

REPAIR INSTRUCTIONS

DRIVE BELT REPLACEMENT - GENERATOR AND WATER PUMP

Removal Procedure

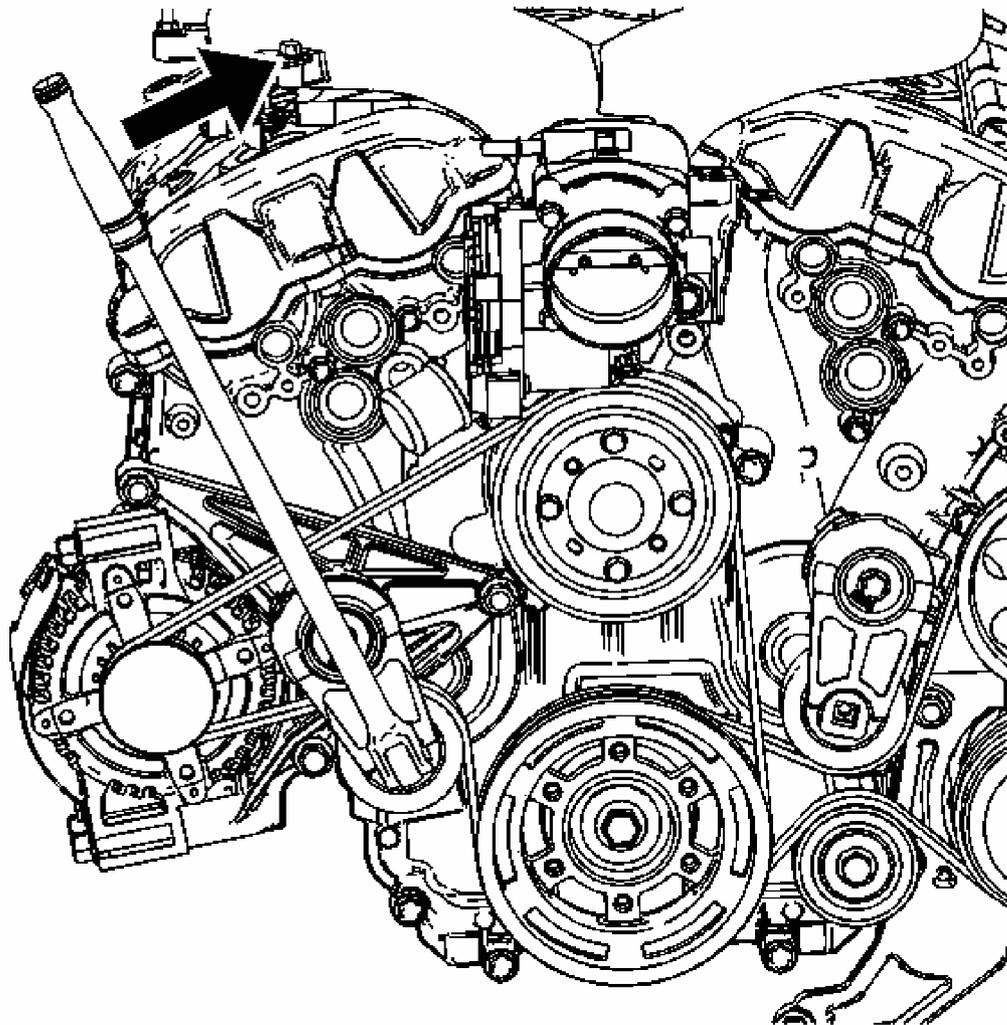


Fig. 1: Removing/Installing Generator & Water Pump Drive Belt
Courtesy of GENERAL MOTORS CORP.

1. Rotate the drive belt tensioner clockwise to release the drive belt tension.

2. Slide the drive belt off of the water pump pulley.
3. Slowly release the drive belt tensioner.
4. Remove the drive belt from the accessory drive pulleys.

Installation Procedure

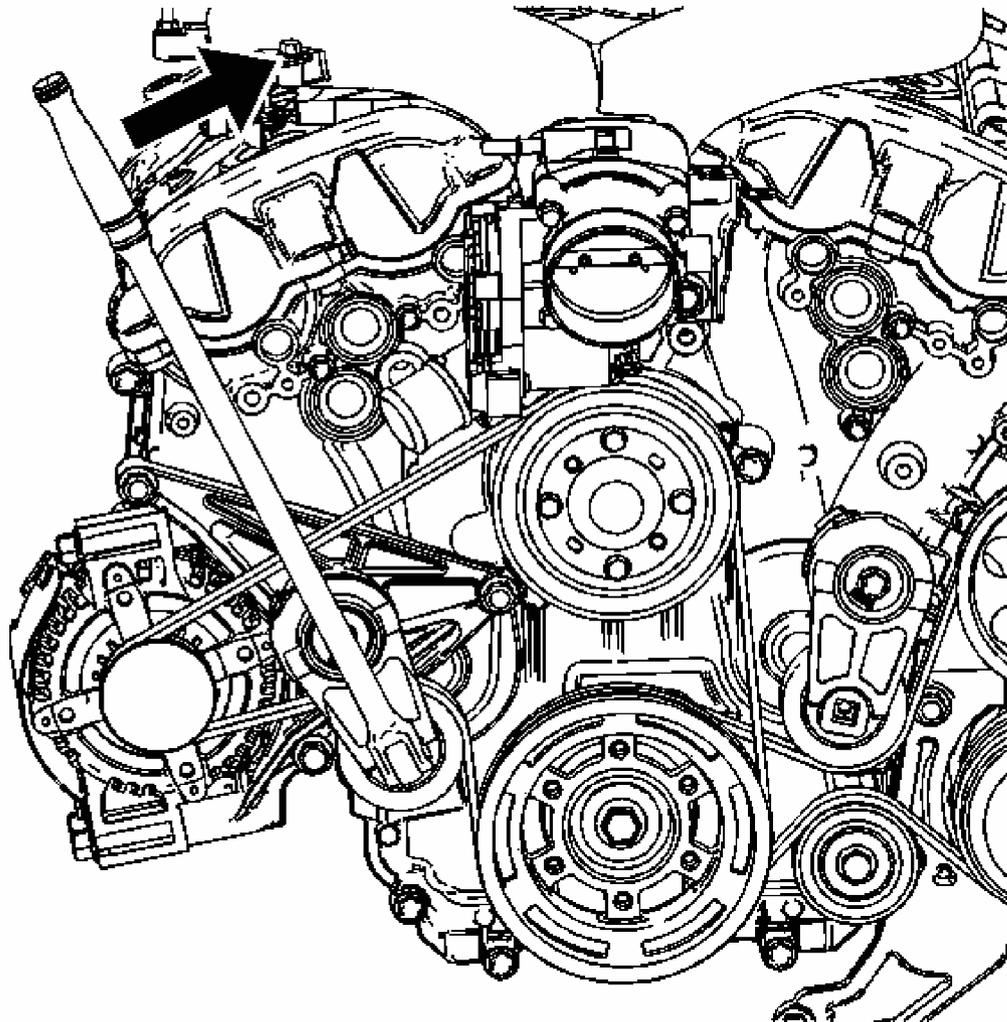


Fig. 2: Removing/Installing Generator & Water Pump Drive Belt
Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt to the crankshaft pulley, the tensioner and the generator.
2. Rotate the drive belt tensioner clockwise.
3. Install the drive belt to the water pump.

IMPORTANT: Ensure the drive belt is properly aligned and seated into the grooves of the accessory drive pulleys.

4. Slowly release the drive belt tensioner.

DRIVE BELT REPLACEMENT - POWER STEERING AND AIR CONDITIONING

Removal Procedure

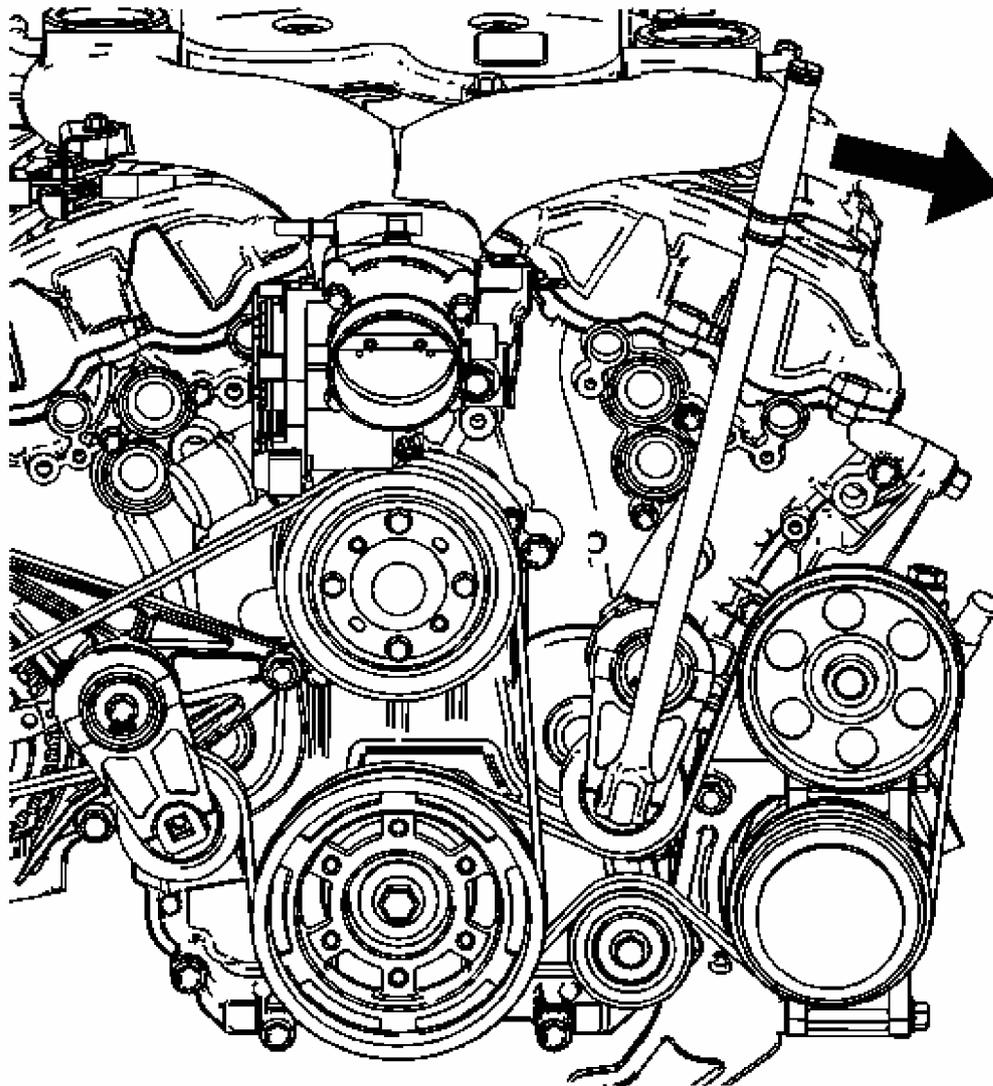


Fig. 3: Removing/Installing Power Steering & A/C Drive Belt
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator and water pump drive belt. Refer to **Drive Belt Replacement - Generator and Water Pump**.
2. Rotate the drive belt tensioner clockwise in order to release the drive belt tension.
3. Remove the drive belt from the power steering pulley.
4. Slowly release the drive belt tensioner.
5. Remove the drive belt from the accessory drive pulleys.

Installation Procedure

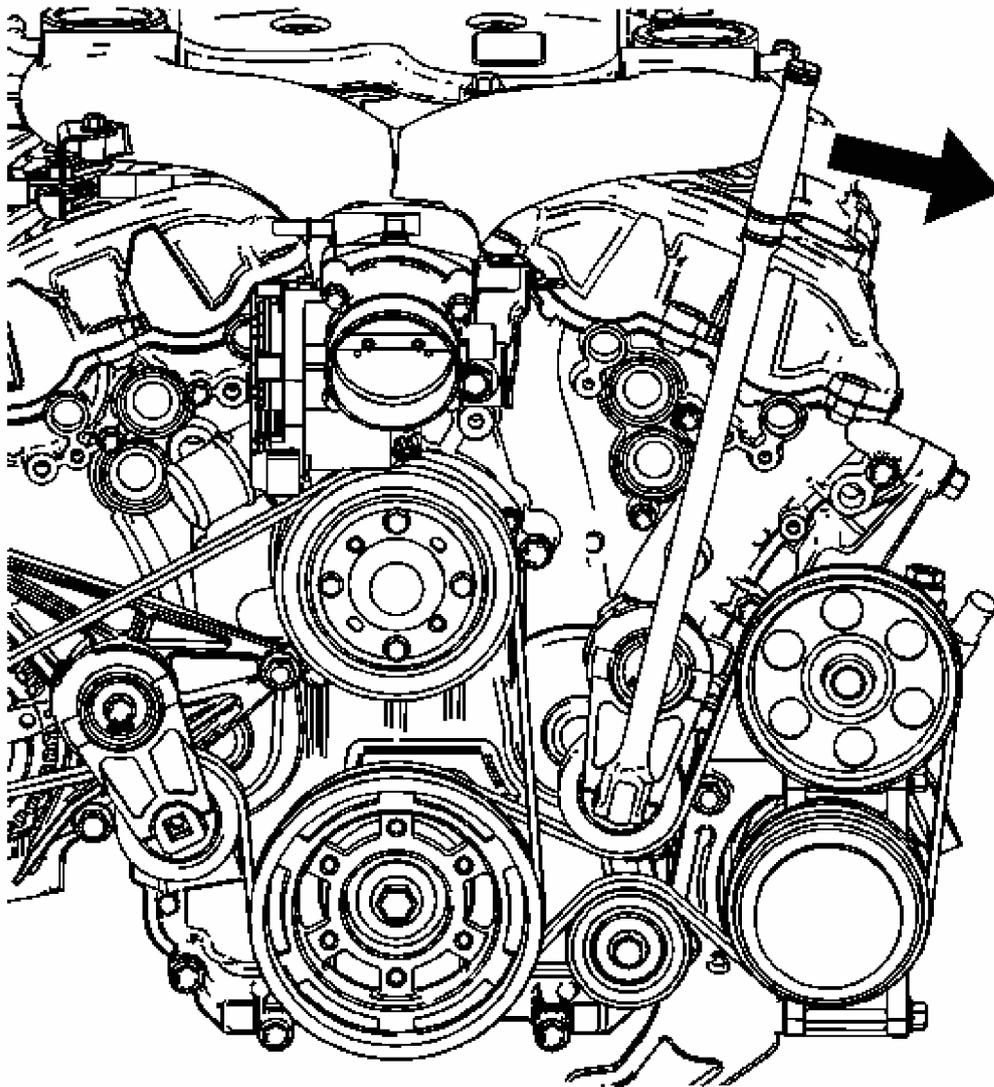


Fig. 4: Removing/Installing Power Steering & A/C Drive Belt

Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt to the crankshaft pulley, the idler pulley and the A/C compressor.
2. Rotate the drive belt tensioner clockwise.
3. Install the drive belt to the power steering pulley.
4. Slowly release the drive belt tensioner.

IMPORTANT: Ensure the drive belt is properly aligned and seated into the grooves of the accessory drive pulleys.

5. Install the generator and water pump drive belt. Refer to **Drive Belt Replacement - Generator and Water Pump**.

DRIVE BELT TENSIONER REPLACEMENT - GENERATOR AND WATER PUMP

Removal Procedure

1. Remove the generator and water pump drive belt. Refer to **Drive Belt Replacement - Generator and Water Pump**.

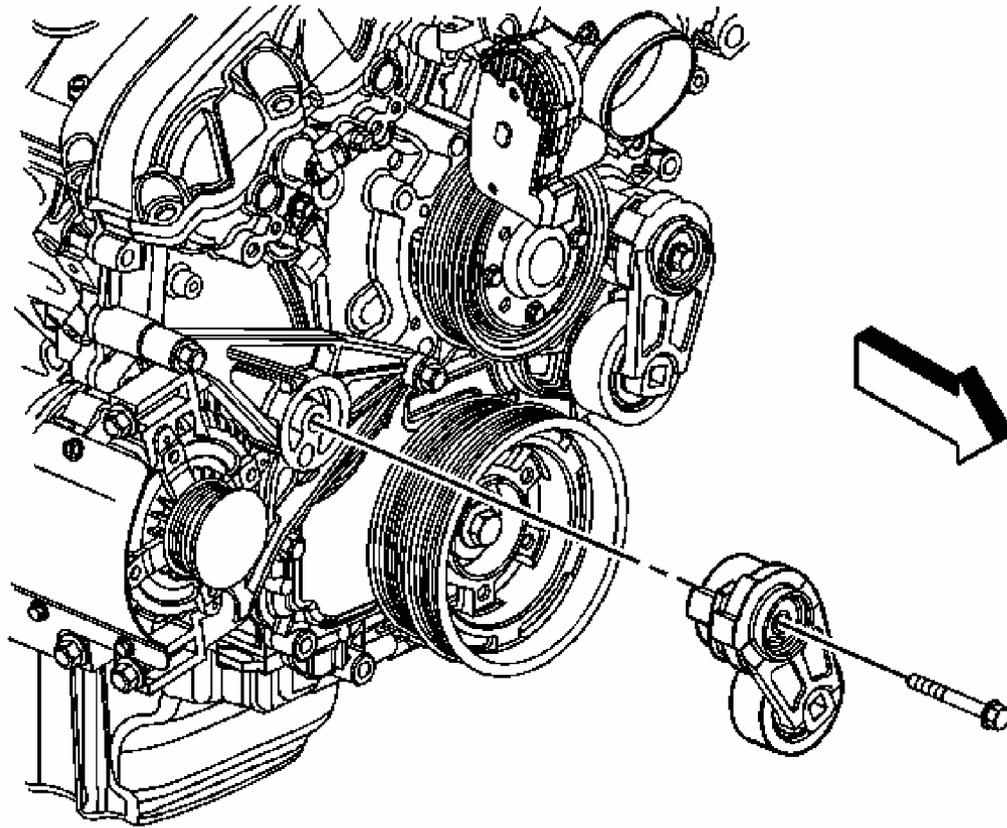


Fig. 5: View Of Generator & Water Pump Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

2. Loosen the drive belt tensioner bolt.
3. Remove the drive belt tensioner and bolt from the engine.

Installation Procedure

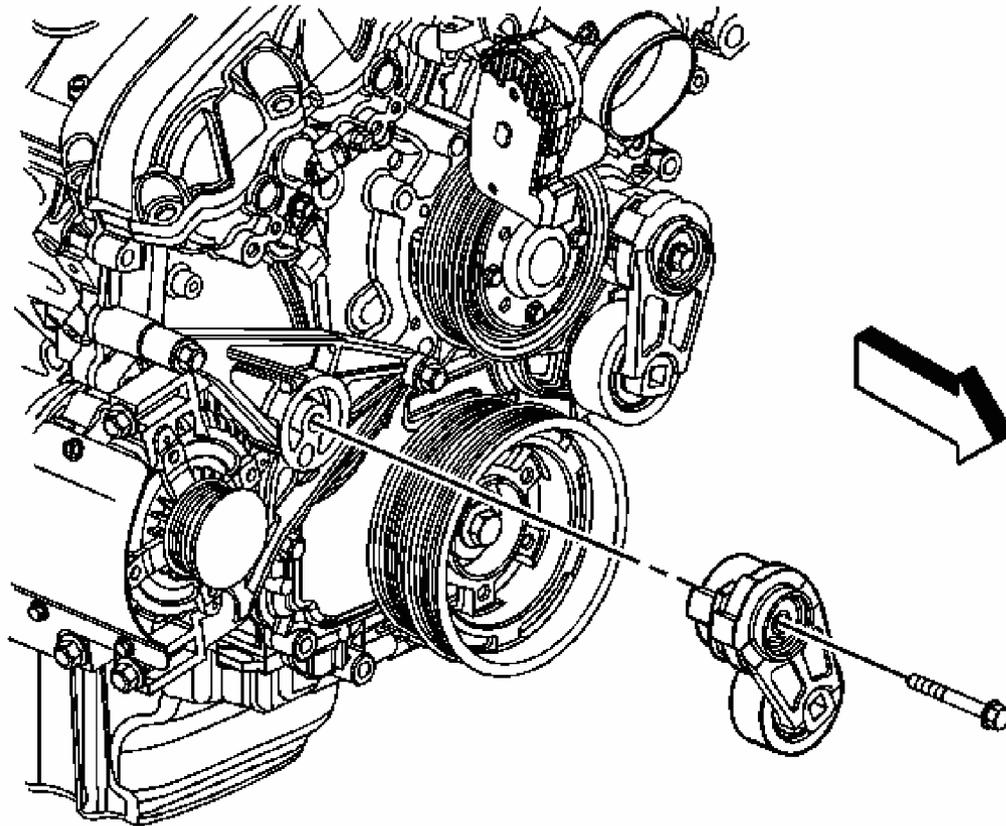


Fig. 6: View Of Generator & Water Pump Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Position the drive belt tensioner and bolt to the engine as an assembly.
2. Ensure that the alignment pin on the rear of the tensioner assembly is aligned with the locating hole on the engine.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the drive belt tensioner bolt.

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

4. Install the generator and water pump drive belt. Refer to Drive Belt Replacement - Generator and Water Pump.

CONDITIONING

Removal Procedure

1. Remove the generator and water pump drive belt. Refer to Drive Belt Replacement - Generator and Water Pump.
2. Remove the power steering and air conditioning drive belt. Refer to Drive Belt Replacement - Power Steering and Air Conditioning.

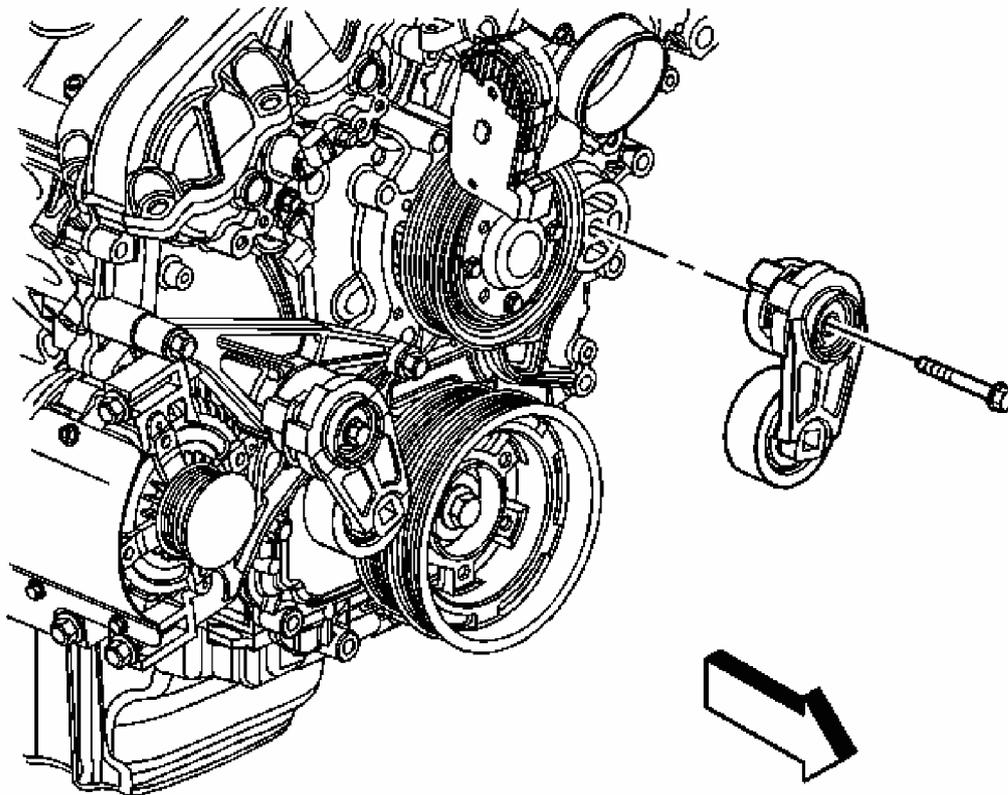


Fig. 7: View Of Power Steering & A/C Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Loosen the drive belt tensioner bolt.
4. Remove the drive belt tensioner and bolt from the engine.

Installation Procedure

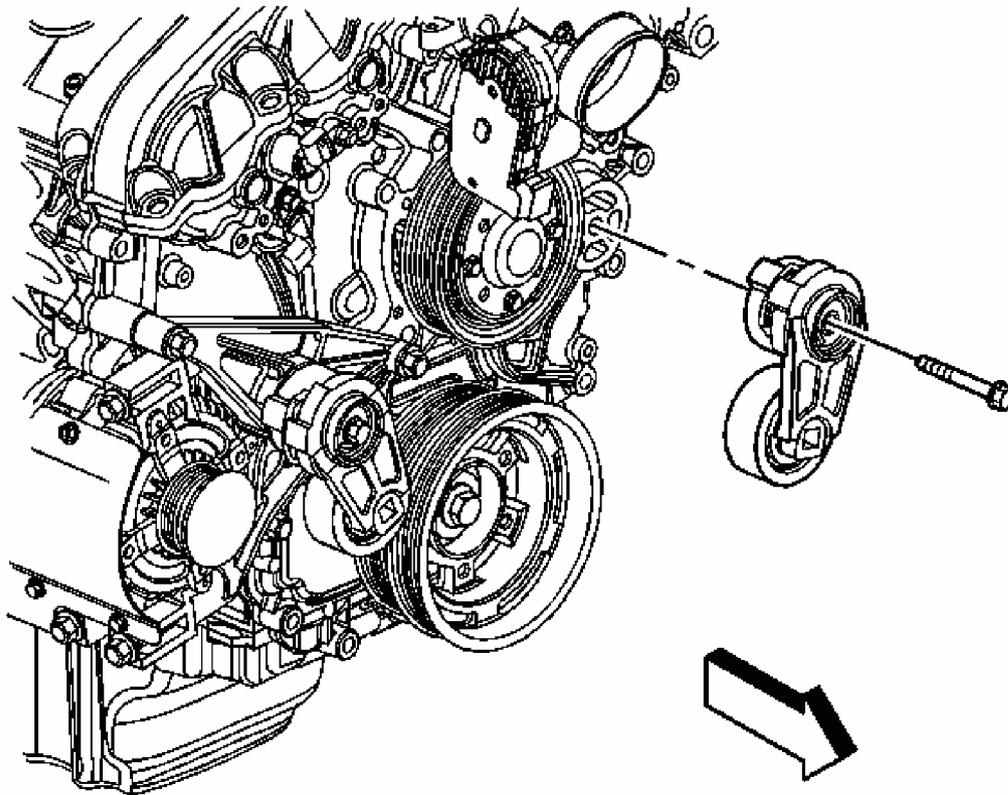


Fig. 8: View Of Power Steering & A/C Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Position the drive belt tensioner and bolt to the engine as an assembly.
2. Ensure that the alignment pin on the rear of the tensioner assembly is aligned with the locating hole on the engine.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the drive belt tensioner bolt.

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

4. Install the power steering and air conditioning drive belt. Refer to Drive Belt Replacement - Power Steering and Air Conditioning.
5. Install the generator and water pump drive belt. Refer to Drive Belt Replacement - Generator and Water Pump.

DRIVE BELT IDLER PULLEY REPLACEMENT

Removal Procedure

IMPORTANT: Do not remove the generator and water pump belt.

1. Remove the power steering and air conditioning drive belt from the power steering pump. Refer to Drive Belt Replacement - Power Steering and Air Conditioning.

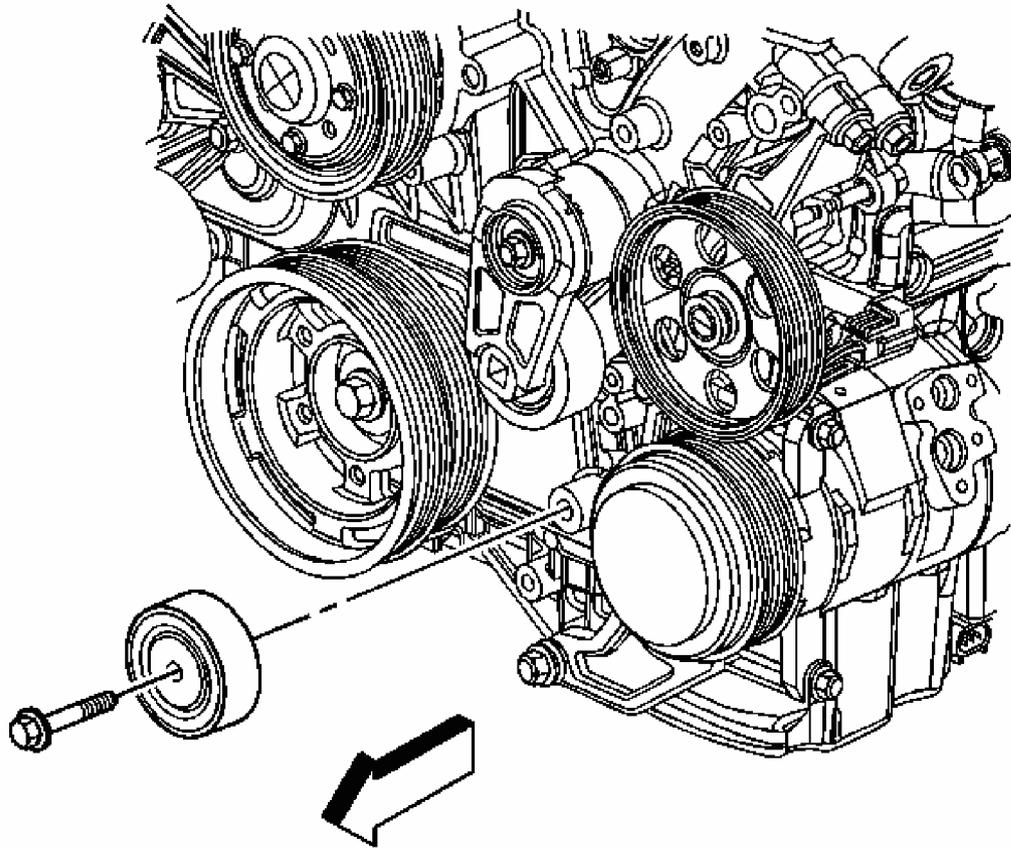


Fig. 9: Removing & Installing Drive Belt Idler Pulley Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the drive belt idler pulley bolt.
3. Remove the drive belt idler pulley.

Installation Procedure

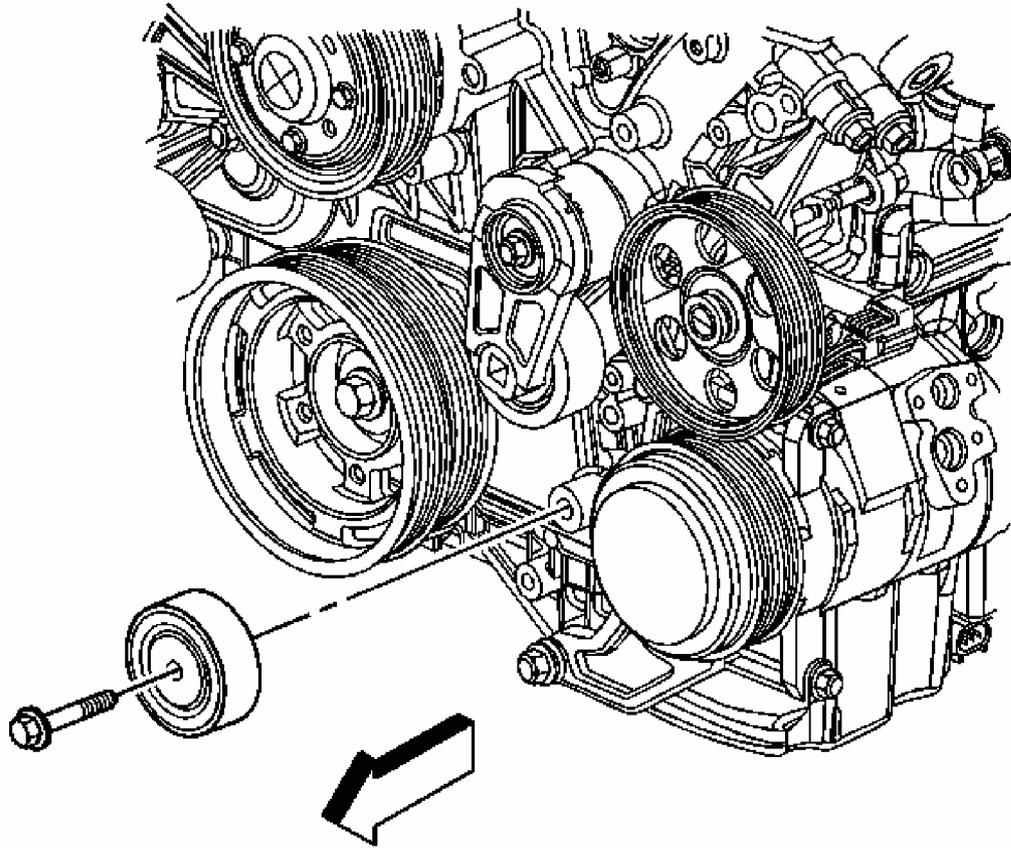


Fig. 10: Removing & Installing Drive Belt Idler Pulley Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt idler pulley.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the drive belt idler pulley bolt.

Tighten: Tighten the drive belt idler pulley bolt to 50 N.m (37 lb ft).

3. Install the drive belt. Refer to Drive Belt Replacement - Power Steering and Air Conditioning.

ENGINE SUPPORT FIXTURE

Tools Required

- J 28467-B Universal Engine Support Fixture
- J 28467-501 Engine Support Fixture Adapters
- J 36857 Engine Lift Bracket

Installation Procedure

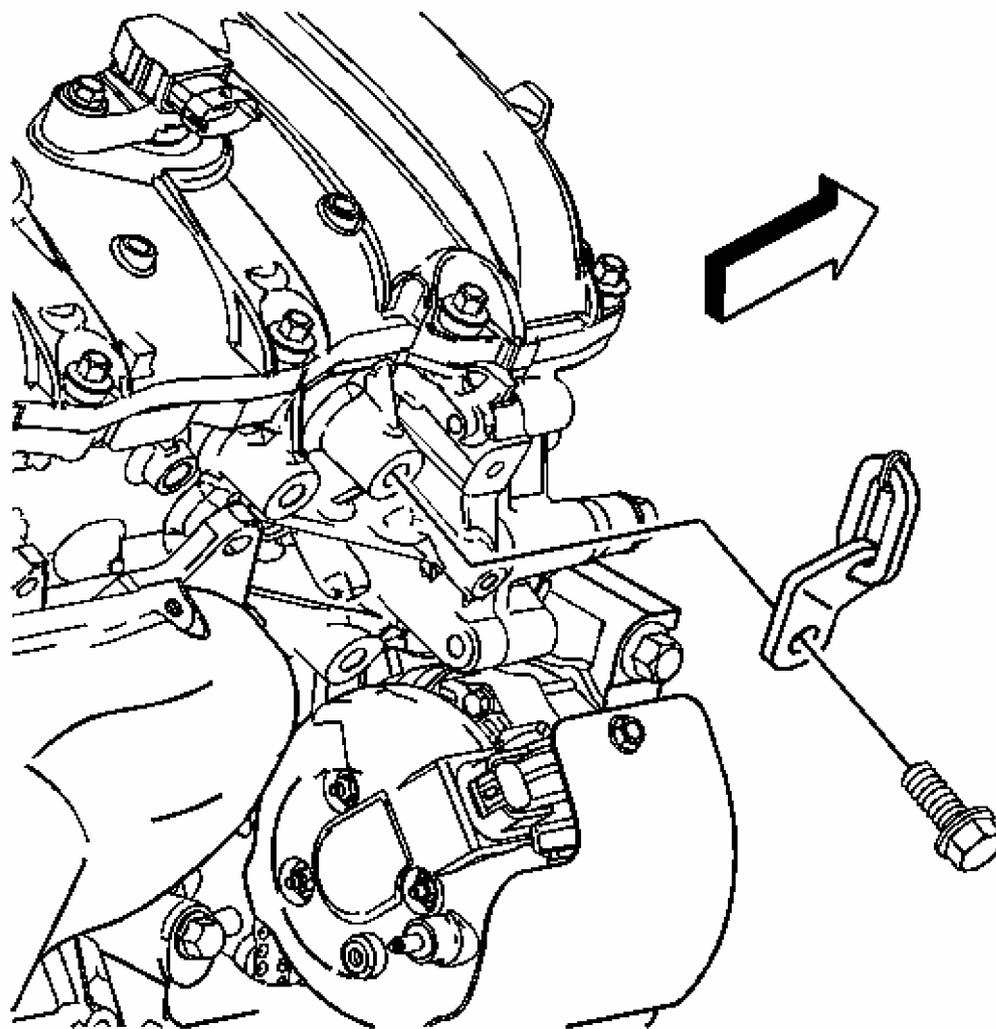


Fig. 11: View Of Engine Lift Bracket - Front Of Right Cylinder Head
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Use a grade 10.9, M10 X 1.5 X 35 bolt (GM P/N 11519182 or equivalent) in order to install an engine lift bracket (OTC #7100, **J 36857** or equivalent) to the front of the right (Bank 1) cylinder head in the location shown.

Tighten: Tighten the bolt to 65 N.m (48 lb ft).

2. Remove the electrical connector bolt and the electrical connector from the rear of the left cylinder head.

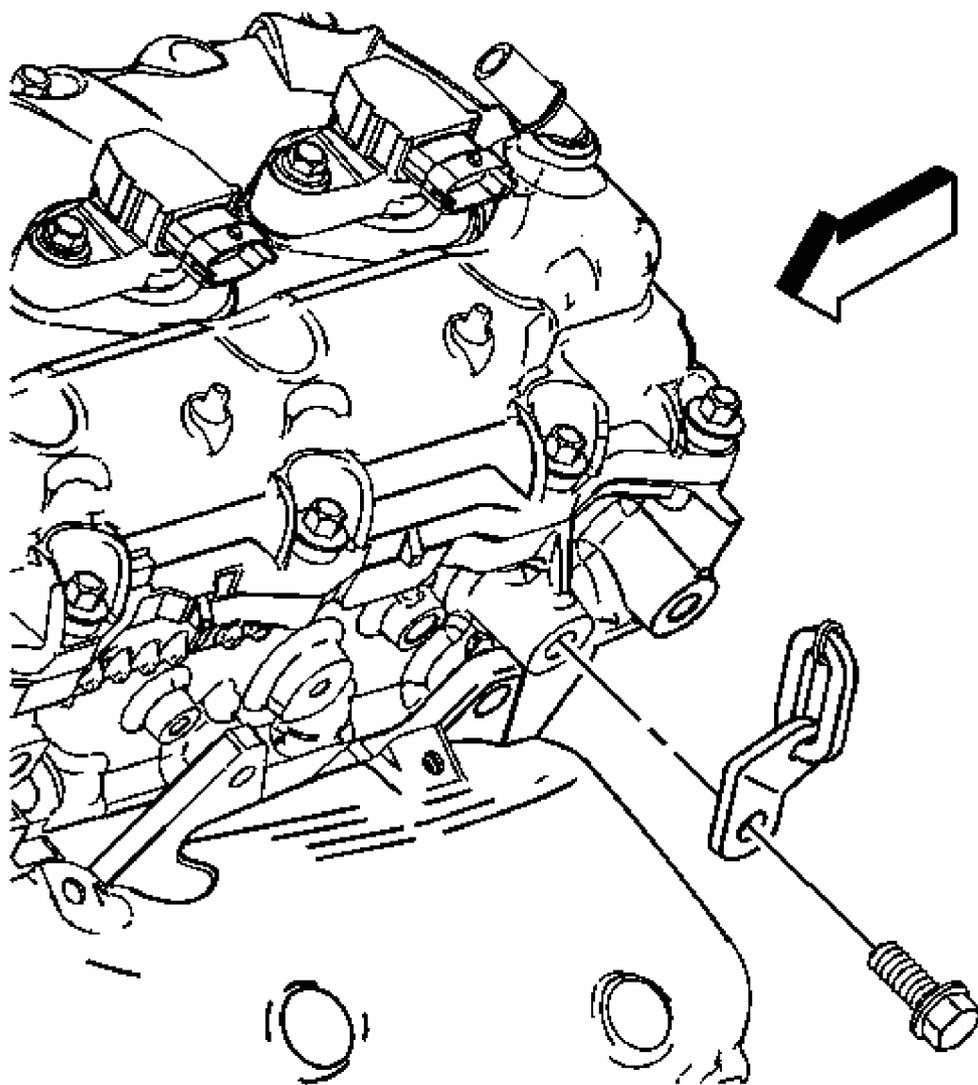


Fig. 12: View Of Engine Lift Bracket - Rear Of Left Cylinder Head

Courtesy of GENERAL MOTORS CORP.

3. Use a grade 10.9, M10 X 1.5 X 35 bolt (GM P/N 11519182 or equivalent) in order to install an engine lift bracket (OTC #7100, **J 36857** or equivalent) to the rear of the left (Bank 2) cylinder head in the location shown.

Tighten: Tighten the bolt to 65 N.m (48 lb ft).

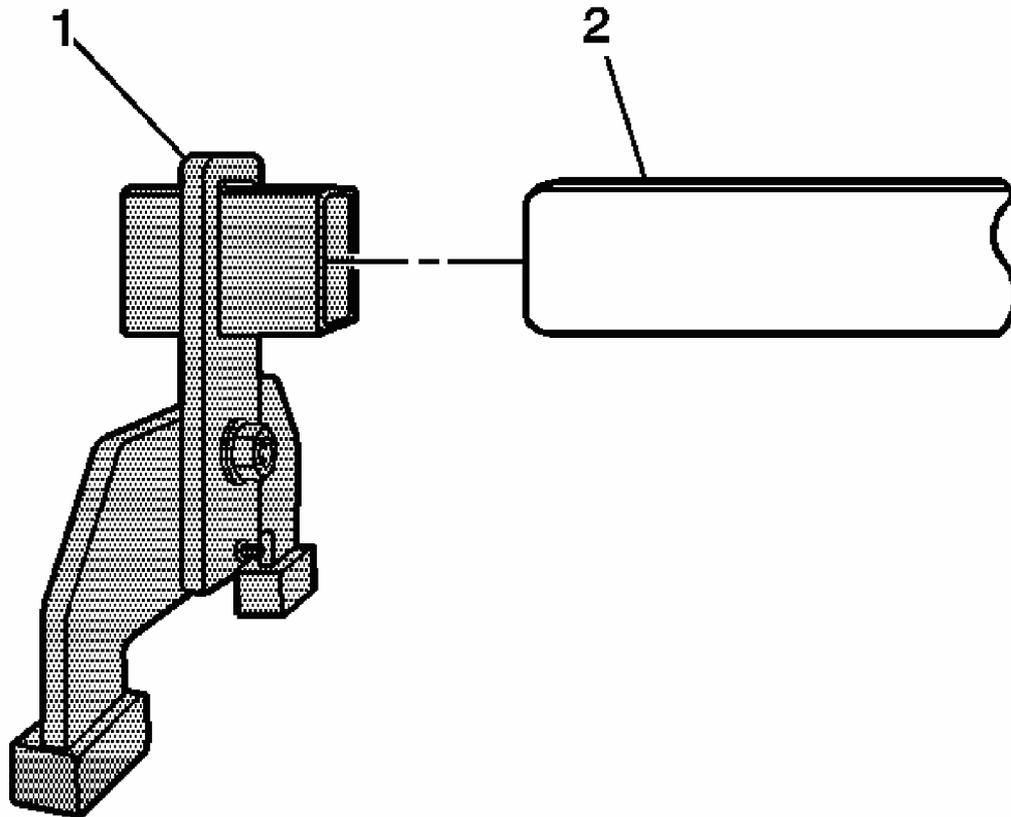


Fig. 13: Identifying J 28467-B & J 28467-3
Courtesy of GENERAL MOTORS CORP.

4. Loosely install the **J 28467-501** (1) to the ends of the strut tower tube **J 28467-3** (2).

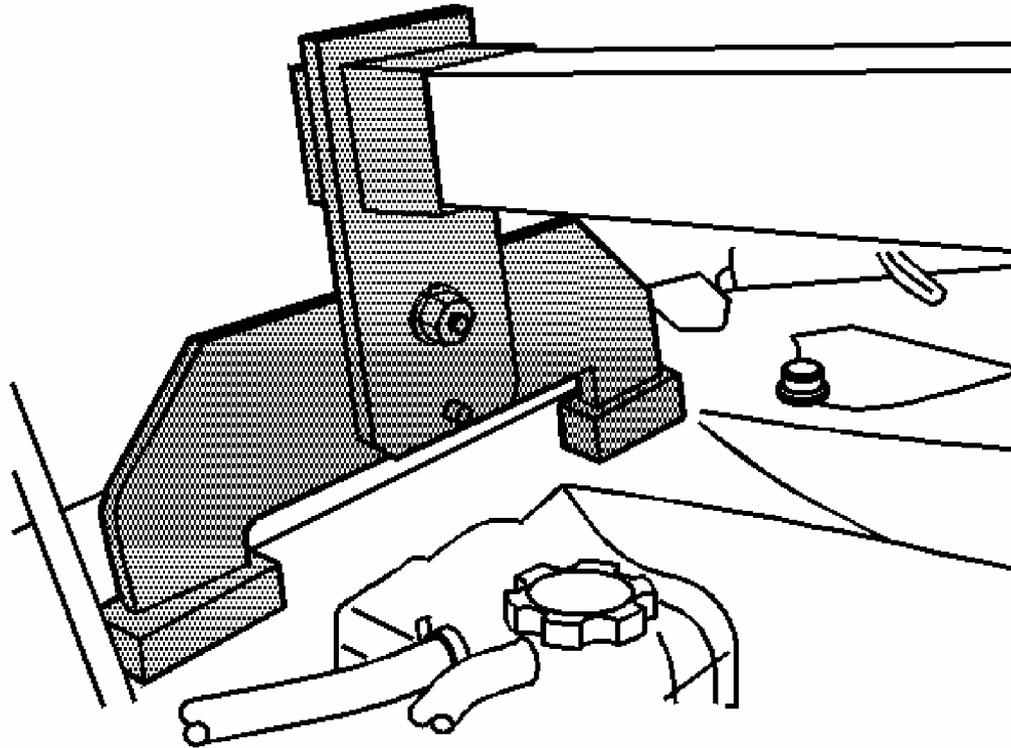


Fig. 14: Placing J 28467-3 & J 28467-501 On Top Of Both Left & Right Fender Lips

Courtesy of GENERAL MOTORS CORP.

5. Place the strut tower tube J 28467-3 and the **J 28467-501** on top of both the left and right fender lips, over the engine rear lift bracket.

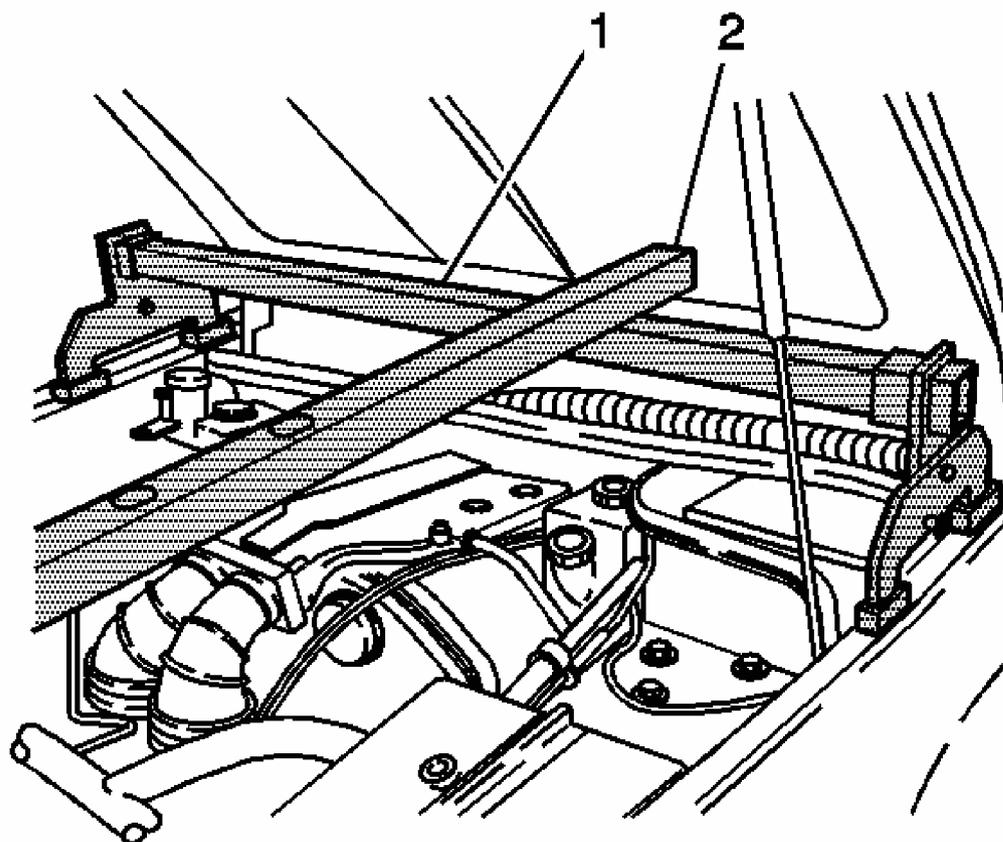


Fig. 15: Installing Radiator Shelf Tube On Top Of Strut Tower Tube
Courtesy of GENERAL MOTORS CORP.

6. Install the radiator shelf tube J 28467-2A (2) on top of the strut tower tube J 28467-3 (1) above the engine front (right bank) lift bracket.

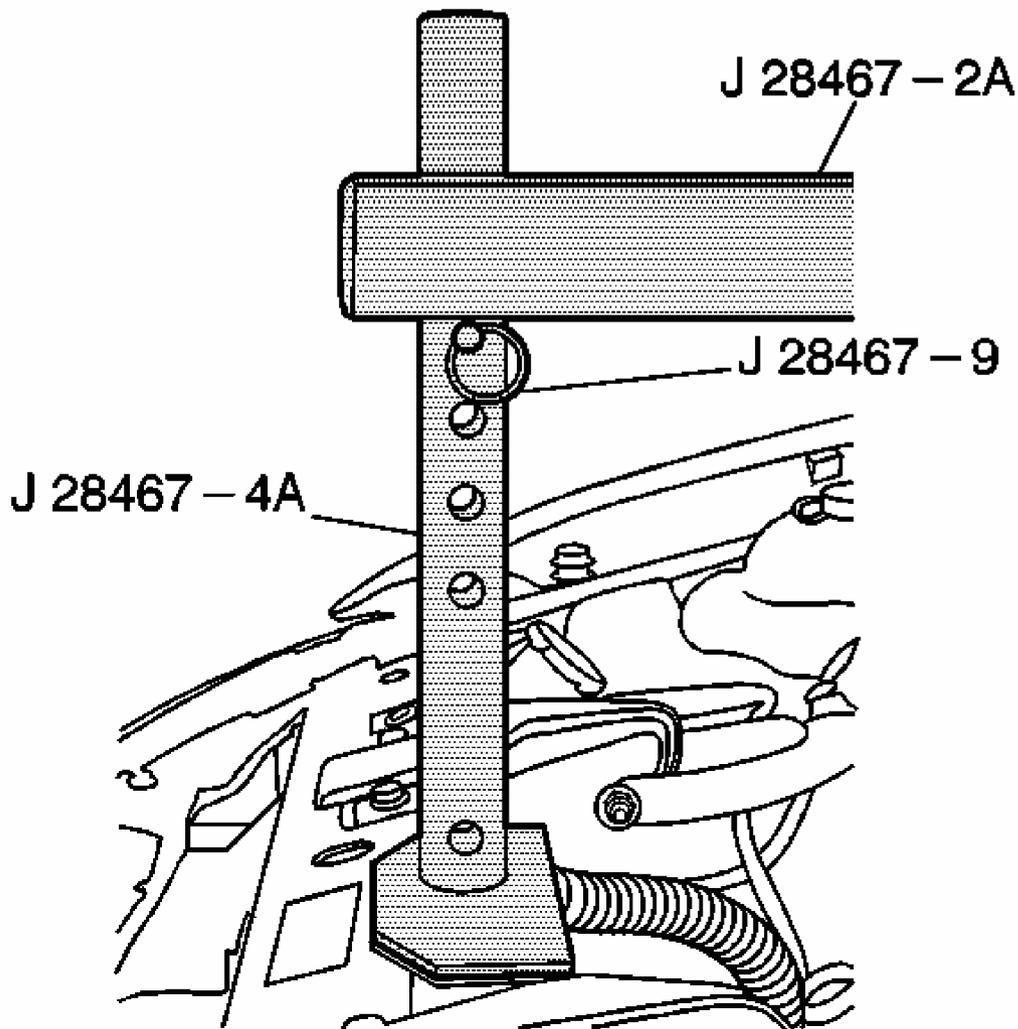


Fig. 16: Installing Quick Release Pin J 28467-9
Courtesy of GENERAL MOTORS CORP.

7. Install the round tube of the front support assembly J 28467-4A through the large hole in the radiator shelf tube J 28467-2A.
8. Remove the upper tie bar cover.
9. Locate the J 28467-4A front support assembly to the upper tie bar.
10. Install the J 28467-9 7/16 in x 2.0 in quick-release pin through the top hole in the J 28467-4A front support assembly.

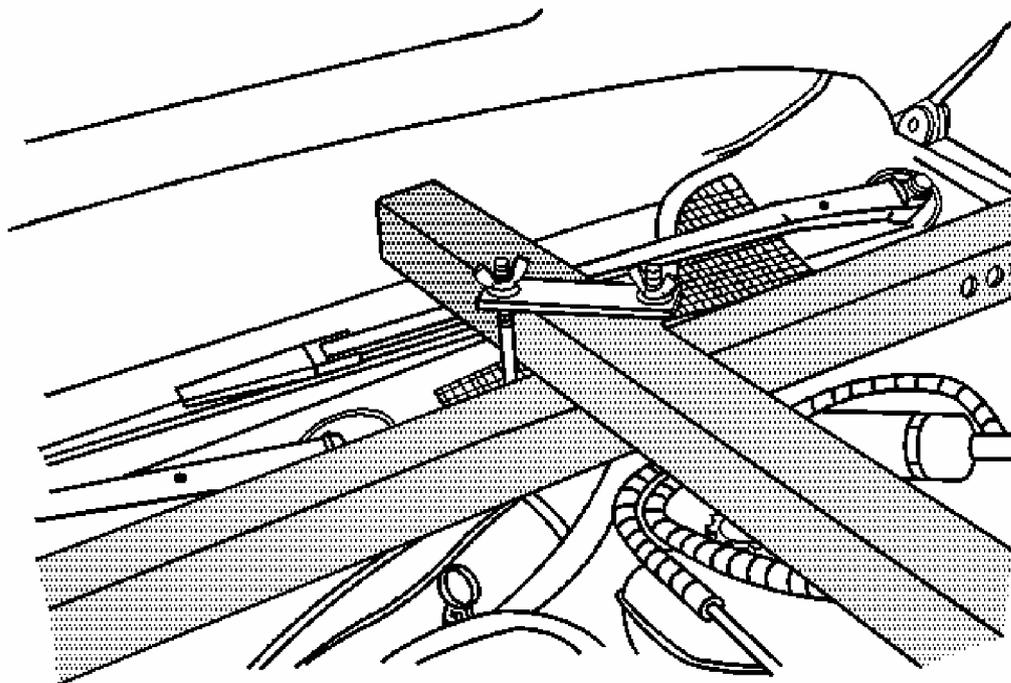


Fig. 17: Using Cross Bracket Assembly
Courtesy of GENERAL MOTORS CORP.

11. Install the J 28467-1A cross bracket assembly.
12. Hand tighten the J 28467-1A cross bracket wing nuts.

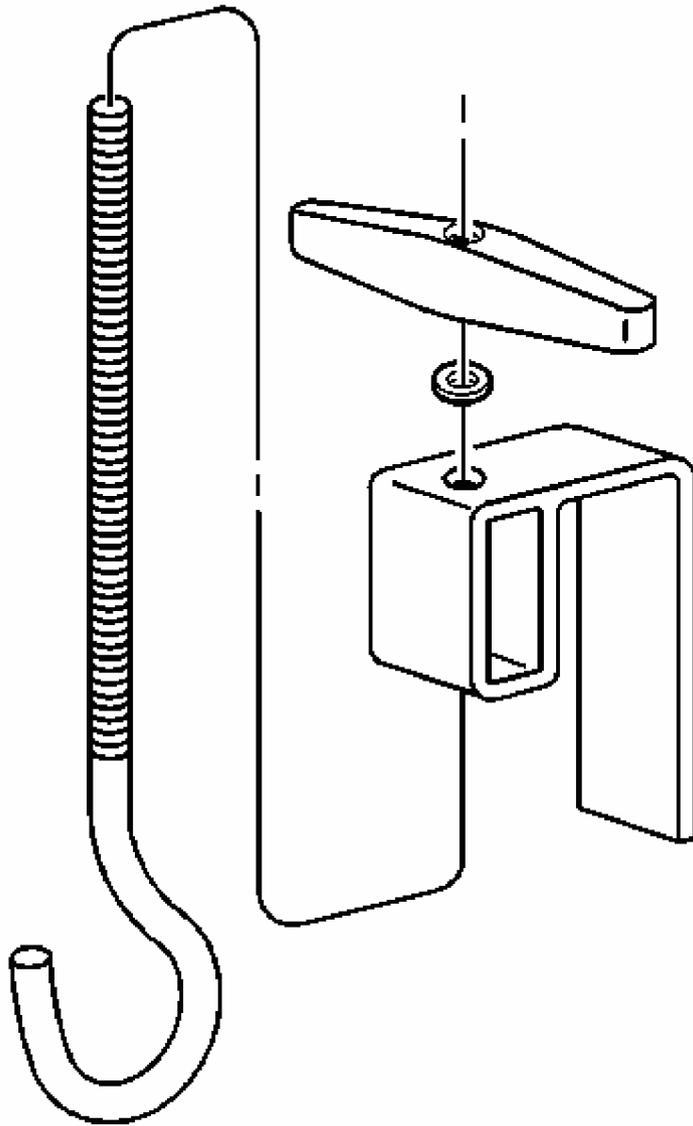


Fig. 18: View Of Lift Hook Assembly
Courtesy of GENERAL MOTORS CORP.

13. Install the J 28467-7A bolt hook through the J 28467-6A bracket.
14. Install the J 28467-34 lift hook wing nut and washer to the J 28467-7A lift hook.
15. Repeat the previous two steps in order to assemble two lift hooks and brackets.

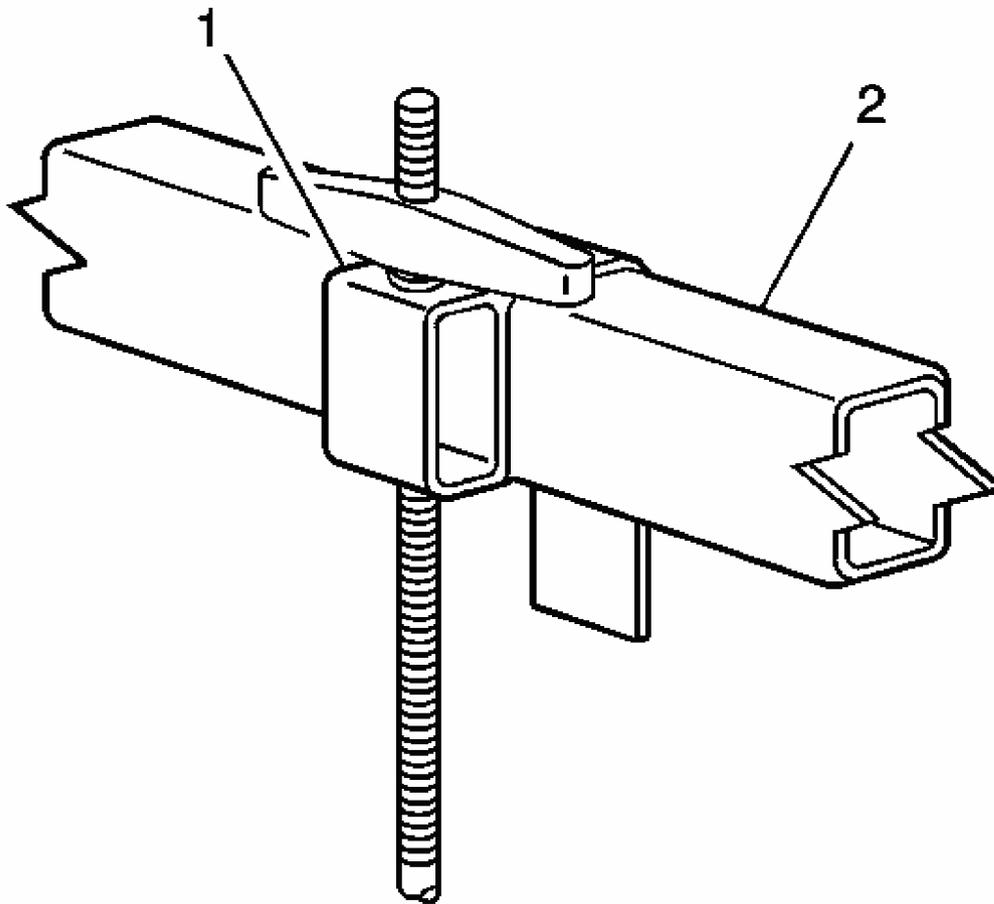


Fig. 19: View Of Lift Hook & Bracket Assembly At Longitudinal Mounted Cross Bar
Courtesy of GENERAL MOTORS CORP.

16. Install one of the lift hook and bracket assemblies (1) to the J 28467-3 strut tower tube (2) above the engine rear lift bracket.
17. Install the lift hook J 28467-7A through the engine rear lift bracket. Ensure the hook does not damage adjacent components.
18. Install the other lift hook and bracket assembly (1) to the J 28467-2A radiator shelf tube (2) above the engine front lift bracket.
19. Install the lift hook J 28467-7A through the engine front lift bracket. Ensure the hook does not damage adjacent components.
20. Hand tighten the lift hook wing nuts J 28467-34 in order to remove all slack from the engine support fixture assembly.

Removal Procedure

1. Remove the **J 28467-B** .
2. Remove the **J 28467-501** .
3. Install the wiring harness electrical connector bracket to the rear of the left (Bank 2) cylinder head.

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**. Raising the engine removes the weight from the engine mount and creates slight tension in the rubber.
2. Observe the engine mount while raising the engine. Replace the engine mount if the engine mount exhibits any of the following conditions:
 - The hard rubber surface 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 GLYCOL™ fluid is leaking from the engine mount.
3. If there is movement between the metal plate of the engine mount and its attaching points, lower the engine on the engine mount. Tighten the bolts or nuts attaching the engine mount to the frame or engine mount bracket. Refer to **Engine Mount Replacement - Left** or **Engine Mount Replacement - Right**.

ENGINE MOUNT REPLACEMENT - LEFT

Removal Procedure

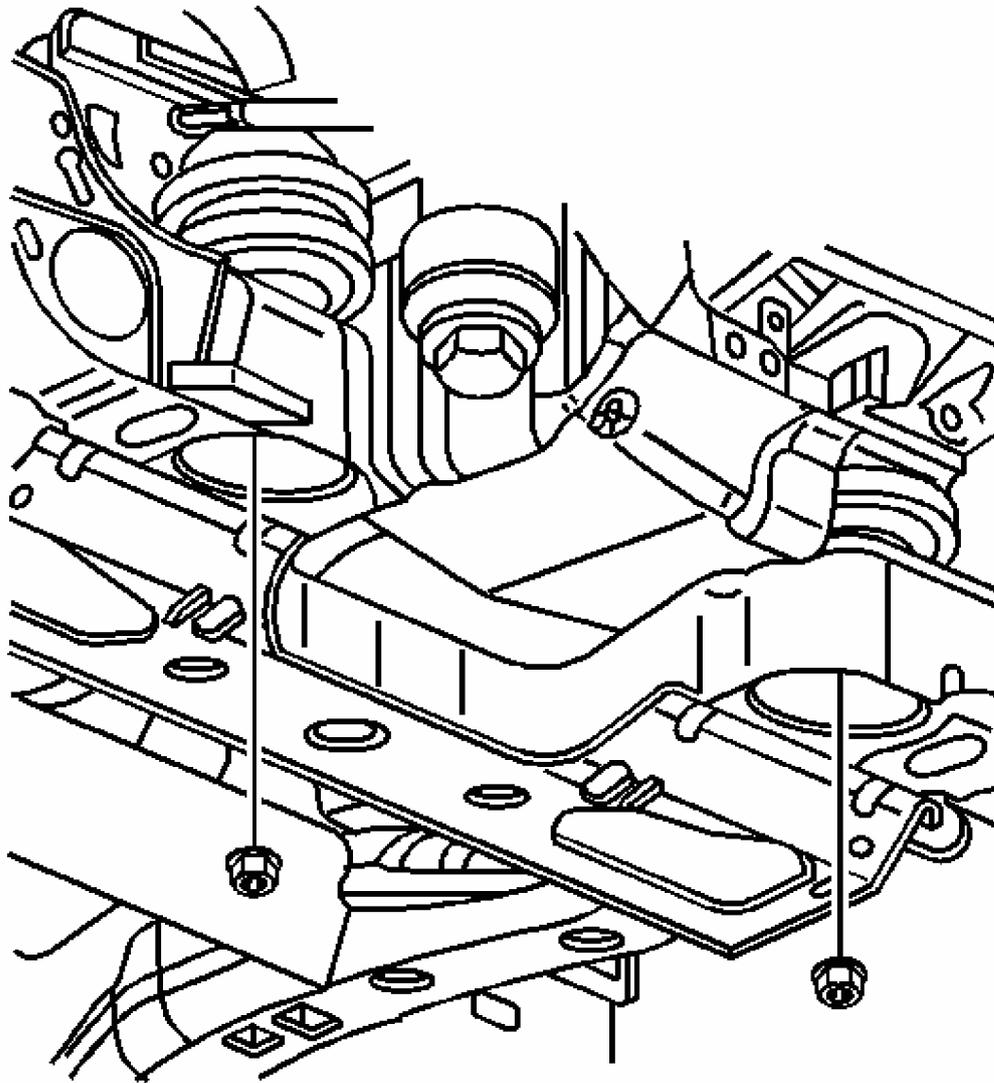


Fig. 20: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Install a screw jack with a block of wood under the oil pan for support.
3. Remove the lower engine mount retaining nut.
4. Raise the engine using the screw jack until the weight is removed from the mount.

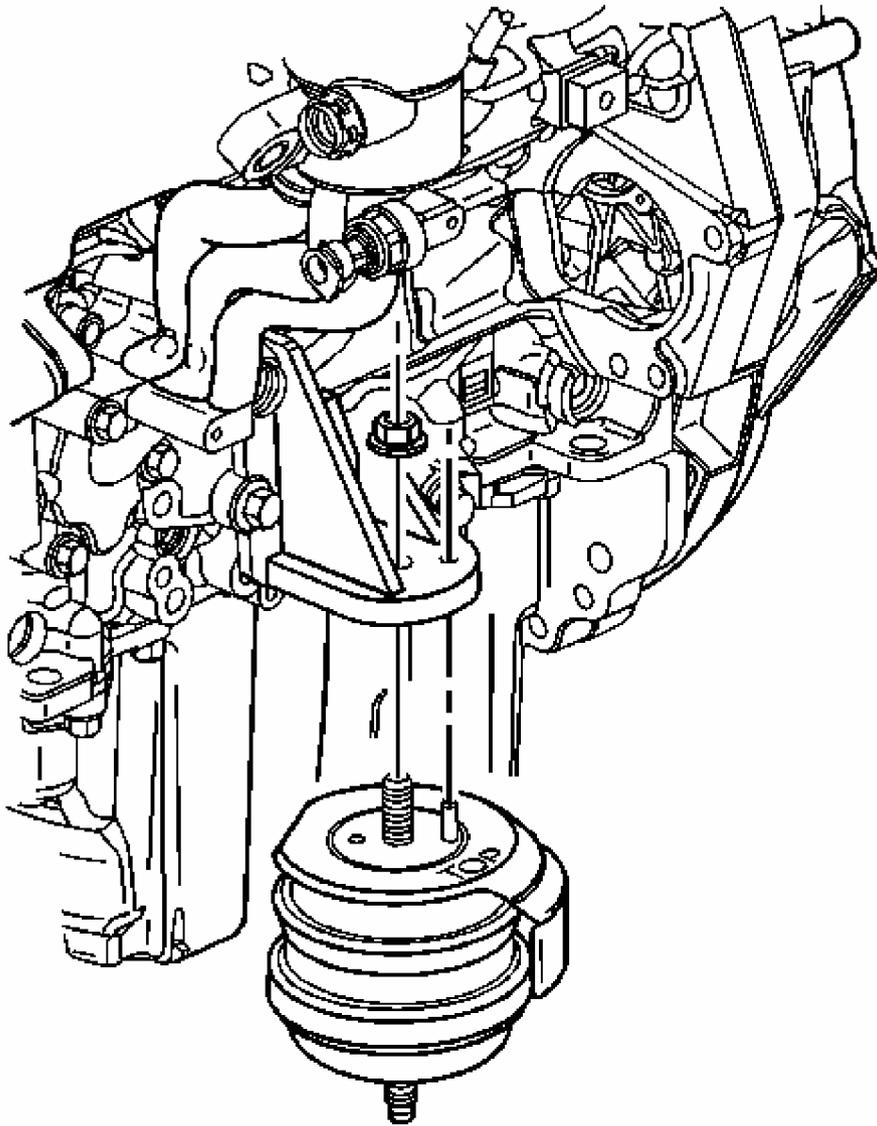


Fig. 21: View Of Left Engine Mount
Courtesy of GENERAL MOTORS CORP.

5. Remove the upper engine mount retaining nut.
6. Remove the engine mount from the vehicle.

Installation Procedure

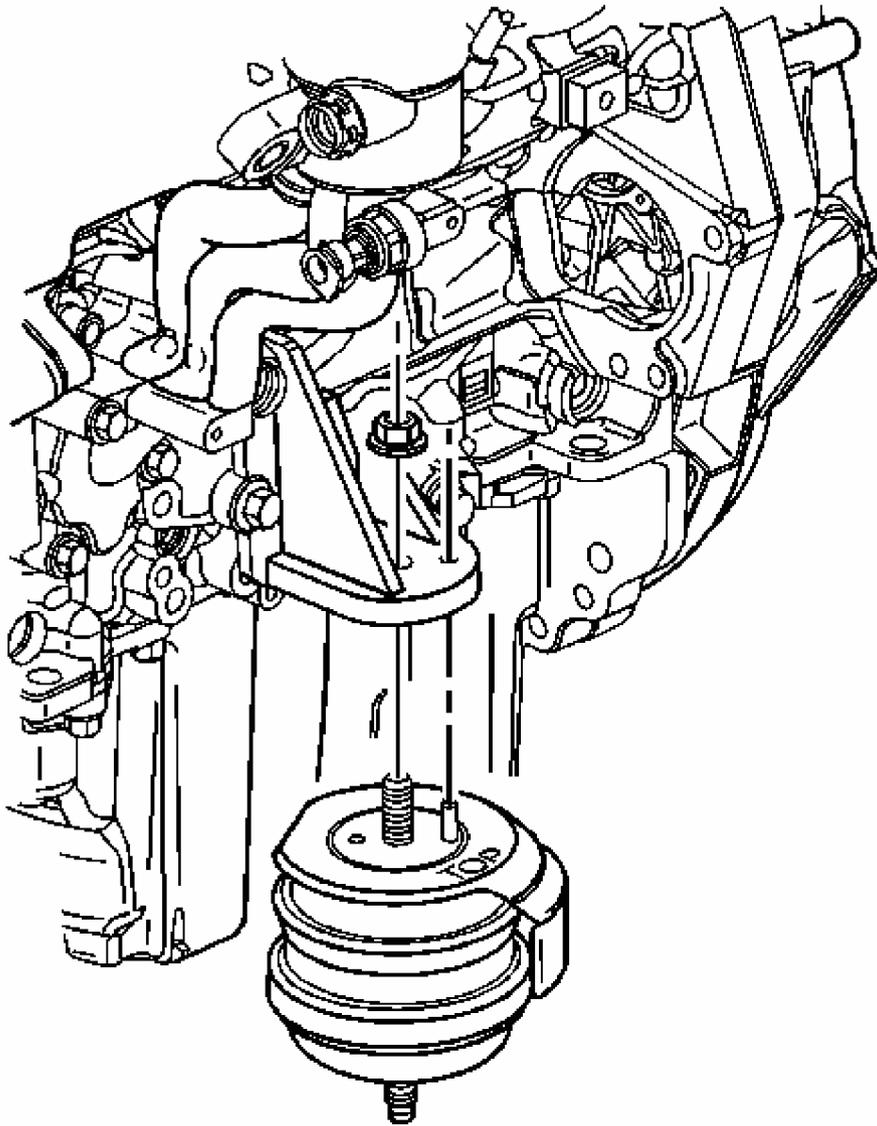


Fig. 22: View Of Left Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Install the engine mount to the vehicle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the upper engine mount retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

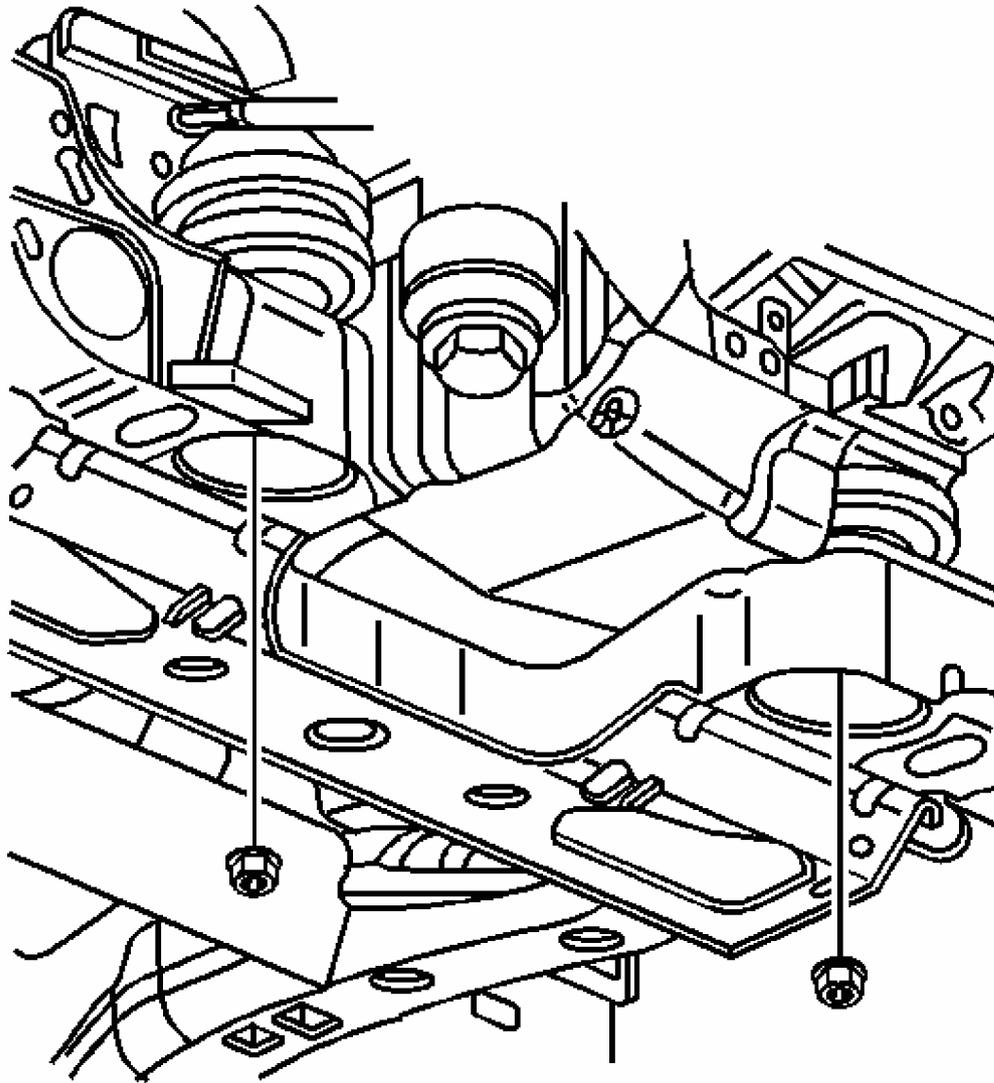


Fig. 23: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

3. Lower the engine using the screw jack until the weight is resting on the mount.
4. Install the engine mount lower retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

5. Remove the screw jack and block of wood from under the oil pan.

6. Lower the vehicle.

ENGINE MOUNT REPLACEMENT - RIGHT

Removal Procedure

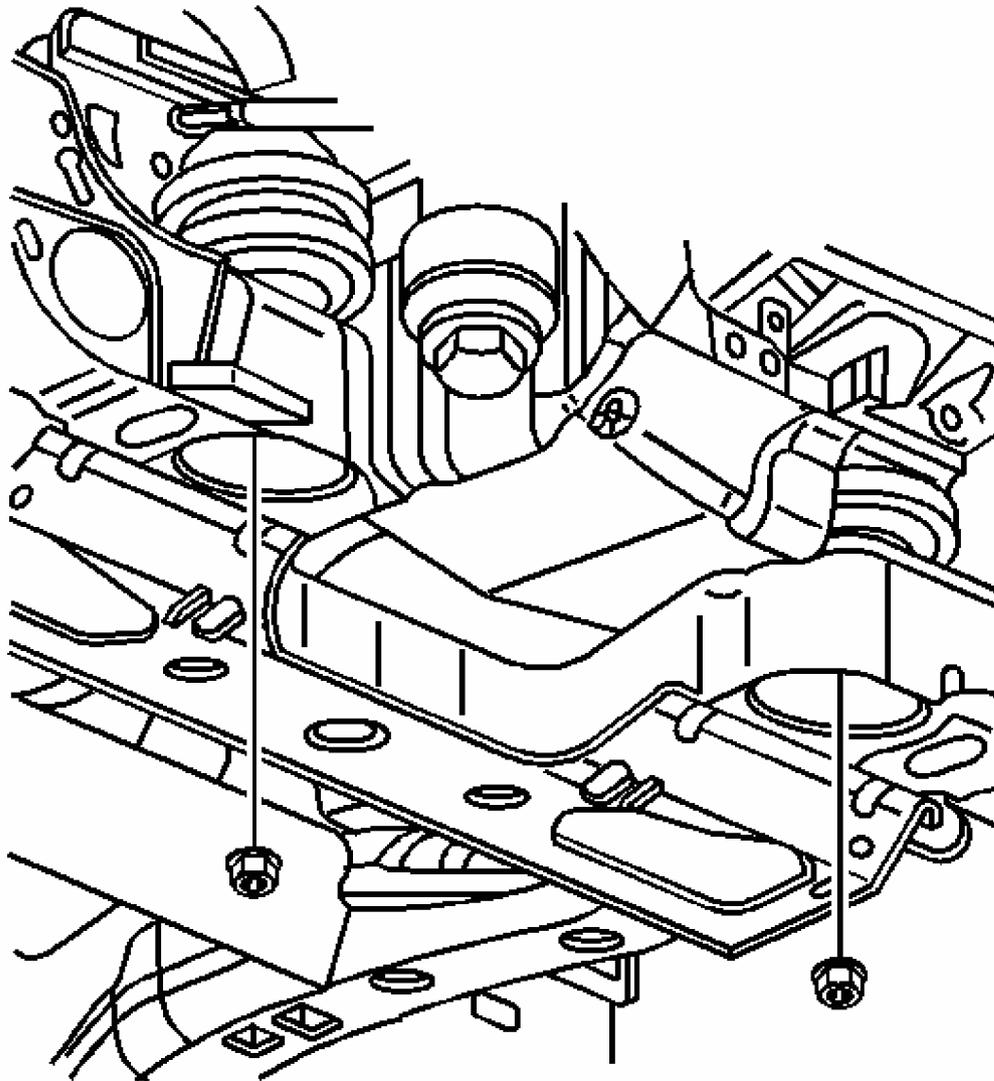


Fig. 24: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

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

2. Install a screw jack with a block of wood under the oil pan for support.
3. Remove the lower engine mount retaining nut.
4. Raise the engine using the screw jack until the weight is removed from the mount.

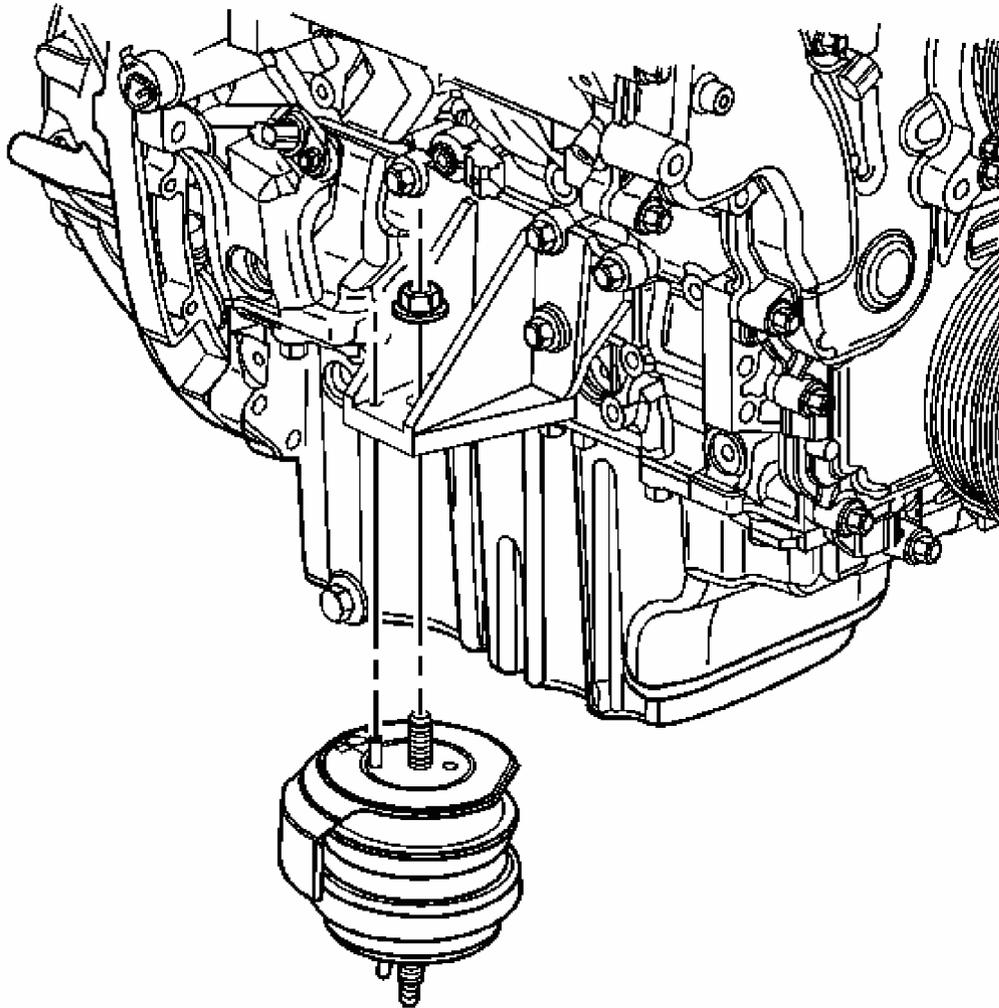


Fig. 25: View Of Right Engine Mount
Courtesy of GENERAL MOTORS CORP.

5. Remove the upper engine mount retaining nut.
6. Remove the engine mount from the vehicle.

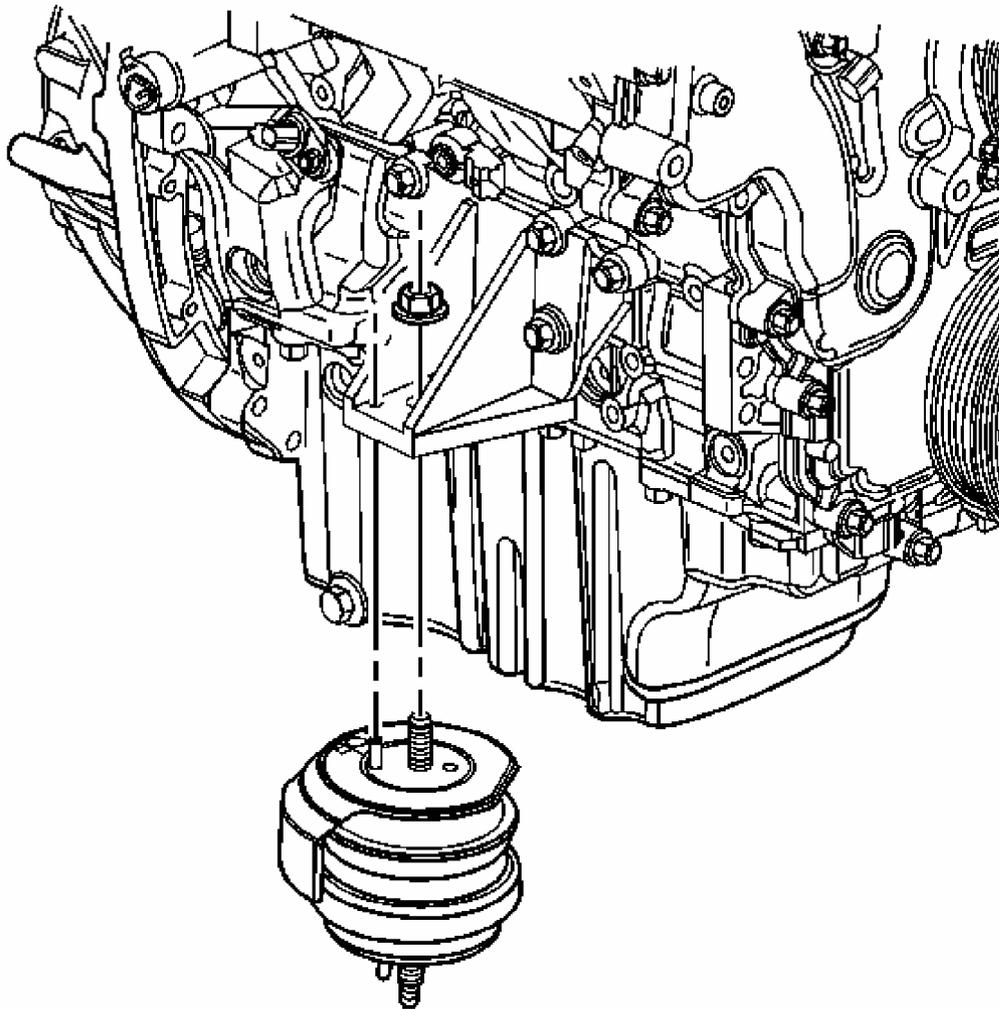


Fig. 26: View Of Right Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Install the engine mount to the vehicle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the upper engine mount retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

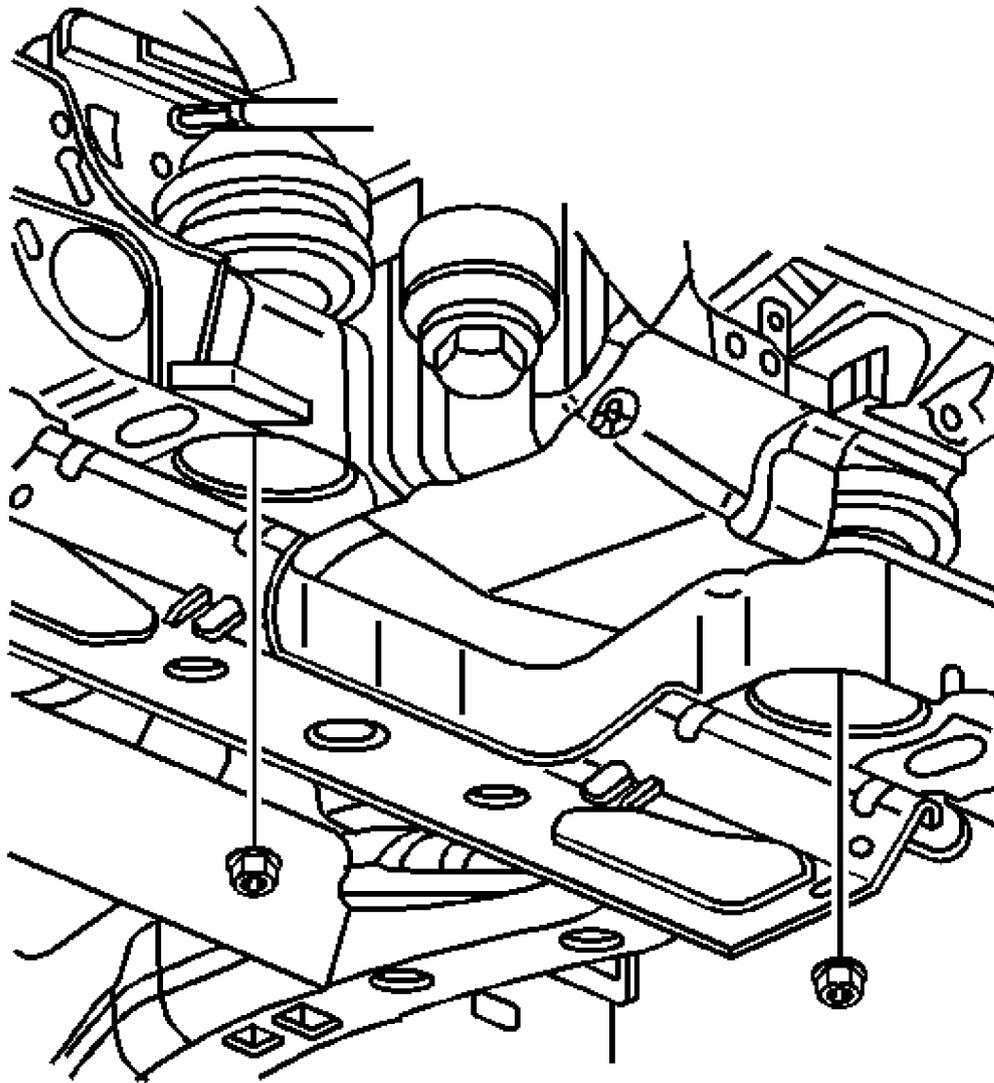


Fig. 27: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

3. Lower the engine using the jack screw until the weight is resting on the mount.
4. Install the engine mount retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

5. Remove the screw jack and block of wood from under the oil pan.
6. Lower the vehicle.

ENGINE MOUNT BRACKET REPLACEMENT - LEFT

Removal Procedure

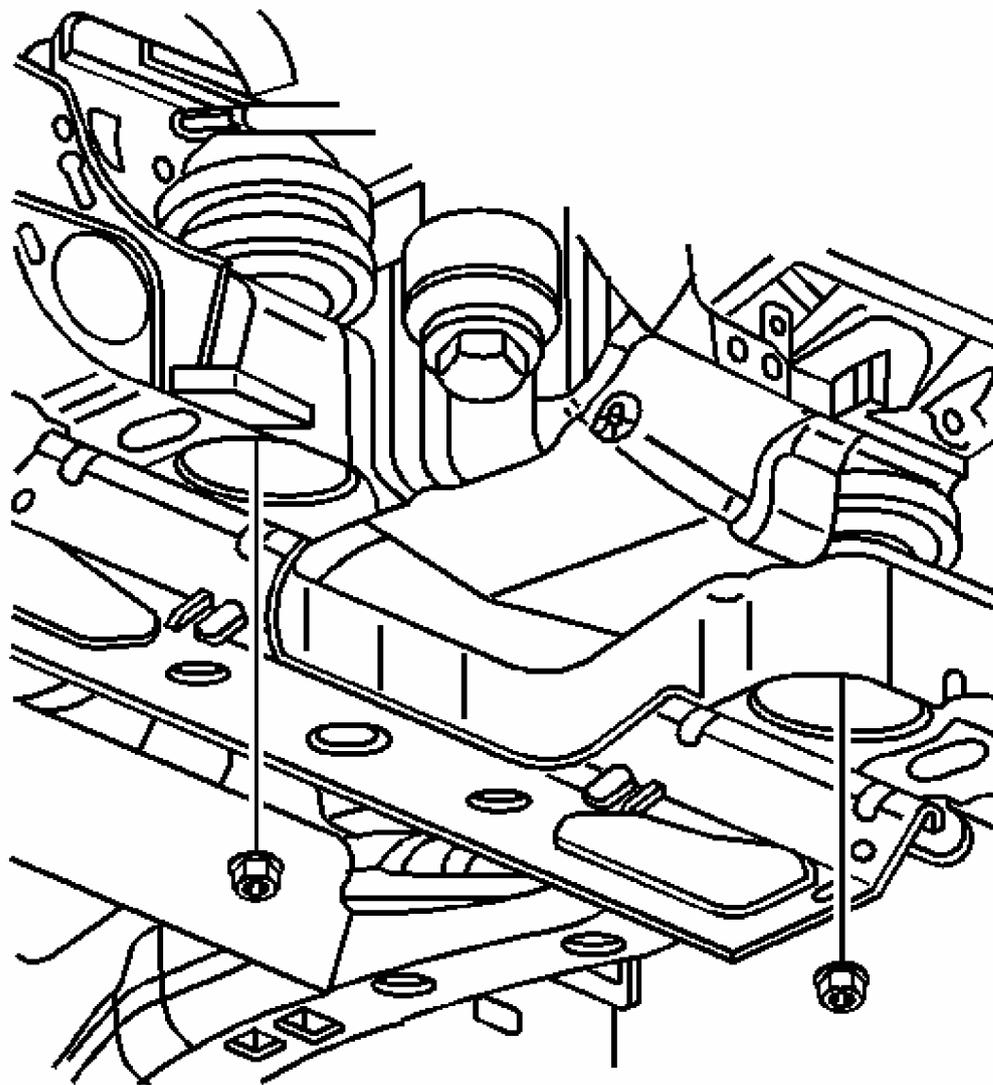


Fig. 28: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Install a screw jack with a block of wood under the oil pan for support.
3. Remove the lower engine mount retaining nut.

4. Raise the engine using the screw jack until the weight is removed from the mount.

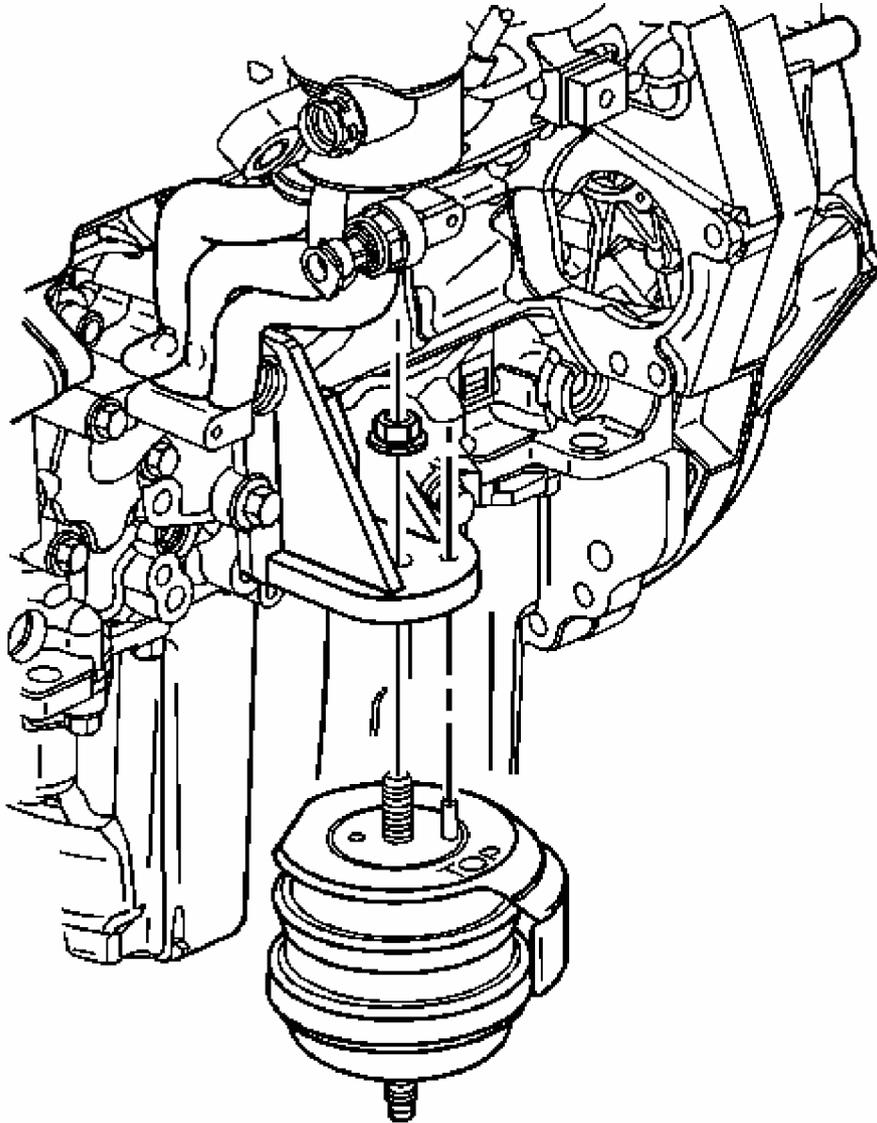


Fig. 29: View Of Left Engine Mount
Courtesy of GENERAL MOTORS CORP.

5. Remove the upper engine mount retaining nut.
6. Remove the engine mount from the vehicle.

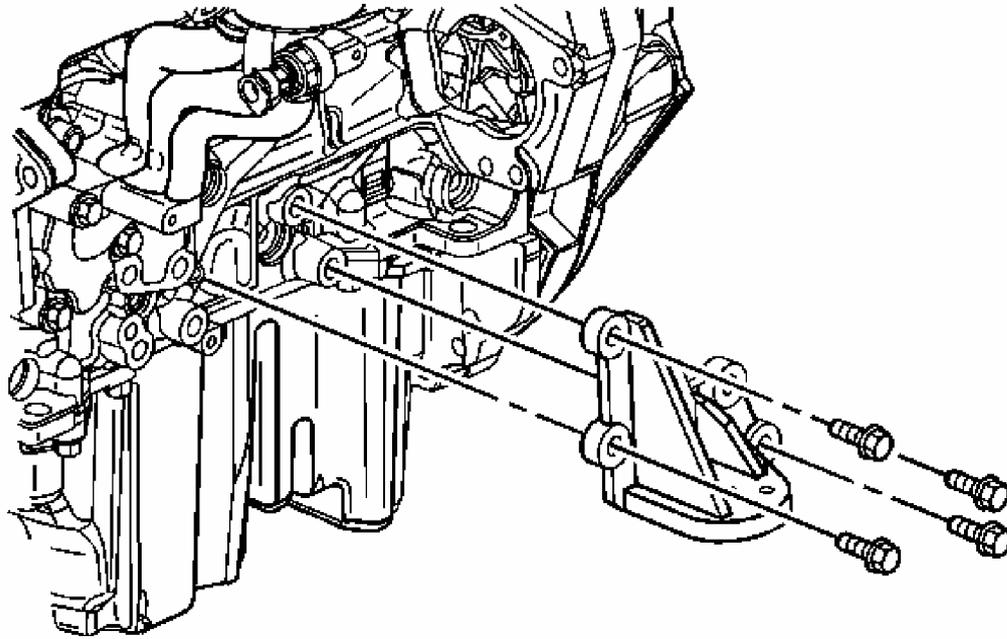


Fig. 30: View Of Left Engine Mount Bracket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure not to distort or bend the engine mount heat shield.

7. Remove the left engine mount bracket retaining bolts.
8. Remove the left engine mount bracket.

Installation Procedure

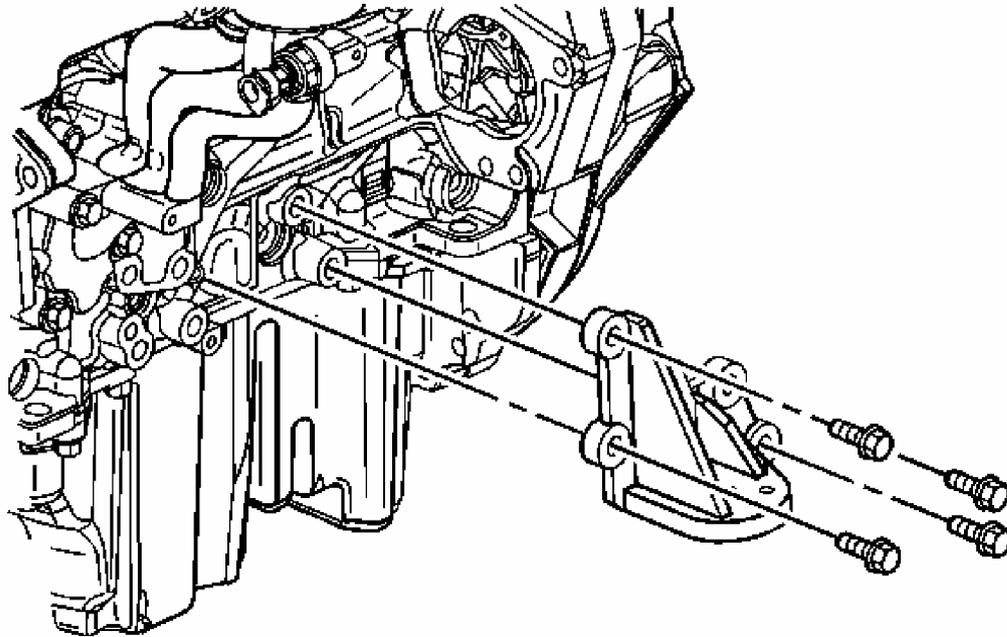


Fig. 31: View Of Left Engine Mount Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the left engine mount bracket.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the left engine mount bracket retaining bolts.

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

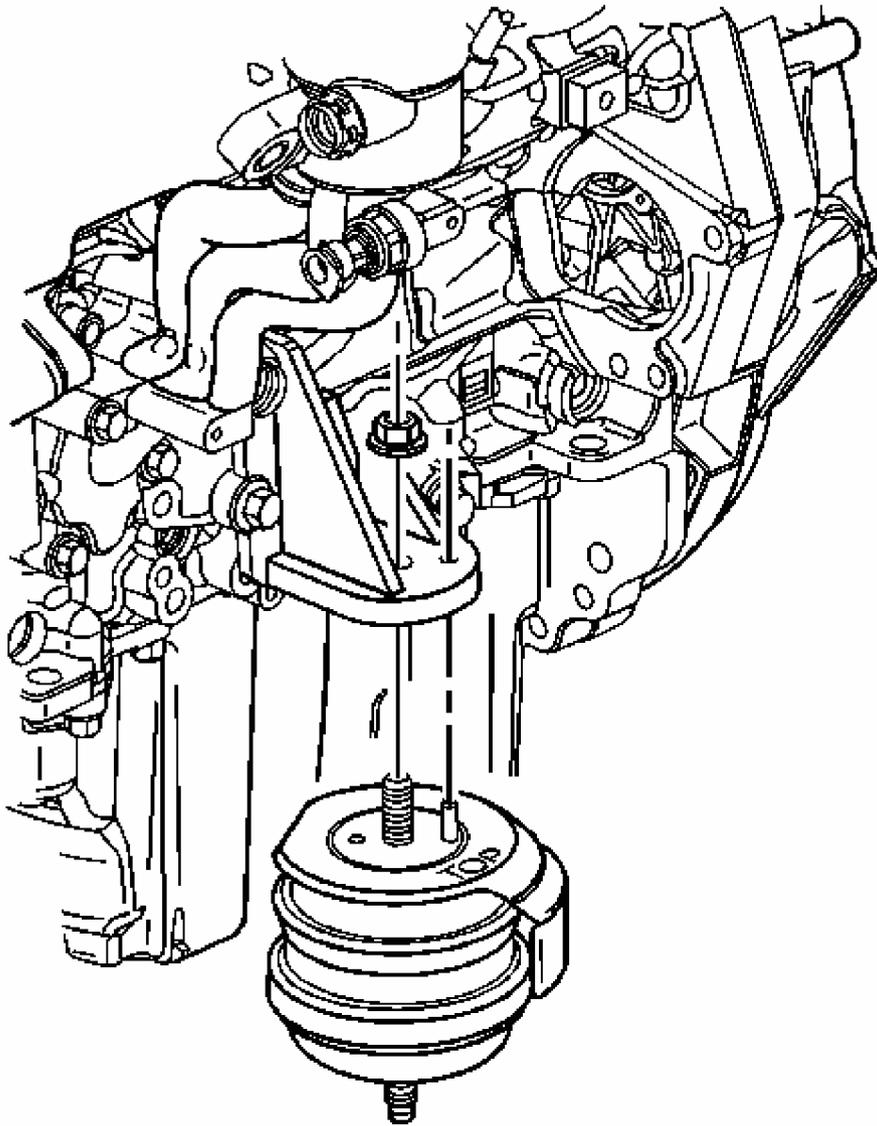


Fig. 32: View Of Left Engine Mount
Courtesy of GENERAL MOTORS CORP.

3. Install the engine mount to the vehicle.
4. Install the upper engine mount retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

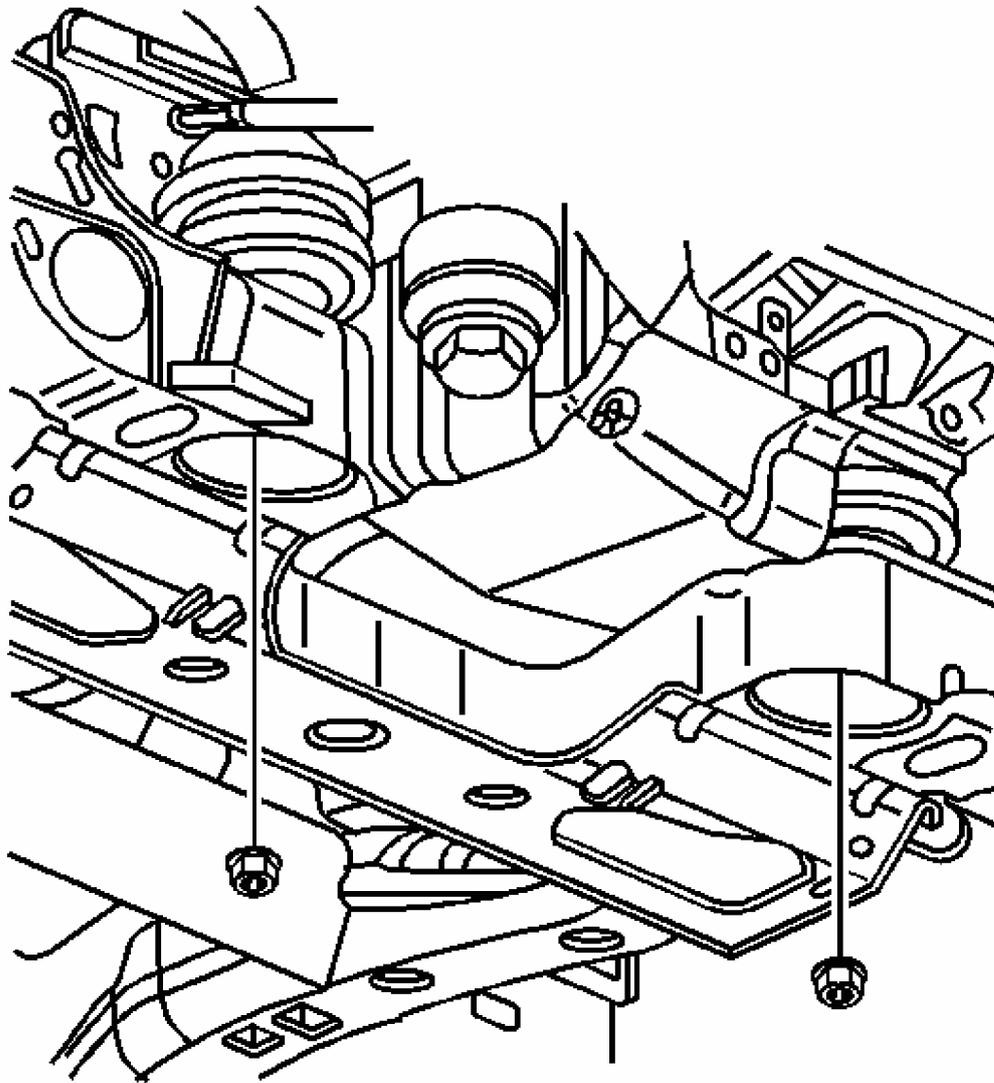


Fig. 33: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

5. Lower the engine using the screw jack until the weight is resting on the mount.
6. Install the engine mount lower retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

7. Remove the screw jack and block of wood from under the oil pan.
8. Lower the vehicle.

ENGINE MOUNT BRACKET REPLACEMENT - RIGHT

Removal Procedure

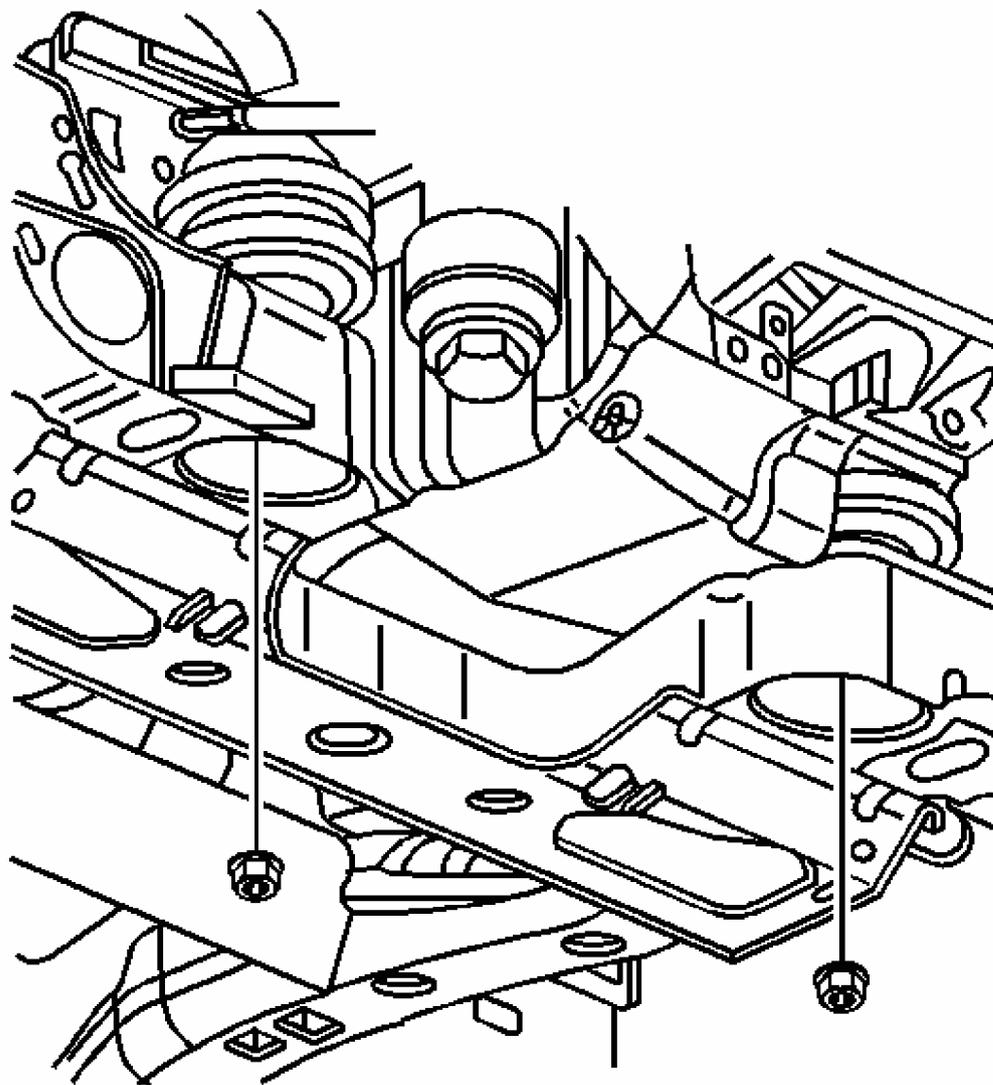


Fig. 34: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Install a screw jack with a block of wood under the oil pan for support.
3. Remove the lower engine mount retaining nut.

4. Raise the engine using the screw jack until the weight is removed from the mount.

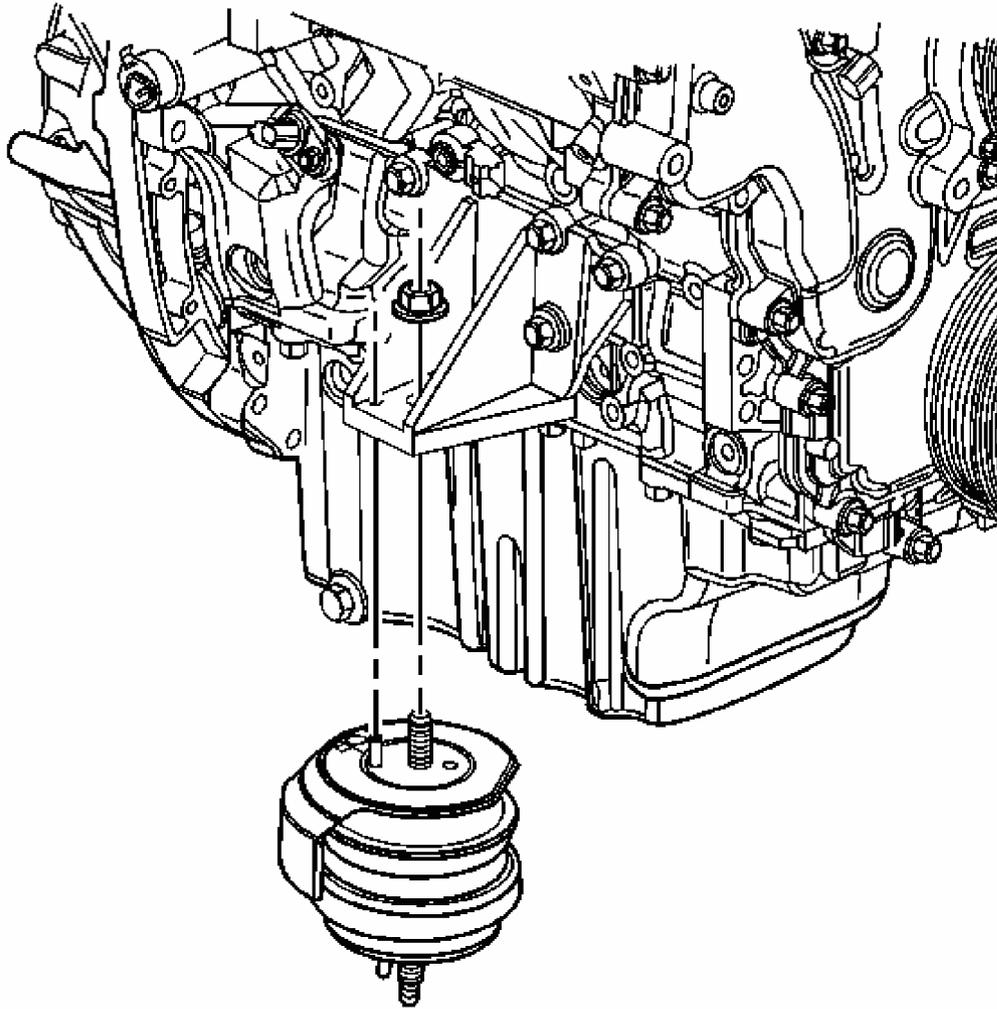


Fig. 35: View Of Right Engine Mount
Courtesy of GENERAL MOTORS CORP.

5. Remove the upper engine mount retaining nut.
6. Remove the engine mount from the vehicle.
7. Remove the starter. Refer to **Starter Motor Replacement (LP1, LY7)** or **Starter Motor Replacement (LS6)** in Engine Electrical.

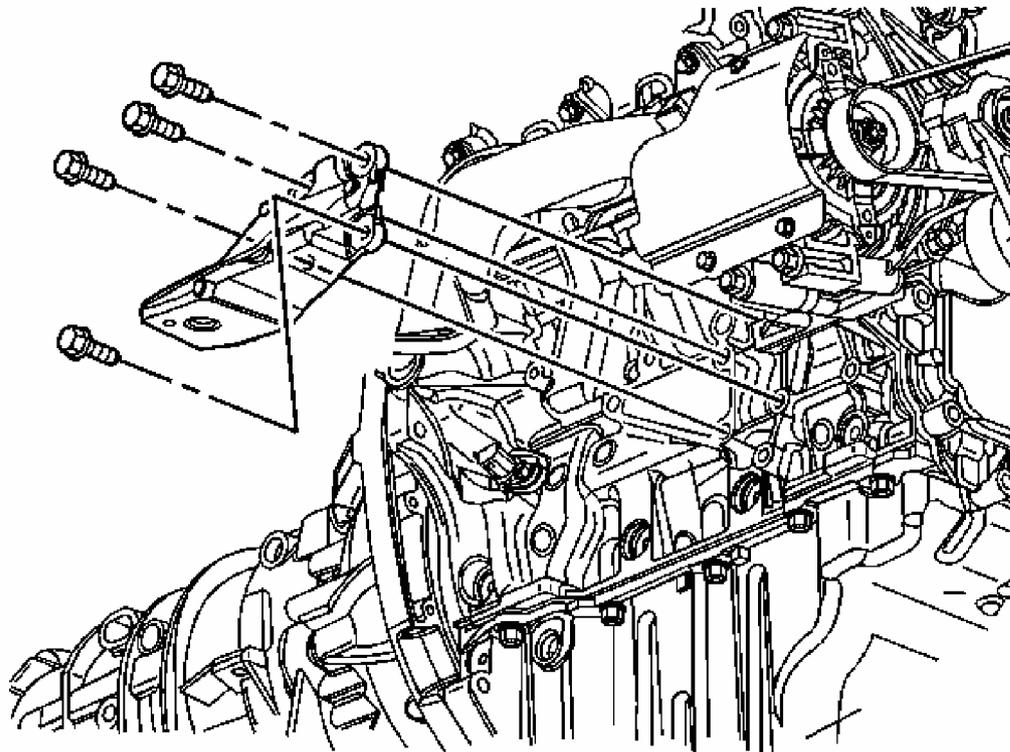


Fig. 36: View Of Right Engine Mount Bracket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure not to distort or bend the engine mount heat shield.

8. Remove the right engine mount bracket mounting bolts.
9. Remove the engine mount bracket from the vehicle.

Installation Procedure

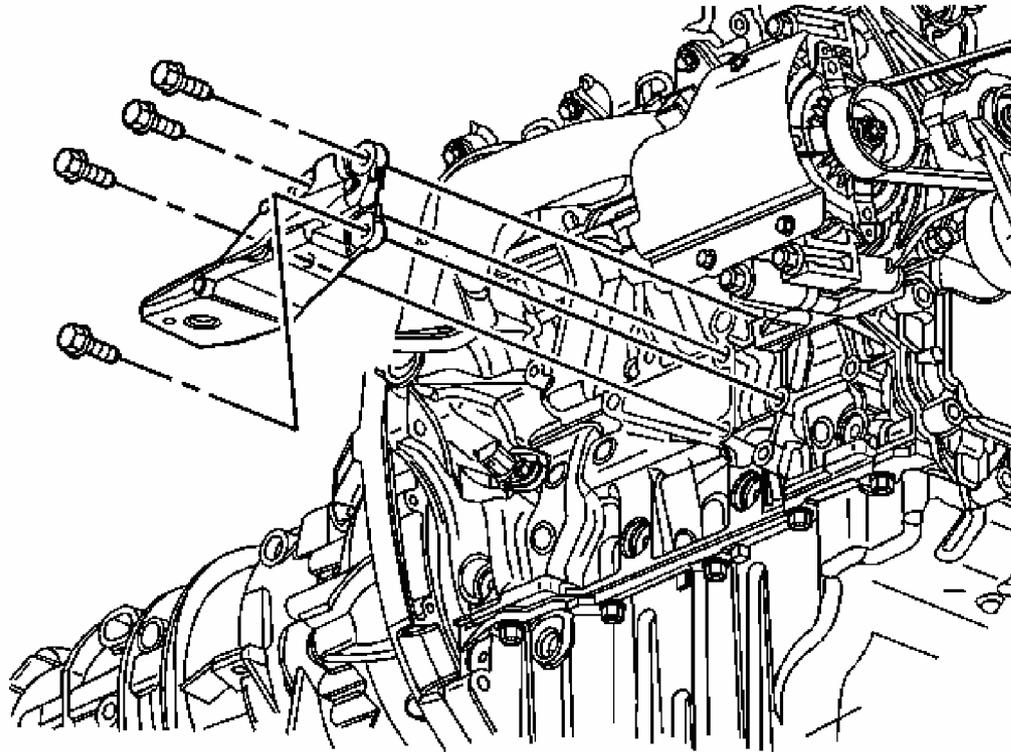


Fig. 37: View Of Right Engine Mount Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the engine mount bracket to the vehicle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Tighten the M 10 engine mount bracket mounting bolts.

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

3. Tighten the M 8 engine mount bracket mounting bolt.

Tighten: Tighten the bolt to 38 N.m (28 lb ft).

4. Install the starter. Refer to Starter Motor Replacement (LP1, LY7) or Starter Motor Replacement (LS6) in Engine Electrical.

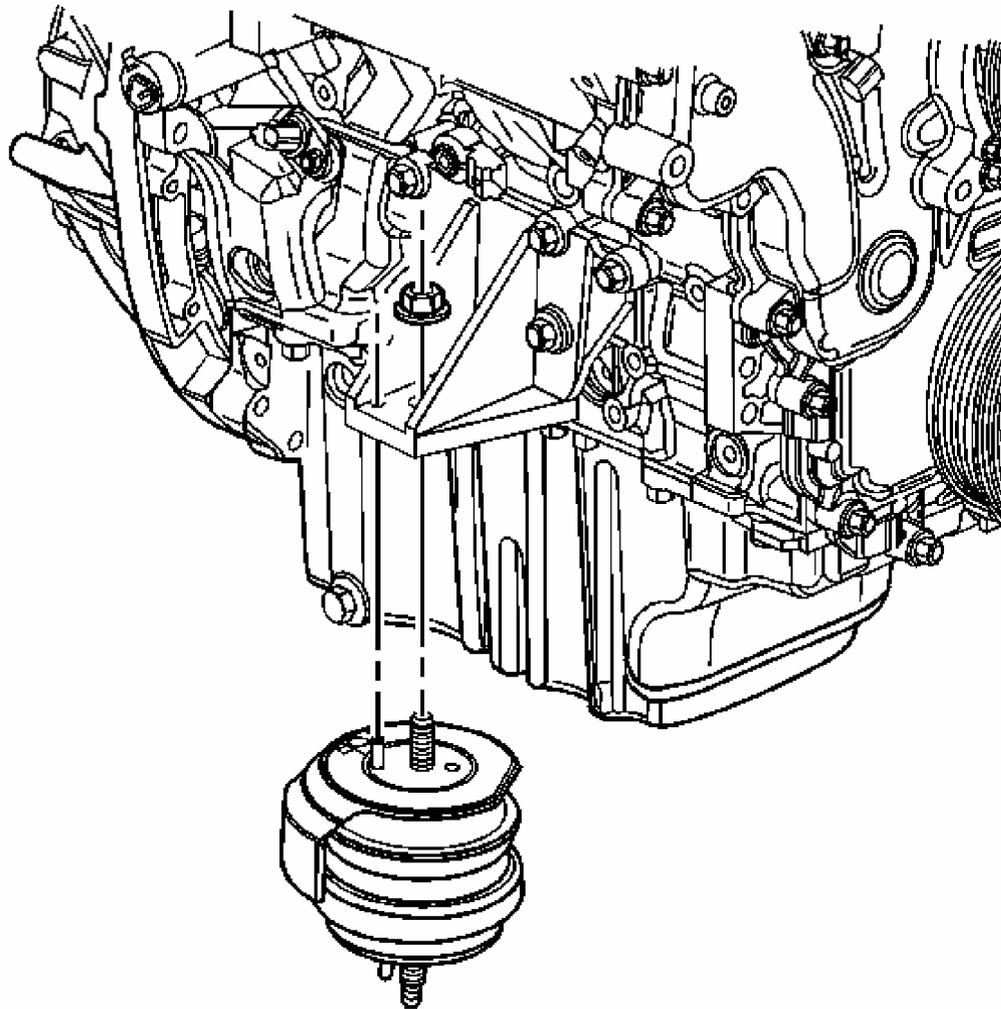


Fig. 38: View Of Right Engine Mount
Courtesy of GENERAL MOTORS CORP.

5. Install the engine mount to the vehicle.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the upper engine mount retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

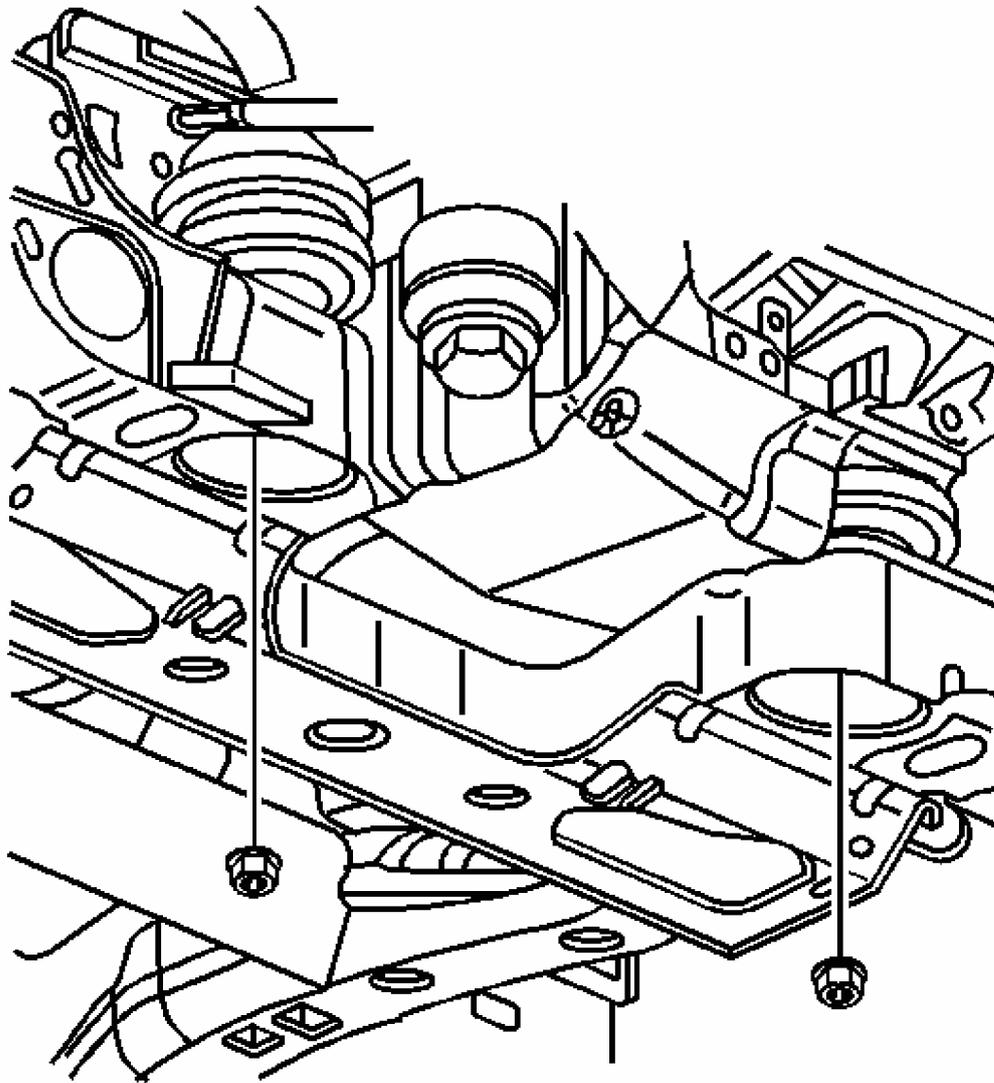


Fig. 39: Identifying Frame Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

7. Lower the engine using the jack screw until the weight is resting on the mount.
8. Install the engine mount retaining nut.

Tighten: Tighten the nut to 80 N.m (59 lb ft).

9. Remove the screw jack and block of wood from under the oil pan.
10. Lower the vehicle.

FUEL INJECTOR SIGHT SHIELD REPLACEMENT

Removal Procedure

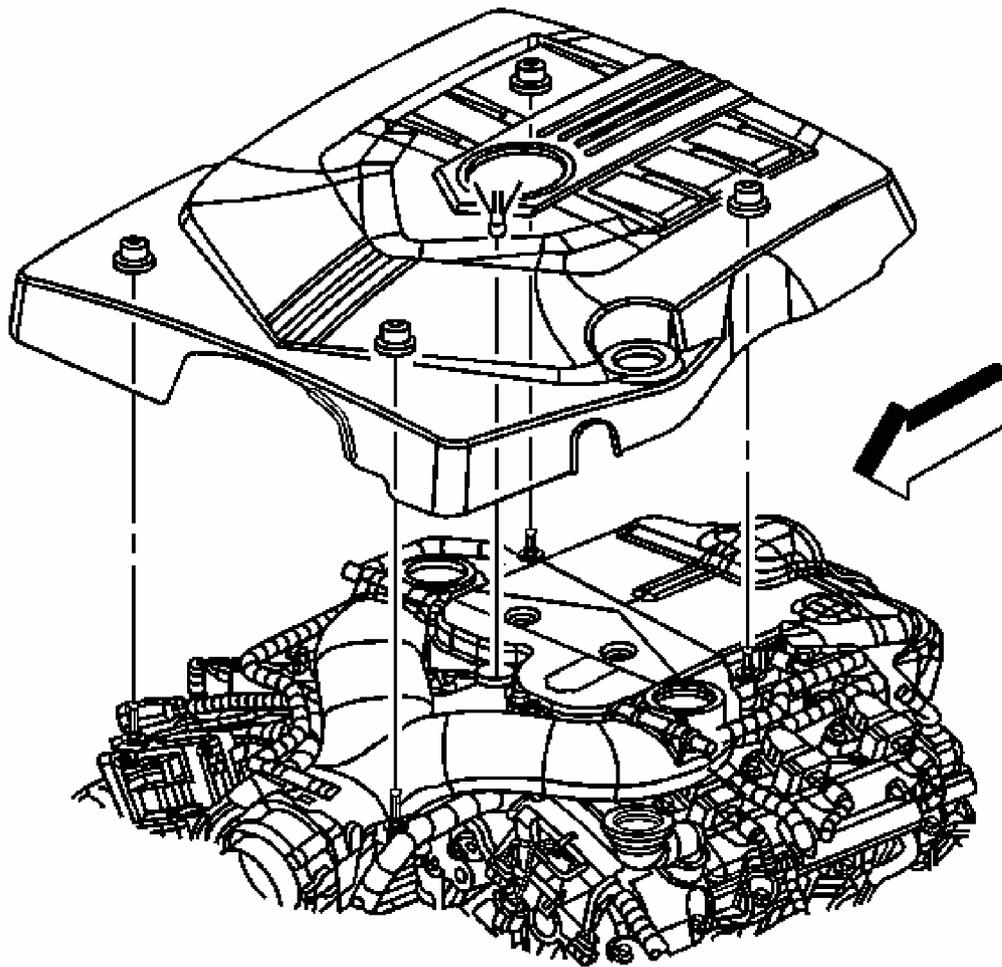


Fig. 40: Removing & Installing Engine Cover/Sight Shield
Courtesy of GENERAL MOTORS CORP.

1. Remove the cross car brace, if necessary. Refer to **Brace Replacement - Cross Vehicle** in Body Front End.
2. Remove the oil fill cap.
3. Disengage the cover/shield from the ball studs by pulling up firmly on the rear and front of the engine cover.
4. Remove the engine cover/sight shield.

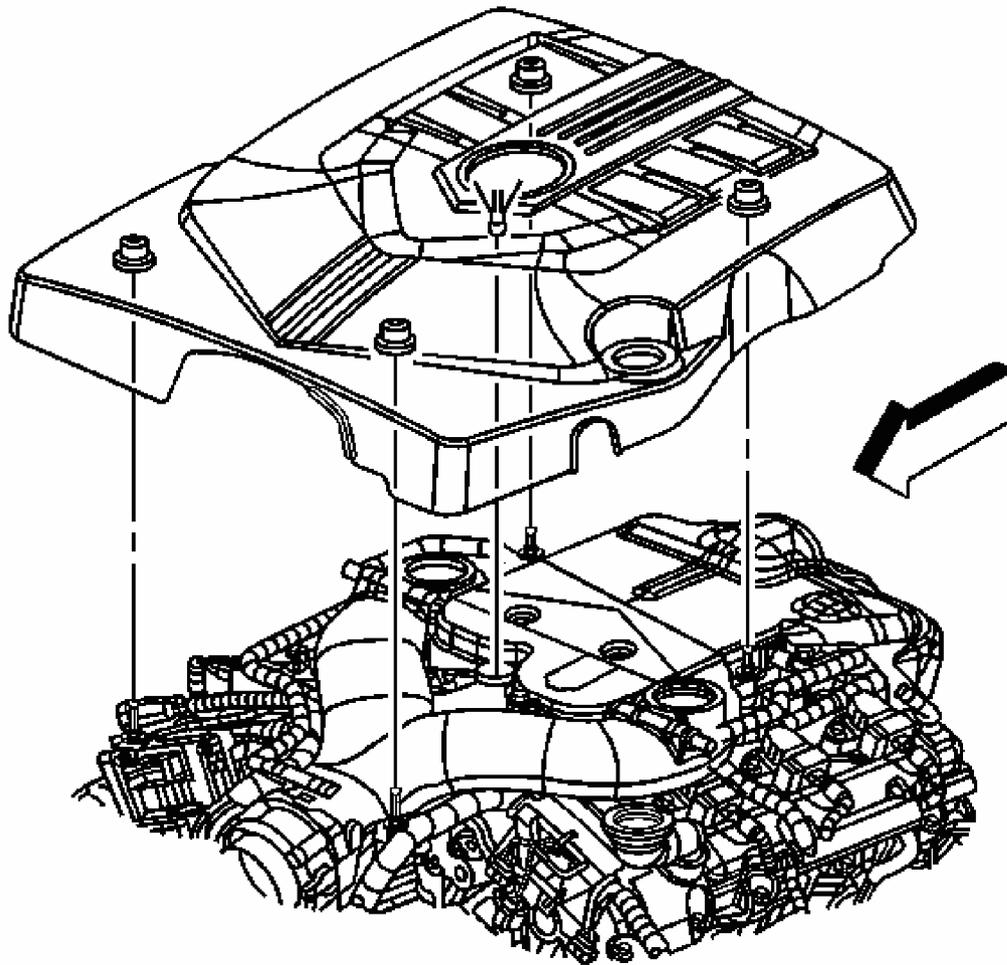


Fig. 41: Removing & Installing Engine Cover/Sight Shield
Courtesy of GENERAL MOTORS CORP.

1. Position the engine cover/sight shield over the intake manifold so the grommets are aligned with the ball studs.
2. Press the engine cover/sight shield down firmly near the ball studs in order to install the engine cover/sight shield.
3. Install the oil fill cap.
4. Install the cross car brace, if necessary. Refer to **Brace Replacement - Cross Vehicle** in Body Front End.

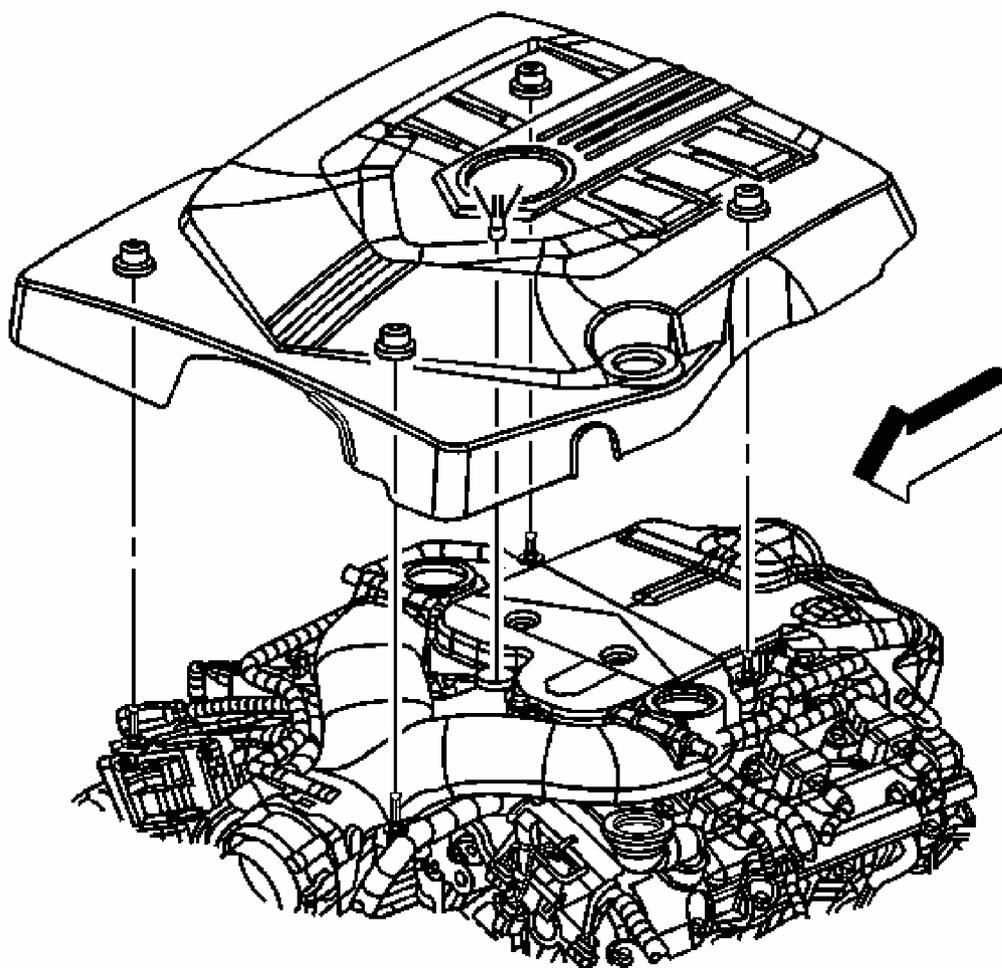


Fig. 42: Removing & Installing Engine Cover/Sight Shield
Courtesy of GENERAL MOTORS CORP.

1. Remove the cross car brace, if necessary. Refer to **Brace Replacement - Cross Vehicle** in Body Front End.
2. Remove the oil fill cap.
3. Disengage the cover/shield from the ball studs by pulling up firmly on the rear and front of the engine cover.
4. Remove the engine cover/sight shield.

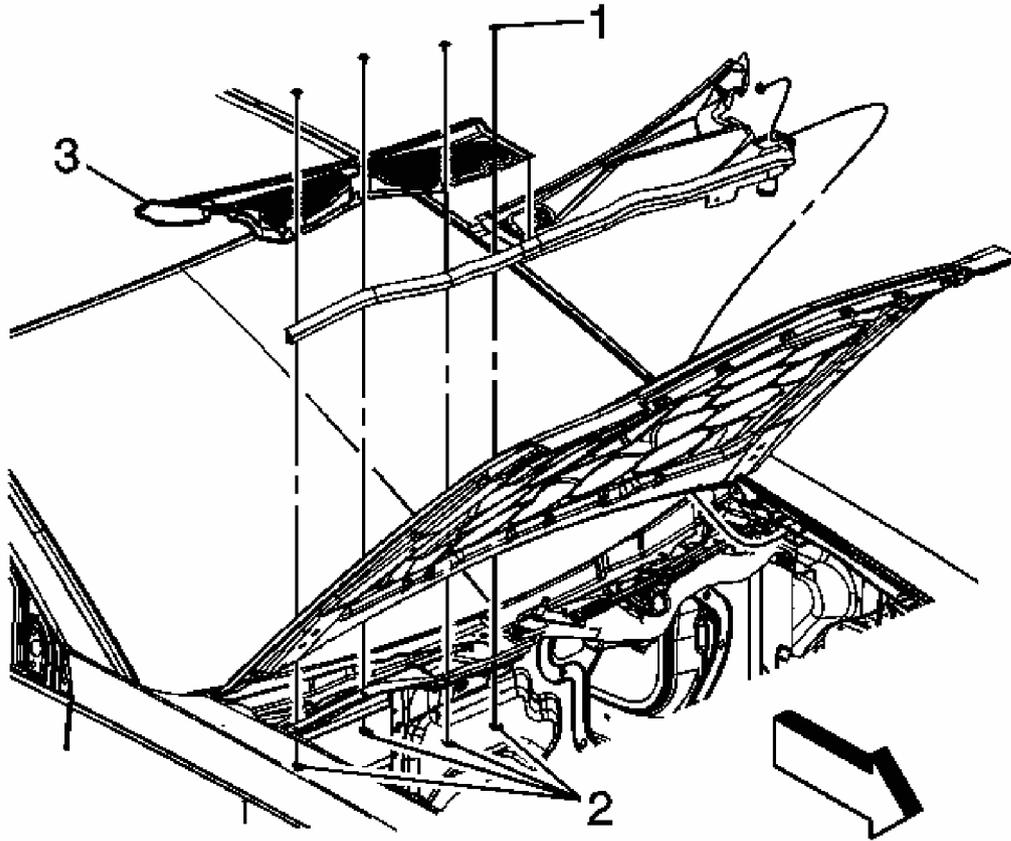


Fig. 43: Removing & Installing Hood Seal & Passenger Side Air Inlet Screen Panel

Courtesy of GENERAL MOTORS CORP.

5. Remove the hood seal from the passenger side air inlet screen panel.
6. Remove the air inlet screen panel bolts (1).
7. Remove the passenger side air inlet screen panel (3).

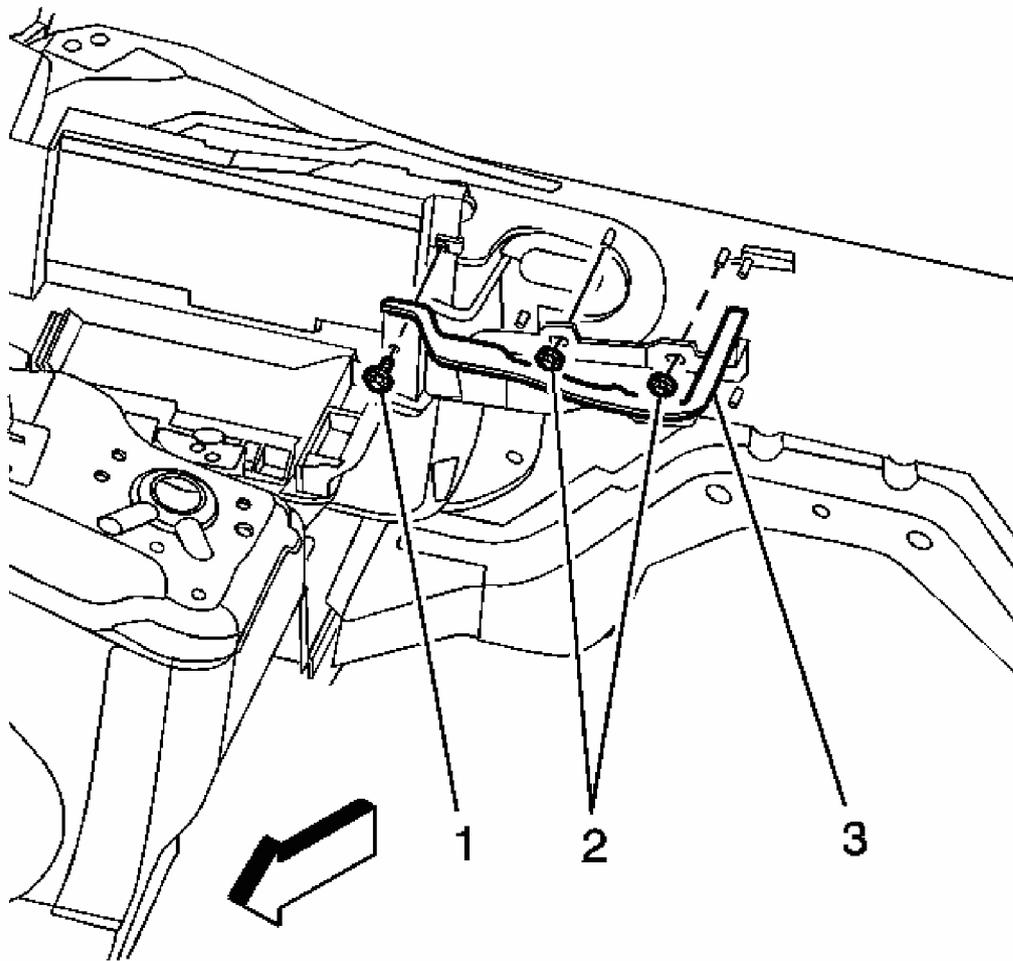


Fig. 44: Removing & Installing Air Inlet Housing Panel
Courtesy of GENERAL MOTORS CORP.

8. Remove the air inlet housing panel bolt (3) and nuts (2).
9. Remove the air inlet housing panel (1).

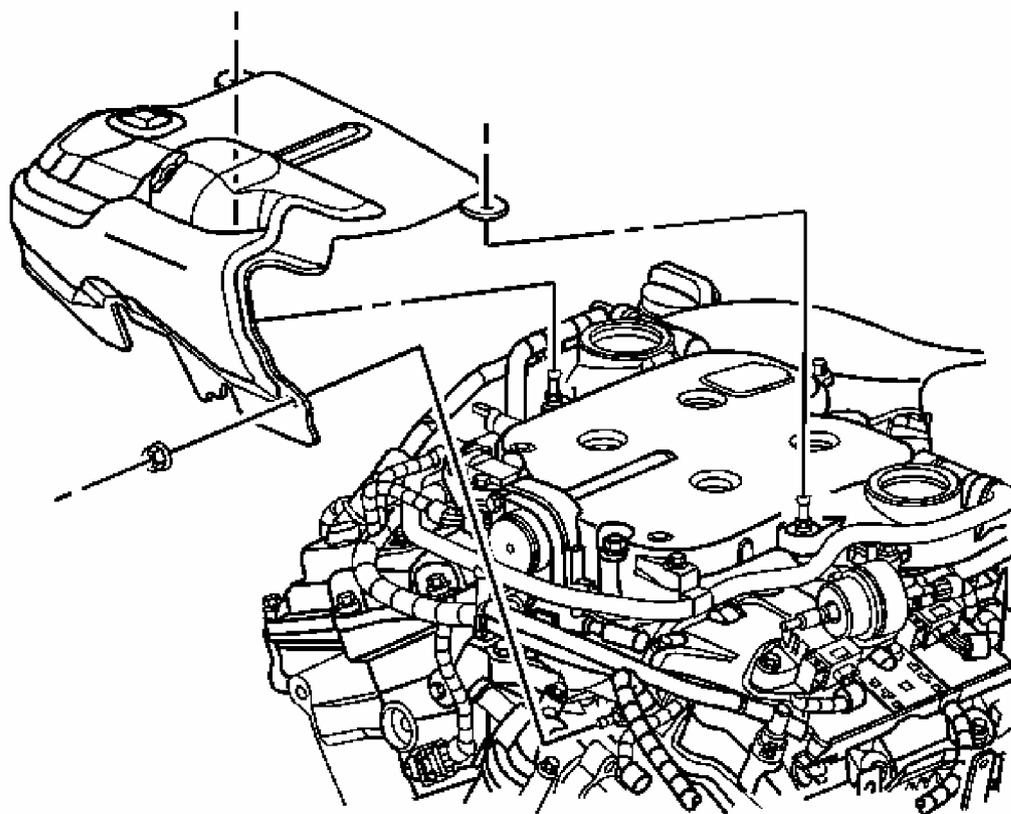


Fig. 45: Removing & Installing Rear Upper Intake Manifold Cover
Courtesy of GENERAL MOTORS CORP.

10. Remove the nut from the rear stud.
11. Remove the cover from the upper studs.

Installation Procedure

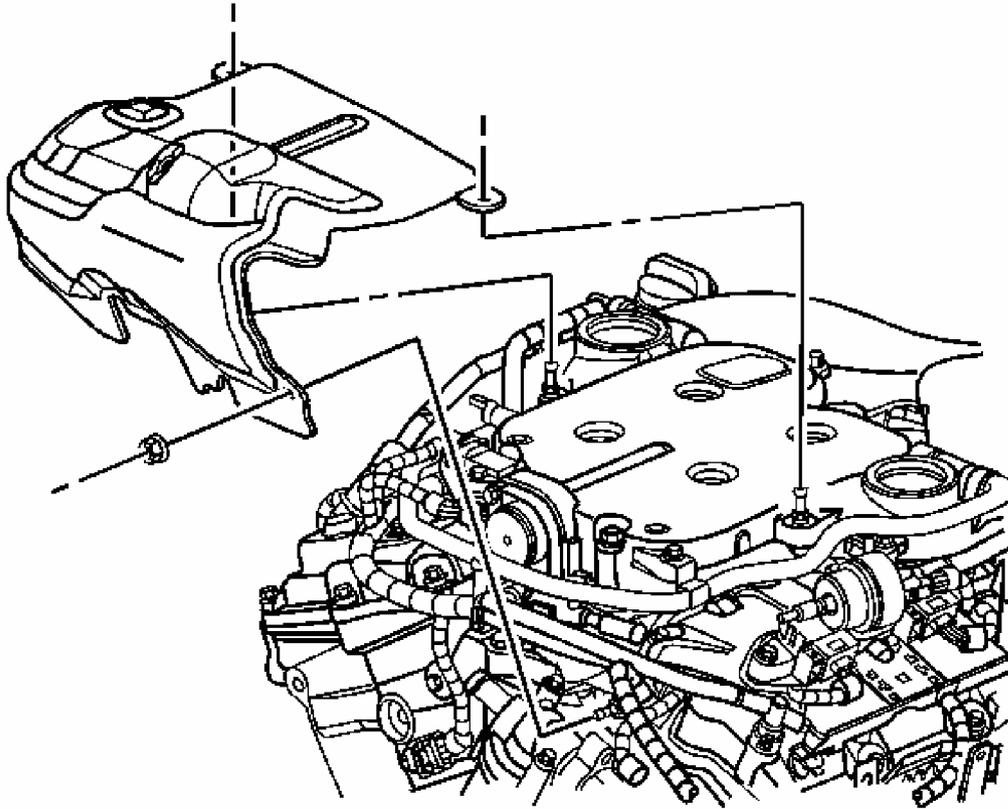


Fig. 46: Removing & Installing Rear Upper Intake Manifold Cover
Courtesy of GENERAL MOTORS CORP.

1. Install the cover to the upper studs.
2. Install the cover to the rear stud.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the cover nut.

Tighten: Tighten the nut to 23 N.m (17 lb ft).

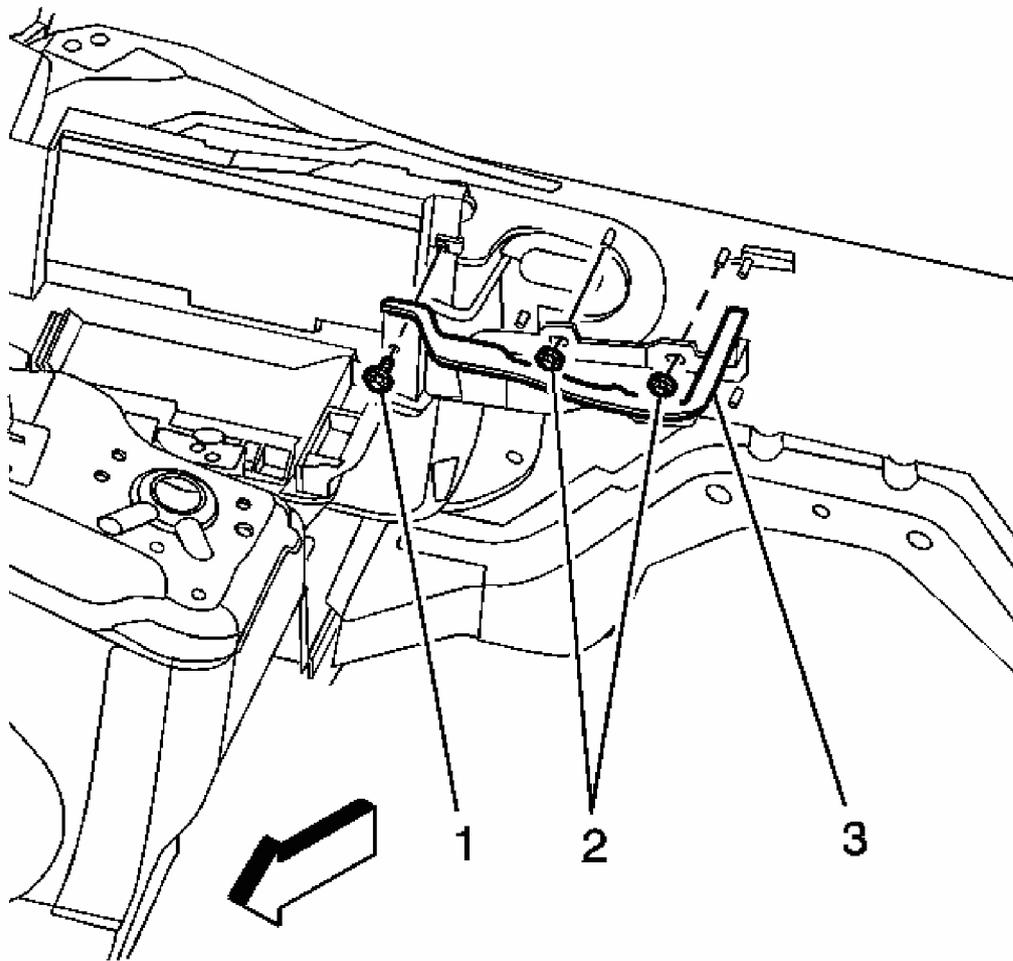


Fig. 47: Removing & Installing Air Inlet Housing Panel
Courtesy of GENERAL MOTORS CORP.

4. Position the slots in the air inlet housing panel (1) over the studs in the front of dash.
5. Instal the air inlet housing panel bolt (3) and nuts (2).

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

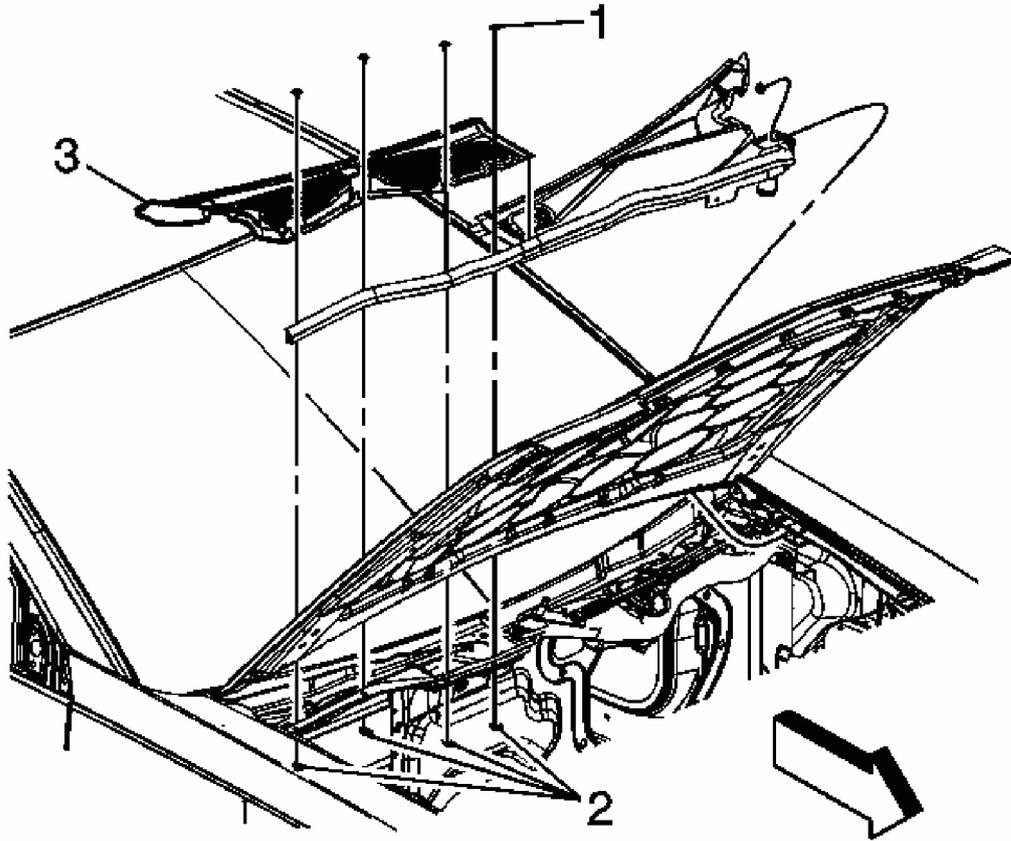


Fig. 48: Removing & Installing Hood Seal & Passenger Side Air Inlet Screen Panel

Courtesy of GENERAL MOTORS CORP.

6. Push the passenger side air inlet screen panel (3) towards the rear of the vehicle until the clips engage the windshield.
7. Align the center seam of the passenger side panel to the driver side panel.
8. Install the cowl vent screen bolts (1).

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

9. Install the hood seal to the panel.

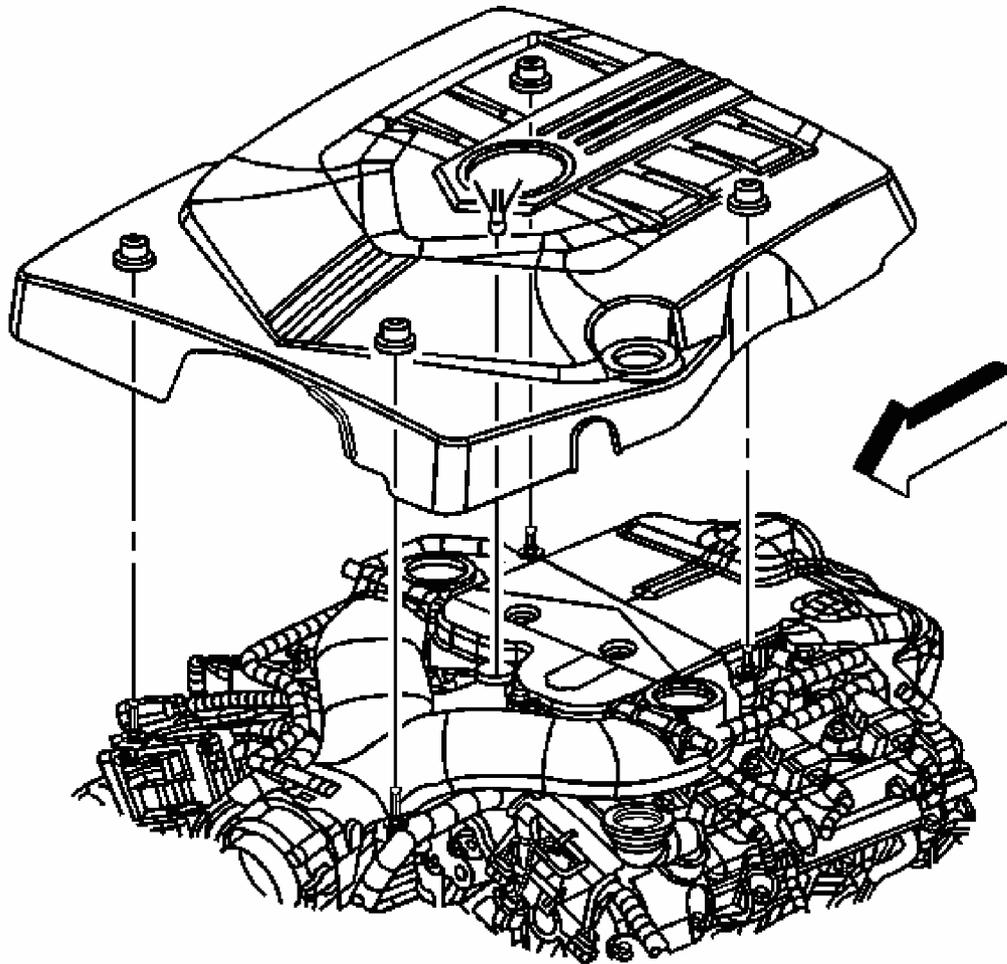


Fig. 49: Removing & Installing Engine Cover/Sight Shield
Courtesy of GENERAL MOTORS CORP.

10. Position the engine cover/sight shield over the intake manifold so the grommets are aligned with the ball studs.
11. Press the engine cover/sight shield down firmly near the ball studs in order to install the engine cover/sight shield.
12. Install the oil fill cap.
13. Install the cross car brace, if necessary. Refer to **Brace Replacement - Cross Vehicle** in Body Front End.

CRANKCASE VENTILATION HOSES/PIPES REPLACEMENT

Removal Procedure

1. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

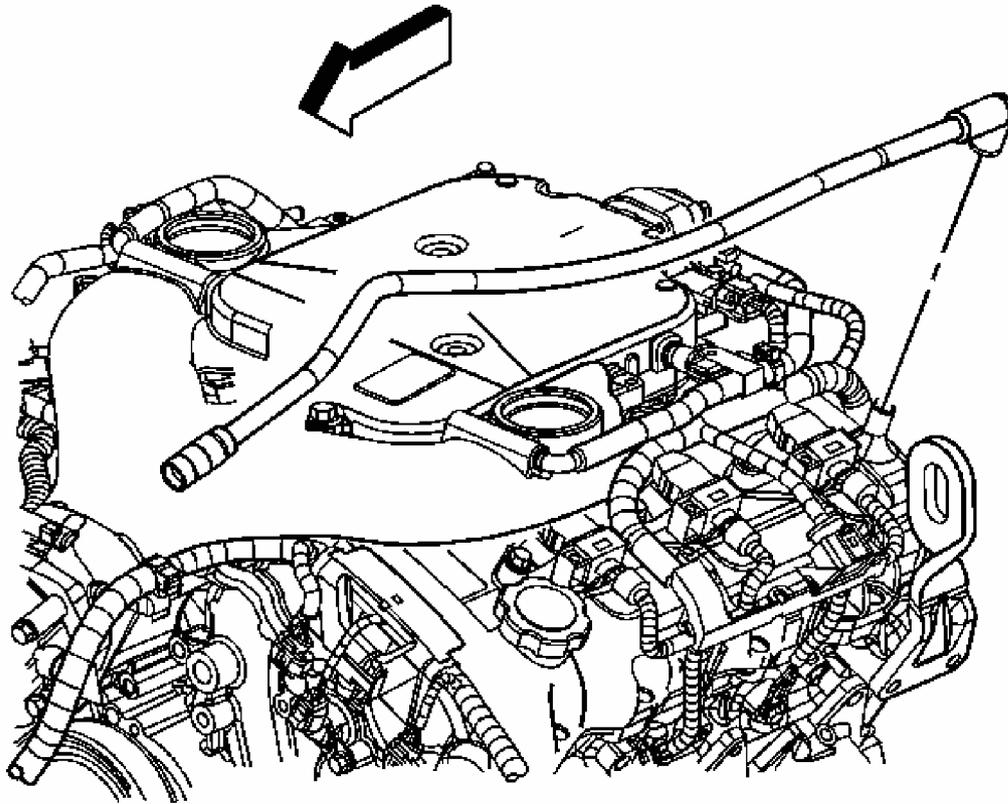


Fig. 50: View Of PCV Fresh Air Tube
Courtesy of GENERAL MOTORS CORP.

2. Remove the positive crankcase ventilation (PCV) fresh air tube from the left camshaft cover.
3. Remove the PCV fresh air tube from the air inlet.

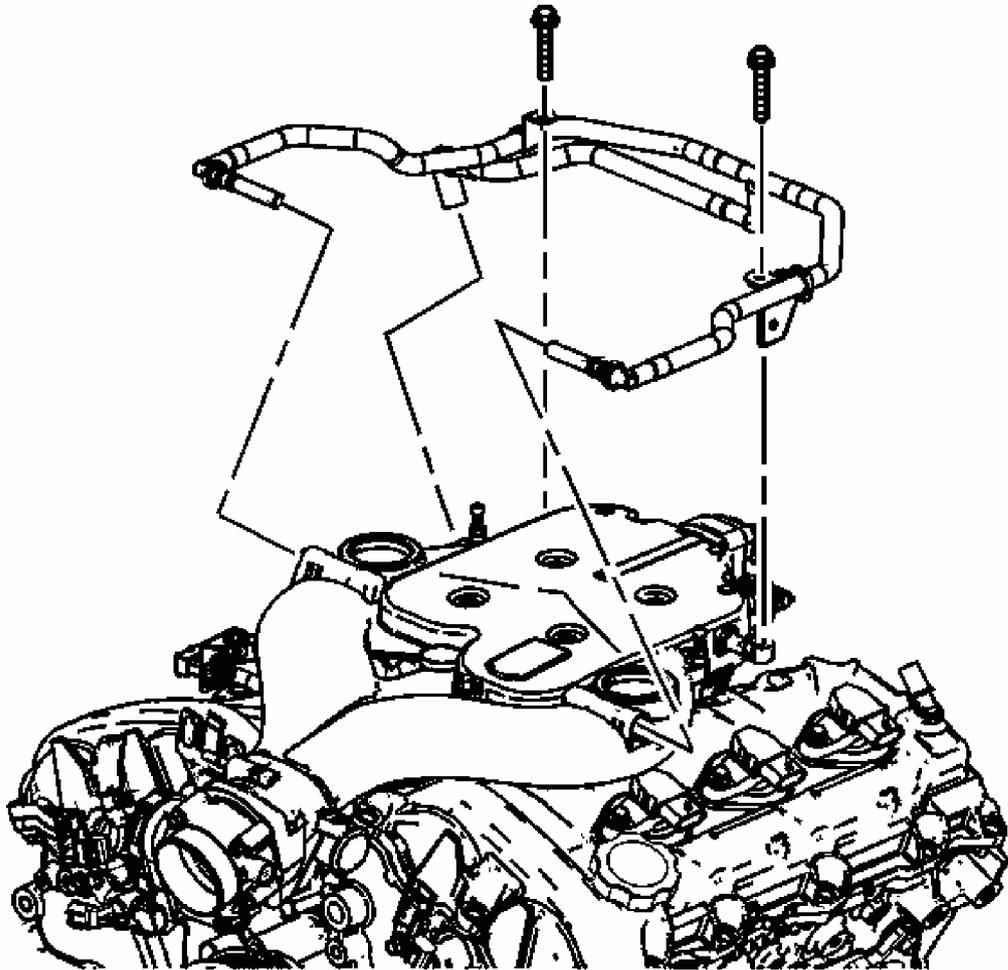


Fig. 51: View Of PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

4. Remove the PCV tube bracket bolts.
5. Remove the PCV dirty air tube from the right camshaft cover.
6. Remove the PCV dirty air tube from the intake manifold.

Installation Procedure

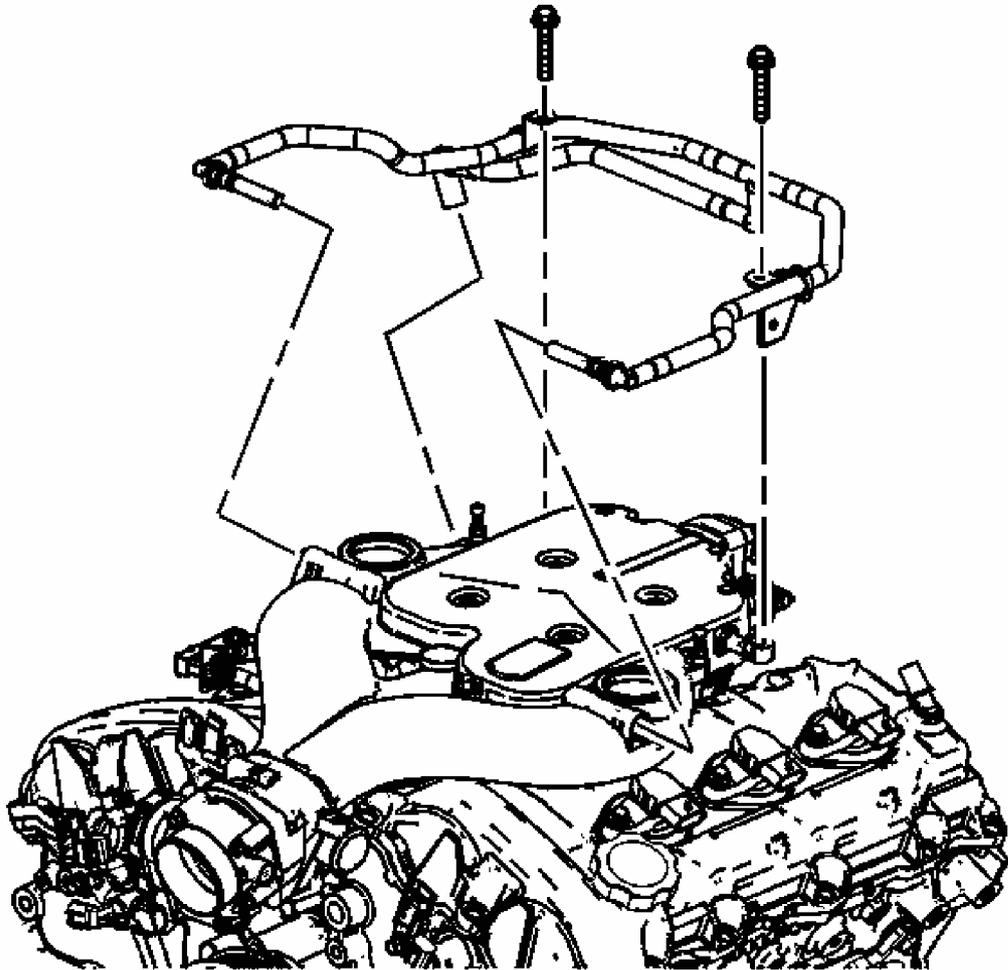


Fig. 52: View Of PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

1. Install the PCV dirty air tube to the intake manifold.
2. Install the PCV dirty air tube to the right camshaft cover.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the PCV tube bracket bolts.

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

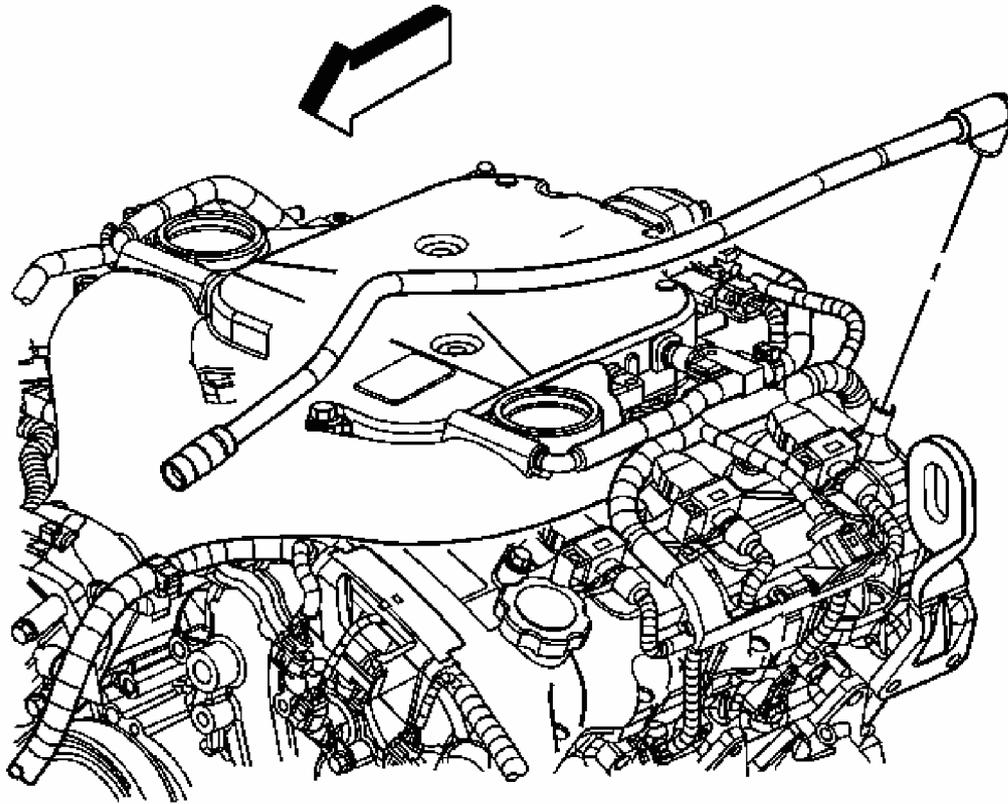


Fig. 53: View Of PCV Fresh Air Tube
Courtesy of GENERAL MOTORS CORP.

4. Install the PCV fresh air tube to the air inlet.
5. Install the PCV fresh air tube to the left camshaft cover.
6. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

INTAKE MANIFOLD REPLACEMENT - UPPER

Removal Procedure

1. Turn the ignition OFF.
2. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

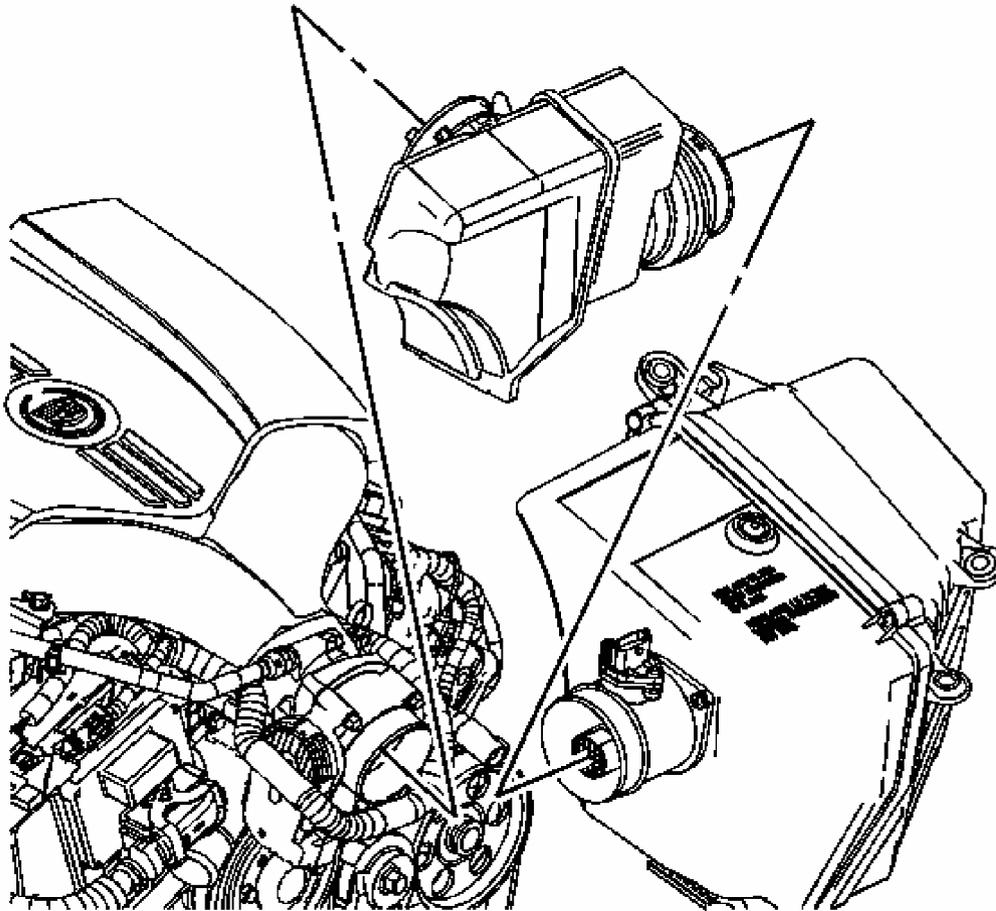


Fig. 54: View Of Air Inlet Duct
Courtesy of GENERAL MOTORS CORP.

3. Remove the air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.6L (LY7).
4. Disconnect the brake booster vacuum hose from the intake manifold.

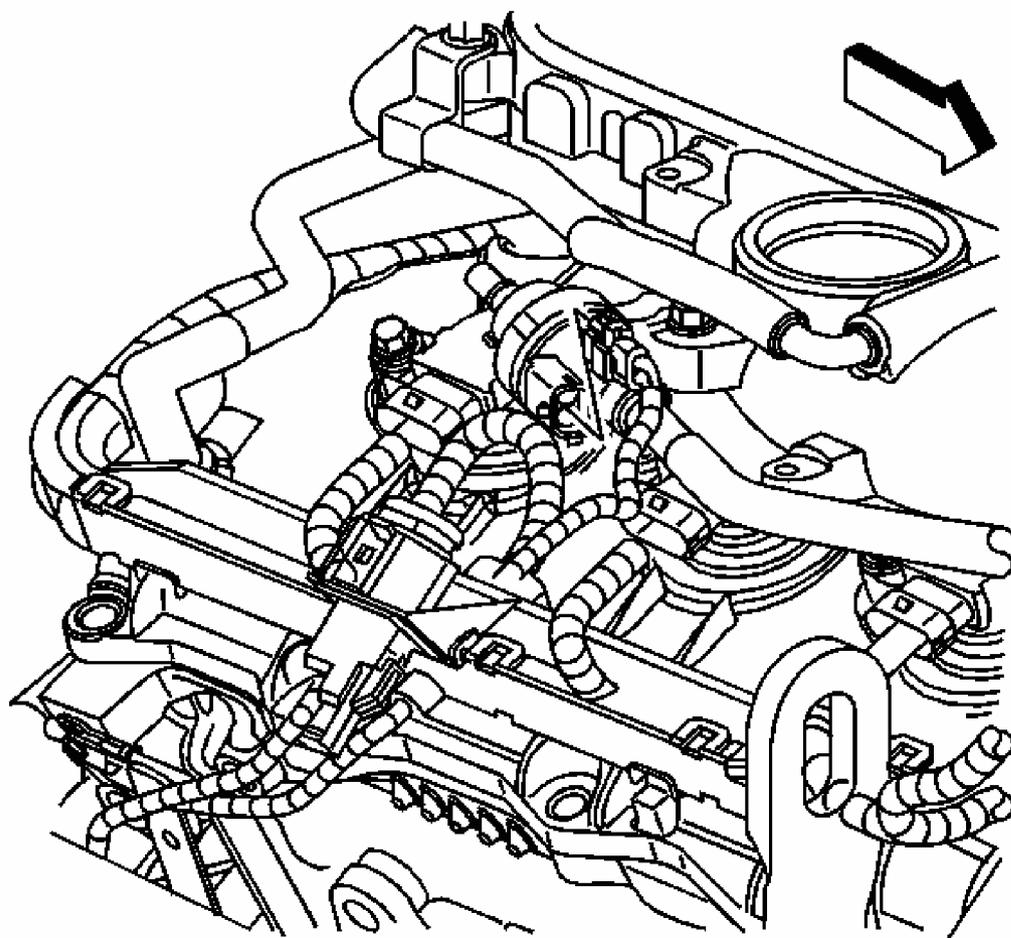


Fig. 55: View Of Purge Solenoid Valve And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the purge solenoid valve electrical connector.

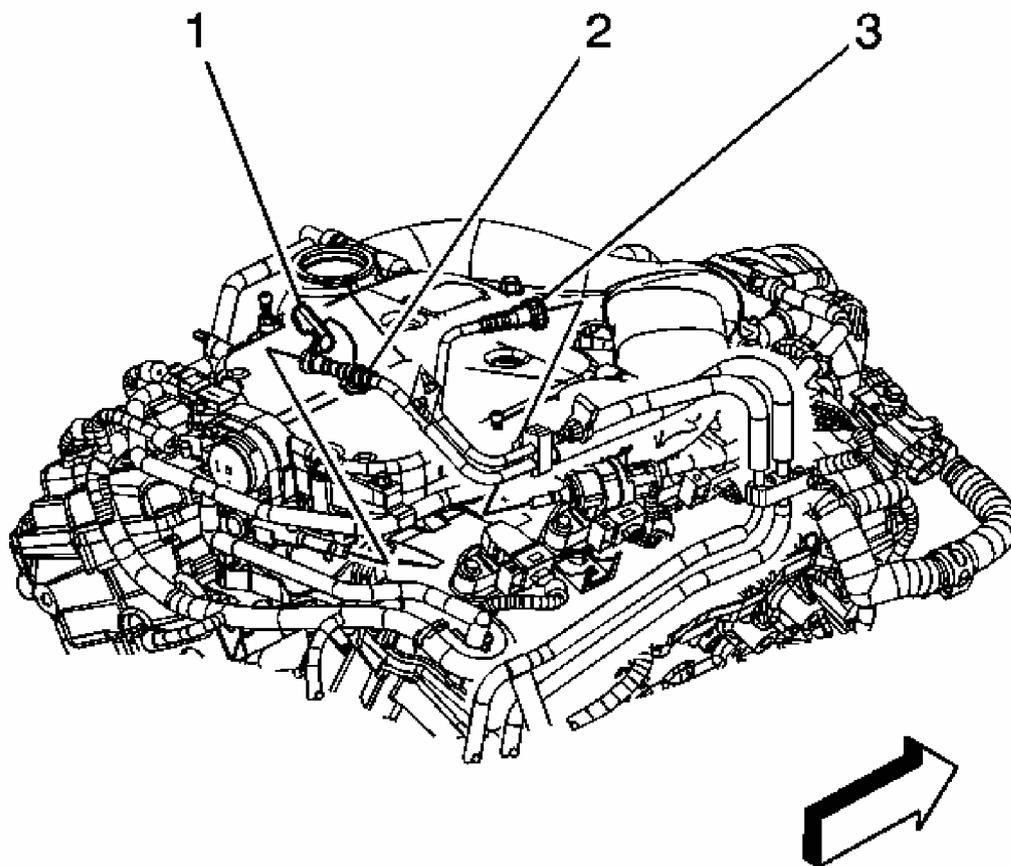


Fig. 56: Top Of Engine View
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the purge line (3) from the purge solenoid valve.

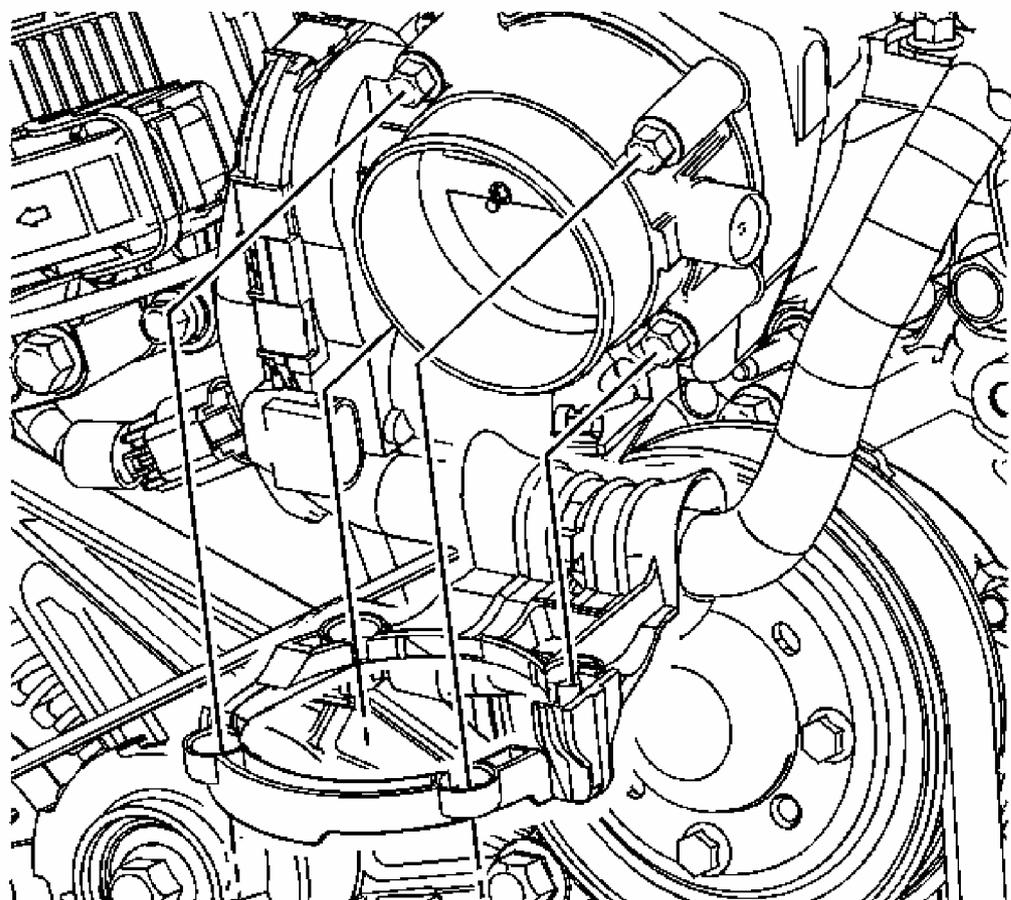


Fig. 57: View Of Wiring Harness Conduit
Courtesy of GENERAL MOTORS CORP.

7. Remove the wiring harness retainer.

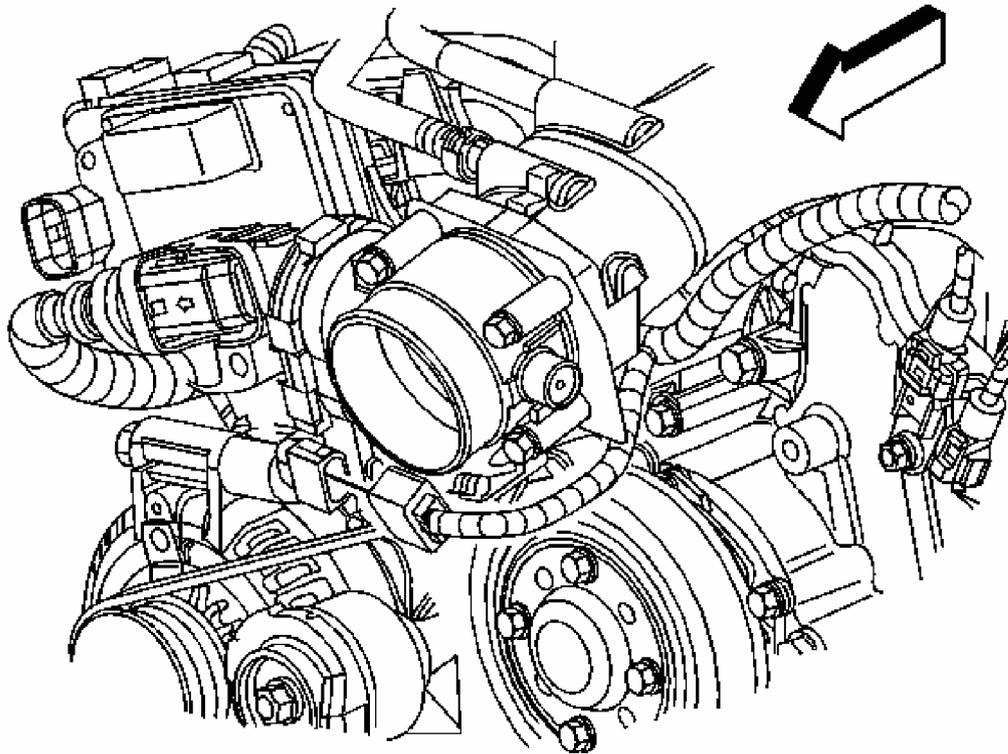


Fig. 58: View Of Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the throttle body electrical connector.

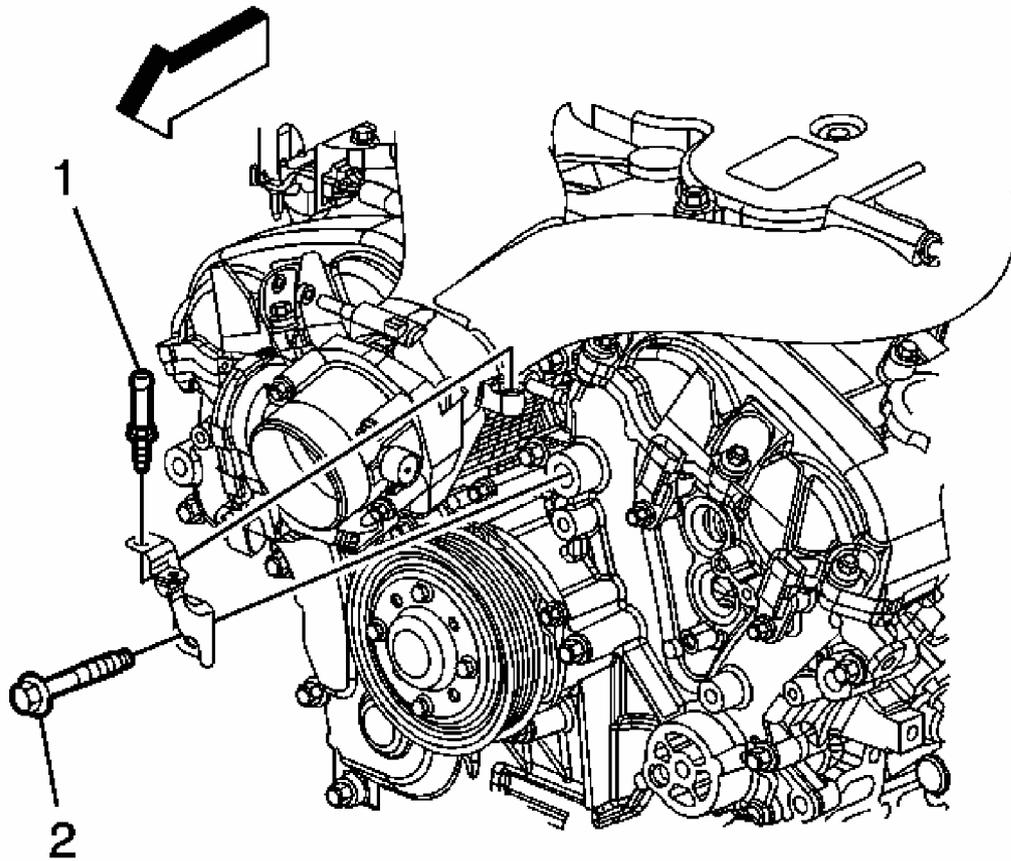


Fig. 59: Identifying Upper Intake Manifold Brace Stud, Bolt & Brace
Courtesy of GENERAL MOTORS CORP.

9. Remove the upper intake manifold brace stud (1), bolt (2) and brace.
10. Disconnect the positive crankcase ventilation (PCV) hose from the right bank camshaft cover.

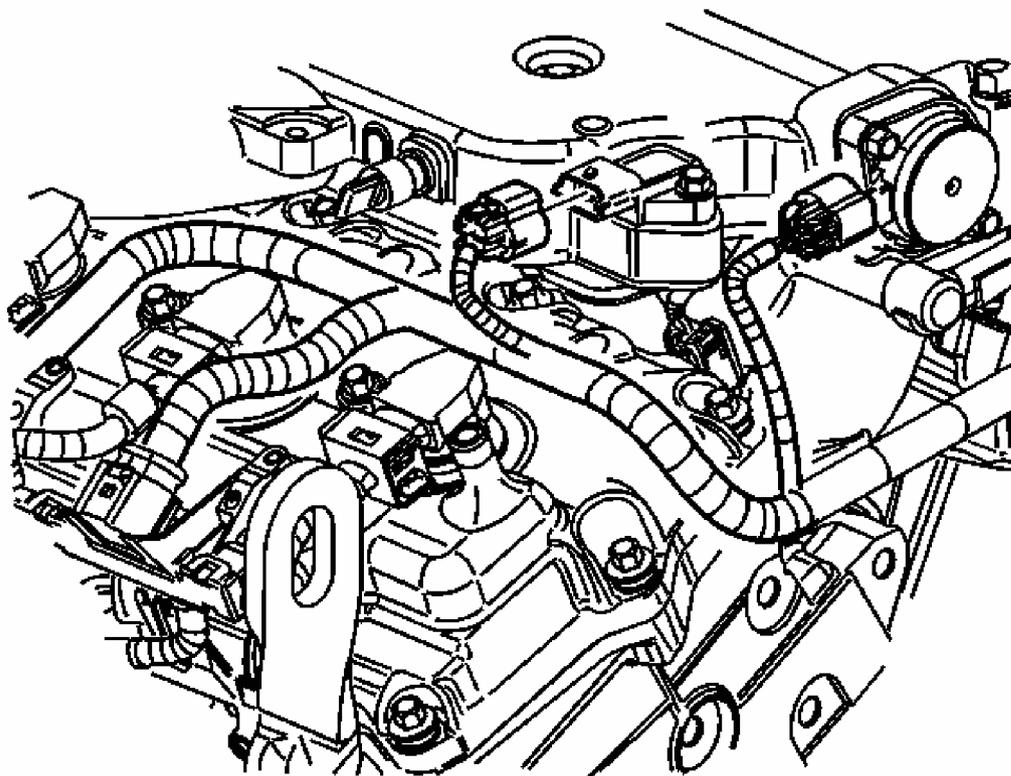


Fig. 60: Identifying Barometric Pressure Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

11. Disconnect the barometric pressure sensor electrical connector.

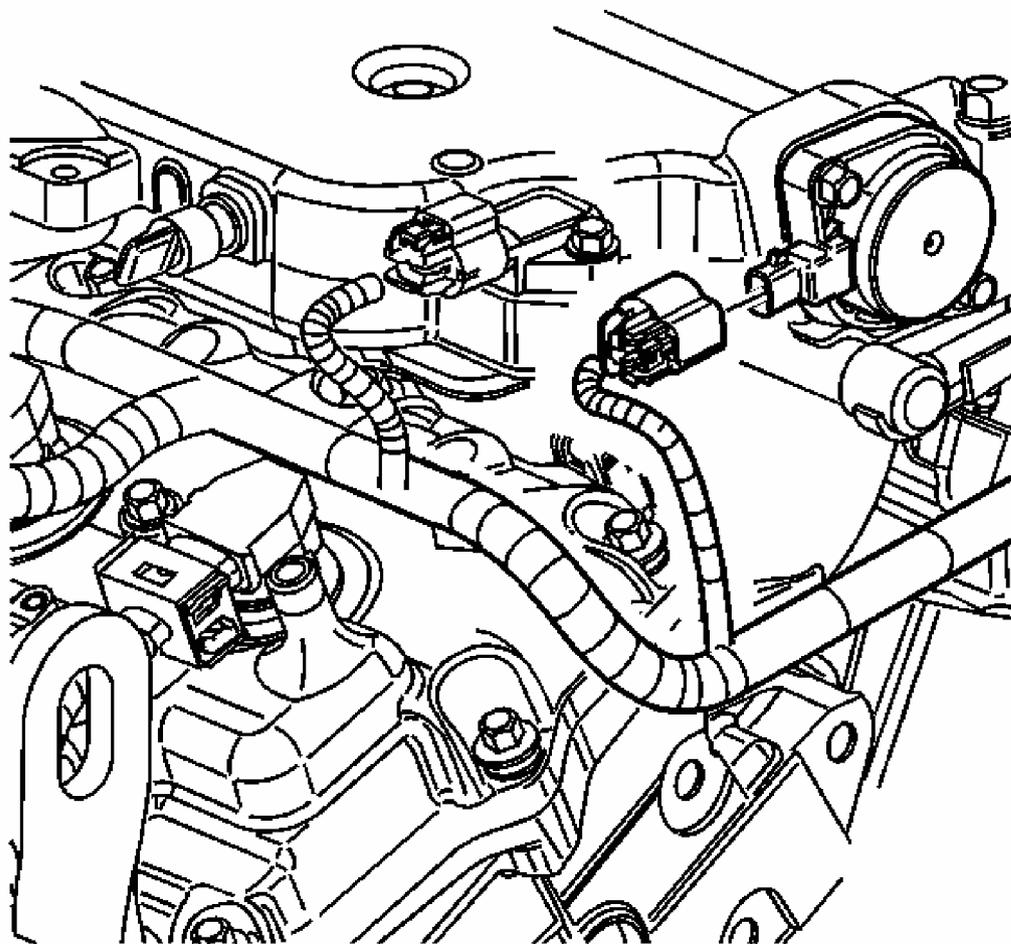


Fig. 61: View Of Communicator And Intake Manifold Runner Control Solenoid Electrical Connectors

Courtesy of GENERAL MOTORS CORP.

12. Disconnect the intake manifold runner control solenoid electrical connector.

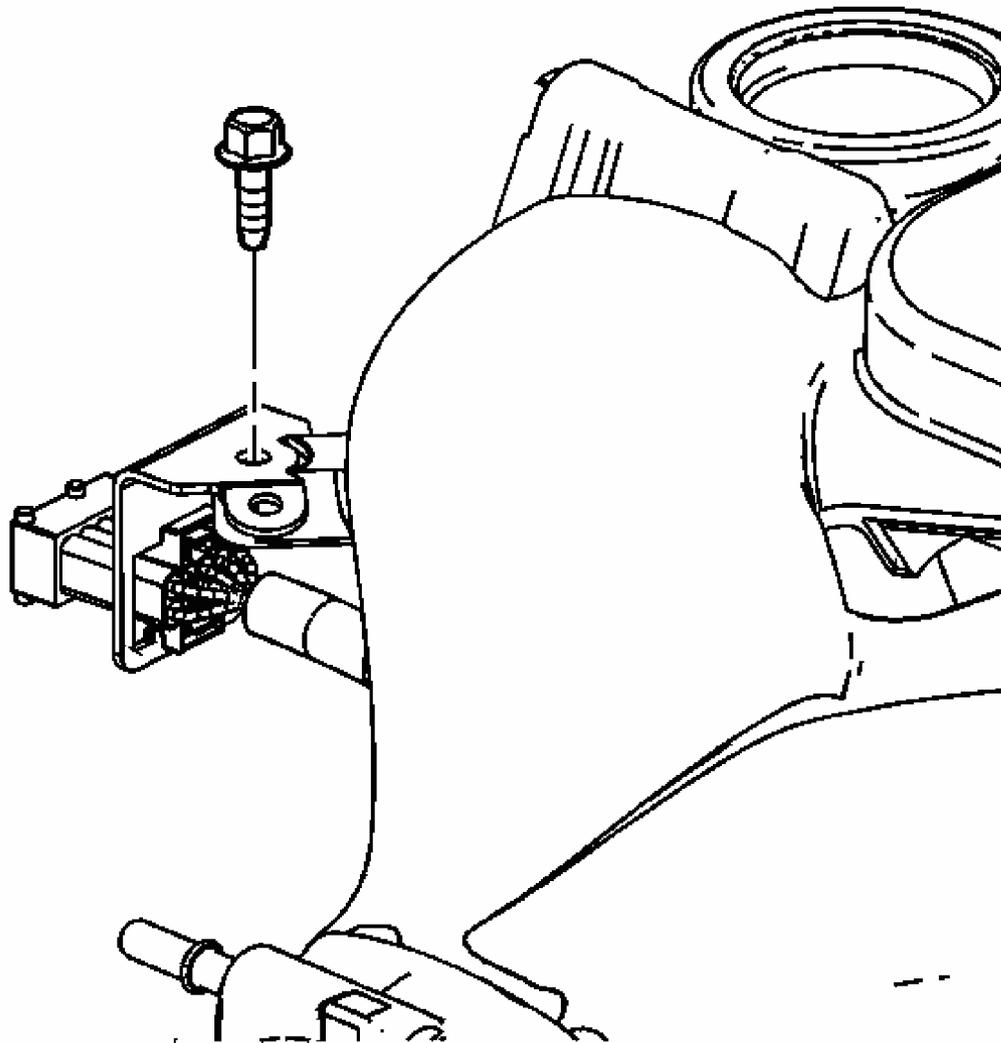


Fig. 62: View Of Injector Harness Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

13. Remove the injector harness bracket bolt.
14. Remove the left bank ignition coil wiring harness from the bracket.

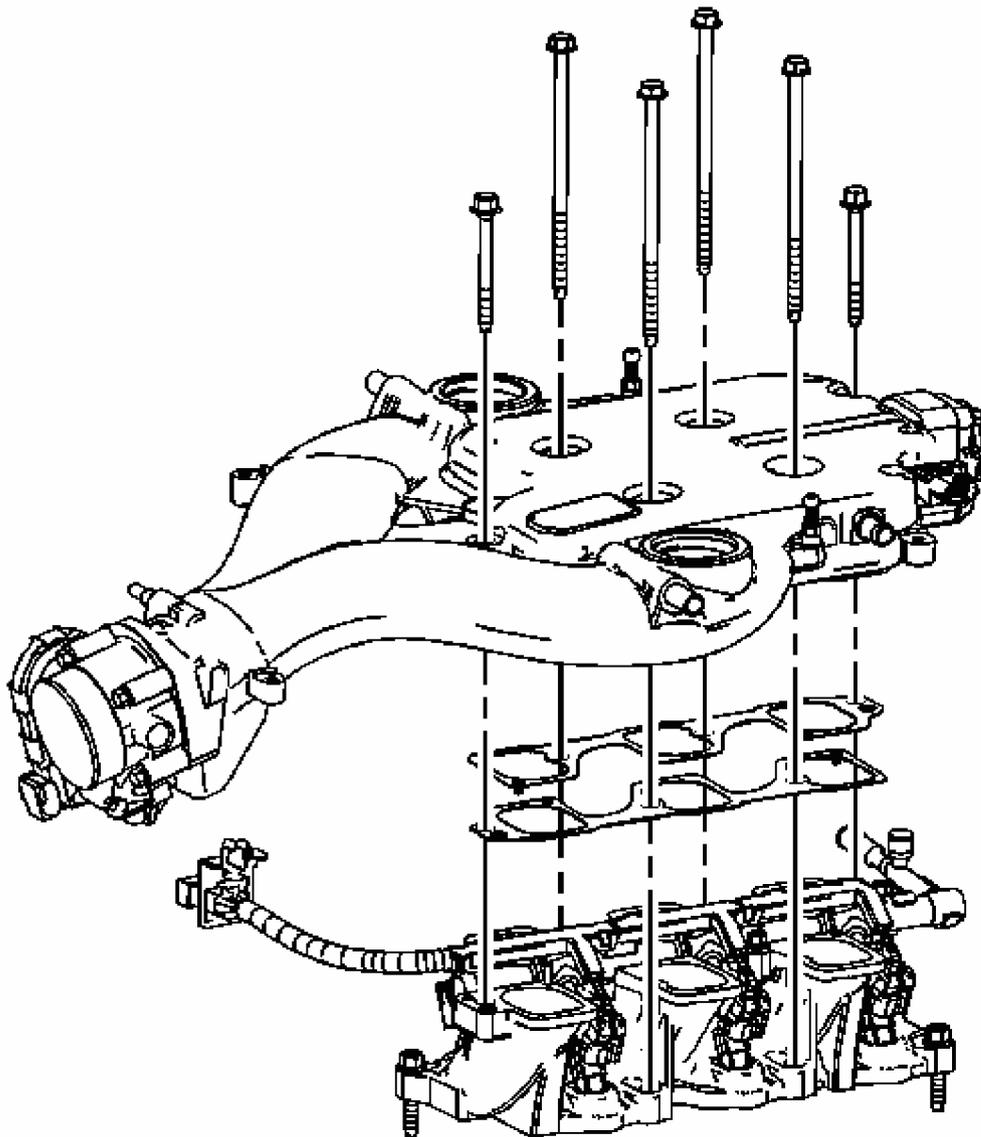


Fig. 63: View Of Upper Intake Manifold
Courtesy of GENERAL MOTORS CORP.

15. Remove the upper intake manifold bolts. Some deflection of the cowl panel may be necessary to extract the right rear bolt.
16. Remove the upper intake manifold with the throttle body.
17. If the upper intake manifold is being replaced, disassemble the intake manifold. Refer to **Intake Manifold Disassemble**.

18. Clean and inspect the intake manifold. Refer to **Intake Manifold Cleaning and Inspection** .

Installation Procedure

1. If the upper intake manifold is being replaced, assemble the intake manifold. Refer to **Intake Manifold Assemble** .

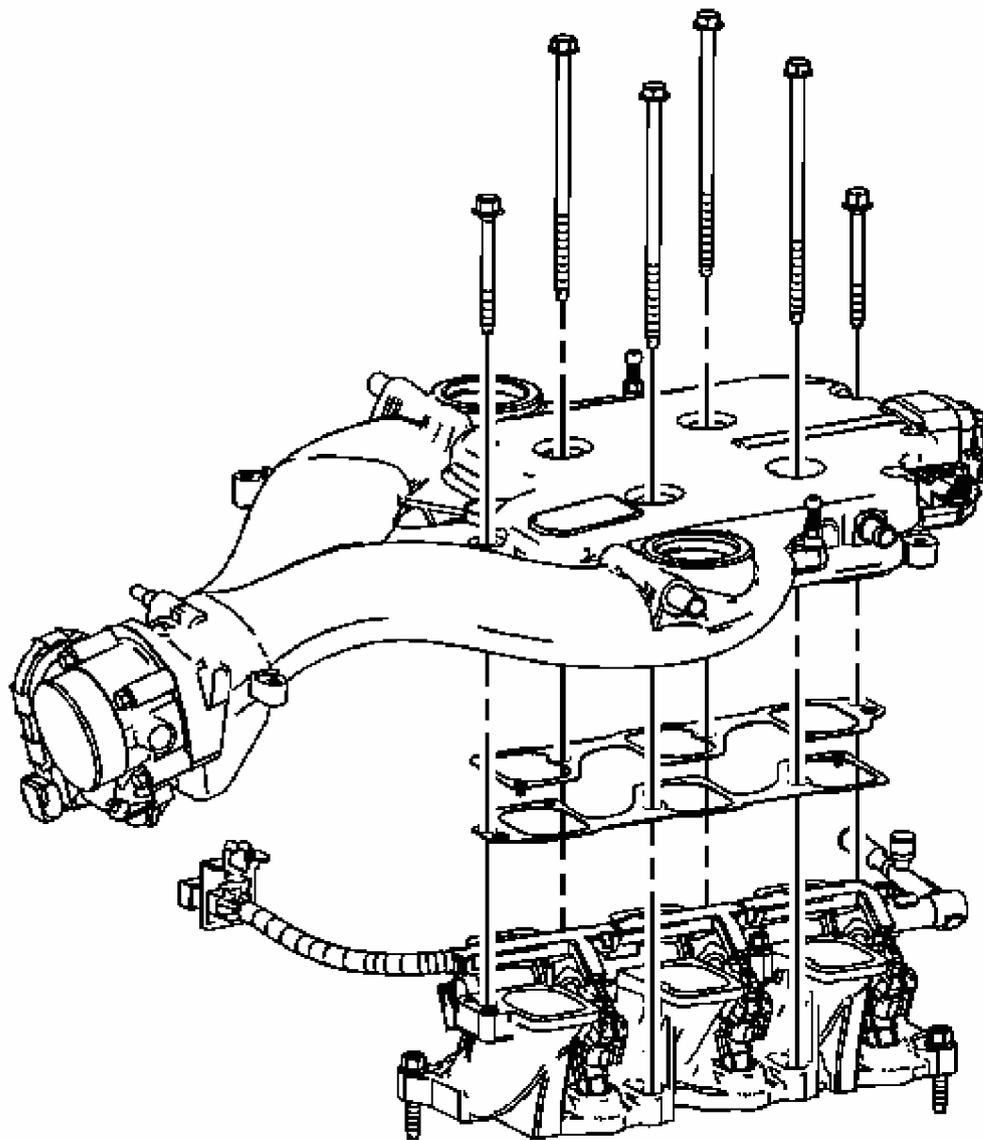


Fig. 64: View Of Upper Intake Manifold

Courtesy of GENERAL MOTORS CORP.

2. Install a NEW upper intake manifold gasket.
3. Install the upper intake manifold.

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: Tighten the intake manifold bolts in a circular pattern starting at the center (long bolts) and moving outward.

4. Install the upper intake manifold bolts.

Tighten: Tighten the upper intake manifold bolts to 23 N.m (17 lb ft).

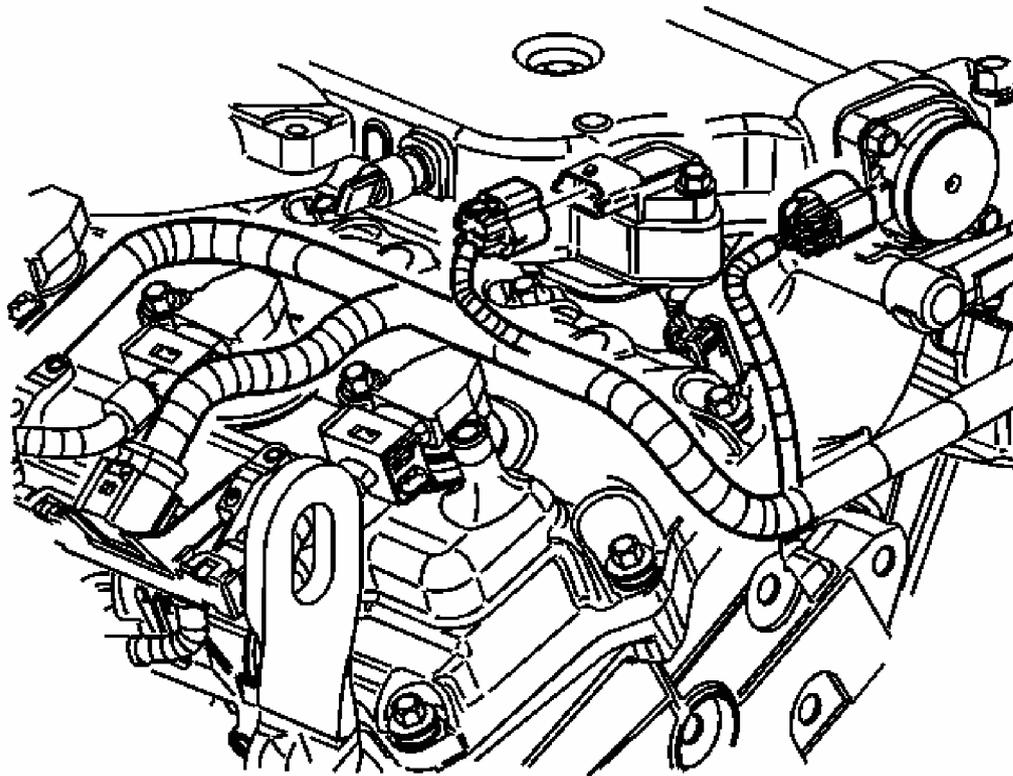


Fig. 65: Identifying Barometric Pressure Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the barometric pressure sensor electrical connector.

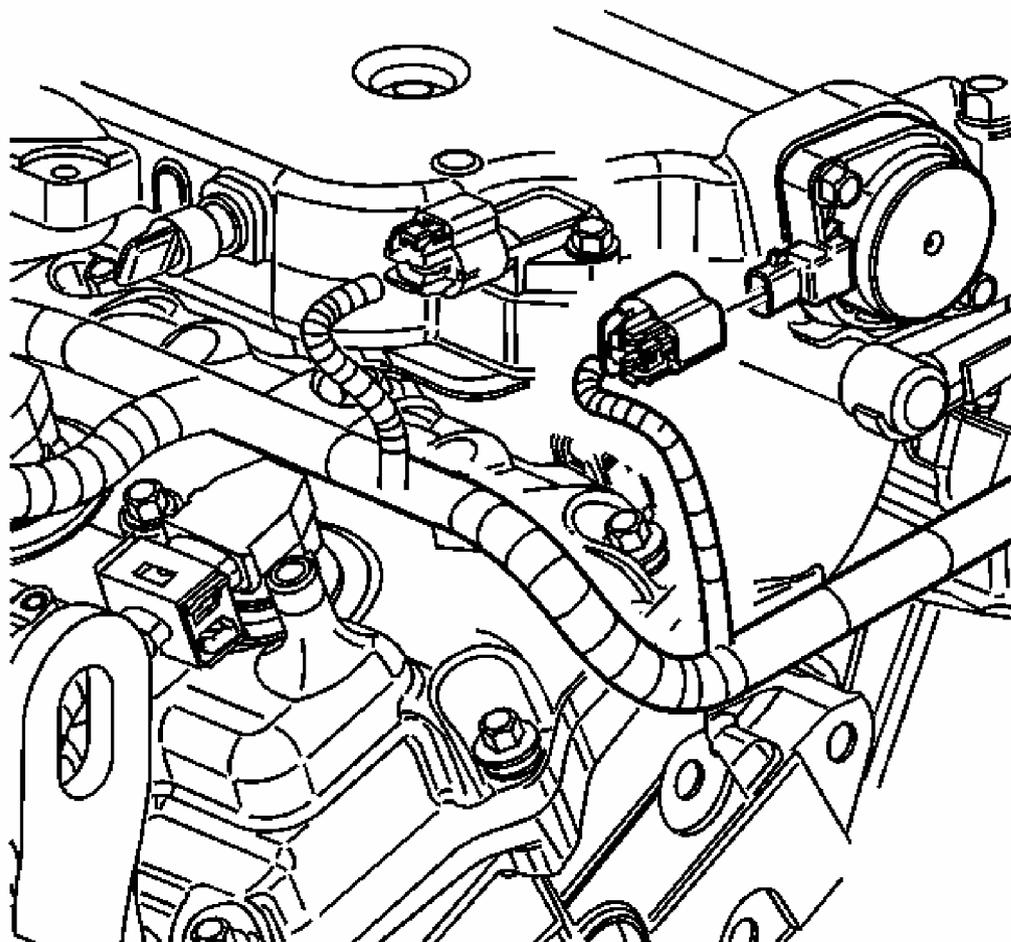


Fig. 66: View Of Communicator And Intake Manifold Runner Control Solenoid Electrical Connectors

Courtesy of GENERAL MOTORS CORP.

6. Connect the intake manifold runner control solenoid electrical connector.
7. Connect the PCV hose to the right bank camshaft cover.

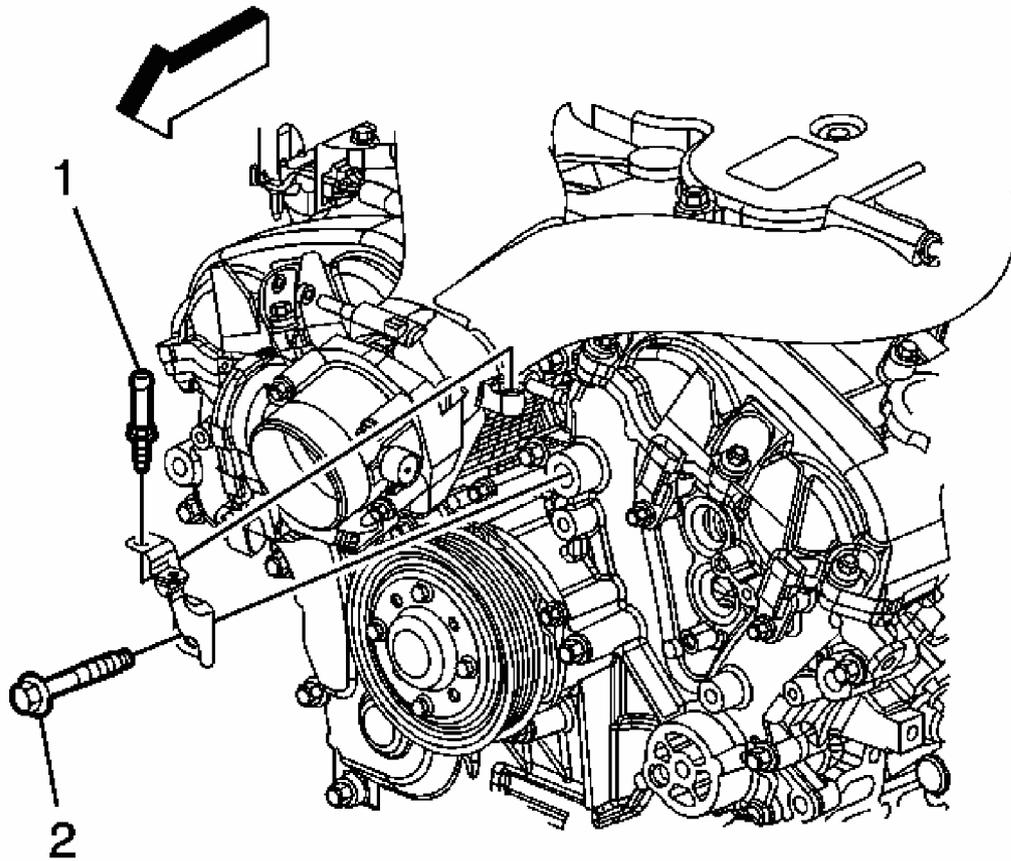


Fig. 67: Identifying Upper Intake Manifold Brace Stud, Bolt & Brace
Courtesy of GENERAL MOTORS CORP.

8. Install the upper intake manifold brace, stud (1), and bolt (2).

Tighten: Tighten the intake manifold brace bolt/stud.

1. Tighten the intake manifold brace bolt (2) to 65 N.m (48 lb ft).
2. Tighten the intake manifold brace stud (1) to 10 N.m (89 lb in).

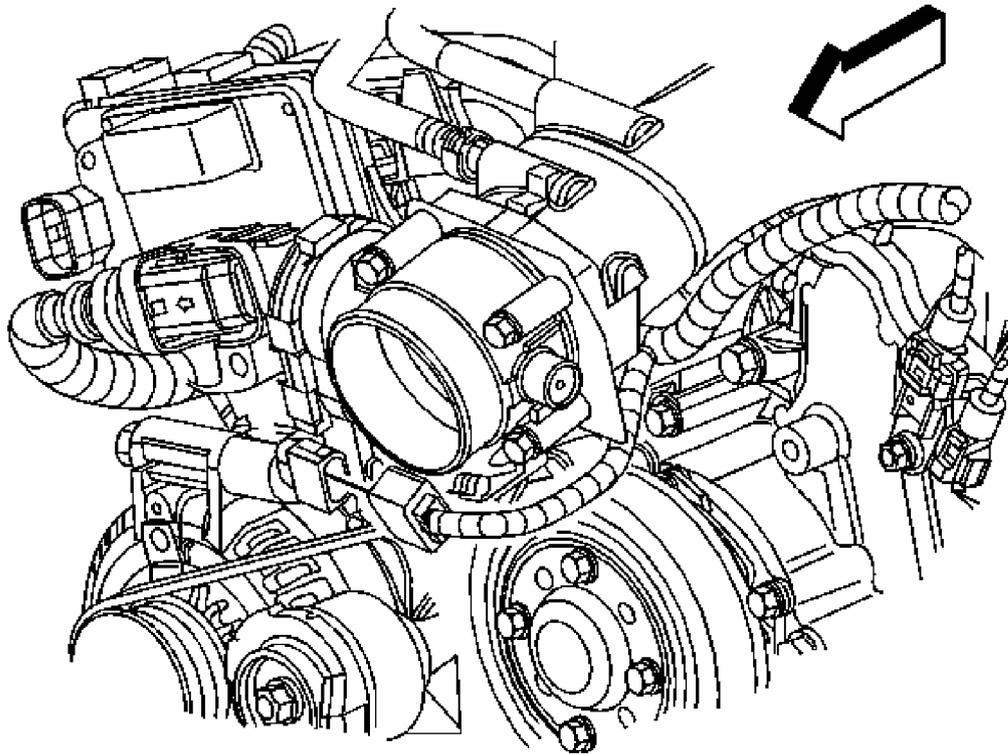


Fig. 68: View Of Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

NOTE: Ensure proper engagement of the wiring harness connector. The wiring harness connector must be installed straight onto the component connector and firmly seated. Visually inspect the connector to ensure that the connector latches are engaged and locked. Any damage to the connector or wiring must be repaired. Failure to follow this procedure can lead to an intermittent electrical connection, driveability concerns, and/or wiring harness or wiring harness connector damage or failure.

9. Connect the electrical connector to the throttle body.

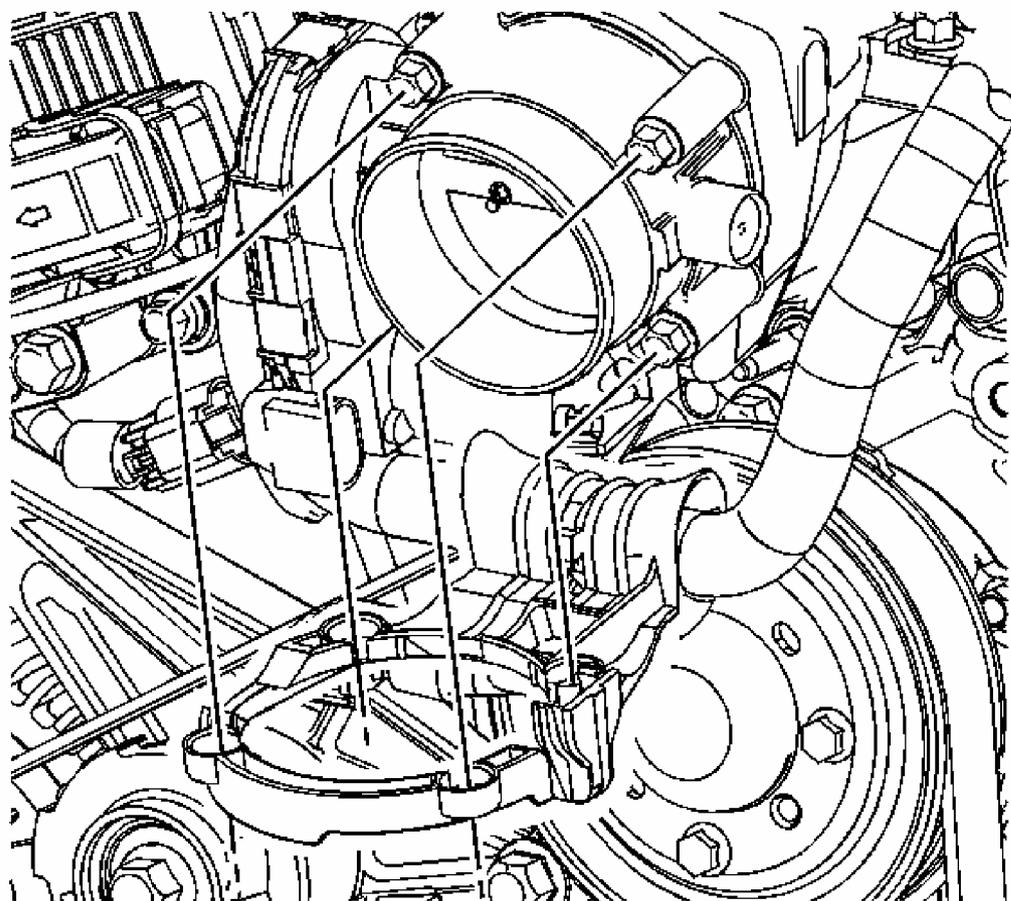


Fig. 69: View Of Wiring Harness Conduit
Courtesy of GENERAL MOTORS CORP.

10. Install the wiring harness retainer.

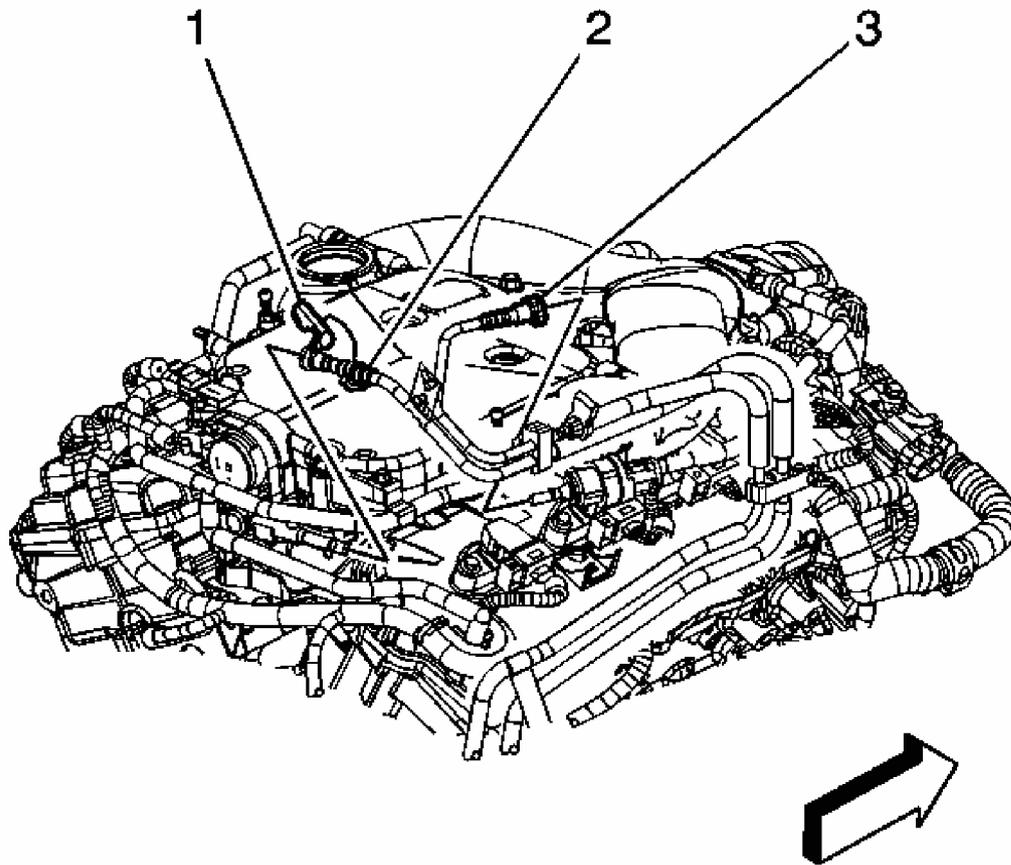


Fig. 70: Top Of Engine View
Courtesy of GENERAL MOTORS CORP.

11. Connect the purge line (3) to the purge solenoid valve.

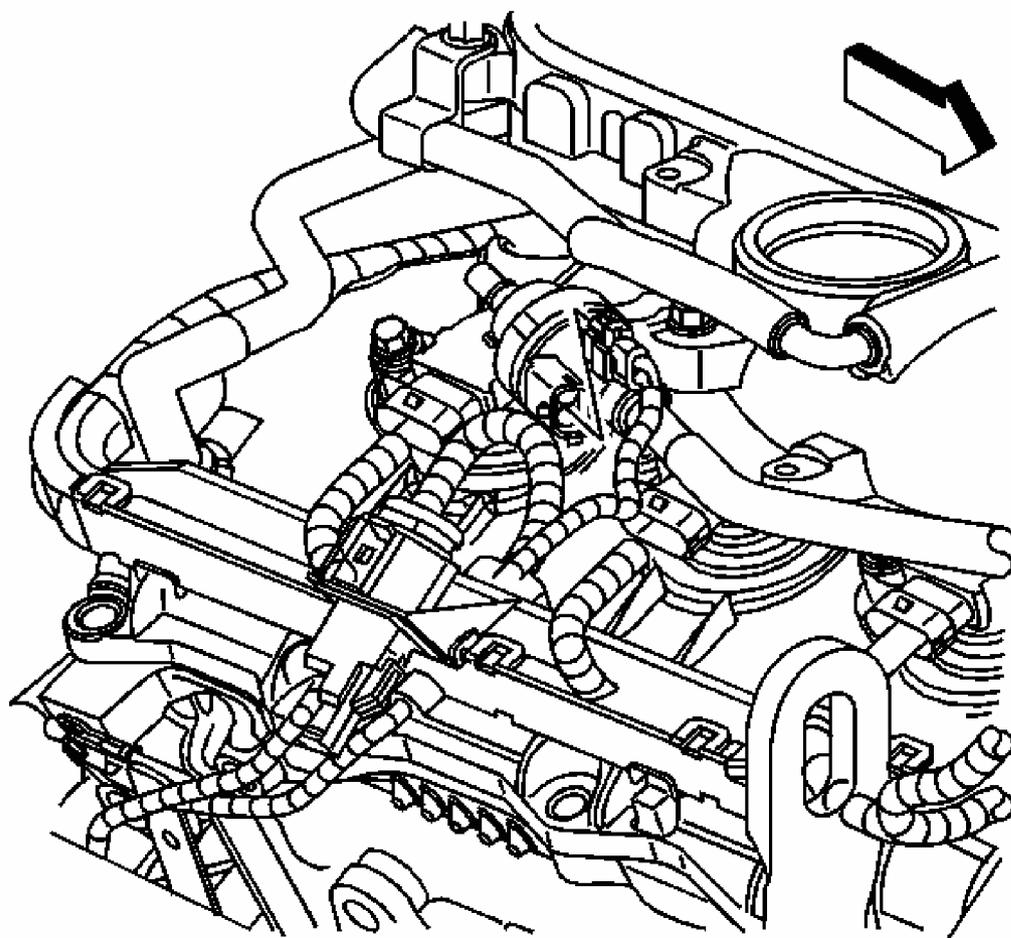


Fig. 71: View Of Purge Solenoid Valve And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

12. Connect the purge solenoid valve electrical connector.
13. Connect the brake booster vacuum hose to the intake manifold.

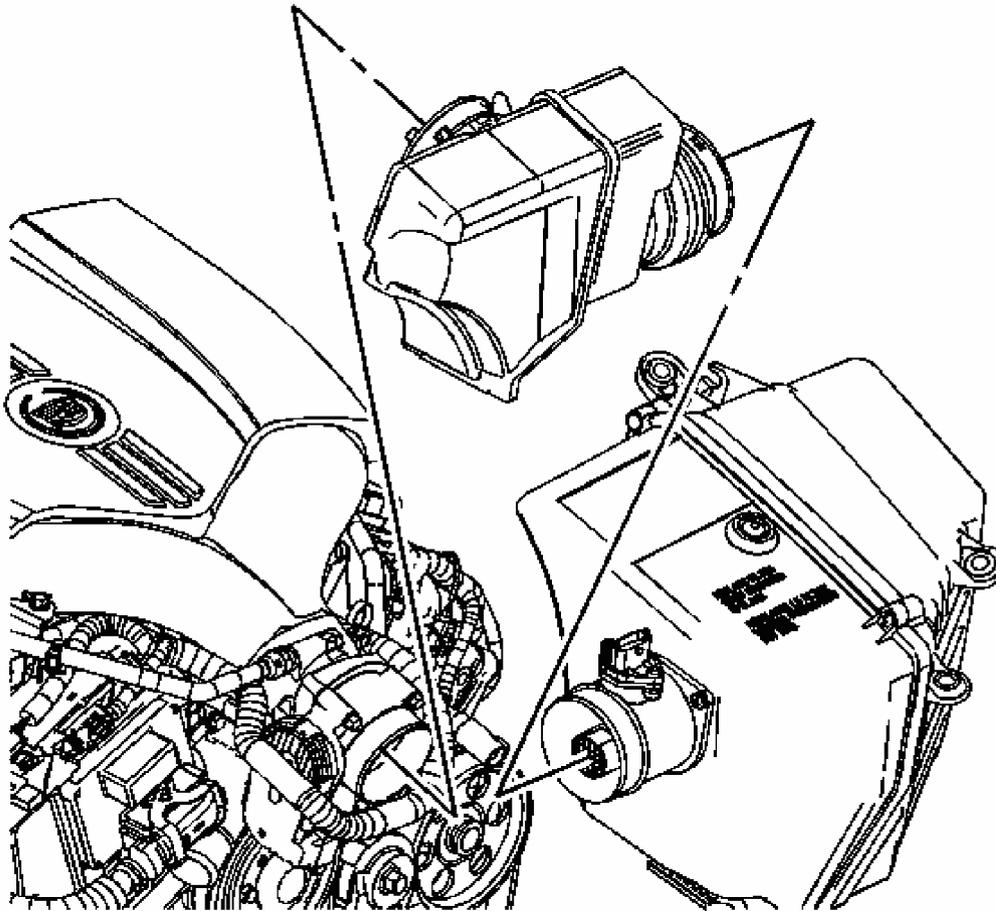


Fig. 72: View Of Air Inlet Duct
Courtesy of GENERAL MOTORS CORP.

14. Install the air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.6L (LY7).
15. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

INTAKE MANIFOLD REPLACEMENT - LOWER

Removal Procedure

1. Turn the ignition OFF.
2. Remove the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

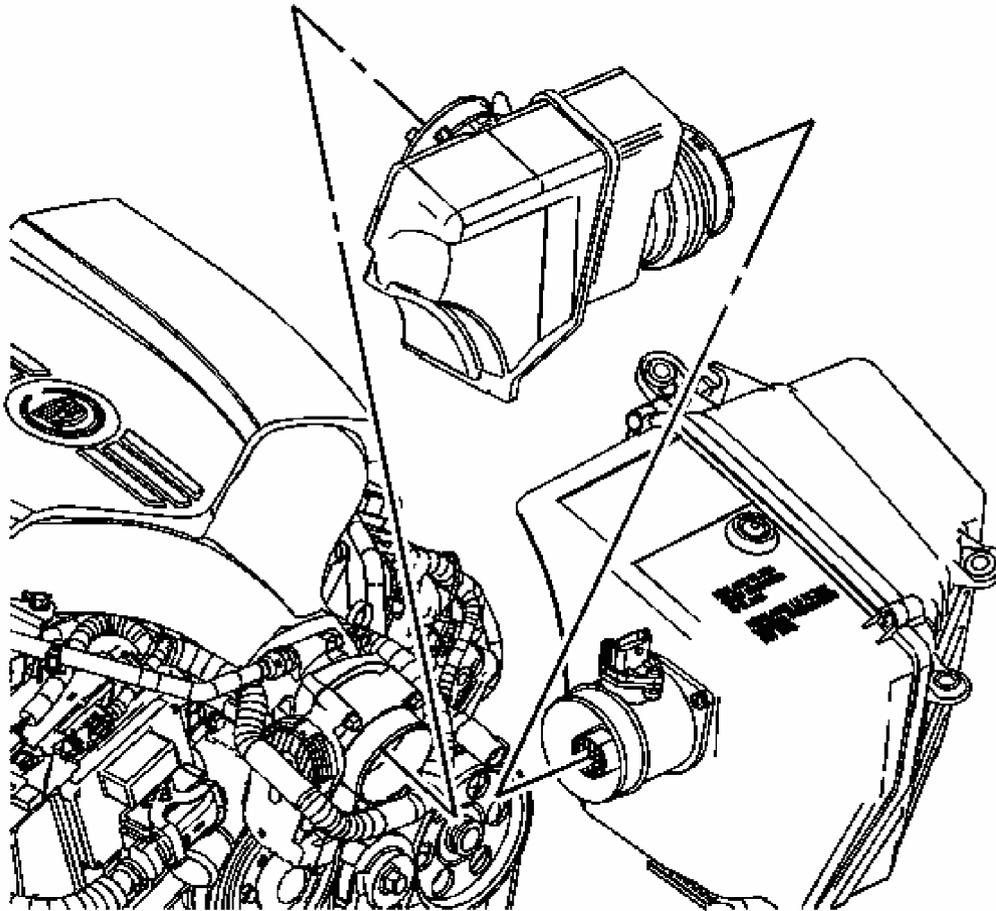


Fig. 73: View Of Air Inlet Duct
Courtesy of GENERAL MOTORS CORP.

3. Remove the air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.6L (LY7).
4. Note the booster hose routing. Disconnect the brake booster check valve and hose from the brake booster.
5. Reposition the brake booster hose to the intake manifold.

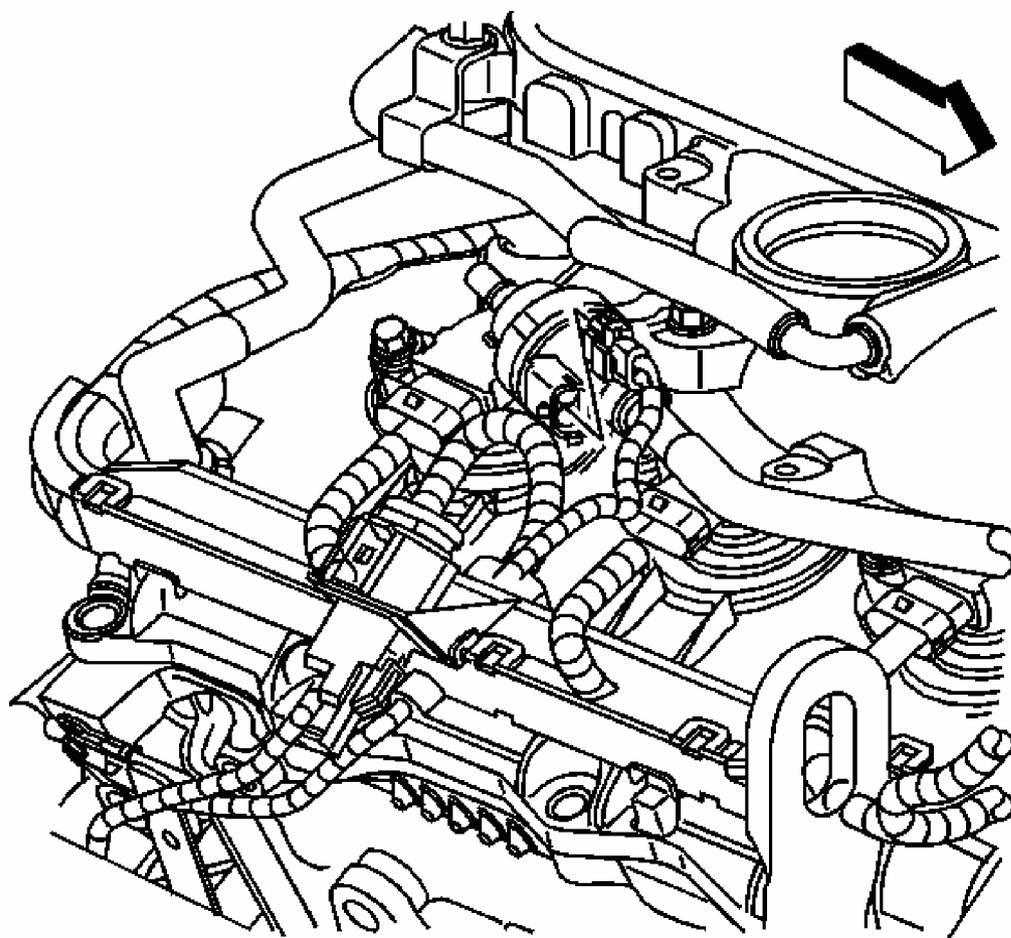


Fig. 74: View Of Purge Solenoid Valve And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the purge solenoid valve electrical connector.

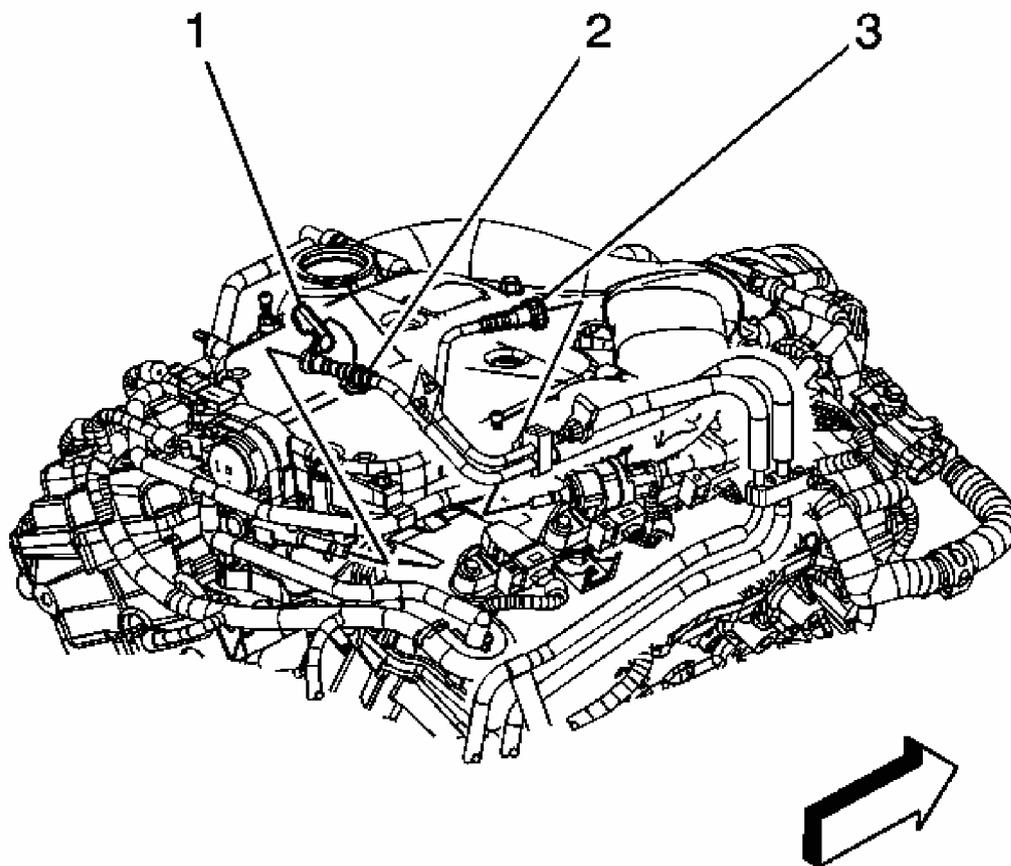


Fig. 75: Top Of Engine View
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the purge line (3) from the purge solenoid valve.

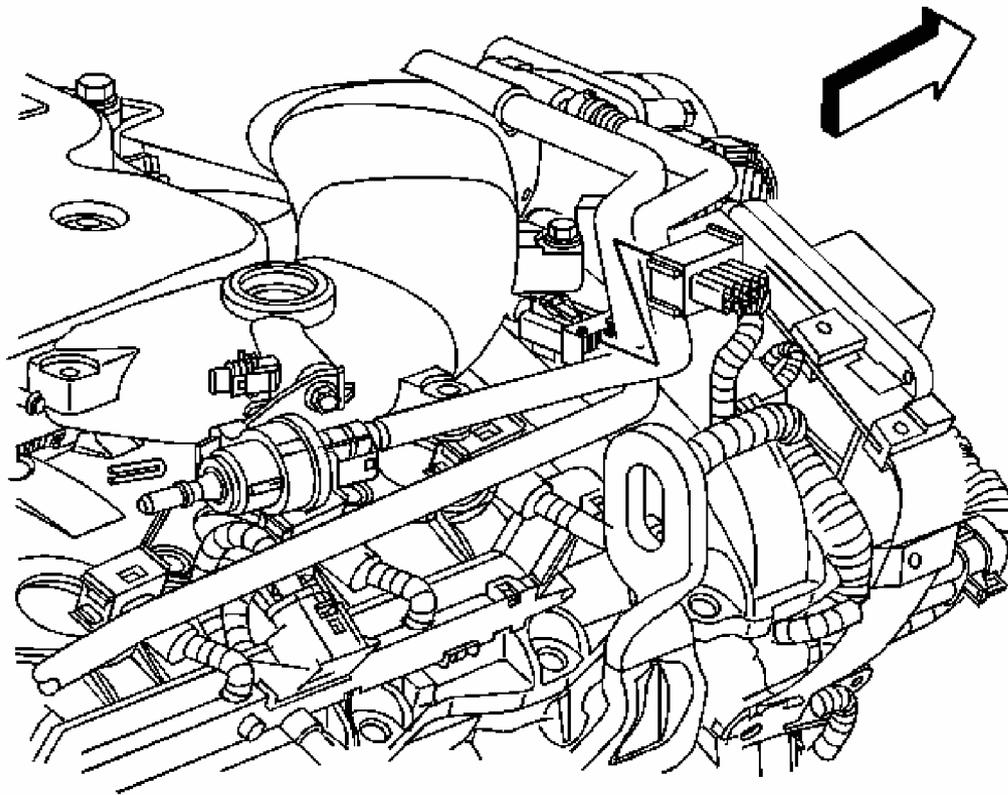


Fig. 76: View Of Fuel Injector Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the fuel injector harness electrical connector.

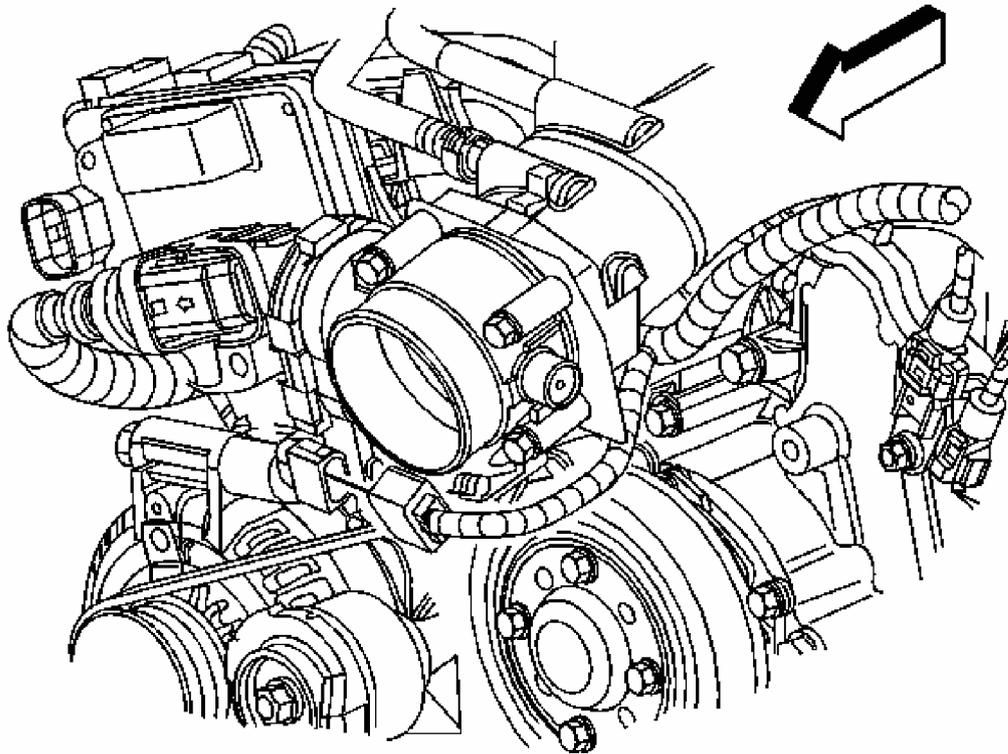


Fig. 77: View Of Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the throttle body electrical connector.

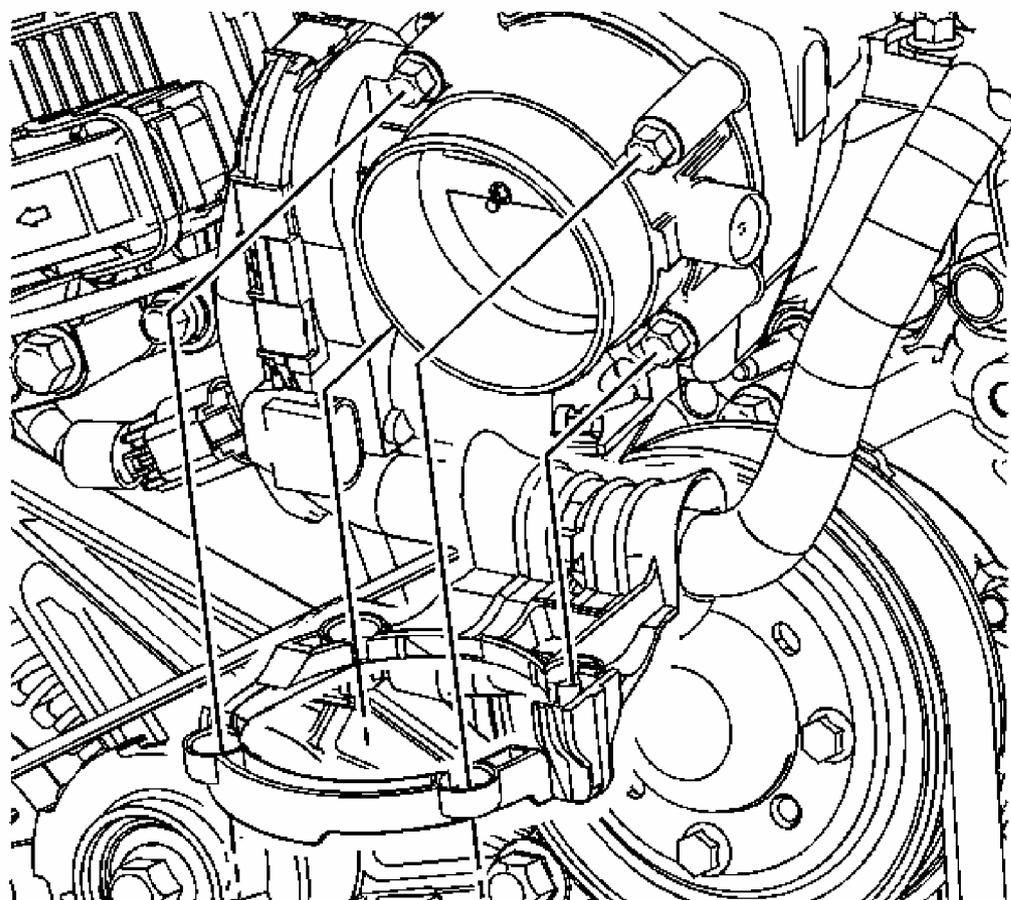


Fig. 78: View Of Wiring Harness Conduit
Courtesy of GENERAL MOTORS CORP.

10. Remove the wiring harness retainer.

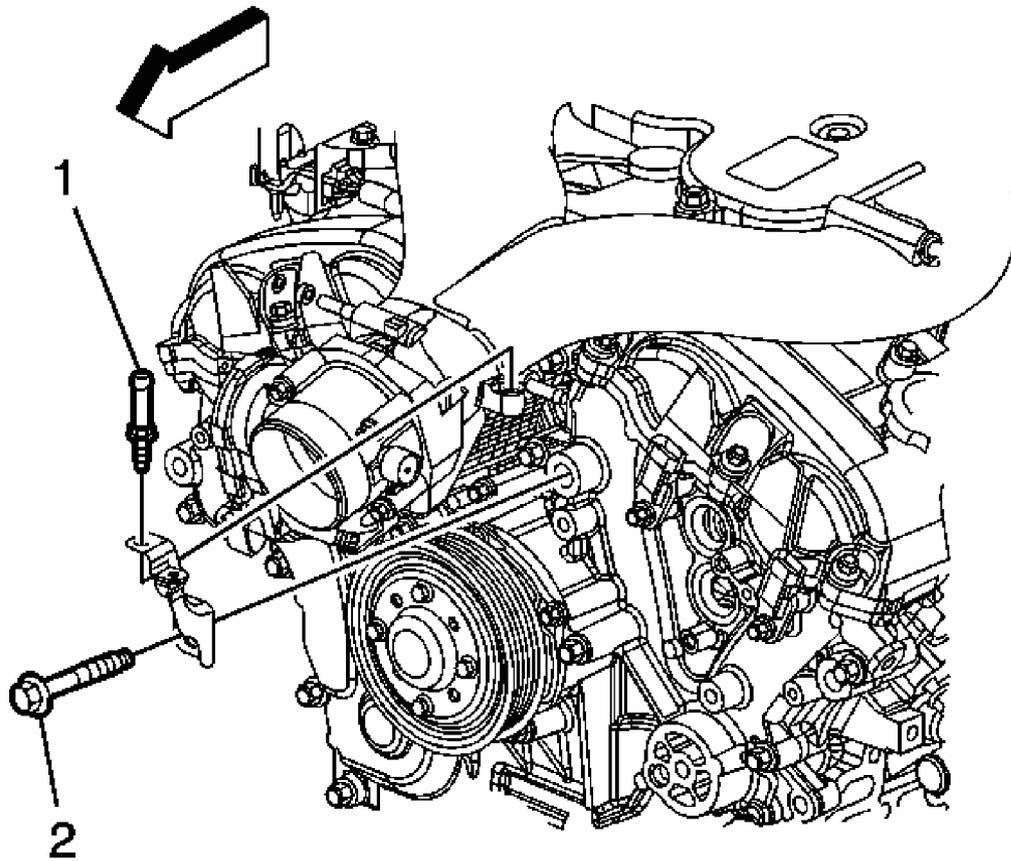


Fig. 79: Identifying Upper Intake Manifold Brace Stud, Bolt & Brace
Courtesy of GENERAL MOTORS CORP.

11. Remove the upper intake manifold brace stud (1), and bolt (2), reposition the brace with the wiring harness.
12. Remove the wiring harness retainer from the right side of the throttle body.
13. Disconnect the positive crankcase ventilation (PCV) hose from the right bank camshaft cover.

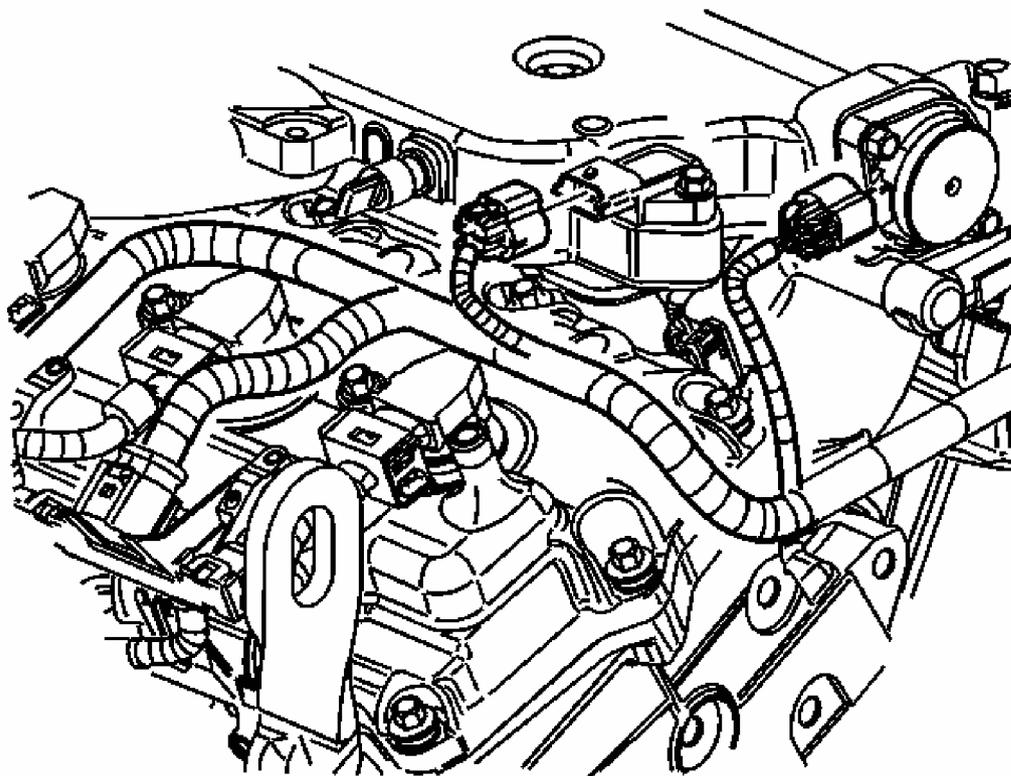


Fig. 80: Identifying Barometric Pressure Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

14. Disconnect the barometric pressure sensor electrical connector.

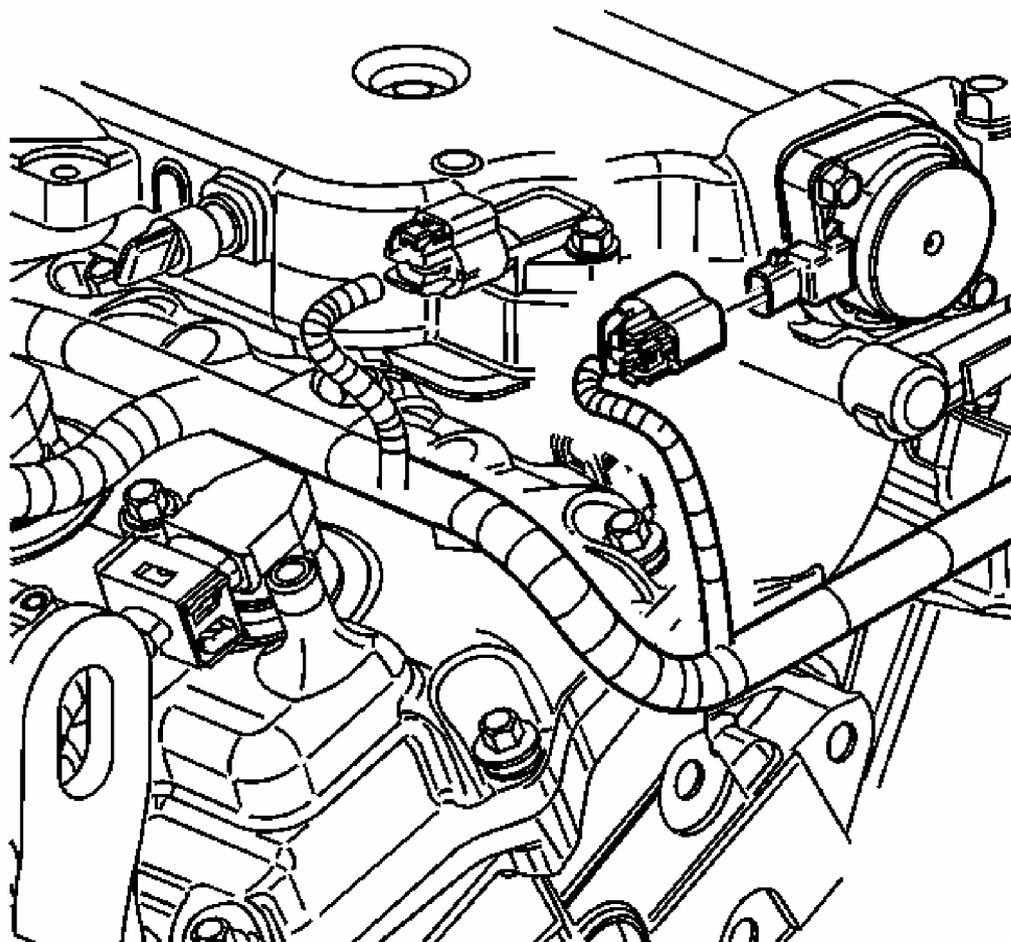


Fig. 81: View Of Communicator And Intake Manifold Runner Control Solenoid Electrical Connectors

Courtesy of GENERAL MOTORS CORP.

15. Disconnect the intake manifold runner control solenoid electrical connector.
16. Remove the left bank ignition coil wiring harness from the bracket.

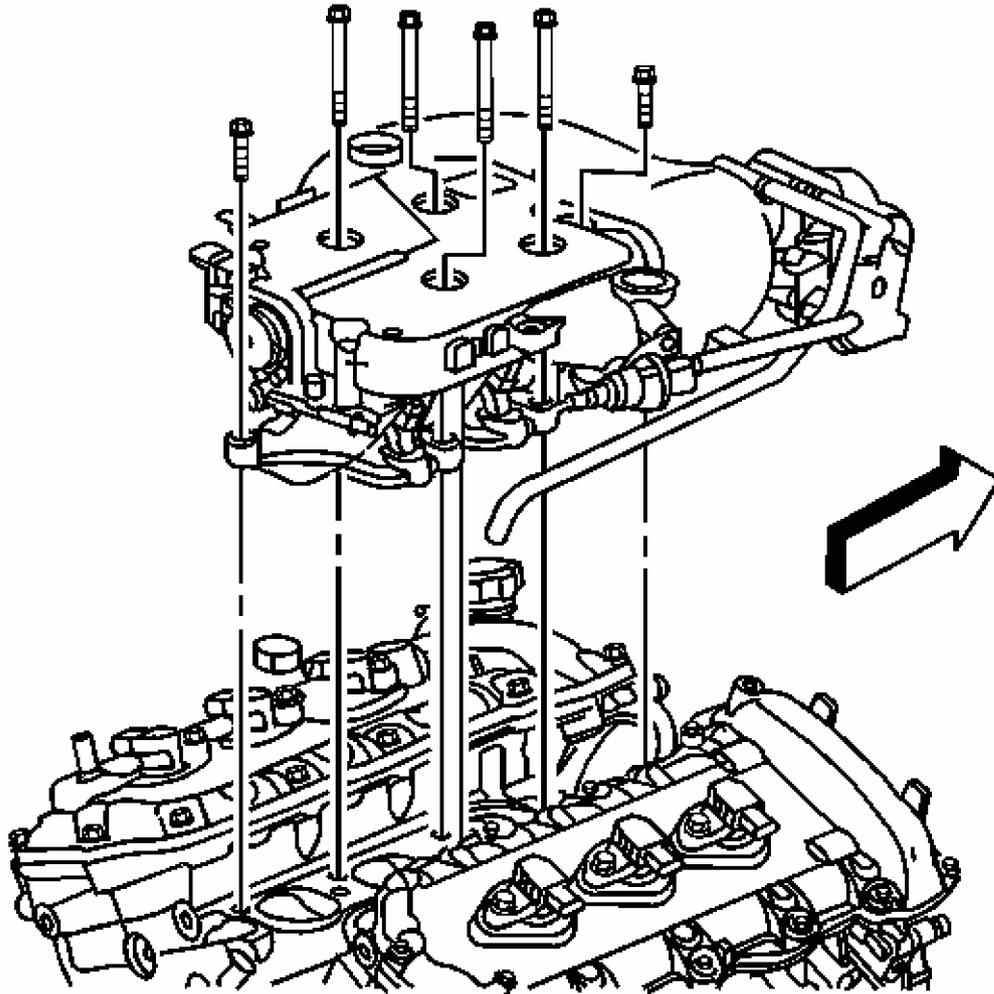


Fig. 82: View Of Lower Intake Manifold
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- Do not remove the upper to lower intake manifold bolts.
- **DO NOT** kink or damage the fuel pipe.

17. Remove the intake manifold bolts.
18. Reposition the intake manifold to gain access to the fuel pipe connector.

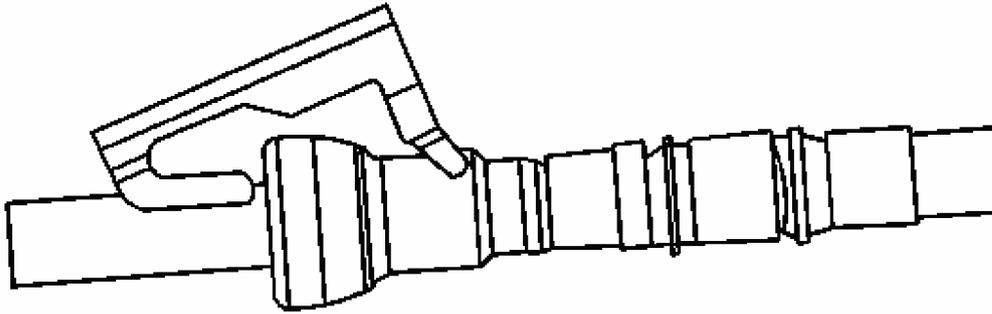


Fig. 83: View Of Quick-Connect Fitting Retainer
Courtesy of GENERAL MOTORS CORP.

19. Remove the fuel feed pipe retainer.
20. Disconnect the fuel feed pipe from the fuel rail. Refer to **Quick Connect Fitting(s) Service (Metal Collar)** in Engine Controls - 3.6L (LY7).
21. Disassemble the intake manifold as necessary. Refer to **Intake Manifold Disassemble** .
22. Clean and inspect the intake manifold and the sealing surfaces. Refer to **Intake Manifold Cleaning and Inspection** .

Installation Procedure

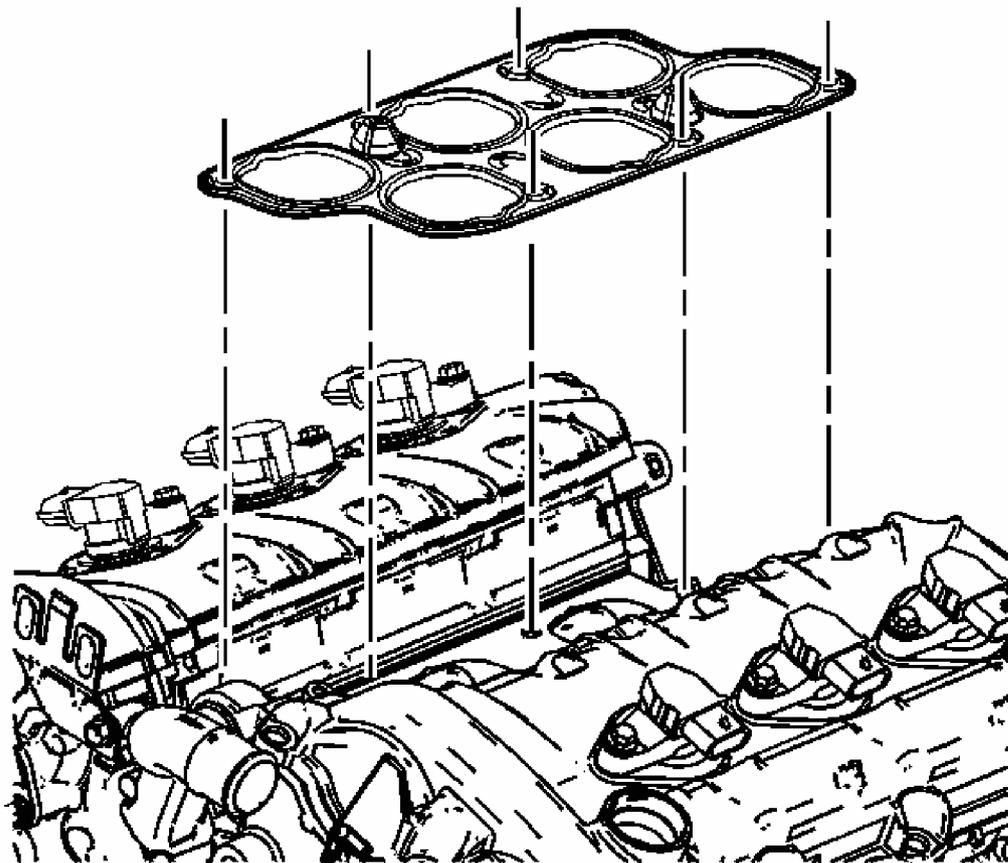


Fig. 84: View Of Lower Intake Manifold Gasket
Courtesy of GENERAL MOTORS CORP.

1. Assemble the intake manifold as necessary. Refer to Intake Manifold Assemble .

IMPORTANT: Inspect and replace the lower intake manifold gasket only if the gasket is worn or damaged.

2. Install the lower intake manifold gasket.

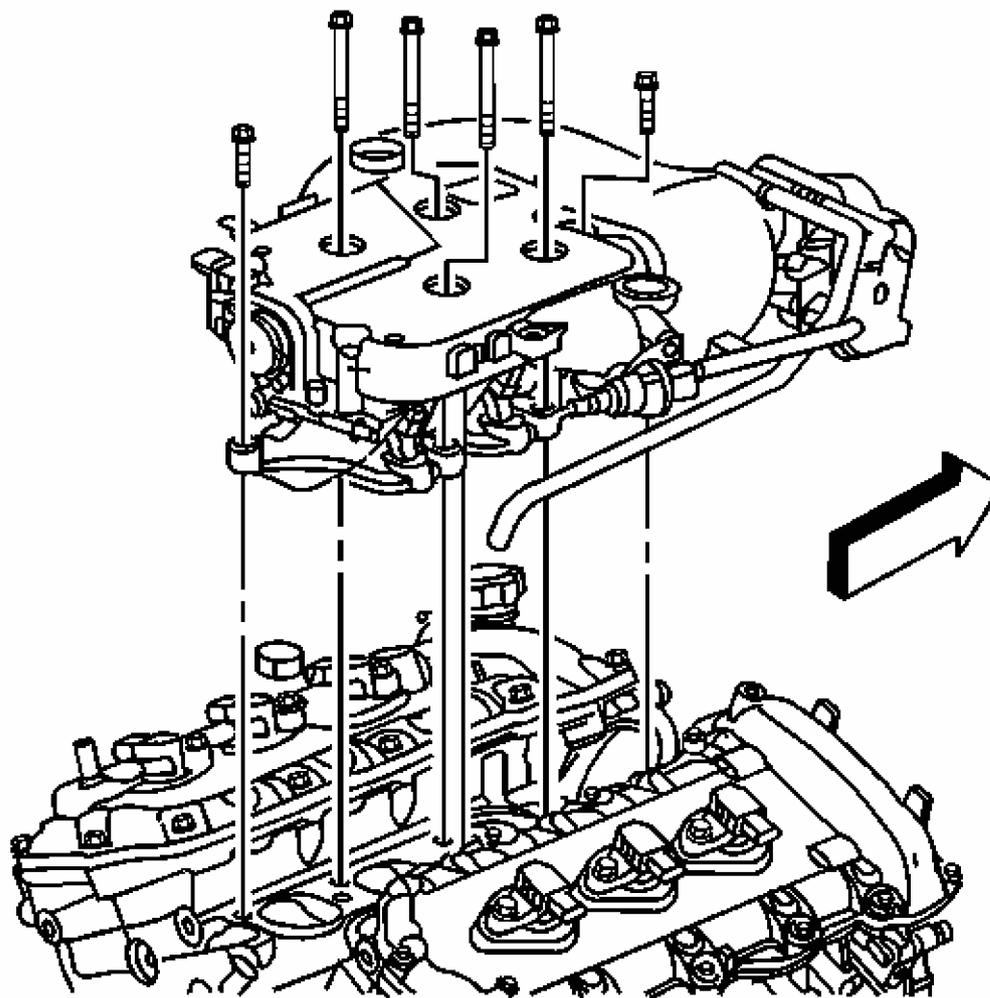


Fig. 85: View Of Lower Intake Manifold
Courtesy of GENERAL MOTORS CORP.

3. Install the intake manifold. Refer to **Intake Manifold Installation** .

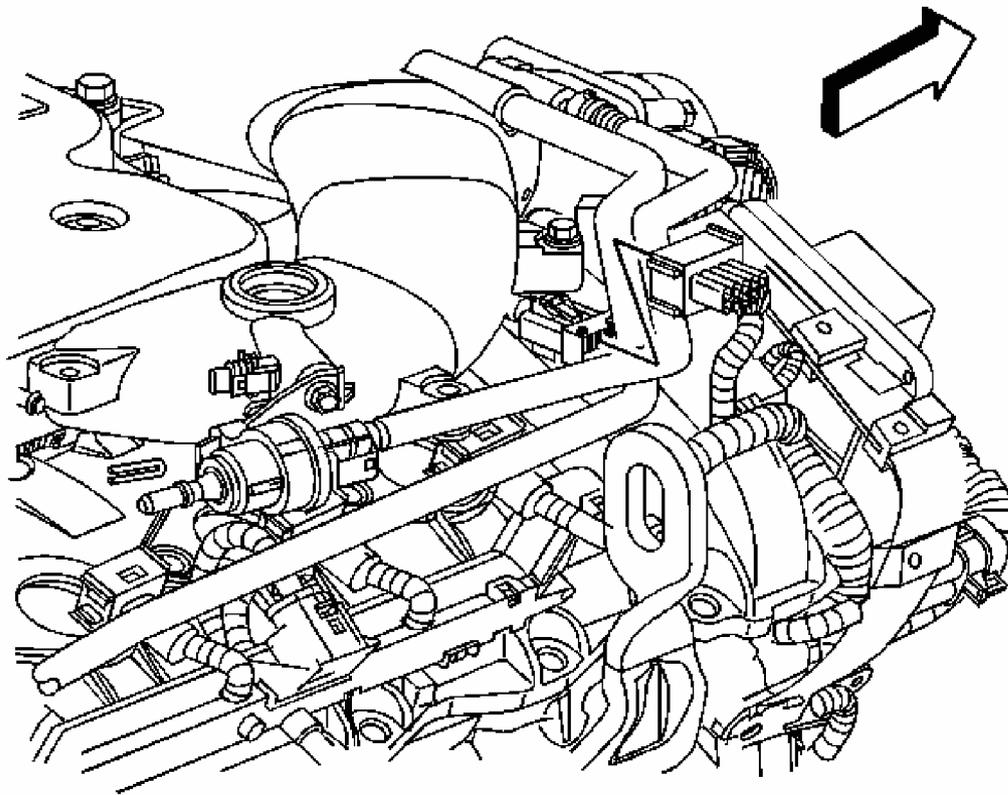


Fig. 86: View Of Fuel Injector Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Connect the fuel injector harness electrical connector.

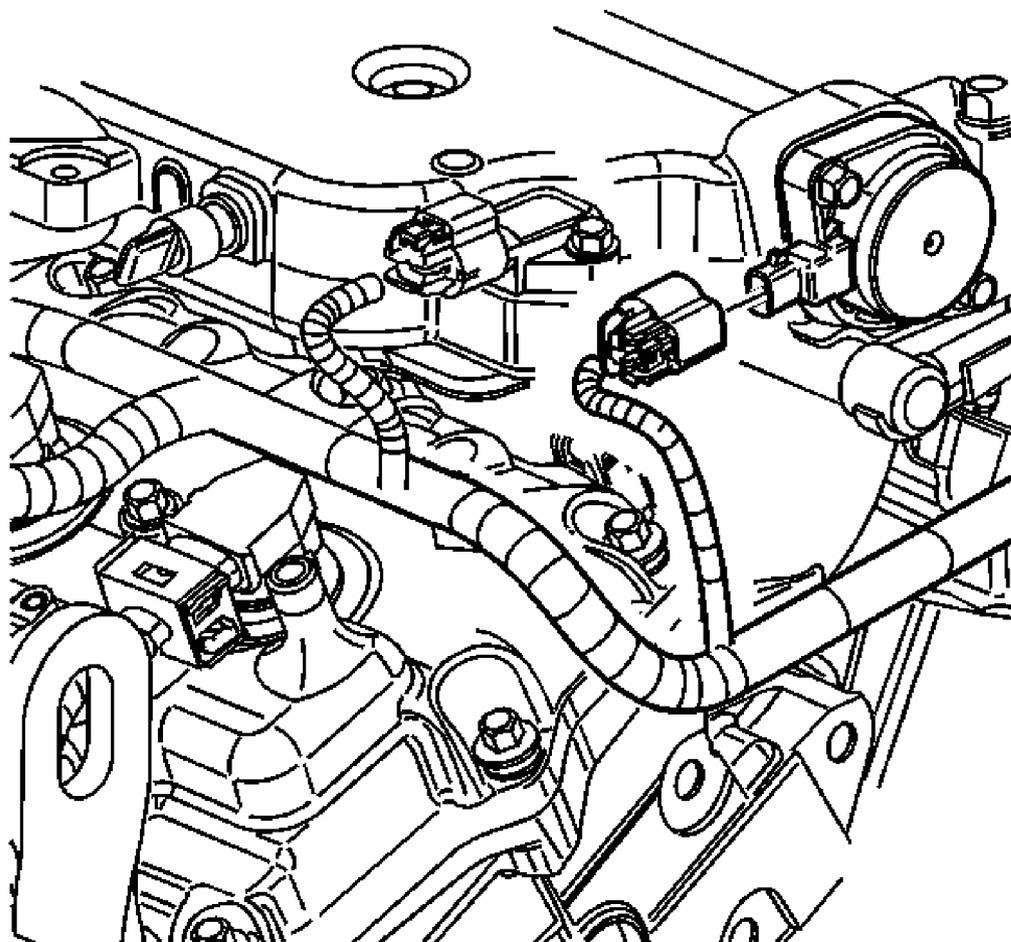


Fig. 87: View Of Communicator And Intake Manifold Runner Control Solenoid Electrical Connectors

Courtesy of GENERAL MOTORS CORP.

5. Connect the intake manifold runner control solenoid electrical connector.

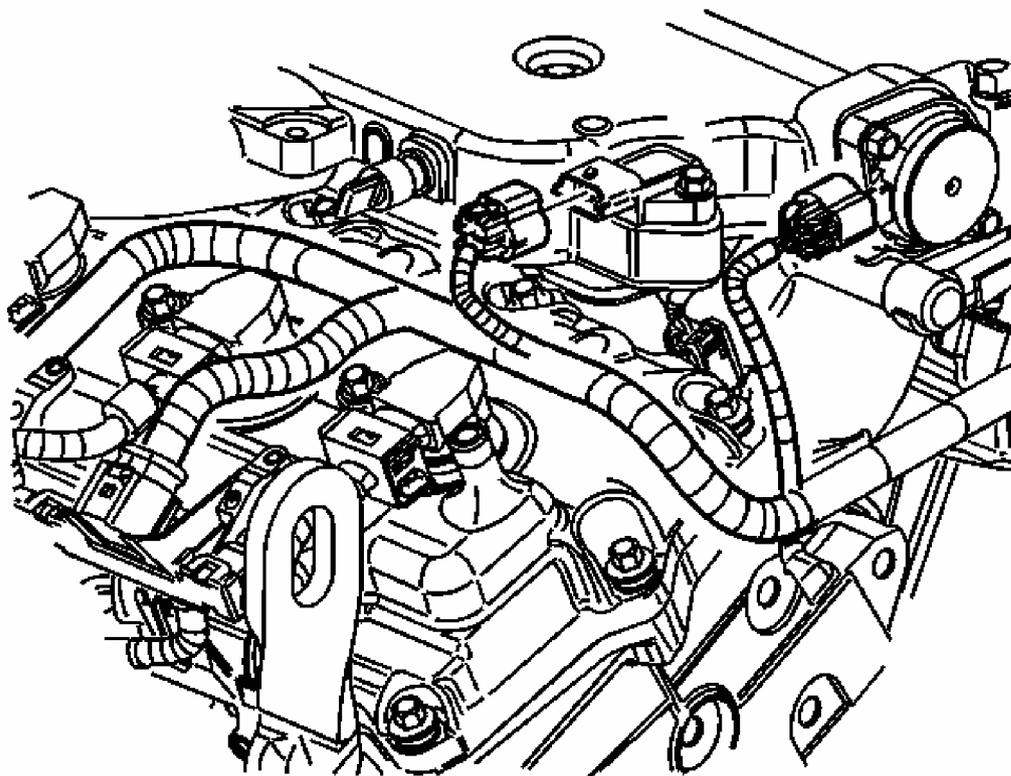


Fig. 88: Identifying Barometric Pressure Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

6. Connect the barometric pressure sensor electrical connector.
7. Connect the PCV hose from the right bank camshaft cover.

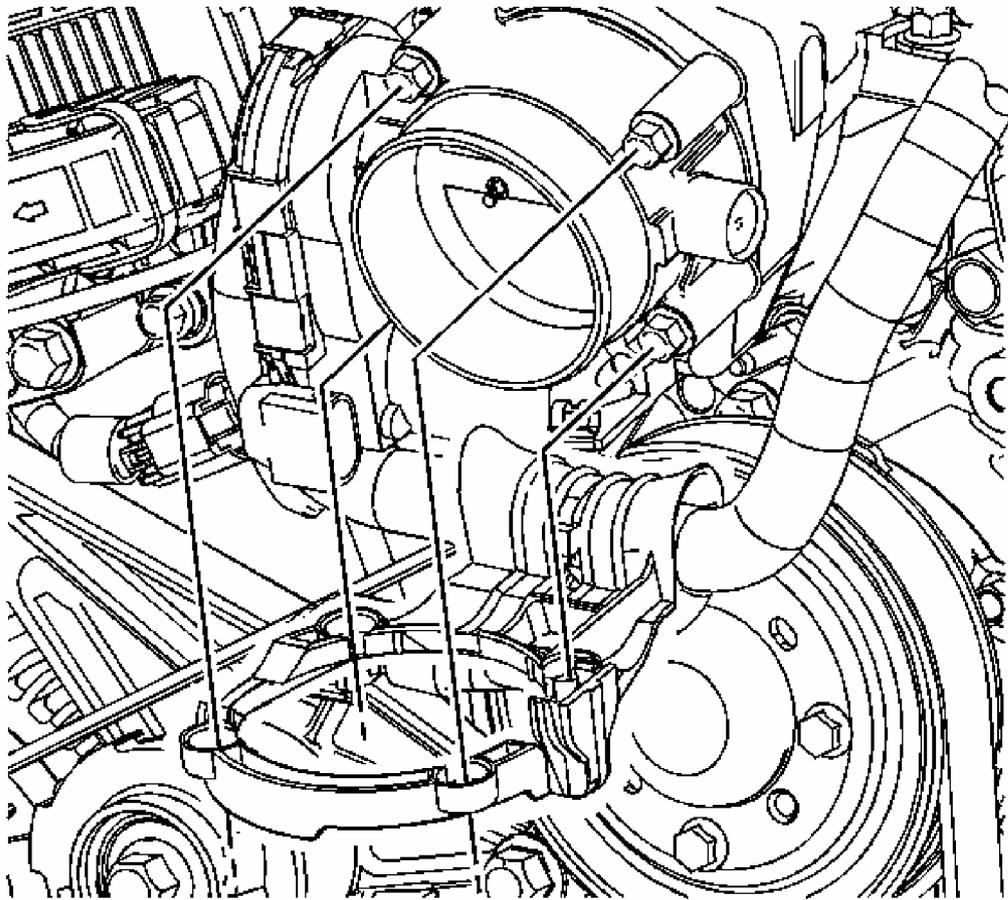


Fig. 89: View Of Wiring Harness Conduit
Courtesy of GENERAL MOTORS CORP.

8. Install the wiring harness retainer.

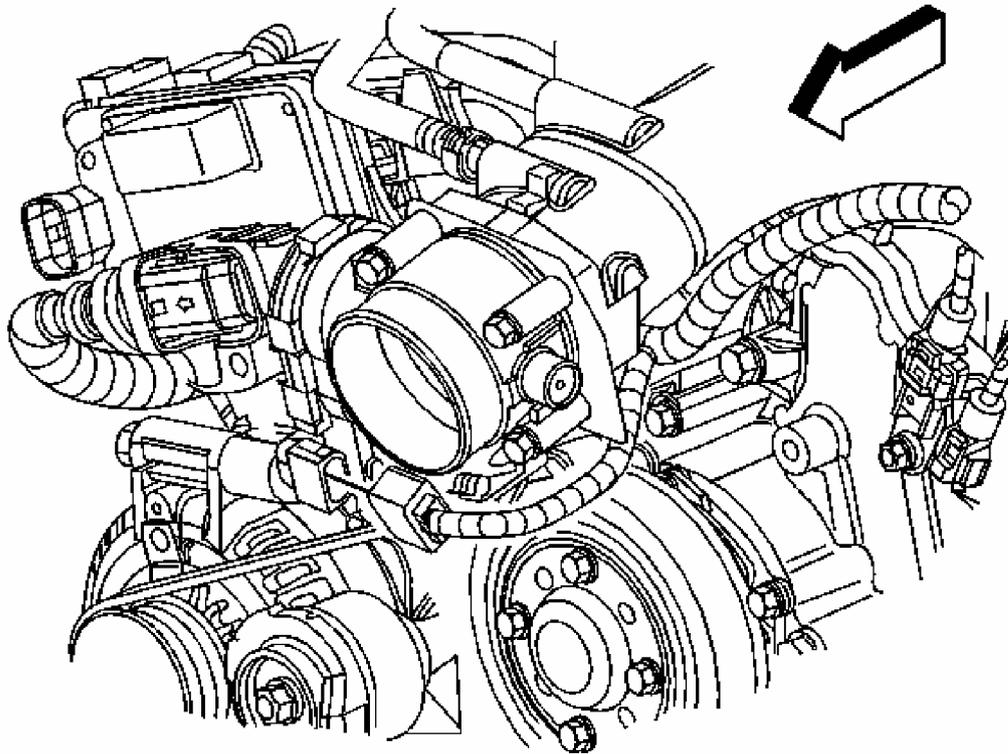


Fig. 90: View Of Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

NOTE: Ensure proper engagement of the wiring harness connector. The wiring harness connector must be installed straight onto the component connector and firmly seated. Visually inspect the connector to ensure that the connector latches are engaged and locked. Any damage to the connector or wiring must be repaired. Failure to follow this procedure can lead to an intermittent electrical connection, driveability concerns, and/or wiring harness or wiring harness connector damage or failure.

9. Connect the throttle body electrical connector.

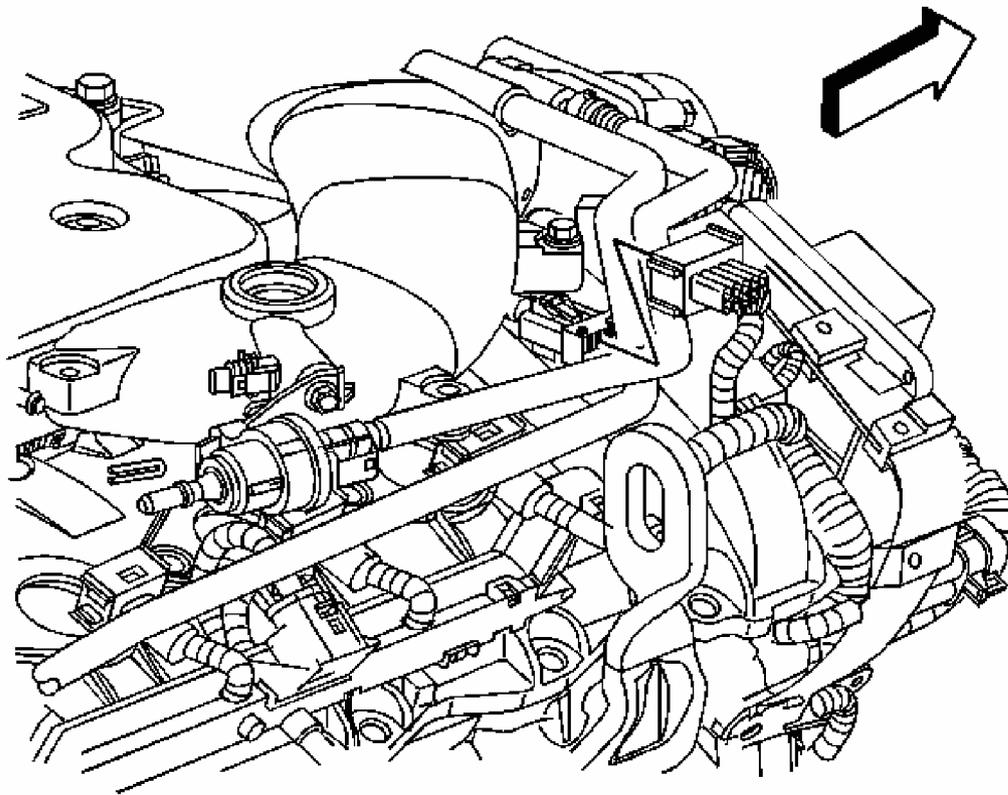


Fig. 91: View Of Fuel Injector Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

10. Connect the fuel injector harness electrical connector.

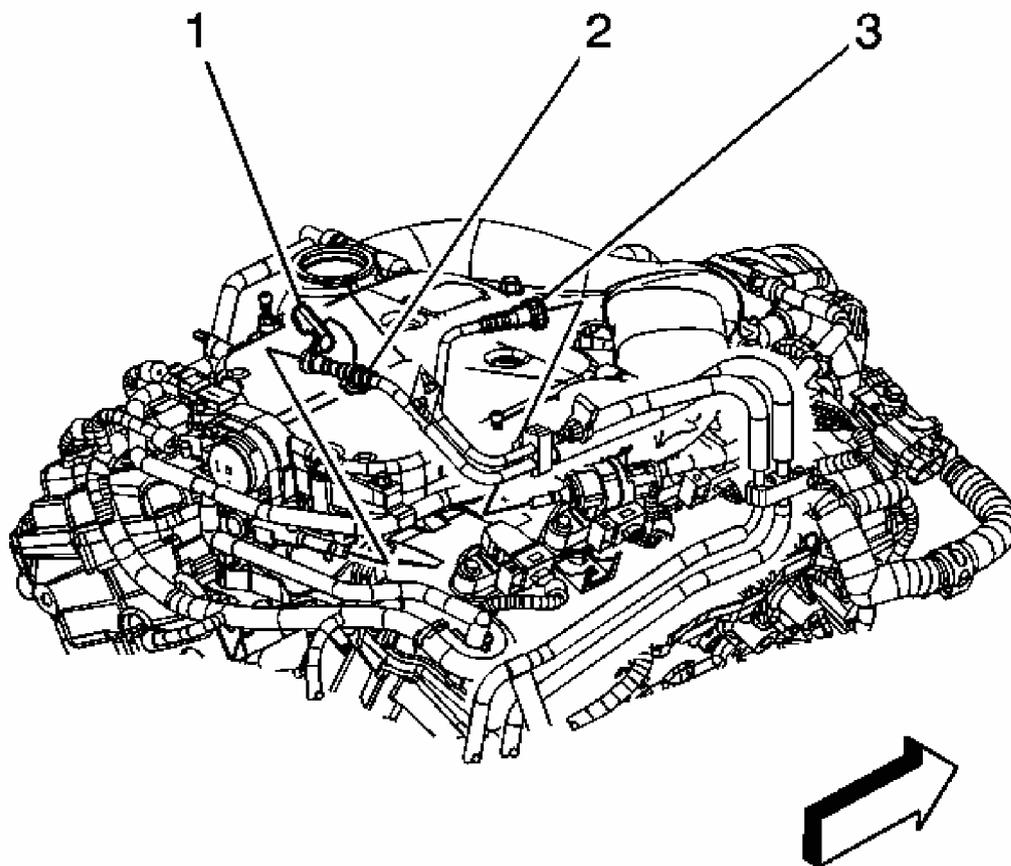


Fig. 92: Top Of Engine View
Courtesy of GENERAL MOTORS CORP.

11. Connect the fuel feed pipe (1) to the fuel rail. Refer to **Quick Connect Fitting(s) Service (Metal Collar)** in Engine Controls - 3.6L (LY7).
12. Connect the purge line (3) to the purge solenoid valve.

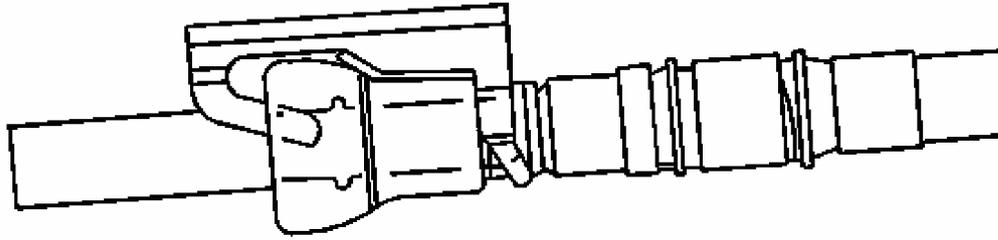


Fig. 93: View Of Fuel Pipe Retainer
Courtesy of GENERAL MOTORS CORP.

13. Install the fuel pipe retainer.

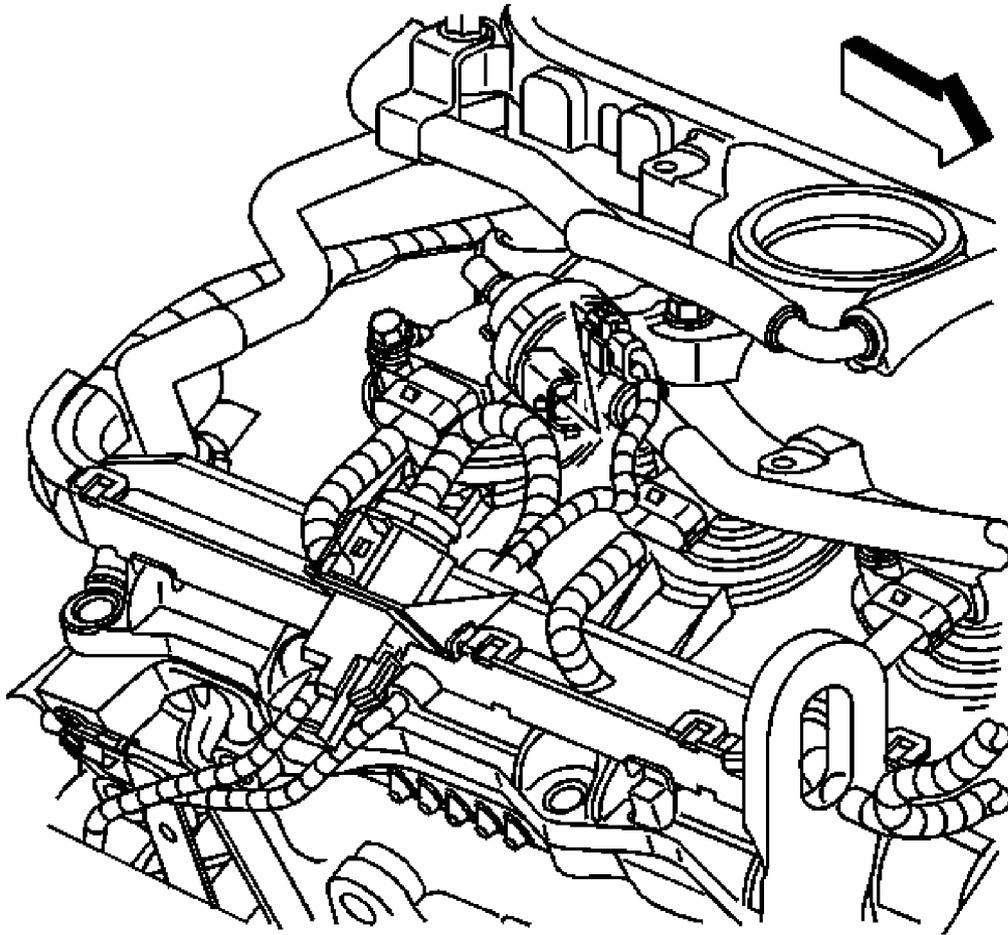


Fig. 94: View Of Purge Solenoid Valve And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

14. Connect the purge solenoid valve electrical connector.
15. Install the brake booster hose and check valve to the brake booster.

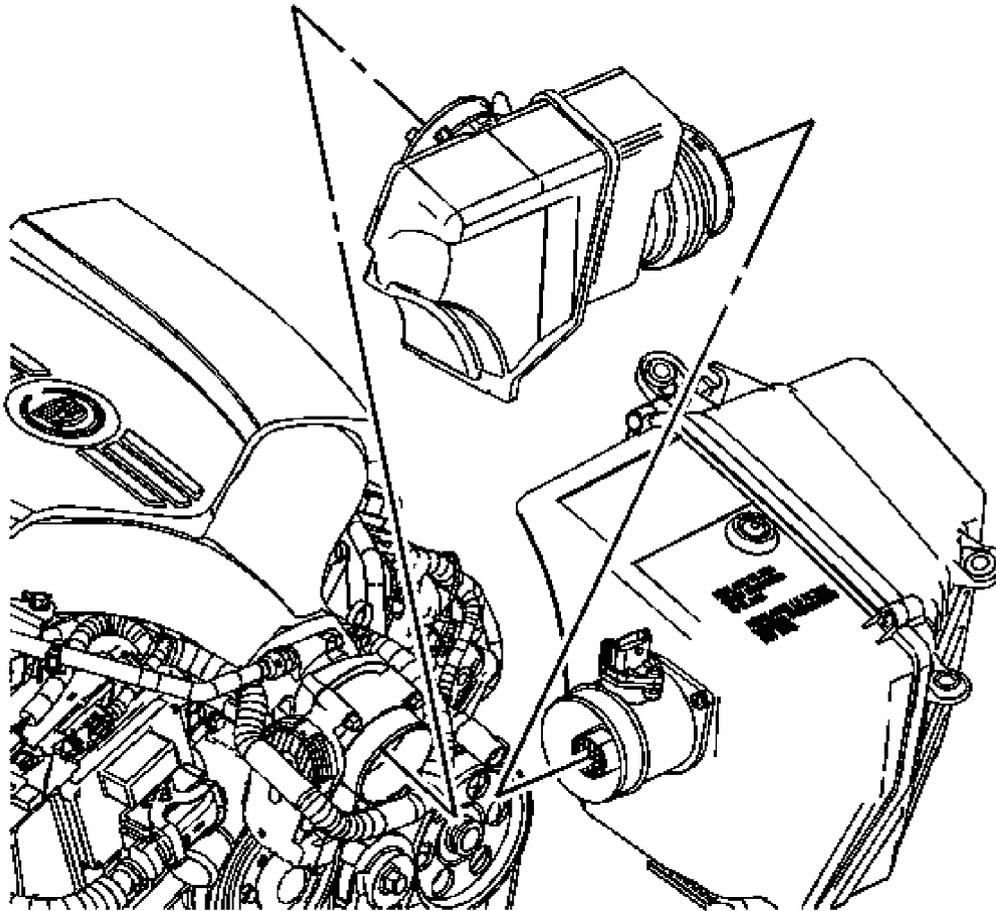


Fig. 95: View Of Air Inlet Duct
Courtesy of GENERAL MOTORS CORP.

16. Install the air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.6L (LY7).
17. Install the fuel injector sight shield. Refer to **Fuel Injector Sight Shield Replacement**.

OIL LEVEL INDICATOR AND TUBE REPLACEMENT

Removal Procedure

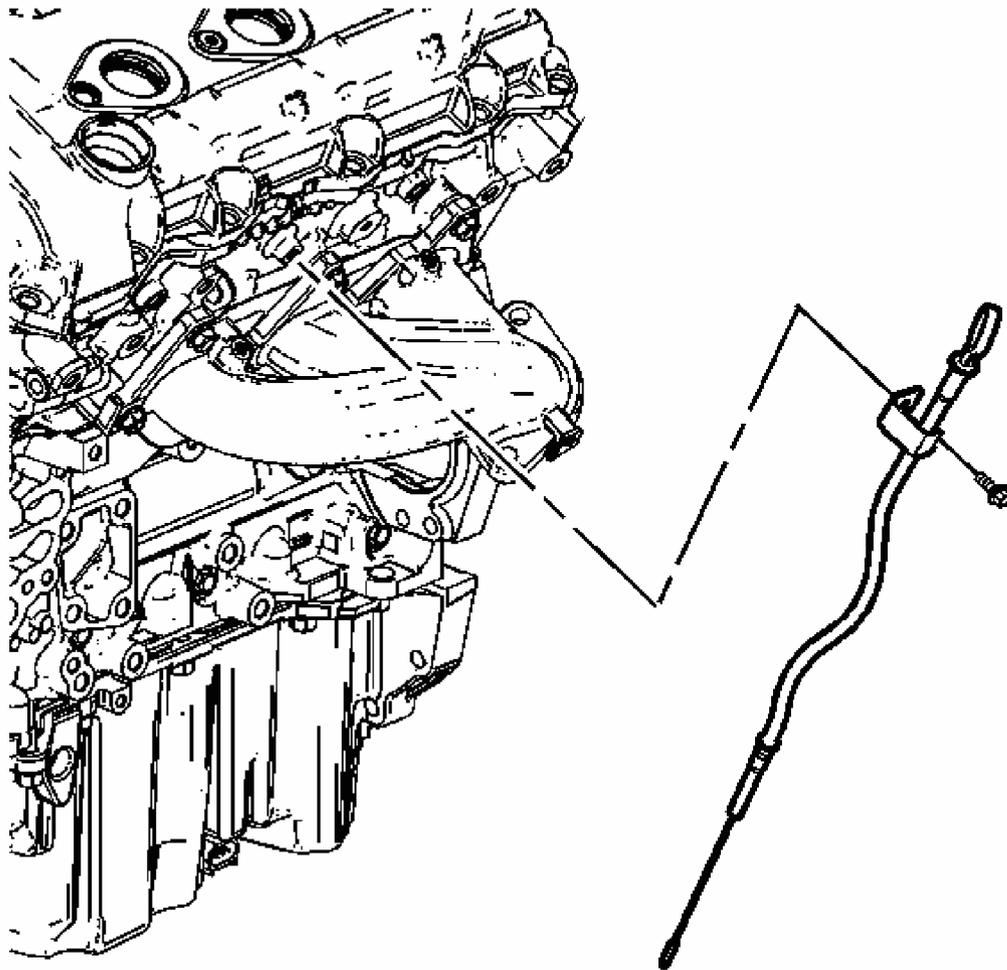


Fig. 96: View Of Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition OFF.
2. Remove the oil level indicator from the oil level indicator tube.
3. Remove the oil level indicator tube bolt.
4. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
5. Remove the knock sensor. Refer to **Knock Sensor (KS) Replacement - Bank 2** in Engine Controls - 3.6L (LY7).
6. Remove the heat shield clip from the oil level indicator tube.
7. Lower the vehicle.

IMPORTANT: Note the location and orientation of the secondary (small square) heat shield.

8. Remove the oil level indicator tube up through the exhaust manifold.
9. If you are replacing only the oil level indicator tube seal, remove and discard the old seal.

Installation Procedure

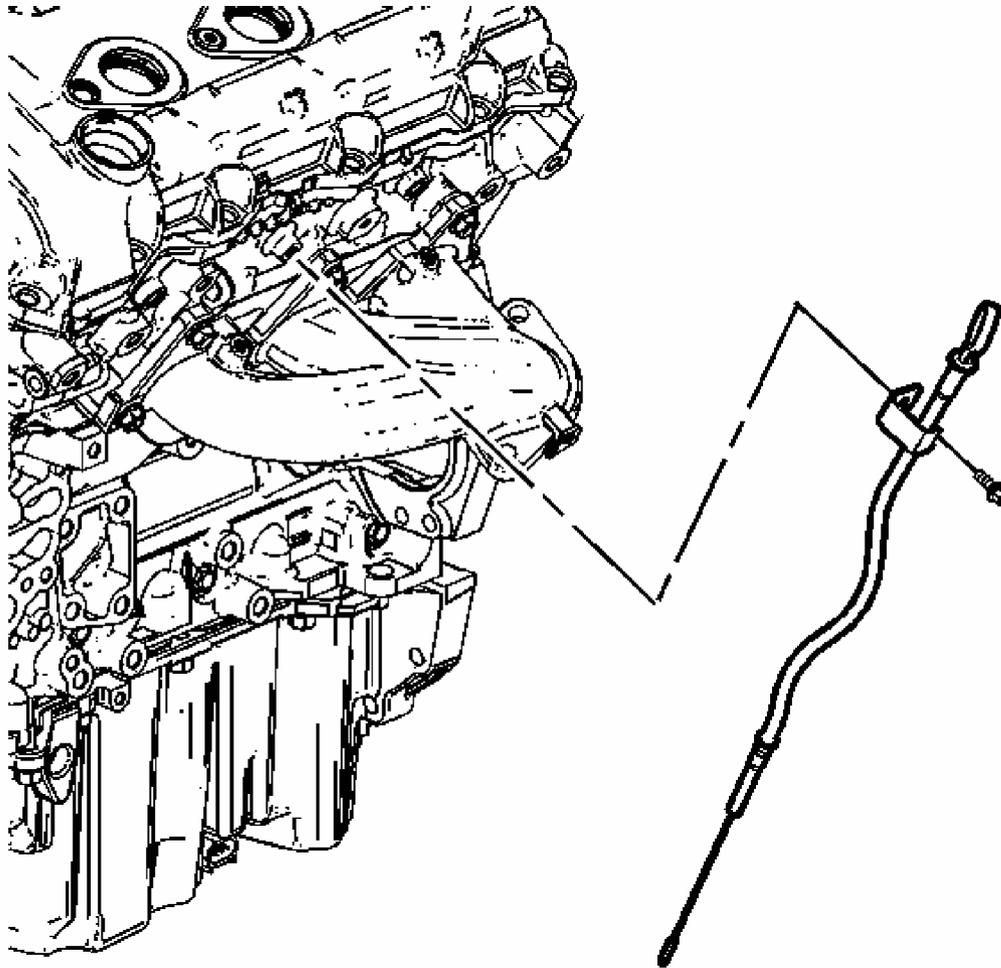


Fig. 97: View Of Oil Level Indicator Tube
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the secondary (small square) heat shield is properly installed to the oil level indicator tube as noted

during removal.

1. Install the oil level indicator and tube. Refer to **Oil Level Indicator and Tube Installation**.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Install the knock sensor. Refer to **Knock Sensor (KS) Replacement - Bank 2** in Engine Controls - 3.6L (LY7).
4. Install the heat shield clip to the oil level indicator tube as noted during removal.
5. Lower the vehicle.

OIL FILTER ADAPTER REPLACEMENT

Removal Procedure

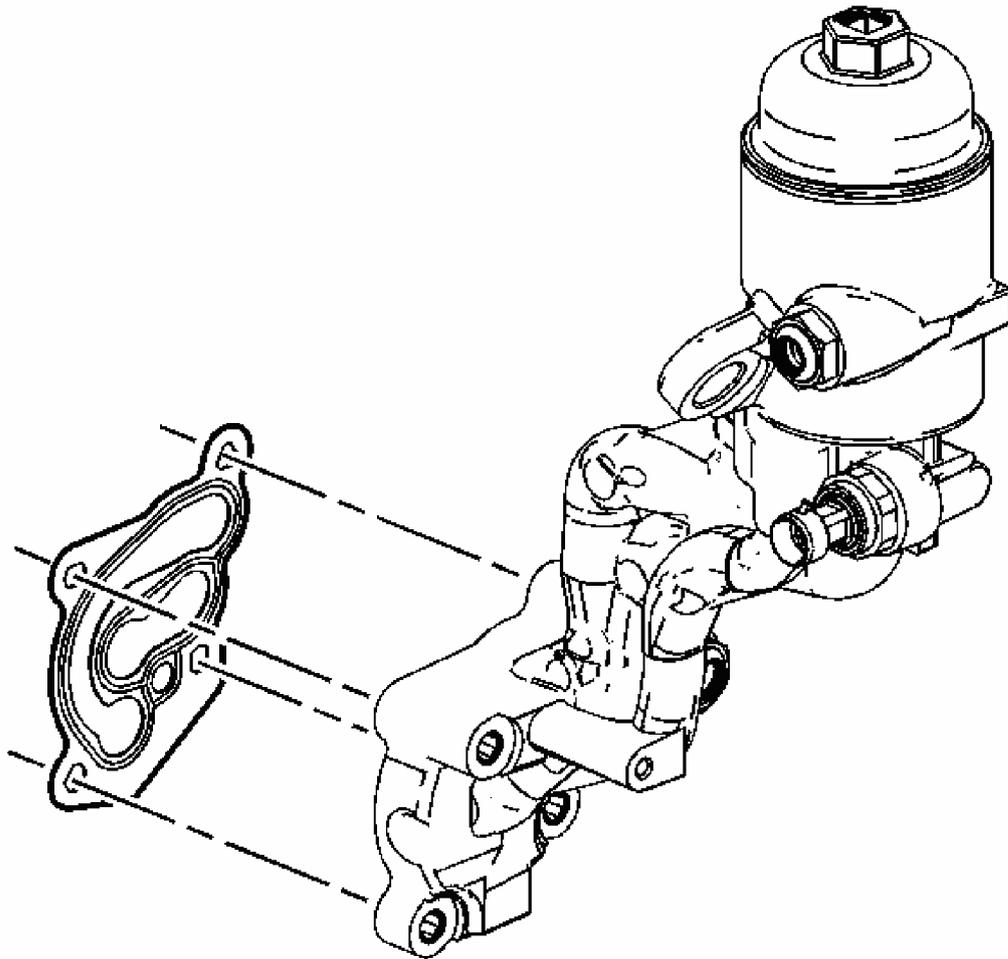


Fig. 98: View Of Oil Filter Adapter & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil filter. Refer to **Engine Oil and Oil Filter Replacement** .
2. Remove the A/C compressor and power steering drive belt. Refer to **Drive Belt Replacement - Power Steering and Air Conditioning**.

IMPORTANT: Do not disconnect the A/C pipes from the A/C compressor.

3. Remove the A/C compressor bolts and reposition the A/C compressor in order to gain access to the oil filter adapter fasteners.
4. Remove the oil filter adapter. Refer to **Oil Filter Adapter Removal** .

Installation Procedure

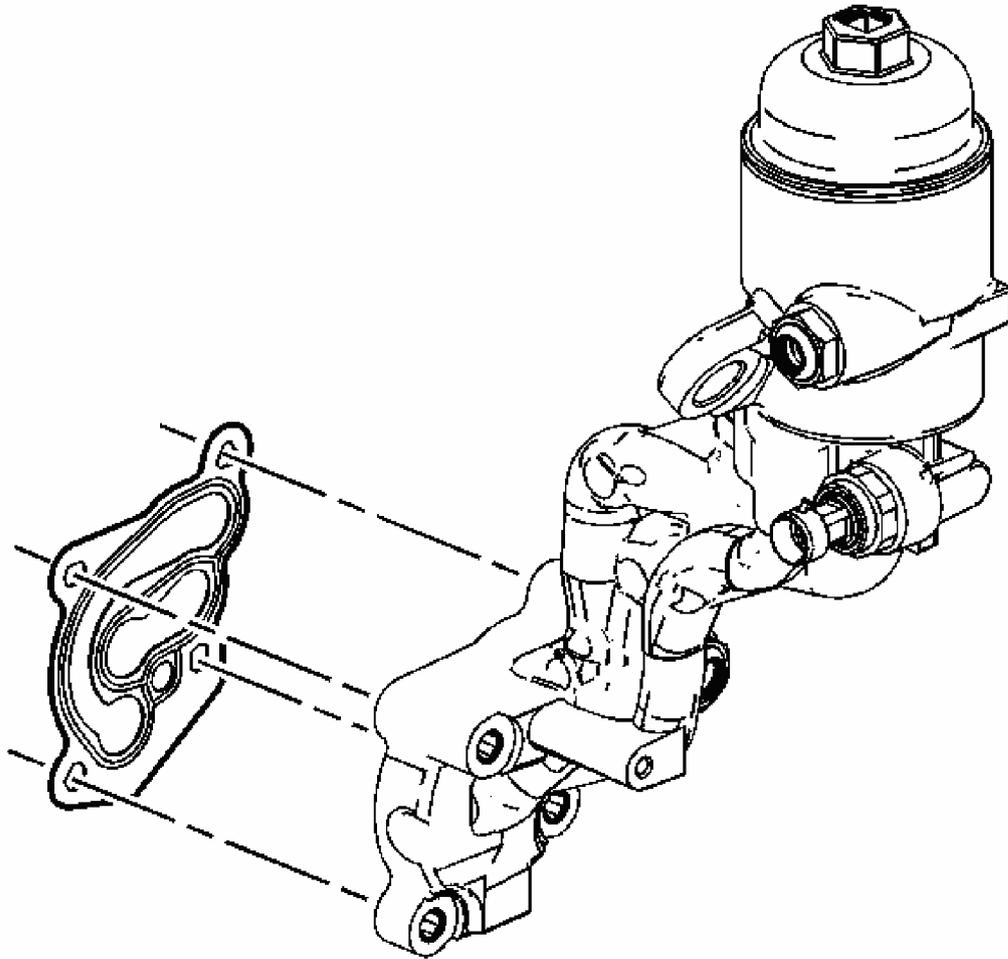


Fig. 99: View Of Oil Filter Adapter & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install the oil filter adapter. Refer to **Oil Filter Adapter Installation** .
2. Install the A/C compressor with the A/C pipes to the engine. Refer to **Compressor Replacement (LHD, LY7)** or **Compressor Replacement (LS6)** or **Compressor Replacement (2.8L (LP1))** in Heating, Ventilation and Air Conditioning.
3. Install the A/C compressor and power steering drive belt. Refer to **Drive Belt Replacement - Power Steering and Air Conditioning**.
4. Install the oil filter. Refer to **Engine Oil and Oil Filter Replacement** .

CRANKSHAFT BALANCER REPLACEMENT

Tools Required

J 24420-C Harmonic Balancer Puller

Removal Procedure

1. Remove the A/C compressor and power steering pump drive belt. Refer to **Drive Belt Tensioner Replacement - Generator and Water Pump**.
2. Remove the generator and water pump drive belt. Refer to **Drive Belt Tensioner Replacement - Power Steering and Air Conditioning**.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

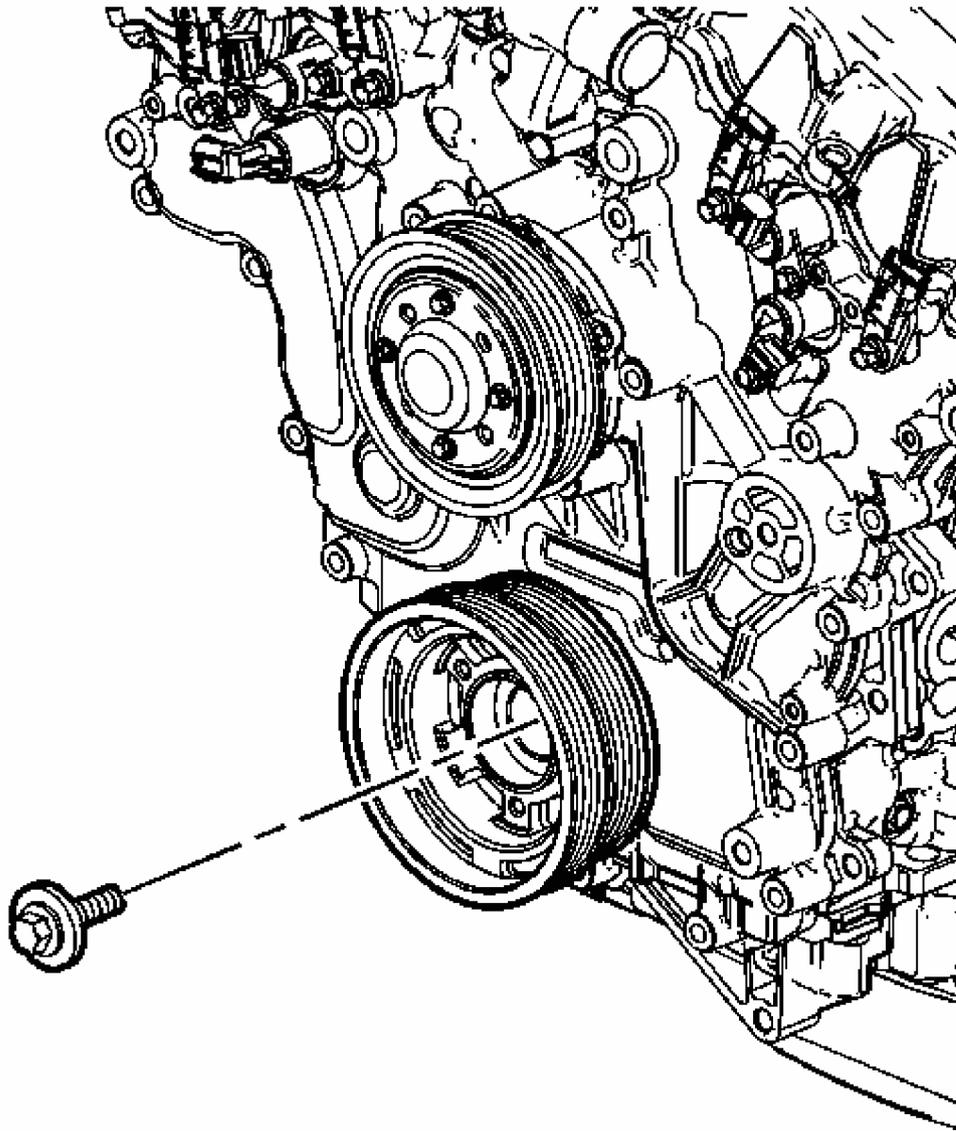


Fig. 100: View Of Crankshaft Balancer & Bolt
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 24420-C** in order to remove the crankshaft balancer. Refer to **Crankshaft Balancer Removal** .

Installation Procedure

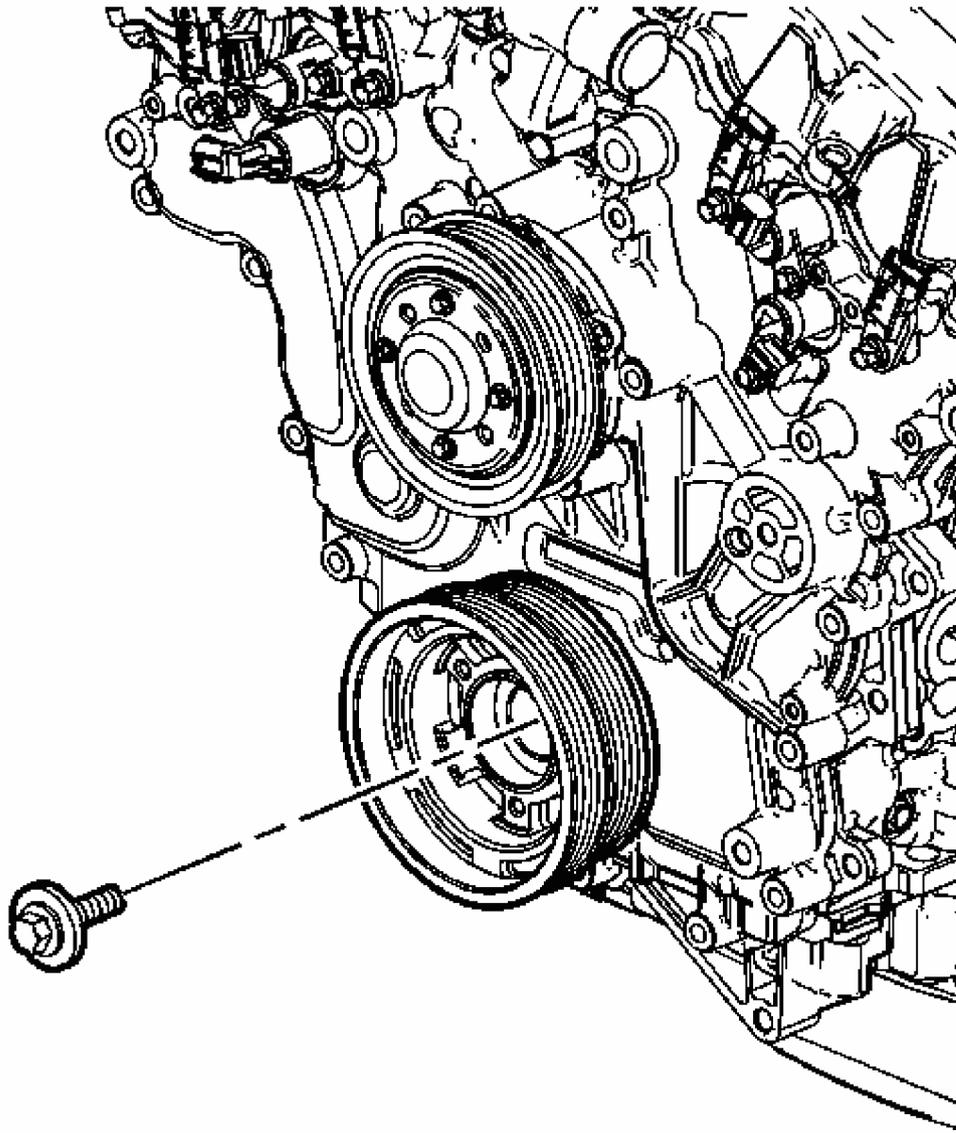


Fig. 101: View Of Crankshaft Balancer & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the crankshaft balancer. Refer to Crankshaft Balancer Installation .
2. Install the generator and water pump drive belt. Refer to Drive Belt Tensioner Replacement - Power Steering and Air Conditioning.
3. Install the A/C compressor and power steering pump drive belt. Refer to Drive Belt Tensioner Replacement - Generator and Water Pump.

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

Tools Required

J 29184 Oil Seal Installer

Removal Procedure

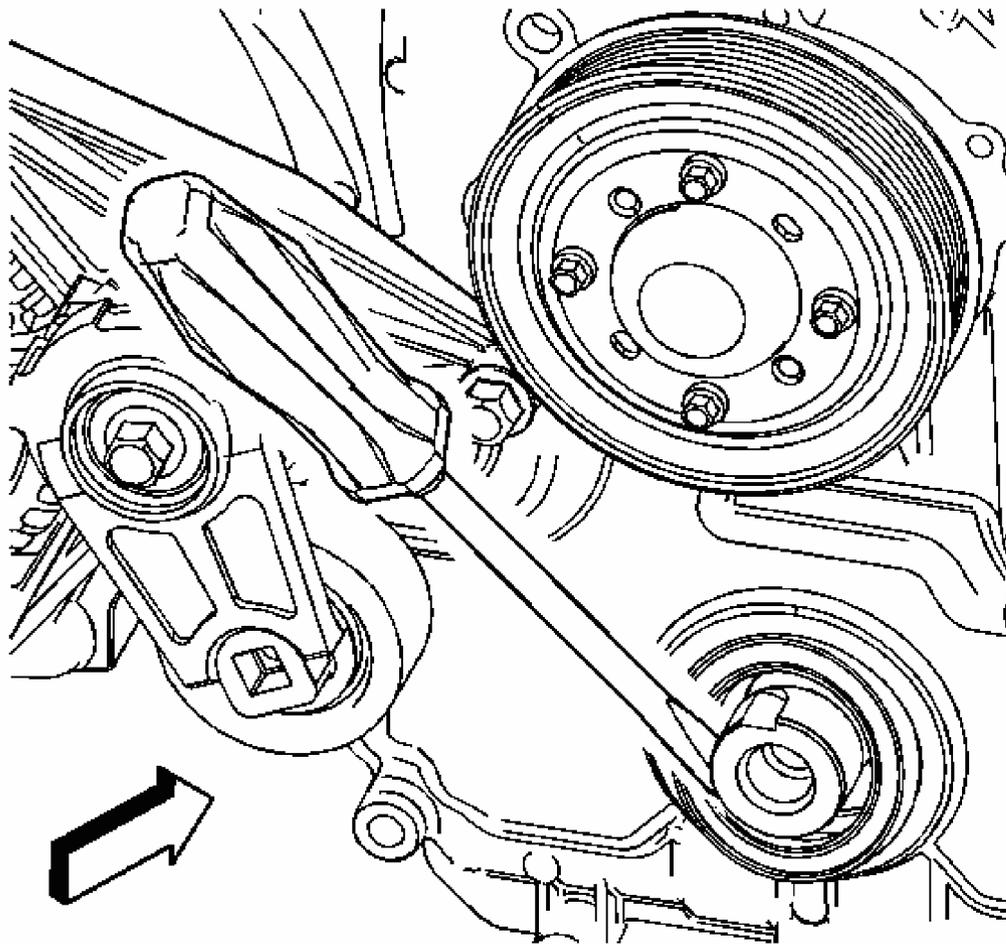


Fig. 102: Removing Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the A/C compressor and power steering pump drive belt. Refer to **Drive Belt Replacement - Power Steering and Air Conditioning**.
2. Remove the generator and water pump drive belt. Refer to **Drive Belt Replacement - Generator and Water Pump**.

3. Remove the crankshaft balancer. Refer to Crankshaft Balancer Removal .
4. Use a flat-bladed tool in order to remove the crankshaft oil seal.

Installation Procedure

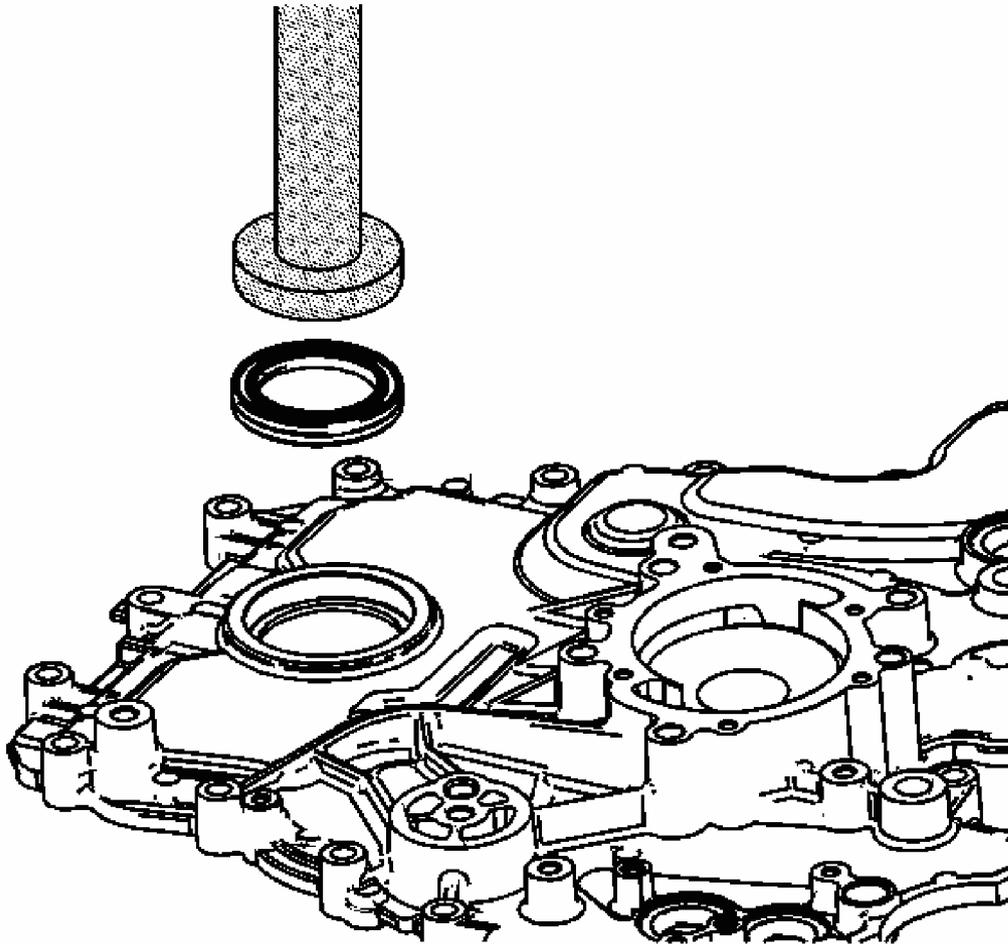


Fig. 103: Installing Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not lubricate the crankshaft front oil seal or the crankshaft balancer sealing surfaces.

1. Use the **J 29184** or equivalent to install the crankshaft front oil seal.
2. Install the crankshaft balancer. Refer to Crankshaft Balancer Installation .
3. Install the generator and water pump drive belt. Refer to Drive Belt Tensioner

Replacement - Power Steering and Air Conditioning.

4. Install the A/C compressor and power steering pump drive belt. Refer to Drive Belt Tensioner Replacement - Generator and Water Pump.

CAMSHAFT COVER REPLACEMENT - LEFT

Removal Procedure

1. Remove the engine cover. Refer to Fuel Injector Sight Shield Replacement.
2. Remove the upper intake manifold with the lower intake manifold. Refer to Intake Manifold Replacement - Lower.

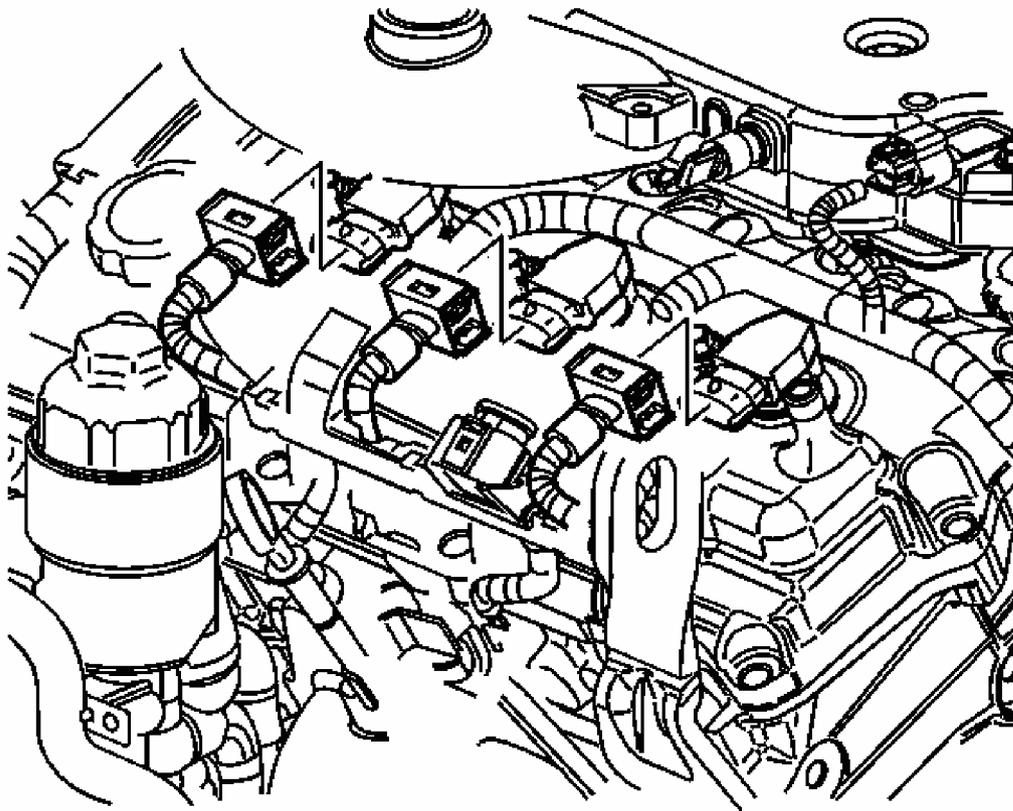


Fig. 104: View Of Left Ignition Coils Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the ignition coil electrical connectors.

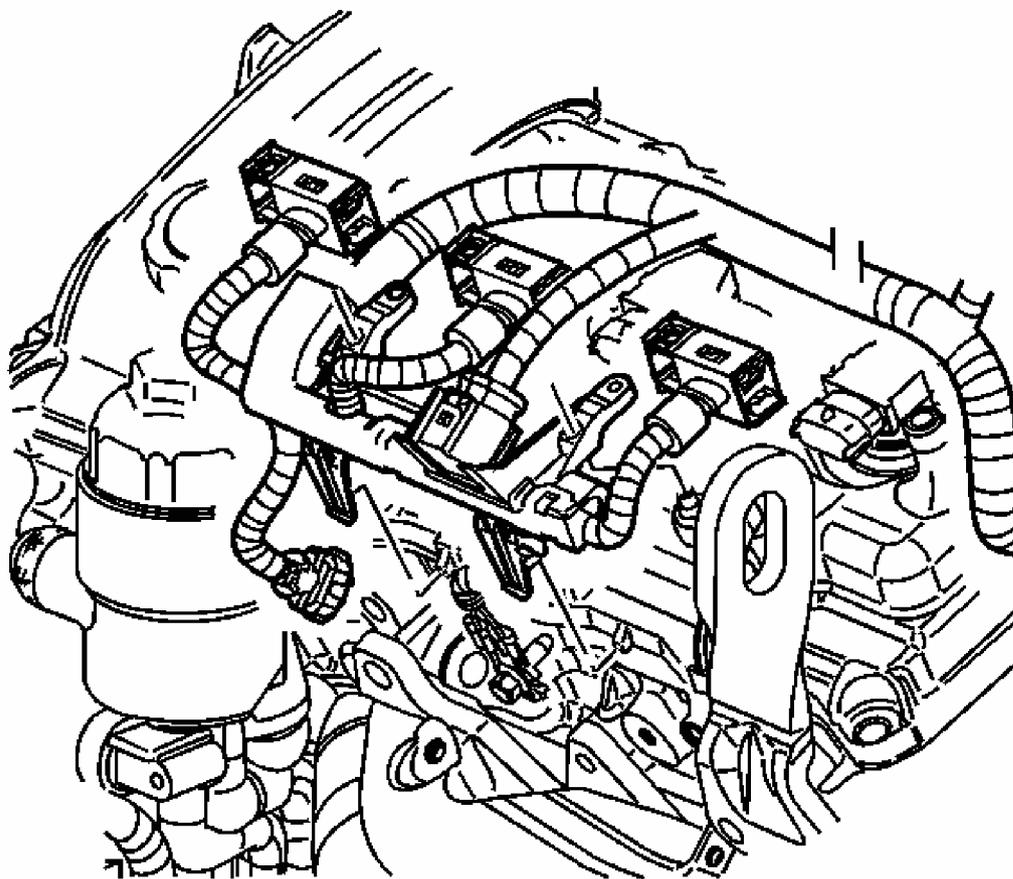


Fig. 105: View Of Left Camshaft Cover Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

4. Remove the wiring harness from the side of the camshaft cover by sliding the conduit down and outboard.
5. Remove the wiring conduit retainers from the camshaft cover by rotating the wiring harness conduit retainers counterclockwise.

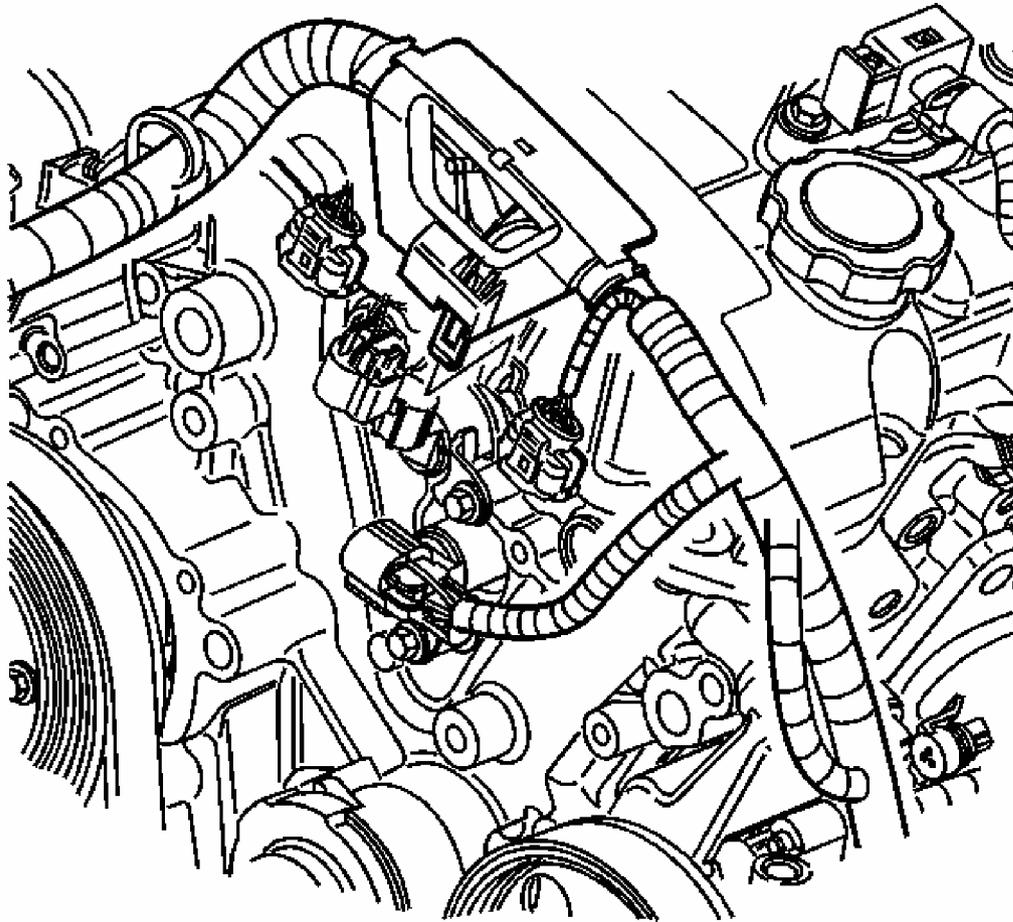


Fig. 106: View Of Left Camshaft Cover Wiring Harness Connector - Front
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: It is not necessary to disconnect the engine front cover electrical connectors.

6. Remove the wiring harness from the front of the camshaft cover.
7. Reposition and secure the wiring harnesses away from the camshaft cover in order to provide clearance.

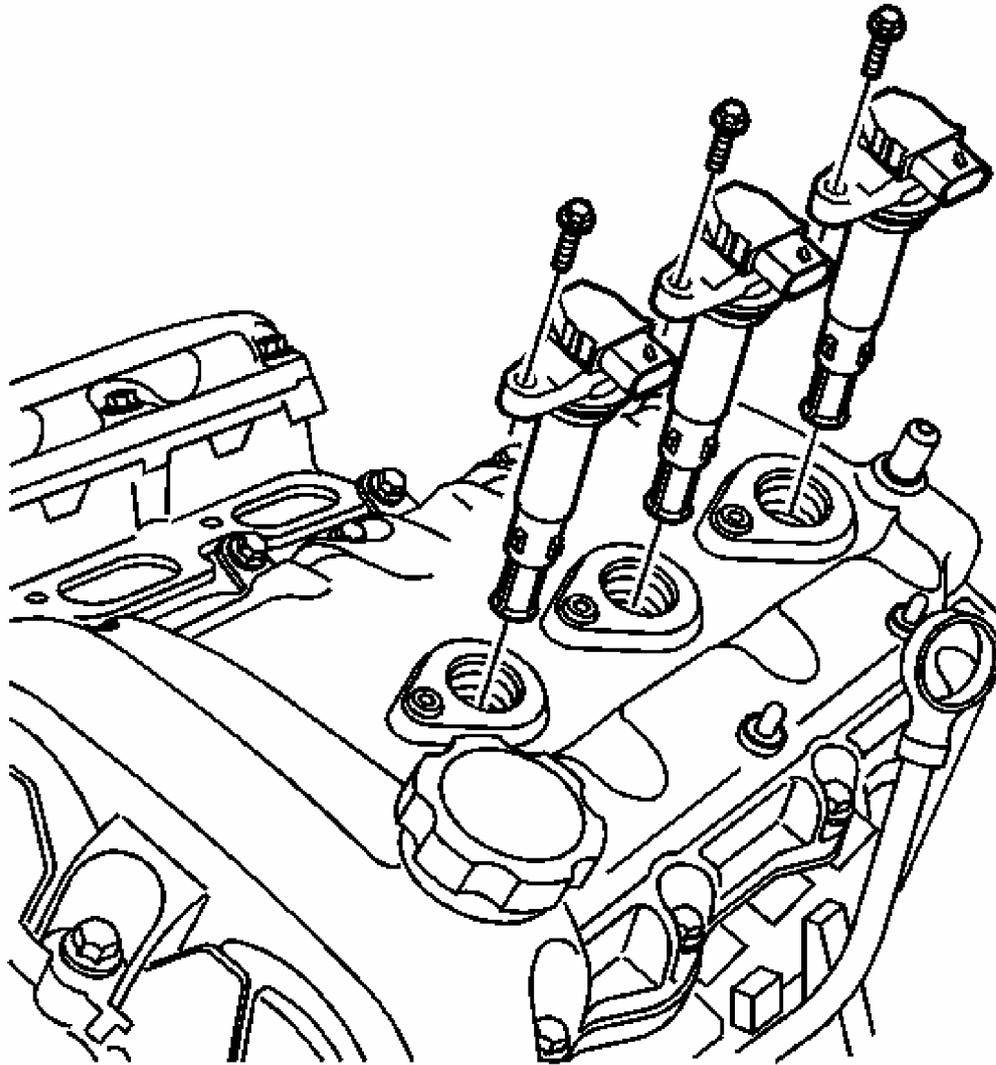


Fig. 107: Identifying Left Cylinder Head Ignition Coils
Courtesy of GENERAL MOTORS CORP.

8. Remove the ignition coils.

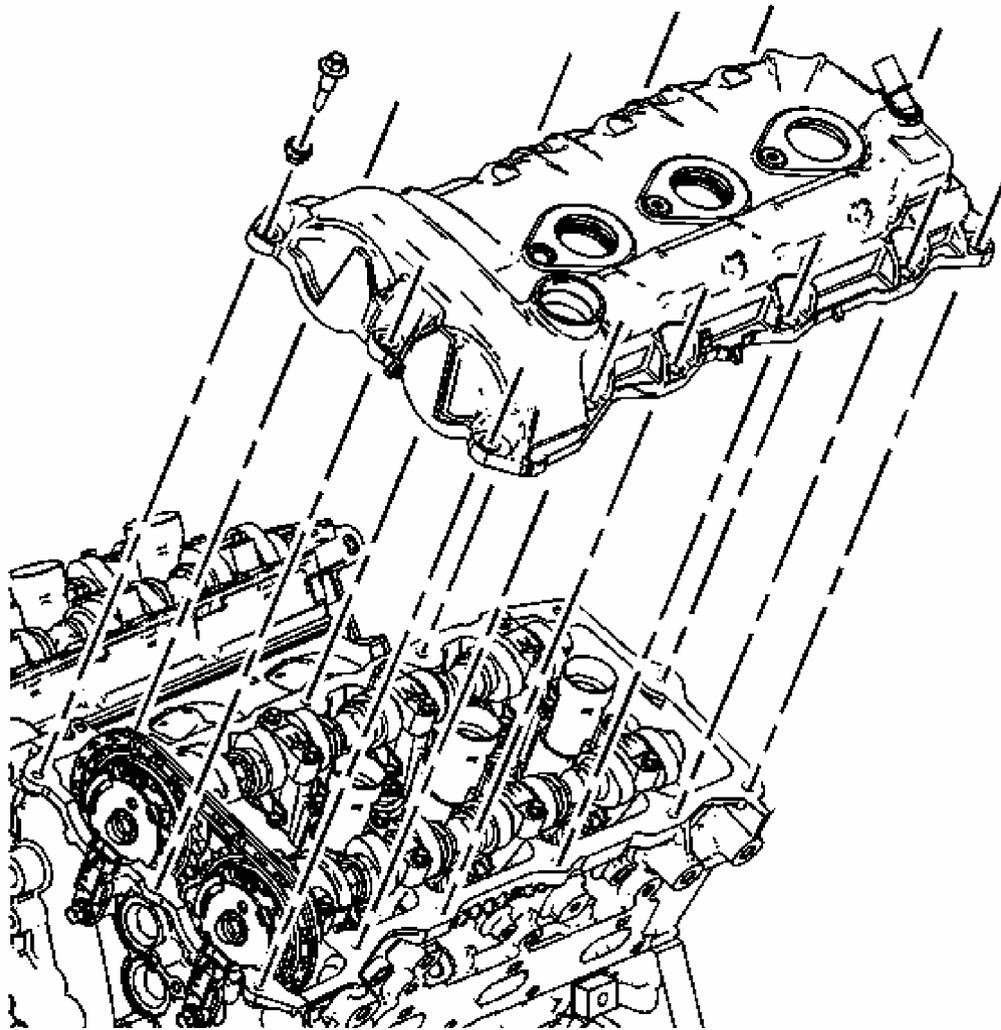


Fig. 108: Removing & Installing Left Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

9. Remove the camshaft cover.
10. Remove and discard the camshaft cover seal and grommets.

Installation Procedure

1. Install a NEW camshaft cover seal and NEW grommets.

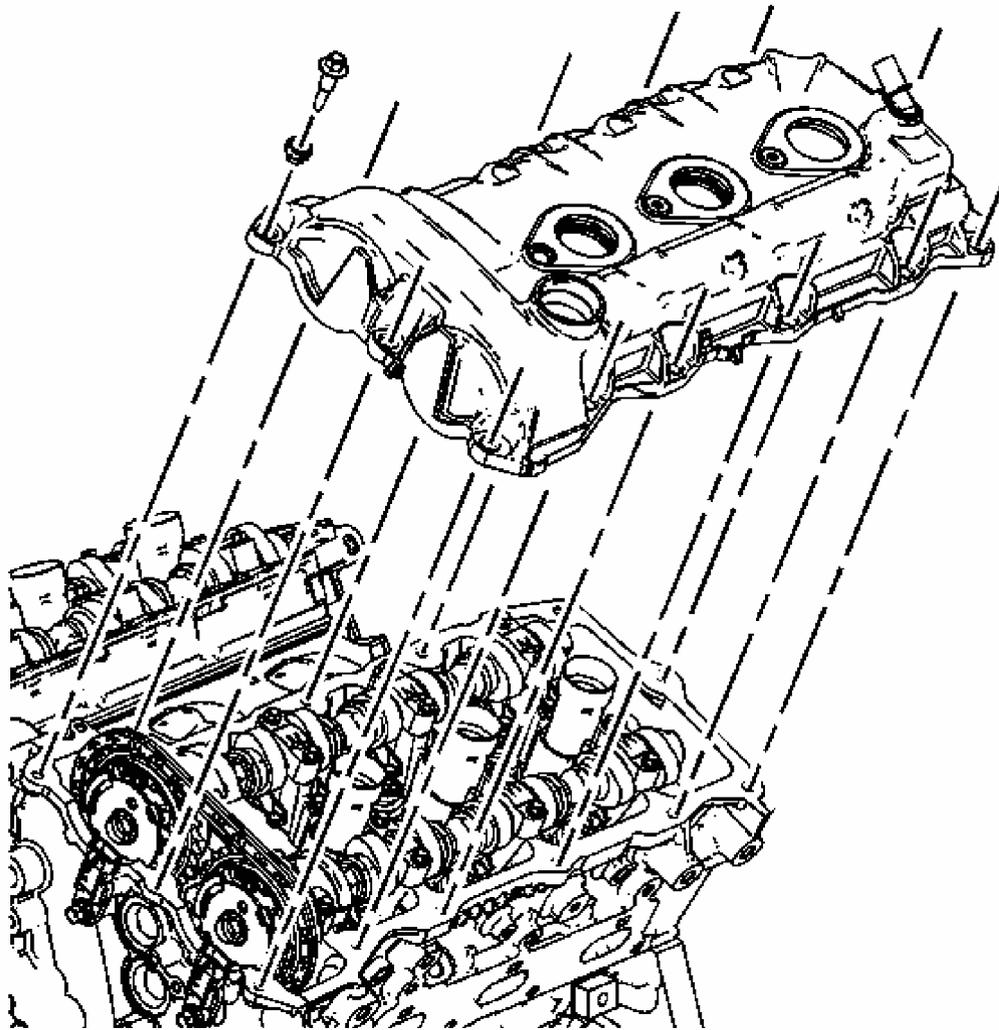


Fig. 109: Removing & Installing Left Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

2. Install the camshaft cover. Refer to Camshaft Cover Installation - Left .

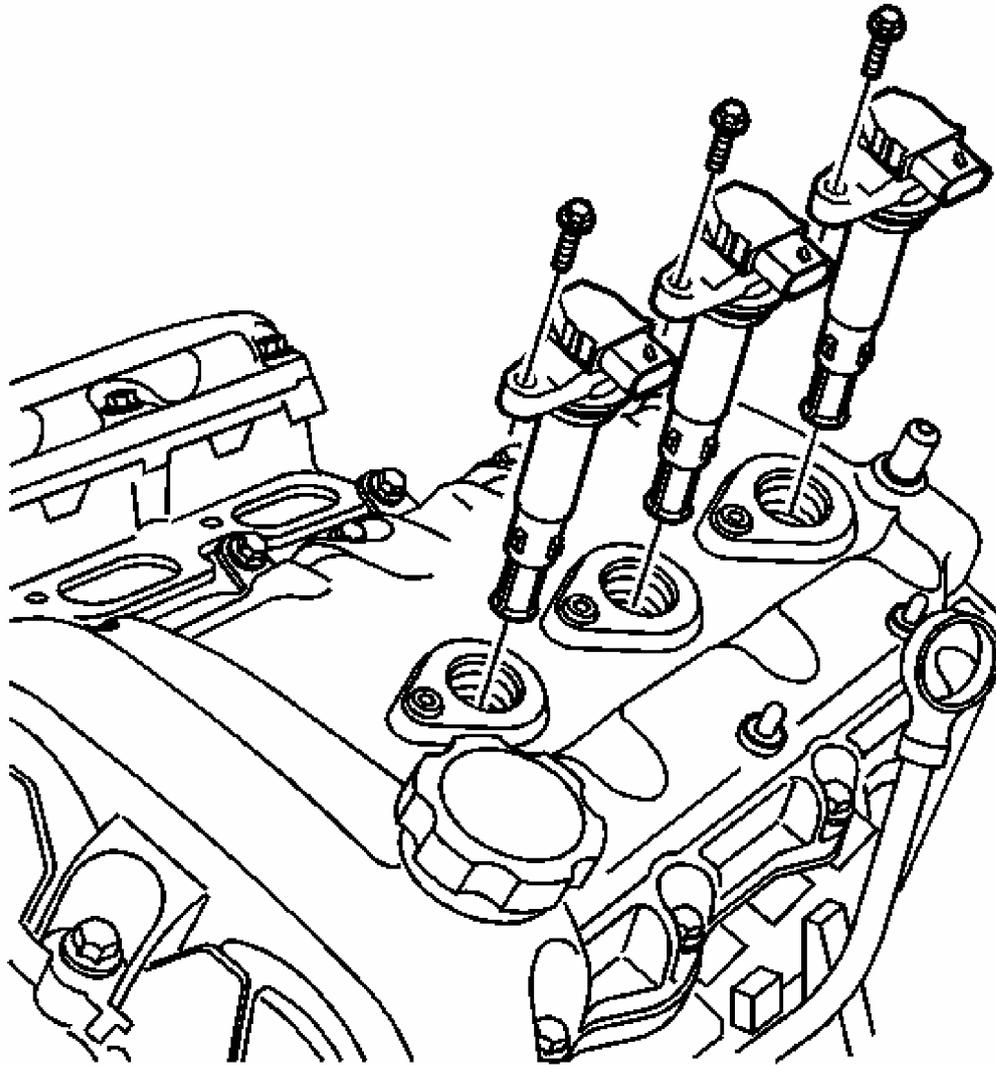


Fig. 110: Identifying Left Cylinder Head Ignition Coils
Courtesy of GENERAL MOTORS CORP.

3. Install the ignition coils.

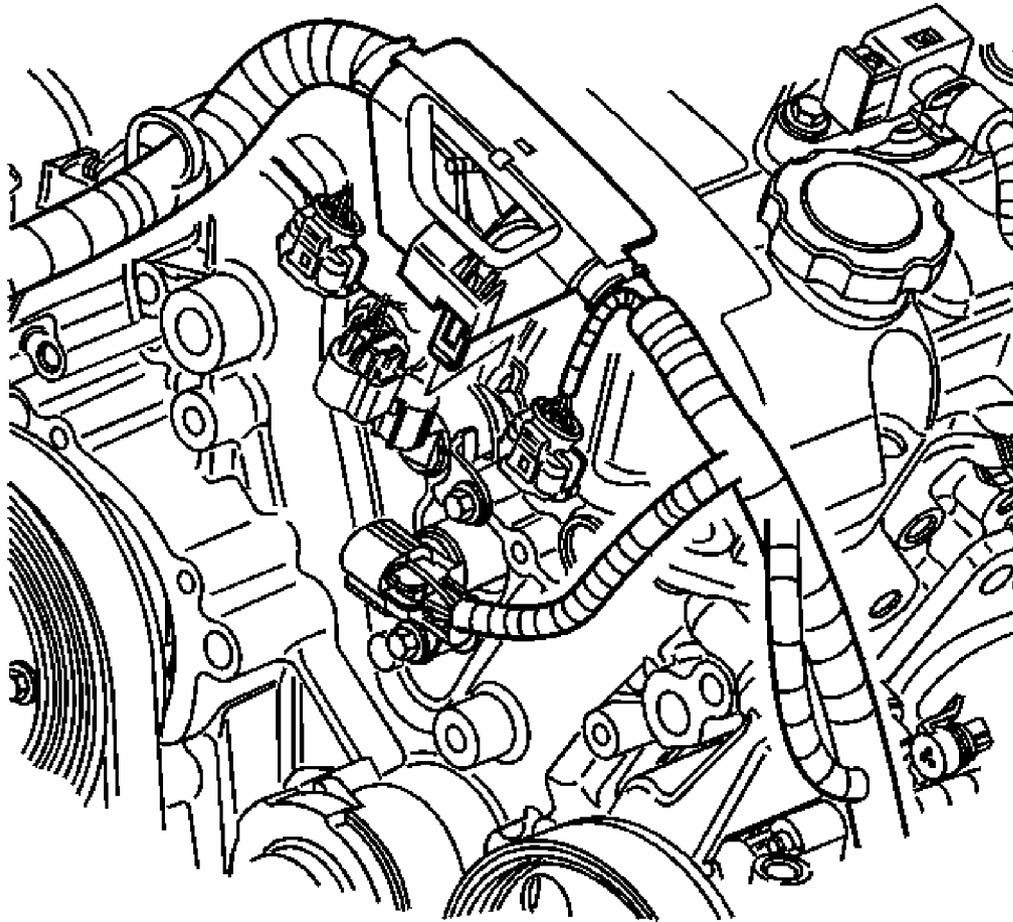


Fig. 111: View Of Left Camshaft Cover Wiring Harness Connector - Front
Courtesy of GENERAL MOTORS CORP.

4. Install the wiring harness to the front of the camshaft cover.
5. Install the wiring harness conduit retainers to the wiring harness conduit.

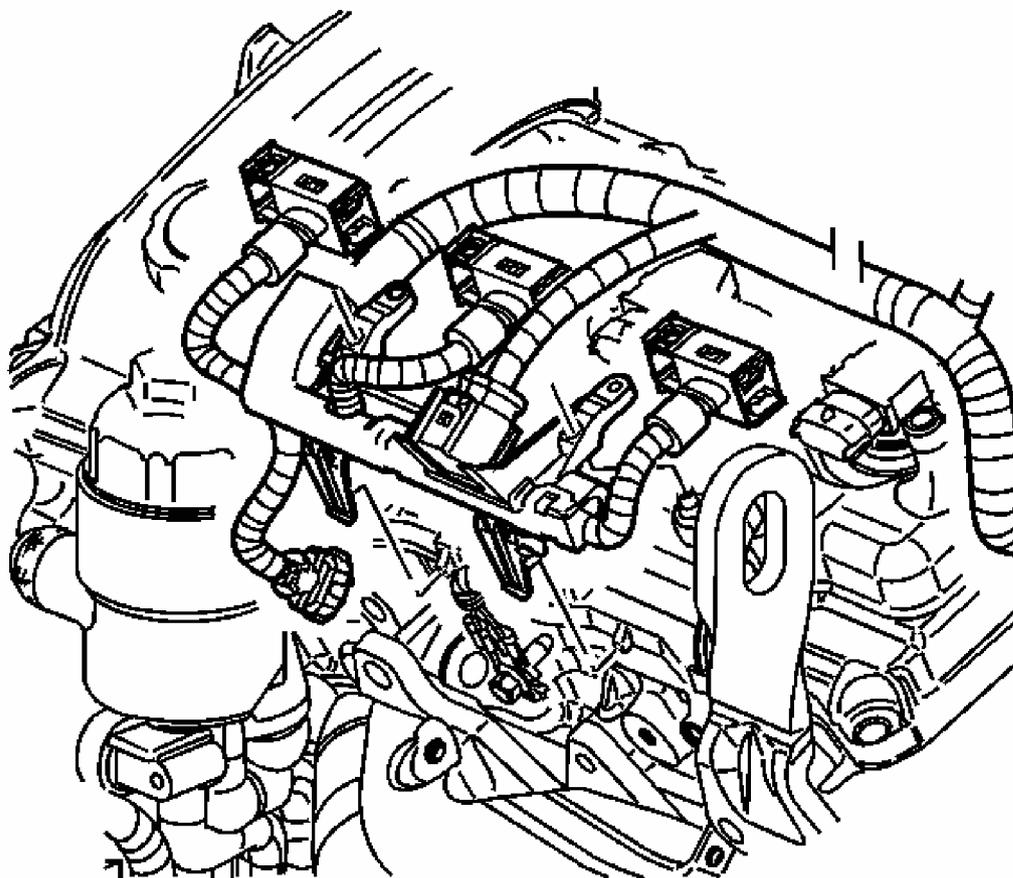


Fig. 112: View Of Left Camshaft Cover Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

6. Install the wiring harness to the side of the camshaft cover.

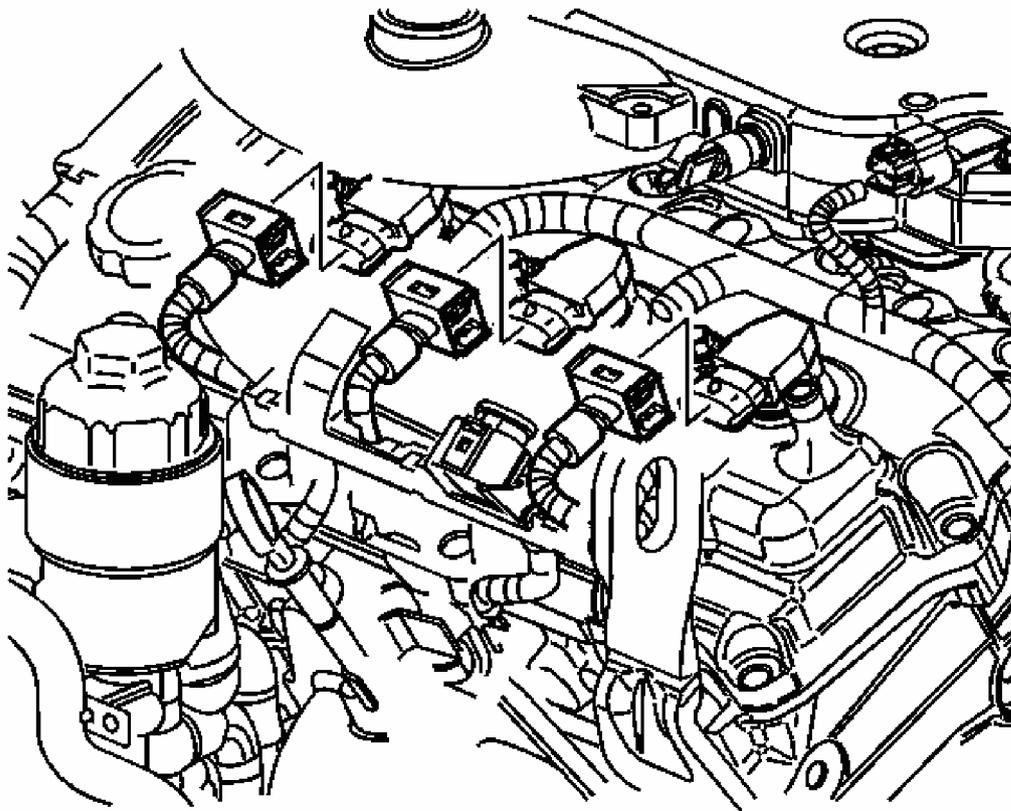


Fig. 113: View Of Left Ignition Coils Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

7. Connect the ignition coil electrical connectors.
8. Install the upper intake manifold with the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.
9. Install the engine cover. Refer to **Fuel Injector Sight Shield Replacement**.

CAMSHAFT COVER REPLACEMENT - RIGHT

Removal Procedure

1. Remove the engine cover. Refer to **Fuel Injector Sight Shield Replacement**.
2. Remove the upper intake manifold with the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.

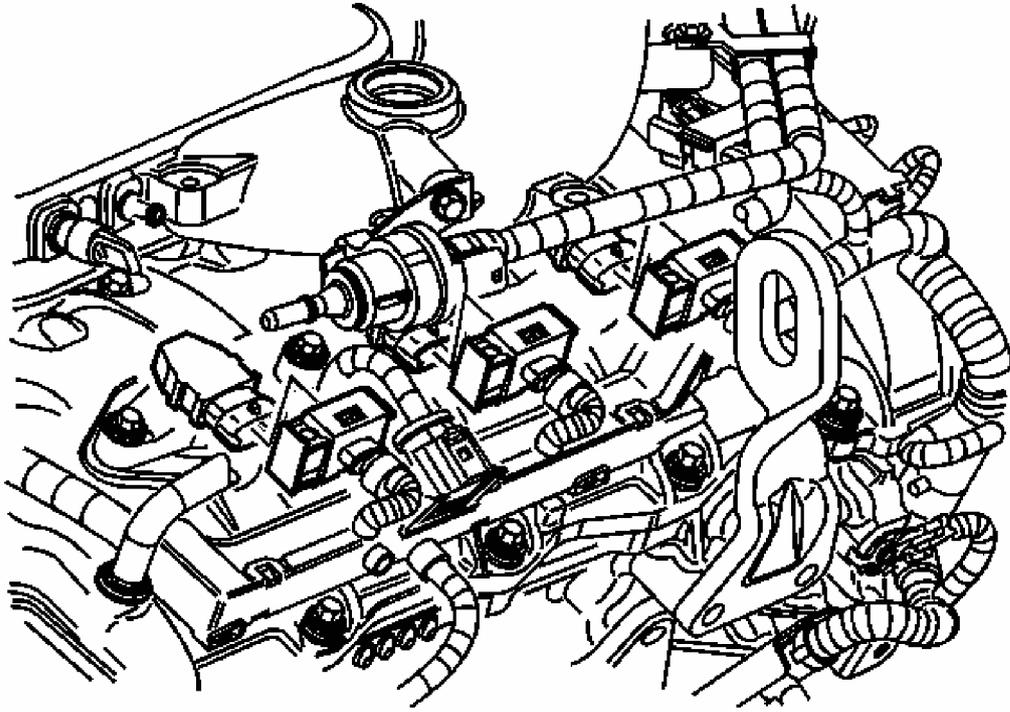


Fig. 114: View Of Right Ignition Coils Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the ignition coil electrical connectors.

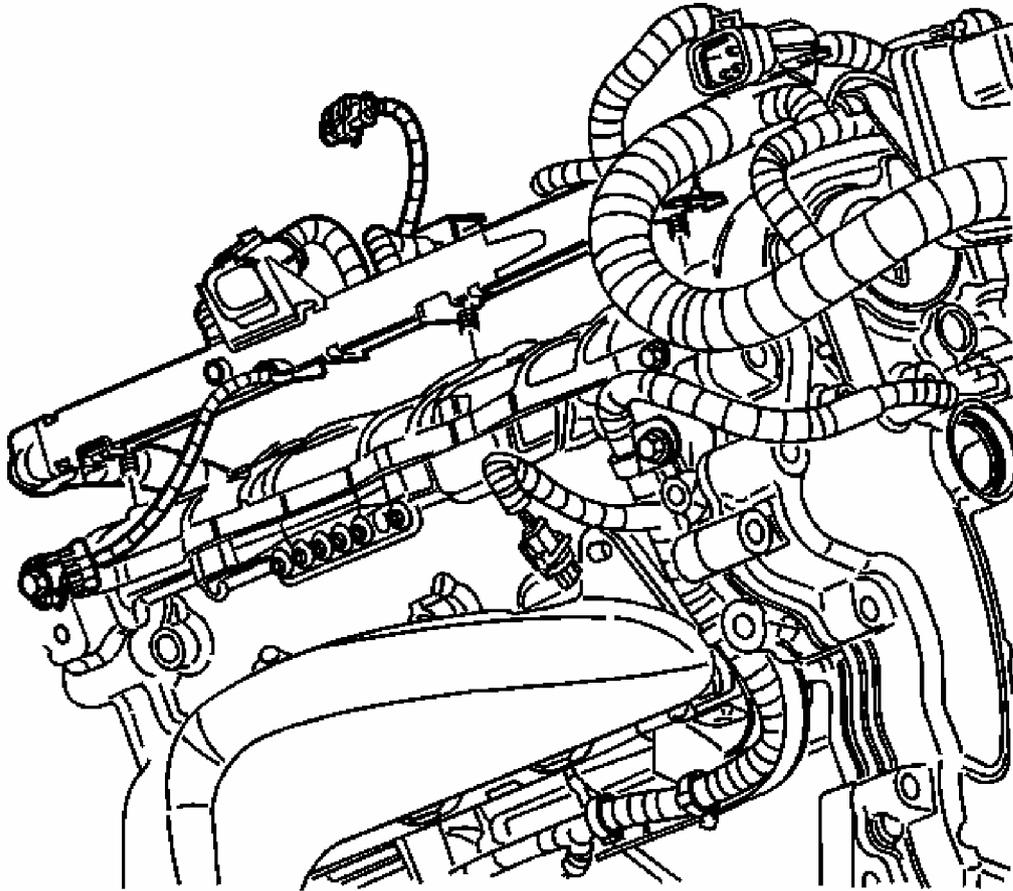


Fig. 115: View Of Right Camshaft Cover Wiring Harness Connector - Top
Courtesy of GENERAL MOTORS CORP.

4. Remove the wiring harness from the side of the camshaft cover by sliding the conduit down and outboard.
5. Remove the wiring conduit retainers from the camshaft cover by rotating the wiring harness conduit retainers counterclockwise.

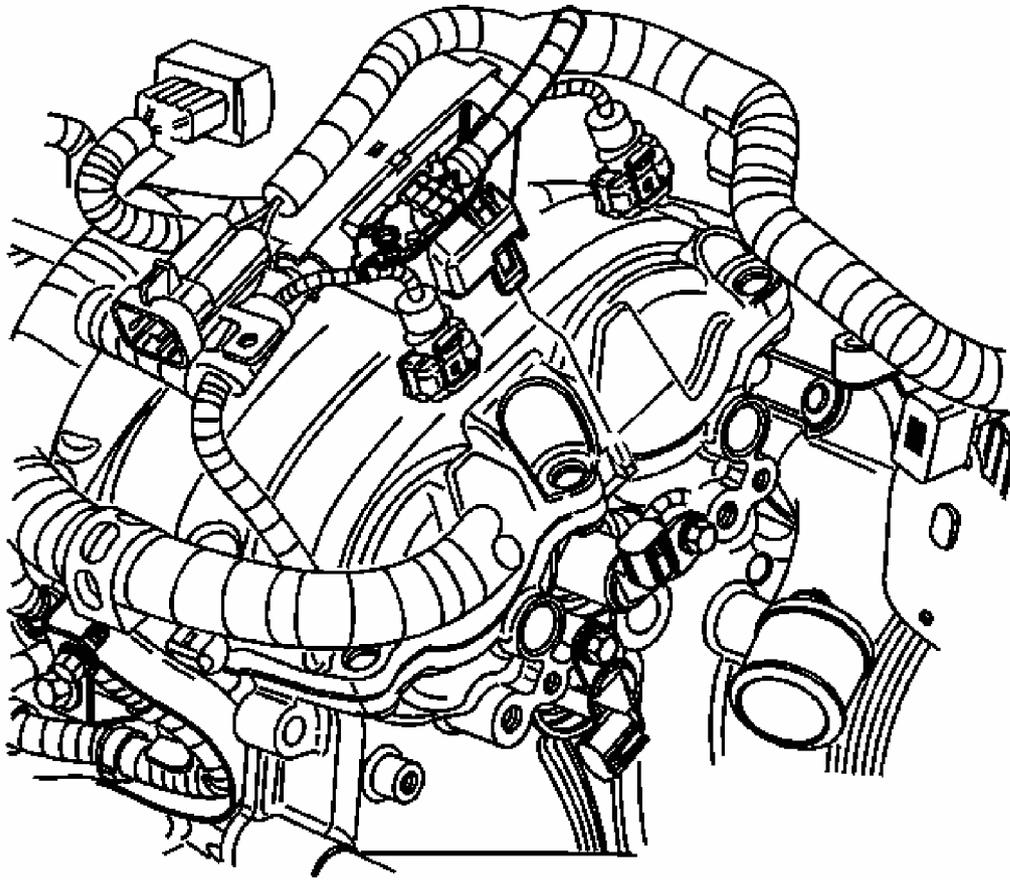


Fig. 116: View Of Right Camshaft Cover Wiring Harness Connector - Front
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: It is not necessary to disconnect the engine front cover electrical connectors.

6. Remove the wiring harness from the front of the camshaft cover.
7. Reposition and secure the wiring harnesses away from the camshaft cover in order to provide clearance.

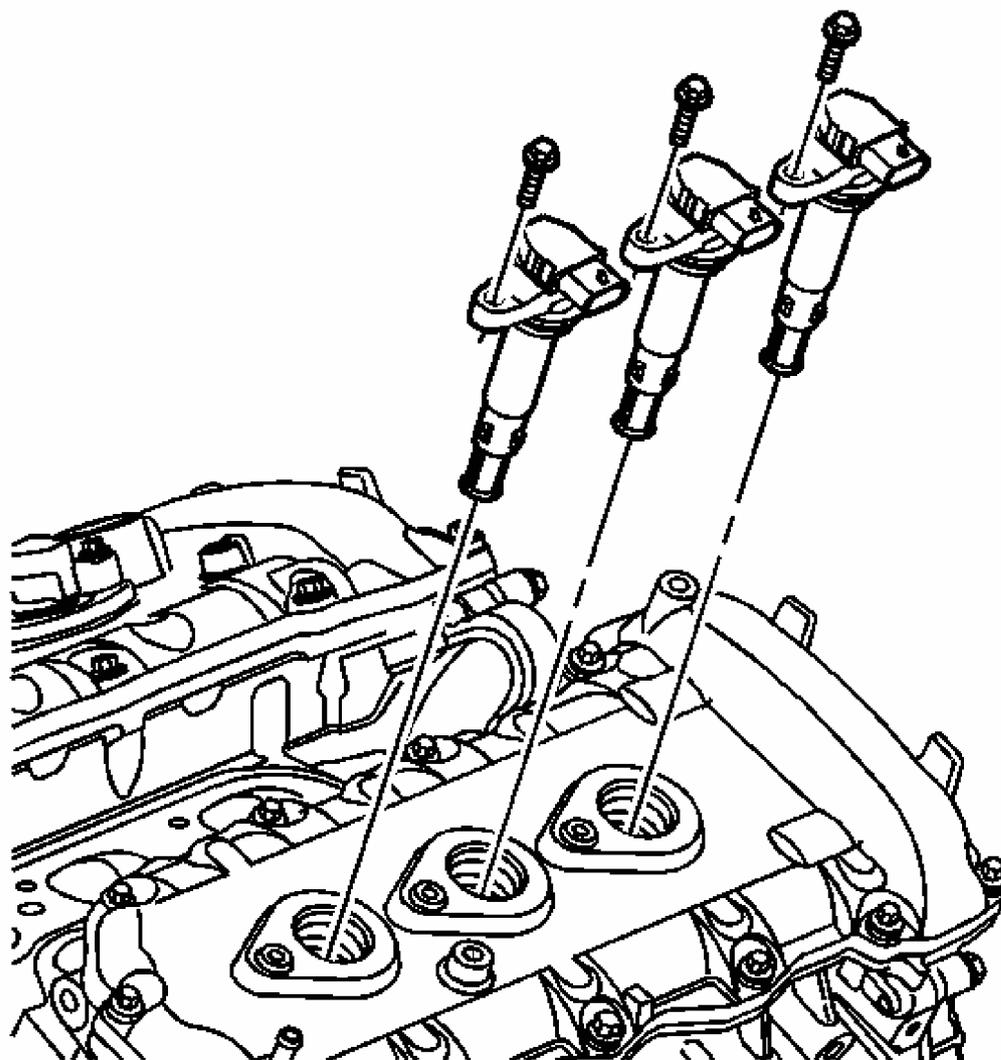


Fig. 117: Ignition Coil View
Courtesy of GENERAL MOTORS CORP.

8. Remove the ignition coils.

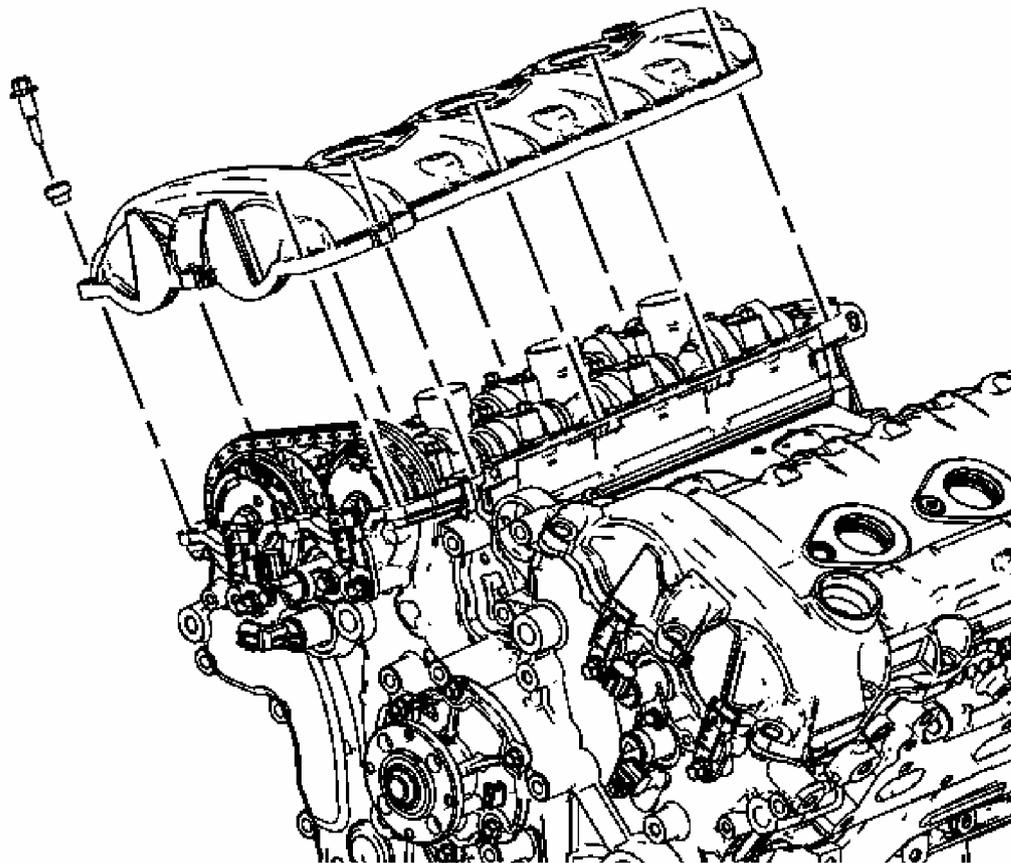


Fig. 118: Removing & Installing Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

9. Remove the camshaft cover.
10. Remove and discard the camshaft cover seal and grommets.

Installation Procedure

1. Install a NEW camshaft cover seal and NEW grommets.

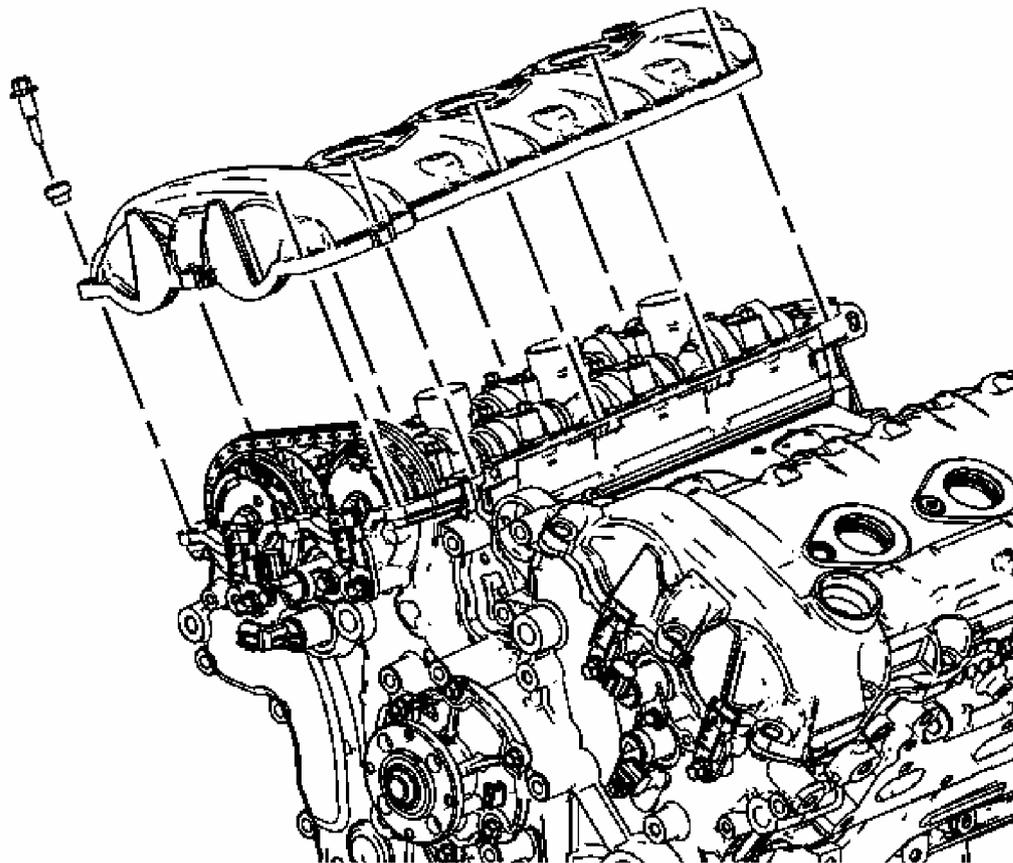


Fig. 119: Removing & Installing Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

2. Install the camshaft cover. Refer to **Camshaft Cover Installation - Right** .

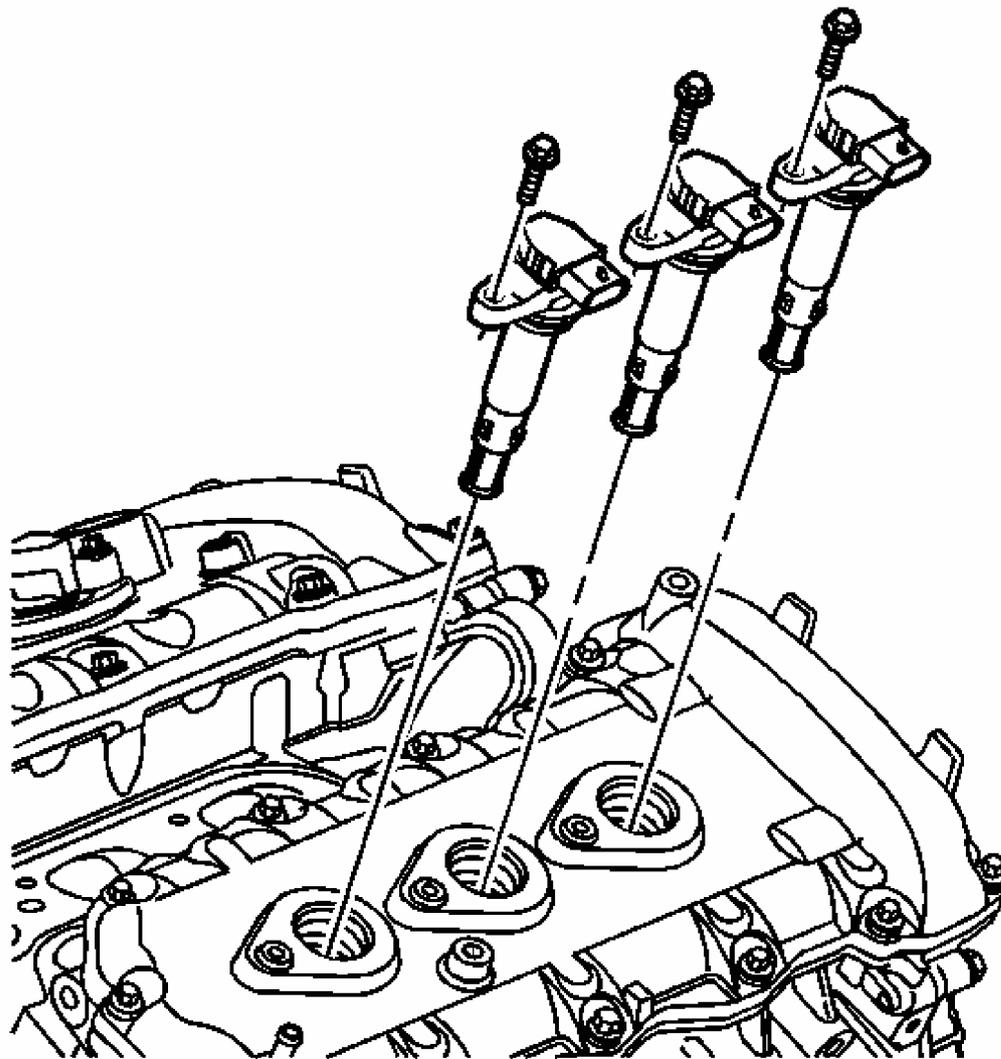


Fig. 120: Ignition Coil View
Courtesy of GENERAL MOTORS CORP.

3. Install the ignition coils.

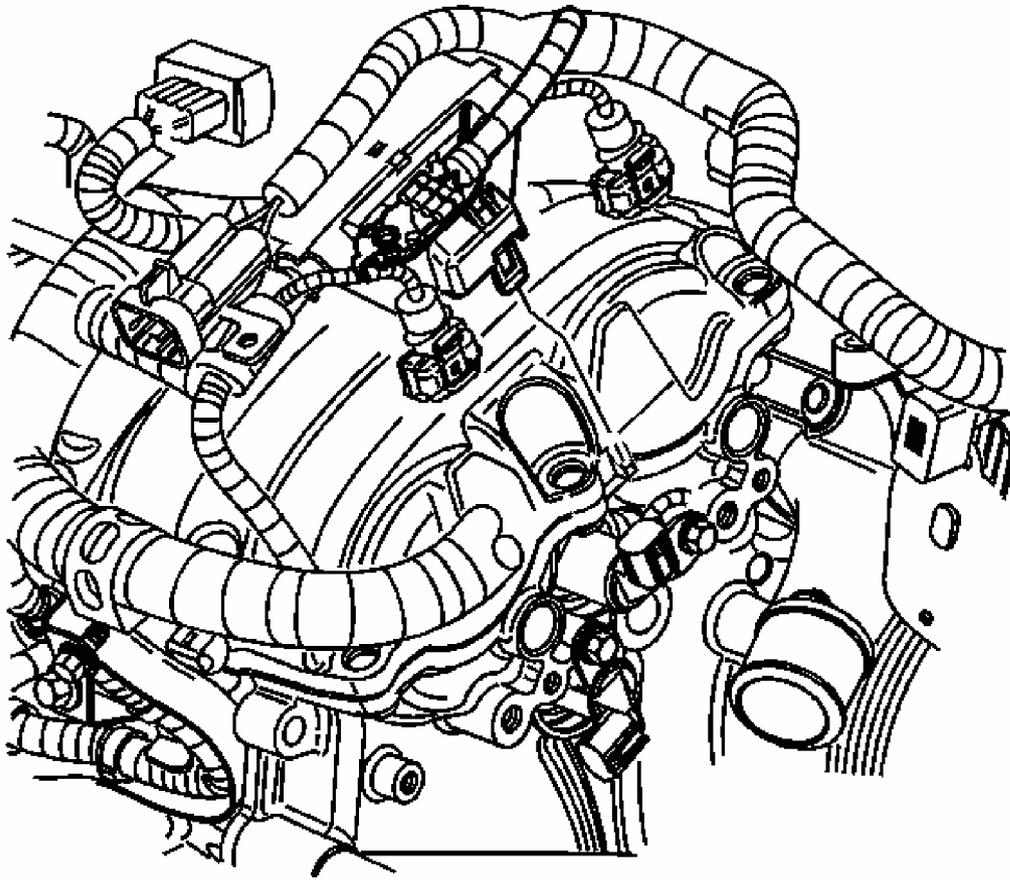


Fig. 121: View Of Right Camshaft Cover Wiring Harness Connector - Front
Courtesy of GENERAL MOTORS CORP.

4. Install the wiring harness to the front of the camshaft cover.
5. Install the wiring harness conduit retainers to the wiring harness conduit.

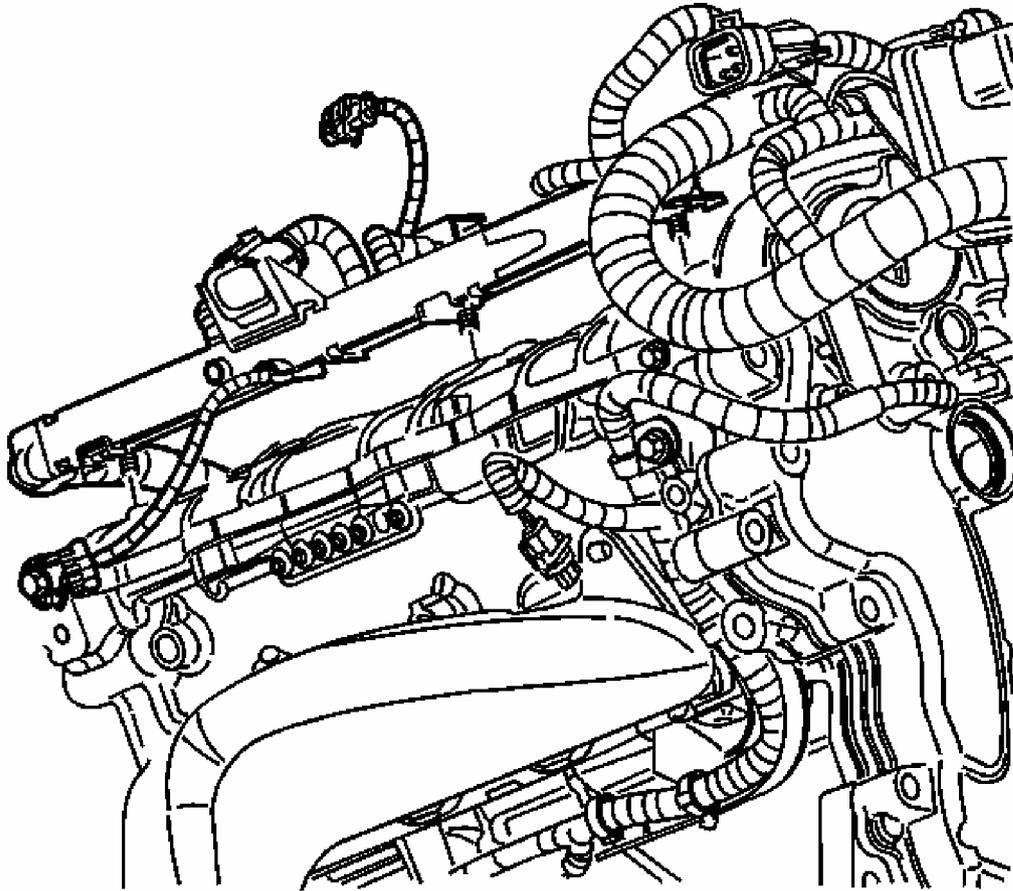


Fig. 122: View Of Right Camshaft Cover Wiring Harness Connector - Top
Courtesy of GENERAL MOTORS CORP.

6. Install the wiring harness to the side of the camshaft cover.

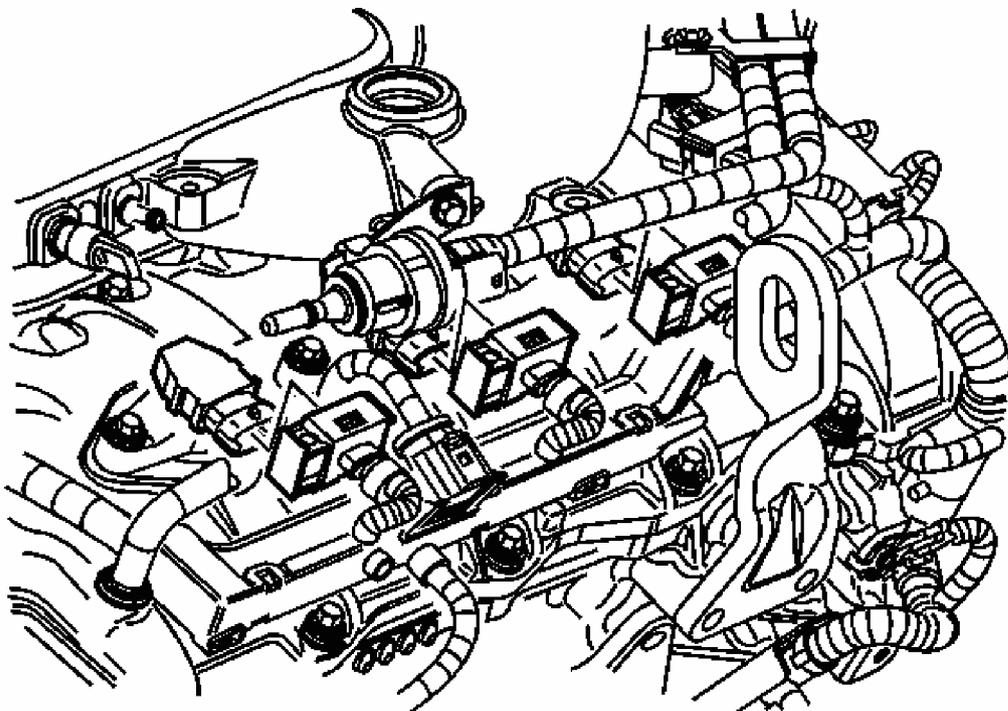


Fig. 123: View Of Right Ignition Coils Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

7. Connect the ignition coil electrical connectors.
8. Install the upper intake manifold with the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.
9. Install the engine cover. Refer to **Fuel Injector Sight Shield Replacement**.

ENGINE FRONT COVER REPLACEMENT

Tools Required

EN 46109 Engine Front Cover Installation Guide Pins

Removal Procedure

1. Remove the engine cover. Refer to **Fuel Injector Sight Shield Replacement**.
2. Remove the upper intake manifold with the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.
3. Remove the camshaft covers. Refer to **Camshaft Cover Replacement - Left** and

Camshaft Cover Replacement - Right.

4. Drain the engine coolant. Refer to **Draining and Filling Cooling System (LP1, LY7)** or **Draining and Filling Cooling System (LS6)** in Engine Cooling.
5. Disconnect the purge vent hose from the water outlet.
6. Remove the water outlet with the radiator hose and reposition aside. Refer to **Water Outlet Housing Replacement (LP1, LY7)** in Engine Cooling.
7. Remove the accessory drive belts. Refer to **Drive Belt Replacement - Generator and Water Pump** and **Drive Belt Replacement - Power Steering and Air Conditioning**.
8. Remove the A/C compressor and power steering belt tensioner. Refer to **Drive Belt Tensioner Replacement - Power Steering and Air Conditioning**.
9. Remove the generator bracket with the generator and the belt tensioner. Refer to **Generator Bracket Replacement (LP1, LY7)** or **Generator Bracket Replacement (LS6)** in Engine Electrical.

IMPORTANT: Do not disconnect the power steering pipes or drain the power steering fluid.

10. Remove the power steering fluid reservoir and reposition the power steering fluid reservoir in order to provide access.
11. Remove the power steering pump pulley. Refer to **Power Steering Pump Removal** .

IMPORTANT: Do not disconnect the power steering pipes/hoses.

12. Remove the power steering pump upper front bolt and loosen the remaining two bolts. Refer to **Power Steering Pump Removal** .
13. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Removal** .
14. Remove the oil control valves. Refer to **Camshaft Position (CMP) Actuator Solenoid Replacement - Bank 2 (Left) Intake** and **Camshaft Position (CMP) Actuator Solenoid Replacement - Bank 2 (Left) Exhaust** in Engine Controls - 3.6L (LY7).

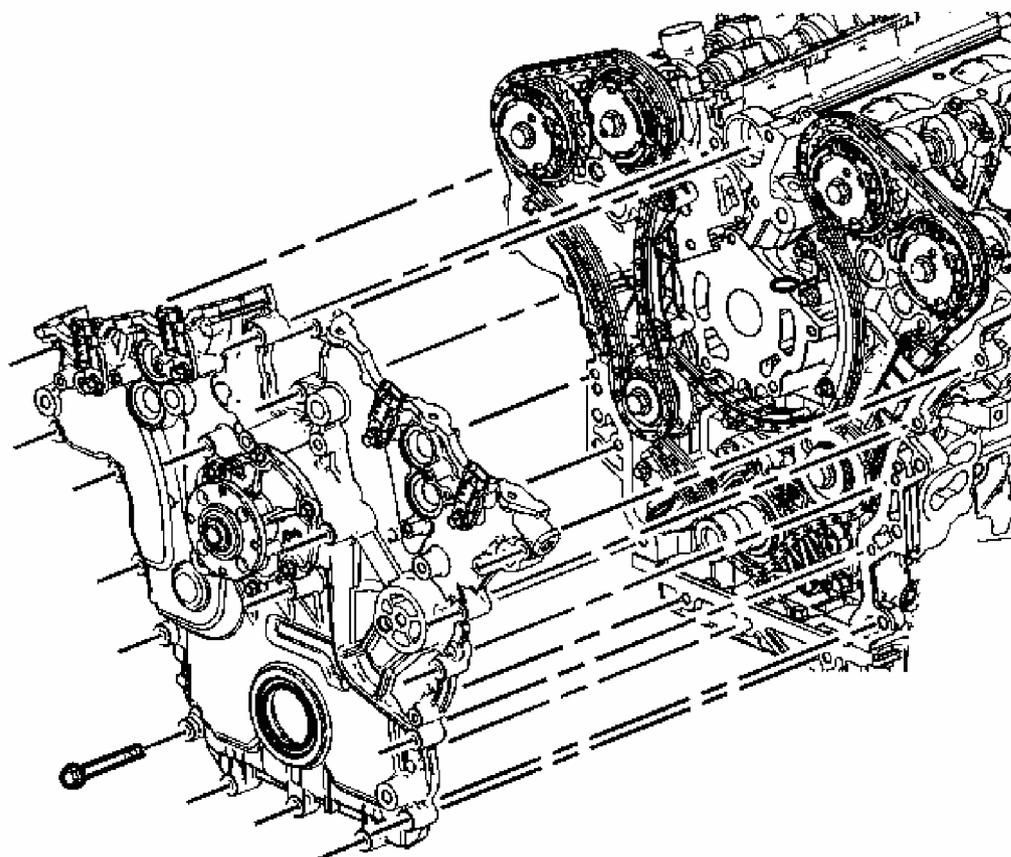


Fig. 124: Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

15. Remove the engine front cover with the water pump. Refer to **Engine Front Cover Removal** .
16. Disassemble the engine front cover as necessary. Refer to **Engine Front Cover Disassemble** .

IMPORTANT: Do NOT use sharp and/or metal gasket scrapers in order to clean the sealing surfaces.

17. Carefully clean the engine front cover sealing surfaces. Refer to **Engine Front Cover Cleaning and Inspection** .

IMPORTANT: Insert a piece of cardboard between the oil pan front and the oil pump in order to prevent any contaminants from

falling into the oil pan.

18. Carefully clean the engine front cover sealing surfaces. Refer to **Engine Front Cover Cleaning and Inspection** .
19. Use compressed air in order to remove any engine coolant from the engine cooling passages and from the top of the oil pan scraper (windage tray).

Installation Procedure

1. Assemble the engine front cover as necessary. Refer to **Engine Front Cover Assemble** .

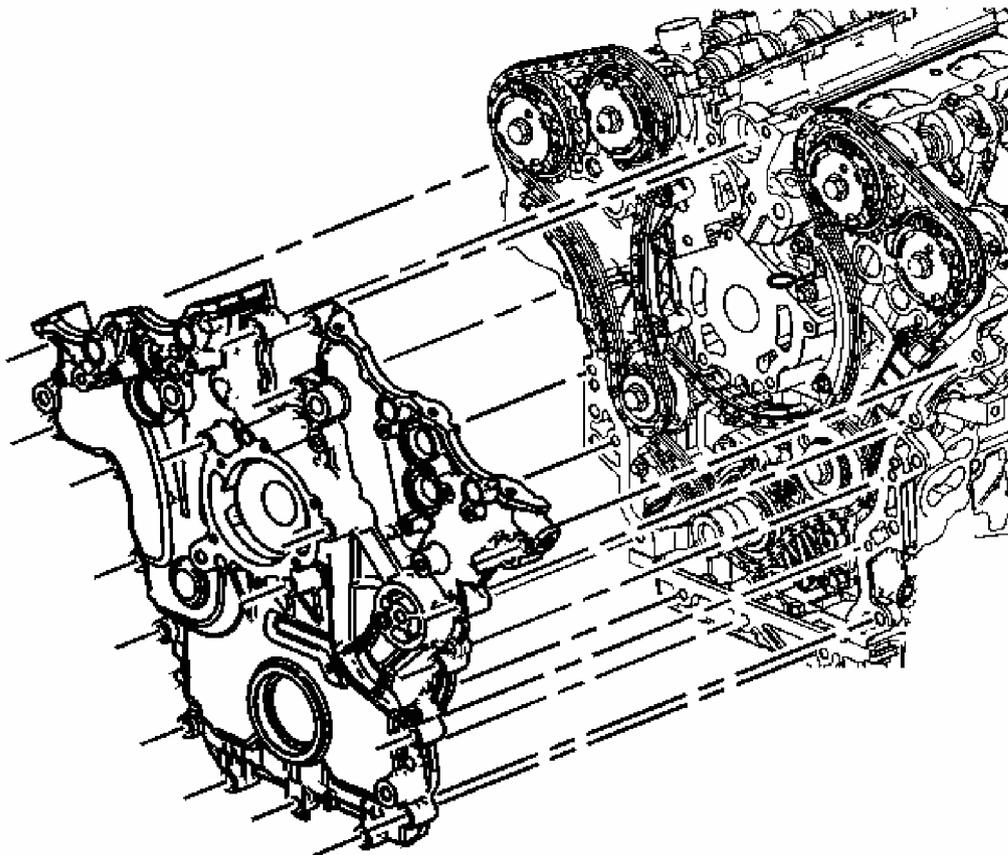


Fig. 125: View Of Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

2. Use the EN 46109 in order to install the engine front cover. Refer to **Engine Front Cover Installation** .
3. Install the oil control valves. Refer to **Camshaft Position (CMP) Actuator Solenoid**

Replacement - Bank 2 (Left) Intake and Camshaft Position (CMP) Actuator

Solenoid Replacement - Bank 2 (Left) Exhaust in Engine Controls - 3.6L (LY7).

4. Install the crankshaft balancer. Refer to **Crankshaft Balancer Installation** .
5. Install the power steering pump. Refer to **Power Steering Pump Installation** .
6. Install the power steering pump pulley. Refer to **Power Steering Pump Installation** .
7. Install the power steering fluid reservoir. Refer to **Remote Power Steering Fluid Reservoir Replacement (LP1, LY7)** or **Remote Power Steering Fluid Reservoir Replacement (LS6)** in Power Steering System.
8. Install the generator bracket with the generator and the belt tensioner. Refer to **Generator Bracket Replacement (LP1, LY7)** or **Generator Bracket Replacement (LS6)** in Engine Electrical.
9. Install the A/C compressor and power steering belt tensioner. Refer to **Drive Belt Tensioner Replacement - Power Steering and Air Conditioning**.
10. Install the accessory drive belts. Refer to **Drive Belt Replacement - Power Steering and Air Conditioning** and **Drive Belt Replacement - Generator and Water Pump**.
11. Install the water outlet. Refer to **Water Outlet Housing Replacement (LP1, LY7)** in Engine Cooling.
12. Install the purge vent hose to the water outlet.
13. Fill the cooling system. Refer to **Draining and Filling Cooling System (LP1, LY7)** or **Draining and Filling Cooling System (LS6)** in Engine Cooling.
14. Install the camshaft covers. Refer to **Camshaft Cover Replacement - Left** and **Camshaft Cover Replacement - Right**.
15. Install the upper intake manifold with the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.
16. Install the engine cover. Refer to **Engine Front Cover Installation** .
17. Fill the cooling system. Refer to **Draining and Filling Cooling System (LP1, LY7)** or **Draining and Filling Cooling System (LS6)** in Engine Cooling.
18. Change the engine oil. Refer to **Engine Oil and Oil Filter Replacement** .

SECONDARY CAMSHAFT DRIVE CHAIN REPLACEMENT - LEFT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
3. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right** .
4. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary**

Camshaft Drive Chain Shoe Removal - Right .

5. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Right .**
6. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right .**
7. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal .**
8. Remove the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Removal - Upper .**
9. Remove the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Removal .**
10. Remove the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Right .**
11. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left .**
12. Remove the left bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Left .**
13. Remove the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Left .**
14. Remove the left bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Left .**

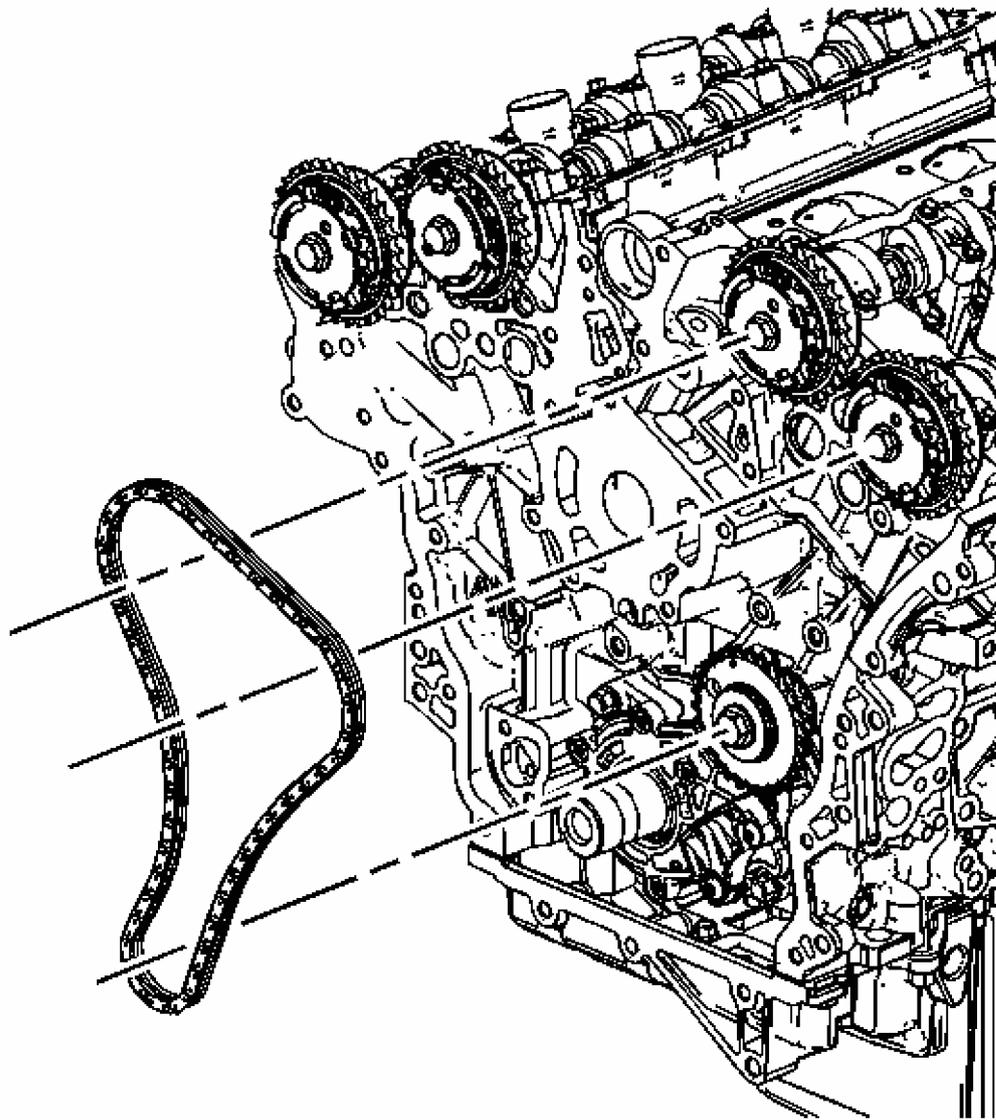


Fig. 126: View Of Left Bank Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

15. Remove the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Left** .
16. Clean and inspect all of the camshaft timing drive components. Refer to **Camshaft Timing Drive Components Cleaning and Inspection** . Replace components as necessary.

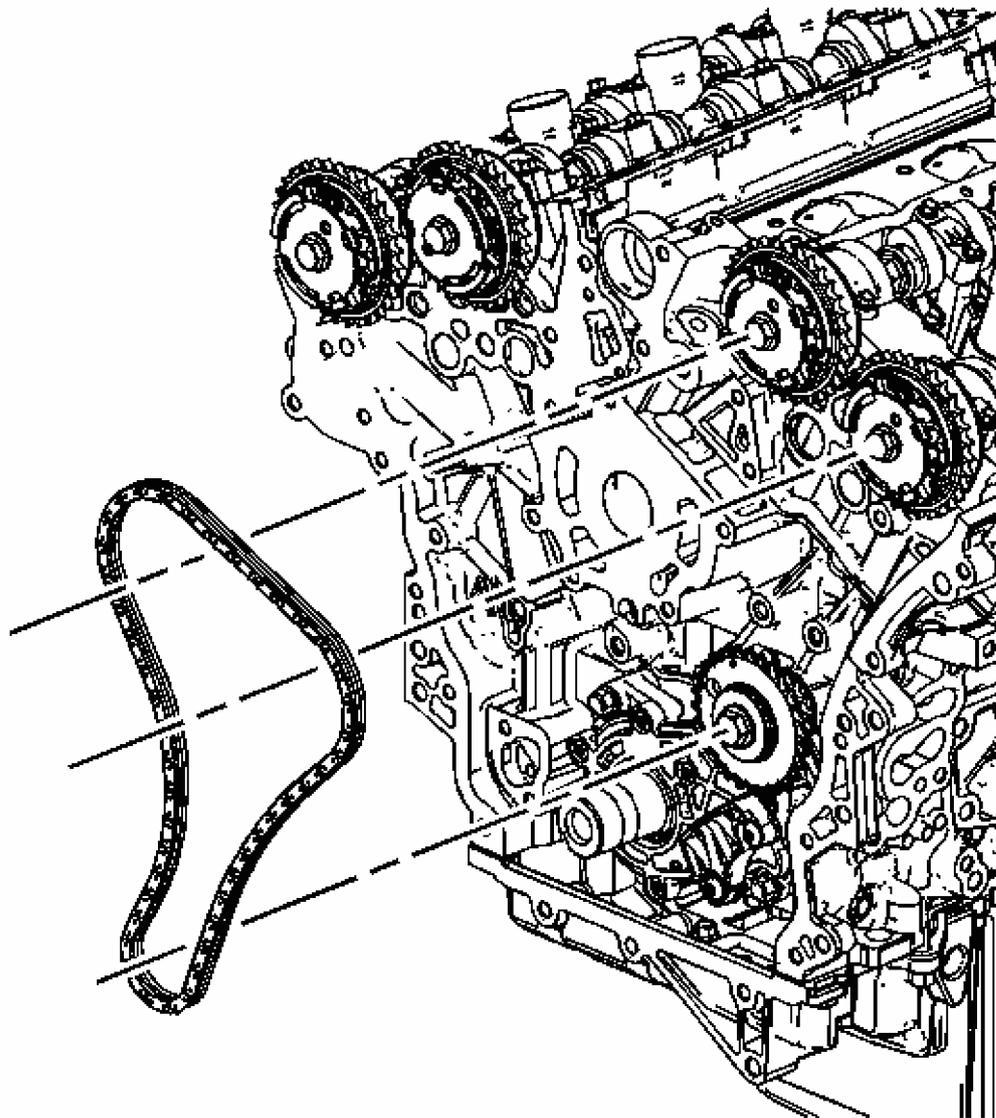


Fig. 127: View Of Left Bank Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Left** .
2. Install the left bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Installation - Left** .
3. Install the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Left** .

4. Install the left bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Left** .
5. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left** .
6. Install the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Installation - Right** .
7. Install the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Installation** .
8. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Installation - Upper** .
9. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation** .
10. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right** .
11. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right** .
12. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right** .
13. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right** .
14. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
15. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN REPLACEMENT - RIGHT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
3. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right** .
4. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Right** .
5. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Right** .

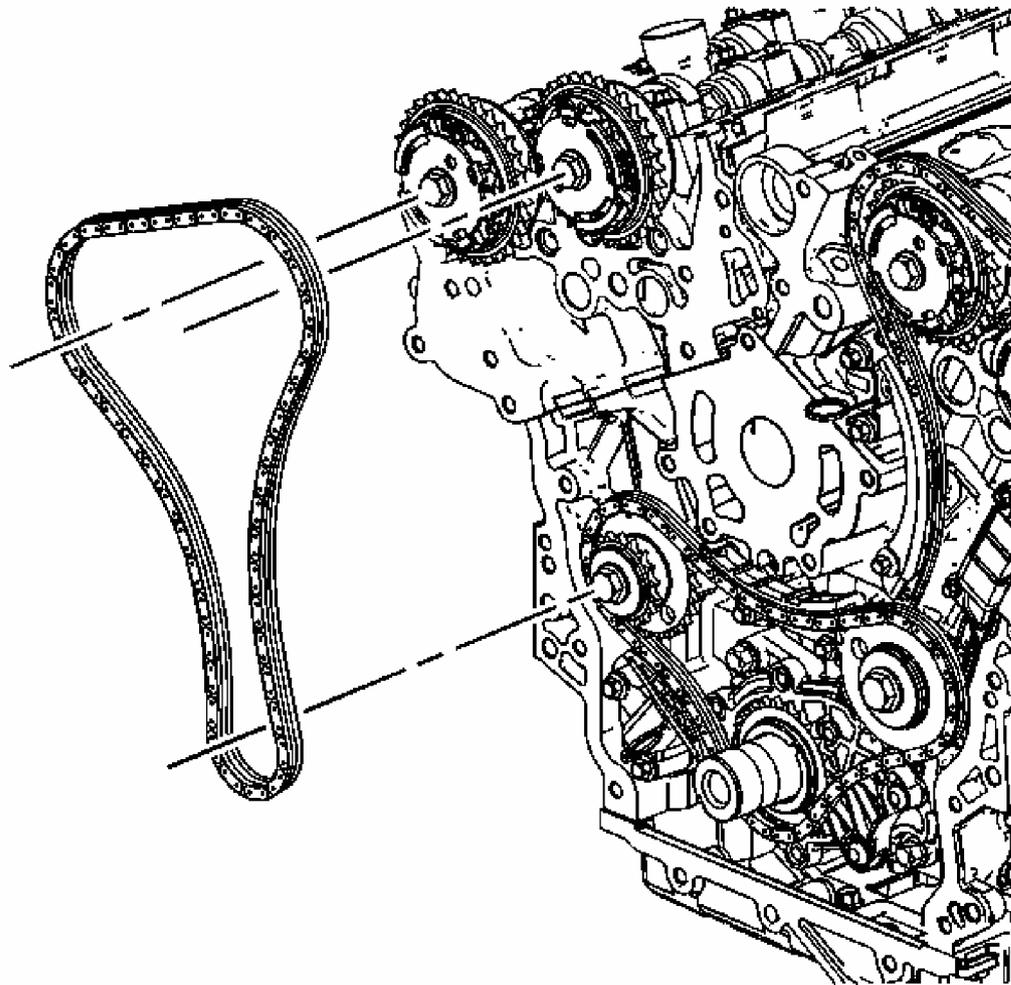


Fig. 128: View Of Right Bank Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

6. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right** .

Installation Procedure

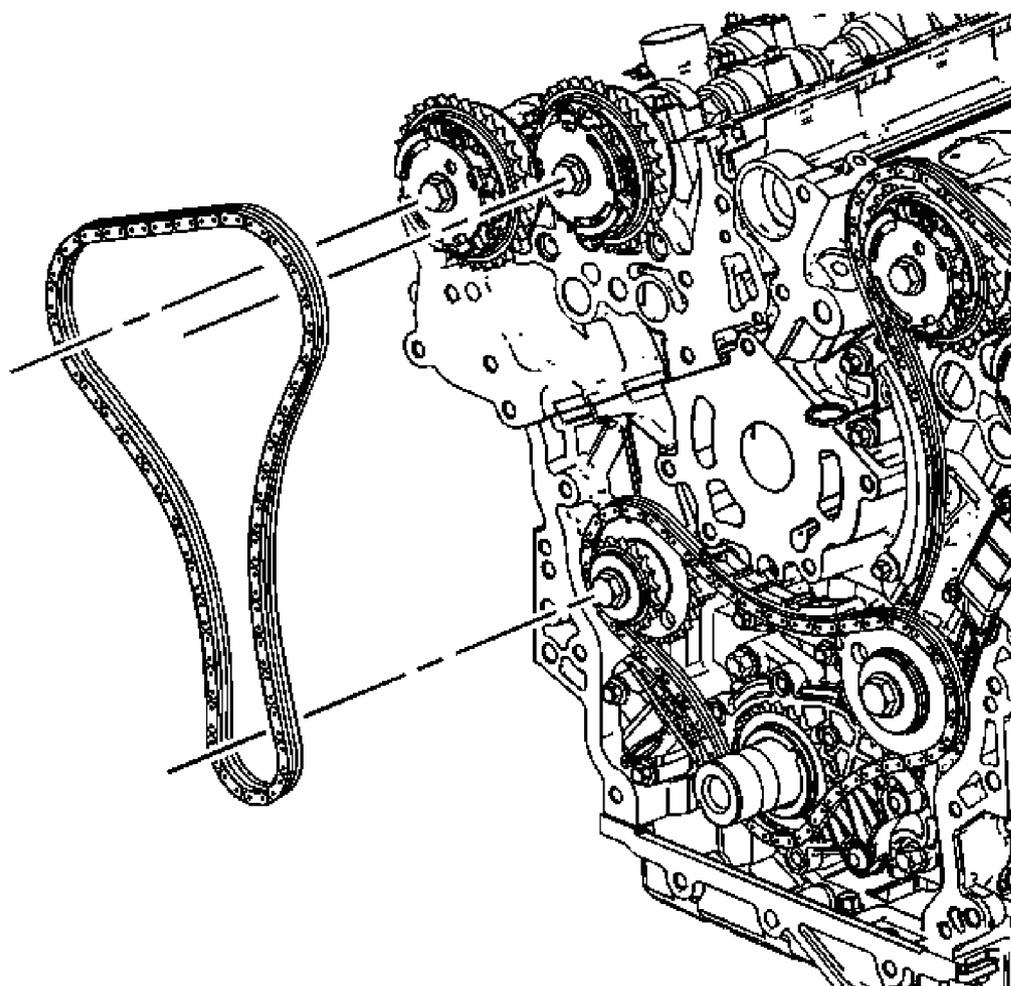


Fig. 129: View Of Right Bank Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

1. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right** .
2. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right** .
3. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right** .
4. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right** .
5. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L

(LY7).

6. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN TENSIONER REPLACEMENT - LEFT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.

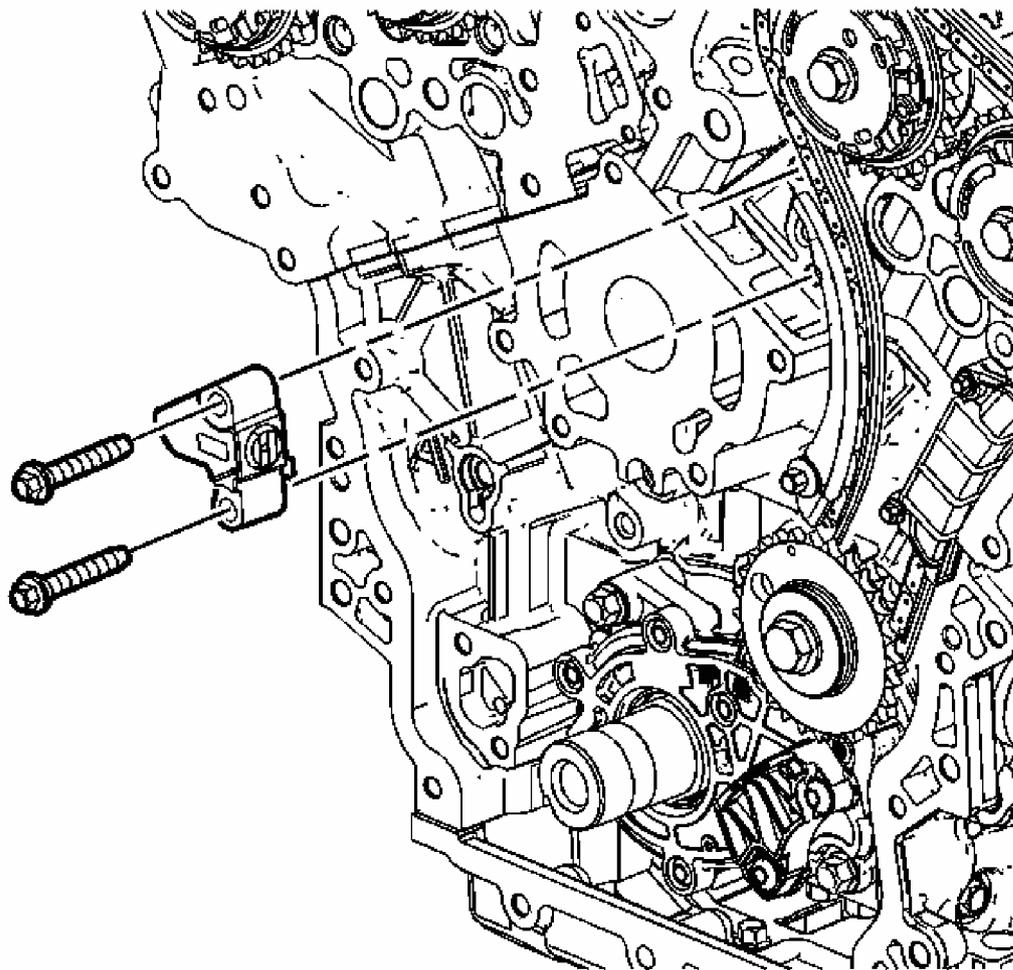


Fig. 130: Location Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left**.

Installation Procedure

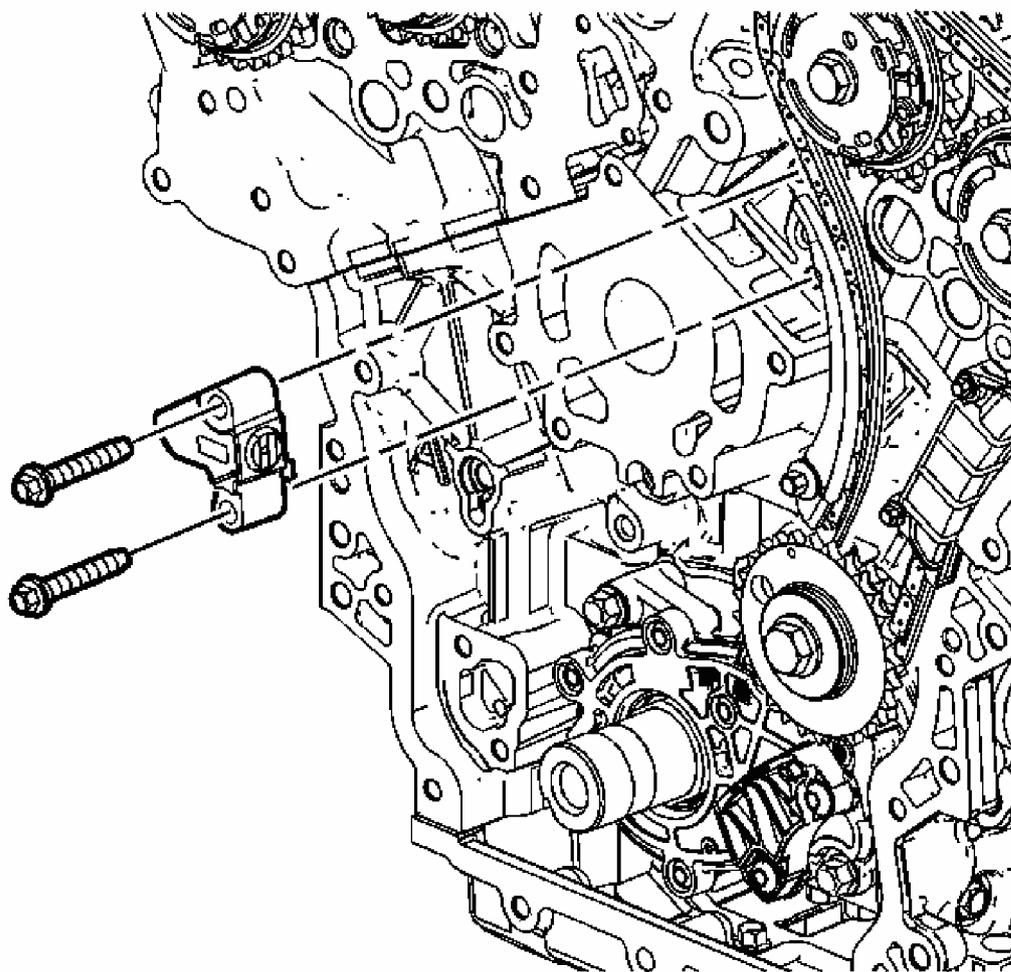


Fig. 131: Location Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left**.
2. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
3. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN TENSIONER REPLACEMENT - RIGHT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.

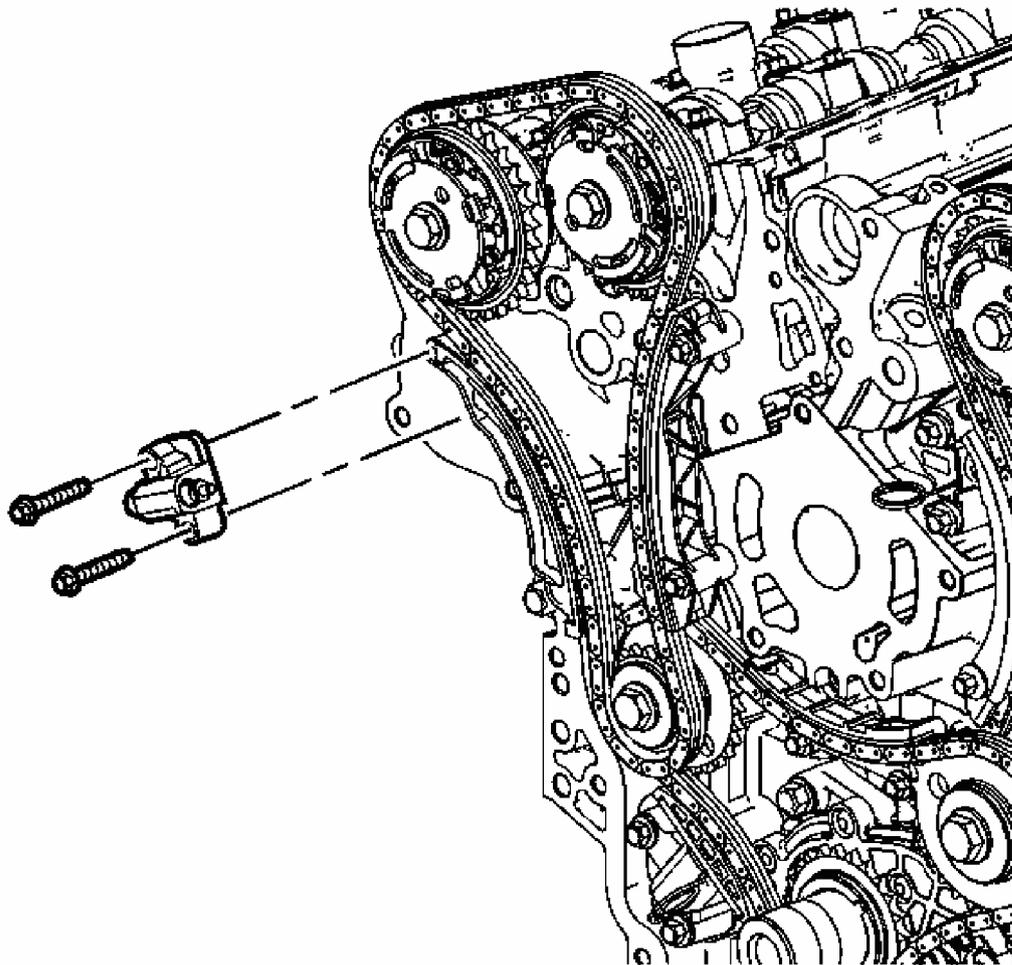


Fig. 132: View Of Right Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right**.

Installation Procedure

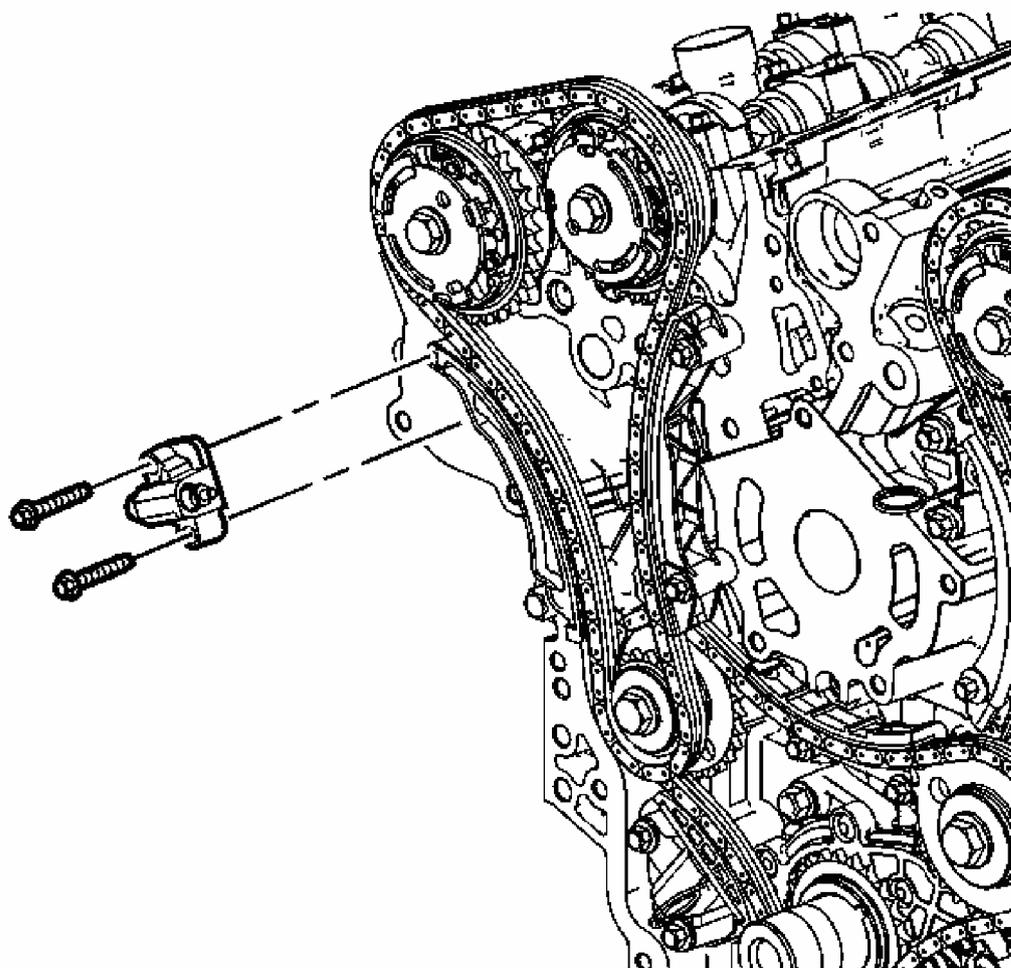


Fig. 133: View Of Right Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right** .
2. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
3. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN SHOE REPLACEMENT - LEFT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug**

Replacement in Engine Controls - 3.6L (LY7).

2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.

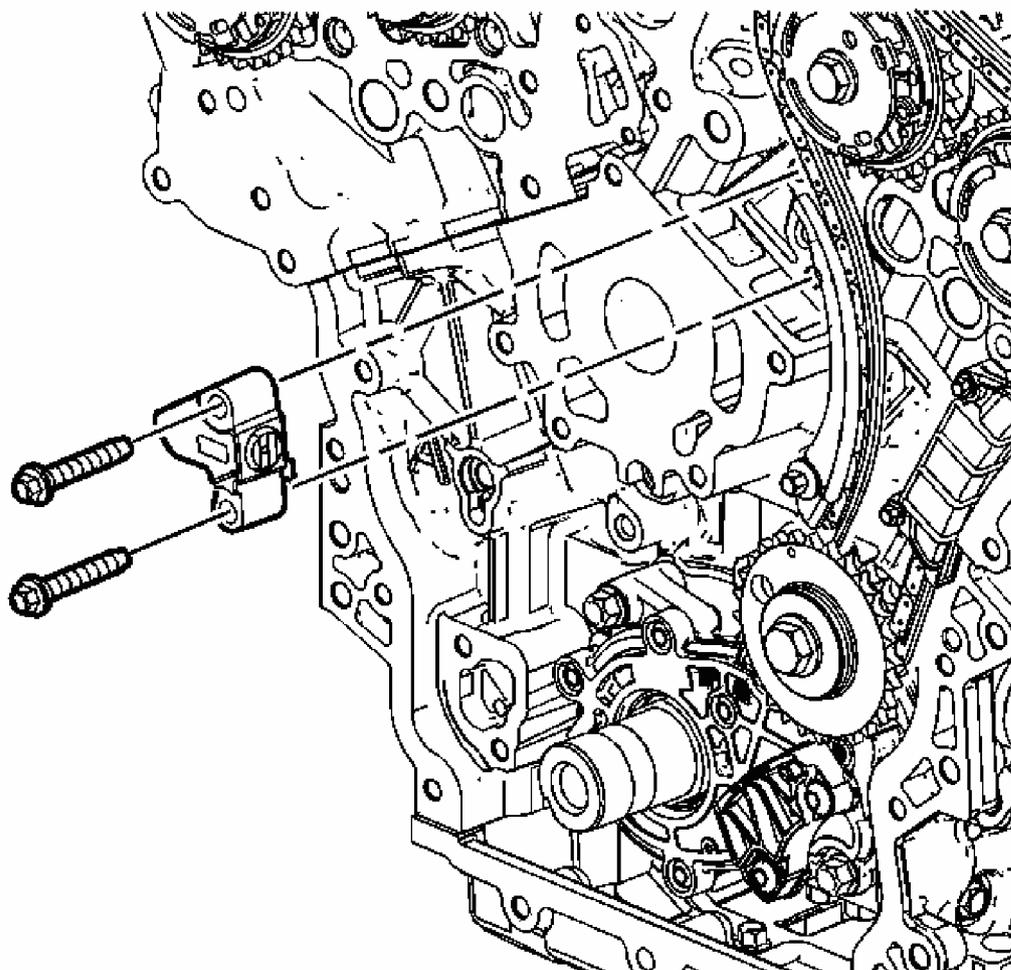


Fig. 134: Location Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left**.

Installation Procedure

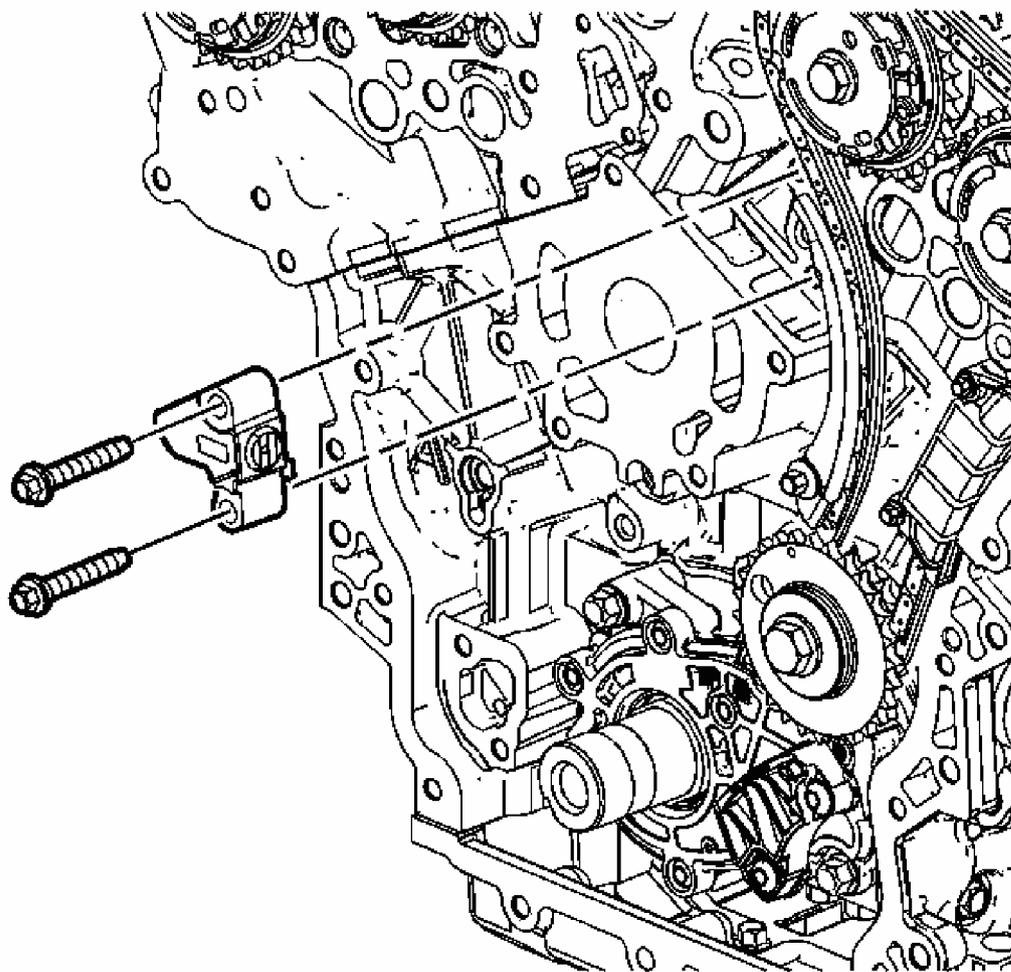


Fig. 135: Location Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left** .
2. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
3. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN SHOE REPLACEMENT - RIGHT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug**

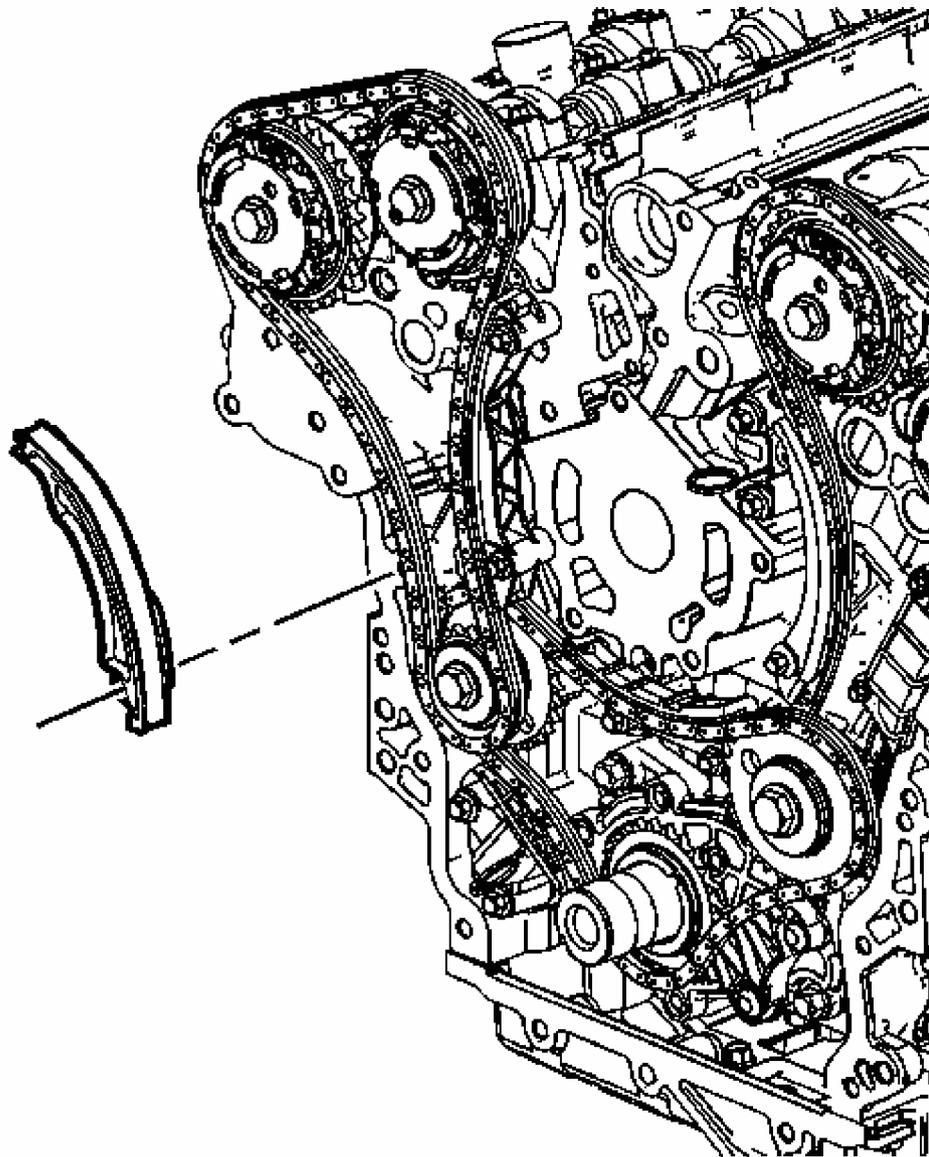


Fig. 136: View Of Right Secondary Camshaft Drive Chain Shoe
Courtesy of GENERAL MOTORS CORP.

2. Remove the engine front cover. Refer to Engine Front Cover Replacement.
3. Remove the right bank secondary camshaft drive chain tensioner. Refer to Secondary Camshaft Drive Chain Tensioner Removal - Right .

4. Remove the right bank secondary camshaft drive chain shoe. Refer to Secondary Camshaft Drive Chain Shoe Removal - Right.

Installation Procedure

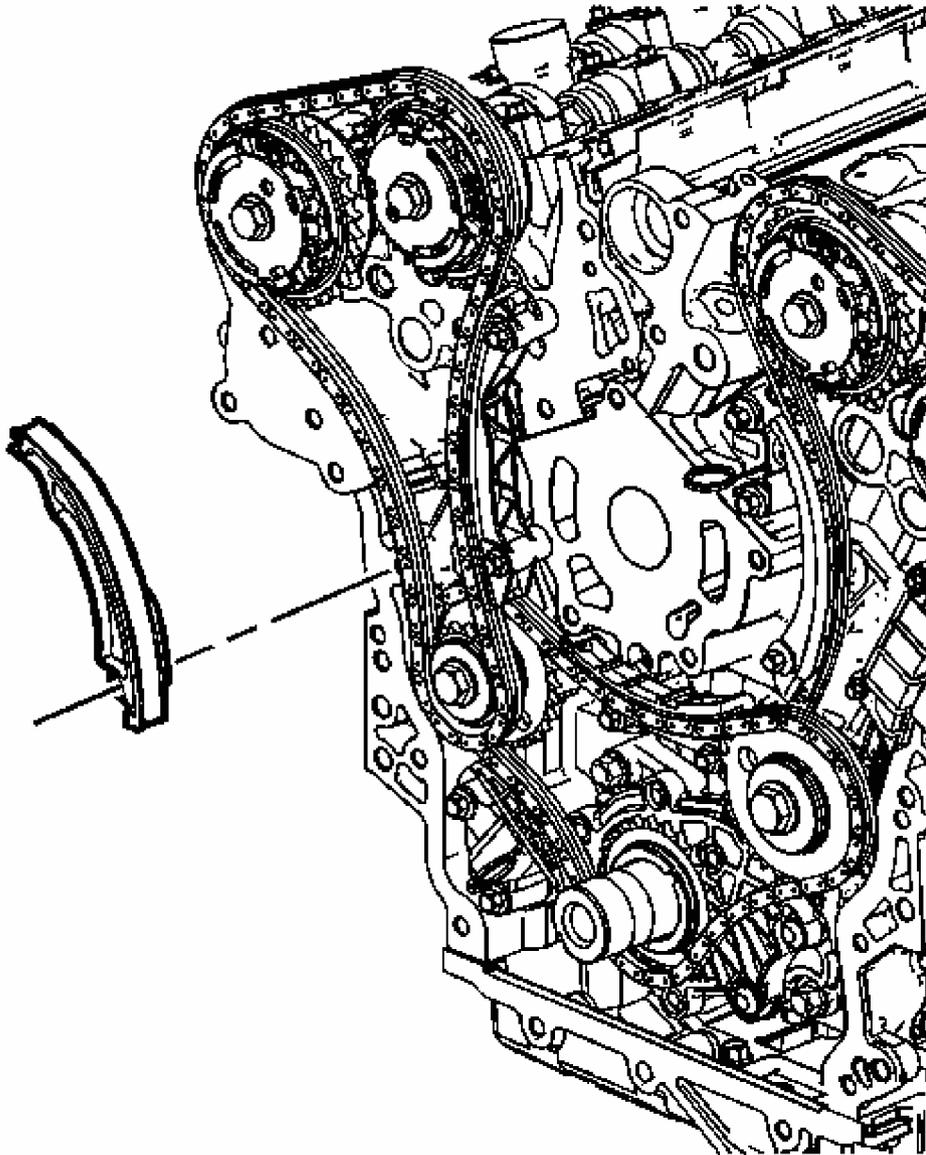


Fig. 137: View Of Right Secondary Camshaft Drive Chain Shoe
Courtesy of GENERAL MOTORS CORP.

1. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary**

Camshaft Drive Chain Shoe Installation - Right .

2. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right .**
3. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
4. Install the engine front cover. Refer to **Engine Front Cover Replacement.**

SECONDARY CAMSHAFT DRIVE CHAIN GUIDE REPLACEMENT - LEFT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement.**
3. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left .**

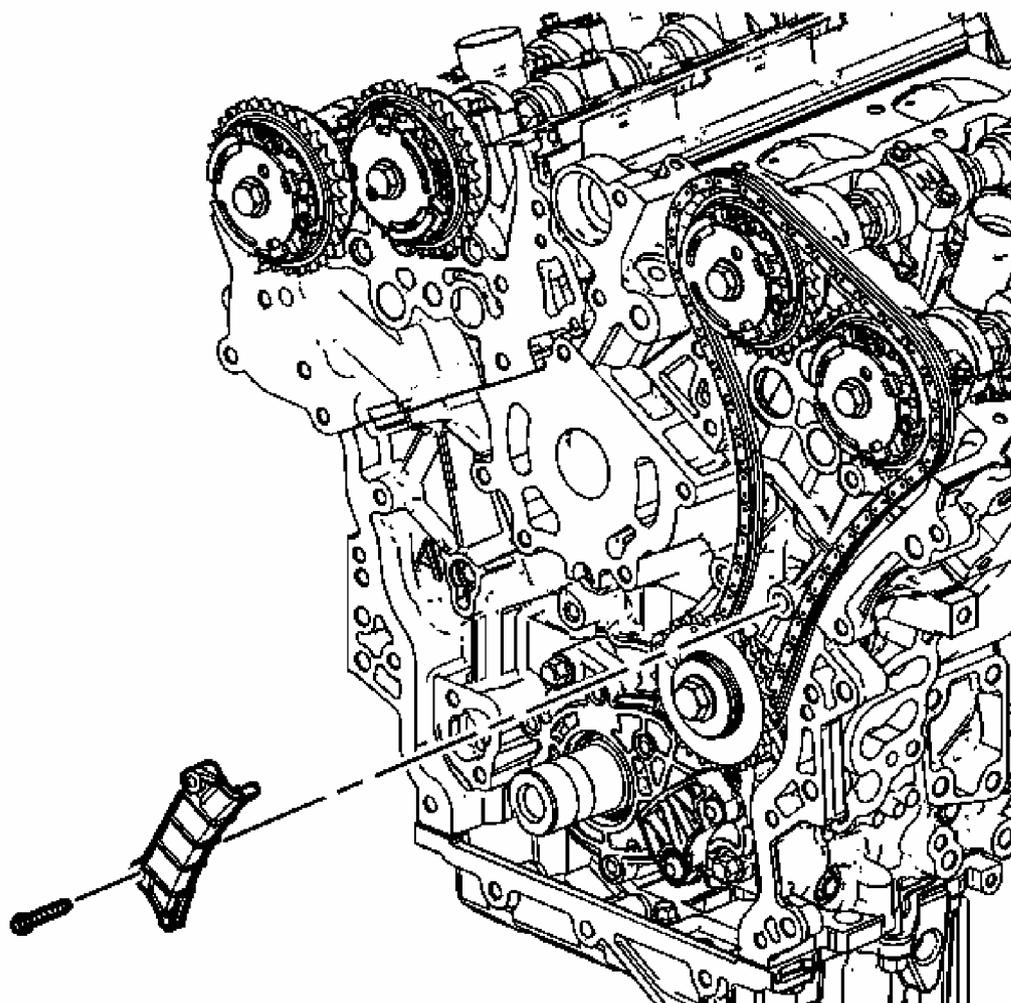


Fig. 138: View Of Left Bank Secondary Camshaft Drive Chain Guide
Courtesy of GENERAL MOTORS CORP.

4. Remove the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Left** .

Installation Procedure

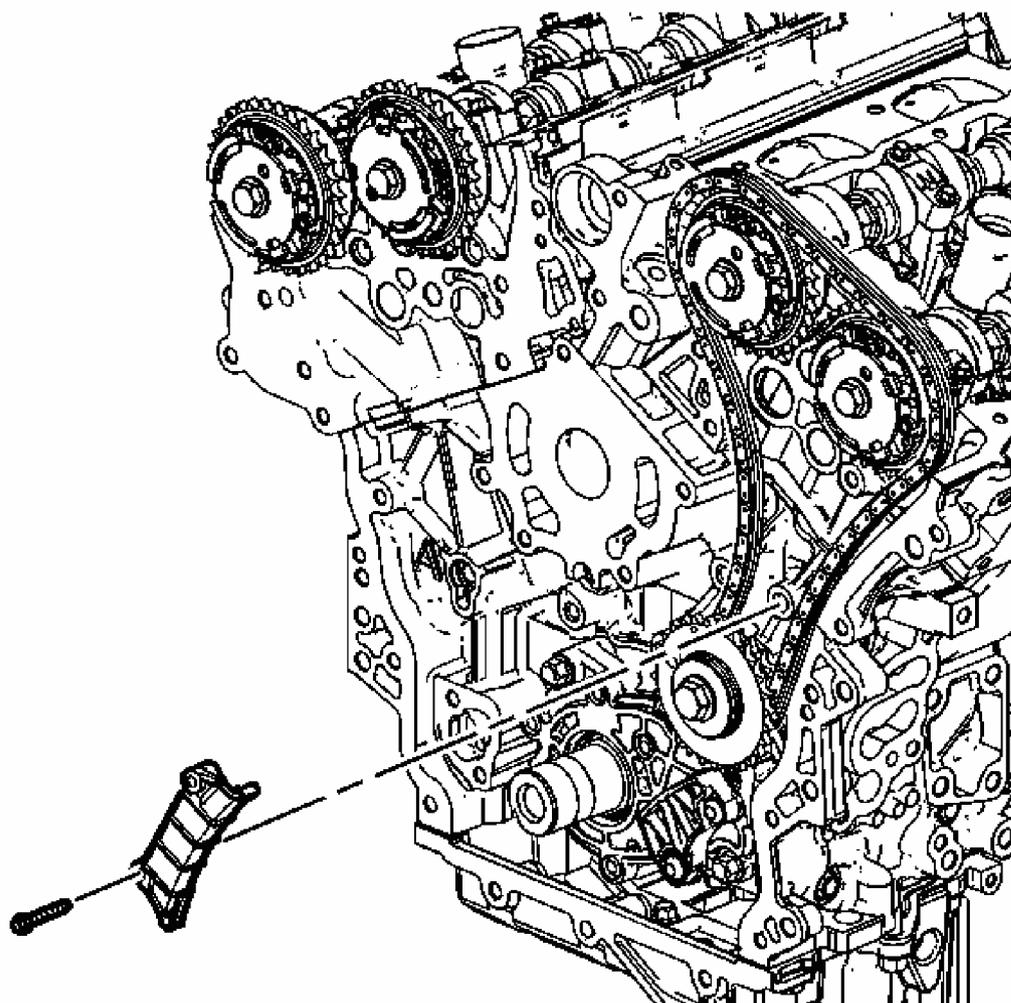


Fig. 139: View Of Left Bank Secondary Camshaft Drive Chain Guide
Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Left** .
2. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left** .
3. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
4. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
3. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right** .

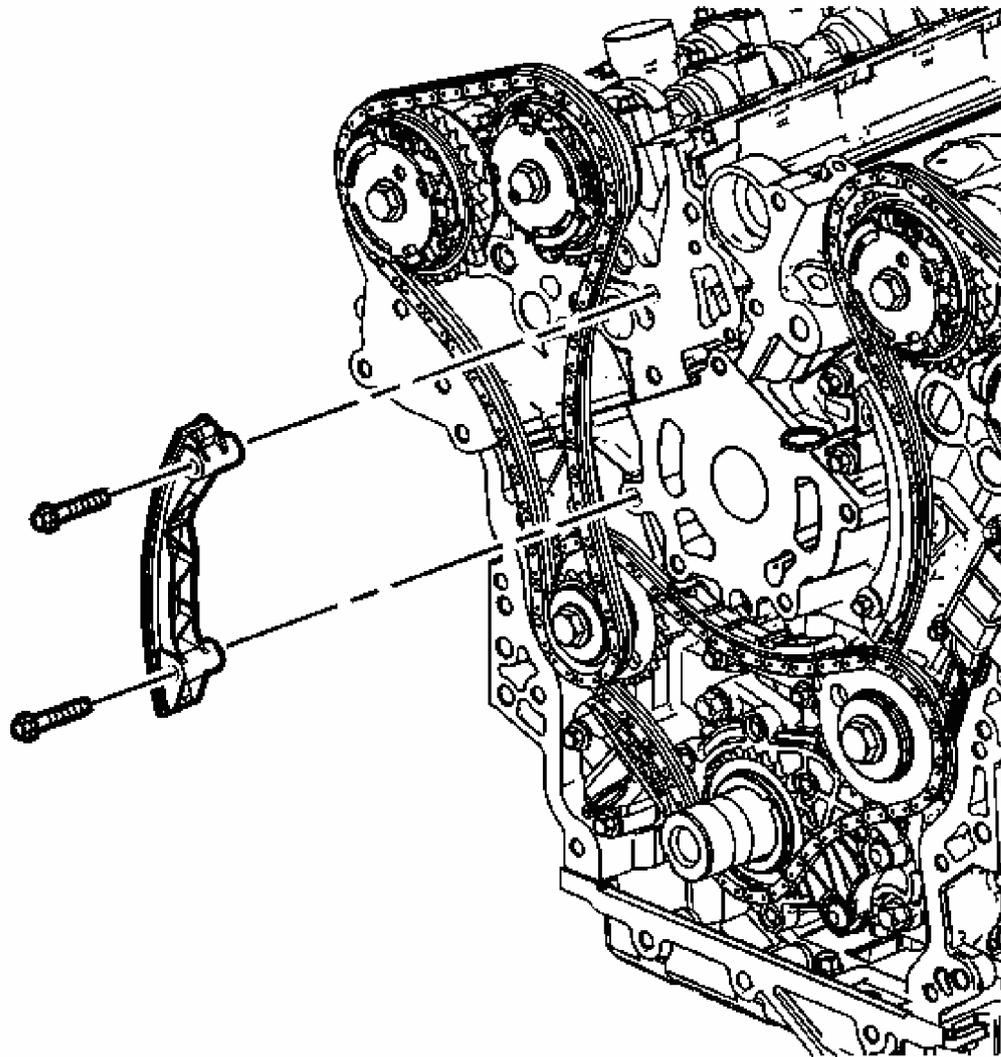


Fig. 140: View Of Right Secondary Camshaft Drive Chain Guide & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the right bank secondary camshaft drive chain guide. Refer to Secondary Camshaft Drive Chain Guide Removal - Right .

Installation Procedure

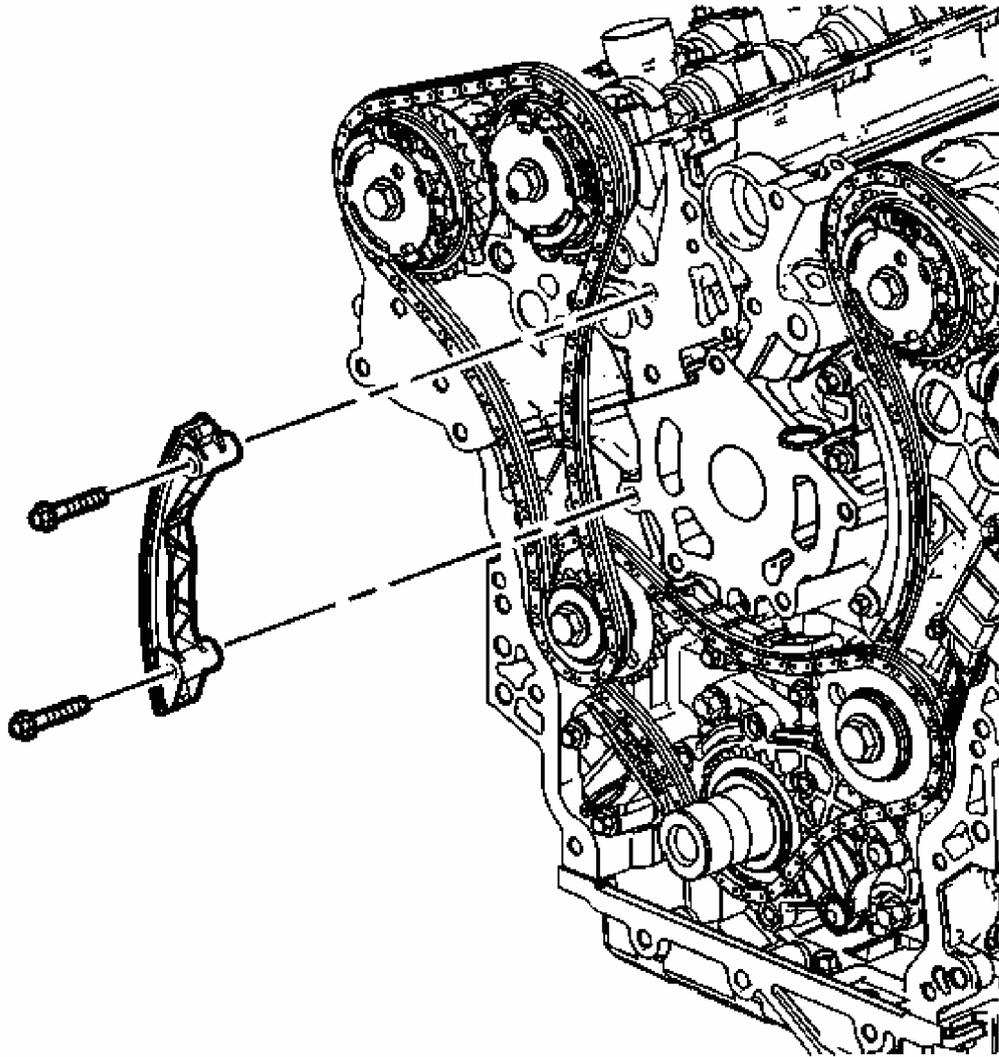


Fig. 141: View Of Right Secondary Camshaft Drive Chain Guide & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the right bank secondary camshaft drive chain guide. Refer to Secondary Camshaft Drive Chain Guide Installation - Right .
2. Install the right bank secondary camshaft drive chain tensioner. Refer to Secondary

Camshaft Drive Chain Tensioner Installation - Right .

3. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
4. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

PRIMARY CAMSHAFT DRIVE CHAIN AND SPROCKETS REPLACEMENT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
3. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right .**
4. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Right .**
5. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Right .**
6. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right .**
7. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal .**
8. Remove the primary camshaft drive chain upper guide. **Primary Camshaft Drive Chain Guide Removal - Upper .**

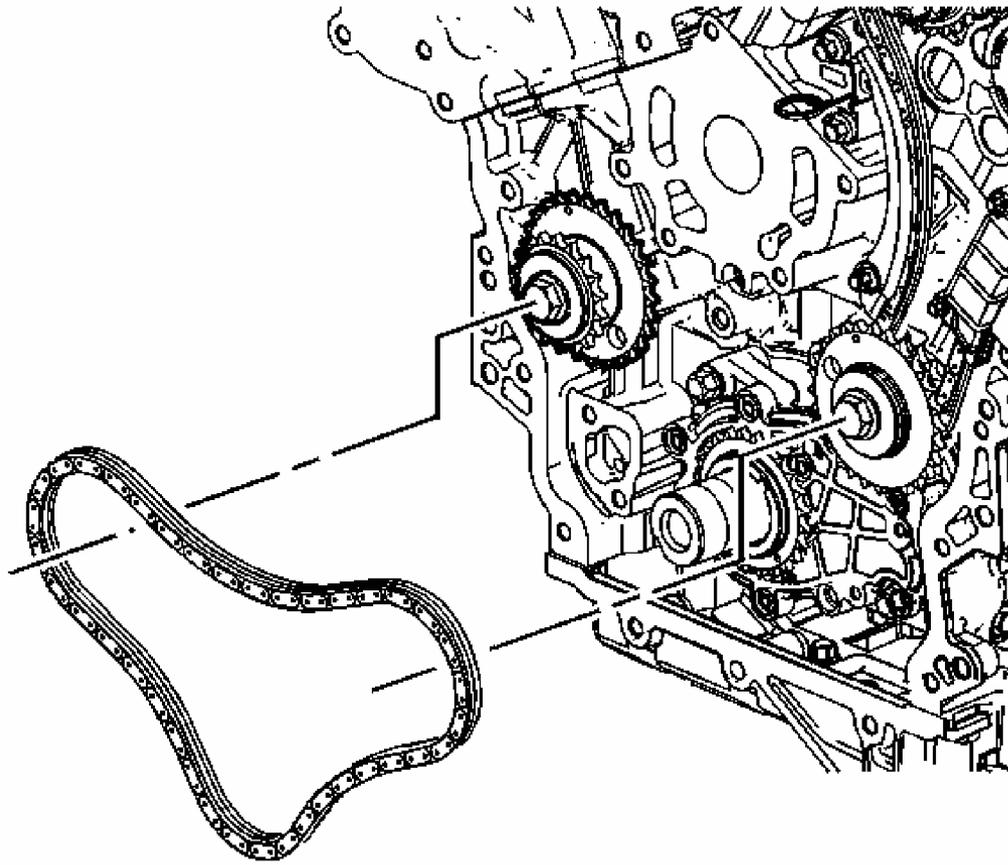


Fig. 142: View Of Primary Camshaft Timing Chain
Courtesy of GENERAL MOTORS CORP.

9. Remove the primary camshaft timing chain. Refer to **Secondary Camshaft Drive Chain Removal - Right** .

Installation Procedure

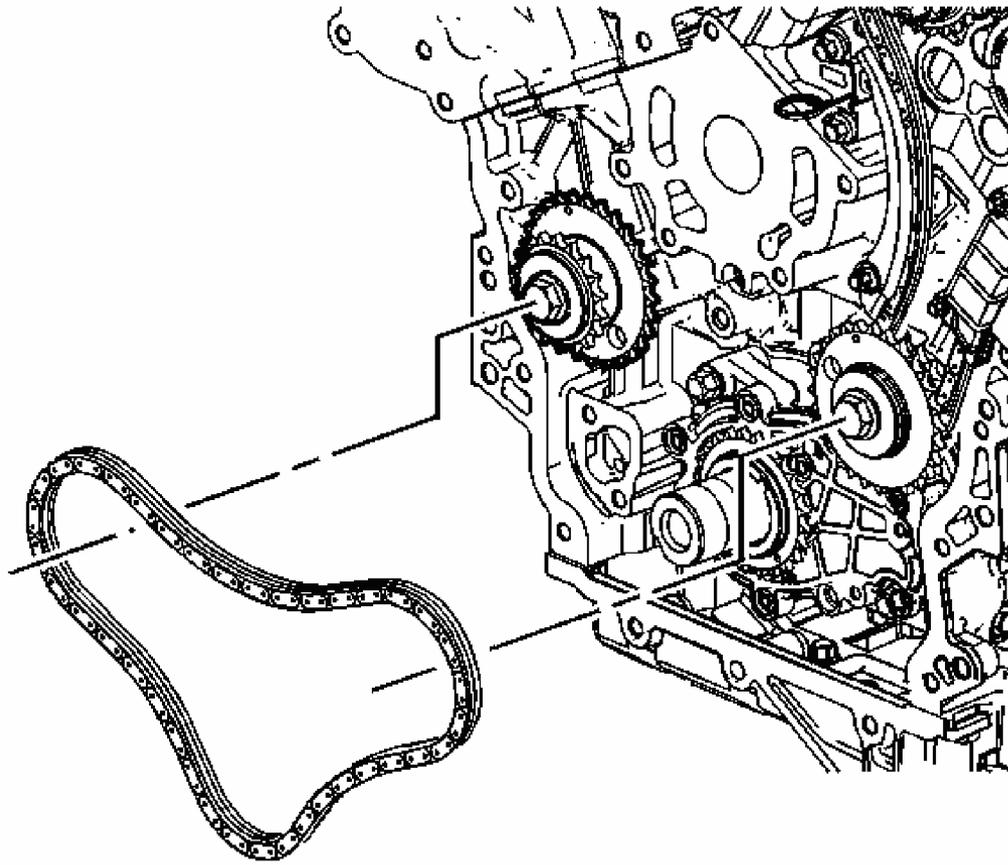


Fig. 143: View Of Primary Camshaft Timing Chain
Courtesy of GENERAL MOTORS CORP.

1. Install the primary camshaft timing chain. Refer to **Primary Camshaft Drive Chain Installation** .
2. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Installation - Upper** .
3. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation** .
4. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right** .
5. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right** .
6. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right** .

7. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right** .
8. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
9. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

CAMSHAFT INTERMEDIATE DRIVE CHAIN IDLER SPROCKET REPLACEMENT - LEFT LEFT

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).

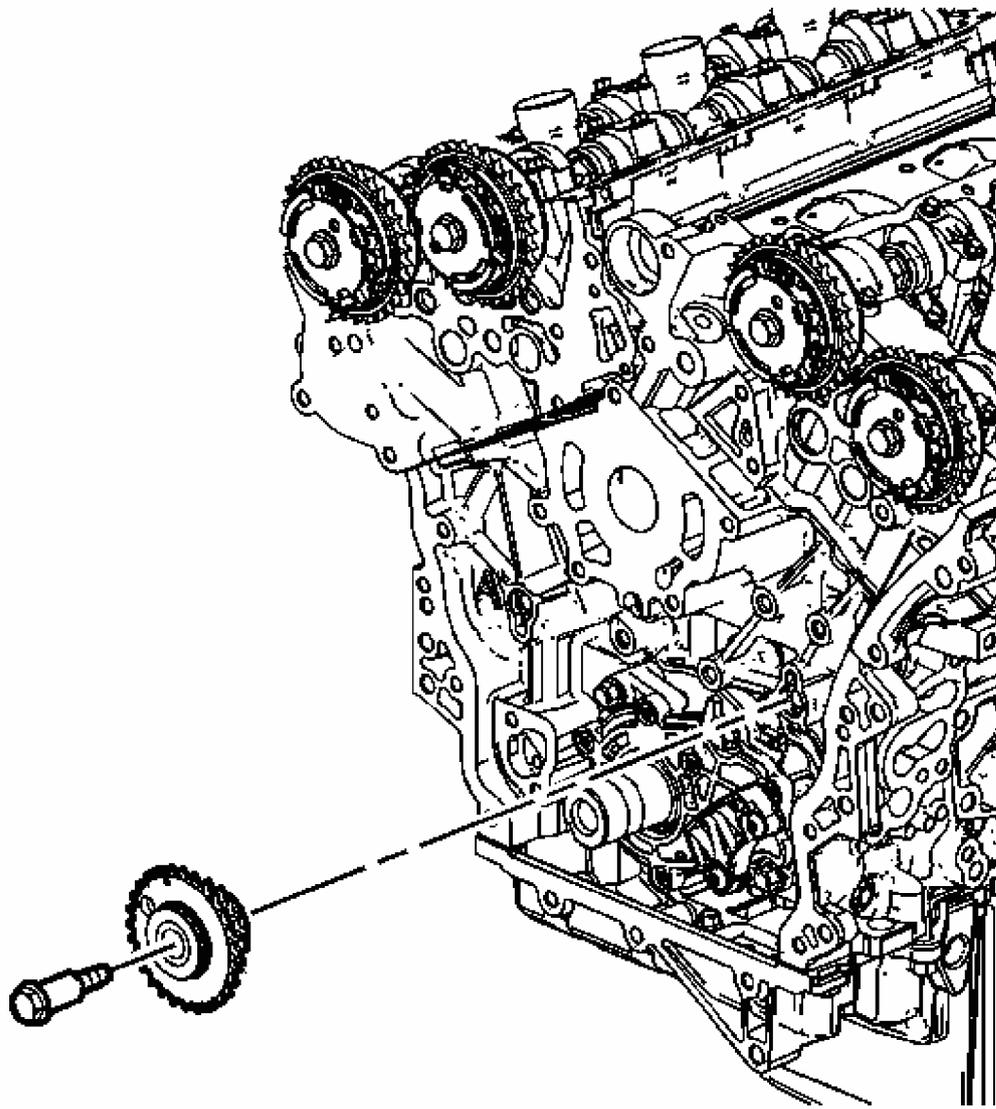


Fig. 144: View Of Left Camshaft Intermediate Drive Chain Idler
Courtesy of GENERAL MOTORS CORP.

2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
3. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right**.
4. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Right**.
5. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary**

Camshaft Drive Chain Guide Removal - Right .

6. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right .**
7. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal .**
8. Remove the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Removal - Upper .**
9. Remove the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Removal .**
10. Remove the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Right .**

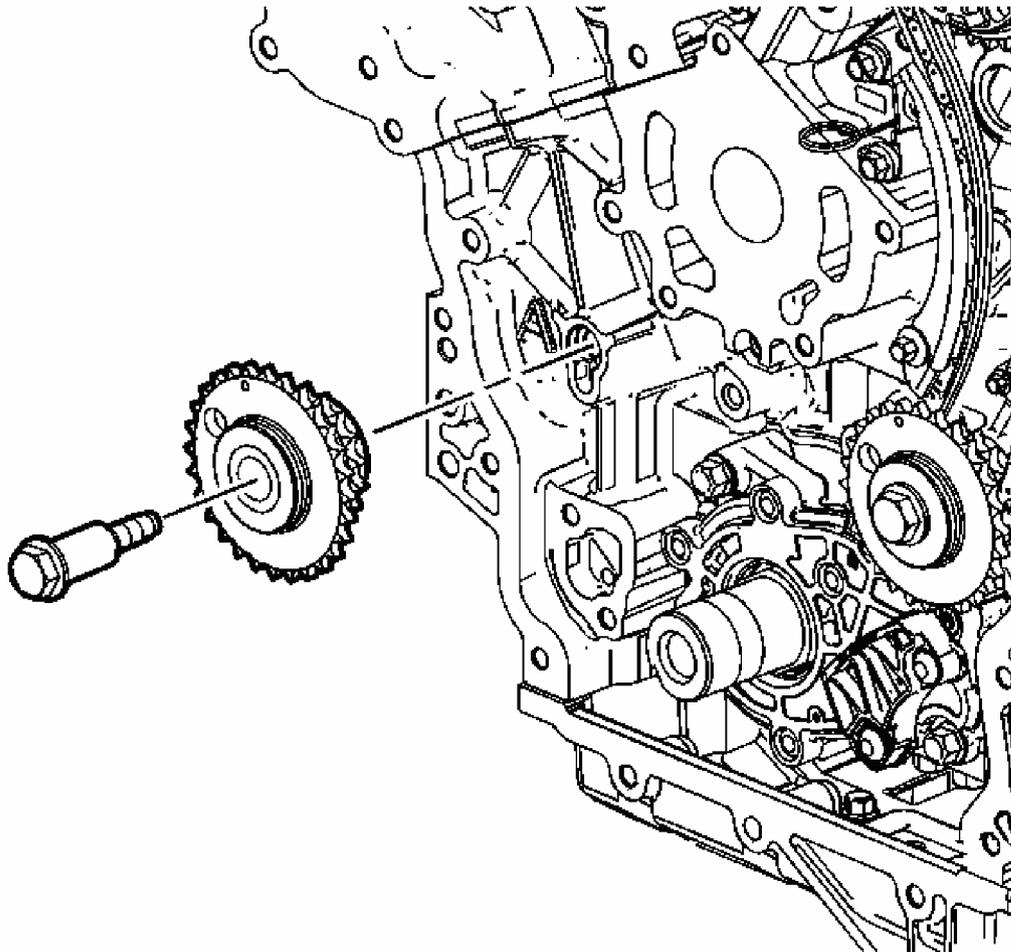


Fig. 145: View Of Right And Left Camshaft Intermediate Drive Chain Idlers

Courtesy of GENERAL MOTORS CORP.

11. If you are servicing the left bank camshaft intermediate drive chain idler, perform the following steps:
 1. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left** .
 2. Remove the left bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Left** .
 3. Remove the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Left** .
 4. Remove the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Left** .
 5. Remove the left bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Left** .

Installation Procedure

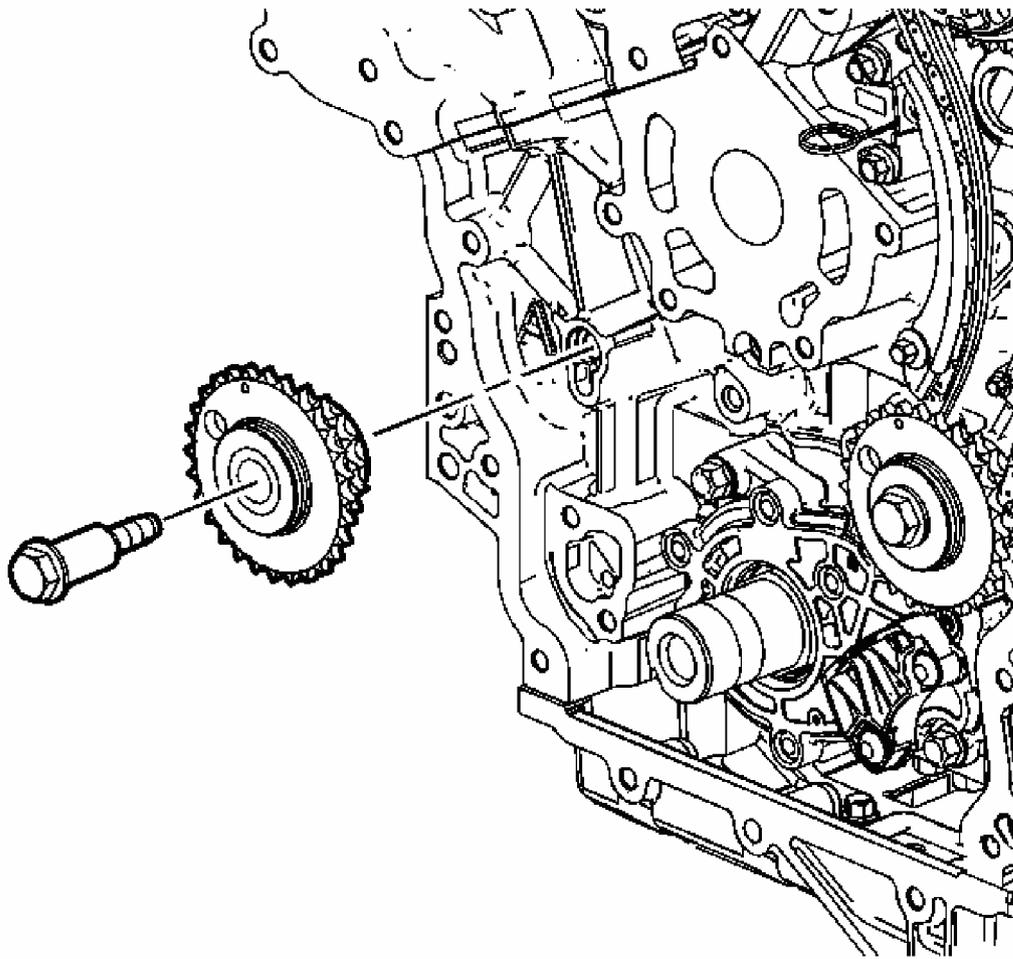


Fig. 146: View Of Right And Left Camshaft Intermediate Drive Chain Idlers
Courtesy of GENERAL MOTORS CORP.

1. If you are servicing the left bank idler sprocket, perform the following steps:
 1. Install the left bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Installation - Left** .
 2. Install the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Left** .
 3. Install the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Left** .
 4. Install the left bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Left** .
 5. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary**

Camshaft Drive Chain Tensioner Installation - Left .

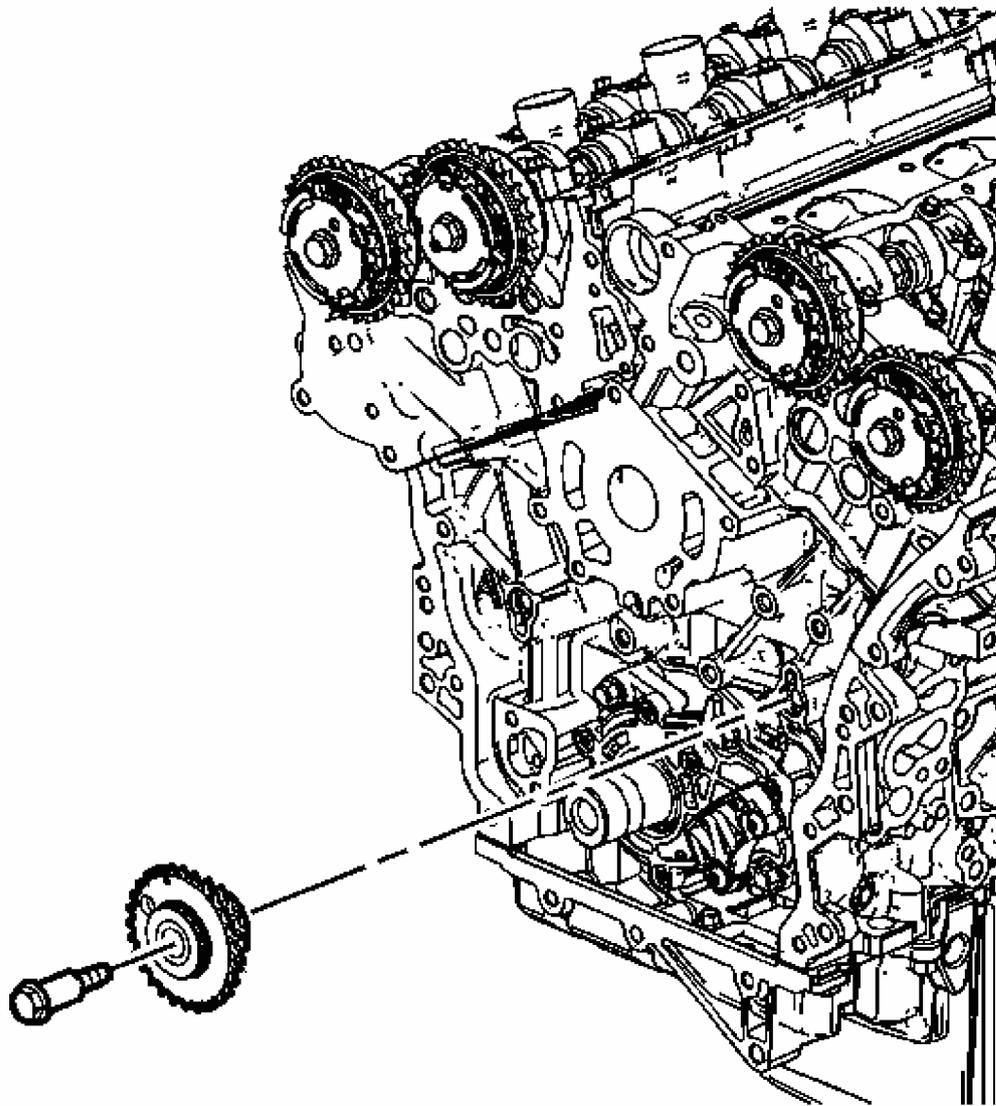


Fig. 147: View Of Left Camshaft Intermediate Drive Chain Idler
Courtesy of GENERAL MOTORS CORP.

2. Install the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Installation - Right** .
3. Install the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Installation** .
4. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft**

Drive Chain Guide Installation - Upper .

5. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation .**
6. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right .**
7. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right .**
8. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right .**
9. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right .**
10. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
11. Install the engine front cover. Refer to **Engine Front Cover Replacement.**

PRIMARY CAMSHAFT DRIVE CHAIN TENSIONER REPLACEMENT

Removal Procedure

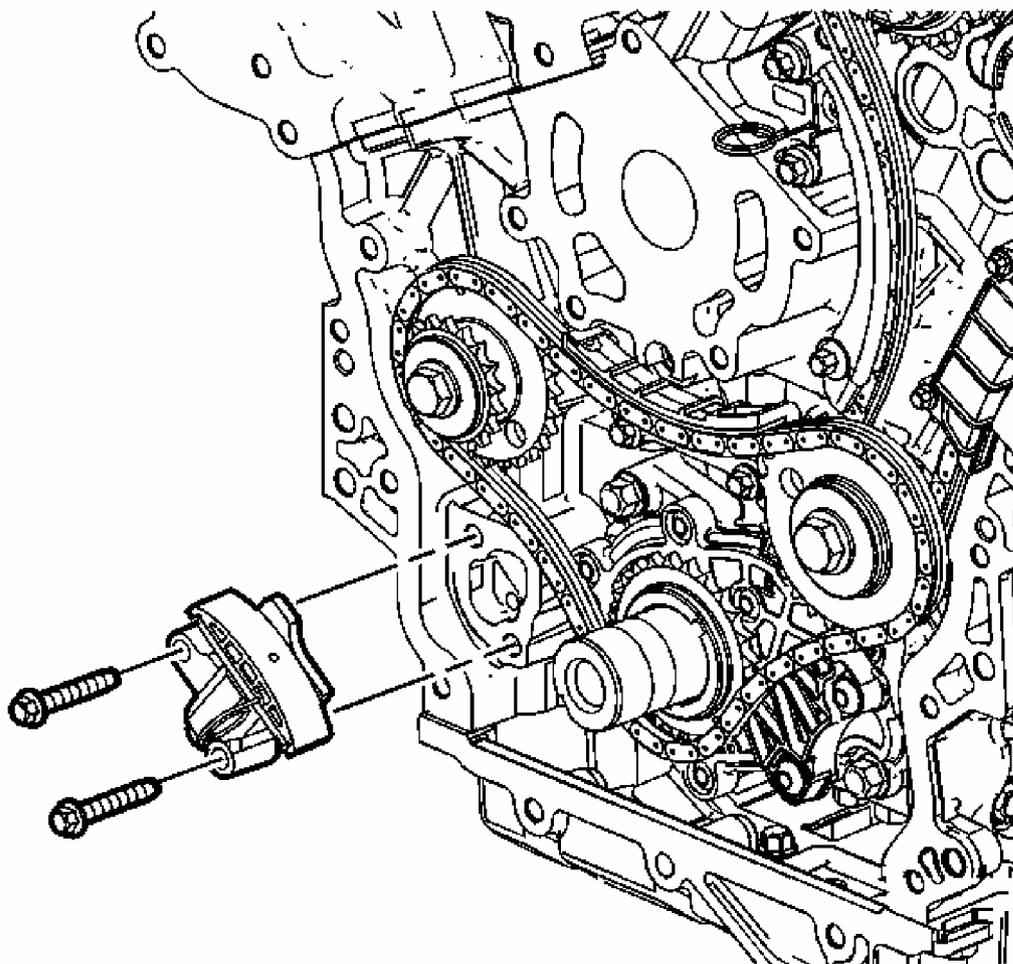


Fig. 148: View Of Primary Camshaft Drive Chain Tensioners
Courtesy of GENERAL MOTORS CORP.

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.

IMPORTANT: If the entire camshaft timing system is not in Stage 2 (**Camshaft Timing Drive Chain Alignment Diagram (With Primary Roller Chain)** or **Camshaft Timing Drive Chain Alignment Diagram (W/Primary (IT) Inverted Tooth Chain)**), mark the timing chain and sprockets in order to ensure proper reassembly.

3. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal** .

Installation Procedure

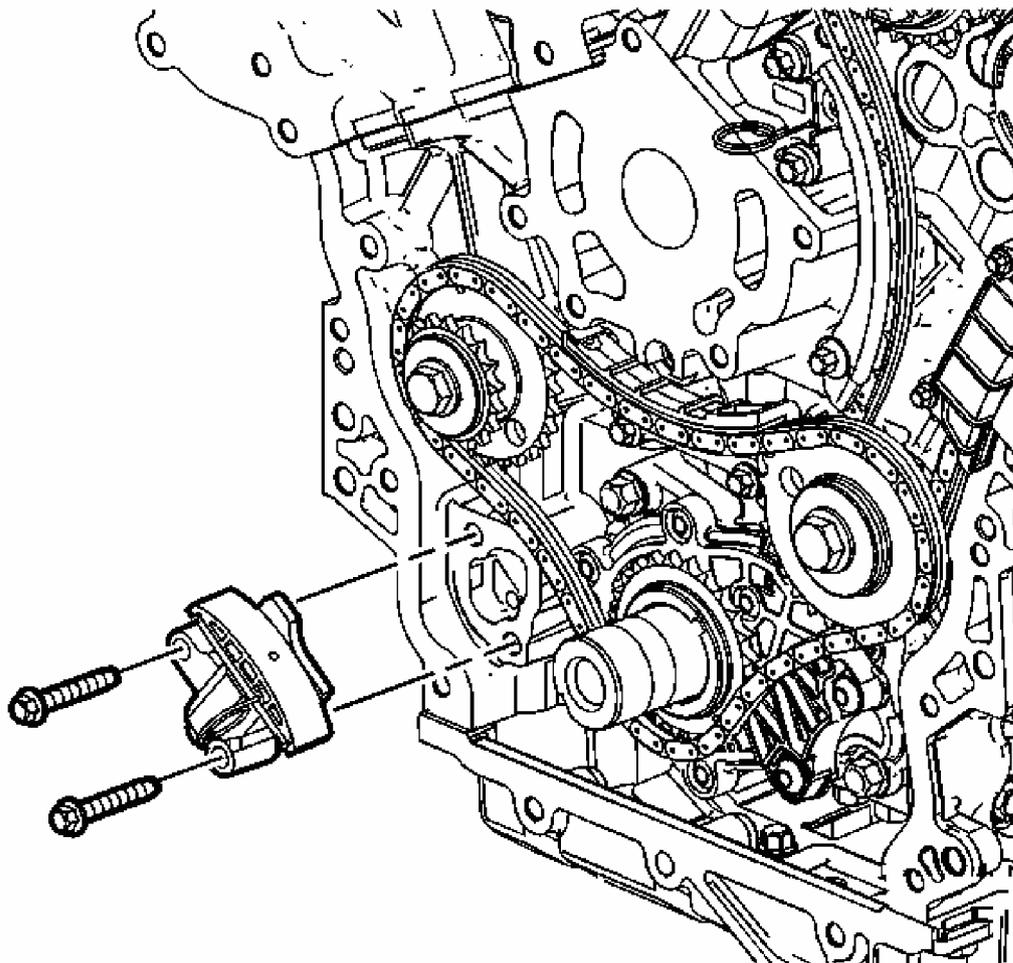


Fig. 149: View Of Primary Camshaft Drive Chain Tensioners
Courtesy of GENERAL MOTORS CORP.

1. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation** .
2. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
3. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REPLACEMENT - LOWER

The primary camshaft drive chain guide is not serviceable separately. If the guide is worn or damaged, the guide must be replaced with the oil pump.

PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REPLACEMENT - UPPER

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.

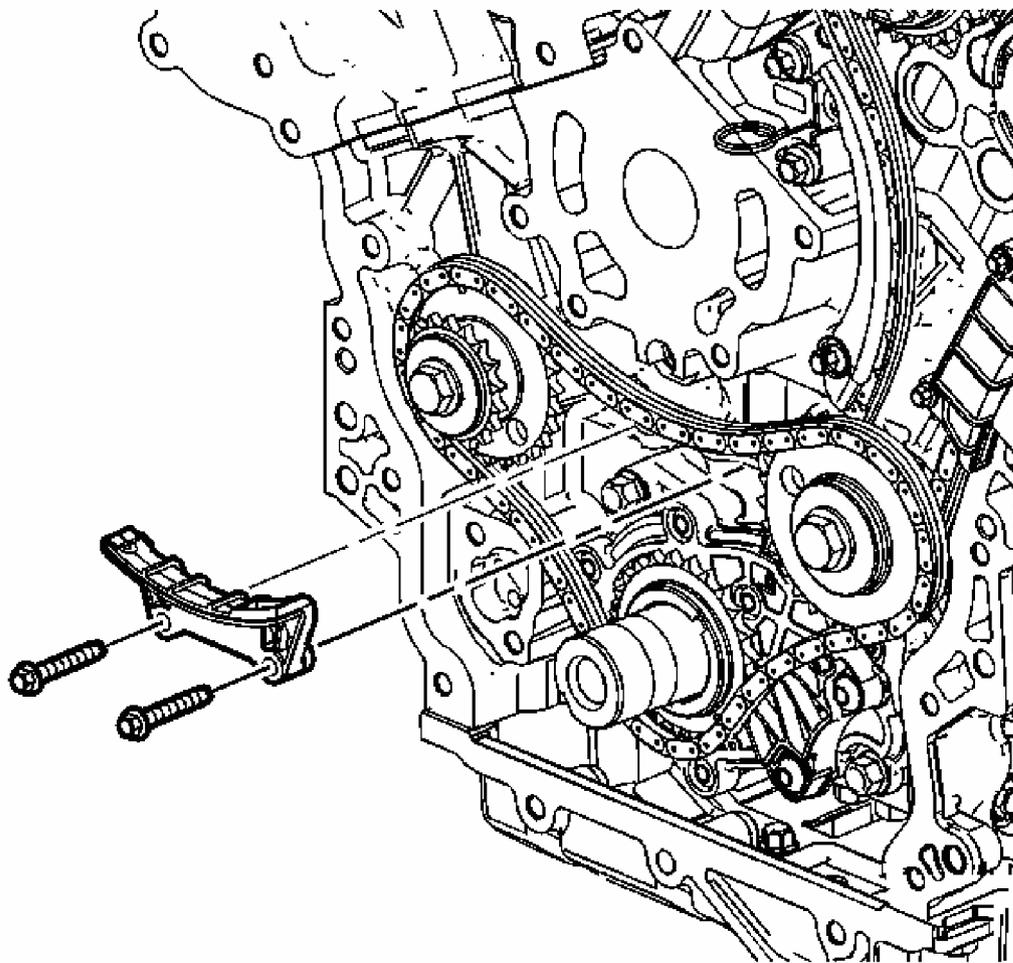


Fig. 150: View Of Upper Primary Camshaft Drive Chain Guides
Courtesy of GENERAL MOTORS CORP.

3. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal** .
4. Remove the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Removal - Upper** .

Installation Procedure

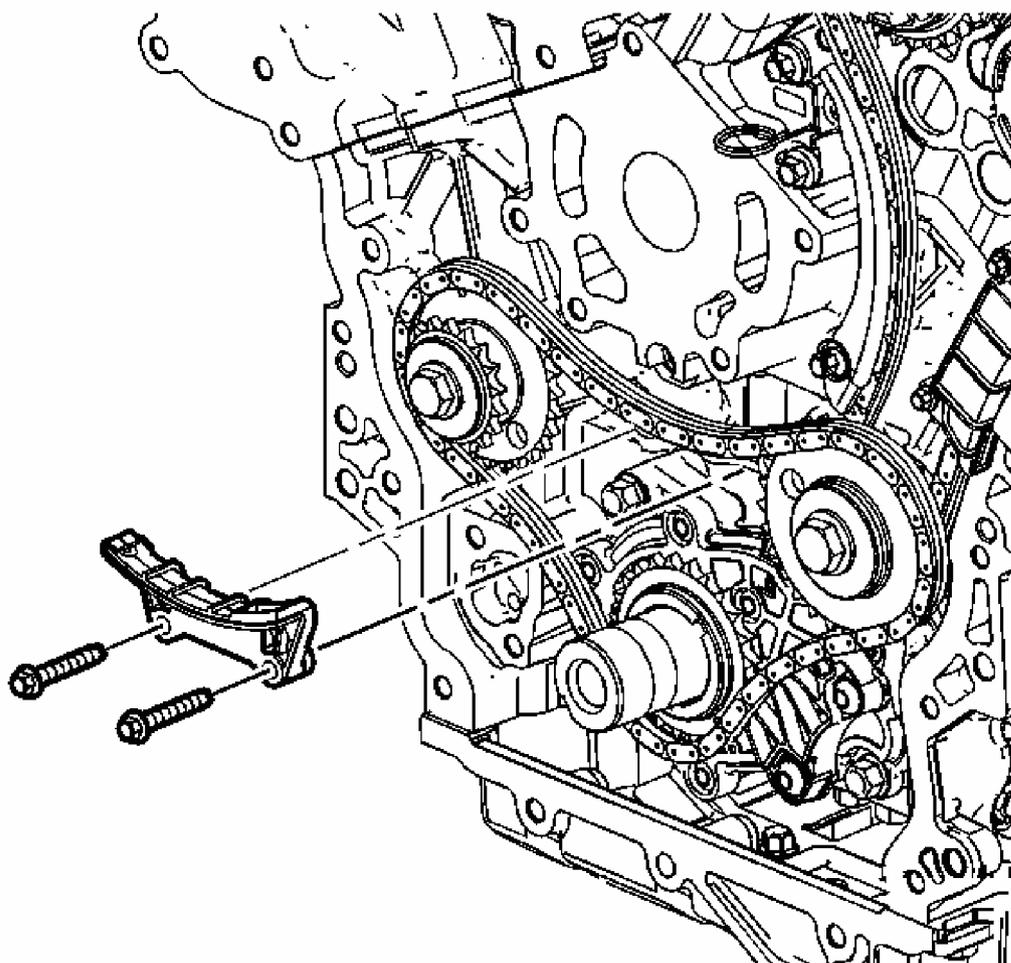


Fig. 151: View Of Upper Primary Camshaft Drive Chain Guides
Courtesy of GENERAL MOTORS CORP.

1. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Installation - Upper** .
2. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation** .

3. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
4. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

CAMSHAFT POSITION (CMP) ACTUATOR REPLACEMENT - BANK 2 (LEFT) EXHAU EXHAUST

Removal Procedure

NOTE: Refer to **Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices**.

1. Remove the camshaft. Refer to **Camshaft Replacement - Left**.

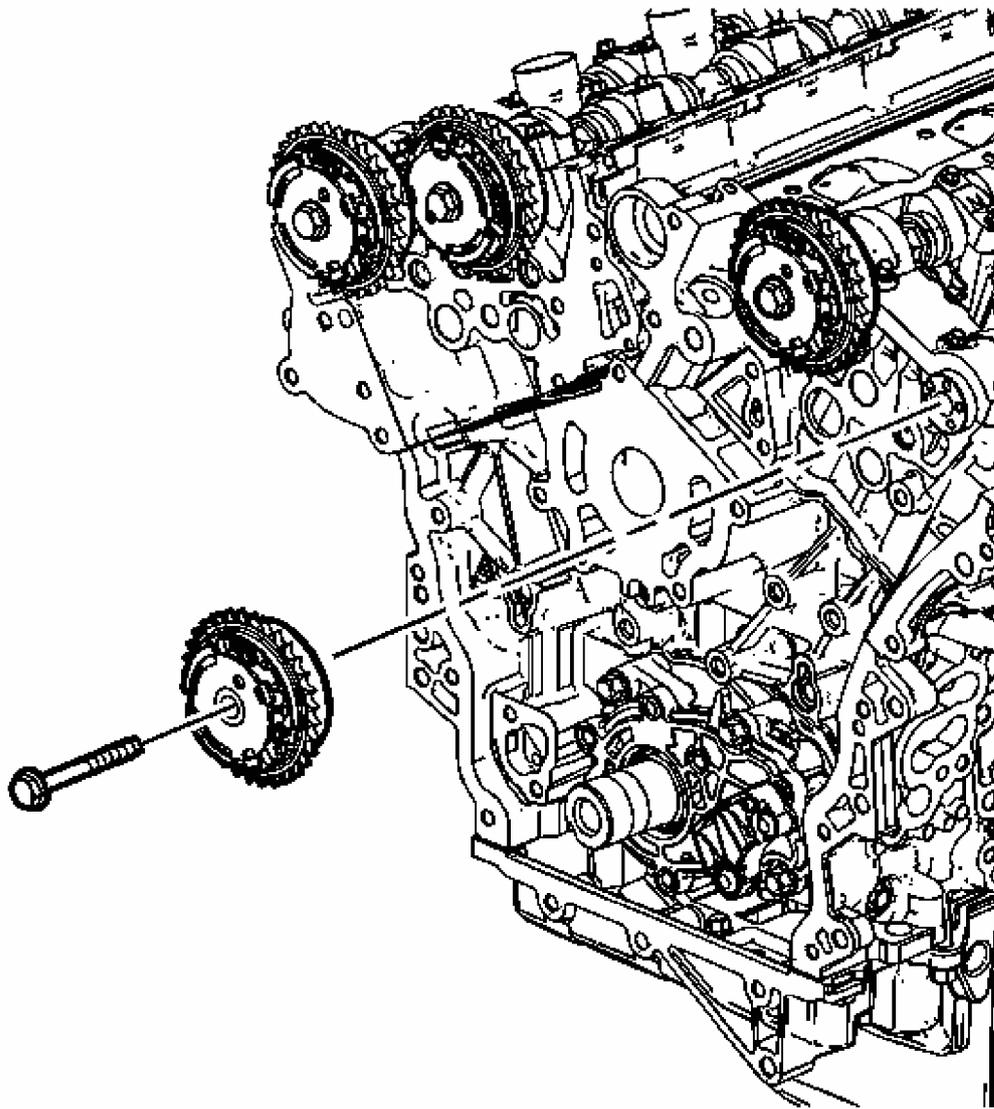


Fig. 152: View Of Camshaft Position (CMP) Actuator - Bank 2 Exhaust
Courtesy of GENERAL MOTORS CORP.

2. Remove the camshaft position actuator from the timing chain.

Installation Procedure

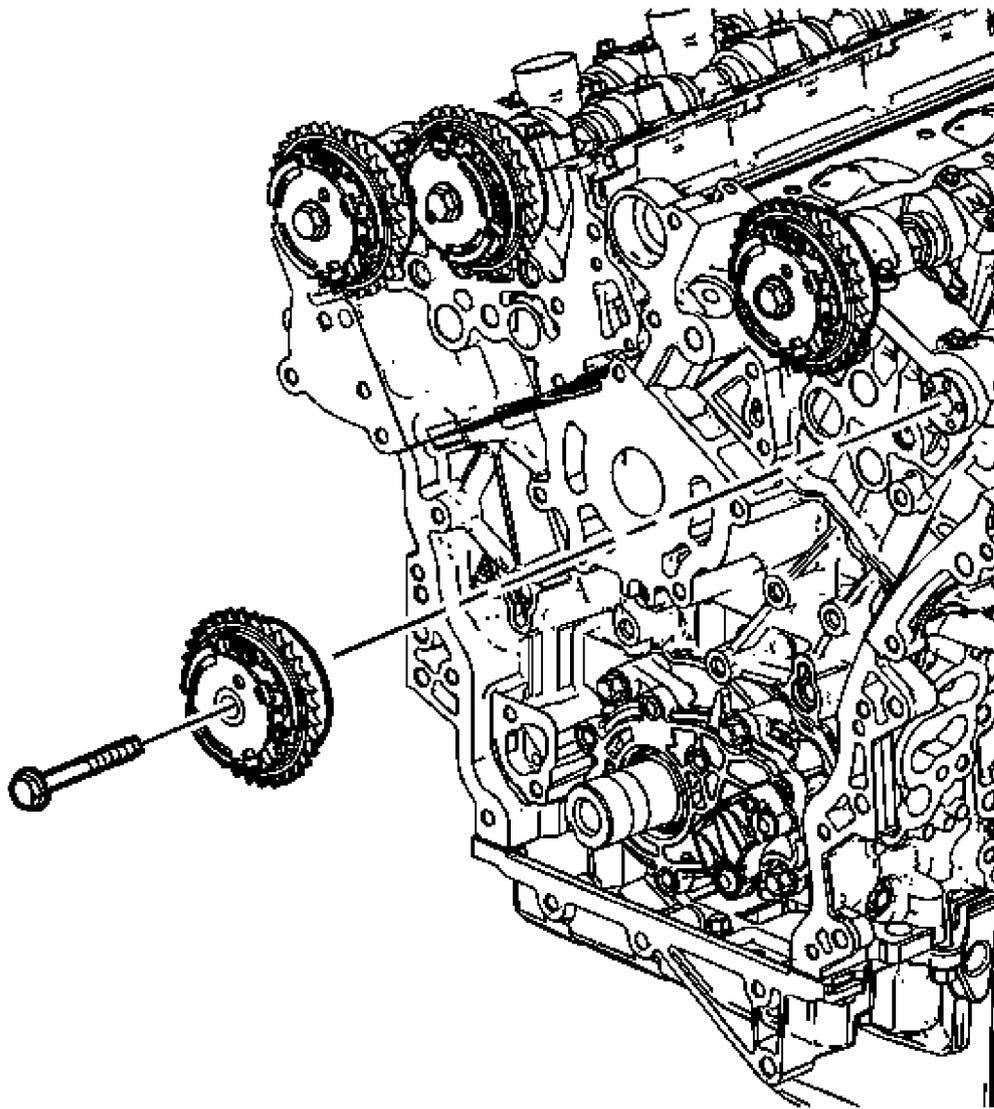


Fig. 153: View Of Camshaft Position (CMP) Actuator - Bank 2 Exhaust
Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft position actuator to the timing chain.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

2. Install the applicable camshaft. Refer to Camshaft Replacement - Left.

CAMSHAFT POSITION (CMP) ACTUATOR REPLACEMENT - BANK 1 (RIGHT) EXHAU EXHAUST

Removal Procedure

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

1. Remove the camshaft. Refer to Camshaft Replacement - Right.

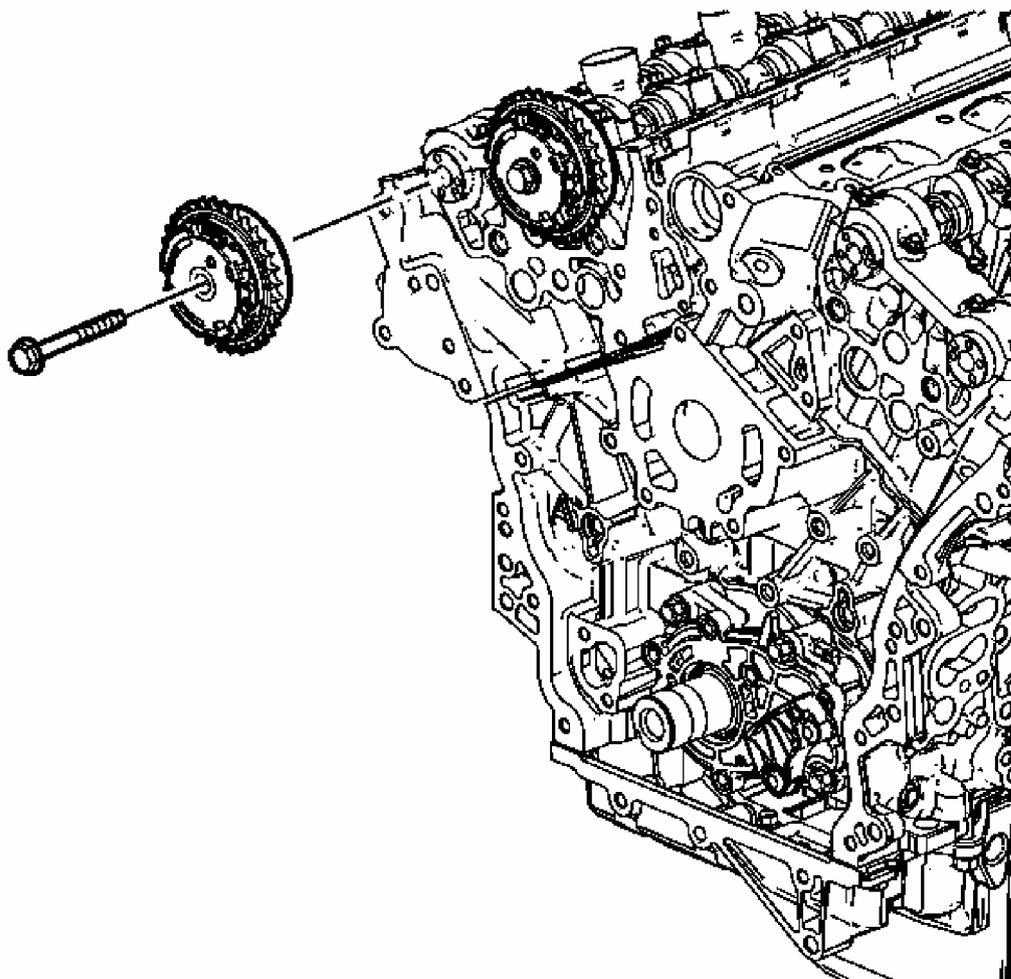


Fig. 154: View Of Right Exhaust Camshaft Position Actuator
Courtesy of GENERAL MOTORS CORP.

2. Remove the camshaft position actuator from the timing chain.

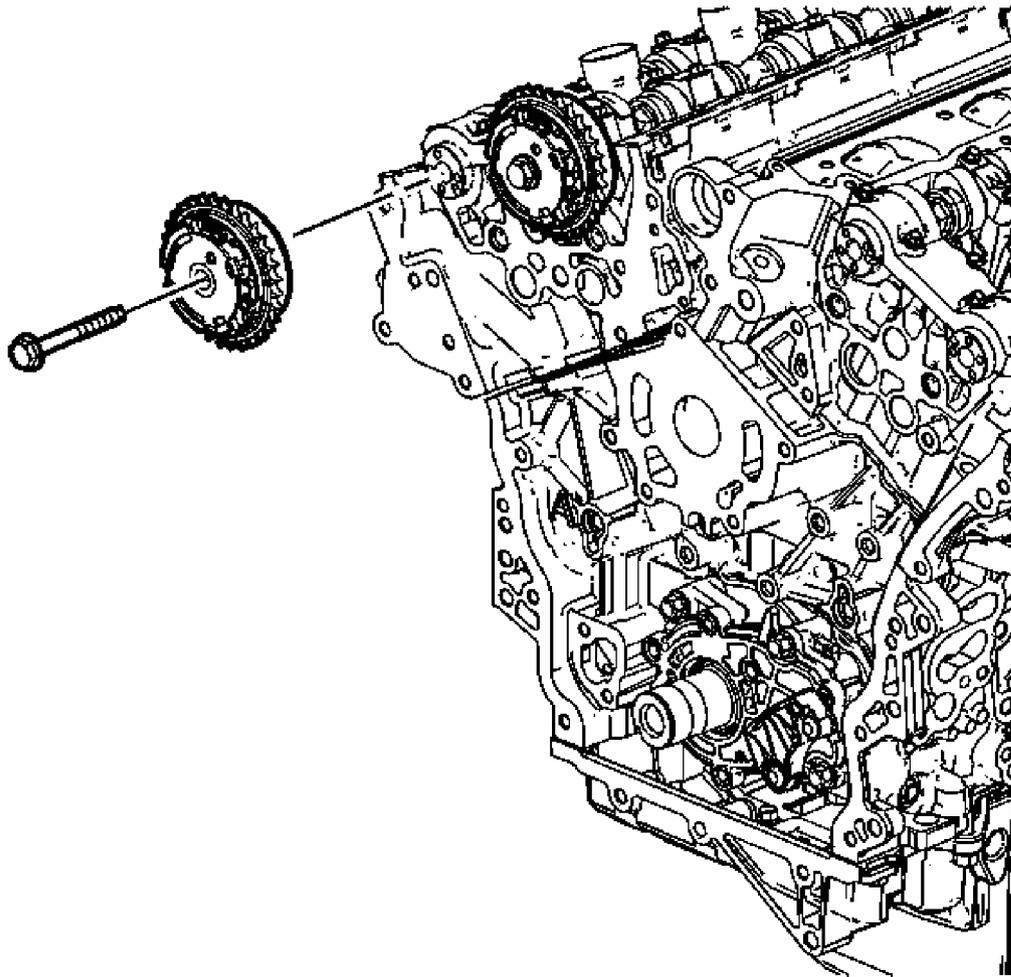


Fig. 155: View Of Right Exhaust Camshaft Position Actuator
Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft position actuator to the timing chain.

NOTE: Refer to **Torque Reaction Against Timing Drive Chain Notice** in Cautions and Notices.

2. Install the camshaft. Refer to **Camshaft Replacement - Right**.

CAMSHAFT POSITION (CMP) ACTUATOR REPLACEMENT - BANK 2 (LEFT) INTAKE

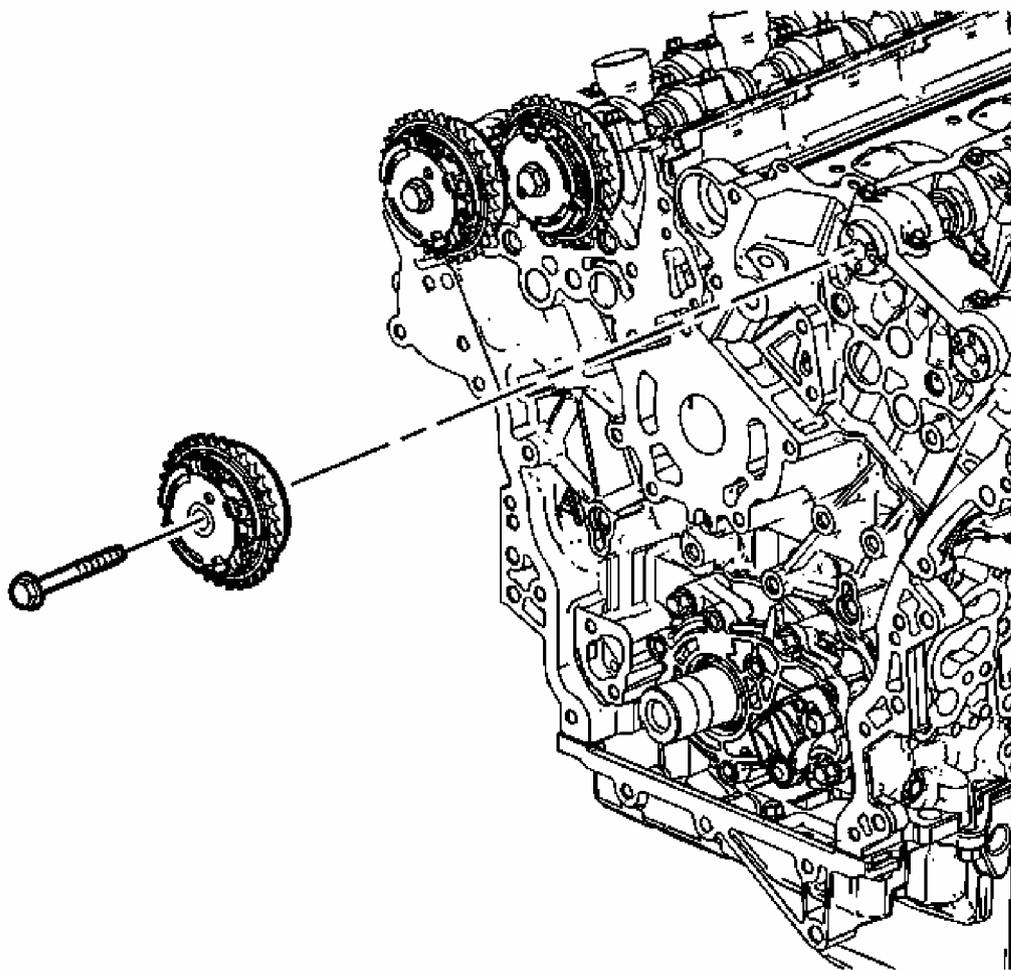


Fig. 156: Removing/Installing Camshaft Position (CMP) Actuator
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

1. Remove the camshaft position actuator from the timing chain.
2. Remove the camshaft. Refer to Camshaft Replacement - Left.

Installation Procedure

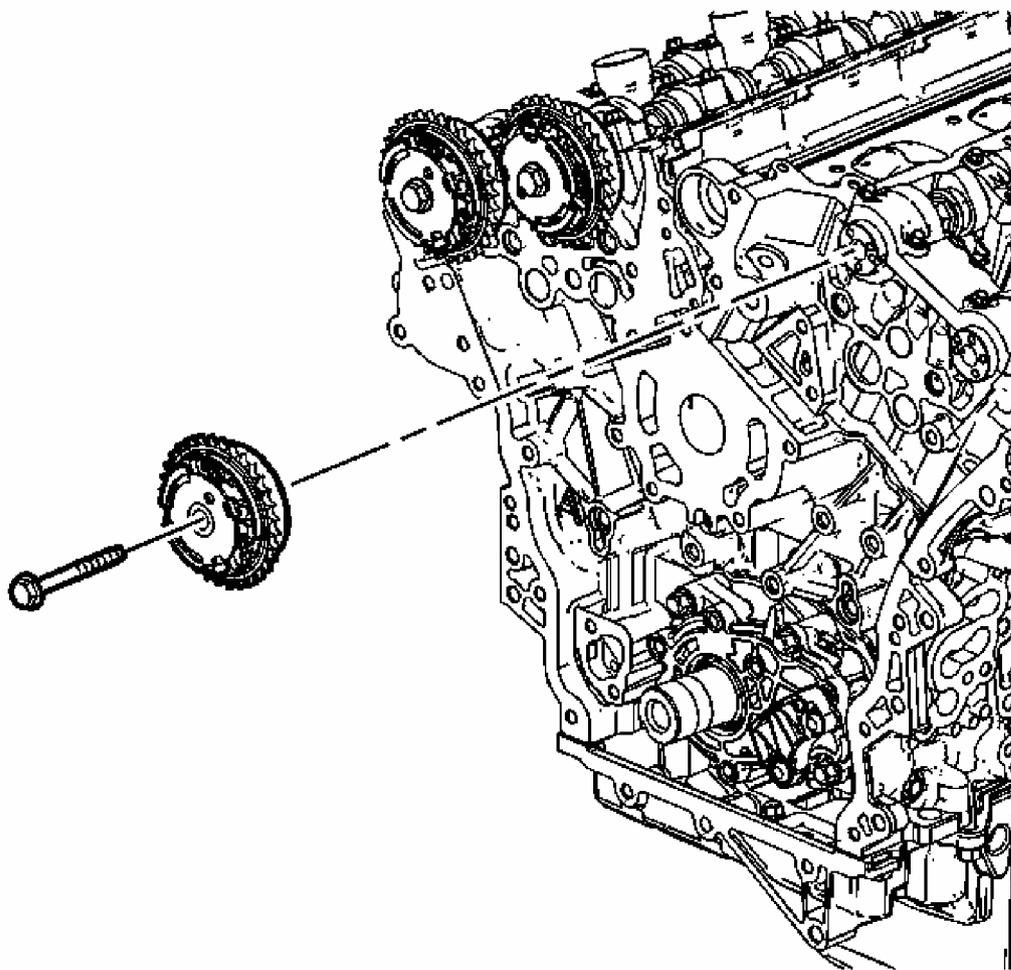


Fig. 157: Removing/Installing Camshaft Position (CMP) Actuator
Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft position actuator to the timing chain.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

2. Install the camshaft. Refer to Camshaft Replacement - Left.

CAMSHAFT POSITION (CMP) ACTUATOR REPLACEMENT - BANK 1 (RIGHT) INTAKE

Removal Procedure

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice

in Cautions and Notices.

1. Remove the camshaft. Refer to Camshaft Replacement - Right.

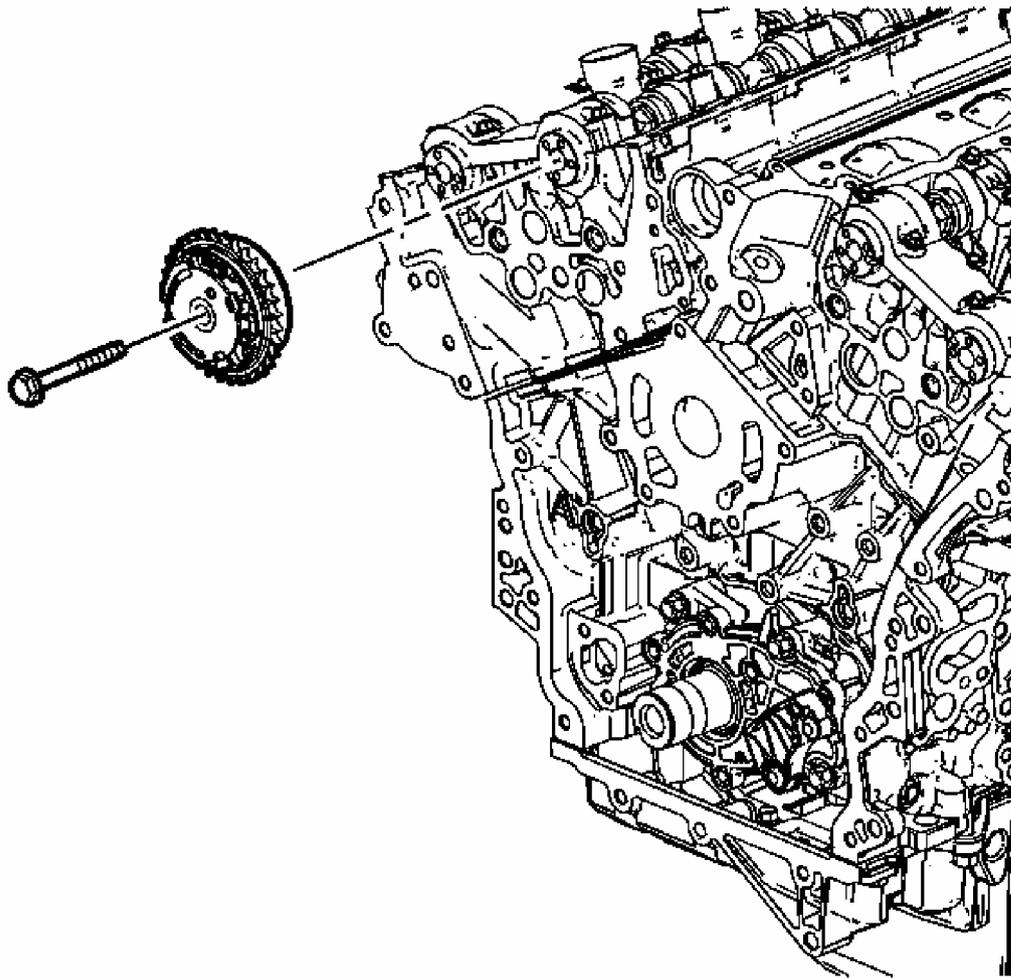


Fig. 158: View Of Camshaft Position (CMP) Actuator - Bank1 Intake
Courtesy of GENERAL MOTORS CORP.

2. Remove the camshaft position actuator from the timing chain.

Installation Procedure

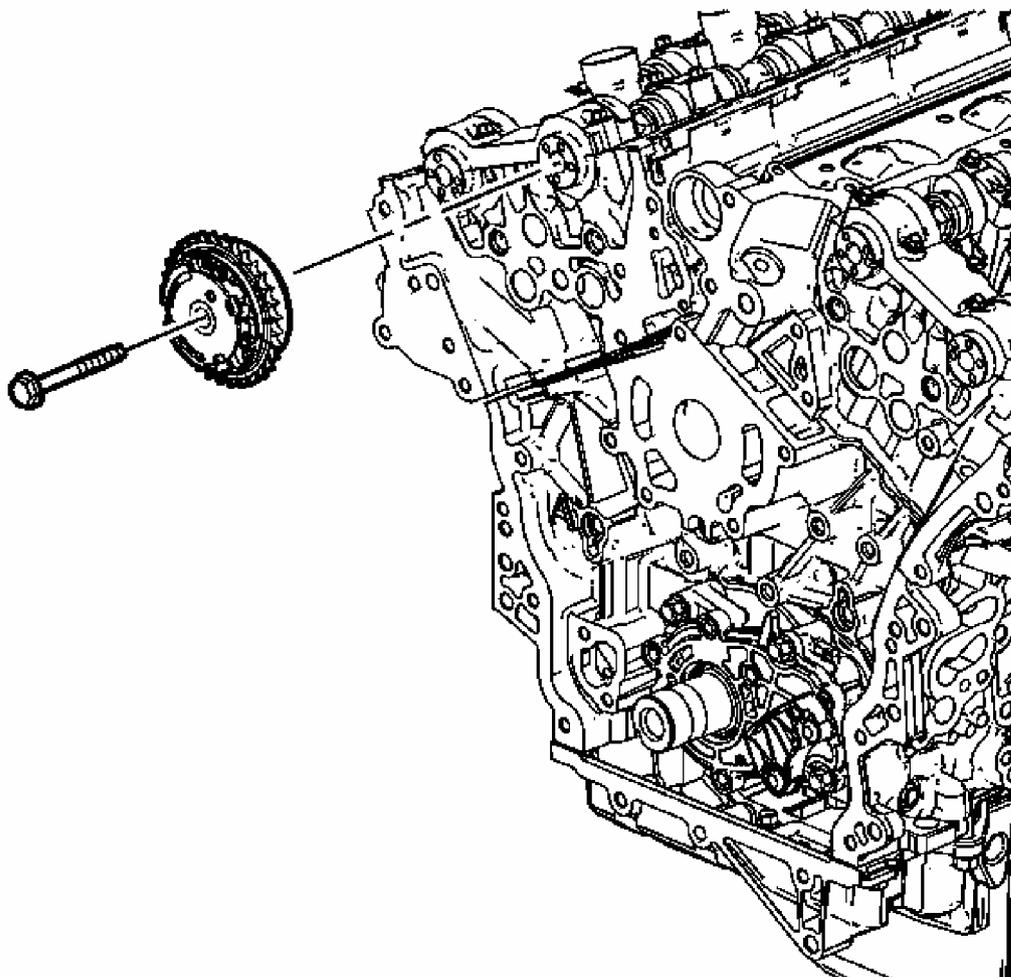


Fig. 159: View Of Camshaft Position (CMP) Actuator - Bank1 Intake
Courtesy of GENERAL MOTORS CORP.

1. Install the camshaft position actuator to the timing chain.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

2. Install the camshaft. Refer to Camshaft Replacement - Right.

SETTING CAMSHAFT TIMING

IMPORTANT: Setting the camshaft timing is necessary whenever the camshaft drive system has been disturbed such that the

relationship between any chain and sprocket has been lost. Even when only one sprocket is involved, multiple crankshaft rotations will not produce conditions where correct timing can be confirmed.

If necessary, follow the left bank secondary camshaft drive chain replacement procedures to reset the camshaft timing. Refer to **Secondary Camshaft Drive Chain Replacement - Left**.

CAMSHAFT REPLACEMENT - LEFT

Tools Required

- **EN 46108** Timing Chain Retention Tool
- **EN 46111** Crankshaft Rotation Socket

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.
2. Remove the left bank camshaft cover. Refer to **Camshaft Cover Replacement - Left**.
3. Remove the camshaft sensors. Refer to **Camshaft Position (CMP) Sensor Replacement - Bank 2 (Left) Exhaust** and **Camshaft Position (CMP) Sensor Replacement - Bank 2 (Left) Intake** in Engine Controls - 3.6L (LY7).
4. Remove the camshaft position actuator solenoid. Refer to **Camshaft Position (CMP) Actuator Solenoid Replacement - Bank 2 (Left) Intake** in Engine Controls - 3.6L (LY7).
5. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Removal** .

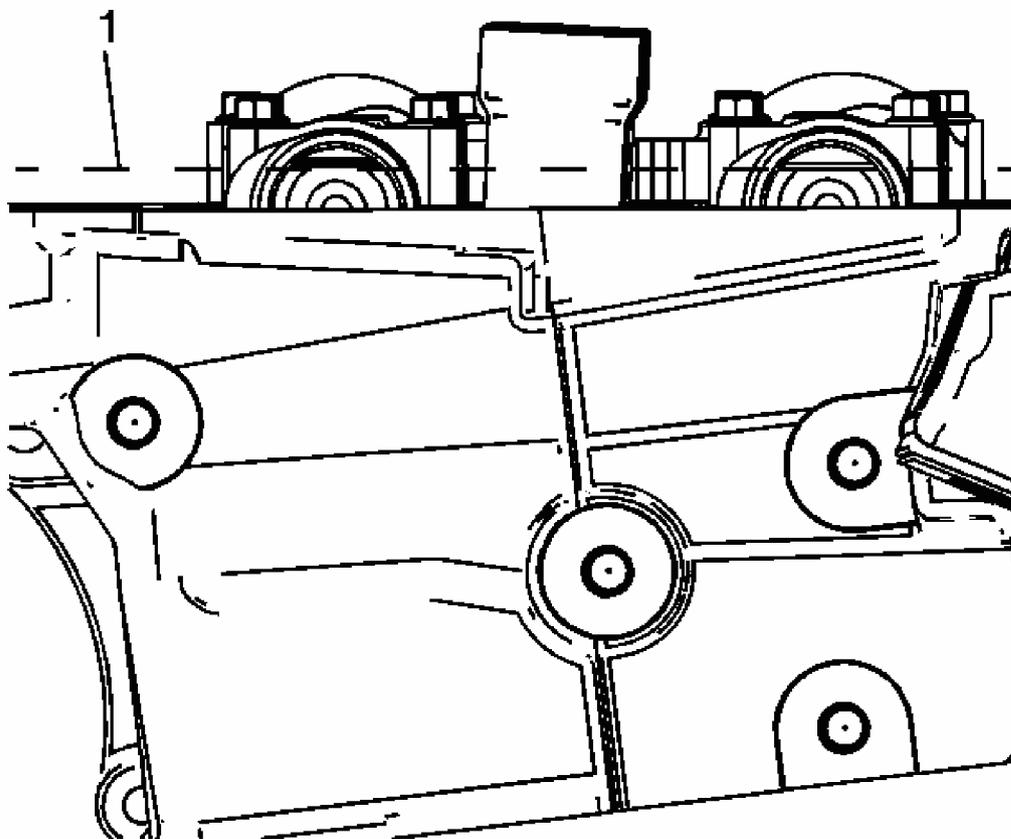


Fig. 160: Camshaft Flats Parallel With Camshaft Cover Rail
Courtesy of GENERAL MOTORS CORP.

6. Rotate the crankshaft with the EN 46111 until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

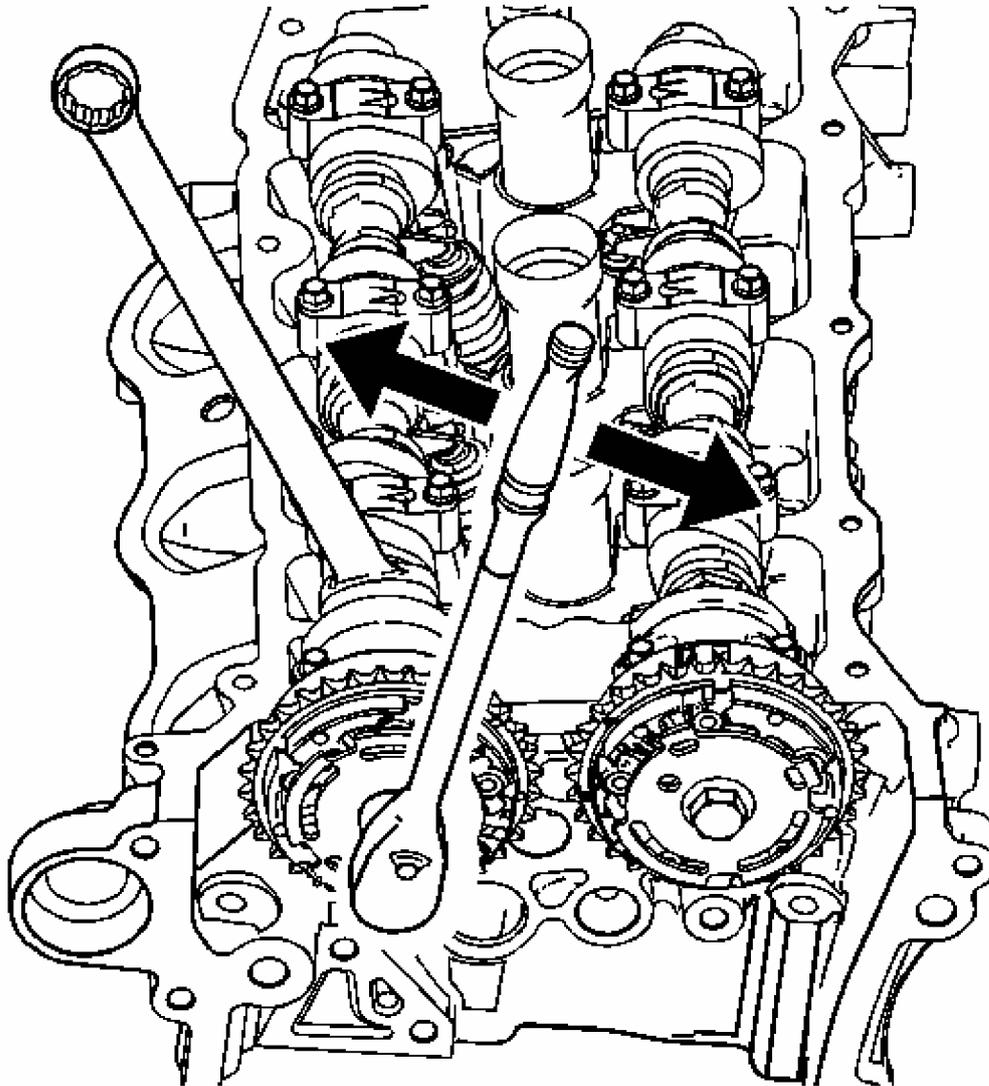


Fig. 161: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

IMPORTANT:

- Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.
- DO NOT remove the camshaft position actuator bolt at

this time.

7. Loosen the camshaft position actuator bolt.

IMPORTANT: Ensure that the tips of the EN 46108 are fully engaged into the timing chain (3 and 4).

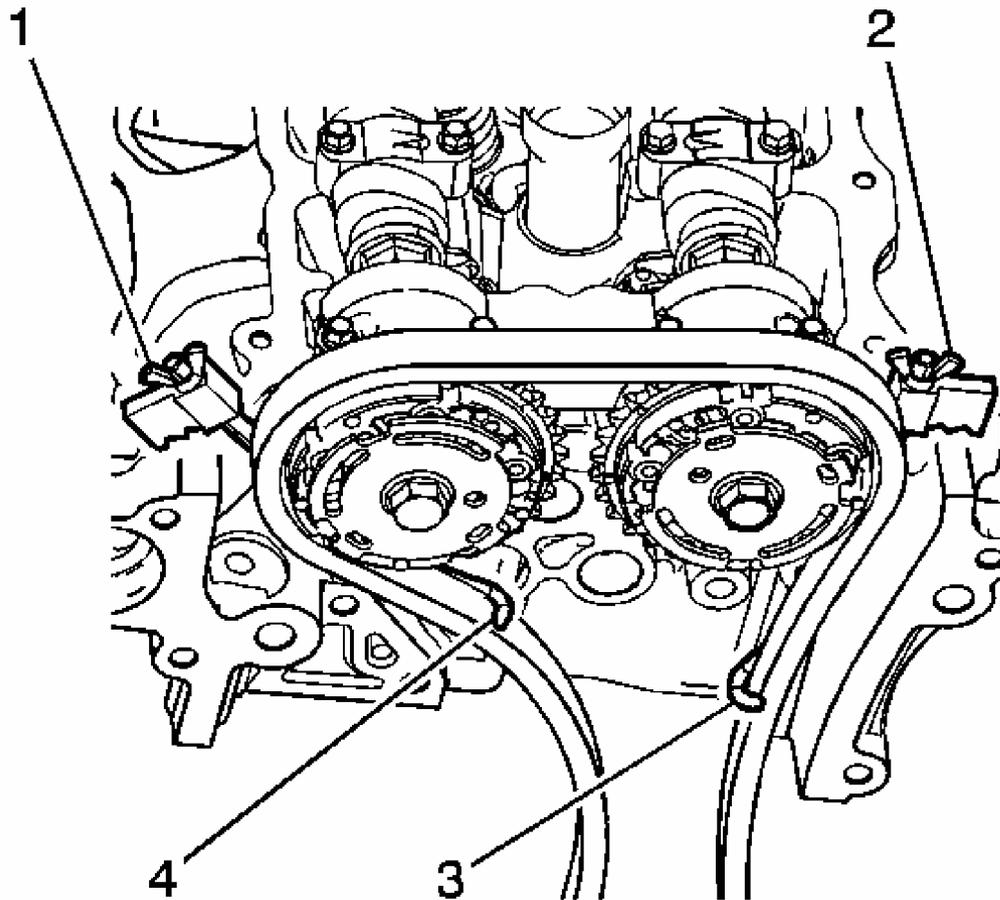


Fig. 162: Identifying EN 46108
Courtesy of GENERAL MOTORS CORP.

8. Install the EN 46108 (1 and 2) in order to retain the timing chain.

Firmly tighten the EN 46108 nuts.

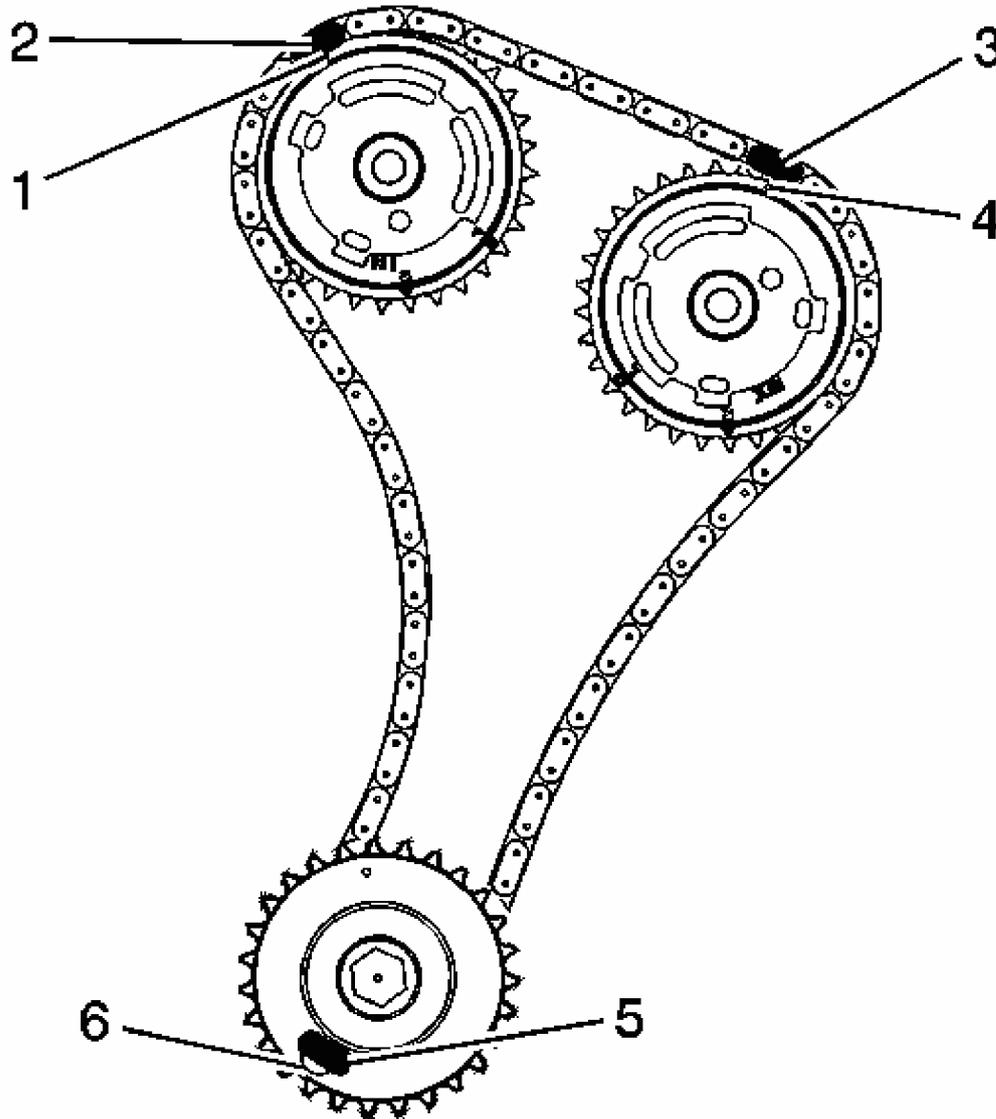


Fig. 163: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

9. Mark the timing chain and the respective locations on the camshaft position actuators (1-4).
10. Remove the camshaft position actuator bolt.

11. Remove the camshafts. Refer to Camshaft Removal - Left.

Installation Procedure

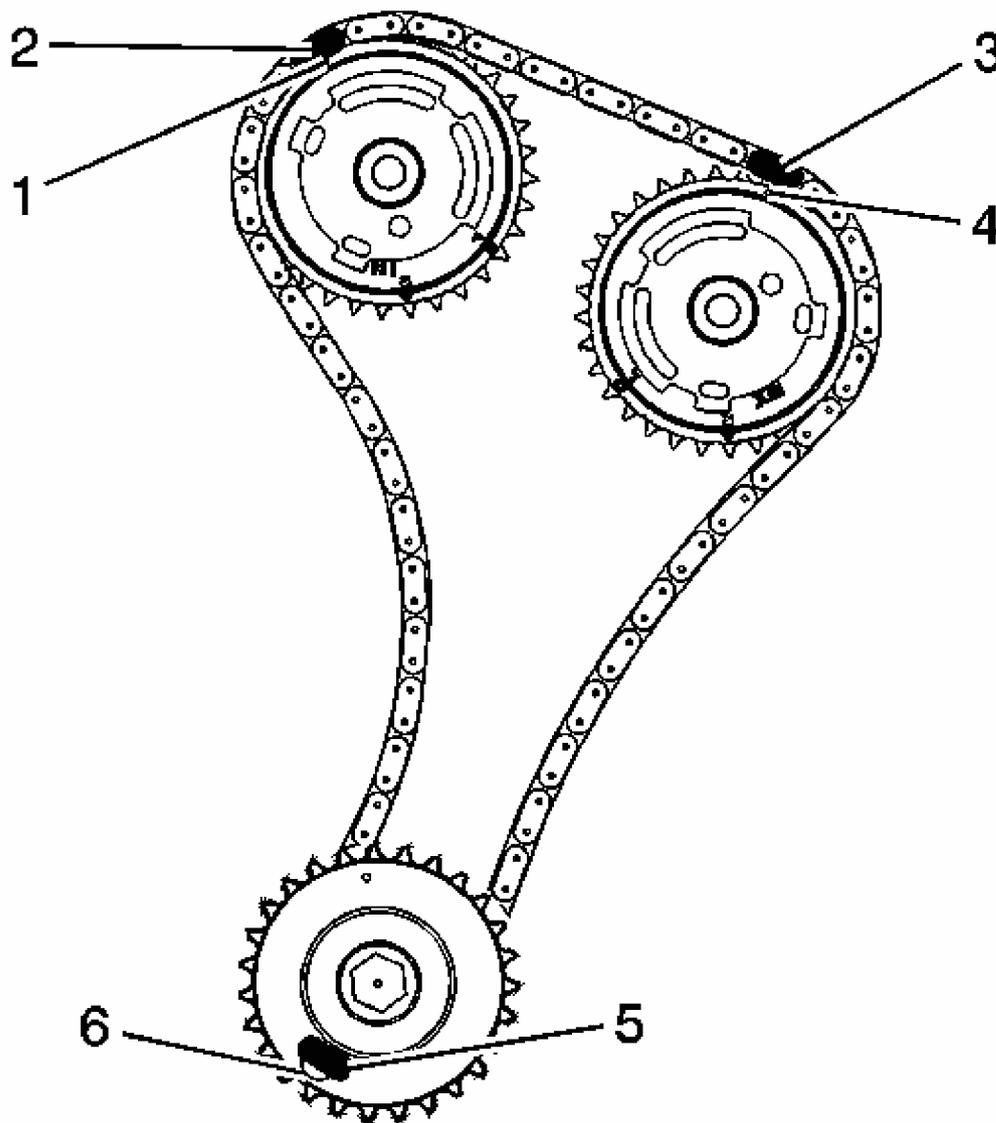


Fig. 164: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- Ensure that the marks on the camshaft position actuator and the timing chain (1-4) are aligned.

- **DO NOT** tighten the camshaft position actuator bolt at this time.

1. Locate the camshafts to the cylinder head and assemble the camshaft actuators to the camshafts.
2. Install the camshafts and the camshaft bearing caps. Refer to Camshaft Installation - Left.
3. Remove the EN 46108.

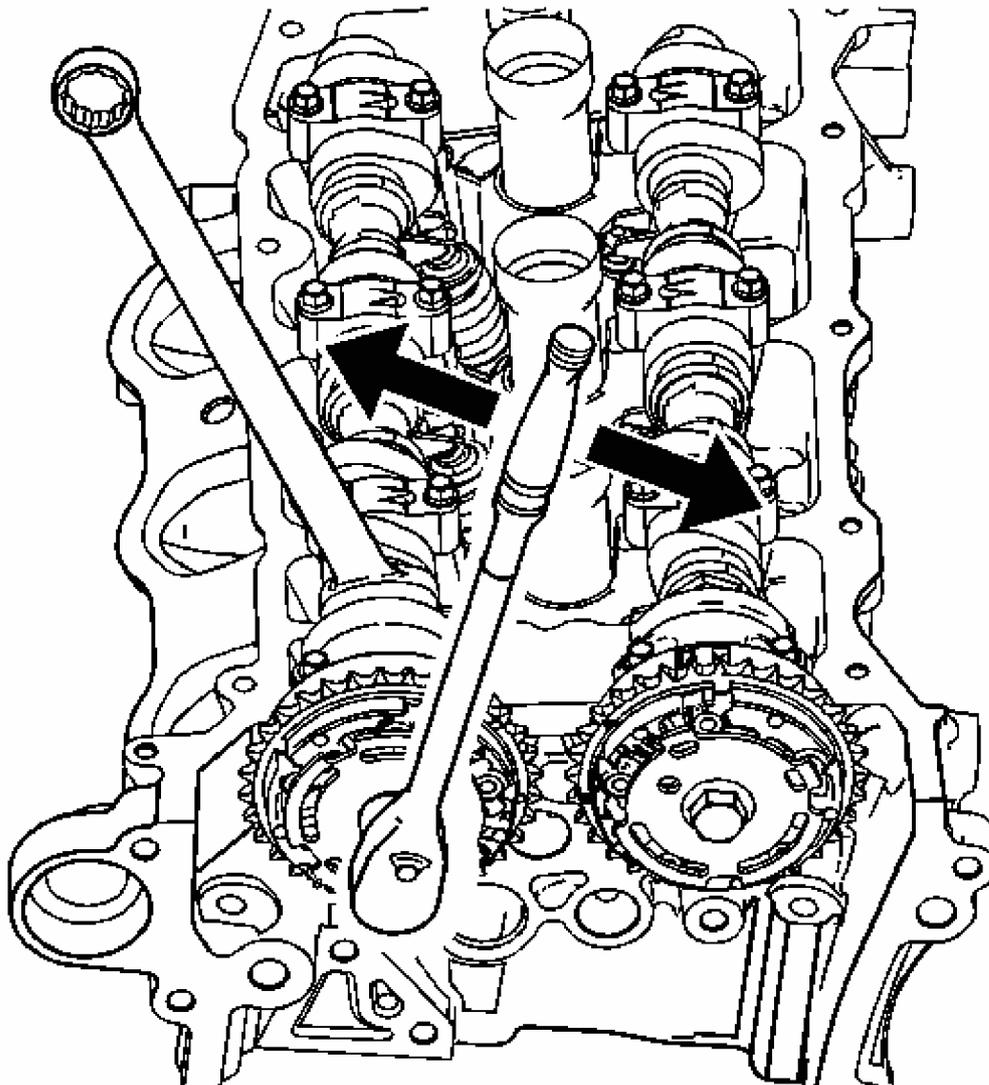


Fig. 165: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

IMPORTANT: Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

4. Install and tighten the camshaft position actuators. Refer to Camshaft Position (CMP) Actuator Installation - Left Intake and Camshaft Position (CMP) Actuator Installation - Left Exhaust .
5. Install the intake camshaft position actuator solenoid. Refer to Camshaft Position (CMP) Actuator Solenoid Replacement - Bank 2 (Left) Intake in Engine Controls - 3.6L (LY7).
6. Install the camshaft sensors. Refer to Camshaft Position (CMP) Sensor Replacement - Bank 2 (Left) Exhaust and Camshaft Position (CMP) Sensor Replacement - Bank 2 (Left) Intake in Engine Controls - 3.6L (LY7).
7. Install the crankshaft balancer. Refer to Crankshaft Balancer Installation .
8. Install the camshaft cover. Refer to Camshaft Cover Replacement - Left.
9. Install the upper intake manifold with the lower intake manifold. Refer to Intake Manifold Replacement - Lower.

CAMSHAFT REPLACEMENT - RIGHT

Tools Required

- EN 46108 Timing Chain Retention Tool
- EN 46111 Crankshaft Rotation Socket

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to Intake Manifold Replacement - Lower.
2. Remove the camshaft cover. Refer to Camshaft Cover Replacement - Right.
3. Remove the camshaft sensors. Refer to Camshaft Position (CMP) Sensor Replacement - Bank 1 (Right) Exhaust and Camshaft Position (CMP) Sensor Replacement - Bank 1 (Right) Intake in Engine Controls - 3.6L (LY7).
4. Remove the intake camshaft position actuator solenoid. Refer to Camshaft Position (CMP) Actuator Solenoid Replacement - Bank 1 (Right) Intake in Engine Controls - 3.6L (LY7).

5. Remove the crankshaft balancer. Refer to Crankshaft Balancer Removal .

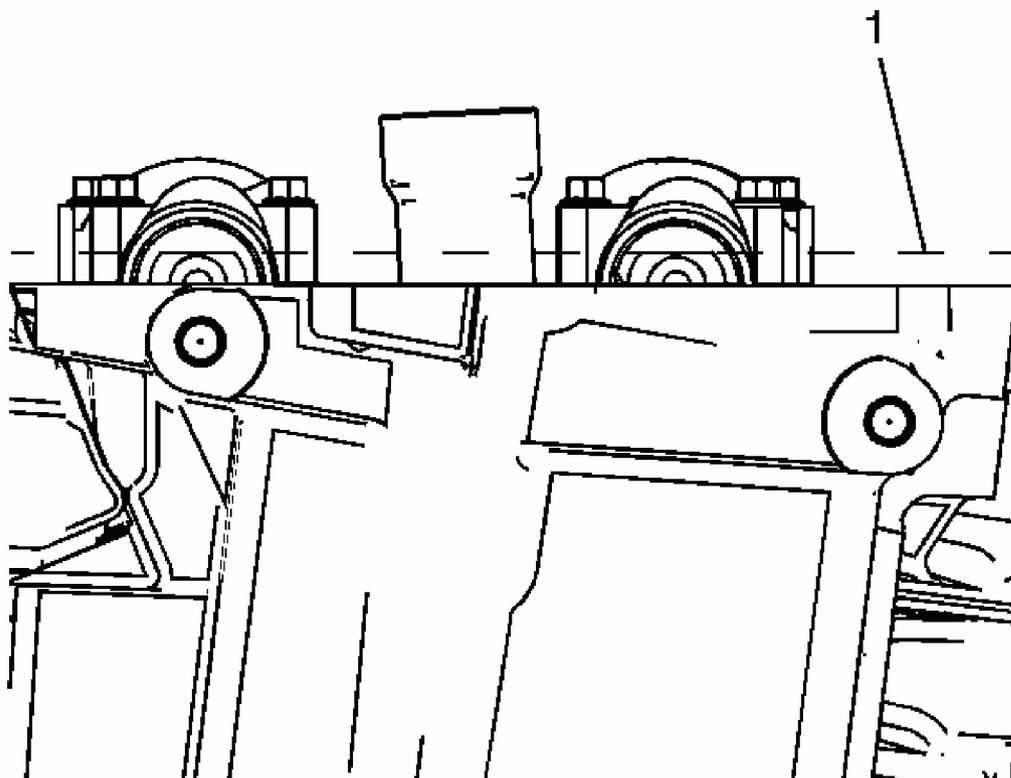


Fig. 166: Identifying Camshaft Neutral (Low Tension) Position
Courtesy of GENERAL MOTORS CORP.

6. Rotate the crankshaft with the EN 46111 until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

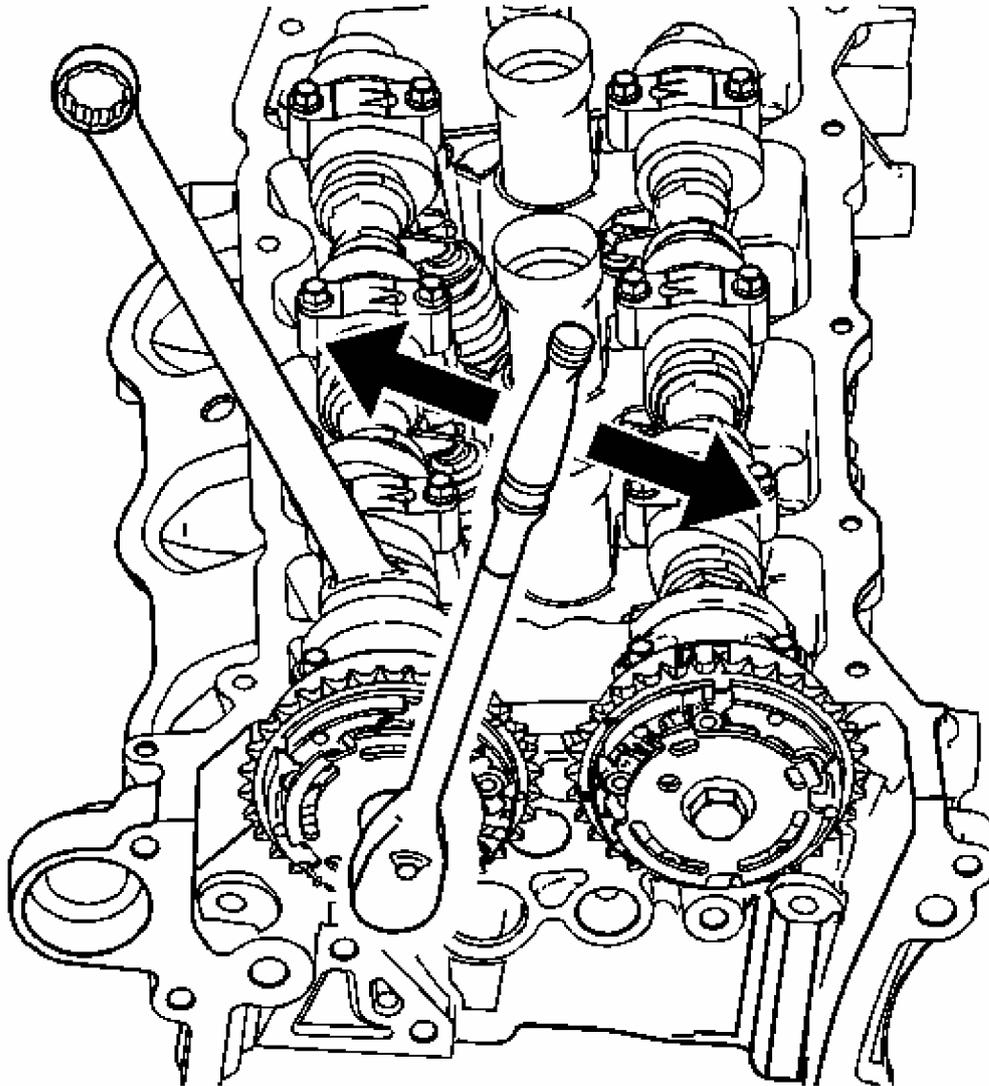


Fig. 167: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

IMPORTANT:

- Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.
- DO NOT remove the camshaft position actuator bolt at

this time.

7. Loosen the camshaft position actuator bolt.

IMPORTANT: Ensure that the tips of the EN 46108 are fully engaged into the timing chain (3 and 4).

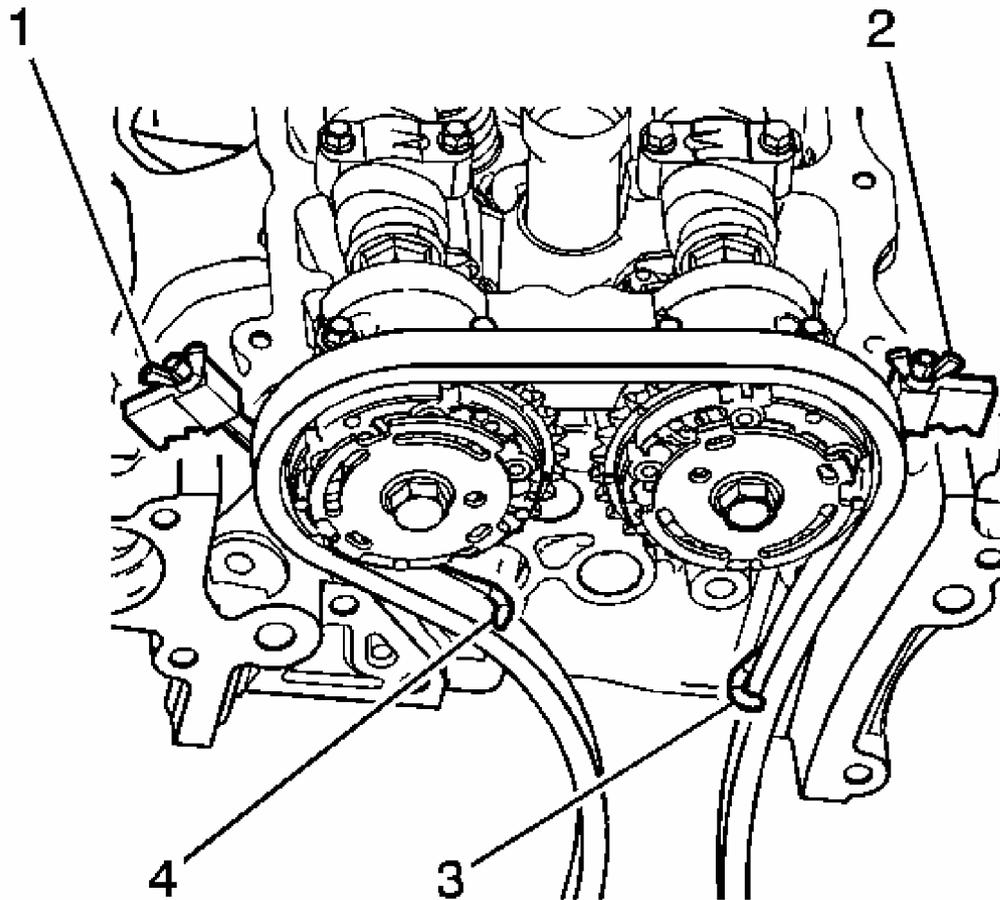


Fig. 168: Identifying EN 46108
Courtesy of GENERAL MOTORS CORP.

8. Install the EN 46108 (1 and 2) in order to retain the timing chain.

Firmly tighten the EN 46108 nuts.

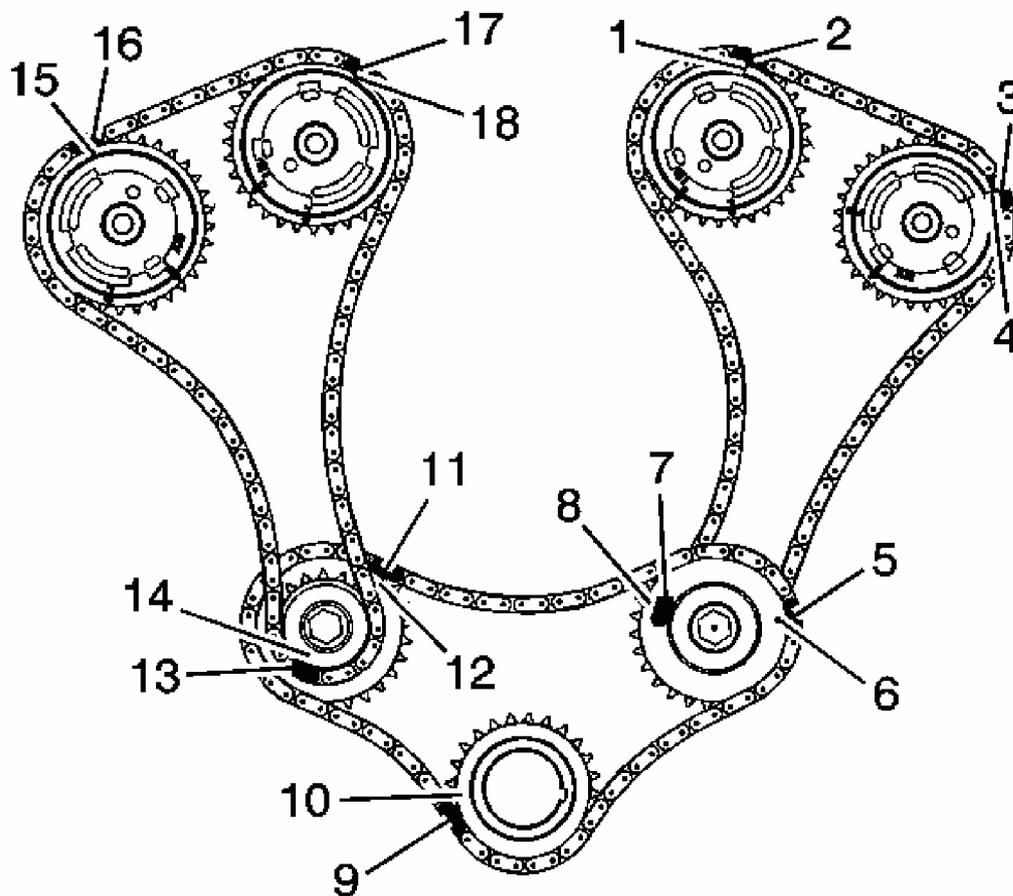


Fig. 169: Identifying Timing Chain Marks And Their Respective Locations On Gears, Sprockets And Actuators

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

9. Mark the timing chain and the respective locations on camshaft position actuators (15-18).
10. Remove the camshaft position actuator bolt.
11. Remove the camshaft bearing caps and the camshaft. Refer to **Camshaft Removal - Right**.

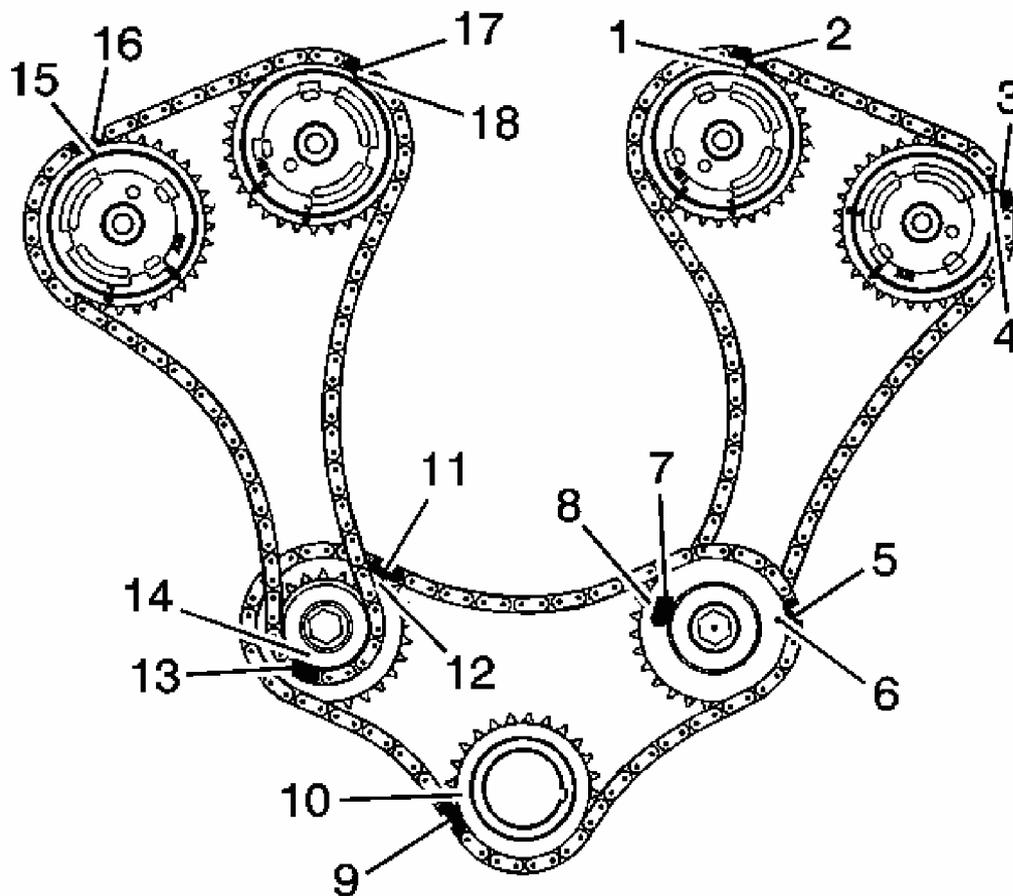


Fig. 170: Identifying Timing Chain Marks And Their Respective Locations On Gears, Sprockets And Actuators

Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- Ensure that the marks on the camshaft position actuators and the timing chain (15-18) are aligned.
- **DO NOT** tighten the camshaft position actuator bolt at this time.

1. Locate the camshafts to the cylinder head and assemble the camshaft actuators to the camshafts.
2. Install the camshafts and the camshaft bearing caps. Refer to **Camshaft Installation - Right** .
3. Remove the EN 46108 .

4. Install the crankshaft balancer. Refer to Crankshaft Balancer Installation .

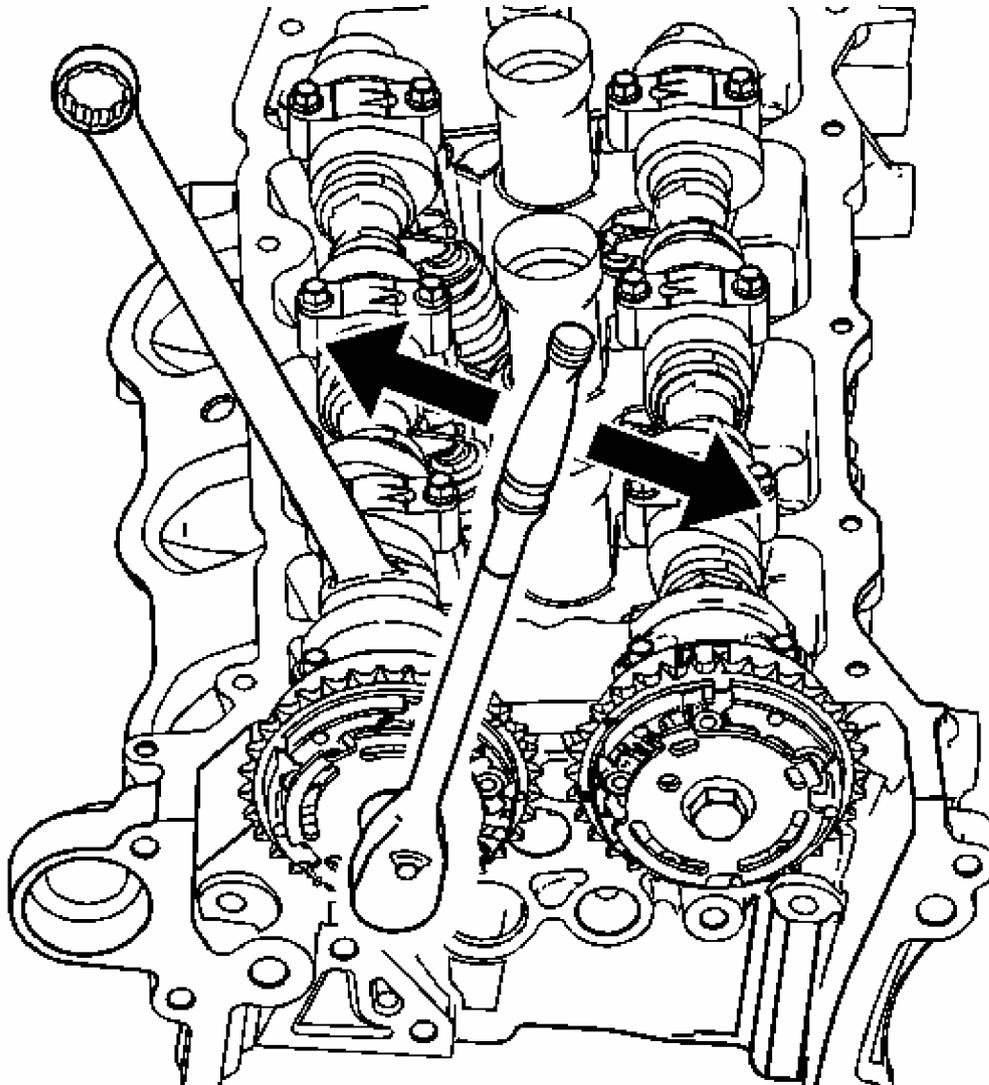


Fig. 171: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice in Cautions and Notices.

IMPORTANT: Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

5. Install and tighten the camshaft position actuators. Refer to **Camshaft Position (CMP) Actuator Installation - Right Intake** and **Camshaft Position (CMP) Actuator Installation - Right Exhaust** .
6. Install the intake camshaft position actuator solenoid. Refer to **Camshaft Position (CMP) Actuator Solenoid Replacement - Bank 1 (Right) Intake** in Engine Controls - 3.6L (LY7).
7. Install the camshaft sensors. Refer to **Camshaft Position (CMP) Sensor Replacement - Bank 1 (Right) Exhaust** and **Camshaft Position (CMP) Sensor Replacement - Bank 1 (Right) Intake** in Engine Controls - 3.6L (LY7).
8. Install the camshaft cover. Refer to **Camshaft Cover Replacement - Right**.
9. Install the upper intake manifold with the lower intake manifold. Refer to **Intake Manifold Replacement - Lower**.

VALVE ROCKER ARM REPLACEMENT - LEFT

Removal Procedure

1. Remove the applicable camshaft(s). Refer to **Camshaft Replacement - Left**.

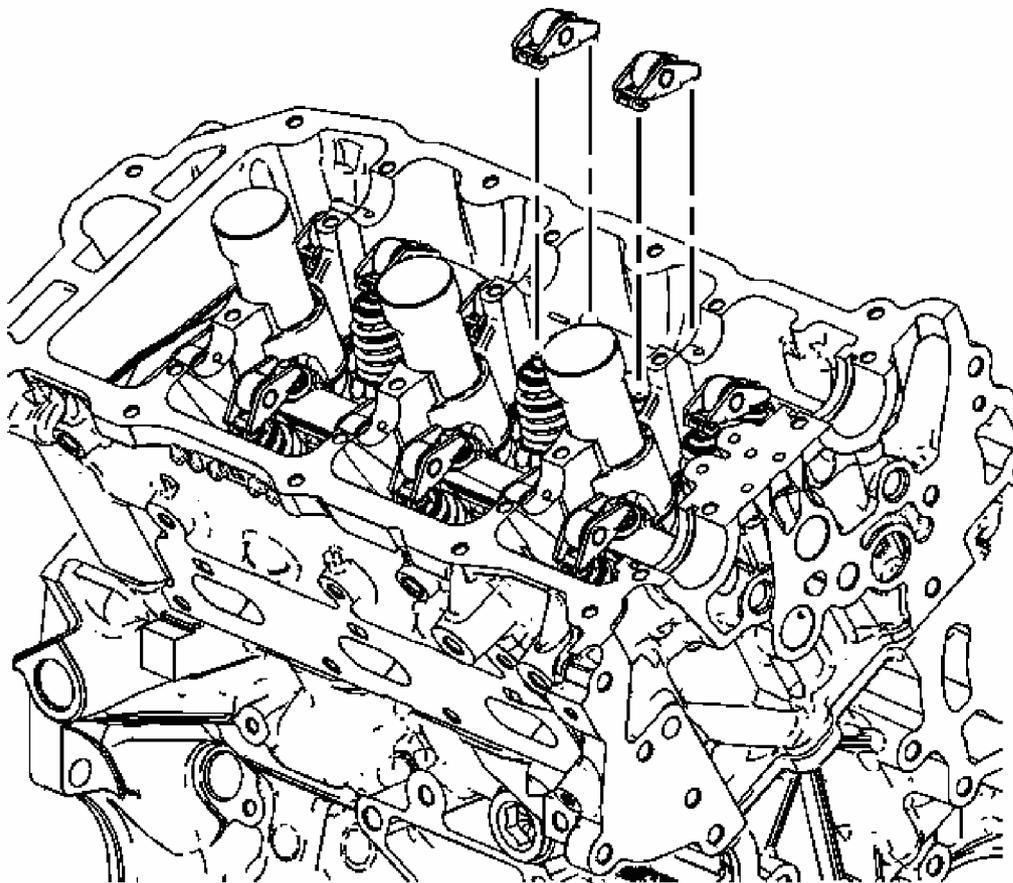


Fig. 172: Identifying Valve Rocker Arms
Courtesy of GENERAL MOTORS CORP.

2. Remove the rocker arms. Refer to **Valve Rocker Arm Removal - Left** .
3. Clean and inspect the camshaft(s) and the rocker arm(s). Repair or replace as necessary. Refer to **Camshaft Cleaning and Inspection** and **Valve Lifters Cleaning and Inspection** .

Installation Procedure

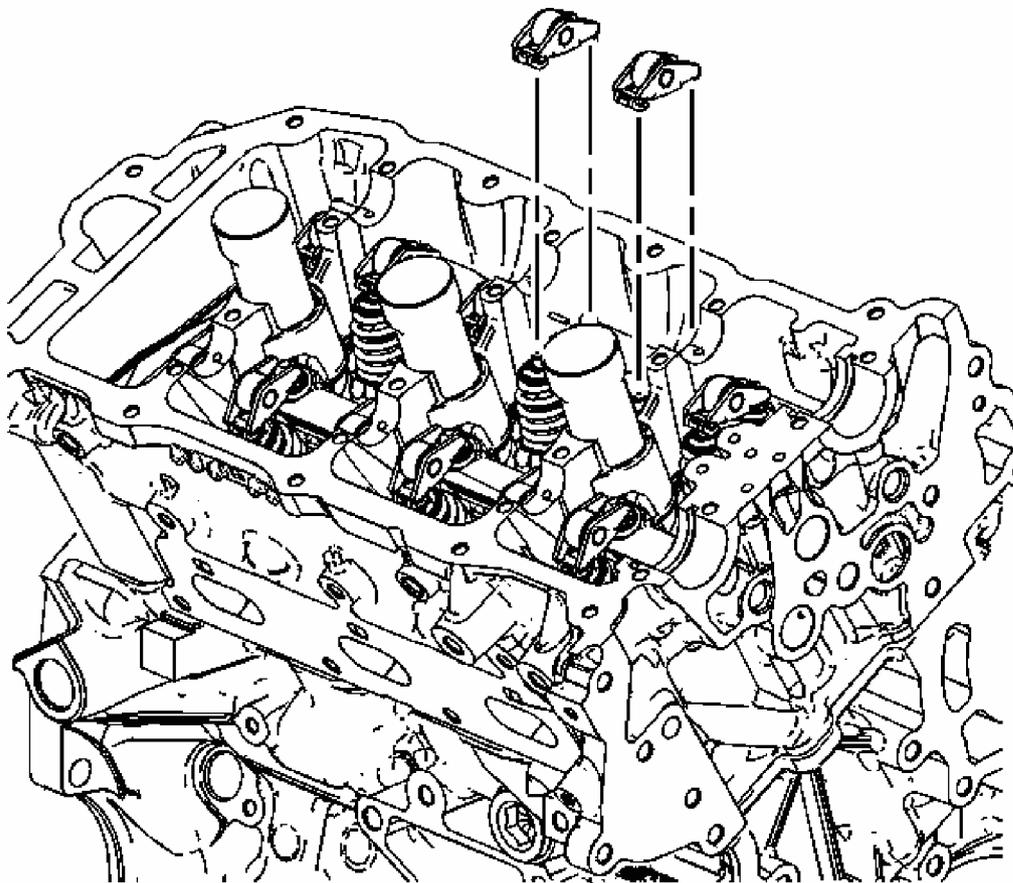


Fig. 173: Identifying Valve Rocker Arms
Courtesy of GENERAL MOTORS CORP.

1. Install the rocker arms. Refer to Valve Rocker Arm Installation - Left.
2. Install the applicable camshaft(s). Refer to Camshaft Replacement - Left.

VALVE ROCKER ARM REPLACEMENT - RIGHT

Removal Procedure

1. Remove the applicable camshaft(s). Refer to Camshaft Replacement - Left.

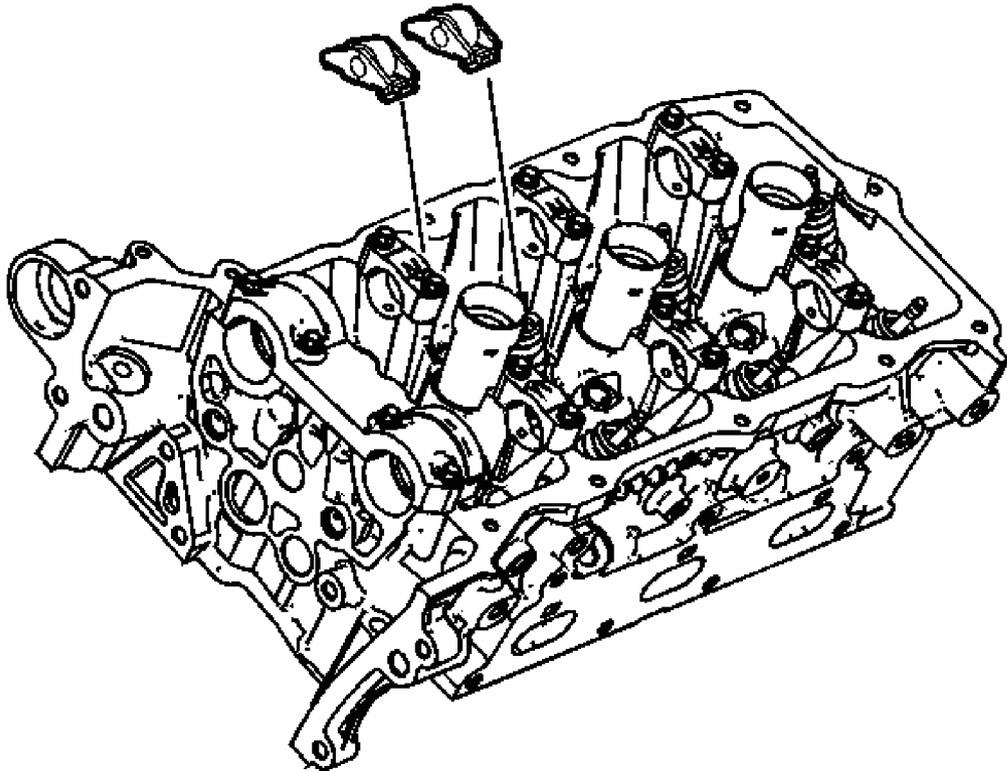


Fig. 174: View Of Valve Rocker Arm
Courtesy of GENERAL MOTORS CORP.

2. Remove the rocker arms. Refer to **Valve Rocker Arm Removal - Right** .
3. Clean and inspect the camshaft(s) and the rocker arm(s). Repair or replace as necessary. Refer to **Camshaft Cleaning and Inspection** and **Valve Lifters Cleaning and Inspection** .

Installation Procedure

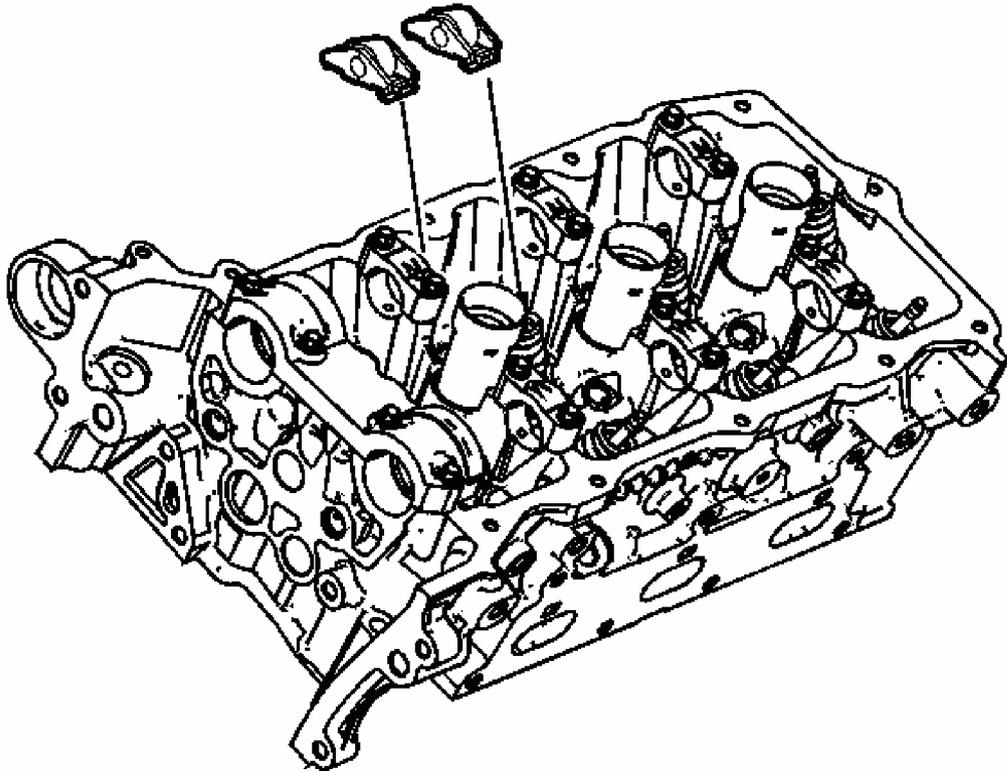


Fig. 175: View Of Valve Rocker Arm
Courtesy of GENERAL MOTORS CORP.

1. Install the rocker arms.
2. Install the applicable camshaft(s). Refer to **Valve Rocker Arm Installation - Right** .

VALVE LIFTER REPLACEMENT - LEFT

Removal Procedure

1. Remove the applicable camshaft(s). Refer to **Camshaft Replacement - Left**.
2. Remove the rocker arms. Refer to **Valve Rocker Arm Removal - Left** .

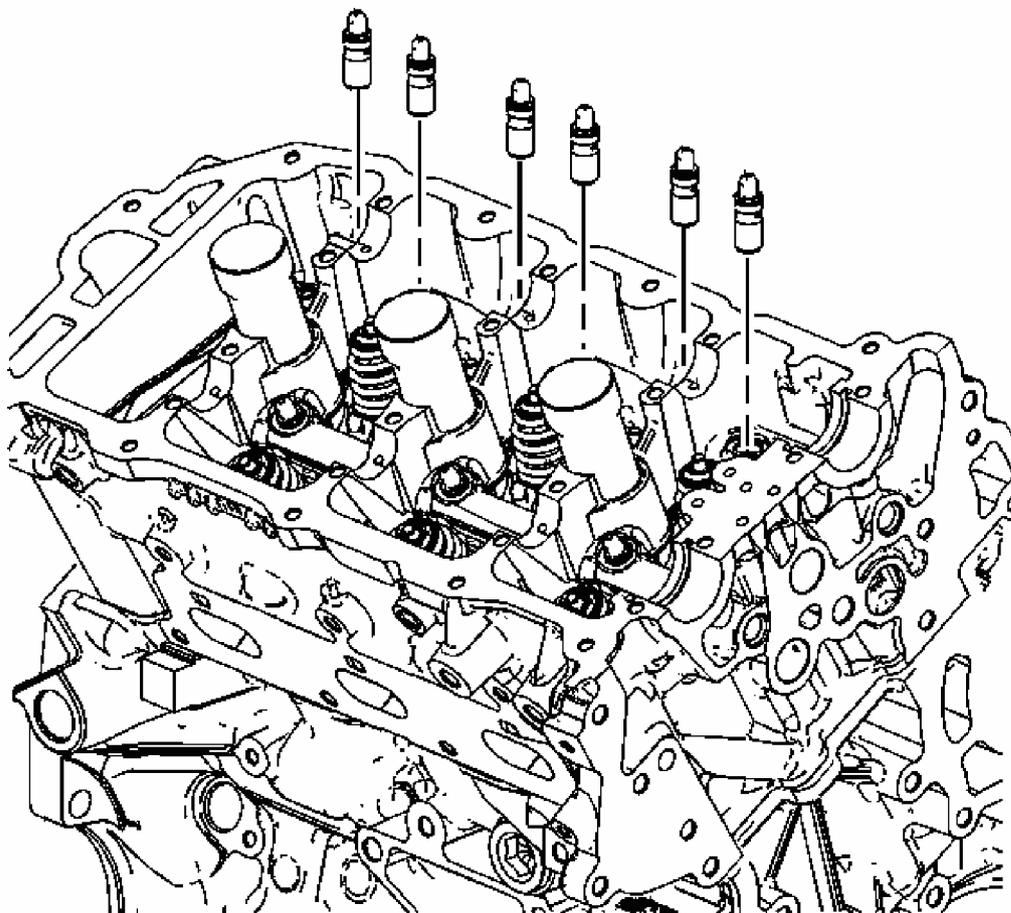


Fig. 176: Identifying Stationary Hydraulic Lash Adjuster (SHLA)
Courtesy of GENERAL MOTORS CORP.

3. Remove the lifters. Refer to Valve Lifter Removal - Left .
4. Clean and inspect the camshaft(s), rocker arm(s) and lifter(s). Repair or replace as necessary. Refer to Camshaft Cleaning and Inspection , Valve Lifters Cleaning and Inspection and Valve Lifters Cleaning and Inspection .

Installation Procedure

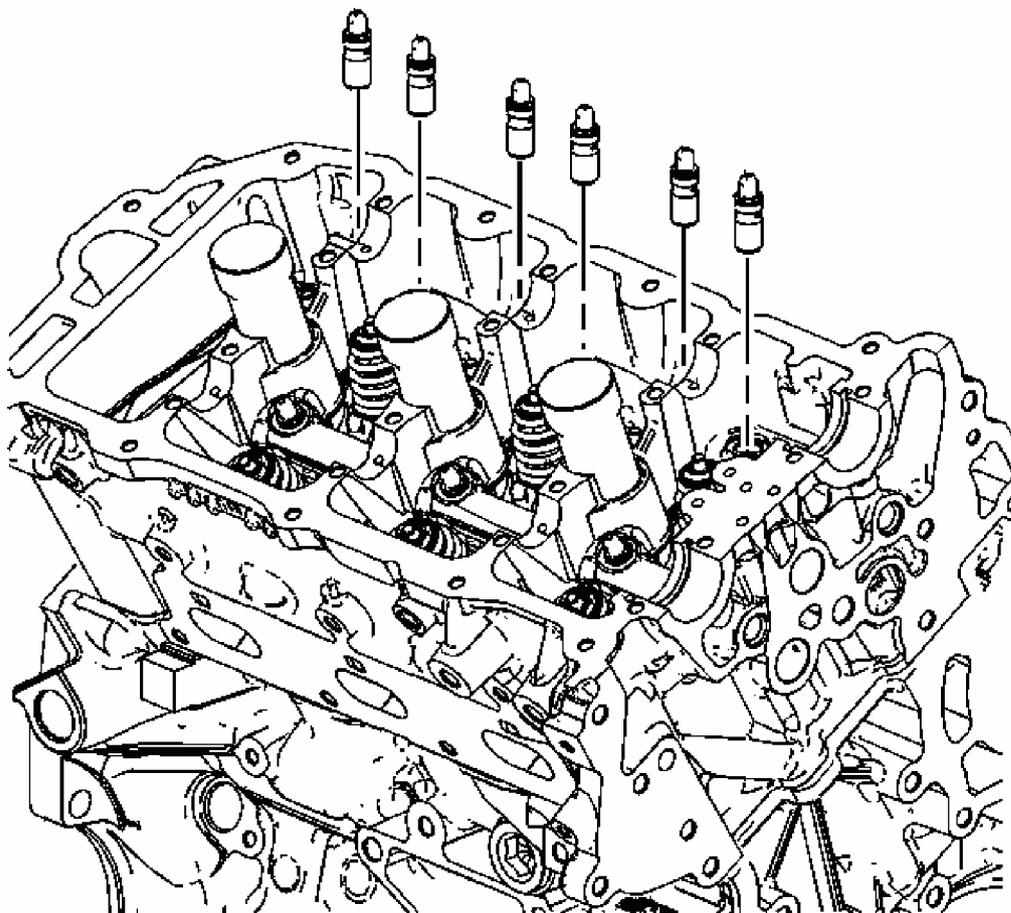


Fig. 177: Identifying Stationary Hydraulic Lash Adjuster (SHLA)
Courtesy of GENERAL MOTORS CORP.

1. Install the lifters. Refer to **Valve Lifter Installation - Left** .
2. Install the rocker arms. Refer to **Valve Rocker Arm Installation - Left** .
3. Install the applicable camshaft(s). Refer to **Camshaft Replacement - Left**.

VALVE LIFTER REPLACEMENT - RIGHT

Removal Procedure

1. Remove the applicable camshaft(s). Refer to **Camshaft Replacement - Right**.
2. Remove the rocker arms. Refer to **Valve Rocker Arm Removal - Right** .

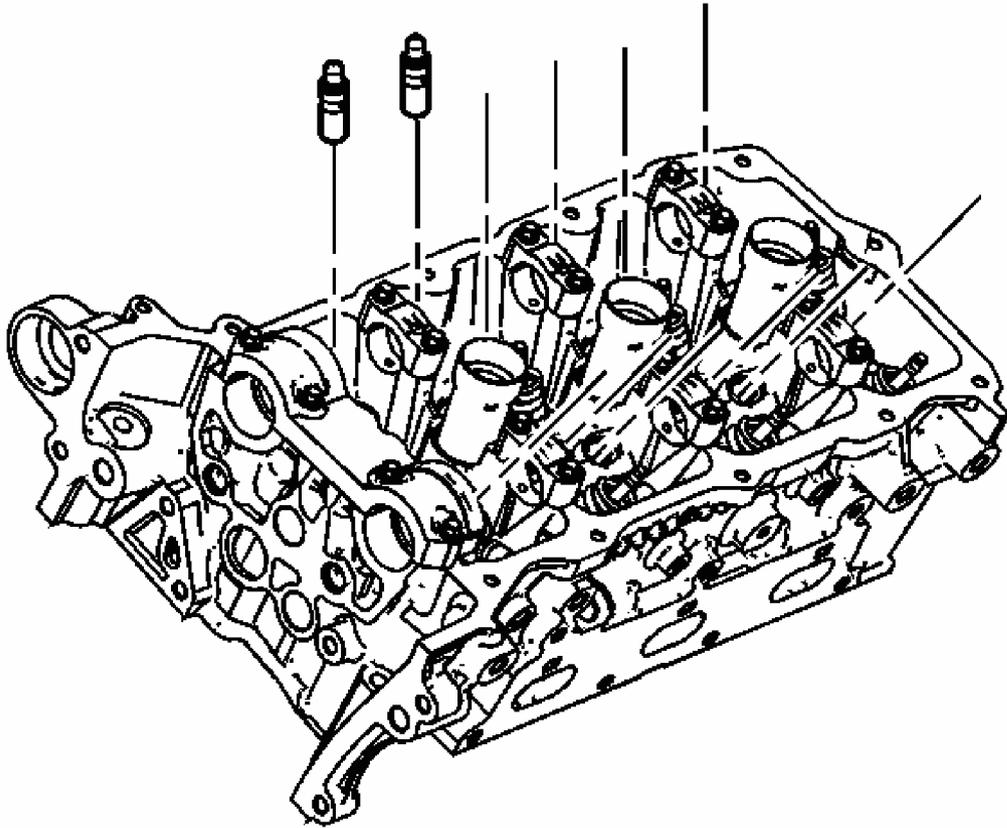


Fig. 178: View Of SHLAs
Courtesy of GENERAL MOTORS CORP.

3. Remove the lifters. Refer to **Valve Lifter Removal - Left** .
4. Clean and inspect the camshaft(s) and the rocker arm(s). Repair or replace as necessary. Refer to **Camshaft Cleaning and Inspection** and **Valve Lifters Cleaning and Inspection** .

Installation Procedure

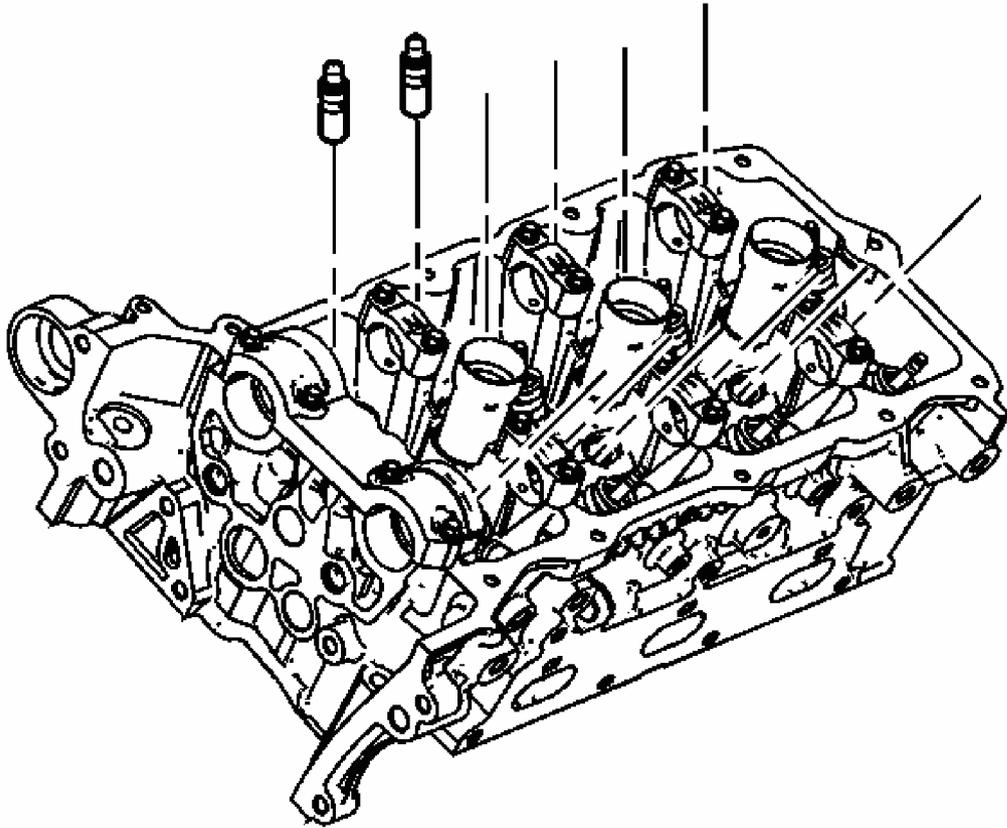


Fig. 179: View Of SHLAs
Courtesy of GENERAL MOTORS CORP.

1. Install the lifters. Refer to **Valve Lifter Installation - Right** .
2. Install the rocker arms. Refer to **Valve Rocker Arm Installation - Right** .
3. Install the applicable camshaft(s). Refer to **Camshaft Replacement - Right**.

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT - LEFT

Tools Required

- EN 46106 Flywheel Holding Tool
- EN 46110 On-Vehicle Valve Spring Compressor
- EN 46116 Valve Stem Seal Remover/Installer
- J 39313 Spark Plug Port Adapter

Removal Procedure

1. Remove the starter motor. Refer to **Starter Motor Replacement (LP1, LY7)** or **Starter Motor Replacement (LS6)** in Engine Electrical.

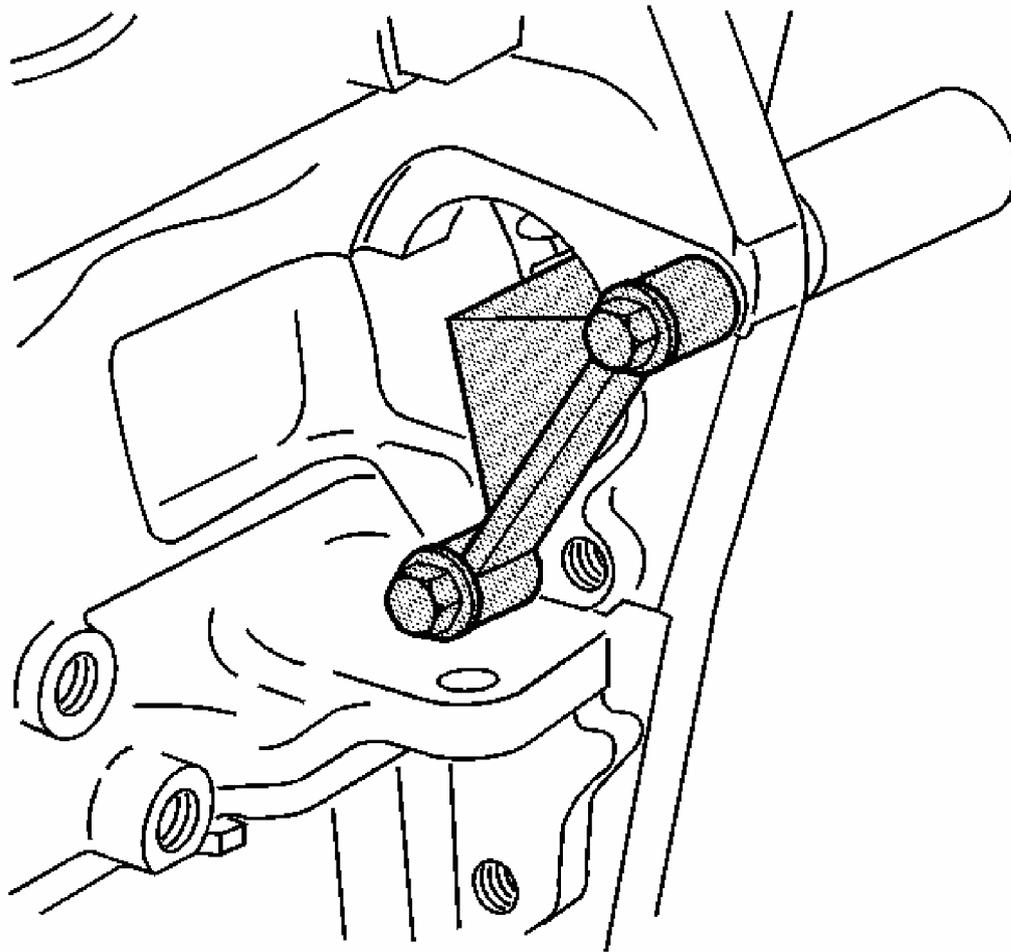


Fig. 180: View Of Tool EN 46106
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the EN 46106 is not installed, the crankshaft may rotate. If the crankshaft rotates, disassembly and reassembly of the entire camshaft timing system may be required.

2. Install the **EN 46106** in order to prevent crankshaft rotation.
3. Remove the camshafts and rocker arms. Refer to **Camshaft Replacement - Left**.
4. Remove the spark plug from the applicable cylinder. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).

5. Install the **J 39313** to the applicable cylinder.
6. Connect the **J 39313** to a compressed air source.

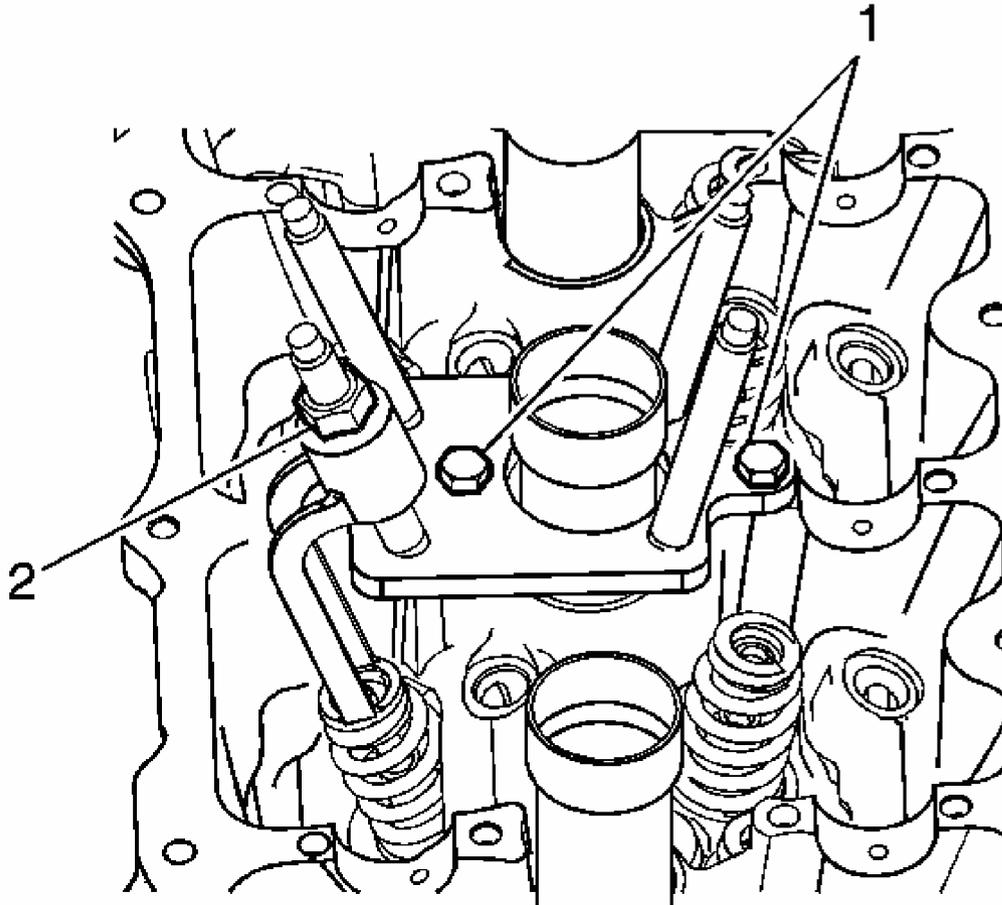


Fig. 181: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

7. Install the **EN 46110** above the applicable cylinder as shown.
8. Tighten the **EN 46110** valve spring compressor nut (2).

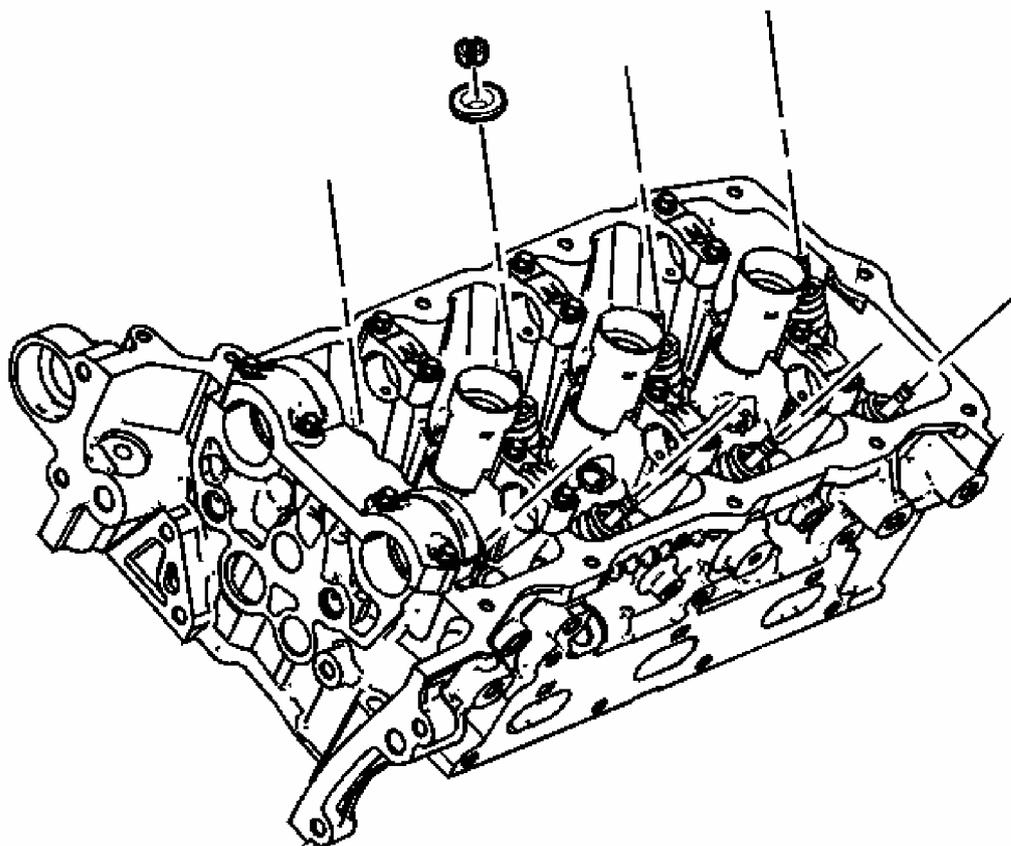


Fig. 182: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

9. Remove the valve keepers.
10. Loosen the **EN 46110** valve spring compressor nut.
11. Remove the valve spring retainer.

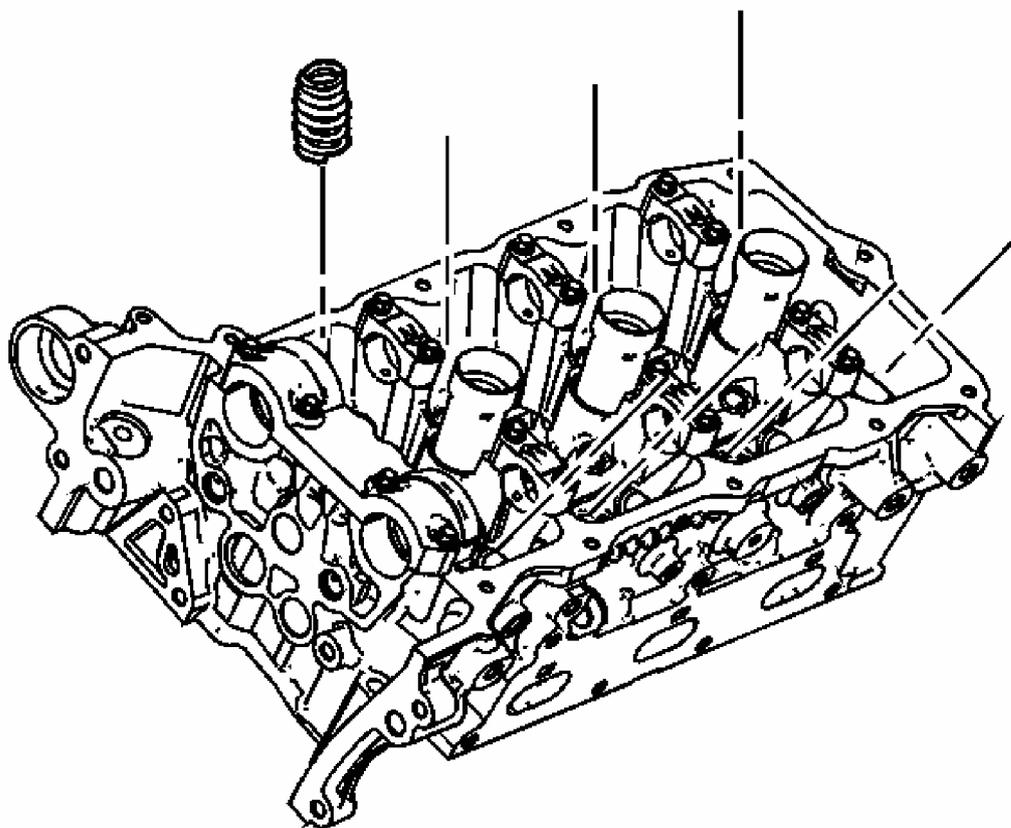


Fig. 183: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

12. Remove the valve spring.

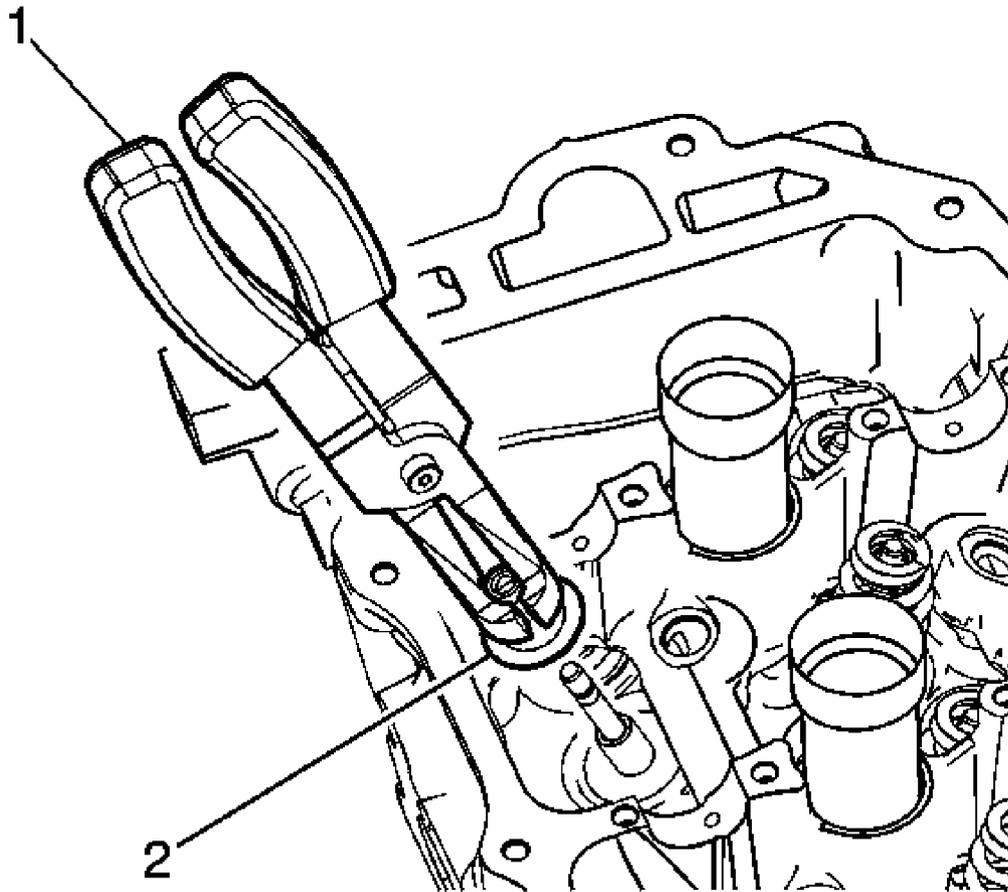


Fig. 184: Removing/Installing Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

13. Use the EN 46116 (1) in order to remove the valve stem seal (2).

Installation Procedure

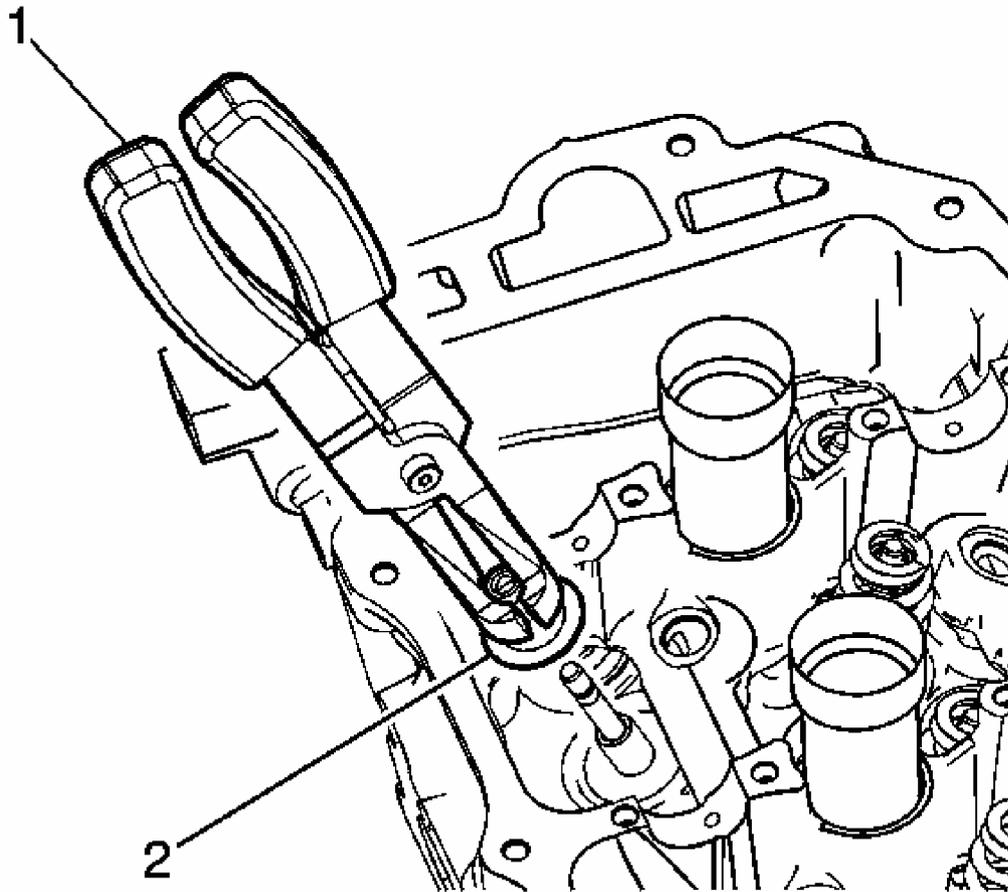


Fig. 185: Removing/Installing Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

1. Use the EN 46116 (1) in order to install the valve stem seal (2).

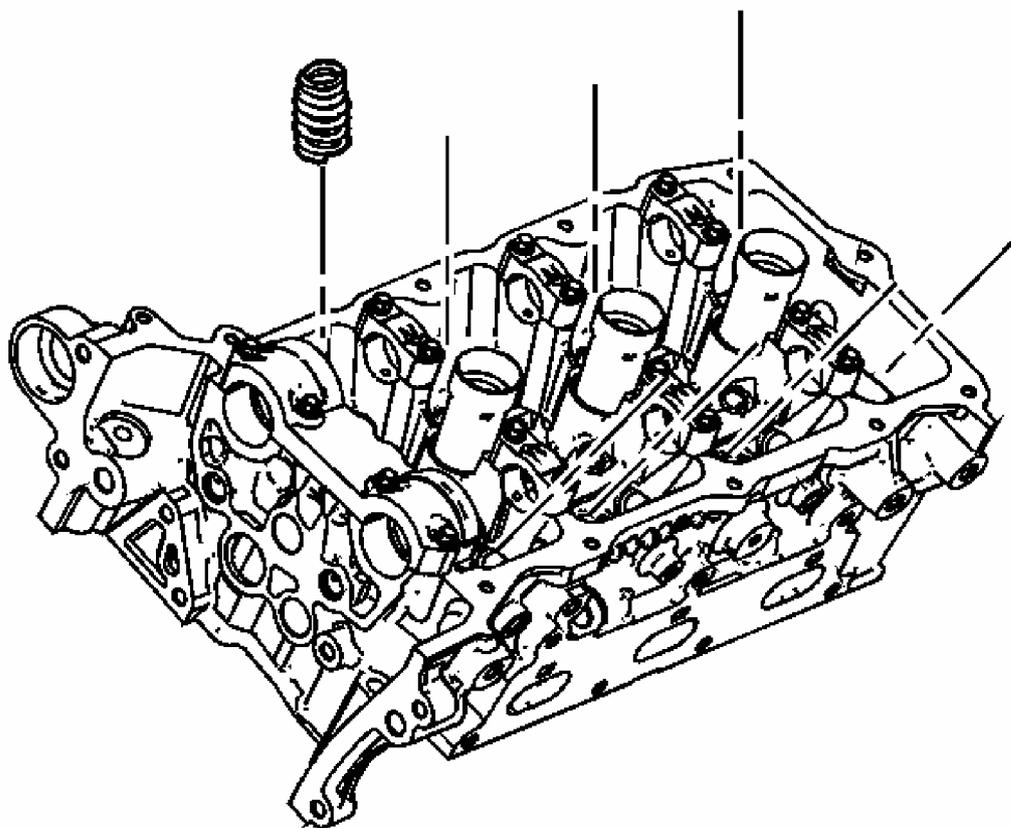


Fig. 186: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

2. Install the valve spring.
3. Install the valve spring retainer.

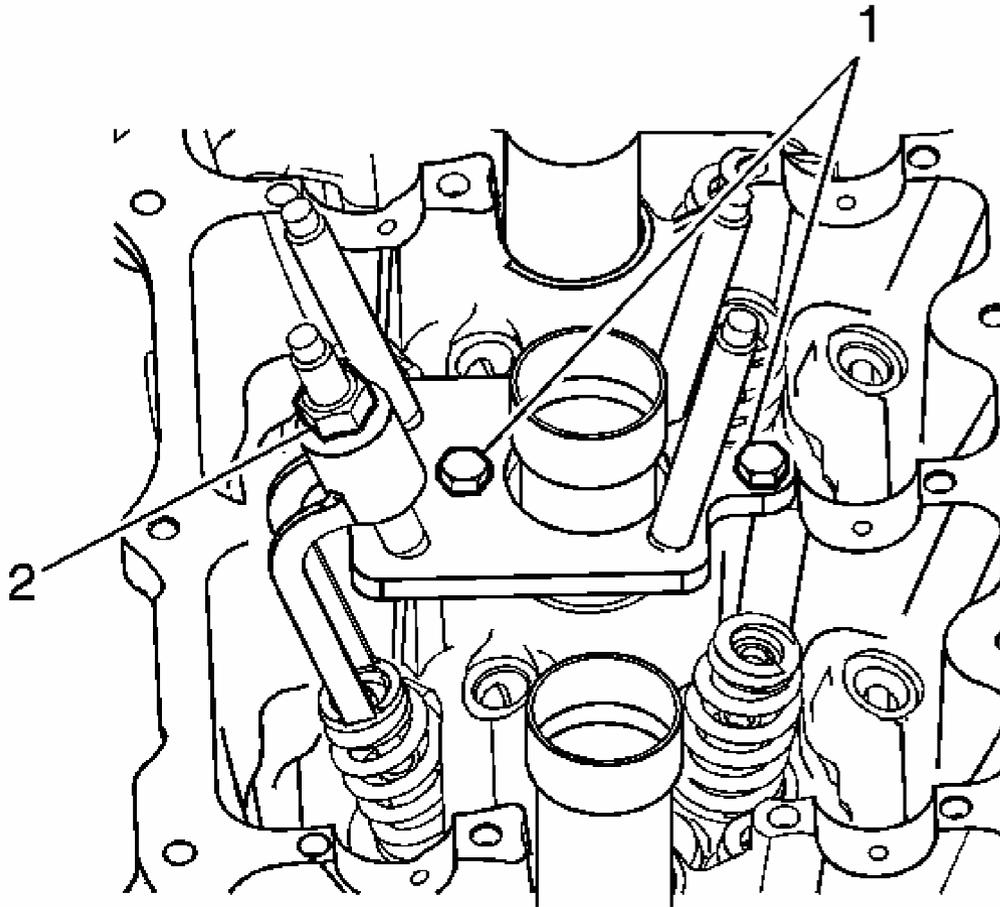


Fig. 187: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

4. Install the EN 46110 above the applicable valve spring as shown.

Tighten the EN 46110 valve spring compressor nut (2).

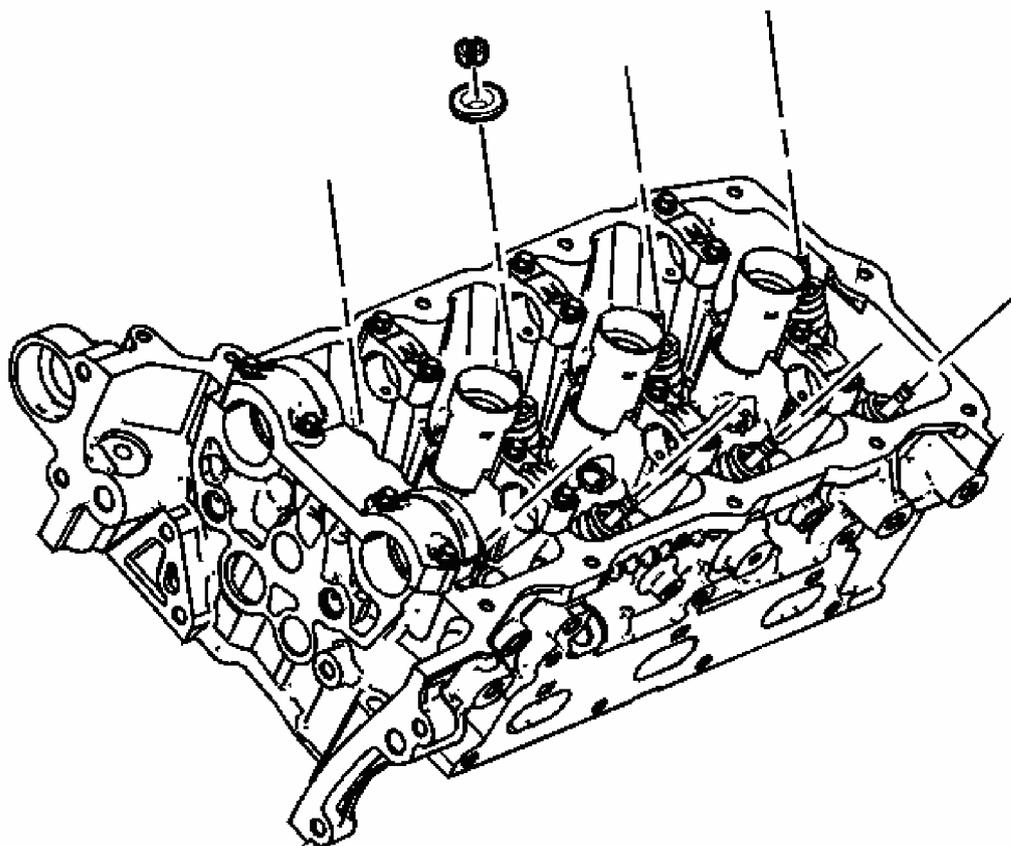


Fig. 188: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

5. Install the valve spring keepers.
6. Remove the **EN 46110** .
7. Disconnect the **J 39313** from the compressed air source.
8. Remove the **J 39313** .
9. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
10. Install the rocker arms and camshafts. Refer to **Camshaft Replacement - Left**.
11. Remove the **EN 46106** in order to prevent crankshaft rotation.
12. Install the starter motor. Refer to **Starter Motor Replacement (LP1, LY7)** or **Starter Motor Replacement (LS6)** in Engine Electrical.

Tools Required

- EN 46106 Flywheel Holding Tool
- EN 46110 On-Vehicle Valve Spring Compressor
- EN 46116 Valve Stem Seal Remover/Installer
- J 39313 Spark Plug Port Adapter

Removal Procedure

1. Remove the starter motor. Refer to **Starter Motor Replacement (LP1, LY7)** or **Starter Motor Replacement (LS6)** in Engine Electrical.

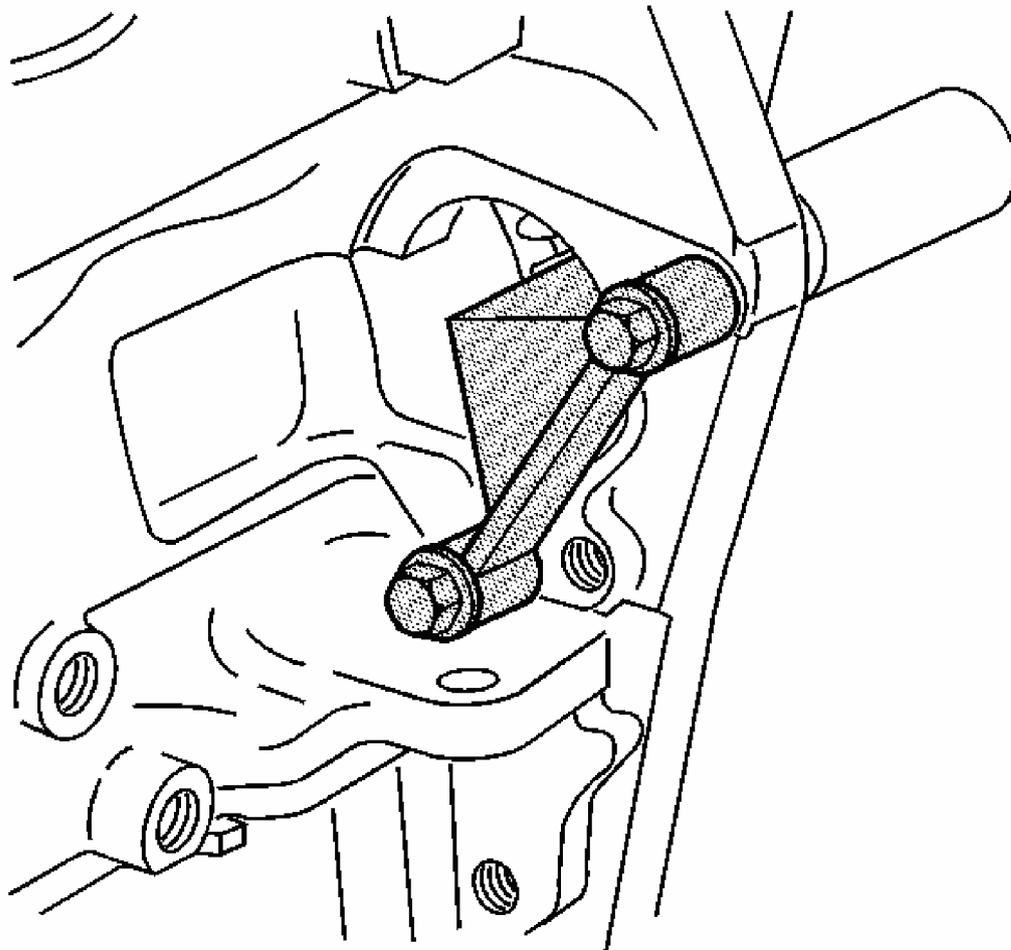


Fig. 189: View Of Tool EN 46106
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the EN 46106 is not installed, the crankshaft may rotate.
If the crankshaft rotates, disassembly and reassembly of
the entire camshaft timing system may be required.

2. Install the EN 46106 in order to prevent crankshaft rotation.
3. Remove the camshafts and rocker arms. Refer to Camshaft Replacement - Right.
4. Remove the spark plug from the applicable cylinder. Refer to Spark Plug Replacement
in Engine Controls - 3.6L (LY7).
5. Install the J 39313 to the applicable cylinder.
6. Connect the J 39313 to a compressed air source.

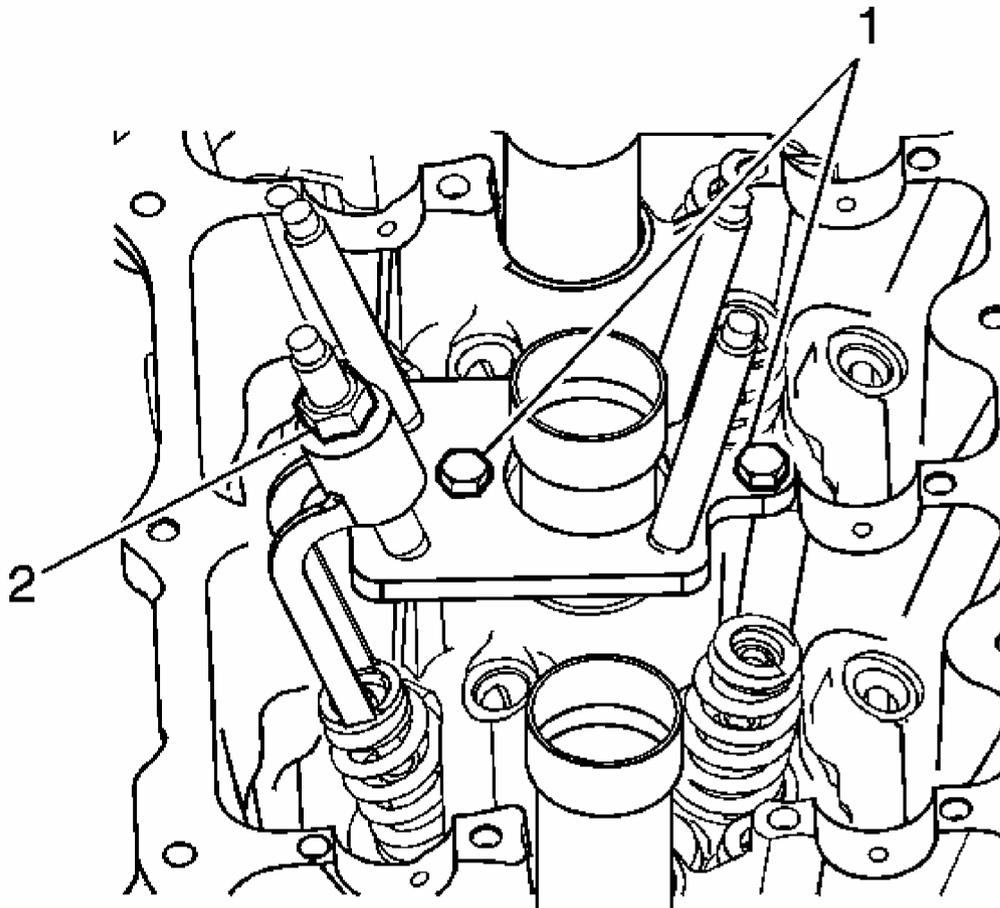


Fig. 190: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

7. Install the **EN 46110** above the applicable cylinder as shown.
8. Tighten the **EN 46110** valve spring compressor nut (2).

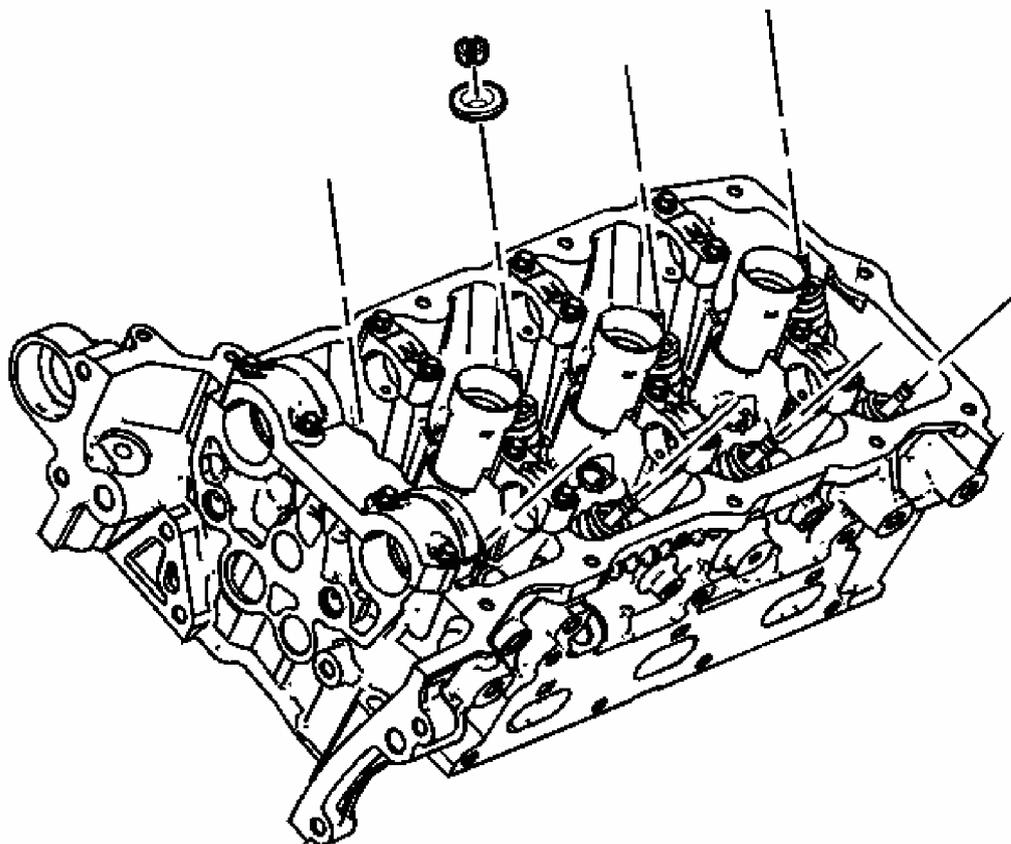


Fig. 191: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

9. Remove the valve keepers.
10. Loosen the **EN 46110** valve spring compressor nut.
11. Remove the valve spring retainer.

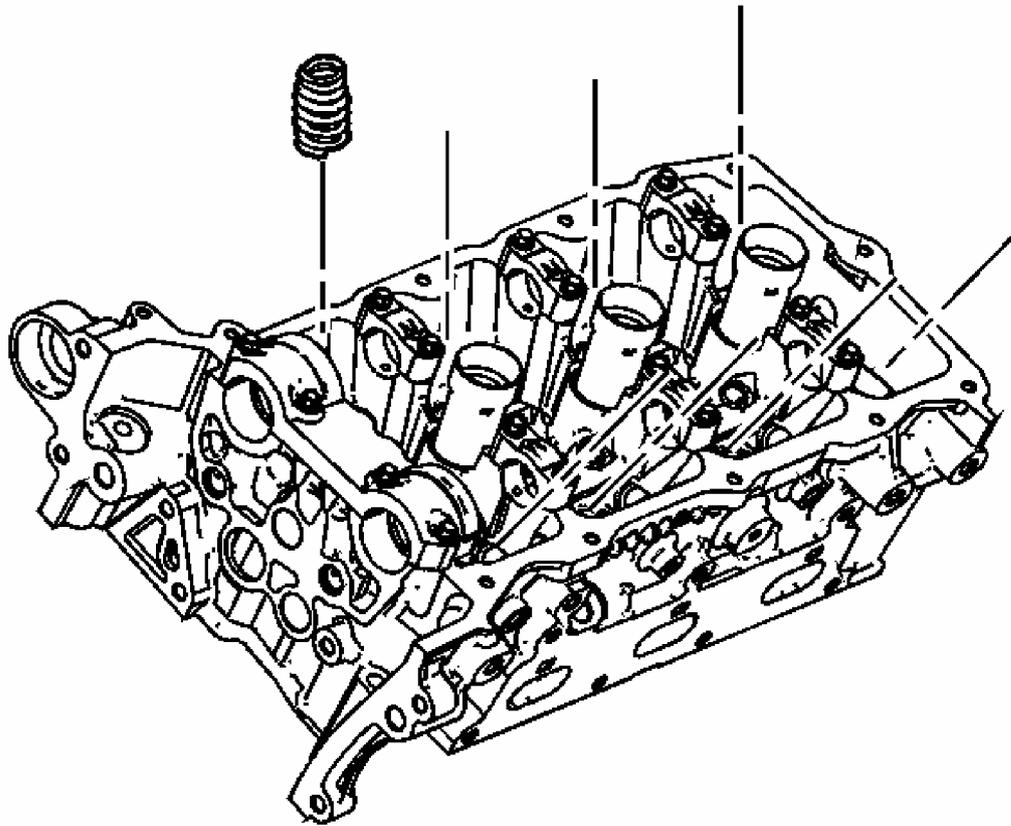


Fig. 192: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

12. Remove the valve springs.

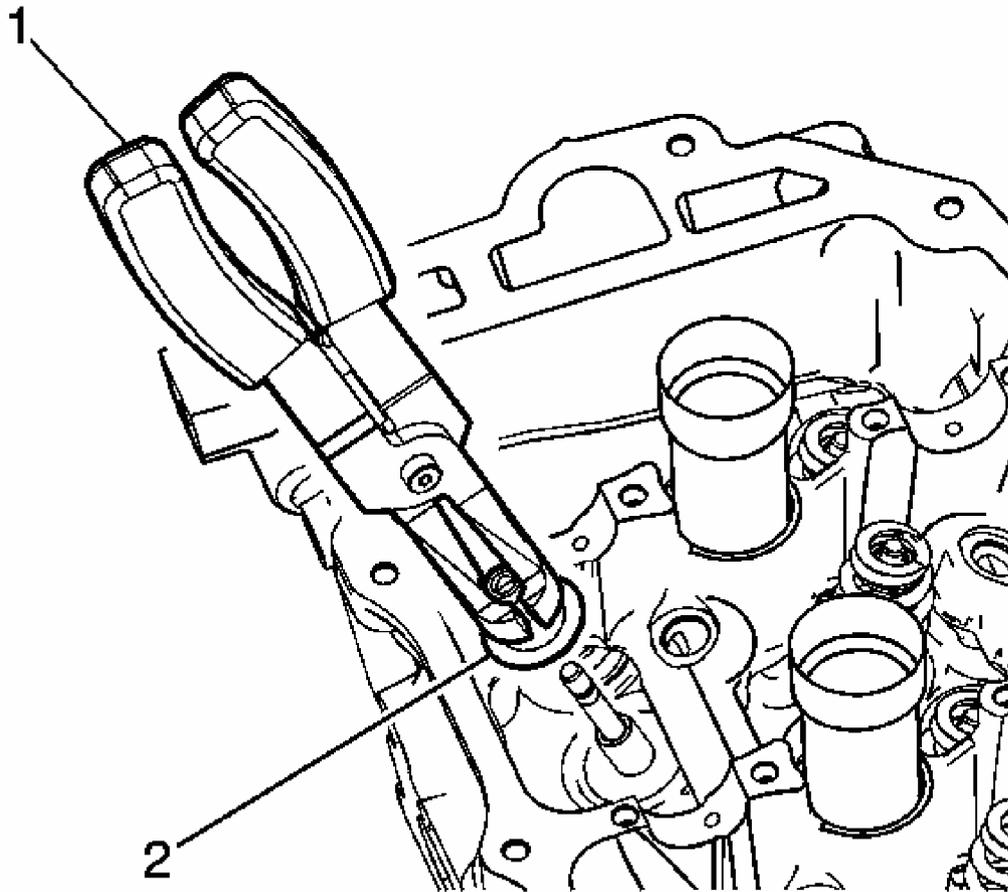


Fig. 193: Removing/Installing Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

13. Use the EN 46116 (1) in order to remove the valve stem seal (2).

Installation Procedure

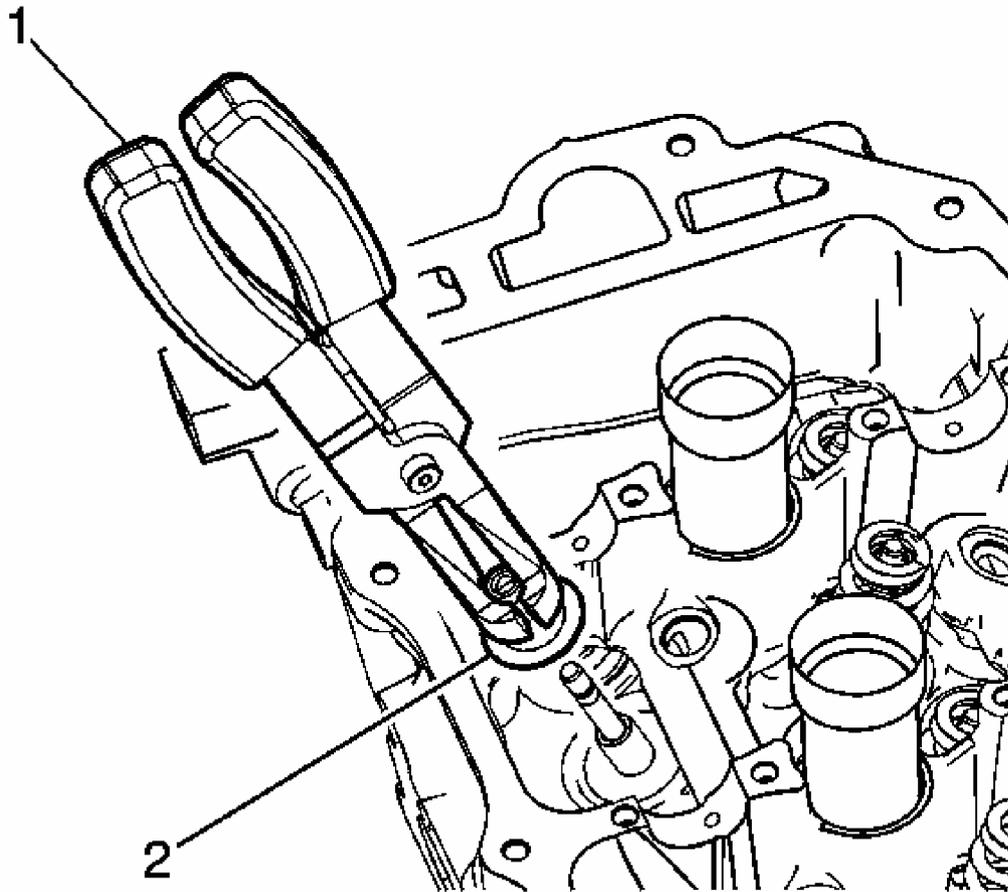


Fig. 194: Removing/Installing Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

1. Use the EN 46116 (1) in order to install the valve stem seals (2).

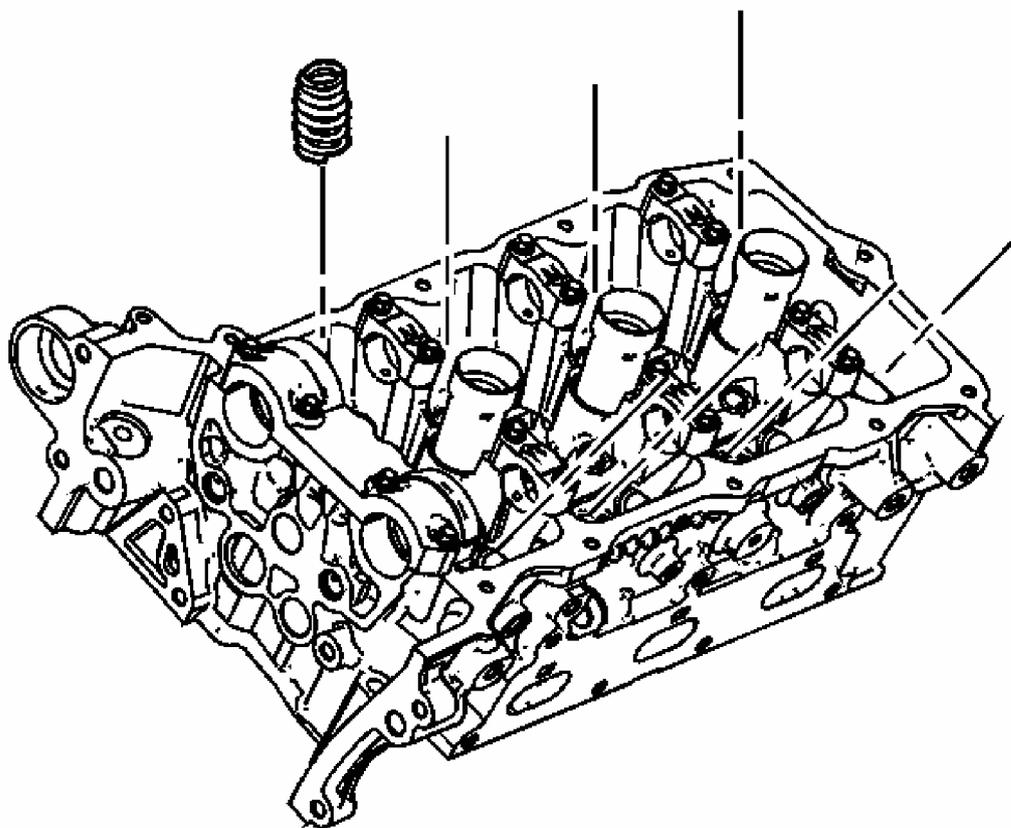


Fig. 195: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

2. Install the valve spring.
3. Install the valve spring retainer.

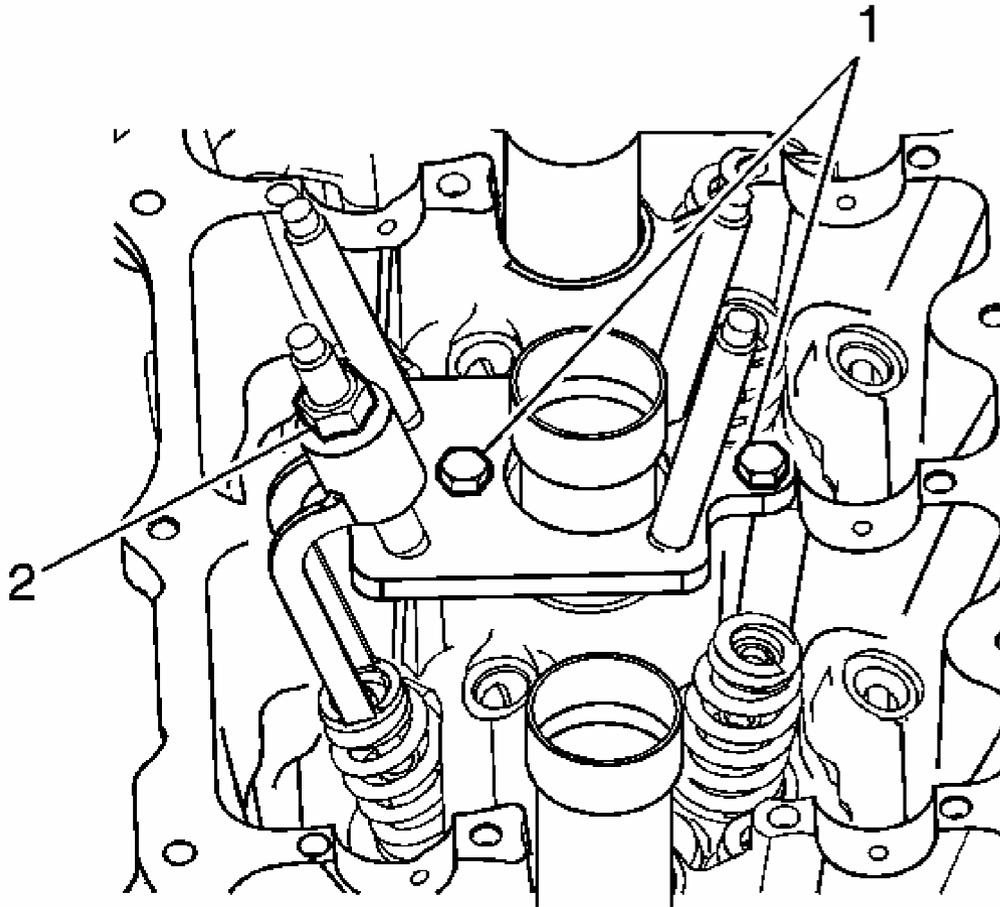


Fig. 196: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

4. Install the EN 46110 above the applicable valve spring as shown.

Tighten the EN 46110 valve spring compressor nut (2).

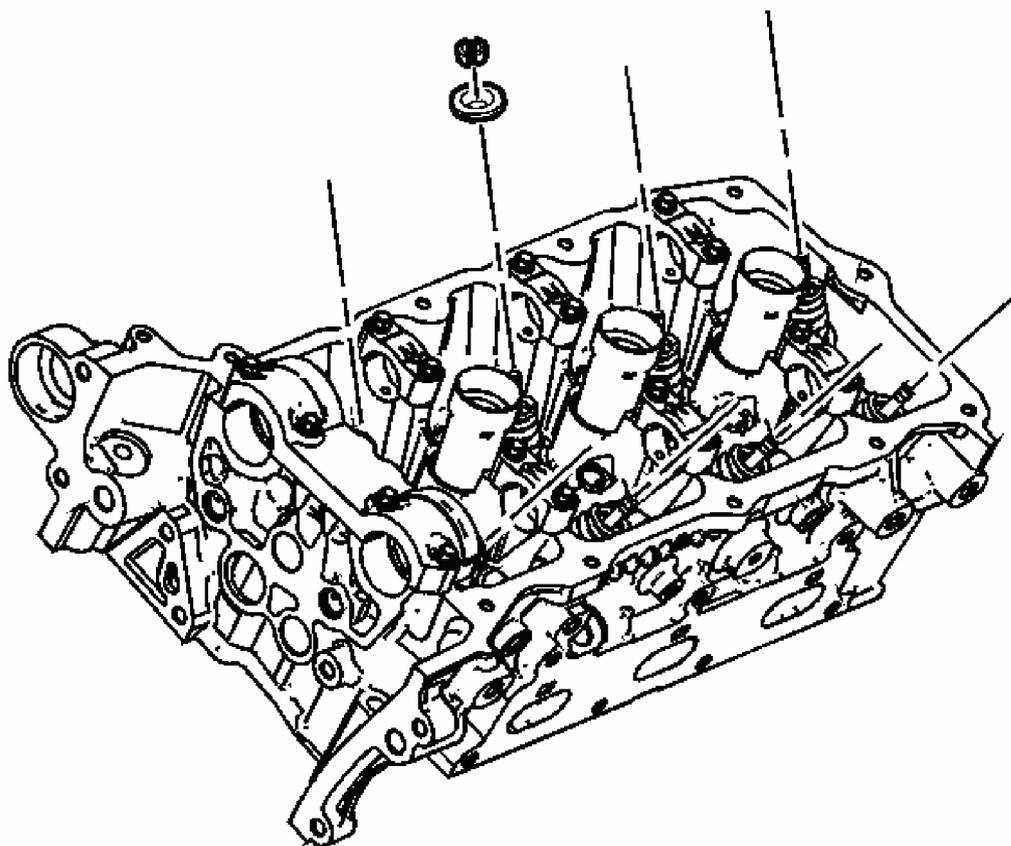


Fig. 197: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

5. Install the valve spring keepers.
6. Remove the **EN 46110** .
7. Disconnect the **J 39313** from the compressed air source.
8. Remove the **J 39313** .
9. Install the spark plugs. Refer to **Spark Plug Replacement** in Engine Controls - 3.6L (LY7).
10. Install the rocker arms and camshafts. Refer to **Camshaft Replacement - Right**.
11. Remove the **EN 46106** .
12. Install the starter motor. Refer to **Starter Motor Replacement (LP1, LY7)** or **Starter Motor Replacement (LS6)** in Engine Electrical.

Removal Procedure

1. Remove the left bank secondary timing chain. Refer to **Secondary Camshaft Drive Chain Replacement - Left**.
2. Remove the oil level indicator. Refer to **Oil Level Indicator and Tube Replacement**.

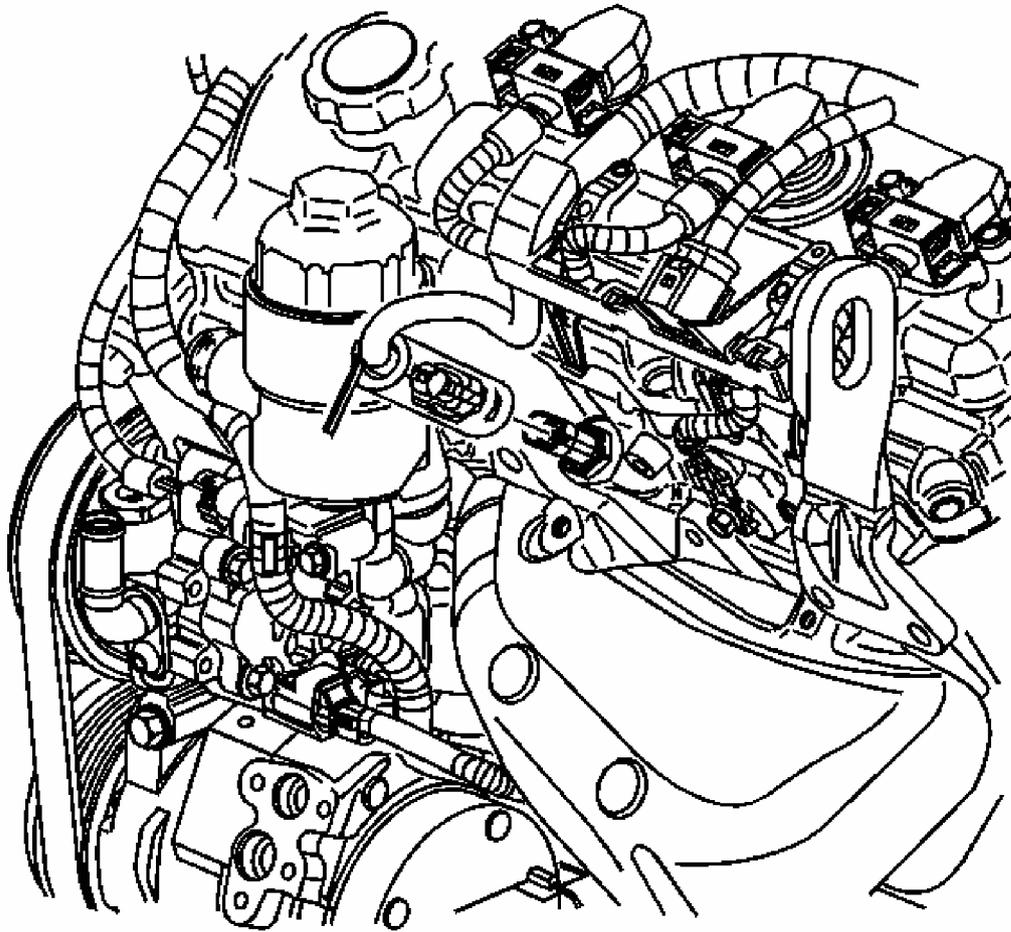


Fig. 198: View Of Coolant Temperature Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Remove the heat shield from the coolant temperature sensor and disconnect the coolant temperature sensor electrical connector.

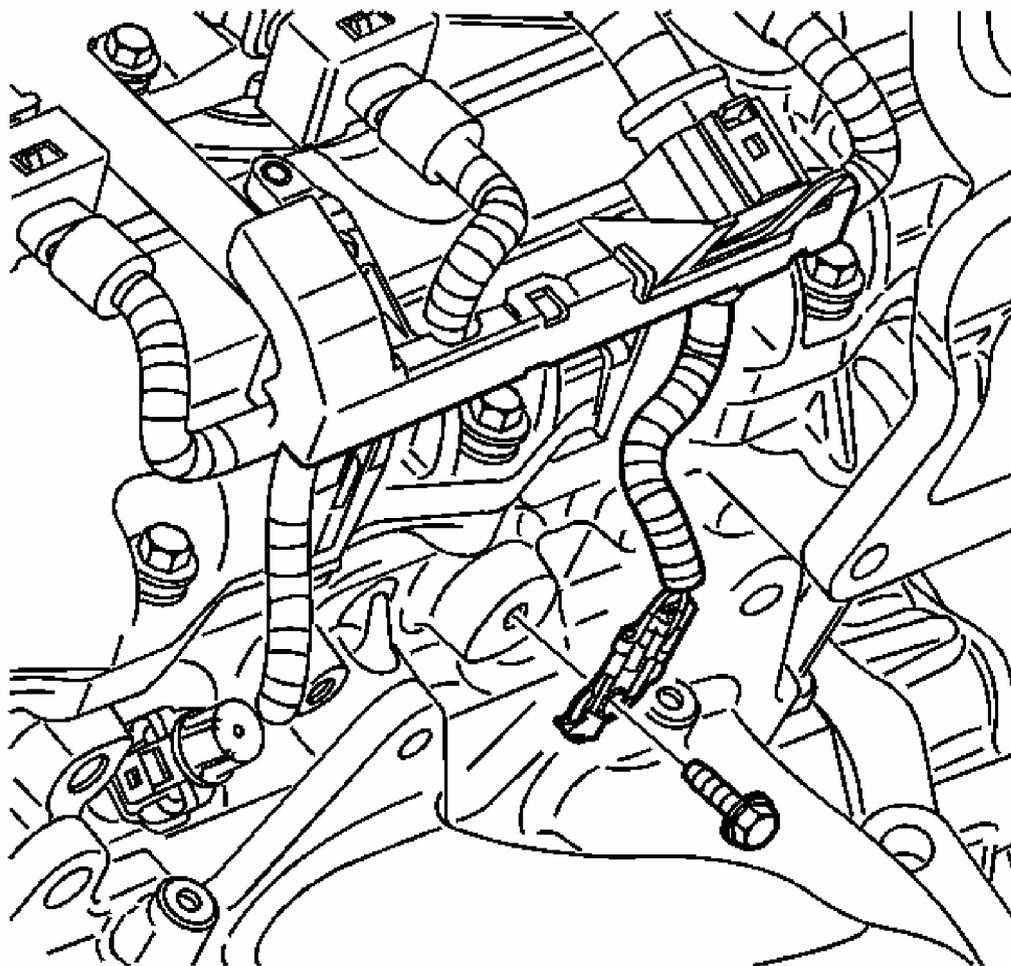


Fig. 199: View Of Left Cylinder Head Wiring Harness Ground Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the wiring harness ground from the cylinder head.
5. Disconnect the wiring harness electrical connector located at the side of the cylinder head.
6. Remove the wiring harness connector bracket from the side of the cylinder head.

IMPORTANT: DO NOT disconnect the power steering pipes and/or hoses.

7. Remove the power steering pump bolts. Refer to **Power Steering Pump Removal**.
8. Remove the surge tank hose from the bracket at the rear of the cylinder head.

9. Remove the wiring harness bracket from the rear of the cylinder head.
10. Remove the catalytic converter. Refer to Catalytic Converter Replacement - Left (LP1, LY7) or Catalytic Converter Replacement - Left (LS6) in Engine Exhaust.
11. Remove the oil level indicator. Refer to Oil Level Indicator and Tube Replacement.

IMPORTANT: Do not remove the oil filter adapter.

12. Remove the oil filter adapter upper bolt.

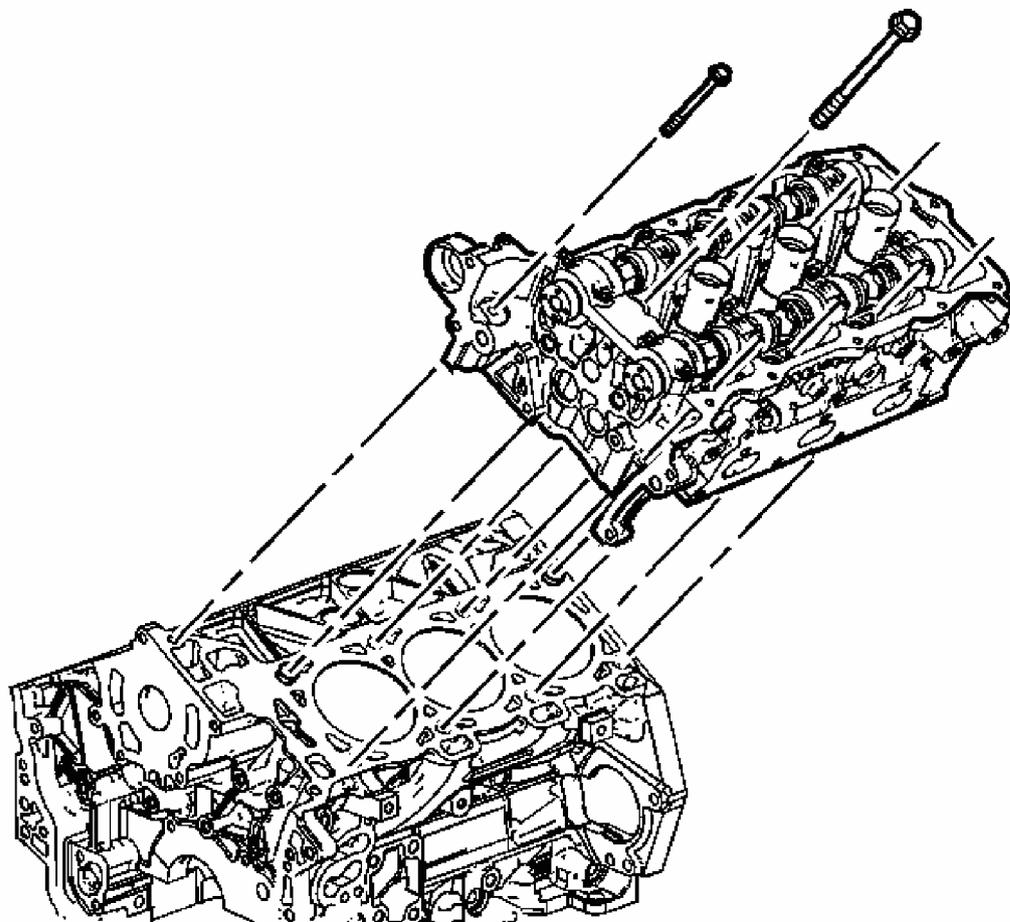


Fig. 200: View Of Left Cylinder Head
Courtesy of GENERAL MOTORS CORP.

13. Remove the cylinder head with the exhaust manifold. Refer to Cylinder Head Removal - Right.

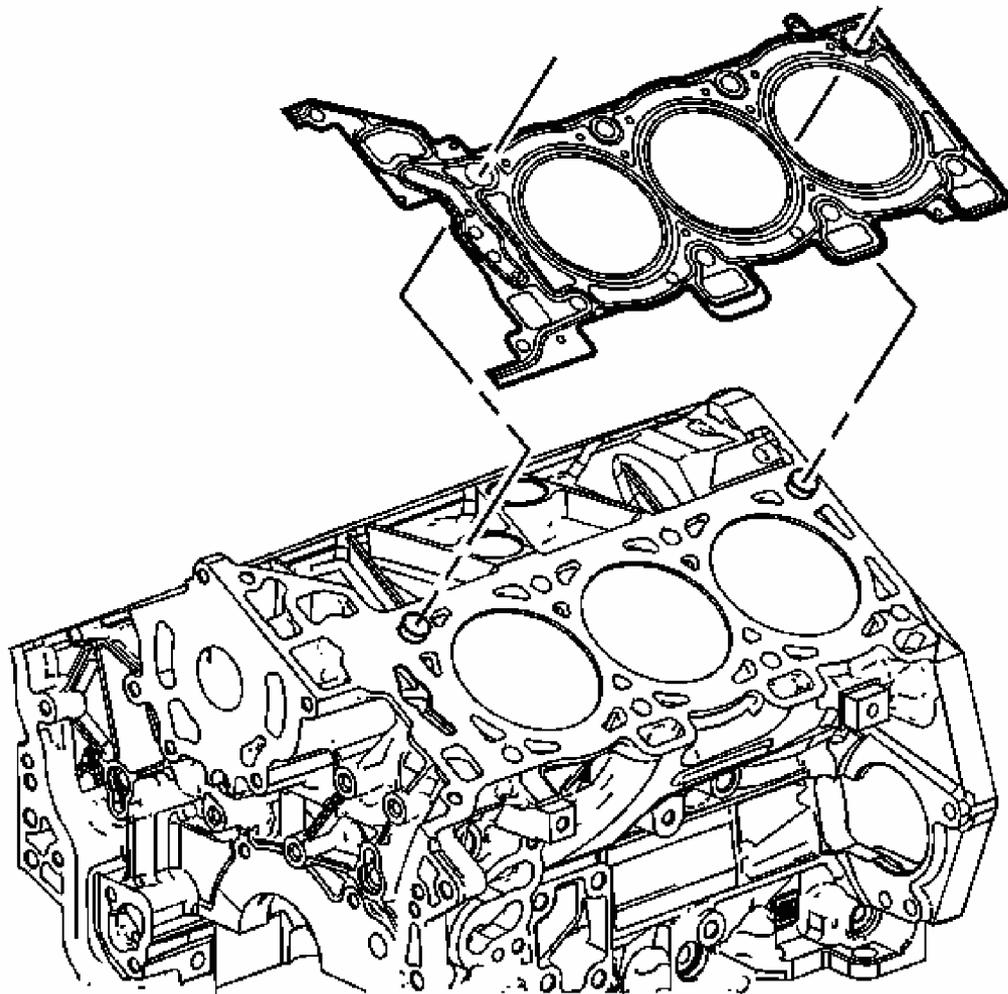


Fig. 201: View Of Left Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

14. Remove and discard the cylinder head gasket.
15. Clean and inspect the cylinder head and the engine block sealing surfaces. Refer to **Cylinder Head Cleaning and Inspection** and **Engine Block Cleaning and Inspection** .
16. If necessary, perform the following steps:
 - Remove the exhaust manifold from the cylinder head. Refer to **Exhaust Manifold Removal - Left**
 - Disassemble the cylinder head. Refer to **Cylinder Head Disassemble** .

1. If necessary, perform the following steps:
 - Assemble the cylinder head. Refer to Cylinder Head Assemble .
 - Install the exhaust manifold to the cylinder head. Refer to Exhaust Manifold Installation - Left

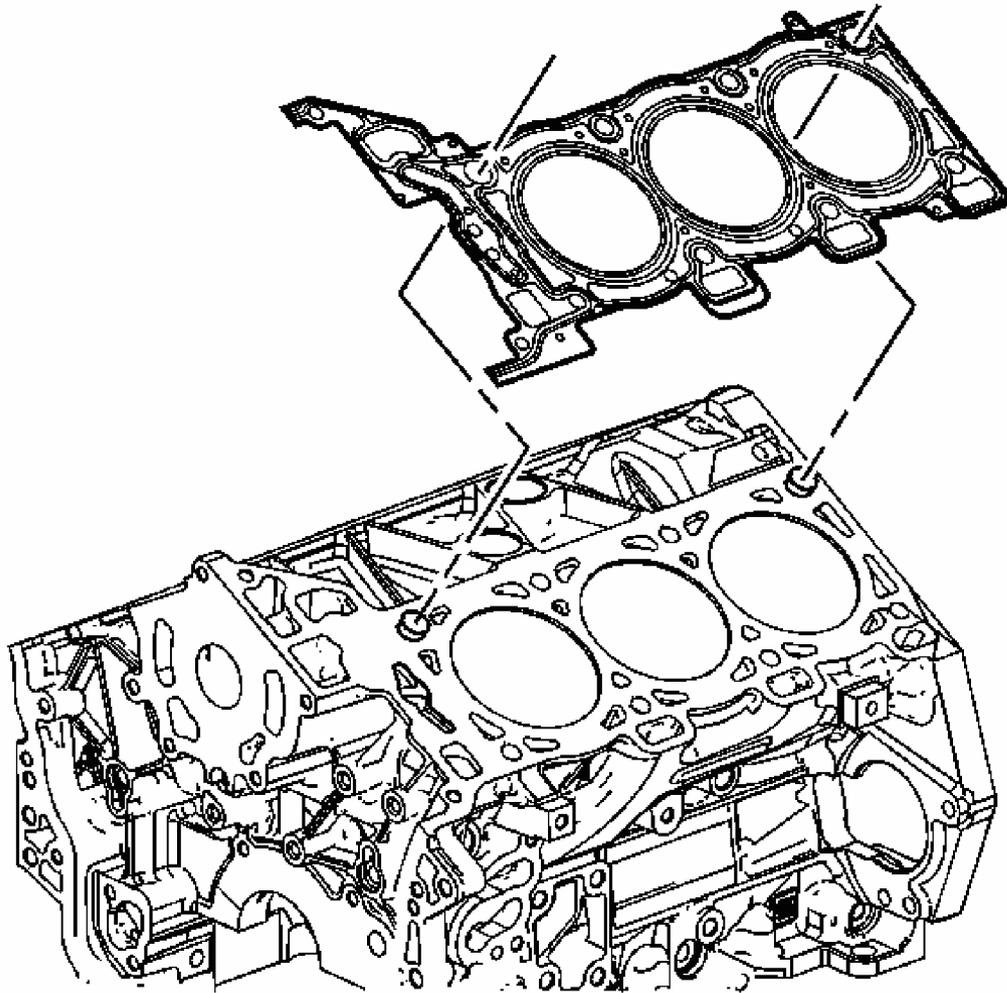


Fig. 202: View Of Left Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

2. Install a NEW cylinder head gasket.

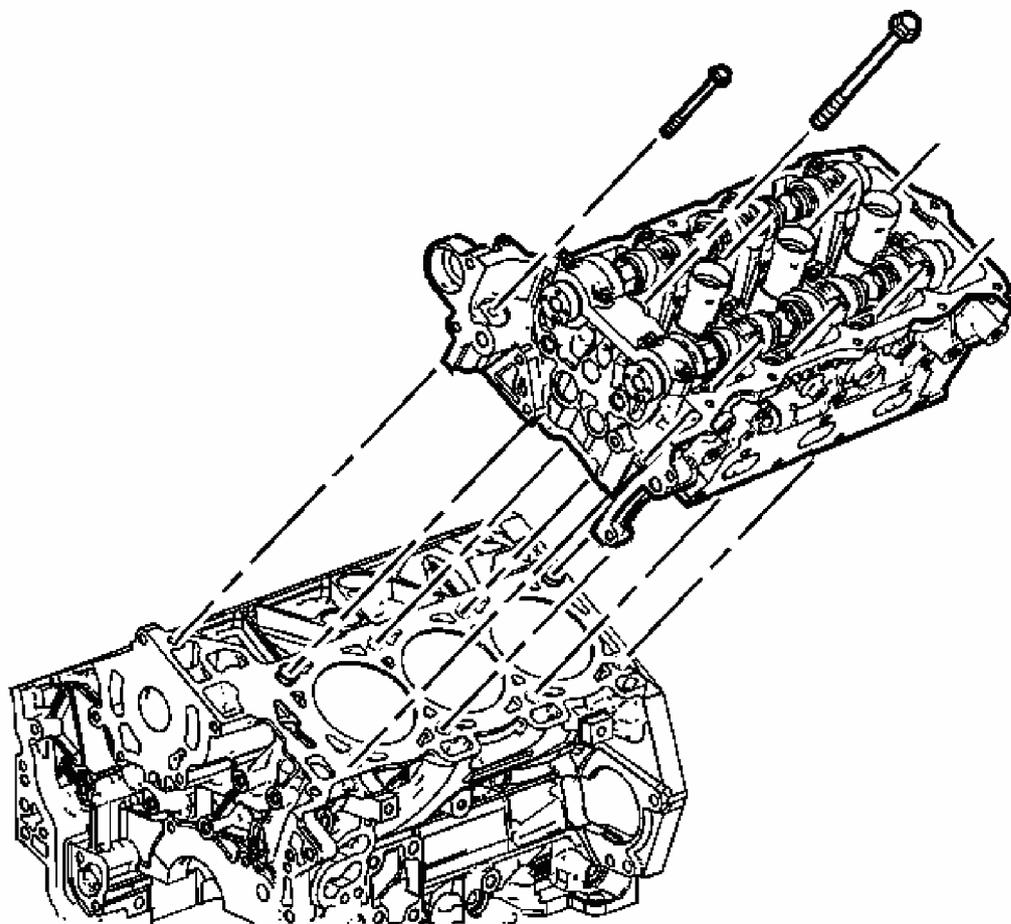


Fig. 203: View Of Left Cylinder Head
Courtesy of GENERAL MOTORS CORP.

3. Carefully install the cylinder head with the exhaust manifold to the engine. Refer to **Cylinder Head Installation - Left** .
4. Install the oil filter adapter upper bolt. Refer to **Oil Filter Adapter Installation** .
5. Install the oil level indicator. Refer to **Oil Level Indicator and Tube Replacement**.
6. Install the catalytic converter to the exhaust manifold. Refer to **Catalytic Converter Replacement - Left (LP1, LY7)** or **Catalytic Converter Replacement - Left (LS6)** in Engine Exhaust.
7. Install the wiring harness bracket to the rear of the cylinder head.
8. Install the surge tank hose to the bracket at the rear of the cylinder head.
9. Install the power steering pump bolts. Refer to **Power Steering Pump Installation** .

10. Install the wiring harness connector bracket from the side of the cylinder head.
11. Disconnect the wiring harness electrical connector located at the side of the cylinder head.

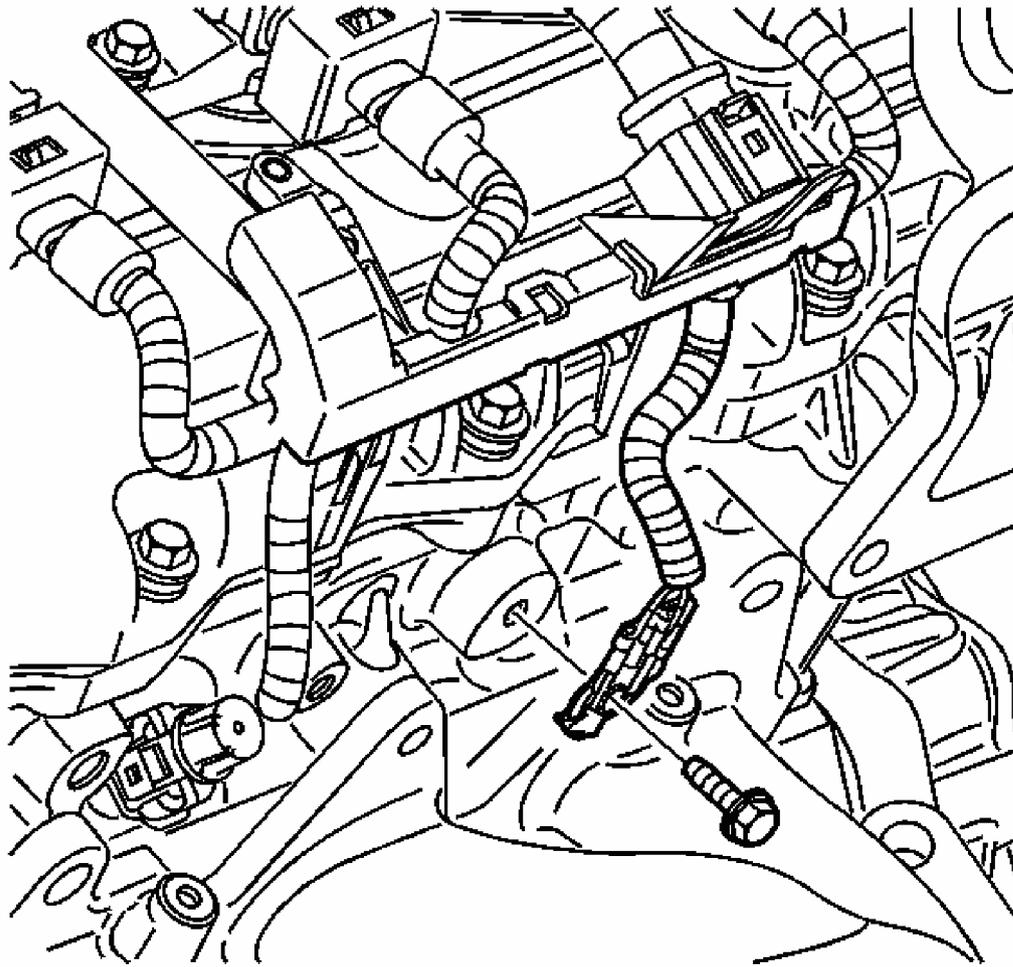


Fig. 204: View Of Left Cylinder Head Wiring Harness Ground Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

12. Install the wiring harness ground to the cylinder head.

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

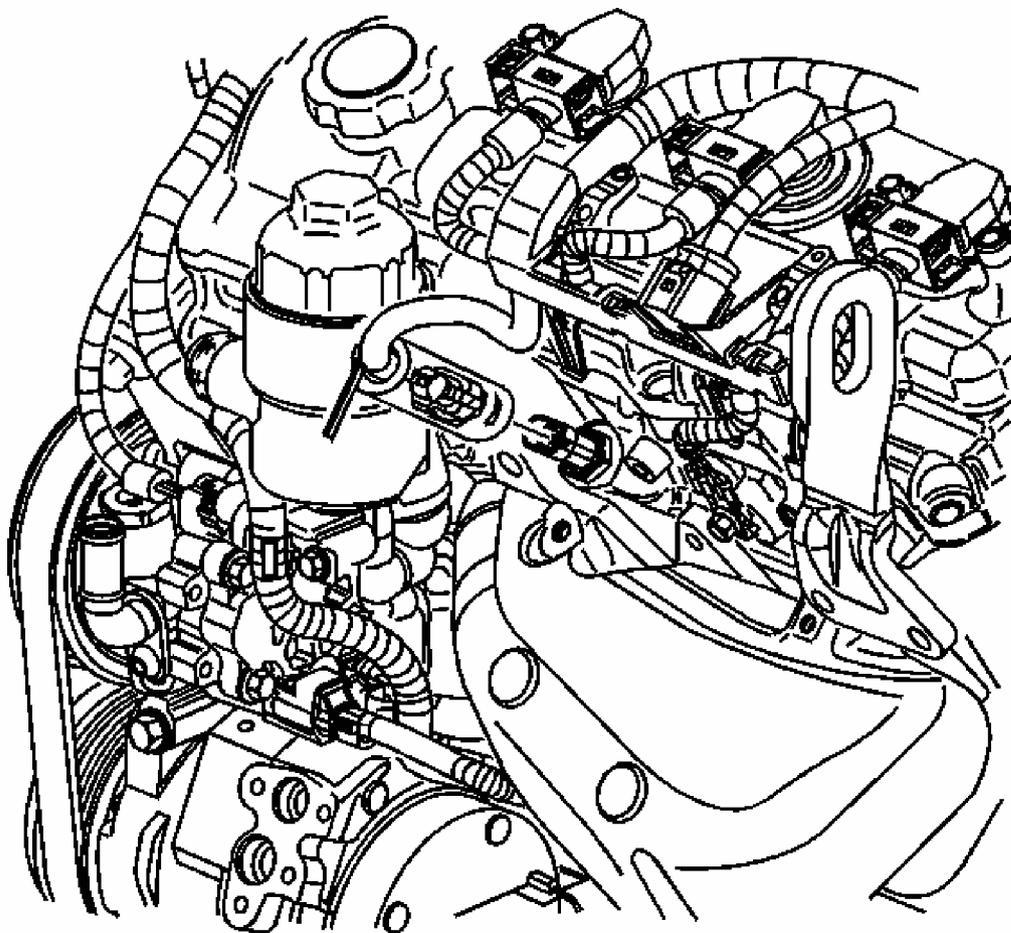


Fig. 205: View Of Coolant Temperature Sensor And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

13. Install the coolant temperature sensor electrical connector heat shield.
14. Install the oil level indicator. Refer to **Oil Level Indicator and Tube Replacement**.
15. Install the left bank secondary timing chain. Refer to **Secondary Camshaft Drive Chain Replacement - Left**.

