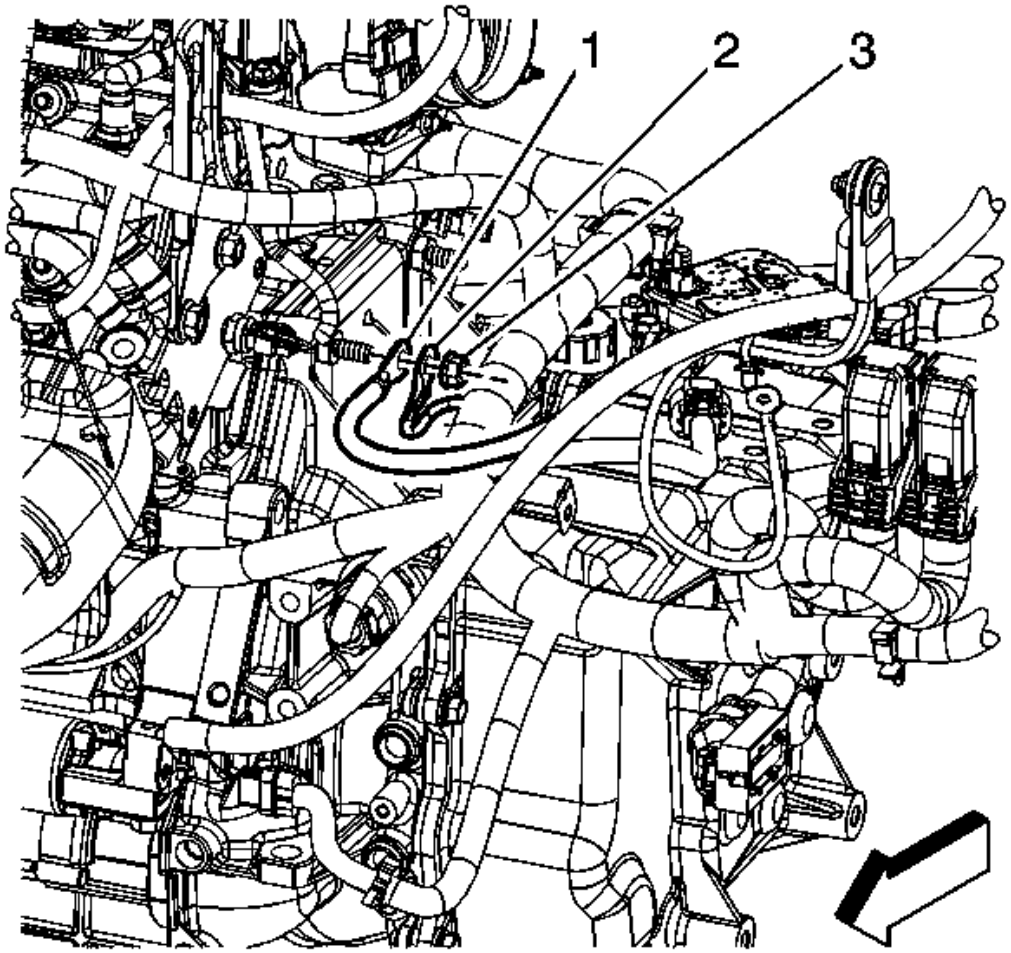

Fig. 118: Identifying Engine Wiring Harness Ground, & Negative Battery Cable Ground & Nut
Courtesy of GENERAL MOTORS CORP.

12. Install the negative battery cable ground (1) and the engine wiring harness ground (2) to the transaxle stud.
13. Install the engine harness ground nut (3) to the transaxle stud and tighten the nut to 25 N.m (18 lb ft).

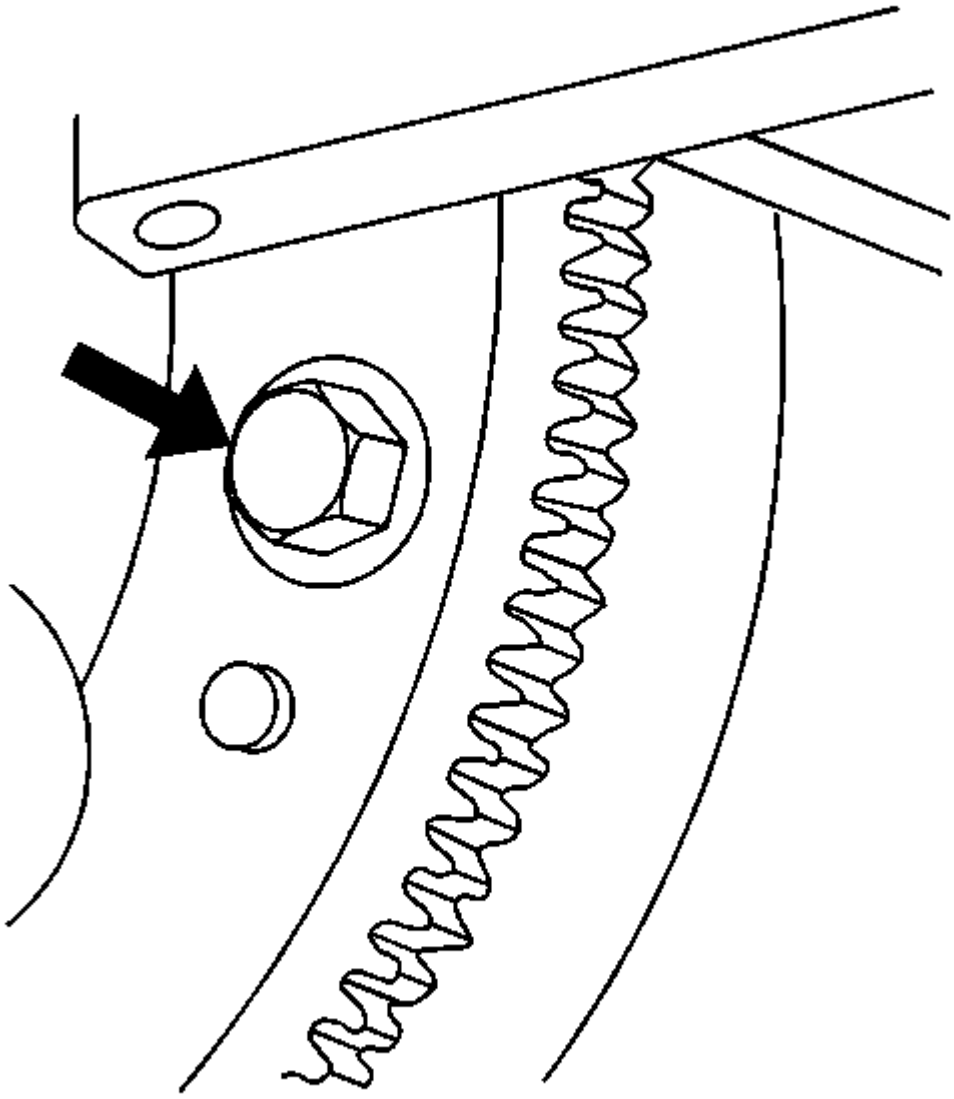

Fig. 119: View Of Flywheel To Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

14. Raise and support the vehicle.
15. Install the flexplate to torque converter bolts and tighten to 62 N.m (46 lb ft).

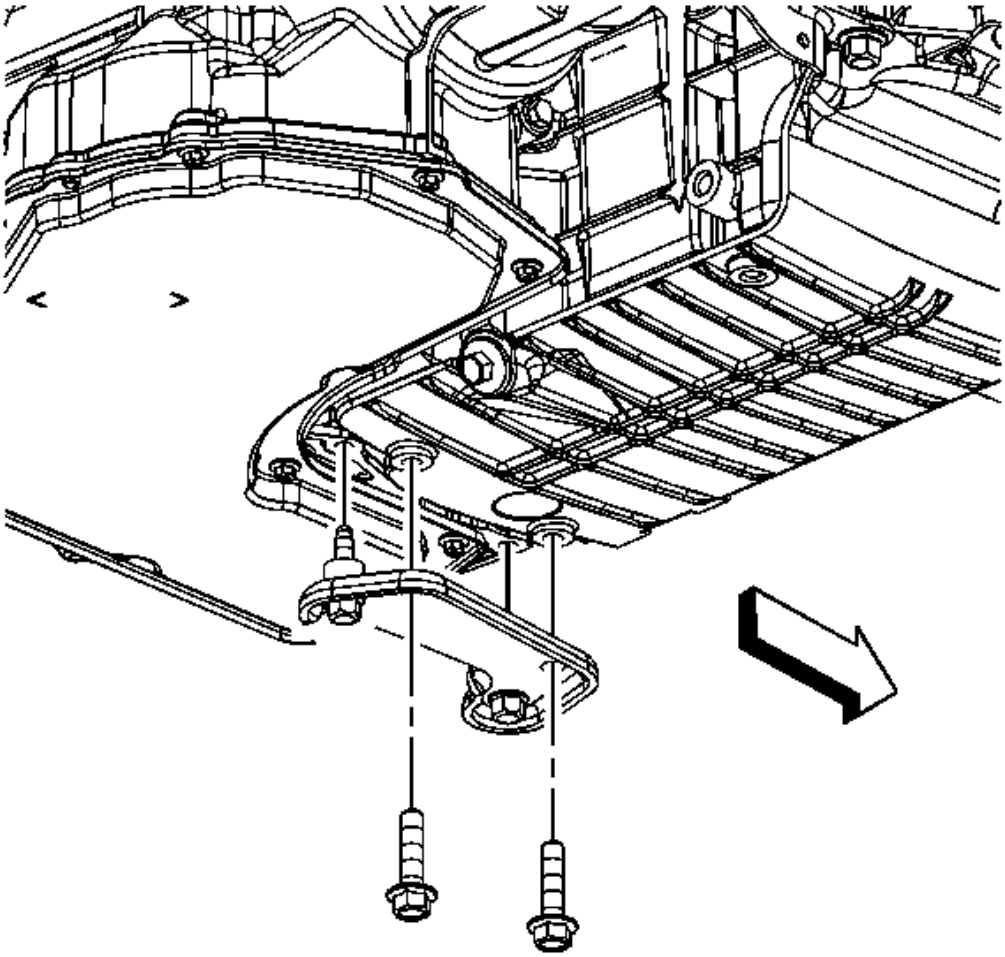

Fig. 120: Identifying Transmission To Engine Brace Bolts
Courtesy of GENERAL MOTORS CORP.

16. Position the transaxle to oil pan brace and install the bolts.

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

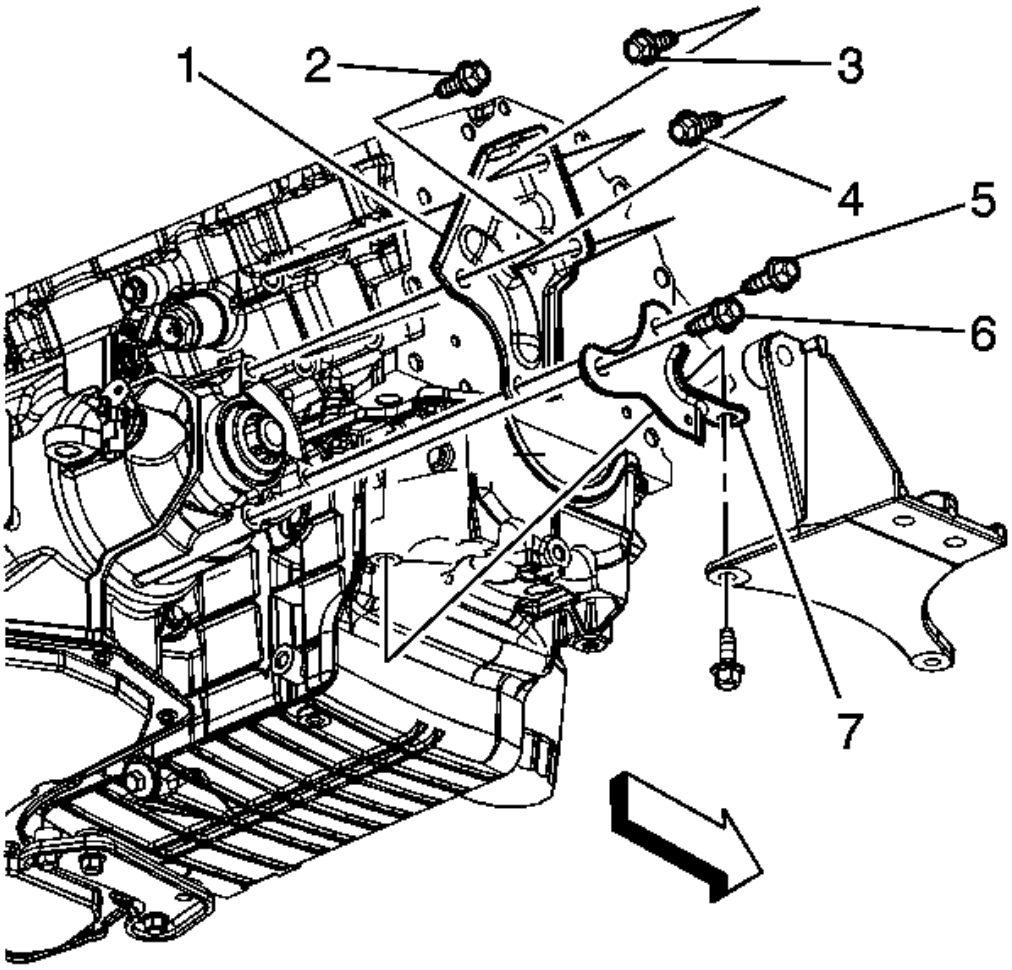

Fig. 121: Identifying Transaxle Brace & Bolts
Courtesy of GENERAL MOTORS CORP.

17. Position the transaxle brace (7) to the transaxle and install the bolts (5, 6) until snug.
18. Install the engine wiring harness clip to the rear of the transaxle brace.

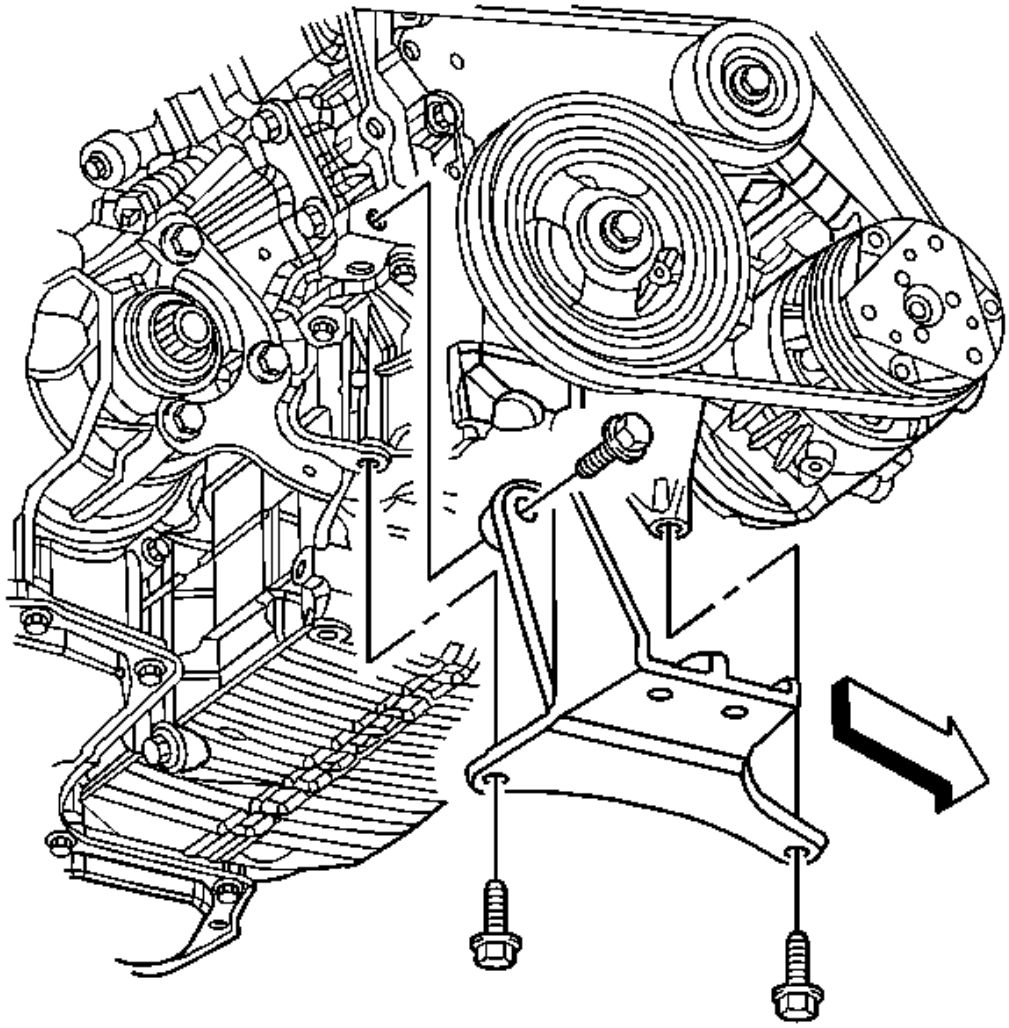

Fig. 122: Identifying Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

19. Position the engine mount bracket to the engine and install the bolts until snug.
20. Tighten the engine mount bracket bolts and transaxle brace bolts.
    - Tighten the engine mount bracket upper bolt to 90 N.m (66 lb ft).
    - Tighten the engine mount bracket lower bolts to 50 N.m (37 lb ft).
    - Tighten the transaxle brace bolts to 72 N.m (53 lb ft).
21. Install the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LZ4)** and **Catalytic Converter Replacement - Right Side (LZ4)** .

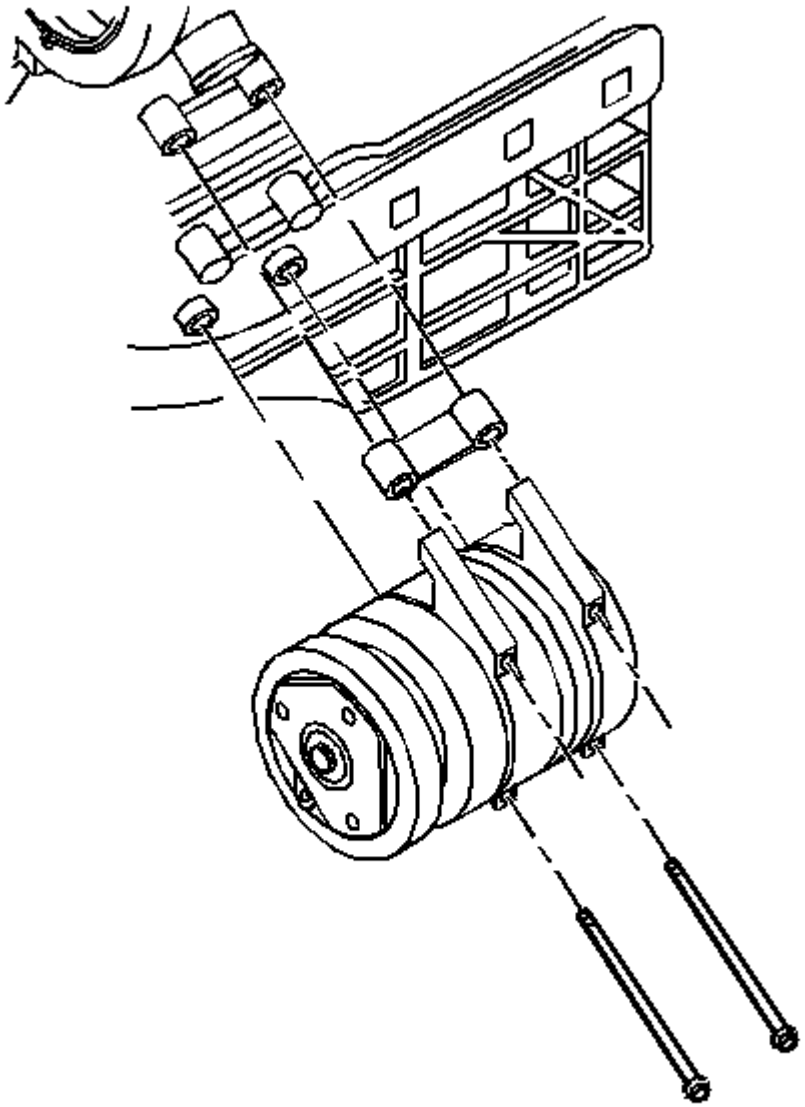

Fig. 123: Removing A/C Compressor, Bolts & Brace
Courtesy of GENERAL MOTORS CORP.

22. Position the A/C compressor and install the bolts. Tighten the bolts to 50 N.m (37 lb ft)

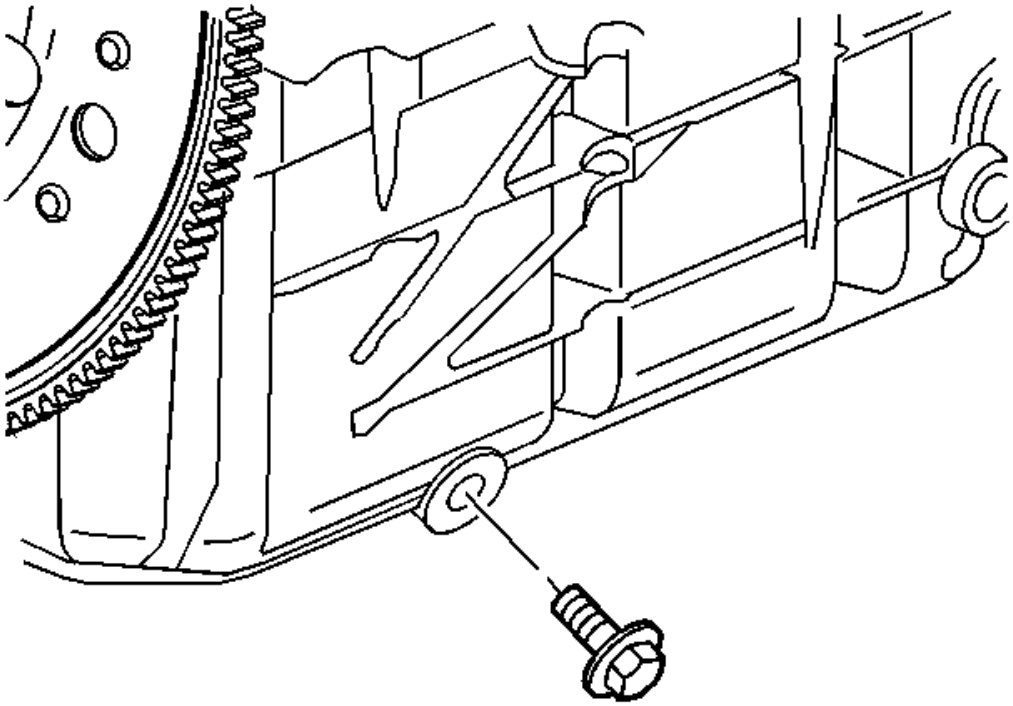

Fig. 124: View Of Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

23. Install the oil filter adapter. Refer to **Oil Filter Adapter and Bypass Valve Assembly Replacement**.
24. Install the starter. Refer to **Starter Replacement (LZ4 or LZE)** .
25. Install the right front splash shield. Refer to **Engine Splash Shield Replacement - Right Side** .
26. Ensure that the oil pan drain plug is tighten to 26 N.m (19 lb ft).
27. Lower the vehicle.
28. Remove the engine support fixture.
29. Install the air cleaner inlet duct. Refer to **Air Cleaner Inlet Duct Replacement** .
30. Install the drive belt and the engine mount snubber. Refer to **Drive Belt Replacement**.
31. Fill the crankcase with oil.
32. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
33. Start the engine and inspect for leaks.

ENGINE OIL PRESSURE SENSOR AND/OR SWITCH REPLACEMENT

REMOVAL PROCEDURE

1. Disconnect the battery negative cable from the battery. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Remove the electrical connector from the engine oil pressure sensor.

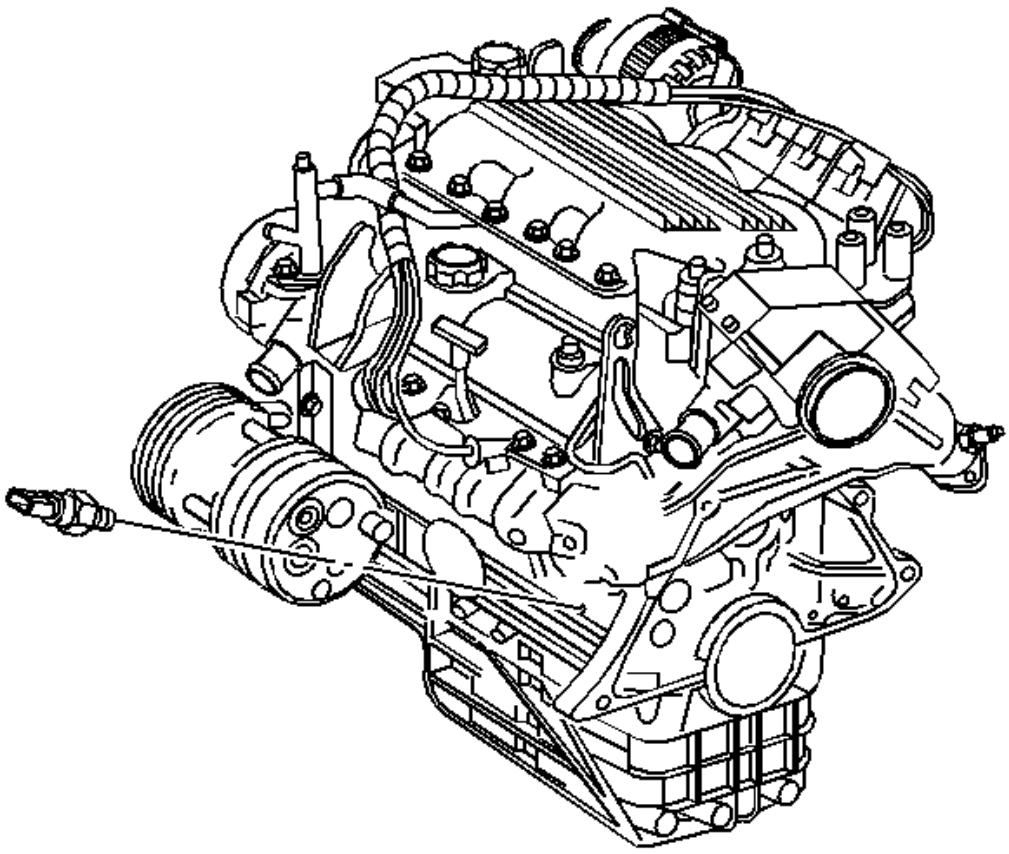

Fig. 125: View Of Oil Pressure Switch
Courtesy of GENERAL MOTORS CORP.

3. Remove the engine oil pressure switch.

INSTALLATION PROCEDURE

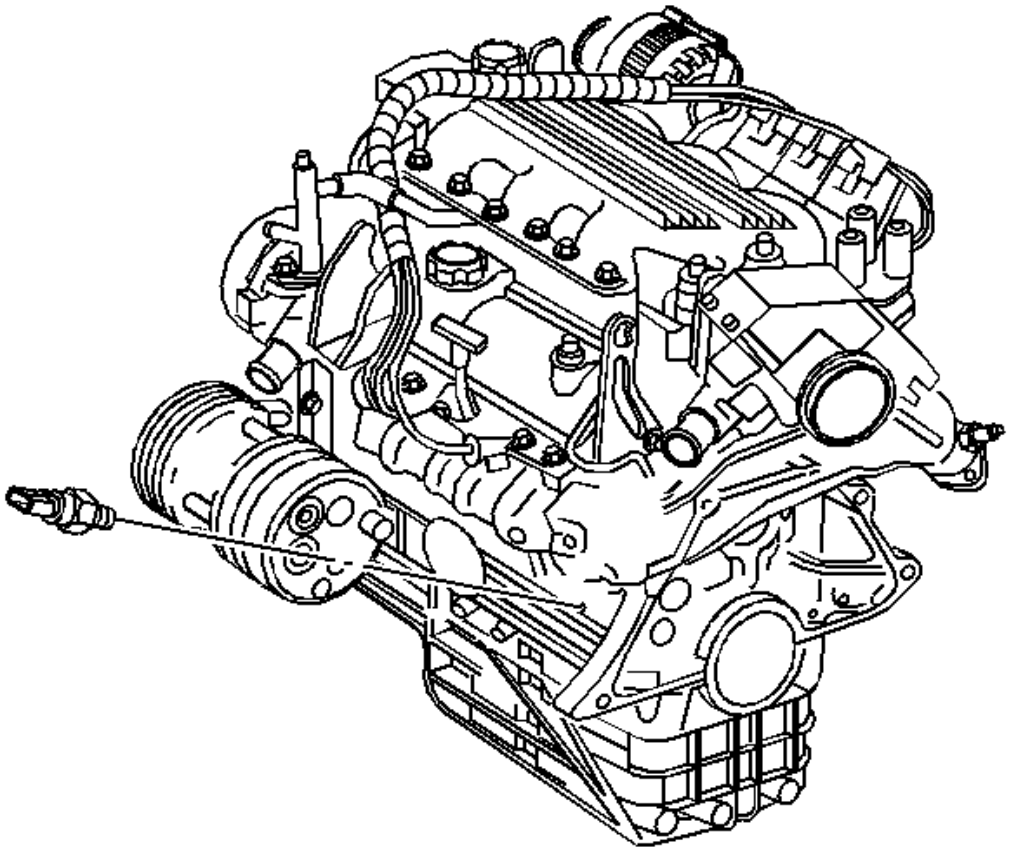

Fig. 126: View Of Oil Pressure Switch
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the engine oil pressure switch.

   Tighten: Tighten the switch to 16 N.m (12 lb ft).

2. Install the electrical connector to the engine oil pressure switch.
3. Connect the battery negative cable to the battery. Refer to **Battery Negative Cable Disconnection and Connection** .

OIL PUMP REPLACEMENT

REMOVAL PROCEDURE

1. Remove the oil pan. Refer to **Oil Pan Replacement**.

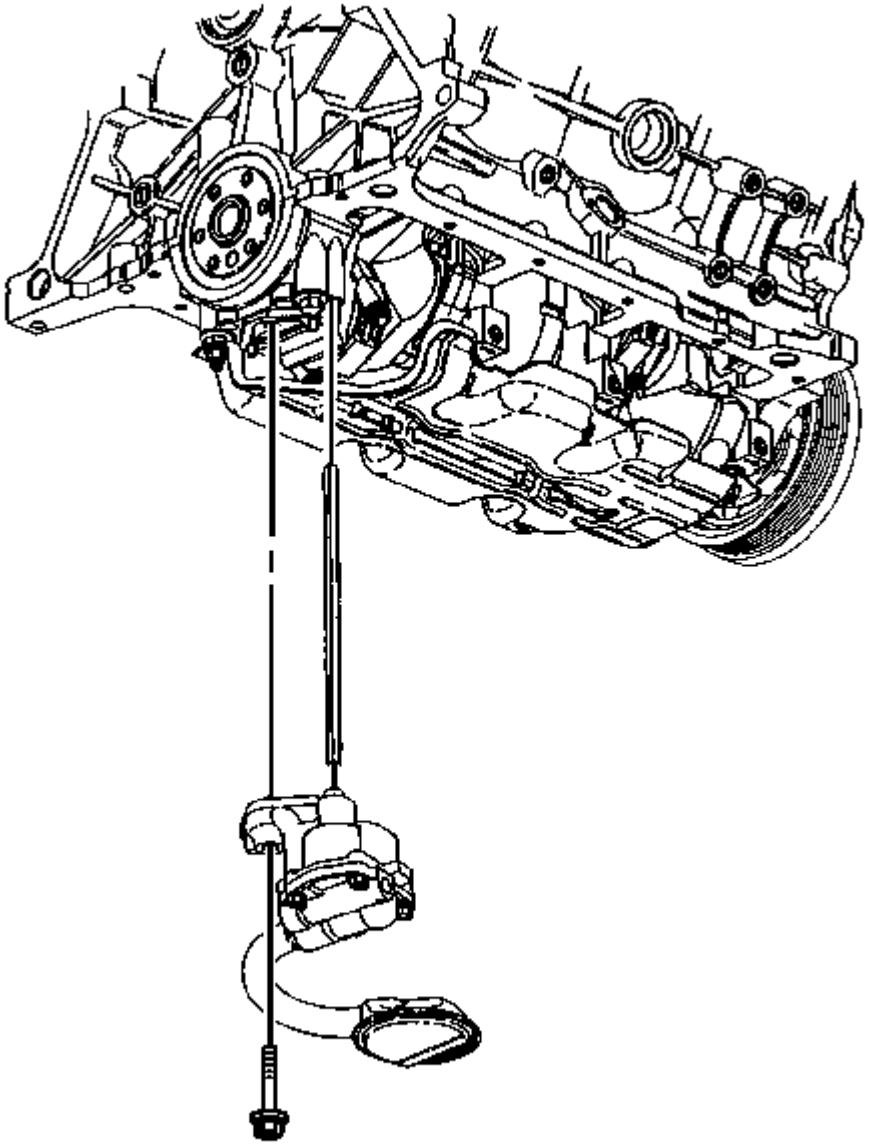

Fig. 127: Identifying Oil Pump & Oil Pump Drive Shaft
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil pump bolt.
3. Remove the oil pump and the oil pump drive shaft.
4. Inspect the oil pump drive shaft and the oil pump. Refer to **Oil Pump Cleaning and Inspection** .

INSTALLATION PROCEDURE

NOTE: Rotate the oil pump drive shaft as necessary in order to obtain the engagement with the oil pump drive unit.

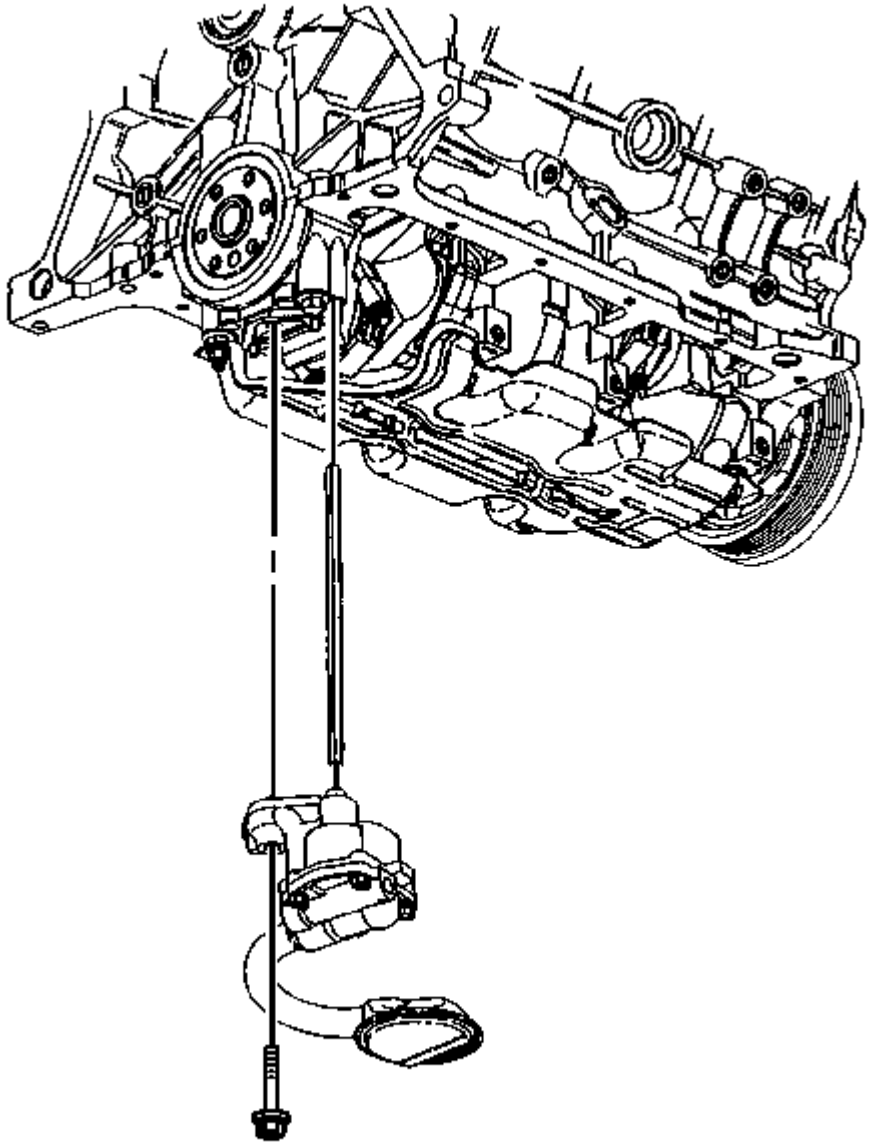

Fig. 128: Identifying Oil Pump & Oil Pump Drive Shaft
Courtesy of GENERAL MOTORS CORP.

1. Install the oil pump drive shaft and the oil pump.

CAUTION: Refer to Fastener Caution .

2. Install the oil pump bolt.

   Tighten: Tighten the bolt to 41 N.m (30 lb ft).

3. Install the oil pan. Refer to **Oil Pan Replacement**.

OIL PUMP DRIVE REPLACEMENT

REMOVAL PROCEDURE

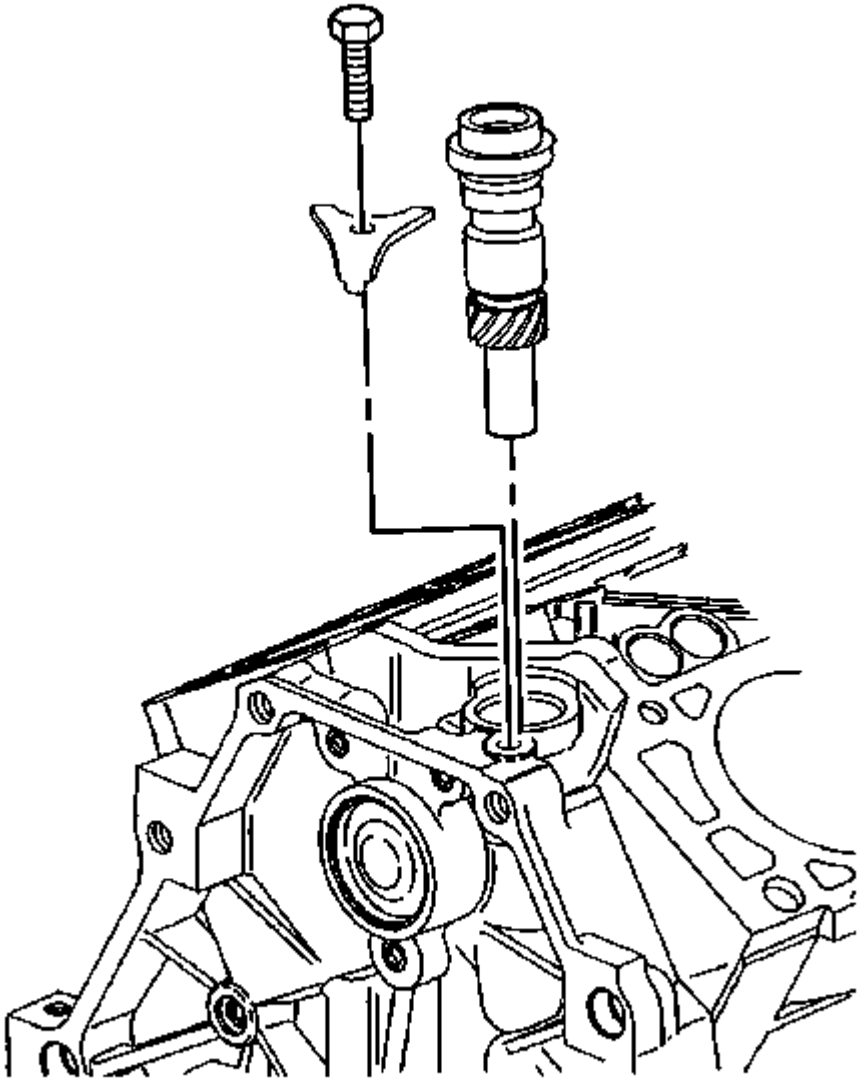

Fig. 129: View Of Oil Pump, Drive Bolt, & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .
2. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.
3. Remove the oil pump drive bolt.
4. Remove the oil pump drive clamp.
5. Remove the oil pump drive.

6. Remove the oil pump drive seal.

INSTALLATION PROCEDURE

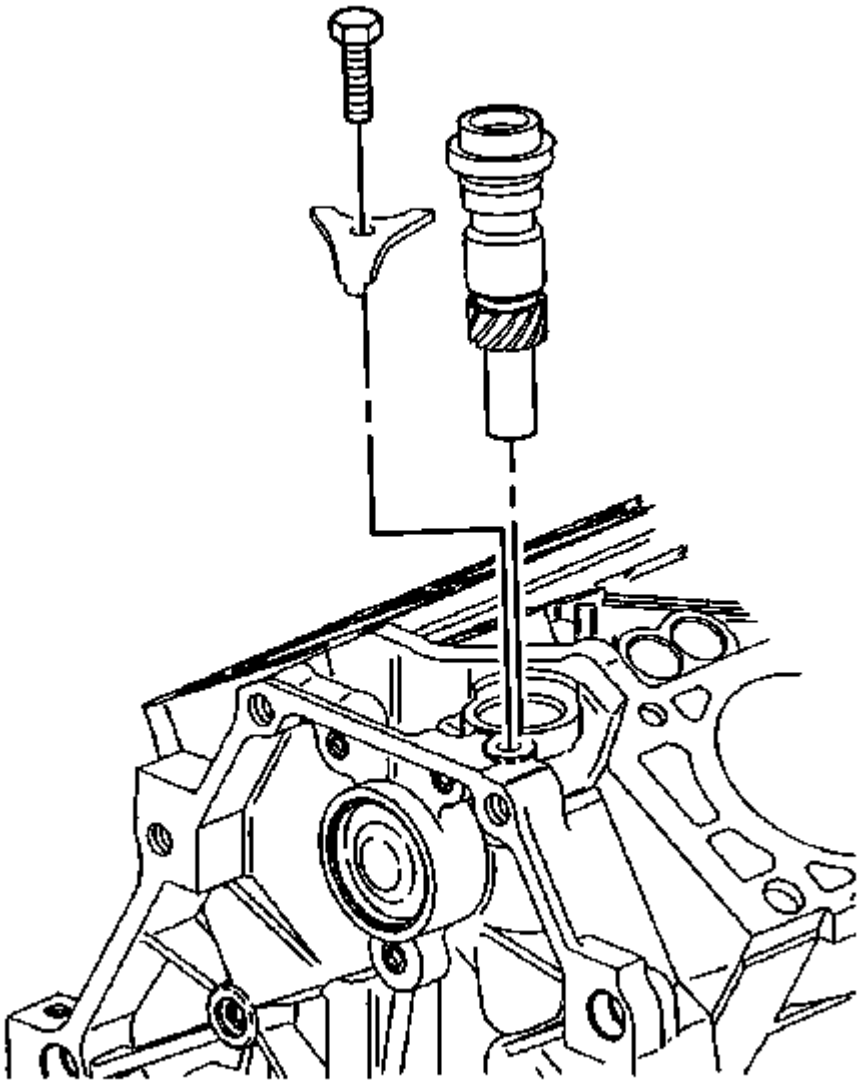

Fig. 130: View Of Oil Pump, Drive Bolt, & Clamp
Courtesy of GENERAL MOTORS CORP.

1. Install the oil pump drive seal. Coat the seal or bore in the engine block with engine oil.
2. Coat the drive gear on the oil pump drive with prelube. Refer to **Adhesives, Fluids, Lubricants, and**

Sealers for the correct part number.

3. Install the oil pump drive.
4. Install the oil pump drive clamp.

CAUTION: Refer to Fastener Caution .

5. Install the oil pump drive bolt.

   Tighten: Tighten the bolt to 36 N.m (27 lb ft).

6. Install the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.
7. Install the air cleaner outlet duct. Refer to **Air Cleaner Outlet Duct Replacement** .

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

SPECIAL TOOLS

EN-48869 Front Crankshaft Seal Installer. See **Special Tools** .

REMOVAL PROCEDURE

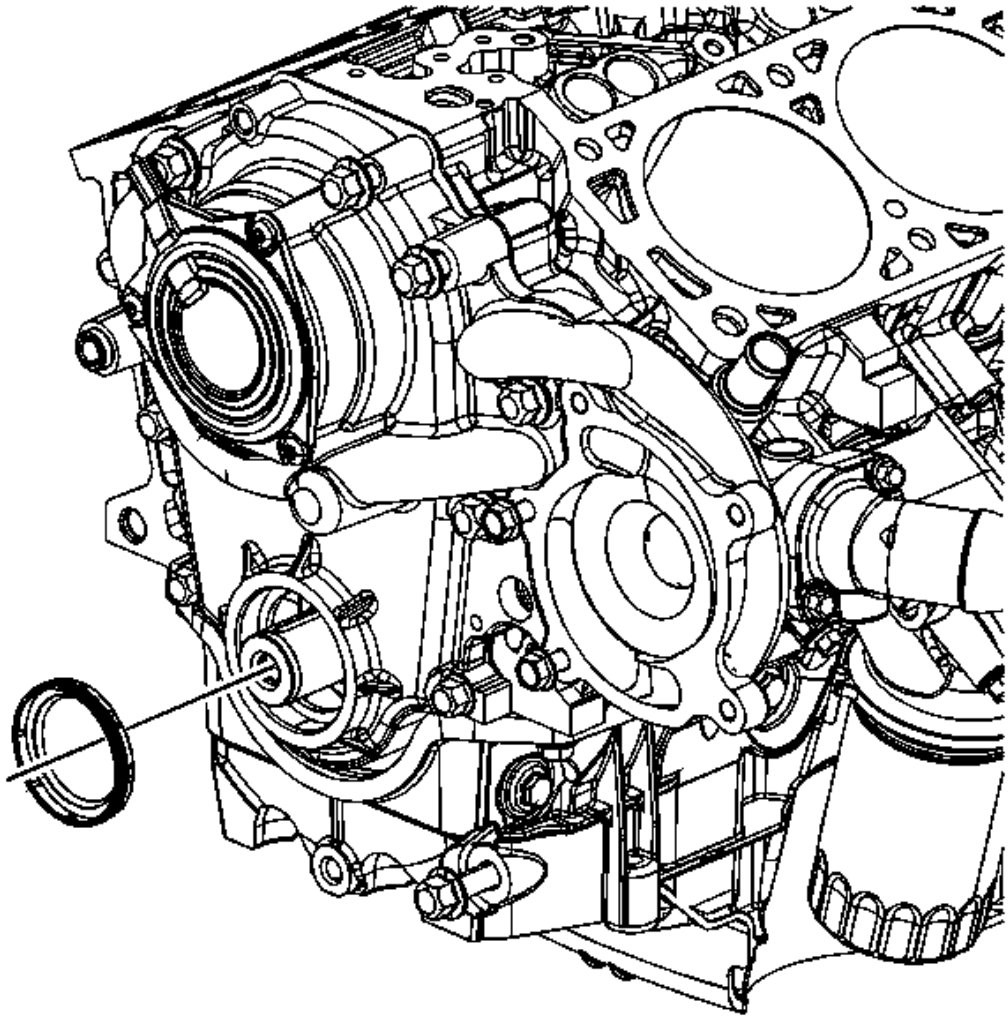

Fig. 131: Identifying Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
2. Remove the crankshaft key from the keyway.
3. Pry out the crankshaft front oil seal using a suitable tool. Use care not to damage the engine front cover or the crankshaft.

INSTALLATION PROCEDURE

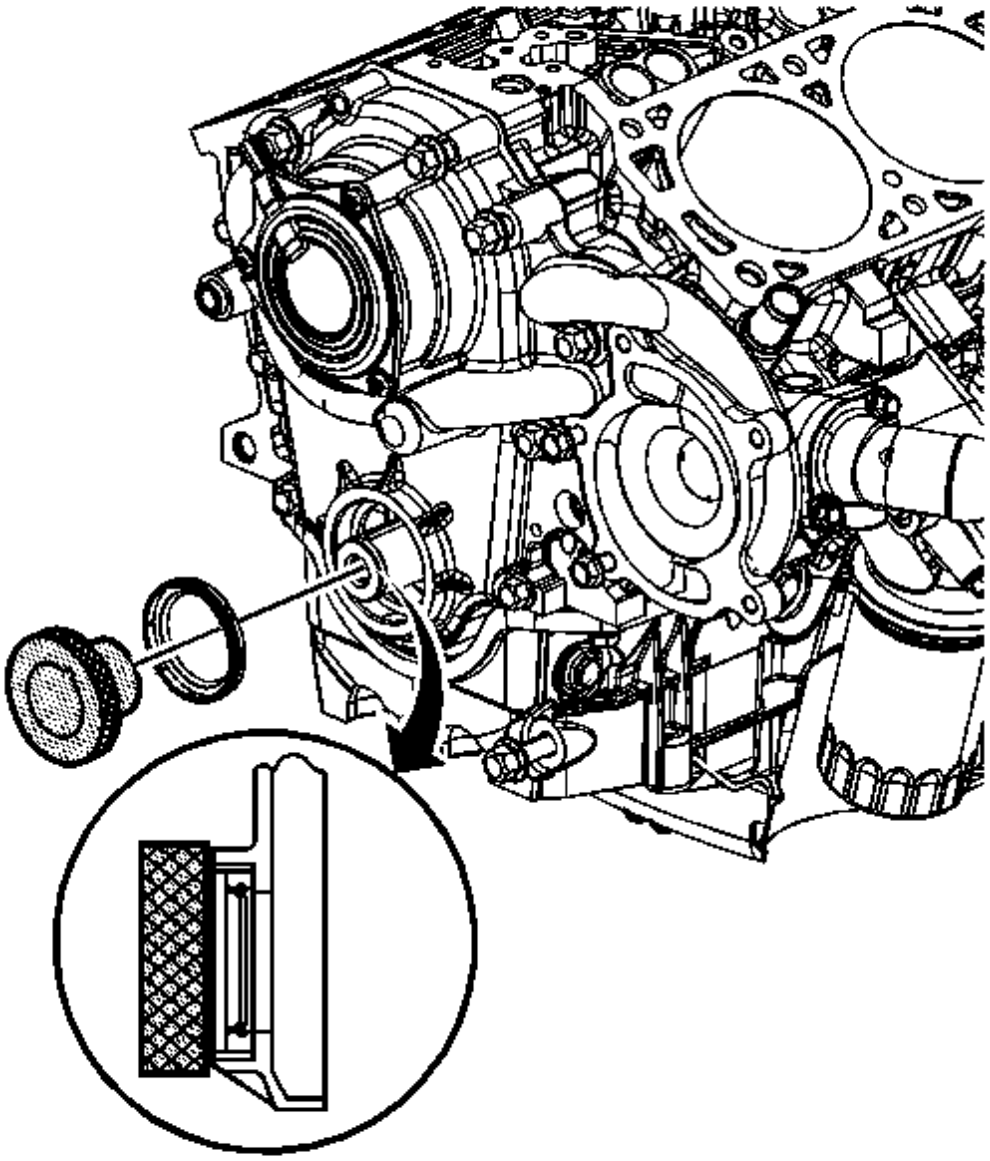

Fig. 132: View Of Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the NEW oil seal with clean engine oil.
2. Align the **EN-48869** and the crankshaft front oil seal with the engine front cover and crankshaft. See **Special Tools** .
3. Install the crankshaft front oil seal using **EN-48869** and a suitable tool. See **Special Tools** .

4. Install the crankshaft key into the keyway.
5. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.

CAMSHAFT POSITION ACTUATOR MAGNET REPLACEMENT

REMOVAL PROCEDURE

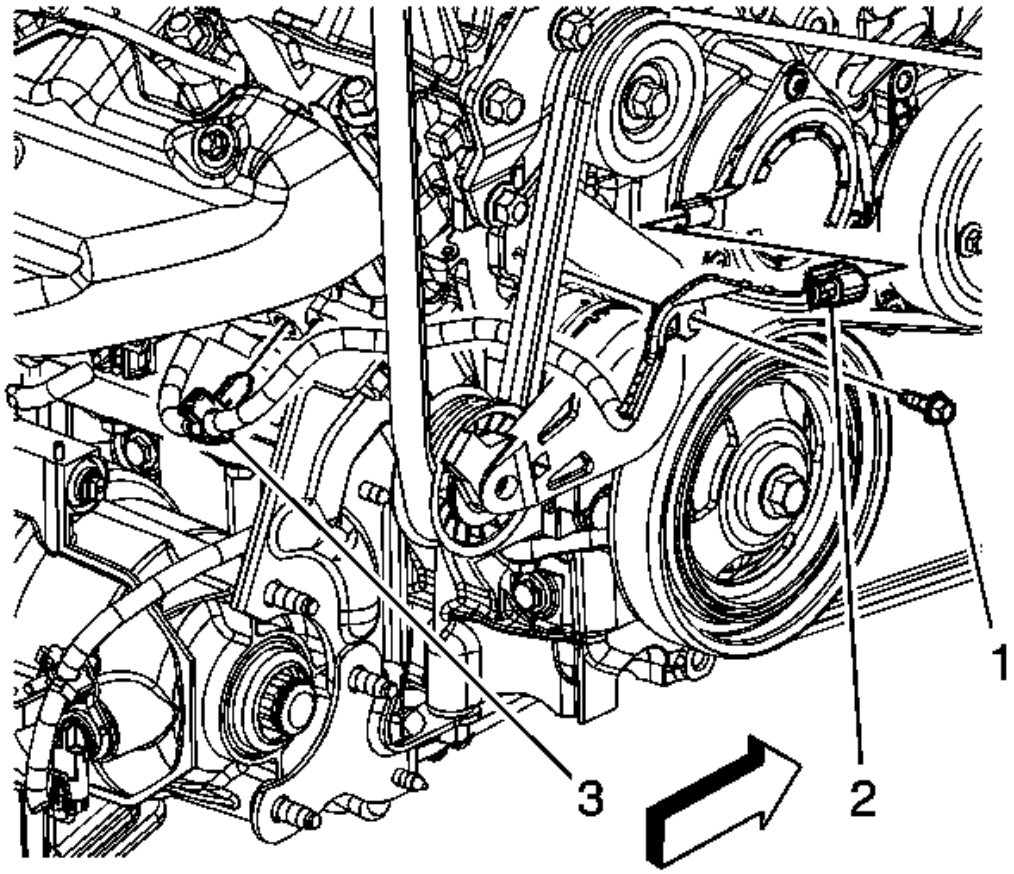

Fig. 133: View Of Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.
2. Remove the engine mount snubber bracket. Refer to **Engine Mount Snubber Bracket Replacement**.
3. Disconnect the engine wiring harness electrical connector (2) from the camshaft position actuator magnet.

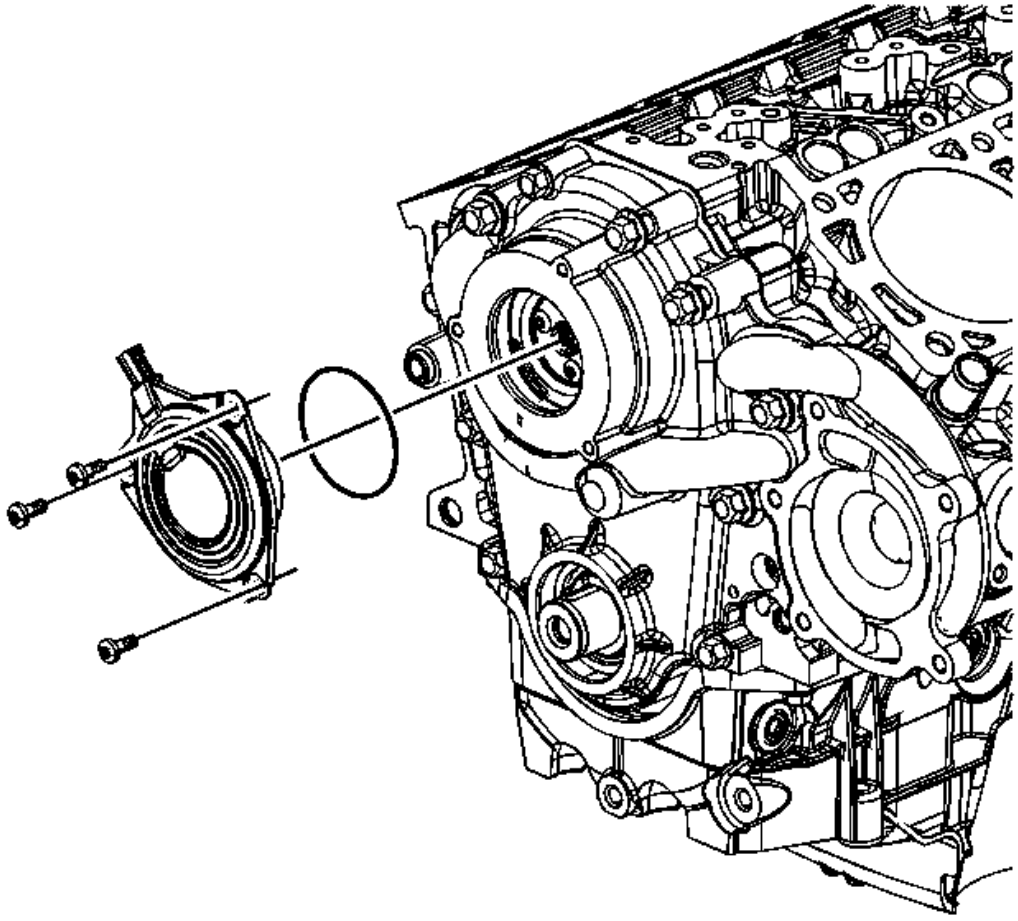

Fig. 134: Identifying Camshaft Position Actuator Magnet & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the camshaft position actuator magnet bolts.
5. Remove the camshaft position actuator magnet and O-ring seal.

INSTALLATION PROCEDURE

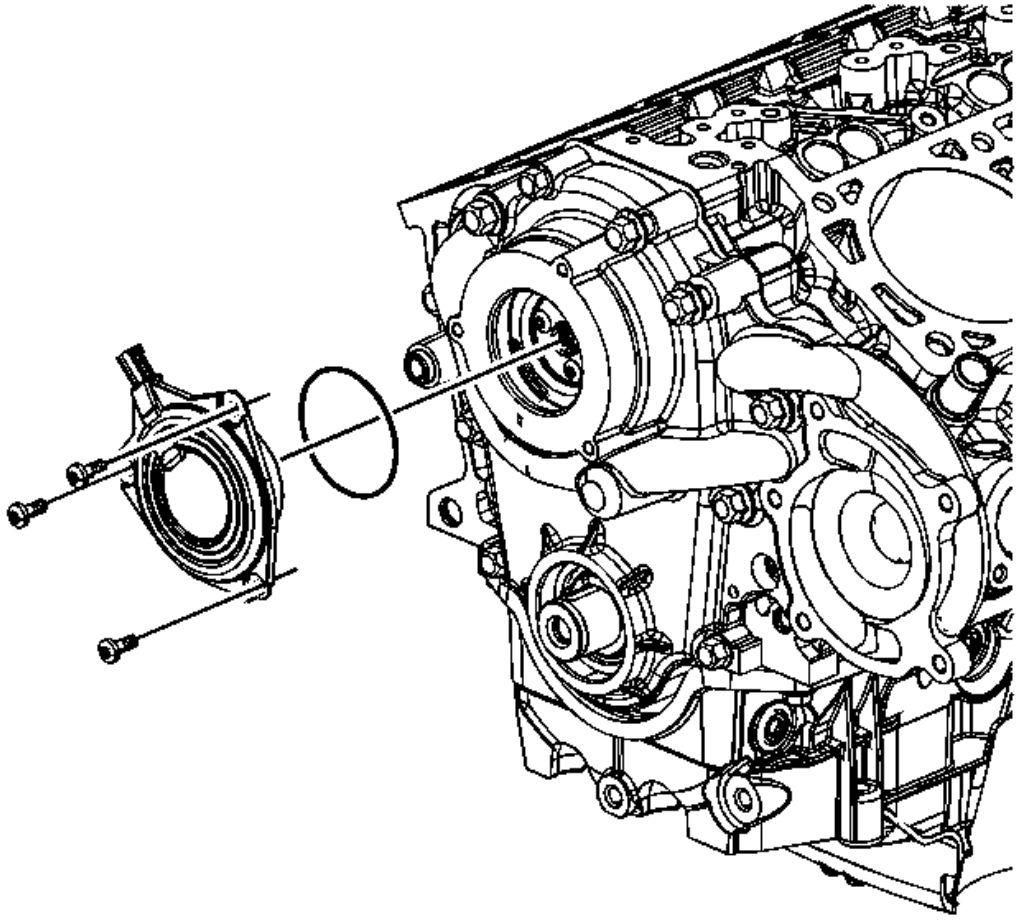

Fig. 135: Identifying Camshaft Position Actuator Magnet & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft position actuator magnet O-ring seal and magnet.

CAUTION: Refer to Fastener Caution .

2. Install the camshaft position actuator magnet bolts and tighten to 10 N.m (89 lb in).

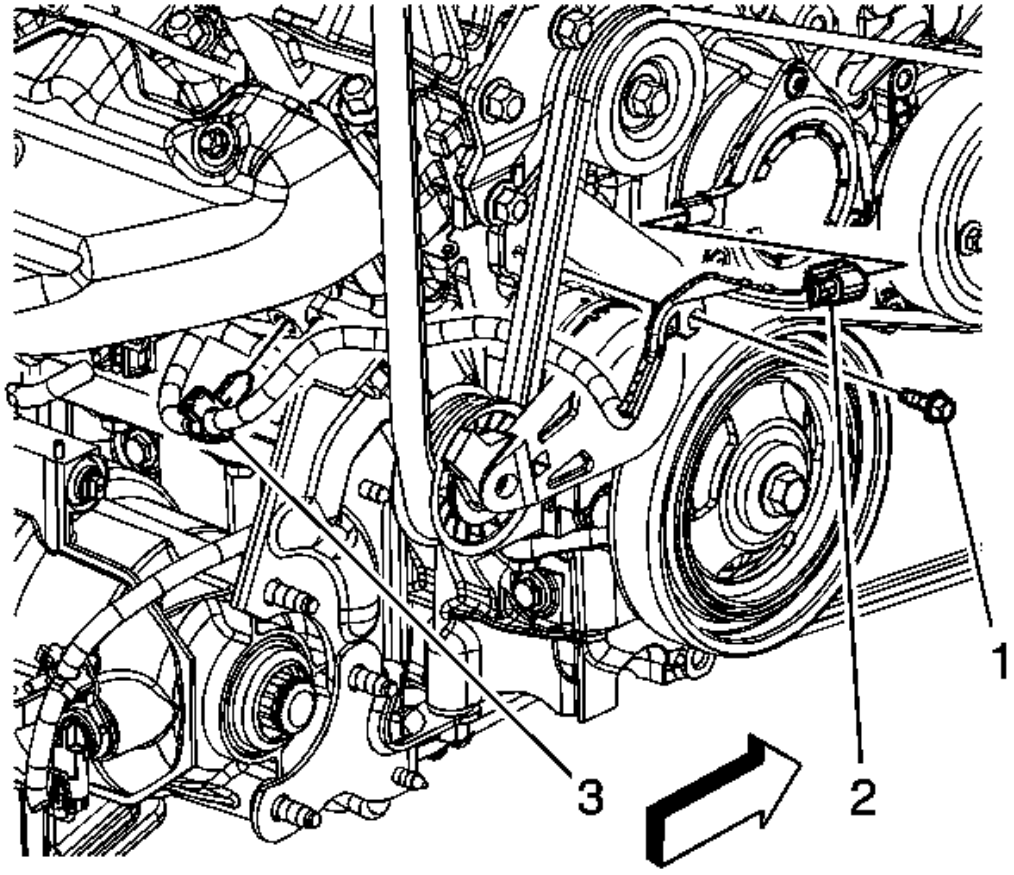

Fig. 136: View Of Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the engine wiring harness electrical connector (2) to the camshaft position actuator magnet.
4. Install the engine mount snubber bracket. Refer to **Engine Mount Snubber Bracket Replacement**.
5. Install the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.

ENGINE FRONT COVER REPLACEMENT

REMOVAL PROCEDURE

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Drain the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .

3. Remove the engine mount bracket, if equipped with a convertible top. Refer to **Engine Mount Bracket Replacement (Convertible)** or **Engine Mount Bracket Replacement (Coupe)**.
4. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
5. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
6. Remove the oil pan. Refer to **Oil Pan Replacement**.
7. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
8. Remove the radiator outlet hose from the engine front cover. Refer to **Radiator Outlet Hose Replacement (LZE, LZ4, LZ9)** .
9. Remove the water pump from the engine front cover. Refer to **Water Pump Replacement (LZ4 and LZ9)** .
10. Remove the CKP sensor wiring harness bracket.

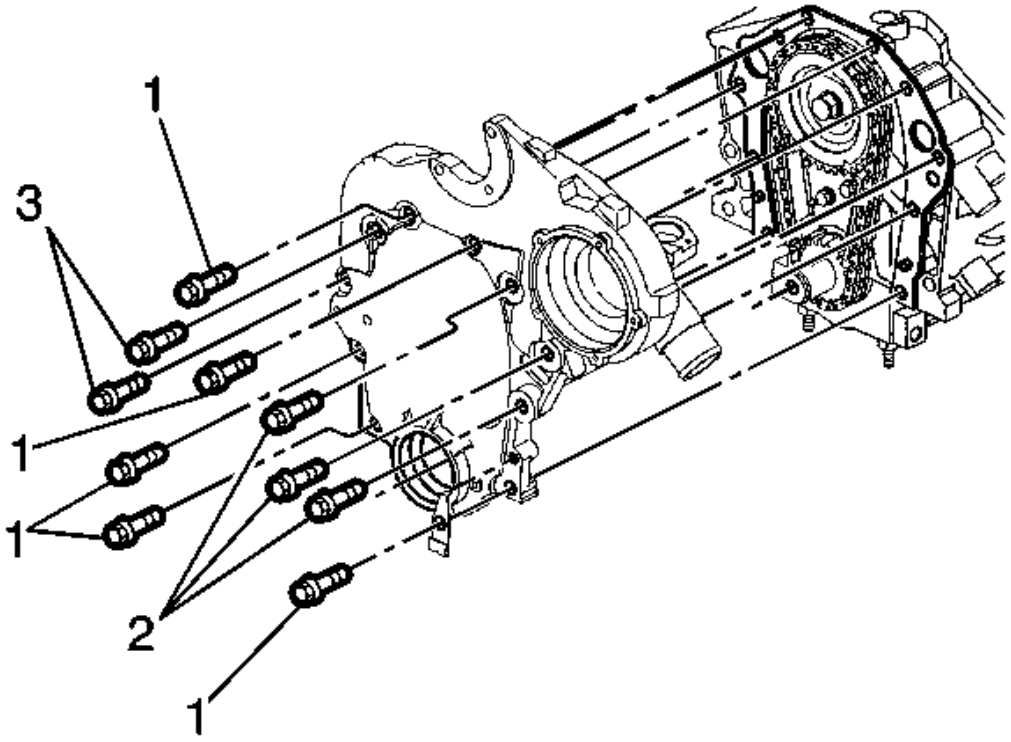

Fig. 137: Identifying Engine Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the engine front cover bolts (1, 2, 3).
12. Remove the engine front cover.

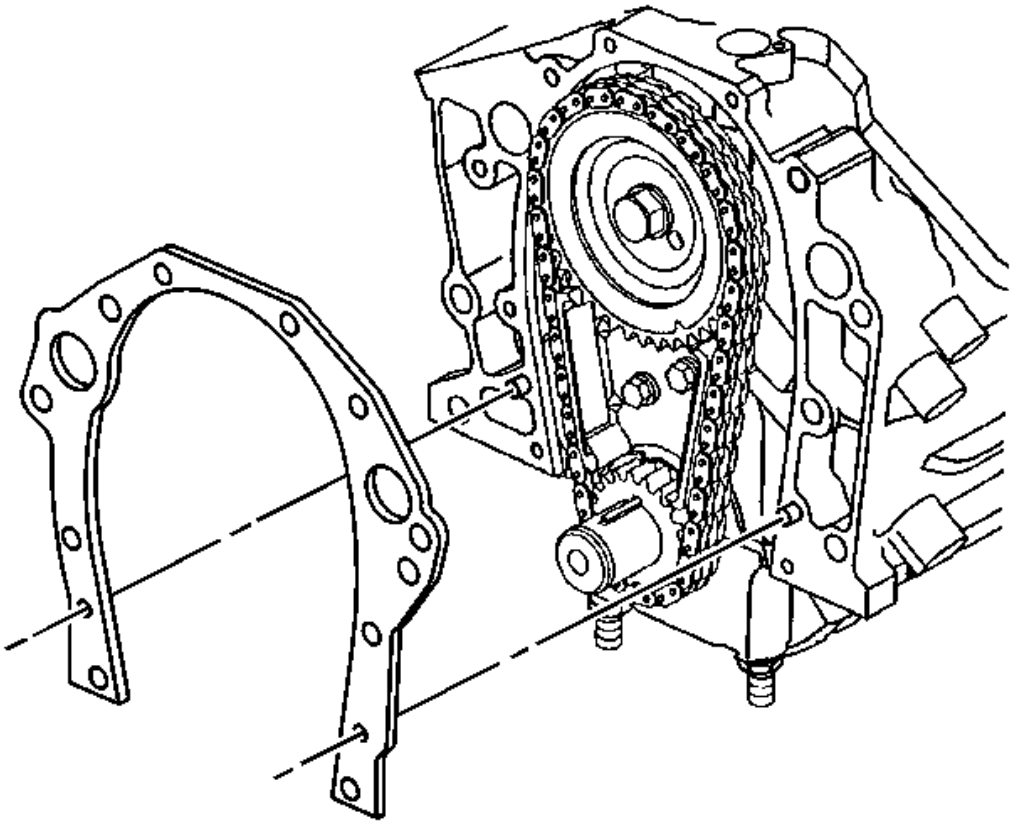

Fig. 138: View Of Engine Front Cover Gasket
Courtesy of GENERAL MOTORS CORP.

13. Remove the engine front cover gasket.
14. Clean and inspect the engine front cover. Refer to **Engine Front Cover Cleaning and Inspection** .
15. If replacing the engine front cover, remove the drive belt shield bolt and the drive belt shield.
16. If replacing the engine front cover, remove the water pump. Refer to **Water Pump Replacement (LZ4 and LZ9)** .

INSTALLATION PROCEDURE

1. If removed install the water pump. Refer to **Water Pump Replacement (LZ4 and LZ9)** .
2. If removed, install the drive belt shield.

CAUTION: Refer to Fastener Caution .

3. Install the drive belt shield bolt.

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

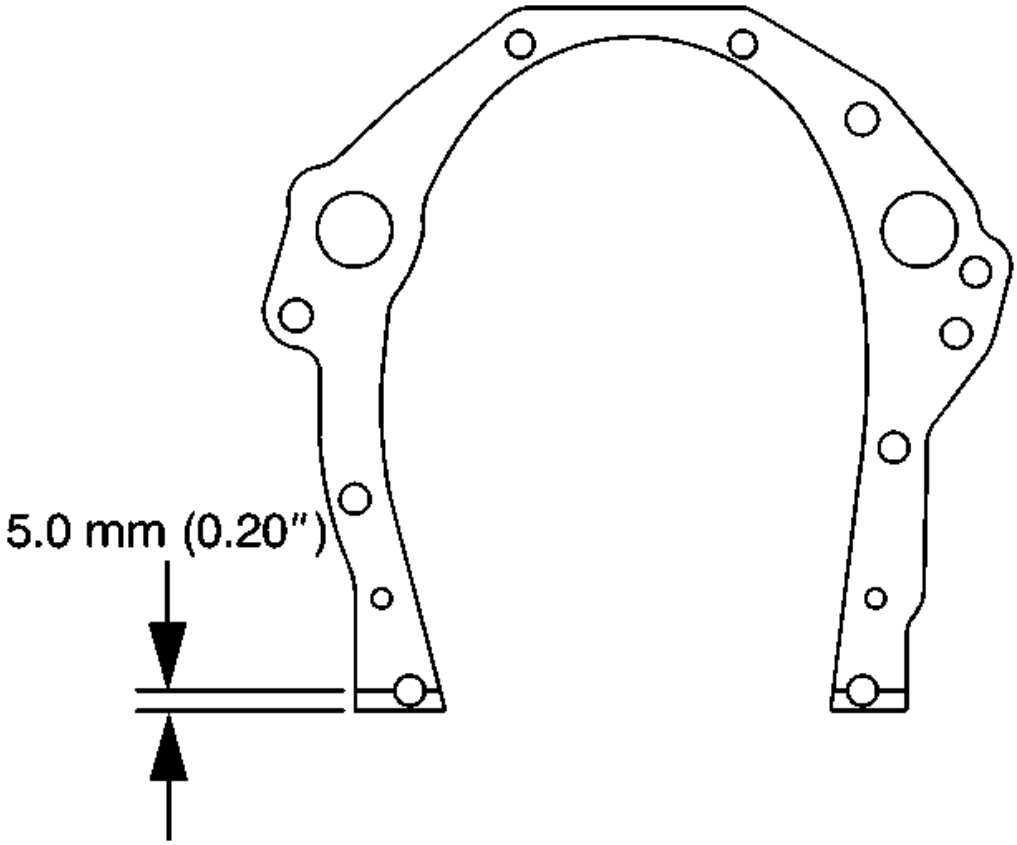

Fig. 139: Identifying Engine Front Cover Gasket
Courtesy of GENERAL MOTORS CORP.

4. Apply sealant to both sides of the lower tabs of the engine front cover gasket. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

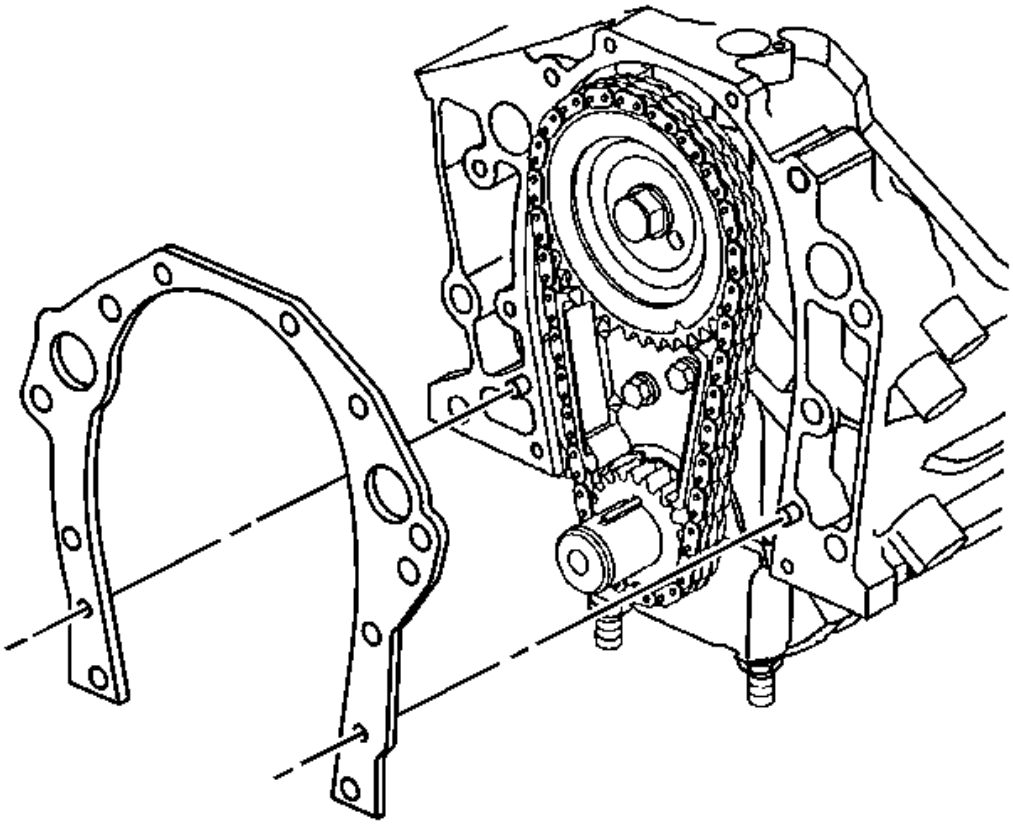

Fig. 140: View Of Engine Front Cover Gasket
Courtesy of GENERAL MOTORS CORP.

5. Install the engine front cover gasket.
6. Install the engine front cover.

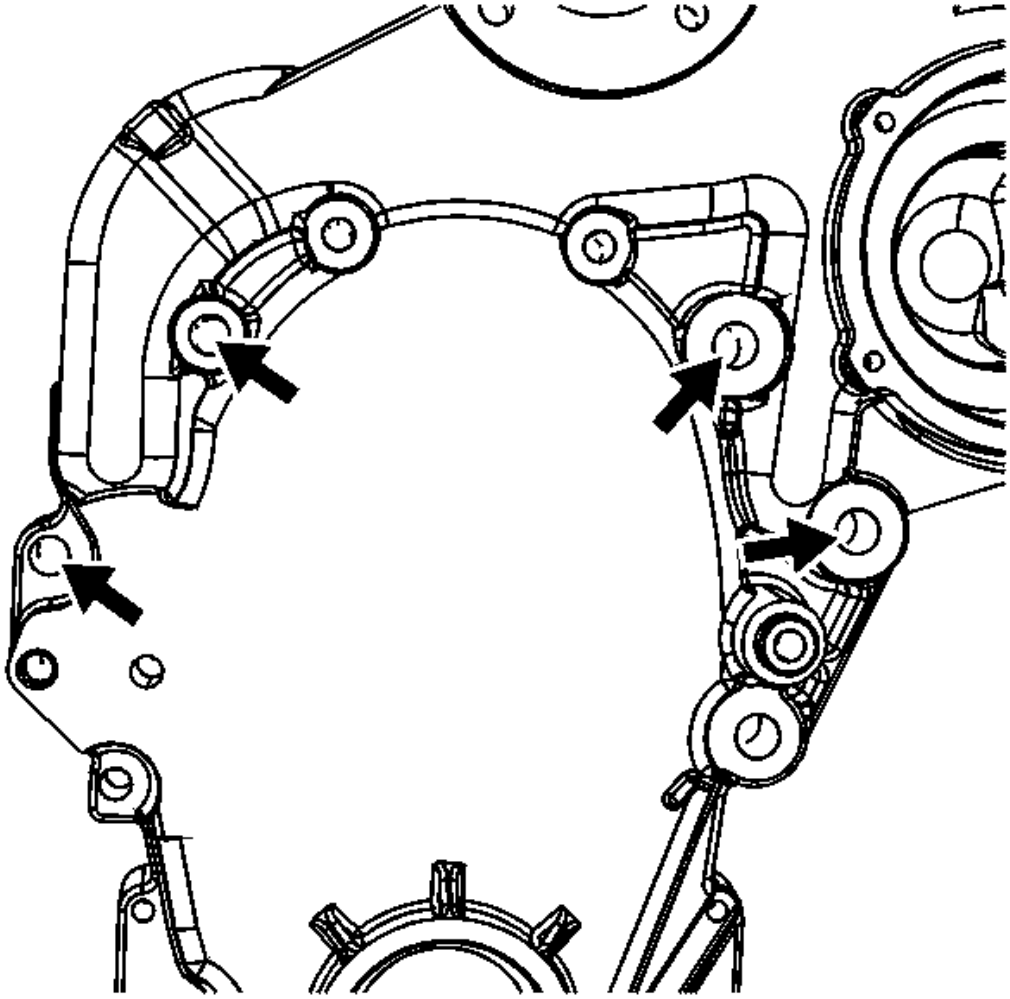

Fig. 141: Identifying Bolt Sealer Locations In Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

7. Apply sealer to the bolts in the locations pointed out in the graphic. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

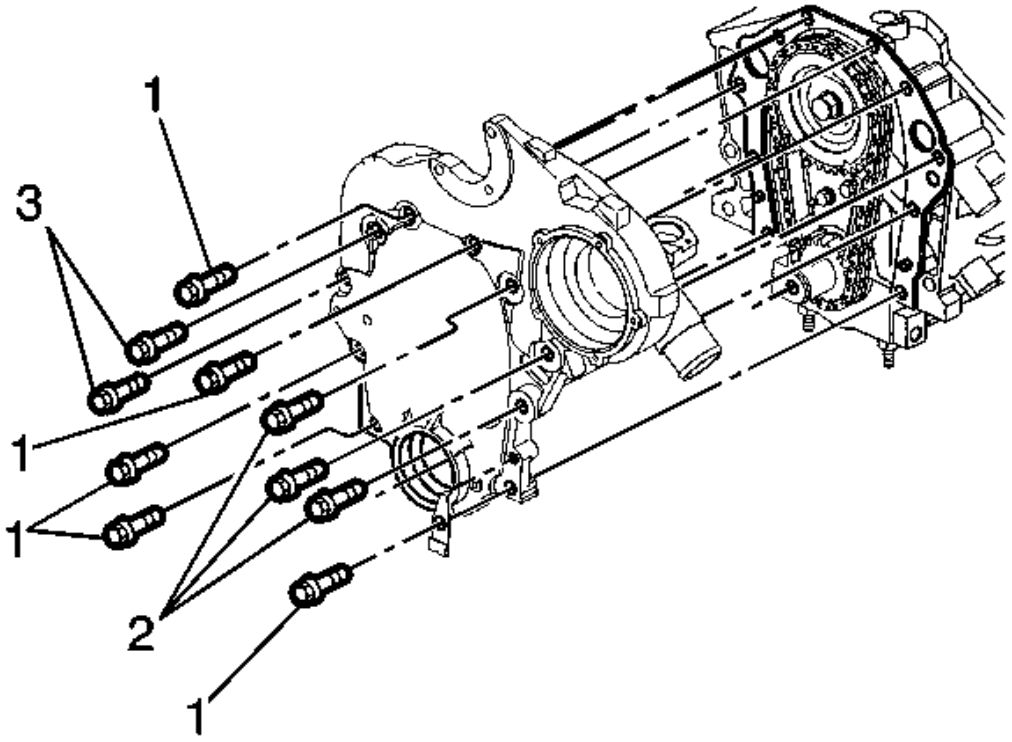

Fig. 142: Identifying Engine Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the engine front cover bolts (1, 2, and 3).

   Tighten:
   - Tighten the small engine front cover bolts (1) to 27 N.m (20 lb ft).
   - Tighten the large engine front cover bolts (2, 3) to 55 N.m (41 lb ft).

9. Install the radiator outlet hose to the engine front cover. Refer to **Radiator Outlet Hose Replacement (LZE, LZ4, LZ9)** .
10. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
11. Install the oil pan. Refer to **Oil Pan Replacement**.
12. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.
13. Install the engine mount bracket, if equipped with a convertible top. Refer to **Engine Mount Bracket Replacement (Convertible)** or **Engine Mount Bracket Replacement (Coupe)**.
14. Fill the crankcase with new engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
15. Fill the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling**

System Draining and Filling (LY7, LZE, LZ4, LZ9) .

16. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .

CAMSHAFT TIMING CHAIN AND SPROCKET REPLACEMENT

SPECIAL TOOLS

EN-47719 Tensioner Compressor. See **Special Tools** .

REMOVAL PROCEDURE

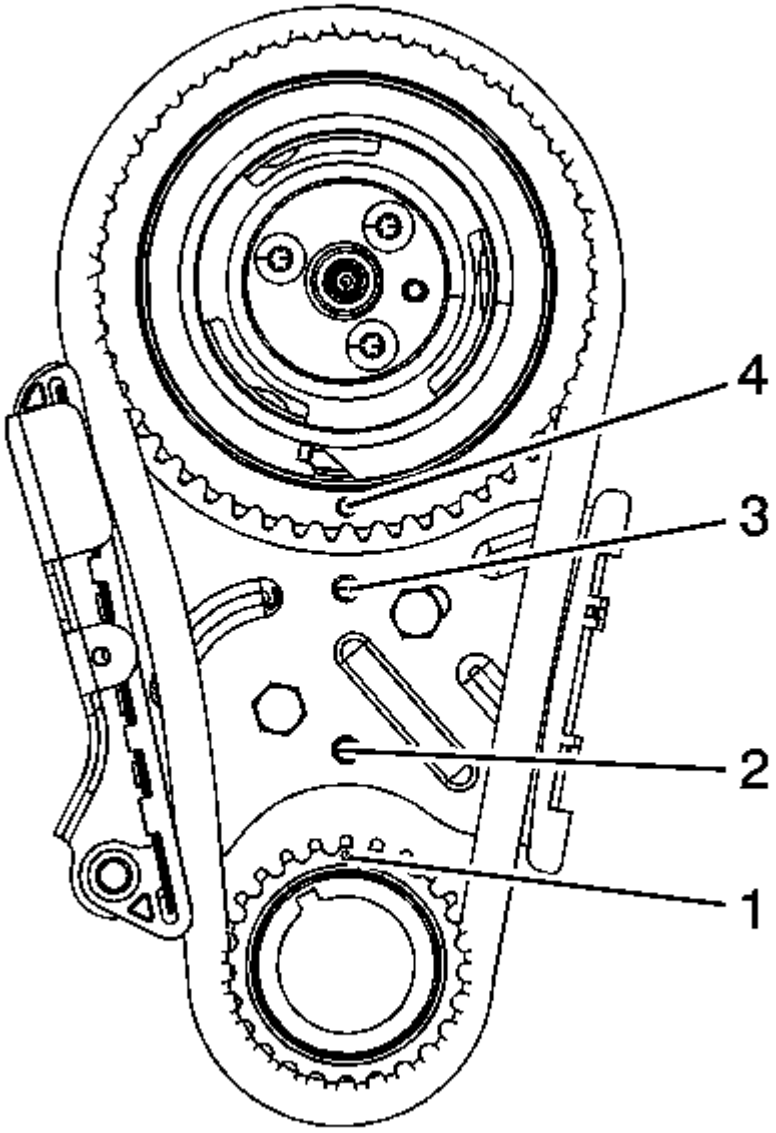

Fig. 143: Identifying Timing Marks & Chain Tensioners
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
2. Align the crankshaft timing mark (1) to the timing mark on the bottom of the timing chain tensioner (2).
3. Align the timing mark on the camshaft position actuator gear (4) with the timing mark on top of the timing chain tensioner (3).

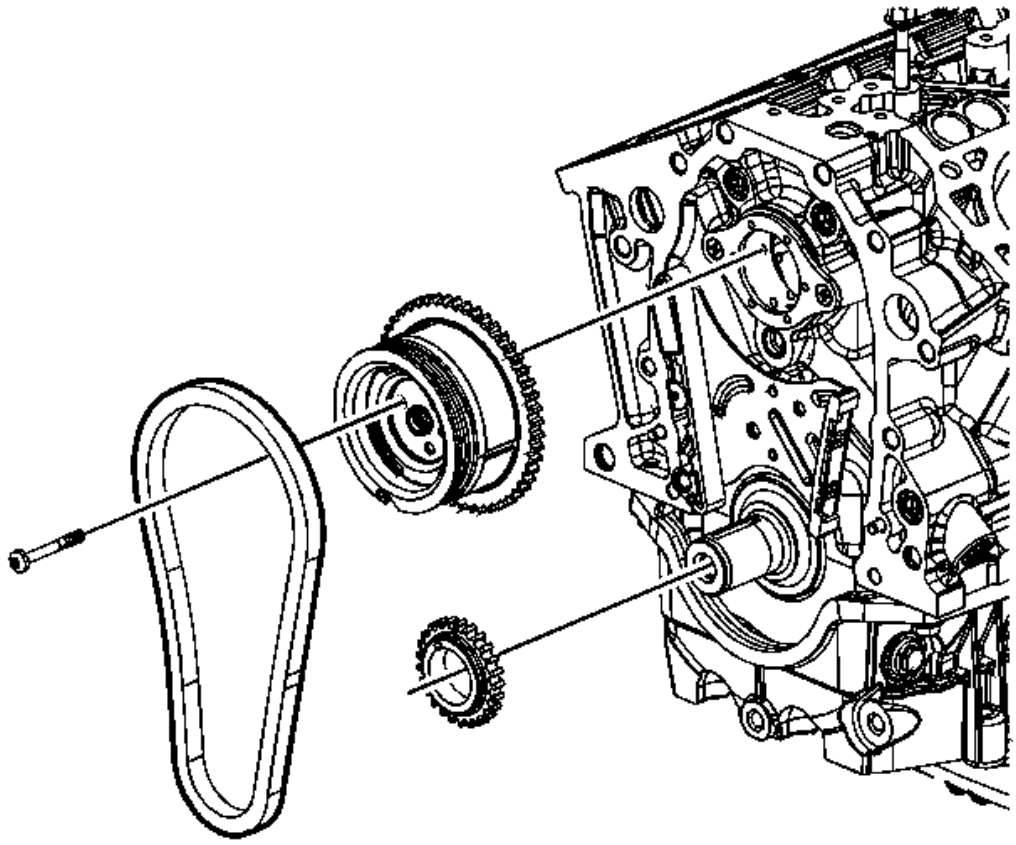

Fig. 144: View Of Timing Chain & Sprockets
Courtesy of GENERAL MOTORS CORP.

4. Remove the camshaft position actuator bolts.
5. Remove the timing chain, camshaft position actuator, and crankshaft sprockets.

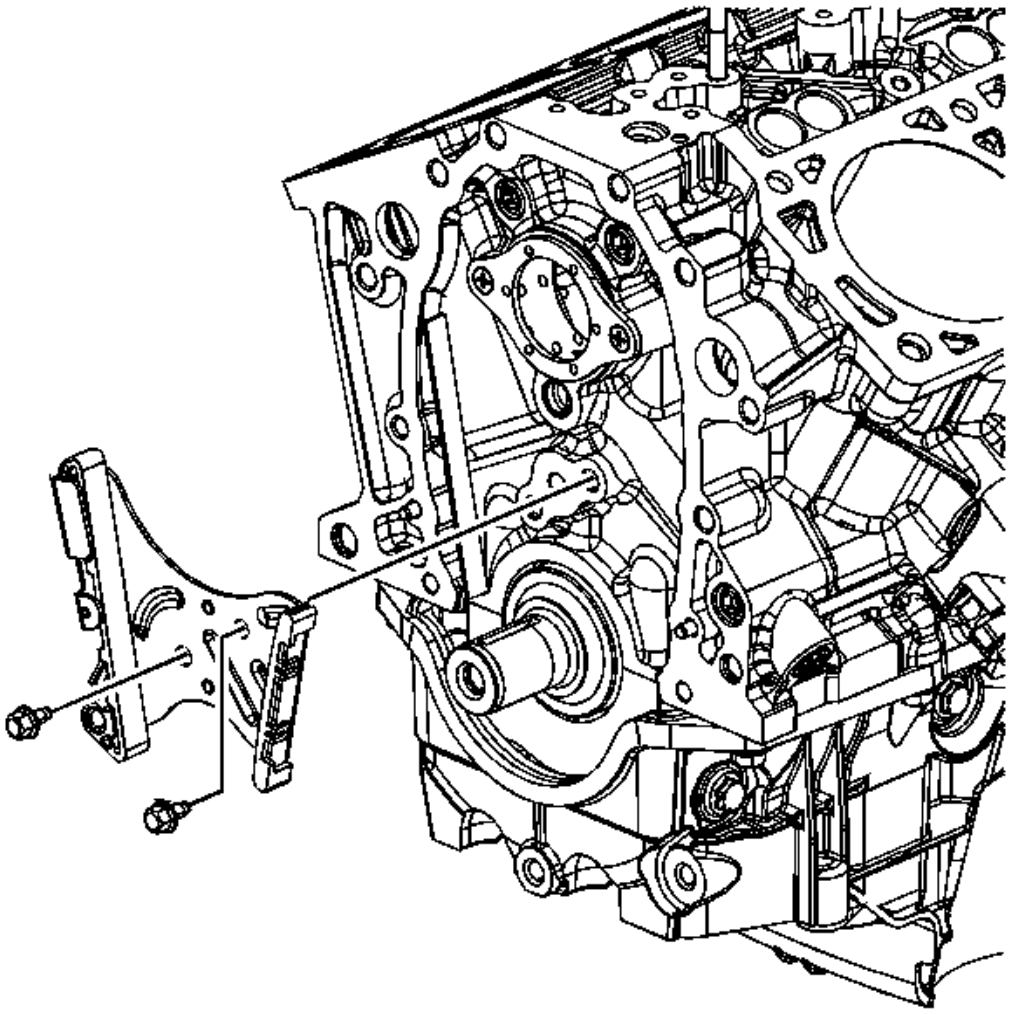

Fig. 145: View Of Timing Chain Tensioner & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the timing chain tensioner bolts.
7. Remove the timing chain tensioner.

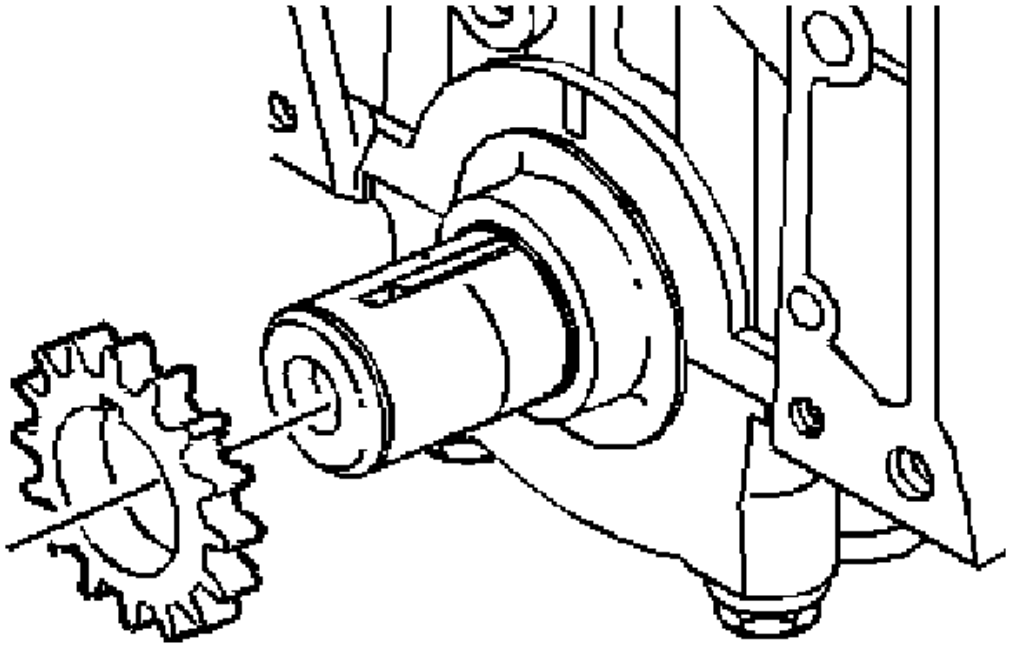

Fig. 146: View Of Crankshaft Sprocket
Courtesy of GENERAL MOTORS CORP.

8. Remove the crankshaft sprocket.

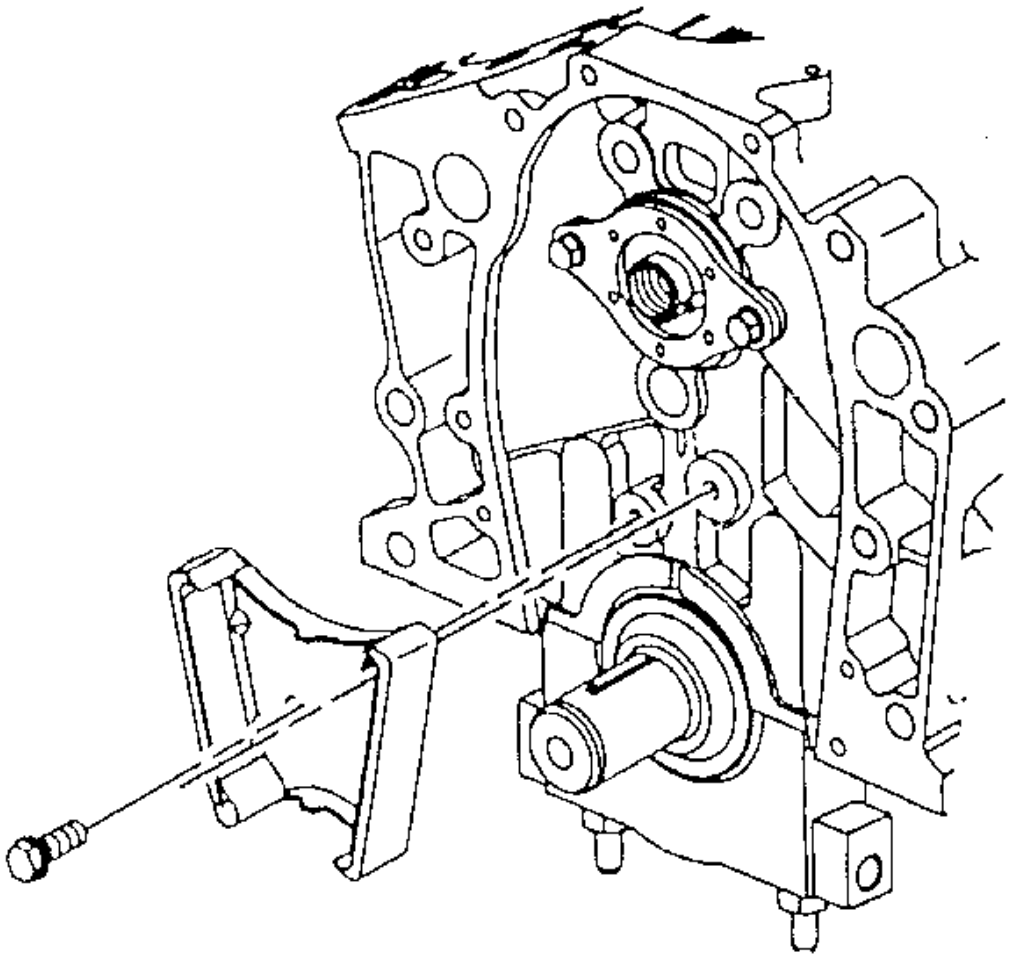

Fig. 147: View Of Timing Chain Dampener & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the timing chain dampener bolts.
10. Remove the timing chain dampener.

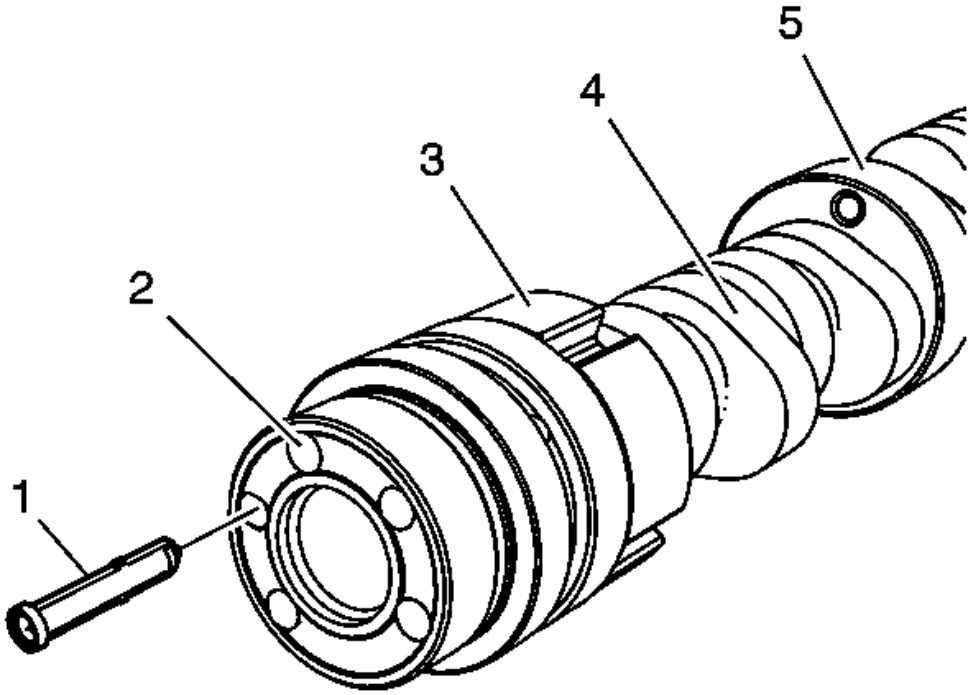

Fig. 148: View Of Camshaft & Actuator Filter
Courtesy of GENERAL MOTORS CORP.

11. Remove and discard the camshaft position actuator filter (1) from the end of the camshaft.

INSTALLATION PROCEDURE

NOTE: Always install a NEW camshaft position actuator filter anytime the camshaft actuator is removed.

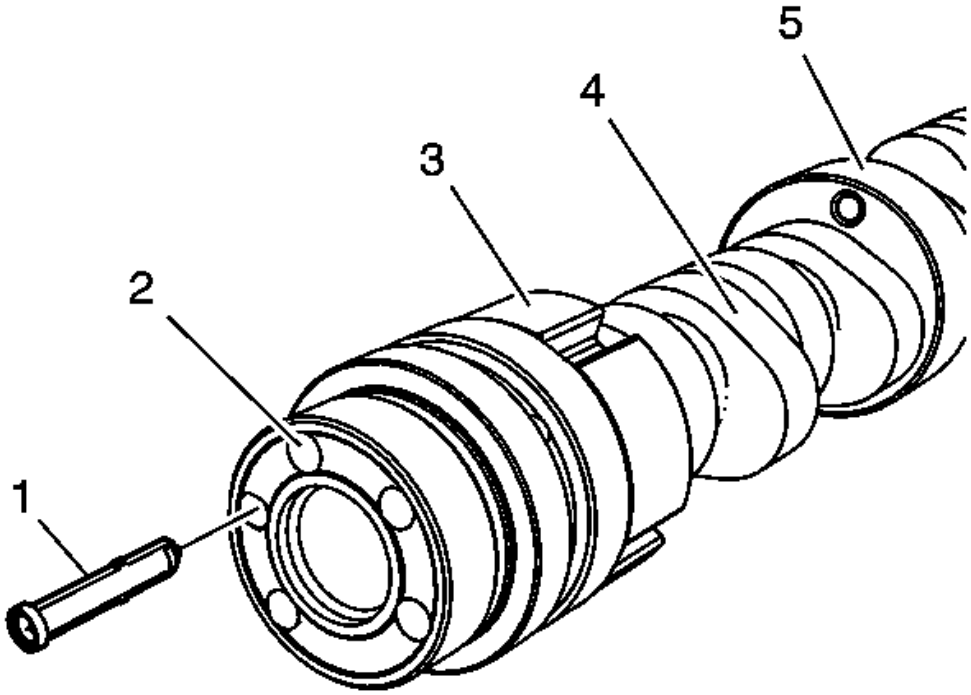

Fig. 149: View Of Camshaft & Actuator Filter
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW the camshaft position actuator filter (1) to the end of the camshaft.

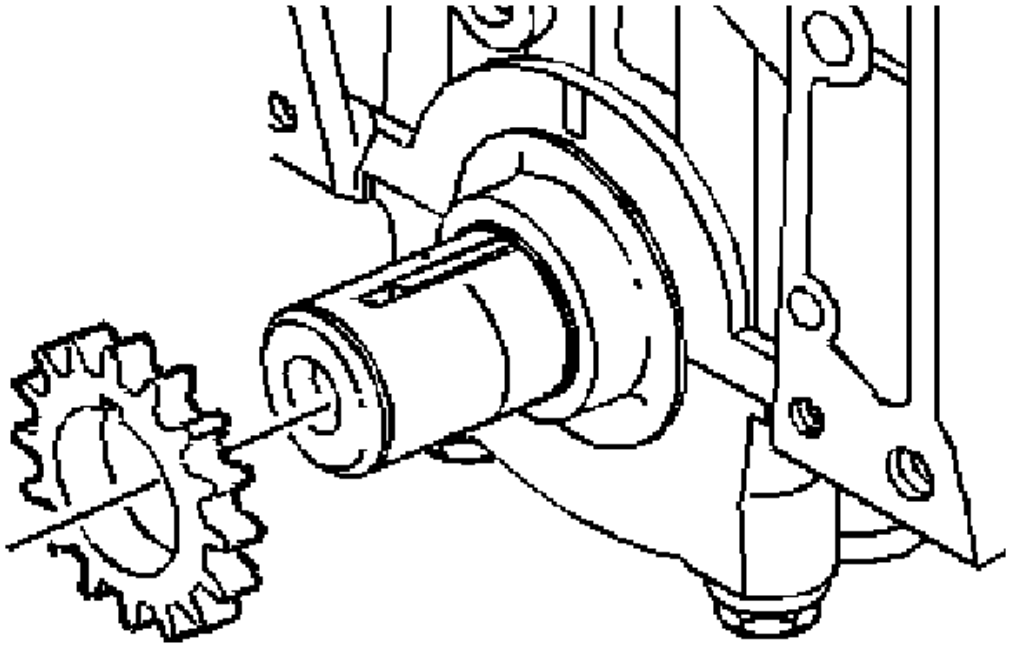

Fig. 150: View Of Crankshaft Sprocket
Courtesy of GENERAL MOTORS CORP.

2. Install the crankshaft sprocket.
3. Apply prelube to the crankshaft sprocket thrust surface. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

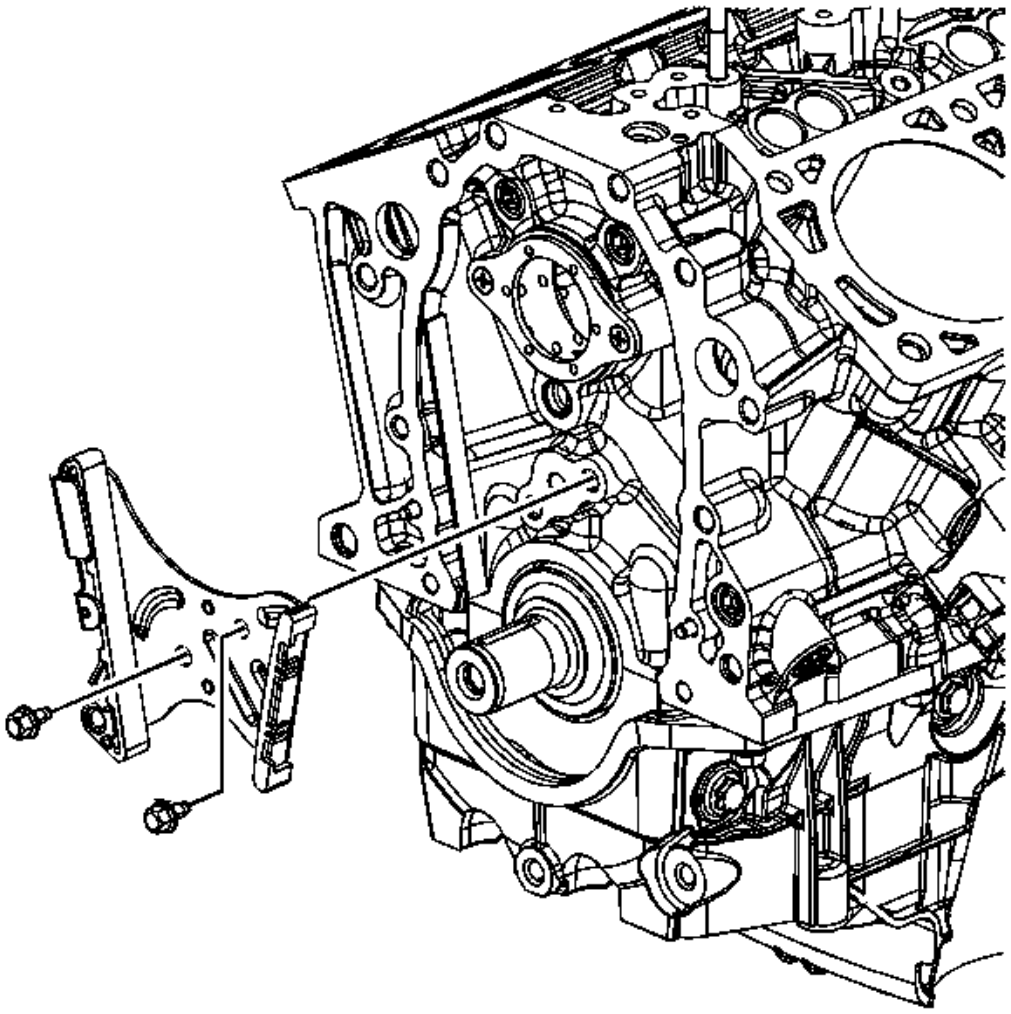

Fig. 151: View Of Timing Chain Tensioner & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the timing chain tensioner.

CAUTION: Refer to Fastener Caution .

5. Install the timing chain tensioner bolts.

Tighten: Tighten the bolts to 21 N.m (15 lb ft).

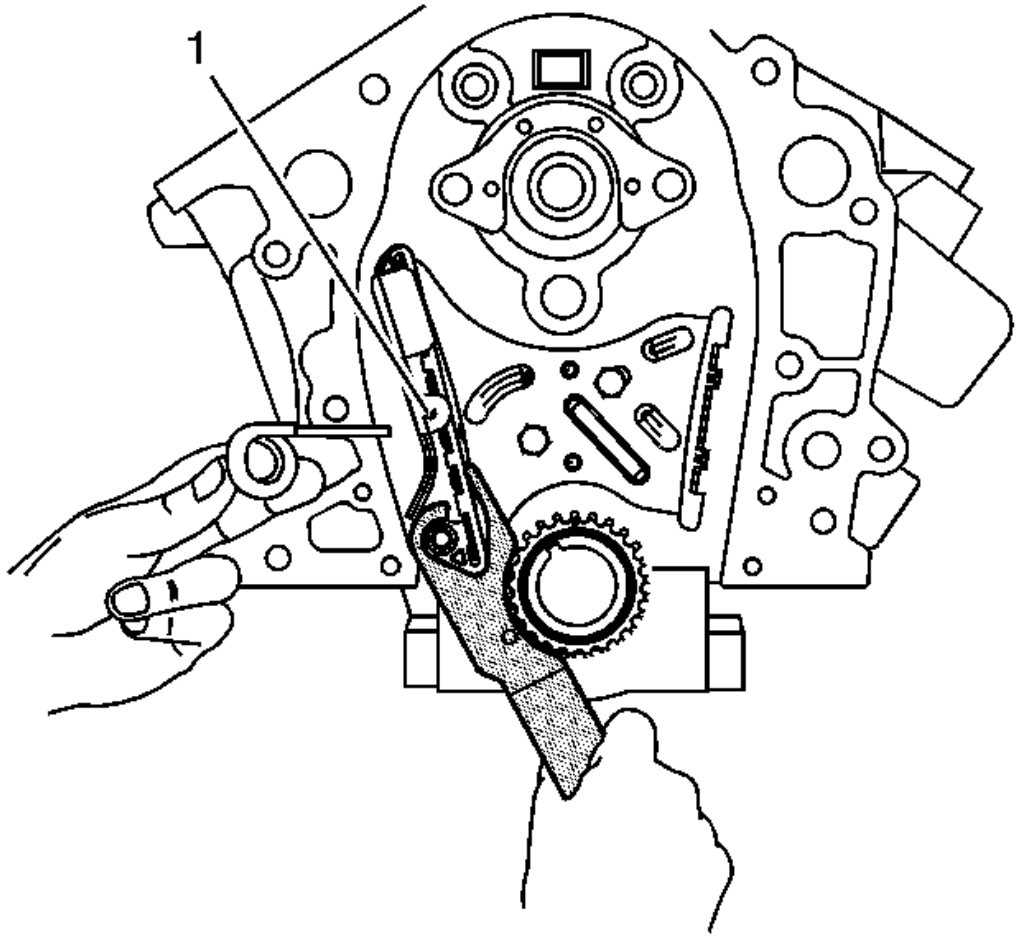

Fig. 152: Identifying Tensioner Collapsing Procedure
Courtesy of GENERAL MOTORS CORP.

6. Using the **EN-47719** , fully collapse the tensioner, and place he tensioner retaining pin into the retaining hole (1). See **Special Tools** .

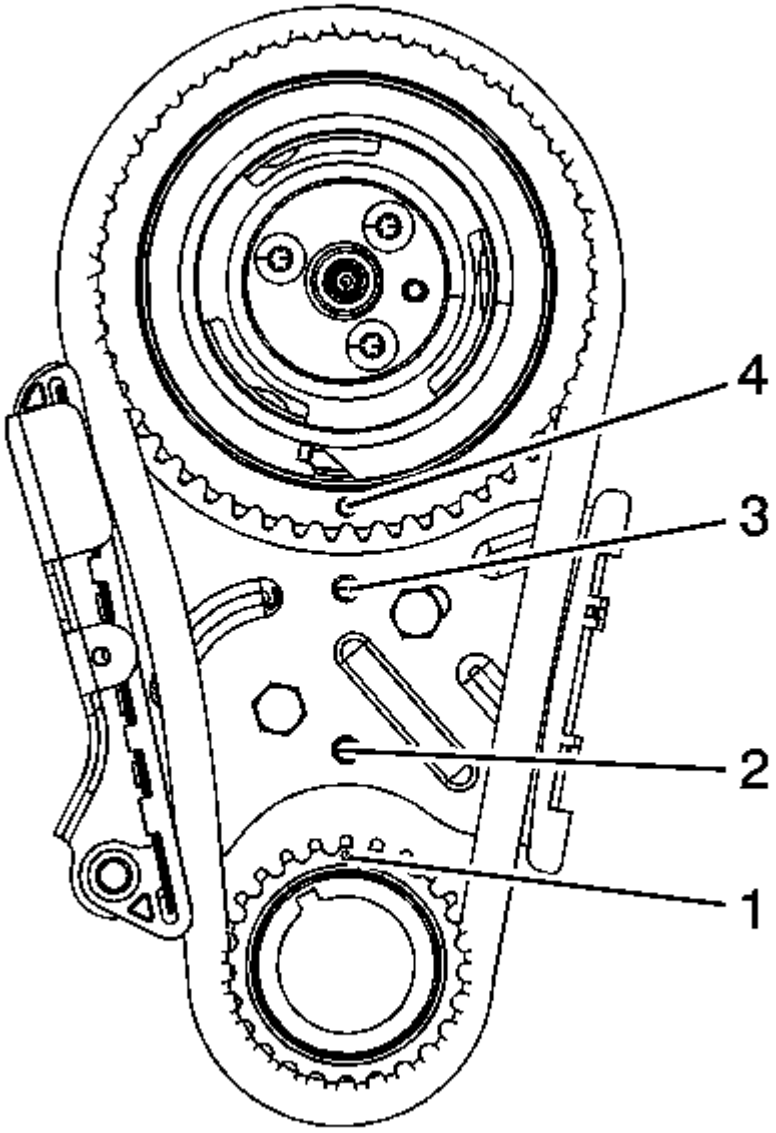

Fig. 153: Identifying Timing Marks & Chain Tensioners
Courtesy of GENERAL MOTORS CORP.

7. Align the crankshaft timing mark (1) to the timing mark on the bottom of the timing chain tensioner (2).
8. Hold the camshaft sprocket with the timing chain hanging down and install the timing chain to the crankshaft gear.
9. Align the timing mark on the camshaft position actuator gear (4) with the timing mark on top of the

timing chain tensioner (3).

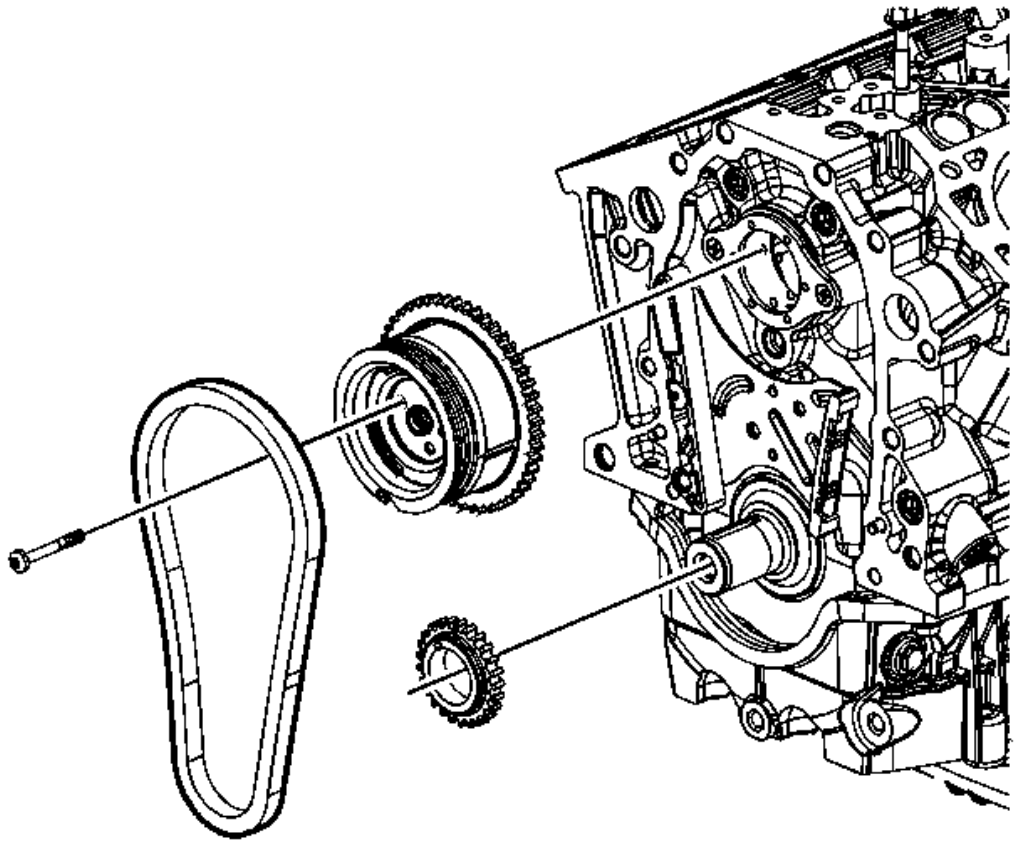

Fig. 154: Identifying Timing Chain & Sprockets
Courtesy of GENERAL MOTORS CORP.

10. Align the dowel in the camshaft position actuator with the dowel hole in the camshaft.
11. Install the camshaft position actuator bolts.

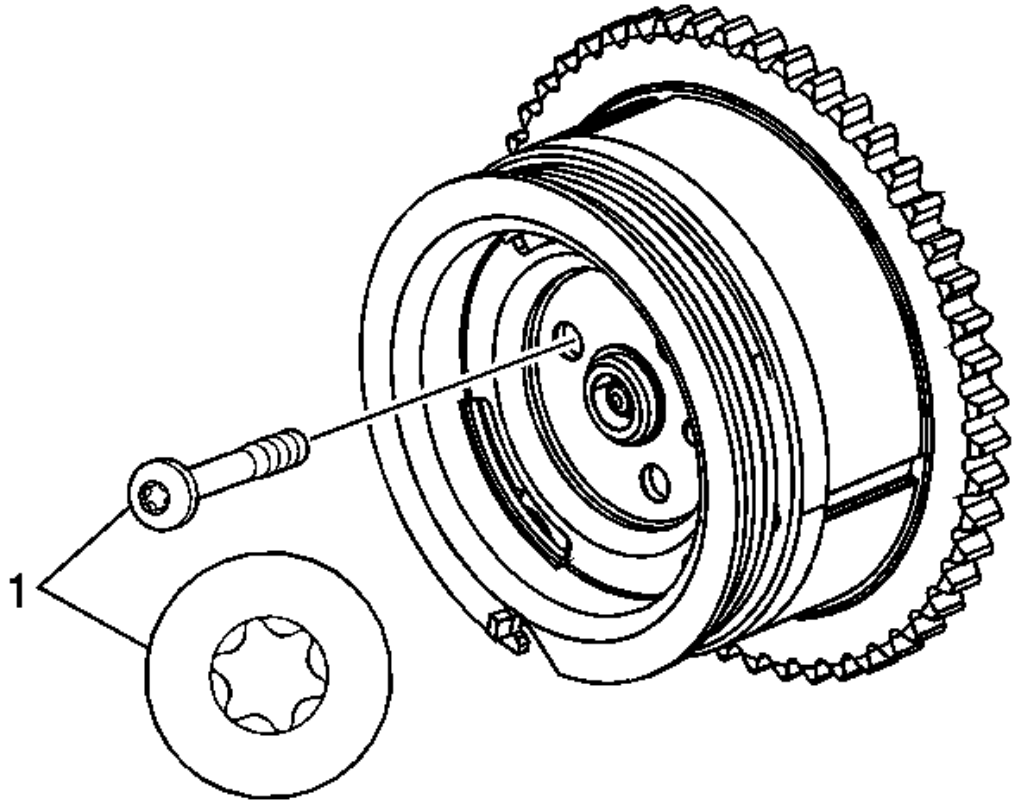

Fig. 155: Identifying Camshaft Position Actuator & Fasteners
Courtesy of GENERAL MOTORS CORP.

CAUTION: Use only a Torx Plus® Bit when removing or installing the camshaft position actuator fasteners (1). The Torx Plus® design differs from typical Torx® fastener. Use of a standard Torx® bit on Torx Plus® fasteners may result in a rounded out fastener head or incorrect faster torque.

NOTE: DO NOT use any type of threadlocking compound on the camshaft position actuator bolts. Usage of a threadlocking compound on the threads could lead to contamination of the camshaft position actuator, possibly resulting in potential damage to the actuator.

12. Draw the camshaft actuator onto the camshaft using the bolts.

    Tighten: Tighten the bolts to 16 N.m (12 lb ft).

13. Remove the retaining pin from the timing chain tensioner in order to make the tensioner active.
14. Coat the crankshaft and camshaft sprockets with clean engine oil.
15. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

CYLINDER HEAD REPLACEMENT - LEFT SIDE

SPECIAL TOOLS

J 45059 Angle Meter

REMOVAL PROCEDURE

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Drain the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .
3. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
4. Lower the vehicle.
5. Remove the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
6. Remove the valve rocker arms and the pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
7. Remove the exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side (LZ4)** .
8. Remove the oil level indicator tube. Refer to **Oil Level Indicator Tube Replacement**.
9. Remove the left spark plug wires from the spark plugs. Refer to **Spark Plug Wire Replacement** .
10. Remove the left spark plugs. Refer to **Spark Plug Replacement** .
11. Remove the left exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side (LZ4)** .

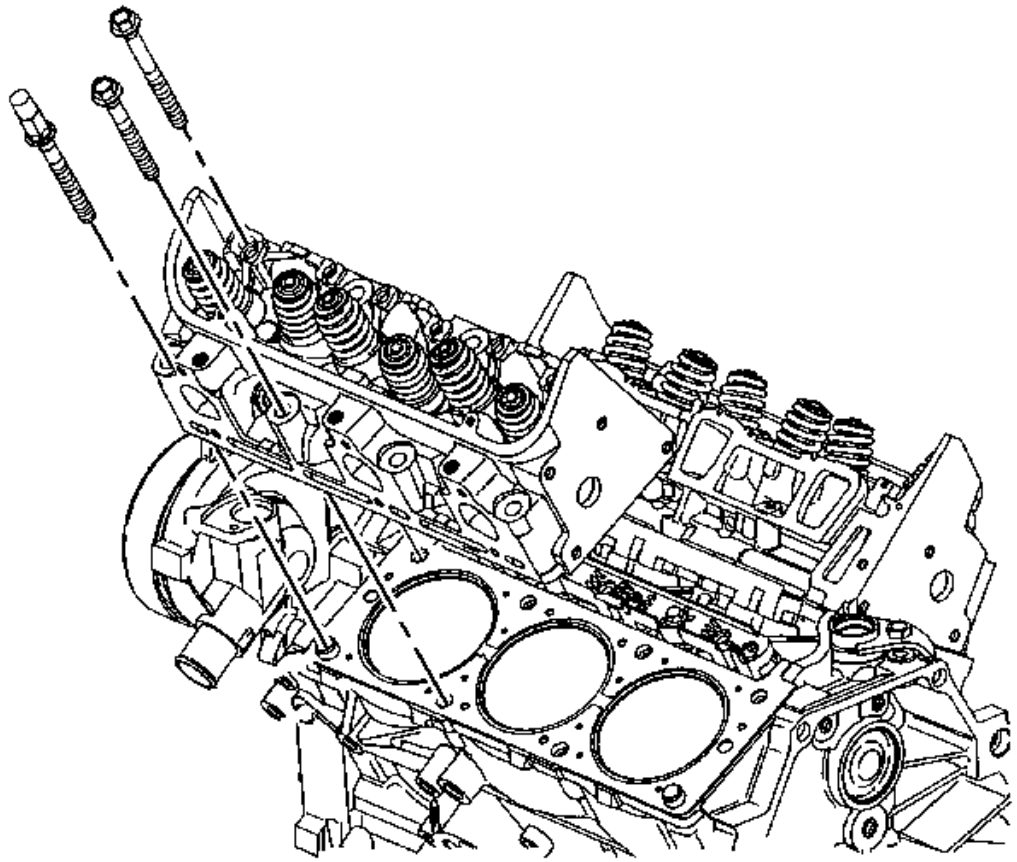

Fig. 156: Identifying Left Cylinder Head
Courtesy of GENERAL MOTORS CORP.

12. Remove the left cylinder head bolts and discard.
13. Remove the left cylinder head.

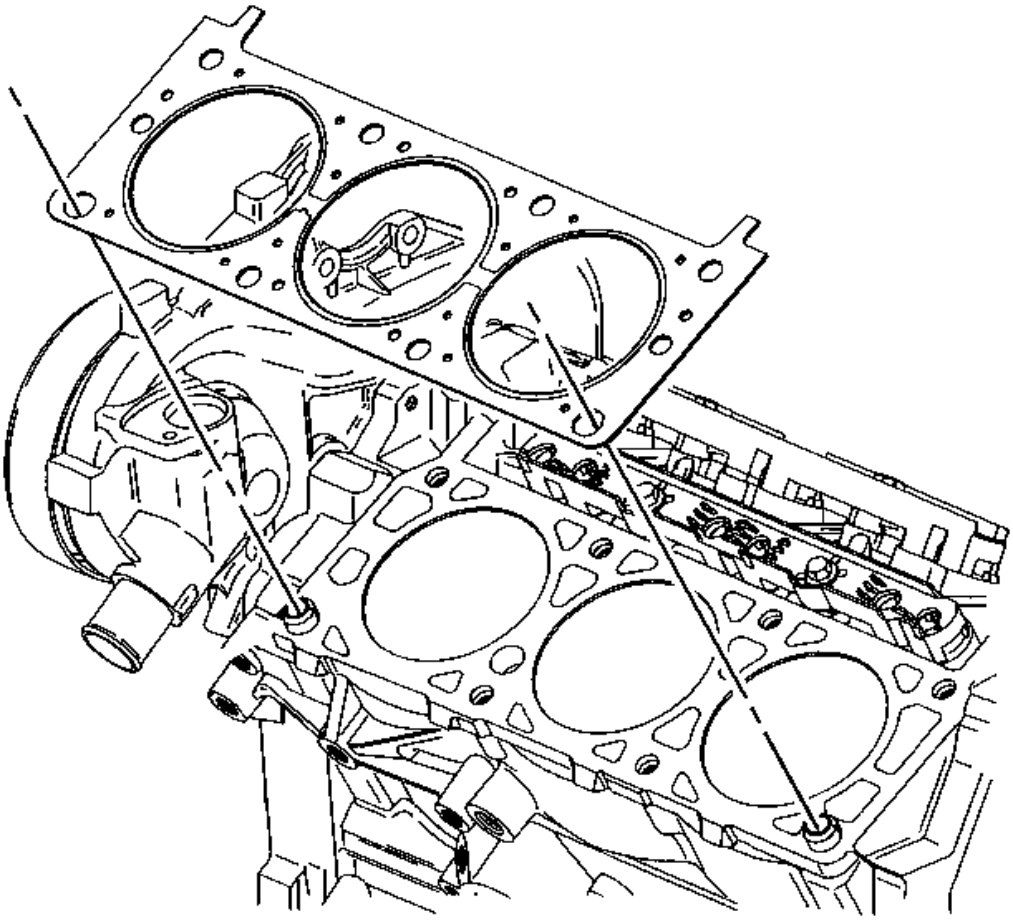

Fig. 157: Identifying Left Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

14. Remove the left cylinder head gasket.
15. Clean and inspect the cylinder head and the gasket mating surfaces. Refer to **Engine Block Cleaning and Inspection** and **Cylinder Head Cleaning and Inspection** .

INSTALLATION PROCEDURE

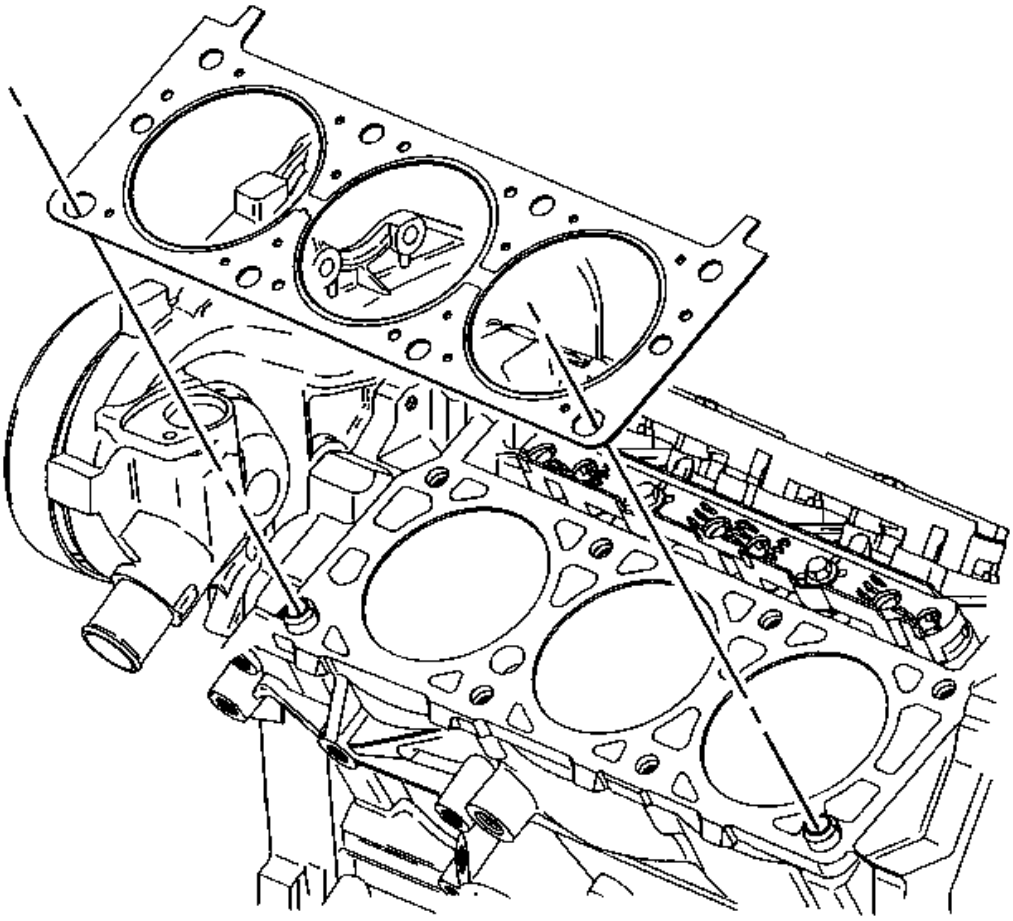

Fig. 158: Identifying Left Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install a new left cylinder head gasket.

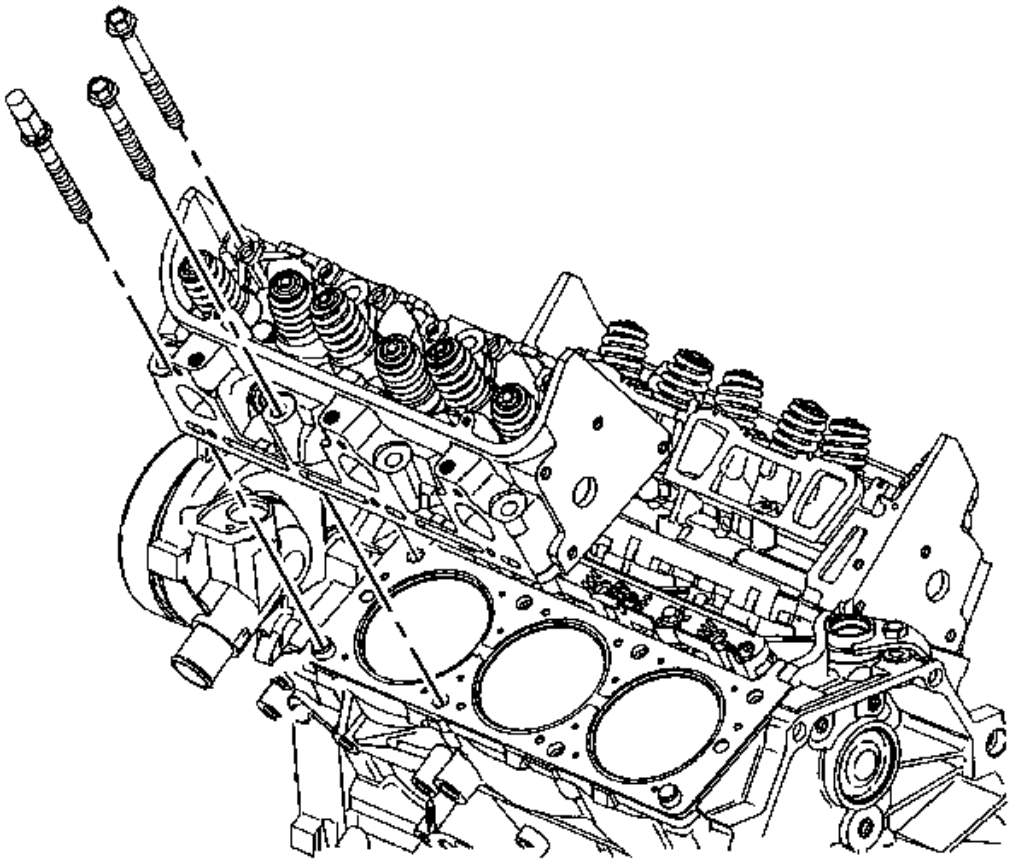

Fig. 159: Identifying Left Cylinder Head
Courtesy of GENERAL MOTORS CORP.

2. Install the left cylinder head over the locator pins and the gasket.

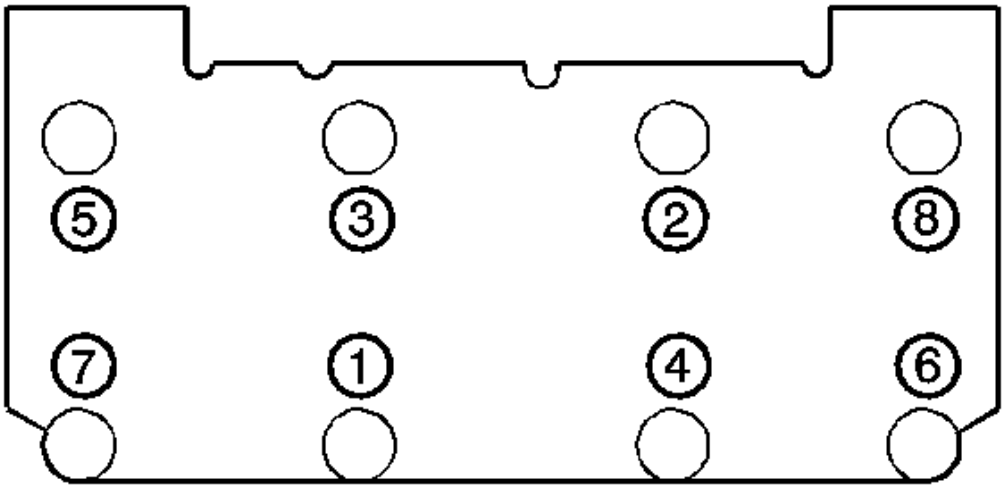

Fig. 160: View Of Cylinder Head Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

3. Install the NEW small hex cylinder head bolts (5 and 8).
4. Install the NEW large hex cylinder head bolts (1, 2, 3, 4, 6 and 7).

Tighten:

1. Tighten the cylinder head bolts a first pass in sequence to 60 N.m (44 lb ft).
2. Tighten the cylinder head bolts a final pass in sequence to 140 degrees using the **J 45059** .

5. Install the left exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side (LZ4)** .
6. Install the left spark plugs. Refer to **Spark Plug Replacement** .
7. Install the left spark plug wires to the spark plugs. Refer to **Spark Plug Wire Replacement** .
8. Install the oil level indicator tube. Refer to **Oil Level Indicator Tube Replacement**.
9. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side (LZ4)** .
10. Install the valve rocker arms and pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
11. Install the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
12. Fill the crankcase with engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
13. Fill the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .

14. Inspect for leaks.

CYLINDER HEAD REPLACEMENT - RIGHT SIDE

SPECIAL TOOLS

J 45059 Angle Meter

REMOVAL PROCEDURE

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Drain the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .
3. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
4. Lower the vehicle.
5. Remove the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
6. Remove the valve rocker arms and push rods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
7. Remove the exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side (LZ4)** .
8. Remove the right spark plug wires from the spark plugs. Refer to **Spark Plug Wire Replacement** .
9. Remove the right spark plugs. Refer to **Spark Plug Replacement** .

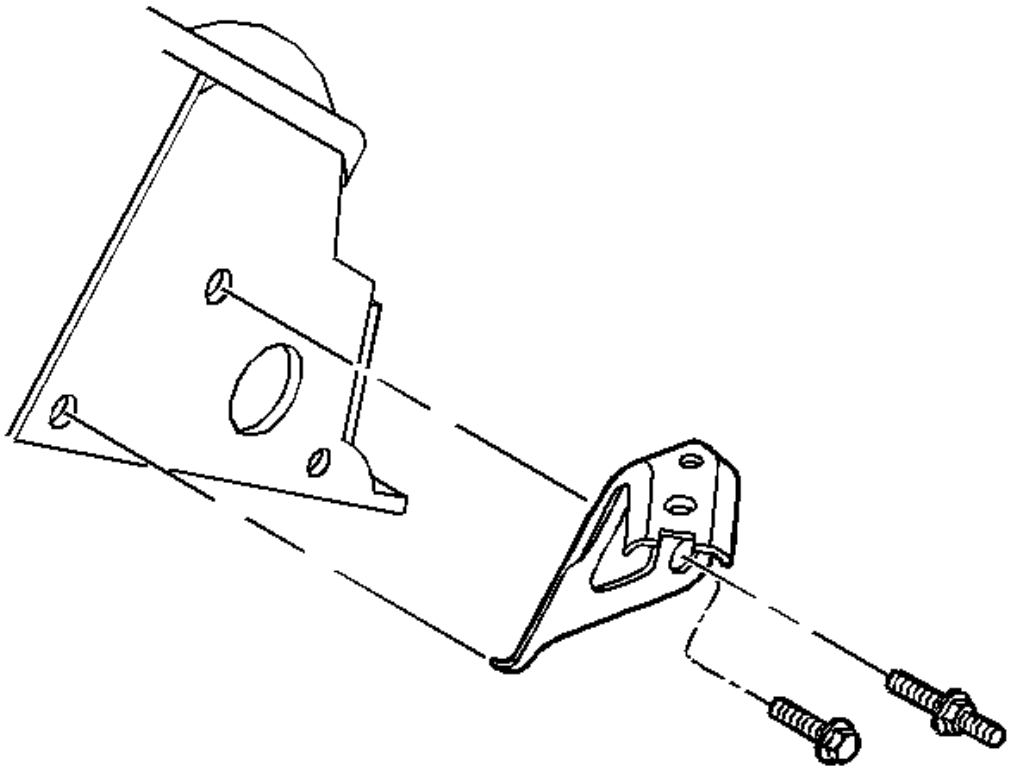

Fig. 161: Identifying Fuel Line Bracket
Courtesy of GENERAL MOTORS CORP.

10. Remove the fuel line bracket bolt and the stud.
11. Remove the fuel line bracket.
12. Remove the generator. Refer to **Generator Replacement (LZ4 or LZE)** .
13. Remove the right exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side (LZ4)** .

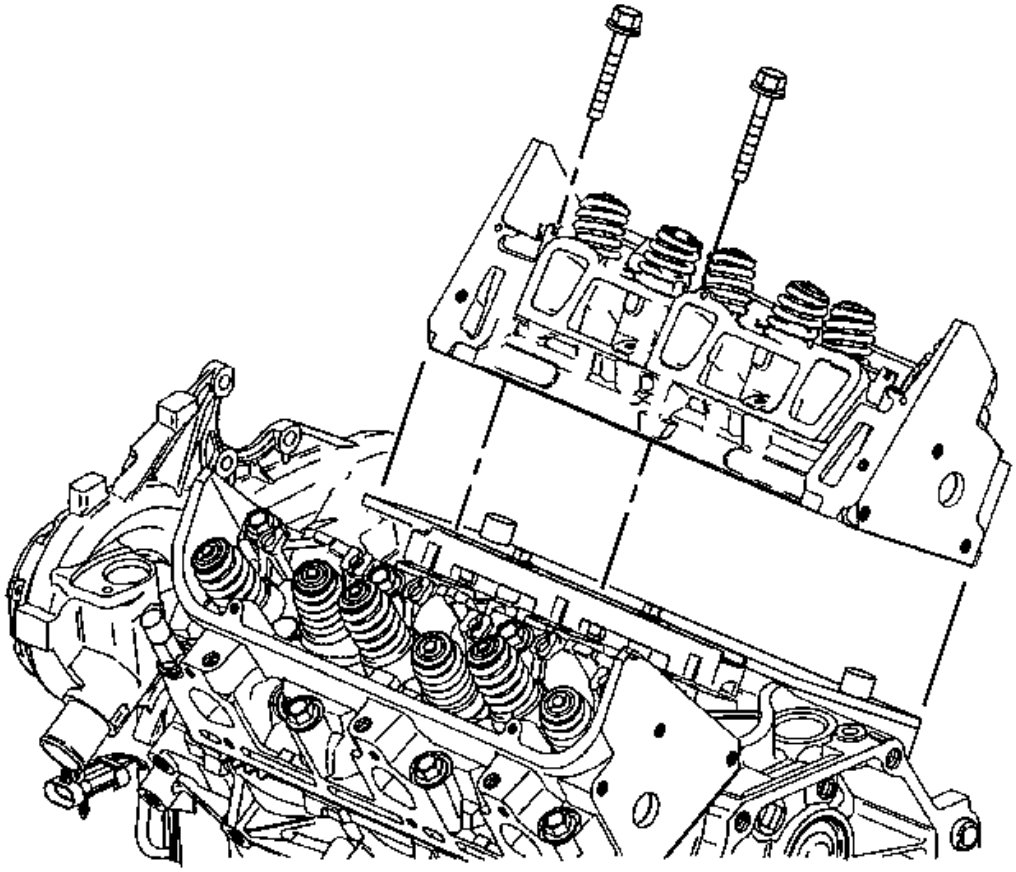

Fig. 162: View Of Right Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

14. Remove the right cylinder head bolts and discard.
15. Remove the right cylinder head.

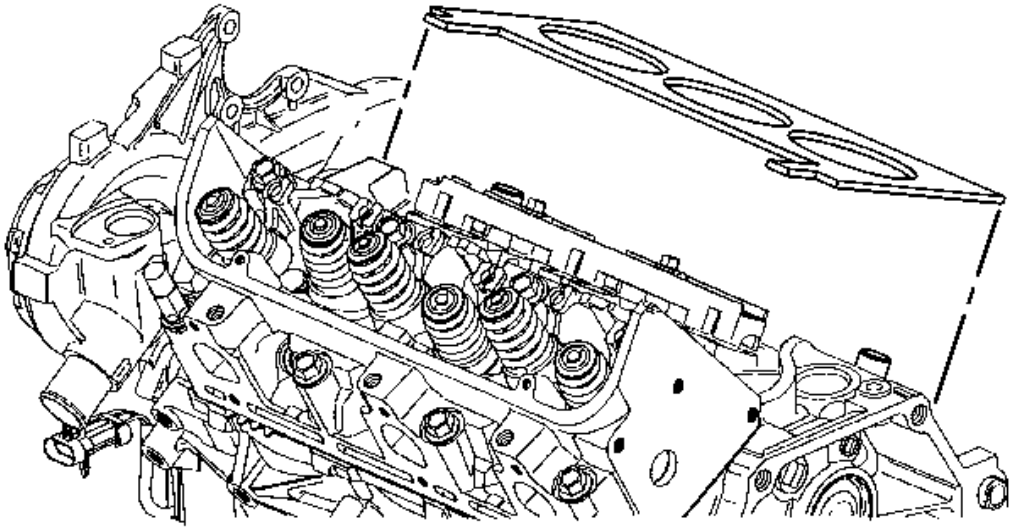

Fig. 163: View Of Right Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

16. Remove the right cylinder head gasket.
17. Clean and inspect the cylinder head and the gasket mating surfaces. Refer to **Engine Block Cleaning and Inspection** and **Cylinder Head Cleaning and Inspection** .

INSTALLATION PROCEDURE

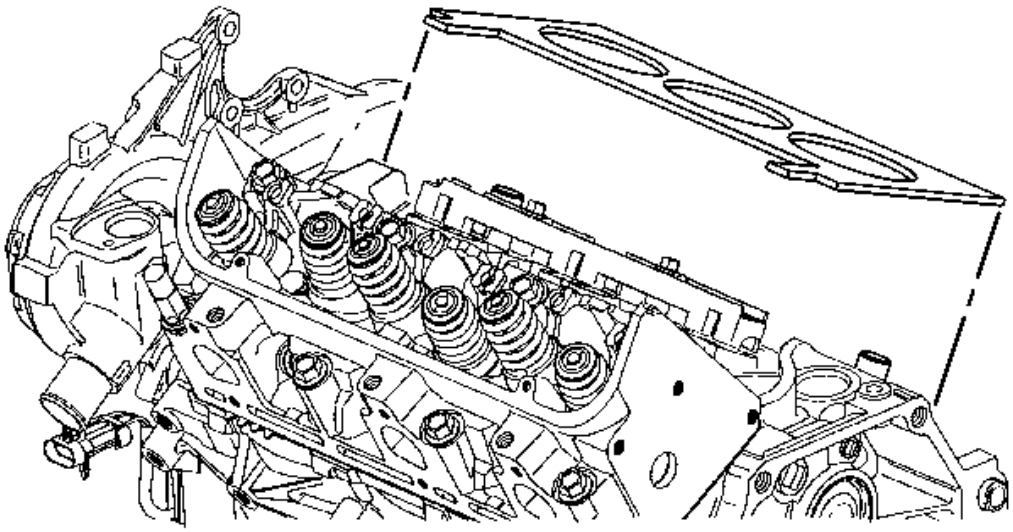

Fig. 164: View Of Right Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install a new right cylinder head gasket.

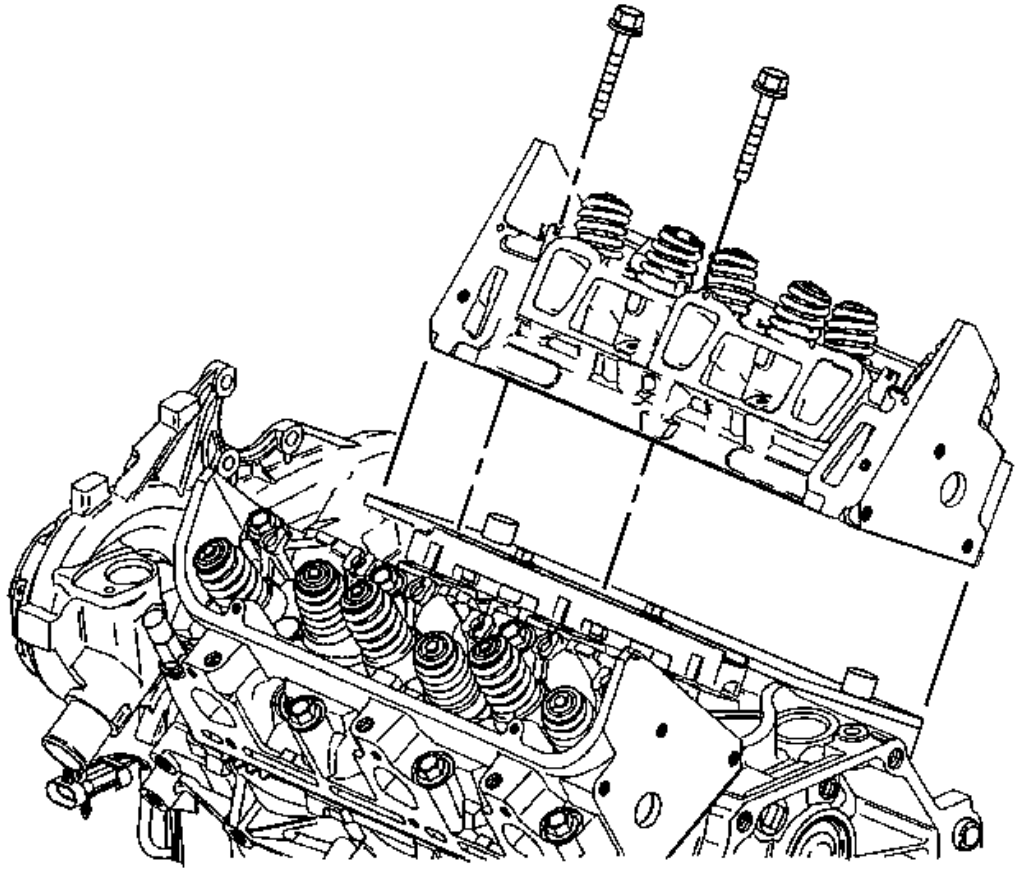

Fig. 165: View Of Right Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

2. Install the right cylinder head over the locator pins and the gasket.

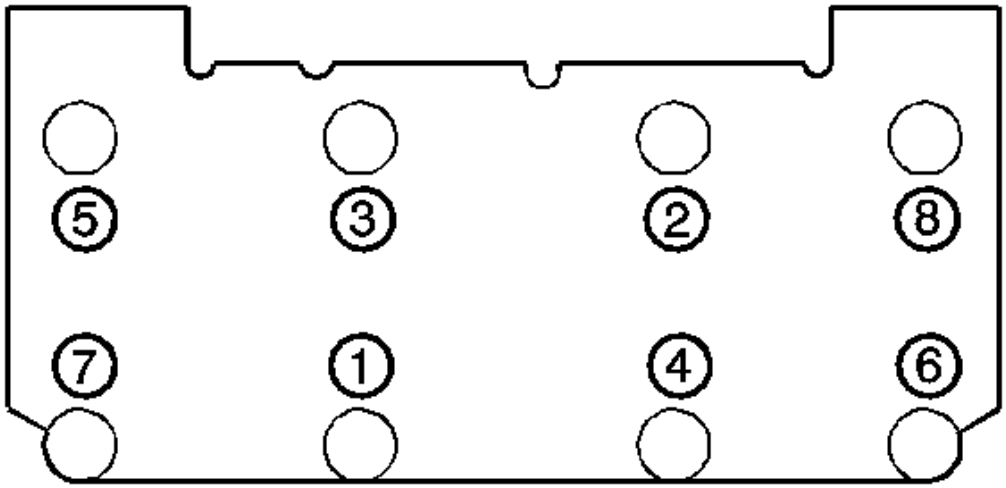

Fig. 166: View Of Cylinder Head Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

3. Install the NEW small hex cylinder head bolts (5 and 8).
4. Install the NEW large hex cylinder head bolts (1, 2, 3, 4, 6 and 7).

Tighten:

1. Tighten the cylinder head bolts a first pass in sequence to 60 N.m (44 lb ft).
2. Tighten the cylinder head bolts a final pass in sequence to 140 degrees using the **J 45059** .

5. Install the right exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side (LZ4)** .
6. Install the generator. Refer to **Generator Replacement (LZ4 or LZE)** .

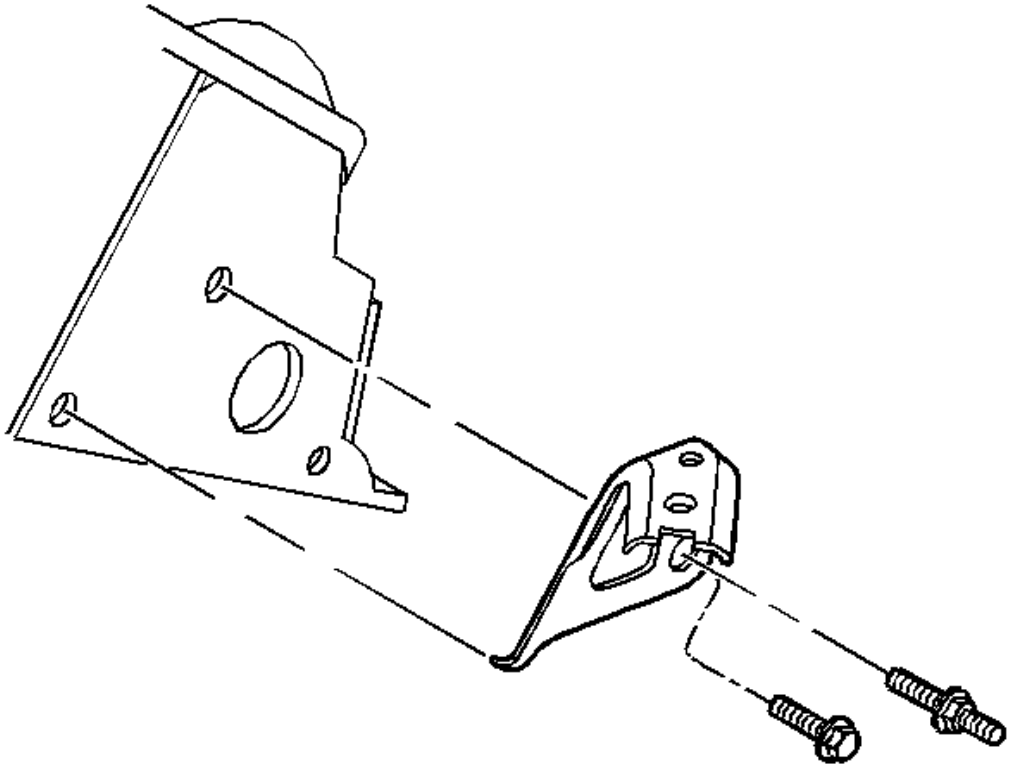

Fig. 167: Identifying Fuel Line Bracket
Courtesy of GENERAL MOTORS CORP.

7. Install the fuel line bracket.
8. Install the fuel line bracket bolt and the stud.

   Tighten: Tighten the bolt and the stud to 50 N.m (37 lb ft).

9. Install the right spark plugs. Refer to **Spark Plug Replacement** .
10. Install the right spark plug wires to the spark plugs. Refer to **Spark Plug Wire Replacement** .
11. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side (LZ4)** .
12. Install the push rods and valve rocker arms. Refer to **Valve Rocker Arm and Push Rod Replacement**.
13. Install the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
14. Fill the crankcase with engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
15. Fill the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .
16. Inspect for leaks.

ENGINE FLYWHEEL REPLACEMENT

SPECIAL TOOLS

J 37096 Flywheel Holder. See **Special Tools** .

REMOVAL PROCEDURE

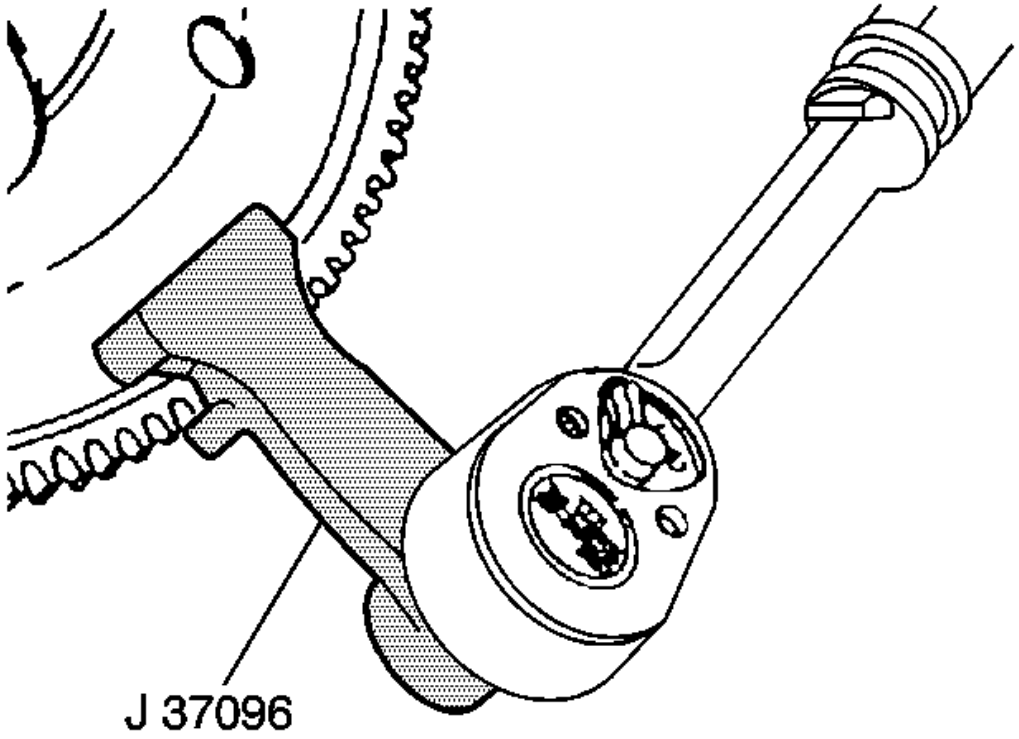

Fig. 168: View Of Flywheel & Flywheel Holder (J 37096)
Courtesy of GENERAL MOTORS CORP.

1. Remove the automatic transaxle. Refer to **Transmission Replacement (3.5L (LZ4) W/MN5)** .
2. Use the **J 37096** to secure the flywheel in order to prevent the crankshaft from rotating. See **Special Tools** .

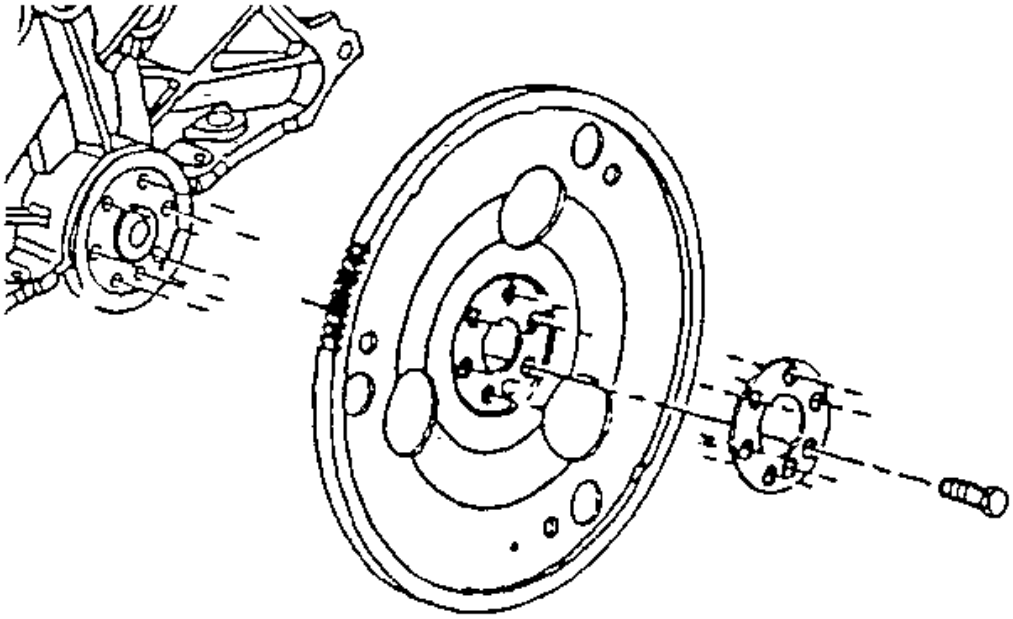

Fig. 169: Identifying Engine Flywheel & Components
Courtesy of GENERAL MOTORS CORP.

3. Loosen the 6 flywheel bolts.
4. Remove 5 of the 6 flywheel bolts leaving one bolt at the top of the crankshaft rotation.
5. Grip the flywheel and remove the remaining bolt. Do not drop the flywheel when removing the final bolt.
6. Remove the engine flywheel retainer and the flywheel.
7. Clean the engine flywheel bolt threads and bolt holes.

INSTALLATION PROCEDURE

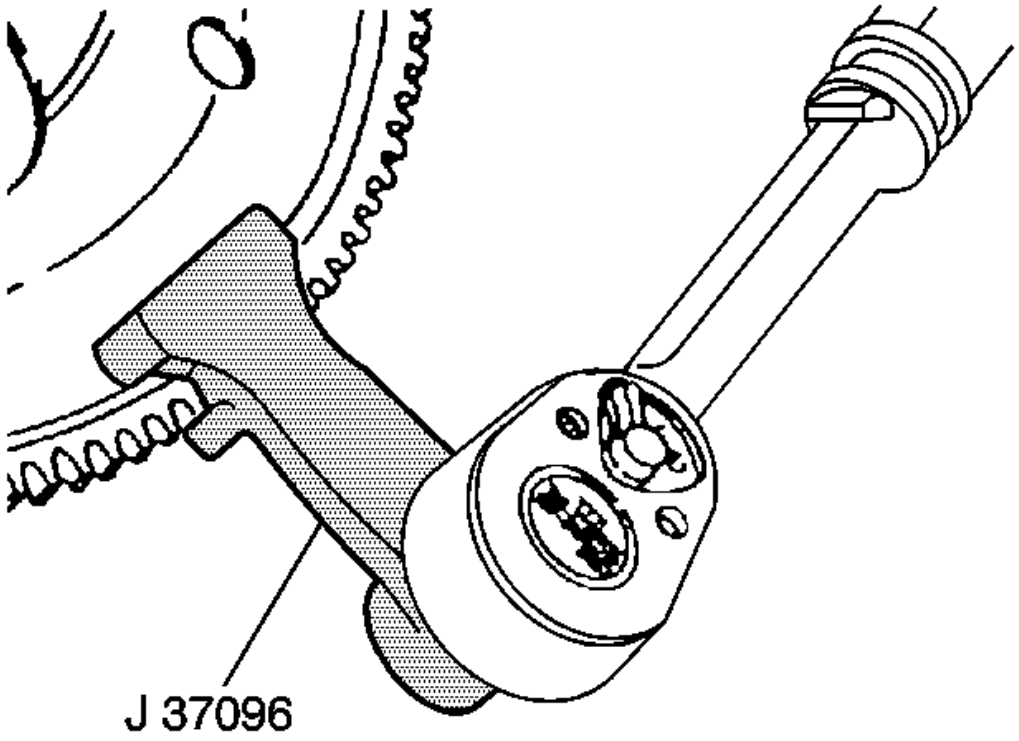

Fig. 170: View Of Flywheel & Flywheel Holder (J 37096)
Courtesy of GENERAL MOTORS CORP.

1. Install the flywheel and the flywheel retainer.
2. Use the **J 37096** to secure the flywheel in order to prevent the crankshaft from rotating. See **Special Tools** .

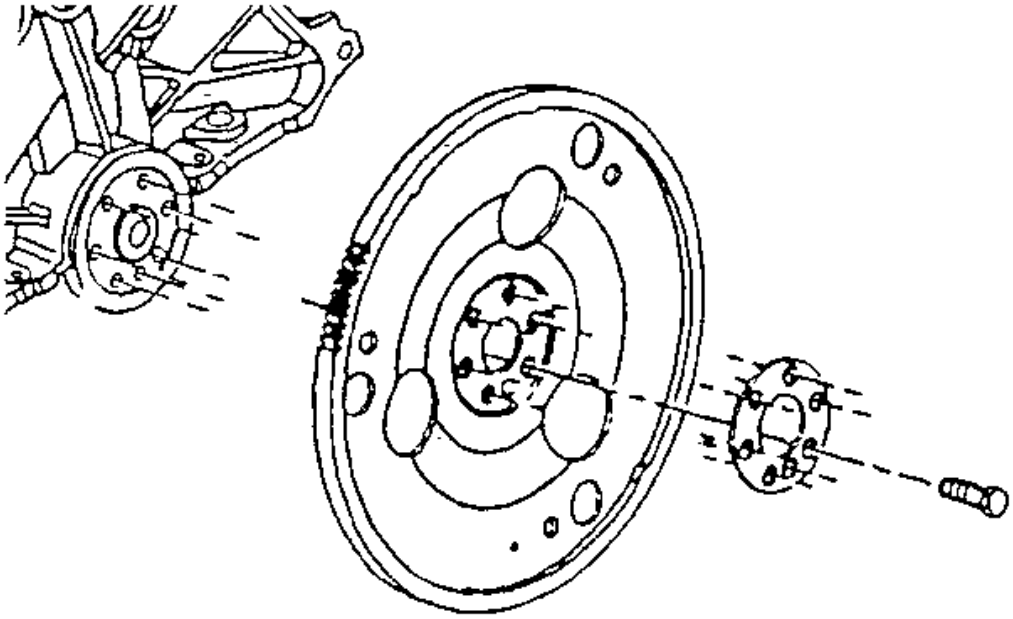

Fig. 171: Identifying Engine Flywheel & Components
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

3. Install the engine flywheel bolts.

   Tighten: Tighten the bolts to 71 N.m (52 lb ft).

4. Measure the flywheel runout:
   1. Install a dial indicator on the engine block and inspect the engine flywheel runout at 3 attaching bosses. Refer to **Engine Mechanical Specifications** .
   2. If the condition cannot be corrected, replace the engine flywheel.
5. Install the automatic transaxle. Refer to **Transmission Replacement (3.5L (LZ4) W/MN5)** .

CRANKSHAFT REAR OIL SEAL REPLACEMENT

REMOVAL PROCEDURE

1. Remove the engine flywheel. Refer to **Engine Flywheel Replacement**.

2. Remove the crankshaft rear oil seal. Refer to **Crankshaft Rear Oil Seal Removal** .

INSTALLATION PROCEDURE

1. Install the rear main seal. Refer to **Crankshaft Rear Oil Seal Installation** .
2. Install the engine flywheel. Refer to **Engine Flywheel Replacement**.

CAMSHAFT REAR BEARING HOLE PLUG REPLACEMENT

REMOVAL PROCEDURE

1. Remove the engine flywheel. Refer to **Engine Flywheel Replacement**.

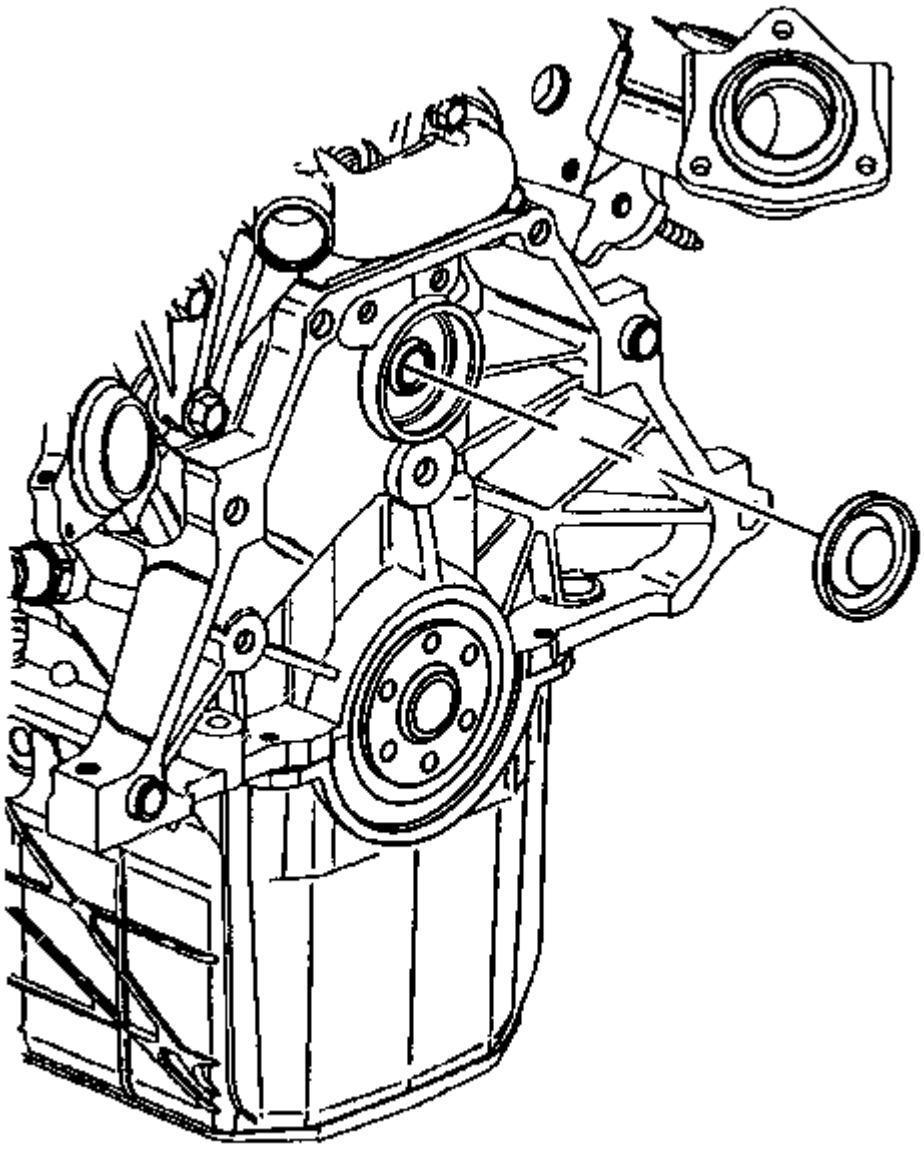

Fig. 172: View Of Camshaft Rear Bearing Hole Plug
Courtesy of GENERAL MOTORS CORP.

2. Remove the camshaft rear bearing hole plug.

INSTALLATION PROCEDURE

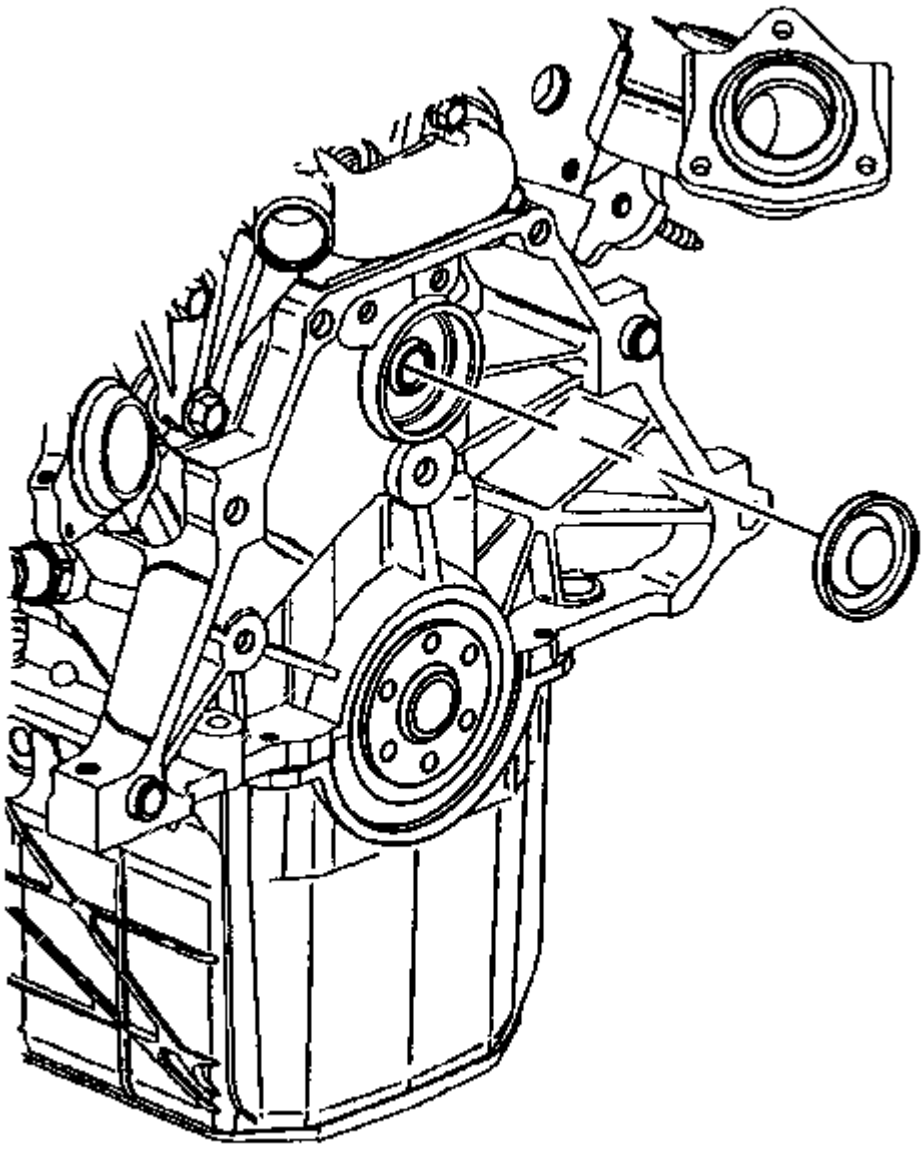

Fig. 173: View Of Camshaft Rear Bearing Hole Plug
Courtesy of GENERAL MOTORS CORP.

1. Coat the camshaft rear bearing hole plug with sealer. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
2. Install the camshaft rear bearing hole plug.

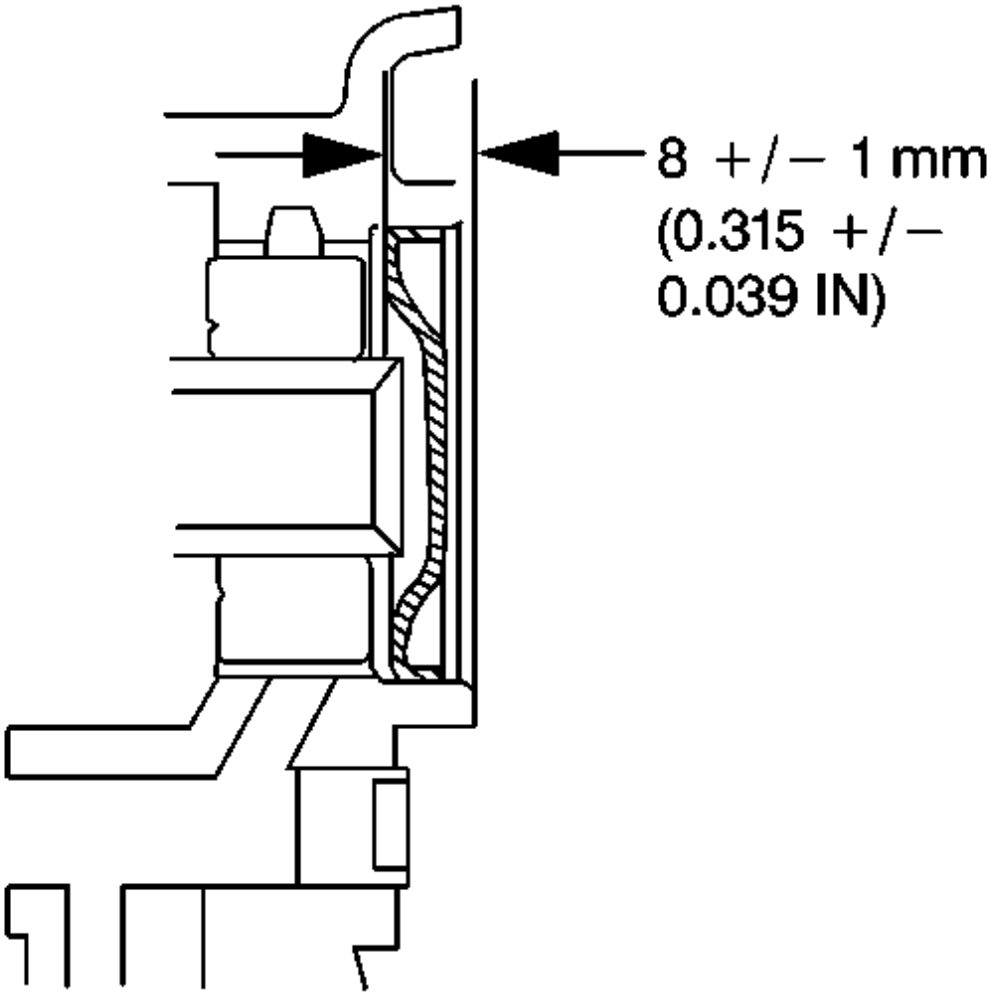

Fig. 174: Illustrating Proper Camshaft Rear Bearing Plug Specifications
Courtesy of GENERAL MOTORS CORP.

3. Ensure that the camshaft rear bearing plug is installed to specifications.
4. Install the engine flywheel. Refer to **Engine Flywheel Replacement**.

ENGINE REPLACEMENT

REMOVAL PROCEDURE

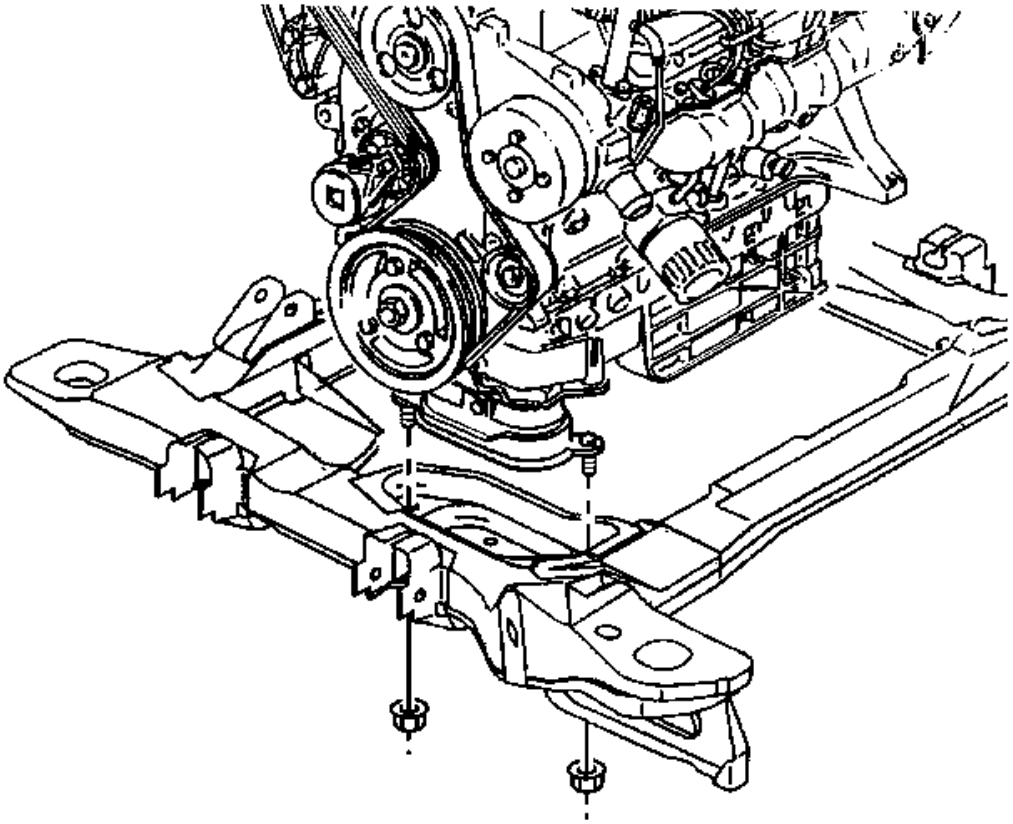

Fig. 175: Identifying Engine Mount Lower Nuts
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
2. Remove the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.
3. Drain the cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .
4. Drain the engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
5. Remove the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .
6. Remove the hood. Refer to **Hood Replacement** .
7. Remove the engine mount snubber and drive belt. Refer to **Drive Belt Replacement**.
8. Disconnect the following electrical connectors:
    - The knock sensor (KS)

- The camshaft position (CMP) sensor
- The crankshaft position (CKP) sensor
- The heated oxygen sensor (HO2S)
- The manifold absolute pressure (MAP) sensor
- The exhaust gas recirculation (EGR) valve
- The evaporative emission (EVAP) canister purge solenoid
- The electronic throttle control
- The ignition coil
- The body wiring harness-to-engine harness

9. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle**
10. Remove the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LZ4)** and **Catalytic Converter Replacement - Right Side (LZ4)** .
11. Remove the engine wiring harness grounds from the transaxle.
12. Remove the engine mount lower nuts.
13. Remove the torque converter covers.
14. Remove the starter motor. Refer to **Starter Replacement (LZ4 or LZE)** .
15. Remove the air conditioning (A/C) compressor. DO NOT discharge the A/C system. Support the compressor. Refer to **Air Conditioning Compressor Replacement (LZE, LZ4, LZ9)** .
16. Remove the torque converter bolts.

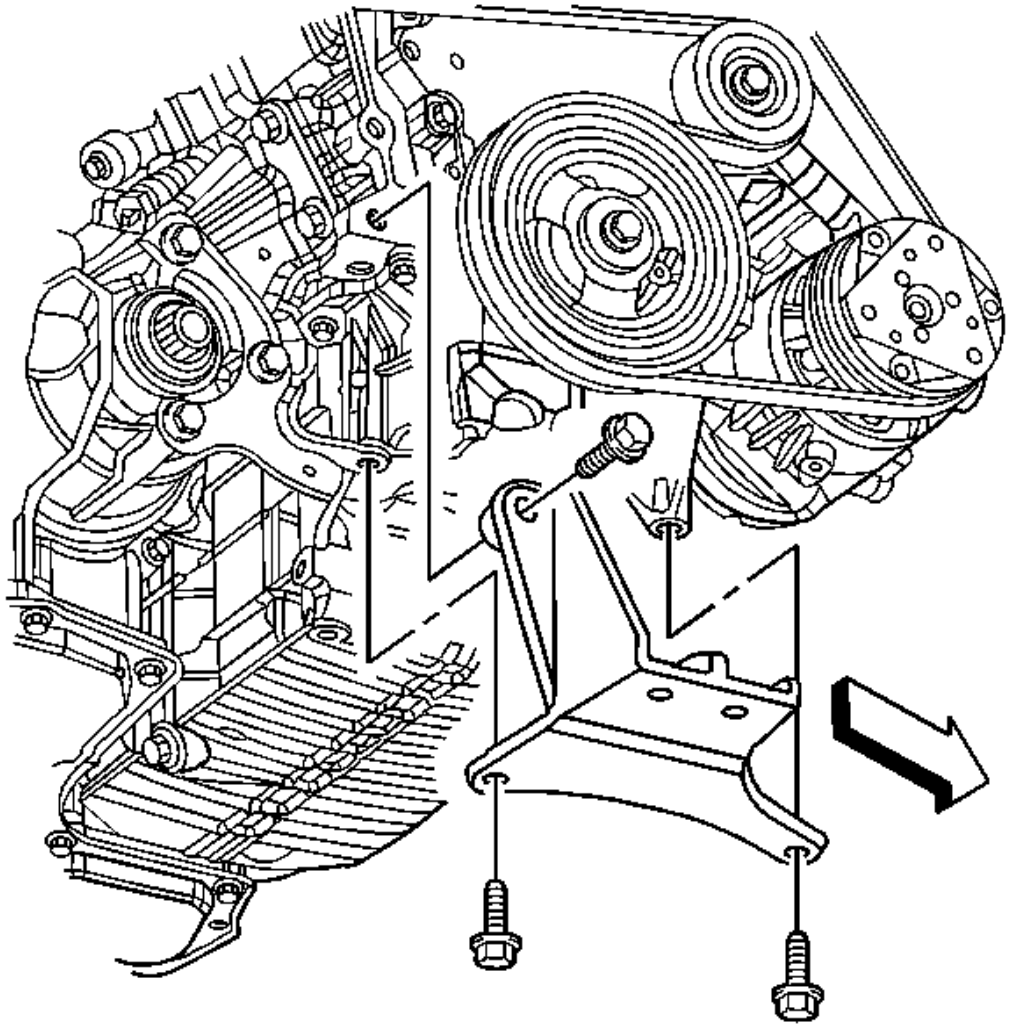

Fig. 176: Identifying Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

17. Remove the engine mount bracket bolts and bracket.

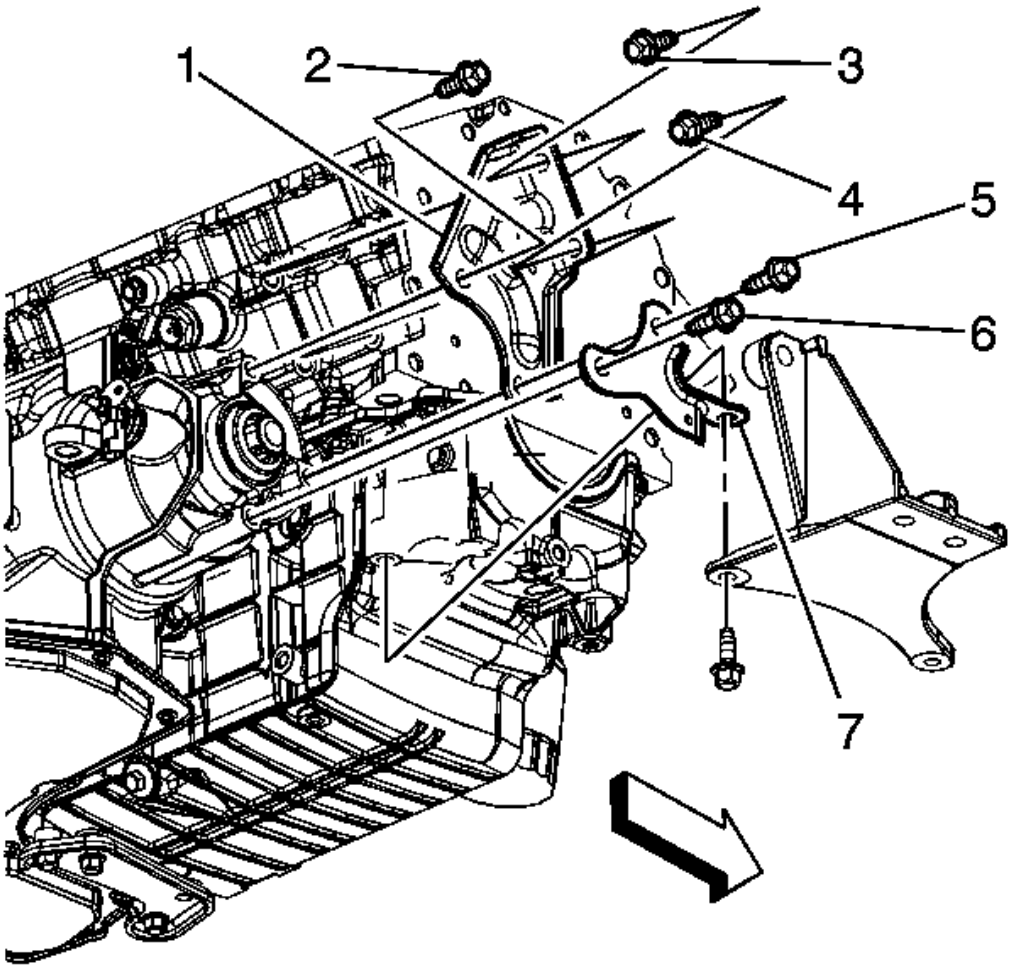

Fig. 177: Identifying Transaxle Brace & Bolts
Courtesy of GENERAL MOTORS CORP.

18. Remove the engine wiring harness clip from the rear of the transaxle brace.
19. Remove the transaxle brace bolts (5 and 6) and remove the brace (7).

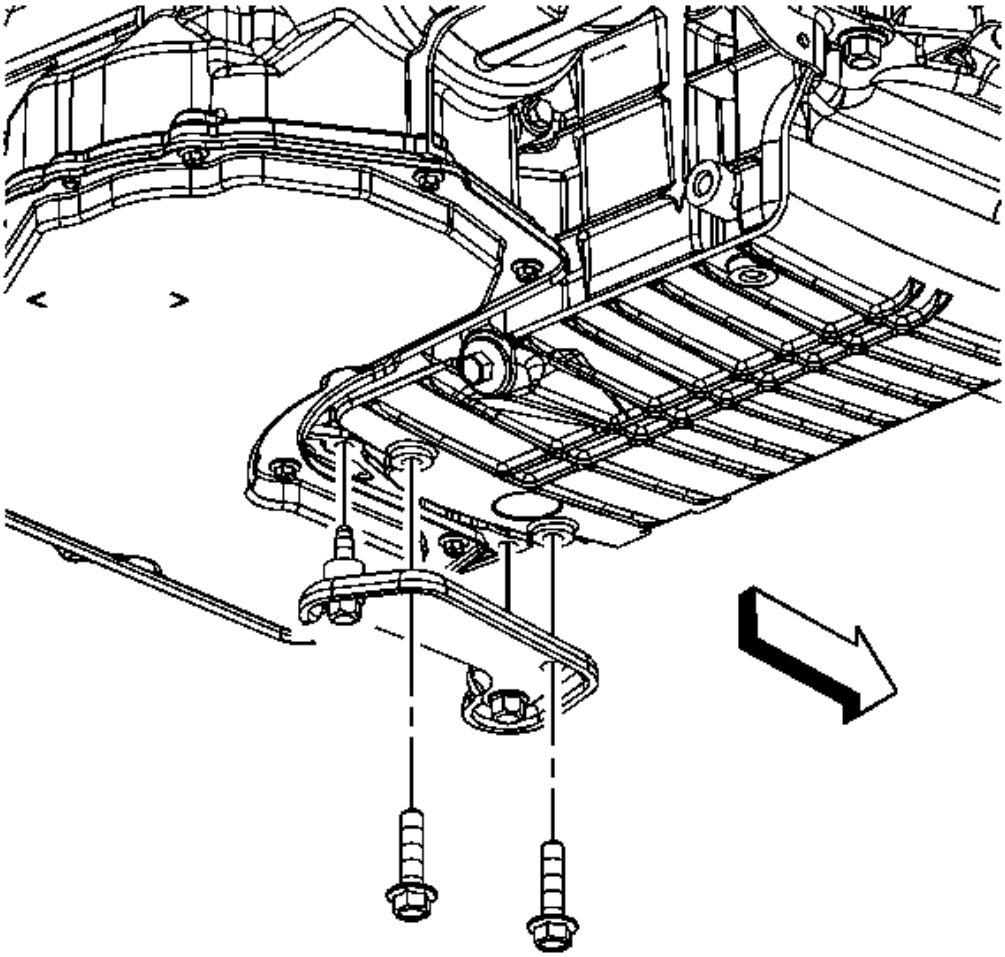

Fig. 178: Identifying Transmission To Engine Brace Bolts
Courtesy of GENERAL MOTORS CORP.

20. Remove the transaxle to oil pan brace bolts and brace.

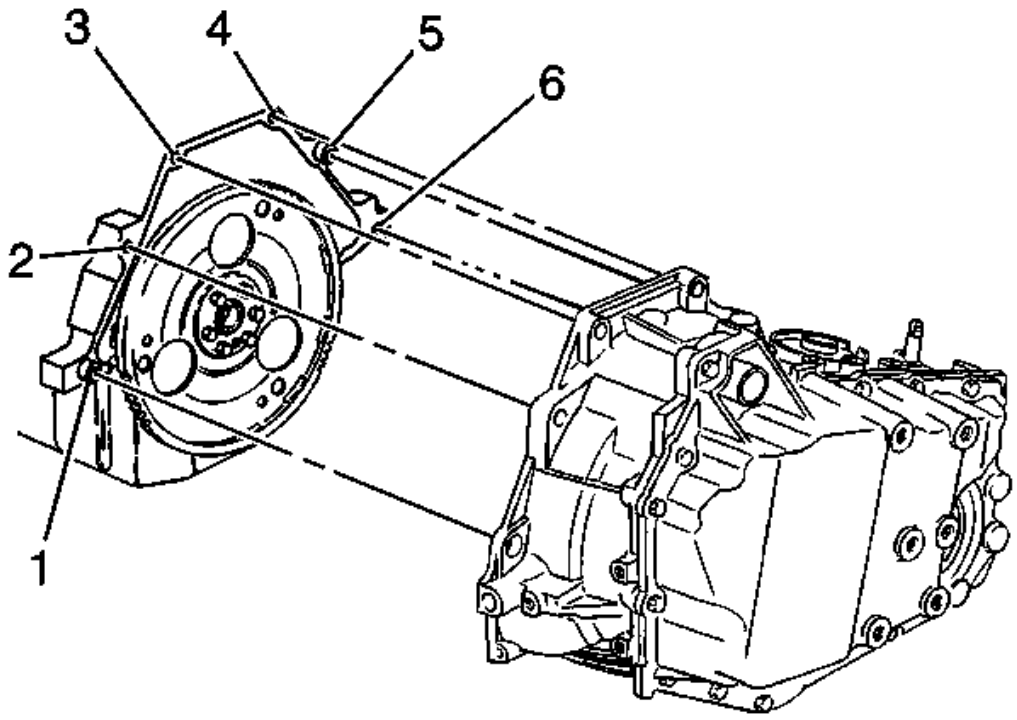

Fig. 179: View of Transaxle To Engine Mounting
Courtesy of GENERAL MOTORS CORP.

21. Remove the lower transaxle-to-engine bolt (6) and the stud (1).
22. Remove the radiator outlet hose from the engine. Refer to **Radiator Outlet Hose Replacement (LZE, LZ4, LZ9)** .
23. Lower the vehicle and support the transaxle.
24. Remove the heater outlet and inlet hoses from the engine.
25. Remove the vacuum hoses from the upper intake manifold.
26. Remove the brake booster vacuum hose from the upper intake manifold.
27. Remove the fuel lines from the fuel rail. Refer to **Fuel Injection Fuel Rail Assembly Replacement** .
28. Remove the radiator inlet hose from the engine. Refer to **Radiator Inlet Hose Replacement (LZE, LZ4, LZ9)** .
29. Install the engine lifting device to the engine.
30. Remove the upper transaxle-to-engine bolts (3, 4, 5) and the stud (2).
31. Remove the engine from the vehicle.
32. Remove the flywheel. Refer to **Engine Flywheel Replacement**.
33. Install the engine to the engine stand.

INSTALLATION PROCEDURE

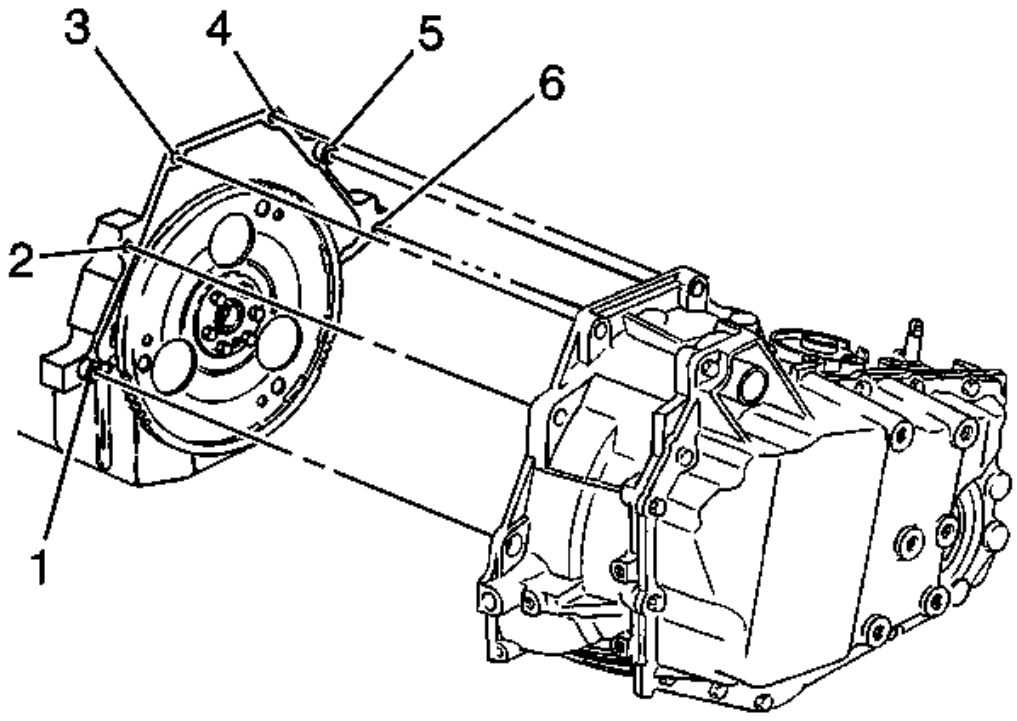

Fig. 180: View of Transaxle To Engine Mounting
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine from the engine stand.
2. Install the flywheel. Refer to **Engine Flywheel Replacement**.
3. Install the engine to the vehicle.

CAUTION: Refer to Fastener Caution .

4. Install the upper transaxle-to-engine bolts (3, 4, 5) and the stud (2) and tighten to 75 N.m (55 lb ft).
5. Remove the engine lifting device.
6. Install the radiator inlet hose to the engine. Refer to **Radiator Inlet Hose Replacement (LZE, LZ4, LZ9)** .
7. Install the fuel lines to the fuel rail. Refer to **Fuel Injection Fuel Rail Assembly Replacement** .
8. Install the brake booster vacuum hose to the upper intake manifold.

9. Install the vacuum hoses to the upper intake manifold.
10. Install the heater inlet and outlet hoses to the engine.
11. Raise the vehicle and remove the transaxle support.
12. Install the radiator outlet hose to the engine. Refer to **Radiator Outlet Hose Replacement (LZE, LZ4, LZ9)** .
13. Install the lower transaxle-to-engine bolt (6) and the stud (1) and tighten to 75 N.m (55 lb ft.

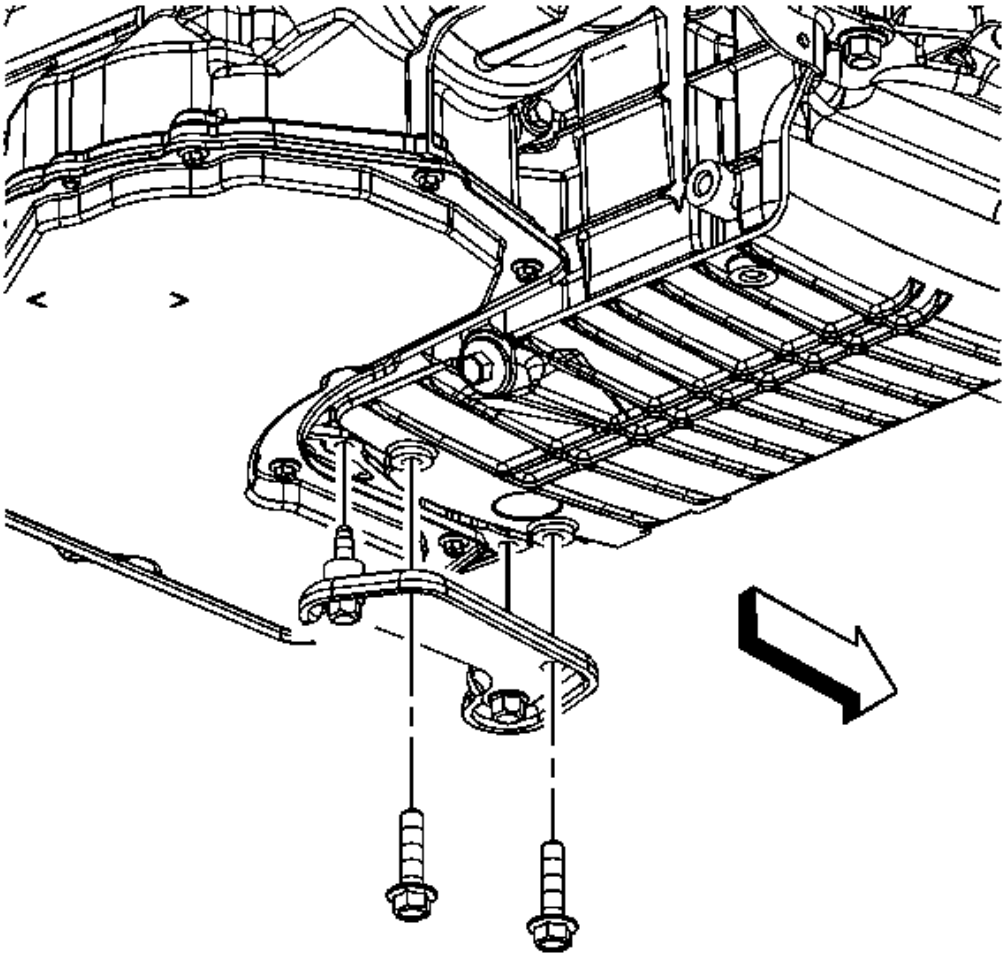

Fig. 181: Identifying Transmission To Engine Brace Bolts
Courtesy of GENERAL MOTORS CORP.

14. Position the transaxle to oil pan brace and install the bolts. Tighten the bolts to 50 N.m (37 lb ft).

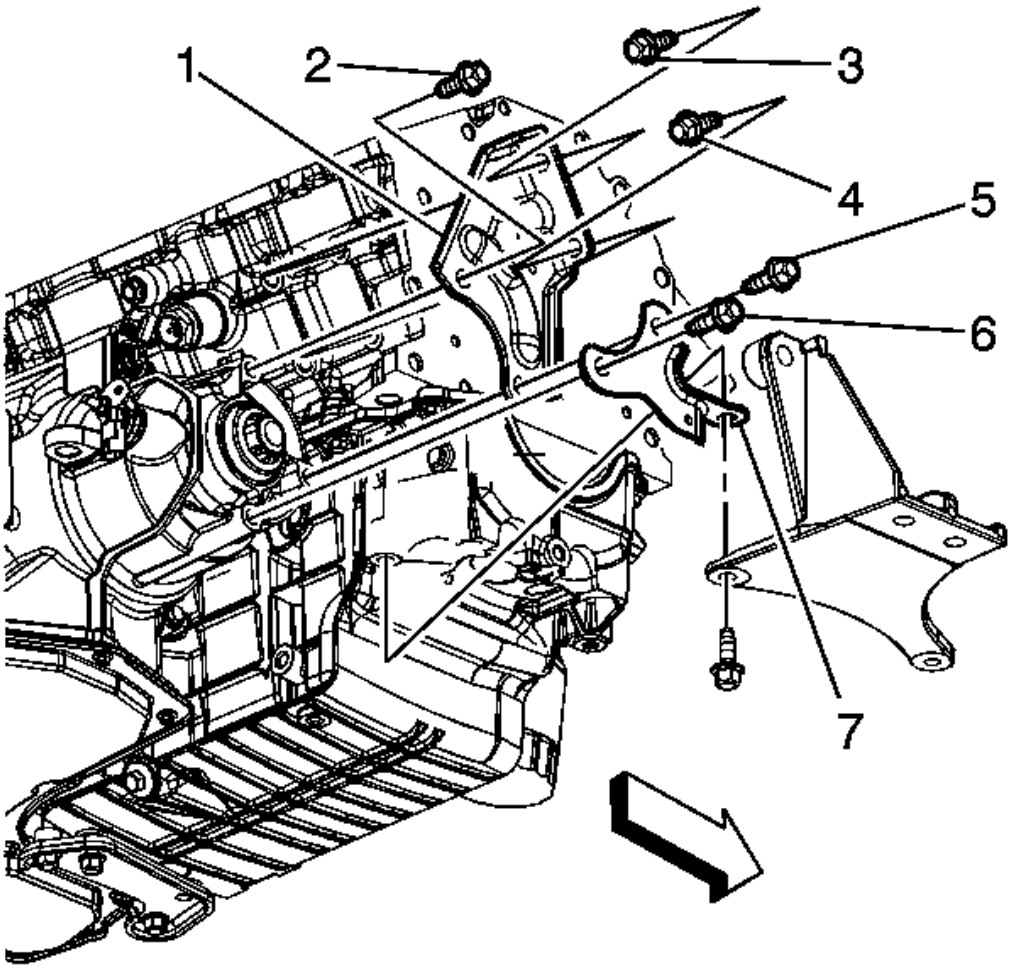

Fig. 182: Identifying Transaxle Brace & Bolts
Courtesy of GENERAL MOTORS CORP.

15. Position the transaxle brace (7) to the transaxle and install the bolts (5 and 6) until snug.
16. Install the engine wiring harness clip to the rear of the transaxle brace.

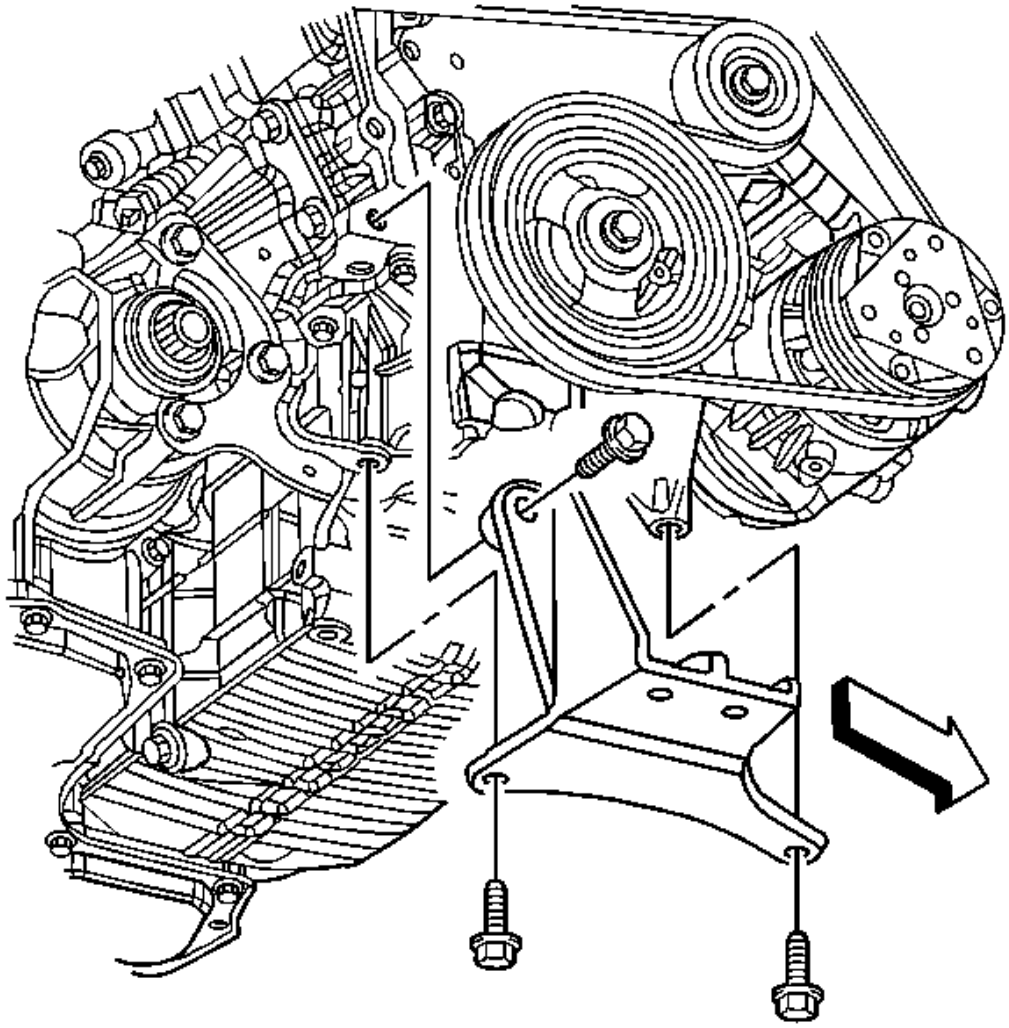

Fig. 183: Identifying Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

17. Position the engine mount bracket to the engine and install the bolts until snug.
18. Tighten the engine mount bracket bolts and transaxle brace bolts.
    - Tighten the engine mount bracket upper bolt to 90 N.m (66 lb ft).
    - Tighten the engine mount bracket lower bolts to 50 N.m (37 lb ft).
    - Tighten the transaxle brace bolts to 72 N.m (53 lb ft).
19. Install the torque converter bolts.
20. Install the A/C compressor. Refer to **Air Conditioning Compressor Replacement (LZE, LZ4, LZ9)** .

21. Install the starter motor. Refer to **Starter Replacement (LZ4 or LZE)** .
22. Install the torque converter covers.

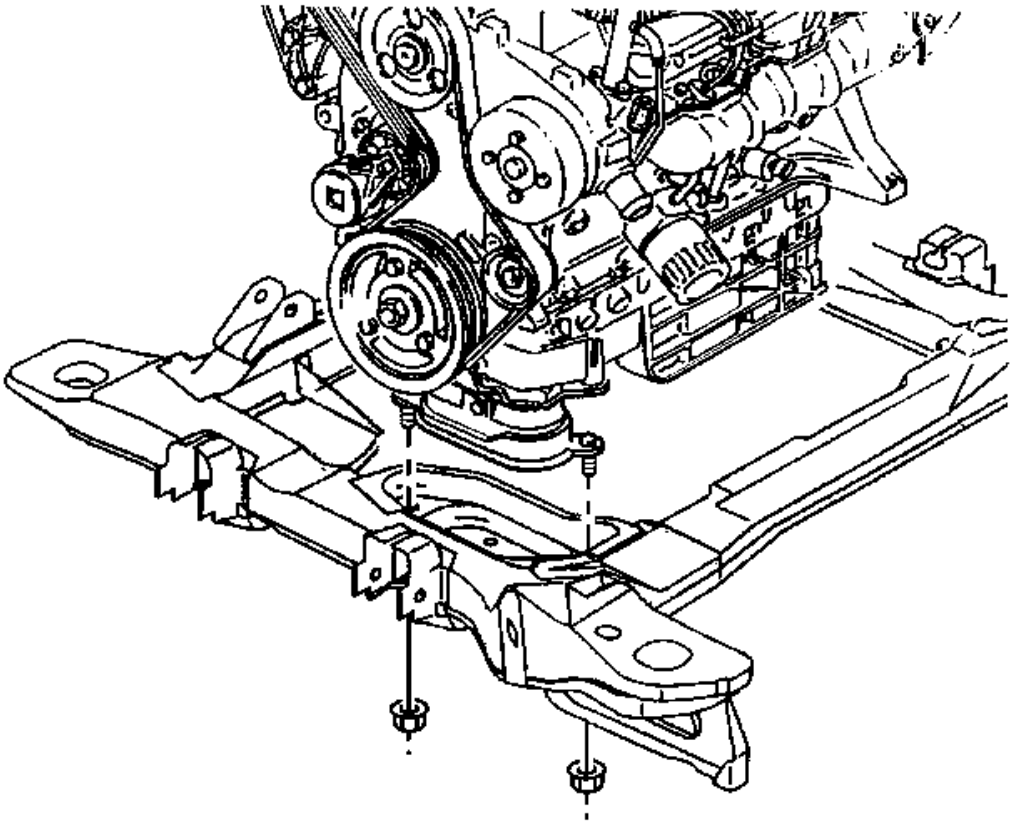

Fig. 184: Identifying Engine Mount Lower Nuts
Courtesy of GENERAL MOTORS CORP.

23. Install the engine mount lower nuts and tighten to 43 N.m (32 lb ft).
24. Install the engine wiring harness grounds to the transaxle.
25. Install the engine wiring harness ground nut to the transaxle stud and tighten the nut to 35 N.m (26 lb ft).
26. Install the catalytic converters. Refer to **Catalytic Converter Replacement - Left Side (LZ4)** and **Catalytic Converter Replacement - Right Side (LZ4)** .
27. Lower the vehicle.
28. Connect the following electrical connectors:
    - The body wiring harness-to-engine harness
    - The ignition coil

- The electronic throttle control
- The EVAP canister purge solenoid
- The EGR valve
- The MAP sensor
- The HO2S
- The CKP sensor
- The CMP sensor
- The KS

29. Install the drive belt and engine mount snubber. Refer to **Drive Belt Replacement**.
30. Install the hood. Refer to **Hood Replacement** .
31. Install the air cleaner assembly. Refer to **Air Cleaner Assembly Replacement (NU6)** or **Air Cleaner Assembly Replacement (NT7)** .
32. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection** .
33. Fill the crankcase with engine oil. Refer to **Engine Oil and Oil Filter Replacement**.
34. Fill cooling system. Refer to **Cooling System Draining and Filling (GE 47716 Fill)** or **Cooling System Draining and Filling (LY7, LZE, LZ4, LZ9)** .
35. Perform a CKP system variation learn procedure. Refer to **Crankshaft Position System Variation Learn** .
36. Install the intake manifold cover. Refer to **Intake Manifold Cover Replacement**.
37. Inspect for leaks.

ENGINE OIL AND OIL FILTER REPLACEMENT

REMOVAL PROCEDURE

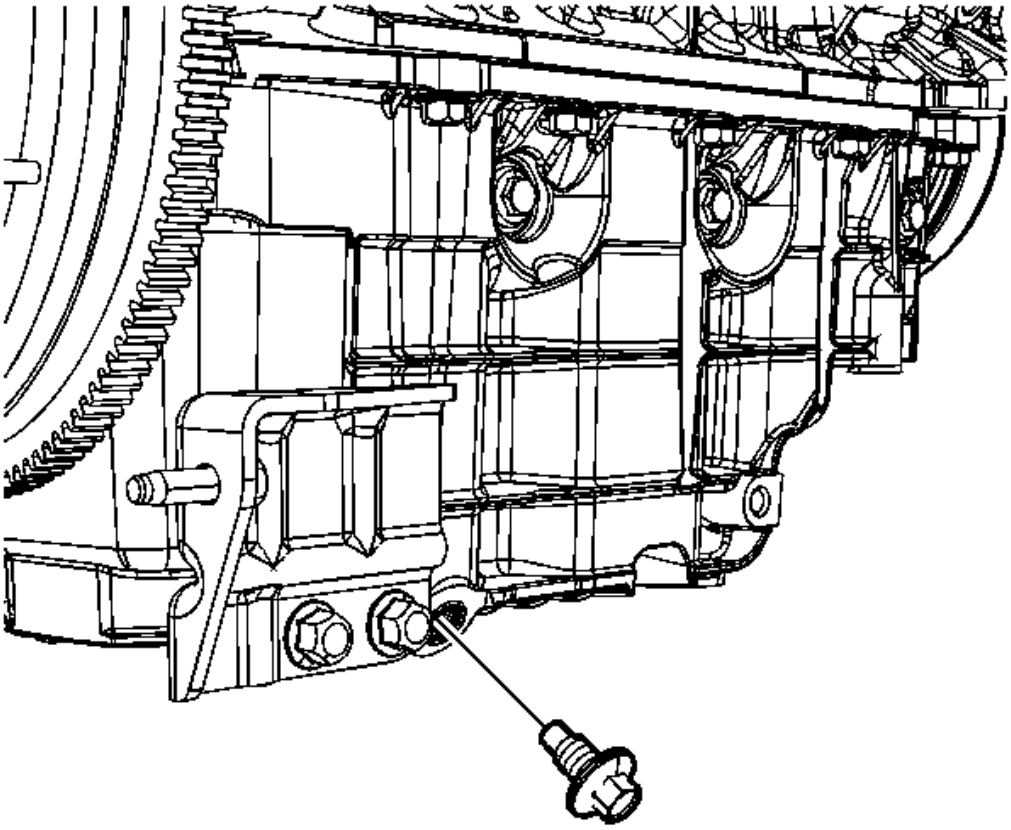

Fig. 185: View Of Oil Drain Plug
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Position a suitable drain pan under the oil pan drain plug.
3. Remove the oil pan drain plug.
4. Allow the engine oil to drain completely.
5. Clean and inspect the oil pan drain plug sealing surface, replace the oil pan if necessary.
6. Wipe any remaining oil from the drain plug hole and reinstall the oil pan drain plug until snug.

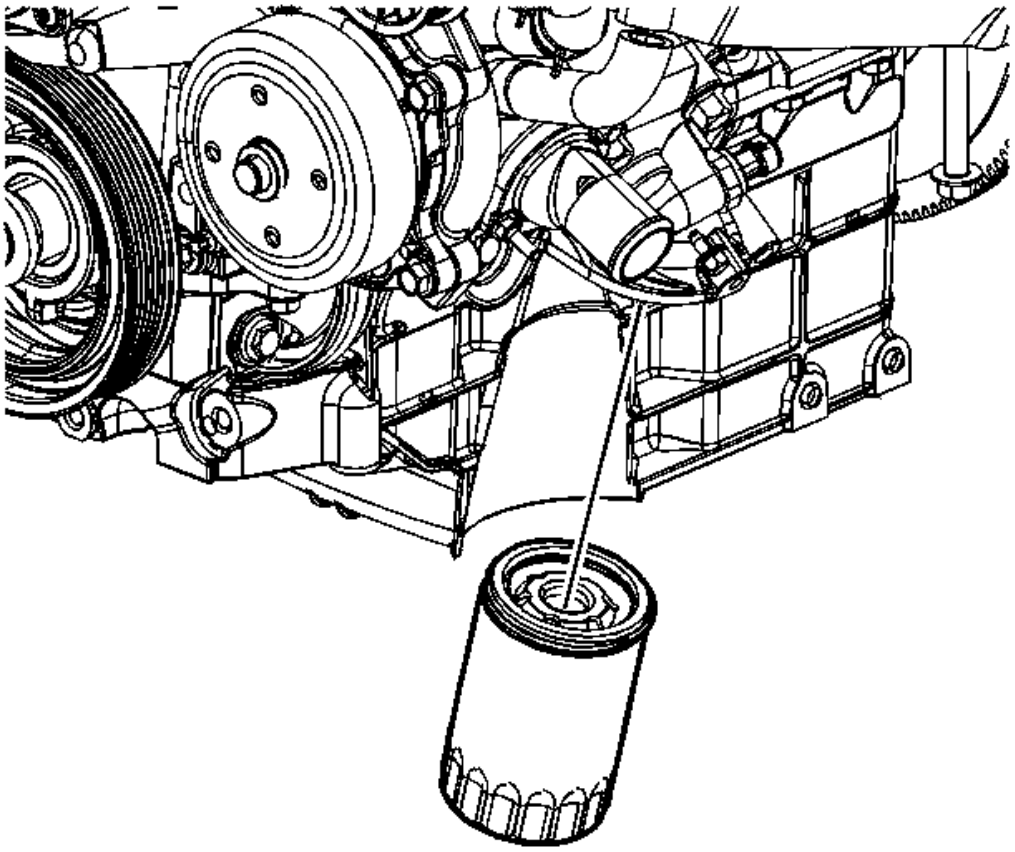

Fig. 186: View Of Oil Filter
Courtesy of GENERAL MOTORS CORP.

7. Position a suitable drain pan under the oil filter.
8. Remove the oil filter.
9. Ensure that the oil filter gasket is still on the old filter. If not remove the oil filter gasket from the adapter.

INSTALLATION PROCEDURE

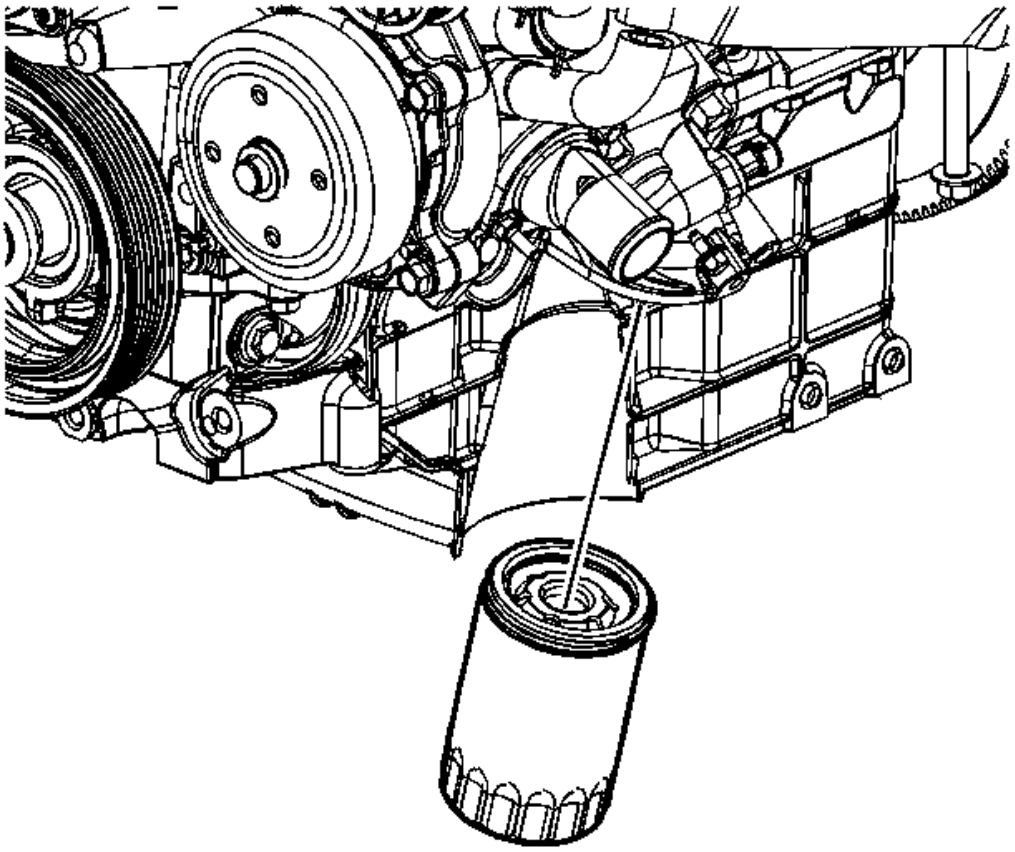

Fig. 187: View Of Oil Filter
Courtesy of GENERAL MOTORS CORP.

1. Apply clean engine oil to the NEW oil filter gasket.
2. Install the NEW oil filter.

Tighten: Tighten the new filter to 3/4 to 1 full turn, after the oil filter gasket contacts the adapter.

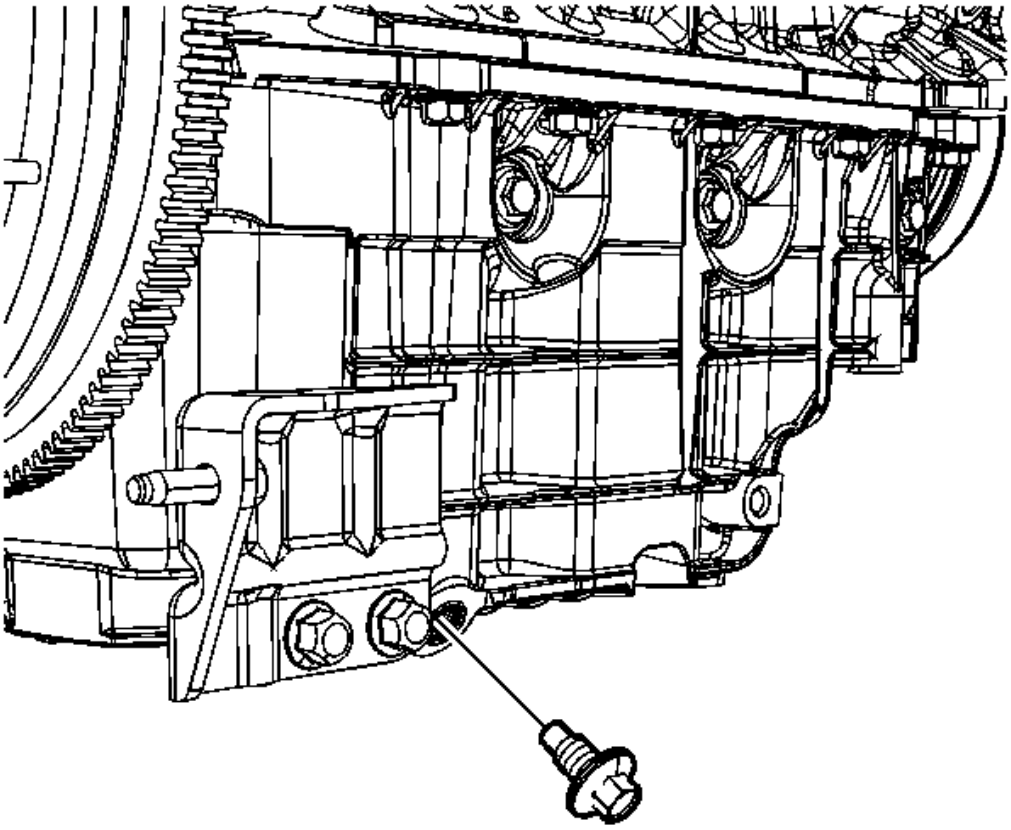

Fig. 188: View Of Oil Drain Plug
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

3. Tighten the oil pan drain plug.

   Tighten: Tighten the oil pan drain plug to 26 N.m (19 lb ft).

4. Remove the oil drain pan from under the vehicle.
5. Lower the vehicle.
6. Fill the engine with new engine oil. Refer to **Approximate Fluid Capacities** and **Fluid and Lubricant Recommendations (USA and Canada)** .
7. Start the engine.
8. Inspect the for oil leaks after engine start up.

9. Turn OFF the engine and allow the oil a few minutes to drain back into the oil pan.
10. Remove the oil level indicator from the oil level indicator tube.
11. Clean off the indicator end of the oil level indicator with a clean paper towel or cloth.
12. Install the oil level indicator into the oil level indicator tube until the oil level indicator handle contacts the top of the oil level indicator tube.
13. Again, remove the oil level indicator from the oil level indicator tube keeping the tip of the oil level indicator down.
14. Check the level if the engine oil on the oil level indicator.
15. If necessary, adjust the oil level by adding or draining oil.
16. Check for oil leaks.

