

2011 ENGINE

Engine Mechanical - Hybrid (HP2) 6.0L (LZ1) - Repair Instructions - On Vehicle - Escalade, Tahoe & Yukon

REPAIR INSTRUCTIONS - ON VEHICLE

DRIVE BELT REPLACEMENT

Removal Procedure

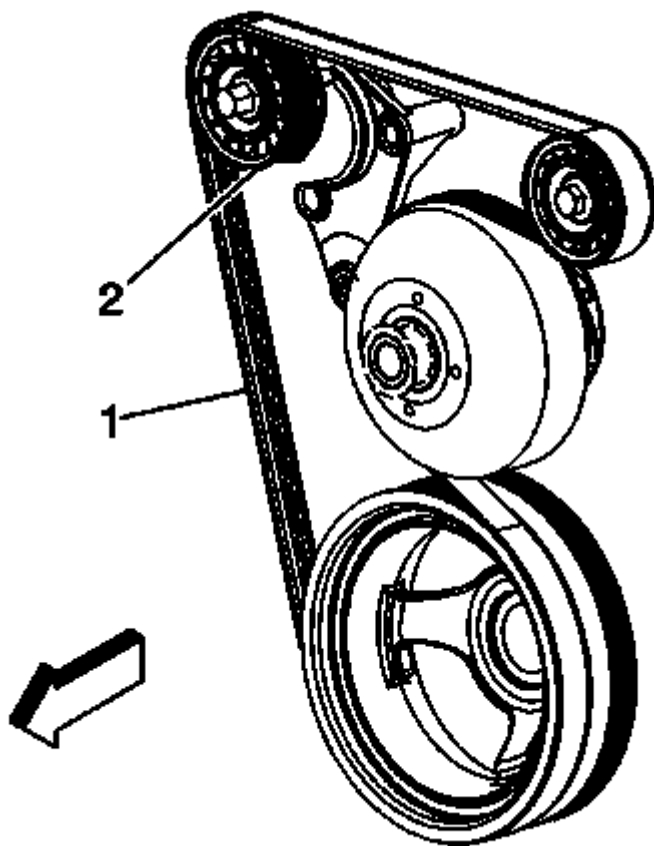
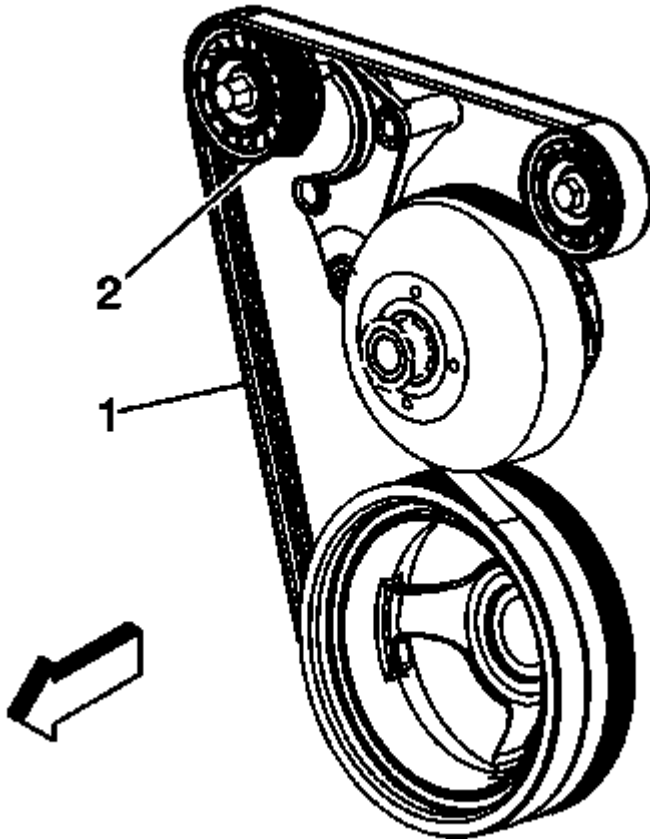


Fig. 1: Drive Belt Routing

Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner resonator outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
2. Install a breaker bar with hex-head socket to the drive belt tensioner bolt.
3. Rotate the drive belt tensioner clockwise in order to relieve tension on the belt.
4. Remove the belt (1) from the pulleys and the drive belt tensioner (2).
5. Slowly release the tension on the drive belt tensioner.

6. Remove the breaker bar and socket from the drive belt tensioner bolt.
7. Clean and inspect the belt surfaces of all the pulleys.

Installation Procedure**Fig. 2: Drive Belt Routing**

Courtesy of GENERAL MOTORS CORP.

1. Route the drive belt (1) around all the pulleys except the idler pulley.
2. Install the breaker bar with hex-head socket to the belt tensioner bolt.
3. Rotate the belt tensioner (2) clockwise in order to relieve the tension on the tensioner.
4. Install the drive belt under the idler pulley.
5. Slowly release the tension on the belt tensioner.
6. Remove the breaker bar and socket from the belt tensioner bolt.
7. Inspect the drive belt for proper installation and alignment.
8. Install the air cleaner resonator outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#) .

DRIVE BELT IDLER PULLEY REPLACEMENT**Removal Procedure**

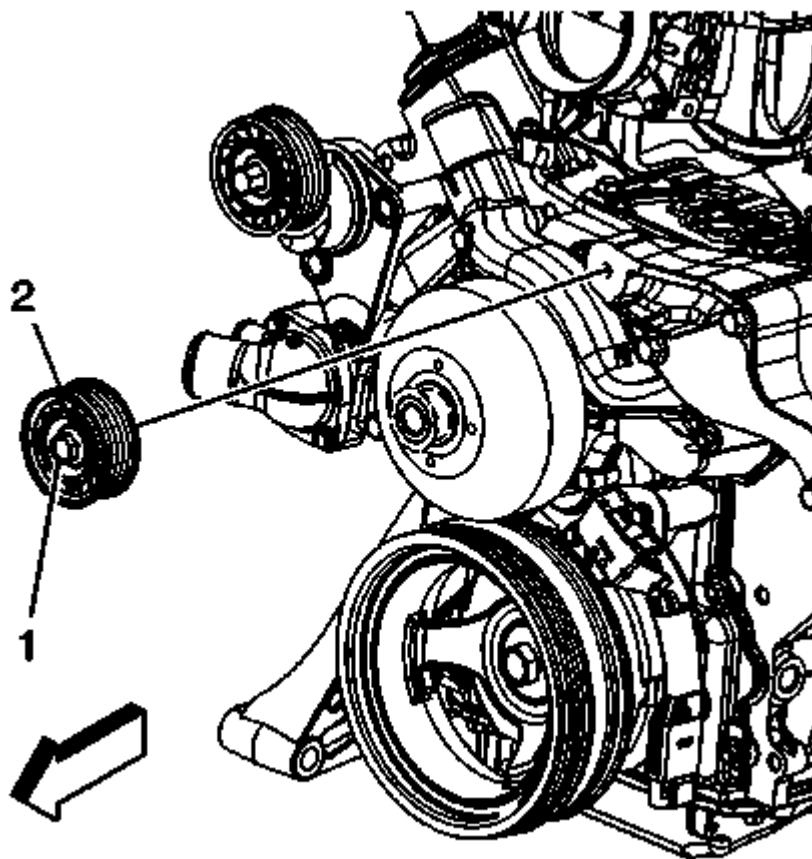


Fig. 3: Drive Belt Idler Pulley

Courtesy of GENERAL MOTORS CORP.

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

Installation Procedure

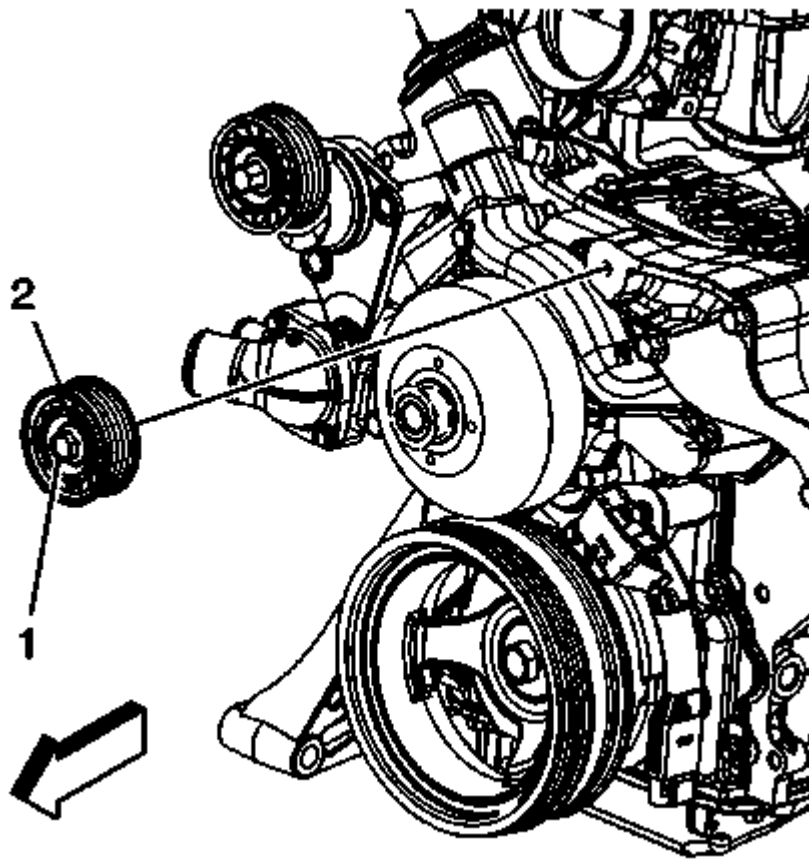


Fig. 4: Drive Belt Idler Pulley

Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt idler pulley (2) and bolt to the generator bracket.

Snug the bolt finger tight.

CAUTION: Refer to Fastener Caution .

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

Tighten

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

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

DRIVE BELT TENSIONER REPLACEMENT

Removal Procedure

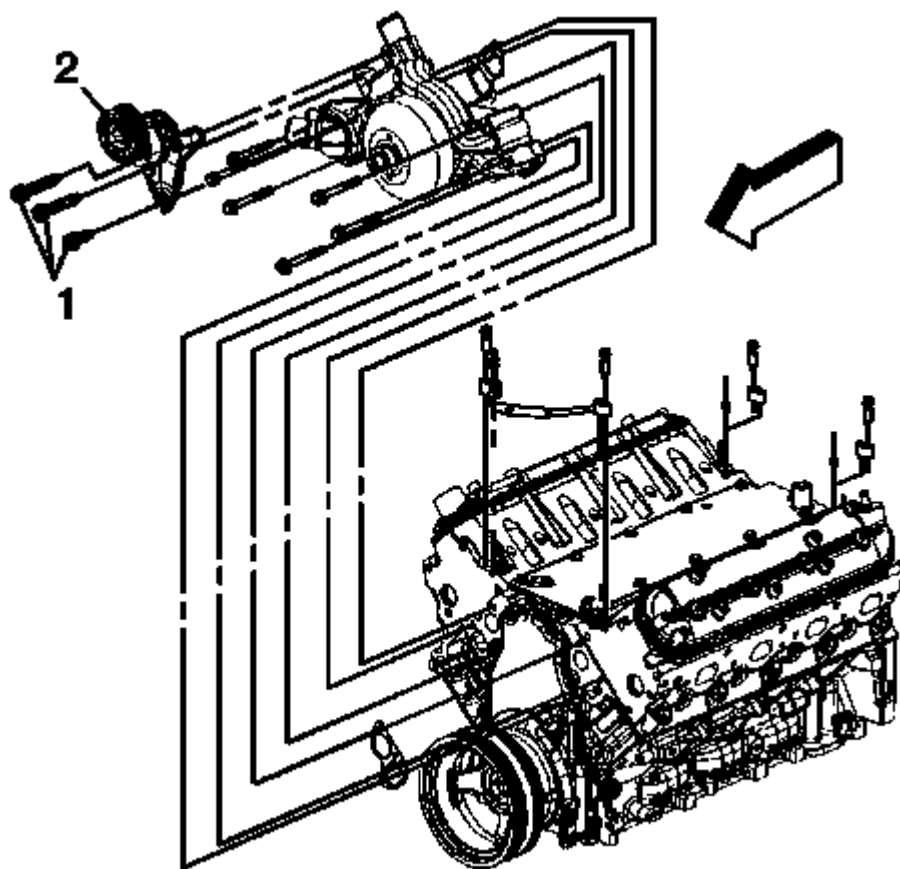


Fig. 5: Drive Belt Tensioner

Courtesy of GENERAL MOTORS CORP.

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the drive belt tensioner bolts (1).
3. Remove the drive belt tensioner (2).

Installation Procedure

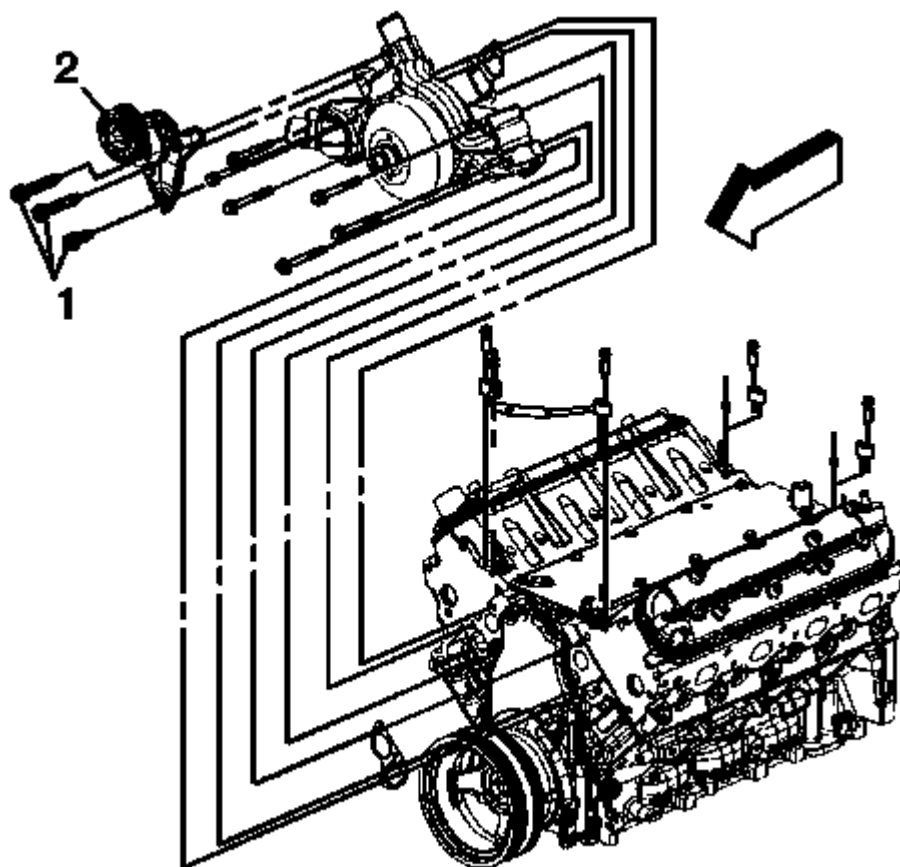


Fig. 6: Drive Belt Tensioner

Courtesy of GENERAL MOTORS CORP.

1. Install the drive belt tensioner (2).
2. Install the drive belt tensioner bolts (1).

CAUTION: Refer to Fastener Caution .

3. Tighten the drive belt tensioner bolts.

Tighten

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

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

ENGINE MOUNT INSPECTION

CAUTION: Broken or deteriorated mounts can cause misalignment and destruction of

certain drive train components. When a single mount breaks, the remaining mounts are subjected to abnormally high stresses.

CAUTION: When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Due to the small clearance between the oil pan and the oil pump screen, jacking against the oil pan may cause the pan to be bent against the pump screen. This will result in a damaged oil pickup unit.

1. Measure the engine movement at the engine mount in order to check for damage to the rubber portions of the mount.
 1. Apply the park brake.
 2. Start the engine.
 3. Firmly apply and hold the primary brakes.
 4. Have an assistant stand to the side of the vehicle in order to observe for engine movement.
 5. Slightly load the engine shifting from drive to reverse a few times.
 6. If the engine moves more than 24 mm (0.945 in) from the at rest position, in either direction, check for loose engine mount bolts.
2. If the engine mount bolt torque is within specifications, check the condition of the engine mount.
3. Replace the engine mount if any of the following conditions exist:
 - Heat check cracks cover the rubber cushion surface.
 - The rubber cushion is separated from the metal plate of the mount.
 - There is a split through the rubber cushion.

ENGINE MOUNT REPLACEMENT - LEFT SIDE

Removal Procedure

CAUTION: When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Due to the small clearance between the oil pan and the oil pump screen, jacking against the oil pan may cause the pan to be bent against the pump screen. This will result in a damaged oil pickup unit.

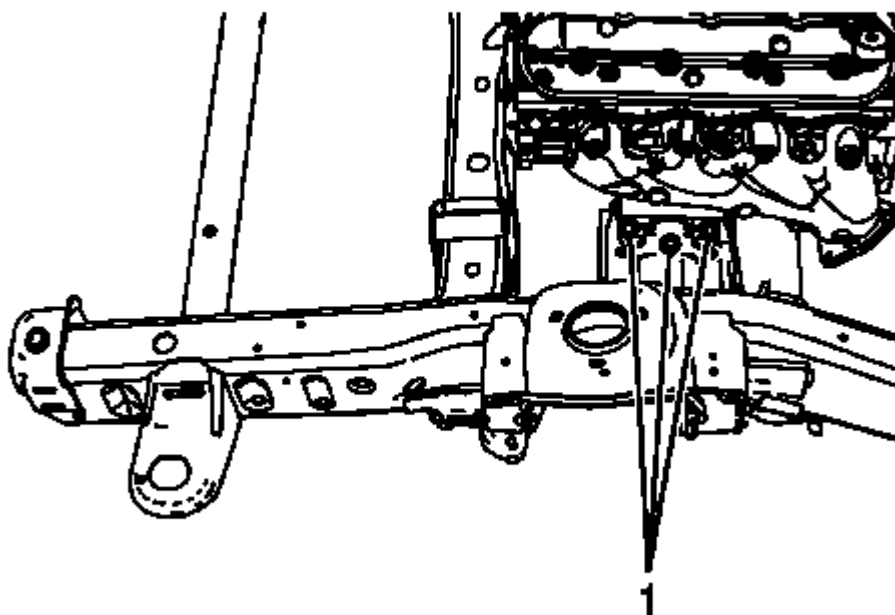


Fig. 7: Engine Mount And Bolts - Left Side
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
2. Lower the vehicle.
3. Remove the engine mount to frame bolts (1).
4. Raise and support the vehicle halfway. Refer to **Lifting and Jacking the Vehicle** .
5. Remove the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Left Side** .

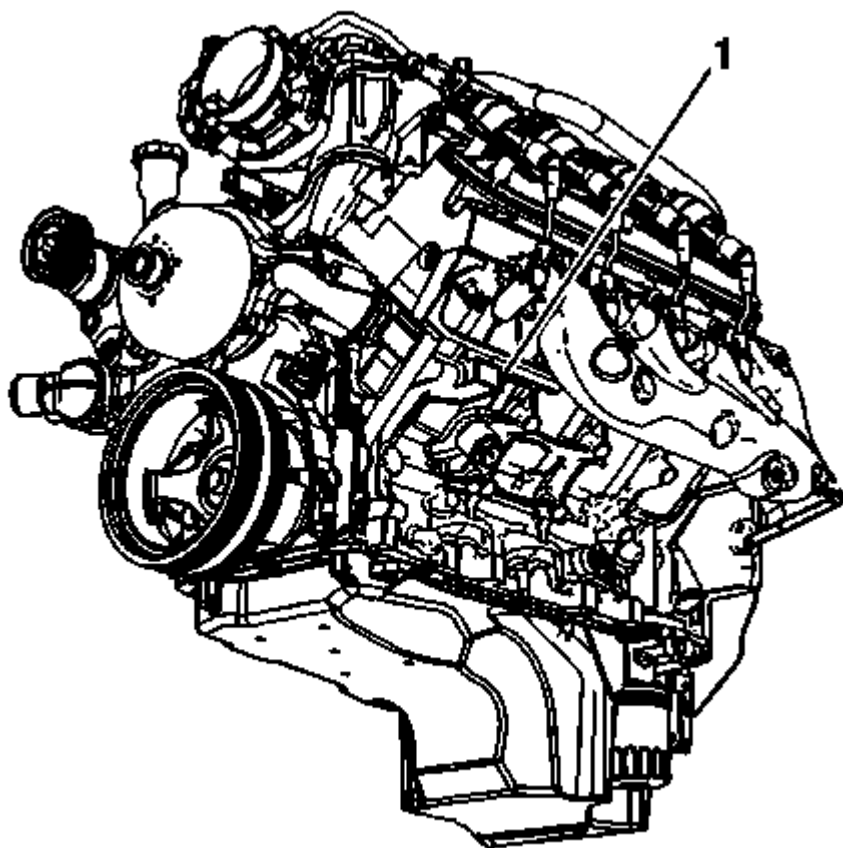


Fig. 8: Engine Block Tab

Courtesy of GENERAL MOTORS CORP.

NOTE: **DO NOT** raise and/or support the engine by the crankshaft balancer, or the oil pan.

6. Place an adjustable (screw type) jack to the tab (1) located on the engine block.

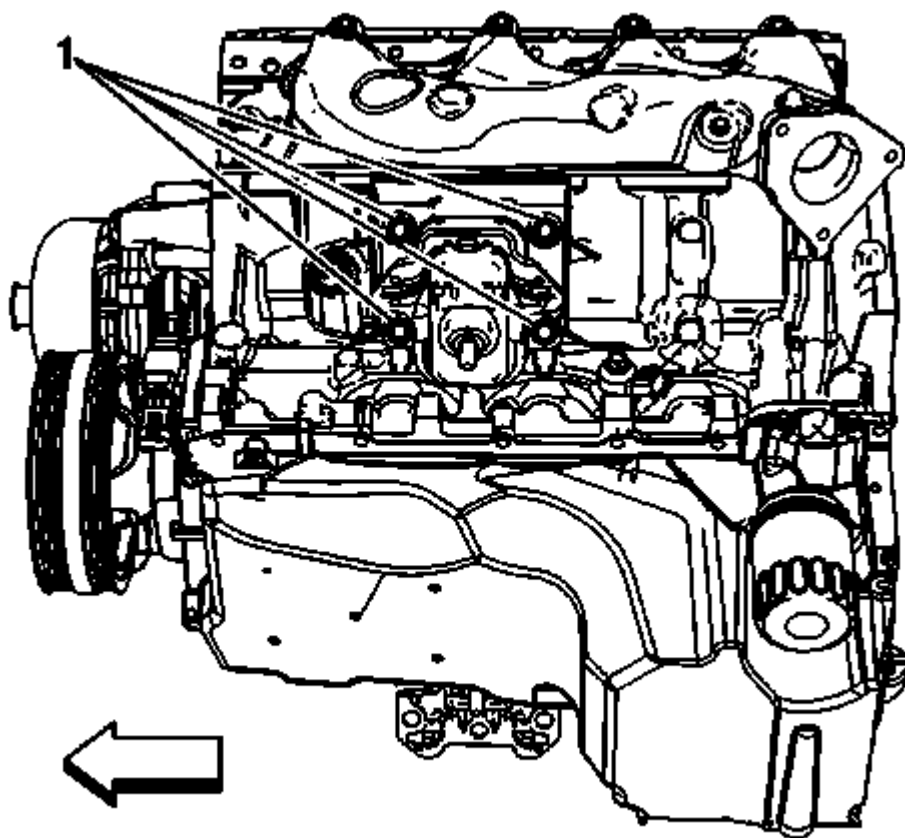


Fig. 9: Engine Mount And Bolts - Left Side
Courtesy of GENERAL MOTORS CORP.

7. Working through the wheelhouse opening, remove the engine mount to engine bolts (1).
8. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.

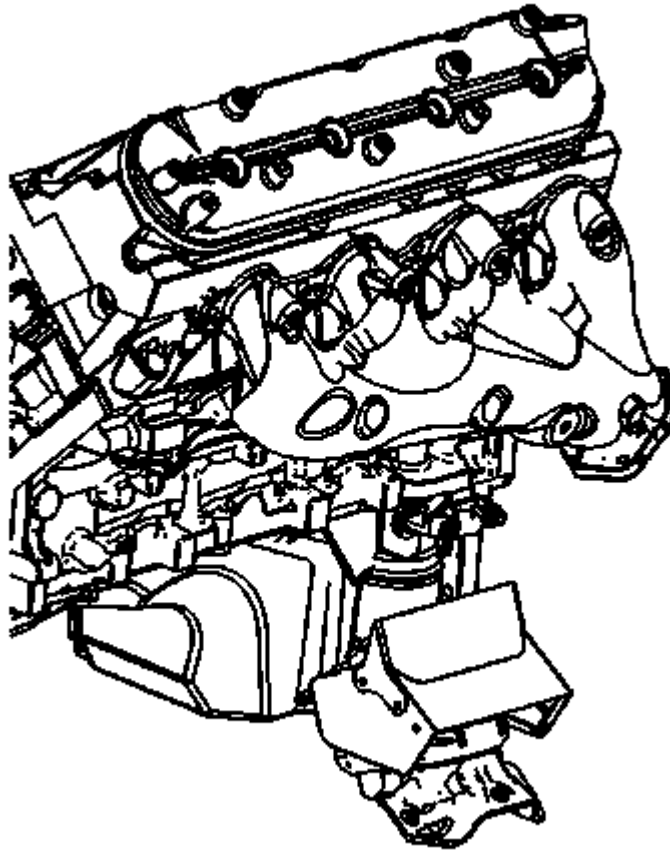


Fig. 10: Engine Mount - Left Side
Courtesy of GENERAL MOTORS CORP.

9. Remove the engine mount.

Installation Procedure

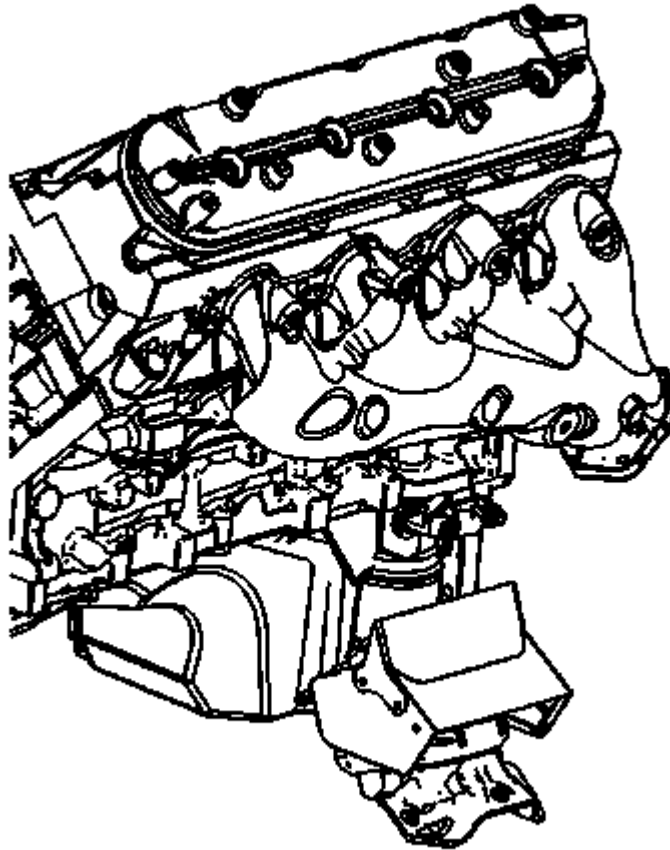


Fig. 11: Engine Mount - Left Side
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

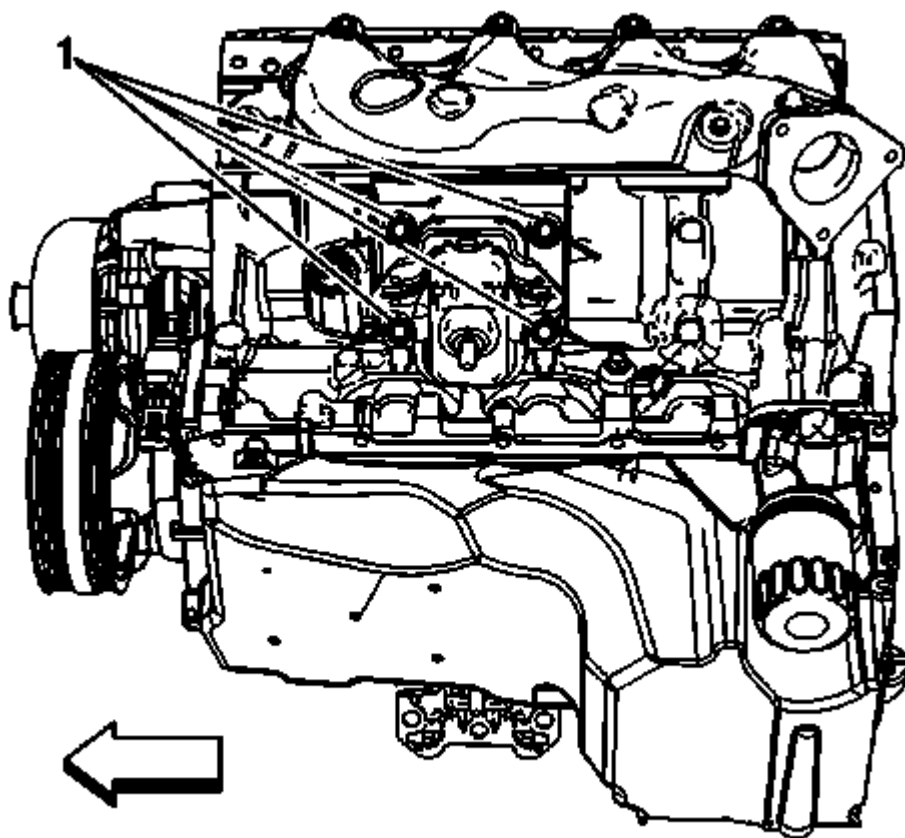


Fig. 12: Engine Mount And Bolts - Left Side
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Working through the wheelhouse opening, install the engine mount to engine bolts (1).

Tighten

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

3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block.

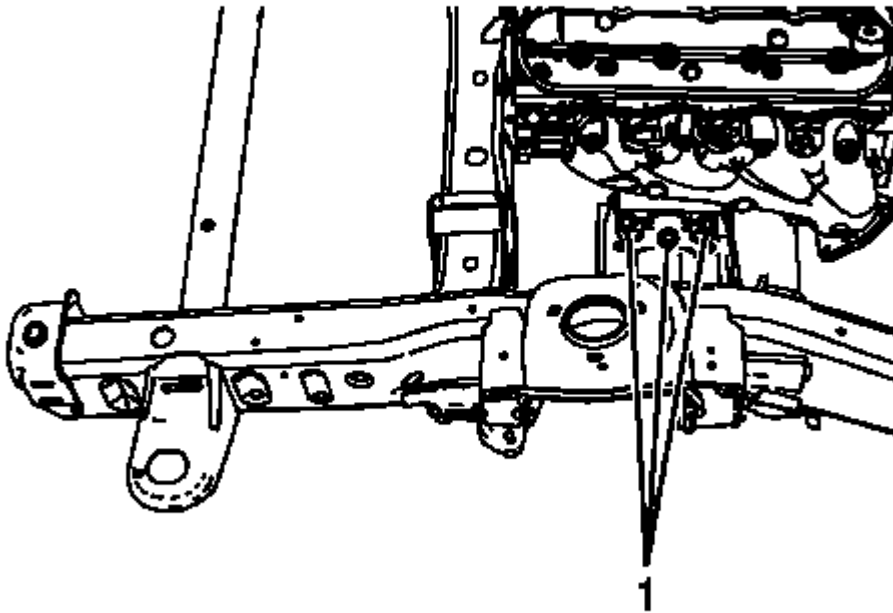


Fig. 13: Engine Mount And Bolts - Left Side
Courtesy of GENERAL MOTORS CORP.

5. Install the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Left Side** .
6. Lower the vehicle.
7. Install the engine mount to frame bolts (1).

Tighten

Tighten the bolts to 65 N.m (48 lb ft) starting with the middle bolt then either side bolt.

8. Lower the vehicle.
9. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

ENGINE MOUNT REPLACEMENT - RIGHT SIDE

Removal Procedure

CAUTION: When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Due to the small clearance between the oil pan and the oil pump screen, jacking

against the oil pan may cause the pan to be bent against the pump screen. This will result in a damaged oil pickup unit.

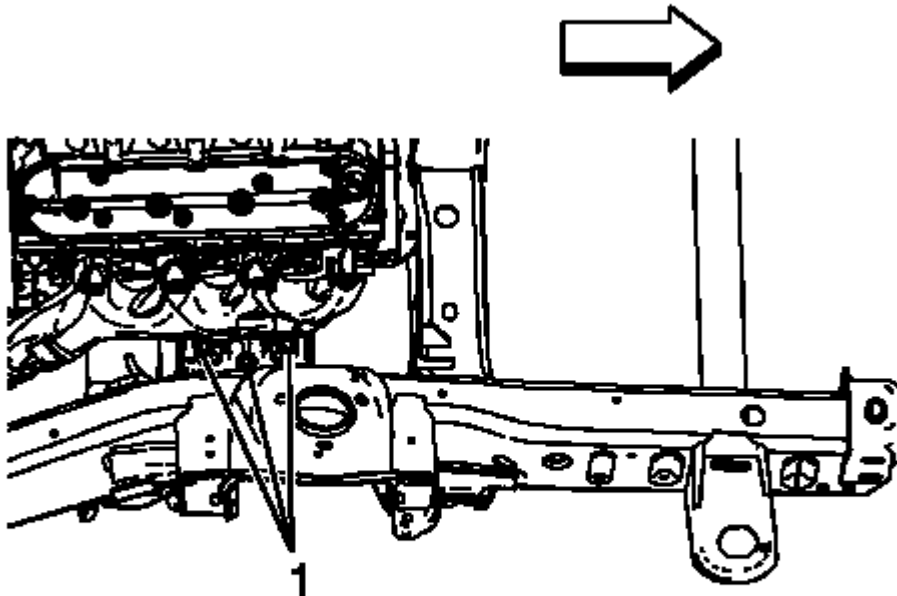


Fig. 14: Engine Mount And Bolts - Right Side
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#) .
2. If the vehicle is equipped with four wheel drive (4WD), remove the front drive axle. Refer to [Differential Carrier Assembly Replacement \(8.25 inch\)](#) , [Differential Carrier Assembly Replacement \(4WD 1500 Hybrid\)](#) , [Differential Carrier Assembly Replacement \(9.25 inch\)](#) .
3. If the vehicle is equipped with 4WD, remove the front drive axle bracket bolts and bracket.
4. Remove the exhaust manifold. Refer to [Exhaust Manifold Replacement - Right Side](#) .
5. Remove the air conditioning (A/C) compressor bracket. Refer to [Air Conditioning Compressor Bracket Replacement \(HP2\)](#) .
6. Remove the engine mount to frame bolts (1).

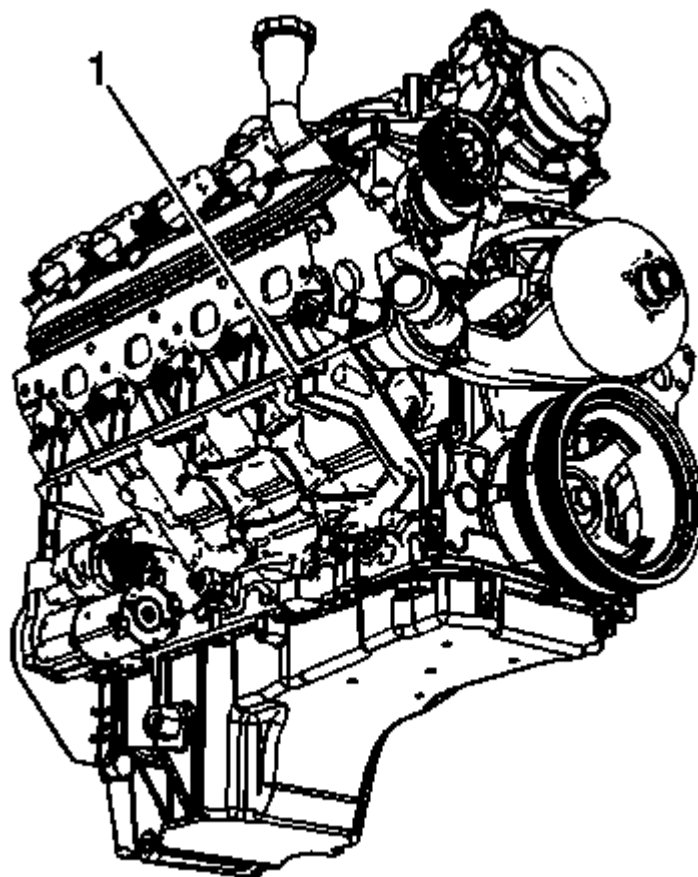


Fig. 15: Engine Block Tab

Courtesy of GENERAL MOTORS CORP.

NOTE: **DO NOT** raise and/or support the engine by the crankshaft balancer or oil pan.

7. Place an adjustable (screw type) jack to the tab (1) located on the engine block.

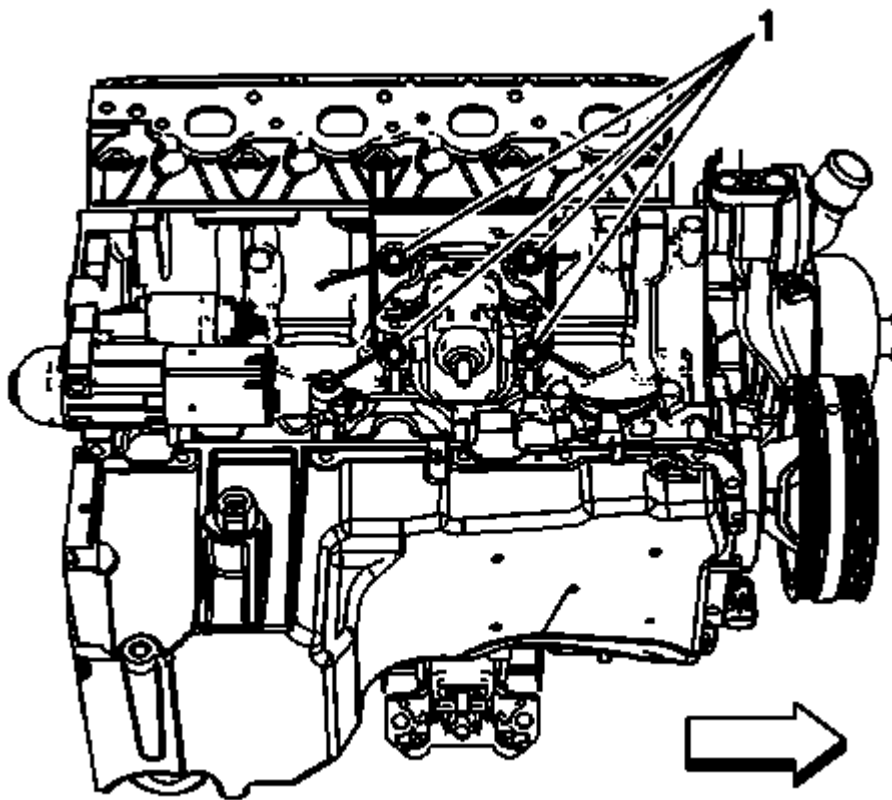


Fig. 16: Engine Mount And Bolts - Right Side
Courtesy of GENERAL MOTORS CORP.

8. Working through the wheelhouse opening, remove the engine mount to engine bolts (1).
9. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.

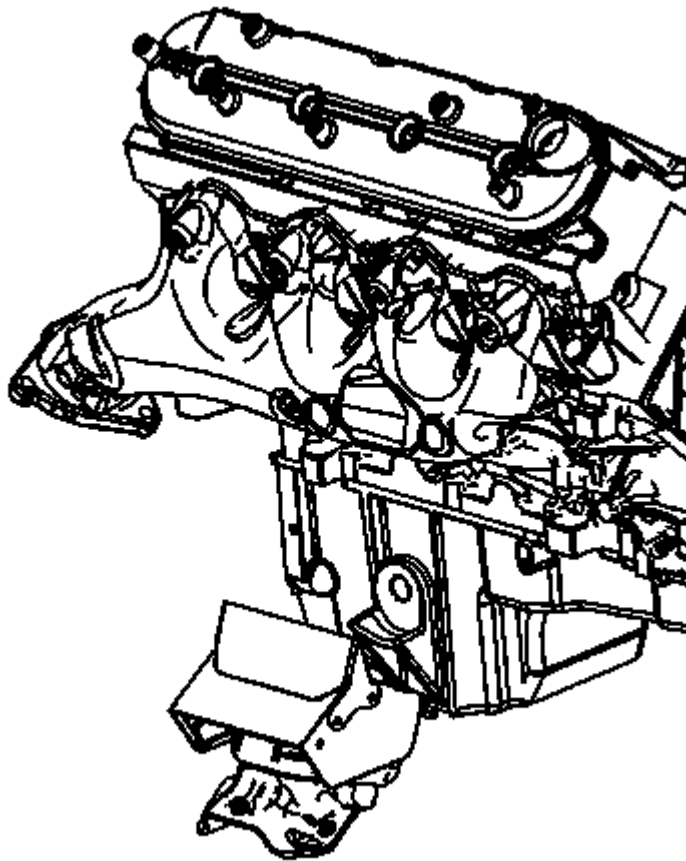


Fig. 17: Engine Mount - Right Side
Courtesy of GENERAL MOTORS CORP.

10. Remove the engine mount.

Installation Procedure

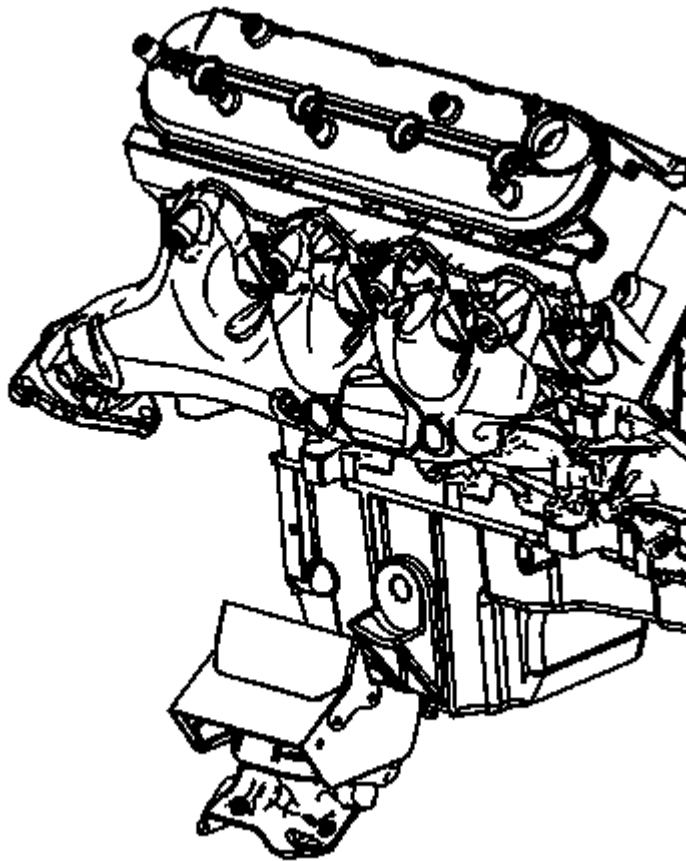


Fig. 18: Engine Mount - Right Side
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

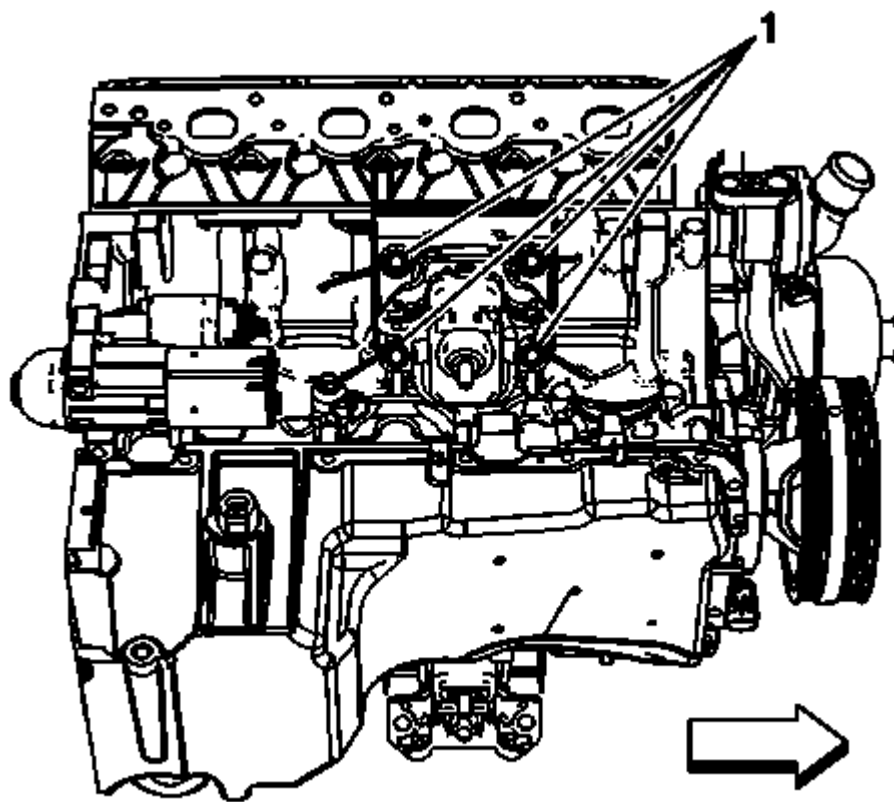


Fig. 19: Engine Mount And Bolts - Right Side
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Working through the wheelhouse opening, install the engine mount to engine bolts (1).

Tighten

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

3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block.

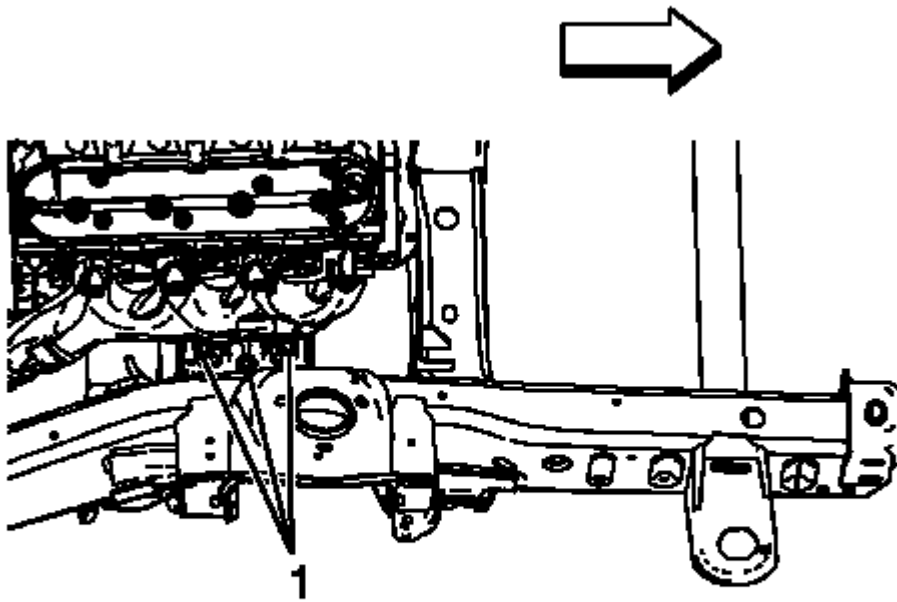


Fig. 20: Engine Mount And Bolts - Right Side
Courtesy of GENERAL MOTORS CORP.

5. Install the engine mount to frame bolts (1).

Tighten

Tighten the bolts to 65 N.m (48 lb ft) starting with the middle bolt then either side bolt.

6. Install the A/C compressor bracket. Refer to **Air Conditioning Compressor Bracket Replacement (HP2)** .
7. If the vehicle is equipped with 4WD, Install the front drive axle bracket and bolts.

Tighten

Tighten the bolts to 90 N.m (67 lb ft).

8. If the vehicle is equipped with 4WD, Install the front drive axle. Refer to **Differential Carrier Assembly Replacement (8.25 inch)** , **Differential Carrier Assembly Replacement (4WD 1500 Hybrid)** , **Differential Carrier Assembly Replacement (9.25 inch)** .
9. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .

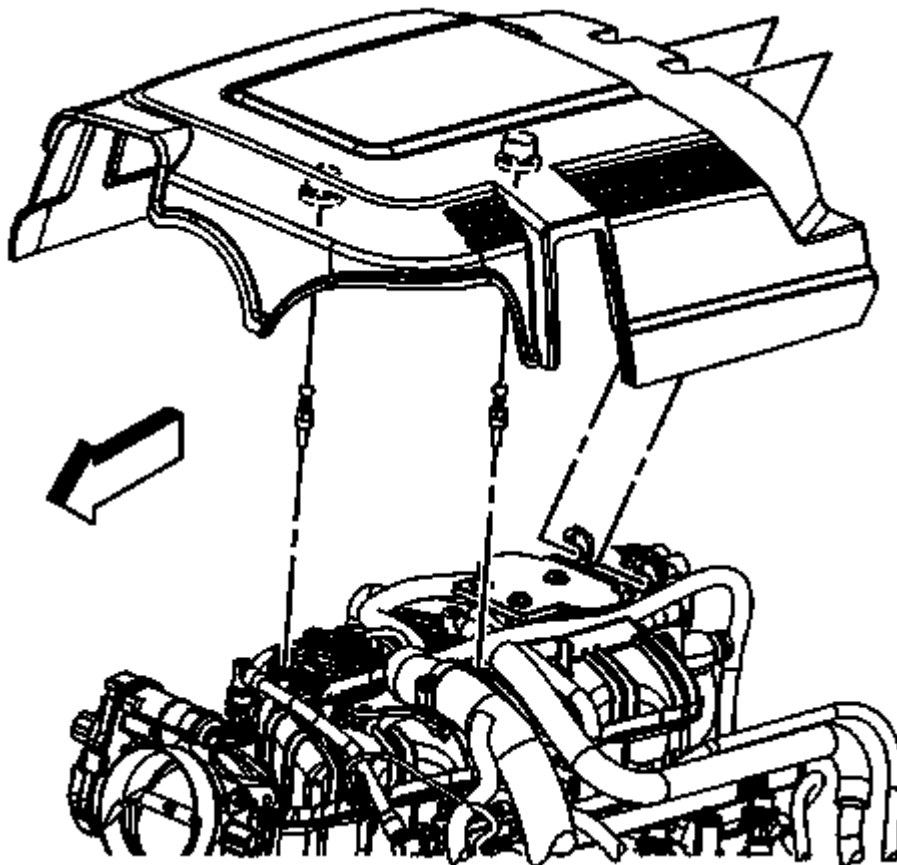
UPPER INTAKE MANIFOLD SIGHT SHIELD REPLACEMENT**Removal Procedure**

Fig. 21: Upper Intake Manifold Sight Shield
Courtesy of GENERAL MOTORS CORP.

1. Open the hood.
2. Grasp the front of the intake manifold sight shield and lift up disengaging the grommets from the studs.
3. Remove the intake manifold sight shield from the retainer slots.

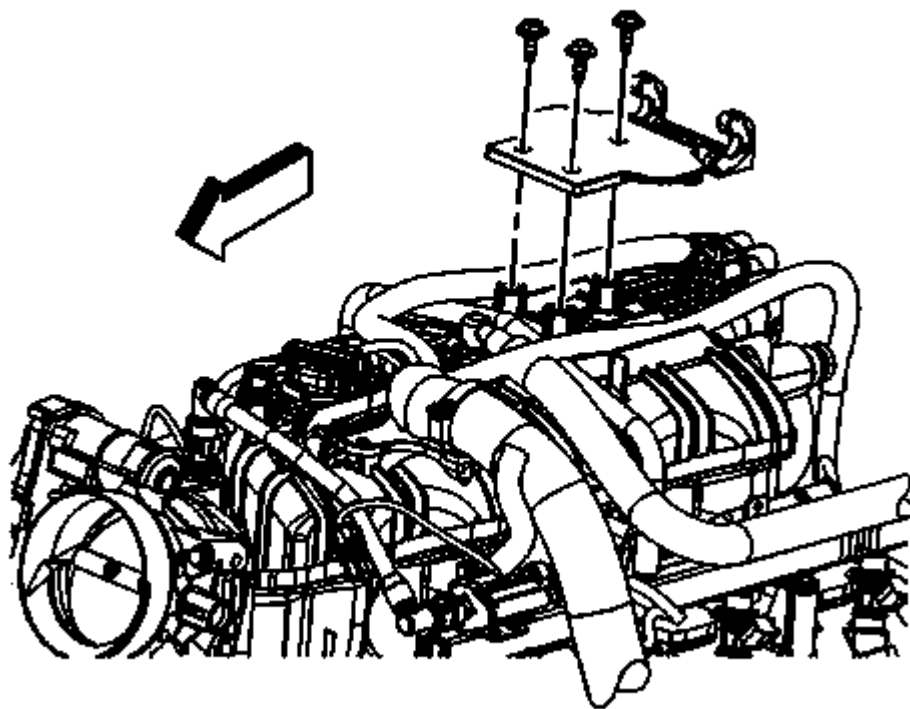


Fig. 22: Manifold Sight Shield Retainer Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the intake manifold sight shield retainer bolts and retainer, if required.

Installation Procedure

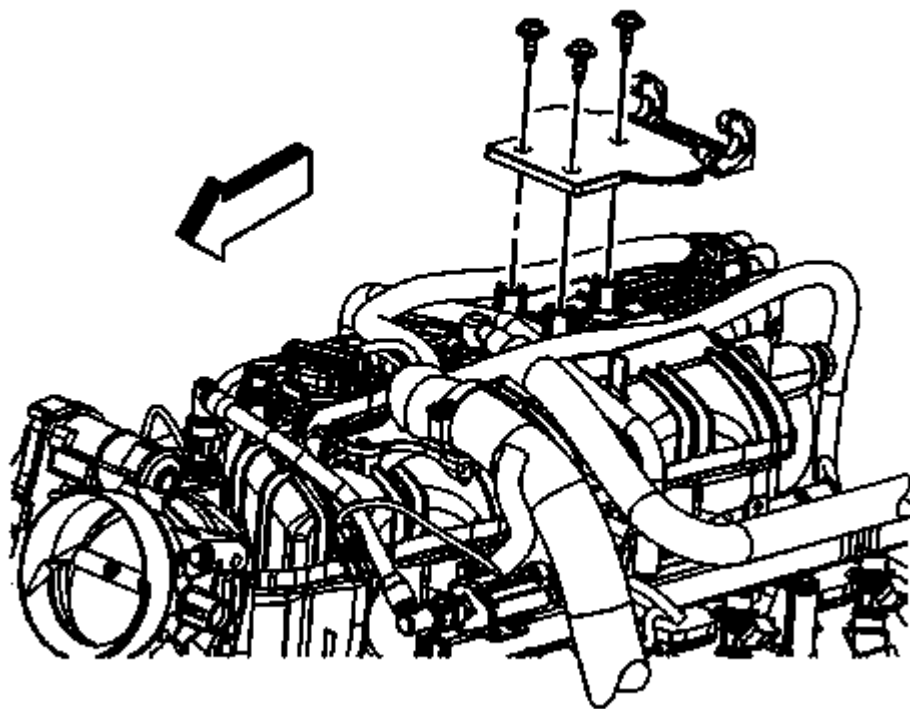


Fig. 23: Manifold Sight Shield Retainer Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Position the intake manifold sight shield on top of the intake manifold, aligning the holes, if required.
2. Install the intake manifold sight shield retainer bolts, if required.

Tighten

Tighten the bolts to 5 N.m (44 lb in).

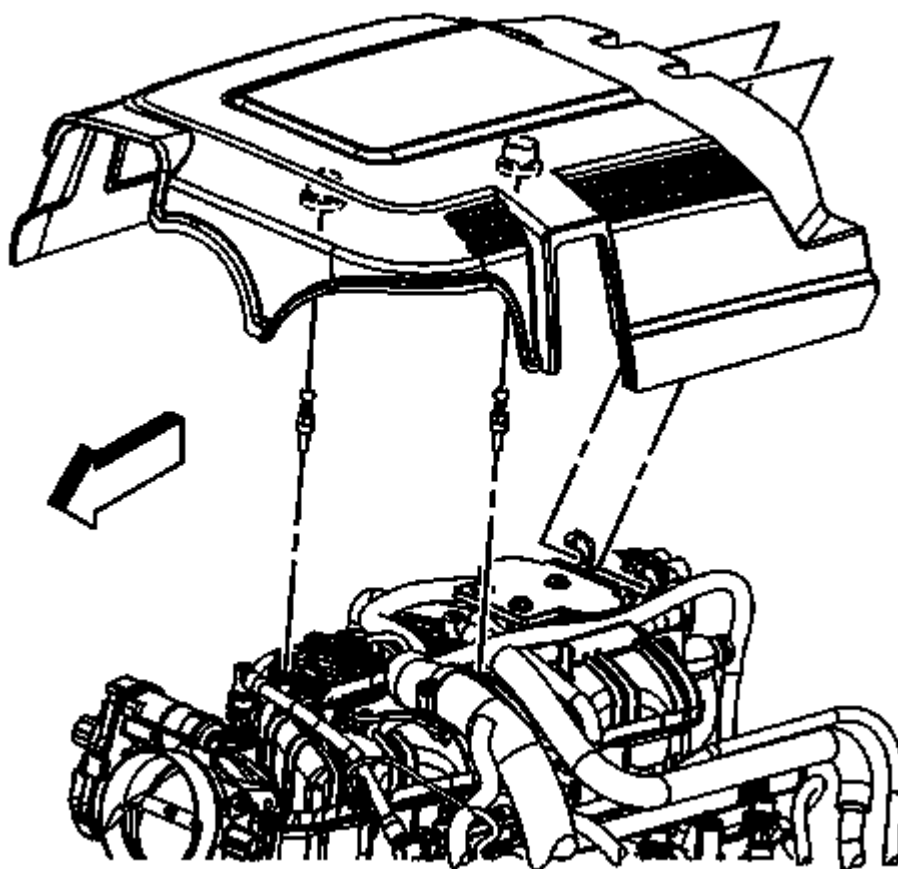


Fig. 24: Upper Intake Manifold Sight Shield
Courtesy of GENERAL MOTORS CORP.

3. Install the intake manifold sight shield tabs into the slots in the retainer.
4. Align the intake manifold sight shield grommets with the studs.
5. Gently push down on the intake manifold sight shield over the grommets, seating the intake manifold sight shield.
6. Close the hood.

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT

Removal Procedure

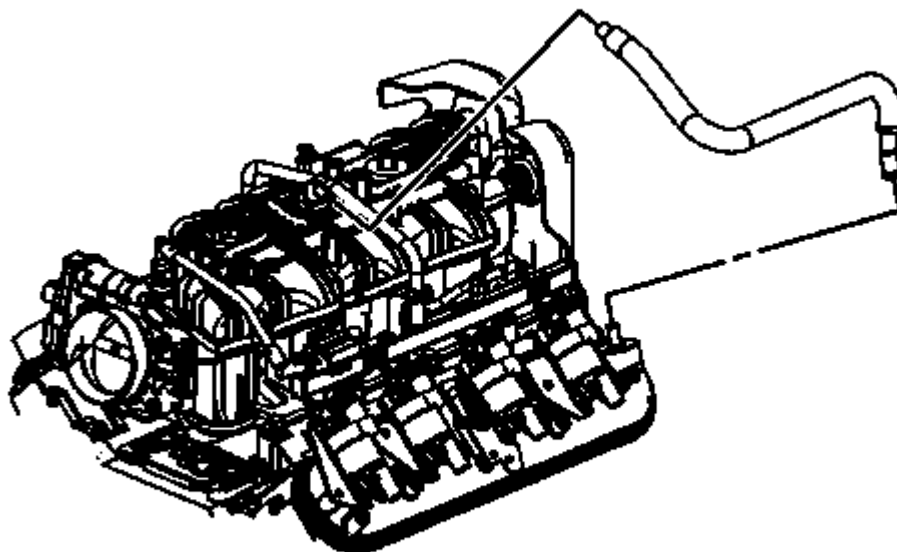


Fig. 25: PCV Hose

Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** .
2. Remove the positive crankcase ventilation (PCV) dirty air hose from the intake manifold fitting and left valve rocker arm cover, if required.

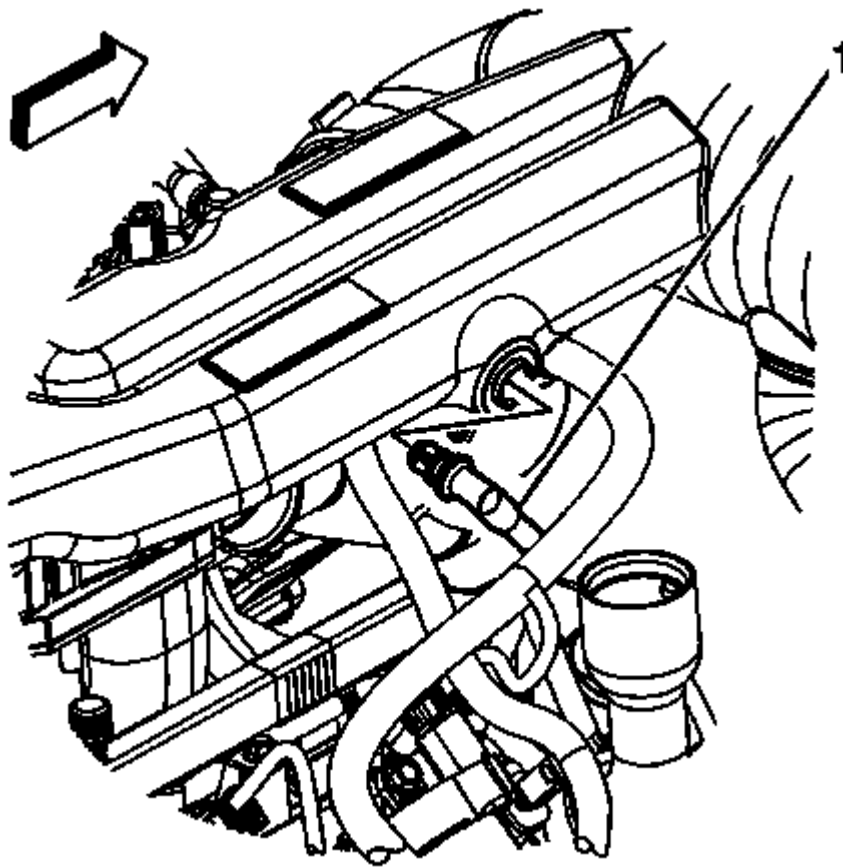


Fig. 26: PCV Tube

Courtesy of GENERAL MOTORS CORP.

3. Remove the PCV fresh air tube (1) from the air cleaner outlet duct, if required.

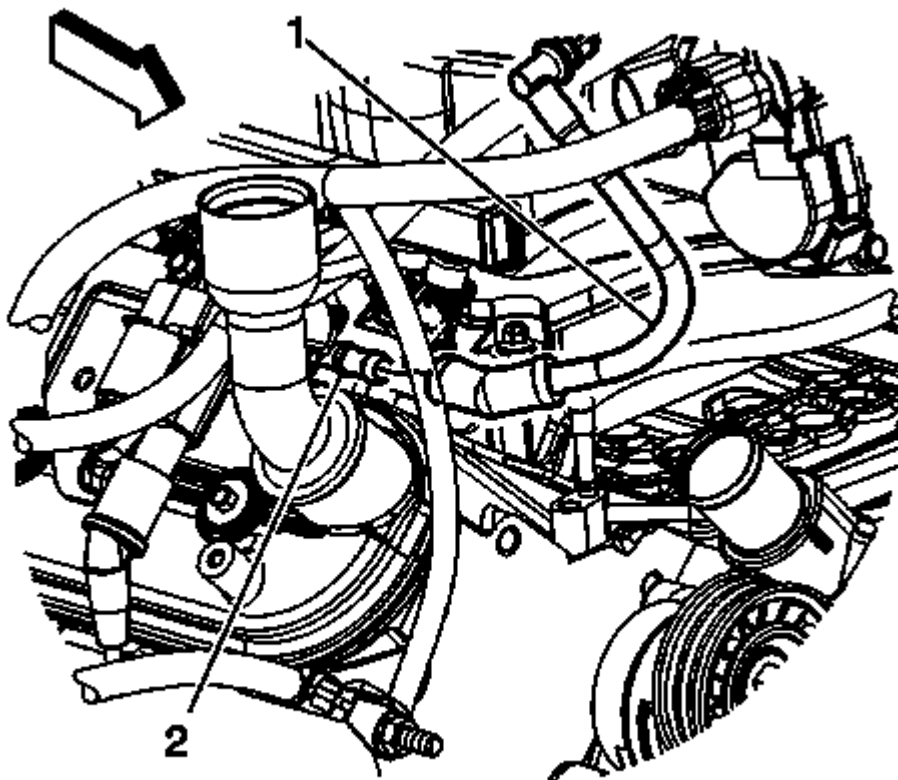


Fig. 27: PCV Tube And Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

4. Remove the PCV fresh air tube (1) from the right valve rocker arm cover fitting (2), if required.
5. Remove the appropriate PCV hose/tube from the vehicle.

Installation Procedure

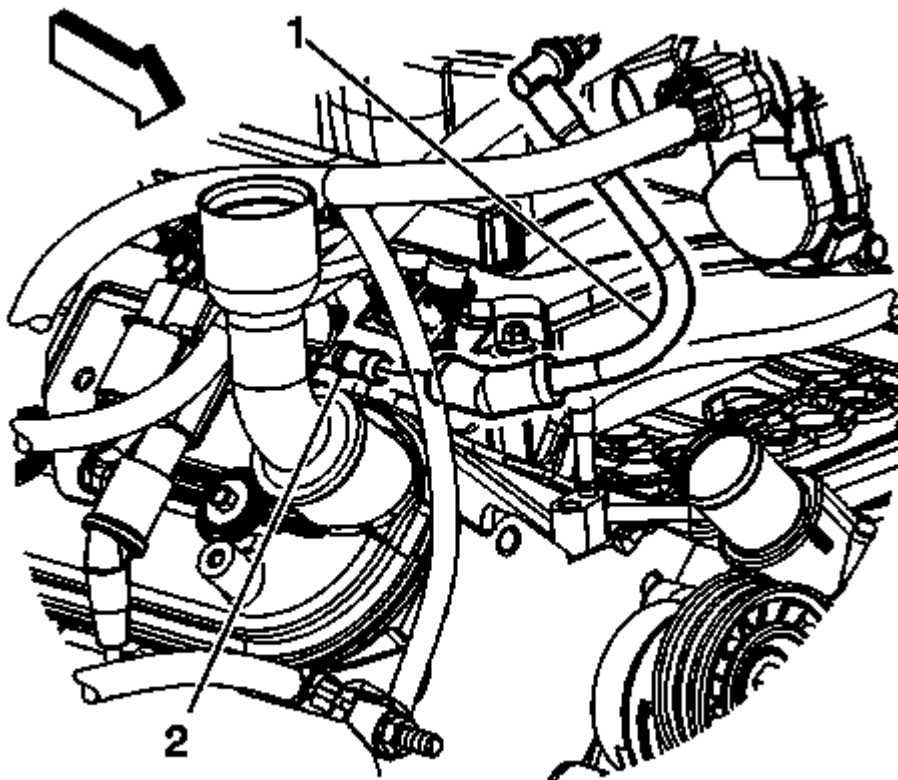


Fig. 28: PCV Tube And Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

1. Install the appropriate PCV hose/tube to the vehicle.
2. Install the PCV fresh air tube (1) to the right valve rocker arm cover fitting (2), if required.

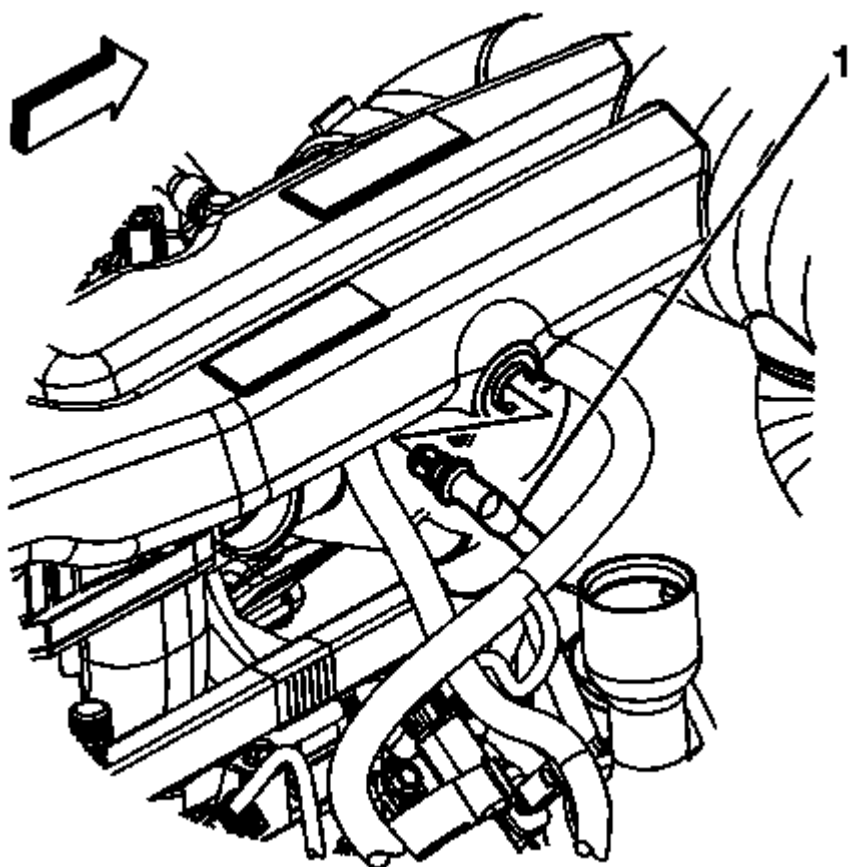


Fig. 29: PCV Tube

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Route the PCV tube between the engine harness and generator battery jumper cable.

3. Install the PCV fresh air tube (1) to the air cleaner outlet duct, if required.

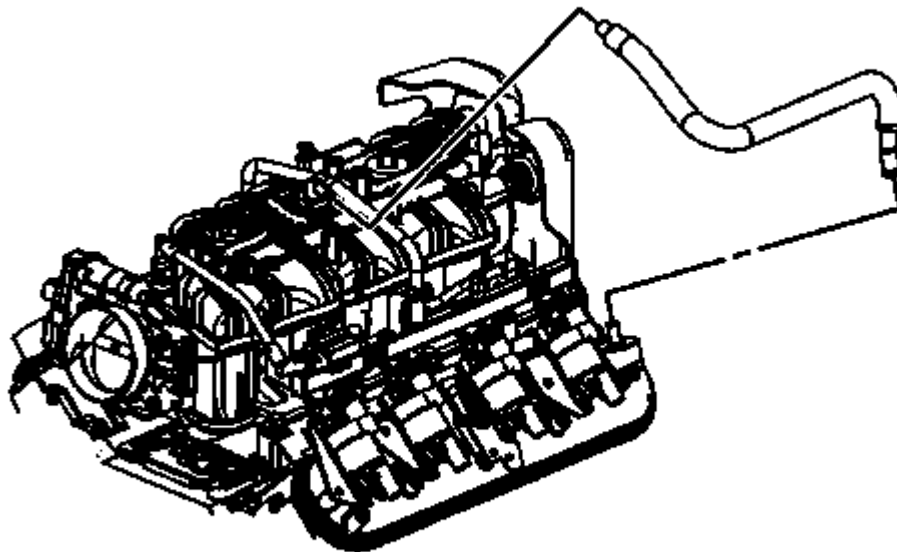


Fig. 30: PCV Hose

Courtesy of GENERAL MOTORS CORP.

4. Install the PCV dirty air hose to the intake manifold fitting and left valve rocker arm cover, if required.
5. Install the intake manifold sight shield. Refer to **Upper Intake Manifold Sight Shield Replacement** .

INTAKE MANIFOLD REPLACEMENT

Removal Procedure

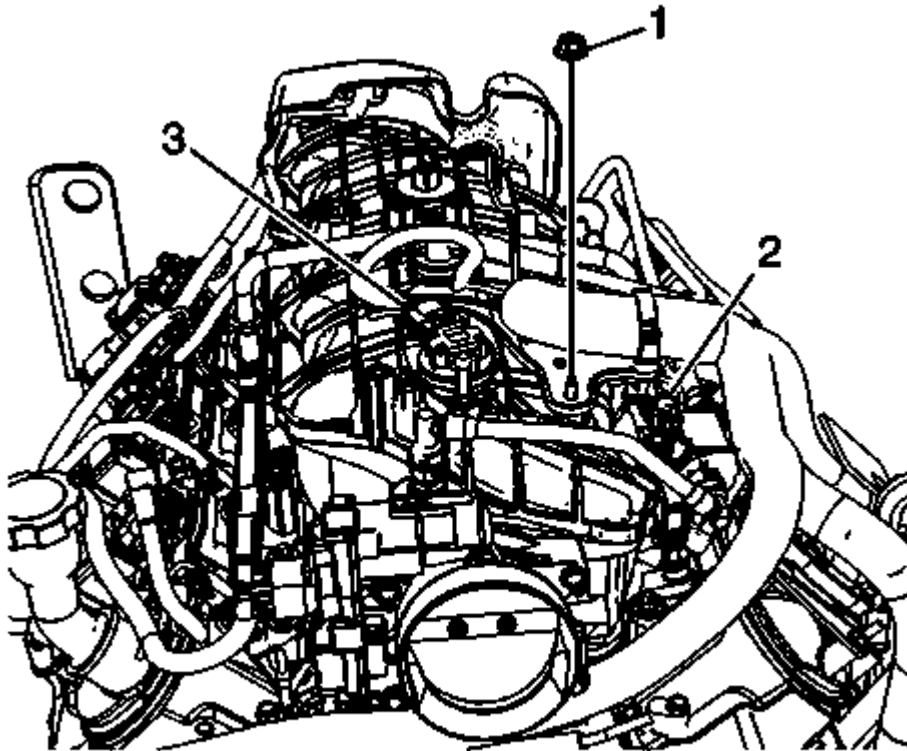


Fig. 31: Engine Harness, Retainer Nut And Connector
Courtesy of GENERAL MOTORS CORP.

WARNING: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure will perform the following tasks:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Failure to follow the procedures exactly as written may result in serious injury or death.

1. Perform the High Voltage Service disconnect. Refer to **High Voltage Disabling** .

2. Disconnect the battery ground cable. Refer to **Battery Negative Cable Disconnection and Connection** .
3. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
4. Remove the engine harness retainer nut (1).
5. Remove the engine harness retainer from the stud and locator pin.
6. Disconnect the engine harness electrical connector (2) from the evaporative emission (EVAP) canister purge solenoid.
7. Disconnect the engine wiring harness electrical connector (3) from the manifold absolute pressure (MAP) sensor.

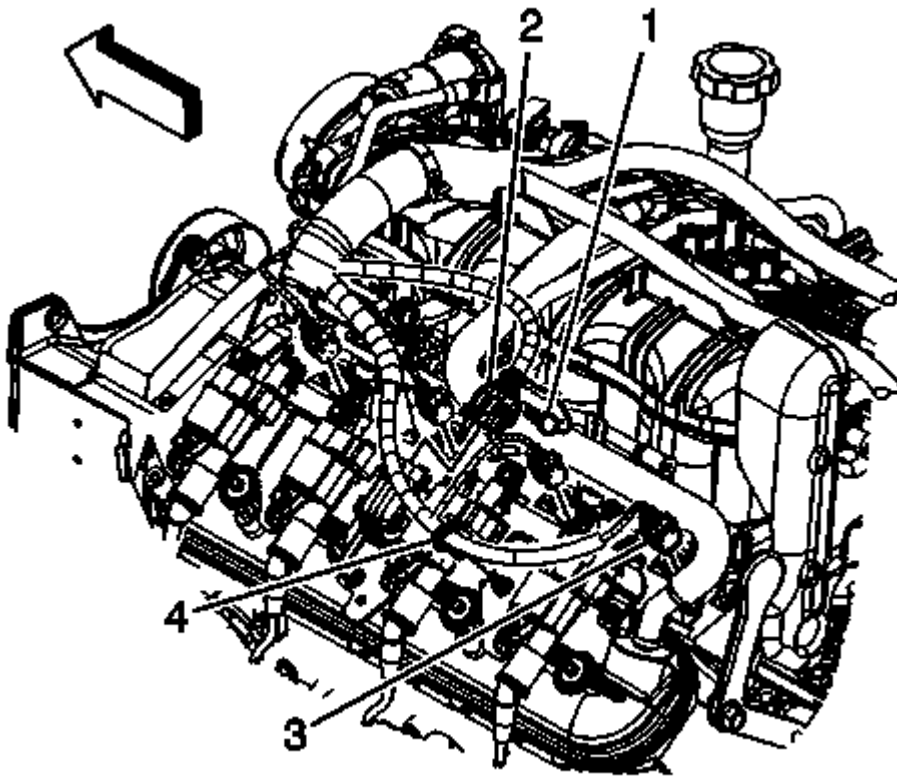


Fig. 32: Engine Harness, Connectors And Retainers
Courtesy of GENERAL MOTORS CORP.

8. Remove the connector position assurance (CPA) retainer (1).
9. Disconnect the engine harness electrical connector (2) from the ignition coil harness electrical connector.
10. Disconnect the engine harness electrical connectors (3) from the left side fuel injectors.
11. Remove the engine harness clip (4) from the ignition coil bracket stud.

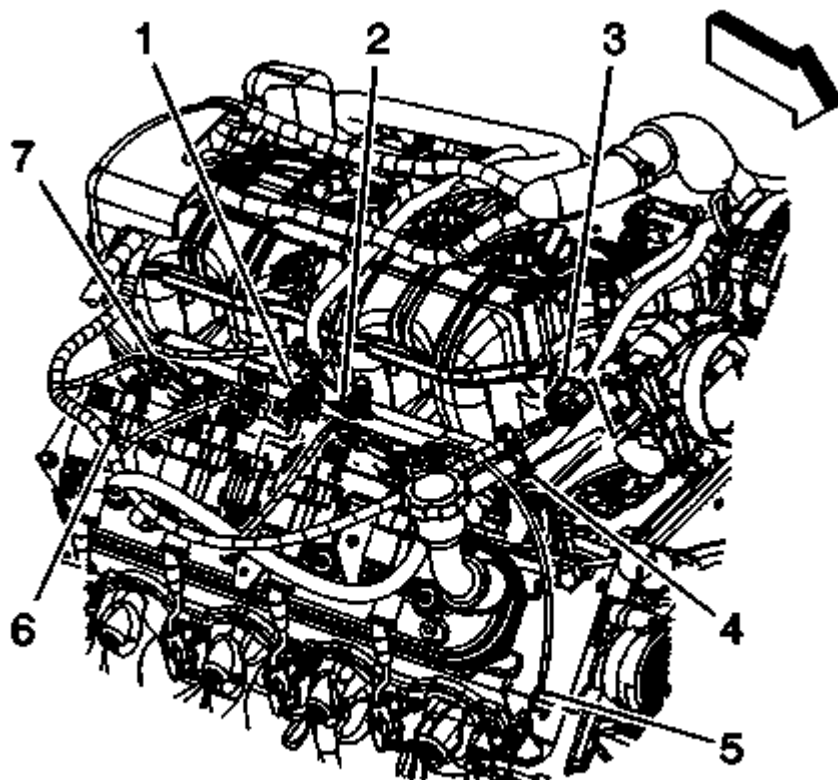


Fig. 33: CPA Retainer, Engine Harness Electrical Connectors And Harness Clips
Courtesy of GENERAL MOTORS CORP.

12. Remove the CPA retainer (1).
13. Disconnect the engine harness electrical connector (2) from the ignition coil harness electrical connector.
14. Disconnect the engine harness electrical connector (3) from the throttle actuator.
15. Remove the engine harness clip (4) from the ignition coil bracket stud.
16. Disconnect the engine harness electrical connectors (5) from the right side fuel injectors.

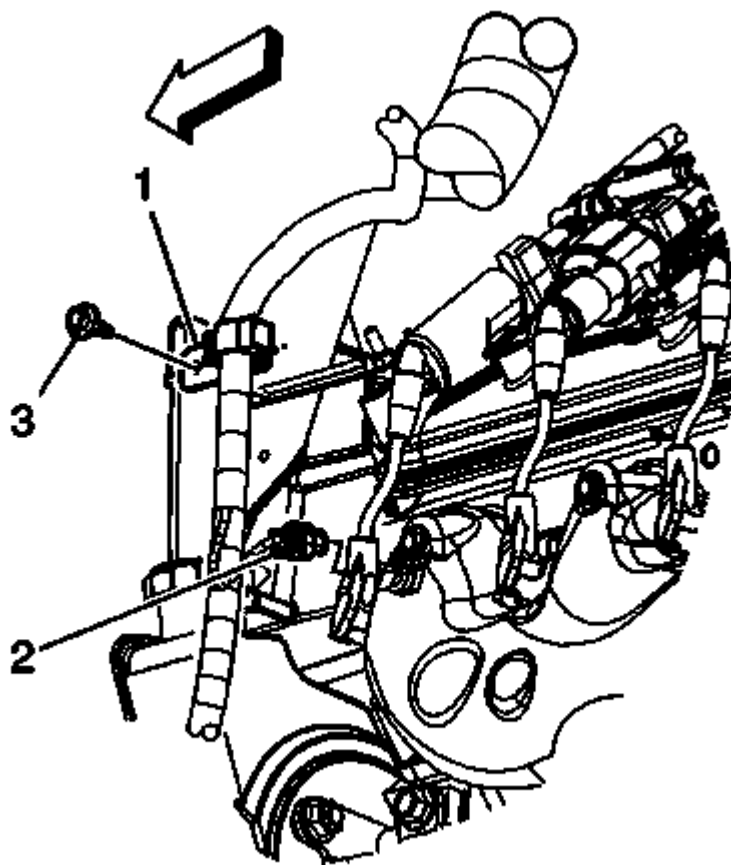


Fig. 34: Engine Wiring Harness, Clip, Bolt And Connectors
Courtesy of GENERAL MOTORS CORP.

17. Remove the engine harness clip (1) bolt (3).
18. Disconnect the engine harness electrical connector (2) from the engine coolant temperature (ECT) sensor.
19. Disconnect the generator control module electrical connector.
20. Gather the engine harness branches and tie the harness up out of the way to the cowl panel.

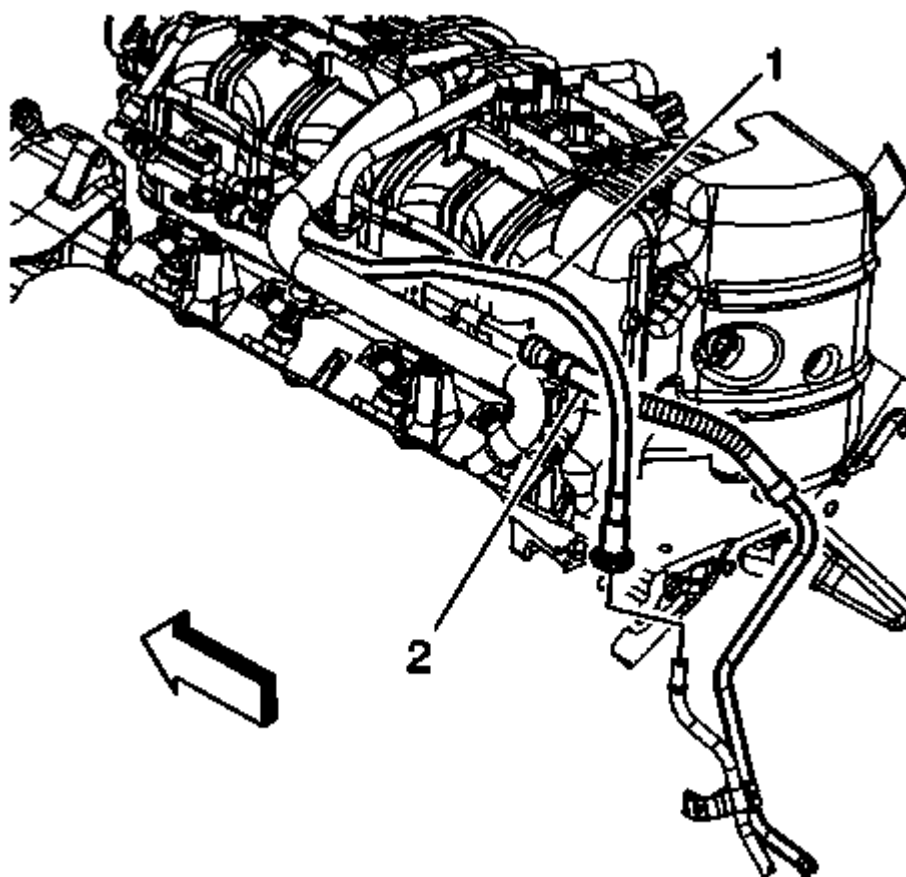


Fig. 35: EVAP Canister Purge Tube And Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

21. Disconnect the EVAP canister purge tube (1) quick connect fitting from the EVAP canister purge solenoid. Refer to **Plastic Collar Quick Connect Fitting Service** .
22. Disconnect the fuel feed line quick connect fitting (2) from the fuel rail. Refer to **Metal Collar Quick Connect Fitting Service** .

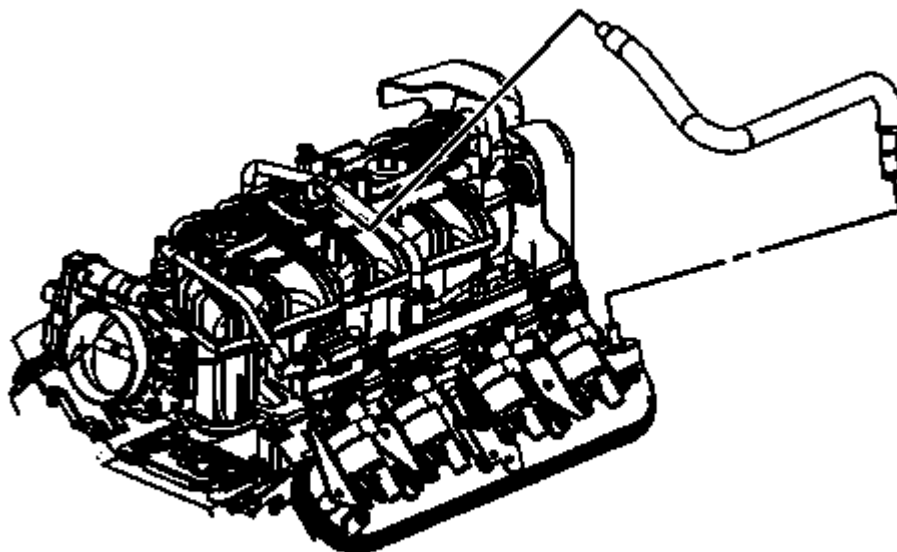


Fig. 36: PCV Hose

Courtesy of GENERAL MOTORS CORP.

23. Remove the positive crankcase ventilation (PCV) hose from the intake manifold fitting.
24. Position the hose out of the way.

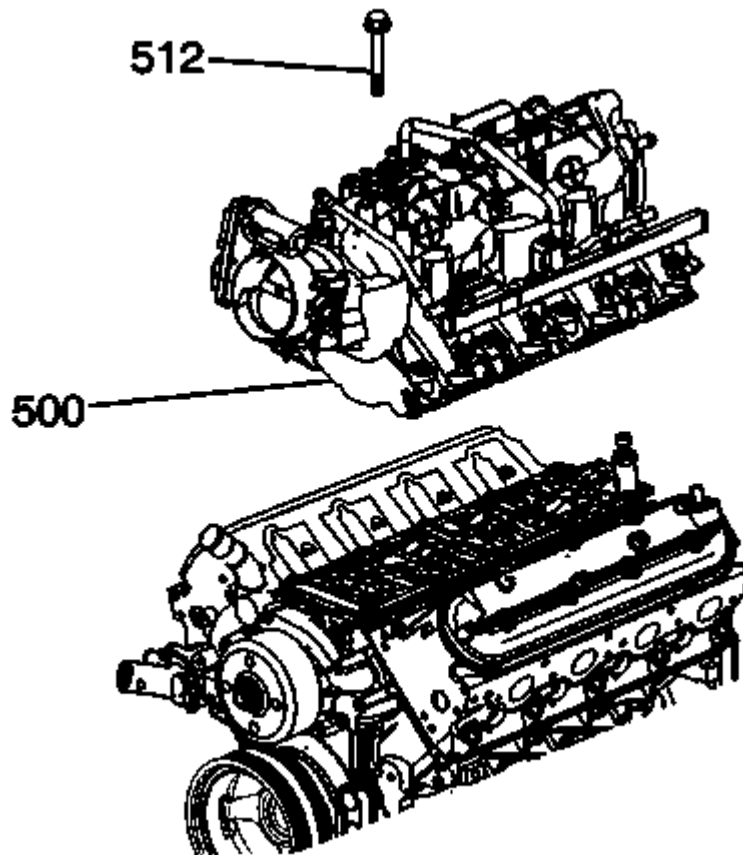


Fig. 37: Intake Manifold

Courtesy of GENERAL MOTORS CORP.

25. Loosen the intake manifold bolts (512).

NOTE: The aid of an assistant may be helpful in holding the engine harness up out of the way so the upper intake manifold cover does not get caught against the engine harness.

26. Remove the intake manifold (500).
27. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.

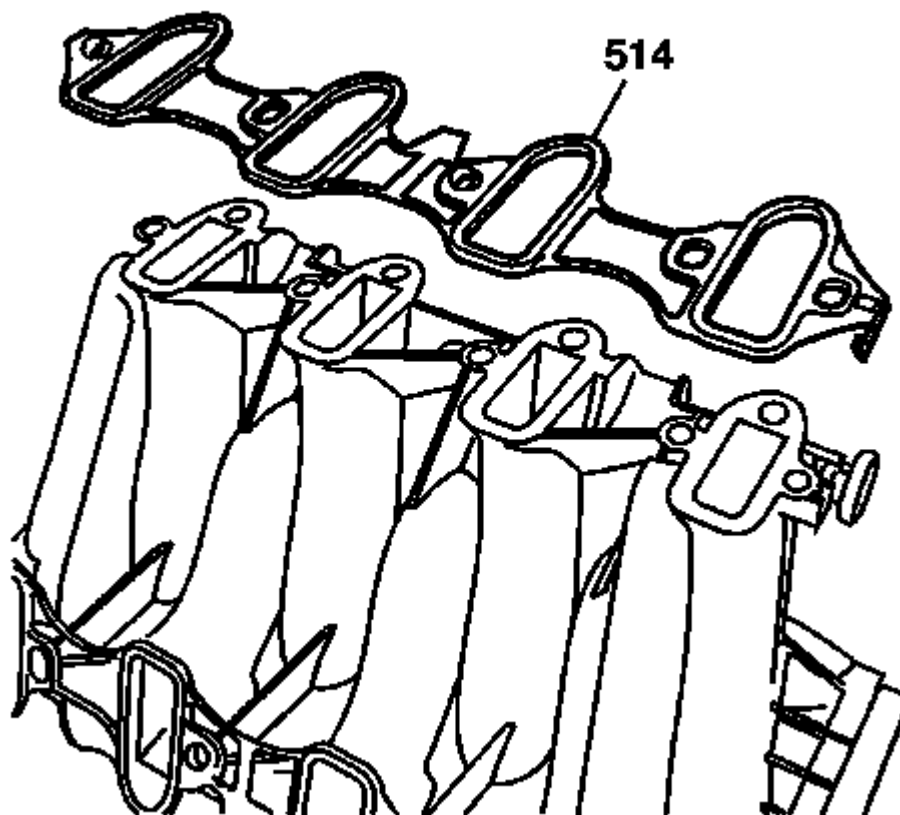


Fig. 38: Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

28. Remove and discard the intake manifold gaskets (514).
29. Clean and inspect the intake manifold. Refer to **Intake Manifold Cleaning and Inspection** .

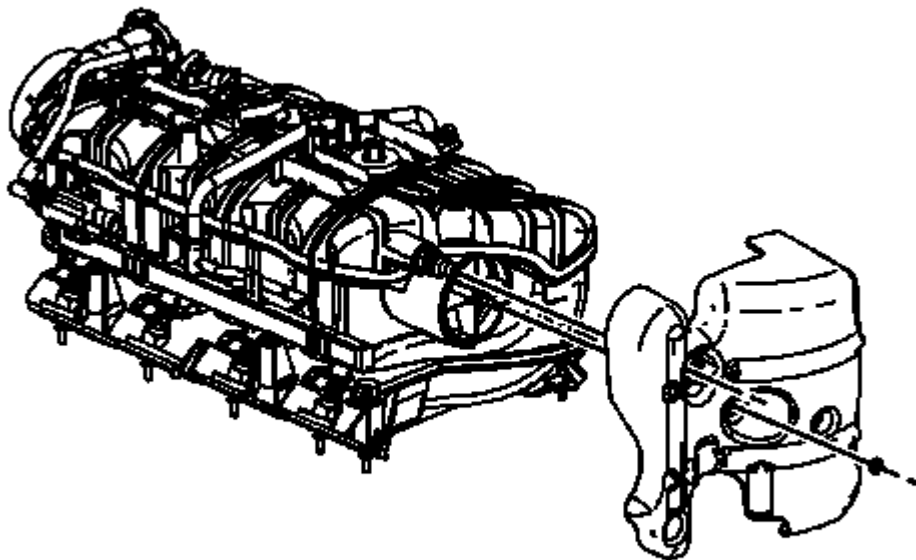


Fig. 39: Upper Intake Manifold Cover And Nut
Courtesy of GENERAL MOTORS CORP.

30. Remove the upper intake manifold cover nut.
31. Remove the upper intake manifold cover.

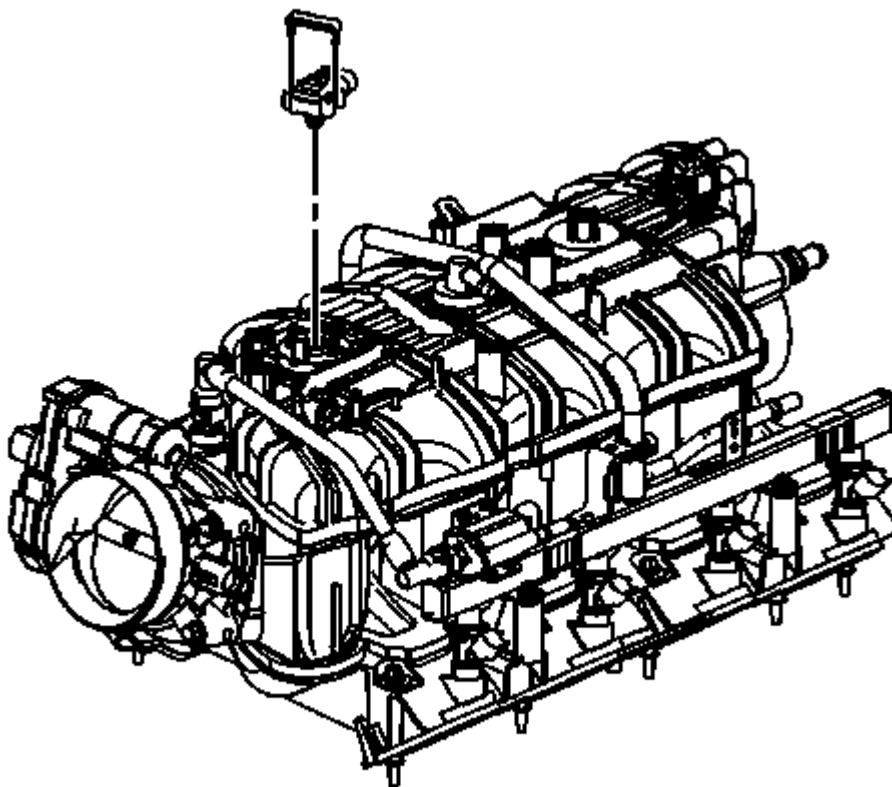


Fig. 40: MAP Sensor And Retainer
Courtesy of GENERAL MOTORS CORP.

32. Remove the manifold absolute pressure (MAP) sensor retainer.
33. Remove the MAP sensor and discard the MAP sensor seal.

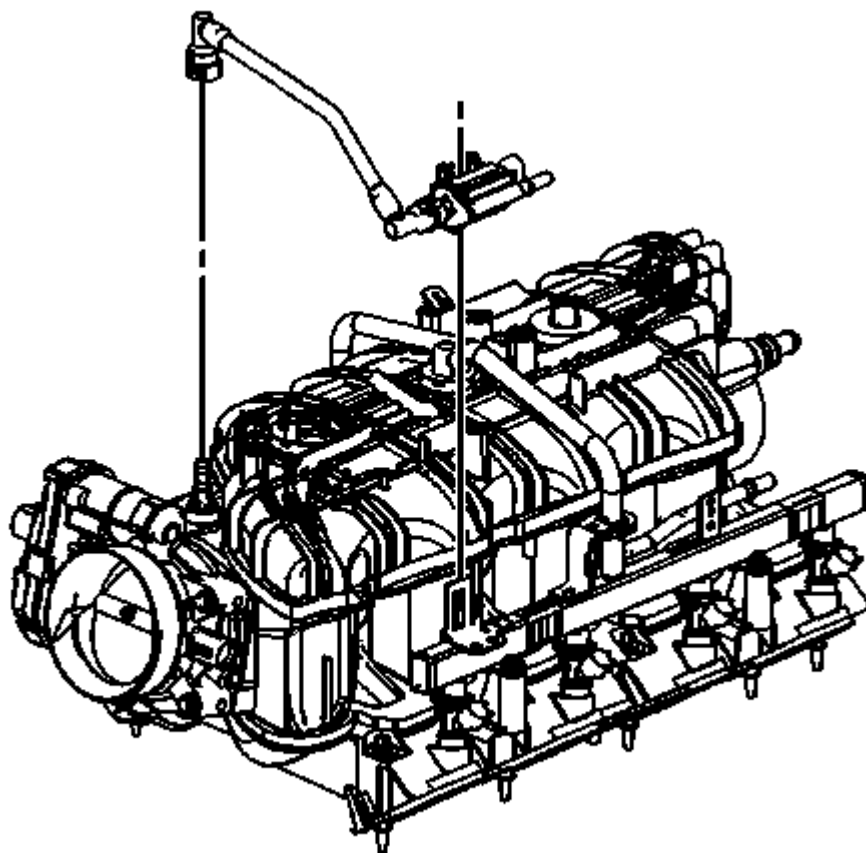


Fig. 41: EVAP Tube And Purge Solenoid
Courtesy of GENERAL MOTORS CORP.

34. Disconnect the EVAP tube quick connect fitting at the intake manifold. Refer to **Plastic Collar Quick Connect Fitting Service** .
35. Disengage the retainer securing the EVAP canister purge solenoid to the fuel rail.
36. Remove the EVAP tube and purge solenoid.

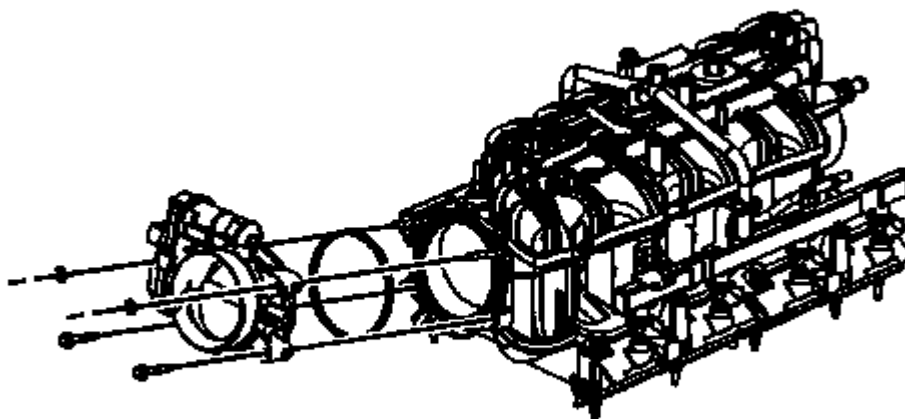


Fig. 42: Throttle Body, Gasket And Bolts/Nuts
Courtesy of GENERAL MOTORS CORP.

37. Remove the throttle body bolts/nuts.
38. Remove the throttle body.
39. Remove and discard the throttle body gasket.

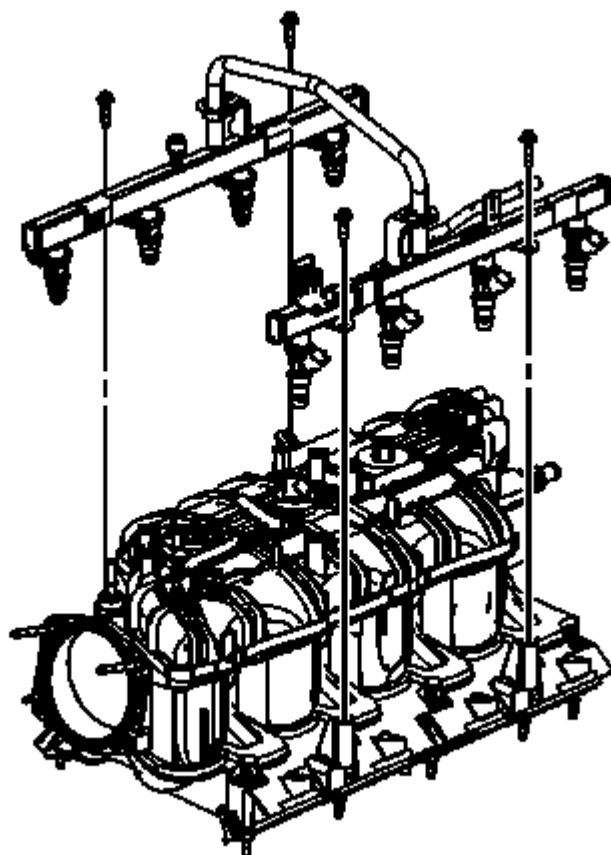


Fig. 43: Fuel Rail And Bolts

Courtesy of GENERAL MOTORS CORP.

40. Remove the fuel rail bolts.

NOTE: Lift evenly on both sides of the fuel rail until all injectors are removed from their bores.

41. Remove the fuel rail.
42. Remove and discard the fuel injector lower O-ring seals.

Installation Procedure

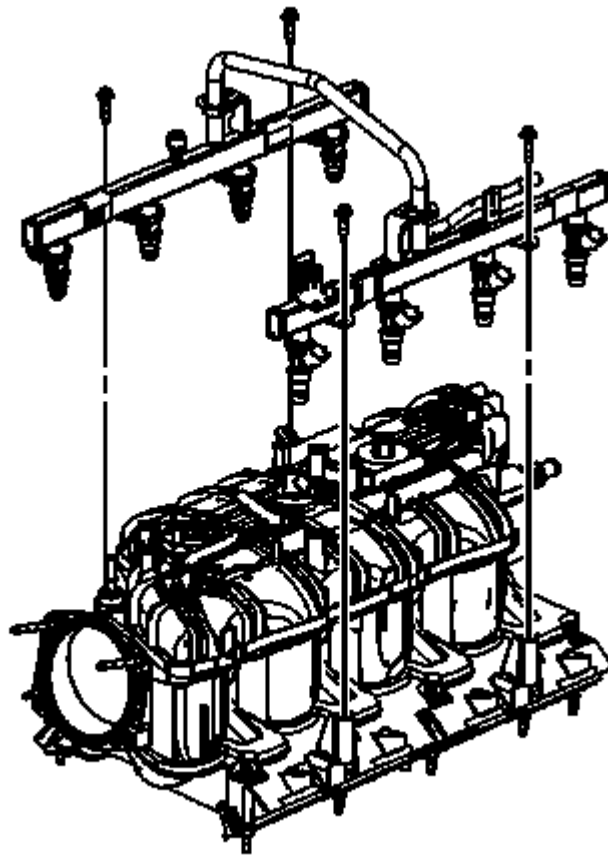


Fig. 44: Fuel Rail And Bolts

Courtesy of GENERAL MOTORS CORP.

1. Install NEW fuel injector lower O-ring seals onto the injectors.
2. Lubricate the NEW O-ring seals with clean engine oil.

NOTE: Push down firmly on both sides of the rail until all the injectors have been seated into their bores.

3. Install the fuel rail.

CAUTION: Refer to Fastener Caution .

4. Install the fuel rail bolts.

Tighten

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

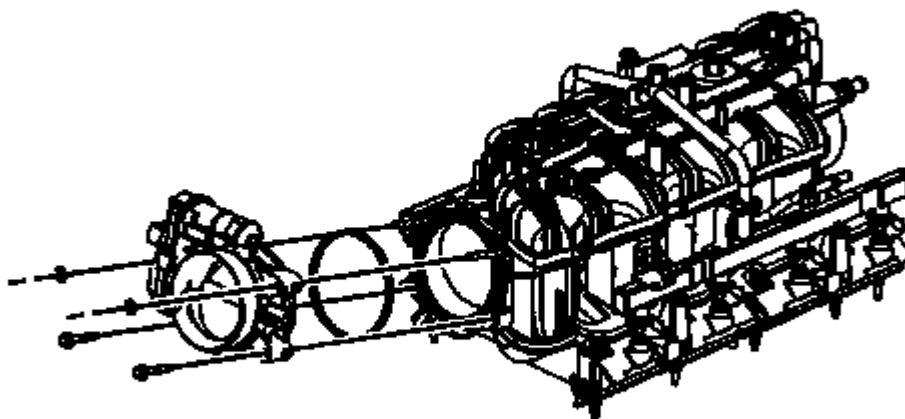


Fig. 45: Throttle Body, Gasket And Bolts/Nuts
Courtesy of GENERAL MOTORS CORP.

5. Install a NEW throttle body gasket to the intake manifold.
6. Install the throttle body.
7. Install the throttle body bolts/nuts.

Tighten

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

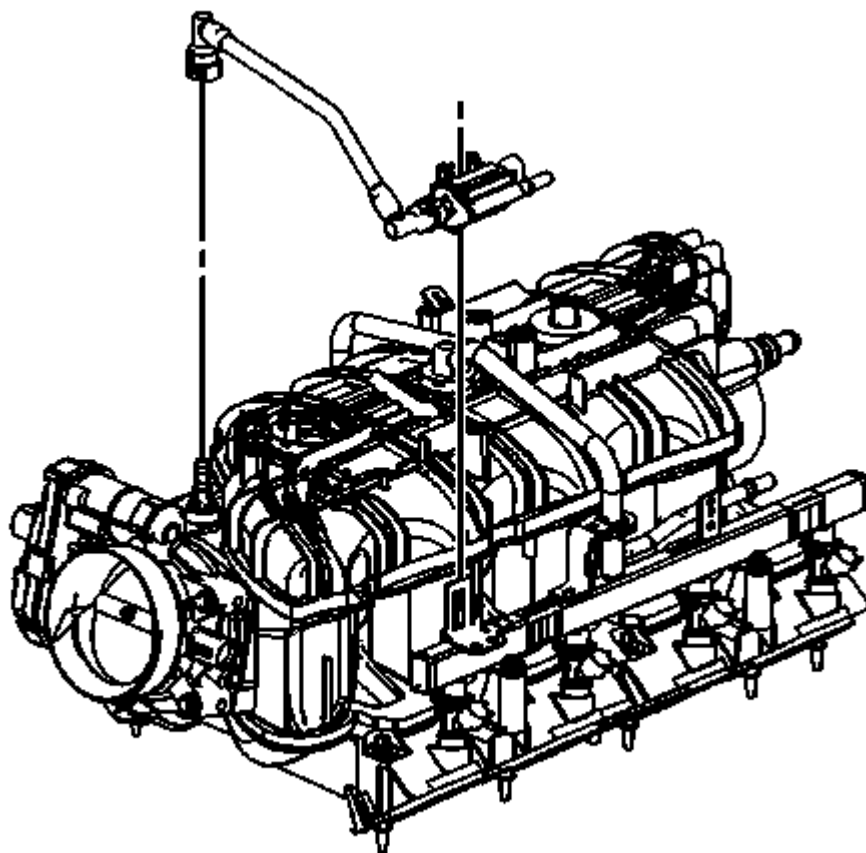


Fig. 46: EVAP Tube And Purge Solenoid
Courtesy of GENERAL MOTORS CORP.

8. Install the EVAP tube and purge solenoid.
9. Install the EVAP canister purge solenoid to the fuel rail bracket and engage the retainer.
10. Connect the EVAP tube quick connect fitting at the intake manifold. Refer to **Plastic Collar Quick Connect Fitting Service** .

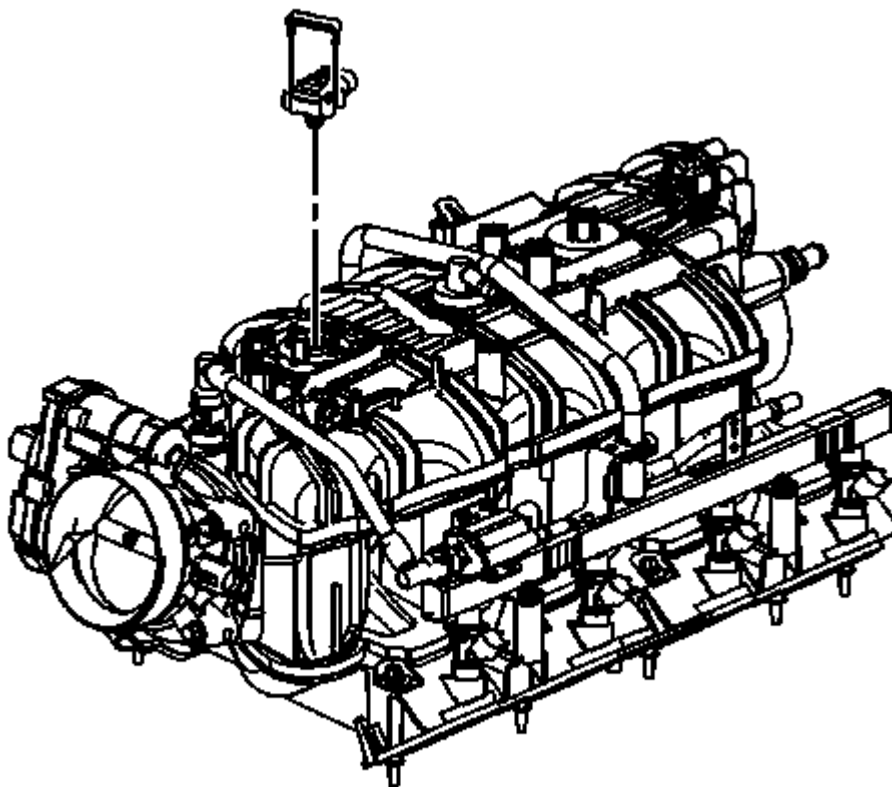


Fig. 47: MAP Sensor And Retainer
Courtesy of GENERAL MOTORS CORP.

11. Lubricate the MAP sensor seal with clean engine oil.
12. Install the MAP sensor with a new seal.
13. Install the MAP sensor retainer.

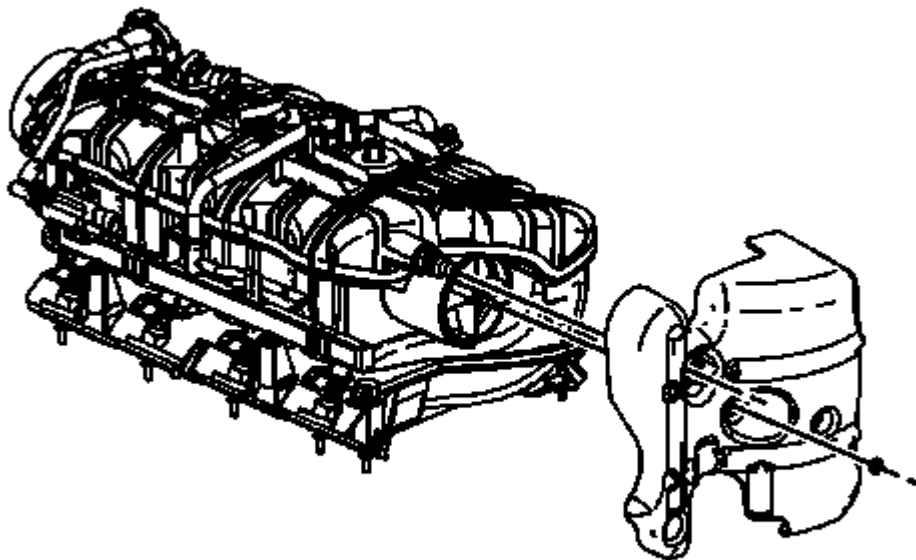


Fig. 48: Upper Intake Manifold Cover And Nut
Courtesy of GENERAL MOTORS CORP.

14. Install the upper intake manifold cover.
15. Install the upper intake manifold cover nut until snug.

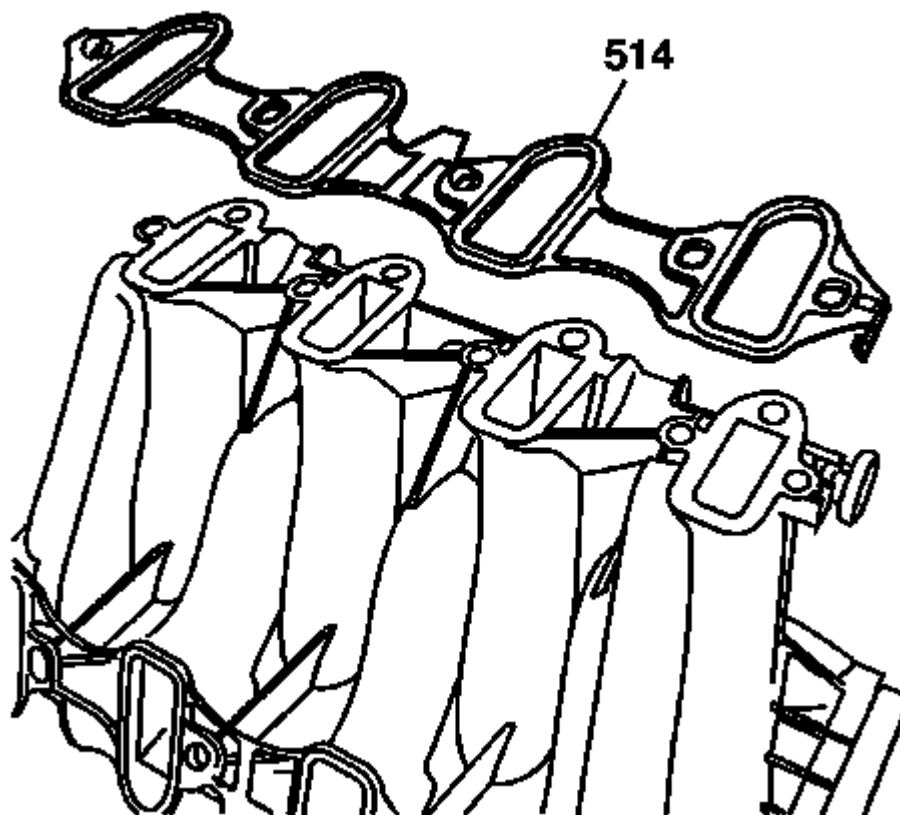


Fig. 49: Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

16. Install NEW intake manifold gaskets (514) to the intake manifold.
17. Remove the covers from the cylinder head passages.

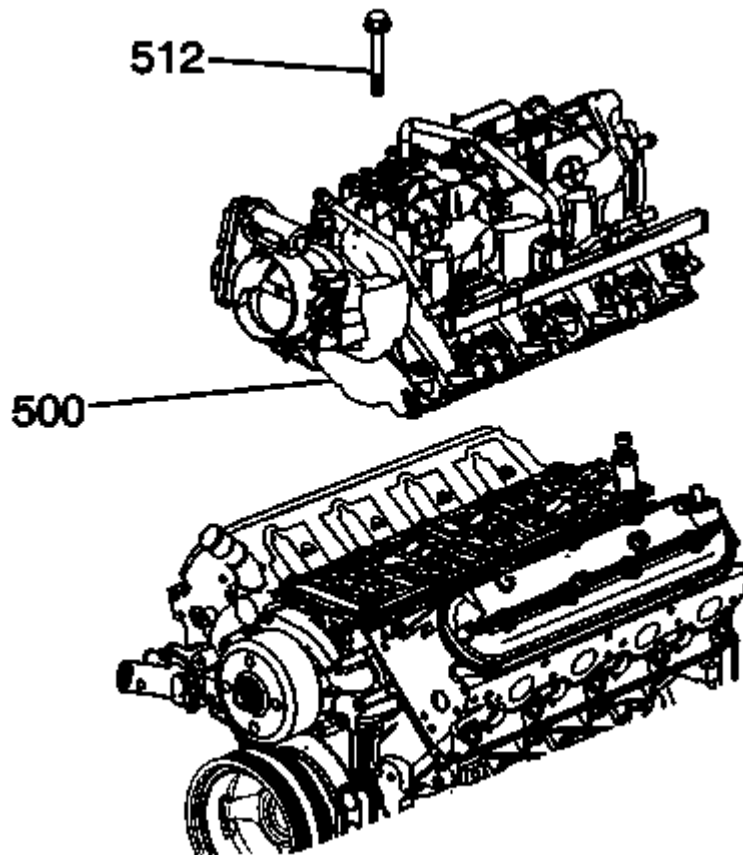


Fig. 50: Intake Manifold

Courtesy of GENERAL MOTORS CORP.

18. Install the intake manifold (500).
19. Apply a 5 mm (0.20 in) band of threadlock GM P/N 12345382 (Canadian P/N 10953489) to the threads of the intake manifold bolts (512). Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

NOTE: The aid of an assistant may be helpful in holding the engine harness up out of the way so the upper intake manifold cover does not get caught against the engine harness.

20. Install the intake manifold bolts (512) finger tight.

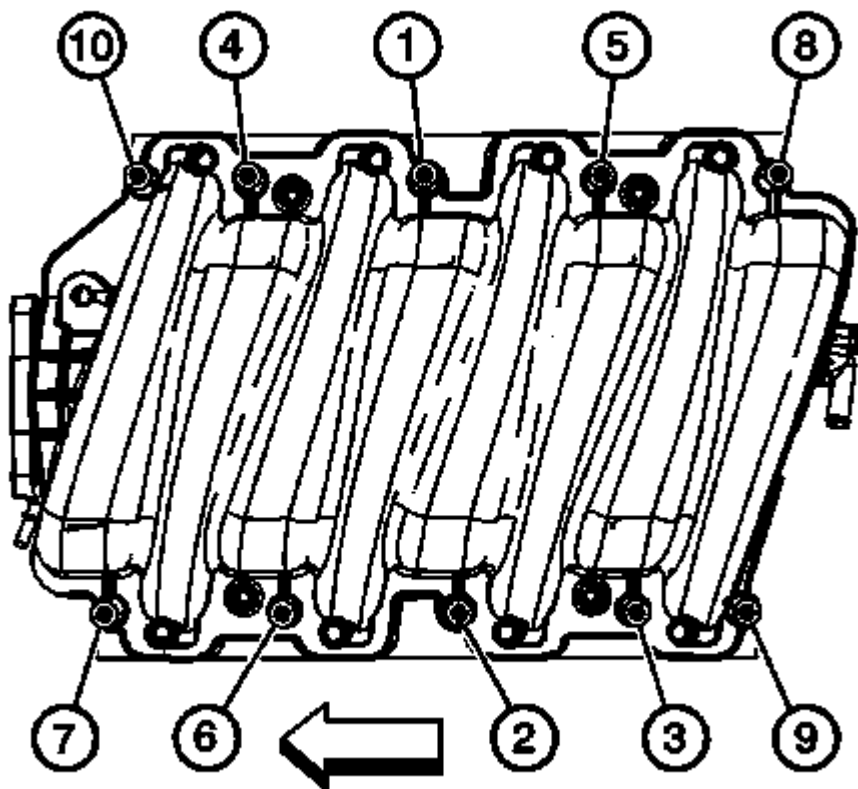


Fig. 51: Intake Manifold Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

21. Tighten the intake manifold bolts to specifications.

Tighten

- Tighten the bolts a first pass in the sequence shown to 5 N.m (44 lb in).
- Tighten the bolts a final pass in the sequence shown to 10 N.m (89 lb in).

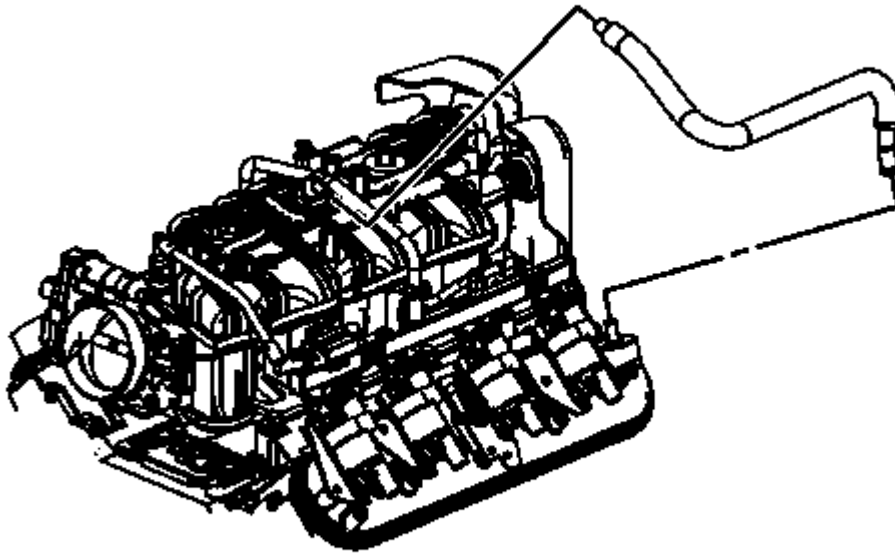


Fig. 52: PCV Hose

Courtesy of GENERAL MOTORS CORP.

22. Position and install the PCV hose to the intake manifold fitting.

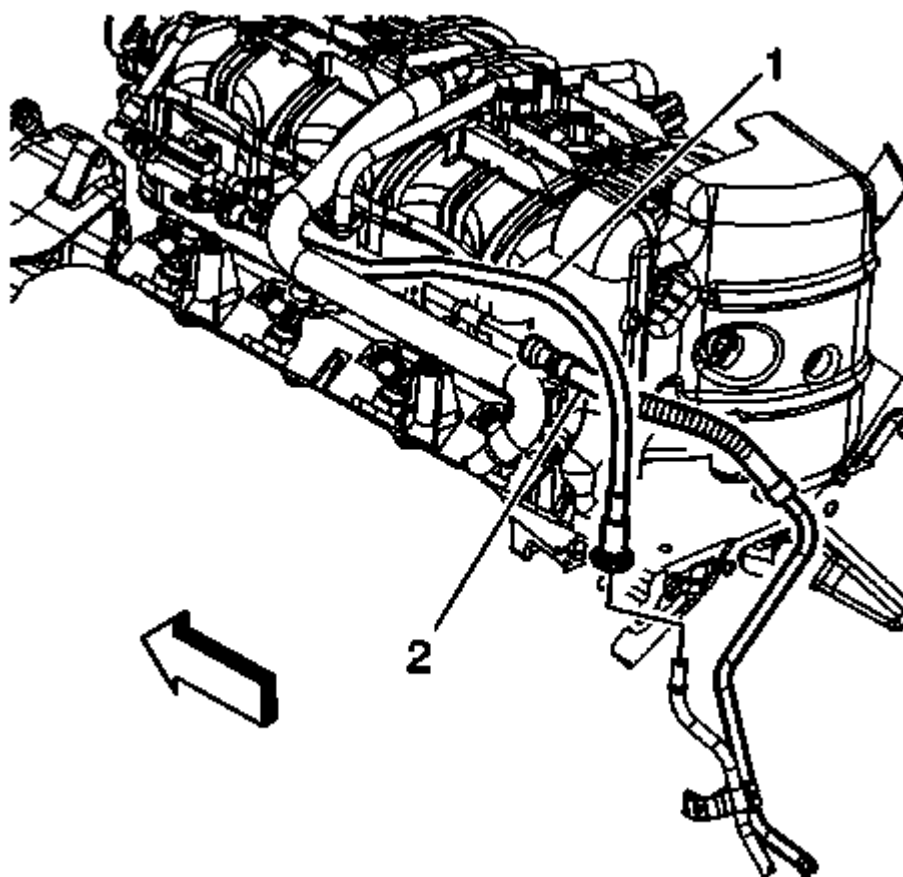


Fig. 53: EVAP Canister Purge Tube And Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

23. Connect the fuel feed line quick connect fitting (2) to the fuel rail. Refer to **Metal Collar Quick Connect Fitting Service** .
24. Connect the EVAP canister purge tube (1) quick connect fitting to the EVAP canister purge solenoid. Refer to **Plastic Collar Quick Connect Fitting Service** .

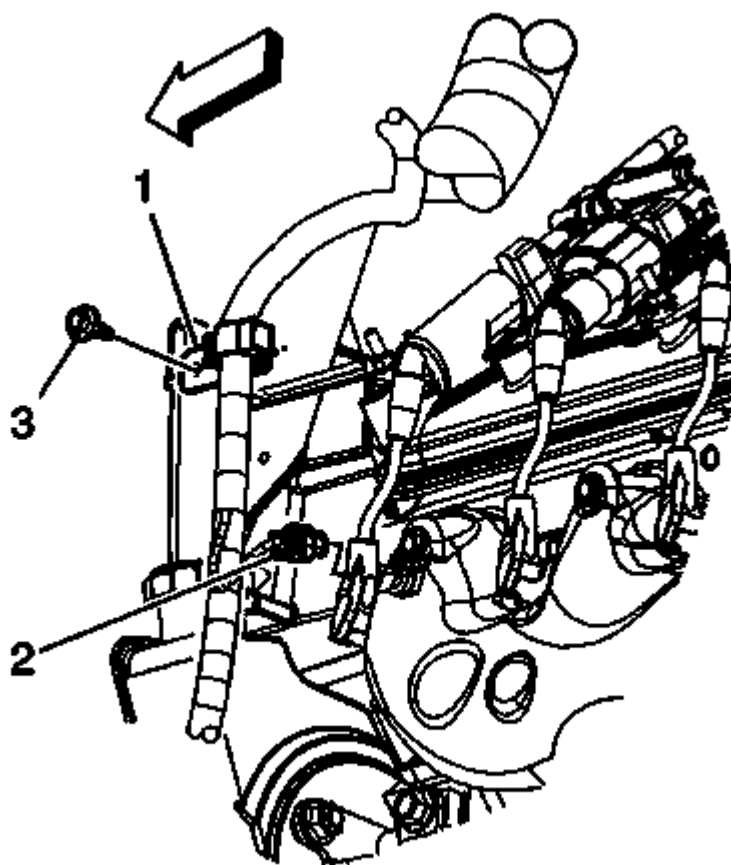


Fig. 54: Engine Wiring Harness, Clip, Bolt And Connectors
Courtesy of GENERAL MOTORS CORP.

25. Untie the engine harness branches from the cowl panel and position over the engine.
26. Connect the engine harness electrical connector (2) to the ECT sensor.
27. Position the engine harness clip (1) to the generator bracket and install the bolt (3).

Tighten

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

28. Connect the generator control module electrical connector.

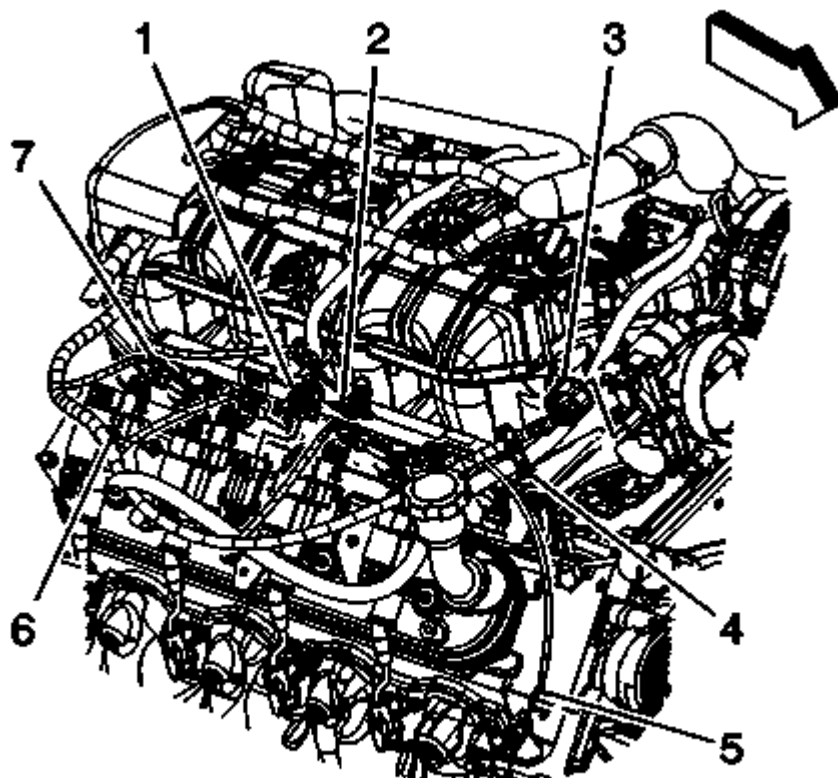


Fig. 55: CPA Retainer, Engine Harness Electrical Connectors And Harness Clips
Courtesy of GENERAL MOTORS CORP.

29. Connect the engine harness electrical connectors (5) to the right side fuel injectors.
30. Install the engine harness clip (4) to the ignition coil bracket stud.
31. Connect the engine harness electrical connector (3) to the throttle actuator.
32. Connect the engine harness electrical connector (2) to the ignition coil harness electrical connector.
33. Install the CPA retainer (1).

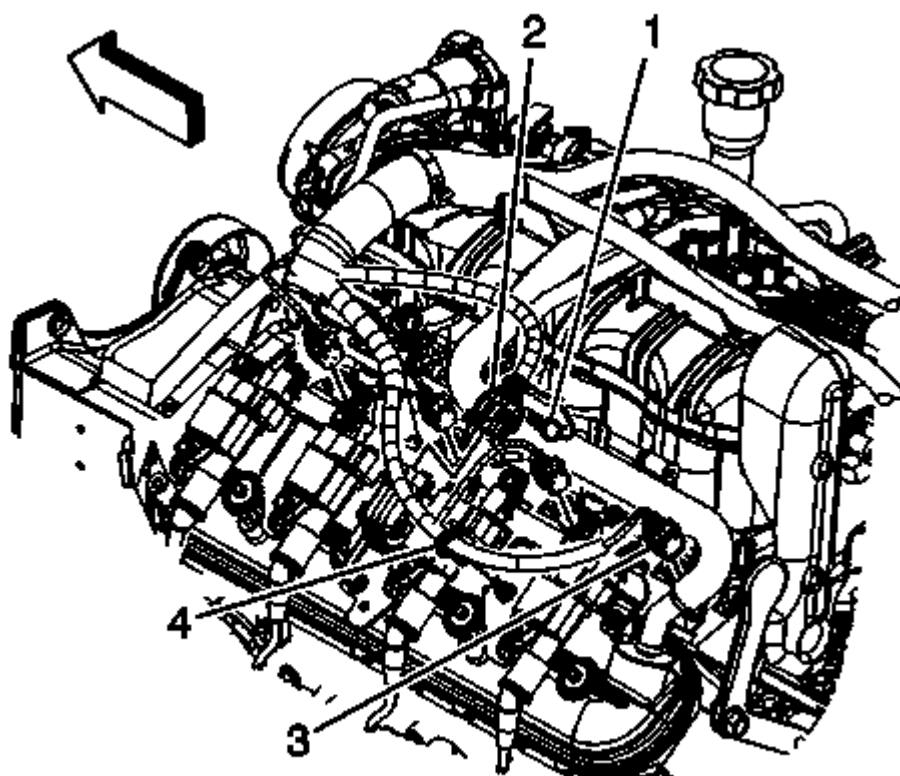


Fig. 56: Engine Harness, Connectors And Retainers
Courtesy of GENERAL MOTORS CORP.

34. Install the engine harness clip (4) to the ignition coil bracket stud.
35. Connect the engine harness electrical connectors (3) to the left side fuel injectors.
36. Connect the engine harness electrical connector (2) to the ignition coil harness electrical connector.
37. Install the CPA retainer (1).

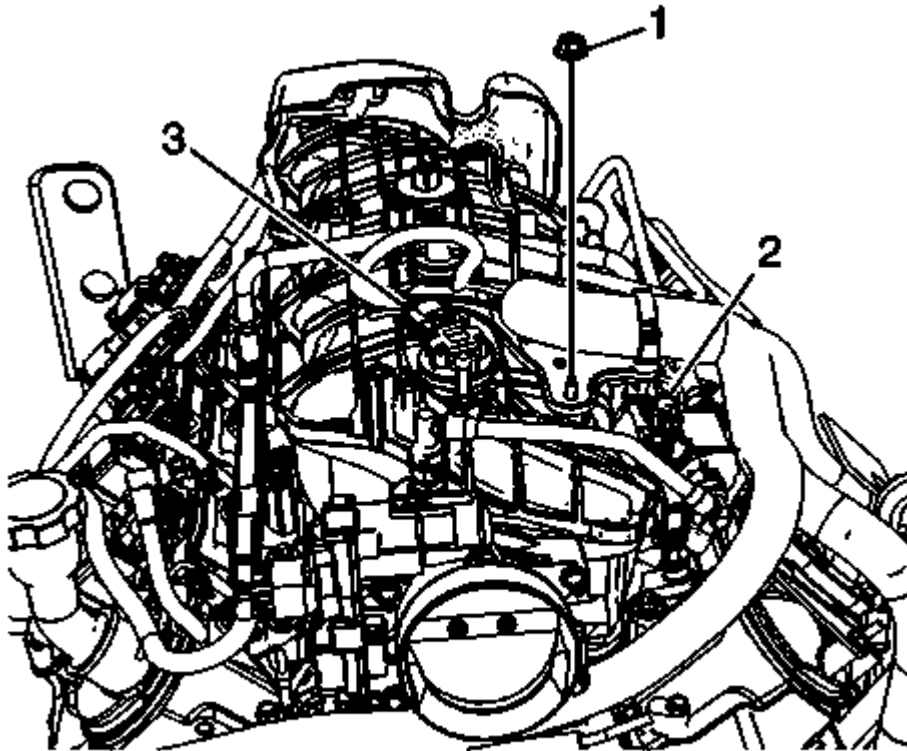


Fig. 57: Engine Harness, Retainer Nut And Connector
Courtesy of GENERAL MOTORS CORP.

38. Connect the engine wiring harness electrical connector (3) to the MAP sensor.
39. Connect the engine harness electrical connector (2) to the EVAP canister purge solenoid.
40. Install the engine harness retainer to the stud and locator pin.
41. Install the engine harness retainer nut (1).

Tighten

Tighten the nut to 5 N.m (44 lb in).

42. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
43. Connect the battery ground cable. Refer to **Battery Negative Cable Disconnection and Connection** .
44. Perform the High Voltage Service connect. Refer to **High Voltage Enabling** .

UPPER INTAKE MANIFOLD COVER REPLACEMENT

Removal Procedure

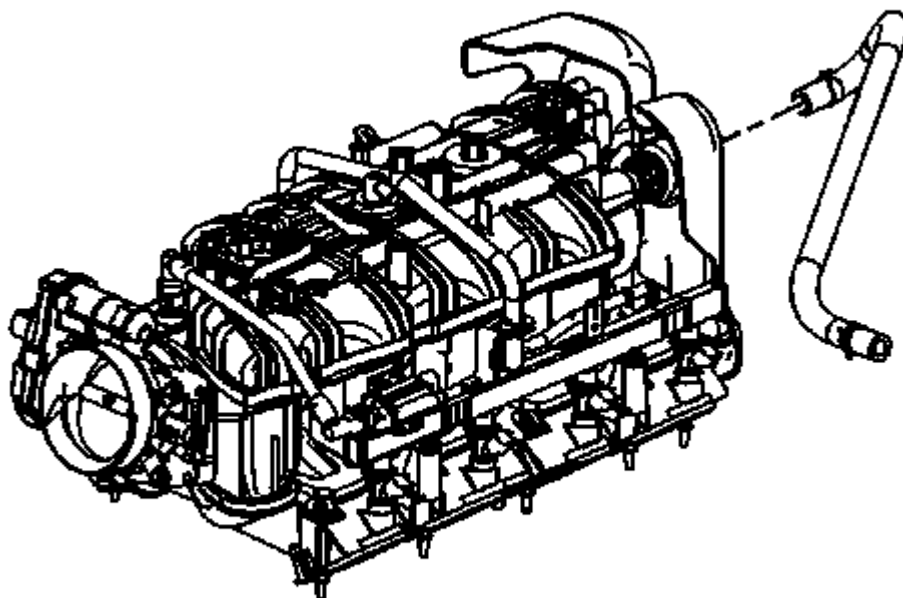


Fig. 58: Brake Booster Vacuum Hose
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
2. Reposition the brake booster vacuum hose clamp at the intake manifold.
3. Remove the brake booster vacuum hose from the intake manifold nipple.

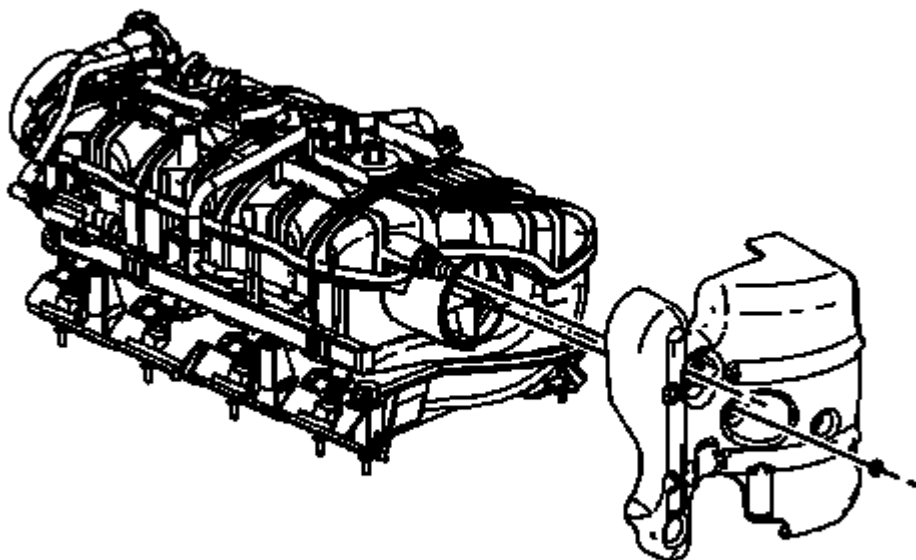


Fig. 59: Upper Intake Manifold Cover And Nut
Courtesy of GENERAL MOTORS CORP.

4. Remove the upper intake manifold cover nut.
5. Remove the upper intake manifold cover.

Installation Procedure

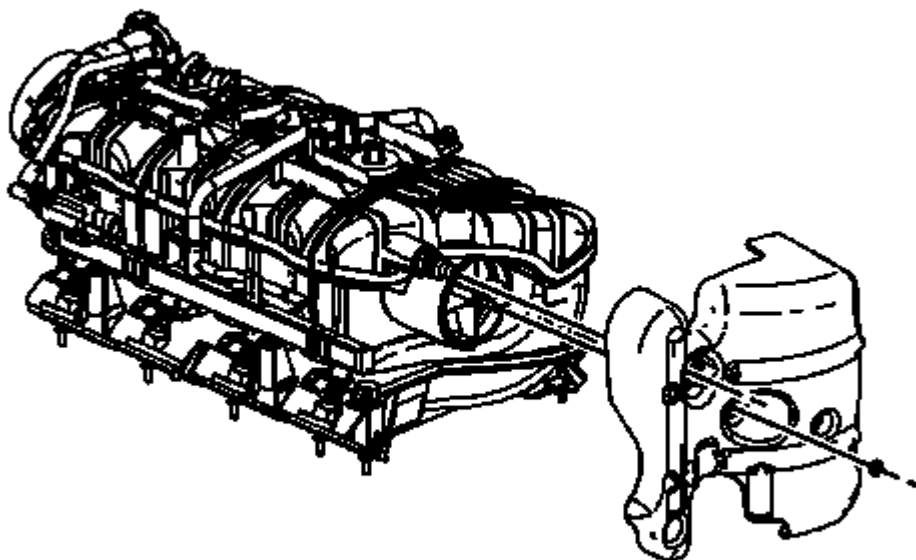


Fig. 60: Upper Intake Manifold Cover And Nut
Courtesy of GENERAL MOTORS CORP.

1. Install the upper intake manifold cover.
2. Install the upper intake manifold cover nut until snug

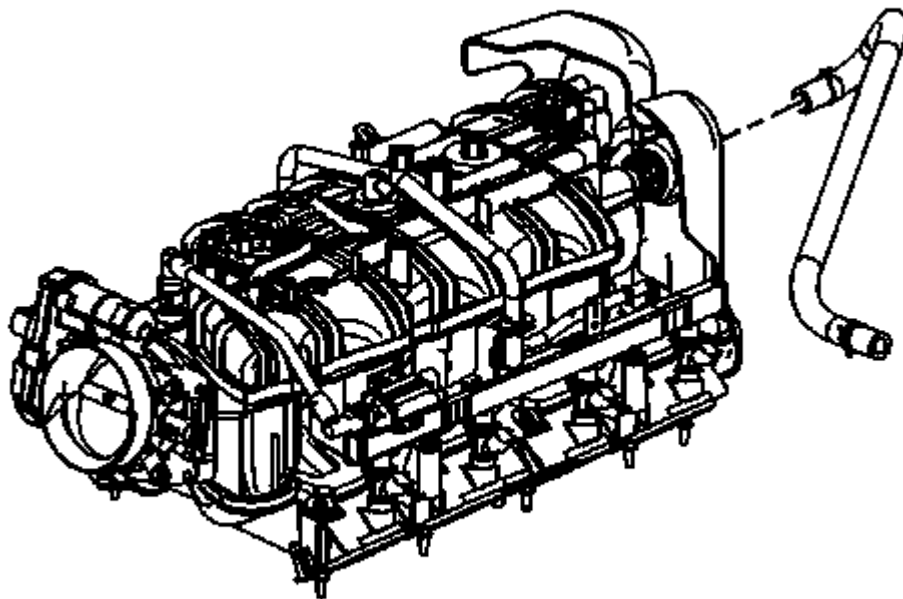


Fig. 61: Brake Booster Vacuum Hose
Courtesy of GENERAL MOTORS CORP.

3. Install the brake booster vacuum hose to the intake manifold nipple.
4. Position the brake booster vacuum hose clamp at the intake manifold.
5. Install the intake manifold. Refer to **Intake Manifold Replacement**.

VALVE LIFTER OIL MANIFOLD REPLACEMENT

Removal Procedure

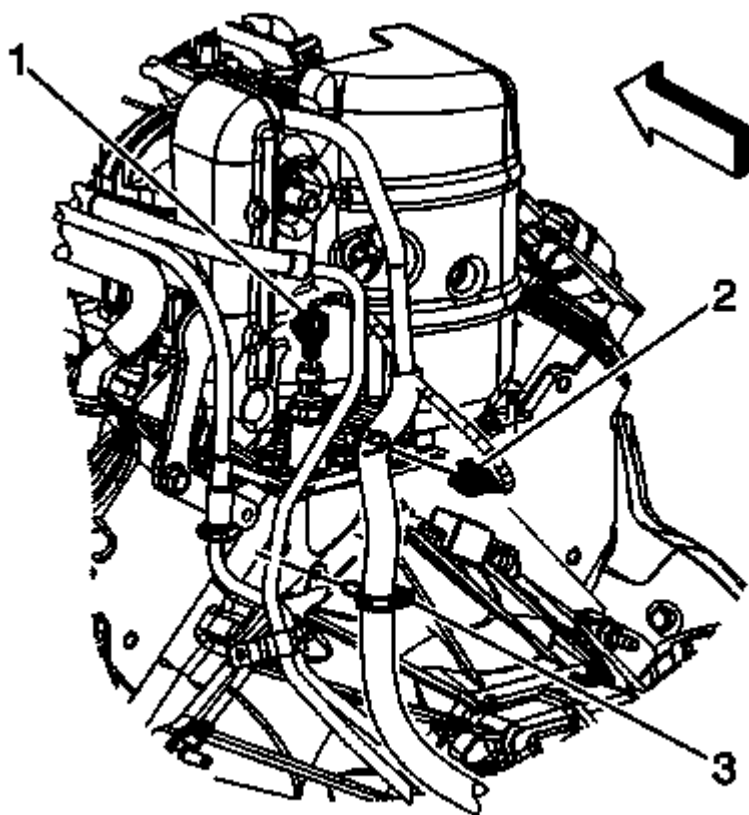


Fig. 62: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.

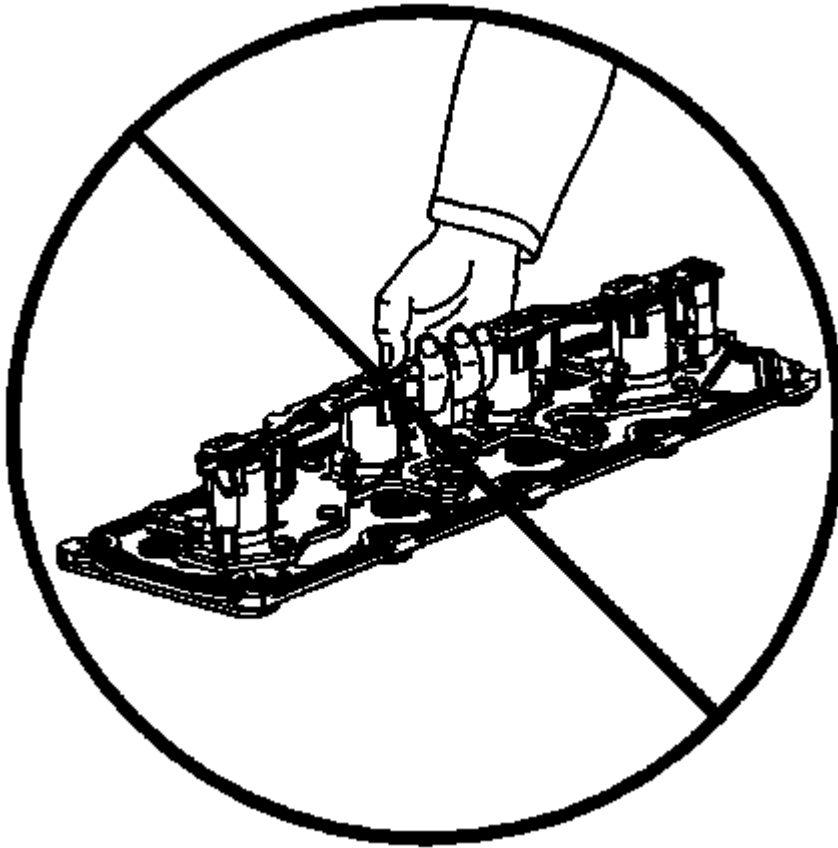


Fig. 63: Valve Lifter Oil Manifold Handling Precaution
Courtesy of GENERAL MOTORS CORP.

3. DO NOT lift the valve lifter oil manifold by the electrical lead frame.

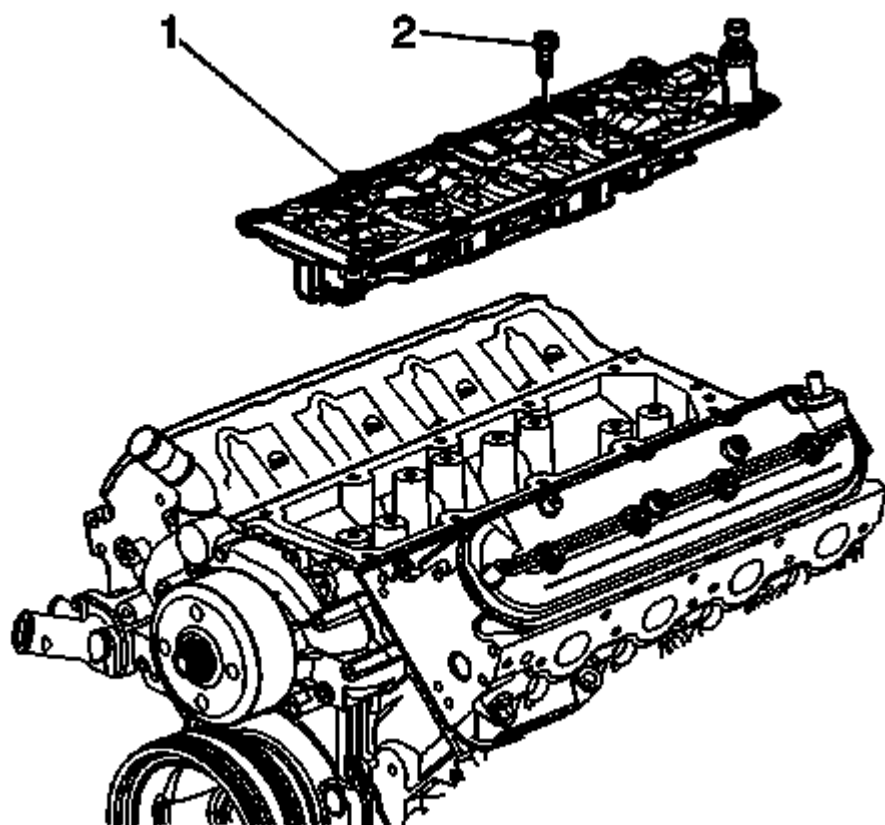


Fig. 64: Valve Lifter Oil Manifold
Courtesy of GENERAL MOTORS CORP.

4. Remove the valve lifter oil manifold bolts (2).
5. Remove the valve lifter oil manifold (1).

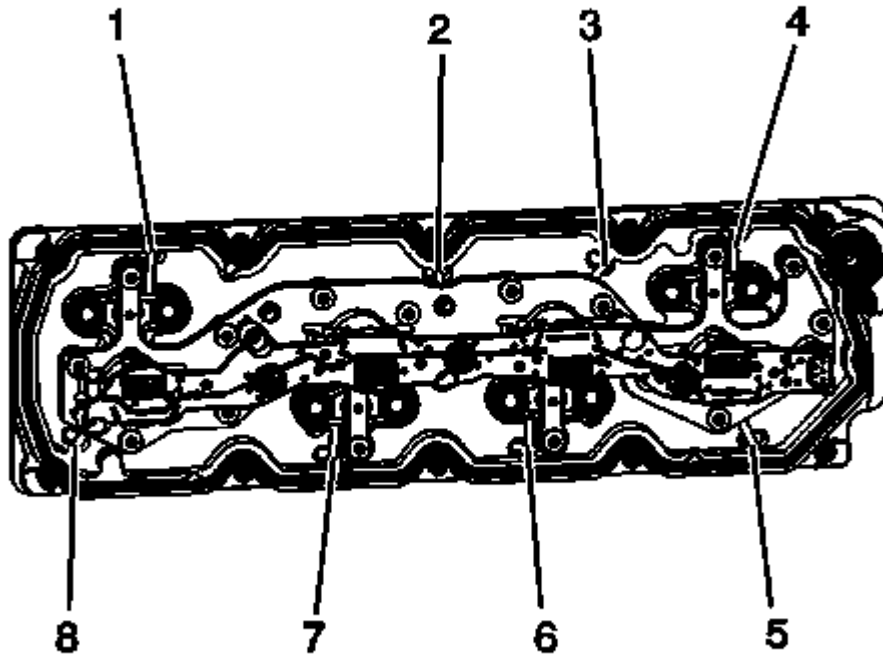


Fig. 65: Gasket Retaining Strap Locations
Courtesy of GENERAL MOTORS CORP.

NOTE: Remove only the outer gasket from the manifold. Do not disassemble any of the internal components of the manifold in an attempt to remove the 8 inner sealing gaskets. If the inner gaskets are cut or damaged, replace the manifold as an assembly. Only use a wire-cutter type tool in order to minimize the amount of debris. Do not use a rotary-type cutting tool on the retaining straps.

6. Identify the 8 gasket retaining strap locations (1-8).

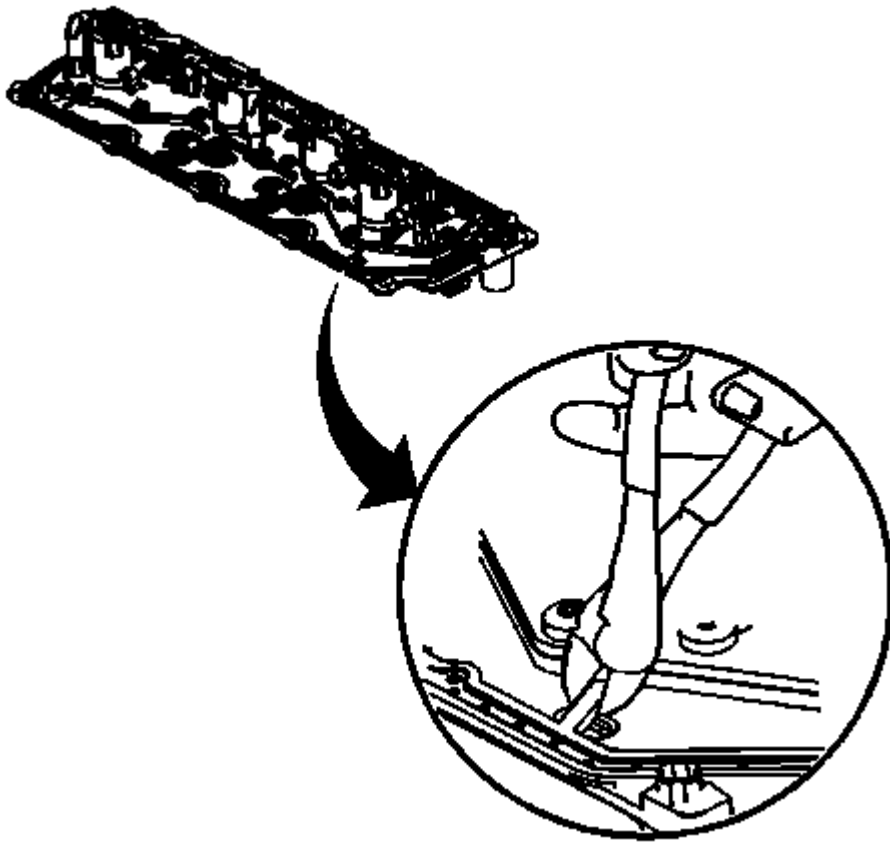


Fig. 66: Cutting Retaining Straps
Courtesy of GENERAL MOTORS CORP.

7. Using a cutter type tool, cut the 8 retaining straps.

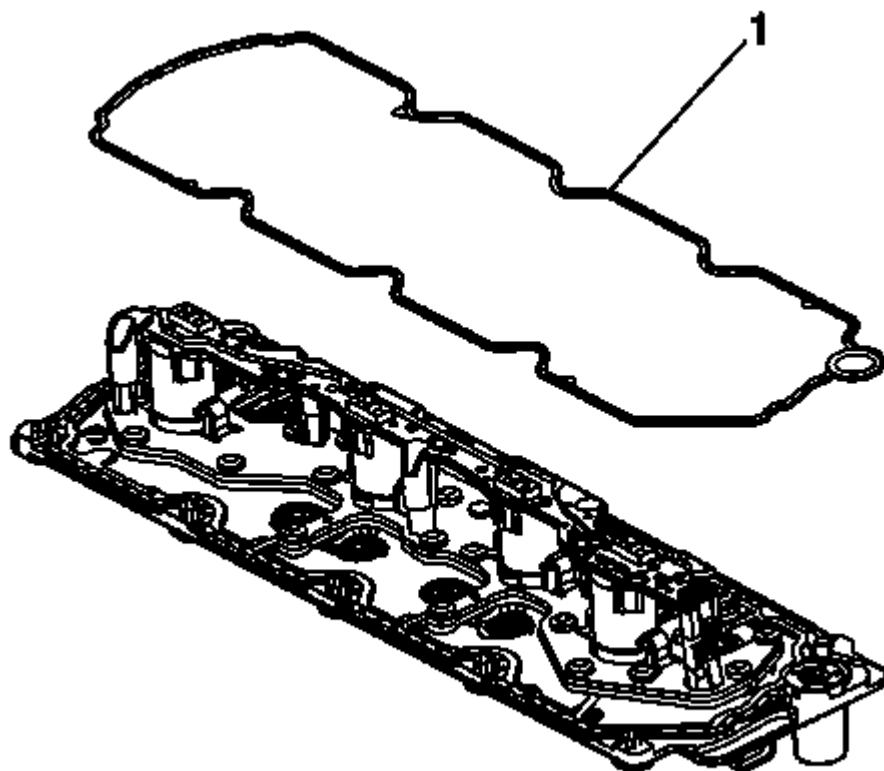


Fig. 67: Valve Cover Outer Gasket
Courtesy of GENERAL MOTORS CORP.

8. Remove the outer gasket (1) from the valve lifter oil manifold.

Installation Procedure

NOTE: All gasket surfaces should be free of oil or other foreign material during assembly.

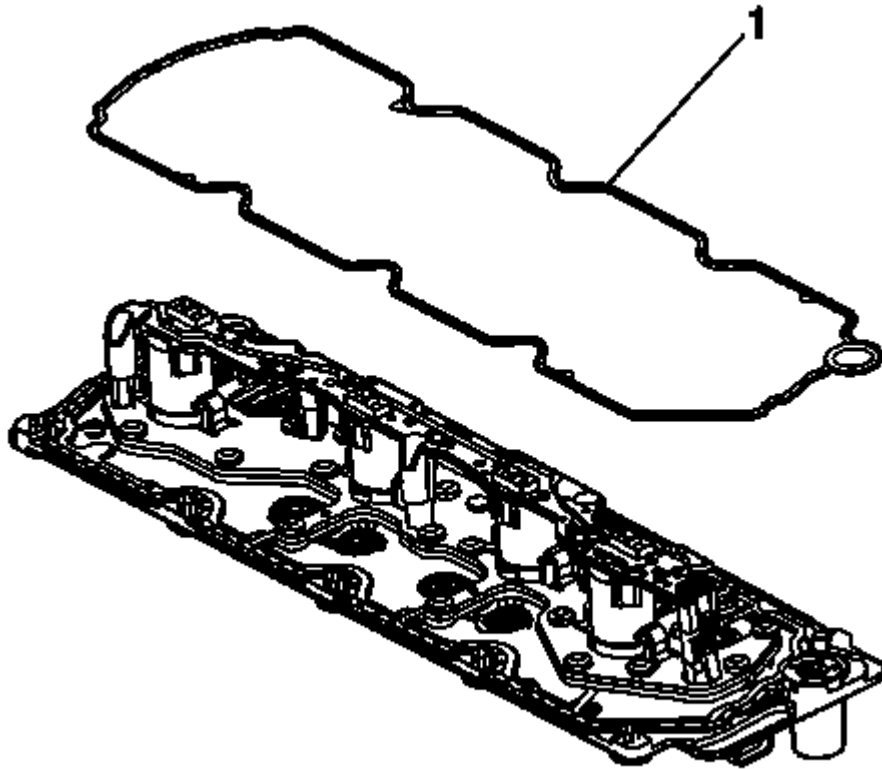


Fig. 68: Valve Cover Outer Gasket
Courtesy of GENERAL MOTORS CORP.

1. Place the service gasket (1) onto the valve lifter oil manifold.

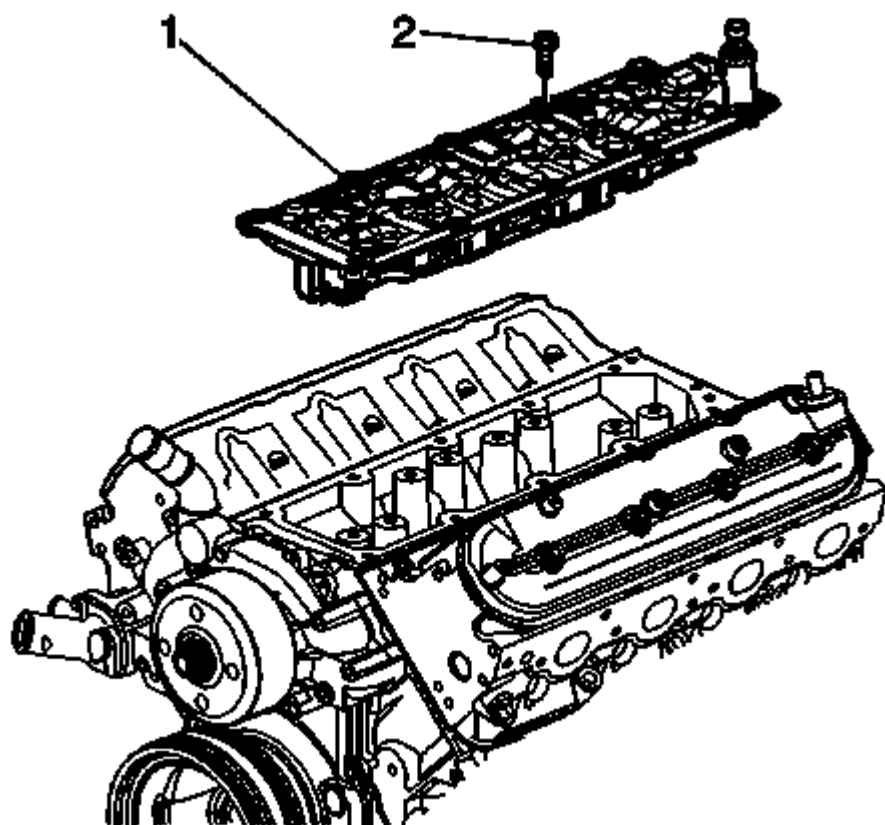


Fig. 69: Valve Lifter Oil Manifold
Courtesy of GENERAL MOTORS CORP.

2. Install the valve lifter oil manifold (1) to the engine.

CAUTION: Refer to Fastener Caution .

3. Install the valve lifter oil manifold bolts (2).

Tighten

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

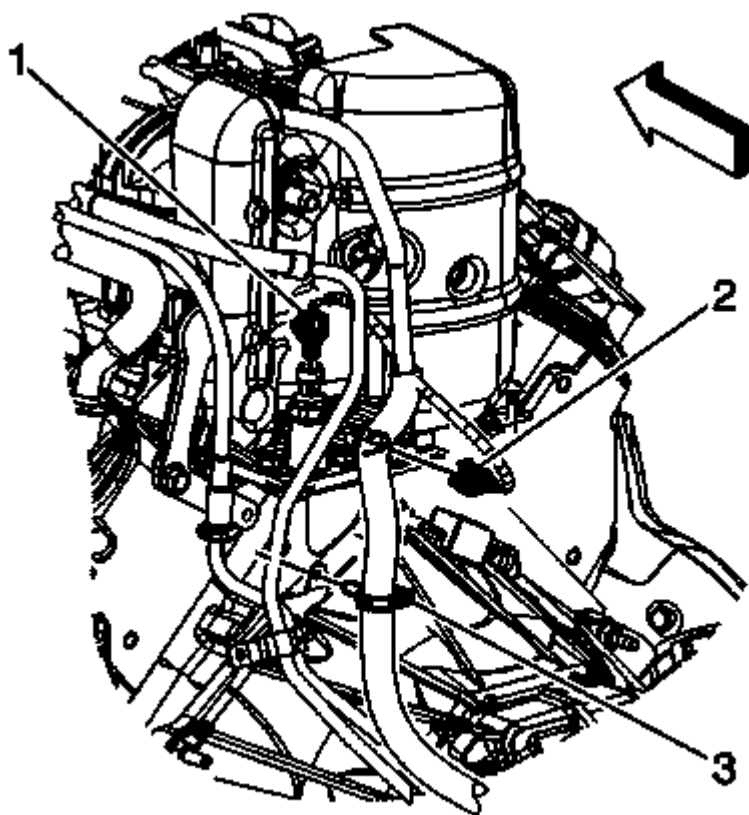


Fig. 70: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

4. Connect the engine harness electrical connector (1) to the oil pressure sensor.
5. Install the intake manifold. Refer to **Intake Manifold Replacement**.

VALVE LIFTER OIL FILTER REPLACEMENT

Removal Procedure

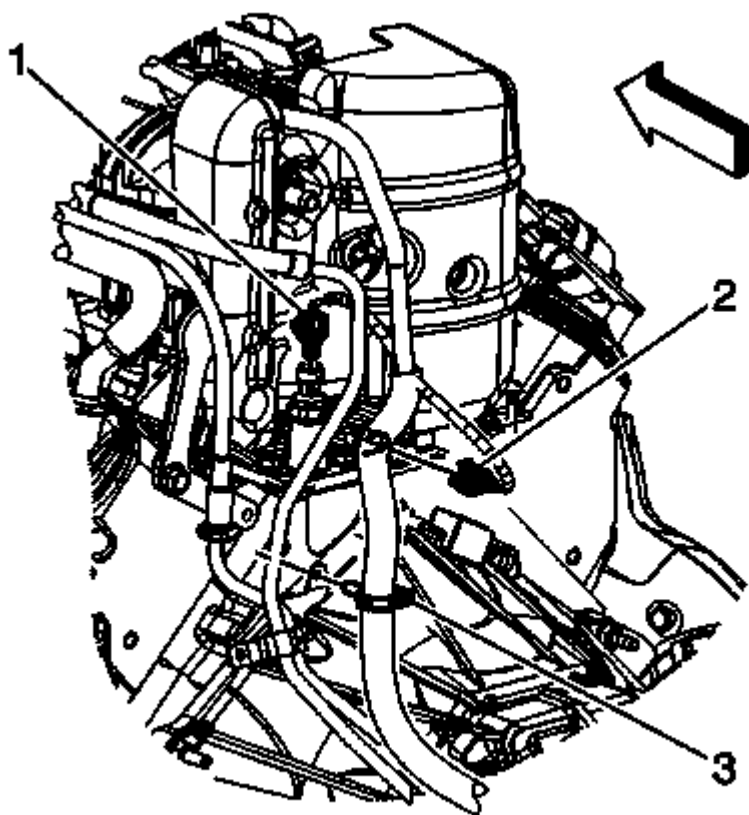


Fig. 71: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.

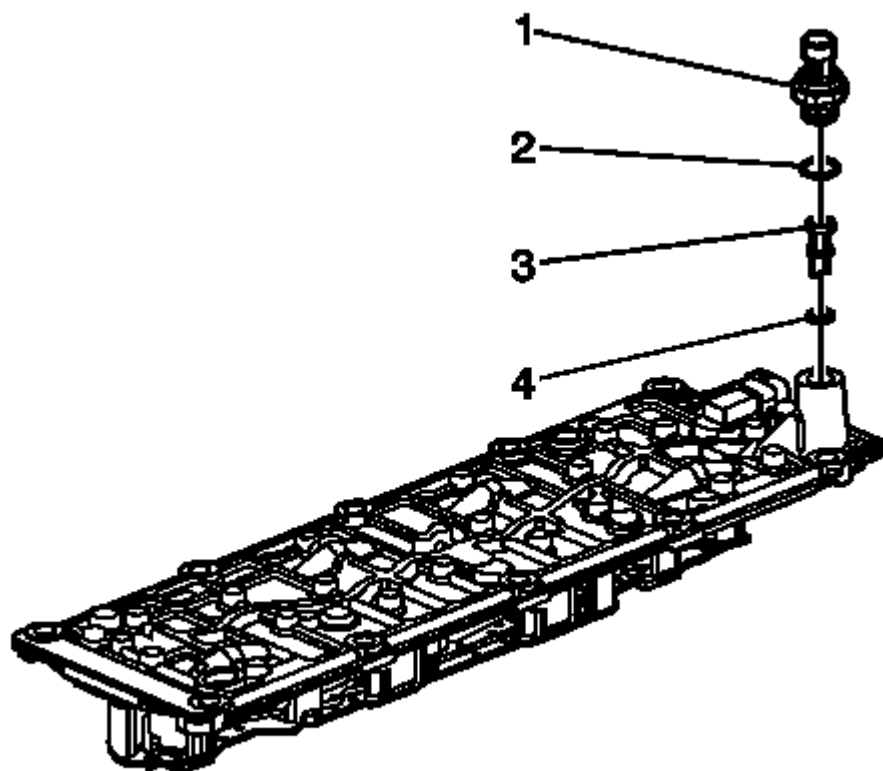
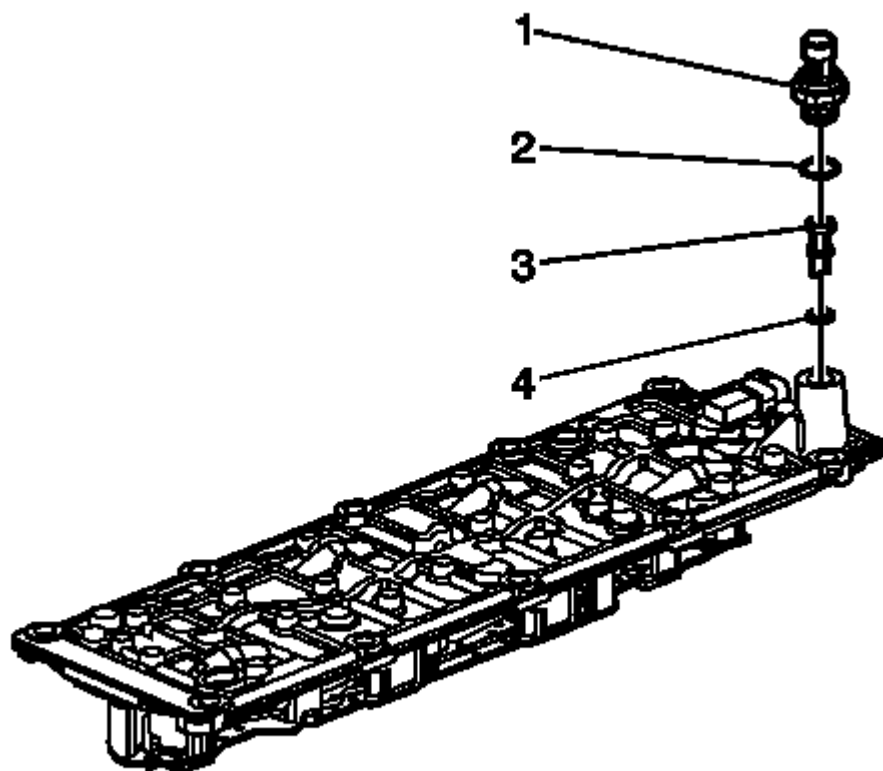


Fig. 72: Oil Pressure Sensor

Courtesy of GENERAL MOTORS CORP.

3. Remove the oil pressure sensor (1) and washer (2).
4. Remove and discard the valve lifter oil filter (3).
5. Remove and discard the valve lifter oil filter O-ring seal (4).

Installation Procedure

**Fig. 73: Oil Pressure Sensor**

Courtesy of GENERAL MOTORS CORP.

1. Install a NEW valve lifter oil filter O-ring seal (4) into the valve lifter oil manifold.
2. Install the NEW valve lifter oil filter (3).
3. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the threads of the oil pressure sensor.

CAUTION: Refer to Fastener Caution .

4. Install the oil pressure sensor washer (2) and sensor (1).

Tighten

Tighten the sensor to 35 N.m (26 lb ft).

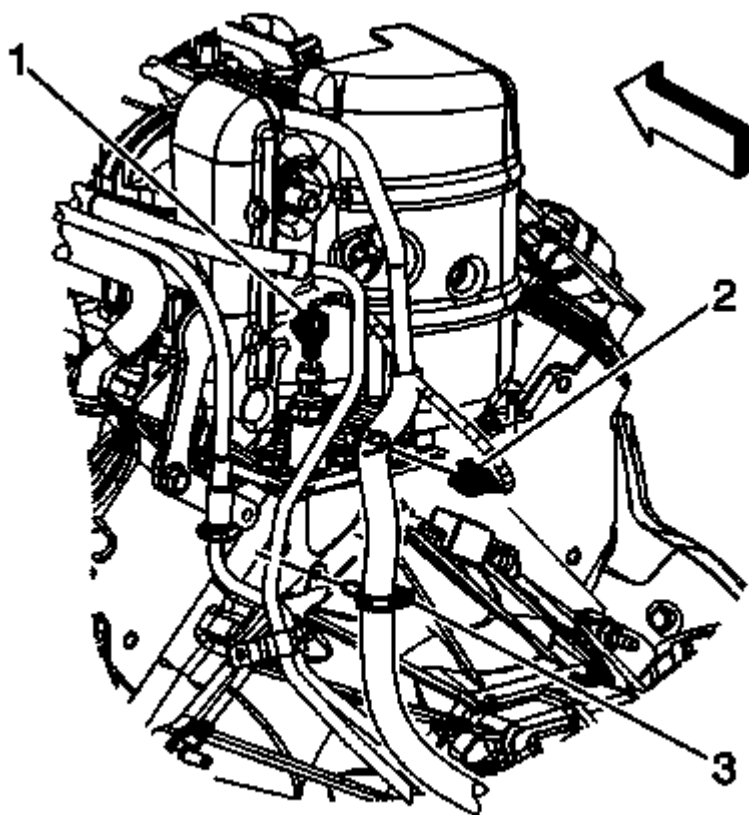


Fig. 74: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

5. Connect the engine harness electrical connector (1) to the oil pressure sensor.
6. Install the intake manifold. Refer to **Intake Manifold Replacement**.

VALVE ROCKER ARM COVER REPLACEMENT - LEFT SIDE

Removal Procedure

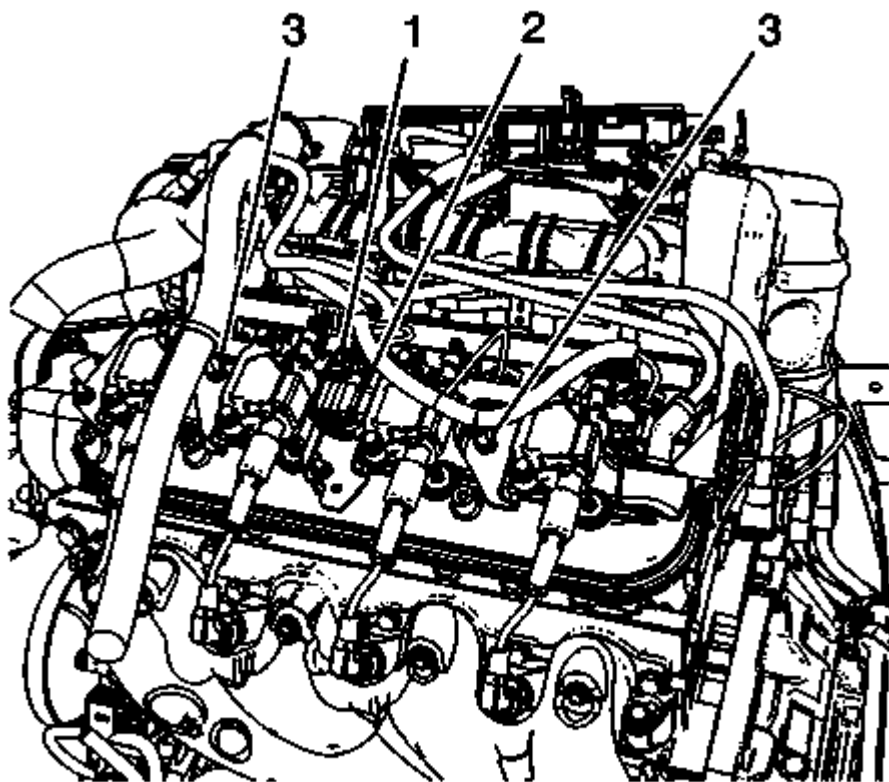


Fig. 75: Connector Position Assurance (CPA) Retainer, Connector And Clips
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold cover. Refer to Upper Intake Manifold Sight Shield Replacement .
2. Remove the connector position assurance (CPA) retainer (2).
3. Disconnect the engine harness electrical connector (1) from the ignition coil wire harness.
4. Remove two engine harness clips (3) from the ignition coil bracket studs.
5. Reposition the engine harness, as necessary.

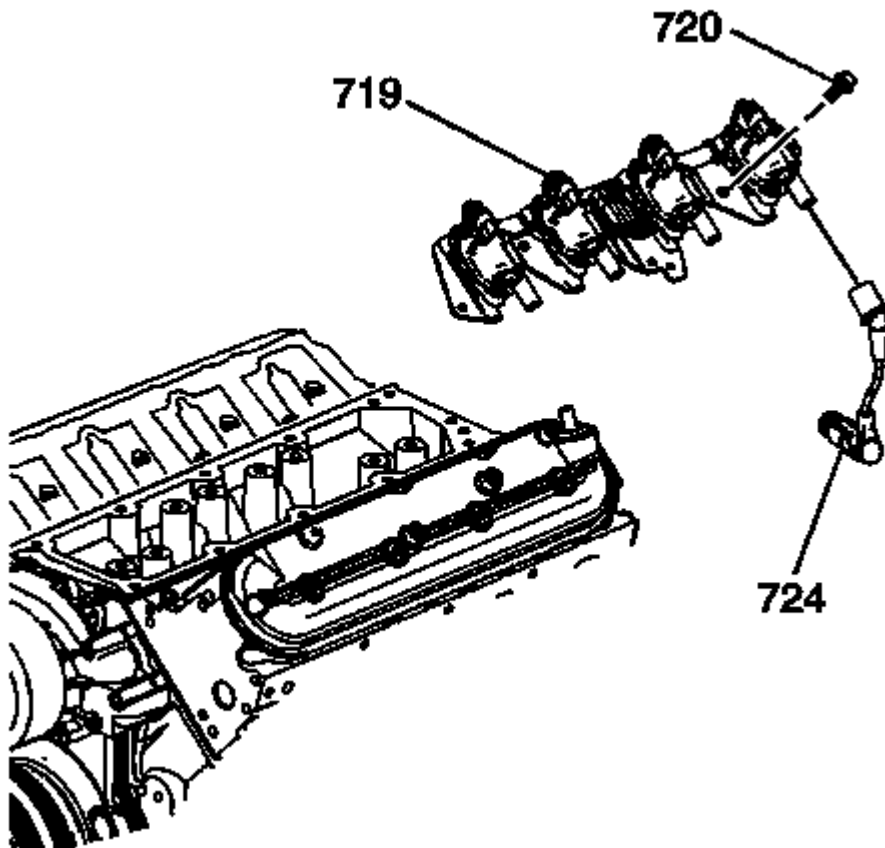


Fig. 76: Ignition Coils And Bracket
Courtesy of GENERAL MOTORS CORP.

6. Remove the spark plug wires (724) from the ignition coils.
 - Twist each plug wire 1/2 turn.
 - Pull only on the boot in order to remove the wire from the ignition coil.
7. Remove the ignition coil bracket studs (720).
8. Remove the ignition coil bracket (719).

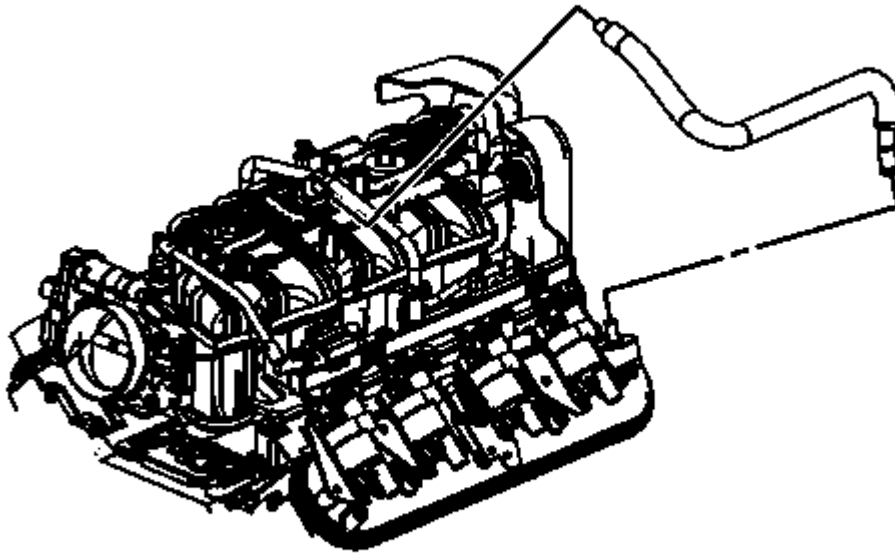


Fig. 77: PCV Hose

Courtesy of GENERAL MOTORS CORP.

9. Remove the positive crankcase ventilation (PCV) hose.

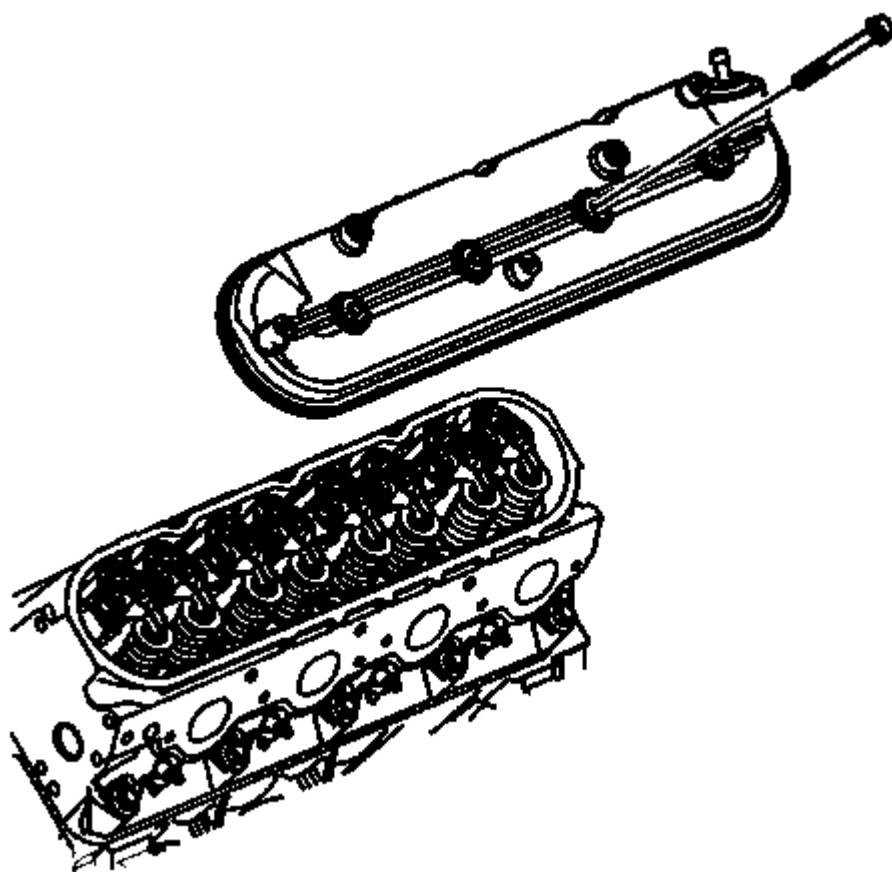


Fig. 78: Valve Rocker Arm Cover
Courtesy of GENERAL MOTORS CORP.

10. Loosen the valve rocker arm cover bolts.
11. Remove the valve rocker arm cover.

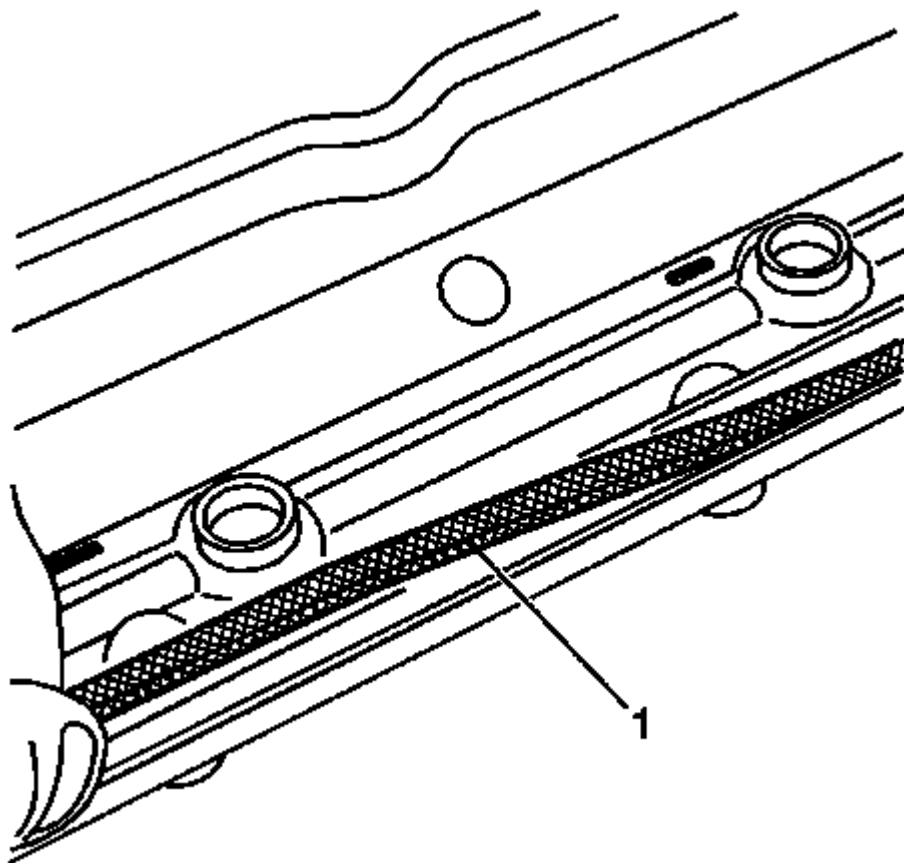


Fig. 79: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

12. Remove and discard the old gasket (1).

Installation Procedure

NOTE:

- All gasket surfaces should be free of oil an/or other foreign material during assembly.
- DO NOT reuse the valve rocker arm cover gasket.
- If the PCV valve grommet has been removed from the rocker cover, install a NEW grommet during assembly.

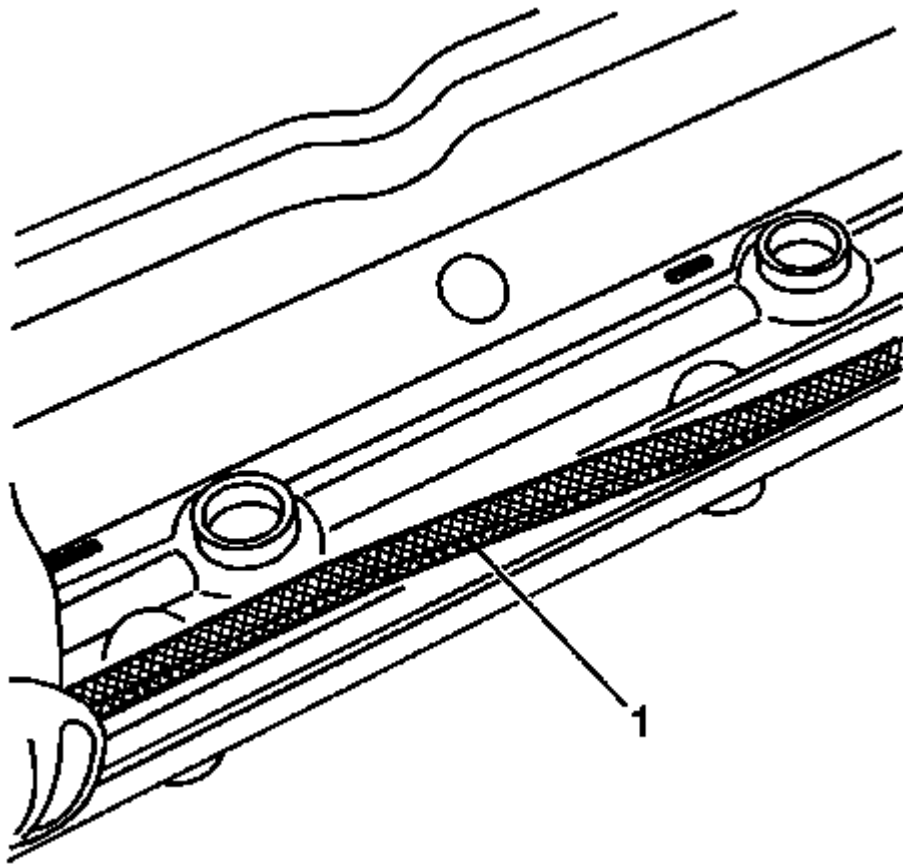


Fig. 80: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW rocker cover gasket (1).

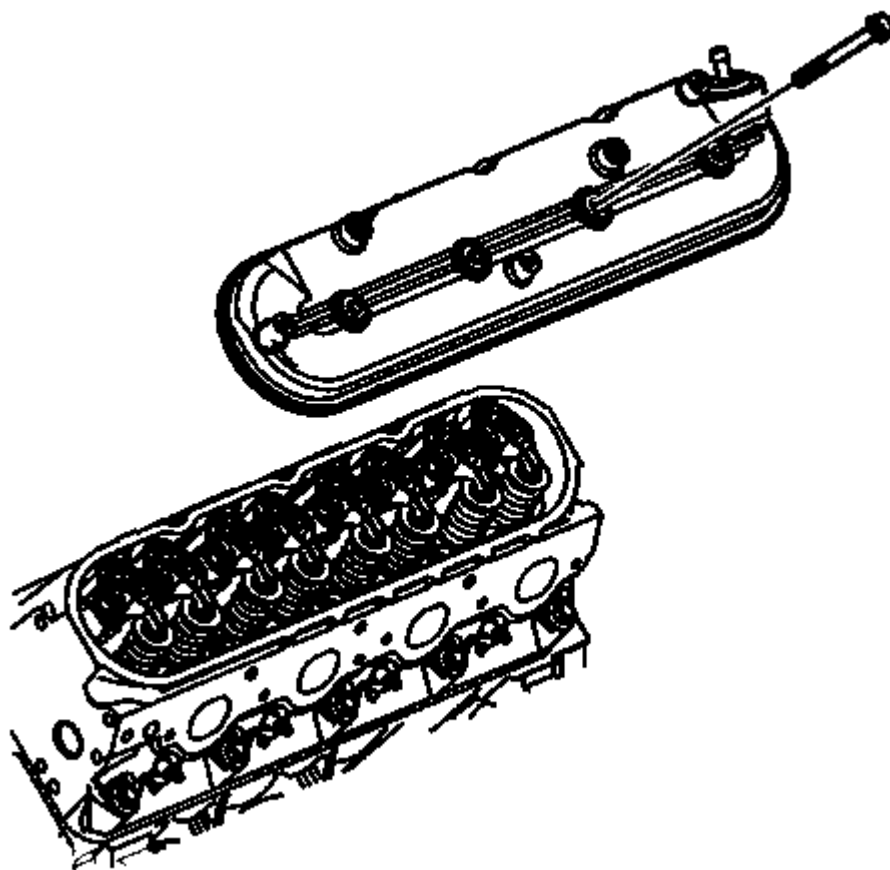


Fig. 81: Valve Rocker Arm Cover
Courtesy of GENERAL MOTORS CORP.

2. Install the valve rocker arm cover.

CAUTION: Refer to Fastener Caution .

3. Tighten the rocker arm cover bolts.

Tighten

Tighten the bolts to 12 N.m (106 lb in).

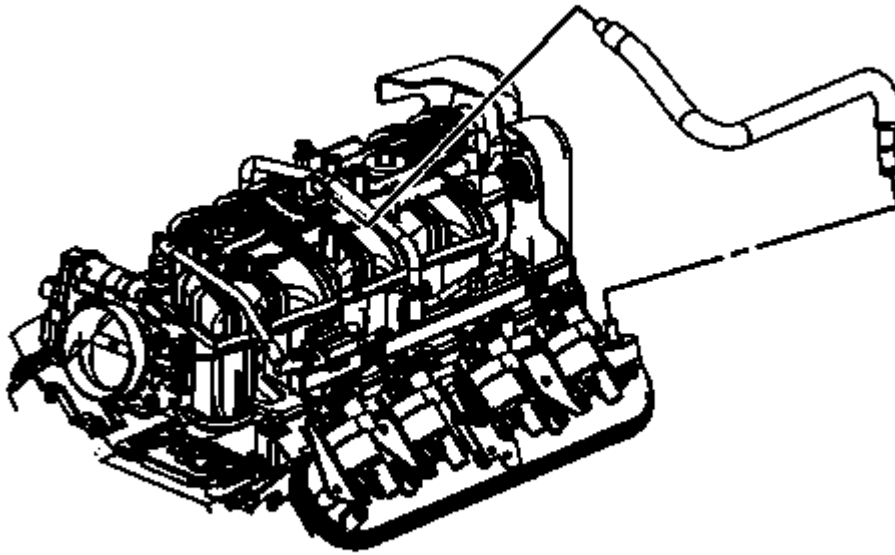


Fig. 82: PCV Hose

Courtesy of GENERAL MOTORS CORP.

4. Install the PCV hose.

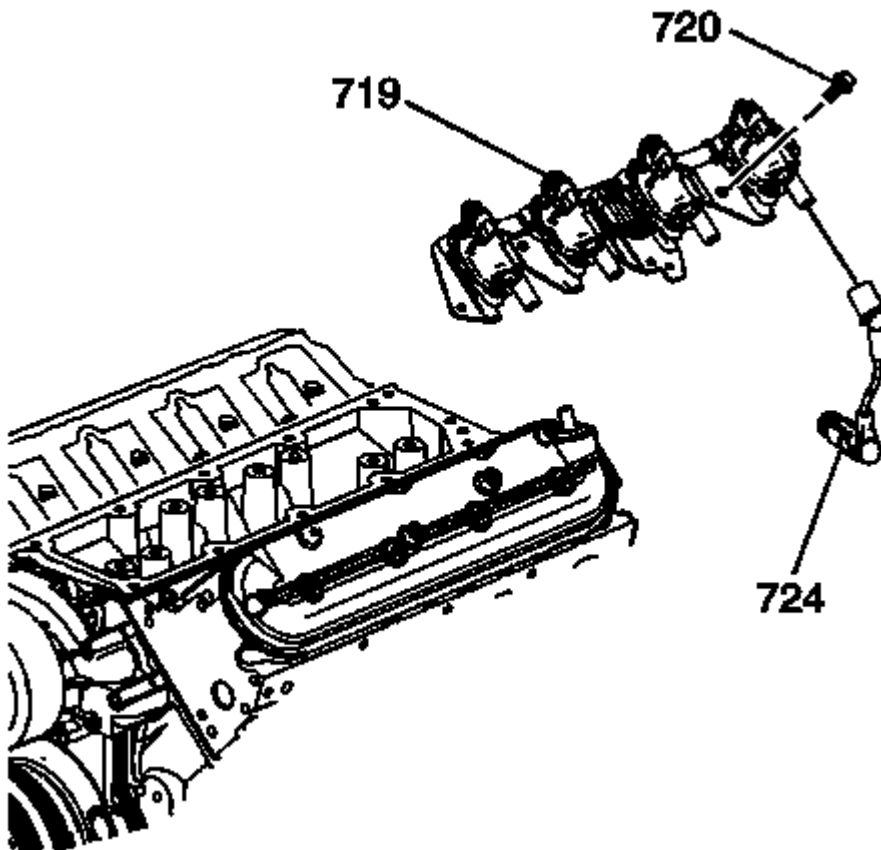


Fig. 83: Ignition Coils And Bracket
Courtesy of GENERAL MOTORS CORP.

5. Apply threadlock to the threads of the ignition coil bracket studs. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .
6. Position the ignition coil bracket (719) onto the rocker cover.
7. Install the ignition coil bracket studs (720).

Tighten

Tighten the studs to 12 N.m (106 lb in).

8. Install the spark plug wires (724) to the ignition coils.

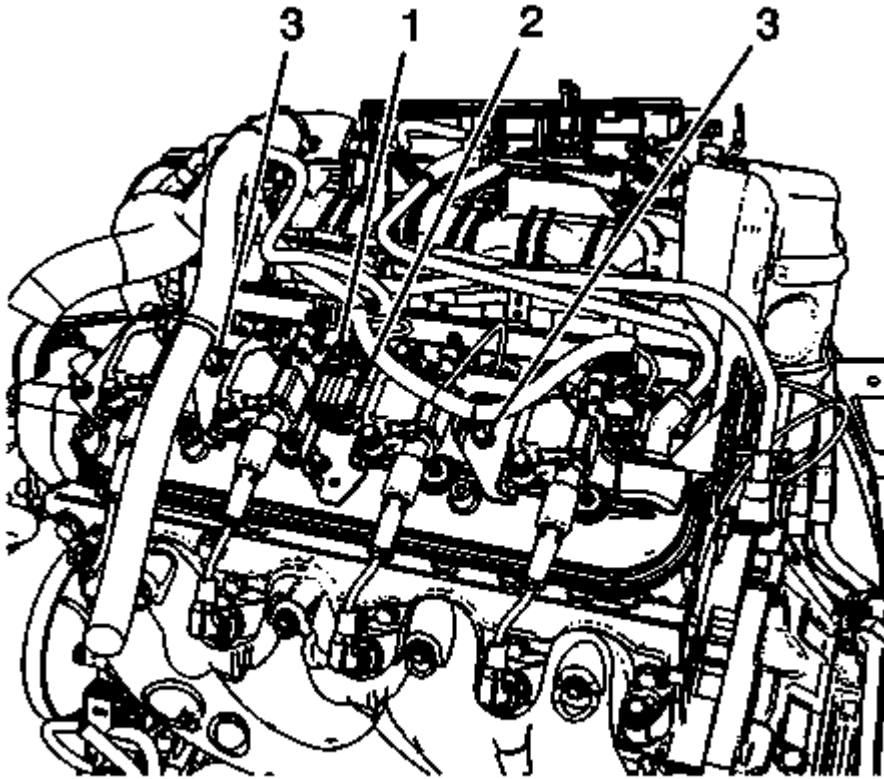


Fig. 84: Connector Position Assurance (CPA) Retainer, Connector And Clips
Courtesy of GENERAL MOTORS CORP.

9. Position the engine harness, as necessary.
10. Install two engine harness clips (3) to the ignition coil bracket studs.
11. Connect the engine harness electrical connector (1) to the ignition coil wire harness.
12. Install the CPA retainer (2).
13. Install the intake manifold cover. Refer to **Upper Intake Manifold Sight Shield Replacement** .

VALVE ROCKER ARM COVER REPLACEMENT - RIGHT SIDE

Removal Procedure

WARNING: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure will perform the following tasks:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Failure to follow the procedures exactly as written may result in serious injury or death.

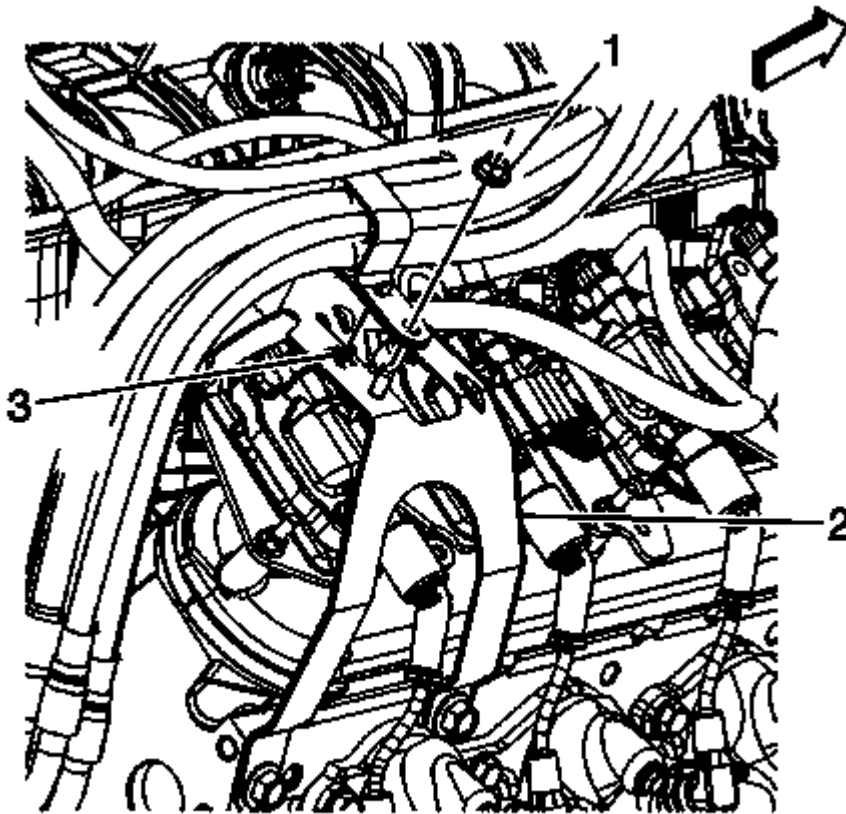


Fig. 85: 3-Phase Cable Clip Nut And Engine Bracket
Courtesy of GENERAL MOTORS CORP.

1. Disable the high voltage system. Refer to **High Voltage Disabling** .
2. Remove the intake manifold cover. Refer to **Upper Intake Manifold Sight Shield Replacement** .
3. Remove the generator control module 3 phase cable clip nut (1).
4. Remove the generator control module 3 phase cable clip from the engine bracket (2).
5. Reposition the generator control module 3 phase cables out of the way.

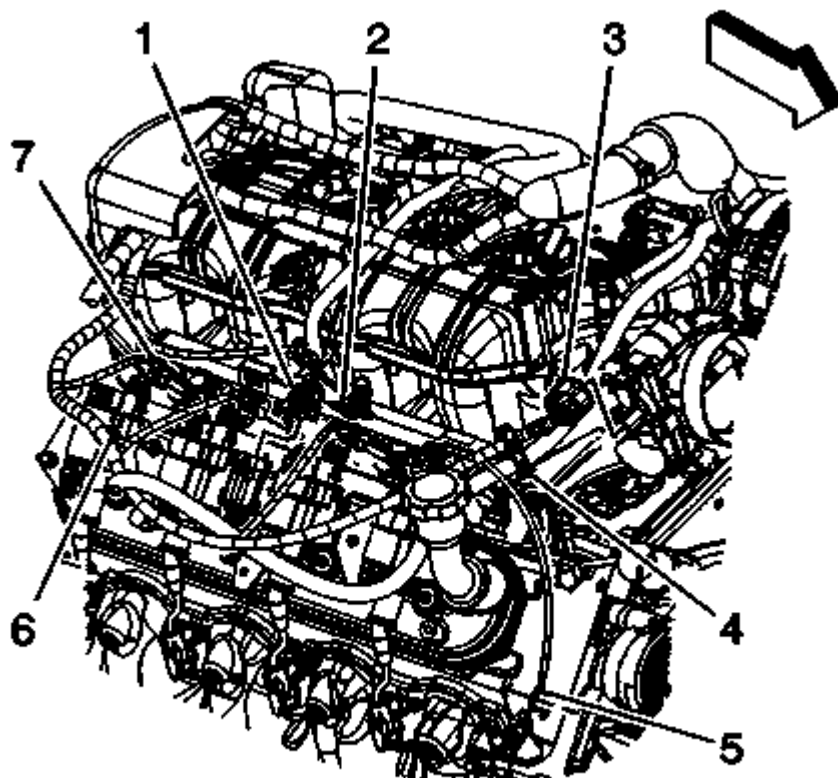


Fig. 86: CPA Retainer, Engine Harness Electrical Connectors And Harness Clips
Courtesy of GENERAL MOTORS CORP.

6. Remove the connector position assurance (CPA) retainer (2).
7. Disconnect the engine harness electrical connector (1) from the ignition coil wire harness.
8. Remove the engine wiring harness (electronic throttle control branch) clip (6) from the ignition coil bracket stud.
9. Reposition the engine wiring harness (electronic throttle control branch) as necessary.

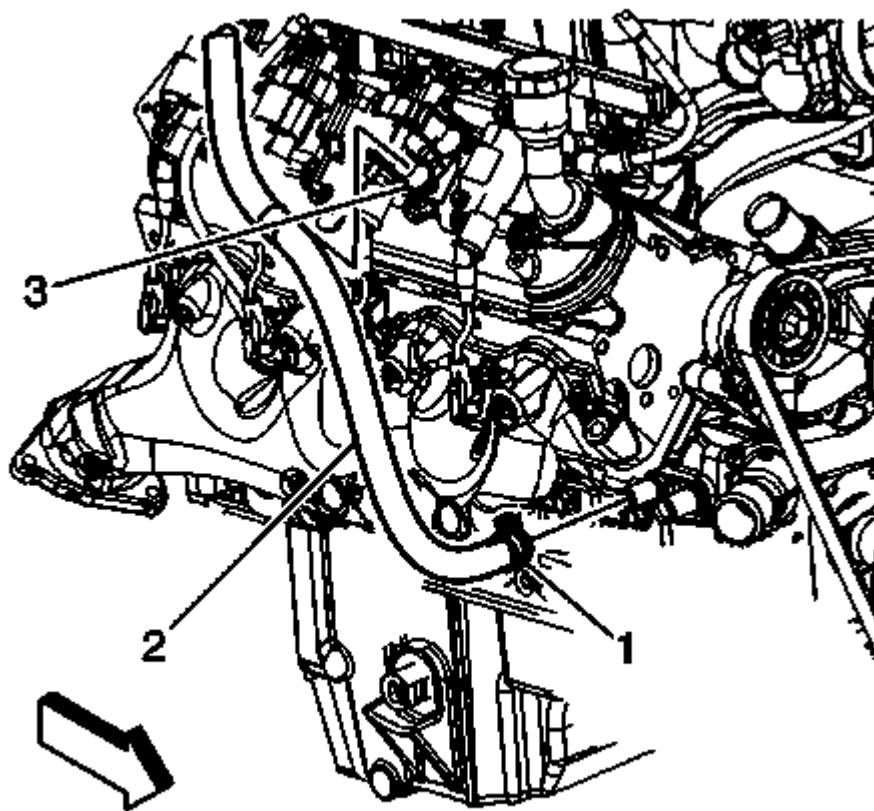


Fig. 87: Heater Inlet Hose And Heater Hose Bracket
Courtesy of GENERAL MOTORS CORP.

10. Remove the heater inlet hose (2) from the heater hose bracket (3).

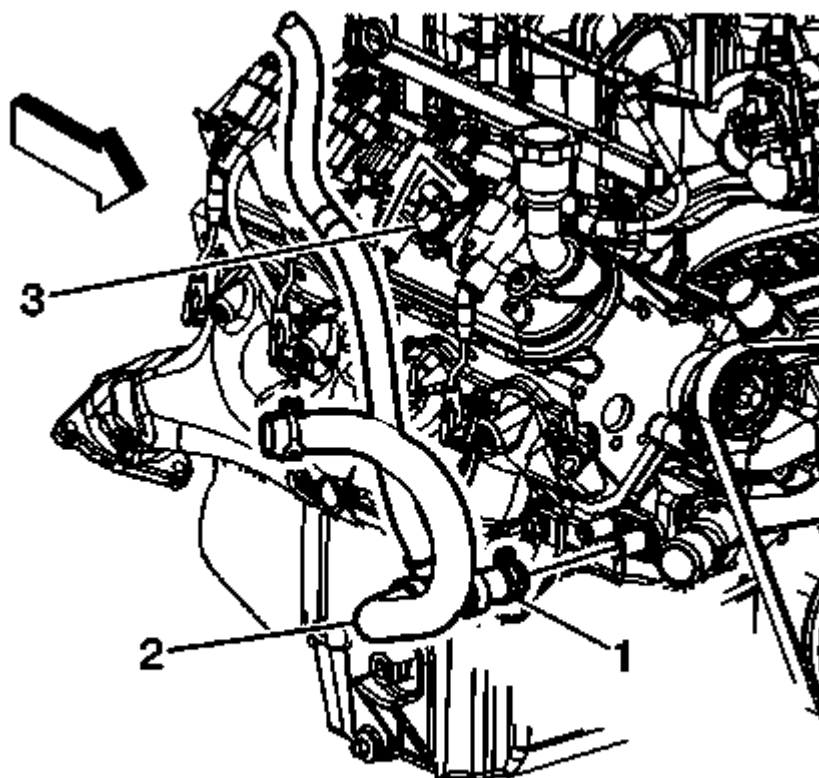


Fig. 88: Heater Outlet Hose And Heater Hose Bracket
Courtesy of GENERAL MOTORS CORP.

11. Remove the surge tank outlet hose (2) from the heater hose bracket (3).

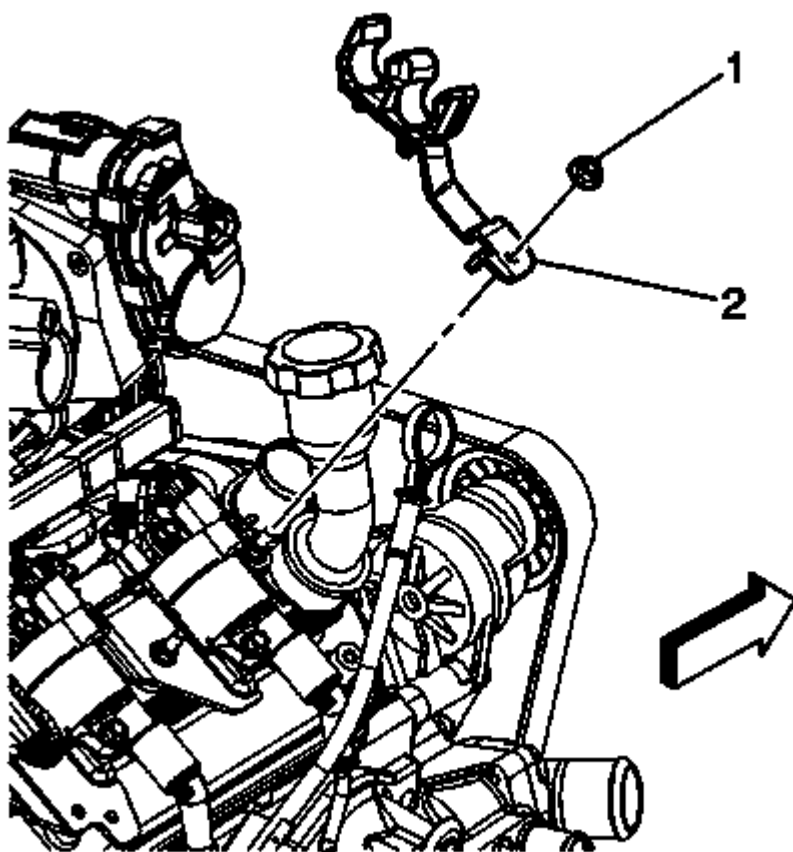


Fig. 89: Heater Hose Bracket And Nut
Courtesy of GENERAL MOTORS CORP.

12. Remove the heater hose bracket nut (1) and bracket (2).

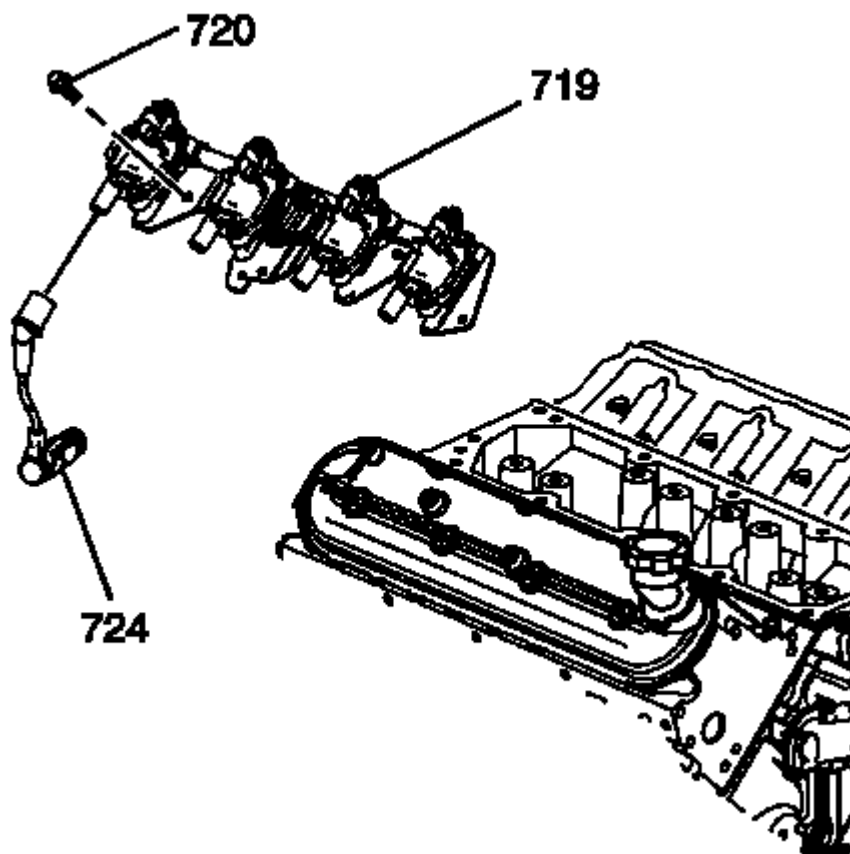


Fig. 90: Ignition Coil And Bracket
Courtesy of GENERAL MOTORS CORP.

13. Remove the spark plug wires (724) from the ignition coils.
 - Twist each plug wire 1/2 turn.
 - Pull only on the boot in order to remove the wire from the ignition coil.
14. Remove the ignition coil bracket studs (720).
15. Remove the ignition coil bracket (719).

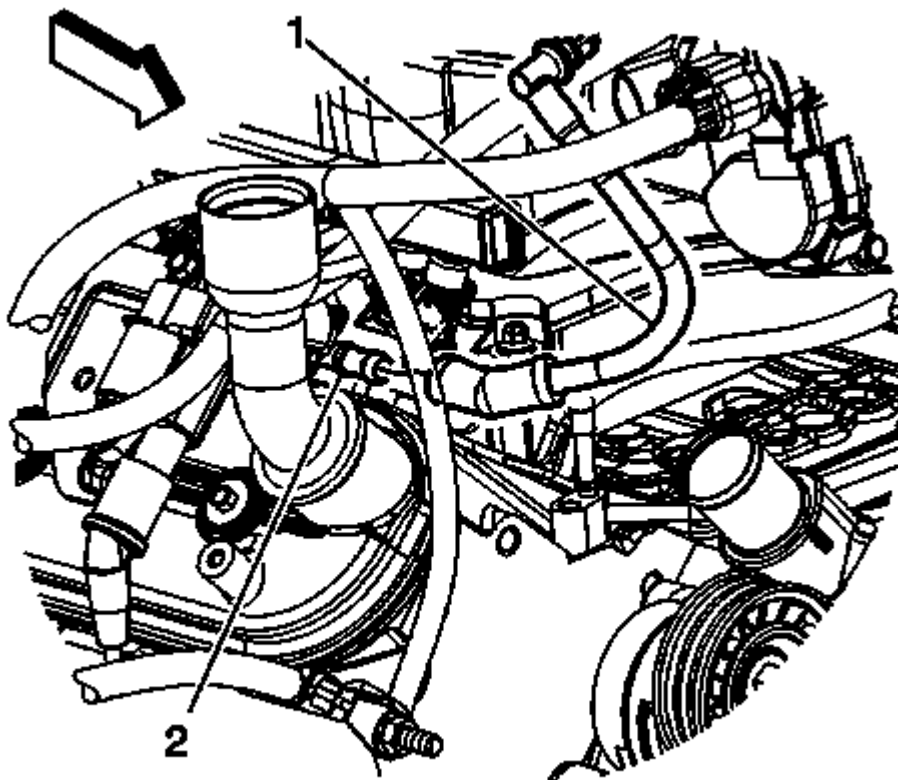


Fig. 91: PCV Tube And Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

16. Remove the positive crankcase ventilation (PCV) tube (1) from the valve rocker cover (2).

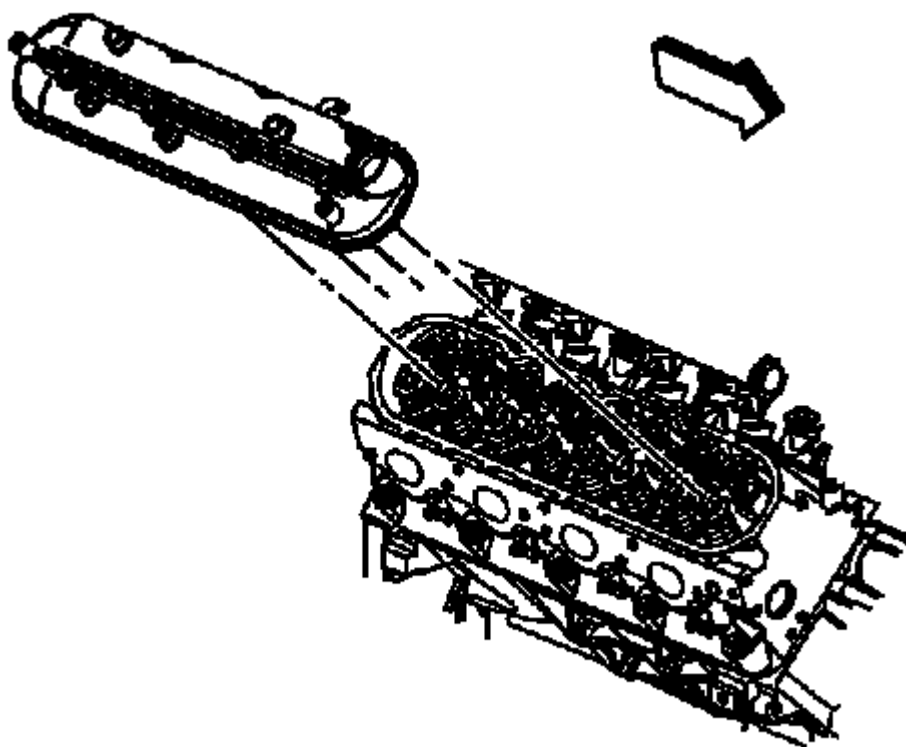


Fig. 92: Valve Rocker Arm Cover (Right)
Courtesy of GENERAL MOTORS CORP.

17. Loosen the valve rocker arm cover bolts.
18. Remove the valve rocker arm cover.

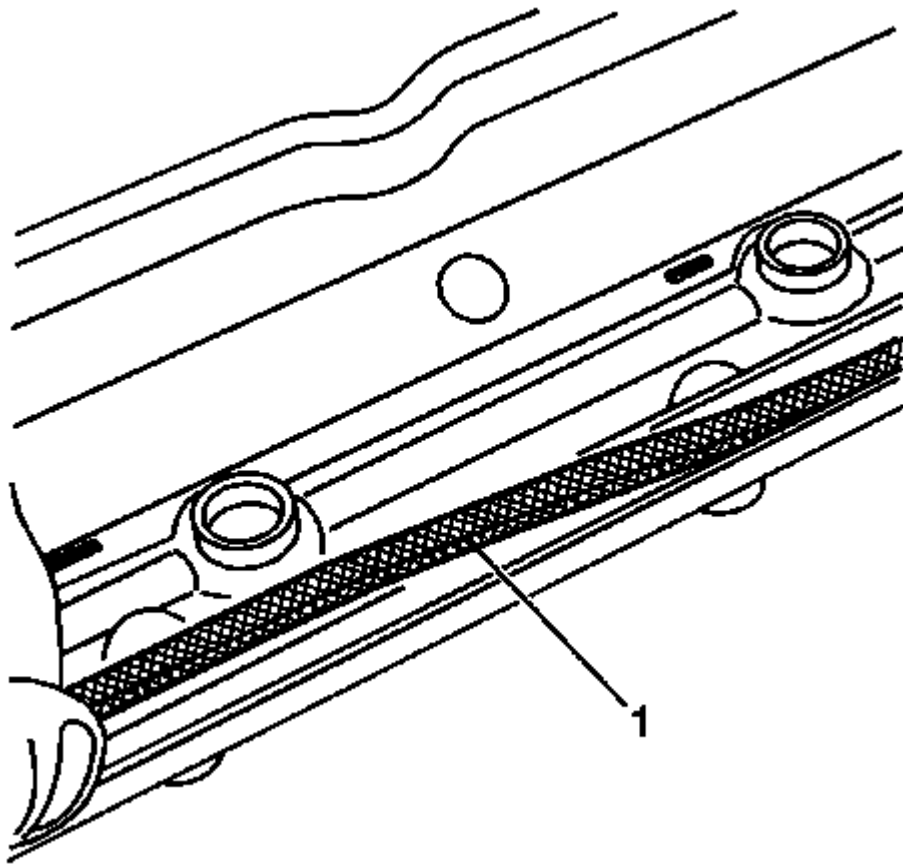


Fig. 93: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

19. Remove and discard the old gasket (1).

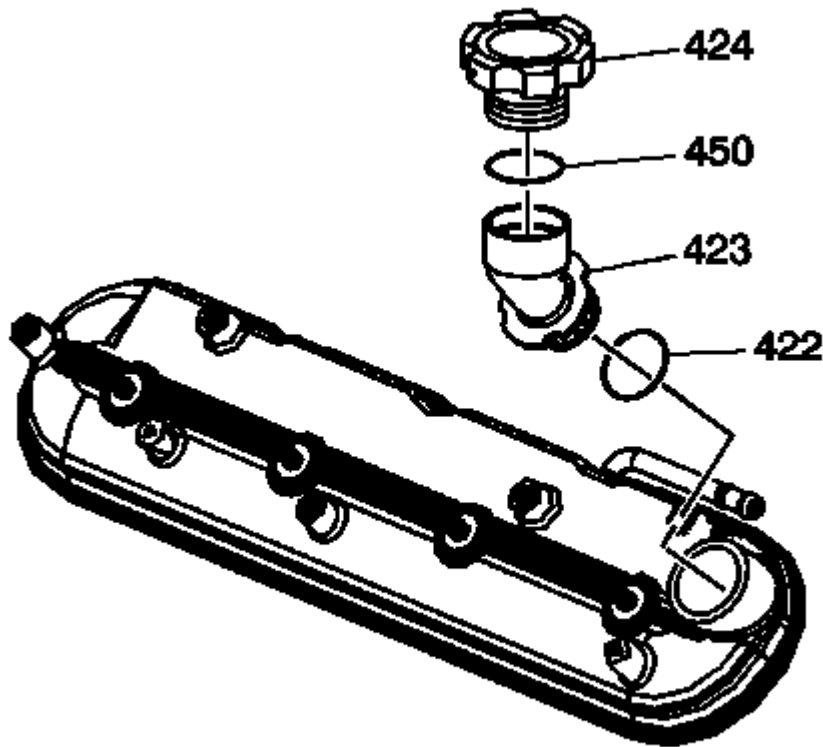


Fig. 94: Oil Fill Cap And Oil Fill Tube
Courtesy of GENERAL MOTORS CORP.

20. Remove the oil fill cap (424) from the oil fill tube (423), if necessary.
21. Remove and discard the oil fill tube, if necessary.

Installation Procedure

NOTE:

- All gasket surfaces should be free of oil or other foreign material during assembly.
- DO NOT reuse the valve rocker arm cover gasket.
- If the oil fill tube has been removed from the rocker arm cover, install a NEW fill tube during assembly.

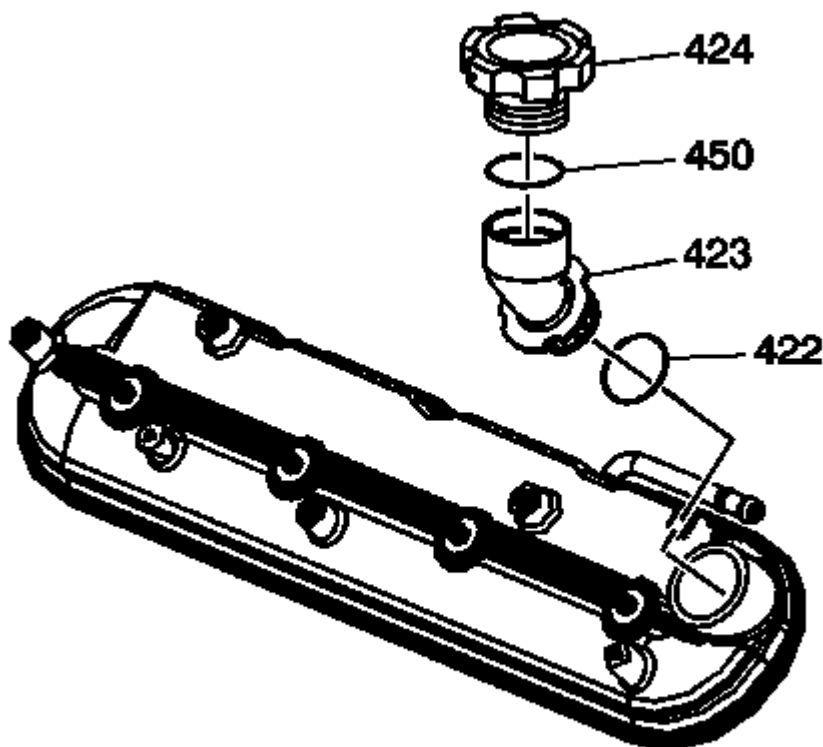


Fig. 95: Oil Fill Cap And Oil Fill Tube
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the O-ring seal (422) of the NEW oil fill tube with clean engine oil.
2. Insert the NEW oil fill tube (423) into the rocker arm cover.

Rotate the tube clockwise until locked in the proper position.

3. Install the oil fill cap (424) into the tube.

Rotate the cap clockwise until locked in the proper position.

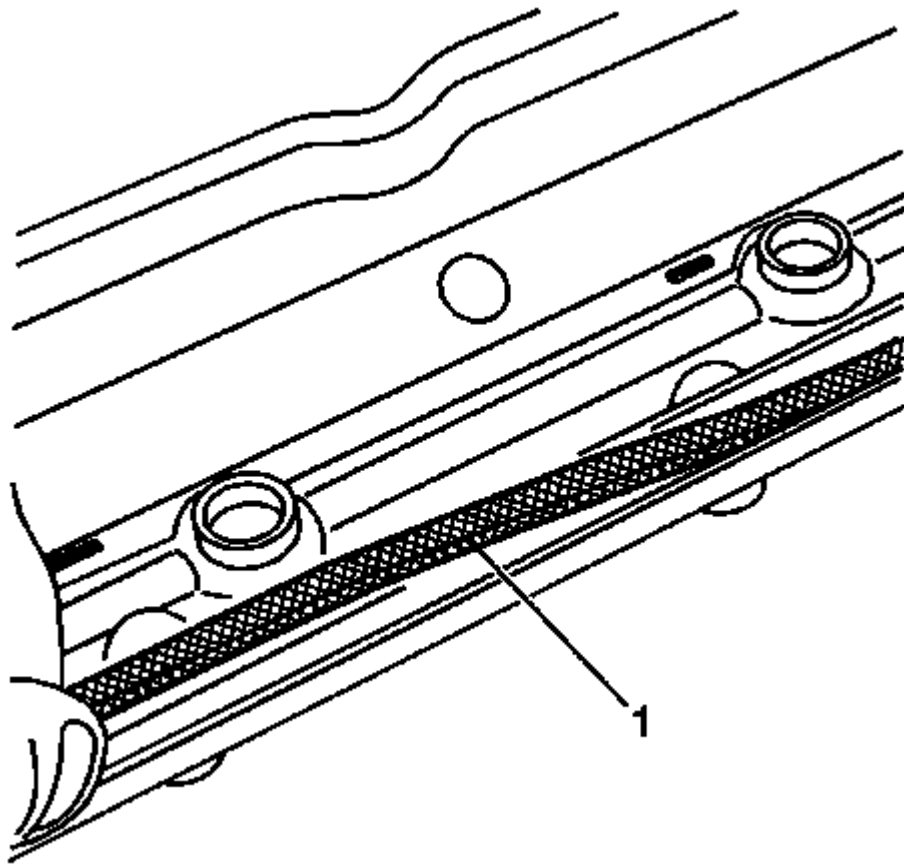


Fig. 96: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

4. Install a NEW rocker cover gasket (1) into the valve rocker arm cover lip.

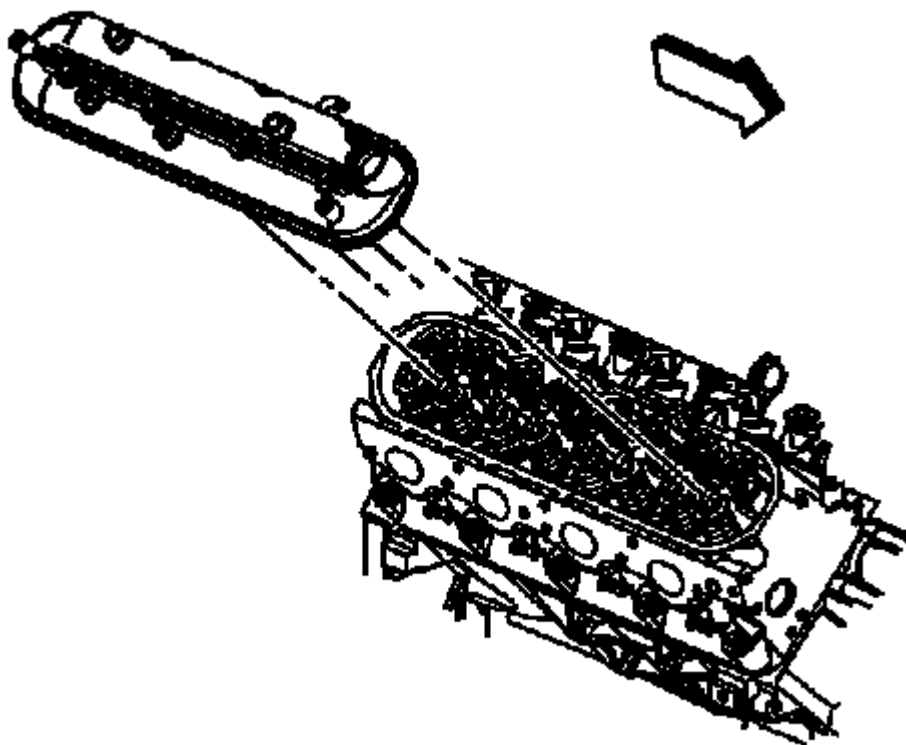


Fig. 97: Valve Rocker Arm Cover (Right)
Courtesy of GENERAL MOTORS CORP.

5. Install the valve rocker arm cover.

CAUTION: Refer to Fastener Caution .

6. Tighten the rocker arm cover bolts.

Tighten

Tighten the bolts to 12 N.m (106 lb in).

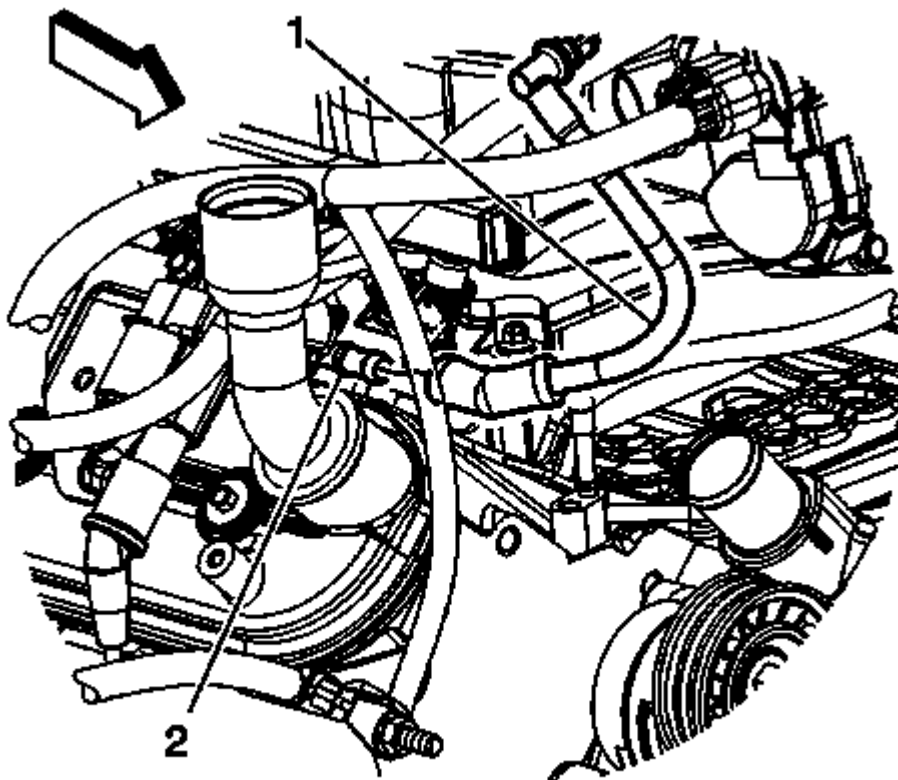


Fig. 98: PCV Tube And Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

7. Install the PCV tube (1) to the valve rocker cover (2).

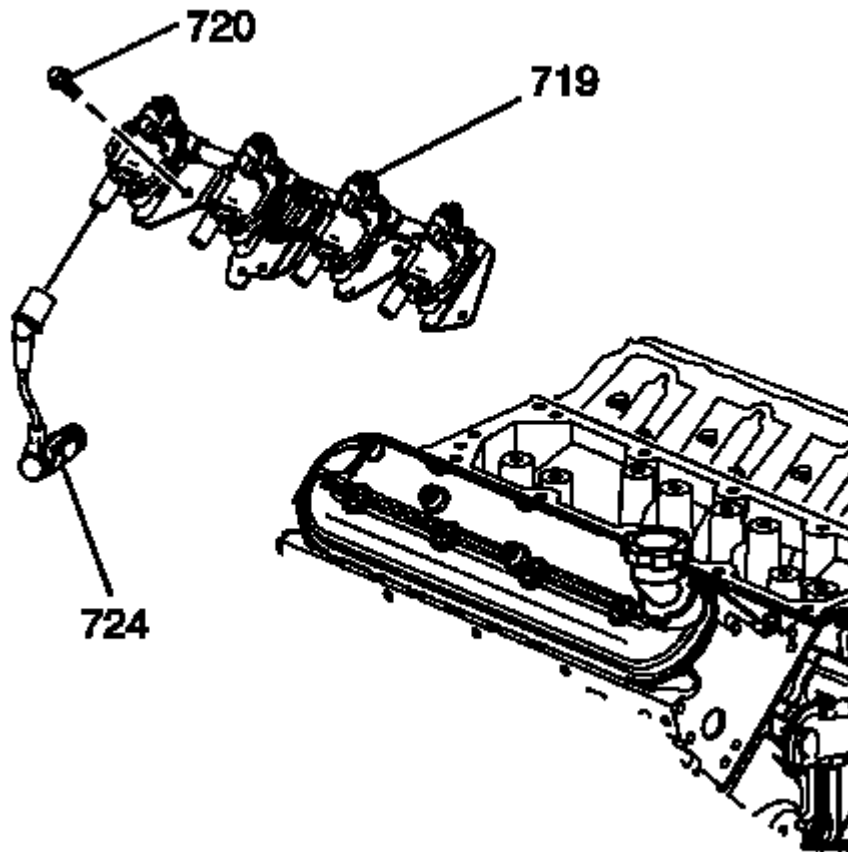


Fig. 99: Ignition Coil And Bracket
Courtesy of GENERAL MOTORS CORP.

8. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent to the threads of the ignition coil bracket studs.
9. Position the ignition coil bracket (719) onto the rocker cover.
10. Install the ignition coil bracket studs (720).

Tighten

Tighten the studs to 12 N.m (106 lb in).

11. Install the spark plug wires (724) to the ignition coils.

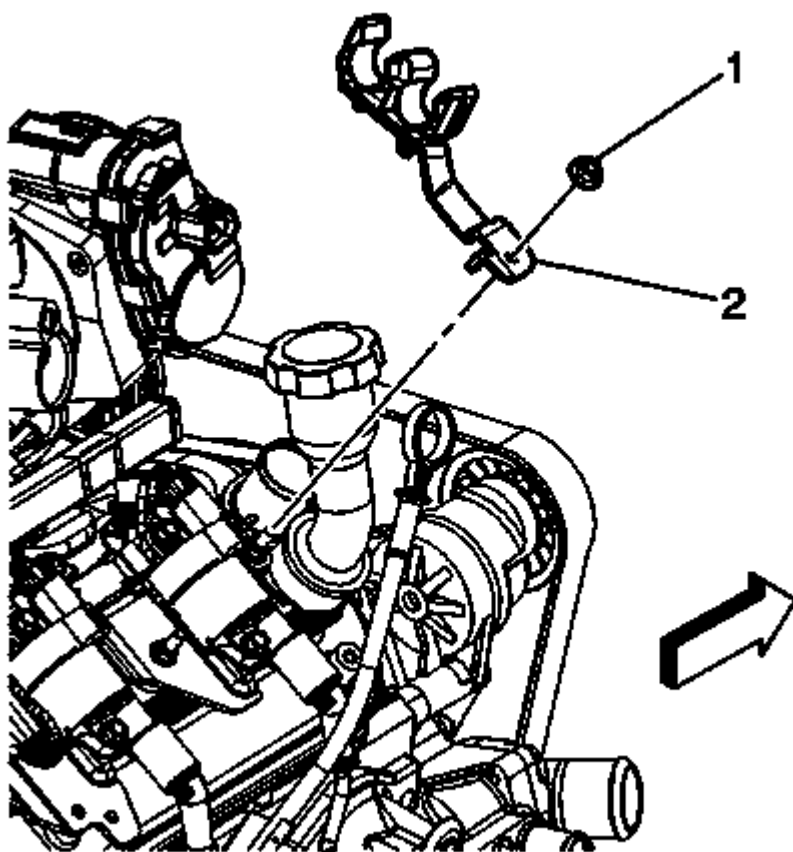


Fig. 100: Heater Hose Bracket And Nut
Courtesy of GENERAL MOTORS CORP.

12. Install the heater hose bracket (2) and nut (1).

Tighten

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

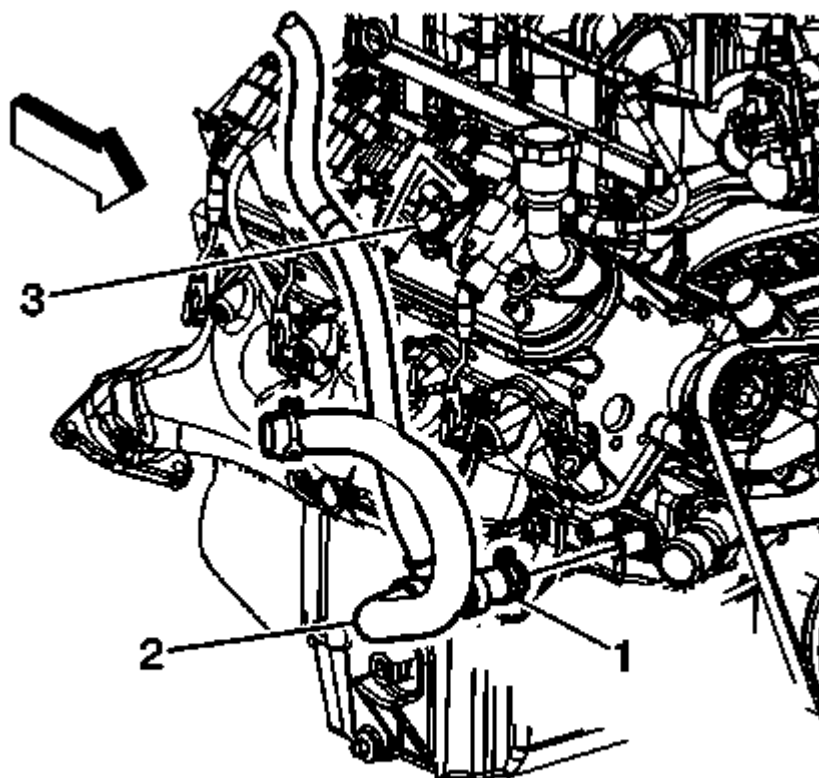


Fig. 101: Heater Outlet Hose And Heater Hose Bracket
Courtesy of GENERAL MOTORS CORP.

13. Install the surge tank outlet hose (2) to the heater hose bracket (3).

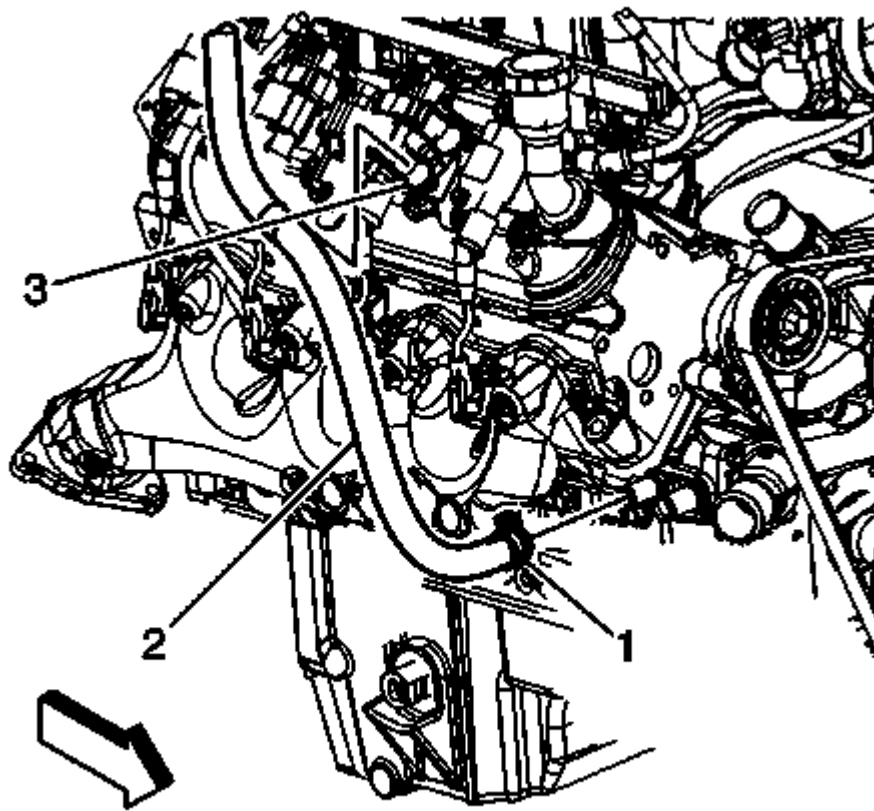


Fig. 102: Heater Inlet Hose And Heater Hose Bracket
Courtesy of GENERAL MOTORS CORP.

14. Install the heater inlet hose (2) to the heater hose bracket (3).

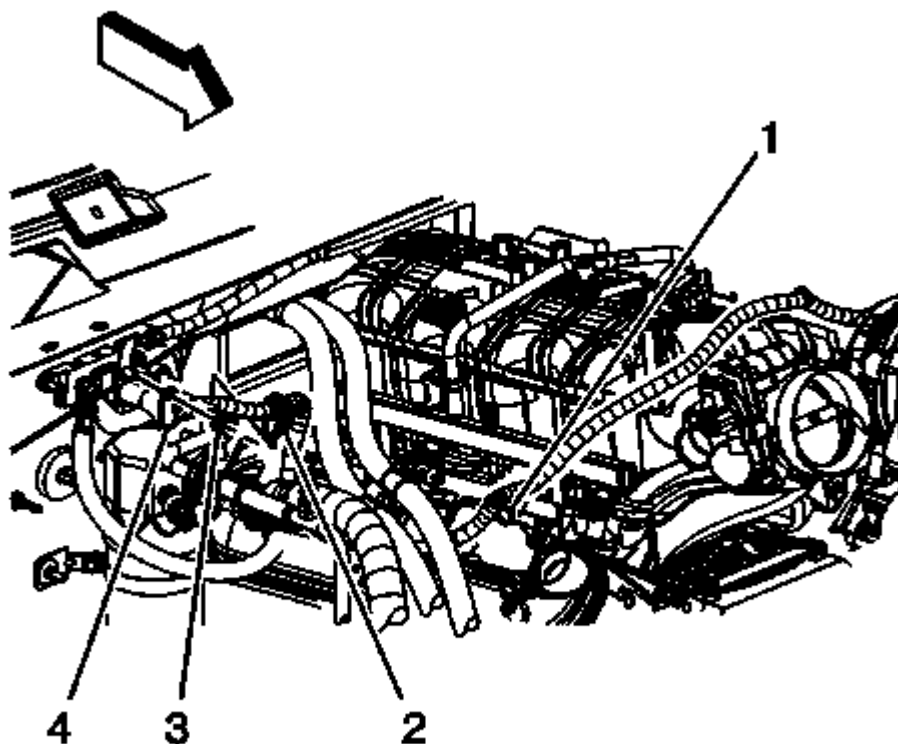


Fig. 103: Generator Battery Jumper Cable
Courtesy of GENERAL MOTORS CORP.

15. Position the generator battery cable as necessary.
16. Install the generator battery cable clip (1) to the ignition coil bracket stud.

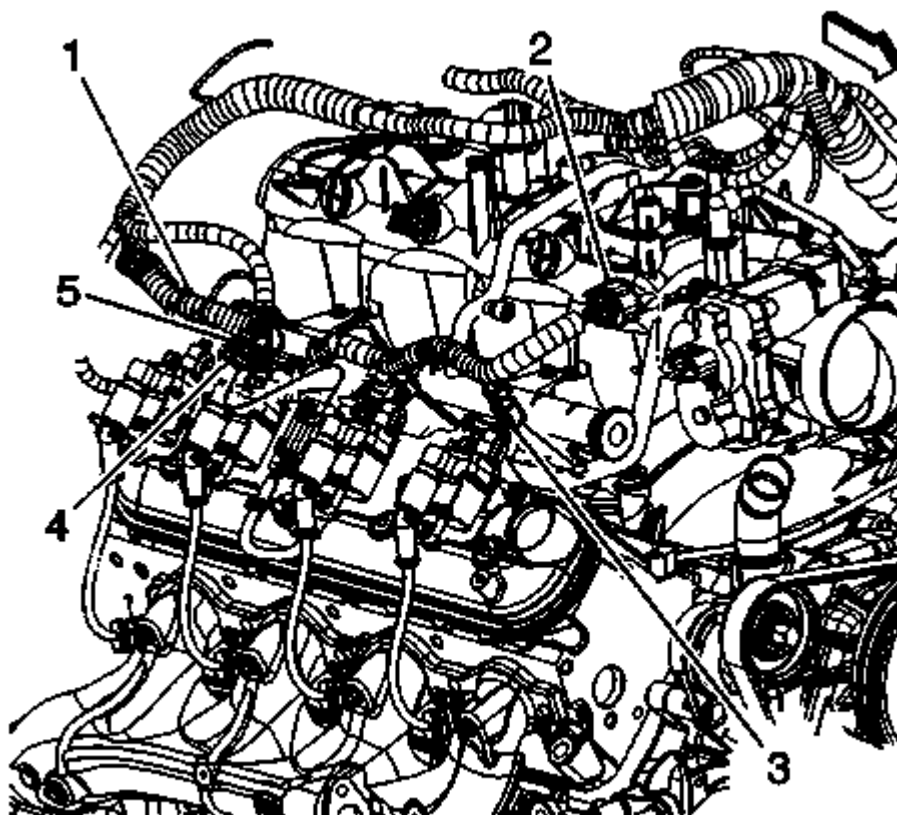


Fig. 104: Right Side Main Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

17. Position the engine wiring harness (electronic throttle control branch) as necessary.
18. Install the engine wiring harness (electronic throttle control branch) clip to the ignition coil bracket stud.
19. Connect the engine harness electrical connector (1) to the ignition coil wire harness.
20. Install the CPA retainer (2).

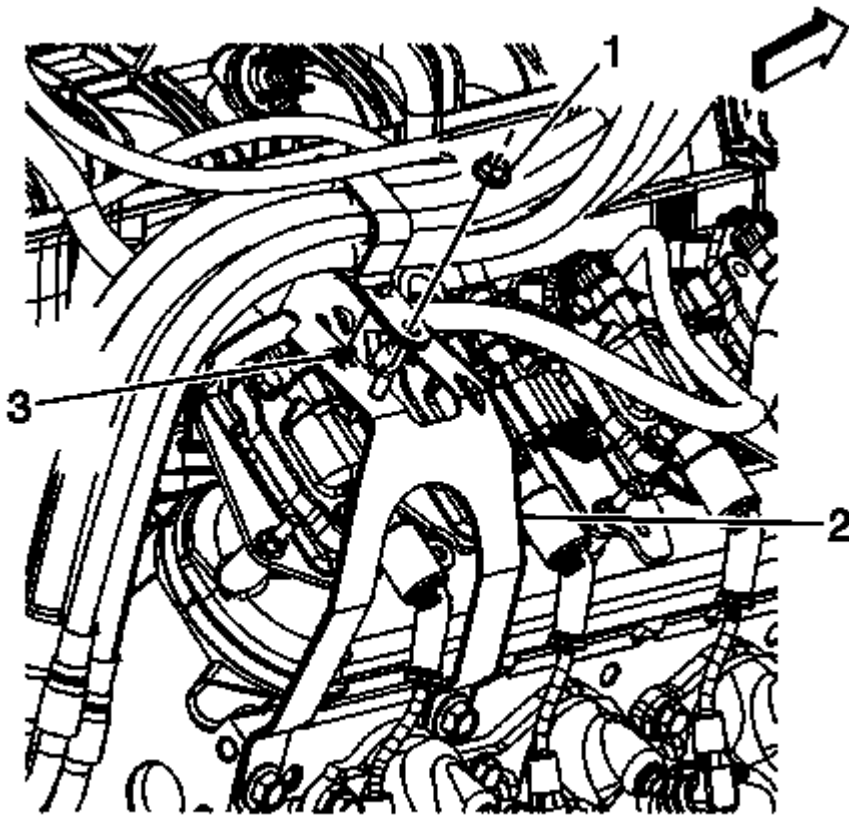


Fig. 105: 3-Phase Cable Clip Nut And Engine Bracket
Courtesy of GENERAL MOTORS CORP.

21. Position the generator control module 3 phase cables to the bracket channel.
22. Install the generator control module 3 phase cable clip to the tab (3) on the engine bracket (2).
23. Install the generator control module 3 phase cable clip nut (1).

Tighten

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

24. Enable the high voltage system. Refer to **High Voltage Enabling** .
25. Install the intake manifold cover. Refer to **Upper Intake Manifold Sight Shield Replacement** .

VALVE ROCKER ARM AND PUSH ROD REPLACEMENT

Removal Procedure

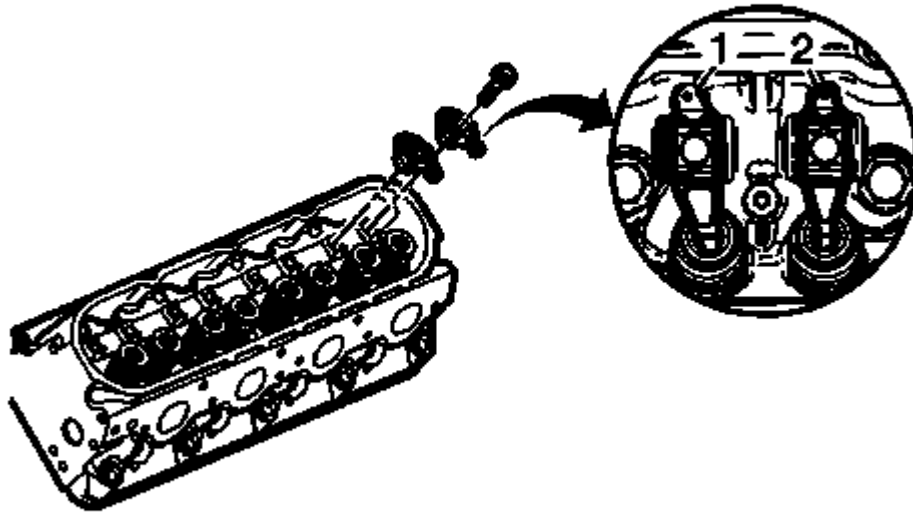


Fig. 106: Rocker Arms And Bolts

Courtesy of GENERAL MOTORS CORP.

1. Remove the rocker arm cover. Refer to Valve Rocker Arm Cover Replacement - Left Side, or Valve Rocker Arm Cover Replacement - Right Side.

NOTE: The engine firing order is 1, 8, 7, 2, 6, 5, 4, 3. Cylinders 1, 3, 5 and 7 are the left bank.

2. Remove the number one cylinder spark plug. Refer to Spark Plug Replacement.

NOTE: Place the rocker arms, pushrods, and pivot support, in a rack so that they can be installed in the same location from which they were removed.

3. Remove the rocker arm bolts.
4. Remove the rocker arms (1, 2).

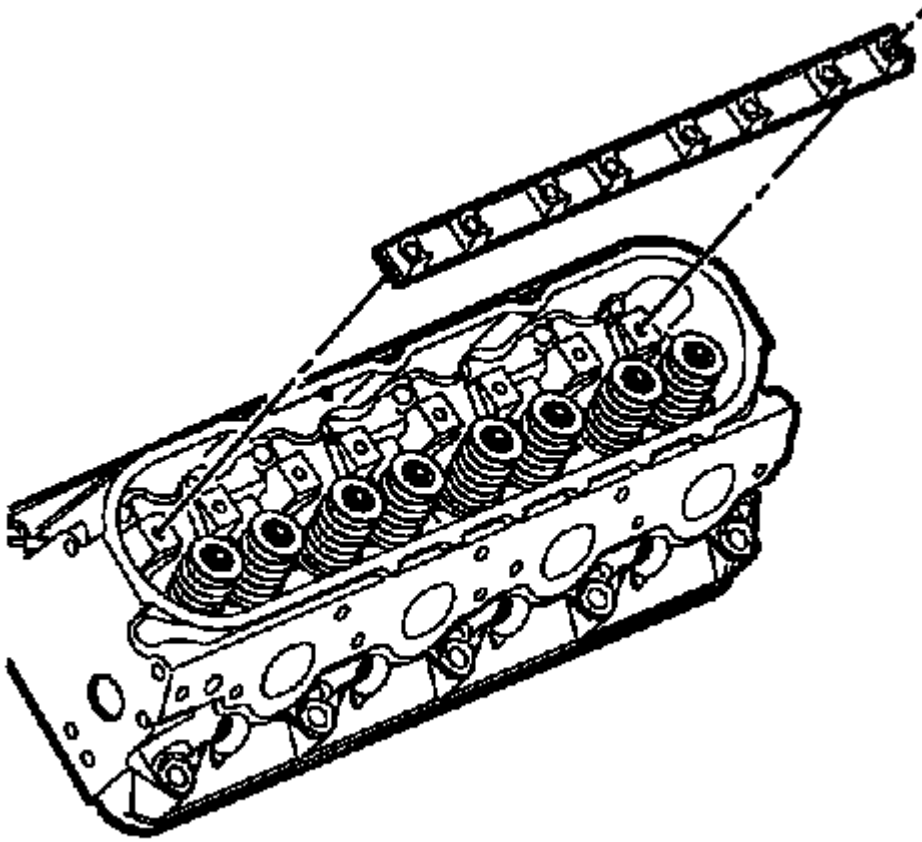


Fig. 107: Rocker Arm Pivot Support
Courtesy of GENERAL MOTORS CORP.

5. Remove the rocker arm pivot support.

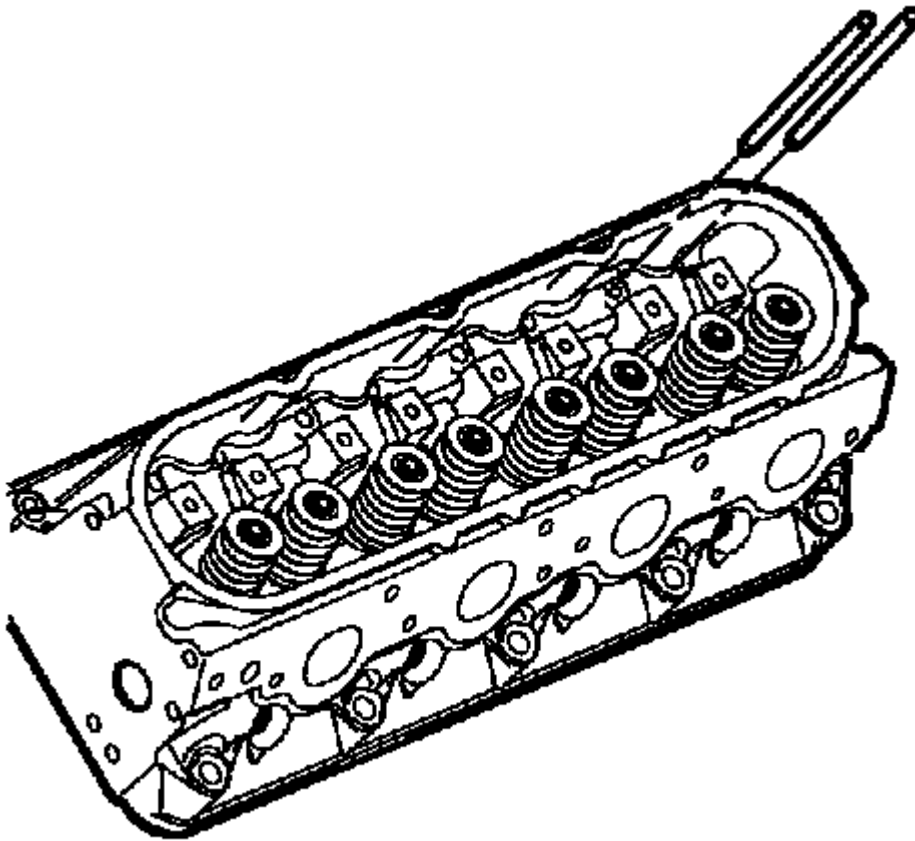


Fig. 108: Pushrods

Courtesy of GENERAL MOTORS CORP.

6. Remove the pushrods.
7. Clean and inspect the rocker arms and pushrods, if required. Refer to **Valve Rocker Arm and Push Rod Cleaning and Inspection** .

Installation Procedure

NOTE: When reusing the valve train components, always install the components to the original location and position.

Valve lash is net build, no valve adjustment is required.

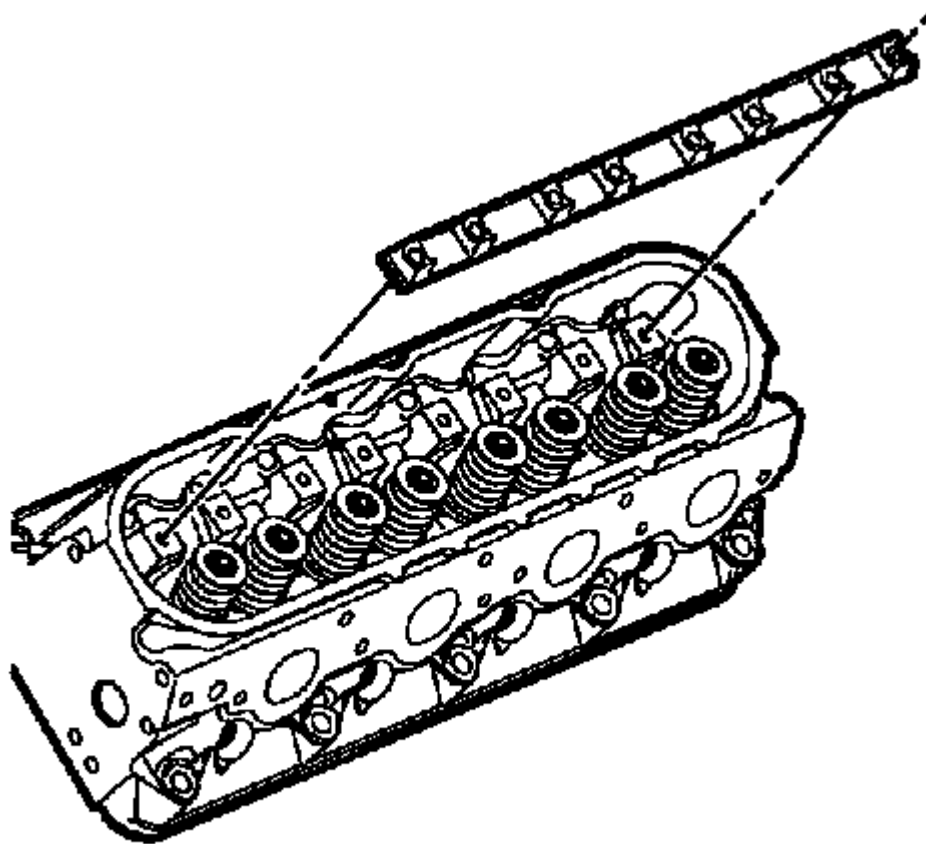


Fig. 109: Rocker Arm Pivot Support
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the rocker arms and pushrods with clean engine oil.
2. Lubricate the flange of the rocker arm bolts with clean engine oil. Lubricate the flange or washer surface of the bolt that will contact the rocker arm.
3. Install the rocker arm pivot support.

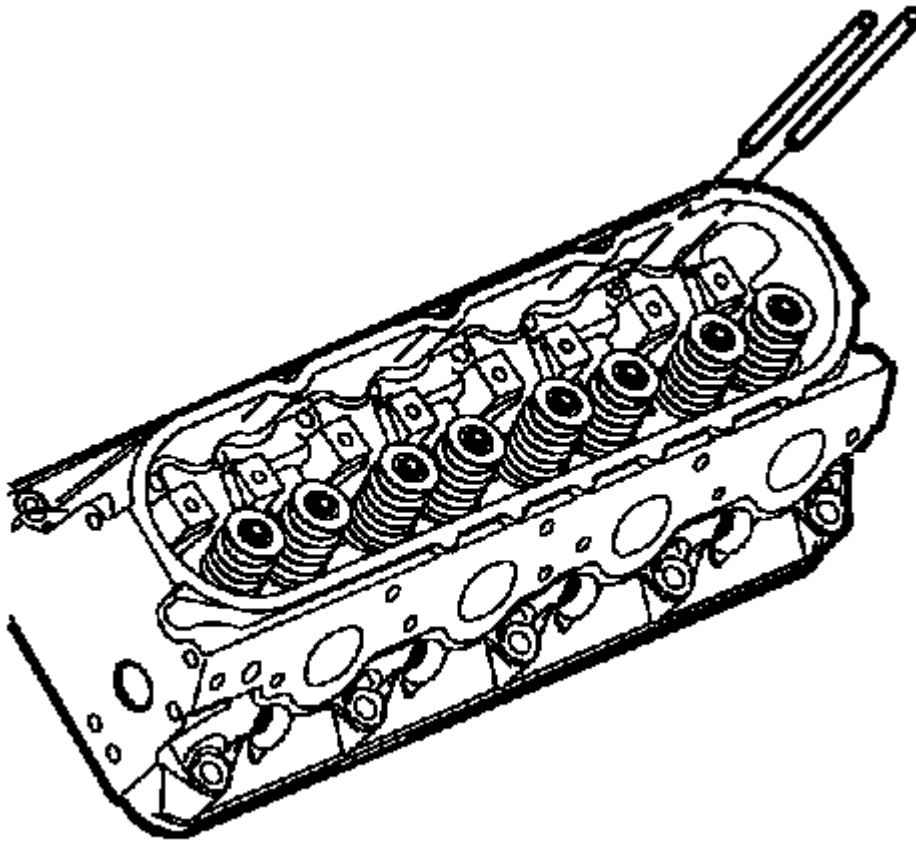


Fig. 110: Pushrods

Courtesy of GENERAL MOTORS CORP.

NOTE: Make sure that the pushrods seat properly to the valve lifter sockets.

4. Install the pushrods.

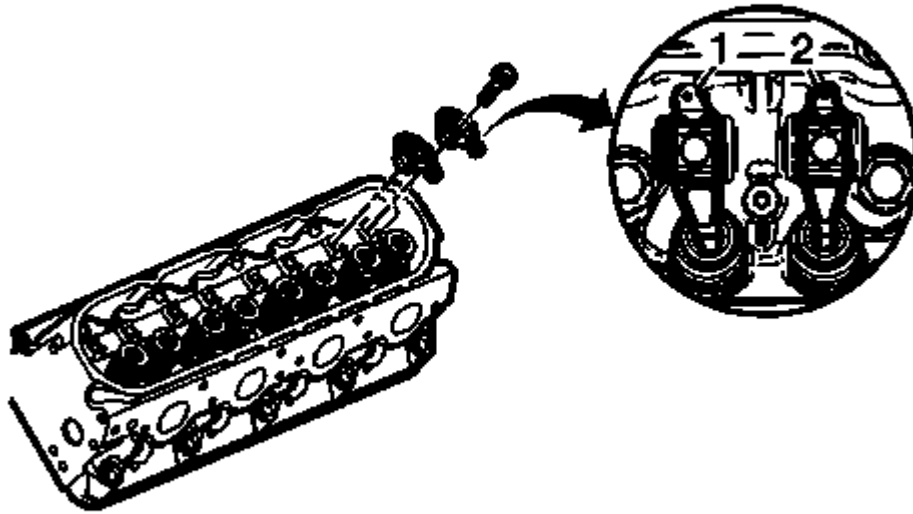


Fig. 111: Rocker Arms And Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Make sure that the pushrods seat properly to the ends of the rocker arms (1, 2). DO NOT tighten the rocker arm bolts at this time.

5. Install the rocker arms and bolts.

NOTE: The engine firing order is 1, 8, 7, 2, 6, 5, 4, 3. Cylinders 1, 3, 5 and 7 are the left bank. Cylinders 2, 4, 6 and 8 are the right bank.

6. Rotate the crankshaft clockwise until the number one piston is at top dead center (TDC) of the compression stroke. In this position, the number one cylinder rocker arms will be off lobe lift.

CAUTION: Refer to Fastener Caution .

7. With the engine in the number one firing position, tighten the following rocker arm bolts:

Tighten

2011 GMC Yukon Hybrid

2011 ENGINE Engine Mechanical - Hybrid (HP2) 6.0L (LZ1) - Repair Instructions - On Vehicle - Escalade, Tahoe & Yukon

- Tighten cylinders 1, 2, 7 and 8 exhaust valve rocker arm bolts to 30 N.m (22 lb ft).
 - Tighten cylinders 1, 3, 4 and 5 intake valve rocker arm bolts to 30 N.m (22 lb ft).
8. Rotate the crankshaft clockwise 360 degrees.
 9. Tighten the following rocker arm bolts:

Tighten

- Tighten cylinders 3, 4, 5 and 6 exhaust valve rocker arm bolts to 30 N.m (22 lb ft).
 - Tighten cylinders 2, 6, 7 and 8 intake valve rocker arm bolts to 30 N.m (22 lb ft).
10. Install the number one cylinder spark plug. Refer to **Spark Plug Replacement**.
 11. Install the rocker arm cover. Refer to **Valve Rocker Arm Cover Replacement - Left Side**, or **Valve Rocker Arm Cover Replacement - Right Side**.

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT

Special Tools

- **J 22794** Spark Plug Port Adapter
- **J 38606** Valve Spring Compressor

Removal Procedure

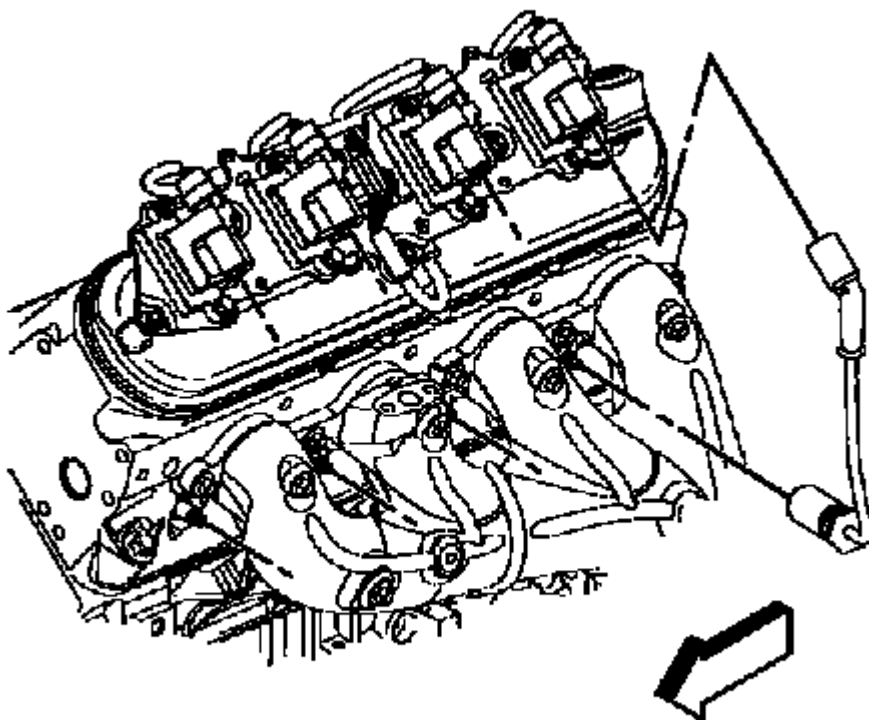


Fig. 112: Spark Plug Wire And Boot
Courtesy of GENERAL MOTORS CORP.

1. Remove the rocker arm. Refer to **Valve Rocker Arm and Push Rod Replacement**.
2. Disconnect the spark plug wire at the spark plug.
 - Twist each plug wire boot 1/2 turn.
 - Pull only on the boot in order to remove the wire from the spark plug.

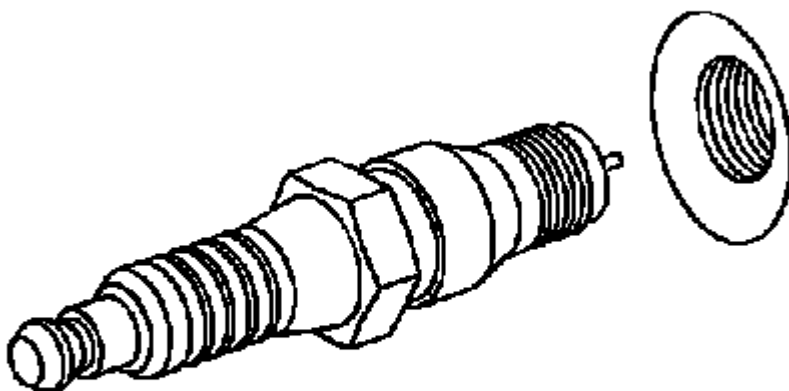


Fig. 113: Spark Plug And Spark Plug Seat
Courtesy of GENERAL MOTORS CORP.

NOTE: Remove the spark plugs from the cylinder head with the engine at room temperature.

3. Loosen the spark plug 1 or 2 turns.
4. Brush or air blast away any dirt or debris from around the spark plug.
5. Remove the spark plug.

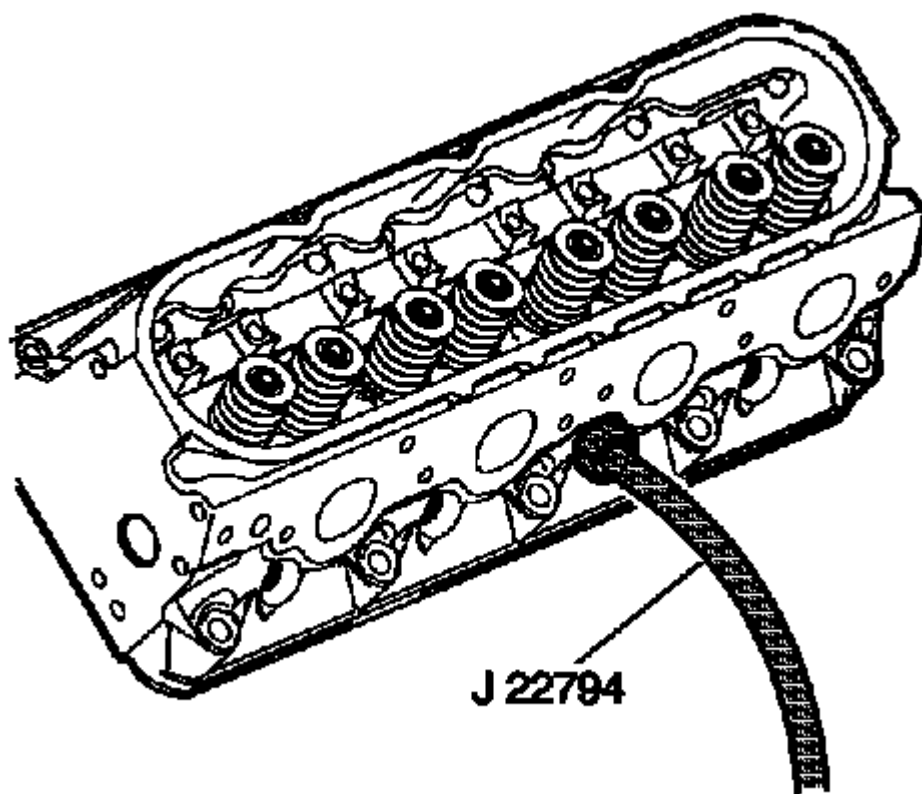


Fig. 114: Spark Plug Port Adapter
Courtesy of GENERAL MOTORS CORP.

6. Install the **J 22794** into the spark plug hole.
7. Attach an air hose to the **J 22794**.
8. Apply compressed air to the **J 22794** in order to hold the valves in place.

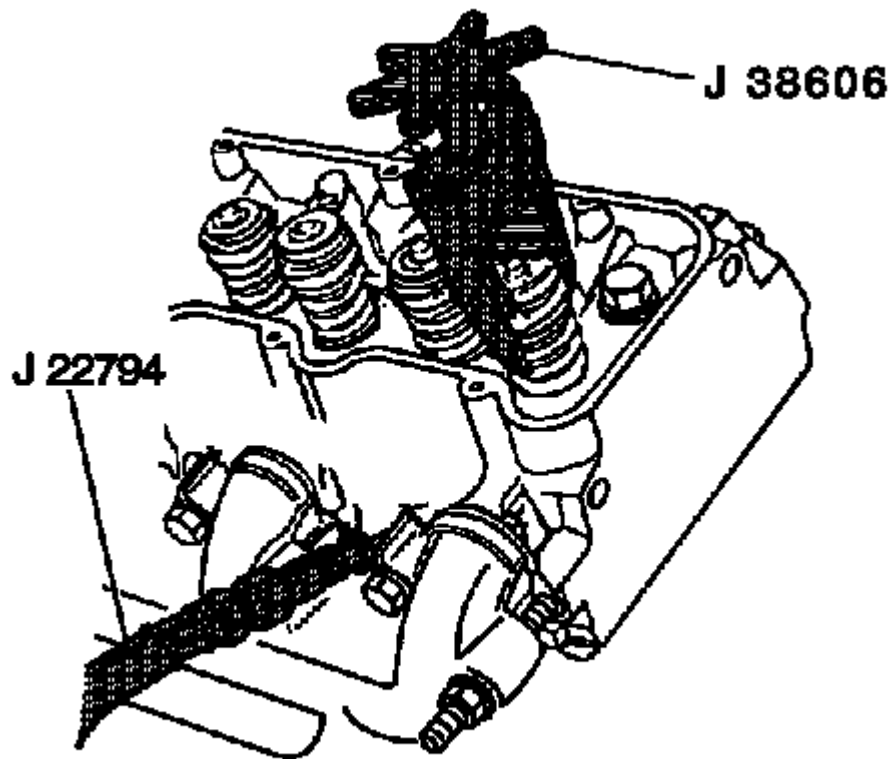


Fig. 115: Compressing Valve Spring
Courtesy of GENERAL MOTORS CORP.

9. Use the **J 38606** in order to compress the valve spring.

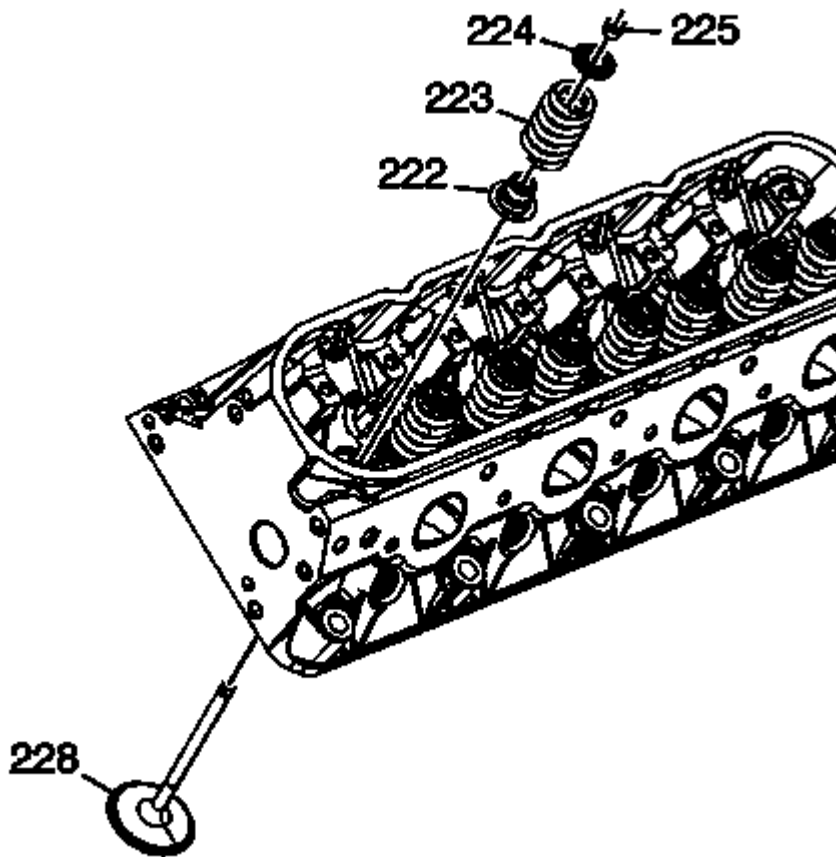


Fig. 116: Valve, Stem Keys, Valve Spring Cap And Valve Spring
Courtesy of GENERAL MOTORS CORP.

10. Remove the valve stem keys (225).
11. Carefully release the valve spring tension.
12. Remove the **J 38606** .
13. Remove the valve spring cap (224).
14. Remove the valve spring (223).
15. Remove the valve stem oil seal (222).
16. Remove the valve (228).

Installation Procedure

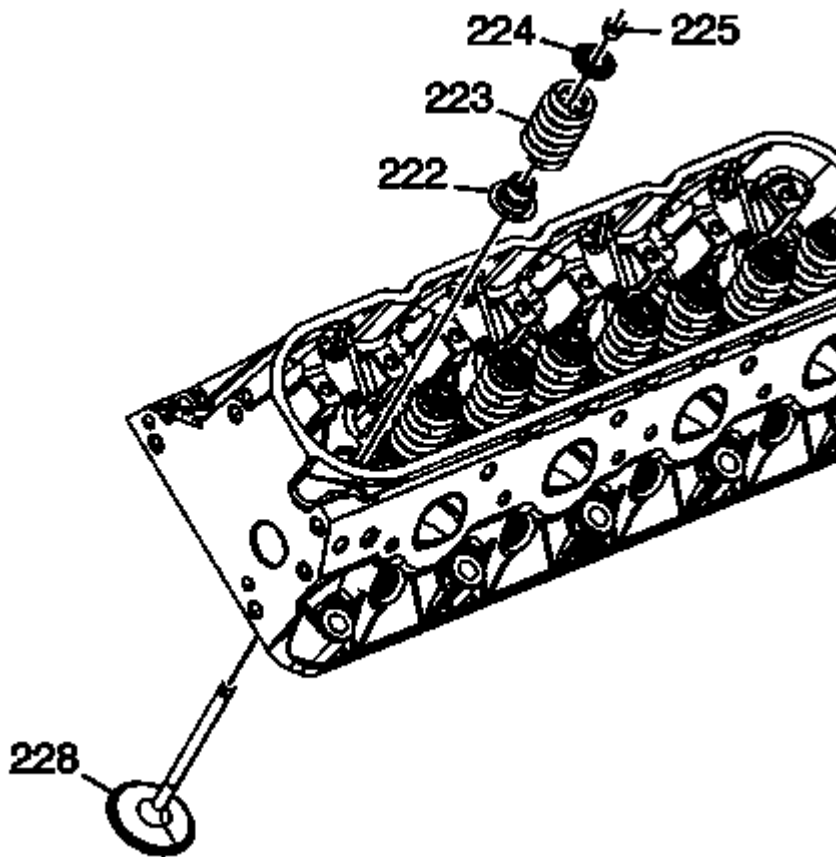


Fig. 117: Valve, Stem Keys, Valve Spring Cap And Valve Spring
Courtesy of GENERAL MOTORS CORP.

1. Clean the cylinder head valve spring seat area.
2. Lubricate the valve guide and valve stem oil seal with clean engine oil.
3. Install the valves (228) into the proper port.
4. Install the valve stem oil seal (222).
5. Install the valve spring (223).
6. Install the valve spring cap (224).

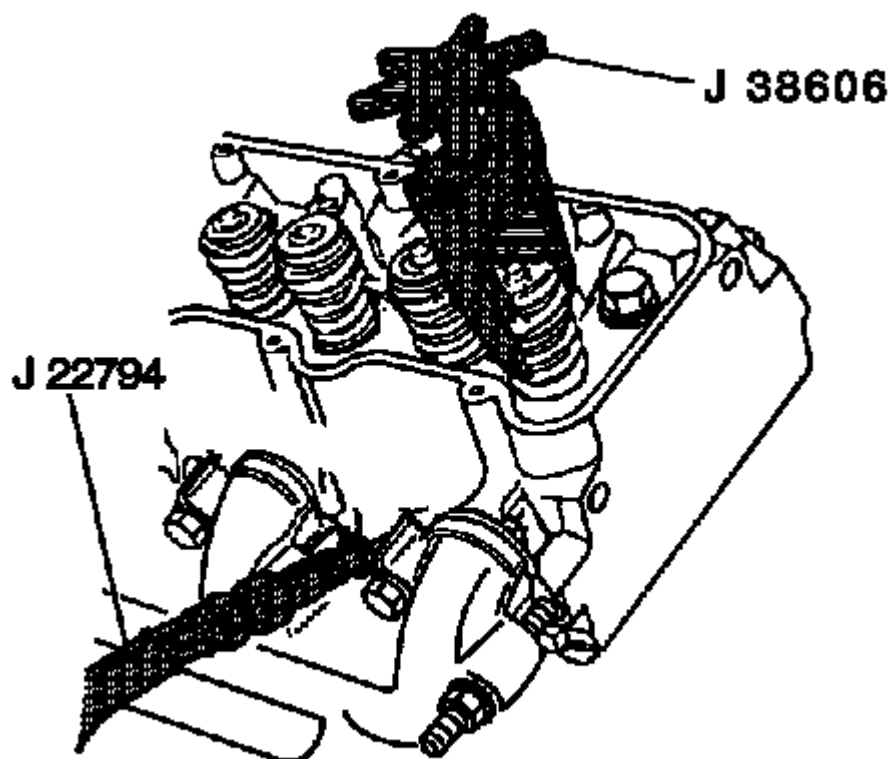


Fig. 118: Compressing Valve Spring
Courtesy of GENERAL MOTORS CORP.

7. Compress the valve spring using the **J 38606**.
8. Install the valve keys.
 - Use grease in order to hold the valve keys in place.
 - Make sure the keys seat properly in the groove of the valve stem.
 - Carefully release the valve spring pressure, making sure the valve keys stay in place.
 - Remove the **J 38606**.
 - Tap the end of the valve stem with a plastic faced hammer to seat the keys, if necessary.

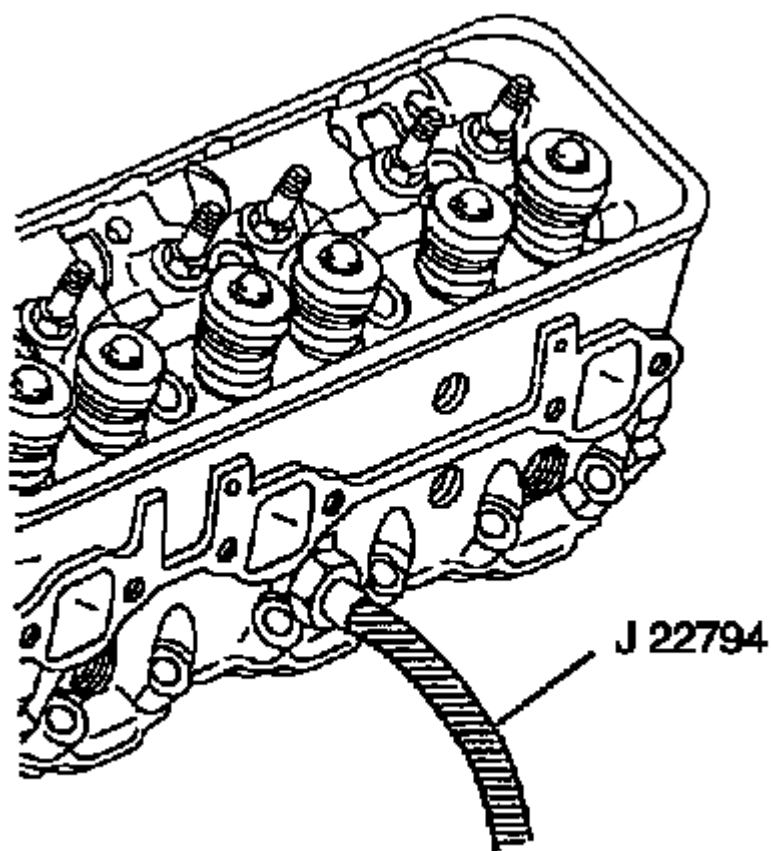


Fig. 119: Spark Plug Port Adapter
Courtesy of GENERAL MOTORS CORP.

9. Remove the **J 22794** from the spark plug port.

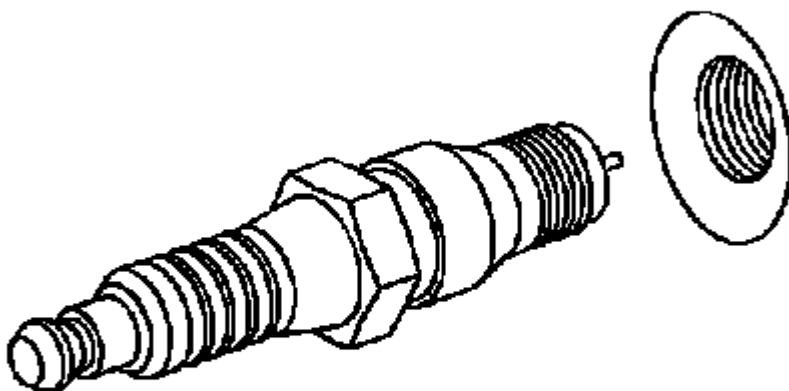


Fig. 120: Spark Plug And Spark Plug Seat
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

10. Hand start the spark plug.

Tighten

Tighten the spark plug to 15 N.m (11 lb ft).

11. Install the spark plug wires at the ignition coil.
12. Install the spark plug wire to the spark plug.
13. Inspect the wires for proper installation:
 - Push sideways on each boot in order to check for proper installation.
 - Reinstall any loose boot.
14. Install the rocker arm. Refer to Valve Rocker Arm and Push Rod Replacement.

OIL LEVEL INDICATOR TUBE REPLACEMENT

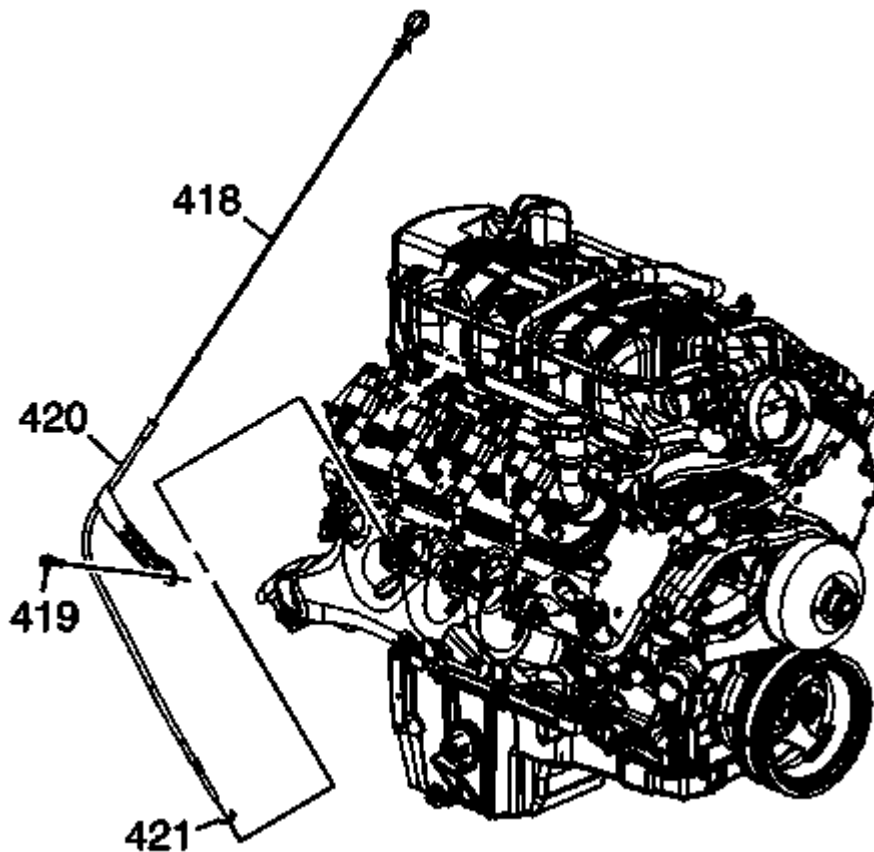
Removal Procedure

Fig. 121: Oil Level Indicator, Tube Bolt, Indicator Tube And O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil level indicator (418).
2. Remove the wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side** .
3. Remove the oil level indicator tube bolt (419).
4. Remove the oil level indicator tube (420) from the engine block.

NOTE: **The O-ring seal may be reused if not cut or damaged.**

5. Inspect the O-ring seal for cuts or damage.
6. Remove the O-ring seal (421) from the tube, if required.

Installation Procedure

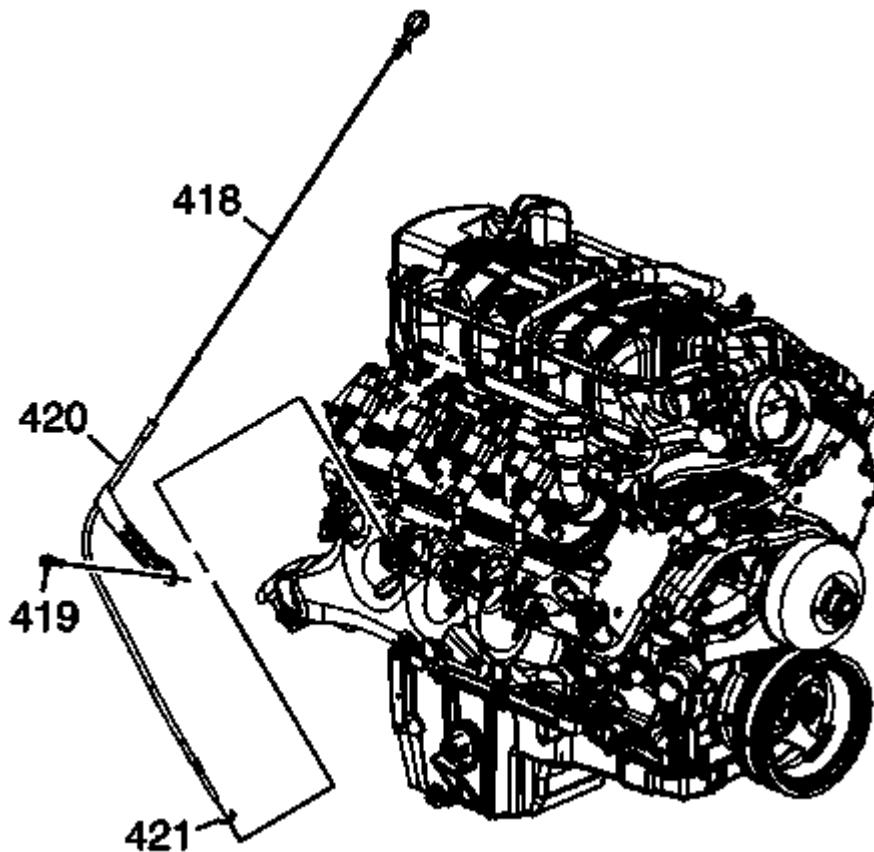


Fig. 122: Oil Level Indicator, Tube Bolt, Indicator Tube And O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the O-ring seal (421) with clean engine oil.
2. Install a NEW O-ring seal onto the oil level indicator tube, if required.
3. Install the oil level indicator tube (420) between the exhaust manifold and engine block.
4. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
5. Insert the oil level indicator tube into the block. The tube must be installed with the collar flush to the block.
6. Lower the vehicle.

CAUTION: Refer to **Fastener Caution** .

7. Install the oil level indicator tube bolt (419).

Tighten

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

8. Install the wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side** .
9. Install the oil level indicator (418).

CYLINDER HEAD REPLACEMENT - LEFT SIDE

Special Tools

- **J 42385-200** Common Thread Repair Kit
- **J 45059** Angle Meter

Removal Procedure

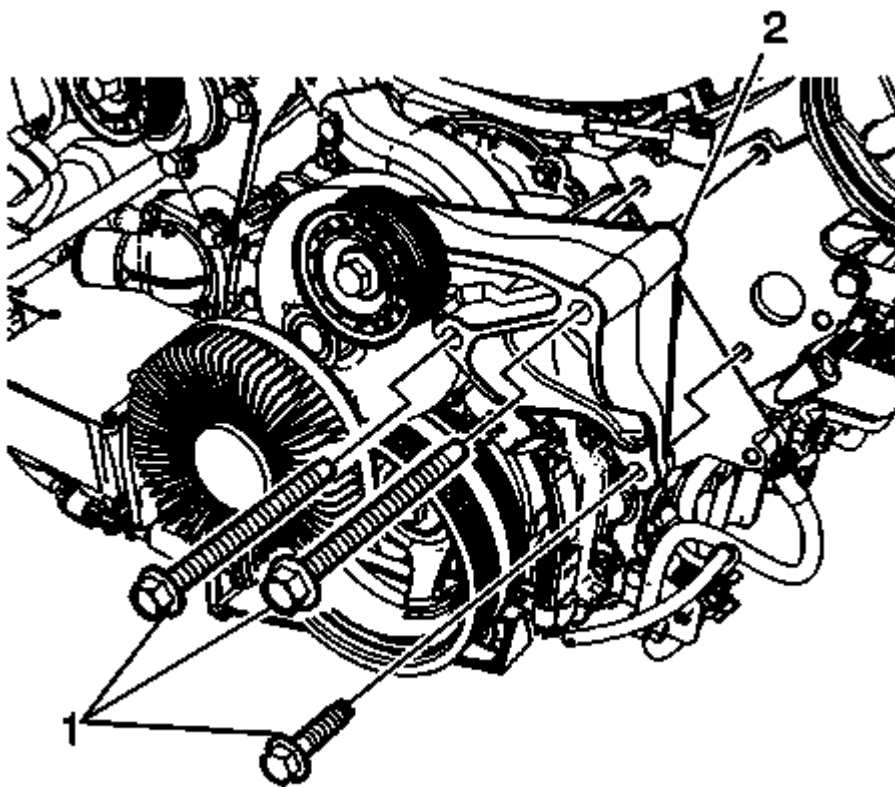


Fig. 123: Drive Belt Idler Pulley Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the drive belt idler pulley bracket bolts (1).
3. Remove the drive belt idler pulley bracket (2).

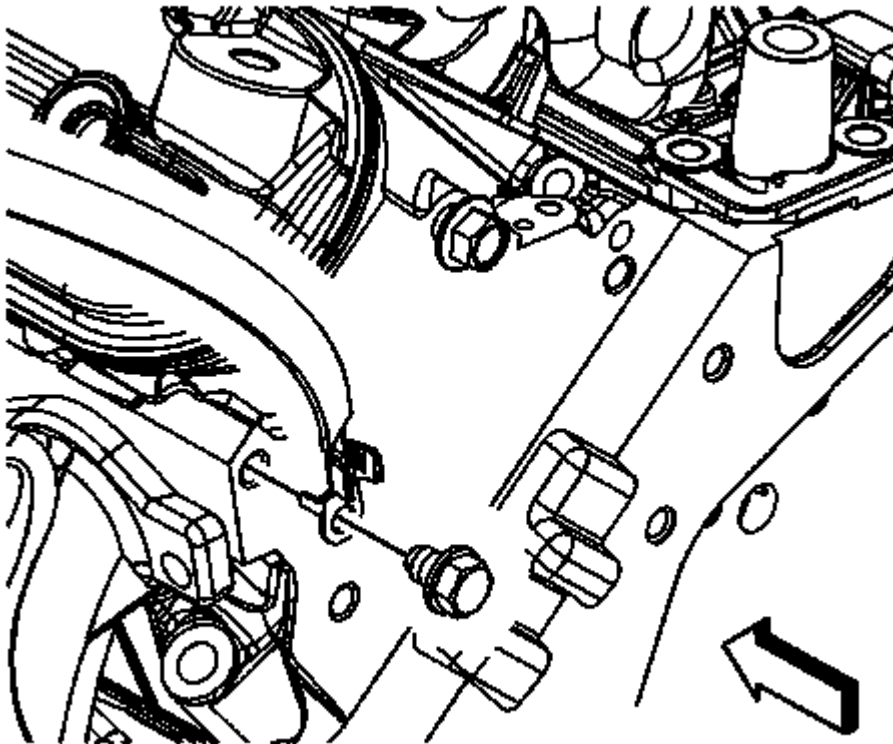


Fig. 124: Engine Ground Strap And Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
5. Remove the coolant air bleed pipe. Refer to **Engine Coolant Air Bleed Pipe Replacement (with AFM)** , **Engine Coolant Air Bleed Pipe Replacement (without AFM)** .
6. Remove the left exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side** .
7. Remove the pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
8. Remove the engine ground strap bolt from the rear of the cylinder head.
9. Remove the ground strap from the cylinder head.

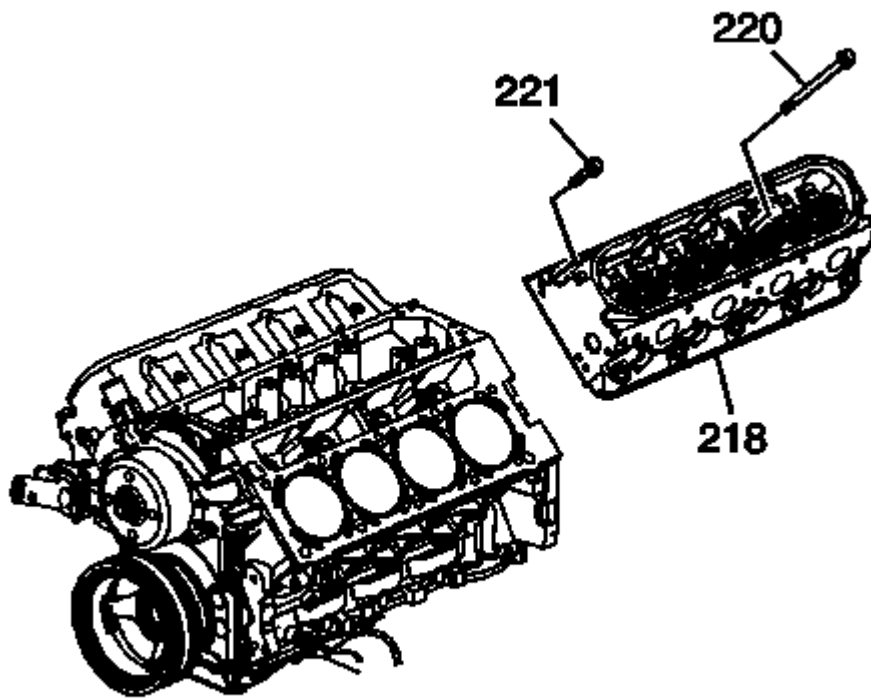


Fig. 125: Cylinder Head And Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: The cylinder head bolts are of a torque-to-yield design and are NOT to be reused.

10. Remove and discard the cylinder head bolts (220, 221).

CAUTION: After removal, place the cylinder head on 2 wood blocks in order to prevent damage to the sealing surfaces.

11. Remove the cylinder head (218).

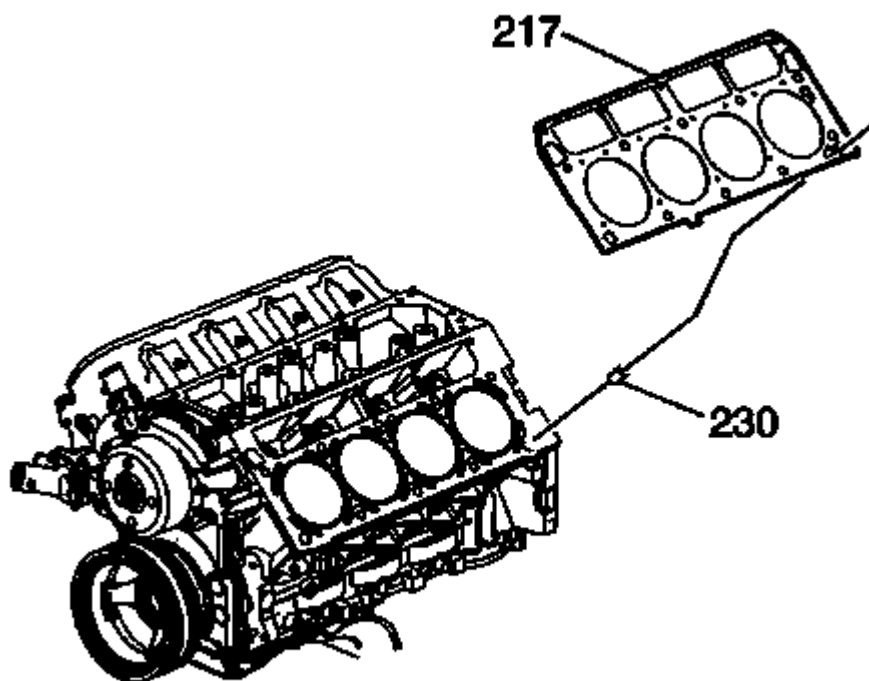


Fig. 126: Cylinder Head Gasket And Locating Pins
Courtesy of GENERAL MOTORS CORP.

12. Remove and discard the cylinder head gasket (217).
13. If required, clean and inspect the cylinder head. Refer to **Cylinder Head Cleaning and Inspection** .

Installation Procedure

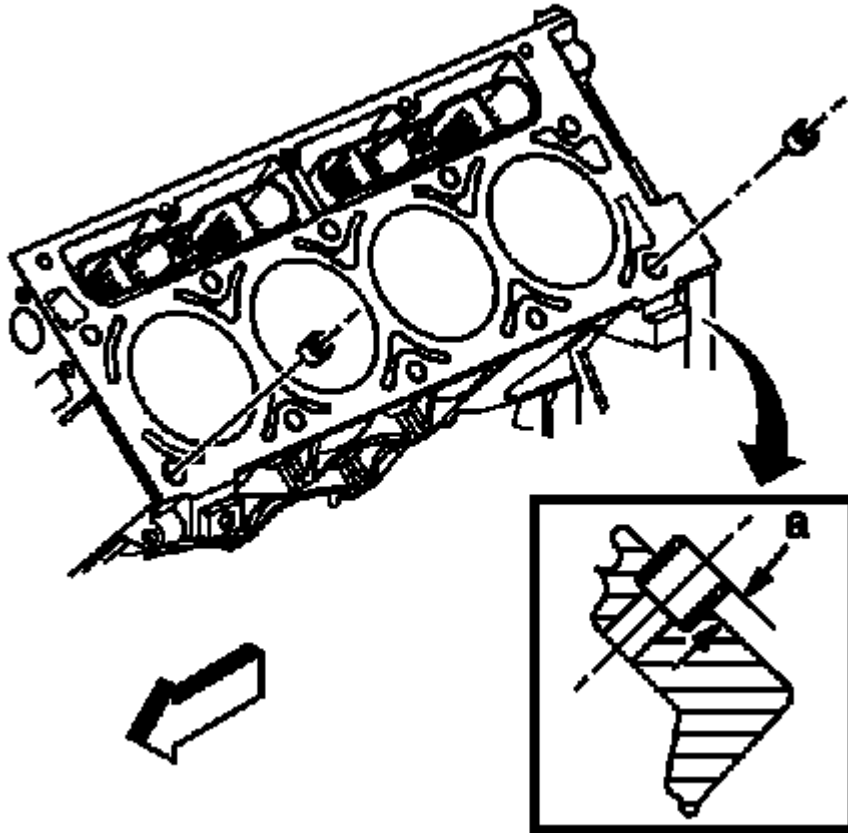


Fig. 127: Checking Cylinder Head Bolt Holes
Courtesy of GENERAL MOTORS CORP.

WARNING: Wear safety glasses in order to avoid eye damage.

CAUTION: Clean all dirt, debris, and coolant from the engine block cylinder head bolt holes. Failure to remove all foreign material may result in damaged threads, improperly tightened fasteners or damage to components.

NOTE: If installing a new cylinder head it is necessary to install a new engine coolant air bleed plug into the rear coolant passage of the cylinder head. Refer to Cylinder Head Assemble .

NOTE:

- Do not reuse the cylinder head bolts. Install NEW cylinder head bolts during assembly.
- Do not use any type of sealant on the cylinder head gasket (unless specified).

1. Clean the engine block cylinder head bolt holes, if required. Thread repair tool J 42385-107, found in **J 42385-200** may be used to clean the threads of old threadlocking material.
2. Spray cleaner GM P/N 12346139, P/N 12377981 (Canadian P/N 10953463), or equivalent into the hole.
3. Clean the cylinder head bolt holes with compressed air.
4. Check the cylinder head locating pins for proper installation (a) 8.3 mm (0.327 in).

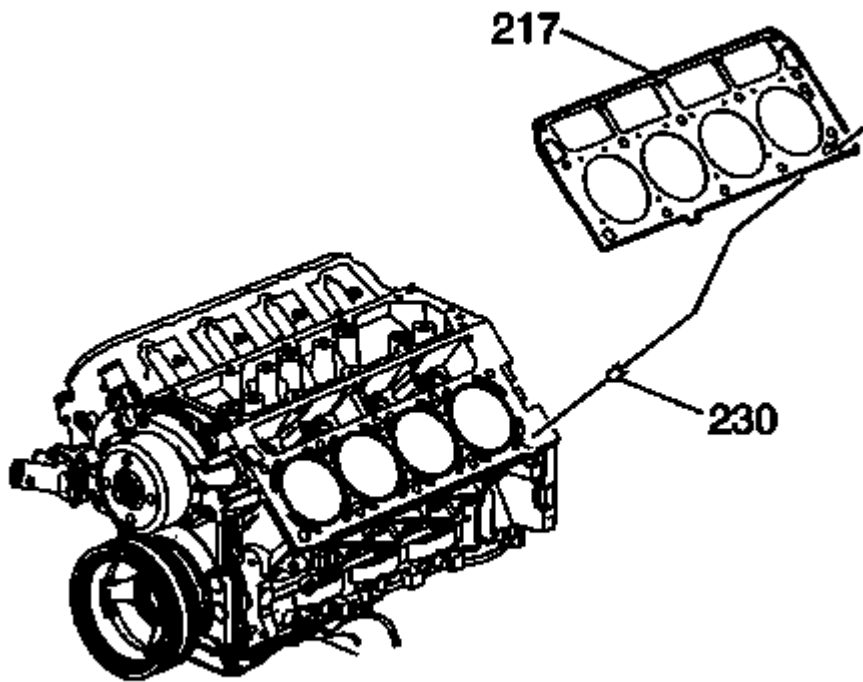


Fig. 128: Cylinder Head Gasket And Locating Pins
Courtesy of GENERAL MOTORS CORP.

NOTE: When properly installed, with **FRONT** on the left side, the tab on the cylinder head gasket should be located left of center.

5. Install the NEW cylinder head gasket (217) onto the locating pins.

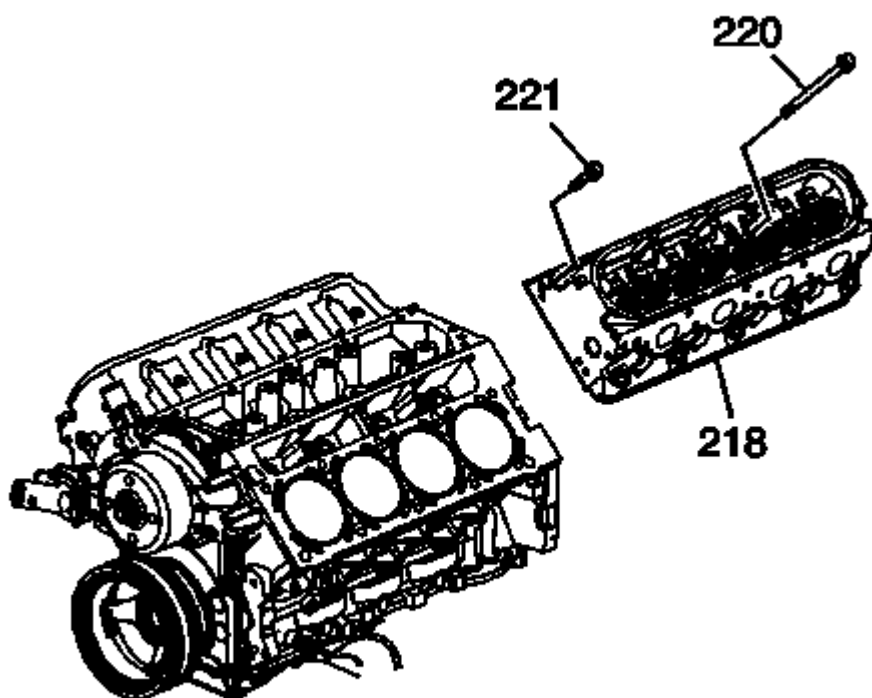


Fig. 129: Cylinder Head And Bolts

Courtesy of GENERAL MOTORS CORP.

6. Install the cylinder head (218) onto the locating pins.
7. Install the NEW cylinder head bolts (220, 221).

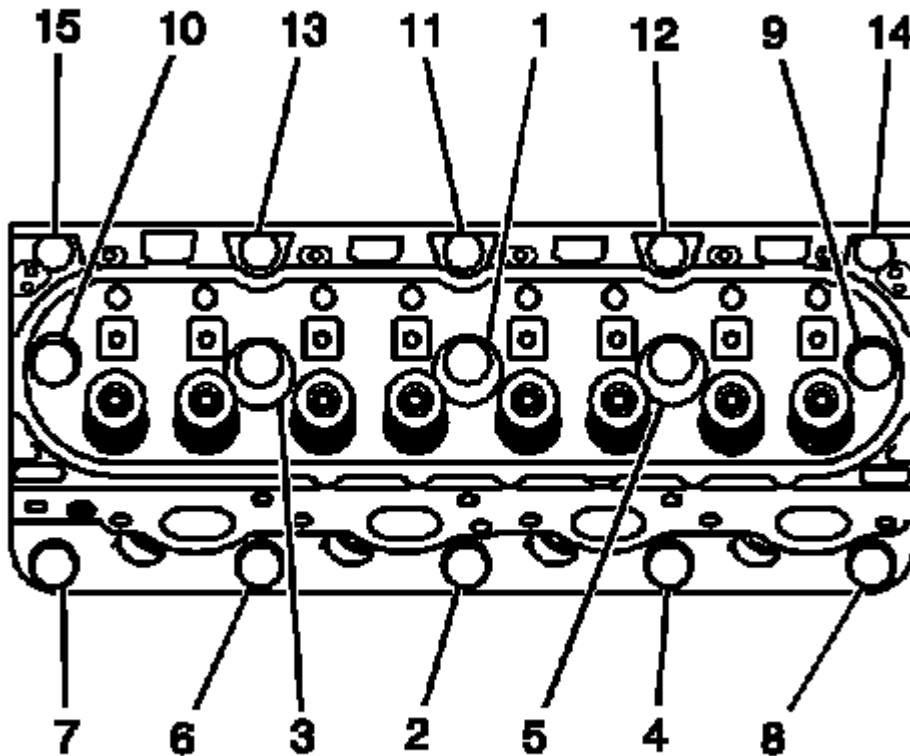


Fig. 130: Cylinder Head Bolts Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

8. Tighten the cylinder head bolts.
 1. Tighten the M11 cylinder head bolts (1-10) a first pass in sequence to 30 N.m (22 lb ft).
 2. Tighten the M11 cylinder head bolts (1-10) a second pass in sequence to 90 degrees using **J 45059** .
 3. Tighten the M11 cylinder head bolts (1-10) a final pass to 70 degrees using **J 45059** .
 4. Tighten the M8 cylinder head bolts (11-15) to 30 N.m (22 lb ft). Begin with the center bolt (11) and alternating side-to-side, work outward tightening all of the bolts.

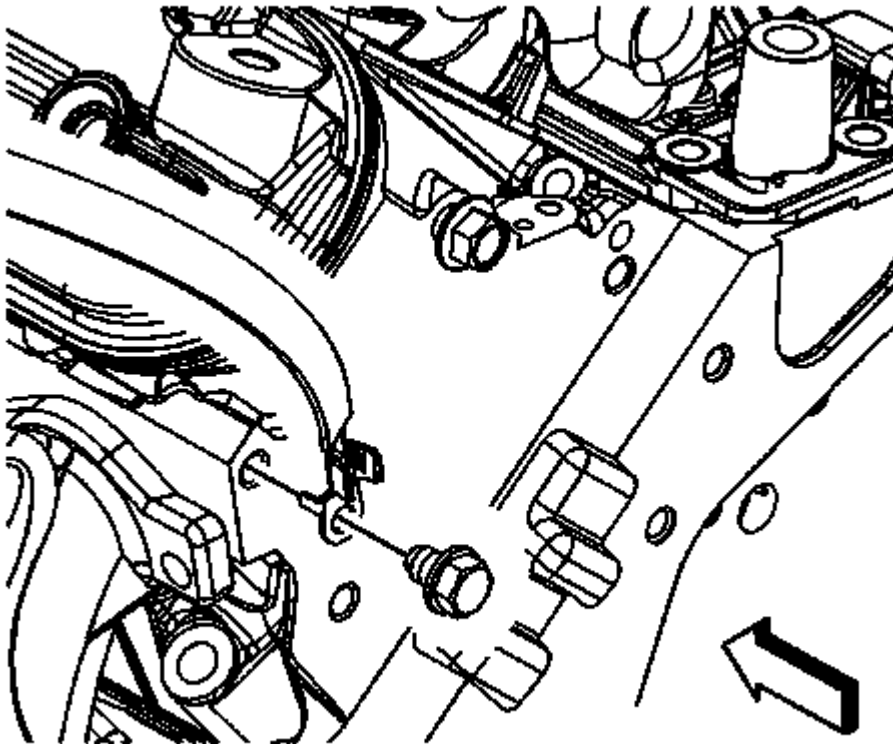


Fig. 131: Engine Ground Strap And Bolt
Courtesy of GENERAL MOTORS CORP.

9. Position the ground strap to the rear of the left cylinder head.
10. Install the engine ground strap bolt to the rear of the left cylinder head and tighten the bolt to 16 N.m (12 lb ft).
11. Install the pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
12. Install the left exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side**.
13. Install the coolant air bleed pipe. Refer to **Engine Coolant Air Bleed Pipe Replacement (with AFM)** , **Engine Coolant Air Bleed Pipe Replacement (without AFM)** .
14. Install the intake manifold. Refer to **Intake Manifold Replacement**.

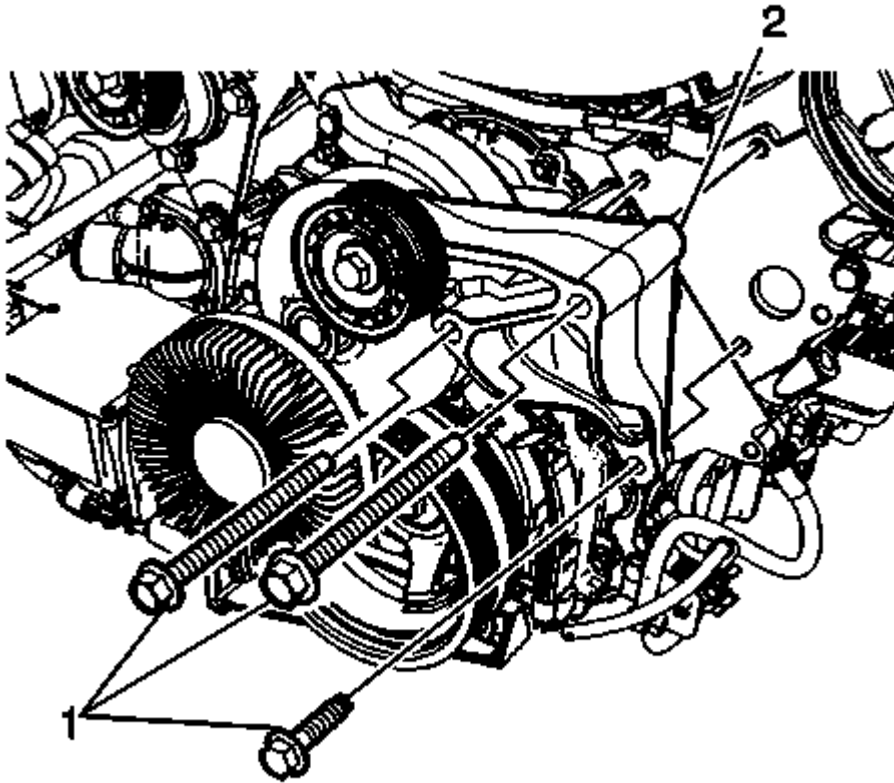


Fig. 132: Drive Belt Idler Pulley Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

15. Position the drive belt idler pulley bracket (2).
16. Install the drive belt idler pulley bracket bolts (1) and tighten to 50 N.m (37 lb ft).
17. Remove the drive belt. Refer to **Drive Belt Replacement**.

CYLINDER HEAD REPLACEMENT - RIGHT SIDE

Special Tools

- **J 42385-200** Common Thread Repair Kit
- **J 45059** Angle Meter

Removal Procedure

1. Remove the drive motor generator control module. Refer to **Drive Motor Generator Control Module Assembly Replacement**.

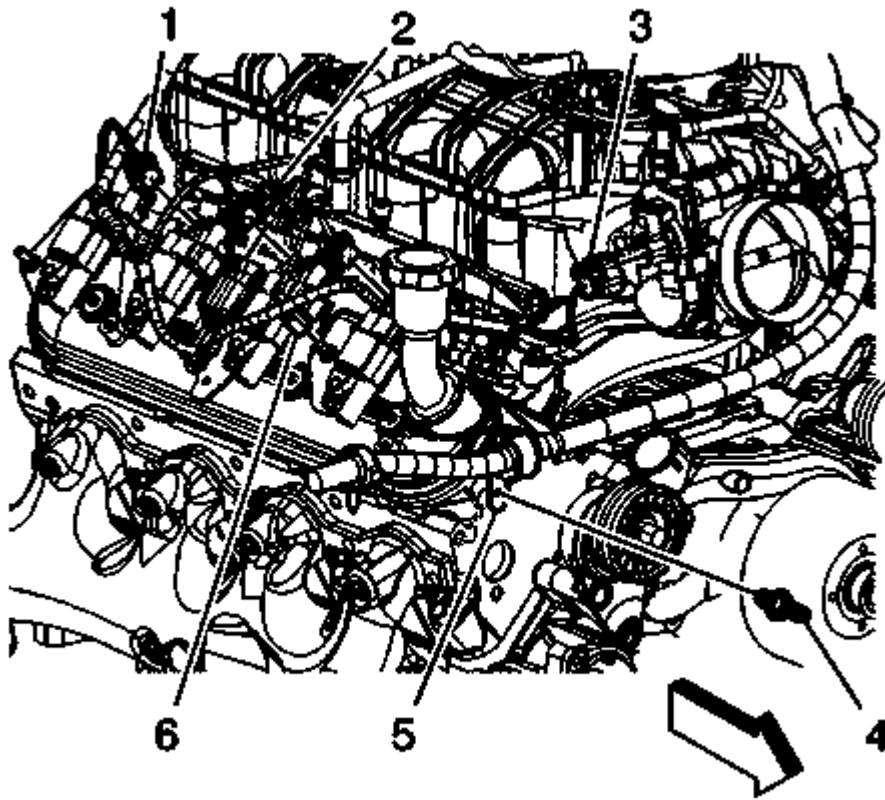


Fig. 133: Right Cylinder Head Engine Harness Studs And Retainers
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil level indicator. Refer to **Oil Level Indicator Tube Replacement** .
3. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
4. Remove the coolant air bleed pipe. Refer to **Engine Coolant Air Bleed Pipe Replacement (with AFM)** , **Engine Coolant Air Bleed Pipe Replacement (without AFM)** .
5. Remove the right exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .
6. Remove the pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
7. Remove the engine harness stud (4) from the front of the right cylinder head.
8. Position the engine harness aside.

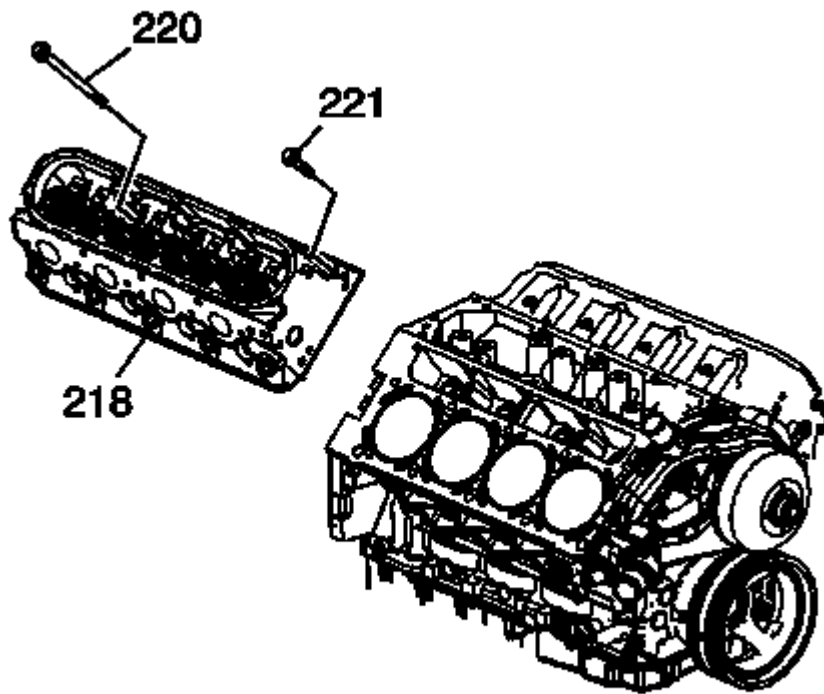


Fig. 134: Cylinder Head And Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: The cylinder head bolts are of a torque-to-yield design and are NOT to be reused.

9. Remove and discard the cylinder head bolts (220, 221).

CAUTION: All camshaft journals are the same diameter, so care must be used in removing or installing the camshaft to avoid damage to the camshaft bearings.

10. Remove the cylinder head (218).

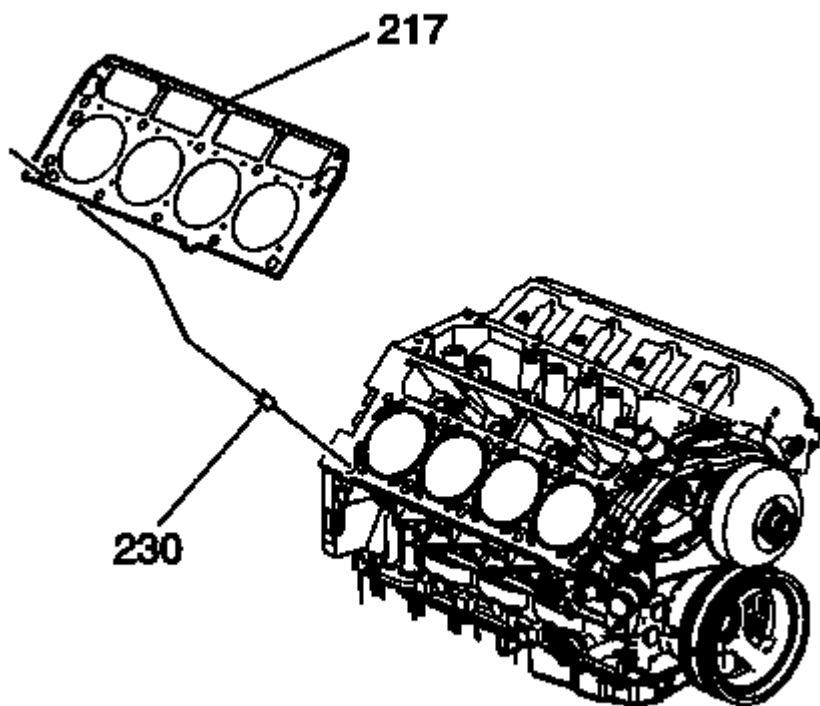


Fig. 135: Cylinder Head Gasket And Locating Pins
Courtesy of GENERAL MOTORS CORP.

11. Remove and discard the cylinder head gasket (217).
12. If required, clean and inspect the cylinder head. Refer to **Cylinder Head Cleaning and Inspection** .

Installation Procedure

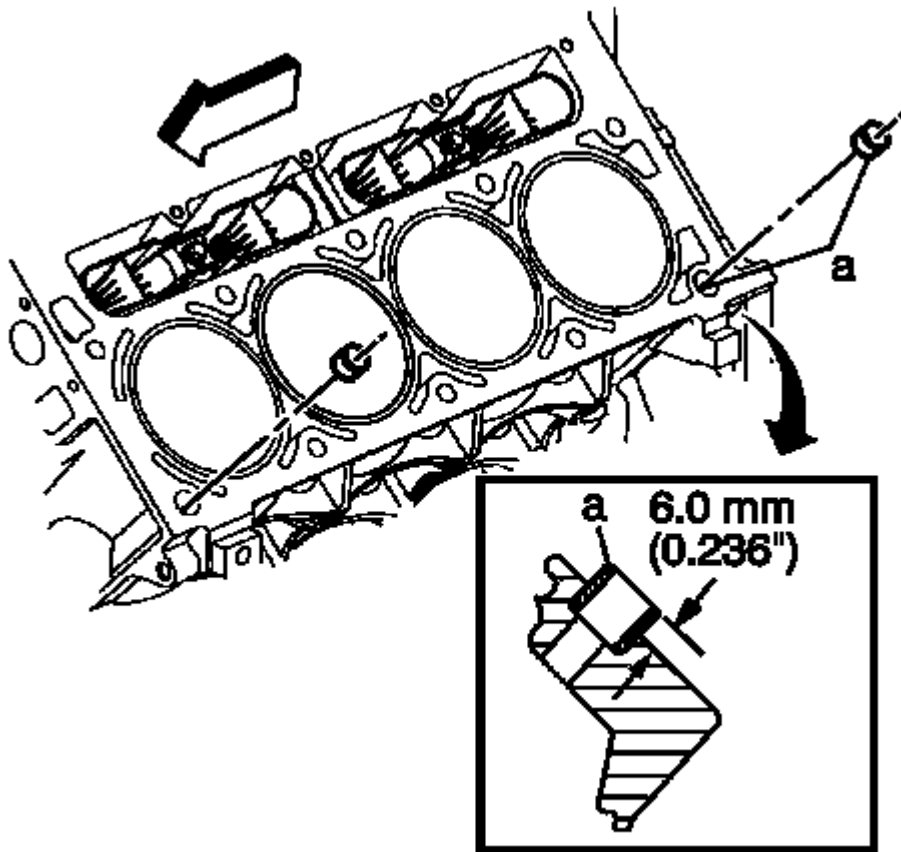


Fig. 136: Cylinder Head Bolt Holes And Locating Pins
Courtesy of GENERAL MOTORS CORP.

WARNING: Wear safety glasses in order to avoid eye damage.

CAUTION: Clean all dirt, debris, and coolant from the engine block cylinder head bolt holes. Failure to remove all foreign material may result in damaged threads, improperly tightened fasteners or damage to components.

NOTE: If installing a new cylinder head it is necessary to install a new engine coolant air bleed plug into the rear coolant passage of the cylinder head. Refer to Cylinder Head Assemble .

NOTE:

- Do not reuse the cylinder head bolts. Install NEW cylinder head bolts during assembly.
- Do not use any type of sealant on the cylinder head gasket, unless specified.

1. Clean the engine block cylinder head bolt holes, if required. Thread repair tool J 42385-107, found in **J 42385-200** may be used to clean the threads of old threadlocking material.
2. Spray cleaner GM P/N 12346139, P/N 12377981 (Canadian P/N 10953463), or equivalent into the hole.
3. Clean the cylinder head bolt holes with compressed air.
4. Check the cylinder head locating pins for proper installation (a) 8.3 mm (0.327 in).

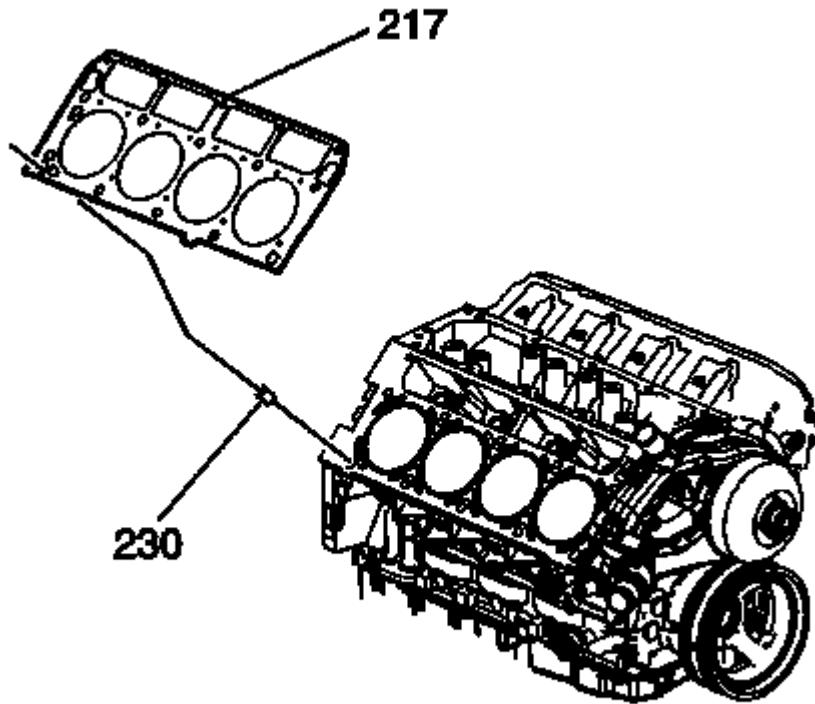


Fig. 137: Cylinder Head Gasket And Locating Pins
Courtesy of GENERAL MOTORS CORP.

NOTE: When properly installed, with FRONT on the right side, the tab on the cylinder head gasket should be located right of center.

5. Install the NEW cylinder head gasket (217) onto the locating pins.

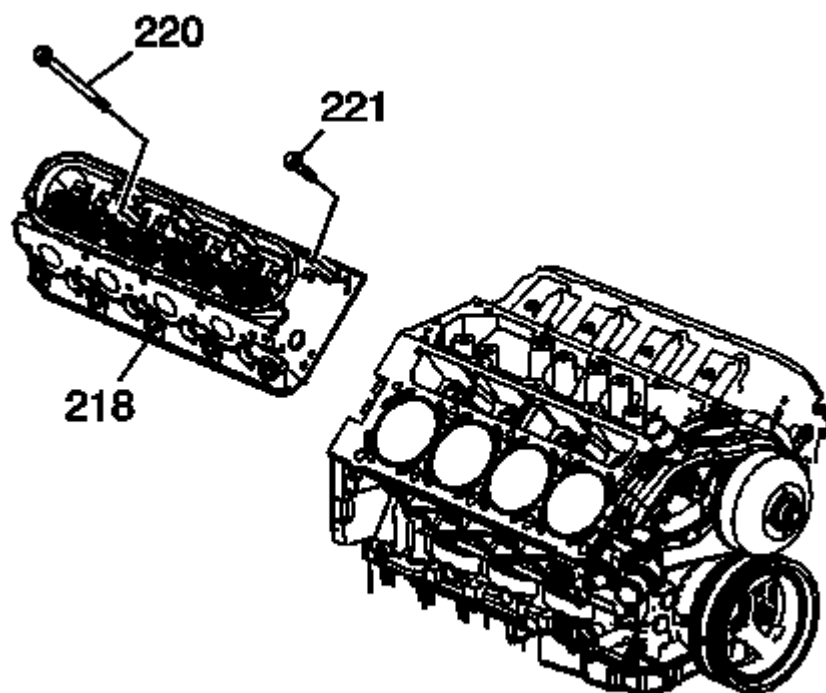


Fig. 138: Cylinder Head And Bolts

Courtesy of GENERAL MOTORS CORP.

6. Install the cylinder head (218) onto the locating pins.
7. Install the NEW cylinder head bolts (220, 221).

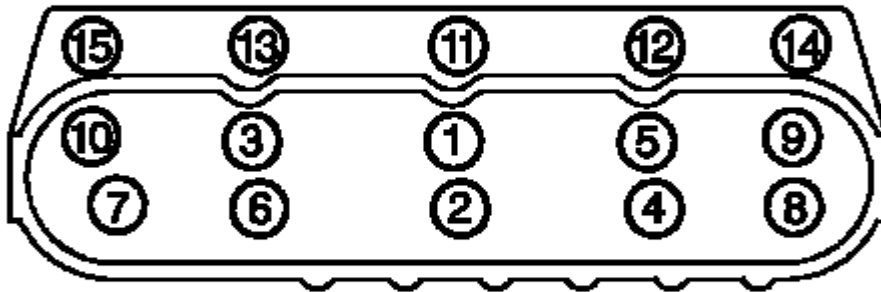


Fig. 139: Cylinder Head Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

8. Tighten the cylinder head bolts.
 1. Tighten the M11 cylinder head bolts (1-10) a first pass in sequence to 30 N.m (22 lb ft).
 2. Tighten the M11 cylinder head bolts (1-10) a second pass in sequence to 90 degrees using **J 45059** .
 3. Tighten the M11 cylinder head bolts (1-10) a final pass to 70 degrees in sequence using **J 45059** .
 4. Tighten the M8 cylinder head bolts (11-15) to 30 N.m (22 lb ft). Begin with the center bolt (11) and alternating side-to-side, work outward tightening all of the bolts.

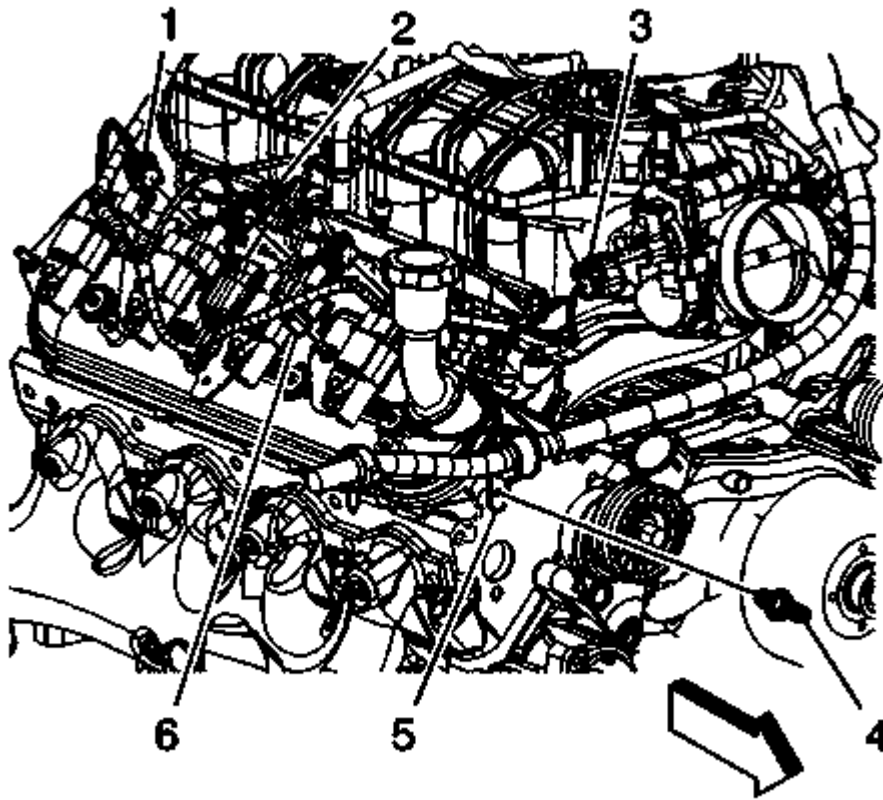


Fig. 140: Right Cylinder Head Engine Harness Studs And Retainers
Courtesy of GENERAL MOTORS CORP.

9. Position the engine harness to the cylinder head.
10. Install the engine harness stud (1) to the front of the right cylinder head and tighten the stud to 25 N.m (18 lb ft).
11. Install the pushrods. Refer to Valve Rocker Arm and Push Rod Replacement.
12. Install the right exhaust manifold. Refer to Exhaust Manifold Replacement - Right Side .
13. Install the coolant air bleed pipe. Refer to Engine Coolant Air Bleed Pipe Replacement (with AFM) , Engine Coolant Air Bleed Pipe Replacement (without AFM) .
14. Install the intake manifold. Refer to Intake Manifold Replacement.
15. Install the oil level indicator. Refer to Oil Level Indicator Tube Replacement .
16. Install the drive motor generator control module. Refer to Drive Motor Generator Control Module Assembly Replacement .

VALVE LIFTER REPLACEMENT

Removal Procedure

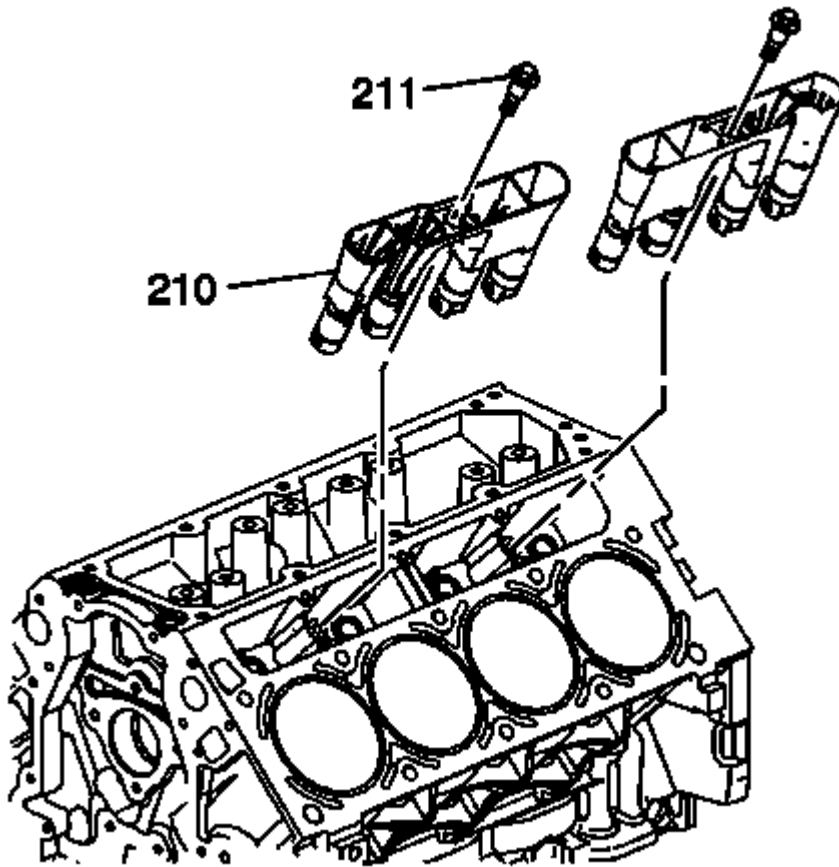


Fig. 141: Valve Lifters And Guides

Courtesy of GENERAL MOTORS CORP.

1. Remove the cylinder head and gasket. Refer to Cylinder Head Replacement - Left Side, or Cylinder Head Replacement - Right Side.
2. Remove the valve lifter guide bolts (211).
3. Remove the valve lifter guides (210) with the lifters. Note the installed position of the guides. The notched area of the guides is to align with the locating tab on the engine block.

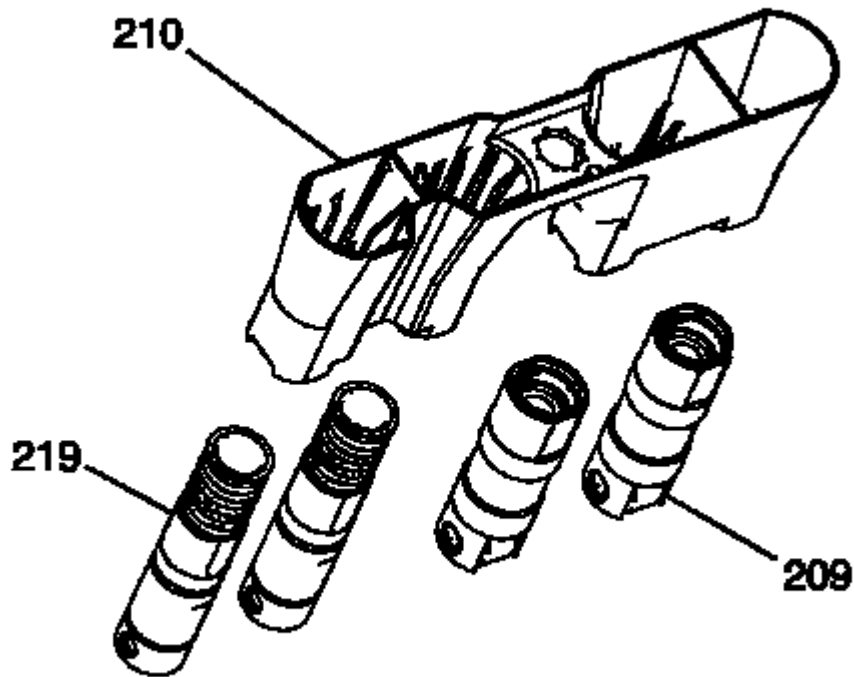


Fig. 142: Valve Lifters And Guide
Courtesy of GENERAL MOTORS CORP.

4. Remove the valve lifters (209) from the guide (210).
5. Organize or mark the components so that they can be installed in the same location from which they were removed, if required.
6. Clean and inspect the valve lifters, if required. Refer to **Valve Lifter and Guide Cleaning and Inspection** .

Installation Procedure

NOTE: When reusing valve lifters, install the lifters to their original locations.

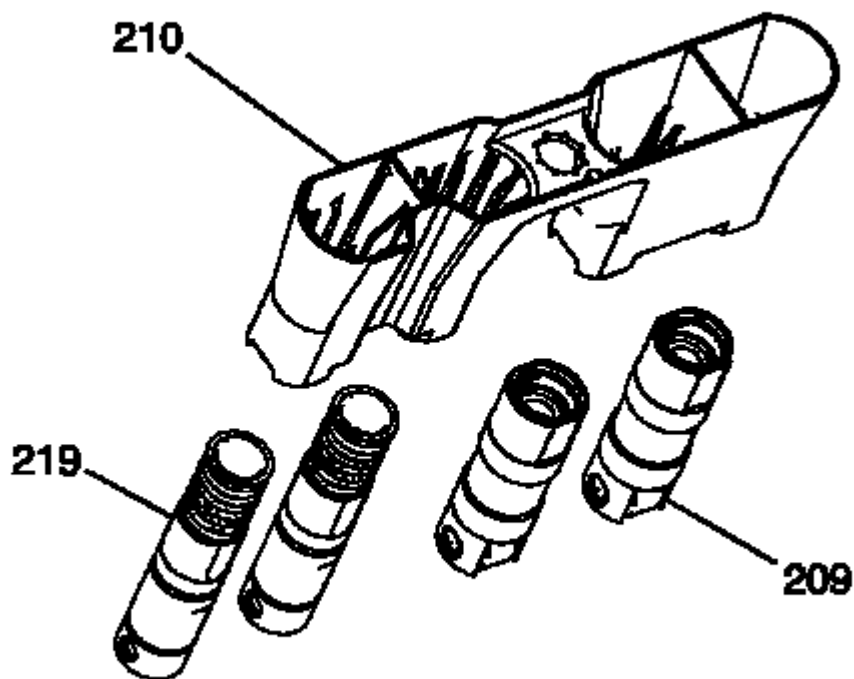


Fig. 143: Valve Lifters And Guide
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the valve lifters (209) and engine block valve lifter bores with clean engine oil.
2. Insert the valve lifters into the lifter guides (210). Align the flat area on the top of the lifter with the flat area in the lifter guide bore. Push the lifter completely into the guide bore.

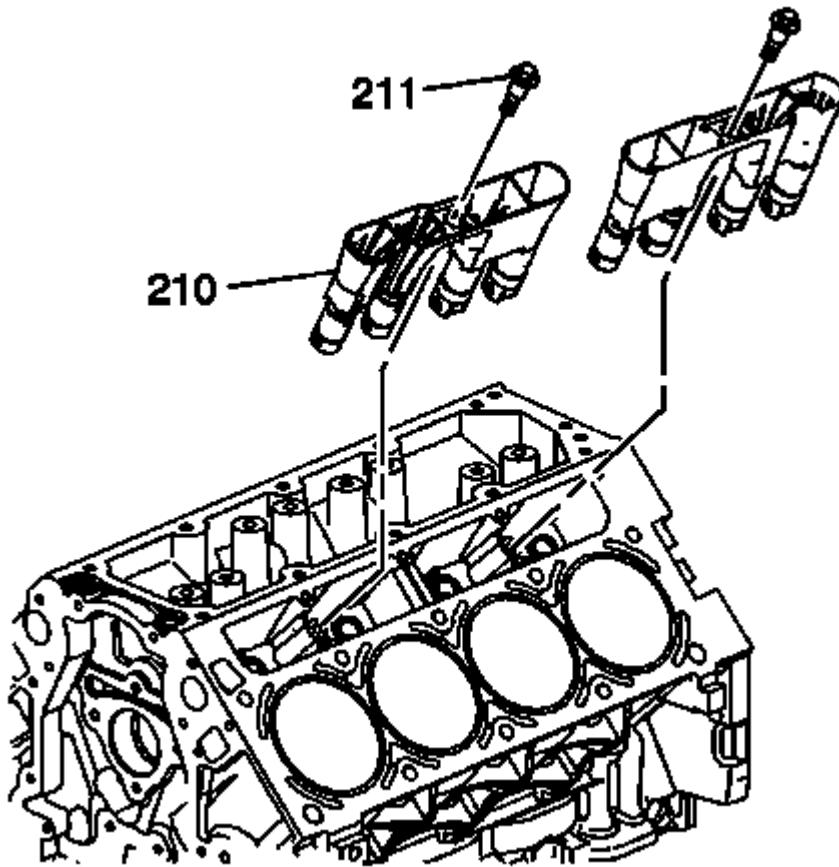


Fig. 144: Valve Lifters And Guides

Courtesy of GENERAL MOTORS CORP.

3. Install the valve lifters and guide (210) to the engine block.

CAUTION: Refer to Fastener Caution .

4. Install the valve lifter guide bolts.

Tighten

Tighten the bolt to 12 N.m (106 lb in).

5. Install the cylinder head and gasket. Refer to Cylinder Head Replacement - Left Side, or Cylinder Head Replacement - Right Side.

CRANKSHAFT BALANCER REPLACEMENT

Special Tools

- **J 41478** Crankshaft Front Oil Seal Installer
- **J 41665** Crankshaft Balancer and Sprocket Installer
- **J 41816-A** Crankshaft Balancer Remover
- **J 41816-2** Crankshaft End Protector
- **J 42386-A** Flywheel Holding Tool
- **J 45059** Angle Meter

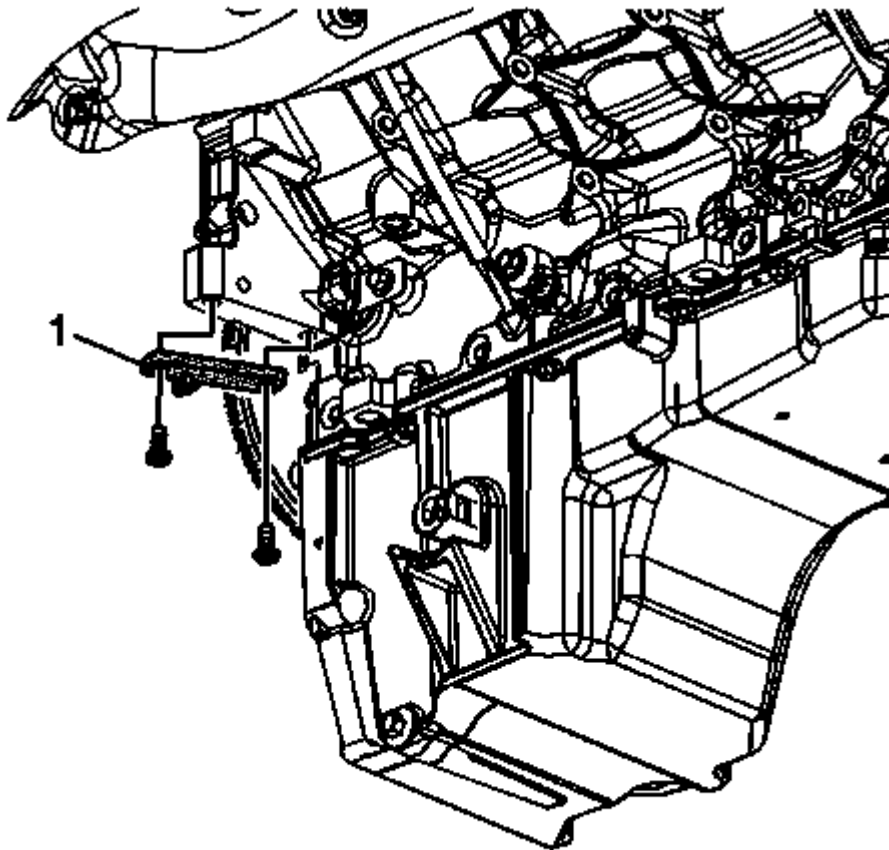
Removal Procedure

Fig. 145: Flywheel Holding Tool
Courtesy of GENERAL MOTORS CORP.

1. Remove the drive belt. Refer to **Drive Belt Replacement**.
2. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement (HP2)**.

CAUTION: Refer to **Fastener Caution**.

NOTE: Ensure that the teeth of the **J 42386-A** mesh with the teeth of the engine

flywheel.

3. Install the **J 42386-A** (1) and bolts. Use one M10-1.5 x 120 mm and one M10-1.5 x 45 mm bolt for proper tool operation.

Tighten

Tighten the **J 42386-A** bolts to 50 N.m (37 lb ft).

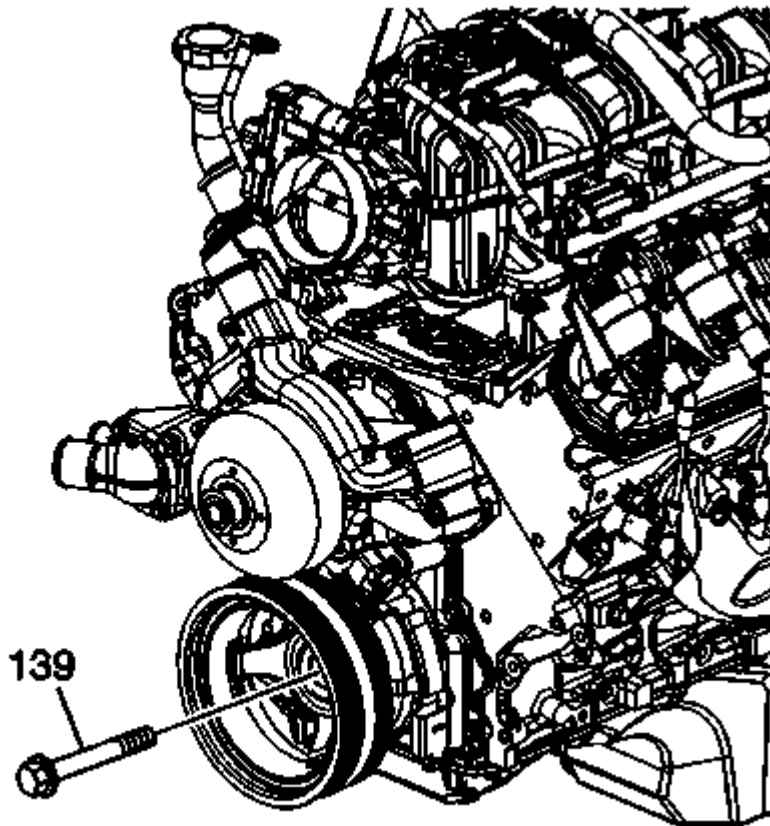


Fig. 146: Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

4. Remove the crankshaft balancer bolt (139). Do not discard the crankshaft balancer bolt at this time. The old balancer bolt will be used during the balancer installation procedure.

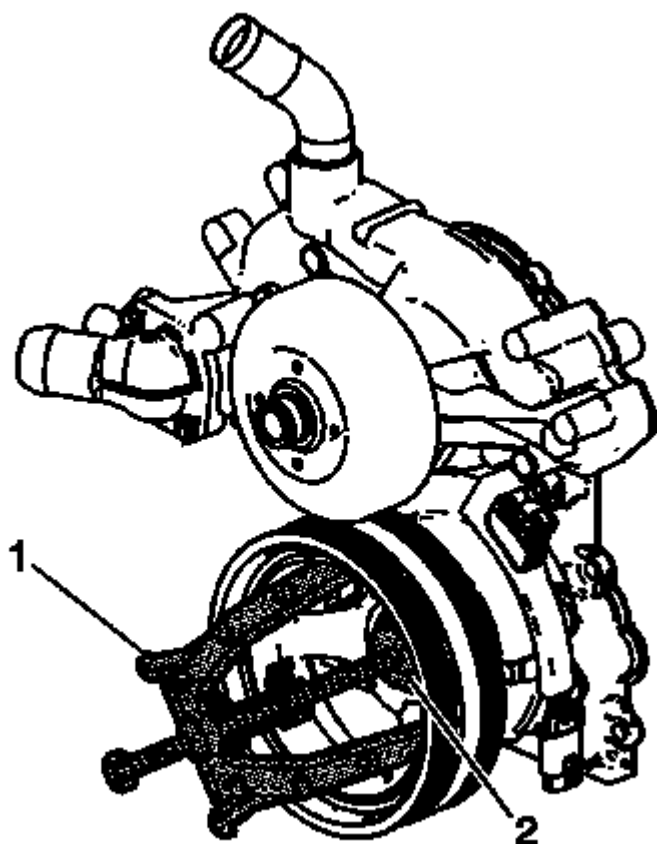


Fig. 147: Crankshaft Balancer With Removal Tools
Courtesy of GENERAL MOTORS CORP.

5. Install the J 41816-A (1) and J 41816-2 (2) to the crankshaft balancer.

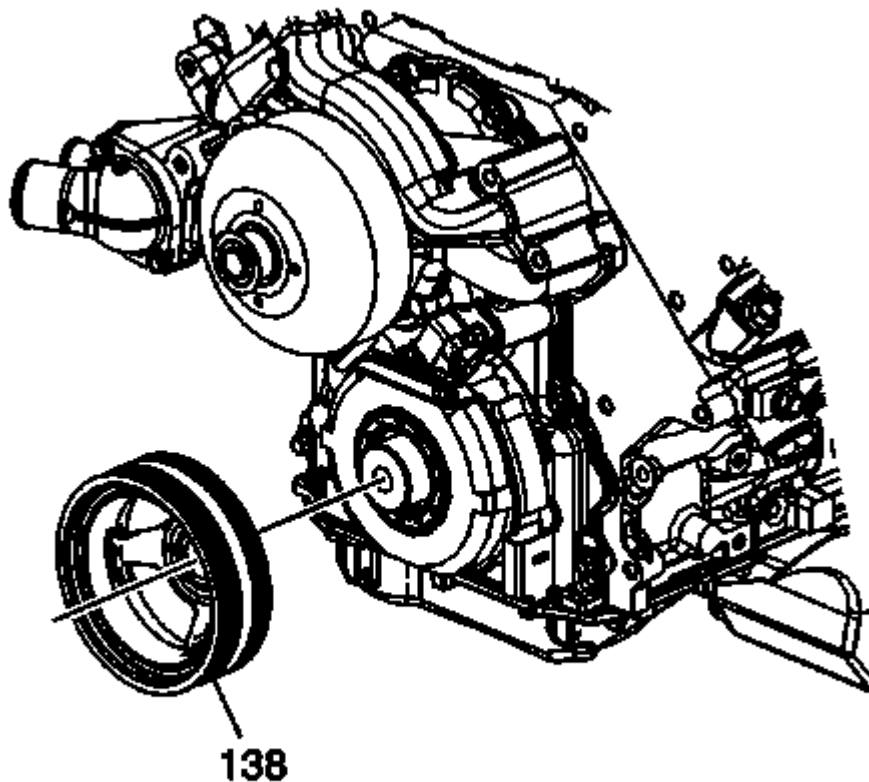


Fig. 148: Crankshaft Balancer

Courtesy of GENERAL MOTORS CORP.

NOTE: The crankshaft balancer is balanced as an individual component. It is not necessary to mark the balancer prior to removal.

6. Use the **J 41816-A** and the **J 41816-2** to remove the crankshaft balancer (138).
7. Remove the **J 41816-A** and the **J 41816-2** from the crankshaft balancer.

Installation Procedure

NOTE:

- The crankshaft balancer installation and bolt tightening involves a four stage tightening process. The first pass ensures that the balancer is installed completely onto the crankshaft. The second, third, and fourth passes tighten the NEW bolt to the proper torque.
- The used crankshaft balancer bolt will be used **ONLY** during the first pass of the balancer installation procedure. Install a NEW bolt and tighten as described in the second, third and fourth passes of the balancer bolt tightening procedure.

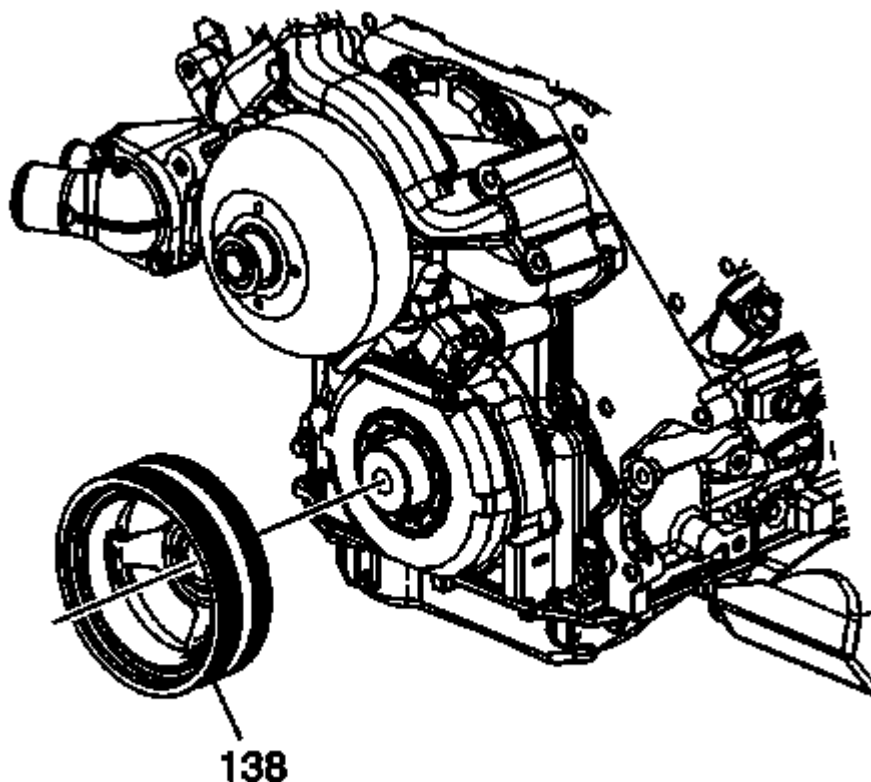


Fig. 149: Crankshaft Balancer

Courtesy of GENERAL MOTORS CORP.

NOTE: The balancer should be positioned onto the end of the crankshaft as straight as possible prior to tool installation.

1. Position the crankshaft balancer (138) onto the end of the crankshaft.

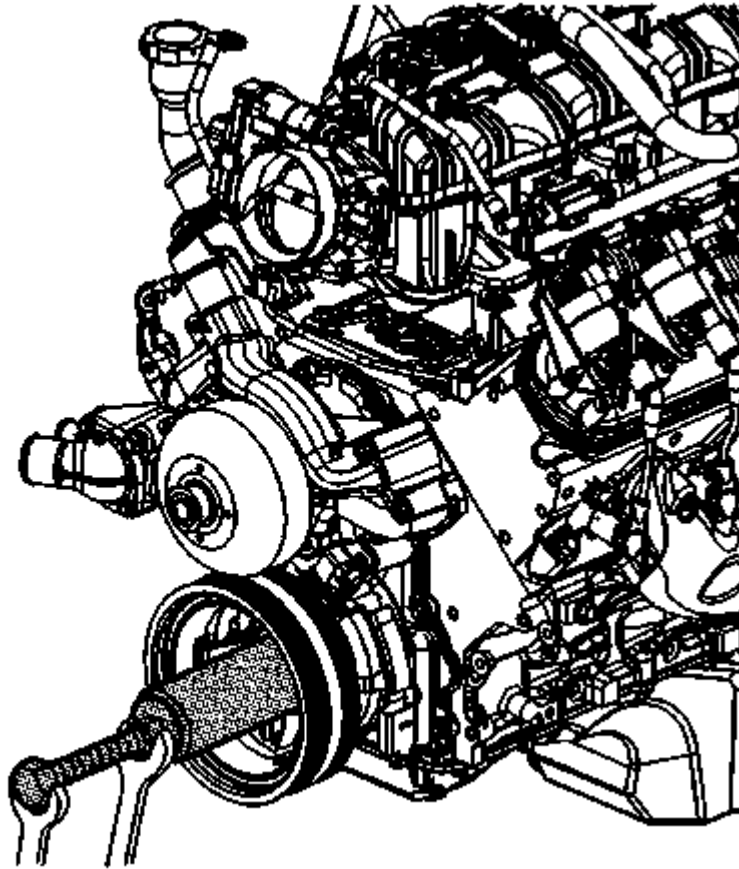


Fig. 150: Crankshaft Balancer Installation Special Tools
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 41665** and the threaded rod from the **J 41478** to crankshaft balancer and install the balancer.
 1. Assemble the threaded rod, nut, washer and installer. Insert the smaller end of the installer into the front of the balancer.
 2. Use a wrench and hold the hex end of the threaded rod.
 3. Use a second wrench and rotate the installation tool nut clockwise until the balancer is started onto the crankshaft.
 4. Remove the tool and reverse the installation tool.

Position the larger end of the installer against the front of the balancer.

5. Use a wrench and hold the hex end of the threaded rod.
6. Use a second wrench and rotate the installation tool nut clockwise until the balancer is installed onto the crankshaft.
7. Remove the **J 41665** and the threaded rod.

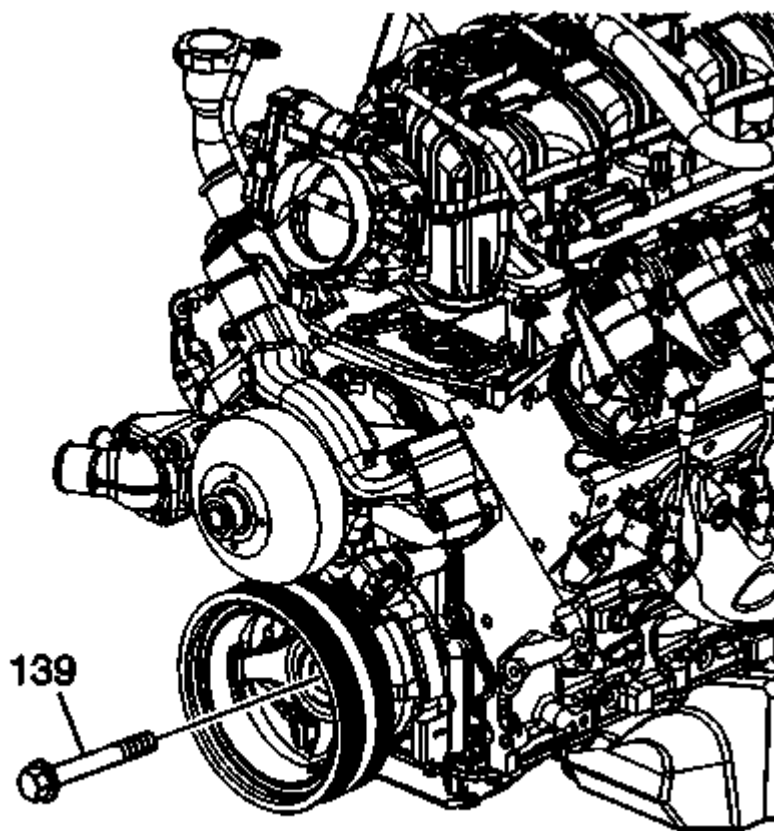


Fig. 151: Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

3. Install the USED crankshaft balancer bolt (139).

Tighten

Tighten the USED bolt to 330 N.m (240 lb ft).

4. Remove the USED crankshaft balancer bolt.

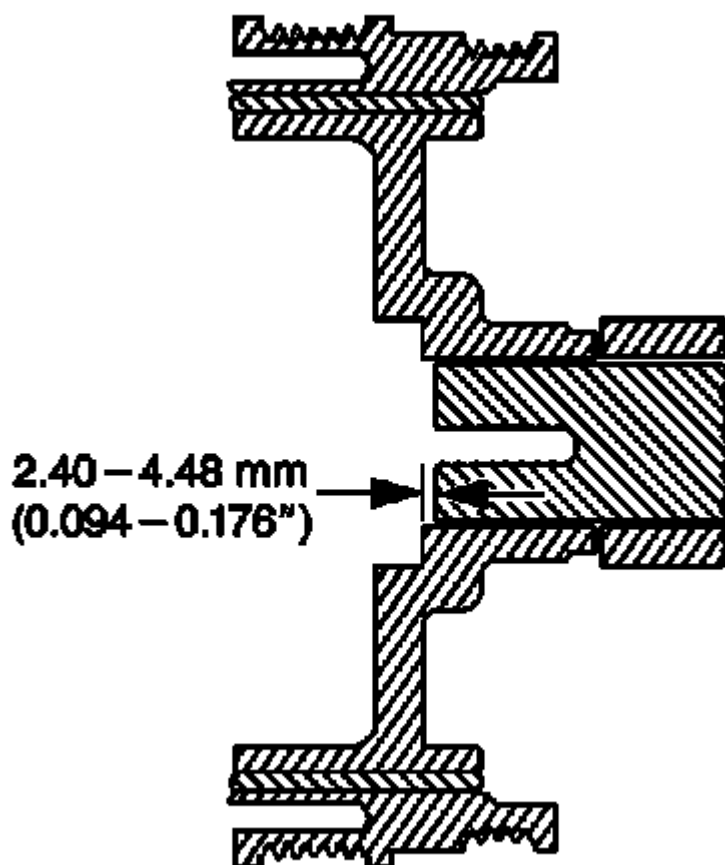


Fig. 152: Hub To Crankshaft Distance
Courtesy of GENERAL MOTORS CORP.

NOTE: The nose of the crankshaft should be recessed 2.4-4.48 mm (0.094-0.176 in) into the balancer bore.

5. Measure for a correctly installed balancer. If the balancer is not installed to the proper dimension, install the **J 41665** and repeat the installation procedure.

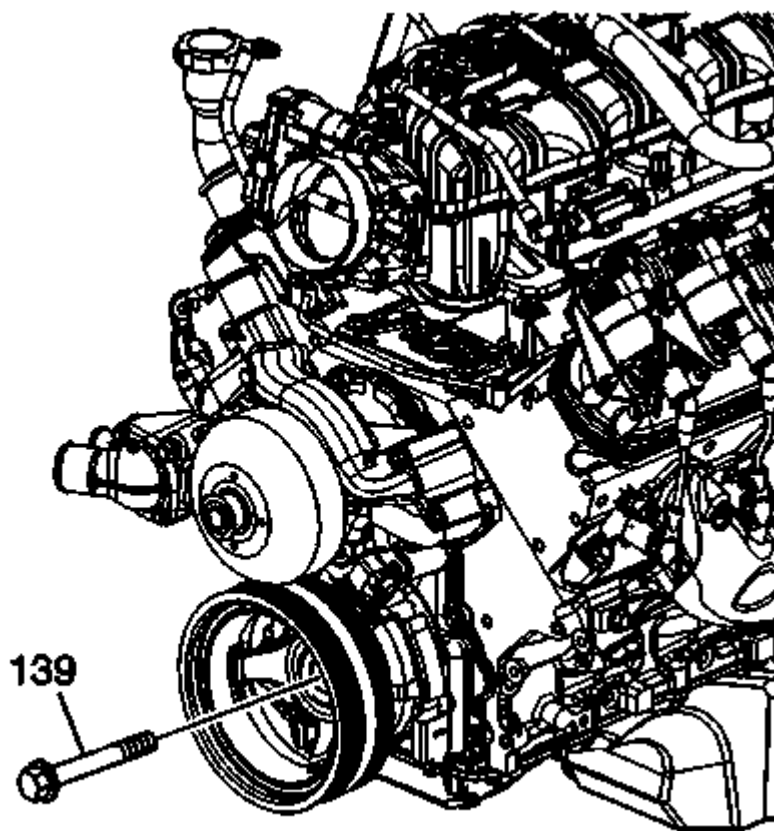


Fig. 153: Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

6. Install the NEW crankshaft balancer bolt (139).

Tighten

1. Tighten the bolt a first pass to 50 N.m (37 lb ft).
2. Tighten the bolt a final pass to 140 degrees using **J 45059** .

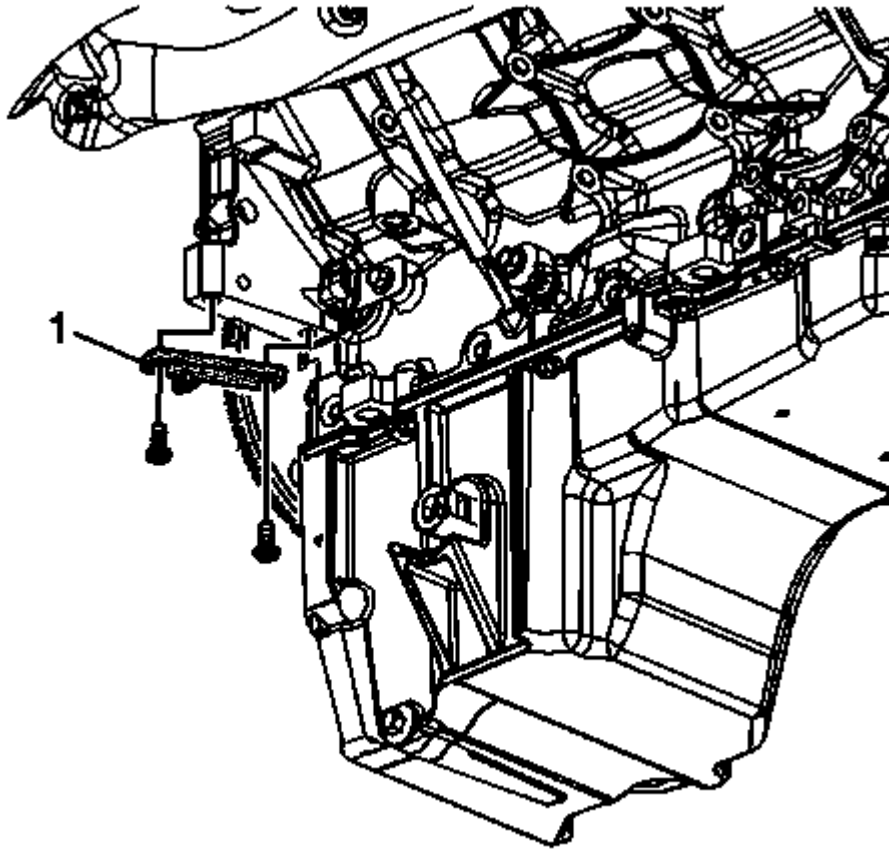


Fig. 154: Flywheel Holding Tool
Courtesy of GENERAL MOTORS CORP.

7. Remove the **J 42386-A** (1) and bolts.
8. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement (HP2)** .
9. Install the drive belt. Refer to **Drive Belt Replacement**.
10. Perform the crankshaft position (CKP) system variation learn procedure. Refer to **Crankshaft Position System Variation Learn** .

CRANKSHAFT FRONT OIL SEAL REPLACEMENT

Special Tools

J 41478 Crankshaft Front Oil Seal Installer

Removal Procedure

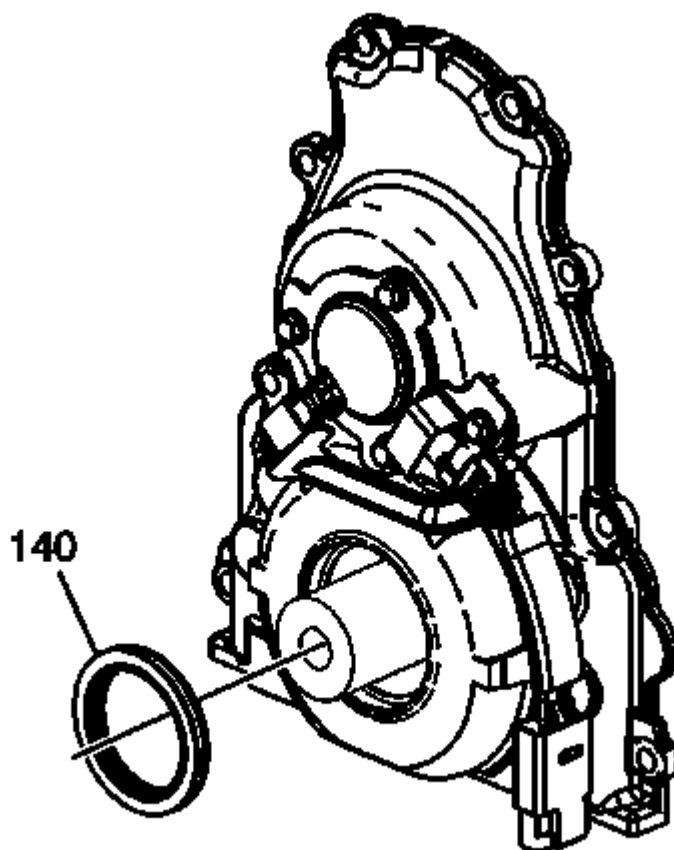


Fig. 155: Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement** .
2. Remove the crankshaft front oil seal (140) from the front cover.

Installation Procedure

- IMPORTANT:**
- Do not lubricate the oil seal sealing surface.
 - Do not reuse the crankshaft front oil seal.

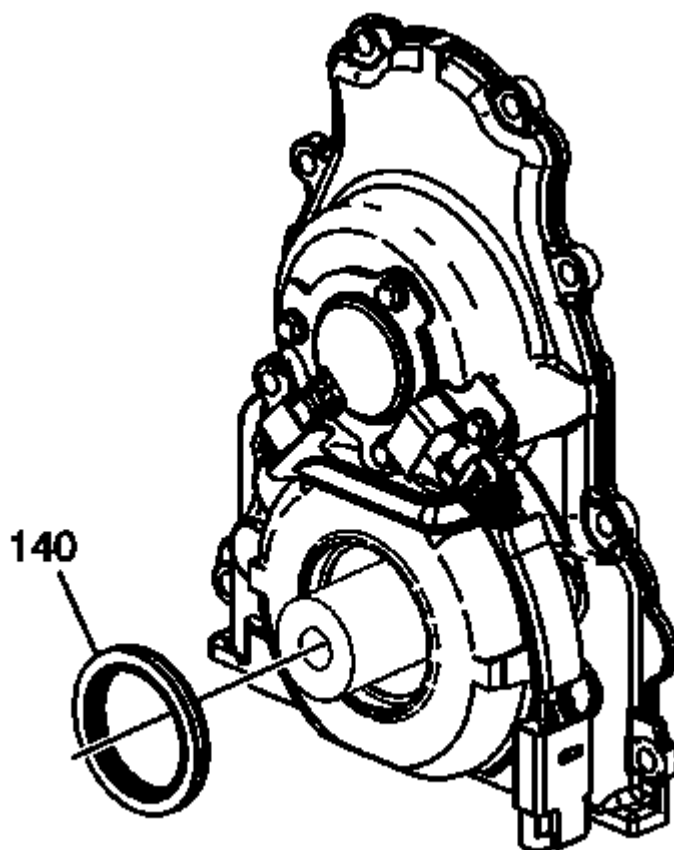


Fig. 156: Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the outer edge of the oil seal (140) with clean engine oil.
2. Lubricate the front cover oil seal bore with clean engine oil.

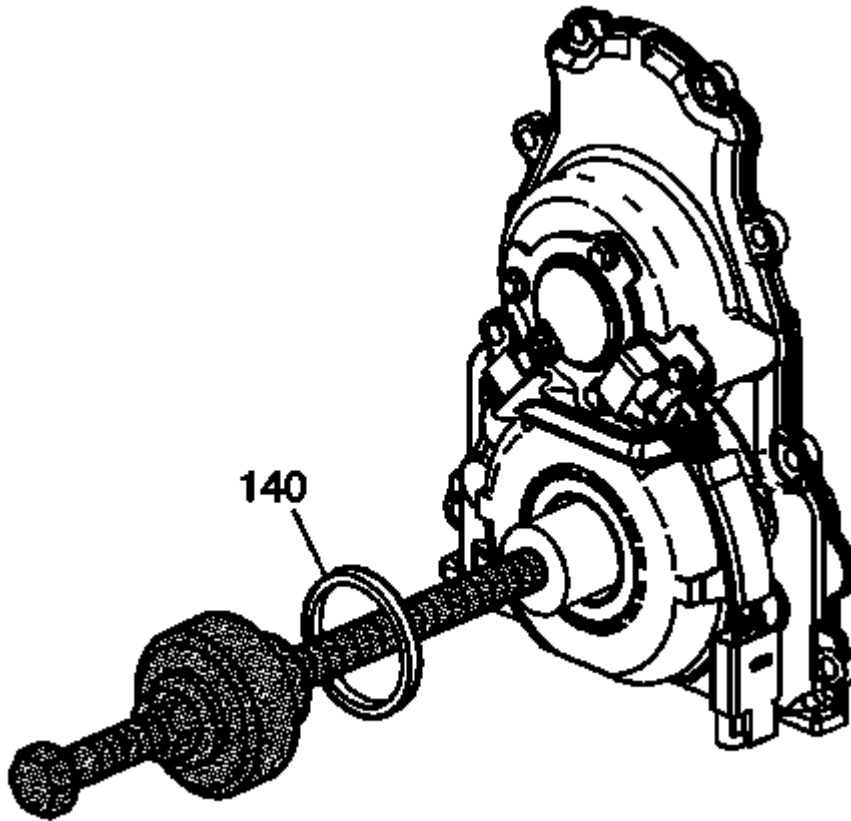


Fig. 157: Front Oil Seal And Special Tool
Courtesy of GENERAL MOTORS CORP.

3. Install the crankshaft front oil seal (140) onto the **J 41478** guide.
4. Install the **J 41478** threaded rod (with nut, washer, guide, and oil seal) into the end of the crankshaft.
5. Use the **J 41478** in order to install the oil seal into the cover bore.
 1. Use a wrench and hold the hex on the installer bolt.
 2. Use a second wrench and rotate the installer nut clockwise until the seal bottoms in the cover bore.
 3. Remove the **J 41478**.
 4. Inspect the oil seal for proper installation. The oil seal should be installed evenly and completely into the front cover bore.
6. Install the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.

CAMSHAFT POSITION ACTUATOR MAGNET REPLACEMENT

Removal Procedure

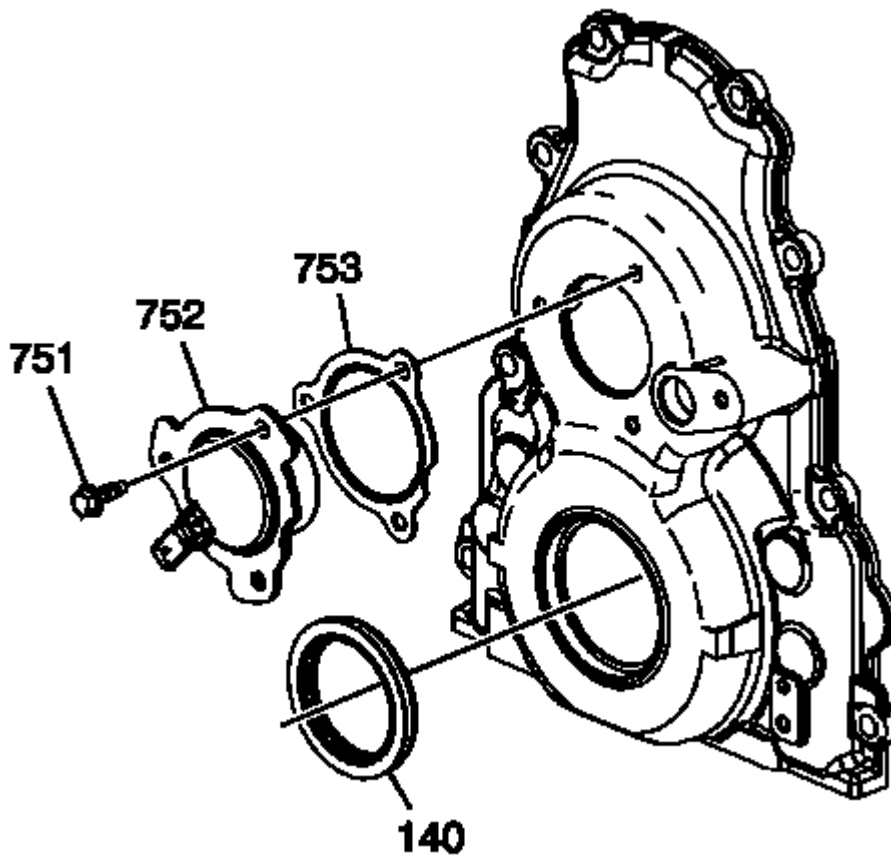


Fig. 158: CMP Actuator Magnet, Bolts, Gasket And Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the water pump. Refer to **Water Pump Replacement** .
2. Disconnect the engine harness electrical connector from the camshaft position (CMP) actuator magnet.
3. Remove the CMP actuator magnet bolts (751) and magnet (752).
4. Remove and discard the CMP actuator magnet gasket (753).

Installation Procedure

NOTE: **The gasket surface should be free of oil or other foreign material during assembly.**

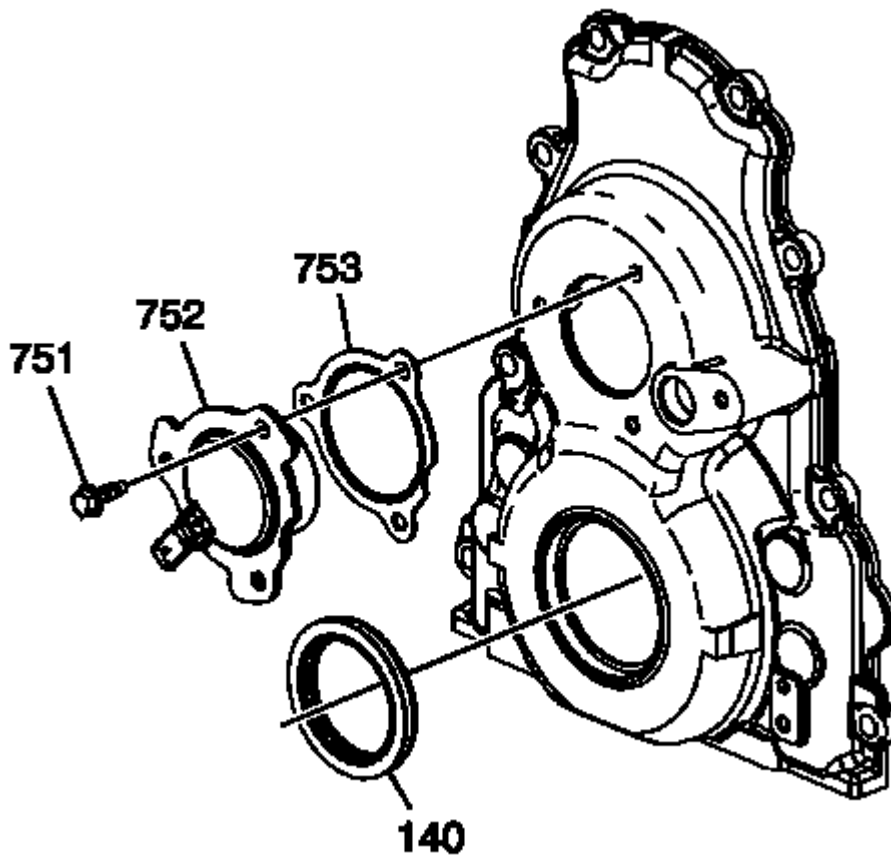


Fig. 159: CMP Actuator Magnet, Bolts, Gasket And Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW CMP actuator magnet gasket (753) onto the CMP actuator magnet.
2. Install the CMP actuator magnet (752) to the front cover.

CAUTION: Refer to Fastener Caution .

3. Install the CMP actuator magnet bolts (751).

Tighten

Tighten the bolts to 12 N.m (106 lb in).

4. Connect the engine harness electrical connector to the CMP actuator magnet.
5. Install the water pump. Refer to Water Pump Replacement .

ENGINE FRONT COVER REPLACEMENT

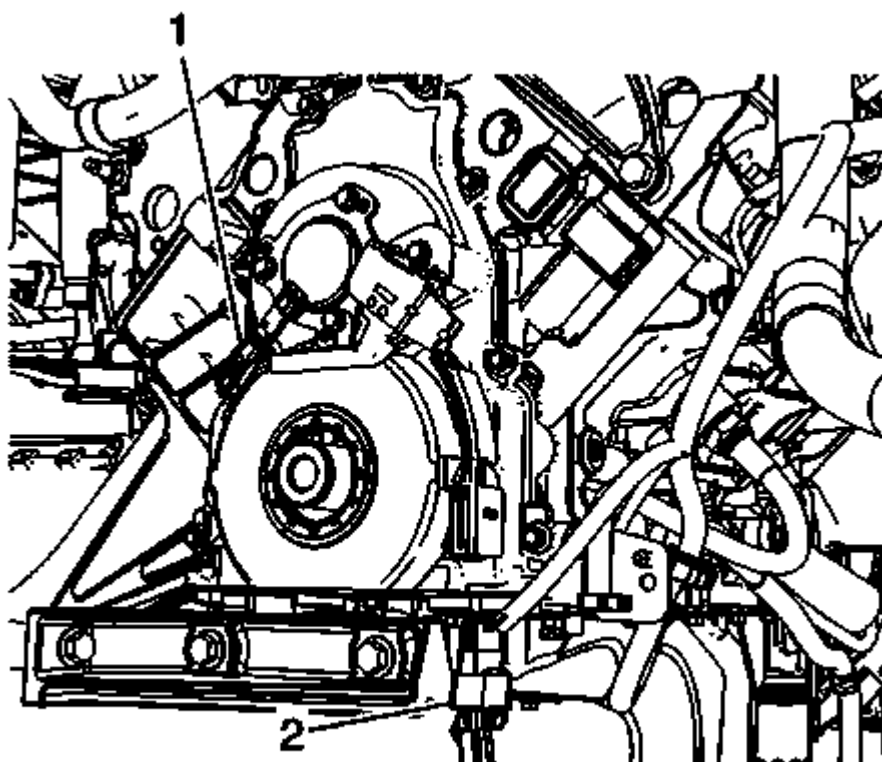
Special Tools**EN-48853** Front Cover Alignment Tool**Removal Procedure**

Fig. 160: CMP Sensor And Connector
Courtesy of GENERAL MOTORS CORP.

1. Remove the water pump. Refer to **Water Pump Replacement** .
2. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement** .
3. Disconnect the camshaft position sensor wire harness electrical connector (1) from the CMP actuator magnet.
4. Disconnect the engine harness electrical connector (2) from the CMP sensor wire harness electrical connector.

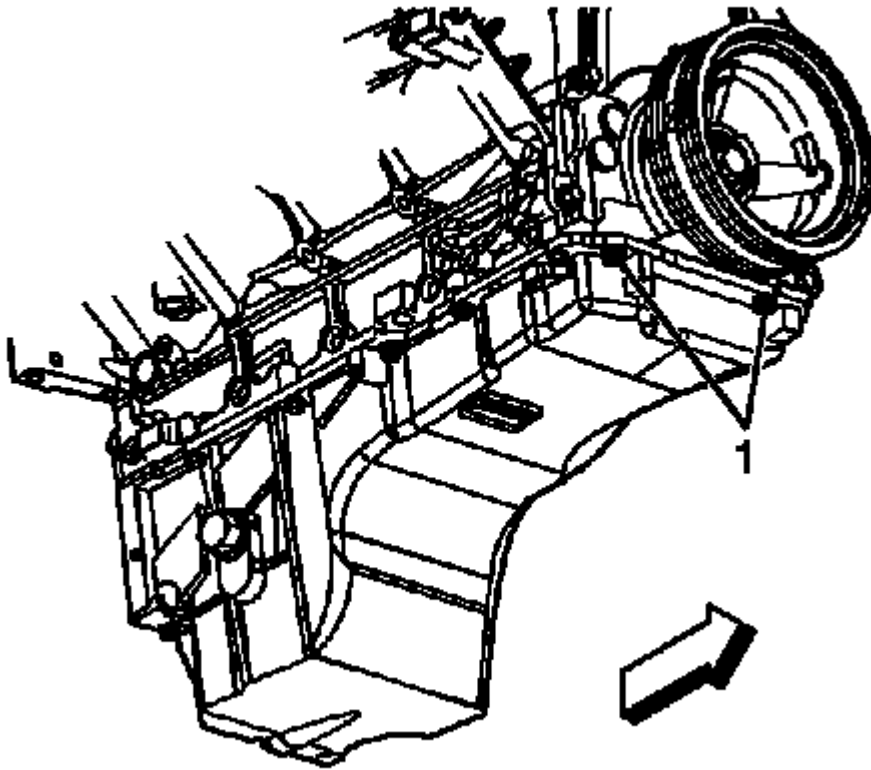


Fig. 161: Oil Pan-To-Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil pan-to-front cover bolts (1).

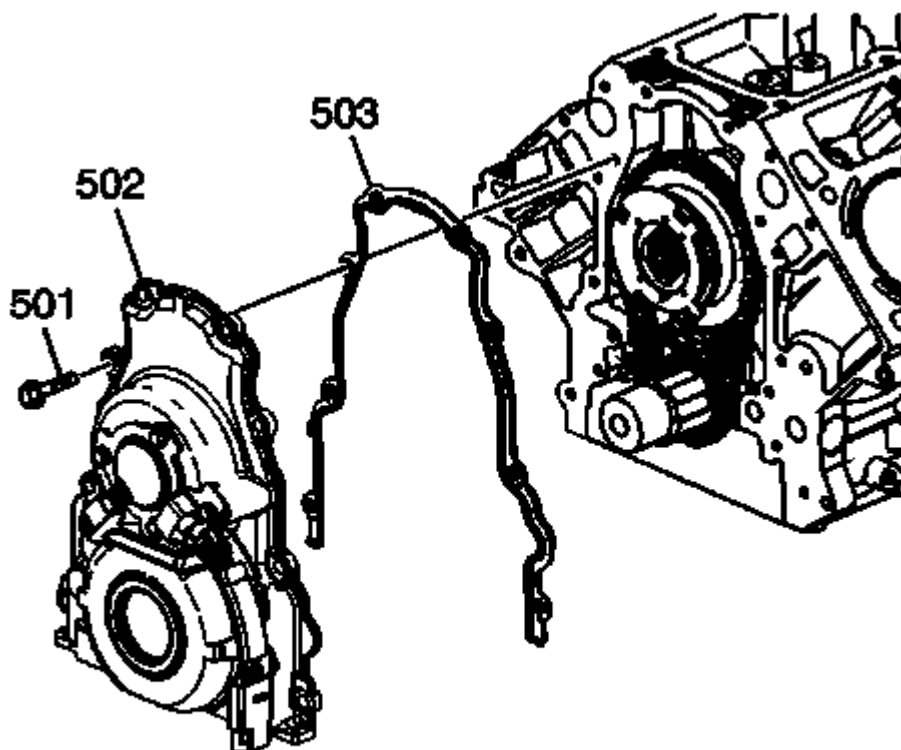


Fig. 162: Front Cover, Bolts And Gasket
Courtesy of GENERAL MOTORS CORP.

6. Remove the front cover bolts (501).
7. Remove the front cover (502) and gasket (503).
8. Discard the front cover gasket.
9. Remove the crankshaft front oil seal.

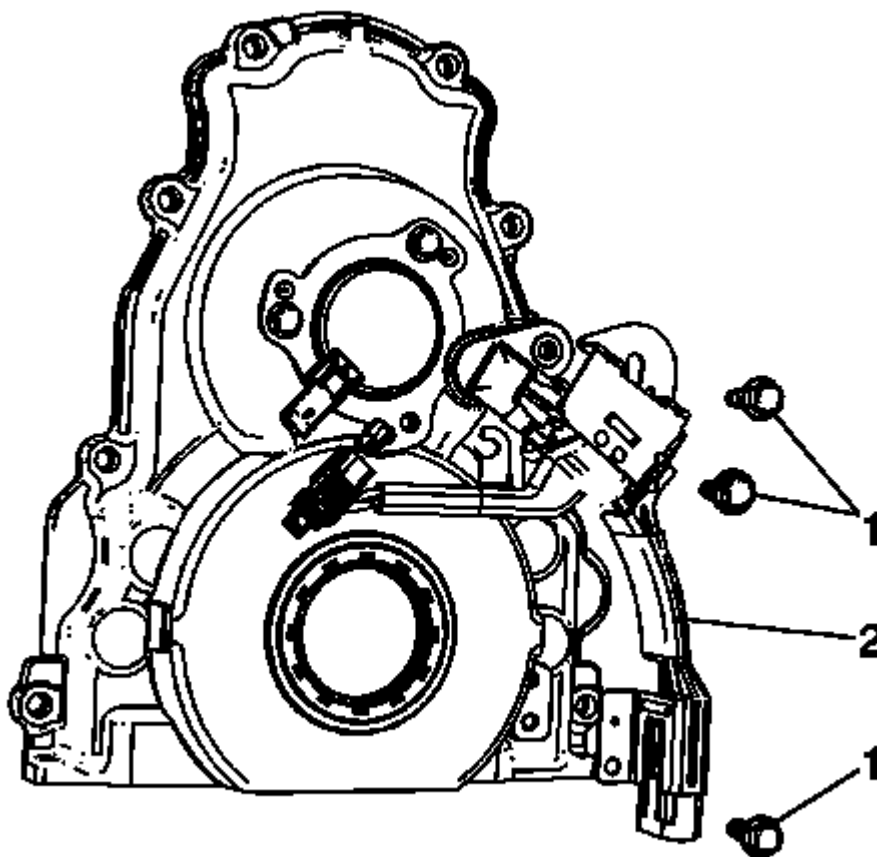


Fig. 163: CMP Sensor, CMP Sensor Wire Harness And Bolts
Courtesy of GENERAL MOTORS CORP.

10. If replacing the engine front cover perform the following steps, otherwise proceed to step 10 of the installation procedure.
11. Remove the CMP sensor wire harness bolts (1).
12. Disconnect the CMP sensor wire harness from the CMP sensor.
13. Remove the CMP sensor wire harness (2).

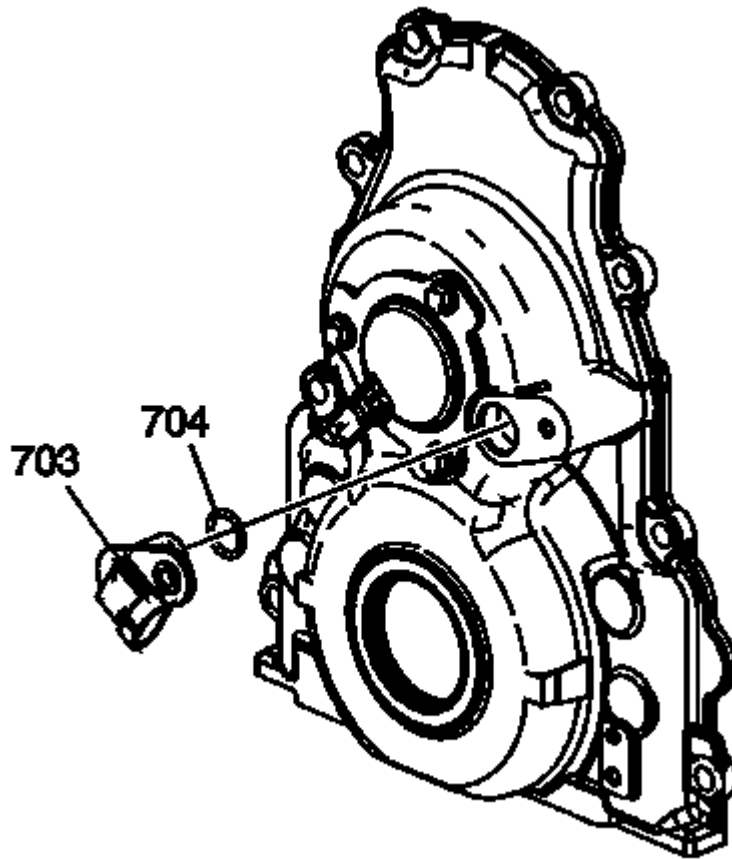


Fig. 164: CMP Sensor And O-Ring
Courtesy of GENERAL MOTORS CORP.

14. Remove the CMP sensor (703).

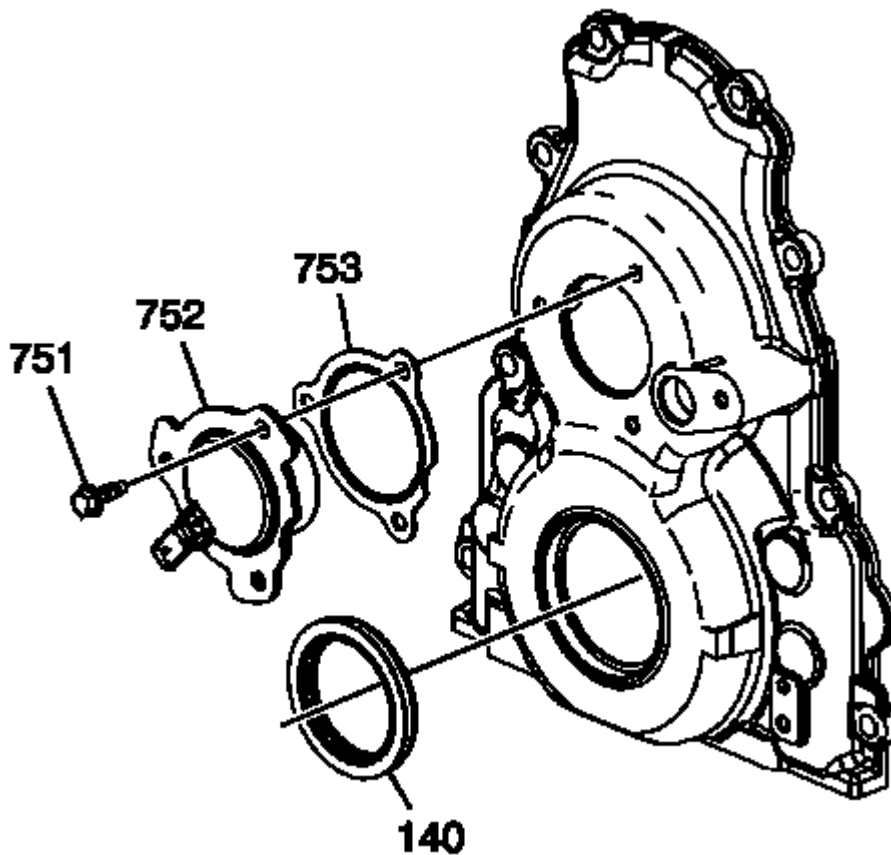


Fig. 165: CMP Actuator Magnet, Bolts, Gasket And Oil Seal
Courtesy of GENERAL MOTORS CORP.

15. Remove the CMP actuator magnet bolts (751), and magnet (752).
16. Remove and discard the CMP actuator magnet gasket (753).

Installation Procedure

NOTE:

- Do not reuse the crankshaft oil seal or front cover gasket.
- Do not apply any type of sealant to the front cover gasket, unless specified.
- The special tool in this procedure is used to properly center the front crankshaft front oil seal.
 - All gasket surfaces should be free of oil or other foreign material during assembly.
 - The crankshaft front oil seal **MUST** be centered in relation to the crankshaft.
 - An improperly aligned front cover may cause premature front oil seal wear and/or engine oil leaks.

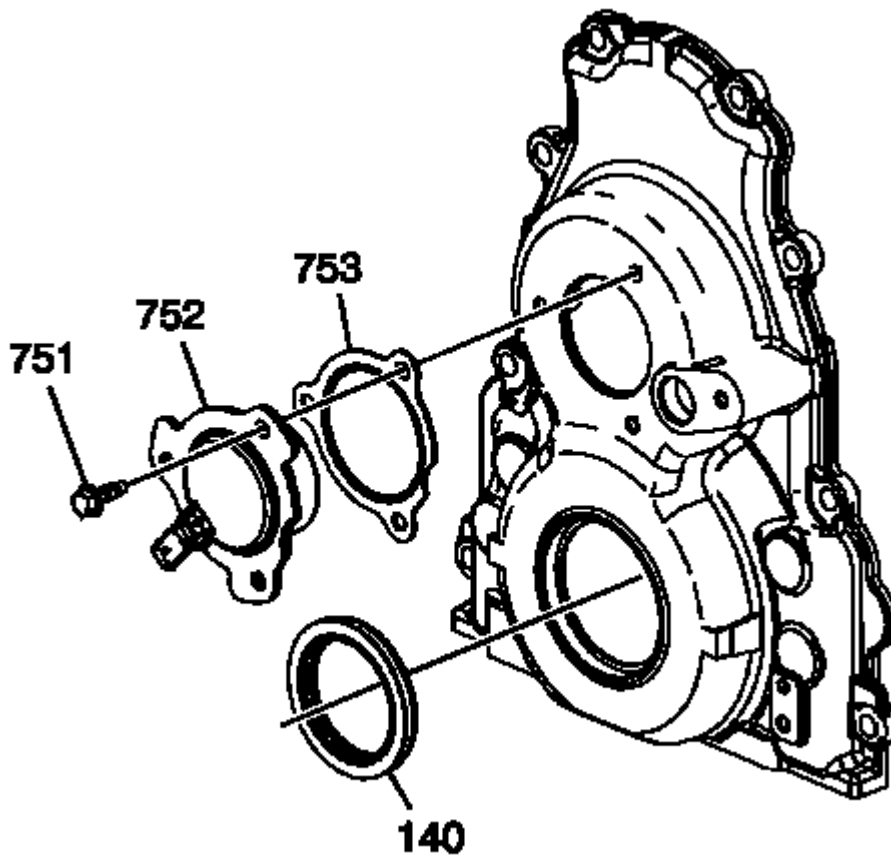


Fig. 166: CMP Actuator Magnet, Bolts, Gasket And Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. If replacing the front cover perform the following steps, otherwise proceed to step 10.
2. Install a NEW CMP actuator magnet gasket (753) onto the magnet.

CAUTION: Refer to Fastener Caution .

3. Install the CMP actuator magnet (752) and bolts (751).

Tighten

Tighten the bolts to 12 N.m (106 lb in).

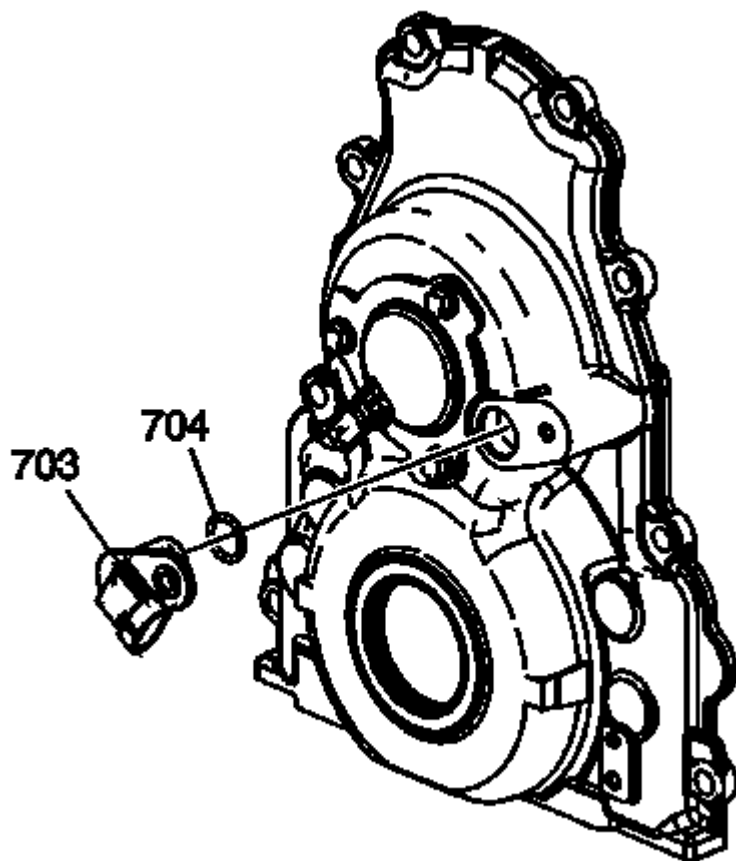


Fig. 167: CMP Sensor And O-Ring
Courtesy of GENERAL MOTORS CORP.

4. Inspect the CMP sensor O-ring seal for cuts or damage. If the seal is not cut or damaged, it may be reused.
5. Lubricate the O-ring seal (704) with clean engine oil.
6. Install the CMP sensor (703).

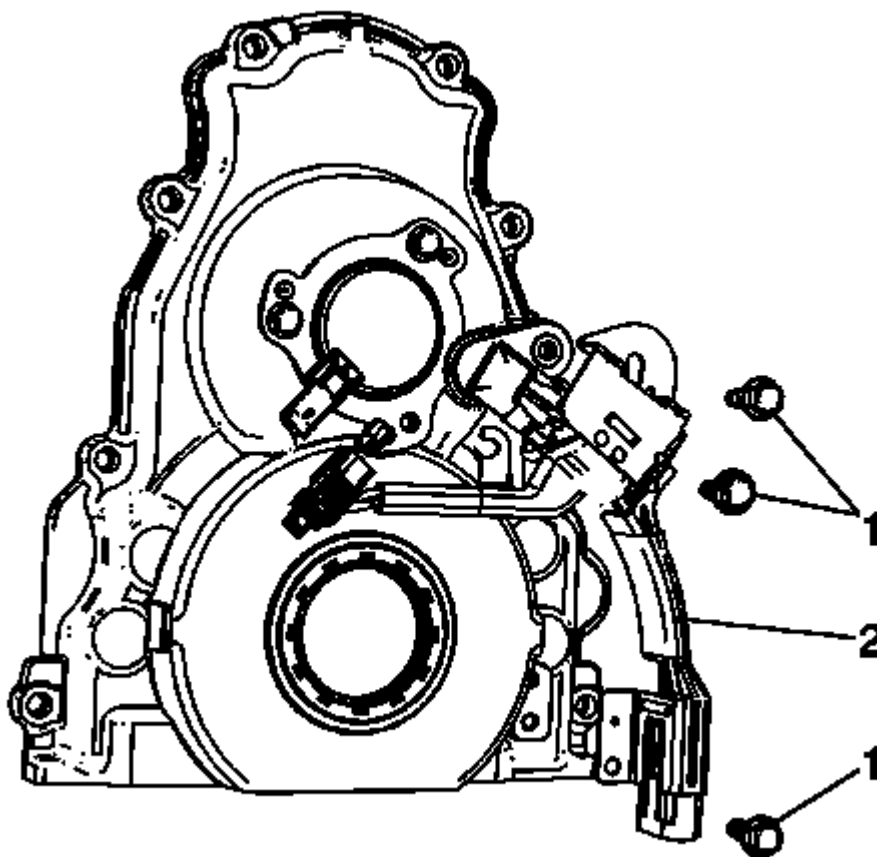


Fig. 168: CMP Sensor, CMP Sensor Wire Harness And Bolts
Courtesy of GENERAL MOTORS CORP.

7. Position the CMP sensor wire harness (2) to the front cover.
8. Connect the CMP sensor wire harness to the CMP sensor.
9. Install the CMP sensor wire harness bolts (1).

Tighten

Tighten the bolts to 12 N.m (106 lb in).

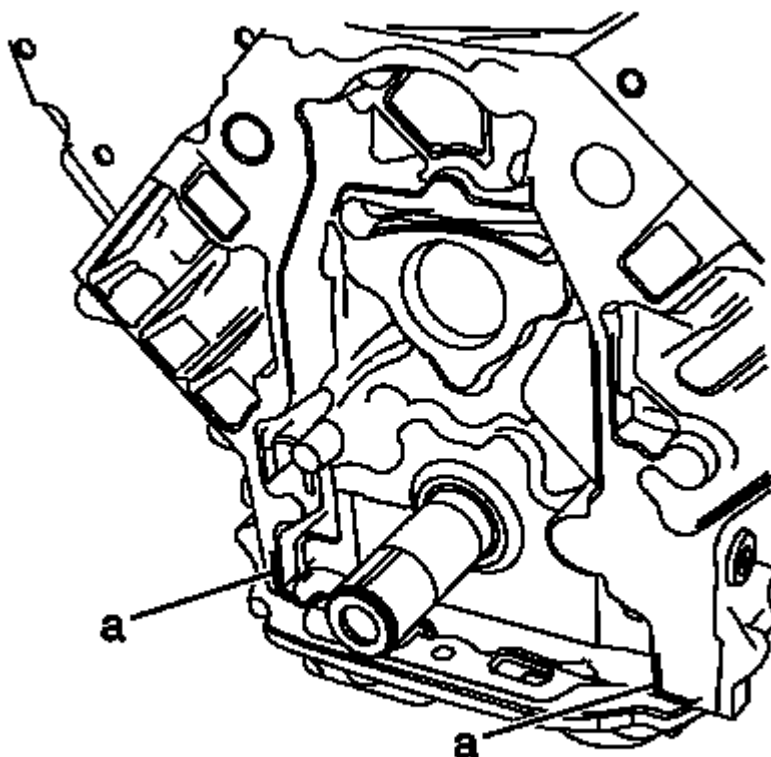


Fig. 169: Sealant Application Areas

Courtesy of GENERAL MOTORS CORP.

10. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.80 in) long to the oil pan to engine block junction. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

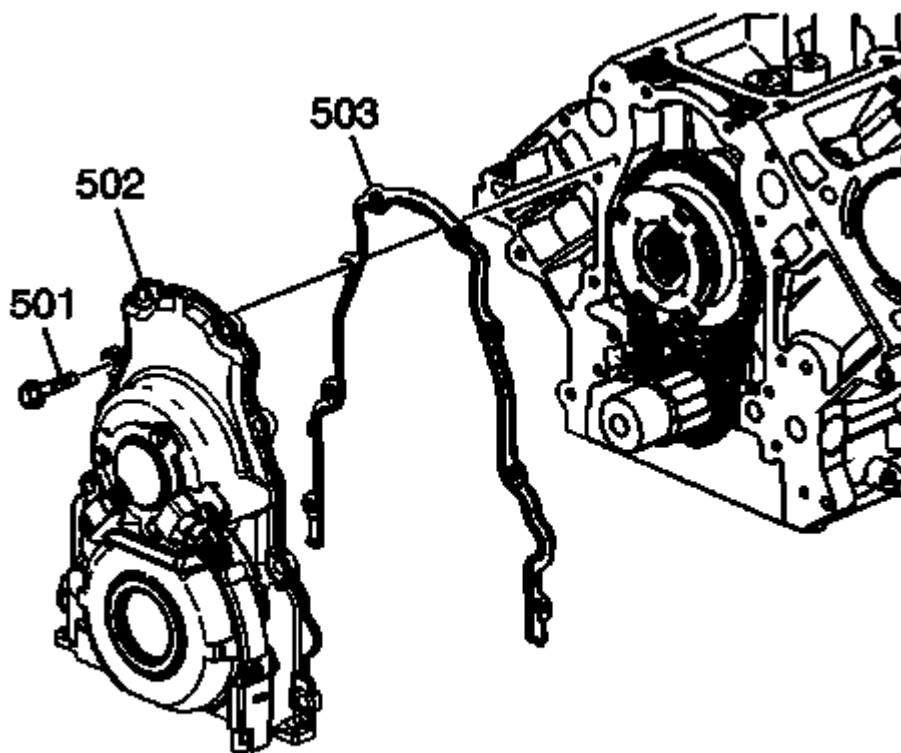


Fig. 170: Front Cover, Bolts And Gasket
Courtesy of GENERAL MOTORS CORP.

11. Position the NEW engine front cover gasket (503) and front cover (502) to the engine.
12. Install the front cover bolts (501) until snug. Do not overtighten.

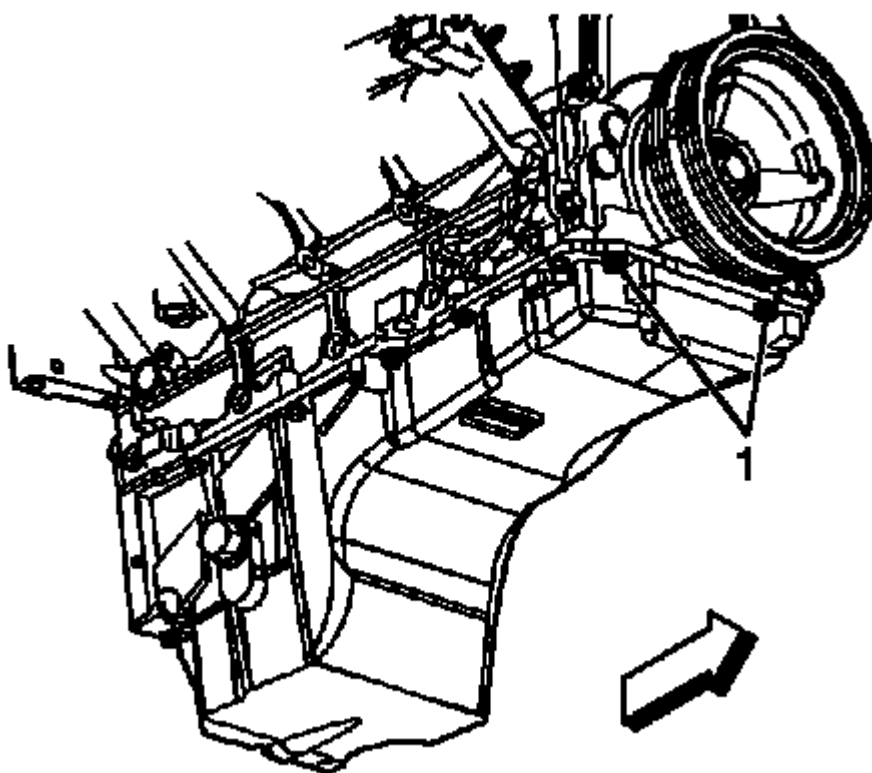


Fig. 171: Oil Pan-To-Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

13. Install the oil pan-to-front cover bolts (1) finger tight. Do not over tighten.

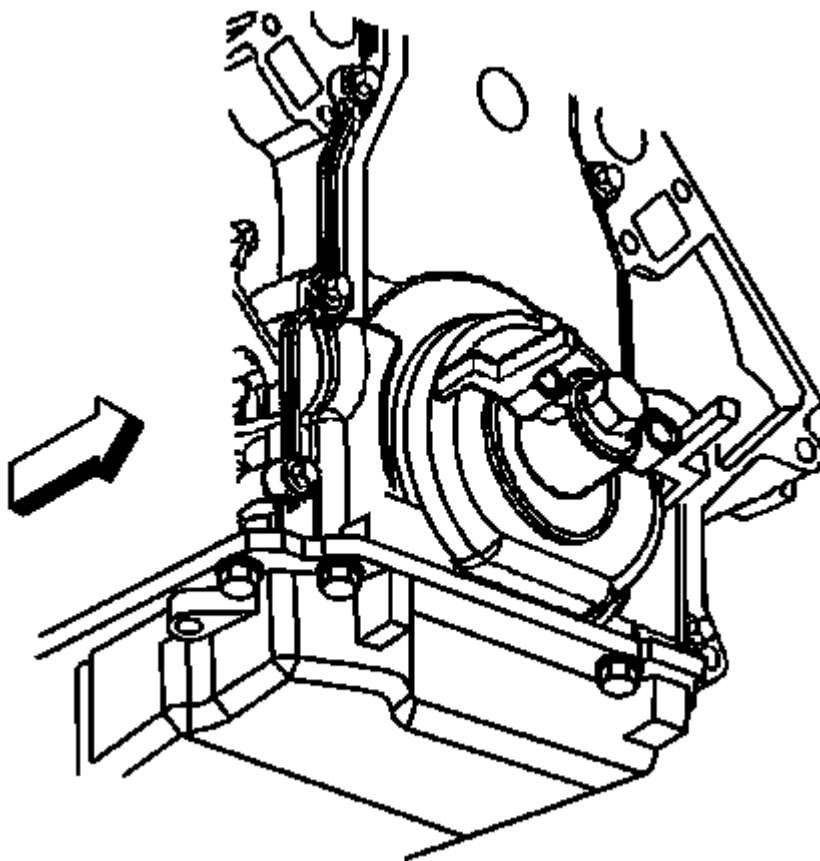


Fig. 172: Special Tool, Oil Pan And Front Cover
Courtesy of GENERAL MOTORS CORP.

14. Install **EN-48853** to the front cover.
15. Install the crankshaft balancer bolt until snug. Do not overtighten.

Tighten

1. Tighten the oil pan to front cover bolts to 25 N.m (18 lb ft).
 2. Tighten the engine front cover bolts to 25 N.m (18 lb ft).
16. Remove the tools.

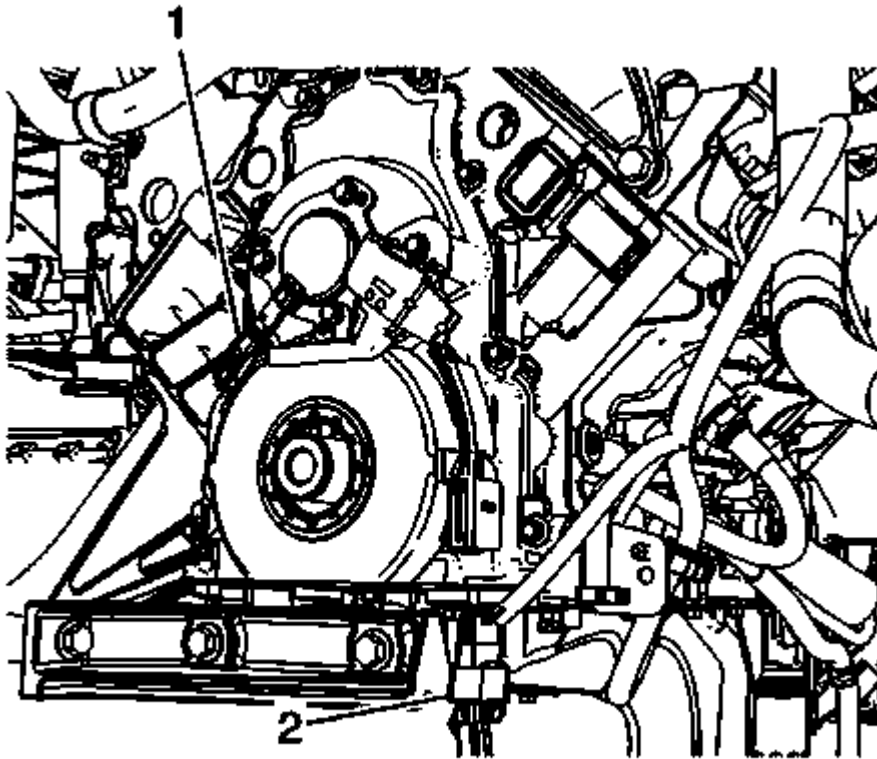


Fig. 173: CMP Sensor And Connector
Courtesy of GENERAL MOTORS CORP.

17. Position the CMP sensor.
18. Connect the engine harness electrical connector (2) to the CMP sensor wire harness electrical connector.
19. Connect the camshaft position sensor wire harness electrical connector (1) to the CMP actuator magnet.
20. Install a NEW crankshaft front oil seal. Refer to **Crankshaft Front Oil Seal Replacement (With LY6)** .
21. Install the water pump. Refer to **Water Pump Replacement** .

CAMSHAFT POSITION ACTUATOR SOLENOID VALVE REPLACEMENT

Special Tools

J 45059 Angle Meter

Removal Procedure

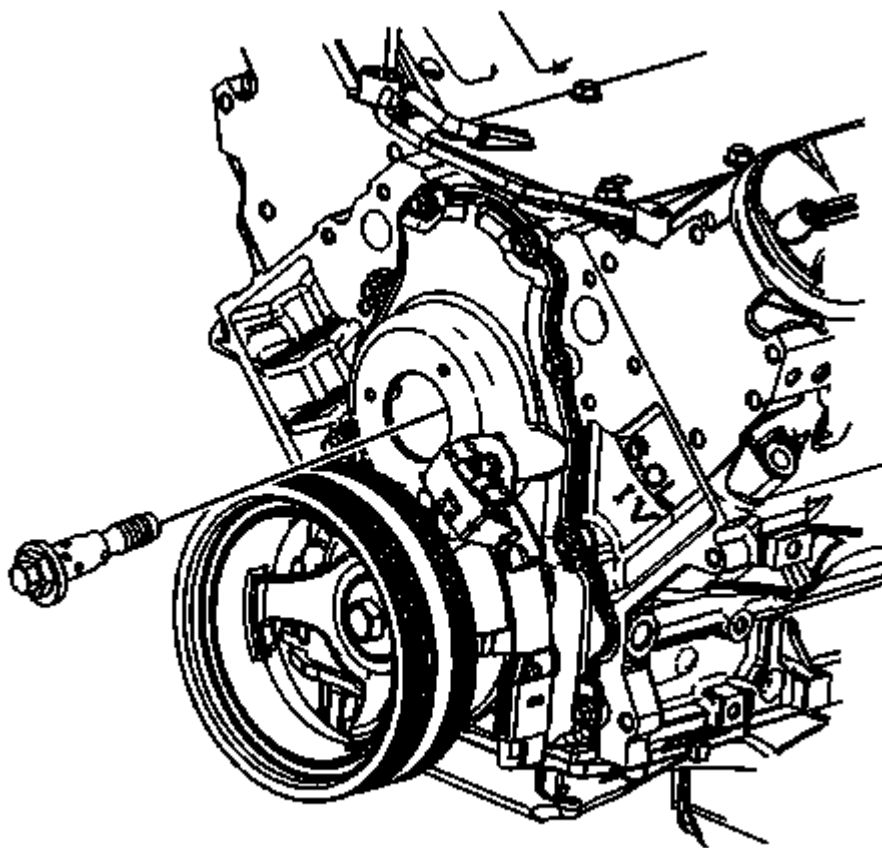


Fig. 174: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

1. Remove the camshaft position (CMP) actuator magnet. Refer to **Camshaft Position Actuator Magnet Replacement**.
2. Remove and discard the CMP actuator solenoid valve.

Installation Procedure

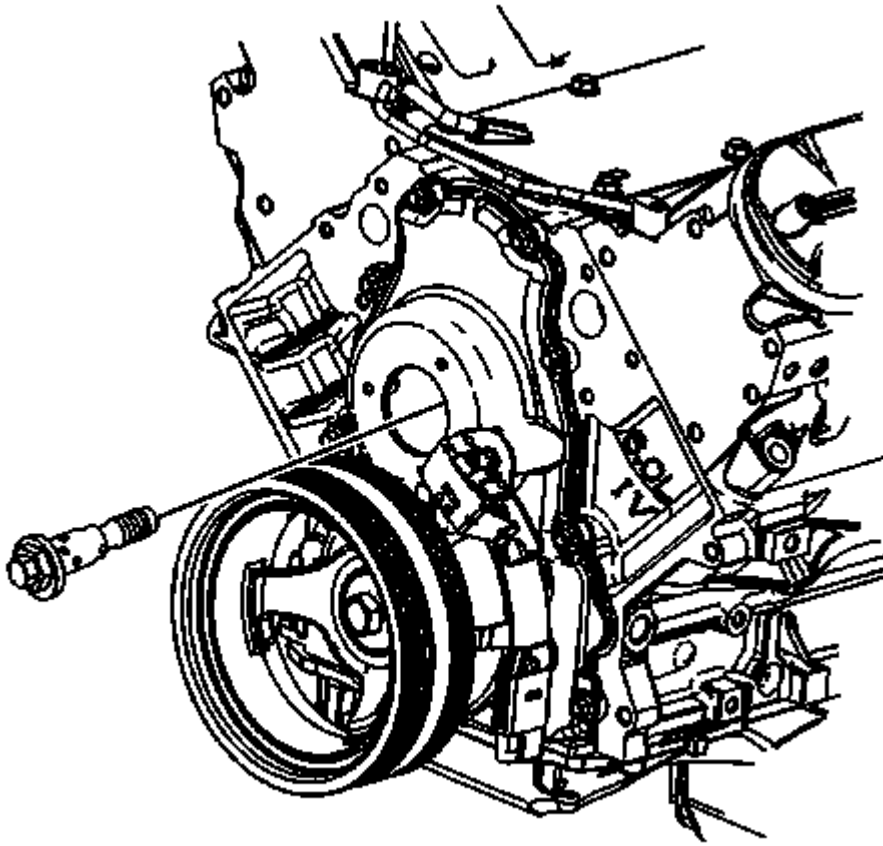


Fig. 175: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

1. Install the a NEW CMP actuator solenoid valve until snug.

With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.

CAUTION: Refer to Fastener Caution .

2. Tighten the CMP actuator solenoid valve.

Tighten

1. Tighten the solenoid valve a first pass to 65 N.m (48 lb ft).
2. Tighten the solenoid valve a final pass and additional 90 degrees using **J 45059** .
3. Install the CMP actuator magnet. Refer to **Camshaft Position Actuator Magnet Replacement**.

CAMSHAFT POSITION ACTUATOR REPLACEMENT

Special Tools

- **EN 46330** Timing Belt Tensioner Retaining Pin
- **J 45059** Angle Meter

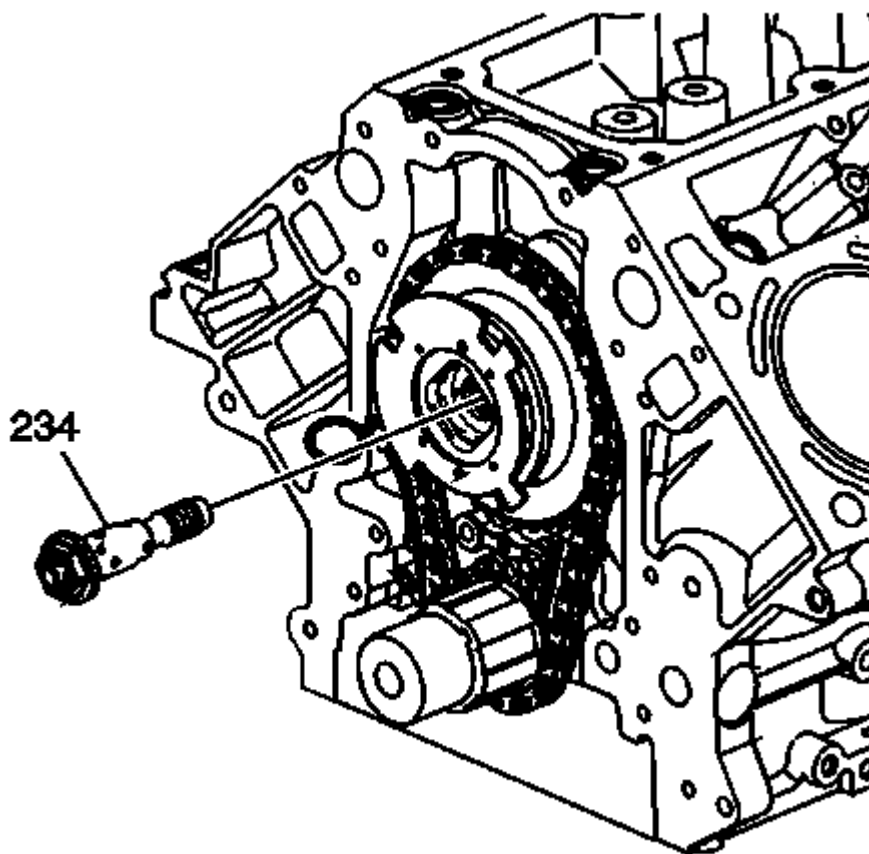
Removal Procedure

Fig. 176: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pump. Refer to **Oil Pump, Screen, and Crankshaft Oil Deflector Replacement**.
2. Remove and discard the camshaft position (CMP) actuator solenoid valve (234).

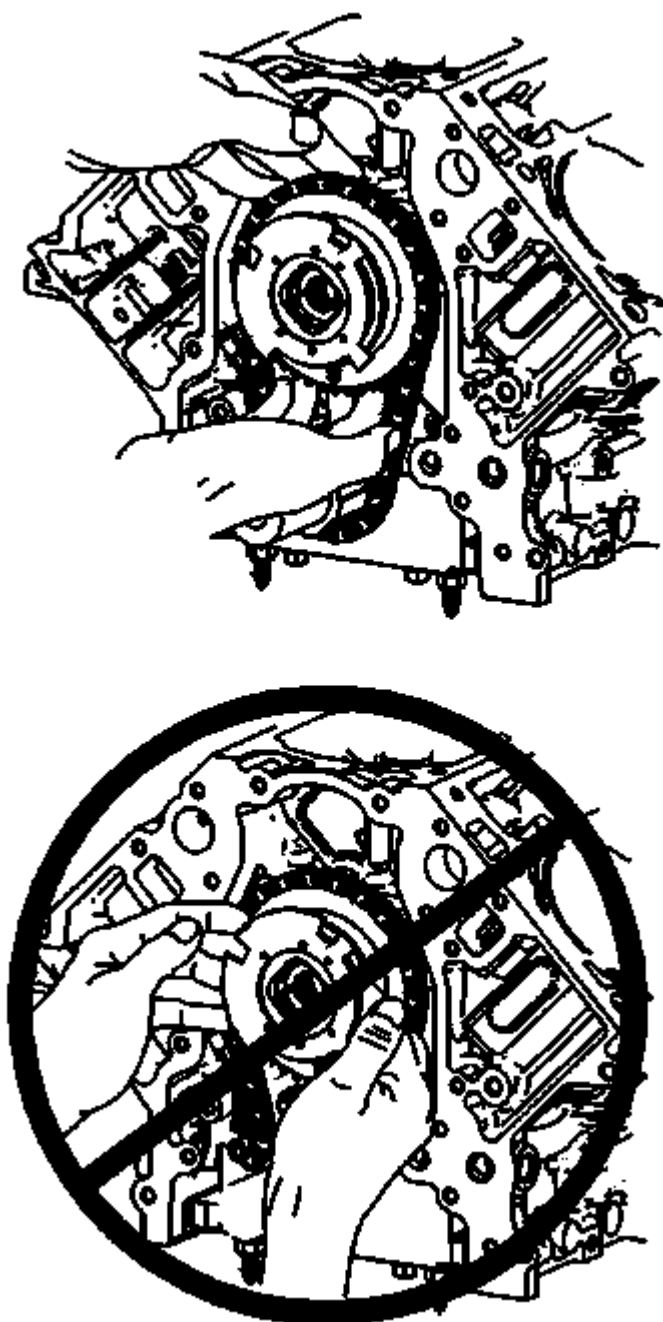


Fig. 177: Proper CMP Actuator Removal
Courtesy of GENERAL MOTORS CORP.

WARNING: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator return spring is under tension and may rotate the dislodged reluctor wheel, causing personal injury.

3. Loosen and separate the CMP actuator and timing chain from the camshaft. Position your fingers behind the actuator sprocket and pull the actuator away from the front of the camshaft. Never pull on the reluctor wheel when attempting to remove the actuator.

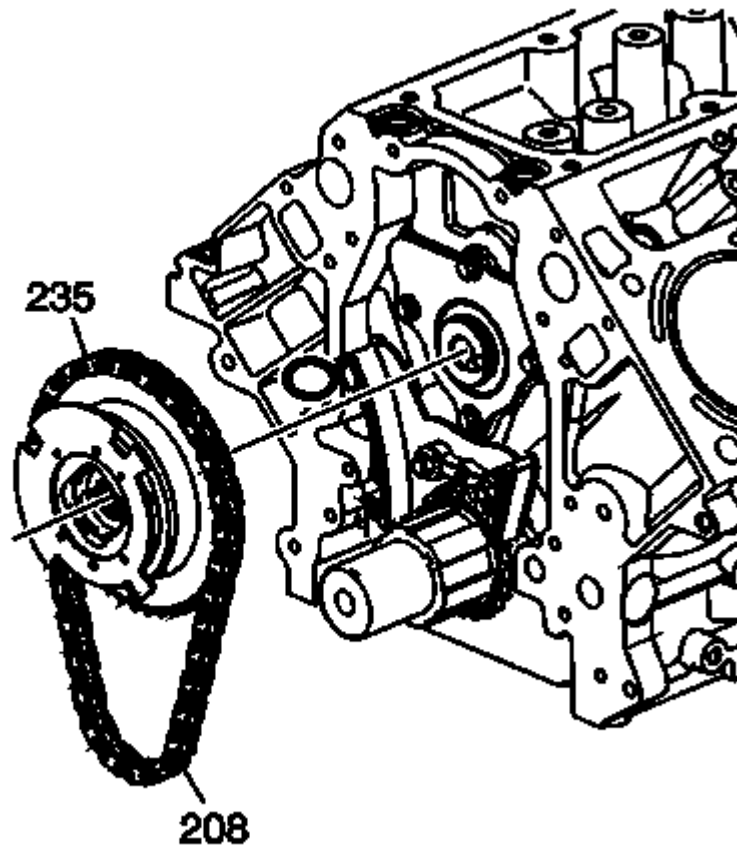


Fig. 178: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

4. Remove the CMP actuator (235) and timing chain (208).

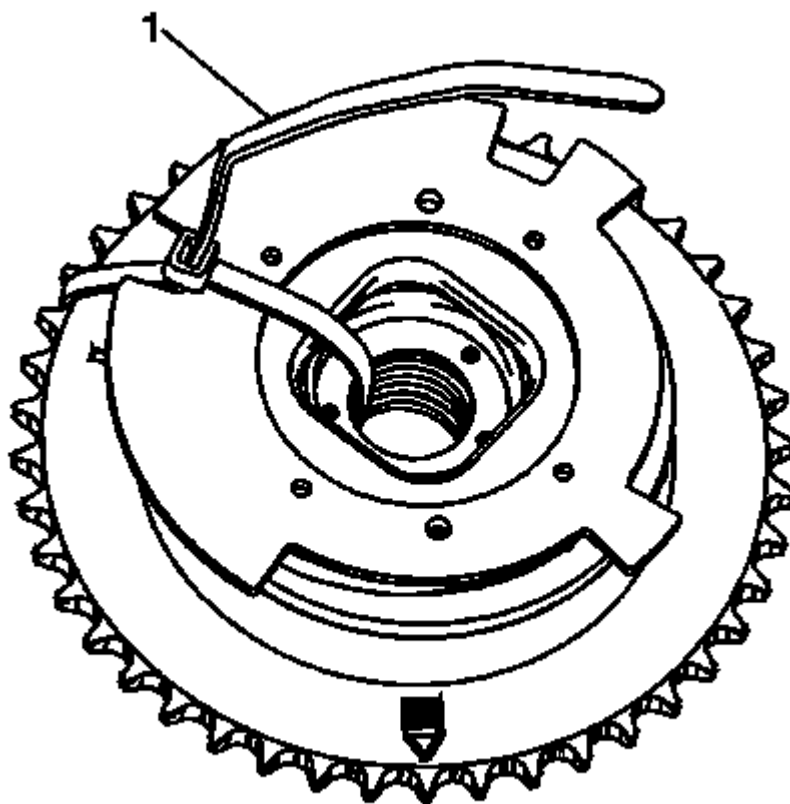


Fig. 179: Tie Strap Through Center Of Actuator
Courtesy of GENERAL MOTORS CORP.

5. Insert and secure a tie strap (1) through the center of the actuator and over the reluctor wheel.

Installation Procedure

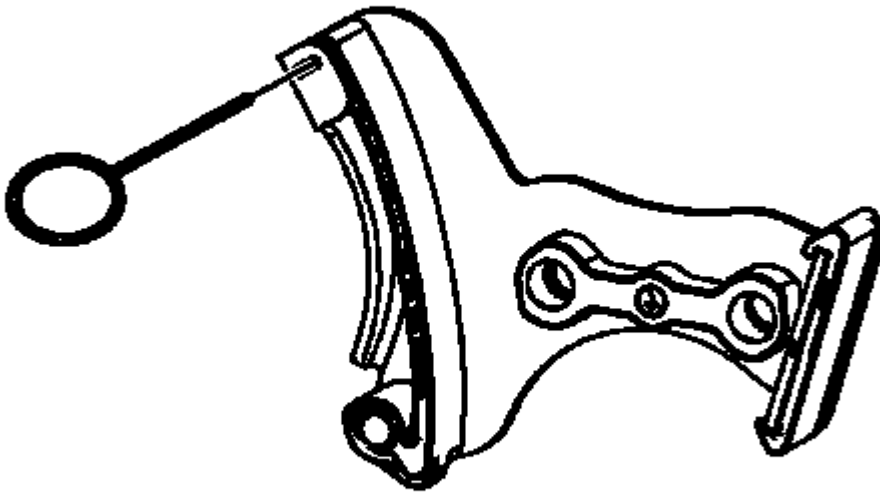


Fig. 180: Timing Belt Tensioner Retaining Pin
Courtesy of GENERAL MOTORS CORP.

1. Compress the timing chain tensioner guide and install the EN 46330 .

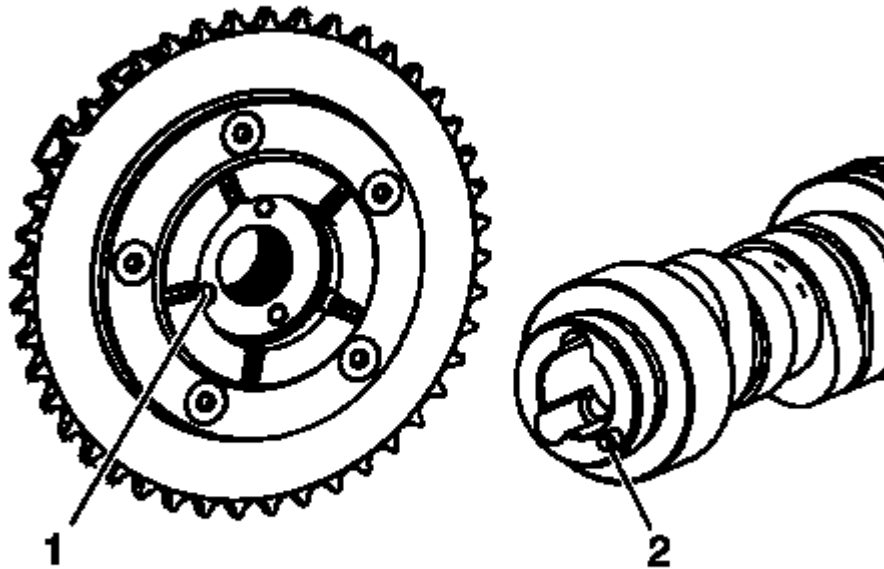


Fig. 181: Alignment Hole And Locating Pin
Courtesy of GENERAL MOTORS CORP.

NOTE:

- Properly locate the CMP actuator on the locating pin of the camshaft.
- The sprocket teeth and timing chain must mesh.
- The camshaft and the crankshaft sprocket alignment marks **MUST** be aligned properly.
- **DO NOT** use the CMP solenoid valve again. Install a **NEW** valve during assembly.

2. Identify the alignment hole (1) in the rear face of the CMP actuator and the locating pin (2) on the front face of the camshaft.

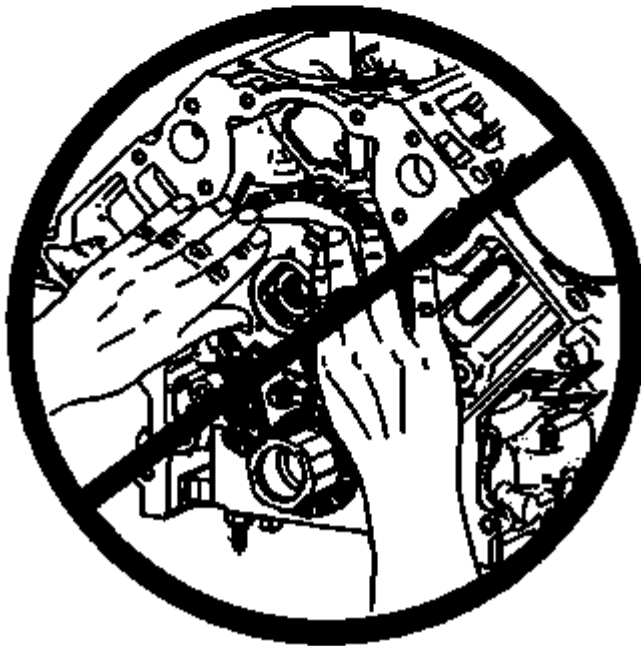


Fig. 182: Proper Installation Of CMP Actuator
Courtesy of GENERAL MOTORS CORP.

WARNING: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator return spring is under tension and may rotate the dislodged reluctor wheel, causing personal injury.

3. Install the CMP actuator and timing chain. Align the hole in the rear face of the CMP actuator with the locating pin on the front face of the camshaft. If necessary, rotate the camshaft or crankshaft sprockets in order to align the timing marks. Use care to install the actuator completely onto the front of the camshaft. Position your fingers onto the face of the actuator sprocket and push the actuator onto the front of the camshaft. Never push on the reluctor wheel when attempting to install the actuator.

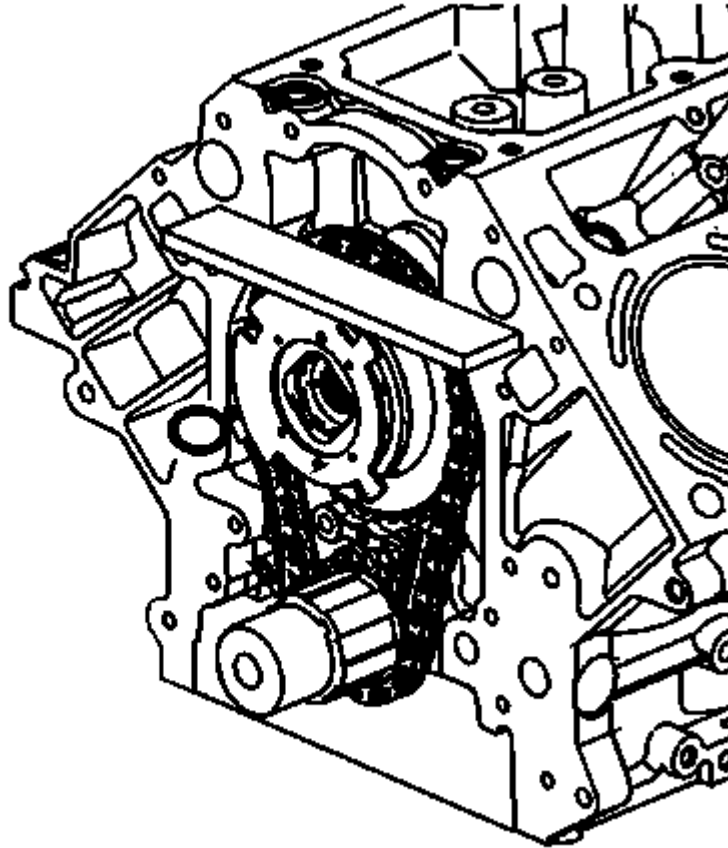


Fig. 183: Inspecting Installation Of CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

4. Place a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and completely installed onto the front of the camshaft, the timing chain will not protrude beyond the front face of the engine block.

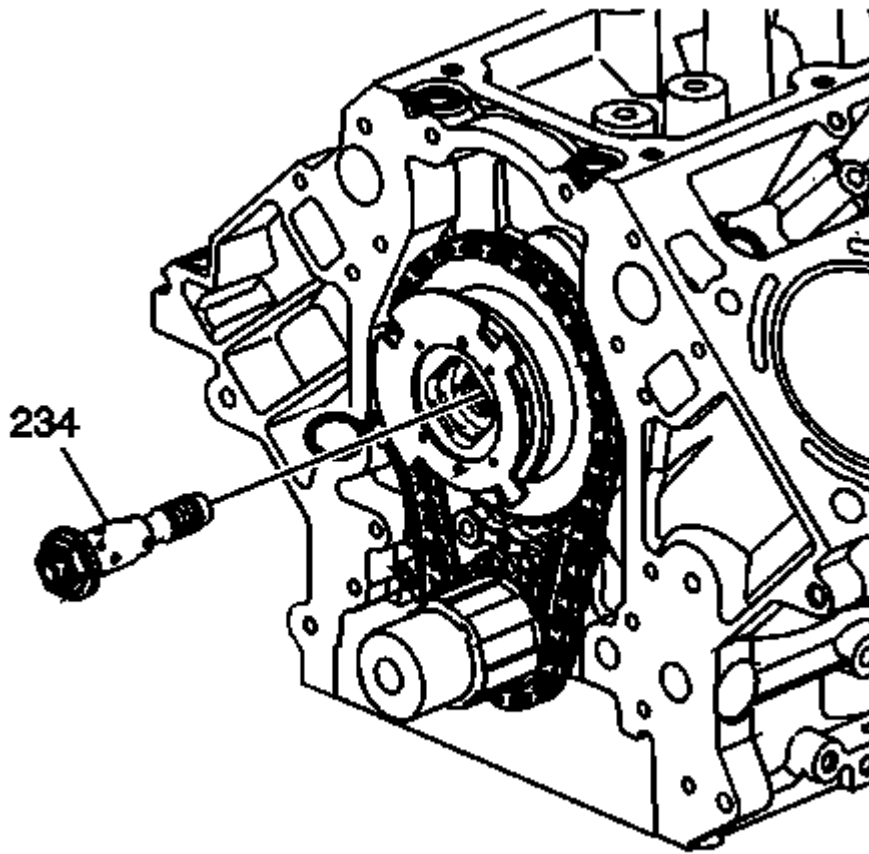


Fig. 184: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

5. Install a NEW CMP actuator solenoid valve (234). With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.

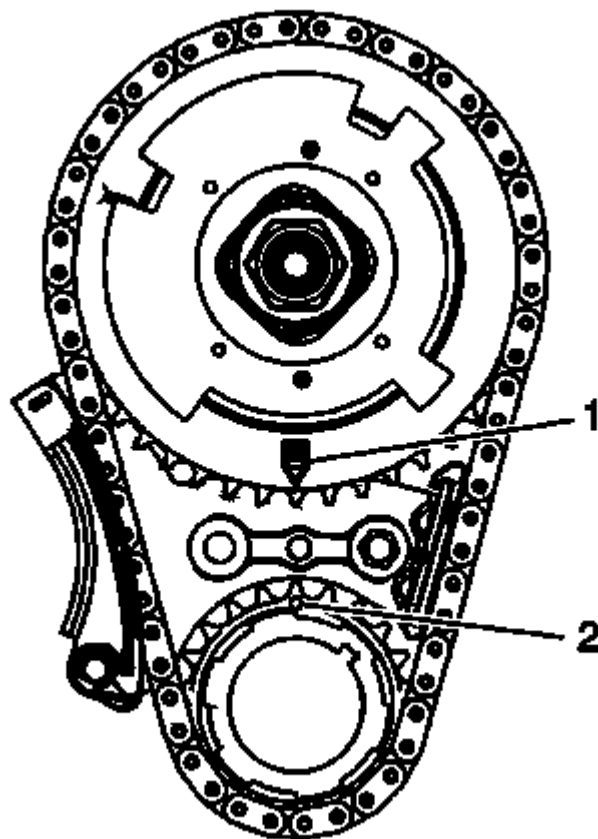


Fig. 185: CMP Actuator Sprocket And Crankshaft Sprocket Alignment Marks
Courtesy of GENERAL MOTORS CORP.

6. Inspect the sprockets for proper alignment. The mark on the CMP actuator sprocket (1) should be located in the 6 o'clock position and the mark on the crankshaft sprocket (2) should be located in the 12 o'clock position.

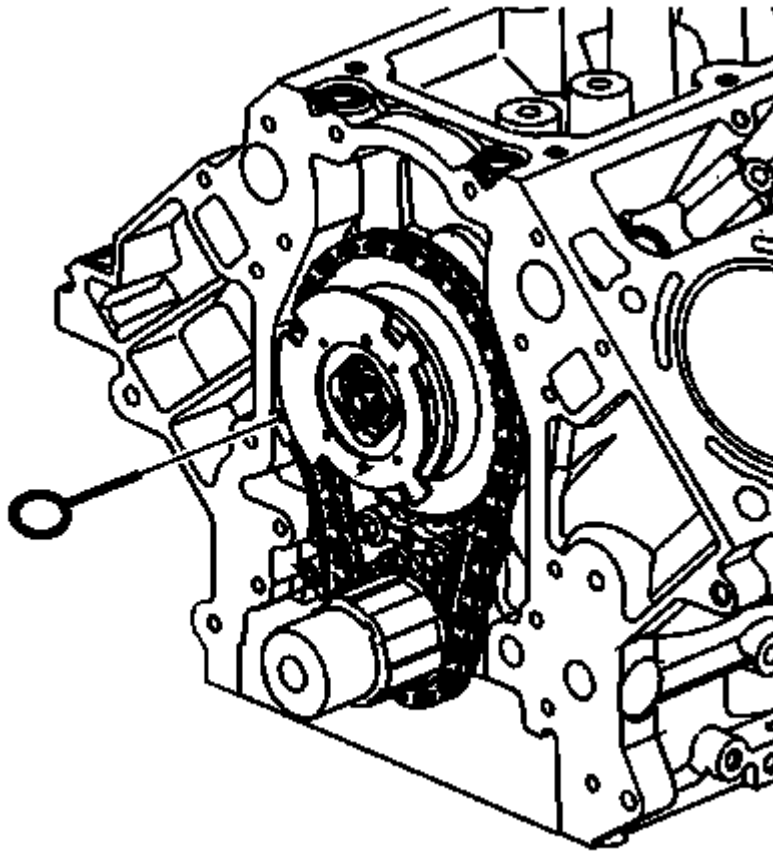


Fig. 186: Timing Belt Tensioner Retaining Pin
Courtesy of GENERAL MOTORS CORP.

7. Remove the EN 46330 .

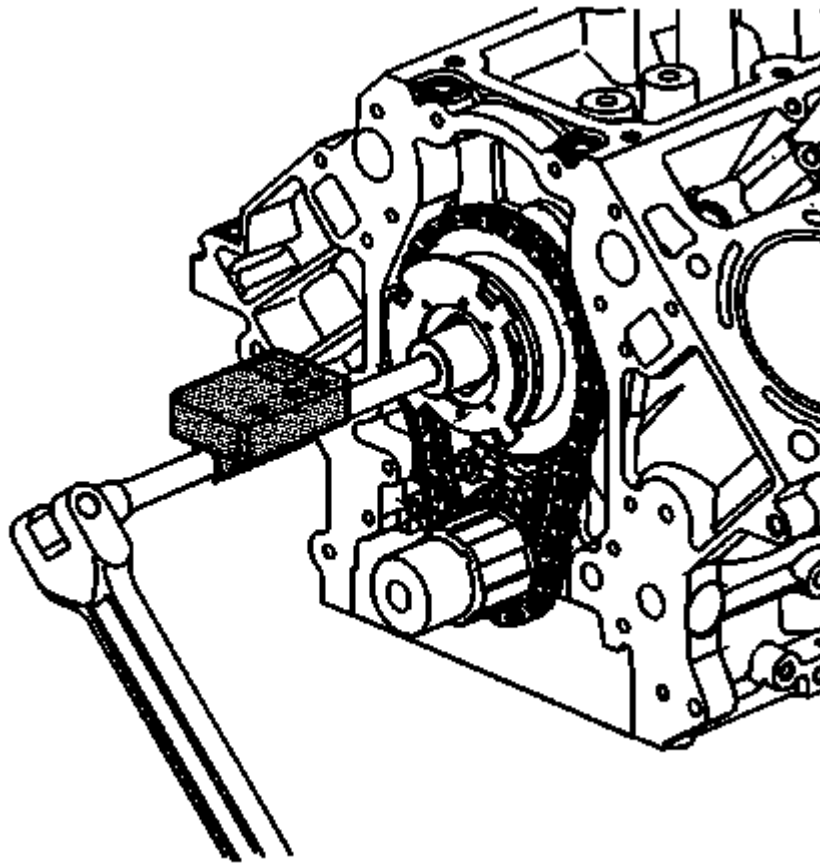


Fig. 187: Tightening CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

8. Tighten the CMP actuator solenoid valve.

Tighten

1. Tighten the valve a first pass to 65 N.m (48 lb ft).
2. Tighten the valve a final pass and additional 90 degrees using **J 45059** .
9. Install the oil pump. Refer to Oil Pump, Screen, and Crankshaft Oil Deflector Replacement.

CRANKSHAFT REAR OIL SEAL REPLACEMENT

Special Tools

J 41479 Crankshaft Rear Oil Seal Installer

Removal Procedure

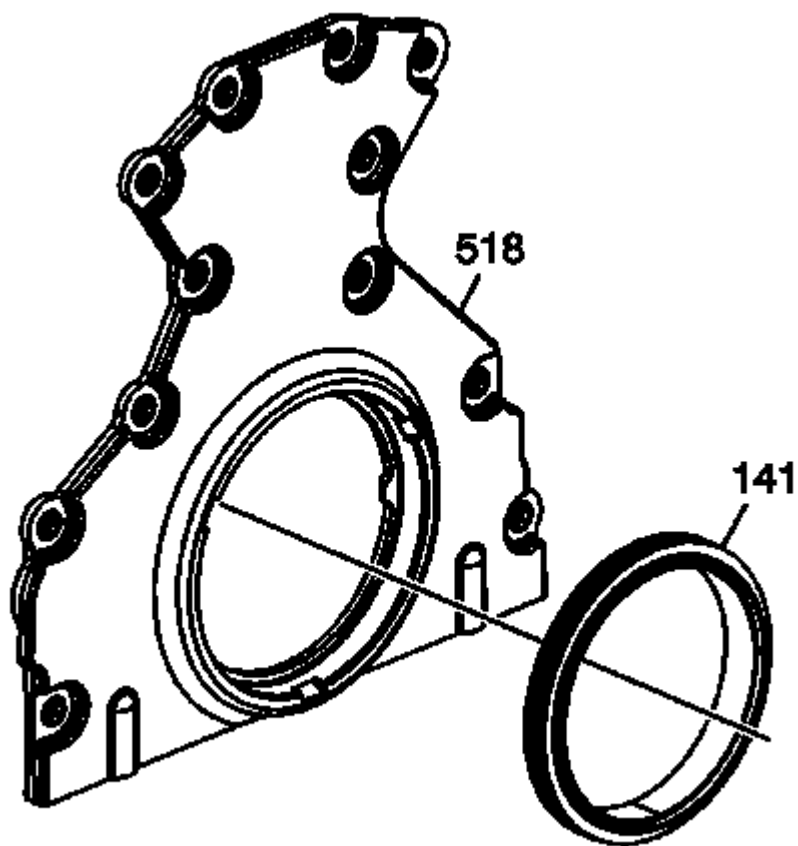


Fig. 188: Crankshaft Rear Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the automatic transmission flexplate, refer to **Automatic Transmission Flex Plate Replacement**.
2. Remove and discard the crankshaft rear oil seal (141).

Installation Procedure

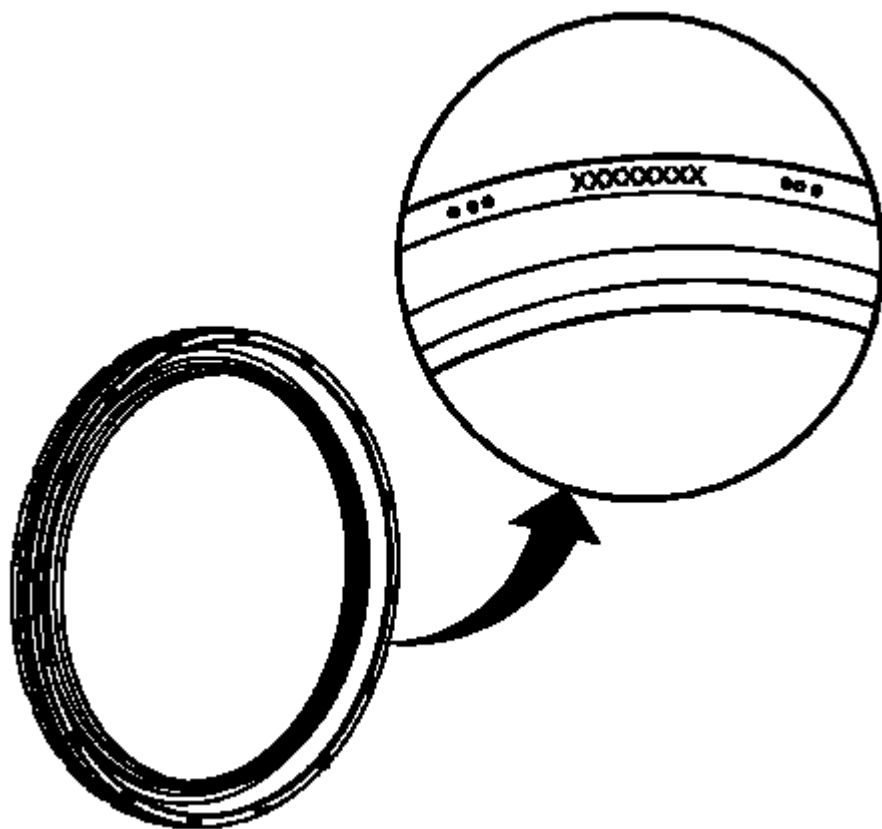


Fig. 189: Oil Seal Orientation

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: For proper orientation, note the installation direction of the oil seal. The oil seal is a reverse-lip design. The part number is applied to the outside face of the seal, as shown.

1. Inspect the seal and identify the part number markings for proper orientation.

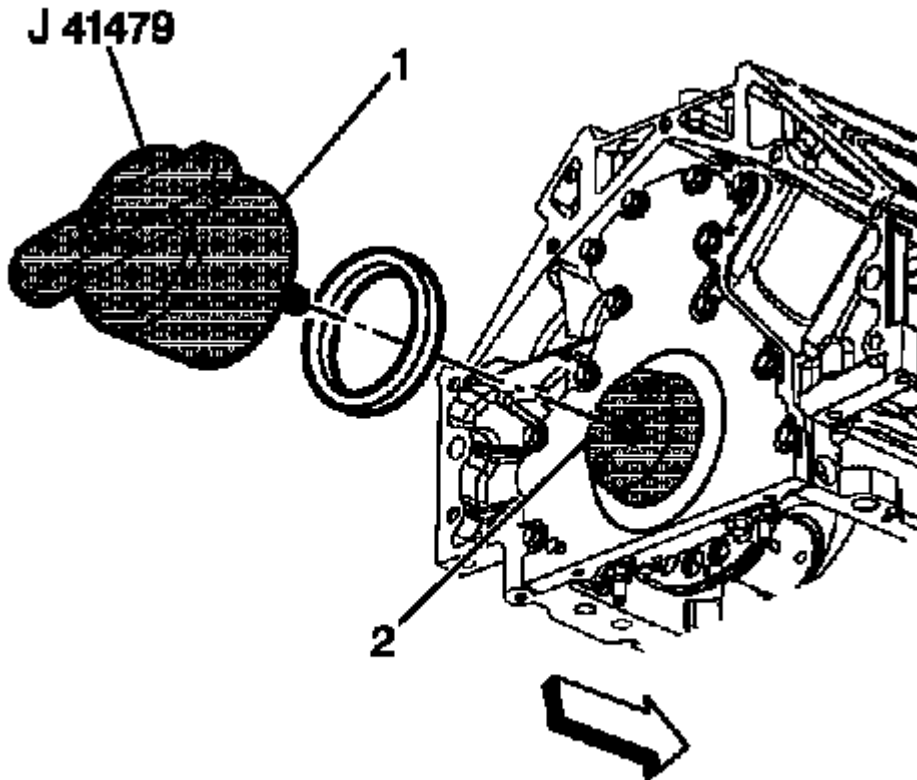


Fig. 190: Tapered Cone And Tool
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 41479** crankshaft rear oil seal installer cone (2) and bolts onto the rear of the crankshaft.
3. Tighten the bolts until snug. Do not overtighten.
4. Install the rear oil seal onto the tapered cone (2) and push the seal to the rear seal bore. Install the oil seal with the part number markings facing away from the engine.
5. Thread the **J 41479** crankshaft rear oil seal installer threaded rod into the tapered cone until the tool (1) contacts the oil seal.
6. Align the oil seal into the tool (1).
7. Rotate the handle of the tool (1) clockwise until the seal enters the rear cover and bottoms into the cover bore.
8. Remove the **J 41479** crankshaft rear oil seal installer.
9. Install the automatic transmission flexplate. refer to **Automatic Transmission Flex Plate Replacement** .

CRANKSHAFT REAR OIL SEAL HOUSING REPLACEMENT

Special Tools

- **J 41476** Front and Rear Cover Alignment Tool
- **J 41479-2A** Crankshaft Rear Oil Seal Installation Guide

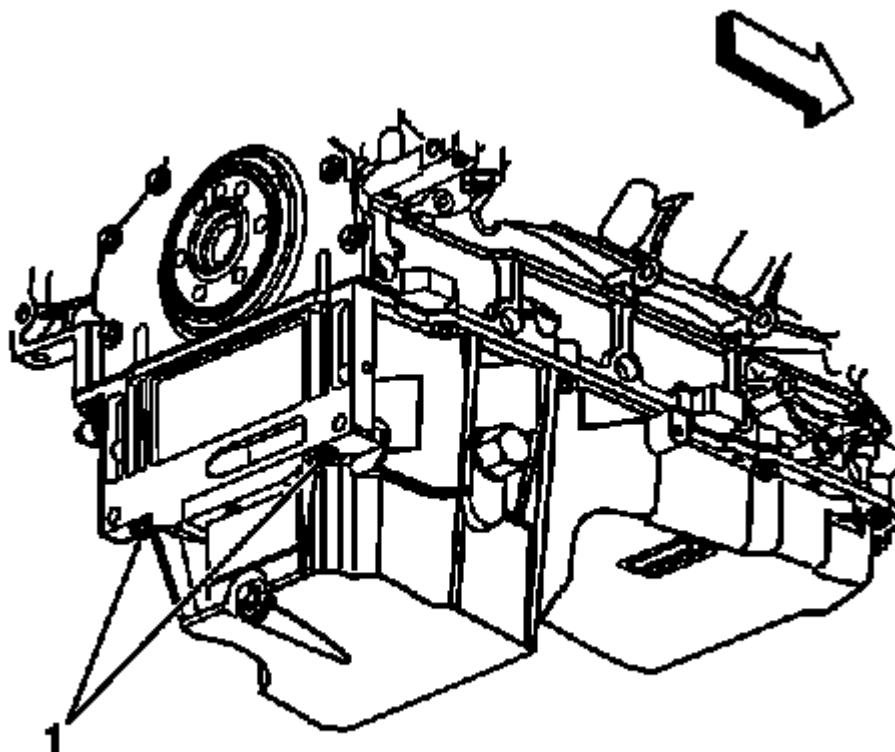
Removal Procedure

Fig. 191: Oil Pan-To-Rear Cover Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the automatic transmission flexplate. Refer to **Automatic Transmission Flex Plate Replacement**.
2. Remove the oil pan-to-rear oil seal housing bolts (1).

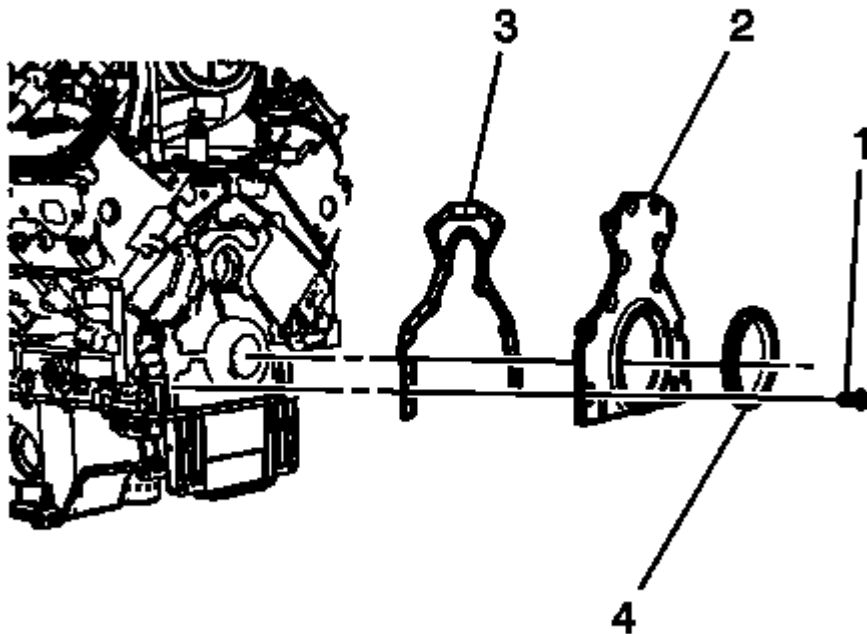


Fig. 192: Rear Oil Seal Housing Components
Courtesy of GENERAL MOTORS CORP.

3. Remove the rear oil seal housing bolts (1).
4. Remove the rear oil seal housing (2) and gasket (3). Discard the gasket.
5. Remove and discard the rear oil seal (4).

Installation Procedure

NOTE:

- Do not reuse the crankshaft oil seal or rear cover gasket.
- Do not apply any type of sealant to the rear cover gasket, unless specified.
- The special tool in this procedure is used to properly center the crankshaft rear oil seal.
- All gasket surfaces should be free of oil or other foreign material during assembly.
- The crankshaft rear oil seal **MUST** be centered in relation to the crankshaft.
- An improperly aligned rear cover may cause premature rear oil seal

wear and/or engine assembly oil leaks.

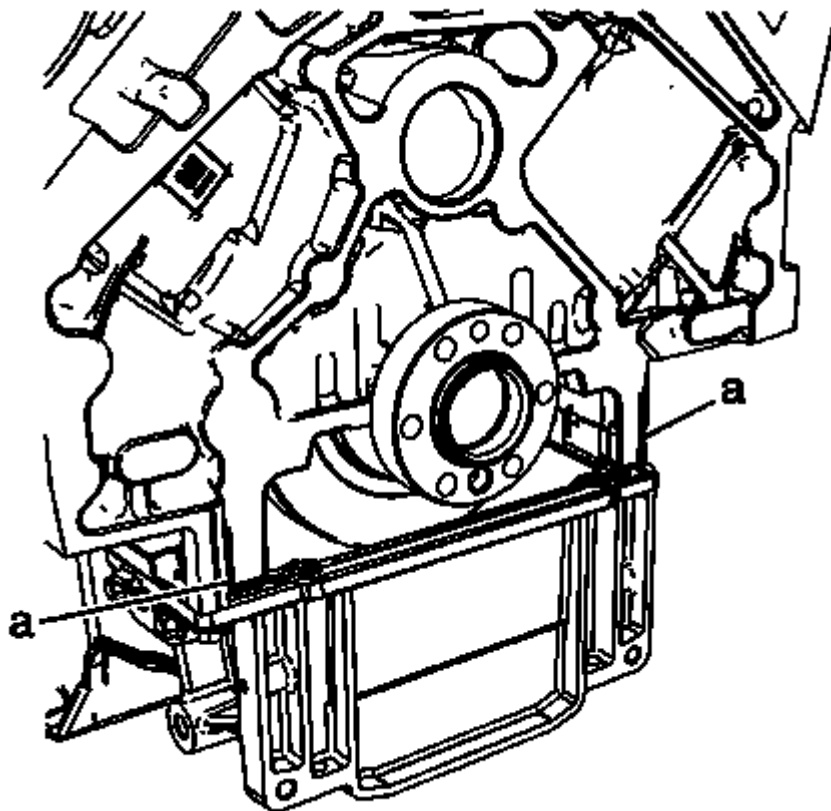


Fig. 193: Applying Sealant To Joints At Rear Of Block/Pan
Courtesy of GENERAL MOTORS CORP.

1. Apply a 5 mm (0.2 in) bead of sealant, 20 mm (0.8 in) to the 2 joints (a) at the rear of the block/pan. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

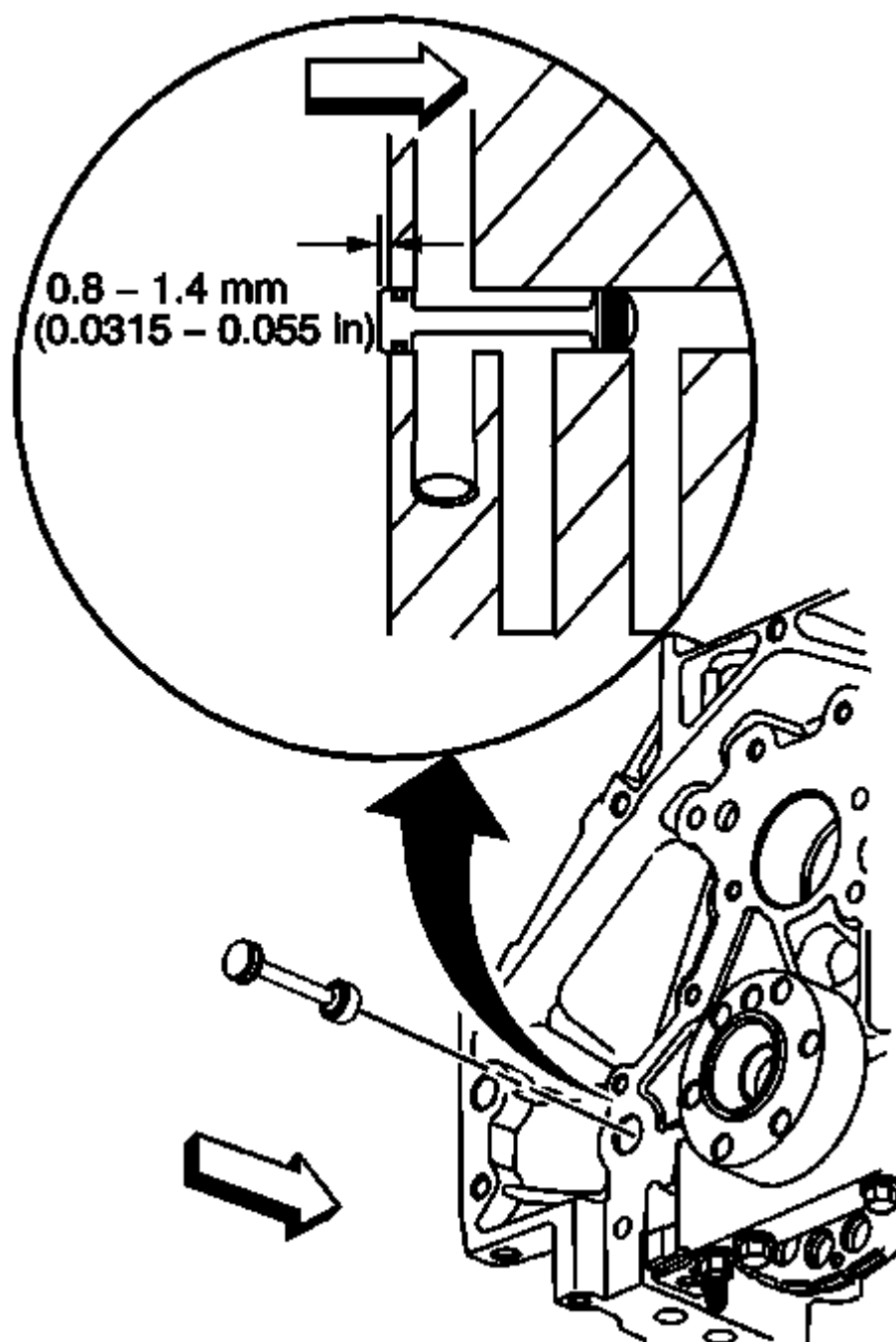


Fig. 194: Engine Block Rear Oil Gallery Plug
 Courtesy of GENERAL MOTORS CORP.

2. Inspect the rear oil gallery plug for proper installation.

Installation Procedure - Cover with Seal

1. Install the **J 41479-2A** cone and bolts onto the rear of the crankshaft.

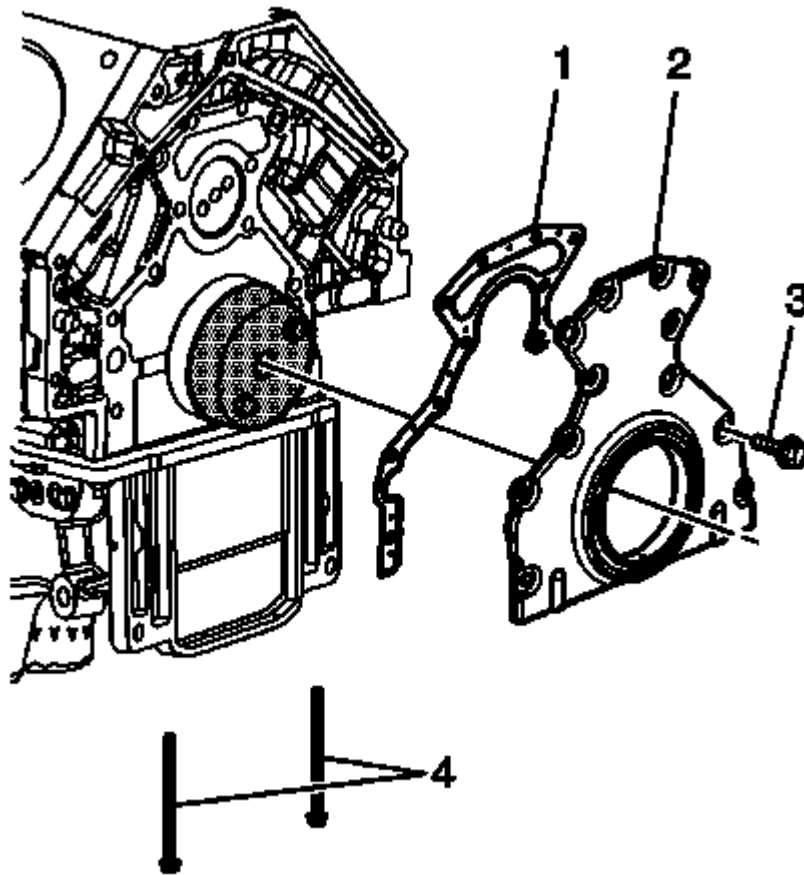


Fig. 195: Rear Housing Components
Courtesy of GENERAL MOTORS CORP.

2. Install the NEW rear housing gasket (1), rear housing with seal (2), rear housing-to-engine bolts (3) and oil pan-to-rear housing bolts (4).

CAUTION: Refer to Fastener Caution .

3. Tighten the rear housing-to-engine bolts (3) until snug. Do not overtighten.

Tighten

Tighten the oil pan-to-rear housing bolts (4) to 12 N.m (106 lb in).

4. Tighten the rear housing-to-engine bolts (3).

Tighten

Tighten the bolts to 30 N.m (22 lb ft).

5. Remove the **J 41479-2A** .
6. Install the automatic transmission flexplate. Refer to **Automatic Transmission Flex Plate Replacement**.

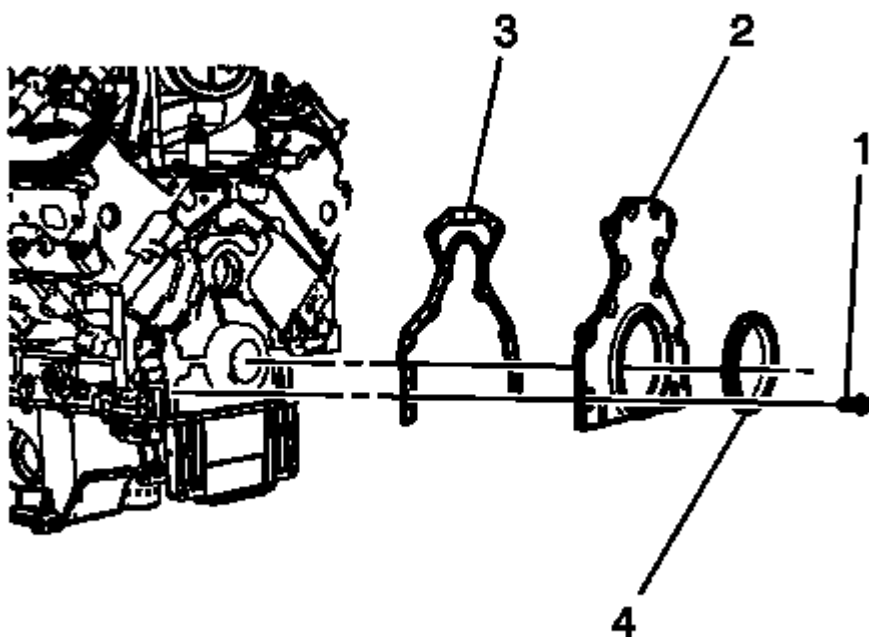
Installation Procedure - Cover without Seal

Fig. 196: Rear Oil Seal Housing Components
Courtesy of GENERAL MOTORS CORP.

1. Position a NEW rear oil seal housing gasket (3) and the housing (2) to the engine.
2. Install the rear oil seal housing bolts (1) until snug. Do not overtighten.
3. Rotate the crankshaft until 2 opposing flywheel bolts holes are parallel to the oil pan surface.

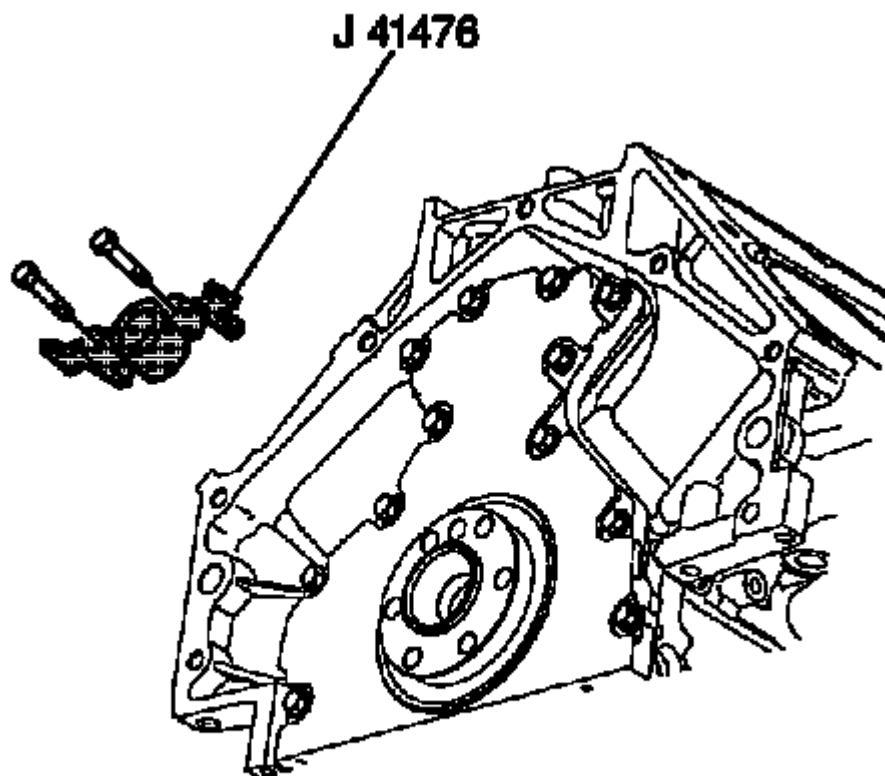


Fig. 197: Housing Alignment Tool
Courtesy of GENERAL MOTORS CORP.

NOTE: The tapered legs of the alignment tool must enter the rear cover oil seal bore.

4. Install the **J 41476** and bolts onto the rear of the crankshaft.
5. Tighten the **J 41476** bolts until snug. Do not overtighten.

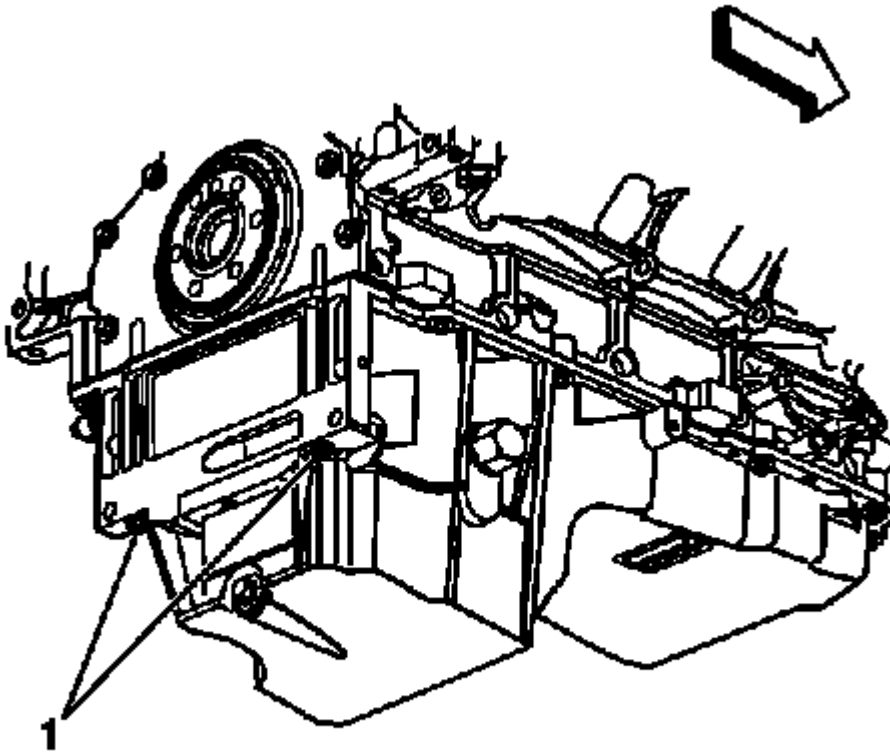


Fig. 198: Oil Pan-To-Rear Cover Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the oil pan-to-rear oil seal housing bolts (1).

Tighten

1. Tighten the oil pan-to-rear cover bolts to 12 N.m (106 lb in).
 2. Tighten the rear oil seal housing-to-engine bolts to 30 N.m (22 lb ft).
7. Remove the **J 41476**.
 8. Install a NEW crankshaft rear oil seal. Refer to **Crankshaft Rear Oil Seal Replacement**.
 9. Install the automatic transmission flexplate. Refer to **Automatic Transmission Flex Plate Replacement**.

OIL FILTER ADAPTER REPLACEMENT

Removal Procedure

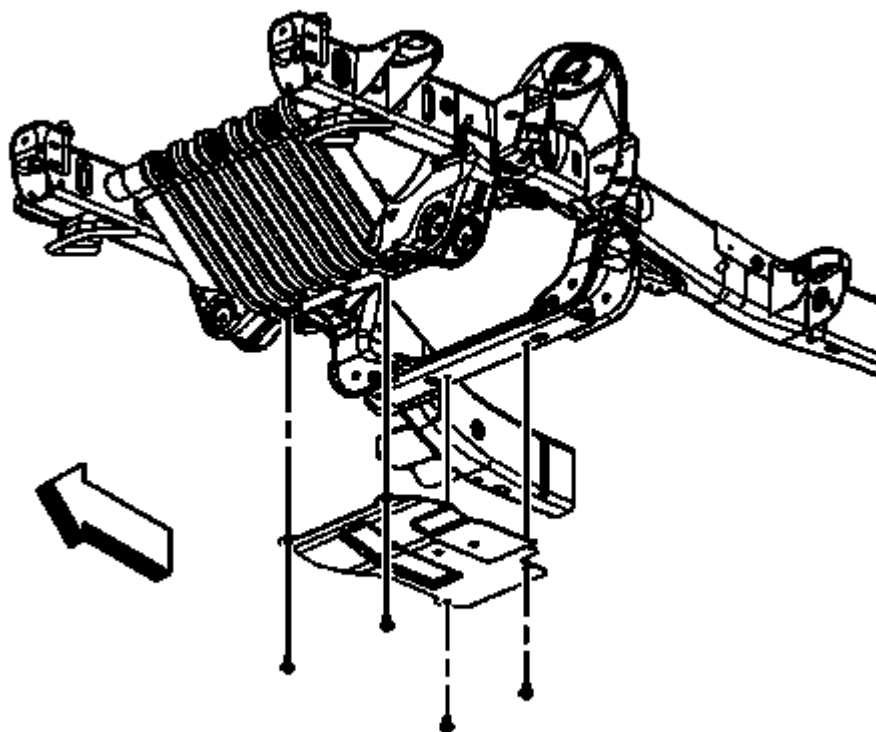


Fig. 199: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. For 1500 series vehicles, remove the oil pan skid plate bolts and skid plate, if equipped.

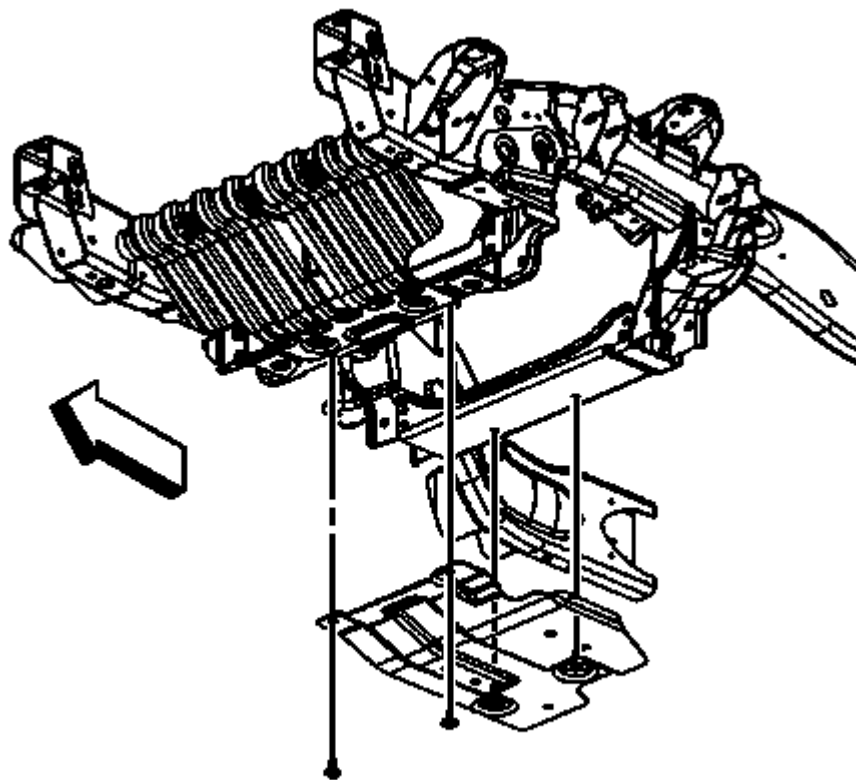


Fig. 200: Oil Pan Skid Plate

Courtesy of GENERAL MOTORS CORP.

3. For 2500 series vehicles, loosen the 2 rear oil pan skid plate bolts, remove the 2 front oil pan skid plate bolts and skid plate, if equipped.

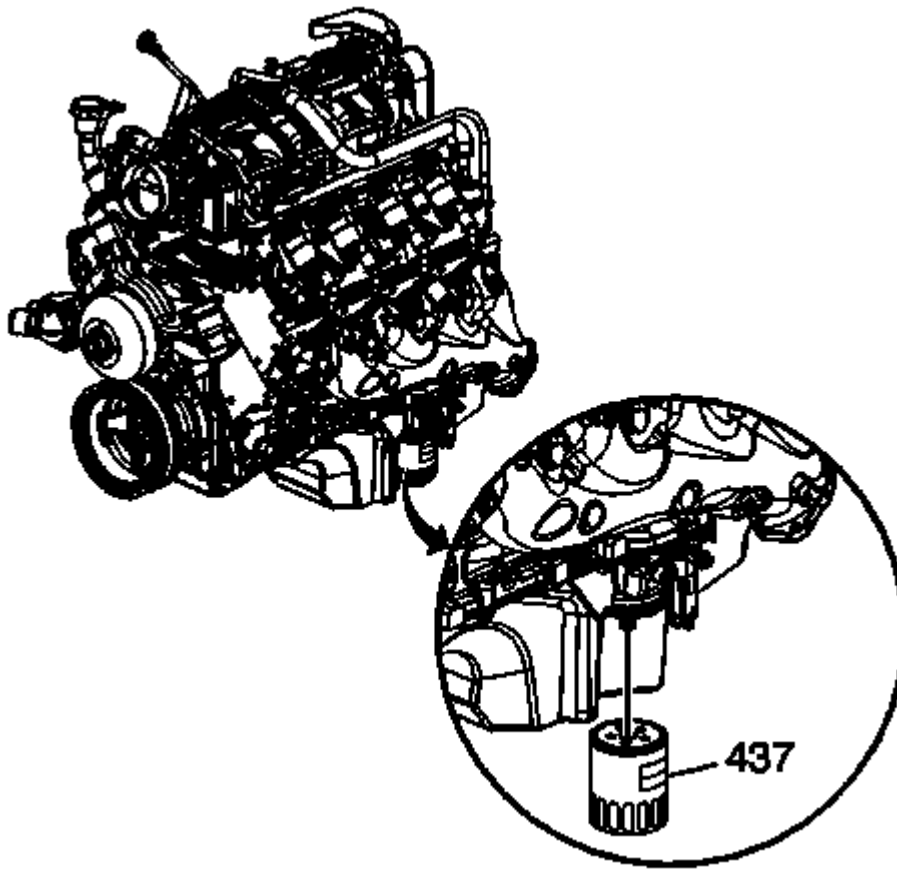


Fig. 201: Engine Oil Filter

Courtesy of GENERAL MOTORS CORP.

4. Place a suitable drain pan under the oil filter.
5. Remove the oil filter (437).

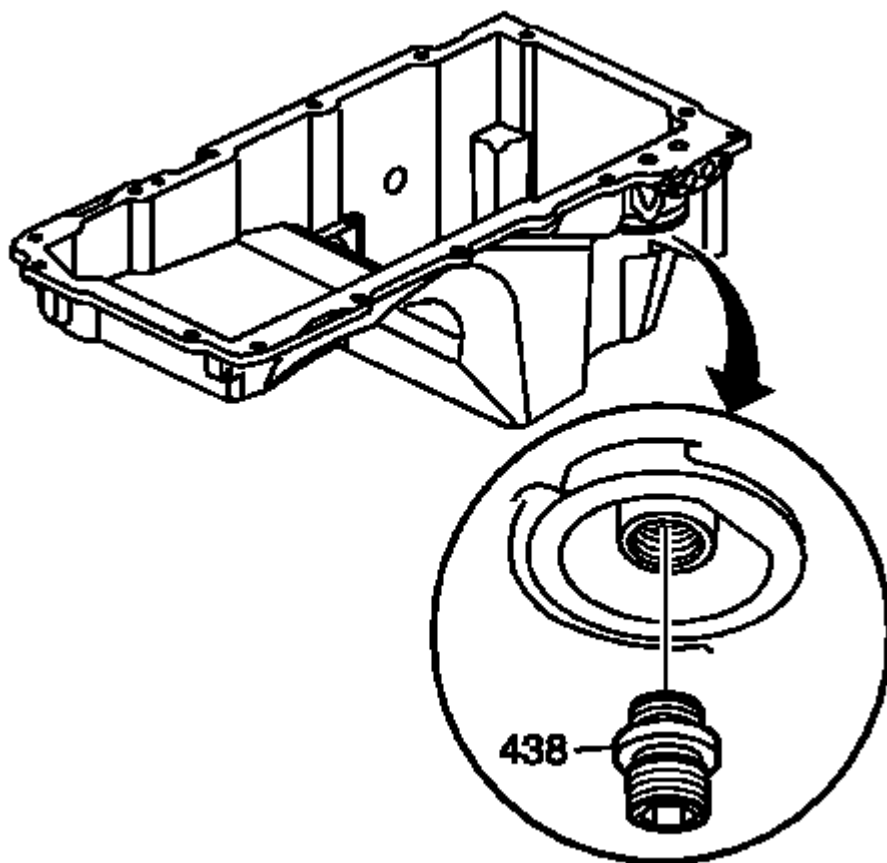


Fig. 202: Oil Filter Fitting

Courtesy of GENERAL MOTORS CORP.

6. Remove the oil filter adapter (438).

Installation Procedure

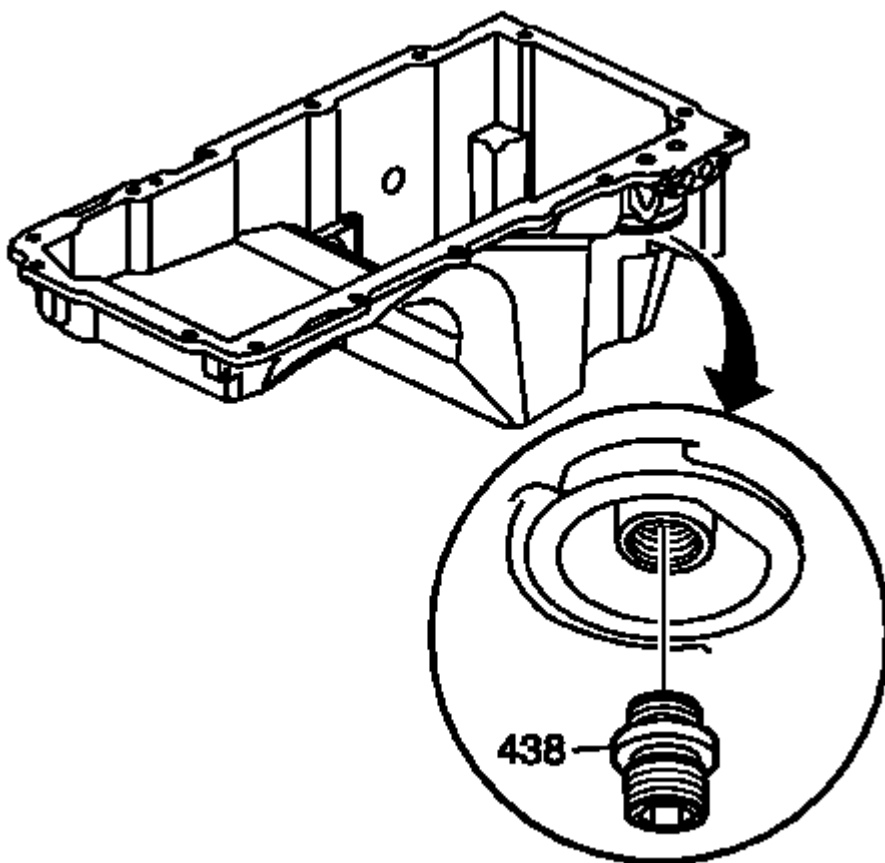


Fig. 203: Oil Filter Fitting

Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the oil filter adapter (438).

Tighten

Tighten the adapter to 55 N.m (40 lb ft).

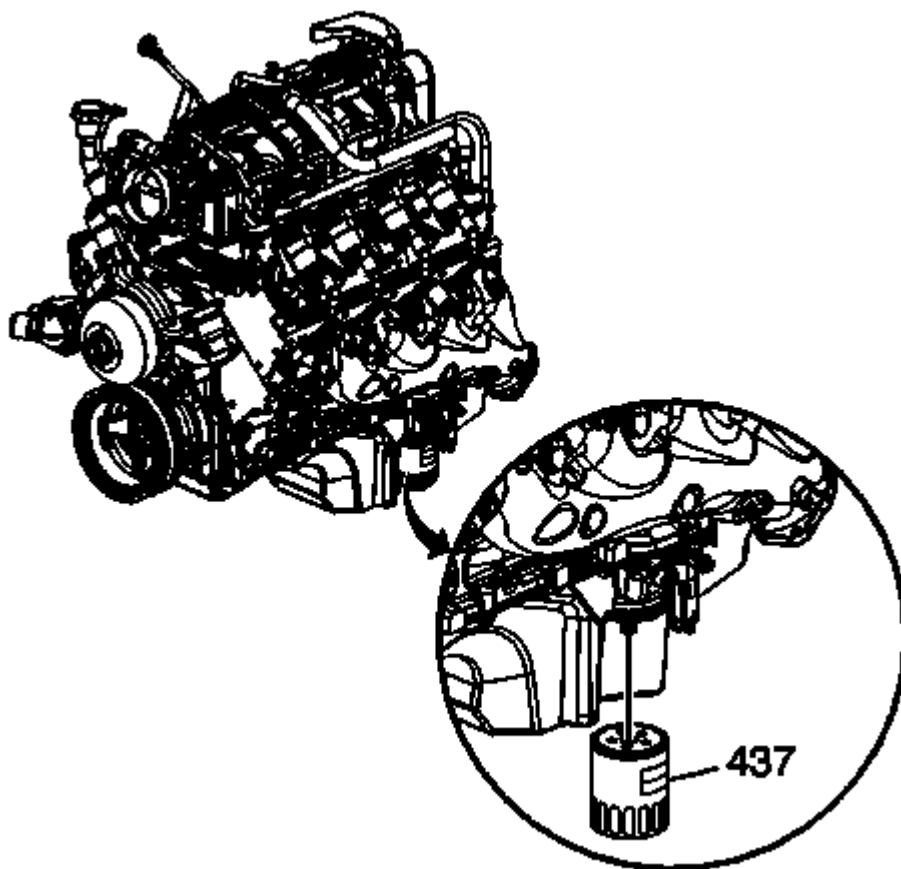


Fig. 204: Engine Oil Filter

Courtesy of GENERAL MOTORS CORP.

2. Lubricate the oil filter seal with clean engine oil.
3. Install the oil filter (437).

Tighten

Tighten the filter to 30 N.m (22 lb ft).

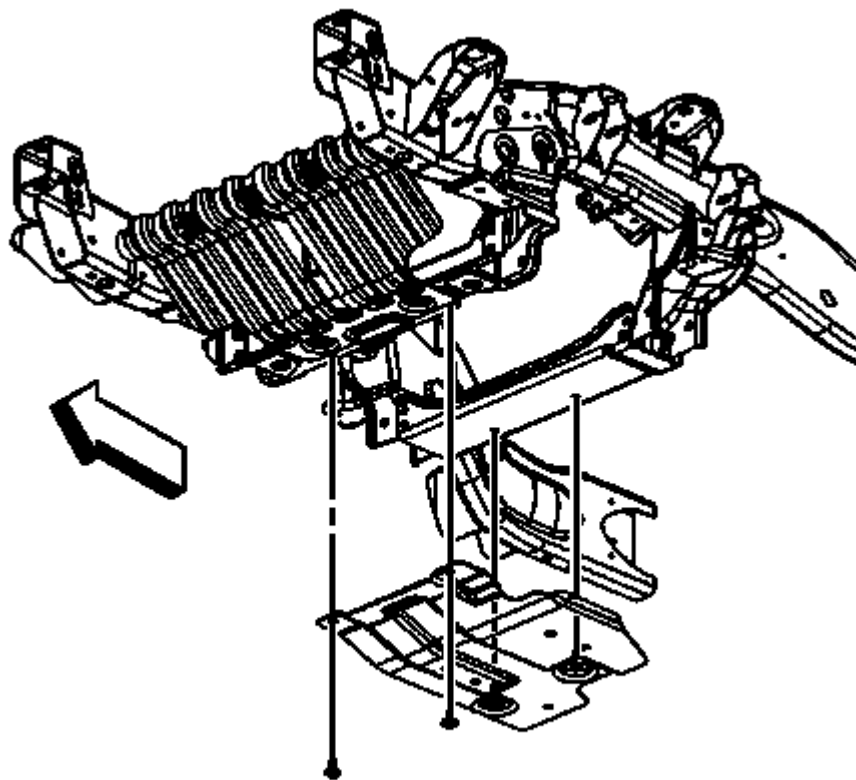


Fig. 205: Oil Pan Skid Plate

Courtesy of GENERAL MOTORS CORP.

4. For 2500 series vehicles, position the oil pan skid plate and tighten until snug the 2 rear oil pan skid plate bolts, install the 2 front oil pan skid plate bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

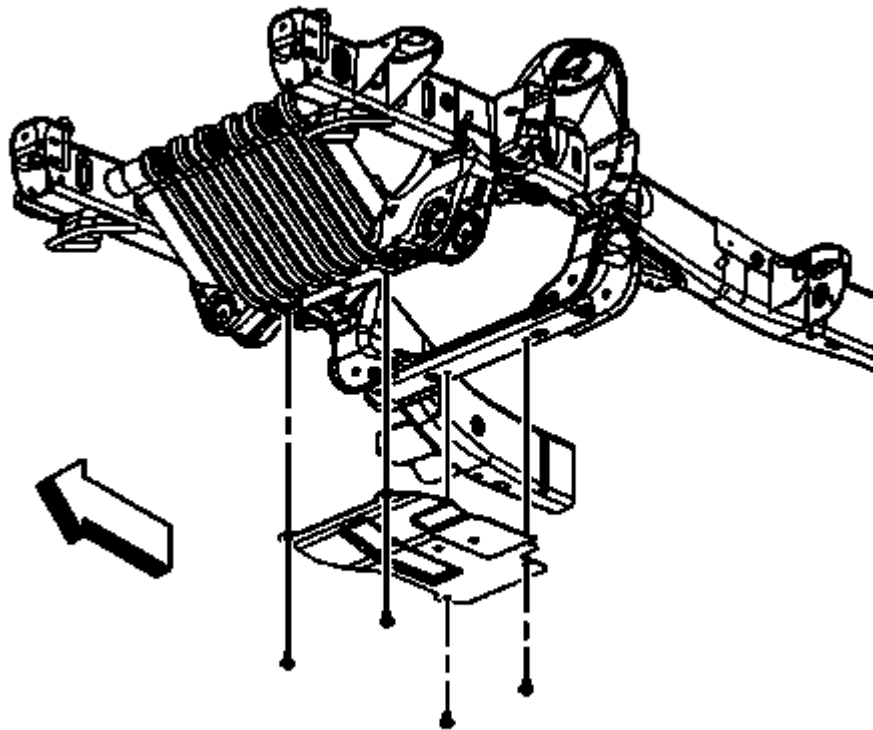


Fig. 206: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

5. For 1500 series vehicles, position the oil pan skid plate and install the oil pan skid plate bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

6. Lower the vehicle.
7. Refill the engine oil. Refer to **Approximate Fluid Capacities** , and/or **Fluid and Lubricant Recommendations** .
8. Start the engine and inspect for leaks.

OIL PAN COVER REPLACEMENT

Removal Procedure

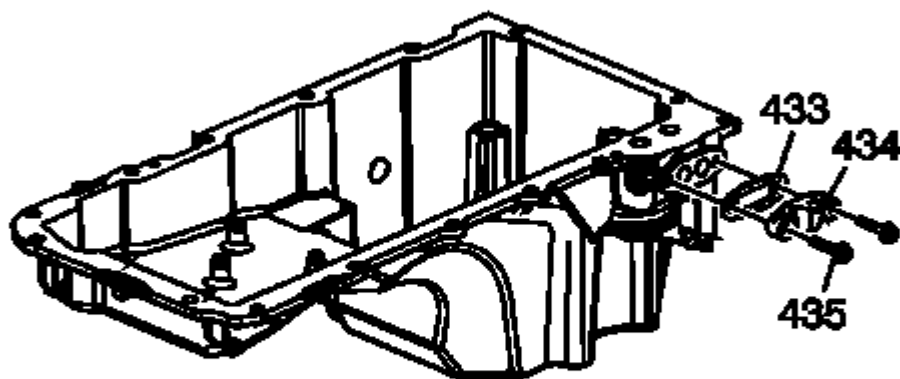


Fig. 207: Oil Pan Cover, Bolts And Gasket
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the oil pan cover bolts (435), cover (434), and gasket (433). Discard the gasket.

Installation Procedure

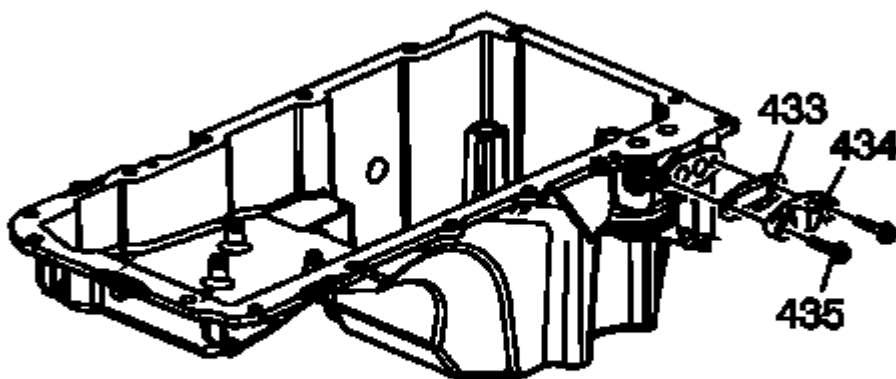


Fig. 208: Oil Pan Cover, Bolts And Gasket
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Position a NEW oil pan cover gasket (433) and the cover (434) to the oil pan and install the bolts (435). Tighten the bolts to 9 N.m (80 lb in).
2. Lower the vehicle.

OIL PAN REPLACEMENT (2WD)

Removal Procedure

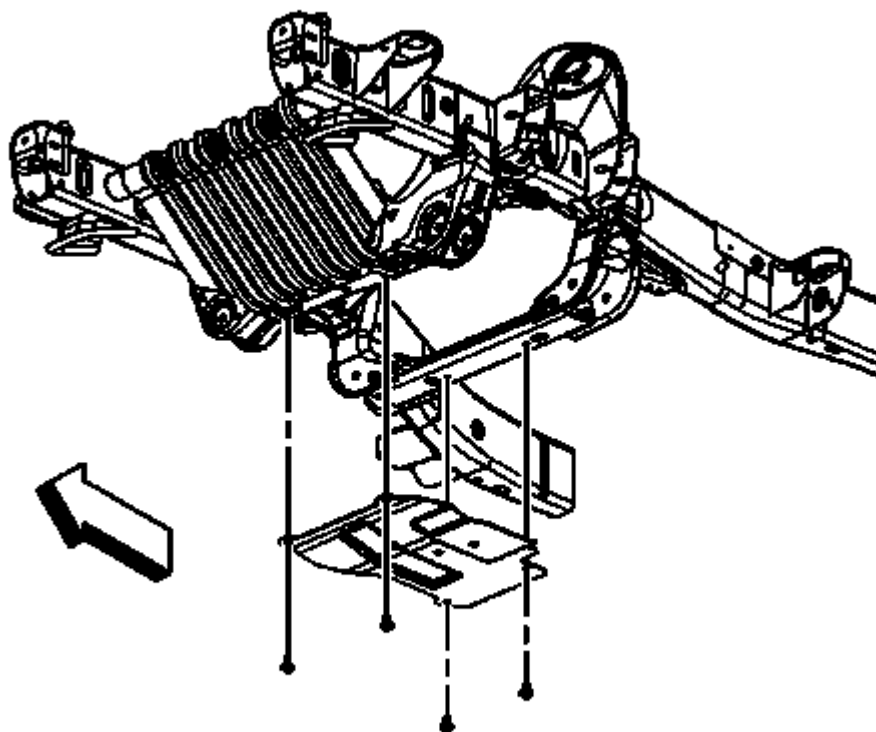


Fig. 209: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. For 1500 series vehicles, remove the oil pan skid plate bolts and skid plate, if equipped.
3. For Hybrid (HP2) vehicles, remove the steering gear motor shield.

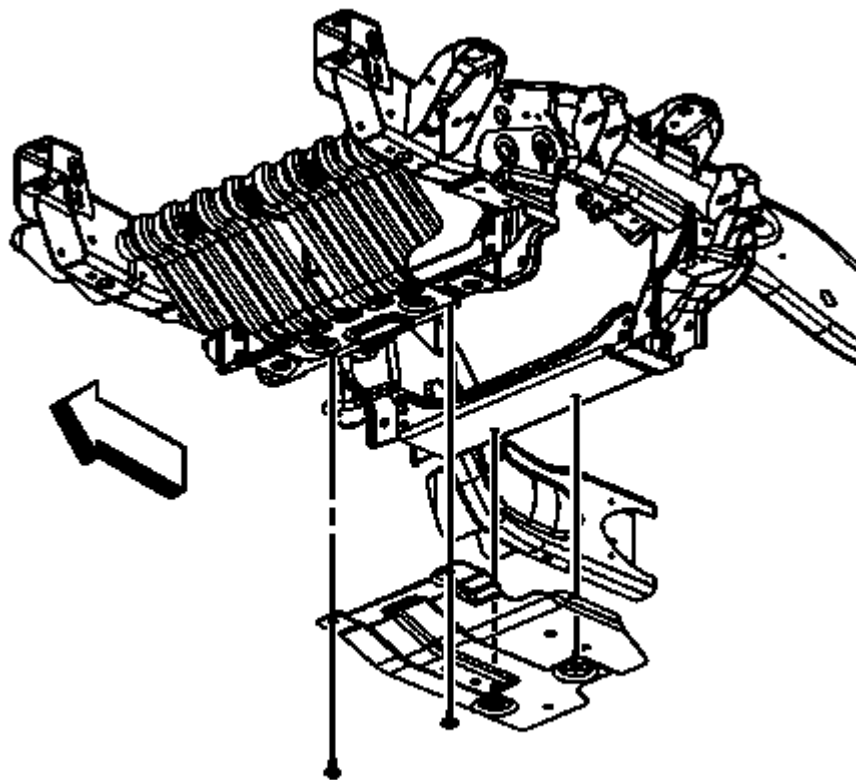
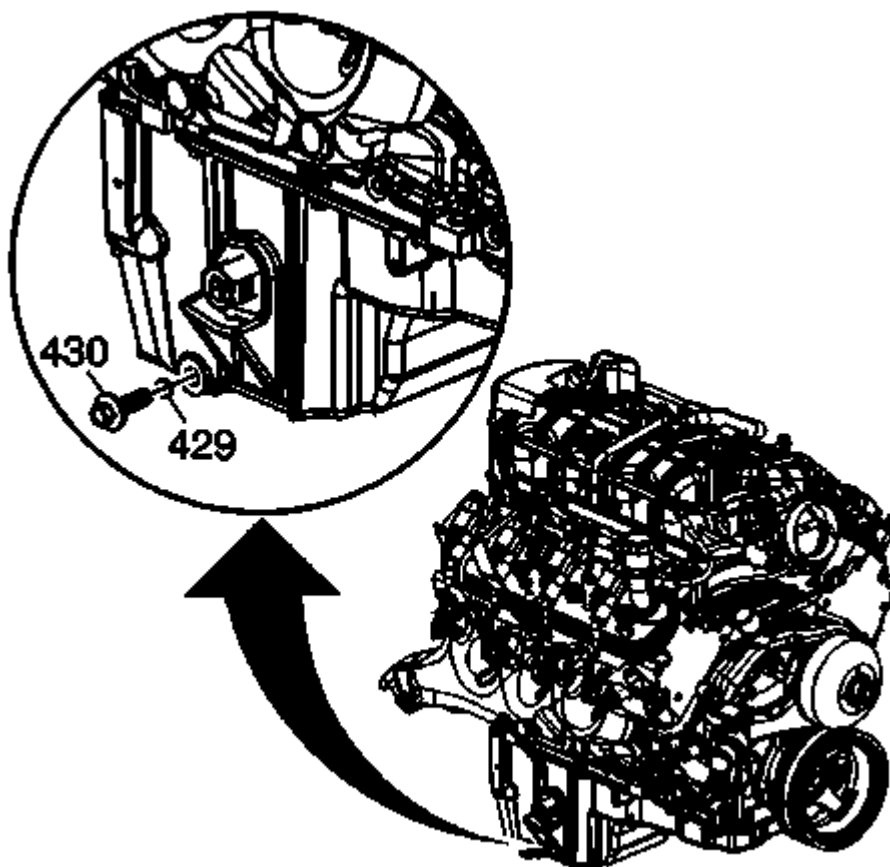


Fig. 210: Oil Pan Skid Plate

Courtesy of GENERAL MOTORS CORP.

4. For 2500 series vehicles, loosen the 2 rear oil pan skid plate bolts, remove the 2 front oil pan skid plate bolts and skid plate, if equipped.
5. Remove the engine shield. Refer to **Engine Shield Replacement** .
6. Unbolt the steering rack and hang downward.

**Fig. 211: Oil Pan Drain Plug**

Courtesy of GENERAL MOTORS CORP.

7. Place a suitable drain pan under the oil pan drain plug.
8. Remove the oil pan drain plug (430).
9. Allow the oil pan to drain completely.

CAUTION: Refer to Fastener Caution .

10. Re-install the oil pan drain plug.

Tighten

Tighten the oil pan drain plug to 25 N.m (18 lb ft).

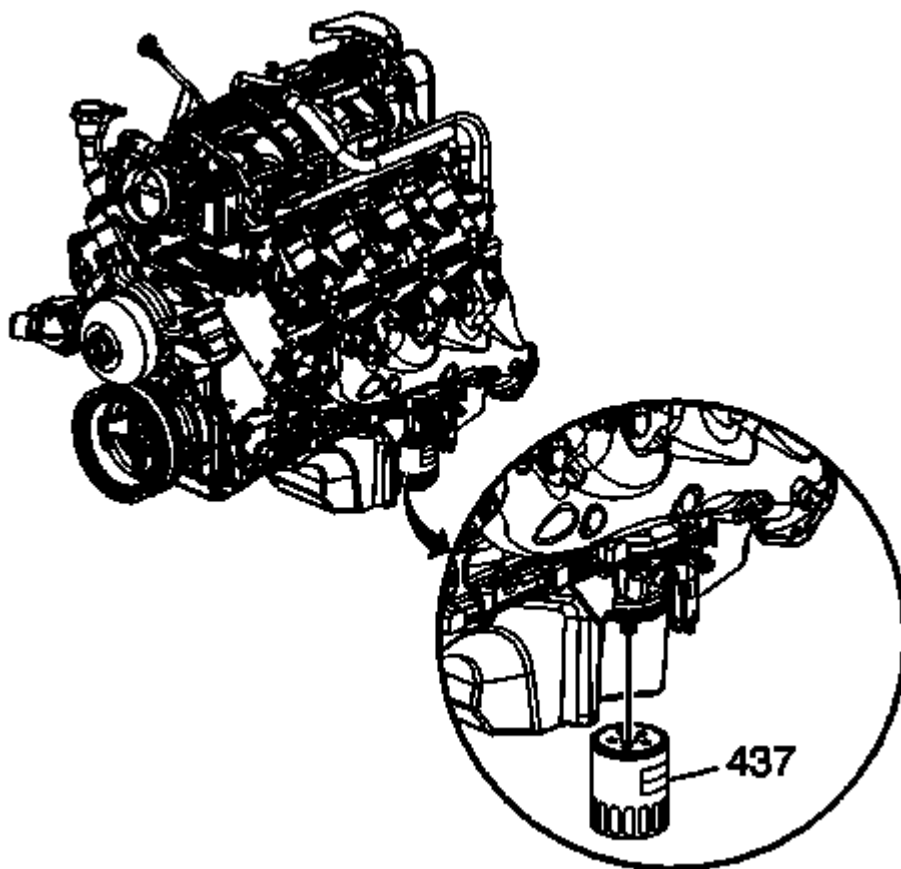


Fig. 212: Engine Oil Filter

Courtesy of GENERAL MOTORS CORP.

11. Place the drain pan under the oil filter.
12. Remove the oil filter (437).
13. Allow the oil to drain completely.
14. Re-install the oil filter.

Tighten

Tighten the oil filter to 30 N.m (22 lb ft).

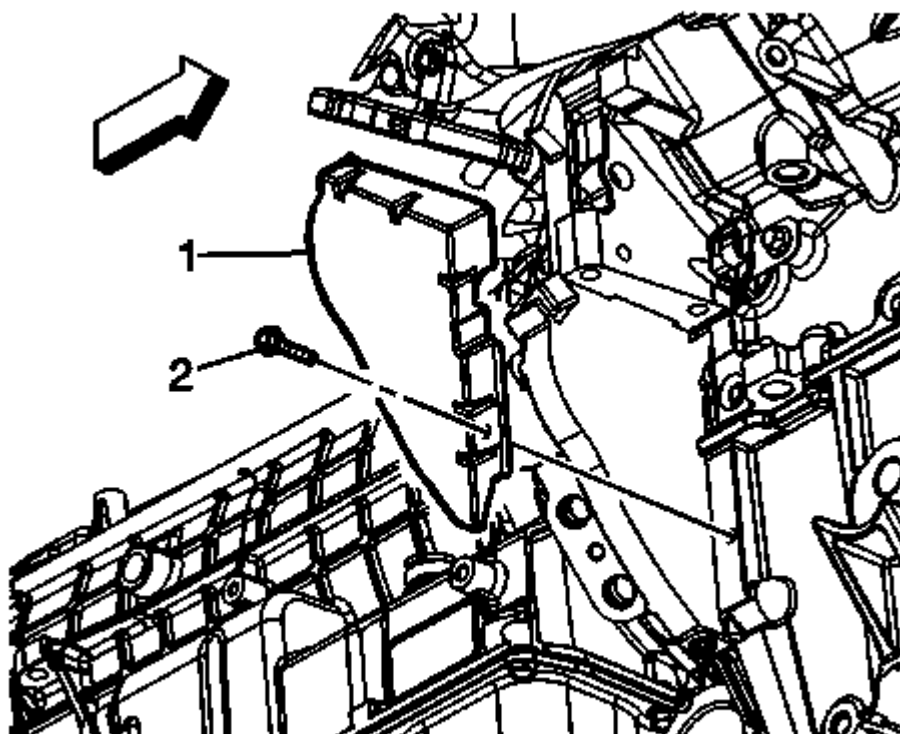


Fig. 213: Right Flex Plate Inspection Cover Bolt
Courtesy of GENERAL MOTORS CORP.

15. Remove the right side transmission cover bolt (2).

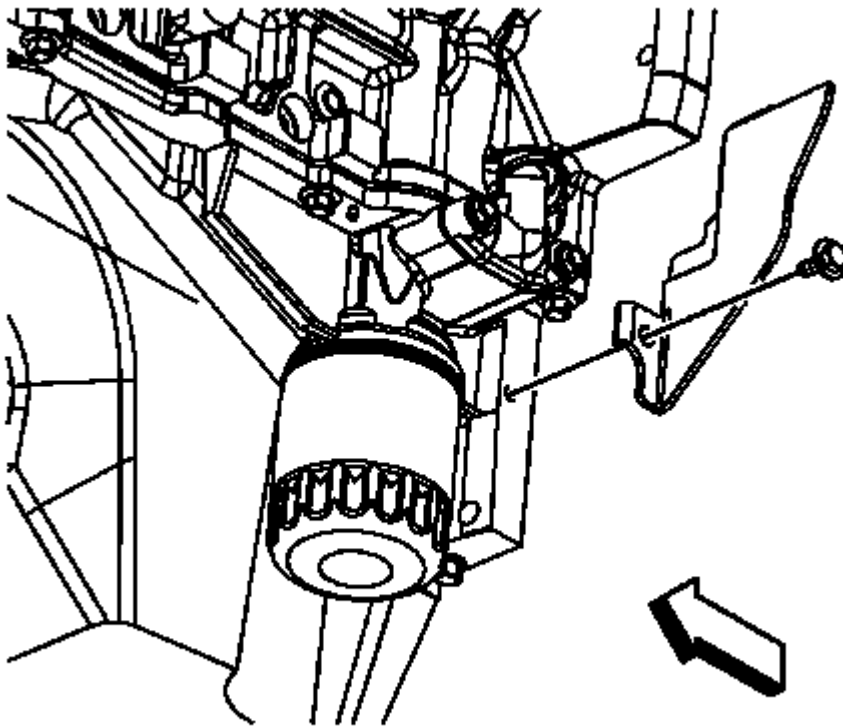


Fig. 214: Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

16. Remove the left side transmission cover bolt and cover.

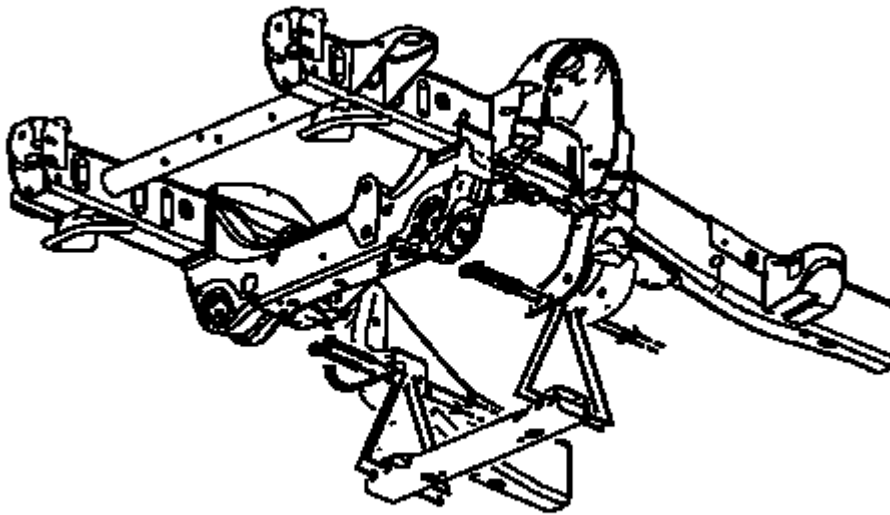


Fig. 215: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

17. For 1500 series vehicles, remove the crossbar bolts/nuts and crossbar.

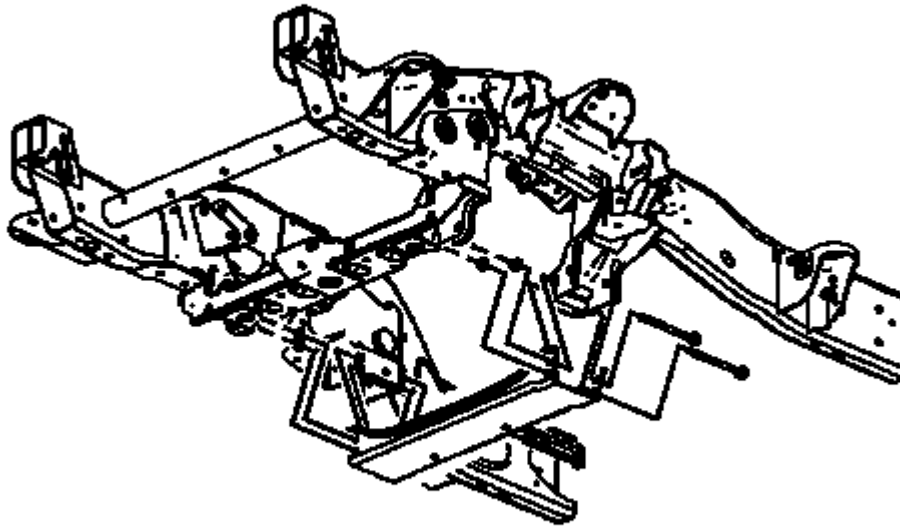


Fig. 216: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

18. For 2500 series vehicles, remove the crossbar bolts/nuts and crossbar.

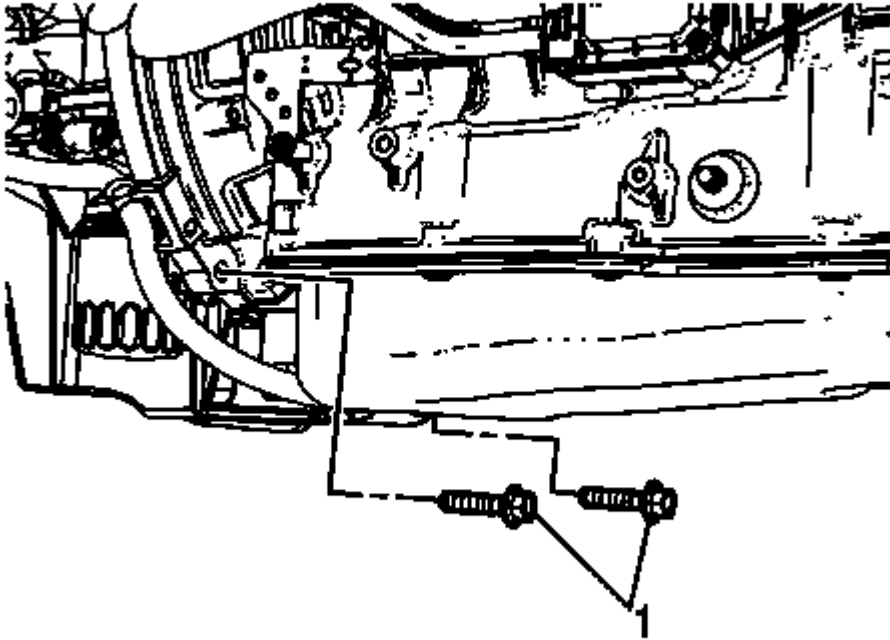


Fig. 217: Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

19. Remove the 2 lower transmission bolts (1).

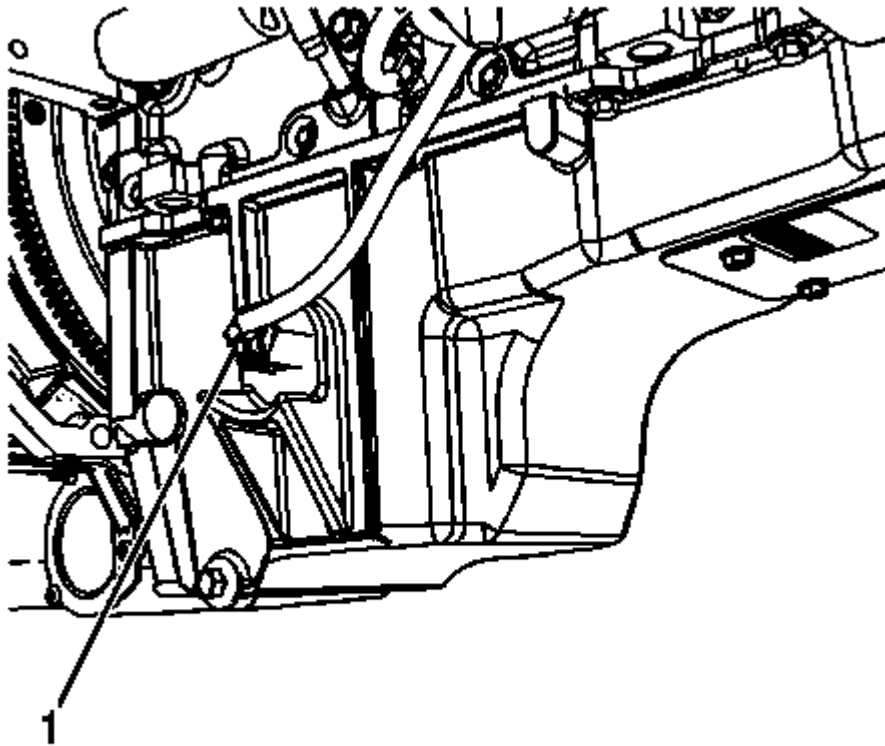


Fig. 218: Engine Harness Electrical Connector And Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

20. Disconnect the engine harness electrical connector (1) from the oil level sensor.

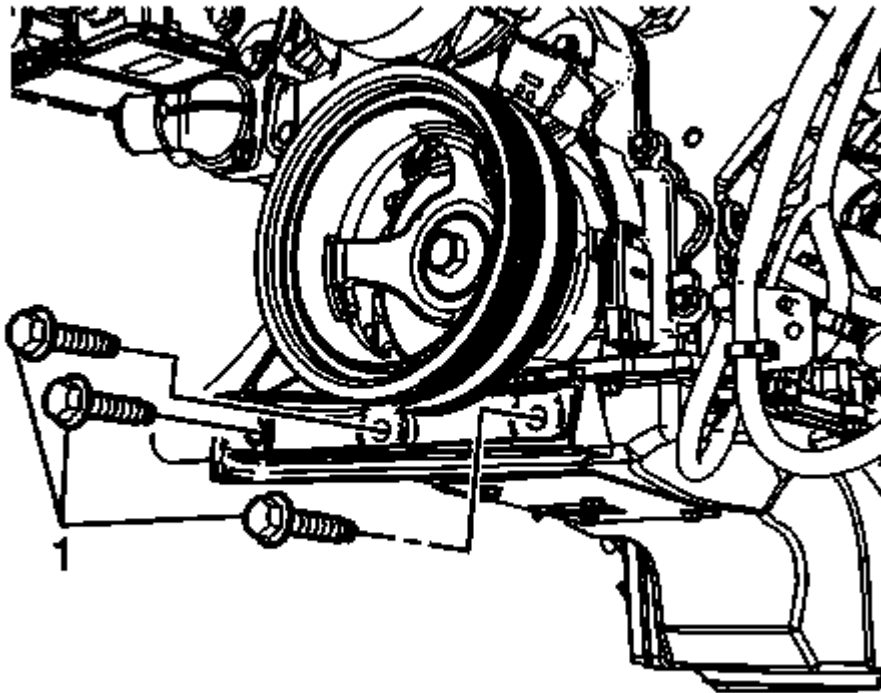


Fig. 219: Air Conditioning (A/C) Compressor Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

21. Remove the air conditioning (A/C) compressor bracket bolts (1).

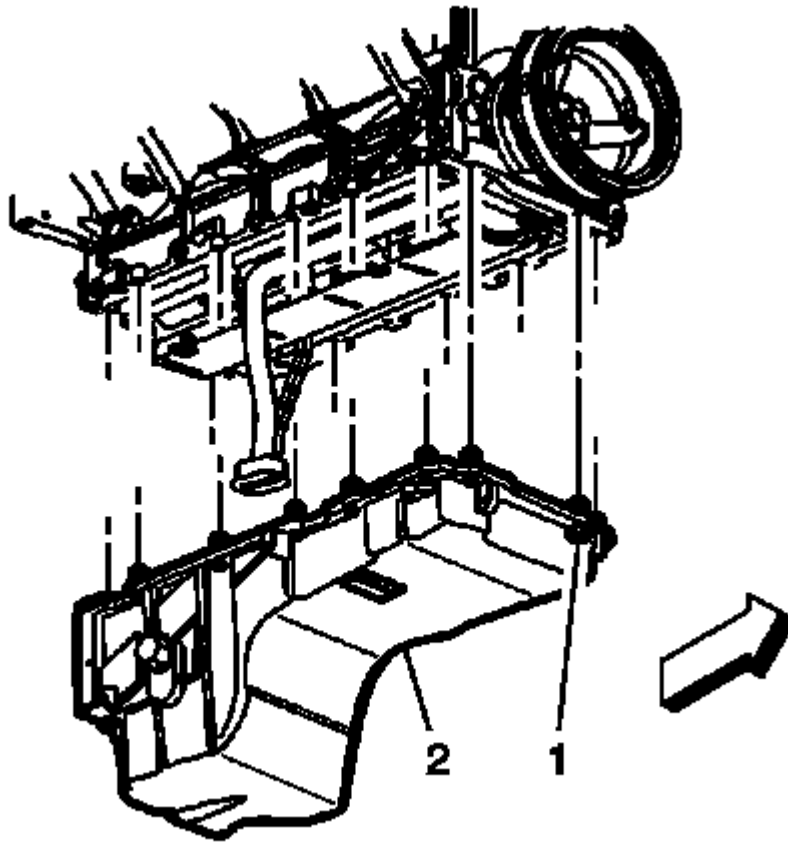


Fig. 220: Oil Pan Bolts

Courtesy of GENERAL MOTORS CORP.

22. Remove the oil pan bolts.
23. Remove the oil pan.

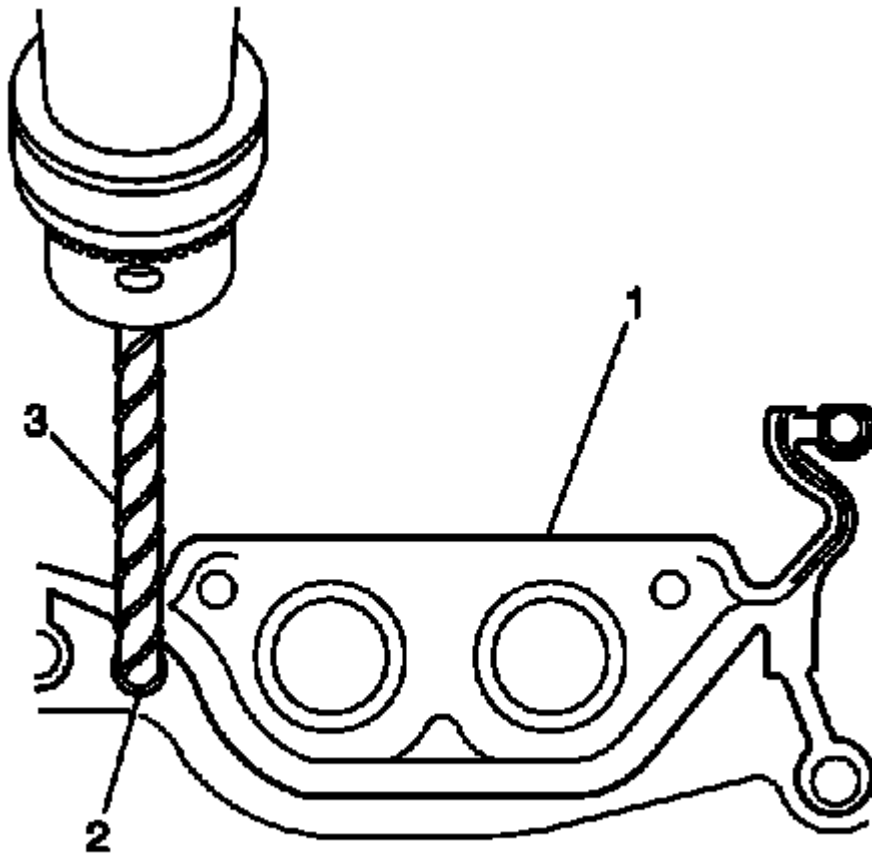


Fig. 221: Drilling Oil Pan Gasket Retaining Rivets
Courtesy of GENERAL MOTORS CORP.

24. If reusing the oil pan perform the following steps, otherwise proceed to step 3 of the installation procedure.

NOTE: **DO NOT allow foreign material to enter the oil passages of the oil pan, cap or cover the openings as required.**

25. Drill out the oil pan gasket rivets (2), if necessary.
26. Remove the oil pan gasket (1) from the pan.
27. Discard the oil pan gasket.
28. Discard the rivets, if necessary.

Installation Procedure

NOTE:

- **The alignment of the structural oil pan is critical. The rear bolt hole locations of the oil pan provide mounting points for the transmission bellhousing. To ensure the rigidity of the powertrain and correct**

transmission alignment, it is important that the rear of the block and the rear of the oil pan must **NEVER** protrude beyond the engine block and transmission bellhousing plane.

- Do not reuse the oil pan gasket.
- It is not necessary to rivet the **NEW** gasket to the oil pan.

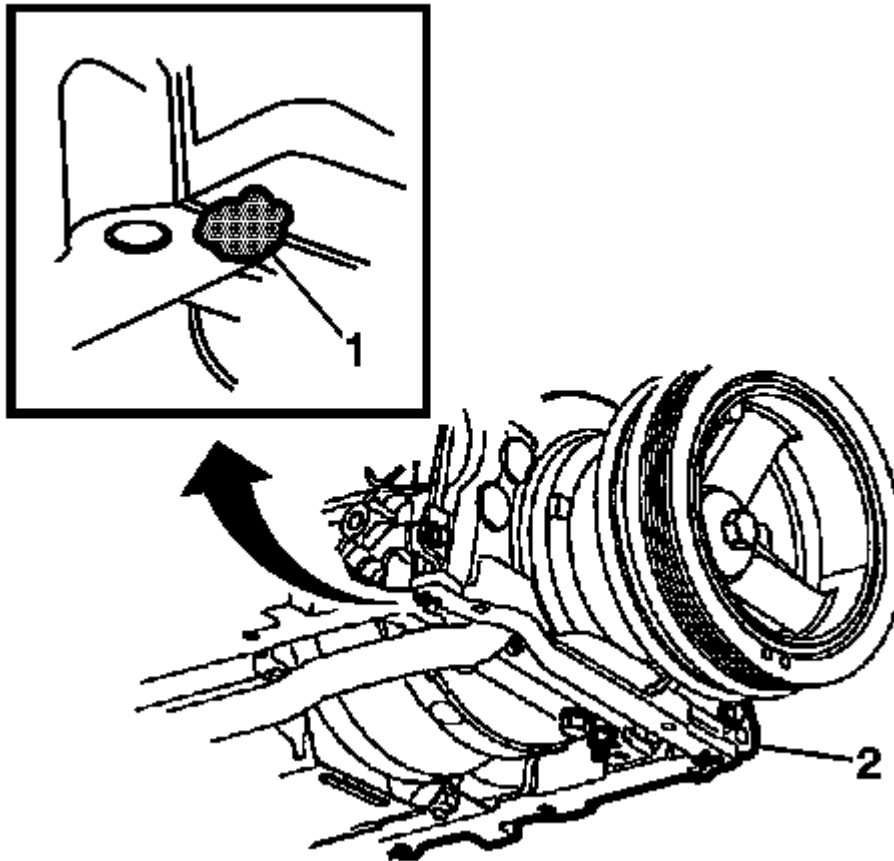


Fig. 222: Front Oil Pan-To-Engine Block Junction Sealant Application Area
Courtesy of GENERAL MOTORS CORP.

1. If reusing the oil pan perform the following step, otherwise proceed to step 3.

NOTE: Be sure to align the oil gallery passages in the oil pan and engine block properly with the oil pan gasket.

2. Place a NEW oil pan gasket onto the oil pan.
3. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.80 in) long to the engine block. Apply the sealant directly onto the tabs of the front cover gasket that protrudes into the oil pan surface. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

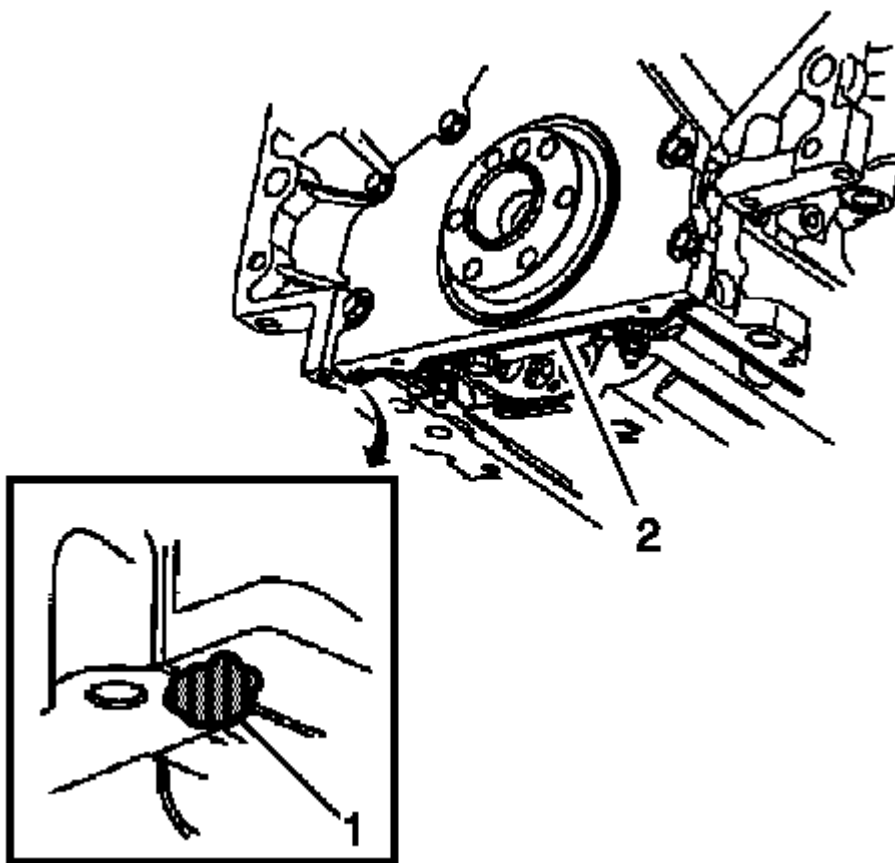


Fig. 223: Rear Oil Pan-To-Engine Block Junction Sealant Application Area
Courtesy of GENERAL MOTORS CORP.

4. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.8 in) long to the engine block. Apply the sealant directly onto the tabs of the rear cover gasket that protrudes into the oil pan surface. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

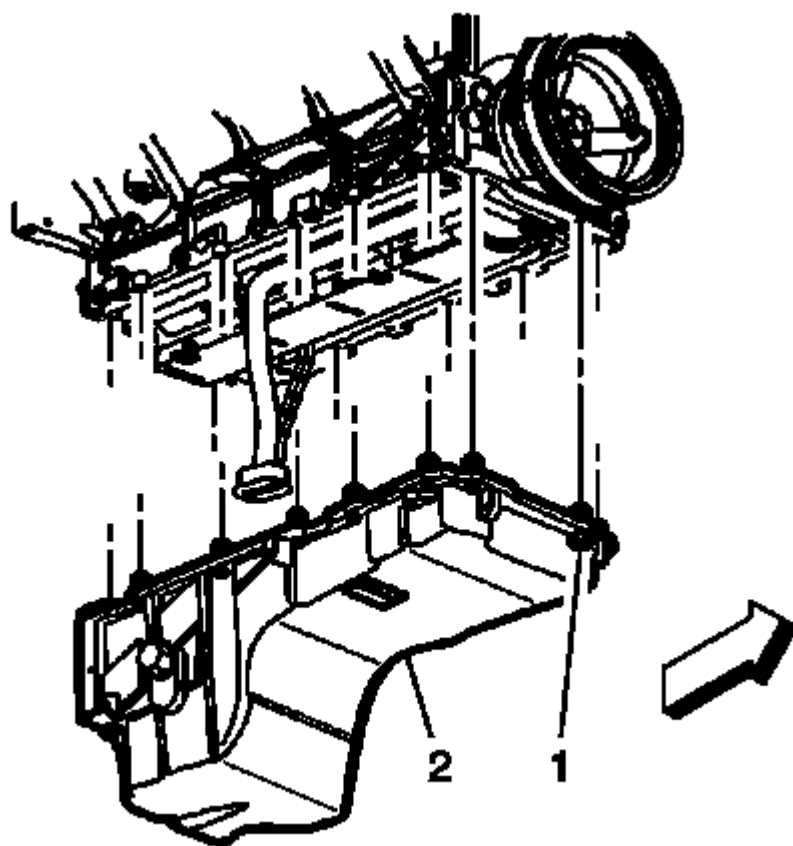


Fig. 224: Oil Pan Bolts

Courtesy of GENERAL MOTORS CORP.

5. Install 1 oil pan bolt into a oil pan bolt hole and up through the gasket.
6. Position and install the oil pan and the rest of the oil pan bolts.
7. Tighten the oil pan bolts.

Tighten

- M6 Bolts-Tighten the bolt to 12 N.m 106 lb in).
- M8 Bolts-Tighten the bolt to 25 N.m (18 lb ft).

8. Install the 2 lower transmission bolts.

Tighten

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

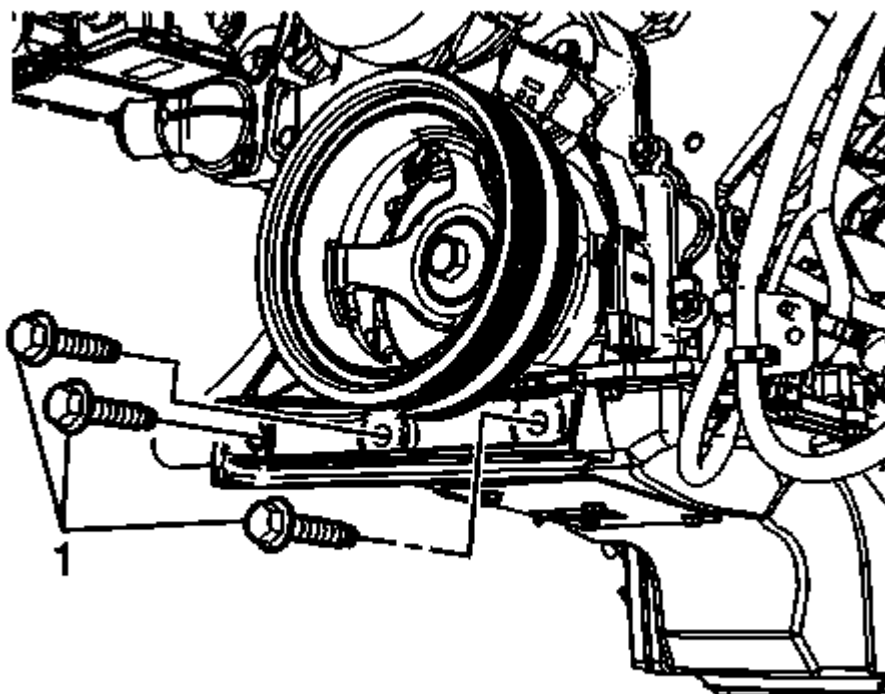


Fig. 225: Air Conditioning (A/C) Compressor Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

9. Install the air conditioning (A/C) compressor bracket bolts (1).

Tighten

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

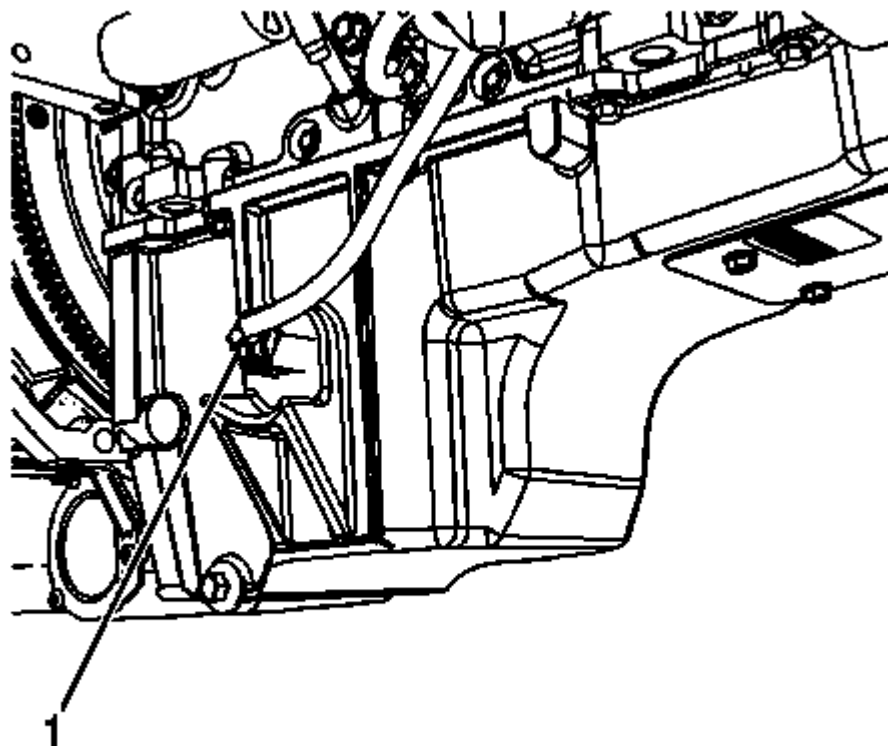


Fig. 226: Engine Harness Electrical Connector And Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

10. Connect the engine harness electrical connector (1) to the oil level sensor.

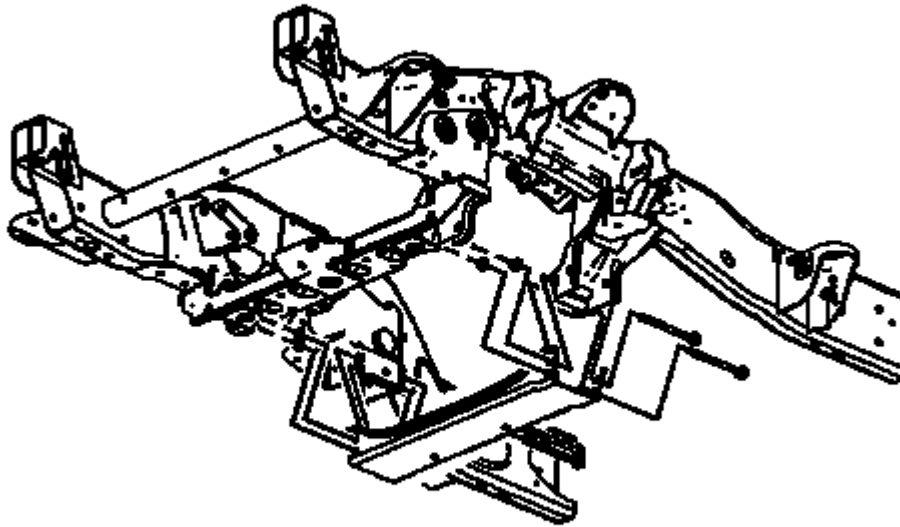


Fig. 227: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

11. For both the 1500 and 2500 series, perform the following steps prior to installing the crossbar bolts:
 1. Remove all traces of the original adhesive patch.
 2. Clean the threads of the bolts with denatured alcohol or equivalent and allow to dry.
 3. Apply threadlock GM P/N 12345493 (Canadian P/N 10953488) or equivalent to the bolt threads.
12. For 2500 series vehicles, install the crossbar and crossbar bolts/nuts.

Tighten

Tighten the nuts to 120 N.m (89 lb ft).

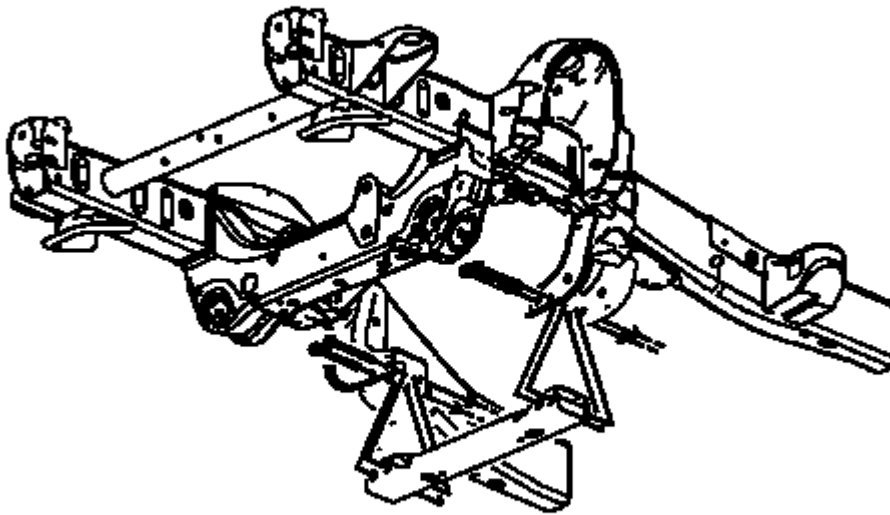


Fig. 228: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

13. For 1500 series vehicles, install the crossbar and crossbar bolts/nuts.

Tighten

Tighten the nuts to 100 N.m (74 lb ft).

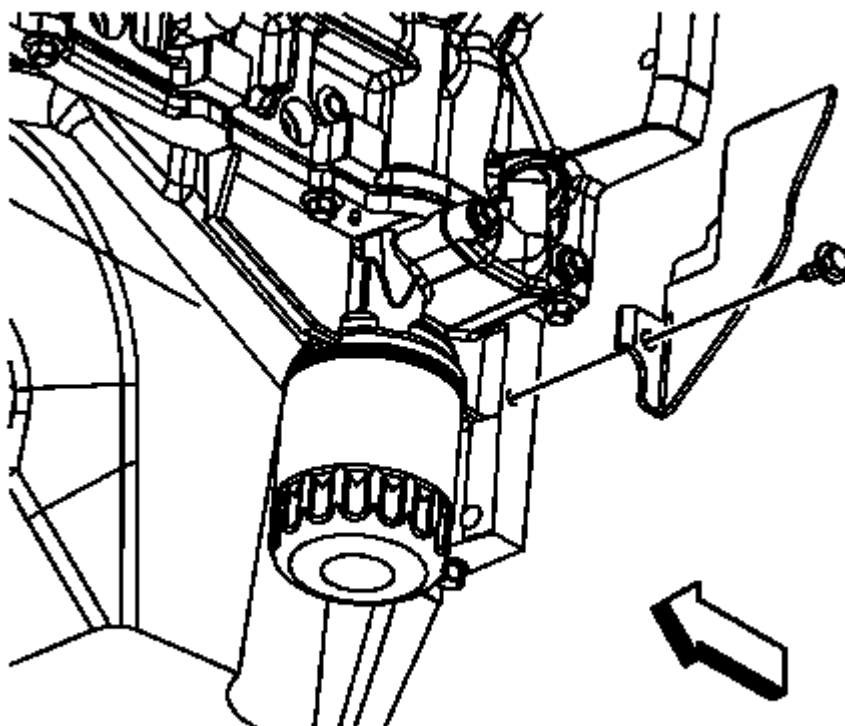


Fig. 229: Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

14. Position the left side transmission cover and install the cover bolt.

Tighten

Tighten the bolt to 12 N.m (106 lb in).

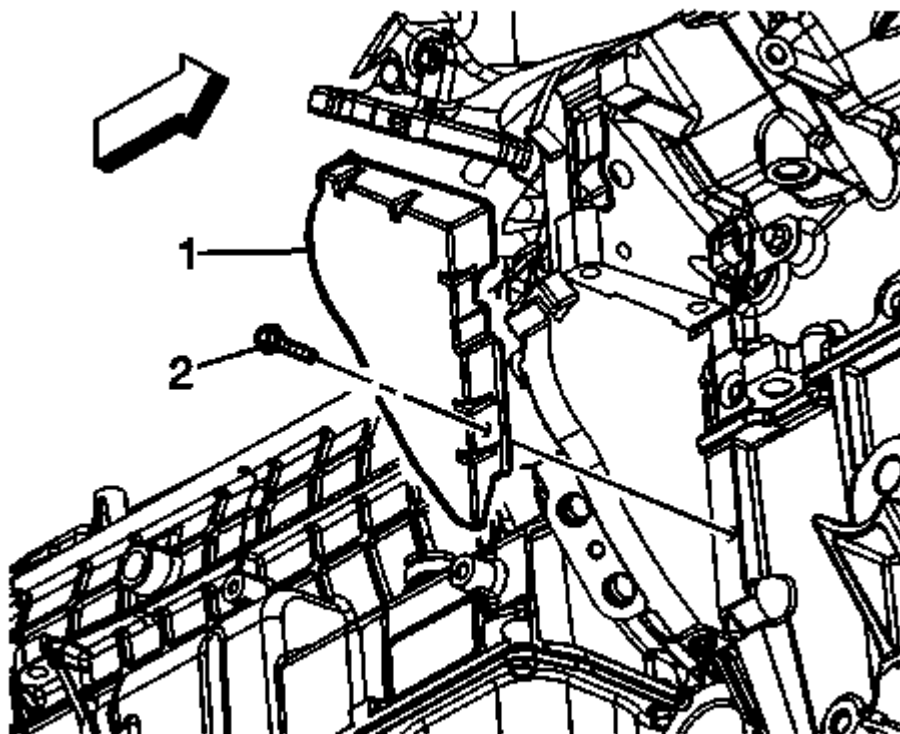


Fig. 230: Right Flex Plate Inspection Cover Bolt
Courtesy of GENERAL MOTORS CORP.

15. Install the right side transmission cover bolt (2).

Tighten

Tighten the bolt to 12 N.m (106 lb in).

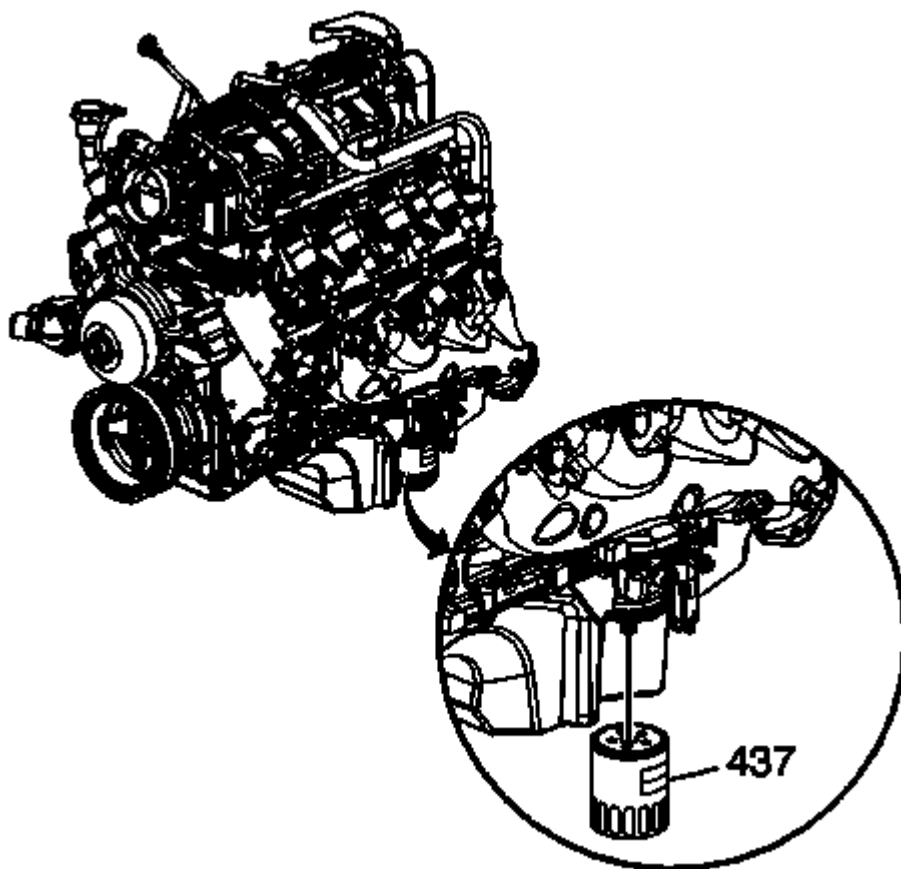


Fig. 231: Engine Oil Filter

Courtesy of GENERAL MOTORS CORP.

16. If reusing the old oil pan remove the old oil filter and install a NEW oil filter.
17. Lubricate the NEW oil filter seal with clean engine oil.
18. Install the NEW oil filter (437).

Tighten

Tighten the oil filter to 30 N.m (22 lb ft).

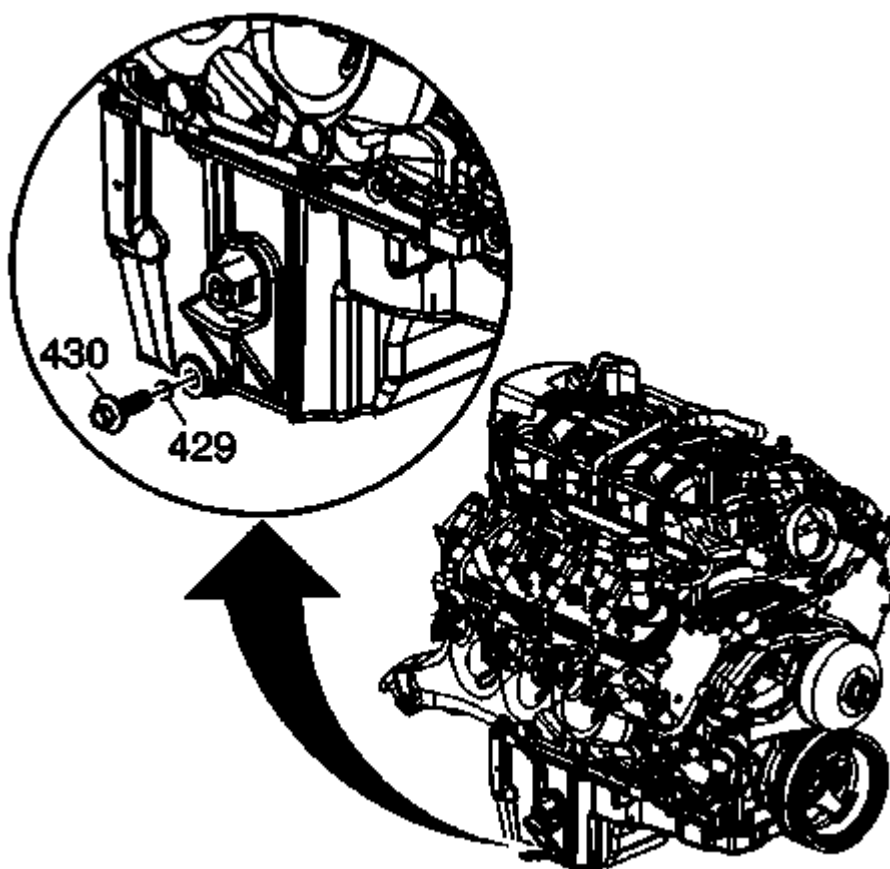


Fig. 232: Oil Pan Drain Plug

Courtesy of GENERAL MOTORS CORP.

19. Install the oil pan drain plug (430).

Tighten

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

20. Raise the steering rack in place and install the steering rack bolts.

Tighten

- Tighten the left side steering rack bolts to 200 N.m (148 lb ft).
- Tighten the right side steering rack bolts to 100 N.m (74 lb ft).

21. Install the engine shield. Refer to **Engine Shield Replacement**.

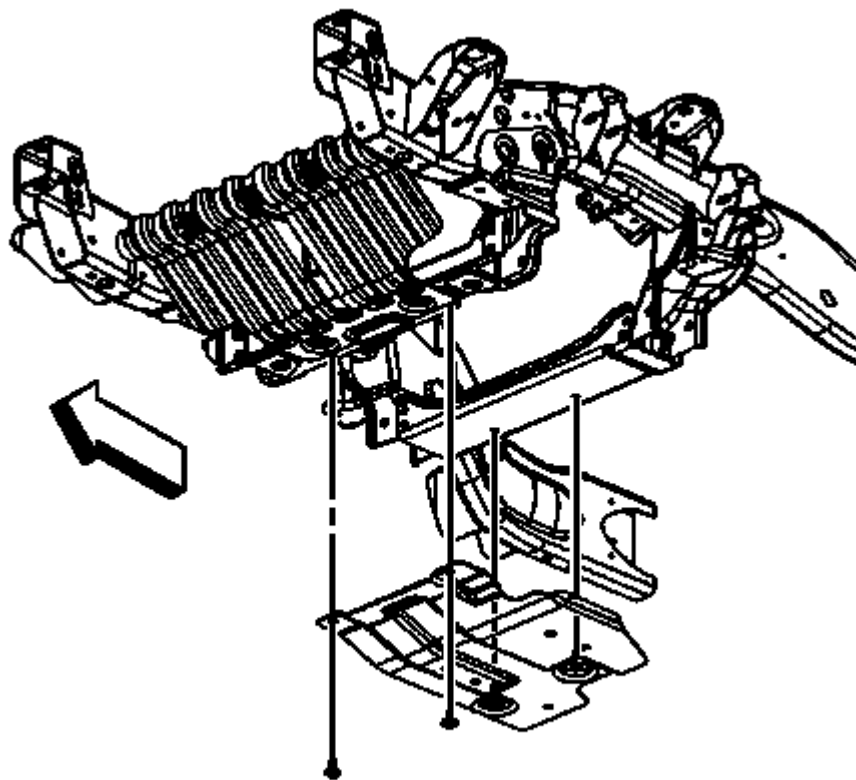


Fig. 233: Oil Pan Skid Plate

Courtesy of GENERAL MOTORS CORP.

22. For 2500 series vehicles, position the oil pan skid plate and tighten until snug the 2 rear oil pan skid plate bolts, install the 2 front oil pan skid plate bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

23. For Hybrid (HP2) vehicles, Install the steering gear motor shield.

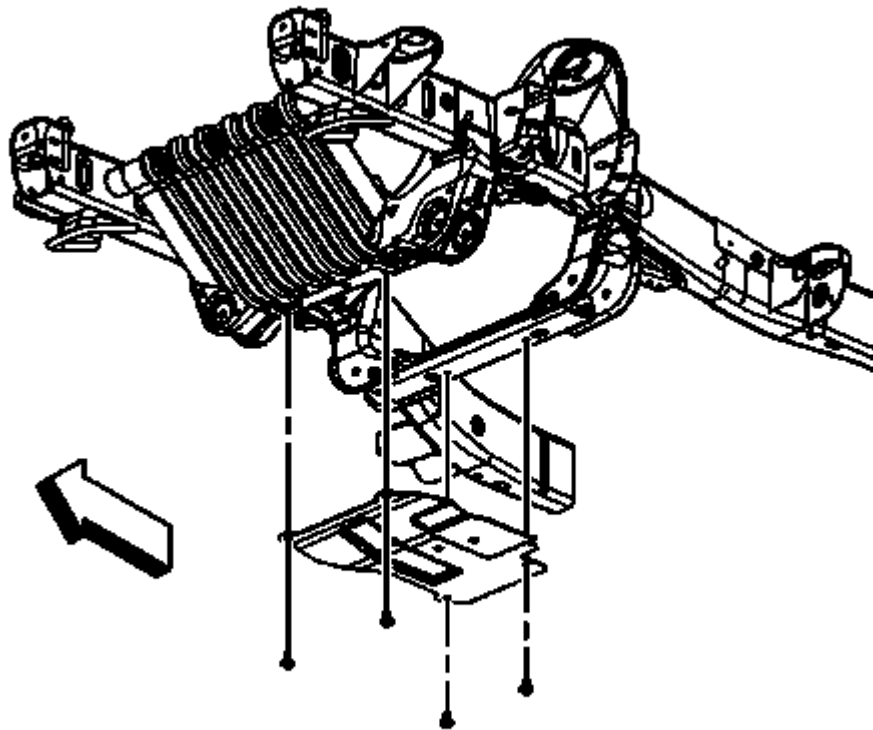


Fig. 234: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

24. For 1500 series vehicles, position the oil pan skid plate and install the oil pan skid plate bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

25. Lower the vehicle.
26. Fill the engine with NEW engine oil. Refer to **Fluid and Lubricant Recommendations** , and **Approximate Fluid Capacities** .
27. Start the engine and inspect for leaks.

OIL PAN REPLACEMENT (4WD)

Removal Procedure

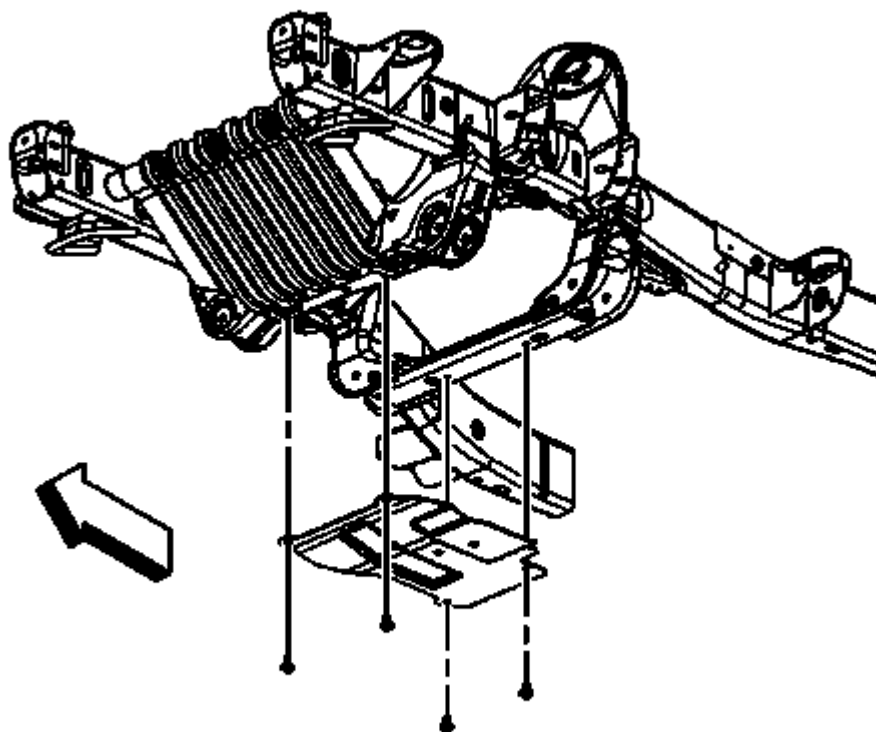


Fig. 235: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. For 1500 series vehicles, remove the oil pan skid plate bolts and skid plate, if equipped.
3. For Hybrid (HP2) vehicles, remove the steering gear motor shield.

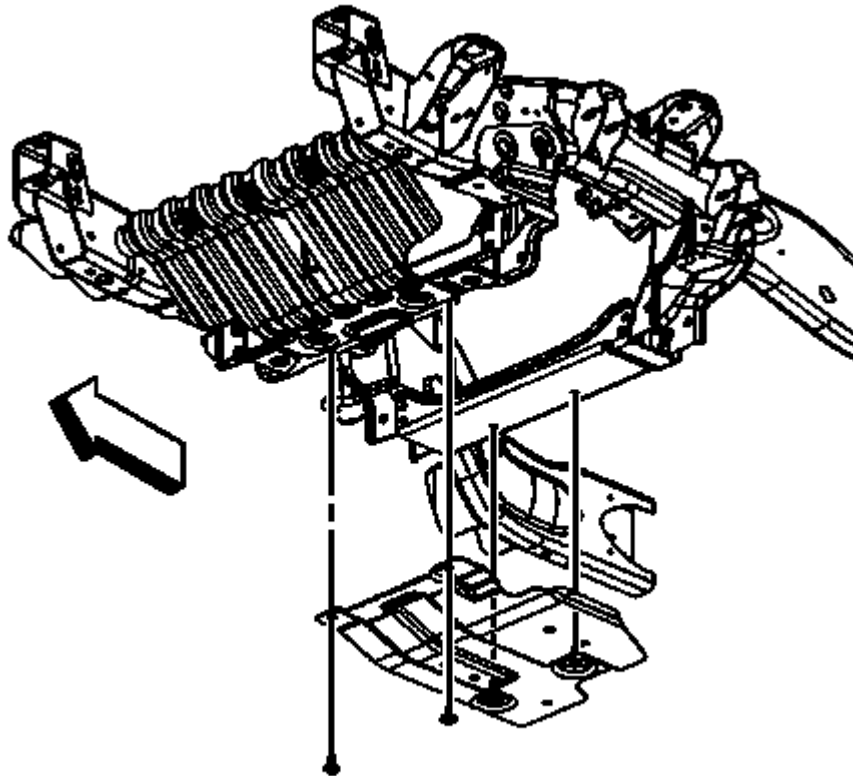


Fig. 236: Oil Pan Skid Plate

Courtesy of GENERAL MOTORS CORP.

4. For 2500 series vehicles, loosen the 2 rear oil pan skid plate bolts, remove the 2 front oil pan skid plate bolts and skid plate, if equipped.
5. Remove the engine shield. Refer to **Engine Shield Replacement** .
6. Remove the front differential carrier. Refer to **Differential Carrier Assembly Replacement (8.25 inch)** , **Differential Carrier Assembly Replacement (4WD 1500 Hybrid)** , **Differential Carrier Assembly Replacement (9.25 inch)** .
7. Unbolt the steering rack and hang downward.

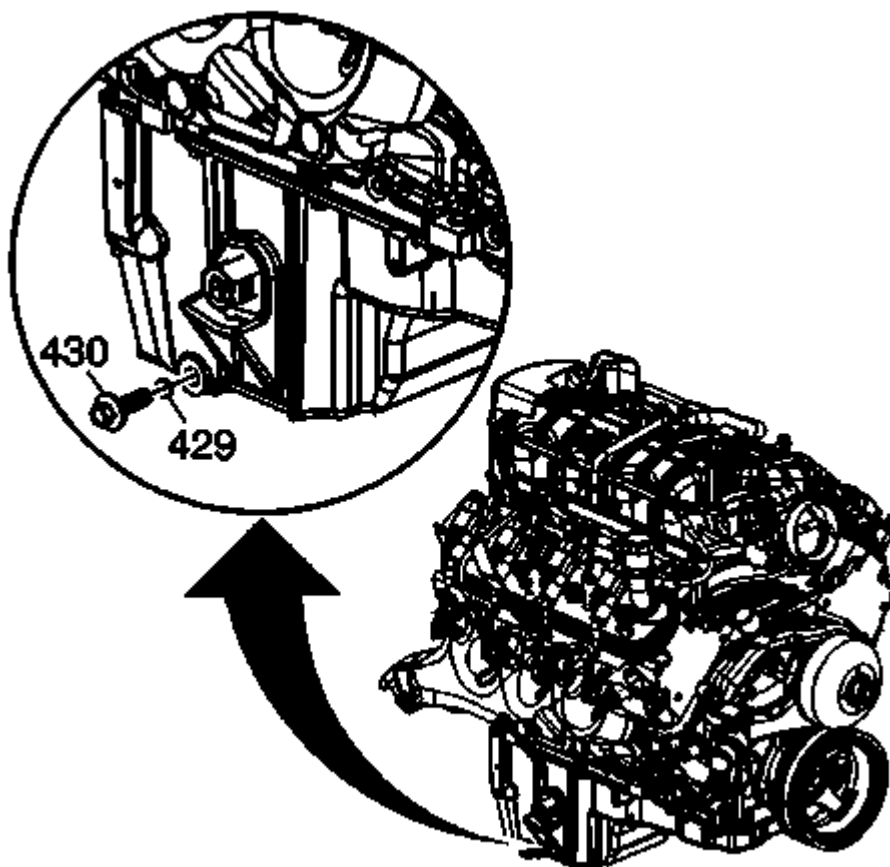


Fig. 237: Oil Pan Drain Plug

Courtesy of GENERAL MOTORS CORP.

8. Place a suitable drain pan under the oil pan drain plug.
9. Remove the oil pan drain plug (430).
10. Allow the oil pan to drain completely.

CAUTION: Refer to Fastener Caution .

11. Re-install the oil pan drain plug.

Tighten

Tighten the oil pan drain plug to 25 N.m (18 lb ft).

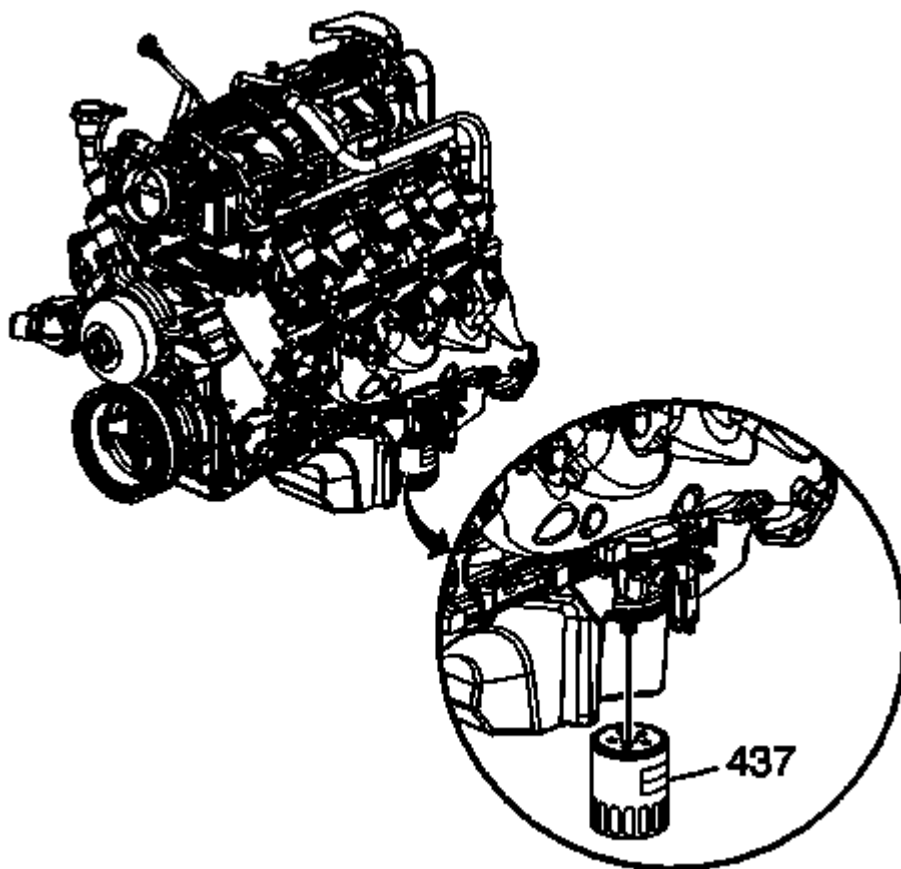


Fig. 238: Engine Oil Filter

Courtesy of GENERAL MOTORS CORP.

12. Place the drain pan under the oil filter.
13. Remove the oil filter (437).
14. Allow the oil to drain completely.
15. Re-install the oil filter.

Tighten

Tighten the oil filter to 30 N.m (22 lb ft).

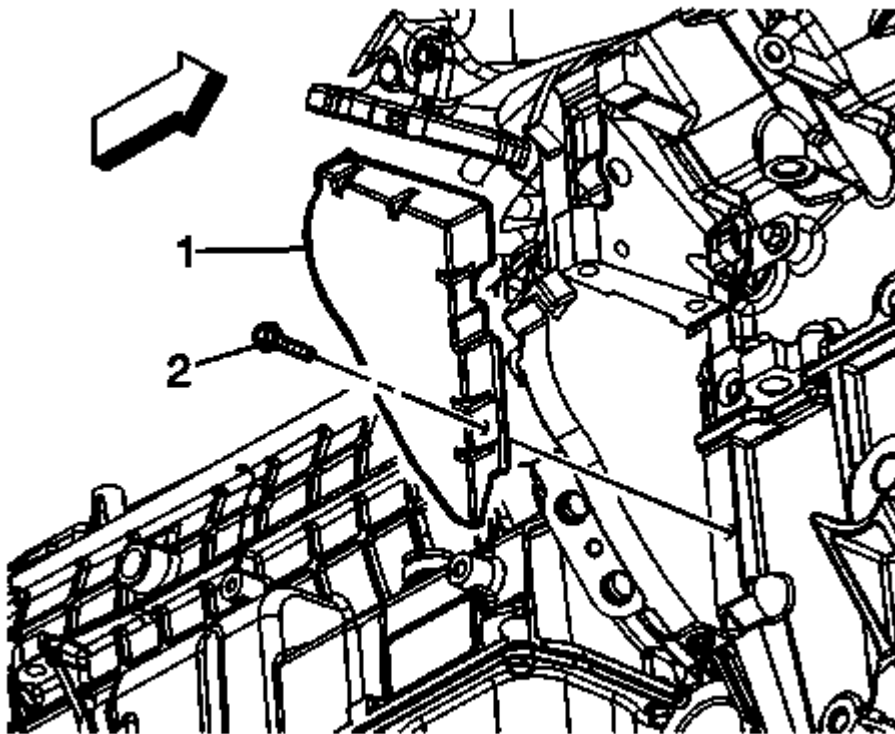


Fig. 239: Right Flex Plate Inspection Cover Bolt
Courtesy of GENERAL MOTORS CORP.

16. Remove the right side transmission cover bolt (2).

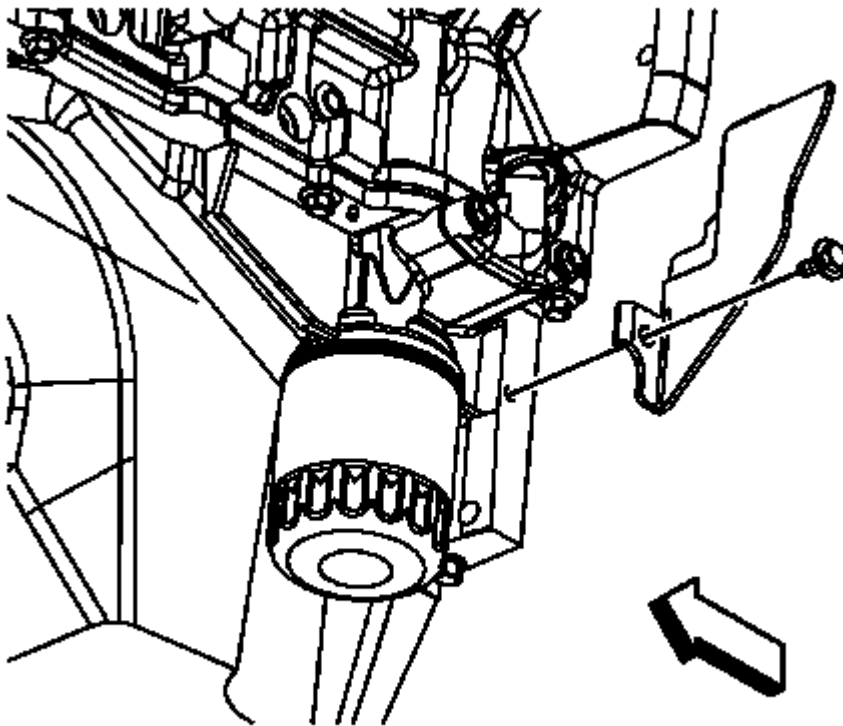


Fig. 240: Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

17. Remove the left side transmission cover bolt and cover.

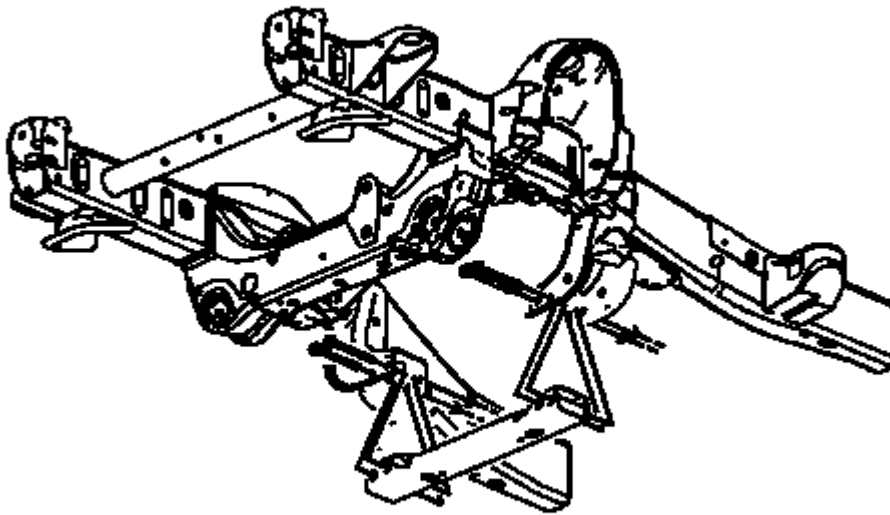


Fig. 241: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

18. For 1500 series vehicles, remove the crossbar bolts/nuts and crossbar.

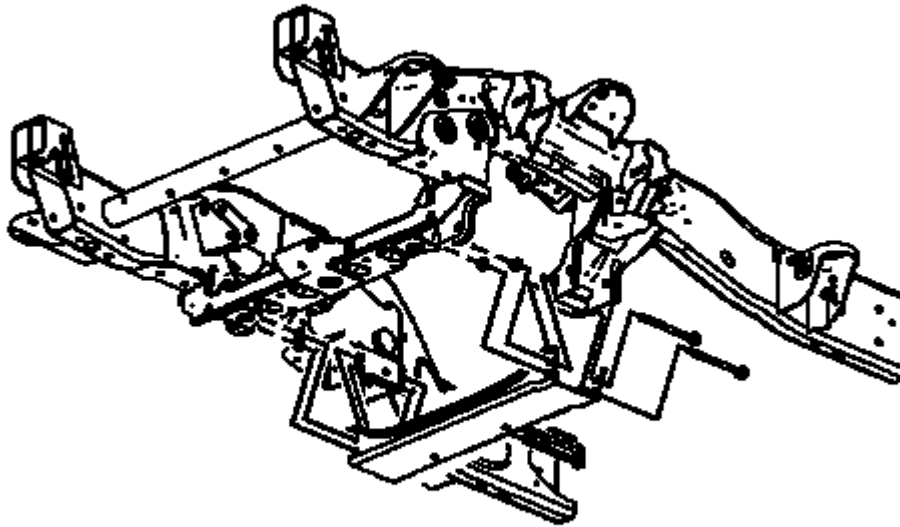


Fig. 242: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

19. For 2500 series vehicles, remove the crossbar bolts/nuts and crossbar.

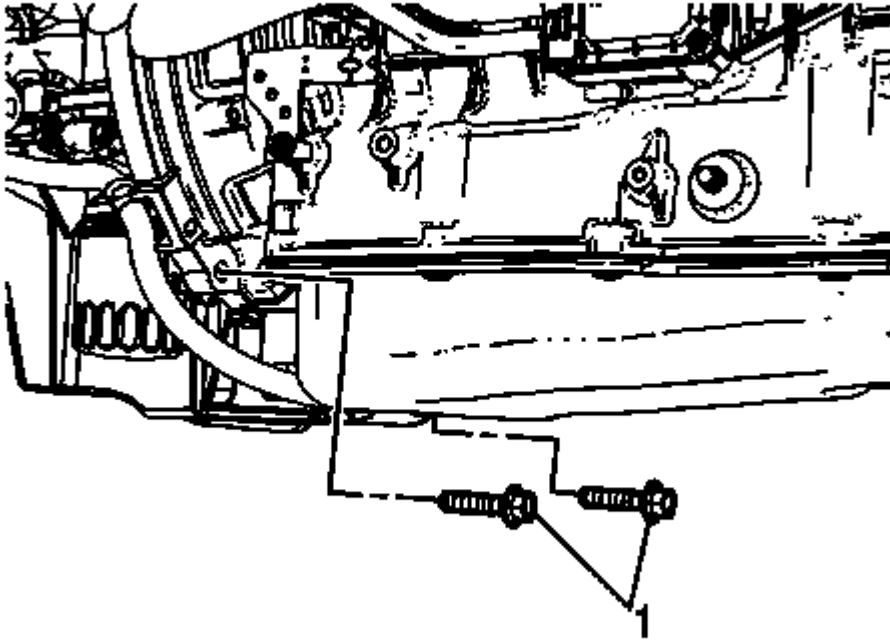


Fig. 243: Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

20. Remove the 2 lower transmission bolts (1).

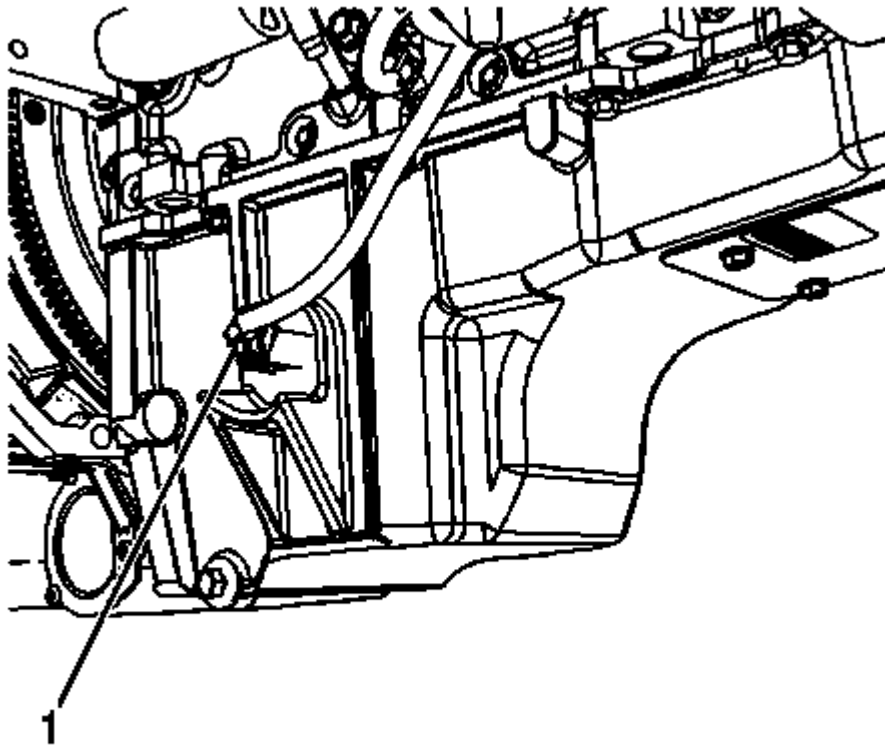


Fig. 244: Engine Harness Electrical Connector And Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

21. Disconnect the engine harness electrical connector (1) from the oil level sensor.

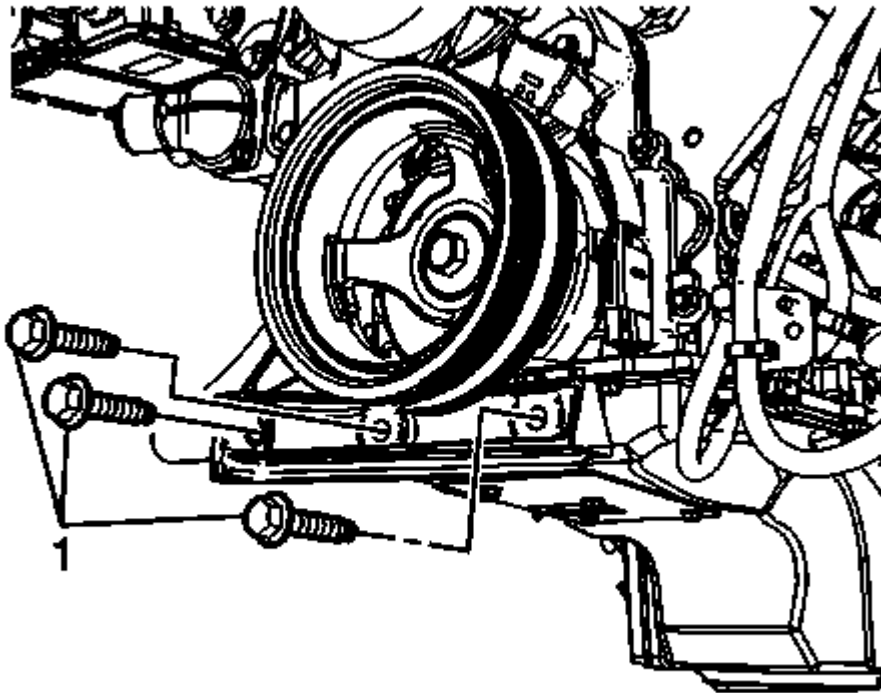


Fig. 245: Air Conditioning (A/C) Compressor Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

22. Remove the air conditioning (A/C) compressor bracket bolts (1).

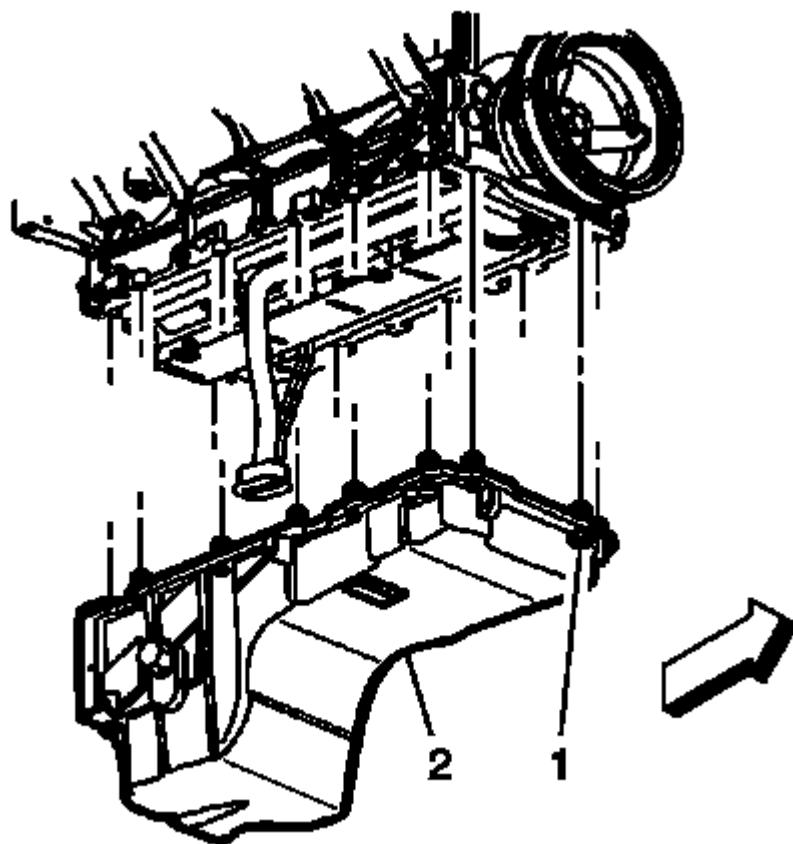


Fig. 246: Oil Pan Bolts

Courtesy of GENERAL MOTORS CORP.

23. Remove the oil pan bolts.
24. Remove the oil pan.

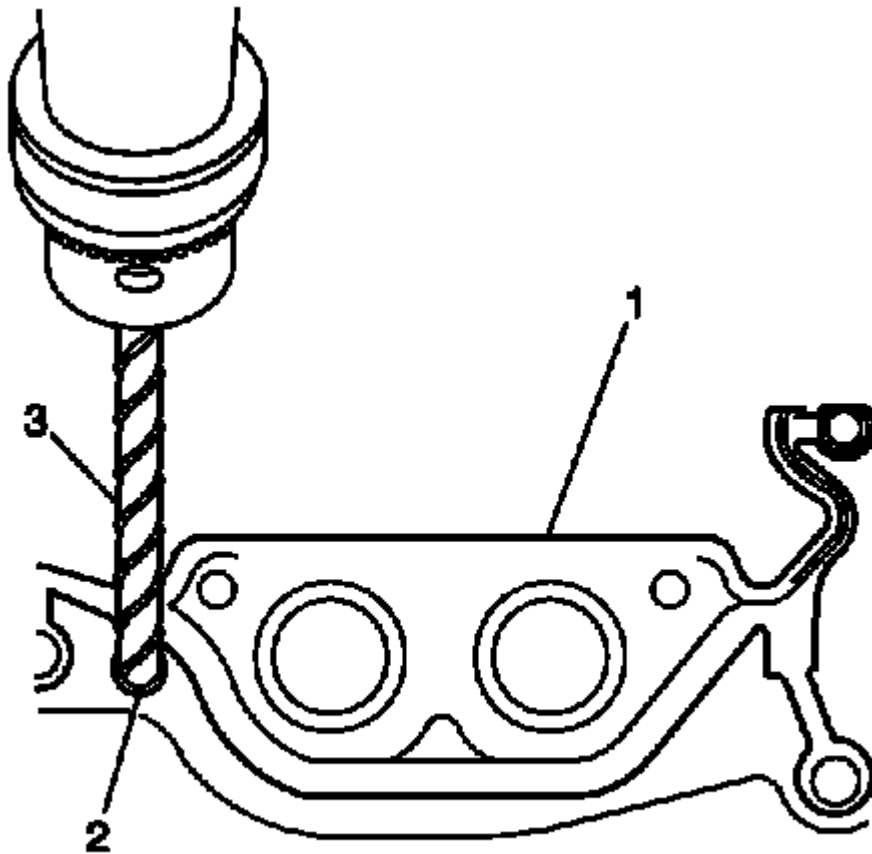


Fig. 247: Drilling Oil Pan Gasket Retaining Rivets
Courtesy of GENERAL MOTORS CORP.

25. If reusing the oil pan perform the following steps, otherwise proceed to step 3 of the installation procedure.

NOTE: **DO NOT allow foreign material to enter the oil passages of the oil pan, cap or cover the openings as required.**

26. Drill out the oil pan gasket rivets (2), if necessary.
27. Remove the oil pan gasket (1) from the pan.
28. Discard the oil pan gasket.
29. Discard the rivets, if necessary.

Installation Procedure

NOTE:

- **The alignment of the structural oil pan is critical. The rear bolt hole locations of the oil pan provide mounting points for the transmission bellhousing. To ensure the rigidity of the powertrain and correct**

transmission alignment, it is important that the rear of the block and the rear of the oil pan must **NEVER** protrude beyond the engine block and transmission bellhousing plane.

- Do not reuse the oil pan gasket.
- It is not necessary to rivet the **NEW** gasket to the oil pan.

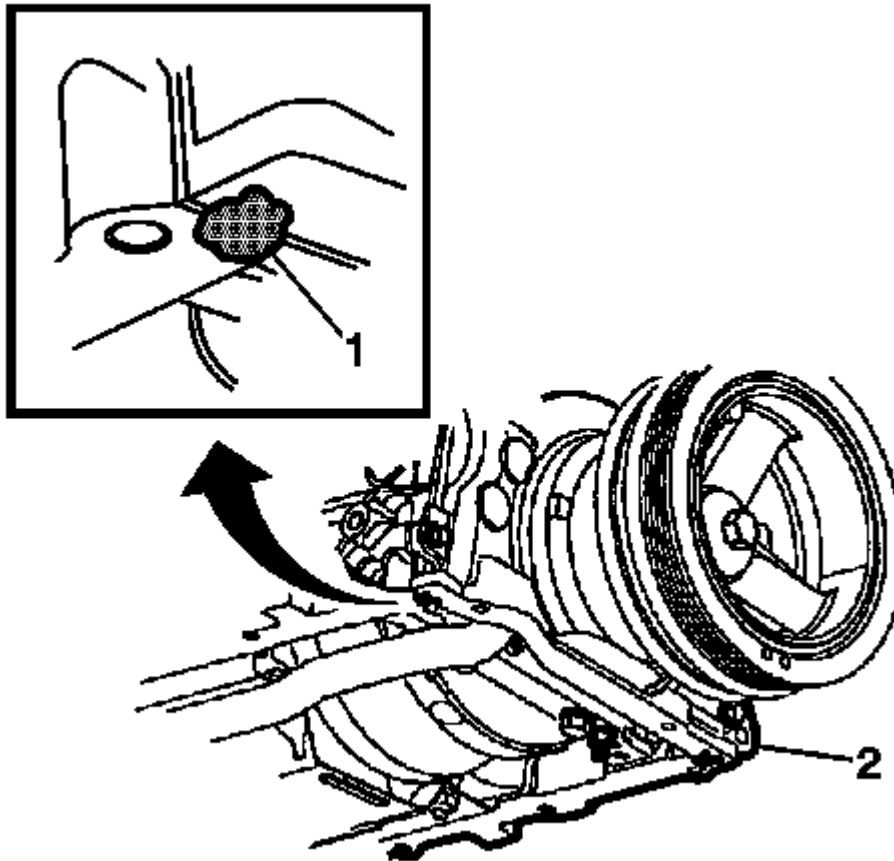


Fig. 248: Front Oil Pan-To-Engine Block Junction Sealant Application Area
Courtesy of GENERAL MOTORS CORP.

1. If reusing the oil pan perform the following step, otherwise proceed to step 3.

NOTE: Be sure to align the oil gallery passages in the oil pan and engine block properly with the oil pan gasket.

2. Place a NEW oil pan gasket onto the oil pan.
3. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.80 in) long to the engine block. Apply the sealant directly onto the tabs of the front cover gasket that protrudes into the oil pan surface. Refer to Adhesives, Fluids, Lubricants, and Sealers .

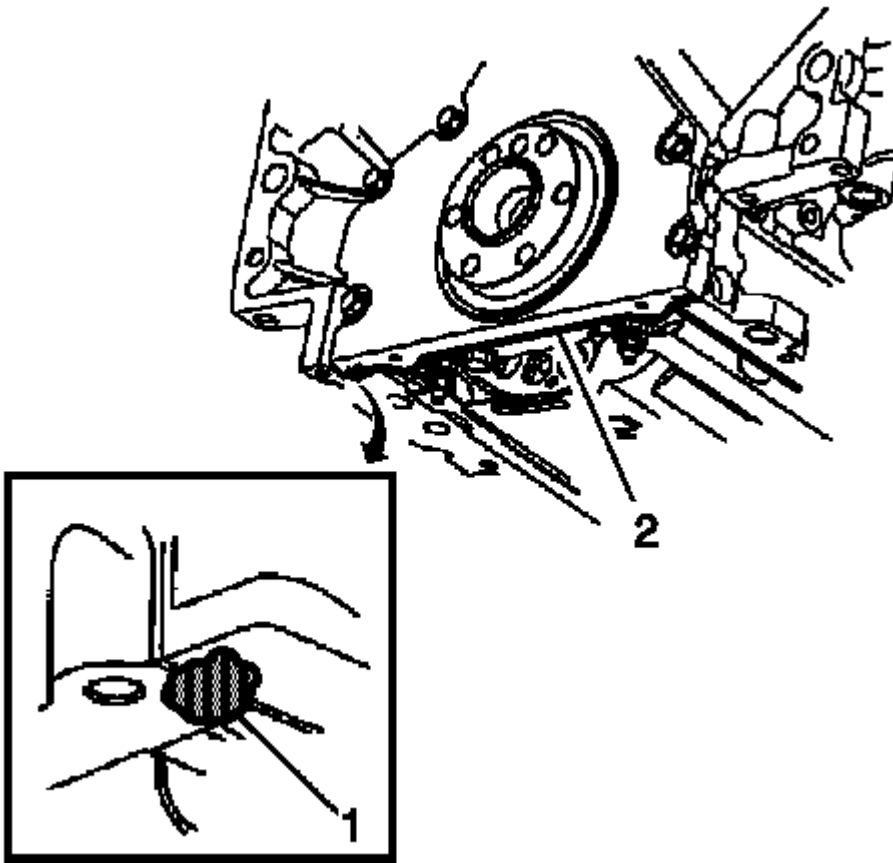


Fig. 249: Rear Oil Pan-To-Engine Block Junction Sealant Application Area
Courtesy of GENERAL MOTORS CORP.

4. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.8 in) long to the engine block. Apply the sealant directly onto the tabs of the rear cover gasket that protrudes into the oil pan surface. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

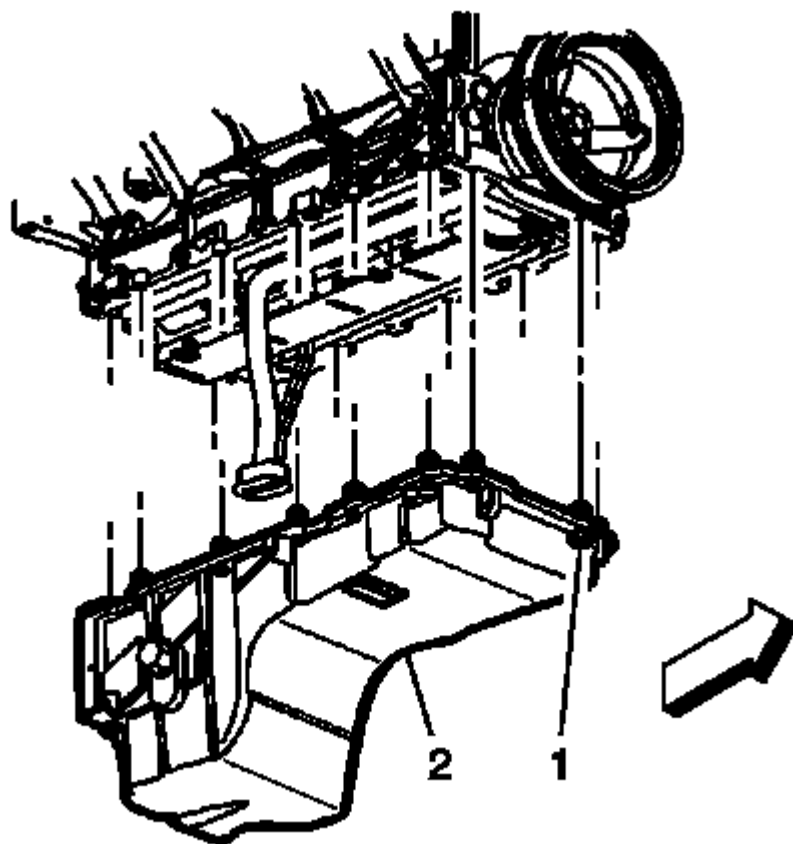


Fig. 250: Oil Pan Bolts

Courtesy of GENERAL MOTORS CORP.

5. Install 1 oil pan bolt into a oil pan bolt hole and up through the gasket.
6. Position and install the oil pan and the rest of the oil pan bolts.

CAUTION: Refer to Fastener Caution .

7. Tighten the oil pan bolts.

Tighten

- M6-Tighten the bolts to 12 N.m (106 lb in).
- M8-Tighten the bolts to 25 N.m (18 lb ft).

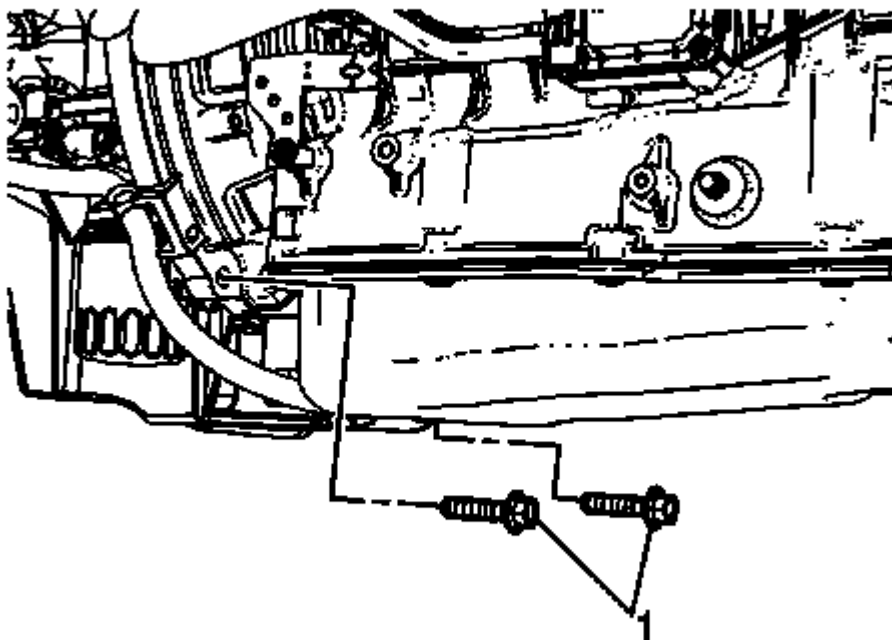


Fig. 251: Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the 2 lower transmission bolts (1) until snug.

Tighten

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

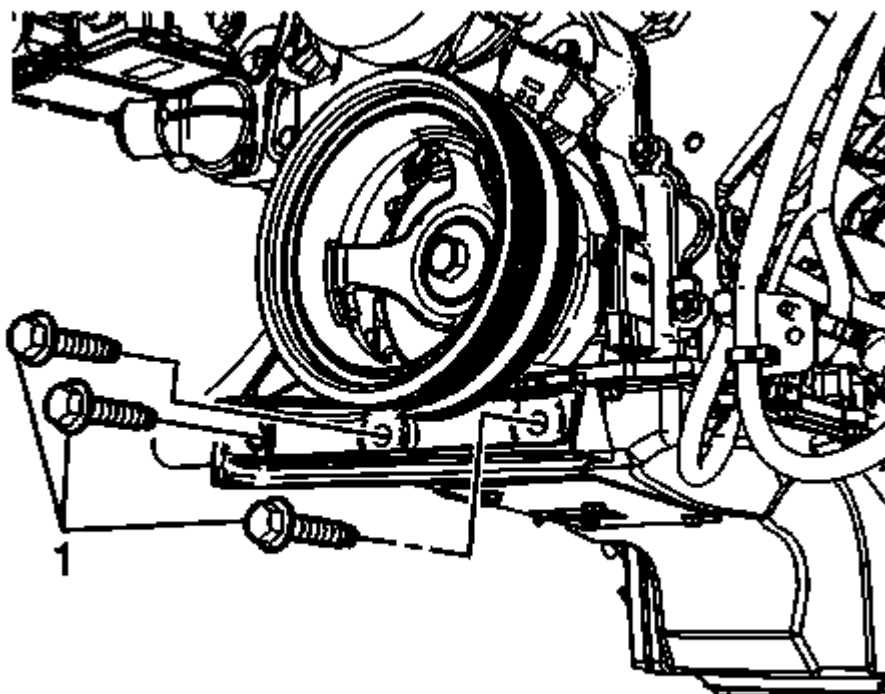


Fig. 252: Air Conditioning (A/C) Compressor Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

9. Install the air conditioning (A/C) compressor bracket bolts (1).

Tighten

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

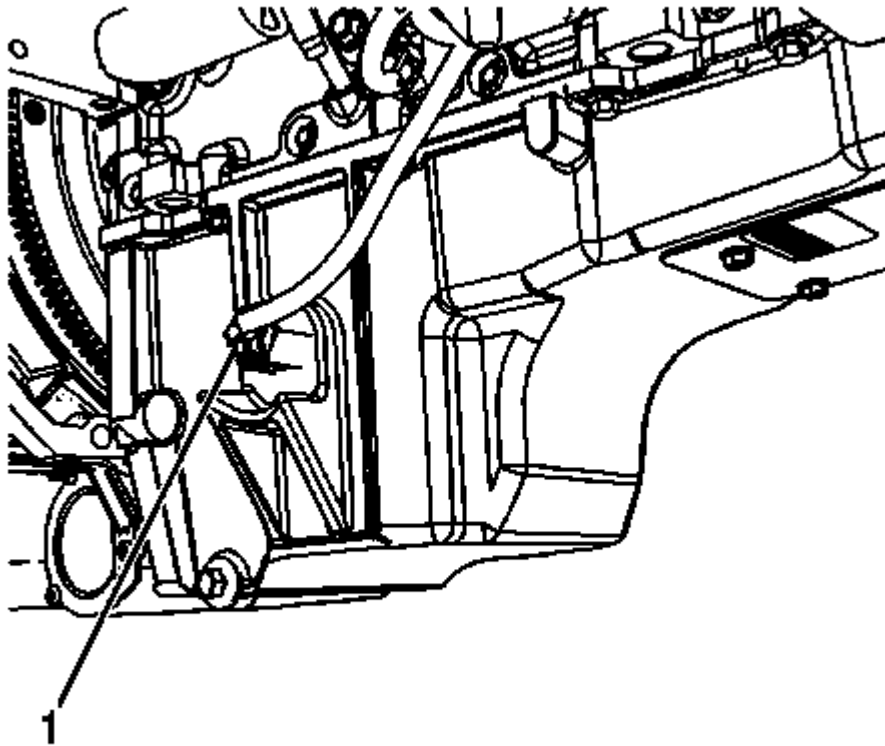


Fig. 253: Engine Harness Electrical Connector And Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

10. Connect the engine harness electrical connector (1) to the oil level sensor.

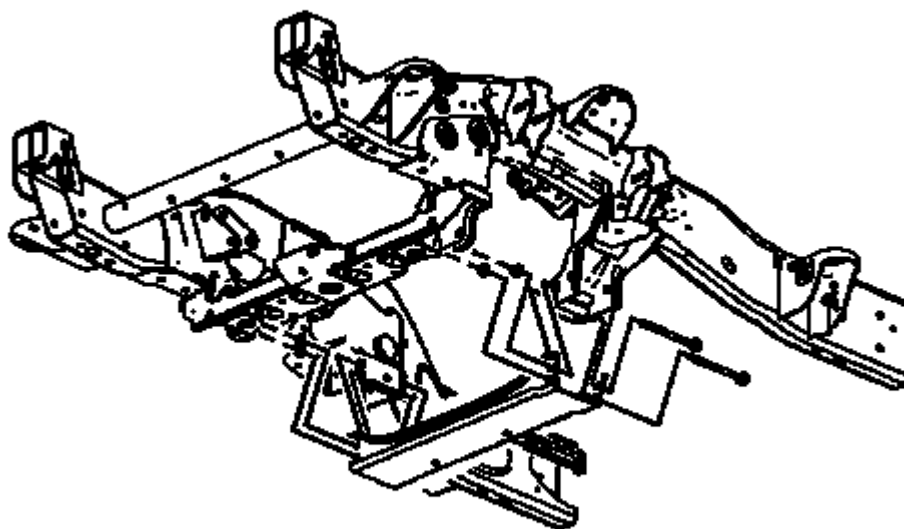


Fig. 254: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

11. For both the 1500 and 2500 series, perform the following steps prior to installing the crossbar bolts.
 1. Remove all traces of the original adhesive patch.
 2. Clean the threads of the bolts with denatured alcohol or equivalent and allow to dry.
 3. Apply threadlock GM P/N 12345493 (Canadian P/N 10953488) or equivalent to the bolt threads.
12. For 2500 series vehicles, install the crossbar and crossbar bolts/nuts.

Tighten

Tighten the nuts to 120 N.m (89 lb ft).

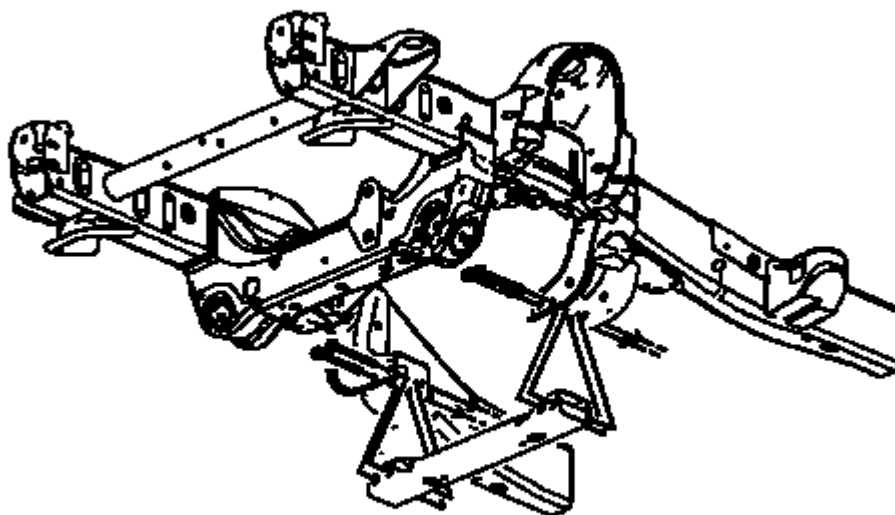


Fig. 255: Vehicle Crossbar, Bolts And Nuts
Courtesy of GENERAL MOTORS CORP.

13. For 1500 series vehicles, install the crossbar and crossbar bolts/nuts.

Tighten

Tighten the nuts to 100 N.m (74 lb ft).

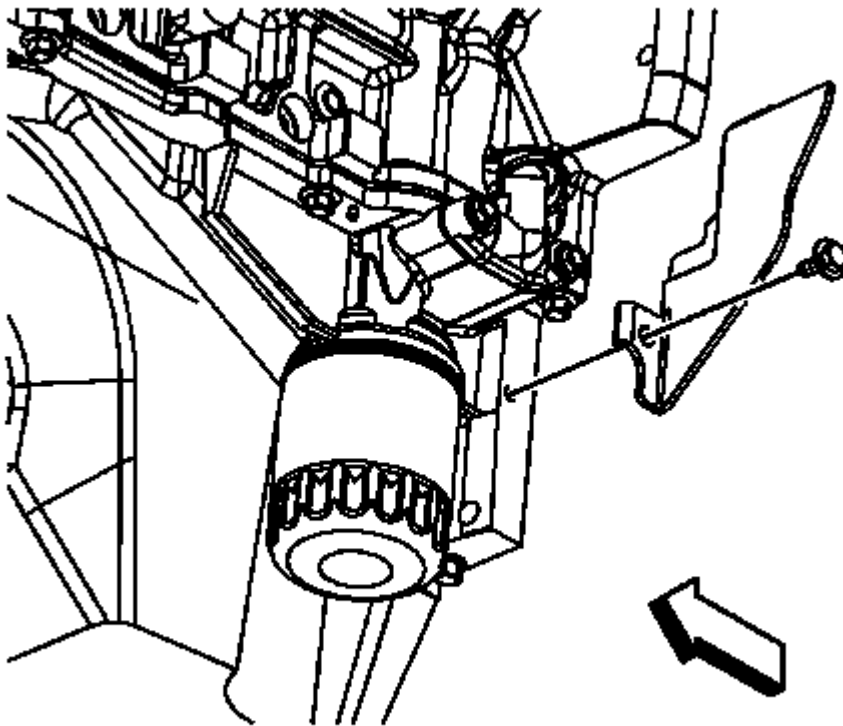


Fig. 256: Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

14. Position the left side transmission cover and install the cover bolt.

Tighten

Tighten the bolt to 12 N.m (106 lb in).

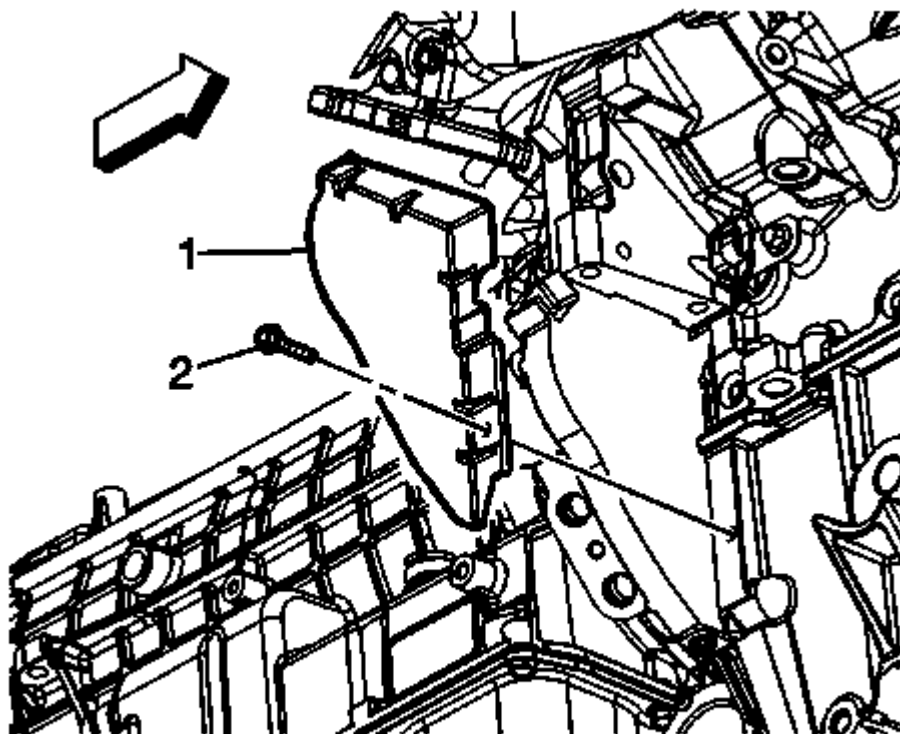


Fig. 257: Right Flex Plate Inspection Cover Bolt
Courtesy of GENERAL MOTORS CORP.

15. Install the right side transmission cover bolt (2).

Tighten

Tighten the bolt to 12 N.m (106 lb in).

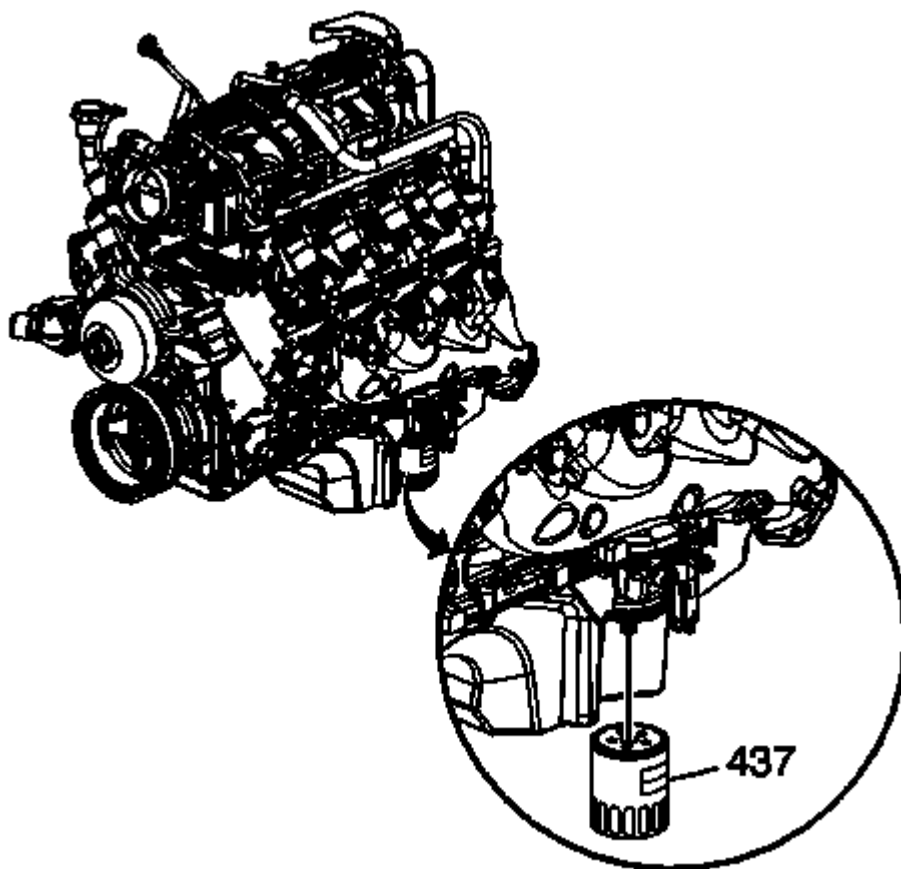


Fig. 258: Engine Oil Filter

Courtesy of GENERAL MOTORS CORP.

16. If reusing the old oil pan remove the old oil filter and install a NEW oil filter.
17. Lubricate the NEW oil filter seal with clean engine oil.
18. Install the NEW oil filter (437).

Tighten

Tighten the oil filter to 30 N.m (22 lb ft).

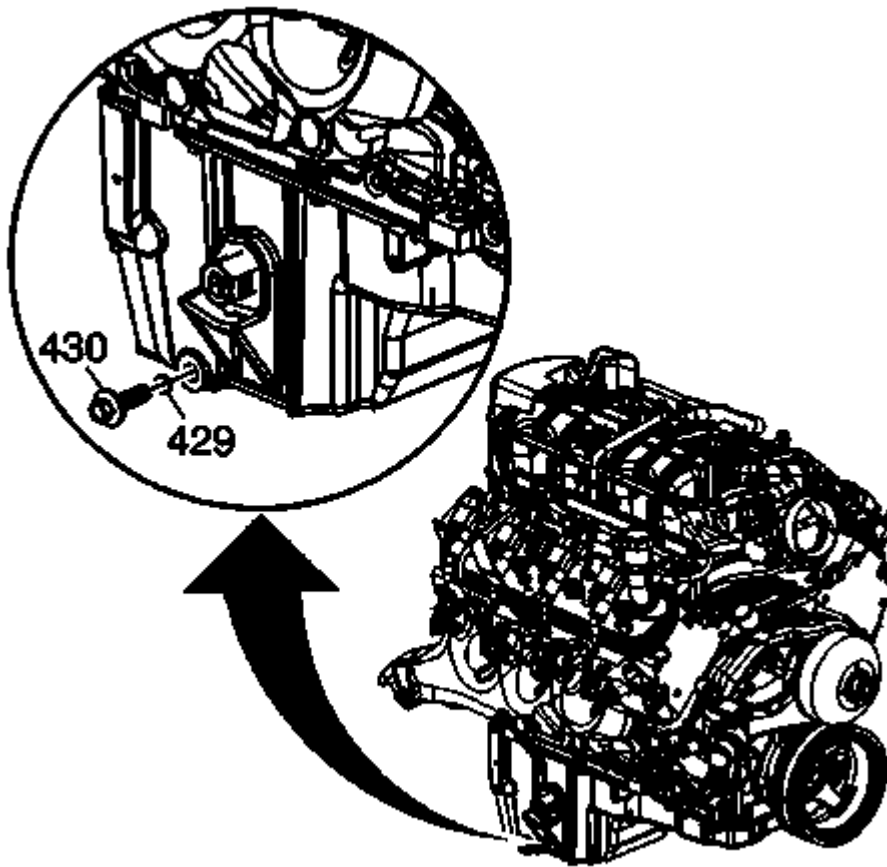


Fig. 259: Oil Pan Drain Plug

Courtesy of GENERAL MOTORS CORP.

19. Install the oil pan drain plug (430).

Tighten

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

20. Install the front differential carrier. Refer to **Differential Carrier Assembly Replacement (8.25 inch)** , **Differential Carrier Assembly Replacement (4WD 1500 Hybrid)** , **Differential Carrier Assembly Replacement (9.25 inch)** .
21. Raise the steering rack in place and install the steering rack bolts.

Tighten

- Tighten the left side steering rack bolts to 200 N.m (148 lb ft).
 - Tighten the right side steering rack bolts to 100 N.m (74 lb ft).
22. Install the engine shield. Refer to **Engine Shield Replacement** .

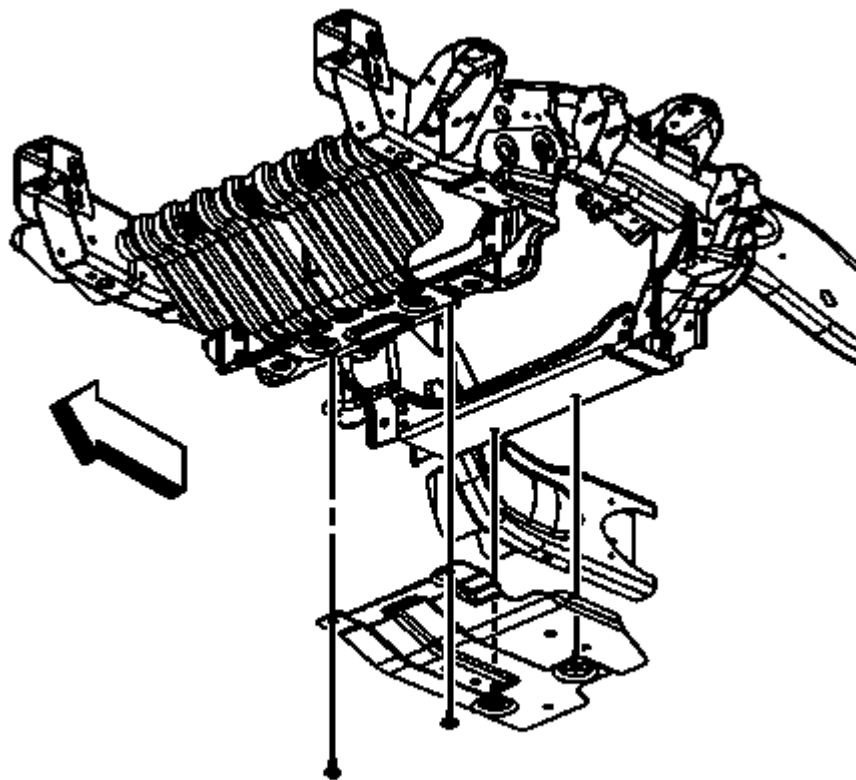


Fig. 260: Oil Pan Skid Plate

Courtesy of GENERAL MOTORS CORP.

23. For 2500 series vehicles, position the oil pan skid plate and tighten until snug the 2 rear oil pan skid plate bolts, install the 2 front oil pan skid plate bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

24. For Hybrid (HP2) vehicles, Install the steering gear motor shield.

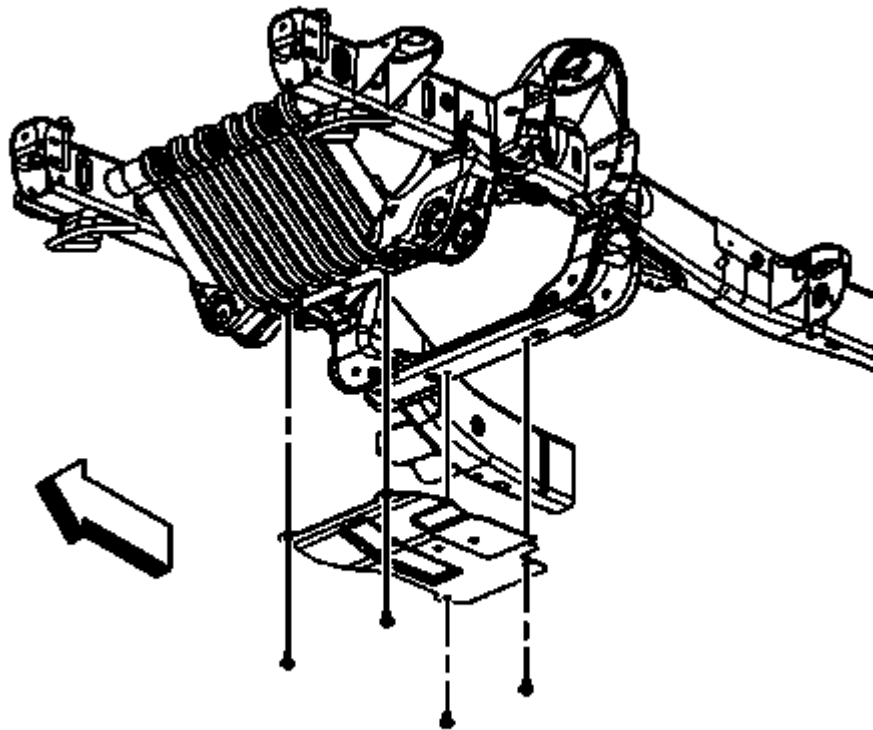


Fig. 261: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

25. For 1500 series vehicles, position the oil pan skid plate and install the oil pan skid plate bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

26. Lower the vehicle.
27. Fill the engine with NEW engine oil. Refer to **Fluid and Lubricant Recommendations** , and **Approximate Fluid Capacities** .
28. Start the engine and inspect for leaks.

ENGINE OIL PRESSURE SENSOR AND/OR SWITCH REPLACEMENT

Special Tools

J 41712 Oil Pressure Switch Socket

Removal Procedure

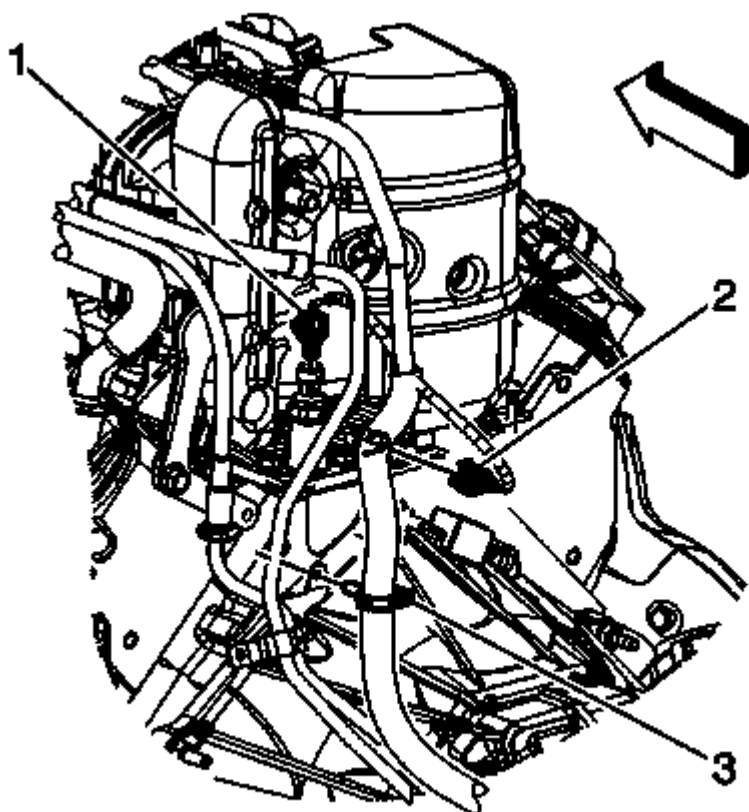


Fig. 262: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9, LMG, LY5, L76)** , **Intake Manifold Replacement (RPOs LY2, LY6)** , **Intake Manifold Replacement (Except RPOs LY2, LY6, LC9, LMG, LY5)** .
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.

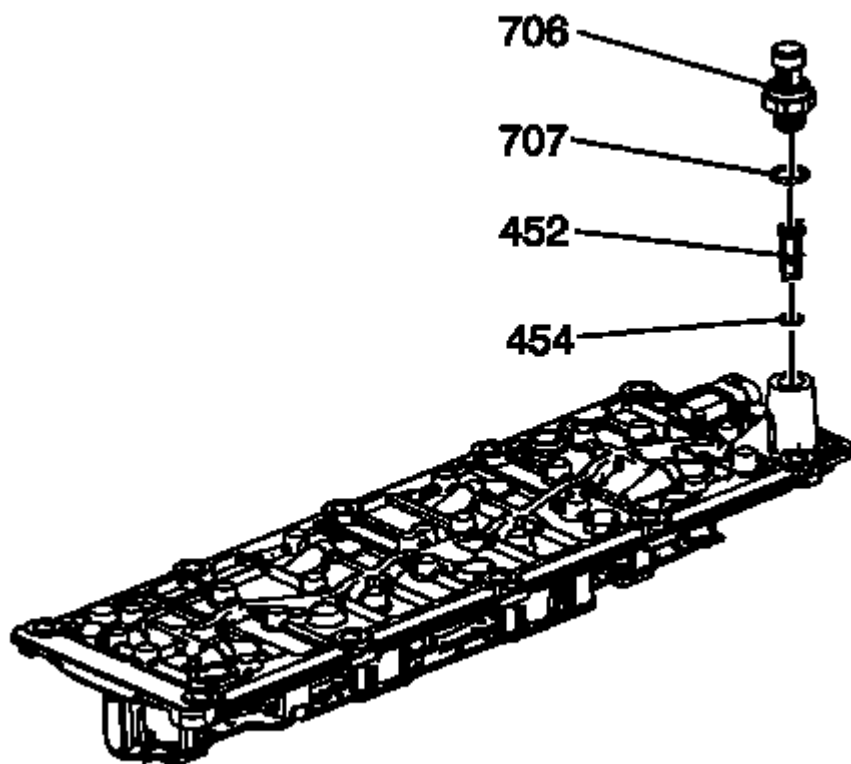


Fig. 263: Oil Pressure Sensor

Courtesy of GENERAL MOTORS CORP.

3. Using the **J 41712** or equivalent, remove the oil pressure sensor (706) and washer (707).

Installation Procedure

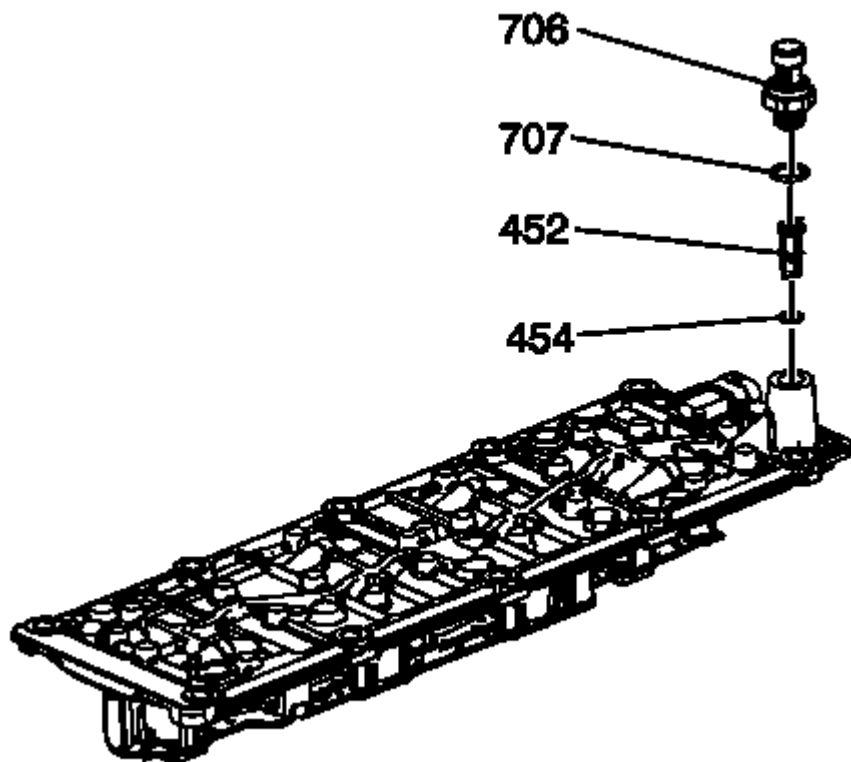


Fig. 264: Oil Pressure Sensor

Courtesy of GENERAL MOTORS CORP.

1. Apply sealant to the threads of the NEW oil pressure sensor. Refer to **Adhesives, Fluids, Lubricants, and Sealers** .

CAUTION: Refer to **Fastener Caution** .

2. Using **J 41712** or equivalent, install the oil pressure sensor (706) and washer (707).

Tighten

Tighten the sensor to 35 N.m (26 lb ft).

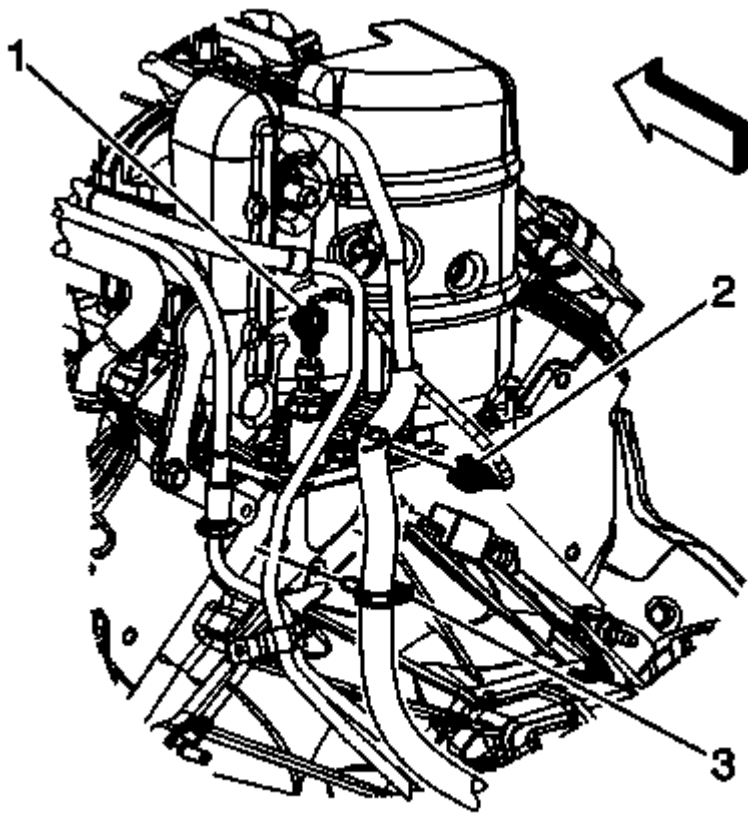


Fig. 265: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

3. Connect the engine harness electrical connector (1) to the oil pressure sensor.

Tighten

Tighten the sensor to 35 N.m (26 lb ft).

4. Install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9, LMG, LY5, L76)** , **Intake Manifold Replacement (RPOs LY2, LY6)** , **Intake Manifold Replacement (Except RPOs LY2, LY6, LC9, LMG, LY5)** .

OIL PUMP, SCREEN, AND CRANKSHAFT OIL DEFLECTOR REPLACEMENT

Removal Procedure

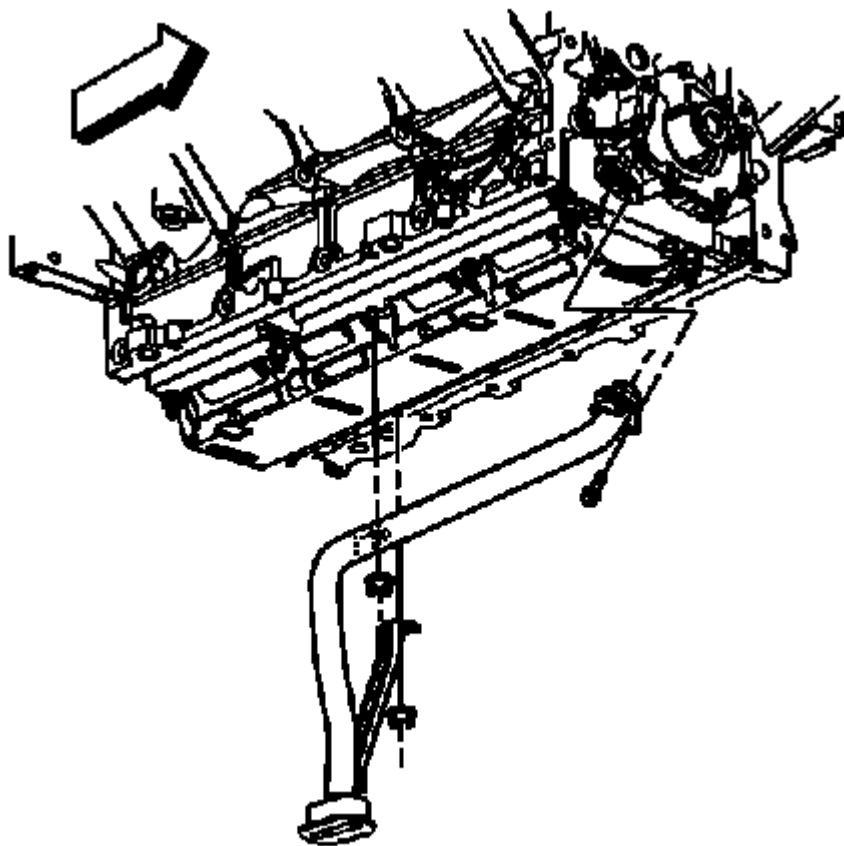


Fig. 266: Oil Pump Screen Bolt Nuts
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pan. Refer to **Oil Pan Replacement (4WD)** , **Oil Pan Replacement (2WD)** .
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement** .
3. Remove the oil pump screen bolt and nuts.
4. Remove the oil pump screen with O-ring seal.
5. Remove the O-ring seal from the pump screen.
6. Discard the O-ring seal.

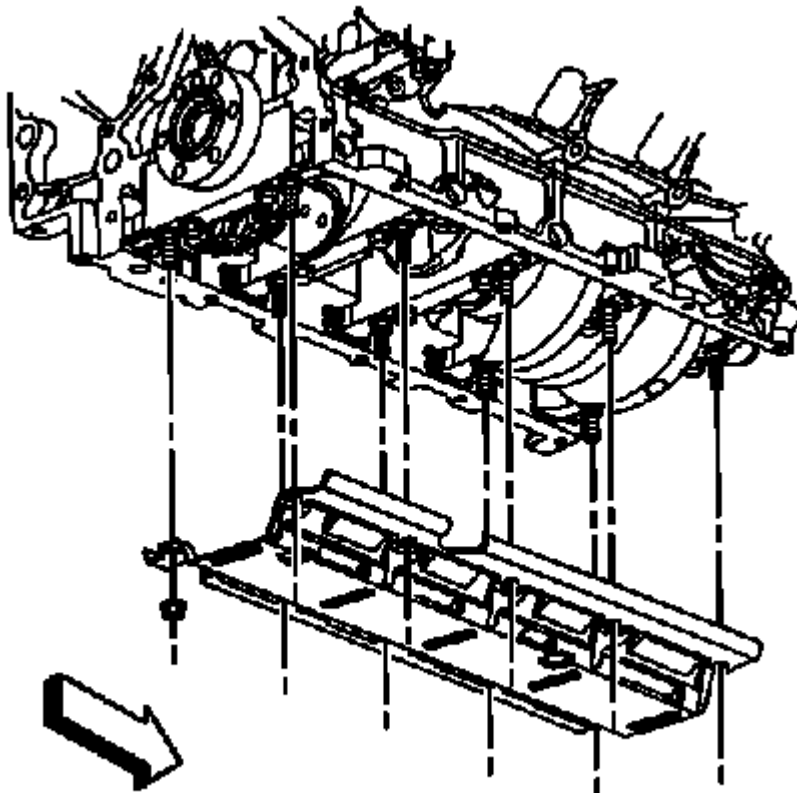


Fig. 267: Crankshaft Oil Deflector And Nuts
Courtesy of GENERAL MOTORS CORP.

7. Remove the remaining crankshaft oil deflector nuts.
8. Remove the crankshaft oil deflector.

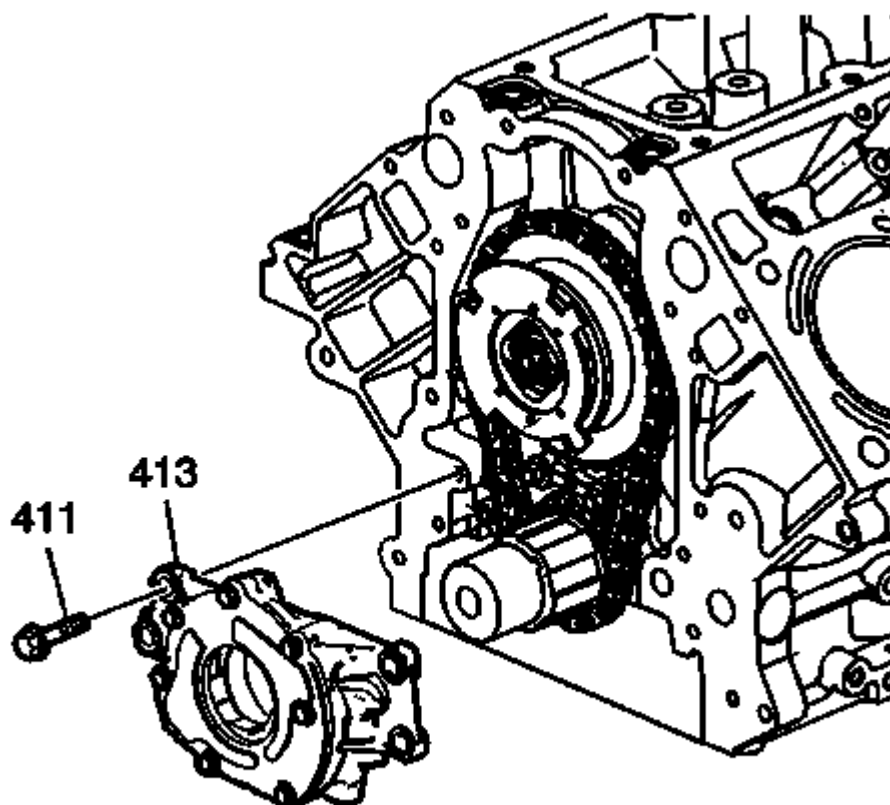


Fig. 268: Oil Pump And Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the oil pump bolts (411).

NOTE: Do not allow dirt or debris to enter the oil pump assembly, cap end as necessary.

10. Remove the oil pump (413)

Installation Procedure

NOTE: Inspect the engine block oil galley passages. These areas must be free and clear of debris or restrictions.

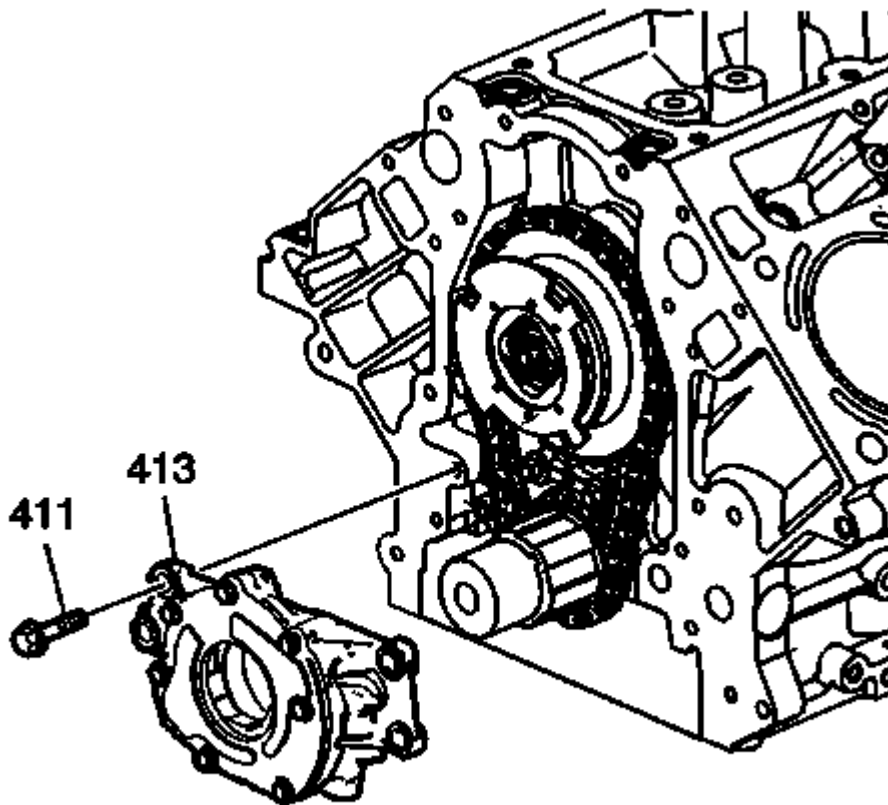


Fig. 269: Oil Pump And Bolts

Courtesy of GENERAL MOTORS CORP.

1. Align the splined surfaces of the crankshaft sprocket and the oil pump drive gear and install the oil pump (413).
2. Install the oil pump (413) onto the crankshaft sprocket until the pump housing contacts the face of the engine block.

CAUTION: Refer to Fastener Caution .

3. Install the oil pump bolts (411).

Tighten

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

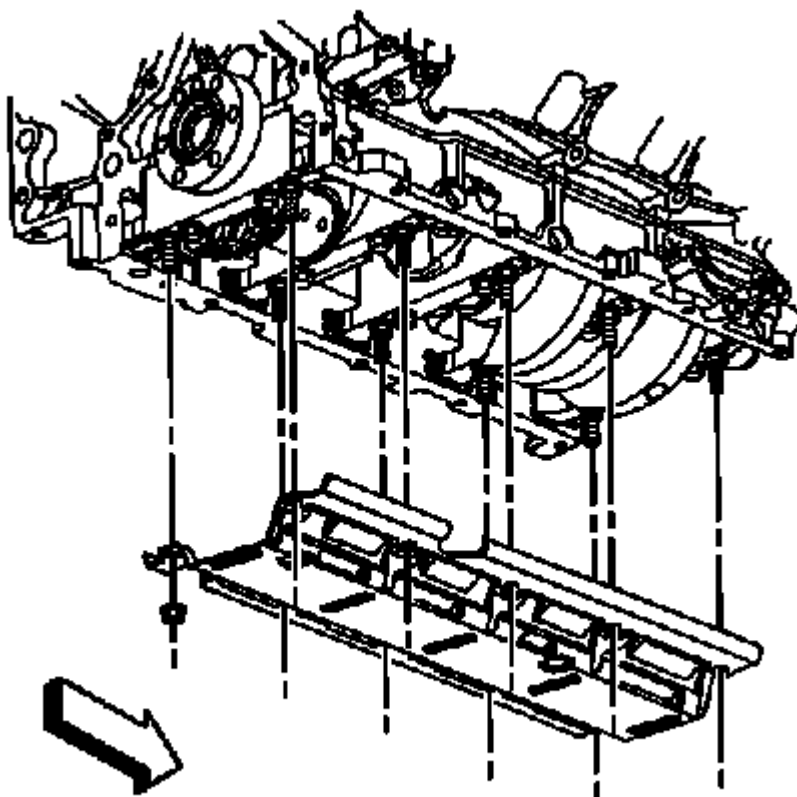


Fig. 270: Crankshaft Oil Deflector And Nuts
Courtesy of GENERAL MOTORS CORP.

4. Position the crankshaft oil deflector and install the nuts until snug.

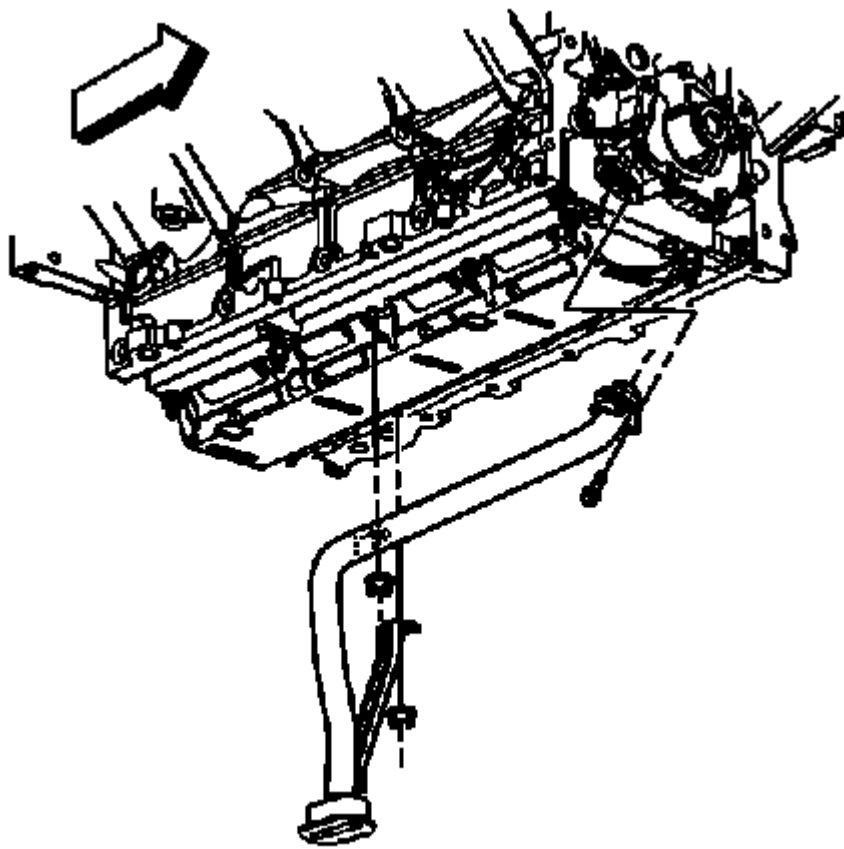


Fig. 271: Oil Pump Screen Bolt Nuts
Courtesy of GENERAL MOTORS CORP.

5. Lubricate a NEW oil pump screen O-ring seal with clean engine oil.
6. Install the NEW O-ring seal onto the oil pump screen.

NOTE: Push the oil pump screen tube completely into the oil pump prior to tightening the bolt. Do not allow the bolt to pull the tube into the pump.

7. Align the oil pump screen mounting brackets with the correct crankshaft bearing cap studs.
8. Install the oil pump screen.
9. Install the oil pump screen bolt and nuts.

Tighten

1. Tighten the bolt to 12 N.m (106 lb in).
 2. Tighten the nuts to 25 N.m (18 lb ft).
10. Install the engine front cover. Refer to **Engine Front Cover Replacement**.
 11. Install the oil pan. Refer to **Oil Pan Replacement (4WD)**, **Oil Pan Replacement (2WD)**.

TIMING CHAIN, CRANKSHAFT SPROCKET, CAMSHAFT POSITION ACTUATOR, AND SOLENOID VALVE REPLACEMENT**Special Tools**

- **EN 46330** Timing Chain Tensioner Retaining Pin
- **J 8433** Puller Bar
- **J 41478** Crankshaft Front Oil Seal Installer
- **J 41558** Crankshaft Sprocket Remover
- **J 41665** Crankshaft Balancer and Sprocket Installer
- **J 41816-2** Crankshaft End Protector
- **J 42386-A** Flywheel Holding Tool
- **J 45059** Angle Meter

Removal Procedure

1. Remove the oil pump. Refer to **Oil Pump, Screen, and Crankshaft Oil Deflector Replacement**.

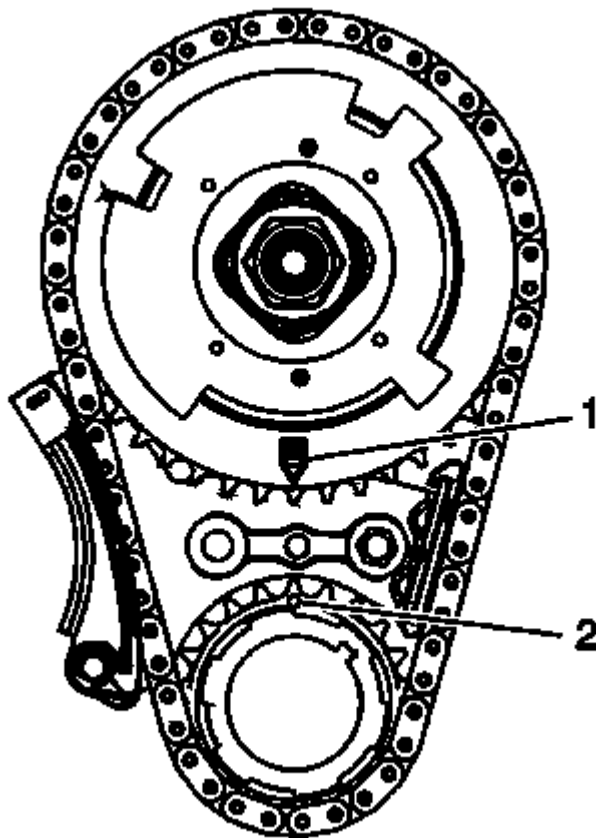


Fig. 272: CMP Actuator Sprocket And Crankshaft Sprocket Alignment Marks
Courtesy of GENERAL MOTORS CORP.

2. Rotate the crankshaft sprocket until the camshaft position (CMP) actuator alignment mark (1) and the crankshaft sprocket alignment mark (2) are aligned.

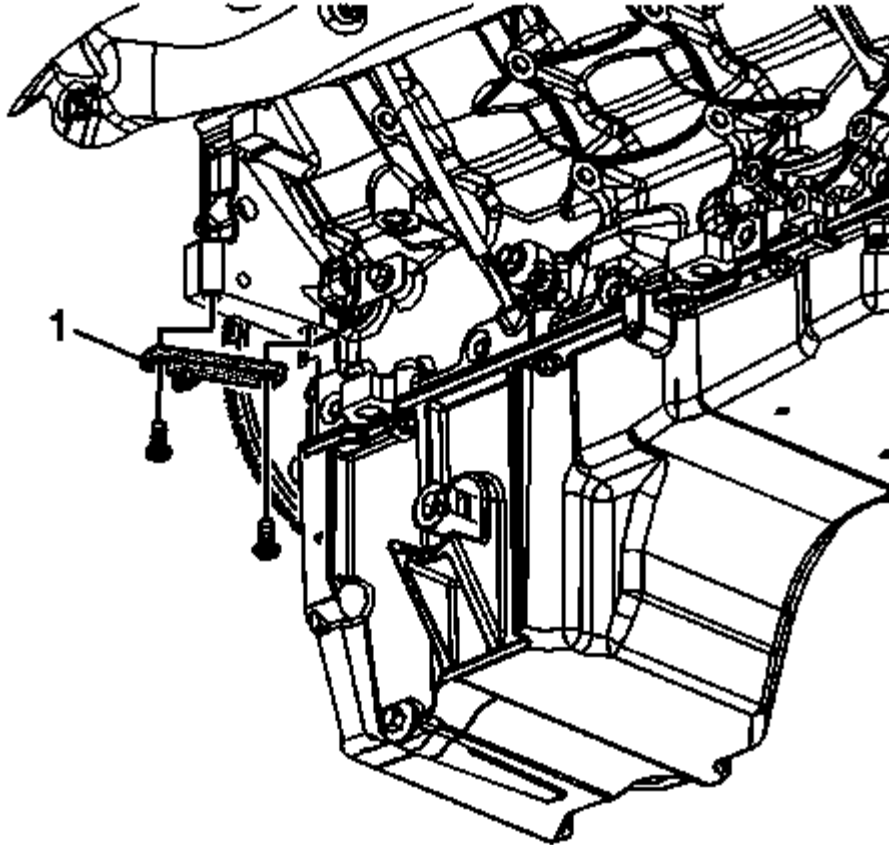


Fig. 273: Flywheel Holding Tool
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

NOTE: Ensure that the teeth of the J 42386-A mesh with the teeth of the engine flywheel.

3. Install the J 42386-A (1) and bolts. Use one M10-1.5 x 120 mm and one M10-1.5 x 45 mm bolt for proper tool operation.

Tighten

Tighten the J 42386-A bolts to 50 N.m (37 lb ft).

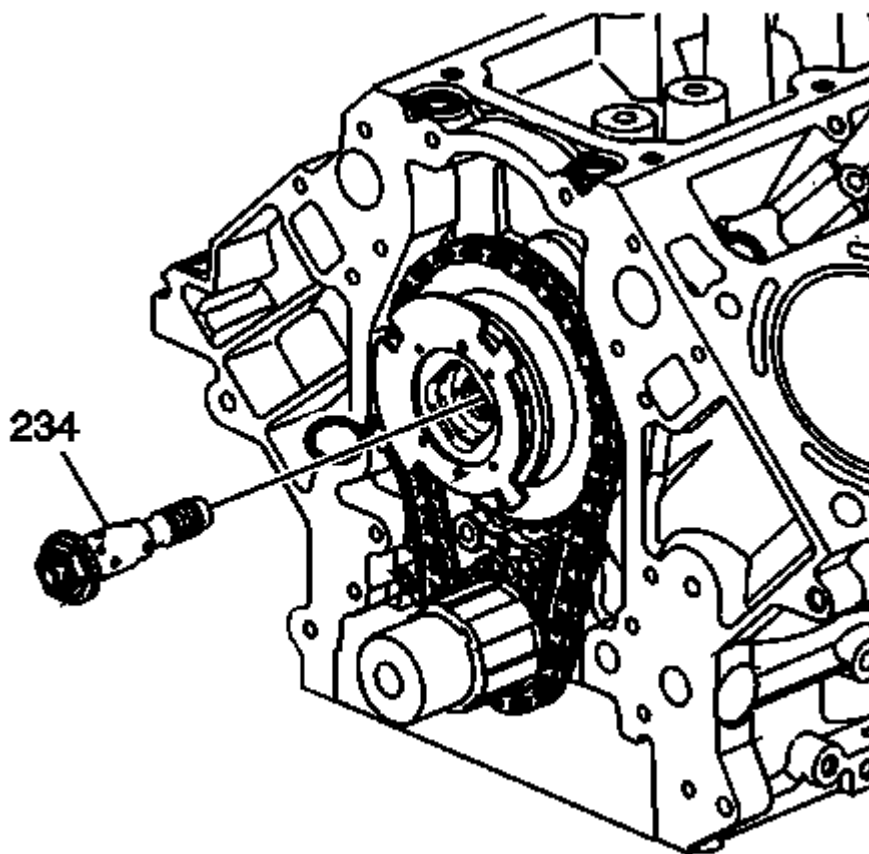


Fig. 274: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

4. Remove and discard the CMP actuator solenoid valve (234).

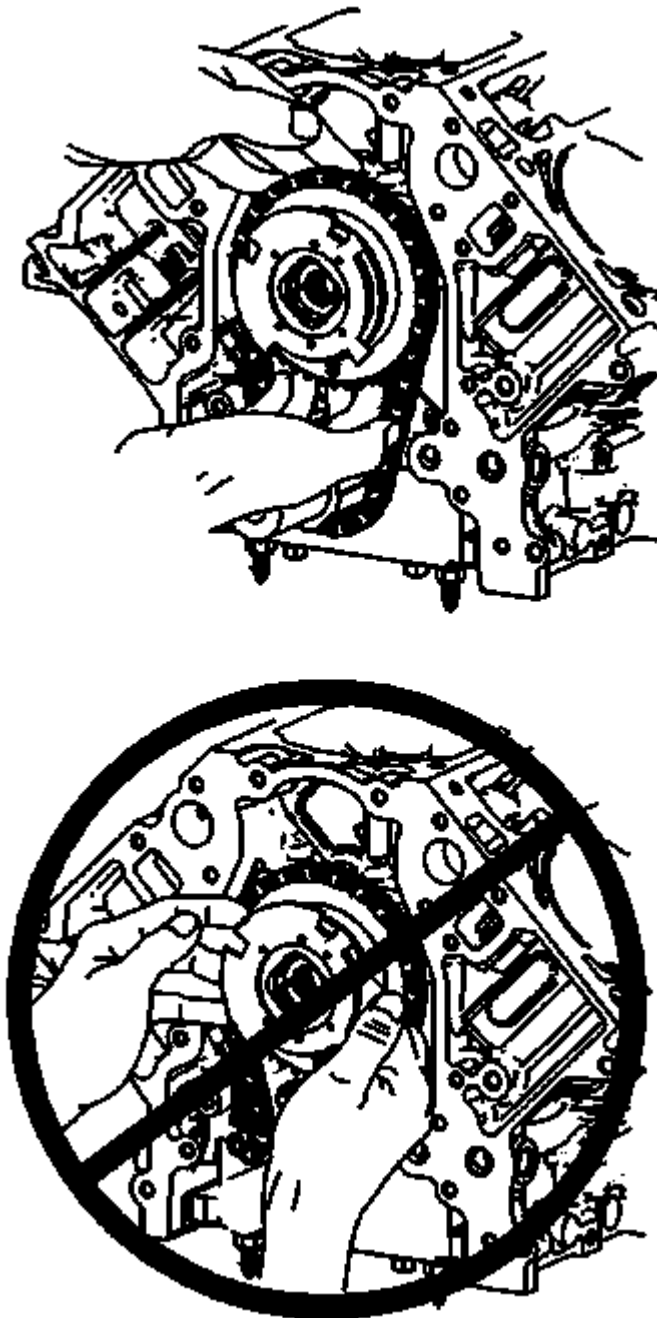


Fig. 275: Proper CMP Actuator Removal
Courtesy of GENERAL MOTORS CORP.

WARNING: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator return spring is under tension and may rotate the dislodged reluctor wheel, causing personal injury.

5. Loosen and separate the CMP actuator and timing chain from the camshaft. Position your fingers behind the actuator sprocket and pull the actuator away from the front of the camshaft. Never pull on the reluctor wheel when attempting to remove the actuator.

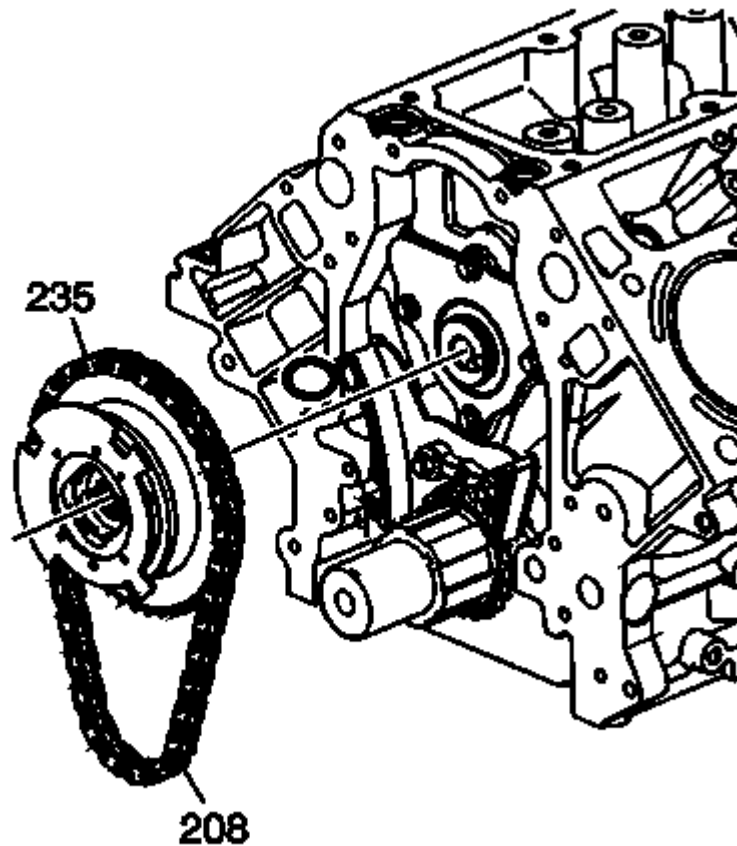


Fig. 276: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not turn the crankshaft assembly after the timing chain has been removed in order to prevent damage to the piston assemblies or the valves.

6. Remove the CMP actuator (235) and timing chain (208).

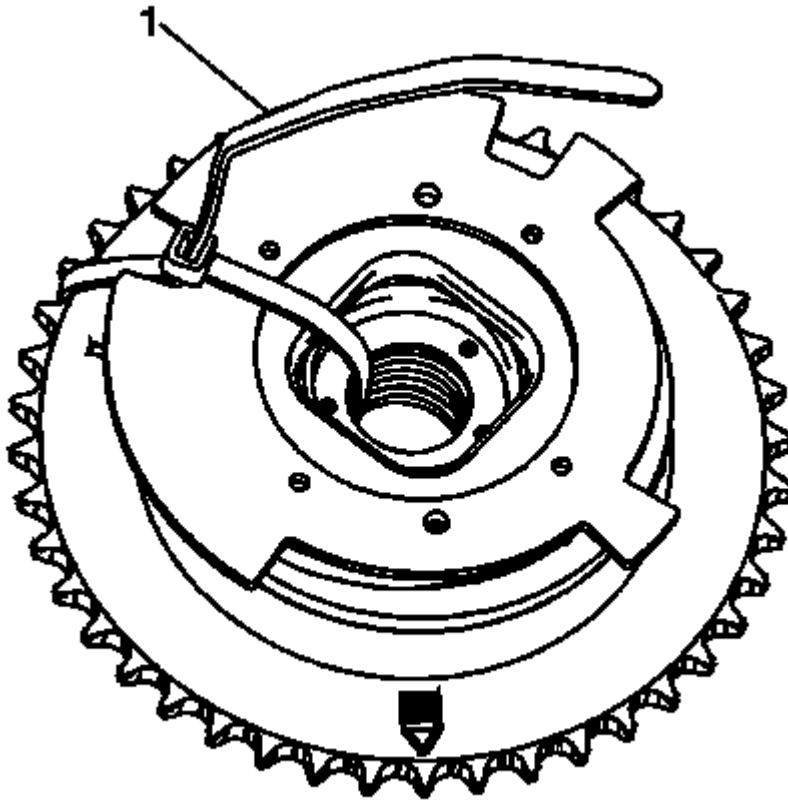


Fig. 277: Tie Strap Through Center Of Actuator
Courtesy of GENERAL MOTORS CORP.

7. Insert and secure a tie strap (1) through the center of the actuator and over the reluctor wheel.

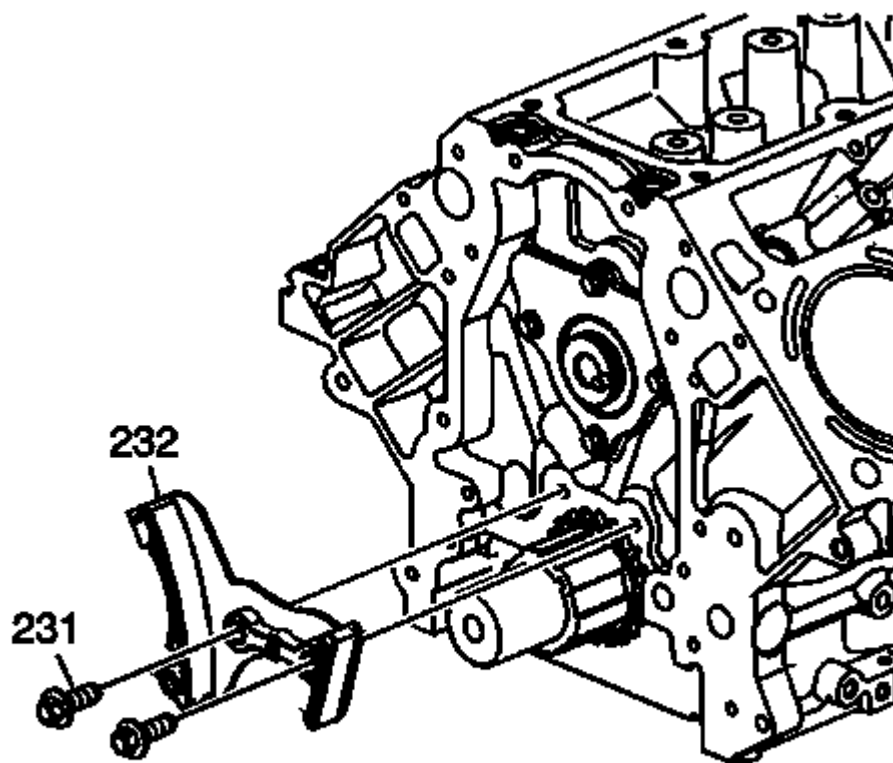


Fig. 278: Timing Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

8. Remove the timing chain tension bolts (231) and tensioner (232).

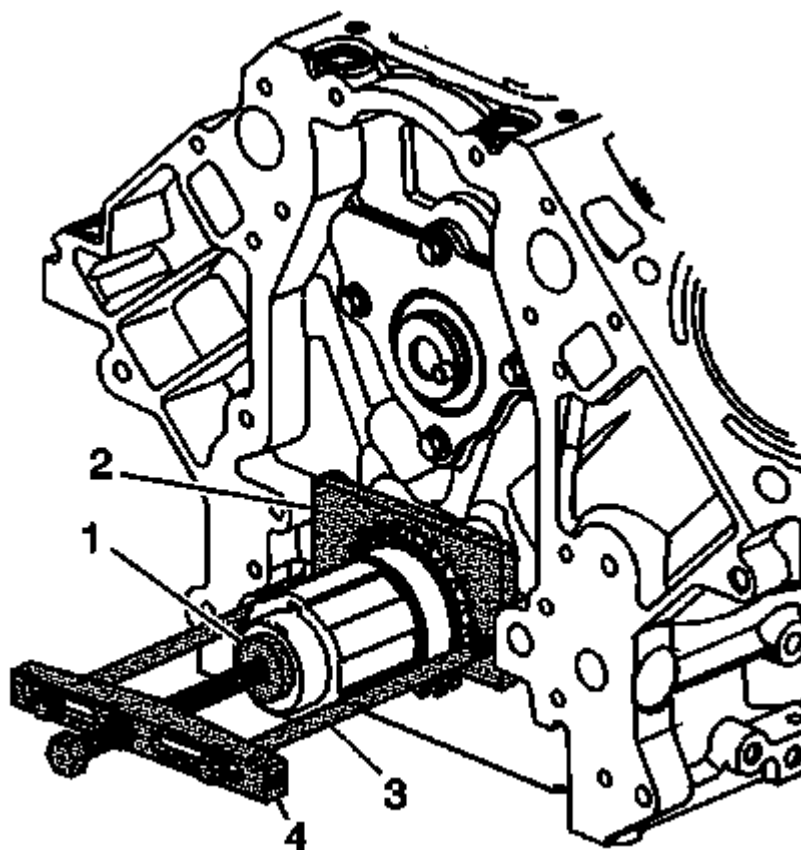


Fig. 279: Crankshaft Sprocket And Special Tools
Courtesy of GENERAL MOTORS CORP.

9. Using the **J 41816-2** (1), the **J 41558** (2), bolts (3) and the **J 8433** (4) in order to remove the crankshaft sprocket.

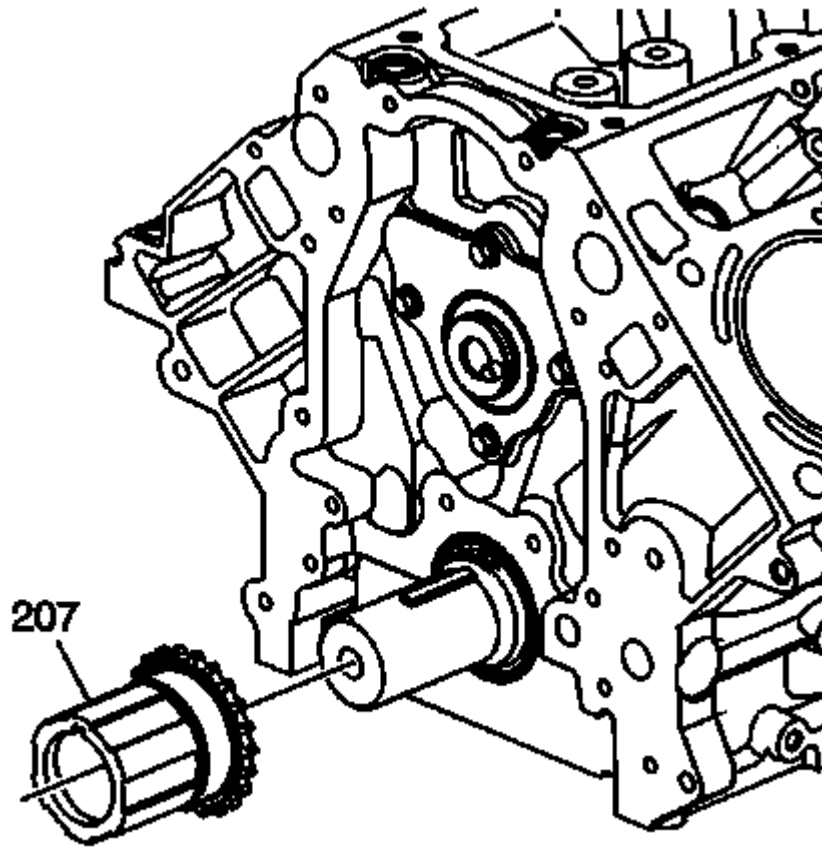


Fig. 280: Crankshaft Sprocket
Courtesy of GENERAL MOTORS CORP.

10. Remove the crankshaft sprocket (207).

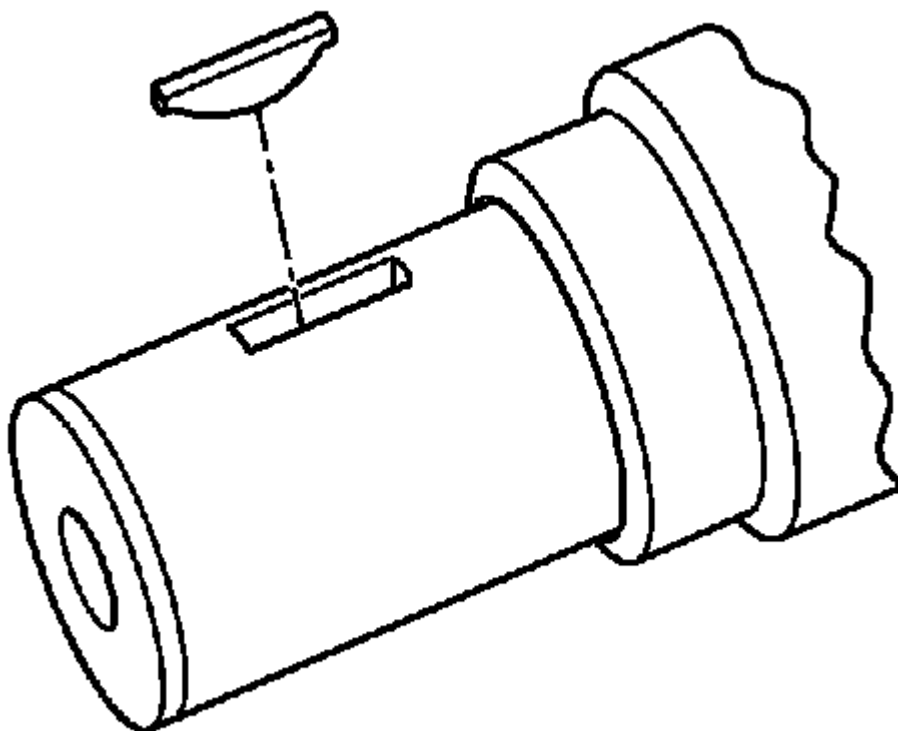


Fig. 281: Crankshaft Key And Keyway
Courtesy of GENERAL MOTORS CORP.

11. Remove the crankshaft sprocket key, if required.

Installation Procedure

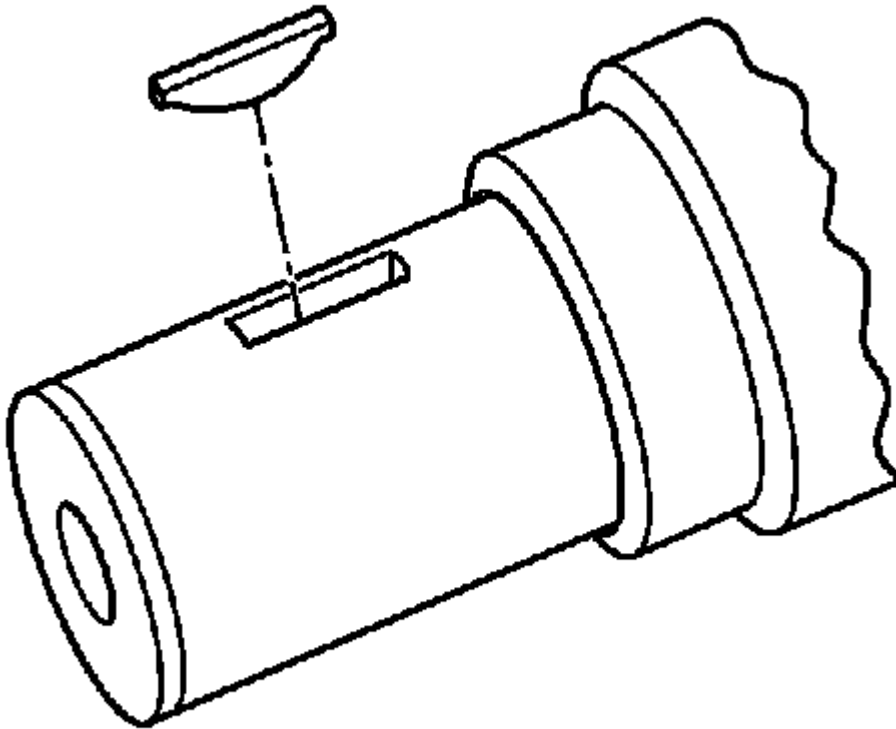
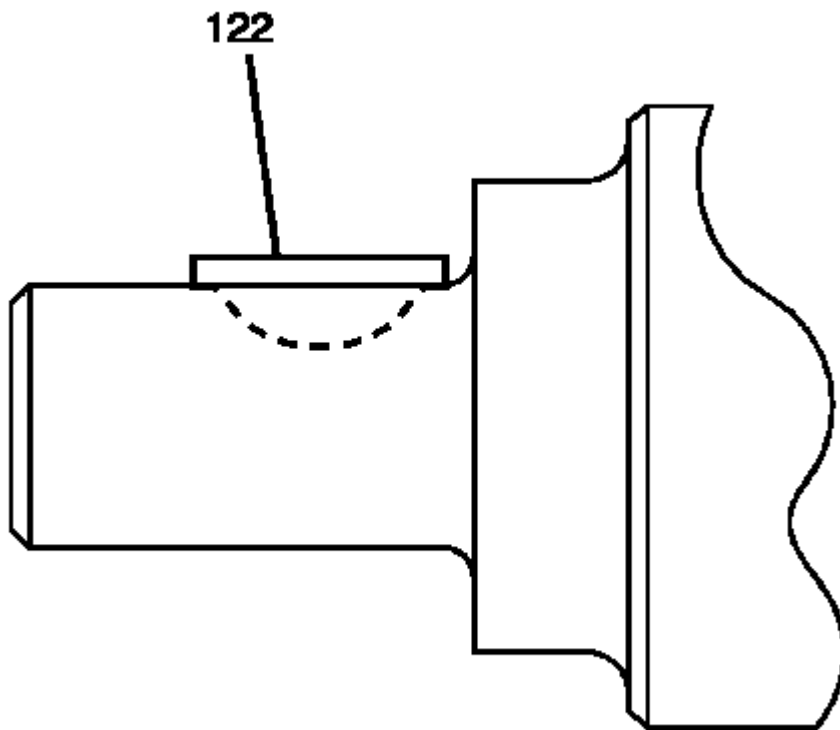


Fig. 282: Crankshaft Key And Keyway
Courtesy of GENERAL MOTORS CORP.

1. Install the key into the crankshaft keyway, if previously removed.

**Fig. 283: Crankshaft Key****Courtesy of GENERAL MOTORS CORP.**

2. Tap the key (122) into the keyway until both ends of the key bottom onto the crankshaft.

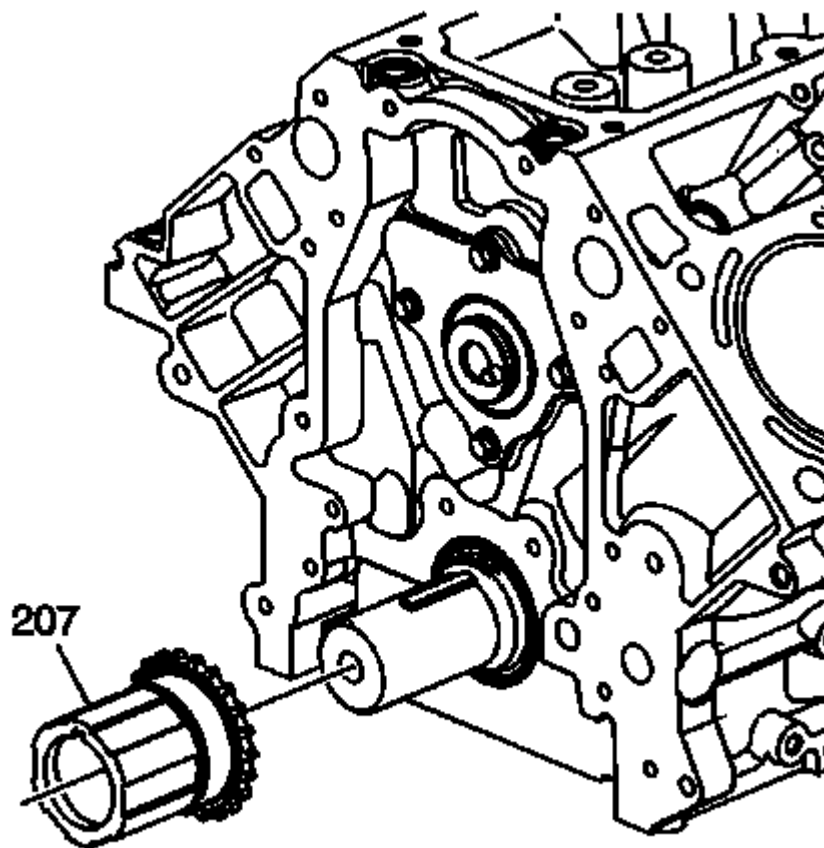


Fig. 284: Crankshaft Sprocket
Courtesy of GENERAL MOTORS CORP.

3. Install the crankshaft sprocket (207) onto the front of the crankshaft. Align the crankshaft key with the crankshaft sprocket keyway.

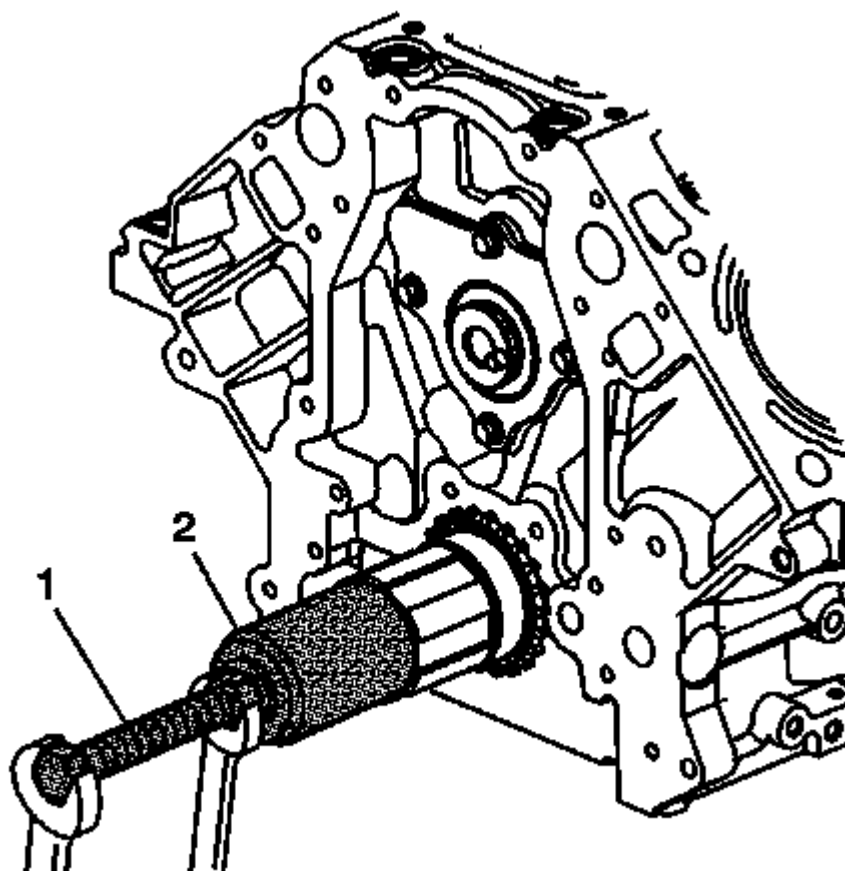


Fig. 285: Crankshaft Sprocket And Installer
Courtesy of GENERAL MOTORS CORP.

4. Use the **J 41478** (1) and the **J 41665** (2) in order to install the crankshaft sprocket. Install the sprocket onto the crankshaft until fully seated against the crankshaft flange.

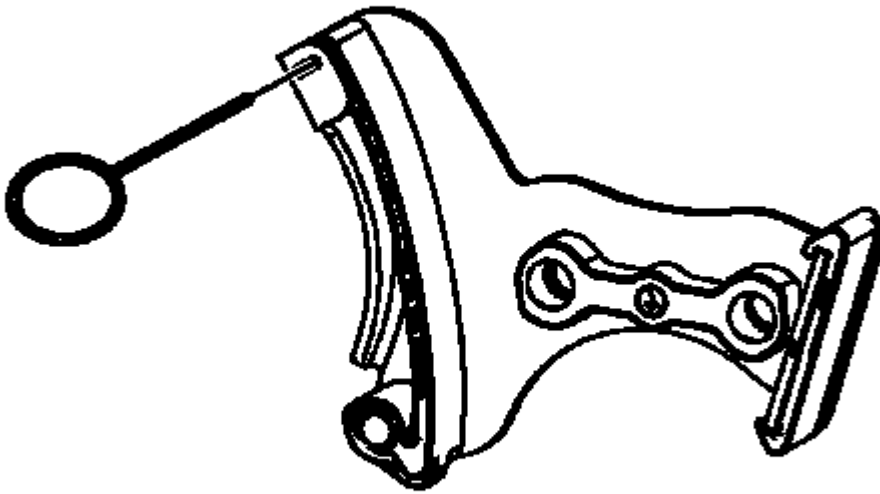


Fig. 286: Timing Belt Tensioner Retaining Pin
Courtesy of GENERAL MOTORS CORP.

5. Compress the timing chain tensioner guide and install the EN 46330 .

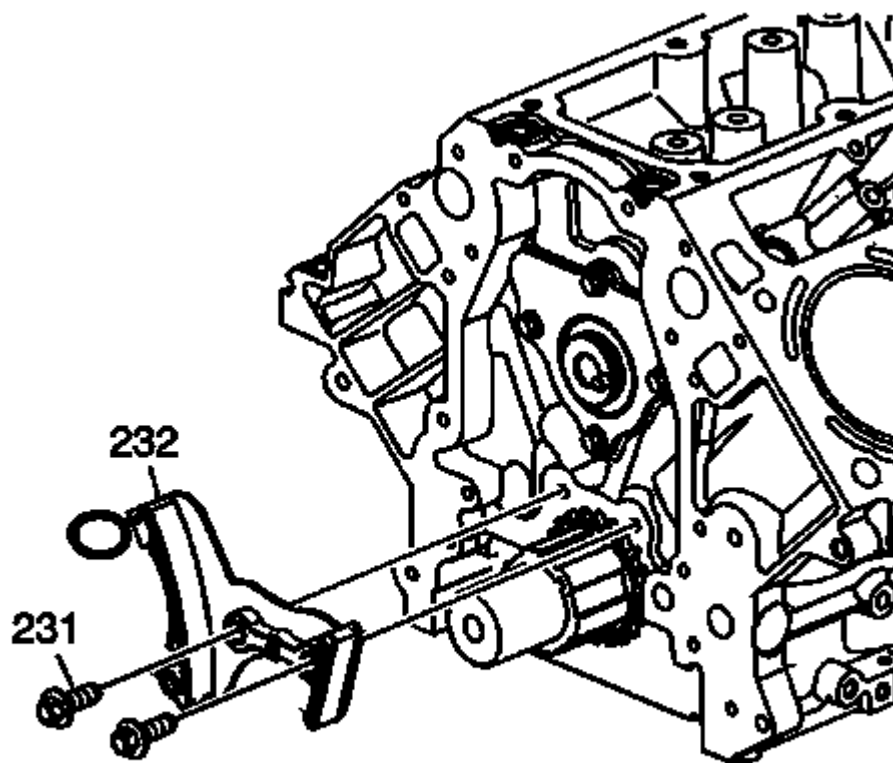


Fig. 287: Timing Chain Tensioner
Courtesy of GENERAL MOTORS CORP.

6. Install the timing chain tensioner (232) and bolts (231).

Tighten

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

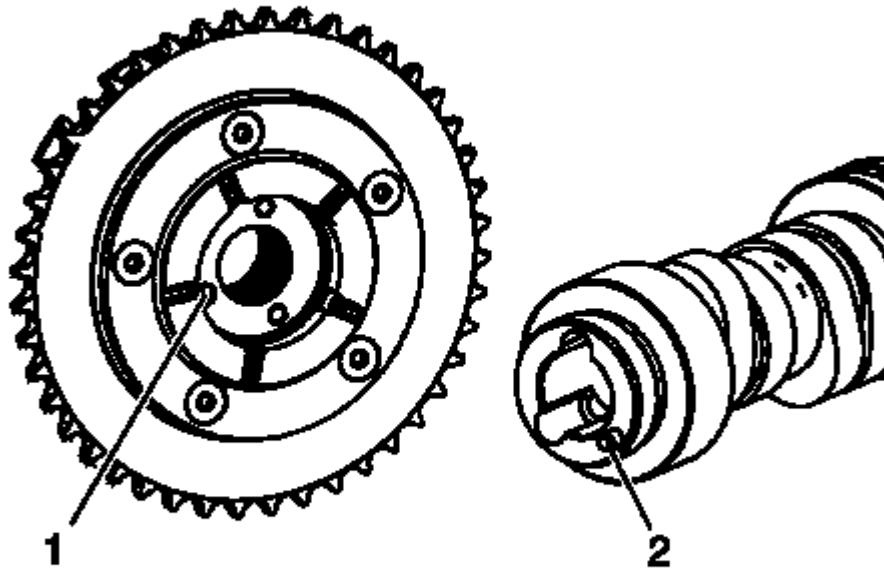


Fig. 288: Alignment Hole And Locating Pin
Courtesy of GENERAL MOTORS CORP.

NOTE:

- Properly locate the CMP actuator onto the locating pin of the camshaft.
- The sprocket teeth and timing chain teeth must mesh.
- The camshaft and the crankshaft sprocket alignment **MUST** be aligned properly.
- Do not use the CMP solenoid valve again. Install a **NEW** CMP valve during assembly.

7. Identify the alignment hole (1) in the rear face of the CMP actuator and the locating pin (2) on the front face of the camshaft.

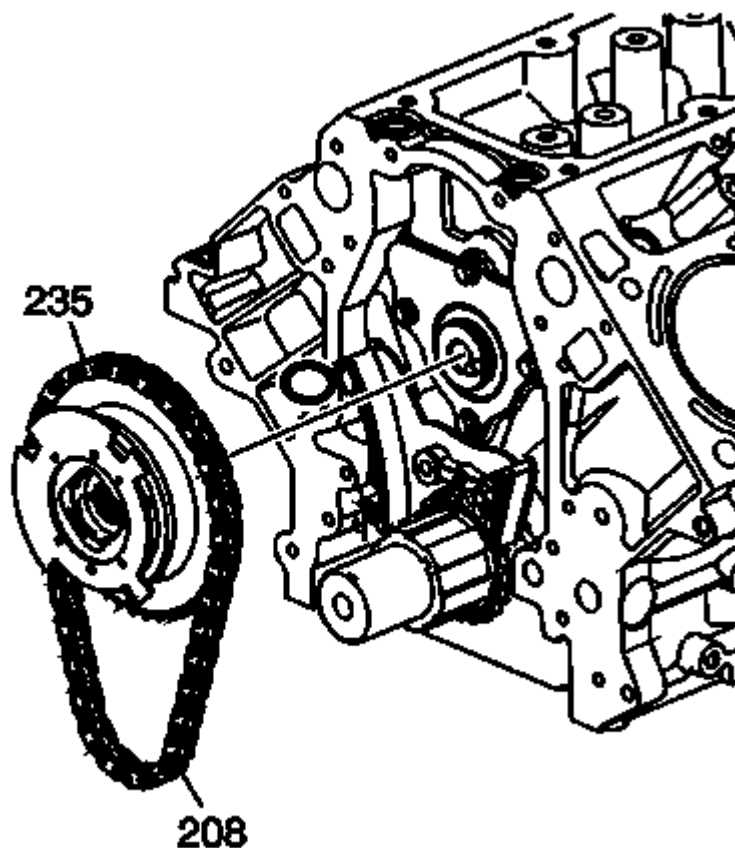


Fig. 289: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

8. Align the CMP actuator so the timing mark is in the 6 o'clock position.
9. Install the CMP actuator (235) and timing chain (208). Align the hole in the face of the CMP actuator with the locating pin on the front face of the camshaft.

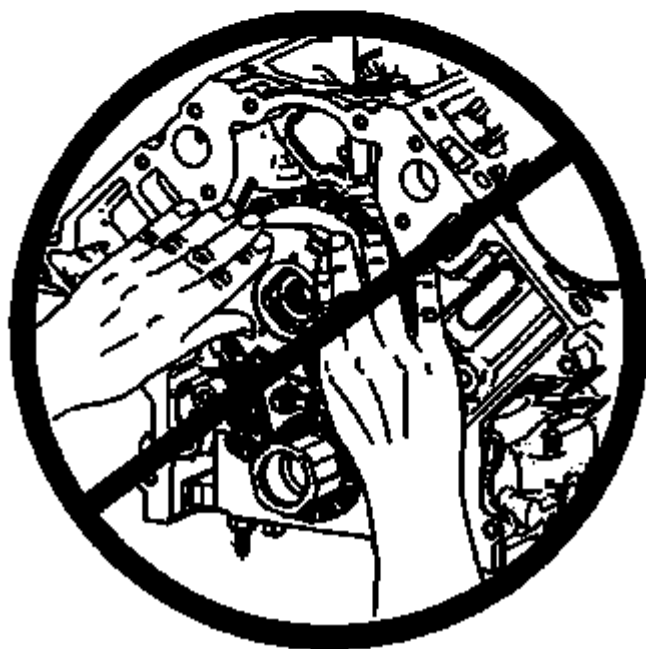
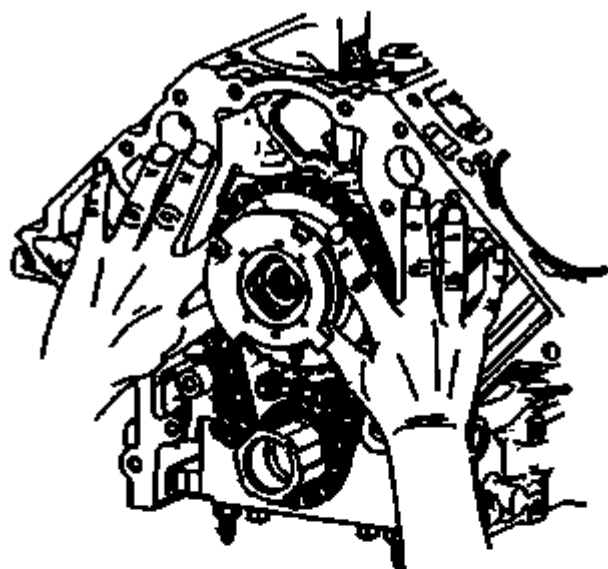


Fig. 290: Proper Installation Of CMP Actuator
Courtesy of GENERAL MOTORS CORP.

WARNING: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator return spring is under tension and may rotate the dislodged reluctor wheel, causing personal injury.

10. Use care to install the actuator completely onto the front of the camshaft. Position your fingers onto the face of the actuator sprocket and push the actuator onto the front of the camshaft. Never push on the reluctor wheel when attempting to install the actuator.

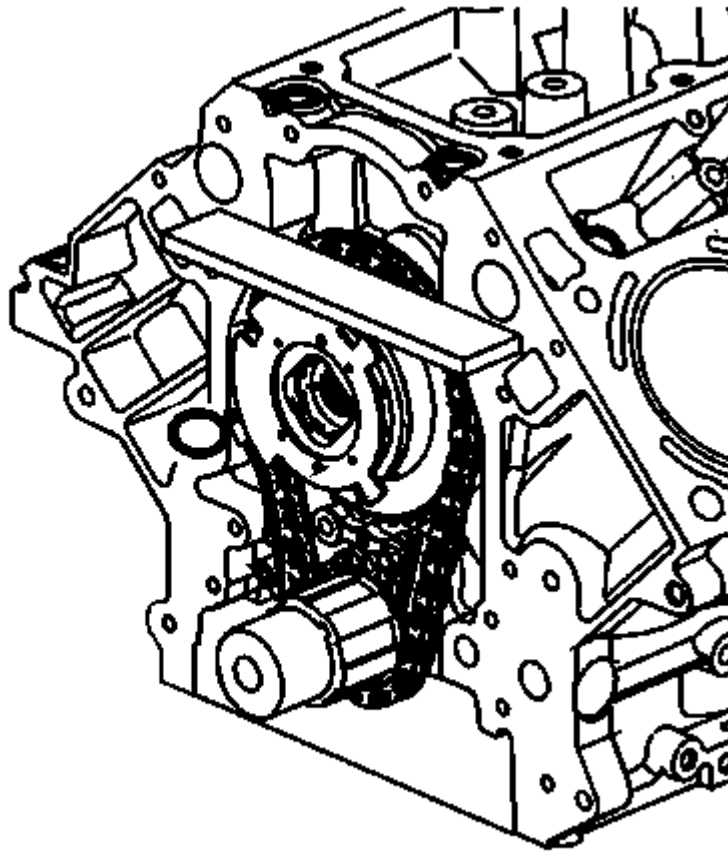


Fig. 291: Inspecting Installation Of CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

11. Place a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and completely installed onto the front of the camshaft, the timing chain will not protrude beyond the front face of the engine block.

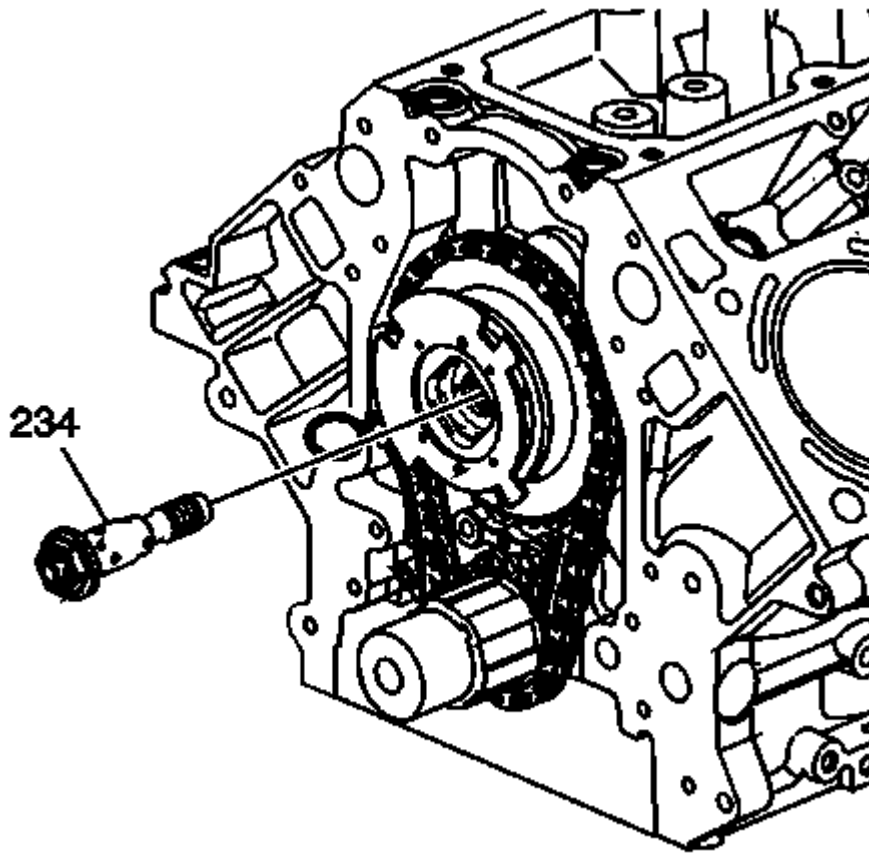


Fig. 292: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

12. Install a NEW CMP actuator valve (234). With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.

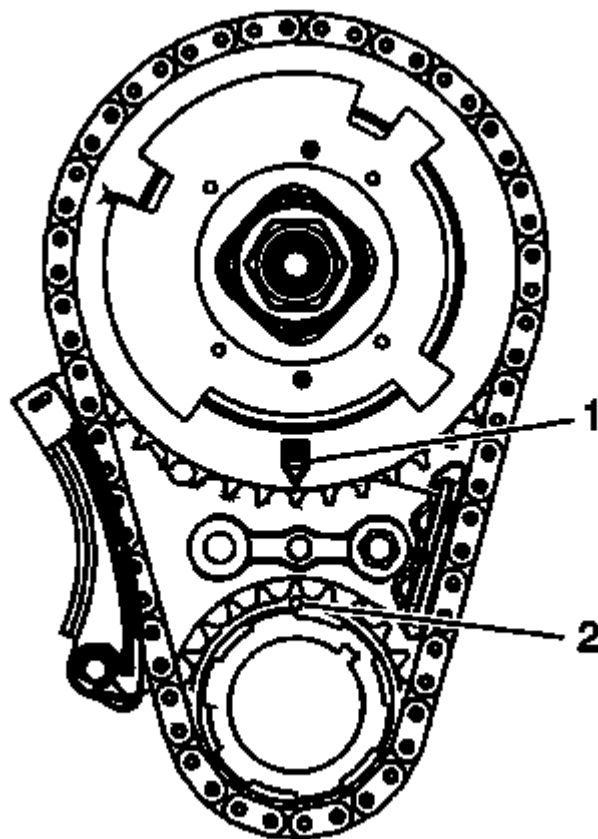


Fig. 293: CMP Actuator Sprocket And Crankshaft Sprocket Alignment Marks
Courtesy of GENERAL MOTORS CORP.

13. Inspect the sprockets for proper alignment. The mark on the CMP (1) actuator sprocket should be located in the 6 o'clock position and the mark on the crankshaft sprocket (2) should be located in the 12 o'clock position.

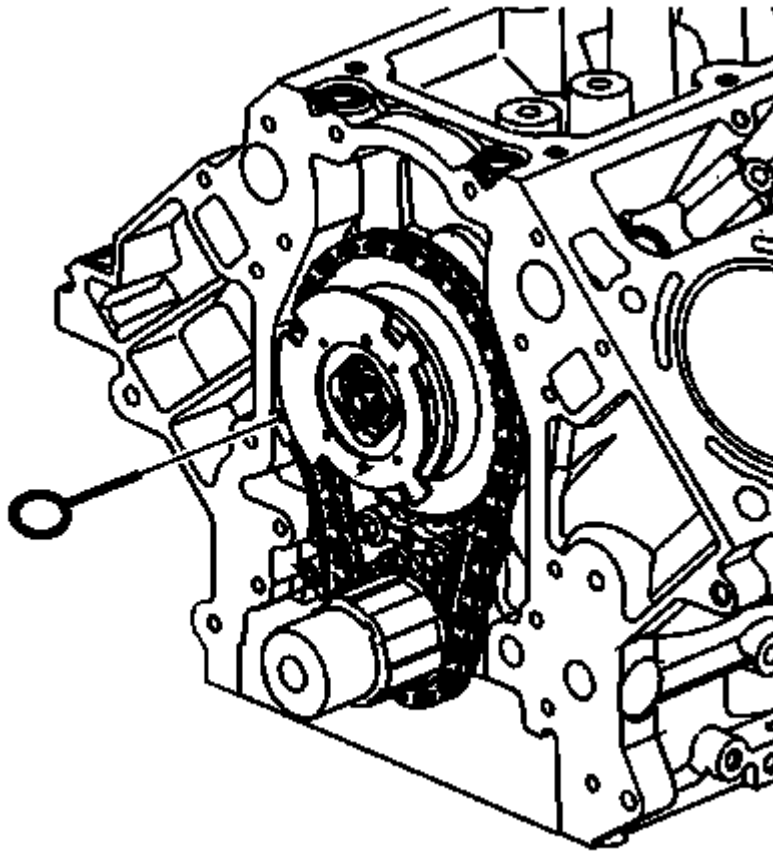


Fig. 294: Timing Belt Tensioner Retaining Pin
Courtesy of GENERAL MOTORS CORP.

14. Remove the EN 46330 .

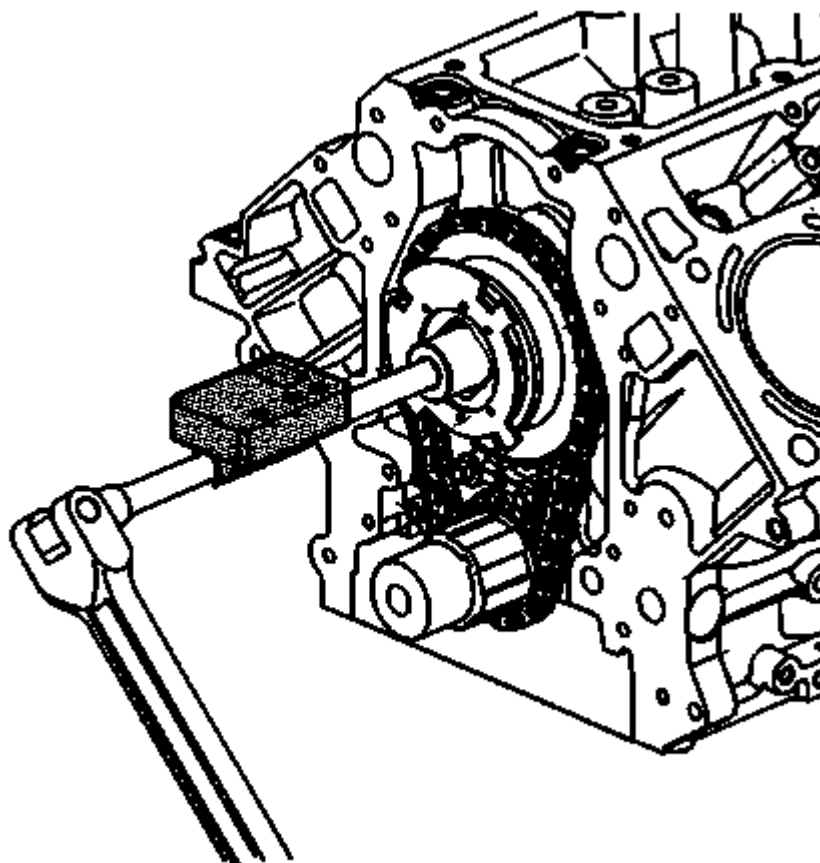


Fig. 295: Tightening CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

15. Tighten the CMP actuator solenoid valve.

Tighten

1. Tighten the bolt a first pass to 65 N.m (48 lb ft).
2. Tighten the bolt a final pass an additional 90 degrees using **J 45059** .

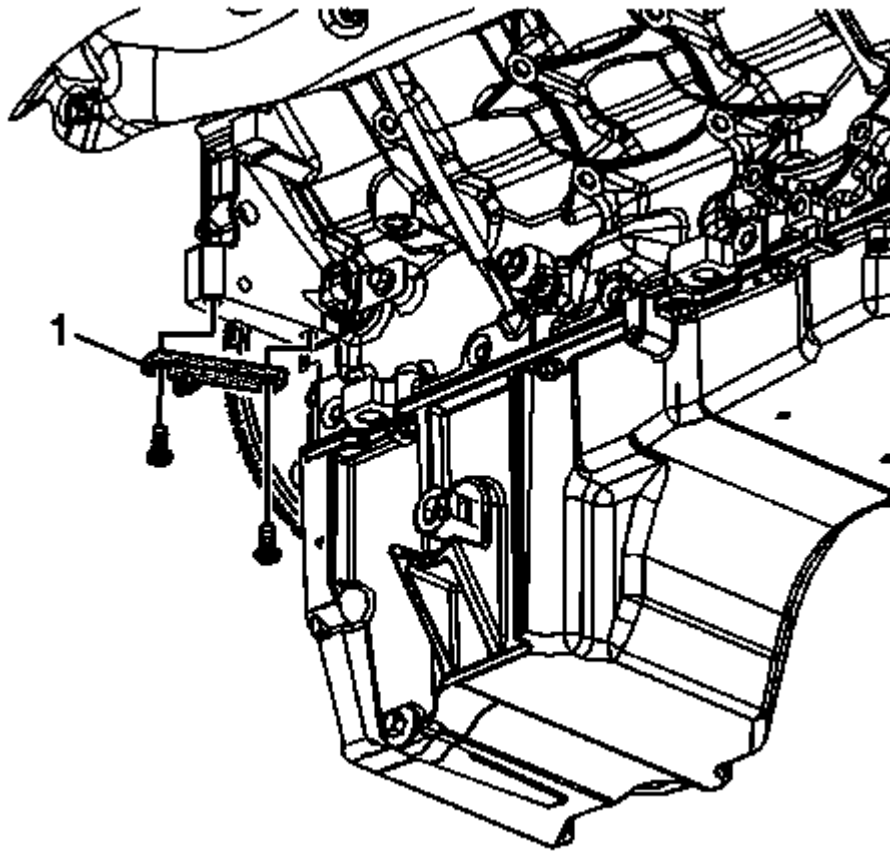


Fig. 296: Flywheel Holding Tool
Courtesy of GENERAL MOTORS CORP.

16. Remove the **J 42386-A** (1) and bolts.
17. Install the oil pump. Refer to **Oil Pump, Screen, and Crankshaft Oil Deflector Replacement**.

CAMSHAFT REPLACEMENT

Special Tools

- **EN 46330** Timing Belt Tensioner Retaining Pin
- **J 42386-A** Flywheel Holding Tool
- **J 45059** Angle Meter

Removal Procedure

NOTE: If camshaft replacement is required, the valve lifters must also be replaced.

1. Remove the radiator support. Refer to **Radiator Support Replacement** .
2. Remove the valve lifters. Refer to **Valve Lifter Replacement**.

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

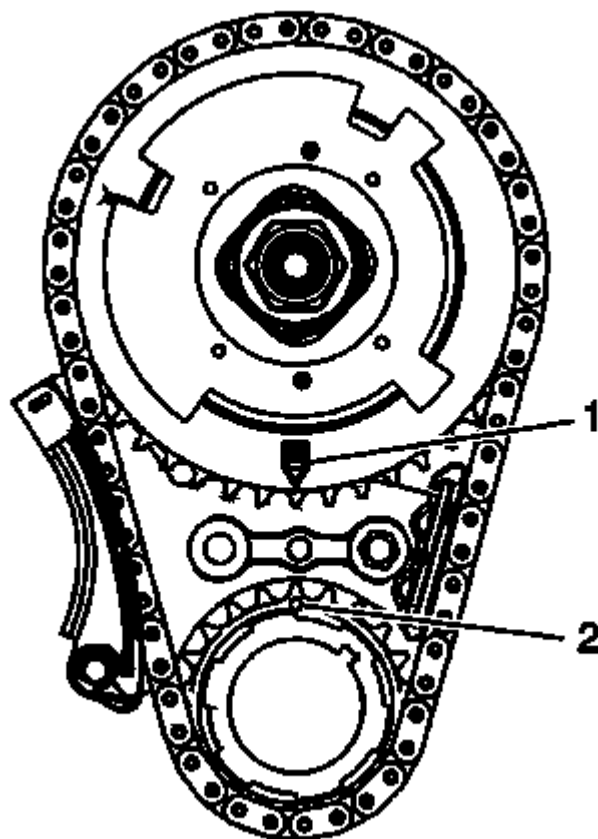


Fig. 297: CMP Actuator Sprocket And Crankshaft Sprocket Alignment Marks
Courtesy of GENERAL MOTORS CORP.

4. Rotate the crankshaft sprocket until the camshaft position (CMP) actuator alignment mark (1) and the crankshaft sprocket alignment mark (2) are aligned.

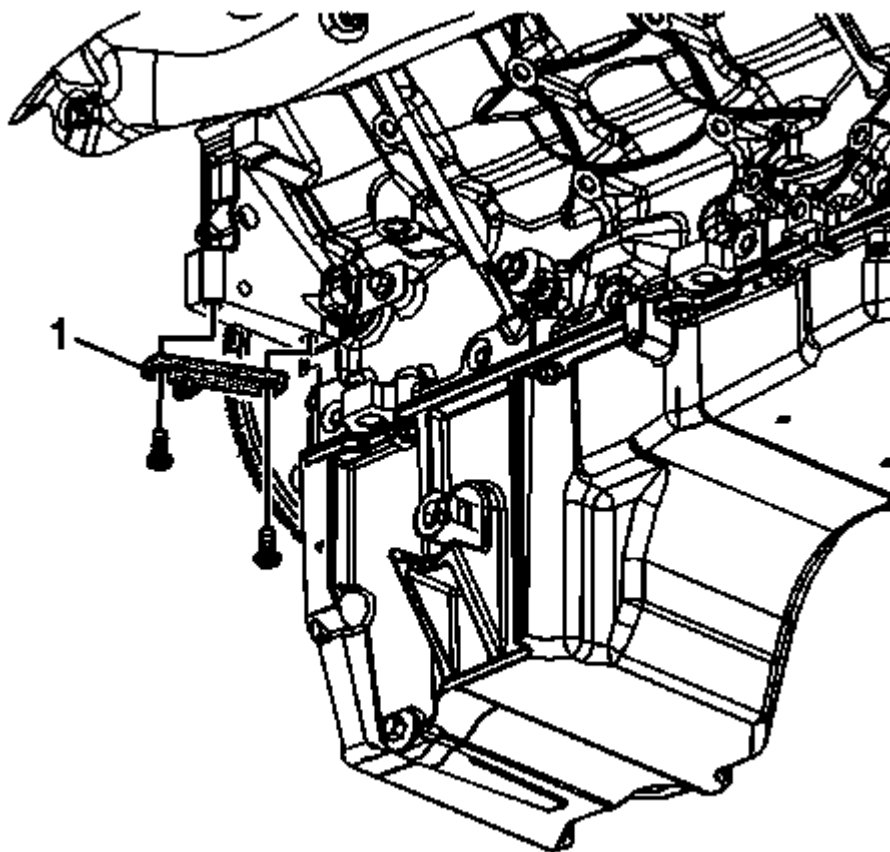


Fig. 298: Flywheel Holding Tool

Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

NOTE: Ensure that the teeth of the J 42386-A mesh with the teeth of the engine flywheel.

5. Install the J 42386-A (1) and bolts. Use one M10-1.5 x 120 mm and one M10-1.5 x 45 mm bolt for proper tool operation.

Tighten

Tighten the J 42386-A bolts to 50 N.m (37 lb ft).

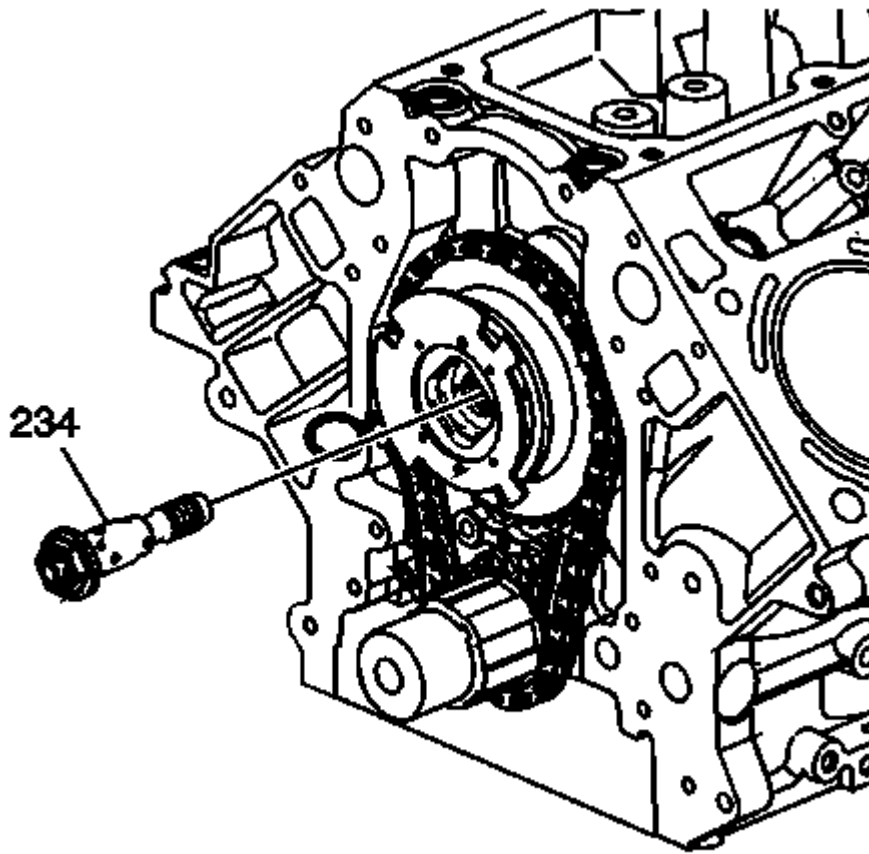


Fig. 299: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

6. Remove and discard the CMP actuator solenoid valve (234).

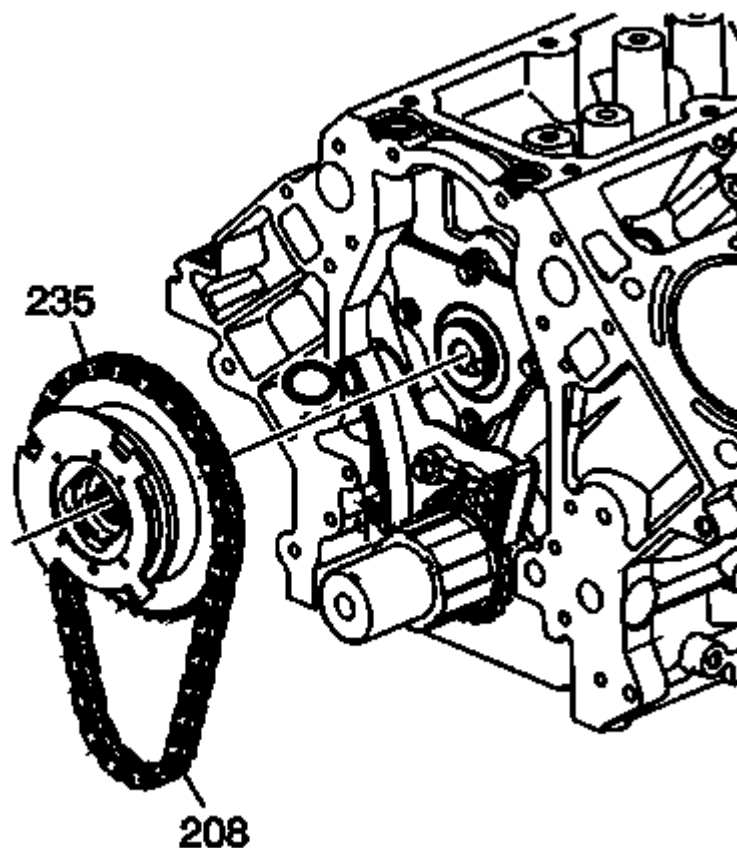


Fig. 300: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not turn the crankshaft assembly after the timing chain has been removed in order to prevent damage to the piston assemblies or the valves.

7. Remove the CMP actuator (235) and timing chain (208).

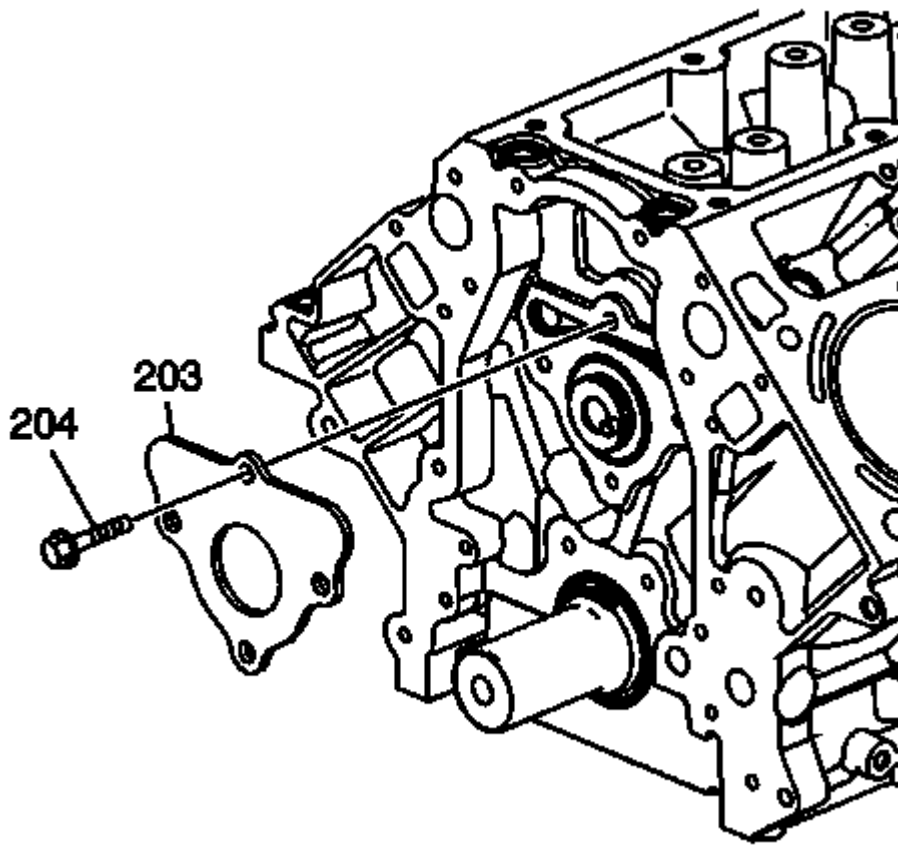


Fig. 301: Camshaft Retainer And Retainer Bolt
Courtesy of GENERAL MOTORS CORP.

8. Remove the camshaft retainer bolts (204) and retainer (203).

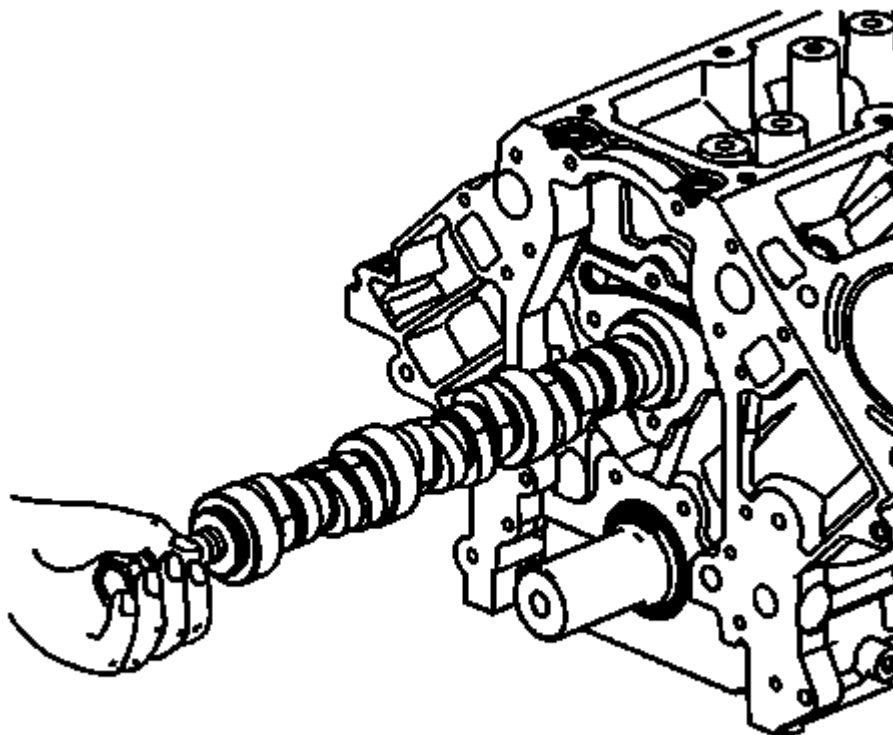


Fig. 302: Camshaft

Courtesy of GENERAL MOTORS CORP.

CAUTION: All camshaft journals are the same diameter, so care must be used in removing or installing the camshaft to avoid damage to the camshaft bearings.

9. Install the camshaft sprocket bolt into the camshaft front bolt hole.
10. Using the bolt as a handle, carefully rotate and remove the camshaft from the engine block.
11. Remove the bolt from the camshaft.

Installation Procedure

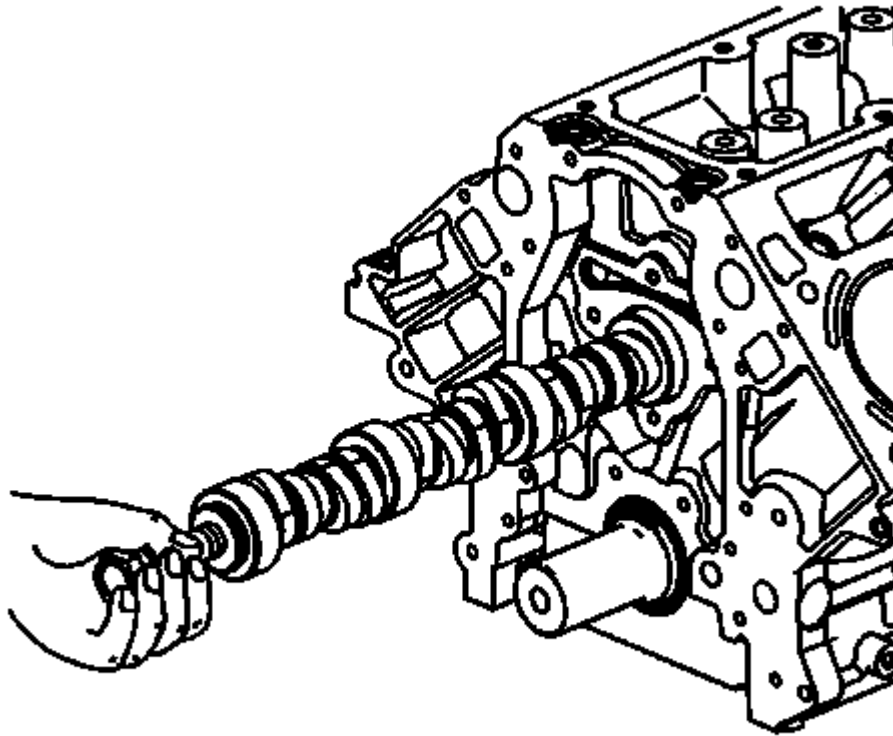


Fig. 303: Camshaft

Courtesy of GENERAL MOTORS CORP.

1. Lubricate the camshaft journals and the bearings with clean engine oil.
2. Install the camshaft sprocket bolt into the camshaft front bolt hole.

CAUTION: All camshaft journals are the same diameter, so care must be used in removing or installing the camshaft to avoid damage to the camshaft bearings.

3. Using the bolt as a handle, carefully install the camshaft into the engine block.
4. Remove the bolt from the front of the camshaft.

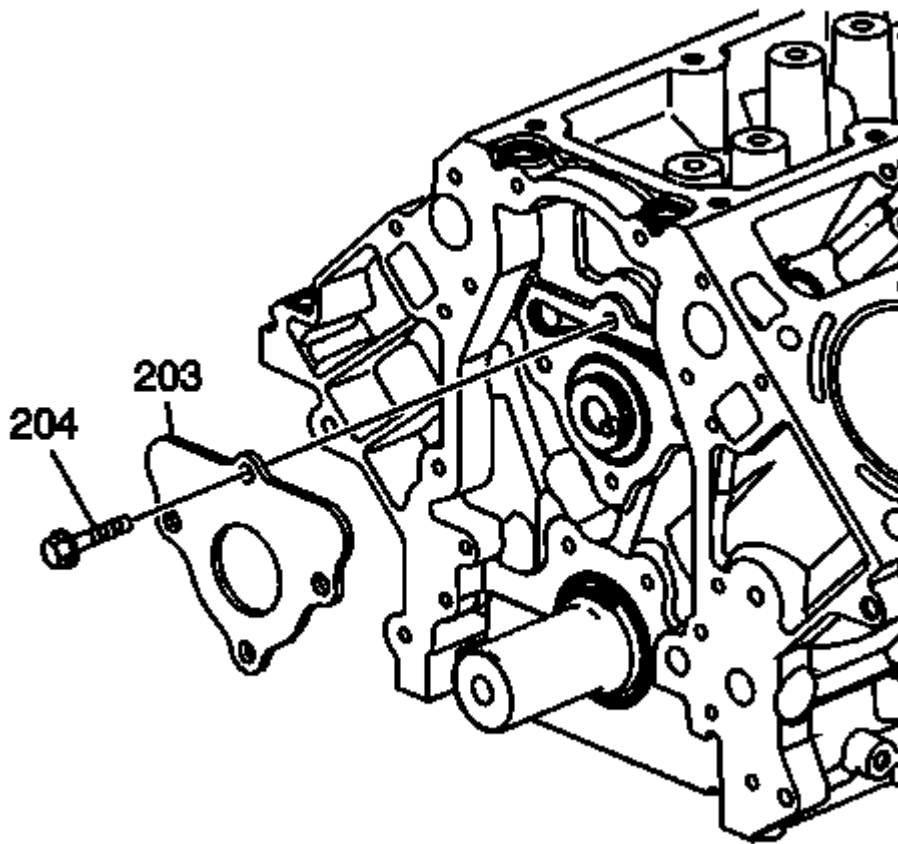


Fig. 304: Camshaft Retainer And Retainer Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: The gasket surface on the engine block should be clean and free of dirt and/or debris.

5. Install the camshaft retainer (203) and bolts (204). Install the retainer with the sealing gasket facing the engine block.

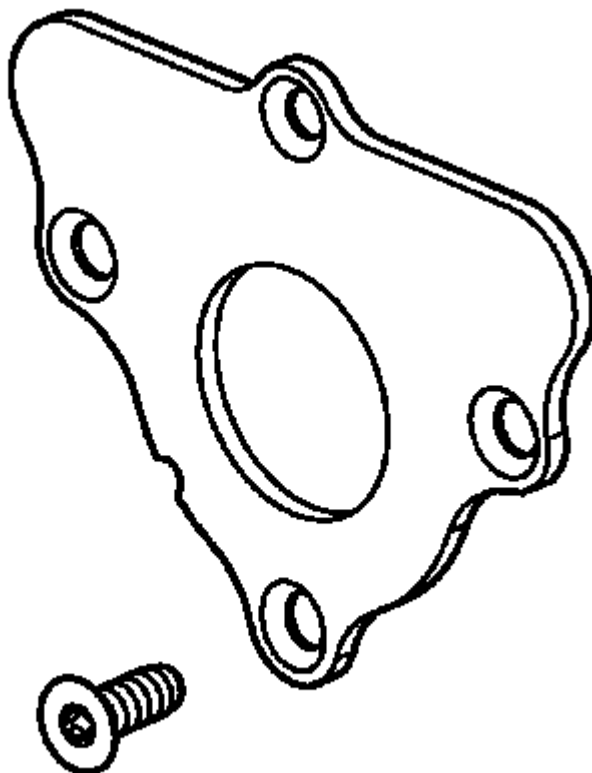


Fig. 305: Camshaft Retainer And Bolt
Courtesy of GENERAL MOTORS CORP.

6. Tighten the camshaft retainer bolts.

Tighten

- Tighten the first design hex head bolts (3) to 25 N.m (18 lb ft).
- Tighten the second design TORX® head bolts (4) to 15 N.m (11 lb ft).

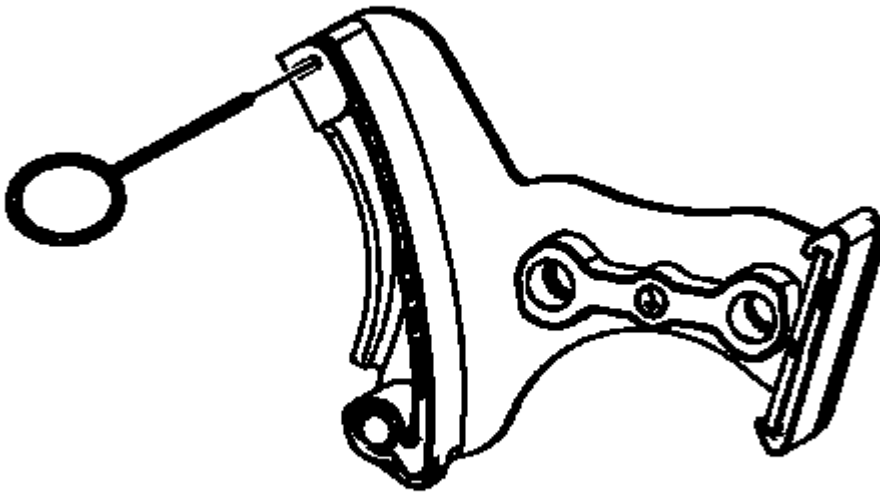


Fig. 306: Timing Belt Tensioner Retaining Pin
Courtesy of GENERAL MOTORS CORP.

7. Compress the timing chain tensioner guide and install the EN 46330 .

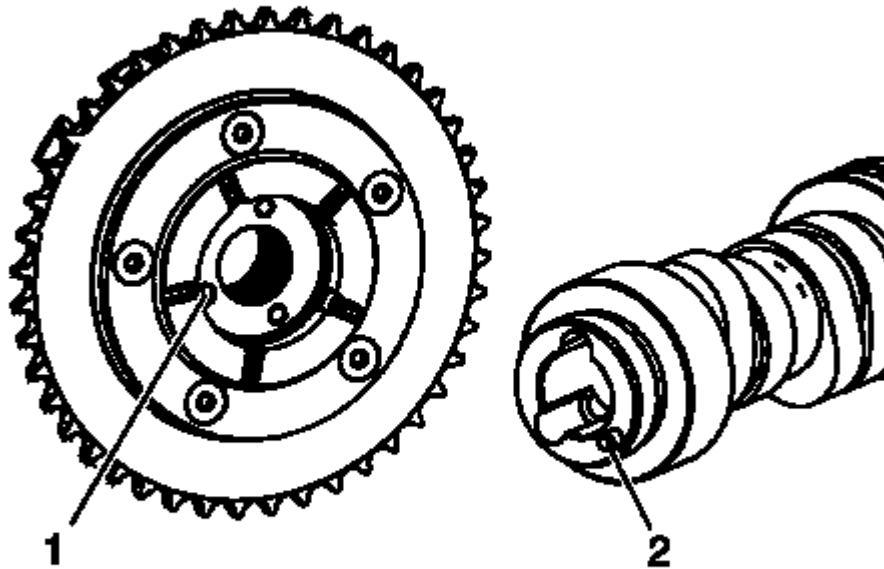


Fig. 307: Alignment Hole And Locating Pin
Courtesy of GENERAL MOTORS CORP.

NOTE:

- Properly locate the CMP actuator onto the locating pin of the camshaft.
- The sprocket teeth and timing chain teeth must mesh.
- The camshaft and the crankshaft sprocket alignment mark **MUST** be aligned properly.
- Do not use the CMP solenoid valve again. Install a **NEW** valve during assembly.

8. Identify the alignment hole (1) in the rear face of the CMP actuator and the locating pin (2) on the front face of the camshaft.

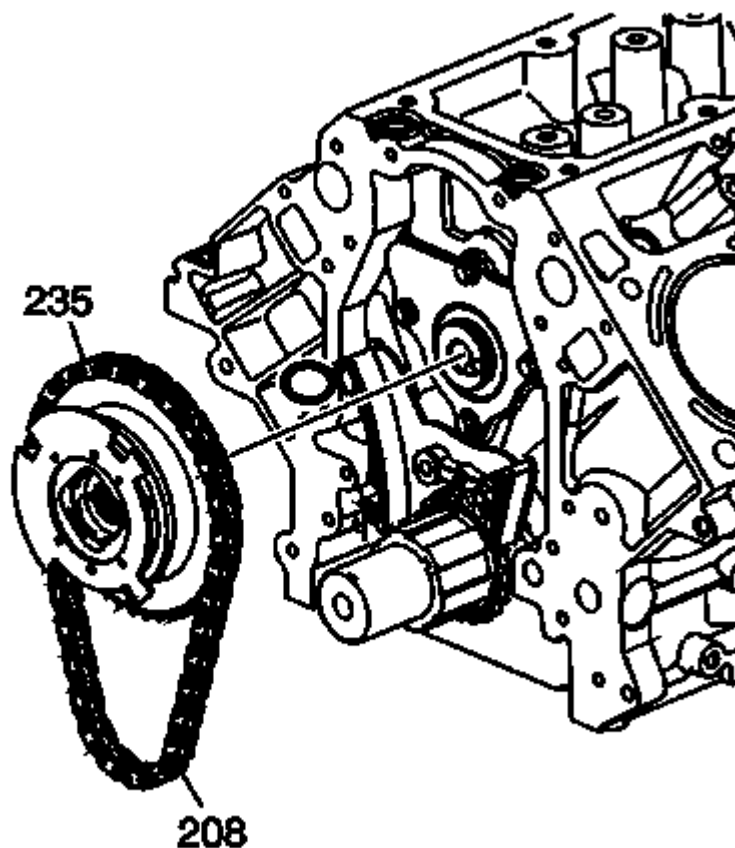


Fig. 308: CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

9. Align the CMP actuator so the timing mark is in the 6 o'clock position.
10. Install the CMP actuator (235) and timing chain (208). Align the hole in the face of the CMP actuator with the locating pin on the front face of the camshaft.

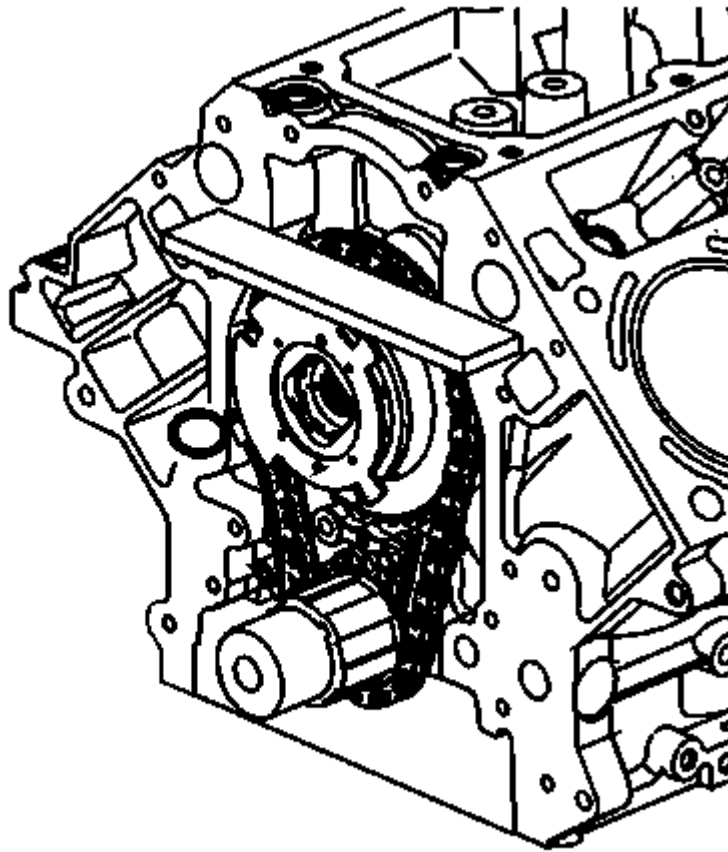


Fig. 309: Inspecting Installation Of CMP Actuator And Timing Chain
Courtesy of GENERAL MOTORS CORP.

11. Place a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and completely installed onto the front of the camshaft, the timing chain will not protrude beyond the front face of the engine block.

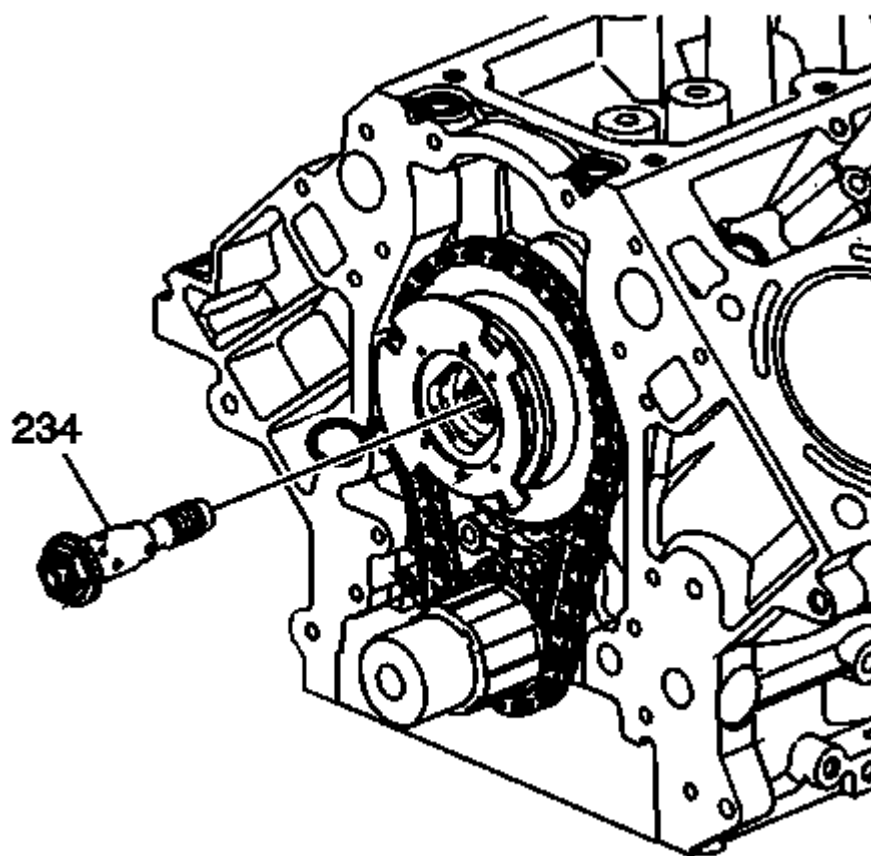


Fig. 310: CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

12. Install a NEW CMP actuator solenoid valve (234). With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.

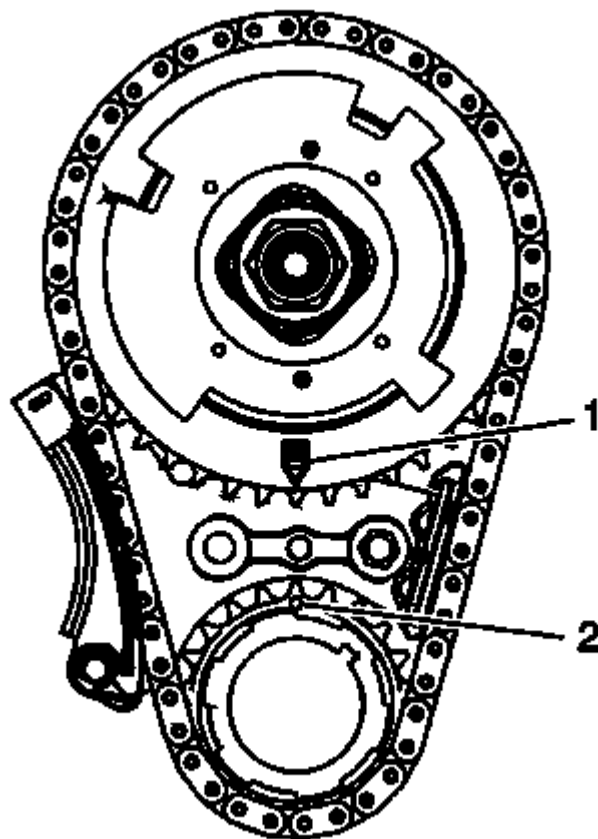


Fig. 311: CMP Actuator Sprocket And Crankshaft Sprocket Alignment Marks
Courtesy of GENERAL MOTORS CORP.

13. Inspect the sprockets for proper alignment. The mark on the CMP actuator sprocket (1) should be located in the 6 o'clock position and the mark on the crankshaft sprocket (2) should be located in the 12 o'clock position.

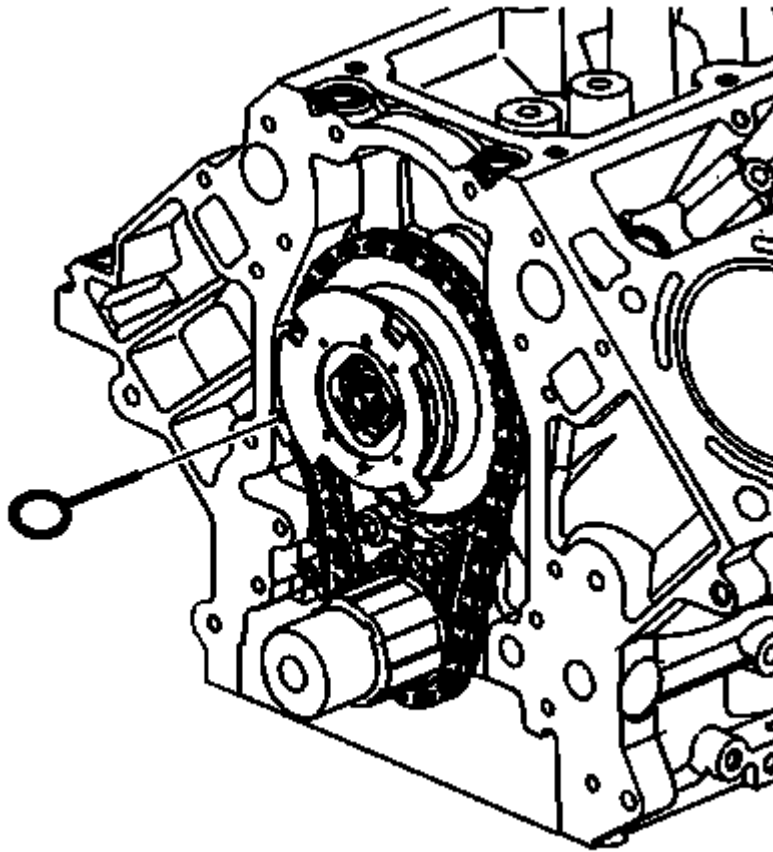


Fig. 312: Timing Belt Tensioner Retaining Pin
Courtesy of GENERAL MOTORS CORP.

14. Remove the EN 46330 .

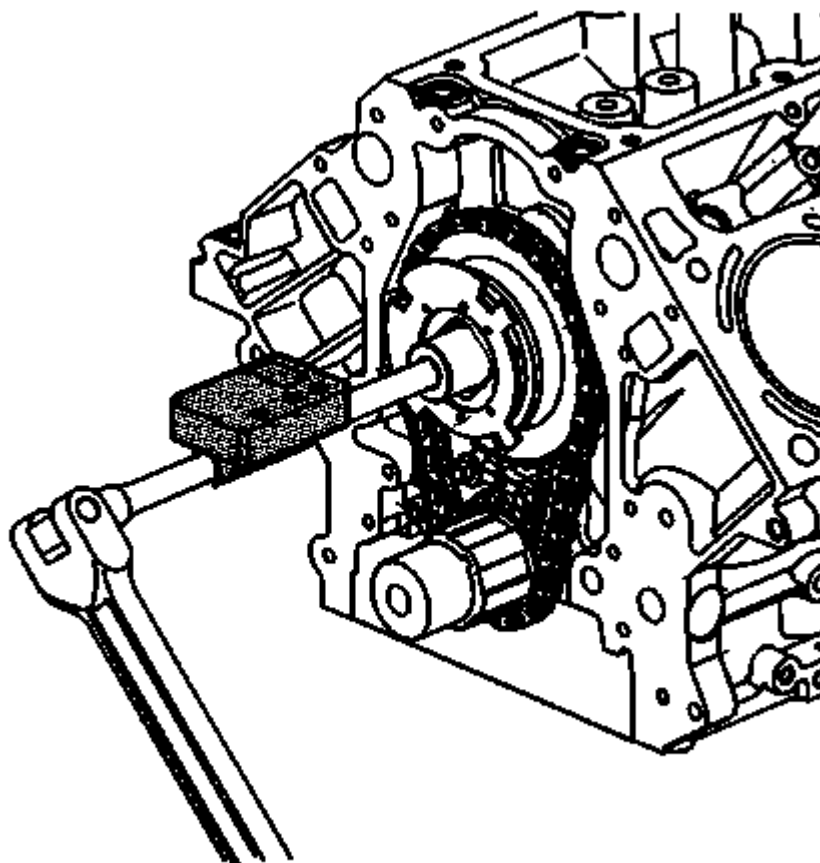


Fig. 313: Tightening CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

15. Tighten the CMP actuator solenoid valve.

Tighten

1. Tighten the valve a first pass to 65 N.m (48 lb ft).
2. Tighten the valve a final pass to 90 degrees using **J 45059**.

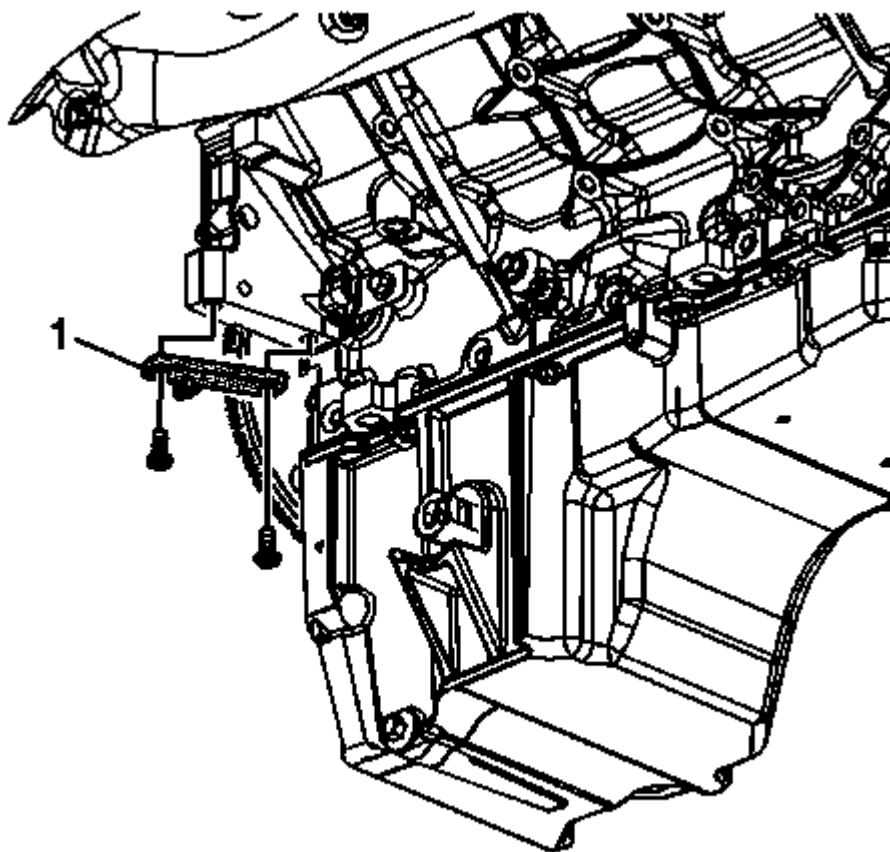


Fig. 314: Flywheel Holding Tool
Courtesy of GENERAL MOTORS CORP.

16. Remove the **J 42386-A** (1) and bolts.
17. Install the engine front cover. Refer to **Engine Front Cover Replacement**.
18. Install the valve lifters. Refer to **Valve Lifter Replacement**.
19. Install the radiator support. Refer to **Radiator Support Replacement**.

AUTOMATIC TRANSMISSION FLEX PLATE REPLACEMENT

Removal Procedure

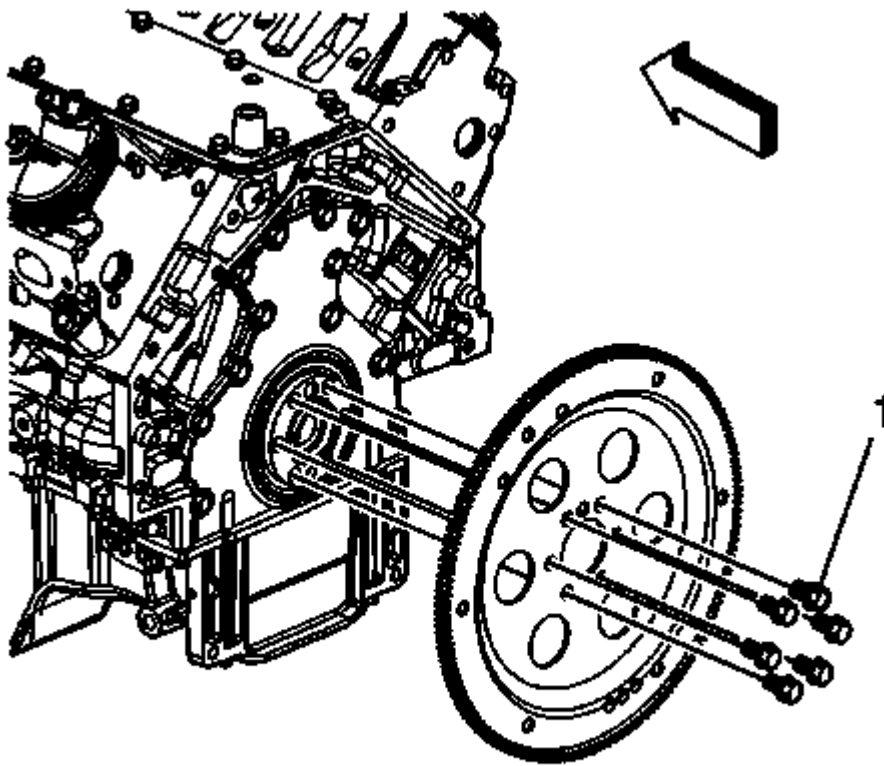


Fig. 315: Automatic Transmission Flex Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the automatic transmission. Refer to Transmission Replacement .

NOTE: Note the position and direction of the engine flywheel before removal.

2. Remove the flywheel bolts (1).
3. Remove the flywheel.

Installation Procedure

NOTE: The flywheel does not use a locating pin for alignment and will not initially seat against the crankshaft flange or spacer, if applicable, but will be pulled onto the crankshaft by the engine flywheel bolts. This procedure requires a three stage tightening process.

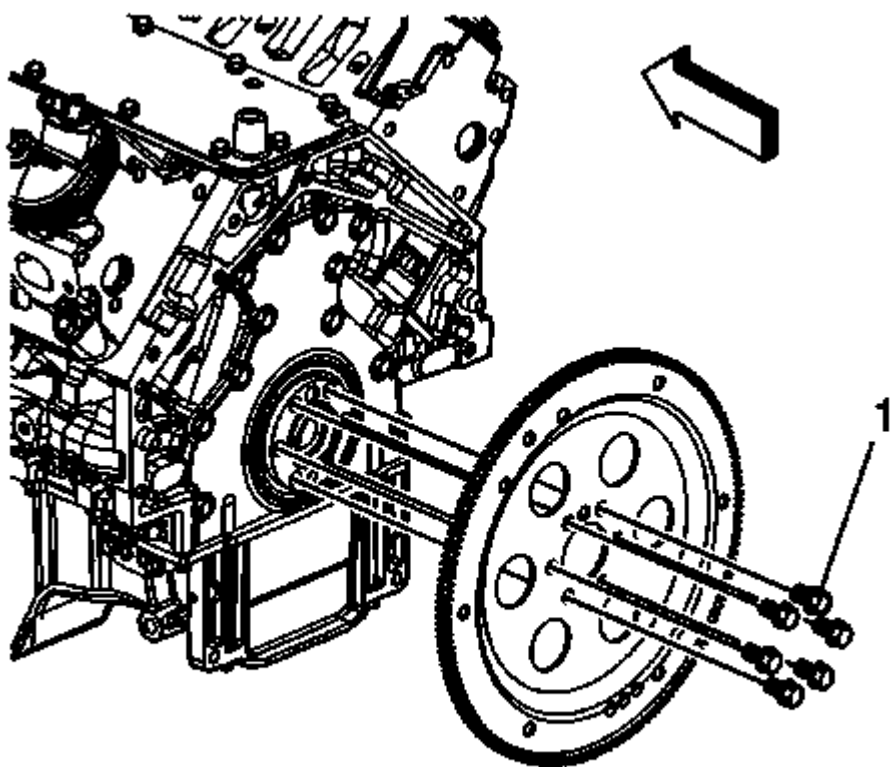


Fig. 316: Automatic Transmission Flex Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the flywheel and bolts (1) to the crankshaft.
2. Apply threadlock to the threads of the flywheel bolts. Refer to **Adhesives, Fluids, Lubricants, and Sealers** for the correct part number.

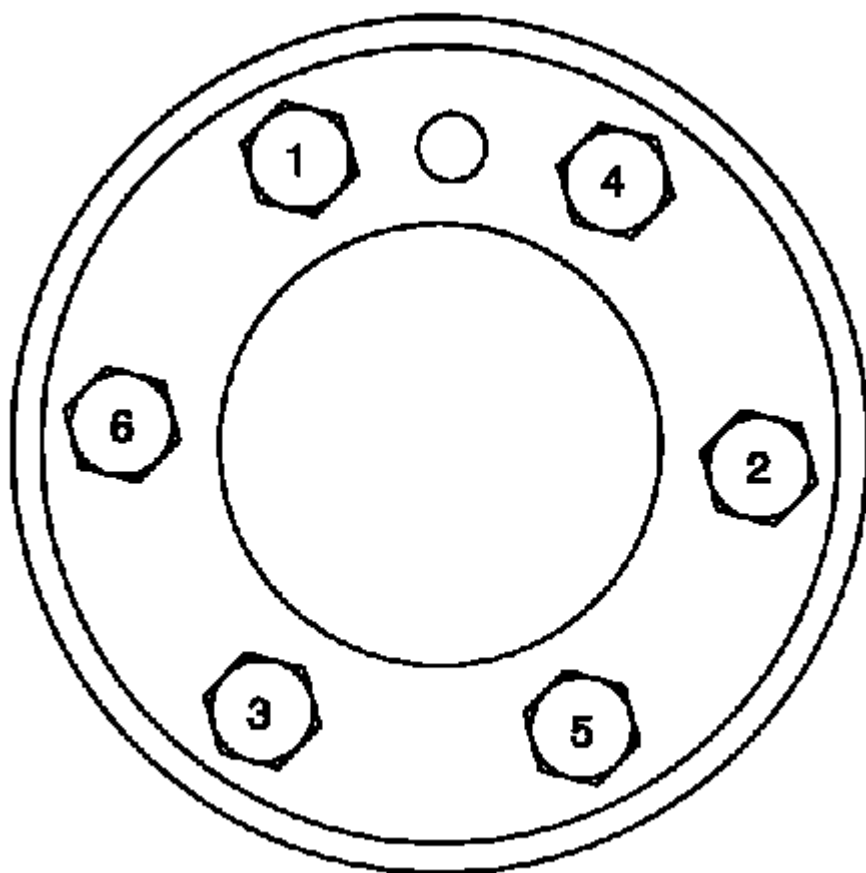


Fig. 317: Flywheel Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

3. Tighten the flywheel bolts.

Tighten

1. Tighten the bolts (1-6) a first pass in sequence to 20 N.m (15 lb ft).
2. Tighten the bolts (1-6) a second pass in sequence to 50 N.m (37 lb ft).
3. Tighten the bolts (1-6) a final pass in sequence to 100 N.m (74 lb ft).
4. Install the automatic transmission. Refer to Transmission Replacement .

ENGINE REPLACEMENT

Special Tools

2011 GMC Yukon Hybrid

2011 ENGINE Engine Mechanical - Hybrid (HP2) 6.0L (LZ1) - Repair Instructions - On Vehicle - Escalade, Tahoe & Yukon

- **J 21366** Converter Holding Strap
- **J 41798** Engine Lift Bracket

Removal Procedure

WARNING: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure will perform the following tasks:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Failure to follow the procedures exactly as written may result in serious injury or death.

1. Disable the high voltage system. Refer to **High Voltage Disabling**

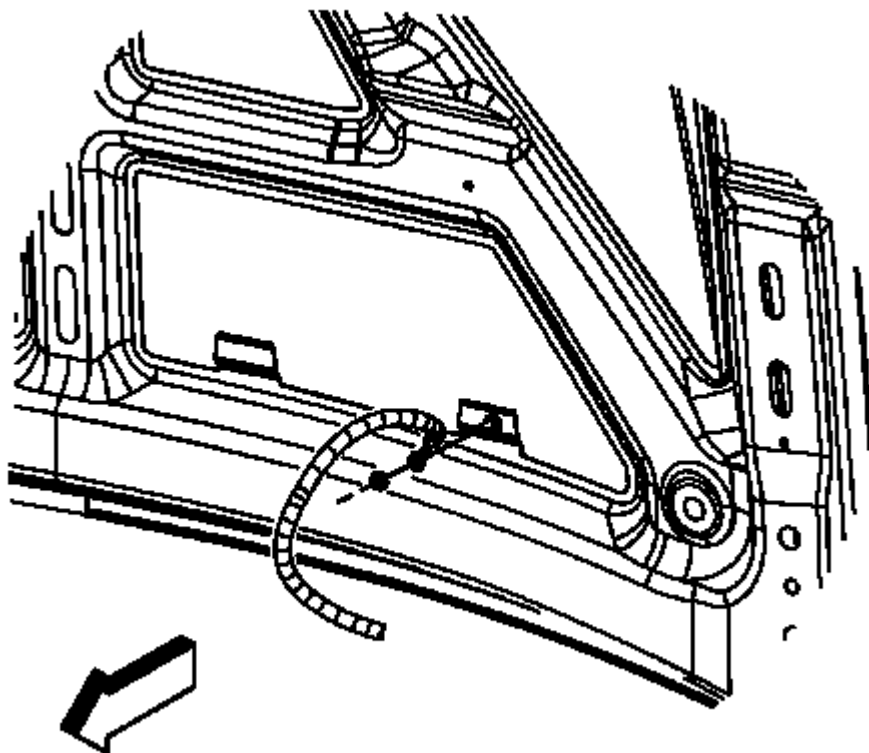


Fig. 318: Ground Strap And Nut
Courtesy of GENERAL MOTORS CORP.

2. Remove the ground strap nut at the hood stud.
3. Remove the ground strap from the stud.

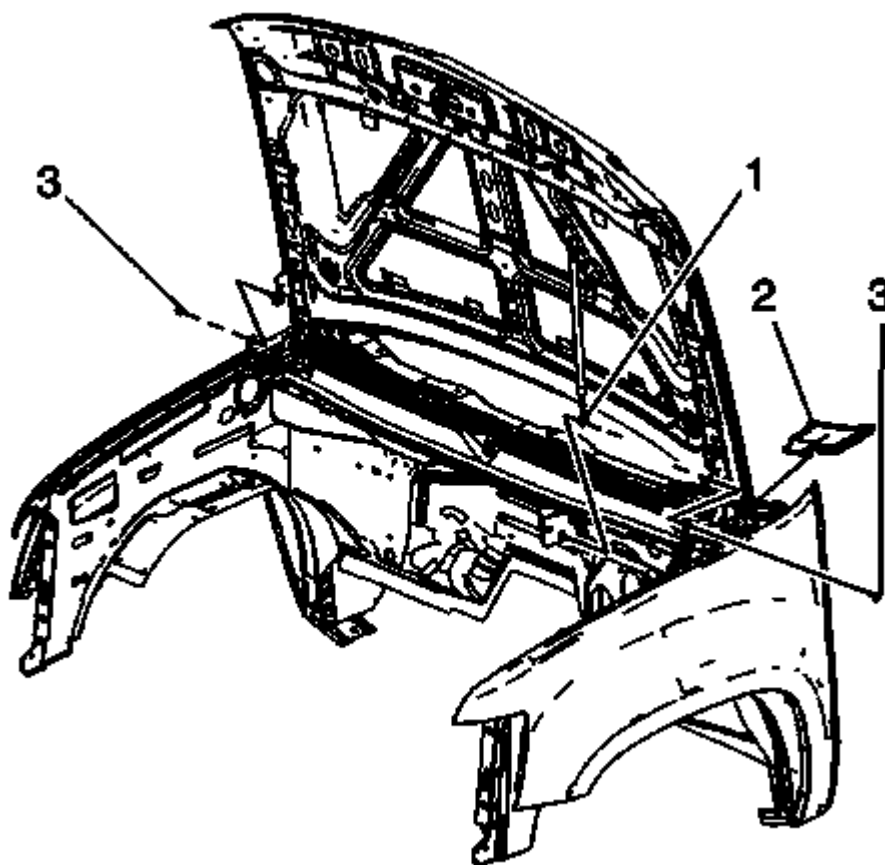


Fig. 319: Hood Strut Rod, Grille End Caps And Hood Hinge Bolts
Courtesy of GENERAL MOTORS CORP.

4. Assemble 2 sets of the following: an M6 bolt, 2 each 19.05 mm (0.75 in) flat washers and an M6 nut.
5. Release the retainer securing the hood strut rod to the hood strut bracket stud.
6. Remove the hood strut rod (1) from the stud.
7. Remove the air inlet grille end caps (2), lift the end cap up in order to disengage the retainers.
8. Have an assistant support the hood.
9. Remove the hood hinge bolts (3) and set aside.

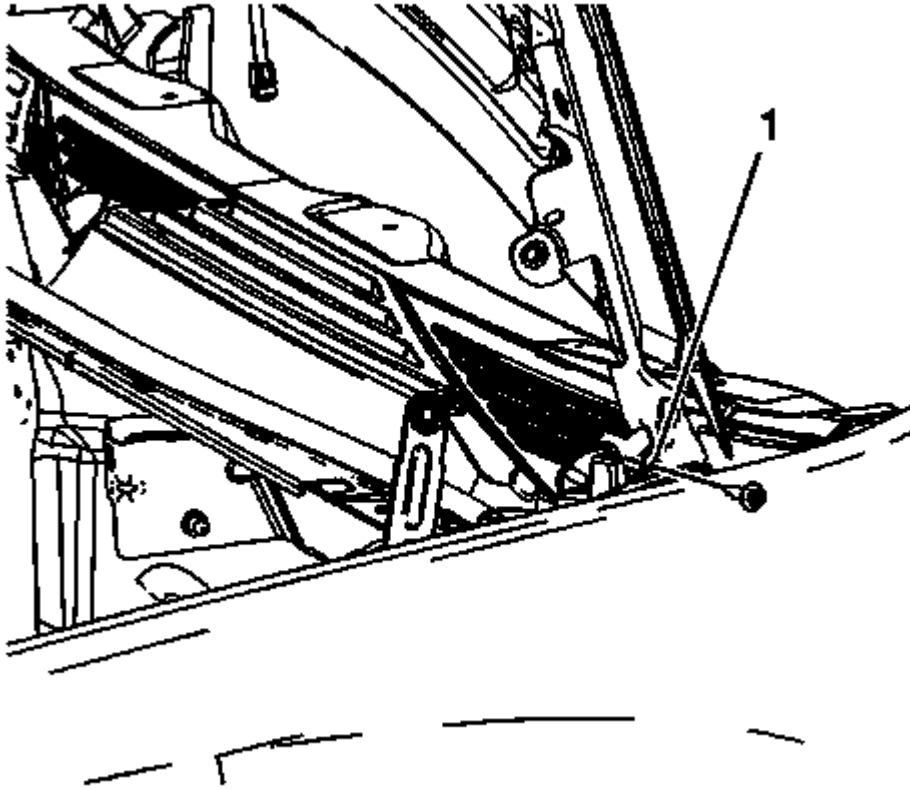


Fig. 320: Service Piston Notch

Courtesy of GENERAL MOTORS CORP.

NOTE: There is a positive stop which limits the hood from being opened too far.

10. Raise the hood until the service position notch (1) in the upper hinge is reached.
11. Install the 2 sets of the M6 bolts to both the left and right side service notches and tighten finger tight.

CAUTION: Refer to Fastener Caution .

12. Lower the hood until the bolts rest against the lower hinge, tighten the bolts to secure the hood.

Tighten

Tighten the bolts to 20 N.m (15 lb ft).

13. The hood is now set in the service position.
14. Remove the hood latch. Refer to Hood Primary and Secondary Latch Replacement .
15. Remove the front end upper tie bar. Refer to Front End Upper Tie Bar Replacement .

16. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
17. Drain the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)**.
18. Disconnect the A/C lines from the A/C compressor. Refer to **Discharge Hose Replacement (HP2)**, and **Suction Hose Replacement (W/O C69-HP2)**, **Suction Hose Replacement (W/C69-HP2)**.
19. Disconnect the A/C pressure sensor electrical connector.
20. Disconnect the cables from the generator control module.

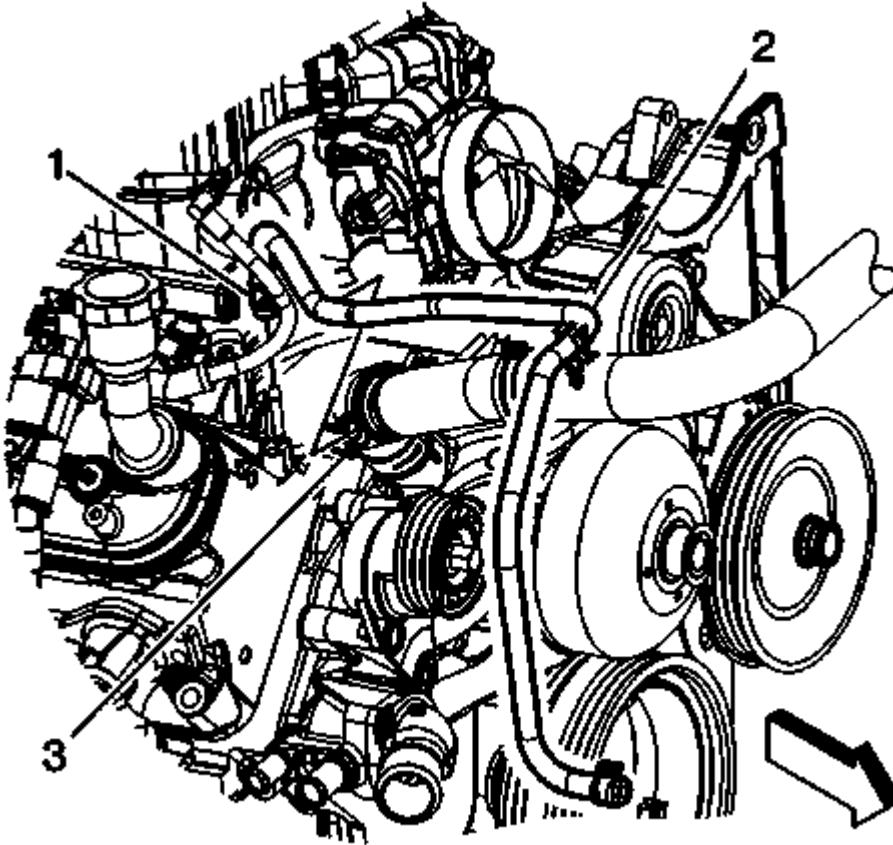


Fig. 321: Radiator Vent Inlet Hose
Courtesy of GENERAL MOTORS CORP.

21. Remove the radiator vent inlet hose (2) from the radiator inlet hose clip (3).
22. Reposition the radiator vent inlet hose clamp (1) at the air bleed pipe.
23. Remove the radiator vent inlet hose (2) from the air bleed pipe and reposition.

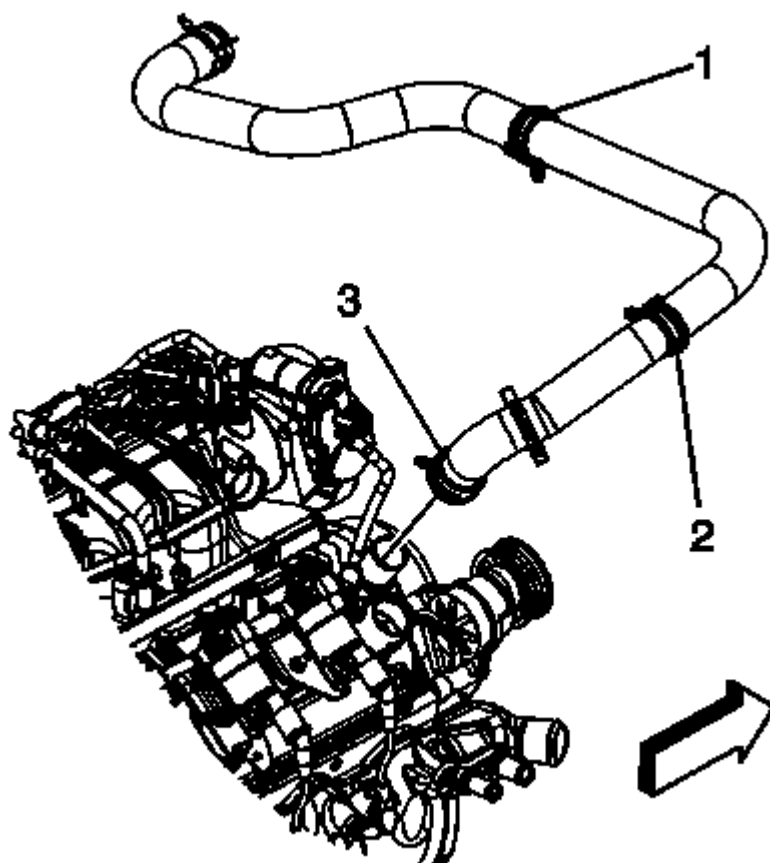


Fig. 322: Radiator Vent Inlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

24. Reposition the radiator inlet hose clamp (3) at the water pump.
25. Remove the radiator inlet hose from the water pump.

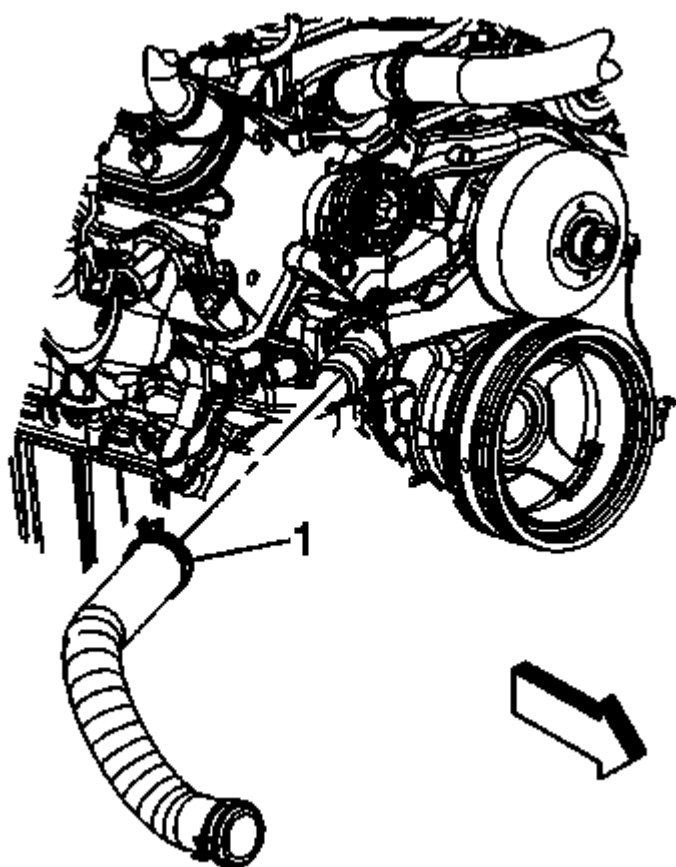


Fig. 323: Radiator Outlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

26. Reposition the radiator outlet hose clamp (1) at the water pump.
27. Remove the radiator outlet hose from the water pump.
28. Remove the heater hoses. Refer to **Heater Inlet Hose Replacement (Pump to Engine-HP2)** , **Heater Inlet Hose Replacement (Pump to Heater Core-HP2)** .

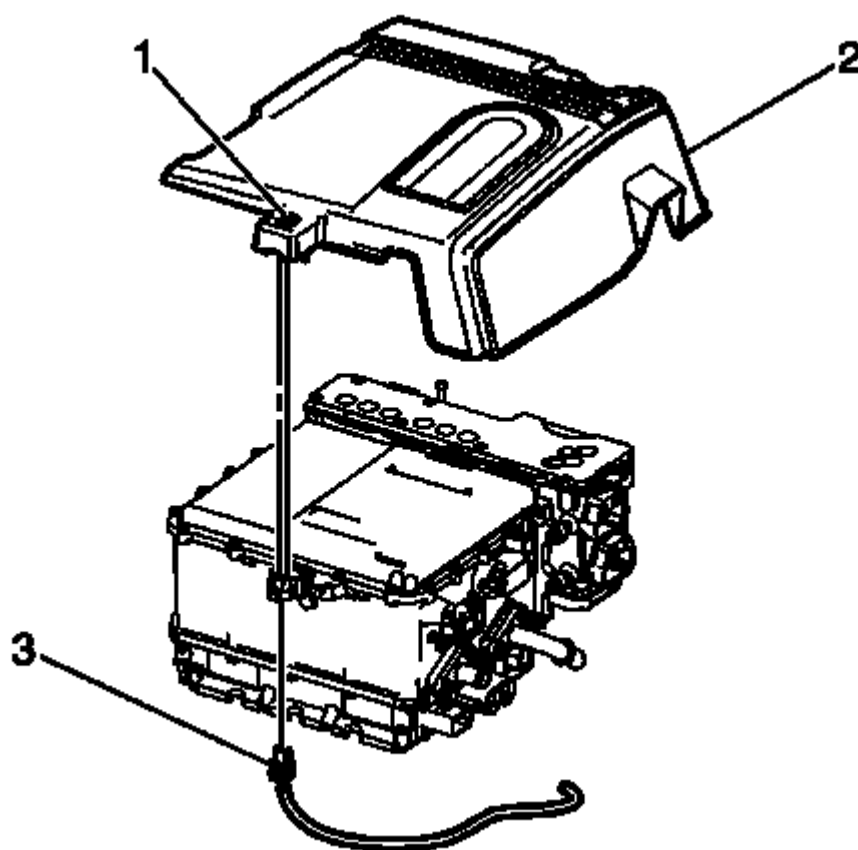


Fig. 324: Drive Motor Generator Power Inverter Module Cover, Bolt And Electrical Connector
Courtesy of GENERAL MOTORS CORP.

29. Disconnect the engine wiring harness electrical connector (3) from the drive motor generator power inverter module cover.
30. Loosen the drive motor generator power inverter module cover bolt (1).
31. Remove the drive motor generator power inverter module cover (2).

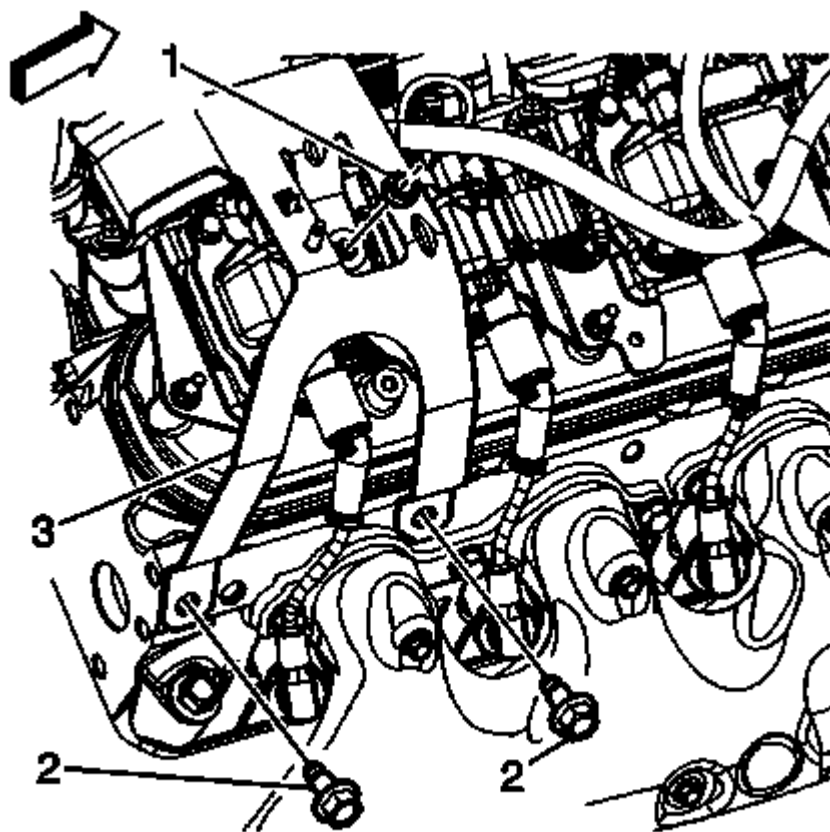


Fig. 325: Engine Bracket, Nut And Bolts
Courtesy of GENERAL MOTORS CORP.

32. Remove the engine bracket bolts (2).
33. Remove the engine bracket (3)

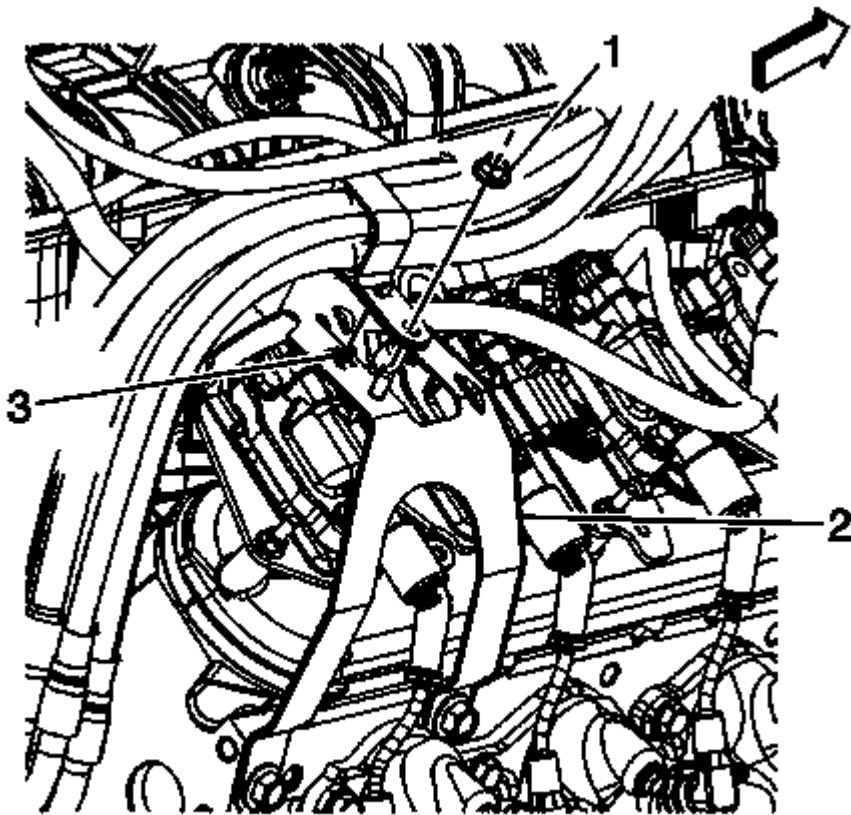


Fig. 326: 3-Phase Cable Clip Nut And Engine Bracket
Courtesy of GENERAL MOTORS CORP.

34. Remove the generator control module 3 phase cable clip nut (1).
35. Remove the generator control module 3 phase cable clip from the engine bracket (2).
36. Reposition the generator control module 3 phase cables out of the way.
37. Remove the right wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side** .

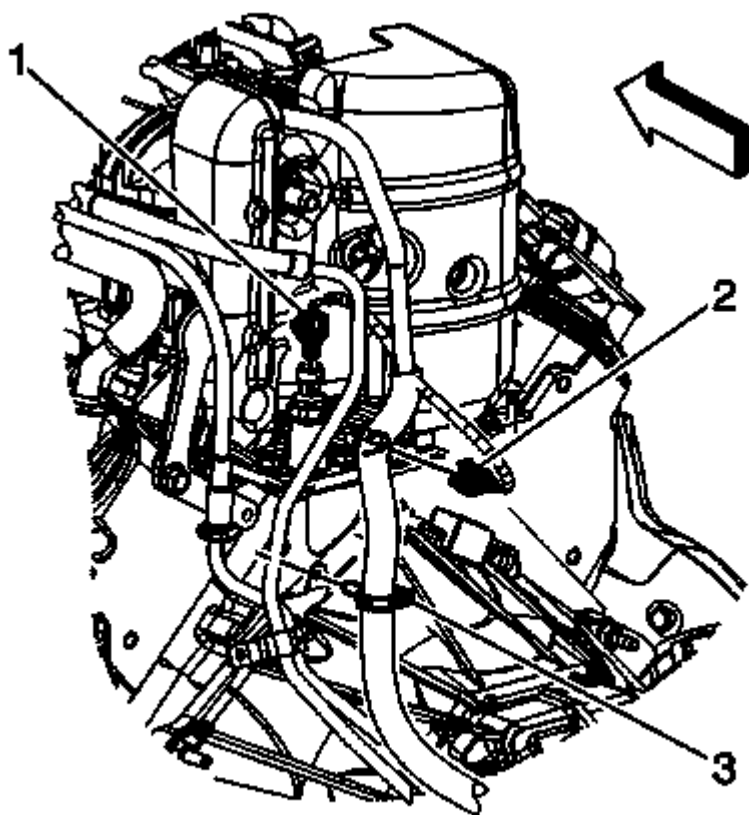


Fig. 327: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

38. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.
39. Disconnect the engine harness electrical connector (2) from the lifter oil manifold.

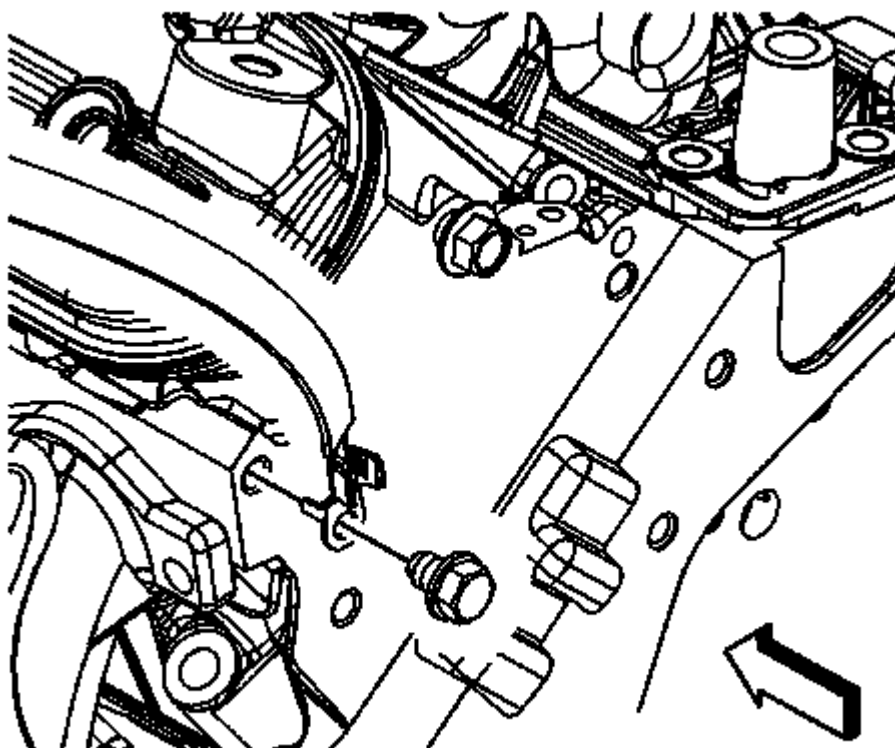


Fig. 328: Engine Ground Strap And Bolt
Courtesy of GENERAL MOTORS CORP.

40. Remove the engine ground strap bolt from the rear of the left cylinder head and cowl and reposition.
41. Remove the engine ground wire from the right cylinder head.

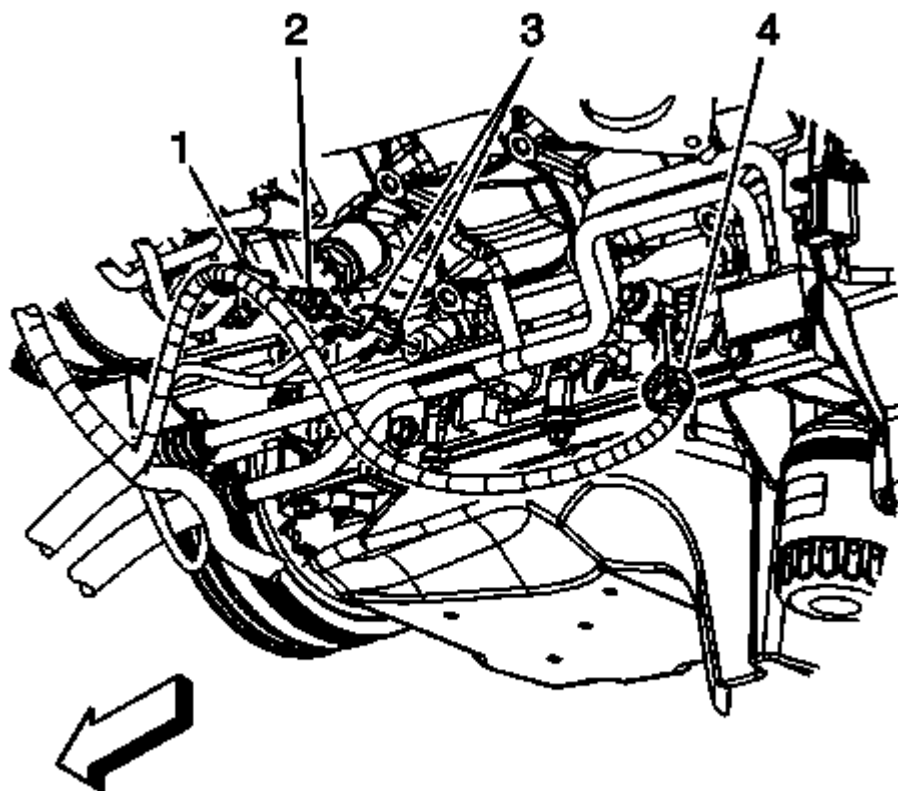


Fig. 329: Engine Harness Components
Courtesy of GENERAL MOTORS CORP.

42. Remove the engine harness clip (1) from the ground stud.
43. Remove the engine harness ground stud (2) from the engine block.
44. Remove the engine harness grounds (3) from the engine block.
45. Disconnect the engine harness electrical connector (4) from the knock sensor.

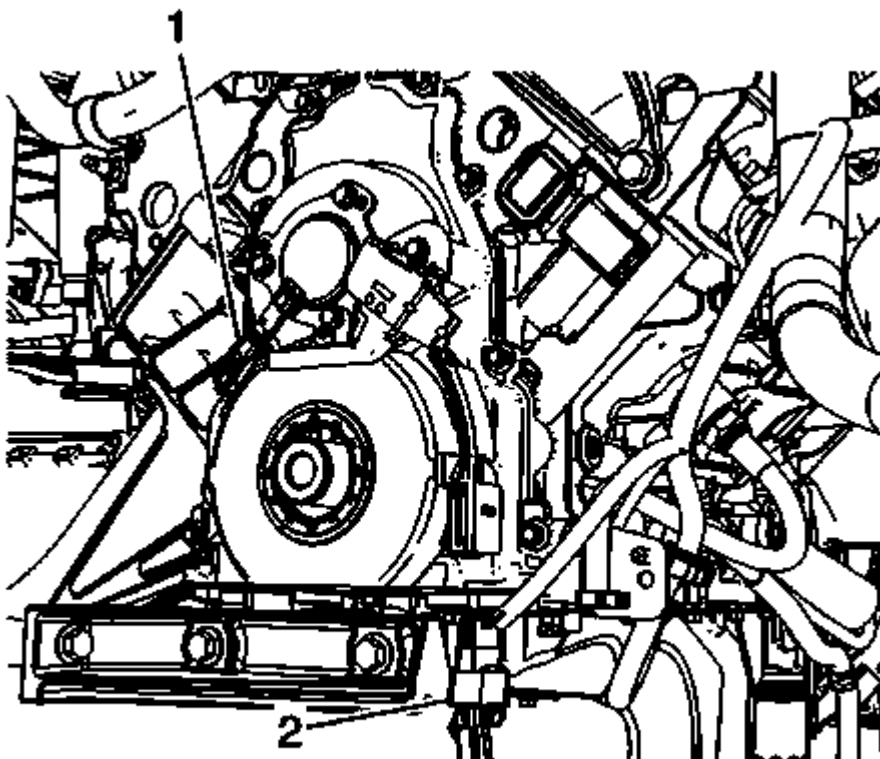


Fig. 330: CMP Sensor And Connector
Courtesy of GENERAL MOTORS CORP.

46. Disconnect the engine harness electrical connector (1) from the camshaft position (CMP) sensor wire harness.

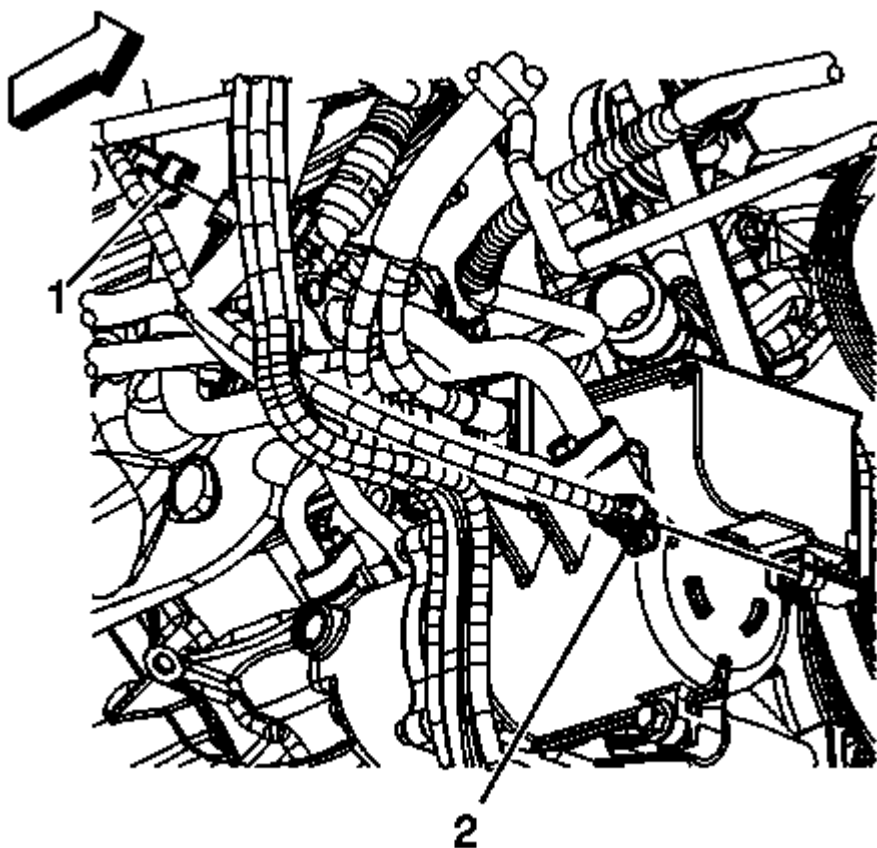


Fig. 331: A/C Refrigerant Pressure Sensor Harness And Connector
Courtesy of GENERAL MOTORS CORP.

47. Disconnect the auxiliary heater water pump electrical connector (1).
48. Disconnect the engine harness electrical connector (2) from the A/C refrigerant pressure sensor.

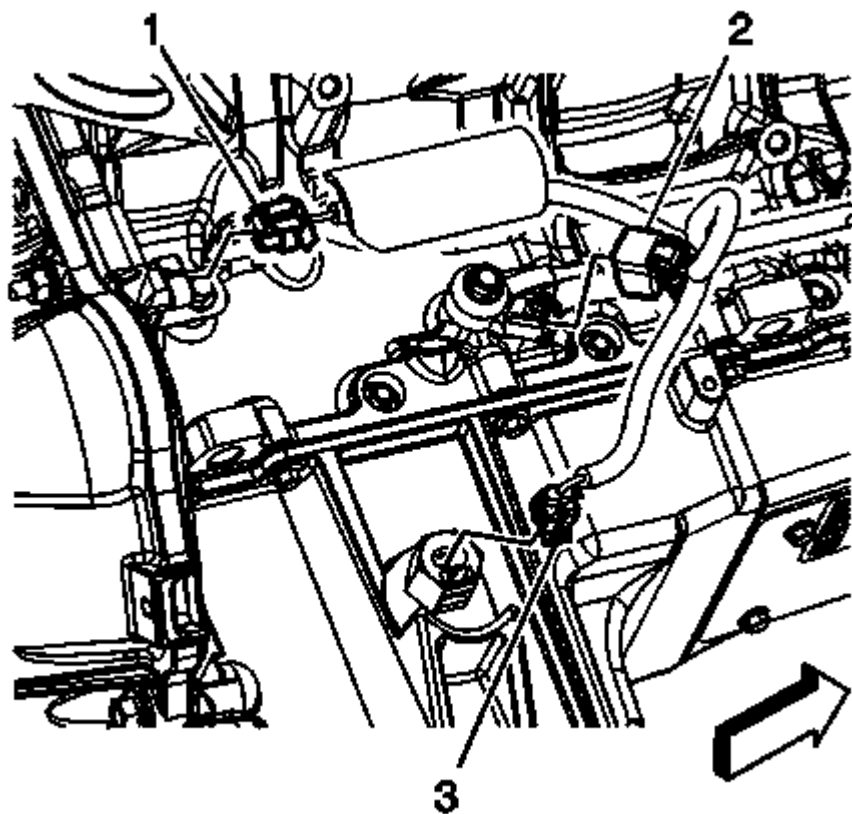


Fig. 332: CKP Sensor Harness And Connector
Courtesy of GENERAL MOTORS CORP.

49. Disconnect the engine harness electrical connector (1) from the crankshaft position (CKP) sensor.
50. Disconnect the engine harness electrical connector (2) from the knock sensor.
51. Disconnect the engine harness electrical connector (3) from the oil level sensor.

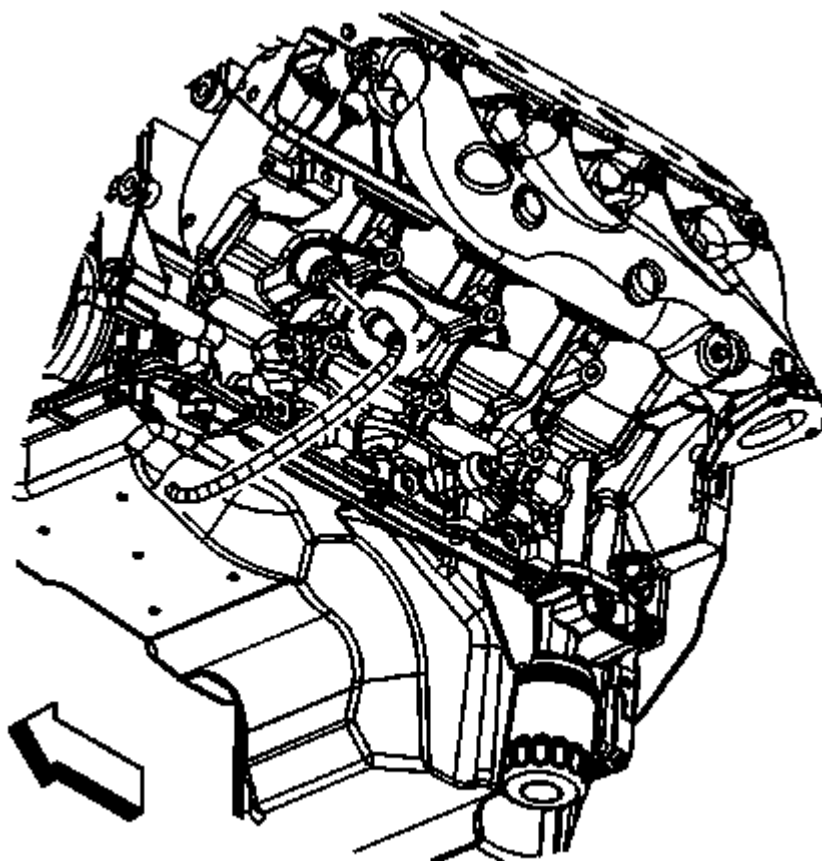


Fig. 333: Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

52. Disconnect the coolant heater cord from the coolant heater, if equipped.
53. Lower the vehicle.
54. Remove the ignition coil, as required for proper fit of the **J 41798** . Before lifting the engine, refer to **Ignition Coil Replacement** .
55. Remove the 3 phase cable bracket from the right cylinder head.

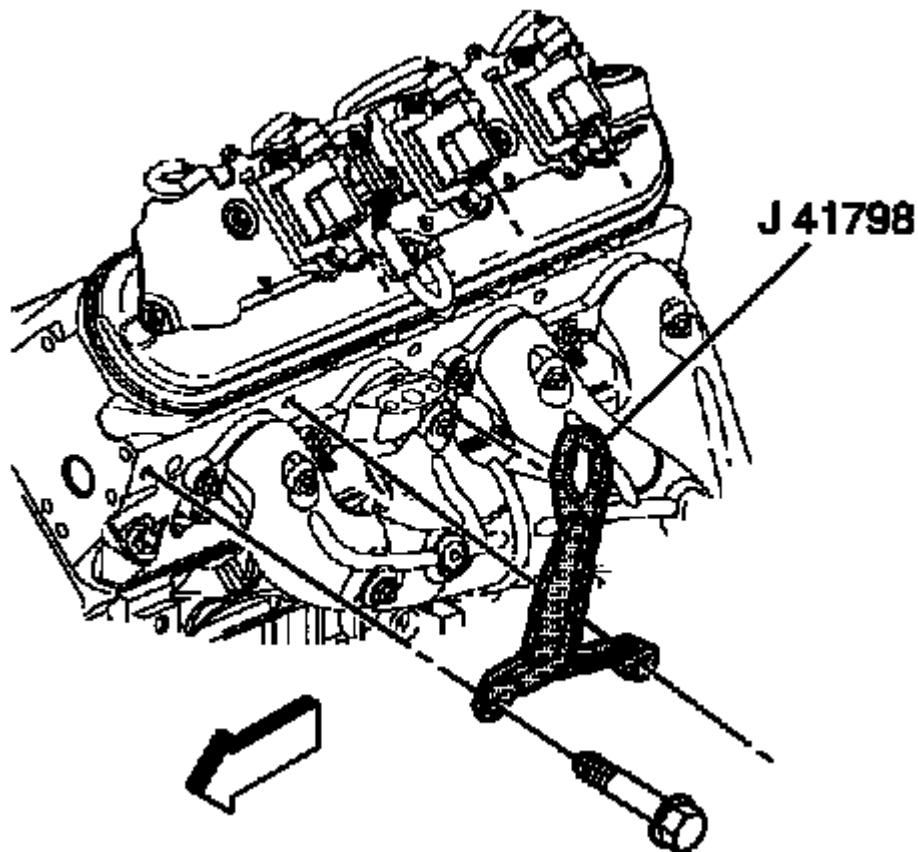


Fig. 334: Engine Lift Bracket

Courtesy of GENERAL MOTORS CORP.

56. Install the J 41798 to left and right cylinder heads.

Tighten

- Tighten the M8 engine lift bracket bolts to 25 N.m (18 lb ft).
- Tighten the M10 engine lift bracket bolts to 50 N.m (37 lb ft).

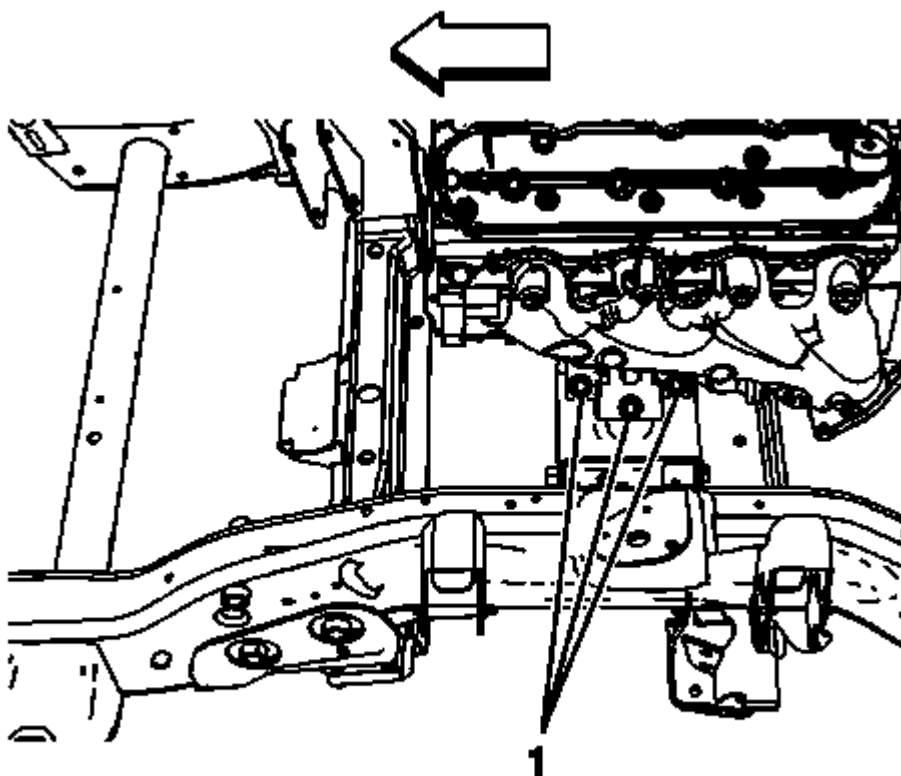


Fig. 335: Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

57. Remove the left and right engine mount to frame bolts (1).
58. Raise the vehicle.

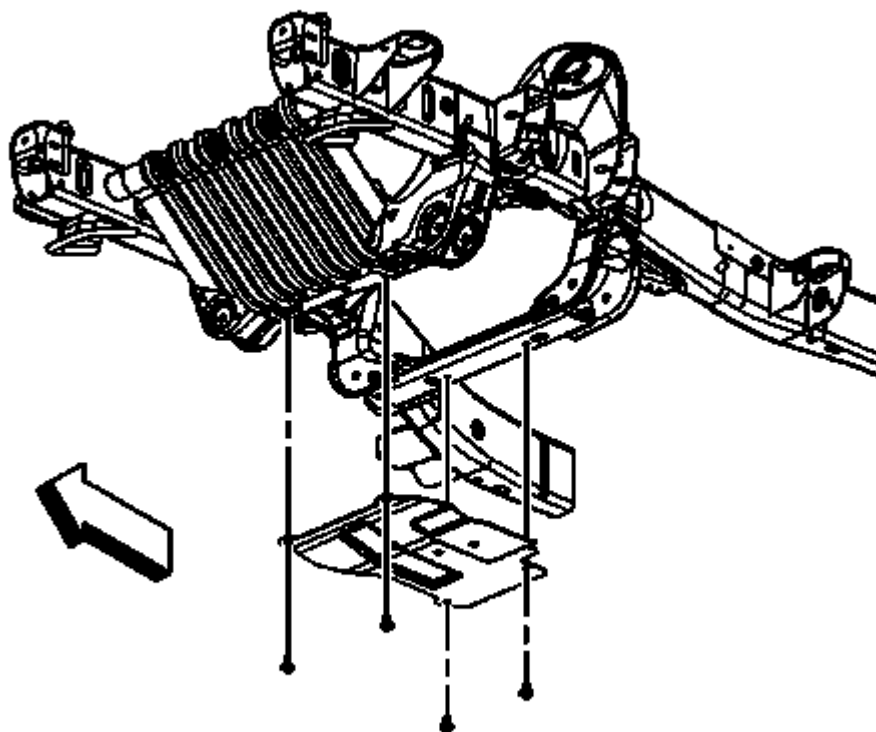


Fig. 336: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

59. Remove the oil pan skid plate bolts and plate, if equipped.

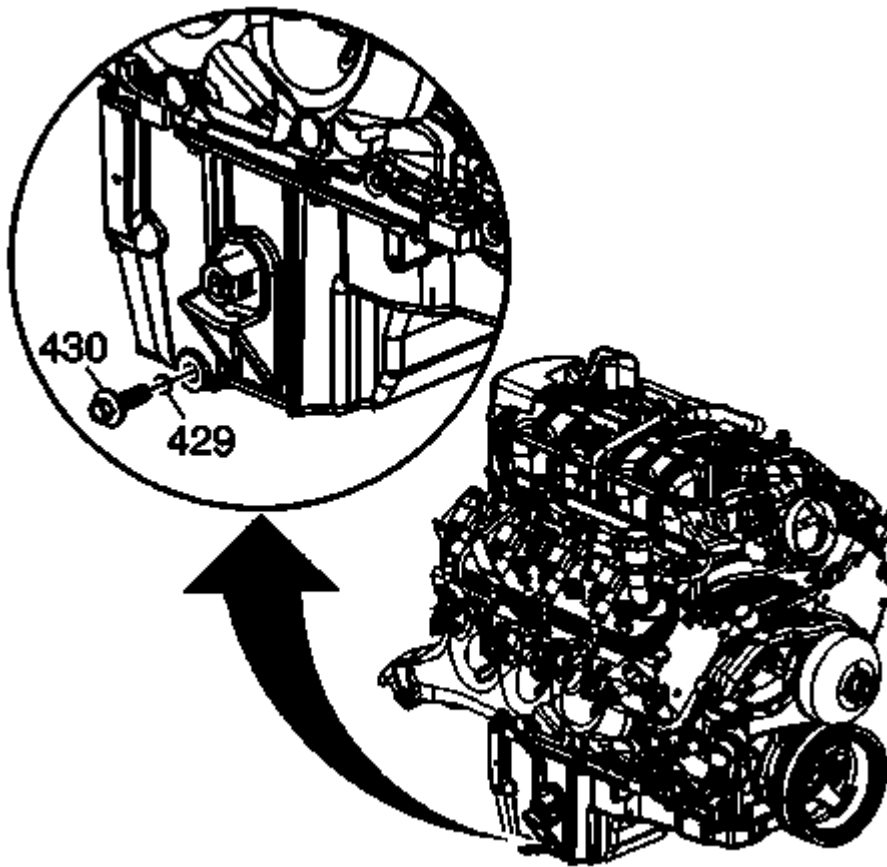


Fig. 337: Oil Pan Drain Plug

Courtesy of GENERAL MOTORS CORP.

60. Place a suitable drain pan under the oil pan drain plug.
61. Remove the oil pan drain plug (430).
62. Allow the oil to drain completely.
63. Reinstall and tighten the oil pan drain plug.

Tighten

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

64. Remove the catalytic converter. Refer to **Catalytic Converter Replacement (with Exhaust Clamp)** .

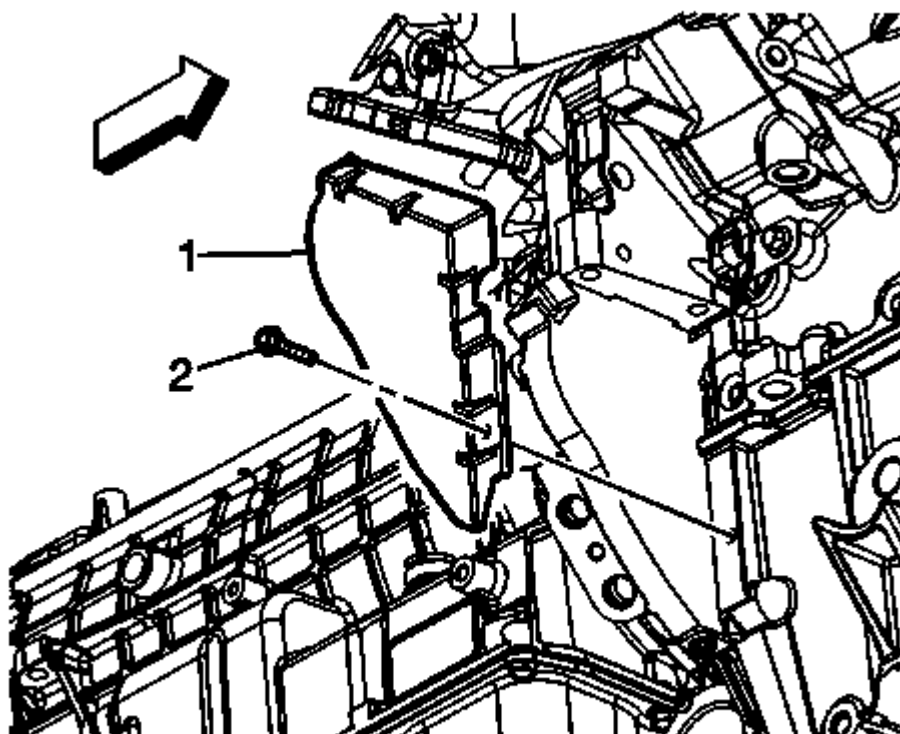


Fig. 338: Right Flex Plate Inspection Cover Bolt
Courtesy of GENERAL MOTORS CORP.

65. Remove the right flex plate inspection cover bolt (2).
66. Remove the right flex plate inspection cover (1).

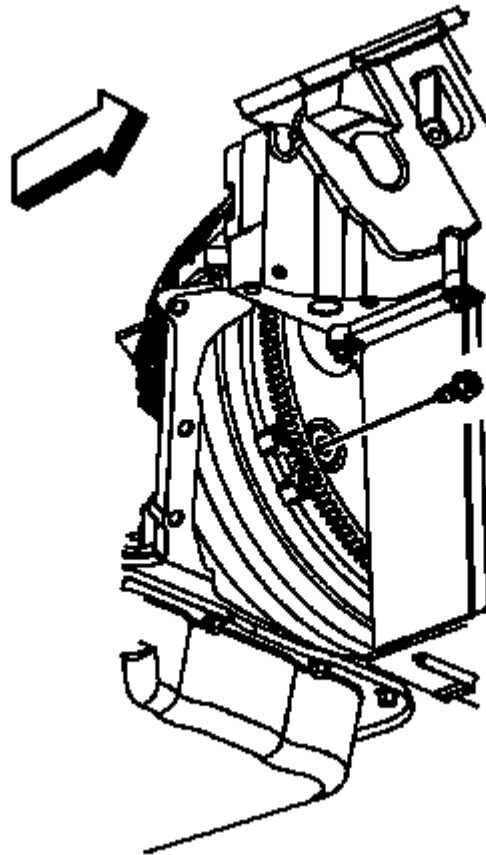


Fig. 339: Flywheel And Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Rotate engine clockwise only.

67. With the aid of an assistant, hold the crank pulley, then remove the flywheel to torque dampener bolts.

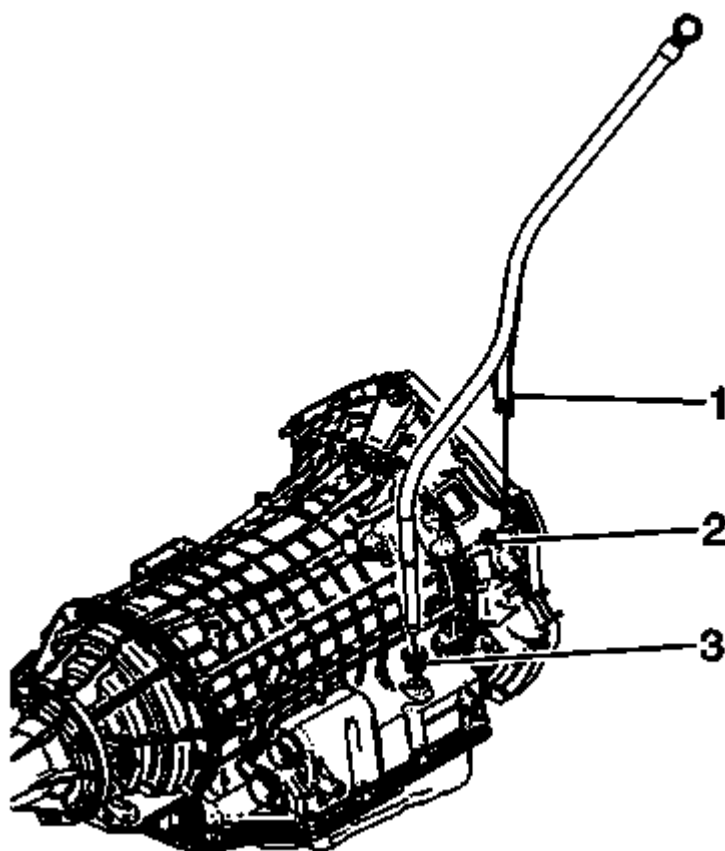


Fig. 340: Fluid Filler Tube Bracket
Courtesy of GENERAL MOTORS CORP.

68. Remove the fluid filler tube retaining nut (2) and reposition fill tube aside as necessary.

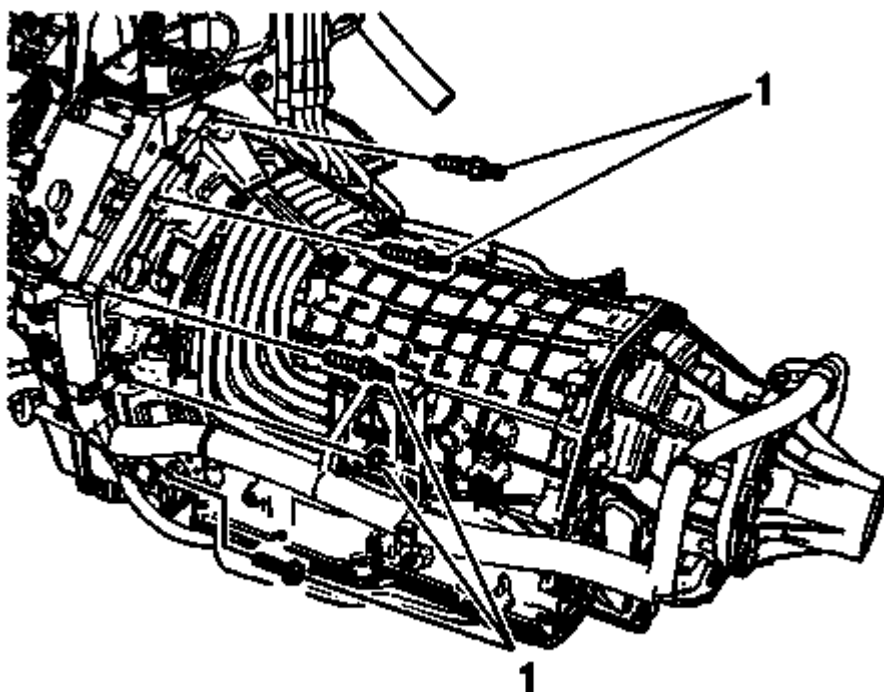


Fig. 341: Transmission Bolts/Studs

Courtesy of GENERAL MOTORS CORP.

69. Remove the transmission bolts/studs (1).
70. Lower the vehicle.
71. Remove the fuel/evaporative emission (EVAP) pipe bracket nut from the transmission stud.
72. Remove the fuel/EVAP pipe bracket from the stud. Reposition the bracket out of the way.

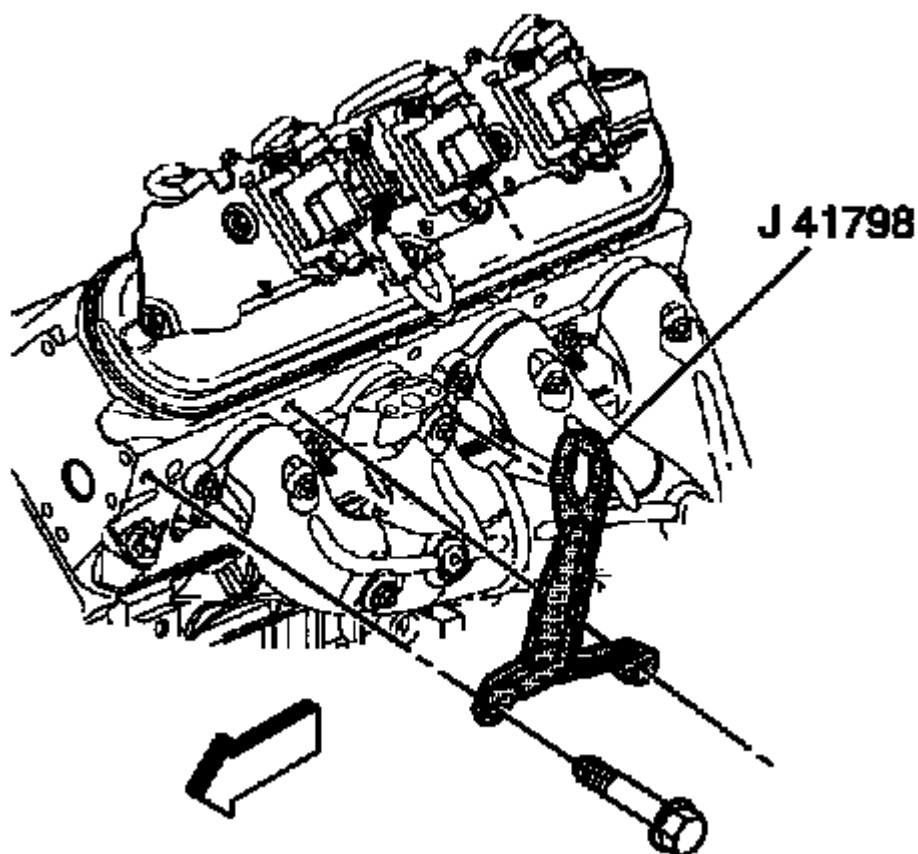


Fig. 342: Engine Lift Bracket

Courtesy of GENERAL MOTORS CORP.

73. Position and install an engine hoist to the J 41798 .
74. Install a floor jack under the transmission for support.
75. Remove the engine from the vehicle.
76. Install the J 21366 .
77. Position and install the engine onto an engine stand.
78. Remove the engine hoist. from the J 41798 .
79. Remove the J 41798 .
80. Transfer parts as necessary.

Installation Procedure

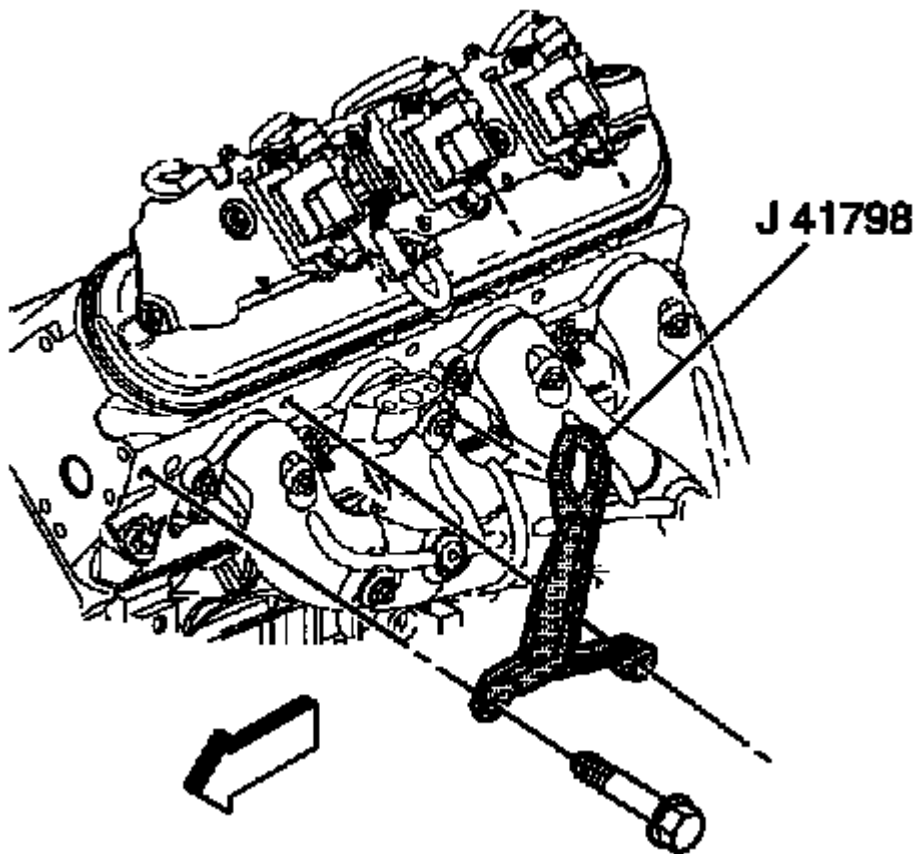


Fig. 343: Engine Lift Bracket
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Install the J 41798 .

Tighten

- Tighten the M8 engine lift bracket bolts to 25 N.m (18 lb ft).
 - Tighten the M10 engine lift bracket bolts to 50 N.m (37 lb ft).
2. Position and install the engine hoist to the J 41798 .
 3. Remove the engine from the engine stand.
 4. Remove the J 21366 .
 5. Install the engine to the vehicle.
 6. Align and install the engine to the transmission. Raise or lower the transmission as required using the floor jack.
 7. Once aligned and mated together completely lower and remove the engine hoist.

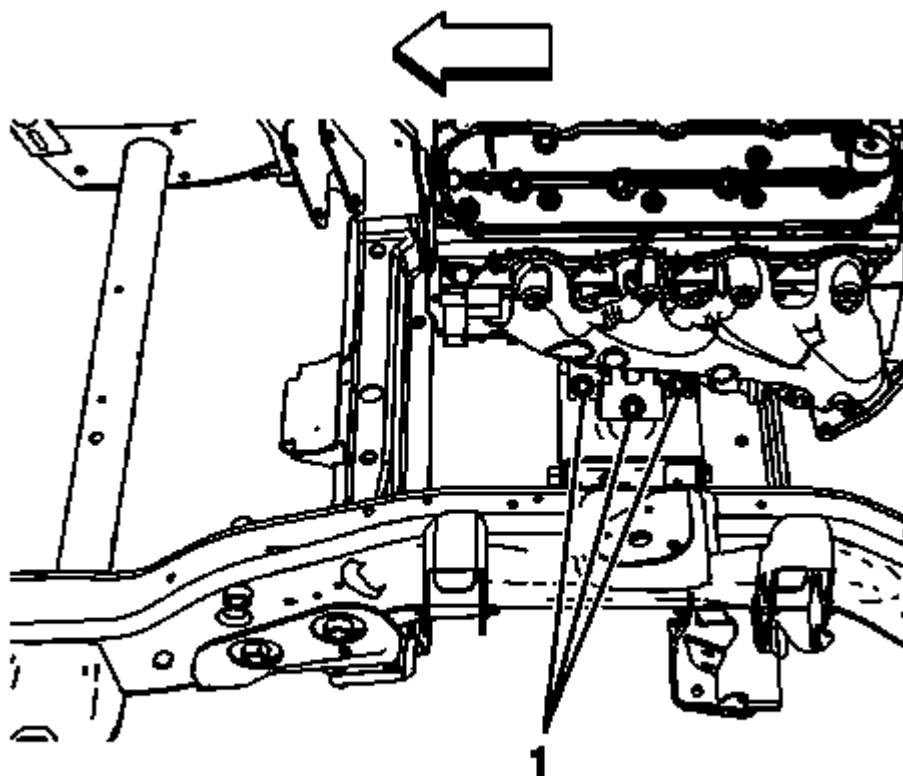


Fig. 344: Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the left and right engine mount to frame bolts (1).

Tighten

Tighten the bolts to 65 N.m (48 lb ft) starting with the middle bolt then either side bolt.

9. Remove the floor jack from under the transmission.
10. Raise the vehicle.

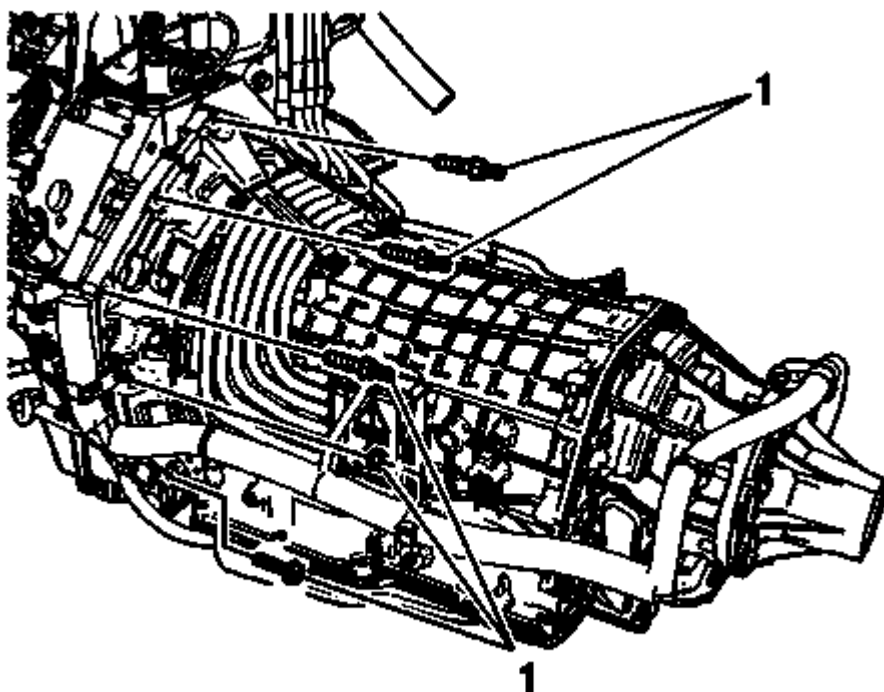


Fig. 345: Transmission Bolts/Studs

Courtesy of GENERAL MOTORS CORP.

11. Install the transmission bolts/studs (1).

Tighten

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

12. Install the fuel/EVAP pipe bracket to the stud.
13. Install the fuel/evaporative emission (EVAP) pipe bracket nut to the transmission stud.

Tighten

Tighten the nut to 18 N.m (13 lb ft).

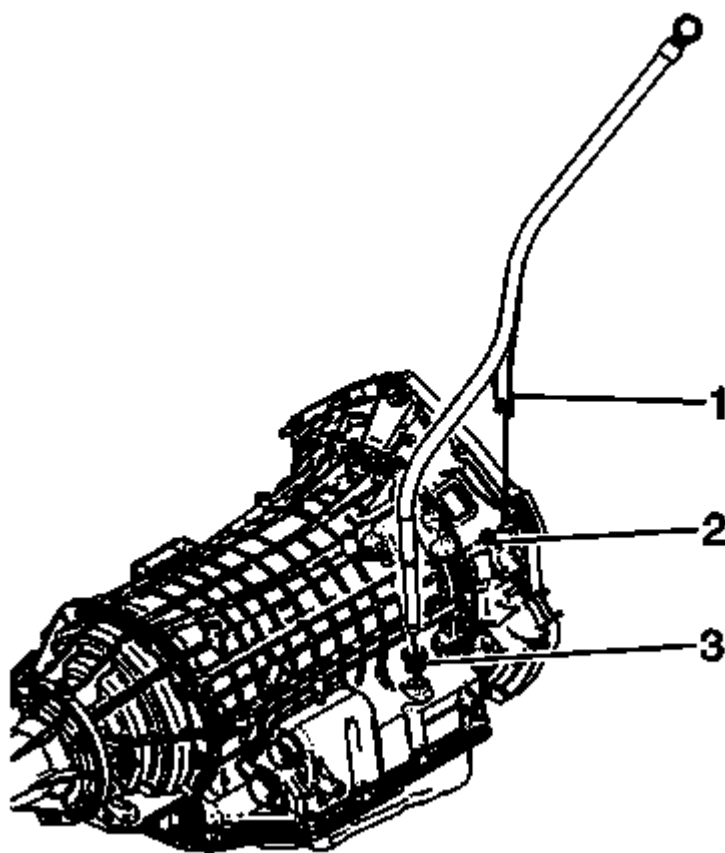


Fig. 346: Fluid Filler Tube Bracket
Courtesy of GENERAL MOTORS CORP.

14. Install the fluid filler tube bracket to the transmission.
15. Install the fluid filler tube retaining nut (2).

Tighten

Tighten the nut to 18 N.m (13 lb ft).

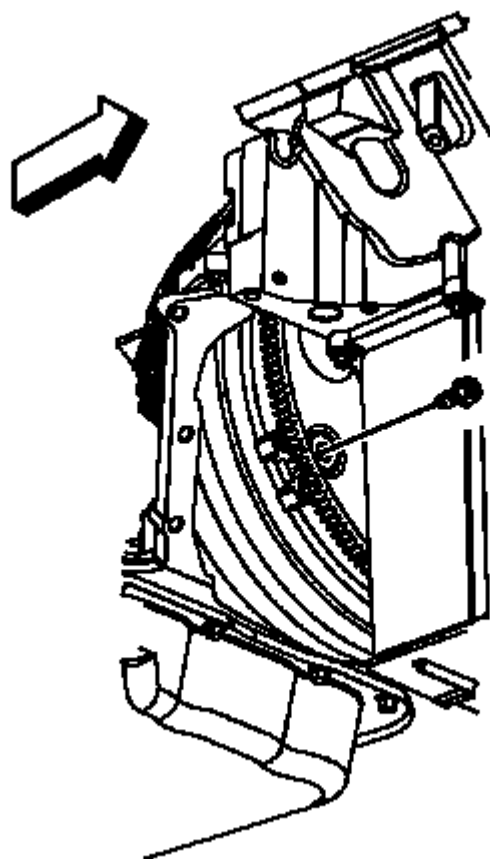


Fig. 347: Flywheel And Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Rotate engine clockwise only.

16. Align the torque dampener bolt holes to the flywheel bolt holes.
17. With the aid of an assistant, hold the crank pulley, then install the flywheel to torque dampener bolts.

Tighten

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

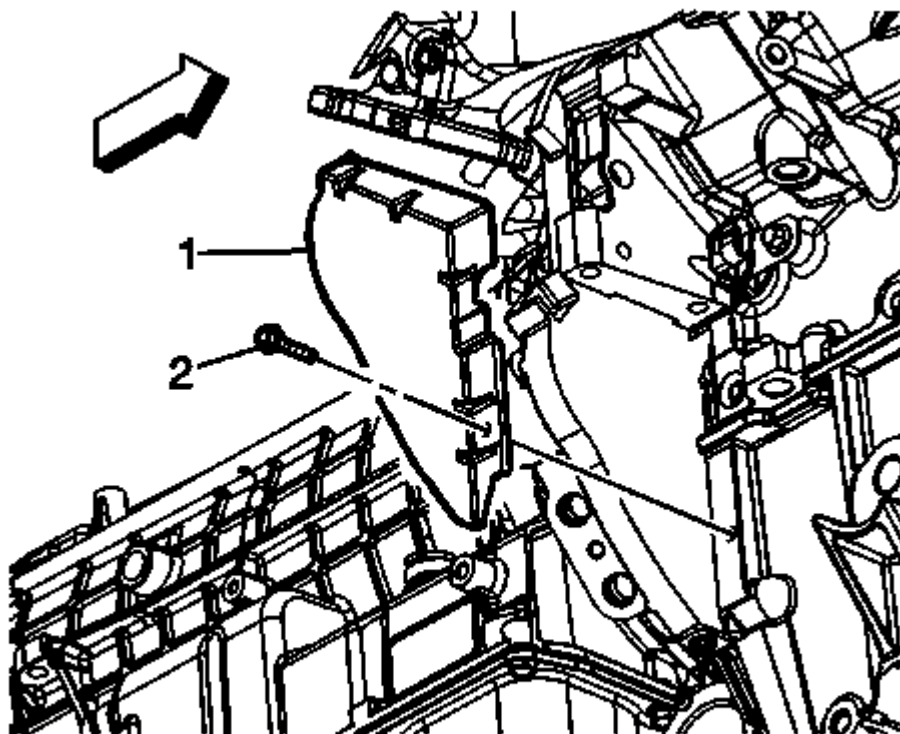


Fig. 348: Right Flex Plate Inspection Cover Bolt
Courtesy of GENERAL MOTORS CORP.

18. Install the right flex plate inspection cover (1).
19. Install the right flex plate inspection cover bolt (2).

Tighten

Tighten the bolt to 12 N.m (106 lb in).

20. Install the catalytic converter. Refer to **Catalytic Converter Replacement (with Exhaust Clamp)** .
21. Lower the vehicle.

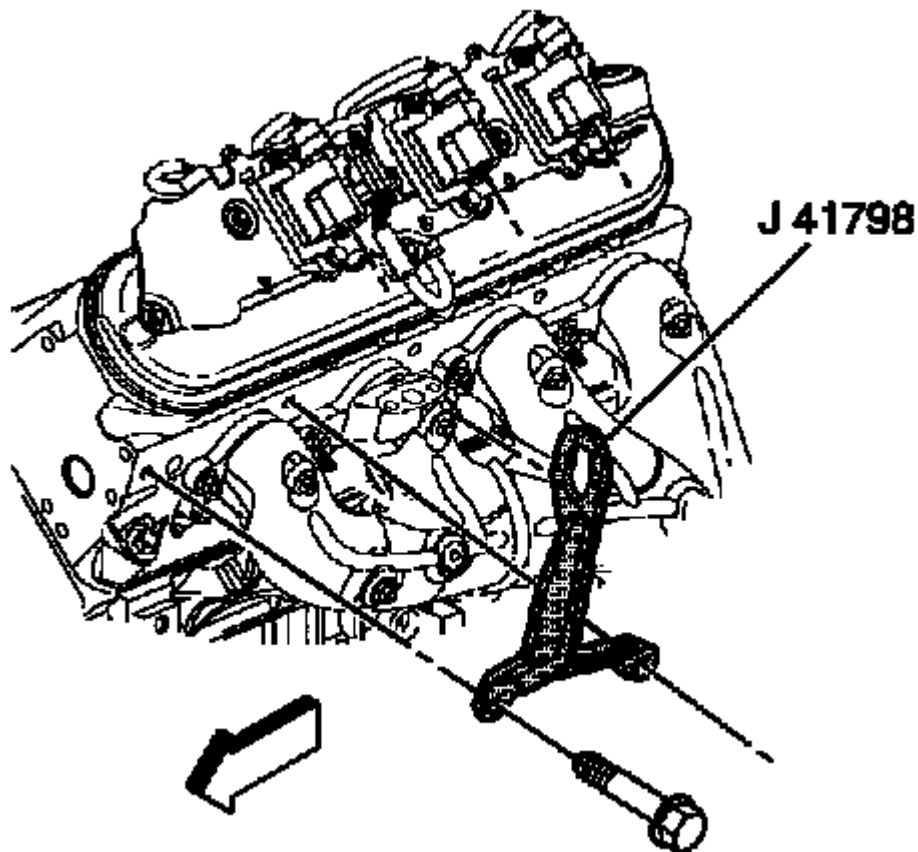


Fig. 349: Engine Lift Bracket
Courtesy of GENERAL MOTORS CORP.

22. Remove the **J 41798** .
23. Install the 3 phase cable bracket to the right cylinder head.
24. Install the ignition coil(s) and spark plug wire(s), as required. Refer to **Ignition Coil Replacement** .
25. Raise the vehicle.

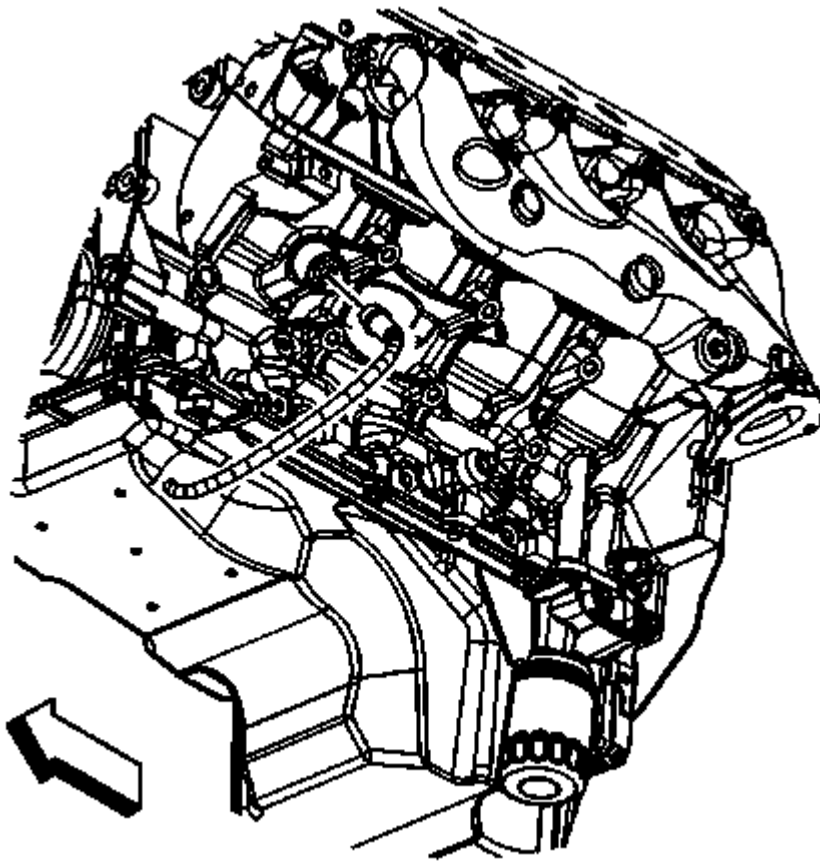


Fig. 350: Coolant Heater Cord
Courtesy of GENERAL MOTORS CORP.

26. Connect the coolant heater cord to the coolant heater, if equipped.

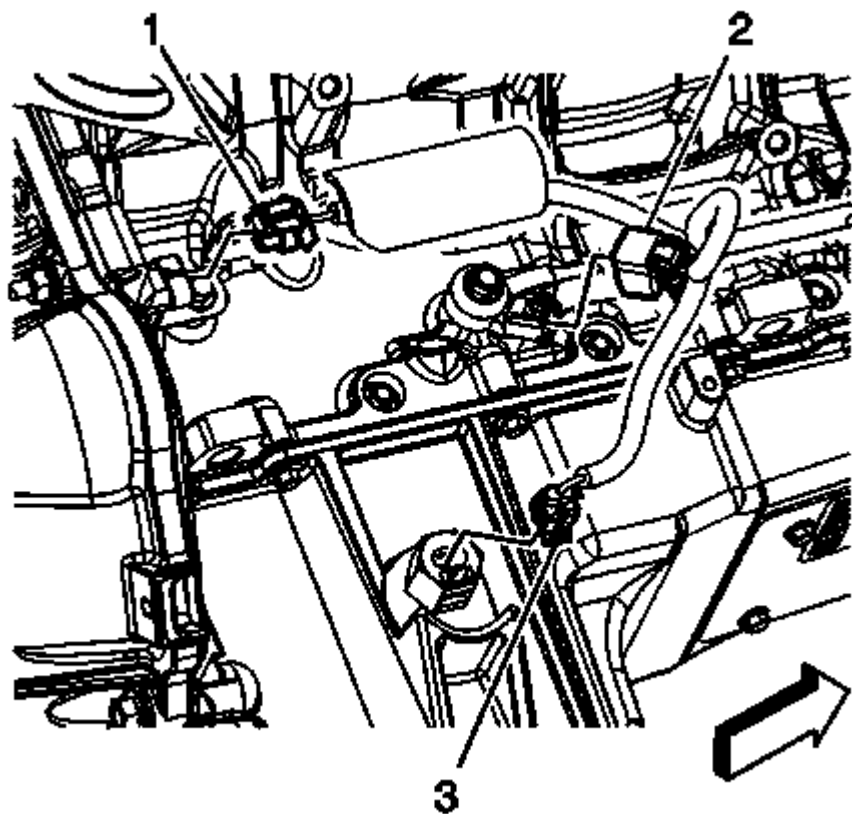


Fig. 351: CKP Sensor Harness And Connector
Courtesy of GENERAL MOTORS CORP.

27. Connect the engine harness electrical connector (1) to the CKP sensor.
28. Connect the engine harness electrical connector (2) to the knock sensor.
29. Connect the engine harness electrical connector (3) to the oil level sensor.

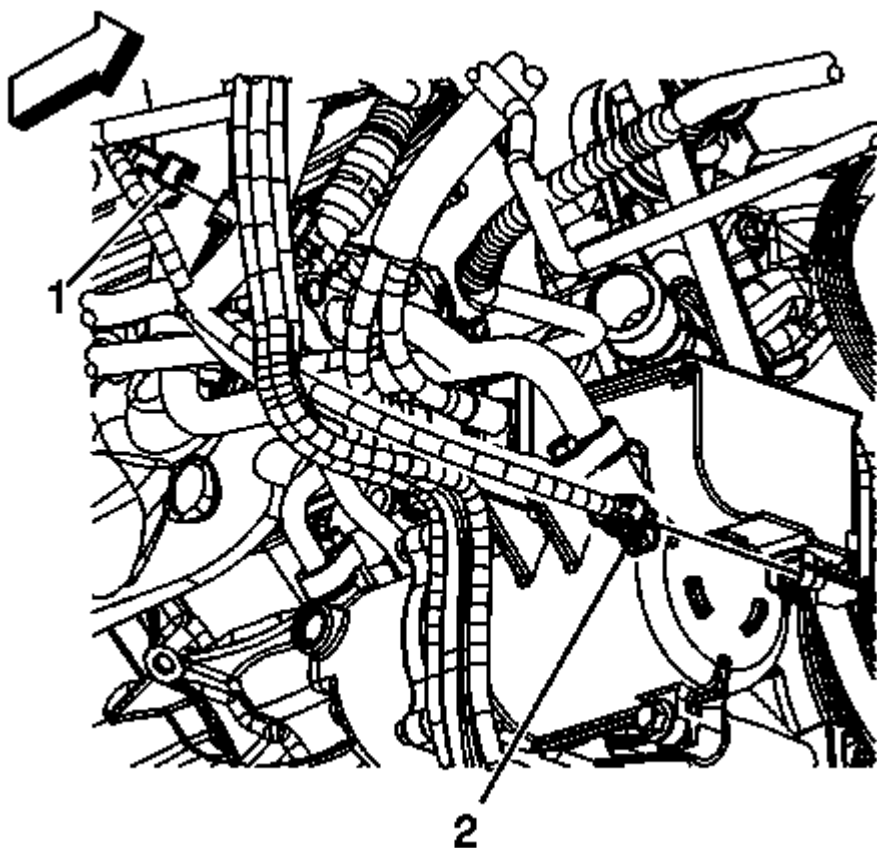


Fig. 352: A/C Refrigerant Pressure Sensor Harness And Connector
Courtesy of GENERAL MOTORS CORP.

30. Connect the engine harness electrical connector (2) to the A/C refrigerant pressure sensor.
31. Connect the auxiliary heater water pump electrical connector (1).

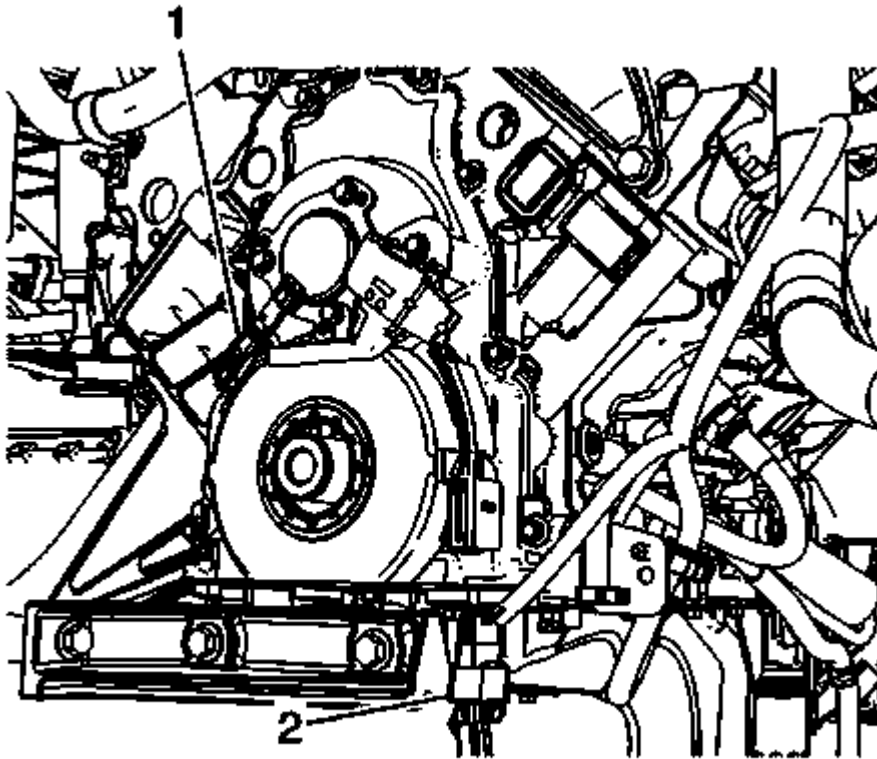


Fig. 353: CMP Sensor And Connector
Courtesy of GENERAL MOTORS CORP.

32. Connect the engine harness electrical connector (1) to the CMP sensor wire harness.

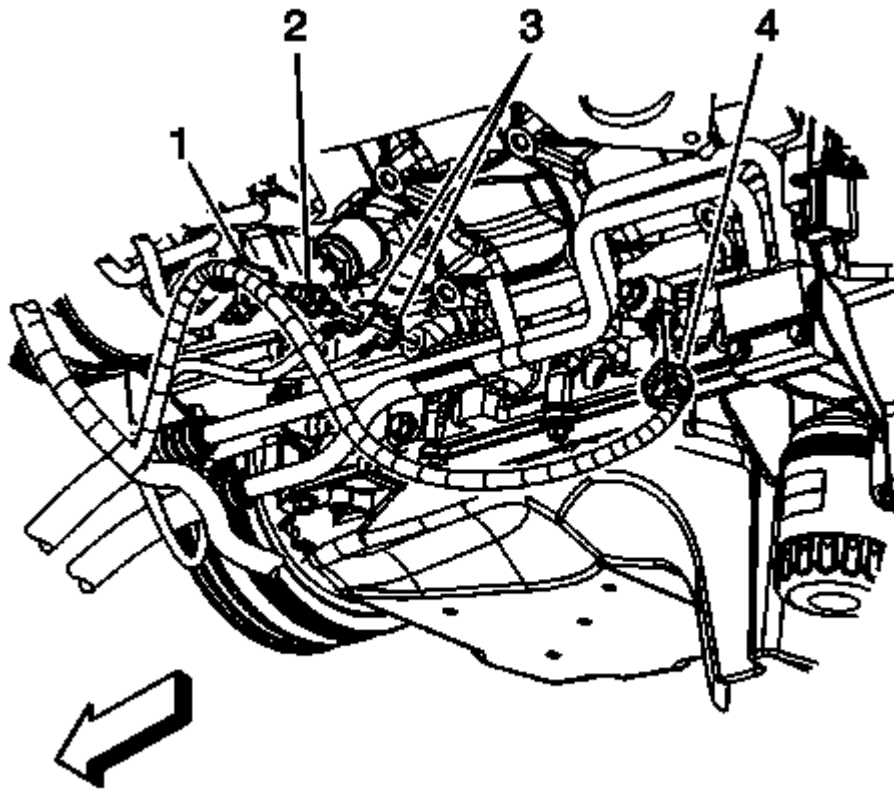


Fig. 354: Engine Harness Components
Courtesy of GENERAL MOTORS CORP.

33. Connect the engine harness electrical connector (4) to the knock sensor.
34. Position the engine harness grounds (3) to the engine block.
35. Install the engine harness ground stud (2) to the engine block.

Tighten

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

36. Install the engine harness clip (1) to the ground stud.
37. Lower the vehicle.
38. Position the engine ground wire to the right cylinder head.
39. Install the engine harness stud (1) to the right cylinder head.

Tighten

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

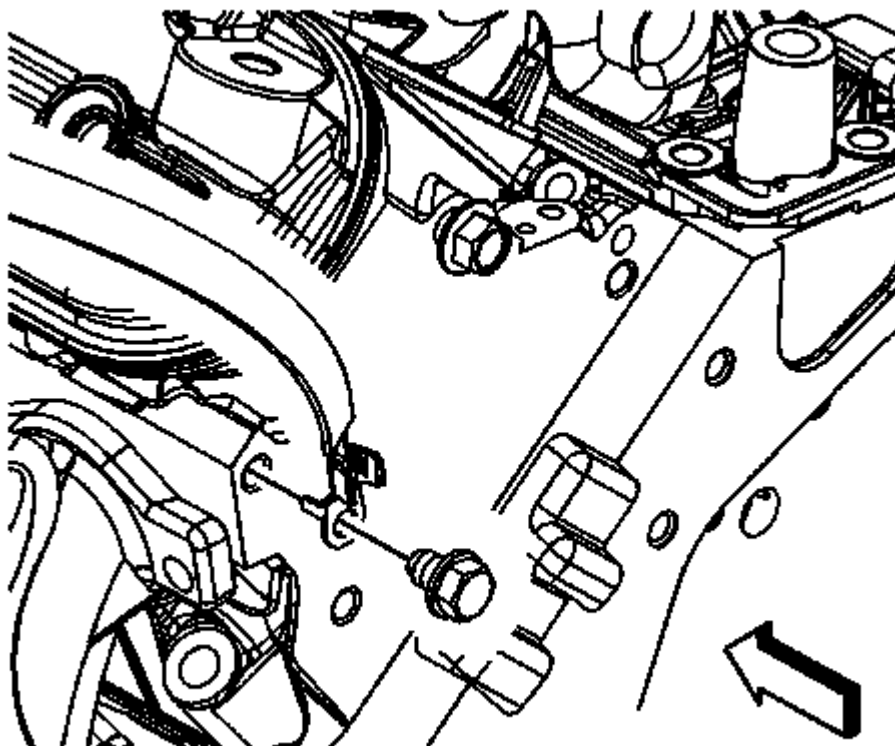


Fig. 355: Engine Ground Strap And Bolt
Courtesy of GENERAL MOTORS CORP.

40. Position the engine ground strap to the cylinder head and cowl.
41. Install the engine ground strap bolt to the rear of the left cylinder head and cowl.

Tighten

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

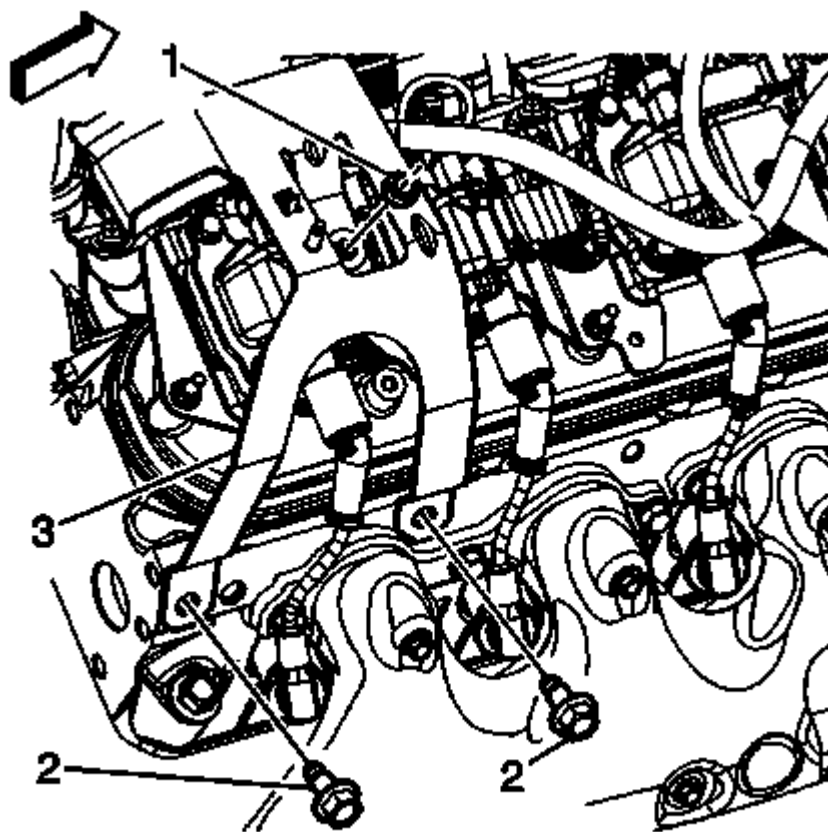


Fig. 356: Engine Bracket, Nut And Bolts
Courtesy of GENERAL MOTORS CORP.

42. Install the engine bracket (3) to the ignition coil bracket stud and install nut (1).

Tighten

Tighten the nut to 12 N.m (106 lb in).

43. Raise the vehicle half way.
44. Working through the wheel opening, install the engine bracket bolts (2).

Tighten

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

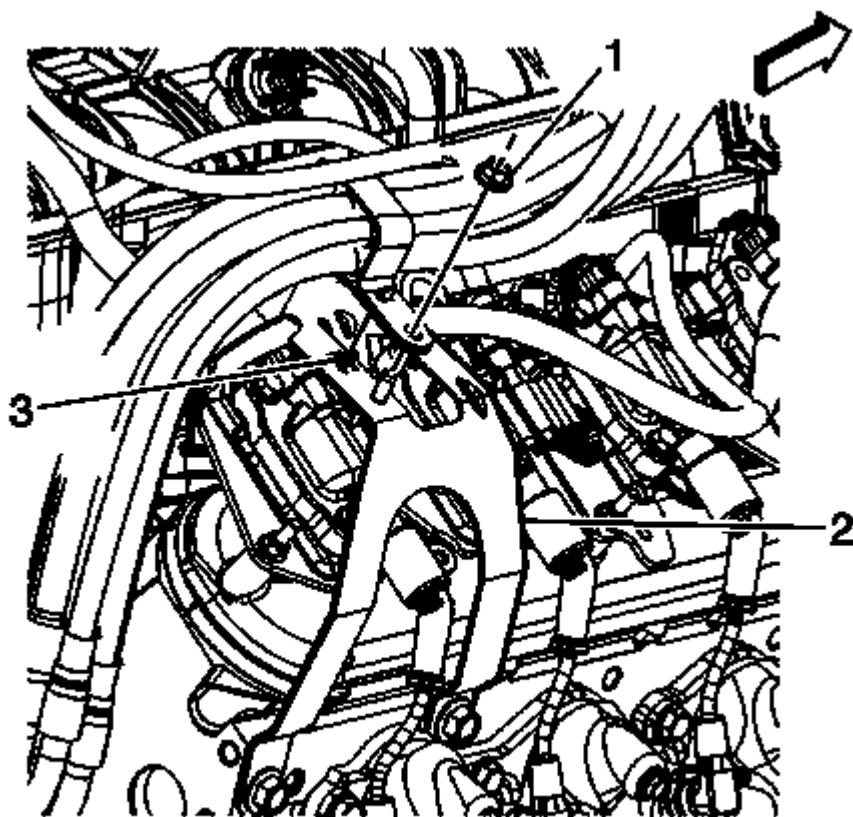


Fig. 357: 3-Phase Cable Clip Nut And Engine Bracket
Courtesy of GENERAL MOTORS CORP.

45. Install the right wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement - Right Side** .
46. Position the generator control module 3 phase cables to the bracket channel.
47. Install the generator control module 3 phase cable clip to the tab (3) on the engine bracket (2).
48. Install the generator control module 3 phase cable clip nut (1).

Tighten

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

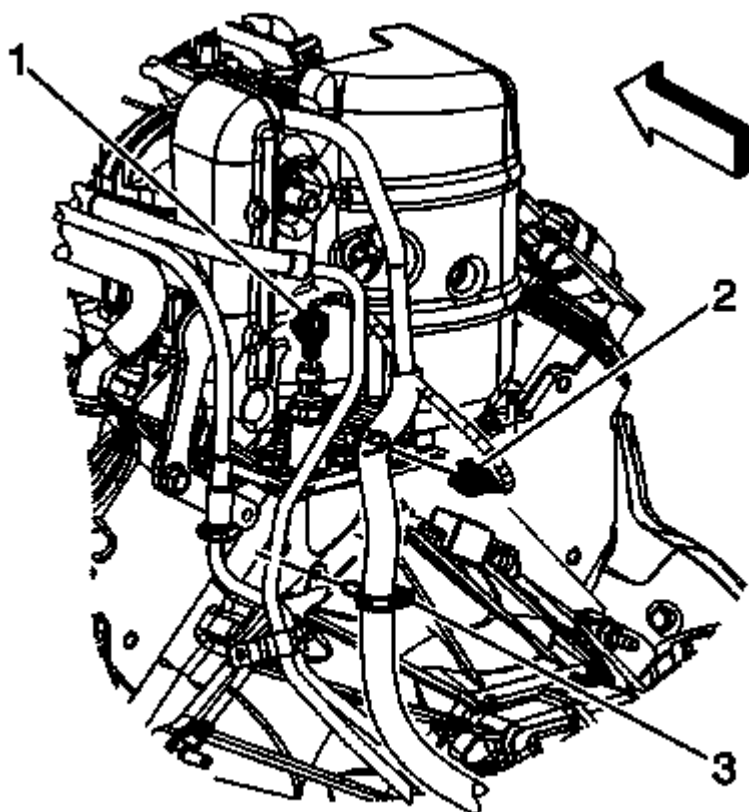


Fig. 358: Engine Harness Electrical Connectors And Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

49. Connect the engine harness electrical connector (1) to the oil pressure sensor.
50. Connect the engine harness electrical connector (2) to the lifter oil manifold.
51. Install the heater hoses. Refer to **Heater Inlet Hose Replacement (Pump to Engine-HP2)** , **Heater Inlet Hose Replacement (Pump to Heater Core-HP2)** .

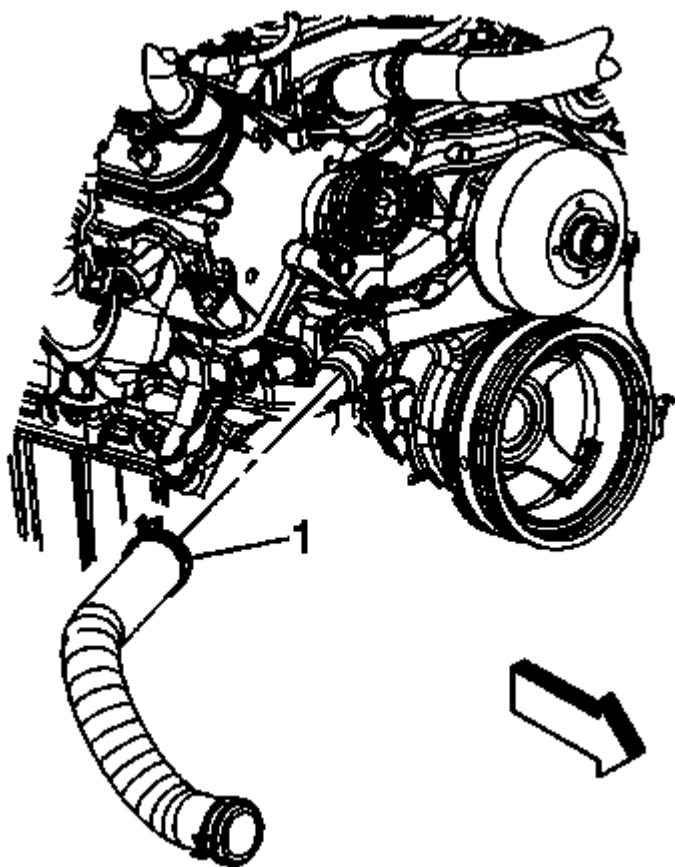


Fig. 359: Radiator Outlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

52. Install the radiator outlet hose to the water pump.
53. Position the radiator outlet hose clamp (1) at the water pump.

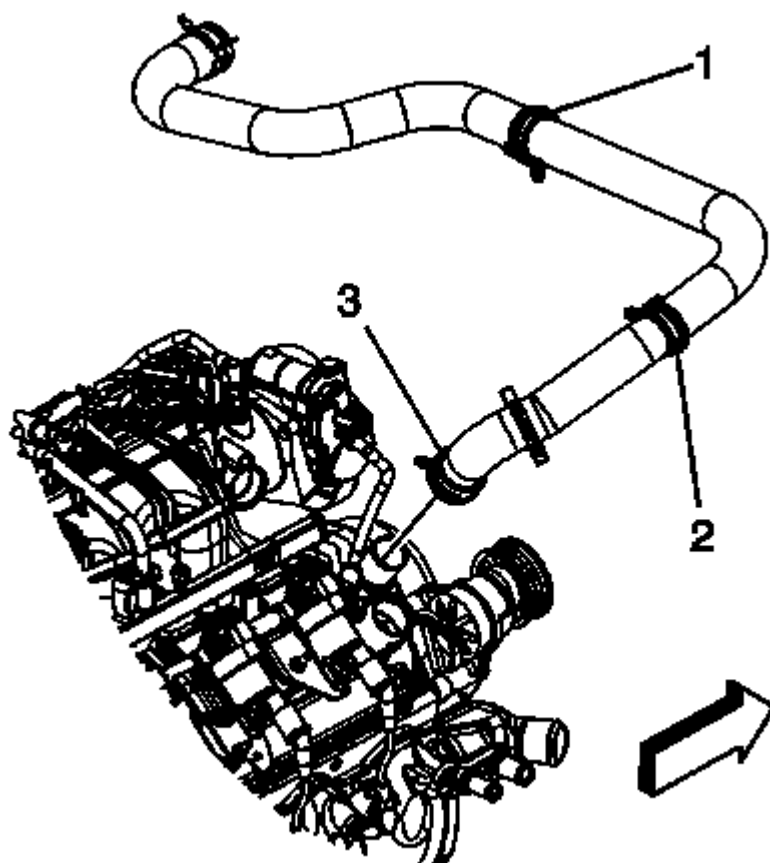


Fig. 360: Radiator Vent Inlet Hose Clamp At Water Pump
Courtesy of GENERAL MOTORS CORP.

54. Install the radiator inlet hose to the water pump.
55. Position the radiator inlet hose clamp (3) at the water pump.

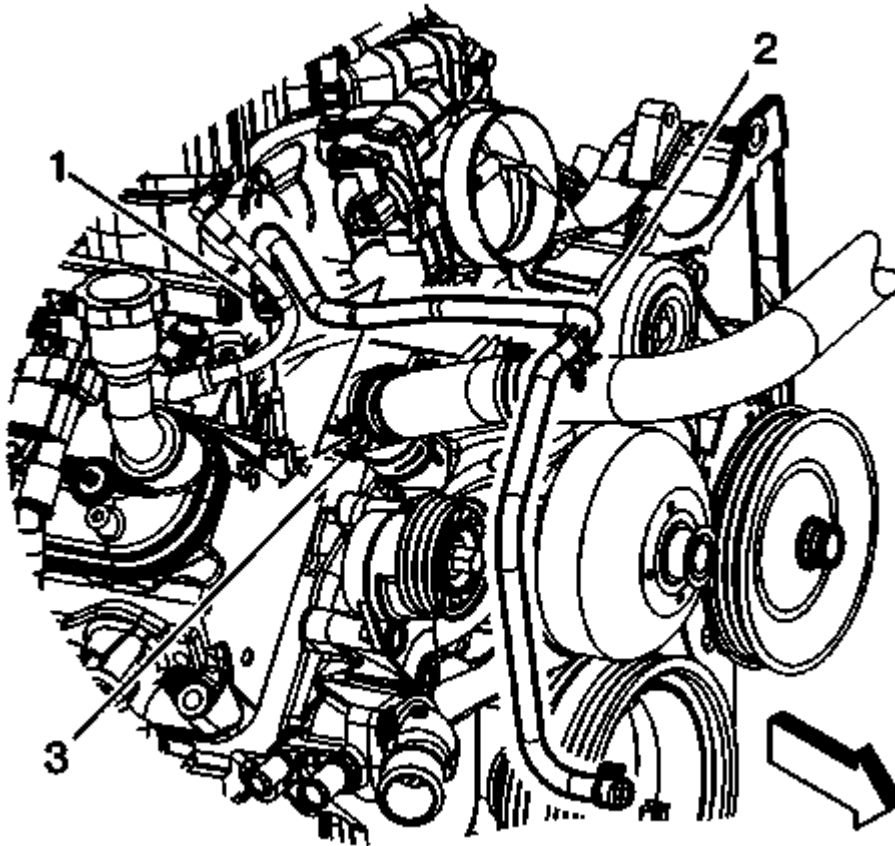


Fig. 361: Radiator Vent Inlet Hose
Courtesy of GENERAL MOTORS CORP.

56. Position and install the radiator vent inlet hose (2) to the air bleed pipe.
57. Position the radiator vent inlet hose clamp (1) at the air bleed pipe.
58. Install the radiator vent inlet hose (2) to the radiator inlet hose clip (3).
59. Position the generator battery jumper to the engine.
60. Install the intake manifold. Refer to **Intake Manifold Replacement**.
61. Connect the cables from the generator control module.
62. Connect the A/C pressure sensor electrical connector.
63. Connect the A/C lines from the A/C compressor. Refer to **Discharge Hose Replacement (LY2, LMF, L76 and L92)** , **Discharge Hose Replacement (HP2)** , and **Suction Hose Replacement (W/O C69-HP2)** , **Suction Hose Replacement (W/C69-HP2)** .

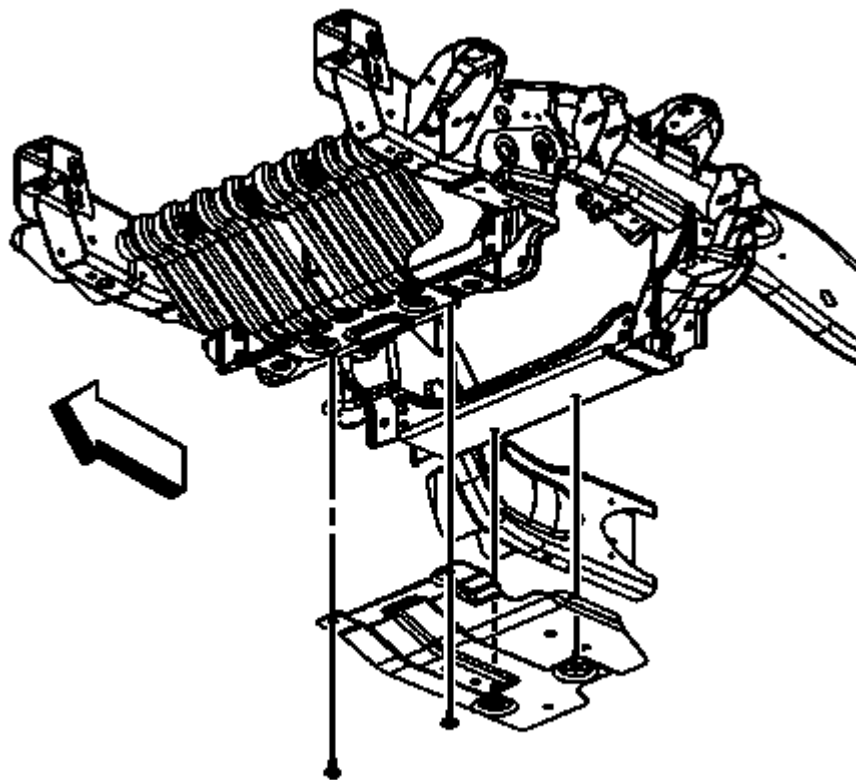


Fig. 362: Oil Pan Skid Plate

Courtesy of GENERAL MOTORS CORP.

64. For 2500 series vehicles, install the oil pan skid plate and bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

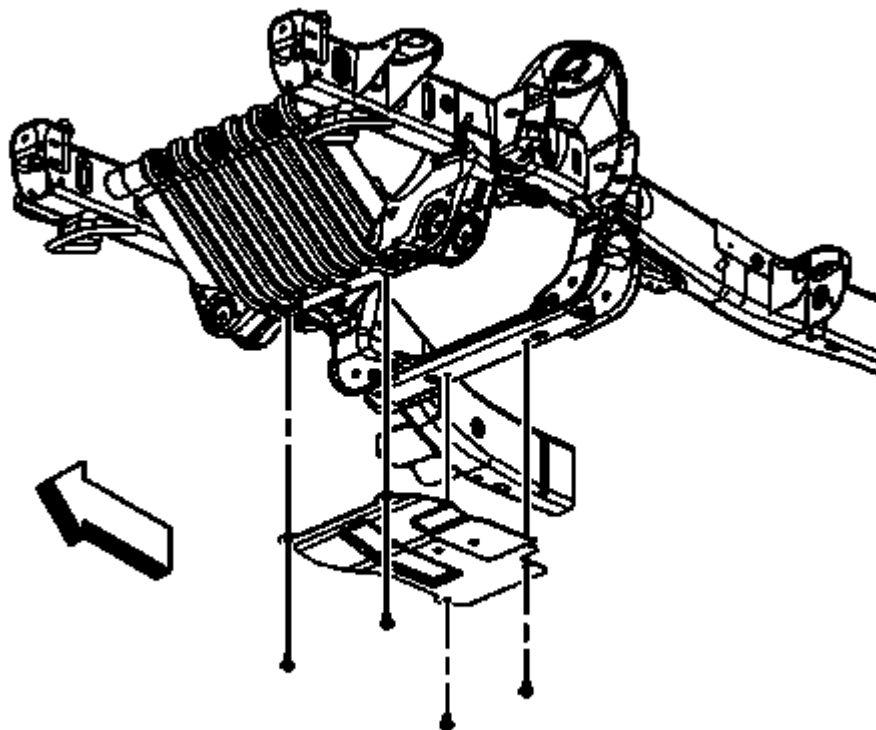


Fig. 363: Oil Pan Skid Plate And Bolts
Courtesy of GENERAL MOTORS CORP.

65. For 1500 series vehicles, install the oil pan skid plate and bolts, if equipped.

Tighten

Tighten the bolts to 28 N.m (21 lb ft).

66. Lower the vehicle.
67. Install the front end upper tie bar. Refer to **Front End Upper Tie Bar Replacement**.
68. Install the hood latch. Refer to **Hood Primary and Secondary Latch Replacement**.

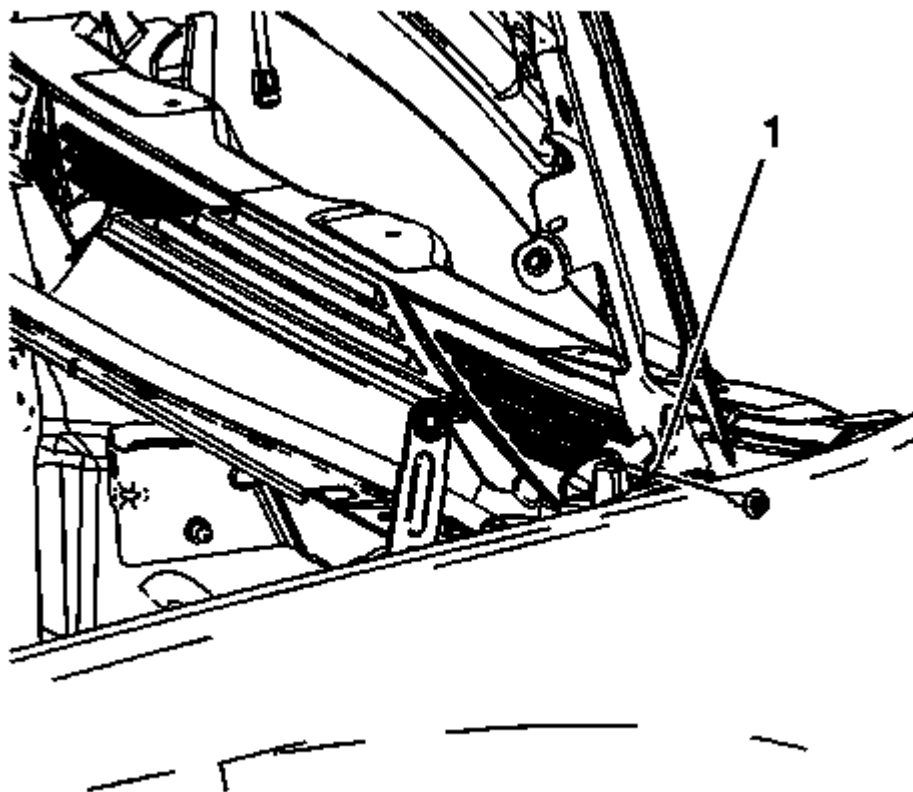


Fig. 364: Service Piston Notch

Courtesy of GENERAL MOTORS CORP.

NOTE: There is a positive stop which limits the hood from being opened too far.

69. With the aid of the assistant raise the hood slightly until the hood hinge bolts can be removed from the service position notch (1).

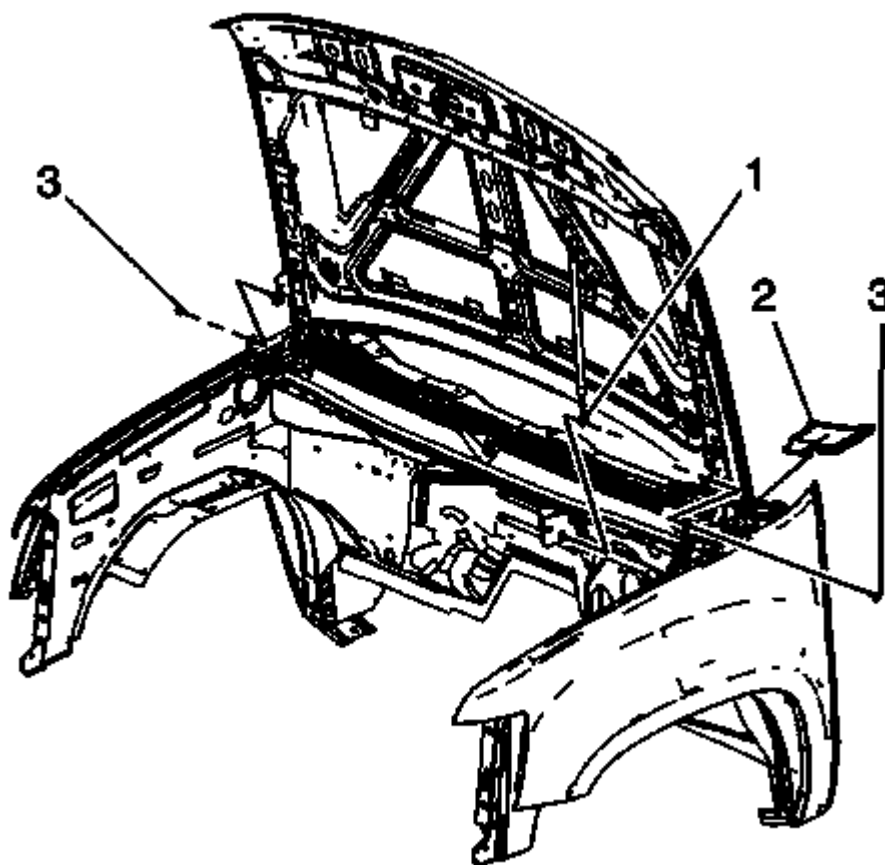


Fig. 365: Hood Strut Rod, Grille End Caps And Hood Hinge Bolts
Courtesy of GENERAL MOTORS CORP.

70. With the aid of an assistant lower the hood and install the hood hinge bolts (3) to the hood hinges.

Tighten

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

71. Install the hood strut rod (1) to the hood strut bracket stud.
72. Install the air inlet grille end caps (2), push down the end cap in order to engage the retainers.

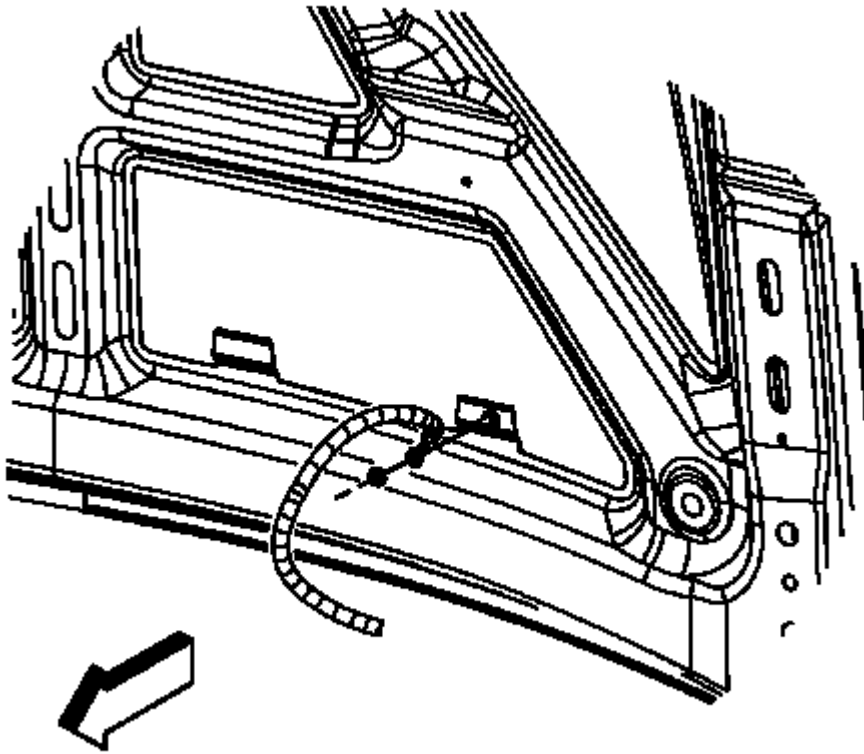


Fig. 366: Ground Strap And Nut
Courtesy of GENERAL MOTORS CORP.

73. Install the ground strap to the hood stud.
74. Install the ground strap nut at the hood stud.

Tighten

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

75. Refill the cooling system. Refer to **Cooling System Draining and Filling (Static Fill)** .
76. Prelube the engine. Refer to **Engine Prelubing** .
77. Enable the high voltage system. Refer to **High Voltage Enabling** .
78. Perform the CKP system variation learn procedure. Refer to **Crankshaft Position System Variation Learn** .

NOTE: **After an overhaul the engine should be tested.**

79. Use the following procedure after the engine is installed in the vehicle:
 1. Disable the ignition system.

2. Crank the engine several times. Listen for any unusual noises or evidence that parts are binding.
3. Enable the ignition system.
4. Start the engine and listen for unusual noises.
5. Check the vehicle oil pressure gauge or light and confirm that the engine has acceptable oil pressure.
6. Run the engine speed at about 1,000 RPM until the engine has reached normal operating temperature.
7. Listen for sticking lifters or other unusual noises.
8. Inspect for fuel, oil and/or coolant leaks while the engine is running.
9. Perform a final inspection for the proper oil and coolant levels.

ENGINE OIL AND OIL FILTER REPLACEMENT

Removal Procedure

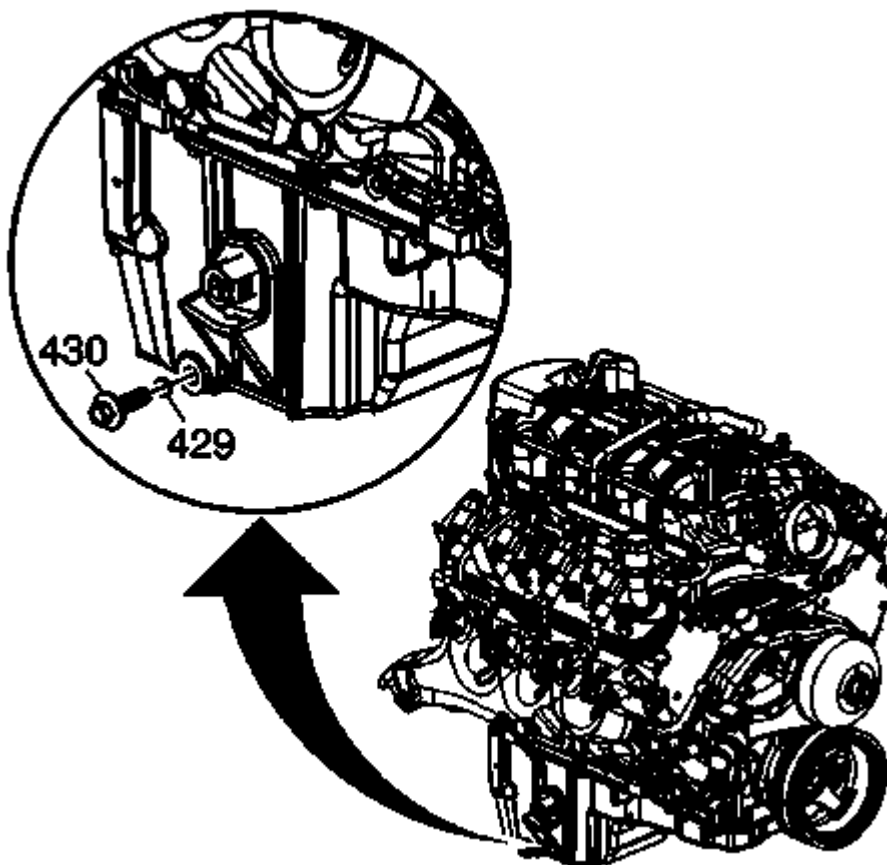


Fig. 367: Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

1. Open the hood.
2. Remove the oil fill cap.

3. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Place a oil drain pan under the oil pan drain plug.
5. Remove the oil pan drain plug (430).
6. Allow the oil to drain completely.
7. Clean and inspect the oil pan drain plug, replace if necessary.
8. Clean and inspect the oil pan sealing surface, replace the oil pan if necessary.
9. Wipe any remaining oil from the drain plug hole and reinstall the oil pan drain plug until snug.

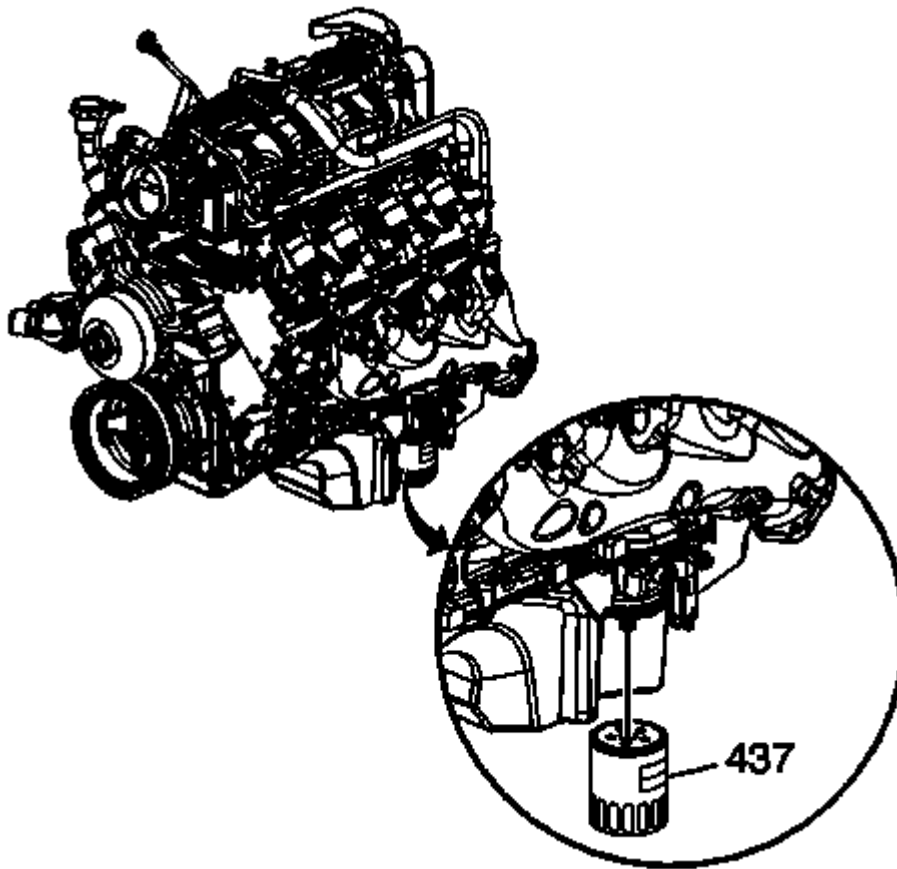


Fig. 368: Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

10. Position the drain pan under the oil filter.
11. Remove the oil filter.
12. Ensure that the oil filter gasket is still on the old filter (437) if not, remove the oil filter gasket from the oil pan.

Installation Procedure

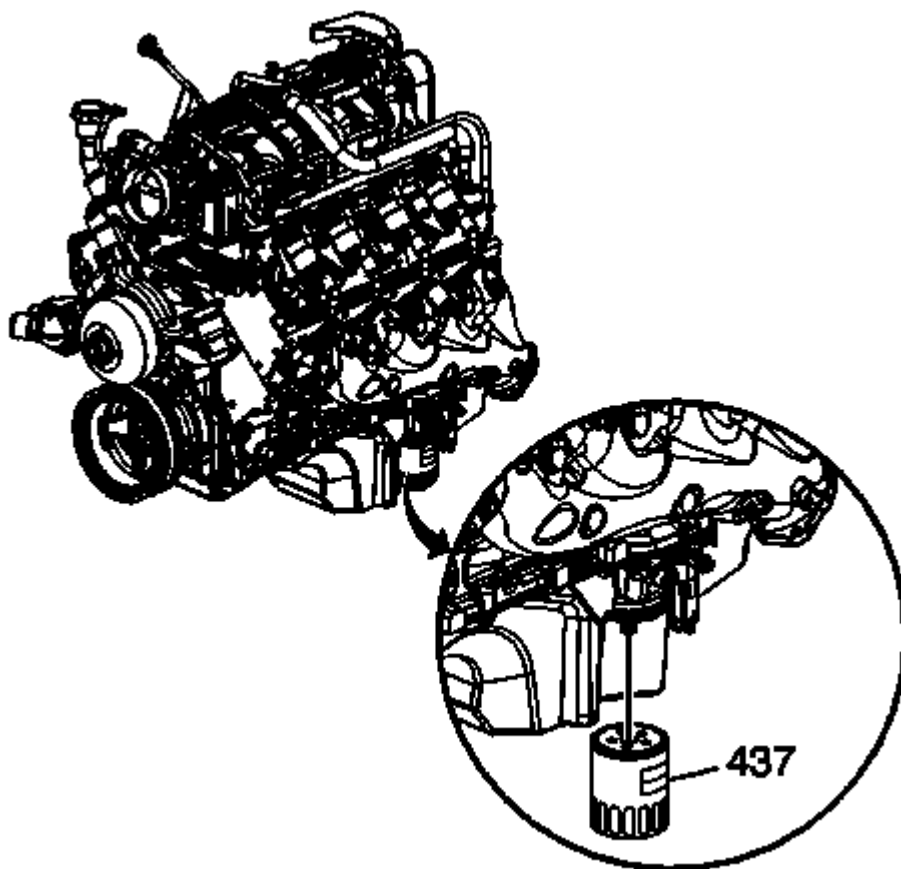


Fig. 369: Engine Oil Filter

Courtesy of GENERAL MOTORS CORP.

1. Apply clean engine oil to the NEW oil filter seal.

CAUTION: Refer to Fastener Caution .

2. Install the NEW oil filter (437).

Tighten

Tighten the oil filter to 30 N.m (22 lb ft).

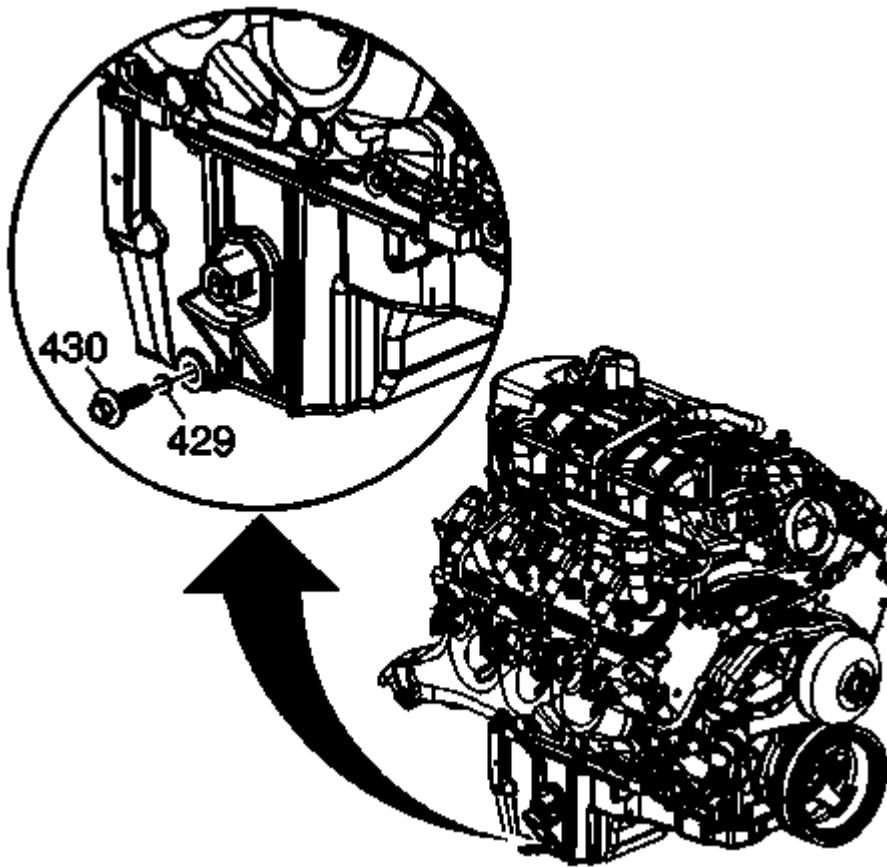


Fig. 370: Oil Pan Drain Plug
Courtesy of GENERAL MOTORS CORP.

3. Tighten the oil pan drain plug (430).

Tighten

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

4. Remove the oil drain pan from under the vehicle.
5. Lower the vehicle.
6. Fill the engine with new engine oil. Refer to Approximate Fluid Capacities , and Fluid and Lubricant Recommendations .
7. Start the engine.
8. Inspect for oil leaks after engine start up.
9. Turn off the engine and allow the oil a few minutes to drain back into the oil pan.
10. Remove the oil level indicator from the indicator tube.
11. Clean off the indicator end of the oil level indicator with a clean paper towel or cloth.
12. Install the oil level indicator into the oil level indicator tube until the oil level indicator handle contacts the top of the oil level indicator tube.

2011 GMC Yukon Hybrid

2011 ENGINE Engine Mechanical - Hybrid (HP2) 6.0L (LZ1) - Repair Instructions - On Vehicle - Escalade, Tahoe & Yukon

13. Again, remove the oil level indicator from the oil level indicator tube keeping the tip of the oil level indicator down.
14. Check the level of the engine oil on the oil level indicator.
15. If necessary, adjust the oil level by adding or draining oil.
16. Check for oil leaks.
17. Close the hood.