

2008 Buick LaCrosse CX
2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

2008 ENGINE

Engine Mechanical - 3.6L - LaCrosse

ON-VEHICLE REPAIR INFORMATION

DRIVE BELT REPLACEMENT

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the right engine splash shield. Refer to **Engine Splash Shield Replacement** .

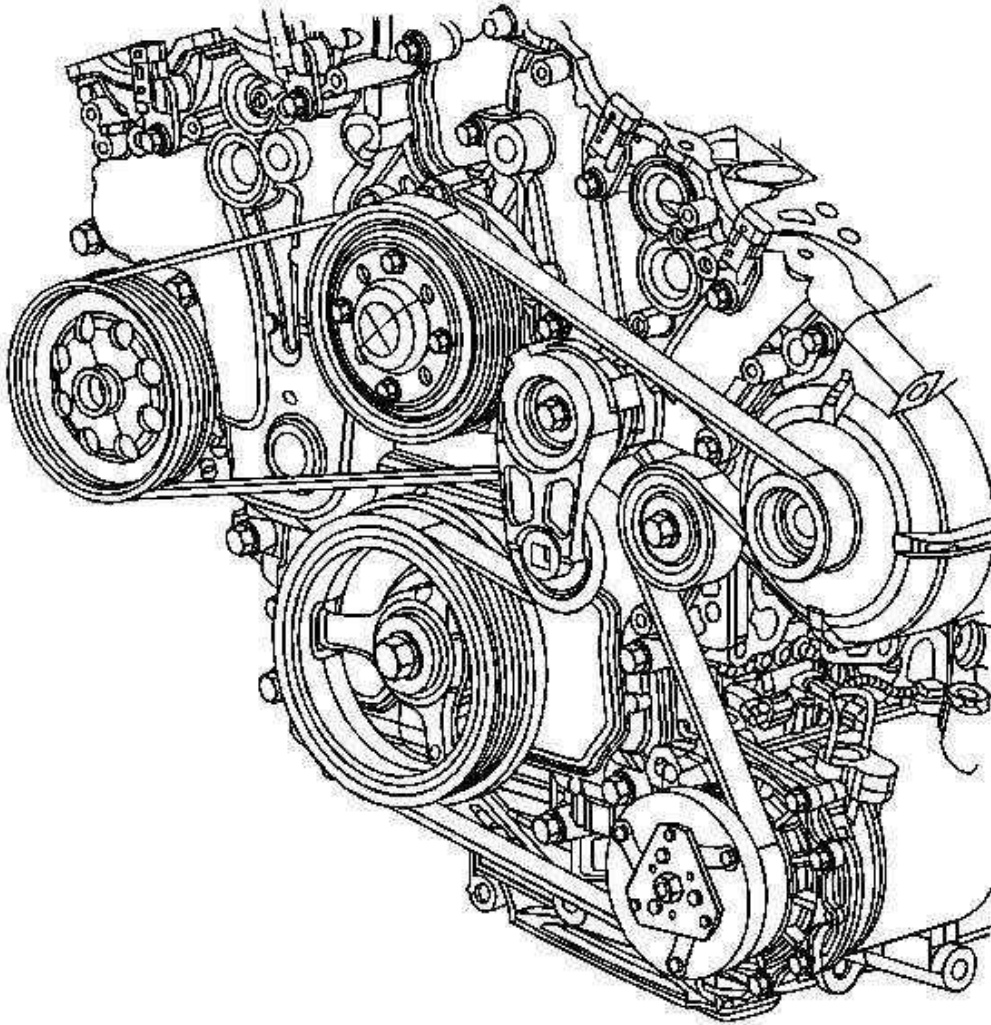


Fig. 1: View Of Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Rotate the drive belt tensioner clockwise to release the drive belt tension.
4. Remove the drive belt from the generator.
5. Slowly release the drive belt tensioner.
6. Remove the drive belt from the accessory drive pulleys.

Installation Procedure

1. Install the right engine splash shield. Refer to **Engine Splash Shield Replacement** .
2. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** .

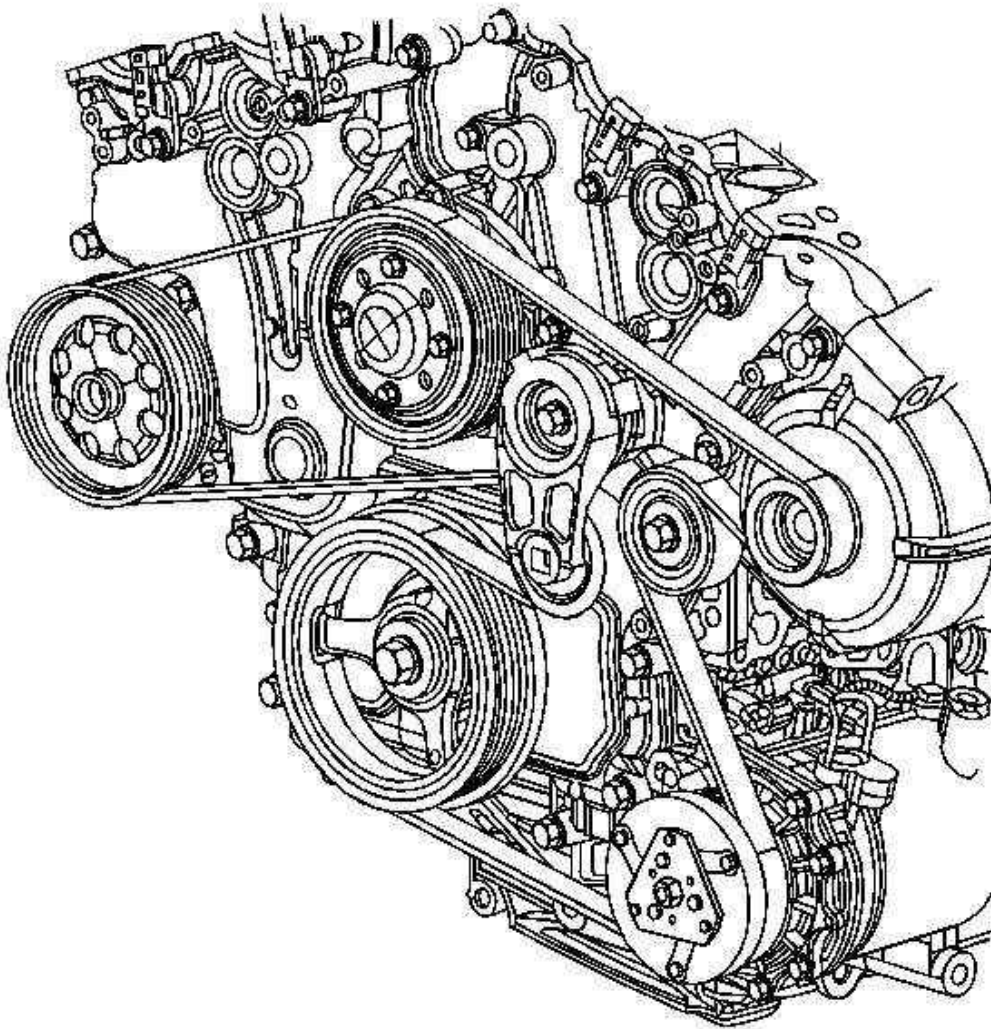


Fig. 2: View Of Drive Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

3. Install the drive belt to the accessory drive pulley.
4. Rotate the drive belt tensioner clockwise.
5. Install the drive belt to the generator.

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

6. Slowly release the drive belt tensioner.

DRIVE BELT TENSIONER REPLACEMENT

Removal Procedure

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the idler pulley. Refer to **Drive Belt Idler Pulley Replacement**.

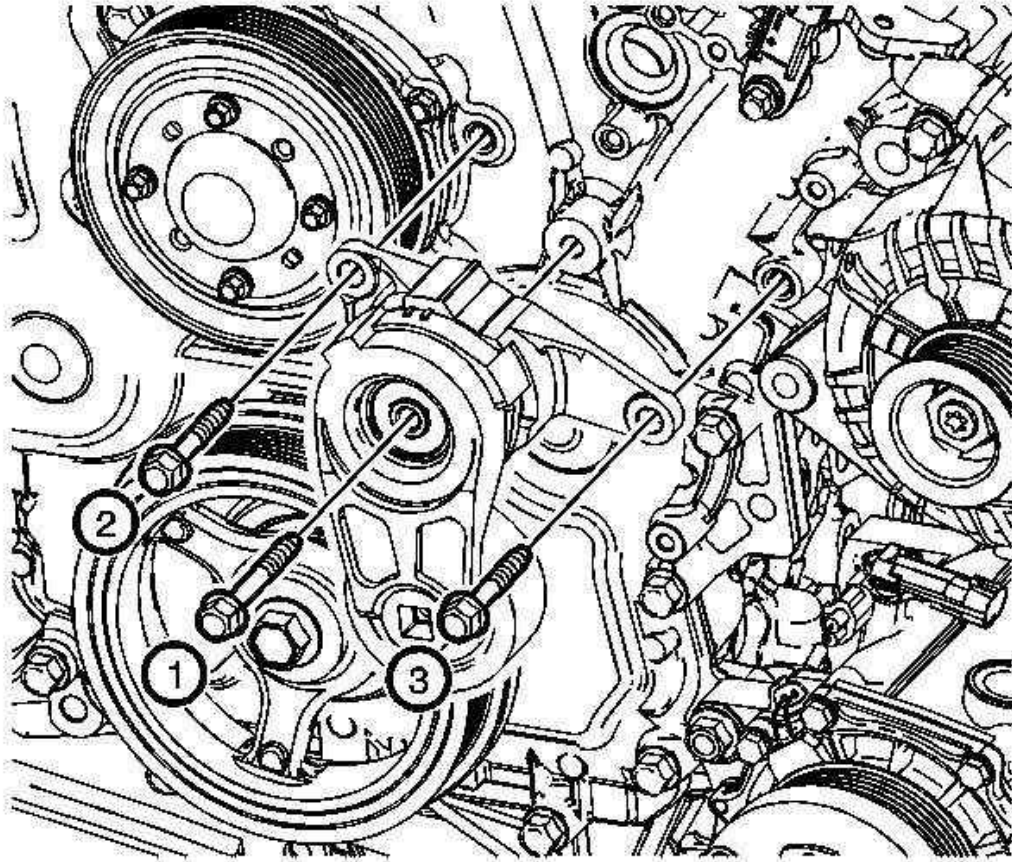


Fig. 3: Identifying Drive Belt Tensioner Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the drive belt tensioner bolts.
4. Remove the drive belt tensioner from the engine.

Installation Procedure

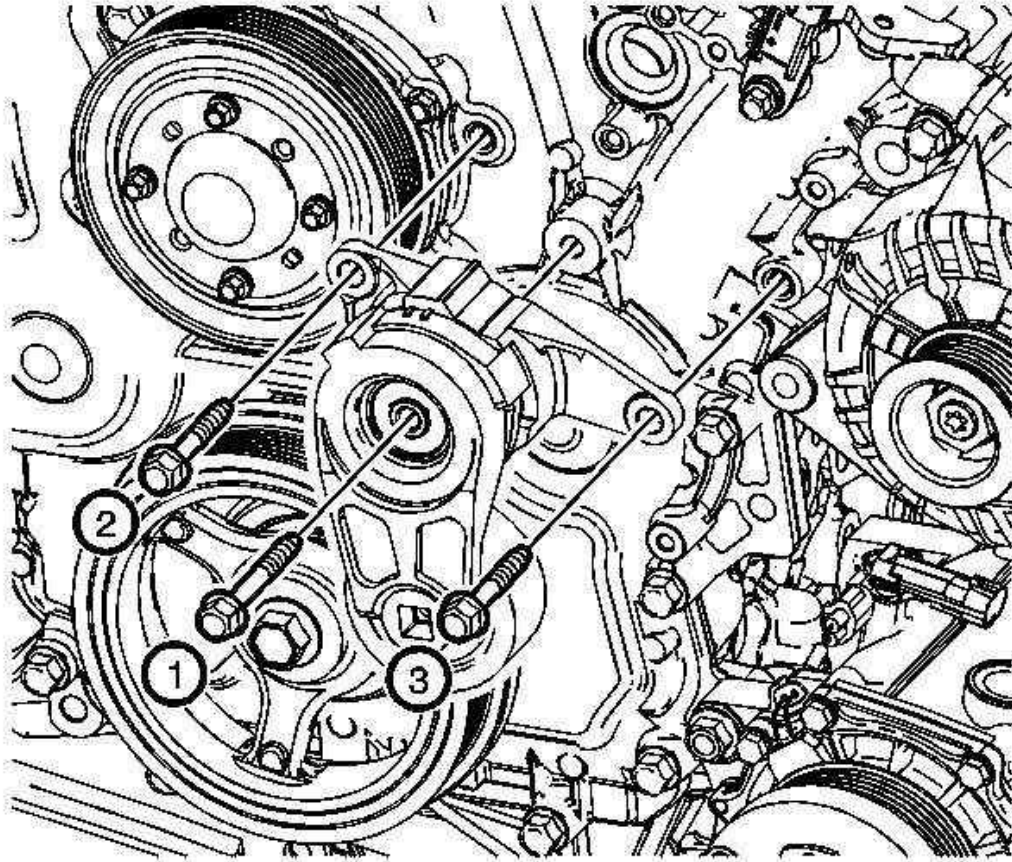


Fig. 4: Identifying Drive Belt Tensioner Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the drive belt tensioner to the engine.

NOTE: Refer to Fastener Notice .

2. Install the drive belt tensioner bolts.

Tighten:

1. Tighten the drive belt tensioner center bolts to 50 N.m (37 lb ft).
2. Tighten the drive belt tensioner outer bolts to 23 N.m (17 lb ft).

3. Install the idler pulley. Refer to **Drive Belt Idler Pulley Replacement**.
4. Install the drive belt. Refer to **Drive Belt Replacement**.

DRIVE BELT IDLER PULLEY REPLACEMENT

Removal Procedure

IMPORTANT: Do not remove the belt from the air conditioning (A/C) compressor or water pump.

1. Remove the drive belt from the generator. Refer to **Drive Belt Replacement**.

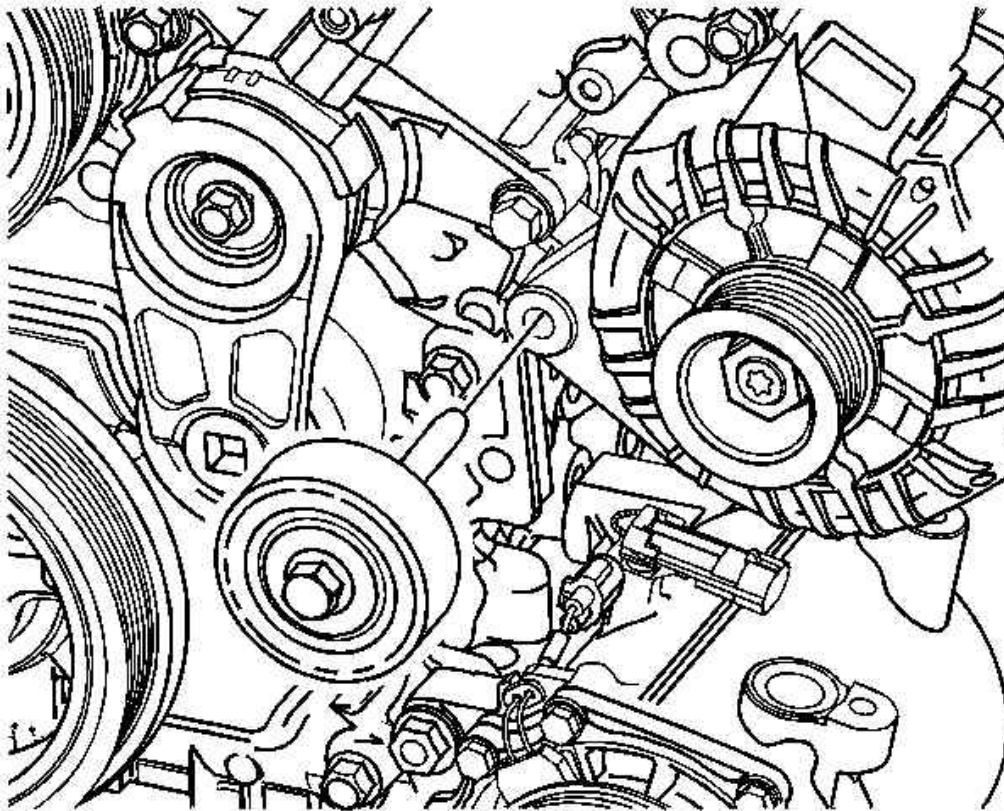


Fig. 5: Locating Drive Belt Idler Pulley
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

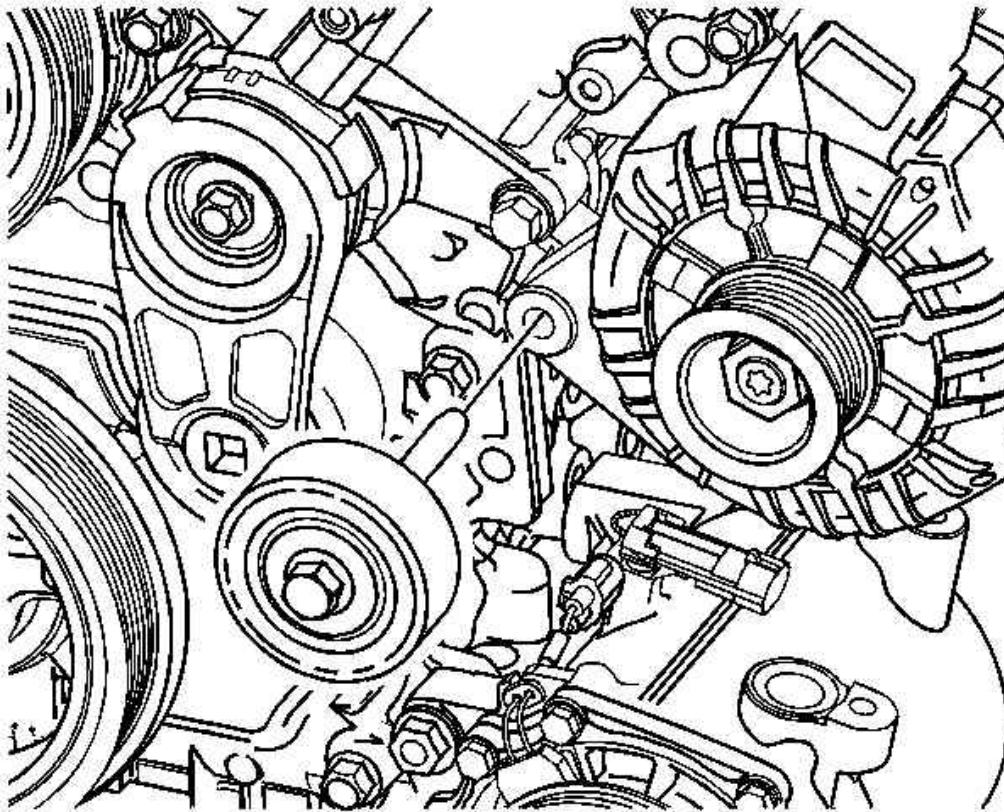


Fig. 6: Locating Drive Belt Idler Pulley
Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt idler pulley.

NOTE: Refer to Fastener Notice .

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**.

ENGINE SUPPORT FIXTURE

Tools Required

- **J 28467-34** Lift Hook Wing Nut and Washer (2). See **Special Tools** .
- **J 28467-6A** Bracket Assembly (2). See **Special Tools** .
- **J 28467-7A** Bolt Hook (2). See **Special Tools** .
- **J 28467-500** Engine Support Fixture Adapters. See **Special Tools** .
- **J 28467-501** Engine Support Fixture Adapters. See **Special Tools** .
- **J 28467-B** Universal Engine Support Fixture. See **Special Tools** .
- J 28467-2A Radiator Tube Shelf Assembly
- J 28467-3 Tube Assembly
- J 28467-4A Front Support Assembly
- J 28467-9 Quick Release Pin
- J 28467-1A Cross Bracket
- J 28467-34 Handle
- **J 45057-2** Lower Support Bar. See **Special Tools** .

Installation Procedure

IMPORTANT: Supplemental support provided near the bottom of the transmission will be required to prevent the powertrain from rotating if the frame is lowered or removed.

1. Remove the fuel injector sight shield.
2. Remove the engine mount struts. Refer to **Engine Mount Strut Replacement - Right Side** and **Engine Mount Strut Replacement - Left Side**.
3. One engine mount strut and nut can be reinstalled to the engine mount strut bracket on engine to be used as an attachment point for front engine attachment.

4. Disconnect the electrical harness clip at the UHJB and at coolant housing.
5. Disconnect the electrical connector at the engine control module (ECM).
6. Remove the coolant recovery reservoir. Refer to **Coolant Recovery Reservoir Replacement (L27, LY7)** .
7. Remove the power steering reservoir and bracket.
8. Remove the attachment screw from the power steering pump reservoir to bracket.
9. Install the power steering reservoir bracket to powertrain.

NOTE: Refer to **Fastener Notice** .

Tighten: Tighten the power steering reservoir bracket bolts: M6 bolt to 9 N.m (7 lb ft) and M8 bolt to M8 Bolt to 25 N.m (18 lb ft).

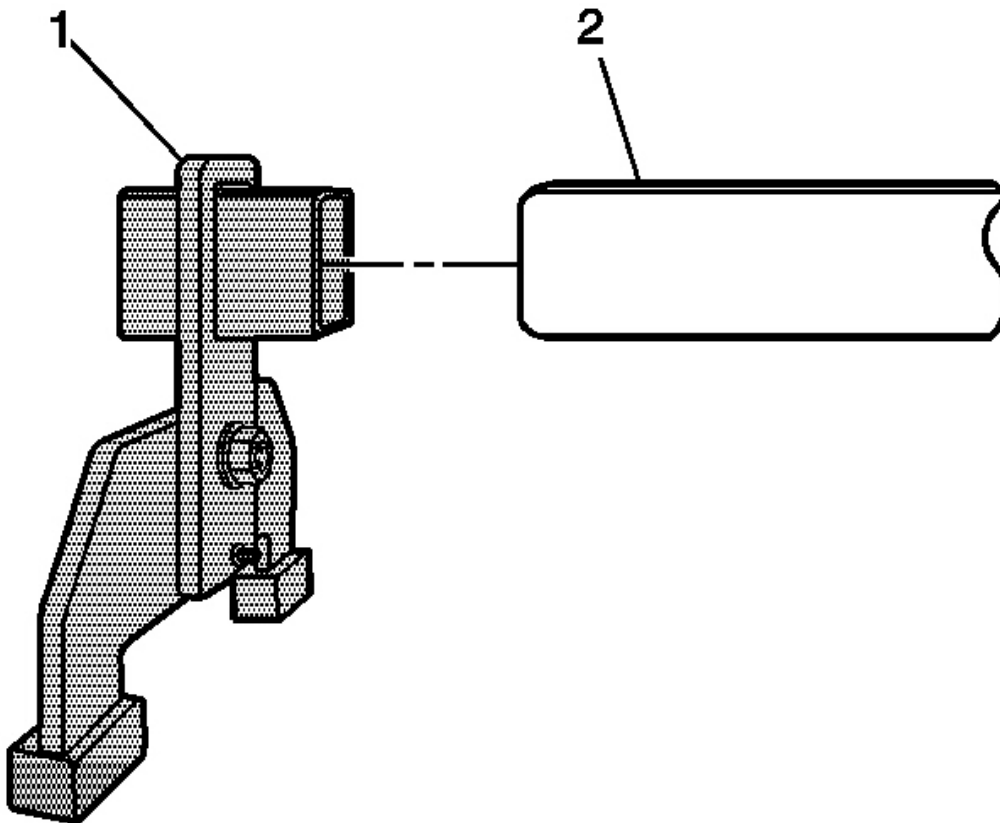


Fig. 7: Identifying J 28467-B & J 28467-3
Courtesy of GENERAL MOTORS CORP.

10. Install a **J 28467-B** and retention pin to each end of the **J 28467-500** beam (2).
See **Special Tools** .

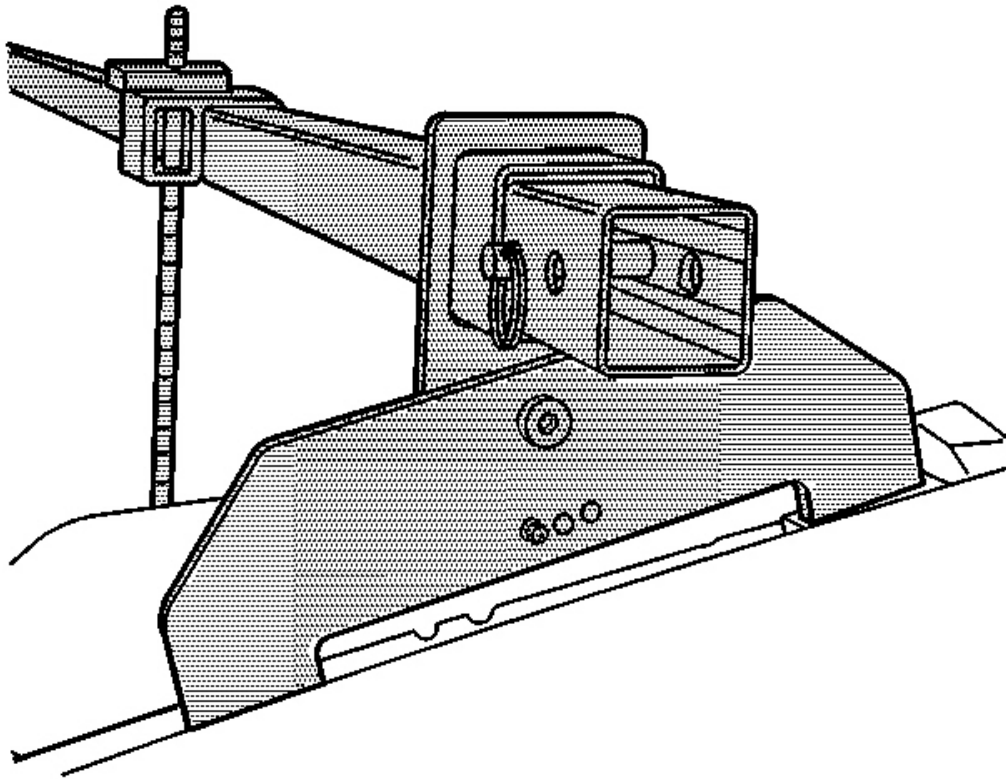


Fig. 8: View Of Engine Lift Bracket
Courtesy of GENERAL MOTORS CORP.

11. Position the **J 28467-B** to the left and right side inner fender rails in order to install the **J 28467-500** . See **Special Tools** .

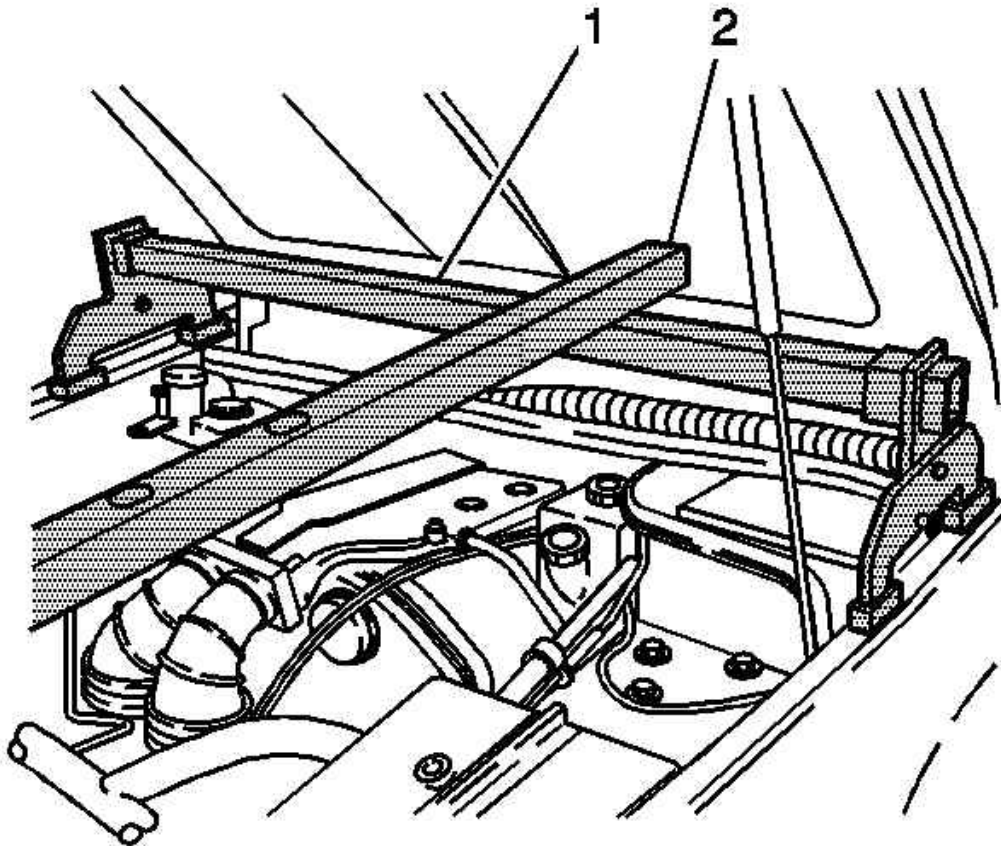


Fig. 9: Installing Radiator Shelf Tube On Top Of Strut Tower Tube
Courtesy of GENERAL MOTORS CORP.

12. 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.

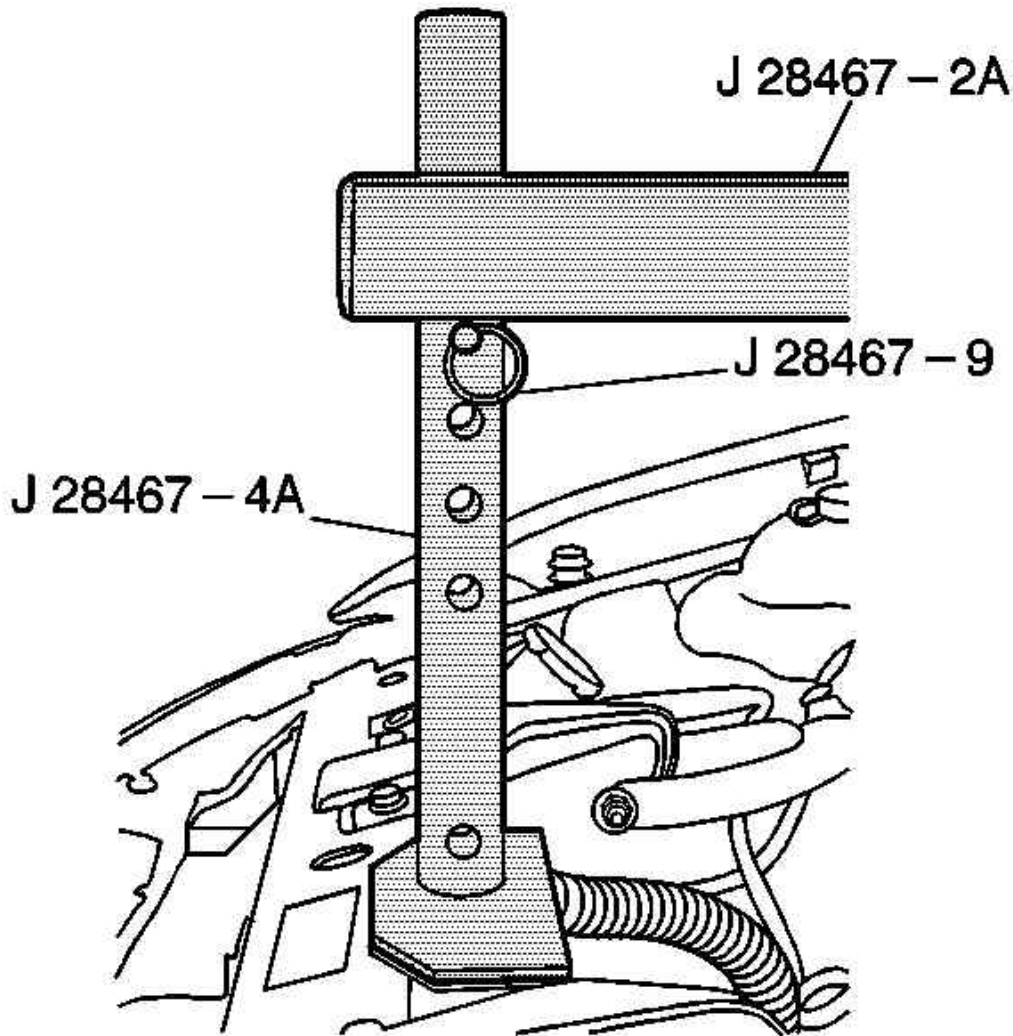


Fig. 10: Identifying Quick Release Pin J 28467-9
Courtesy of GENERAL MOTORS CORP.

13. Install the round tube of the front support assembly J 28467-4A through the large hole in the radiator shelf tube J 28467-2A.
14. Locate the J 28467-4A front support assembly to the upper tie bar.
15. 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.

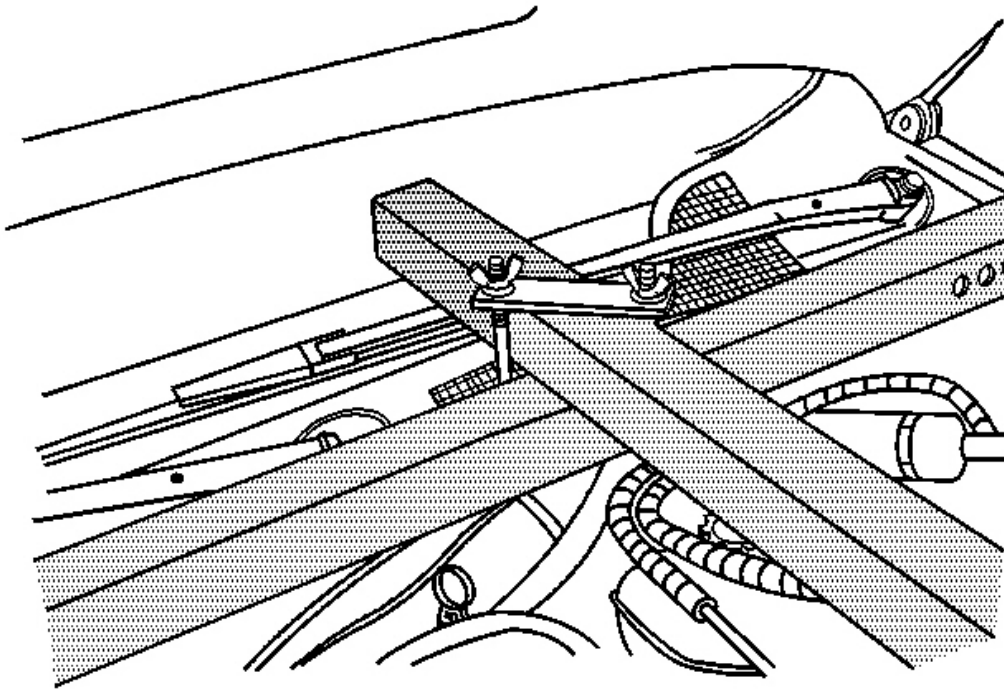


Fig. 11: View of Cross Bracket Assembly with J28467--1A & Nuts
Courtesy of GENERAL MOTORS CORP.

16. Install the J 28467-1A cross bracket assembly.
17. Assemble the following to create 2 lift hook assemblies as shown:
 - J 28467-34 . See **Special Tools** .
 - J 28467-6A . See **Special Tools** .
 - J 28467-7A . See **Special Tools** .

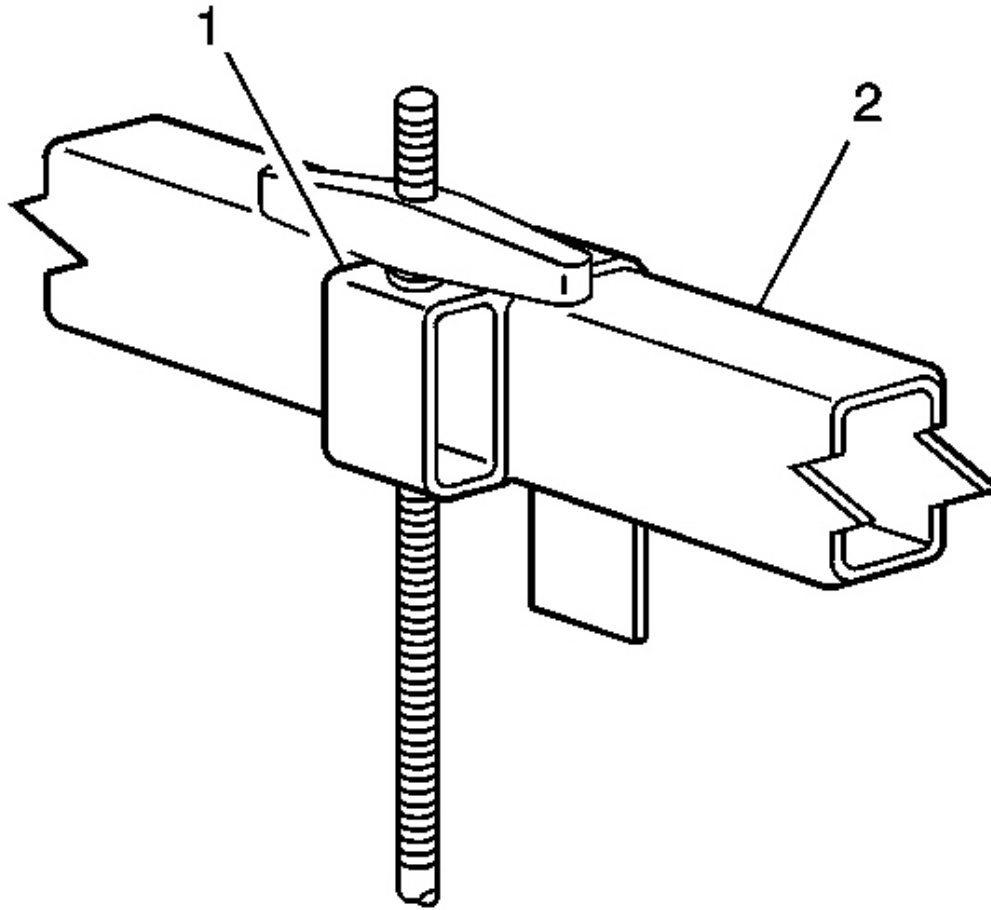


Fig. 12: View Of Lift Hook & Bracket Assembly At Longitudinal Mounted Cross Bar

Courtesy of GENERAL MOTORS CORP.

18. Install the 2 lift hook assemblies (1) to the **J 45057-2** (2). See **Special Tools** .
19. Install the LH engine mount strut nuts and bolts to the strut brackets.

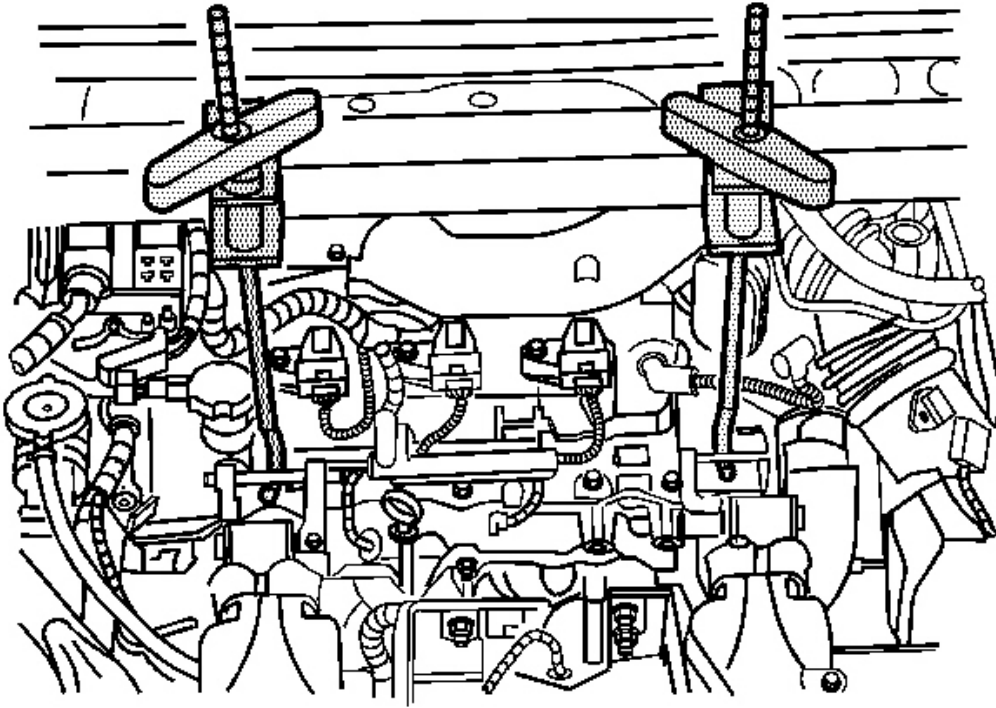


Fig. 13: Identifying J 28467-34
Courtesy of GENERAL MOTORS CORP.

20. Install the RH engine lift hook through the power steering reservoir bracket.
21. Gently tighten the **J 28467-34** lift hook wing nuts to support powertrain. See **Special Tools** .

Removal Procedure

1. Remove the complete engine support fixture assembly.
2. Remove the power steering reservoir bracket.
3. Attach the power steering reservoir to bracket and install the screws.

Tighten: Tighten the power steering reservoir screws to bracket to 6 N.m (53 lb in).

4. Install the power steering reservoir and bracket assembly.

Tighten: Tighten the power steering reservoir bracket bolts: M6 bolt to 9 N.m (7 lb ft) and M8 bolt to M8 Bolt to 25 N.m (18 lb ft).

5. Install the engine mount struts. Refer to **Engine Mount Strut Replacement - Right Side** and **Engine Mount Strut Replacement - Left Side**.

ENGINE MOUNT INSPECTION

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

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

1. Raise the engine in order to remove the weight from the engine mount and create 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.
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 Bracket Replacement - Right Side**.
4. For information on the transaxle mount, refer to **Transmission Mount Inspection**.

ENGINE MOUNT REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Disconnect the battery ground (negative) cable. Refer to **Battery Negative Cable Disconnection and Connection (LY7)** .
2. Remove the throttle body air inlet duct. Refer to **Air Cleaner Inlet Duct Replacement** .
3. Remove the engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** or **Engine Mount Strut Replacement - Right Side**.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Remove the three-way catalytic converter pipe from the engine right side exhaust manifold. Refer to **Catalytic Converter Replacement** .
6. Remove the right front wheel and tire. Refer to **Tire and Wheel Removal and Installation** .
7. Remove the right engine splash shield. Refer to **Engine Splash Shield Replacement** .

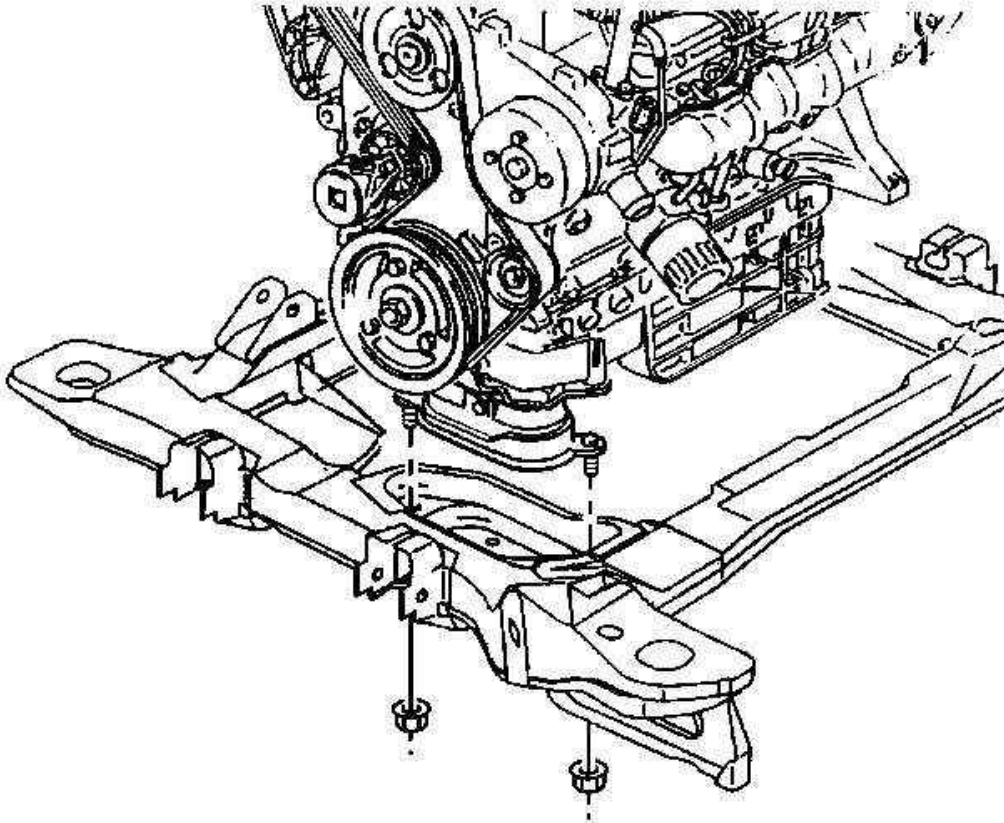


Fig. 14: Identifying Engine Mount Lower Nuts
Courtesy of GENERAL MOTORS CORP.

8. Remove the engine mount lower nuts.

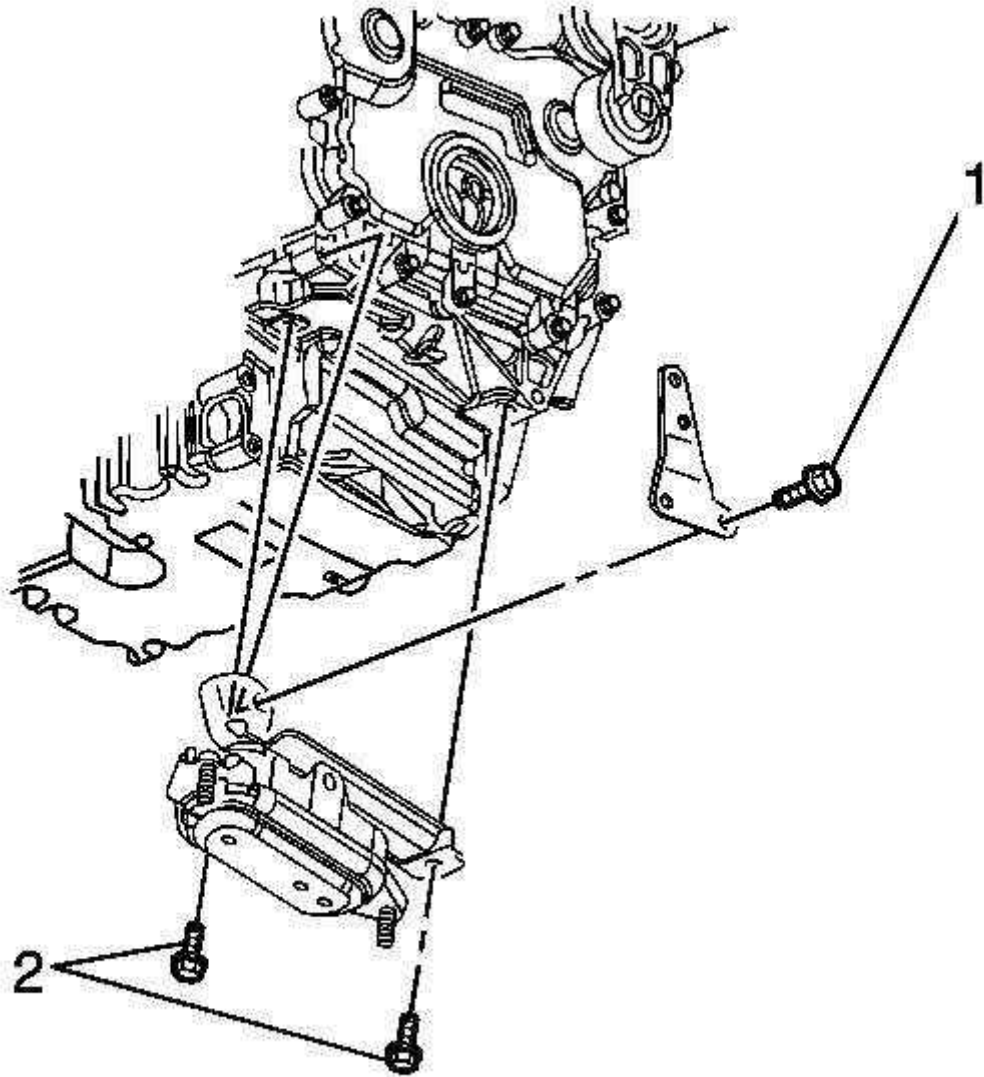


Fig. 15: Locating Engine Mount Bracket-To-Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

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

support.

9. Use a utility stand and a block of wood in order to raise the engine.
10. Remove the engine mount bracket-to-oil pan bolts (2).
11. Remove the engine mount bracket-to-engine bolts (1).
12. Remove the engine mount and the engine mount bracket.

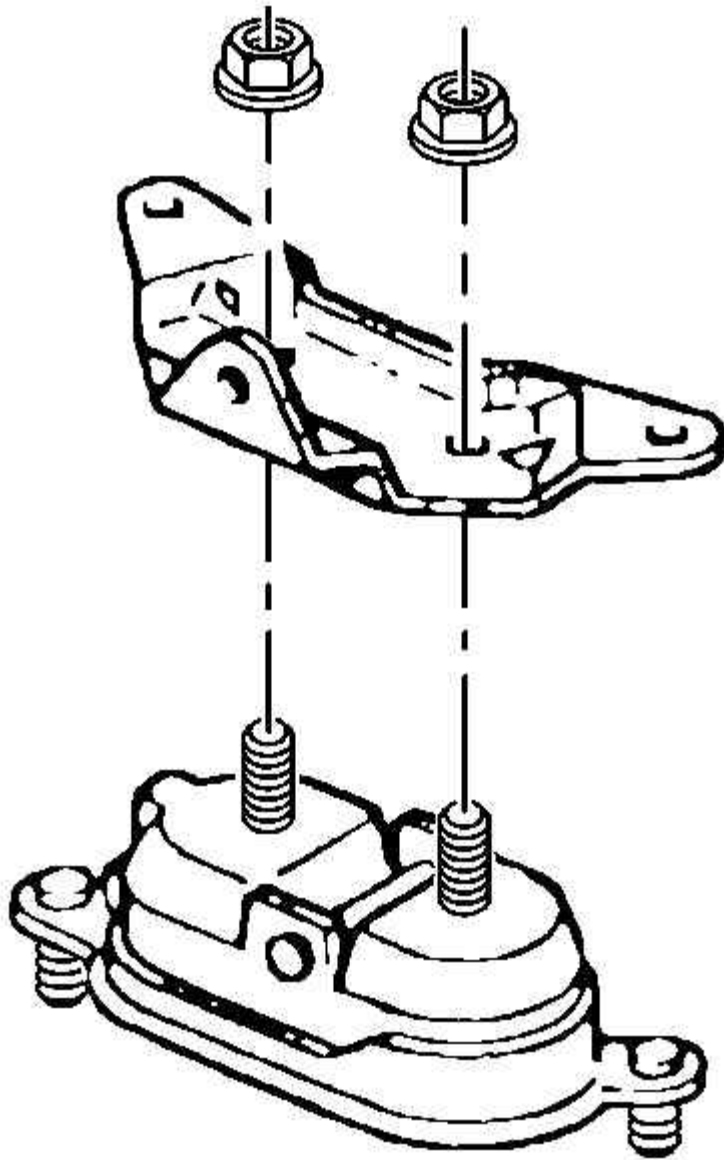


Fig. 16: Identifying Engine Mount Upper Nuts
Courtesy of GENERAL MOTORS CORP.

13. Remove the engine mount upper nuts.
14. Remove the engine mount from the engine mount bracket.

Installation Procedure

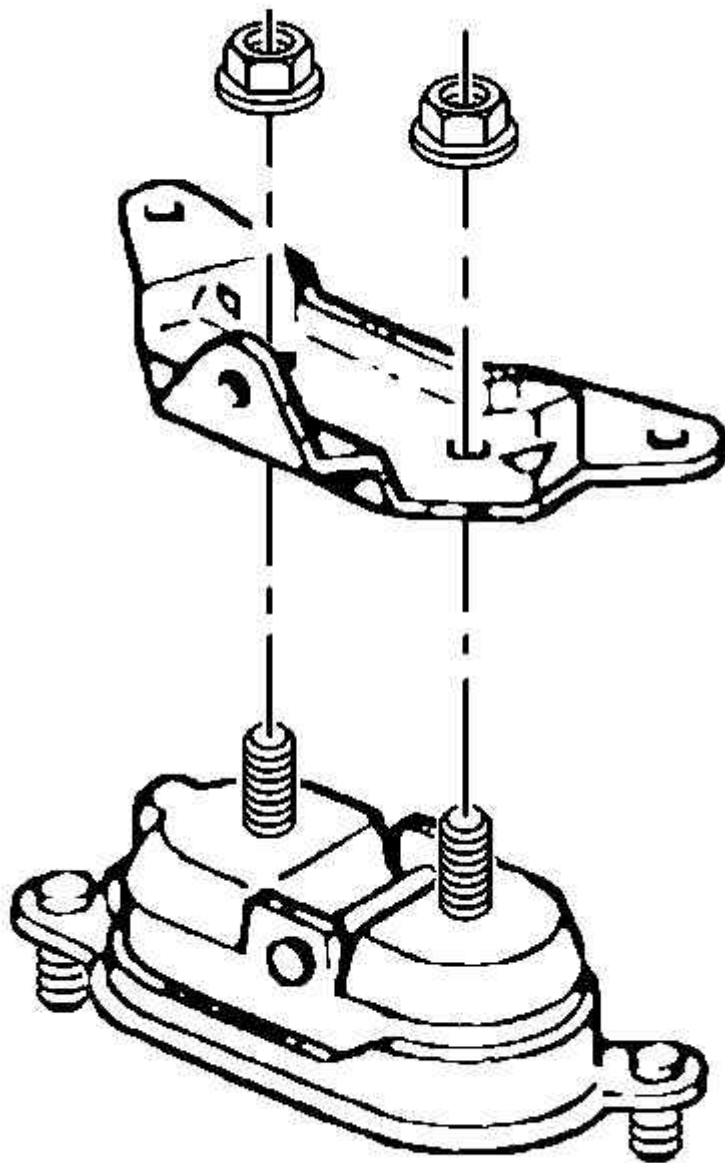


Fig. 17: Identifying Engine Mount Upper Nuts
Courtesy of GENERAL MOTORS CORP.

2008 Buick LaCrosse CX

2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

1. Install the engine mount to the engine mount bracket.

NOTE: Refer to Fastener Notice .

2. Install the engine mount upper nuts.

Tighten: Tighten the engine mount upper nuts to 53 N.m (39 lb ft).

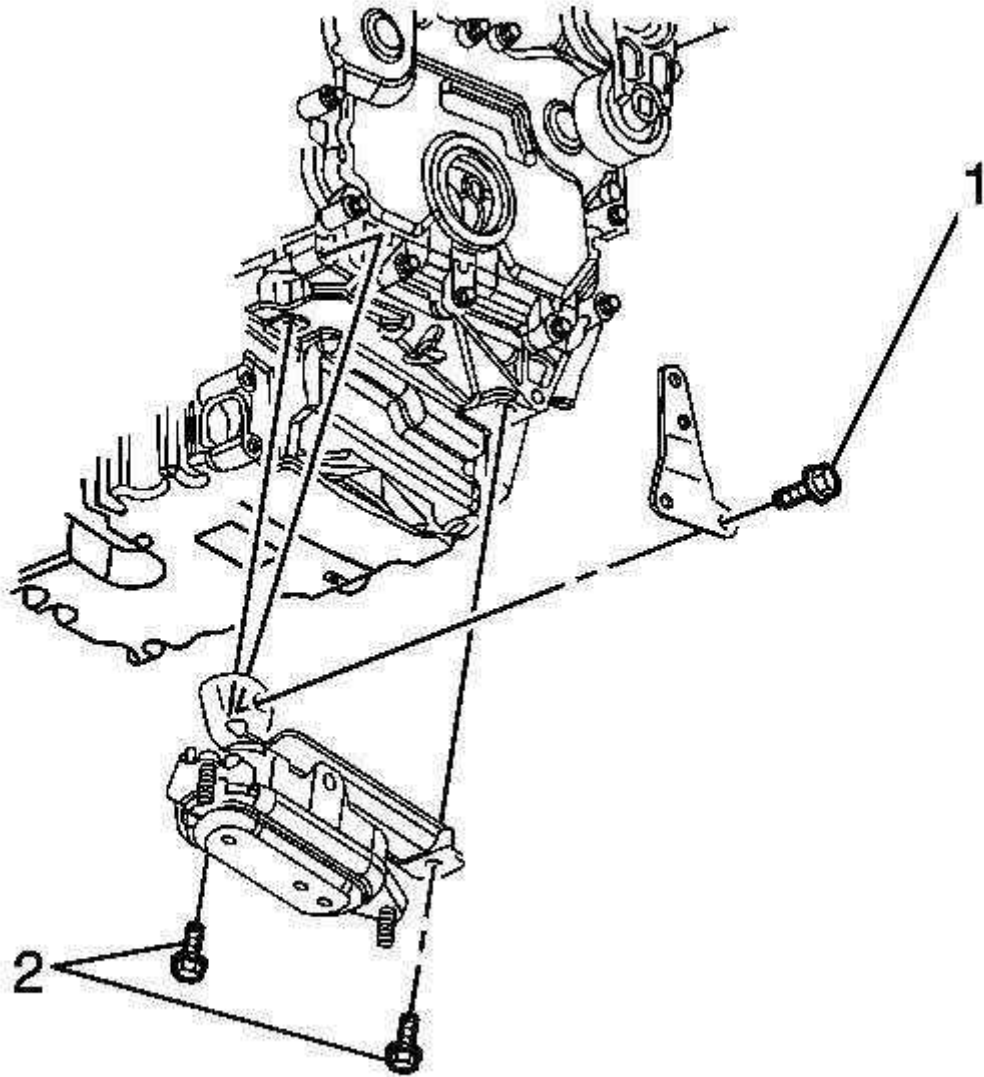


Fig. 18: Locating Engine Mount Bracket-To-Oil Pan Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the engine mount bracket with the engine mount to the oil pan.
4. Install all the engine mount bracket bolts (1, 2). Hand tighten only.
5. Install the engine mount bracket bolt.

Tighten: Tighten the bolts to 58 N.m (43 lb ft).

6. Use the utility stand in order to lower the engine.

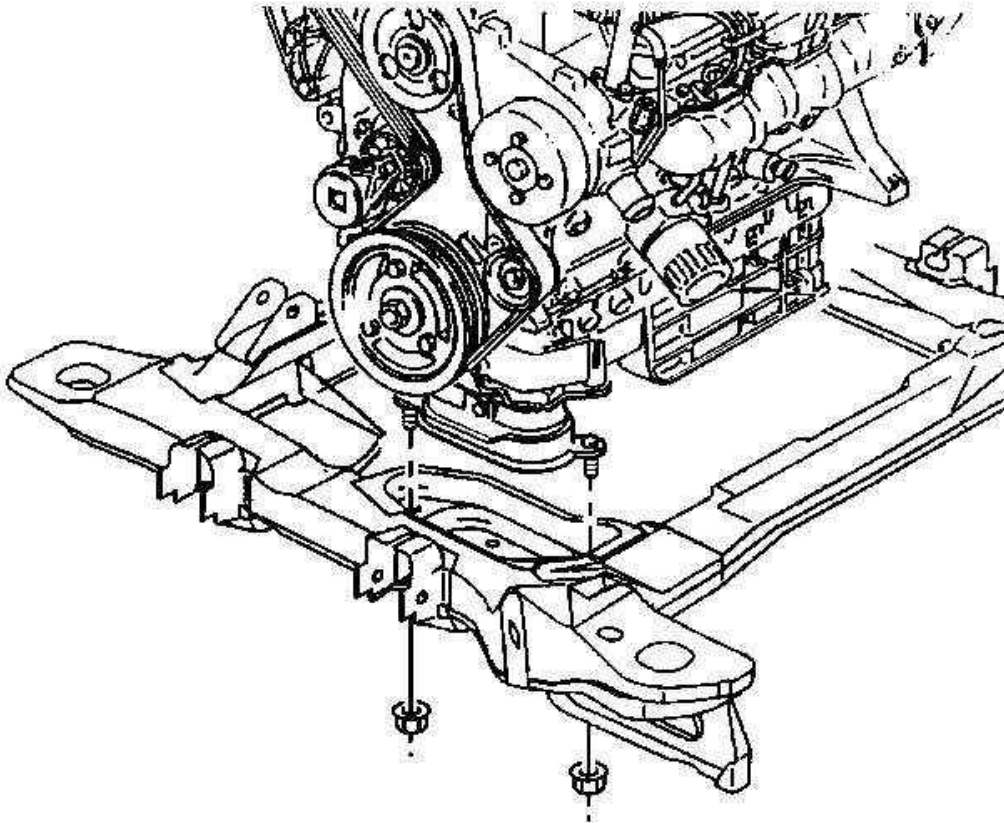


Fig. 19: Identifying Engine Mount Lower Nuts
Courtesy of GENERAL MOTORS CORP.

7. Install the engine mount lower nuts.

Tighten: Tighten the engine mount lower nuts to 47 N.m (35 lb ft).

8. Install the right engine splash shield. Refer to **Engine Splash Shield Replacement** .
9. Install the right front wheel and tire. Refer to **Tire and Wheel Removal and**

Installation .

10. Connect the three-way catalytic converter pipe to the engine right side exhaust manifold. Refer to **Catalytic Converter Replacement .**
11. Lower the vehicle.
12. Install the engine mount struts. Refer to **Engine Mount Strut Replacement - Left Side** and **Engine Mount Strut Replacement - Right Side**.
13. Install the throttle body air inlet duct. Refer to **Air Cleaner Inlet Duct Replacement .**
14. Connect the battery ground (negative) cable. Refer to **Battery Negative Cable Disconnection and Connection (LY7) .**

ENGINE MOUNT BRACKET REPLACEMENT - RIGHT SIDE

Removal Procedure

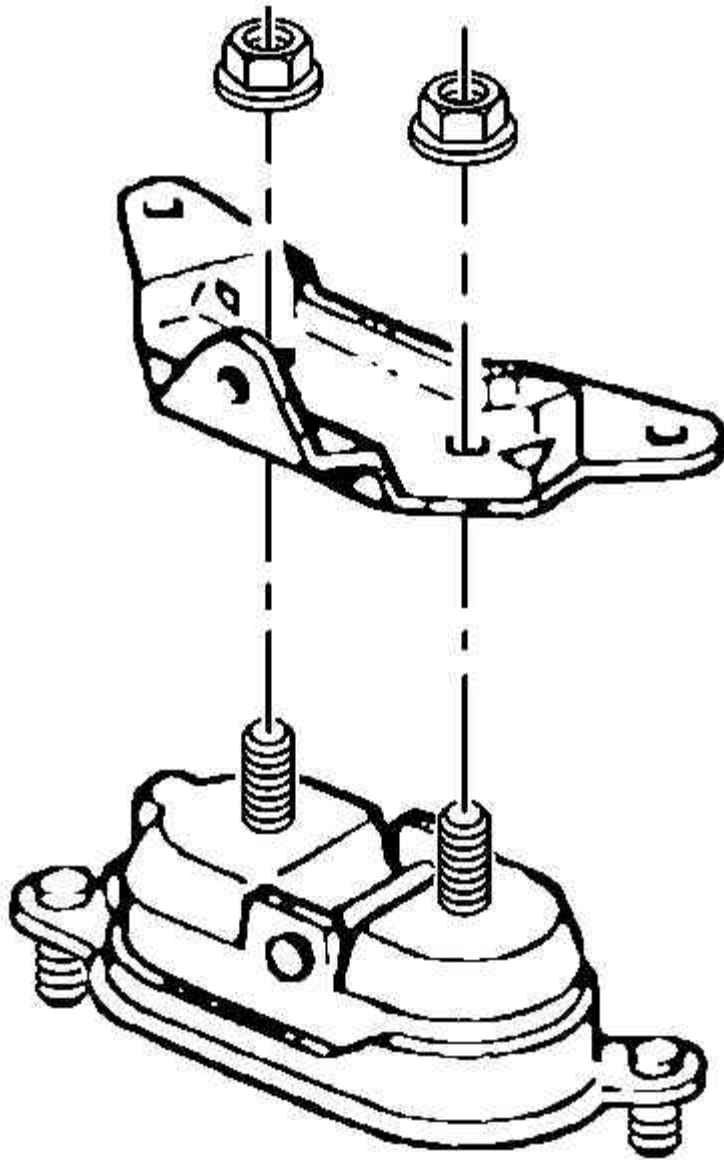


Fig. 20: Identifying Engine Mount Upper Nuts
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine mount. Refer to **Engine Mount Replacement - Right Side.**

2. Remove the engine mount upper nuts.
3. Remove the engine mount bracket from the engine mount.

Installation Procedure

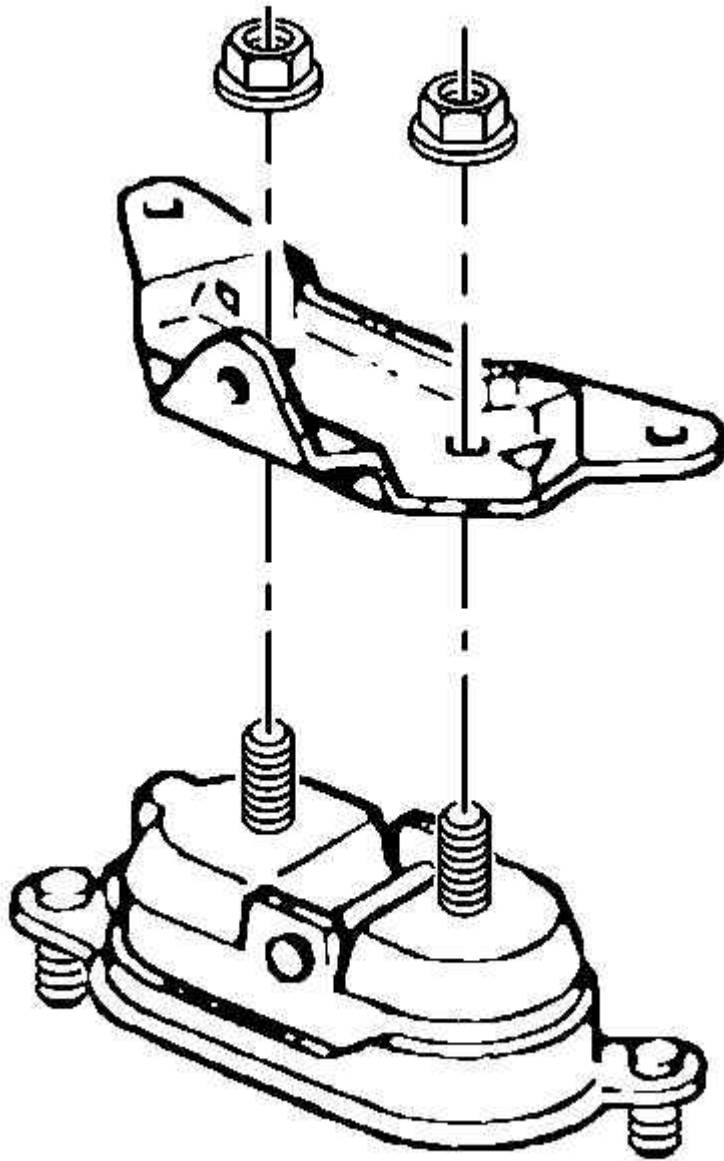


Fig. 21: Identifying Engine Mount Upper Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the engine mount bracket to the engine mount.

NOTE: Refer to Fastener Notice .

2. Install the engine mount upper nuts.

Tighten: Tighten the engine mount upper nuts to 53 N.m (39 lb ft).

3. Install the engine mount. Refer to Engine Mount Replacement - Right Side.

ENGINE MOUNT STRUT REPLACEMENT - LEFT SIDE

Removal Procedure

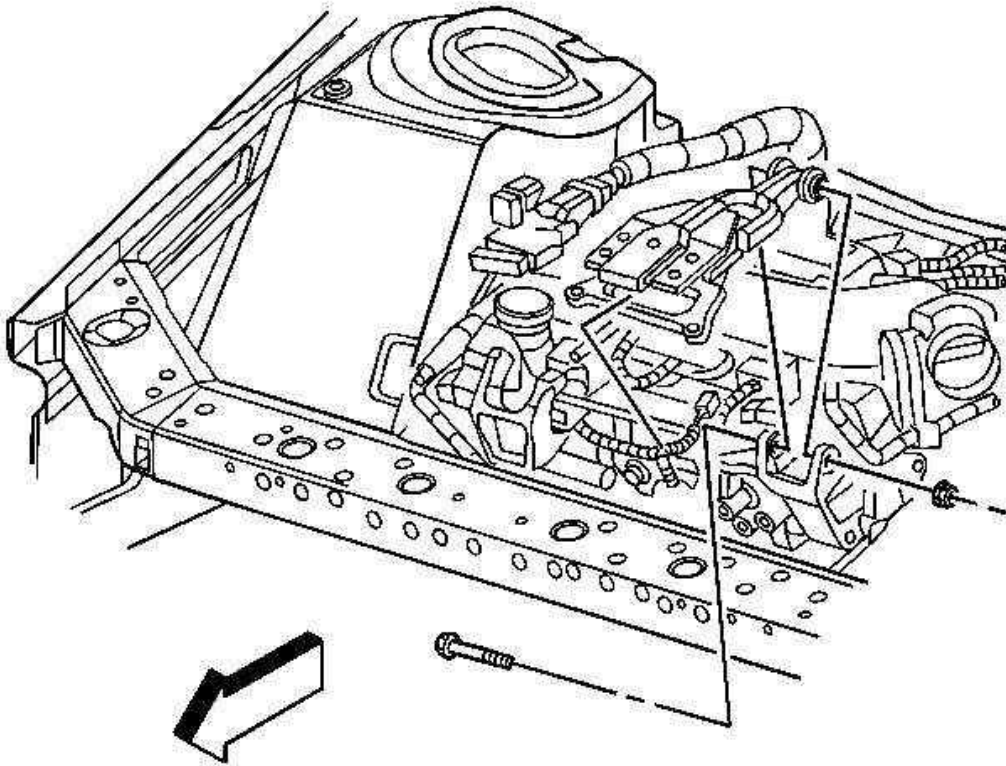


Fig. 22: Identifying Left Engine Mount Strut
Courtesy of GENERAL MOTORS CORP.

1. Remove the bolt and the nut from the engine mount strut at the left engine mount strut bracket on the engine.

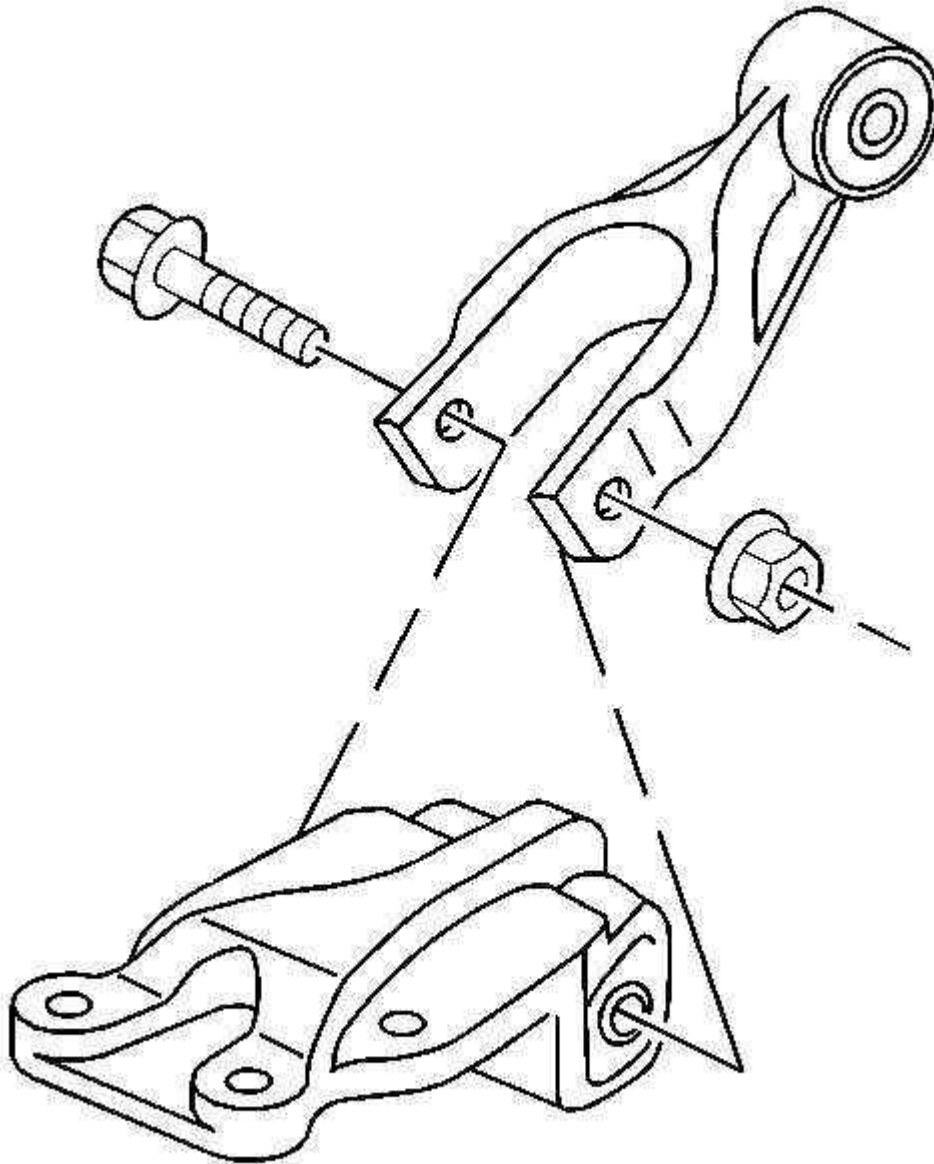


Fig. 23: View Of Bolt & Nut For Engine Mount Strut At Engine Mount Strut Bracket On Upper Radiator Support
Courtesy of GENERAL MOTORS CORP.

2. Remove the bolt and the nut from the engine mount strut at the engine mount

strut bracket on the upper radiator support.

3. Remove the engine mount strut.

Installation Procedure

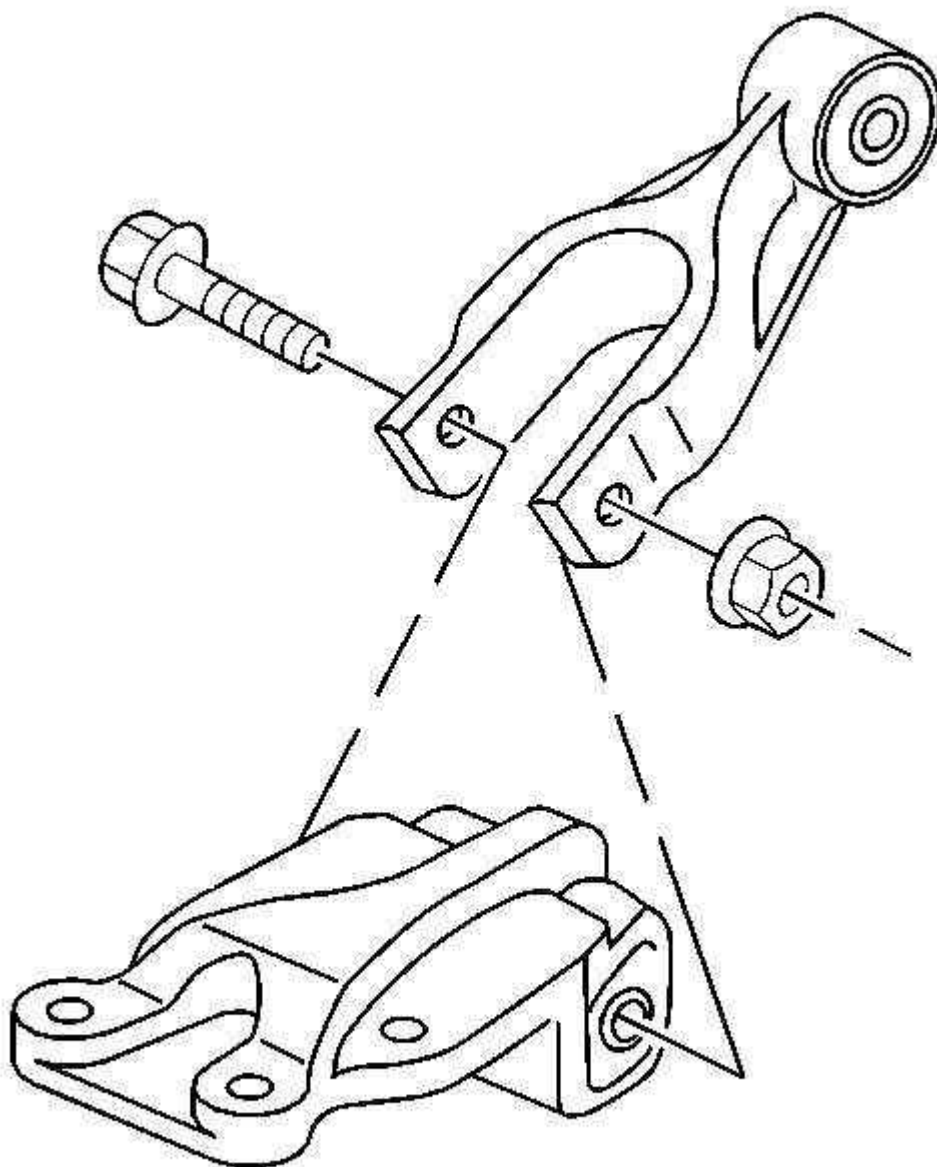


Fig. 24: View Of Bolt & Nut For Engine Mount Strut At Engine Mount Strut Bracket On Upper Radiator Support
Courtesy of GENERAL MOTORS CORP.

1. Install the engine mount strut.
2. Install the bolt and the nut to the engine mount strut at the engine mount strut bracket on the upper radiator support. HAND TIGHTEN ONLY.

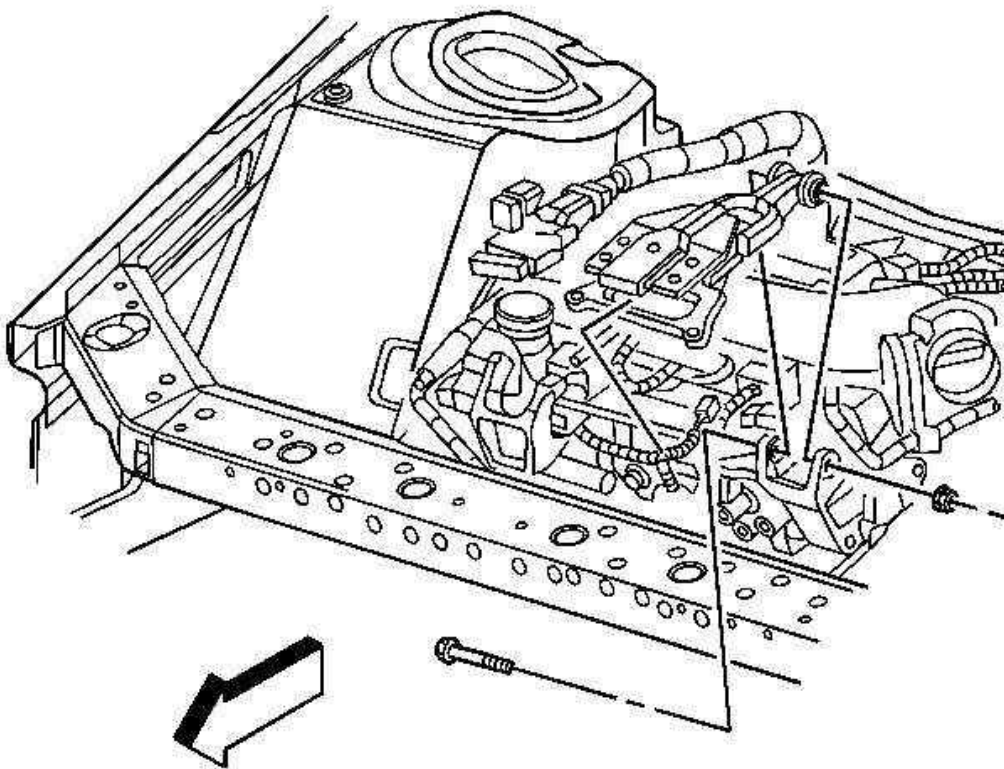


Fig. 25: Identifying Left Engine Mount Strut
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the bolt and the nut to the engine mount strut at the left engine mount

strut bracket on the engine.

Tighten: Tighten bolt engine mount strut nuts to 48 N.m (35 lb ft).

ENGINE MOUNT STRUT REPLACEMENT - RIGHT SIDE

Removal Procedure

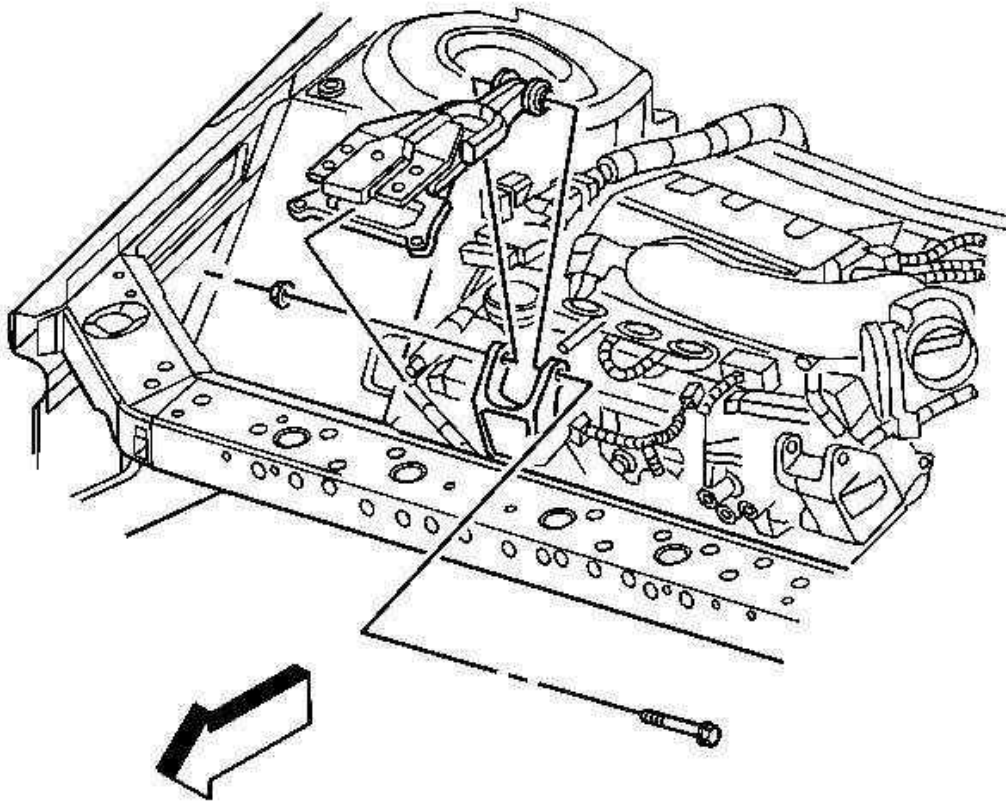


Fig. 26: Identifying Right Engine Mount Strut
Courtesy of GENERAL MOTORS CORP.

1. Remove the bolt and the nut from the engine mount strut at the right engine mount strut bracket on the engine.

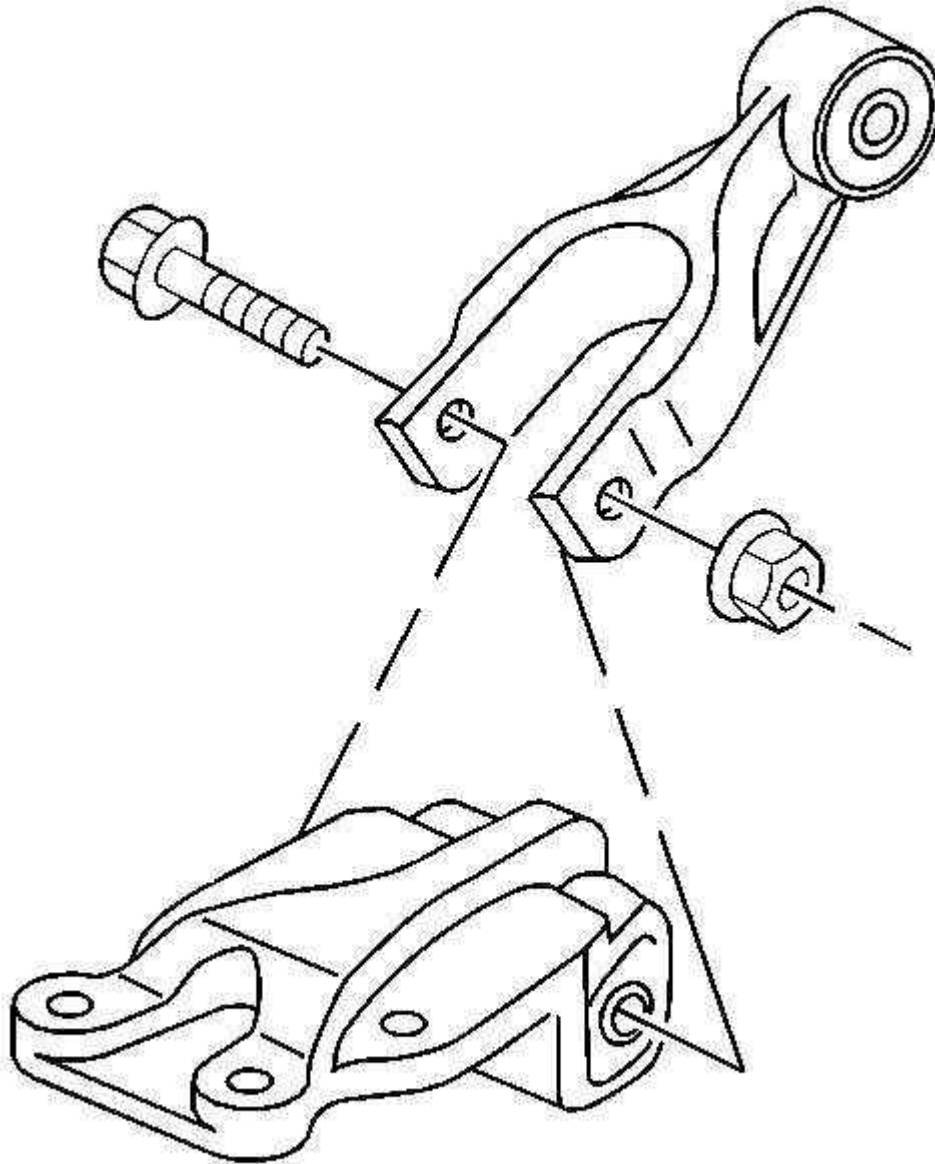


Fig. 27: View Of Bolt & Nut For Engine Mount Strut At Engine Mount Strut Bracket On Upper Radiator Support
Courtesy of GENERAL MOTORS CORP.

2. Remove the bolt and the nut from the engine mount strut at the engine mount

strut bracket on the upper radiator support.

3. Remove the engine mount strut.

Installation Procedure

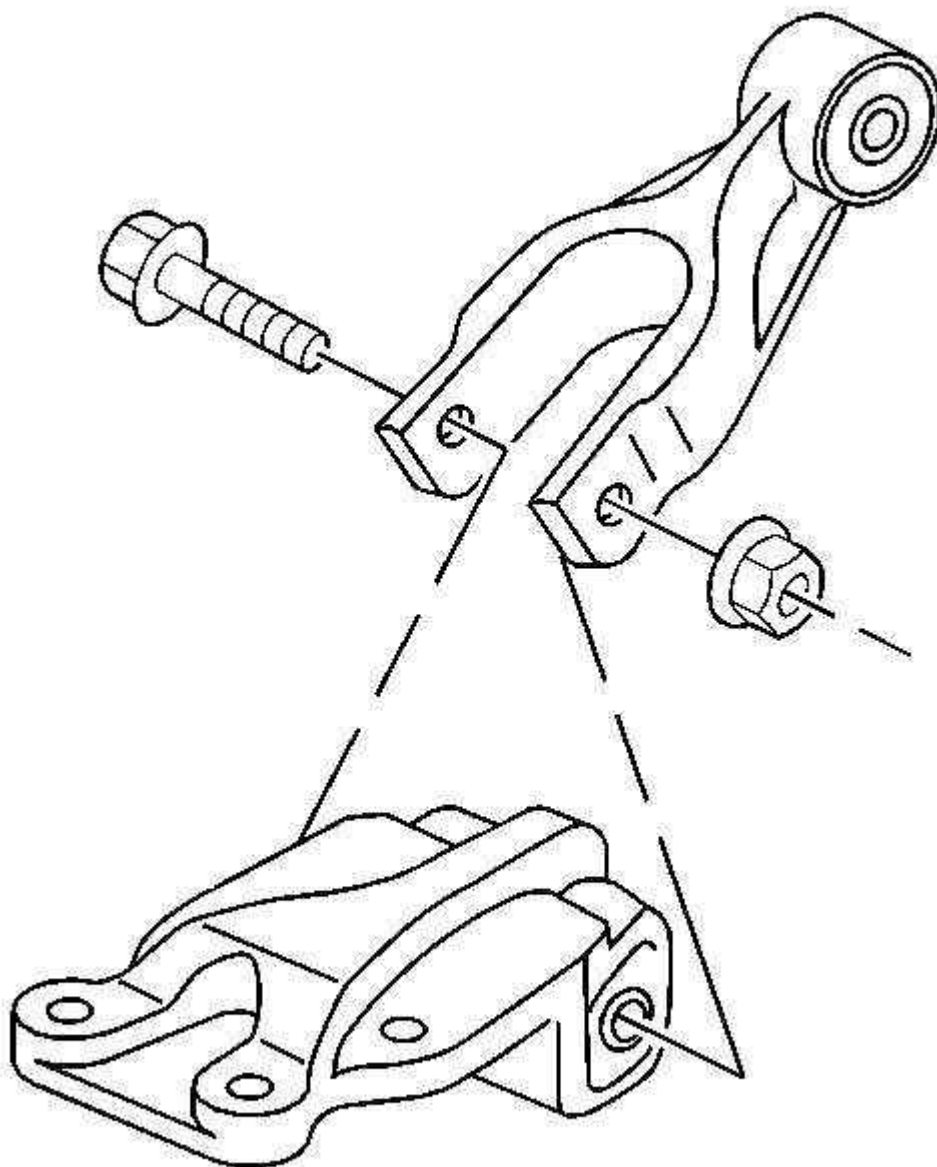


Fig. 28: View Of Bolt & Nut For Engine Mount Strut At Engine Mount Strut Bracket On Upper Radiator Support
Courtesy of GENERAL MOTORS CORP.

1. Install the engine mount strut.
2. Install the bolt and the nut to the engine mount strut at the engine mount strut bracket on the upper radiator support. HAND TIGHTEN ONLY.

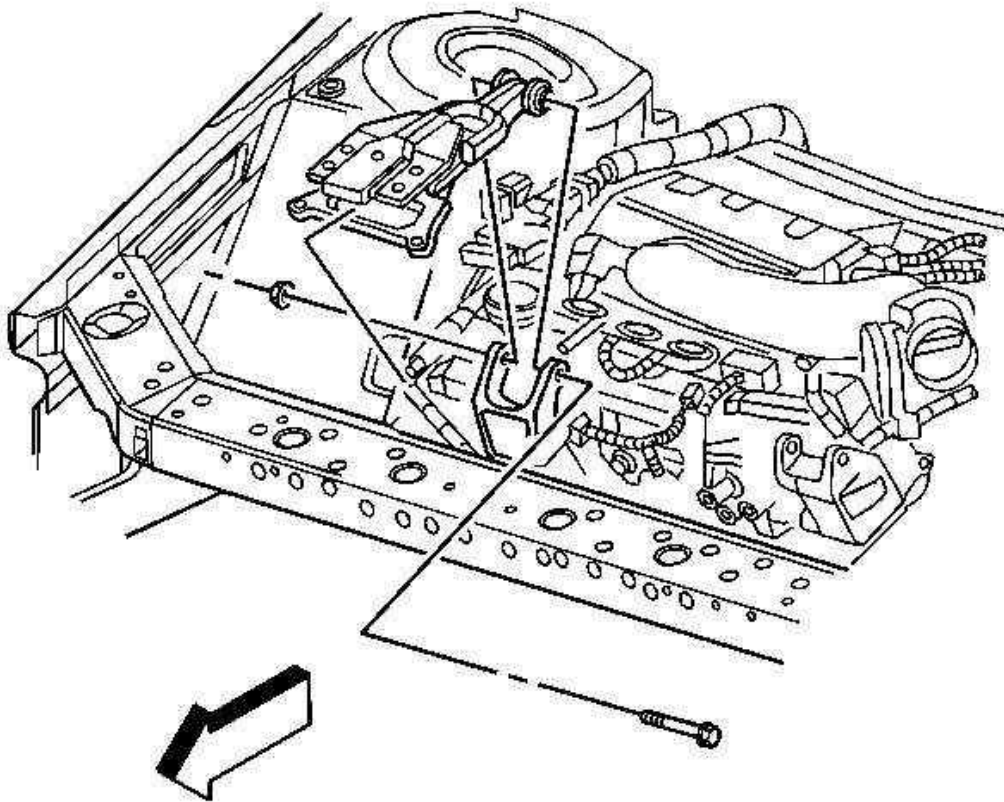


Fig. 29: Identifying Right Engine Mount Strut
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the bolt and the nut to the engine mount strut at the right engine mount

strut bracket on the engine.

Tighten: Tighten both engine mount strut nuts to 48 N.m (35 lb ft).

ENGINE MOUNT STRUT BRACKET REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the left engine mount strut from the left engine mount strut bracket. Refer to **Engine Mount Strut Replacement - Left Side**.
2. Disconnect the positive crankcase ventilation (PCV) tube from the air intake duct.

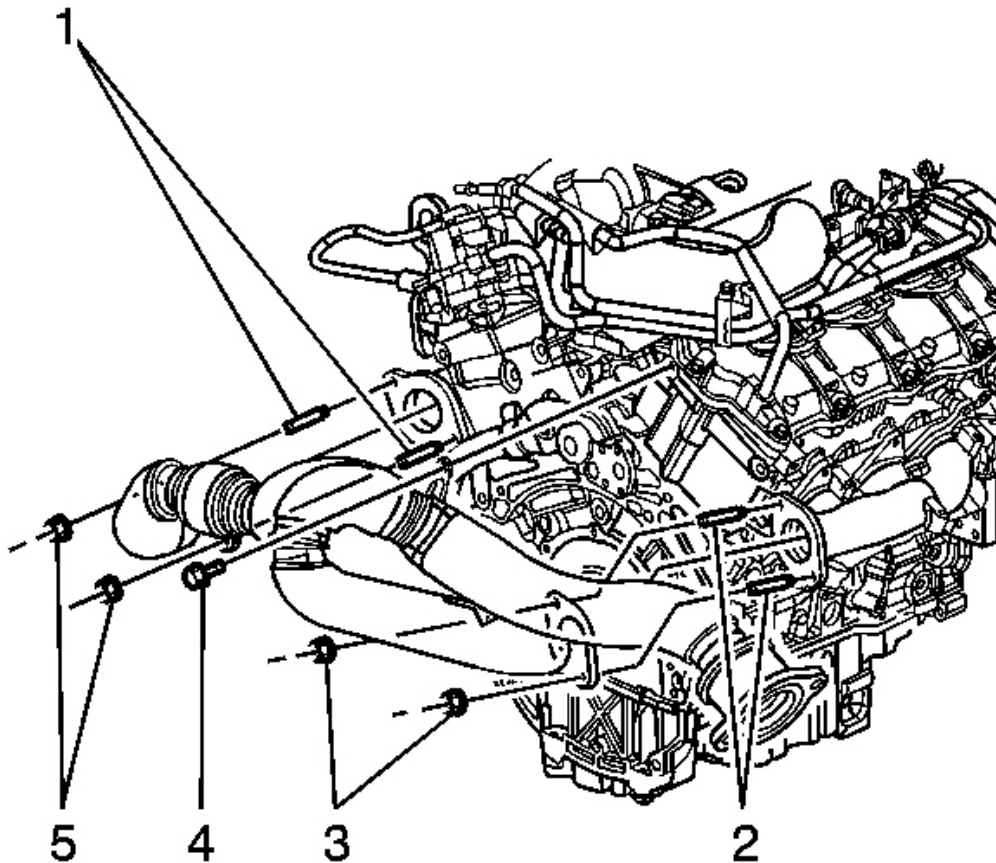


Fig. 30: Identifying Exhaust Crossover Pipe Nuts & Studs
Courtesy of GENERAL MOTORS CORP.

3. Remove the exhaust crossover pipe nuts (5) and studs (1).

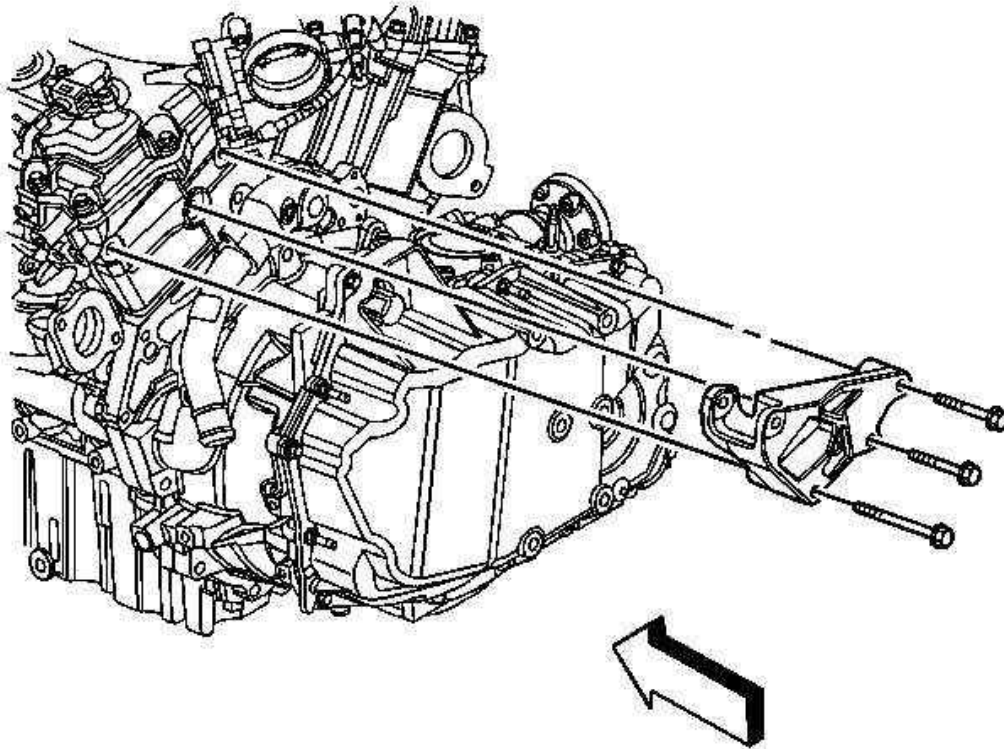


Fig. 31: View Of Engine Mount Strut Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the engine mount strut bracket bolts from the cylinder head.
5. Remove the left engine mount strut bracket and bolts from the vehicle.

Installation Procedure

1. Install the left engine mount strut bracket and bolts to the vehicle.

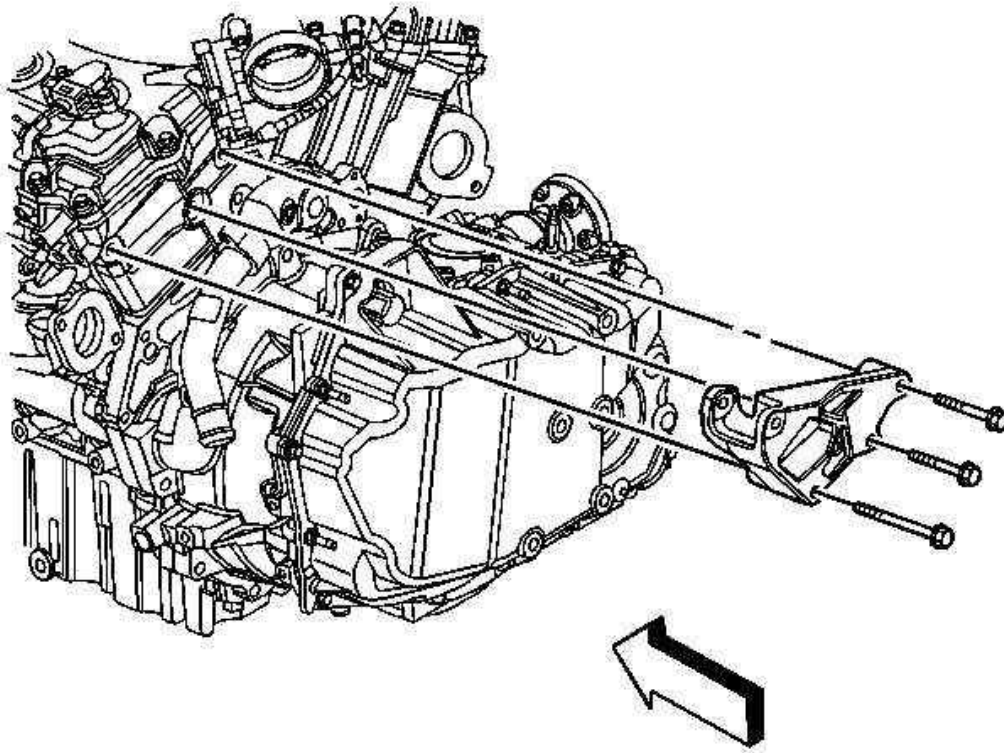


Fig. 32: View Of Engine Mount Strut Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Connect the engine mount strut bracket bolts to the cylinder head.

Tighten: Tighten the engine mount strut bracket bolts to 50 N.m (37 lb ft).

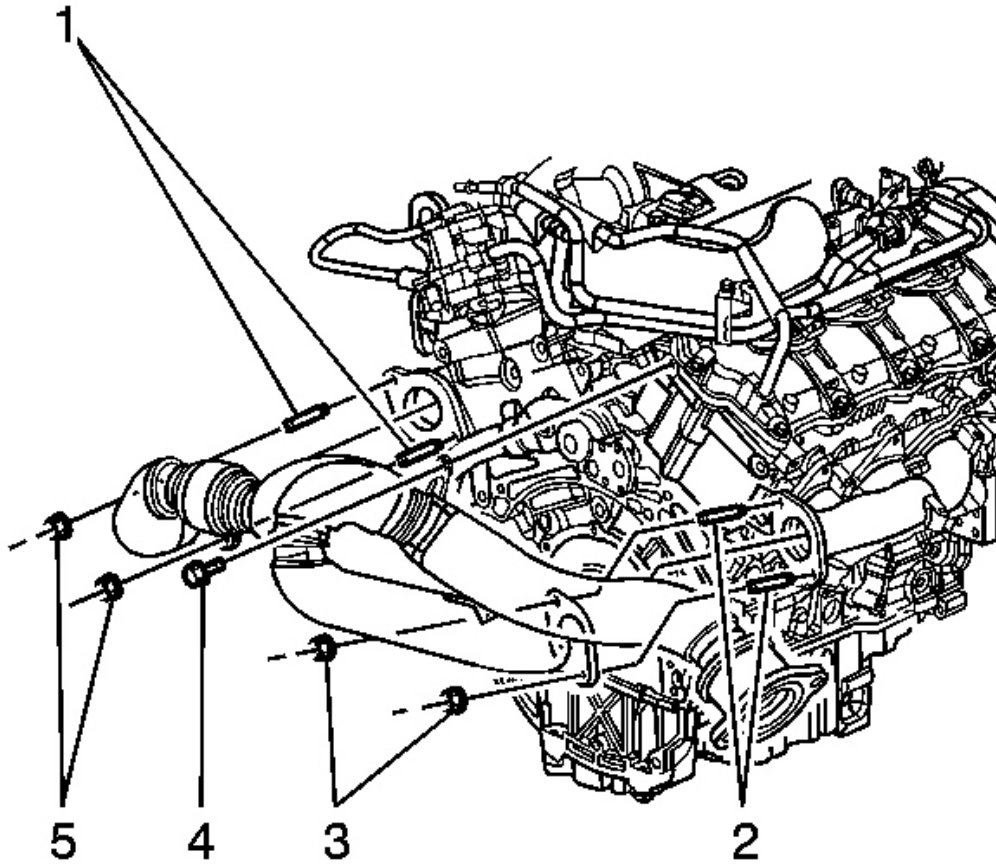


Fig. 33: Identifying Exhaust Crossover Pipe Nuts & Studs
Courtesy of GENERAL MOTORS CORP.

3. Install the exhaust crossover pipe nuts (5) and studs (1).

Tighten: Tighten the exhaust crossover pipe nuts (5) to 34 N.m (25 lb ft).

4. Connect the PCV tube to the air intake duct.
5. Install the left engine mount strut to the left engine mount strut bracket. Refer to **Engine Mount Strut Replacement - Left Side**.

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (LY7)** .
2. Disconnect the pulley from the generator.
3. Remove the right engine mount strut and radiator support bracket from the right engine mount strut bracket. Refer to **Engine Mount Strut Replacement - Right Side**.
4. Remove the generator bolts from the generator.
5. Move the generator off to the side to provide access to the engine mount strut bracket bolts.

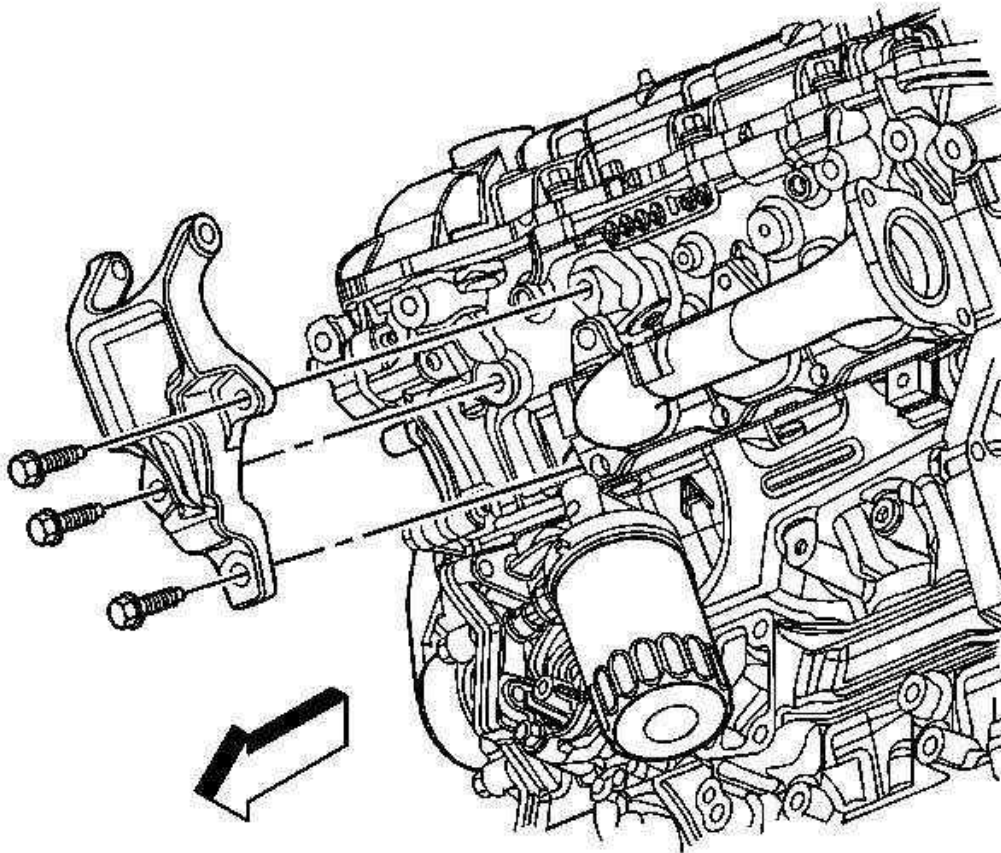


Fig. 34: Locating Engine Mount Strut Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the engine mount strut bracket bolts from the cylinder head.
7. Remove the right engine mount strut bracket from the vehicle.

Installation Procedure

1. Install the right engine mount strut bracket to the vehicle.

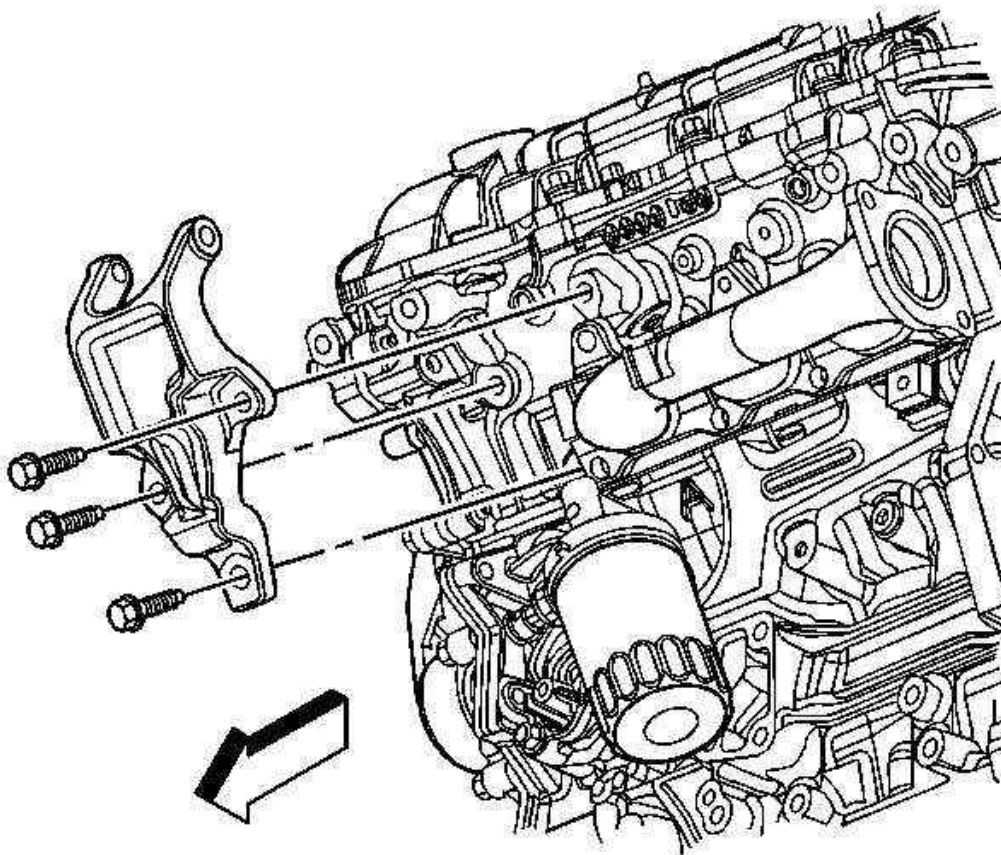


Fig. 35: Locating Engine Mount Strut Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

2. Connect the engine mount strut bracket bolts to the cylinder head.

Tighten: Tighten the engine mount strut bracket bolts to 50 N.m (37 lb ft).

3. Install the generator into the proper position.
4. Install the generator bolts.

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

5. Install the right engine mount strut and radiator support bracket to the right engine mount strut bracket. Refer to **Engine Mount Strut Replacement - Right Side**.
6. Connect the pulley to the generator.
7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (LY7)** .

FUEL INJECTOR SIGHT SHIELD REPLACEMENT

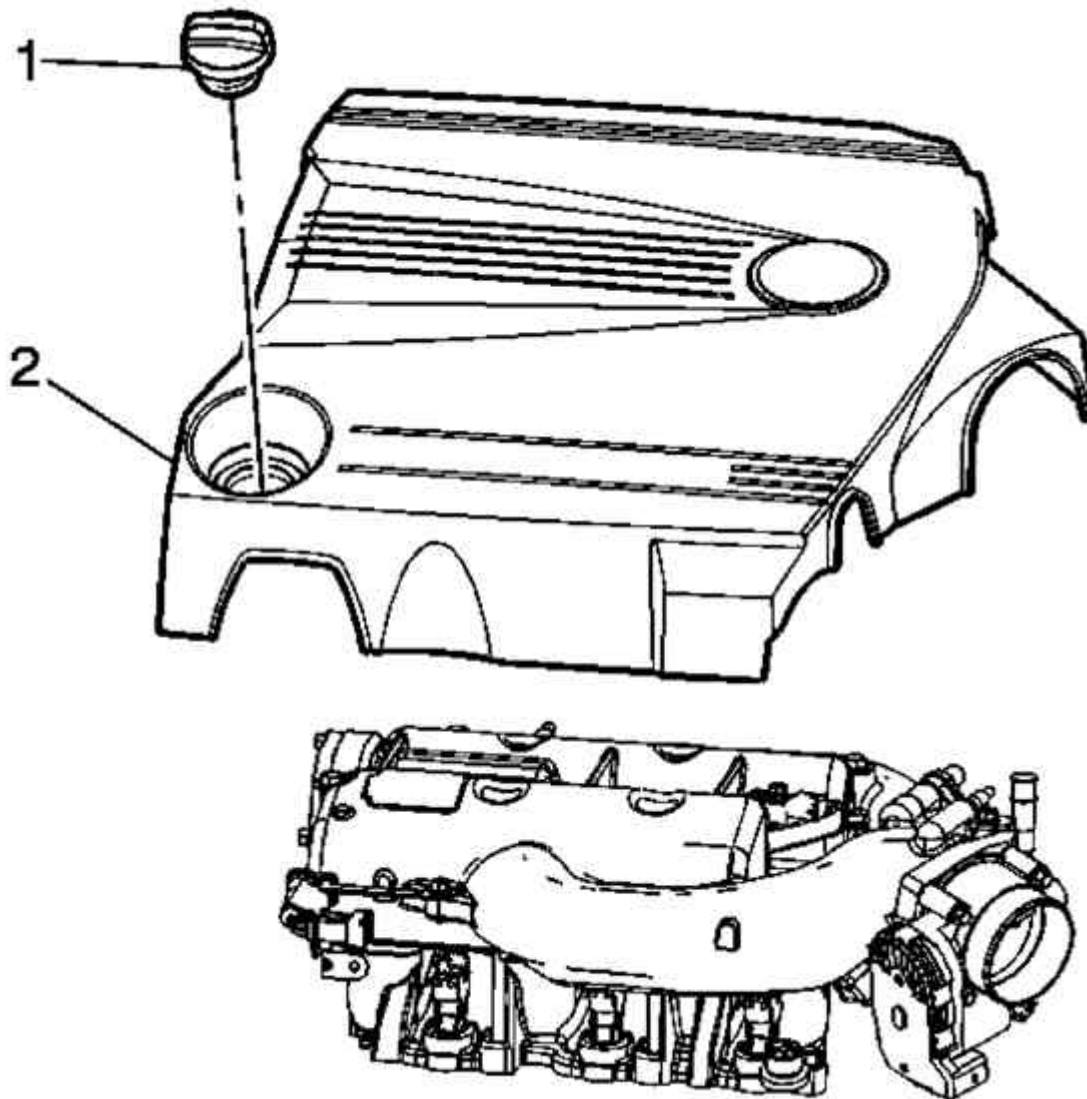


Fig. 36: View Of Fuel Injector Sight Shield
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications .	
1	Cap, Oil Filler Tip: Clean the area around the oil fill cap before removing.
2	Shield, Fuel Injection Sight

Removal Procedure

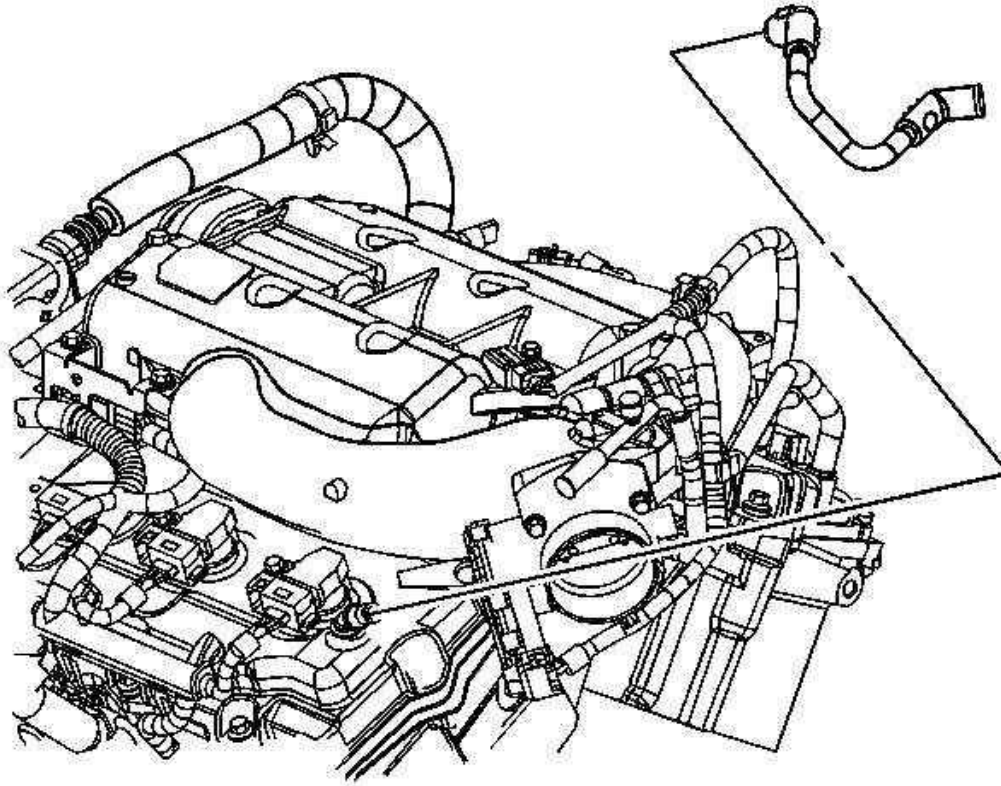


Fig. 37: View Of Positive Crankcase Ventilation (PCV) Fresh Air Tube
Courtesy of GENERAL MOTORS CORP.

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

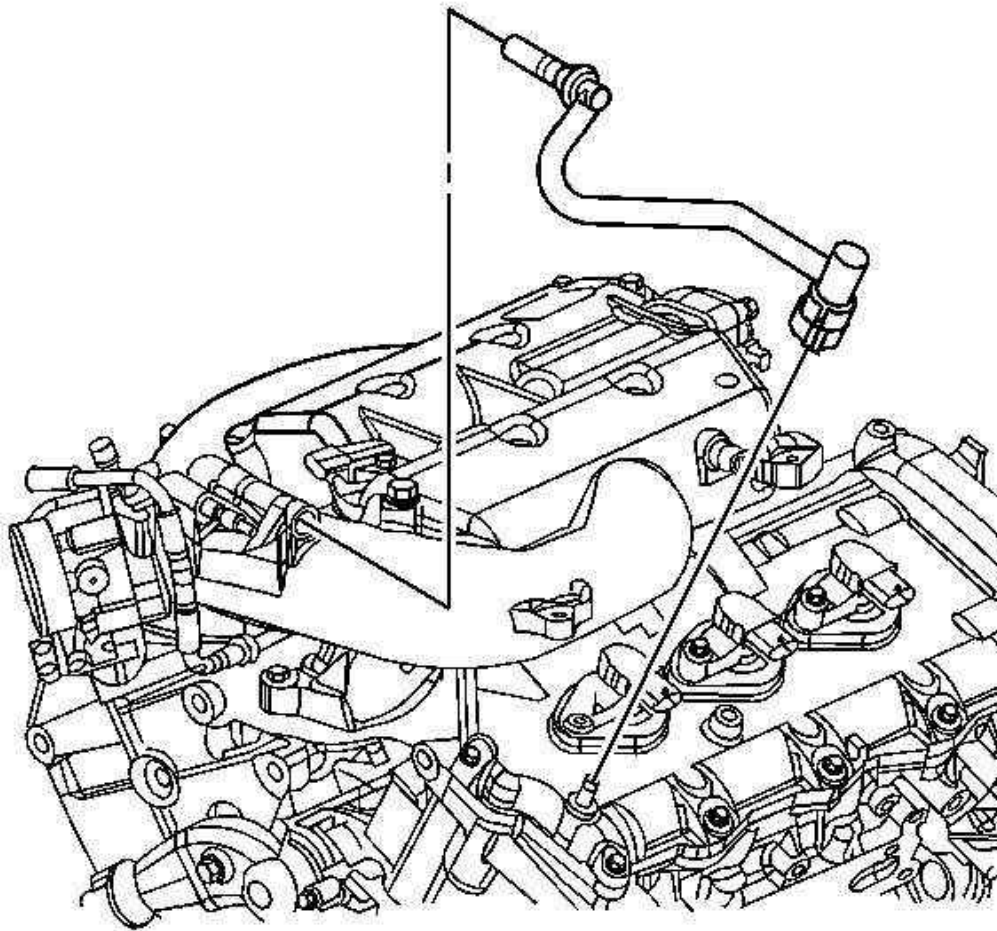


Fig. 38: Locating PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

3. Remove the PCV dirty air tube from the right camshaft cover.
4. Remove the PCV dirty air tube from the intake manifold.

Installation Procedure

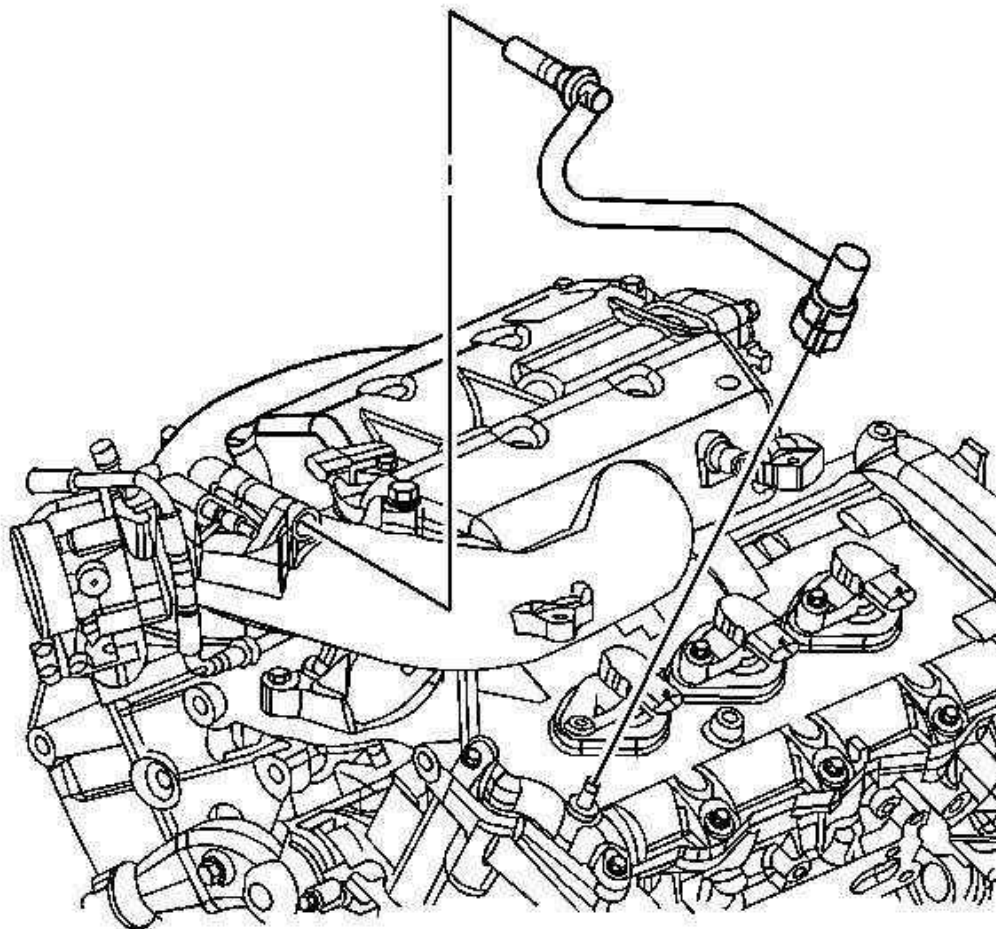


Fig. 39: Locating PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

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

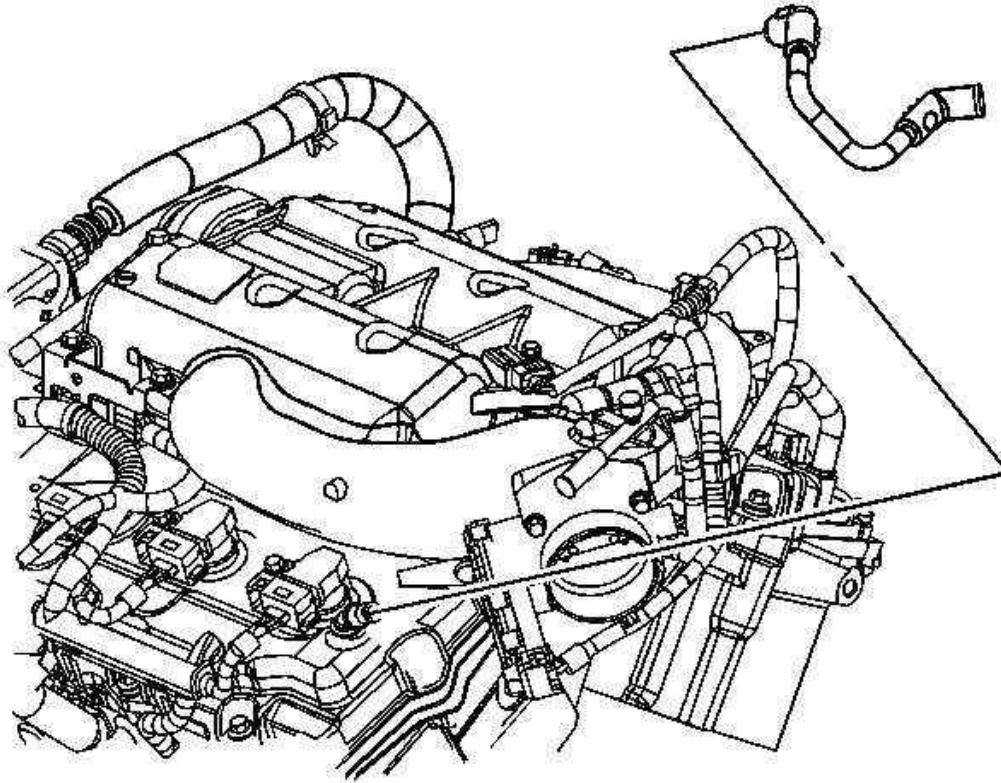


Fig. 40: View Of Positive Crankcase Ventilation (PCV) Fresh Air Tube
Courtesy of GENERAL MOTORS CORP.

3. Install the PCV fresh air tube to the air inlet duct.
4. Install the PCV fresh air tube to the left camshaft cover.

UPPER INTAKE MANIFOLD REPLACEMENT

Removal Procedure

1. Turn the ignition OFF.
2. Remove the air inlet duct. Refer to **Air Cleaner Inlet Duct Replacement** .
3. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief (With CH 48027)** or **Fuel Pressure Relief (Without CH 48027)** .

4. Remove the fuel pressure and evaporative emission (EVAP) hoses from the engine. Refer to **Metal Collar Quick Connect Fitting Service** and **Plastic Collar Quick Connect Fitting Service** .

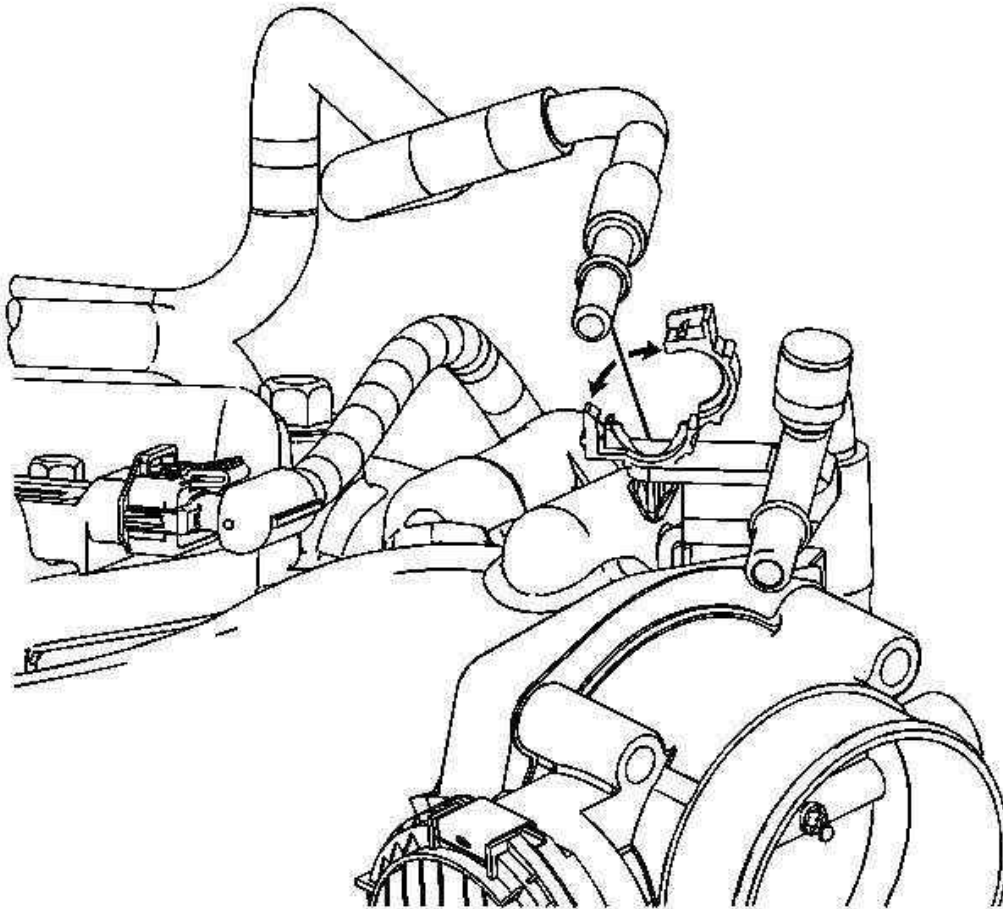


Fig. 41: Identifying Purge Line Retainer
Courtesy of GENERAL MOTORS CORP.

5. Remove the purge line from the purge line retainer.

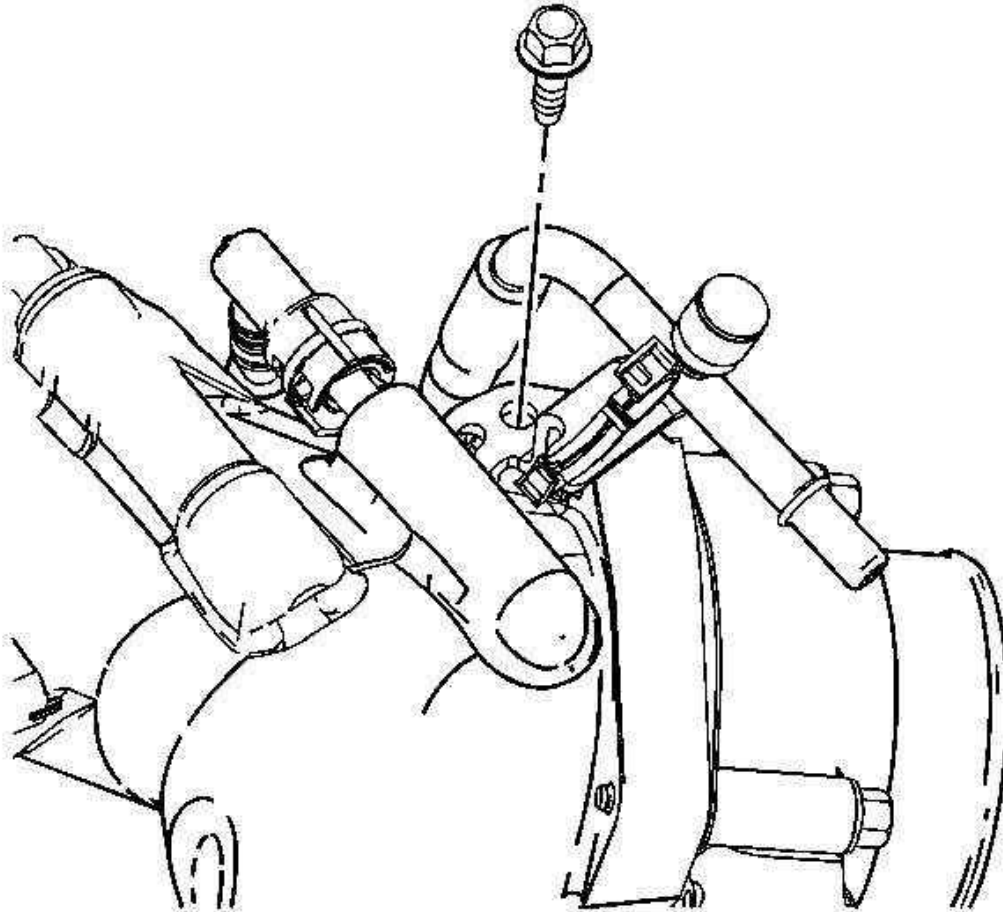


Fig. 42: View Of Fuel Feed Hose Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

6. Remove the fuel feed hose bracket bolt and reposition the fuel feed hose.

IMPORTANT:

- Do not disconnect the engine control module (ECM) electrical connectors.
- Do not remove the ECM from the ECM bracket.

7. Remove the ECM bracket with the ECM and reposition aside. Refer to **Engine Control Module Replacement** .

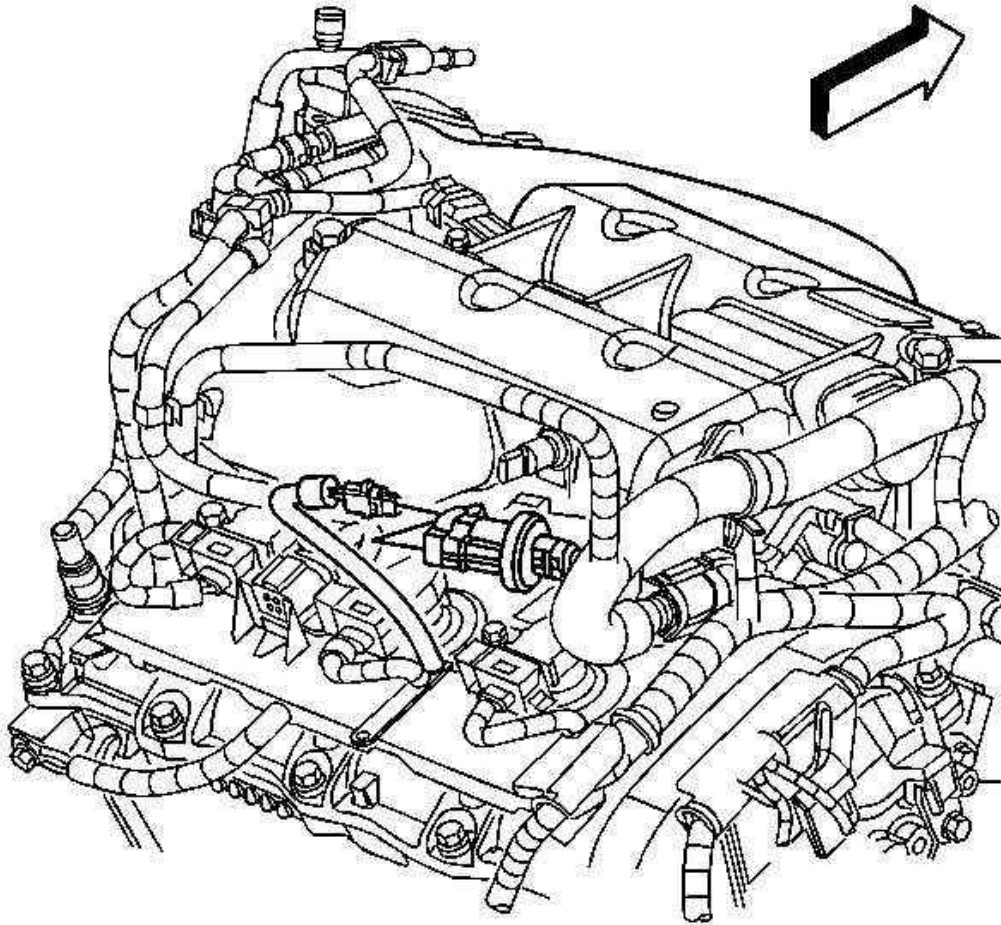


Fig. 43: Identifying Purge Valve Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the purge solenoid electrical connector.

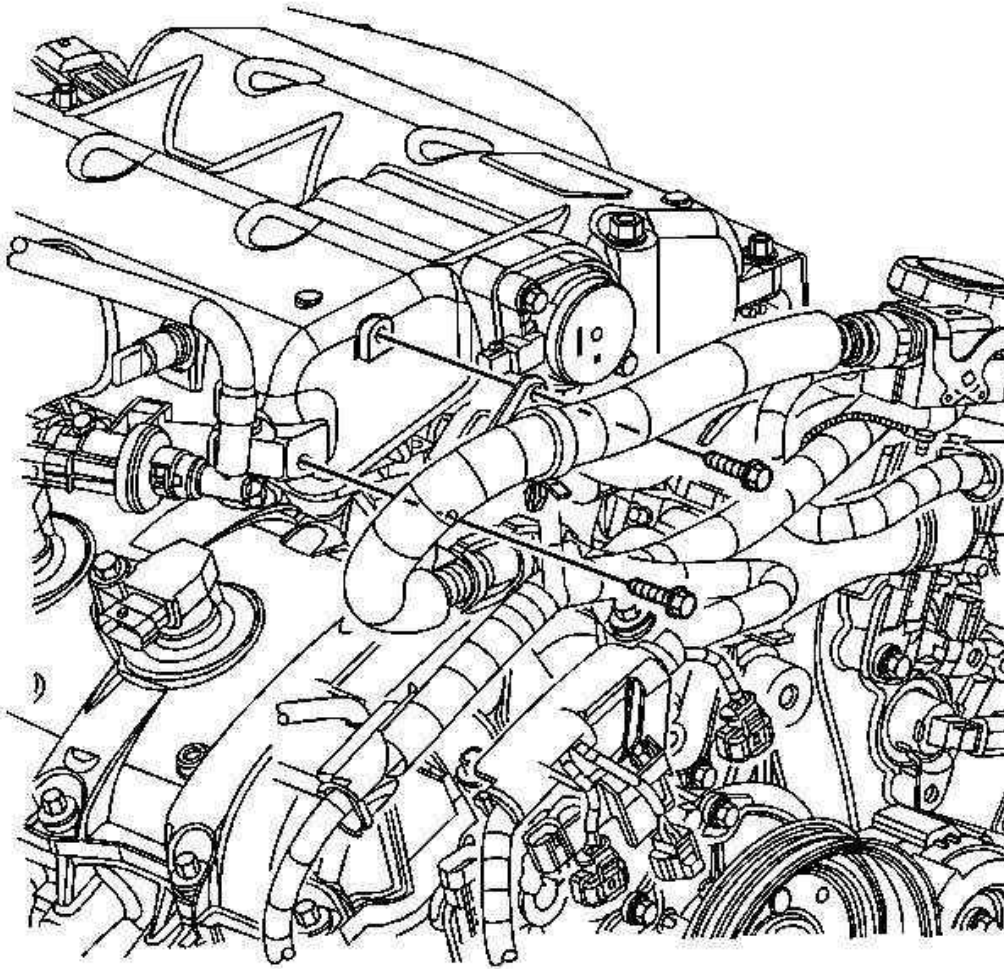


Fig. 44: Identifying Wiring Harness Bracket Bolts On Right Side Of Intake Manifold
Courtesy of GENERAL MOTORS CORP.

9. Remove the wiring harness from the right side of the intake manifold.

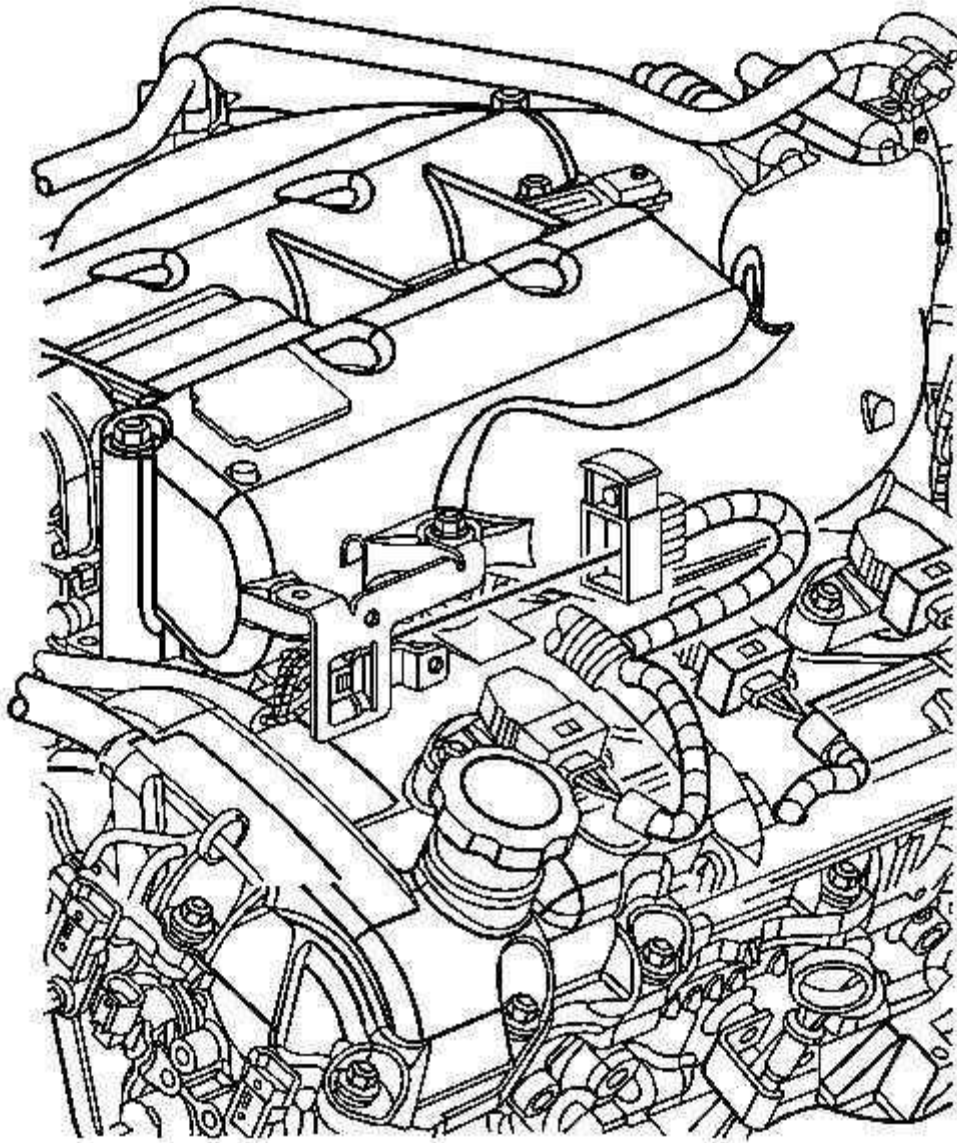


Fig. 45: View Of Fuel Injector Electrical Connector
Courtesy of GENERAL MOTORS CORP.

10. Disconnect the fuel injector electrical connector.
11. Remove the fuel injector electrical connector from the fuel injector electrical

connector bracket.

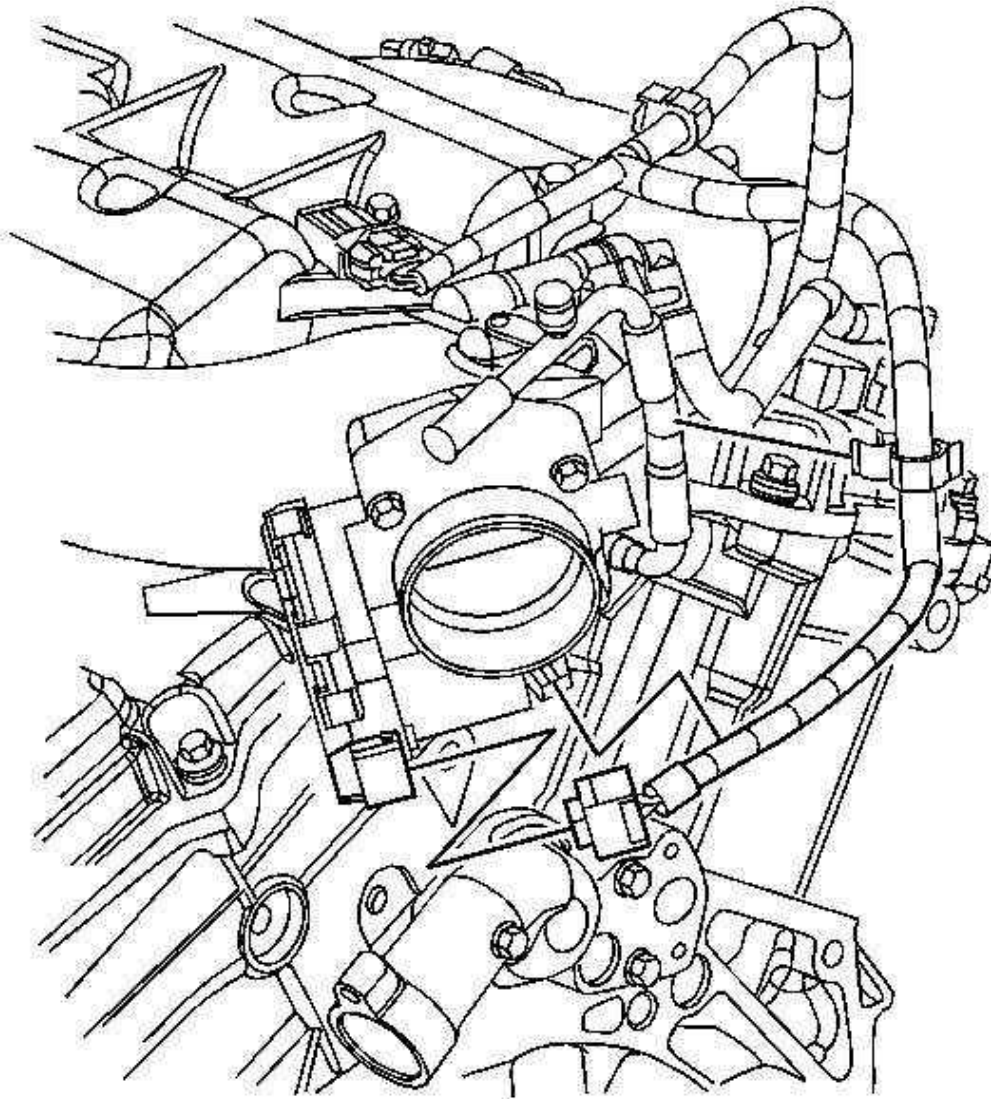


Fig. 46: Identifying Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

12. Remove the throttle body electrical connector.
13. Remove the brake booster vacuum hose and check valve from the brake

booster.

14. Remove the electrical connector for the BARO sensor.

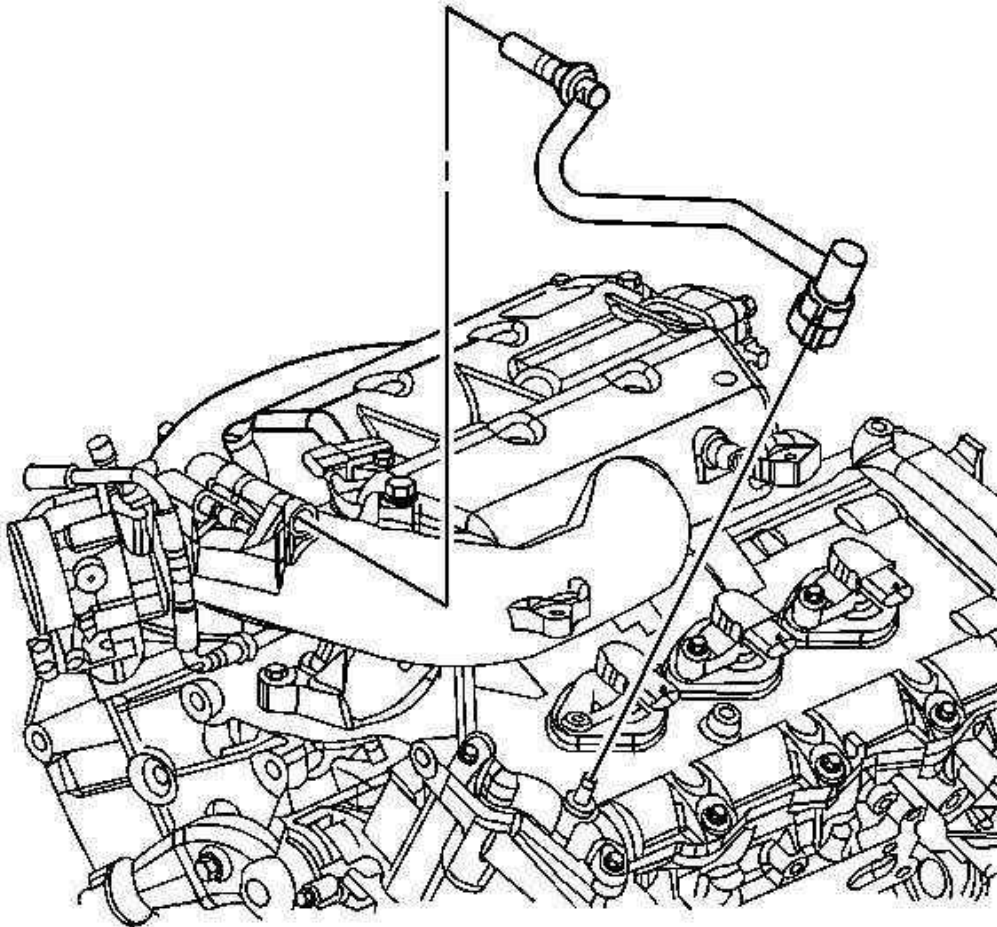


Fig. 47: Locating PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

15. Remove the positive crankcase ventilation (PCV) hose from the intake manifold.

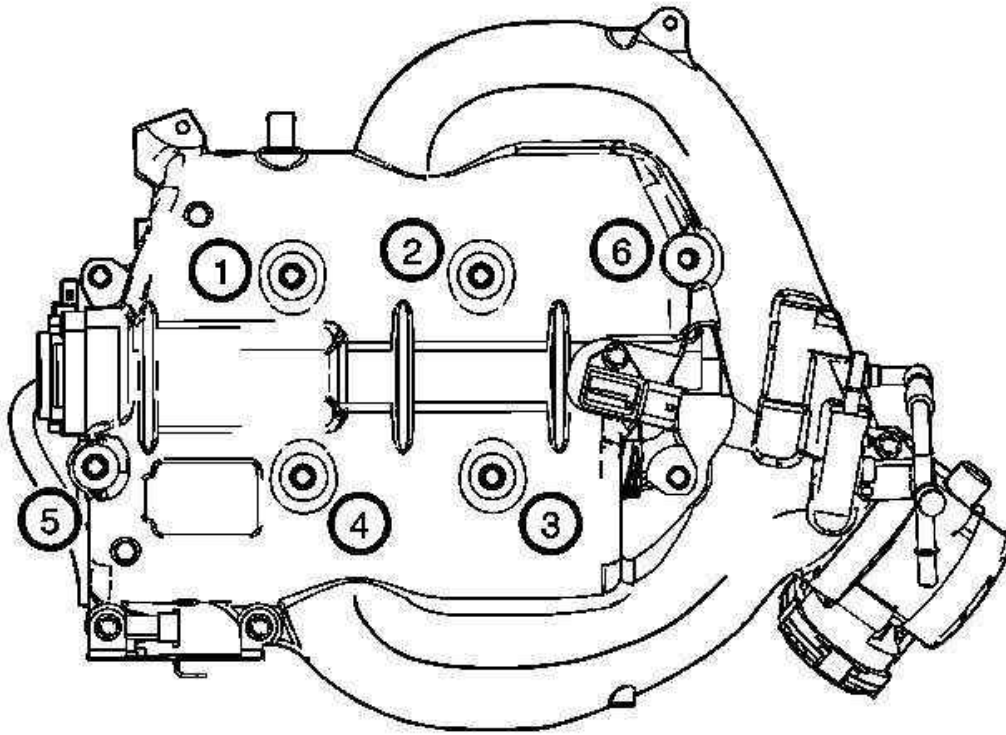


Fig. 48: Identifying Intake Manifold Bolts
Courtesy of GENERAL MOTORS CORP.

16. Remove the intake manifold bolts (1-6).

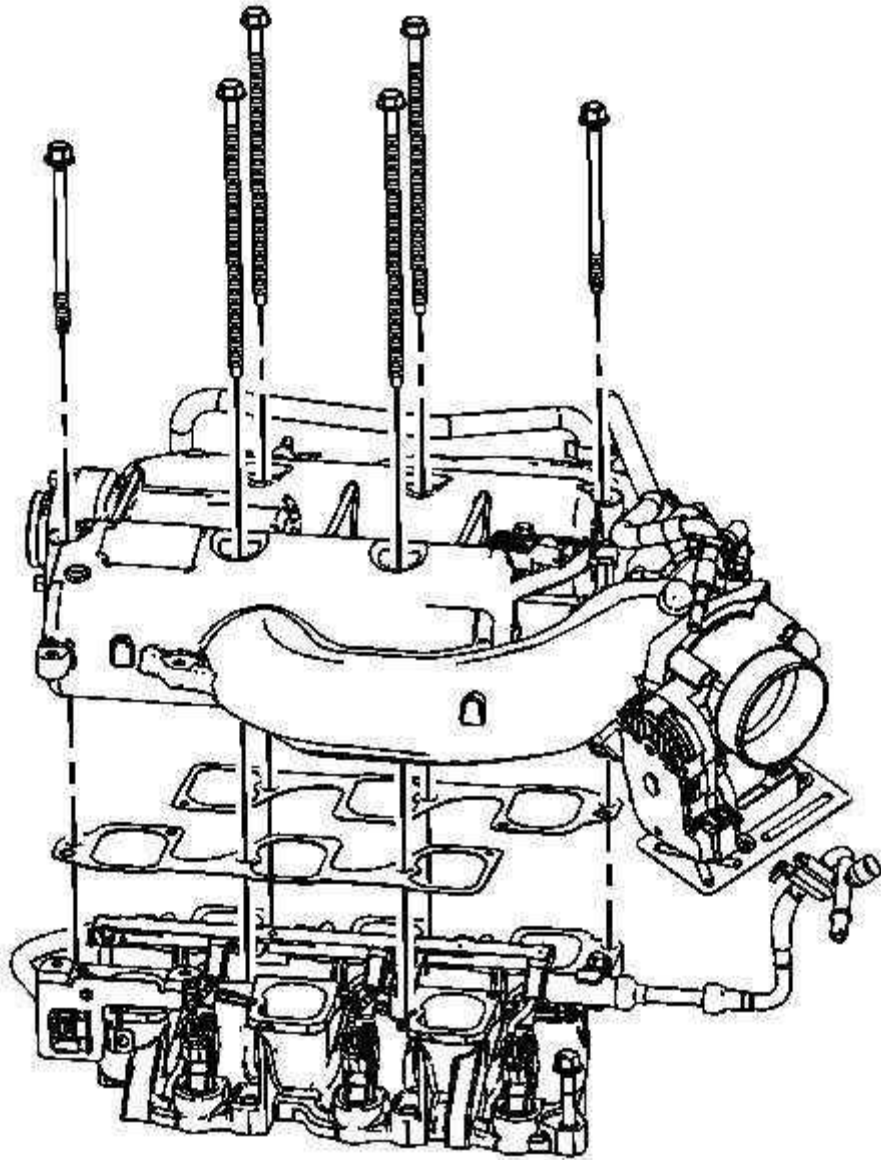


Fig. 49: View Of Upper Intake Manifold
Courtesy of GENERAL MOTORS CORP.

17. Remove the upper intake manifold.
18. Remove and discard the upper intake manifold gasket.

2008 Buick LaCrosse CX
2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

19. Disassemble the intake manifold if necessary. Refer to **Intake Manifold Disassemble** .
20. Clean and inspect the intake manifold and the sealing surfaces. Refer to **Intake Manifold Cleaning and Inspection** .

Installation Procedure

1. Assemble the intake manifold if necessary. Refer to **Intake Manifold Assemble** .

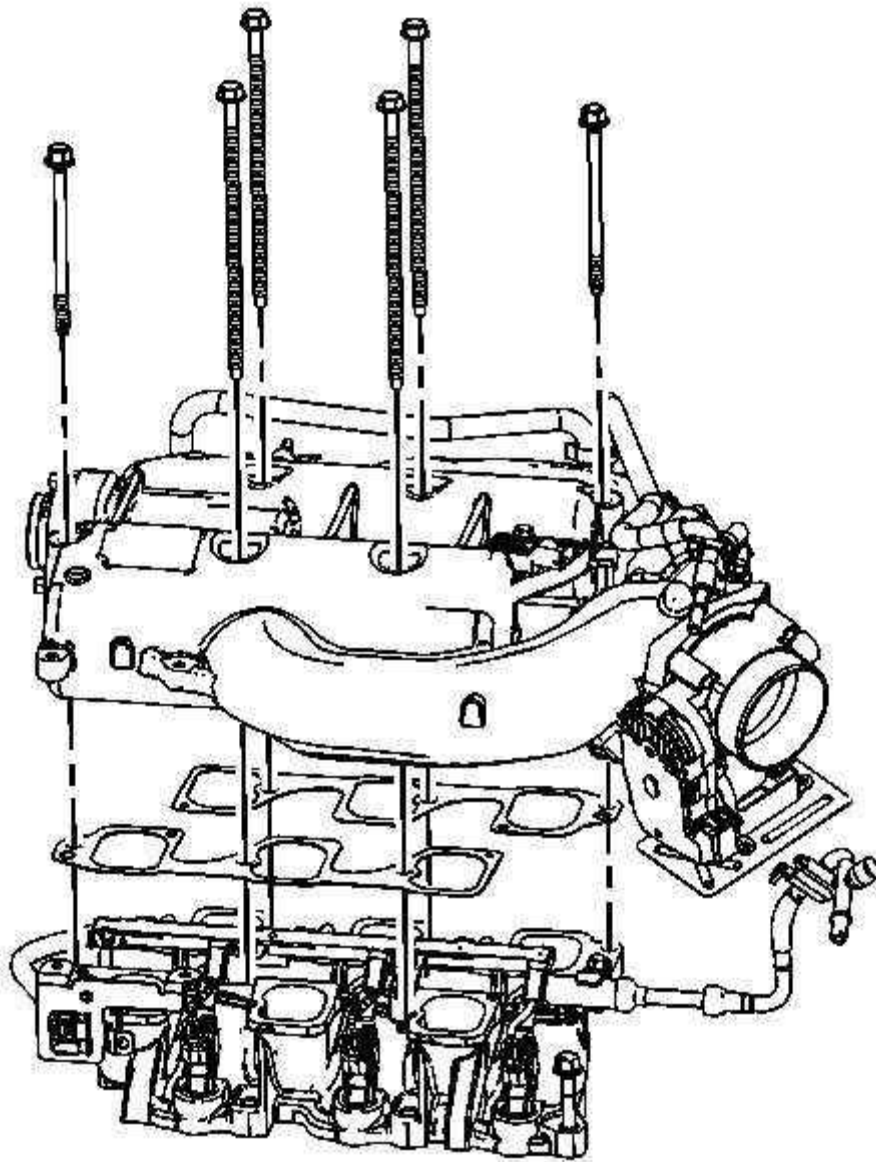


Fig. 50: View Of Upper Intake Manifold
Courtesy of GENERAL MOTORS CORP.

2. Install the intake manifold.

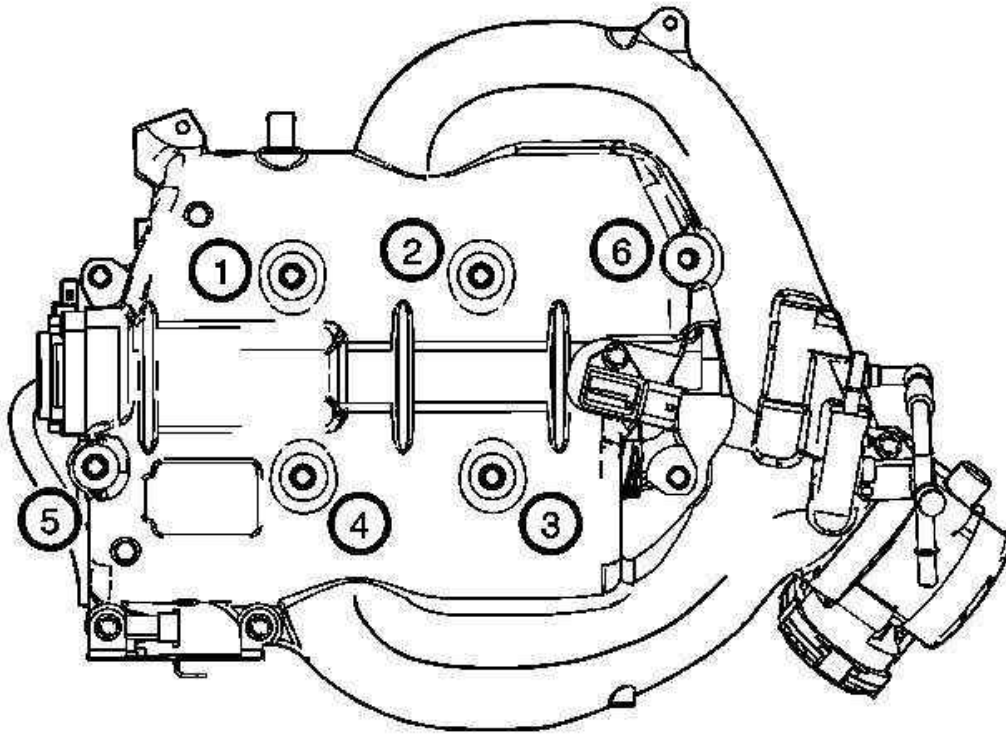


Fig. 51: Identifying Intake Manifold Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

3. Install the intake manifold bolts (1-6).

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

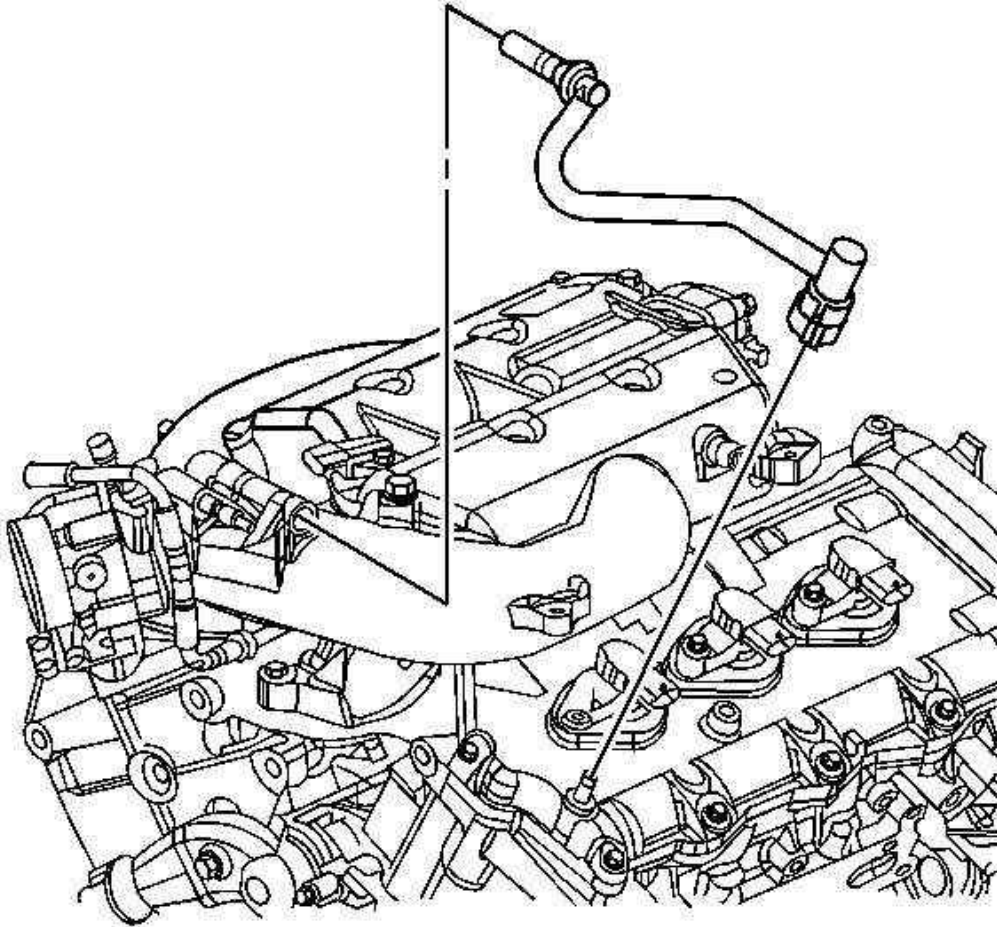


Fig. 52: Locating PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

4. Install the PCV hose to the intake manifold.
5. Install the brake booster vacuum hose and check valve to the brake booster.

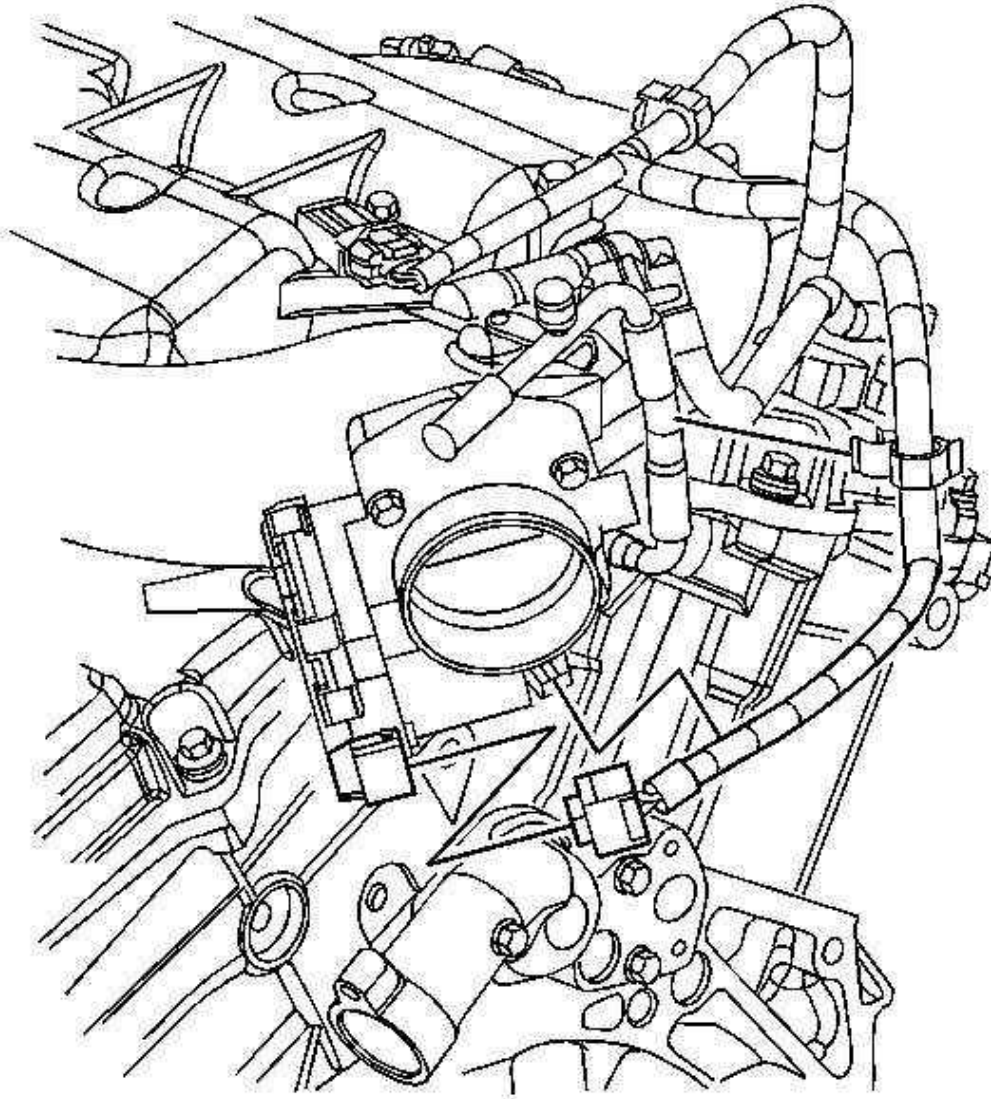


Fig. 53: Identifying Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

6. Install the throttle body electrical connector.
7. Reconnect the electrical connector for the BARO sensor.
8. Install the fuel injector electrical connector to the fuel injector electrical

connector bracket.

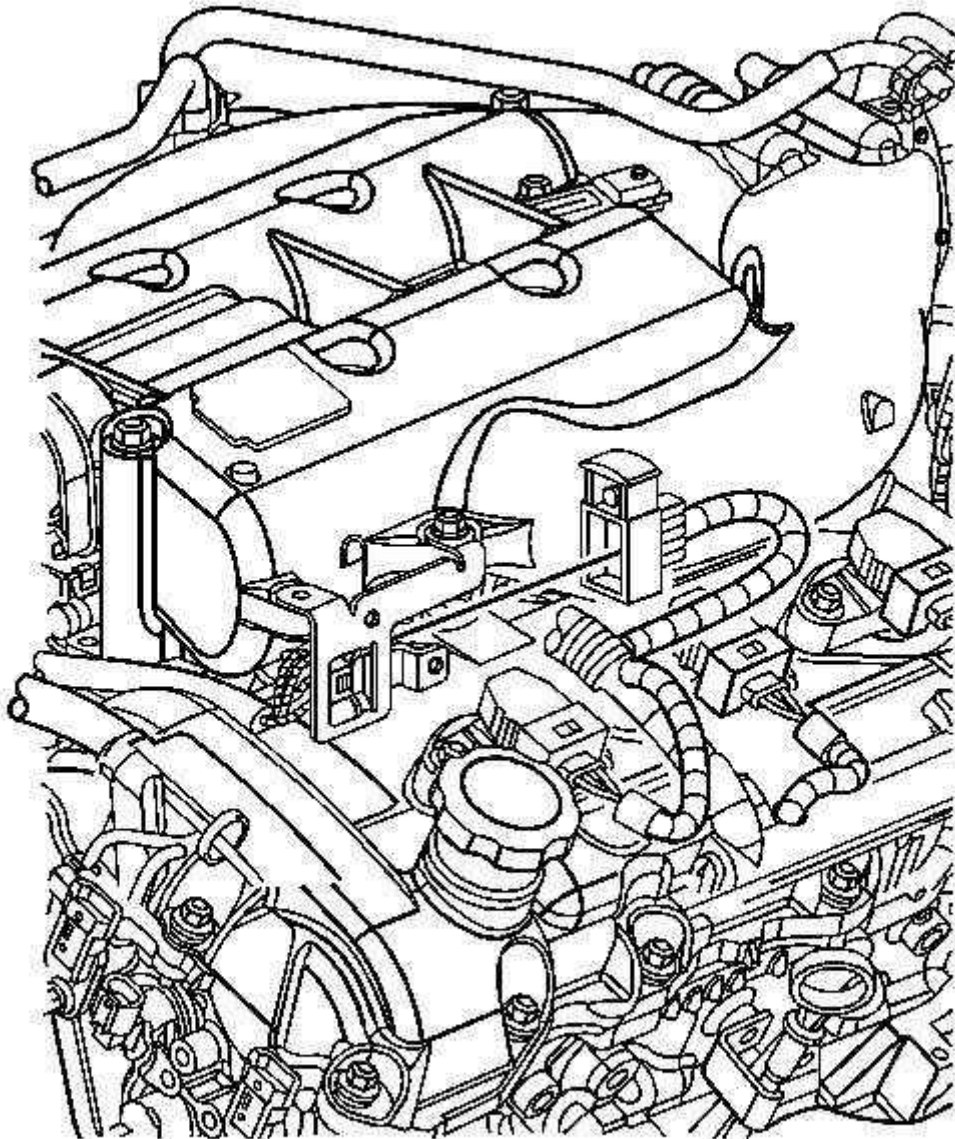


Fig. 54: View Of Fuel Injector Electrical Connector
Courtesy of GENERAL MOTORS CORP.

9. Connect the fuel injector electrical connector.

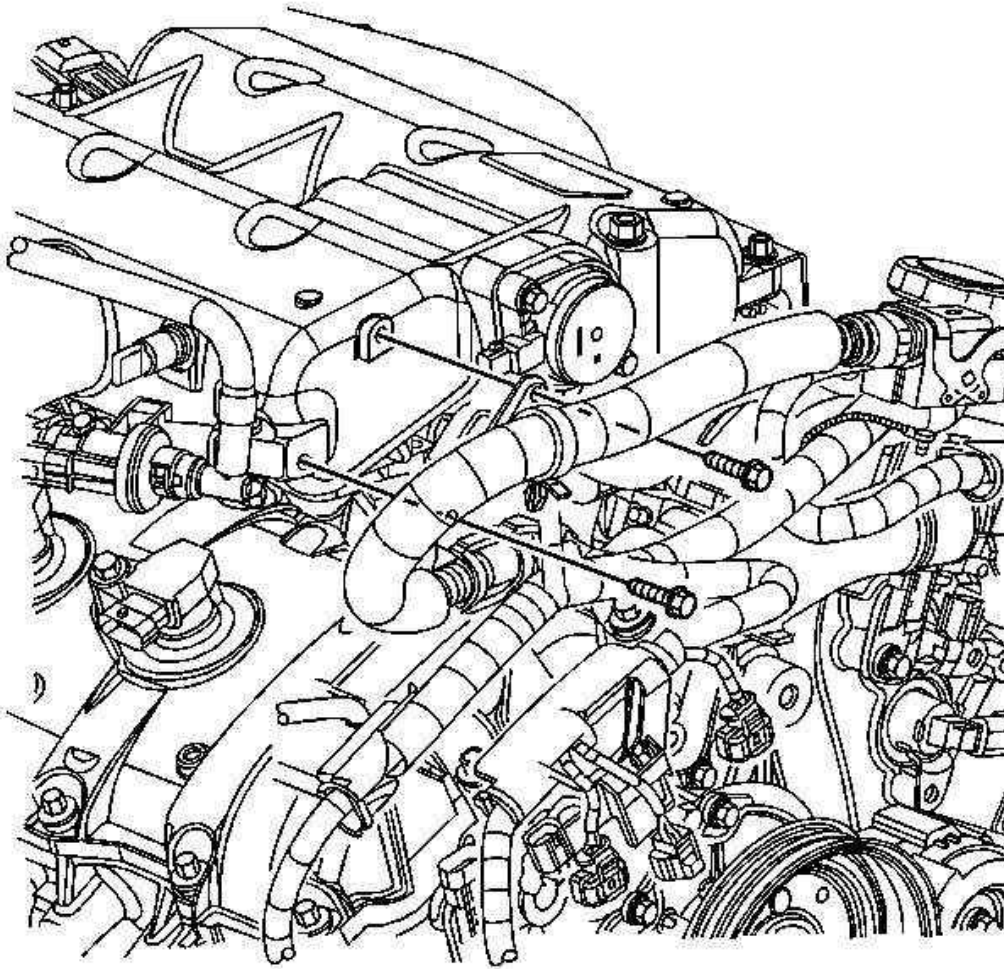


Fig. 55: Identifying Wiring Harness Bracket Bolts On Right Side Of Intake Manifold
Courtesy of GENERAL MOTORS CORP.

10. Install the wiring harness and bracket to the right side of the intake manifold.

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

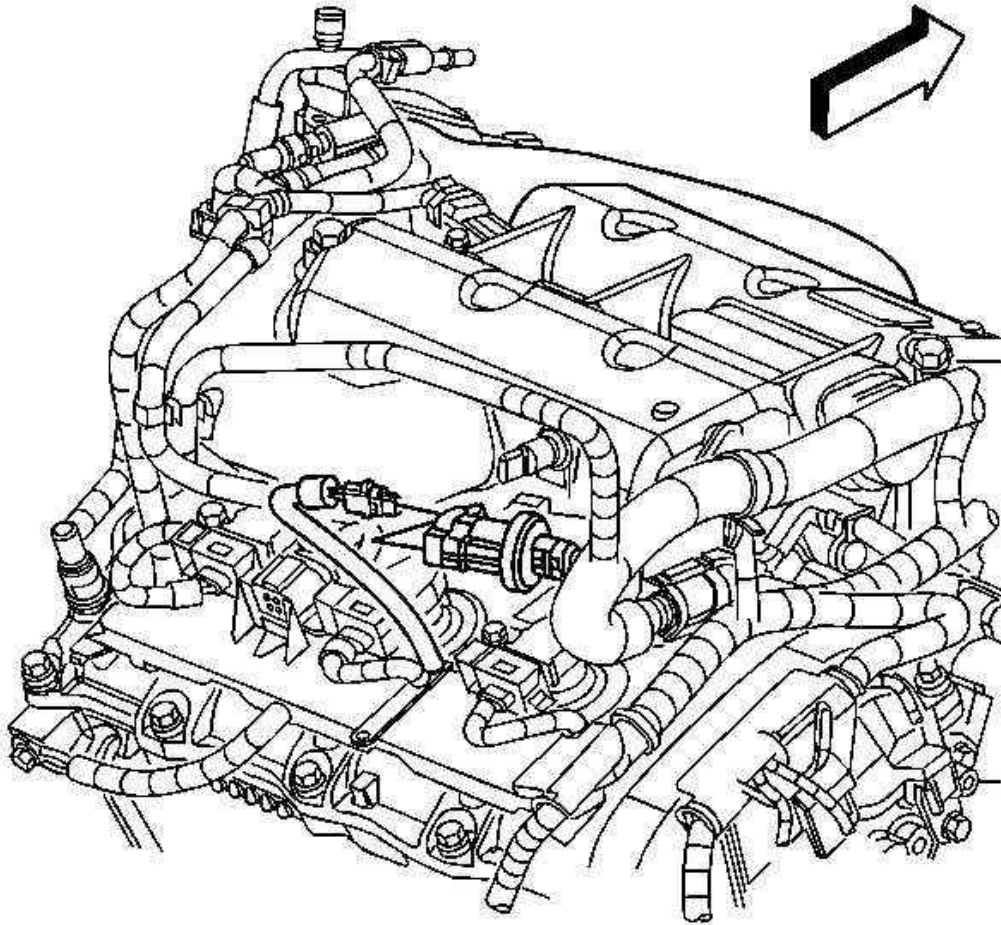


Fig. 56: Identifying Purge Valve Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

11. Connect the purge solenoid electrical connector.
12. Install the ECM bracket with the ECM. Refer to **Engine Control Module Replacement** .

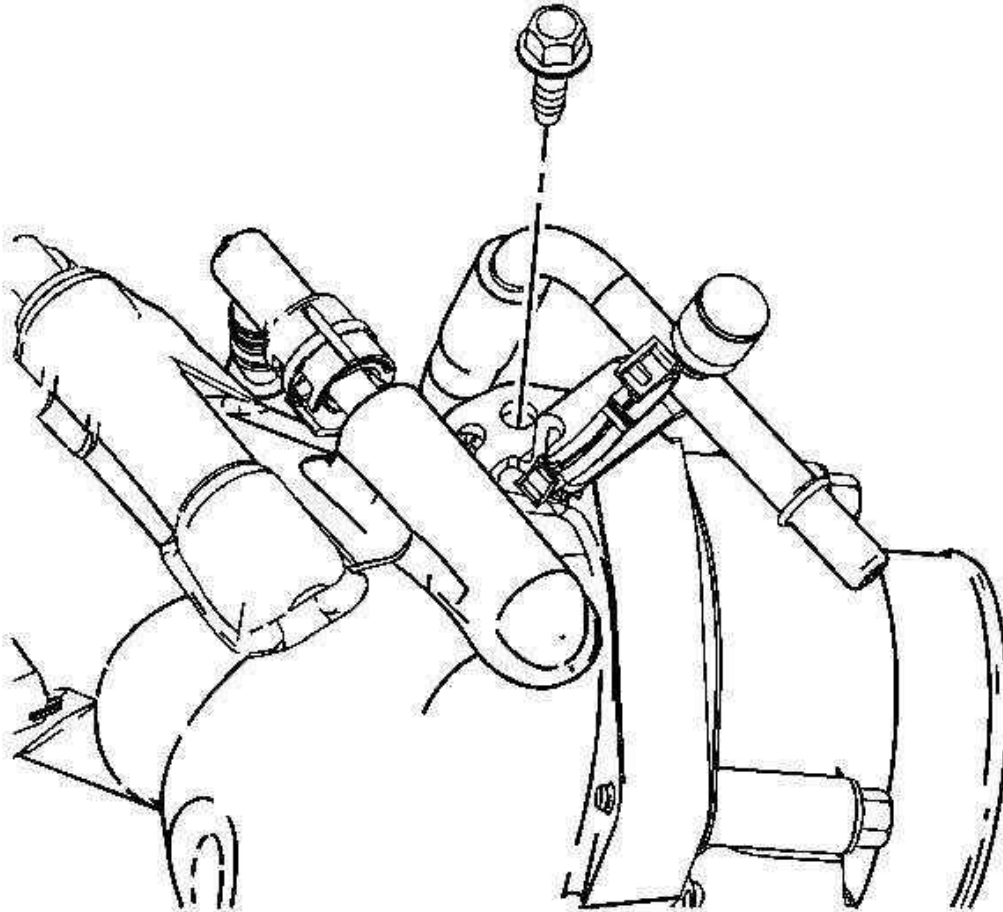


Fig. 57: View Of Fuel Feed Hose Bracket Bolt
Courtesy of GENERAL MOTORS CORP.

13. Install the fuel feed hose bracket and the fuel feed hose bracket bolt.

Tighten: Tighten the fuel feed hose bracket bolt to 10 N.m (89 lb in).

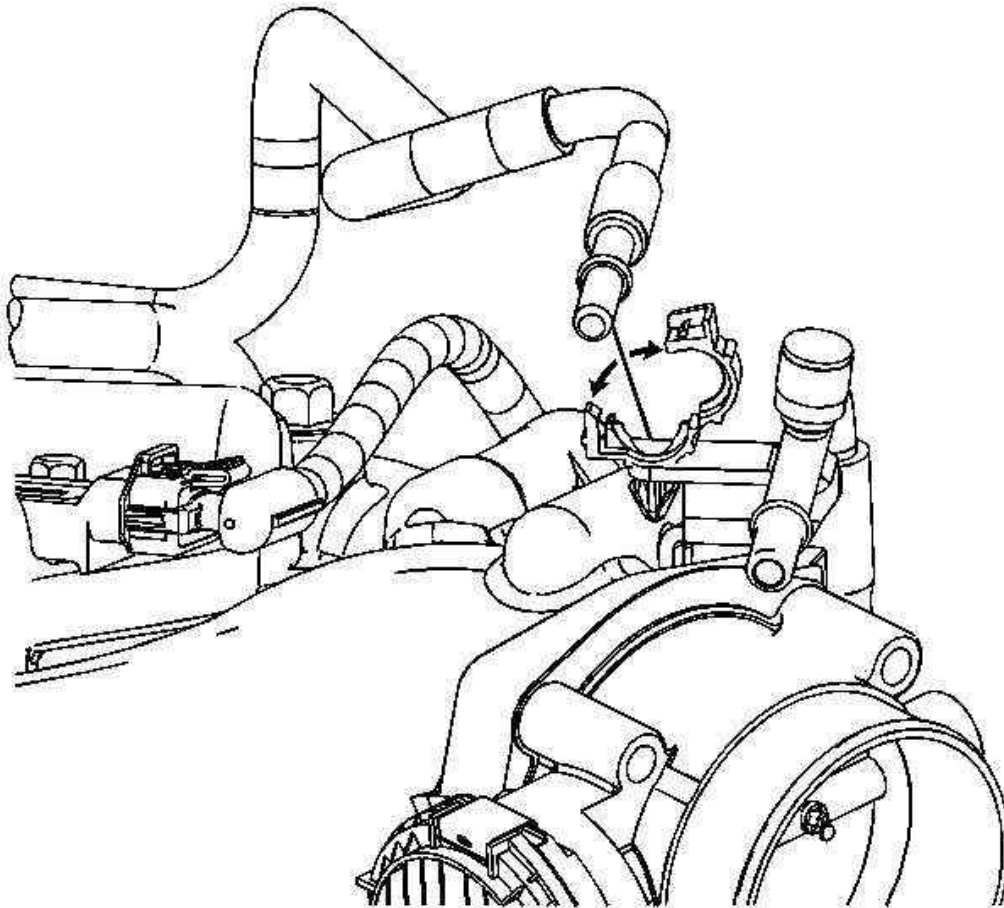


Fig. 58: Identifying Purge Line Retainer
Courtesy of GENERAL MOTORS CORP.

14. Install the purge line to the purge line retainer.
15. Install the fuel pressure and EVAP hoses to the engine. Refer to **Metal Collar Quick Connect Fitting Service** and **Plastic Collar Quick Connect Fitting Service** .
16. Install the air inlet duct. Refer to **Air Cleaner Inlet Duct Replacement** .

LOWER INTAKE MANIFOLD REPLACEMENT

Removal Procedure

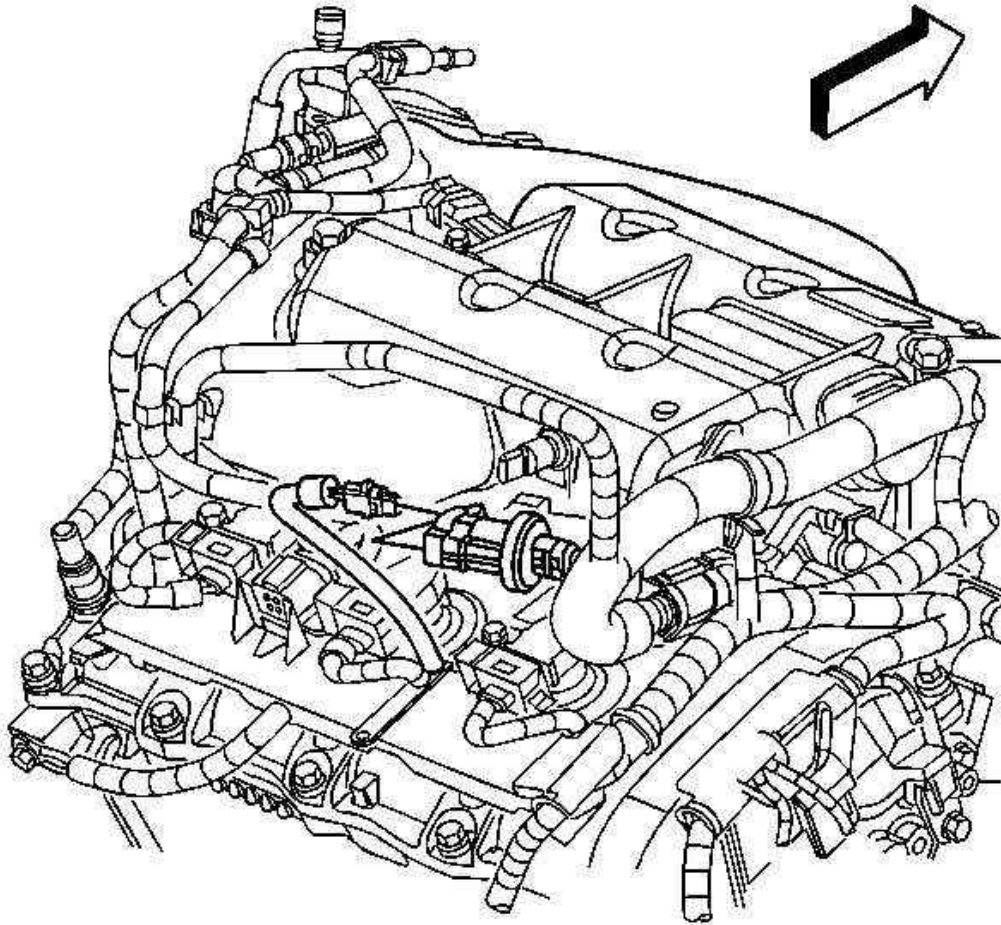


Fig. 59: Identifying Purge Valve Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Turn the ignition OFF.
2. Remove the air inlet duct. Refer to **Air Cleaner Inlet Duct Replacement** .
3. Remove the fuel pressure and evaporative emission (EVAP) hoses from the engine. Refer to **Metal Collar Quick Connect Fitting Service** and **Plastic Collar Quick Connect Fitting Service** .
4. Disconnect the BARO sensor electrical connector.

IMPORTANT: Do not disconnect the engine control module (ECM) electrical connectors.

5. Remove the ECM bracket with the ECM and reposition aside. Refer to **Engine Control Module Replacement** .
6. Disconnect the purge solenoid electrical connector.
7. Disconnect the purge solenoid electrical connector.

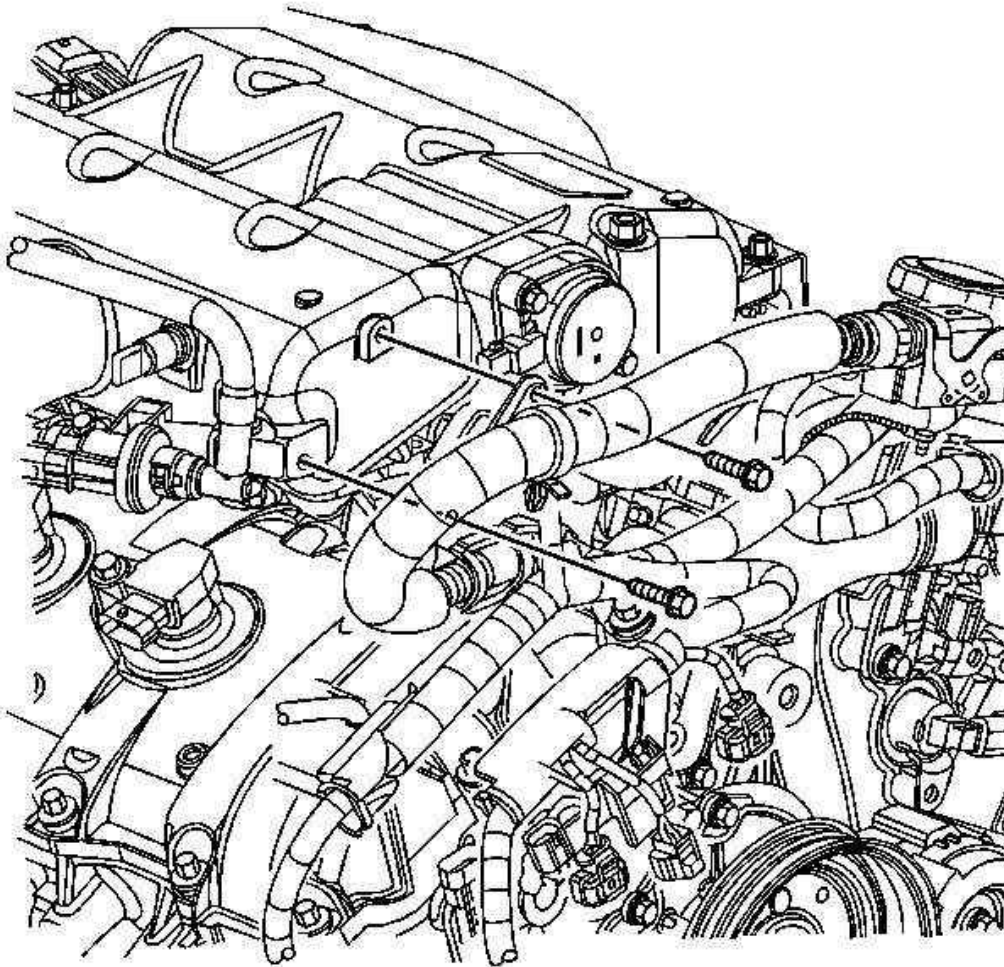


Fig. 60: Identifying Wiring Harness Bracket Bolts On Right Side Of Intake Manifold

Courtesy of GENERAL MOTORS CORP.

8. Remove the wiring harness from the right side of the intake manifold.

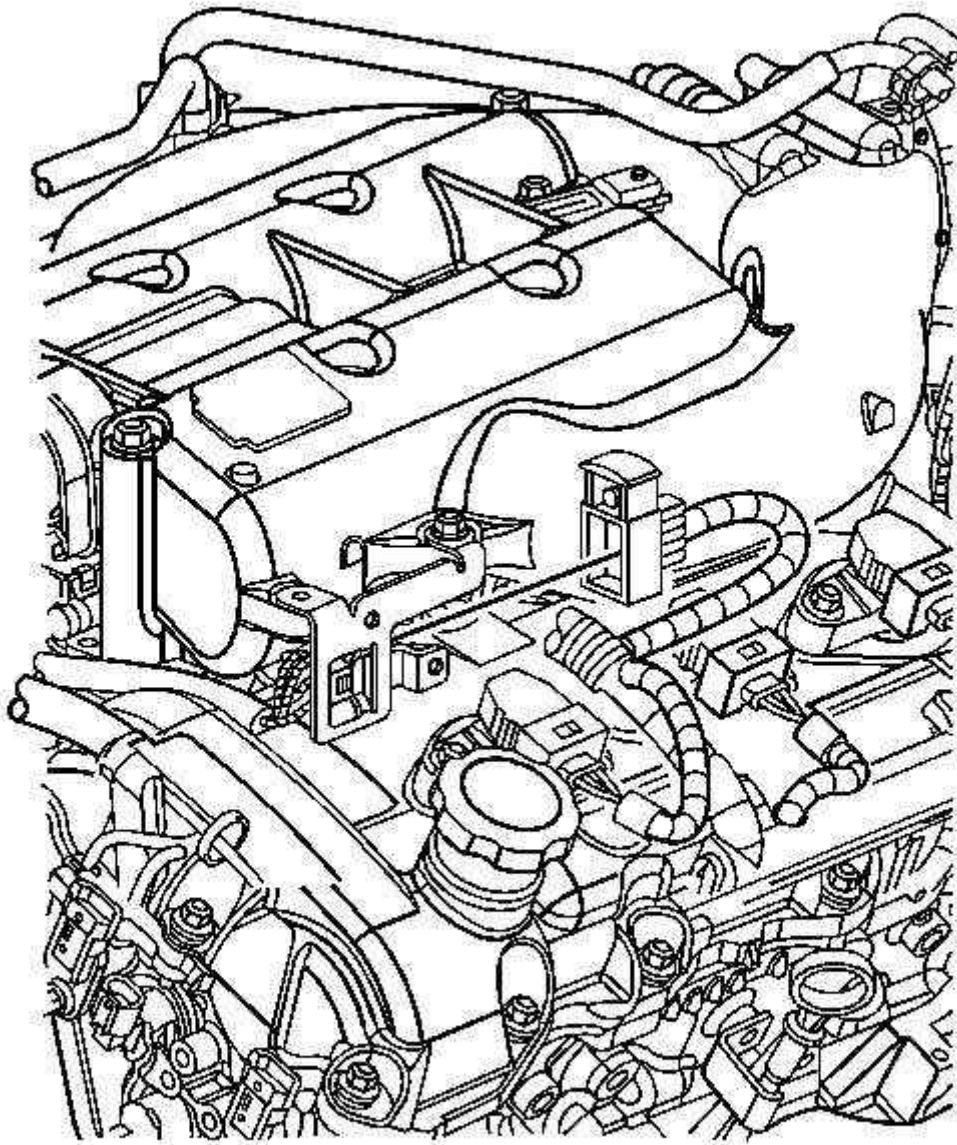


Fig. 61: View Of Fuel Injector Electrical Connector
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the fuel injector electrical connector.

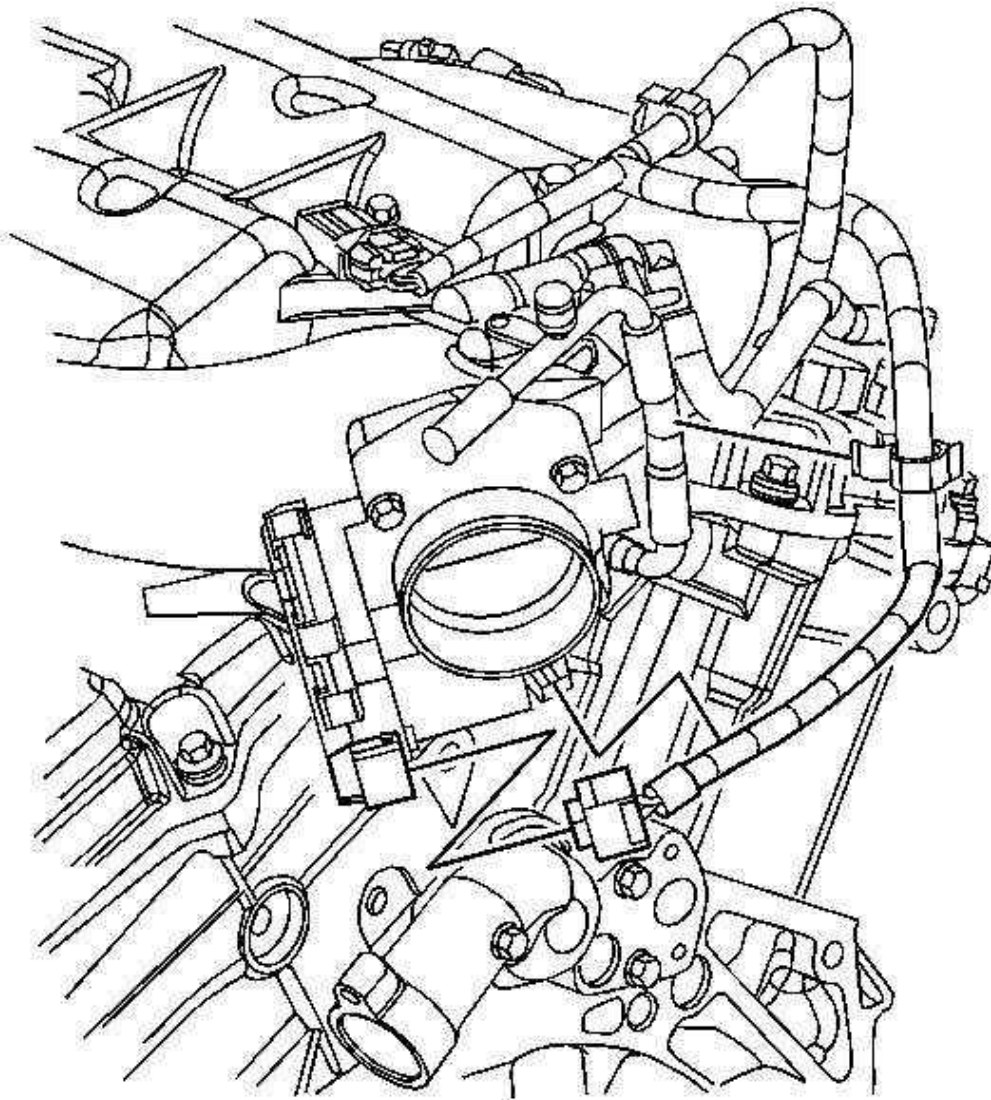


Fig. 62: Identifying Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

10. Remove the throttle body electrical connector.

11. Remove the brake booster vacuum hose and check valve from the brake booster.

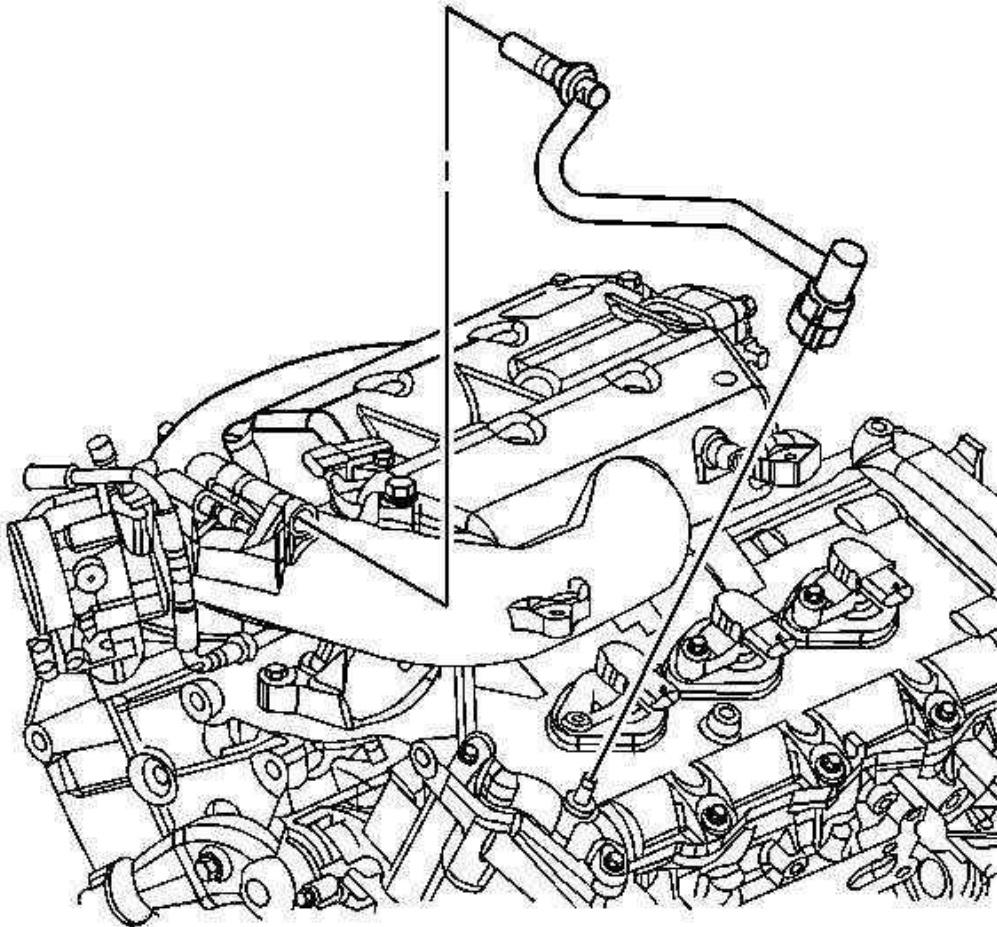


Fig. 63: Locating PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

12. Remove the positive crankcase ventilation (PCV) hose from the intake manifold.

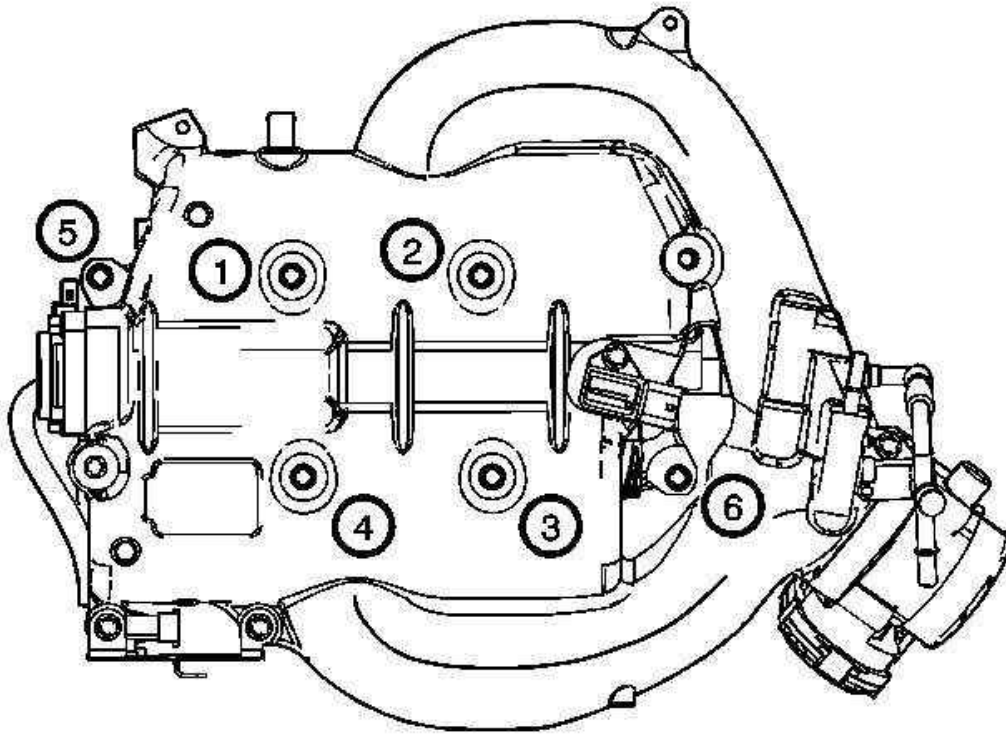


Fig. 64: Identifying Intake Manifold Bolts
Courtesy of GENERAL MOTORS CORP.

13. Remove the intake manifold bolts (1-6).

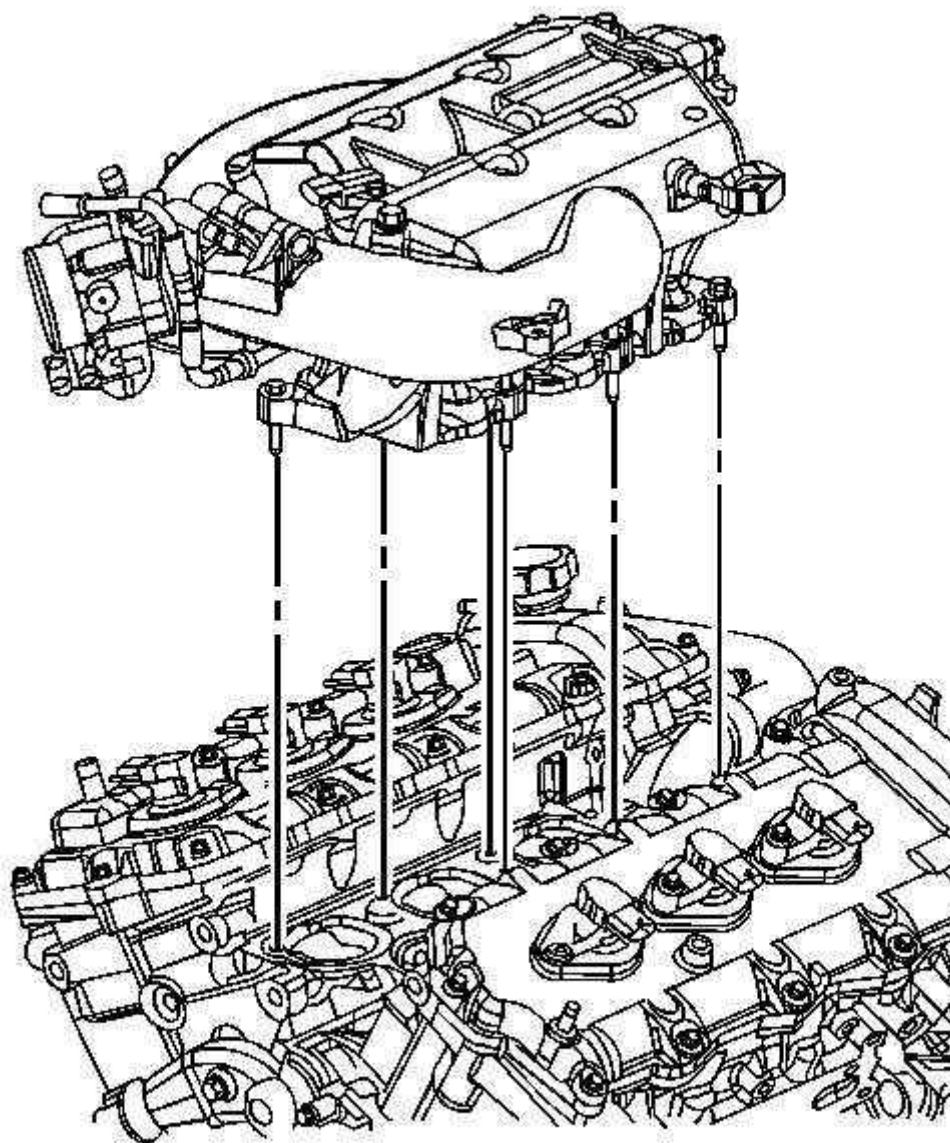


Fig. 65: View Of Intake Manifold
Courtesy of GENERAL MOTORS CORP.

14. Remove the intake manifold.
15. Disassemble the intake manifold as necessary. Refer to **Intake Manifold**

Disassemble .

16. Clean and inspect the intake manifold and the sealing surfaces. Refer to **Intake Manifold Cleaning and Inspection .**

Installation Procedure

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

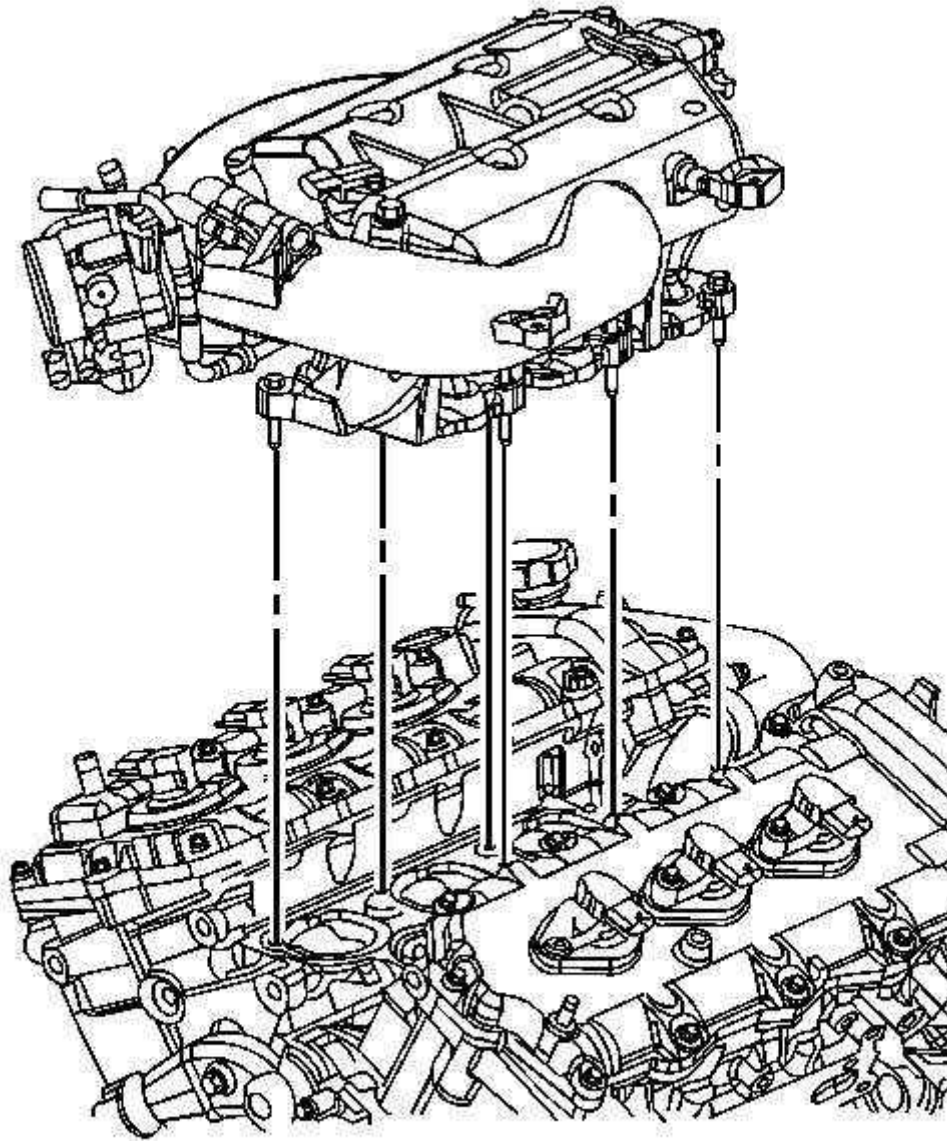


Fig. 66: View Of Intake Manifold
Courtesy of GENERAL MOTORS CORP.

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

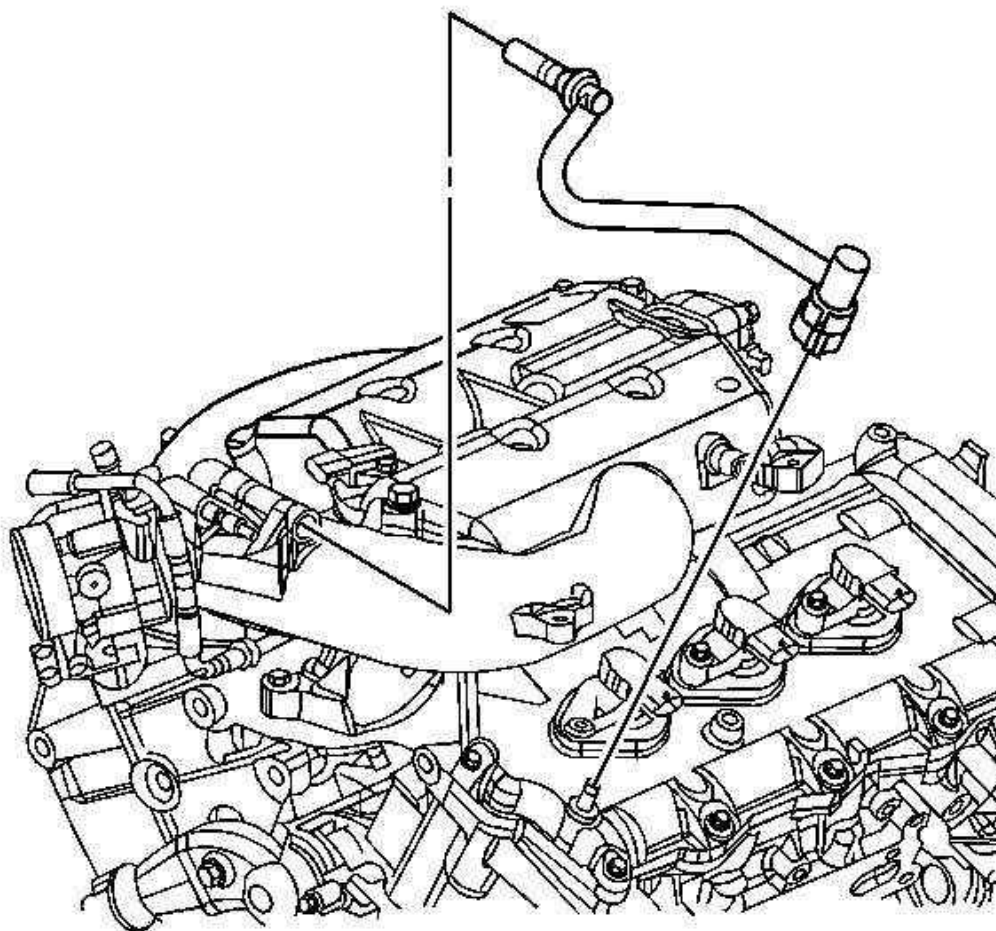


Fig. 67: Locating PCV Dirty Air Tube
Courtesy of GENERAL MOTORS CORP.

3. Install the PCV hose to the intake manifold.
4. Install the brake booster vacuum hose and check valve to the brake booster.

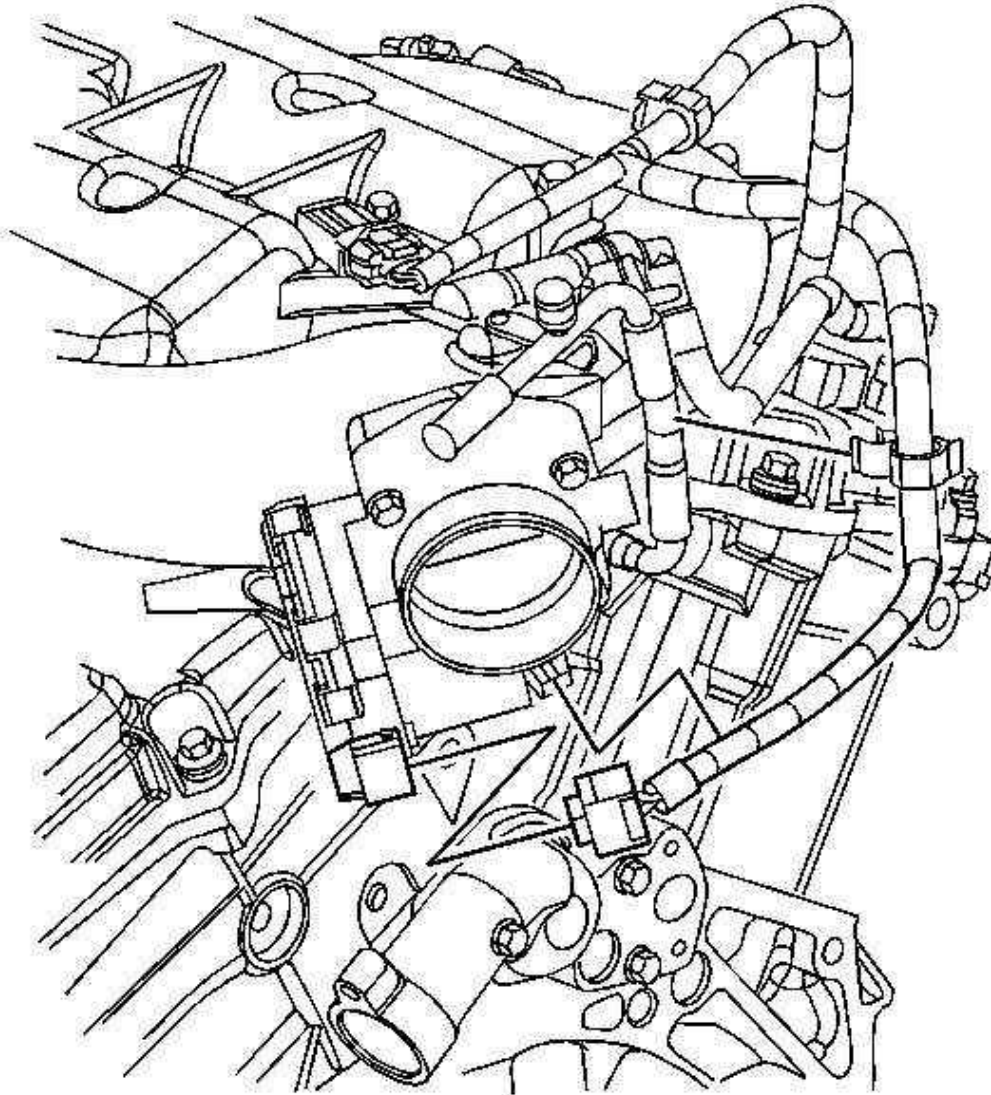


Fig. 68: Identifying Throttle Body Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Install the throttle body electrical connector.

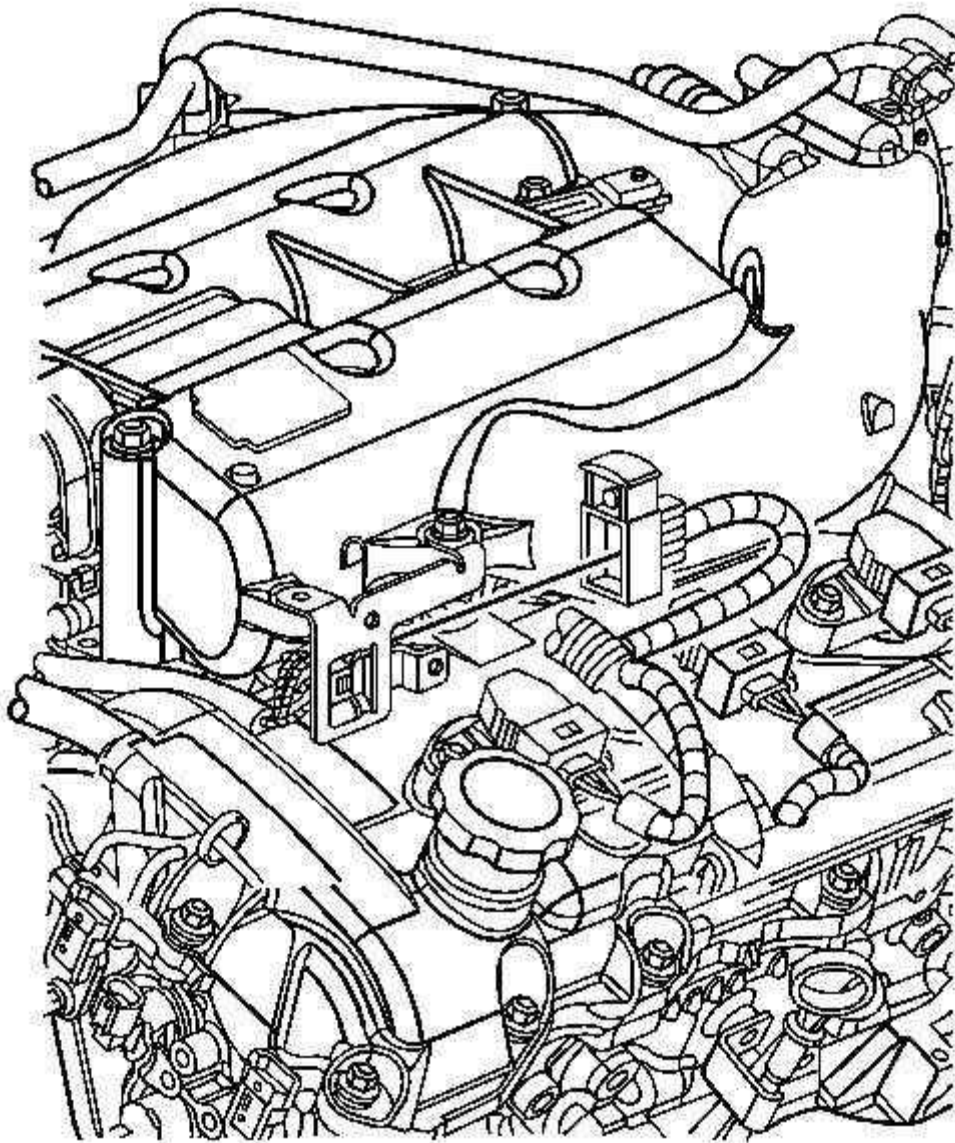


Fig. 69: View Of Fuel Injector Electrical Connector
Courtesy of GENERAL MOTORS CORP.

6. Connect the fuel injector electrical connector.

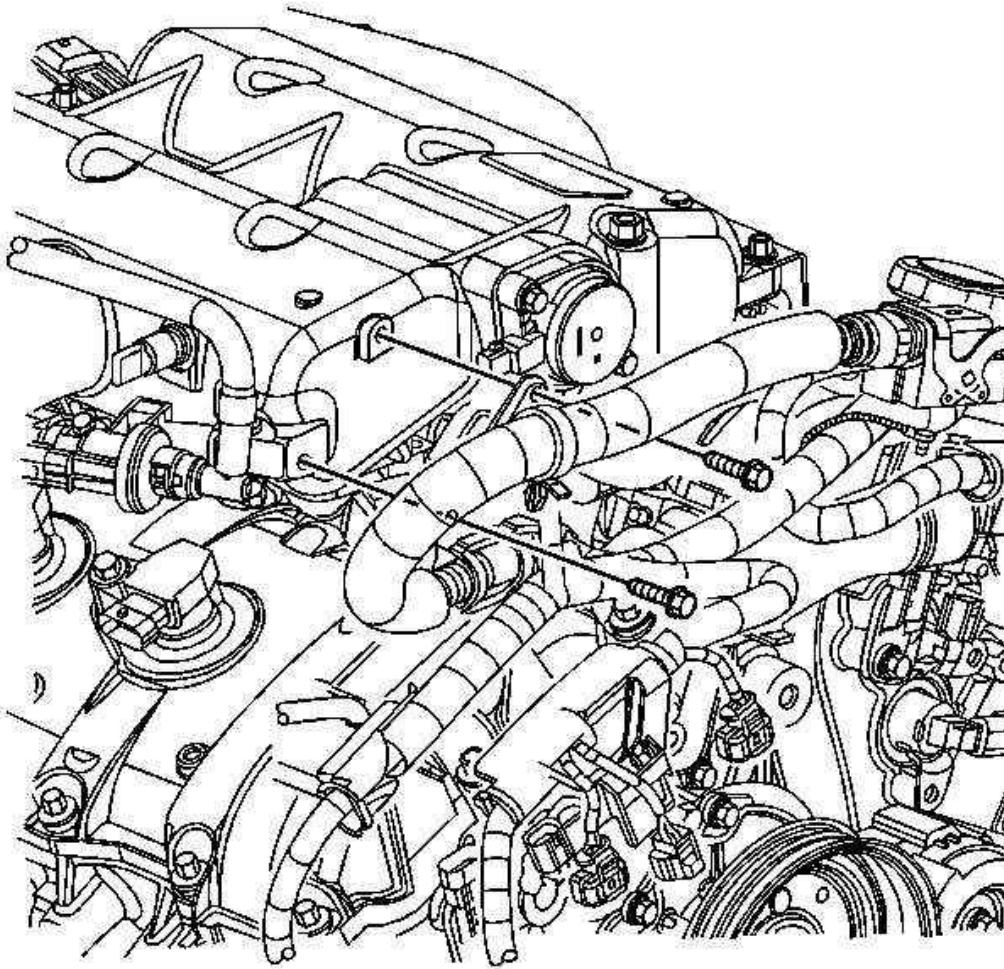


Fig. 70: Identifying Wiring Harness Bracket Bolts On Right Side Of Intake Manifold

Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

7. Install the wiring harness to the right side of the intake manifold.

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

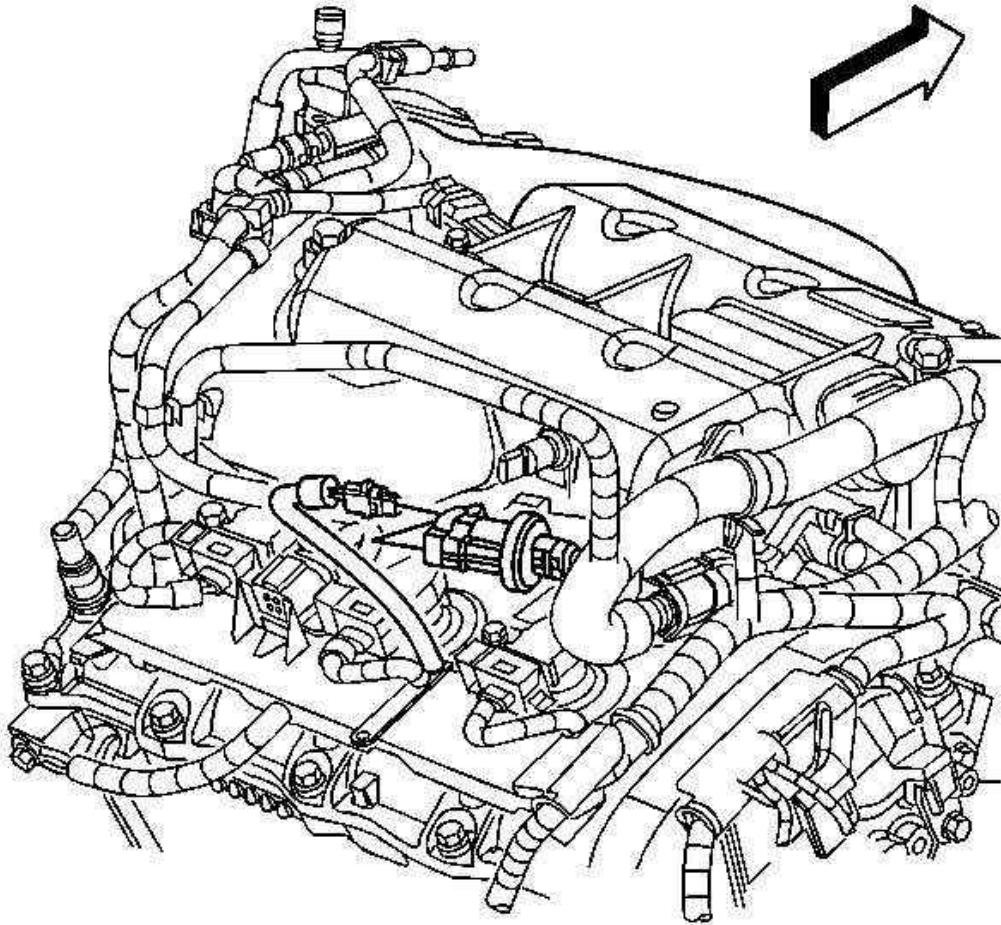


Fig. 71: Identifying Purge Valve Solenoid Electrical Connector
Courtesy of GENERAL MOTORS CORP.

8. Connect the purge solenoid electrical connector.
9. Install the ECM bracket with the ECM. Refer to **Engine Control Module Replacement** .
10. Connect the BARO sensor electrical connector.
11. Install the fuel pressure and EVAP hoses to the engine. Refer to **Metal Collar Quick Connect Fitting Service** and **Plastic Collar Quick Connect Fitting Service** .

12. Install the air inlet duct. Refer to **Air Cleaner Inlet Duct Replacement** .

OIL LEVEL INDICATOR AND TUBE REPLACEMENT

Removal Procedure

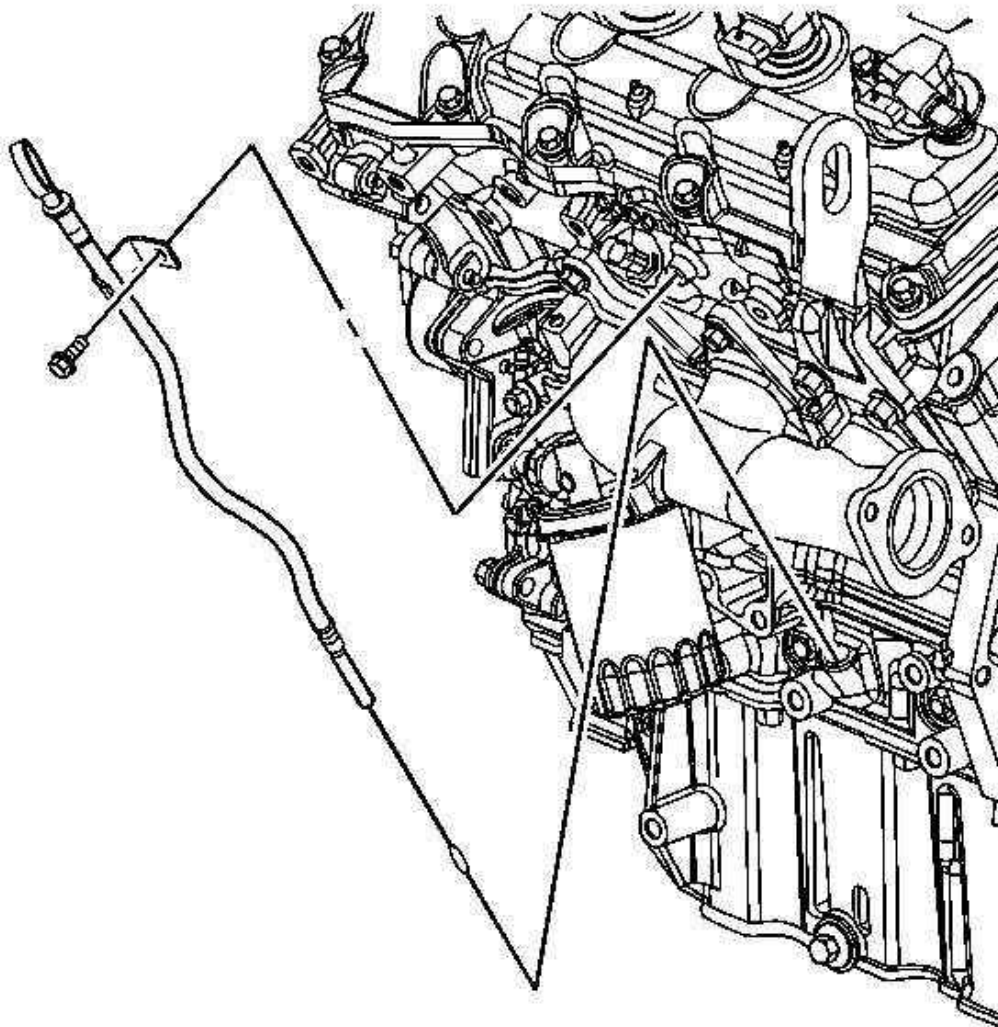


Fig. 72: View Of Oil Level Indicator & Tube
Courtesy of GENERAL MOTORS CORP.

2008 Buick LaCrosse CX

2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

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

Installation Procedure

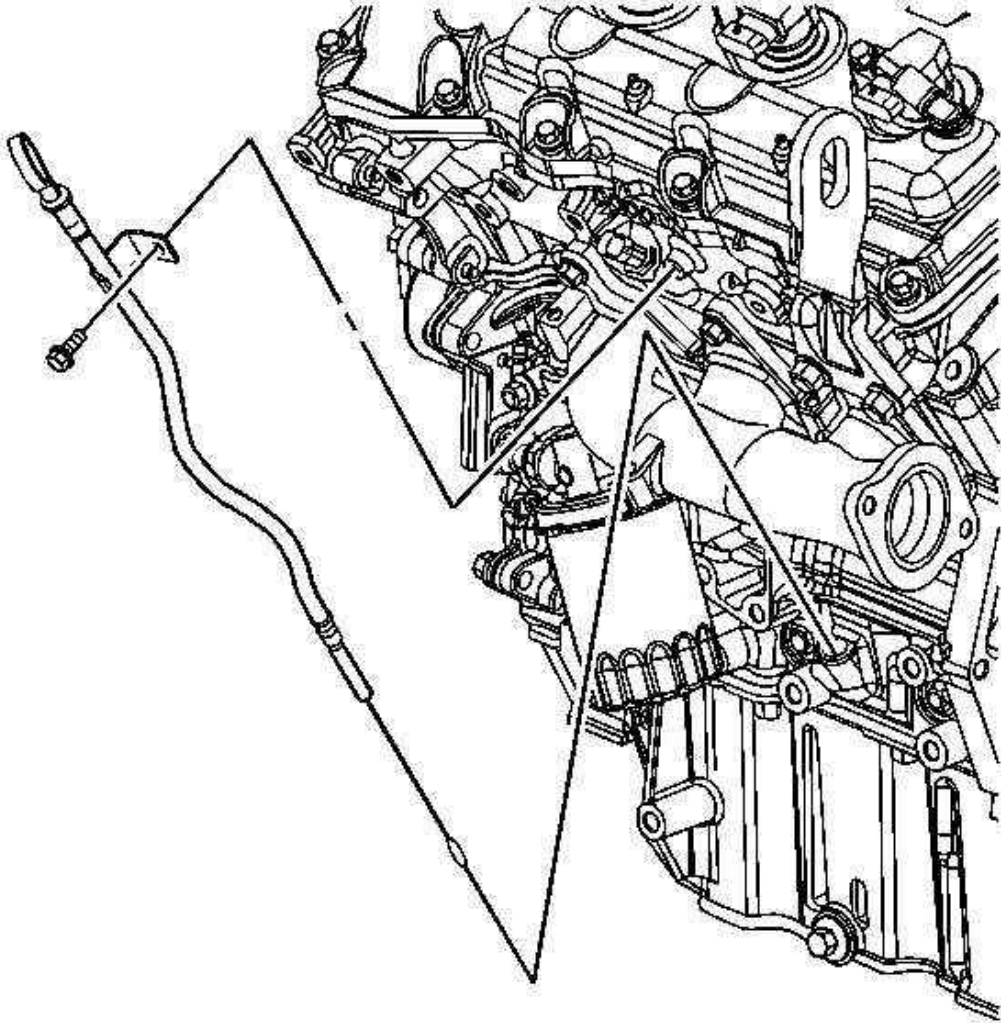


Fig. 73: View Of Oil Level Indicator & Tube
Courtesy of GENERAL MOTORS CORP.

1. Install the oil level indicator and tube. Refer to **Oil Level Indicator and Tube Installation** .
2. Lower the vehicle.

Removal Procedure

1. Remove the generator. Refer to **Generator Replacement (LY7)** .

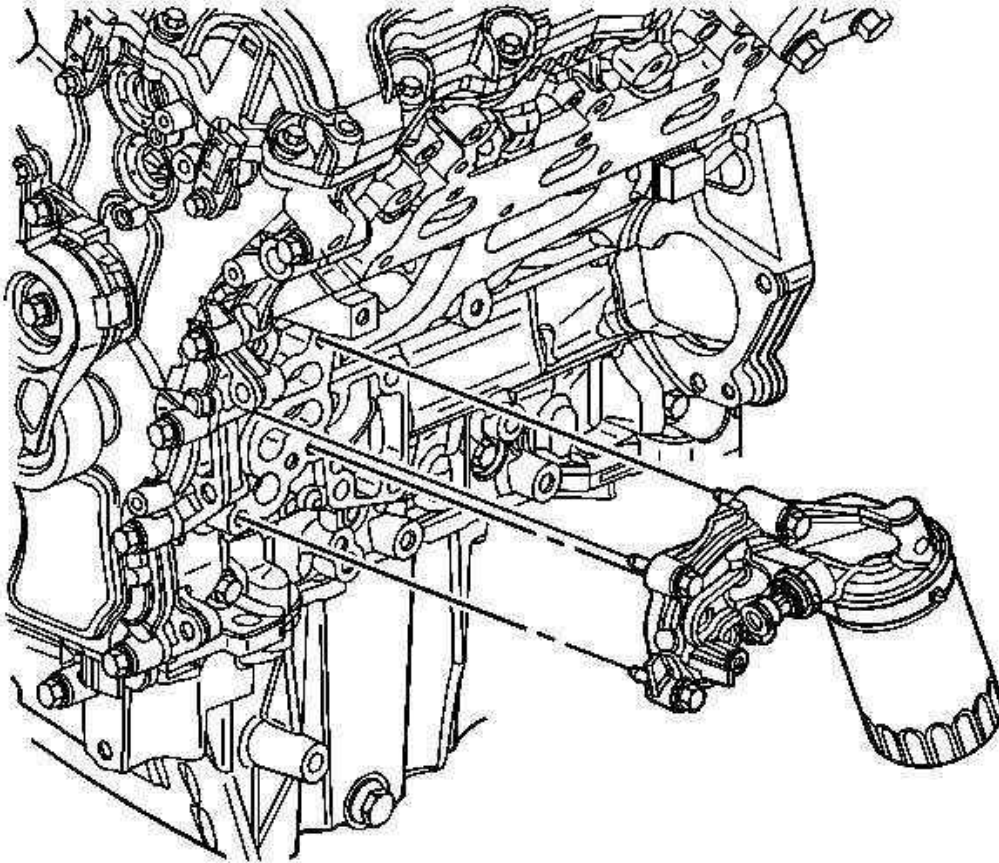


Fig. 74: Locating Oil Filter
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil filter. Refer to **Engine Oil and Oil Filter Replacement** .
3. Remove the oil filter adapter. Refer to **Oil Filter Adapter Removal** .
4. Disassemble the oil filter adapter as necessary. Refer to **Oil Filter Adapter Disassemble** .

Installation Procedure

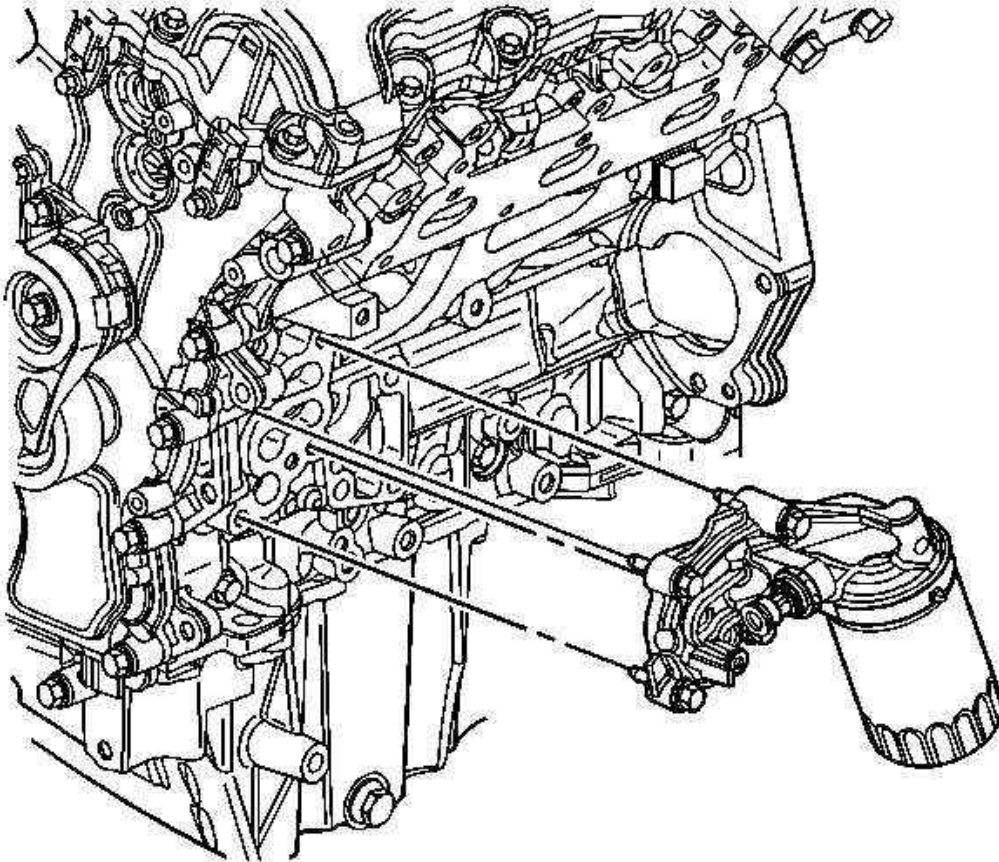


Fig. 75: Locating Oil Filter
Courtesy of GENERAL MOTORS CORP.

1. Assemble the oil filter adapter. Refer to **Oil Filter Adapter Assemble** .
2. Install the oil filter adapter. Refer to **Oil Filter Adapter Installation** .
3. Install the generator. Refer to **Generator Replacement (LY7)** .

CRANKSHAFT BALANCER REPLACEMENT

Tools Required

J 41816-A Harmonic Balancer Puller. See **Special Tools** .

Removal Procedure

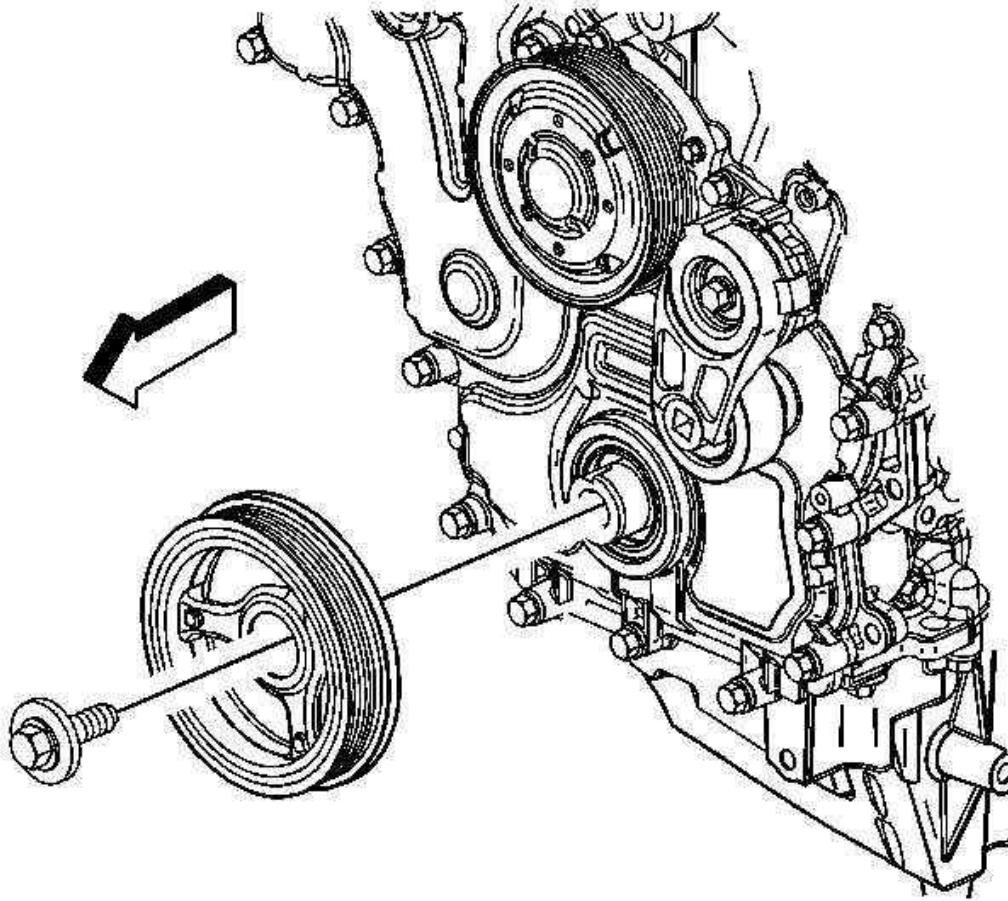


Fig. 76: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

1. Remove the accessory drive belt. Refer to **Drive Belt Replacement**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle**.
3. Use the **J 41816-A** in order to remove the crankshaft balancer. See **Special Tools**. Refer to **Crankshaft Balancer Removal**.

Installation Procedure

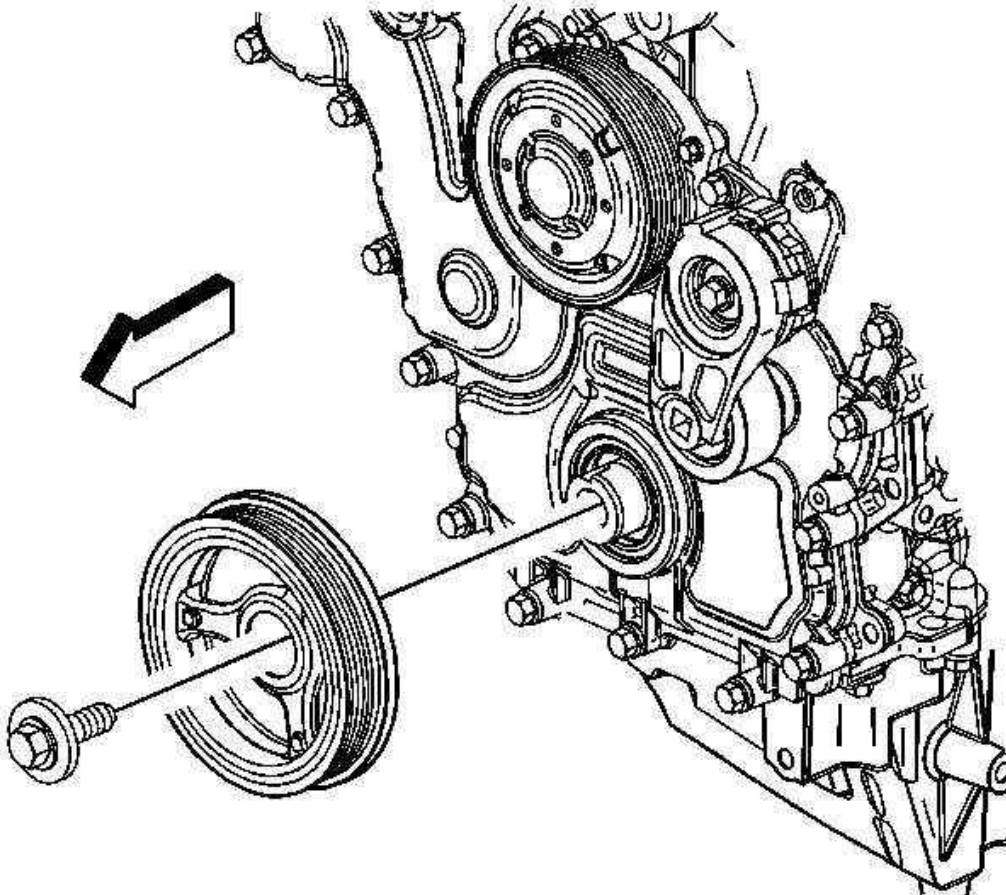


Fig. 77: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

1. Install the crankshaft balancer. Refer to **Crankshaft Balancer Installation** .
2. Install the accessory drive belt. Refer to **Drive Belt Replacement**.
3. Lower the vehicle.

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

Tools Required

- **J 29184** Oil Seal Installer. See **Special Tools** .

- **J 45000** Seal Remover. See Special Tools .

Removal Procedure

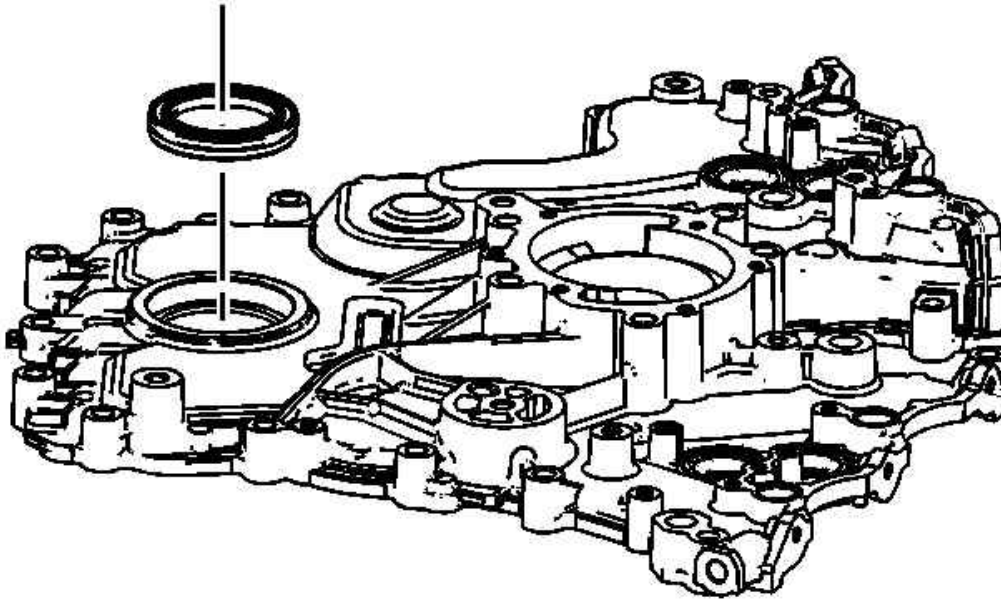


Fig. 78: View Of Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the crankshaft balancer. Refer to Crankshaft Balancer Replacement.
2. Use **J 45000** in order to remove the crankshaft oil seal. See Special Tools .

Installation Procedure

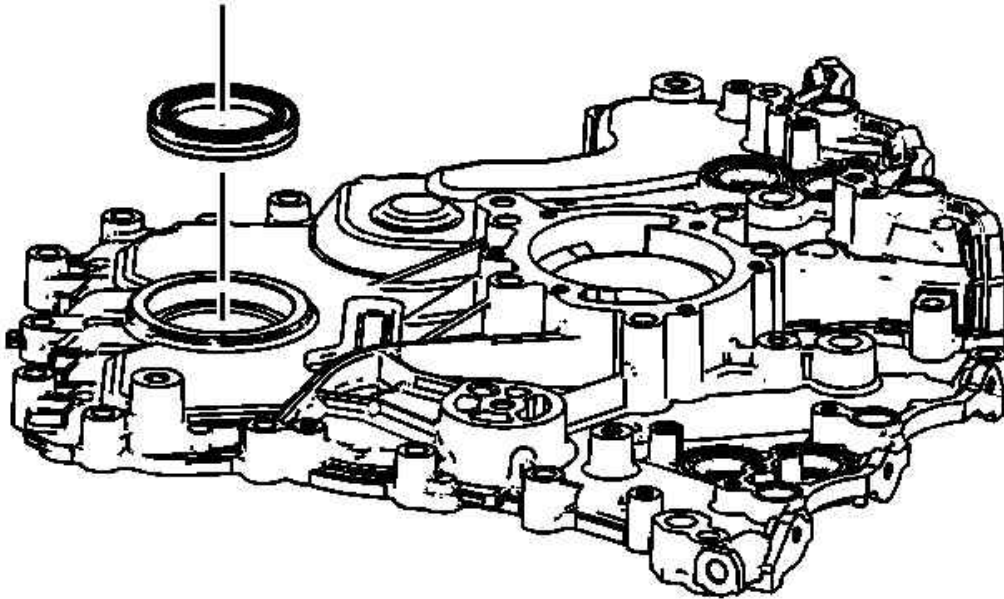


Fig. 79: View Of Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

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. See **Special Tools** .
2. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.

CAMSHAFT COVER REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

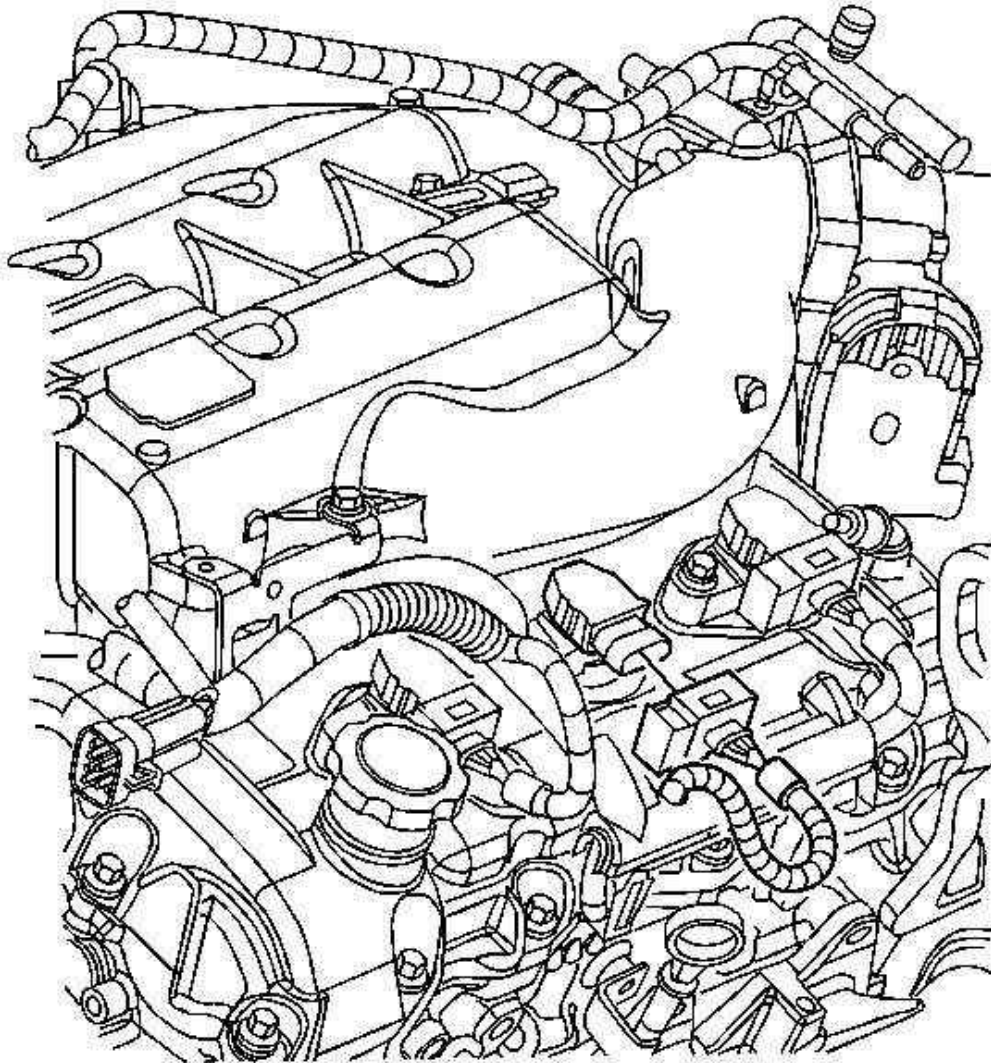


Fig. 80: Identifying Ignition Coil Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the ignition coil electrical connectors.

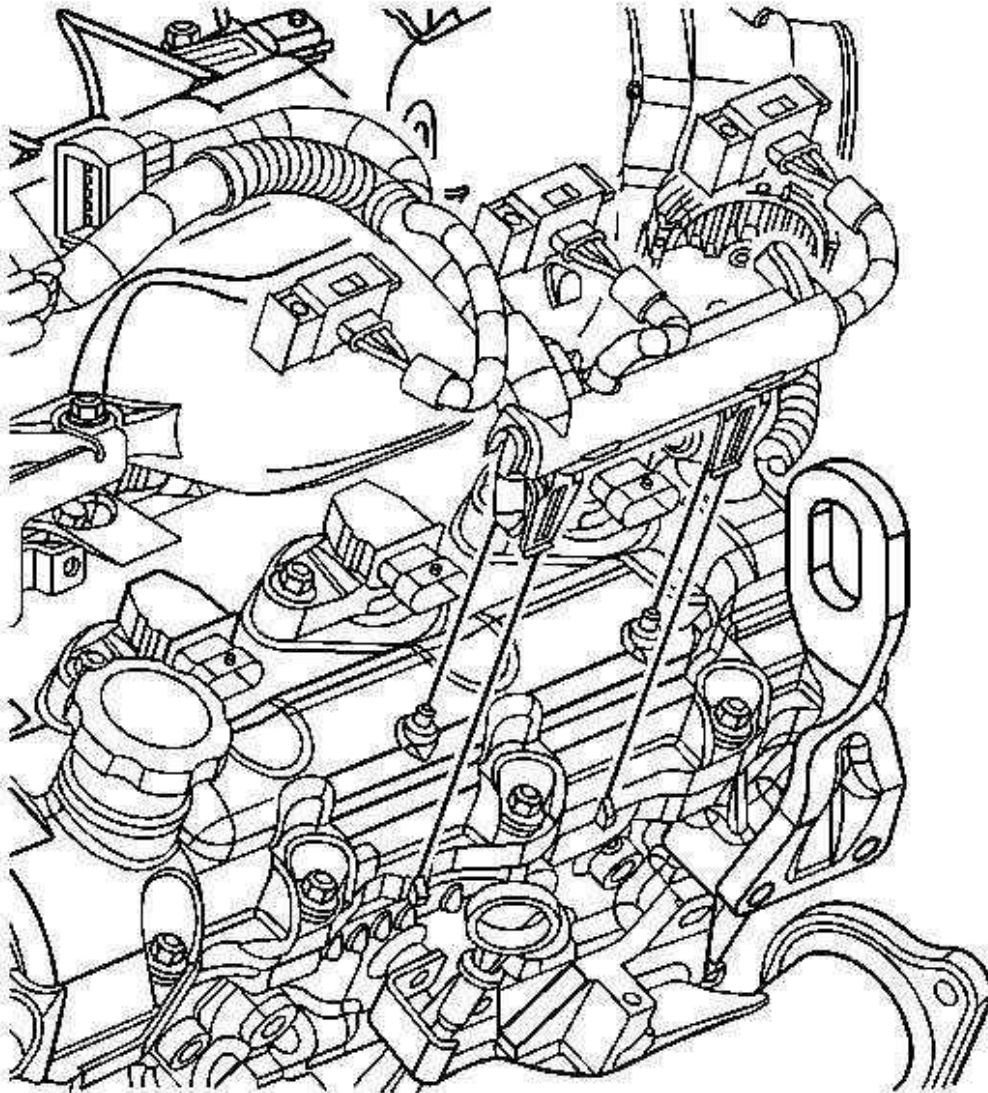


Fig. 81: Locating Wiring Conduit Retainers
Courtesy of GENERAL MOTORS CORP.

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

wiring harness conduit retainers counterclockwise.

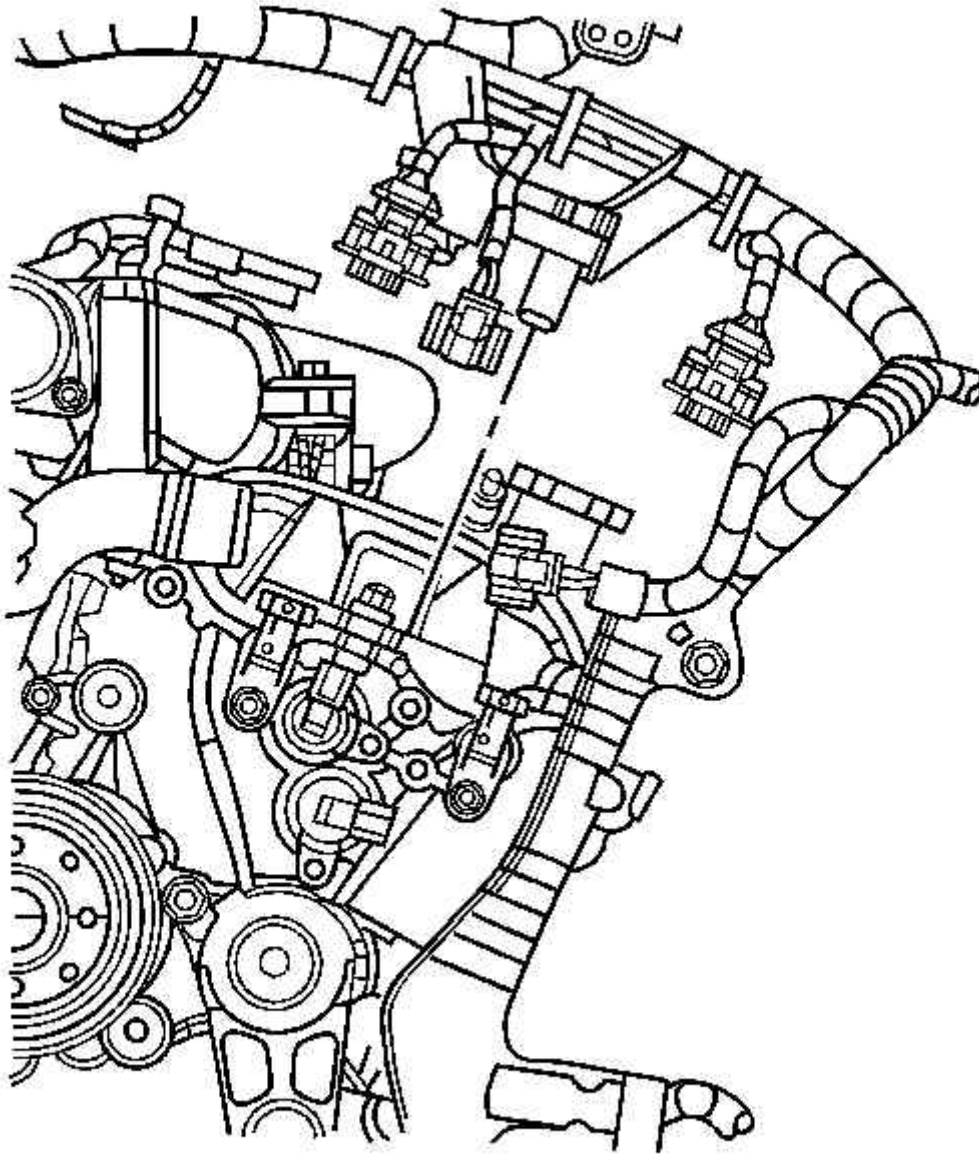


Fig. 82: Locating Wiring Harness In Front Of Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

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

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

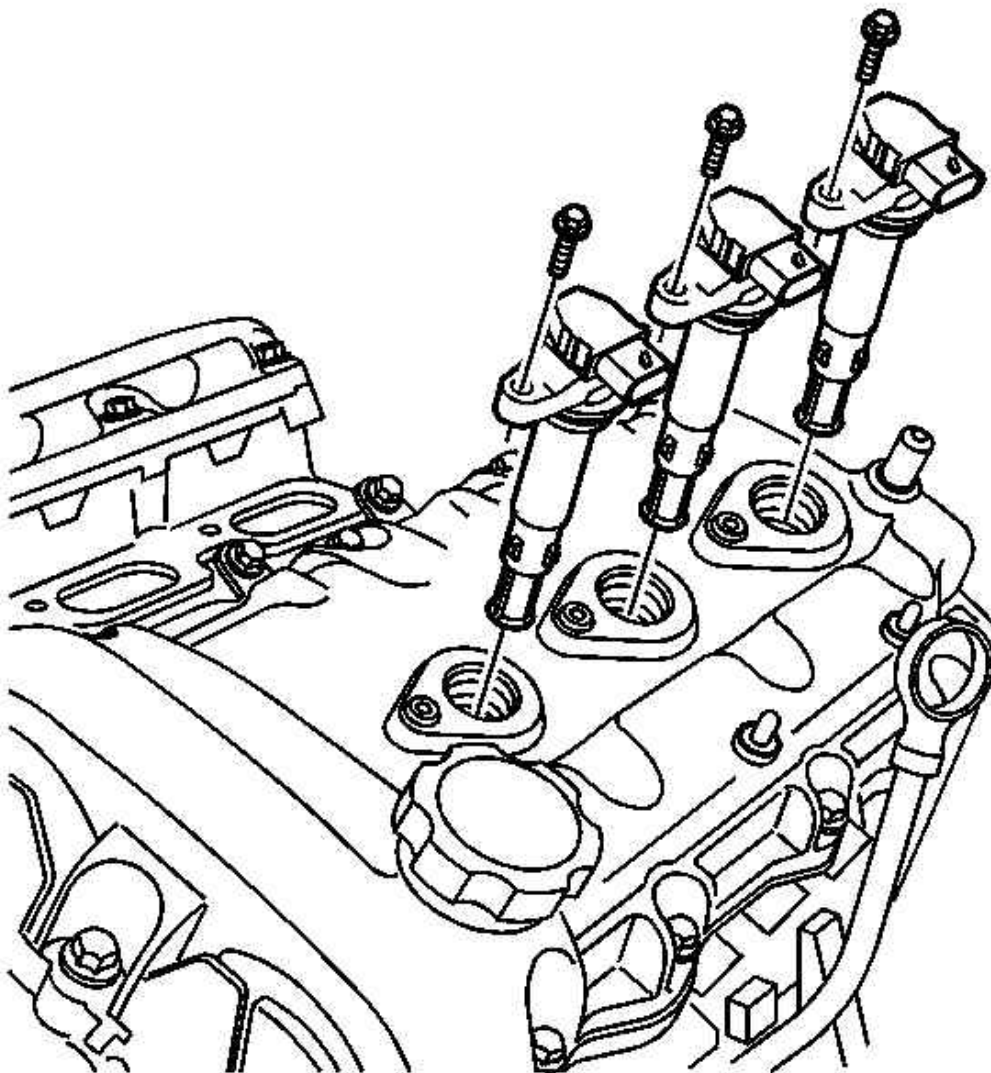


Fig. 83: Identifying Left Cylinder Head Ignition Coils
Courtesy of GENERAL MOTORS CORP.

7. Remove the ignition coils.
8. Loosen the left engine strut bracket.
9. Loosen the left engine strut bracket-to-cylinder head bolts.

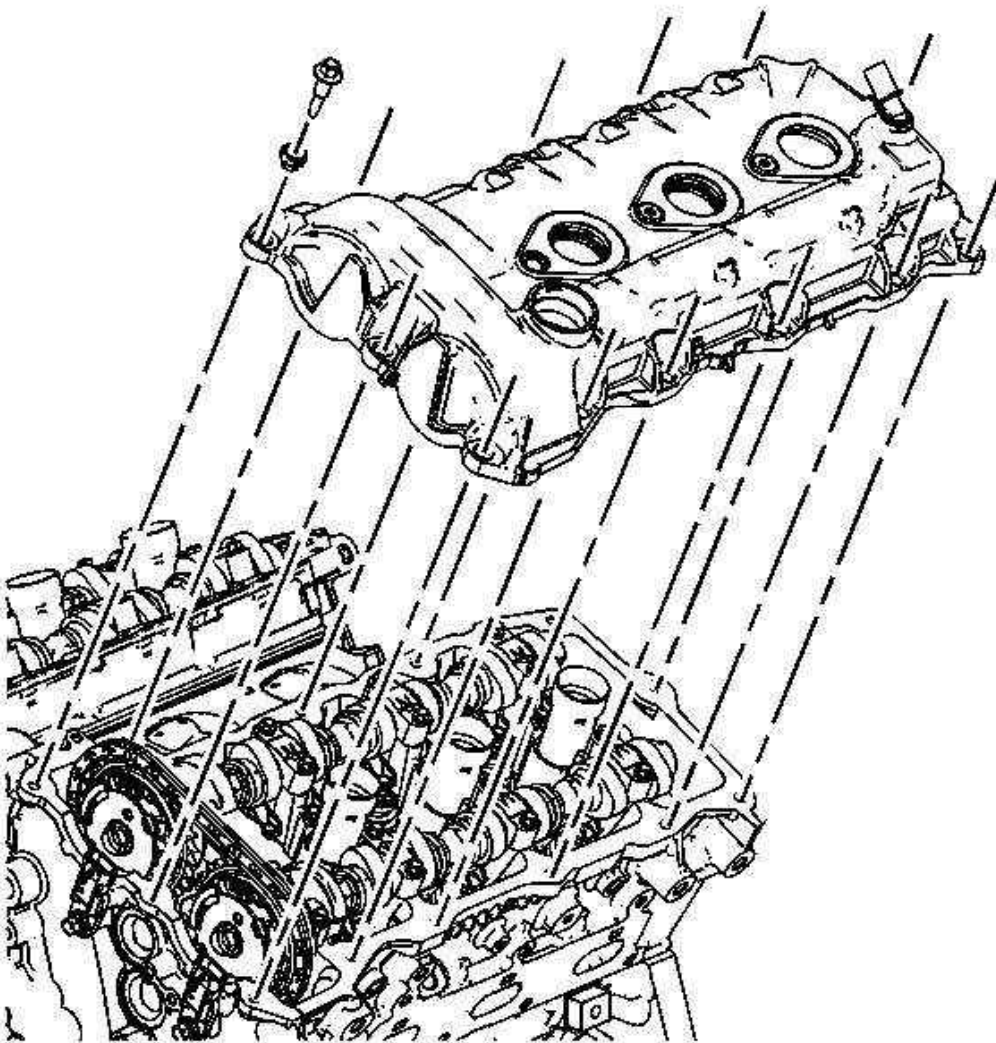


Fig. 84: View Of Left Camshaft Cover

Courtesy of GENERAL MOTORS CORP.

10. Remove the camshaft cover bolts and camshaft cover.
11. Remove and discard the camshaft cover seal and grommets. DO NOT reuse.

Installation Procedure

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

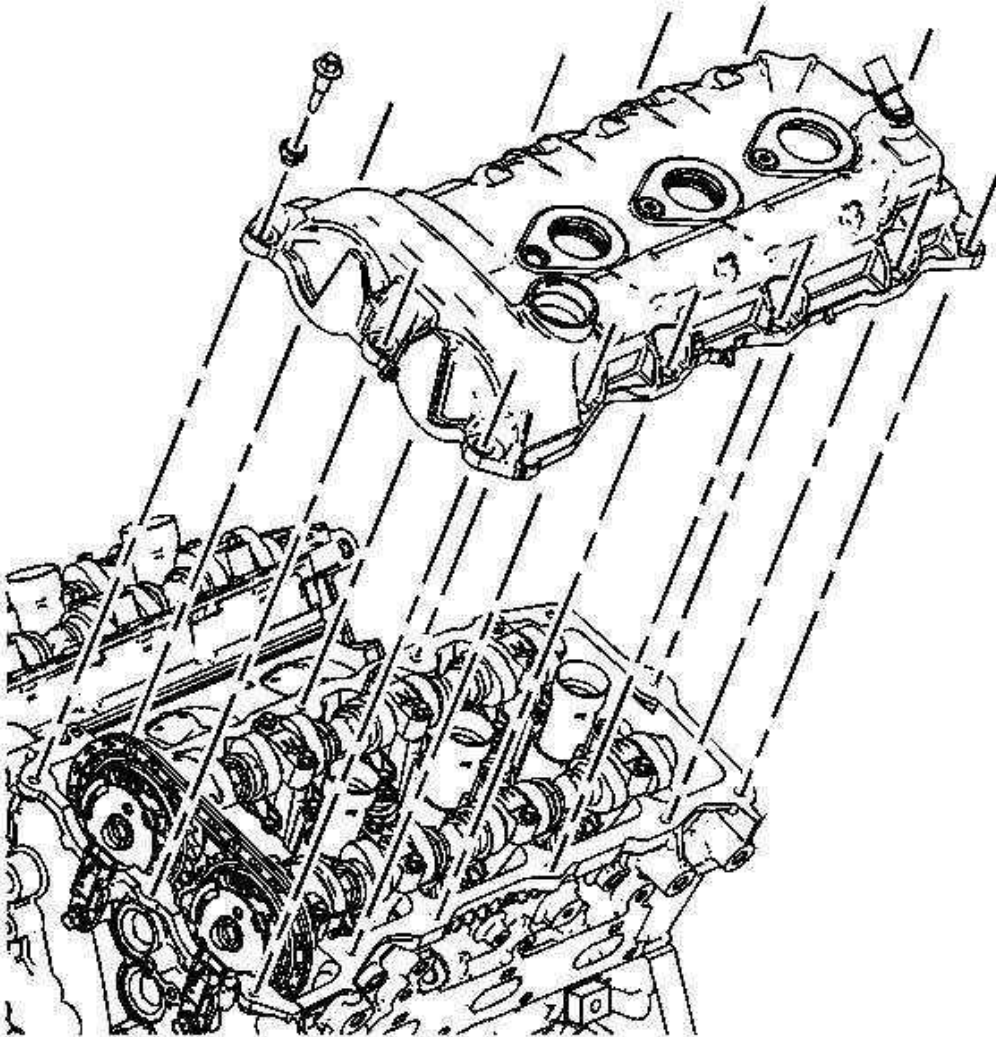


Fig. 85: View Of Left Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

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

NOTE: Refer to **Fastener Notice** .

3. Tighten the left engine strut bracket-to-cylinder head bolts.

Tighten: Tighten the left engine strut bracket-to-cylinder head bolts to 50 N.m (37 lb ft).

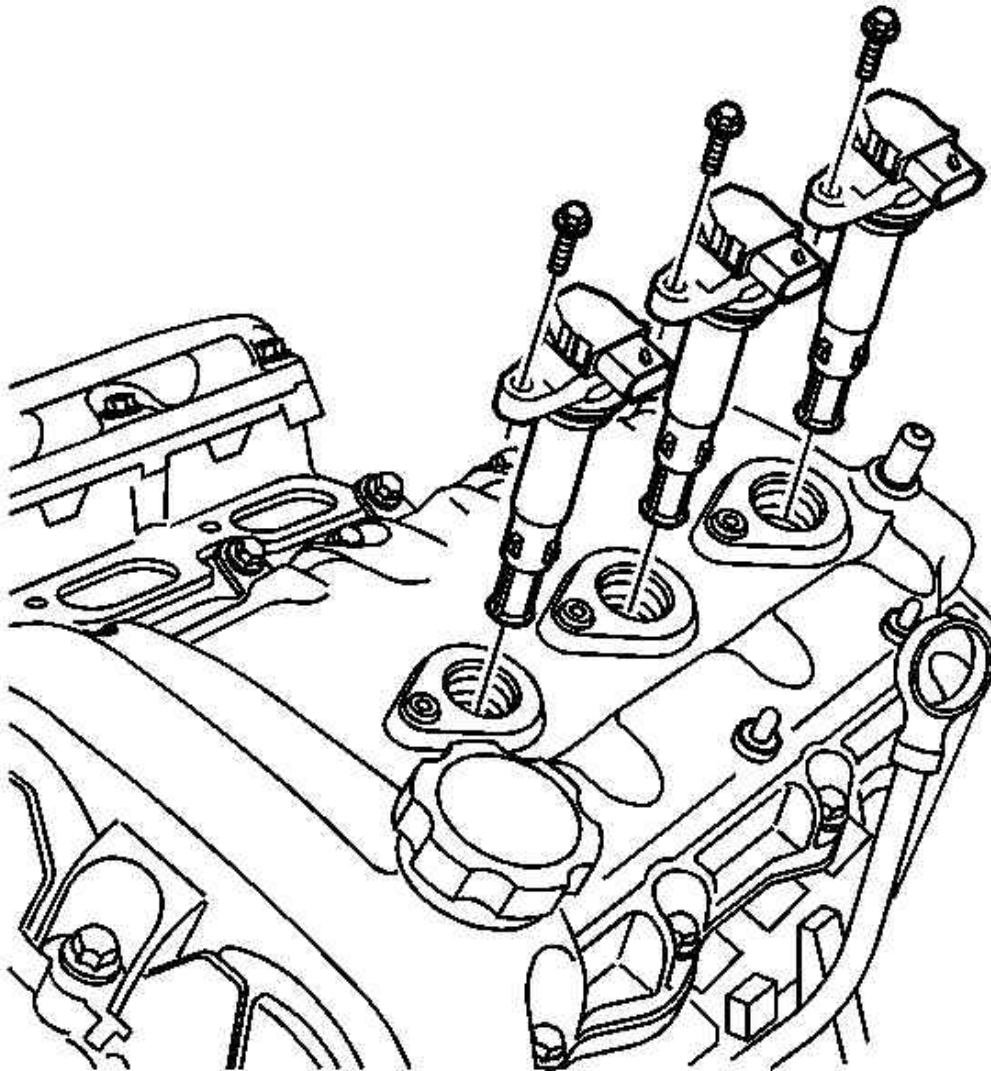


Fig. 86: Identifying Left Cylinder Head Ignition Coils
Courtesy of GENERAL MOTORS CORP.

4. Install the ignition coils.

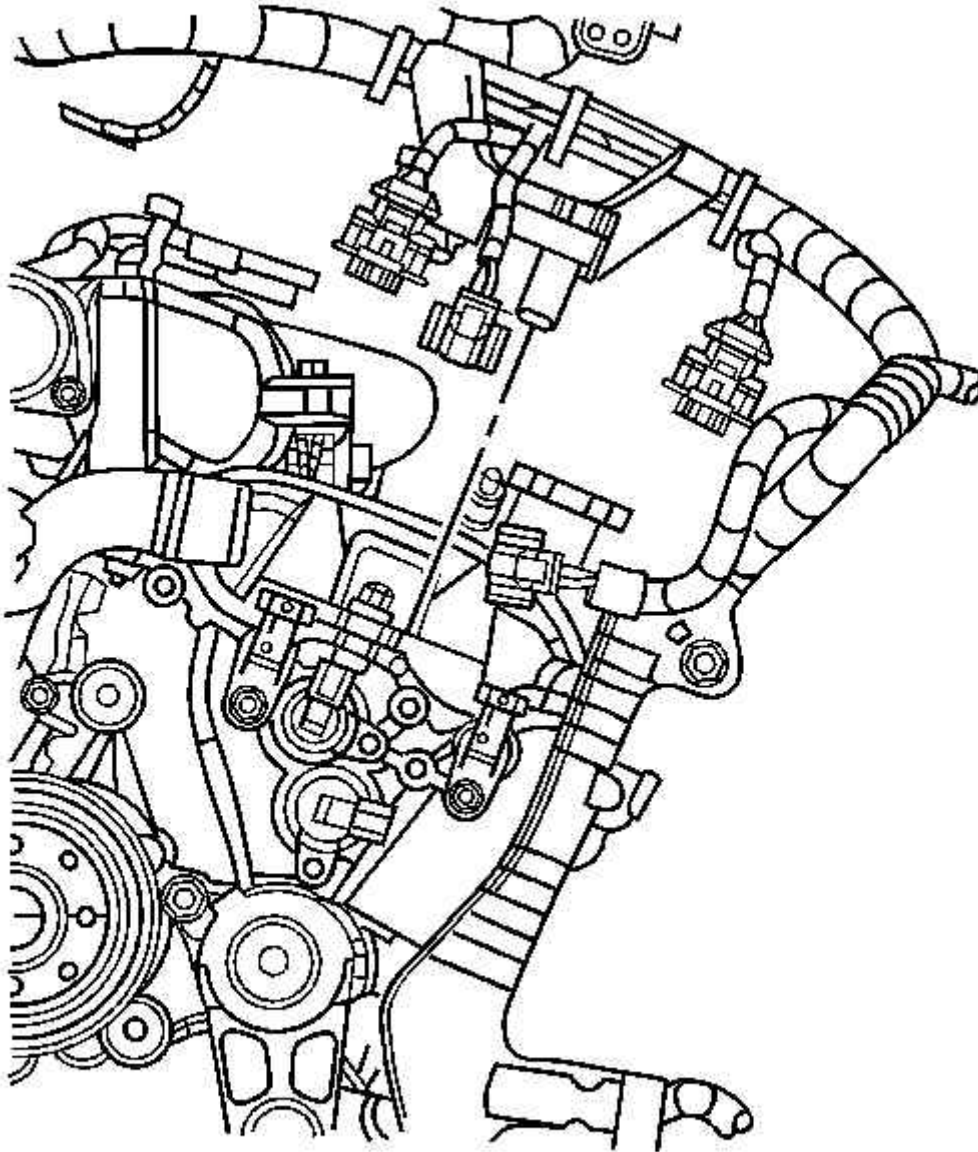


Fig. 87: Locating Wiring Harness In Front Of Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

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

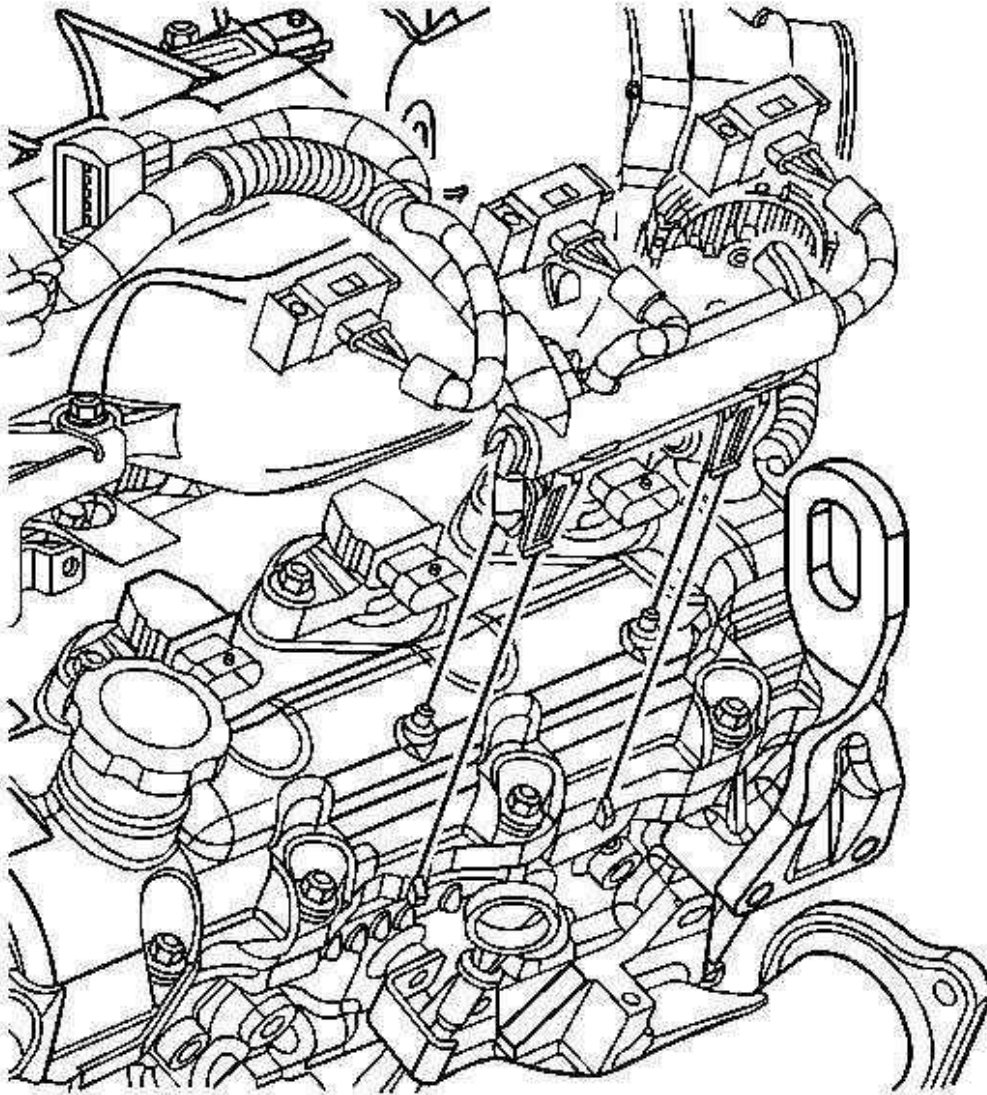


Fig. 88: Locating Wiring Conduit Retainers
Courtesy of GENERAL MOTORS CORP.

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

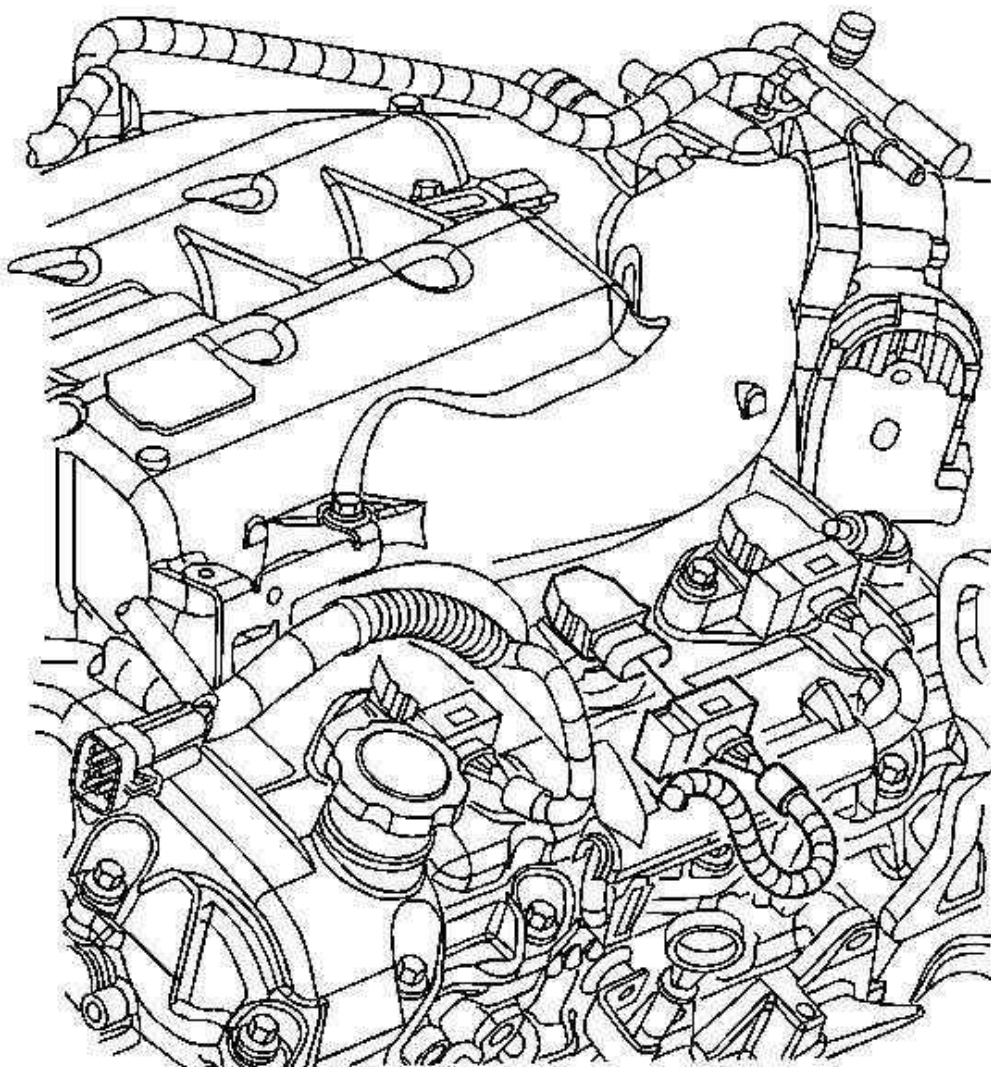


Fig. 89: Identifying Ignition Coil Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

8. Connect the ignition coil electrical connectors.
9. Install the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

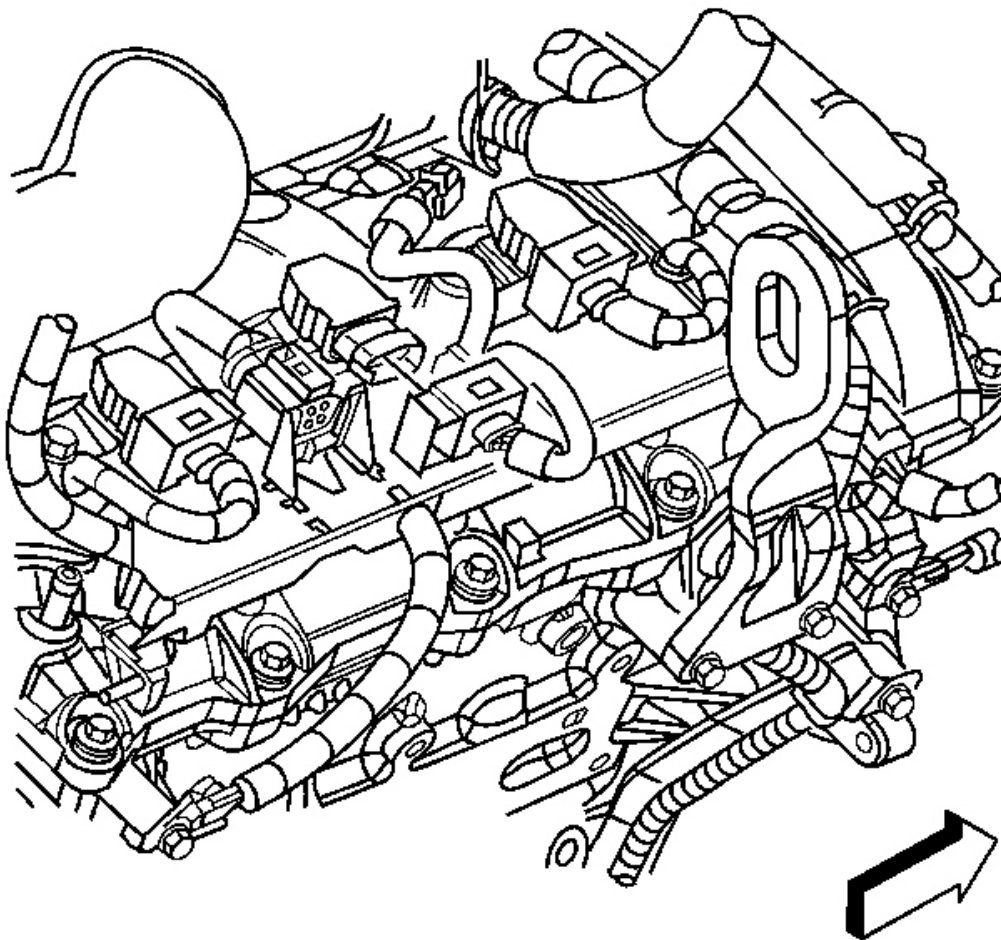


Fig. 90: Locating Ignition Coil Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the ignition coil electrical connectors.

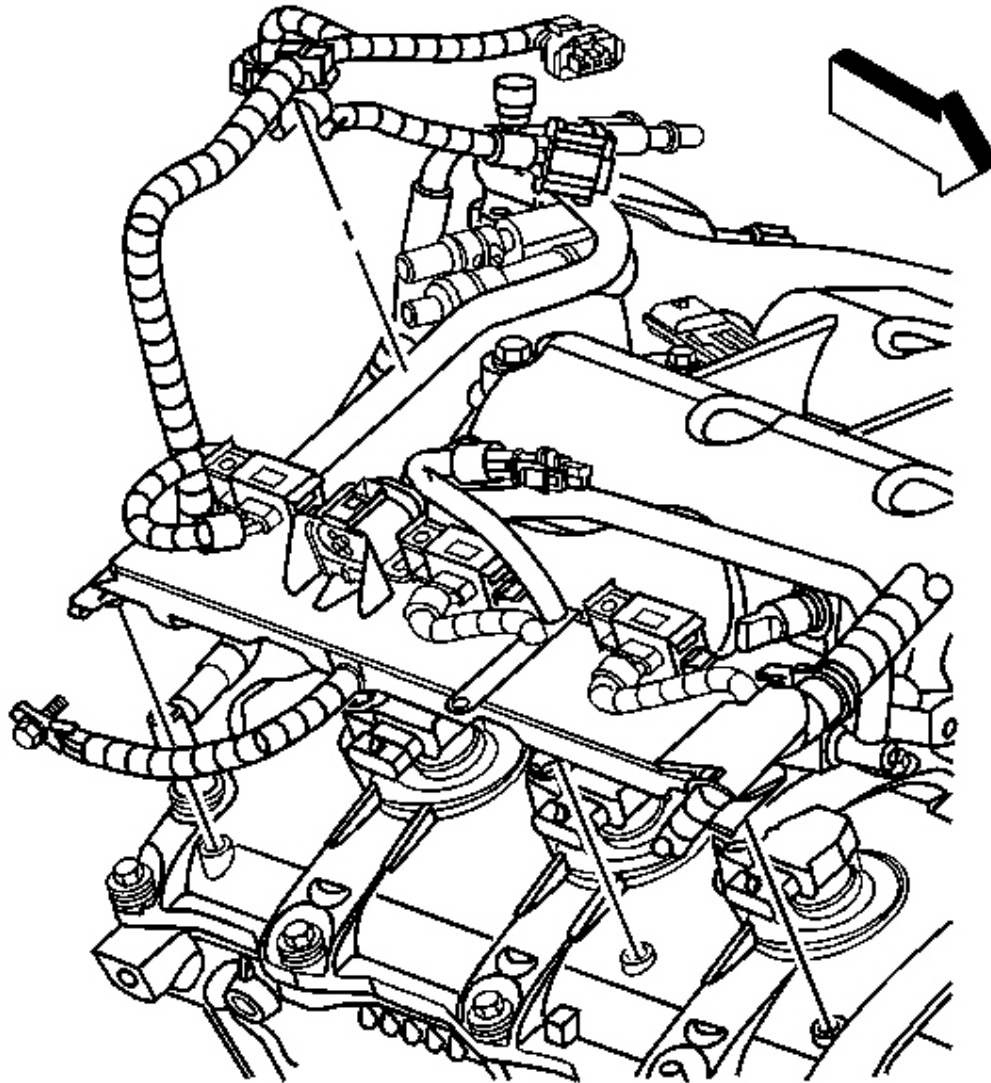


Fig. 91: View Of Wiring Conduit Retainers
Courtesy of GENERAL MOTORS CORP.

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

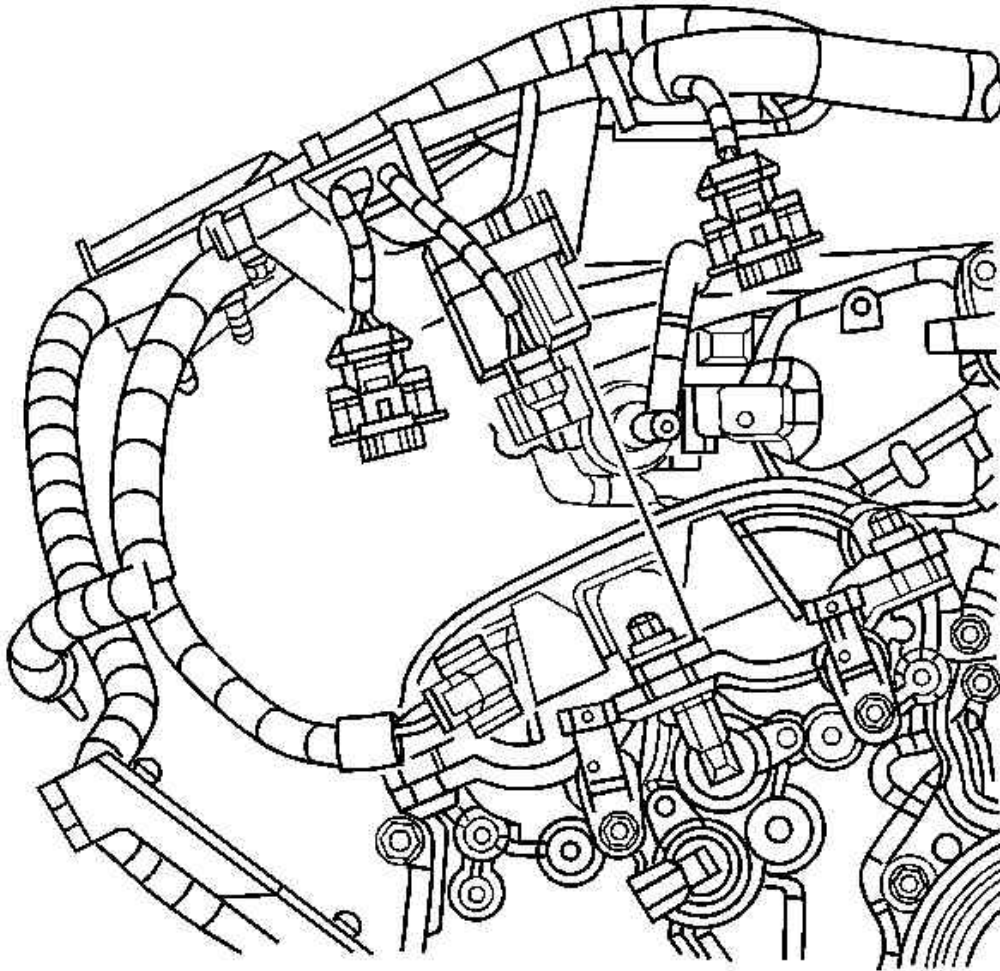


Fig. 92: Identifying Wiring Harness On Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

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

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

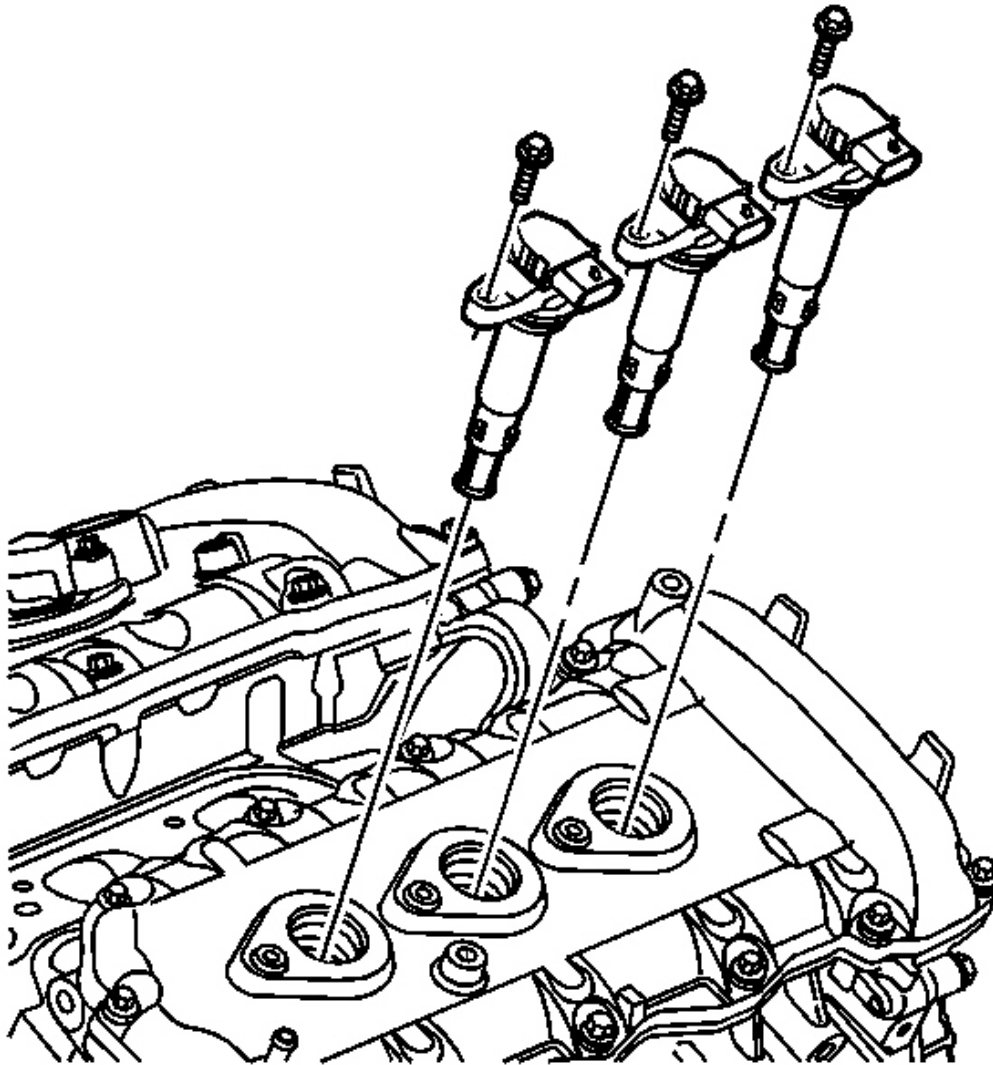


Fig. 93: View Of Ignition Coils
Courtesy of GENERAL MOTORS CORP.

7. Remove the ignition coils.

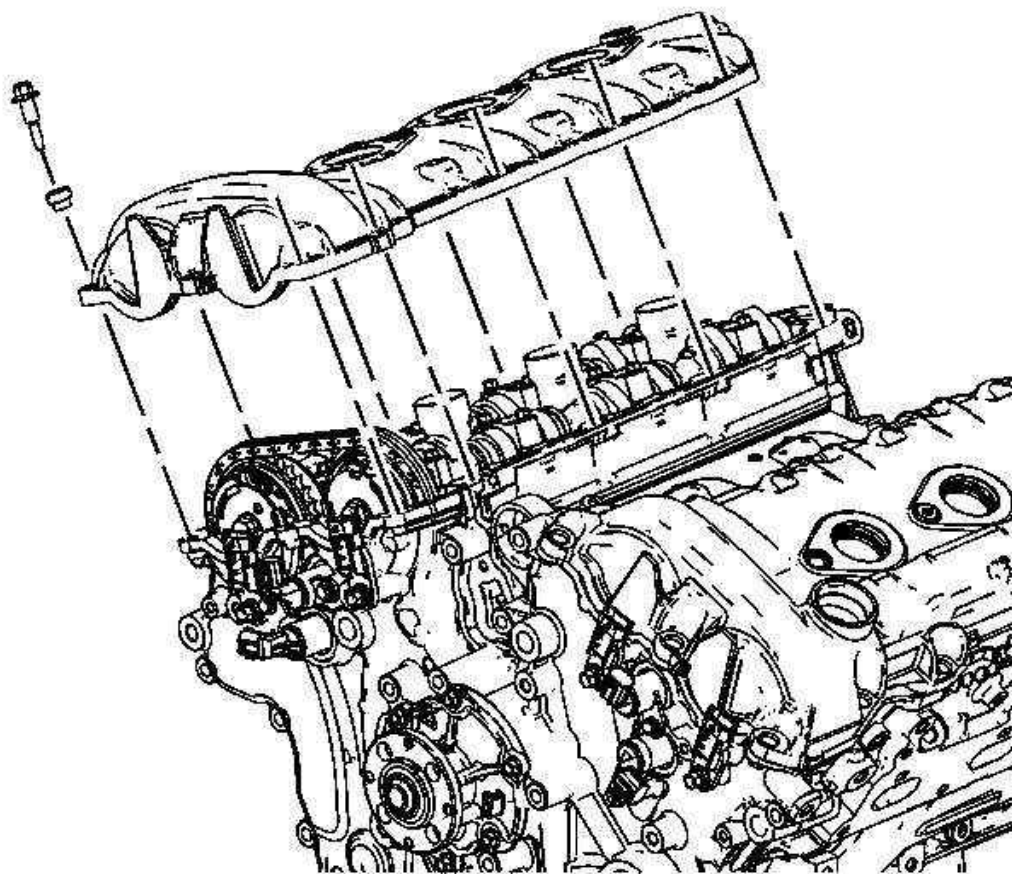


Fig. 94: Identifying Right Camshaft Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

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

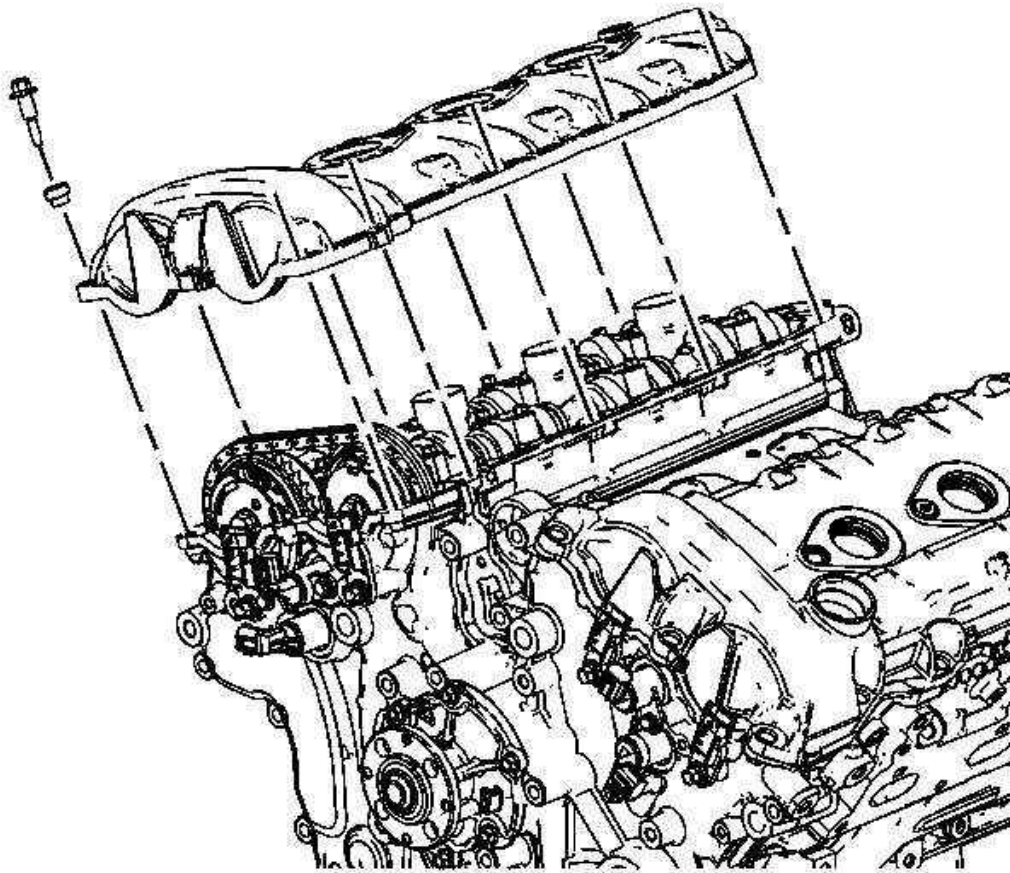


Fig. 95: Identifying Right Camshaft Cover & Bolts
Courtesy of GENERAL MOTORS CORP.

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

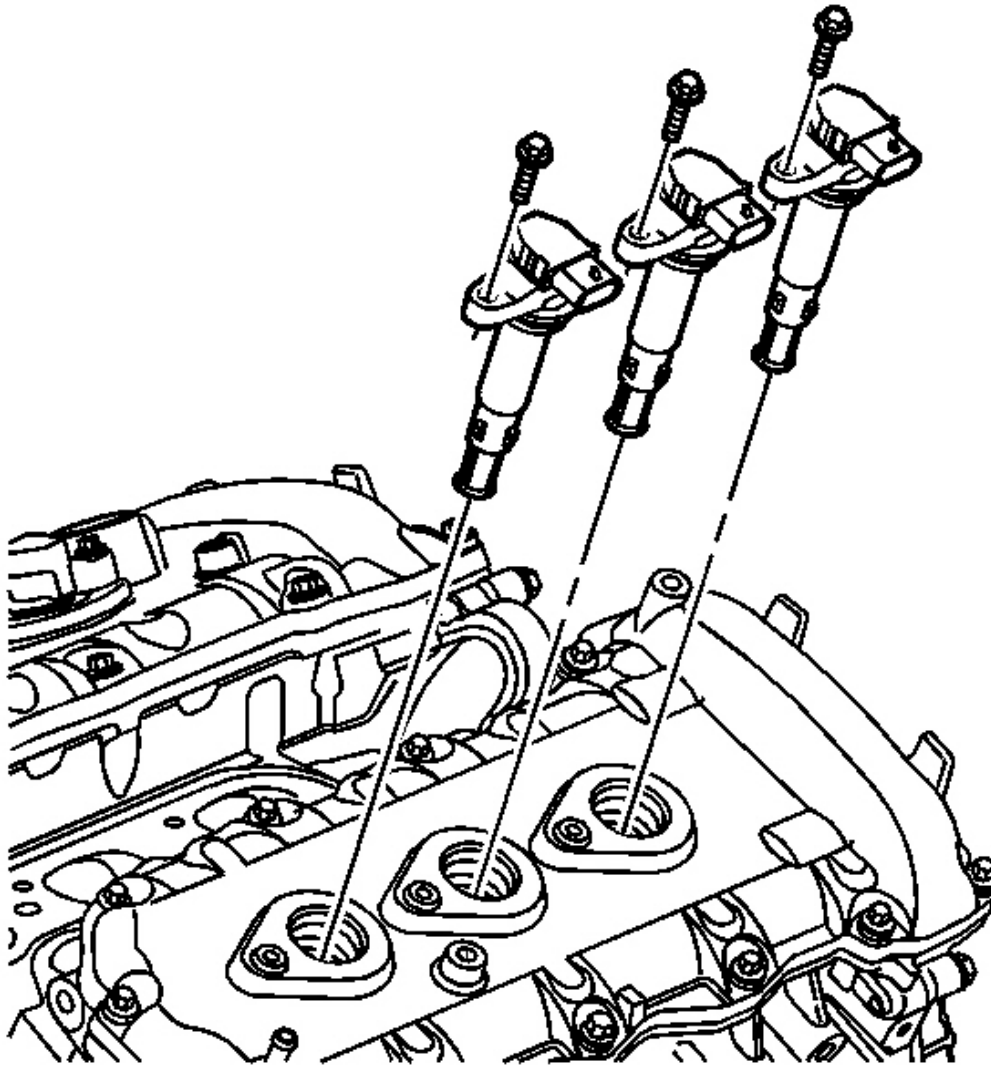


Fig. 96: View Of Ignition Coils
Courtesy of GENERAL MOTORS CORP.

3. Install the ignition coils.

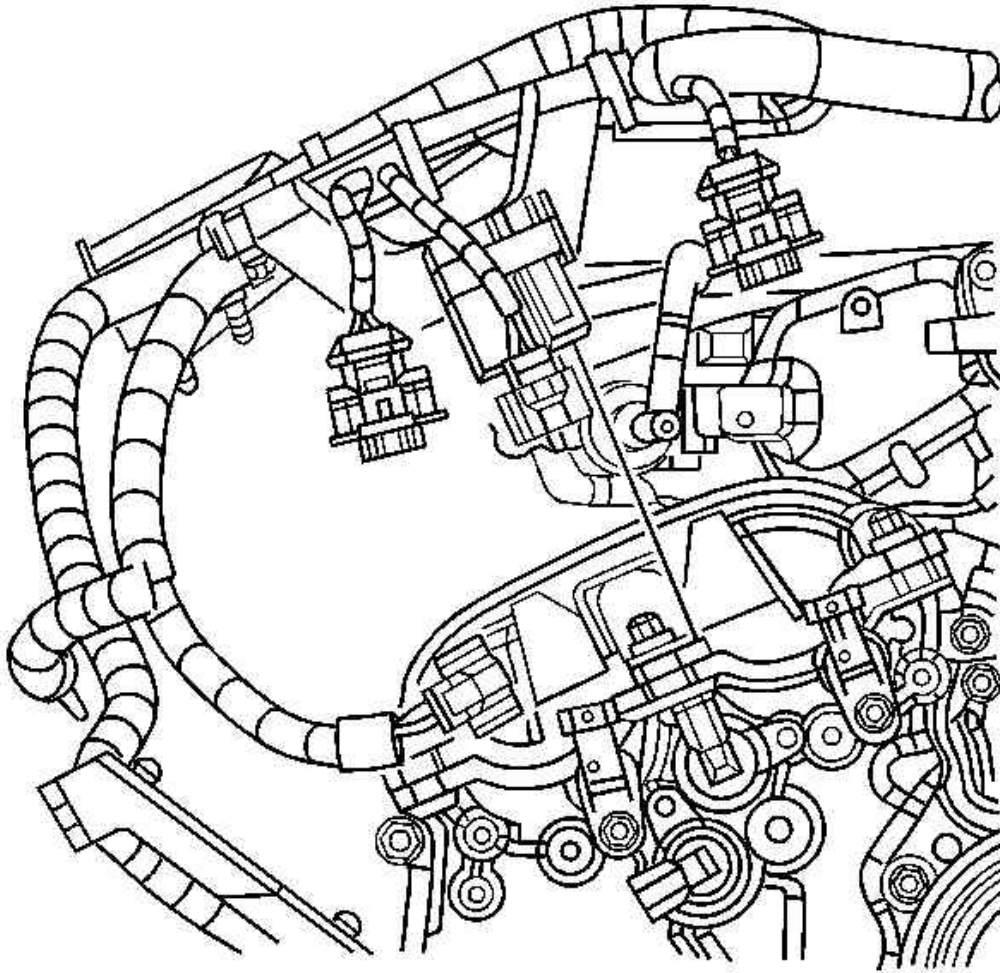


Fig. 97: Identifying Wiring Harness On Camshaft Cover
Courtesy of GENERAL MOTORS CORP.

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

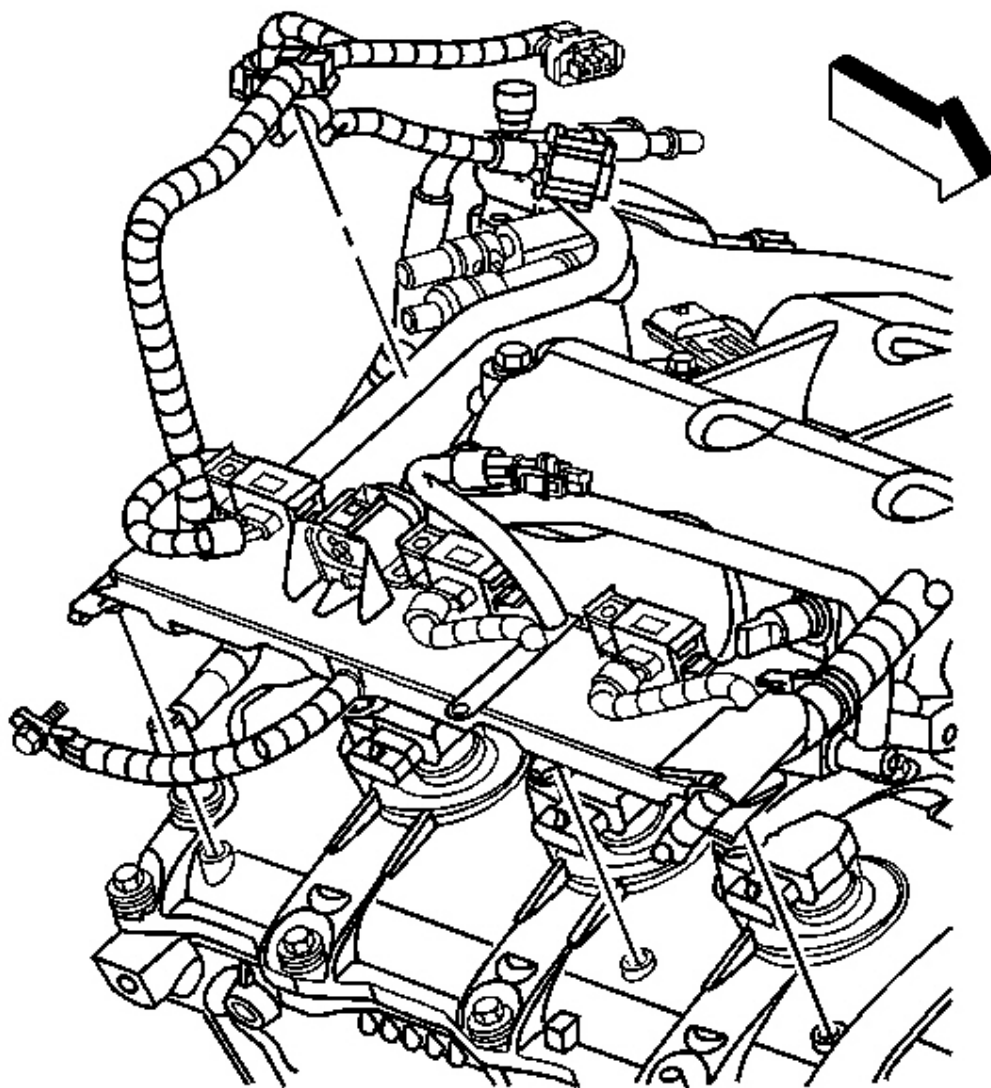


Fig. 98: View Of Wiring Conduit Retainers
Courtesy of GENERAL MOTORS CORP.

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

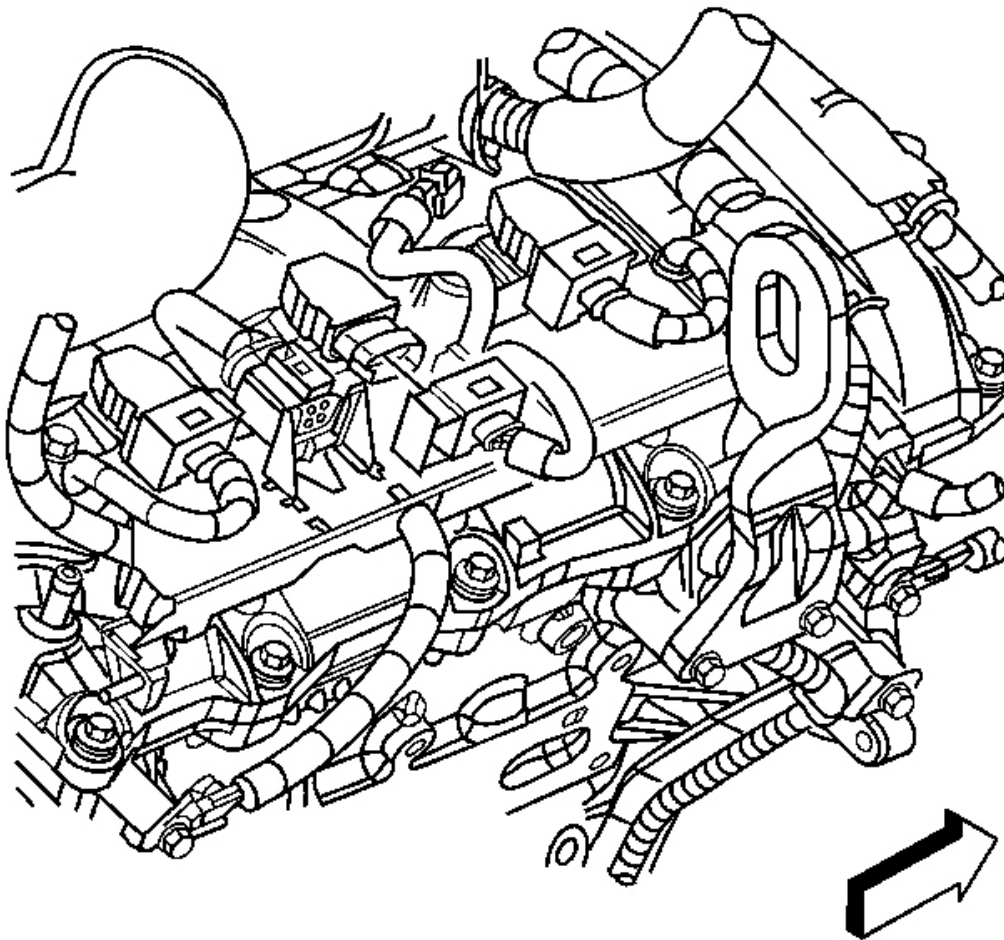


Fig. 99: Locating Ignition Coil Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

7. Connect the ignition coil electrical connectors.
8. Install the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

ENGINE FRONT COVER REPLACEMENT

Removal Procedure

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable**

Disconnection and Connection (LY7) .

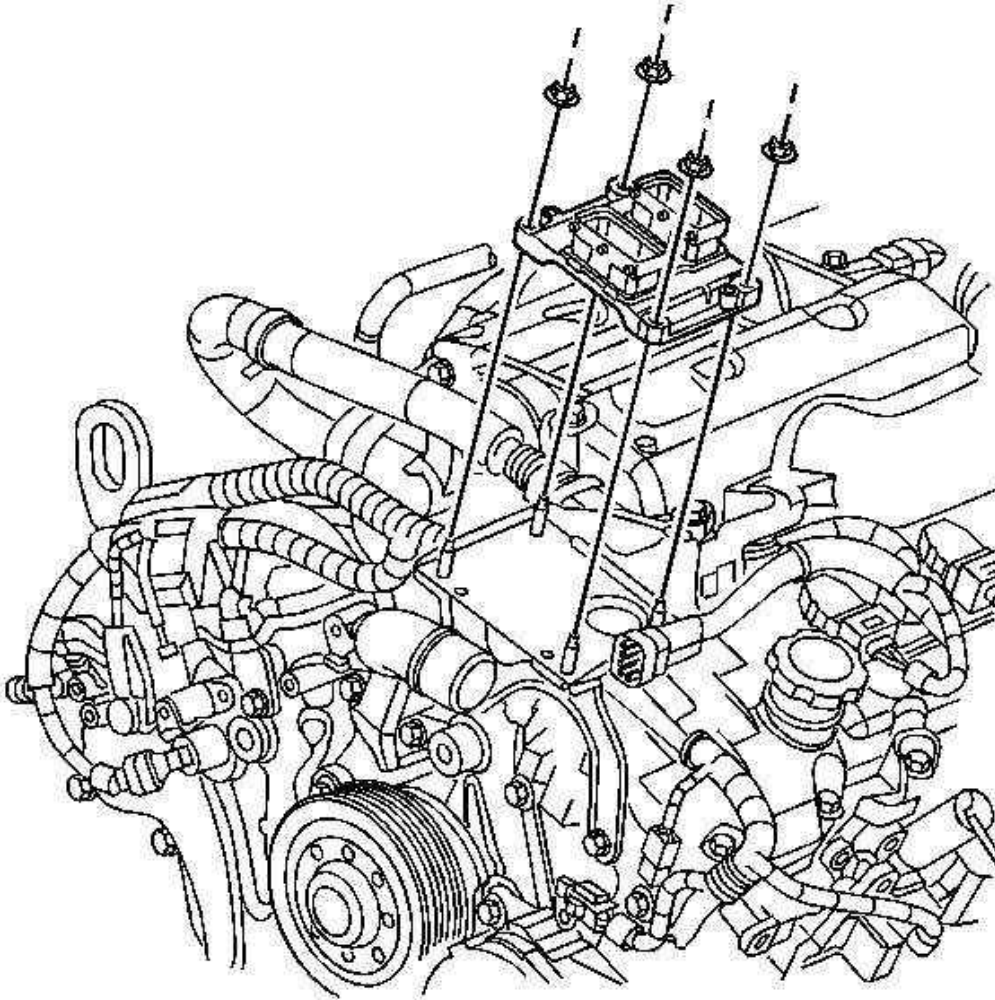


Fig. 100: View Of ECM Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the engine control module (ECM) module. Refer to **Engine Control Module Replacement** .

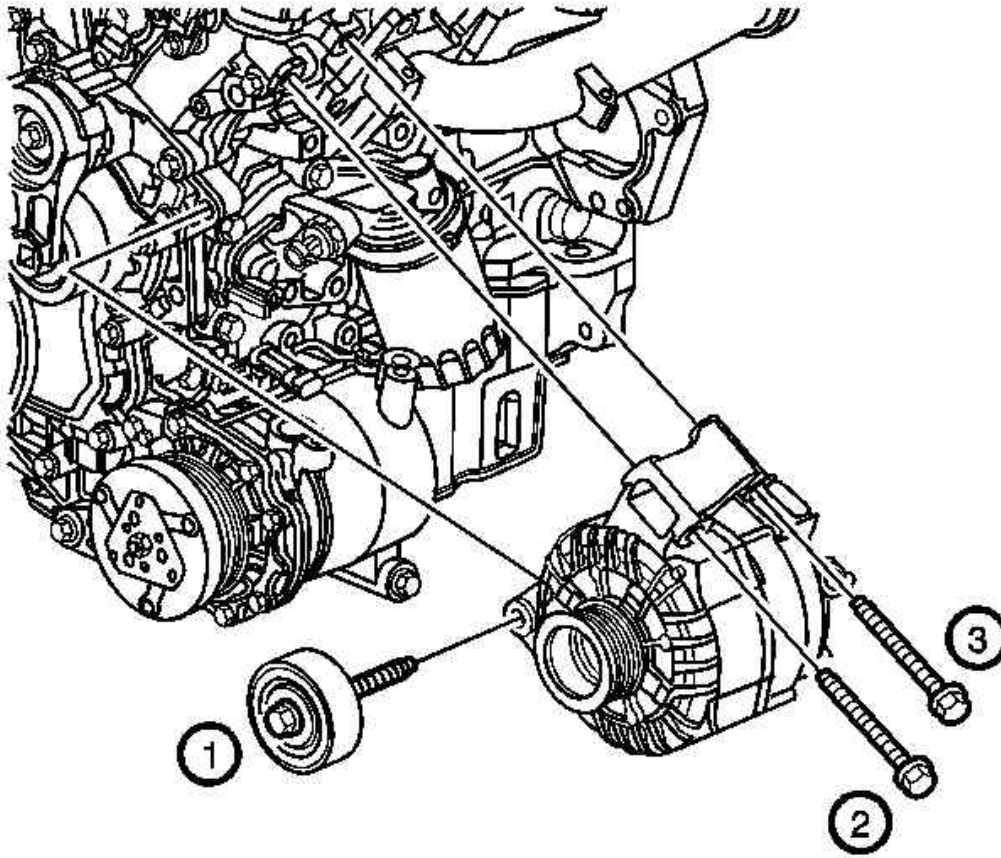


Fig. 101: View Of Generator Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the generator assembly. Refer to **Generator Replacement (LY7)** .
4. Remove the coolant overflow reservoir. Refer to **Coolant Recovery Reservoir Replacement (L27, LY7)** .
5. Remove the power steering reservoir. Refer to **Remote Power Steering Fluid Reservoir Replacement (LY7)** .
6. Remove the camshaft covers.
 - For the left camshaft cover, refer to **Camshaft Cover Replacement - Left Side**.

- For the right camshaft cover, refer to **Camshaft Cover Replacement - Right Side**.
7. Remove the radiator inlet hose. Refer to **Radiator Inlet Hose Replacement (LY7)**.
 8. Remove the coolant outlet. Refer to **Water Outlet Removal**.

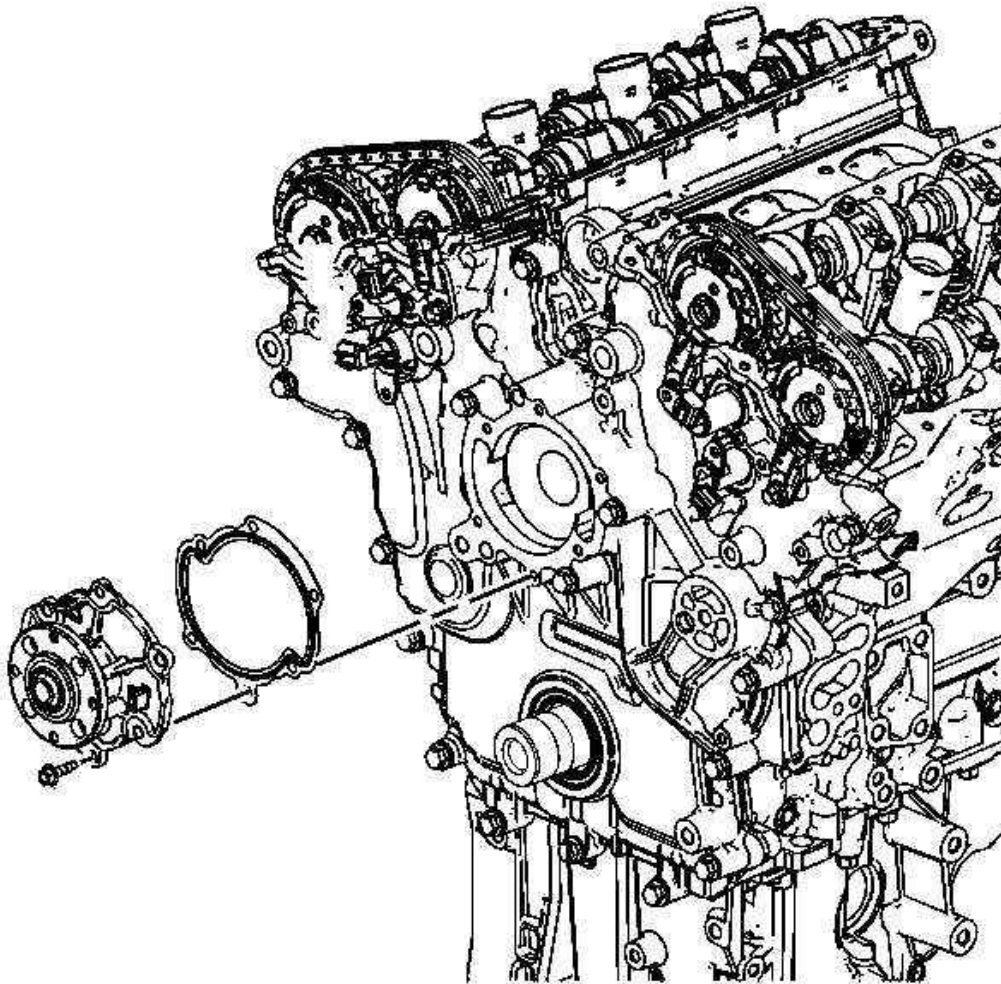


Fig. 102: View Of Water Pump
Courtesy of GENERAL MOTORS CORP.

9. Remove the water pump. Refer to **Water Pump Replacement (LY7)** .
10. Remove the engine splash shield. Refer to **Engine Splash Shield Replacement** .

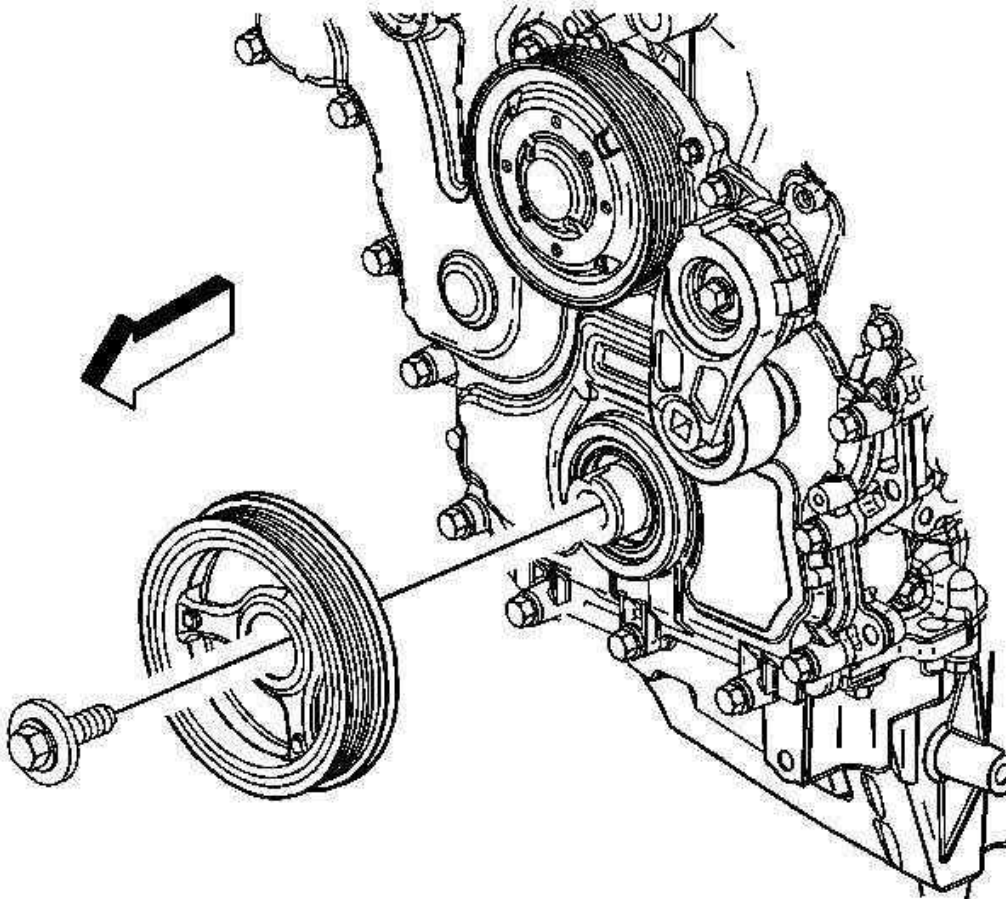


Fig. 103: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

11. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Removal** .
12. Remove the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.

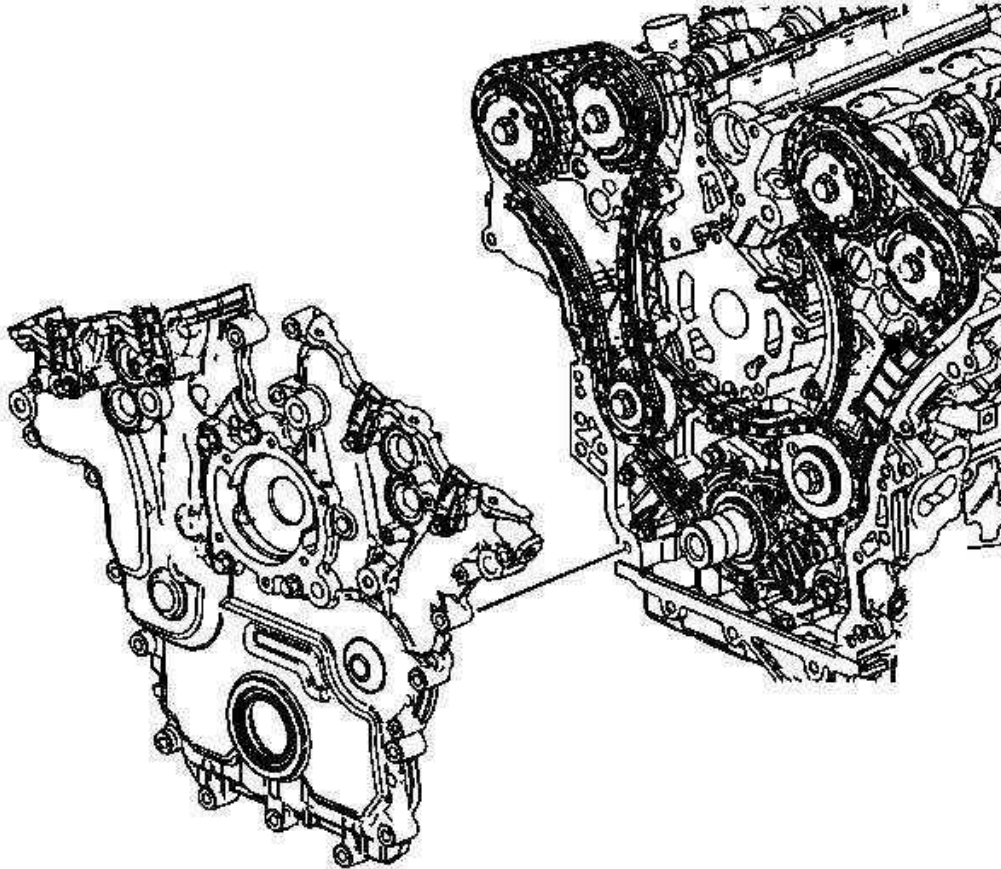


Fig. 104: View Of Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

13. Remove the engine front cover from the engine block. Refer to **Engine Front Cover Removal** .

Installation Procedure

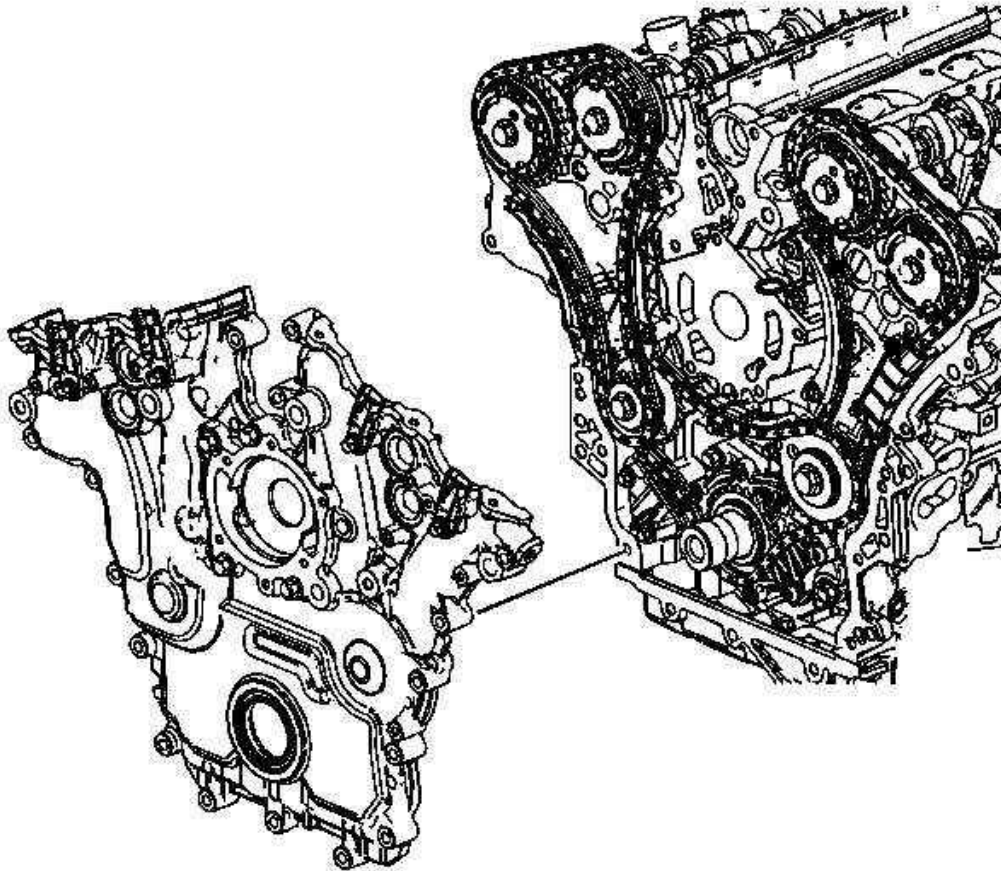


Fig. 105: View Of Engine Front Cover
Courtesy of GENERAL MOTORS CORP.

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

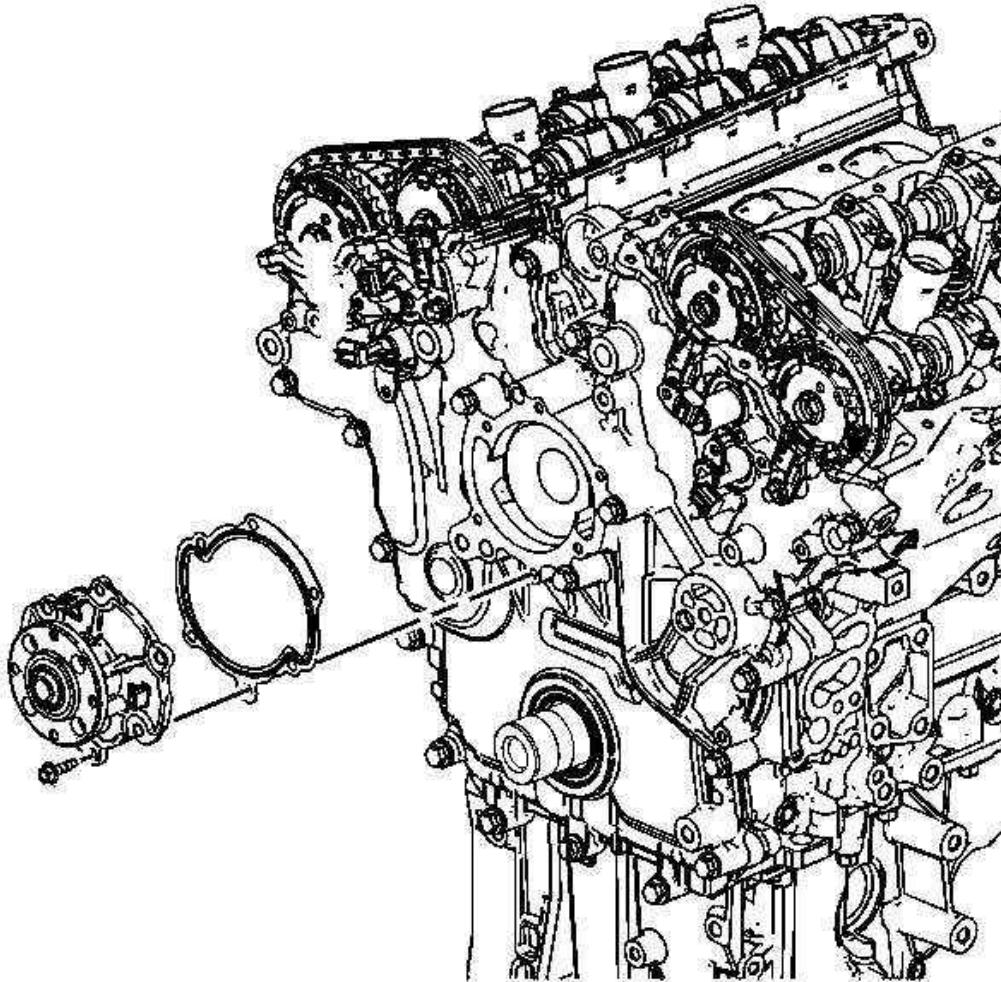


Fig. 106: View Of Water Pump
Courtesy of GENERAL MOTORS CORP.

2. Install the water pump. Refer to **Water Pump Replacement (LY7)** .
3. Install the camshaft covers.
 - For the left camshaft cover, refer to **Camshaft Cover Replacement - Left Side**.
 - For the right camshaft cover, refer to **Camshaft Cover Replacement - Right Side**.

4. Install the drive belt tensioner. Refer to **Drive Belt Tensioner Replacement**.

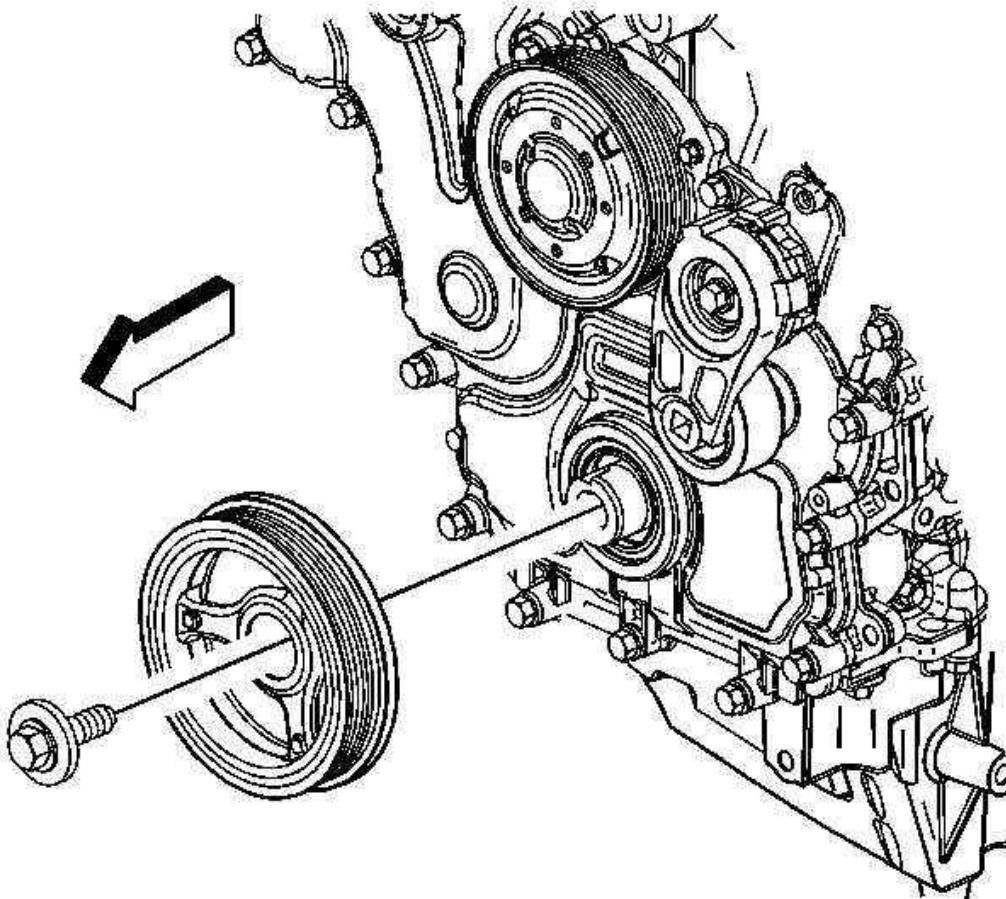


Fig. 107: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

5. Install the crankshaft balancer. Refer to **Crankshaft Balancer Installation** .
6. Install the coolant overflow reservoir. Refer to **Coolant Recovery Reservoir Replacement (L27, LY7)** .
7. Install the power steering reservoir. Refer to **Remote Power Steering Fluid Reservoir Replacement (LY7)** .
8. Install the radiator inlet hose. Refer to **Radiator Inlet Hose Replacement**

(LY7) .

9. Install the coolant outlet. Refer to **Water Outlet Installation** .

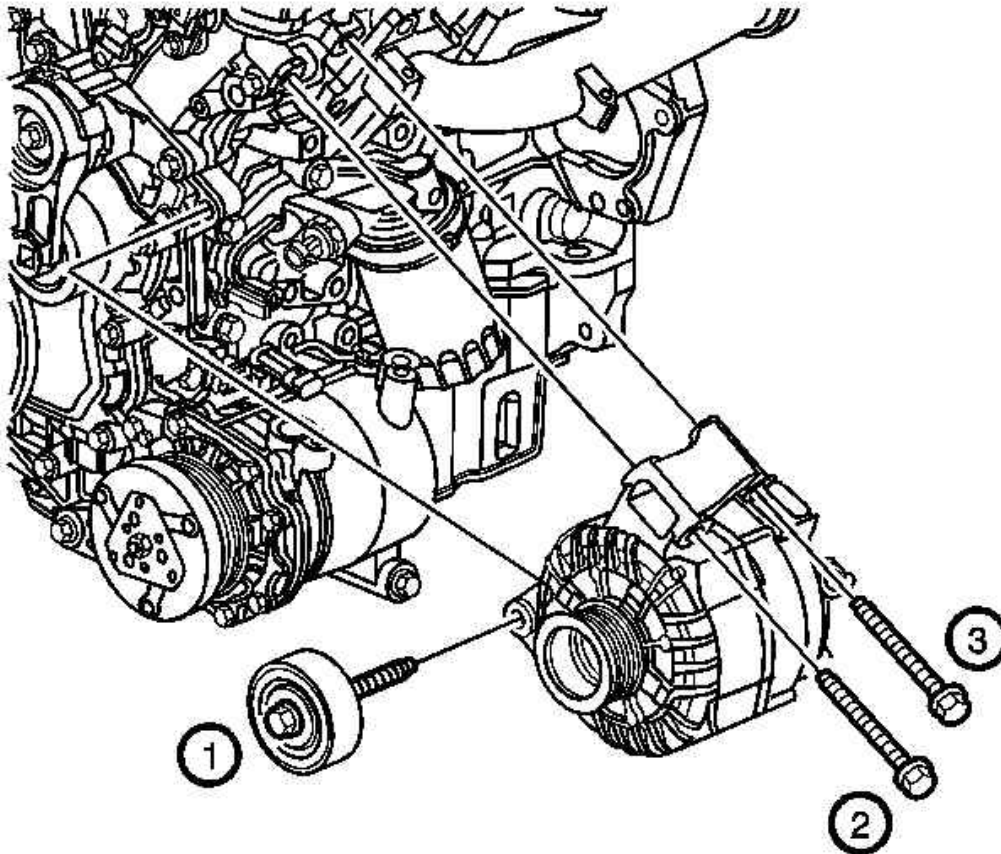


Fig. 108: View Of Generator Bolts
Courtesy of GENERAL MOTORS CORP.

10. Install the generator assembly. Refer to **Generator Replacement (LY7)** .
11. Install engine splash shield. Refer to **Engine Splash Shield Replacement** .

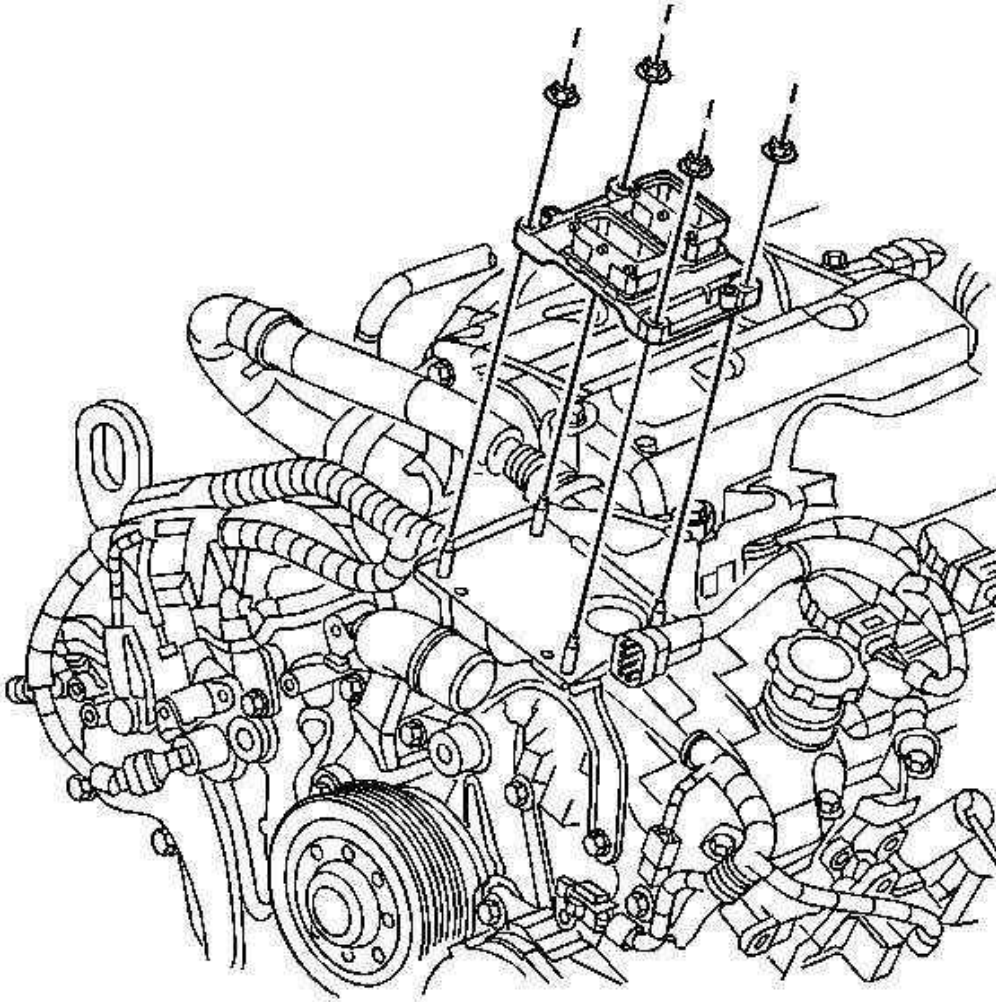


Fig. 109: View Of ECM Bolts
Courtesy of GENERAL MOTORS CORP.

12. Install the ECM module. Refer to **Engine Control Module Replacement** .
13. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (LY7)** .

SECONDARY CAMSHAFT DRIVE CHAIN REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right Side (Fourth Design)** .
3. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Right Side (Fourth Design)** .
4. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Right Side (Fourth Design)** .
5. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right Side (Fourth Design)** .
6. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal (Fourth Design)** .
7. Remove the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Removal - Upper (Fourth Design)** .
8. Remove the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Removal (Fourth Design)** .
9. Remove the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Right Side (Fourth Design)** .
10. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left Side (Fourth Design)** .
11. Remove the left bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Left Side (Fourth Design)** .
12. Remove the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Left Side (Fourth Design)** .
13. Remove the left bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Left Side (Fourth Design)** .

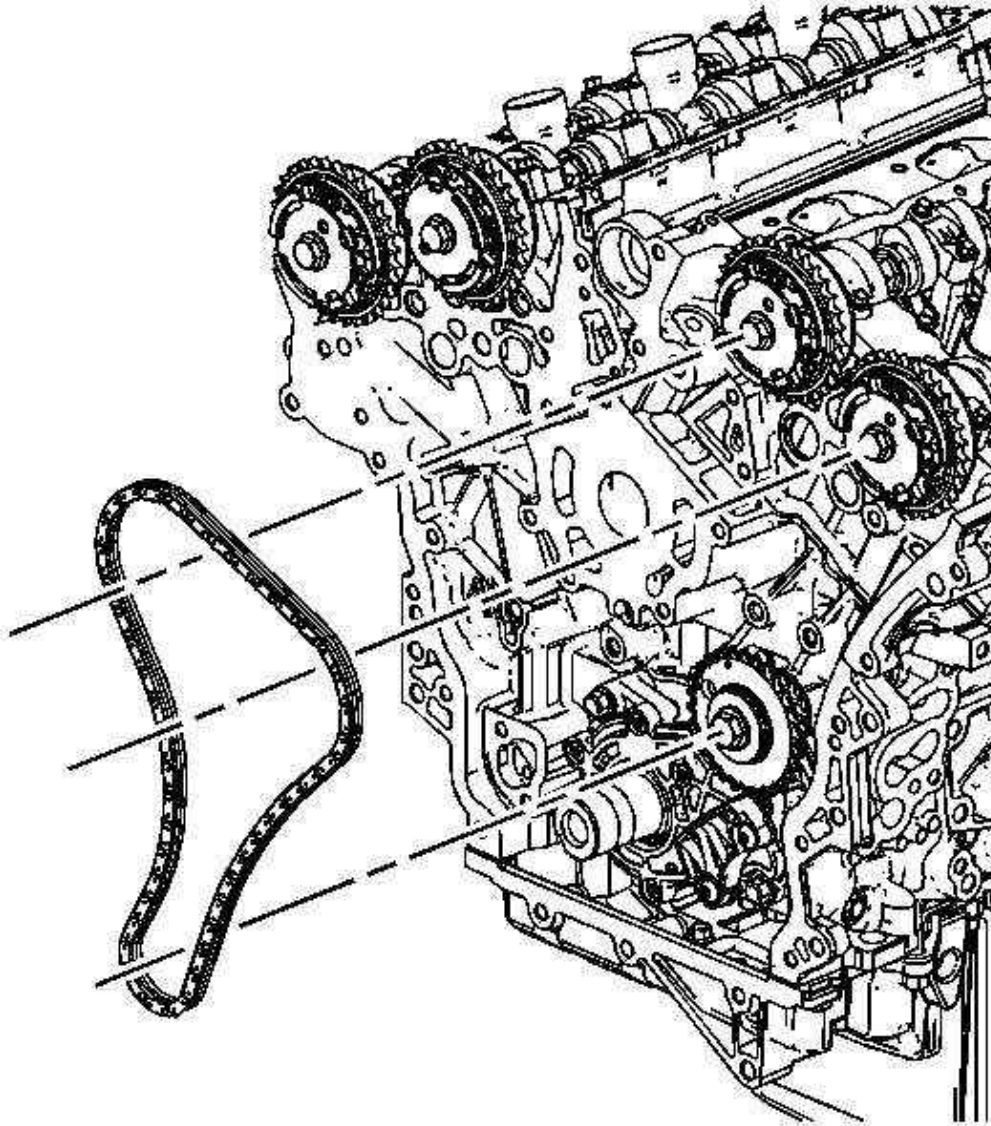


Fig. 110: View Of Left Bank Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

14. Remove the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Left Side (Fourth Design)** .
15. Clean and inspect all of the camshaft timing drive components. Refer to

Camshaft Timing Drive Components Cleaning and Inspection (Third Design) or Camshaft Timing Drive Components Cleaning and Inspection (Fourth Design) . Replace components as necessary.

Installation Procedure

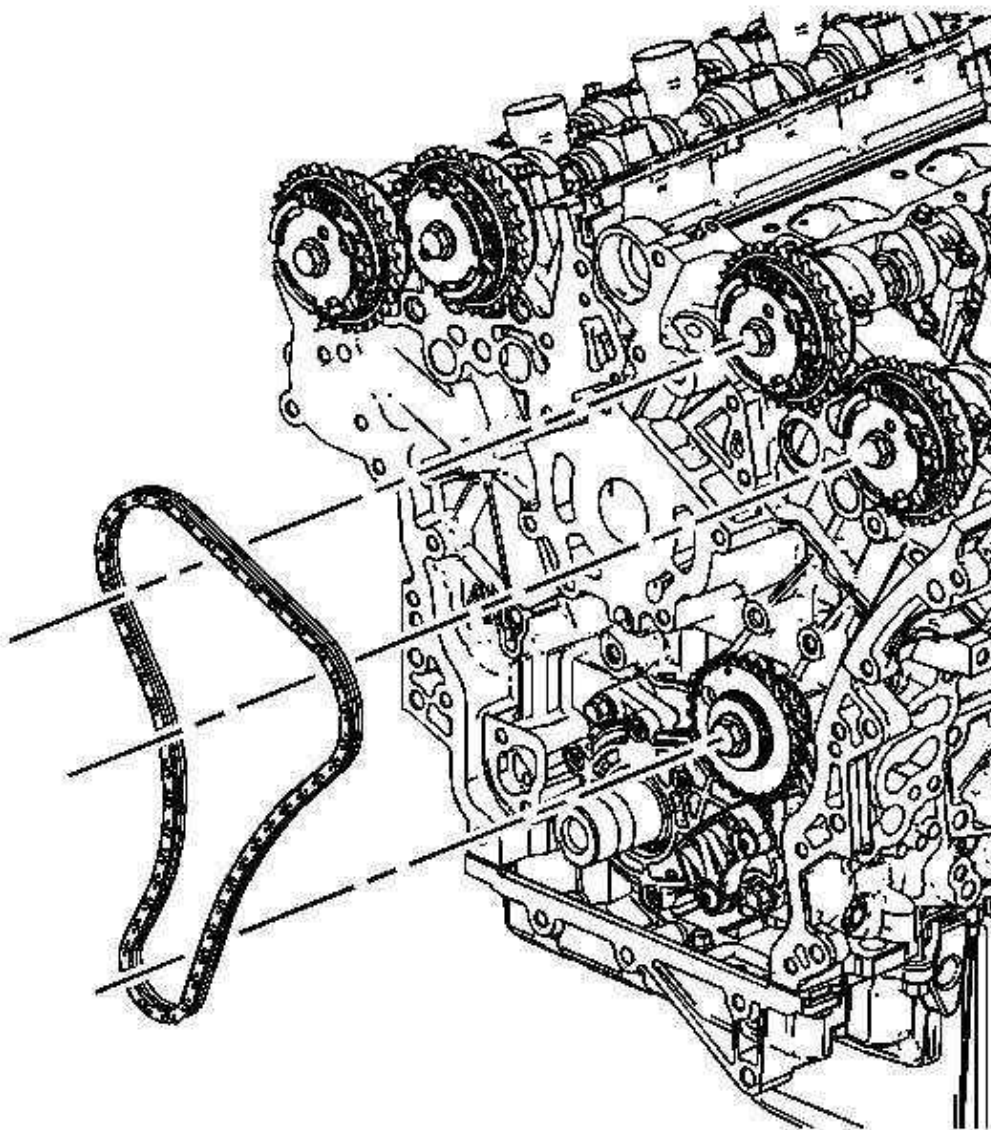


Fig. 111: View Of Left Bank Secondary Camshaft Drive Chain

Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Left Side (Fourth Design)** .
2. Install the left bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Installation - Left Side (Fourth Design)** .
3. Install the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Left Side (Fourth Design)** .
4. Install the left bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Left Side (Fourth Design)** .
5. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left Side (Fourth Design)** .
6. Install the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Installation - Right Side (Fourth Design)** .
7. Install the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Installation (Fourth Design)** .
8. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Installation - Upper (Fourth Design)** .
9. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation (Fourth Design)** .
10. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right Side (Fourth Design)** .
11. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right Side (Fourth Design)** .
12. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right Side (Fourth Design)** .
13. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right Side (Fourth Design)** .
14. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN REPLACEMENT - RIGHT SIDE

Removal Procedure

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

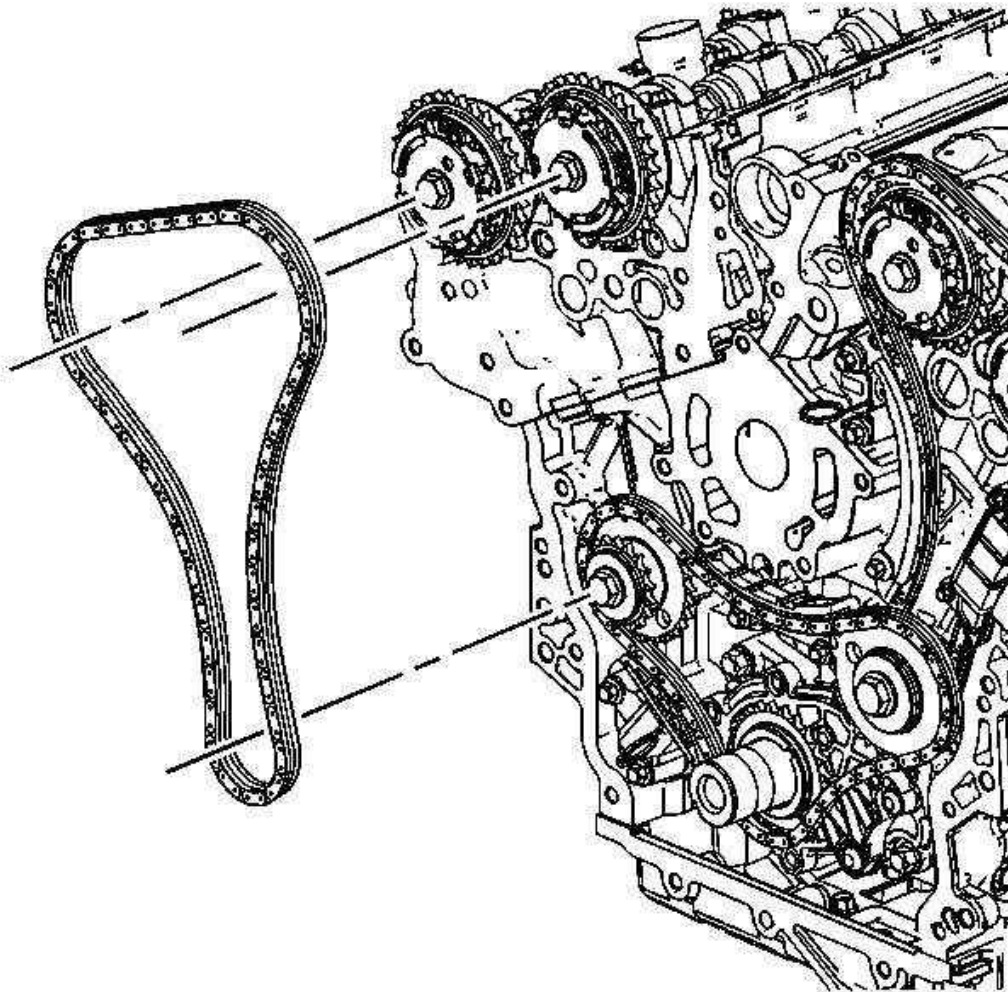


Fig. 112: View Of Right Bank Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

5. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right Side (Fourth Design)** .

Installation Procedure

1. Ensure the stage 1 camshaft timing is correct. Refer to **Setting Camshaft Timing**.

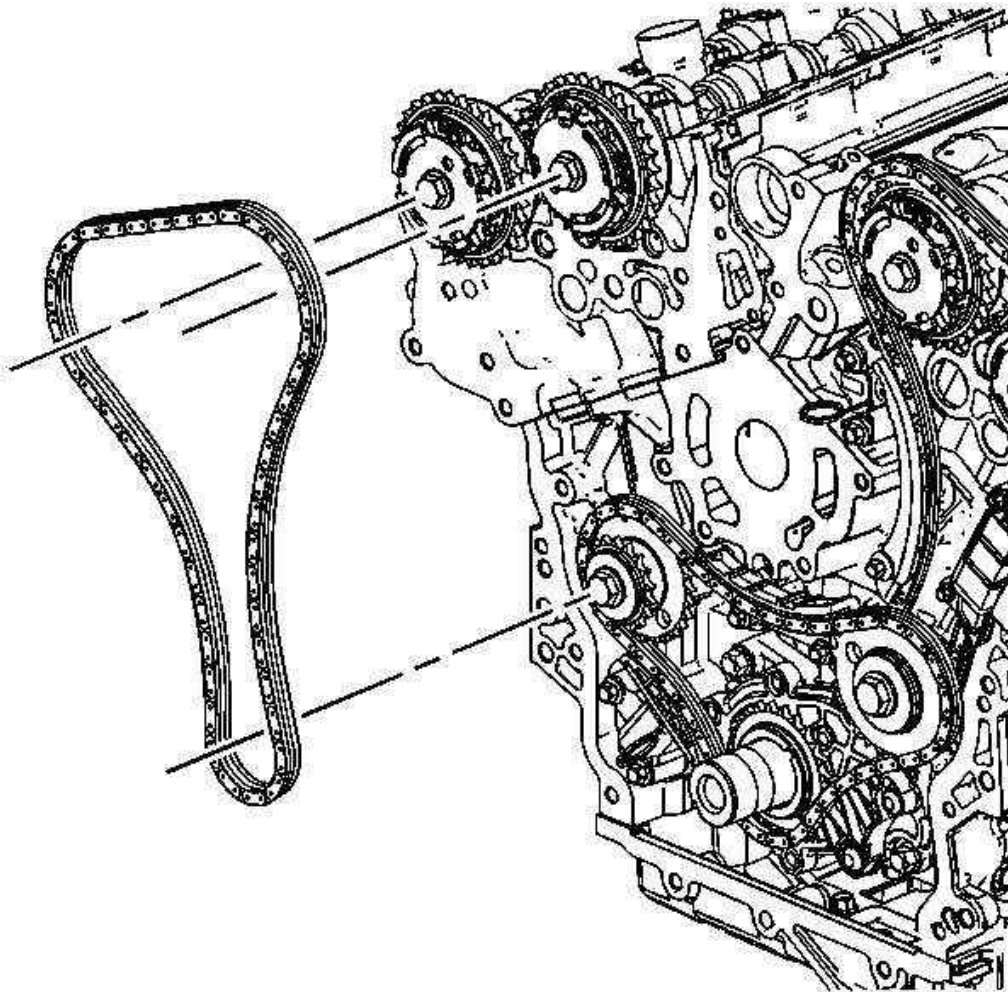


Fig. 113: View Of Right Bank Secondary Camshaft Drive Chain
Courtesy of GENERAL MOTORS CORP.

2. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right Side (Fourth Design)** .
3. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right Side (Fourth Design)** .
4. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary**

Camshaft Drive Chain Shoe Installation - Right Side (Fourth Design) .

5. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right Side (Fourth Design) .**
6. Install the engine front cover. Refer to **Engine Front Cover Replacement.**

SECONDARY CAMSHAFT DRIVE CHAIN TENSIONER REPLACEMENT - LEFT SIDE

Removal Procedure

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

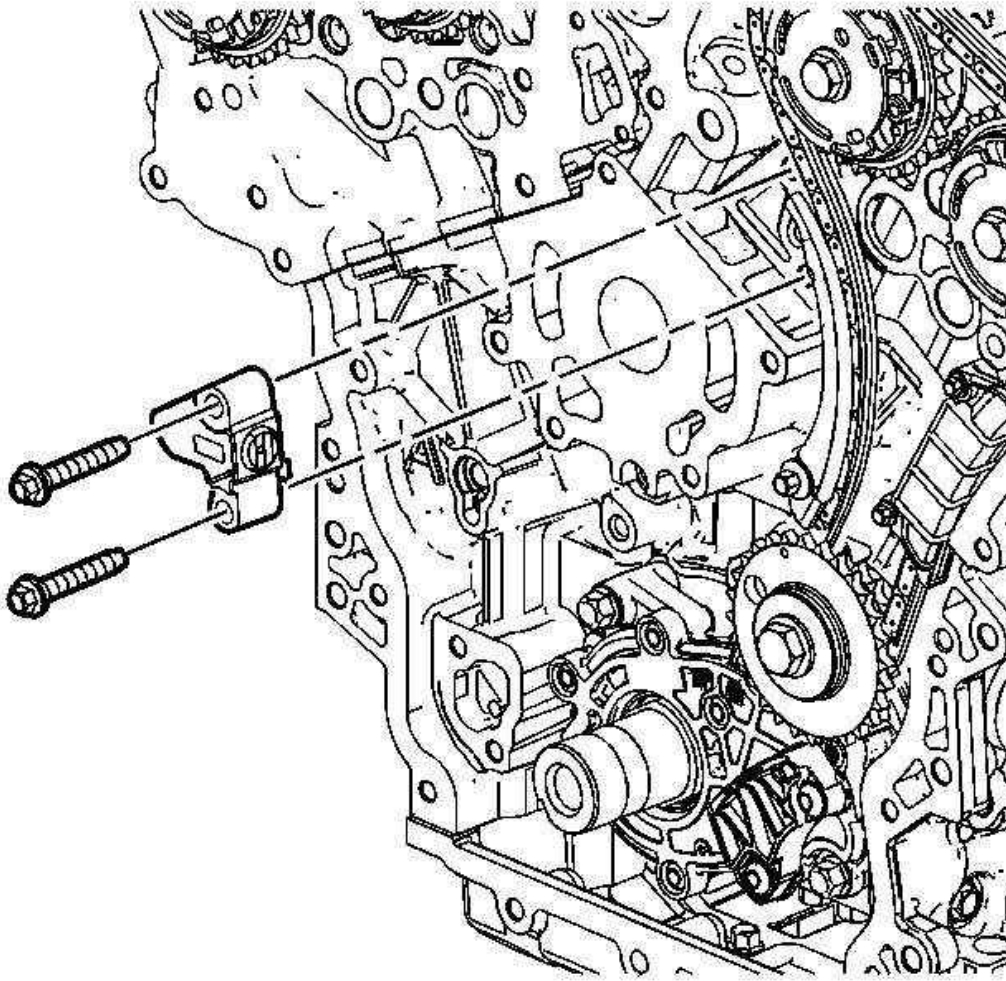


Fig. 114: View Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

2. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left Side (Fourth Design)** .

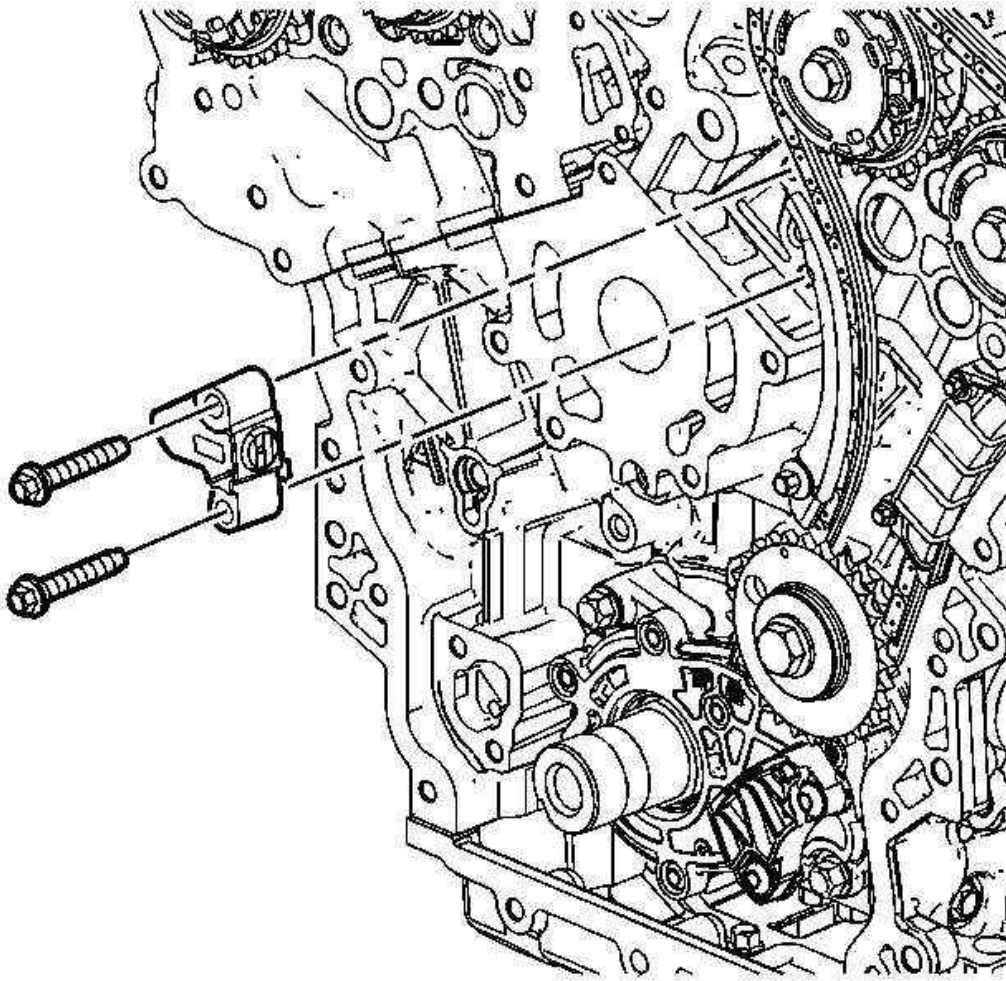


Fig. 115: View Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left Side (Fourth Design)** .
2. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN TENSIONER REPLACEMENT - RIGHT SIDE

Removal Procedure

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

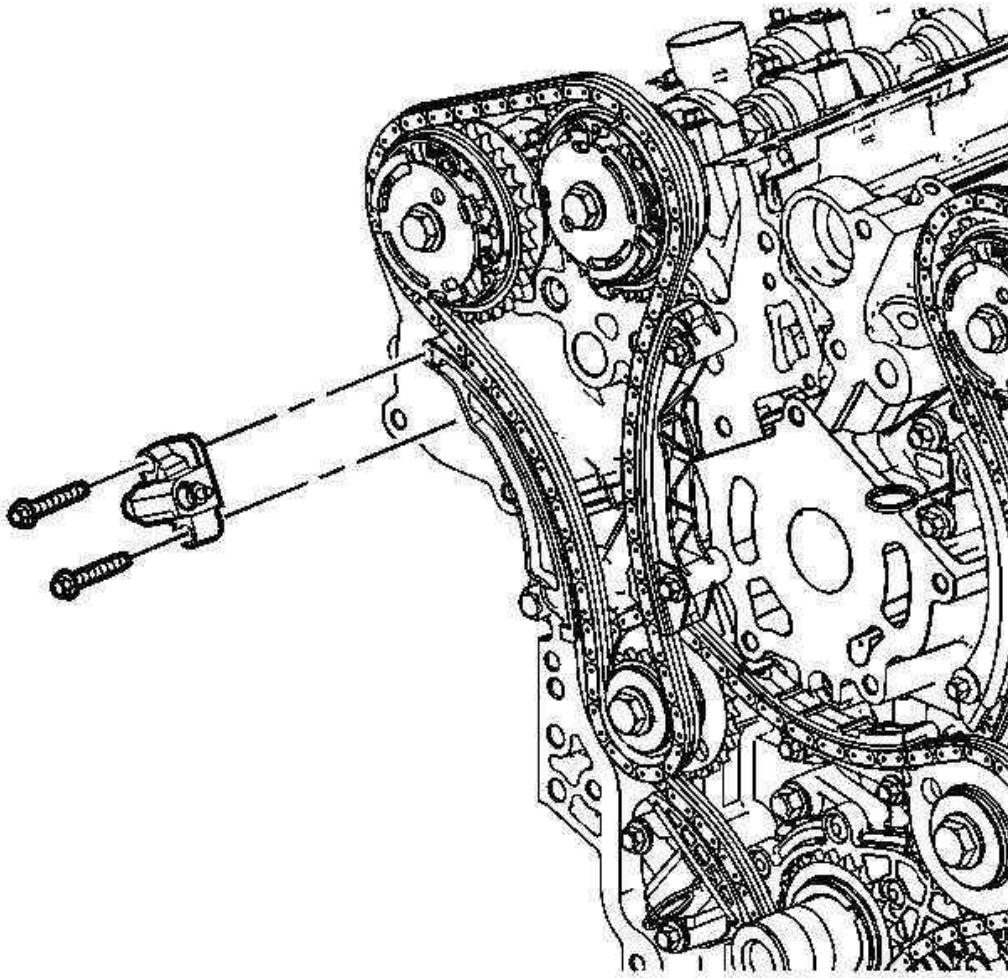


Fig. 116: View Of Right Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

2. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right Side (Fourth Design)** .

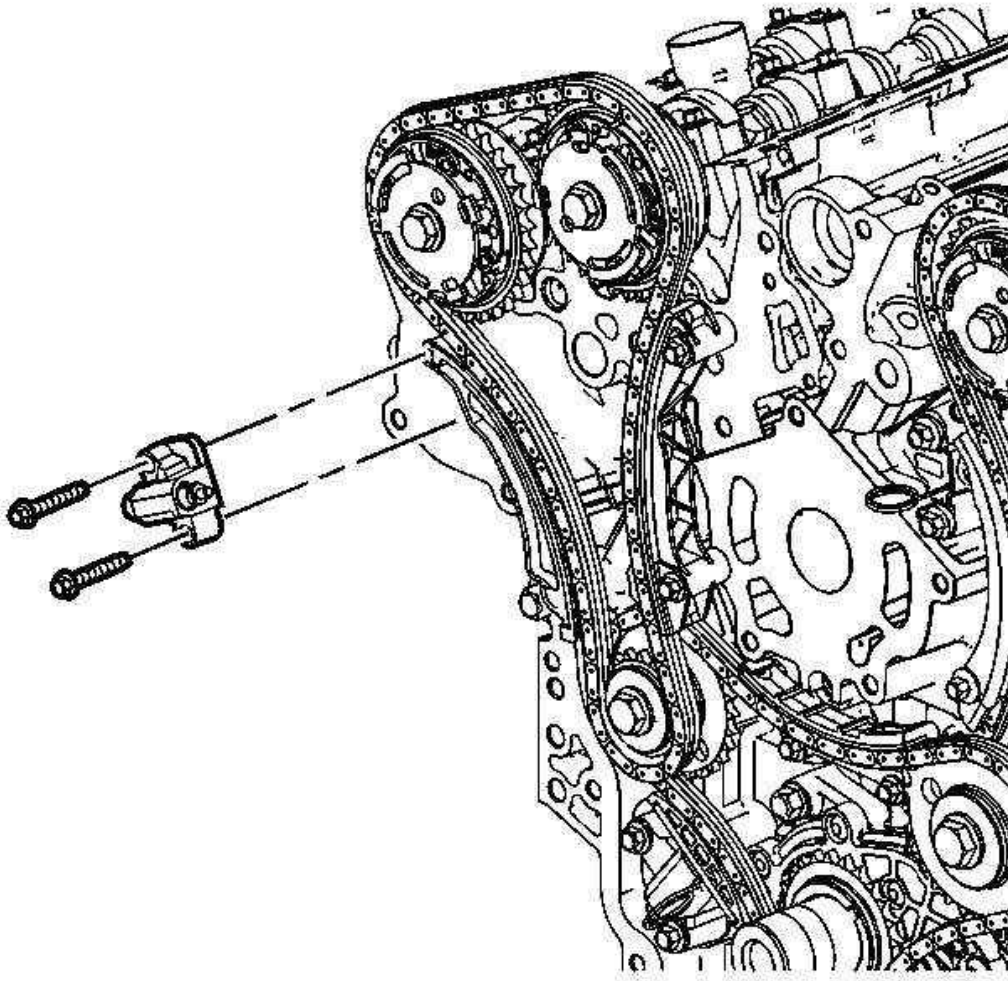


Fig. 117: View Of Right Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right Side (Fourth Design)** .
2. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN SHOE REPLACEMENT - LEFT SIDE

Removal Procedure

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

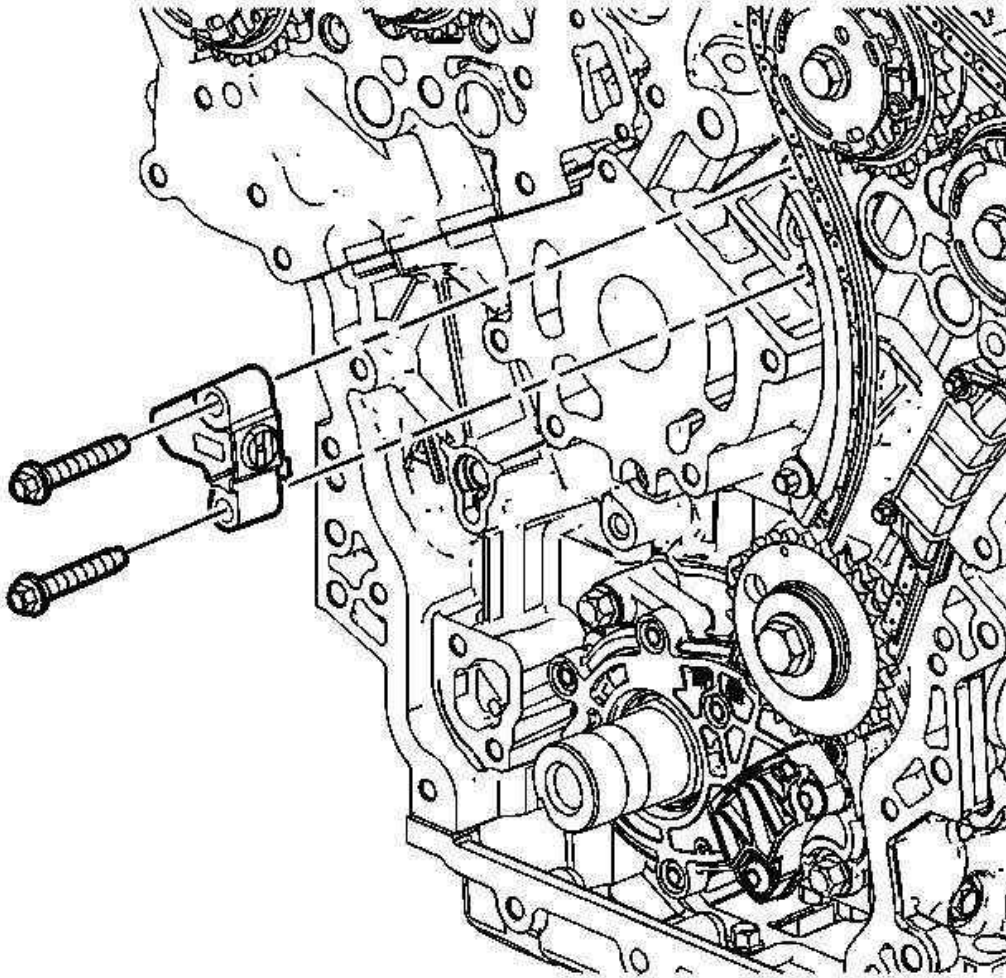


Fig. 118: View Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

2. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left Side (Fourth Design)** .

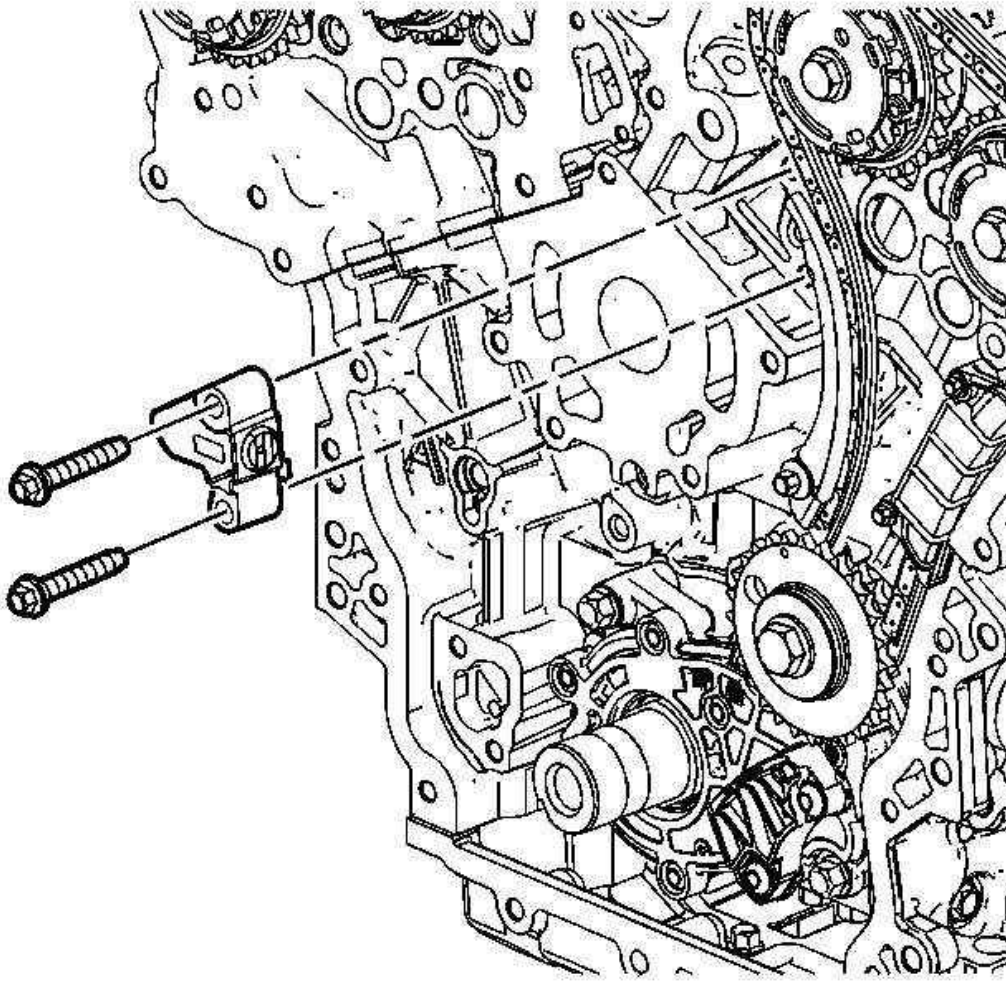


Fig. 119: View Of Left Bank Secondary Camshaft Drive Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left Side (Fourth Design)** .
2. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN SHOE REPLACEMENT - RIGHT SIDE

Removal Procedure

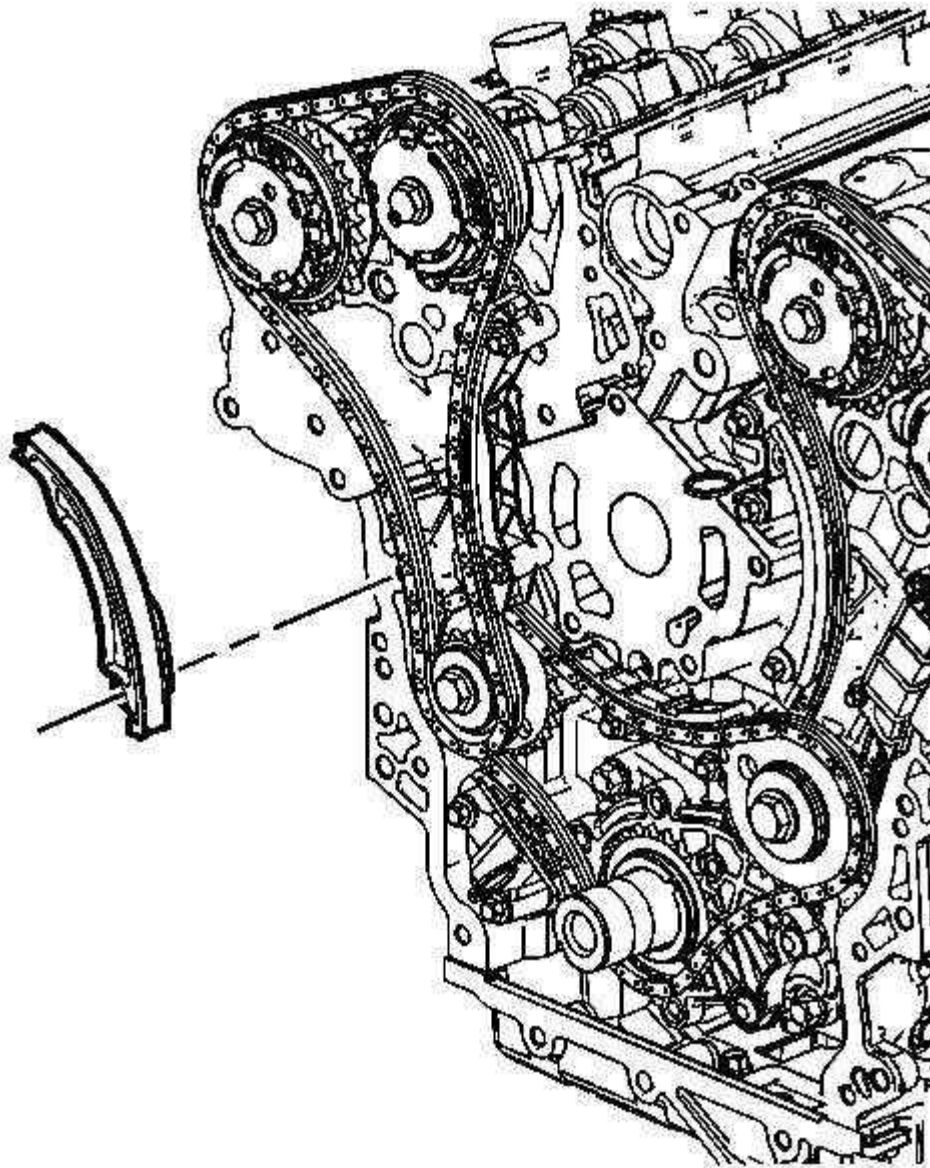


Fig. 120: View Of Right Secondary Camshaft Drive Chain Shoe
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to

2008 Buick LaCrosse CX
2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

Secondary Camshaft Drive Chain Tensioner Removal - Right Side (Fourth Design) .

3. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Right Side (Fourth Design) .**

Installation Procedure

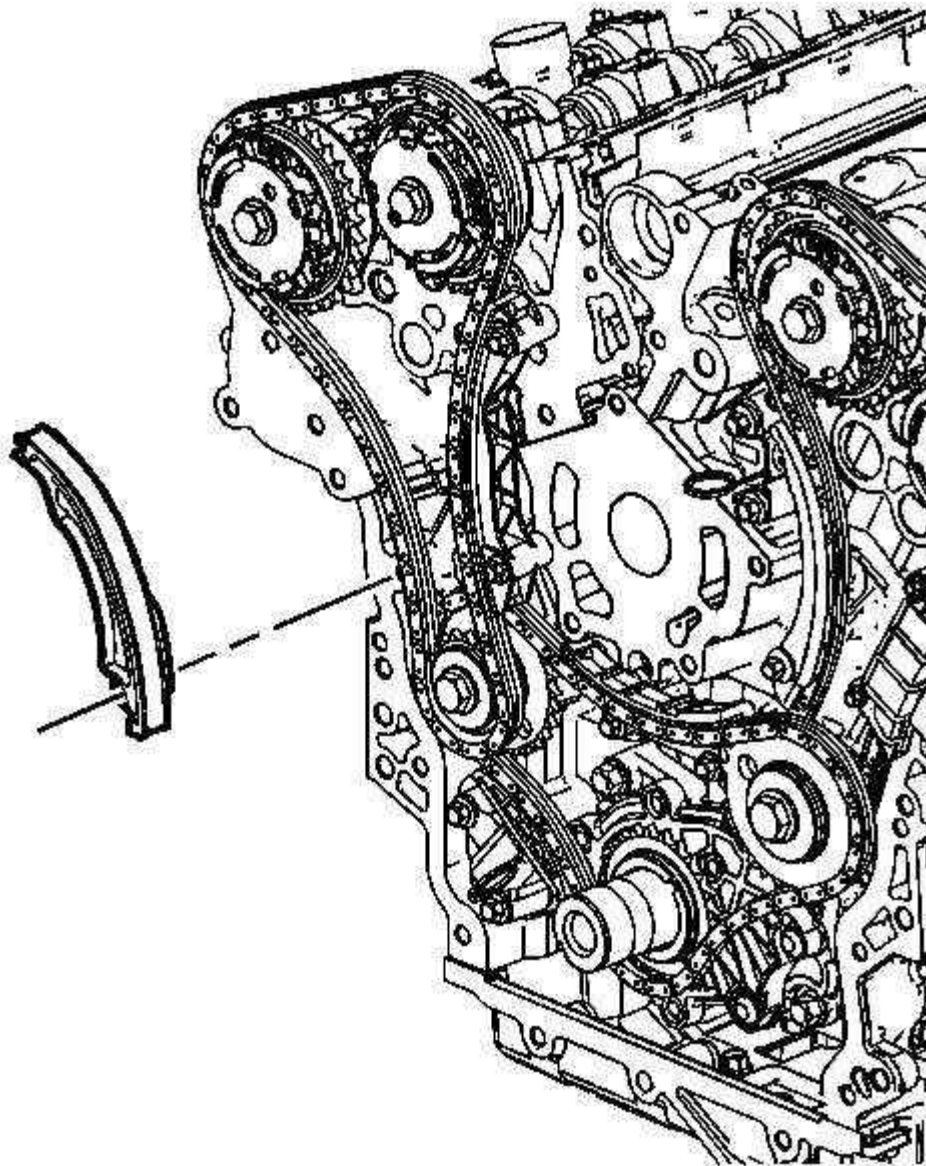


Fig. 121: View Of Right Secondary Camshaft Drive Chain Shoe
Courtesy of GENERAL MOTORS CORP.

1. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right Side (Fourth Design)** .

2. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right Side (Fourth Design)** .
3. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

SECONDARY CAMSHAFT DRIVE CHAIN GUIDE REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
2. Remove the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Left Side (Fourth Design)** .

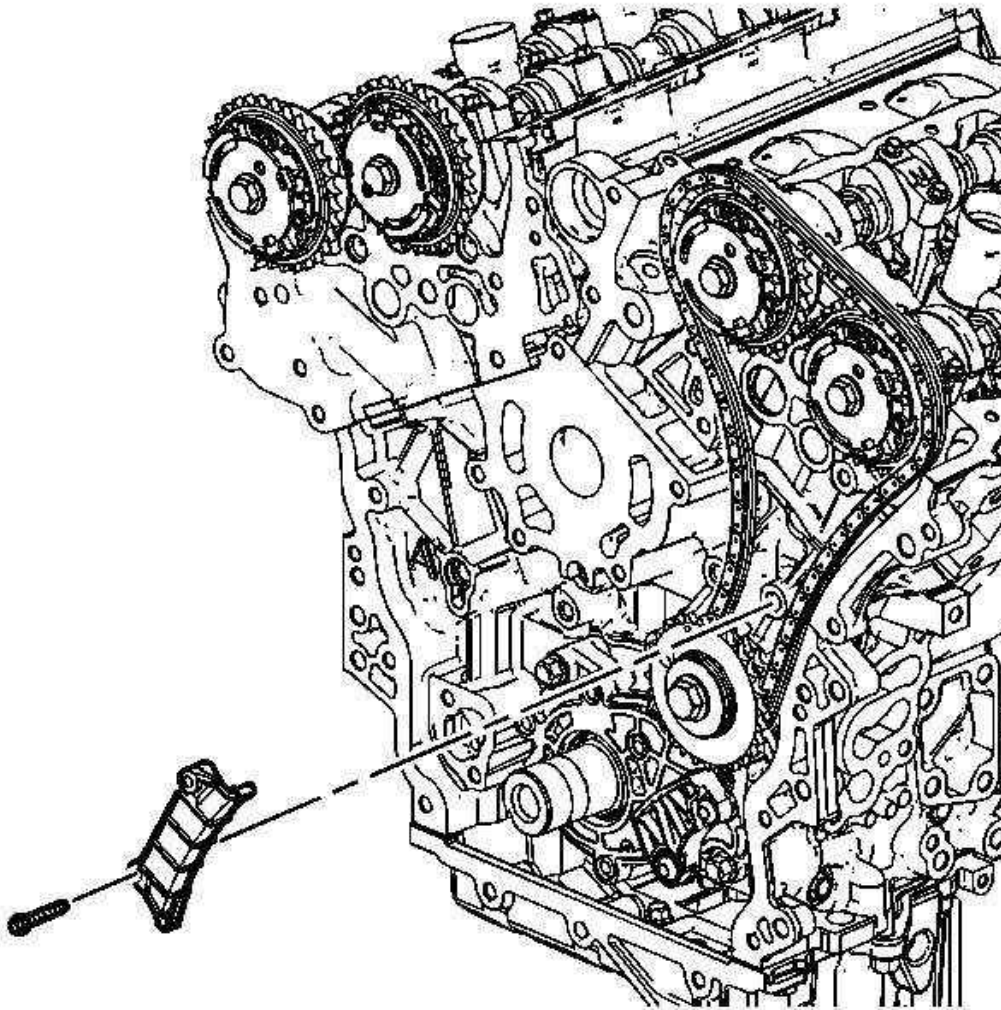


Fig. 122: View Of Left Bank Secondary Camshaft Drive Chain Guide
Courtesy of GENERAL MOTORS CORP.

3. Remove the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Left Side (Fourth Design)** .

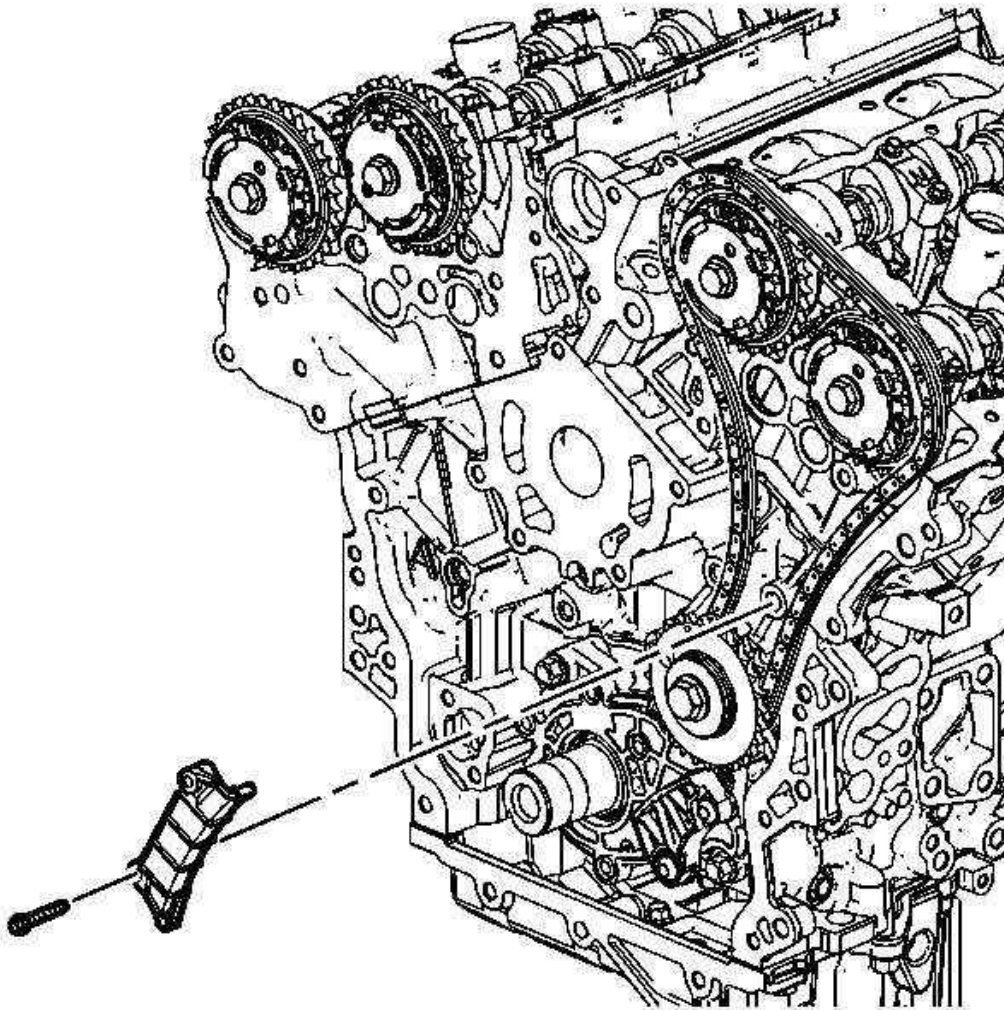


Fig. 123: View Of Left Bank Secondary Camshaft Drive Chain Guide
Courtesy of GENERAL MOTORS CORP.

1. Install the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Left Side (Fourth Design)** .
2. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left Side (Fourth Design)** .
3. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

2008 Buick LaCrosse CX
2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

SECONDARY CAMSHAFT DRIVE CHAIN GUIDE REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right Side (Fourth Design)** .

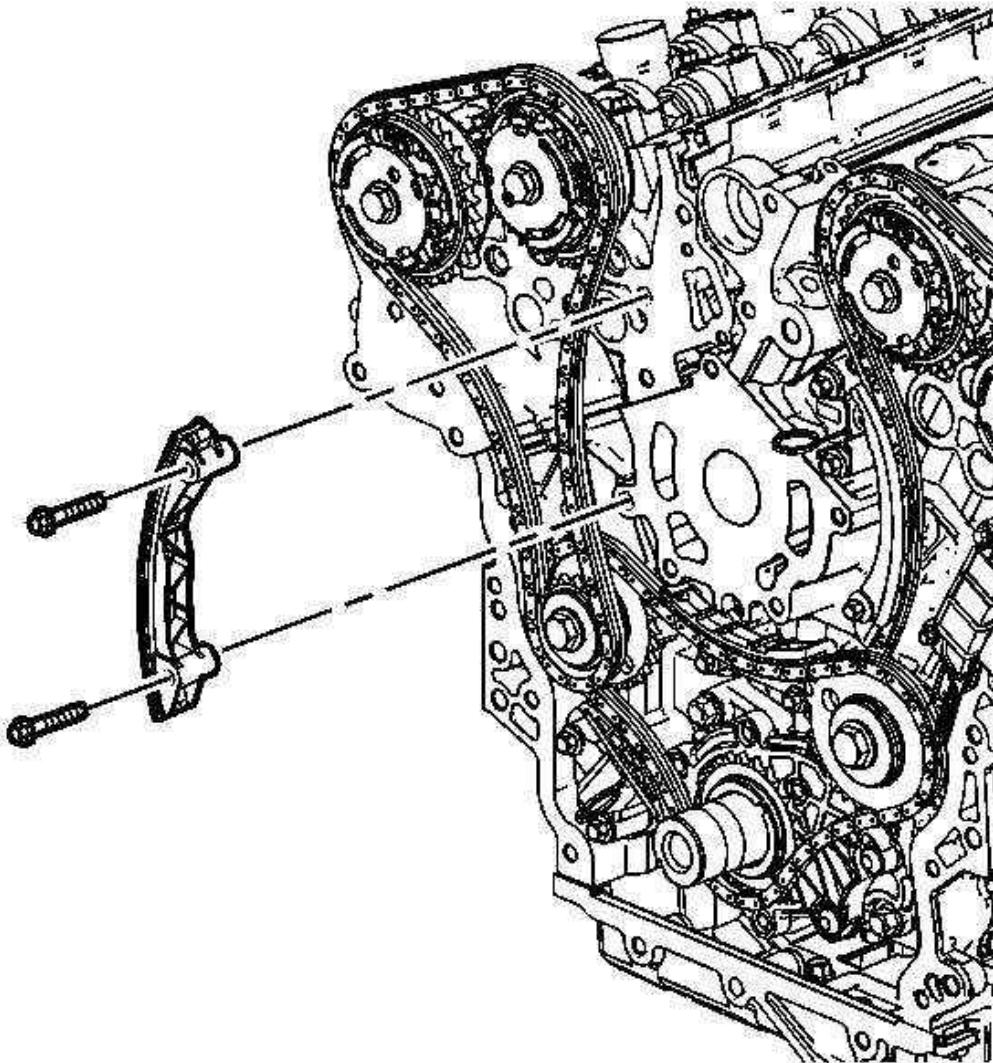


Fig. 124: View Of Right Secondary Camshaft Drive Chain Guide & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Right Side (Fourth Design)** .

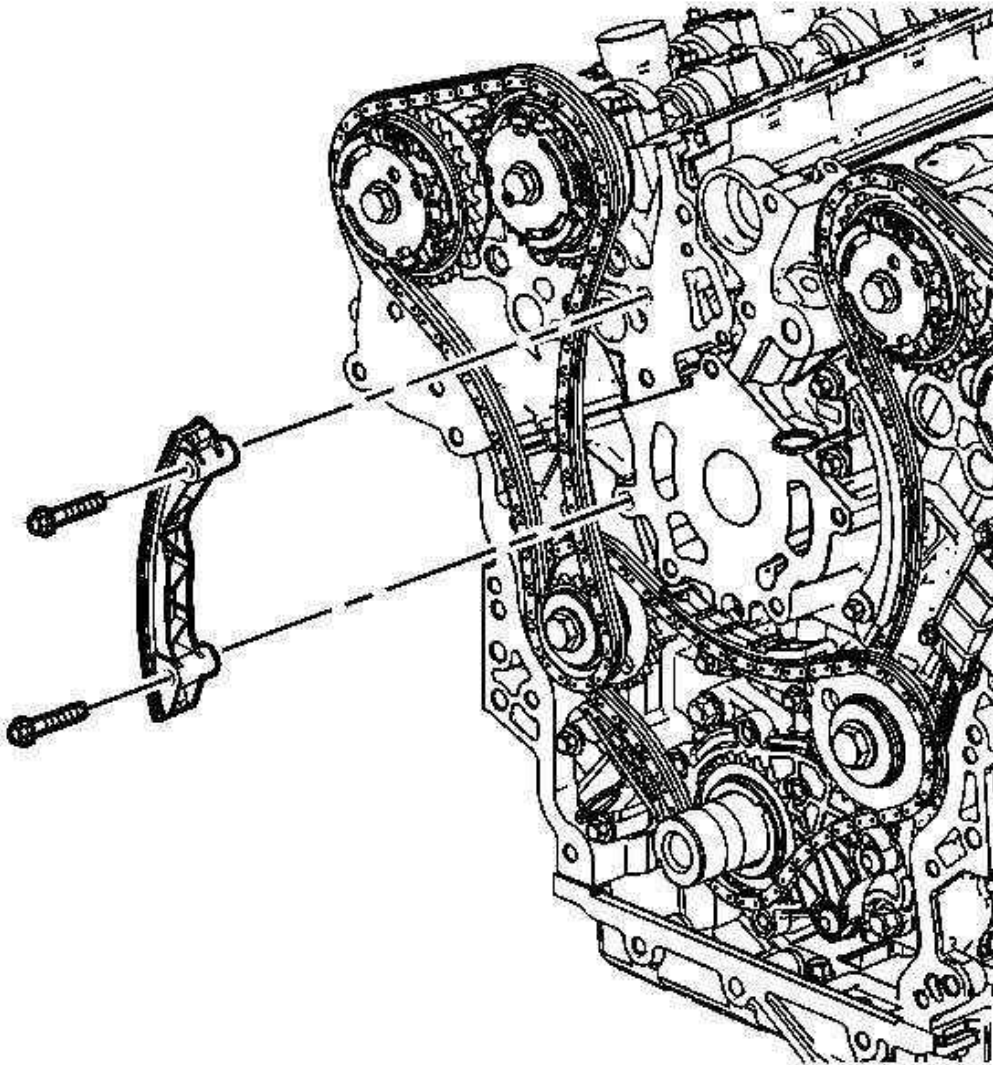


Fig. 125: View Of Right Secondary Camshaft Drive Chain Guide & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right Side (Fourth Design)** .
2. Install the right bank secondary camshaft drive chain tensioner. Refer to

Secondary Camshaft Drive Chain Tensioner Installation - Right Side (Fourth Design) .

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

PRIMARY CAMSHAFT DRIVE CHAIN AND SPROCKETS REPLACEMENT

Removal Procedure

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement.**
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Removal - Right Side (Fourth Design) .**
3. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Right Side (Fourth Design) .**
4. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Right Side (Fourth Design) .**
5. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right Side (Fourth Design) .**
6. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal (Fourth Design) .**
7. Remove the primary camshaft drive chain upper guide. **Primary Camshaft Drive Chain Guide Removal - Upper (Fourth Design) .**

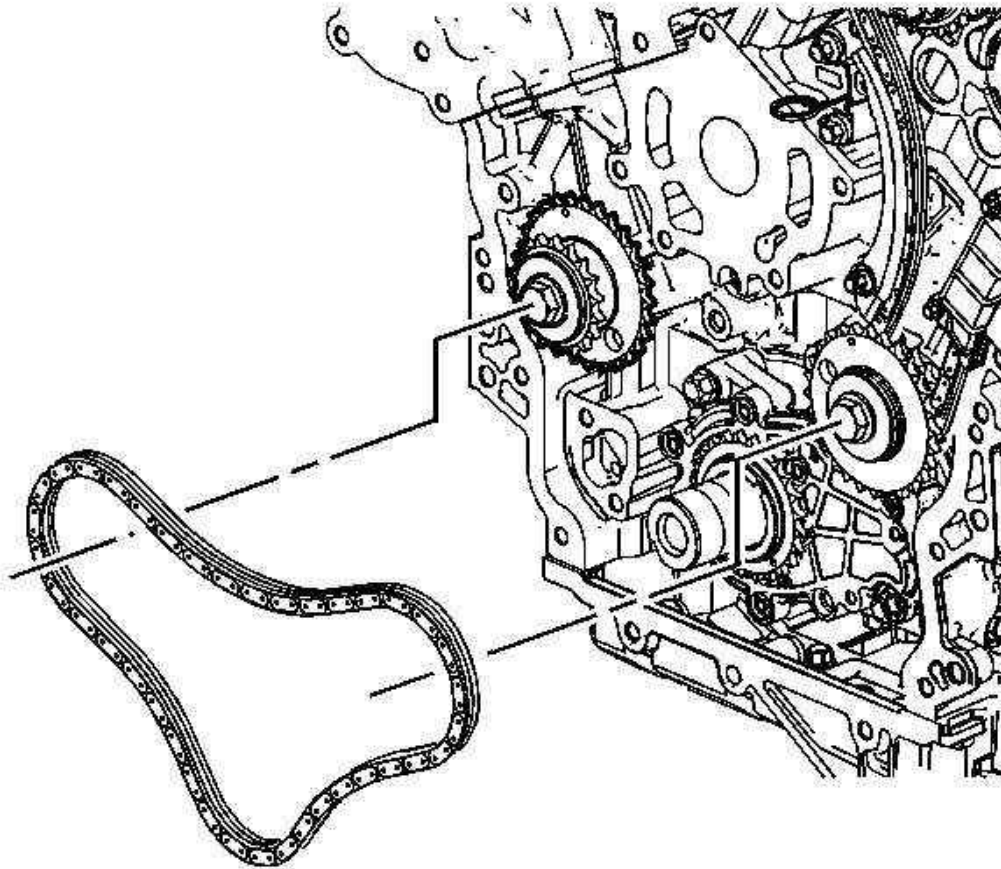


Fig. 126: View Of Primary Camshaft Timing Chain
Courtesy of GENERAL MOTORS CORP.

8. Remove the primary camshaft timing chain. Refer to **Secondary Camshaft Drive Chain Removal - Right Side (Fourth Design)** .

Installation Procedure

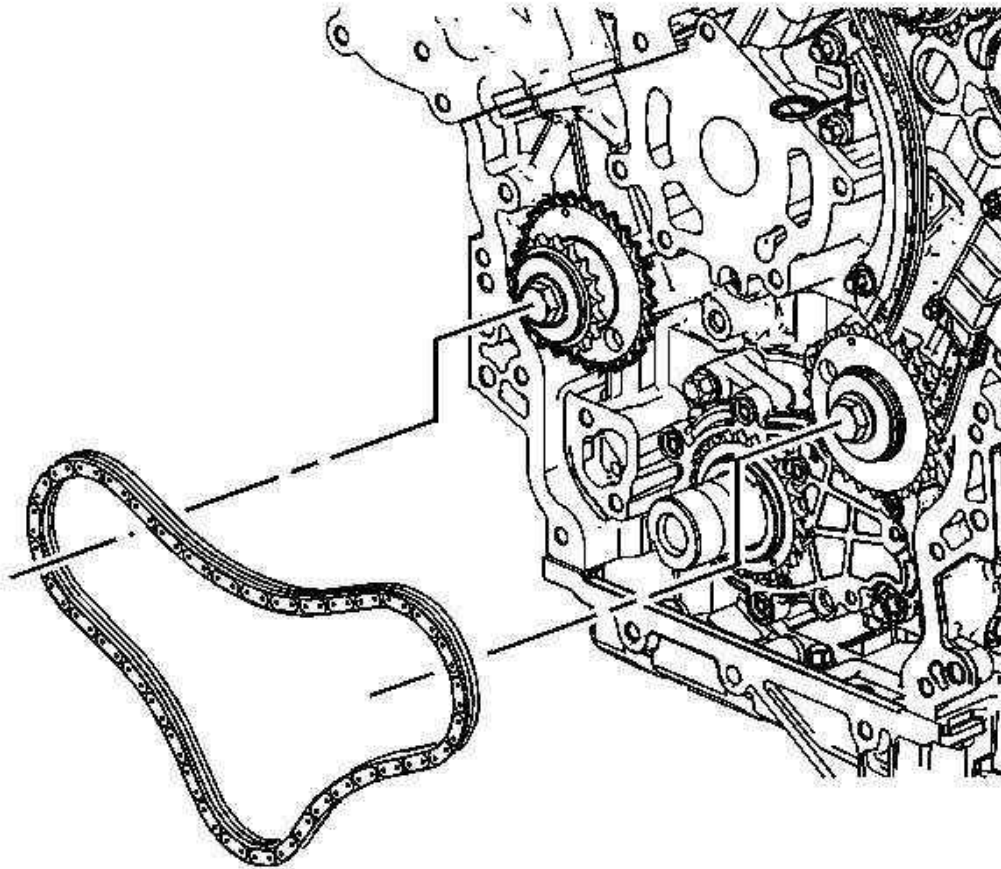


Fig. 127: View Of Primary Camshaft Timing Chain
Courtesy of GENERAL MOTORS CORP.

1. Install the primary camshaft timing chain. Refer to **Primary Camshaft Drive Chain Installation (Fourth Design)** .
2. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Installation - Upper (Fourth Design)** .
3. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation (Fourth Design)** .
4. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right Side (Fourth Design)** .

5. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right Side (Fourth Design)** .
6. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right Side (Fourth Design)** .
7. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right Side (Fourth Design)** .
8. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

CAMSHAFT INTERMEDIATE DRIVE CHAIN IDLER SPROCKET REPLACEMENT - LEFT SIDE

Removal Procedure

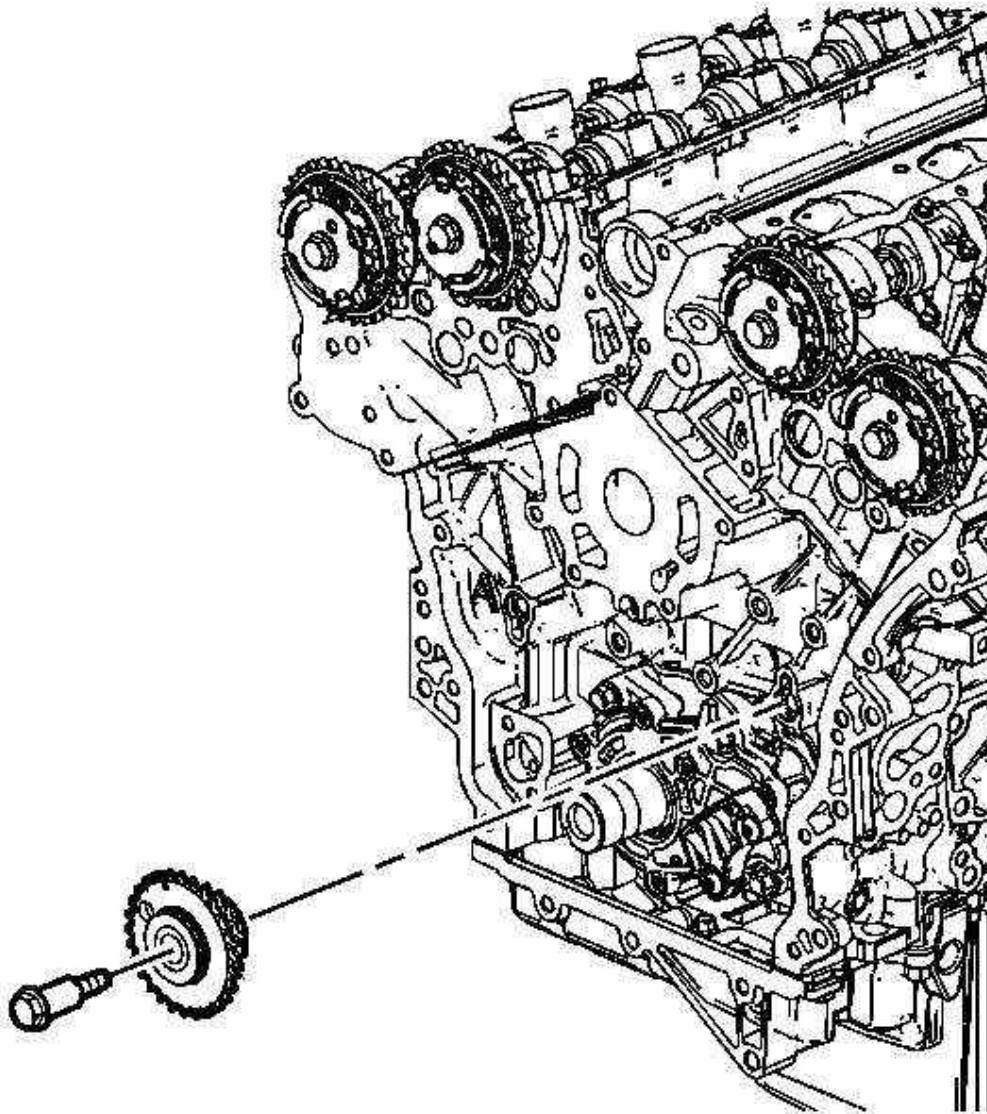


Fig. 128: View Of Left Camshaft Intermediate Drive Chain Idler
Courtesy of GENERAL MOTORS CORP.

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

Design) .

3. Remove the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Removal - Right Side (Fourth Design)** .
4. Remove the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Right Side (Fourth Design)** .
5. Remove the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Right Side (Fourth Design)** .
6. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal (Fourth Design)** .
7. Remove the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Removal - Upper (Fourth Design)** .
8. Remove the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Removal (Fourth Design)** .
9. Remove the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Right Side (Fourth Design)** .

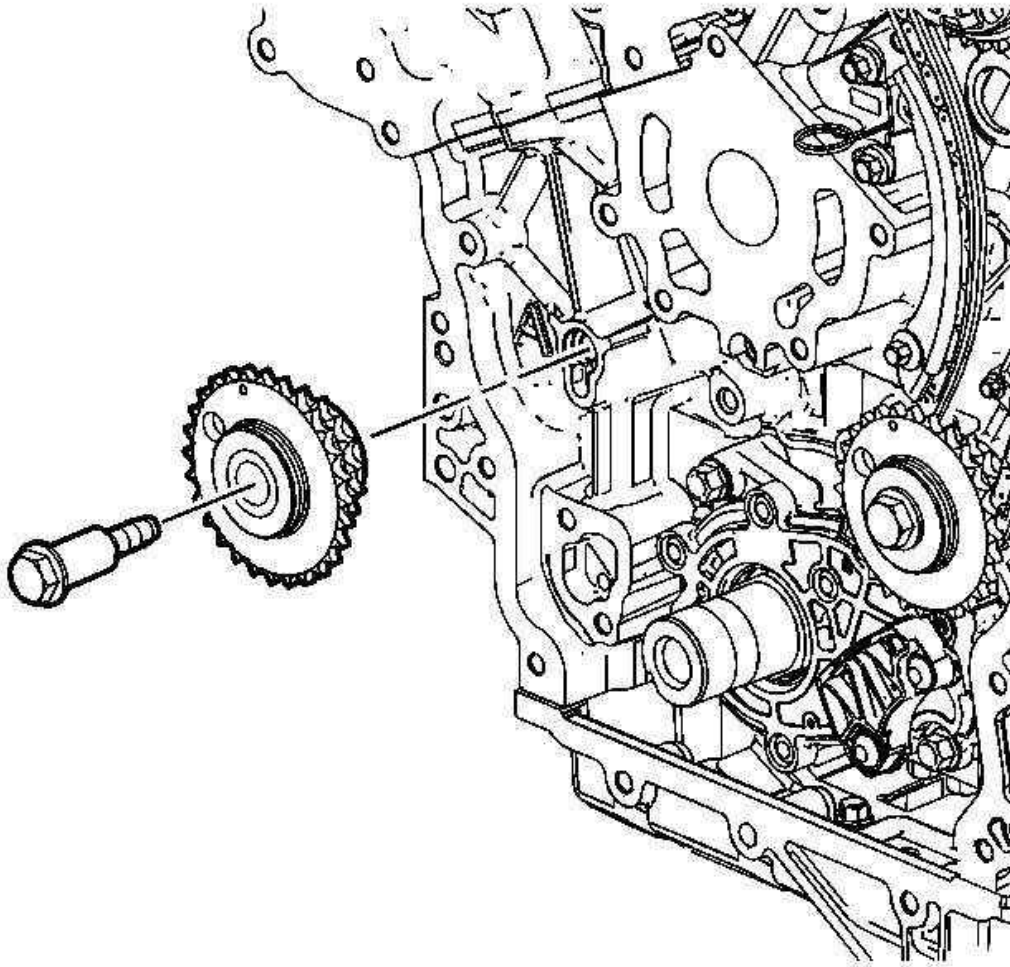


Fig. 129: View Of Right And Left Camshaft Intermediate Drive Chain Idlers

Courtesy of GENERAL MOTORS CORP.

10. 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 Side (Fourth Design)** .
 2. Remove the left bank secondary camshaft drive chain shoe. Refer to

Secondary Camshaft Drive Chain Shoe Removal - Left Side (Fourth Design) .

3. Remove the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Removal - Left Side (Fourth Design) .**
4. Remove the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Removal - Left Side (Fourth Design) .**
5. Remove the left bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Removal - Left Side (Fourth Design) .**

Installation Procedure

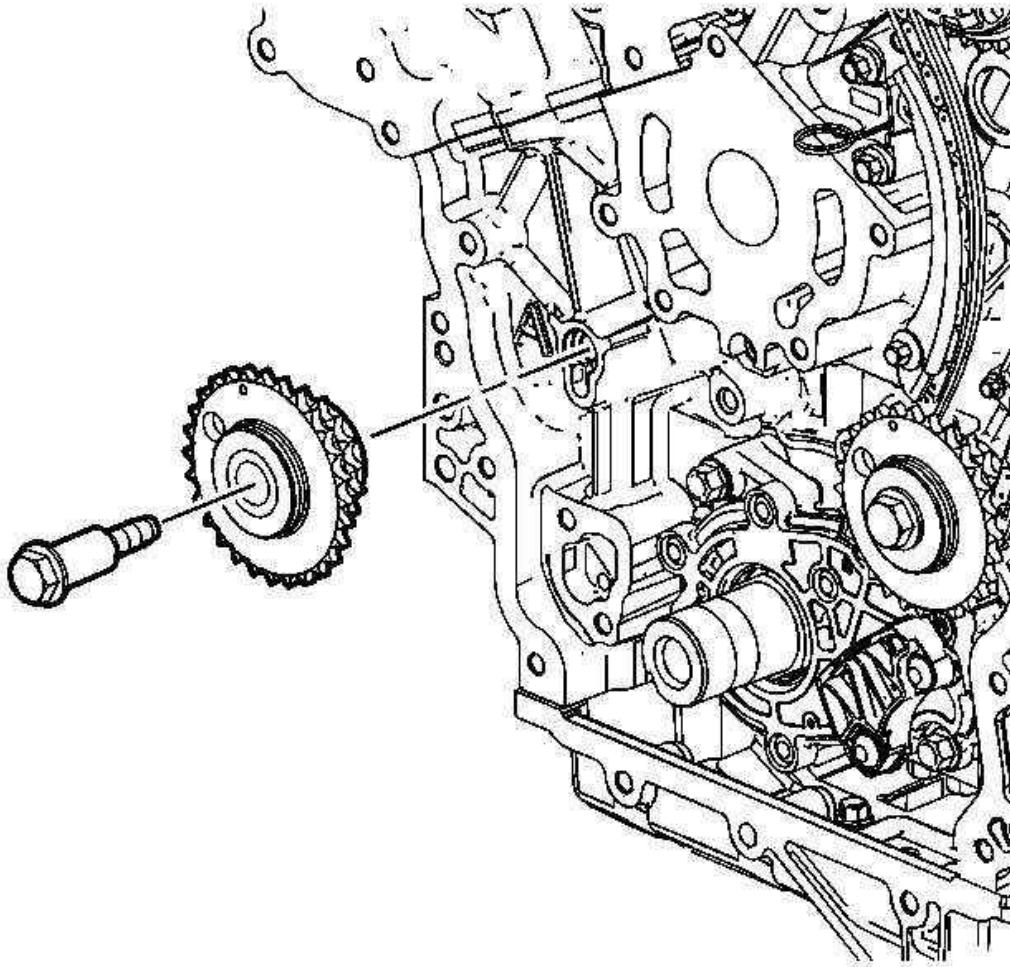


Fig. 130: View Of Right And Left Camshaft Intermediate Drive Chain Idlers

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 Side (Fourth Design)** .
 2. Install the left bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Left Side (Fourth Design)** .

3. Install the left bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Left Side (Fourth Design)** .
4. Install the left bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Left Side (Fourth Design)** .
5. Install the left bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Left Side (Fourth Design)** .

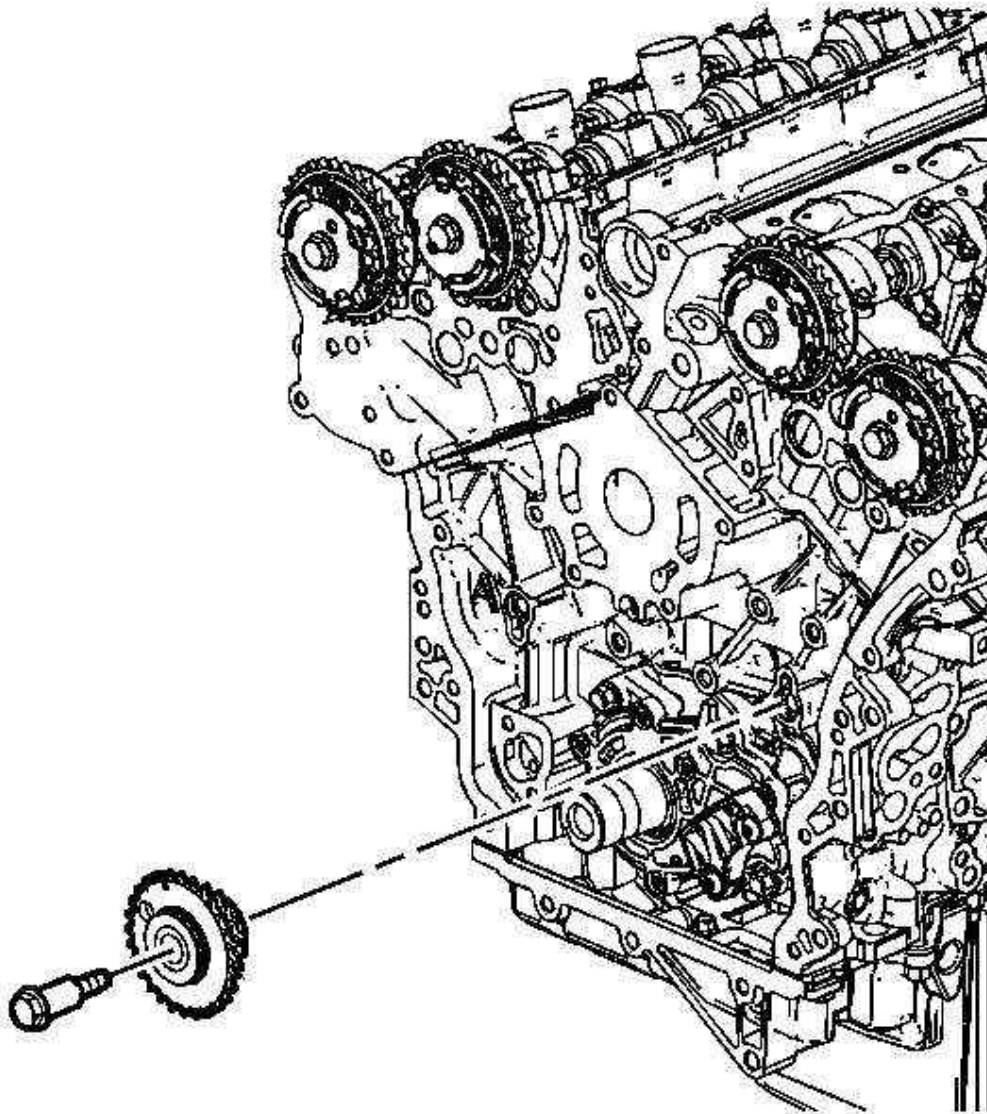


Fig. 131: View Of Left Camshaft Intermediate Drive Chain Idler
Courtesy of GENERAL MOTORS CORP.

2. Install the right bank camshaft intermediate drive chain idler. Refer to **Camshaft Intermediate Drive Chain Idler Installation - Right Side (Fourth Design)** .

3. Install the primary camshaft drive chain. Refer to **Primary Camshaft Drive Chain Installation (Fourth Design)** .
4. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Installation - Upper (Fourth Design)** .
5. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation (Fourth Design)** .
6. Install the right bank secondary camshaft drive chain. Refer to **Secondary Camshaft Drive Chain Installation - Right Side (Fourth Design)** .
7. Install the right bank secondary camshaft drive chain guide. Refer to **Secondary Camshaft Drive Chain Guide Installation - Right Side (Fourth Design)** .
8. Install the right bank secondary camshaft drive chain shoe. Refer to **Secondary Camshaft Drive Chain Shoe Installation - Right Side (Fourth Design)** .
9. Install the right bank secondary camshaft drive chain tensioner. Refer to **Secondary Camshaft Drive Chain Tensioner Installation - Right Side (Fourth Design)** .
10. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

PRIMARY CAMSHAFT DRIVE CHAIN TENSIONER REPLACEMENT

Removal Procedure

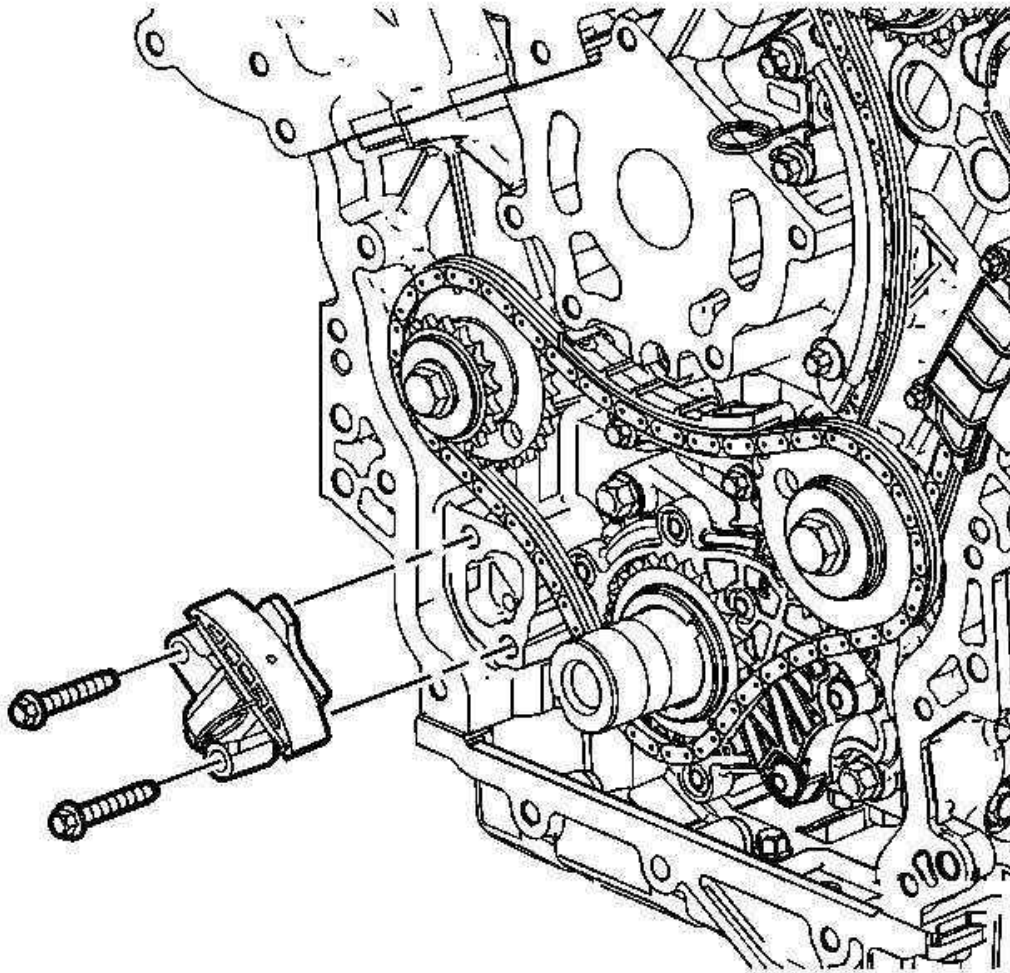


Fig. 132: View Of Primary Camshaft Drive Chain Tensioners
Courtesy of GENERAL MOTORS CORP.

1. 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 (Third Design) or Camshaft Timing Drive Chain Alignment Diagram (Fourth Design) , mark the timing chain and sprockets in order to ensure

proper reassembly.

2. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal (Fourth Design)** .

Installation Procedure

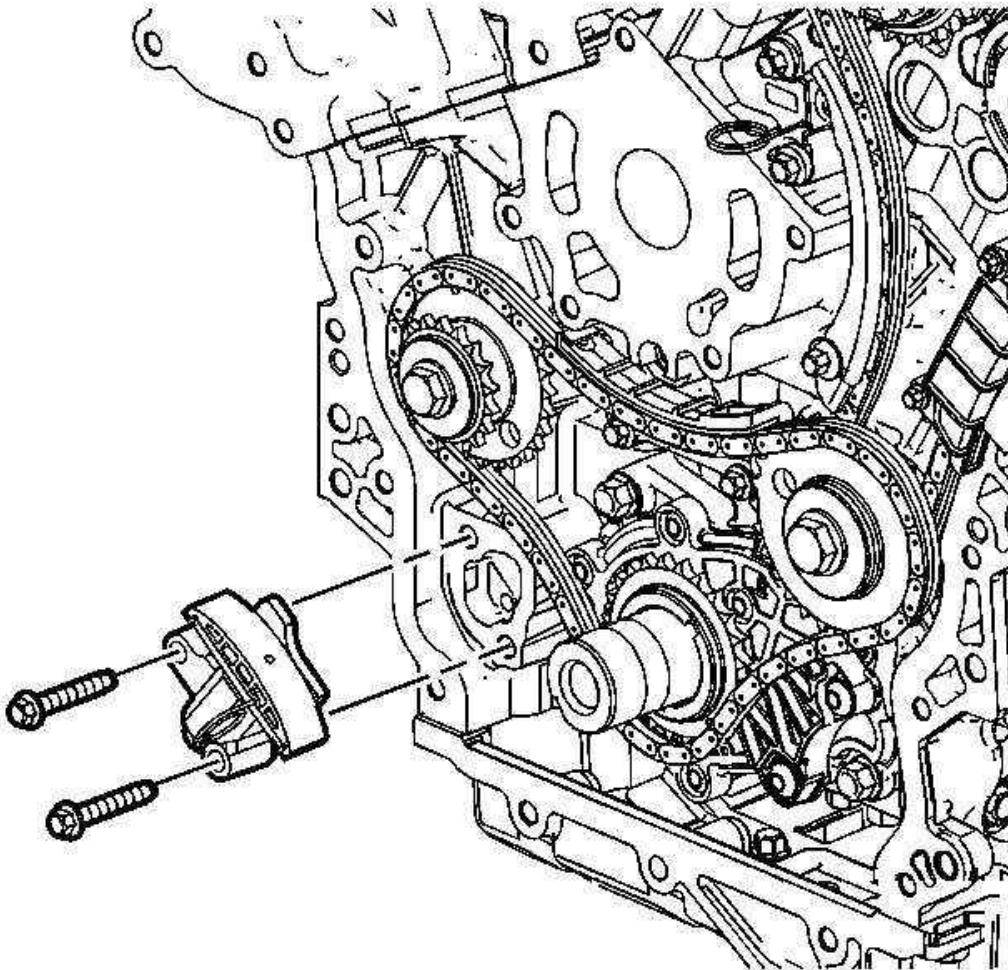


Fig. 133: View Of Primary Camshaft Drive Chain Tensioners
Courtesy of GENERAL MOTORS CORP.

1. Install the primary camshaft drive chain tensioner. Refer to **Primary**

Camshaft Drive Chain Tensioner Installation (Fourth Design) .

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

PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REPLACEMENT - LOWER

Removal Procedure

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

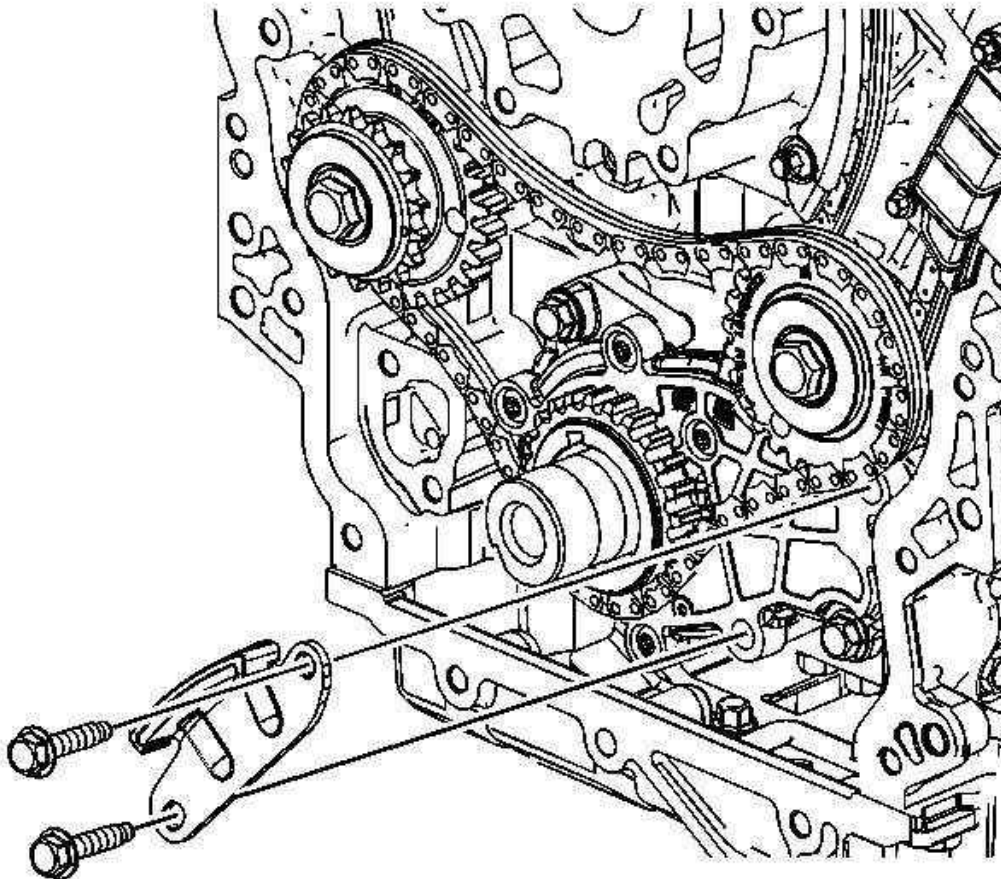


Fig. 134: View Of Primary Camshaft Drive Chain Lower Guide Bolts
Courtesy of GENERAL MOTORS CORP.

2. Remove the primary camshaft drive chain lower guide bolts.
3. Remove the primary camshaft drive chain lower guide.

Installation Procedure

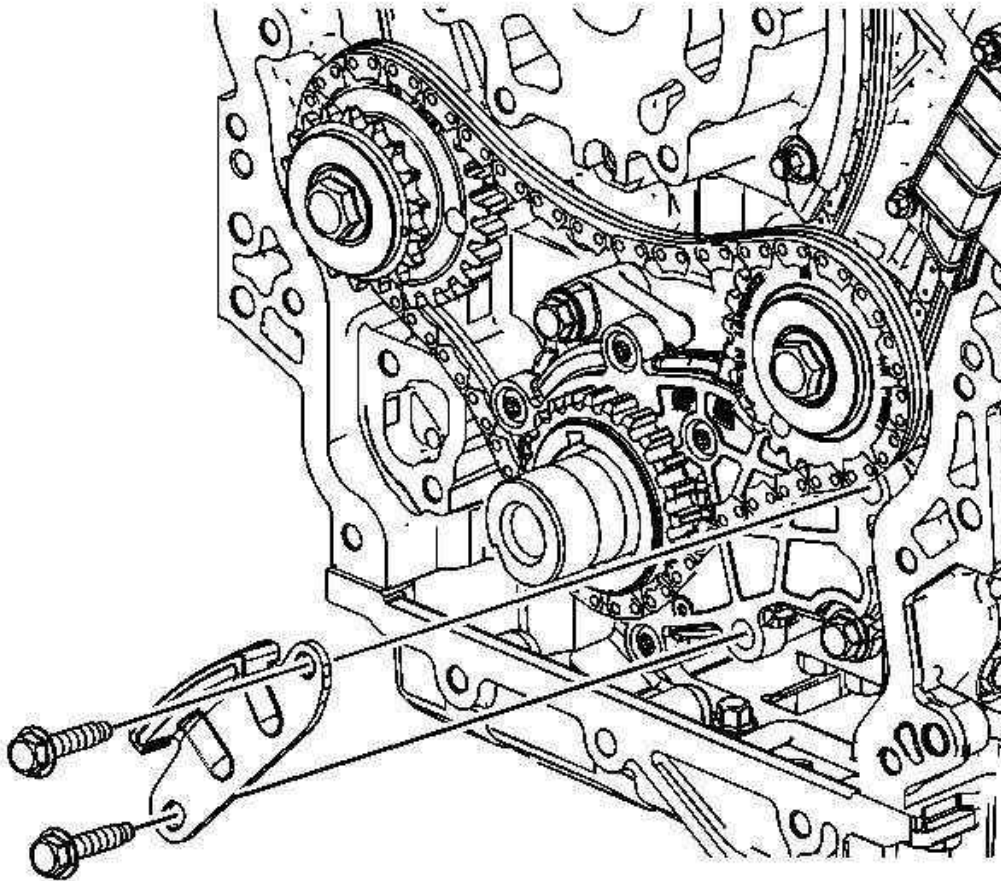


Fig. 135: View Of Primary Camshaft Drive Chain Lower Guide Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the primary camshaft drive chain lower guide to the oil pump.

NOTE: Refer to Fastener Notice .

2. Install the primary camshaft drive chain lower guide bolts.

Tighten: Tighten the primary camshaft drive chain lower guide bolts to 23 N.m (17 lb ft).

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

PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REPLACEMENT - UPPER

Removal Procedure

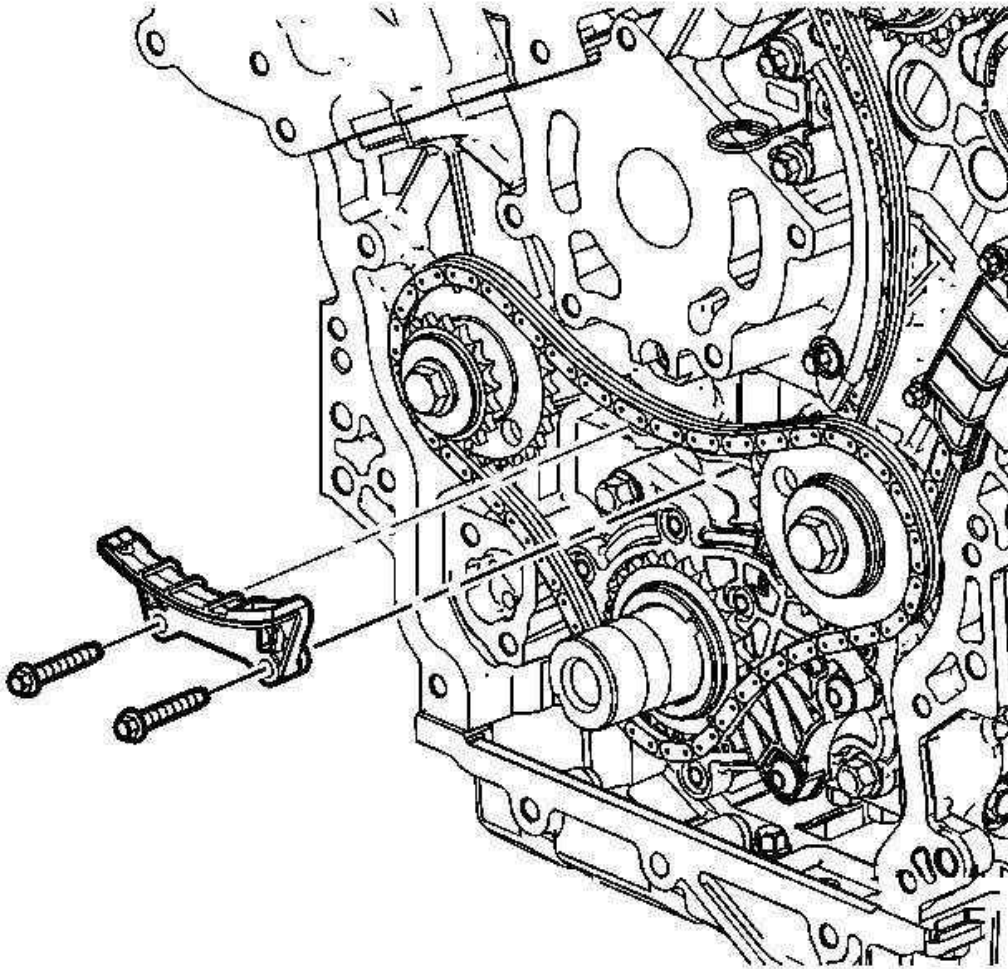


Fig. 136: View Of Upper Primary Camshaft Drive Chain Guides
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine front cover. Refer to **Engine Front Cover Replacement**.
2. Remove the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Removal (Fourth Design)** .
3. Remove the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Removal - Upper (Fourth Design)** .

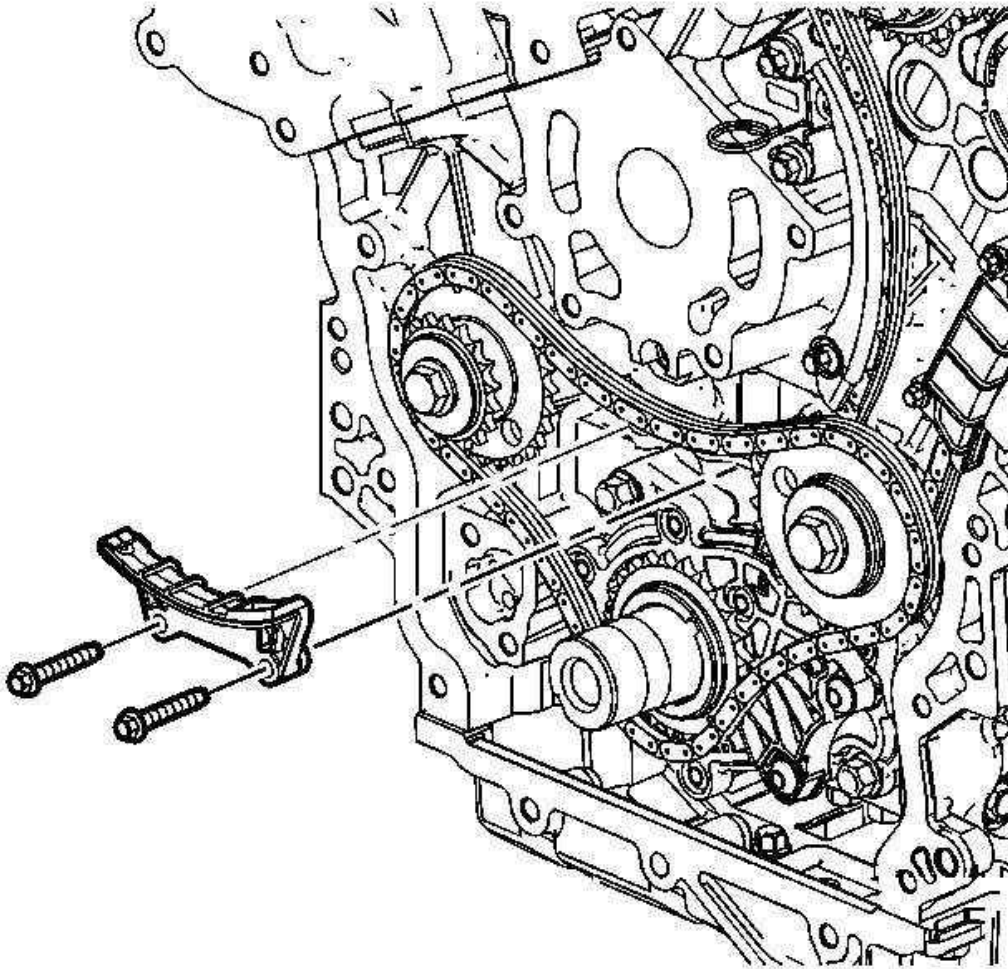


Fig. 137: View Of Upper Primary Camshaft Drive Chain Guides
Courtesy of GENERAL MOTORS CORP.

1. Install the primary upper camshaft drive chain guide. Refer to **Primary Camshaft Drive Chain Guide Installation - Upper (Fourth Design)** .
2. Install the primary camshaft drive chain tensioner. Refer to **Primary Camshaft Drive Chain Tensioner Installation (Fourth Design)** .
3. Install the engine front cover. Refer to **Engine Front Cover Replacement**.

DESIGN)

Tools Required

EN 46108 Timing Chain Retention Tool. See **Special Tools** .

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
2. Remove the left bank camshaft cover. Refer to **Camshaft Cover Replacement - Left Side**.
3. Remove the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Intake** .
4. Remove the camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Intake** .

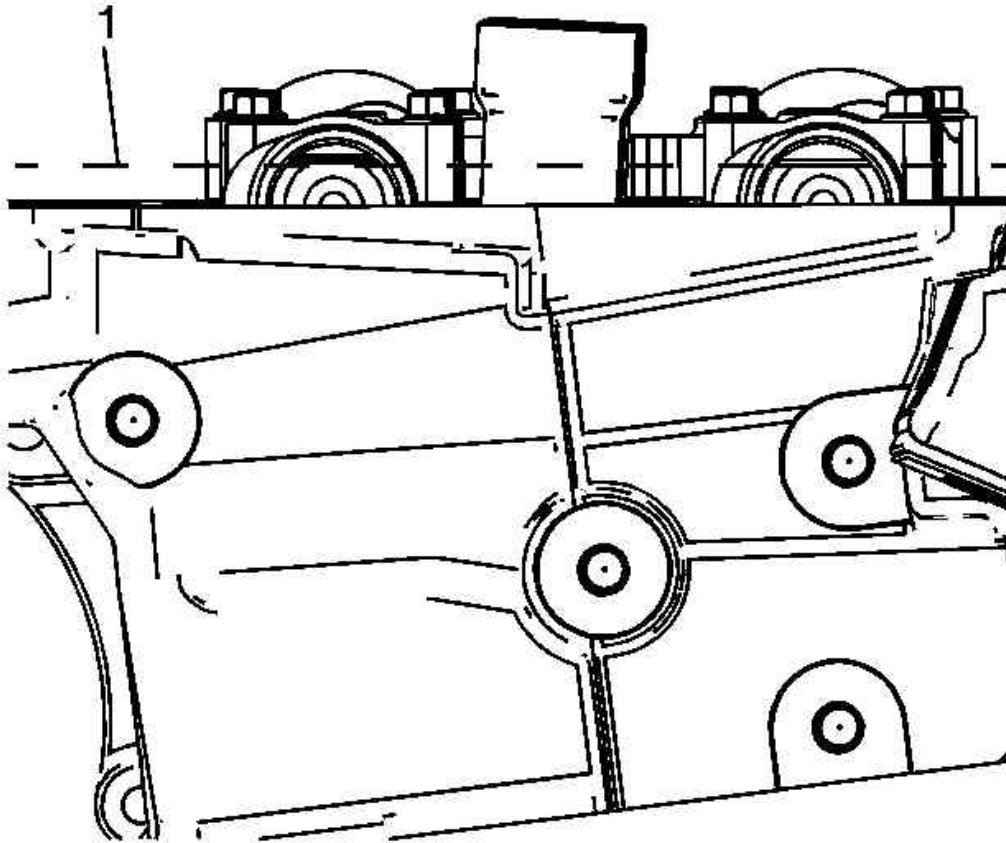


Fig. 138: Rotating Camshaft Flats Parallel With Camshaft Cover Rail
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Rotate the crankshaft balancer in a clockwise rotation ONLY.

5. Rotate the crankshaft using the crankshaft balancer bolt until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

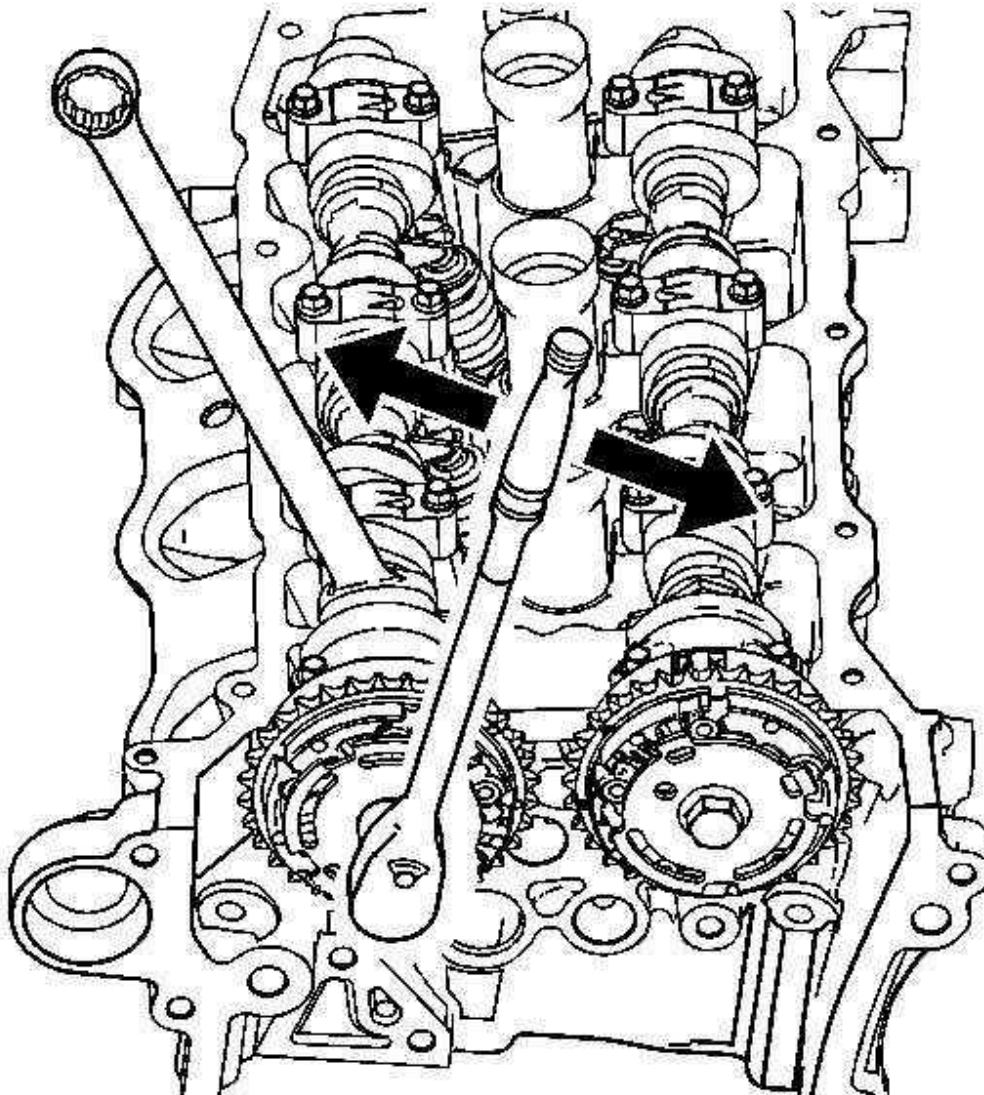


Fig. 139: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

- 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.

6. 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). See Special Tools .

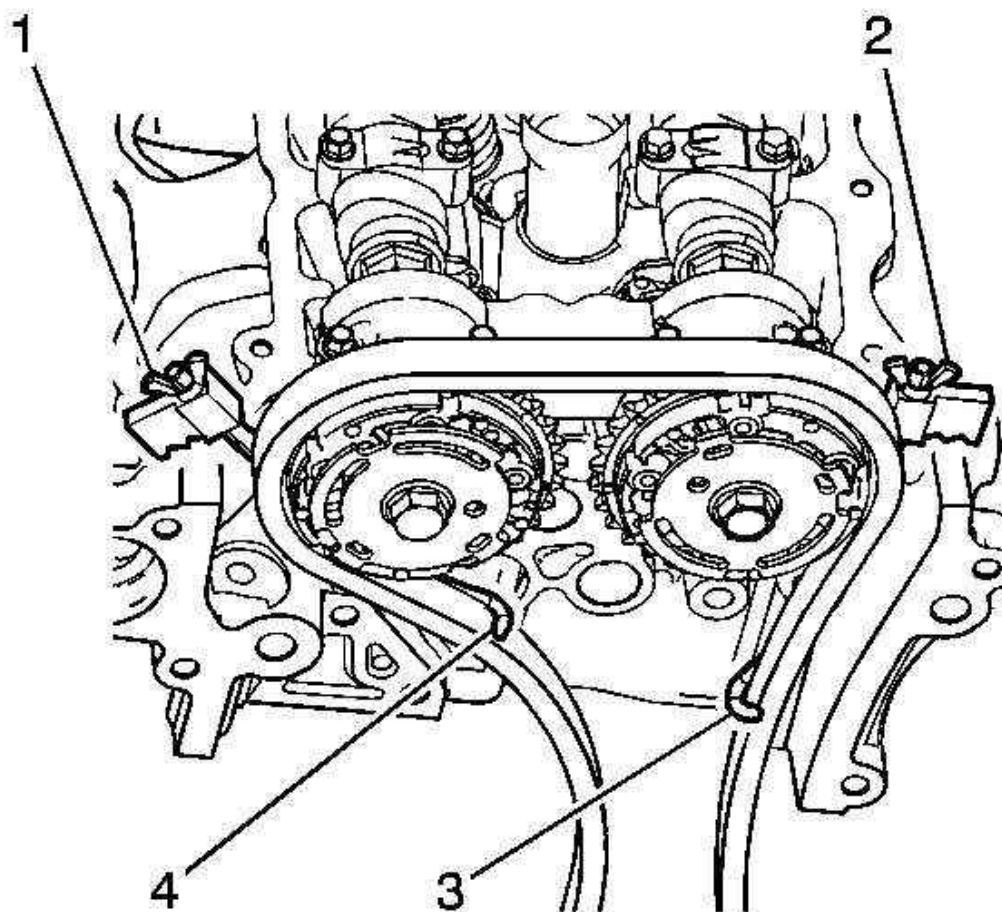


Fig. 140: Identifying EN 46108 & Timing Chain
Courtesy of GENERAL MOTORS CORP.

7. Install the **EN 46108** (1 and 2) in order to retain the timing chain. See **Special Tools** .

Firmly tighten the **EN 46108** nuts. See **Special Tools** .

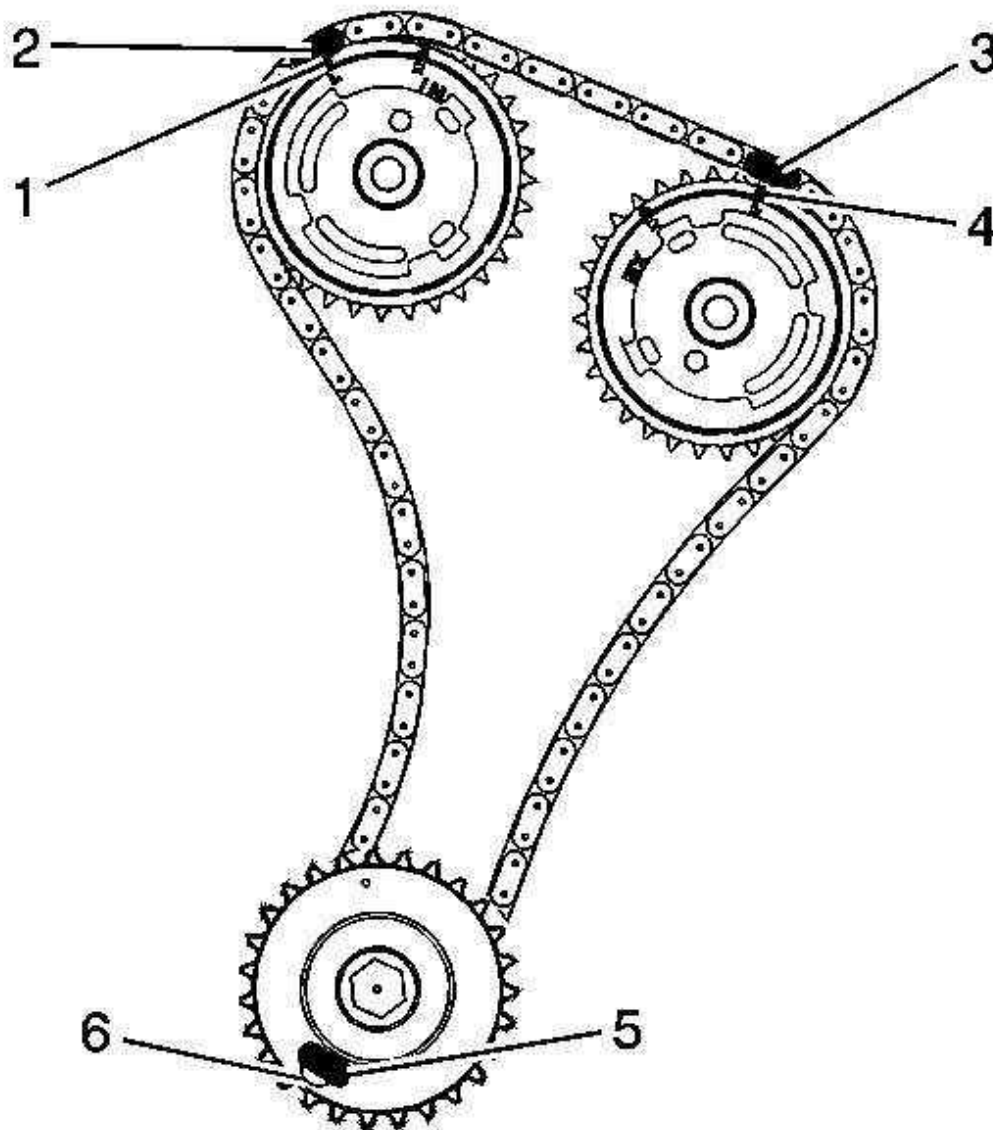


Fig. 141: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

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

assembly.

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

Installation Procedure

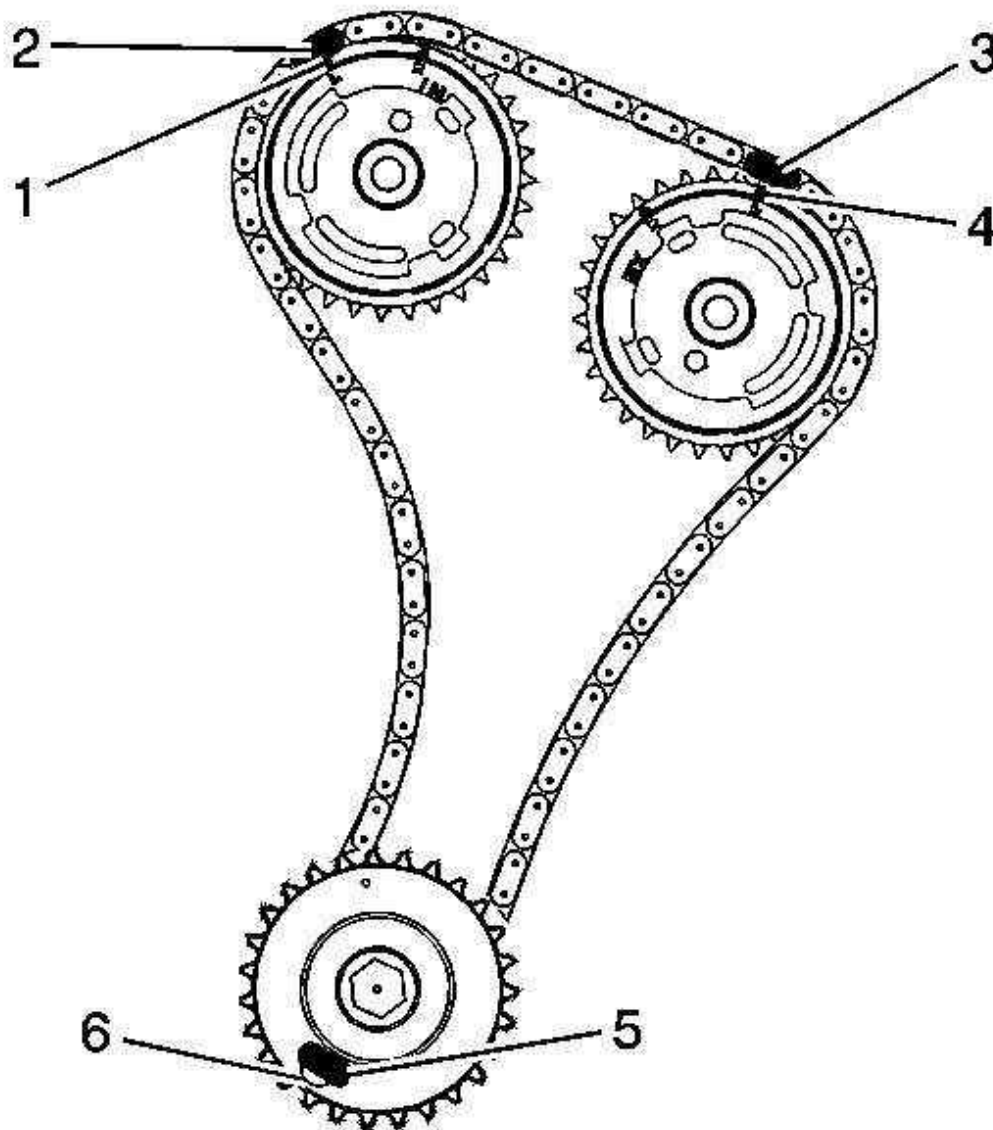


Fig. 142: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

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

2008 Buick LaCrosse CX

2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

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

1. Locate the camshaft position actuator to the camshaft and loosely install the bolt.
2. Remove the **EN 46108** . See **Special Tools** .

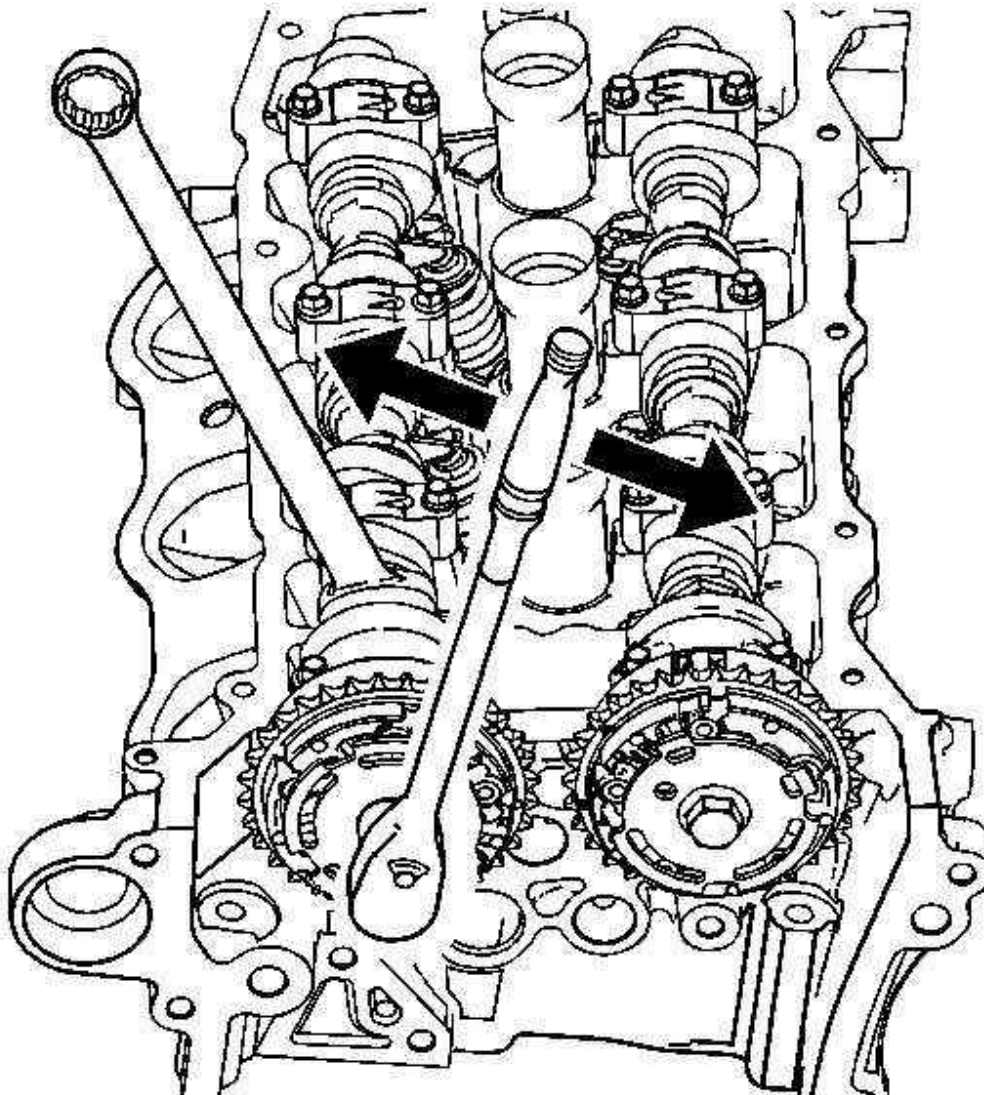


Fig. 143: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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

3. Tighten the camshaft position actuator bolt. Refer to **Camshaft Position Actuator Installation - Left Side Exhaust (Fourth Design)** .
4. Install the camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Intake** .
5. Install the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Intake** .
6. Install the camshaft cover. Refer to **Camshaft Cover Replacement - Left Side**.
7. Install the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

CAMSHAFT POSITION ACTUATOR REPLACEMENT - BANK 2 (LEFT SIDE) EXHAUST (FOURTH DESIGN)

Tools Required

EN-48313 Timing Chain Retention Tool. See **Special Tools** .

Removal Procedure

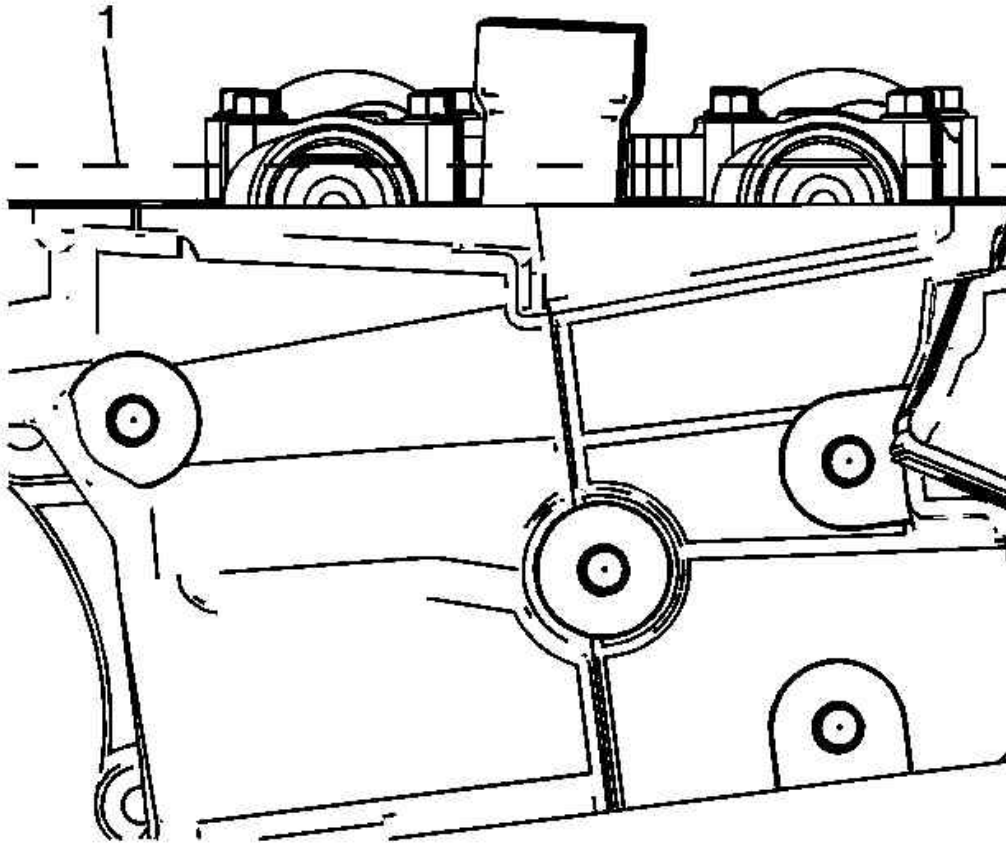


Fig. 144: Rotating Camshaft Flats Parallel With Camshaft Cover Rail
Courtesy of GENERAL MOTORS CORP.

1. Remove the lower intake manifold with the upper manifold. Refer to **Lower Intake Manifold Replacement**.
2. Remove the left camshaft cover. Refer to **Camshaft Cover Replacement - Left Side**.
3. Remove the left intake and exhaust camshaft position sensors. Refer to **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Intake** and **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Exhaust**.
4. Remove the left intake and exhaust camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement -**

Bank 2 (Left Side) Intake and Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Exhaust .

IMPORTANT: Rotate the crankshaft balancer bolt in a clockwise direction ONLY.

5. Rotate the crankshaft balancer using the balancer bolt until the camshafts are in a neutral (low tension) position. The camshafts will be parallel with the camshaft cover rail (1).

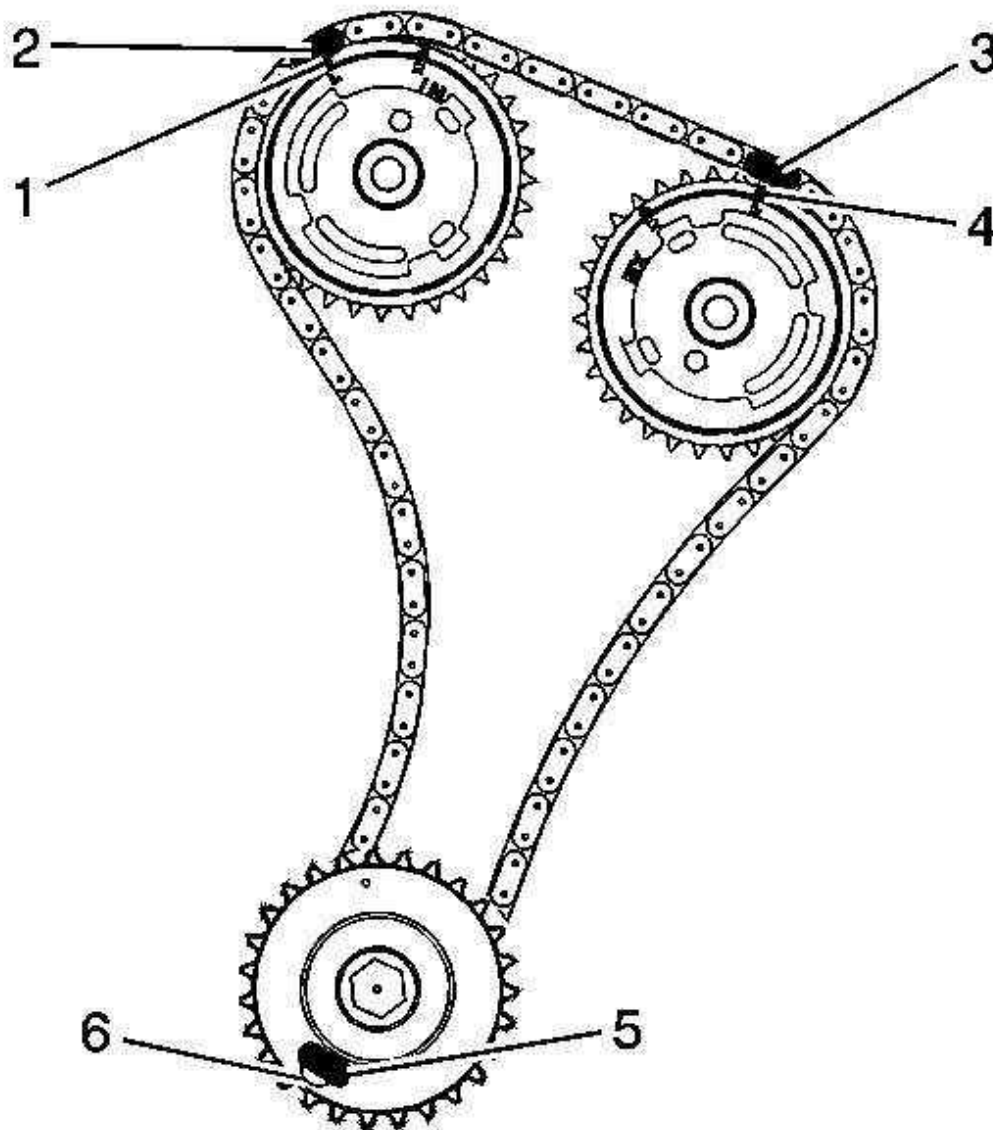


Fig. 145: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

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

assembly.

6. Use a paint stick to create an alignment mark on one of the timing chain links (2) and the adjacent tooth on the exhaust camshaft position actuator (1).
7. Use a paint stick to create an alignment mark on one of the timing chain links (3) and the adjacent tooth on the intake camshaft position actuator (4).

NOTE: **Refer to Torque Reaction Against Timing Drive Chain Notice .**

8. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.

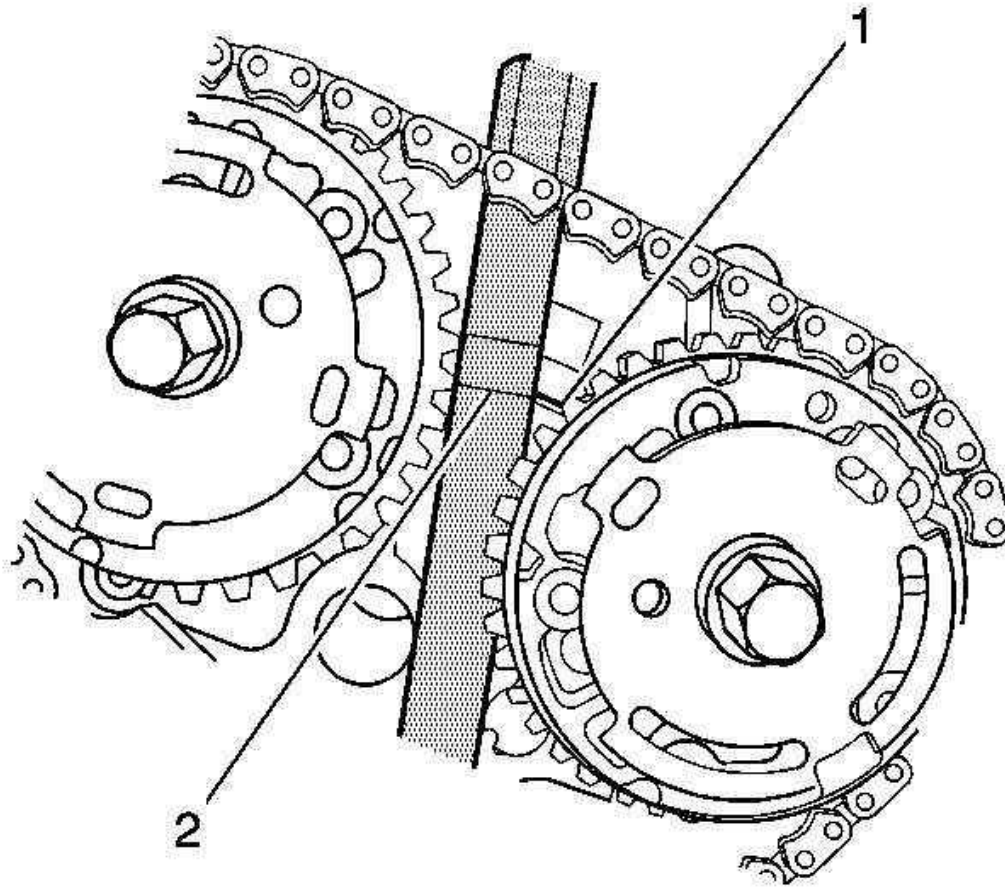


Fig. 146: Inserting Timing Chain Retention Tool
Courtesy of GENERAL MOTORS CORP.

9. Unscrew the **EN-48313** so that the legs of the tool are retracted. See **Special Tools** .
10. Insert the **EN-48313** between the camshaft actuators, rearward of the timing chain until the bottom line that is scribed in the body of the tool (2) is adjacent to the top surface of the cylinder head (1). See **Special Tools** . This is the approximate installed position.

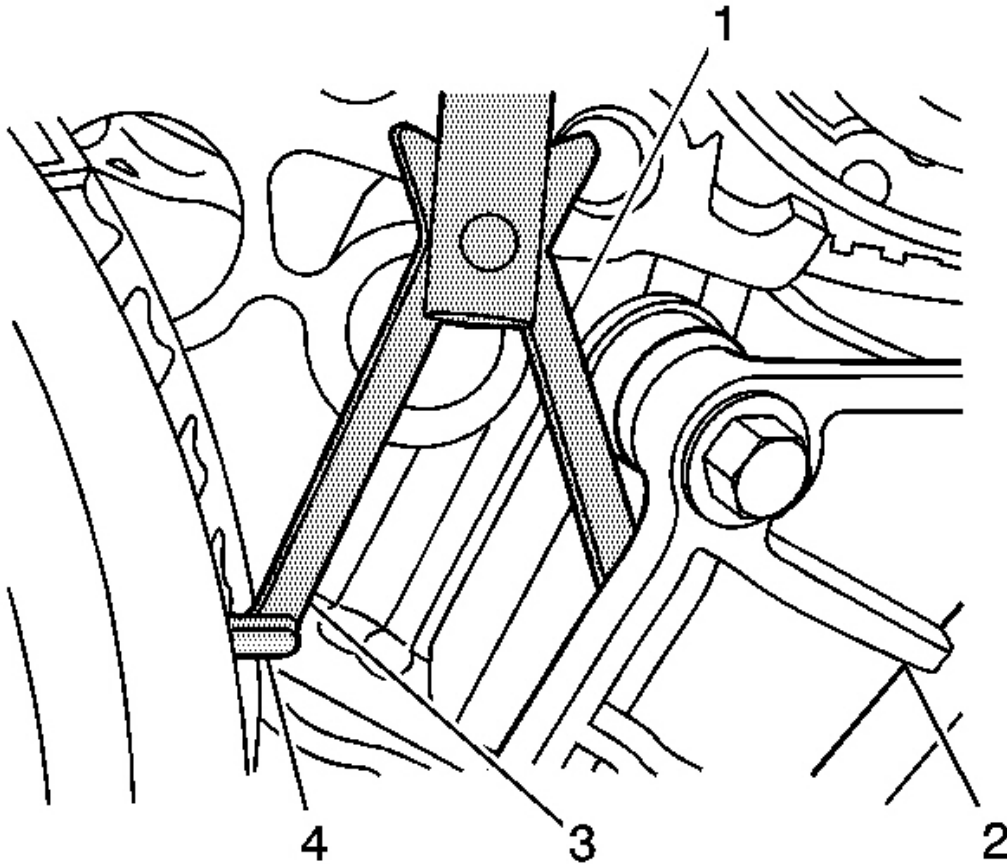


Fig. 147: View Of Feet, Legs & Timing Chain Guide
 Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

11. Ensure that the feet (4) on the legs of the tool are facing the front of the engine.
12. Partially expand the legs (1, 3) of the **EN-48313** by turning the T-shaped handle clockwise. See **Special Tools** .
13. Insert the leg of the tool (1) behind the timing chain guide (2).

14. Continue expanding the **EN-48313** until the legs (1, 3) contact the timing chain. See **Special Tools** . Do not tighten at this time.

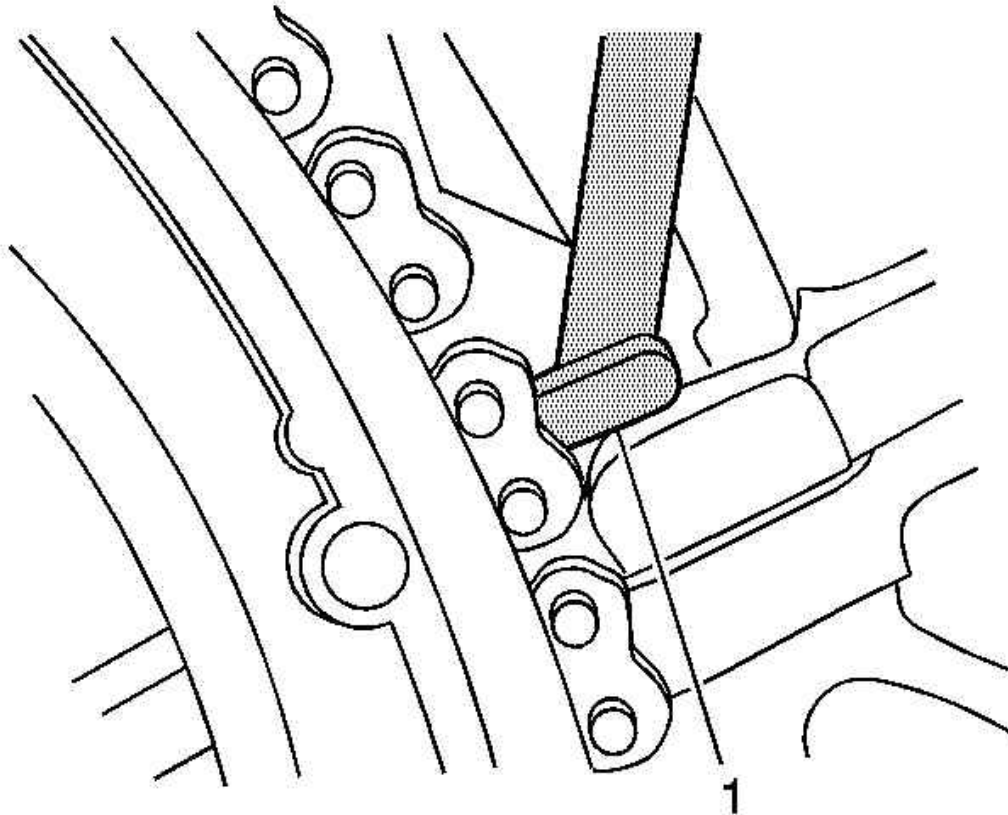


Fig. 148: Identifying Foot Of Special Tool EN-48313
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the foot (1) of the EN-48313 is engaged into one of the link pockets to prevent tool slippage during tightening of the EN-48313 . See **Special Tools** .

15. Hand tighten the **EN-48313** . See **Special Tools** .

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

16. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.

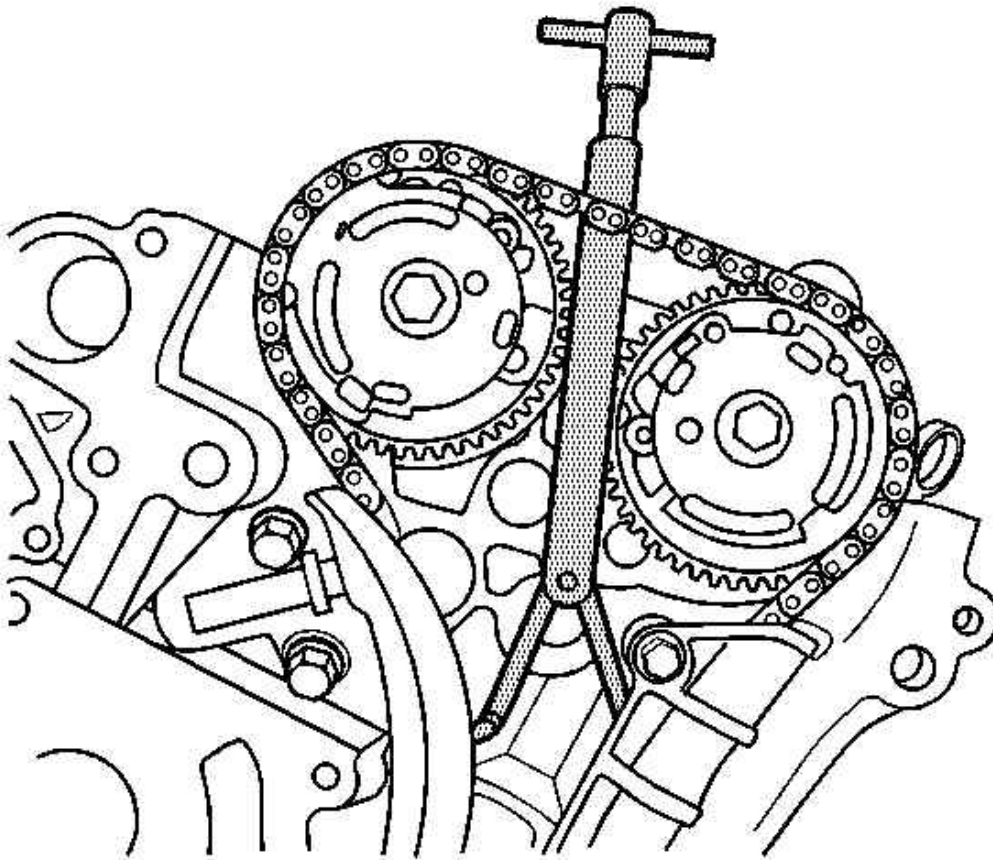


Fig. 149: Identifying Special Tool - EN-48313
Courtesy of GENERAL MOTORS CORP.

17. The **EN-48313** is now properly installed to hold the timing chain in position. See Special Tools .

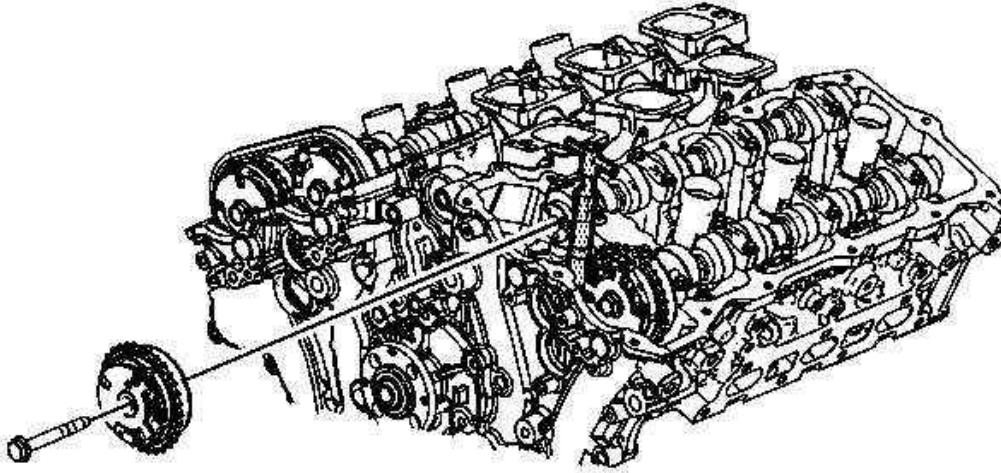


Fig. 150: View Of Exhaust Camshaft Position Actuator Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

18. Use an open end wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.
19. Remove the left exhaust camshaft position actuator bolt.
20. Remove the left exhaust camshaft position actuator. When removing the actuator, place the chain on the engine block side of the actuators.
21. Rotate the actuator in order to align the opening in the actuator reluctor wheel with the cam sensor boss in the front cover, to allow actuator removal.
22. If removing both the exhaust and intake camshaft actuators, the timing chain can be draped over the **EN-48313** once the actuators have been removed. See Special Tools .

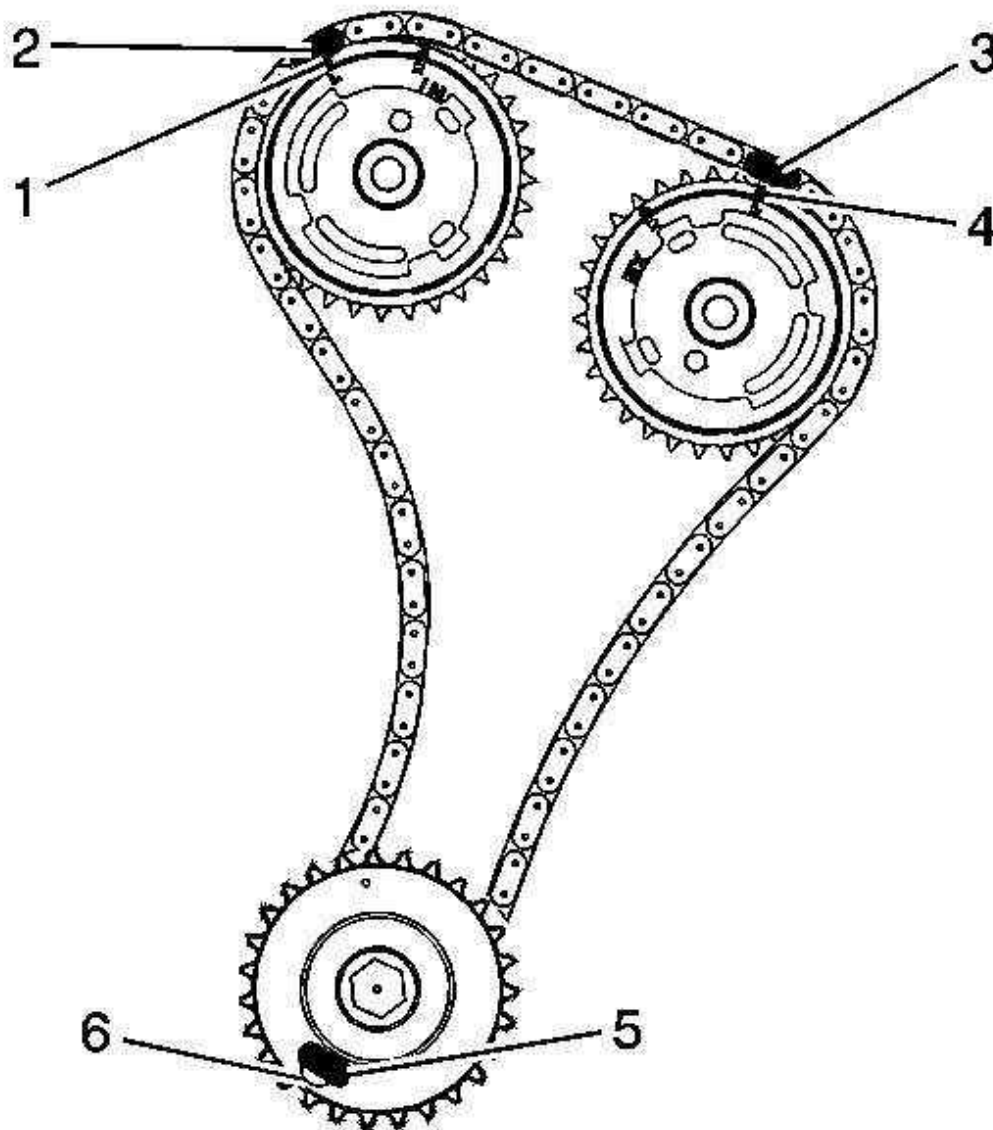


Fig. 151: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

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

assembly.

1. Align the exhaust camshaft actuator alignment mark (1) to the timing chain alignment mark (2) made during disassembly.
2. Ensure that the intake camshaft actuator alignment mark (4) and the timing chain alignment mark (3) are also aligned.
3. Position the exhaust camshaft actuator to the camshaft and install the actuator bolt hand tight.
4. Remove the **EN-48313** . See **Special Tools** .

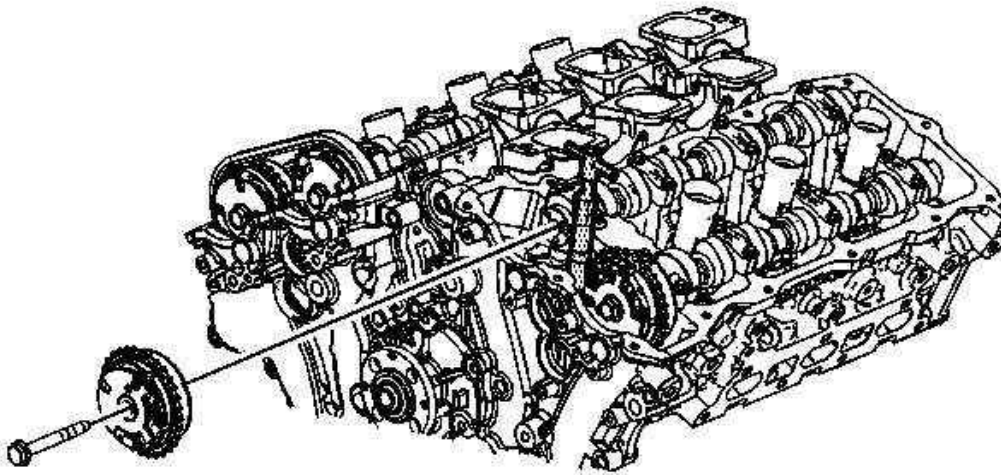


Fig. 152: View Of Exhaust Camshaft Position Actuator Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to **Fastener Notice** .

5. Tighten the exhaust camshaft position actuator bolt.

Tighten: Tighten the bolt to 58 N.m (43 lb ft).

6. Install the left intake and exhaust camshaft position actuator solenoids. Refer to

Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Intake and Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Exhaust .

7. Install the left intake and exhaust camshaft position sensors. Refer to **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Intake and Camshaft Position Sensor Replacement - Bank 2 (Left Side) Exhaust .**
8. Install the left camshaft cover. Refer to **Camshaft Cover Replacement - Left Side.**
9. Install the lower intake manifold with the upper manifold. Refer to **Lower Intake Manifold Replacement.**

CAMSHAFT POSITION ACTUATOR REPLACEMENT - BANK 1 (RIGHT SIDE) EXHAUST (FIRST DESIGN)

Tools Required

EN 46108 Timing Chain Retention Tool. See **Special Tools .**

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement.**
2. Remove the camshaft cover. Refer to **Camshaft Cover Replacement - Right Side.**
3. Remove the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Intake .**
4. Remove the intake camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Intake .**

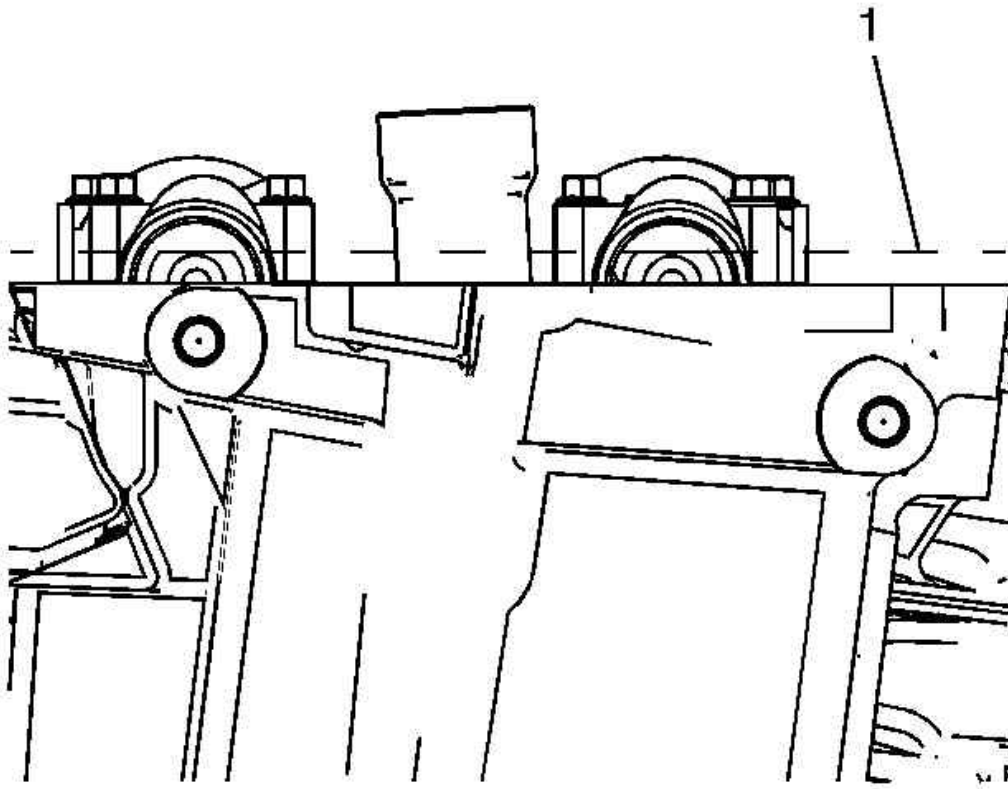


Fig. 153: Identifying Camshaft Neutral (Low Tension) Position
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Rotate the crankshaft balancer in a clockwise rotation **ONLY**.

5. Rotate the crankshaft using the crankshaft balancer bolt until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

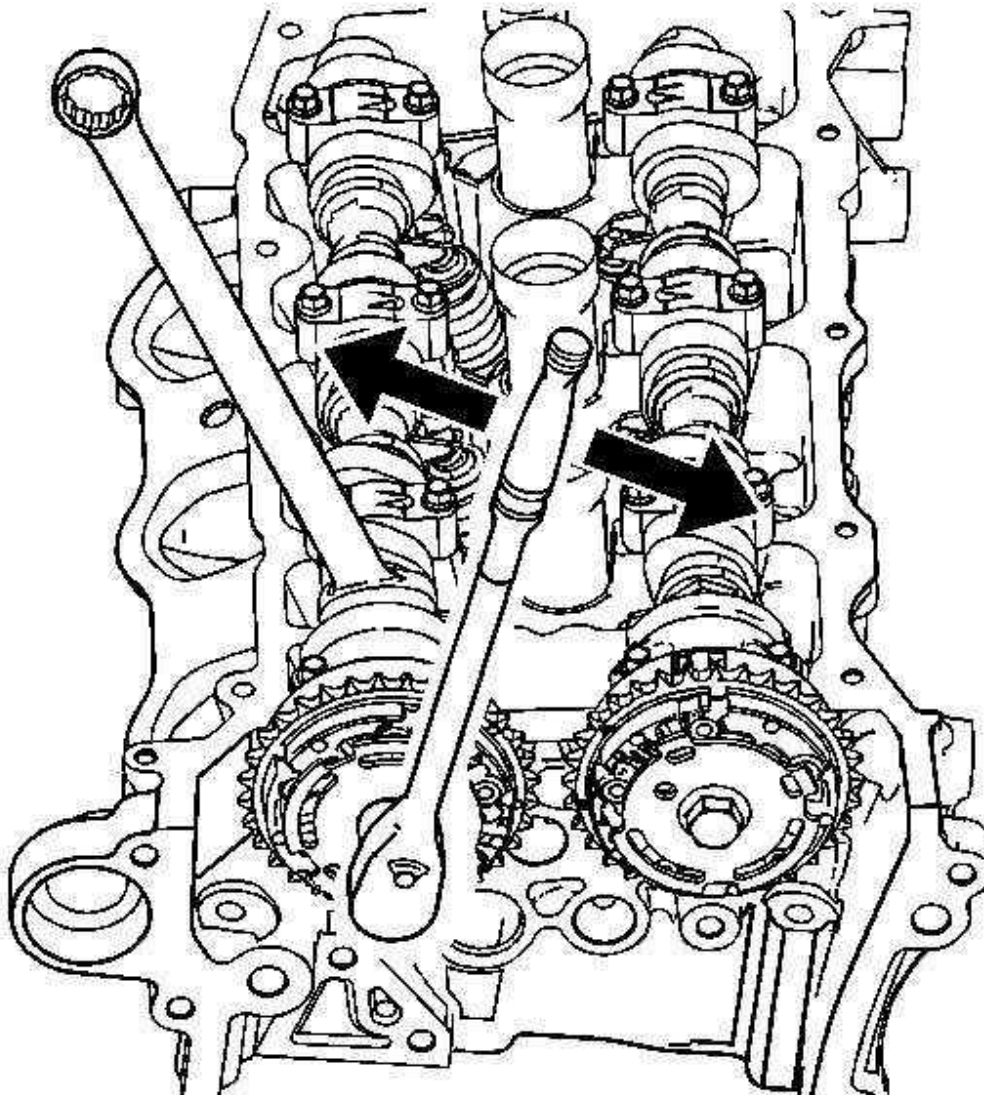


Fig. 154: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

- 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.

6. 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). See Special Tools .

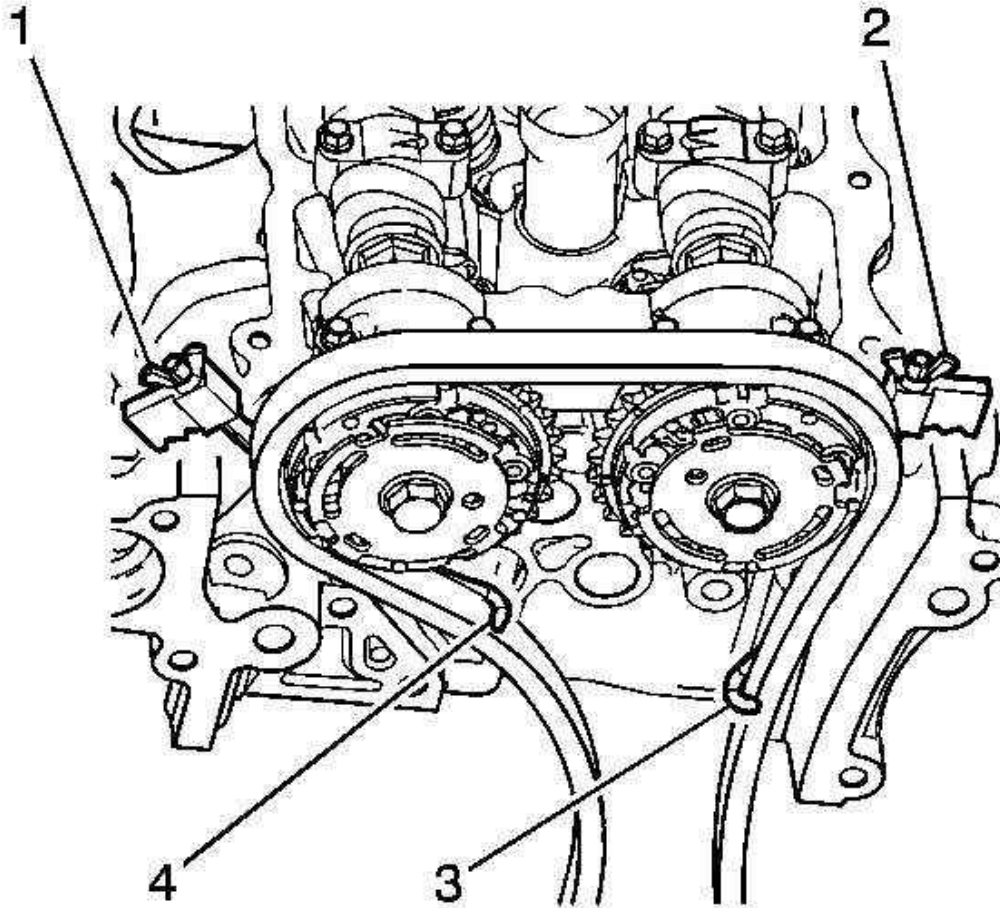


Fig. 155: Identifying EN 46108 & Timing Chain
Courtesy of GENERAL MOTORS CORP.

7. Install the **EN 46108** (1 and 2) in order to retain the timing chain. See **Special Tools** .

Firmly tighten the **EN 46108** nuts. See **Special Tools** .

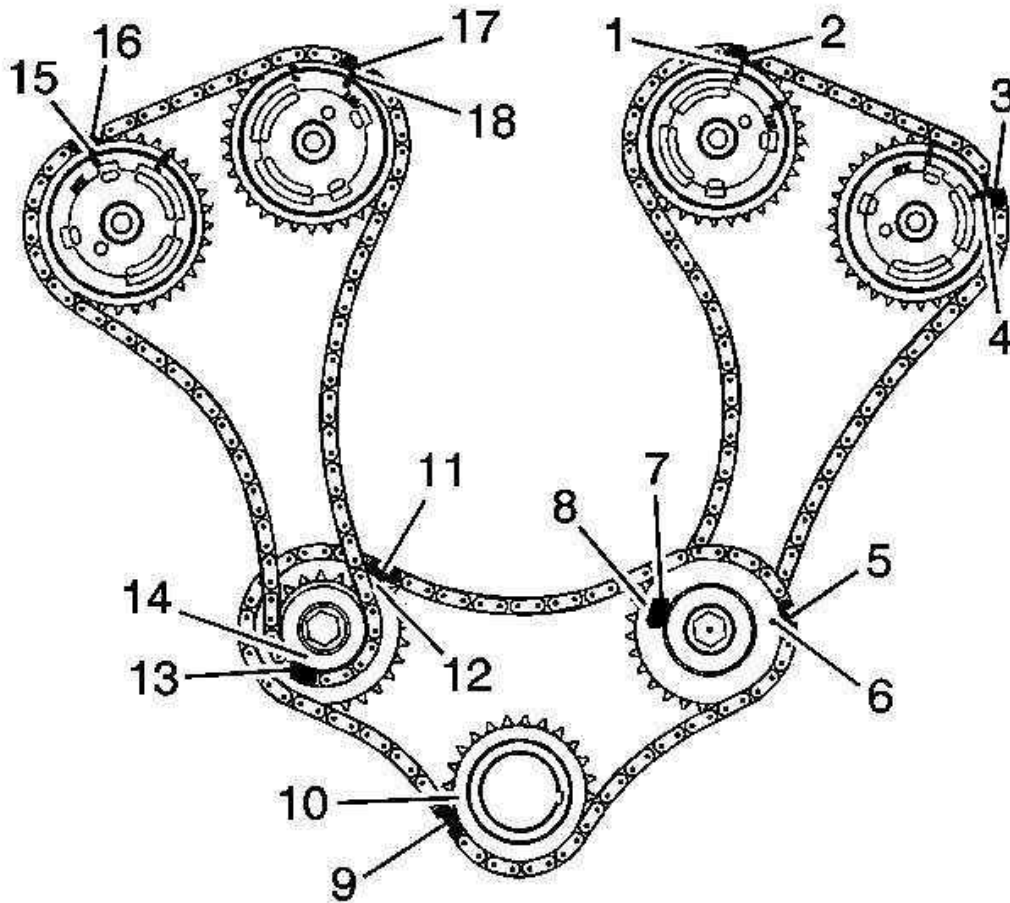


Fig. 156: Identifying Timing Chain Marks & Their Respective Locations On Gears, Sprockets & Actuators

Courtesy of GENERAL MOTORS CORP.

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

8. Mark the timing chain and the respective locations on camshaft position actuators (15-18).
9. Remove the right exhaust camshaft position actuator bolt.

10. Remove the right exhaust camshaft actuator.

Installation Procedure

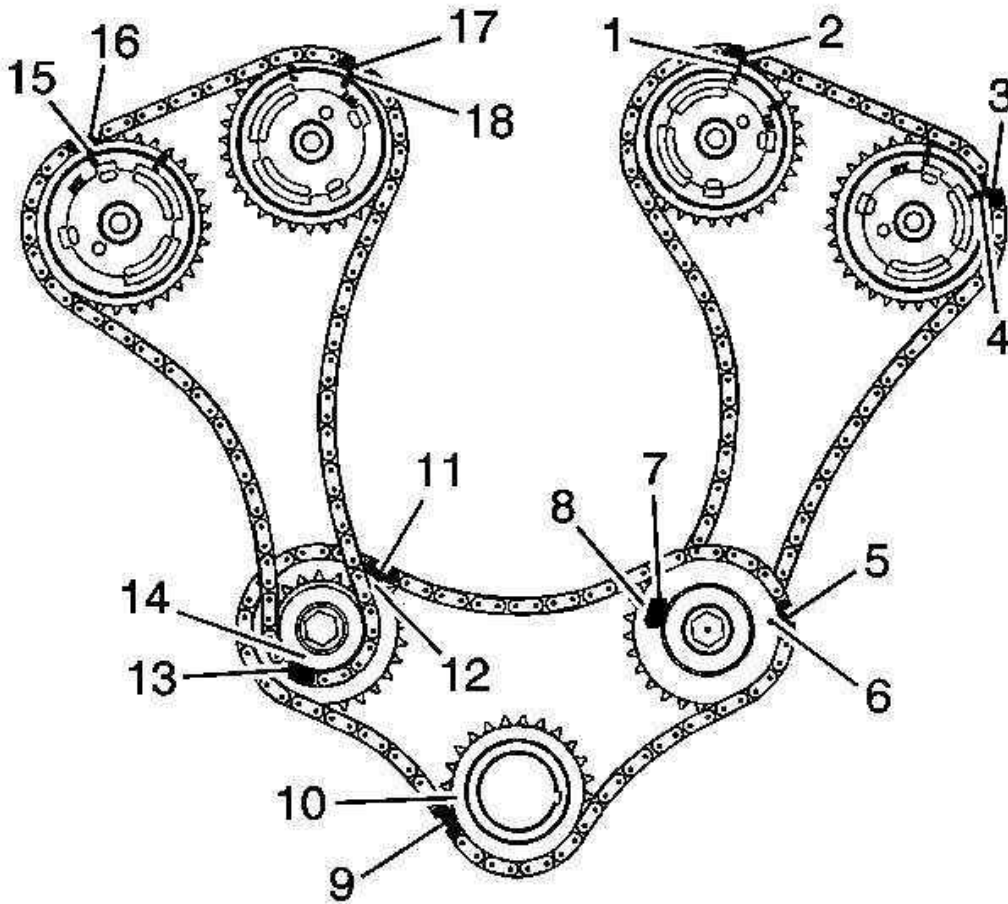


Fig. 157: Identifying Timing Chain Marks & Their Respective Locations On Gears, Sprockets & Actuators
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- Ensure that the marks on the camshaft position actuators and the timing chain (15-18) are aligned.

2008 Buick LaCrosse CX

2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

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

1. Assemble the camshaft actuator to the camshaft.
2. Loosely install the camshaft actuator bolt.
3. Remove the **EN 46108** . See **Special Tools** .

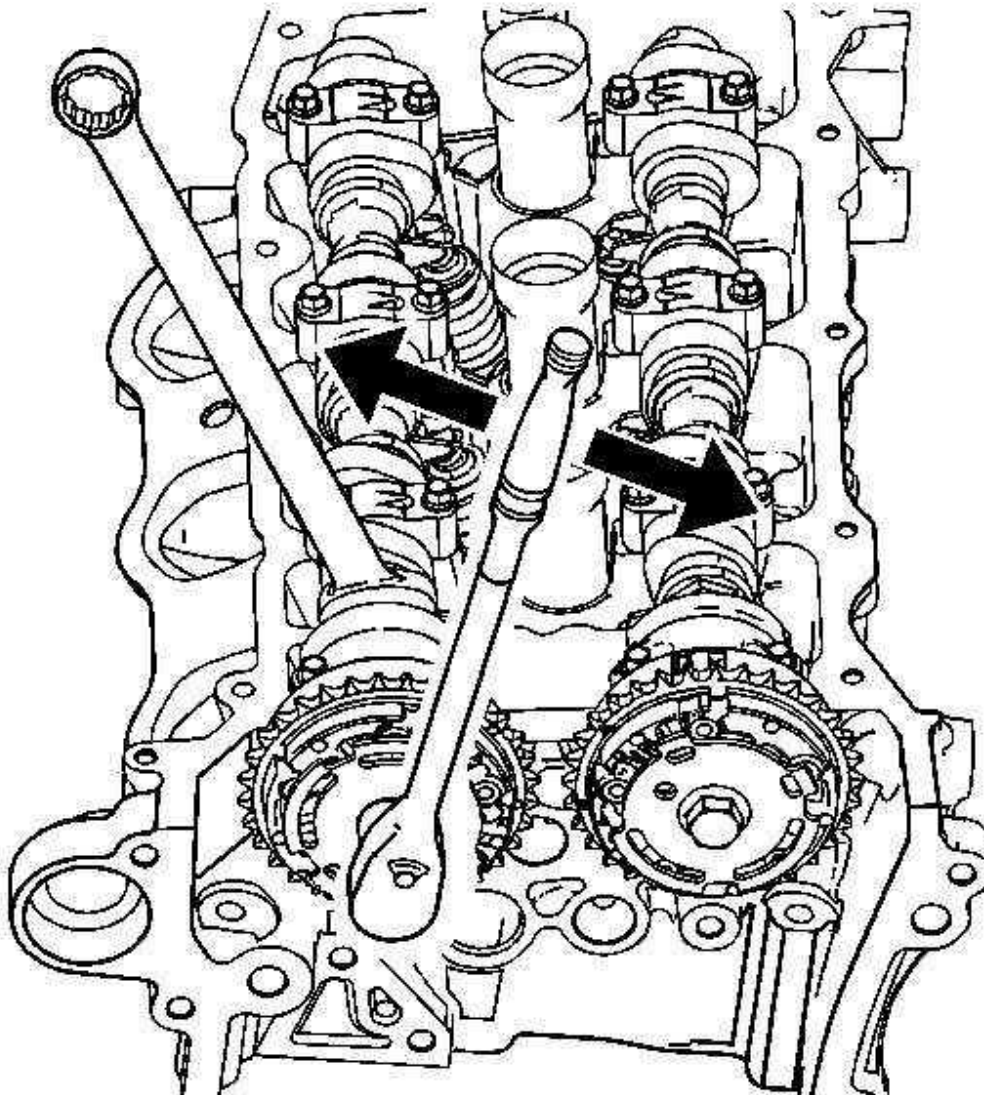


Fig. 158: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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

4. Tighten the camshaft position actuator. Refer to **Camshaft Position Actuator Installation - Right Side Exhaust (Fourth Design)** .
5. Install the intake camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Intake** .
6. Install the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Intake** .
7. Install the camshaft cover. Refer to **Camshaft Cover Replacement - Right Side**.
8. Install the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

CAMSHAFT POSITION ACTUATOR REPLACEMENT - BANK 1 (RIGHT SIDE) EXHAUST (SECOND DESIGN)

Tools Required

EN-48313 Timing Chain Retention Tool. See **Special Tools** .

Removal Procedure

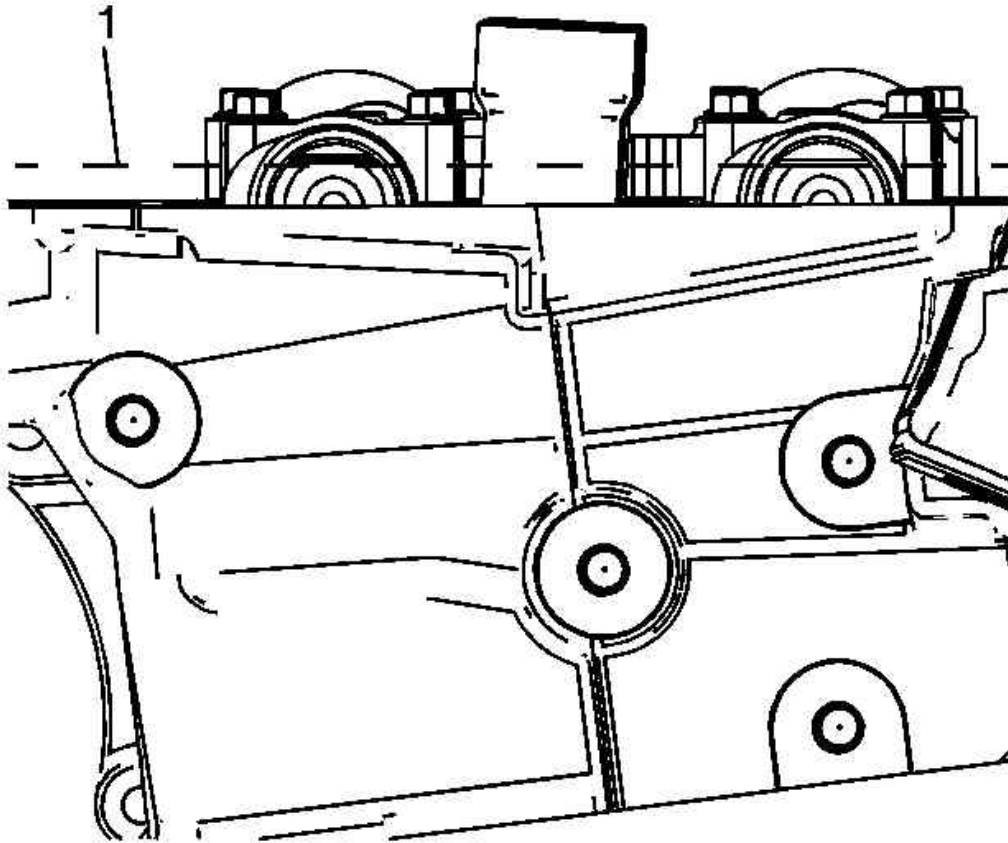


Fig. 159: Rotating Camshaft Flats Parallel With Camshaft Cover Rail
Courtesy of GENERAL MOTORS CORP.

1. Remove the lower intake manifold with the upper manifold. Refer to **Lower Intake Manifold Replacement**.
2. Remove the right camshaft cover. Refer to **Camshaft Cover Replacement - Right Side**.
3. Remove the right intake and exhaust camshaft position sensors. Refer to **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Intake** and **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Exhaust**.
4. Remove the right intake and exhaust camshaft position actuator solenoids. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement**.

- Bank 1 (Right Side) Intake and Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Exhaust .

IMPORTANT: Rotate the crankshaft balancer bolt in a clockwise direction ONLY.

5. Rotate the crankshaft balancer using the balancer bolt until the camshafts are in a neutral (low tension) position. The camshafts will be parallel with the camshaft cover rail (1).

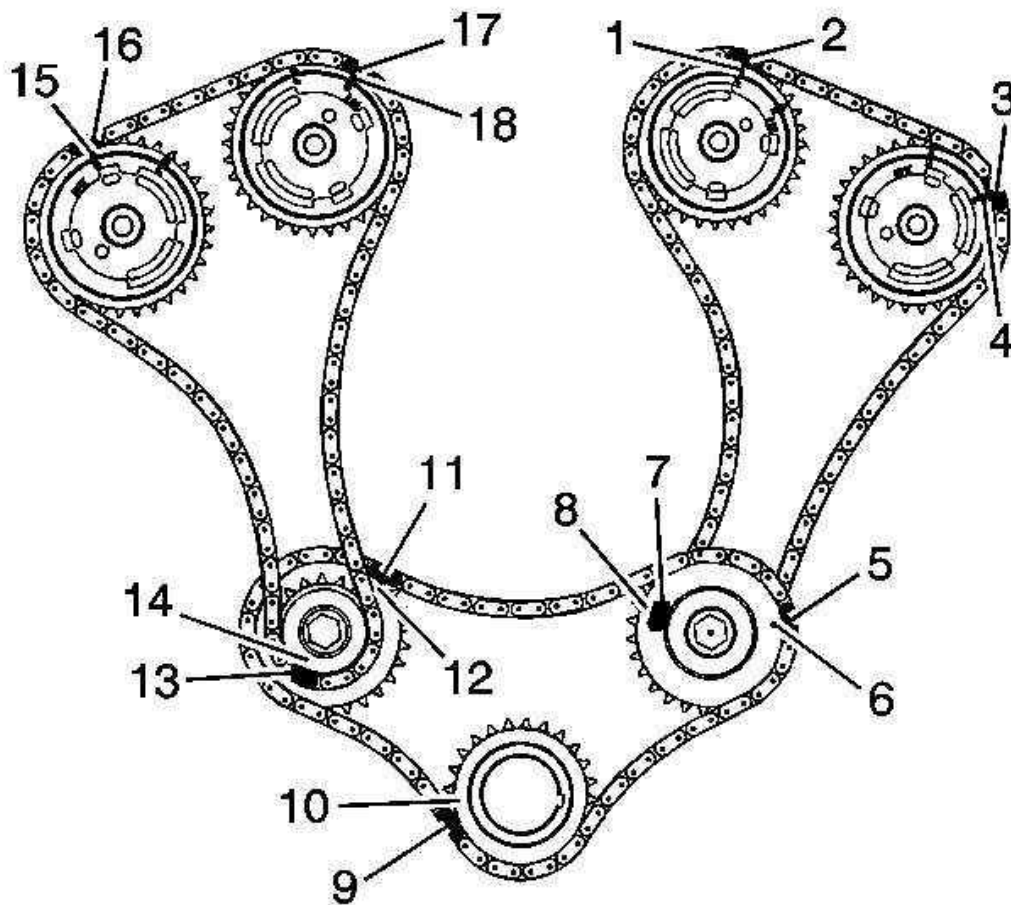


Fig. 160: Identifying Timing Chain Marks & Their Respective Locations On Gears, Sprockets & Actuators

Courtesy of GENERAL MOTORS CORP.

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

6. Use a paint stick to create an alignment mark (17) on one of the timing chain links and the adjacent tooth on the exhaust camshaft position actuator (18).
7. Use a paint stick to create an alignment mark (16) on one of the timing chain links and the adjacent tooth on the intake camshaft position actuator (15).

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

8. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.

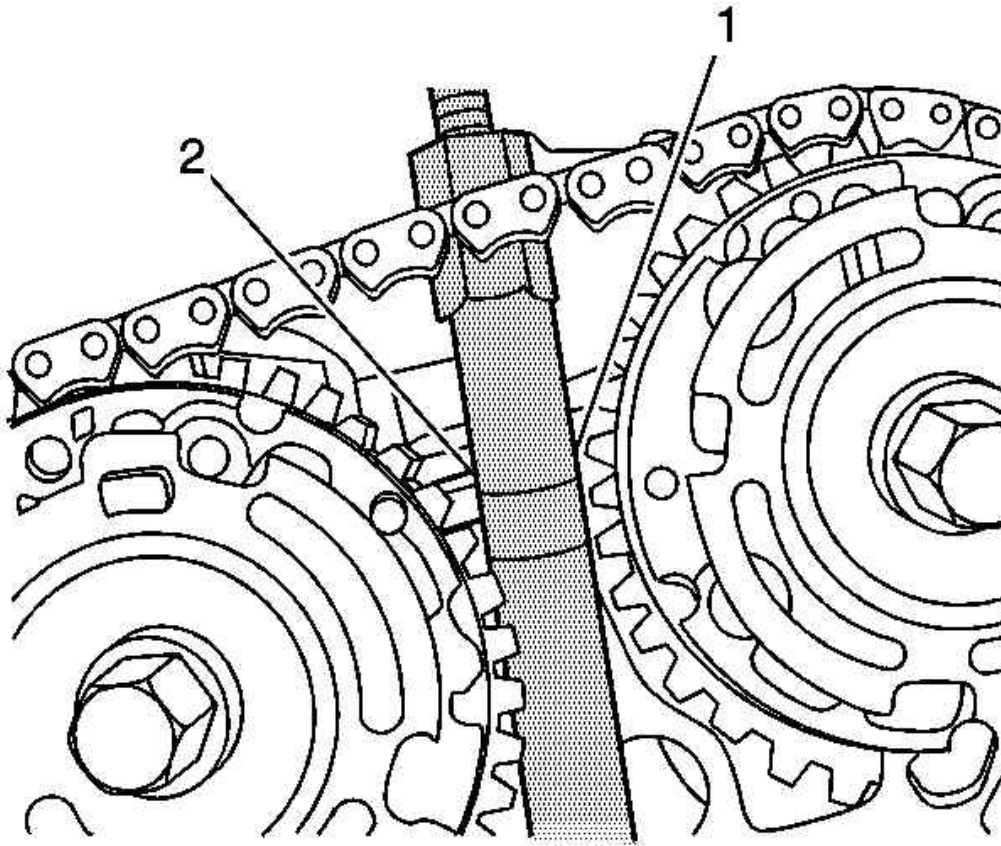


Fig. 161: View Of Cylinder Head & Special Tool
Courtesy of GENERAL MOTORS CORP.

9. Unscrew the **EN-48313** so that the legs of the tool are retracted. See **Special Tools** .
10. Insert the **EN-48313** between the camshaft actuators, rearward of the timing chain until the top line that is scribed in the body of the tool (1) is adjacent to the top surface of the cylinder head (2). See **Special Tools** . This is the approximate installed position.

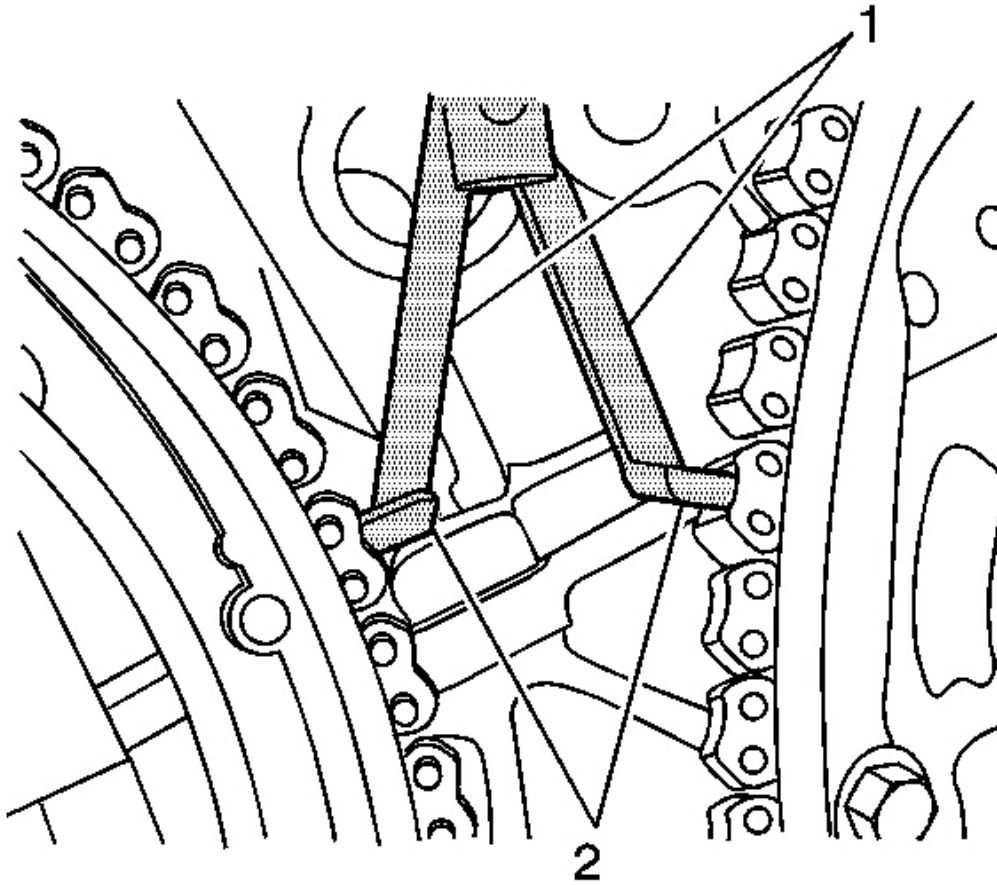


Fig. 162: View Of Feet, Legs & Timing Chain Guide
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

11. Ensure that the feet (2) on the legs of the tool are facing the front of the engine.
12. Partially expand the legs (1) of the **EN-48313** by turning the T-shaped handle clockwise. See **Special Tools** .
13. Continue expanding the **EN-48313** until the feet (1) contact the timing chain.

See **Special Tools** . Do not tighten at this time.

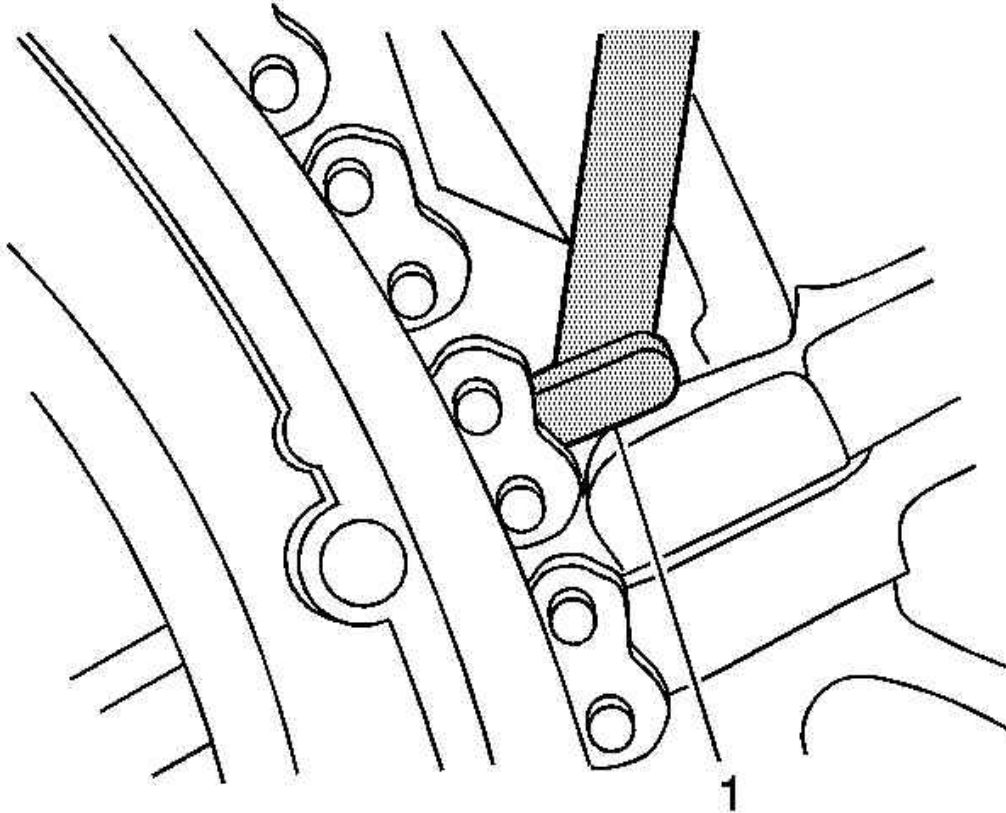


Fig. 163: Identifying Foot Of Special Tool EN-48313
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the foot (1) of the EN-48313 is engaged into one of the link pockets to prevent chain slippage during tightening of the EN-48313 . See **Special Tools** .

IMPORTANT: Do not allow the body of the EN-48313 to rotate when tightening the T-handle. See **Special Tools** .

14. Hand tighten the **EN-48313** . See Special Tools .

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

15. Use an open end wrench on the hex cast into the body of the **EN-48313** and hand tighten the T-handle. See Special Tools .

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

16. Use an open end wrench on the hex cast into the right intake and exhaust camshafts and rotate the camshafts towards each other in order to create slack in the chain between the actuators.

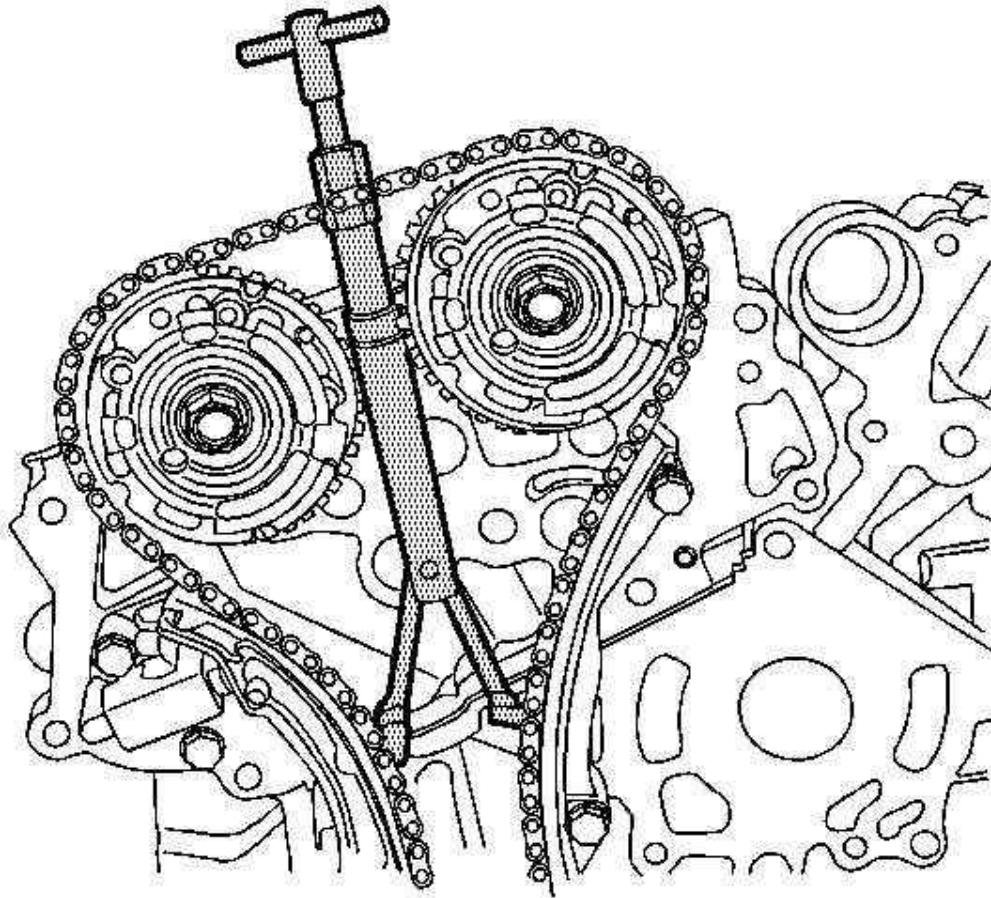


Fig. 164: View Of EN-48313 Between Actuators
Courtesy of GENERAL MOTORS CORP.

17. The **EN-48313** is now properly installed to hold the timing chain in position.
See **Special Tools** .

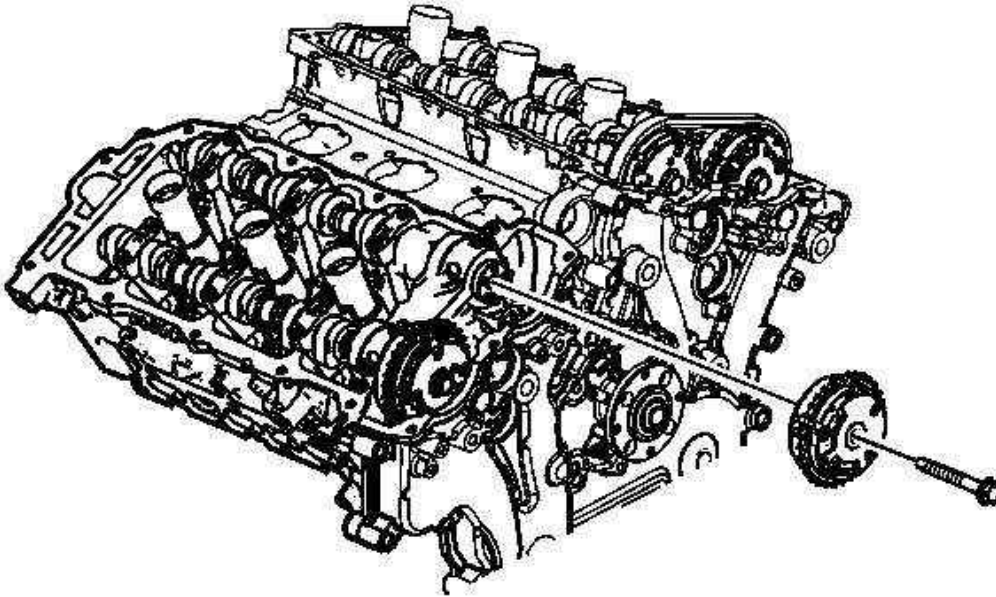


Fig. 165: View Of Right Exhaust Camshaft Position Actuator Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

18. Use an open end wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.
19. Remove the right exhaust camshaft position actuator bolt.
20. Remove the right exhaust camshaft position actuator. When removing the actuator, place the chain on the engine block side of the actuators.
21. Rotate the actuator in order to align the opening in the actuator reluctor wheel with the cam sensor boss in the front cover, to allow actuator removal.
22. If removing both the exhaust and intake camshaft actuators, the timing chain can be draped over the **EN-48313** once the actuators have been removed. See Special Tools .

Installation Procedure

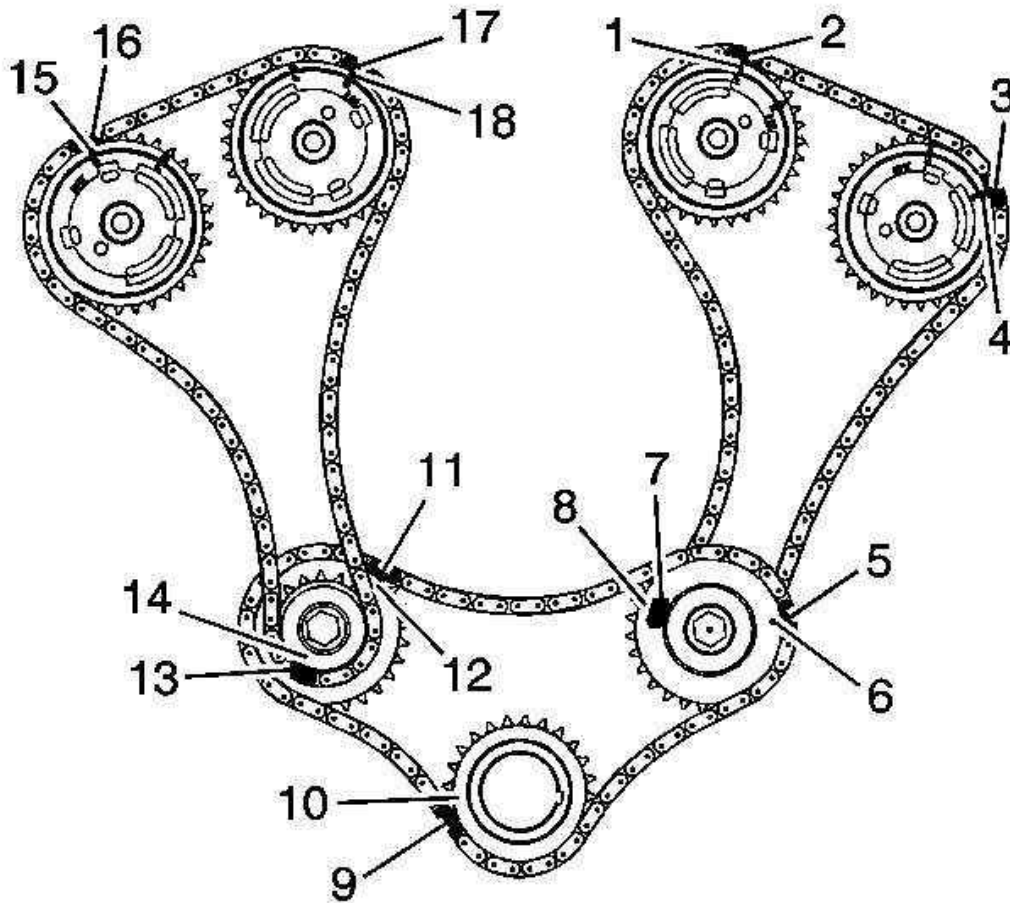


Fig. 166: Identifying Timing Chain Marks & Their Respective Locations On Gears, Sprockets & Actuators
Courtesy of GENERAL MOTORS CORP.

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

1. Align the exhaust camshaft actuator alignment mark (18) to the timing chain alignment mark (17) made during disassembly.

2. Ensure that the intake camshaft actuator alignment mark (15) and the timing chain alignment mark (16) are also aligned.
3. Position the exhaust camshaft actuator to the camshaft and install the actuator bolt hand tight.
4. Remove the **EN-48313** . See **Special Tools** .

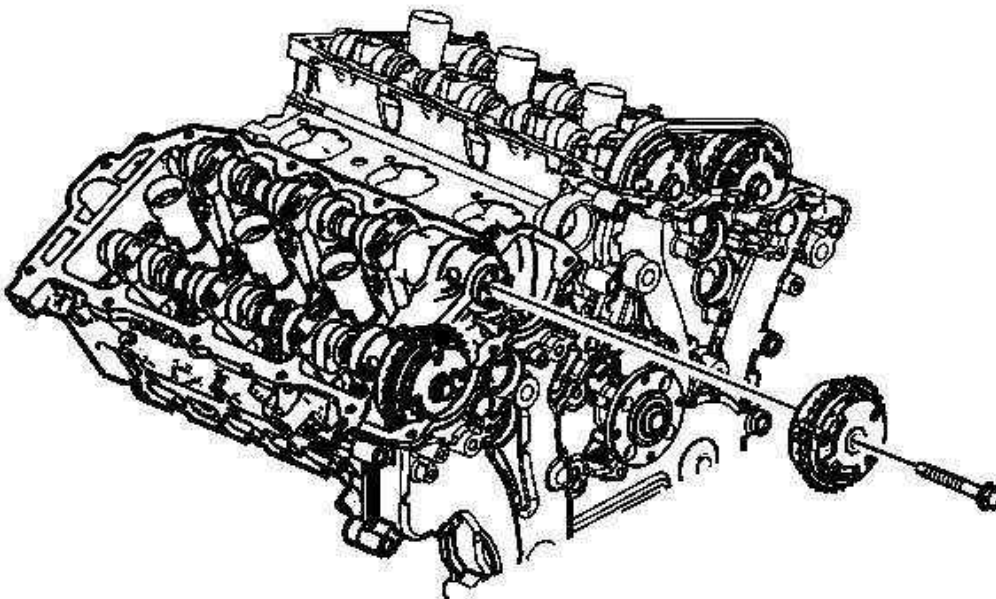


Fig. 167: View Of Right Exhaust Camshaft Position Actuator Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to **Fastener Notice** .

5. Tighten the right exhaust camshaft position actuator bolt.

Tighten: Tighten the bolt to 58 N.m (43 lb ft).

6. Install the right intake and exhaust camshaft position actuator solenoids. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement** -

Bank 1 (Right Side) Intake and Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Exhaust .

7. Install the right intake and exhaust camshaft position sensors. Refer to **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Intake and Camshaft Position Sensor Replacement - Bank 1 (Right Side) Exhaust .**
8. Install the right camshaft cover. Refer to **Camshaft Cover Replacement - Right Side.**
9. Install the lower intake manifold with the upper manifold. Refer to **Lower Intake Manifold Replacement.**

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

Removal Procedure

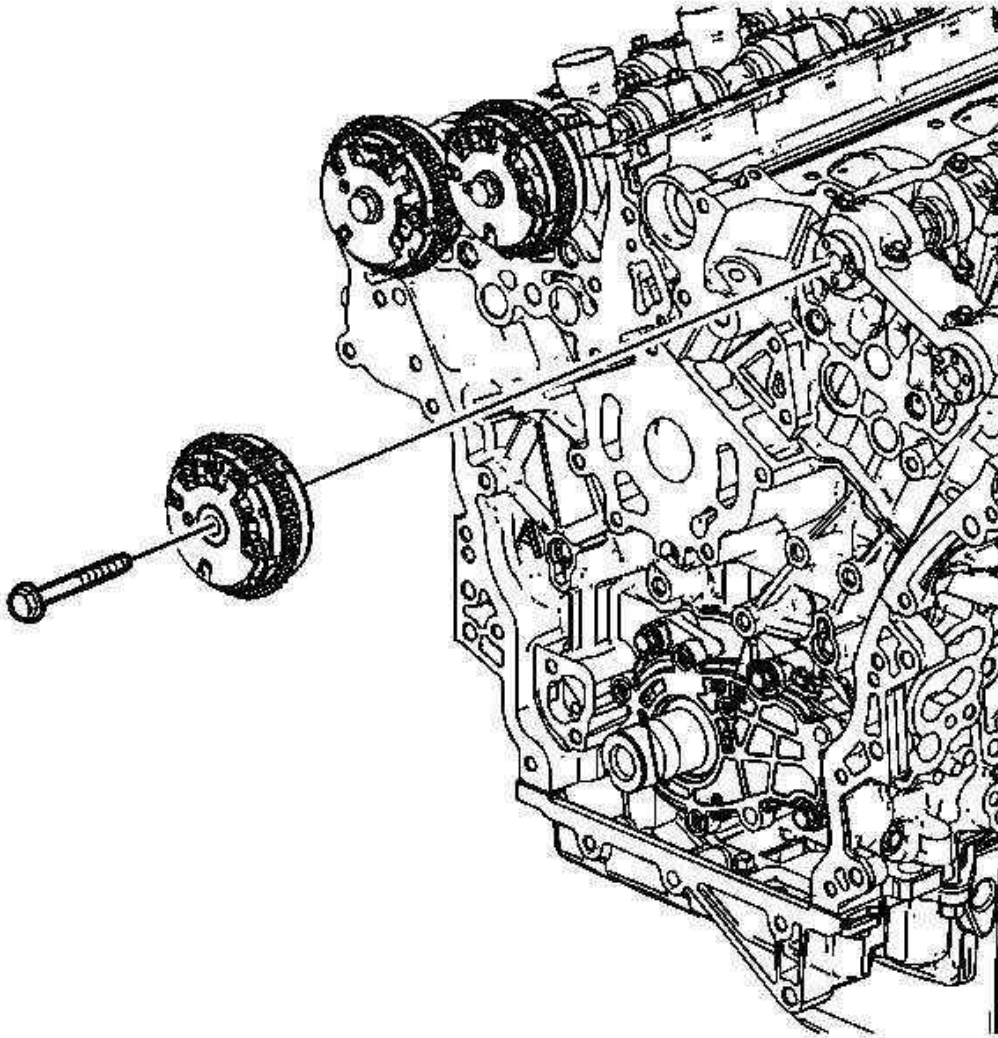


Fig. 168: View Of Camshaft Position Actuator Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the left exhaust camshaft actuator. Refer to **Camshaft Position Actuator Replacement - Bank 2 (Left Side) Exhaust (First Design)** or **Camshaft Position Actuator Replacement - Bank 2 (Left Side) Exhaust (Fourth Design)**.
2. Remove the intake camshaft position actuator bolt.

3. Remove the left intake camshaft position actuator.

Installation Procedure

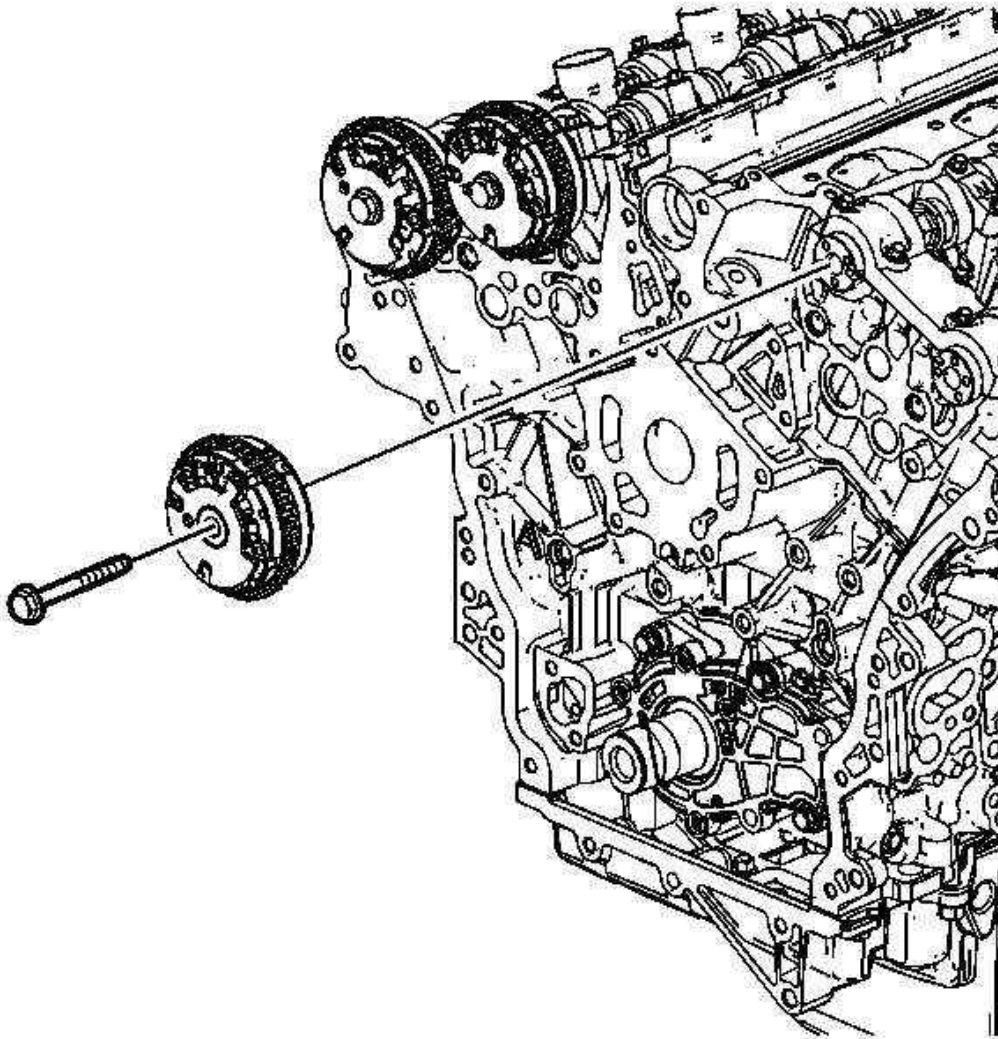


Fig. 169: View Of Camshaft Position Actuator Bolt
Courtesy of GENERAL MOTORS CORP.

1. Locate the intake camshaft position actuator to the camshaft and loosely install the bolt.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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

2. Tighten the camshaft position actuator bolt. Refer to Camshaft Position Actuator Installation - Left Side Intake (Fourth Design) .
3. Install the left exhaust camshaft actuator. Refer to Camshaft Position Actuator Replacement - Bank 2 (Left Side) Exhaust (First Design) or Camshaft Position Actuator Replacement - Bank 2 (Left Side) Exhaust (Fourth Design).

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

Removal Procedure

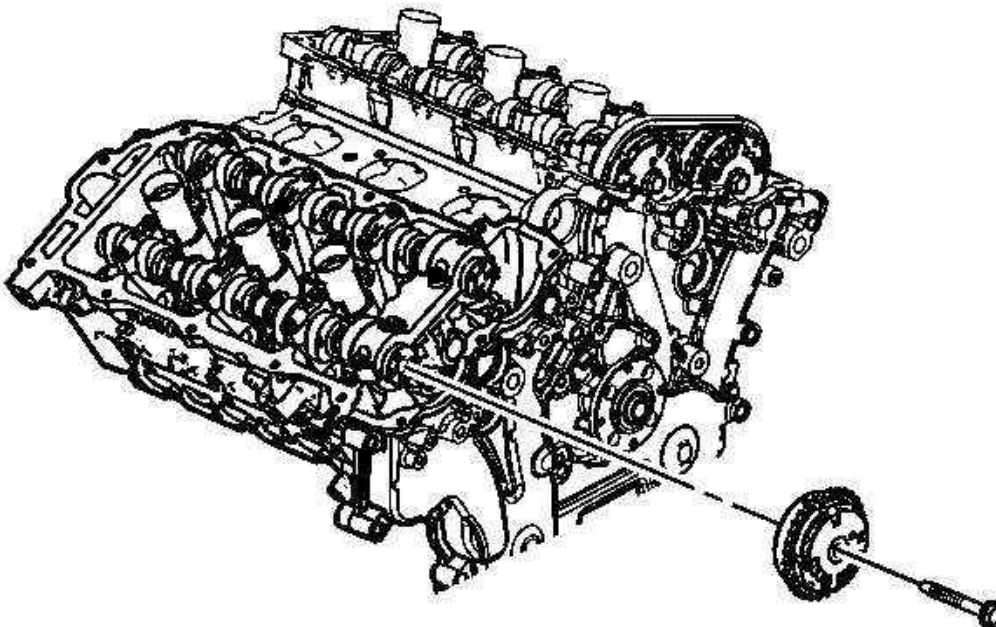


Fig. 170: View Of Intake Camshaft Position Actuator Bolt

Courtesy of GENERAL MOTORS CORP.

1. Remove the right exhaust camshaft actuator. Refer to **Camshaft Position Actuator Replacement - Bank 1 (Right Side) Exhaust (First Design)** or **Camshaft Position Actuator Replacement - Bank 1 (Right Side) Exhaust (Second Design)**.
2. Remove the intake camshaft position actuator bolt.
3. Remove the right intake camshaft position actuator.

Installation Procedure

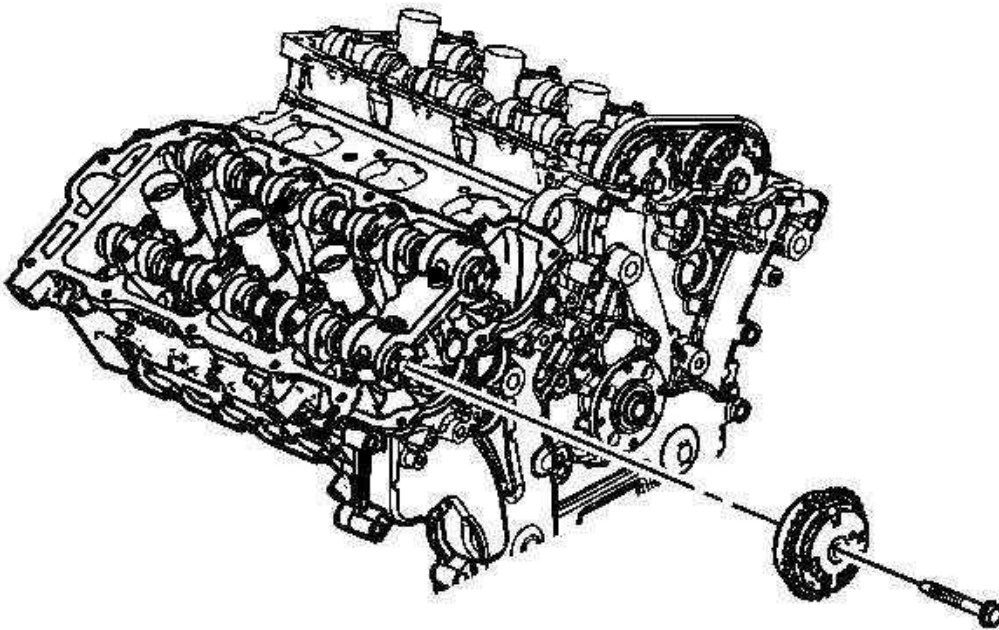


Fig. 171: View Of Intake Camshaft Position Actuator Bolt
Courtesy of GENERAL MOTORS CORP.

1. Locate the intake camshaft position actuator to the camshaft and loosely install the bolt.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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

2. Tighten the camshaft position actuator bolt. Refer to Camshaft Position Actuator Installation - Right Side Intake (Fourth Design) .
3. Install the right exhaust camshaft actuator. Refer to Camshaft Position Actuator Replacement - Bank 1 (Right Side) Exhaust (First Design) or Camshaft Position Actuator Replacement - Bank 1 (Right Side) Exhaust (Second Design).

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.

Follow the left bank secondary camshaft drive chain replacement procedures to reset the camshaft timing. Refer to Secondary Camshaft Drive Chain Replacement - Left Side.

CAMSHAFT REPLACEMENT - LEFT SIDE

Tools Required

EN-48313 Timing Chain Retention Tool. See Special Tools .

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to Lower Intake Manifold Replacement.
2. Remove the left bank camshaft cover. Refer to Camshaft Cover Replacement - Left Side.

3. Remove the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Intake** .
4. Remove the camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Intake** .

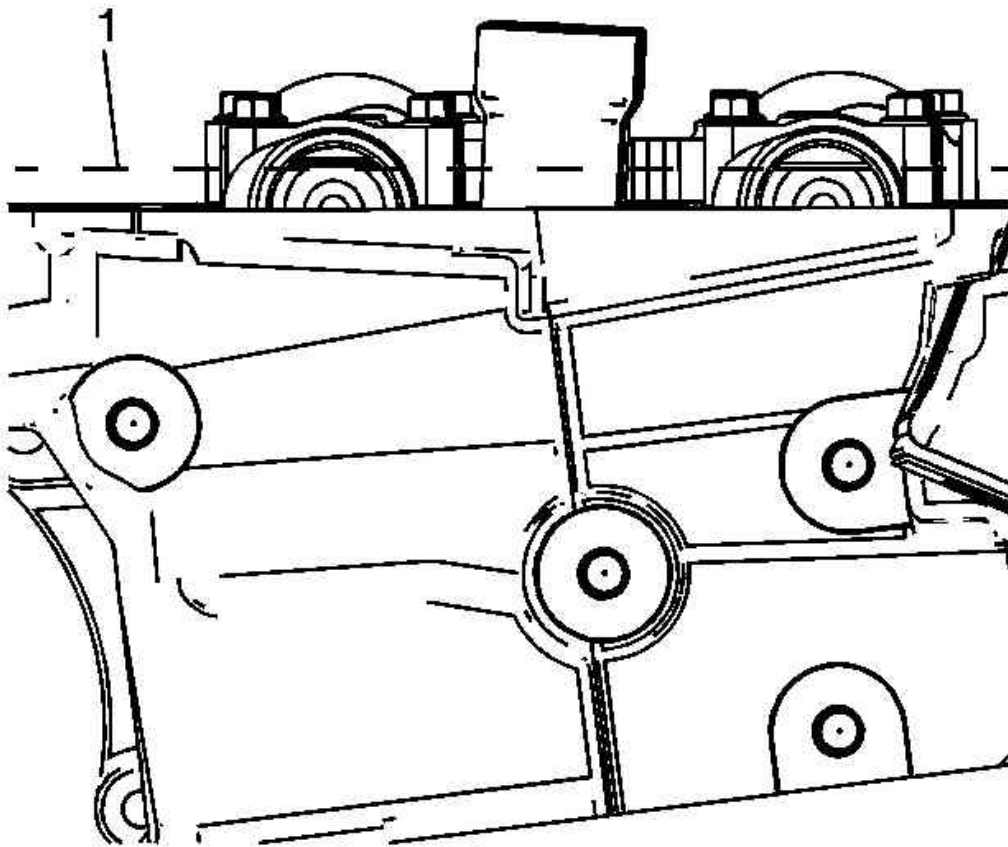


Fig. 172: Rotating Camshaft Flats Parallel With Camshaft Cover Rail
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Rotate the crankshaft balancer in a clockwise rotation ONLY.

5. Rotate the crankshaft using the crankshaft balancer bolt until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

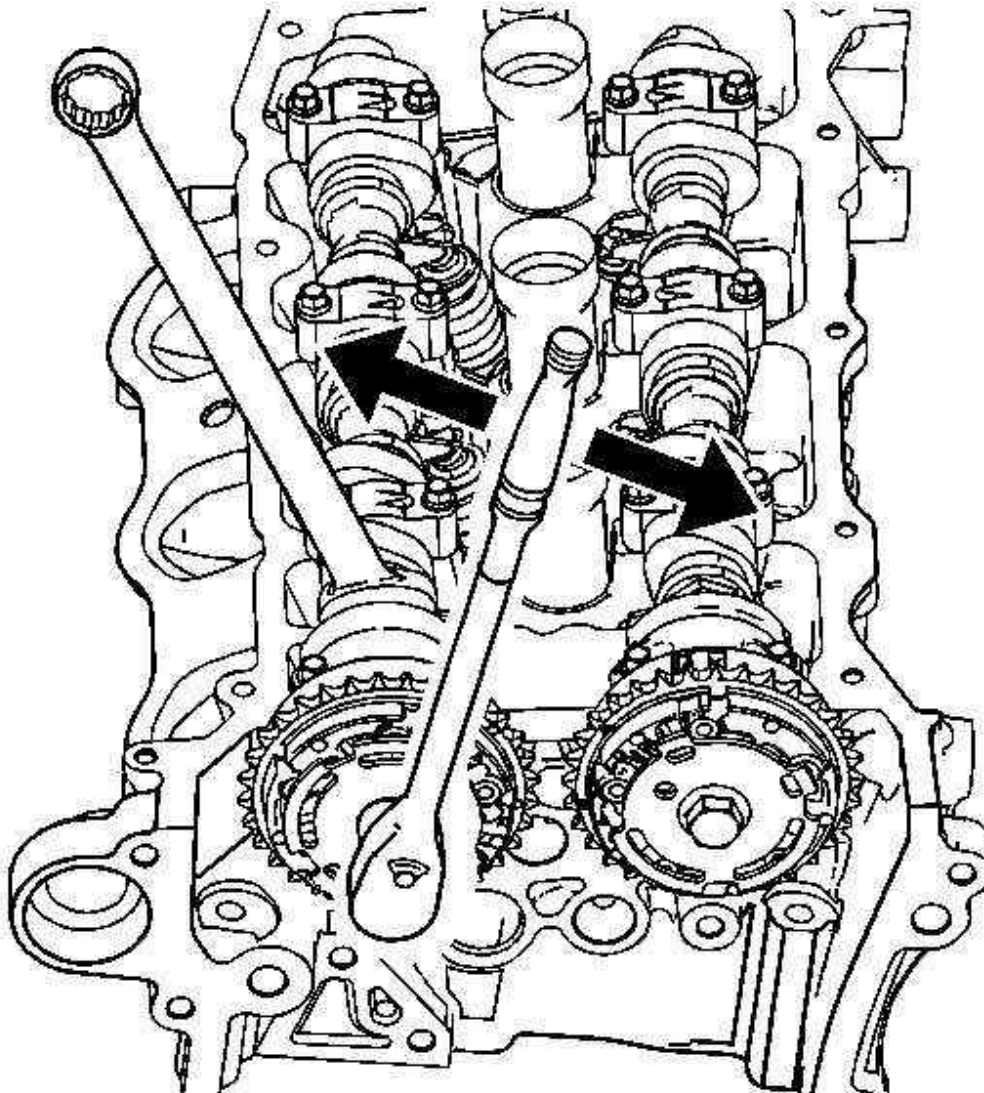


Fig. 173: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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.

6. Loosen the camshaft position actuator bolt.

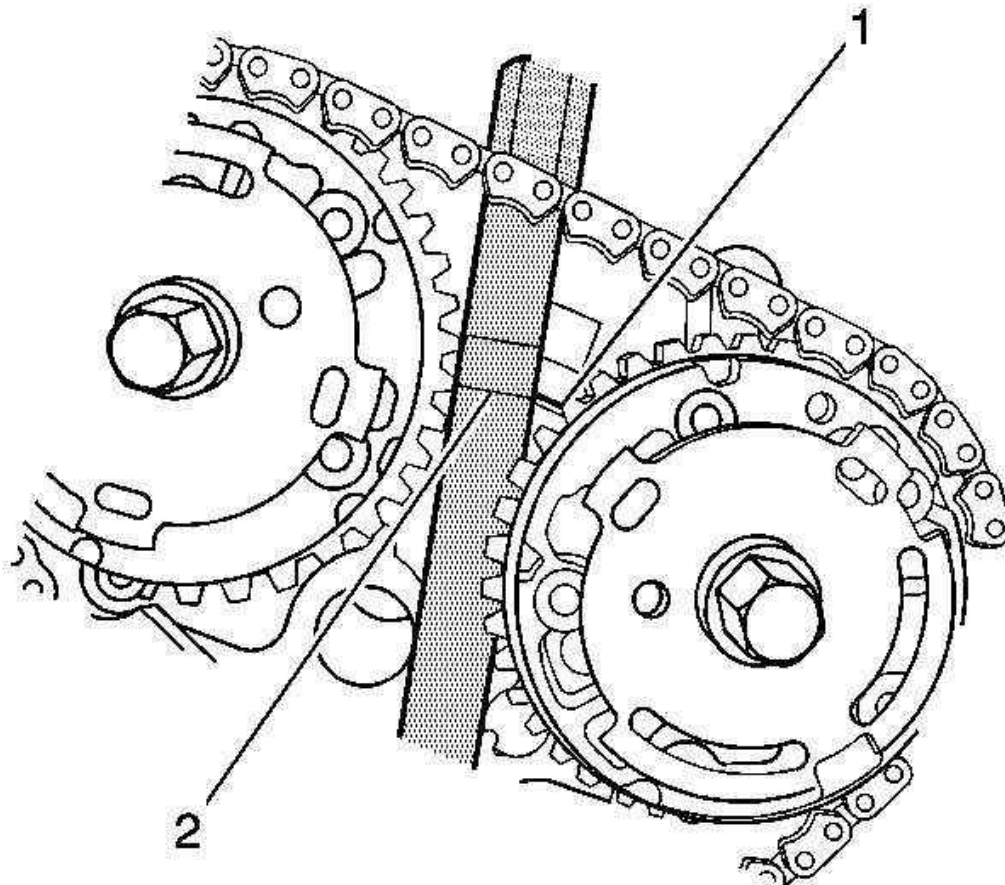


Fig. 174: Inserting Timing Chain Retention Tool

Courtesy of GENERAL MOTORS CORP.

7. Unscrew the **EN-48313** so that the legs of the tool are retracted. See **Special Tools** .
8. Insert the **EN-48313** between the camshaft actuators, rearward of the timing chain until the bottom line that is scribed in the body of the tool (2) is adjacent to the top surface of the cylinder head (1). See **Special Tools** . This is the approximate installed position.

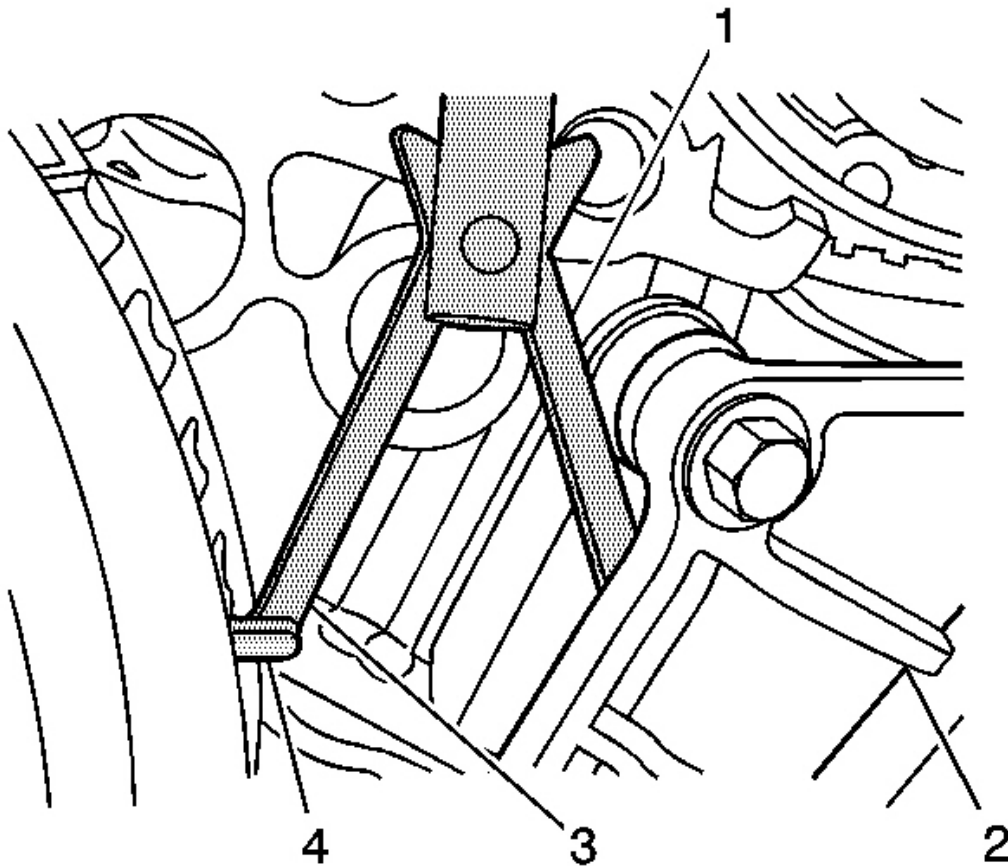


Fig. 175: View Of Feet, Legs & Timing Chain Guide
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

9. Ensure that the feet (4) on the legs of the tool are facing the front of the engine.
10. Partially expand the legs (1, 3) of the **EN-48313** by turning the T-shaped handle clockwise. See **Special Tools** .
11. Insert the leg of the tool (1) behind the timing chain guide (2).
12. Continue expanding the **EN-48313** until the legs (1, 3) contact the timing chain. See **Special Tools** . Do not tighten at this time.

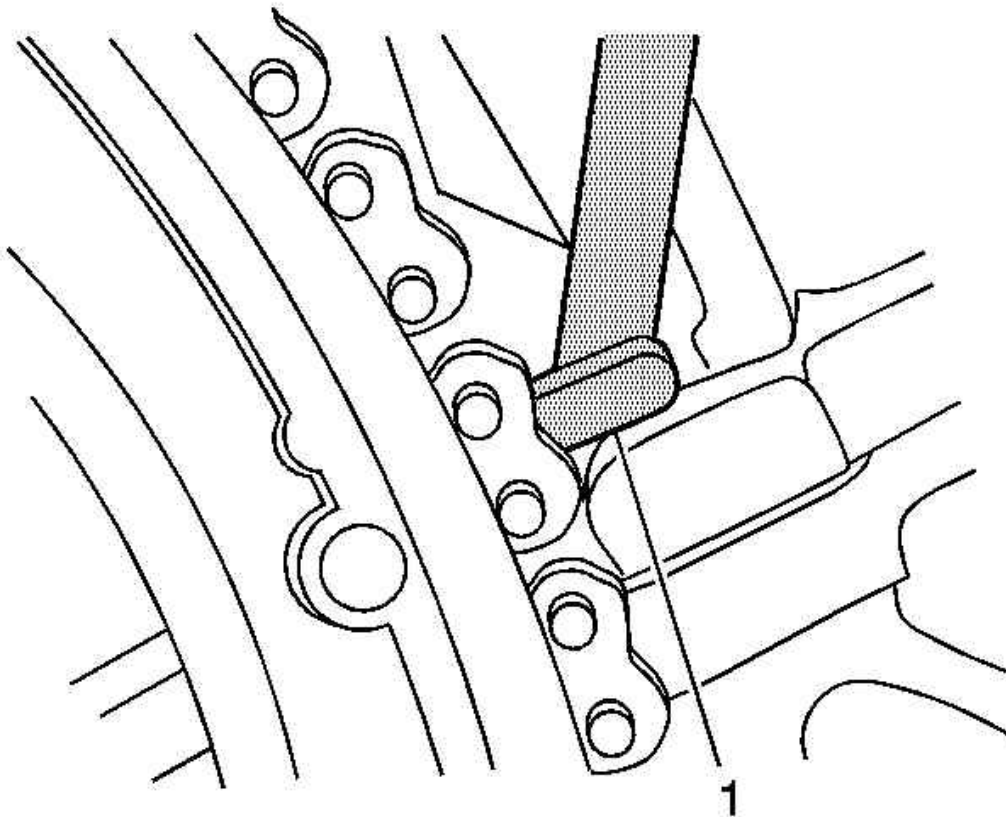


Fig. 176: Identifying Foot Of Special Tool EN-48313

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the foot (1) of the EN-48313 is engaged into one of the link pockets to prevent tool slippage during tightening of the EN-48313 . See Special Tools .

13. Hand tighten the EN-48313 . See Special Tools .

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

14. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.

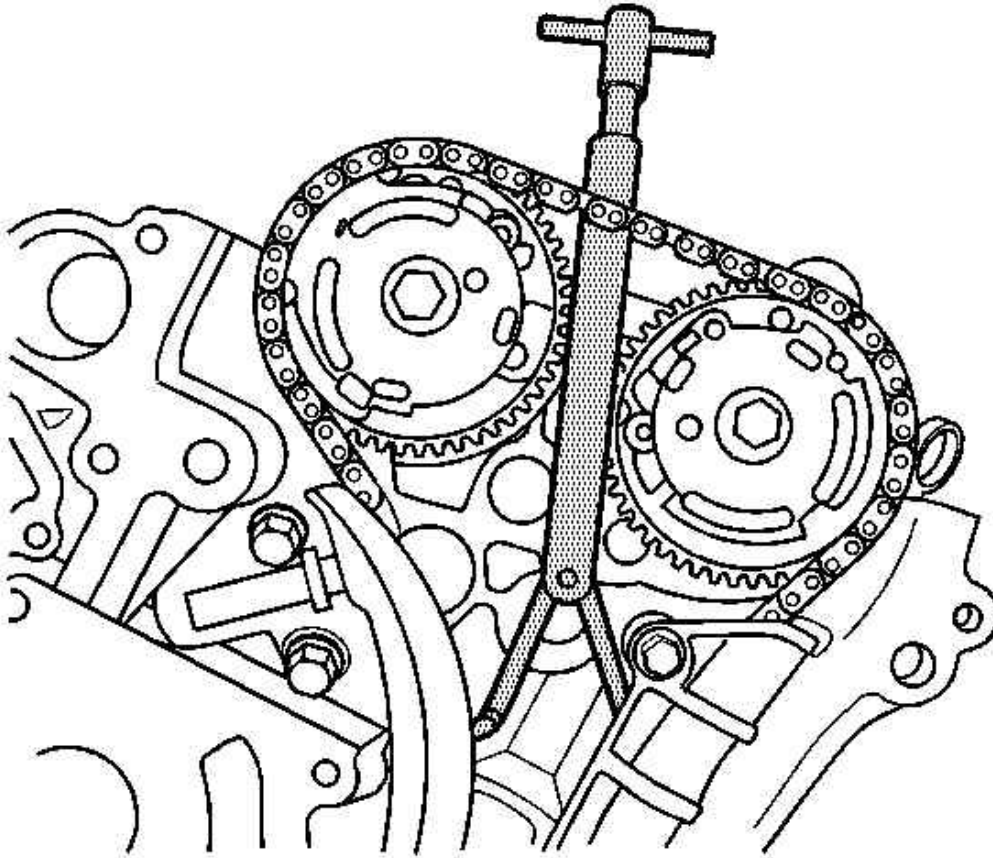


Fig. 177: Identifying Special Tool - EN-48313
Courtesy of GENERAL MOTORS CORP.

15. The **EN-48313** is now properly installed to hold the timing chain in position.
See **Special Tools** .

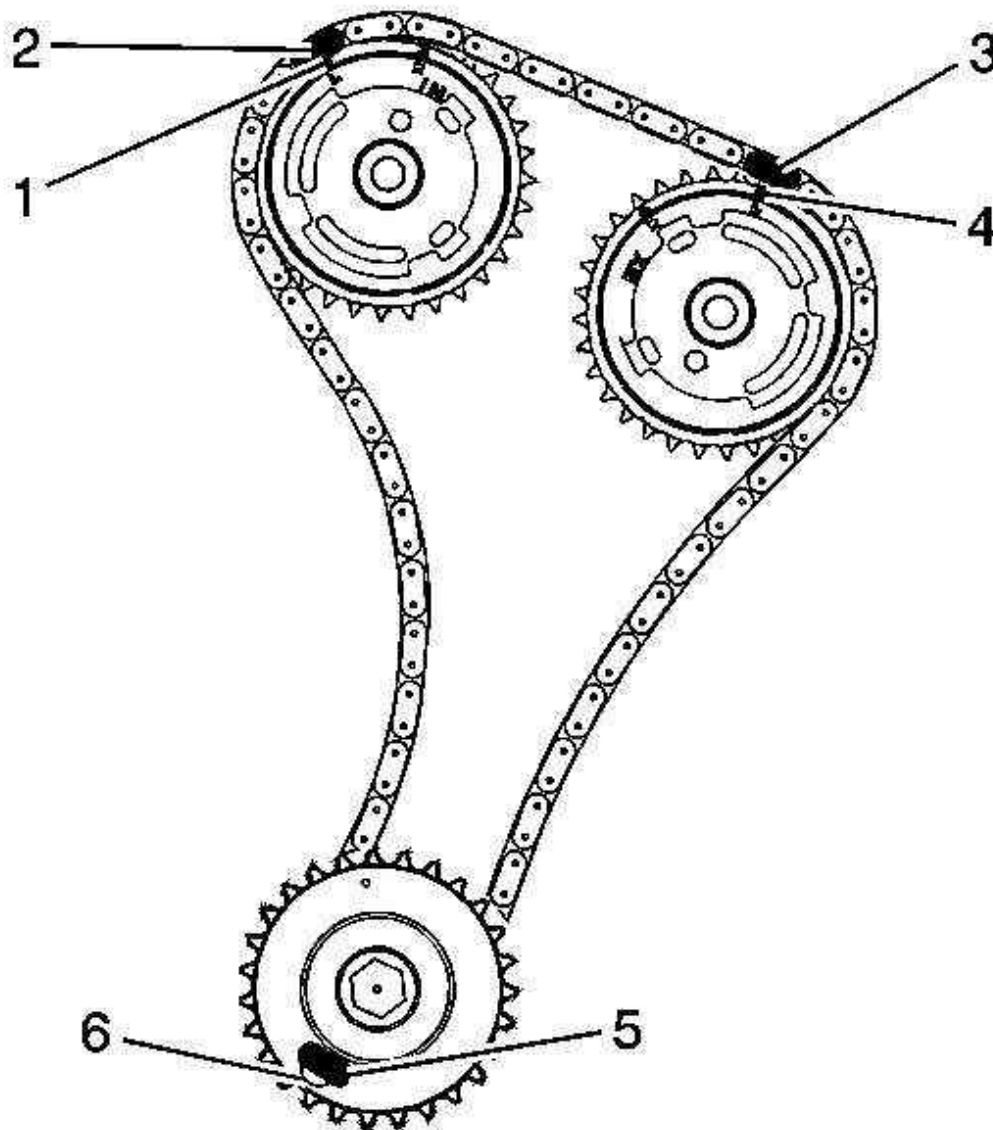


Fig. 178: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

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

assembly.

16. Mark the timing chain and the respective locations on the camshaft position actuators (1-4).
17. Remove the camshaft position actuator bolt.
18. Remove the camshafts. Refer to **Camshaft Removal - Left Side** .

Installation Procedure

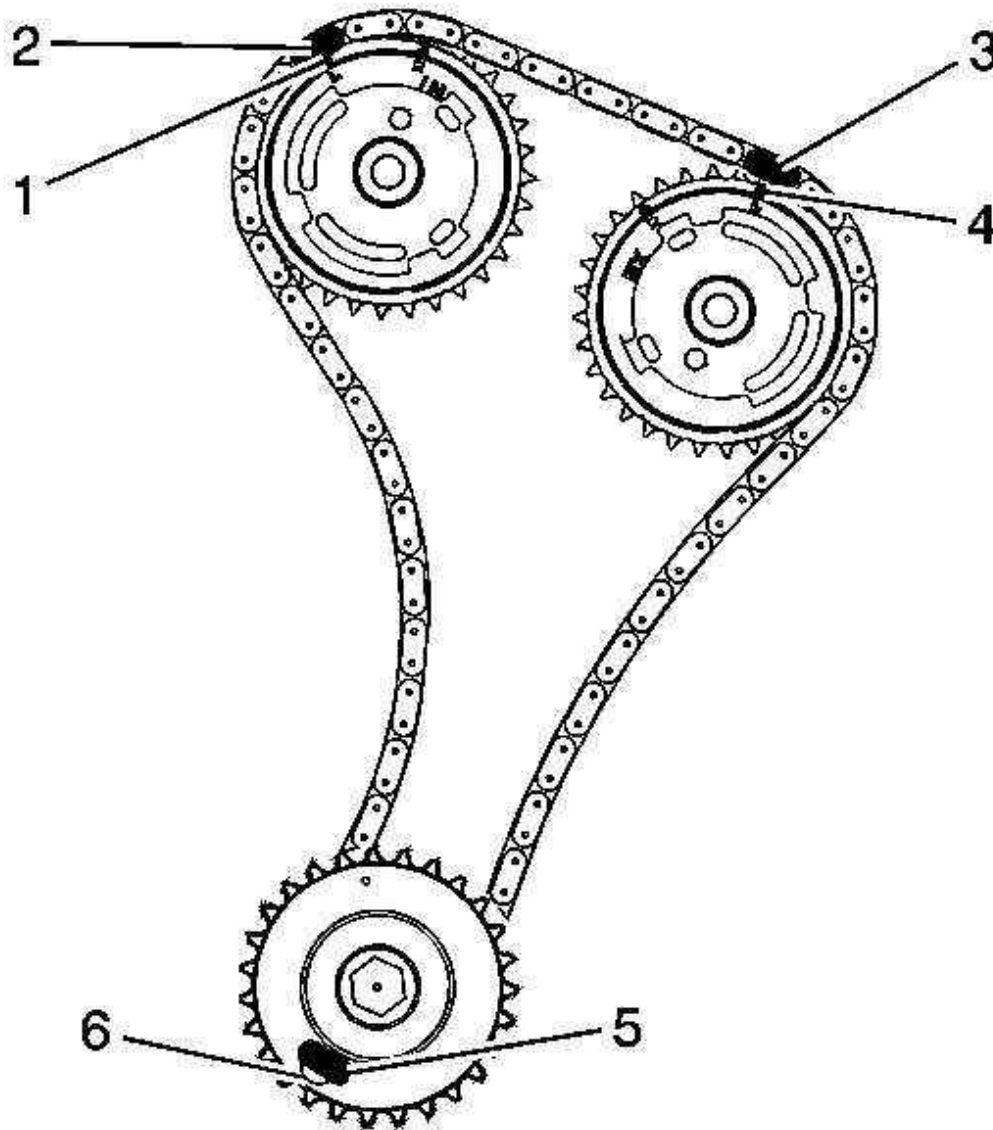


Fig. 179: Locating Left Secondary Camshaft Drive Chain Timing Marks
Courtesy of GENERAL MOTORS CORP.

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 Side** .
3. Remove the **EN-48313** . See **Special Tools** .

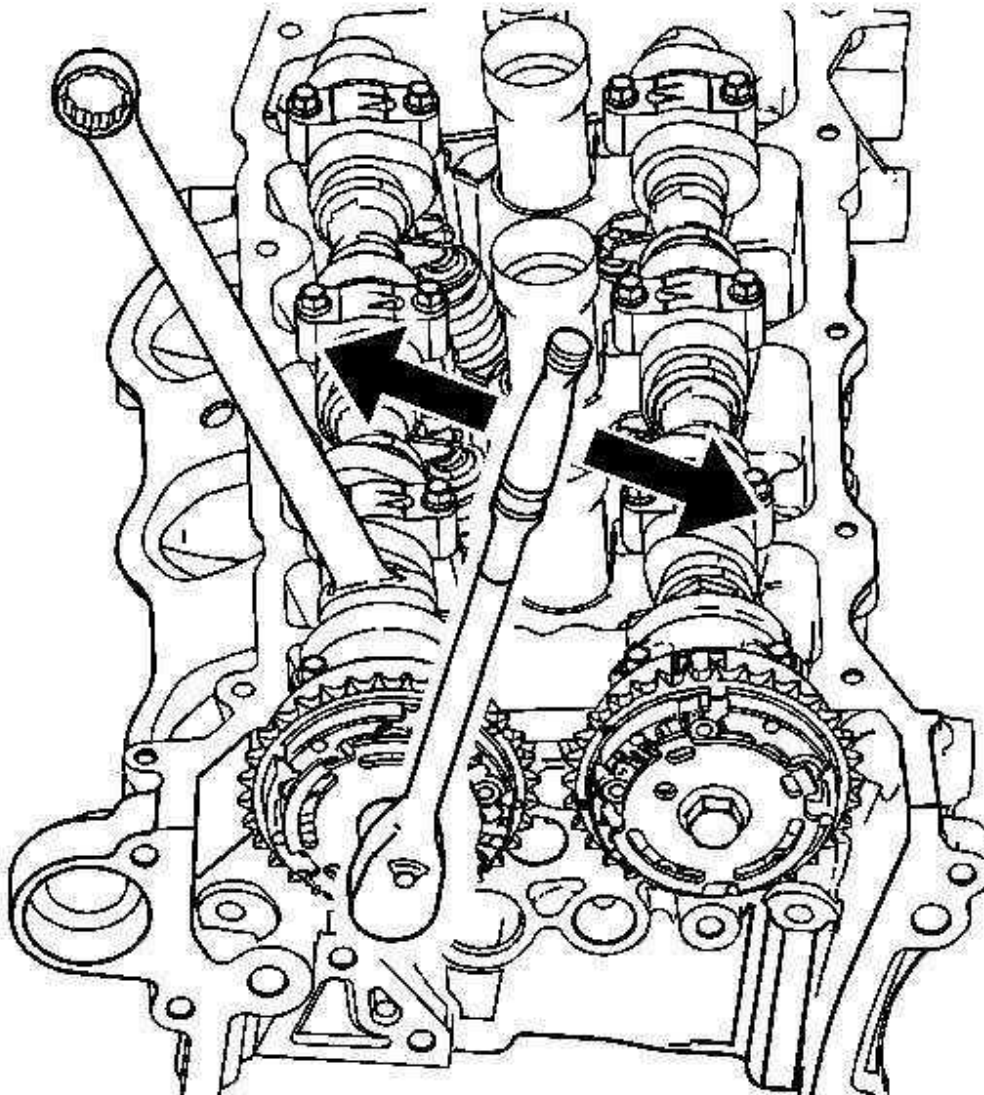


Fig. 180: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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 Actuator Installation - Left Side Intake (Fourth Design)** and **Camshaft Position Actuator Installation - Left Side Exhaust (Fourth Design)** .
5. Install the intake camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Intake** .
6. Install the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 2 (Left Side) Intake** .
7. Install the camshaft cover. Refer to **Camshaft Cover Replacement - Left Side**.
8. Install the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

CAMSHAFT REPLACEMENT - RIGHT SIDE (LY7)

Tools Required

EN-48313 Timing Chain Retention Tool. See **Special Tools** .

Removal Procedure

1. Remove the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.
2. Remove the camshaft cover. Refer to **Camshaft Cover Replacement - Right Side**.
3. Remove the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Intake** .
4. Remove the intake camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Intake** .

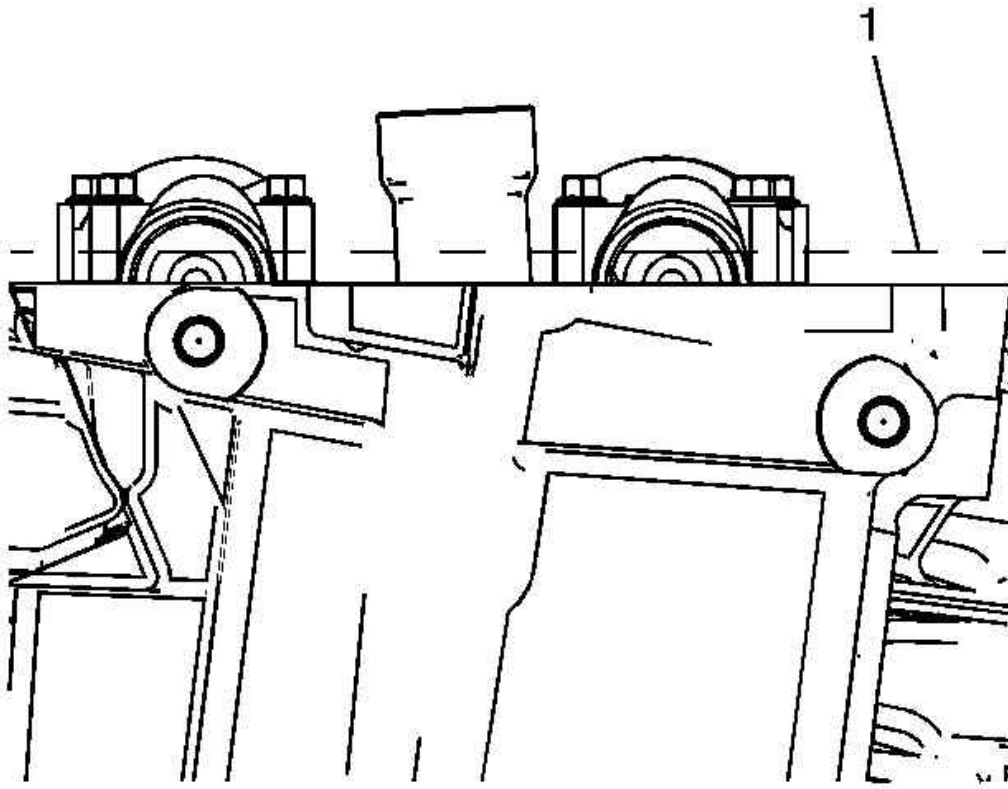


Fig. 181: Identifying Camshaft Neutral (Low Tension) Position
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Rotate the crankshaft balancer in a clockwise rotation ONLY.

5. Rotate the crankshaft using the crankshaft balancer bolt until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

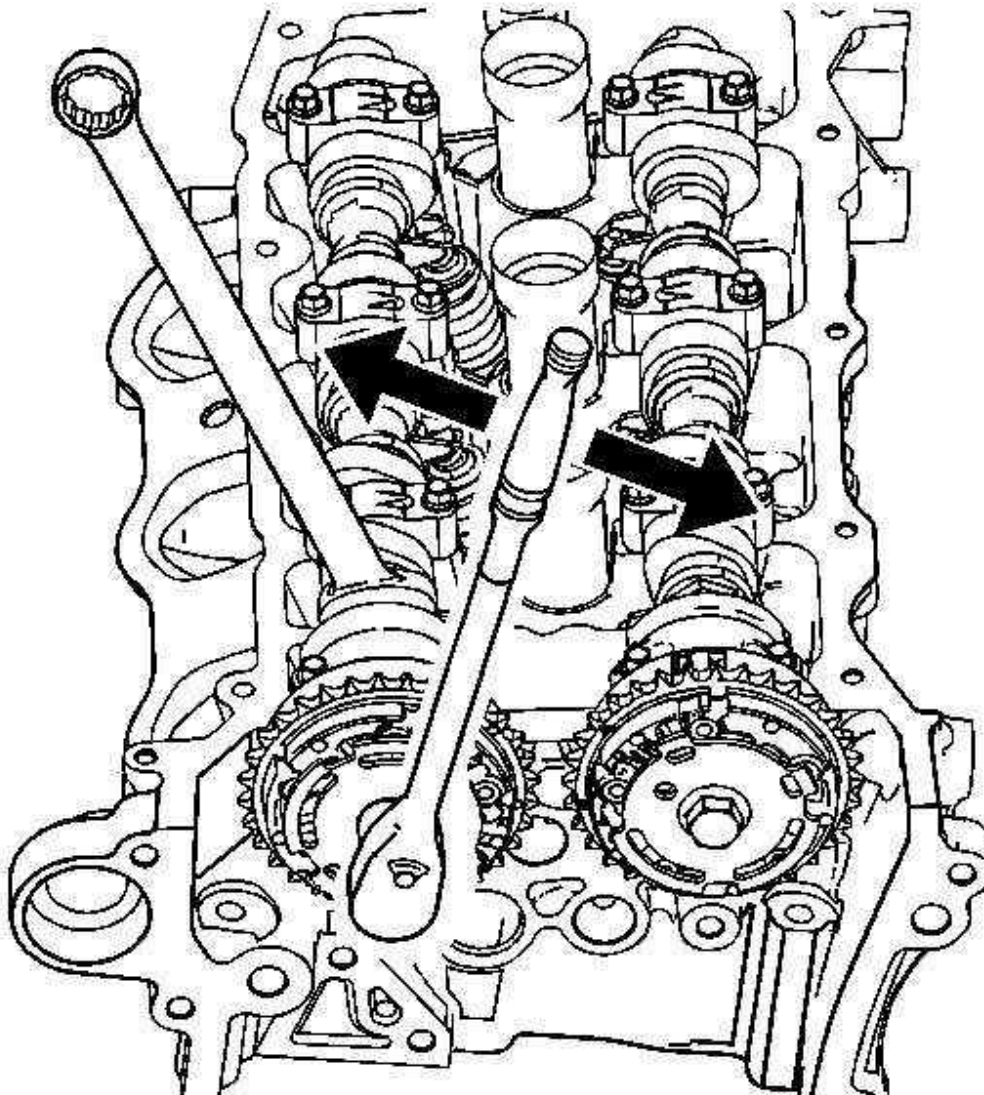


Fig. 182: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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.

6. Loosen the camshaft position actuator bolt.

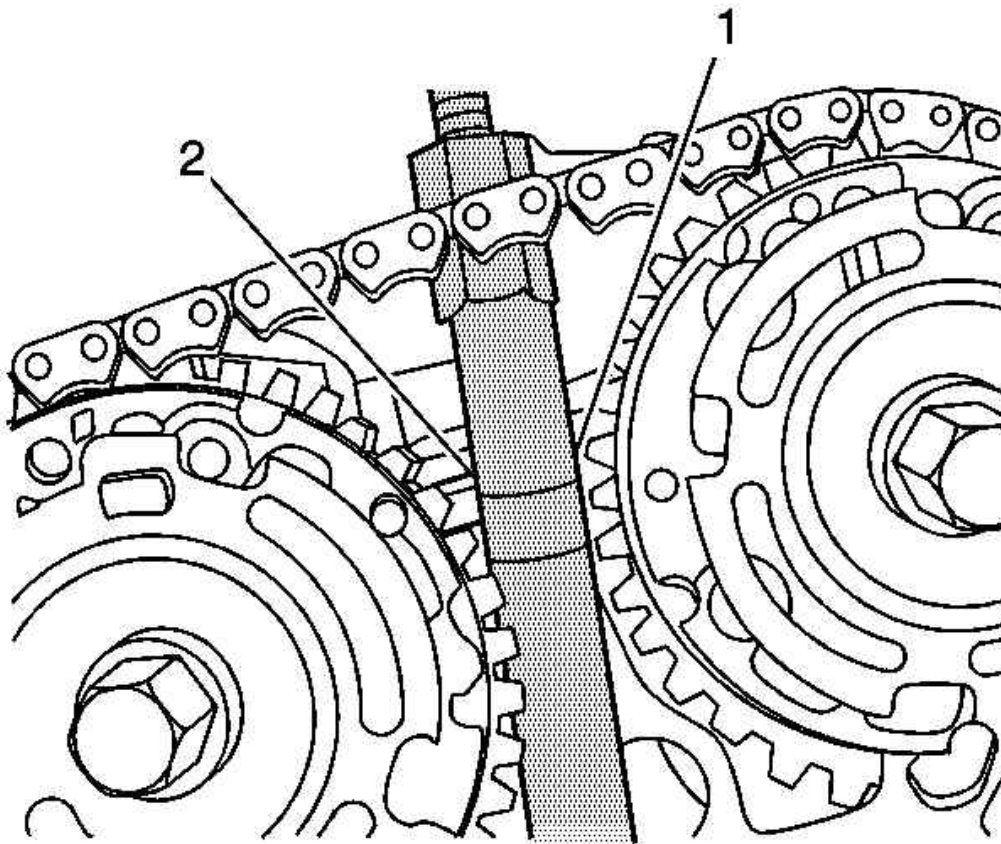


Fig. 183: View Of Cylinder Head & Special Tool
Courtesy of GENERAL MOTORS CORP.

7. Unscrew the **EN-48313** so that the legs of the tool are retracted. See **Special Tools** .

8. Insert the **EN-48313** between the camshaft actuators, rearward of the timing chain until the top line that is scribed in the body of the tool (1) is adjacent to the top surface of the cylinder head (2). See **Special Tools** . This is the approximate installed position.

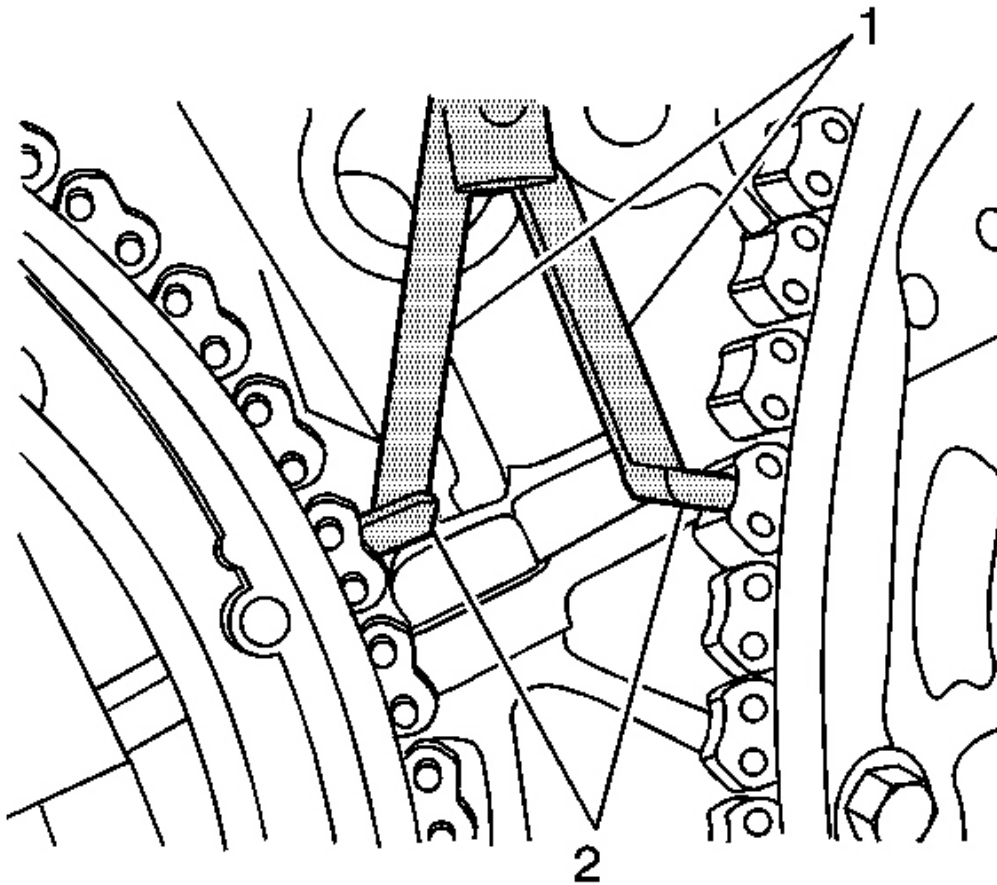


Fig. 184: View Of Feet, Legs & Timing Chain Guide
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

9. Ensure that the feet (2) on the legs of the tool are facing the front of the engine.
10. Partially expand the legs (1) of the **EN-48313** by turning the T-shaped handle clockwise. See **Special Tools** .
11. Continue expanding the **EN-48313** until the feet (1) contact the timing chain. See **Special Tools** . Do not tighten at this time.

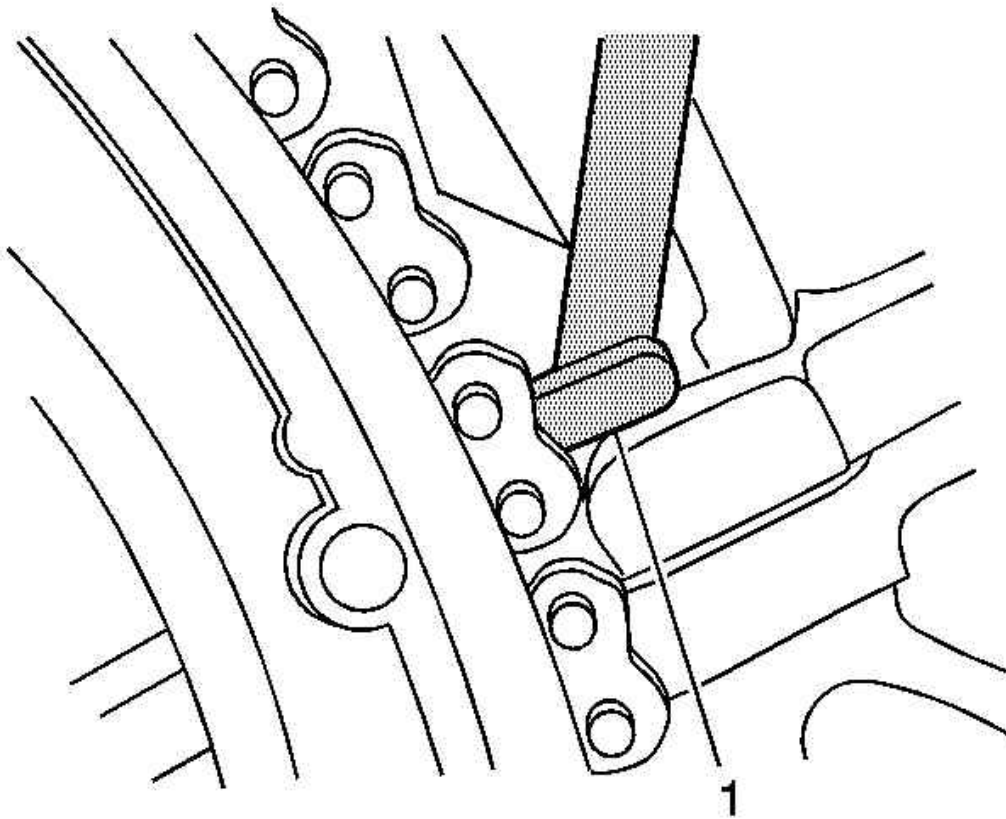


Fig. 185: Identifying Foot Of Special Tool EN-48313
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure that the foot (1) of the EN-48313 is engaged into one of the link pockets to prevent chain slippage during tightening of the EN-48313 . See

Special Tools .

IMPORTANT: Do not allow the body of the EN-48313 to rotate when tightening the T-handle. See **Special Tools** .

12. Hand tighten the EN-48313 . See **Special Tools** .

NOTE: Refer to **Torque Reaction Against Timing Drive Chain Notice** .

13. Use an open end wrench on the hex cast into the body of the EN-48313 and hand tighten the T-handle. See **Special Tools** .

NOTE: Refer to **Torque Reaction Against Timing Drive Chain Notice** .

14. Use an open end wrench on the hex cast into the right intake and exhaust camshafts and rotate the camshafts towards each other in order to create slack in the chain between the actuators.

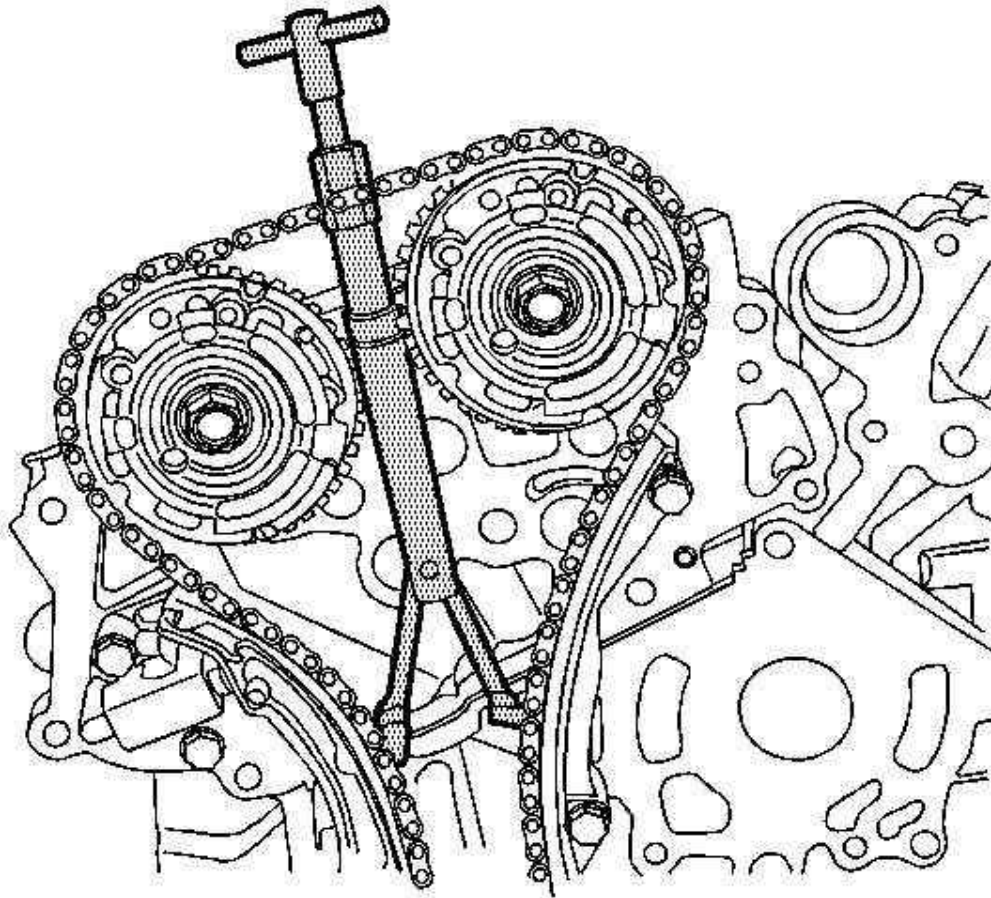


Fig. 186: View Of EN-48313 Between Actuators
Courtesy of GENERAL MOTORS CORP.

15. The **EN-48313** is now properly installed to hold the timing chain in position.
See **Special Tools** .

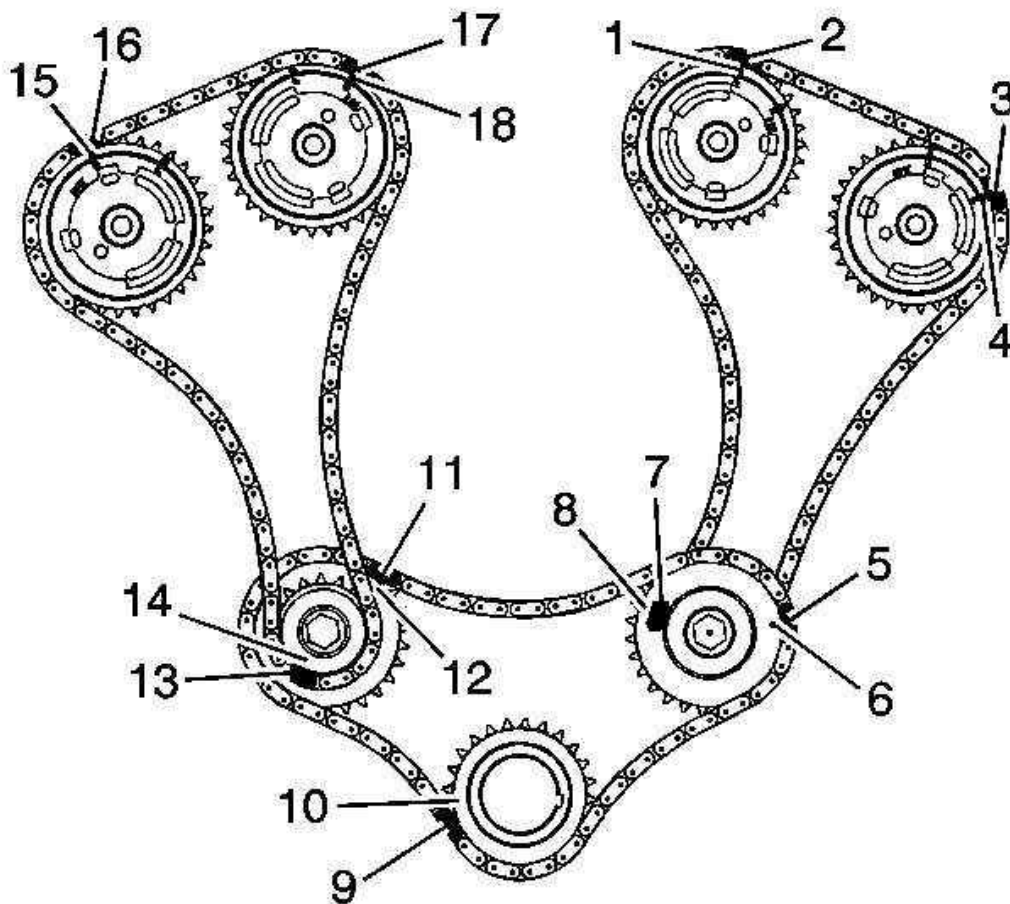


Fig. 187: Identifying Timing Chain Marks & Their Respective Locations On Gears, Sprockets & Actuators

Courtesy of GENERAL MOTORS CORP.

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

16. Mark the timing chain and the respective locations on camshaft position actuators (15-18).
17. Remove the camshaft position actuator bolt.

18. Remove the camshaft bearing caps and the camshaft. Refer to **Camshaft Removal - Right Side** .

Installation Procedure

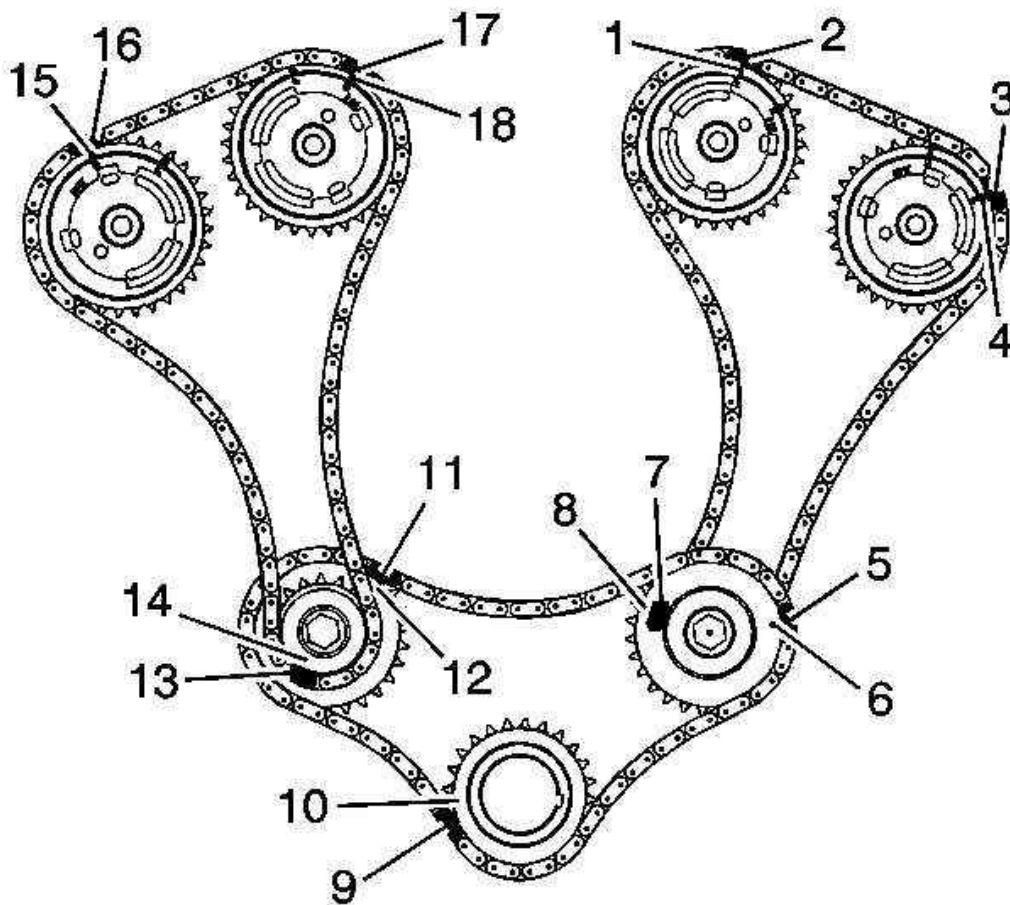


Fig. 188: Identifying Timing Chain Marks & Their Respective Locations On Gears, Sprockets & Actuators
Courtesy of GENERAL MOTORS CORP.

- 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 Side** .
3. Remove the **EN-48313** . See **Special Tools** .

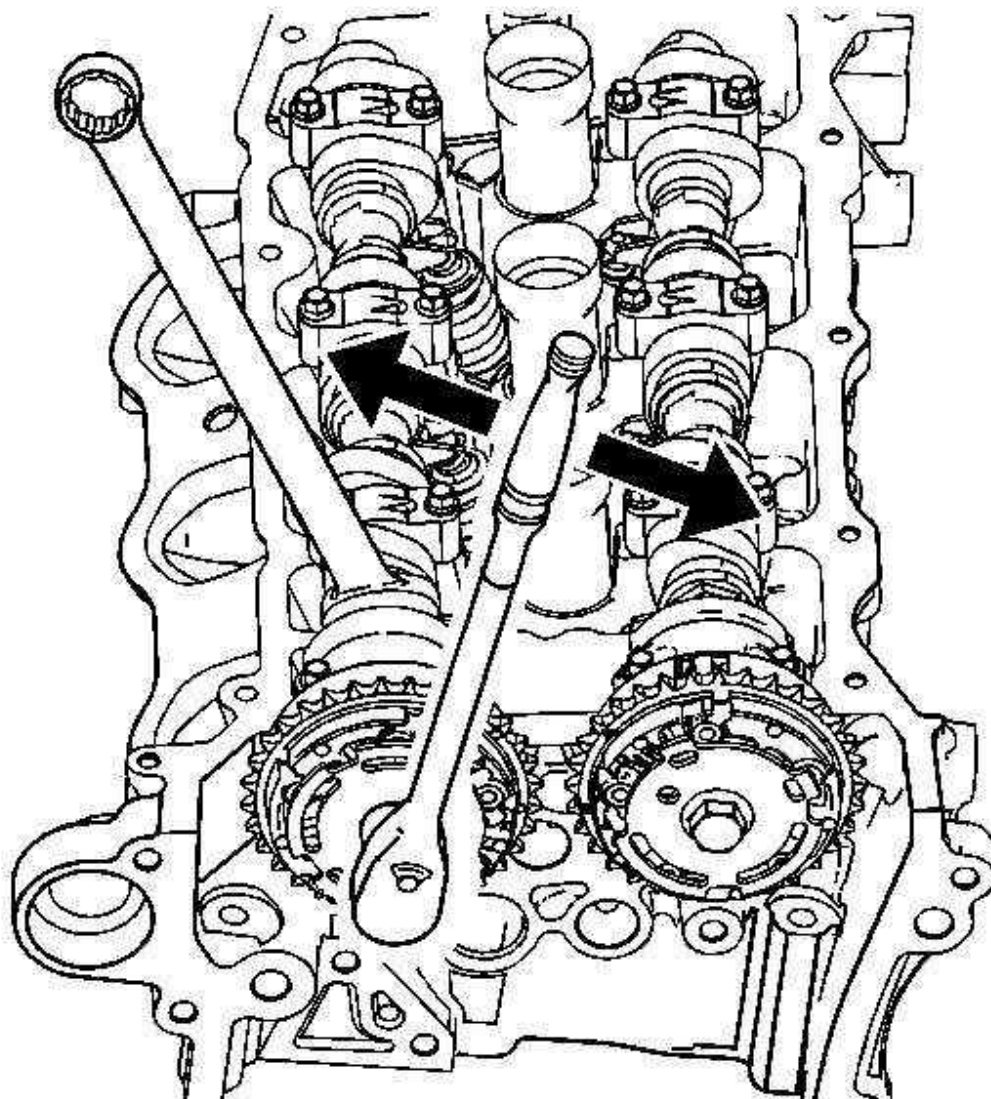


Fig. 189: Preventing Camshaft/Engine Rotation Using Open-End Wrench
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Torque Reaction Against Timing Drive Chain Notice .

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 Actuator Installation - Right Side Intake (Fourth Design)** and **Camshaft Position Actuator Installation - Right Side Exhaust (Fourth Design)** .
5. Install the intake camshaft position actuator solenoid. Refer to **Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Intake** .
6. Install the camshaft sensors. Refer to **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Exhaust** and **Camshaft Position Sensor Replacement - Bank 1 (Right Side) Intake** .
7. Install the camshaft cover. Refer to **Camshaft Cover Replacement - Right Side**.
8. Install the upper intake manifold with the lower intake manifold. Refer to **Lower Intake Manifold Replacement**.

VALVE ROCKER ARM REPLACEMENT - LEFT SIDE

Removal Procedure

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

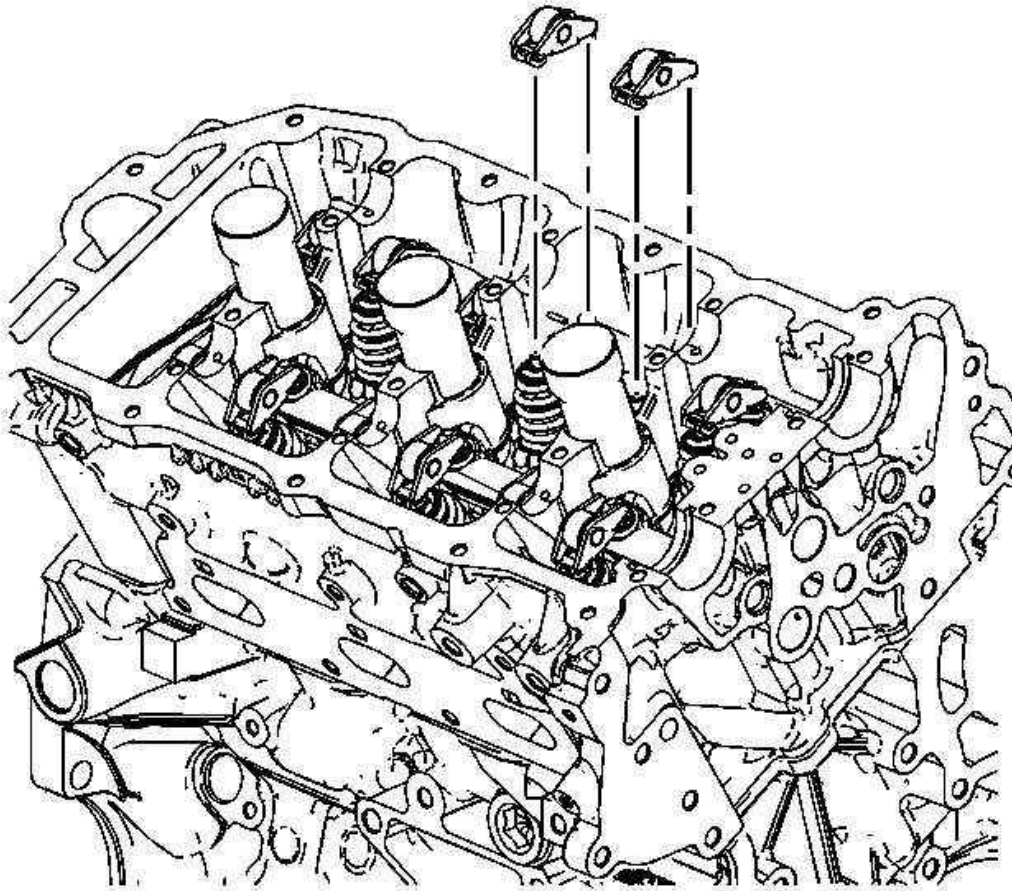


Fig. 190: Identifying Valve Rocker Arms
Courtesy of GENERAL MOTORS CORP.

2. Remove the rocker arms. Refer to **Valve Rocker Arm Removal - Left Side** .
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** .

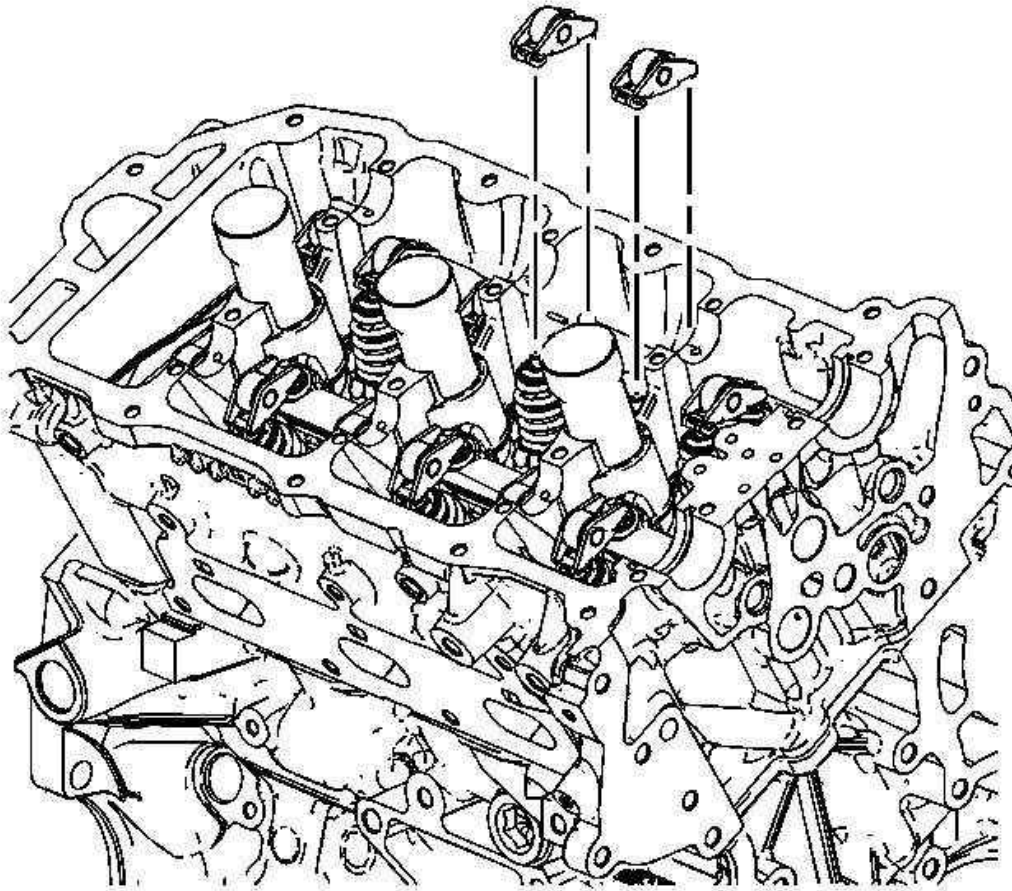


Fig. 191: Identifying Valve Rocker Arms
Courtesy of GENERAL MOTORS CORP.

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

VALVE ROCKER ARM REPLACEMENT - RIGHT SIDE

Removal Procedure

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

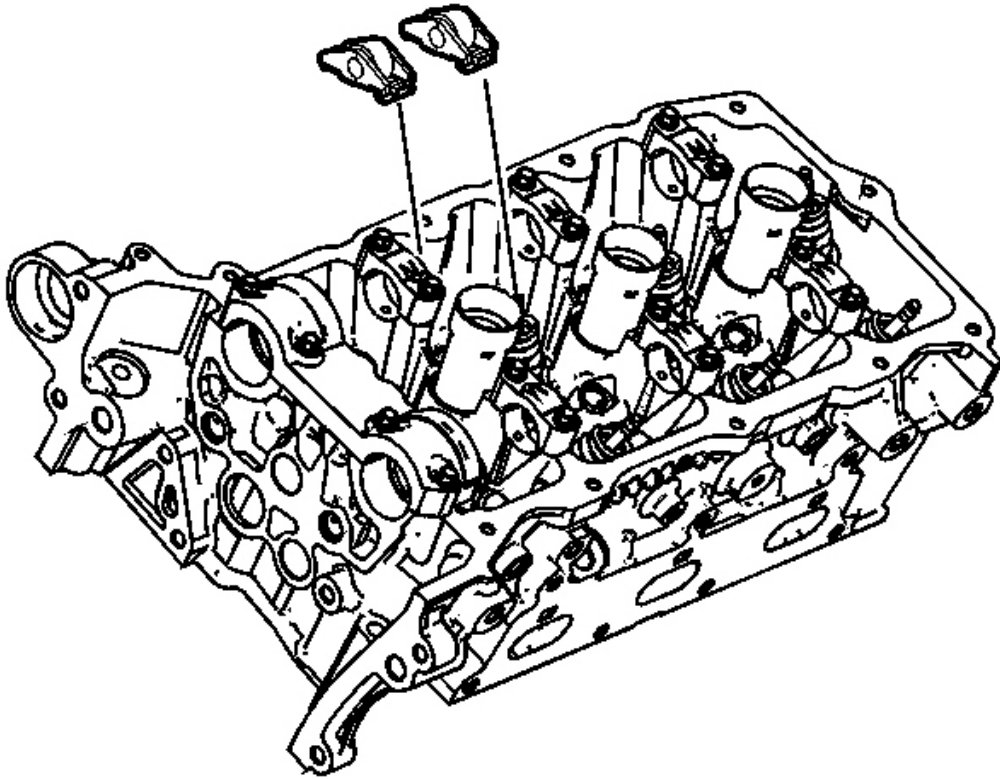


Fig. 192: View Of Valve Rocker Arms
Courtesy of GENERAL MOTORS CORP.

2. Remove the rocker arms. Refer to **Valve Rocker Arm Removal - Right Side** .
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

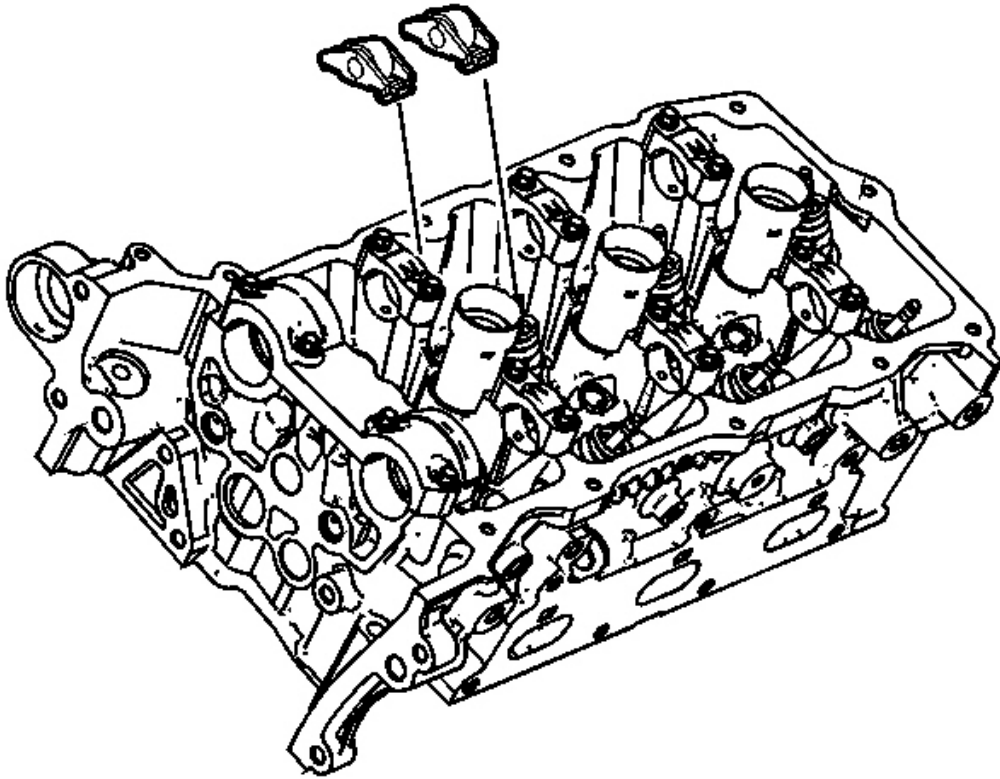


Fig. 193: View Of Valve Rocker Arms
Courtesy of GENERAL MOTORS CORP.

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

VALVE LIFTER REPLACEMENT - LEFT SIDE

Removal Procedure

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

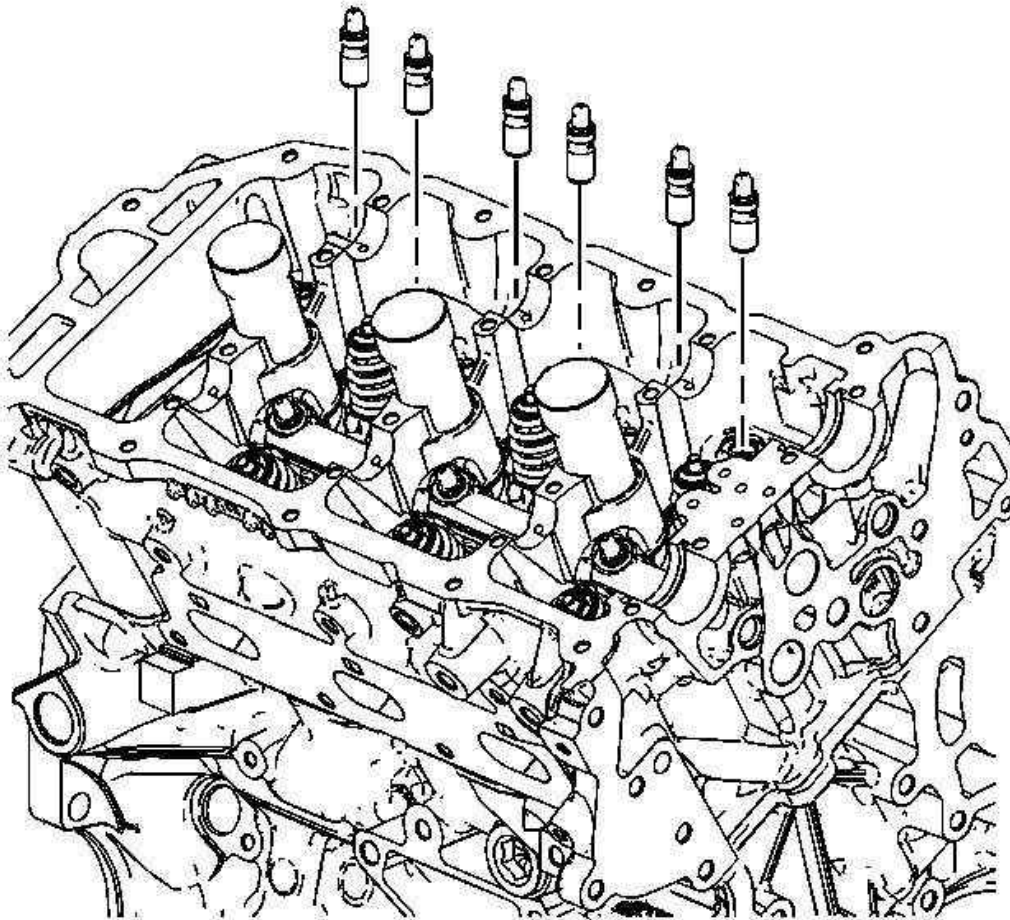


Fig. 194: Identifying Stationary Hydraulic Lash Adjuster (SHLA)
Courtesy of GENERAL MOTORS CORP.

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

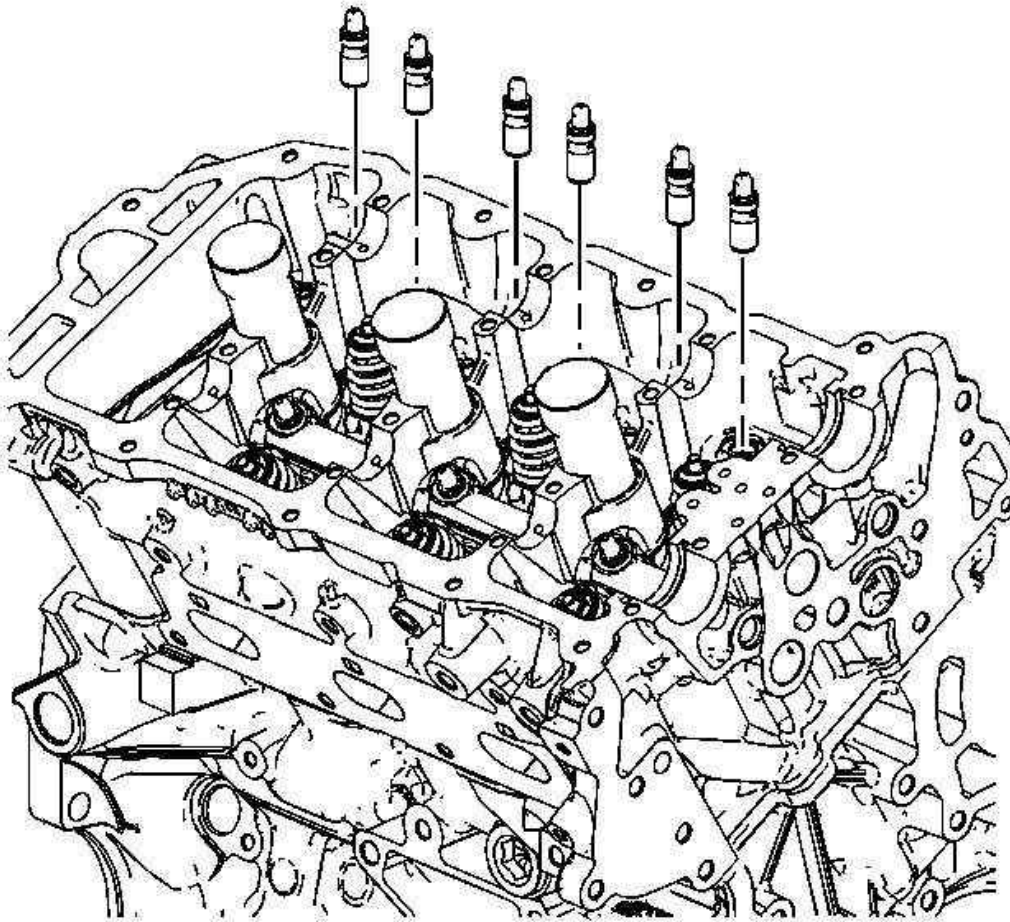


Fig. 195: Identifying Stationary Hydraulic Lash Adjuster (SHLA)
Courtesy of GENERAL MOTORS CORP.

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

VALVE LIFTER REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Remove the applicable camshaft(s). Refer to **Camshaft Replacement - Right Side (LY7)**.
2. Remove the rocker arms. Refer to **Valve Rocker Arm Removal - Right Side**.

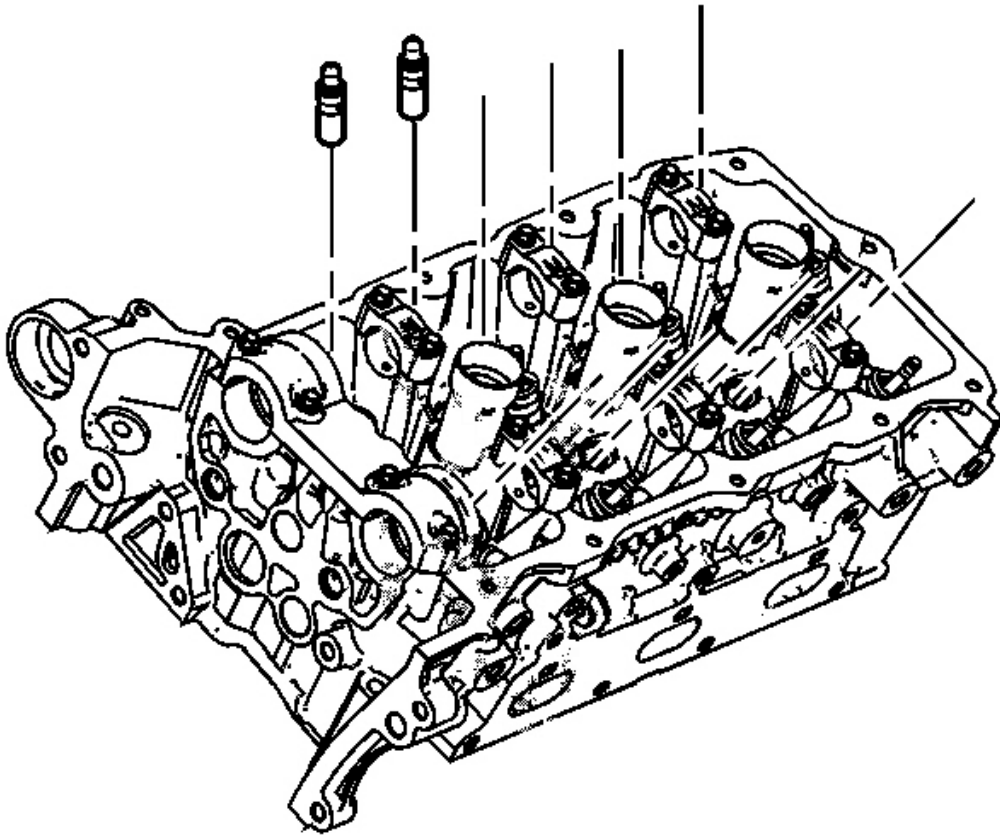


Fig. 196: View Of SHLAs
Courtesy of GENERAL MOTORS CORP.

3. Remove the lifters. Refer to **Valve Lifter Removal - Left Side**.
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**.

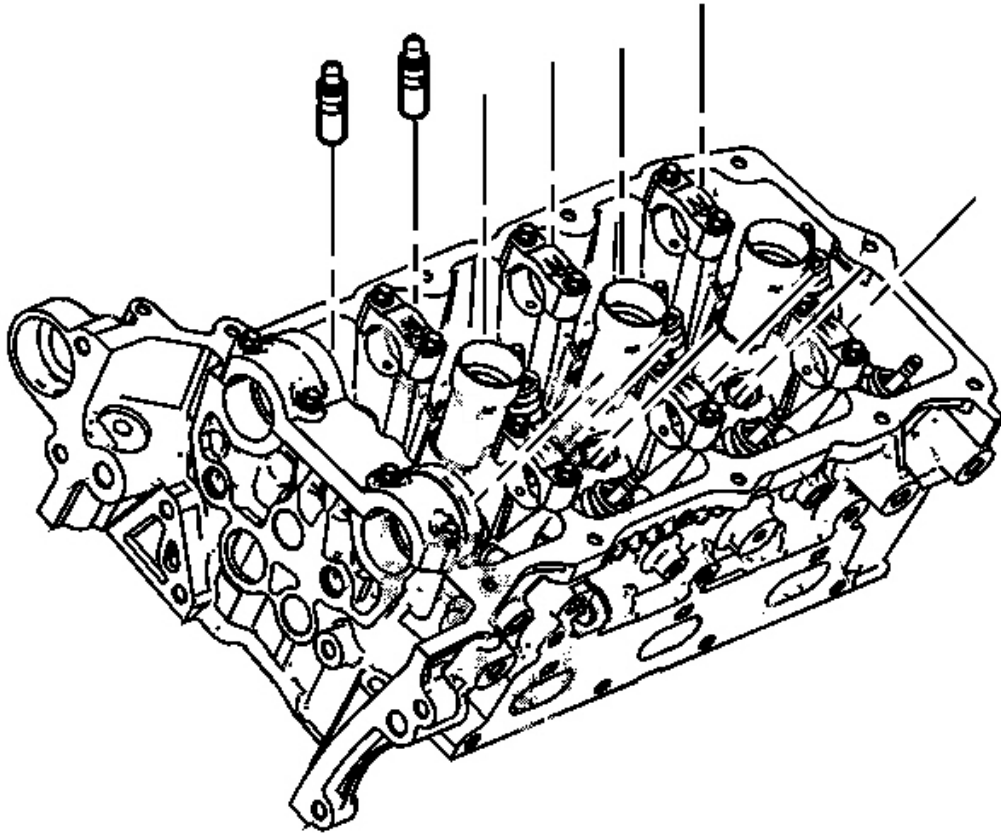


Fig. 197: View Of SHLAs
Courtesy of GENERAL MOTORS CORP.

1. Install the lifters. Refer to Valve Lifter Installation - Right Side .
2. Install the rocker arms. Refer to Valve Rocker Arm Installation - Right Side .
3. Install the applicable camshaft(s). Refer to Camshaft Replacement - Right Side (LY7).

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT - LEFT SIDE

Tools Required

- **EN 46106** Flywheel Holding Tool. See **Special Tools** .
- **EN 46110** On-Vehicle Valve Spring Compressor. See **Special Tools** .
- **EN 46116** Valve Stem Seal Remover/Installer. See **Special Tools** .
- **EN 46117** Valve Stem Key Remover/Installer. See **Special Tools** .
- **J 39313** Spark Plug Port Adapter. See **Special Tools** .

Removal Procedure

1. Remove the starter motor. Refer to **Starter Motor Replacement (LY7)** .

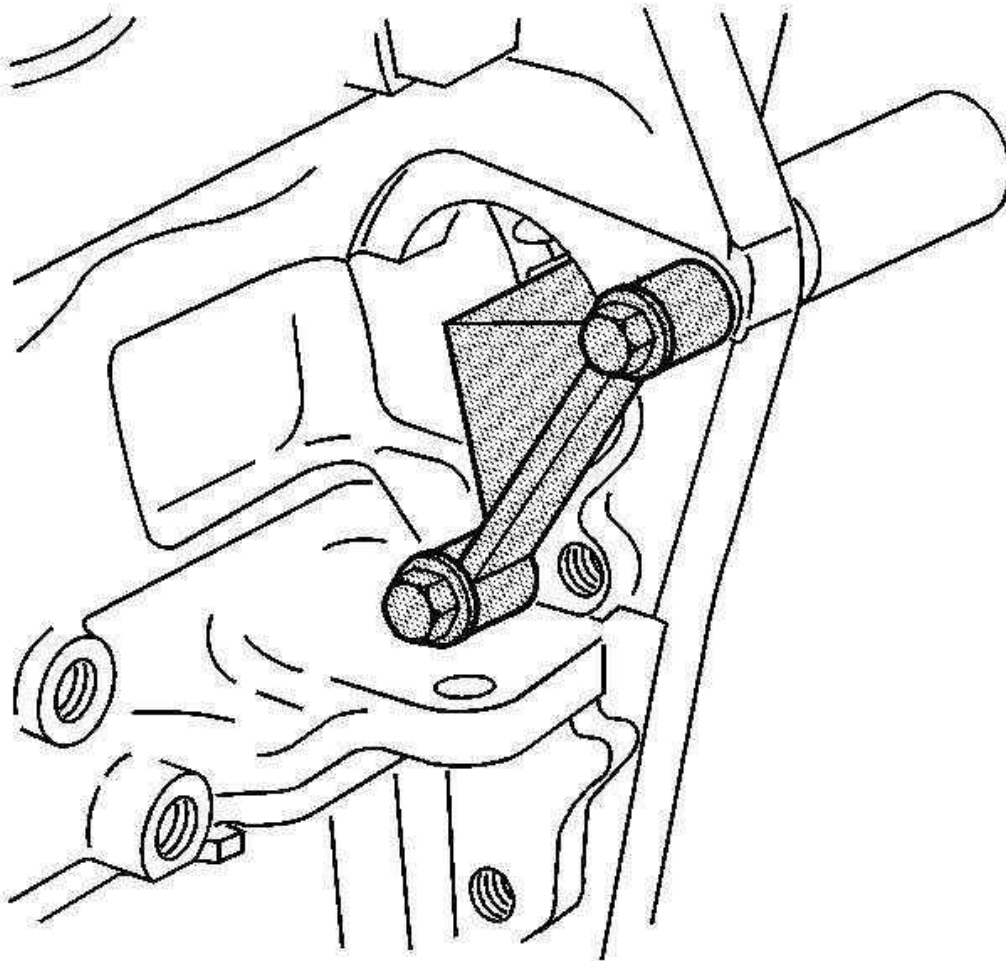


Fig. 198: View Of Special Tool EN 46106
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the EN 46106 is not installed, the crankshaft may rotate. See Special Tools . 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. See Special Tools .
3. Remove the camshafts and rocker arms. Refer to Camshaft Replacement - Left Side.
4. Remove the spark plug from the applicable cylinder. Refer to Spark Plug Replacement .
5. Install the **J 39313** to the applicable cylinder. See Special Tools .
6. Connect the **J 39313** to a compressed air source. See Special Tools .

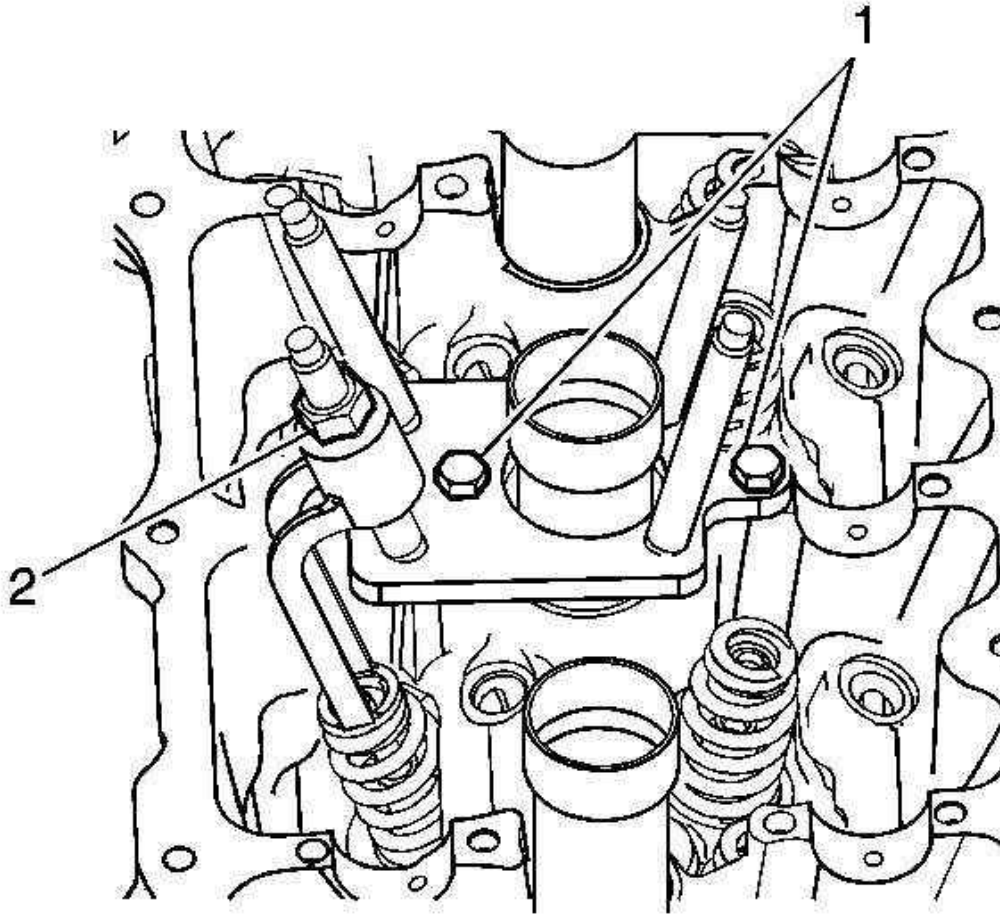


Fig. 199: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

7. Install the **EN 46110** above the applicable cylinder as shown. See **Special Tools** .

CAUTION: Compressed valve springs have high tension against the valve spring compressor. Valve springs that are not properly compressed by or released from the valve spring compressor can be ejected from the valve spring compressor with

intense force. Use care when compressing or releasing the valve spring with the valve spring compressor and when removing or installing the valve stem keys. Failing to use care may cause personal injury.

NOTE: Do not compress the valve springs less than 24.0 mm (0.943 in). Contact between the valve spring retainer and the valve stem oil seal can cause potential valve stem oil seal damage.

8. Tighten the **EN 46110** valve spring compressor nut (2). See **Special Tools** .

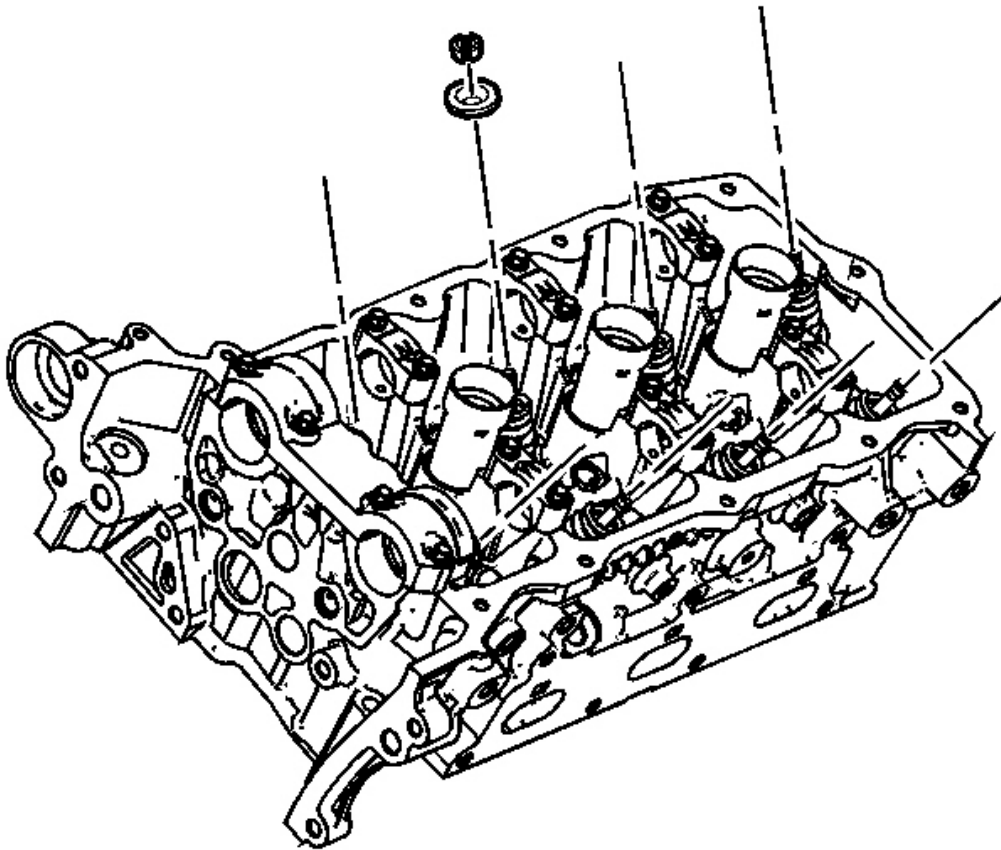


Fig. 200: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

9. Using the **EN 46117** , remove the valve keepers. See **Special Tools** .
10. Loosen the **EN 46110** valve spring compressor nut. See **Special Tools** .
11. Remove the valve spring retainer.

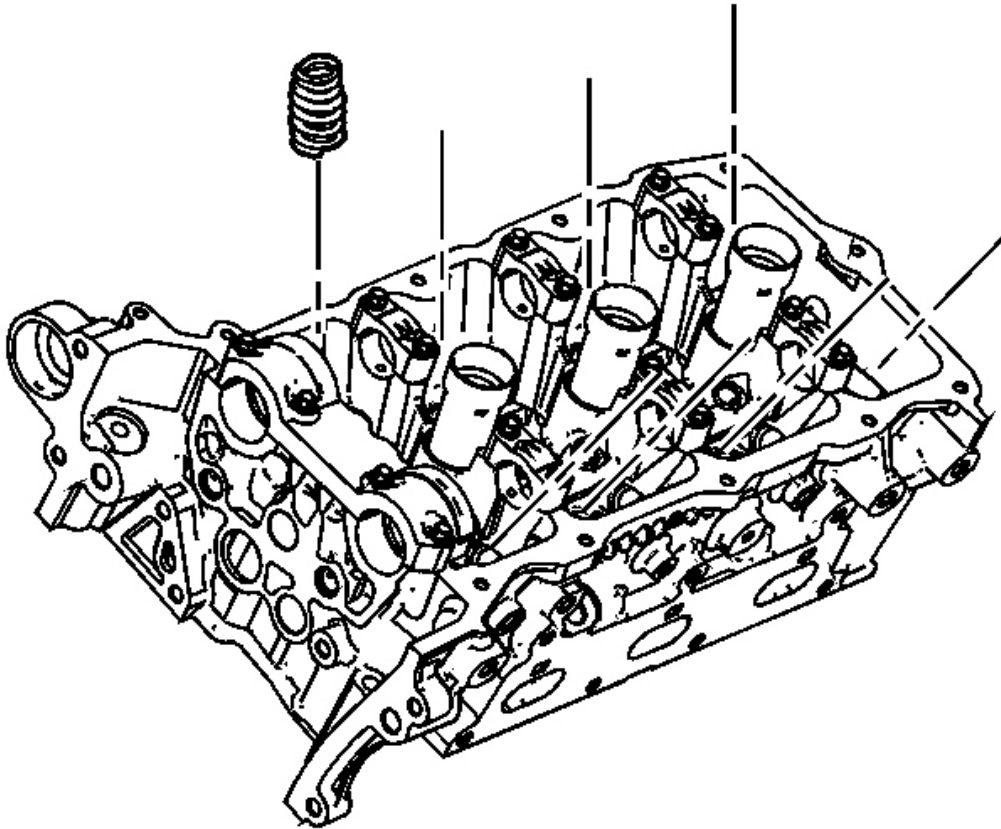


Fig. 201: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

12. Remove the valve spring.

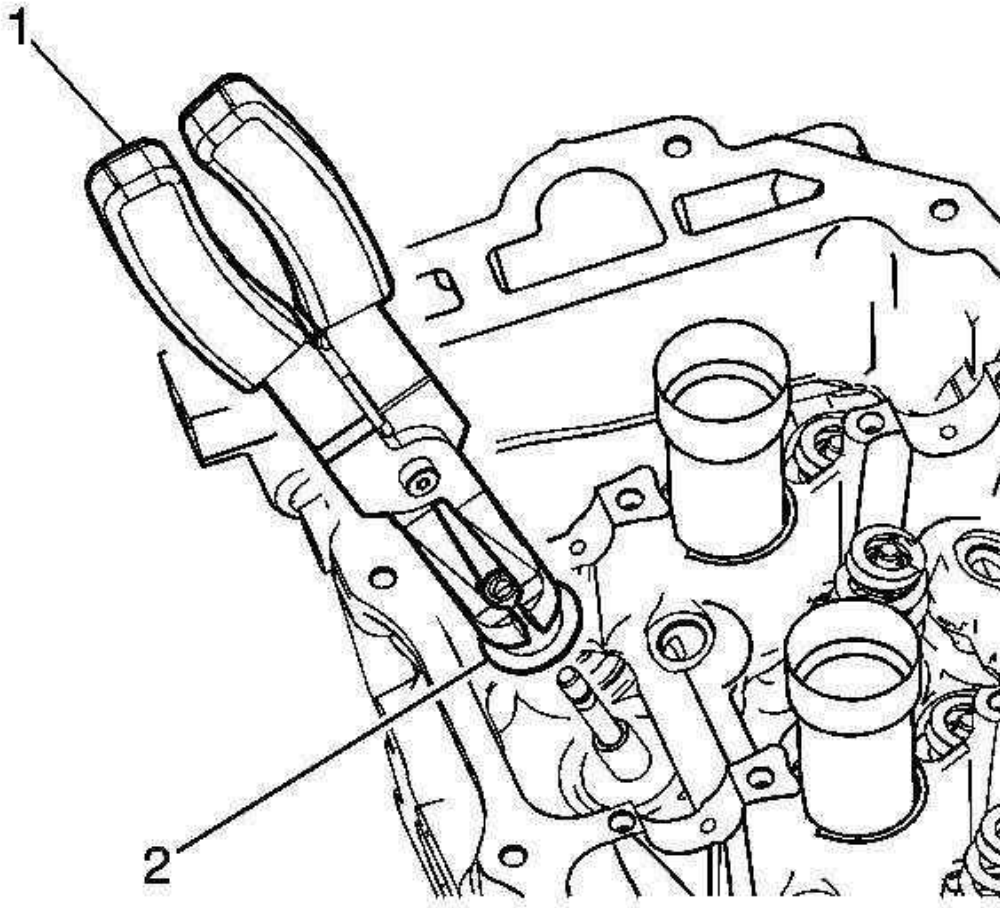


Fig. 202: Identifying Special Tool - EN-46116 & Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

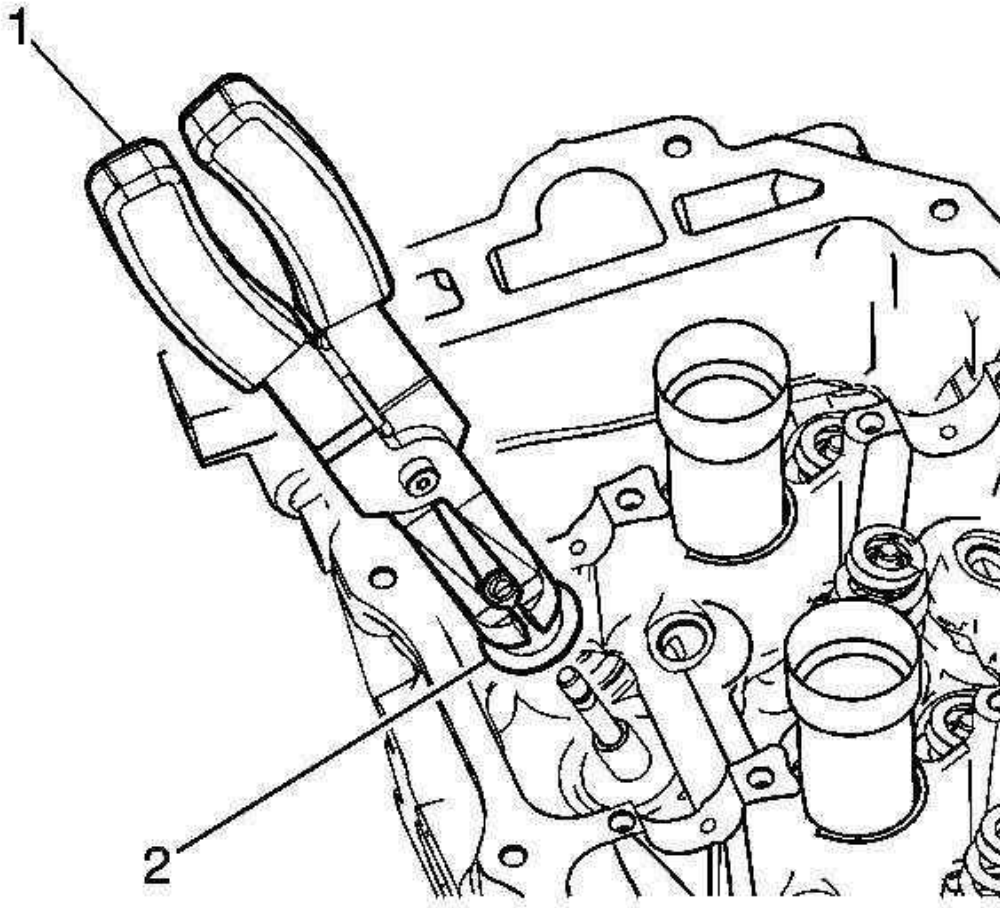


Fig. 203: Identifying Special Tool - EN-46116 & Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

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

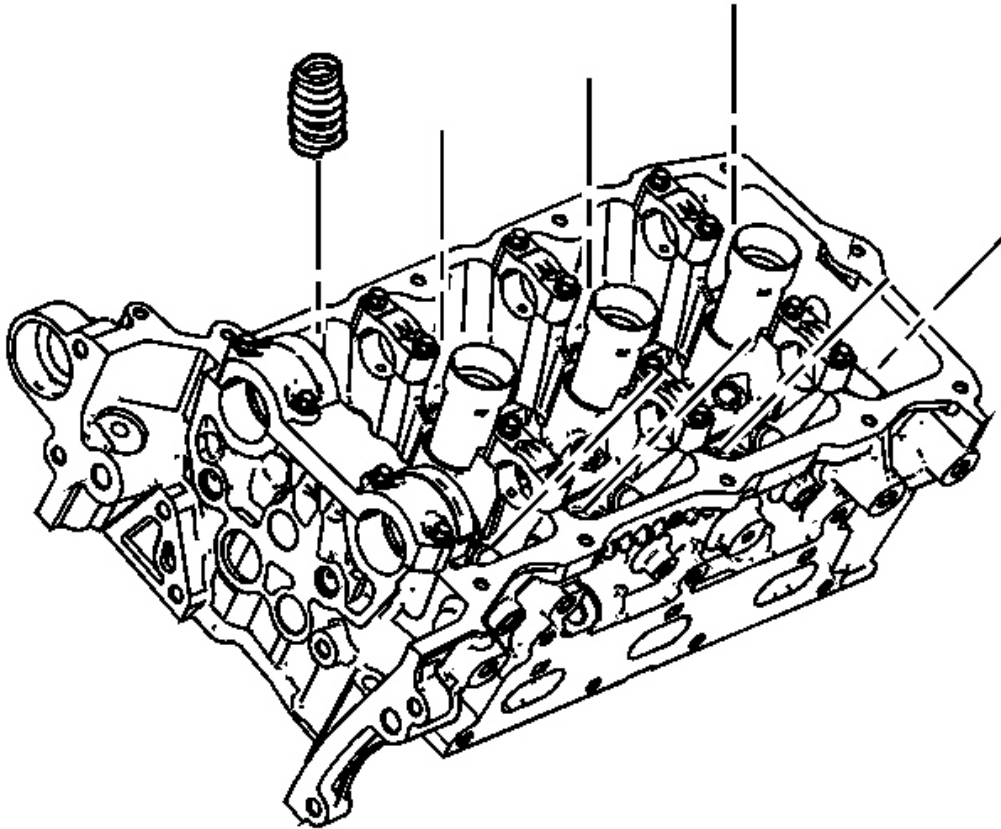


Fig. 204: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

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

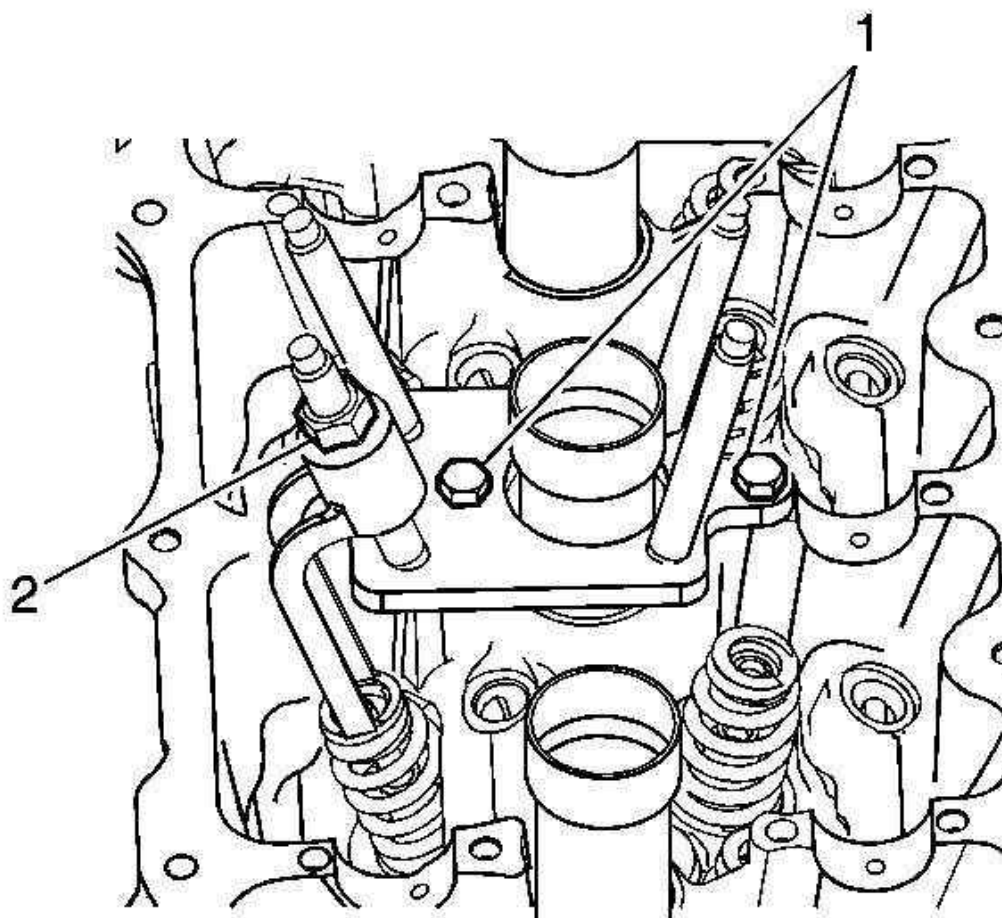


Fig. 205: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

4. Install the **EN 46110** above the applicable valve spring as shown. See **Special Tools** .

Tighten the **EN 46110** valve spring compressor nut (2). See **Special Tools** .

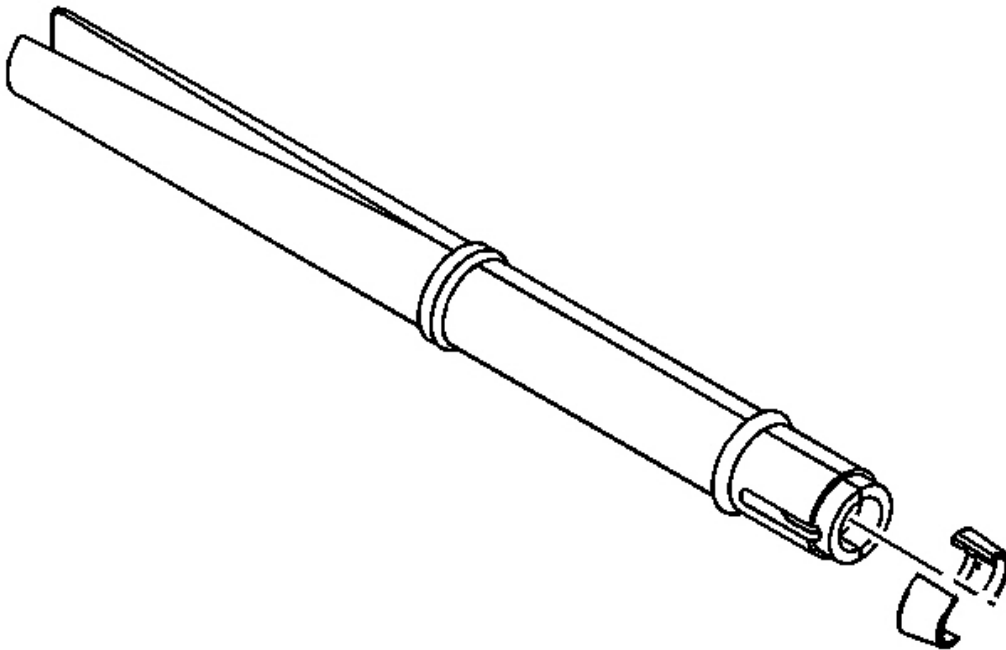


Fig. 206: View Of Valve Keepers With EN 46117
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure proper directional placement of valve keepers in the EN 46117 . See Special Tools . The valve keepers must be installed with the tapered end towards the valve stem seal.

5. With the spring compressed, install the valve keepers into the **EN 46117** . See Special Tools .

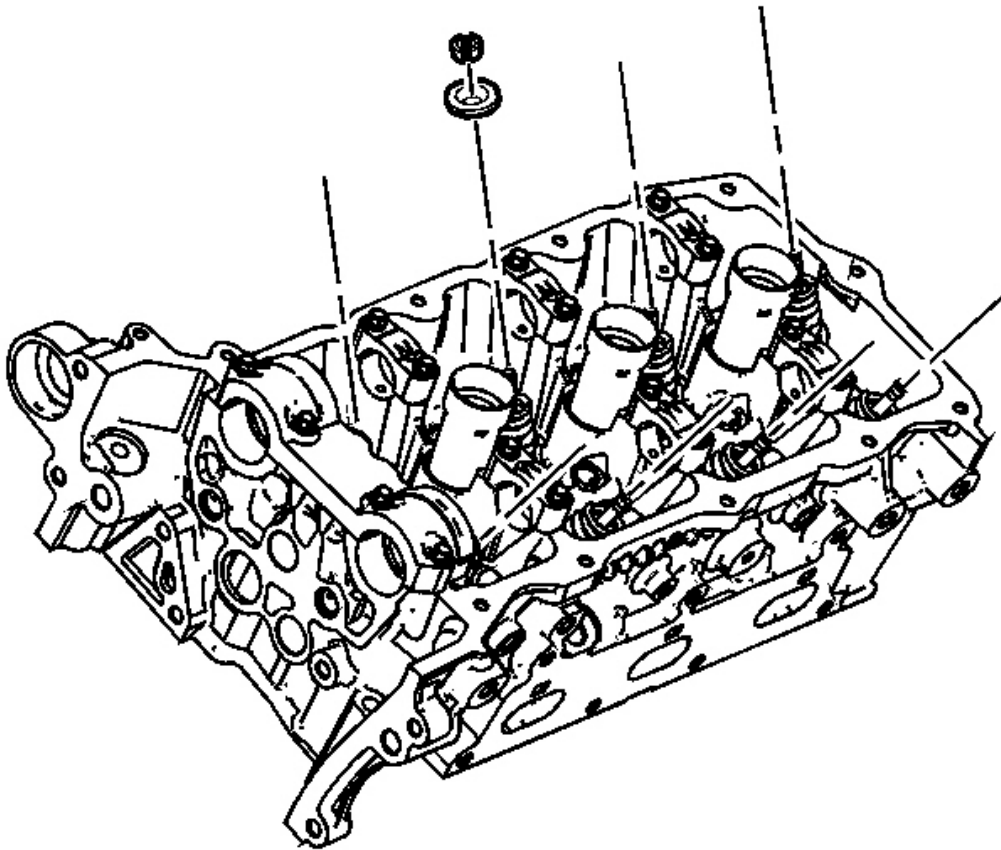


Fig. 207: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

6. Install the valve spring keepers.
7. Remove the **EN 46110** . See **Special Tools** .
8. Disconnect the **J 39313** from the compressed air source. See **Special Tools** .
9. Remove the **J 39313** . See **Special Tools** .
10. Install the spark plugs. Refer to **Spark Plug Replacement** .
11. Install the rocker arms and camshafts. Refer to **Camshaft Replacement - Left Side**.
12. Remove the **EN 46106** in order to prevent crankshaft rotation. See **Special**

Tools .

13. Install the starter motor. Refer to **Starter Motor Replacement (LY7)** .

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT - RIGHT SIDE

Tools Required

- **EN 46106** Flywheel Holding Tool. See **Special Tools** .
- **EN 46110** On-Vehicle Valve Spring Compressor. See **Special Tools** .
- **EN 46116** Valve Stem Seal Remover/Installer. See **Special Tools** .
- **EN 46117** Valve Stem Key Remover/Installer. See **Special Tools** .
- **J 39313** Spark Plug Port Adapter. See **Special Tools** .

Removal Procedure

1. Remove the starter motor. Refer to **Starter Motor Replacement (LY7)** .

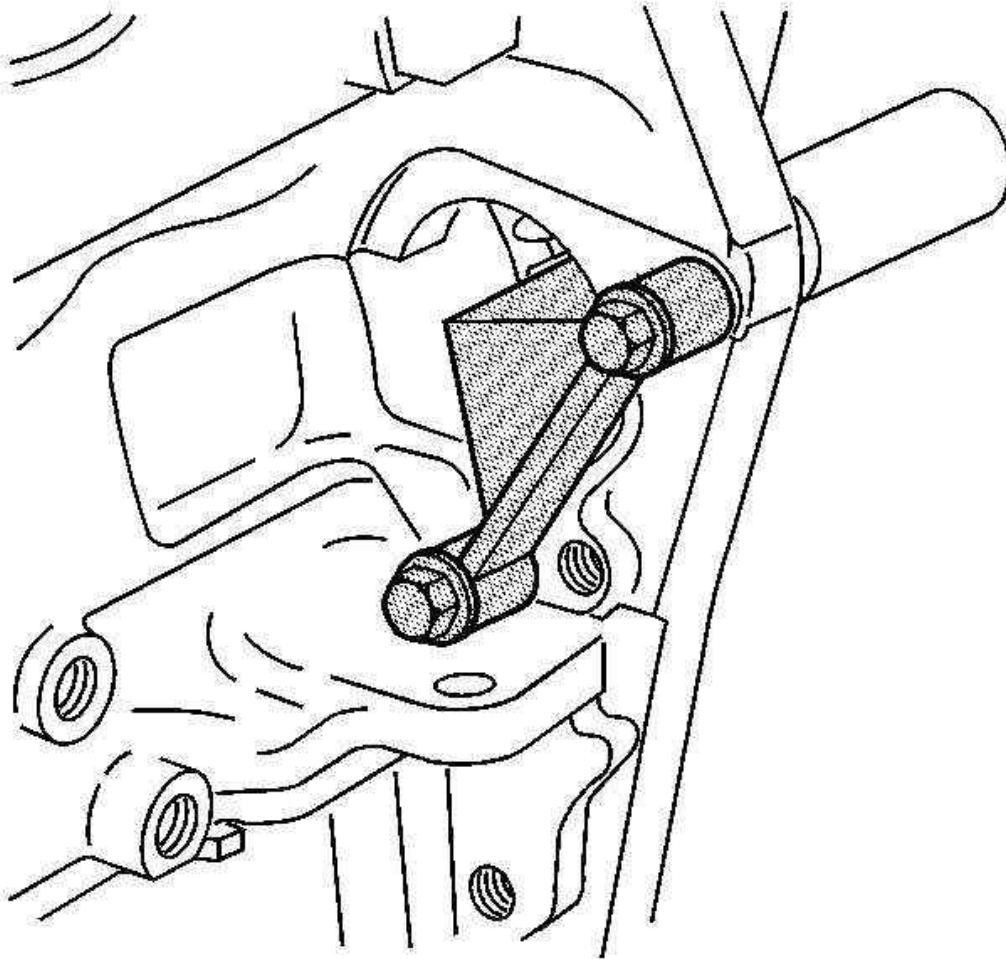


Fig. 208: View Of Special Tool EN 46106
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the EN 46106 is not installed, the crankshaft may rotate. See Special Tools . 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. See Special Tools .

3. Remove the camshafts and rocker arms. Refer to **Camshaft Replacement - Right Side (LY7)**.
4. Remove the spark plug from the applicable cylinder. Refer to **Spark Plug Replacement**.
5. Install the **J 39313** to the applicable cylinder. See **Special Tools**.
6. Connect the **J 39313** to a compressed air source. See **Special Tools**.

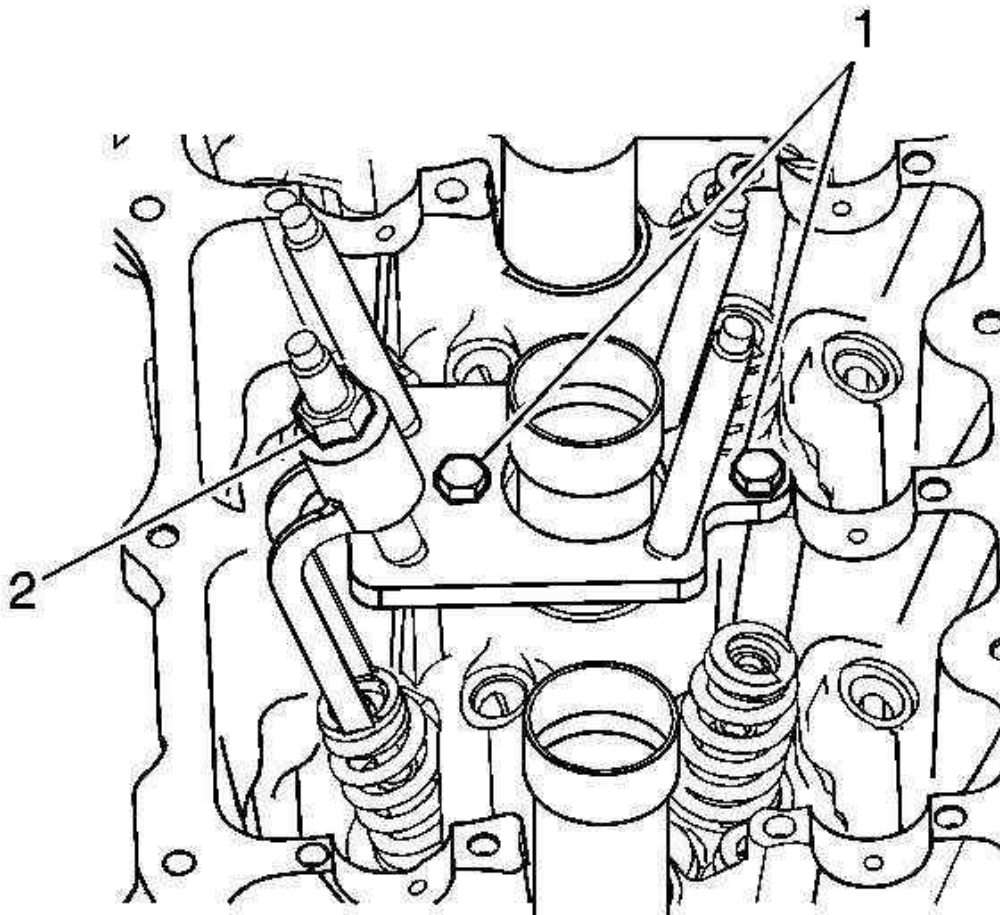


Fig. 209: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

7. Install the **EN 46110** above the applicable cylinder as shown. See **Special Tools** .

CAUTION: Compressed valve springs have high tension against the valve spring compressor. Valve springs that are not properly compressed by or released from the valve spring compressor can be ejected from the valve spring compressor with intense force. Use care when compressing or releasing the valve spring with the valve spring compressor and when removing or installing the valve stem keys. Failing to use care may cause personal injury.

NOTE: Do not compress the valve springs less than 24.0 mm (0.943 in). Contact between the valve spring retainer and the valve stem oil seal can cause potential valve stem oil seal damage.

8. Tighten the **EN 46110** valve spring compressor nut (2). See **Special Tools** .

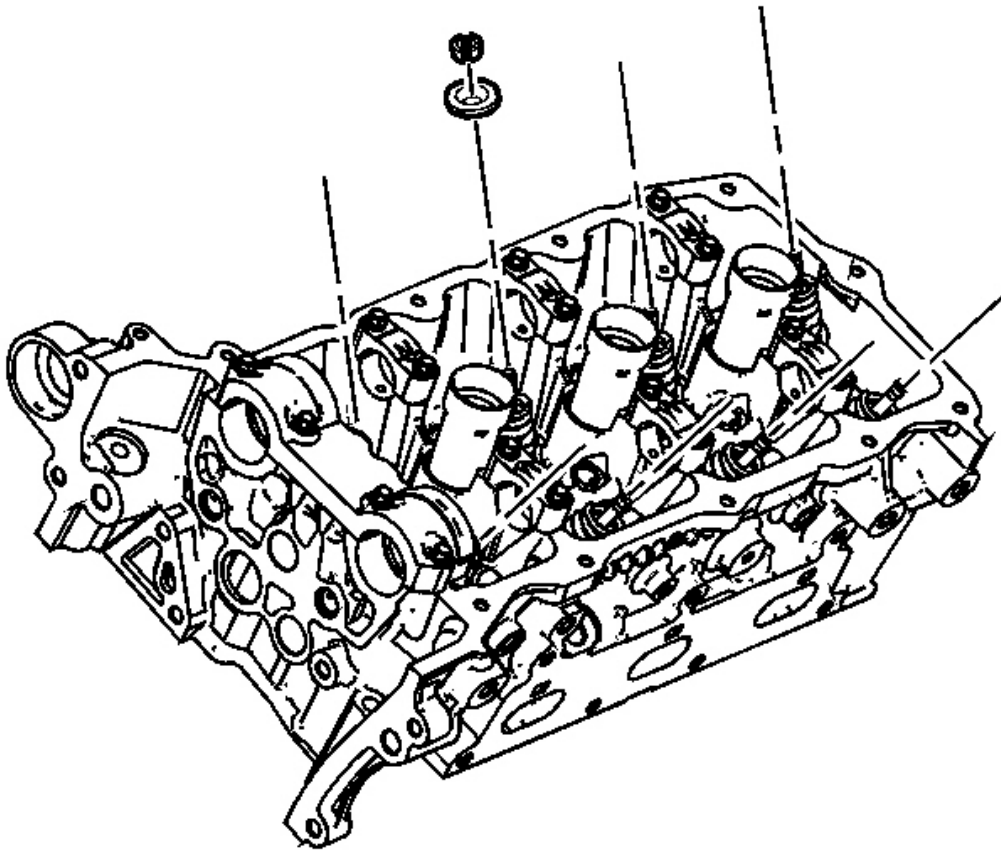


Fig. 210: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

9. Using the **EN 46117** remove the valve keepers. See **Special Tools** .
10. Loosen the **EN 46110** valve spring compressor nut. See **Special Tools** .
11. Remove the valve spring retainer.

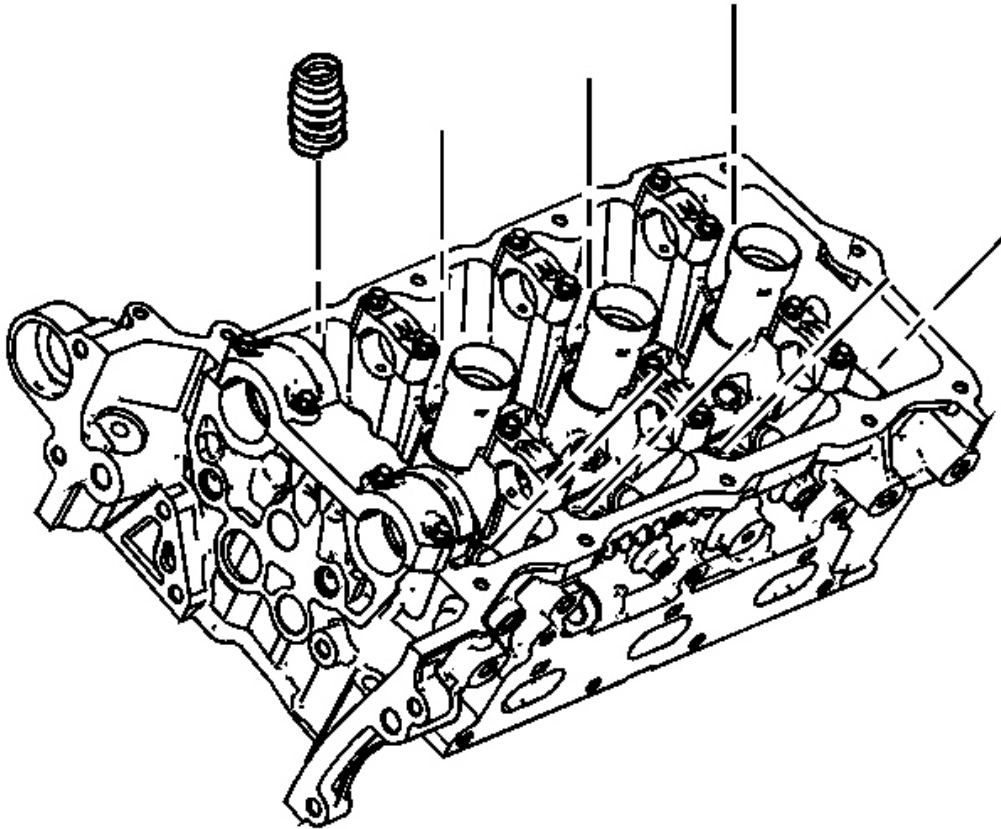


Fig. 211: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

12. Remove the valve springs.

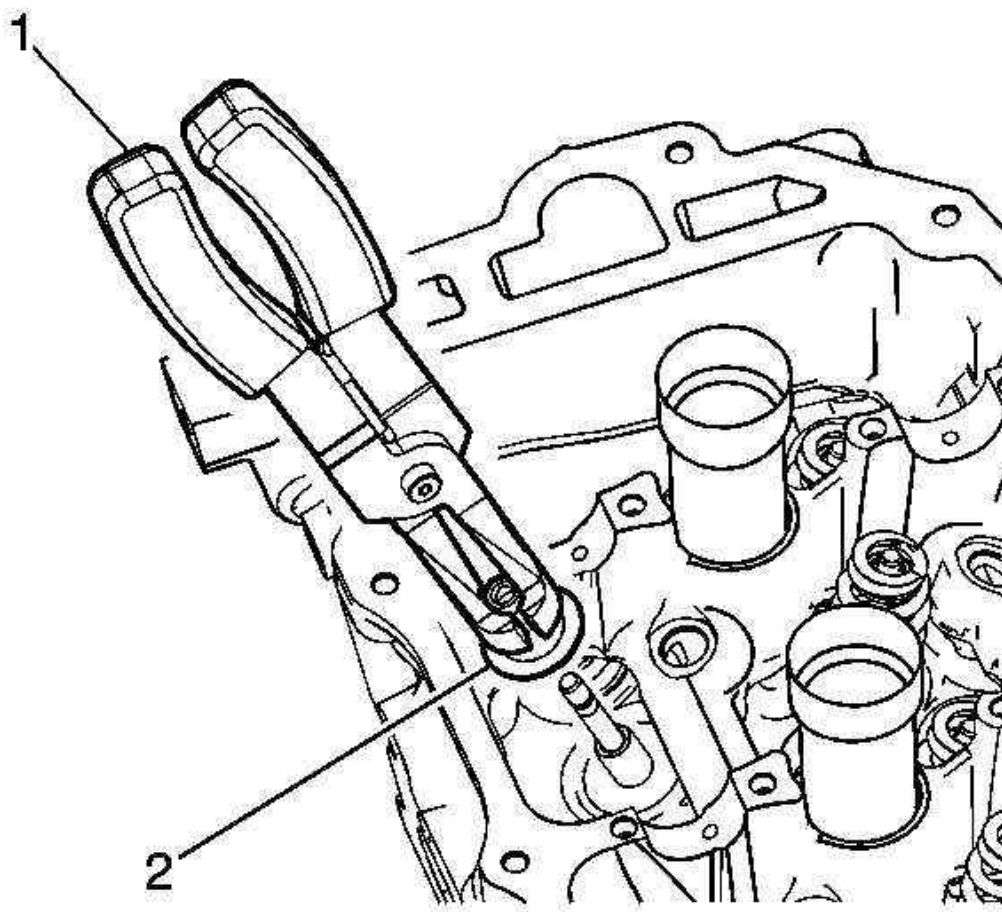


Fig. 212: Identifying Special Tool - EN-46116 & Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

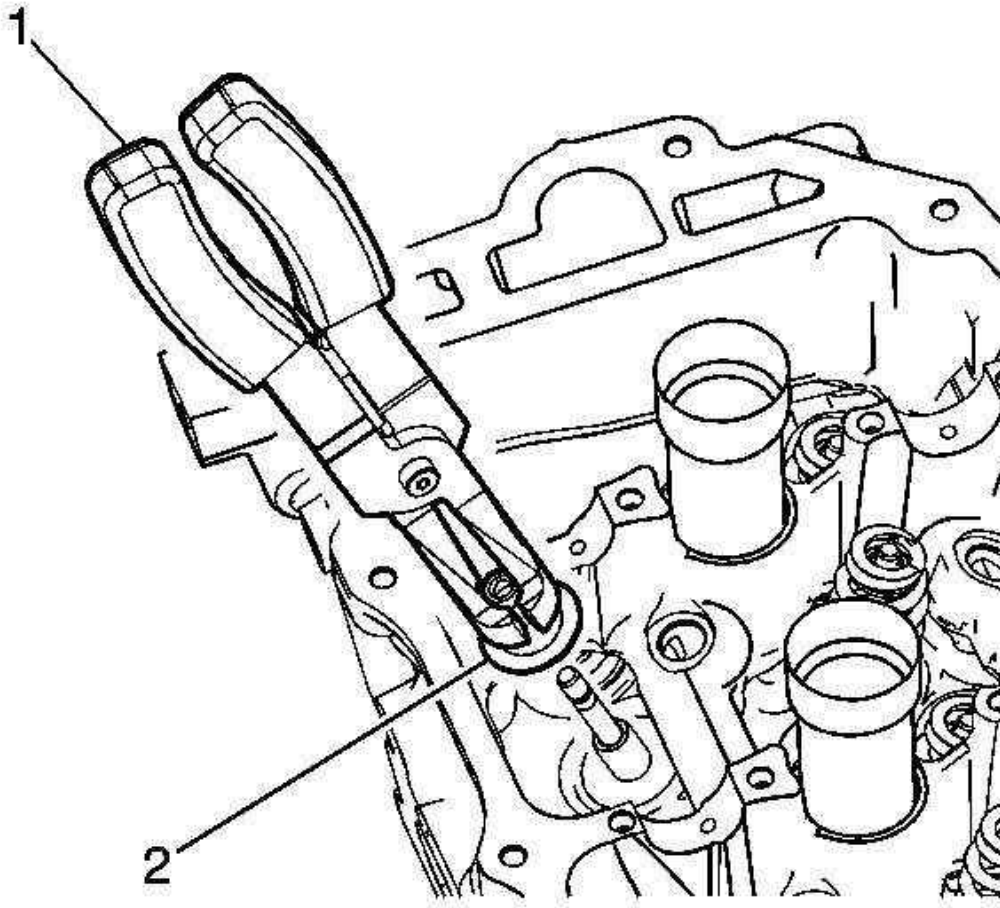


Fig. 213: Identifying Special Tool - EN-46116 & Valve Stem Seal
Courtesy of GENERAL MOTORS CORP.

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

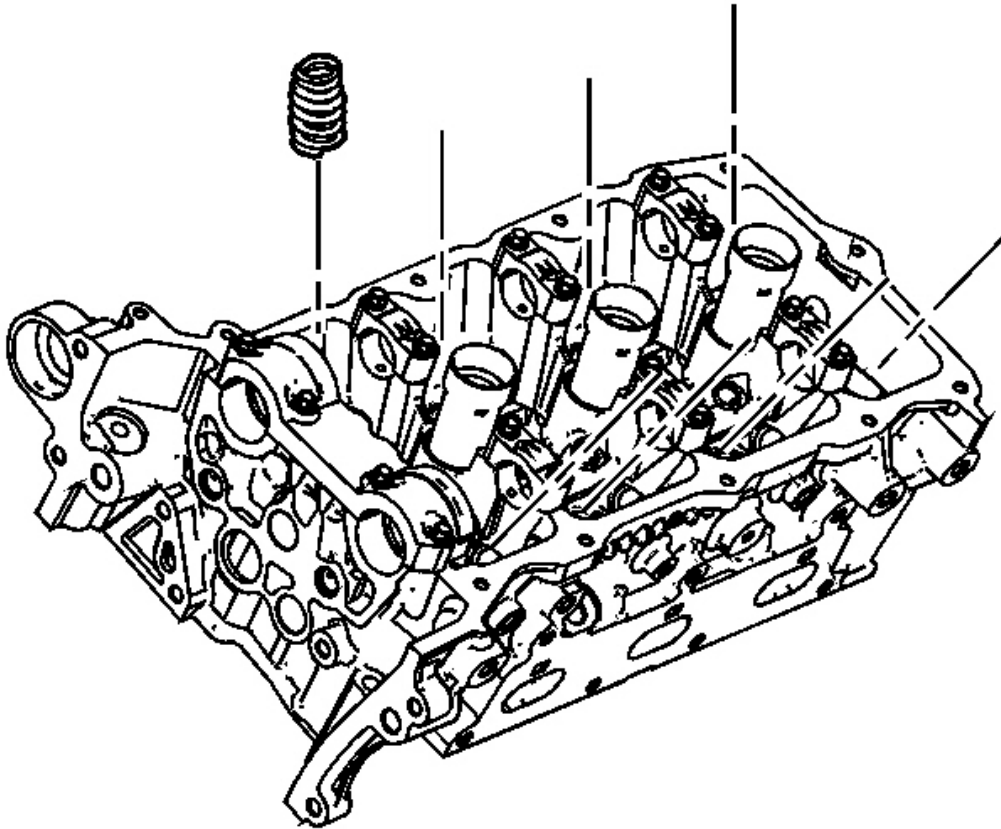


Fig. 214: View Of Valve Spring
Courtesy of GENERAL MOTORS CORP.

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

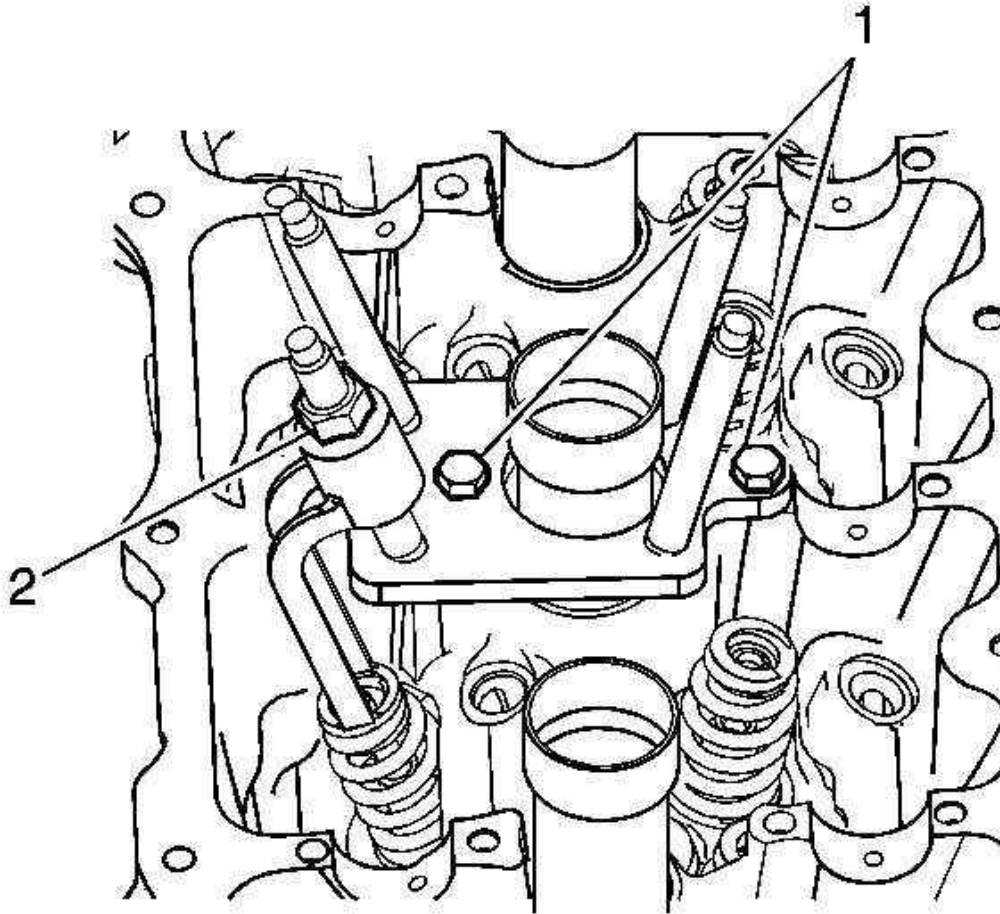


Fig. 215: View Of Installed Valve Spring Compressor Tool
Courtesy of GENERAL MOTORS CORP.

4. Install the **EN 46110** above the applicable valve spring as shown. See **Special Tools** .

Tighten the **EN 46110** valve spring compressor nut (2). See **Special Tools** .

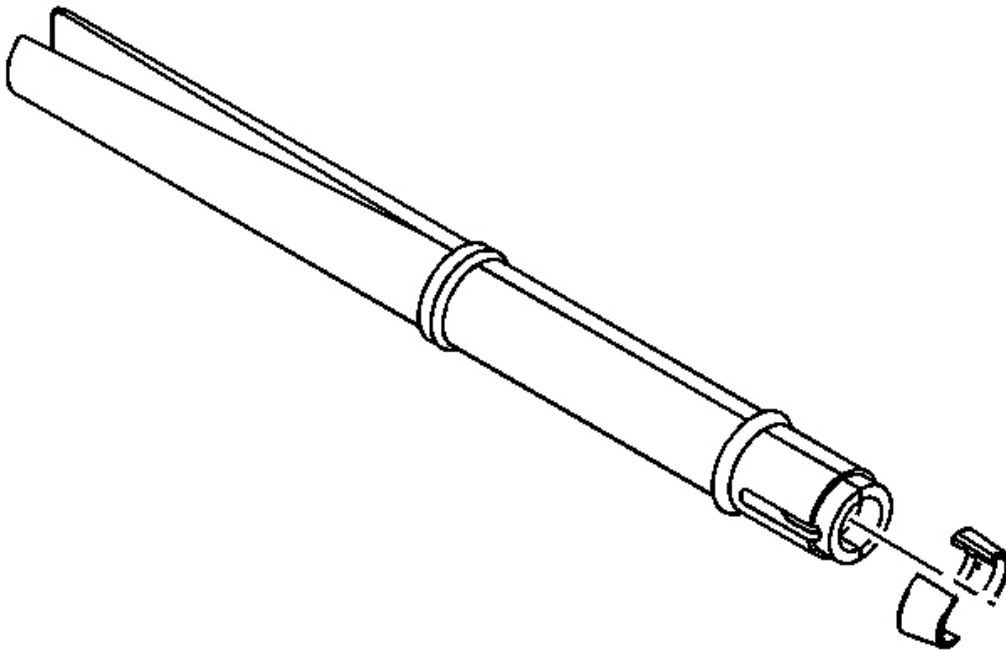


Fig. 216: View Of Valve Keepers With EN 46117
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure proper directional placement of valve keepers in the EN 46117 . See Special Tools . The valve keepers must be installed with the tapered end towards the valve stem seal.

5. With the spring compressed, install the valve keepers into the **EN 46117** . See Special Tools .

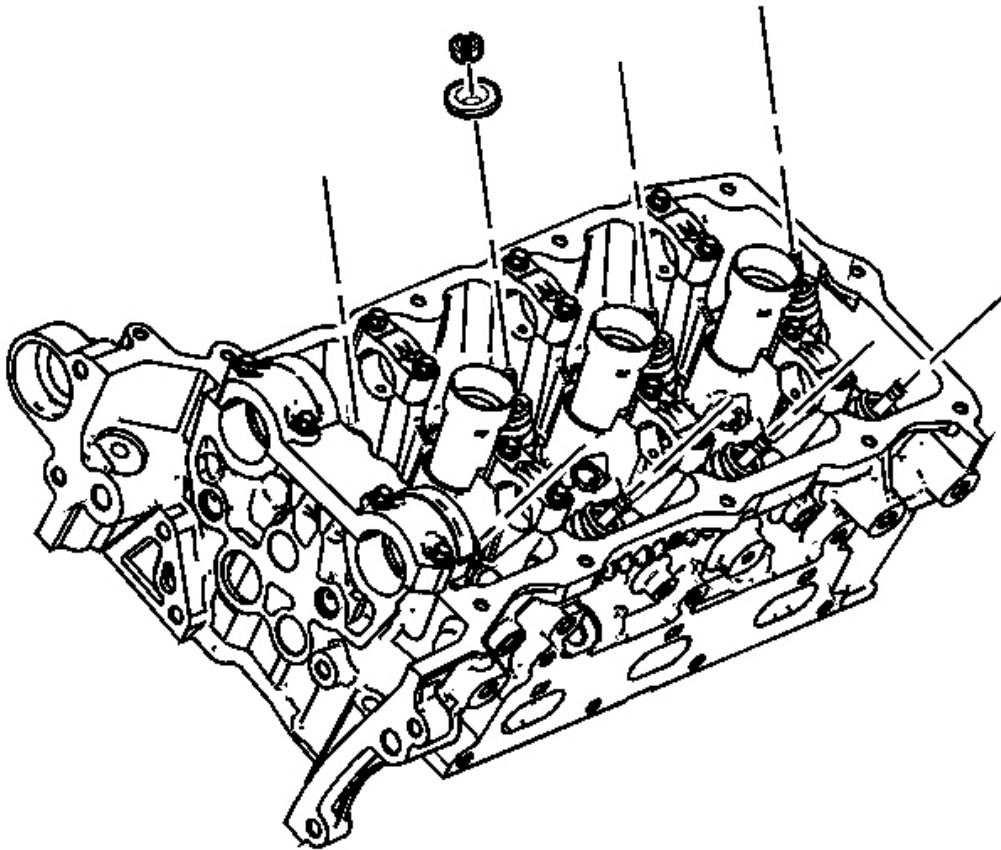


Fig. 217: View Of Valve Spring Keepers
Courtesy of GENERAL MOTORS CORP.

6. Install the valve spring keepers.
7. Remove the **EN 46110** . See **Special Tools** .
8. Disconnect the **J 39313** from the compressed air source. See **Special Tools** .
9. Remove the **J 39313** . See **Special Tools** .
10. Install the spark plugs. Refer to **Spark Plug Replacement** .
11. Install the rocker arms and camshafts. Refer to **Camshaft Replacement - Right Side (LY7)**.
12. Remove the **EN 46106** . See **Special Tools** .

2008 Buick LaCrosse CX
2008 ENGINE Engine Mechanical - 3.6L - LaCrosse

13. Install the starter motor. Refer to **Starter Motor Replacement (LY7)** .