2007 ENGINE

Engine Mechanical - 4.8L, 5.3L, 6.0L and 6.2L - Avalanche, Escalade, Suburban, Tahoe & Yukon

DRIVE BELT REPLACEMENT - ACCESSORY

REMOVAL PROCEDURE

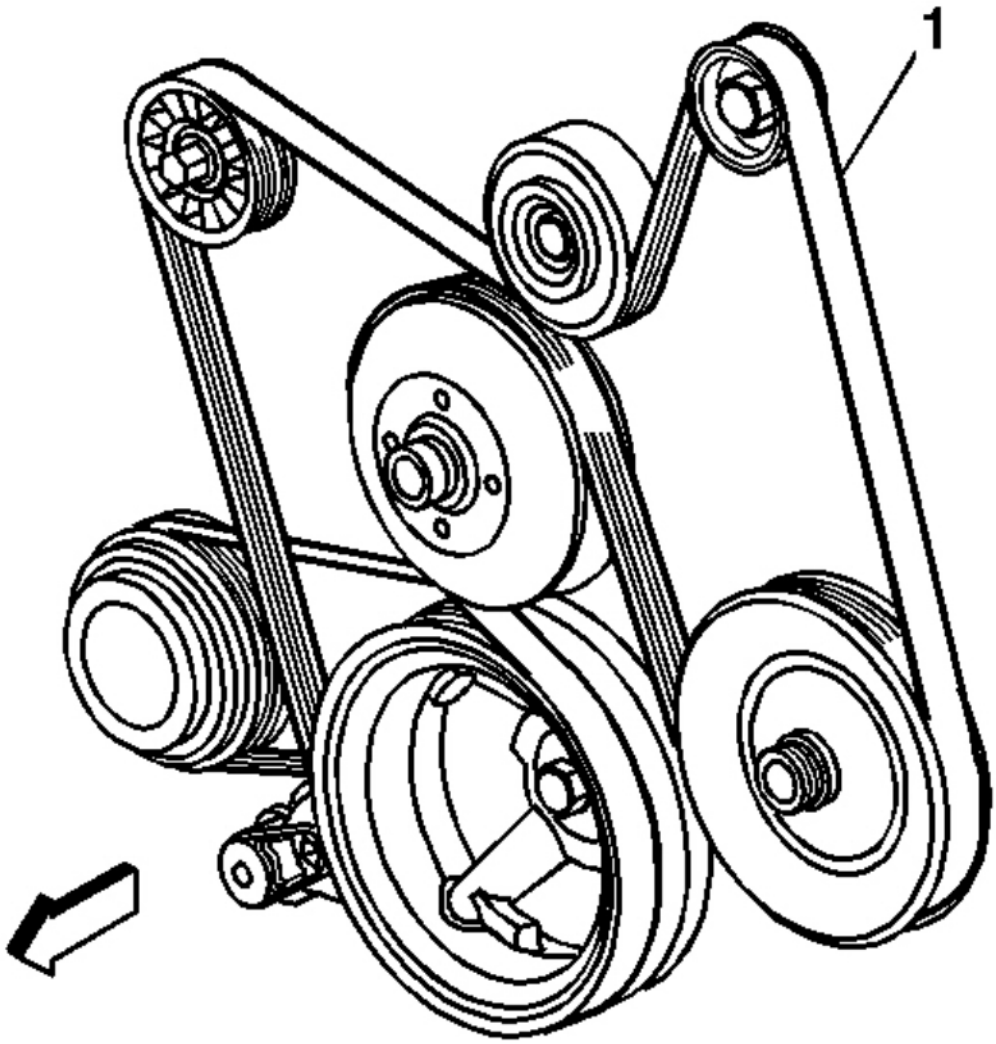


Fig. 1: View Of Accessory Drive Belt Routing

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Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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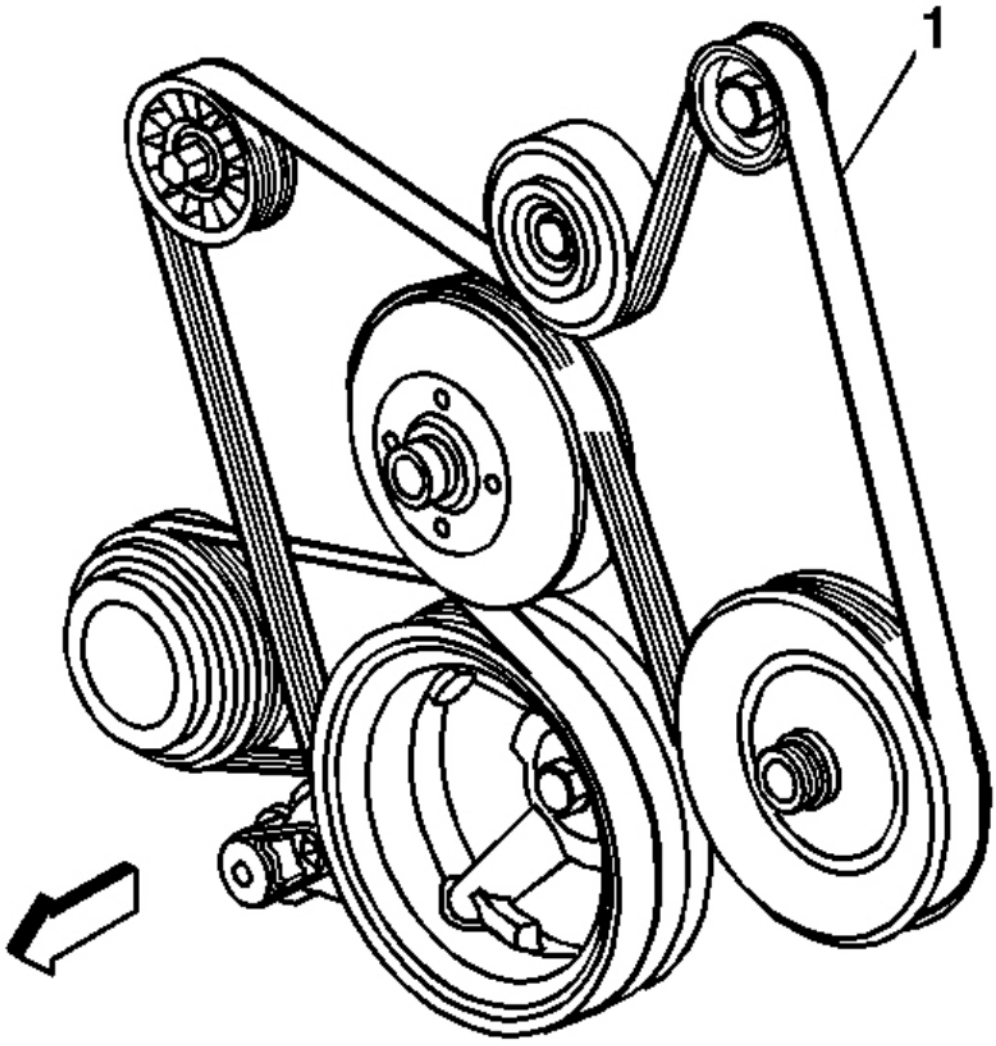


Fig. 2: View Of Accessory Drive Belt Routing
Courtesy of GENERAL MOTORS CORP.

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 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.

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7. Inspect the drive belt for proper installation and alignment.
8. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
9. Start the vehicle and inspect the drive belt for proper operation.
10. Close the hood.

DRIVE BELT REPLACEMENT - AIR CONDITIONING

REMOVAL PROCEDURE

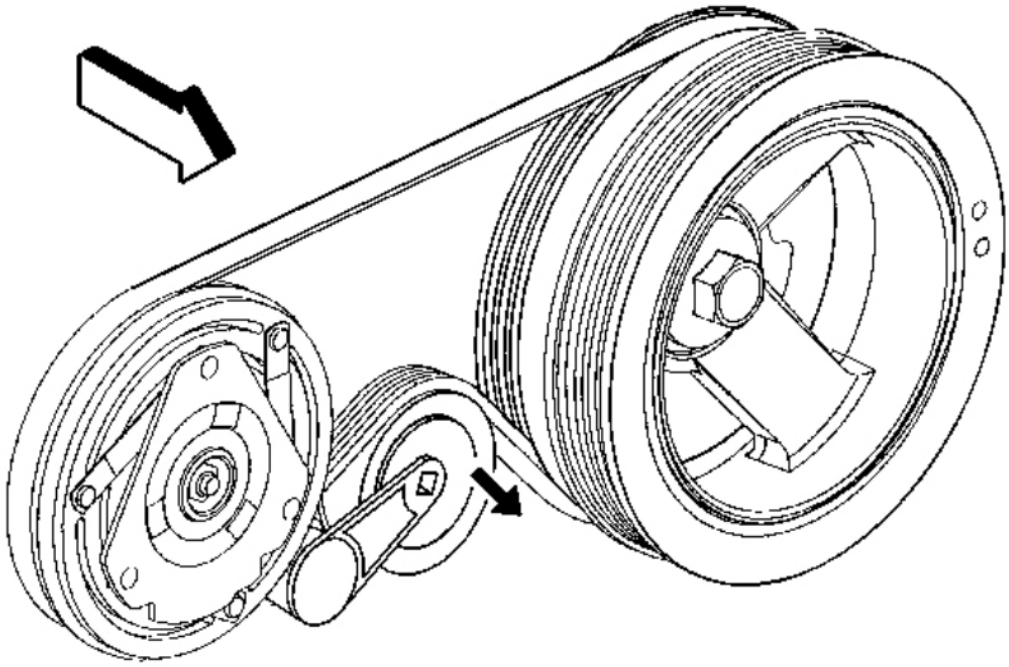


Fig. 3: A/C Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory**.
2. Install a ratchet into the air conditioning (A/C) belt tensioner adapter opening.
3. Rotate the A/C belt tensioner clockwise in order to relieve tension on the A/C belt.
4. Remove the A/C belt from the pulleys.
5. Slowly release the tension on the A/C belt tensioner.
6. Remove the ratchet from the A/C belt tensioner.

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7. Clean and inspect the belt surfaces of all the pulleys.

INSTALLATION PROCEDURE

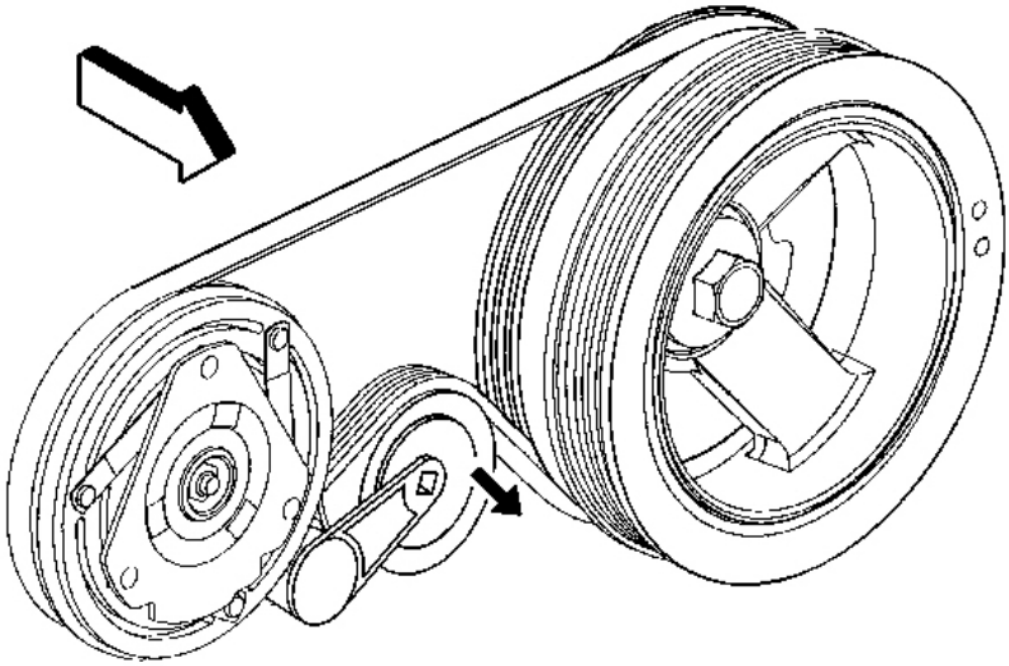


Fig. 4: A/C Belt Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Install the A/C belt over the crankshaft balancer.
2. Install a ratchet into the A/C drive belt tensioner adapter opening
3. Rotate the A/C belt tensioner clockwise in order to relieve tension on the belt tensioner.
4. Install the A/C belt over the tensioner pulley.
5. Install the A/C belt around the A/C compressor pulley.
6. Slowly release the tension on the A/C belt tensioner.
7. Remove the ratchet from the A/C belt tensioner.
8. Inspect the A/C belt for proper installation and alignment.
9. Install the accessory drive belt. Refer to **Drive Belt Replacement - Accessory**.

DRIVE BELT IDLER PULLEY REPLACEMENT

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REMOVAL PROCEDURE

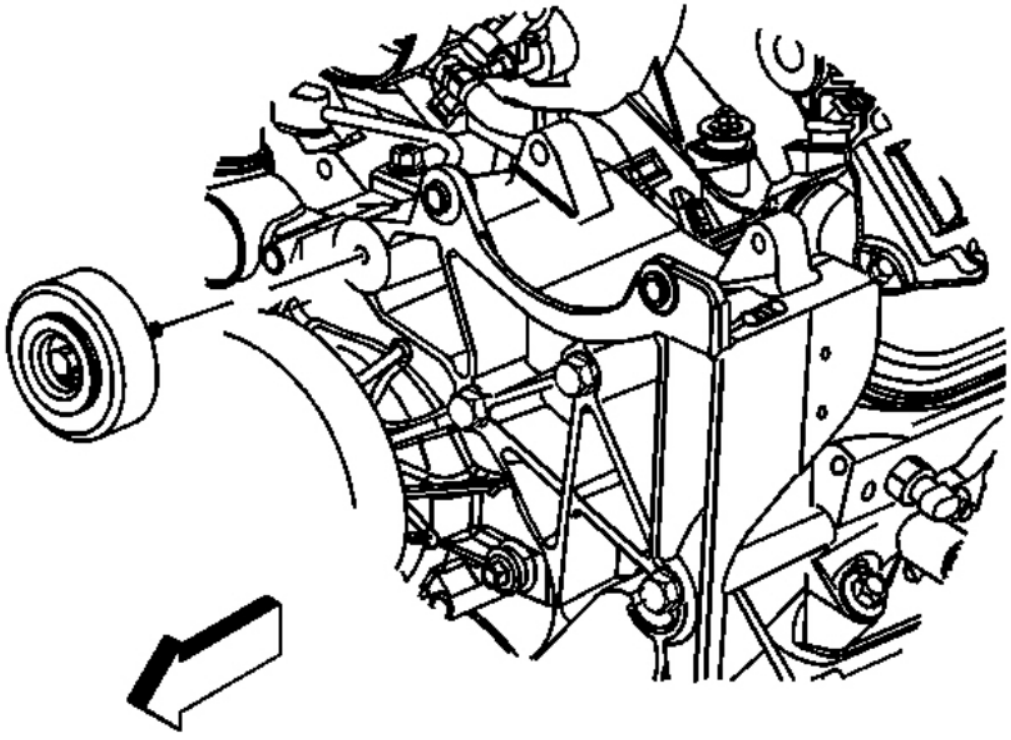


Fig. 5: View Of Drive Belt Idler Pulley
Courtesy of GENERAL MOTORS CORP.

1. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory**.
2. Loosen the drive belt idler pulley bolt and remove the idler pulley.

INSTALLATION PROCEDURE

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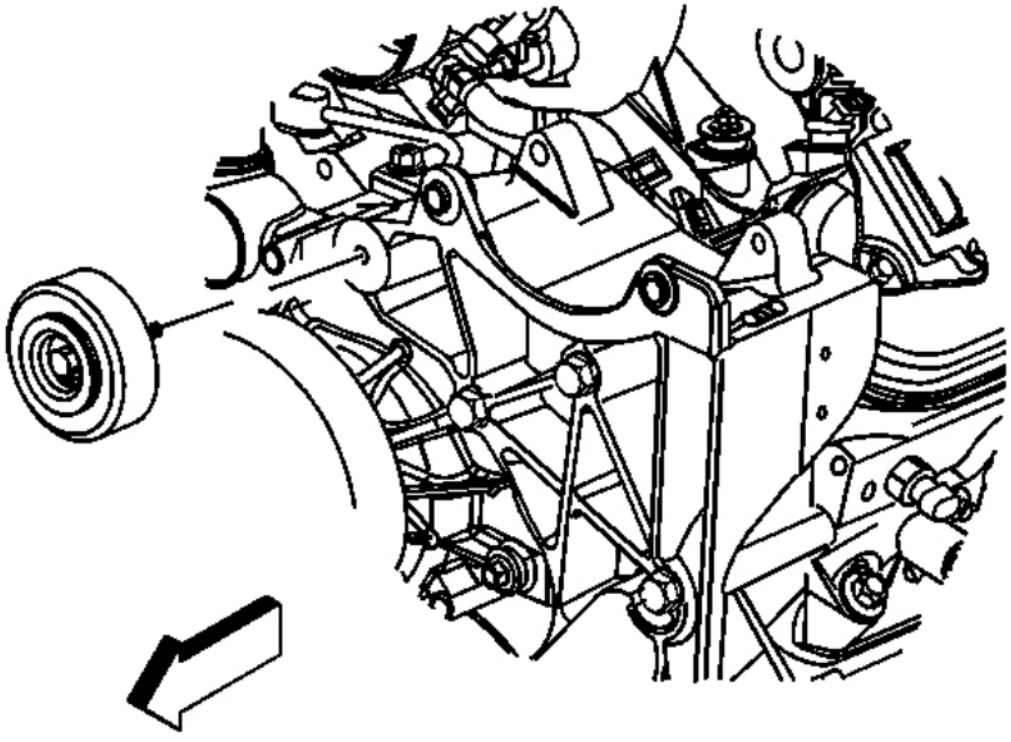


Fig. 6: View Of Drive Belt Idler Pulley
Courtesy of GENERAL MOTORS CORP.

1. Position the drive belt idler pulley to the generator bracket and tighten the idler pulley bolt finger tight.

   NOTE: Refer to Fastener Notice .

2. Tighten the drive belt idler pulley bolt.

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

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

DRIVE BELT TENSIONER REPLACEMENT - ACCESSORY

REMOVAL PROCEDURE

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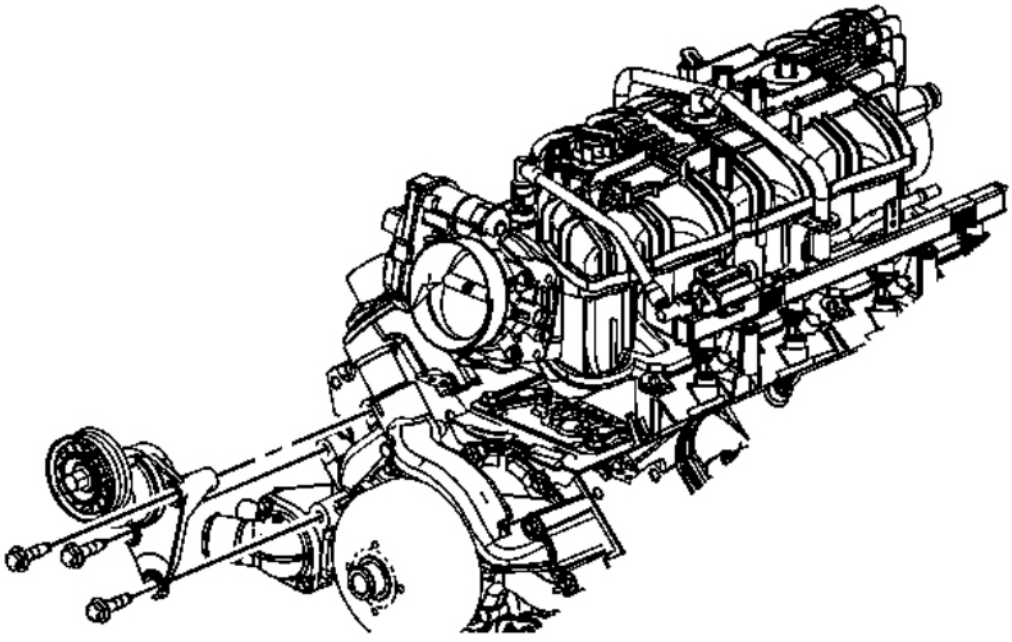


Fig. 7: View Of Drive Belt Tensioner & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the accessory drive belt. Refer to **Drive Belt Replacement - Accessory**.
2. Remove the drive belt tensioner bolts.
3. Remove the drive belt tensioner.

INSTALLATION PROCEDURE

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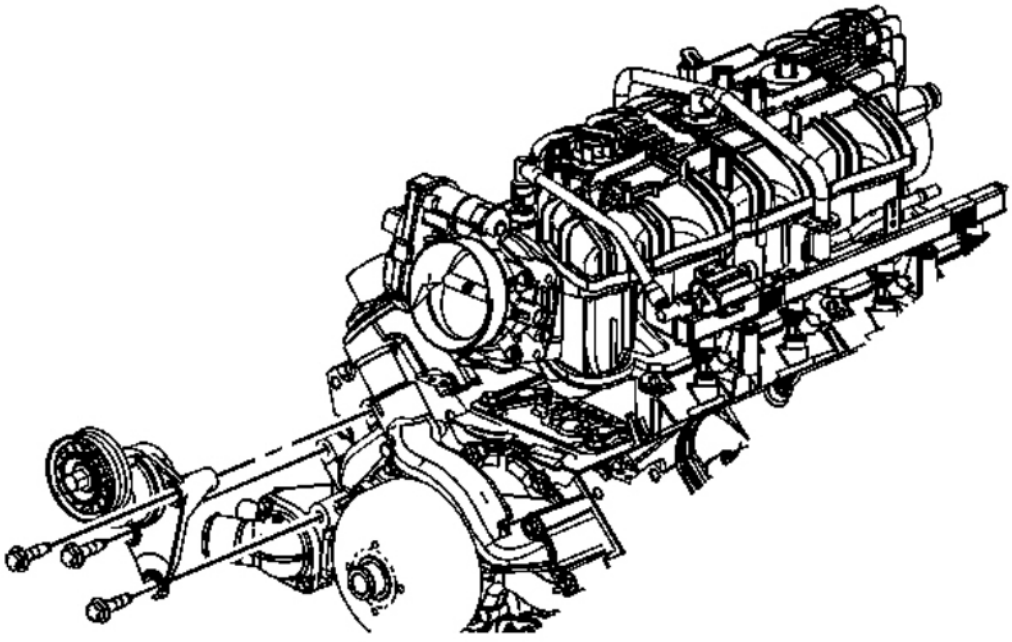


Fig. 8: View Of Drive Belt Tensioner & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the drive belt tensioner to the water pump.

NOTE: **Refer to Fastener Notice .**

2. Install and tighten the drive belt tensioner bolts.

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

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

DRIVE BELT TENSIONER REPLACEMENT - AIR CONDITIONING

REMOVAL PROCEDURE

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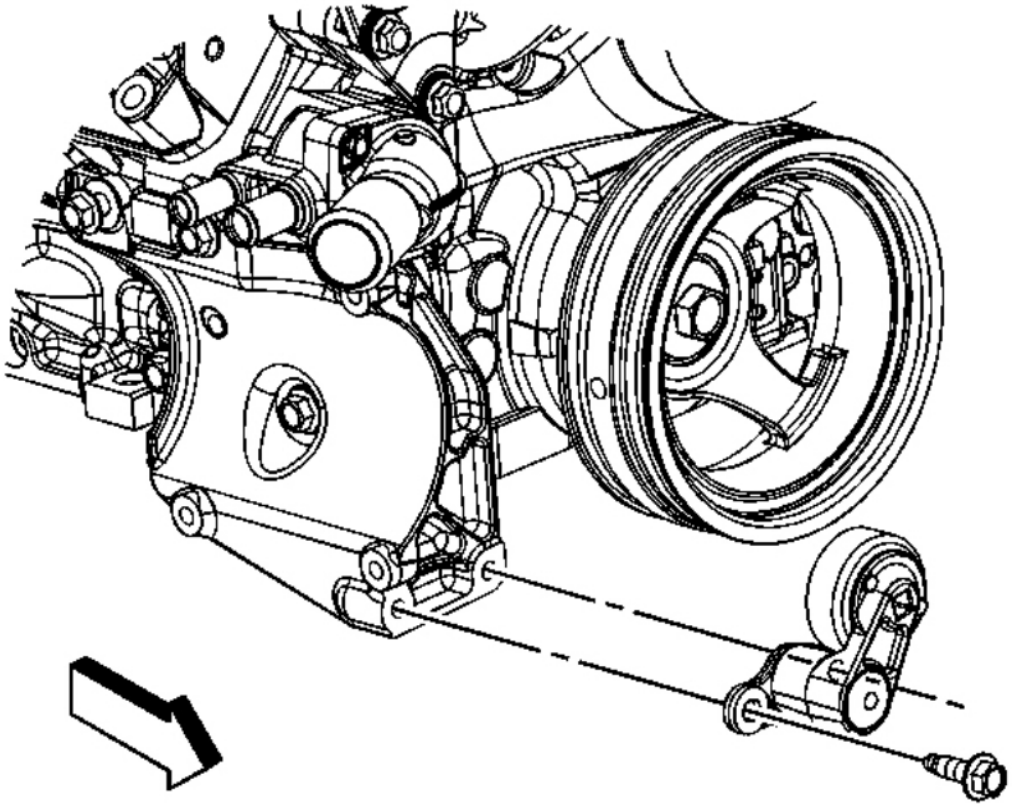


Fig. 9: View Of A/C Drive Belt Tensioner & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the air conditioning (A/C) drive belt. Refer to **Drive Belt Replacement - Air Conditioning**.
2. Remove the A/C drive belt tensioner bolts.
3. Remove the A/C drive belt tensioner.

INSTALLATION PROCEDURE

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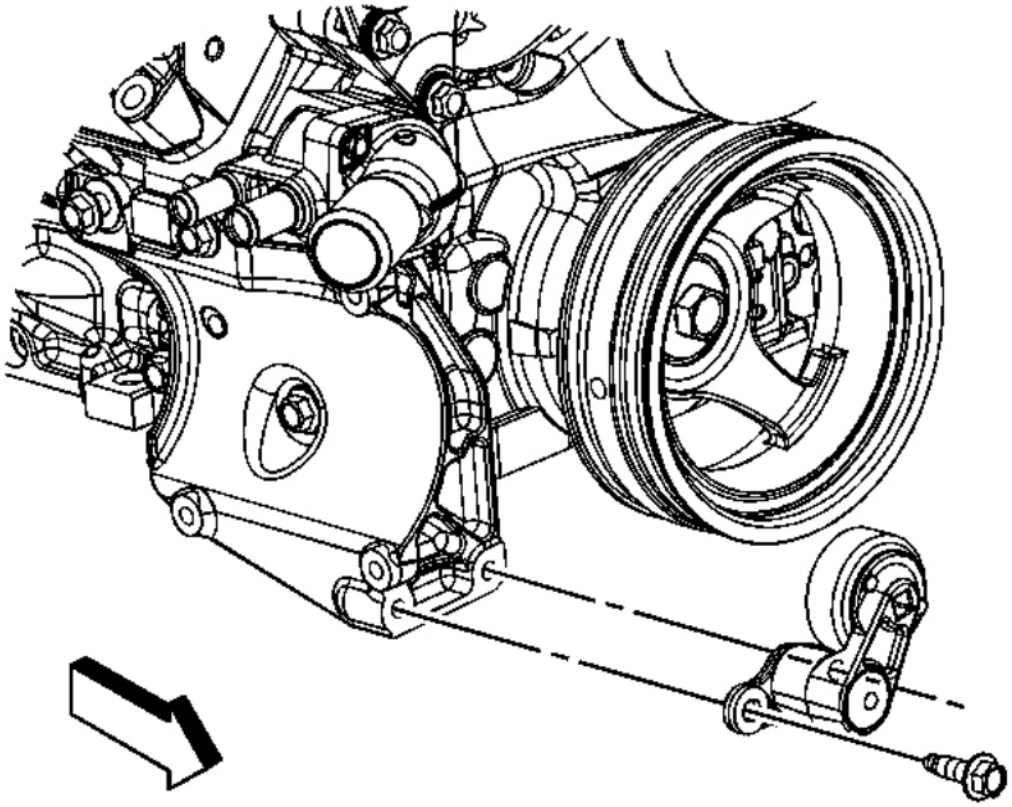


Fig. 10: View Of A/C Drive Belt Tensioner & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Position the A/C drive belt tensioner to the A/C compressor bracket.
2. Install and tighten the A/C drive belt tensioner bolts.

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

3. Install the A/C drive belt. Refer to **Drive Belt Replacement - Air Conditioning**.

ENGINE MOUNT INSPECTION

NOTE: Broken or deteriorated mounts can cause misalignment and destruction of certain drive train components. When a single mount breaks, the remaining

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mounts are subjected to abnormally high stresses.

NOTE: 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.

Visual/Physical Inspection

1. Support the powertrain using the appropriate support method; refer to the powertrain mount replacement procedure. Raising the powertrain removes the weight from the engine mount and creates slight tension in the rubber.
2. Clean the mount and surrounding area to ensure good visibility of the mount condition.
3. Verify all attaching fasteners are present and at the correct torque. Refer to **Engine Mount Replacement - Left Side (1500 w/RPO LY2)** or **Engine Mount Replacement - Left Side (1500 w/RPOs LC9/LMG/LY5/L76/L92)** or **Engine Mount Replacement - Left Side (2500 w/RPO LY6)** and/or **Engine Mount Replacement - Right Side (1500 w/RPO LY2)** or **Engine Mount Replacement - Right Side (1500 w/RPOs LC9/LMG/LY5/L76/L92)** or **Engine Mount Replacement - Right Side (2500 w/RPO LY6)** for any torque sequencing and/or torque specifications.

   IMPORTANT: Observe the engine mount while raising the engine. If the engine mount exhibits any of the following conditions the mount may require replacement. Refer to Engine Mount Replacement - Left Side (1500 w/RPO LY2) or Engine Mount Replacement - Left Side (1500 w/RPOs LC9/LMG/LY5/L76/L92) or Engine Mount Replacement - Left Side (2500 w/RPO LY6) and/or Engine Mount Replacement - Right Side (1500 w/RPO LY2) or Engine Mount Replacement - Right Side (1500 w/RPOs LC9/LMG/LY5/L76/L92) or Engine Mount Replacement - Right Side (2500 w/RPO LY6).

4. Slightly raise the engine approximately 5-7 mm.
5. Inspect the mount for any of the following conditions:
   - Hard rubber surfaces - covered with extreme heat check cracks.
   - Rubber separation from the metal plate of the engine mount.
   - Rubber is split through the center of the engine mount.

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

   - If equipped with a hydraulic mount, inspect for GLYCOL™ fluid leaking from the engine mount.

ENGINE MOUNT REPLACEMENT - LEFT SIDE (1500 W/RPO LY2)

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REMOVAL PROCEDURE

NOTE: **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.**

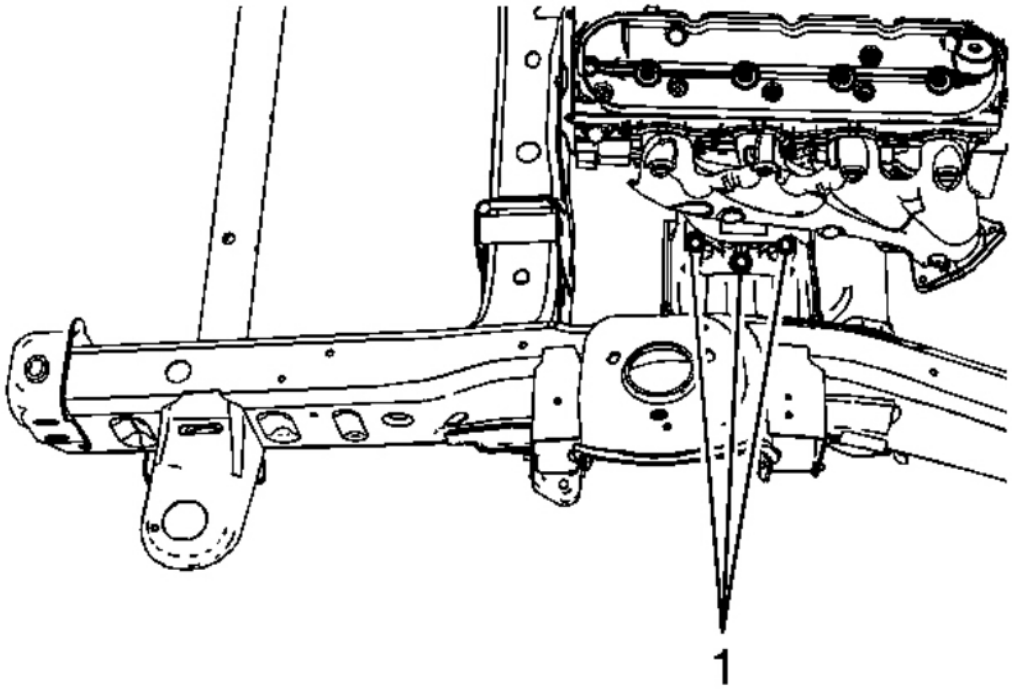


Fig. 11: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
3. Lower the vehicle.
4. Remove the generator bracket. Refer to **Generator Bracket Replacement** .
5. Remove the engine mount to frame bolts (1).
6. Raise and support the vehicle halfway. Refer to **Lifting and Jacking the Vehicle** .

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7. Remove the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .

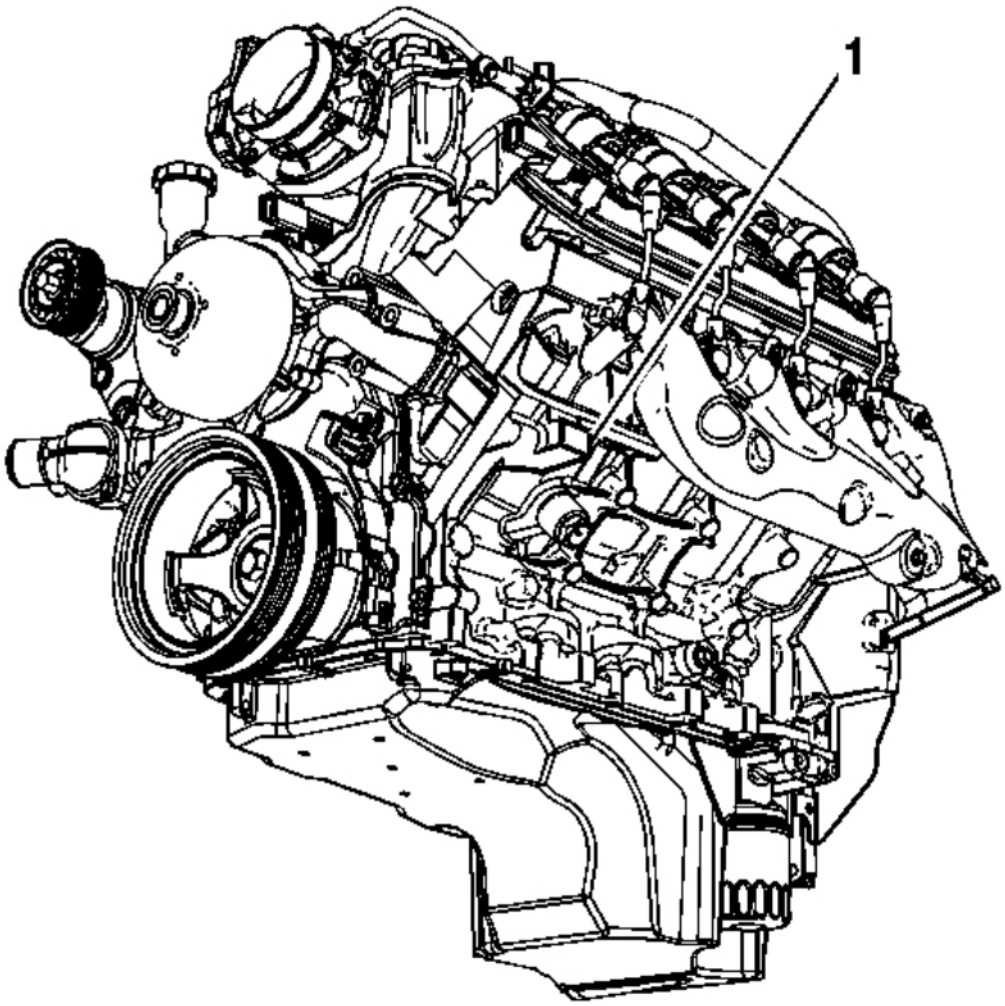


Fig. 12: View Of Engine Block Tab
Courtesy of GENERAL MOTORS CORP.

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

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

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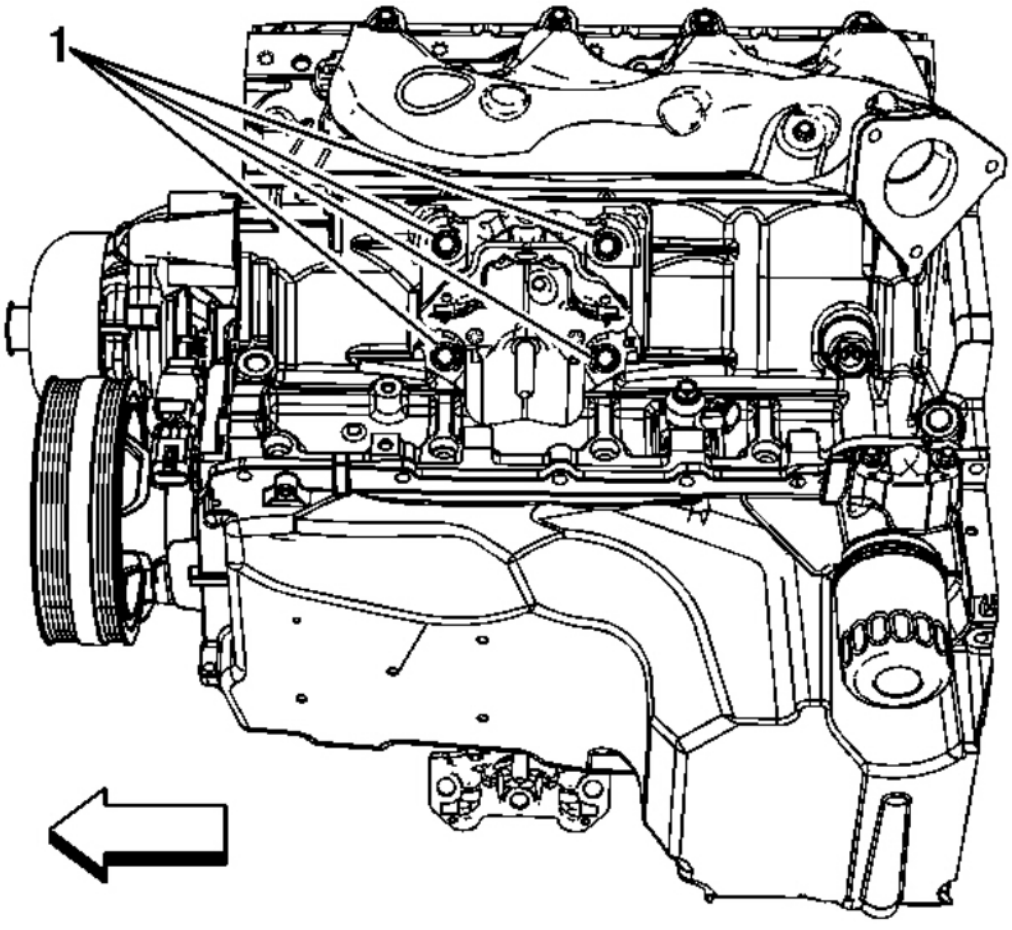


Fig. 13: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

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

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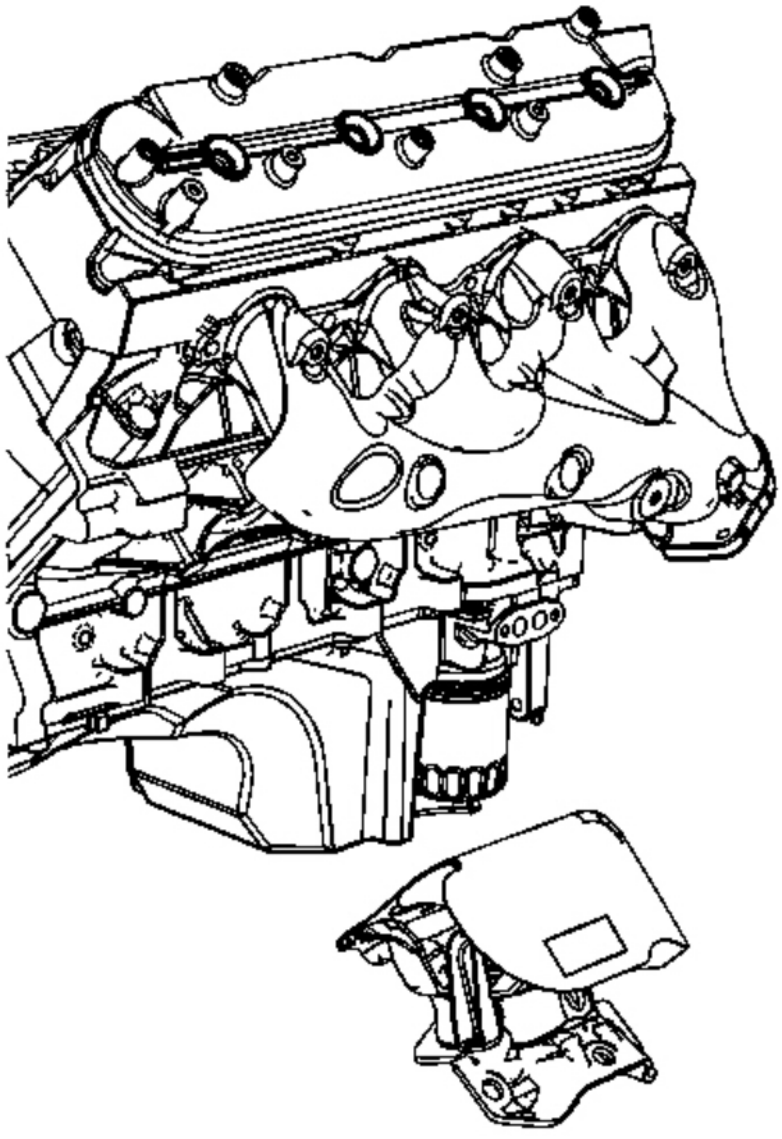


Fig. 14: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

11. Remove the engine mount.

INSTALLATION PROCEDURE

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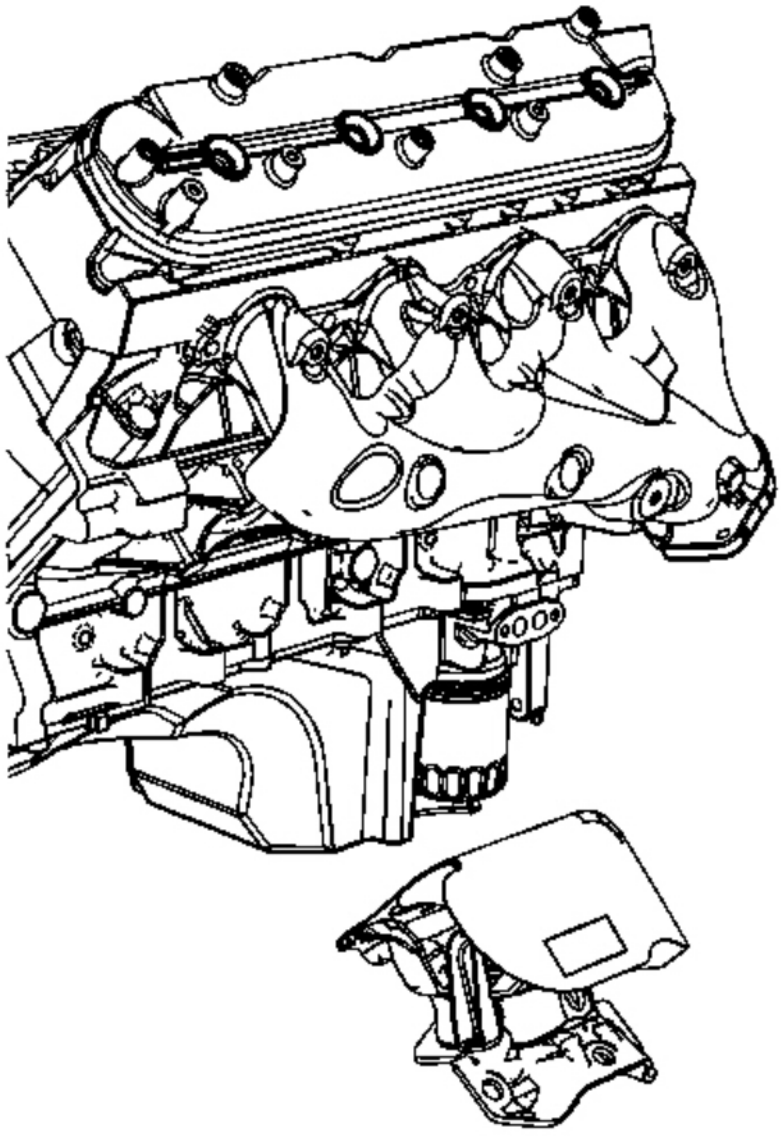


Fig. 15: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

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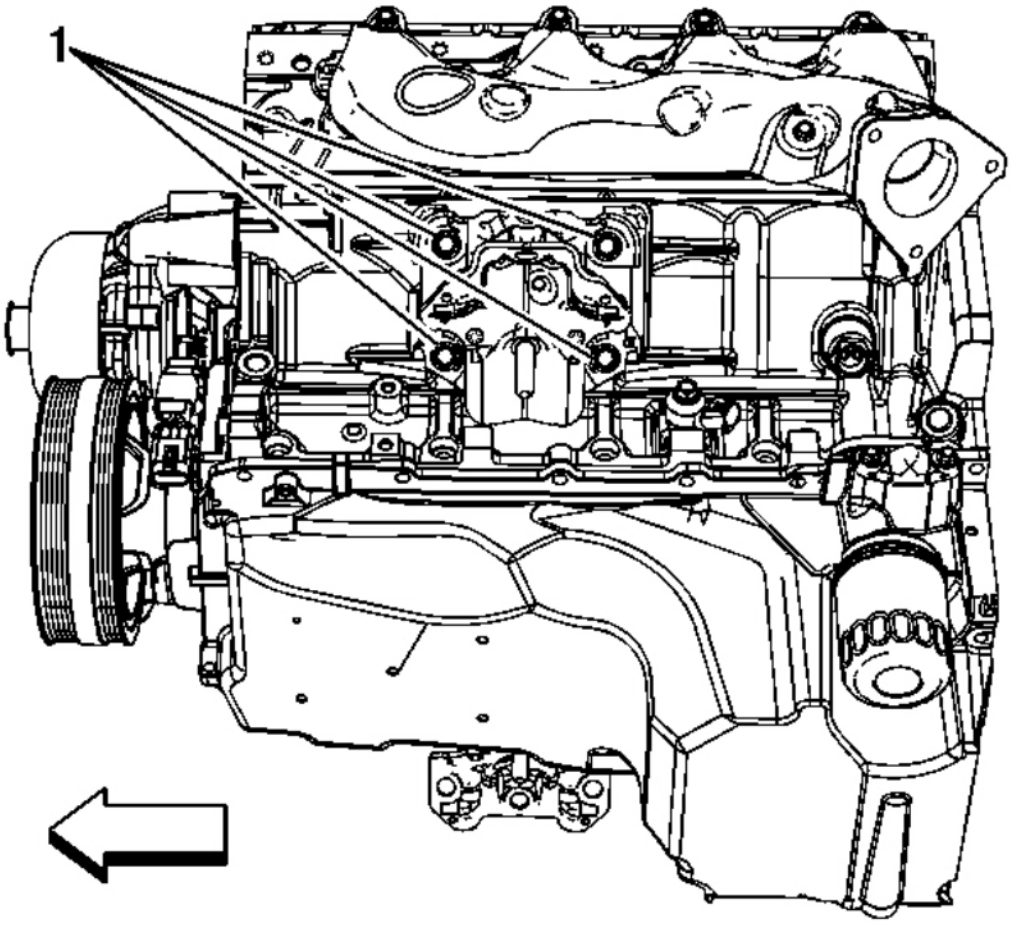


Fig. 16: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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.

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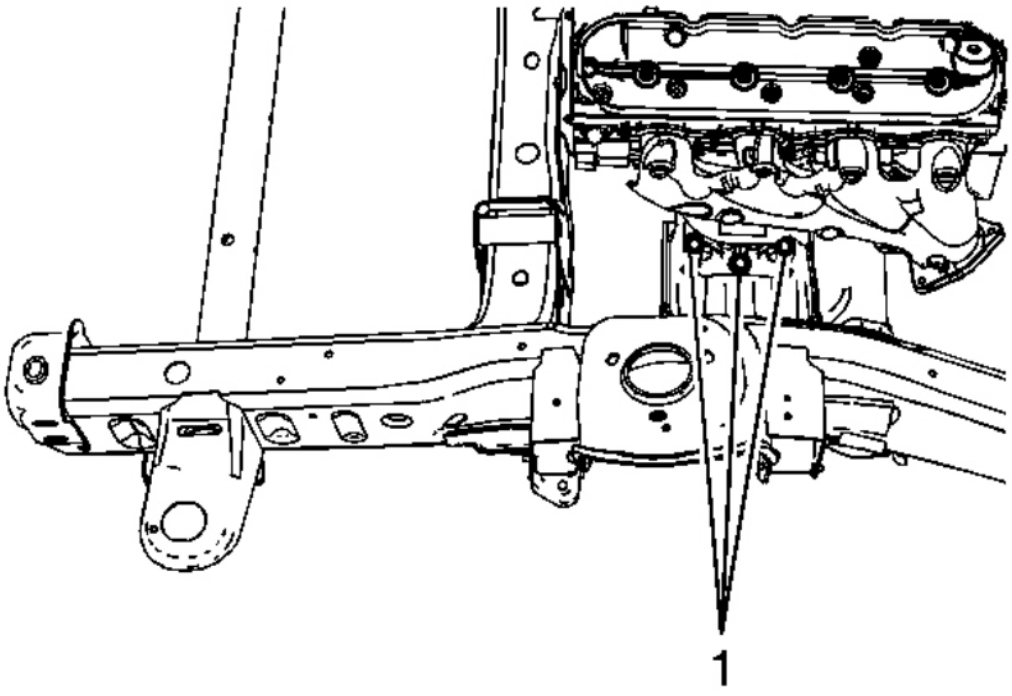


Fig. 17: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
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. Install the generator bracket. Refer to **Generator Bracket Replacement** .
9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to **Differential Carrier Assembly Replacement (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
10. Lower the vehicle.
11. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

ENGINE MOUNT REPLACEMENT - LEFT SIDE (1500 W/RPOS LC9/LMG/LY5/L76/L92)

REMOVAL PROCEDURE

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NOTE: **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.**

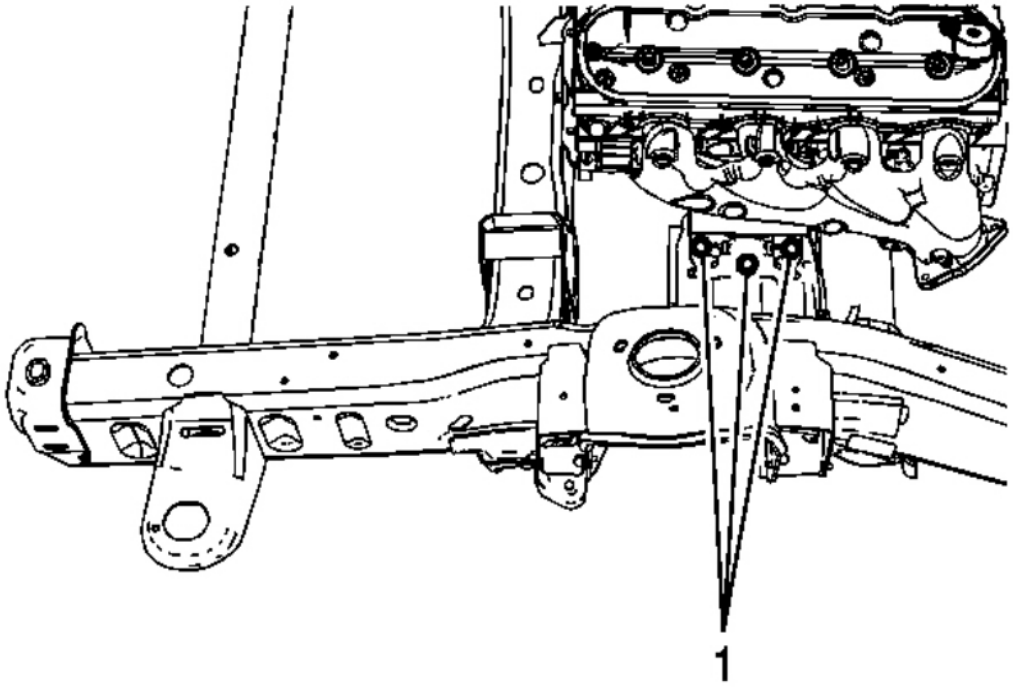


Fig. 18: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
3. Lower the vehicle.
4. Remove the generator bracket. Refer to **Generator Bracket Replacement** .
5. Remove the engine mount to frame bolts (1).
6. Raise and support the vehicle halfway. Refer to **Lifting and Jacking the Vehicle** .
7. Remove the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .

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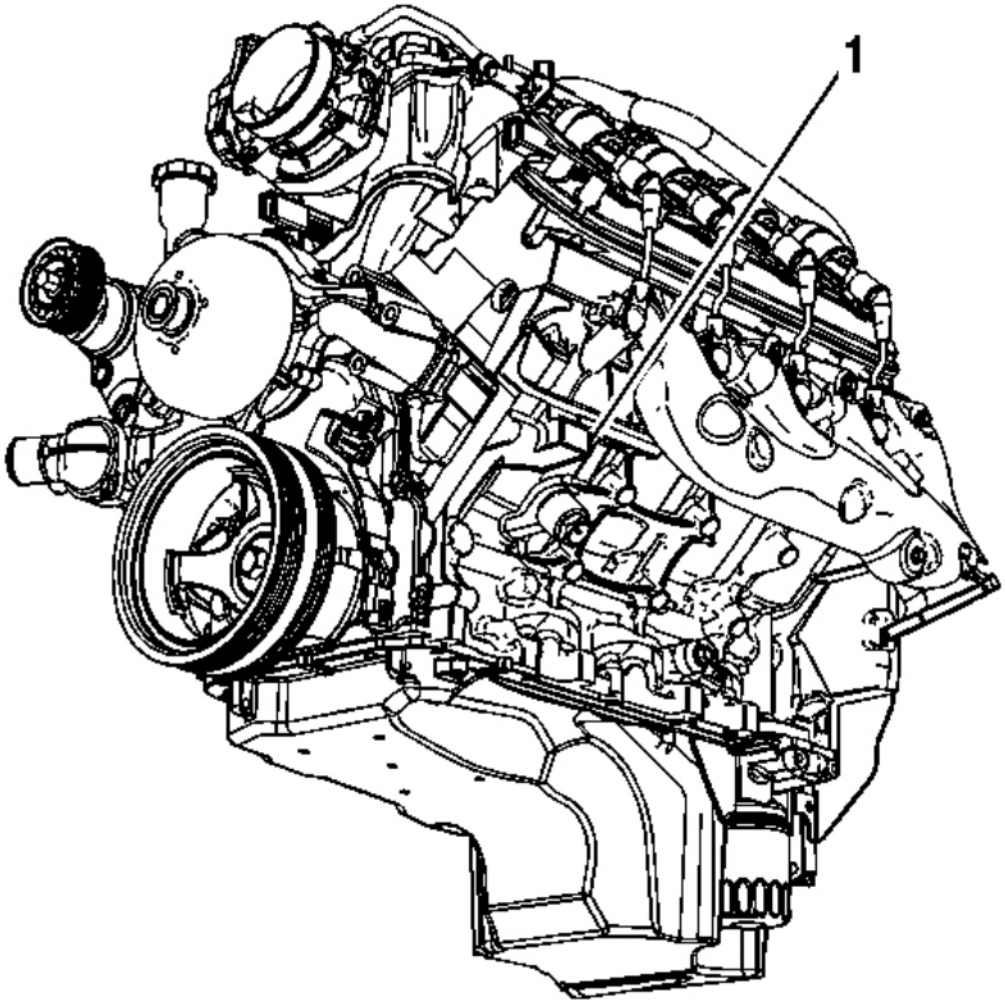


Fig. 19: View Of Engine Block Tab
Courtesy of GENERAL MOTORS CORP.

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

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

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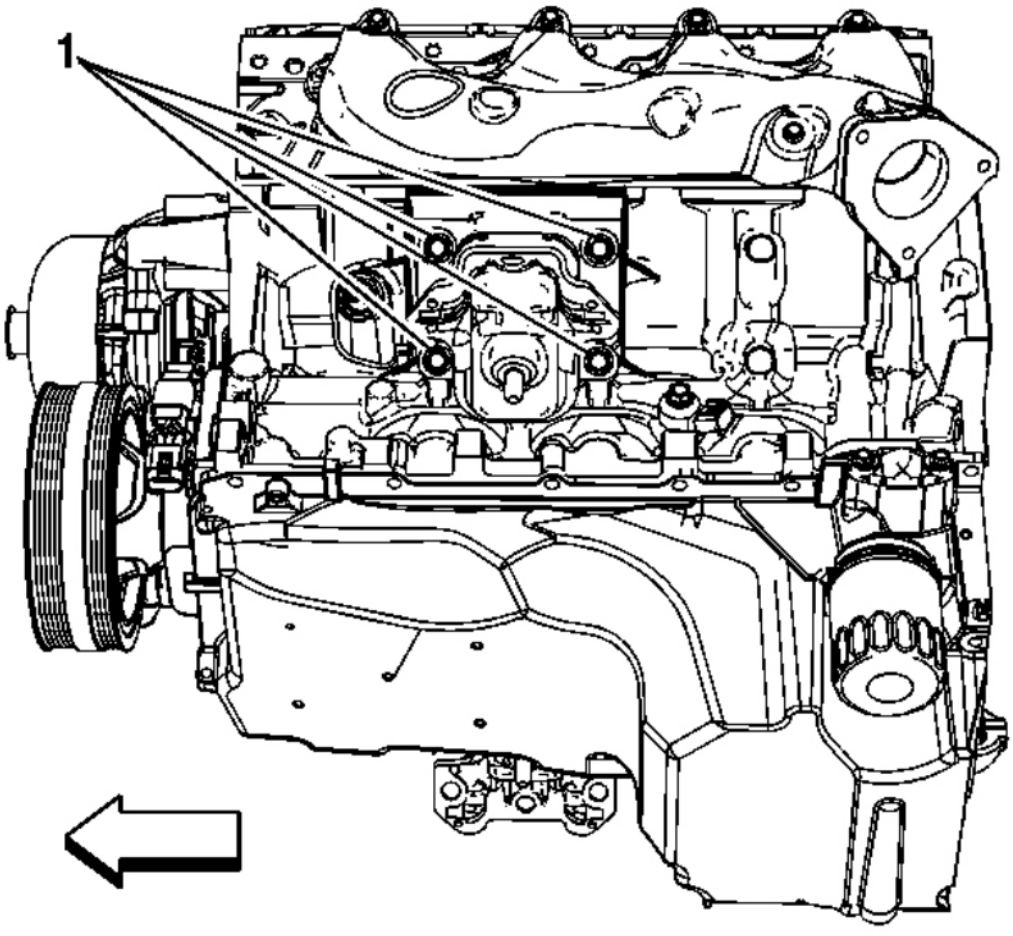


Fig. 20: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

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

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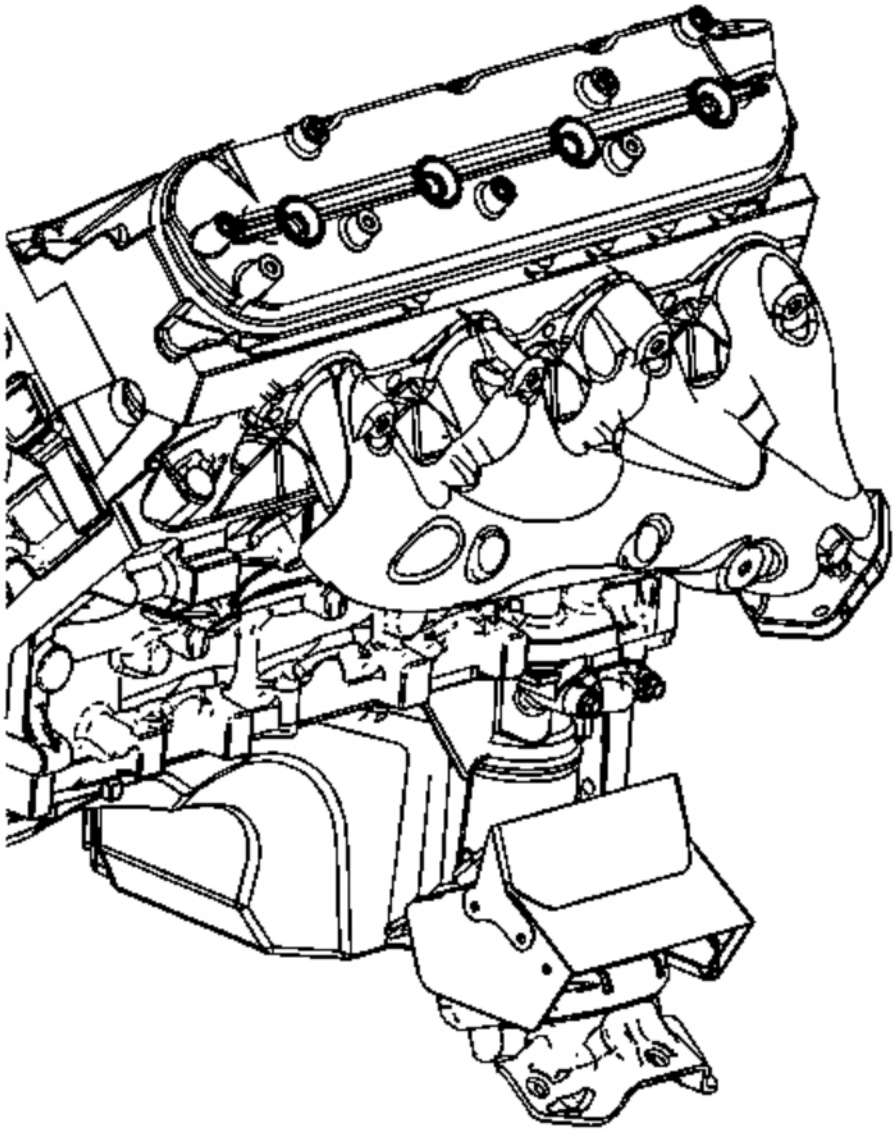


Fig. 21: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

11. Remove the engine mount.

INSTALLATION PROCEDURE

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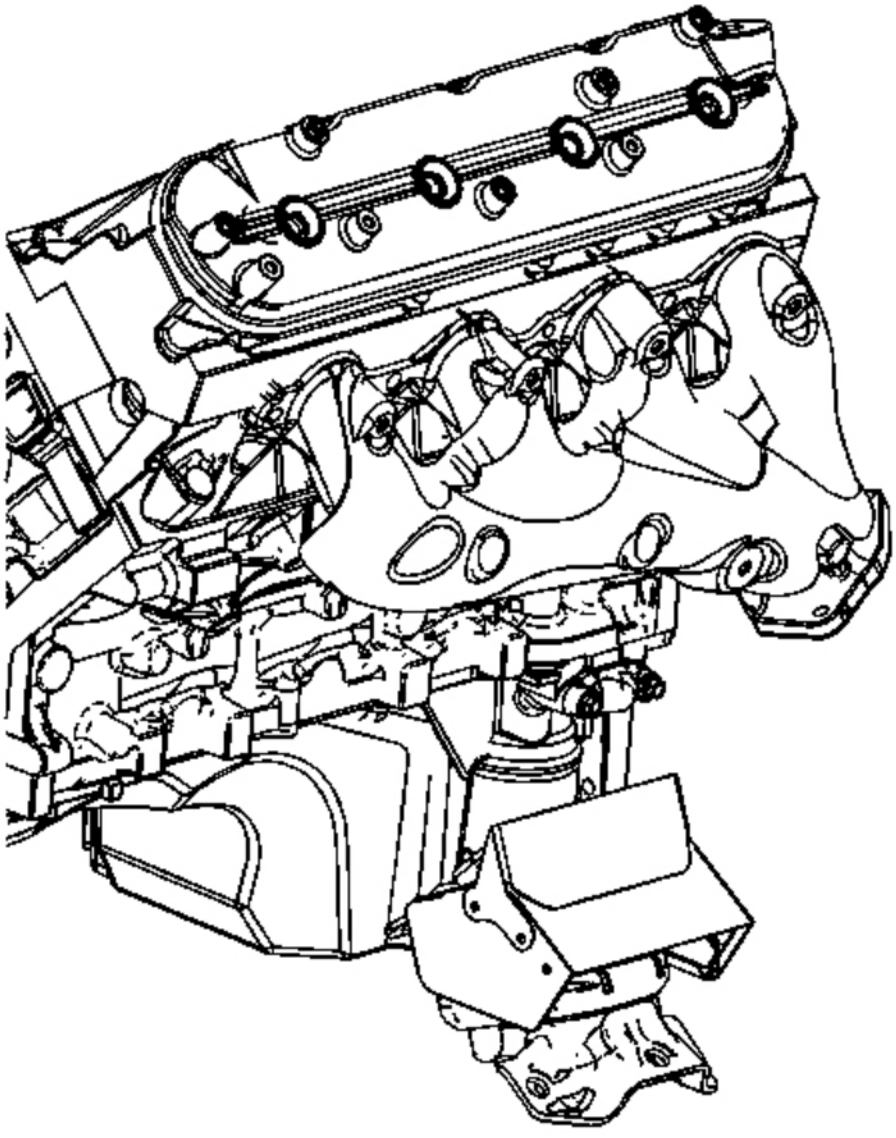


Fig. 22: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

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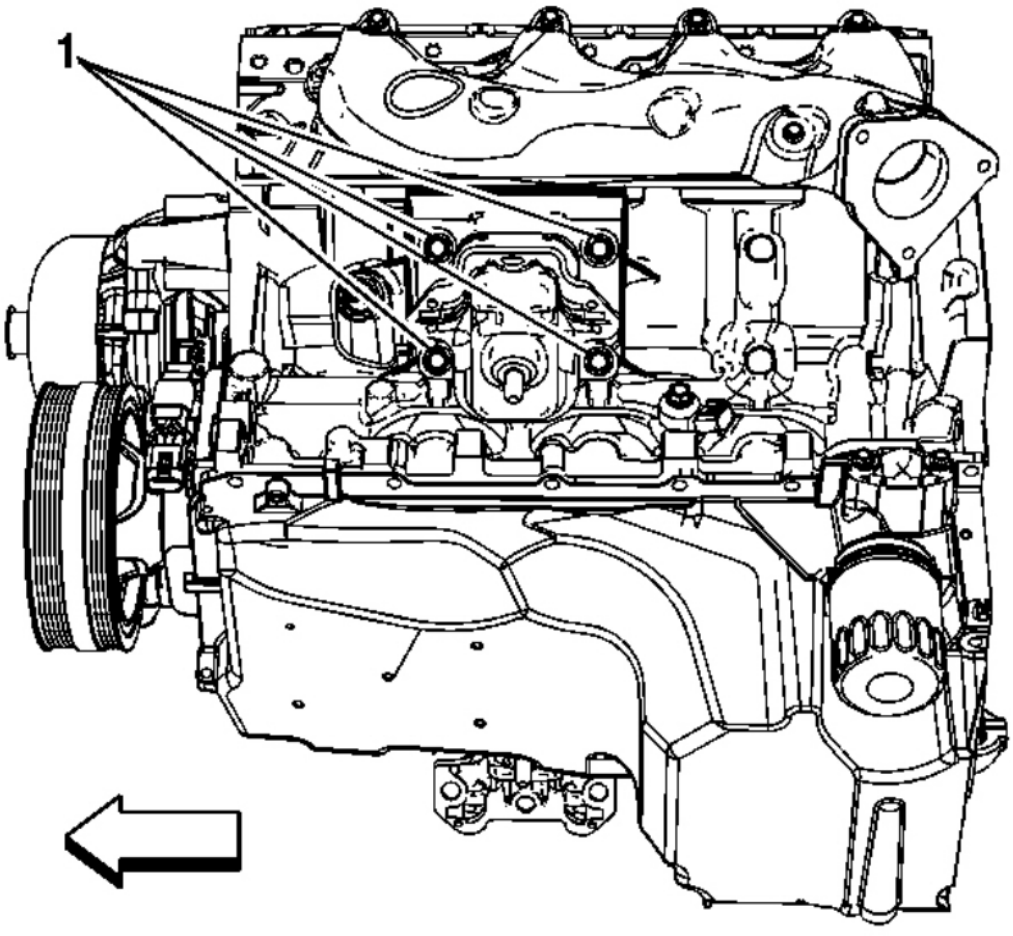


Fig. 23: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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.

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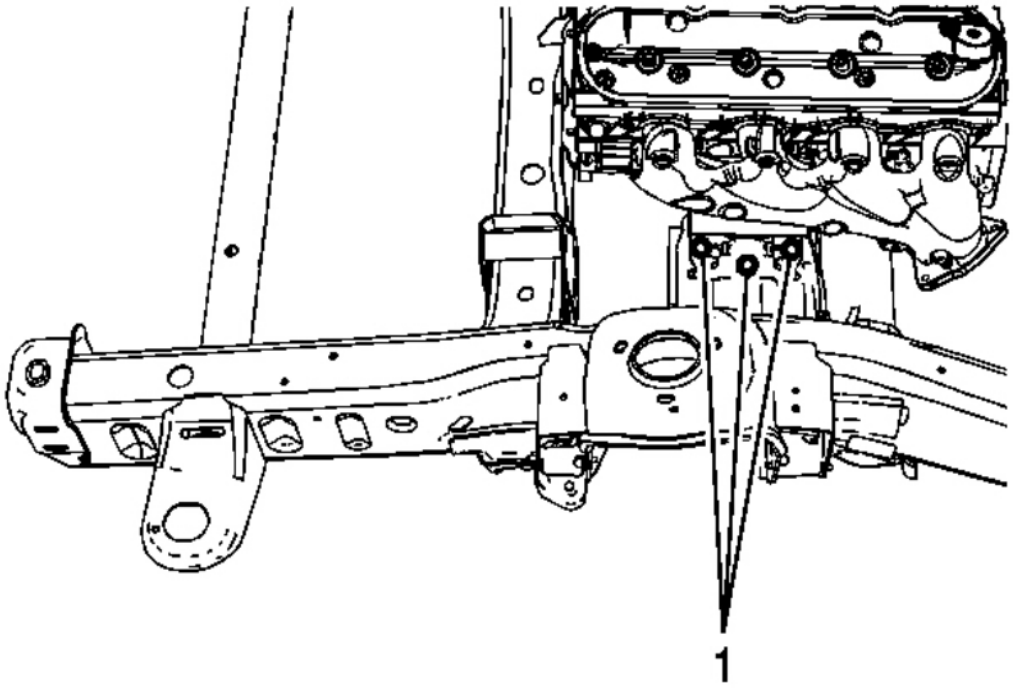


Fig. 24: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
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. Install the generator bracket. Refer to **Generator Bracket Replacement** .
9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to **Differential Carrier Assembly Replacement (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
10. Lower the vehicle.
11. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

ENGINE MOUNT REPLACEMENT - LEFT SIDE (2500 W/RPO LY6)

REMOVAL PROCEDURE

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NOTE: **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.**

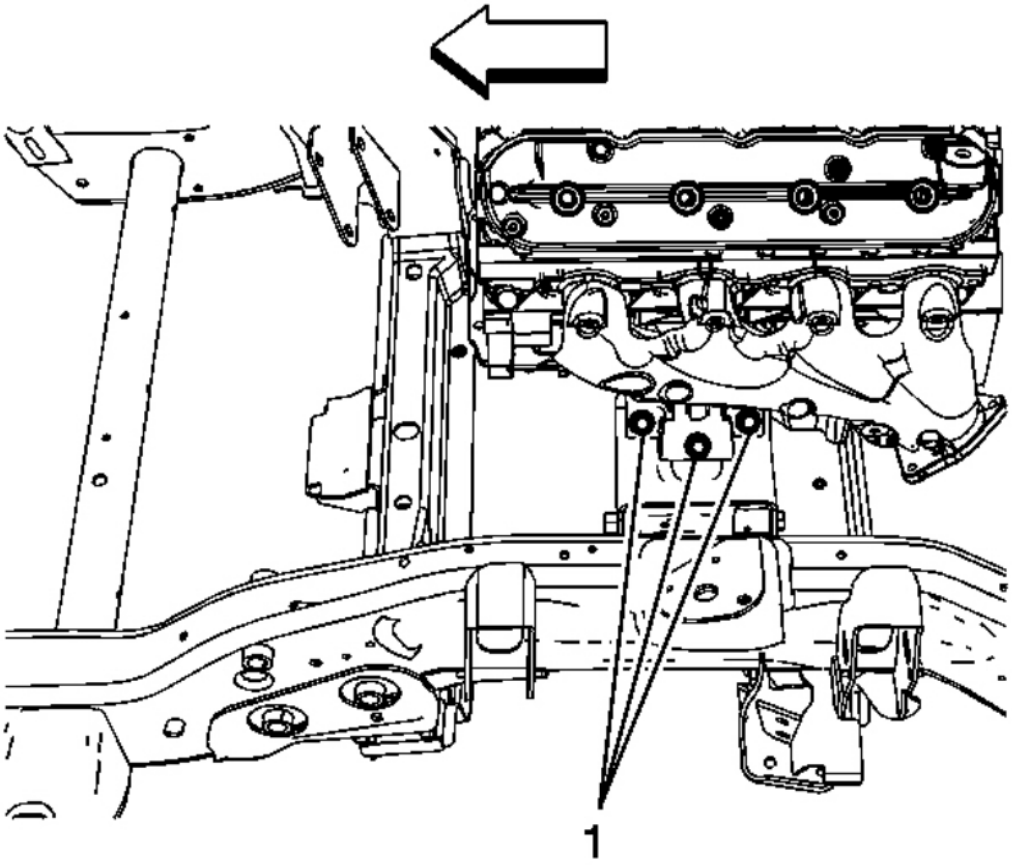


Fig. 25: View Of Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

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 (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
3. Lower the vehicle.
4. Remove the generator bracket. Refer to **Generator Bracket Replacement** .

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5. Remove the engine mount to frame bolts (1).
6. Raise and support the vehicle halfway. Refer to **Lifting and Jacking the Vehicle** .
7. Remove the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .

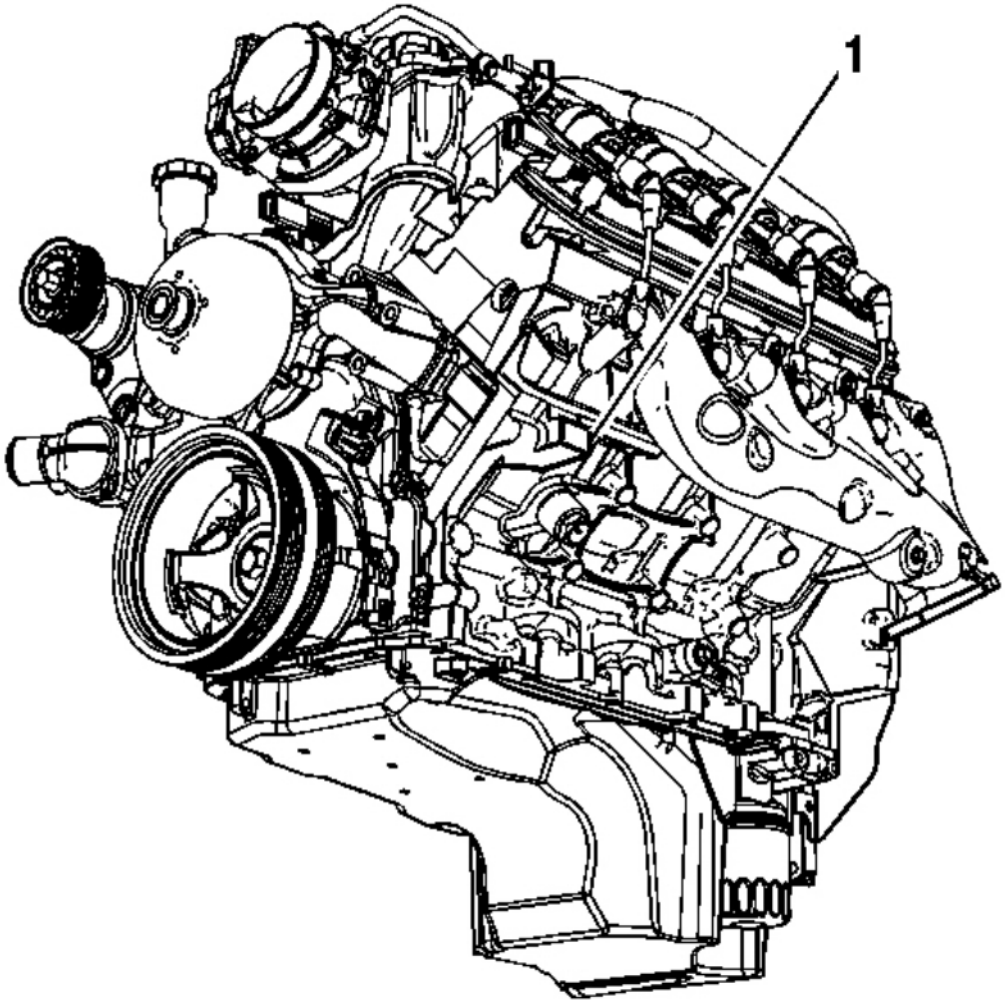


Fig. 26: View Of Engine Block Tab
Courtesy of GENERAL MOTORS CORP.

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

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

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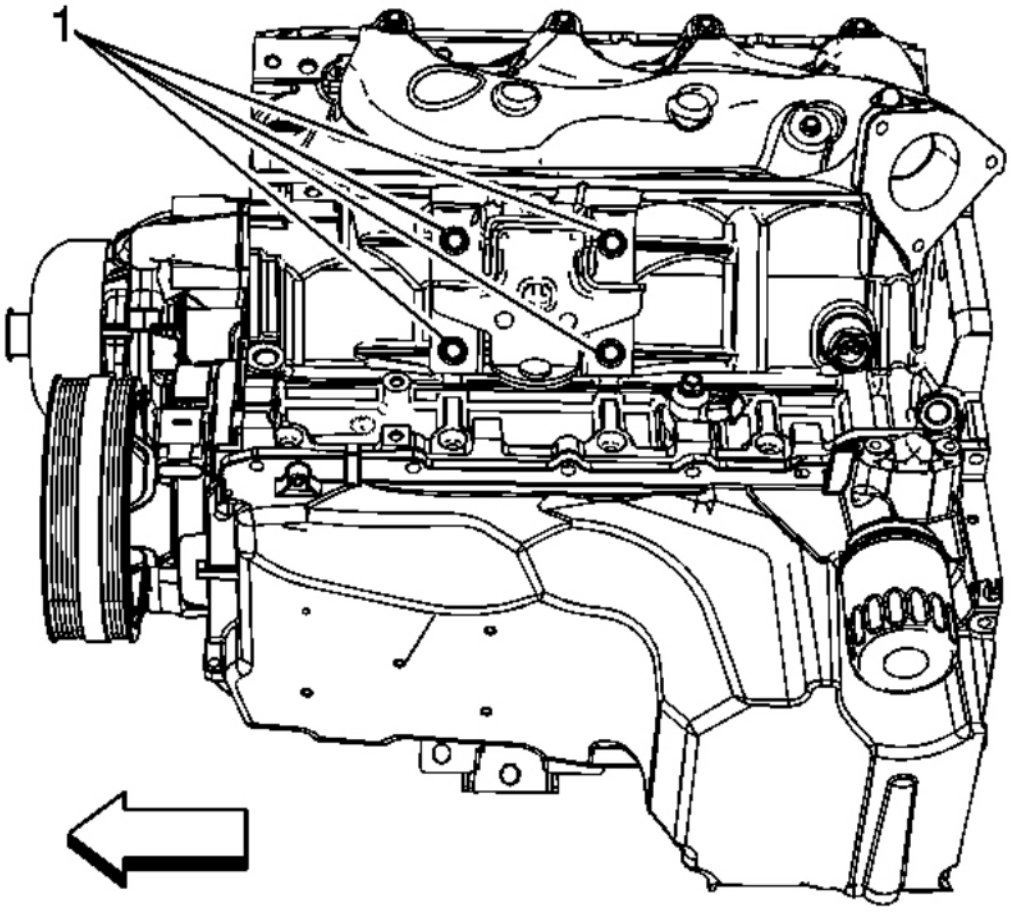


Fig. 27: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

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

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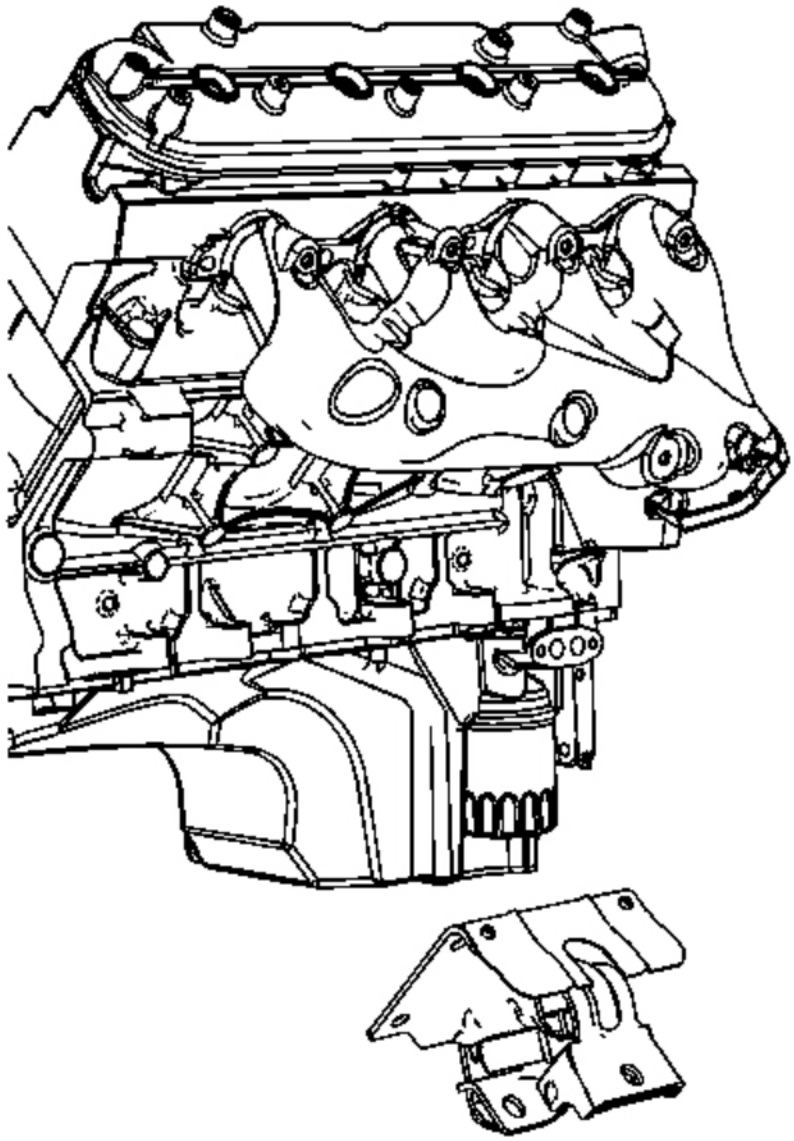


Fig. 28: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

11. Remove the engine mount.

INSTALLATION PROCEDURE

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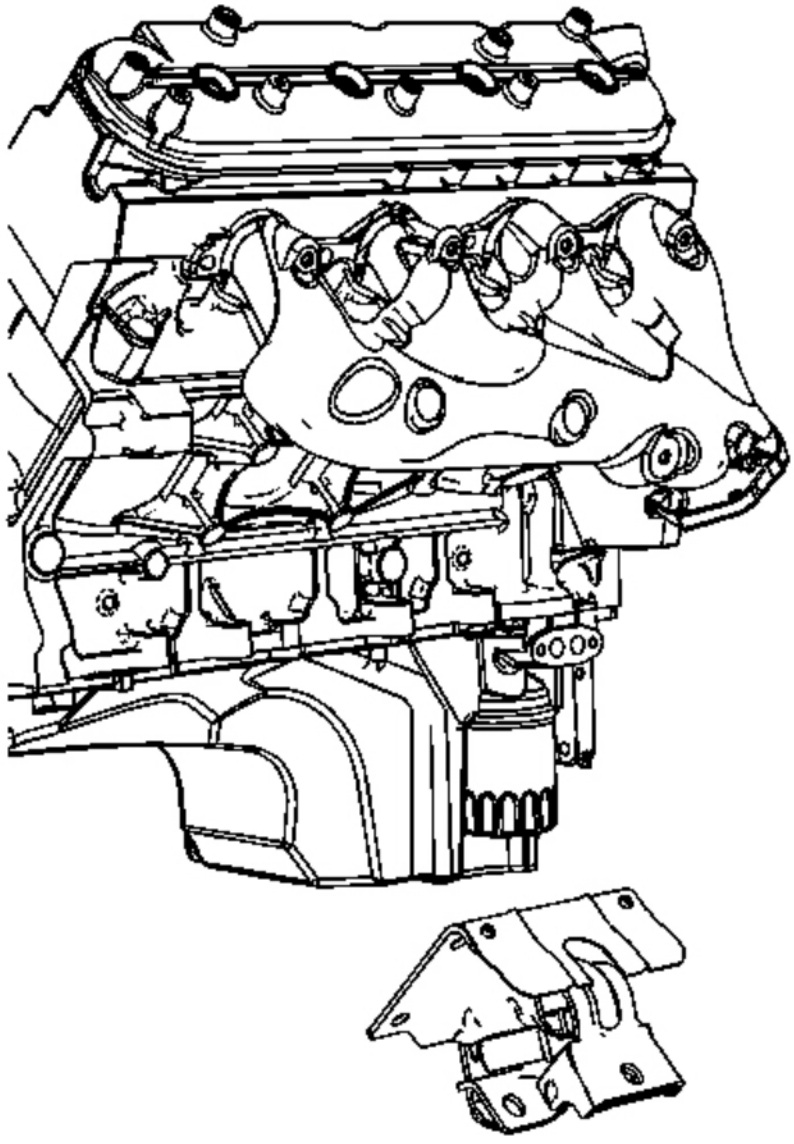


Fig. 29: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

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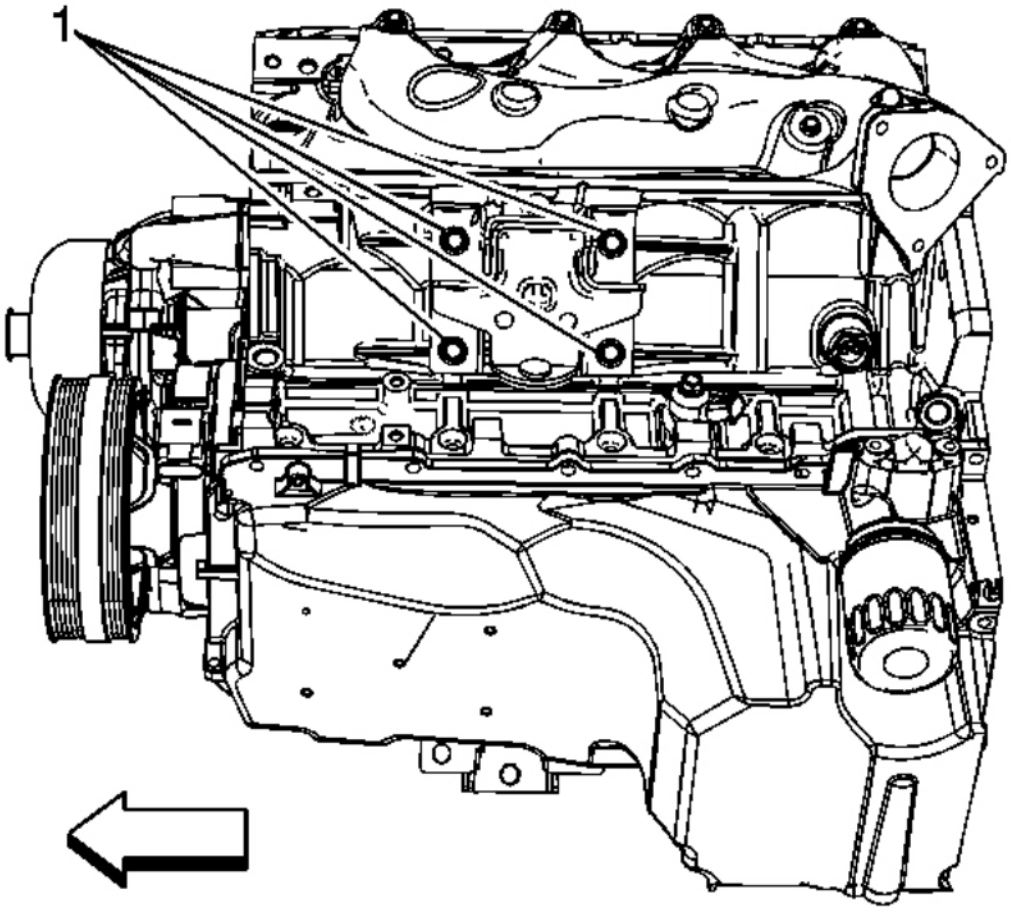


Fig. 30: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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 engine mount bracket.
4. Remove the adjustable jack from the engine block.

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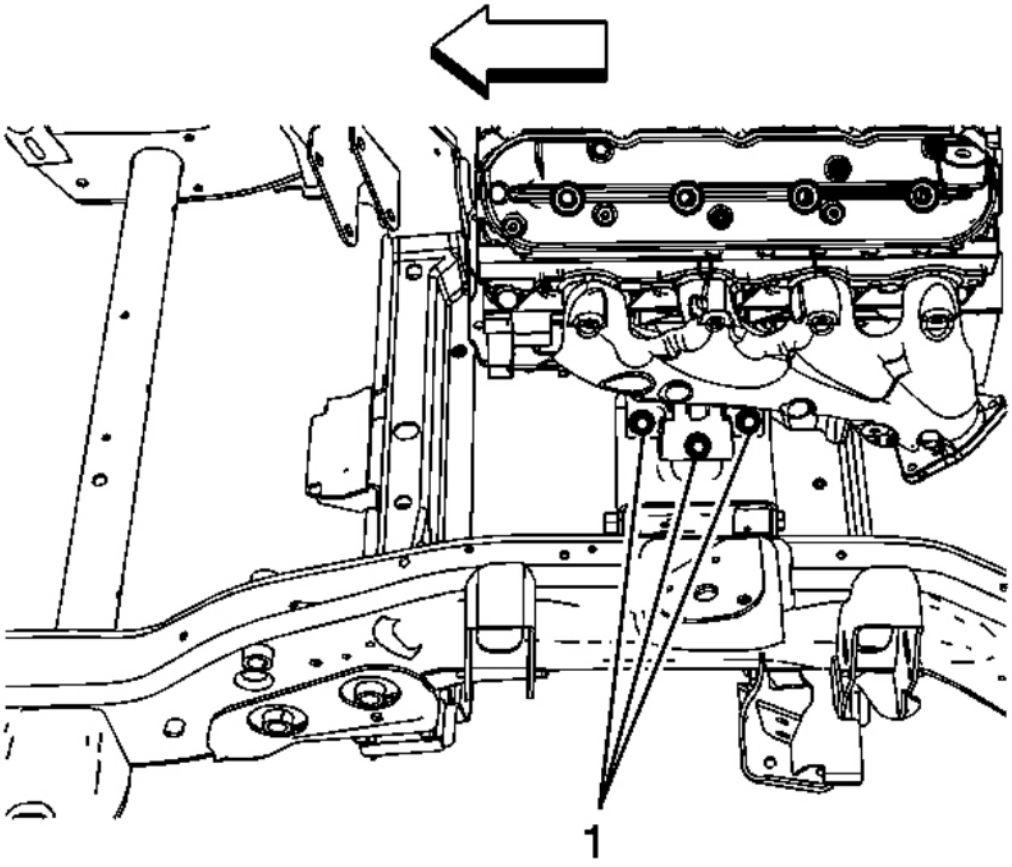


Fig. 31: View Of Engine Mount Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the left wheelhouse liner. Refer to **Front Wheelhouse Liner Replacement** .
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. Install the generator bracket. Refer to **Generator Bracket Replacement** .
9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to **Differential Carrier Assembly Replacement (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
10. Lower the vehicle.
11. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

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ENGINE MOUNT BRACKET REPLACEMENT - LEFT SIDE (2500 W/RPO LY6)

REMOVAL PROCEDURE

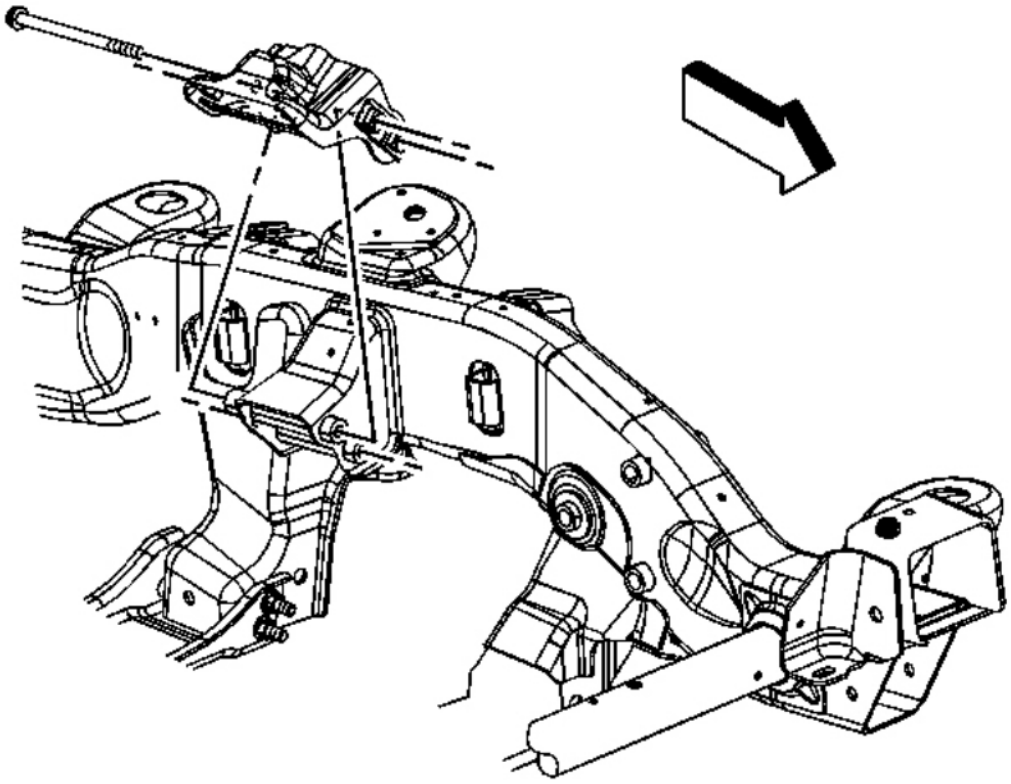


Fig. 32: View Of Engine Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine mount. Refer to **Engine Mount Replacement - Left Side (1500 w/RPO LY2)** or **Engine Mount Replacement - Left Side (1500 w/RPOs LC9/LMG/LY5/L76/L92)** or **Engine Mount Replacement - Left Side (2500 w/RPO LY6)**.
2. Remove the engine mount bracket bolts.
3. Remove the engine mount bracket.

INSTALLATION PROCEDURE

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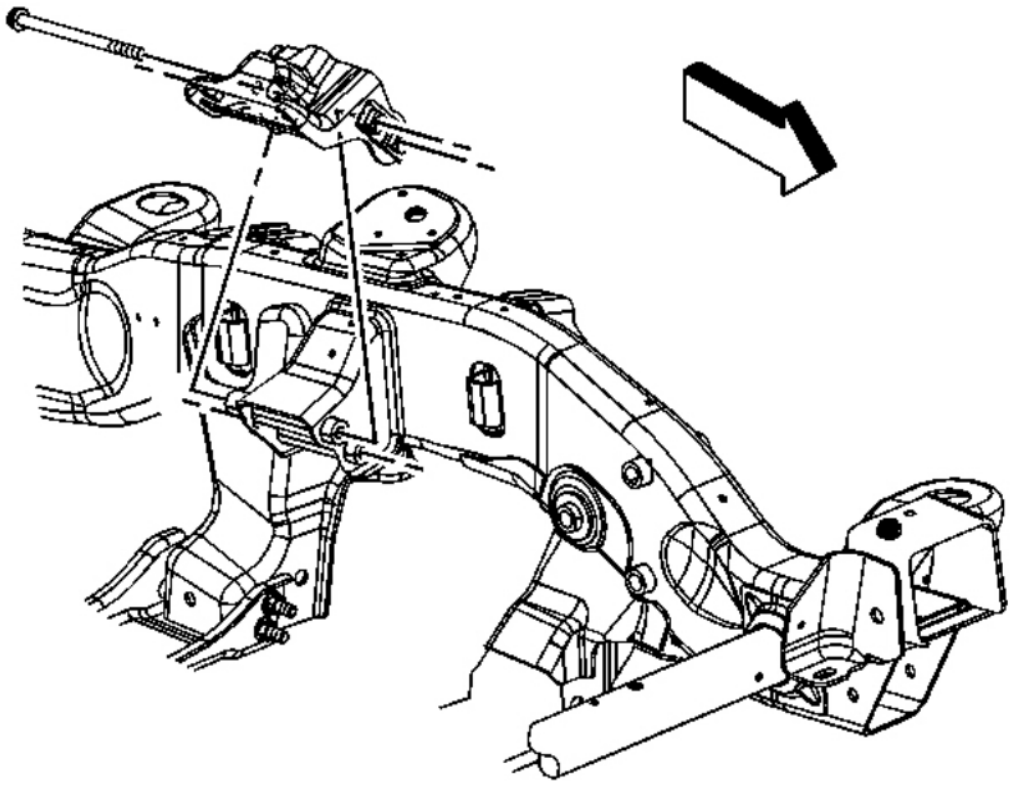


Fig. 33: View Of Engine Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount bracket onto the frame.
2. Perform the following steps prior to installing the engine mount bracket bolts.
   - Remove all traces of the original adhesive patch.
   - Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
   - Apply threadlock GM P/N 12345382 (Canadian P/N 10953489) or equivalent to the bolts.

NOTE: **Refer to Fastener Notice .**

3. Install the engine mount bracket bolts.

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

4. Install the engine mount. Refer to **Engine Mount Replacement - Left Side (1500 w/RPO LY2)** or **Engine Mount Replacement - Left Side (1500 w/RPOs LC9/LMG/LY5/L76/L92)** or **Engine Mount**

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Replacement - Left Side (2500 w/RPO LY6).

ENGINE MOUNT REPLACEMENT - RIGHT SIDE (1500 W/RPO LY2)

REMOVAL PROCEDURE

NOTE: **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.**

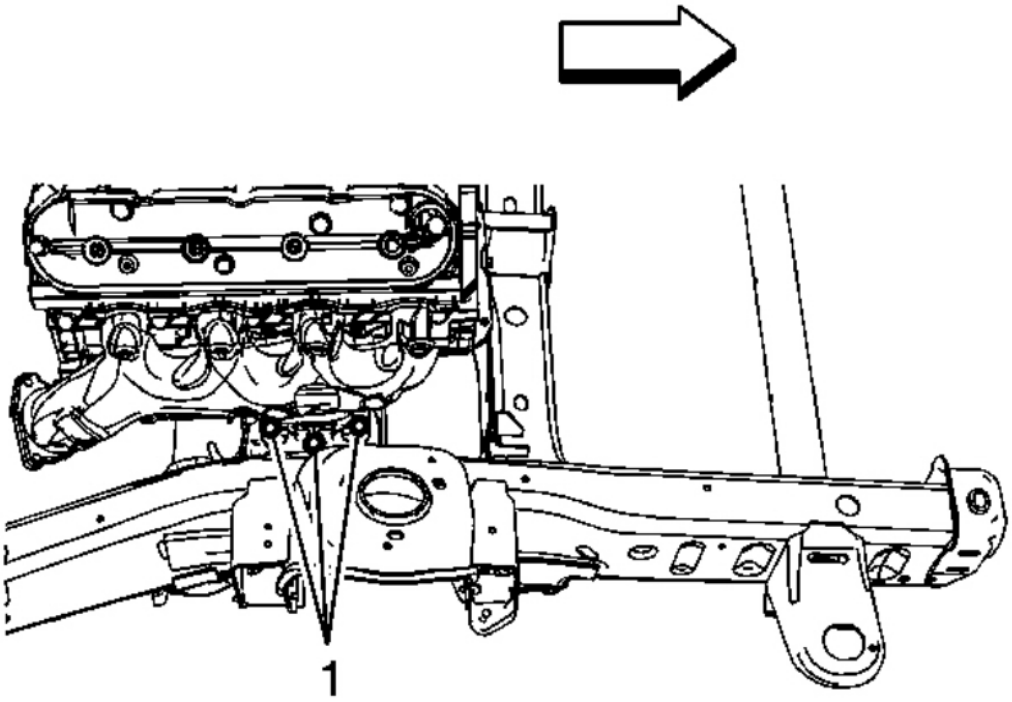


Fig. 34: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .

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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 **Compressor Mounting Bracket Replacement** .
6. Remove the engine mount to frame bolts (1).

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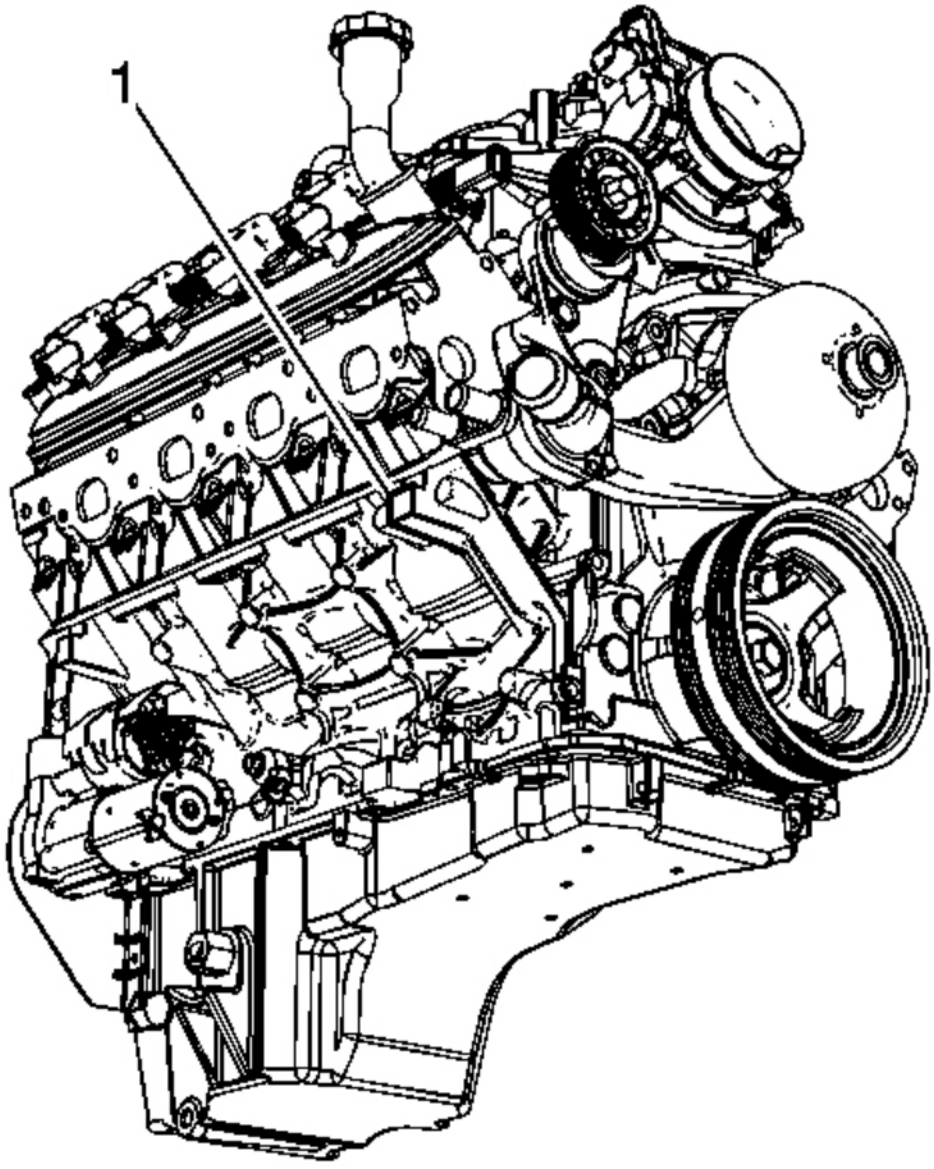


Fig. 35: View Of Engine Block Tab
Courtesy of GENERAL MOTORS CORP.

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

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

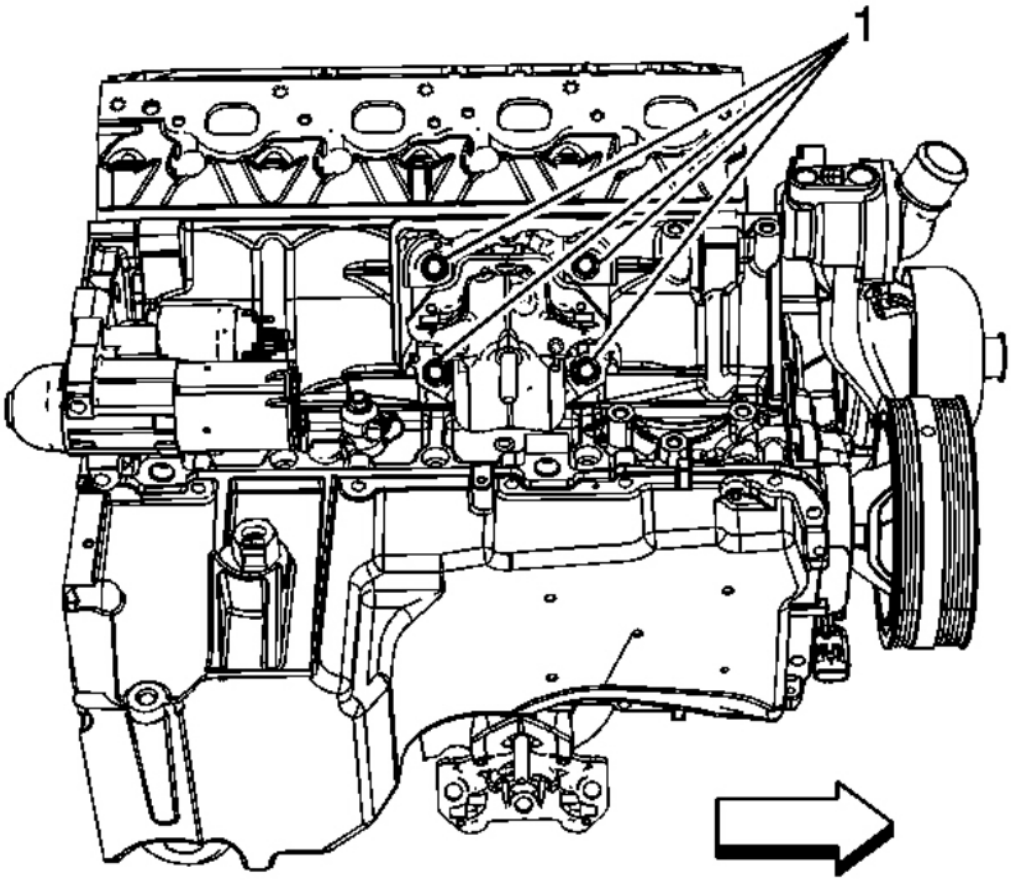


Fig. 36: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

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.

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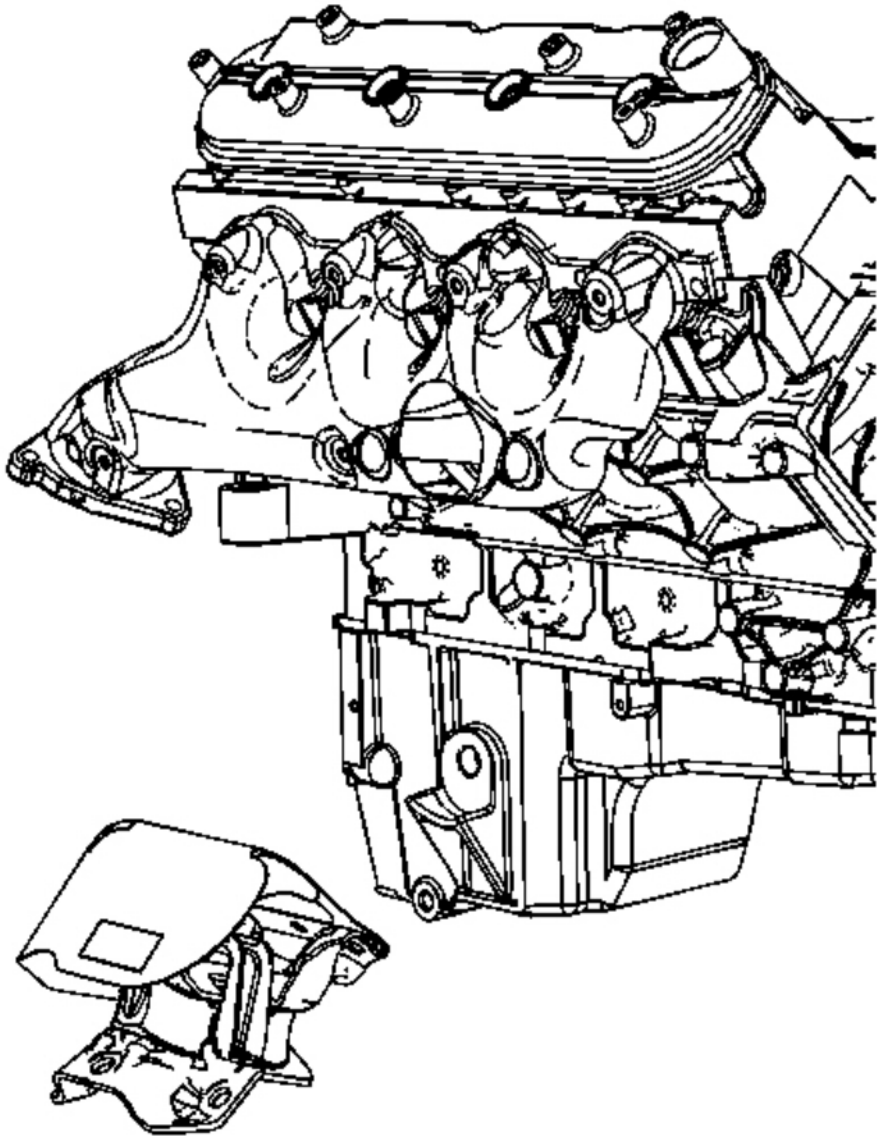


Fig. 37: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

10. Remove the engine mount.

INSTALLATION PROCEDURE

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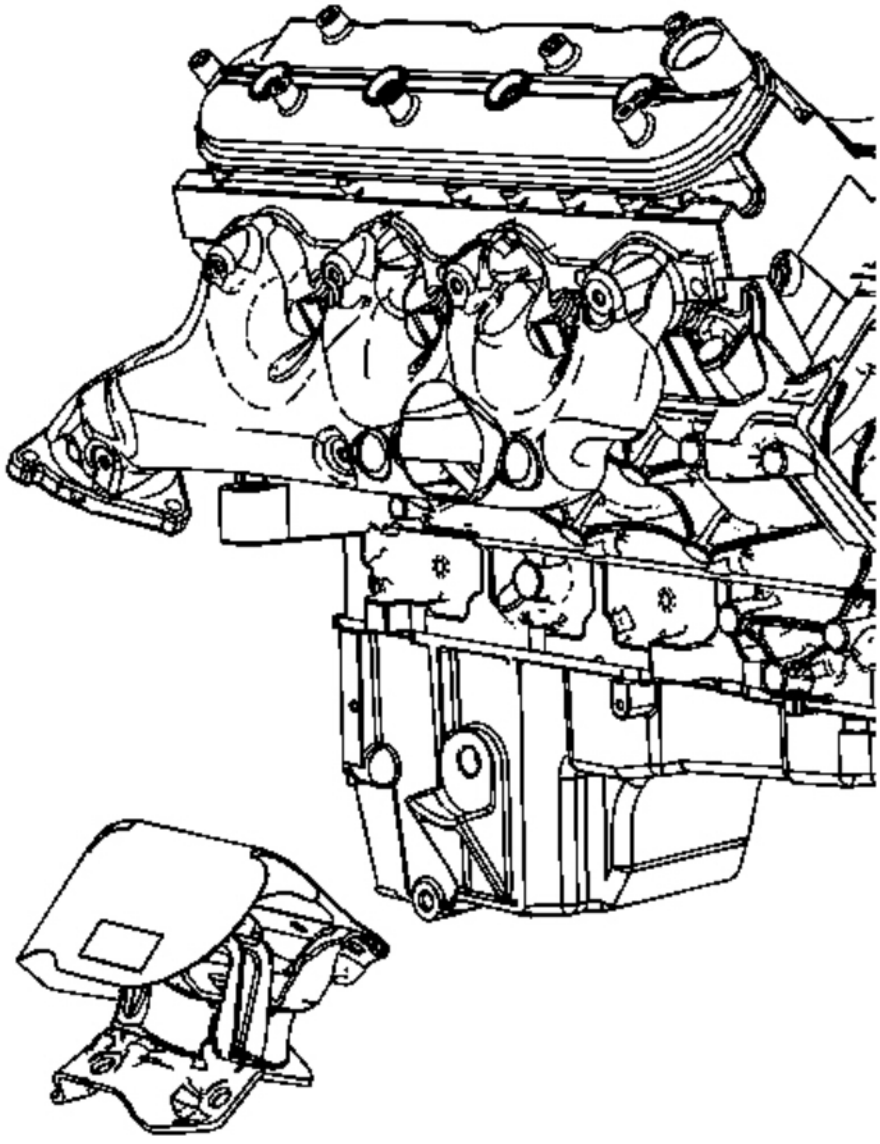


Fig. 38: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

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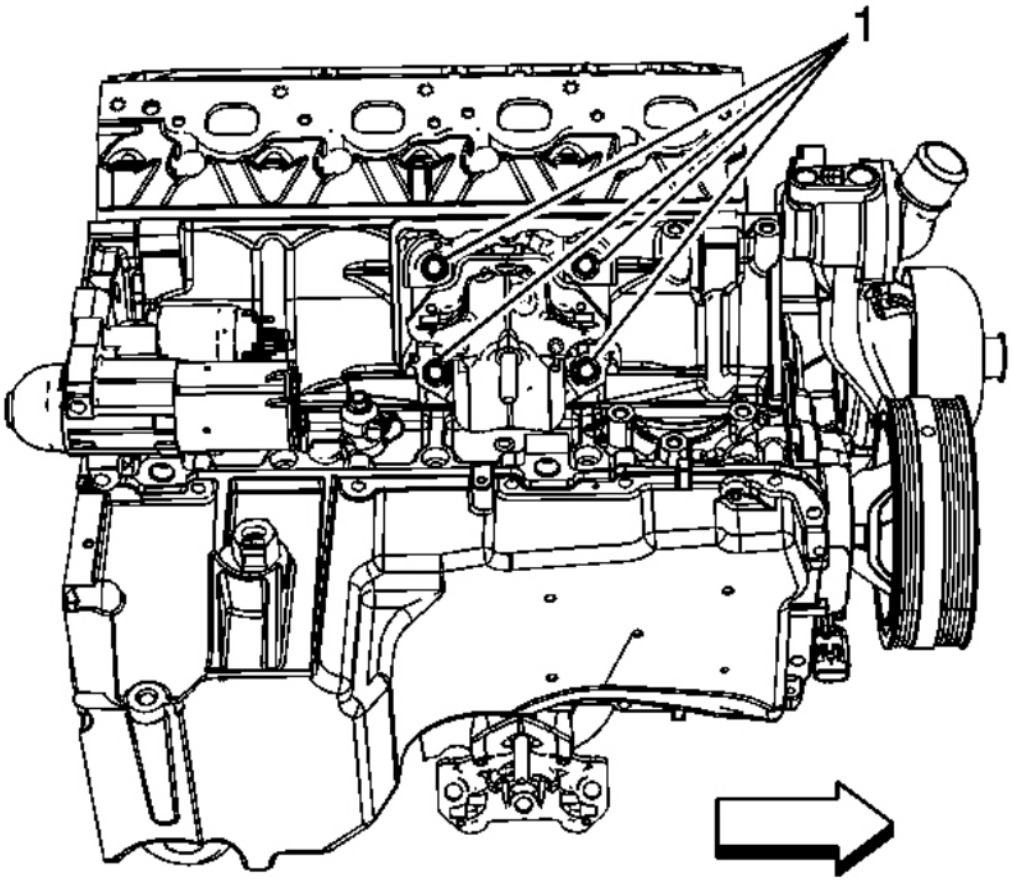


Fig. 39: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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.

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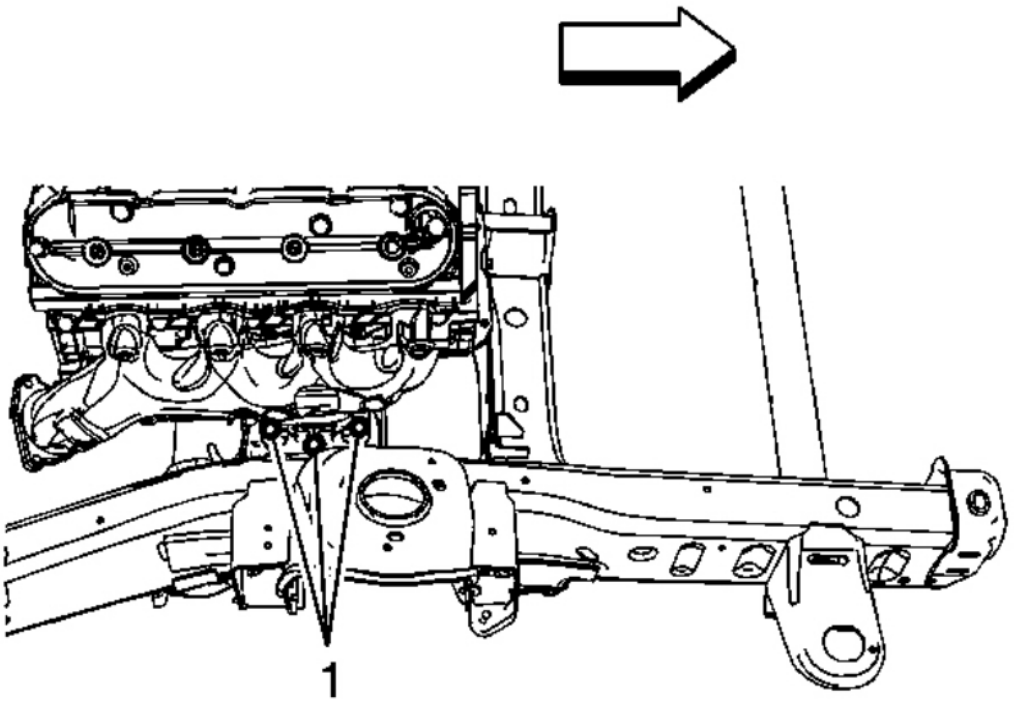


Fig. 40: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 **Compressor Mounting Bracket Replacement** .
7. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .
8. 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).

9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to **Differential Carrier Assembly Replacement (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
10. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

ENGINE MOUNT REPLACEMENT - RIGHT SIDE (1500 W/RPOS LC9/LMG/LY5/L76/L92)

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REMOVAL PROCEDURE

NOTE: **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.**

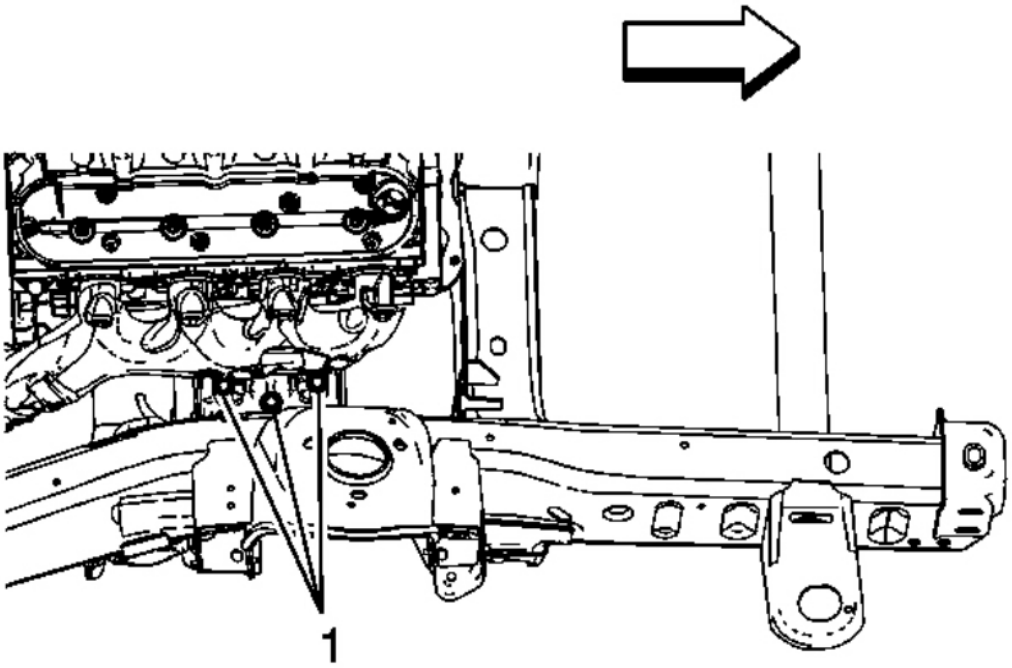


Fig. 41: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
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 **Compressor Mounting Bracket Replacement** .
6. Remove the engine mount to frame bolts (1).

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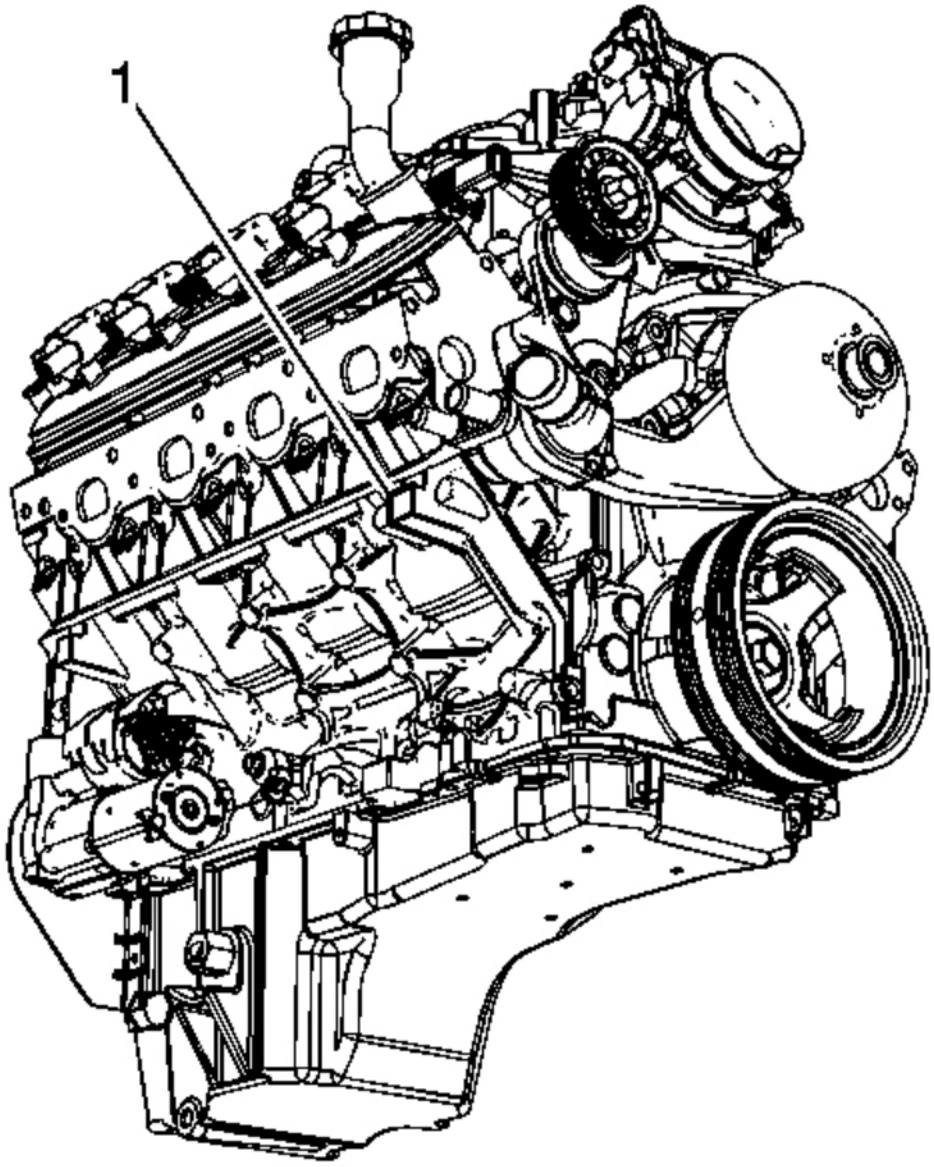


Fig. 42: View Of Engine Block Tab
Courtesy of GENERAL MOTORS CORP.

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

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

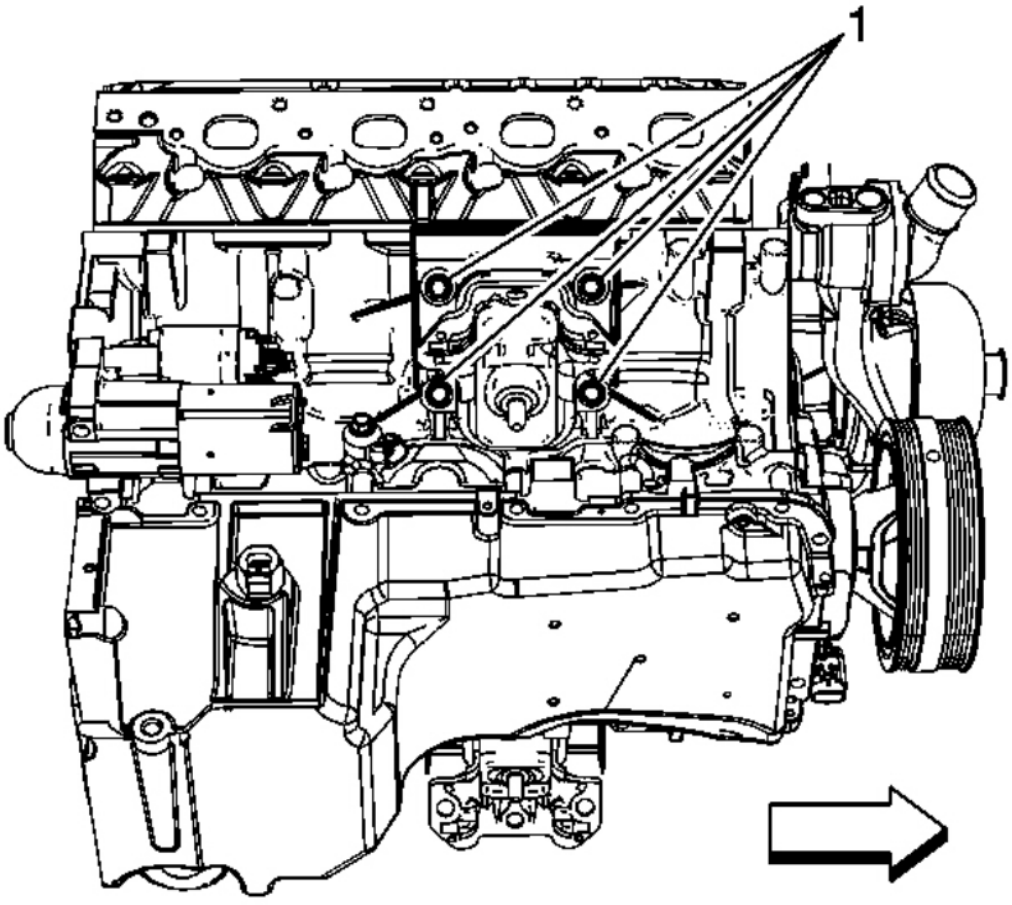


Fig. 43: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

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.

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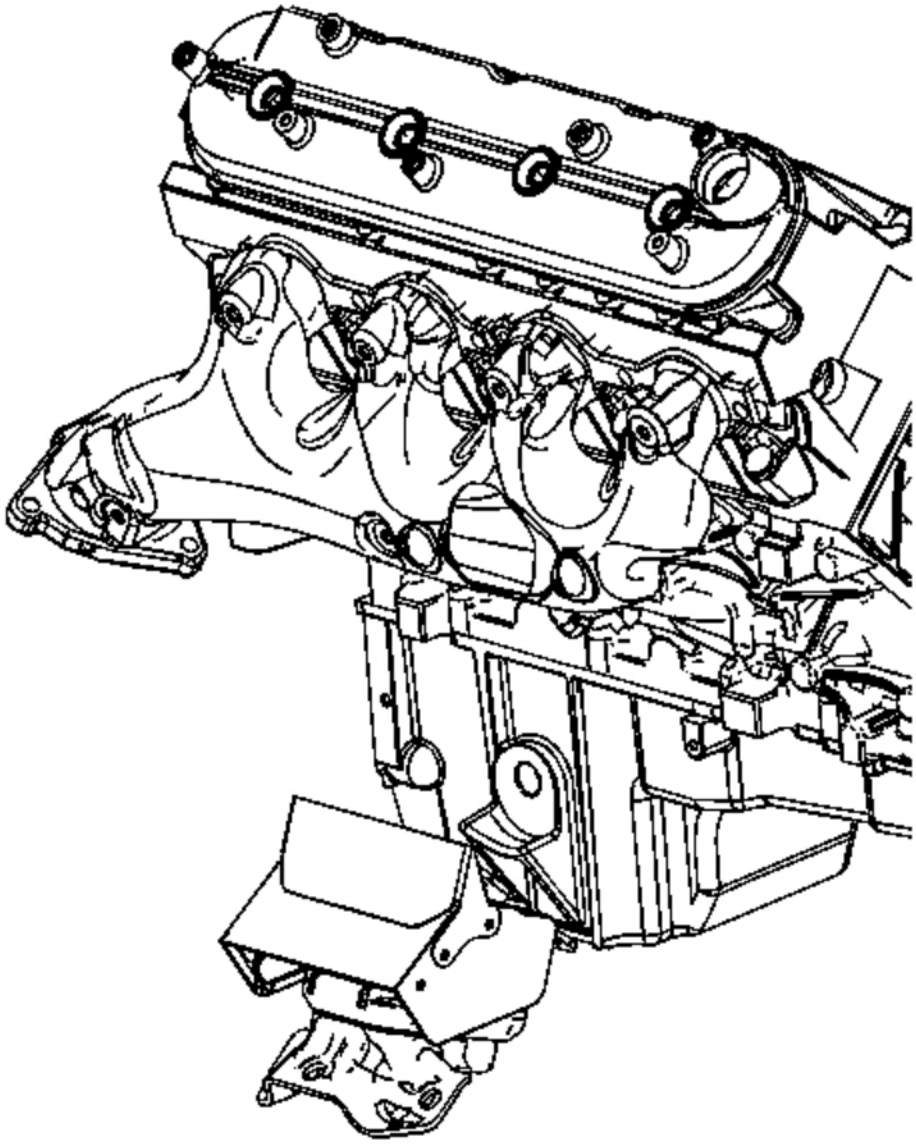


Fig. 44: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

10. Remove the engine mount.

INSTALLATION PROCEDURE

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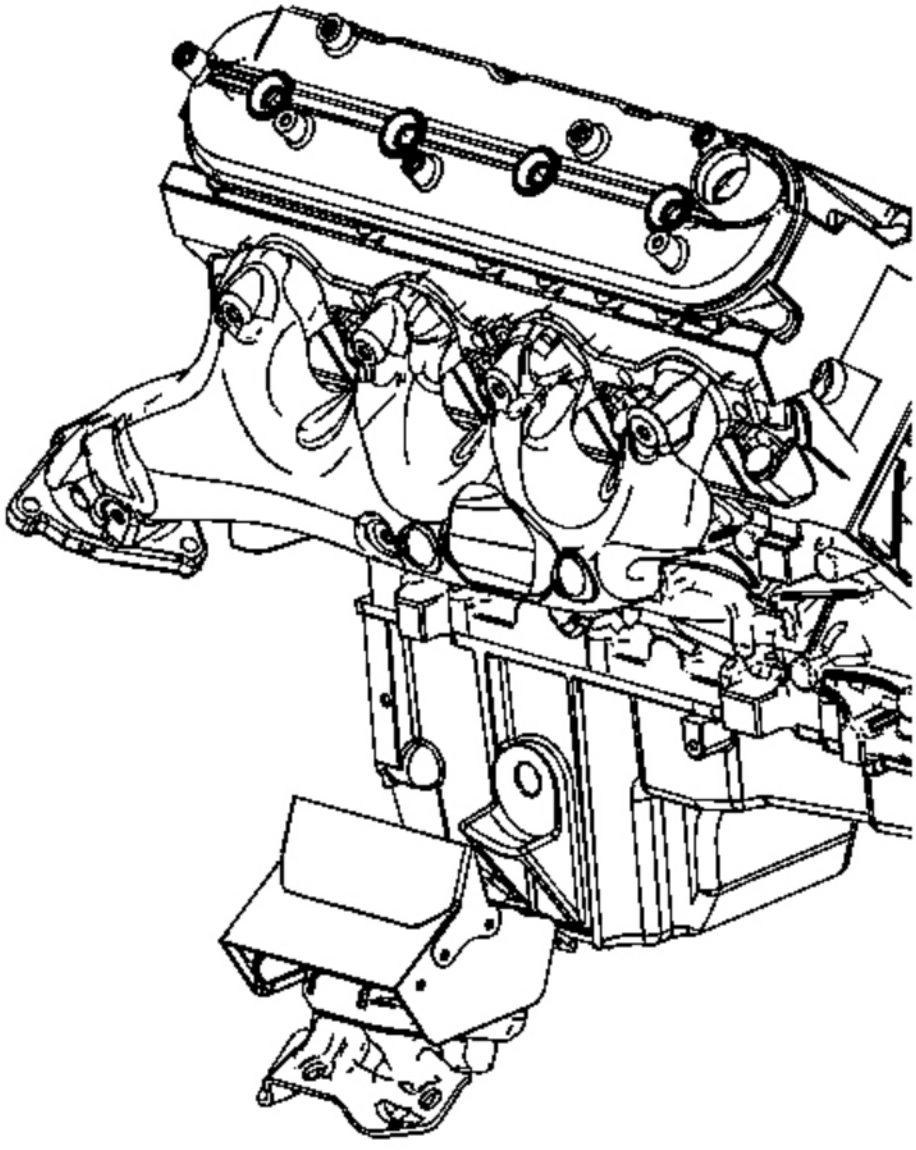


Fig. 45: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

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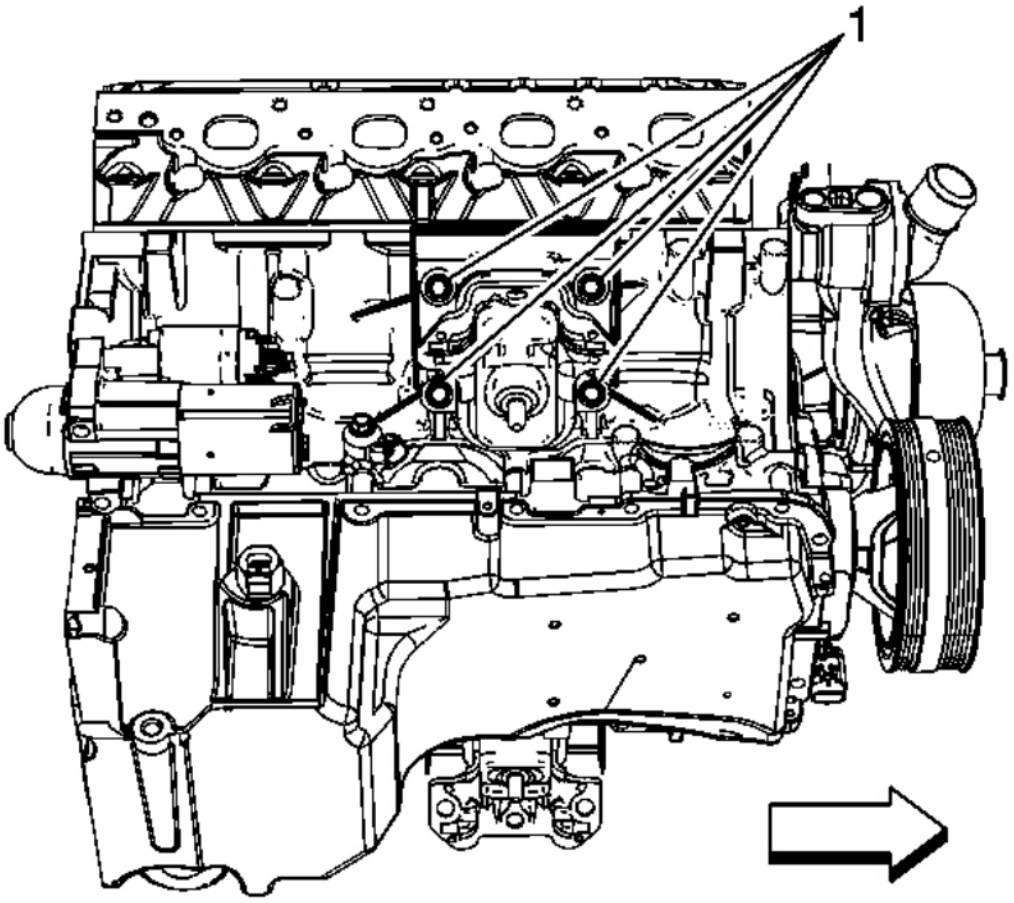


Fig. 46: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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.

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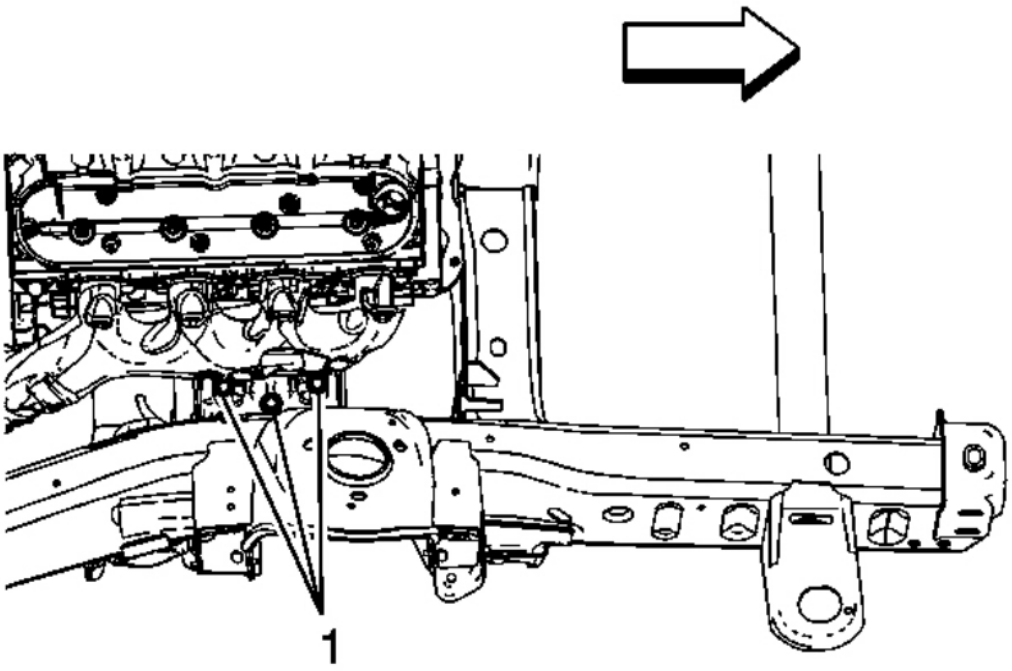


Fig. 47: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 **Compressor Mounting Bracket Replacement** .
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 (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
9. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .

ENGINE MOUNT REPLACEMENT - RIGHT SIDE (2500 W/RPO LY6)

REMOVAL PROCEDURE

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NOTE: **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.**

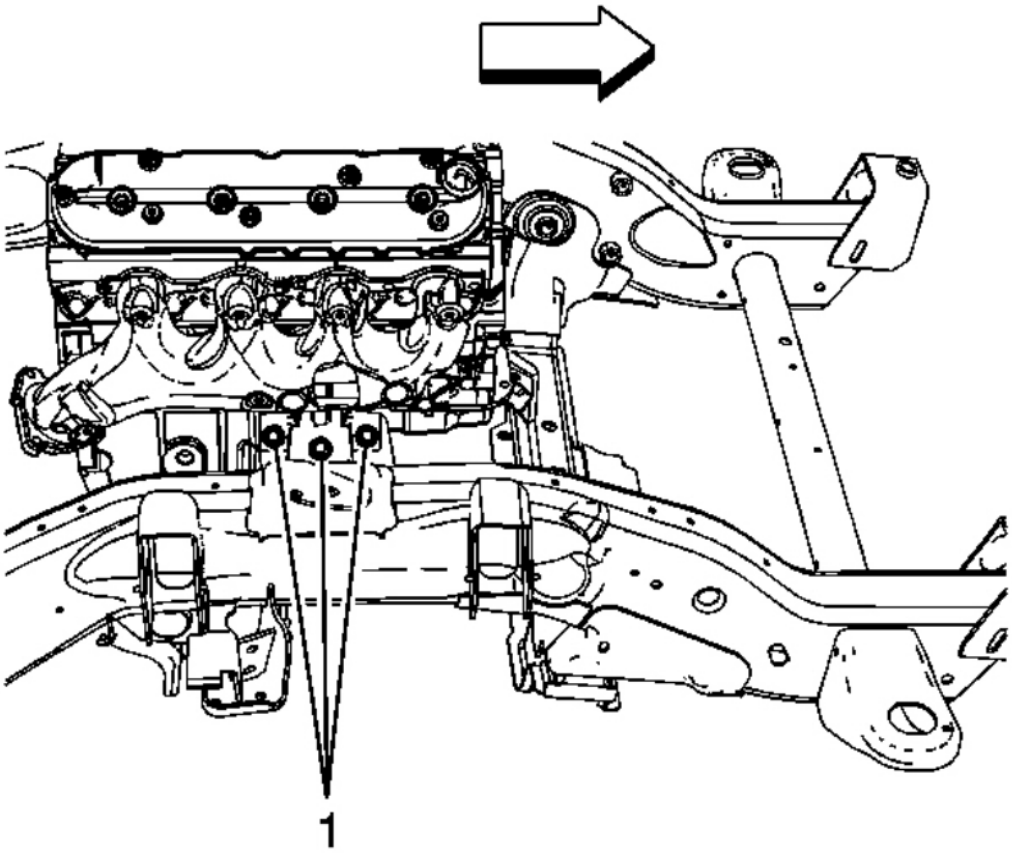


Fig. 48: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
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** .

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5. Remove the air conditioning (A/C) compressor bracket. Refer to **Compressor Mounting Bracket Replacement** .
6. Remove the engine mount to frame bolts (1).

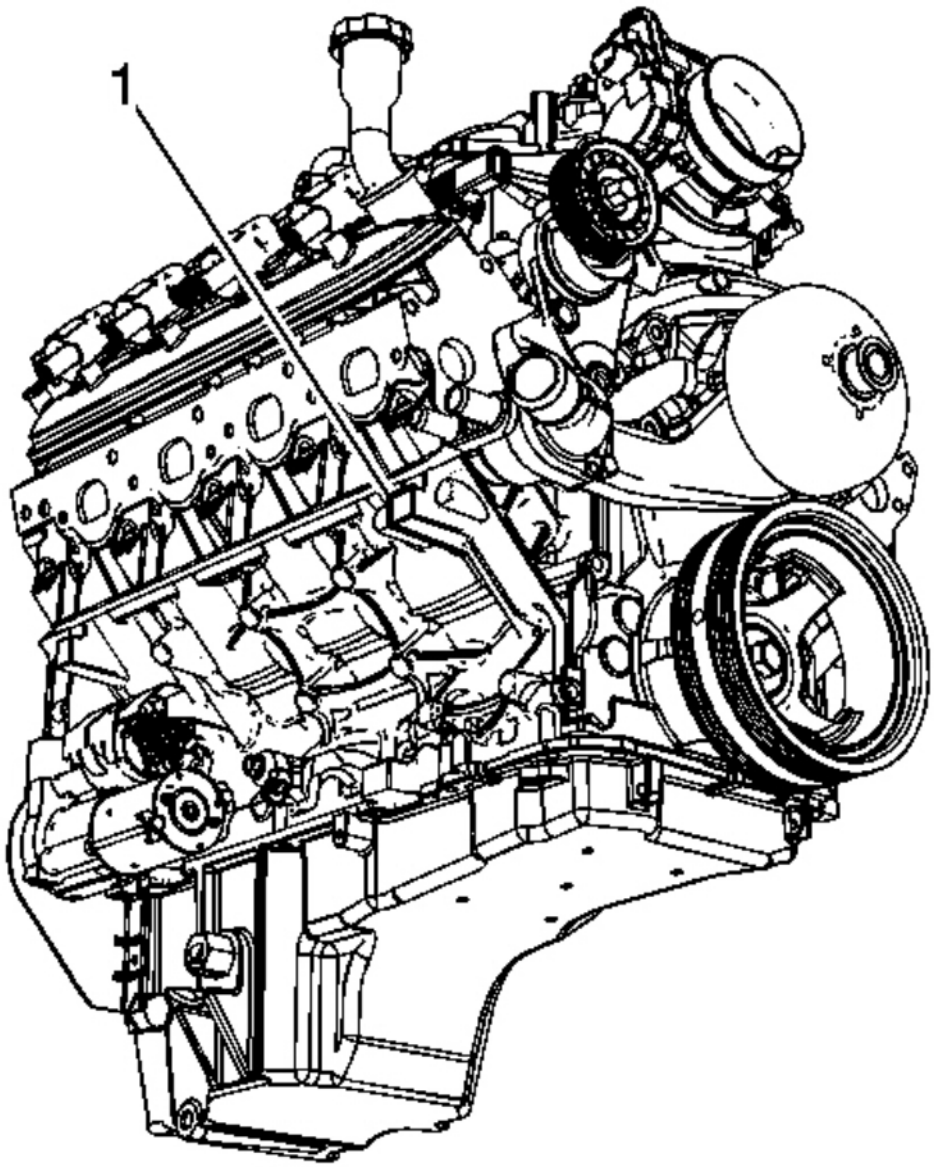


Fig. 49: View Of Engine Block Tab
Courtesy of GENERAL MOTORS CORP.

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IMPORTANT: 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.

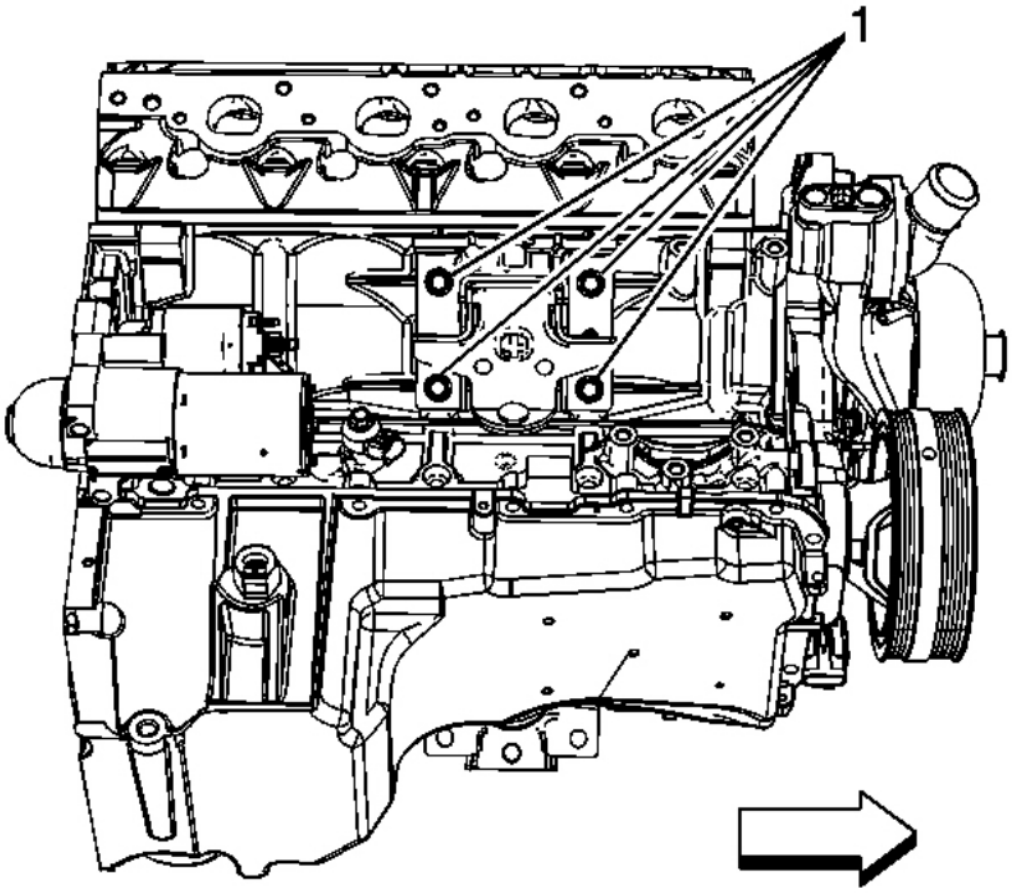


Fig. 50: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

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.

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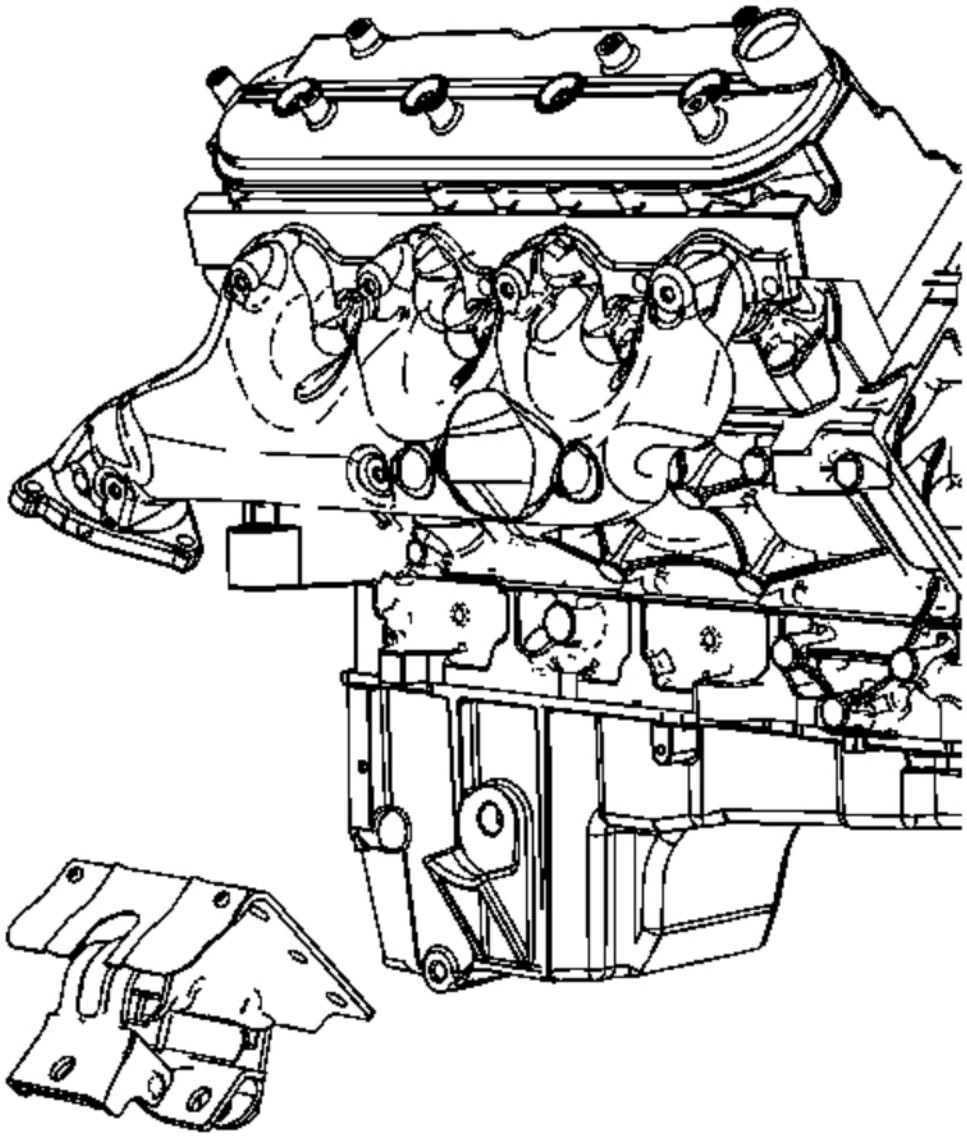


Fig. 51: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

10. Remove the engine mount.

INSTALLATION PROCEDURE

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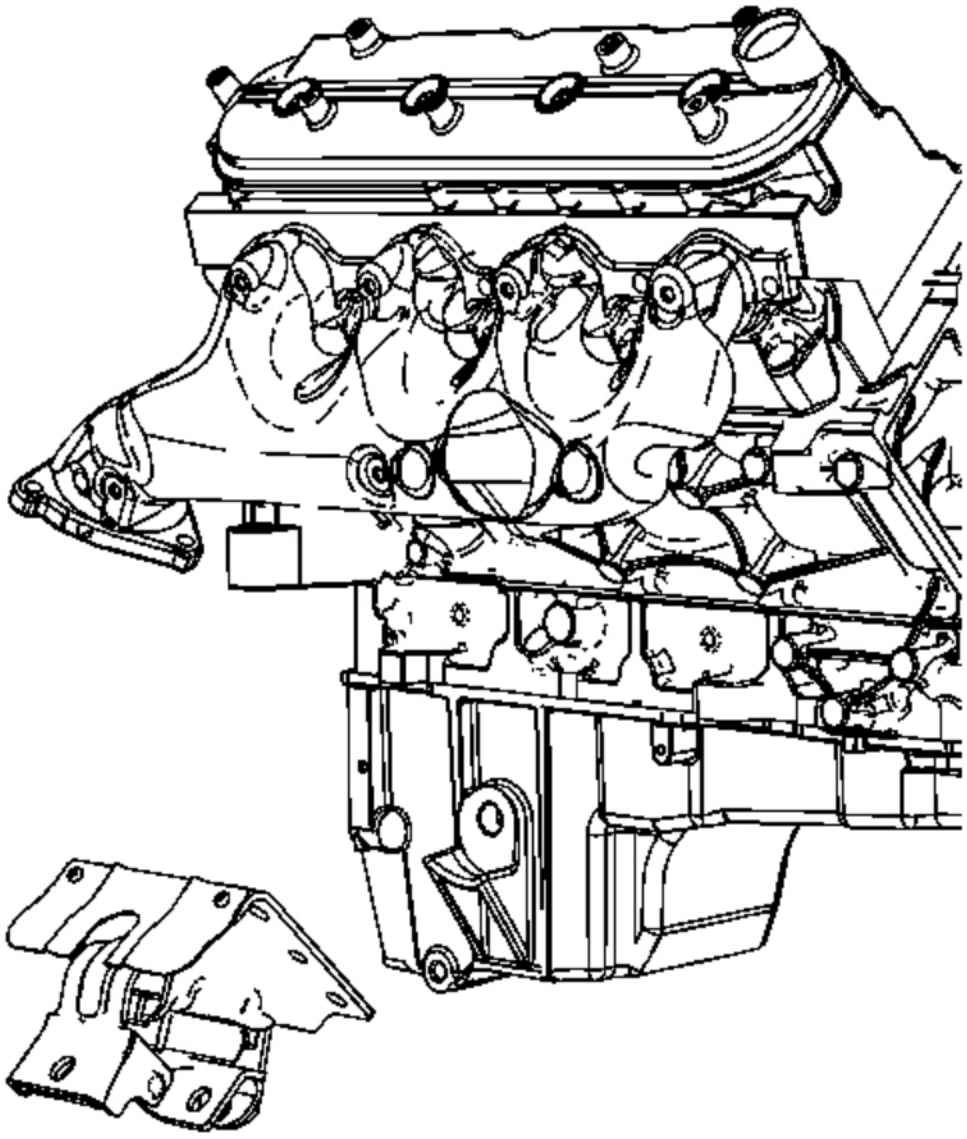


Fig. 52: View Of Engine Mount
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount to the engine.

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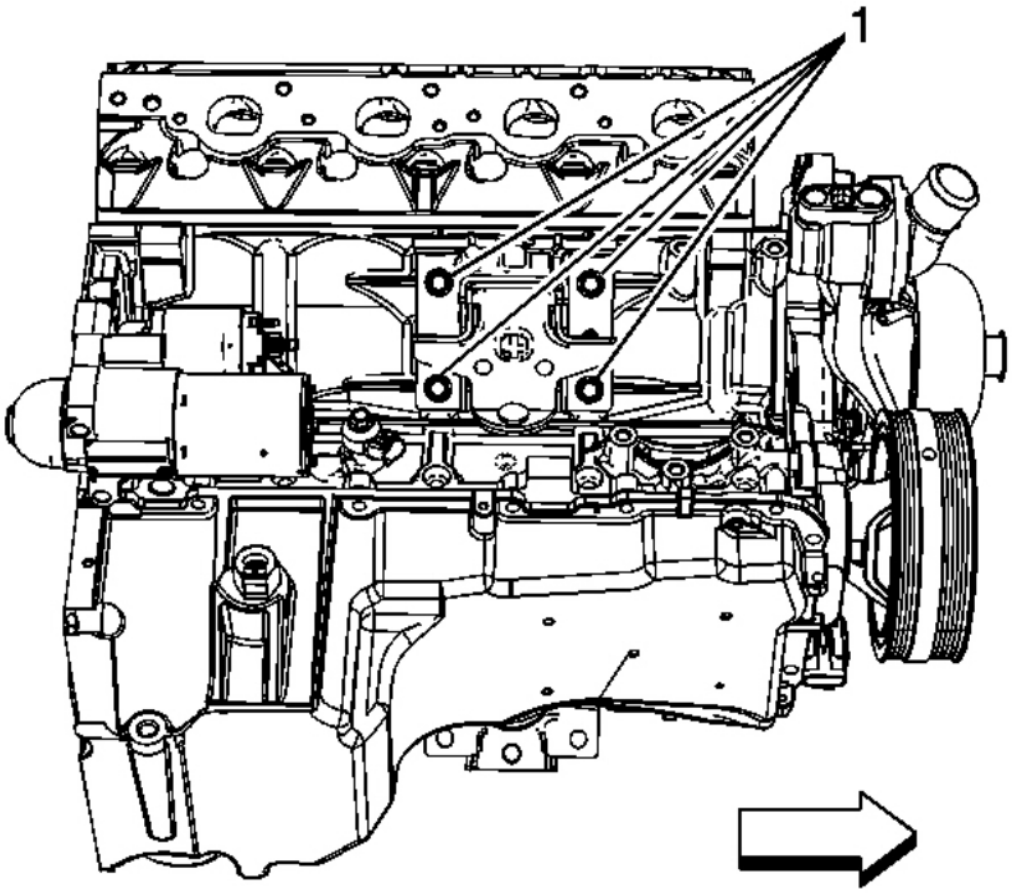


Fig. 53: View Of Engine Mount To Engine Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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 engine mount bracket.
4. Remove the adjustable jack from the engine block.

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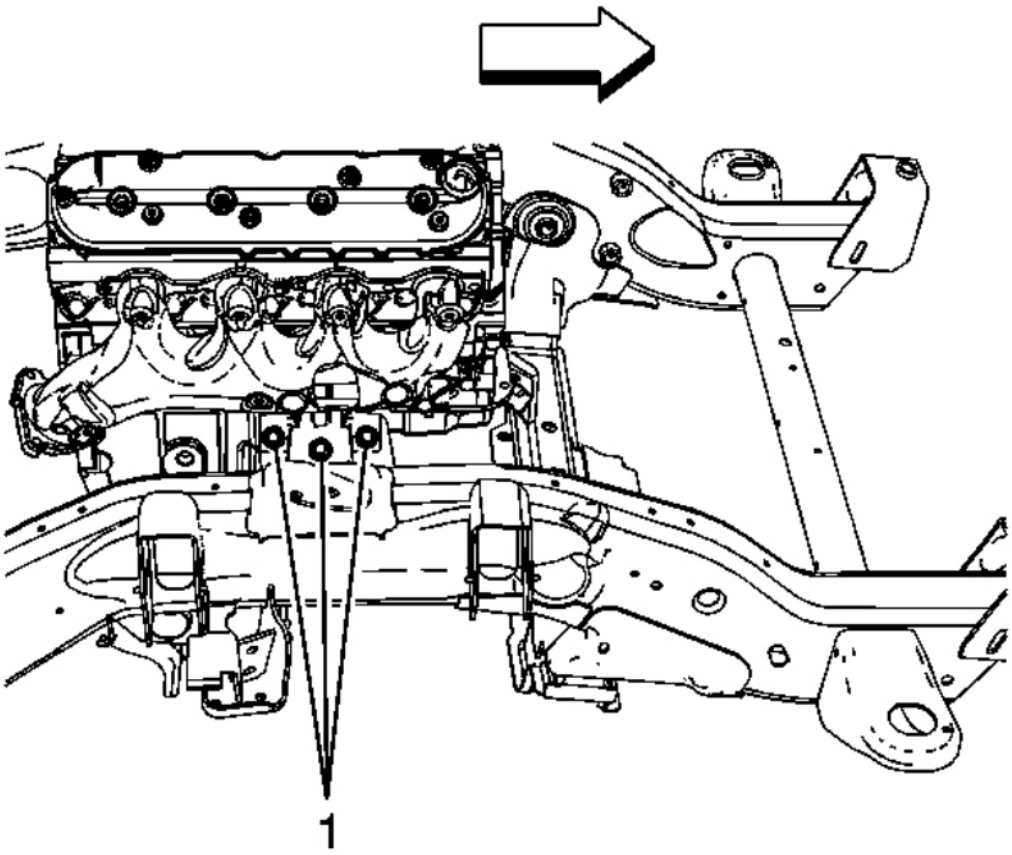


Fig. 54: View Of Engine Mount To Frame Bolts
Courtesy of GENERAL MOTORS CORP.

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 **Compressor Mounting Bracket Replacement** .
7. Install the exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .
8. 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).

9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to **Differential Carrier Assembly Replacement (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .
10. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

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ENGINE MOUNT BRACKET REPLACEMENT - RIGHT SIDE (2500 W/RPO LY6)

REMOVAL PROCEDURE

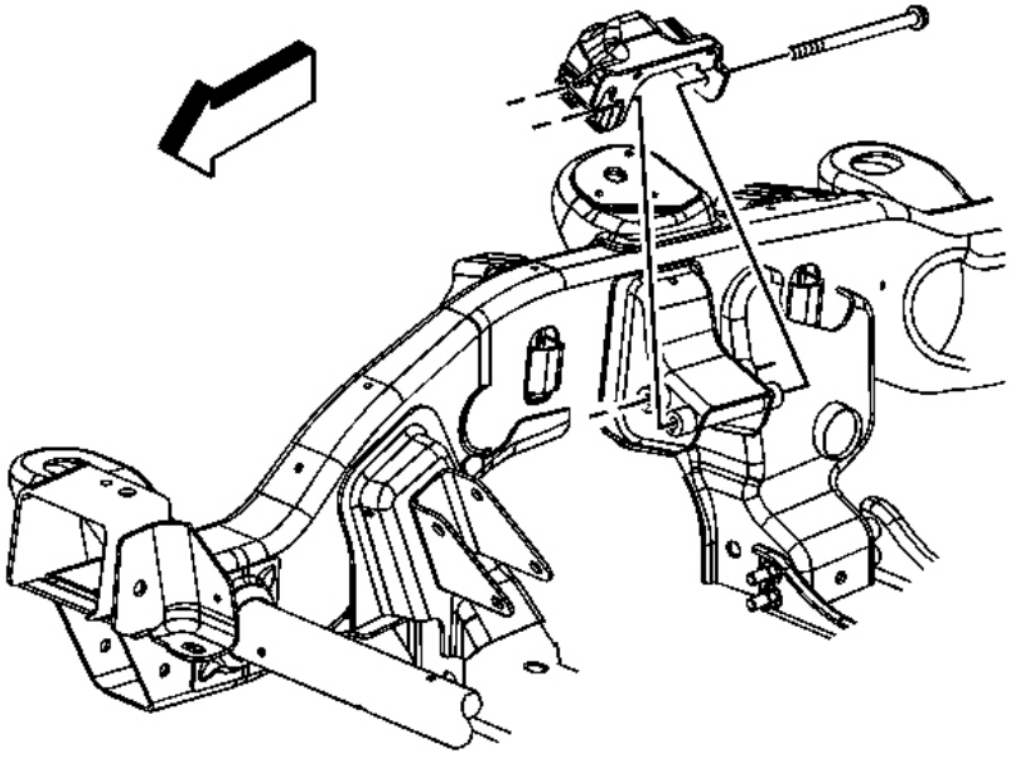


Fig. 55: View Of Engine Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the engine mount. Refer to **Engine Mount Replacement - Right Side (1500 w/RPO LY2)** or **Engine Mount Replacement - Right Side (1500 w/RPOs LC9/LMG/LY5/L76/L92)** or **Engine Mount Replacement - Right Side (2500 w/RPO LY6)**.
2. Remove the engine mount bracket bolts.
3. Remove the engine mount bracket.

INSTALLATION PROCEDURE

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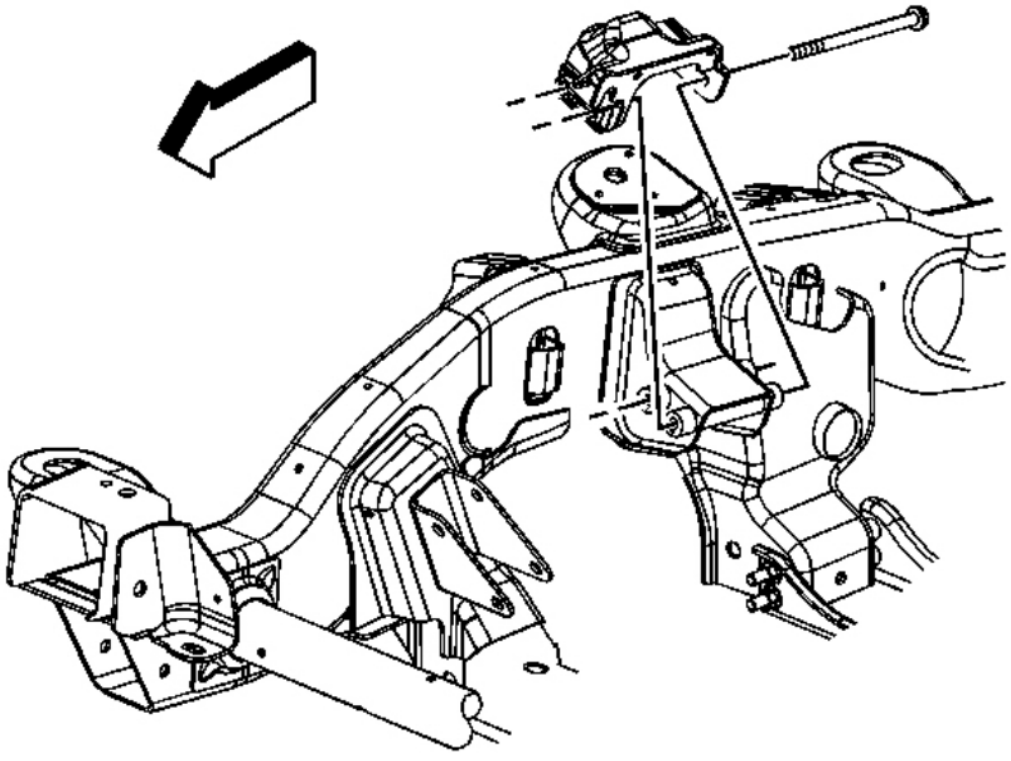


Fig. 56: View Of Engine Mount Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position the engine mount bracket to the frame.
2. Perform the following steps prior to installing the engine mount bracket bolts.
   - Remove all traces of the original adhesive patch.
   - Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
   - Apply threadlock GM P/N 12345382 (Canadian P/N 10953489) or equivalent to the bolts.

NOTE: **Refer to Fastener Notice .**

3. Install the engine mount bracket bolts.

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

4. Install the engine mount. Refer to **Engine Mount Replacement - Right Side (1500 w/RPO LY2)** or **Engine Mount Replacement - Right Side (1500 w/RPOs LC9/LMG/LY5/L76/L92)** or **Engine Mount**

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Replacement - Right Side (2500 w/RPO LY6).

UPPER INTAKE MANIFOLD SIGHT SHIELD REPLACEMENT

REMOVAL PROCEDURE

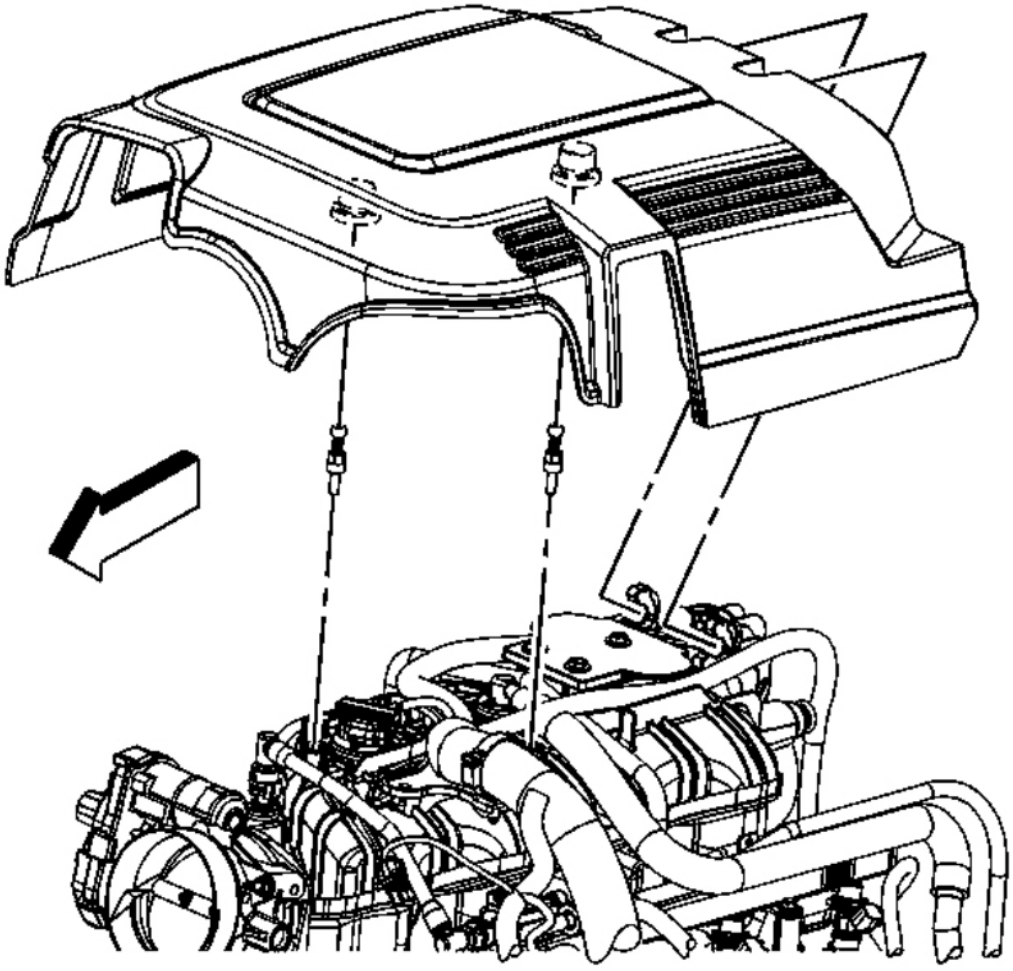


Fig. 57: View Of Upper Intake Manifold Sight Shield
Courtesy of GENERAL MOTORS CORP.

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.

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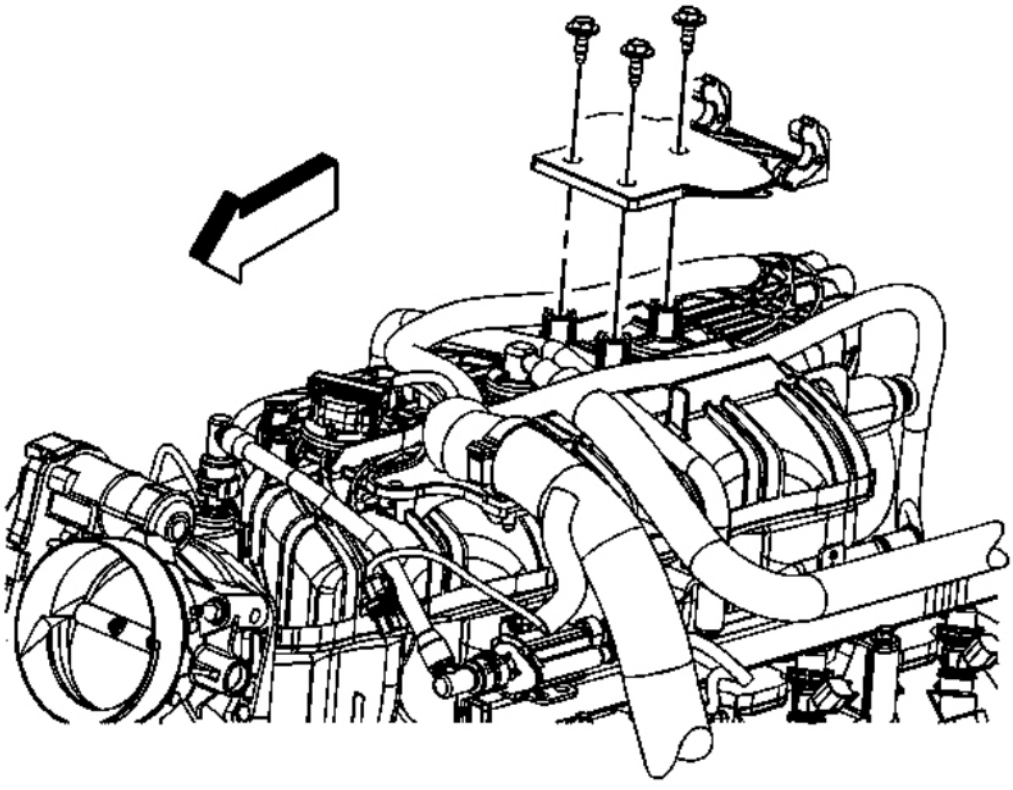


Fig. 58: View Of Intake Manifold Sight Shield Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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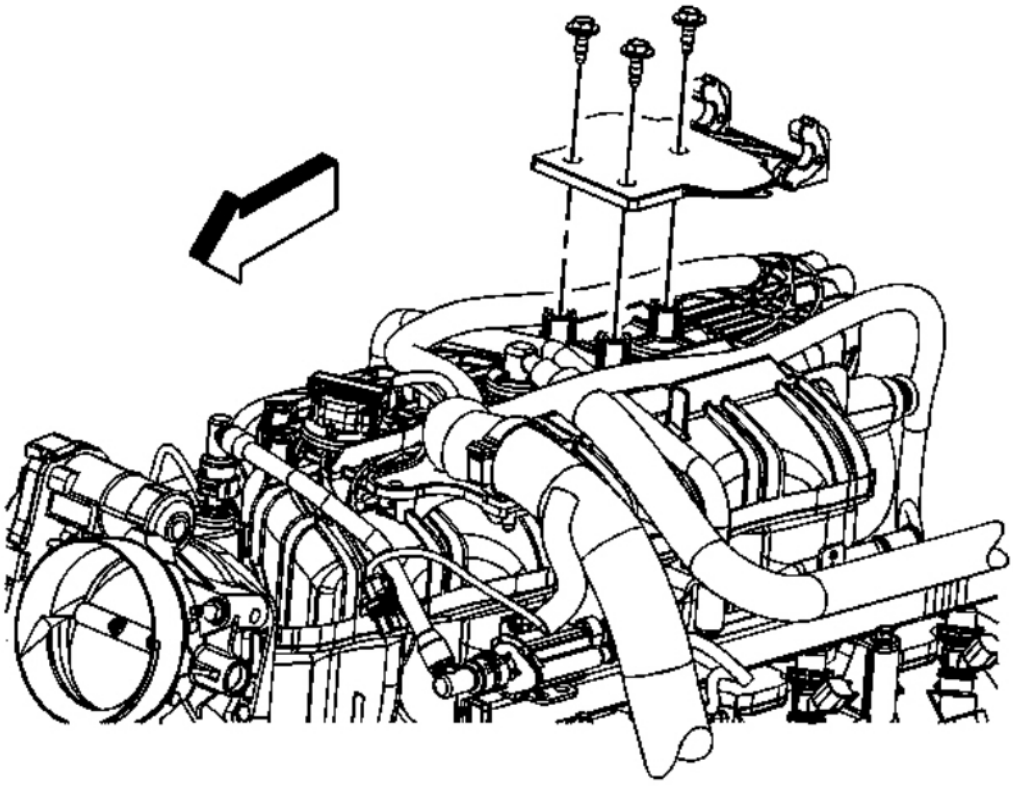


Fig. 59: View Of Intake Manifold Sight Shield Retainer & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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).

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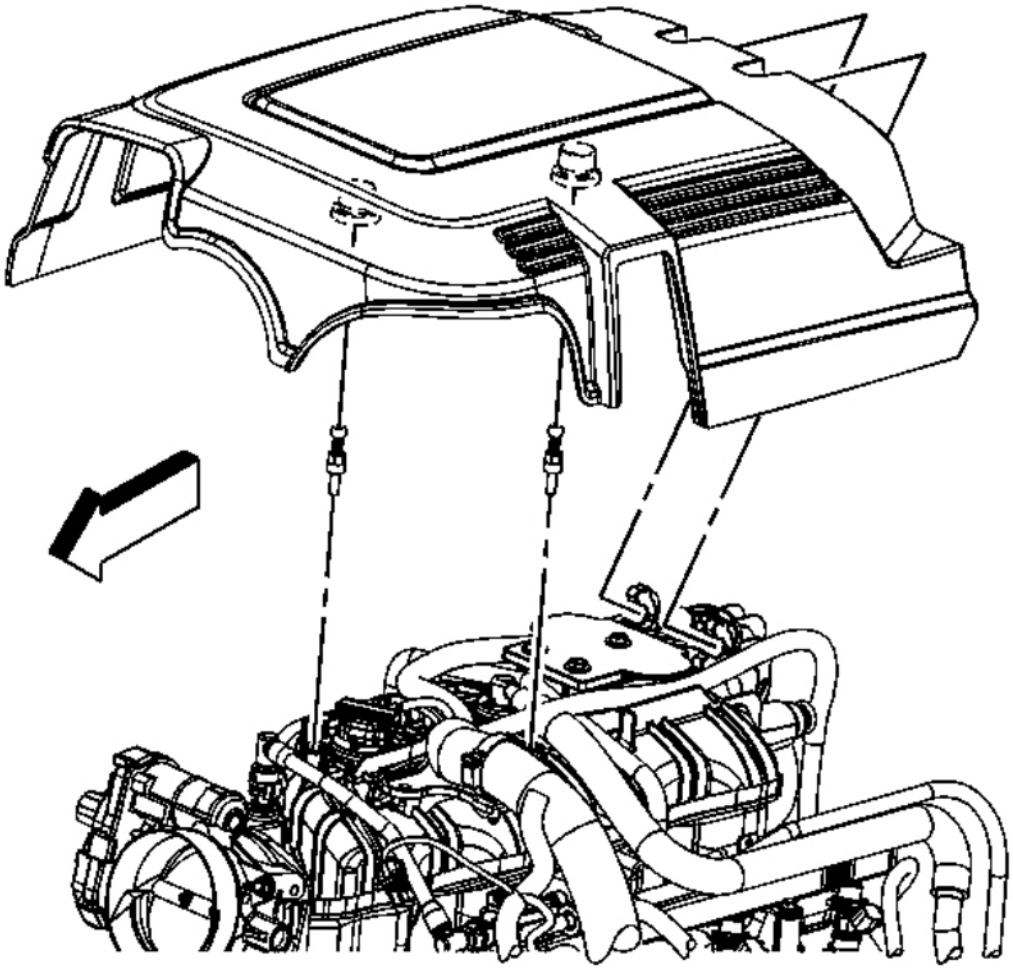


Fig. 60: View Of Upper Intake Manifold Sight Shield
Courtesy of GENERAL MOTORS CORP.

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.

CRANKCASE VENTILATION HOSES/PIPES REPLACEMENT

REMOVAL PROCEDURE

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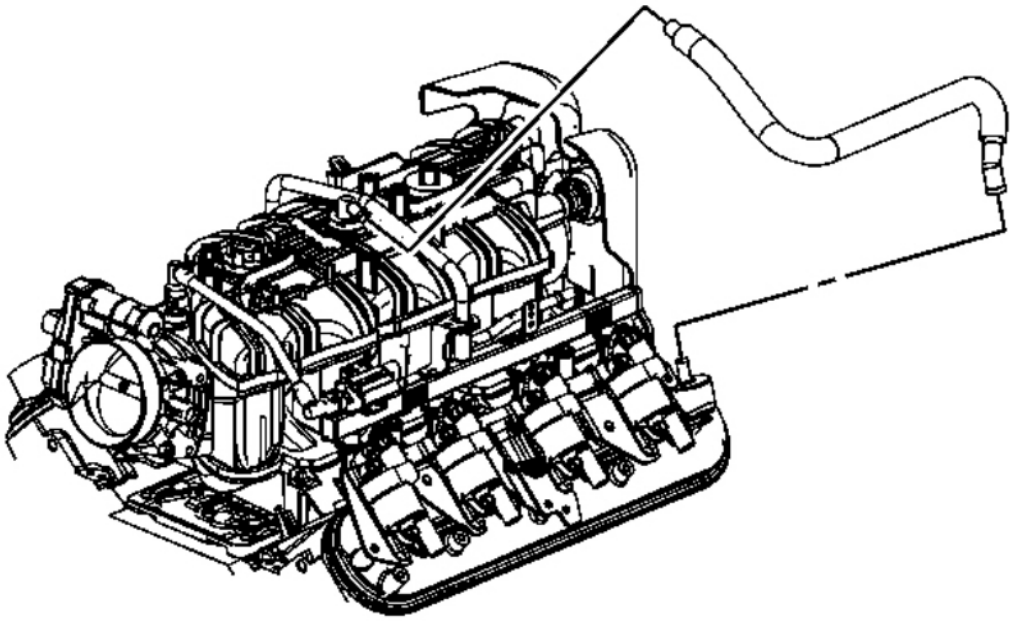


Fig. 61: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

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

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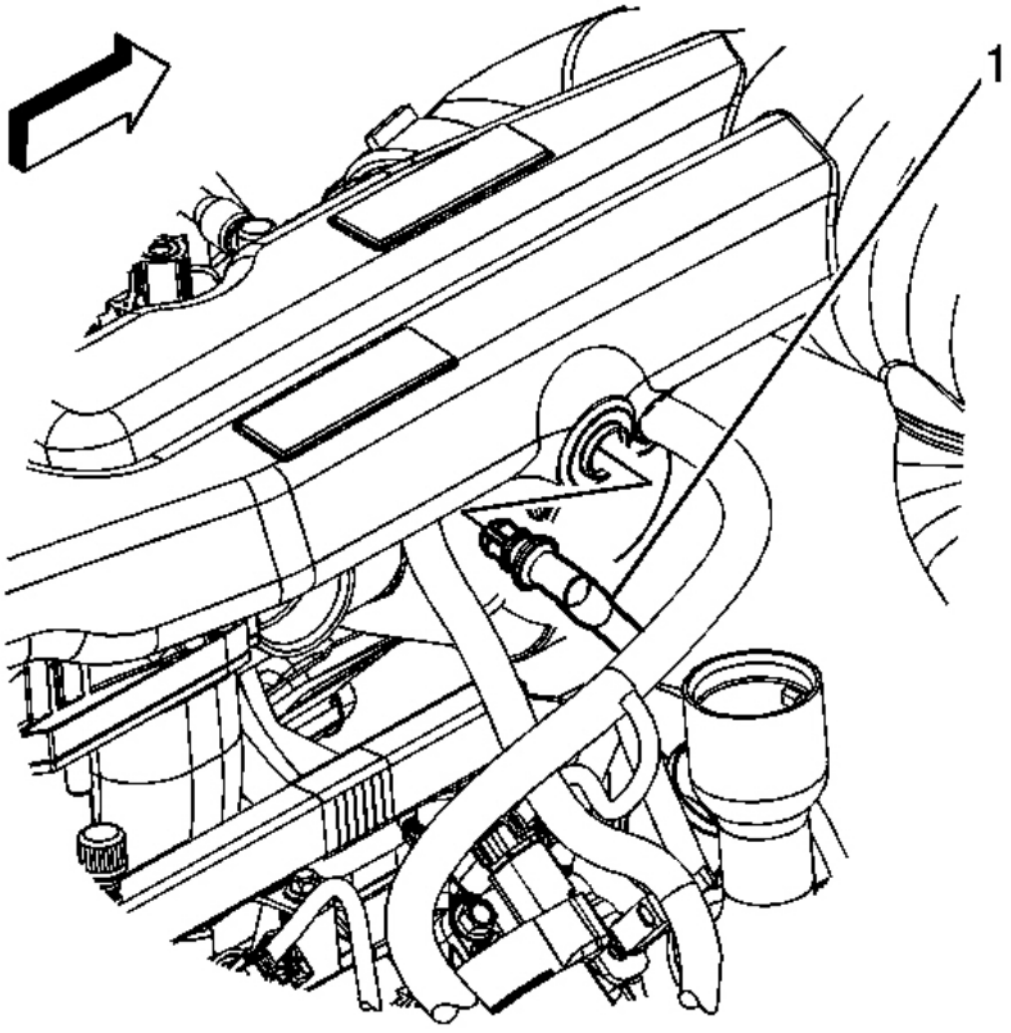


Fig. 62: View Of PCV Tube
Courtesy of GENERAL MOTORS CORP.

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

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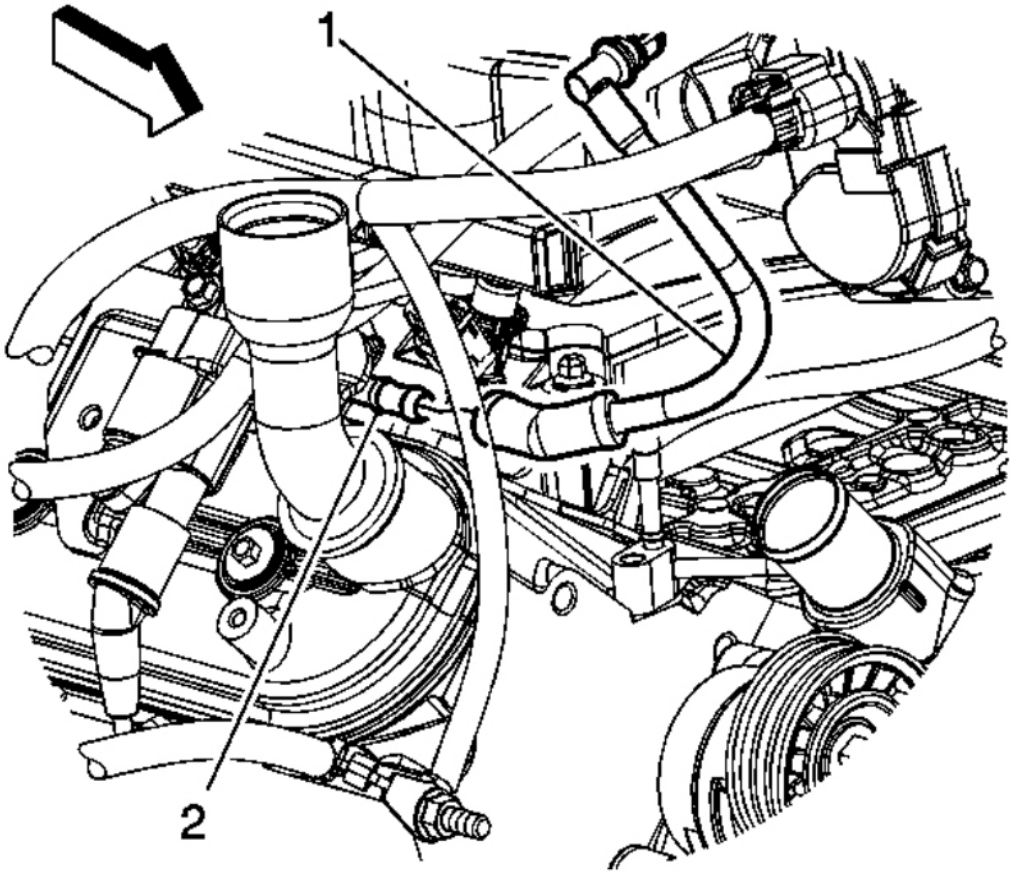


Fig. 63: View Of PCV Tube & Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

4. Remove the PCV 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

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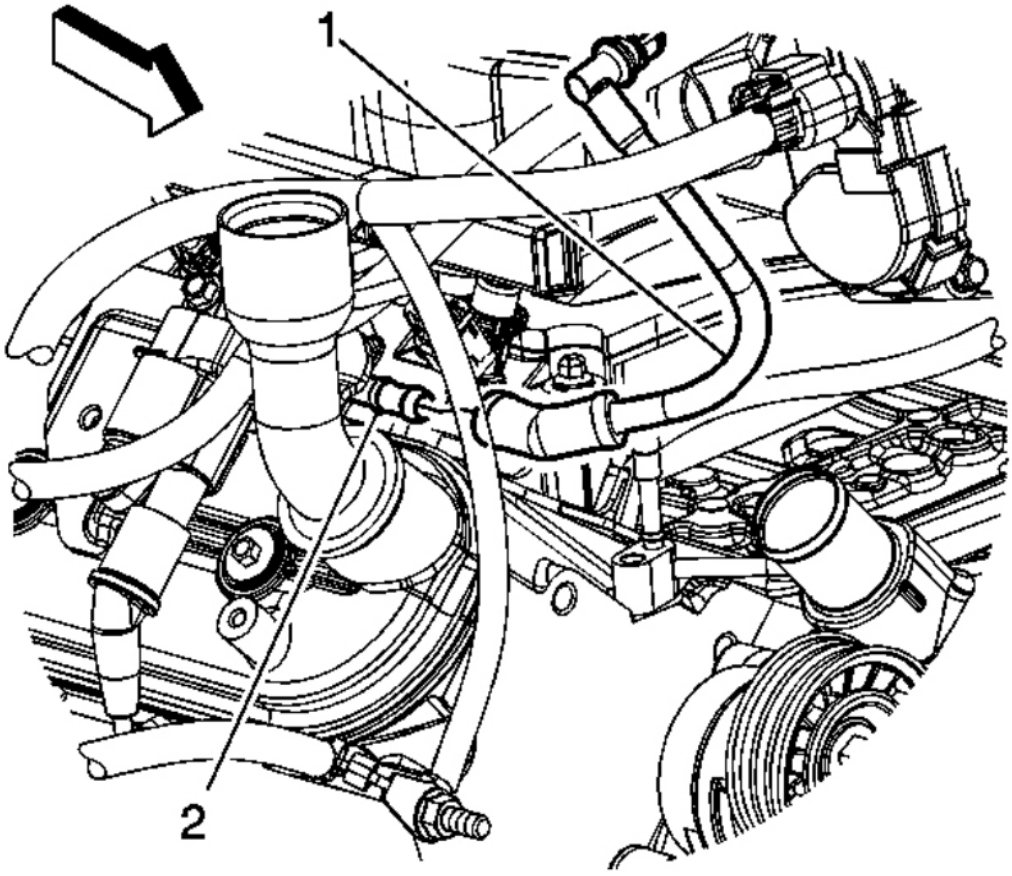


Fig. 64: View Of PCV Tube & Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

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

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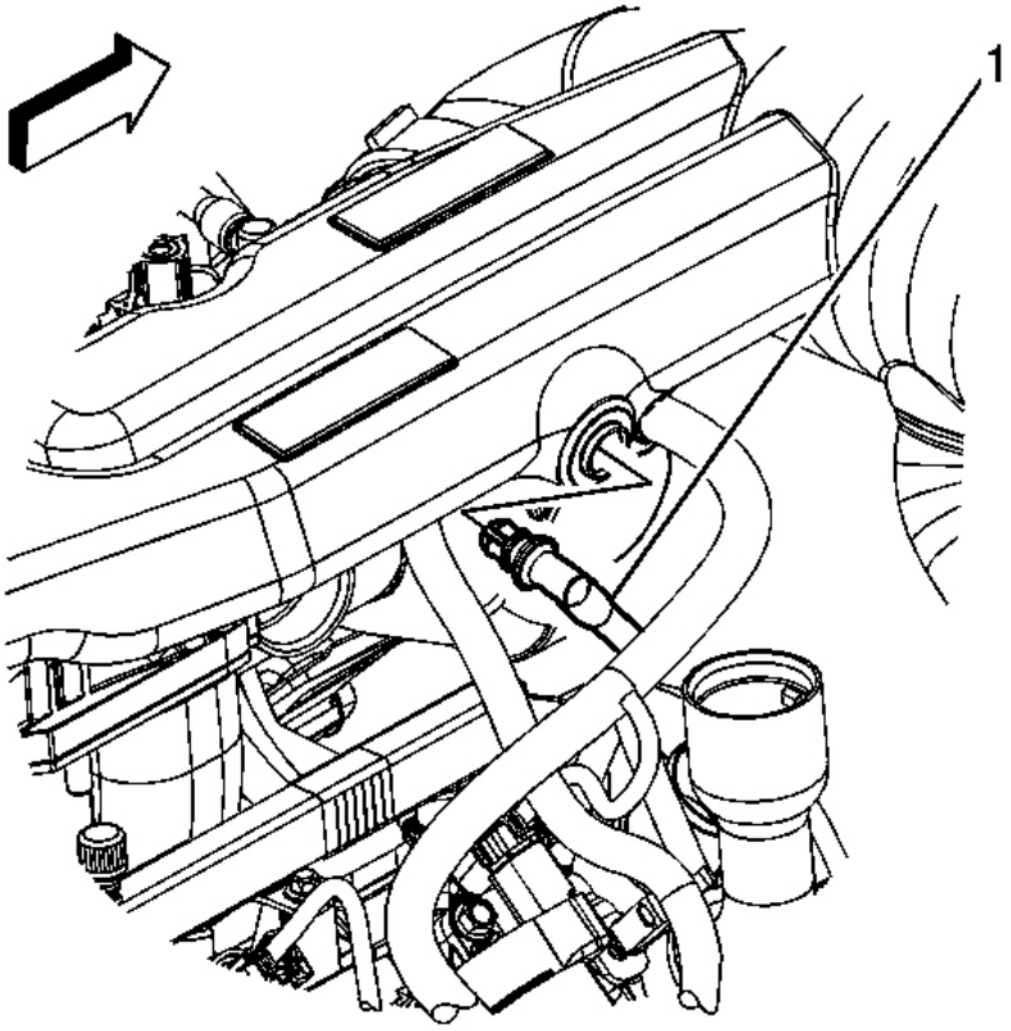


Fig. 65: View Of PCV Tube
Courtesy of GENERAL MOTORS CORP.

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

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

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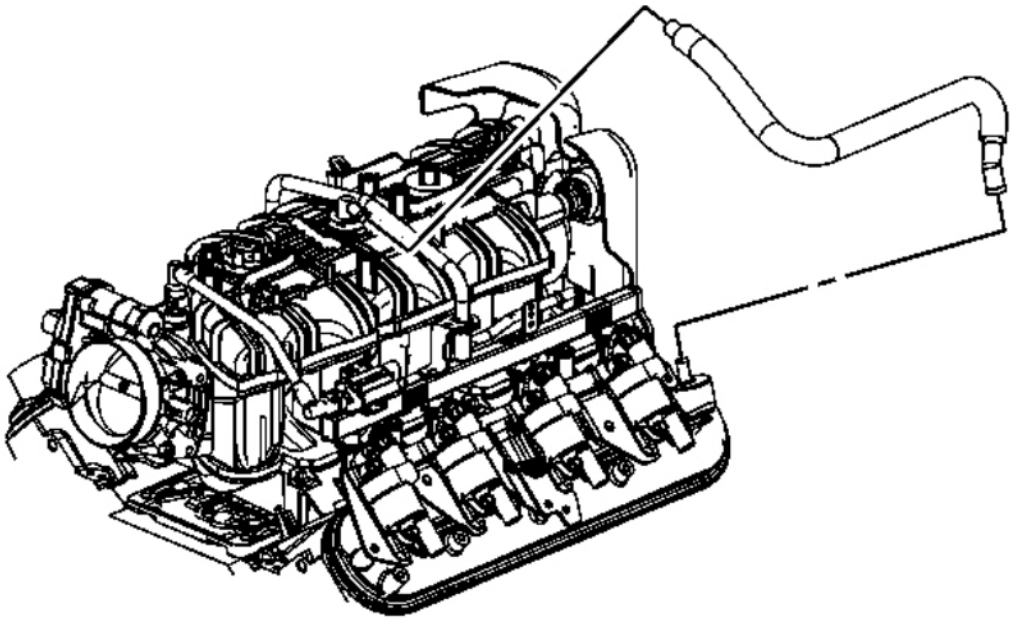


Fig. 66: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

4. Install the PCV 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 (RPOS LC9/LMG/LY5/L76/L92)

REMOVAL PROCEDURE

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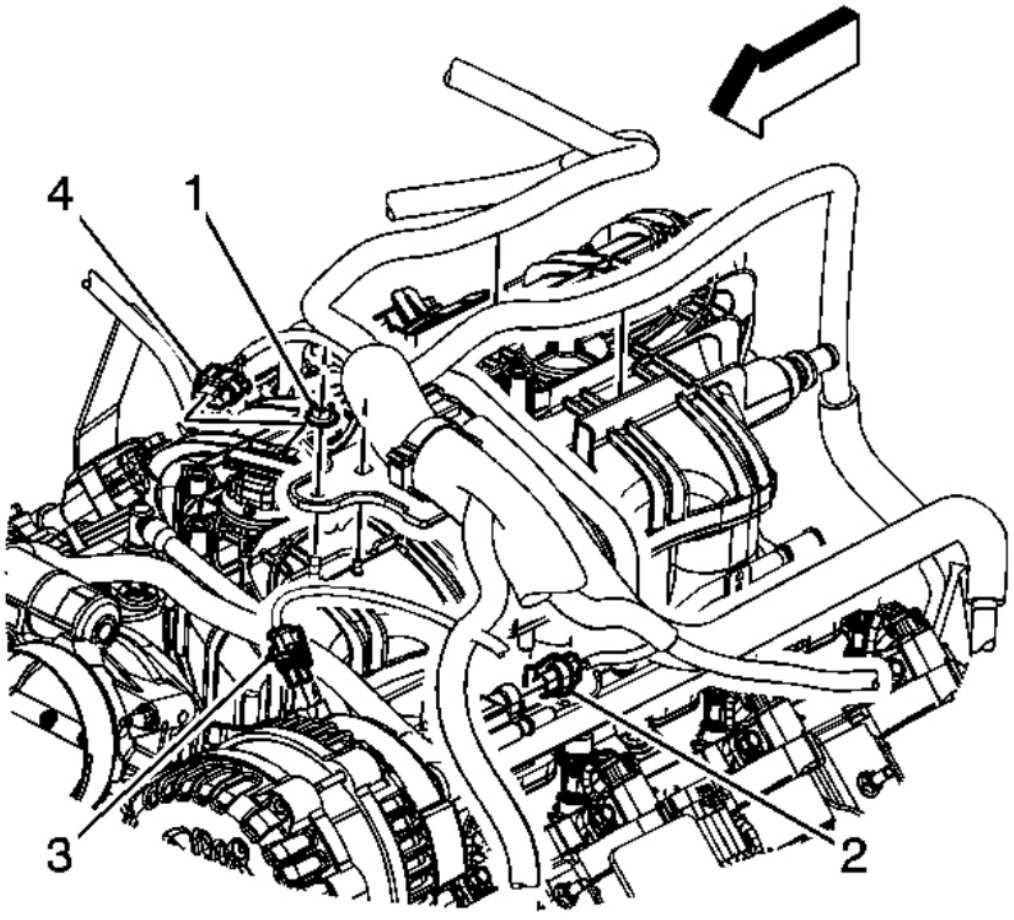


Fig. 67: View Of Engine Harness Retainer Nut & Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
2. Remove the generator. Refer to **Generator Replacement** .
3. Remove the engine harness retainer nut (1).
4. Remove the engine harness retainer from the stud and locator.
5. Disconnect the engine harness electrical connector (2) from the evaporative emission (EVAP) canister purge solenoid.
6. Disconnect the engine wiring harness electrical connector (4) from the manifold absolute pressure (MAP) sensor.

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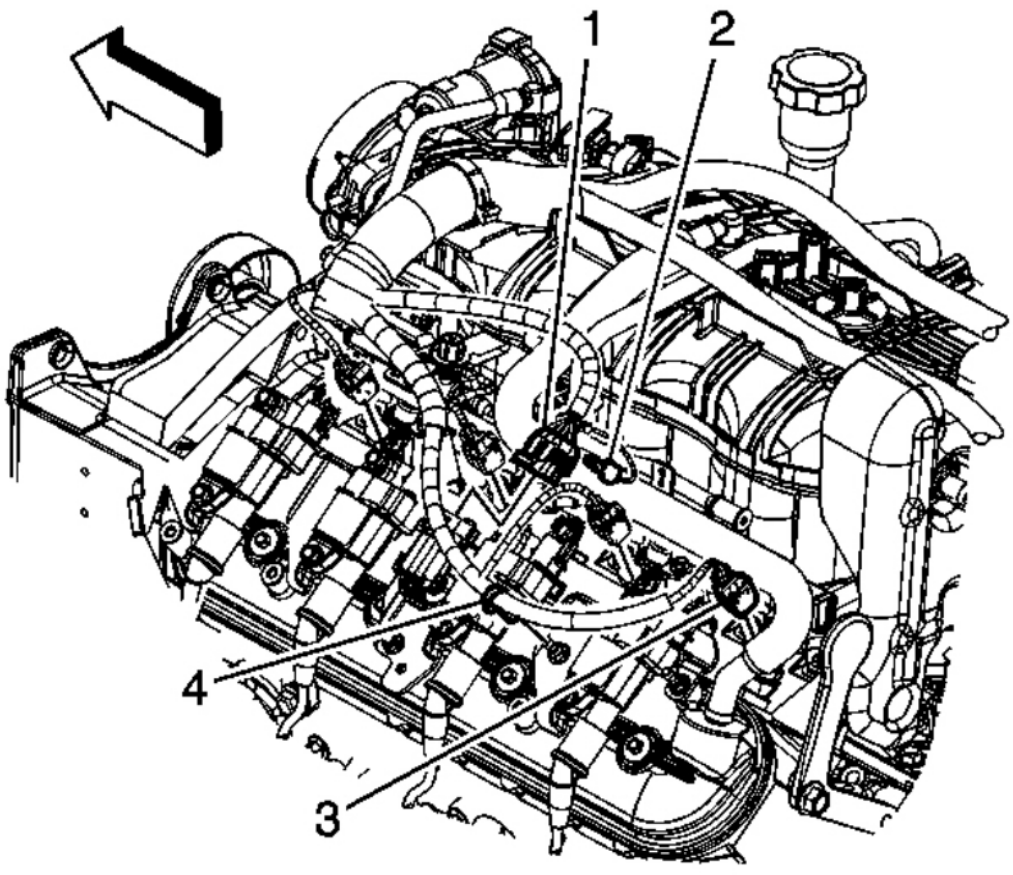


Fig. 68: View Of CPA Retainer, Electrical Connectors & Engine Harness Clips
Courtesy of GENERAL MOTORS CORP.

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

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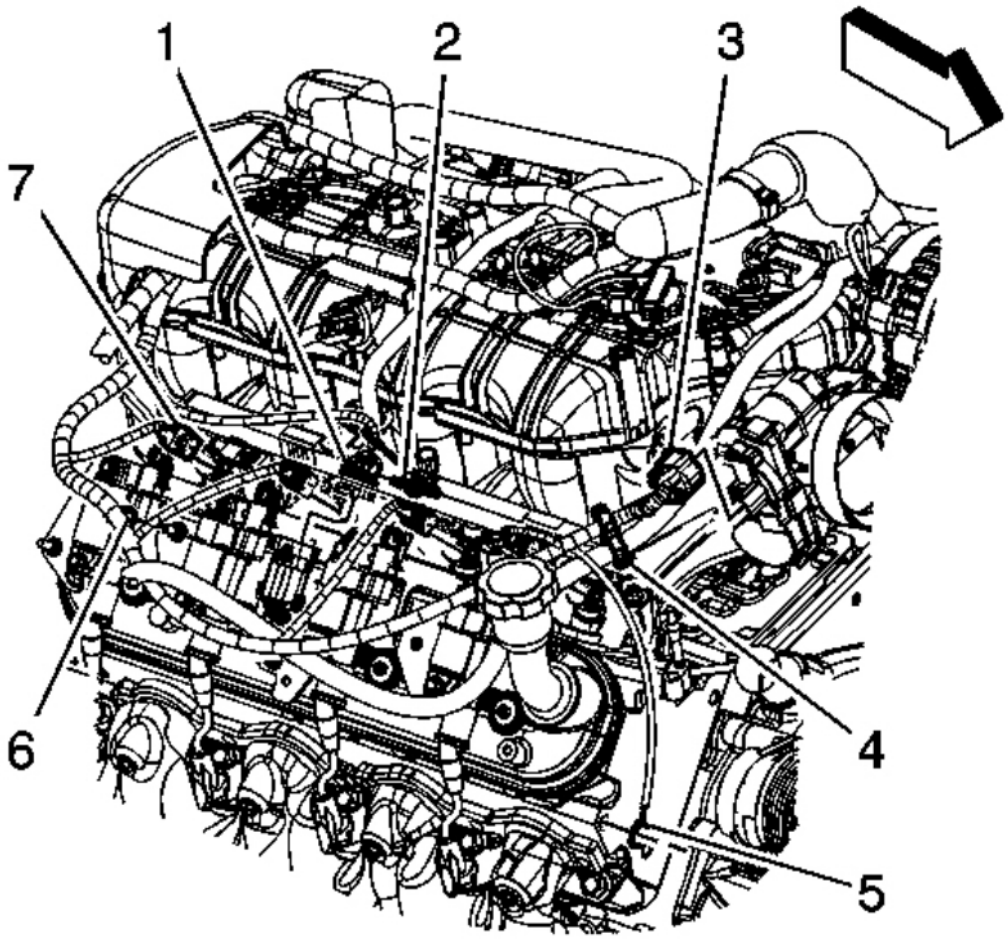


Fig. 69: View Of CPA Retainer, Engine Harness Electrical Connectors & Harness Clips
Courtesy of GENERAL MOTORS CORP.

11. Remove the CPA retainer (2).
12. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
13. Disconnect the engine harness electrical connector (3) from the throttle actuator.
14. Remove the engine harness clip (4) from the generator battery jumper cable.
15. Remove the engine harness clip (6) from the ignition coil bracket stud.
16. Disconnect the engine harness electrical connectors (7) from the right side fuel injectors.

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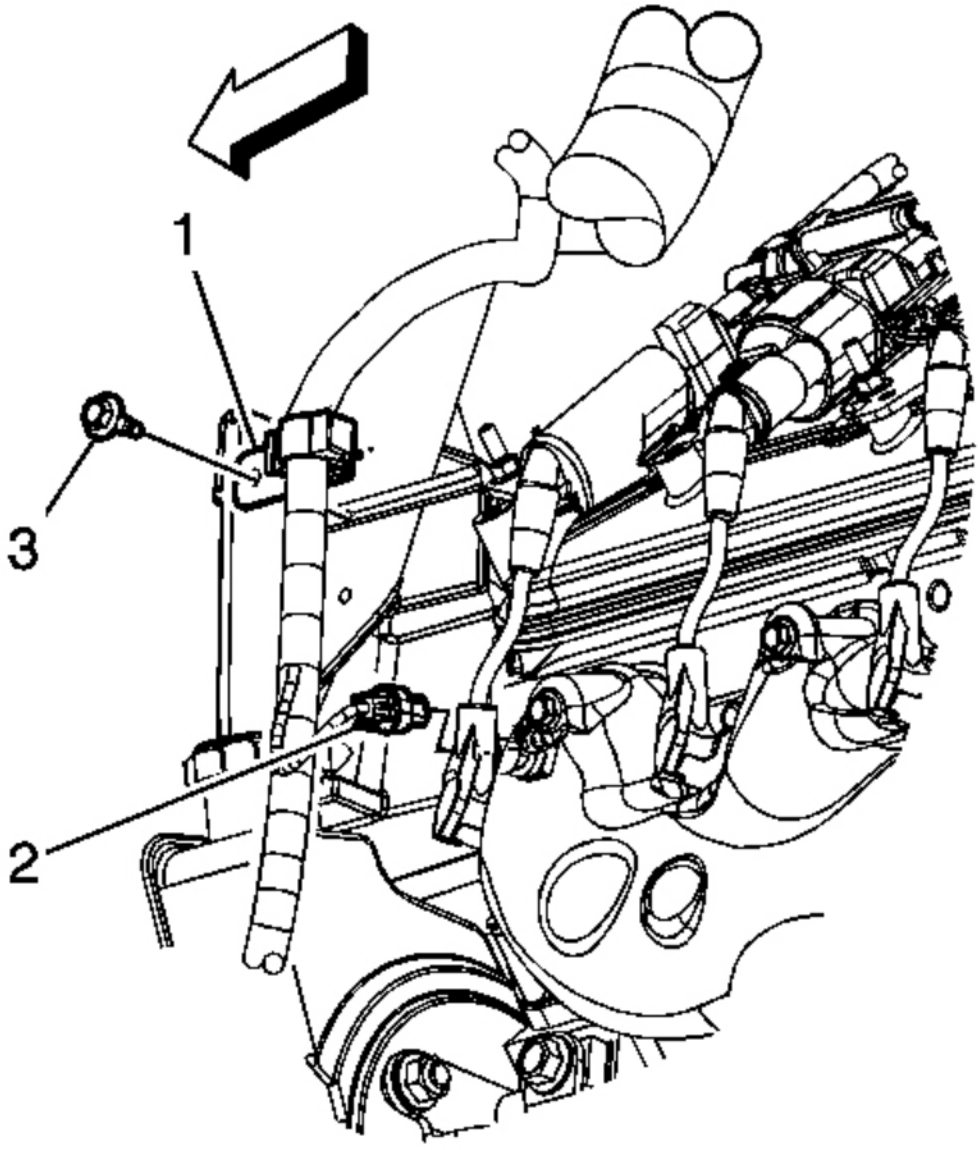


Fig. 70: View Of Engine Wiring Harness, Clip, Bolt & Connector
Courtesy of GENERAL MOTORS CORP.

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. Gather the engine harness branches and tie the harness up out of the way to the cowl panel.

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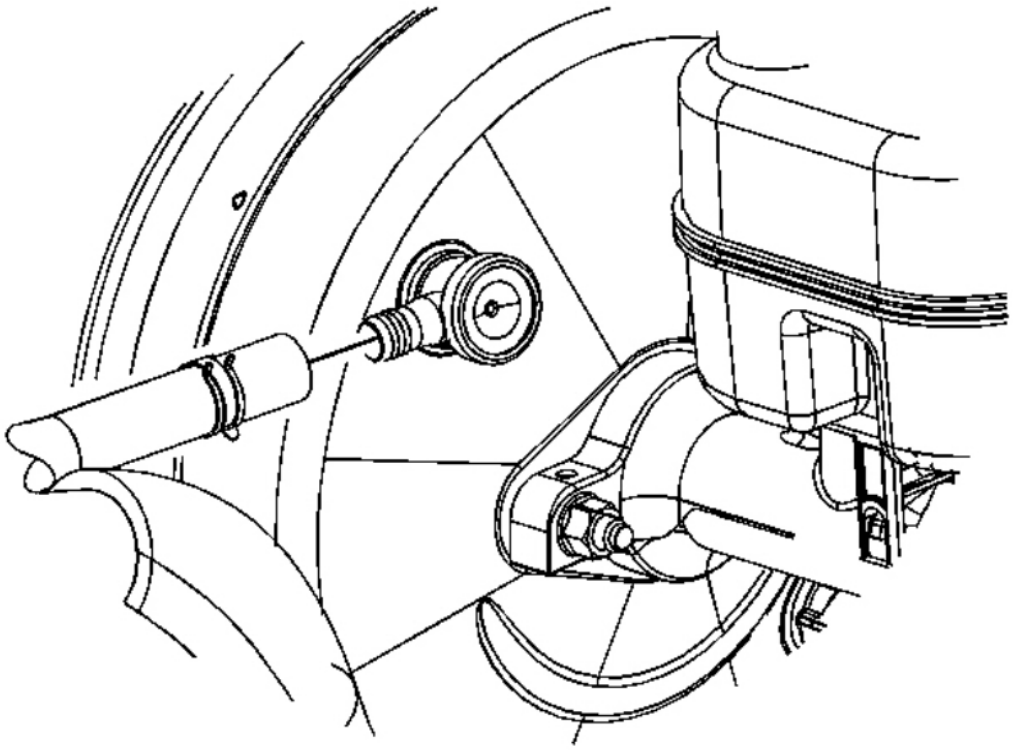


Fig. 71: View Of Brake Booster Vacuum Hose & Booster Fitting
Courtesy of GENERAL MOTORS CORP.

20. Reposition the brake booster vacuum hose clamp at the booster.
21. Remove the brake booster vacuum hose from the booster fitting.
22. Secure the brake booster vacuum hose to the intake manifold.

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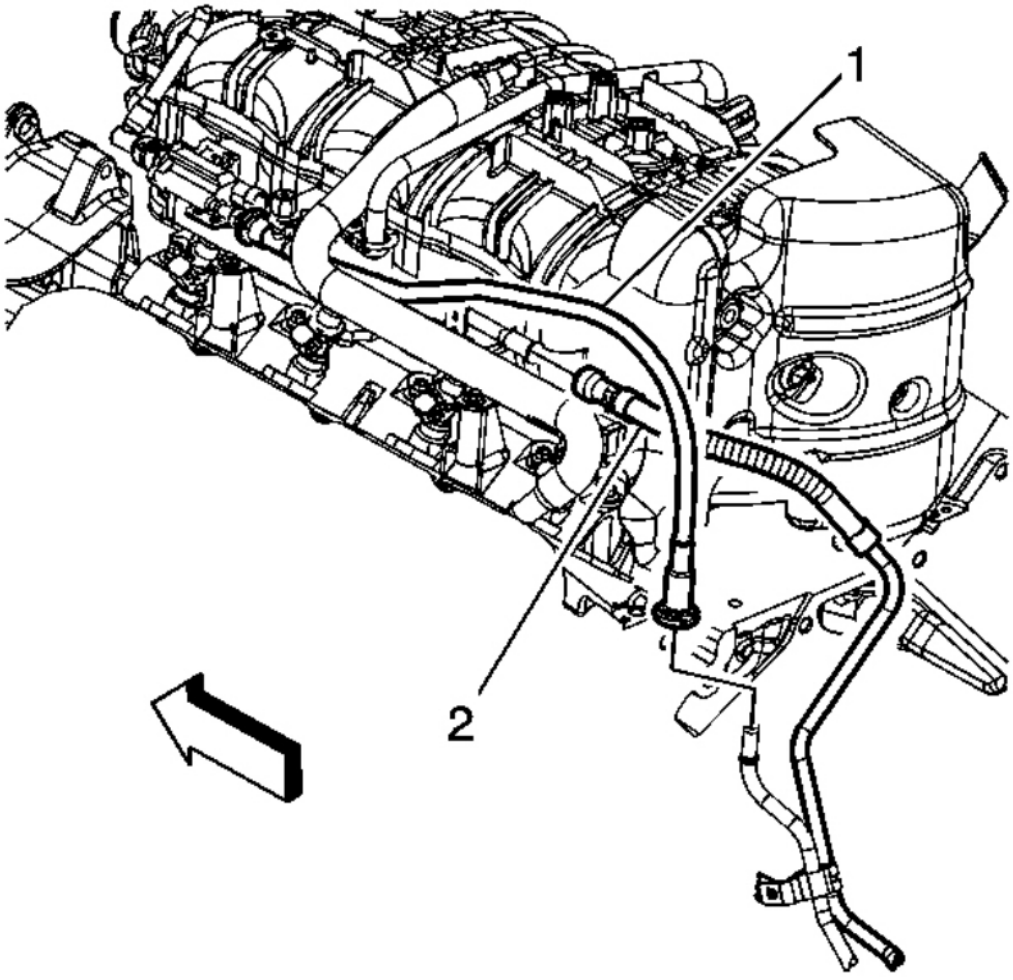


Fig. 72: View Of EVAP Canister Purge Tube & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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

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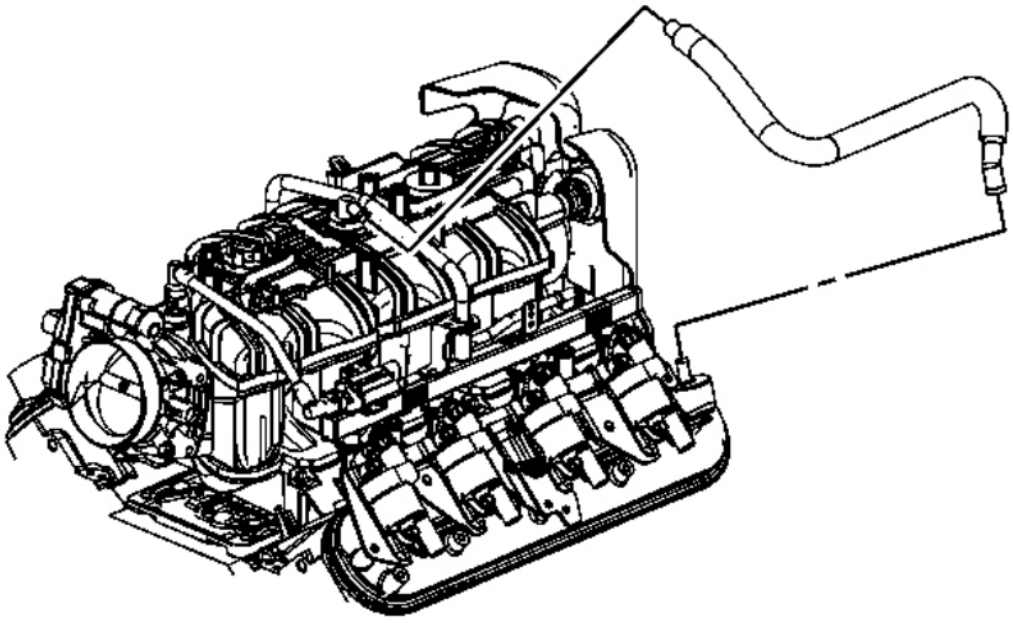


Fig. 73: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

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

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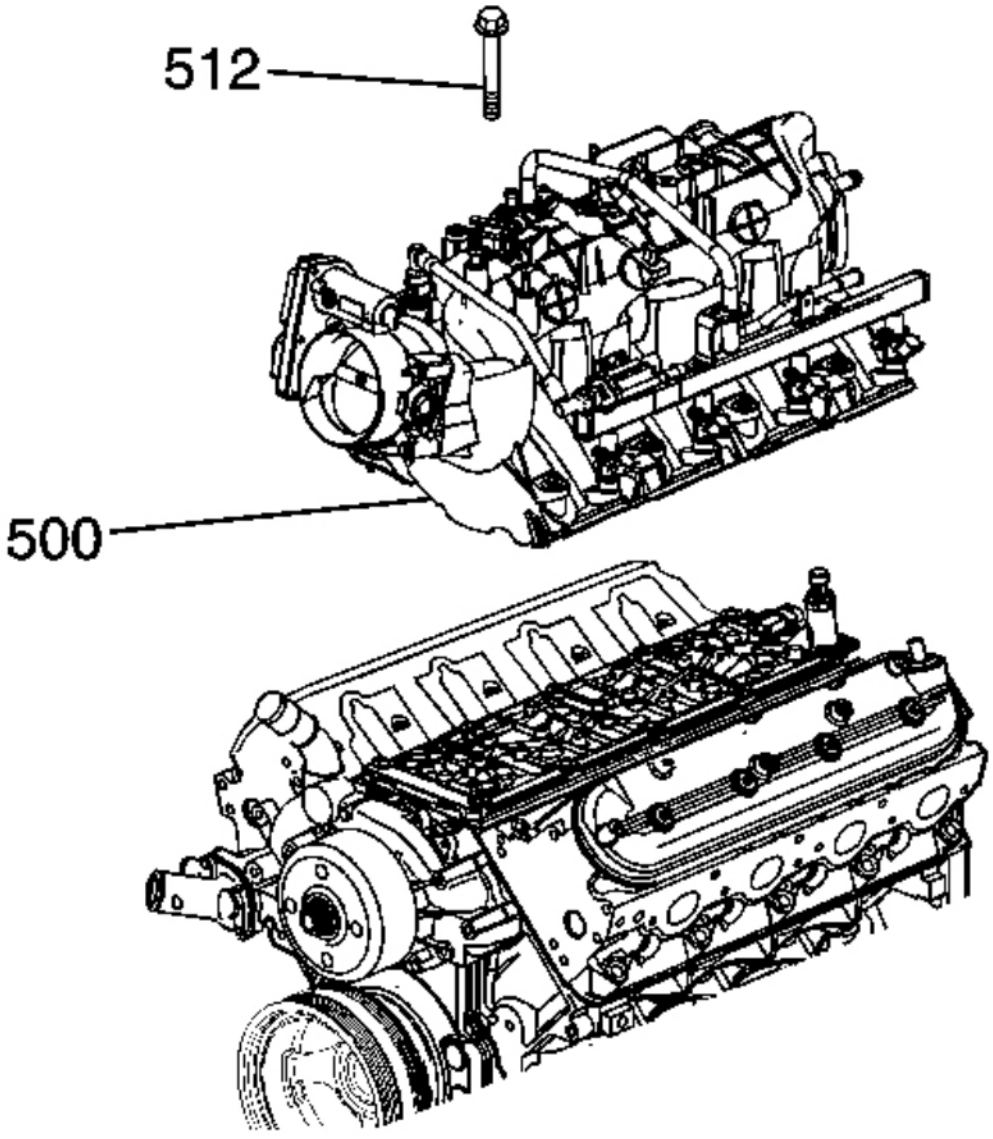


Fig. 74: View Of Intake Manifold
Courtesy of GENERAL MOTORS CORP.

26. Loosen the intake manifold bolts.
27. Remove the intake manifold (500).

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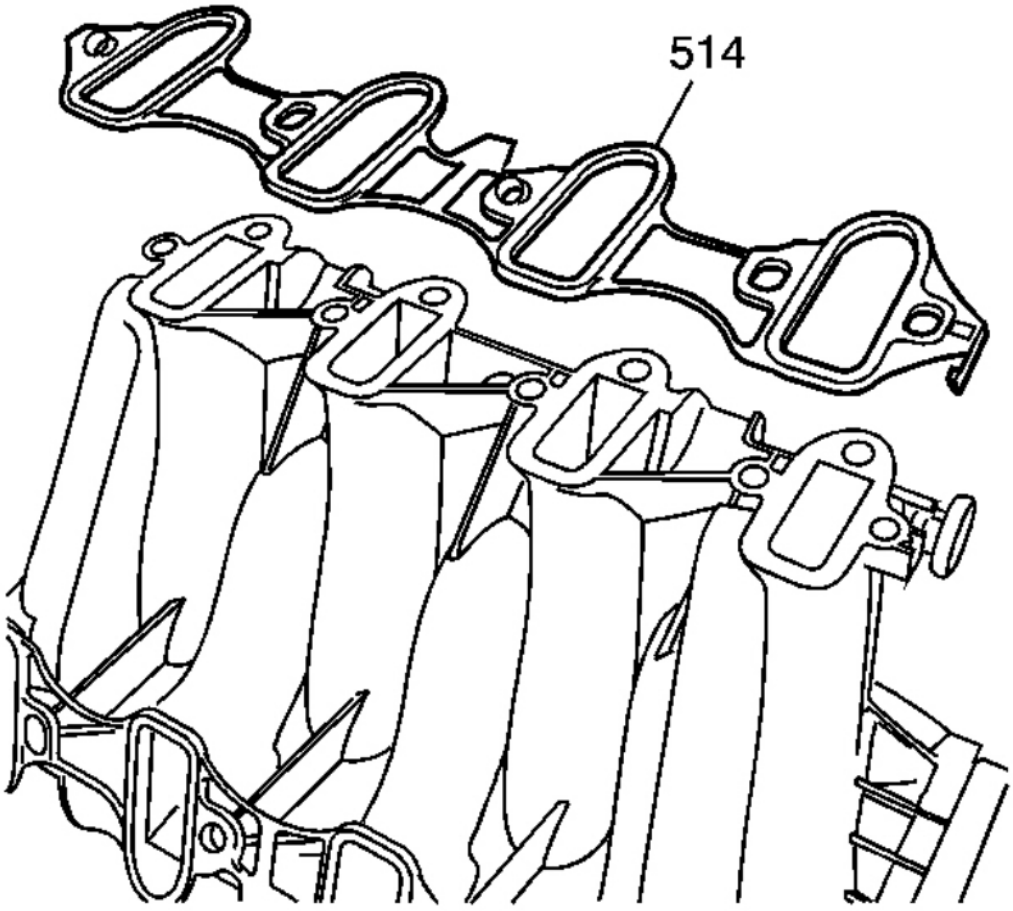


Fig. 75: View Of Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

28. Remove and discard the intake manifold gaskets (514).
29. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.

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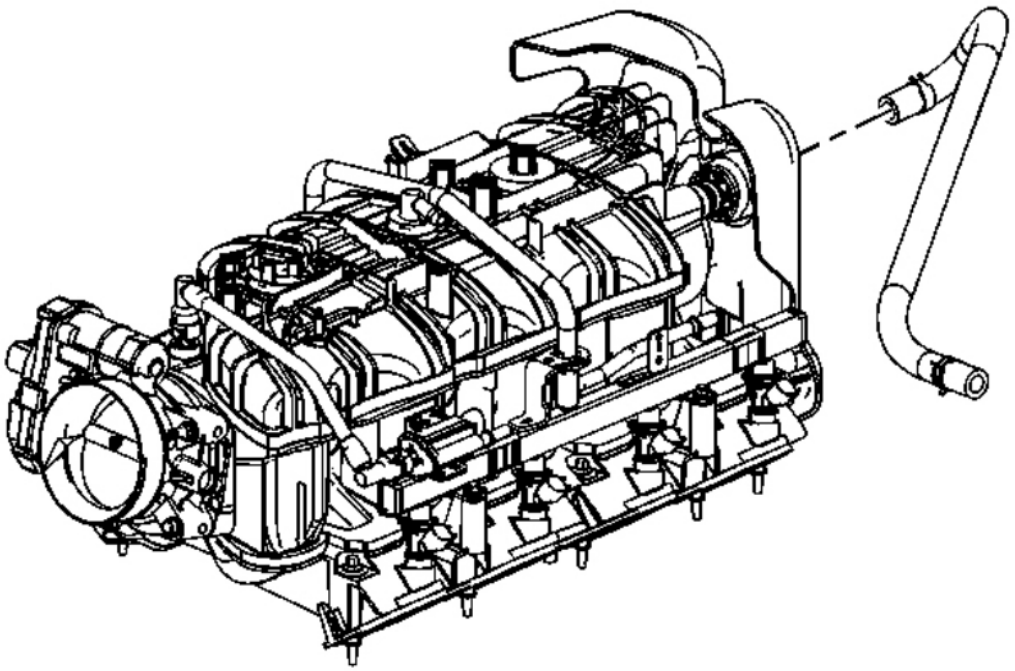


Fig. 76: View Of Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

30. If replacing the intake manifold, perform the following steps, otherwise proceed to step 21 of the installation procedure.
31. Place the intake manifold on a clean work surface.
32. Reposition the brake booster vacuum hose clamp at the intake manifold.
33. Remove the brake booster vacuum hose from the intake manifold nipple.

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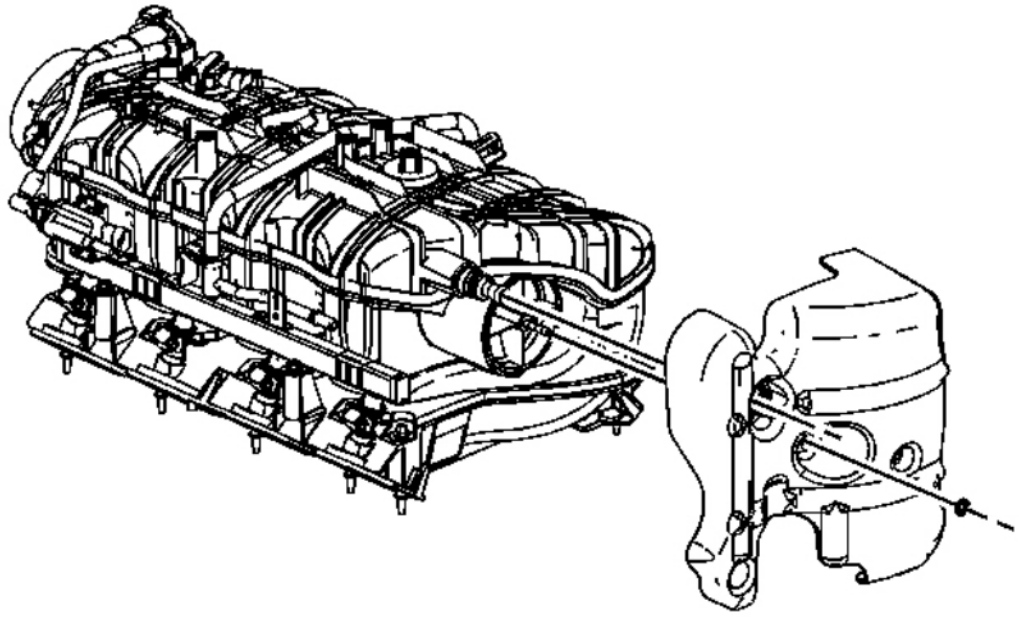


Fig. 77: View Of Upper Intake Manifold Cover & Nut
Courtesy of GENERAL MOTORS CORP.

34. Remove the upper intake manifold cover nut.
35. Remove the upper intake manifold cover.

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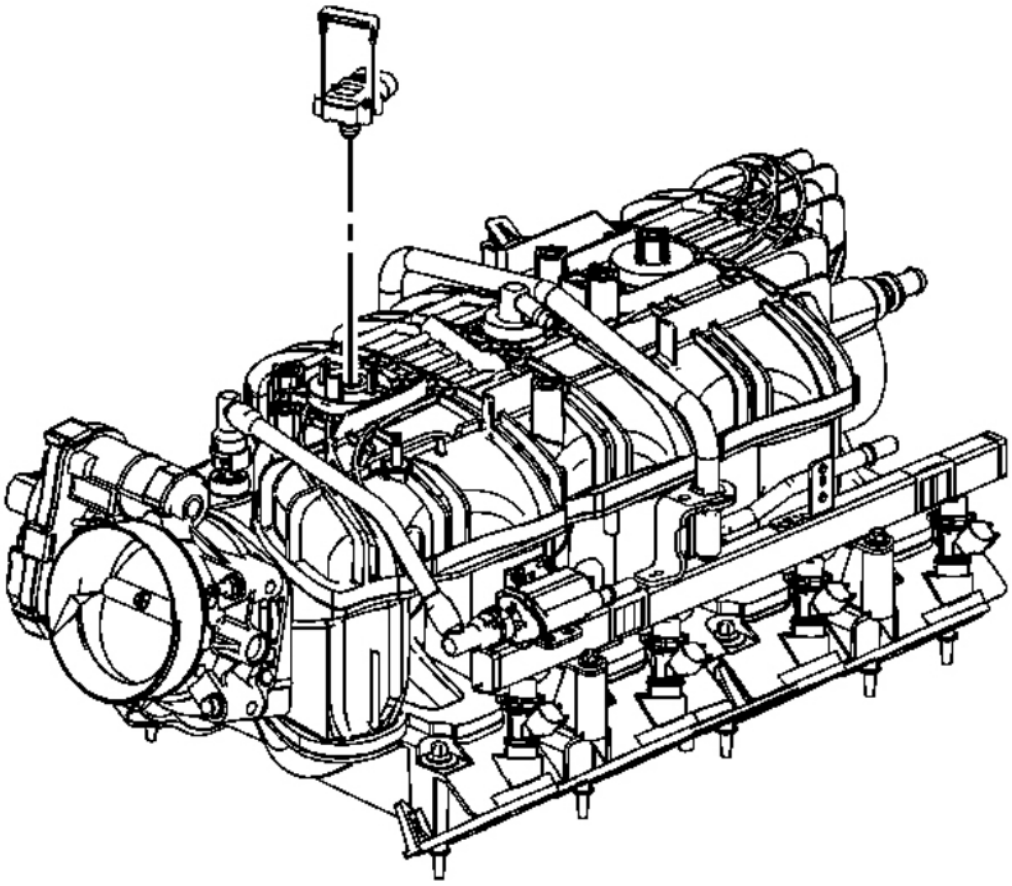


Fig. 78: View Of MAP Sensor & Retainer
Courtesy of GENERAL MOTORS CORP.

36. Remove the manifold absolute pressure (MAP) sensor retainer.
37. Remove the MAP sensor.

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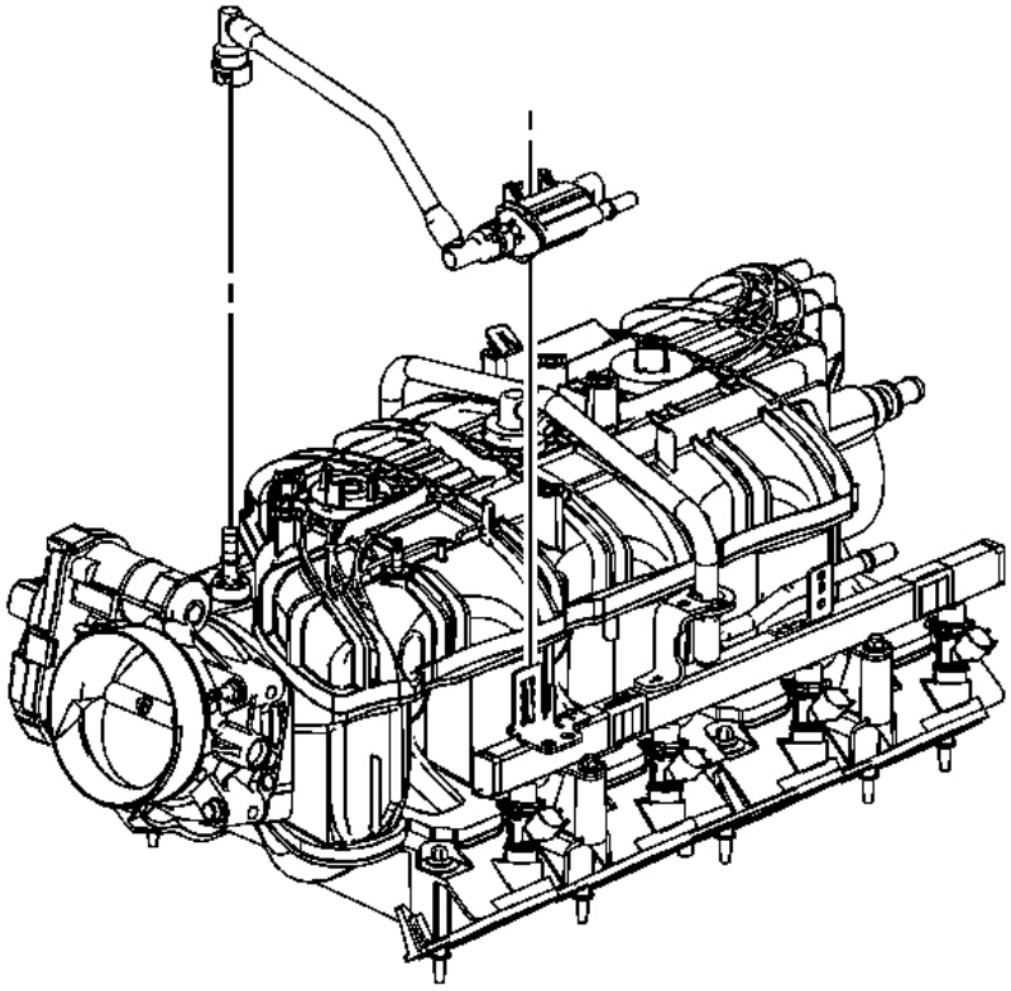


Fig. 79: View Of EVAP Tube & Purge Solenoid
Courtesy of GENERAL MOTORS CORP.

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

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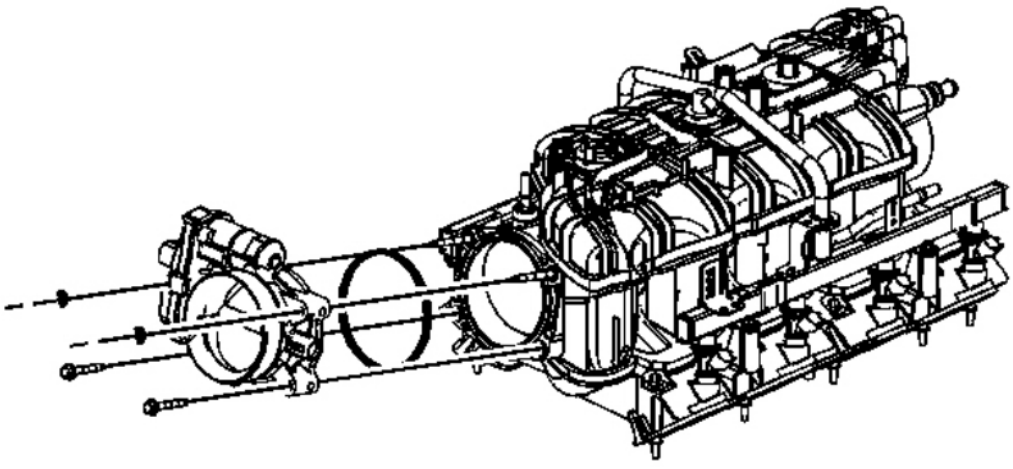


Fig. 80: View Of Throttle Body, Gasket & Bolts/Nuts
Courtesy of GENERAL MOTORS CORP.

41. Remove the throttle body bolts/nuts.
42. Remove the throttle body.
43. Remove and discard the throttle body gasket.

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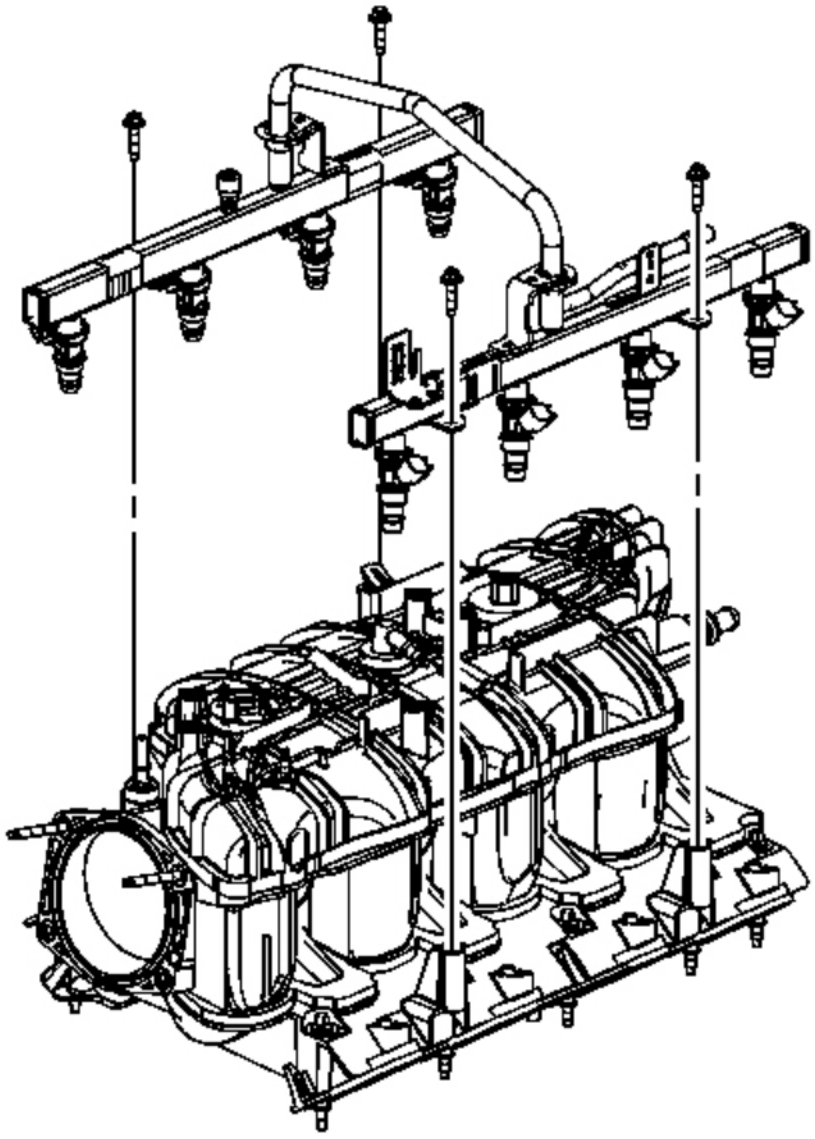


Fig. 81: View Of Fuel Rail & Bolts
Courtesy of GENERAL MOTORS CORP.

44. Remove the fuel rail bolts.

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

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45. Remove the fuel rail.
46. Remove and discard the fuel injector lower O-ring seals.

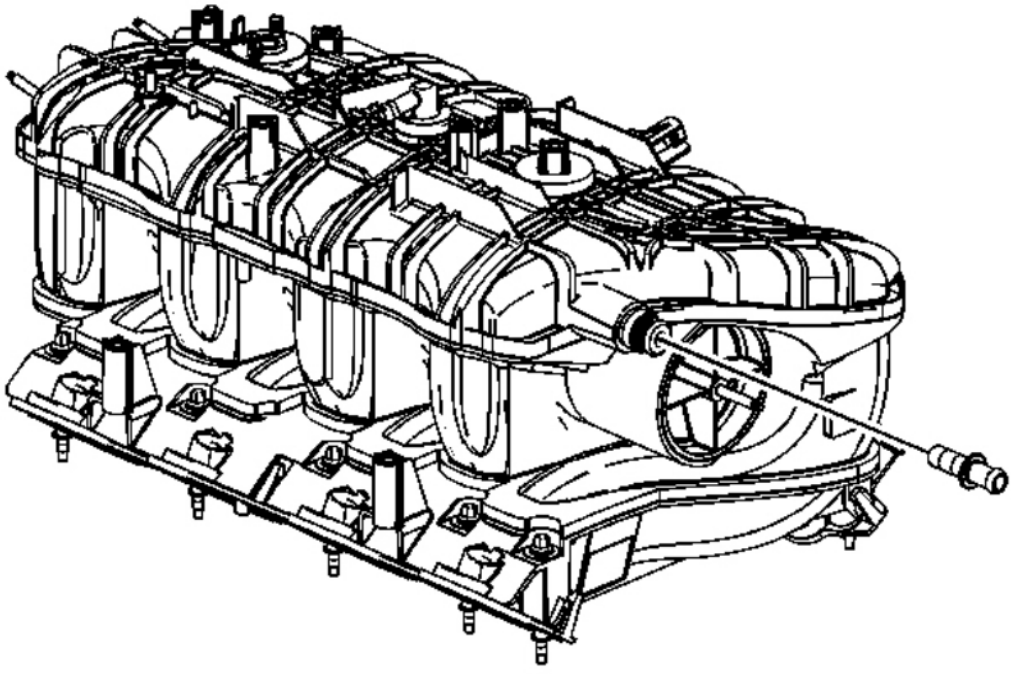


Fig. 82: View Of Brake Booster Vacuum Hose Nipple
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Evenly push in the RED collar in order to remove the nipple.

47. Remove the brake booster vacuum hose nipple.

INSTALLATION PROCEDURE

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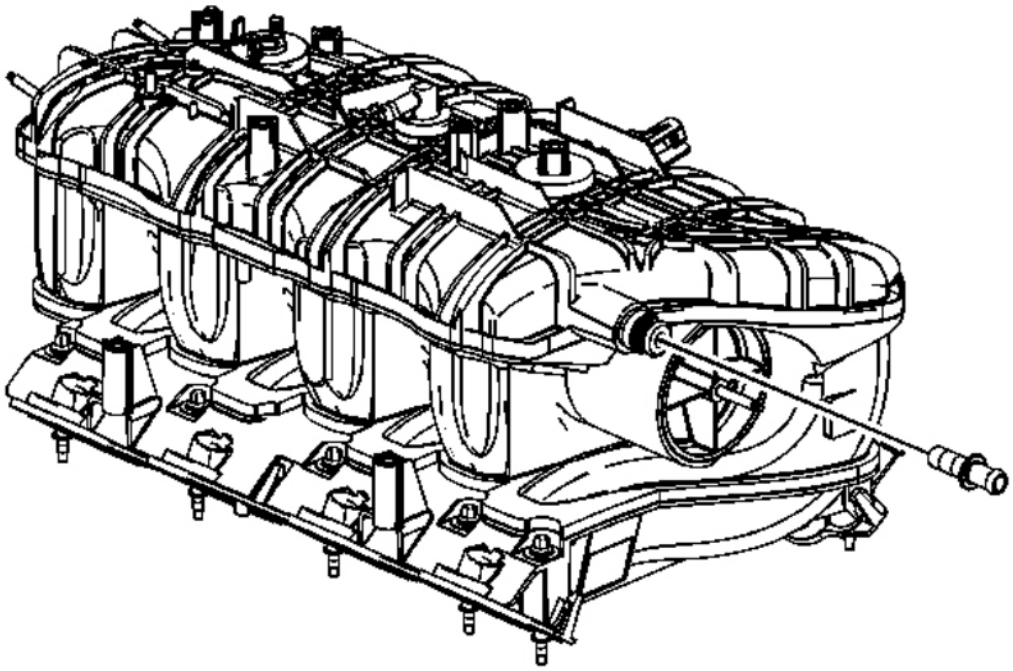


Fig. 83: View Of Brake Booster Vacuum Hose Nipple
Courtesy of GENERAL MOTORS CORP.

1. If the intake manifold was replaced perform the following steps, otherwise proceed to step 21.

IMPORTANT: Evenly push in the RED collar in order to install the nipple.

2. Install the brake booster vacuum hose nipple to the NEW intake manifold.

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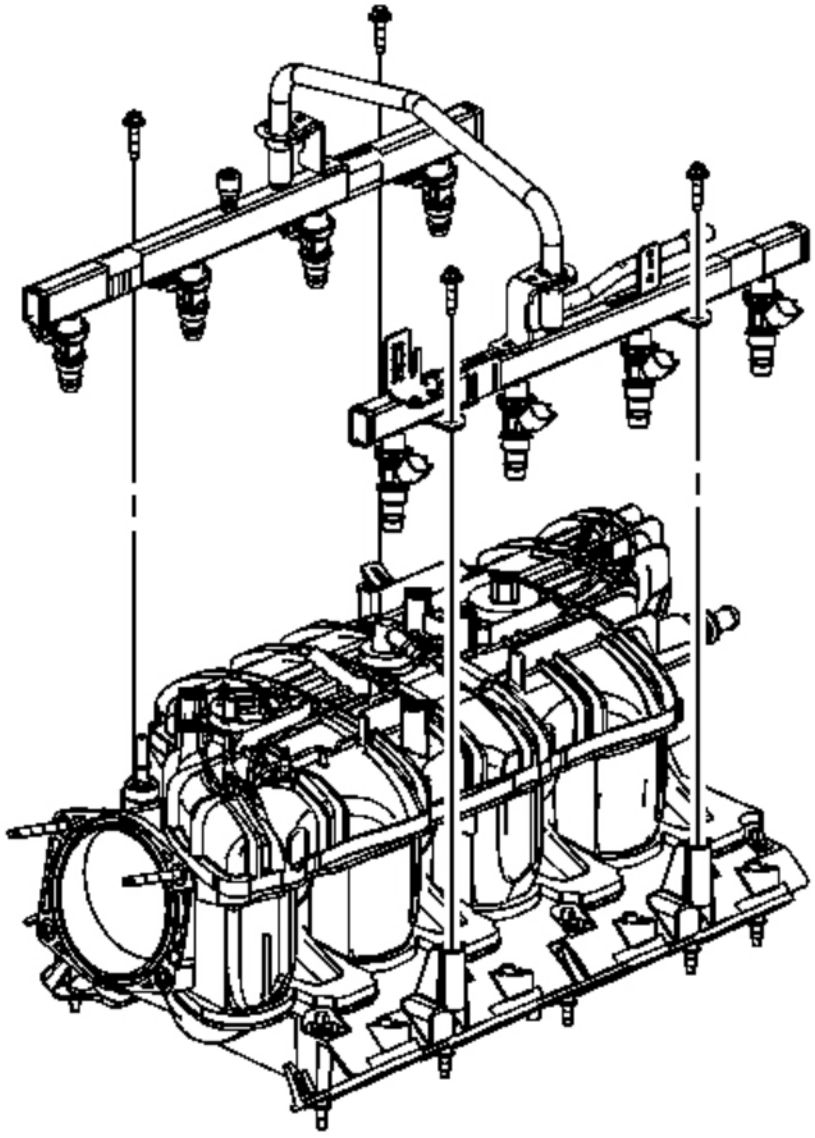


Fig. 84: View Of Fuel Rail & Bolts
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: Push down firmly on both sides of the rail until all the injectors have been

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seated into their bores.

5. Install the fuel rail.

NOTE: **Refer to Fastener Notice .**

6. Install the fuel rail bolts.

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

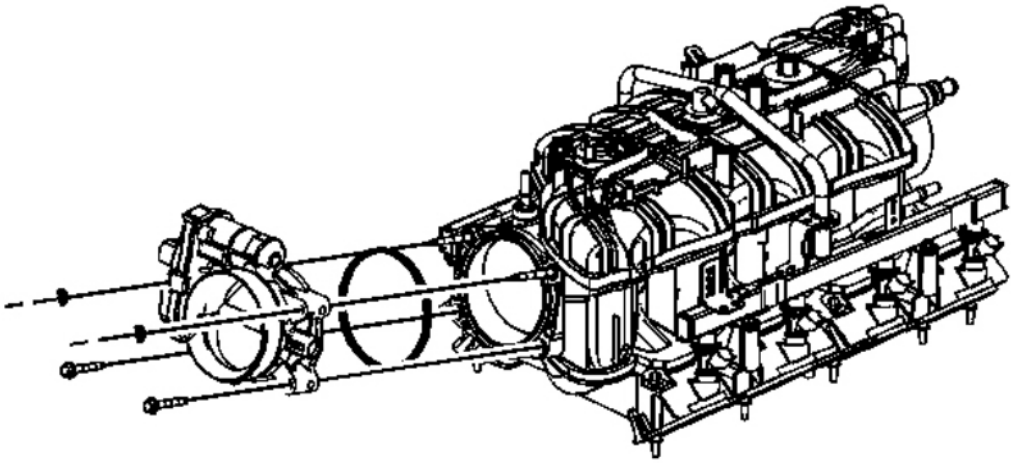


Fig. 85: View Of Throttle Body, Gasket & Bolts/Nuts
Courtesy of GENERAL MOTORS CORP.

7. Install a NEW throttle body gasket to the intake manifold.
8. Install the throttle body.
9. Install the throttle body bolts/nuts.

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

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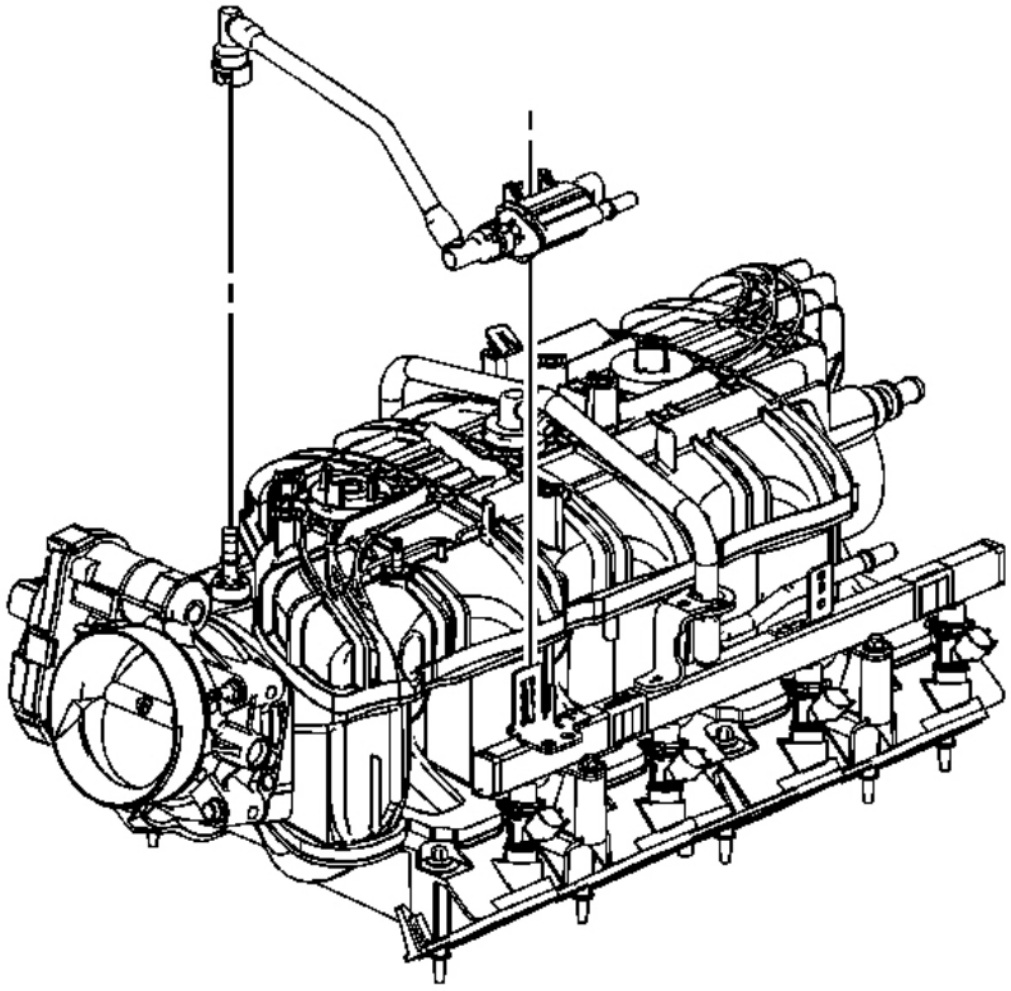


Fig. 86: View Of EVAP Tube & Purge Solenoid
Courtesy of GENERAL MOTORS CORP.

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

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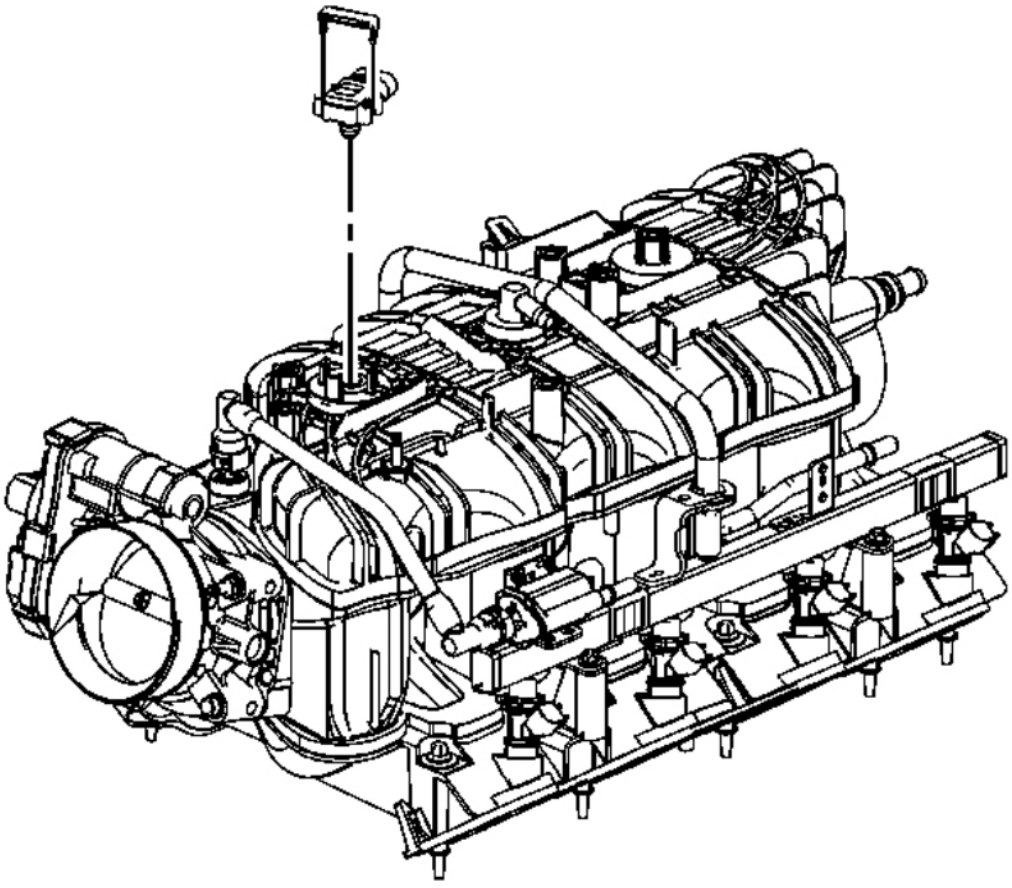


Fig. 87: View Of MAP Sensor & Retainer
Courtesy of GENERAL MOTORS CORP.

13. Lubricate the MAP sensor seal with clean engine oil.
14. Install the MAP sensor.
15. Install the MAP sensor retainer.

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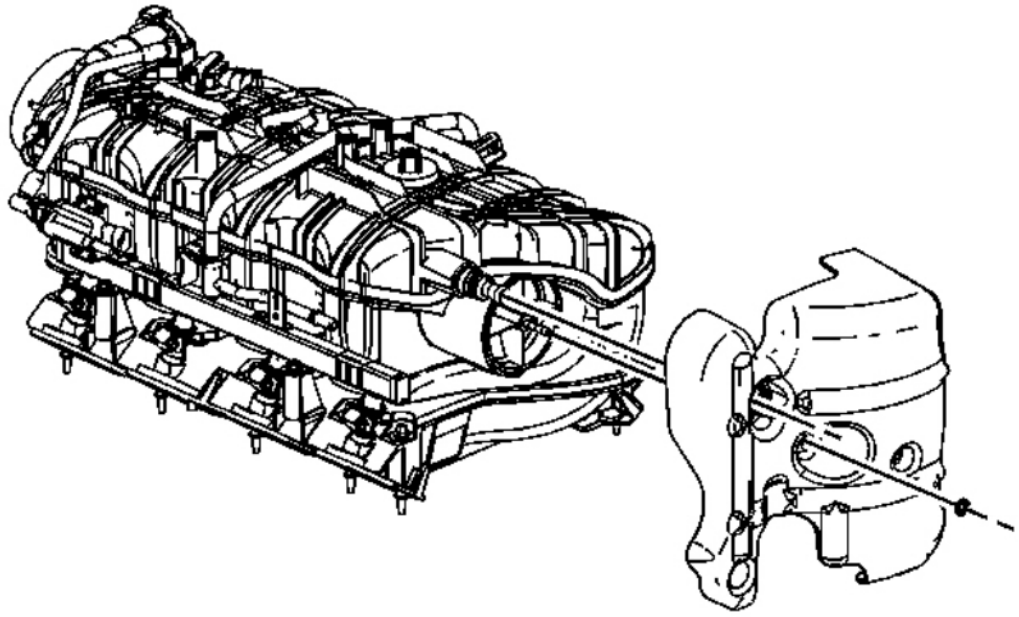


Fig. 88: View Of Upper Intake Manifold Cover & Nut
Courtesy of GENERAL MOTORS CORP.

16. Install the upper intake manifold cover.
17. Install the upper intake manifold cover nut until snug

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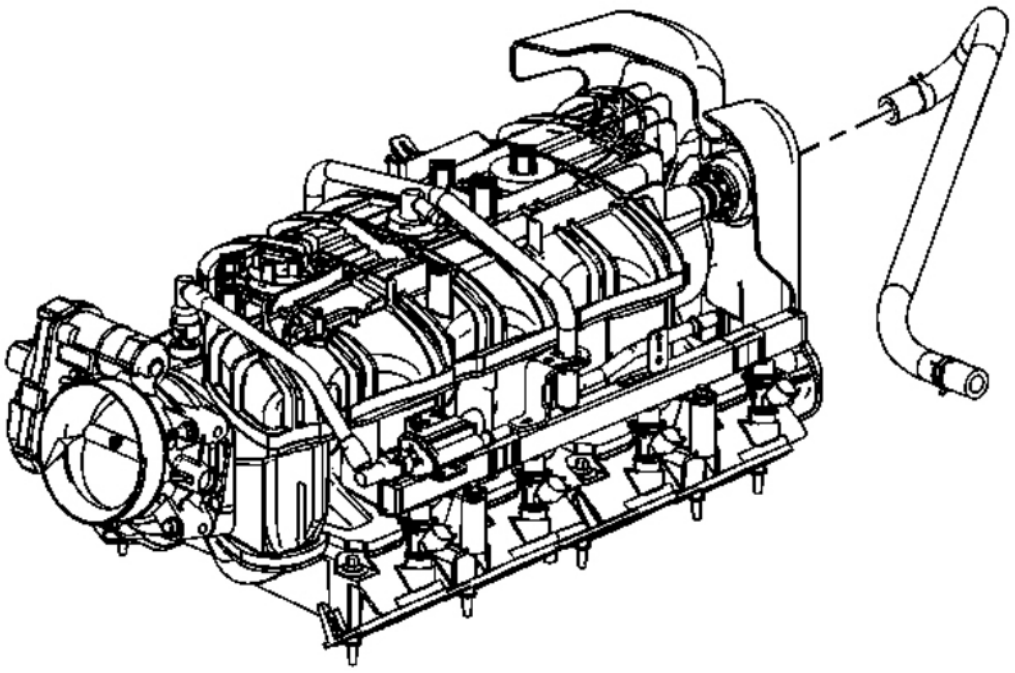


Fig. 89: View Of Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

18. Install the brake booster vacuum hose to the intake manifold nipple.
19. Position the brake booster vacuum hose clamp at the intake manifold.
20. Secure the brake booster vacuum hose to the intake manifold.

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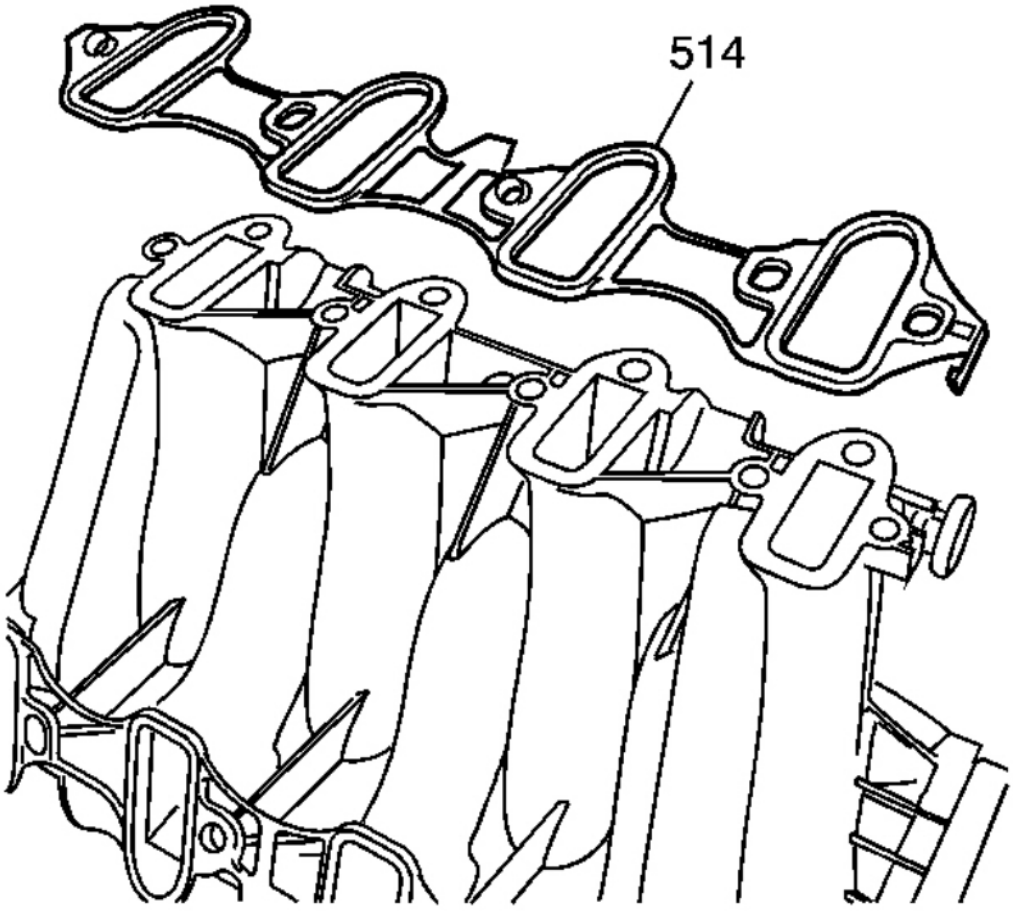


Fig. 90: View Of Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

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

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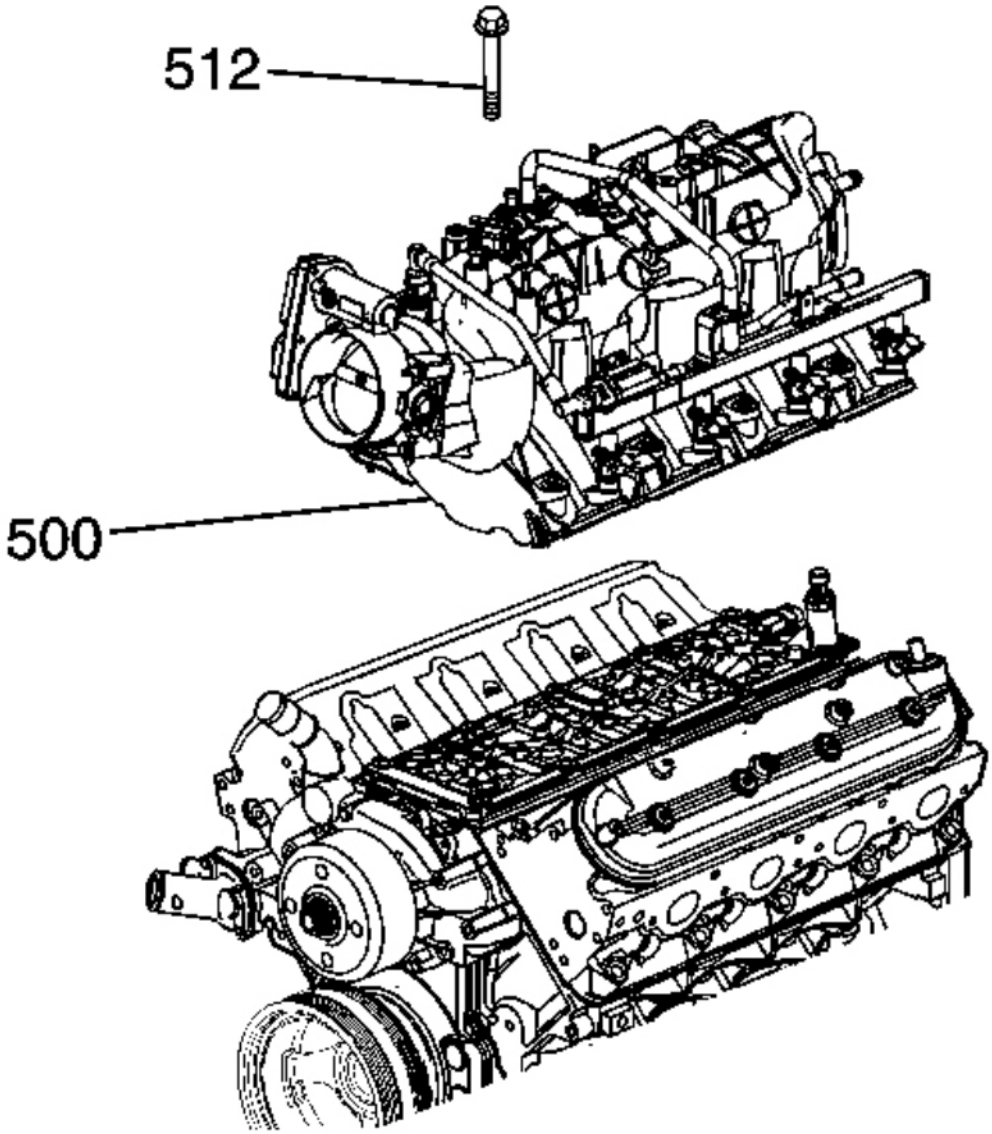


Fig. 91: View Of Intake Manifold
Courtesy of GENERAL MOTORS CORP.

23. Install the intake manifold (500).

IMPORTANT: 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

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against the engine harness.

24. Tighten the intake manifold bolts (512) until snug.

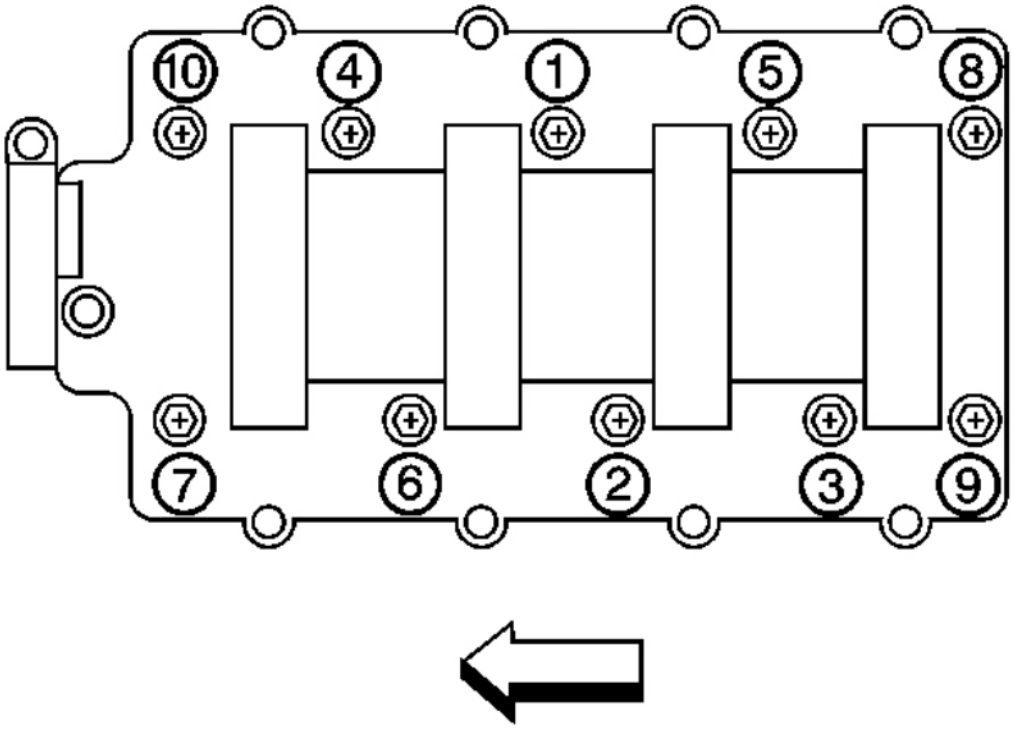


Fig. 92: Identifying Intake Manifold Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

25. 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).

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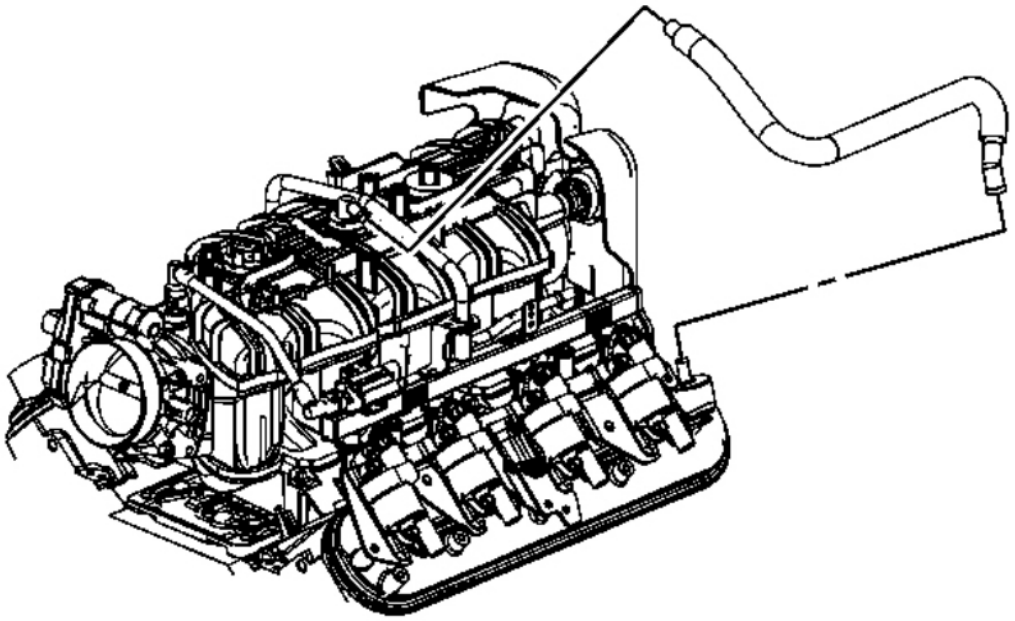


Fig. 93: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

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

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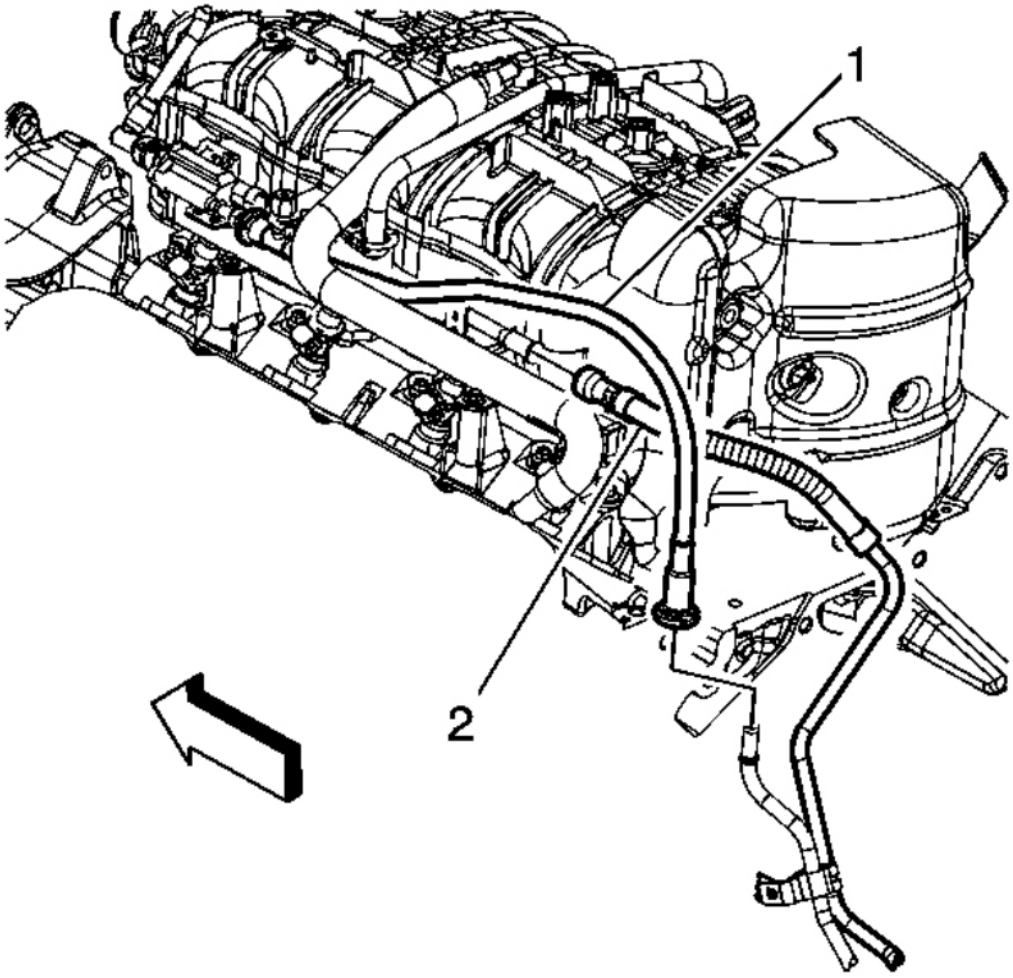


Fig. 94: View Of EVAP Canister Purge Tube & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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

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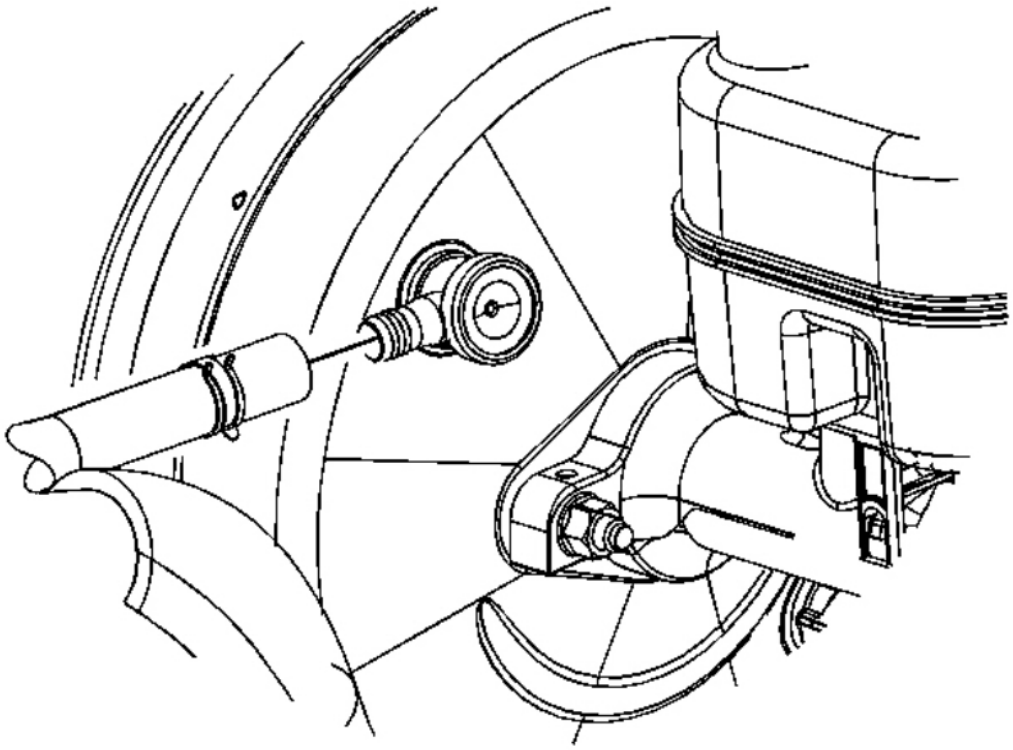


Fig. 95: View Of Brake Booster Vacuum Hose & Booster Fitting
Courtesy of GENERAL MOTORS CORP.

29. Unsecure the brake booster vacuum hose from the intake manifold.
30. Install the brake booster vacuum hose to the booster fitting.
31. Position the brake booster vacuum hose clamp at the booster.

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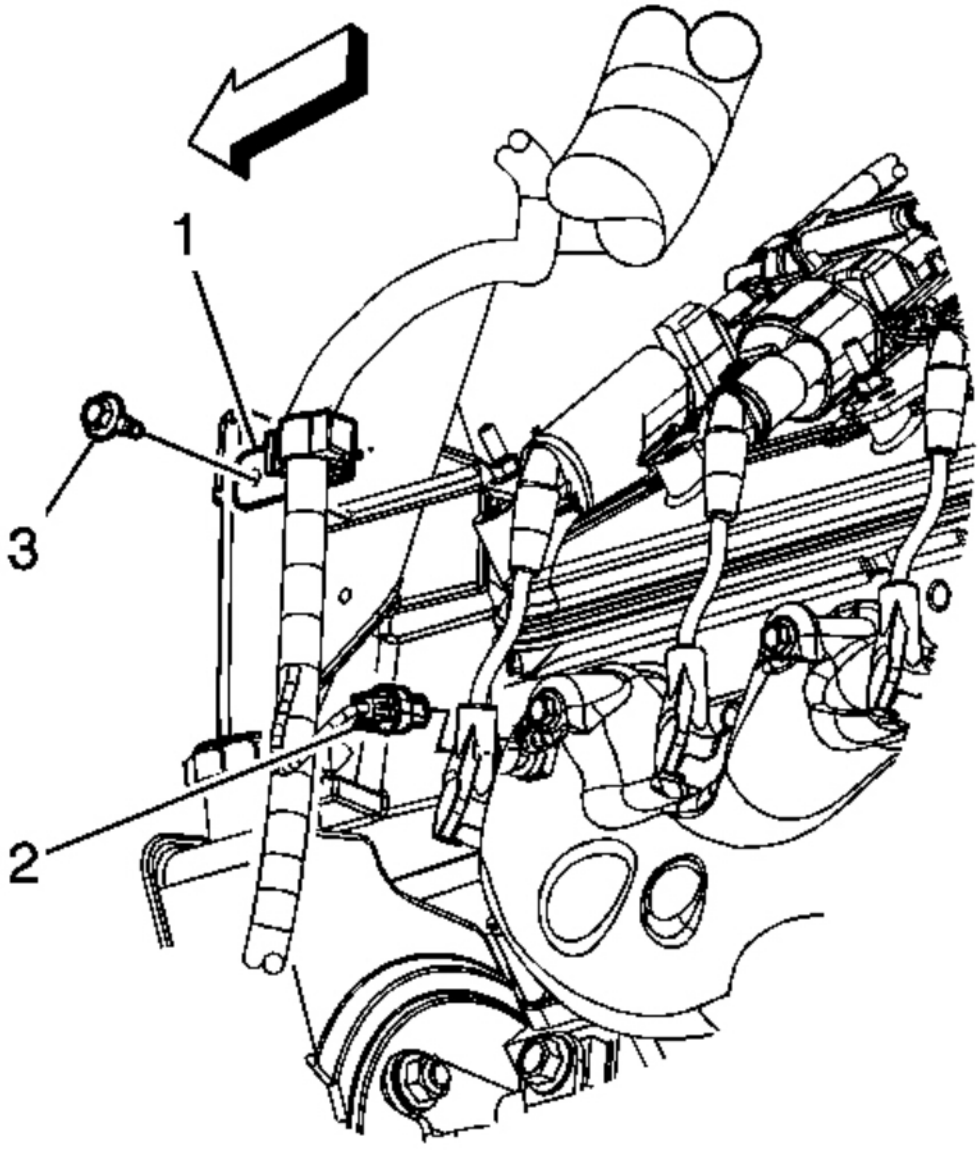


Fig. 96: View Of Engine Wiring Harness, Clip, Bolt & Connector
Courtesy of GENERAL MOTORS CORP.

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

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

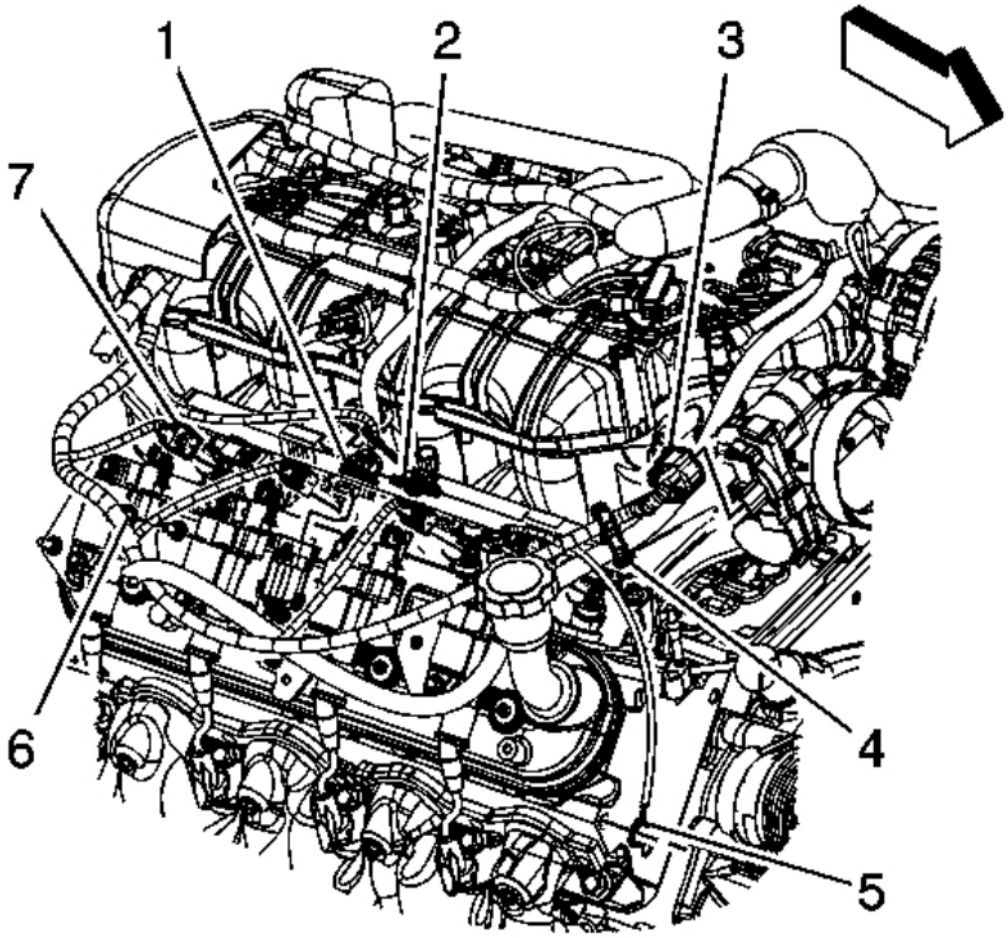


Fig. 97: View Of CPA Retainer, Engine Harness Electrical Connectors & Harness Clips
Courtesy of GENERAL MOTORS CORP.

35. Connect the engine harness electrical connectors (7) to the right side fuel injectors.
36. Install the engine harness clip (6) to the ignition coil bracket stud.
37. Install the engine harness clip (4) to the generator battery jumper cable.
38. Connect the engine harness electrical connector (3) to the throttle actuator.
39. Connect the engine harness electrical connector (1) to the ignition coil harness electrical connector.
40. Install the CPA retainer (2).

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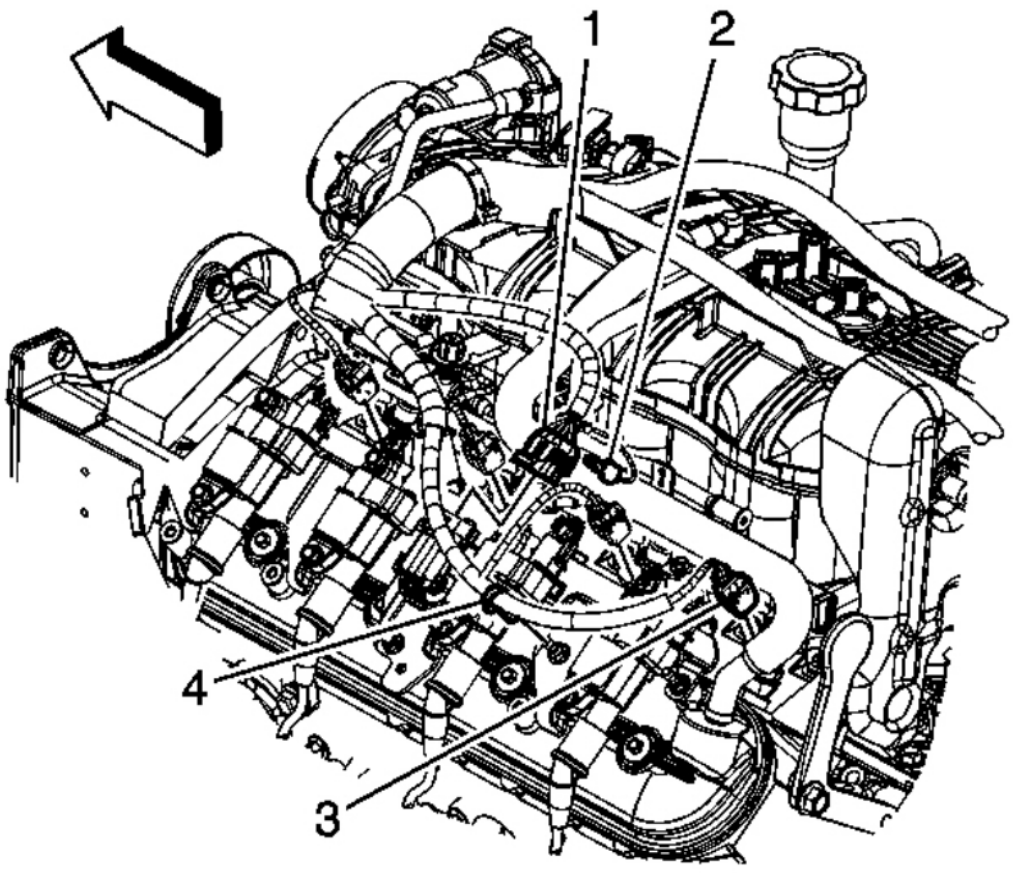


Fig. 98: View Of CPA Retainer, Electrical Connectors & Engine Harness Clips
Courtesy of GENERAL MOTORS CORP.

41. Install the engine harness clip (4) to the ignition coil bracket stud.
42. Connect the engine harness electrical connectors (3) to the left side fuel injectors.
43. Connect the engine harness electrical connector (1) to the ignition coil harness electrical connector.
44. Install the CPA retainer (1).

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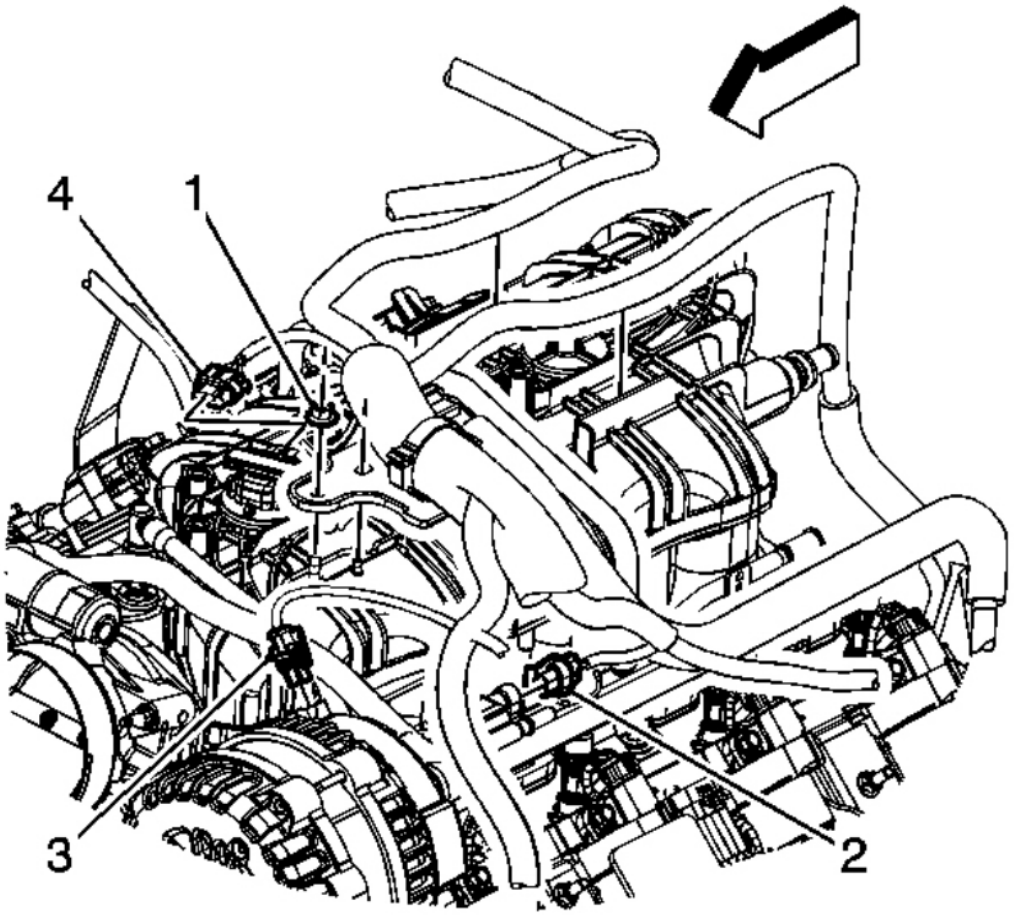


Fig. 99: View Of Generator & Related Connectors
Courtesy of GENERAL MOTORS CORP.

45. Connect the engine wiring harness electrical connector (4) to the MAP sensor.
46. Connect the engine harness electrical connector (2) to the EVAP canister purge solenoid.
47. Install the engine harness retainer to the stud and locator pin.
48. Install the engine harness retainer nut (1).

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

49. Install the generator. Refer to **Generator Replacement** .
50. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

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INTAKE MANIFOLD REPLACEMENT (RPOS LY2/LY6)

REMOVAL PROCEDURE

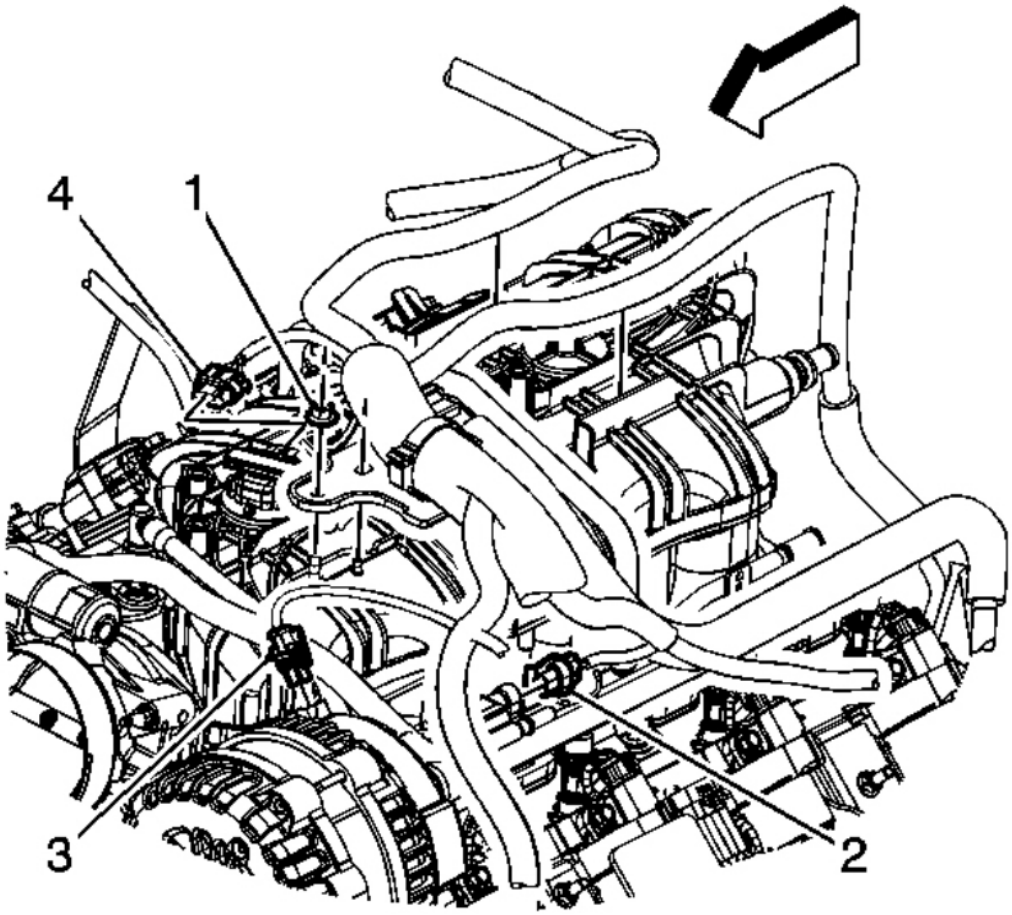


Fig. 100: View Of Generator & Related Connectors
Courtesy of GENERAL MOTORS CORP.

1. Remove the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .
2. Remove the generator. Refer to **Generator Replacement** .
3. Remove the engine harness retainer nut (1).
4. Remove the engine harness retainer from the stud and locator pin.
5. Disconnect the engine harness electrical connector (2) from the evaporative emission (EVAP) canister purge solenoid.

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6. Disconnect the engine wiring harness electrical connector (4) from the manifold absolute pressure (MAP) sensor.

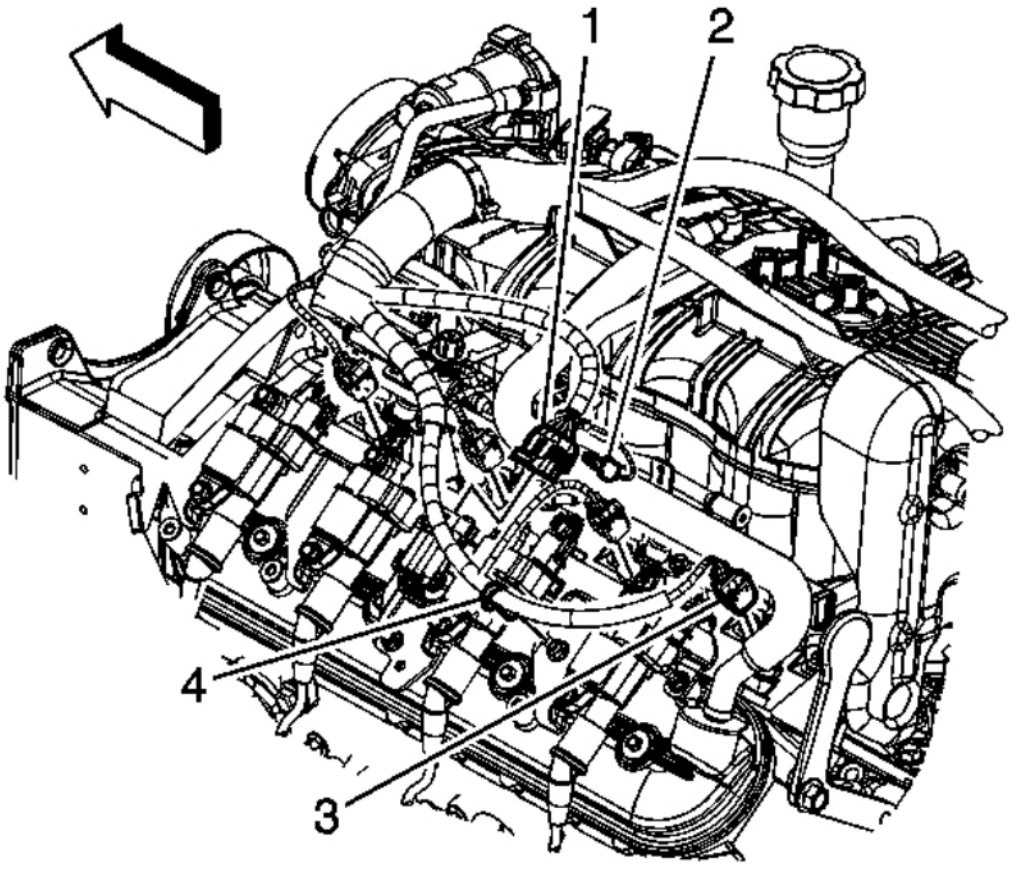


Fig. 101: View Of CPA Retainer, Electrical Connectors & Engine Harness Clips
Courtesy of GENERAL MOTORS CORP.

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

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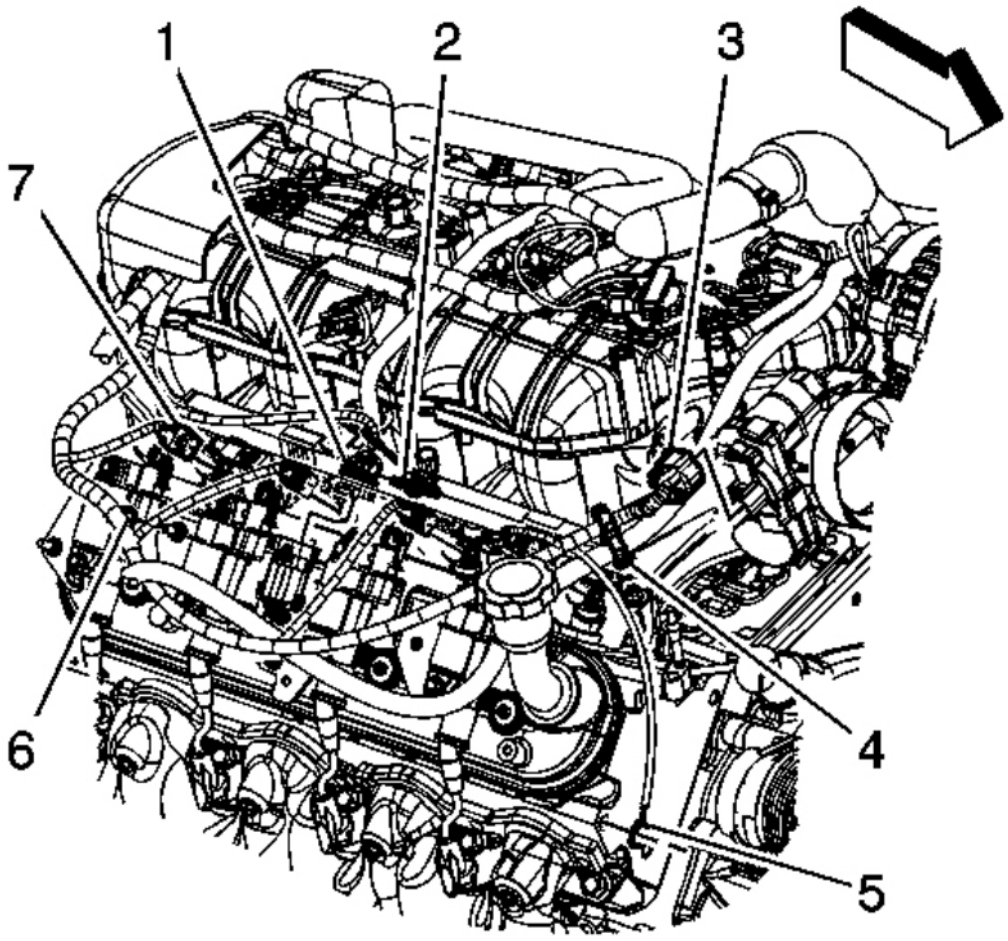


Fig. 102: View Of CPA Retainer, Engine Harness Electrical Connectors & Harness Clips
Courtesy of GENERAL MOTORS CORP.

11. Remove the CPA retainer (2).
12. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
13. Disconnect the engine harness electrical connector (3) from the throttle actuator.
14. Remove the engine harness clip (4) from the generator battery jumper cable.
15. Remove the engine harness clip (6) from the ignition coil bracket stud.
16. Disconnect the engine harness electrical connectors (7) from the right side fuel injectors.

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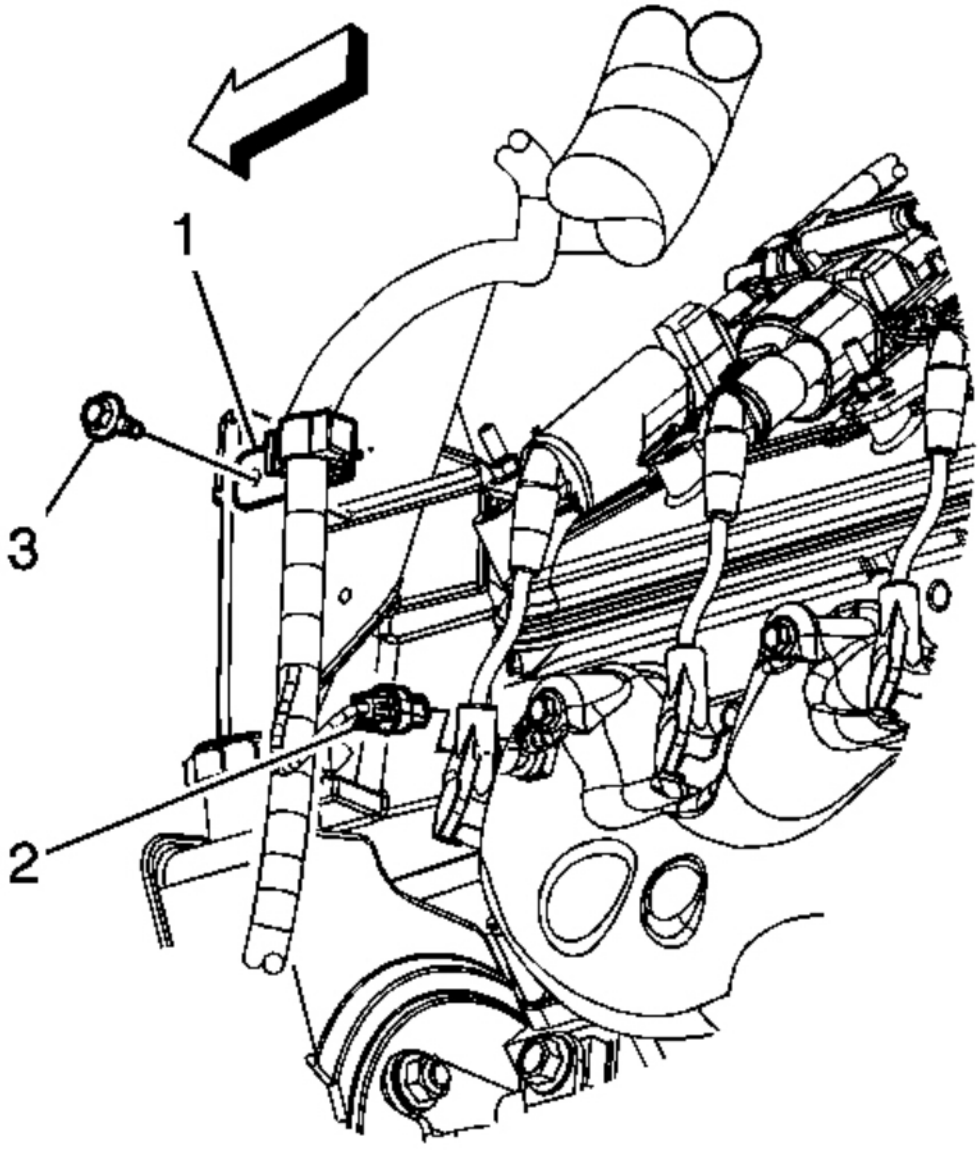


Fig. 103: View Of Engine Wiring Harness, Clip, Bolt & Connector
Courtesy of GENERAL MOTORS CORP.

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. Gather the engine harness branches and tie the harness up out of the way to the cowl panel.

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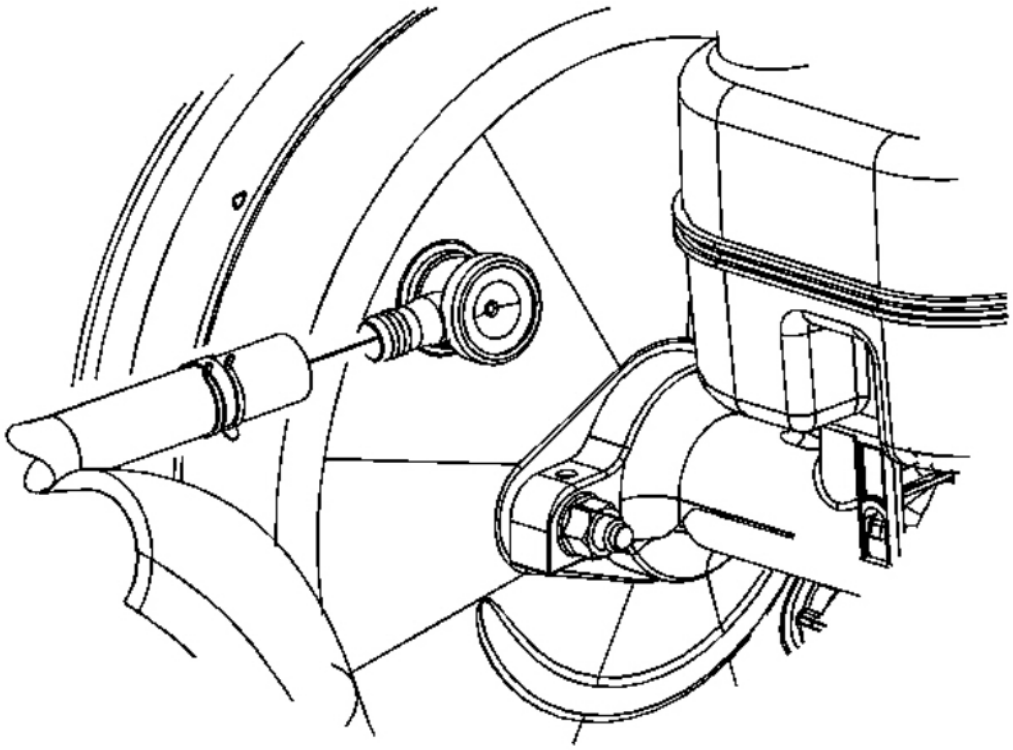


Fig. 104: View Of Brake Booster Vacuum Hose & Booster Fitting
Courtesy of GENERAL MOTORS CORP.

20. Reposition the brake booster vacuum hose clamp at the booster.
21. Remove the brake booster vacuum hose from the booster fitting.
22. Secure the brake booster vacuum hose to the intake manifold.

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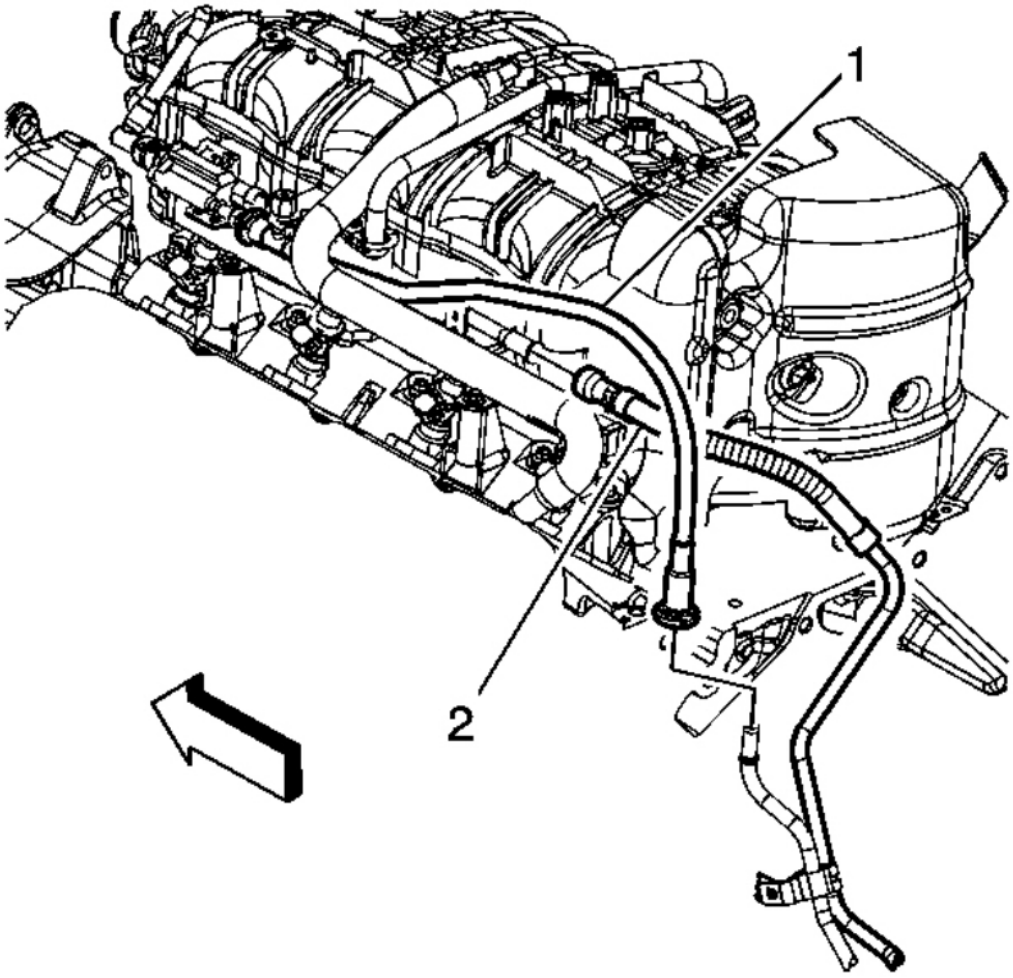


Fig. 105: View Of EVAP Canister Purge Tube & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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

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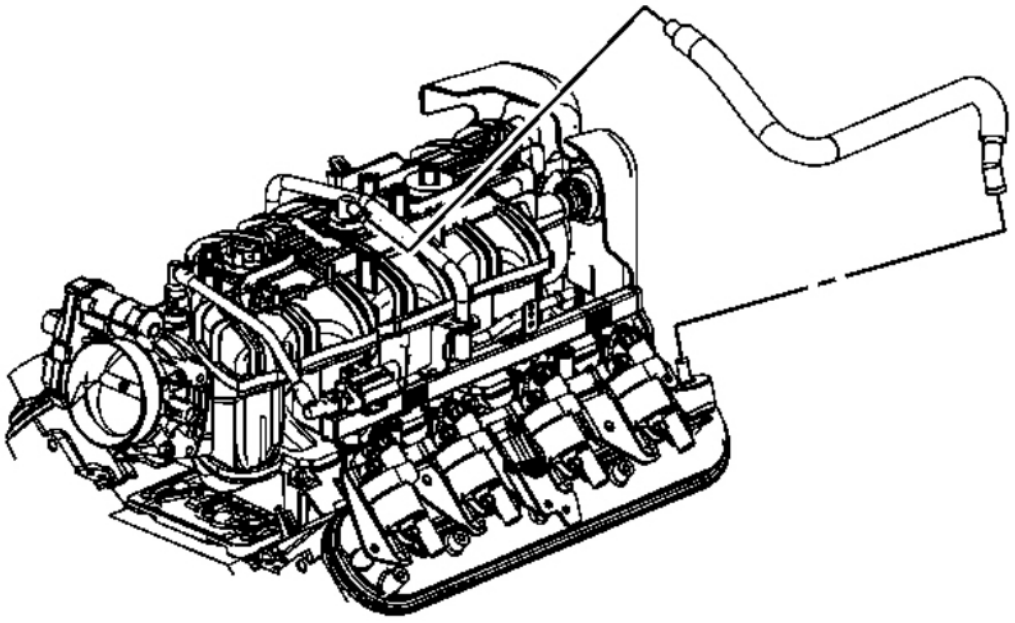


Fig. 106: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

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

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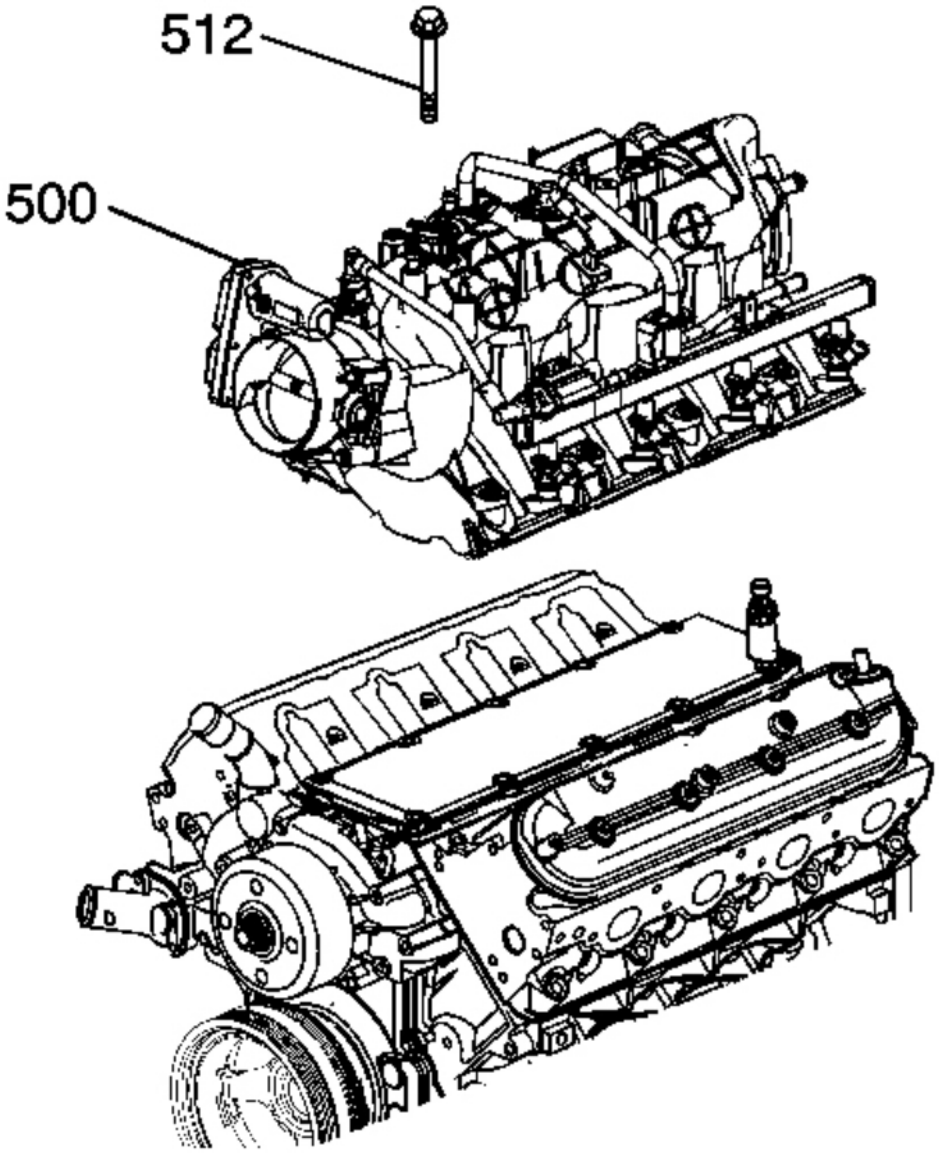


Fig. 107: View Of Intake Manifold & Bolts
Courtesy of GENERAL MOTORS CORP.

27. Loosen the intake manifold bolts (512).

IMPORTANT: The aid of an assistant may be helpful in holding the engine harness up

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out of the way so the upper intake manifold cover does not get caught against the engine harness.

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

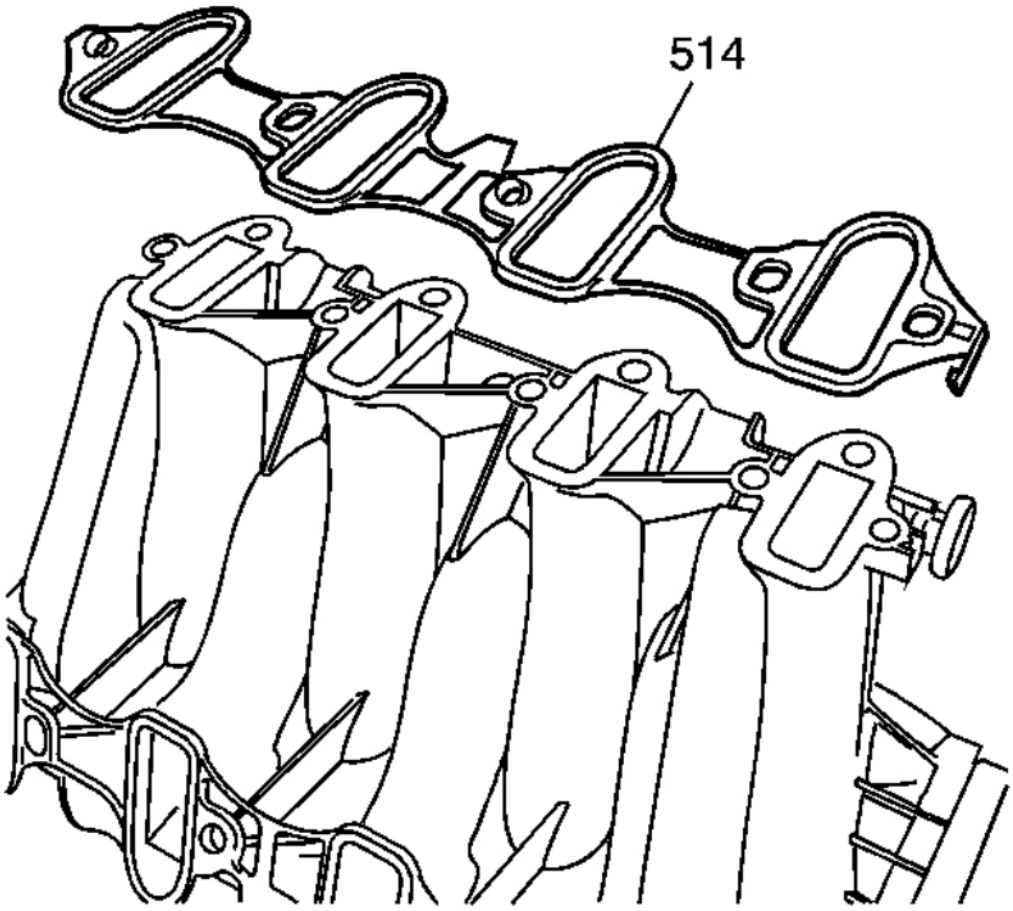


Fig. 108: View Of Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

30. Remove and discard the intake manifold gaskets (514).

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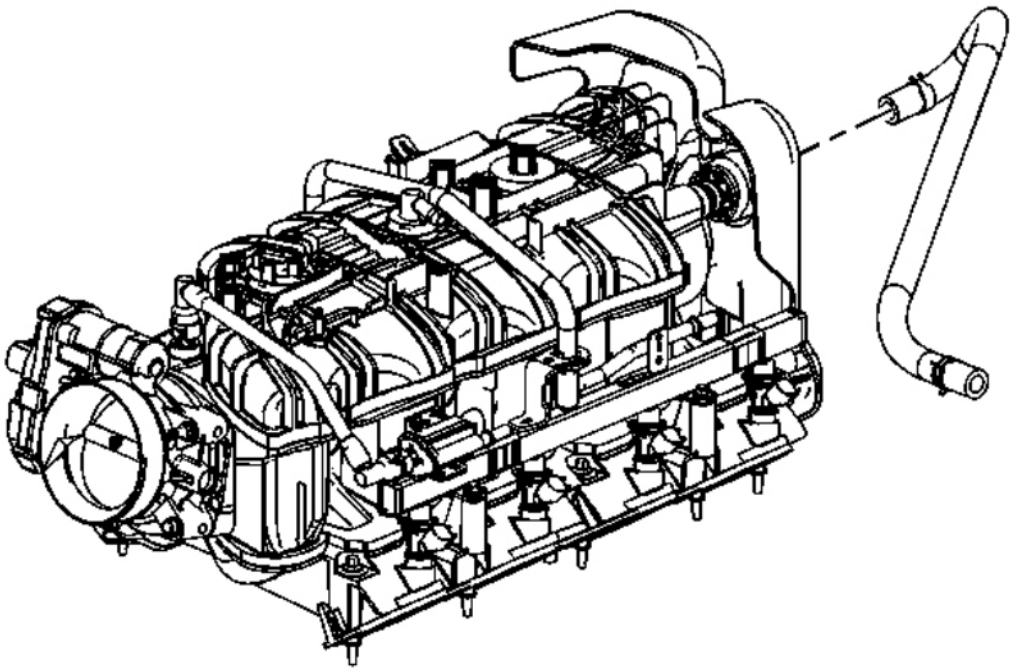


Fig. 109: View Of Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

31. If replacing the intake manifold, perform the following steps, otherwise proceed to step 21 of the installation procedure.
32. Place the intake manifold on a clean work surface.
33. Reposition the brake booster vacuum hose clamp at the intake manifold.
34. Remove the brake booster vacuum hose from the intake manifold nipple.

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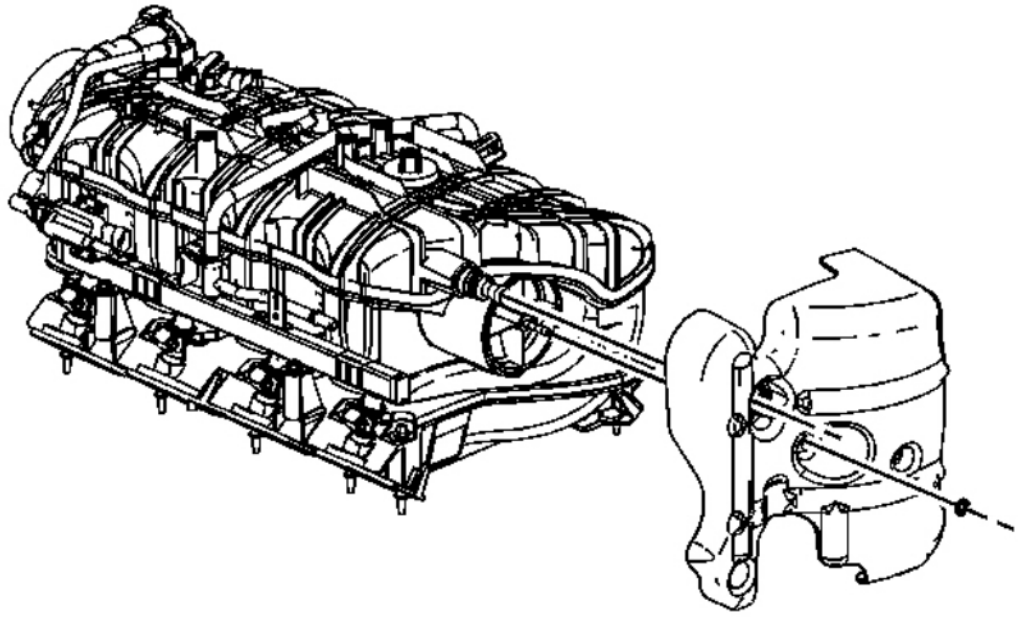


Fig. 110: View Of Upper Intake Manifold Cover & Nut
Courtesy of GENERAL MOTORS CORP.

35. Remove the upper intake manifold cover nut.
36. Remove the upper intake manifold cover.

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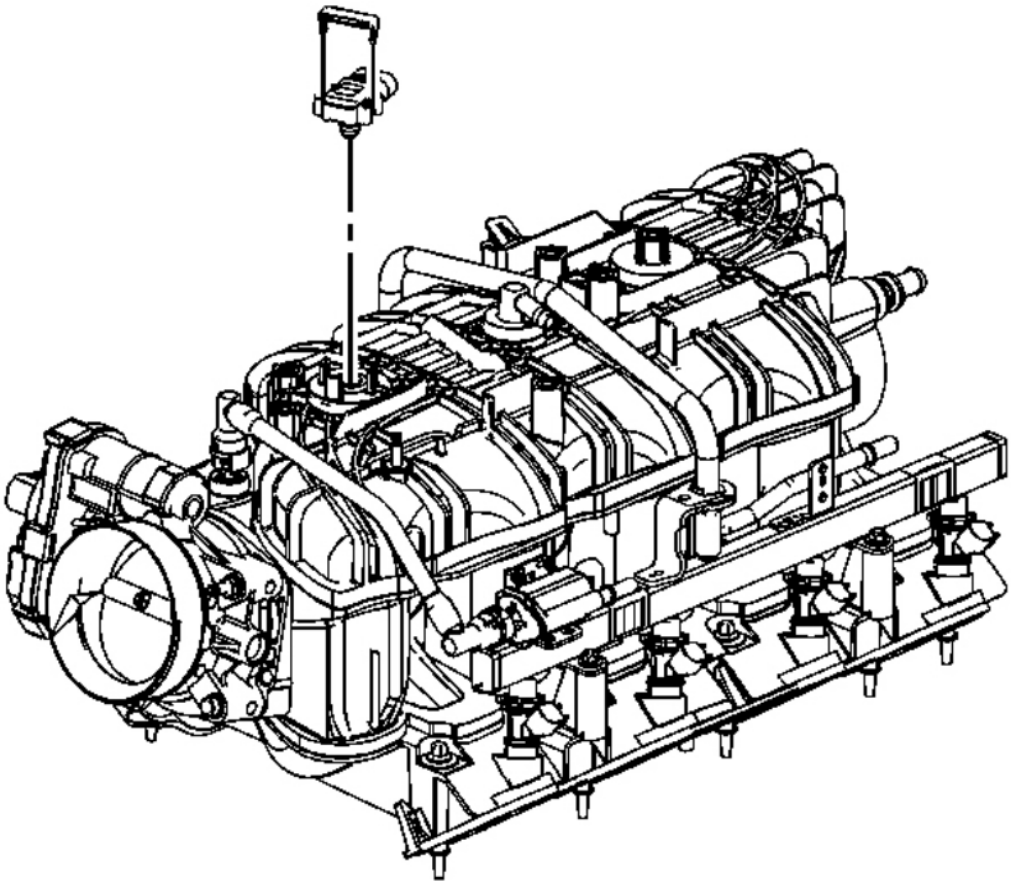


Fig. 111: View Of MAP Sensor & Retainer
Courtesy of GENERAL MOTORS CORP.

37. Remove the manifold absolute pressure (MAP) sensor retainer.
38. Remove the MAP sensor.

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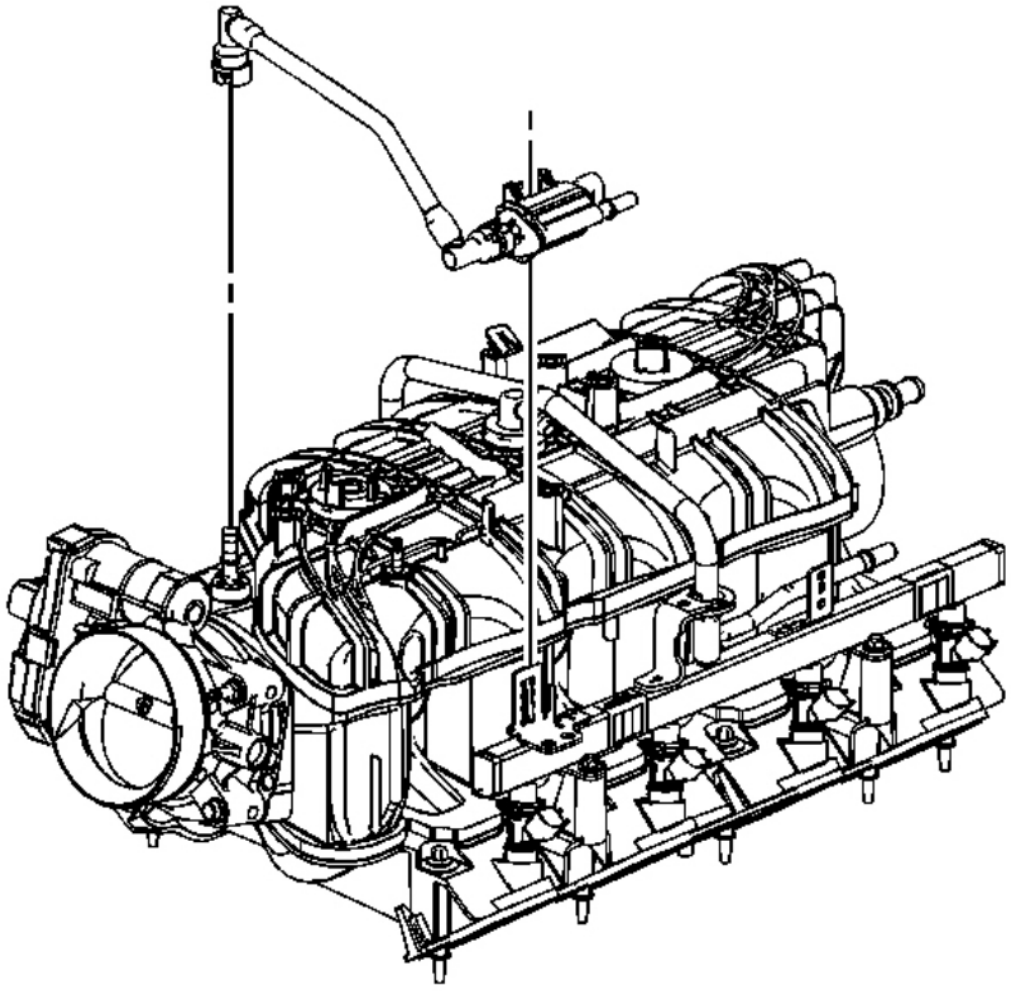


Fig. 112: View Of EVAP Tube & Purge Solenoid
Courtesy of GENERAL MOTORS CORP.

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

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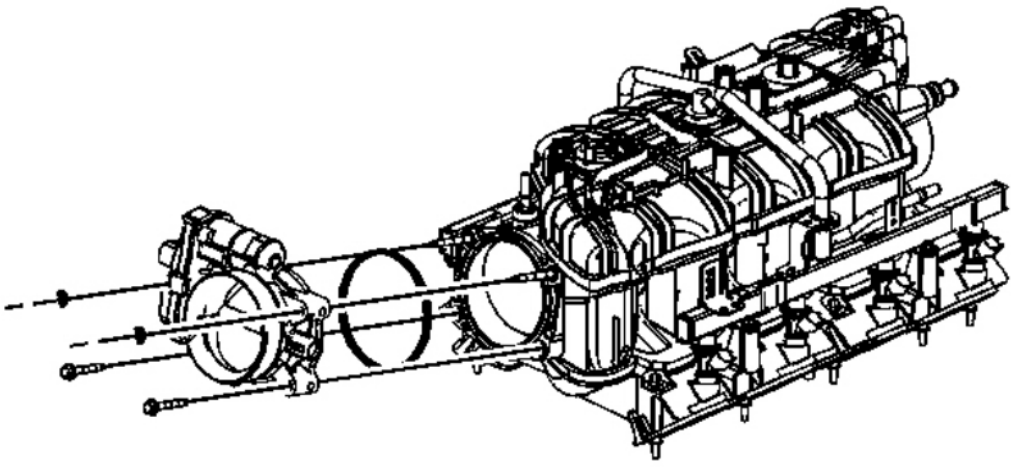


Fig. 113: View Of Throttle Body, Gasket & Bolts/Nuts
Courtesy of GENERAL MOTORS CORP.

42. Remove the throttle body bolts/nuts.
43. Remove the throttle body.
44. Remove and discard the throttle body gasket.

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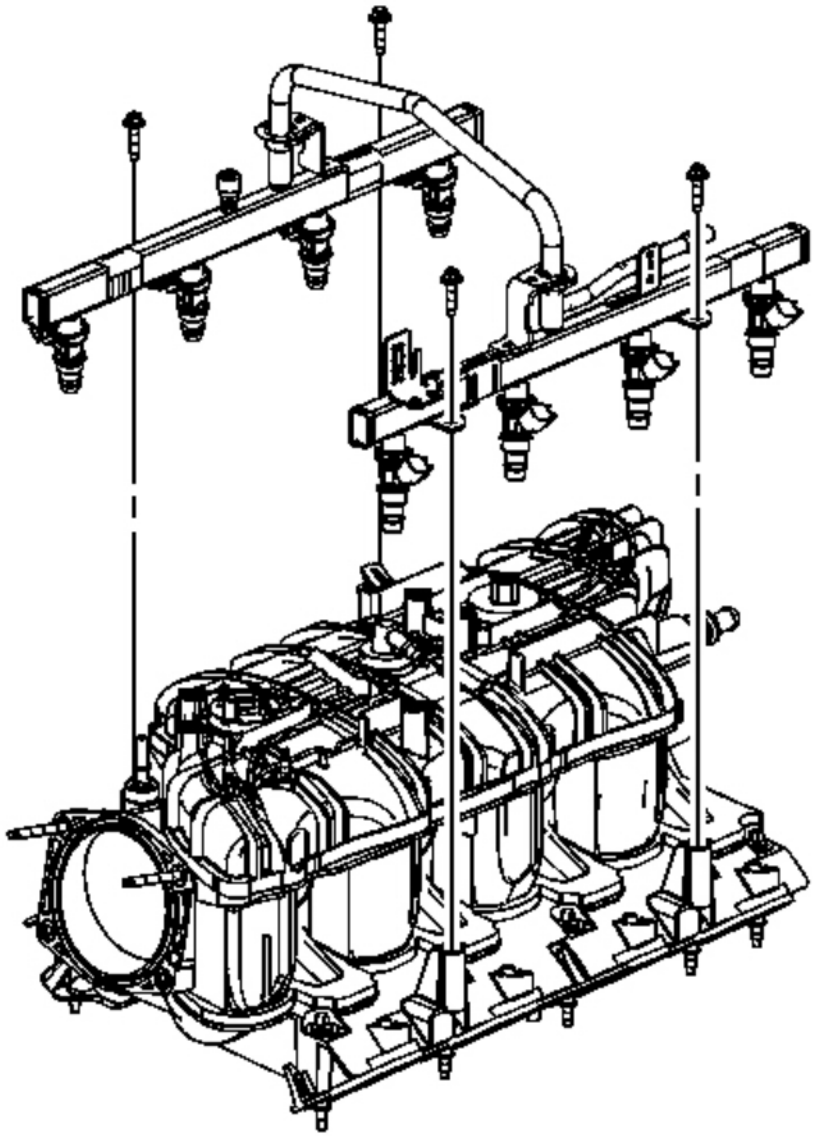


Fig. 114: View Of Fuel Rail & Bolts
Courtesy of GENERAL MOTORS CORP.

45. Remove the fuel rail bolts.

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

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46. Remove the fuel rail.
47. Remove and discard the fuel injector lower O-ring seals.

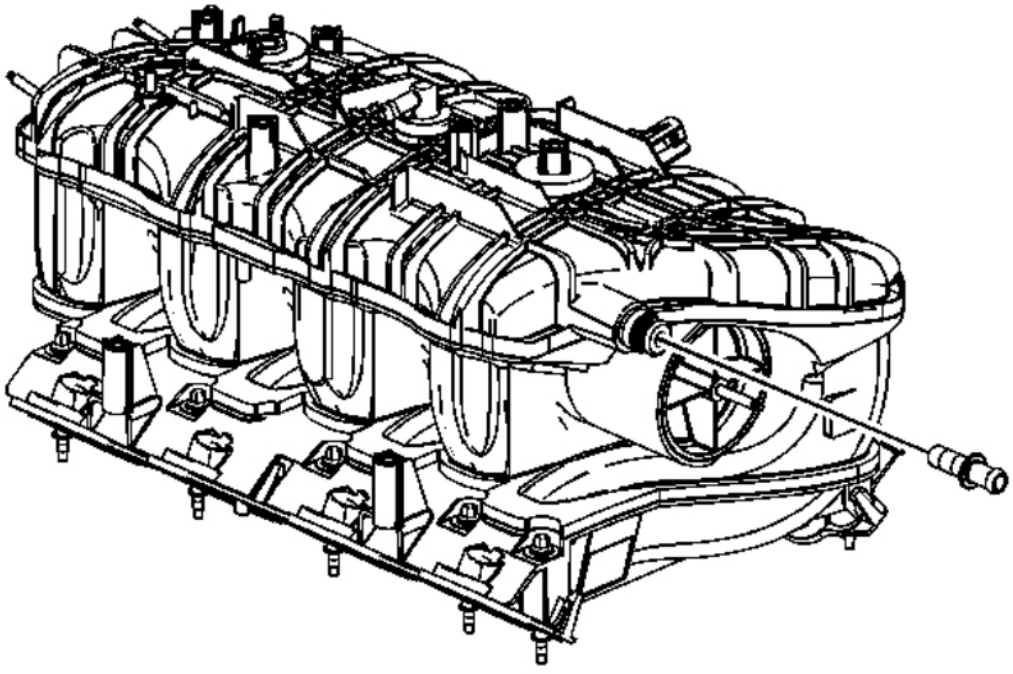


Fig. 115: View Of Brake Booster Vacuum Hose Nipple
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Evenly push in the RED collar in order to remove the nipple.

48. Remove the brake booster vacuum hose nipple.

INSTALLATION PROCEDURE

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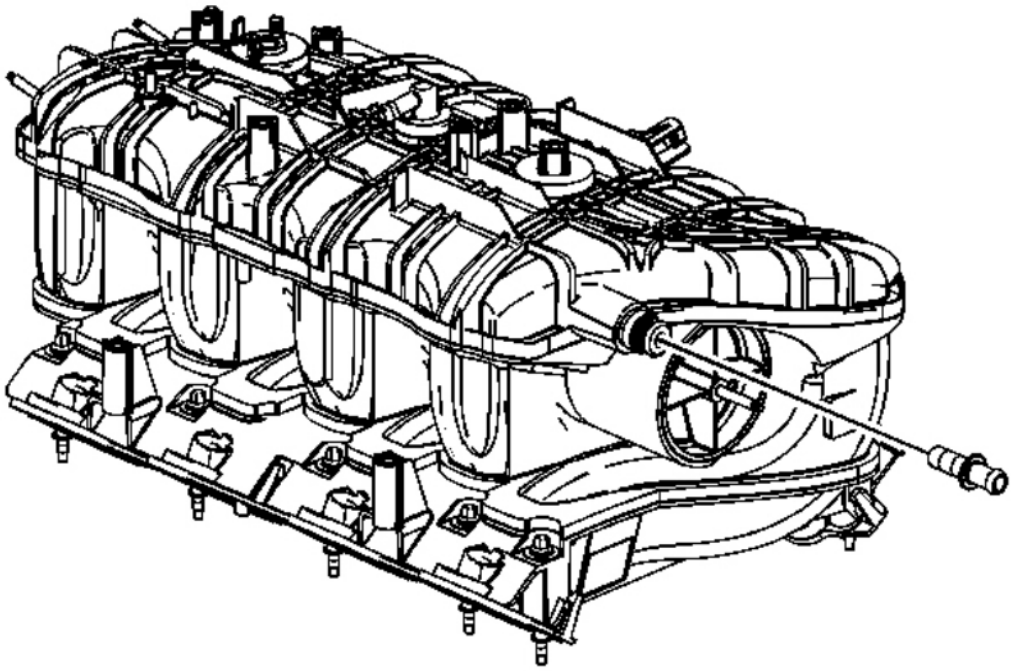


Fig. 116: View Of Brake Booster Vacuum Hose Nipple
Courtesy of GENERAL MOTORS CORP.

1. If the intake manifold was replaced perform the following steps, otherwise proceed to step 21.

IMPORTANT: Evenly push in the RED collar in order to install the nipple.

2. Install the brake booster vacuum hose nipple to the NEW intake manifold.

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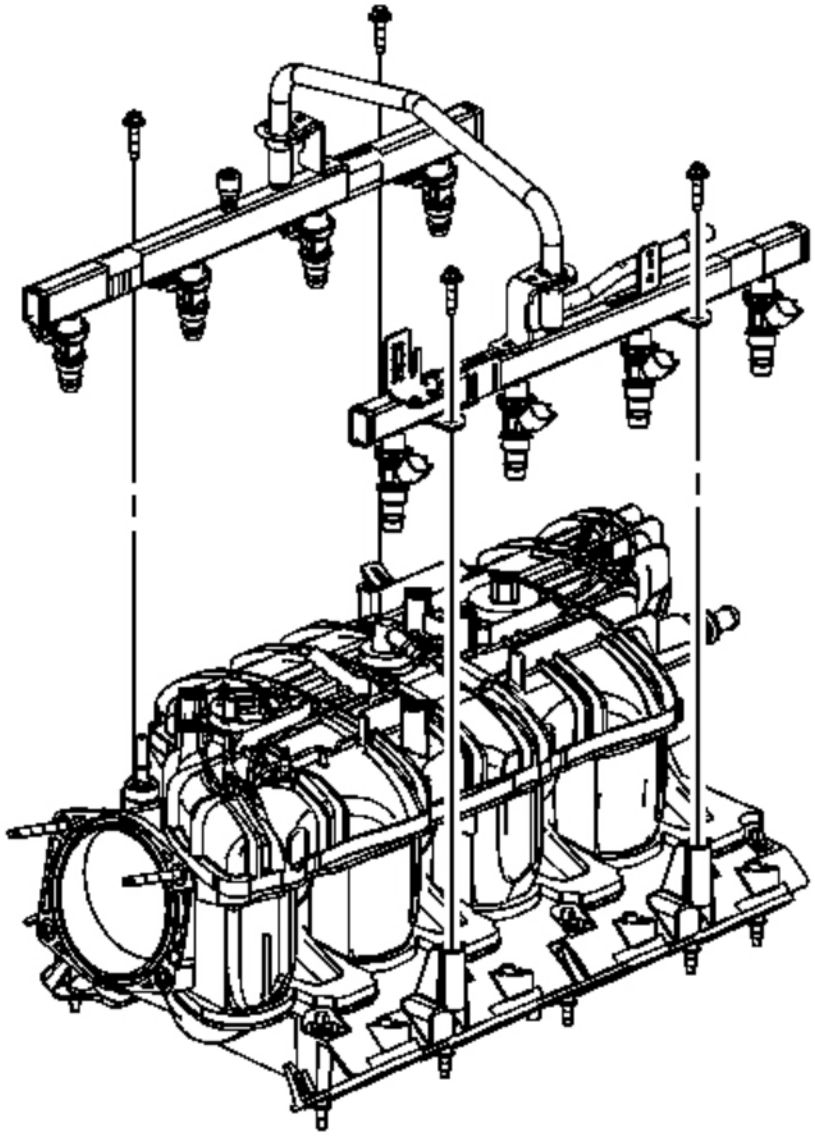


Fig. 117: View Of Fuel Rail & Bolts
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: Push down firmly on both sides of the rail until all the injectors have been

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seated into their bores.

5. Install the fuel rail.

NOTE: **Refer to Fastener Notice .**

6. Install the fuel rail bolts.

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

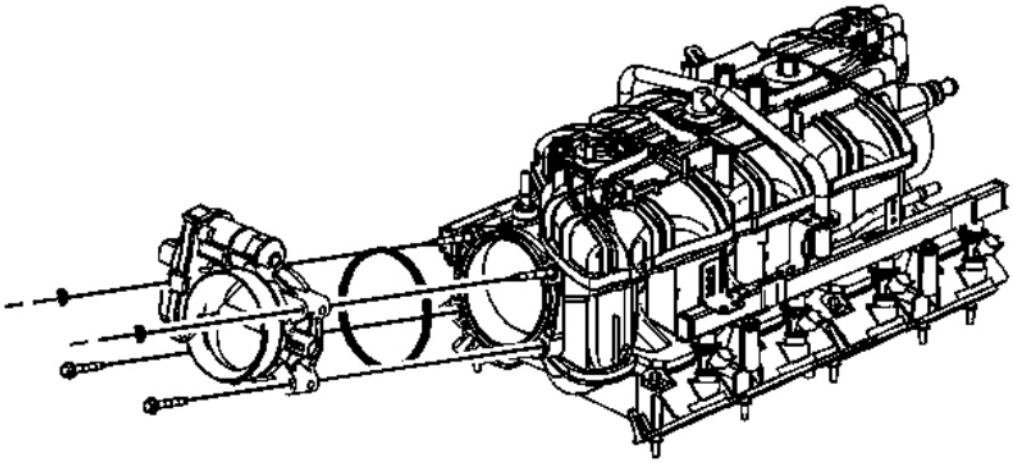


Fig. 118: View Of Throttle Body, Gasket & Bolts/Nuts
Courtesy of GENERAL MOTORS CORP.

7. Install a NEW throttle body gasket to the intake manifold.
8. Install the throttle body.
9. Install the throttle body bolts/nuts.

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

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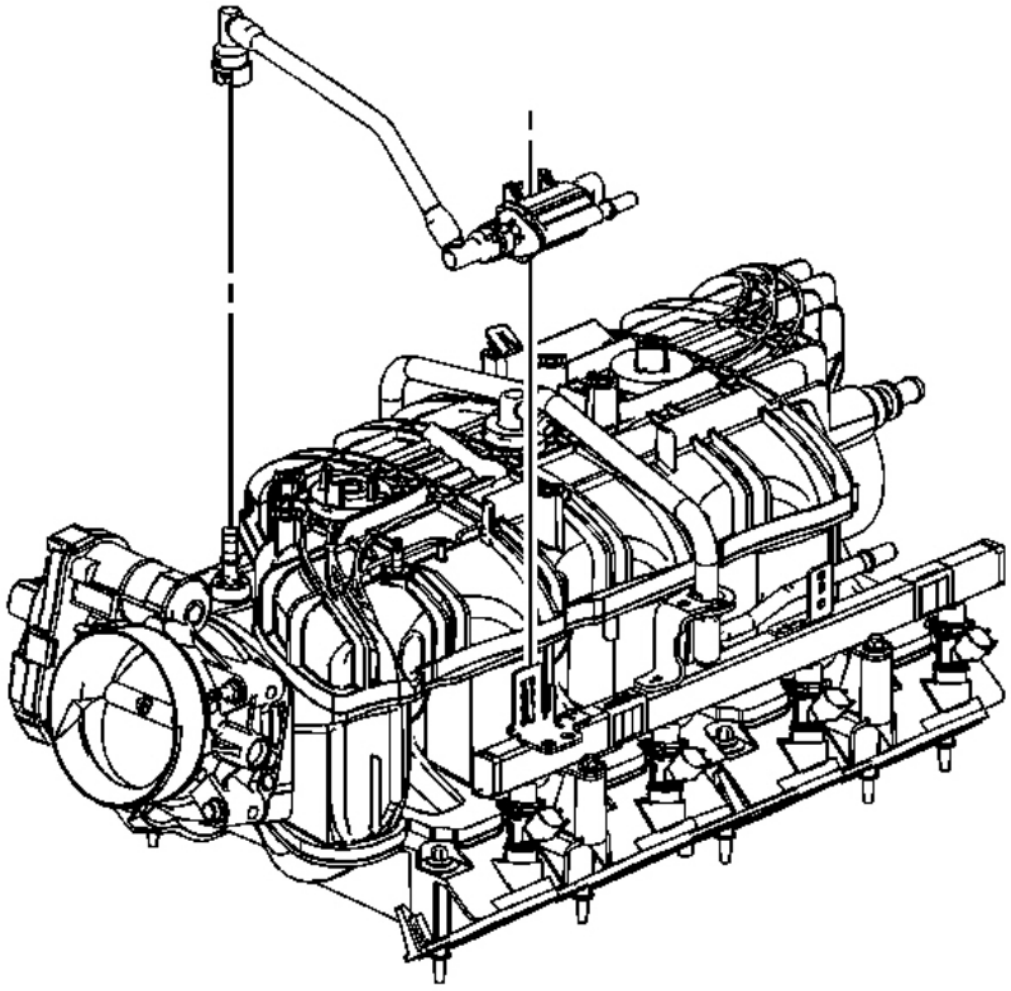


Fig. 119: View Of EVAP Tube & Purge Solenoid
Courtesy of GENERAL MOTORS CORP.

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

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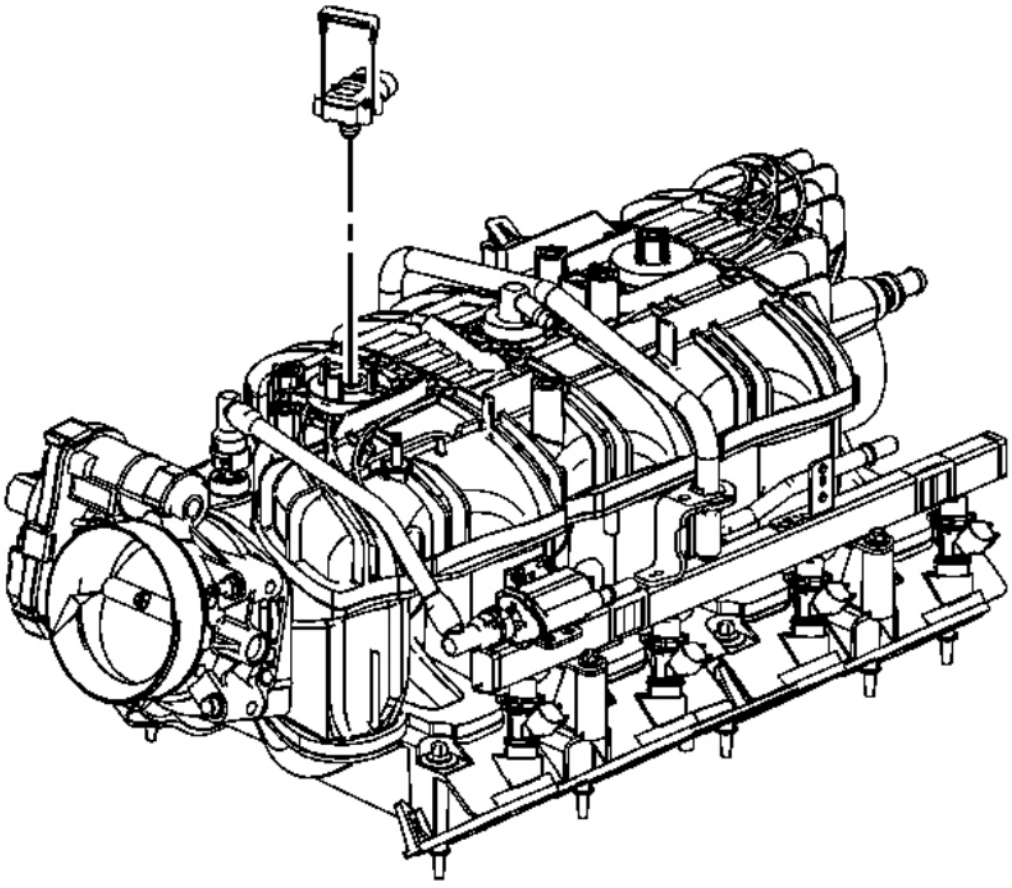


Fig. 120: View Of MAP Sensor & Retainer
Courtesy of GENERAL MOTORS CORP.

13. Lubricate the MAP sensor seal with clean engine oil.
14. Install the MAP sensor.
15. Install the MAP sensor retainer.

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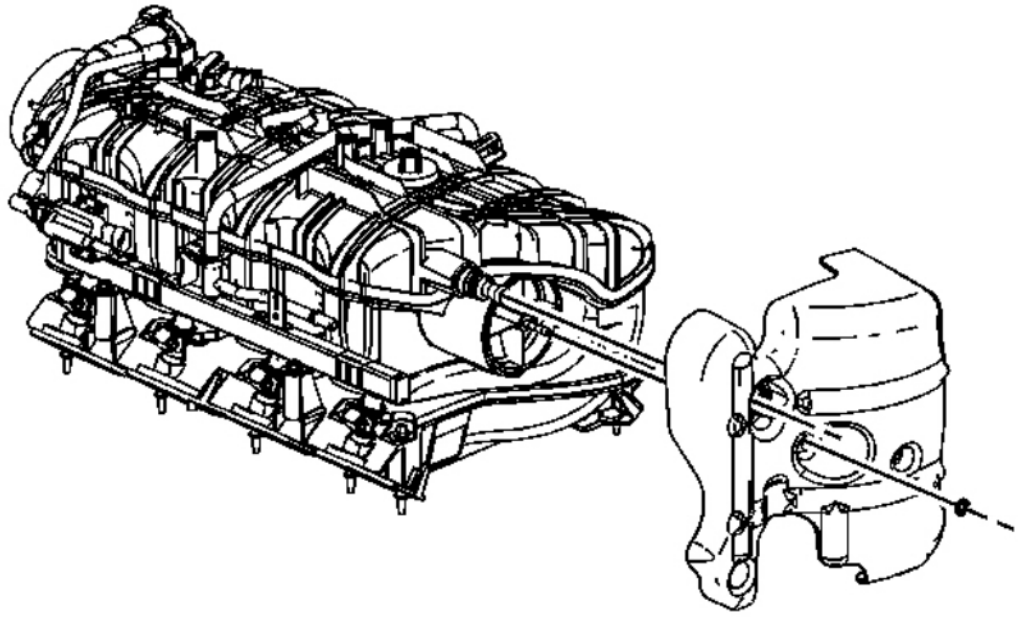


Fig. 121: View Of Upper Intake Manifold Cover & Nut
Courtesy of GENERAL MOTORS CORP.

16. Install the upper intake manifold cover.
17. Install the upper intake manifold cover nut until snug

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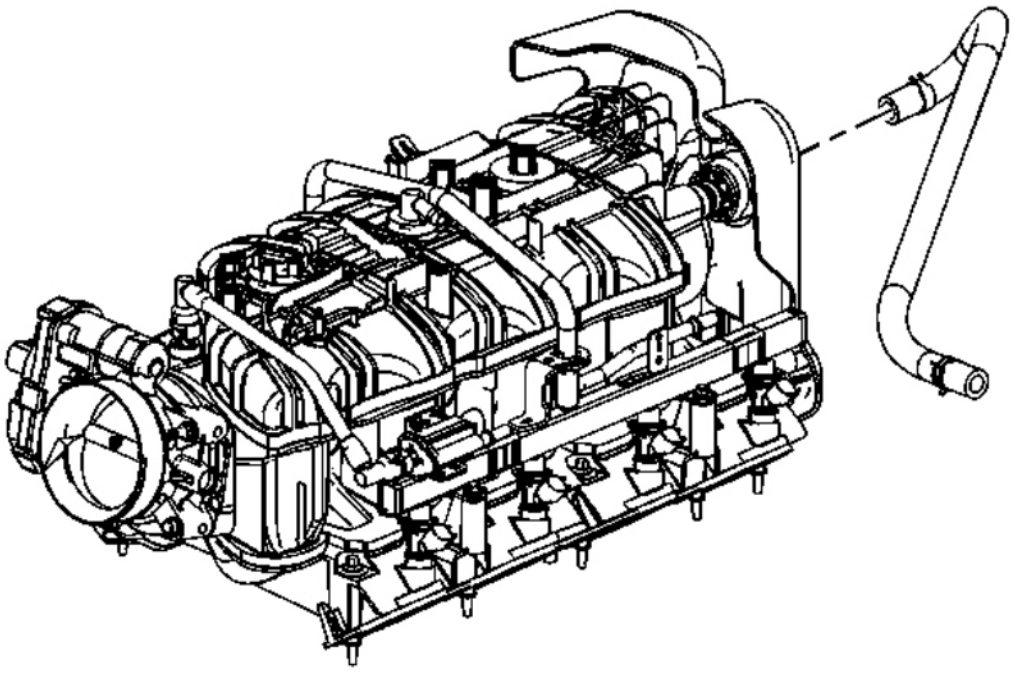


Fig. 122: View Of Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

18. Install the brake booster vacuum hose to the intake manifold nipple.
19. Position the brake booster vacuum hose clamp at the intake manifold.
20. Secure the brake booster vacuum hose to the intake manifold.

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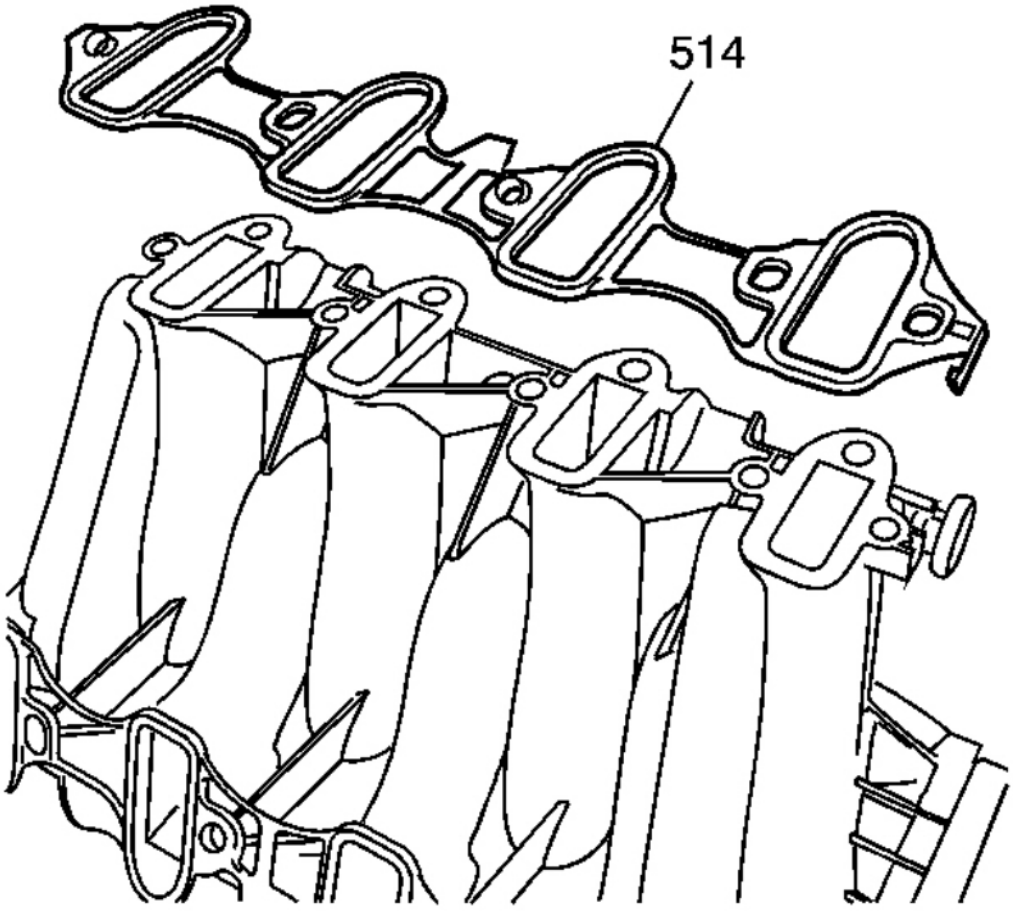


Fig. 123: View Of Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

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

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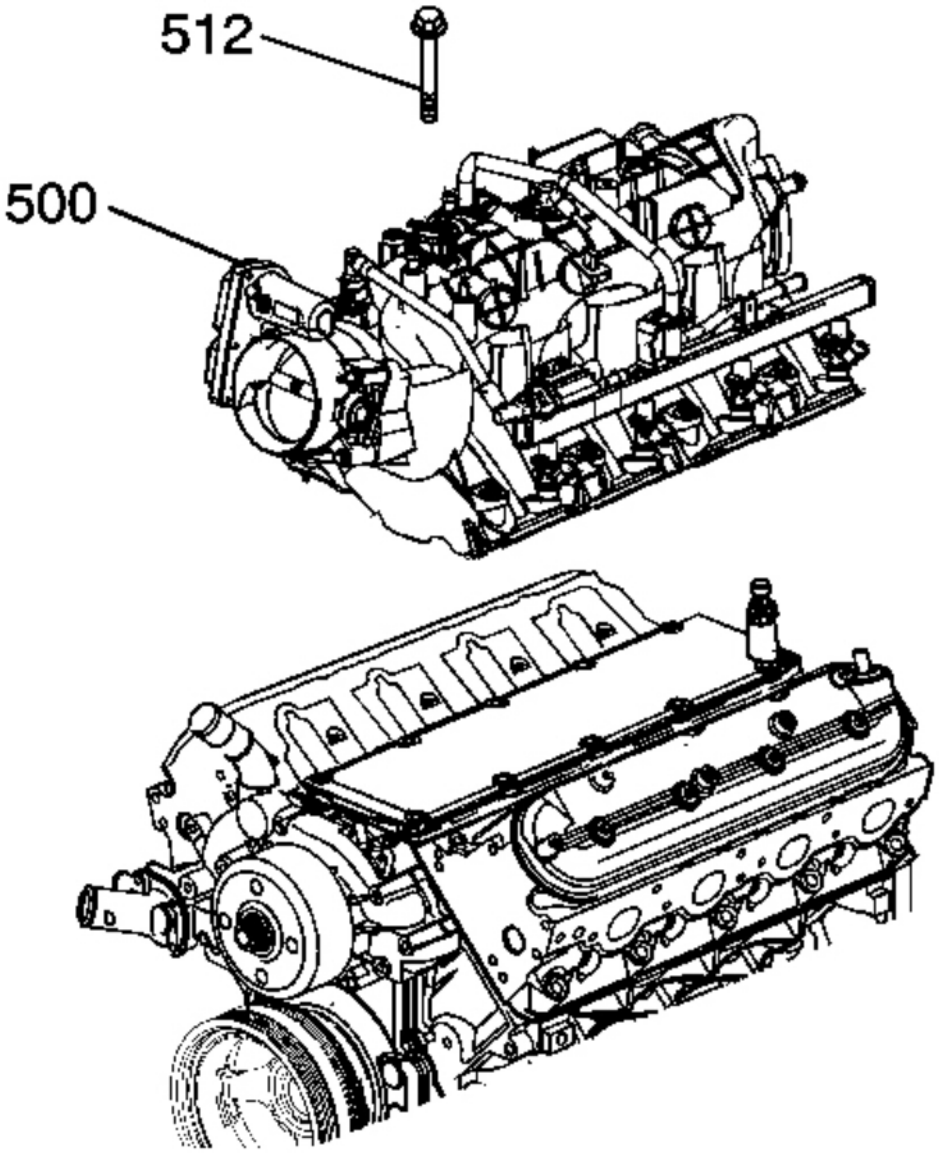


Fig. 124: View Of Intake Manifold & Bolts
Courtesy of GENERAL MOTORS CORP.

23. Install the intake manifold (500).

IMPORTANT: The aid of an assistant may be helpful in holding the engine harness up

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out of the way so the upper intake manifold cover does not get caught against the engine harness.

24. Tighten the intake manifold bolts (512) until snug.

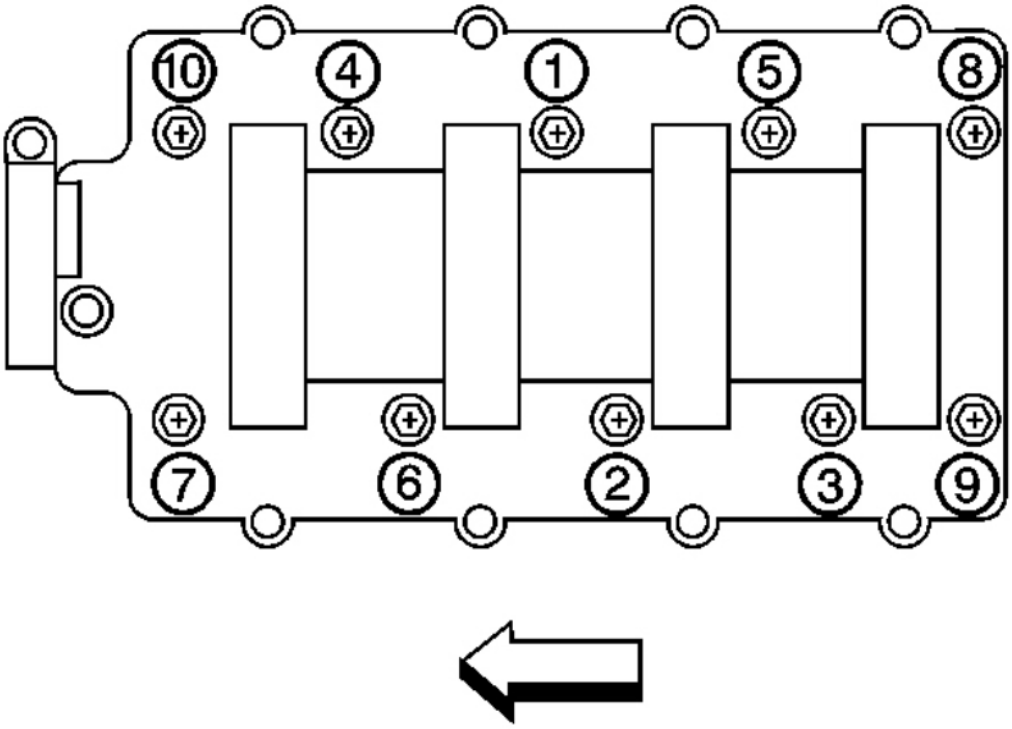


Fig. 125: Identifying Intake Manifold Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

25. 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).

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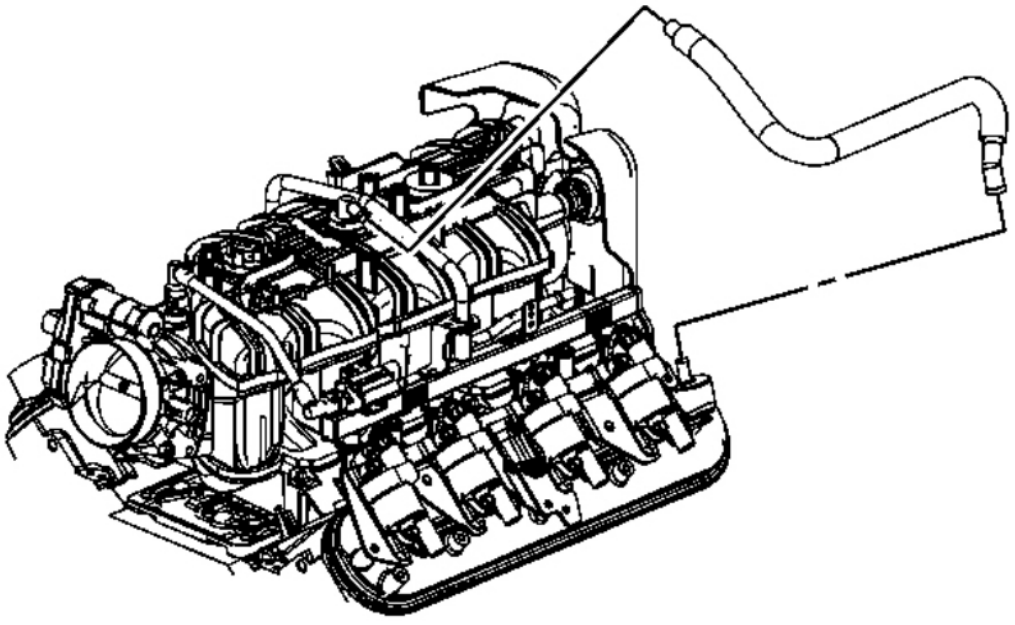


Fig. 126: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

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

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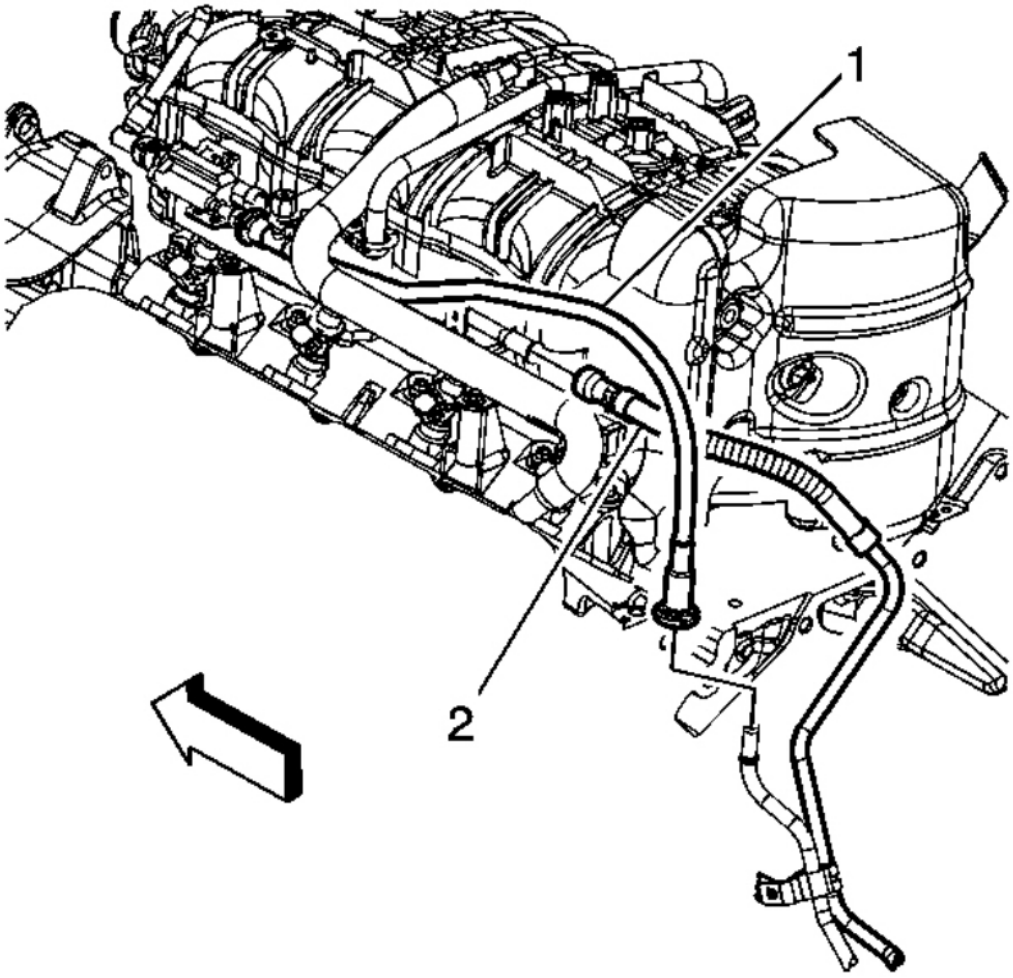


Fig. 127: View Of EVAP Canister Purge Tube & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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

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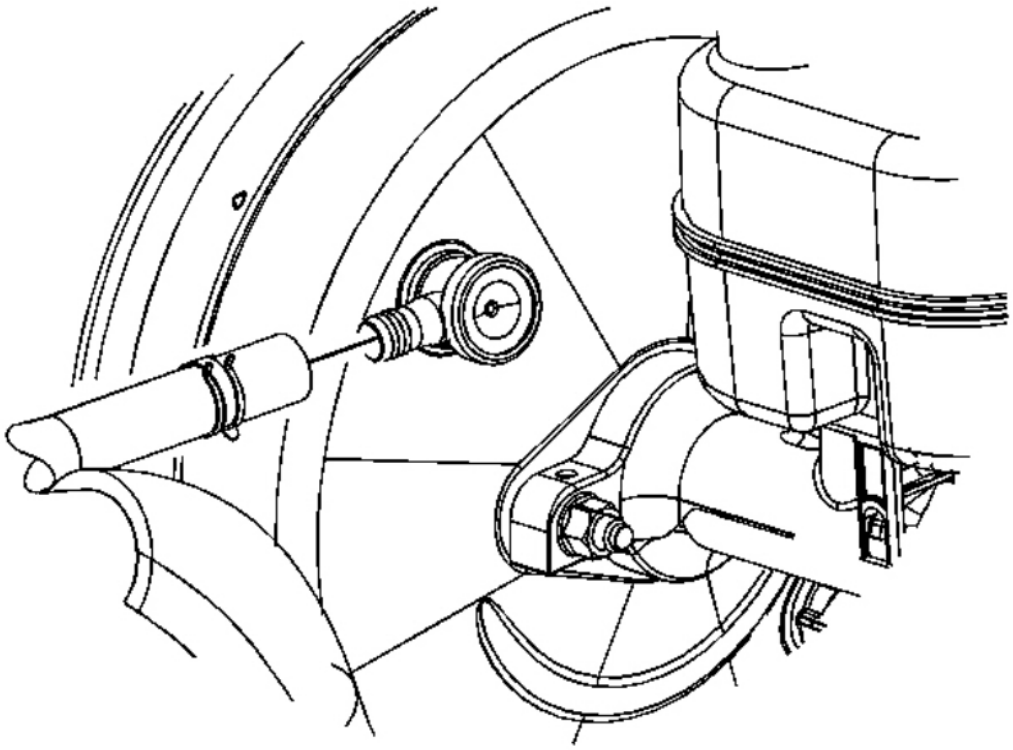


Fig. 128: View Of Brake Booster Vacuum Hose & Booster Fitting
Courtesy of GENERAL MOTORS CORP.

29. Unsecure the brake booster vacuum hose from the intake manifold.
30. Install the brake booster vacuum hose to the booster fitting.
31. Position the brake booster vacuum hose clamp at the booster.

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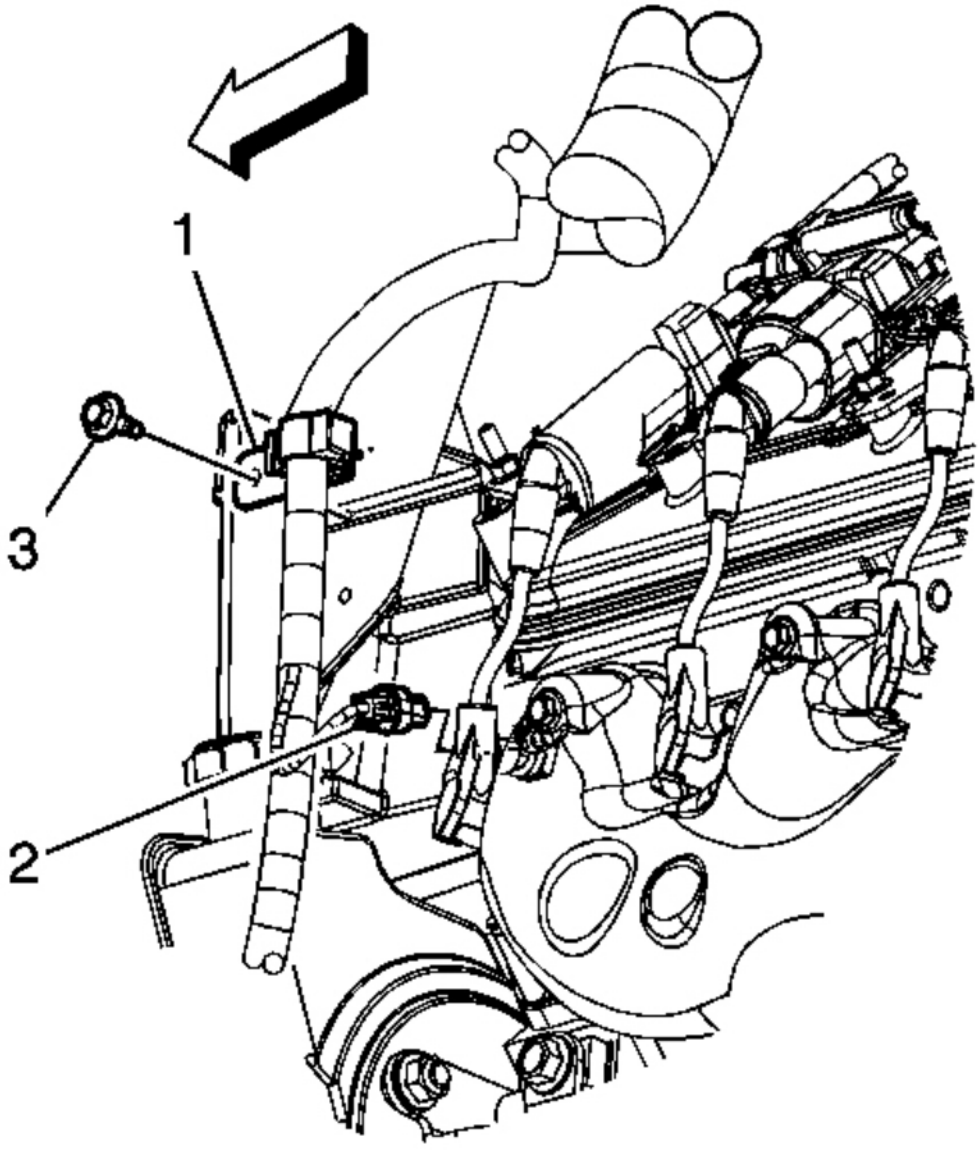


Fig. 129: View Of Engine Wiring Harness, Clip, Bolt & Connector
Courtesy of GENERAL MOTORS CORP.

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

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

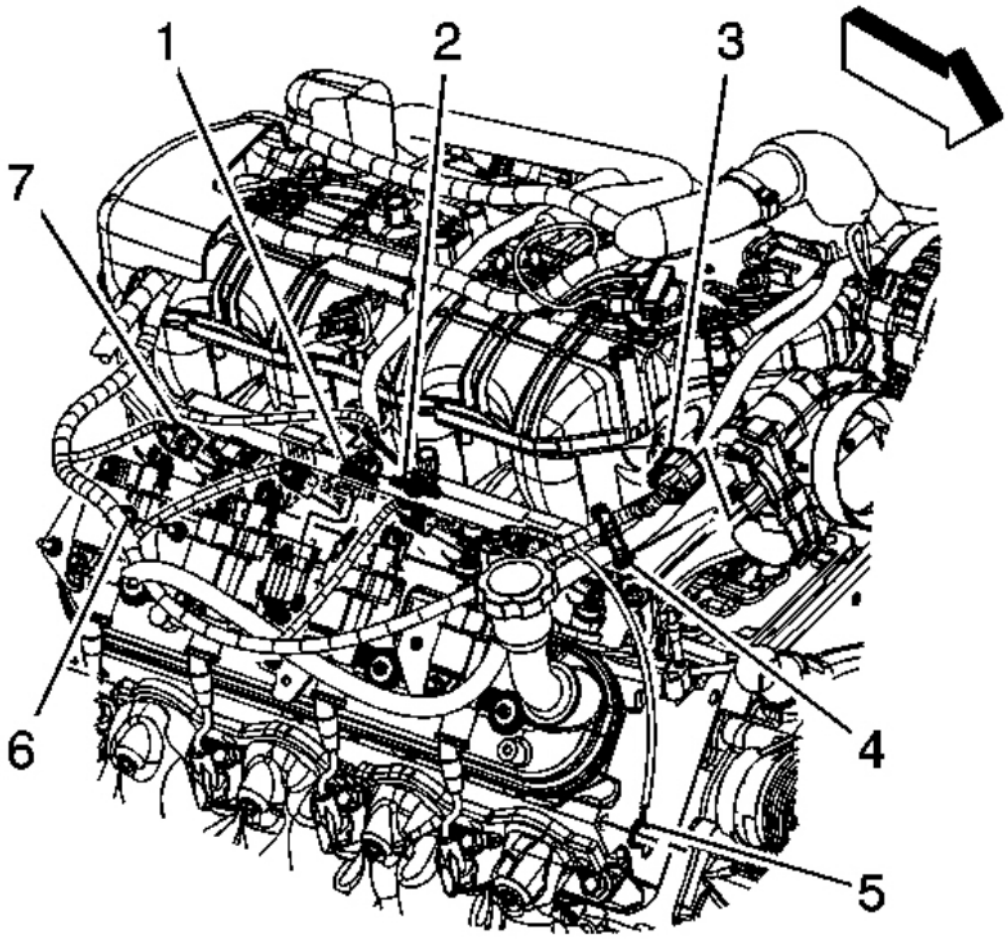


Fig. 130: View Of CPA Retainer, Engine Harness Electrical Connectors & Harness Clips
Courtesy of GENERAL MOTORS CORP.

35. Connect the engine harness electrical connectors (7) to the right side fuel injectors.
36. Install the engine harness clip (6) to the ignition coil bracket stud.
37. Install the engine harness clip (4) to the generator battery jumper cable.
38. Connect the engine harness electrical connector (3) to the throttle actuator.
39. Connect the engine harness electrical connector (1) to the ignition coil harness electrical connector.
40. Install the CPA retainer (2).

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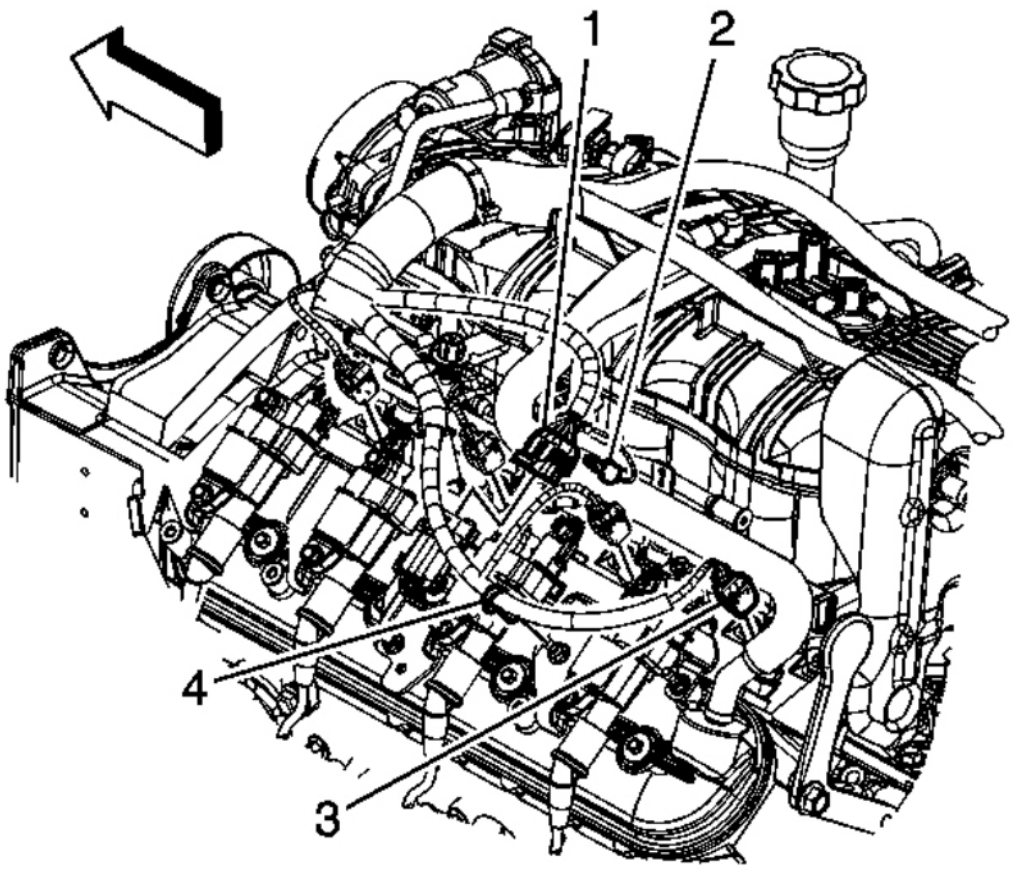


Fig. 131: View Of CPA Retainer, Electrical Connectors & Engine Harness Clips
Courtesy of GENERAL MOTORS CORP.

41. Install the engine harness clip (4) to the ignition coil bracket stud.
42. Connect the engine harness electrical connectors (3) to the left side fuel injectors.
43. Connect the engine harness electrical connector (1) to the ignition coil harness electrical connector.
44. Install the CPA retainer (1).

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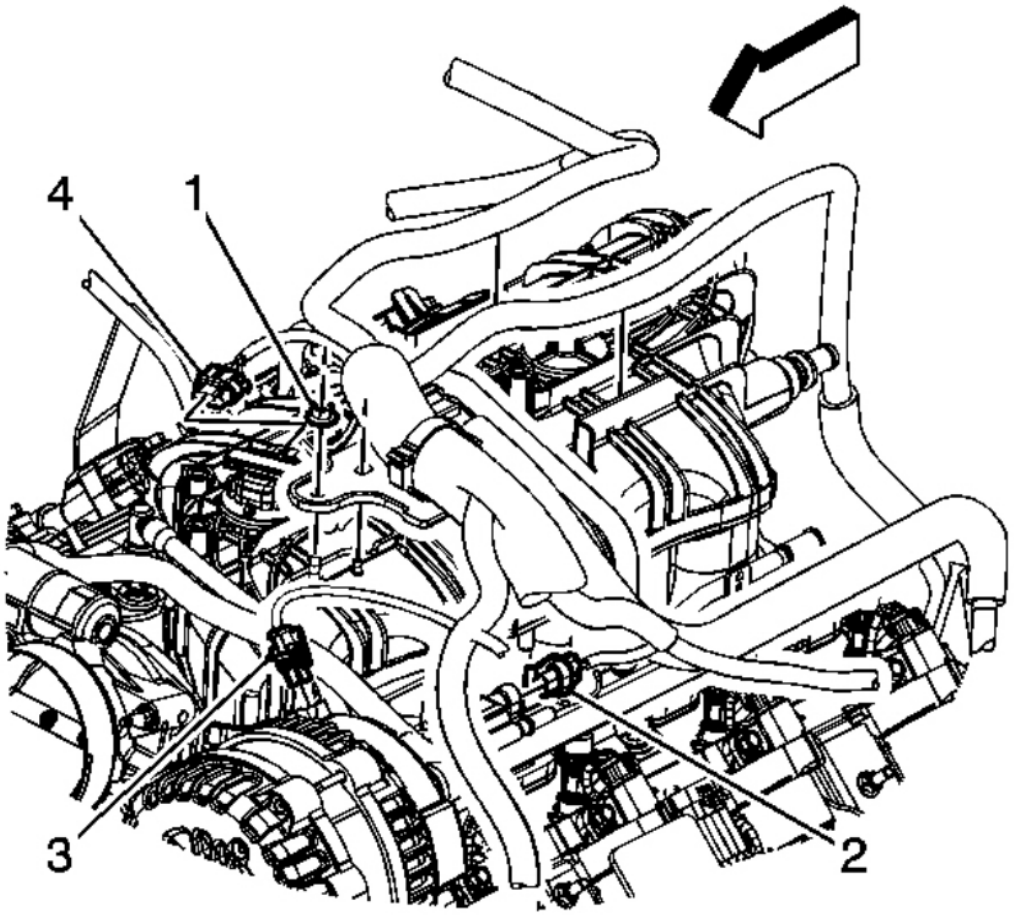


Fig. 132: View Of Generator & Related Connectors
Courtesy of GENERAL MOTORS CORP.

45. Connect the engine wiring harness electrical connector (4) to the MAP sensor.
46. Connect the engine harness electrical connector (2) to the EVAP canister purge solenoid.
47. Install the engine harness retainer to the stud and locator pin.
48. Install the engine harness retainer nut (1).

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

49. Install the generator. Refer to **Generator Replacement** .
50. Install the air cleaner outlet duct. Refer to **Air Cleaner Resonator Outlet Duct Replacement** .

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UPPER INTAKE MANIFOLD COVER REPLACEMENT

REMOVAL PROCEDURE

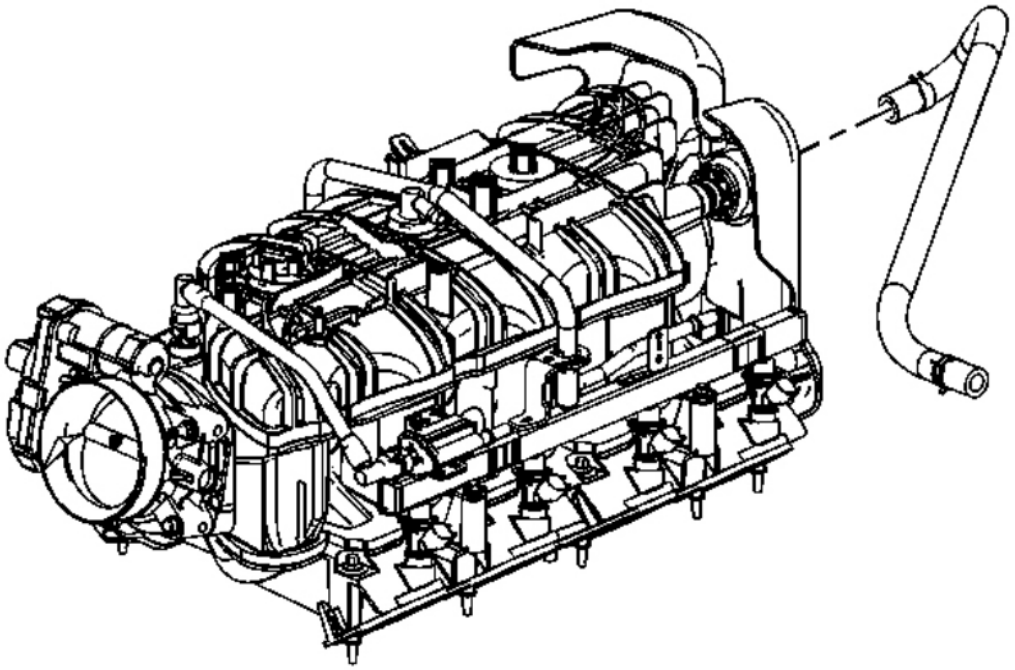


Fig. 133: View Of Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
2. Reposition the brake booster vacuum hose clamp at the intake manifold.
3. Remove the brake booster vacuum hose from the intake manifold nipple.

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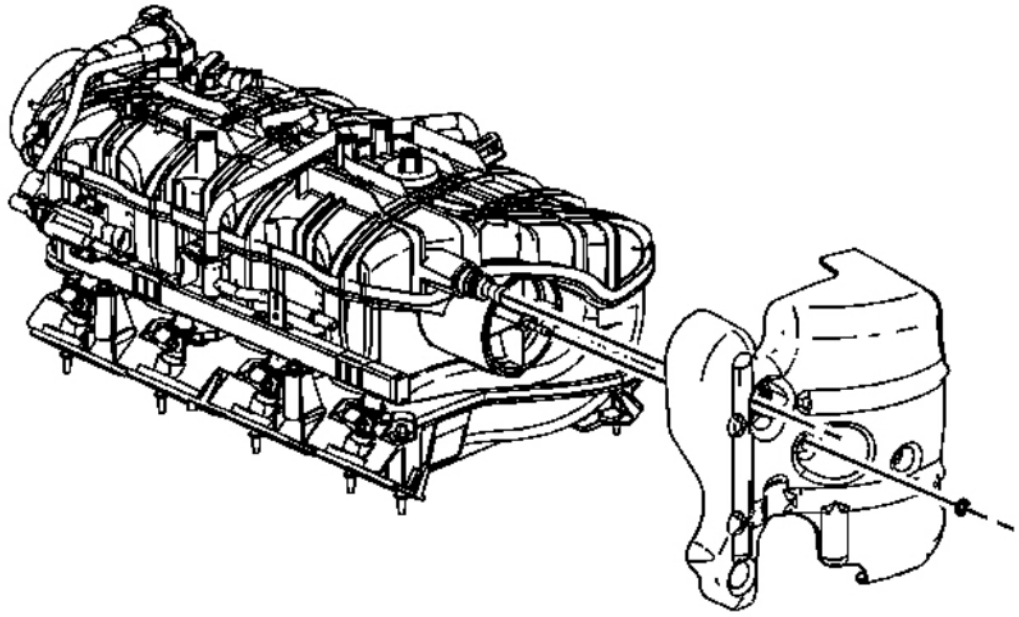


Fig. 134: View Of Upper Intake Manifold Cover & Nut
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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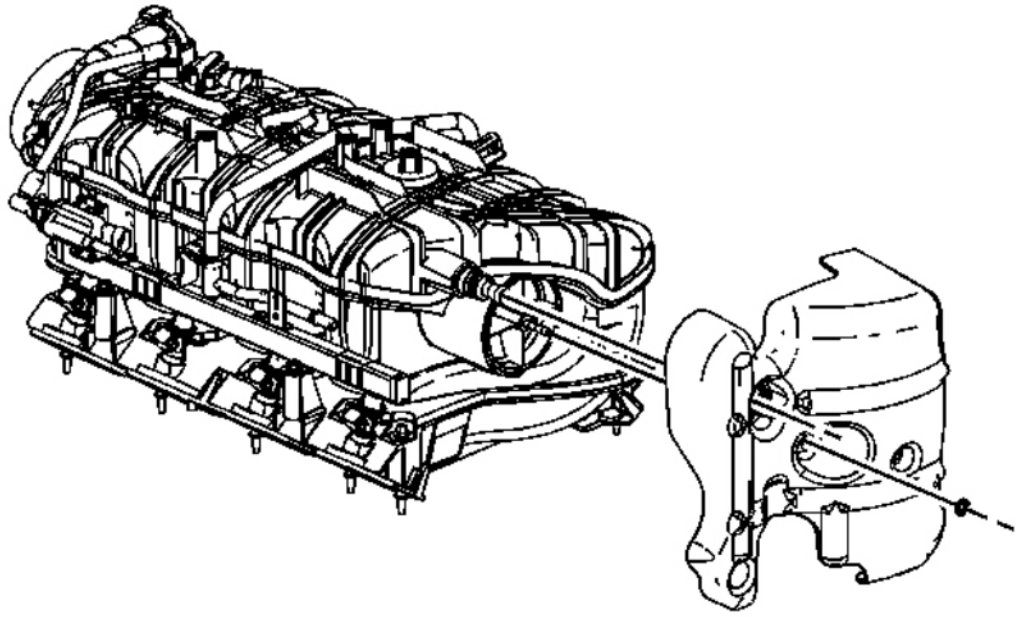


Fig. 135: View Of Upper Intake Manifold Cover & Nut
Courtesy of GENERAL MOTORS CORP.

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

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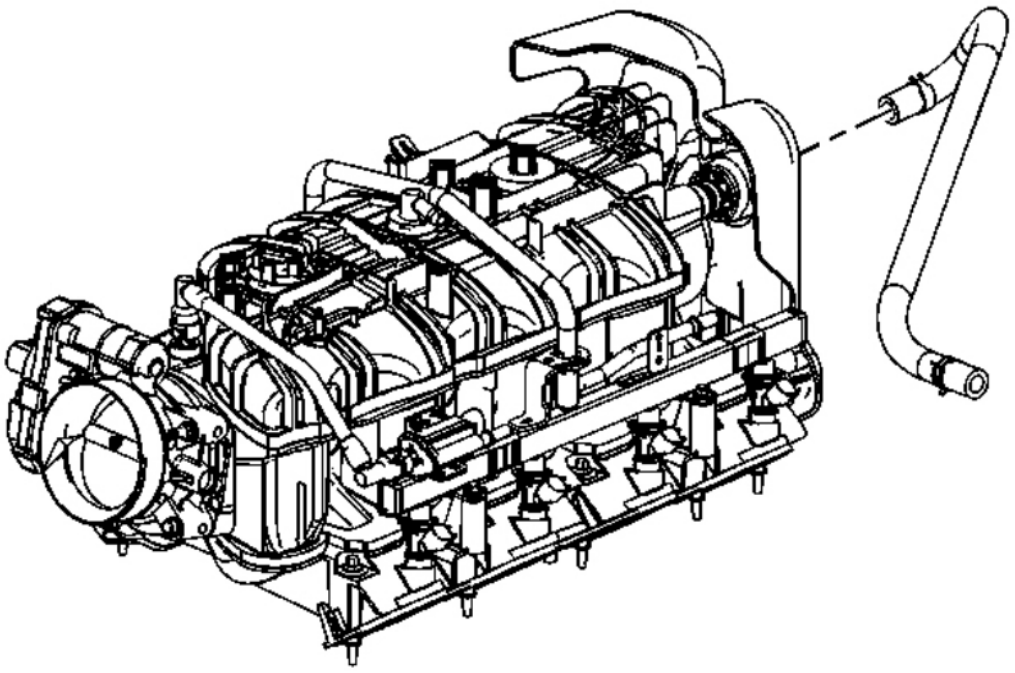


Fig. 136: View Of Vacuum Brake Booster Hose
Courtesy of GENERAL MOTORS CORP.

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 (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.

ENGINE VALLEY COVER REPLACEMENT

REMOVAL PROCEDURE

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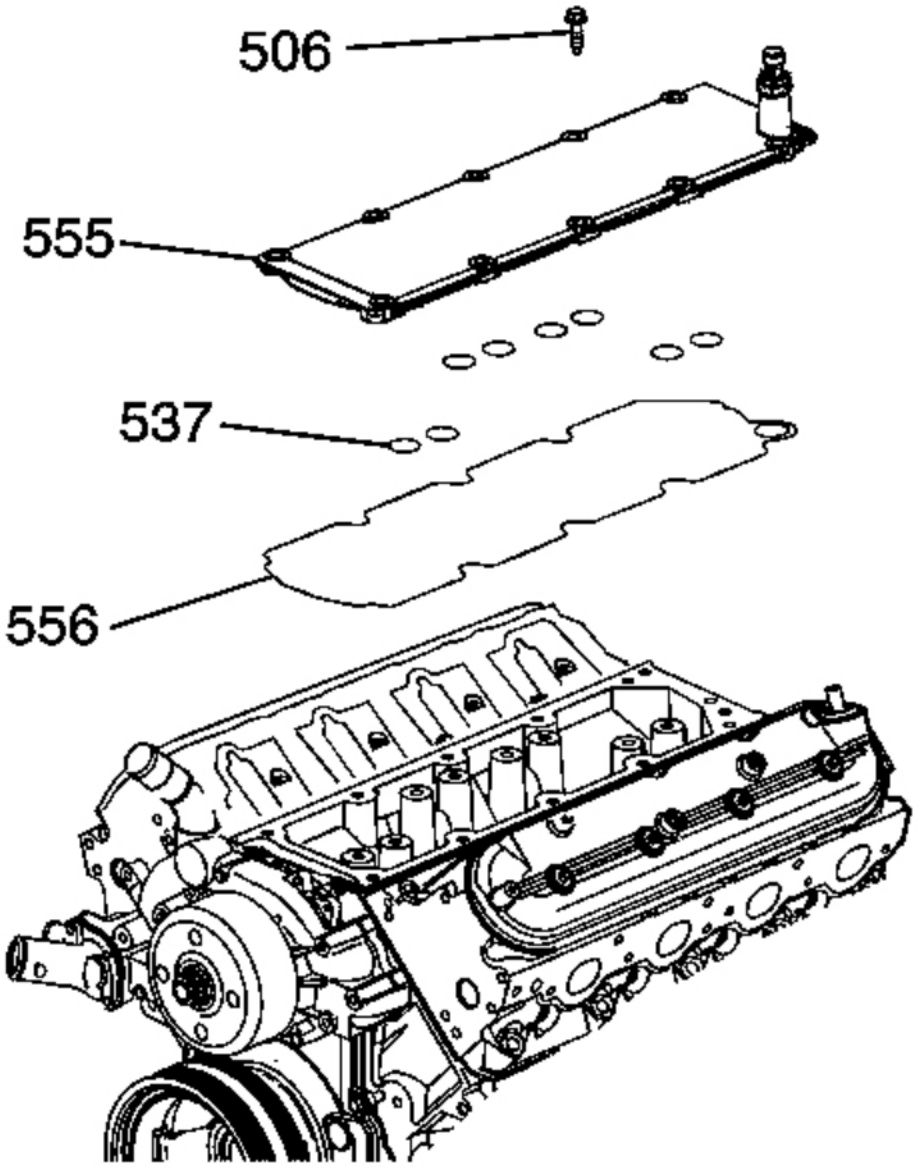


Fig. 137: View Of Engine Valley Cover & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
2. Remove the engine valley cover bolts (506).

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3. Remove the engine valley cover (555) and gasket (556).
4. Remove the O-ring seals (537) from the cover.

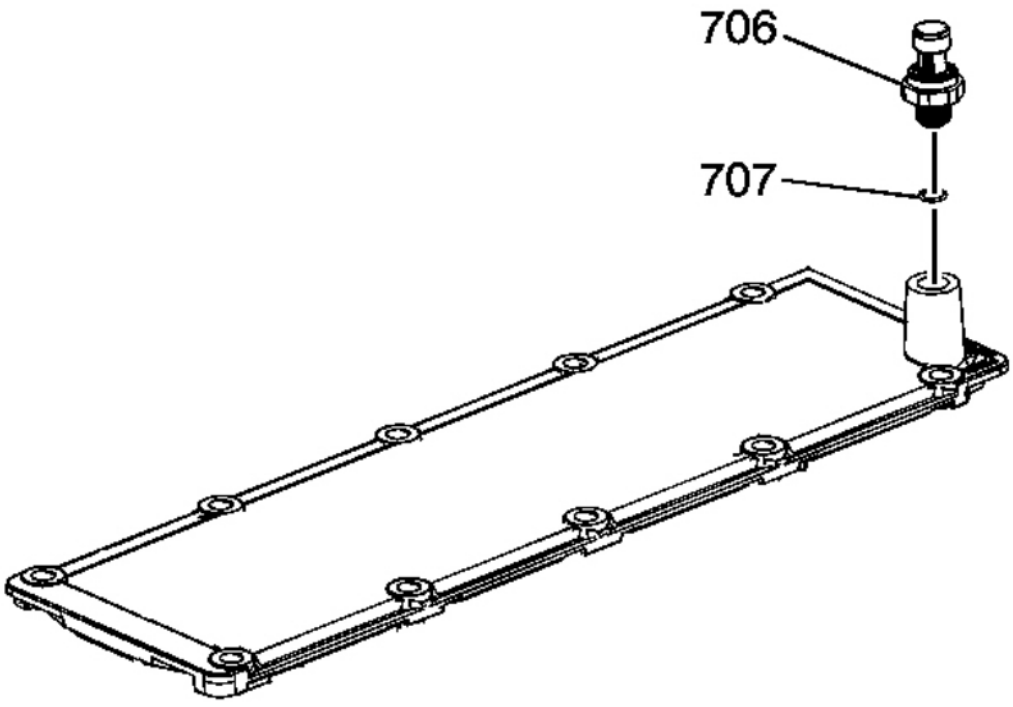


Fig. 138: View Of Oil Pressure Sensor & Washer
Courtesy of GENERAL MOTORS CORP.

5. Remove the oil pressure sensor (706) and washer (707).

INSTALLATION PROCEDURE

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

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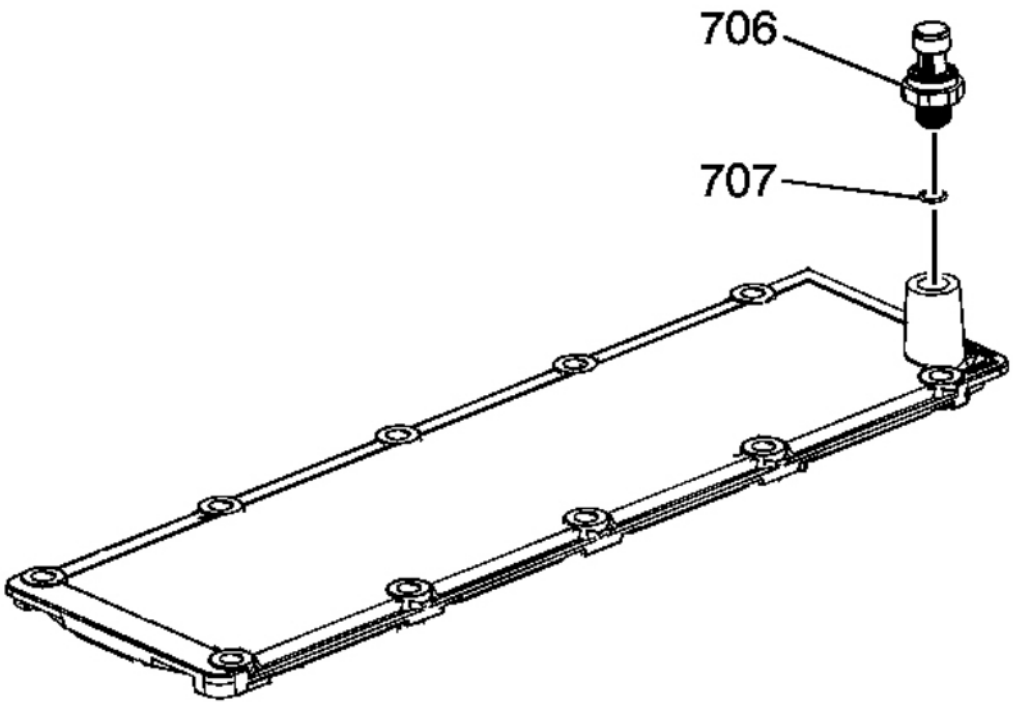


Fig. 139: View Of Oil Pressure Sensor & Washer
Courtesy of GENERAL MOTORS CORP.

1. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent, to the threads of the oil pressure sensor.

NOTE: **Refer to Fastener Notice .**

2. Install a NEW washer (707) and the oil pressure sensor (706).

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

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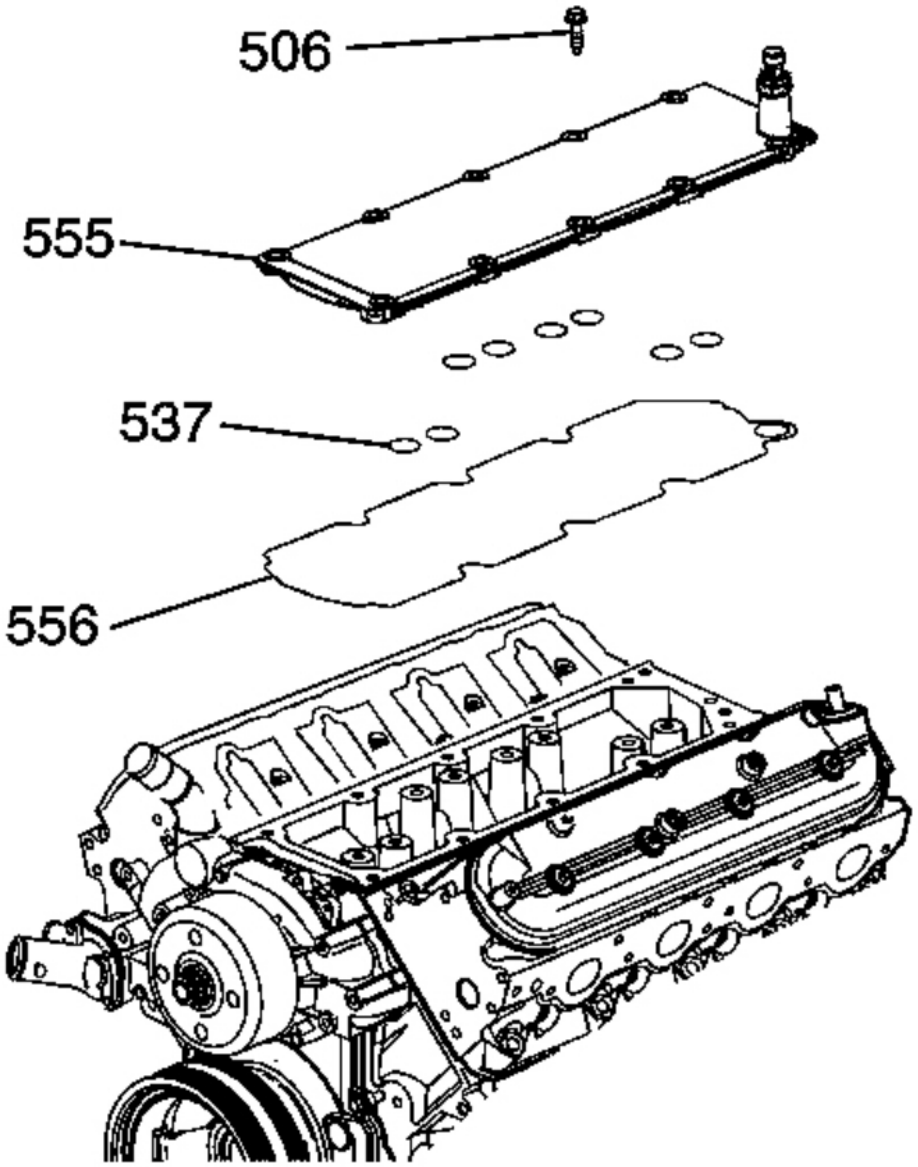


Fig. 140: View Of Engine Valley Cover & Gasket
Courtesy of GENERAL MOTORS CORP.

3. Lubricate the O-ring seals with clean engine oil.
4. Install the O-ring seals (537) to the cover.
5. Set the engine valley cover (555) onto the engine.

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6. Install the engine valley cover bolts (506).

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

7. Install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.

VALVE LIFTER OIL MANIFOLD REPLACEMENT

REMOVAL PROCEDURE

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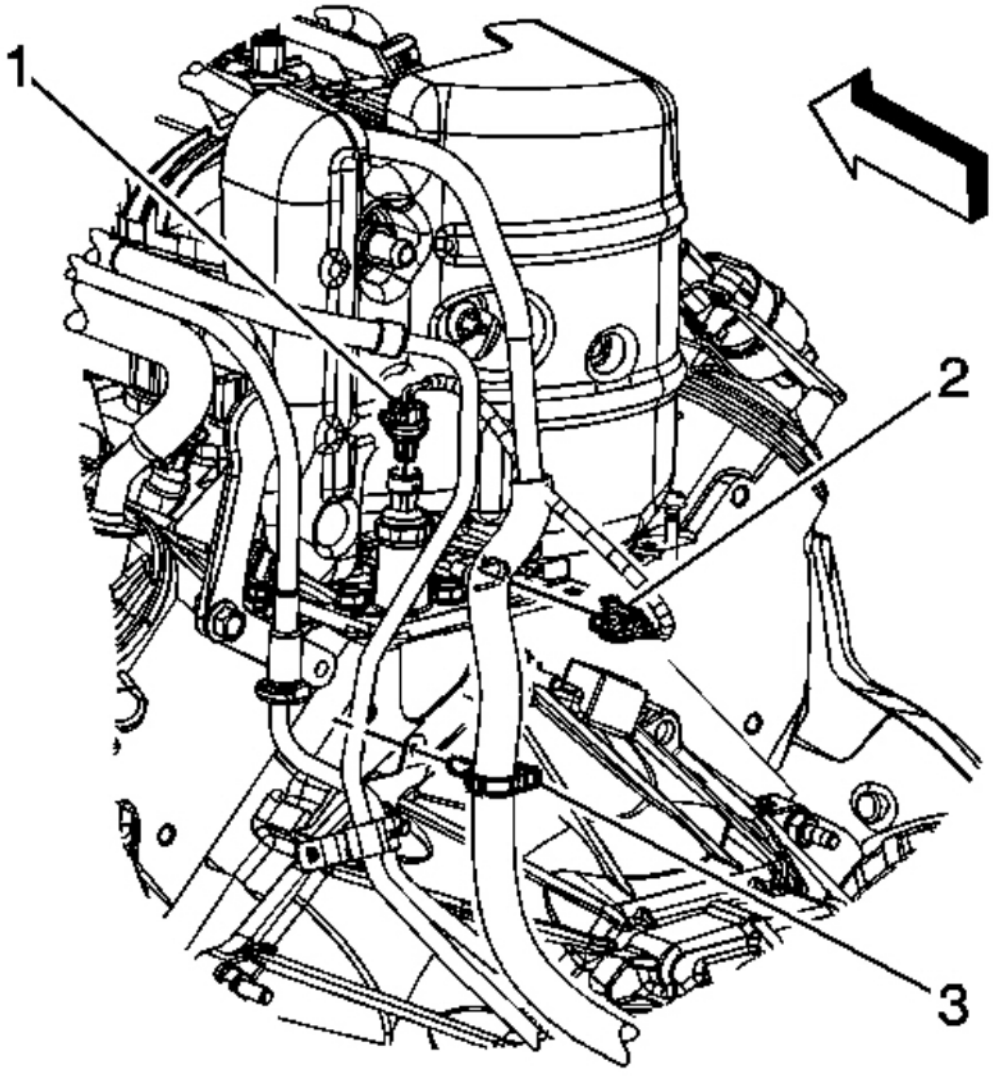


Fig. 141: View Of Engine Harness Electrical Connectors & Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.

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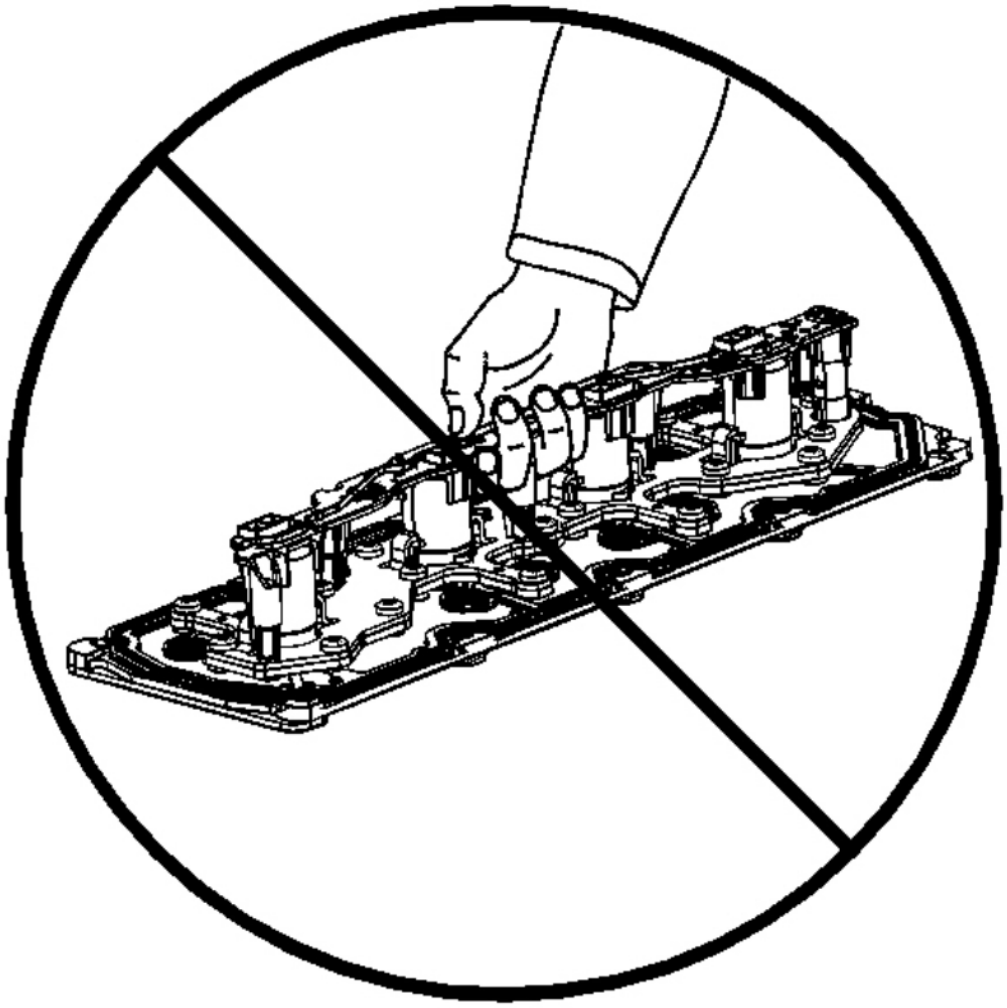


Fig. 142: Valve Lifter Oil Manifold
Courtesy of GENERAL MOTORS CORP.

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

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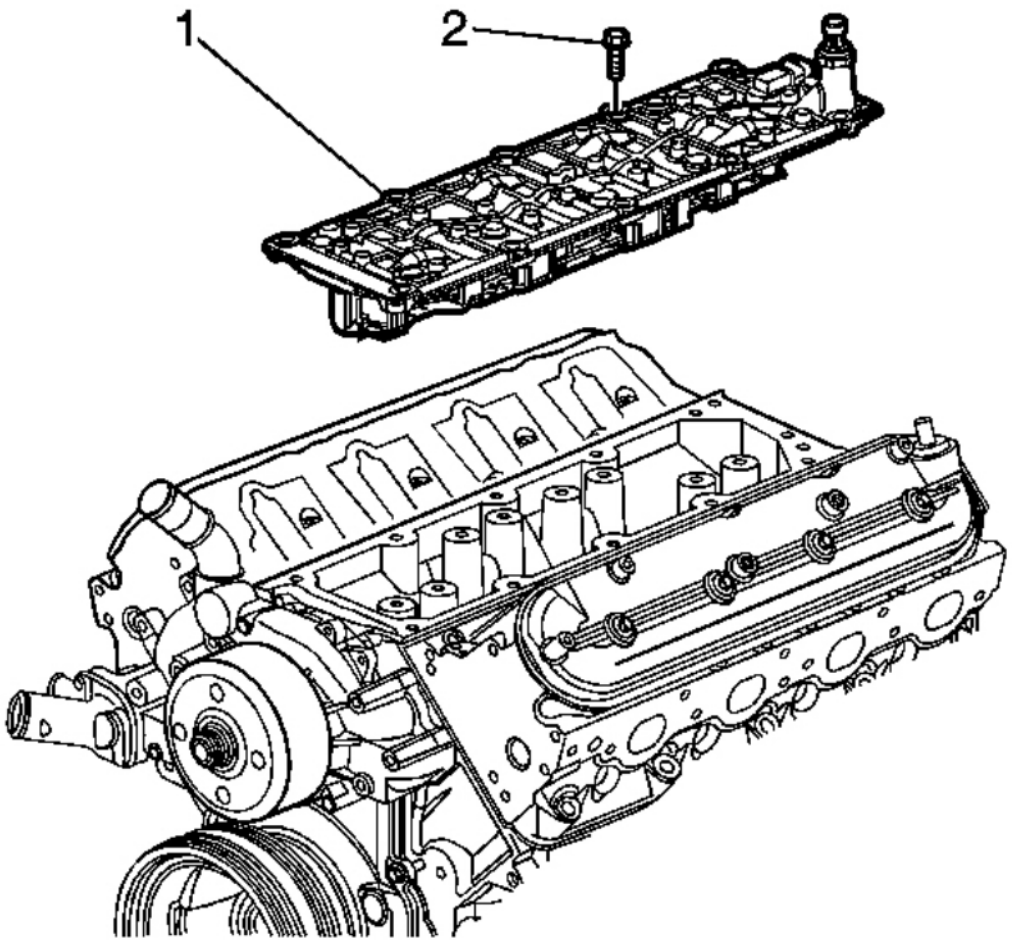


Fig. 143: Valve Lifter Oil Manifold
Courtesy of GENERAL MOTORS CORP.

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

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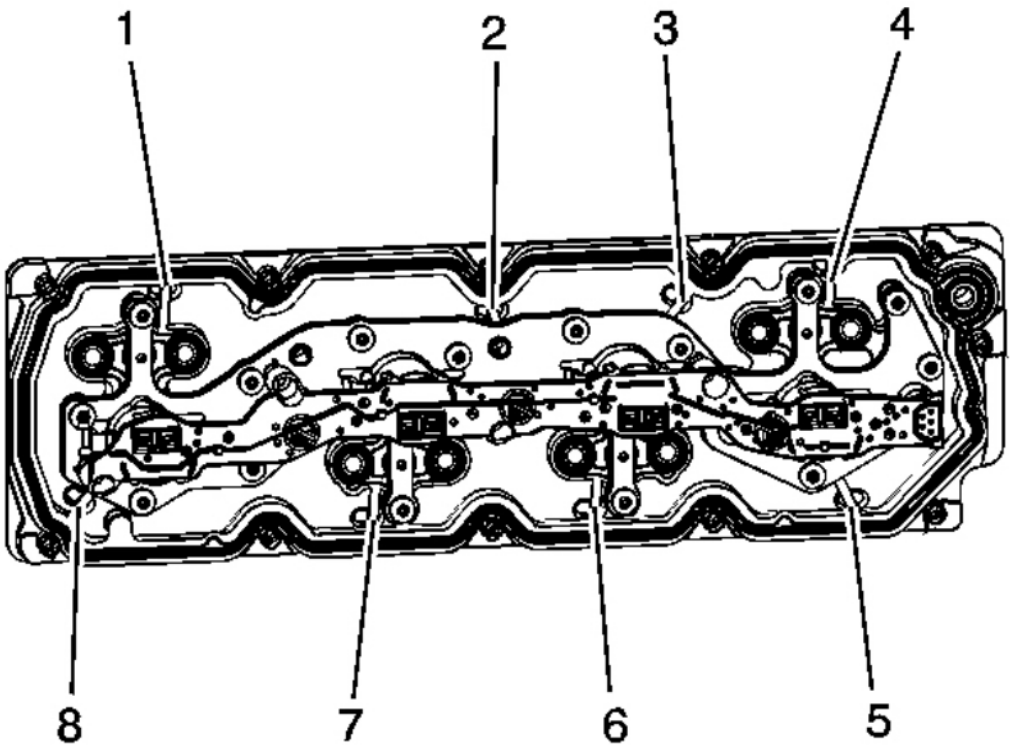


Fig. 144: Gasket Retaining Strap Locations
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: 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).

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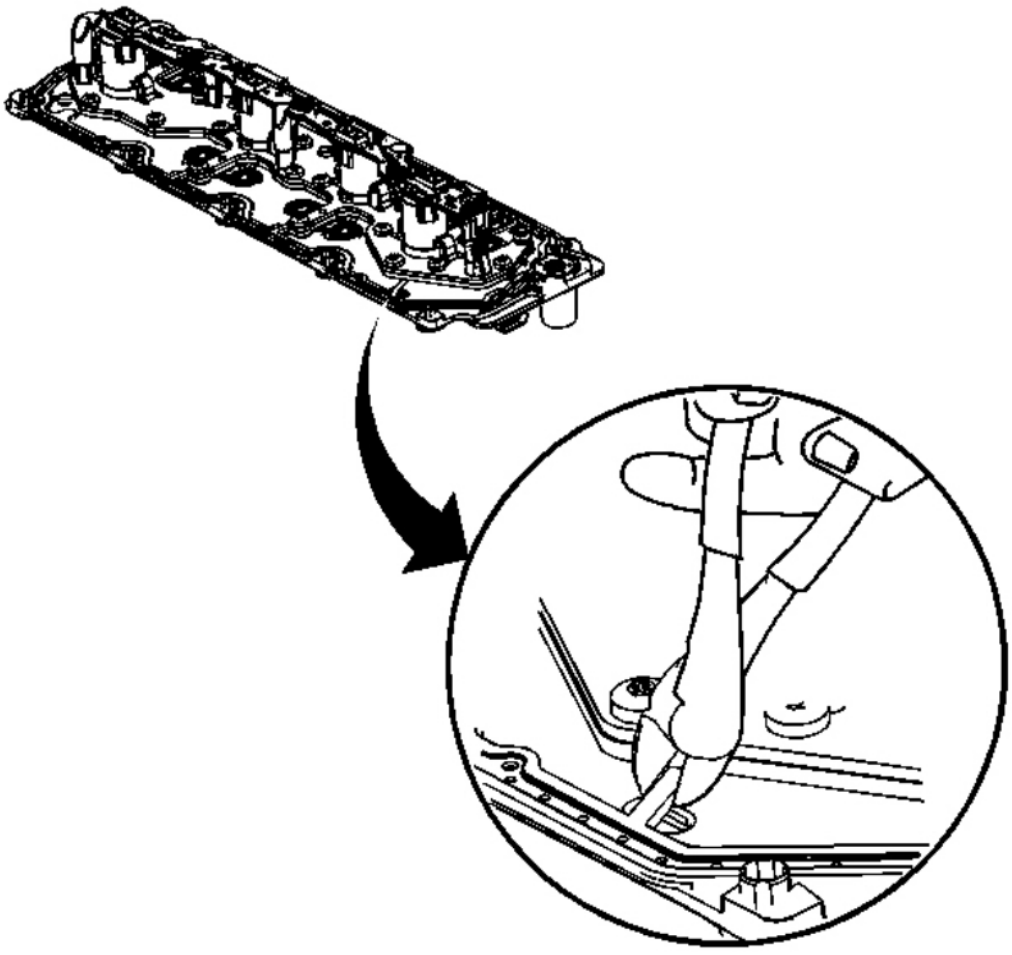


Fig. 145: Cutting Gasket Retaining Straps
Courtesy of GENERAL MOTORS CORP.

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

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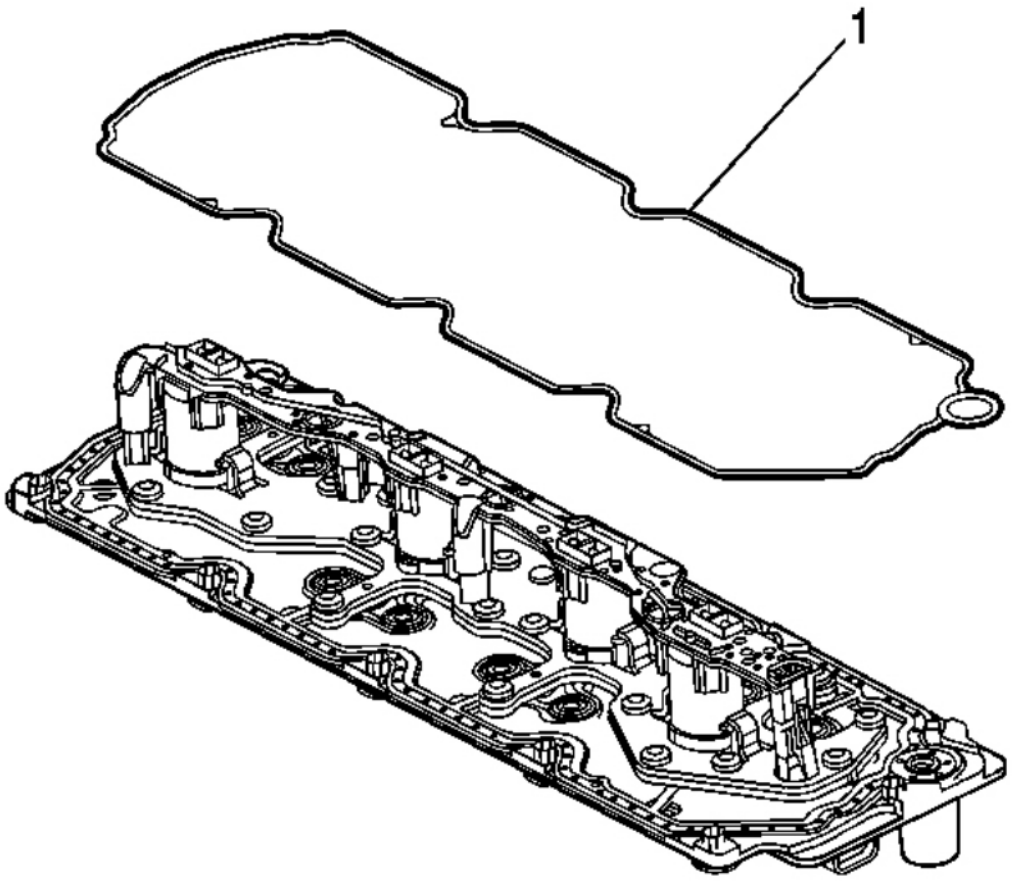


Fig. 146: Identifying Valve Cover Outer Gasket
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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

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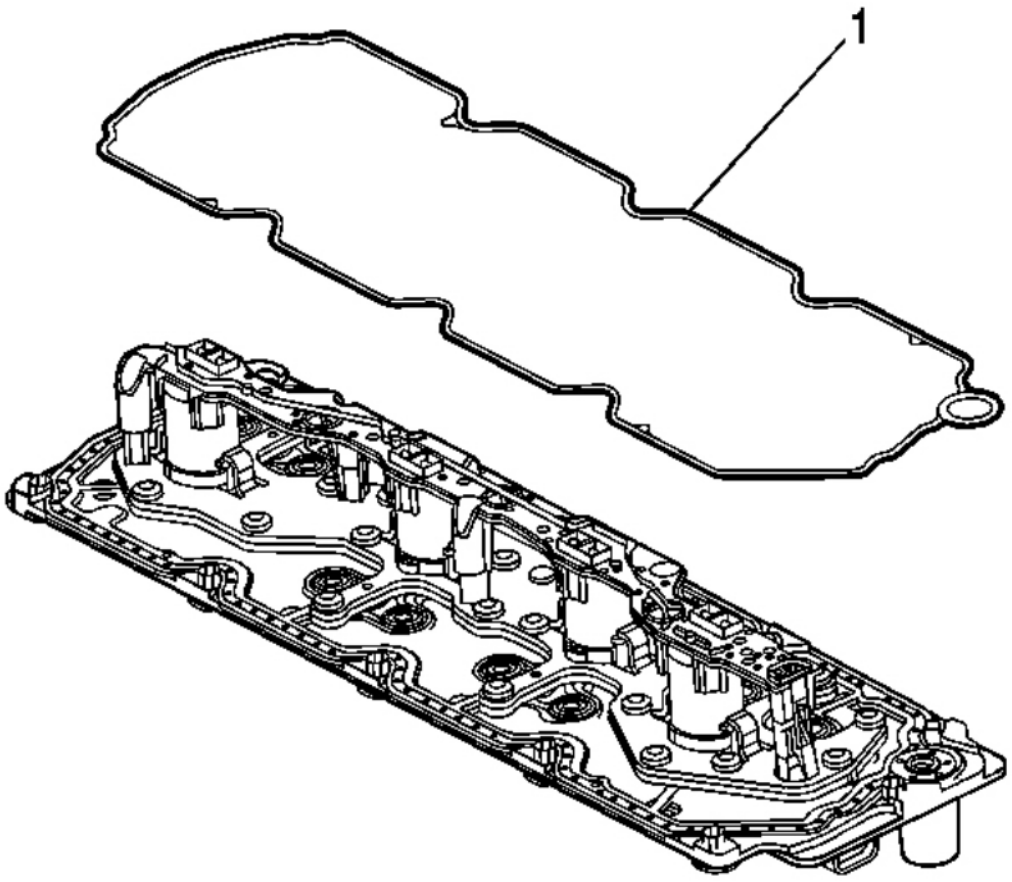


Fig. 147: Identifying Valve Cover Outer Gasket
Courtesy of GENERAL MOTORS CORP.

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

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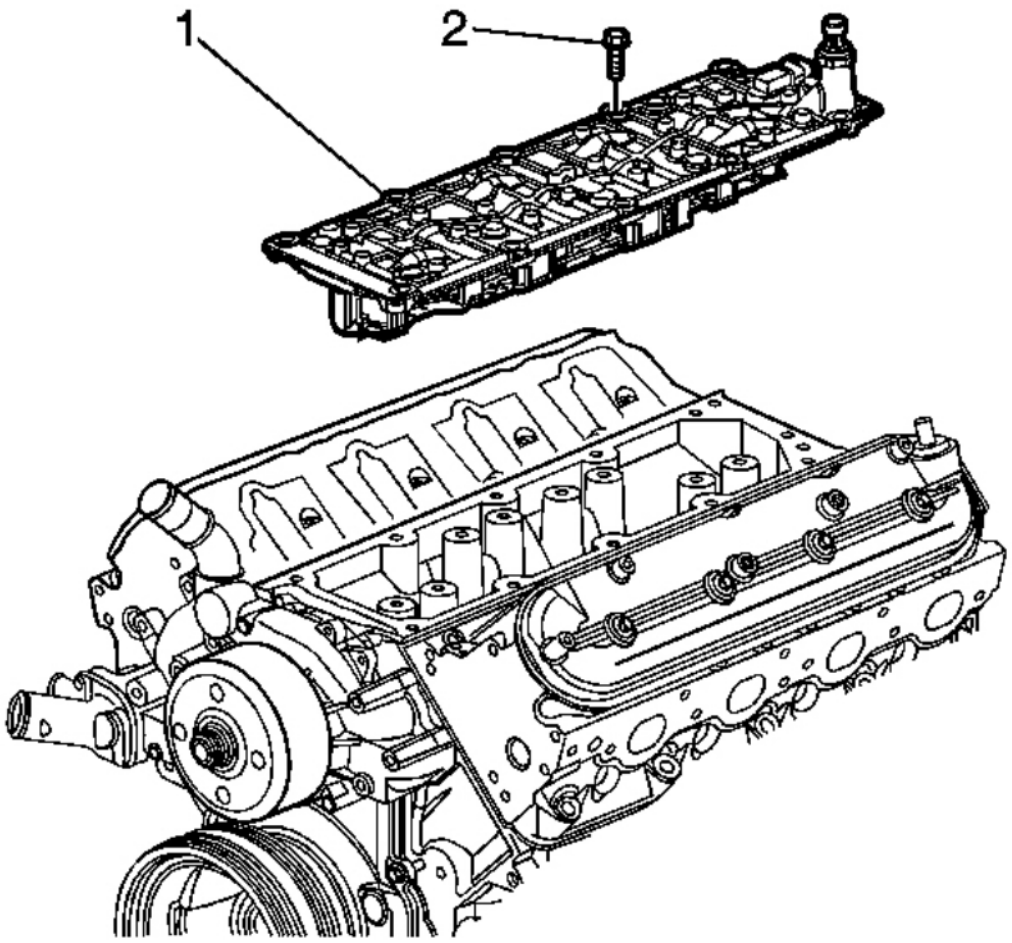


Fig. 148: Valve Lifter Oil Manifold
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

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

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

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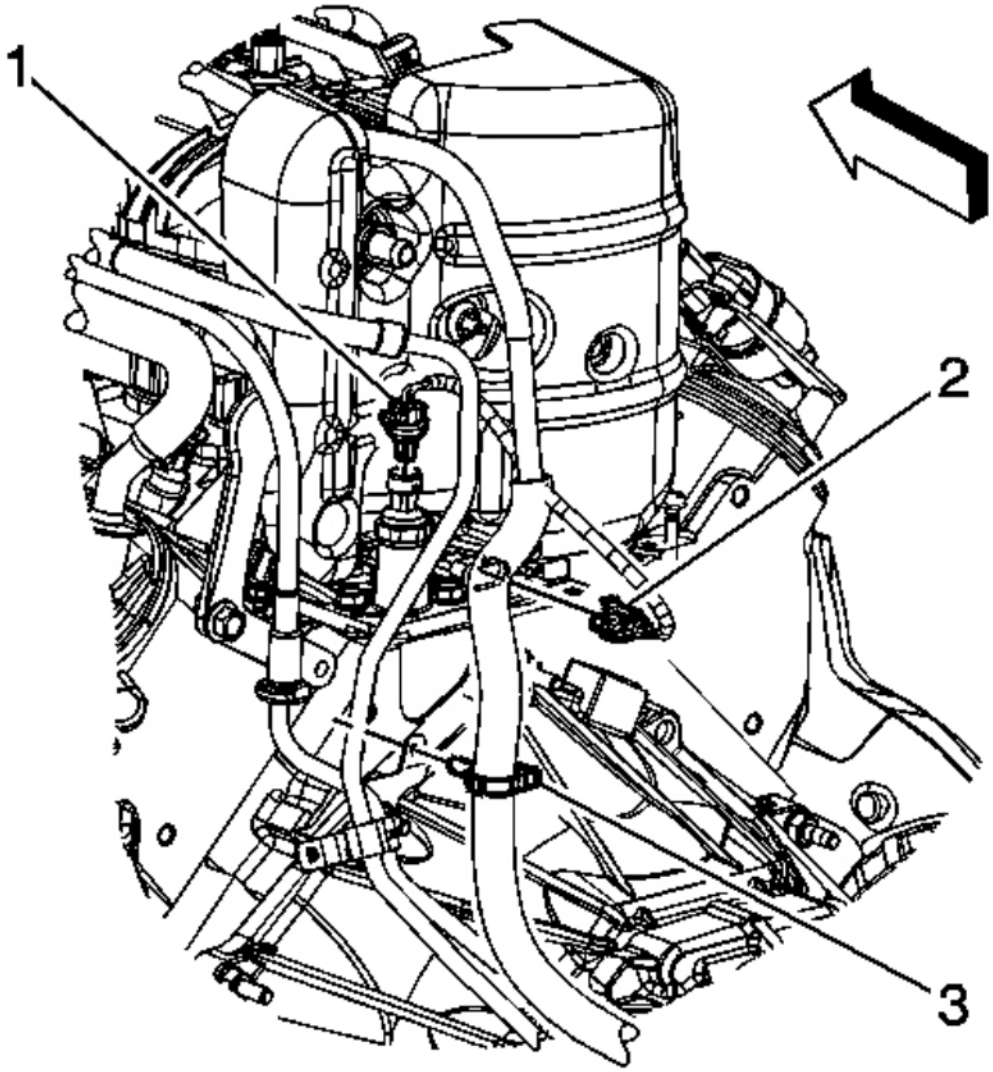


Fig. 149: View Of Engine Harness Electrical Connectors & Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

4. Connect the engine harness electrical connector (1) to the oil pressure sensor.
5. Install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.

VALVE LIFTER OIL FILTER REPLACEMENT

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REMOVAL PROCEDURE

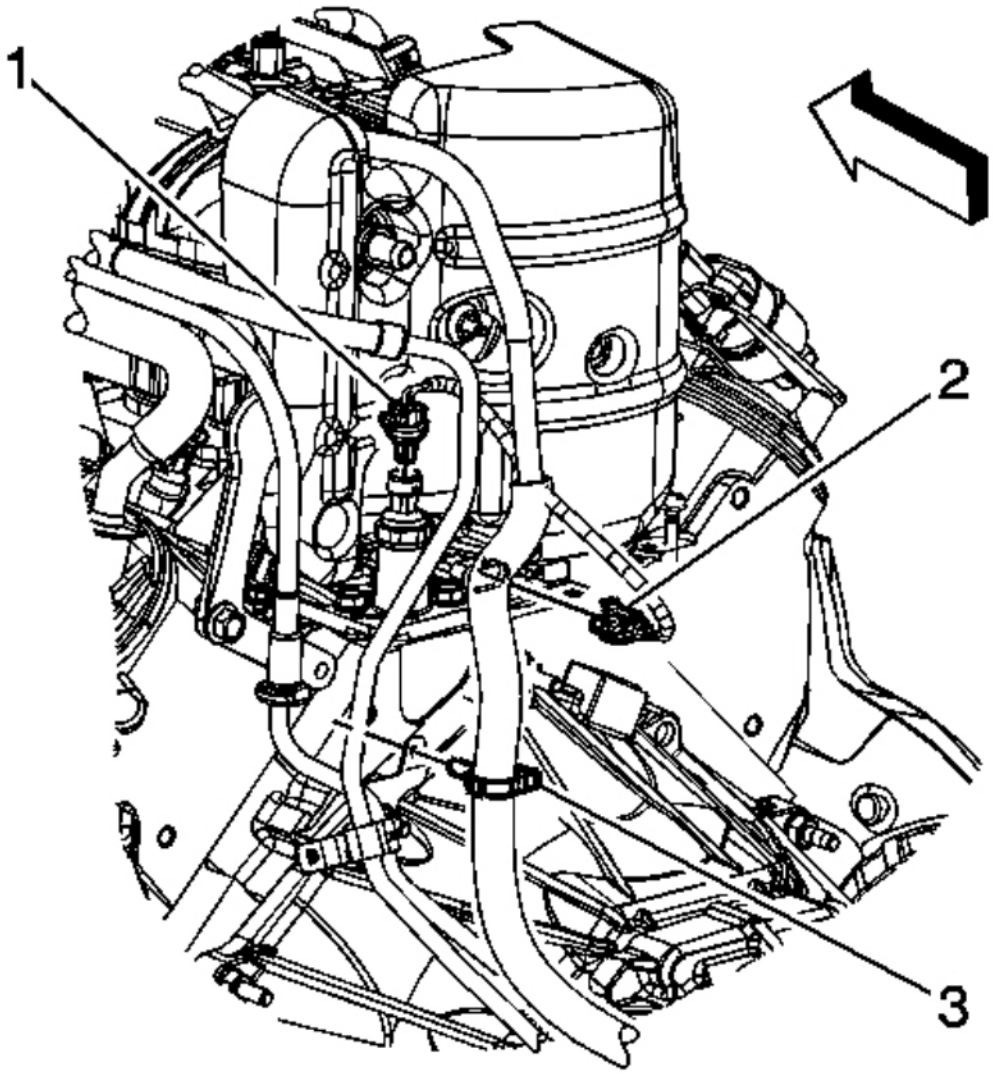


Fig. 150: View Of Engine Harness Electrical Connectors & Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.

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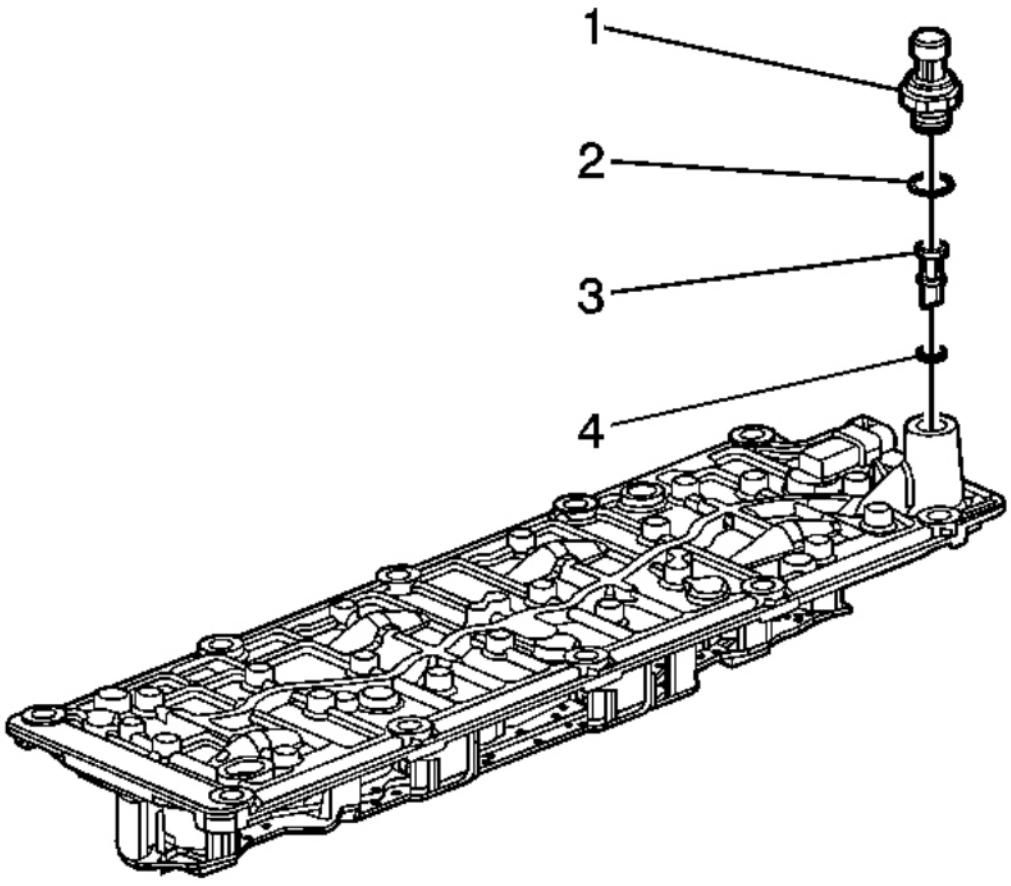


Fig. 151: View Of Oil Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

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

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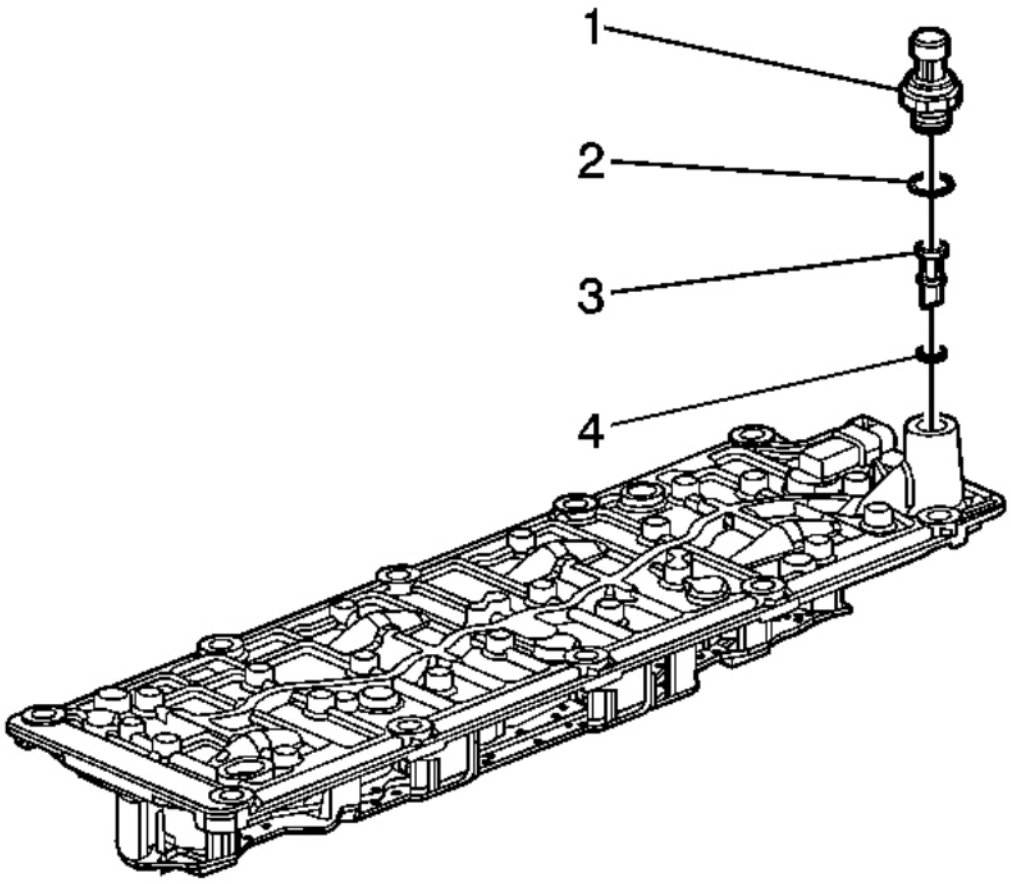


Fig. 152: View Of Oil Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

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.

NOTE: **Refer to Fastener Notice .**

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

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

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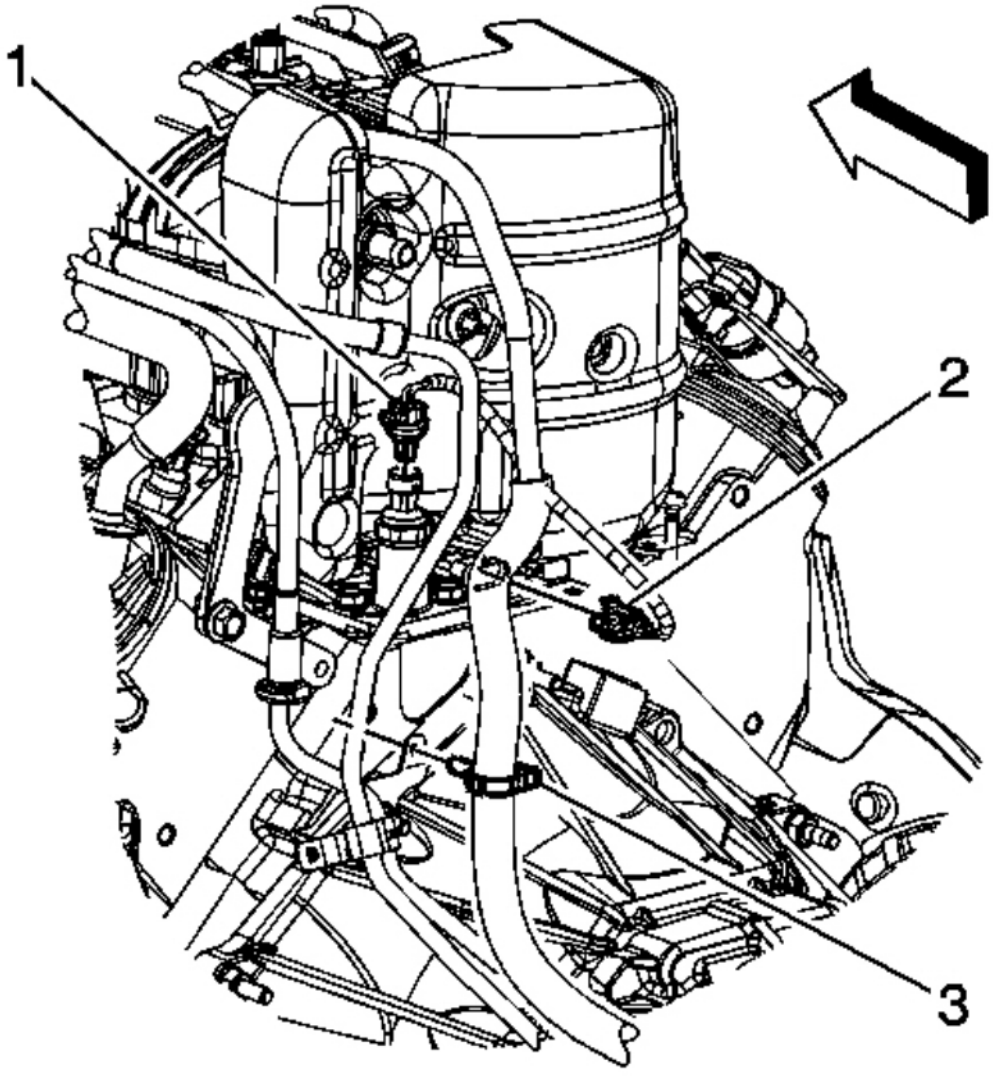


Fig. 153: View Of Engine Harness Electrical Connectors & Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

5. Connect the engine harness electrical connector (1) to the oil pressure sensor.
6. Install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.

VALVE ROCKER ARM COVER REPLACEMENT - LEFT SIDE

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REMOVAL PROCEDURE

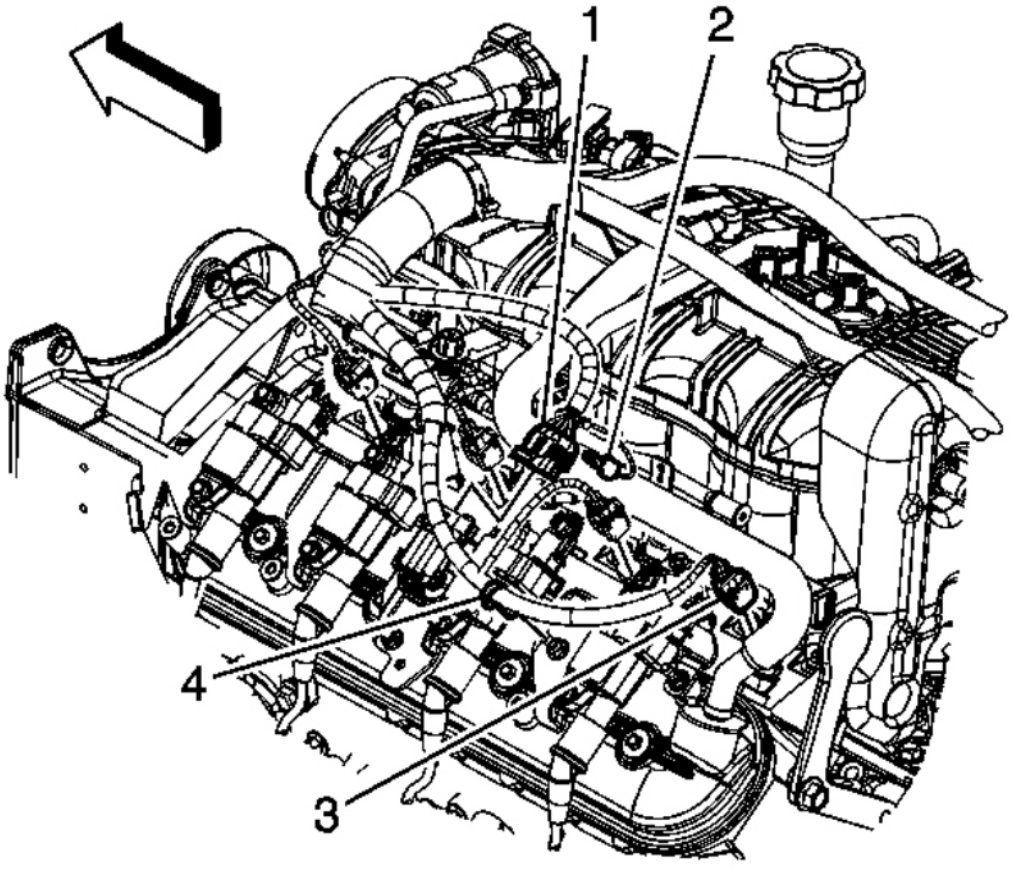


Fig. 154: View Of CPA Retainer, Electrical Connectors & Engine Harness Clips
Courtesy of GENERAL MOTORS CORP.

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 the engine harness clip (4) from the ignition coil bracket stud.
5. Reposition the engine harness, as necessary.

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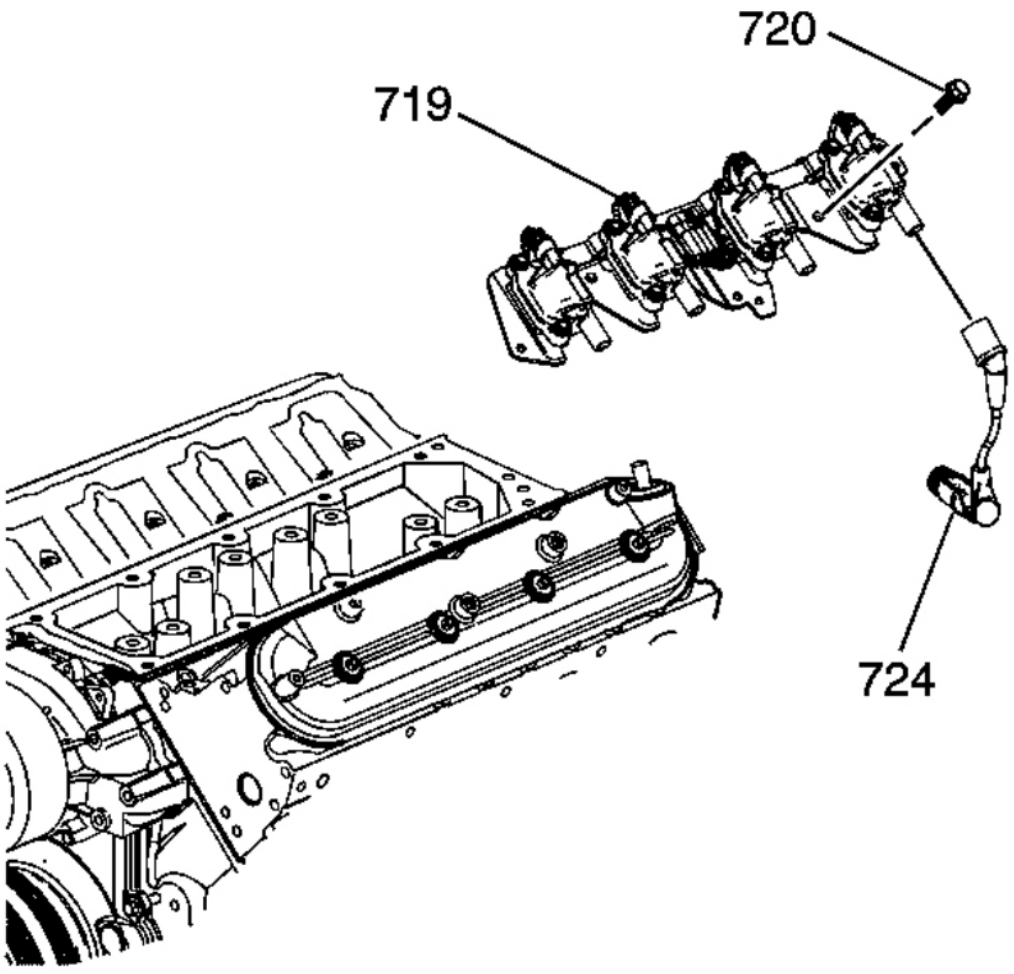


Fig. 155: Ignition Coils & Bracket
Courtesy of GENERAL MOTORS CORP.

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).

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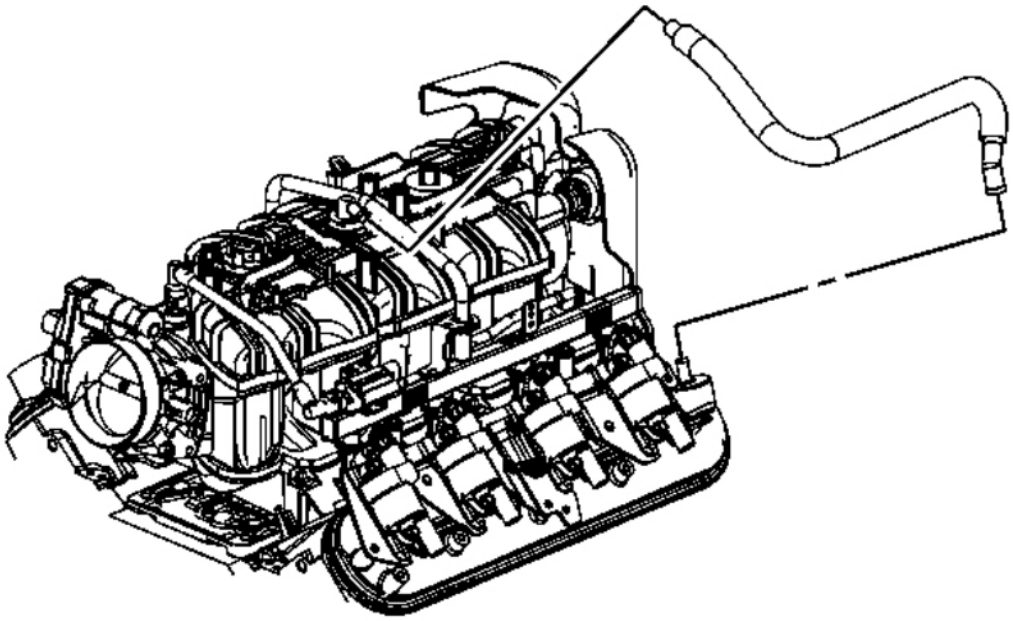


Fig. 156: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

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

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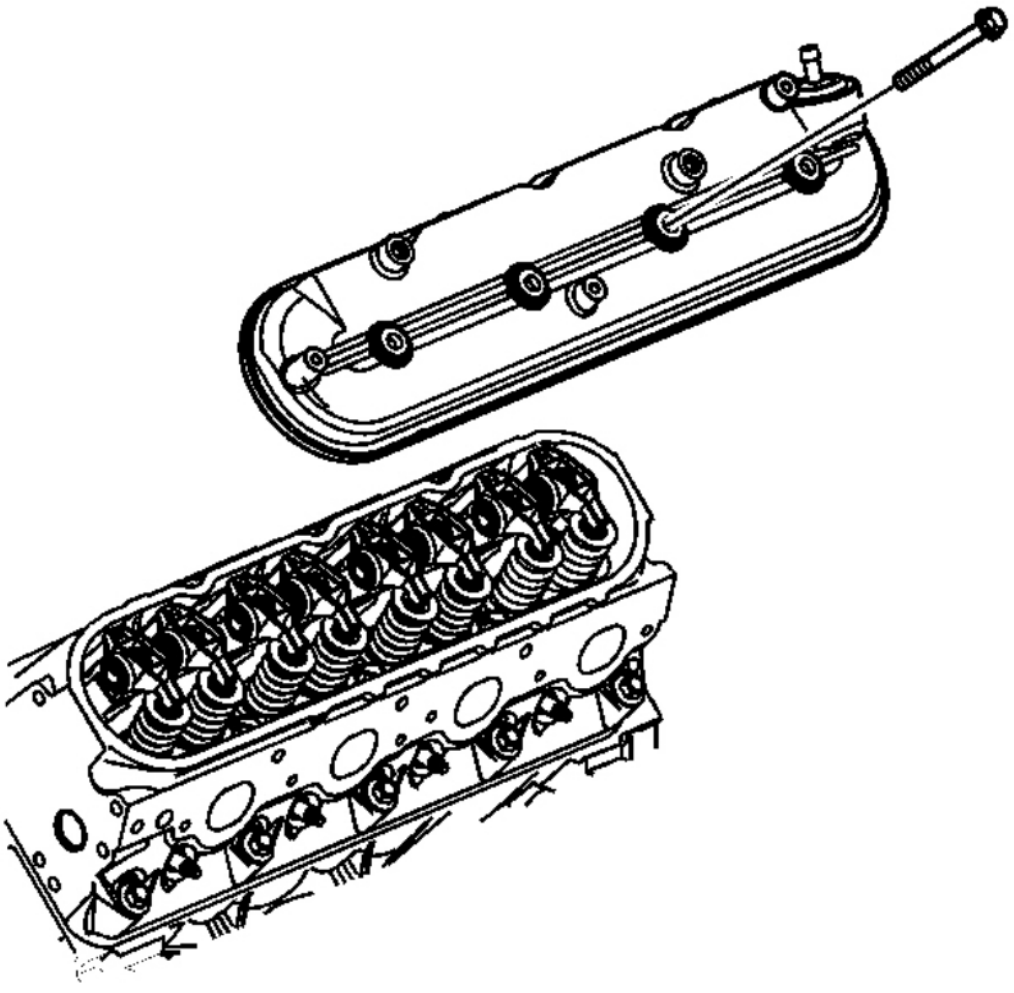


Fig. 157: View Of Valve Rocker Arm Cover
Courtesy of GENERAL MOTORS CORP.

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

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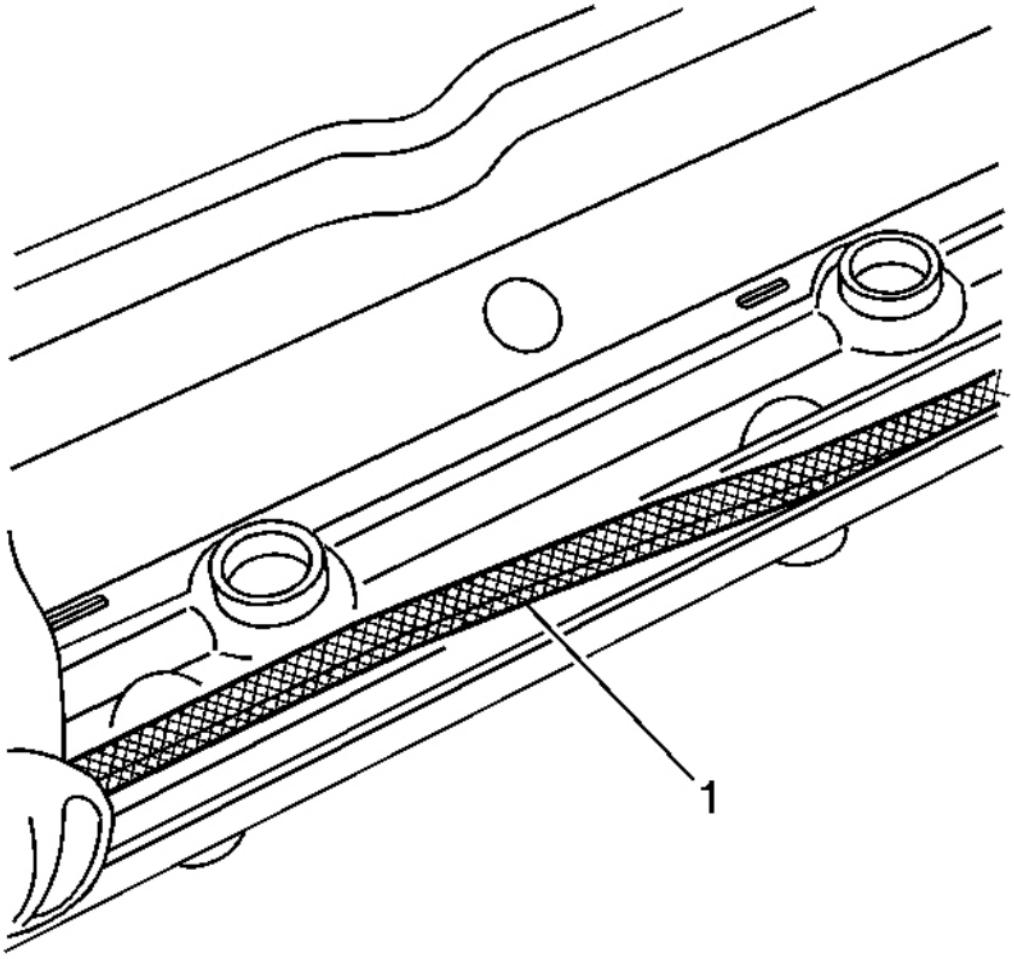


Fig. 158: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

IMPORTANT:

- **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.**

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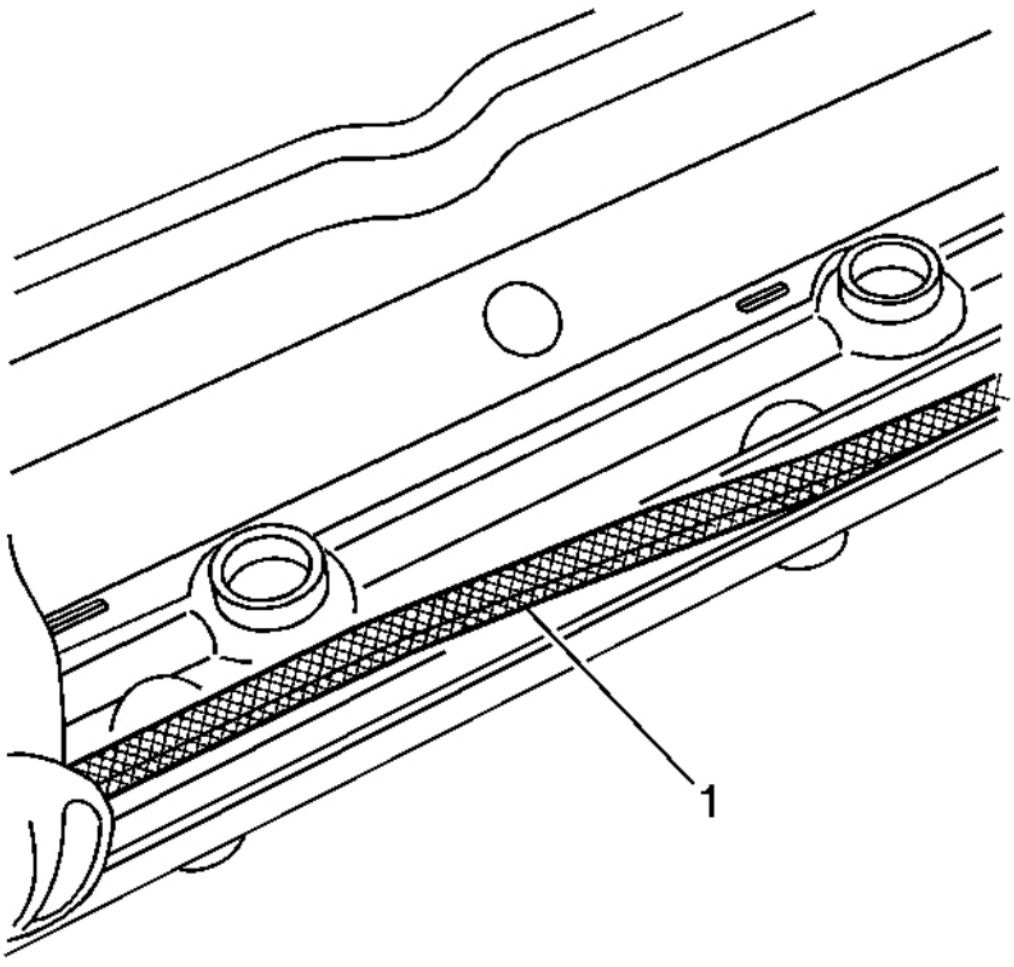


Fig. 159: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

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

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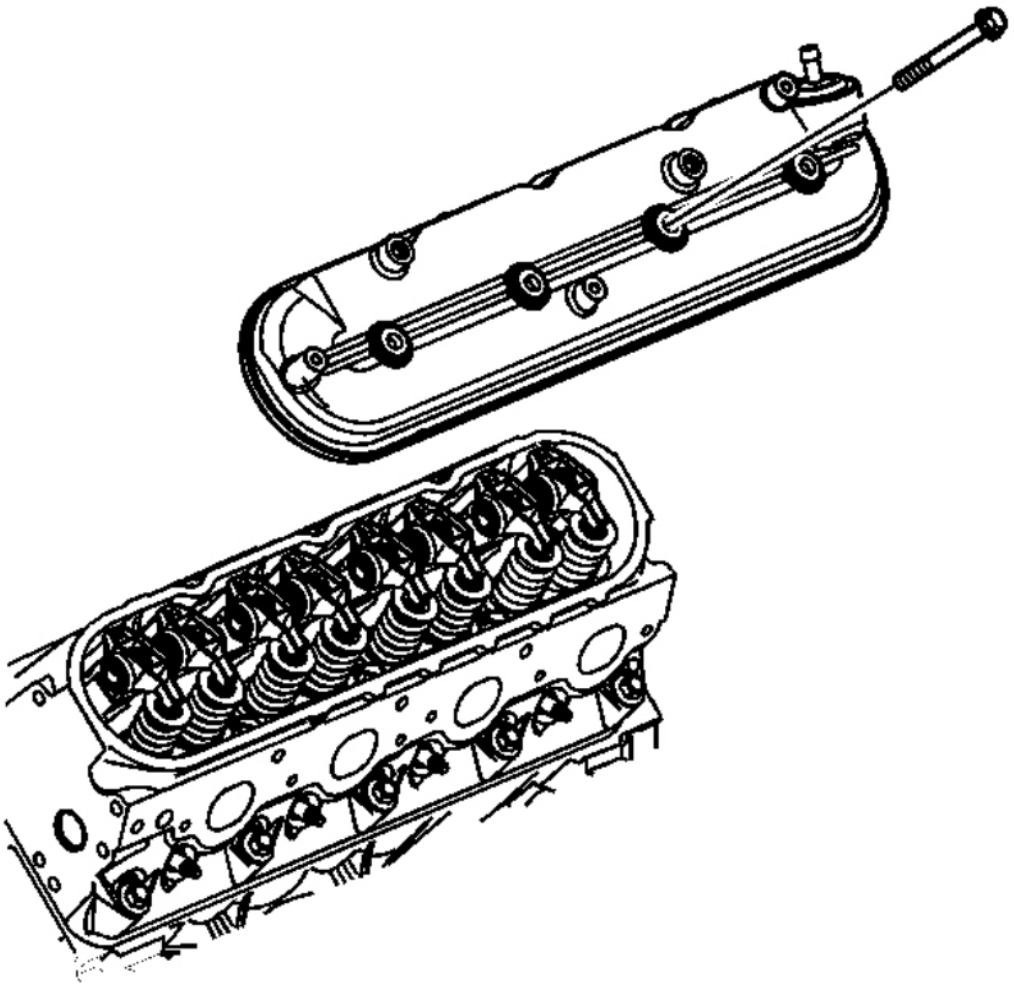


Fig. 160: View Of Valve Rocker Arm Cover
Courtesy of GENERAL MOTORS CORP.

2. Install the valve rocker arm cover.

NOTE: **Refer to Fastener Notice .**

3. Tighten the rocker arm cover bolts.

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

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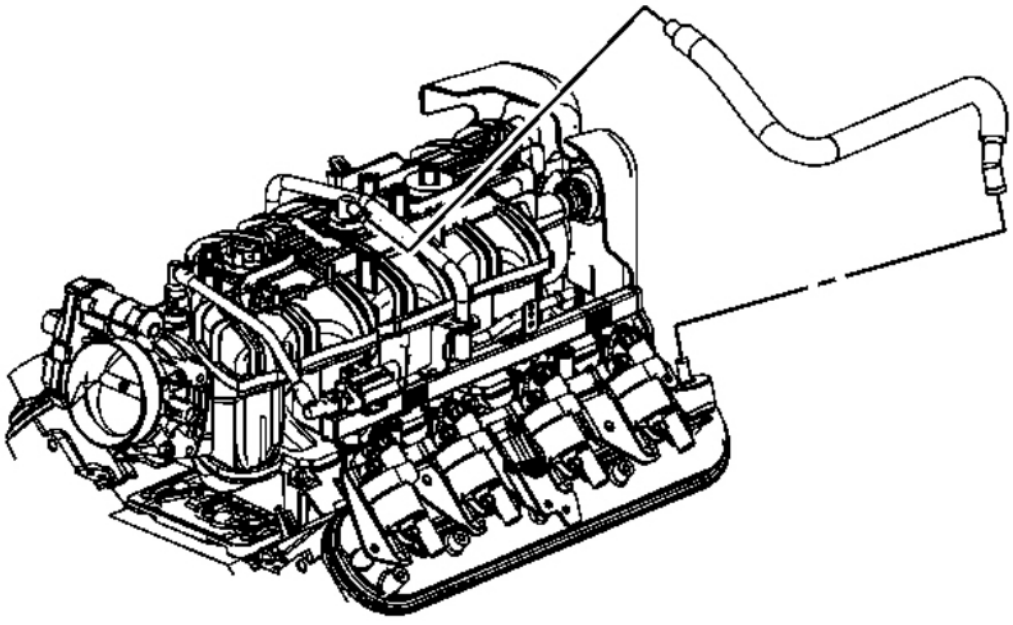


Fig. 161: View Of PCV Hose
Courtesy of GENERAL MOTORS CORP.

4. Install the PCV hose.

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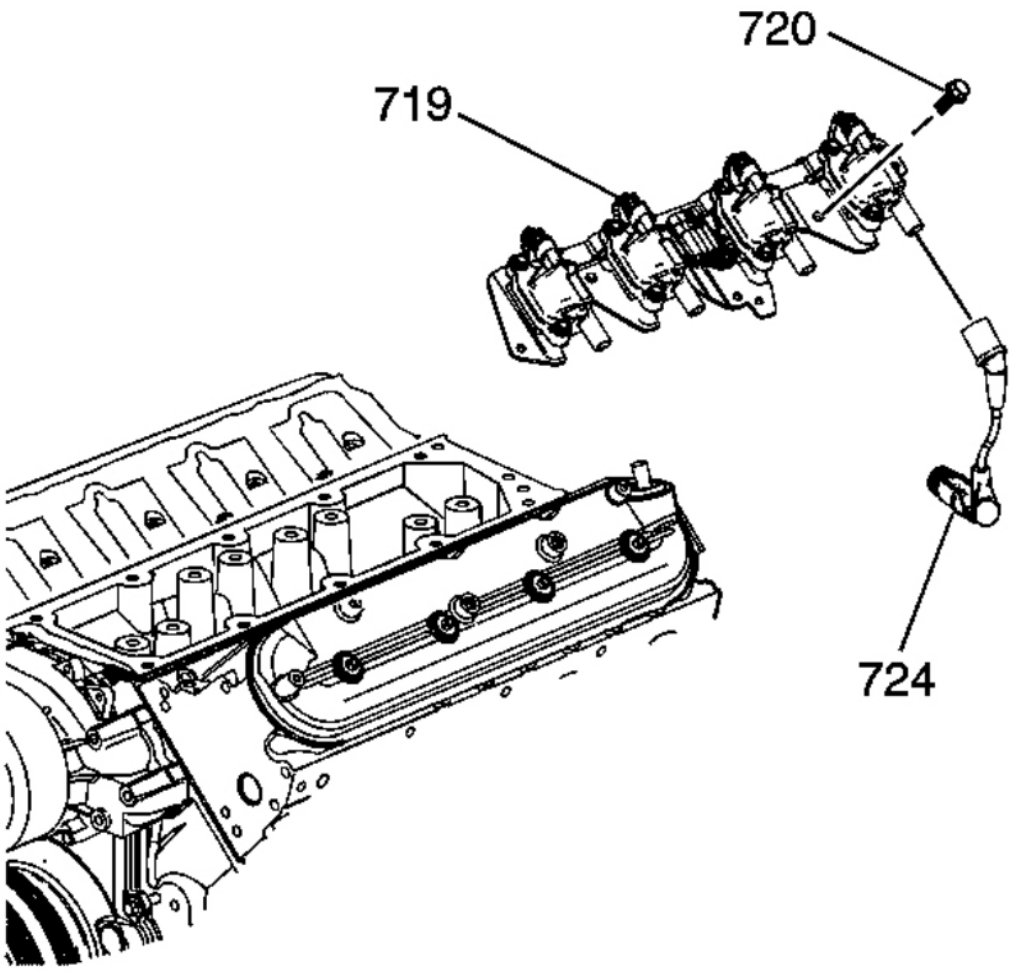


Fig. 162: Ignition Coils & Bracket
Courtesy of GENERAL MOTORS CORP.

5. Apply threadlock to the threads of the ignition coil bracket studs. Refer to **Sealers, Adhesives, and Lubricants** .
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.

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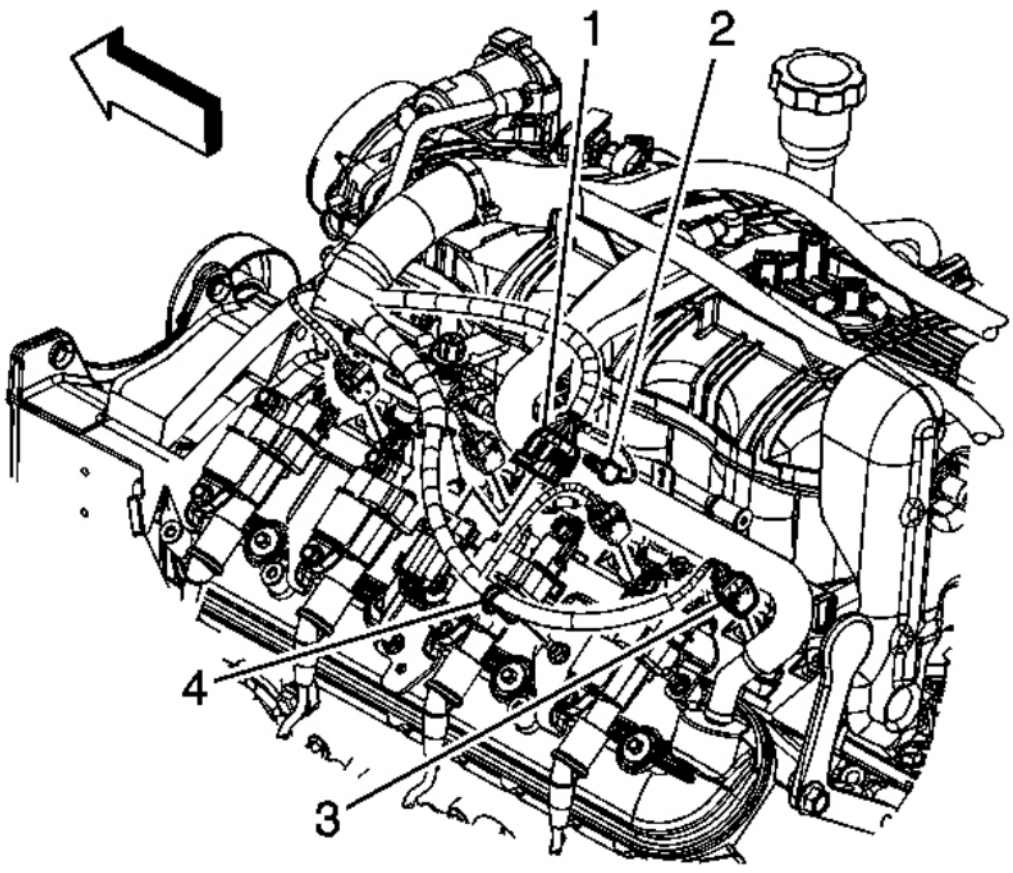


Fig. 163: View Of CPA Retainer, Electrical Connectors & Engine Harness Clips
Courtesy of GENERAL MOTORS CORP.

9. Position the engine harness, as necessary.
10. Install the engine harness clip (4) to the ignition coil bracket stud.
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

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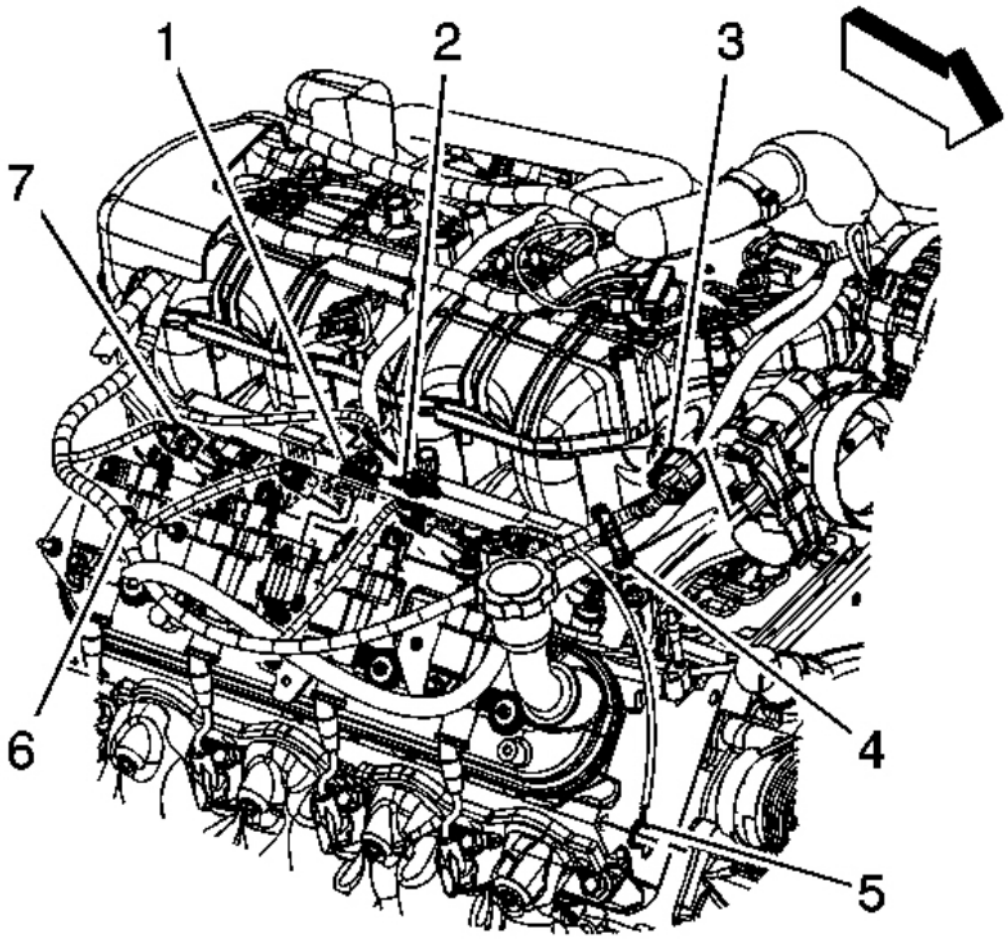


Fig. 164: View Of CPA Retainer, Engine Harness Electrical Connectors & Harness Clips
Courtesy of GENERAL MOTORS CORP.

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 the engine wiring harness (electronic throttle control branch) clip (6) from the ignition coil bracket stud.
5. Reposition the engine wiring harness (electronic throttle control branch) as necessary.

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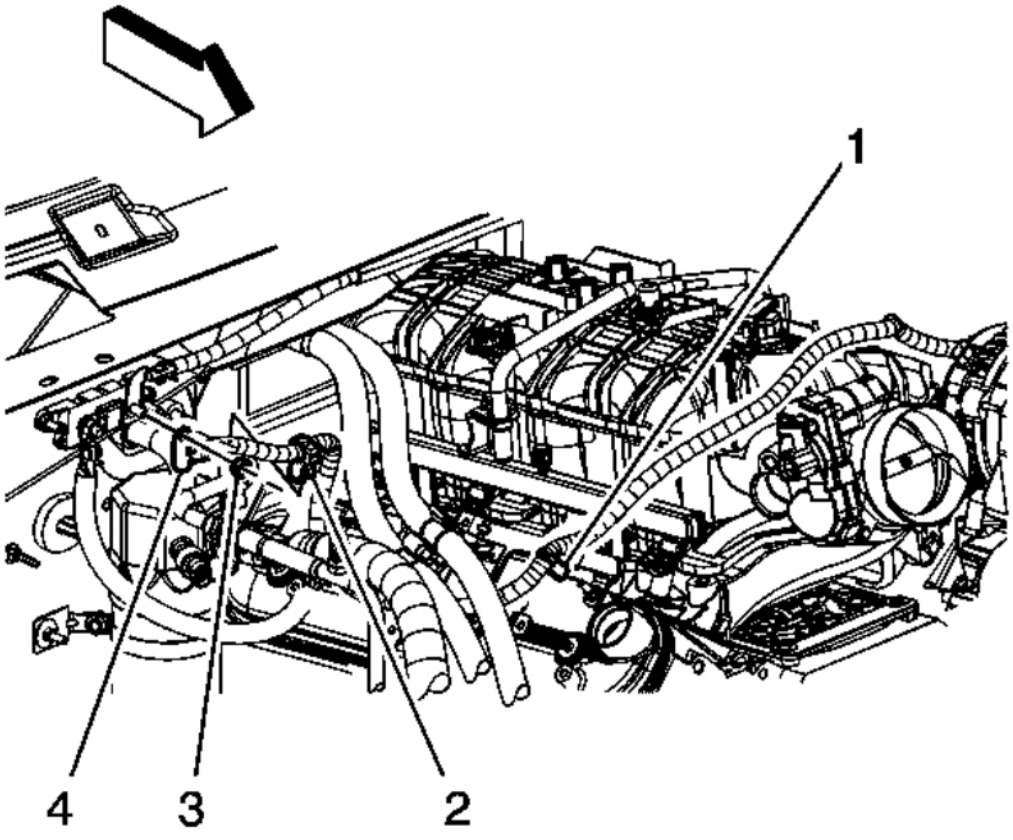


Fig. 165: View Of Generator Battery Jumper Cable & Components
Courtesy of GENERAL MOTORS CORP.

6. Remove the generator battery cable clip (1) from the ignition coil bracket stud.
7. Reposition the generator battery cable as necessary.

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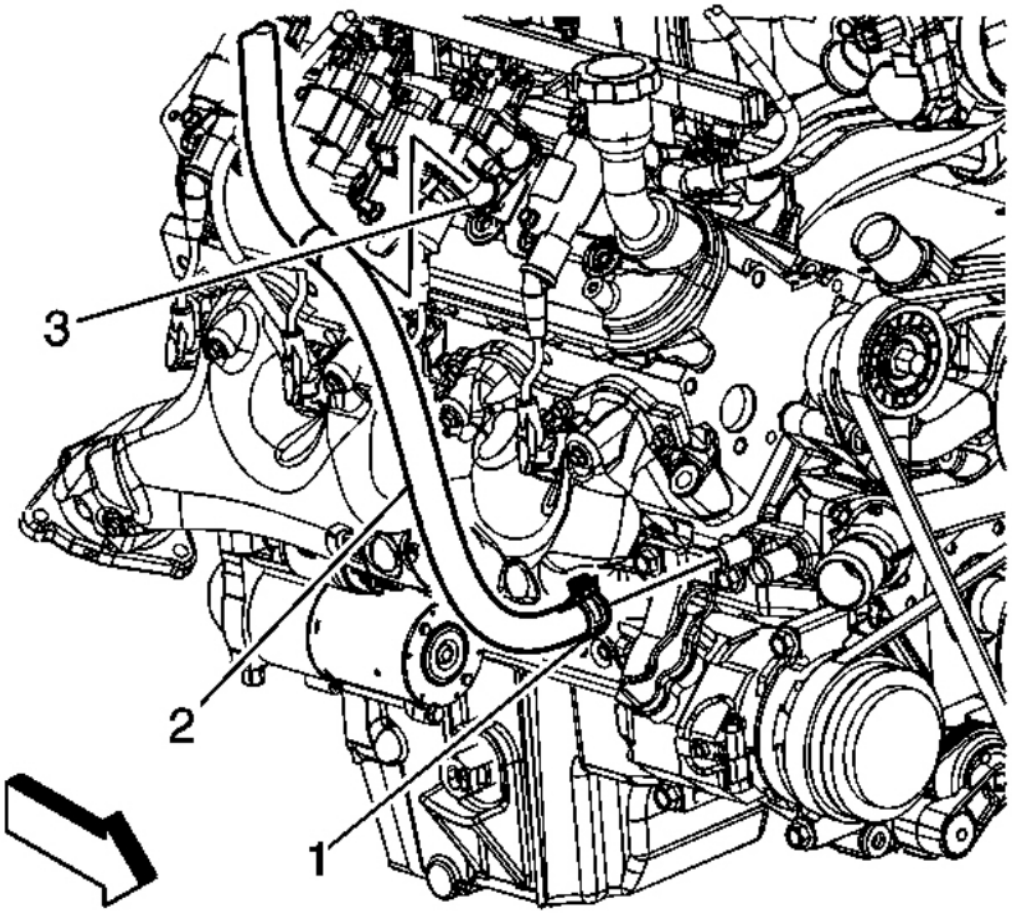


Fig. 166: View Of Heater Inlet Hose, Clamp & Waterpump
Courtesy of GENERAL MOTORS CORP.

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

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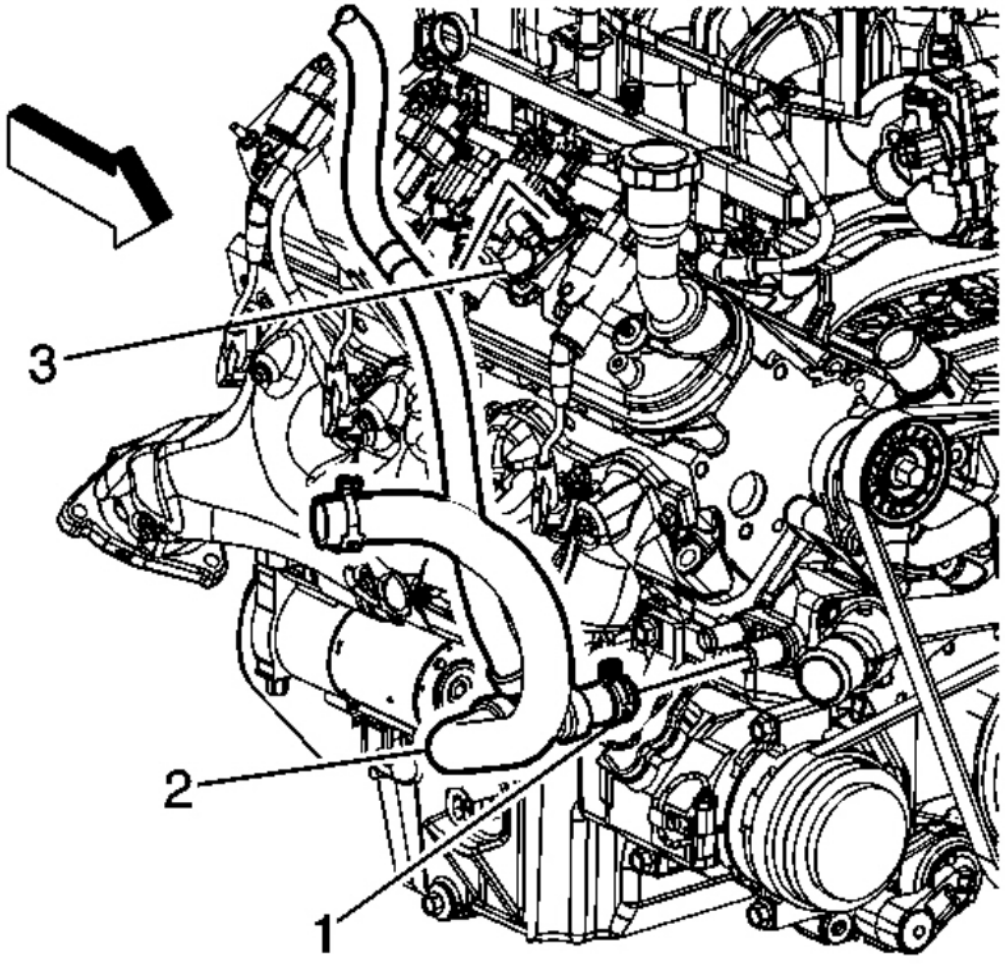


Fig. 167: View Of Radiator Surge Tank Outlet Hose, Clamp & Water Pump
Courtesy of GENERAL MOTORS CORP.

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

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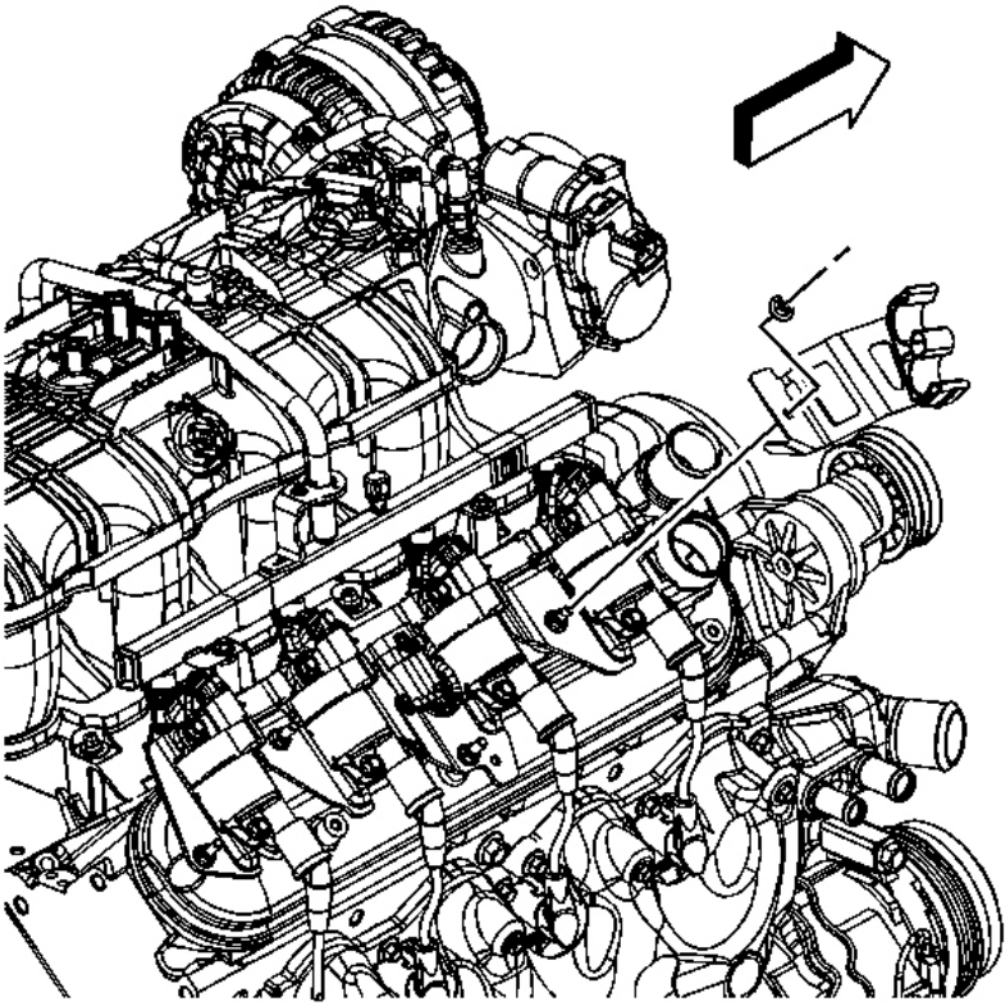


Fig. 168: View Of Heater Hose Bracket & Nut
Courtesy of GENERAL MOTORS CORP.

10. Remove the heater hose bracket nut and bracket

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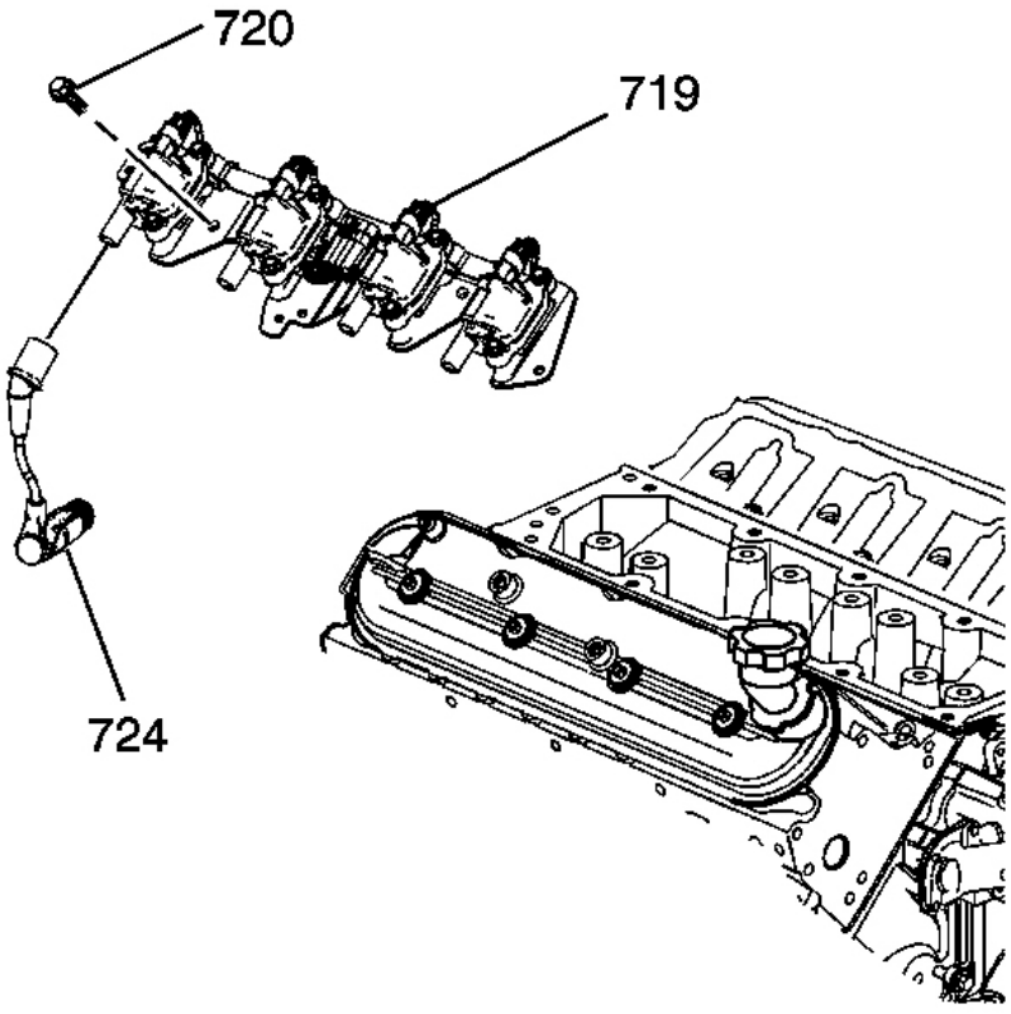


Fig. 169: Ignition Coils & Bracket
Courtesy of GENERAL MOTORS CORP.

11. 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.
12. Remove the ignition coil bracket studs (720).
13. Remove the ignition coil bracket (719).

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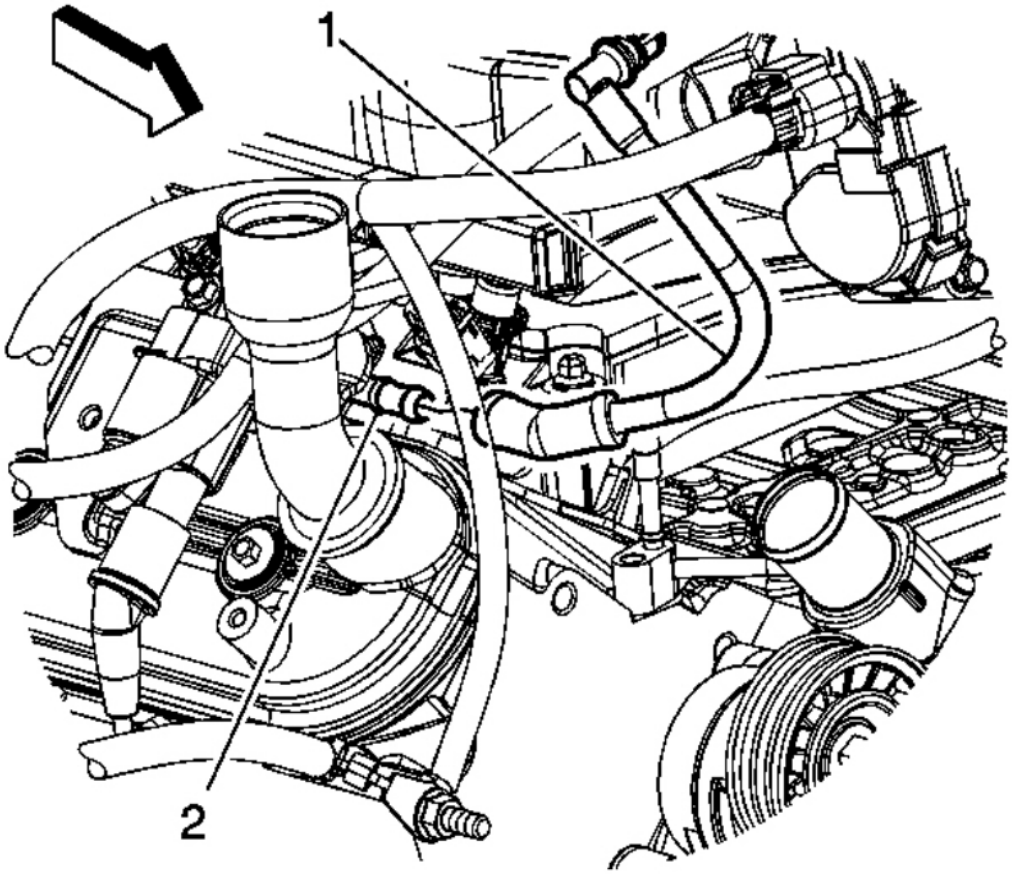


Fig. 170: View Of PCV Tube & Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

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

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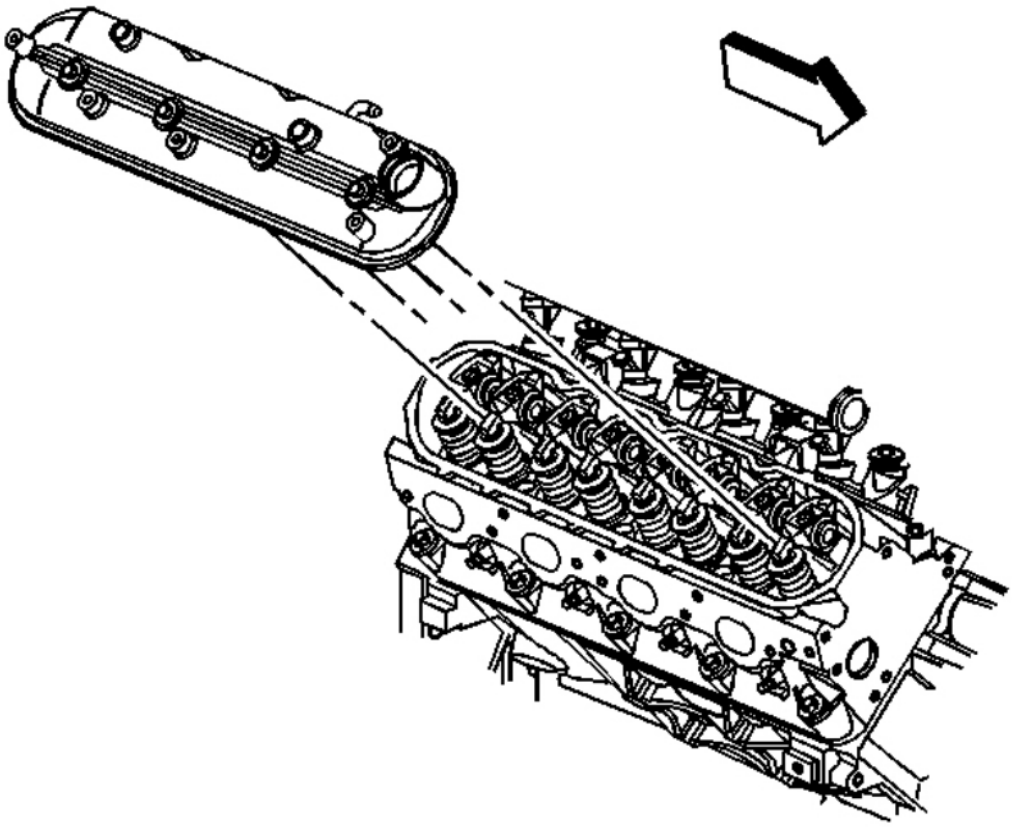


Fig. 171: View Of Valve Rocker Arm Cover (Right)
Courtesy of GENERAL MOTORS CORP.

15. Loosen the valve rocker arm cover bolts.
16. Remove the valve rocker arm cover.

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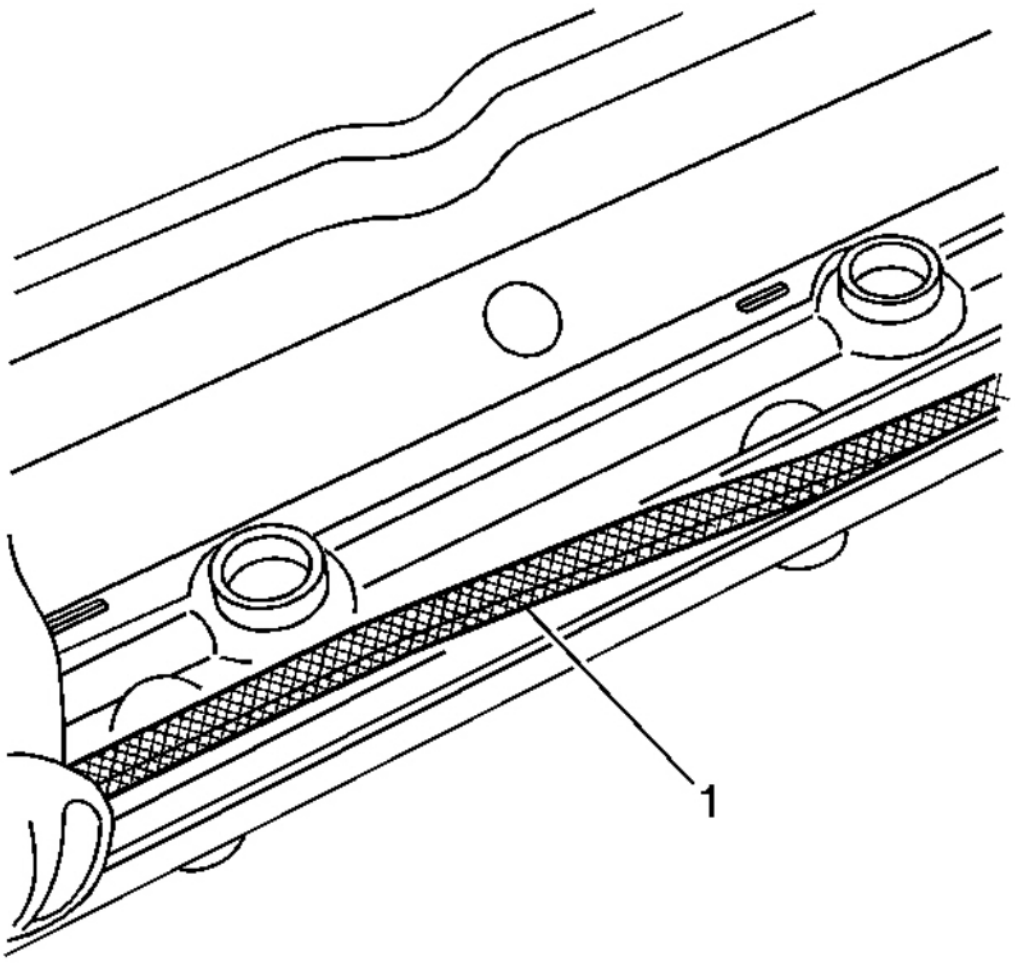


Fig. 172: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

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

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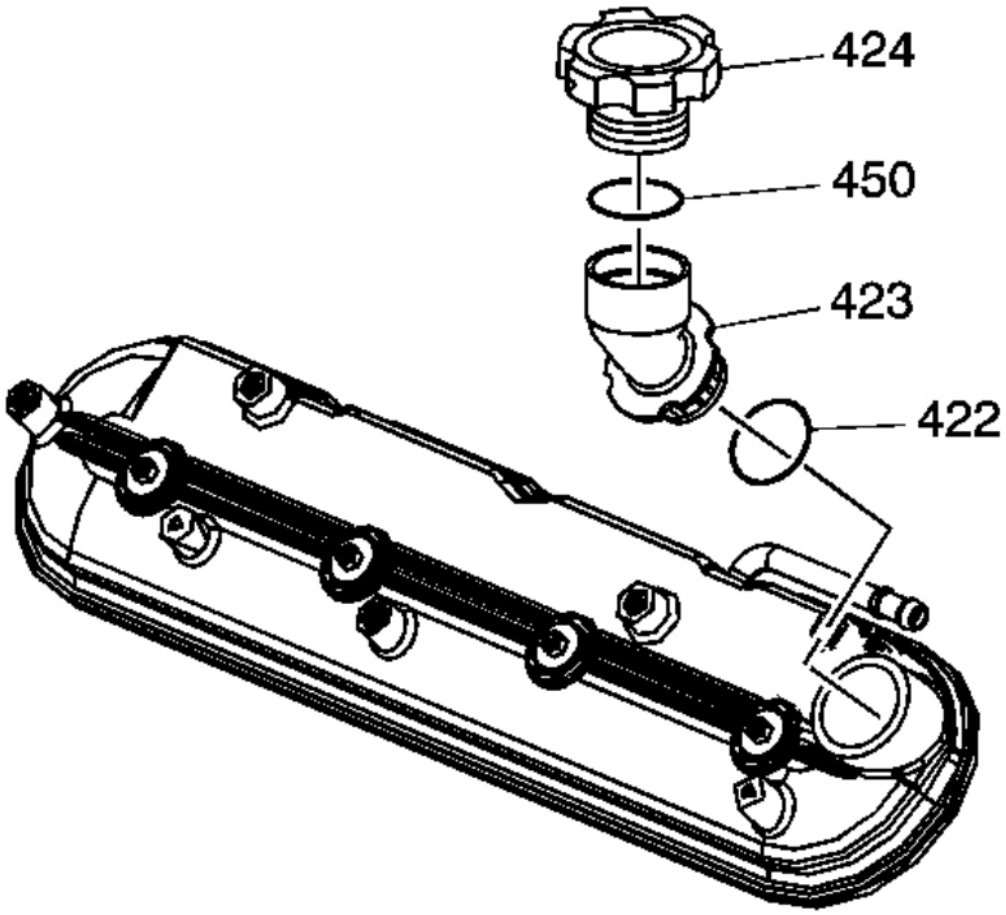


Fig. 173: Oil Fill Cap & Oil Fill Tube
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

IMPORTANT:

- **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.**

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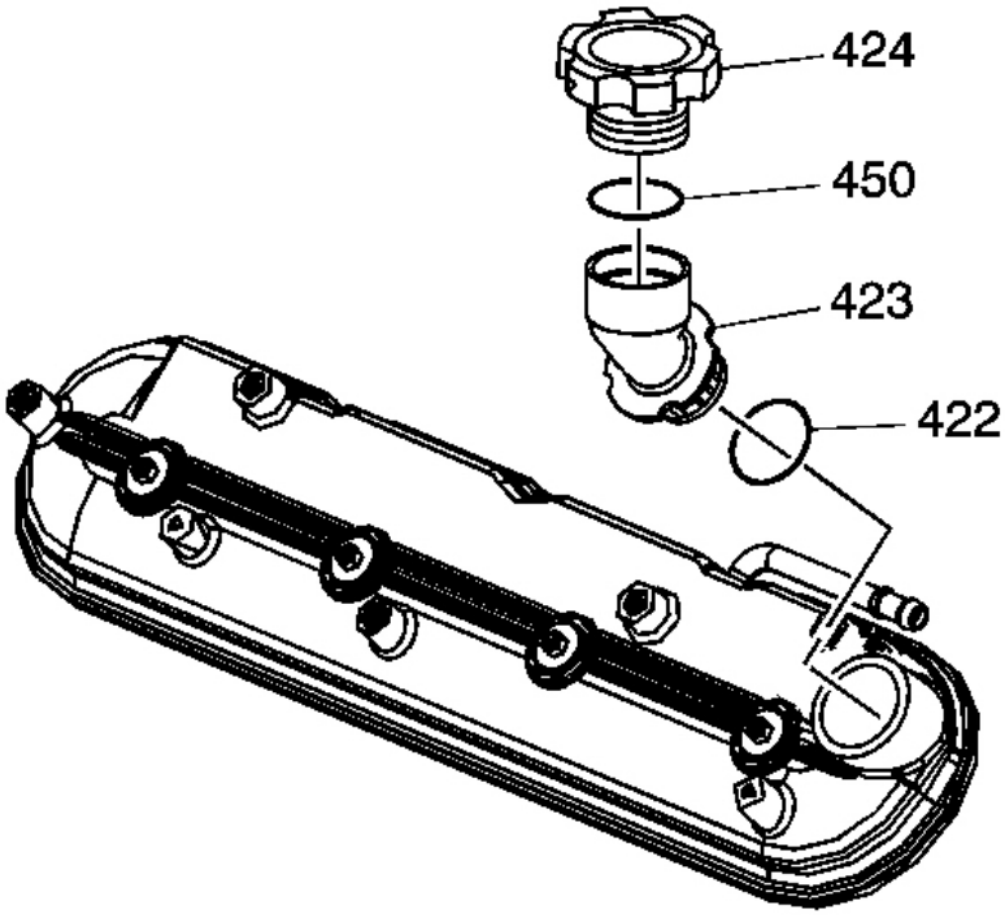


Fig. 174: Oil Fill Cap & Oil Fill Tube
Courtesy of GENERAL MOTORS CORP.

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.

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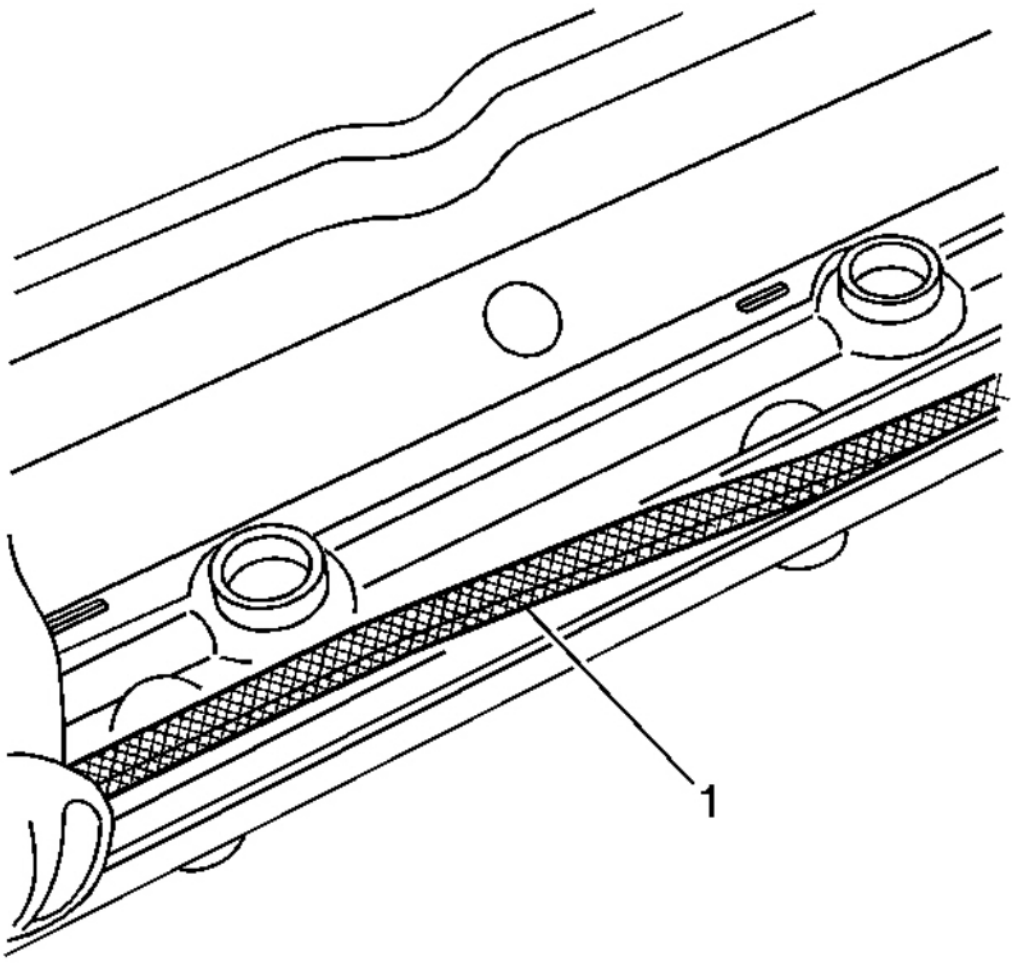


Fig. 175: Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

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

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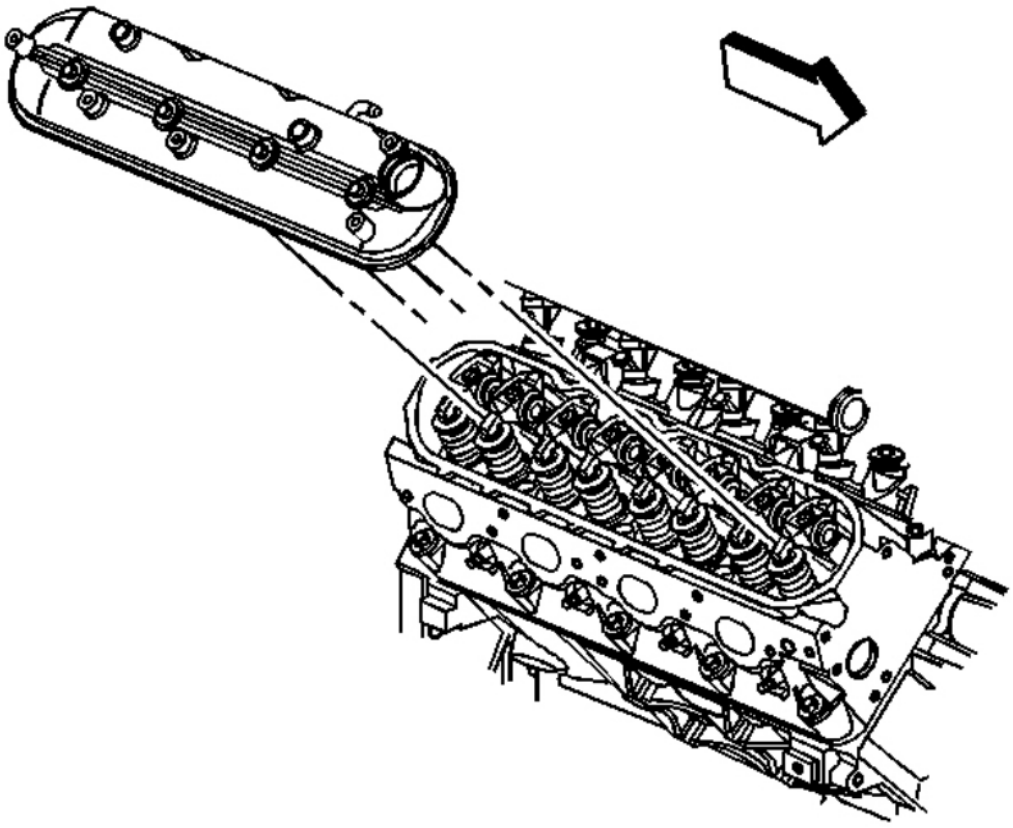


Fig. 176: View Of Valve Rocker Arm Cover (Right)
Courtesy of GENERAL MOTORS CORP.

5. Install the valve rocker arm cover.

NOTE: **Refer to Fastener Notice .**

6. Tighten the rocker arm cover bolts.

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

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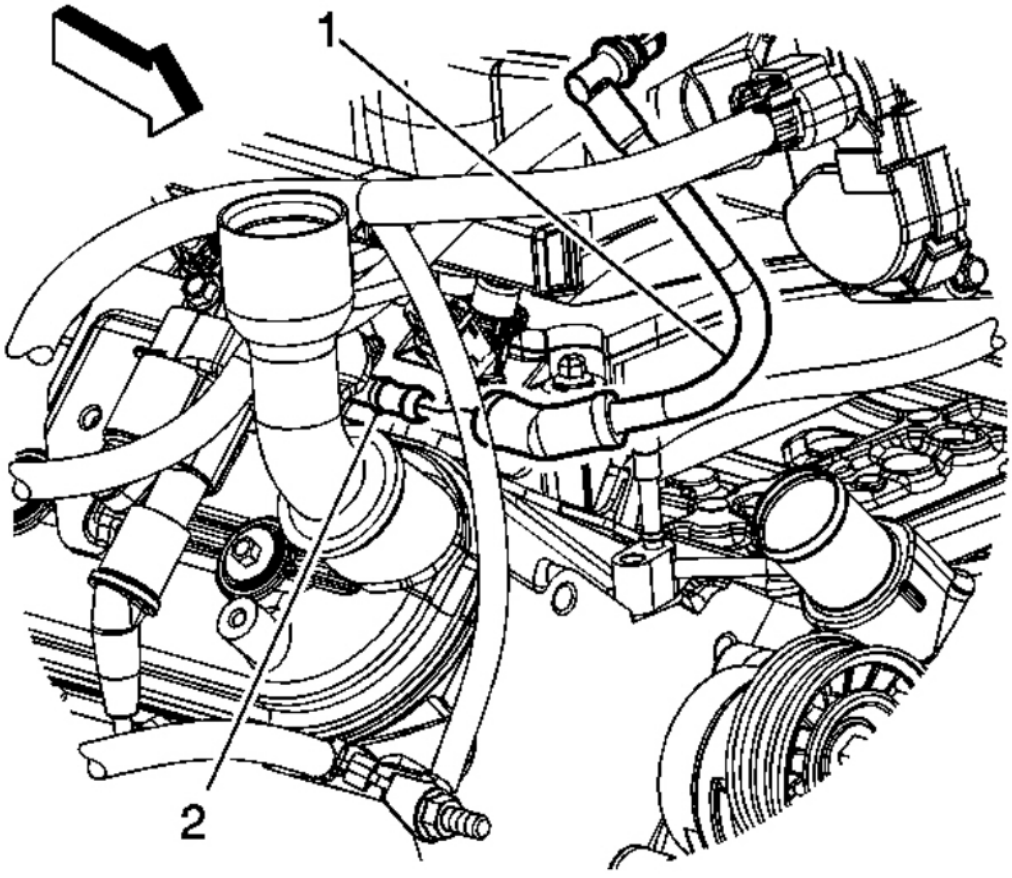


Fig. 177: View Of PCV Tube & Right Valve Rocker Arm Cover Fitting
Courtesy of GENERAL MOTORS CORP.

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

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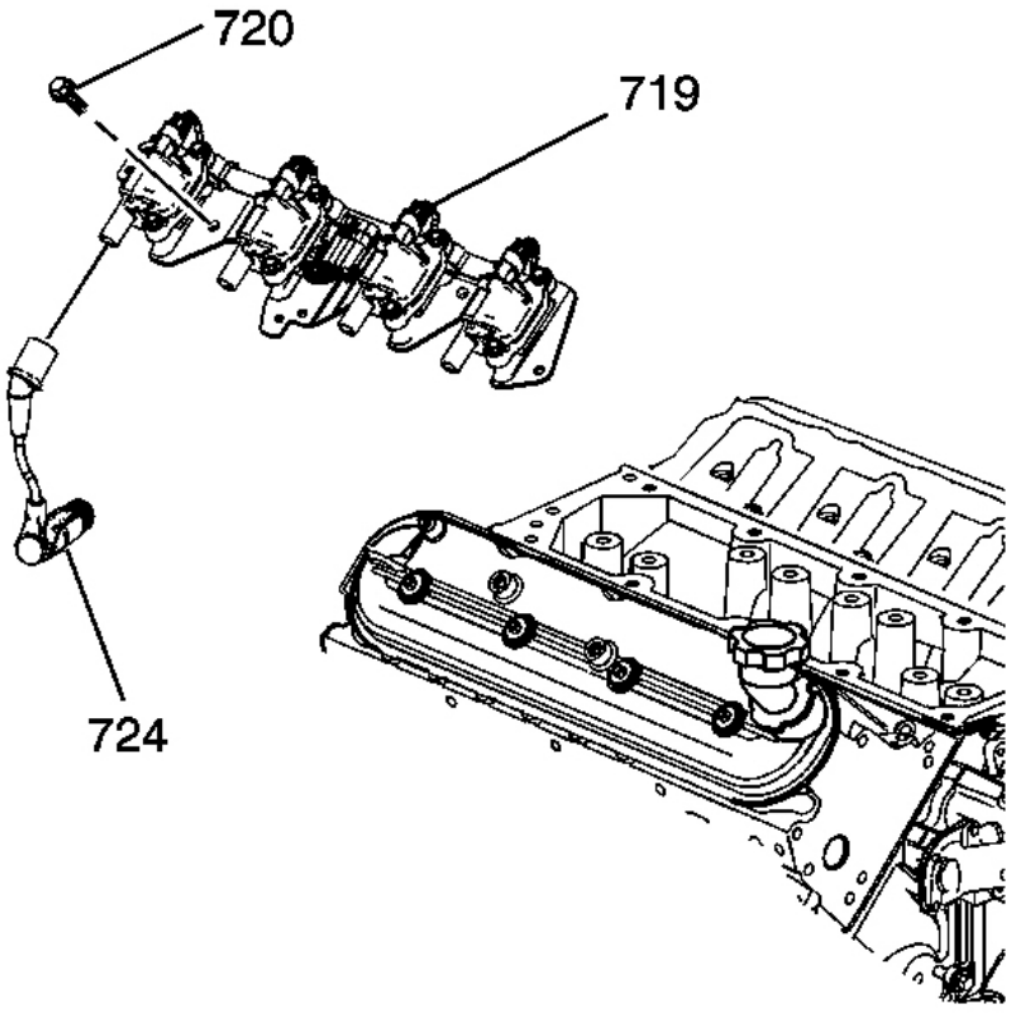


Fig. 178: Ignition Coils & Bracket
Courtesy of GENERAL MOTORS CORP.

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.

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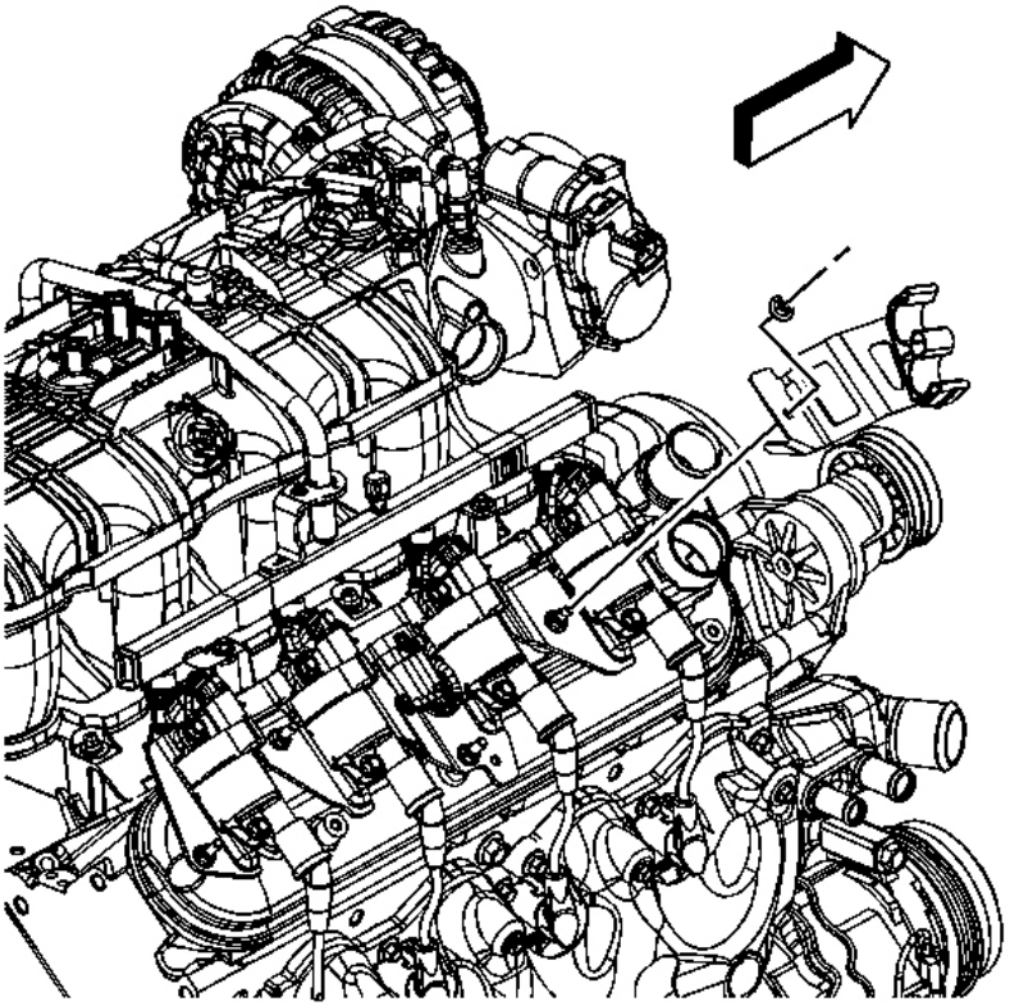


Fig. 179: View Of Heater Hose Bracket & Nut
Courtesy of GENERAL MOTORS CORP.

12. Install the heater hose bracket and nut.

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

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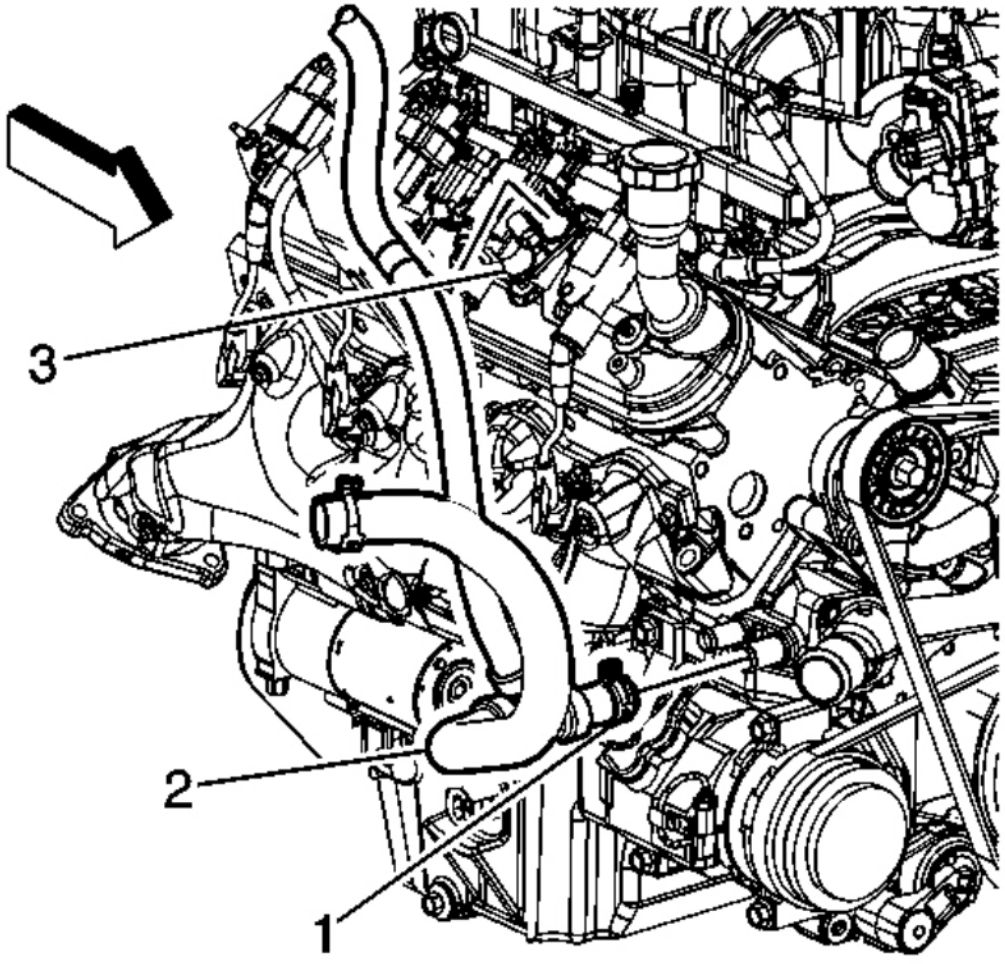


Fig. 180: View Of Radiator Surge Tank Outlet Hose, Clamp & Water Pump
Courtesy of GENERAL MOTORS CORP.

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

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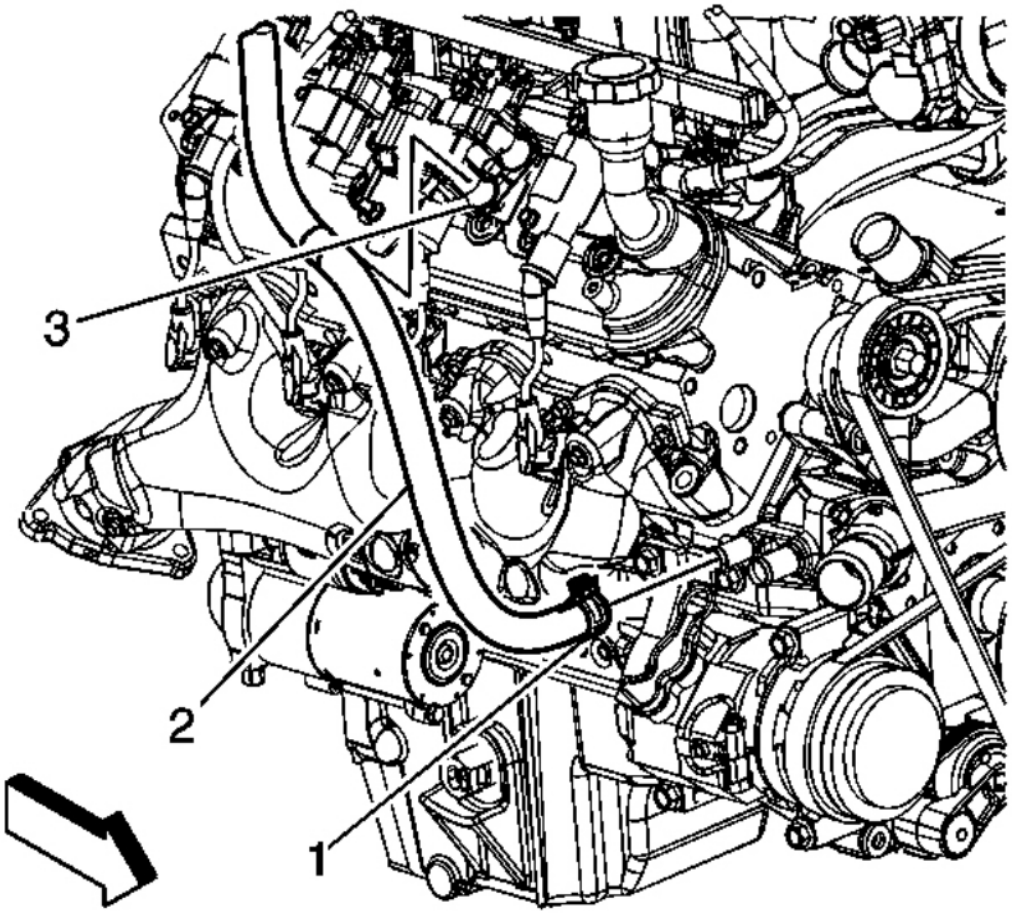


Fig. 181: View Of Heater Inlet Hose, Clamp & Waterpump
Courtesy of GENERAL MOTORS CORP.

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

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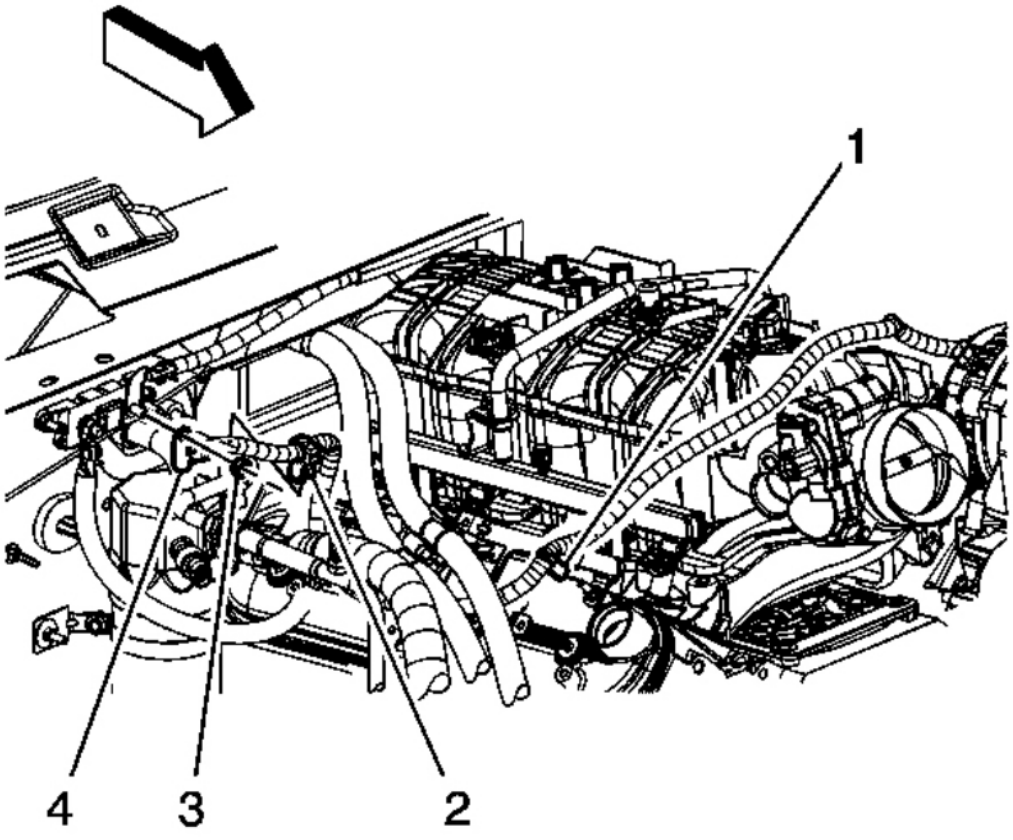


Fig. 182: View Of Generator Battery Jumper Cable & Components
Courtesy of GENERAL MOTORS CORP.

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

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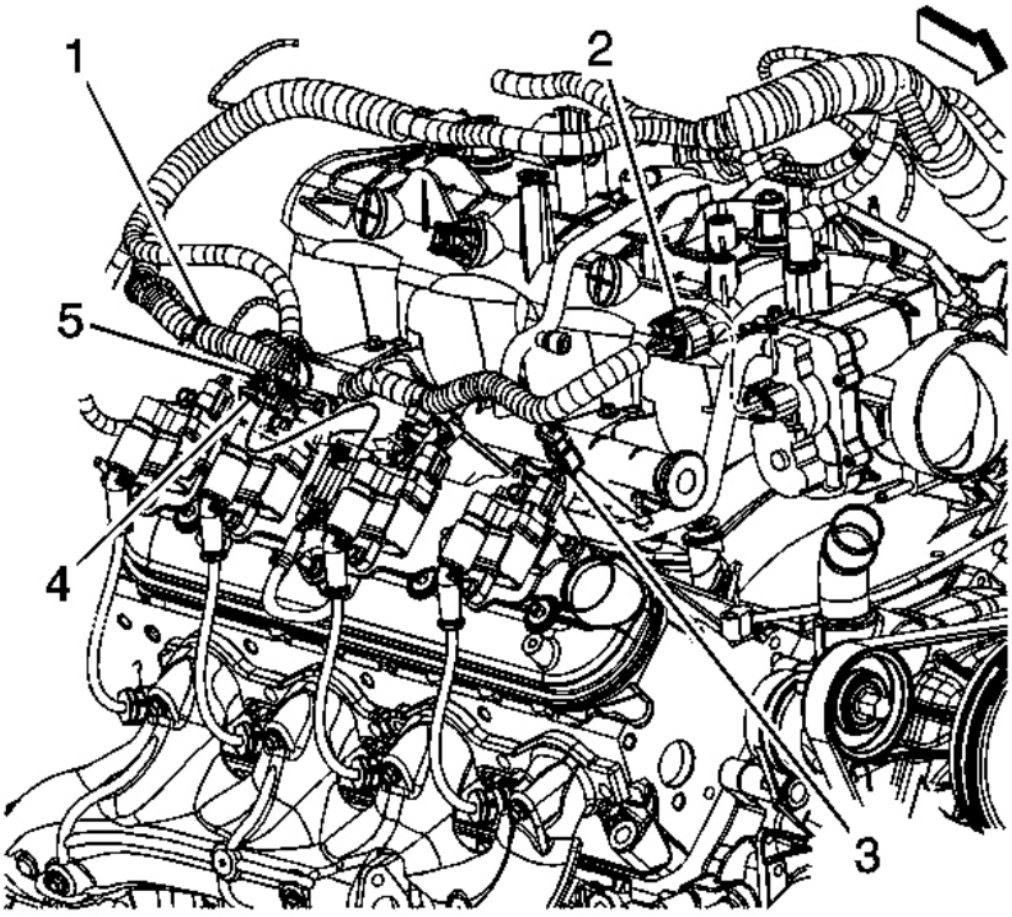


Fig. 183: Identifying Right Side Main Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

17. Position the engine wiring harness (electronic throttle control branch) as necessary.
18. Install the engine wiring harness (electronic throttle control branch) clip (6) 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).
21. Install the intake manifold cover. Refer to **Upper Intake Manifold Sight Shield Replacement**.

VALVE ROCKER ARM AND PUSH ROD REPLACEMENT

REMOVAL PROCEDURE

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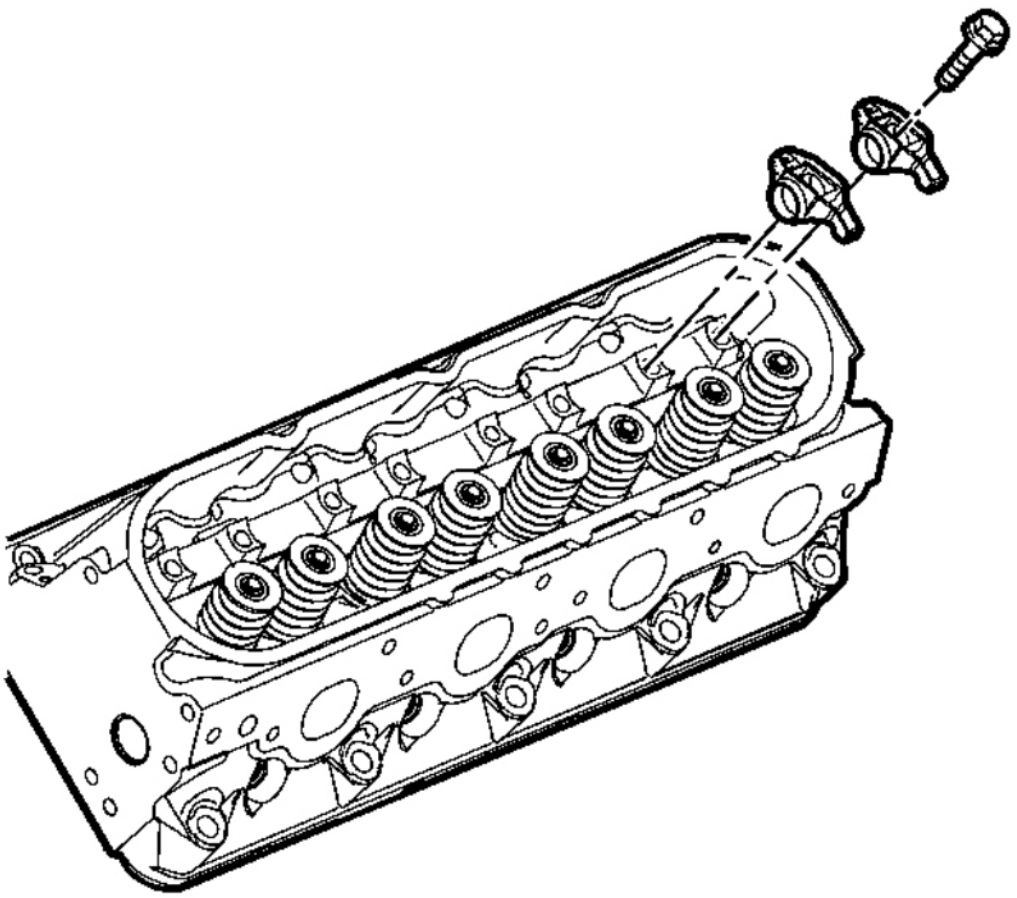


Fig. 184: View Of Rocker Arms & Bolts
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: 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** .

IMPORTANT: 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.

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4. Remove the rocker arms.

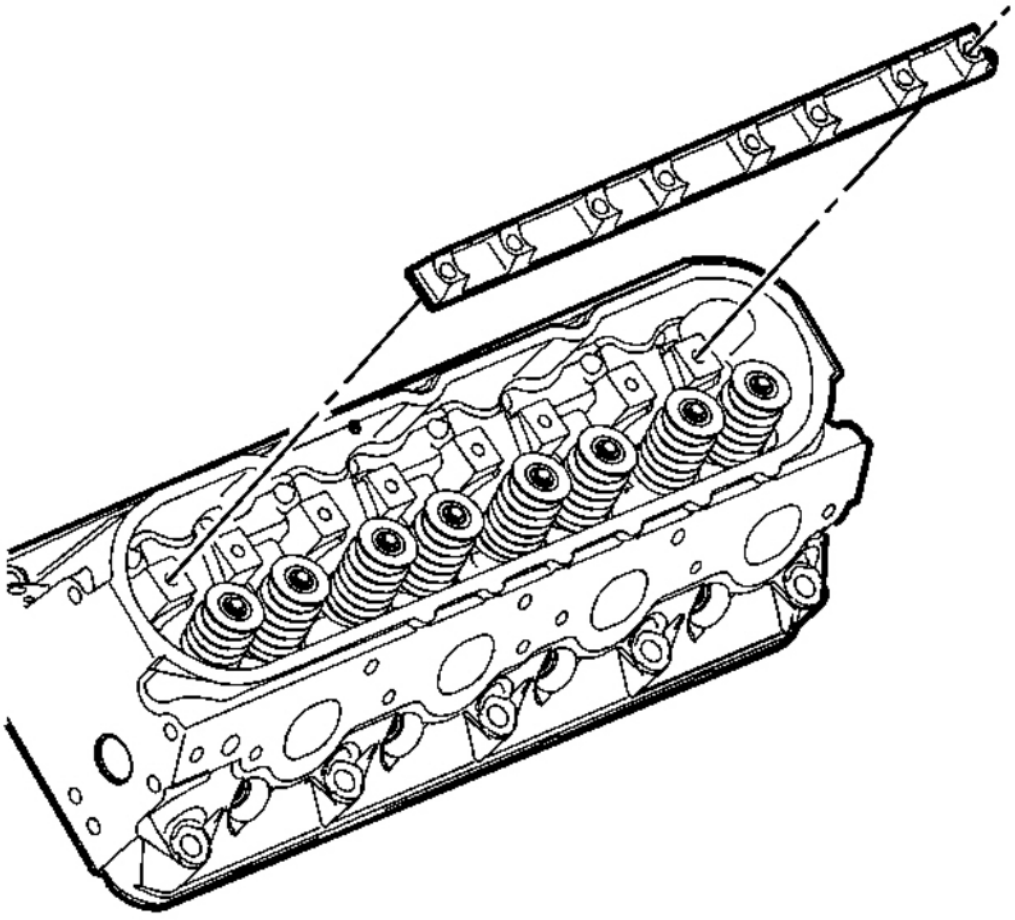


Fig. 185: View Of Valve Rocker Arm Pivot Support
Courtesy of GENERAL MOTORS CORP.

5. Remove the rocker arm pivot support.

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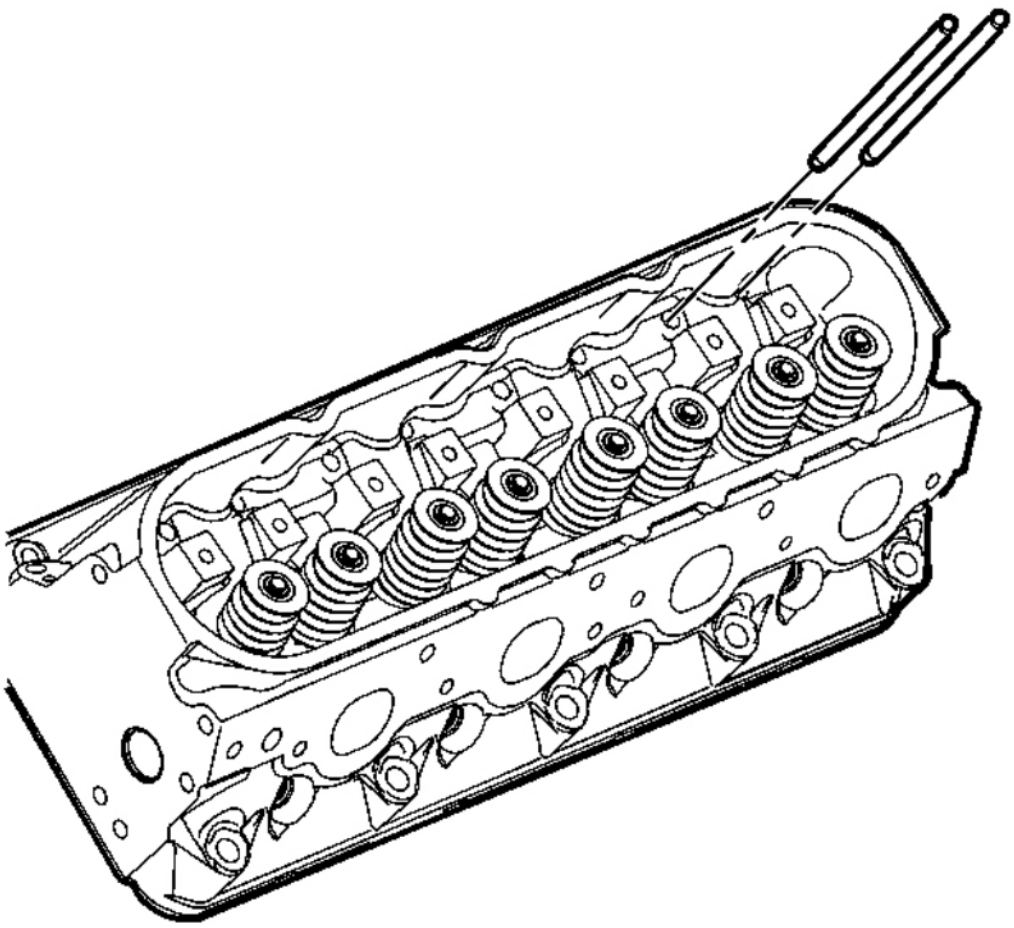


Fig. 186: View Of Pushrods
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

IMPORTANT: 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.

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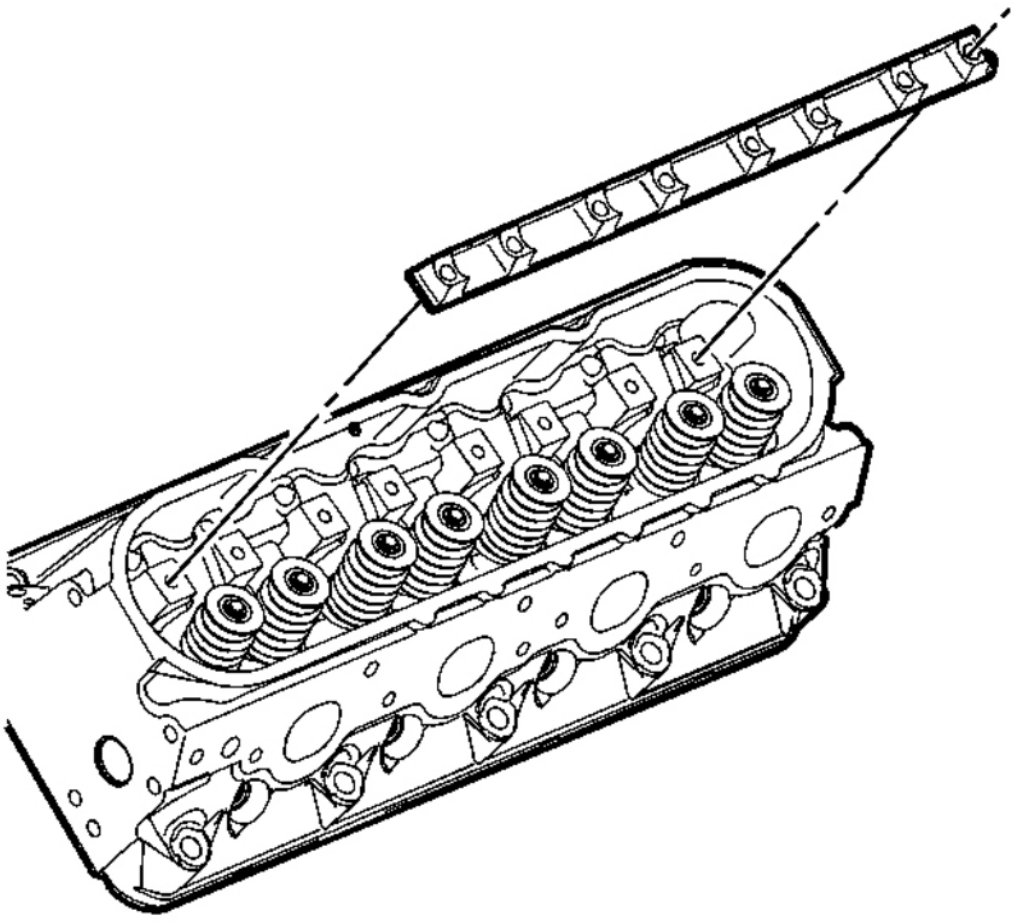


Fig. 187: View Of Valve Rocker Arm Pivot Support
Courtesy of GENERAL MOTORS CORP.

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.

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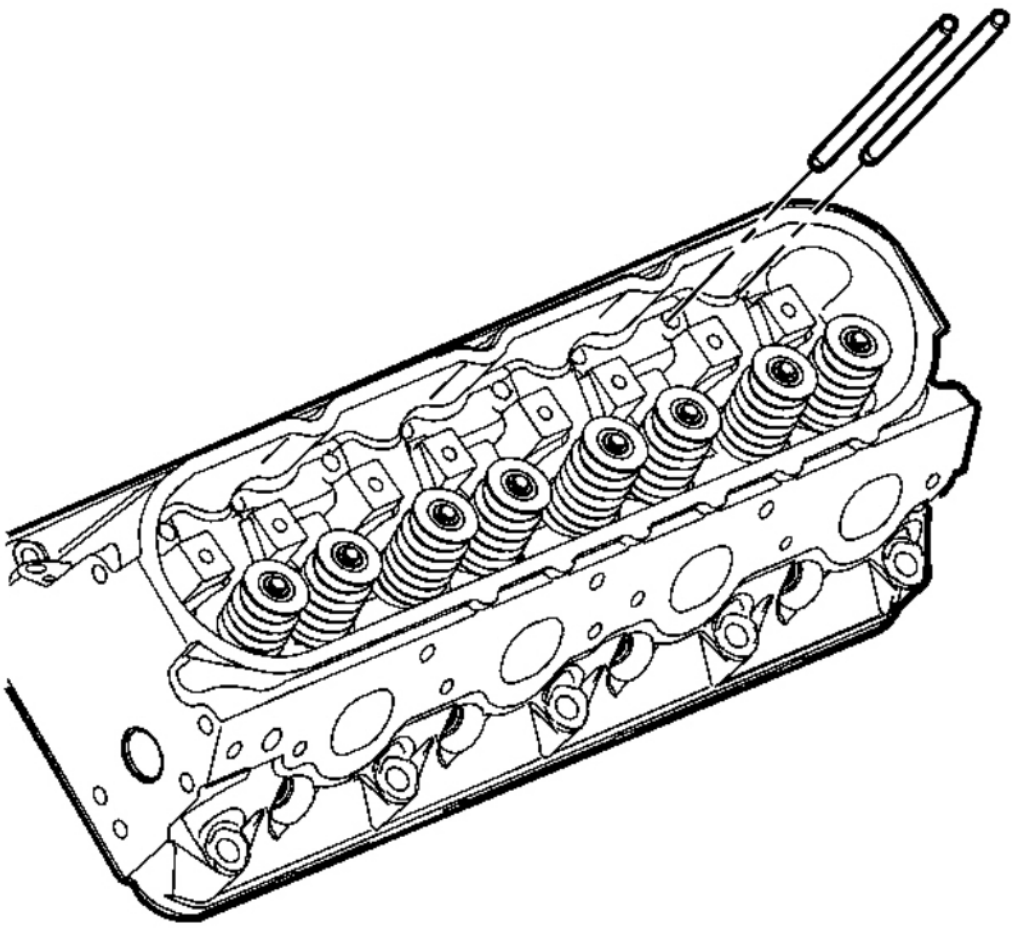


Fig. 188: View Of Pushrods
Courtesy of GENERAL MOTORS CORP.

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

4. Install the pushrods.

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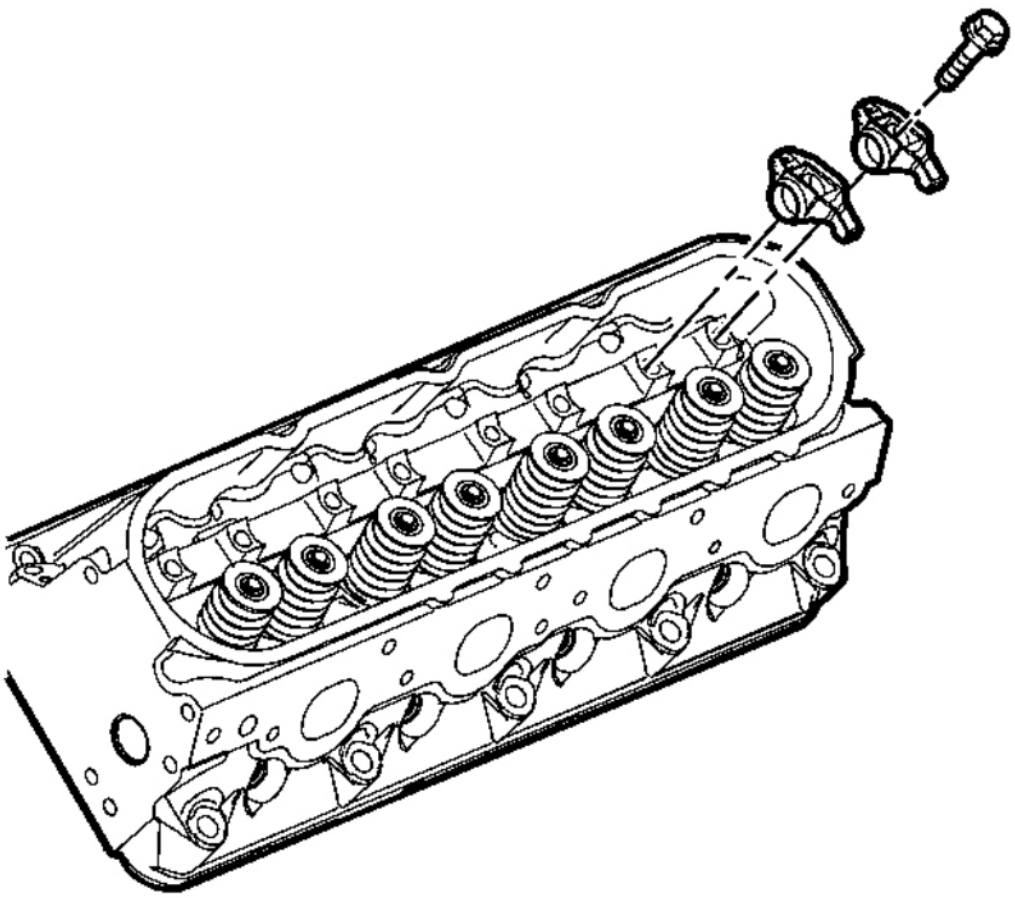


Fig. 189: View Of Rocker Arms & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Make sure that the pushrods seat properly to the ends of the rocker arms. DO NOT tighten the rocker arm bolts at this time.

5. Install the rocker arms and bolts.

IMPORTANT: 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 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.

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NOTE: **Refer to Fastener Notice .**

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

   Tighten:
   - 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 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

Tools Required

- **J 22794** Spark Plug Port Adapter. See **Special Tools** .
- **J 38606** Valve Spring Compressor. See **Special Tools** .

REMOVAL PROCEDURE

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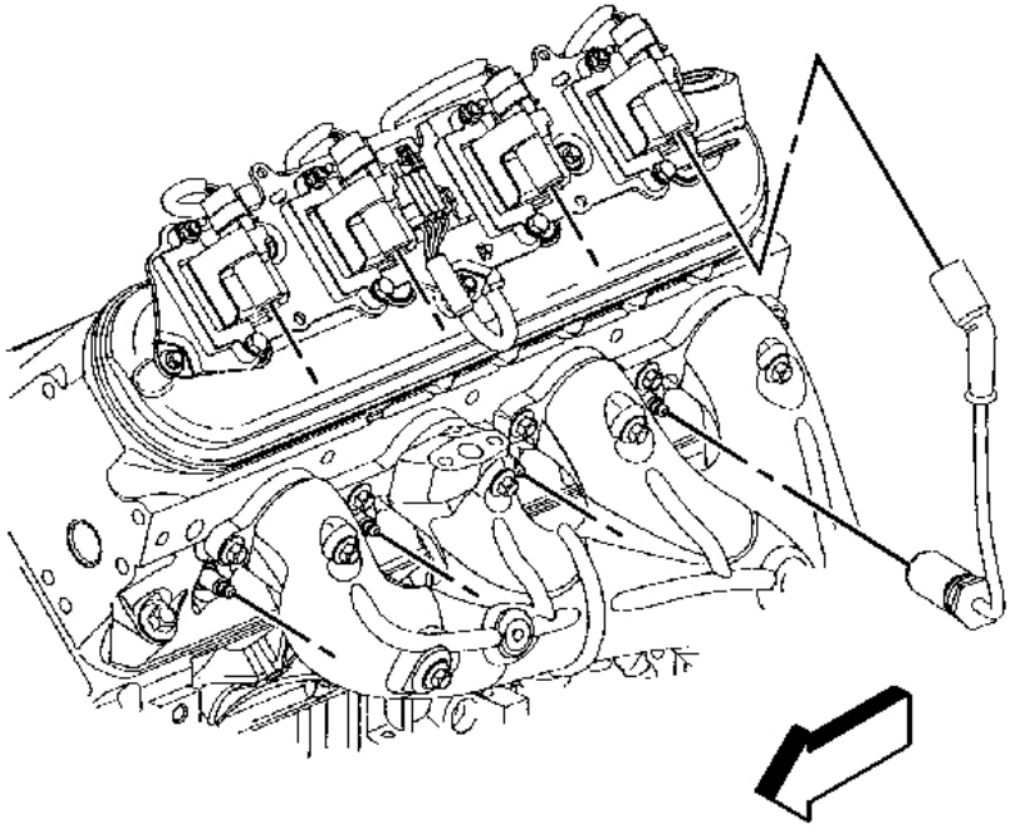


Fig. 190: View Of Spark Plug Wire & Boot
Courtesy of GENERAL MOTORS CORP.

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.

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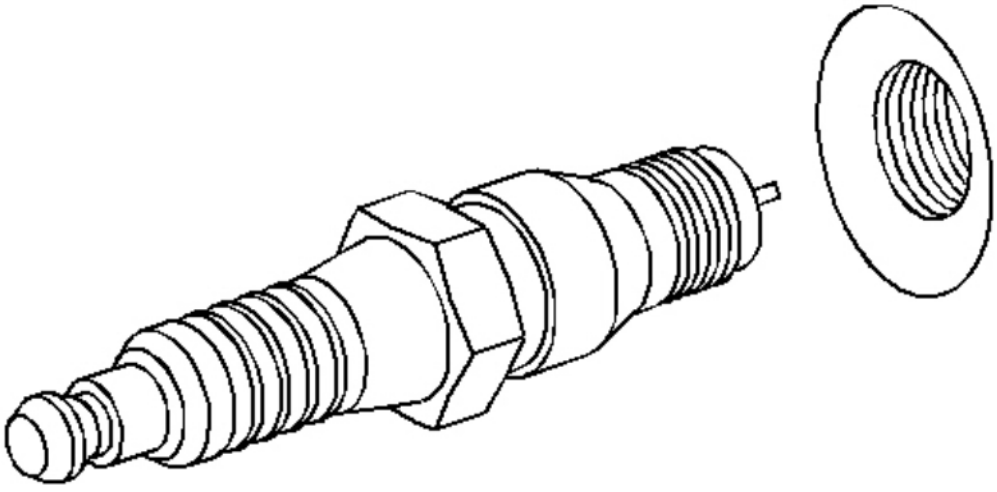


Fig. 191: View Of Spark Plug & Spark Plug Seat
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: 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.

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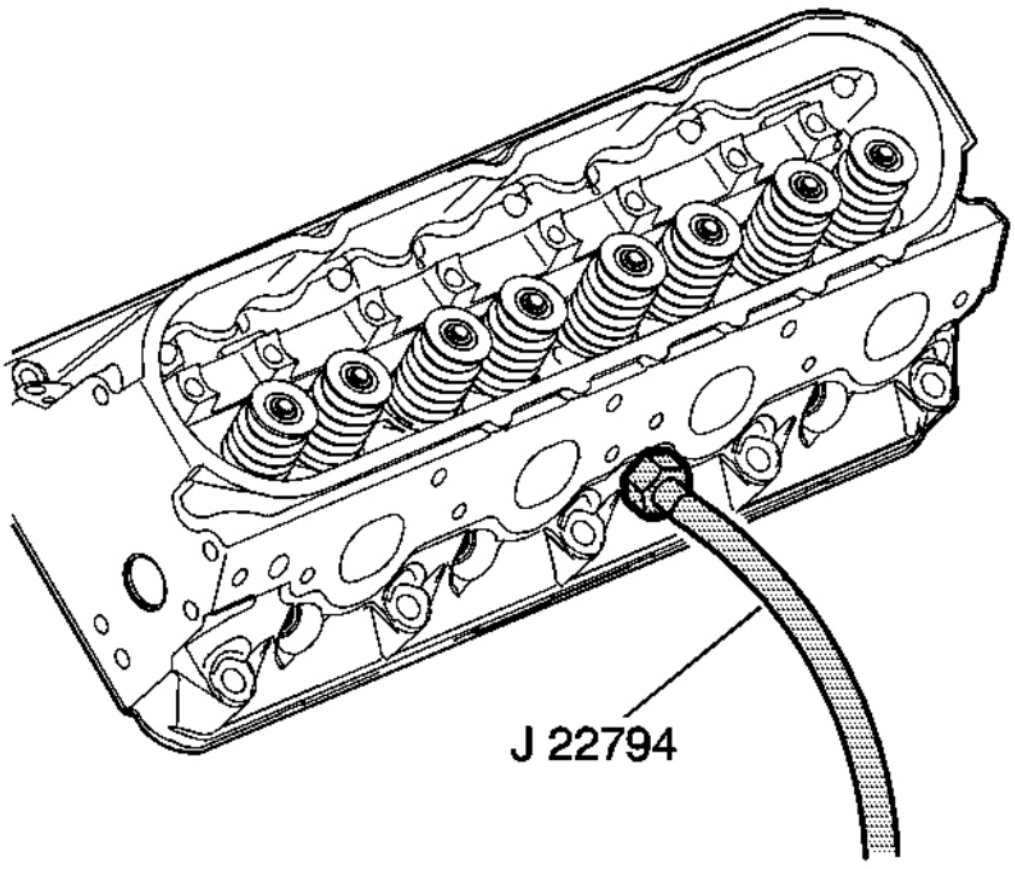


Fig. 192: Applying Compressed Air To J 22794
Courtesy of GENERAL MOTORS CORP.

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

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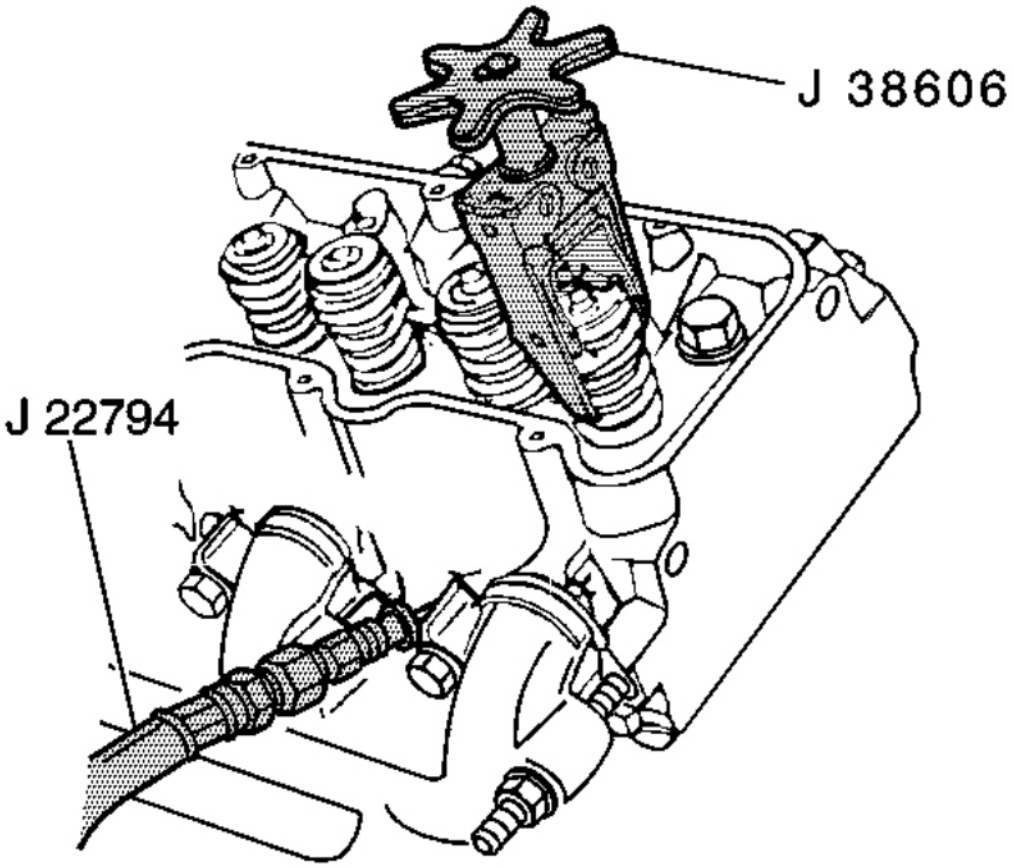


Fig. 193: Compress The Valve Spring (Cylinder Head Installed) Using Special Tools
Courtesy of GENERAL MOTORS CORP.

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

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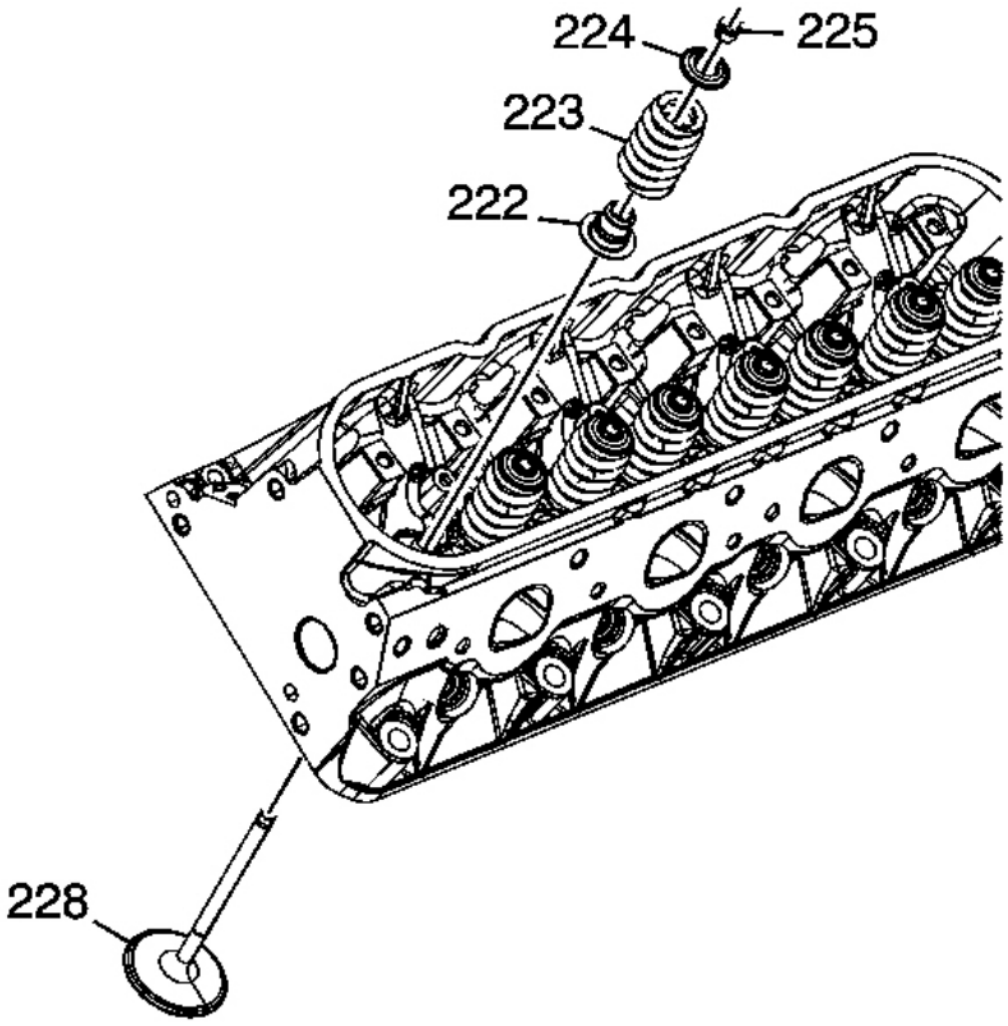


Fig. 194: View Of Valve Components
Courtesy of GENERAL MOTORS CORP.

10. Remove the valve stem keys (225).
11. Carefully release the valve spring tension.
12. Remove the **J 38606** . See **Special Tools** .
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).

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INSTALLATION PROCEDURE

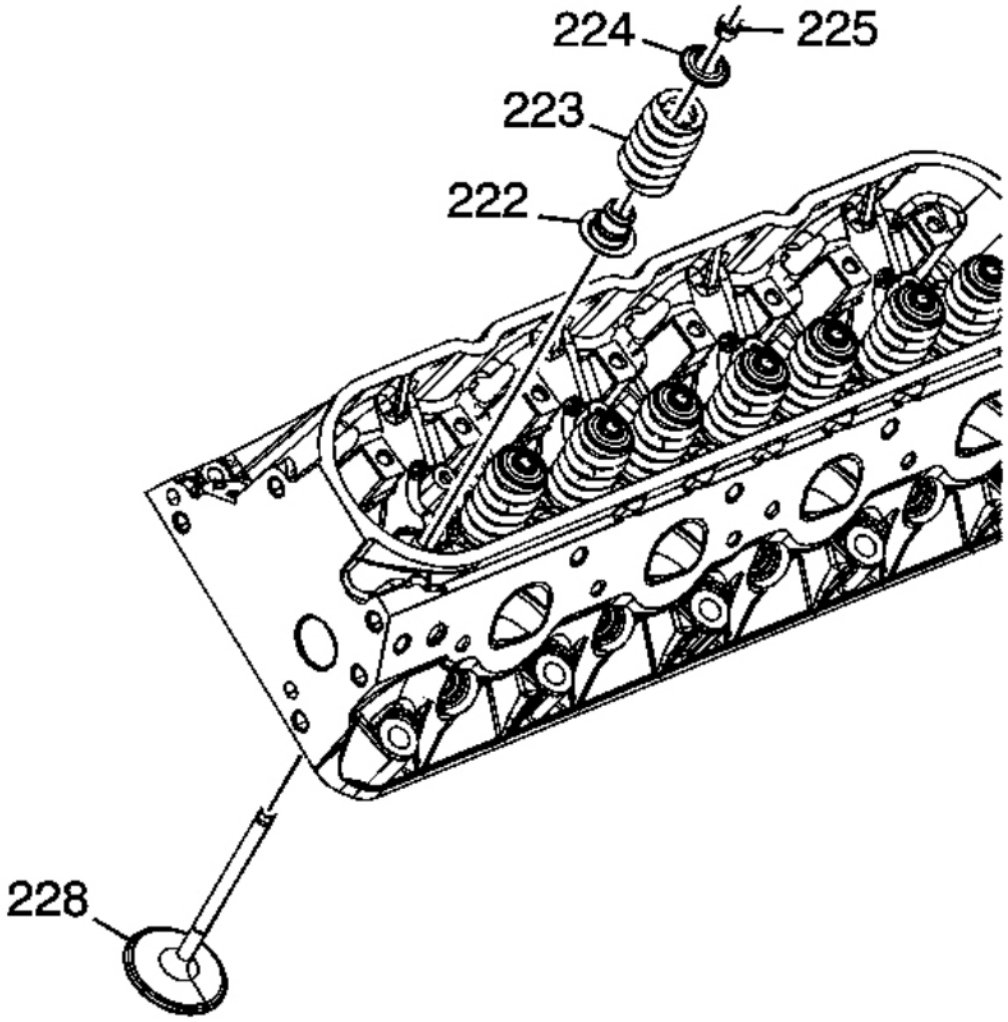


Fig. 195: View Of Valve Components
Courtesy of GENERAL MOTORS CORP.

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).

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6. Install the valve spring cap (224).

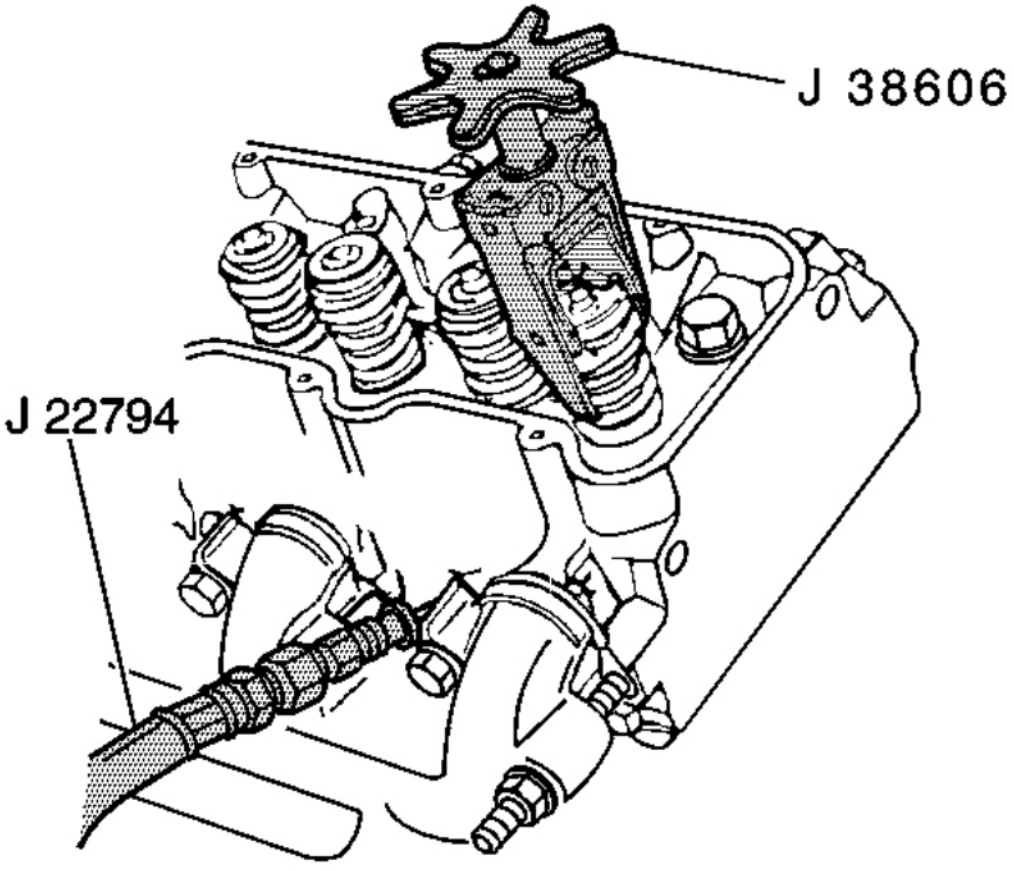


Fig. 196: Compress The Valve Spring (Cylinder Head Installed) Using Special Tools
Courtesy of GENERAL MOTORS CORP.

7. Compress the valve spring using the **J 38606** . See **Special Tools** .
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** . See **Special Tools** .
   - Tap the end of the valve stem with a plastic faced hammer to seat the keys, if necessary.

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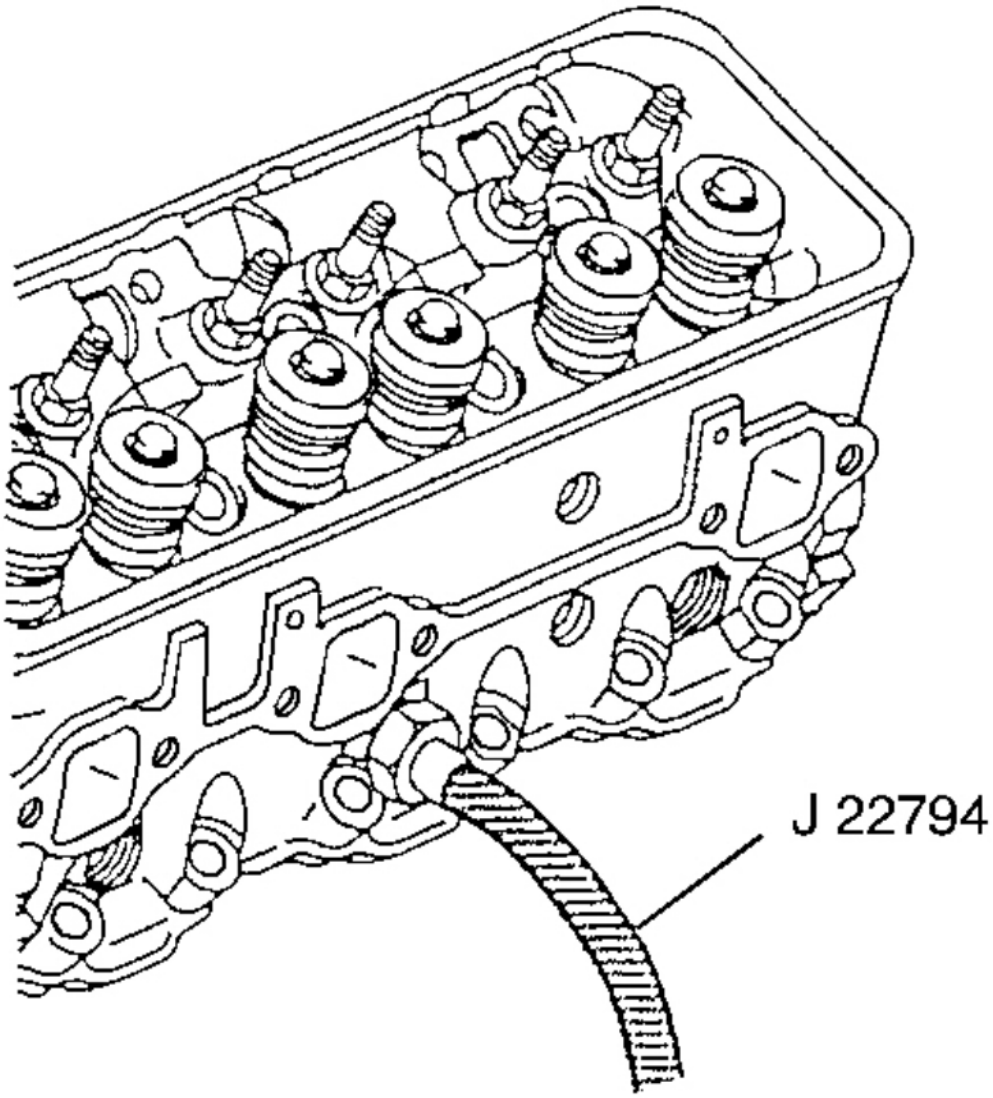


Fig. 197: View Of J 22794
Courtesy of GENERAL MOTORS CORP.

9. Remove the **J 22794** from the spark plug port. See **Special Tools** .

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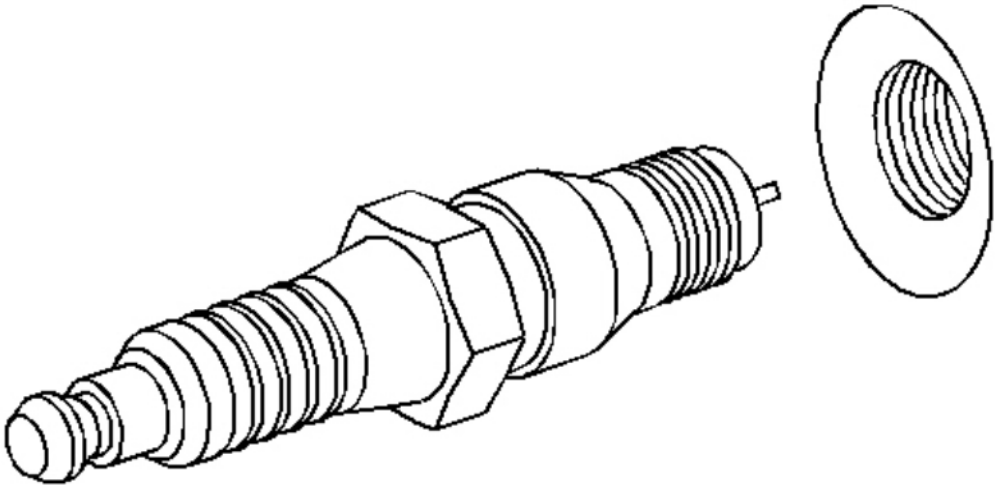


Fig. 198: View Of Spark Plug & Spark Plug Seat
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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 AND TUBE REPLACEMENT

REMOVAL PROCEDURE

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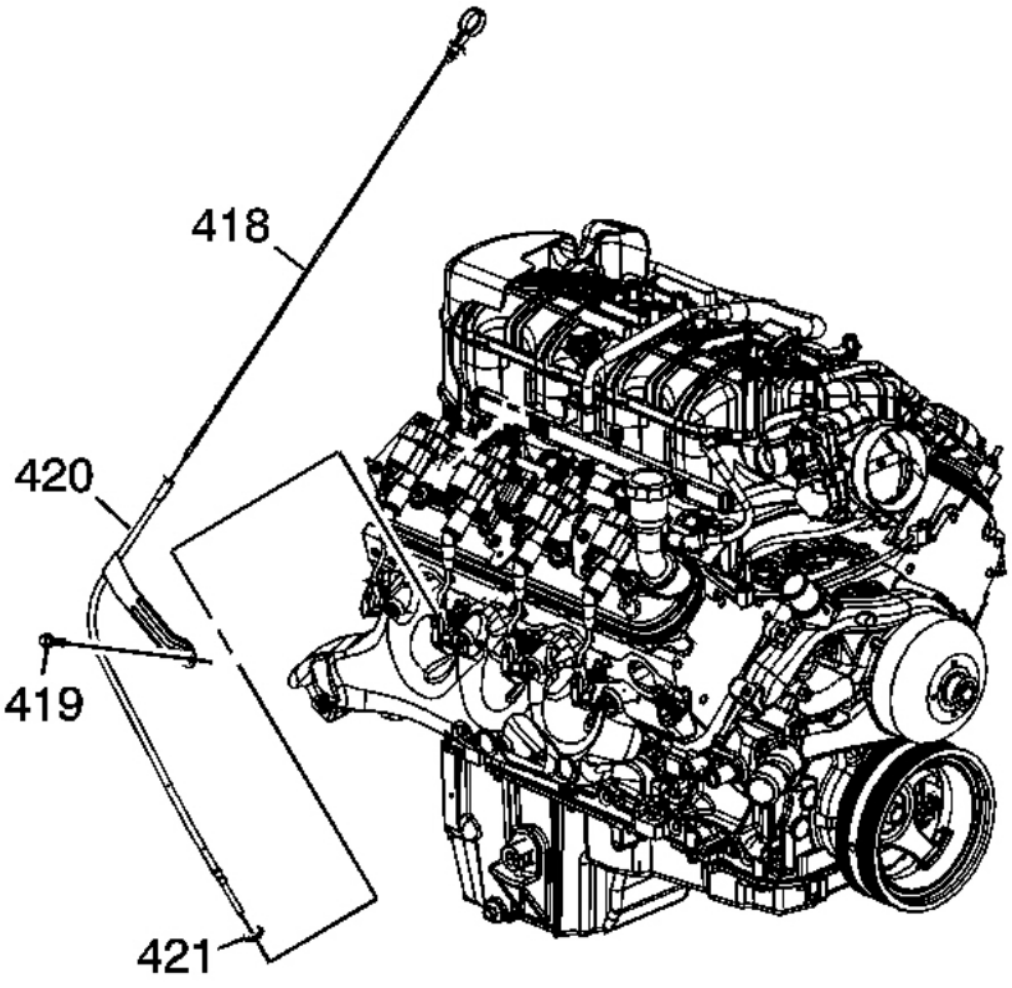


Fig. 199: View Of Oil Level Indicator, Tube Bolt, Indicator Tube & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil level indicator (418).
2. Remove the oil level indicator tube bolt (419).
3. Remove the oil level indicator tube (420) from the engine block.

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

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

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INSTALLATION PROCEDURE

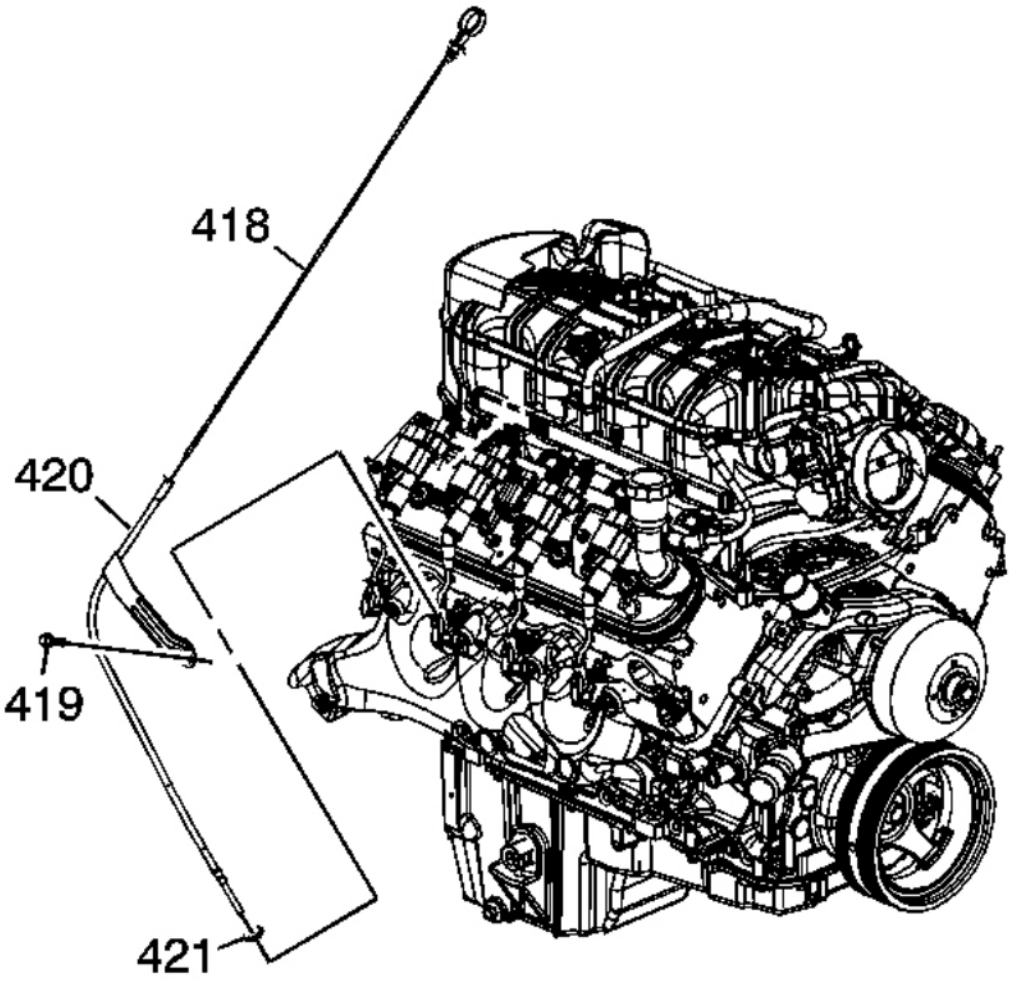


Fig. 200: View Of Oil Level Indicator, Tube Bolt, Indicator Tube & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

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.

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NOTE: **Refer to Fastener Notice .**

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

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

8. Install the oil level indicator (418).

CYLINDER HEAD REPLACEMENT - LEFT SIDE

Tools Required

- **J 45059** Angle Meter. See **Special Tools** .
- **J 42385-200** Common Thread Repair Kit. See **Special Tools** .

REMOVAL PROCEDURE

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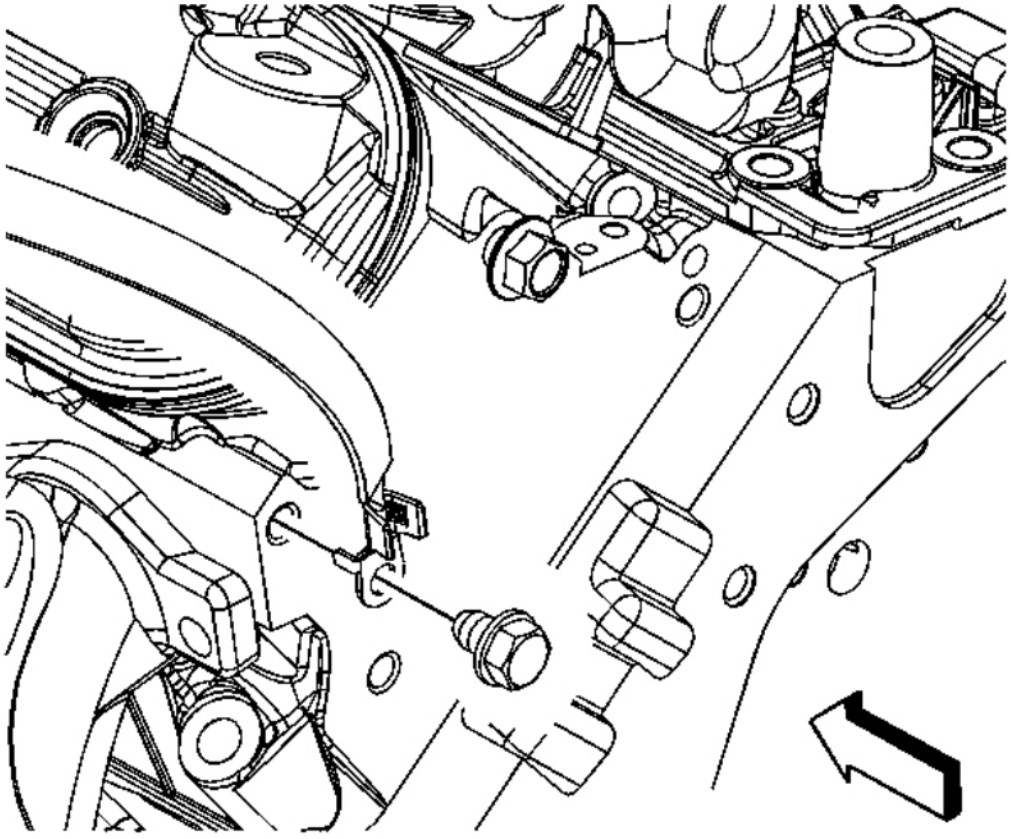


Fig. 201: View Of Engine Ground Strap & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Remove the generator bracket. Refer to **Generator Replacement** .
2. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
3. Remove the coolant air bleed pipe. Refer to **Coolant Air Bleed Pipe Assembly Replacement (RPOs LC9/LY5/LMG/L76/L92)** or **Coolant Air Bleed Pipe Assembly Replacement (RPOs LY2/LY6)** .
4. Remove the left exhaust manifold. Refer to **Exhaust Manifold Replacement - Left Side** .
5. Remove the pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
6. Remove the engine ground strap bolt from the rear of the cylinder head.
7. Remove the ground strap from the cylinder head.

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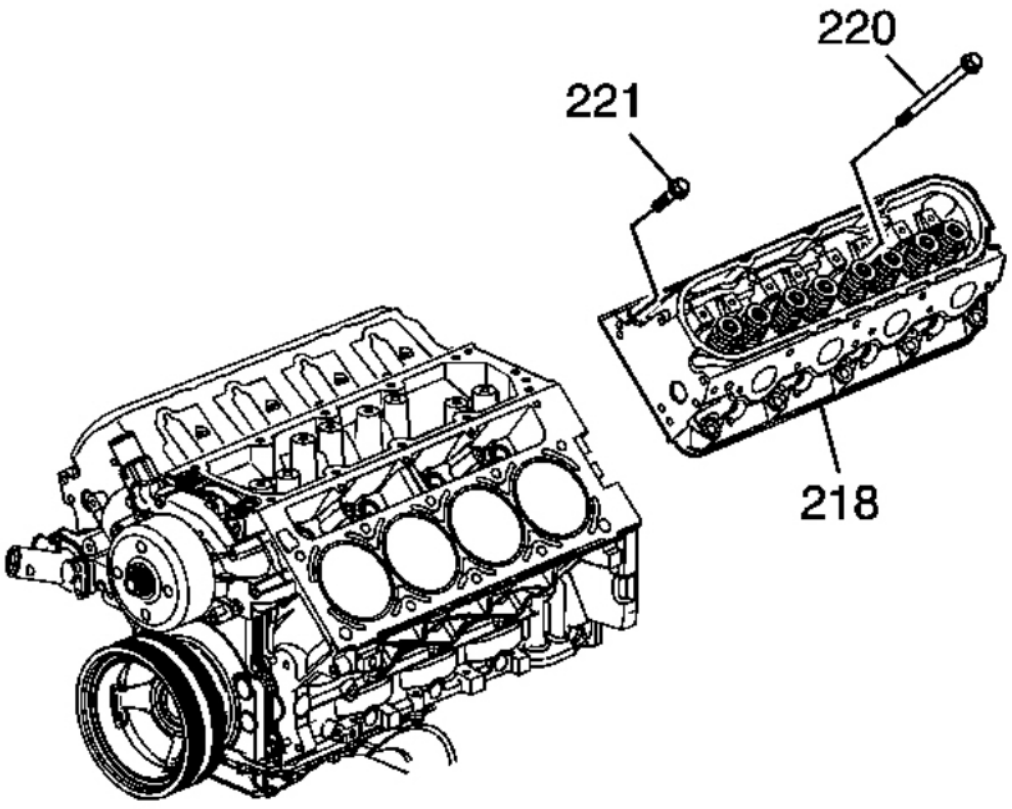


Fig. 202: View Of Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

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

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

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

9. Remove the cylinder head (218).

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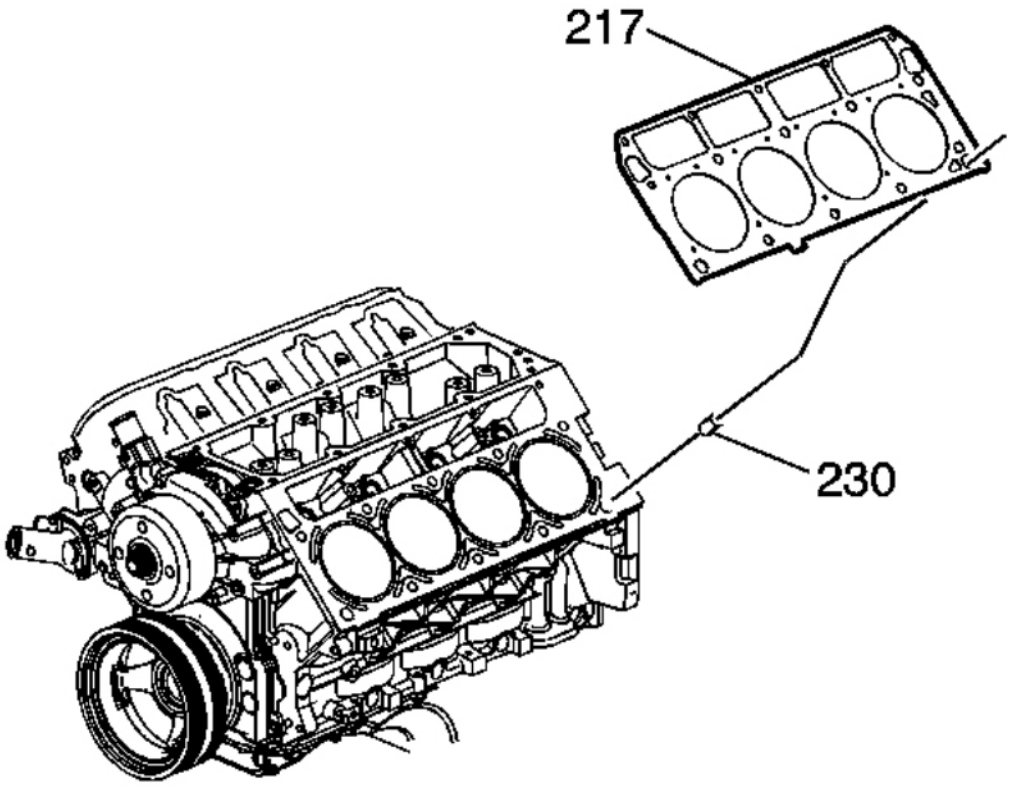


Fig. 203: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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

NOTE: **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.**

IMPORTANT:
- **Do not reuse the cylinder head bolts. Install NEW cylinder head bolts**

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during assembly.

- **Do not use any type of sealant on the cylinder head gasket (unless specified).**

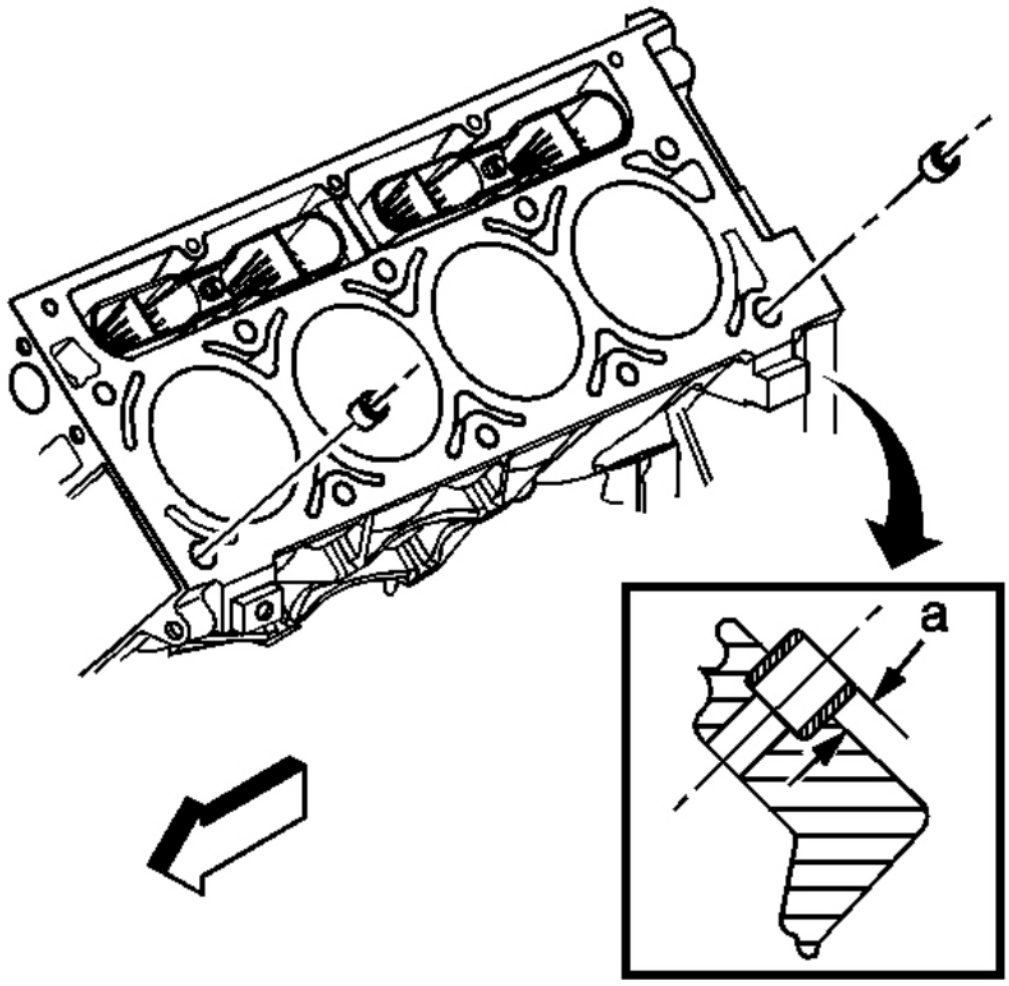


Fig. 204: Checking Cylinder Head Bolt Holes
Courtesy of GENERAL MOTORS CORP.

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. See **Special Tools** .
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.

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4. Check the cylinder head locating pins for proper installation (a) 8.3 mm (0.327 in).

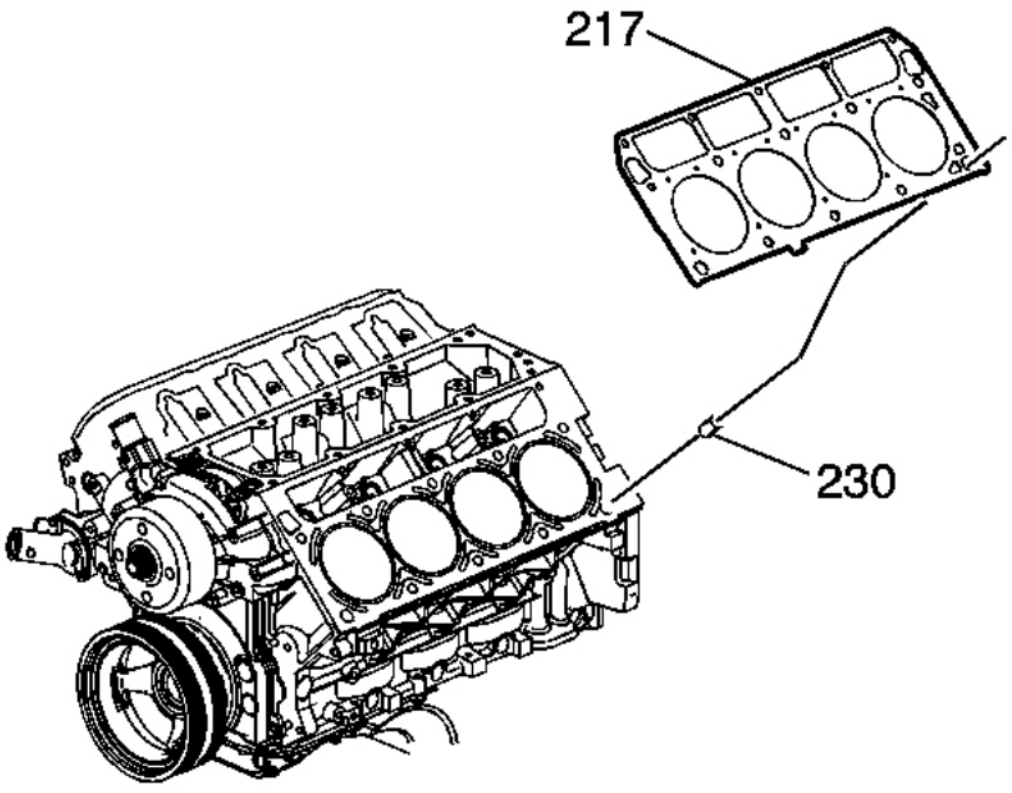


Fig. 205: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: 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.

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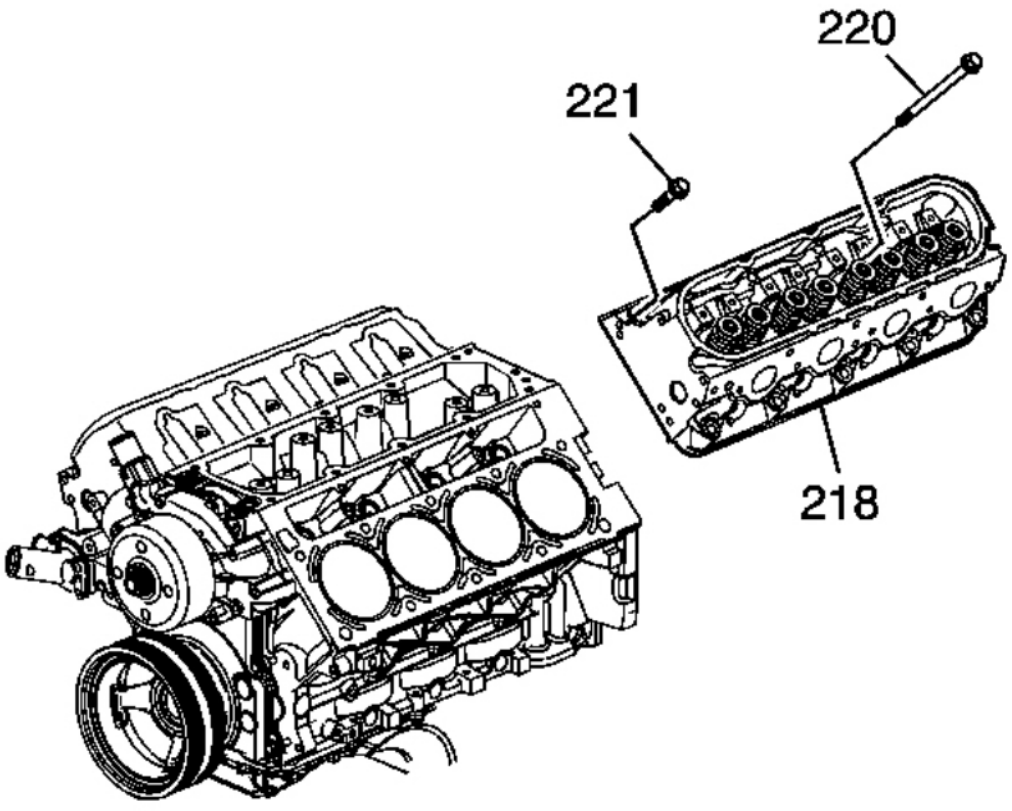


Fig. 206: View Of Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

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

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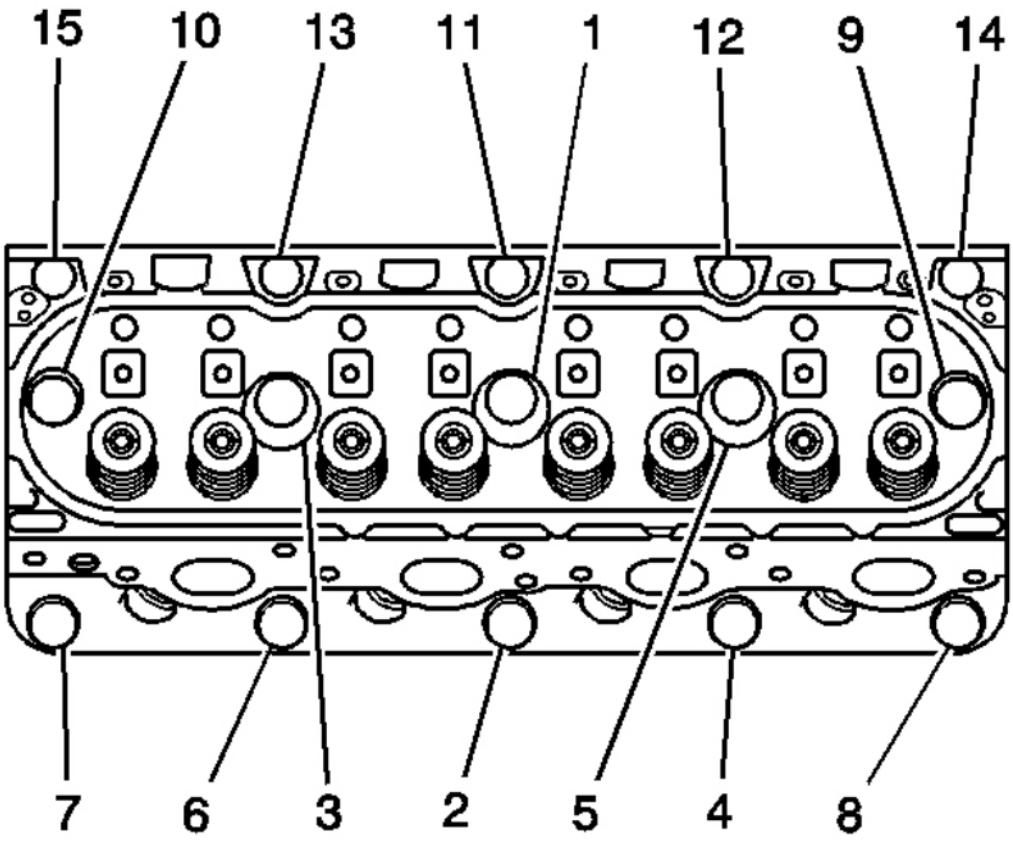


Fig. 207: Tightening Sequence For Cylinder Head Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

8. Tighten the cylinder head bolts.

Tighten:

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** . See **Special Tools** .
3. Tighten the M11 cylinder head bolts (1-10) a final pass to 70 degrees using **J 45059** . See **Special Tools** .
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.

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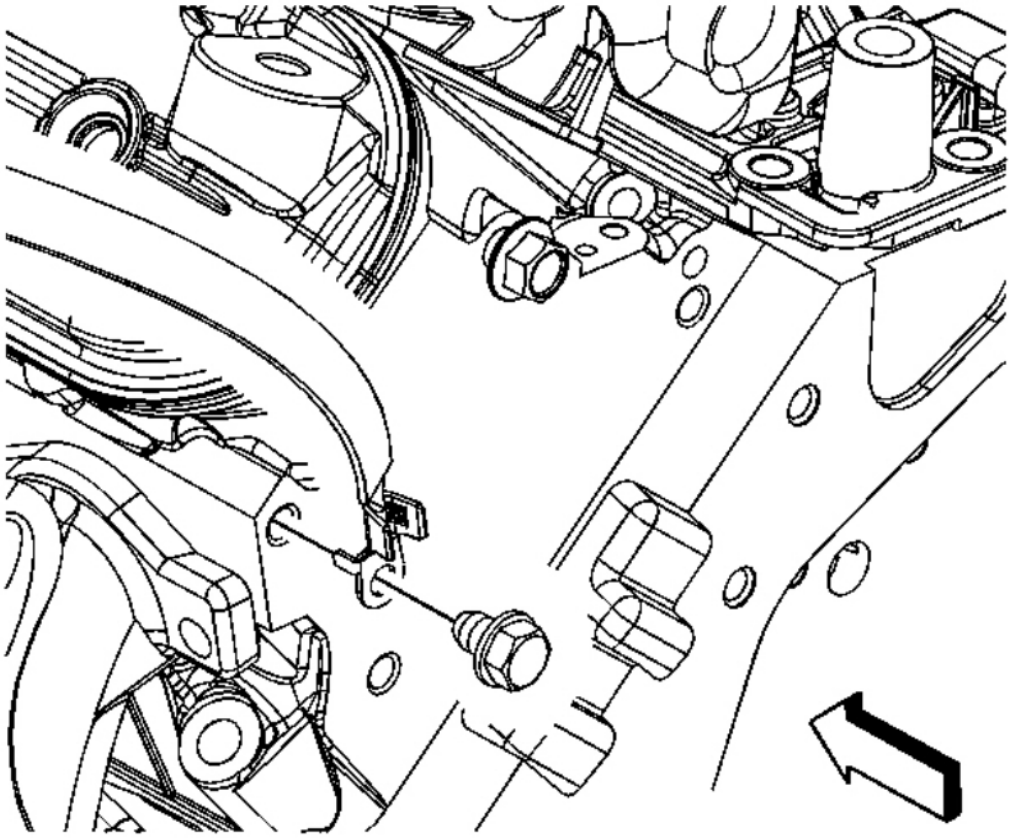


Fig. 208: View Of Engine Ground Strap & Bolt
Courtesy of GENERAL MOTORS CORP.

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.

    Tighten: 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 **Coolant Air Bleed Pipe Assembly Replacement (RPOs LC9/LY5/LMG/L76/L92)** or **Coolant Air Bleed Pipe Assembly Replacement (RPOs LY2/LY6)** .
14. Install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
15. Install the generator bracket. Refer to **Generator Replacement** .

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CYLINDER HEAD REPLACEMENT - RIGHT SIDE

Tools Required

- **J 45059** Angle Meter. See **Special Tools** .
- **J 42385-200** Common Thread Repair Kit. See **Special Tools** .

REMOVAL PROCEDURE

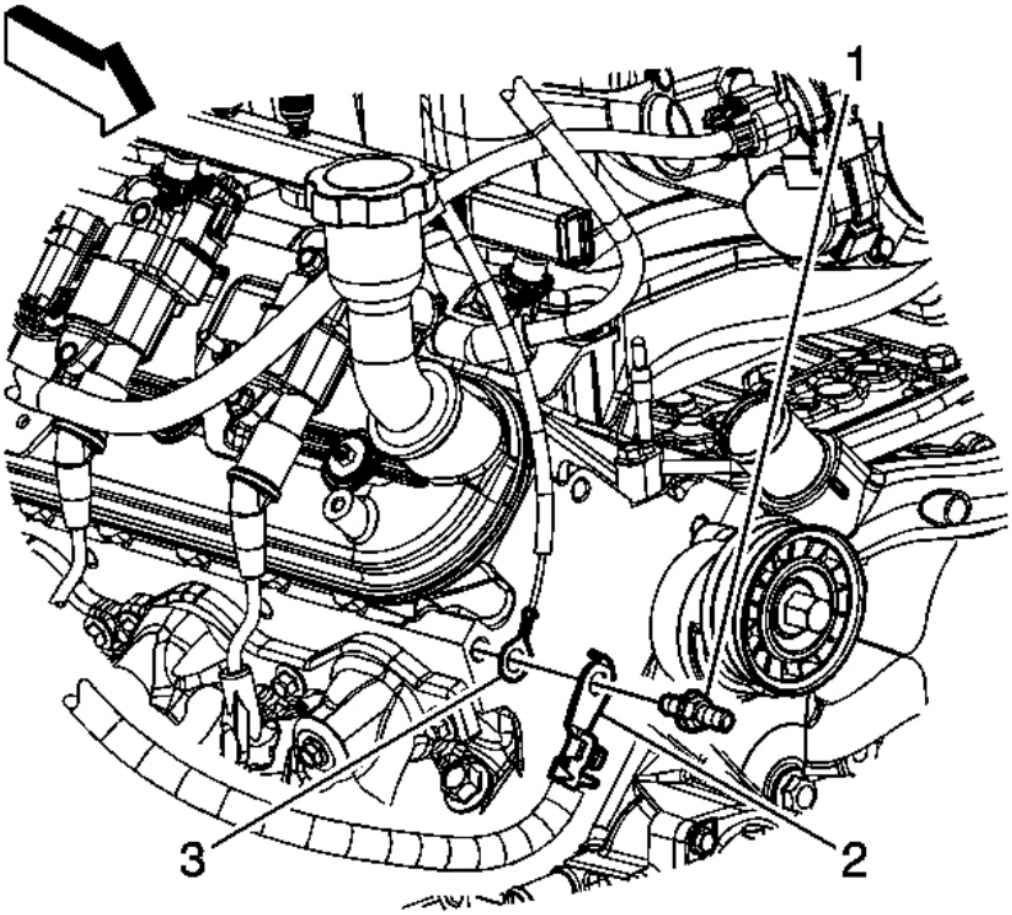


Fig. 209: View Of Battery Cable Terminals & Stud
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil level indicator. Refer to **Oil Level Indicator and Tube Replacement**.
2. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)**

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or **Intake Manifold Replacement (RPOs LY2/LY6)**.

3. Remove the coolant air bleed pipe. Refer to **Coolant Air Bleed Pipe Assembly Replacement (RPOs LC9/LY5/LMG/L76/L92)** or **Coolant Air Bleed Pipe Assembly Replacement (RPOs LY2/LY6)** .
4. Remove the right exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .
5. Remove the pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
6. Remove the negative battery cable stud (1) from the front of the right cylinder head.
7. Remove the negative battery cable terminal (2) and the engine harness terminal (3) from the cylinder head.

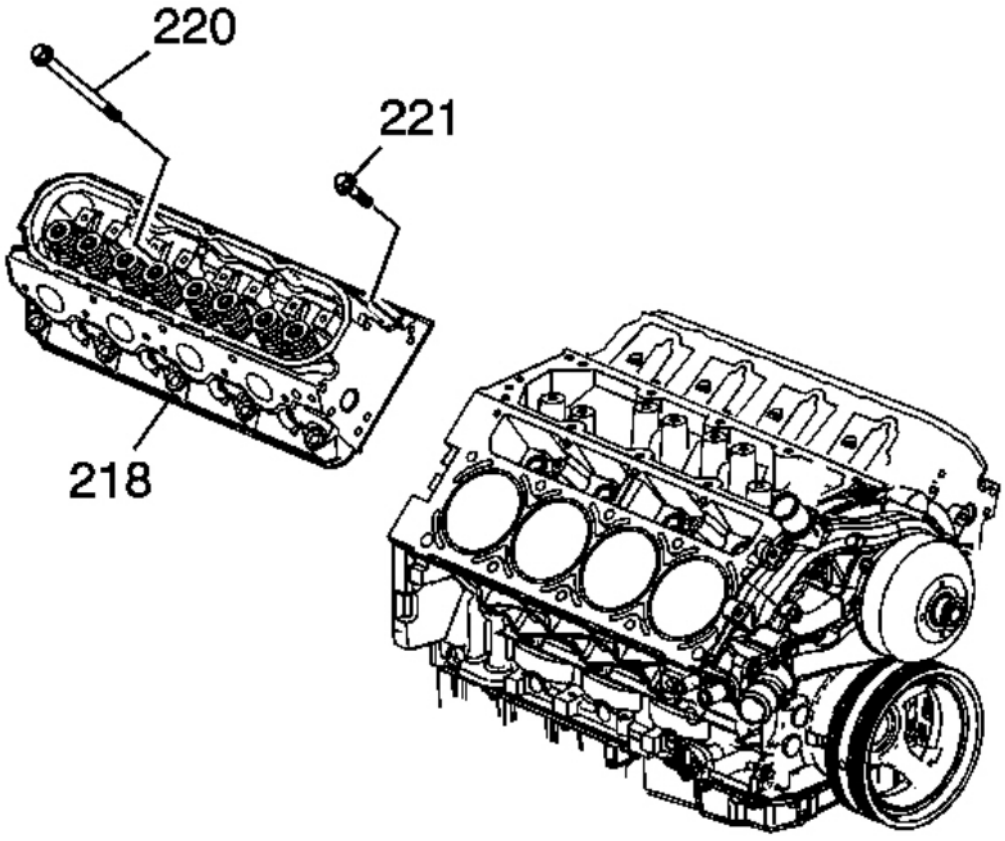


Fig. 210: View Of Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

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

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

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

9. Remove the cylinder head (218).

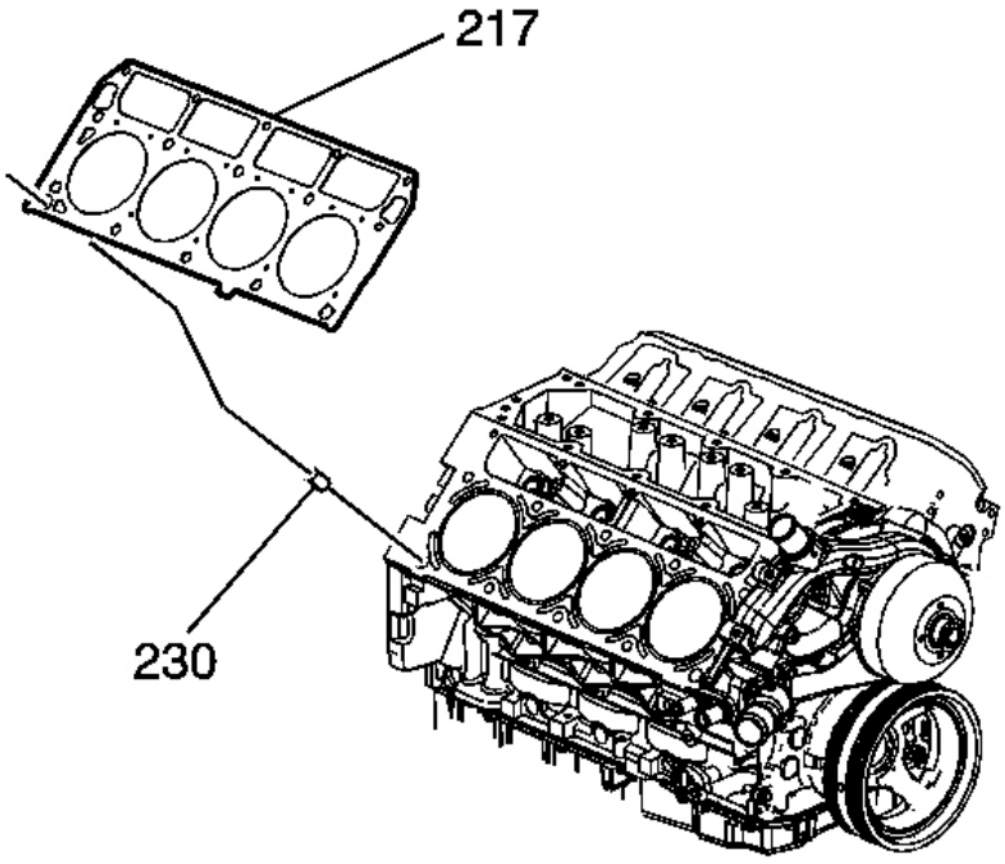


Fig. 211: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

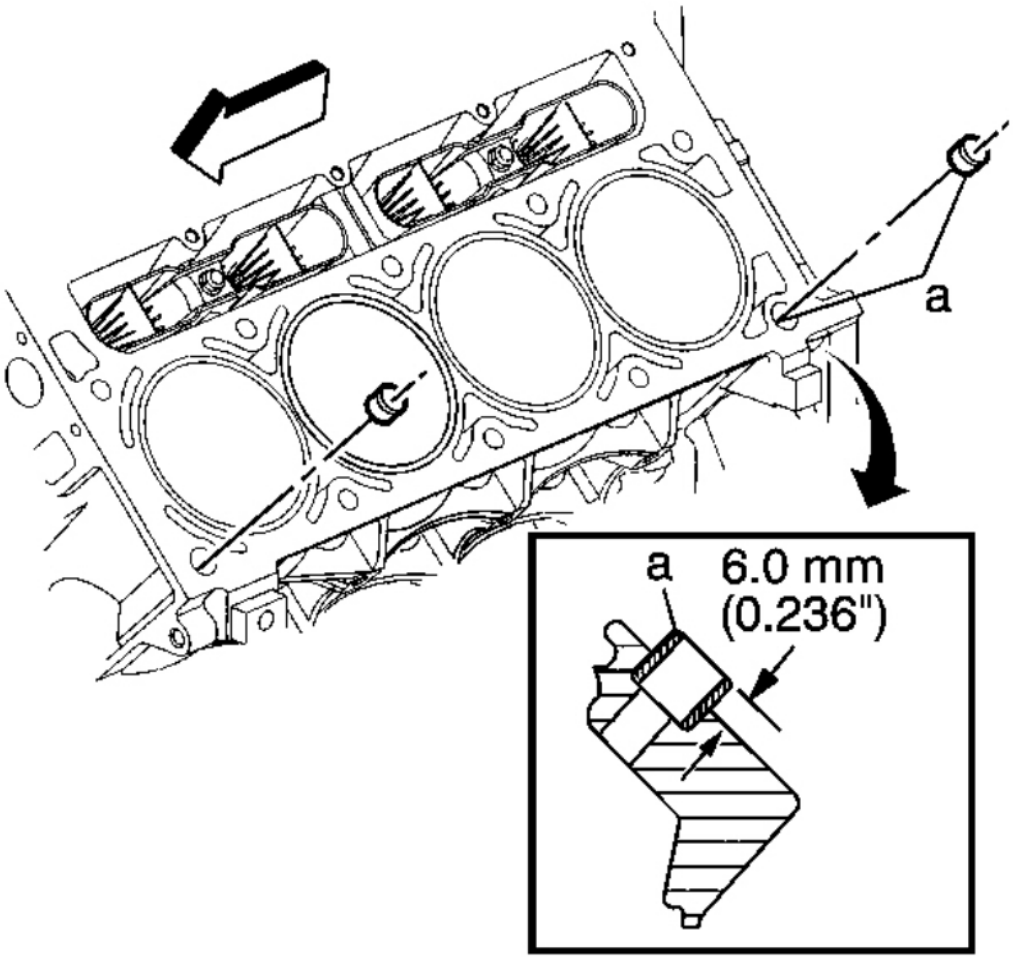
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CAUTION: Wear safety glasses in order to avoid eye damage.

NOTE: **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.**

IMPORTANT:

- **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).**



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Fig. 212: Identifying Cylinder Head Locating Pins Installation Position
Courtesy of GENERAL MOTORS CORP.

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. See **Special Tools** .
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).

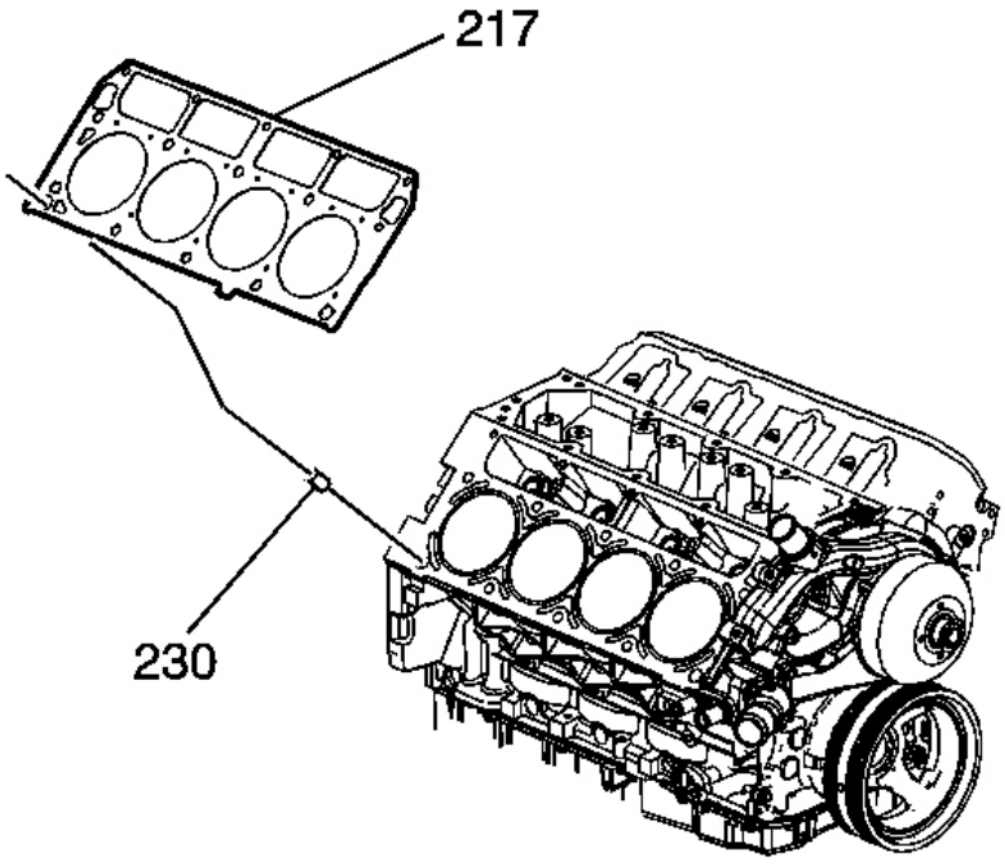


Fig. 213: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

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

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

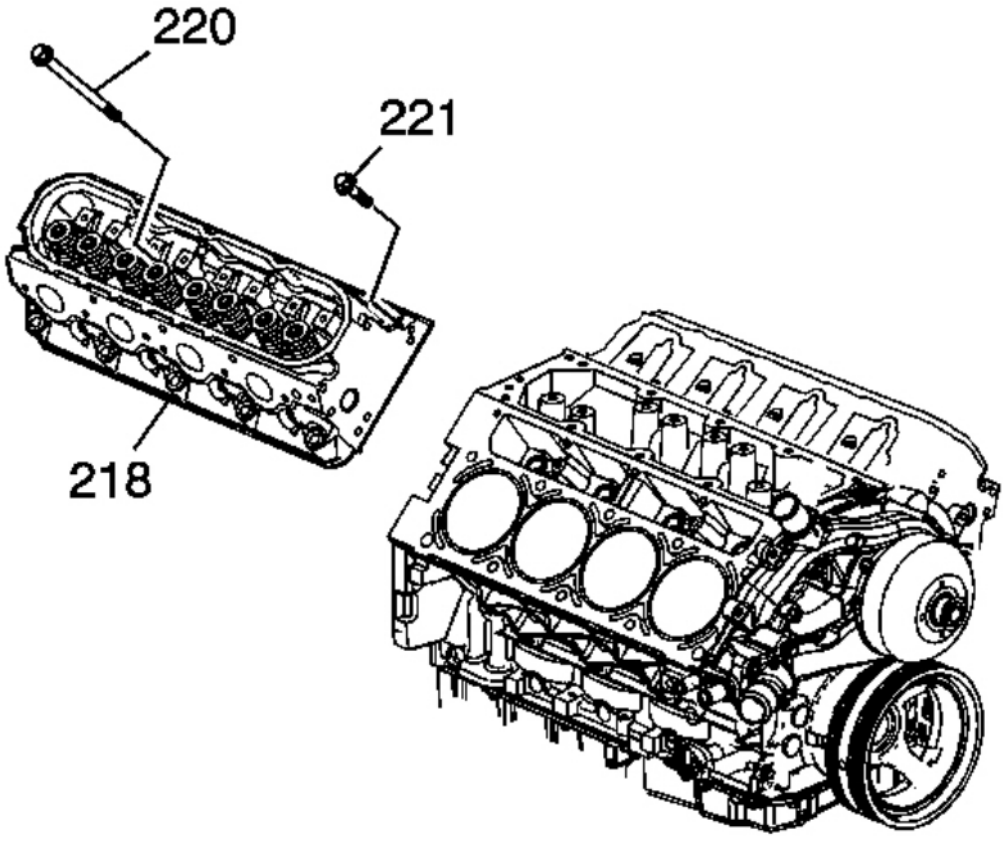


Fig. 214: View Of Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

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

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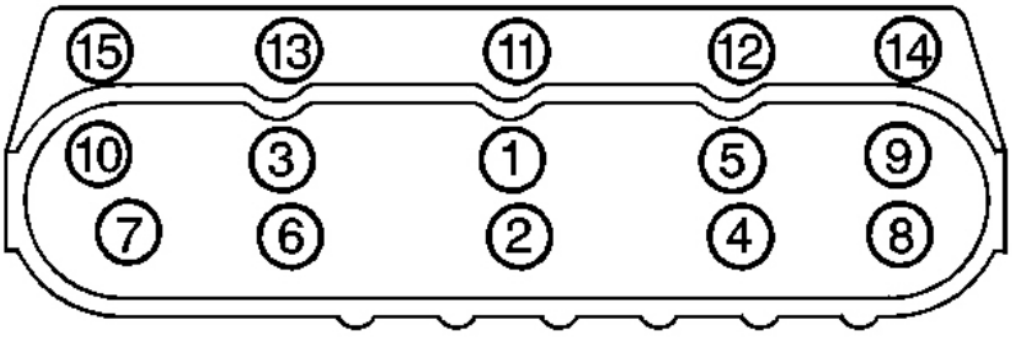


Fig. 215: Cylinder Head Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

8. Tighten the cylinder head bolts.

Tighten:

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** . See **Special Tools** .
3. Tighten the M11 cylinder head bolts (1-10) a final pass to 70 degrees in sequence using **J 45059** . See **Special Tools** .
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.

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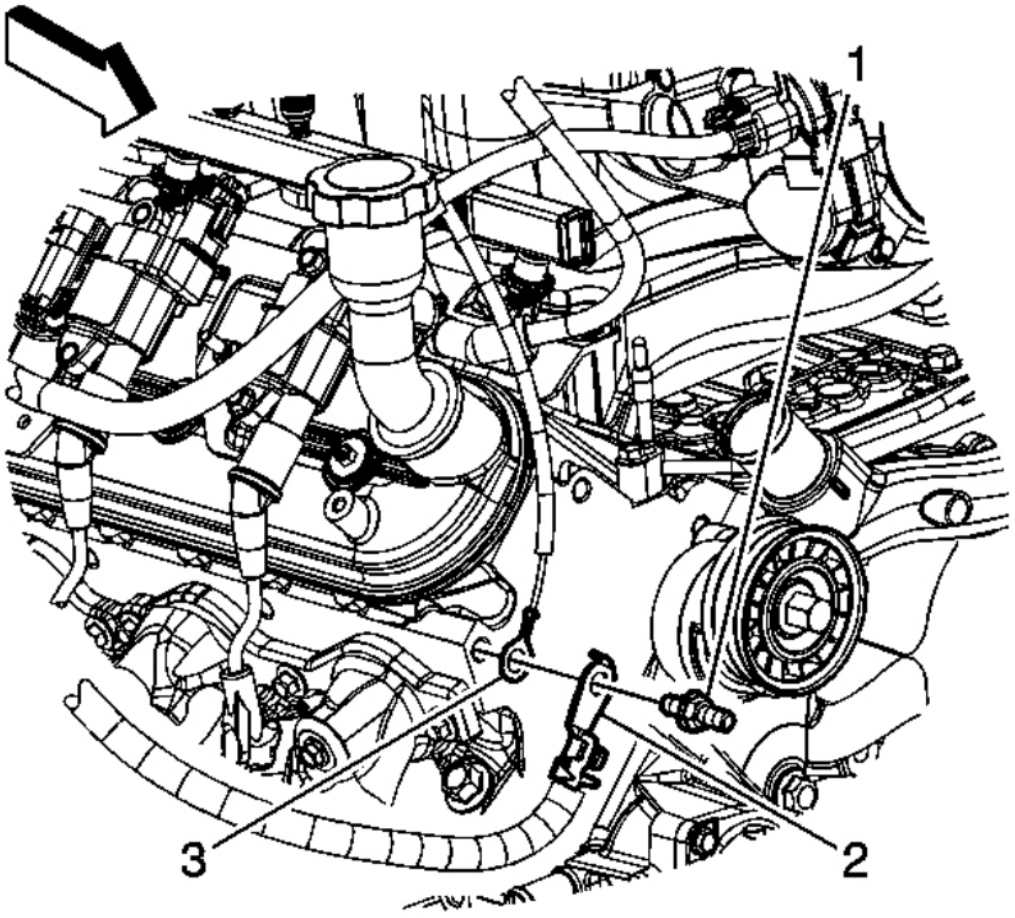


Fig. 216: View Of Battery Cable Terminals & Stud
Courtesy of GENERAL MOTORS CORP.

9. Ensure that the engine harness terminal (3) is positioned behind the negative battery cable terminal (2).
10. Position the negative battery cable terminal (2) to the cylinder head.
11. Install the negative battery cable stud (1) to the front of the right cylinder head.

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

12. Install the pushrods. Refer to **Valve Rocker Arm and Push Rod Replacement**.
13. Install the right exhaust manifold. Refer to **Exhaust Manifold Replacement - Right Side** .
14. Install the coolant air bleed pipe. Refer to **Coolant Air Bleed Pipe Assembly Replacement (RPOs LC9/LY5/LMG/L76/L92)** or **Coolant Air Bleed Pipe Assembly Replacement (RPOs LY2/LY6)** .

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15. Install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
16. Install the oil level indicator. Refer to **Oil Level Indicator and Tube Replacement**.

VALVE LIFTER REPLACEMENT (RPOS LC9/LMG/LY5/L76/L92)

REMOVAL PROCEDURE

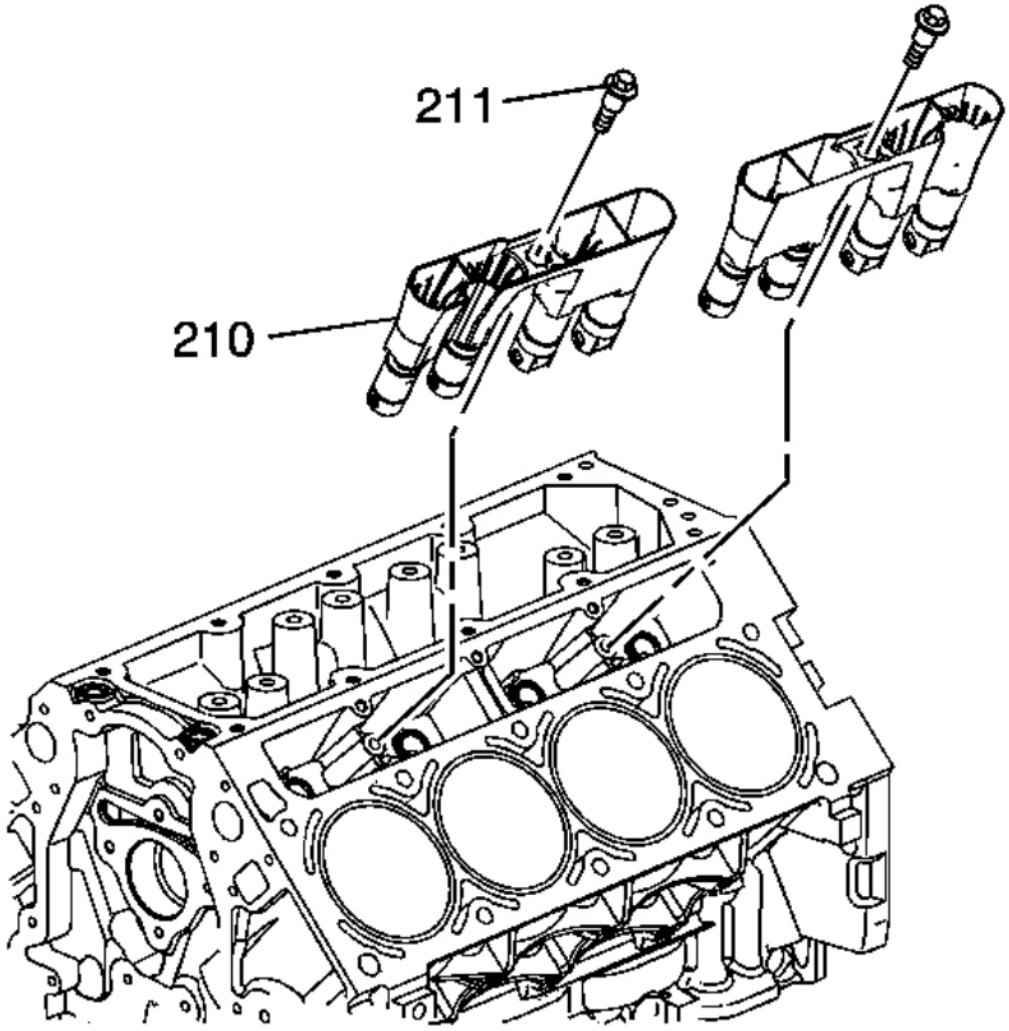


Fig. 217: View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

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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.

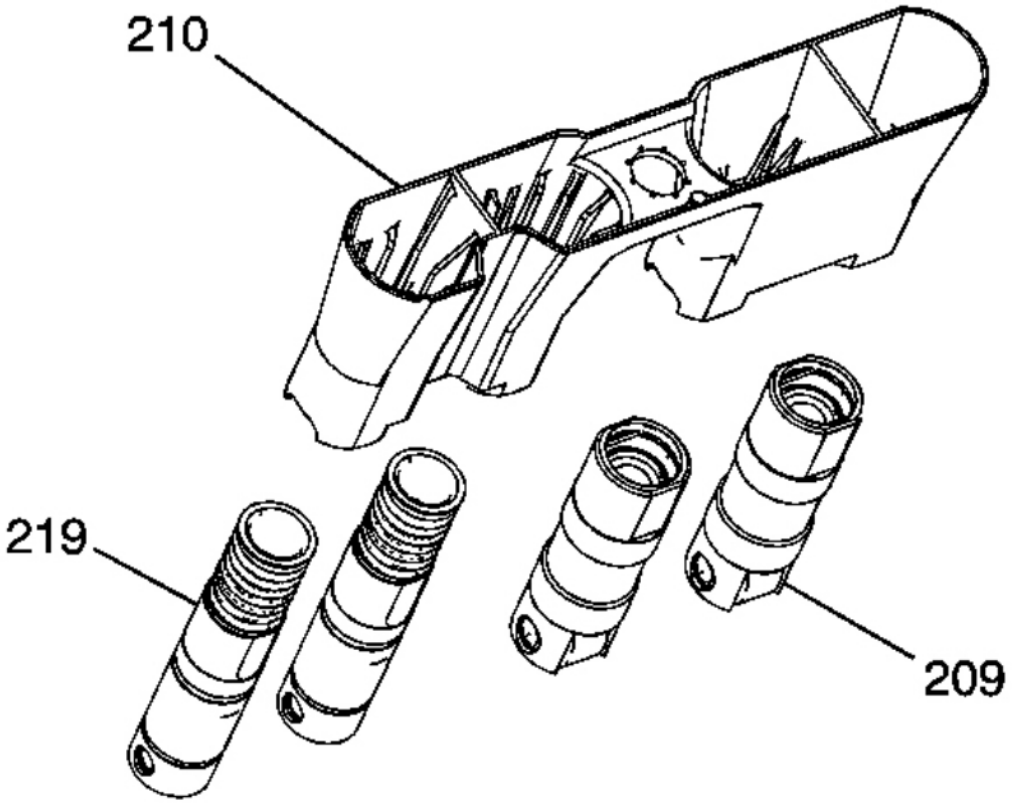


Fig. 218: Exploded View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

4. Remove the valve lifters (209, 219) from the guide (210).

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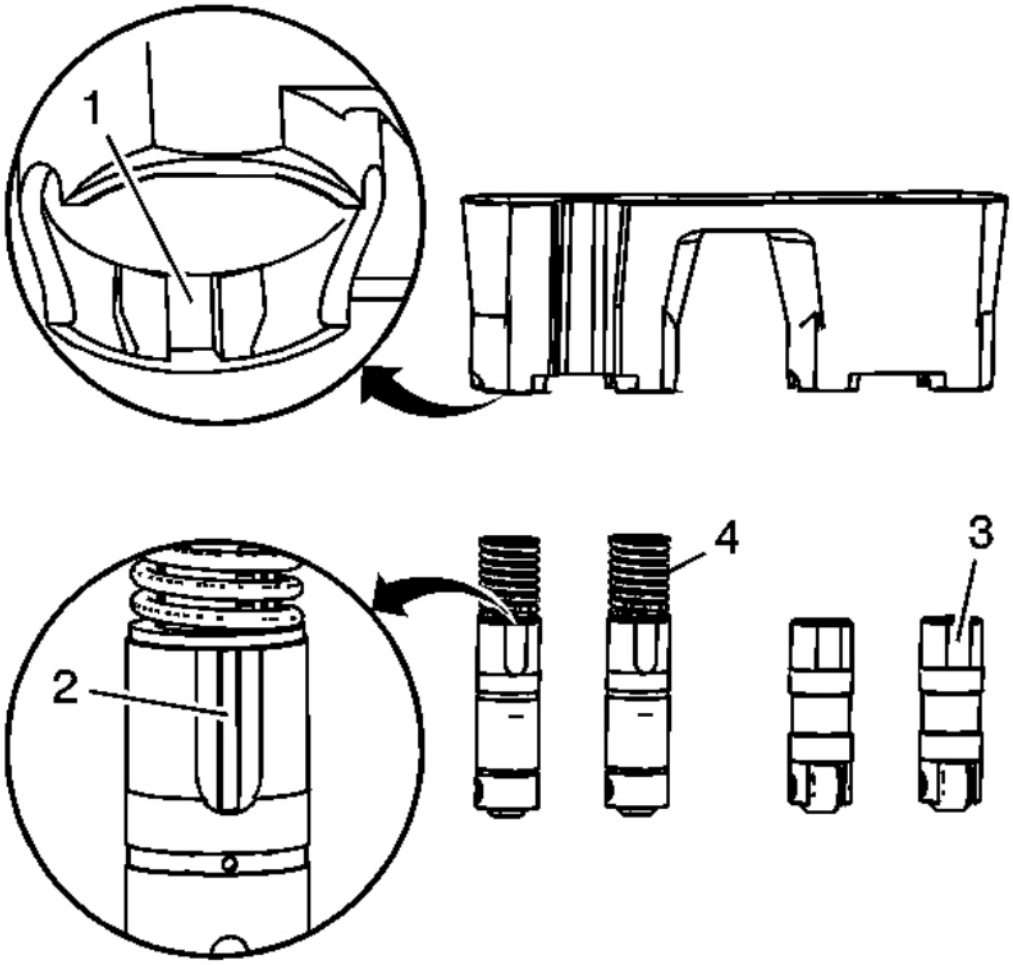


Fig. 219: Inserting Valve Lifters Into Lifter Guides
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The active fuel management lifters are installed into the guide by aligning the notched area of the guide (1) with the raised surface on the side of the lifter (2).

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 Lifters and Guides Cleaning and Inspection (RPO LY2/LY6)** or **Valve Lifters and Guides Cleaning and Inspection (RPO LC9/LY5/LMG/L76/L92)** .

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INSTALLATION PROCEDURE

IMPORTANT:

- **When reusing valve lifters, install the lifters to their original locations.**
- **Each of the 4 valve guide assemblies will contain 2 active fuel management valve lifters and 2 non active fuel management valve lifters.**
- **With the lifters and guides properly installed, cylinders 1, 4, 6, and 7 lifter bores will each contain 2 active fuel management valve lifters.**

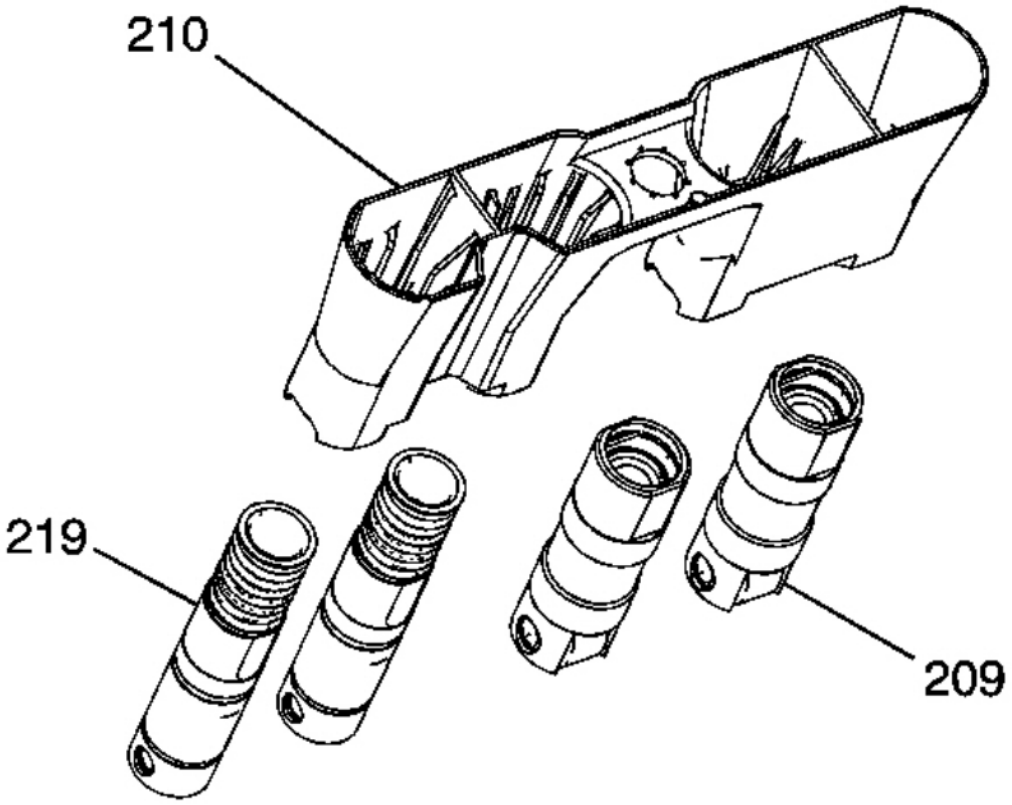


Fig. 220: Exploded View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the valve lifters (209, 219) and engine block valve lifter bores with clean engine oil.

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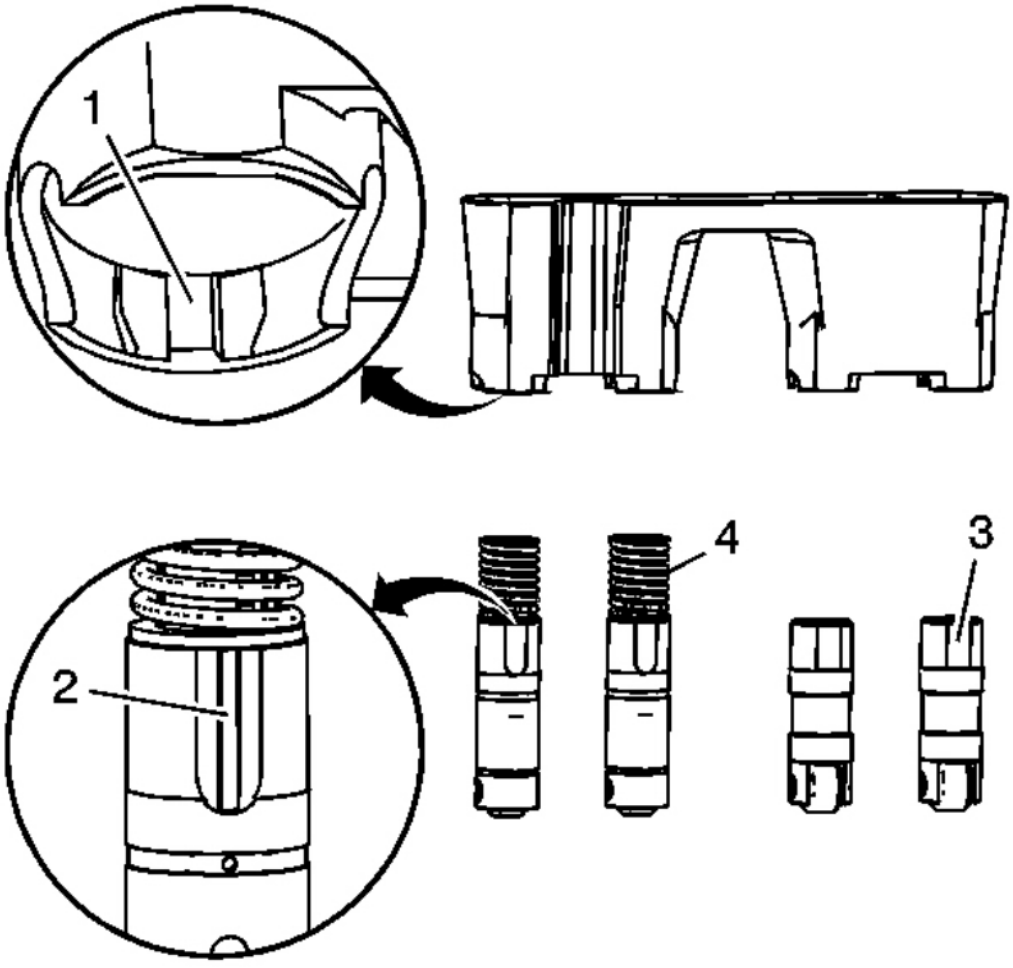


Fig. 221: Inserting Valve Lifters Into Lifter Guides
Courtesy of GENERAL MOTORS CORP.

2. Insert the valve lifters into the lifter guides.
    - Align the flat area (3) on the top of the non active fuel management lifter with the flat area in the lifter guide bore. Push the lifter completely into the guide bore.
    - The active fuel management lifters are to be installed into the guide, with the notch in the guide (1) aligned with the raised area (2) of the lifter.

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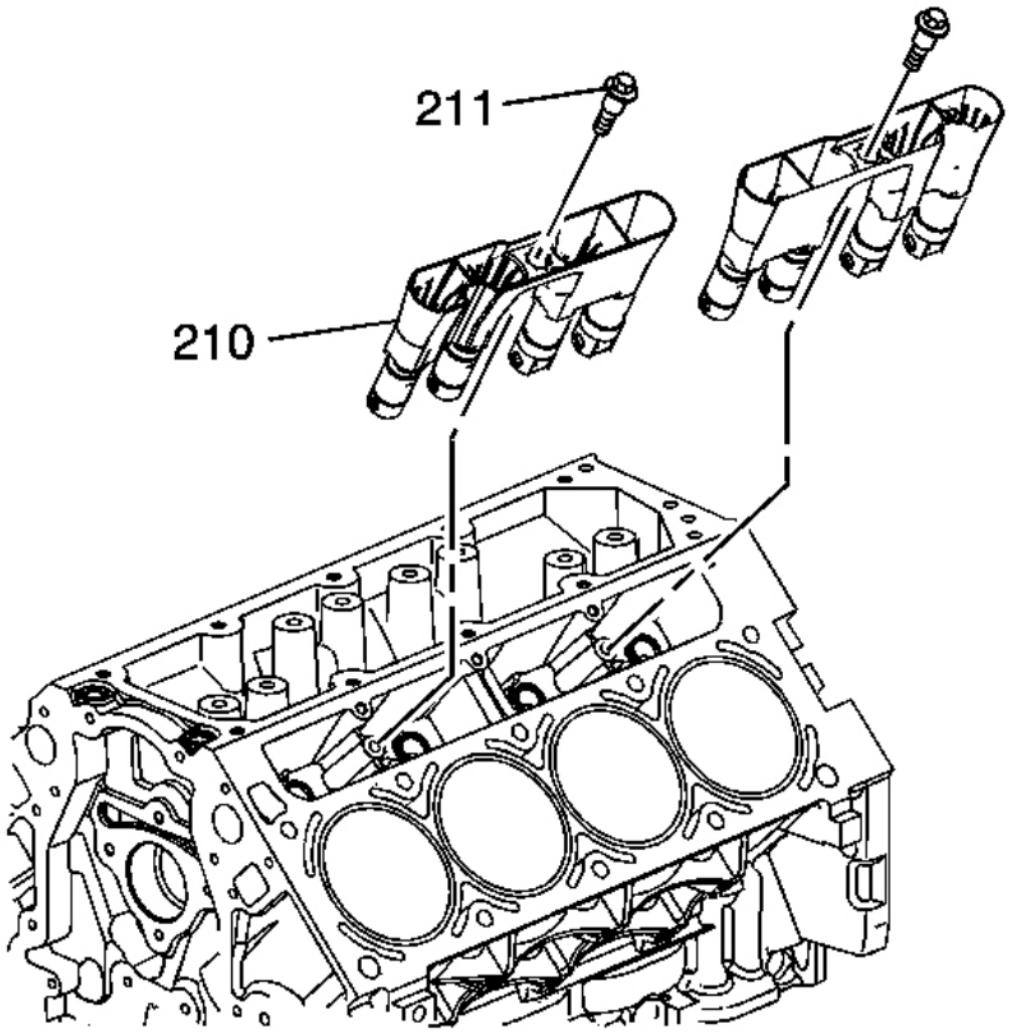


Fig. 222: View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

4. Install the valve lifter guide bolts (211).

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

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

VALVE LIFTER REPLACEMENT (RPOS LY2/LY6)

REMOVAL PROCEDURE

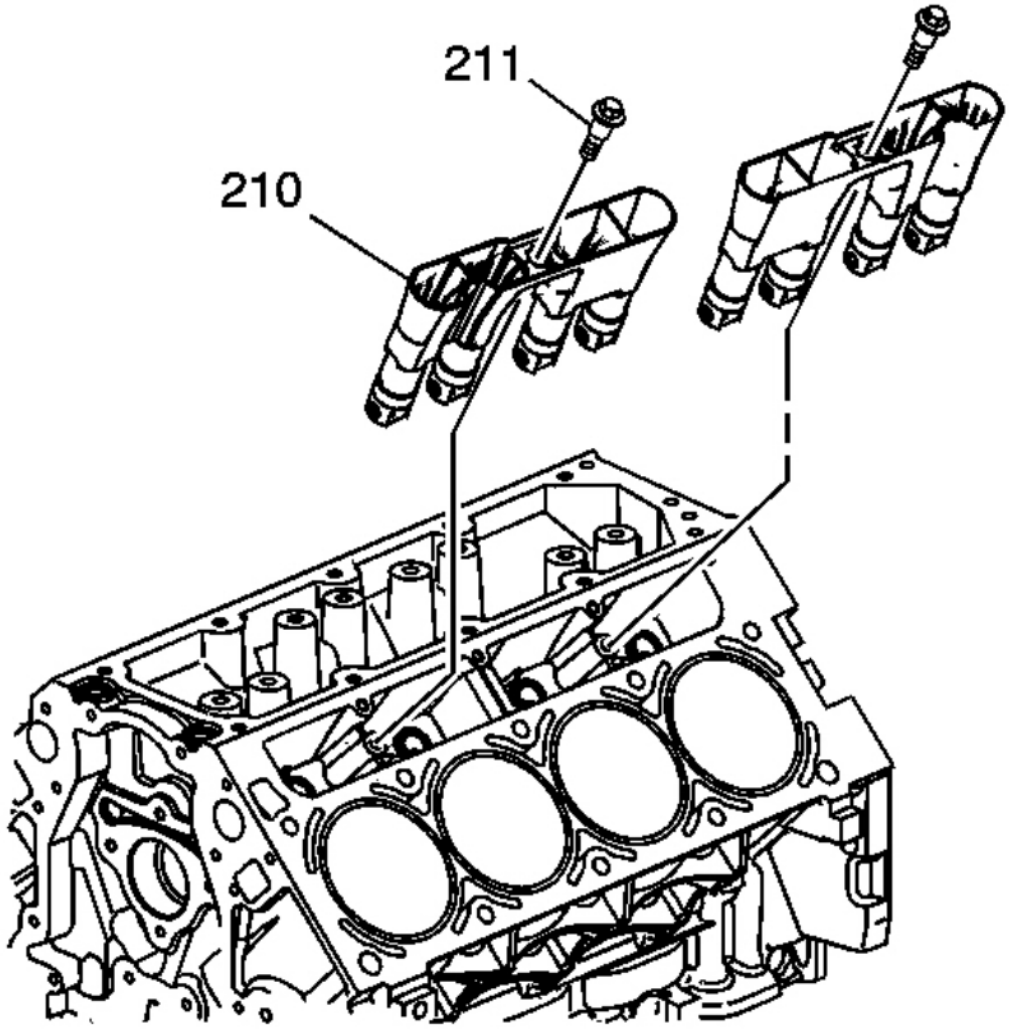


Fig. 223: Valve Lifter Guides, Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the cylinder head and gasket. Refer to **Cylinder Head Replacement - Left Side** or **Cylinder**

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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.

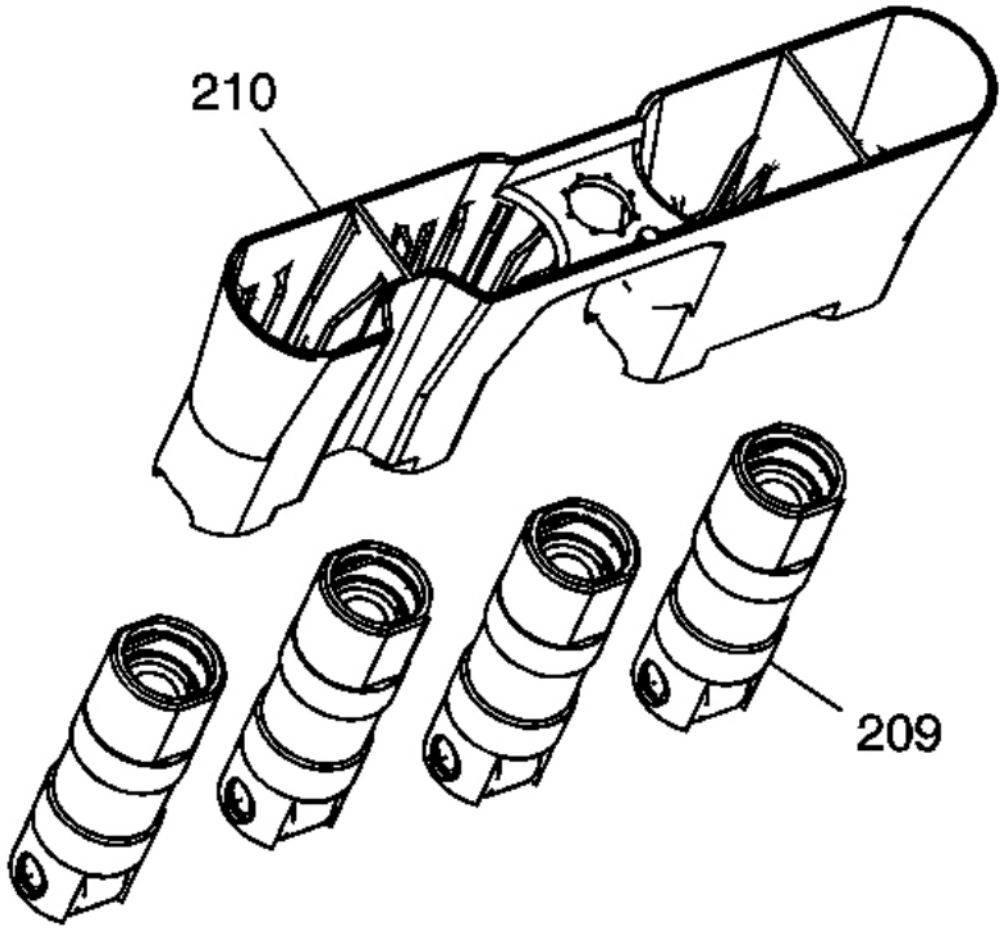


Fig. 224: Valve Lifter Guides & Bolts
Courtesy of GENERAL MOTORS CORP.

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 Lifters and Guides Cleaning and**

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Inspection (RPO LY2/LY6) or **Valve Lifters and Guides Cleaning and Inspection (RPO LC9/LY5/LMG/L76/L92)** .

INSTALLATION PROCEDURE

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

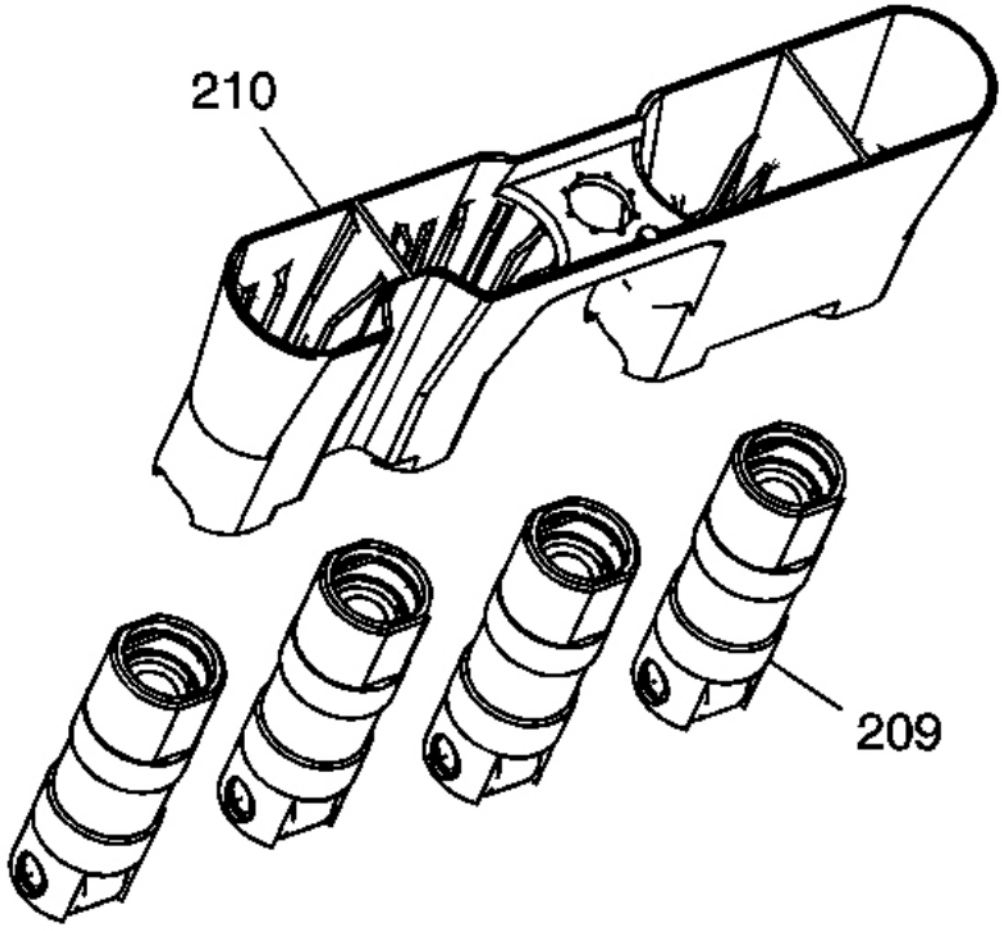


Fig. 225: Valve Lifter Guides & Bolts
Courtesy of GENERAL MOTORS CORP.

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.

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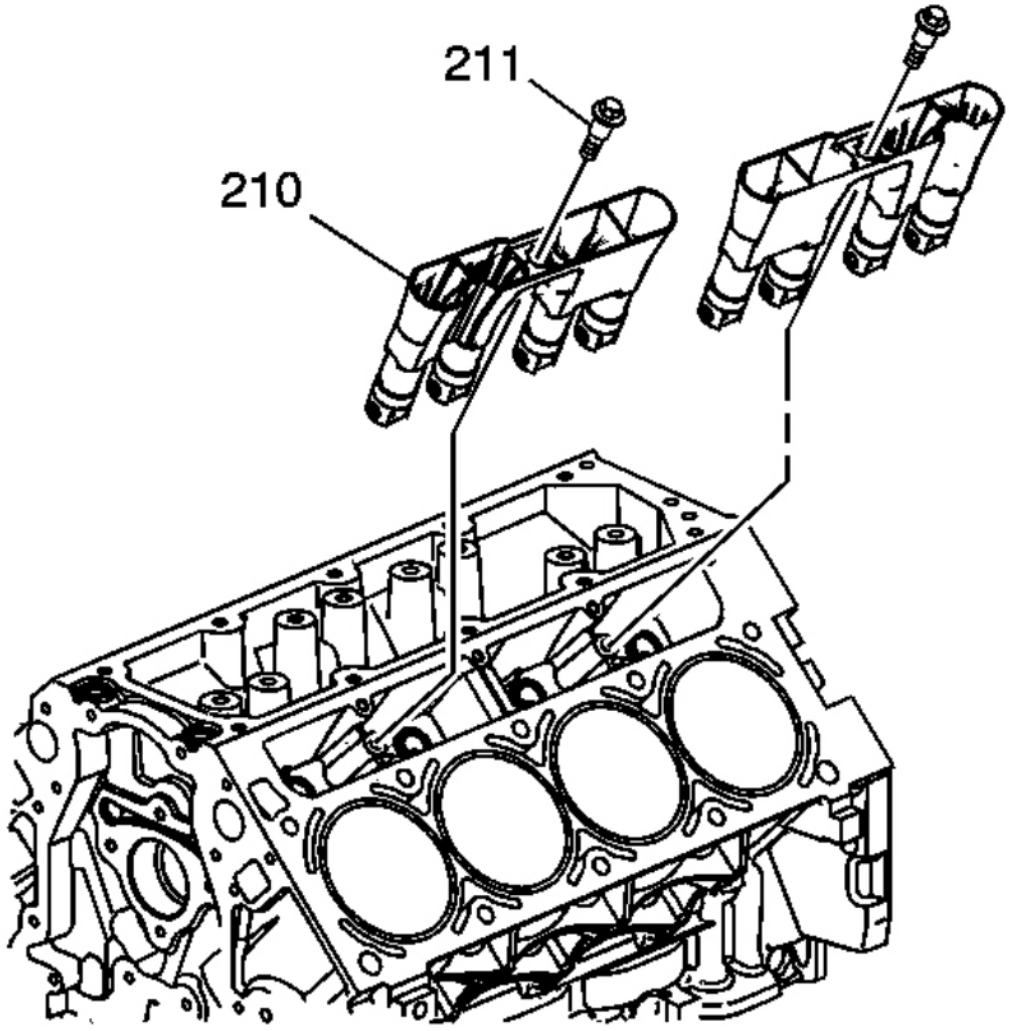


Fig. 226: Valve Lifter Guides, Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

4. Install the valve lifter guide bolts.

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

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

CRANKSHAFT BALANCER REPLACEMENT

Tools Required

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

REMOVAL PROCEDURE

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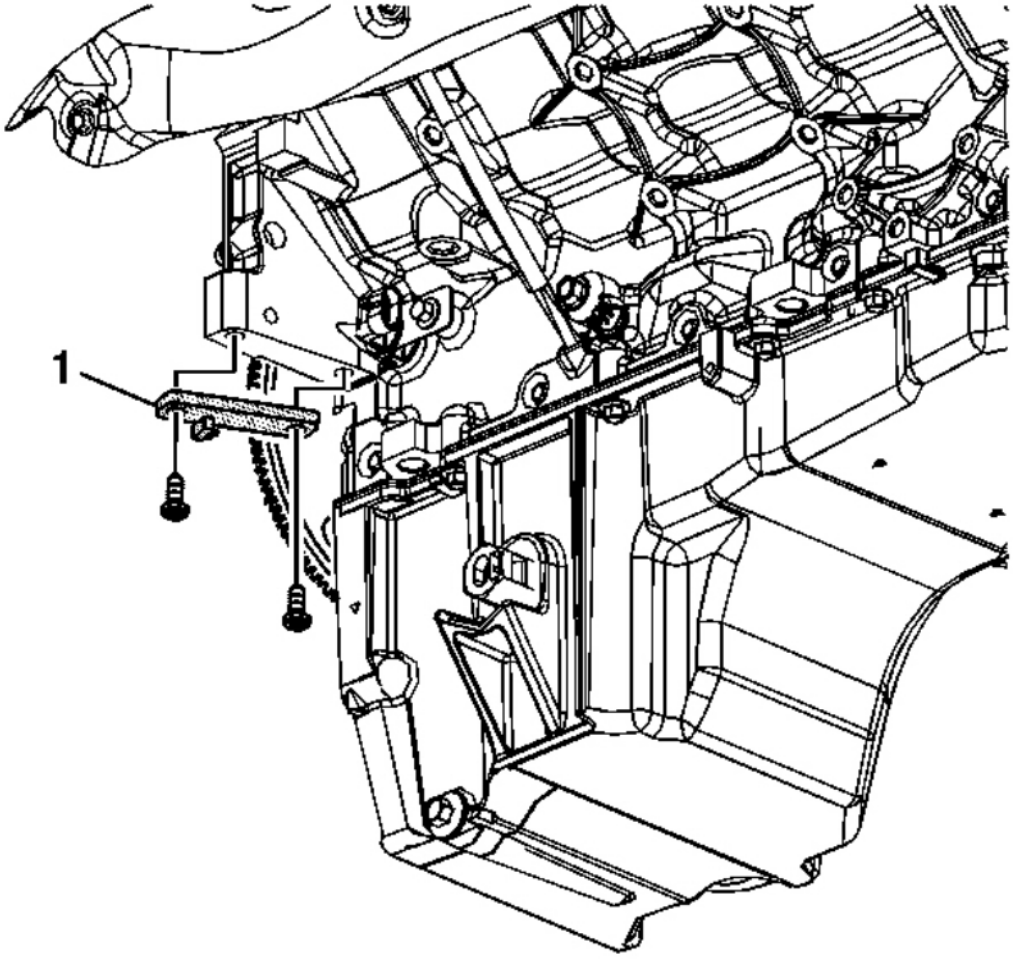


Fig. 227: View Of Special Tool & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the air conditioning (A/C) drive belt. Refer to **Drive Belt Replacement - Air Conditioning**.
2. Remove the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement** .
3. Remove the starter motor. Refer to **Starter Motor Replacement** .

NOTE: **Refer to Fastener Notice .**

IMPORTANT: Ensure that the teeth of the J 42386-A mesh with the teeth of the engine flywheel. See Special Tools .

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4. Install the **J 42386-A** (1) and bolts. See **Special Tools** . 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. See **Special Tools** .m (37 lb ft).

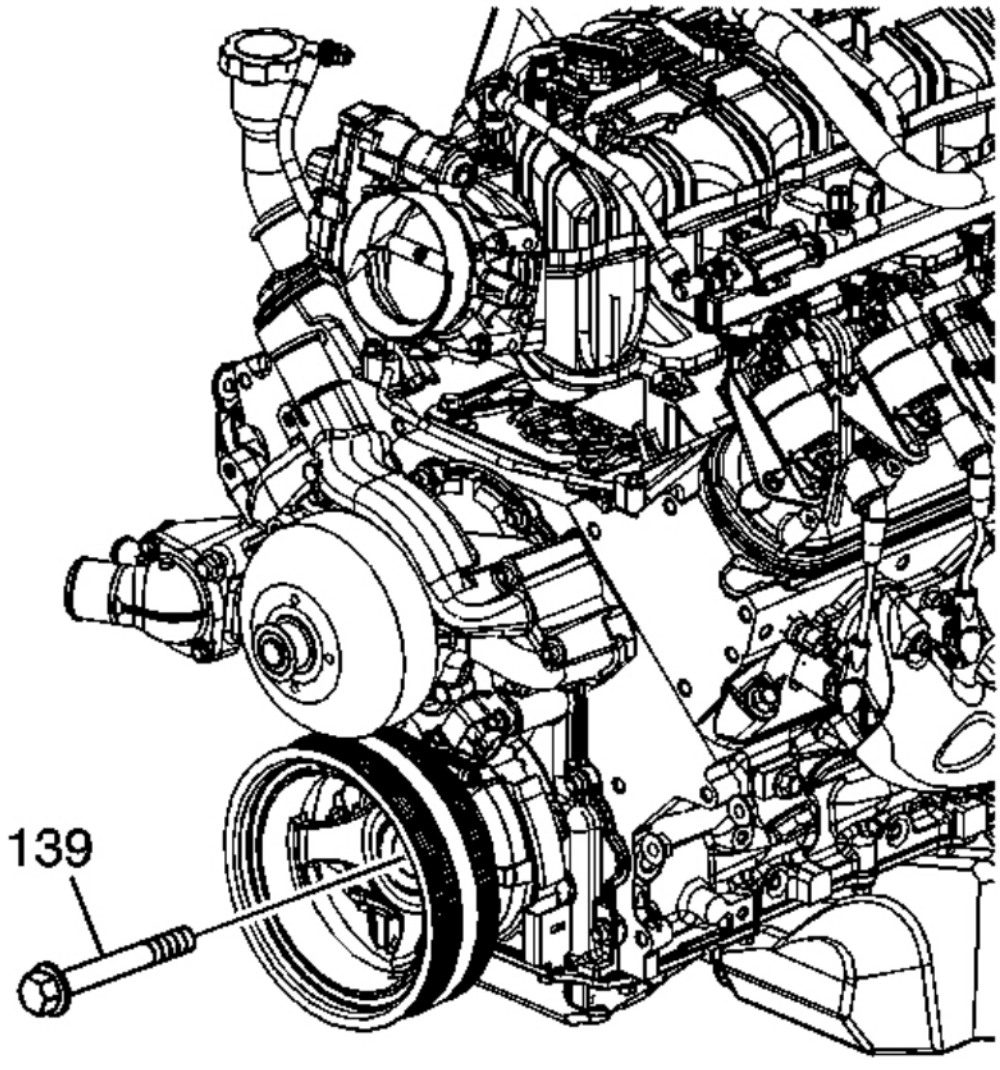


Fig. 228: View Of Used Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

5. Remove the crankshaft balancer bolt (139). Do not discard the crankshaft balancer bolt at this time. The

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old balancer bolt will be used during the balancer installation procedure.

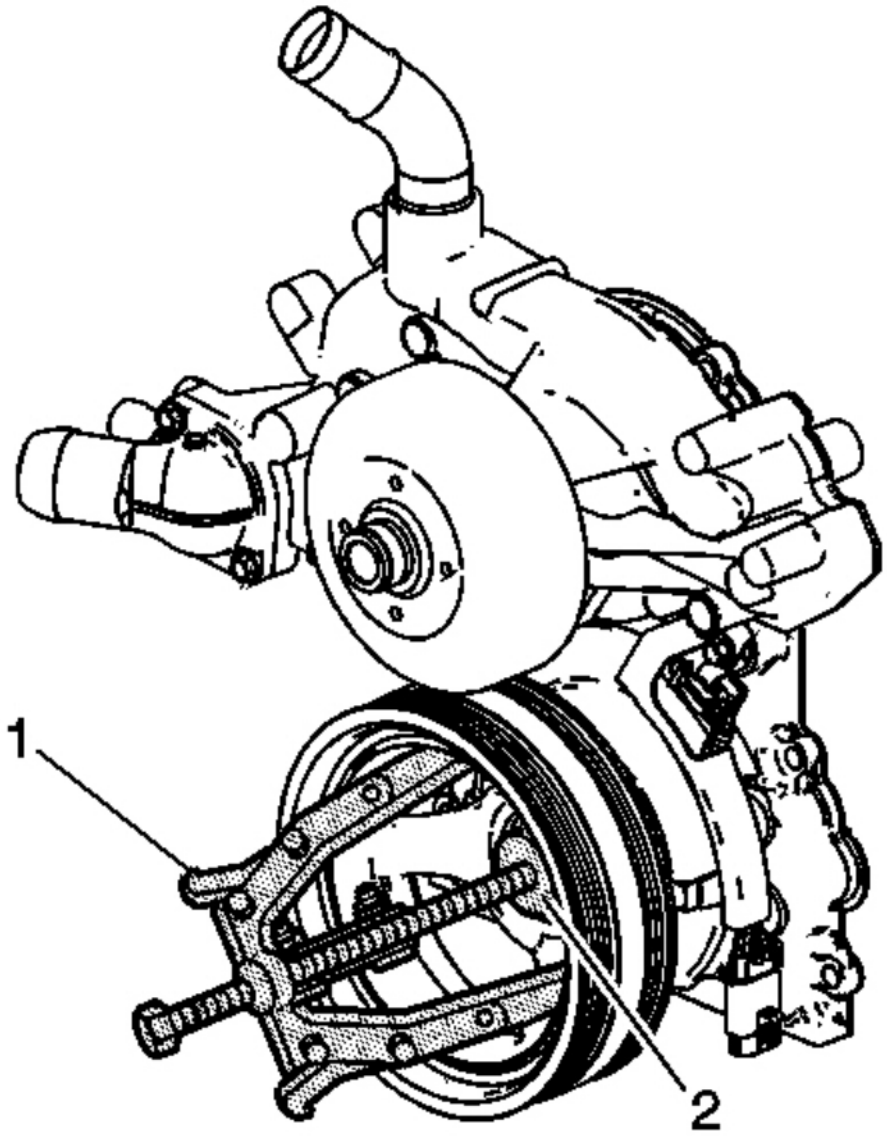


Fig. 229: View Of Crankshaft Balancer With J 41816 & J 41816-2 Removal Tools
Courtesy of GENERAL MOTORS CORP.

6. Install the **J 41816** (1) and **J 41816-2** (2) to the crankshaft balancer. See **Special Tools** .

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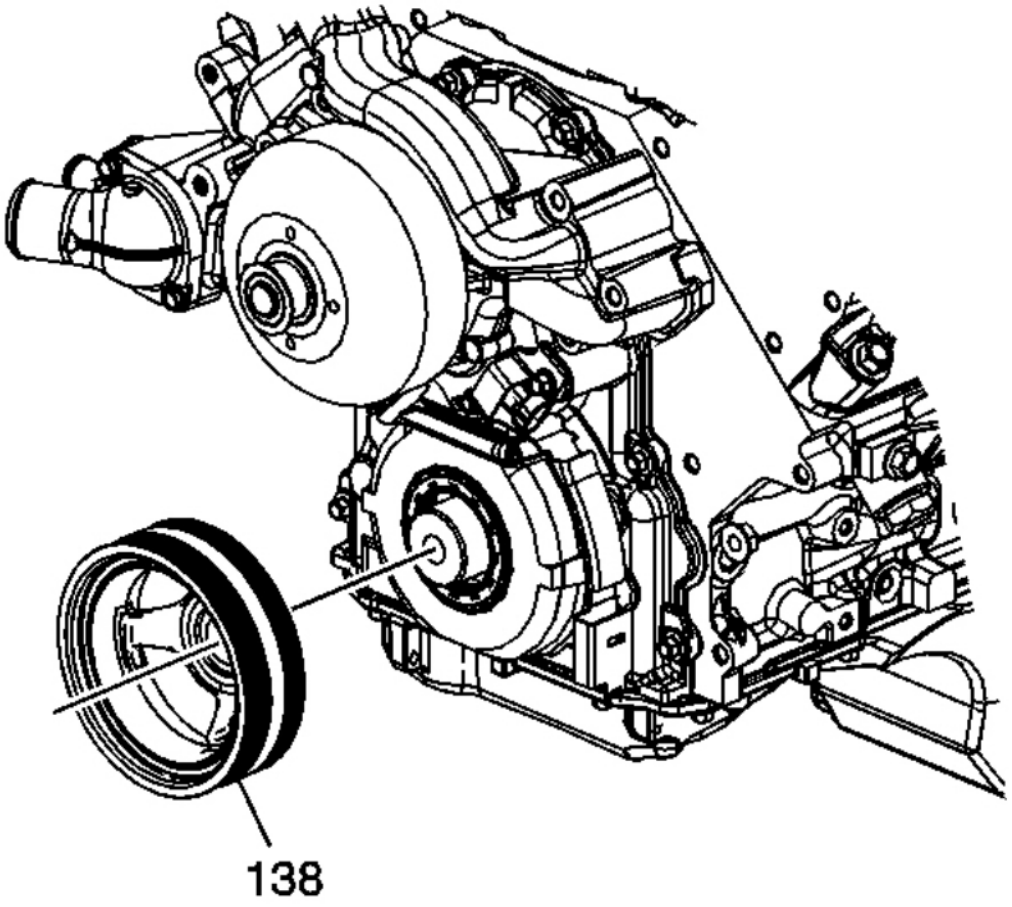


Fig. 230: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

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

7. Use the **J 41816** and the **J 41816-2** to remove the crankshaft balancer (138). See **Special Tools** .
8. Remove the **J 41816** and the **J 41816-2** from the crankshaft balancer. See **Special Tools** .

INSTALLATION PROCEDURE

IMPORTANT:

- **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**

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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.**

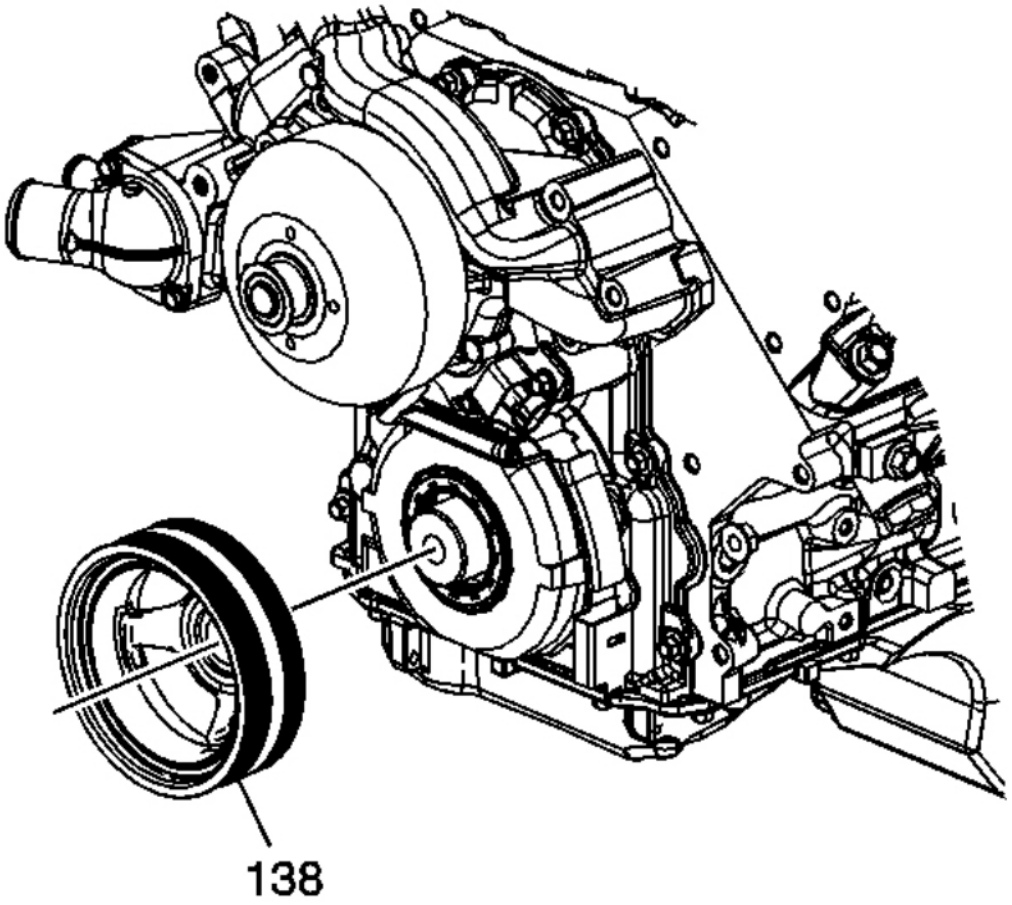


Fig. 231: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: 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.

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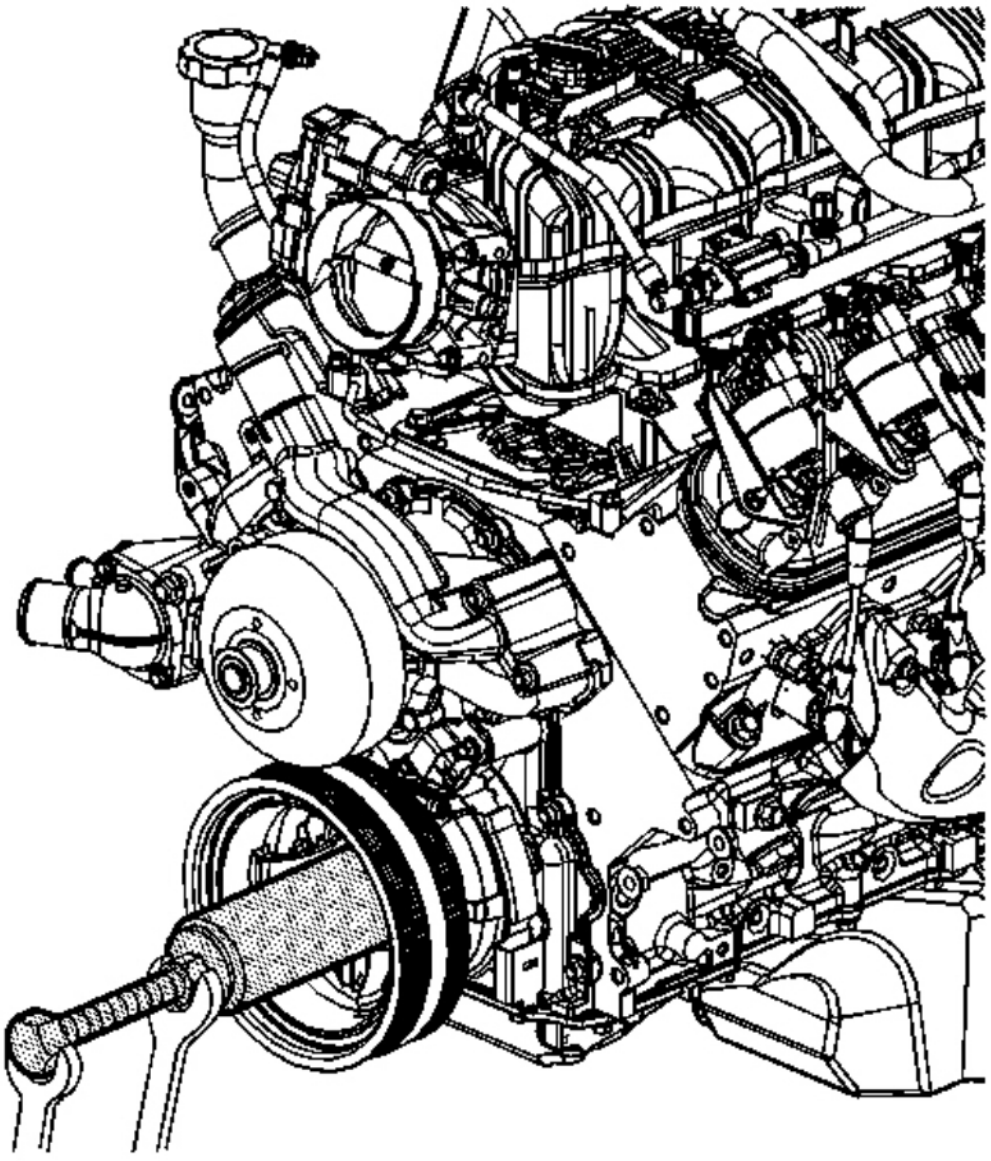


Fig. 232: View Of Balancer Installation Special Tools
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 41665** and the threaded rod from the **J 41478** to crankshaft balancer and install the balancer. See **Special Tools** .
    1. Assemble the threaded rod, nut, washer and installer. Insert the smaller end of the installer into the

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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. See **Special Tools** .

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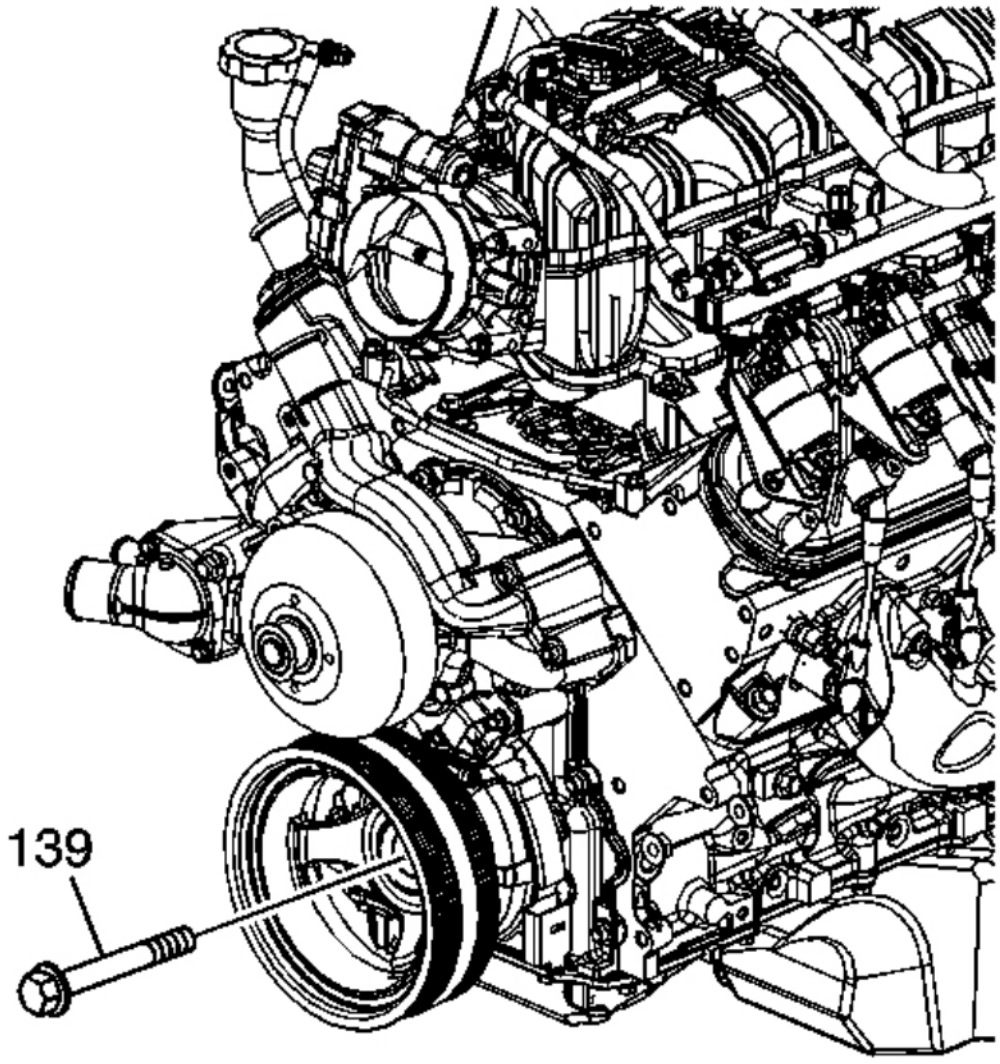


Fig. 233: View Of Used Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

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.

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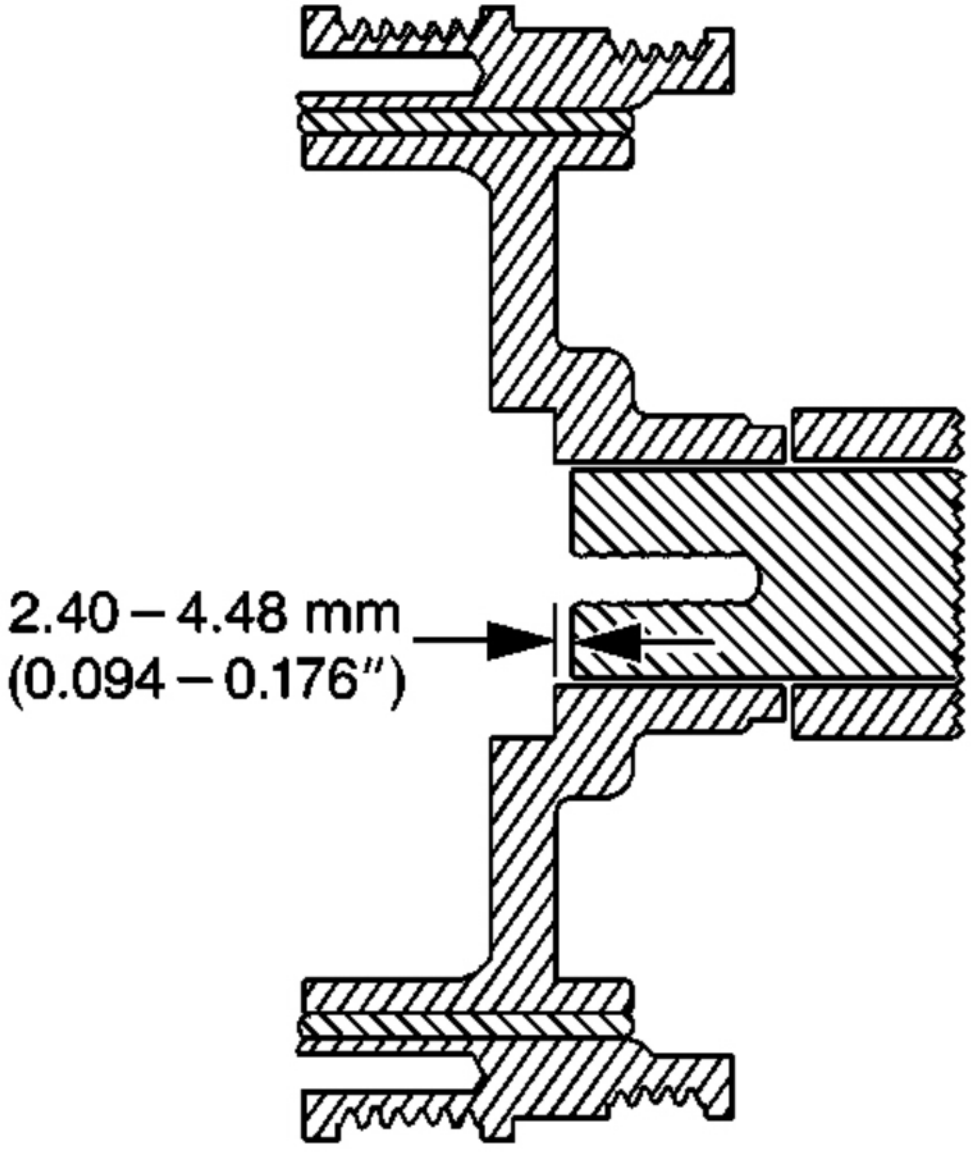


Fig. 234: Identifying Hub To Crankshaft Distance
Courtesy of GENERAL MOTORS CORP.

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

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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. See **Special Tools** .

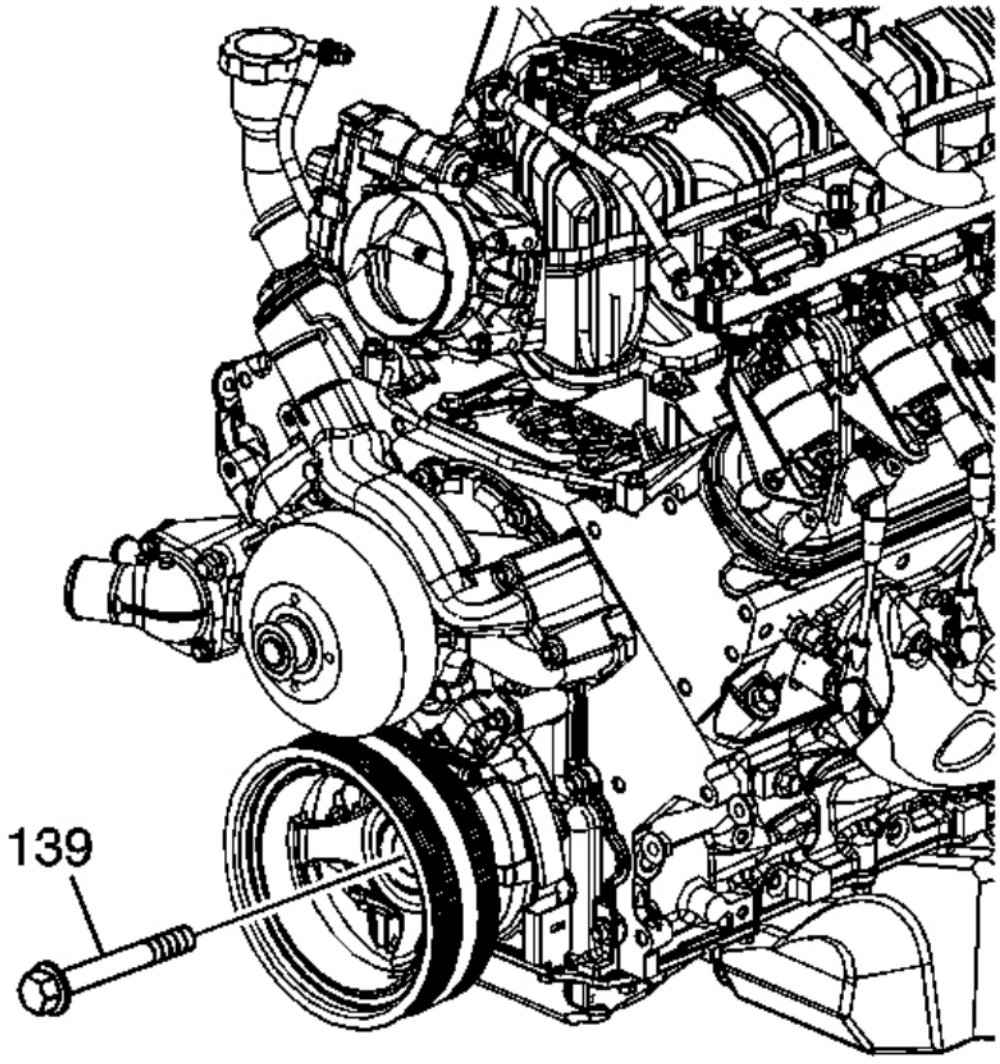


Fig. 235: View Of Used Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

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

Tighten:

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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** . See **Special Tools** .

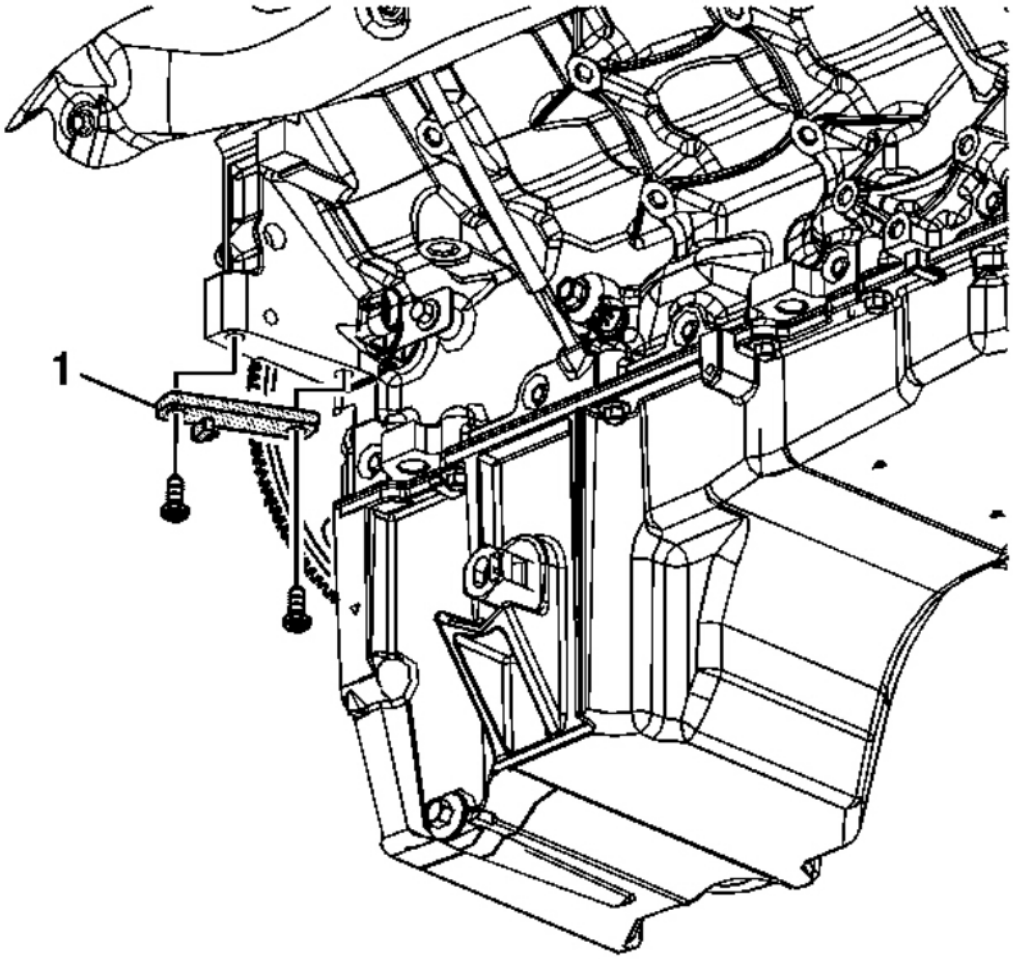


Fig. 236: View Of Special Tool & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the **J 42386-A** (1) and bolts. See **Special Tools** .
8. Install the starter motor. Refer to **Starter Motor Replacement** .
9. Install the cooling fan and shroud. Refer to **Cooling Fan and Shroud Replacement** .
10. Install the A/C drive belt. Refer to **Drive Belt Replacement - Air Conditioning**.
11. Perform the crankshaft position (CKP) system variation learn procedure. Refer to **Crankshaft Position System Variation Learn** .

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CRANKSHAFT FRONT OIL SEAL REPLACEMENT (RPOS LC9/LMG/LY2/LY5)

TOOLS REQUIRED

J 41478 Crankshaft Front Oil Seal Installer. See **Special Tools** .

REMOVAL PROCEDURE

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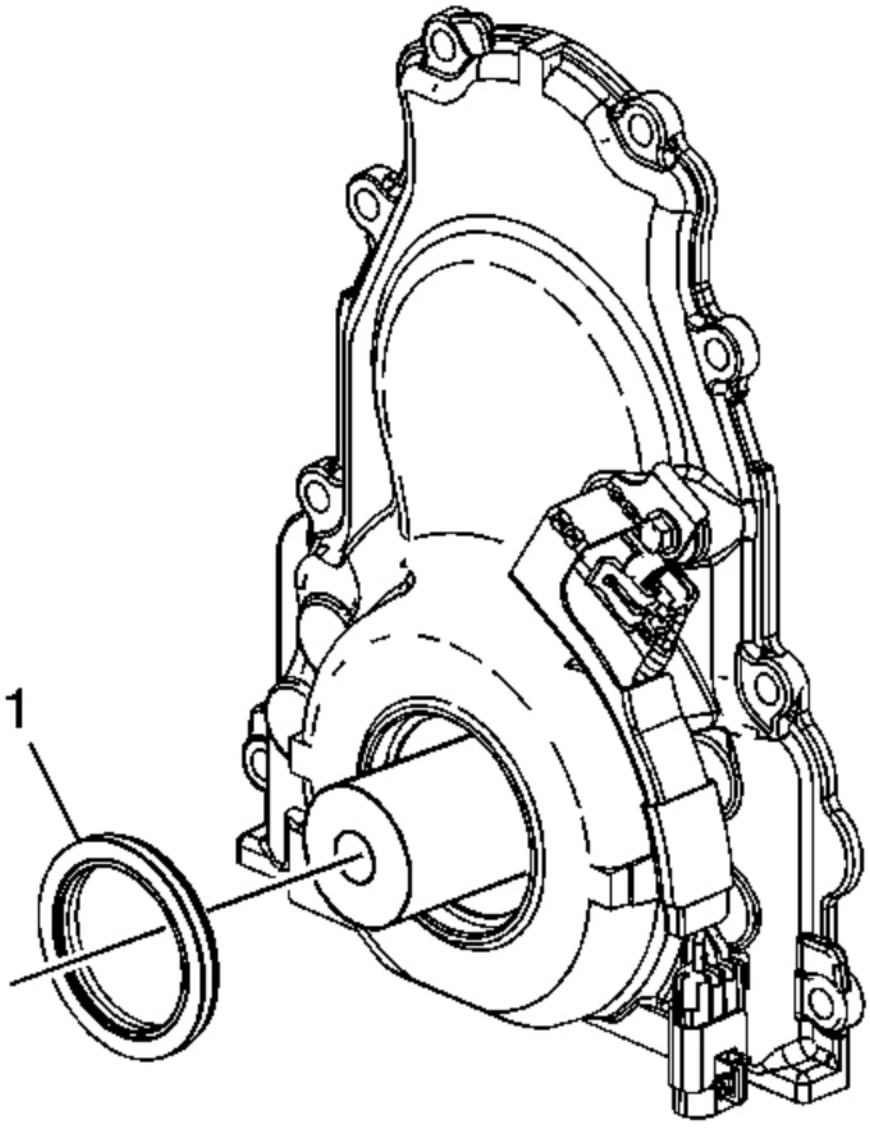


Fig. 237: View Of Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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IMPORTANT:

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

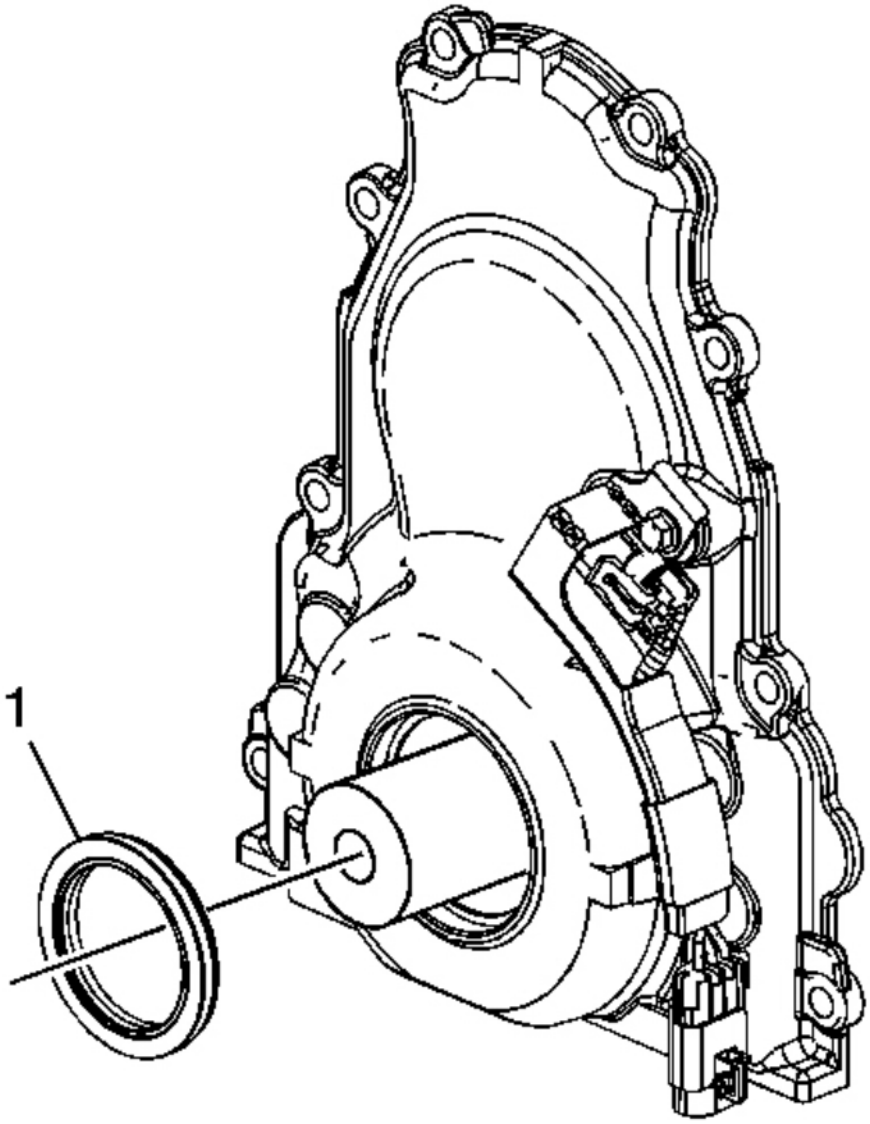


Fig. 238: View Of Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the outer edge of the oil seal (1) with clean engine oil.

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2. Lubricate the front cover oil seal bore with clean engine oil.

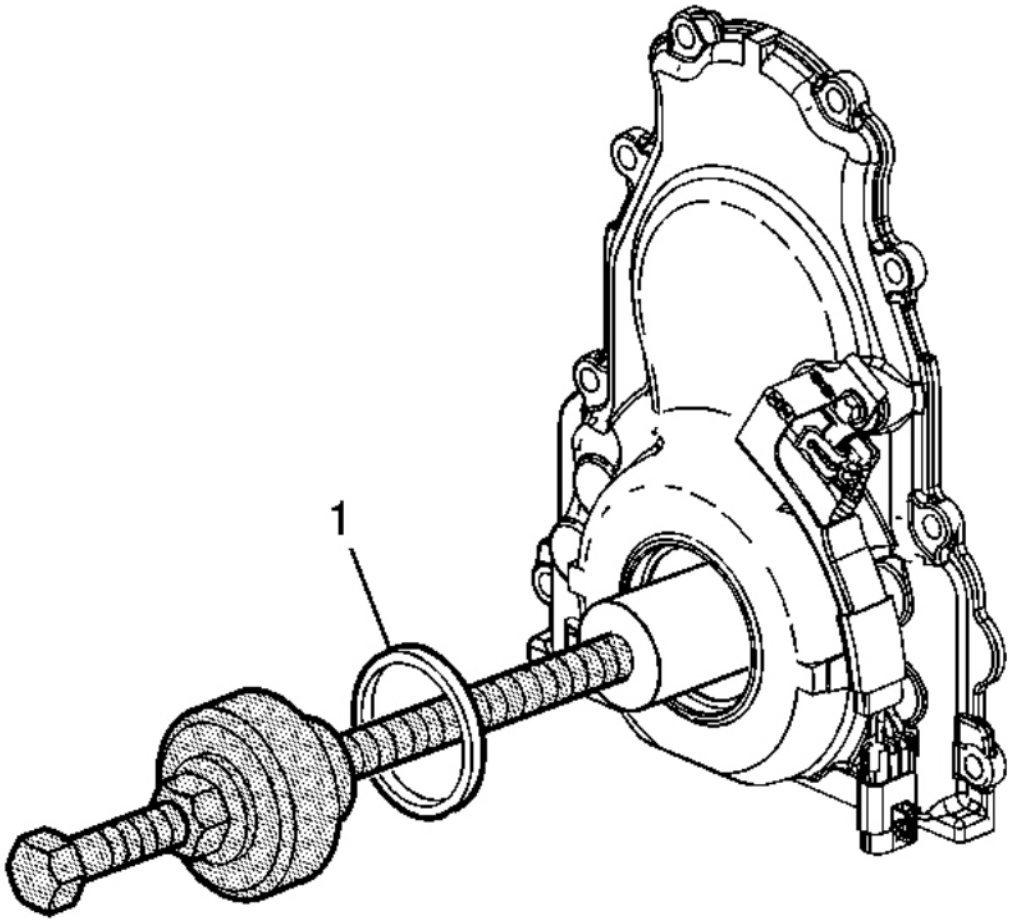


Fig. 239: View Of Crankshaft Front Oil Seal Installation
Courtesy of GENERAL MOTORS CORP.

3. Install the crankshaft front oil seal (1) onto the **J 41478** guide. See **Special Tools** .
4. Install the **J 41478** threaded rod (with nut, washer, guide, and oil seal) into the end of the crankshaft. See **Special Tools** .
5. Use the **J 41478** in order to install the oil seal into the cover bore. See **Special Tools** .
    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** . See **Special Tools** .

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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**.

CRANKSHAFT FRONT OIL SEAL REPLACEMENT (RPOS LY6/L76/L92)

TOOLS REQUIRED

J 41478 Crankshaft Front Oil Seal Installer. See **Special Tools** .

REMOVAL PROCEDURE

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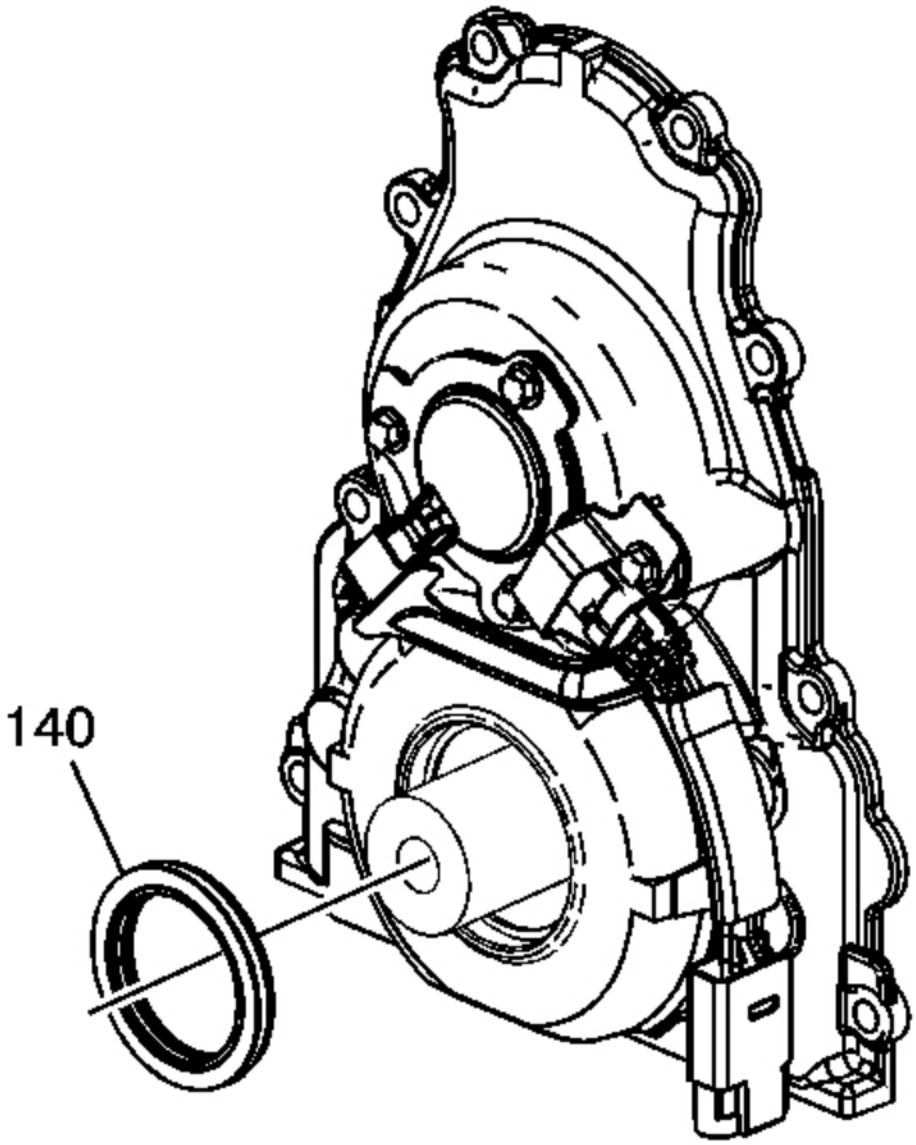


Fig. 240: View Of Outer Edge Of The Oil Seal
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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IMPORTANT:

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

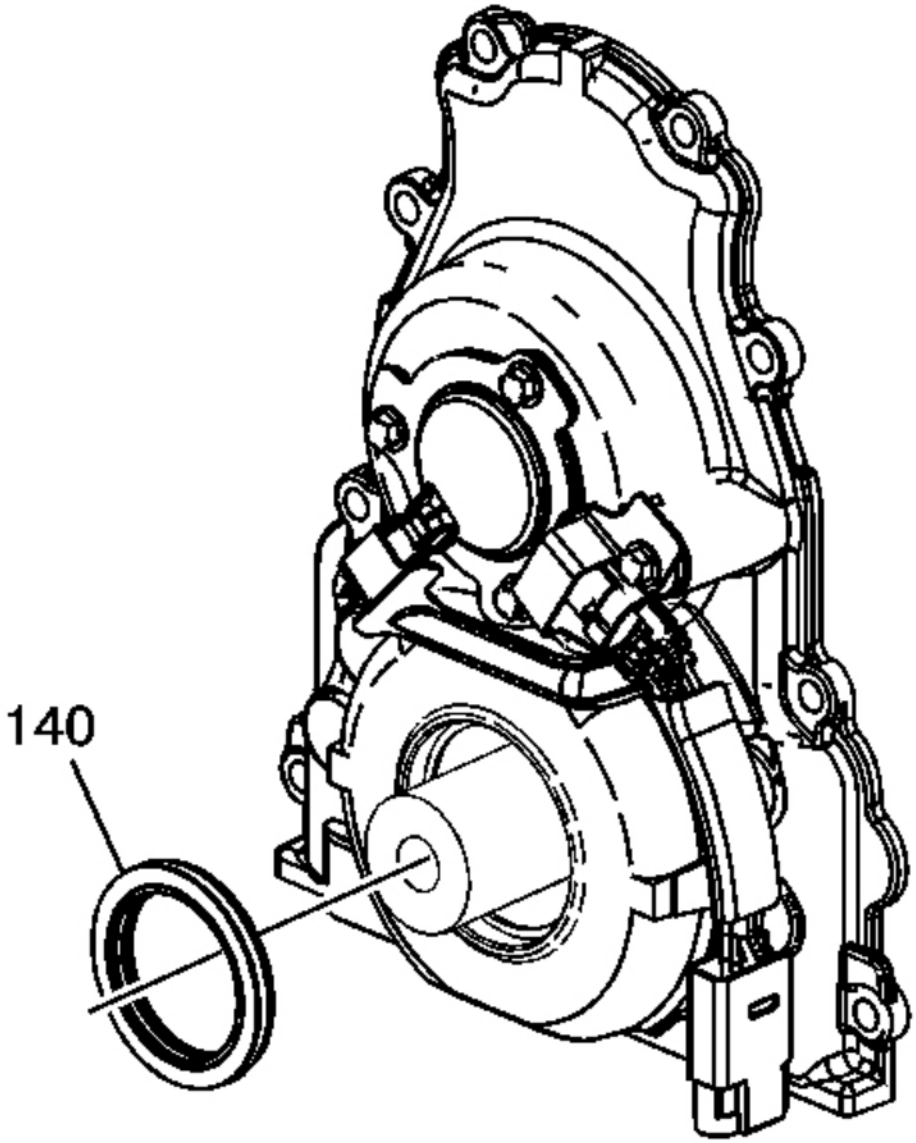


Fig. 241: View Of Outer Edge Of The Oil Seal
Courtesy of GENERAL MOTORS CORP.

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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.

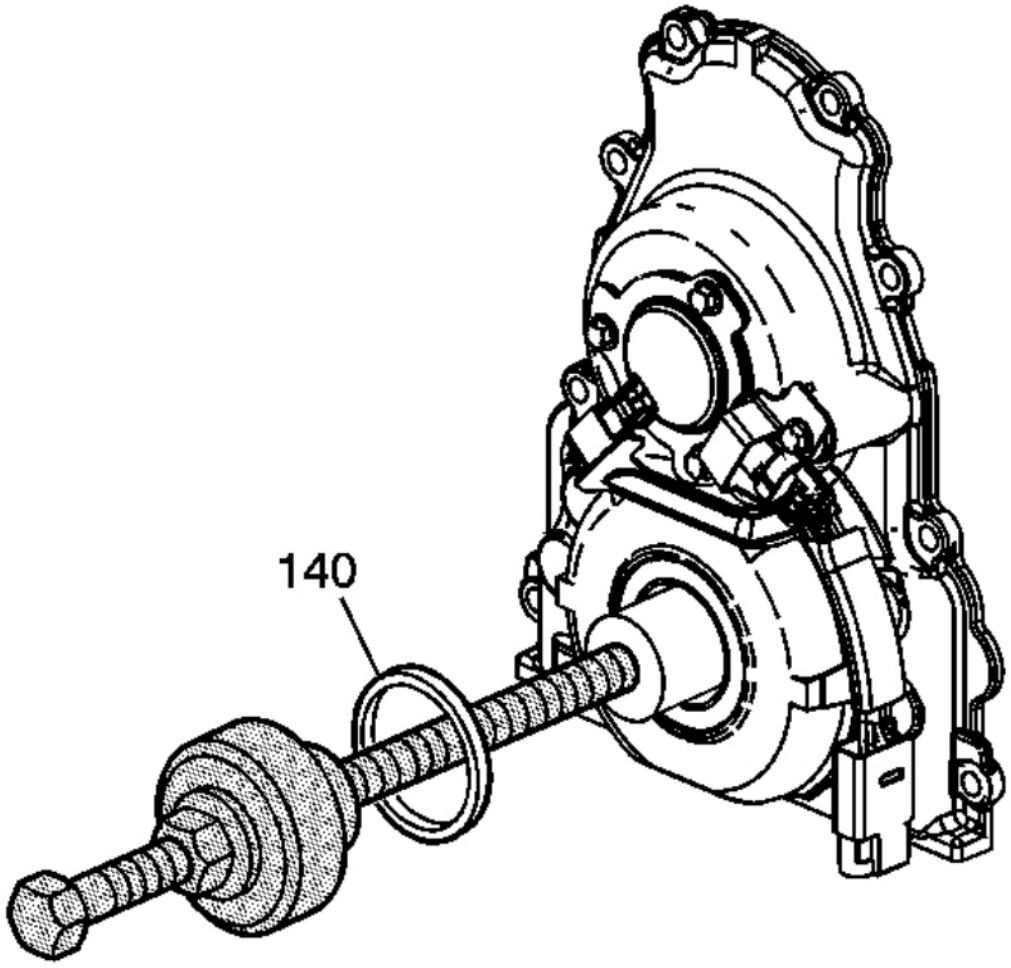


Fig. 242: View Of Front Oil Seal & Special Tool
Courtesy of GENERAL MOTORS CORP.

3. Install the crankshaft front oil seal (140) onto the **J 41478** guide. See **Special Tools** .
4. Install the **J 41478** threaded rod (with nut, washer, guide, and oil seal) into the end of the crankshaft. See **Special Tools** .
5. Use the **J 41478** in order to install the oil seal into the cover bore. See **Special Tools** .
    1. Use a wrench and hold the hex on the installer bolt.

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2. Use a second wrench and rotate the installer nut clockwise until the seal bottoms in the cover bore.
3. Remove the **J 41478** . See **Special Tools** .
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

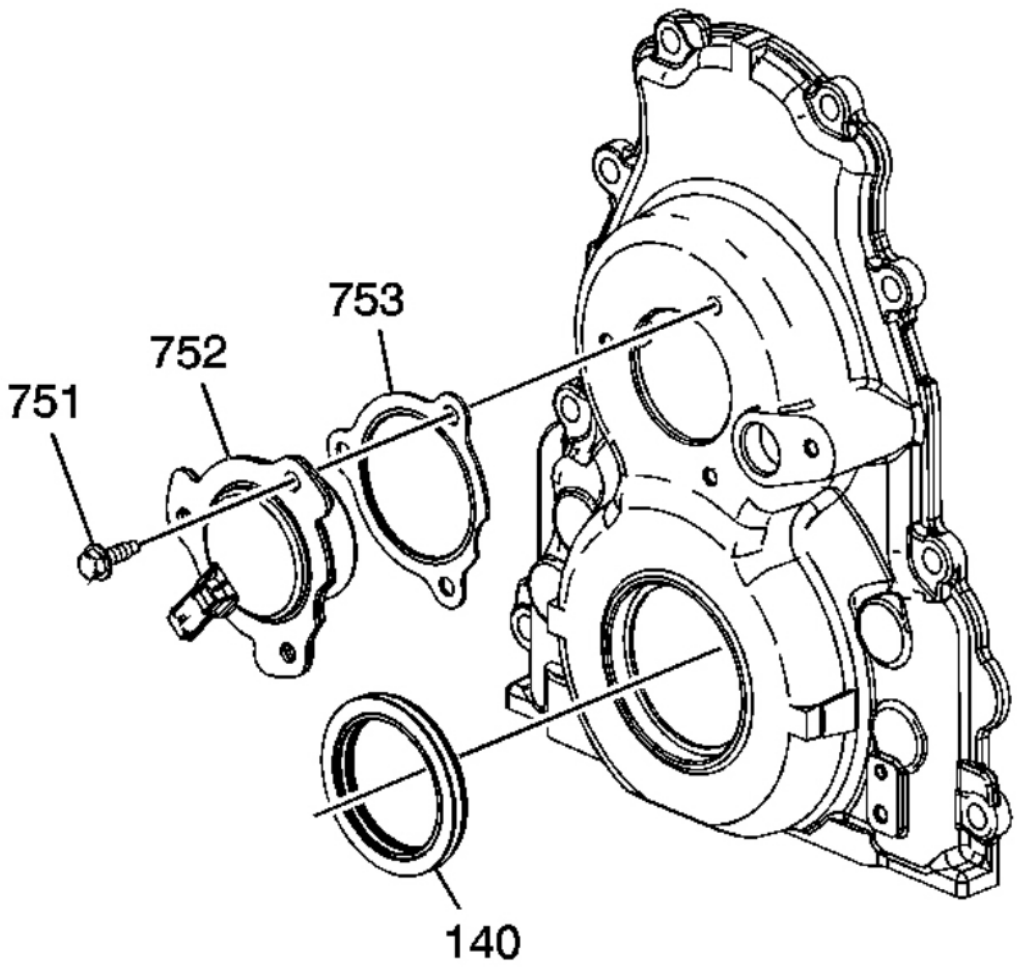


Fig. 243: View Of CMP Actuator Magnet, Bolts, Gasket & Oil Seal
Courtesy of GENERAL MOTORS CORP.

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1. Remove the water pump. Refer to **Water Pump Replacement (RPOs LY2/LC9/LY5/LMG)** or **Water Pump Replacement (RPOs LY6/L76/L92)** .
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

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

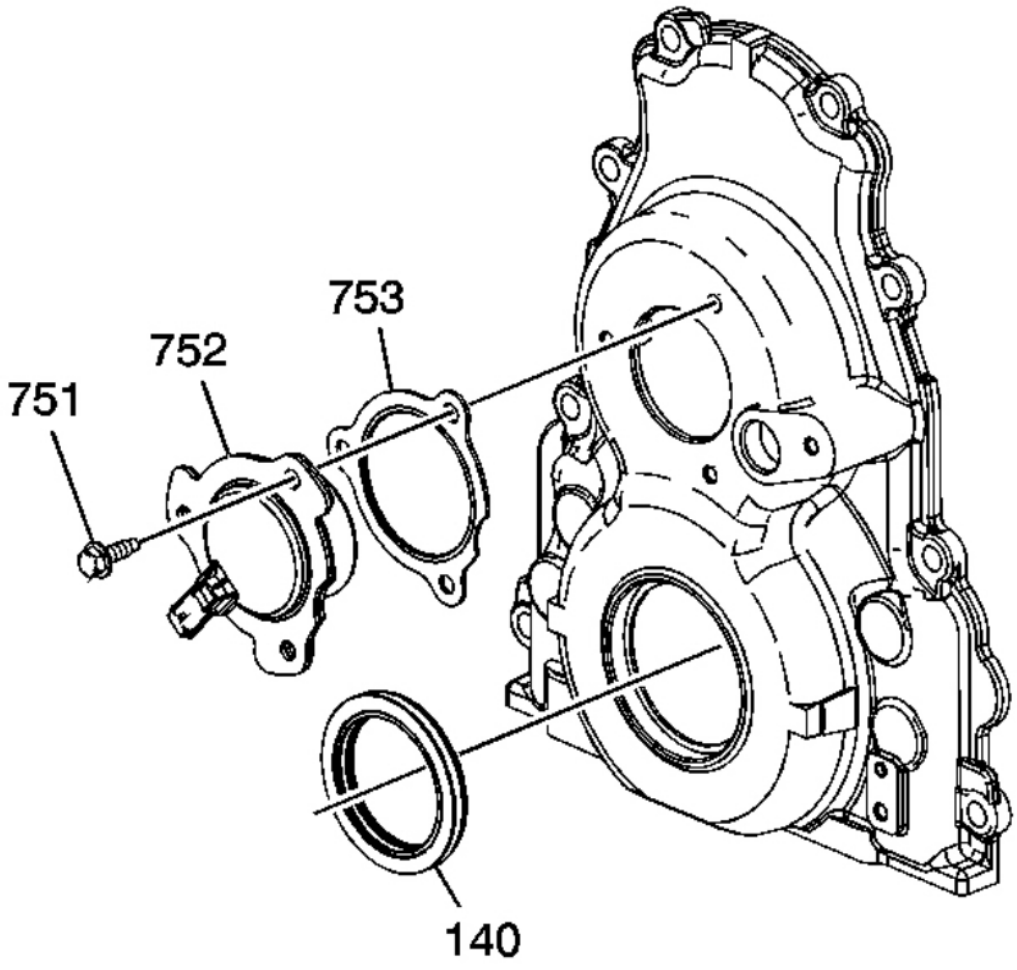


Fig. 244: View Of CMP Actuator Magnet, Bolts, Gasket & Oil Seal

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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.

NOTE: **Refer to Fastener Notice .**

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 (RPOs LY2/LC9/LY5/LMG)** or **Water Pump Replacement (RPOs LY6/L76/L92)** .

ENGINE FRONT COVER REPLACEMENT (RPOS LC9/LMG/LY2/LY5)

TOOLS REQUIRED

J 41476 Front and Rear Cover Alignment Tool. See **Special Tools** .

REMOVAL PROCEDURE

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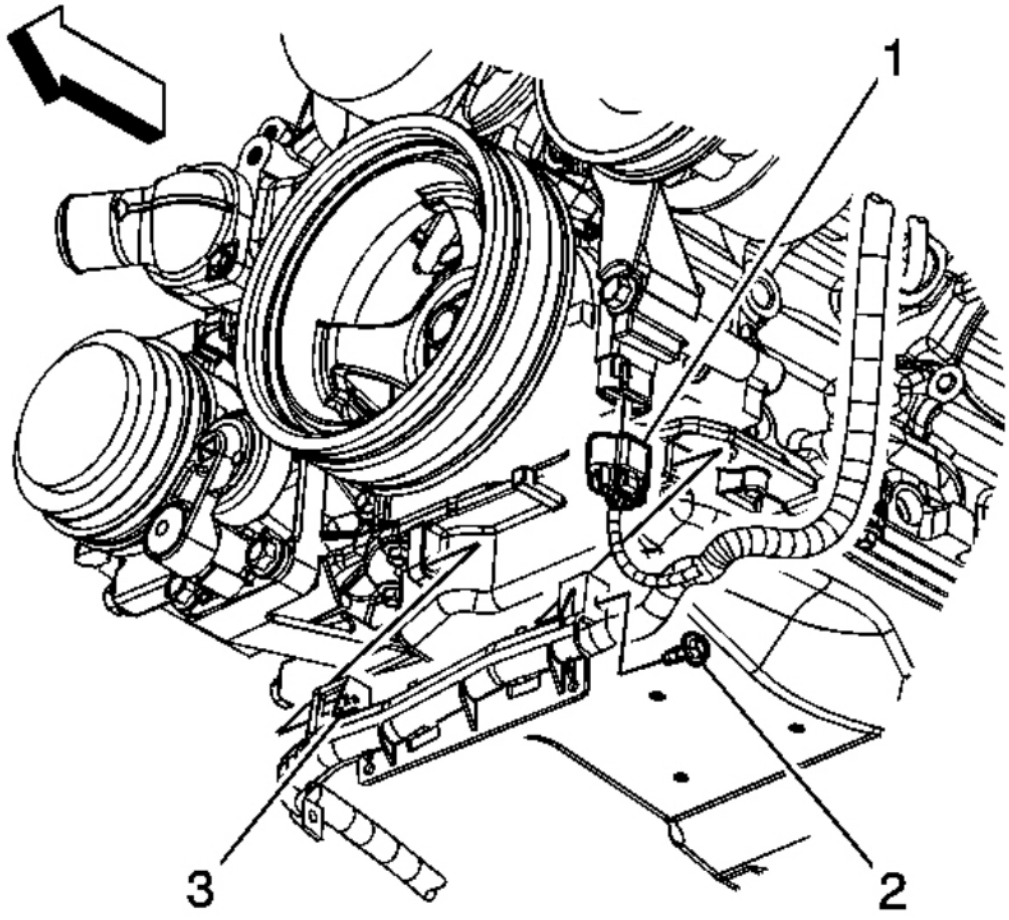


Fig. 245: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

1. Remove the water pump. Refer to **Water Pump Replacement (RPOs LY2/LC9/LY5/LMG)** or **Water Pump Replacement (RPOs LY6/L76/L92)** .
2. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
3. Disconnect the engine harness electrical connector (1) from the camshaft position (CMP) sensor wire harness electrical connector.

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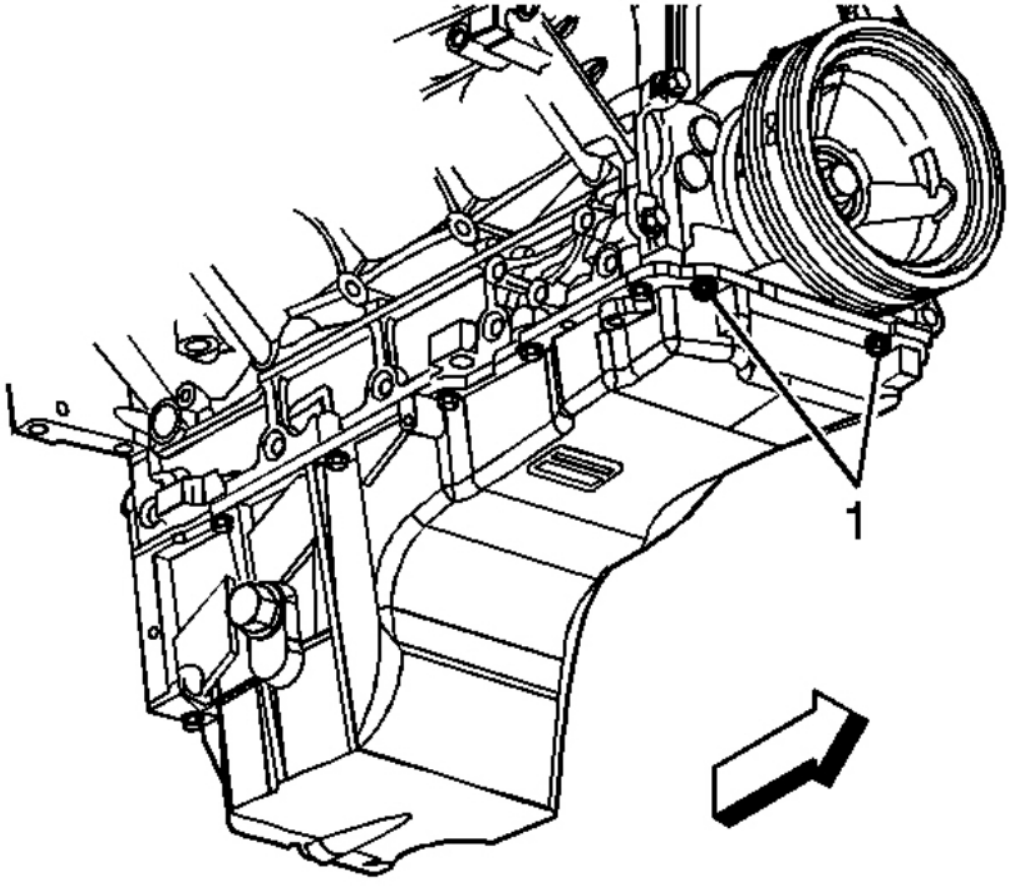


Fig. 246: View Of Oil Pan-To-Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

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

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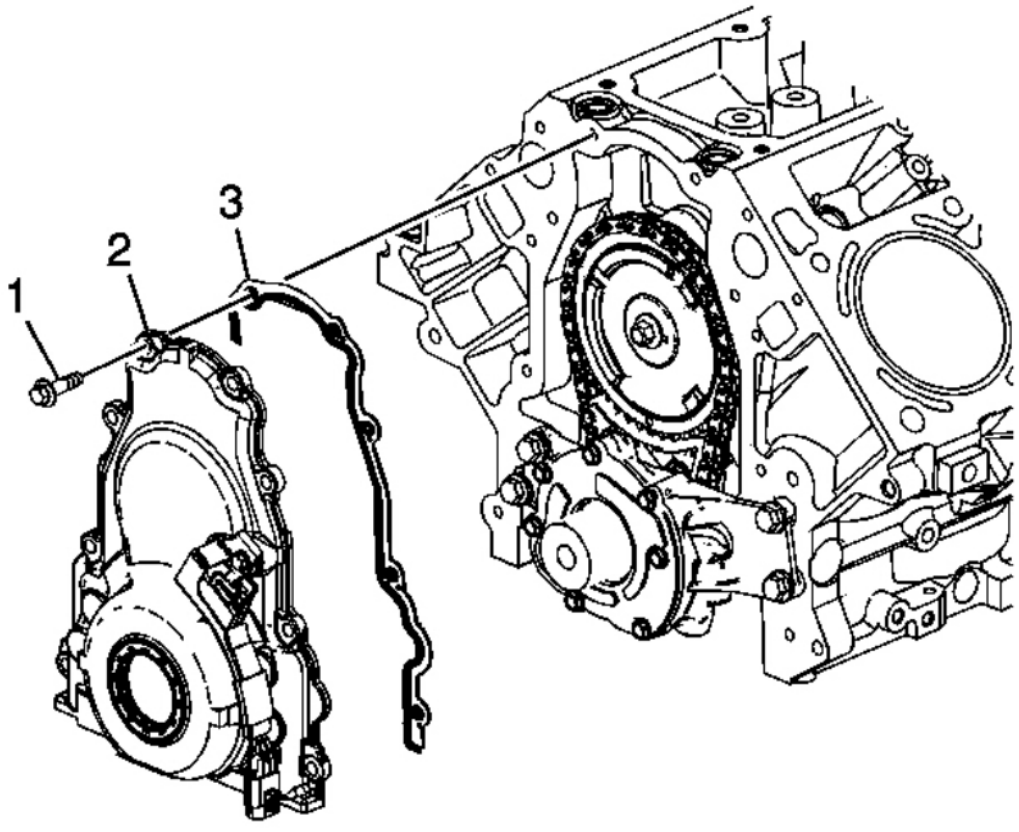


Fig. 247: View Of Front Cover & Gasket
Courtesy of GENERAL MOTORS CORP.

5. Remove the front cover bolts (1).
6. Remove the front cover (2) and gasket (3).
7. Discard the front cover gasket.

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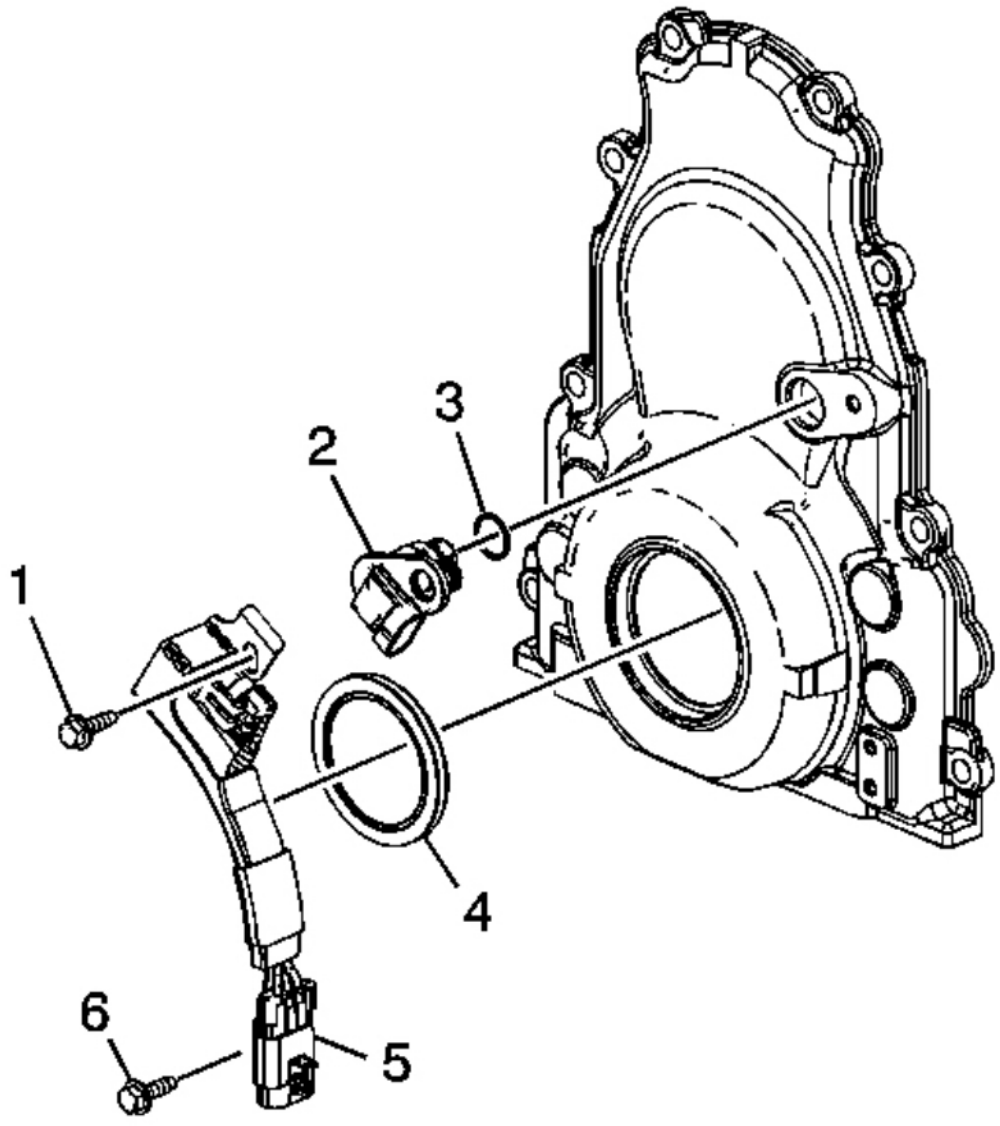


Fig. 248: View Of Front Cover, Oil Seal, Camshaft Position Sensor, Bracket & O Ring
Courtesy of GENERAL MOTORS CORP.

8. Remove the crankshaft front oil seal (4).
9. If replacing the engine front cover perform the following steps, otherwise proceed to step 8 of the installation procedure.
10. Remove the CMP sensor wire harness bolts (1 and 6).

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11. Disconnect the CMP sensor wire harness from the CMP sensor.
12. Remove the CMP sensor wire harness (5).
13. Remove the CMP sensor (2).

INSTALLATION PROCEDURE

IMPORTANT:

- **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.**

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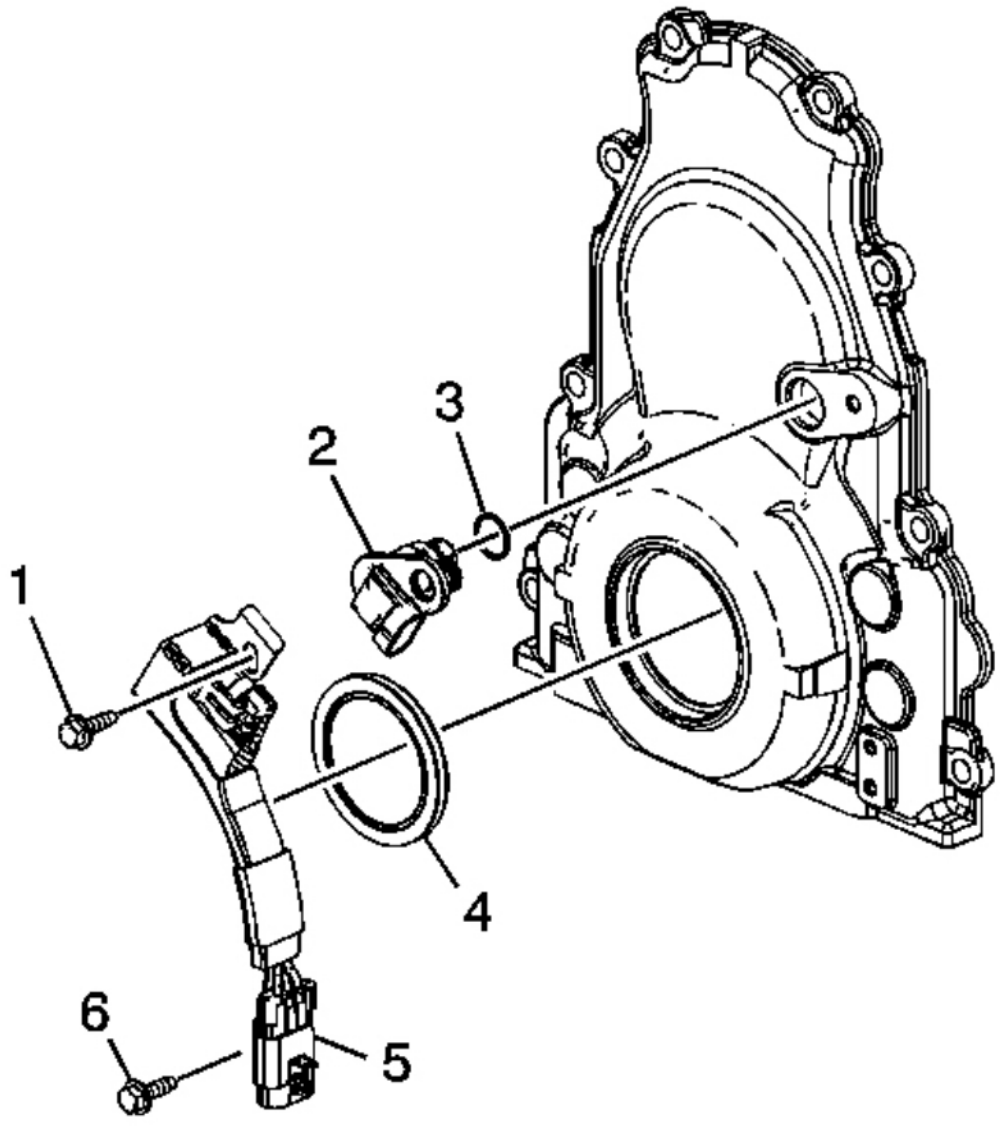


Fig. 249: View Of Front Cover, Oil Seal, Camshaft Position Sensor, Bracket & O Ring
Courtesy of GENERAL MOTORS CORP.

1. If replacing the front cover perform the following steps, otherwise proceed to step 8.
2. Inspect the CMP sensor O-ring seal for cuts or damage. If the seal is not cut or damaged, it may be reused.
3. Lubricate the O-ring seal (3) with clean engine oil.

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4. Install the CMP sensor (2).
5. Position the CMP sensor wire harness (5) to the front cover.
6. Connect the CMP sensor wire harness to the CMP sensor.

NOTE: **Refer to Fastener Notice .**

7. Install the CMP sensor wire harness bolts (1 and 6).

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

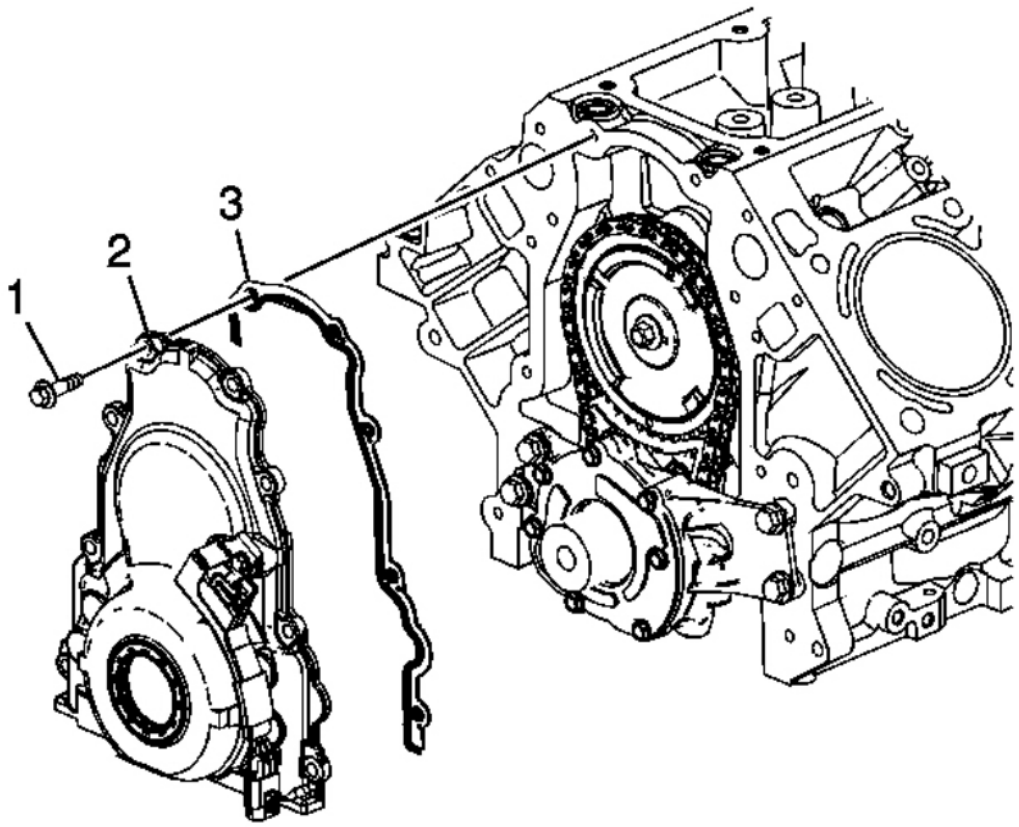


Fig. 250: View Of Front Cover & Gasket
Courtesy of GENERAL MOTORS CORP.

8. 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 **Sealers, Adhesives, and Lubricants** .
9. Position the NEW engine front cover gasket (3) and front cover (2) to the engine.

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10. Install the front cover bolts (1) until snug. Do not overtighten.

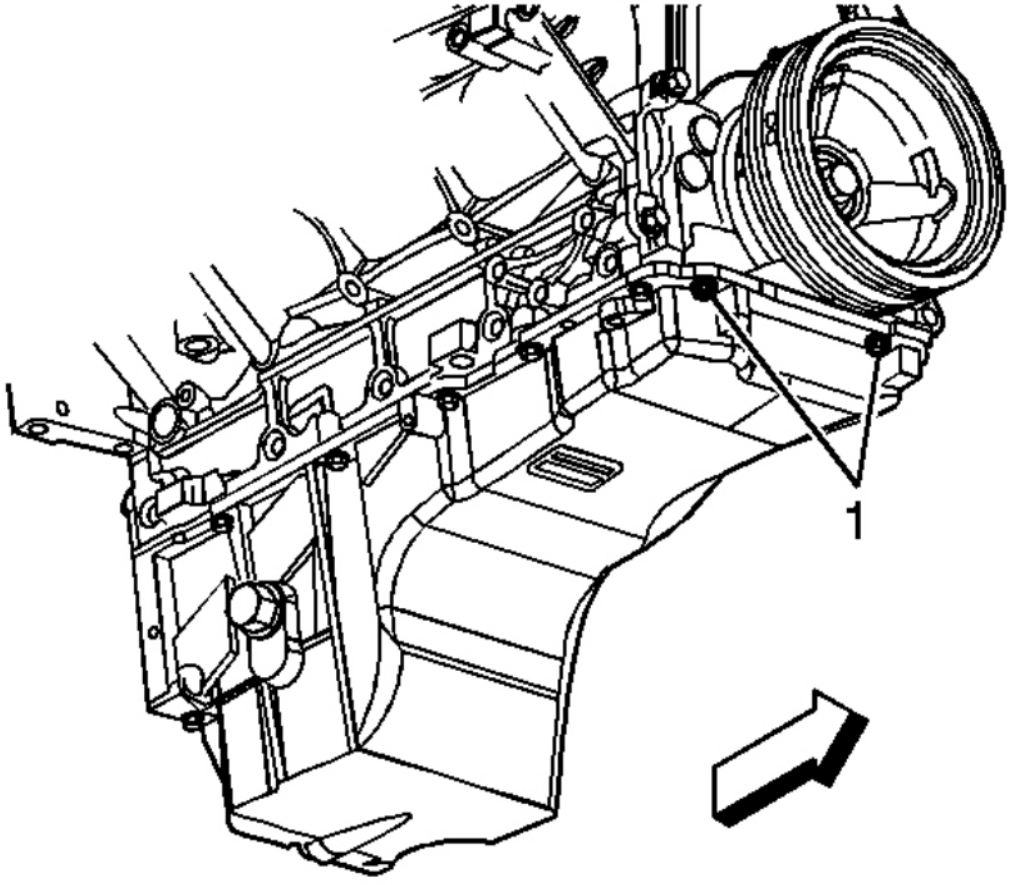


Fig. 251: View Of Oil Pan-To-Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

11. Install the oil pan-to-front cover bolts (1) until snug. Do not over tighten.

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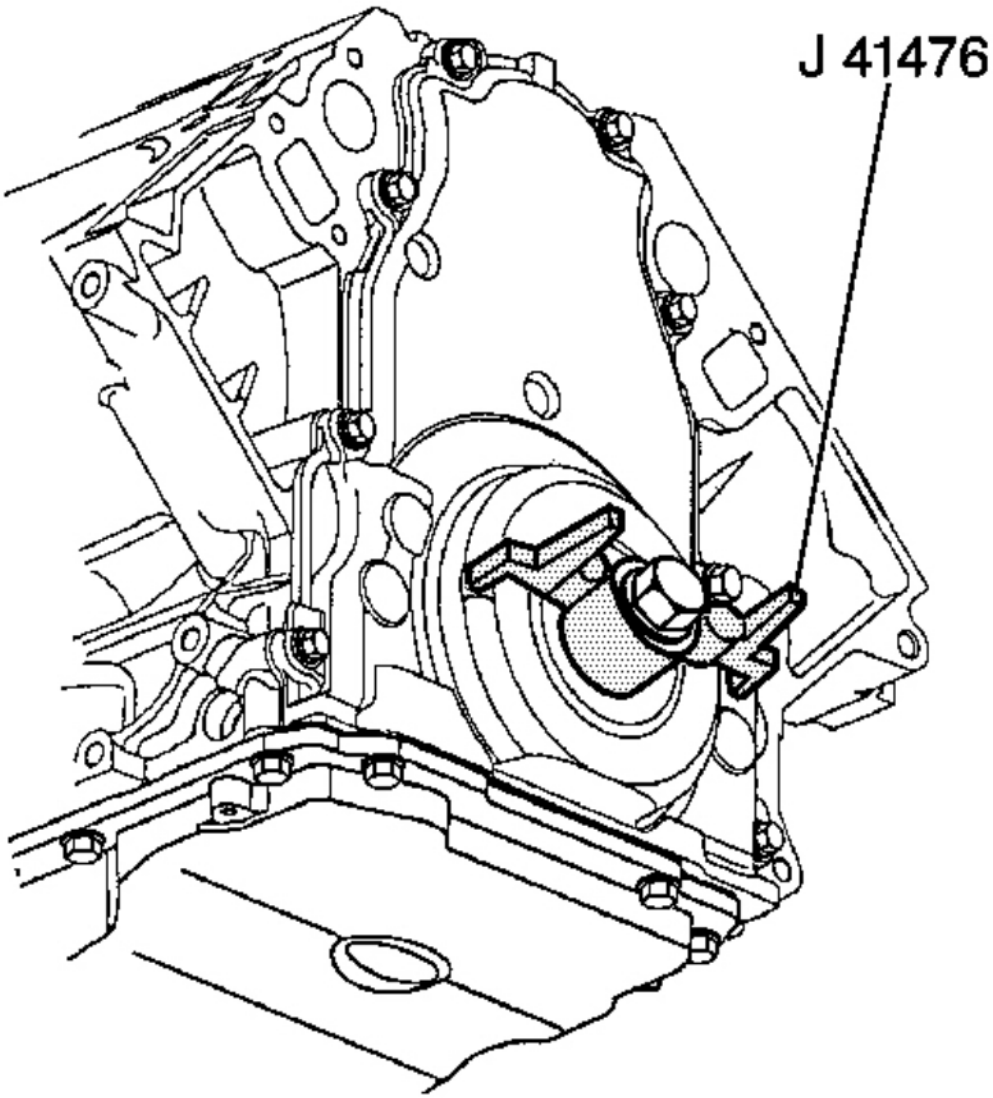


Fig. 252: View of J 41476 Installed To Front Cover
Courtesy of GENERAL MOTORS CORP.

12. Install **J 41476** to the front cover. See **Special Tools** .
13. Align the tapered legs of the **J 41476** with the machined alignment surfaces on the front cover. See **Special Tools** .
14. Install the crankshaft balancer bolt until snug. Do not overtighten.

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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).

15. Remove the **J 41476** . See **Special Tools** .

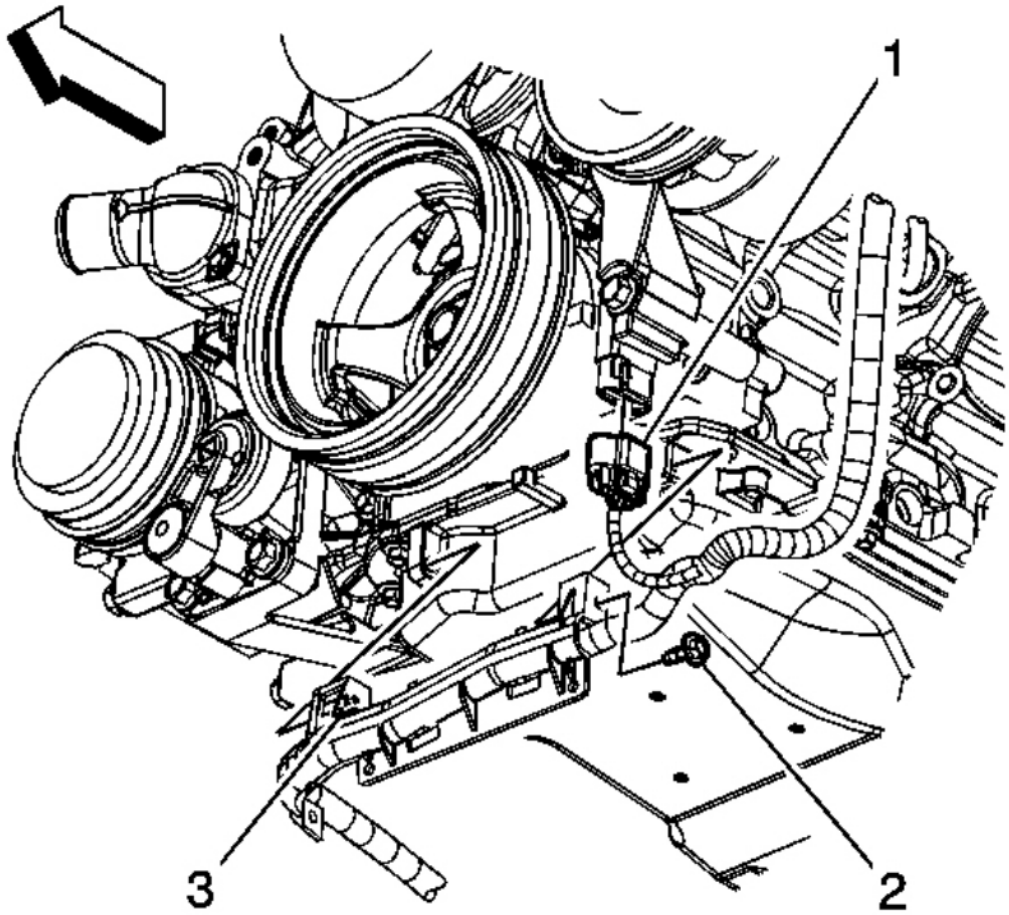


Fig. 253: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

16. Connect the engine harness electrical connector (1) to the CMP sensor wire harness electrical connector.
17. Install a NEW crankshaft front oil seal. Refer to **Crankshaft Front Oil Seal Replacement (RPOs LC9/LMG/LY2/LY5)** or **Crankshaft Front Oil Seal Replacement (RPOs LY6/L76/L92)**.
18. Install the water pump. Refer to **Water Pump Replacement (RPOs LY2/LC9/LY5/LMG)** or **Water**

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Pump Replacement (RPOs LY6/L76/L92) .

ENGINE FRONT COVER REPLACEMENT (RPOS LY6/L76/L92)

TOOLS REQUIRED

J 41476 Front and Rear Cover Alignment Tool. See **Special Tools** .

REMOVAL PROCEDURE

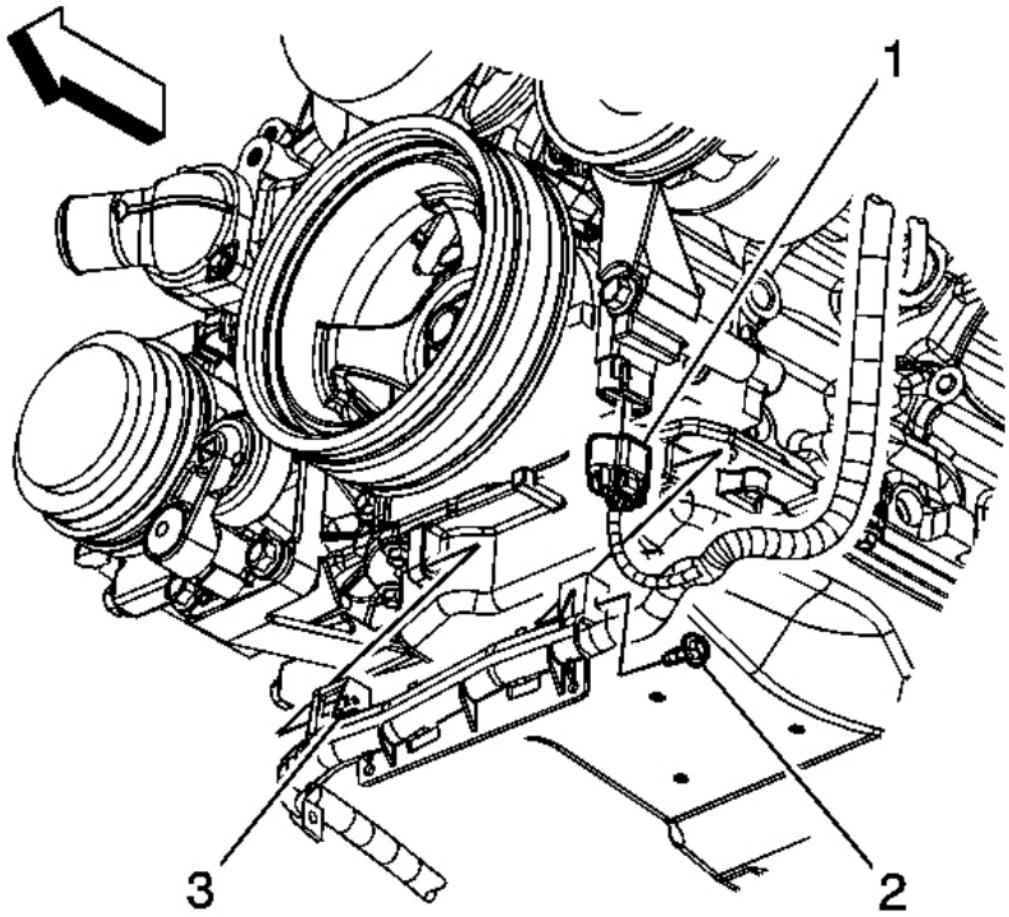


Fig. 254: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

1. Remove the water pump. Refer to **Water Pump Replacement (RPOs LY2/LC9/LY5/LMG)** or **Water**

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Pump Replacement (RPOs LY6/L76/L92) .

2. Remove the crankshaft balancer. Refer to **Crankshaft Balancer Replacement**.
3. Disconnect the engine harness electrical connector (1) from the camshaft position (CMP) sensor wire harness electrical connector.

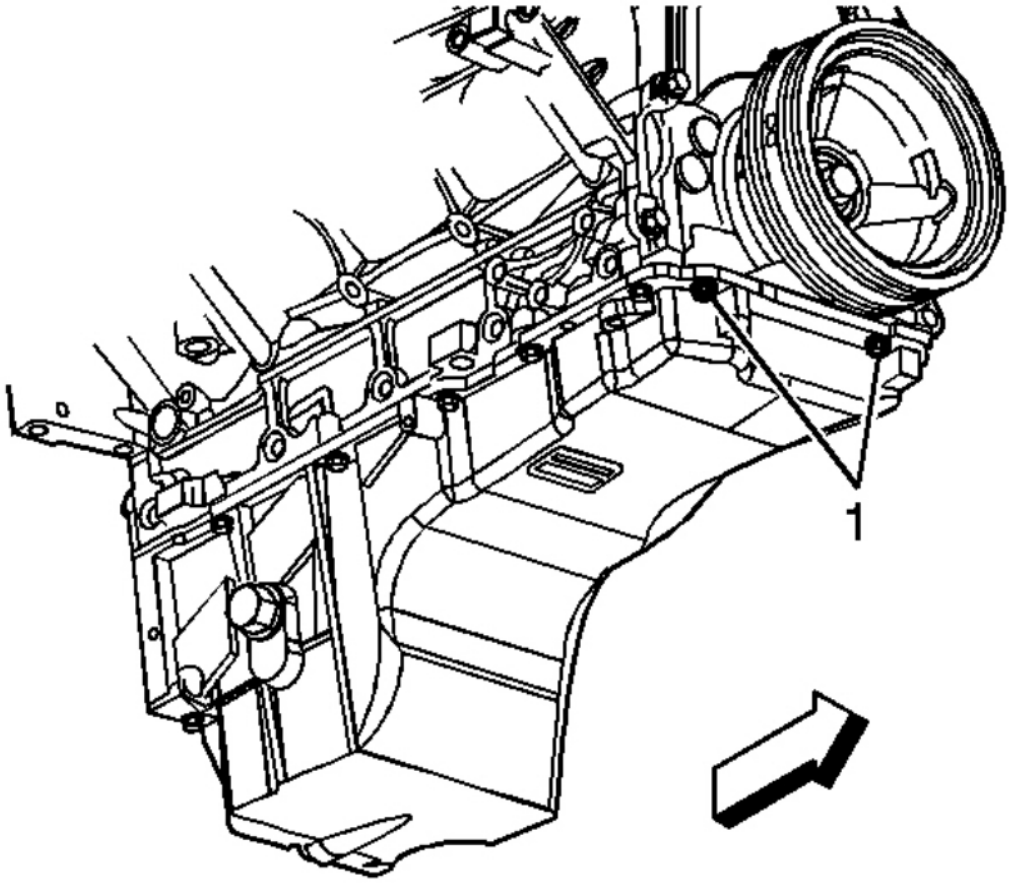


Fig. 255: View Of Oil Pan-To-Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

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

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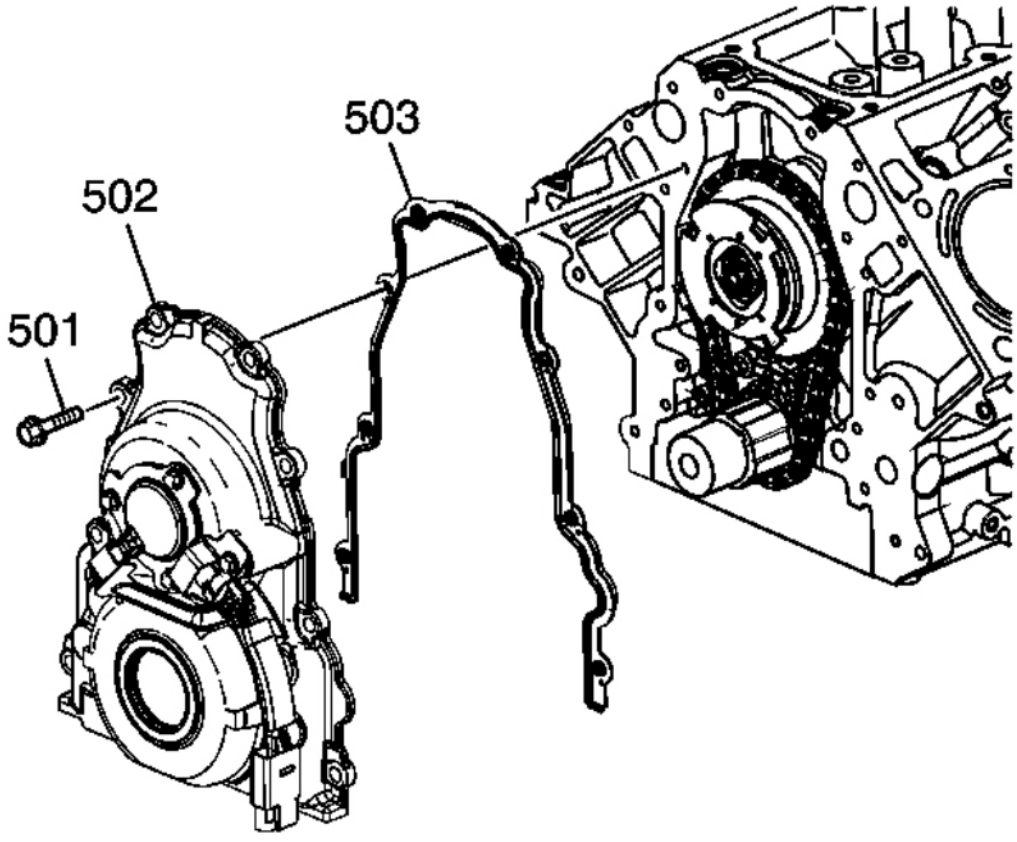


Fig. 256: View Of Front Cover, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

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

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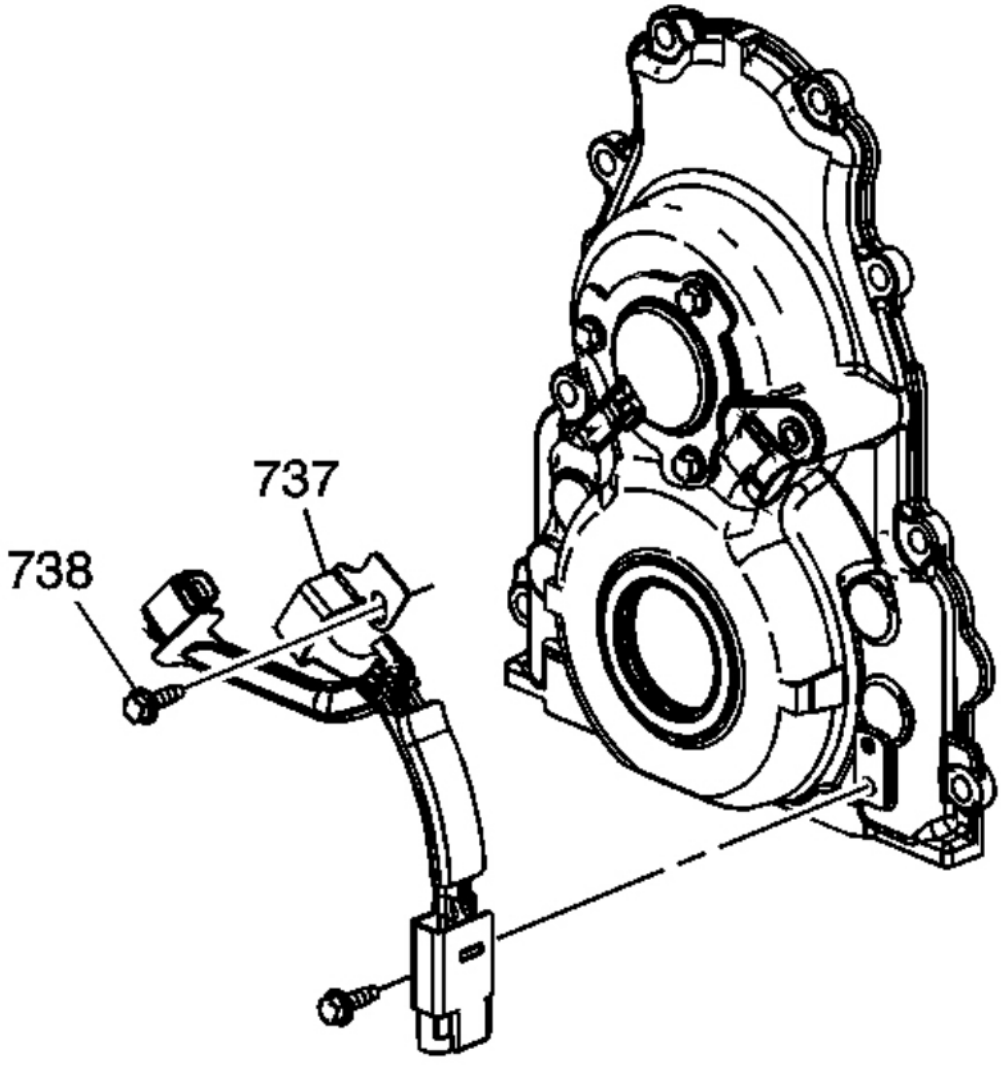


Fig. 257: View Of CMP Sensor Wire Harness & Bolts
Courtesy of GENERAL MOTORS CORP.

9. If replacing the engine front cover perform the following steps, otherwise proceed to step 10 of the installation procedure.
10. Remove the CMP sensor wire harness bolts (738).
11. Disconnect the CMP sensor wire harness from the CMP sensor.
12. Remove the CMP sensor wire harness (737).

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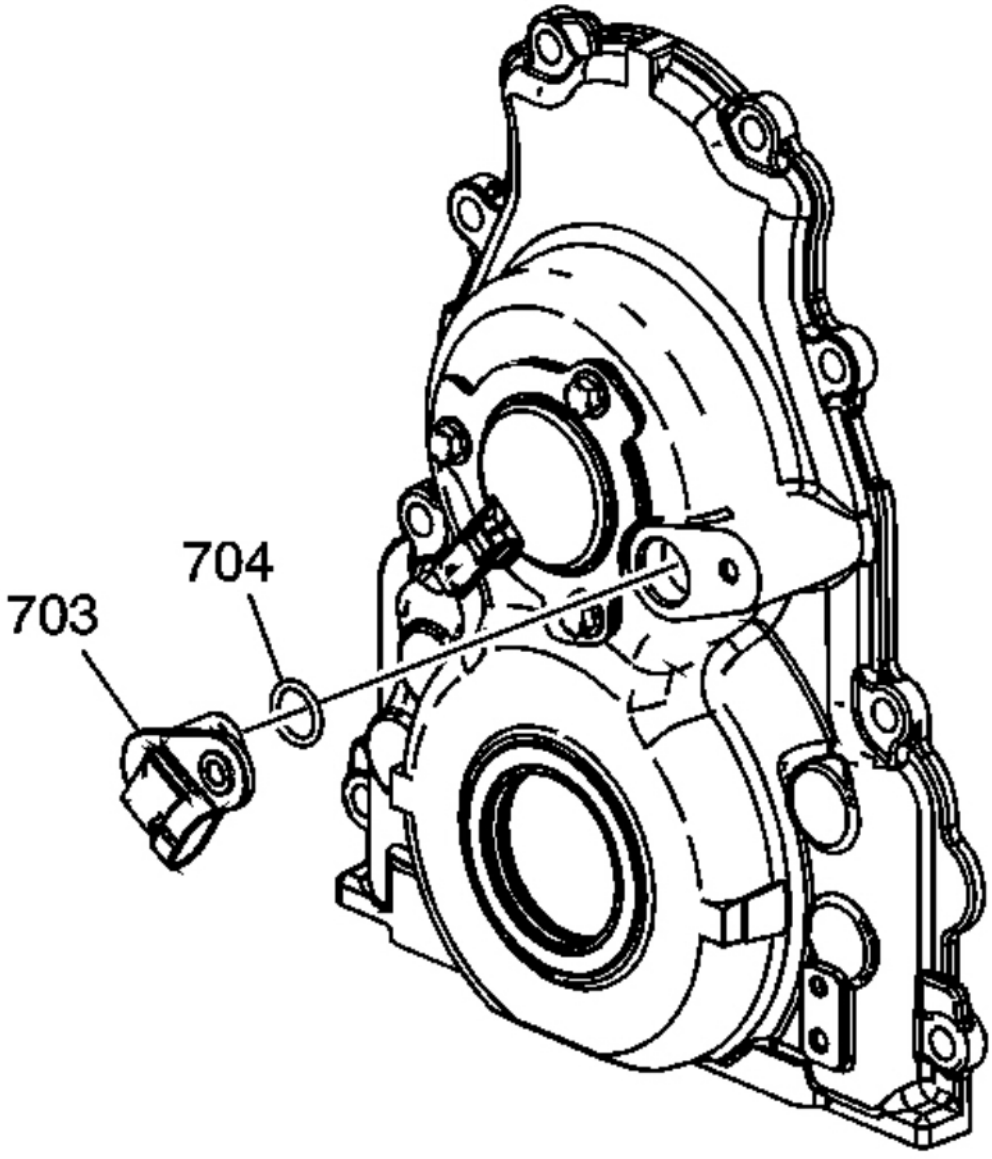


Fig. 258: View Of CMP Sensor & O-Ring
Courtesy of GENERAL MOTORS CORP.

13. Remove the CMP sensor (703).

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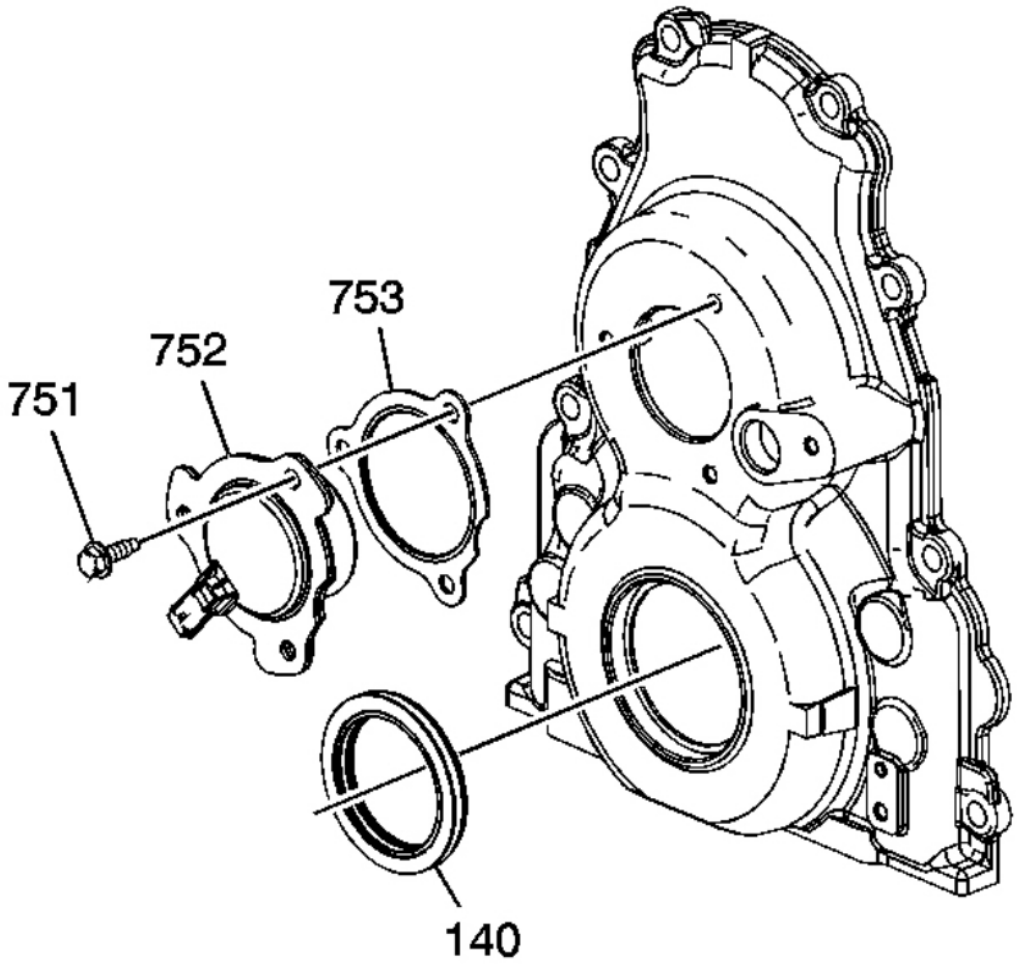


Fig. 259: View Of CMP Actuator Magnet, Bolts, Gasket & Oil Seal
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

IMPORTANT:

- **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**

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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.**

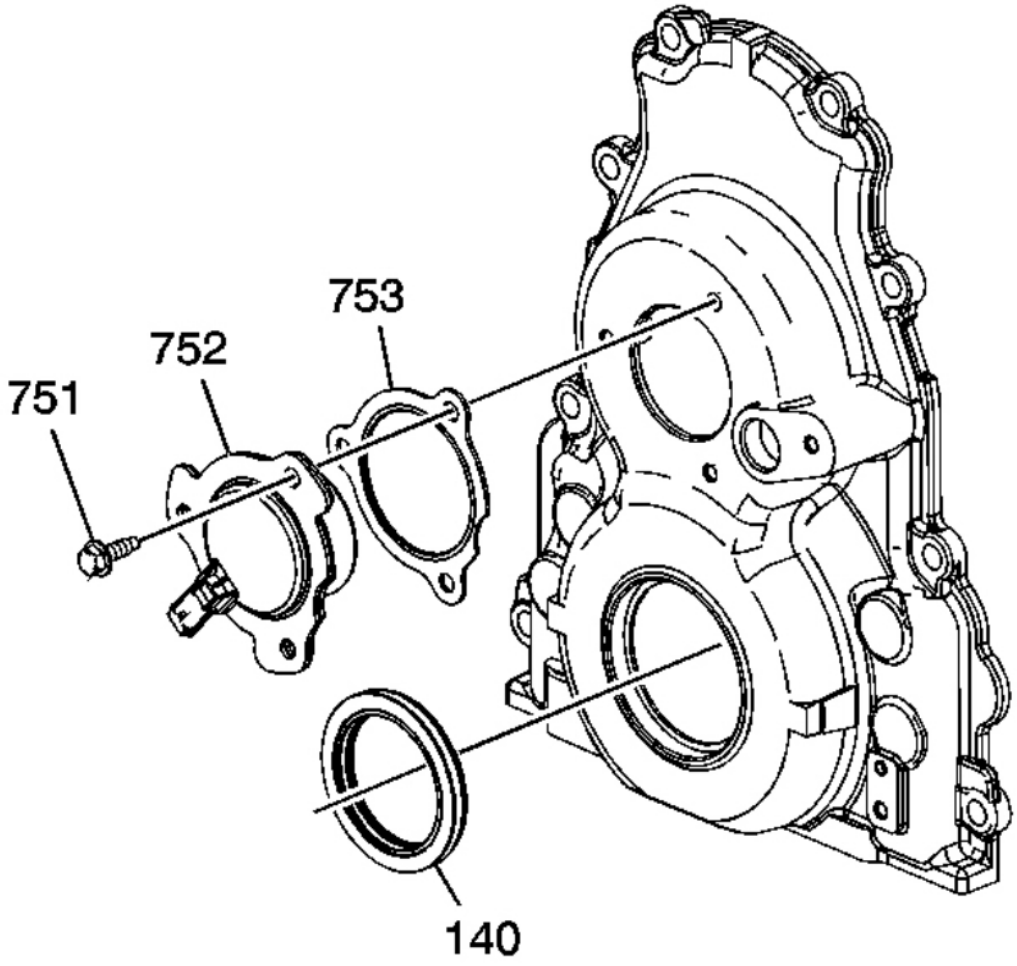


Fig. 260: View Of CMP Actuator Magnet, Bolts, Gasket & Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. If replacing the front cover perform the following steps, otherwise proceed to step 10.

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2. Install a NEW CMP actuator magnet gasket (753) onto the magnet.

NOTE: **Refer to Fastener Notice .**

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

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

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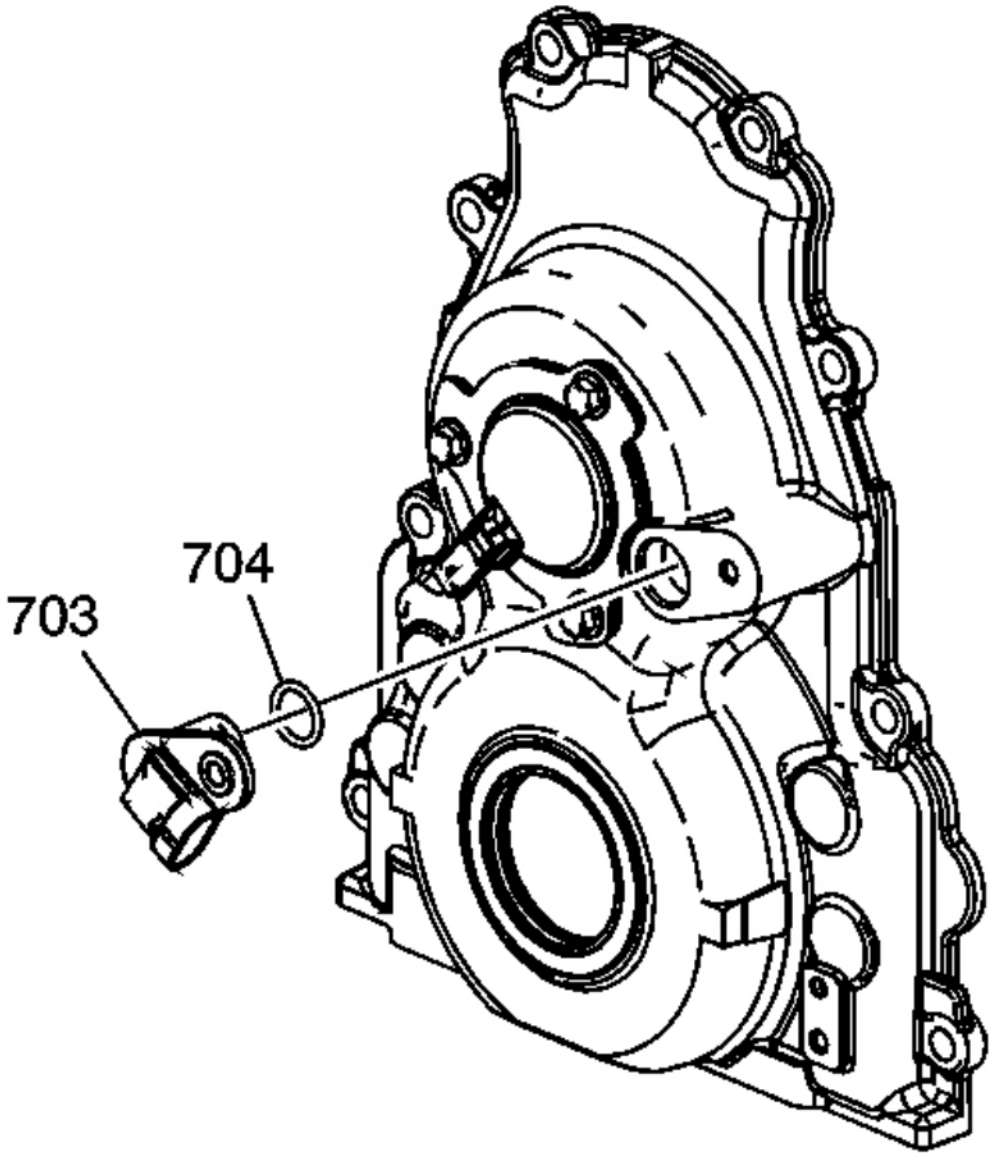


Fig. 261: View Of CMP Sensor & O-Ring
Courtesy of GENERAL MOTORS CORP.

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.

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6. Install the CMP sensor (703).

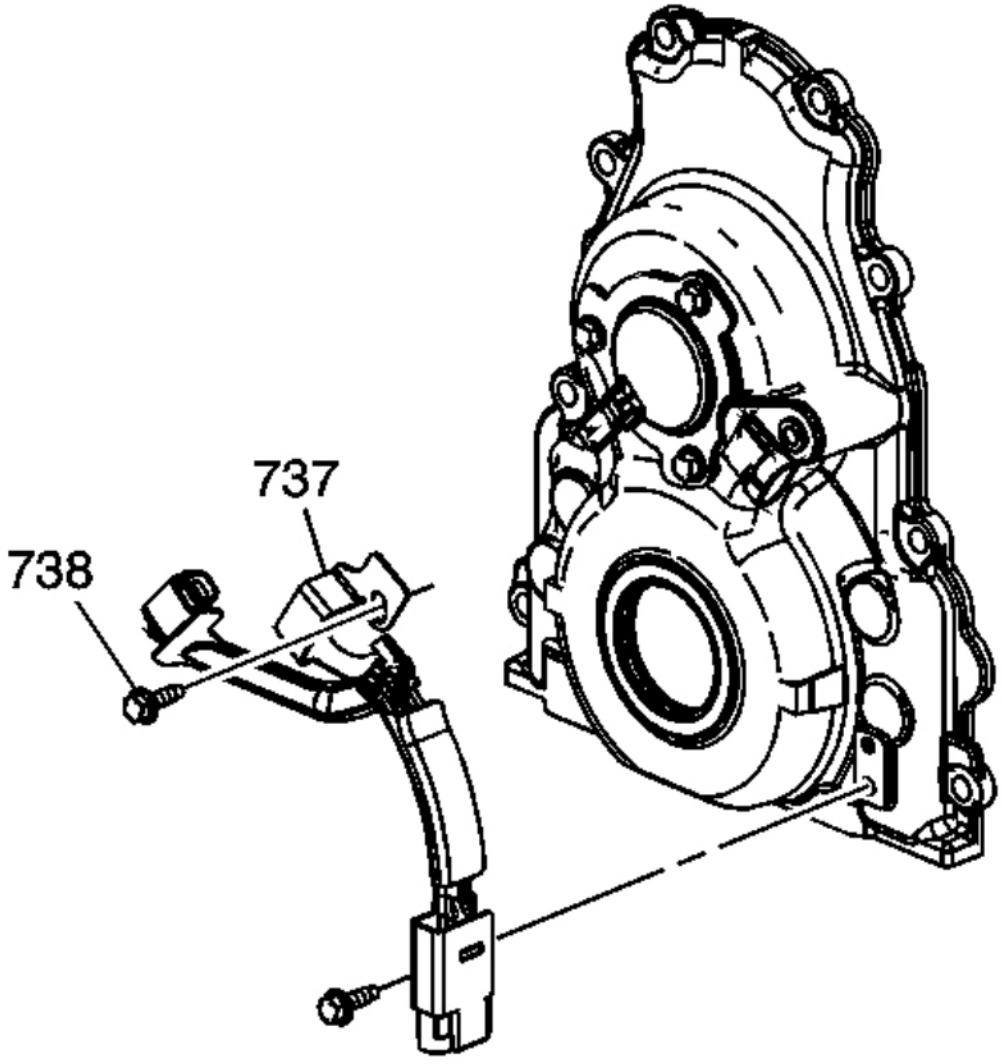


Fig. 262: View Of CMP Sensor Wire Harness & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Position the CMP sensor wire harness (737) to the front cover
8. Connect the CMP sensor wire harness to the CMP sensor.
9. Install the CMP sensor wire harness bolts (738).

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

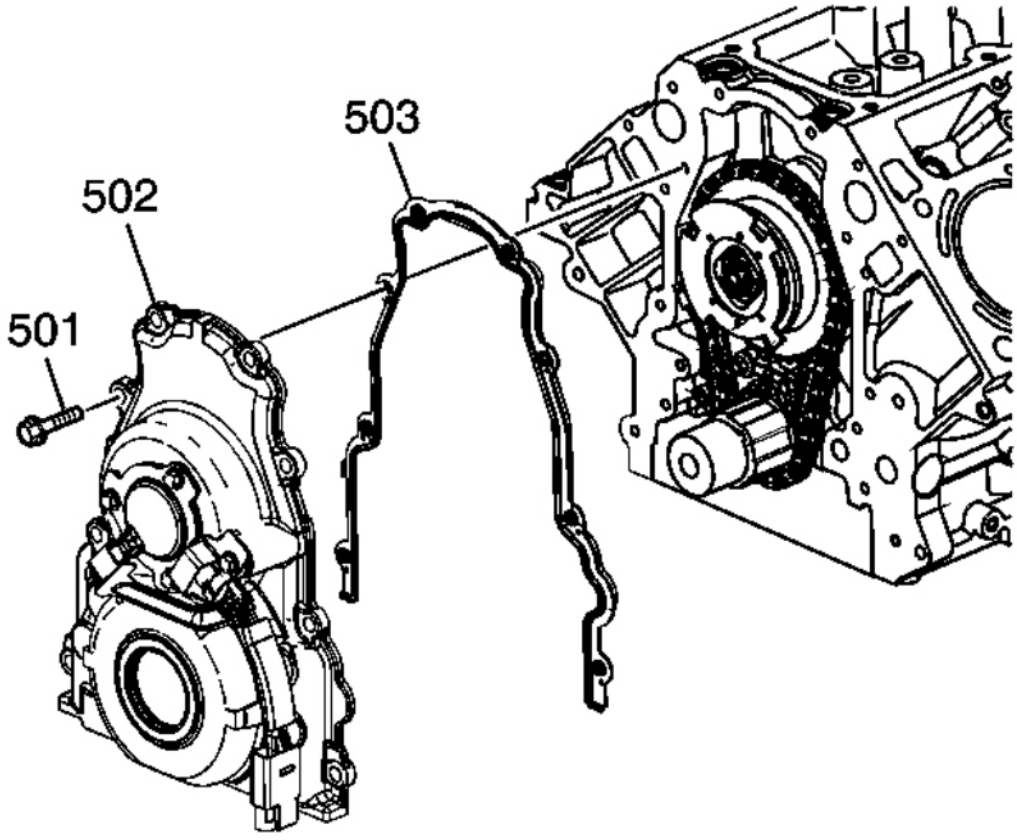


Fig. 263: View Of Front Cover, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

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 **Sealers, Adhesives, and Lubricants** .
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.

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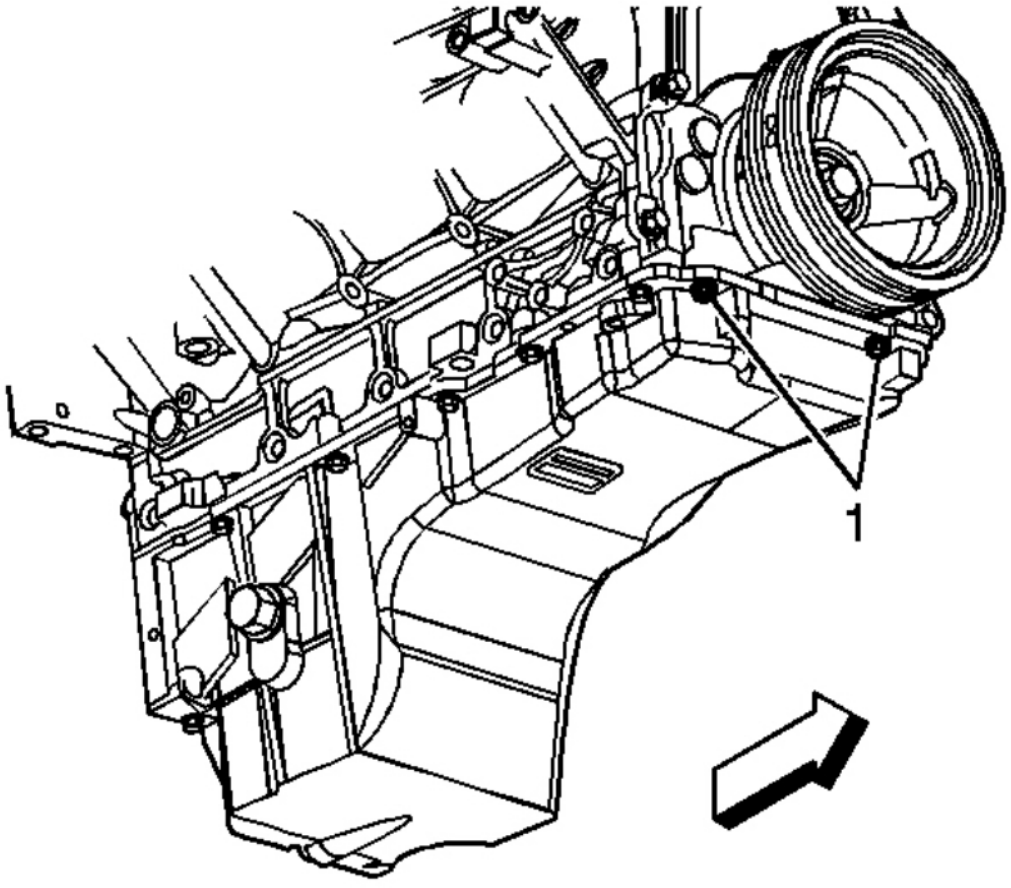


Fig. 264: View Of Oil Pan-To-Front Cover Bolts
Courtesy of GENERAL MOTORS CORP.

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

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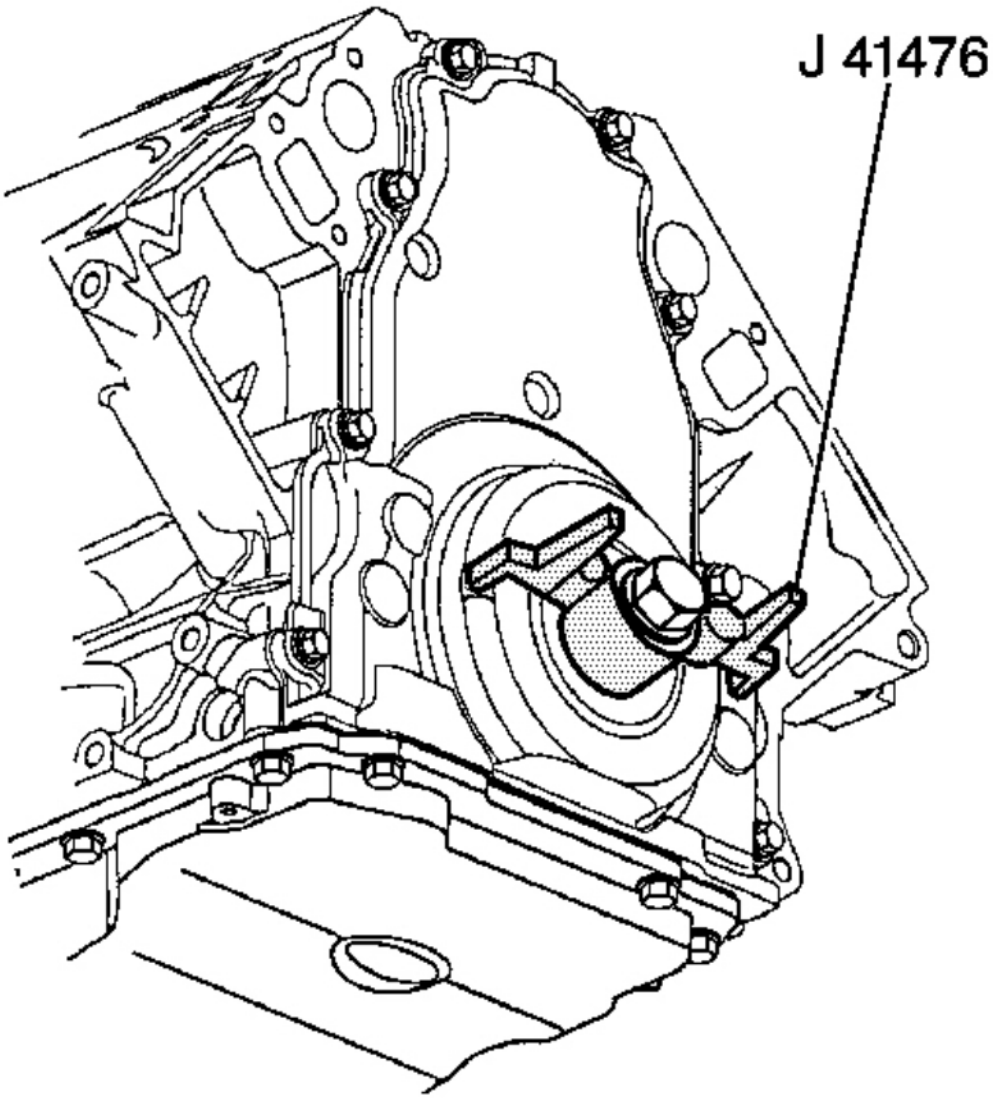


Fig. 265: View of J 41476 Installed To Front Cover
Courtesy of GENERAL MOTORS CORP.

14. Install **J 41476** to the front cover. See **Special Tools** .
15. Align the tapered legs of the **J 41476** with the machined alignment surfaces on the front cover. See **Special Tools** .
16. Install the crankshaft balancer bolt until snug. Do not overtighten.

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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).

17. Remove the **J 41476** . See **Special Tools** .

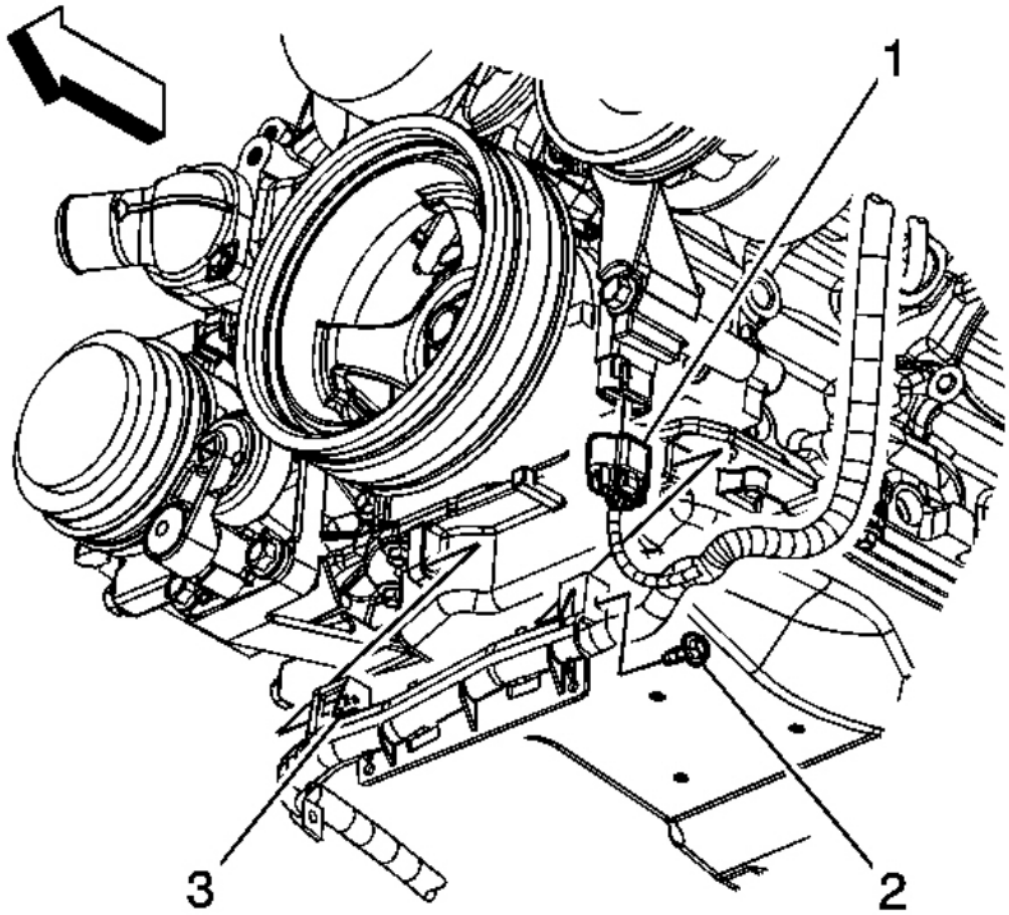


Fig. 266: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

18. Connect the engine harness electrical connector (1) to the CMP sensor wire harness electrical connector.
19. Install a NEW crankshaft front oil seal. Refer to **Crankshaft Front Oil Seal Replacement (RPOs LC9/LMG/LY2/LY5)** or **Crankshaft Front Oil Seal Replacement (RPOs LY6/L76/L92)**.
20. Install the water pump. Refer to **Water Pump Replacement (RPOs LY2/LC9/LY5/LMG)** or **Water**

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Pump Replacement (RPOs LY6/L76/L92) .

CAMSHAFT POSITION ACTUATOR SOLENOID VALVE REPLACEMENT

TOOLS REQUIRED

J 45059 Angle Meter. See **Special Tools** .

REMOVAL PROCEDURE

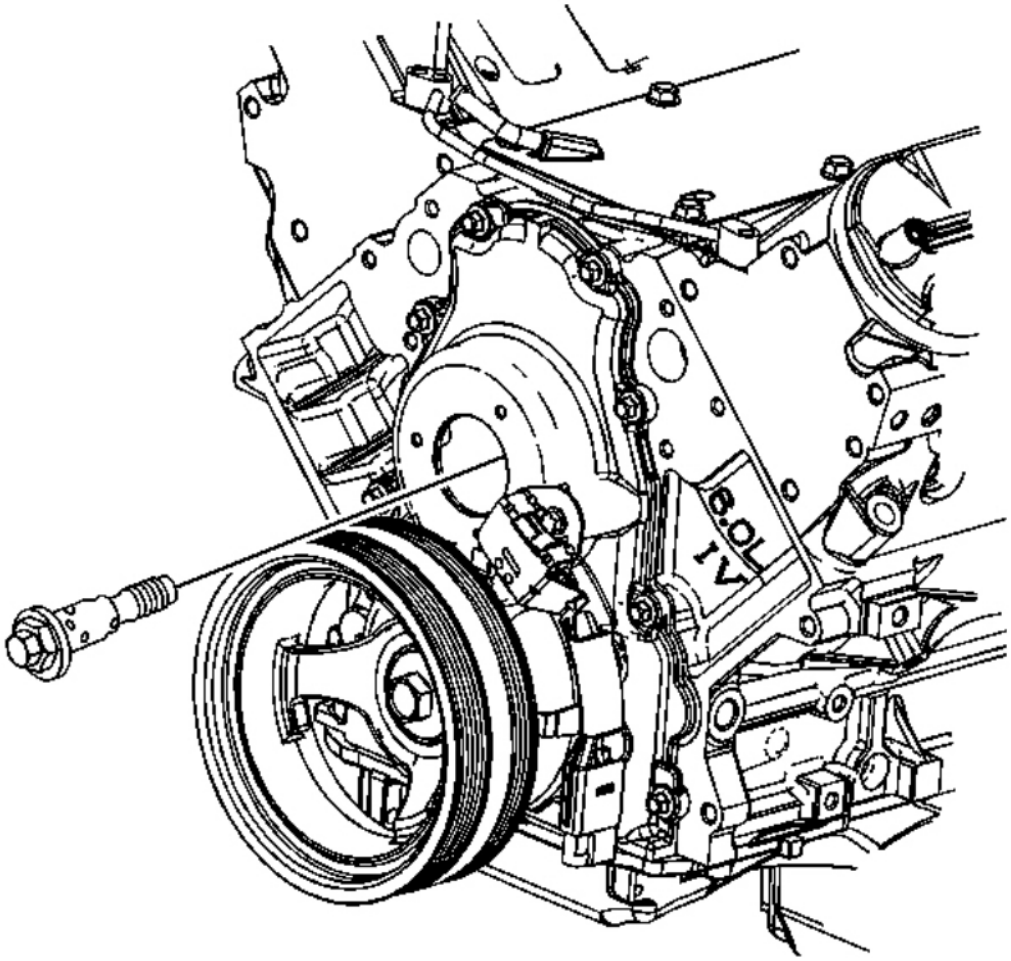


Fig. 267: View Of CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

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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

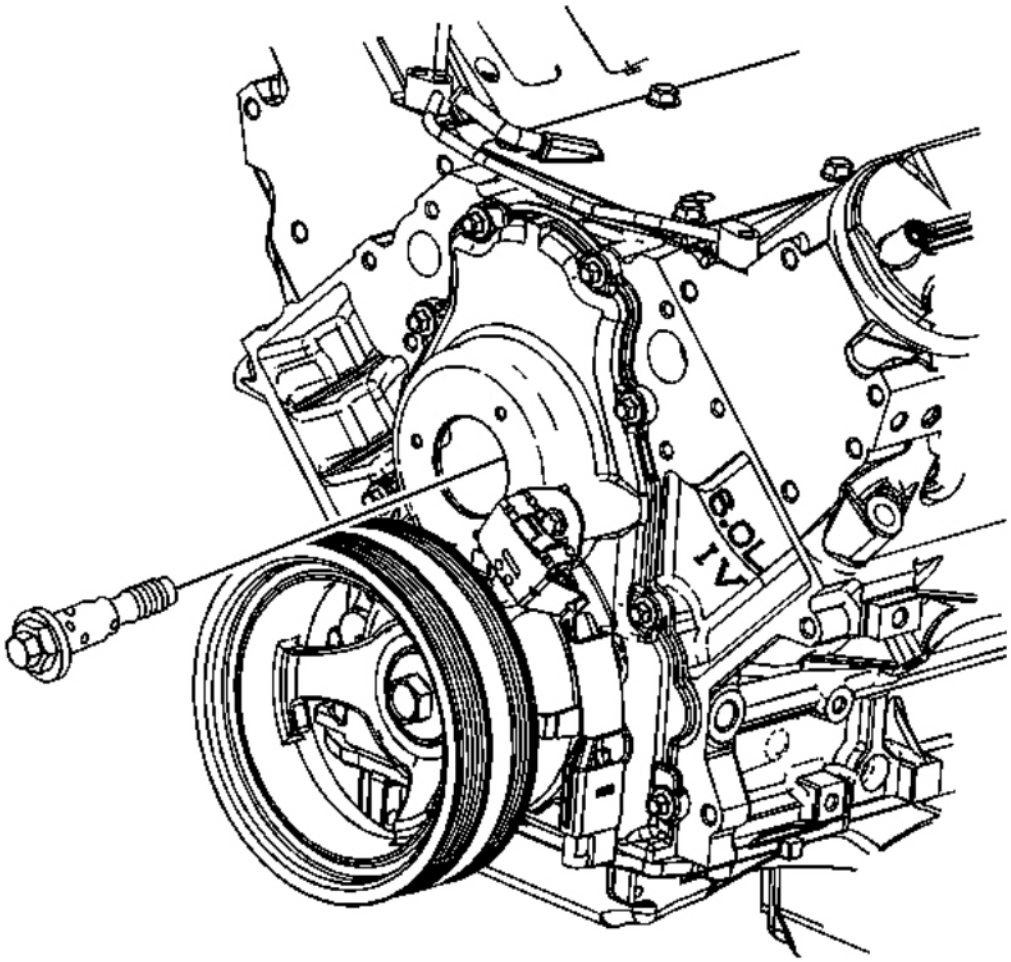


Fig. 268: View Of CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

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.

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NOTE: **Refer to Fastener Notice .**

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** . See **Special Tools** .

3. Install the CMP actuator magnet. Refer to **Camshaft Position Actuator Magnet Replacement**.

CAMSHAFT POSITION ACTUATOR REPLACEMENT

Tools Required

- **EN 46330** Timing Belt Tensioner Retaining Pin. See **Special Tools** .
- **J 45059** Angle Meter. See **Special Tools** .

REMOVAL PROCEDURE

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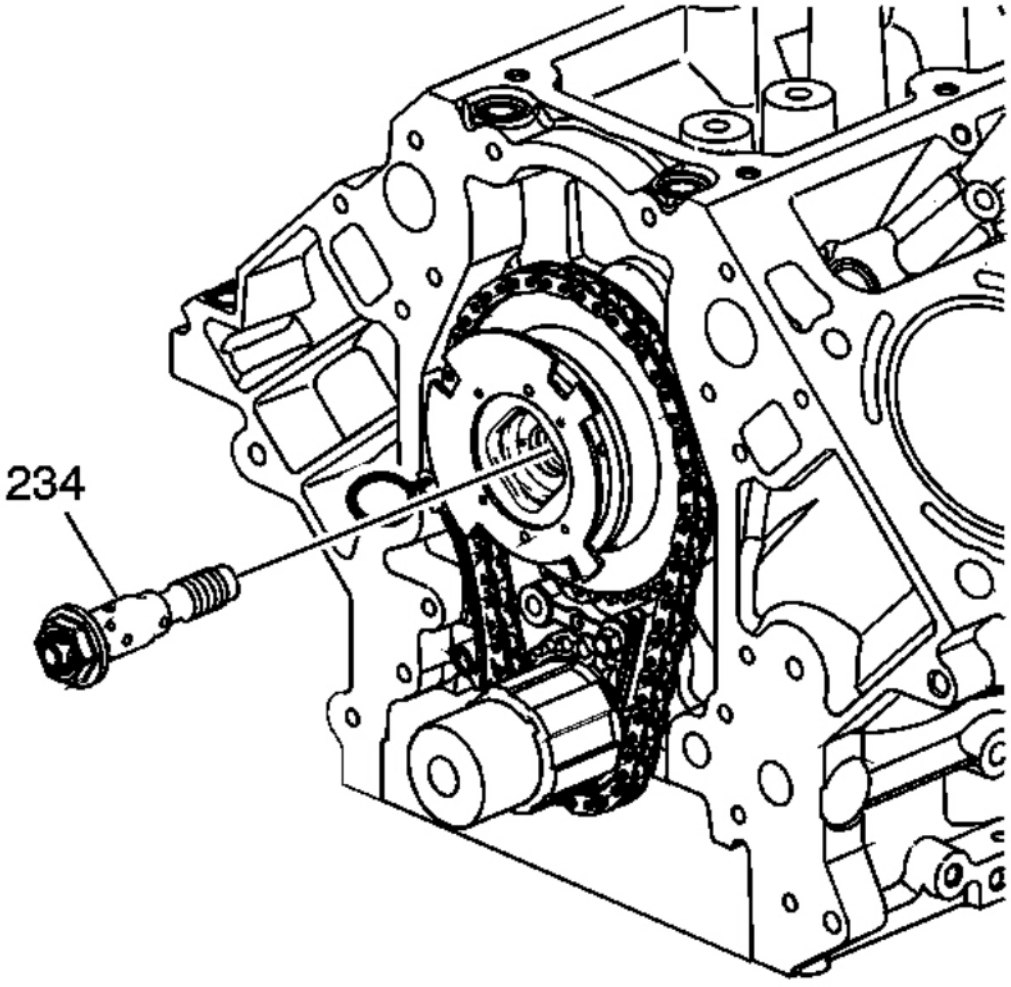


Fig. 269: View Of CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pump. Refer to **Oil Pump, Screen and Crankshaft Oil Deflector Replacement (RPOs LC9/LMG/LY2/LY5)** or **Oil Pump, Screen and Crankshaft Oil Deflector Replacement (RPOs LY6/L76/L92)**.
2. Remove and discard the camshaft position (CMP) actuator solenoid valve (234).

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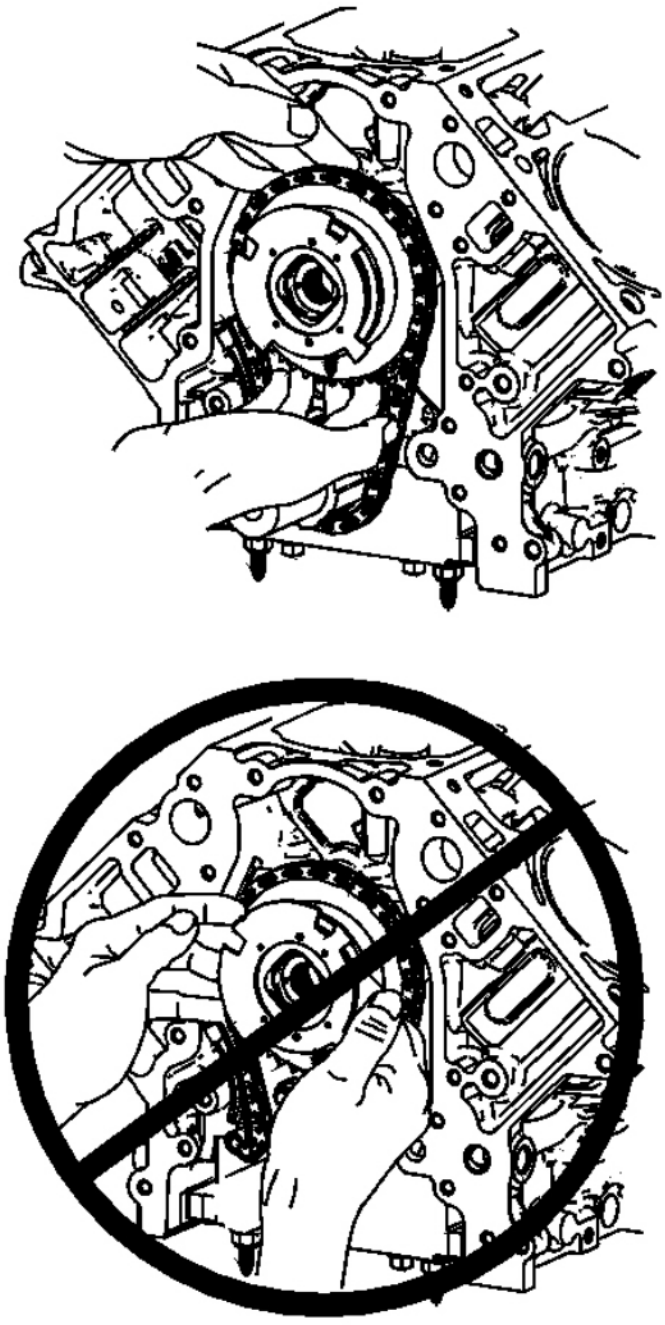


Fig. 270: View Of Proper CMP Actuator Removal
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not push or pull on the reluctor wheel of the camshaft position

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(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.

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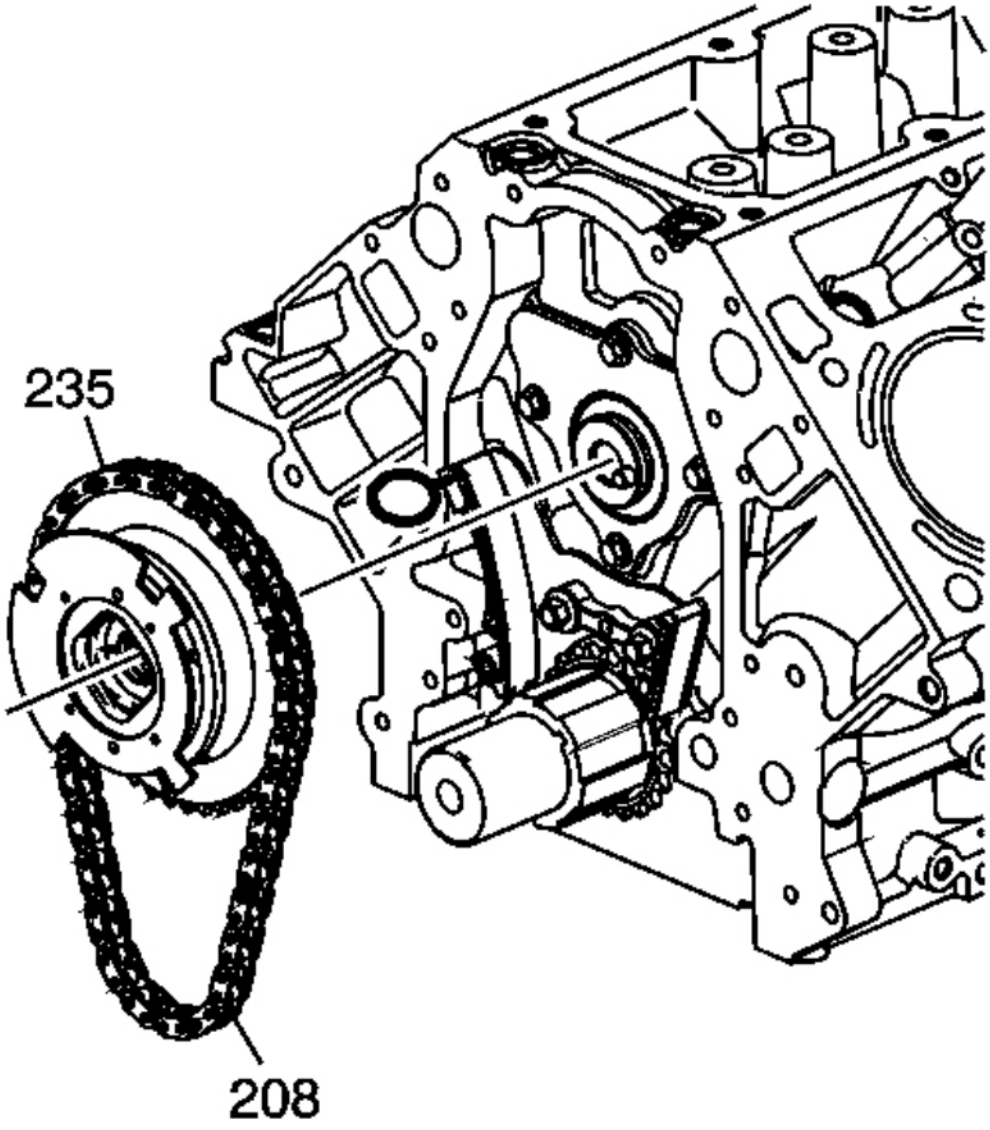


Fig. 271: View Of CMP Actuator & Timing Chain
Courtesy of GENERAL MOTORS CORP.

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

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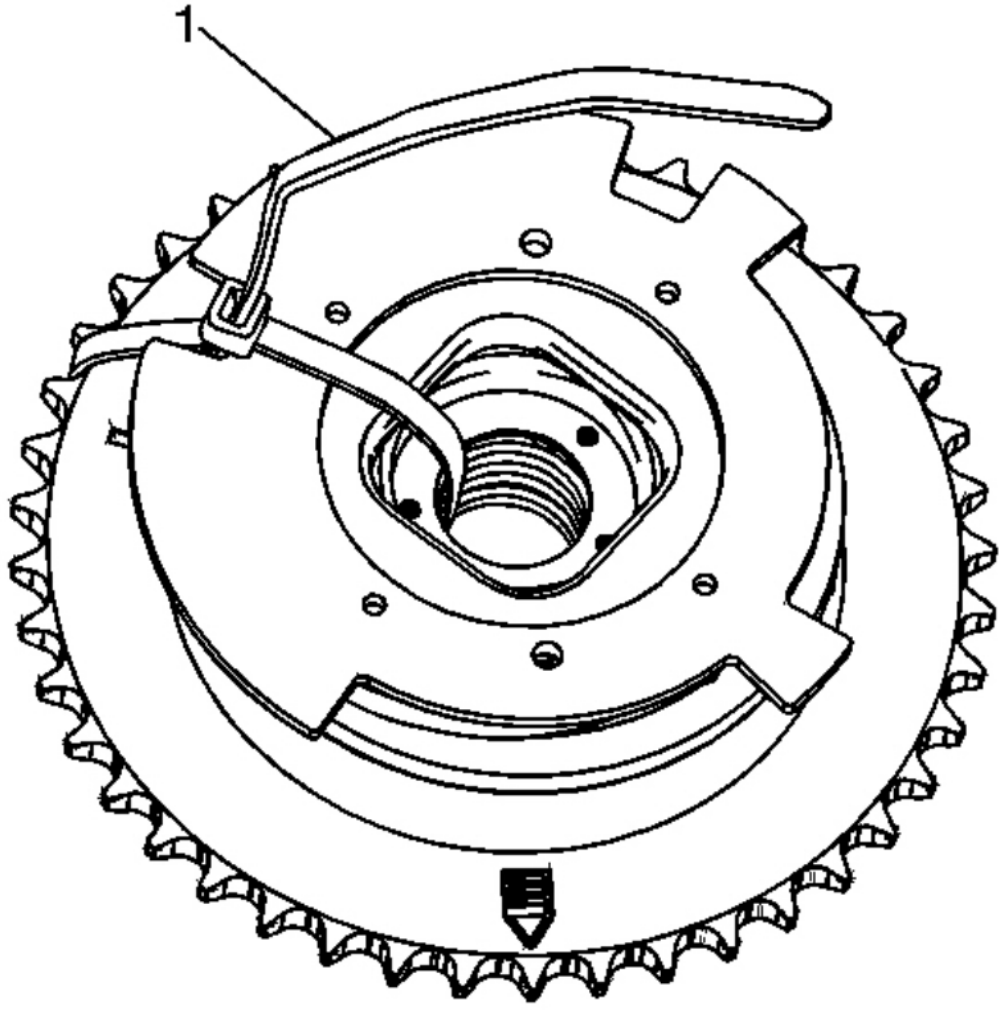


Fig. 272: View Of Tie Strap Through Center Of Actuator
Courtesy of GENERAL MOTORS CORP.

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

INSTALLATION PROCEDURE

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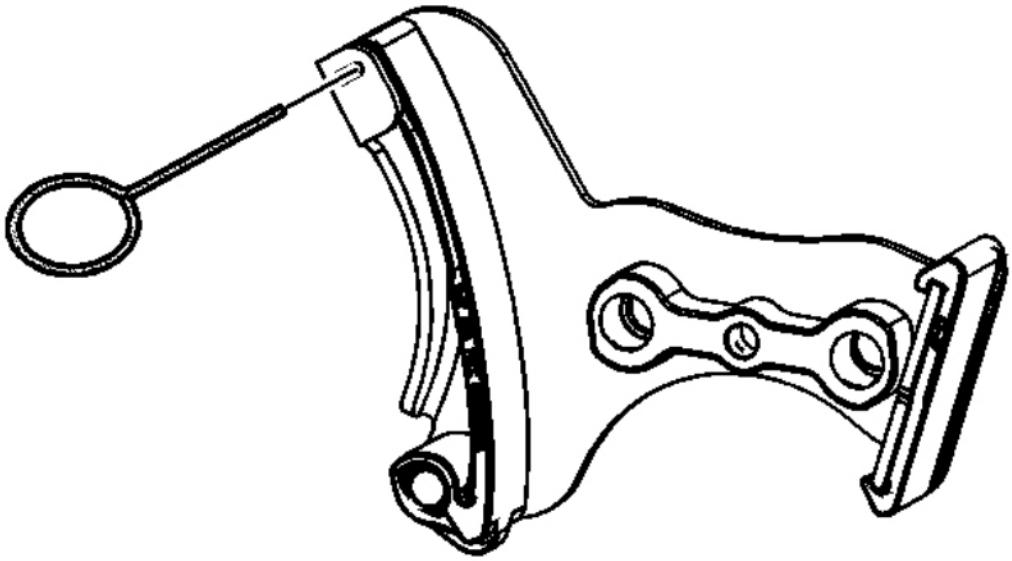


Fig. 273: Installing EN 46330 In Compressed Tensioner
Courtesy of GENERAL MOTORS CORP.

1. Compress the timing chain tensioner guide and install the **EN 46330** . See **Special Tools** .

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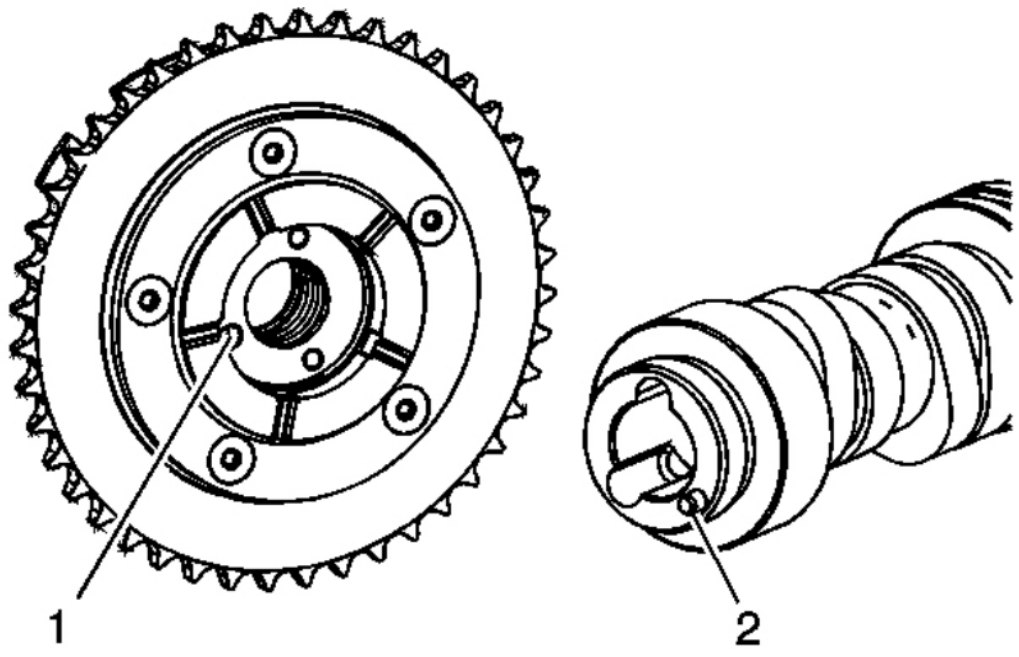


Fig. 274: Identifying Alignment Hole & Locating Pin
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **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.

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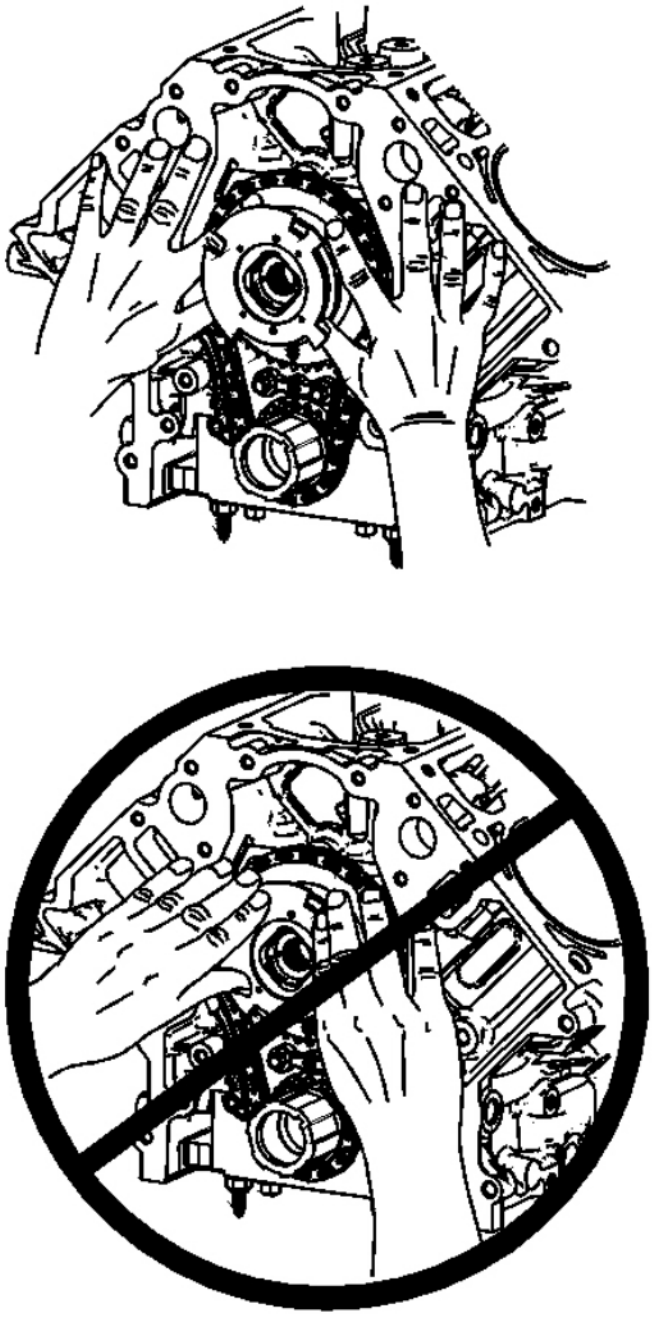


Fig. 275: Proper Installation Of CMP Actuator
Courtesy of GENERAL MOTORS CORP.

CAUTION: Do not push or pull on the reluctor wheel of the camshaft position

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(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.

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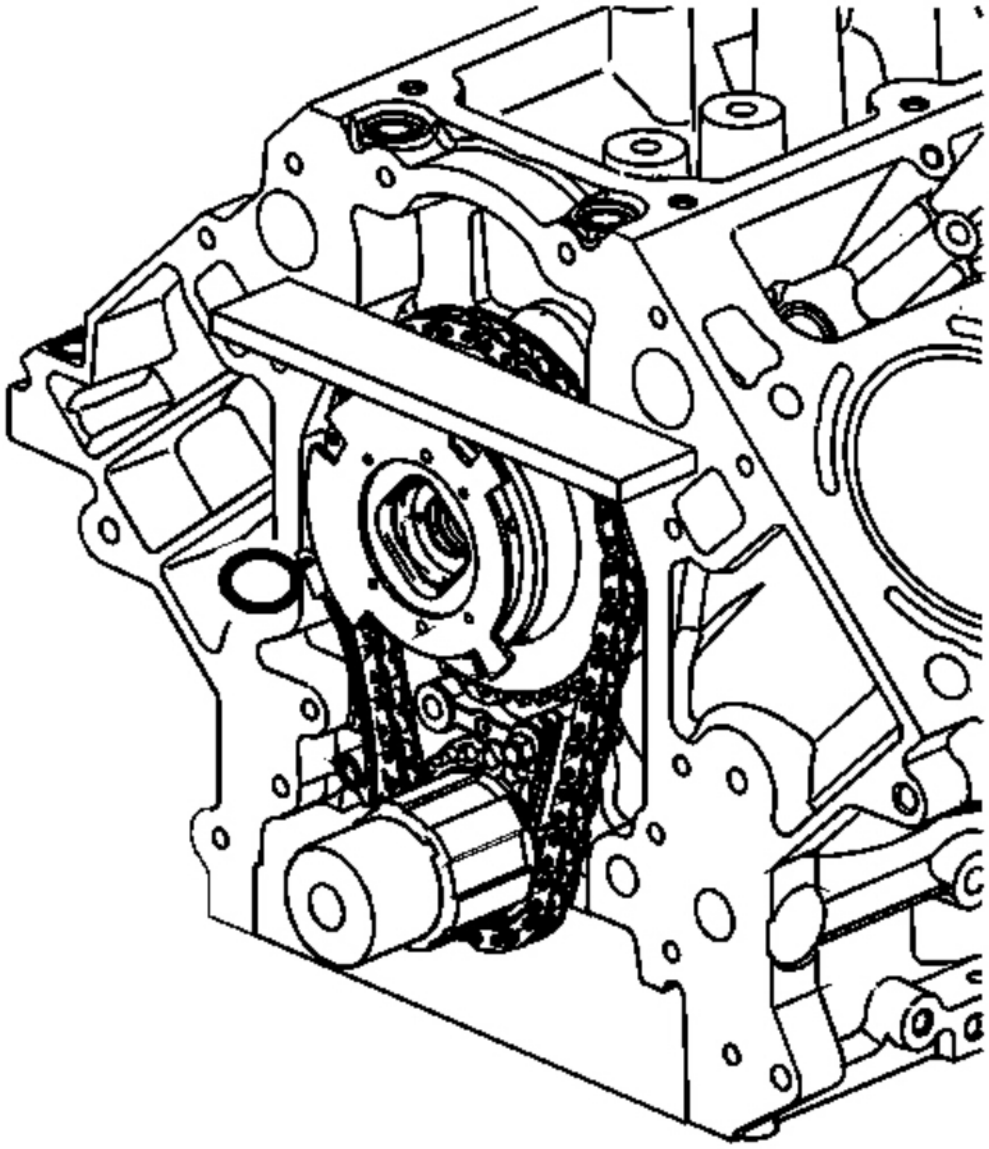


Fig. 276: Inspecting For Proper Installation Of CMP Actuator & Timing Chain
Courtesy of GENERAL MOTORS CORP.

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.

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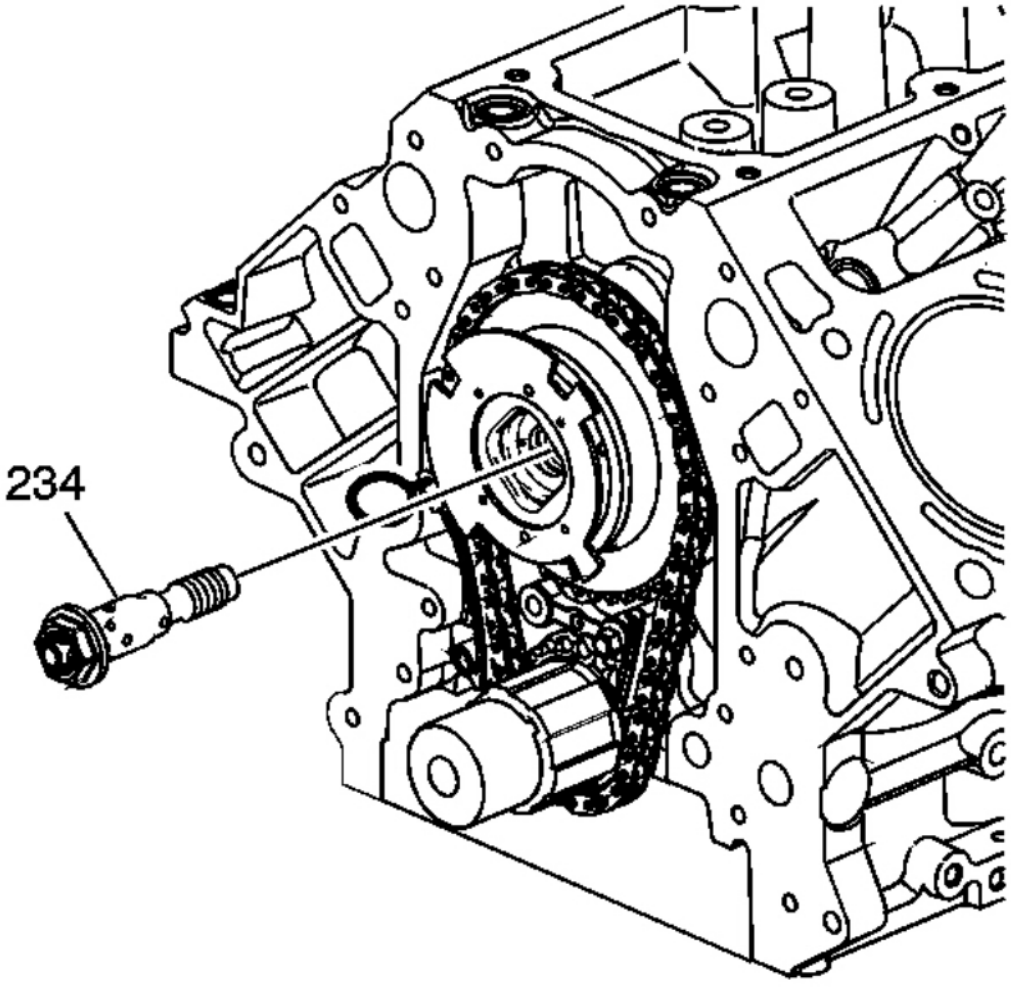


Fig. 277: View Of CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

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.

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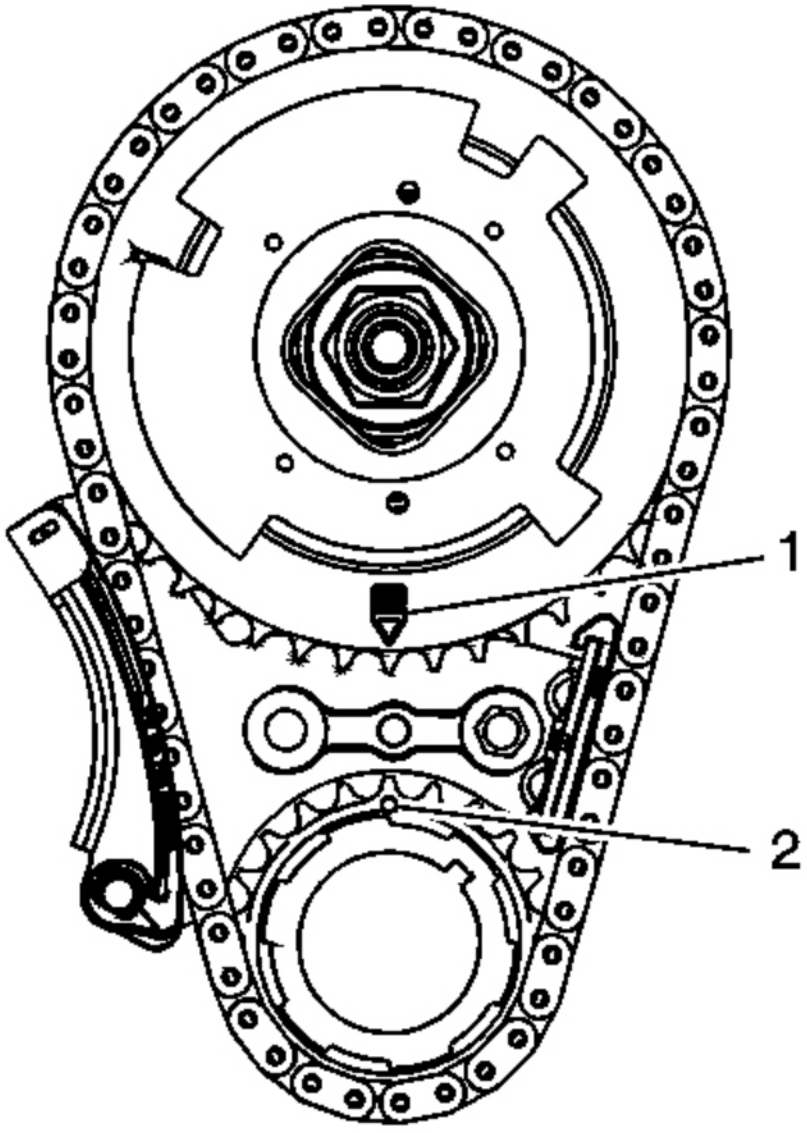


Fig. 278: View Of CMP Actuator Alignment Mark & Crankshaft Sprocket Alignment Mark
Courtesy of GENERAL MOTORS CORP.

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.

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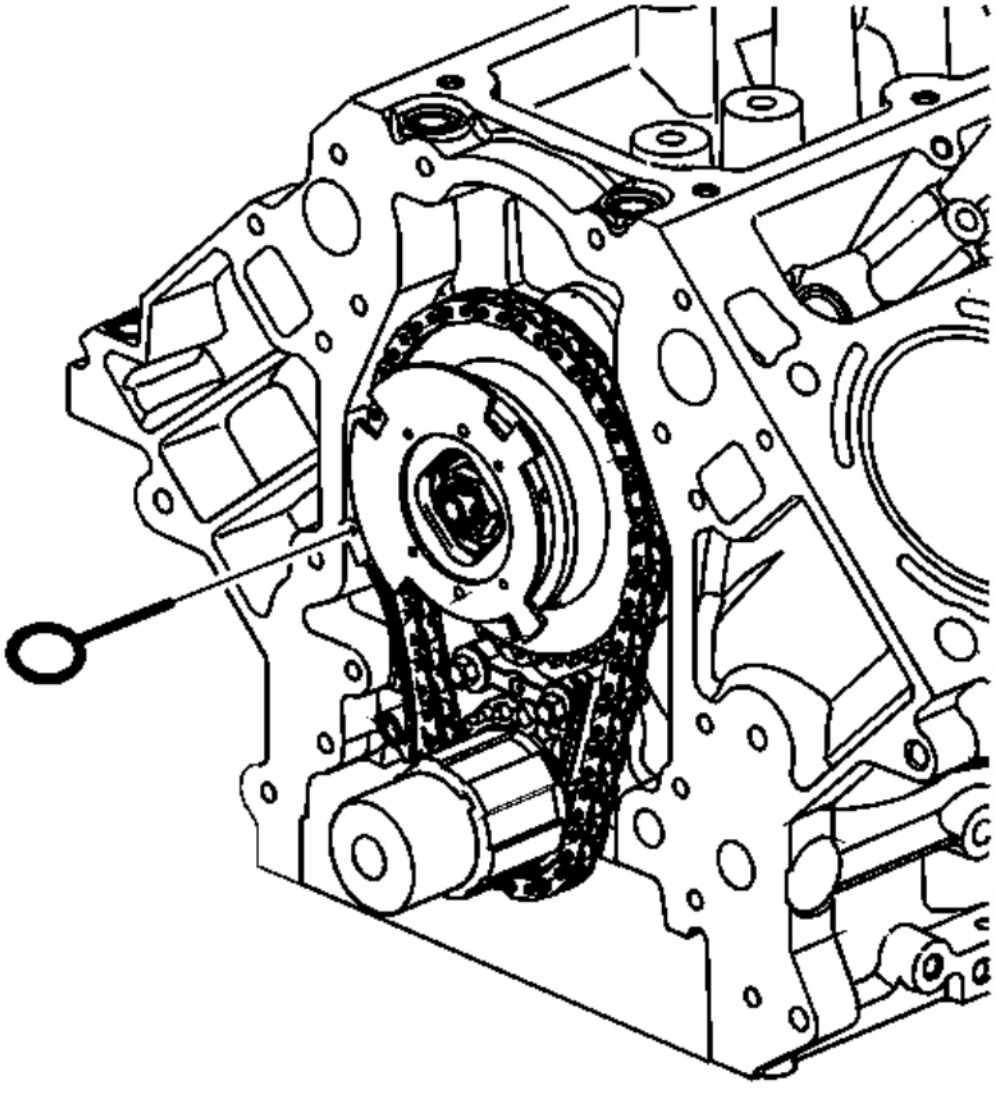


Fig. 279: View Of Special Tool EN 46330
Courtesy of GENERAL MOTORS CORP.

7. Remove the **EN 46330** . See **Special Tools** .

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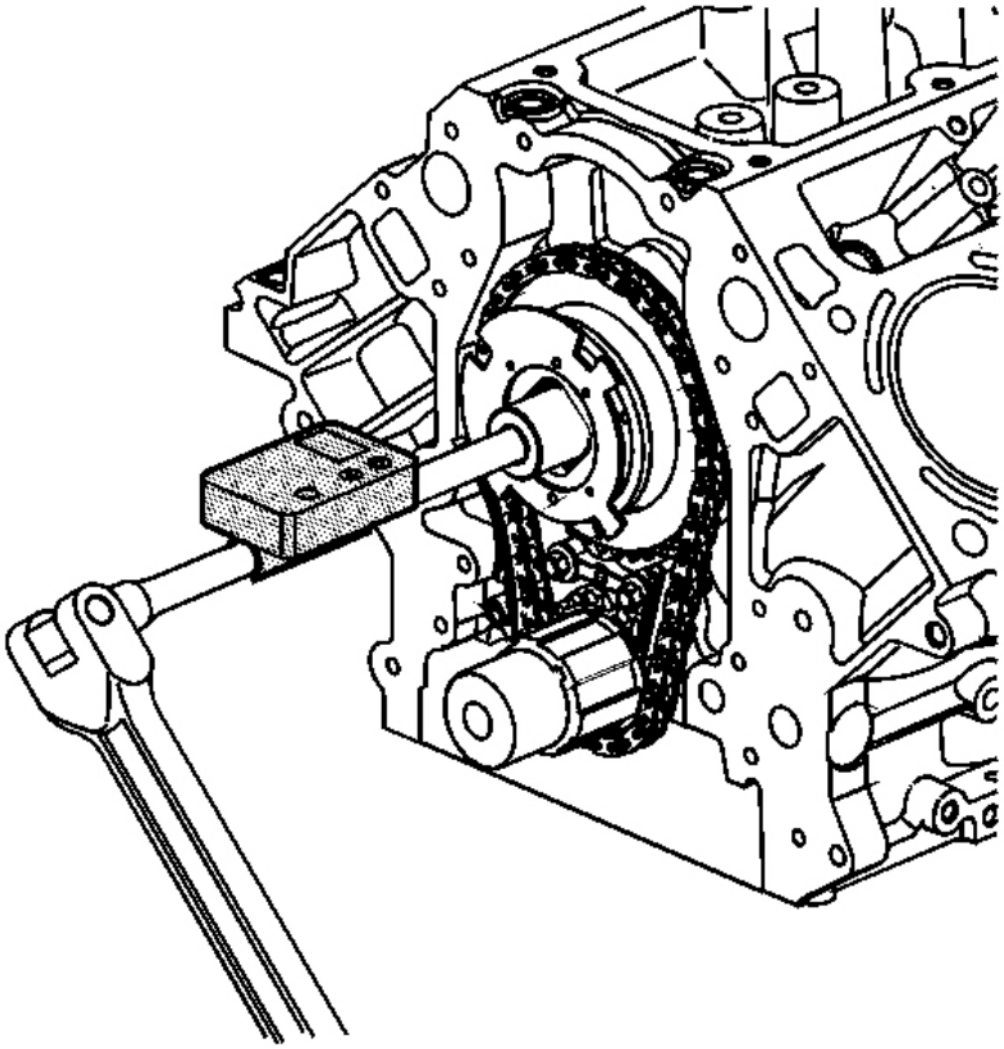


Fig. 280: Tightening The CMP Actuator Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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** . See **Special Tools** .

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9. Install the oil pump. Refer to **Oil Pump, Screen and Crankshaft Oil Deflector Replacement (RPOs LC9/LMG/LY2/LY5)** or **Oil Pump, Screen and Crankshaft Oil Deflector Replacement (RPOs LY6/L76/L92)**.

CRANKSHAFT REAR OIL SEAL REPLACEMENT

TOOLS REQUIRED

J 41479 Crankshaft Rear Oil Seal Installer. See **Special Tools** .

REMOVAL PROCEDURE

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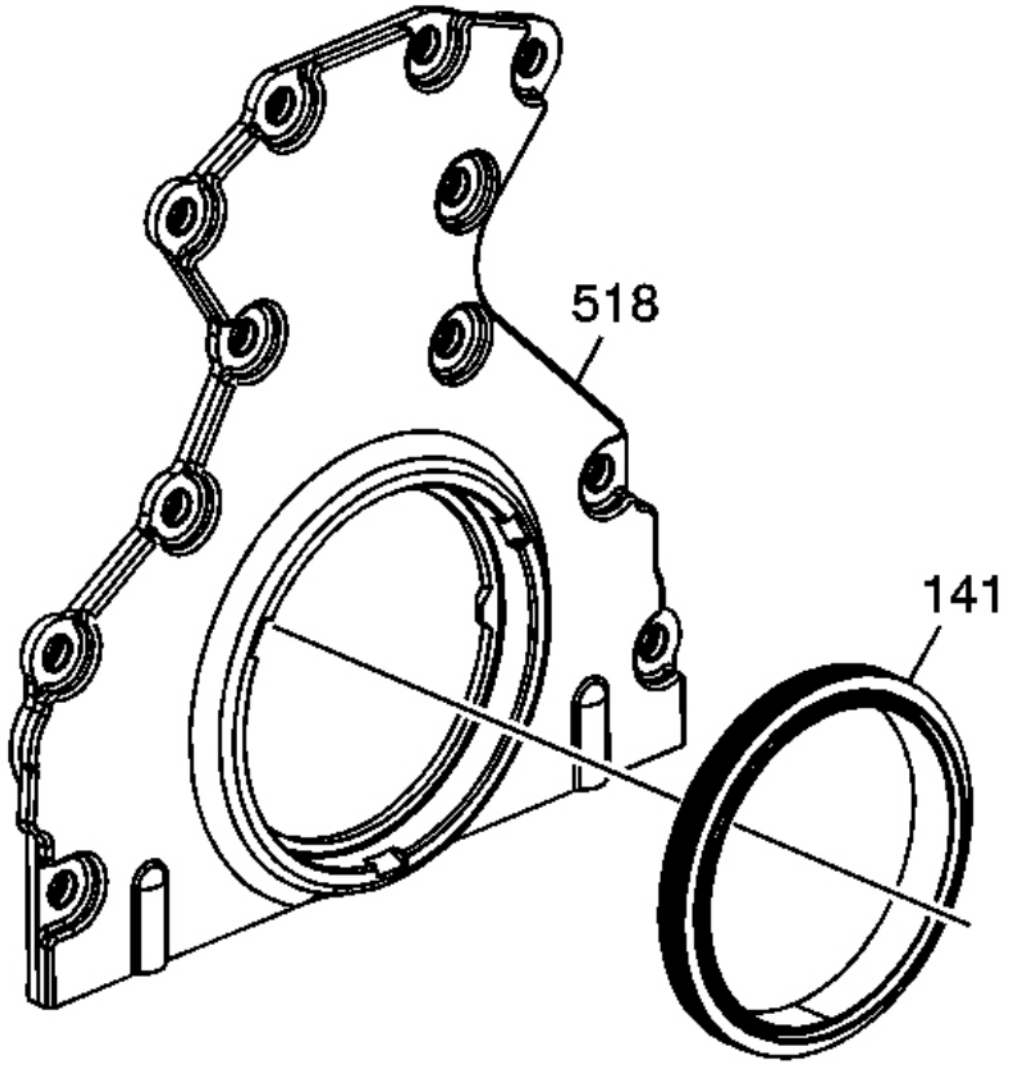


Fig. 281: View Of Crankshaft Rear Oil Seal & Housing
Courtesy of GENERAL MOTORS CORP.

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

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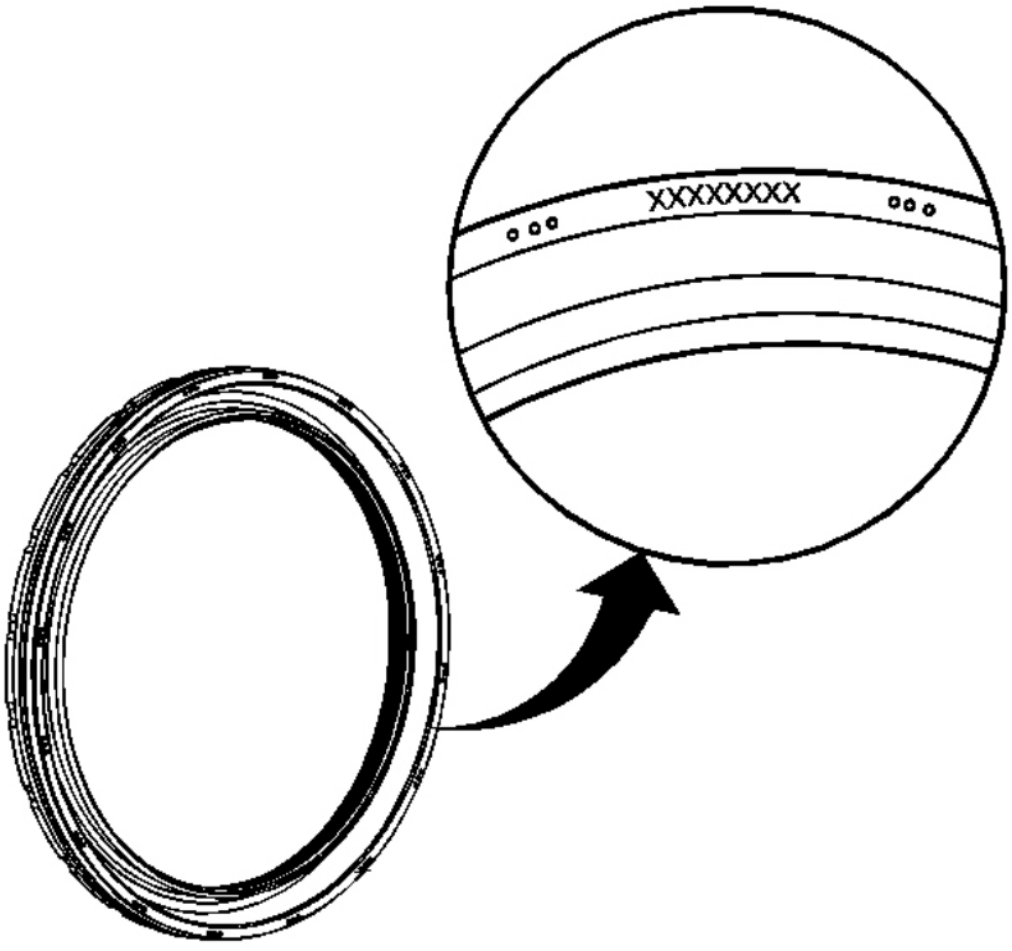


Fig. 282: Identifying Oil Seal
Courtesy of GENERAL MOTORS CORP.

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.

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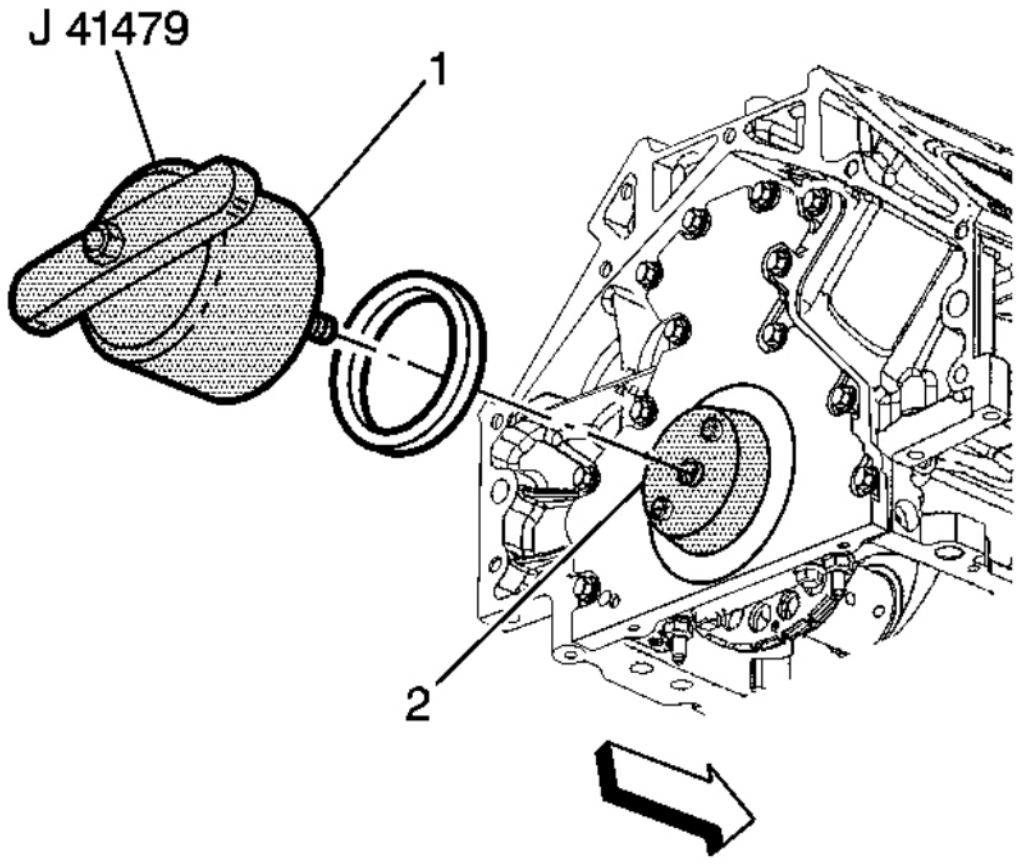


Fig. 283: Installing Crankshaft Rear Oil Seal Using J 41479
Courtesy of GENERAL MOTORS CORP.

2. Install the **J 41479** cone (2) and bolts onto the rear of the crankshaft. See **Special Tools** .
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** threaded rod into the tapered cone until the tool (1) contacts the oil seal. See **Special Tools** .
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** . See **Special Tools** .
9. Install the automatic transmission flexplate, refer to **Automatic Transmission Flex Plate Replacement** .

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ENGINE REAR COVER REPLACEMENT

TOOLS REQUIRED

J 41476 Front and Rear Cover Alignment Tool. See **Special Tools** .

REMOVAL PROCEDURE

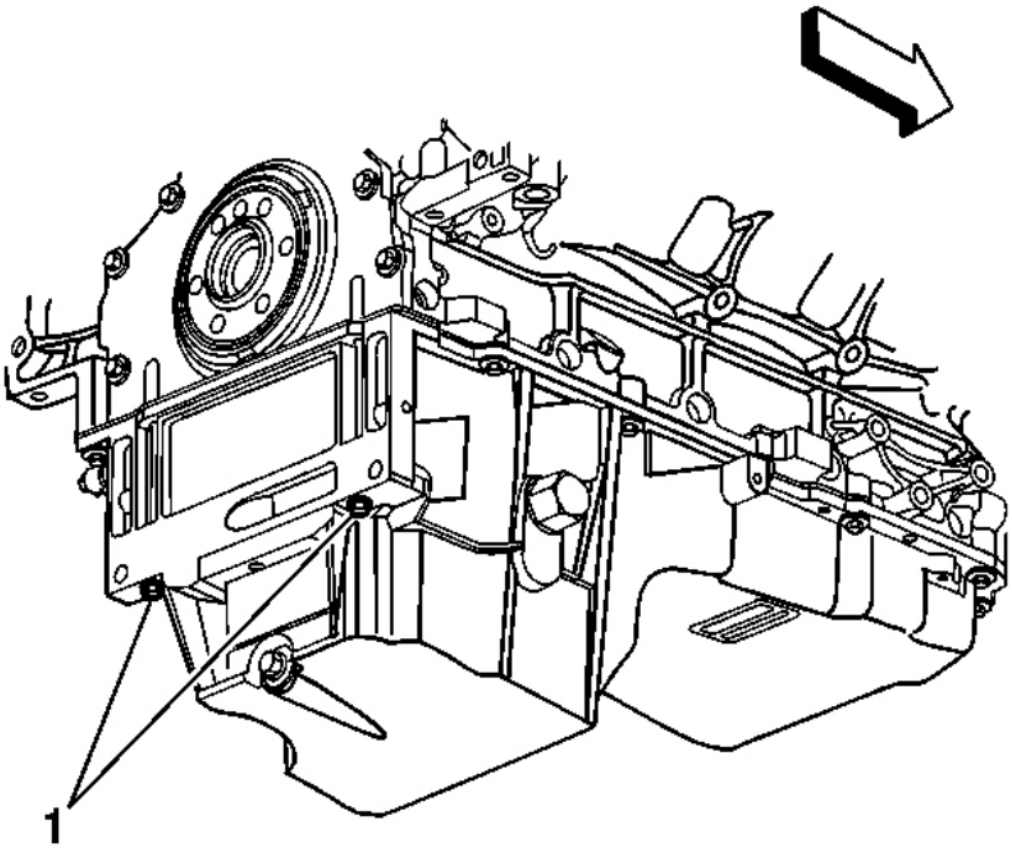


Fig. 284: View Of Oil Pan-To-Rear Cover Bolts
Courtesy of GENERAL MOTORS CORP.

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).

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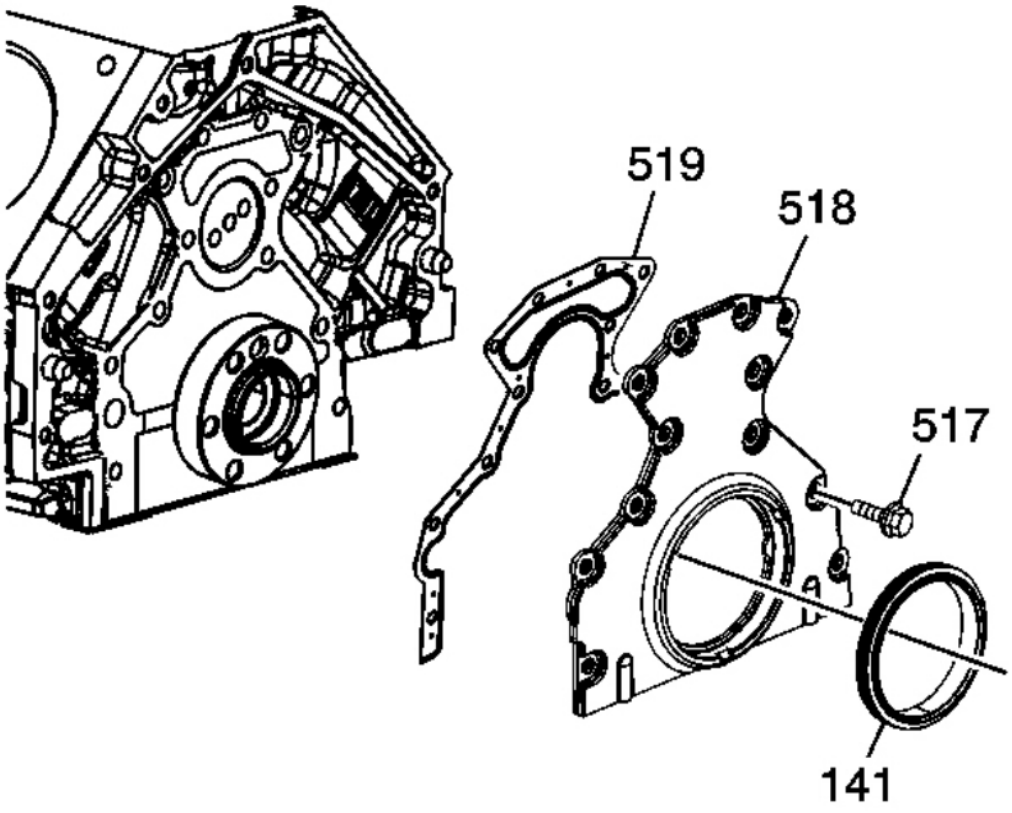


Fig. 285: View Of Rear Housing, Gasket & Seal
Courtesy of GENERAL MOTORS CORP.

3. Remove the rear oil seal housing bolts (517).
4. Remove the rear oil seal housing (518) and gasket (519). Discard the gasket.
5. Remove and discard the rear oil seal (141).

INSTALLATION PROCEDURE

IMPORTANT:

- **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.**
- **The crankshaft rear oil seal will be installed after the rear cover has been installed and aligned. Install the rear cover without the crankshaft oil seal.**

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- **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.**

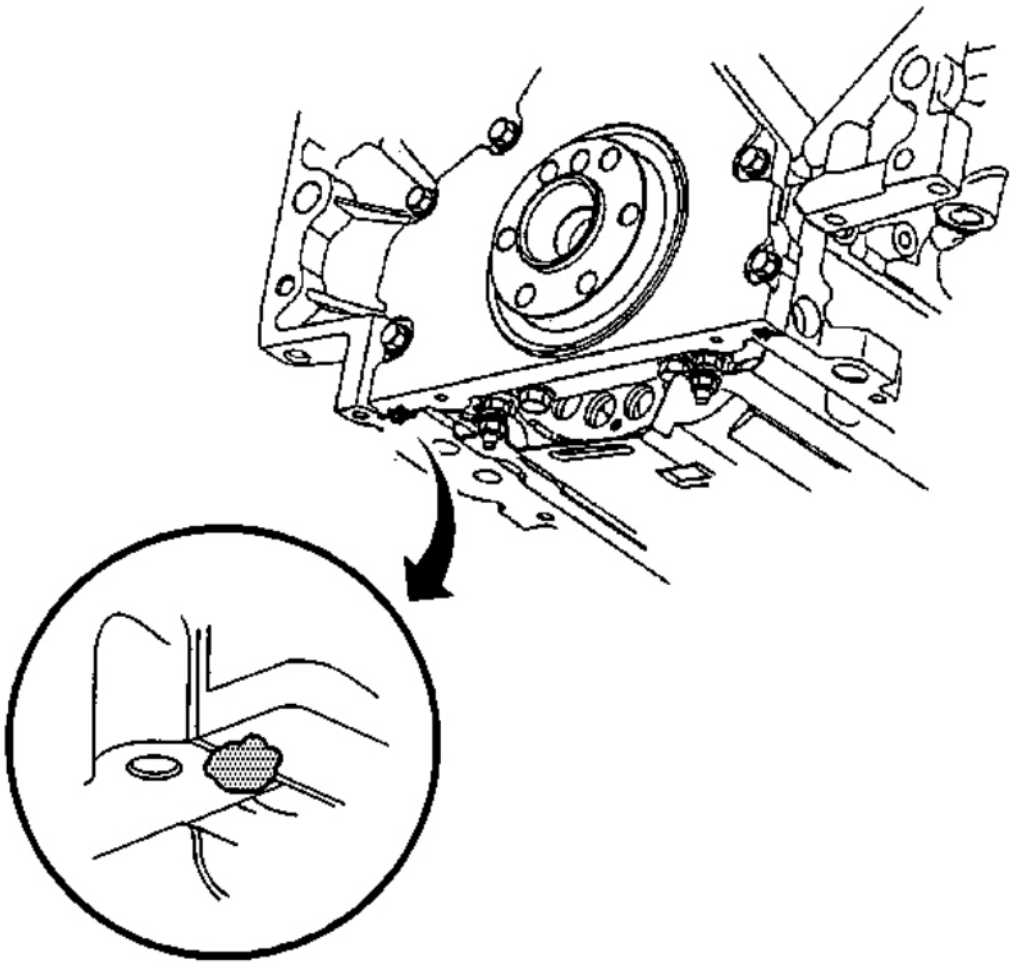


Fig. 286: View Of Sealant Applied To Rear Oil Pan-To-Engine Block Junction
Courtesy of GENERAL MOTORS CORP.

1. Apply a 5 mm (0.2 in) bead of sealant, 20 mm (0.8 in) long to the oil pan to engine block junction. Refer to **Sealers, Adhesives, and Lubricants** .

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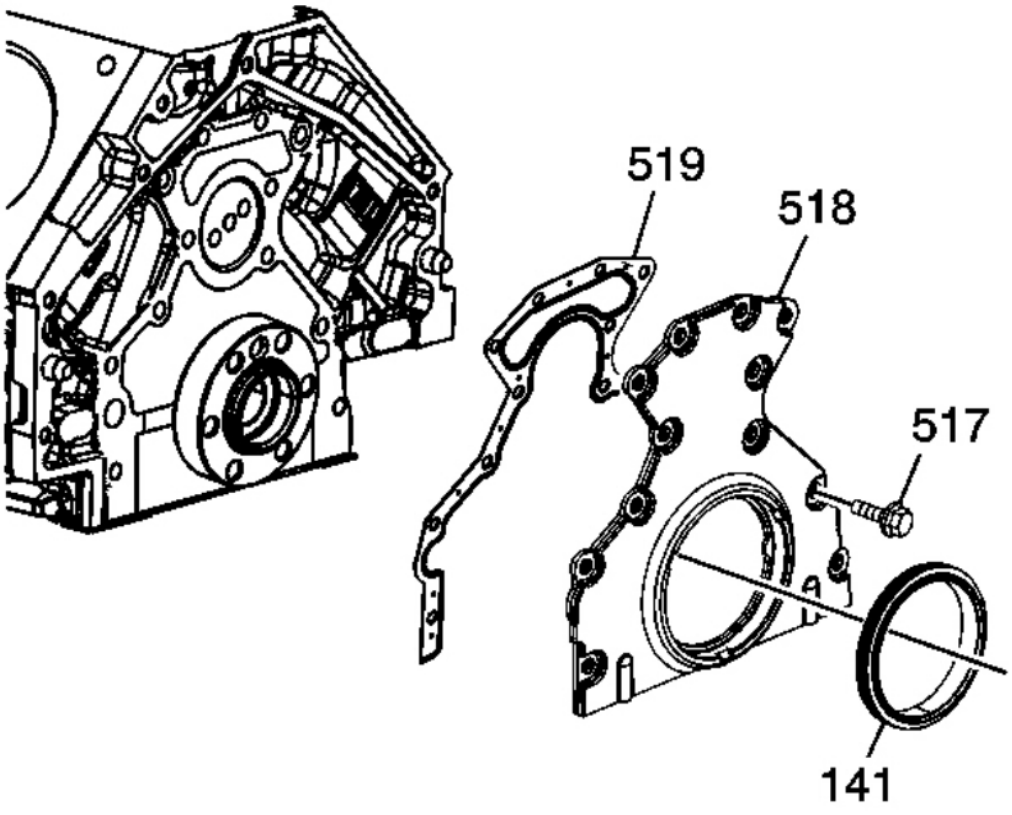


Fig. 287: View Of Rear Housing, Gasket & Seal
Courtesy of GENERAL MOTORS CORP.

2. Position a NEW rear oil seal housing gasket (519) and the housing (518) to the engine.
3. Install the rear oil seal housing bolts until snug. Do not overtighten.

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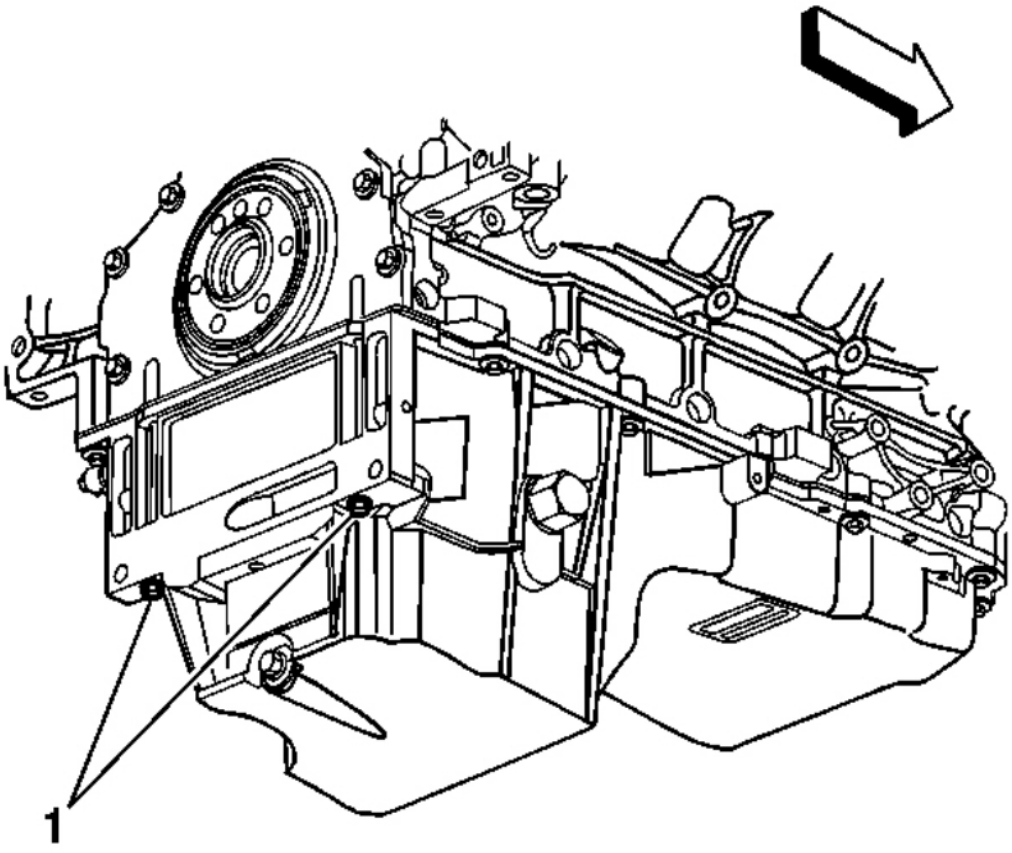


Fig. 288: View Of Oil Pan-To-Rear Cover Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the oil pan-to-rear oil seal housing bolts (1) until snug. Do not overtighten.

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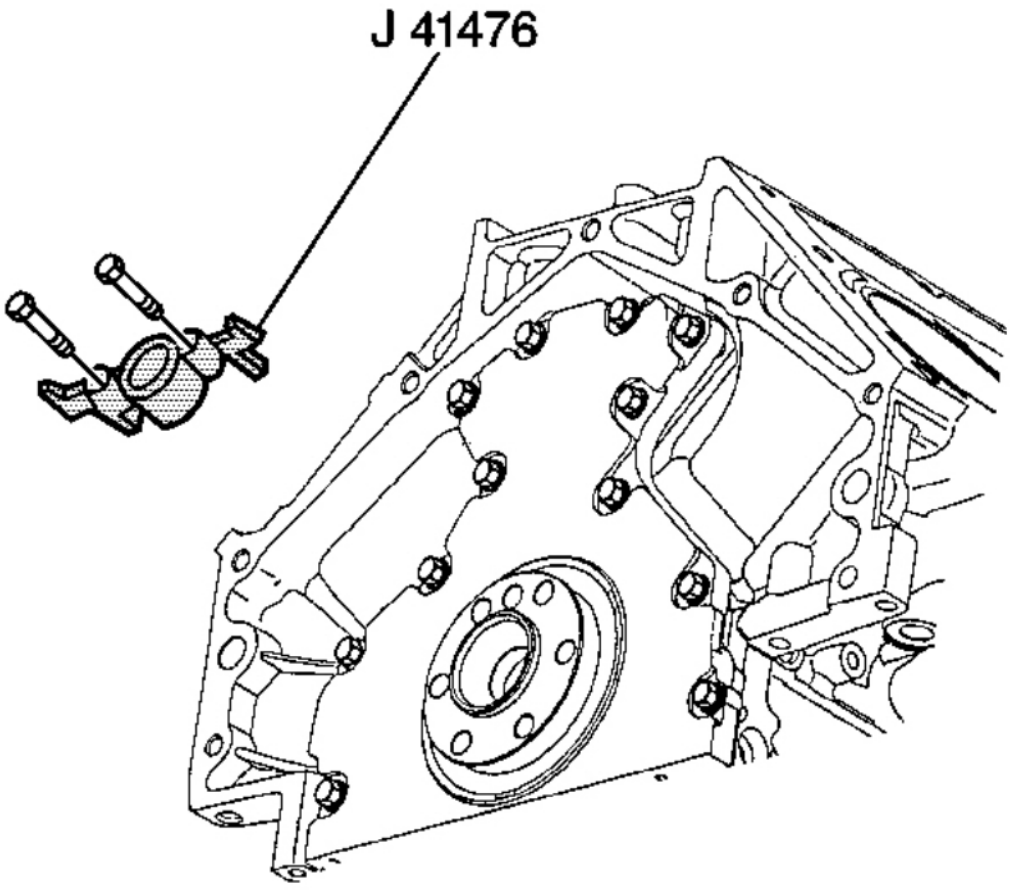


Fig. 289: View Of J 41476
Courtesy of GENERAL MOTORS CORP.

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

5. Rotate the crankshaft until 2 opposing flywheel bolt holes are parallel to the oil pan surface.
6. Install the **J 41476** and bolts onto the rear of the crankshaft. See **Special Tools** .

NOTE: Refer to Fastener Notice .

7. Tighten the **J 41476** bolts until snug. See **Special Tools** . Do not overtighten.

Tighten:

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1. Tighten the oil pan-to-rear oil seal housing bolts to 12 N.m (106 lb in).
2. Tighten the rear oil seal housing bolts to 30 N.m (22 lb ft).

8. Remove the **J 41476** . See **Special Tools** .
9. Install a NEW crankshaft rear oil seal. Refer to **Crankshaft Rear Oil Seal Replacement**.
10. Remove the automatic transmission flexplate, refer to **Automatic Transmission Flex Plate Replacement** .

OIL FILTER ADAPTER REPLACEMENT

REMOVAL PROCEDURE

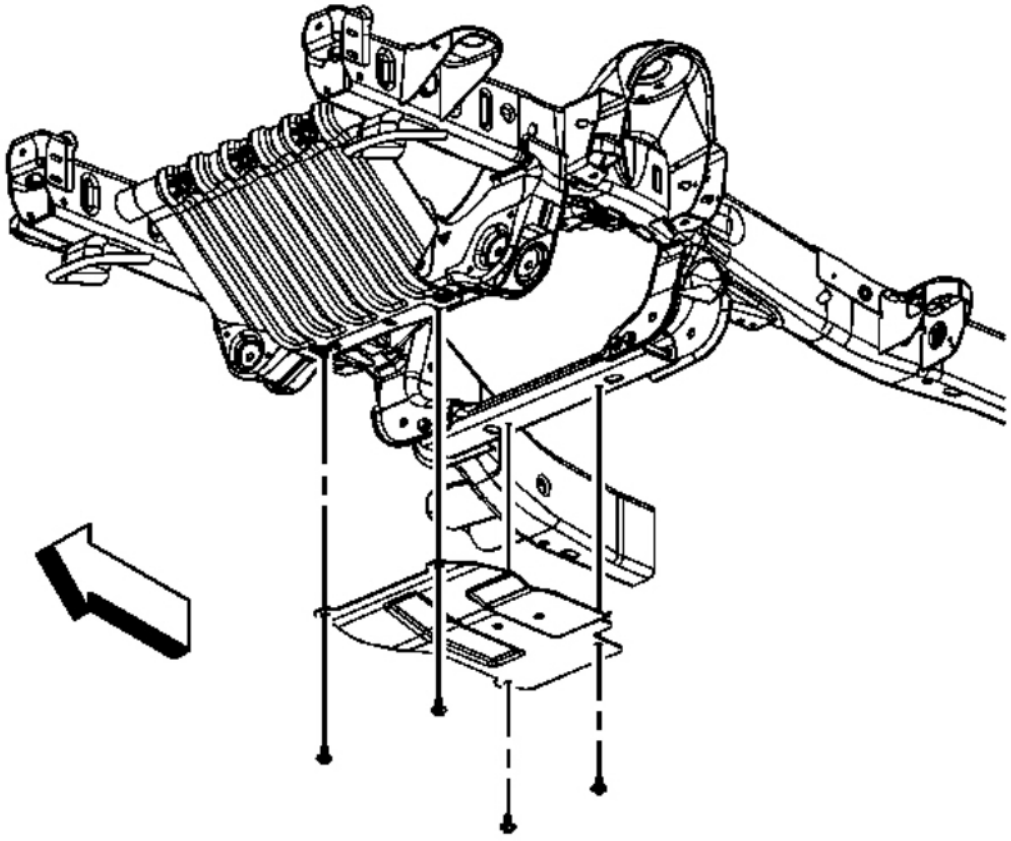


Fig. 290: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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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.

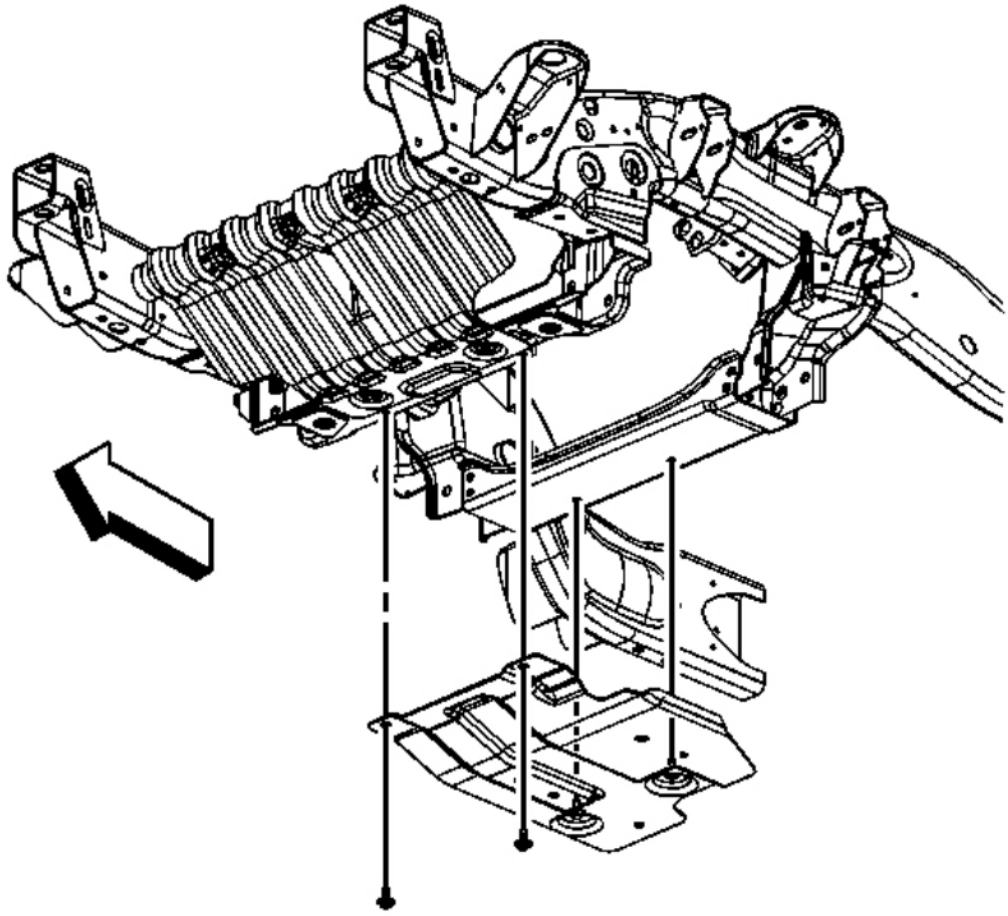


Fig. 291: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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.

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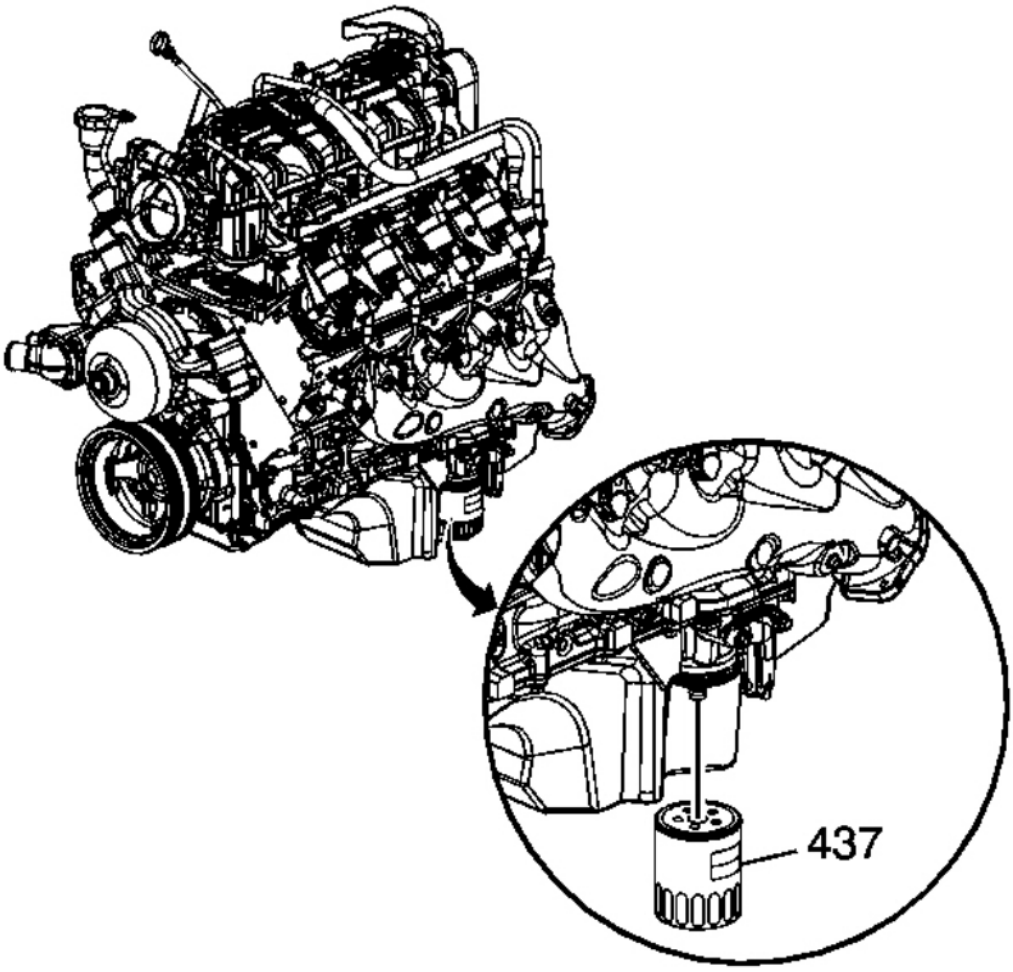


Fig. 292: View Of Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

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

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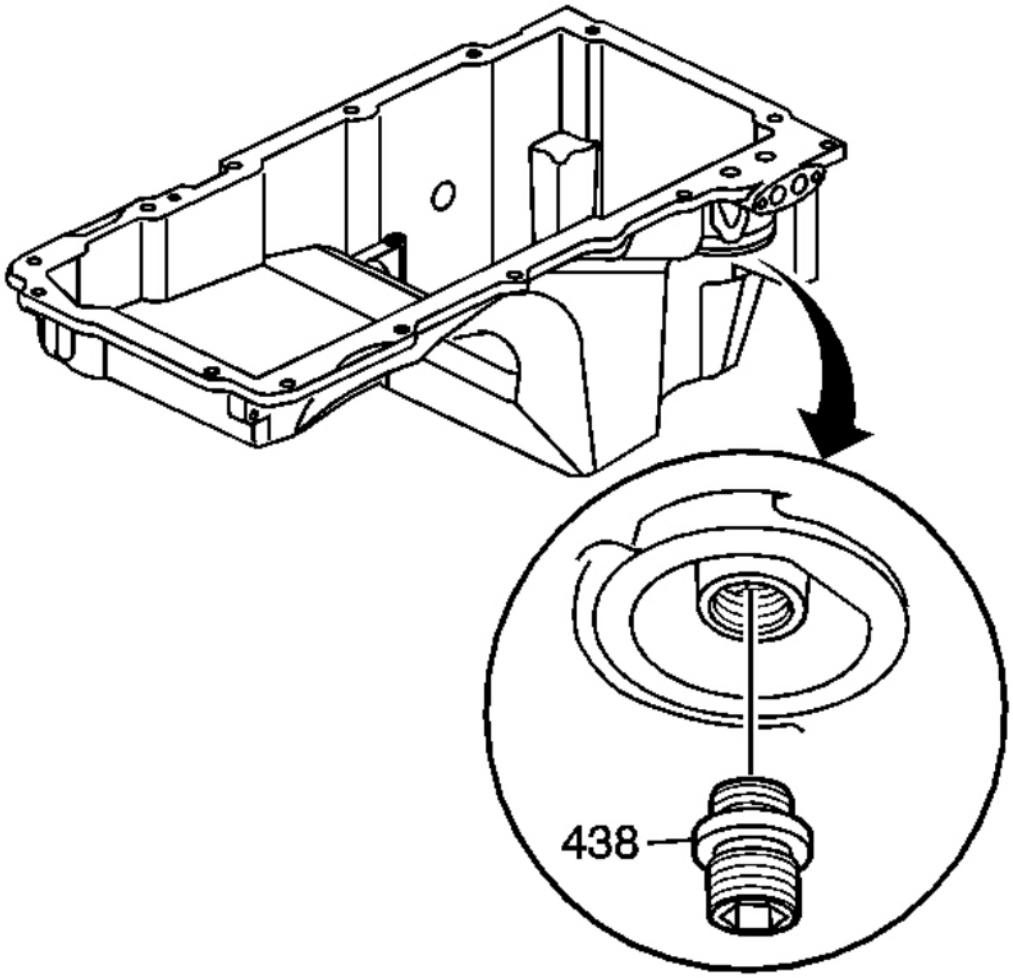


Fig. 293: View Of Oil Filter Fitting
Courtesy of GENERAL MOTORS CORP.

6. Remove the oil filter adapter (438).

INSTALLATION PROCEDURE

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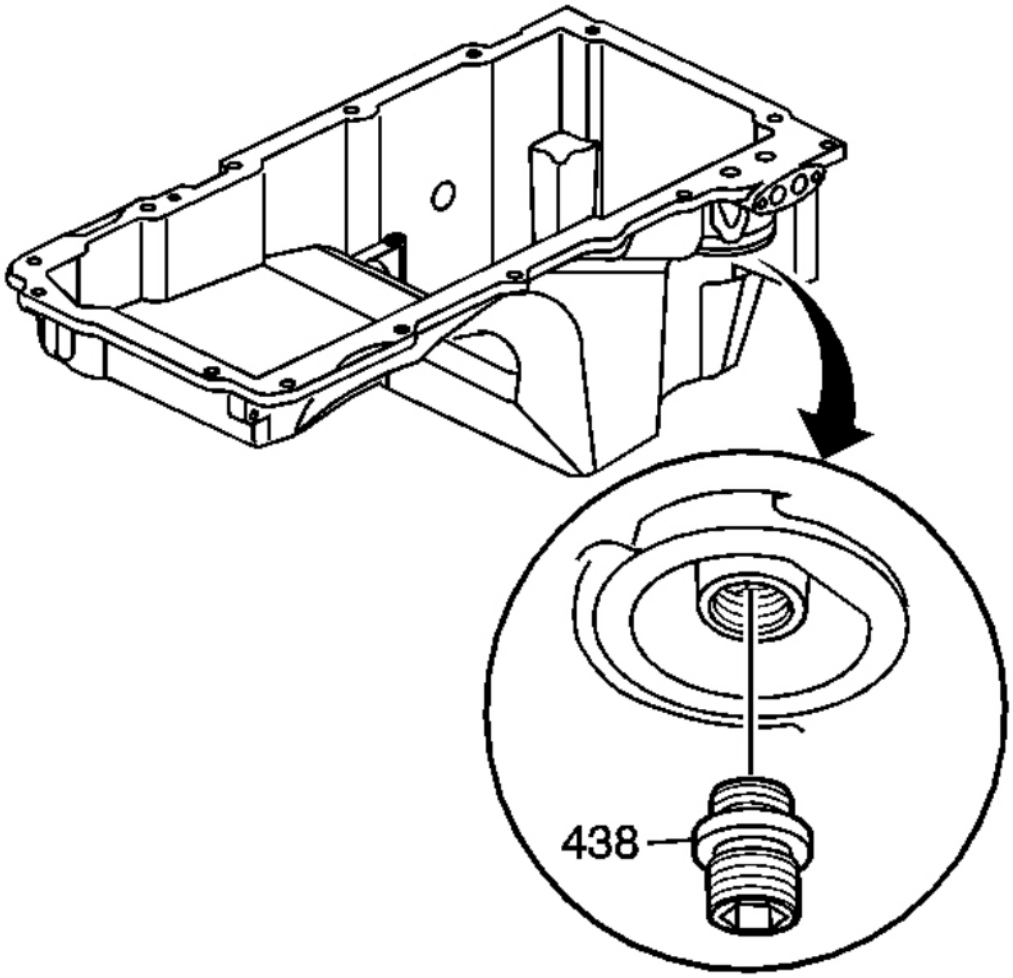


Fig. 294: View Of Oil Filter Fitting
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

1. Install the oil filter adapter (438).

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

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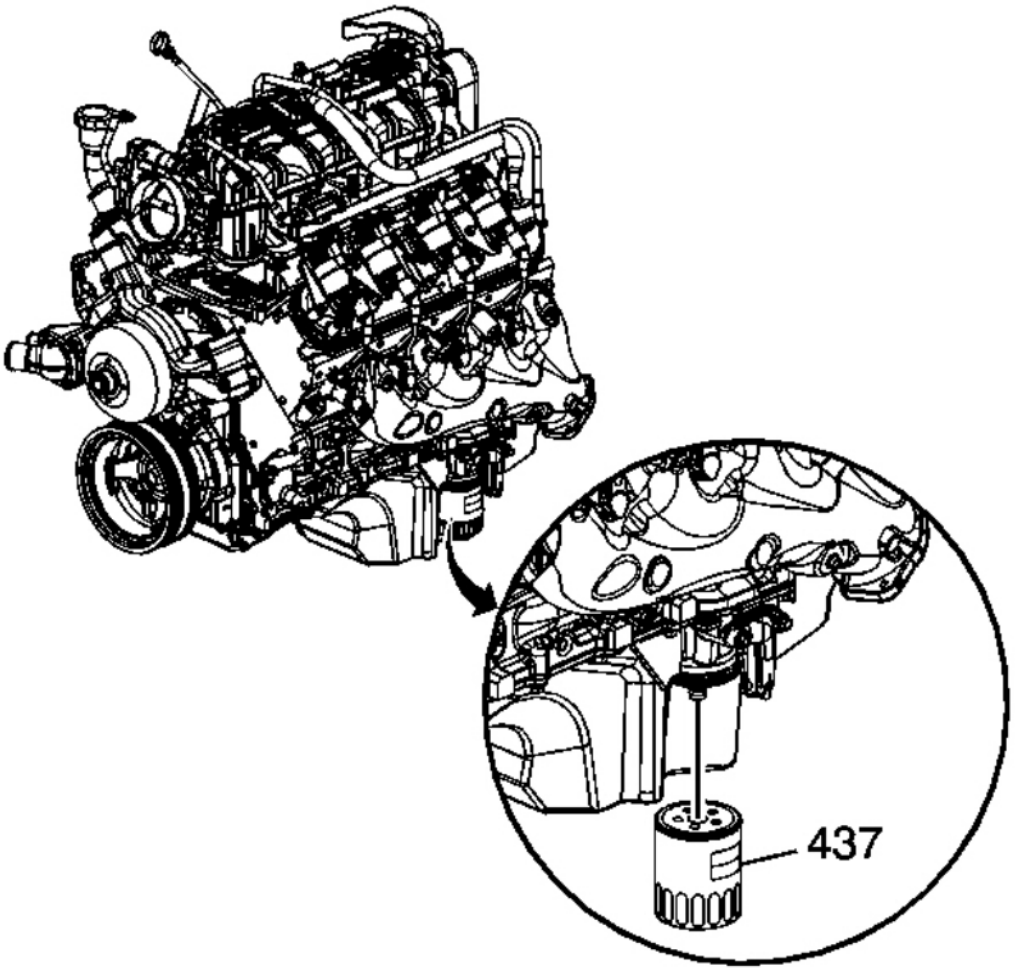


Fig. 295: View Of Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

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).

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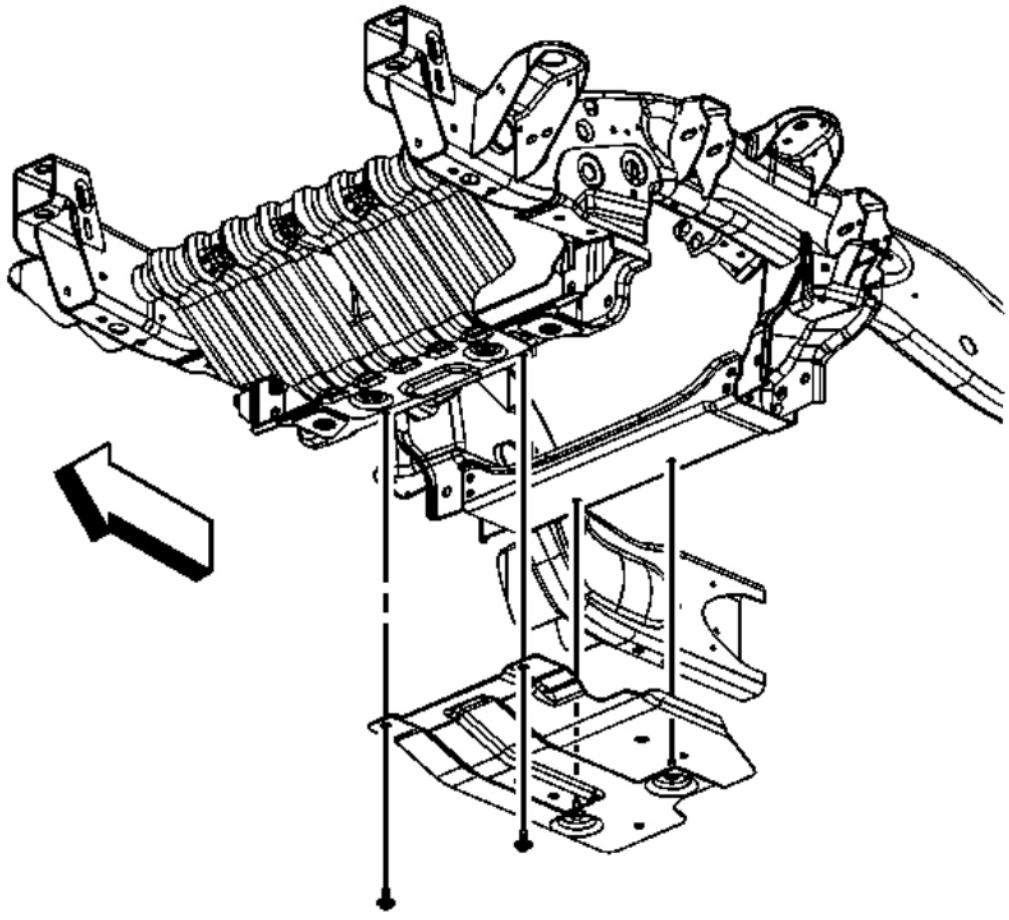


Fig. 296: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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).

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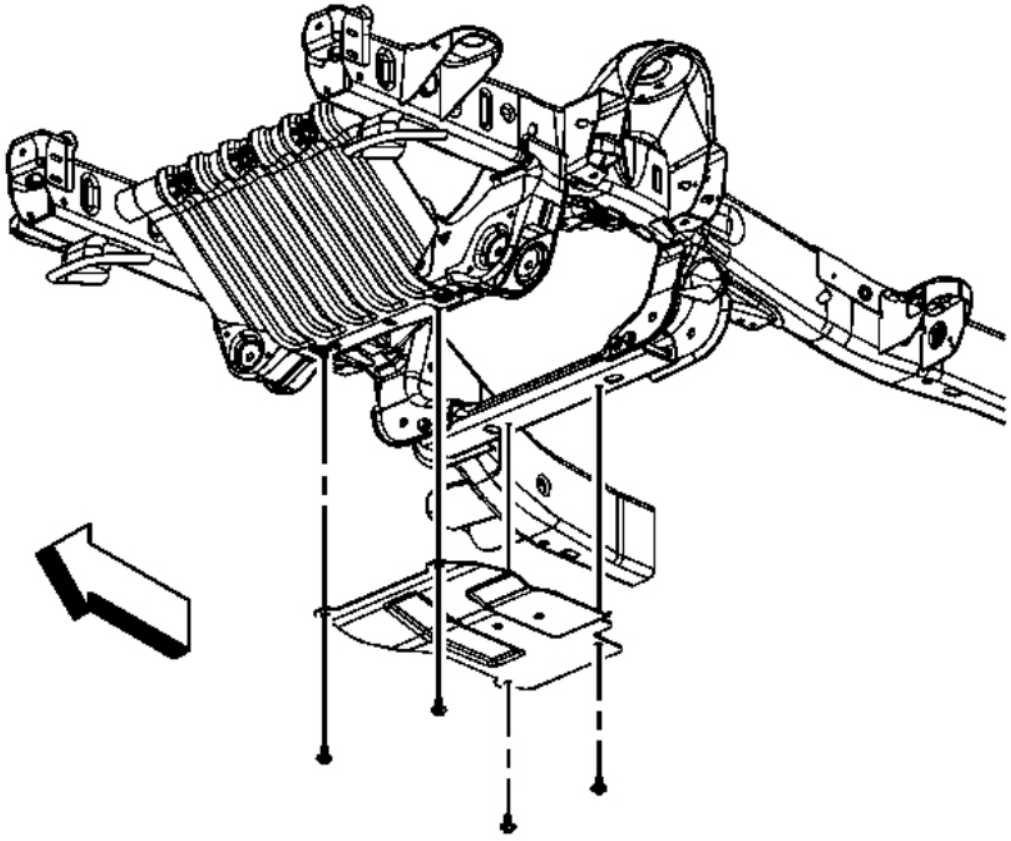


Fig. 297: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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 **Capacities - Approximate Fluid** and/or **Fluid and Lubricant Recommendations** .
8. Start the engine and inspect for leaks.

OIL PAN COVER REPLACEMENT

REMOVAL PROCEDURE

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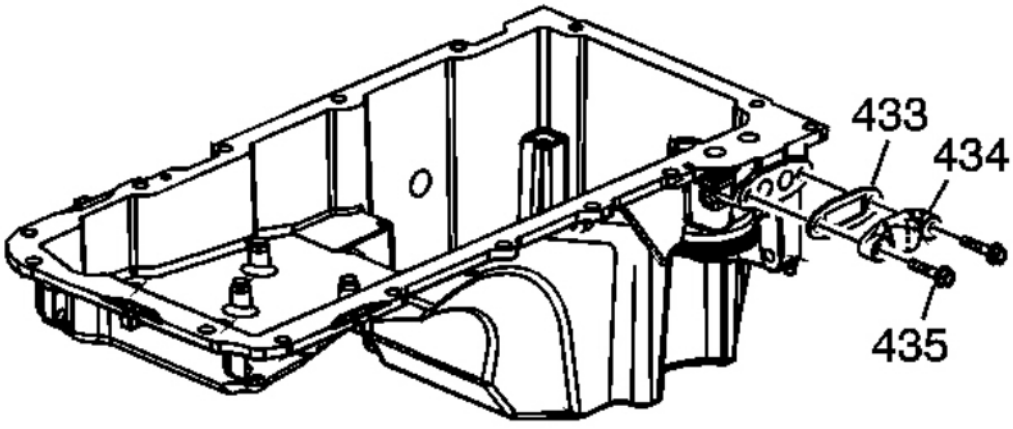


Fig. 298: View Of Oil Pan Cover, Bolts & Gasket
Courtesy of GENERAL MOTORS CORP.

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

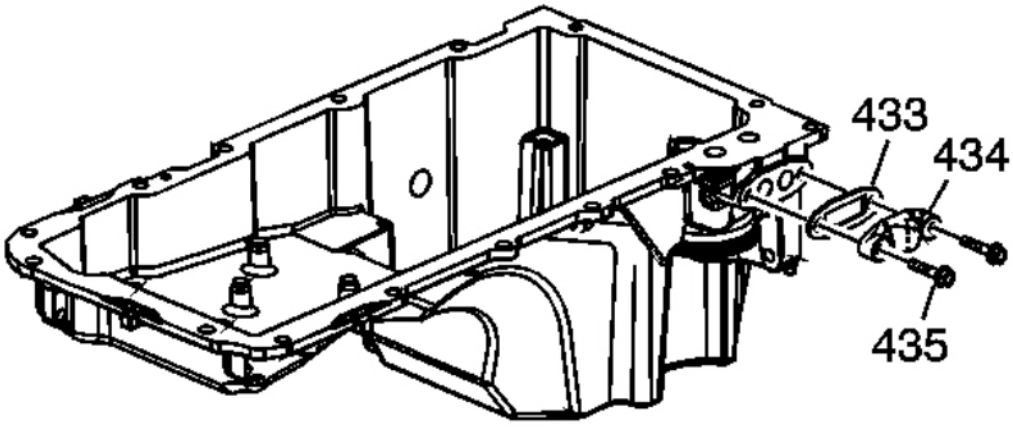


Fig. 299: View Of Oil Pan Cover, Bolts & Gasket

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Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

1. Position a NEW oil pan cover gasket (433) and the cover (434) to the oil pan and install the bolts (435).

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

2. Lower the vehicle.

OIL PAN REPLACEMENT (2WD)

REMOVAL PROCEDURE

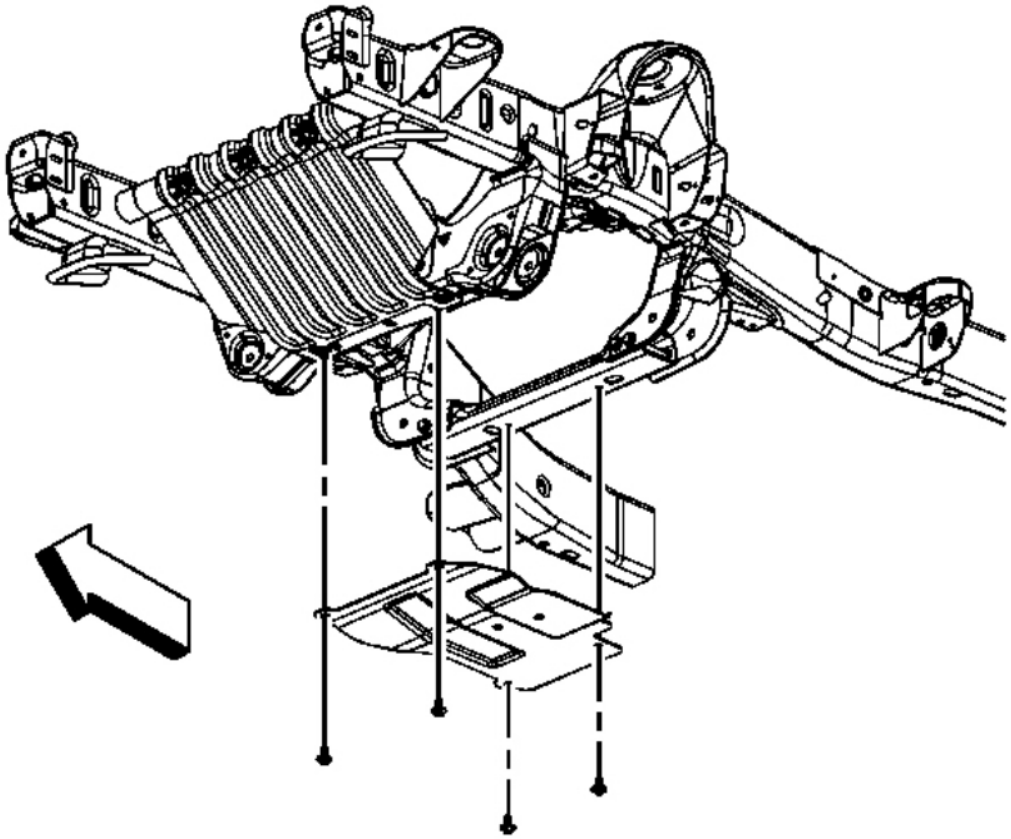


Fig. 300: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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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.

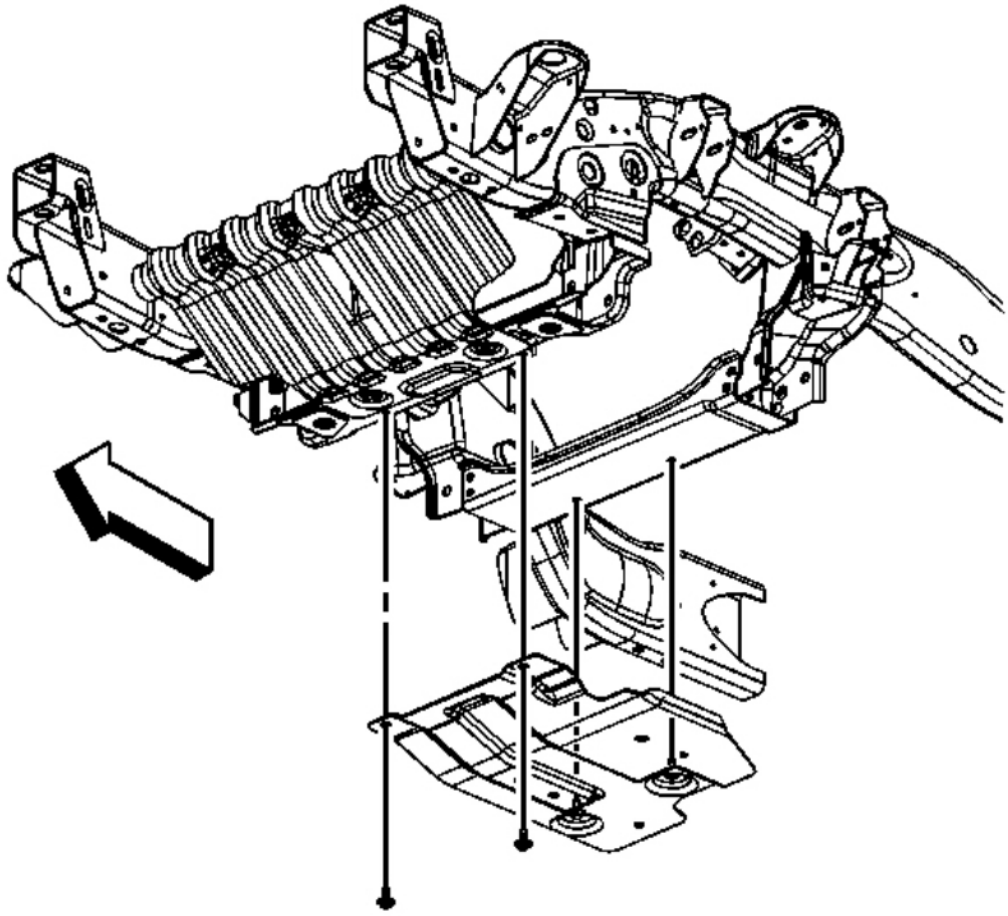


Fig. 301: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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.

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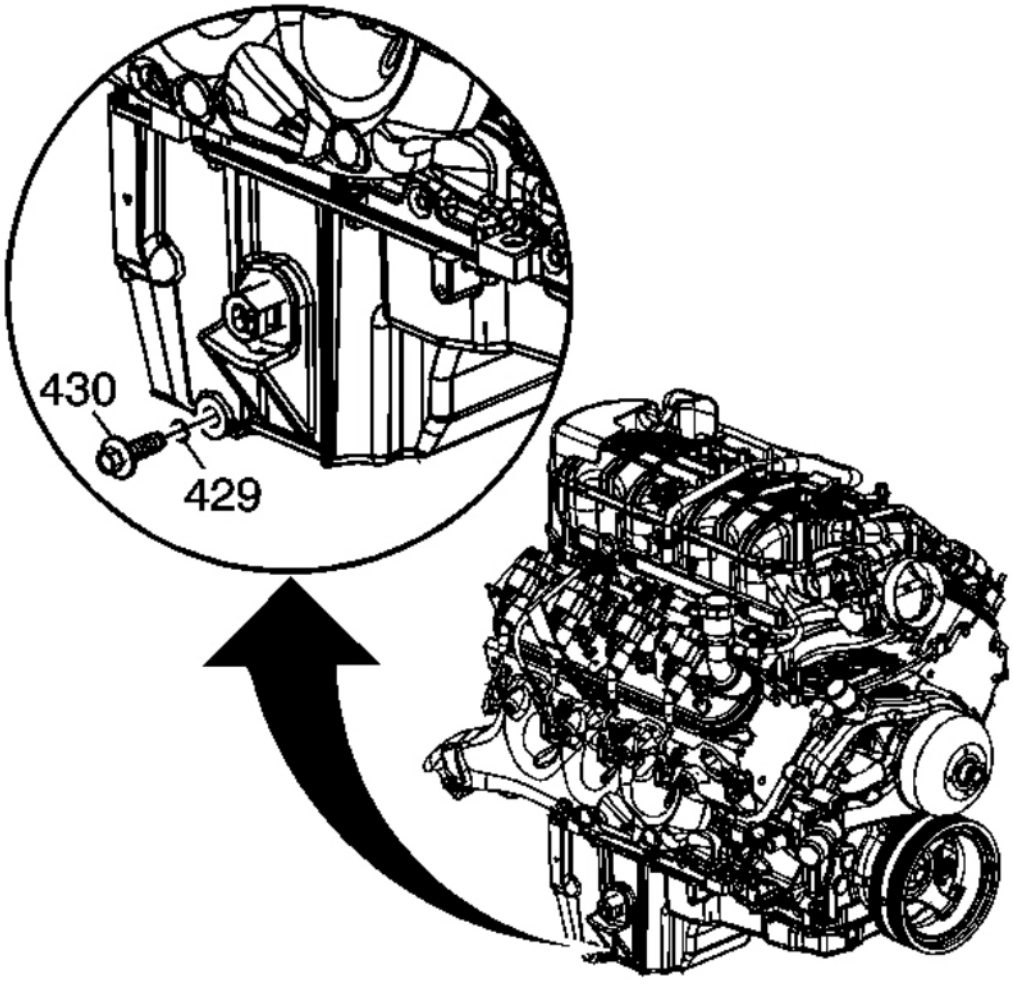


Fig. 302: View Of Oil Pan Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

4. Place a suitable drain pan under the oil pan drain plug.
5. Remove the oil pan drain plug (430).
6. Allow the oil pan to drain completely.
7. Re-install the oil pan drain plug until snug.

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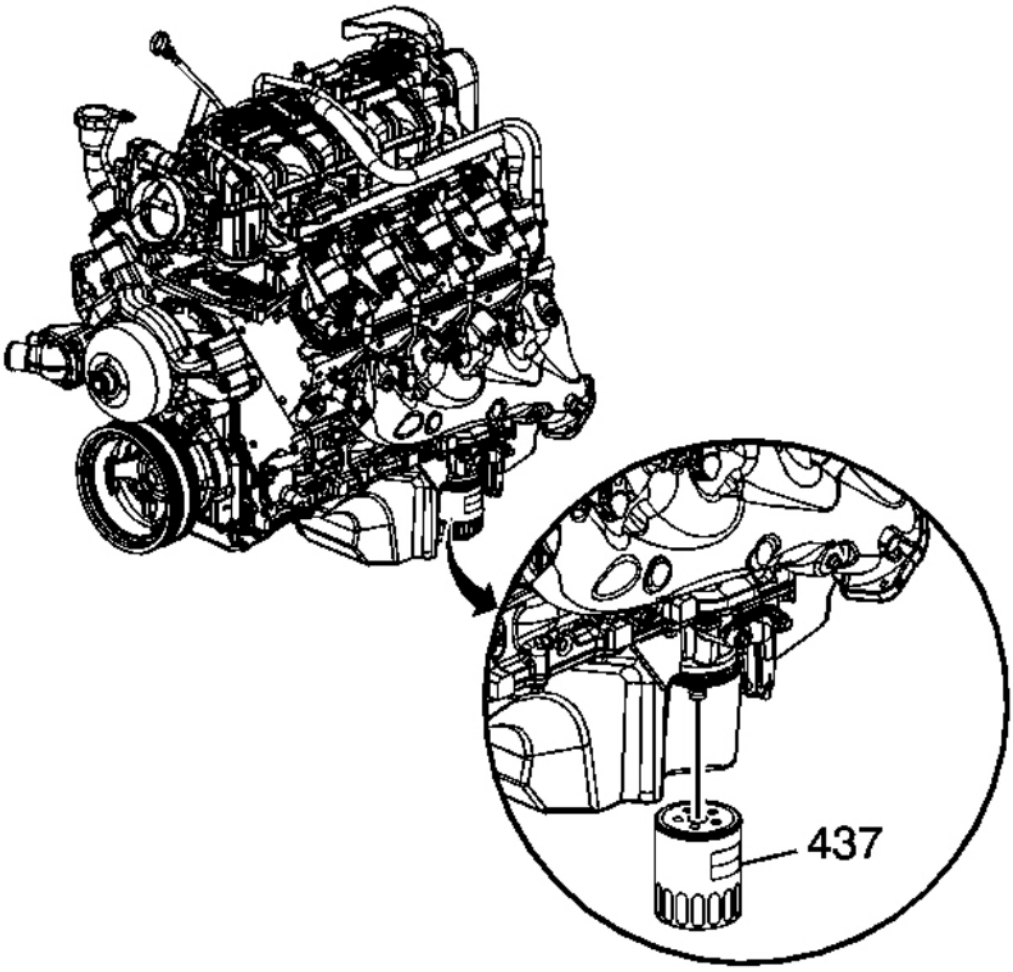


Fig. 303: View Of Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

8. Place the drain pan under the oil filter.
9. Remove the oil filter (437).
10. Allow the oil to drain completely.
11. Re-install the oil filter until snug.

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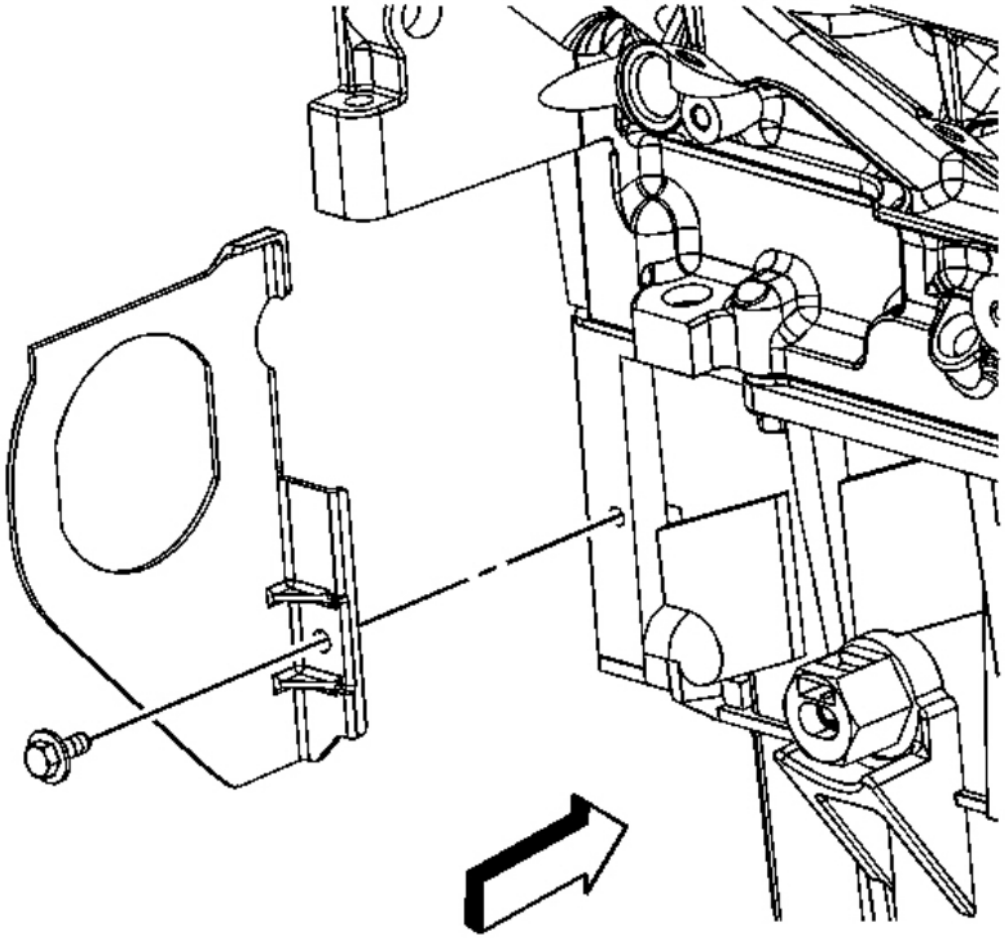


Fig. 304: View Of Right Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

12. Remove the right side transmission cover bolt.

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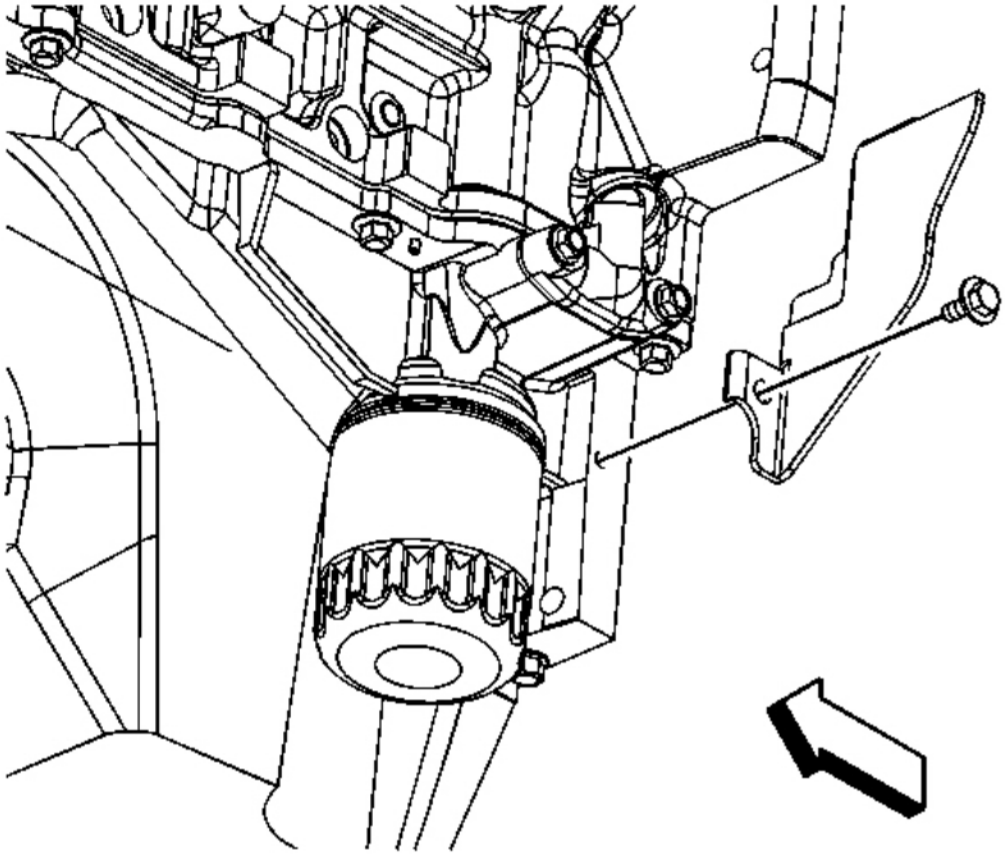


Fig. 305: View Of Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

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

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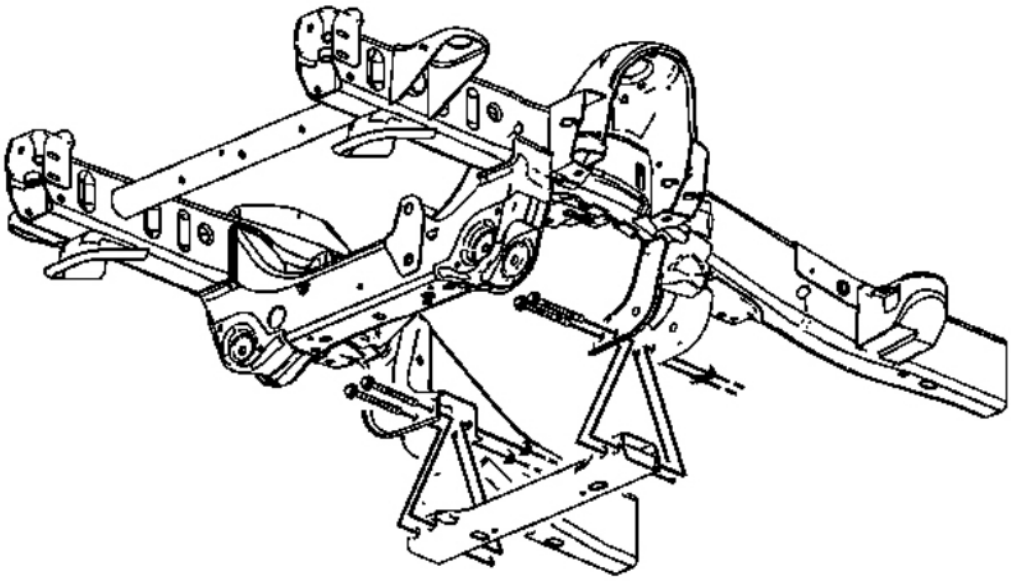


Fig. 306: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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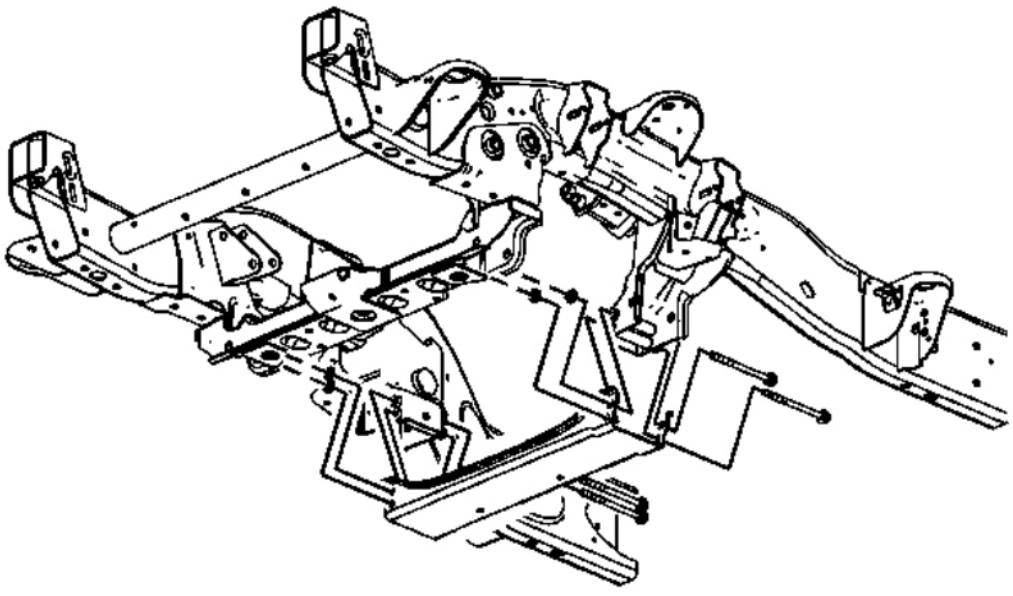


Fig. 307: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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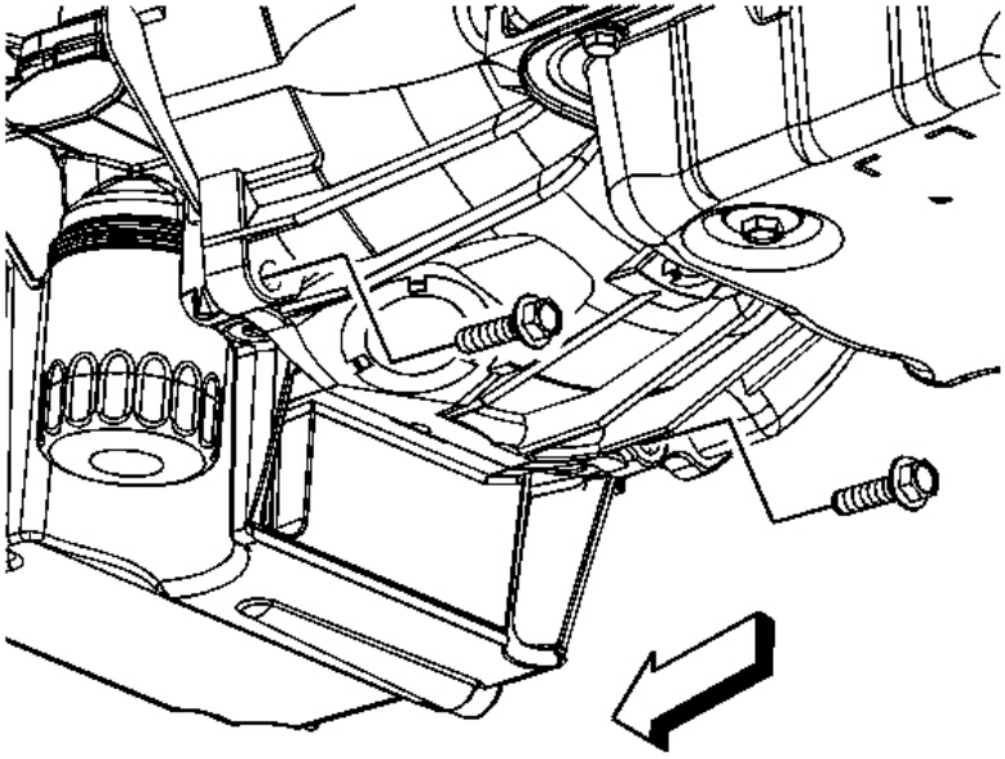


Fig. 308: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

16. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the 2 lower transmission bolts.

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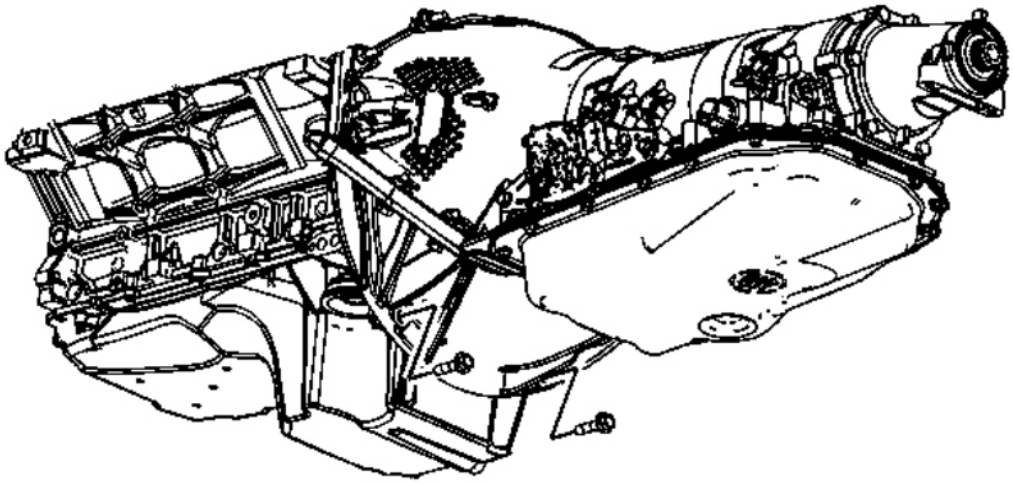


Fig. 309: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

17. For vehicles with a 4L80-E automatic transmission, remove the 2 lower transmission bolts.

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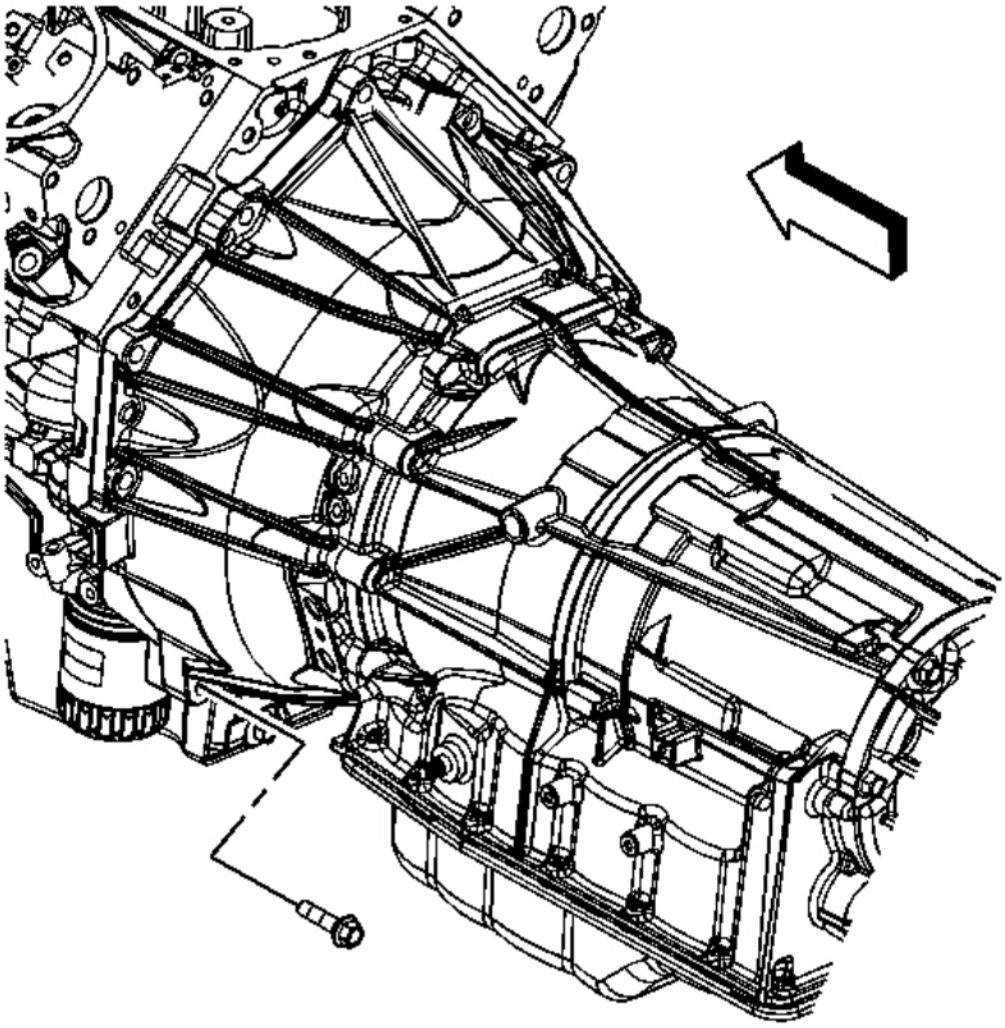


Fig. 310: View Of Lower Transmission Bolt
Courtesy of GENERAL MOTORS CORP.

18. For vehicles with a 6L80-E automatic transmission, remove the lower left transmission bolt.

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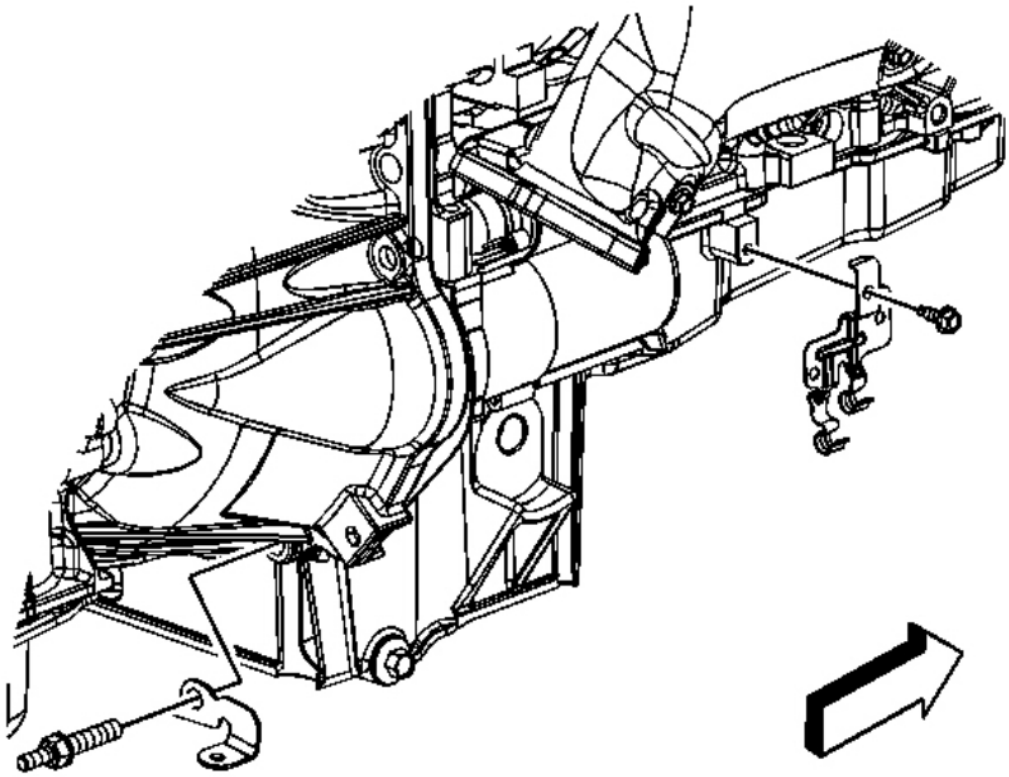


Fig. 311: View Of Lower Transmission Stud
Courtesy of GENERAL MOTORS CORP.

19. For vehicles with a 6L80-E automatic transmission, remove the lower right transmission stud.

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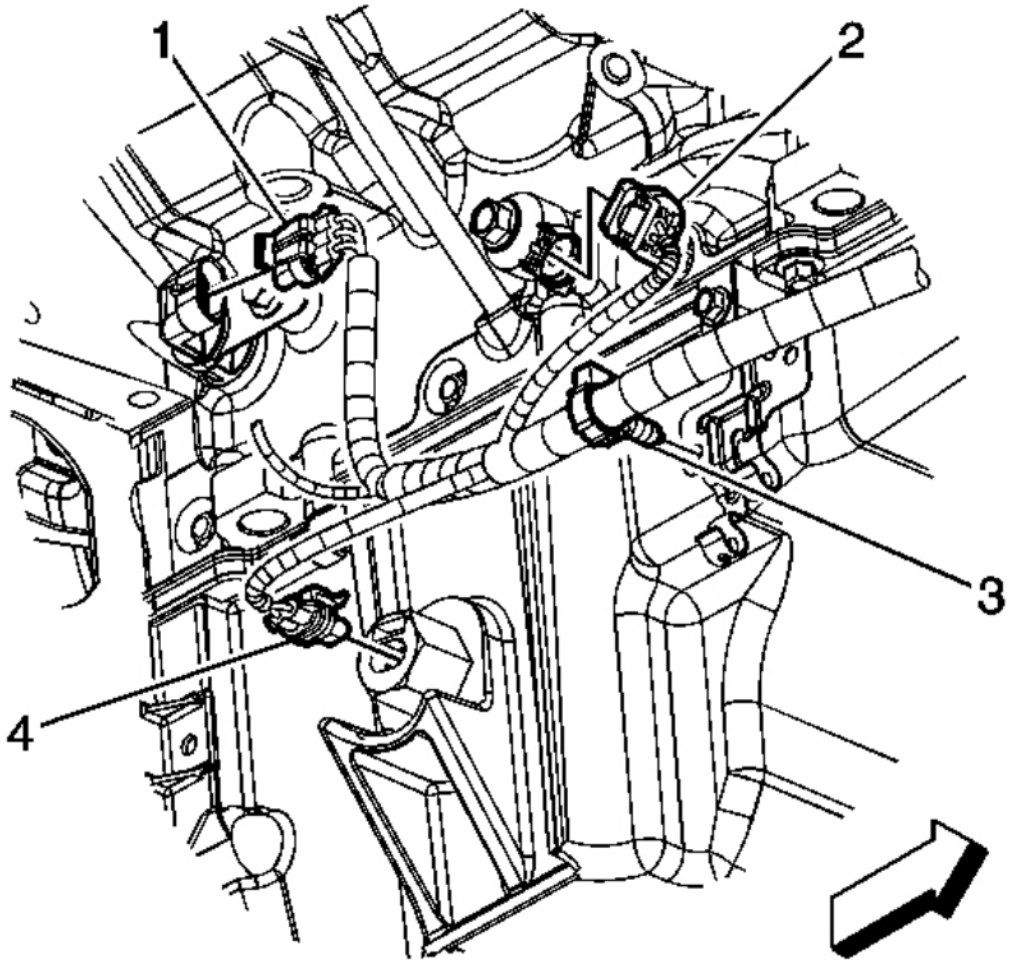


Fig. 312: View Of Electrical Connectors & Clips
Courtesy of GENERAL MOTORS CORP.

20. Disconnect the engine harness electrical connector (4) from the oil level sensor.
21. Remove the engine harness clip (3) from the transmission oil cooler line bracket.

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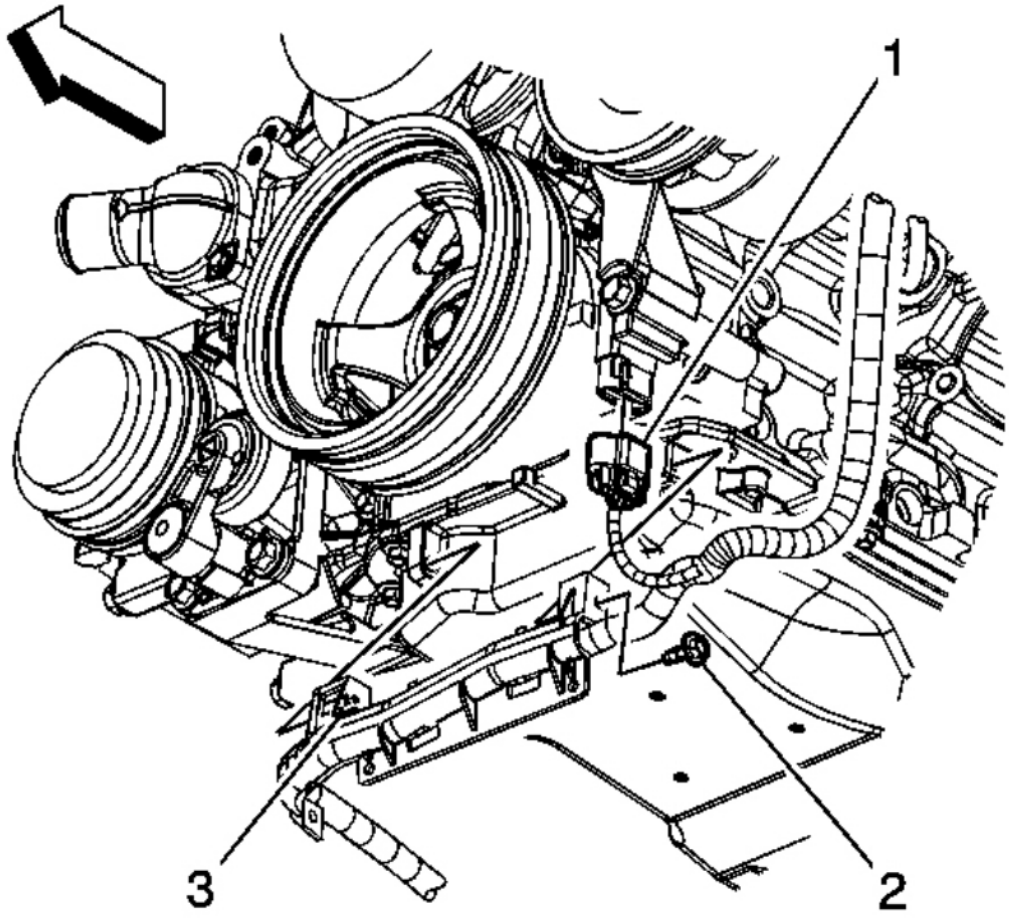


Fig. 313: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

22. Remove the battery cable channel bolt (2).
23. Slide the channel pin (3) out of the oil pan tab.

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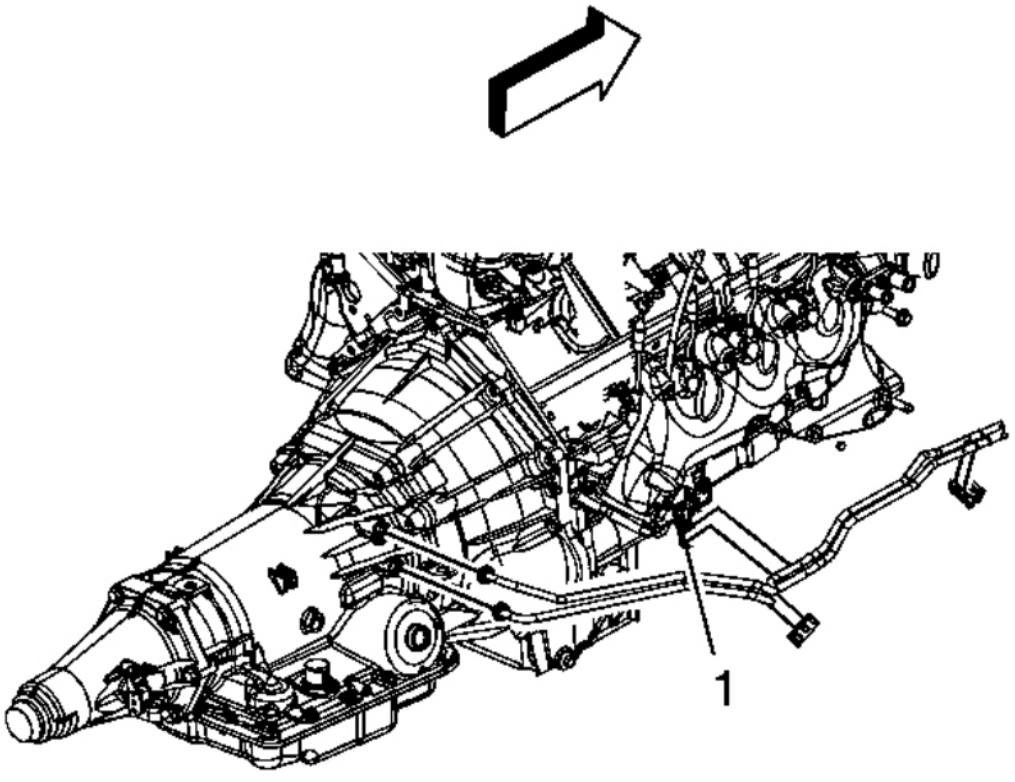


Fig. 314: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

24. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.

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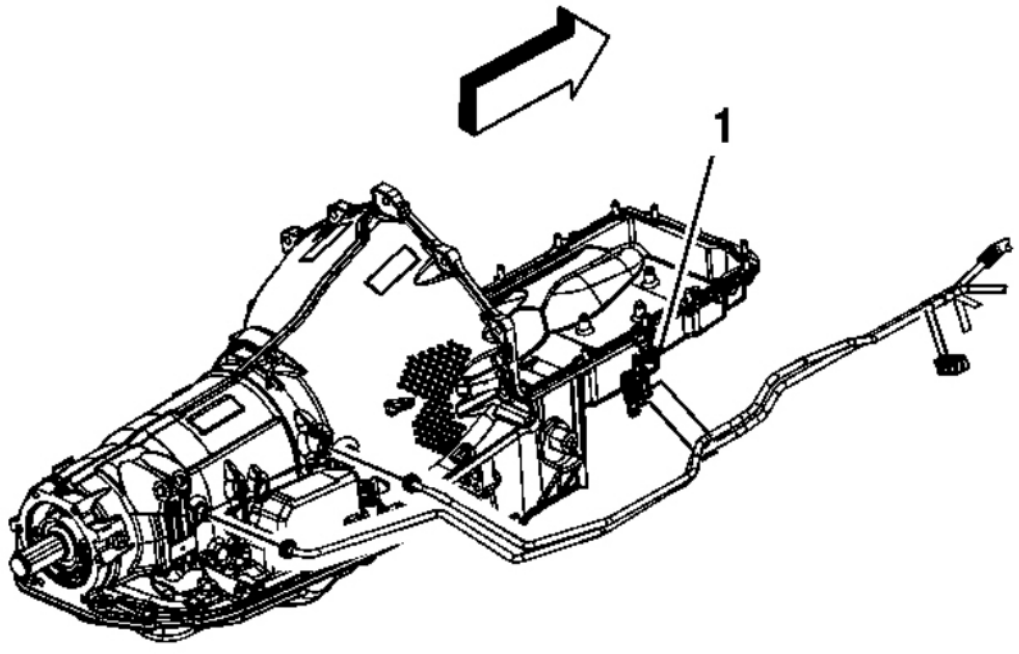


Fig. 315: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

25. For vehicles with a 4L80-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.

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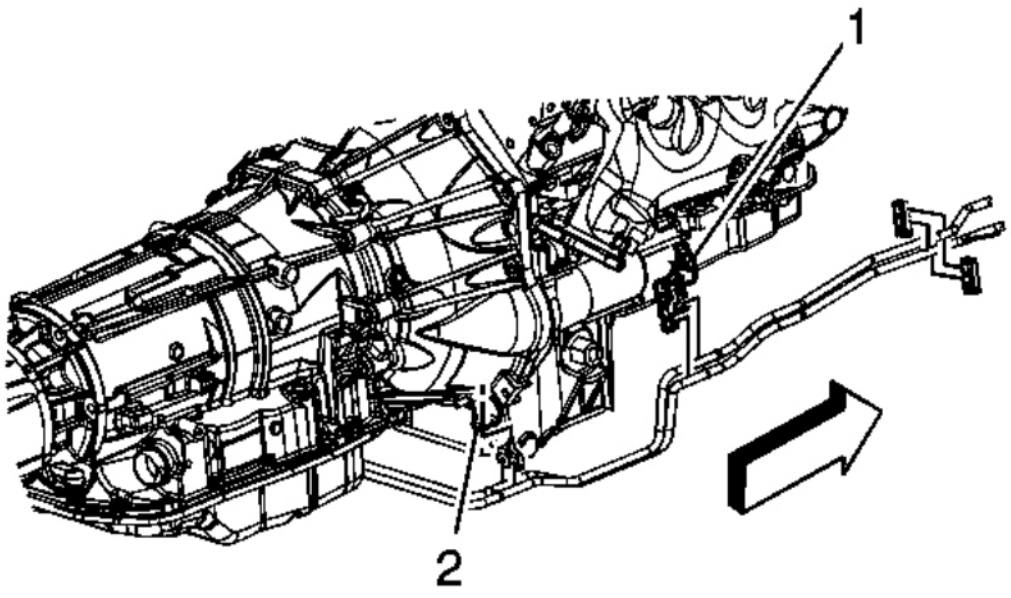


Fig. 316: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

26. For vehicles with a 6L80-E automatic transmission, remove the oil cooler lines from the clip (1).

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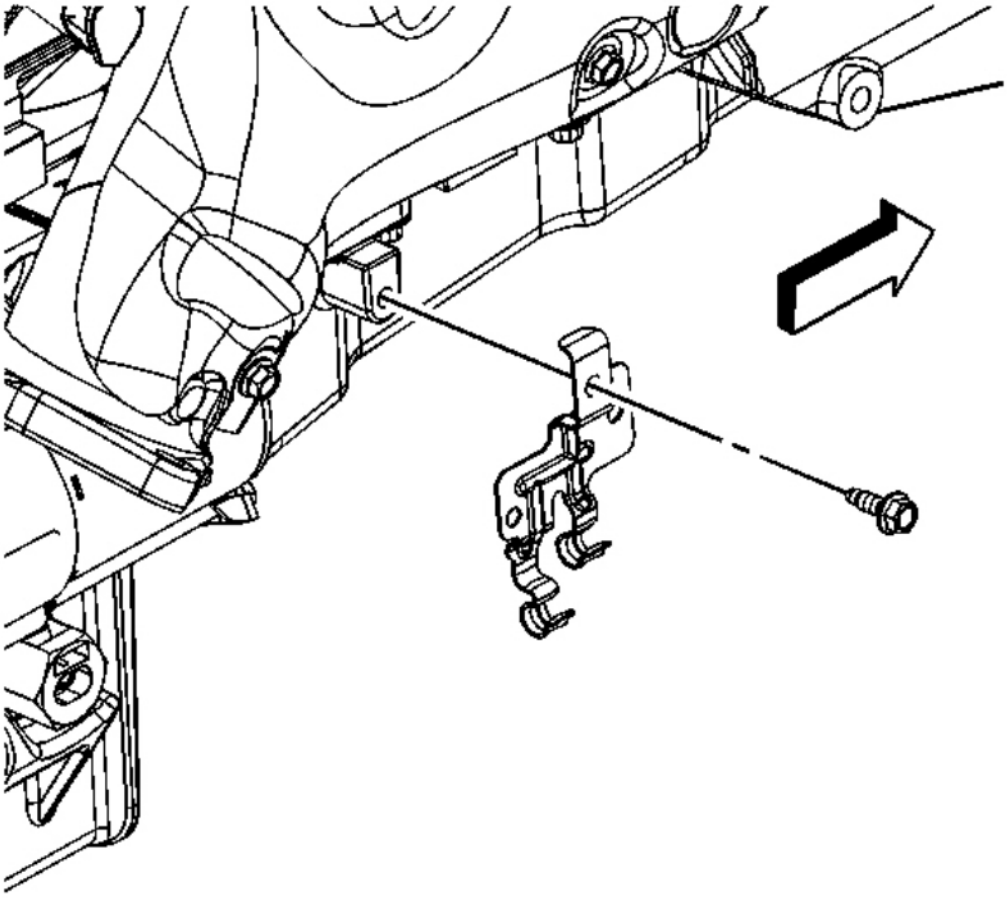


Fig. 317: View Of Oil Cooler Line Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

27. Remove the transmission oil cooler line clip bolt and clip from the oil pan.

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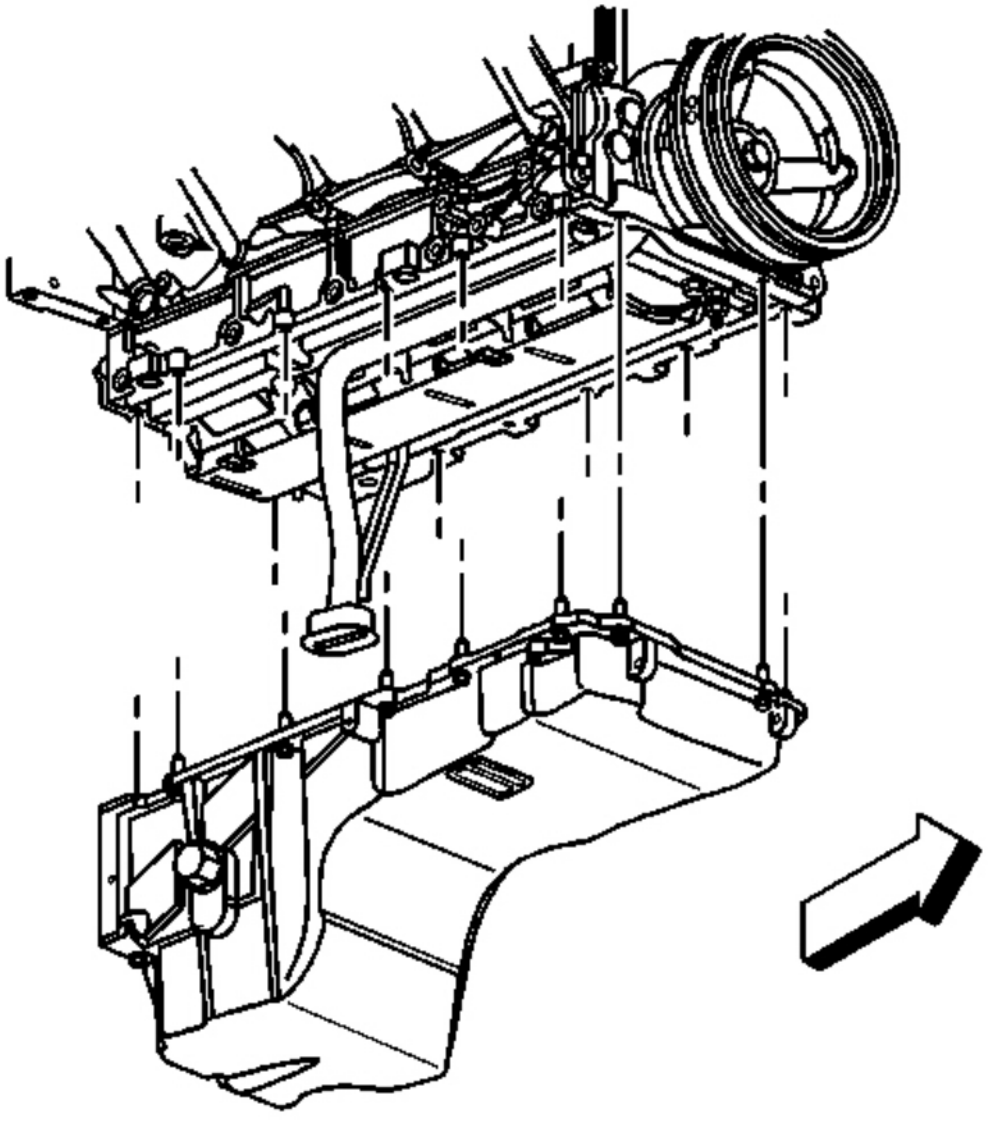


Fig. 318: View Of Oil Pan & Bolts
Courtesy of GENERAL MOTORS CORP.

28. Remove the oil pan bolts.
29. Remove the oil pan.

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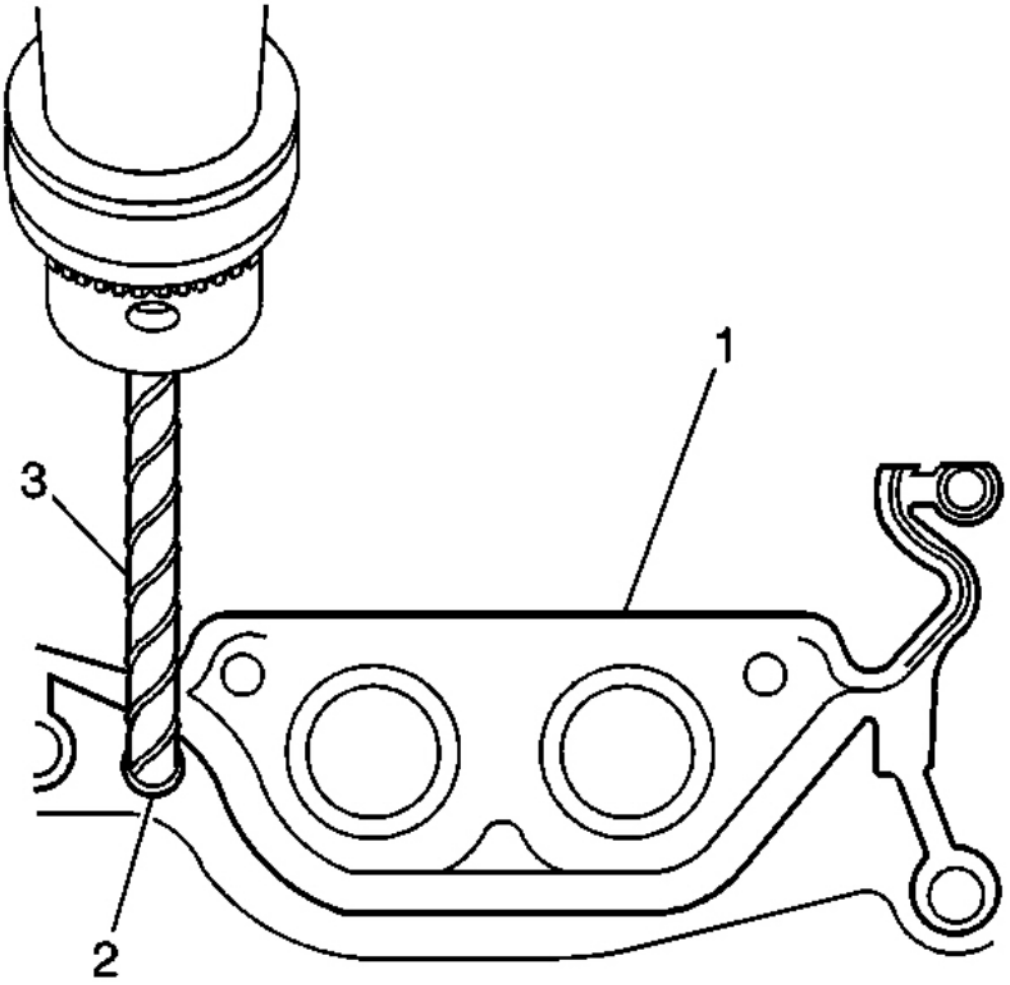


Fig. 319: Drilling Oil Pan Gasket Retaining Rivets
Courtesy of GENERAL MOTORS CORP.

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

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

31. Drill out the oil pan gasket rivets (2), if necessary.
32. Remove the oil pan gasket (1) from the pan.
33. Discard the oil pan gasket.

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34. Discard the rivets, if necessary.

INSTALLATION PROCEDURE

IMPORTANT:

- **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.**

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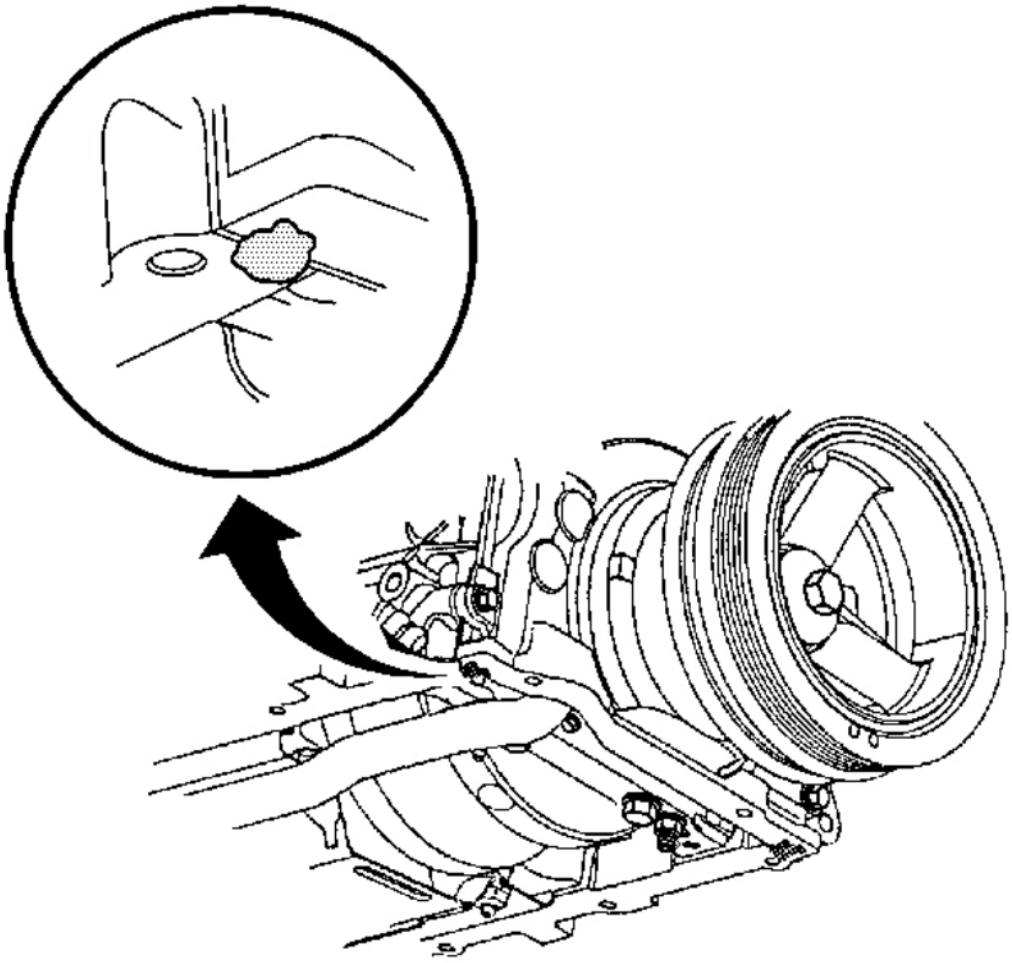


Fig. 320: View Of Sealant Applied To Front Oil Pan-To-Engine Block Junction
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: 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 **Sealers, Adhesives, and Lubricants** .

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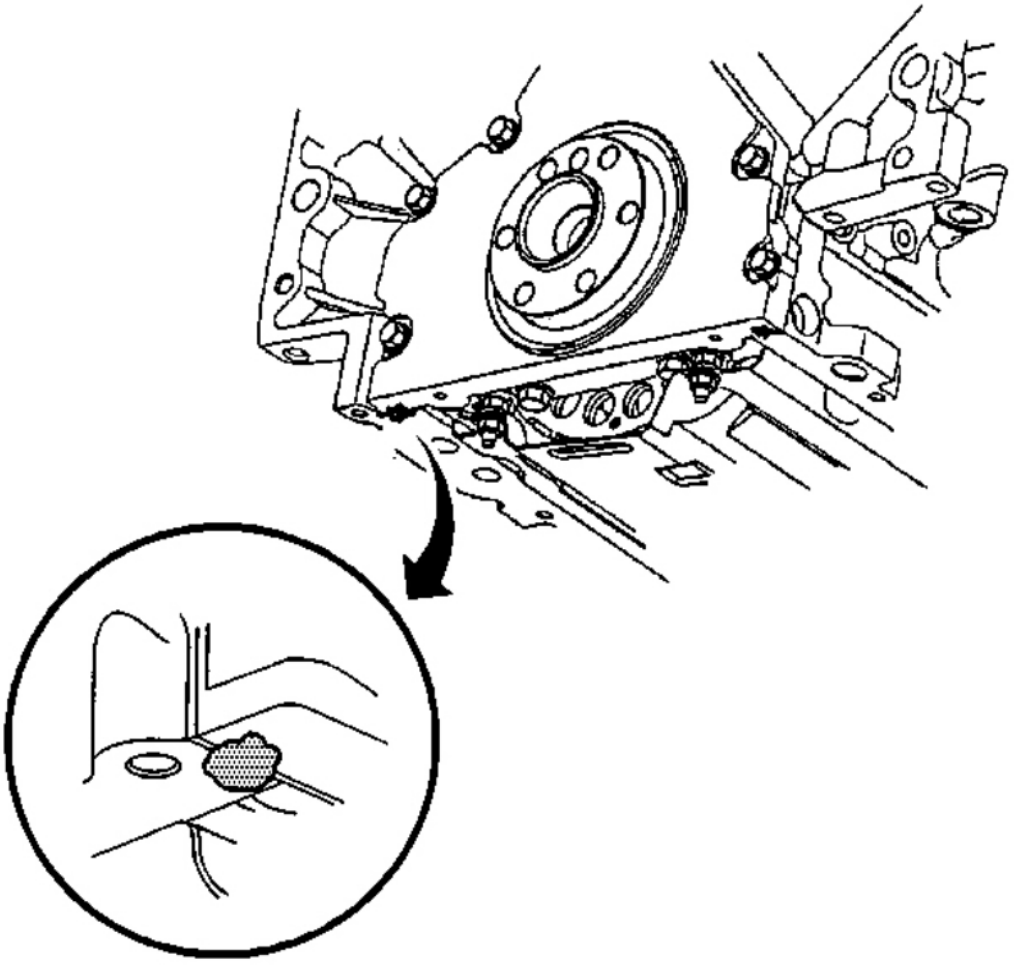


Fig. 321: View Of Sealant Applied To Rear Oil Pan-To-Engine Block Junction
Courtesy of GENERAL MOTORS CORP.

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 **Sealers, Adhesives, and Lubricants** .

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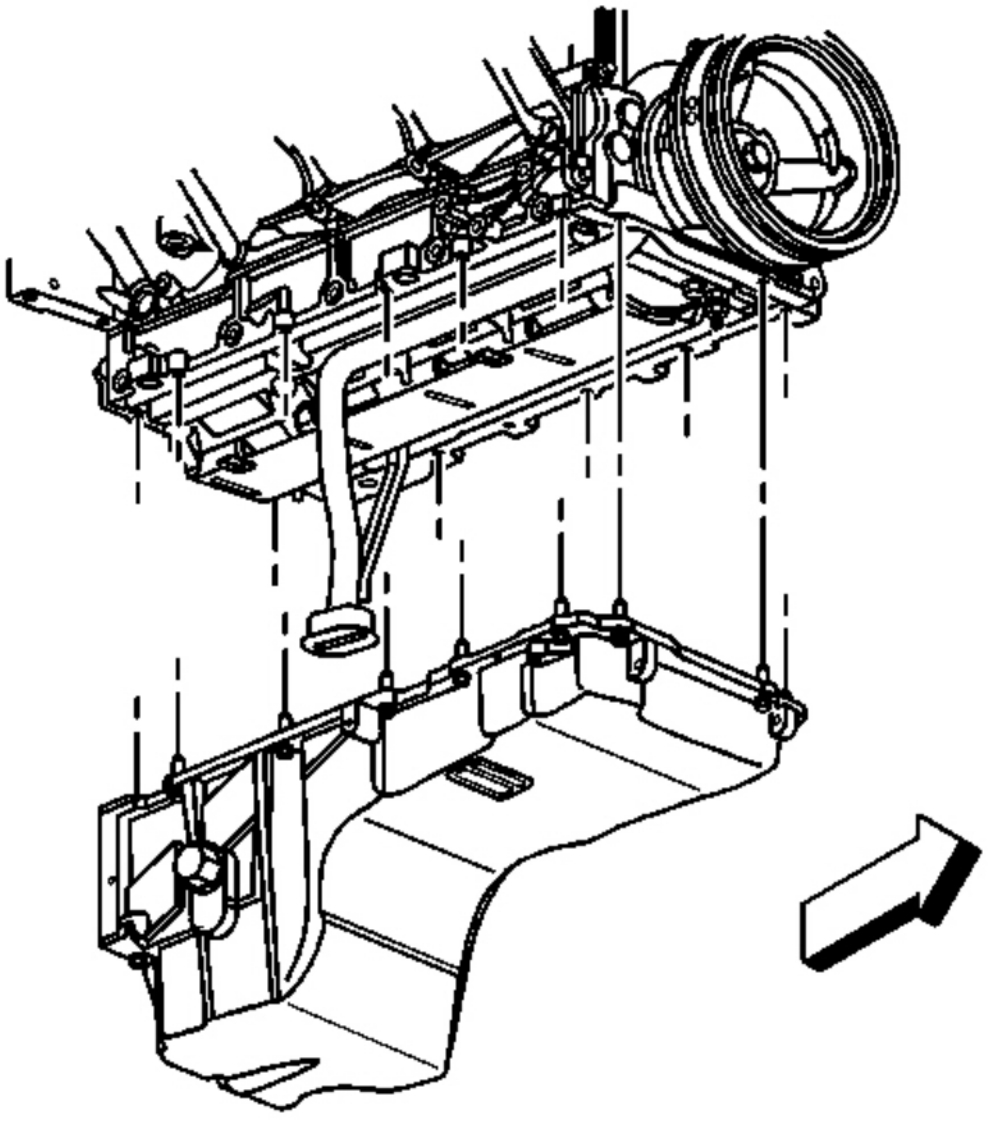


Fig. 322: View Of Oil Pan & Bolts
Courtesy of GENERAL MOTORS CORP.

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 until snug.

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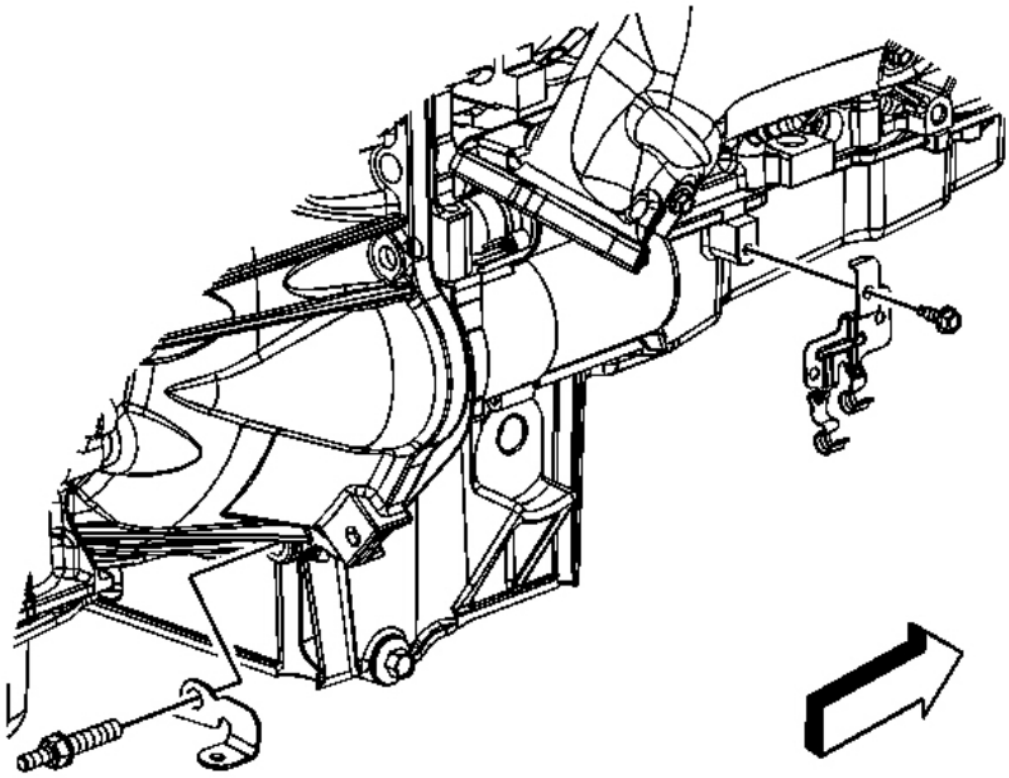


Fig. 323: View Of Lower Transmission Stud
Courtesy of GENERAL MOTORS CORP.

8. For vehicles with a 6L80-E automatic transmission, position the oil cooler bracket and install the lower right transmission stud until snug.

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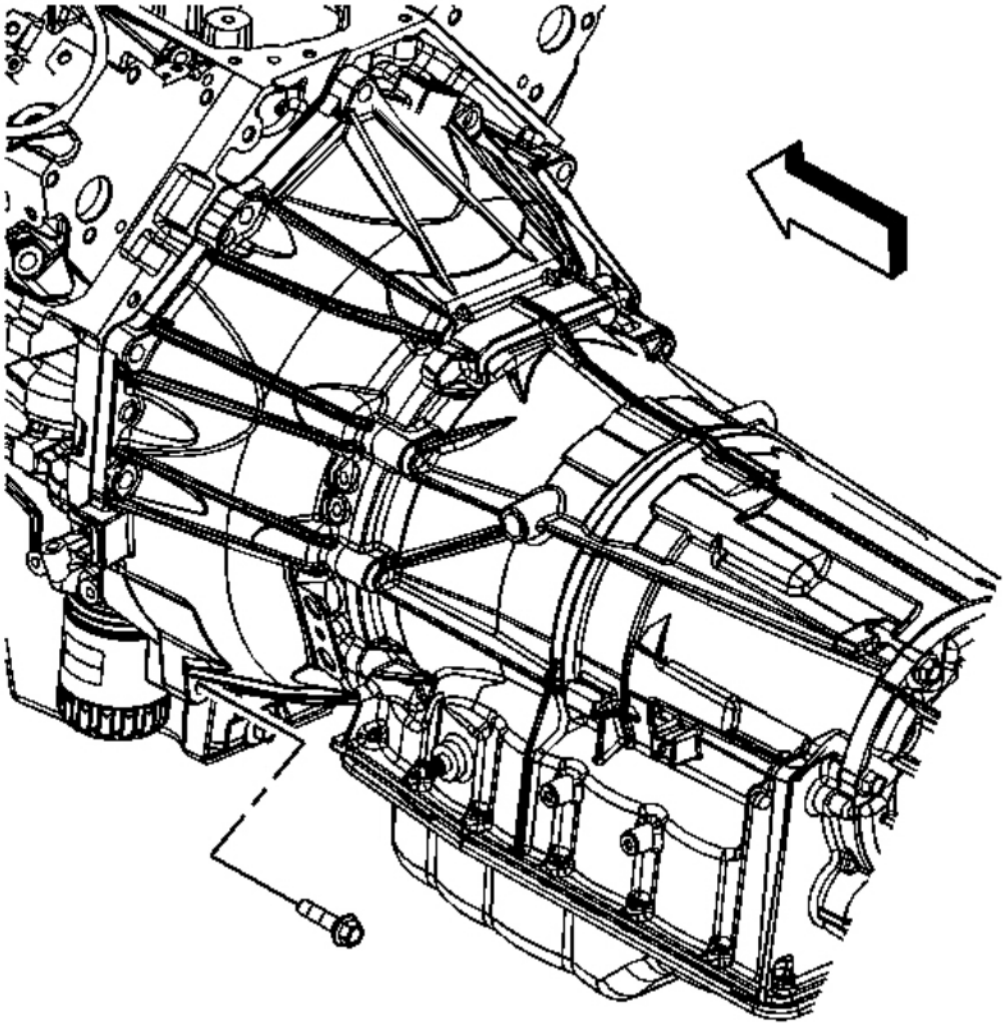


Fig. 324: View Of Lower Transmission Bolt
Courtesy of GENERAL MOTORS CORP.

9. For vehicles with a 6L80-E automatic transmission, install the lower left transmission bolt until snug.

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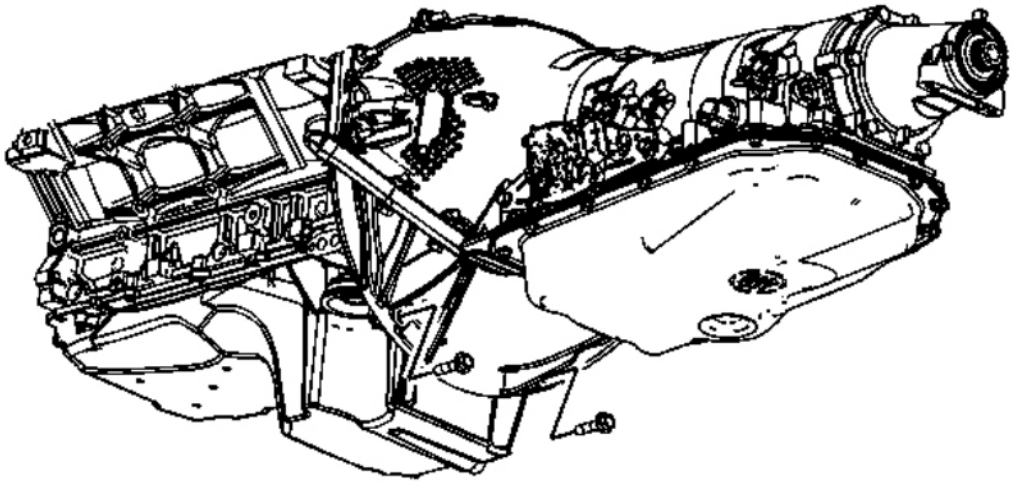


Fig. 325: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

10. For vehicles with a 4L80-E automatic transmission, install the 2 lower transmission bolts until snug.

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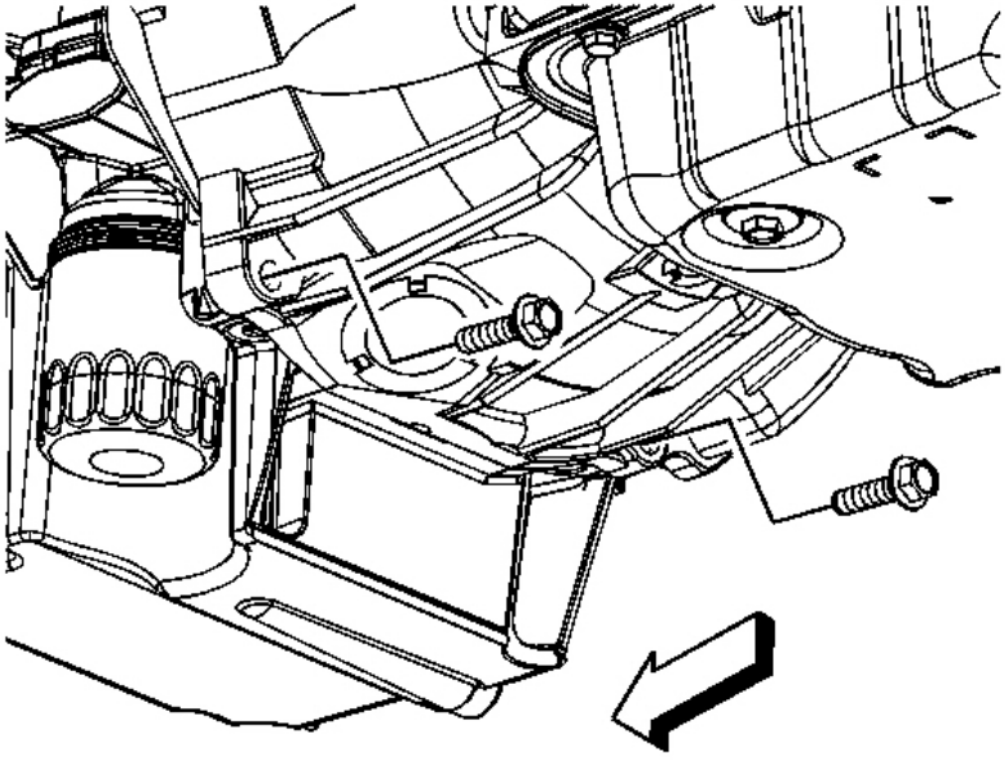


Fig. 326: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

11. For vehicles with a 4L60-E/4L70-E automatic transmission, install the 2 lower transmission bolts until snug.

Tighten:

1. Tighten the oil pan and oil pan-to-oil pan front cover bolts to 25 N.m (18 lb ft).
2. Tighten the oil pan-to-rear cover bolts to 12 N.m (106 lb in).
3. Tighten the transmission bolts/stud to 50 N.m (37 lb ft).

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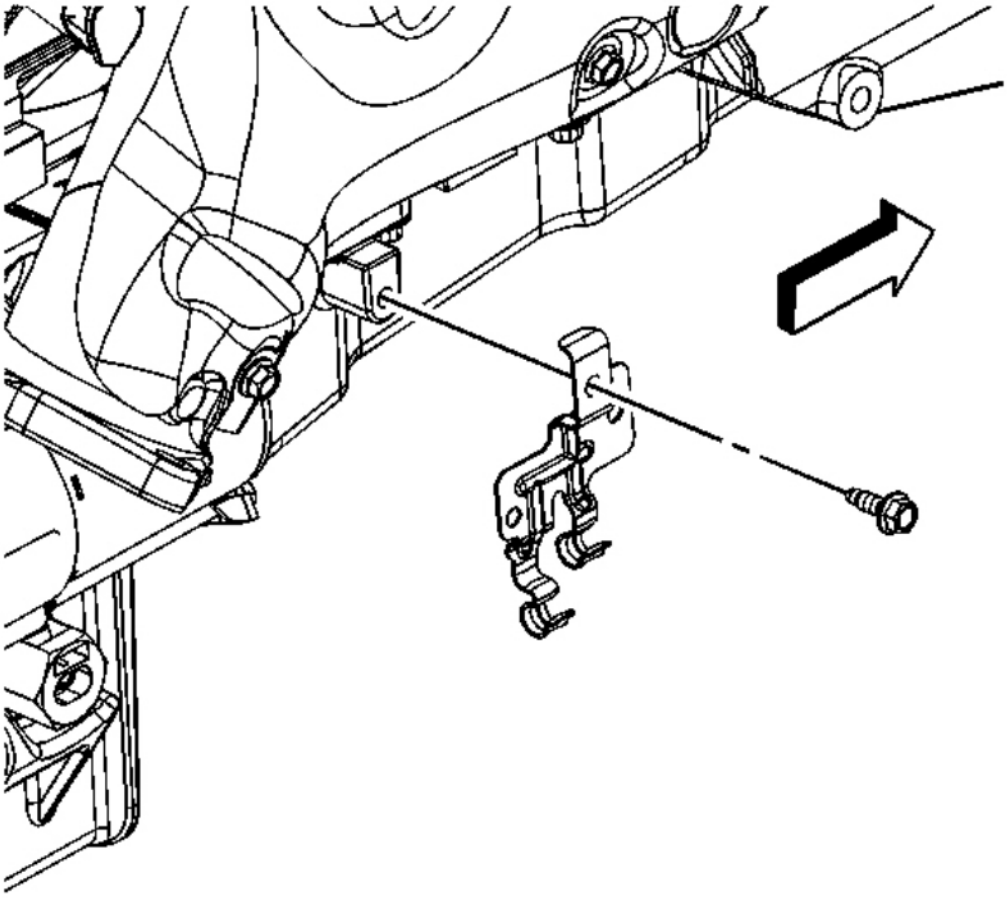


Fig. 327: View Of Oil Cooler Line Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Position the transmission oil cooler line clip and install the bolt to the oil pan.

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

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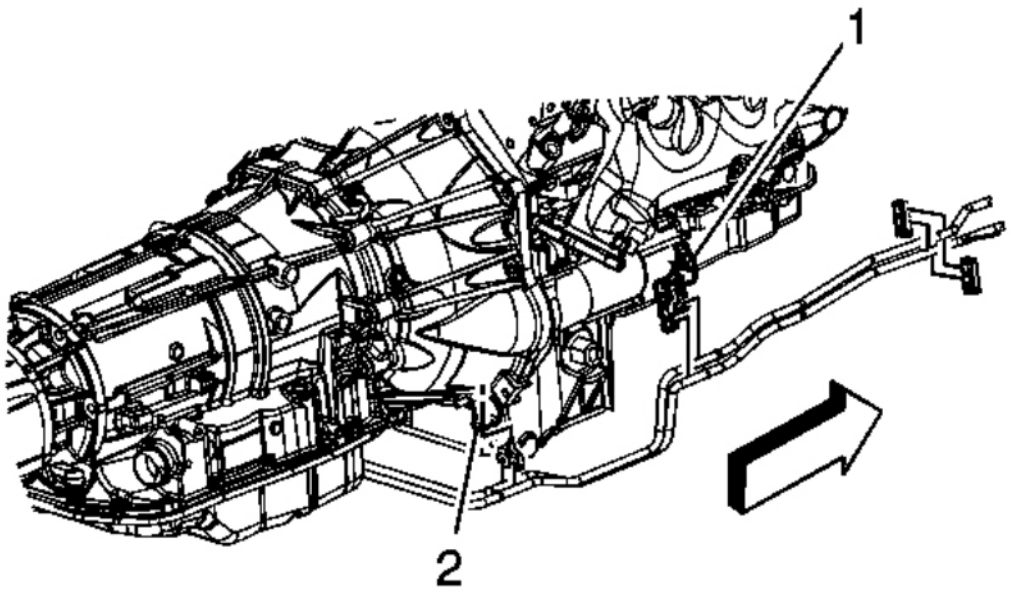


Fig. 328: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

13. For vehicles with a 6L80-E automatic transmission, install the oil cooler lines to the clip (1).

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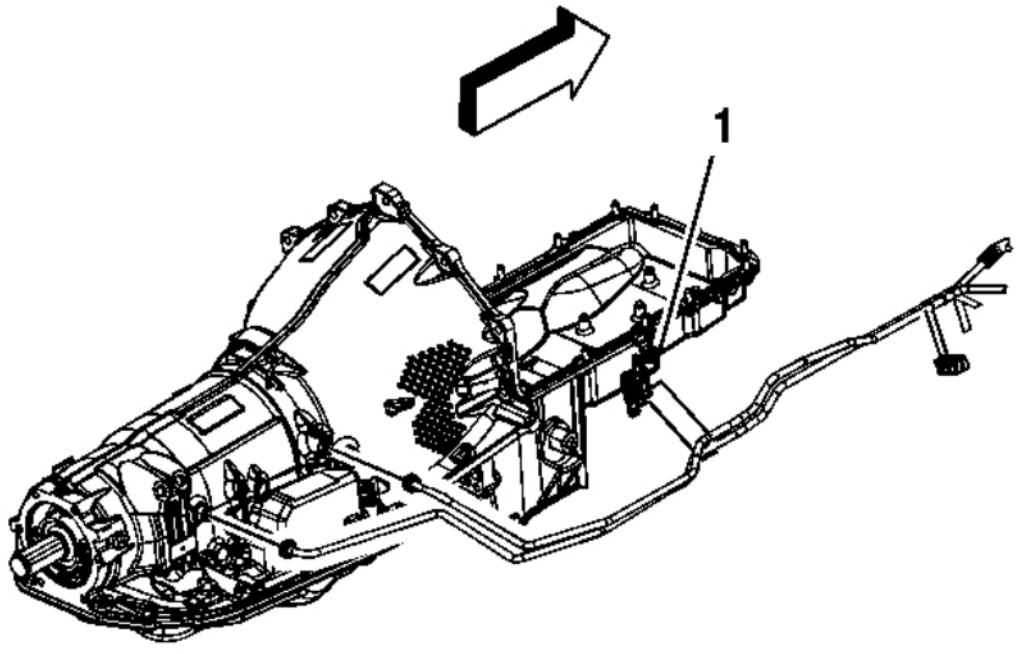


Fig. 329: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

14. For vehicles with a 4L80-E automatic transmission, install the oil cooler lines to the clip (1), if equipped.

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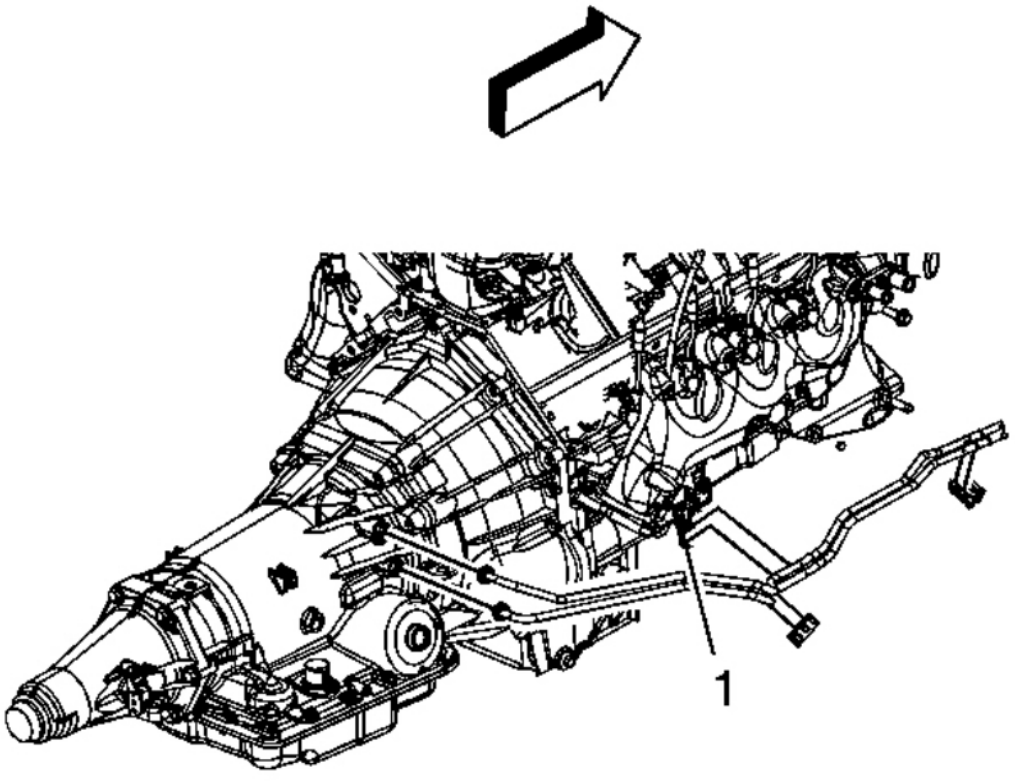


Fig. 330: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

15. For vehicles with a 4L60-E/4L70-E automatic transmission, install the oil cooler lines to the clip (1), if equipped.

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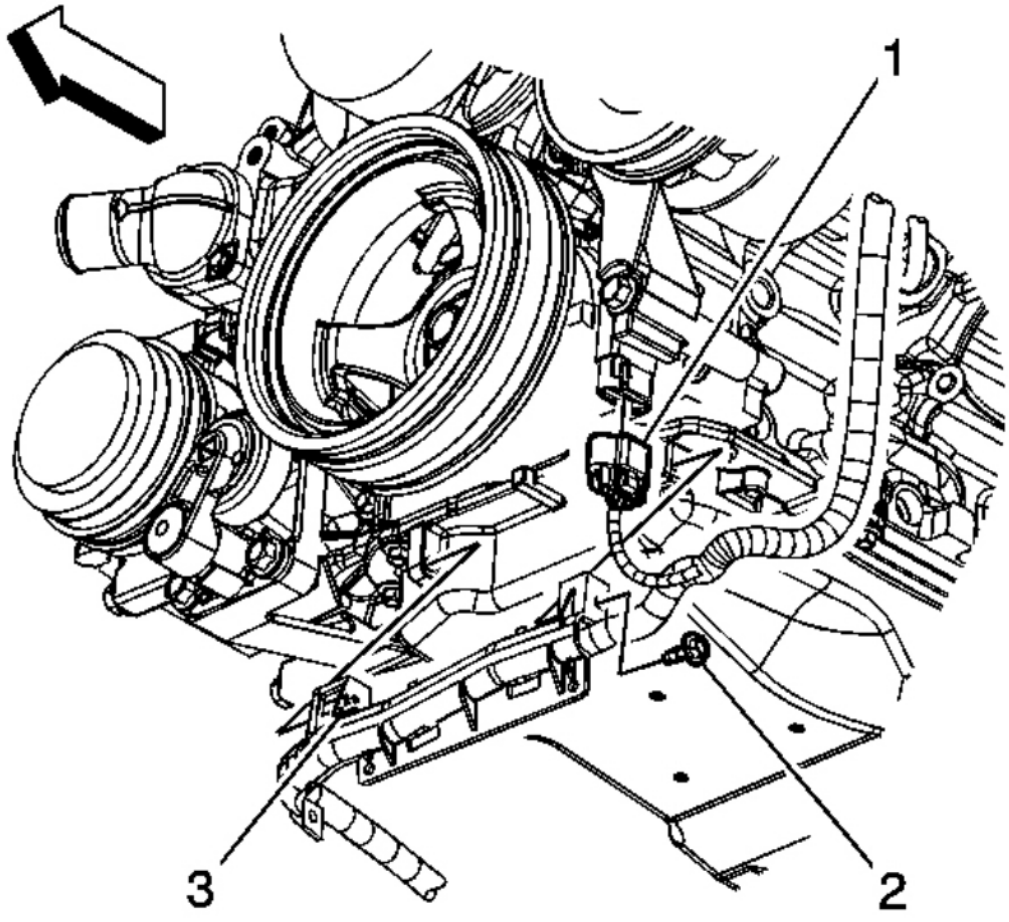


Fig. 331: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

16. Position the channel and slide the channel pin (3) into the oil pan tab.
17. Install the battery cable channel bolt (2).

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

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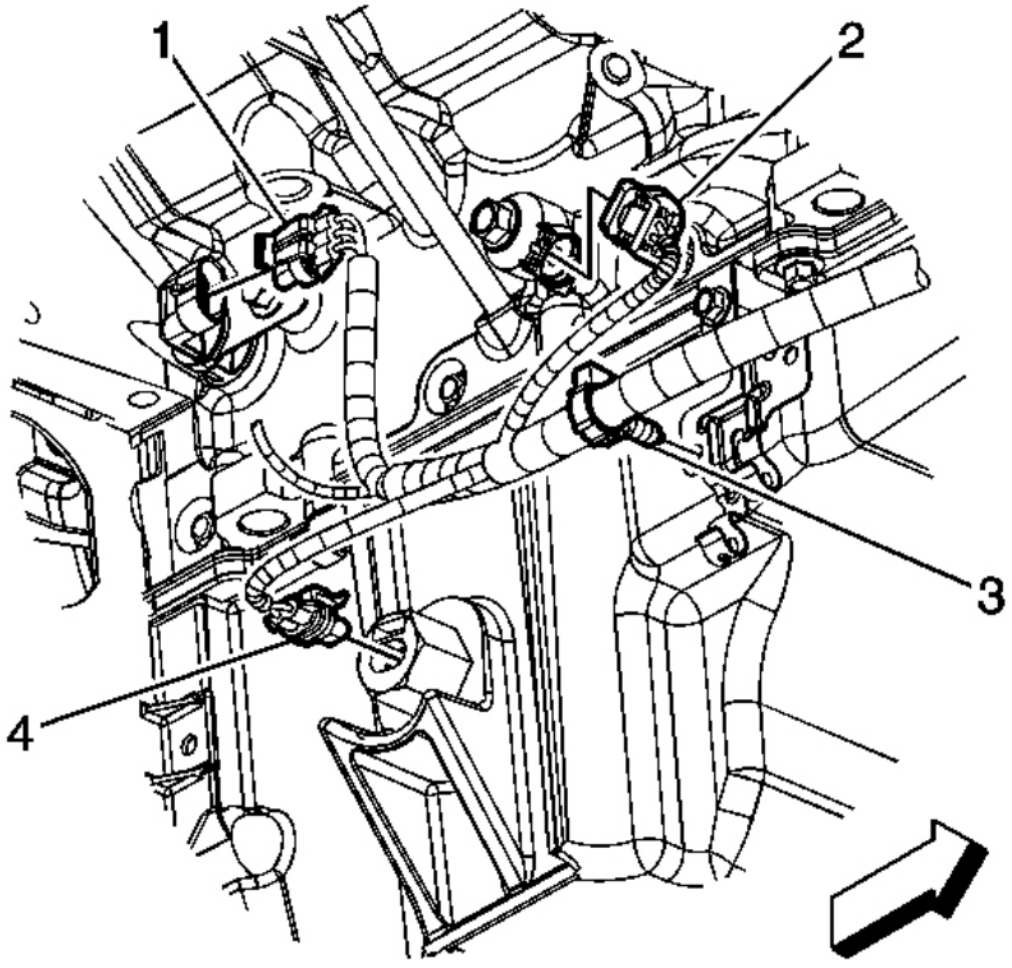


Fig. 332: View Of Electrical Connectors & Clips
Courtesy of GENERAL MOTORS CORP.

18. Connect the engine harness electrical connector (4) to the oil level sensor.
19. Install the engine harness clip (3) to the transmission oil cooler line bracket.

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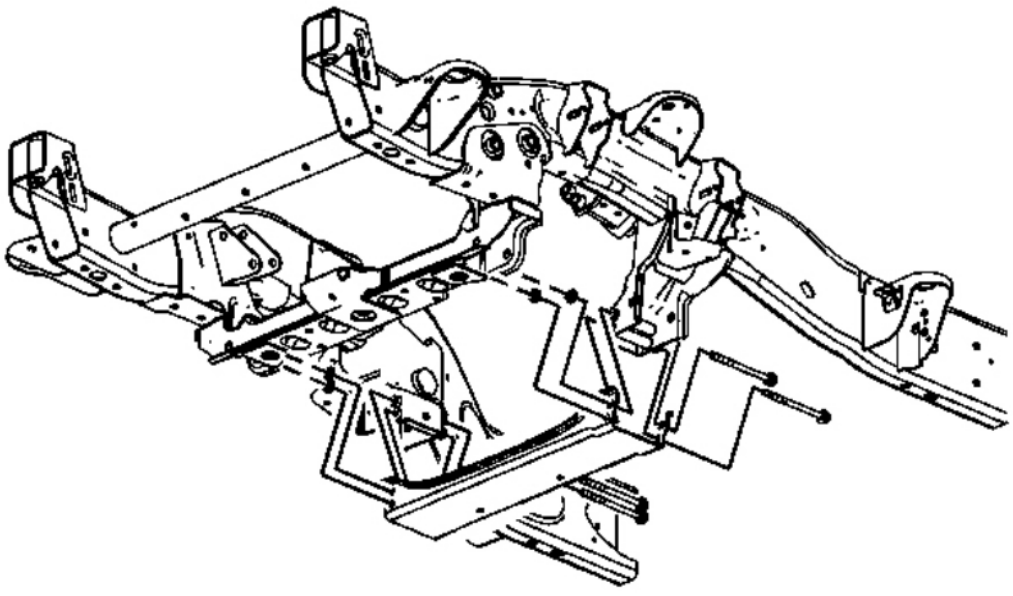


Fig. 333: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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

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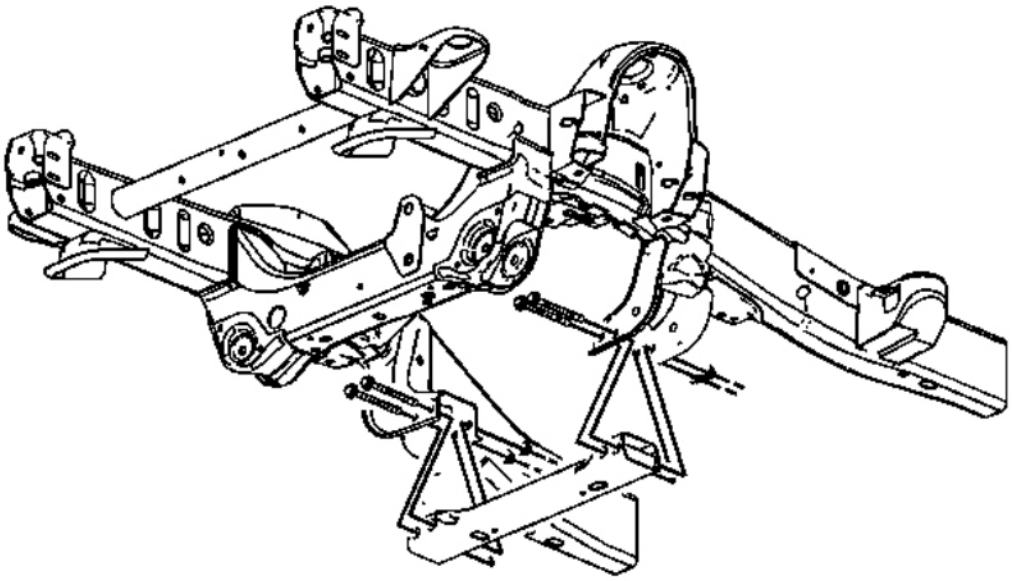


Fig. 334: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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

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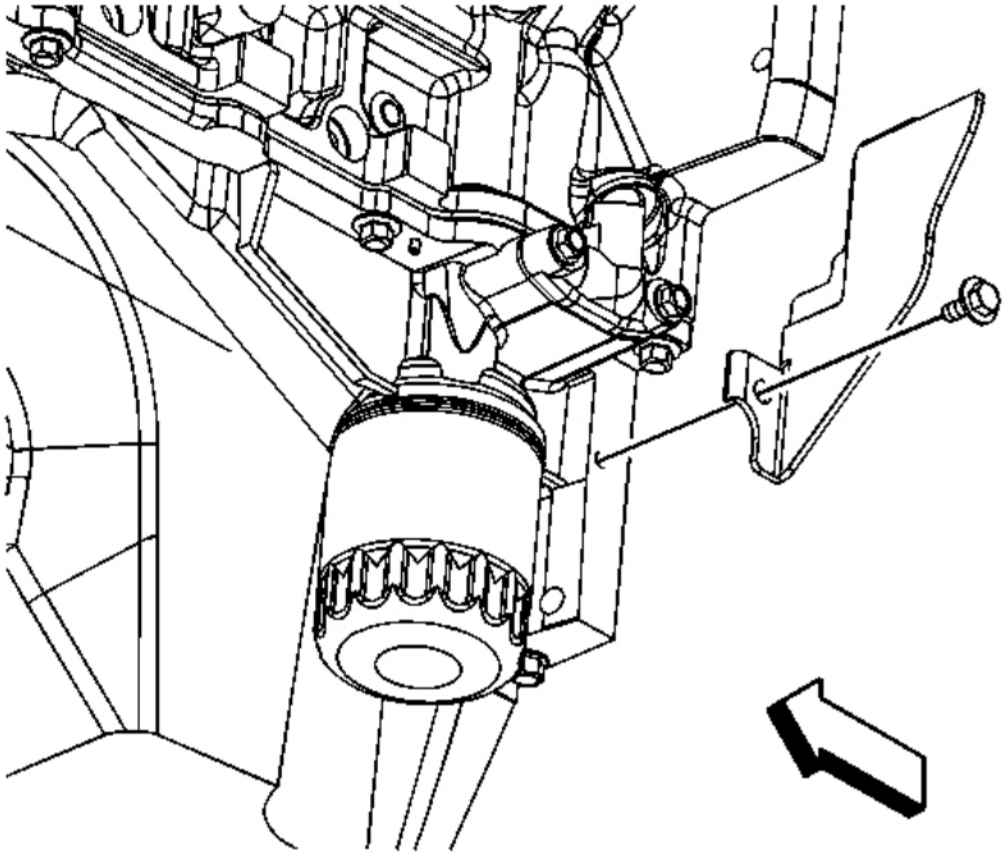


Fig. 335: View Of Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

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

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

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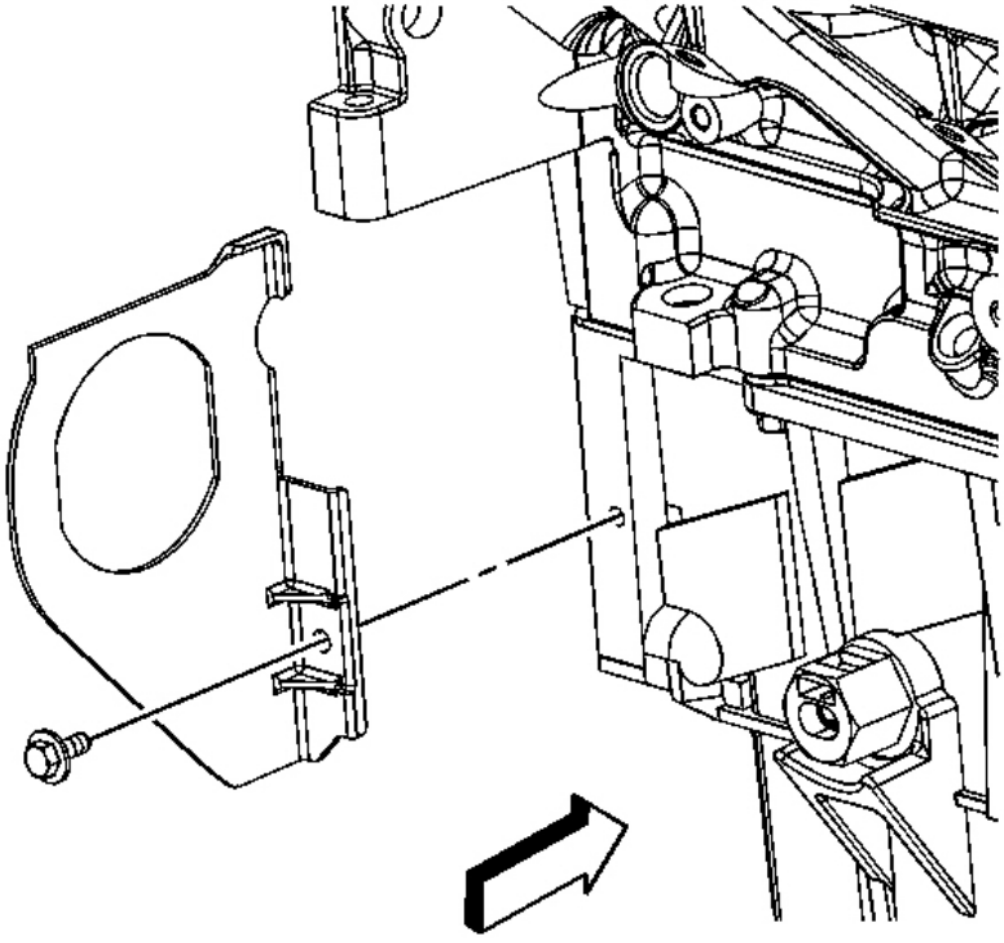


Fig. 336: View Of Right Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

24. Install the right side transmission cover bolt.

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

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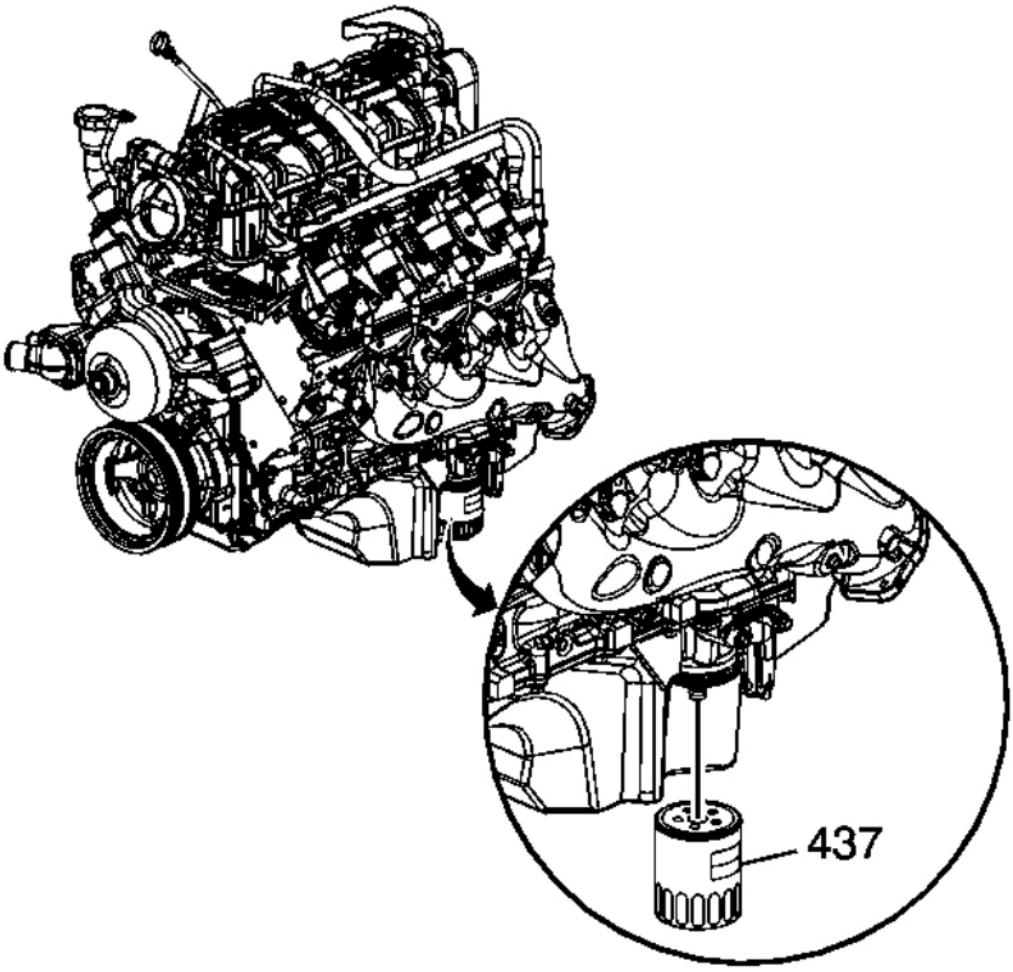


Fig. 337: View Of Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

25. If reusing the old oil pan remove the old oil filter and install a NEW oil filter.
26. Lubricate the NEW oil filter seal with clean engine oil.
27. Install the NEW oil filter (437).

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

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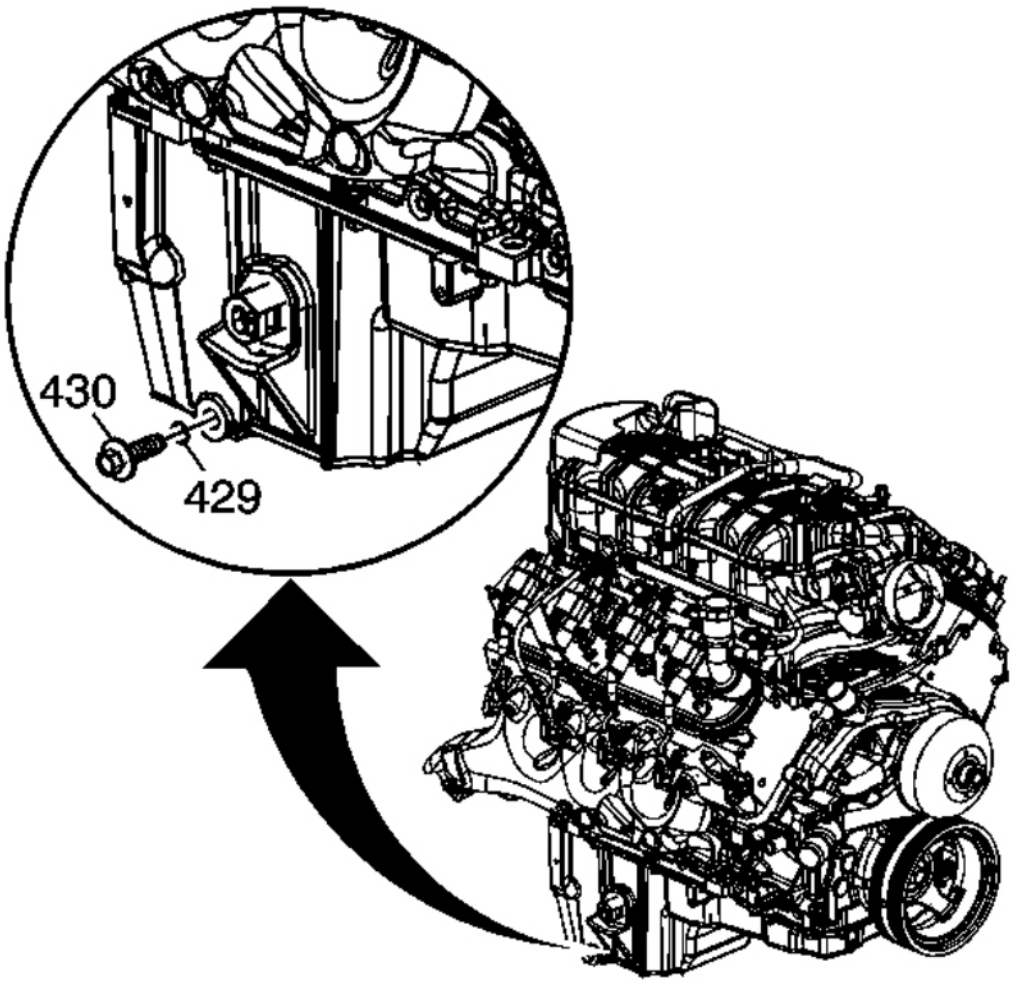


Fig. 338: View Of Oil Pan Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

28. Ensure that the oil pan drain plug (430) is tight.

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

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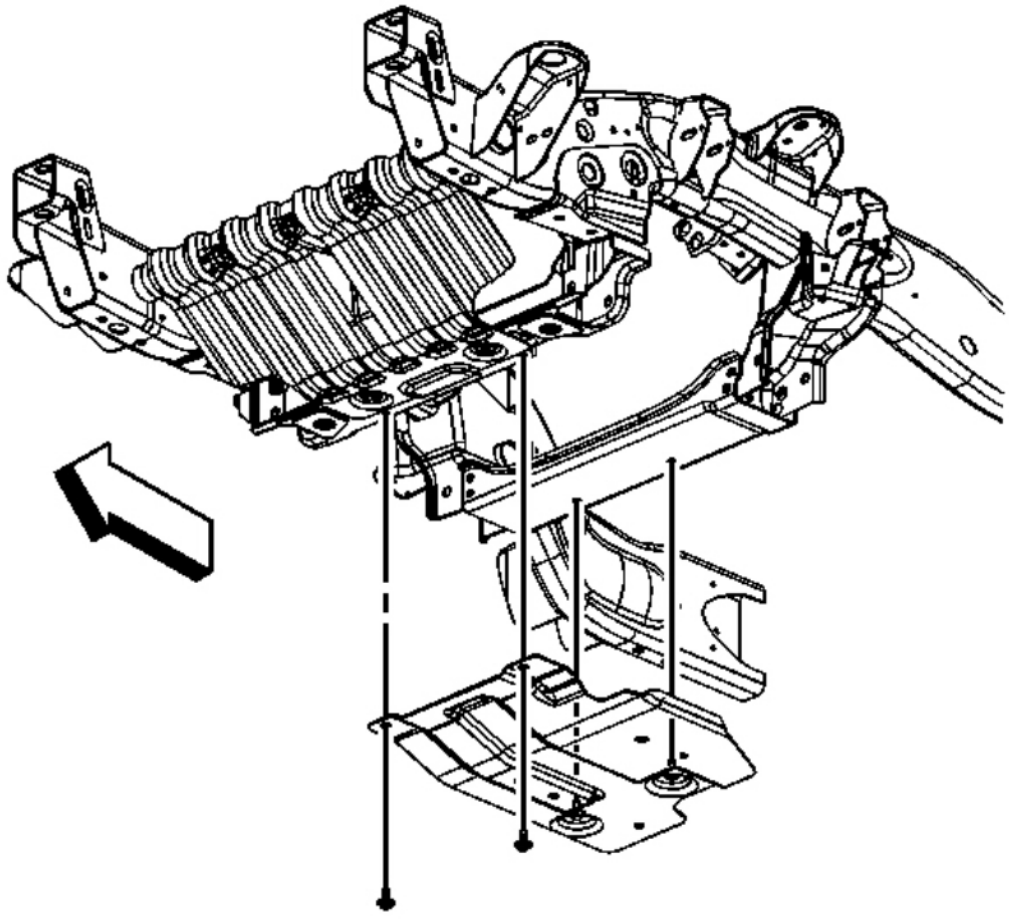


Fig. 339: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

29. 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).

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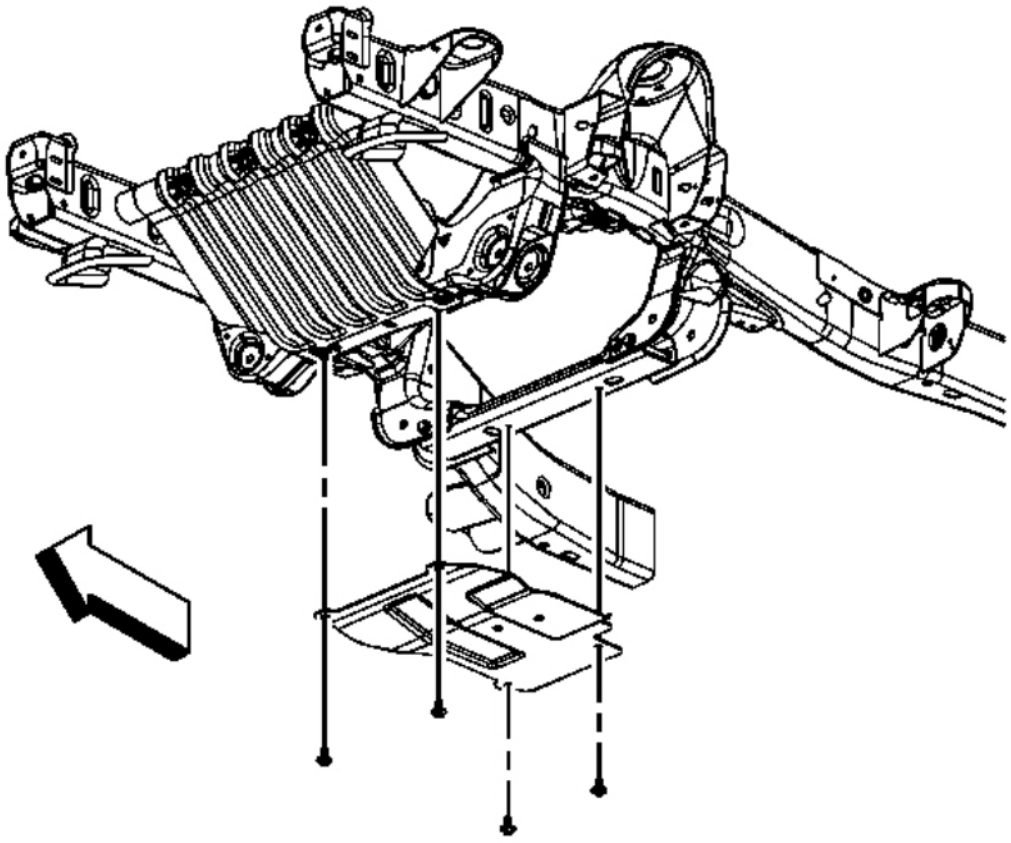


Fig. 340: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

30. 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).

31. Lower the vehicle.
32. Fill the engine with NEW engine oil. Refer to **Fluid and Lubricant Recommendations** and **Capacities - Approximate Fluid** .
33. Start the engine and inspect for leaks.

OIL PAN REPLACEMENT (4WD)

REMOVAL PROCEDURE

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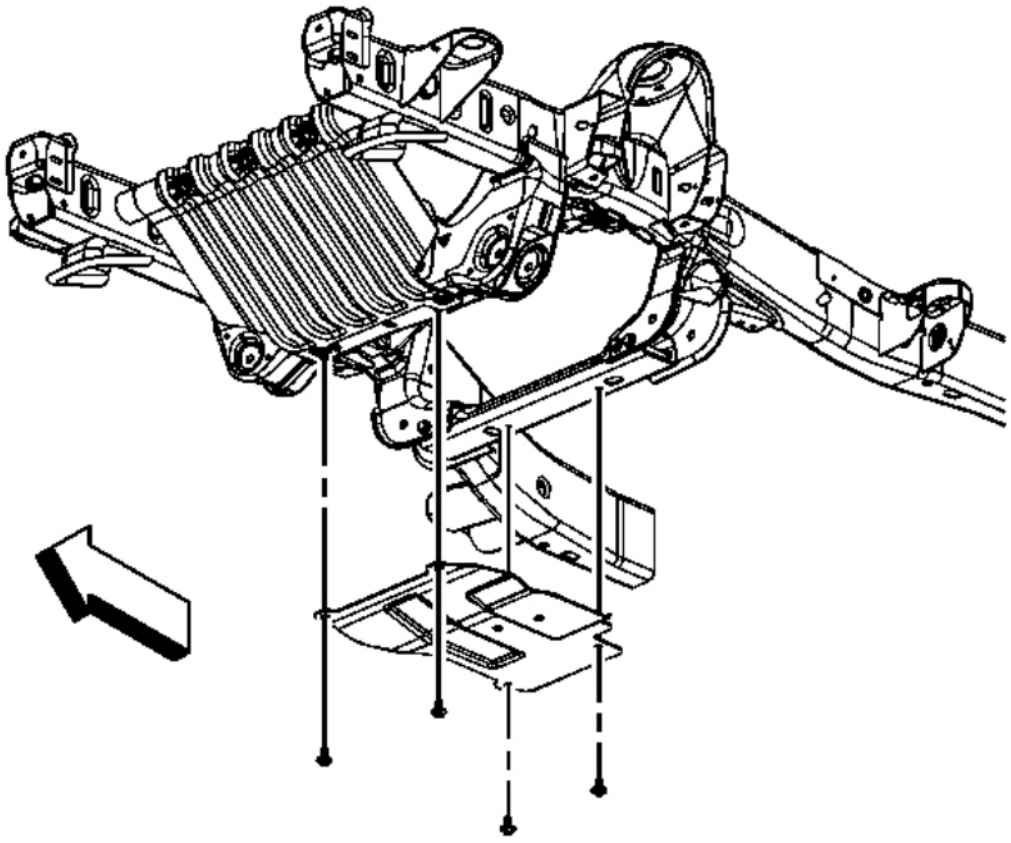


Fig. 341: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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.

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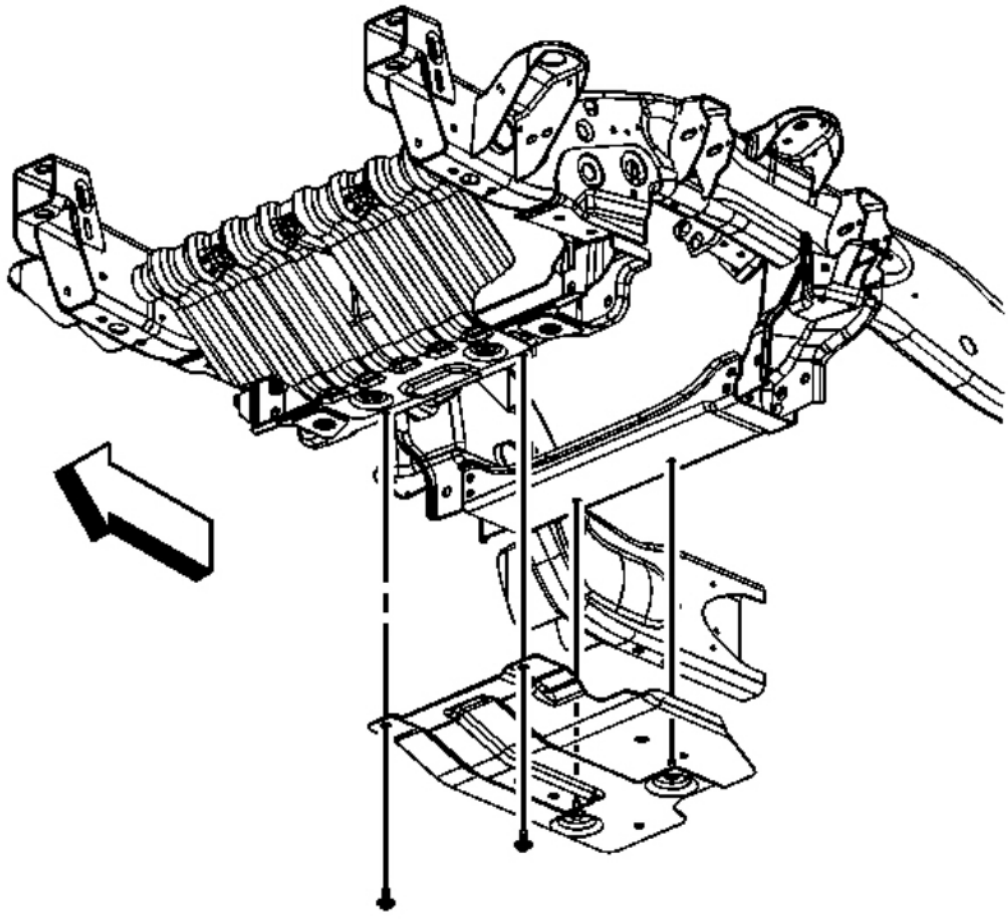


Fig. 342: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

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.
4. Remove the front differential carrier. Refer to **Differential Carrier Assembly Replacement (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .

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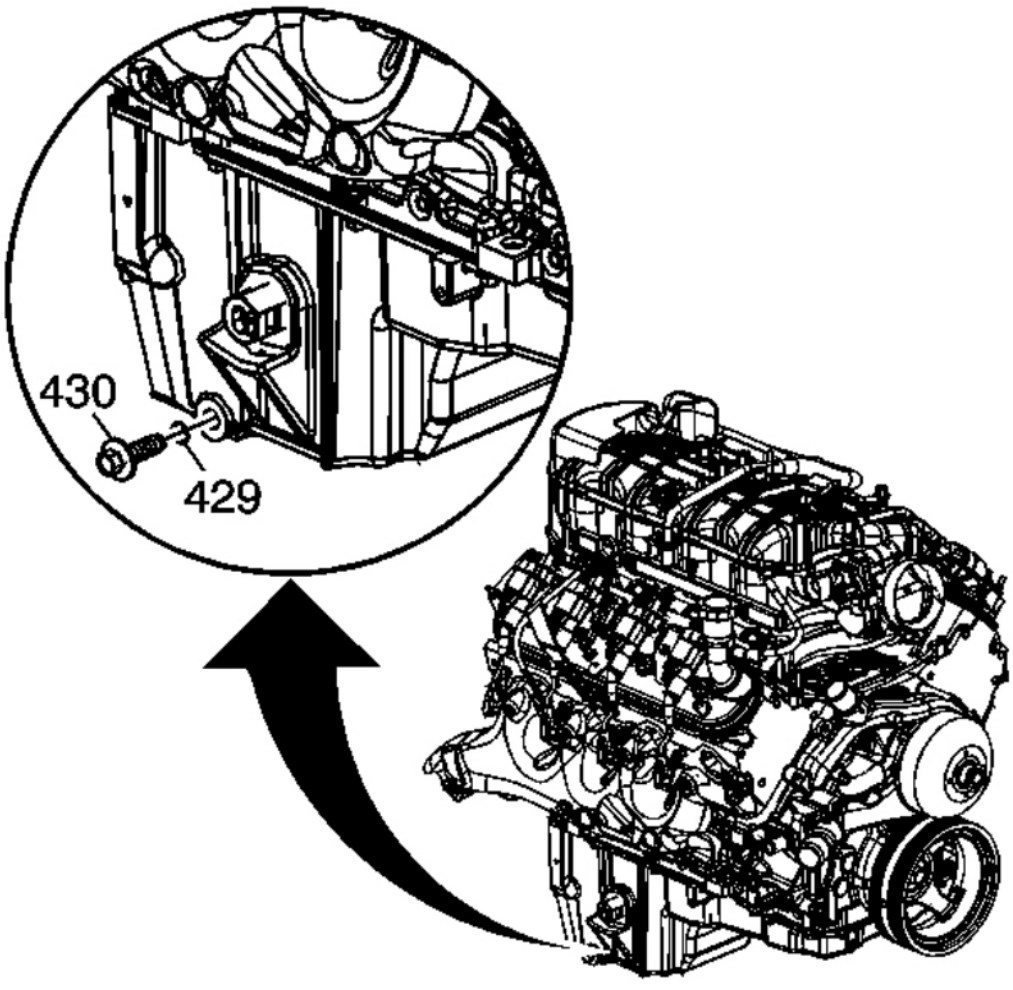


Fig. 343: View Of Oil Pan Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

5. Place a suitable drain pan under the oil pan drain plug.
6. Remove the oil pan drain plug (430).
7. Allow the oil pan to drain completely.
8. Re-install the oil pan drain plug until snug.

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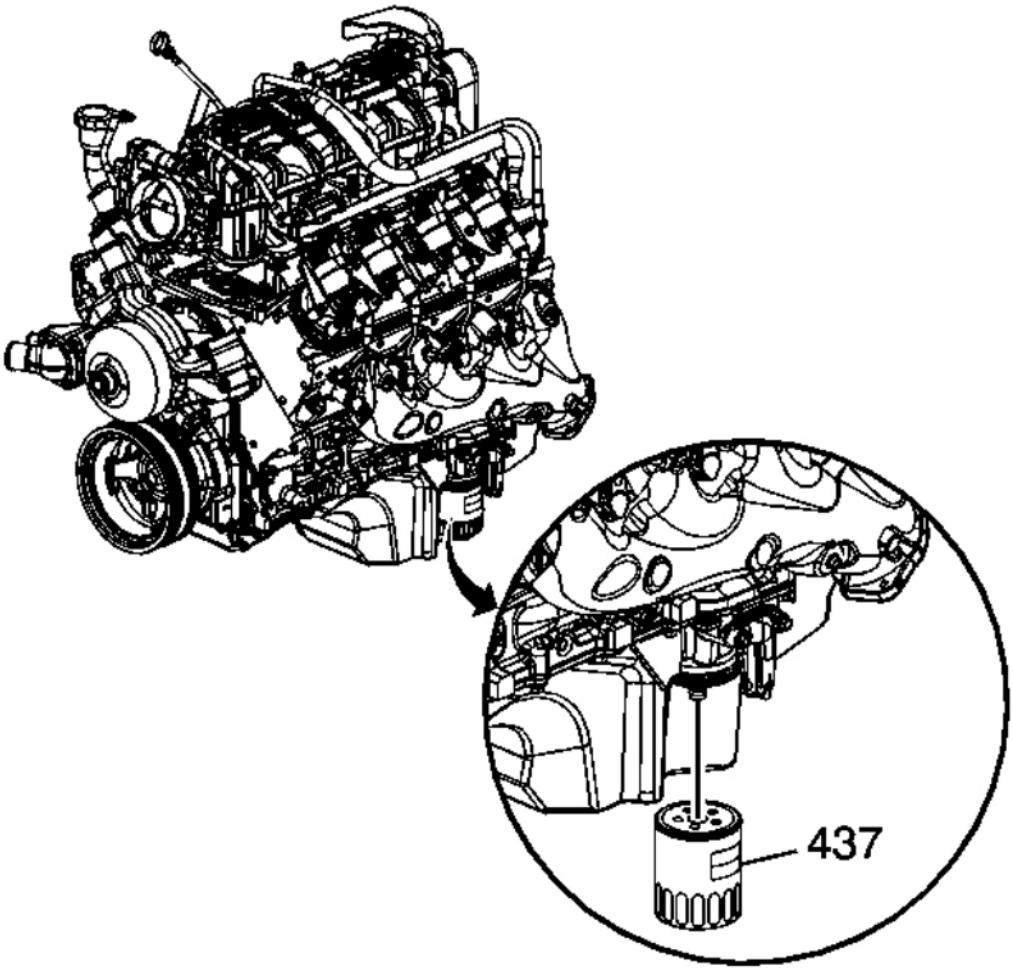


Fig. 344: View Of Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

9. Place the drain pan under the oil filter.
10. Remove the oil filter (437).
11. Allow the oil to drain completely.
12. Re-install the oil filter until snug.

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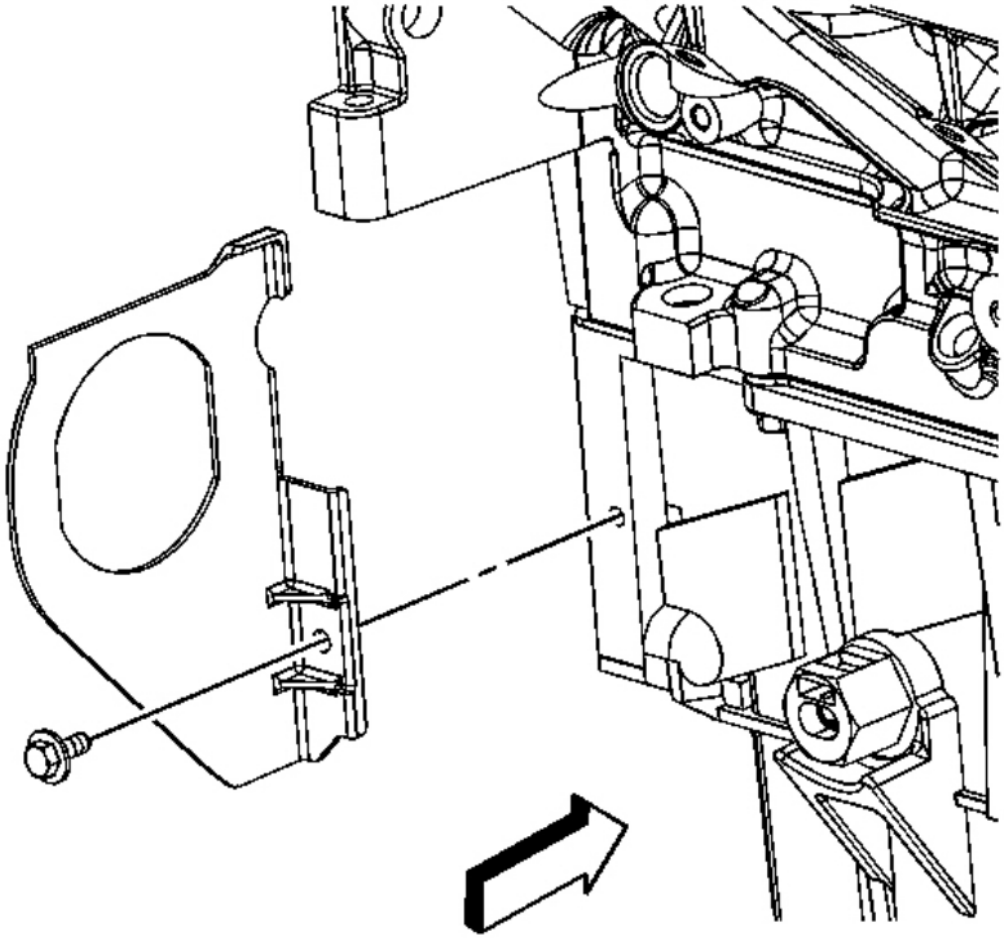


Fig. 345: View Of Right Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

13. Remove the right side transmission cover bolt.

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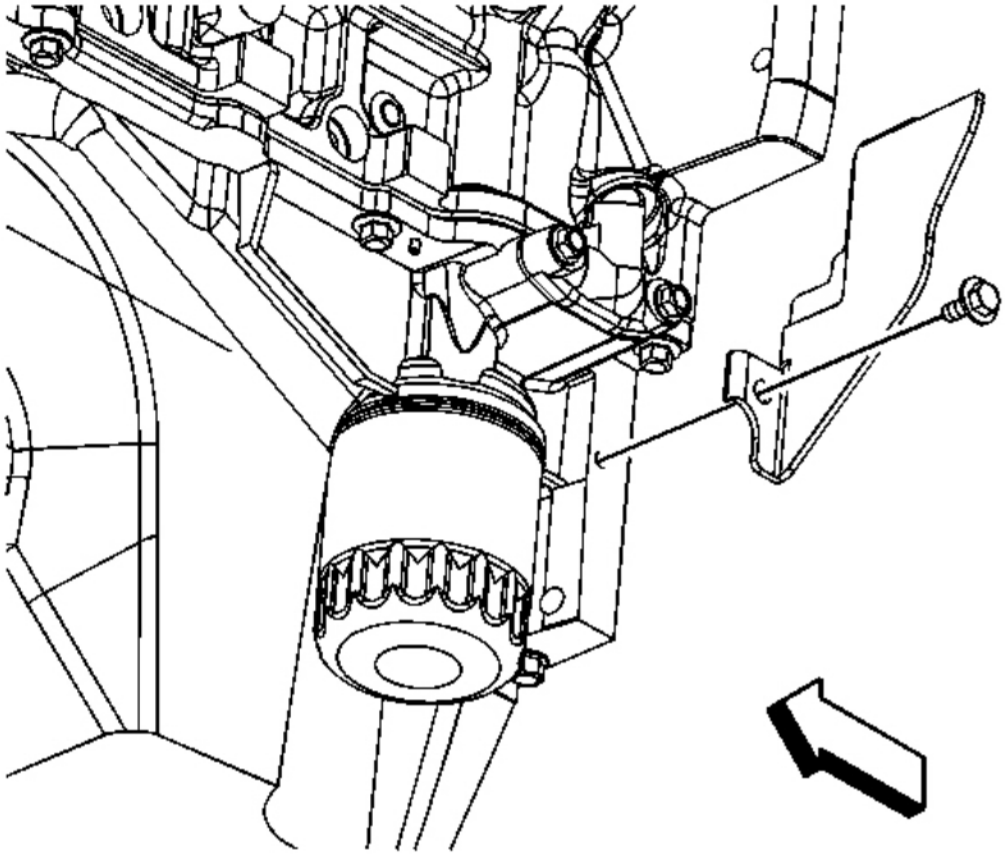


Fig. 346: View Of Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

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

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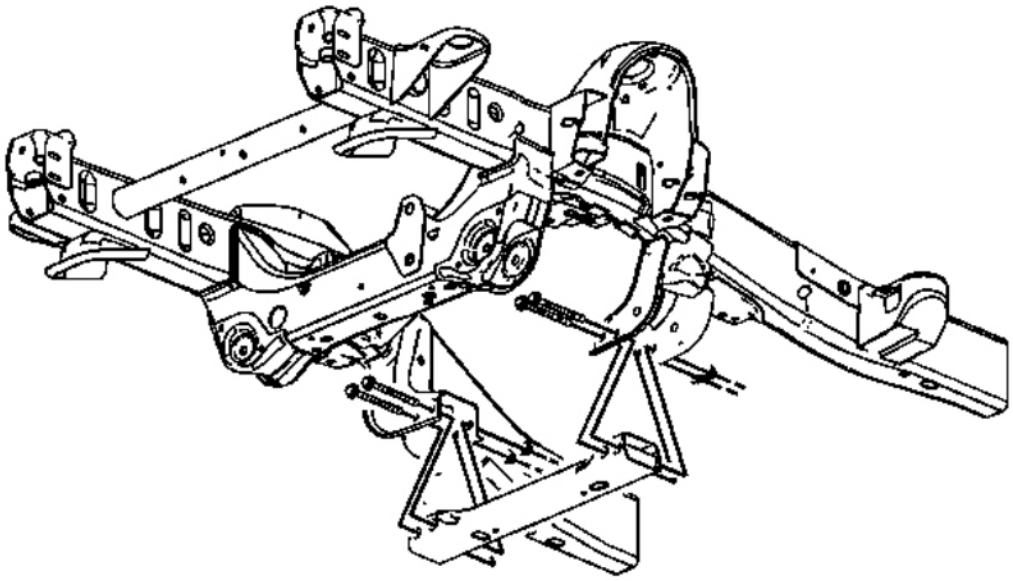


Fig. 347: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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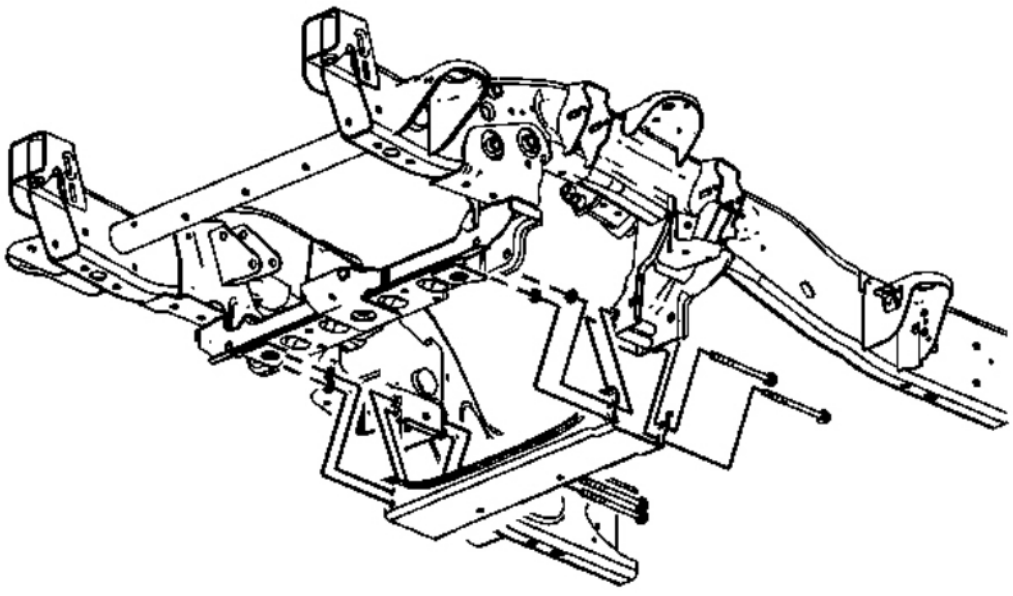


Fig. 348: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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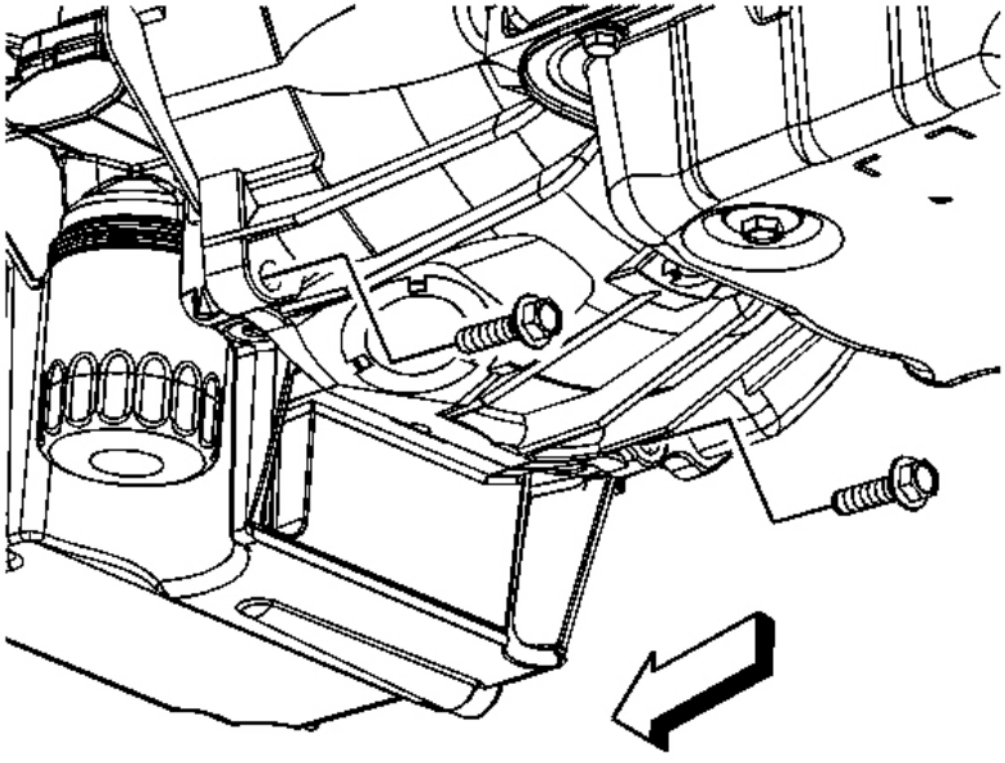


Fig. 349: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

17. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the 2 lower transmission bolts.

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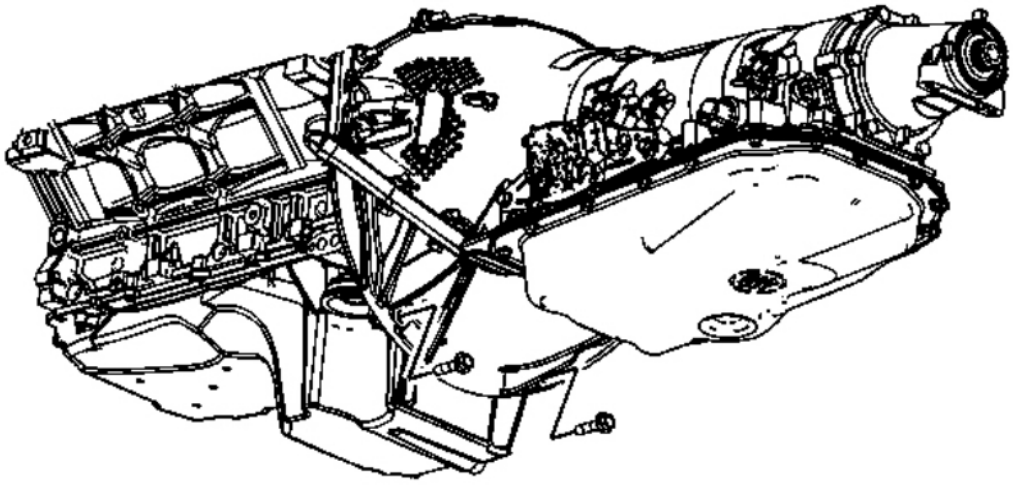


Fig. 350: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

18. For vehicles with a 4L80-E automatic transmission, remove the 2 lower transmission bolts.

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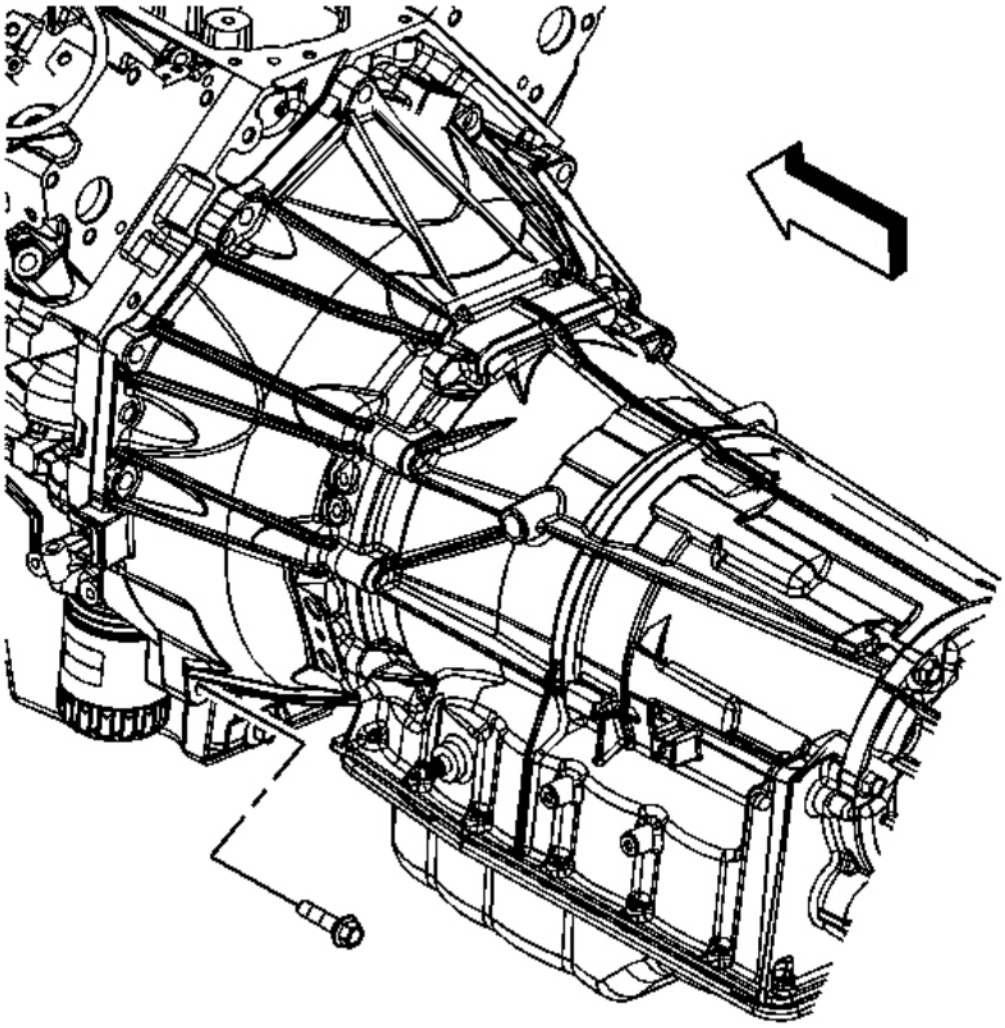


Fig. 351: View Of Lower Transmission Bolt
Courtesy of GENERAL MOTORS CORP.

19. For vehicles with a 6L80-E automatic transmission, remove the lower left transmission bolt.

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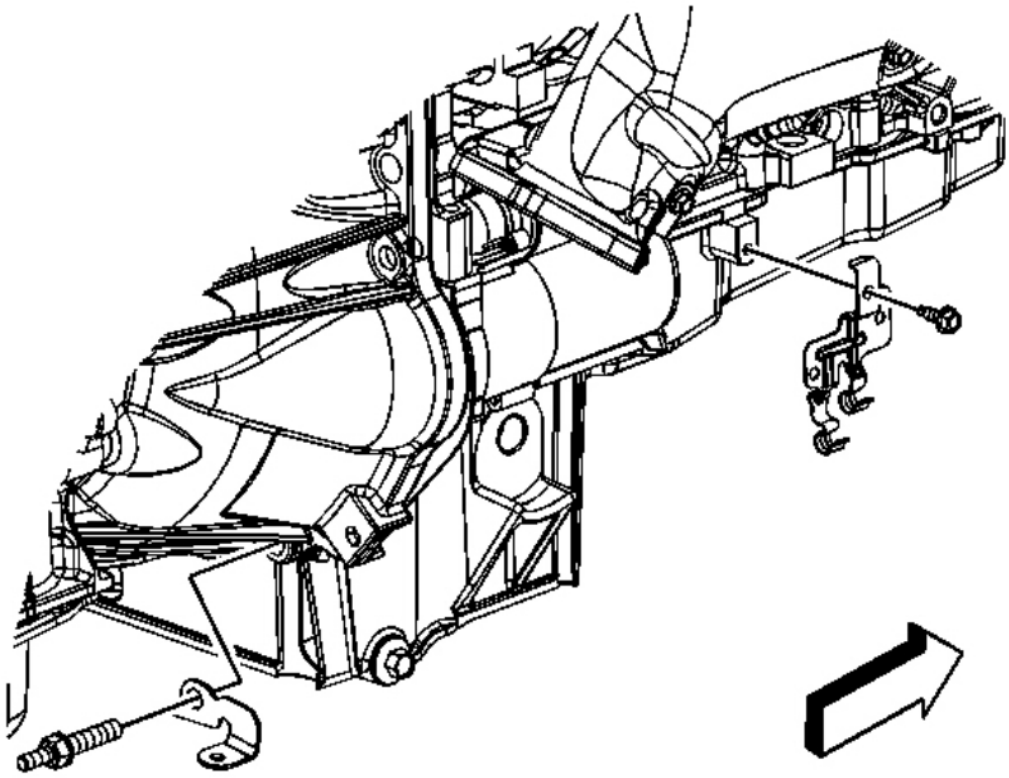


Fig. 352: View Of Lower Transmission Stud
Courtesy of GENERAL MOTORS CORP.

20. For vehicles with a 6L80-E automatic transmission, remove the lower right transmission stud.

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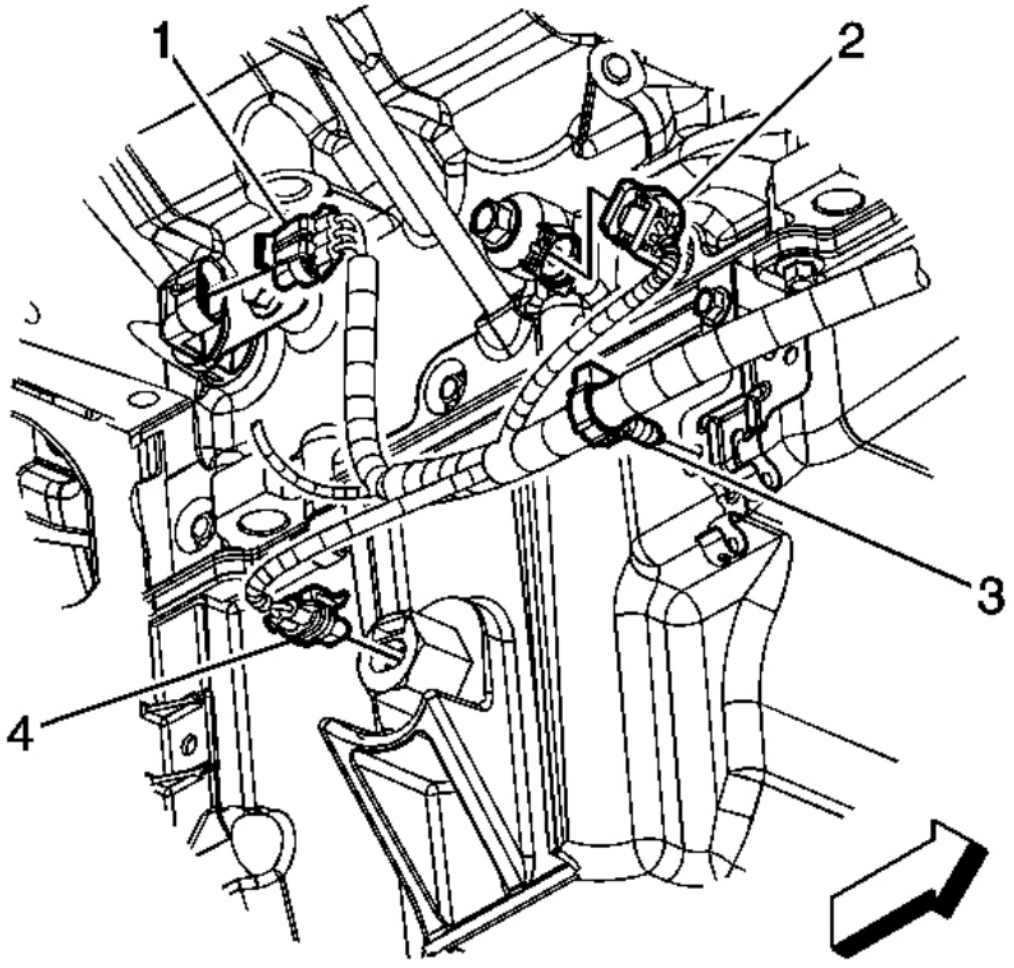


Fig. 353: View Of Electrical Connectors & Clips
Courtesy of GENERAL MOTORS CORP.

21. Disconnect the engine harness electrical connector (4) from the oil level sensor.
22. Remove the engine harness clip (3) from the transmission oil cooler line bracket.

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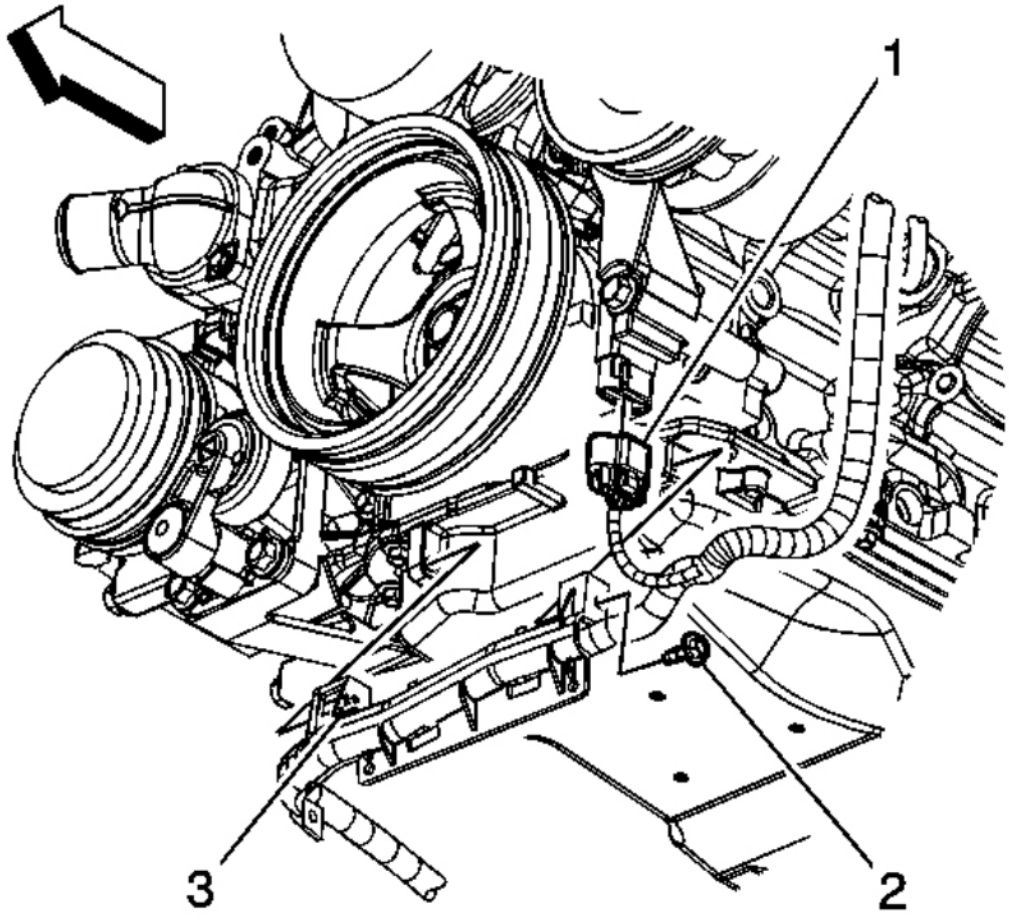


Fig. 354: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

23. Remove the battery cable channel bolt (2).
24. Slide the channel pin (3) out of the oil pan tab.

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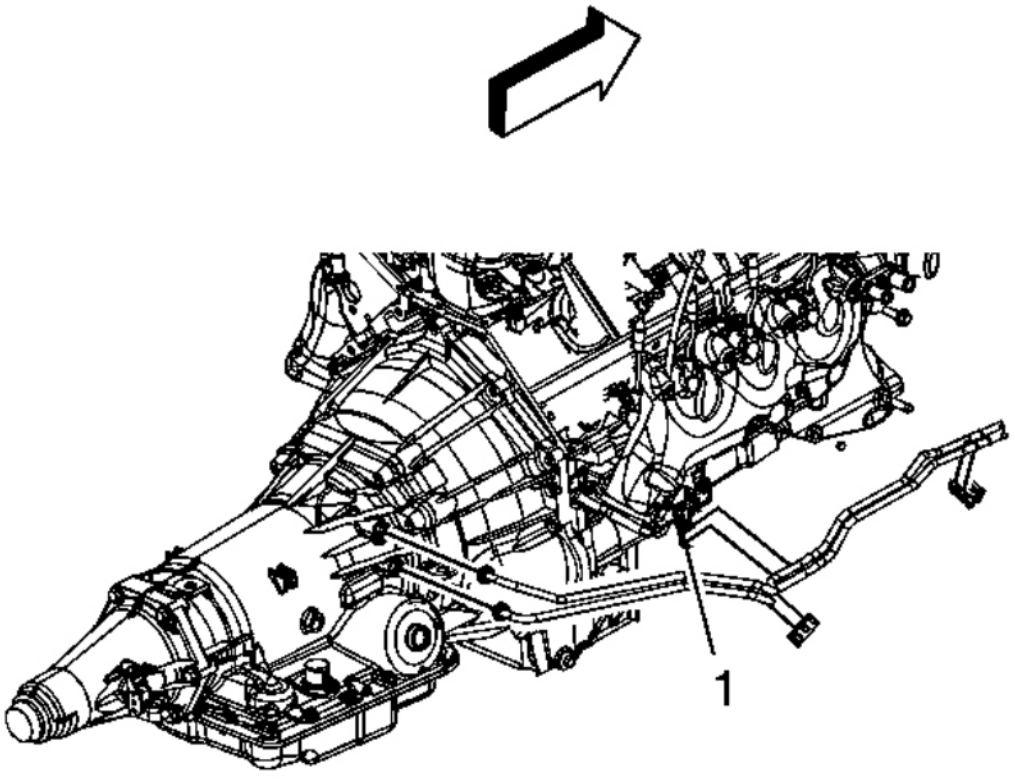


Fig. 355: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

25. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.

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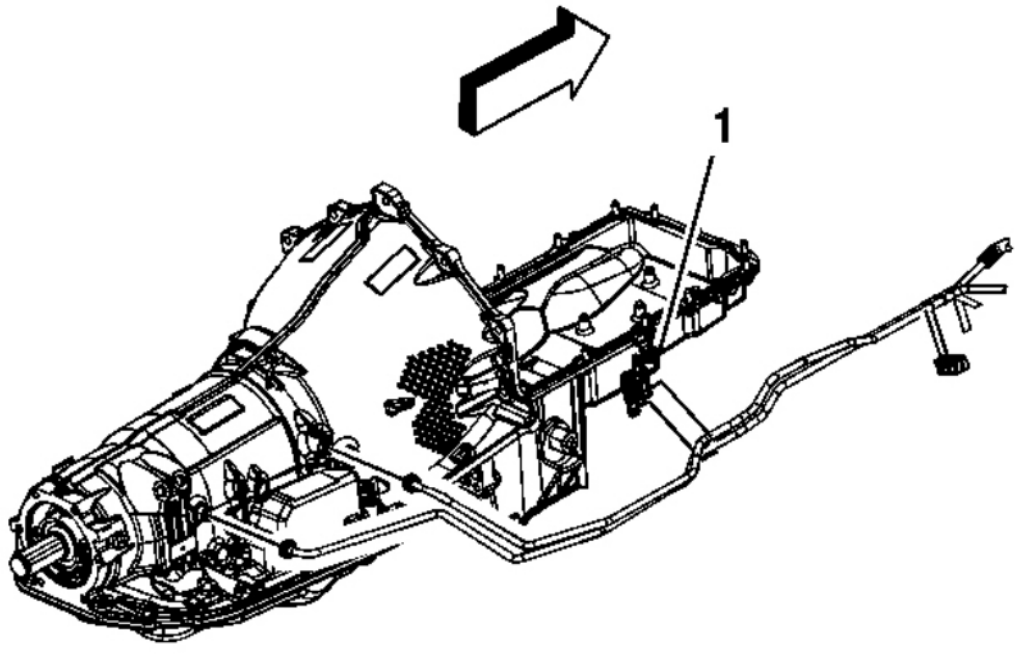


Fig. 356: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

26. For vehicles with a 4L80-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.

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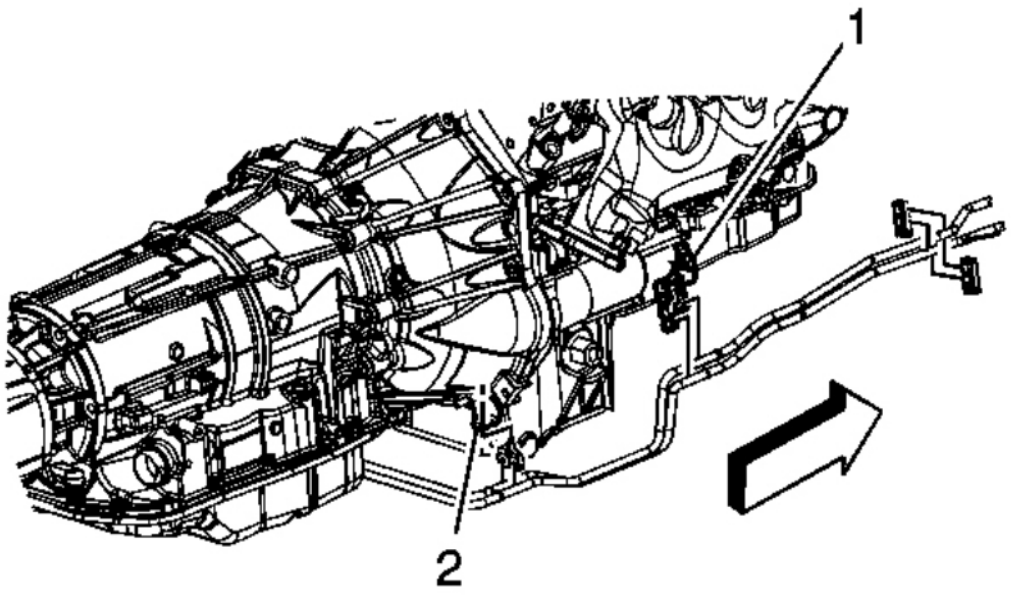


Fig. 357: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

27. For vehicles with a 6L80-E automatic transmission, remove the oil cooler lines from the clip (1).

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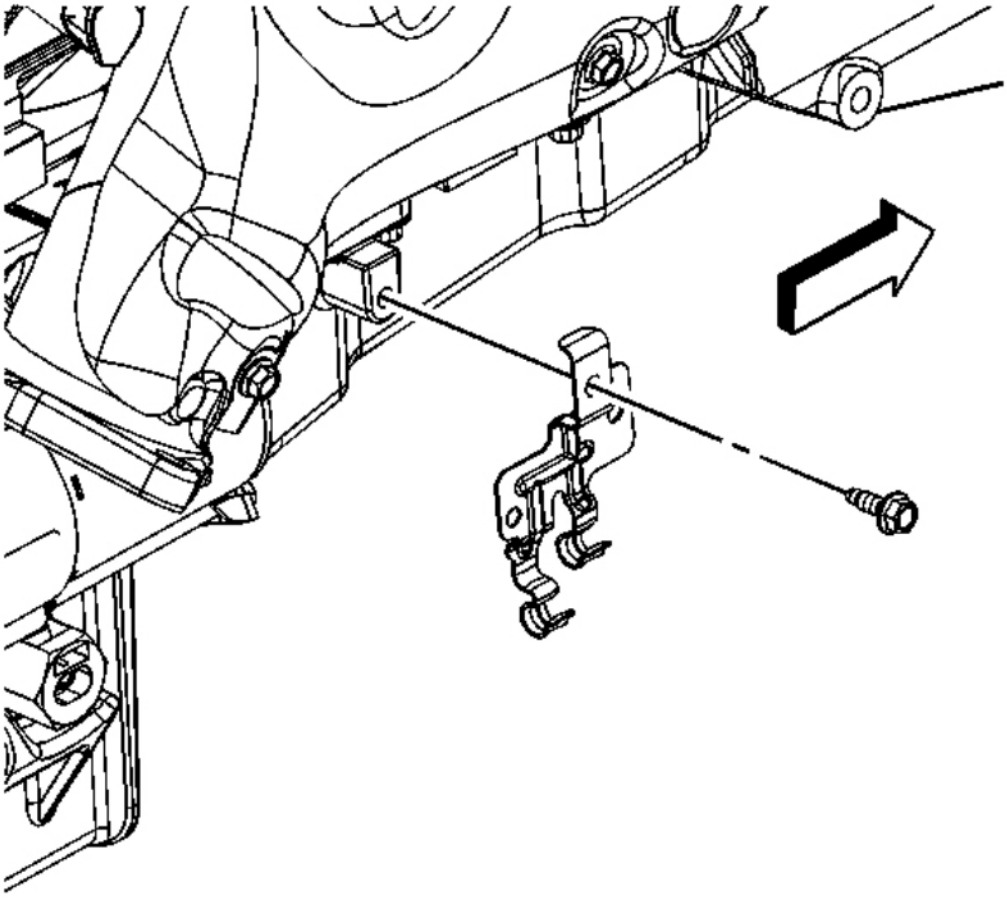


Fig. 358: View Of Oil Cooler Line Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

28. Remove the transmission oil cooler line clip bolt and clip from the oil pan.

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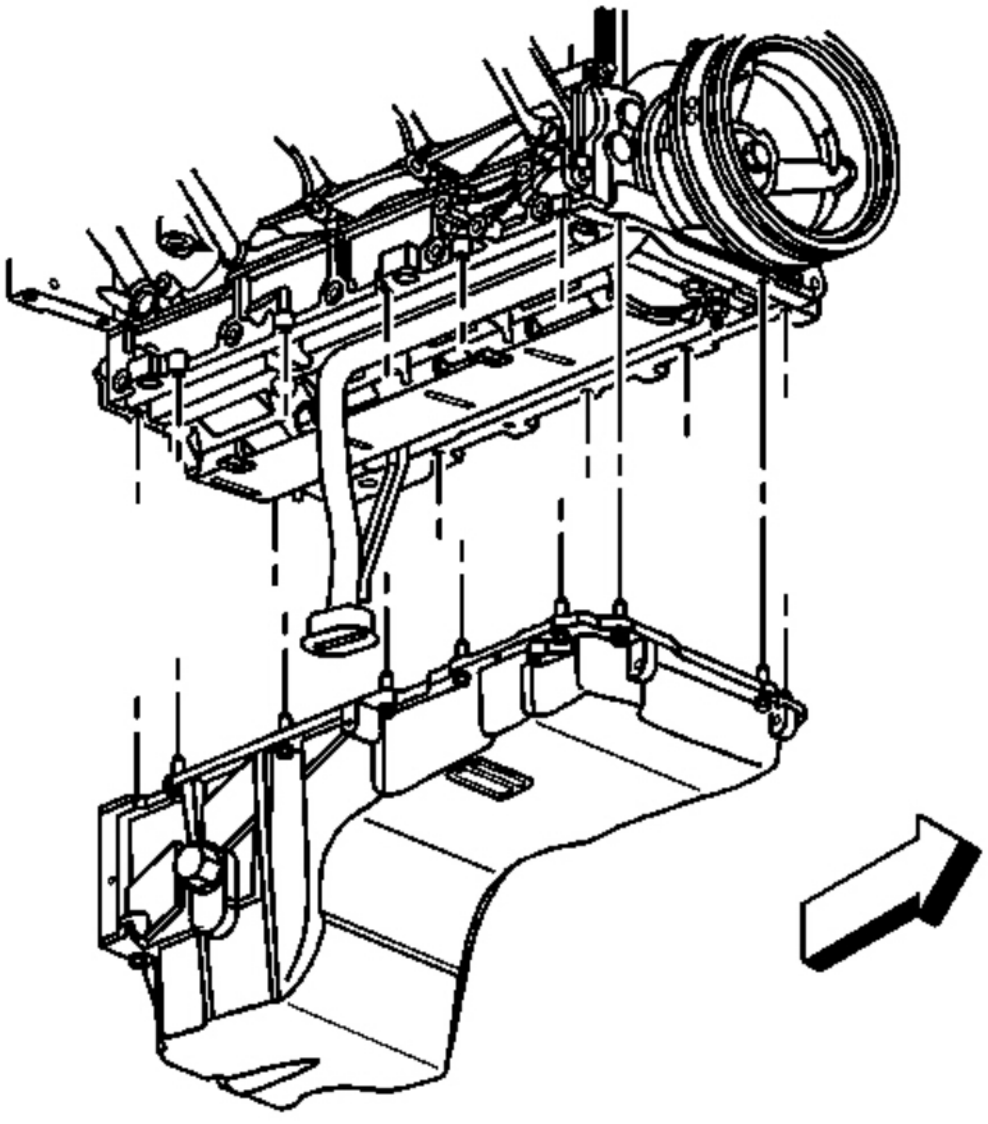


Fig. 359: View Of Oil Pan & Bolts
Courtesy of GENERAL MOTORS CORP.

29. Remove the oil pan bolts.
30. Remove the oil pan.

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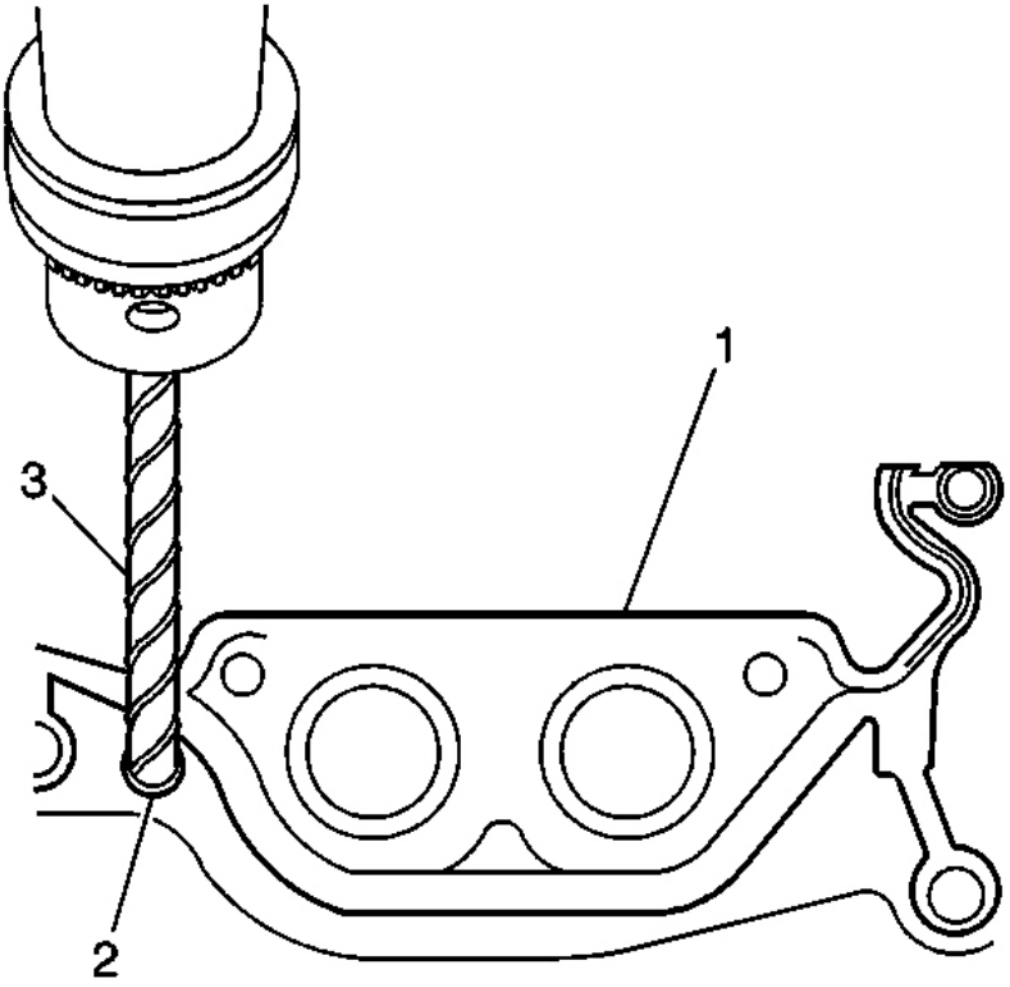


Fig. 360: Drilling Oil Pan Gasket Retaining Rivets
Courtesy of GENERAL MOTORS CORP.

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

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

32. Drill out the oil pan gasket rivets (2), if necessary.
33. Remove the oil pan gasket (1) from the pan.
34. Discard the oil pan gasket.

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35. Discard the rivets, if necessary.

INSTALLATION PROCEDURE

IMPORTANT:

- **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.**

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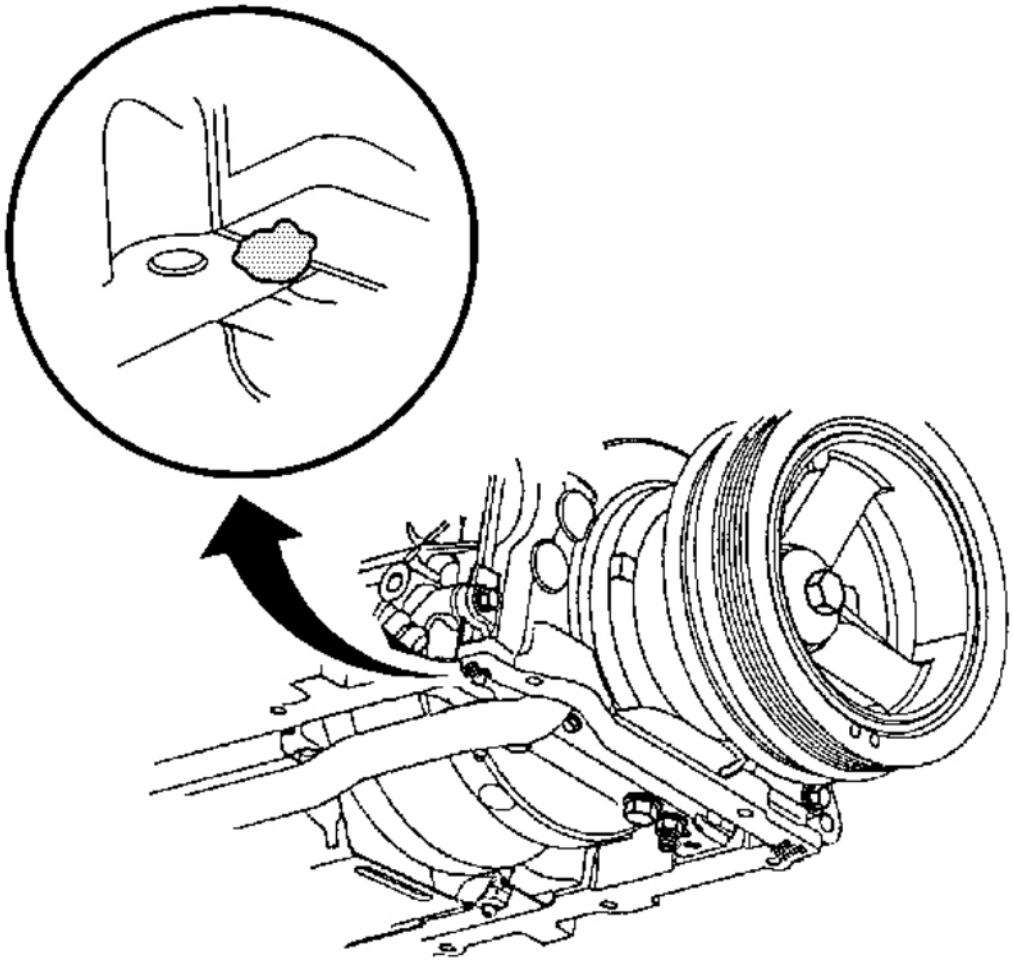


Fig. 361: View Of Sealant Applied To Front Oil Pan-To-Engine Block Junction
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: 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 **Sealers, Adhesives, and Lubricants** .

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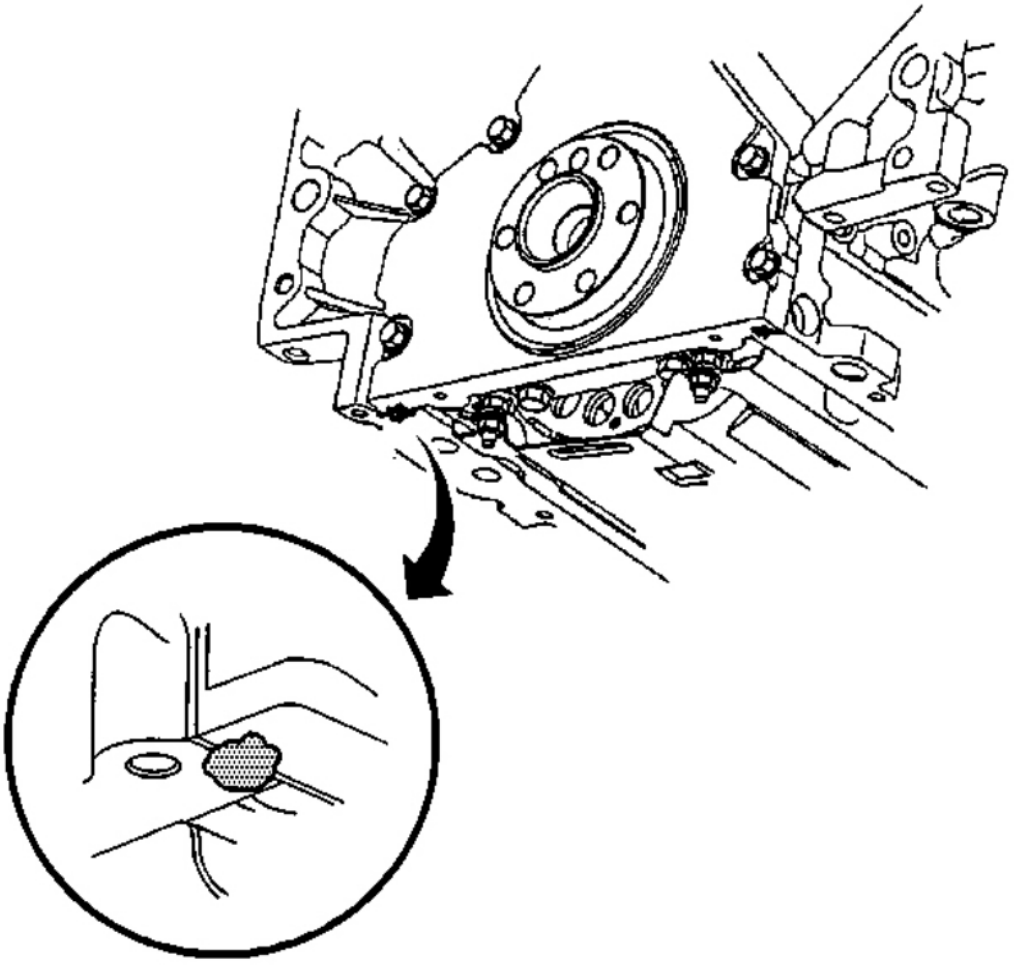


Fig. 362: View Of Sealant Applied To Rear Oil Pan-To-Engine Block Junction
Courtesy of GENERAL MOTORS CORP.

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 **Sealers, Adhesives, and Lubricants** .

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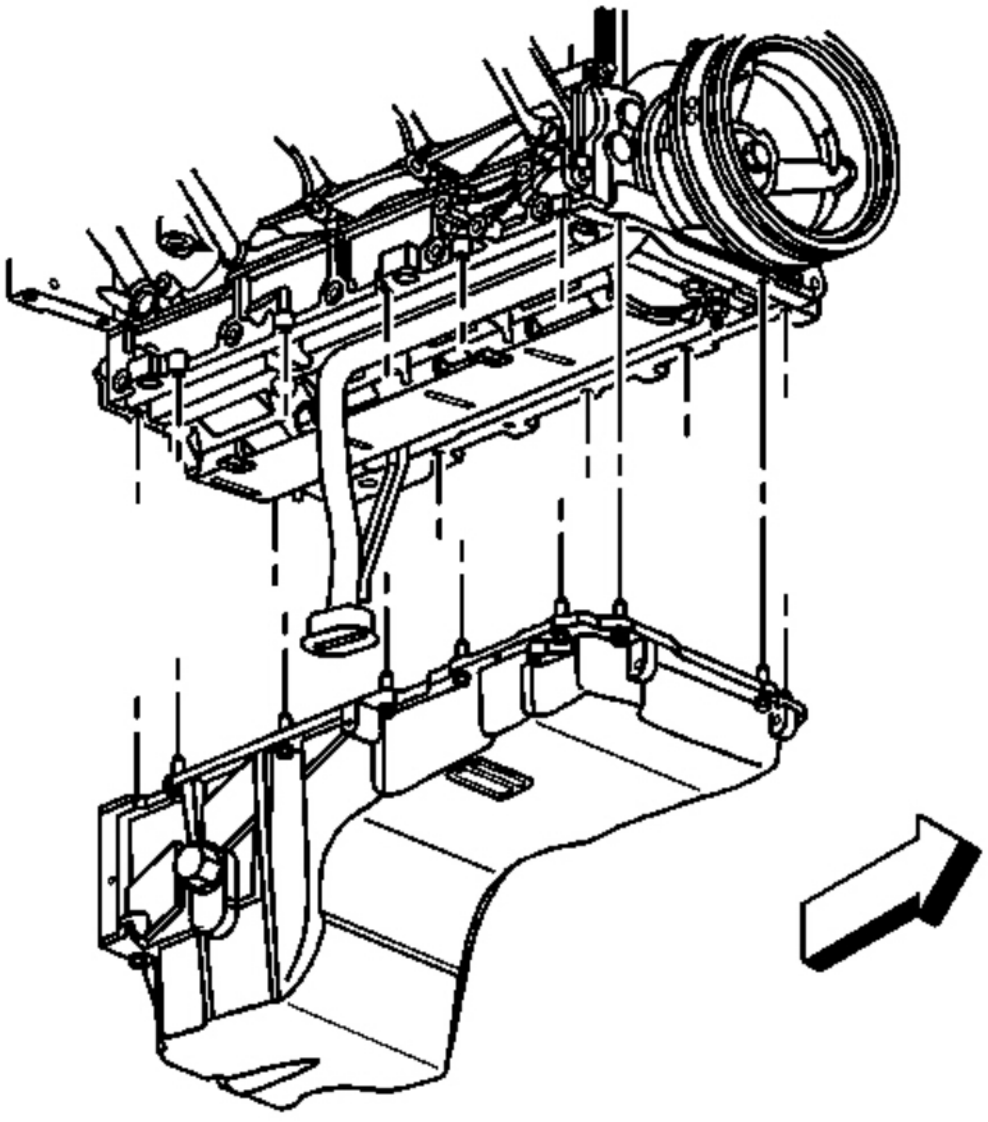


Fig. 363: View Of Oil Pan & Bolts
Courtesy of GENERAL MOTORS CORP.

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 until snug.

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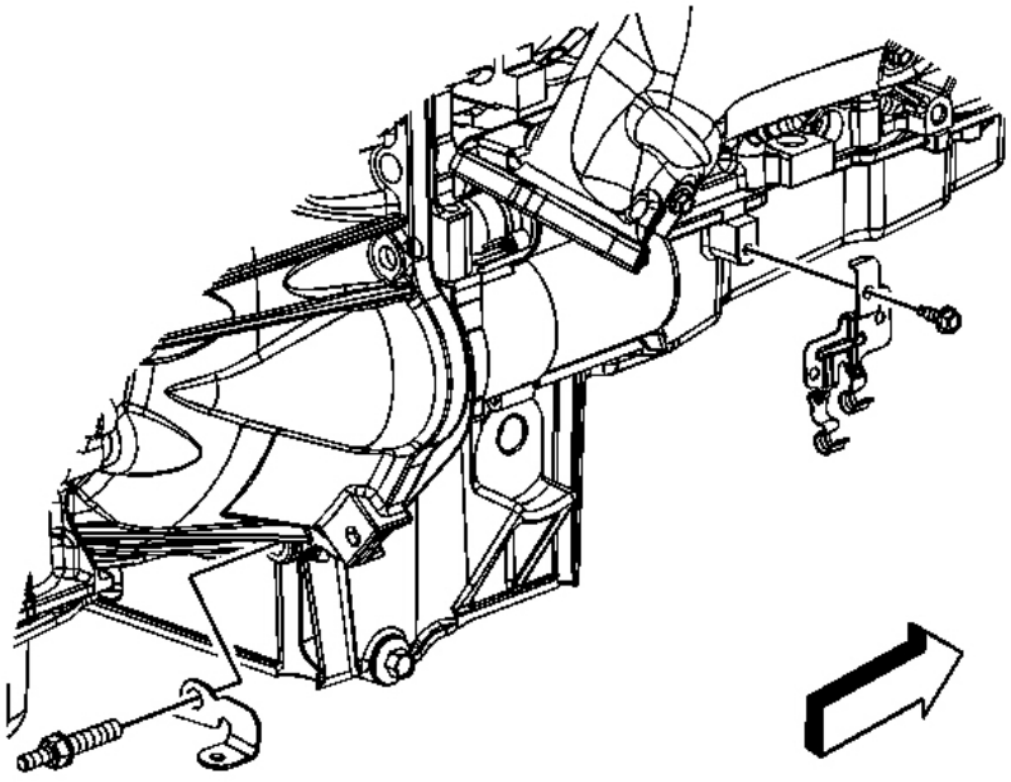


Fig. 364: View Of Lower Transmission Stud
Courtesy of GENERAL MOTORS CORP.

8. For vehicles with a 6L80-E automatic transmission, position the oil cooler bracket and install the lower right transmission stud until snug.

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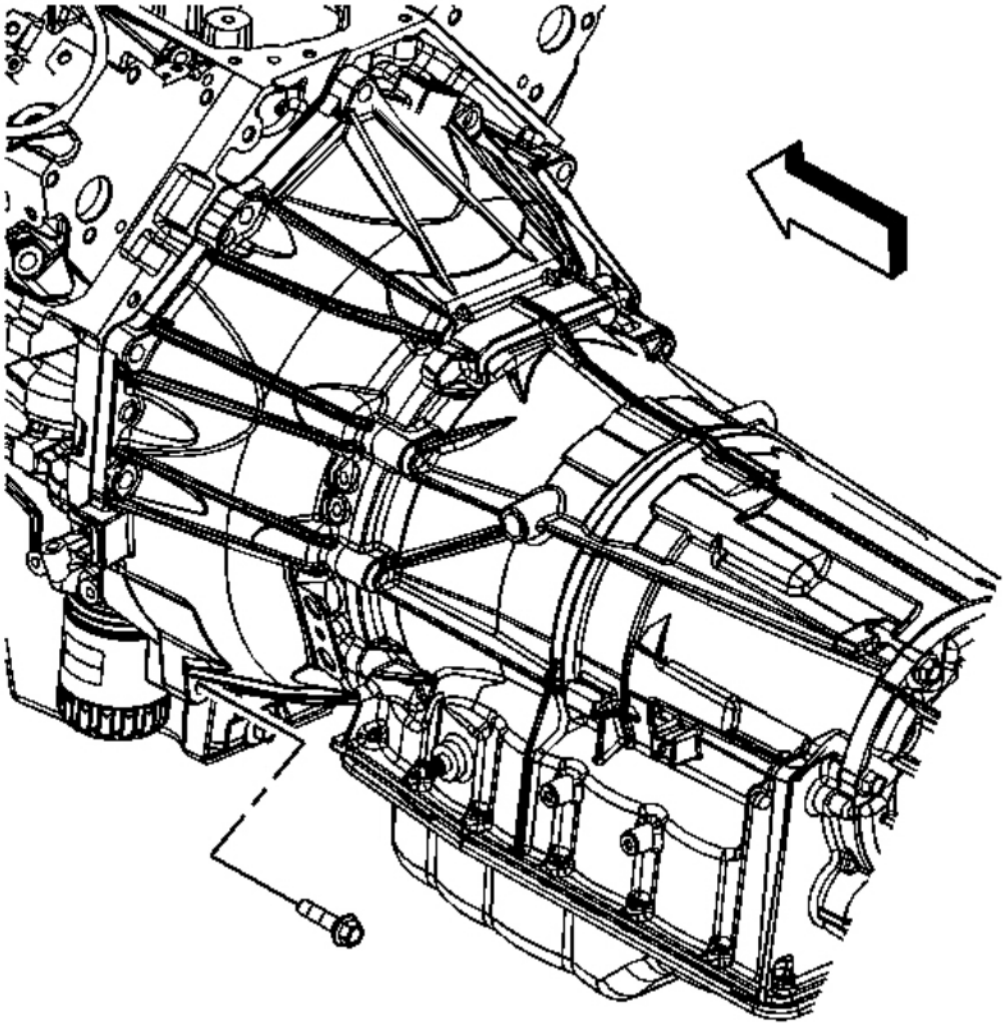


Fig. 365: View Of Lower Transmission Bolt
Courtesy of GENERAL MOTORS CORP.

9. For vehicles with a 6L80-E automatic transmission, install the lower left transmission bolt until snug.

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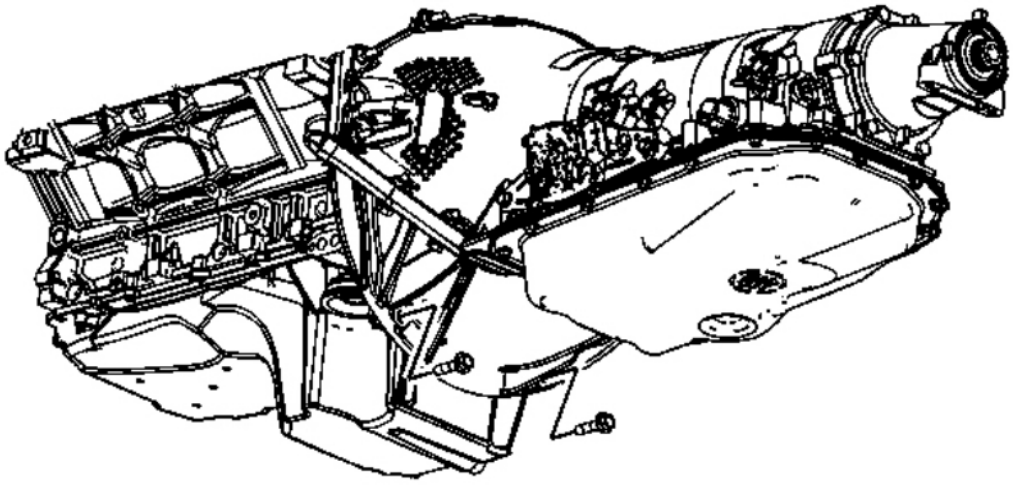


Fig. 366: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

10. For vehicles with a 4L80-E automatic transmission, install the 2 lower transmission bolts until snug.

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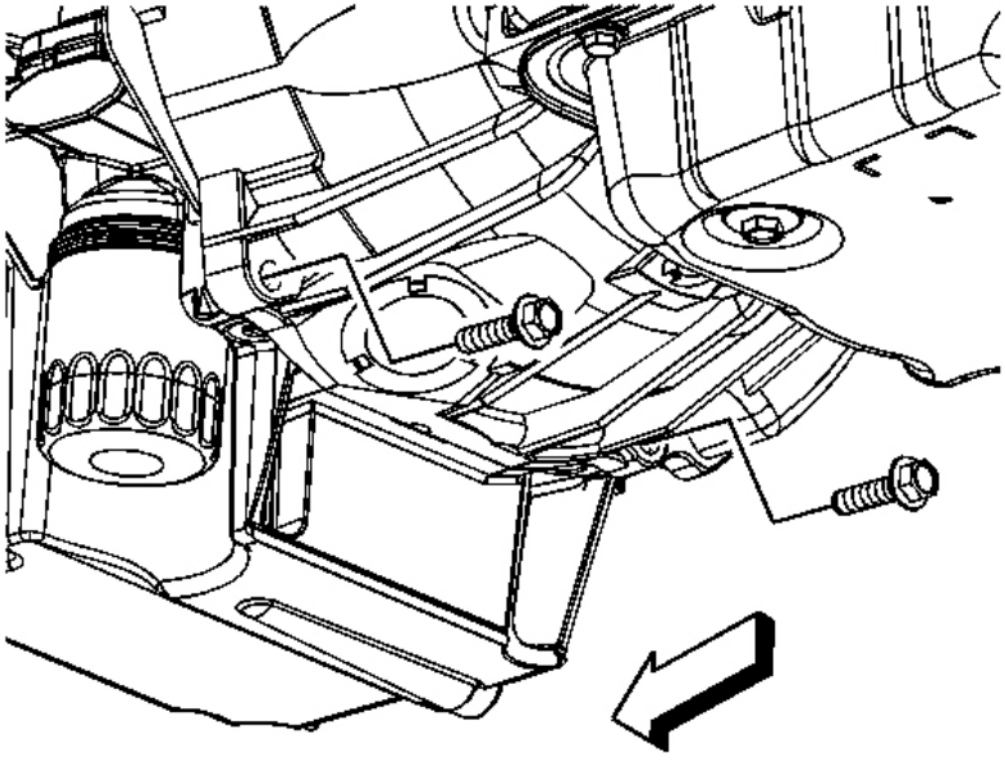


Fig. 367: View Of Lower Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

11. For vehicles with a 4L60-E/4L70-E automatic transmission, install the 2 lower transmission bolts until snug.

Tighten:

1. Tighten the oil pan and oil pan-to-oil pan front cover bolts to 25 N.m (18 lb ft).
2. Tighten the oil pan-to-rear cover bolts to 12 N.m (106 lb in).
3. Tighten the transmission bolts/stud to 50 N.m (37 lb ft).

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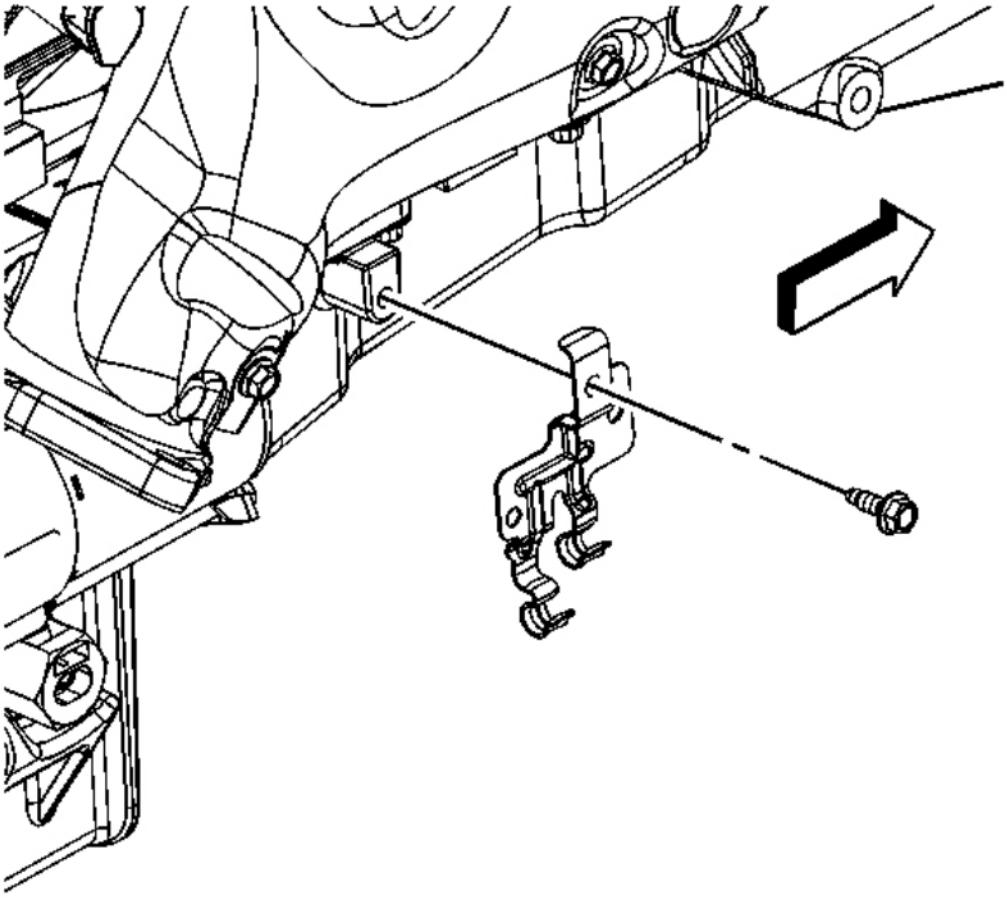


Fig. 368: View Of Oil Cooler Line Clip & Bolt
Courtesy of GENERAL MOTORS CORP.

12. Position the transmission oil cooler line clip and install the bolt to the oil pan.

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

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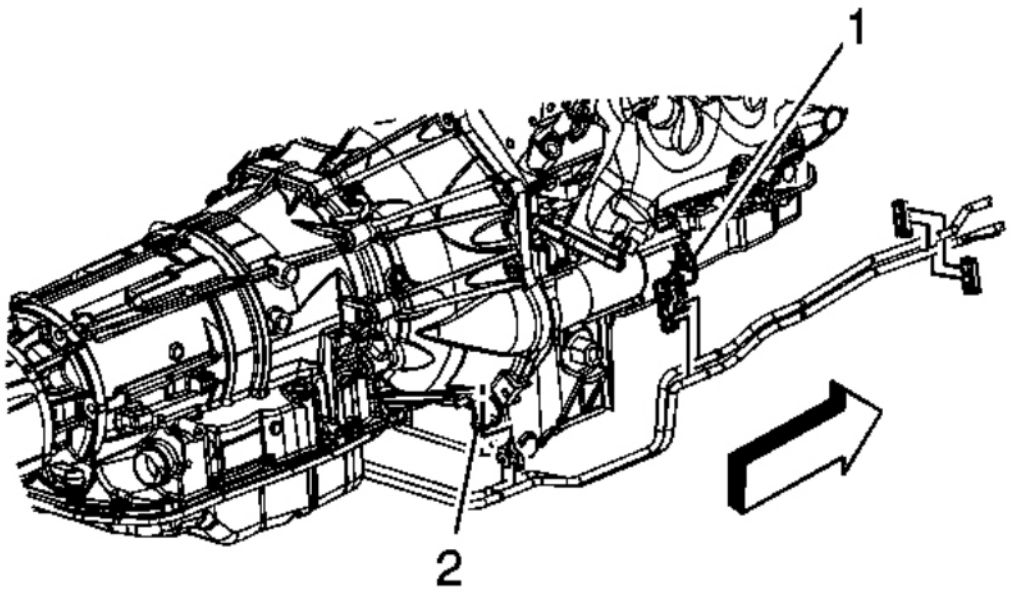


Fig. 369: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

13. For vehicles with a 6L80-E automatic transmission, install the oil cooler lines to the clip (1).

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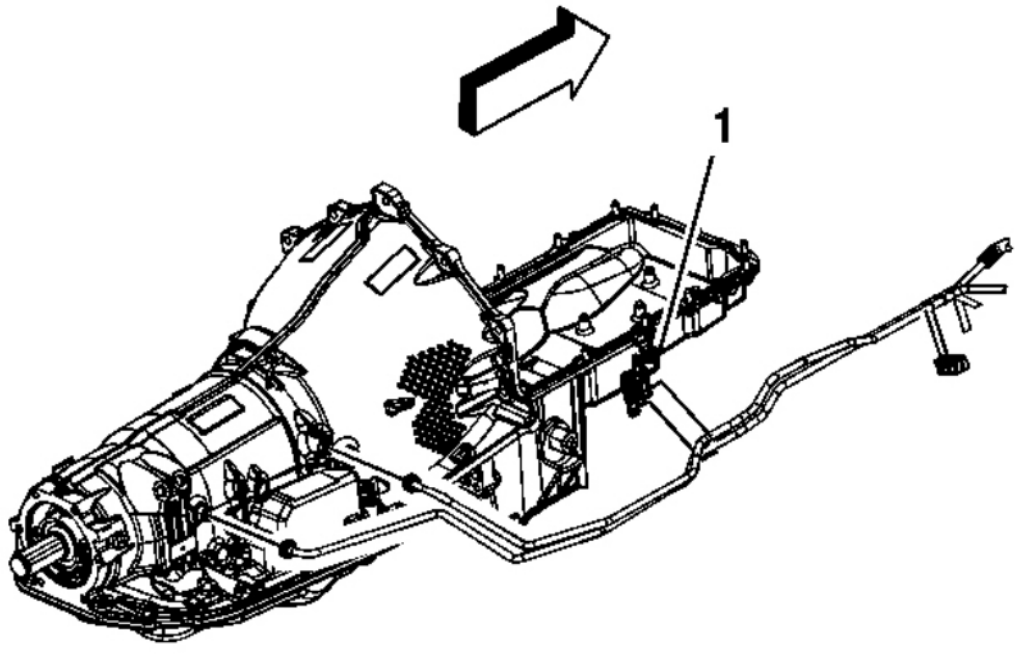


Fig. 370: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

14. For vehicles with a 4L80-E automatic transmission, install the oil cooler lines to the clip (1), if equipped.

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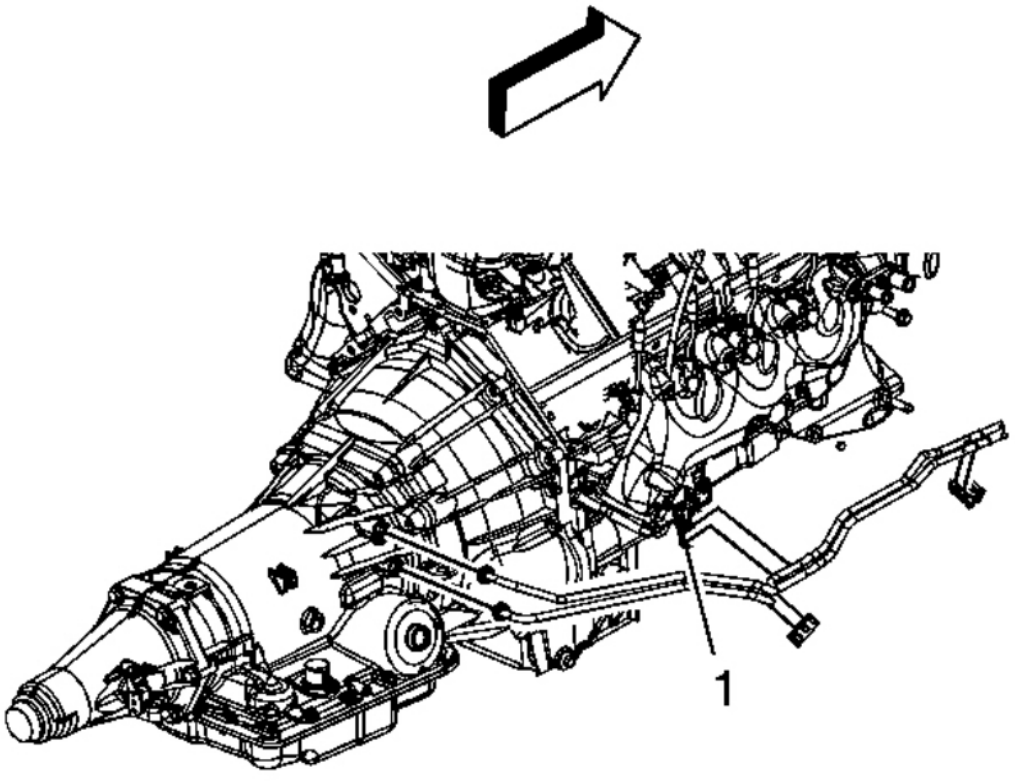


Fig. 371: View Of Oil Cooler Line Clip
Courtesy of GENERAL MOTORS CORP.

15. For vehicles with a 4L60-E/4L70-E automatic transmission, install the oil cooler lines to the clip (1), if equipped.

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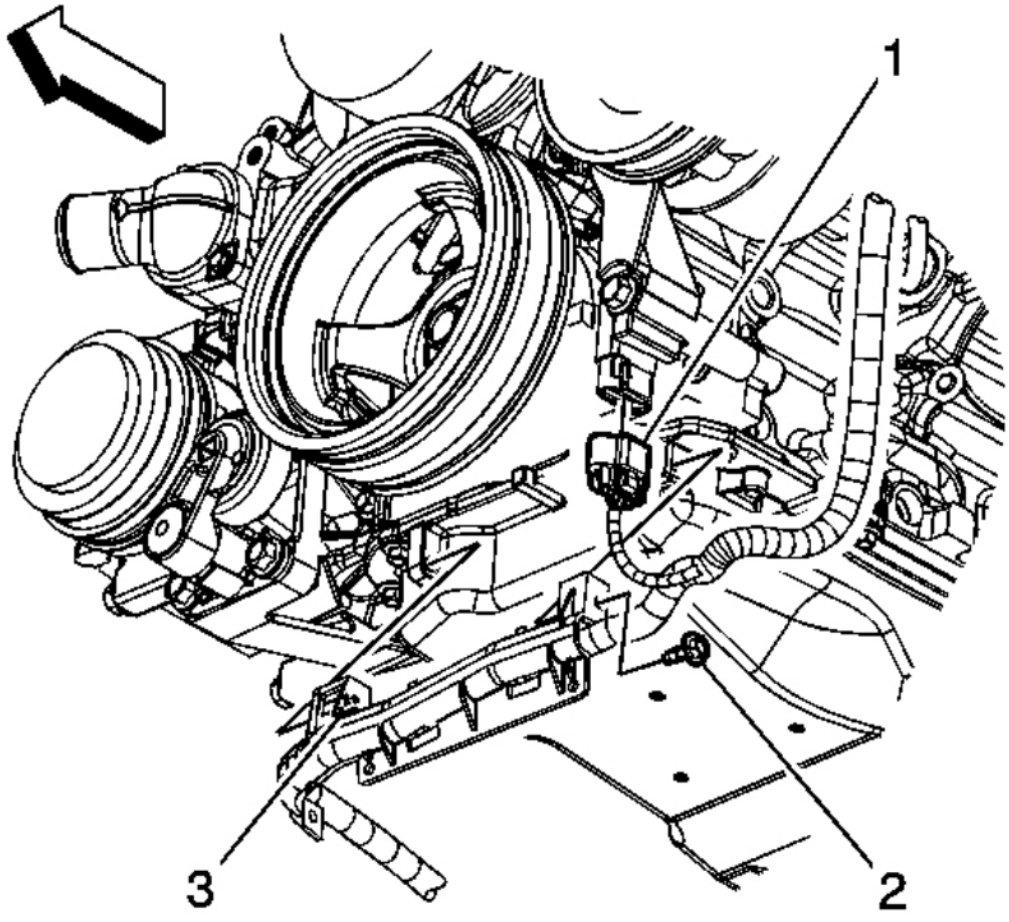


Fig. 372: View Of Electrical Connector, Cable Channel Bolt & Pin
Courtesy of GENERAL MOTORS CORP.

16. Position the channel and slide the channel pin (3) into the oil pan tab.
17. Install the battery cable channel bolt (2).

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

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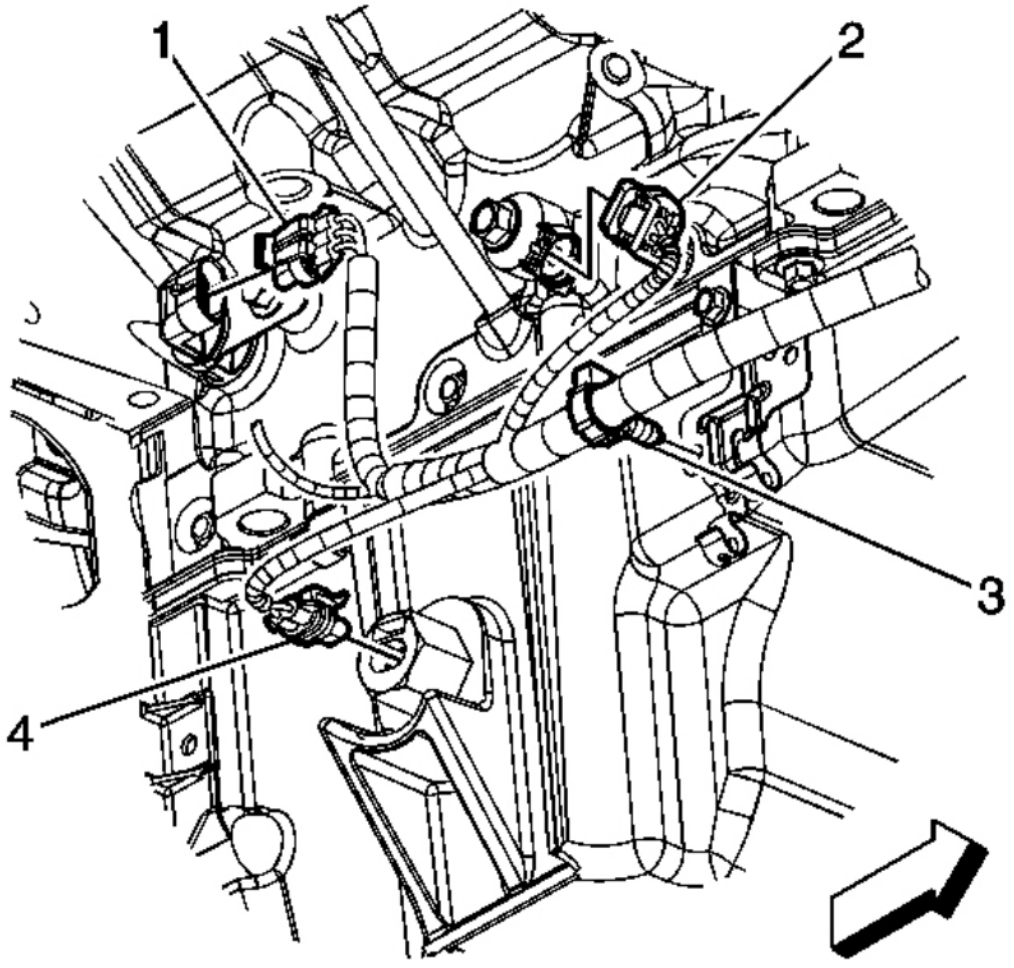


Fig. 373: View Of Electrical Connectors & Clips
Courtesy of GENERAL MOTORS CORP.

18. Connect the engine harness electrical connector (4) to the oil level sensor.
19. Install the engine harness clip (3) to the transmission oil cooler line bracket.

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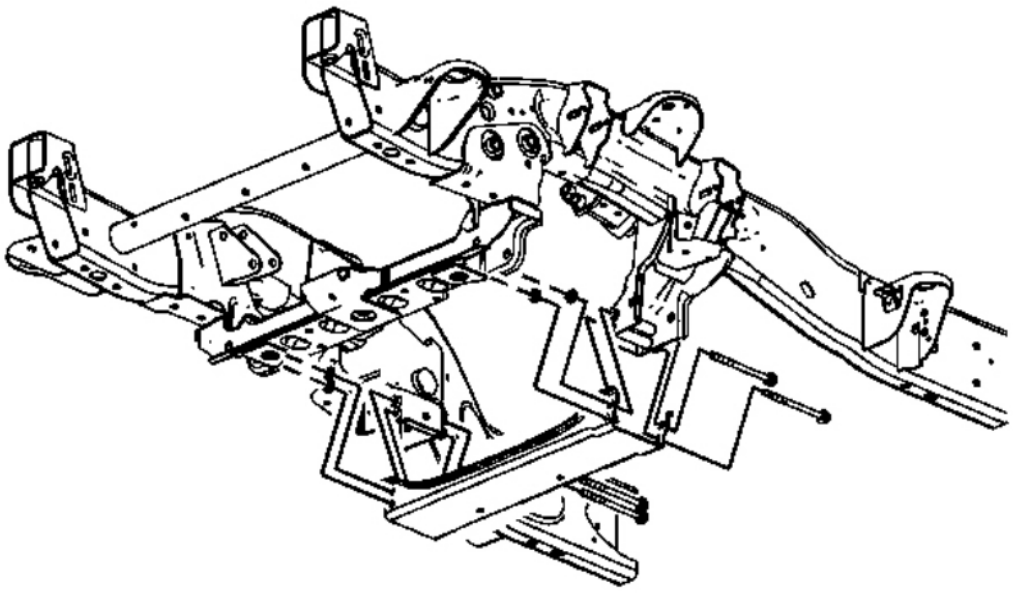


Fig. 374: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

20. 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.
21. For 2500 series vehicles, install the crossbar and crossbar bolts/nuts.

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

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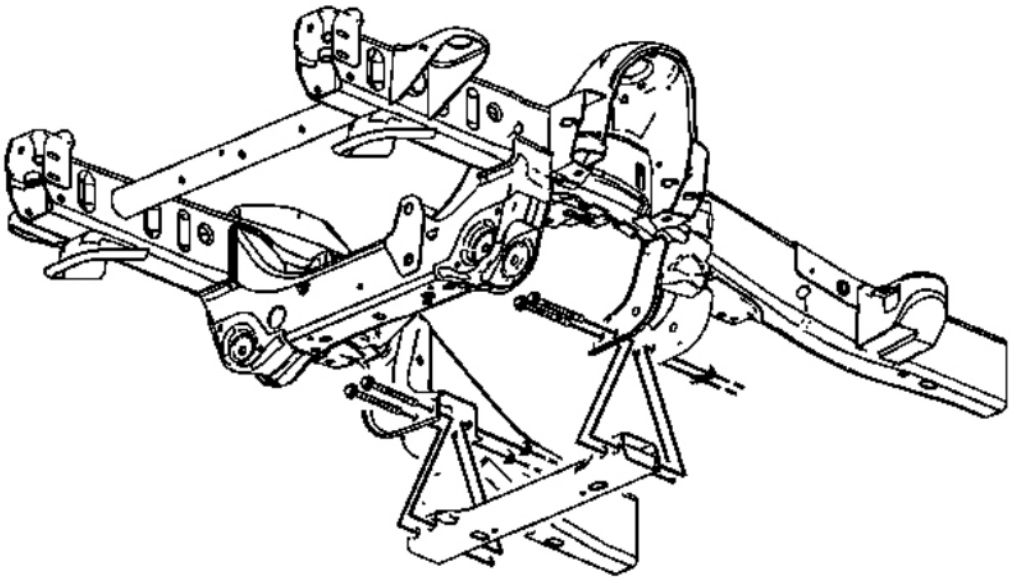


Fig. 375: View Of Vehicle Crossbar, Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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

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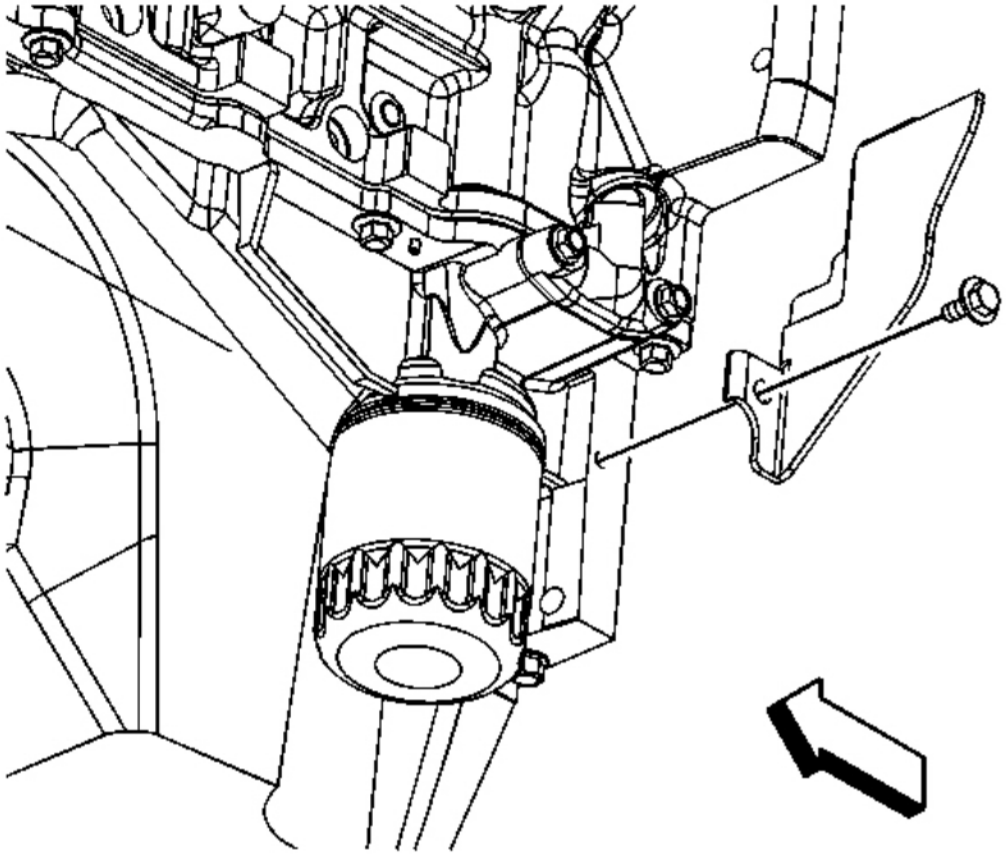


Fig. 376: View Of Left Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

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

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

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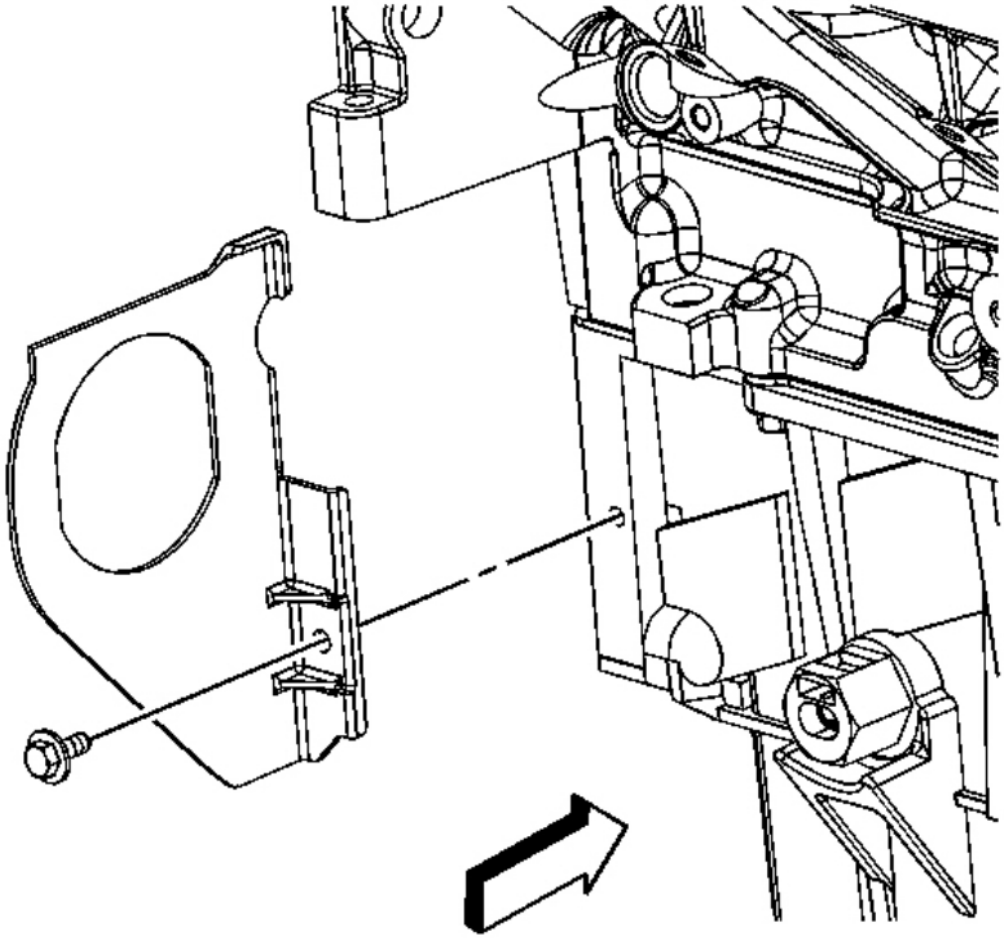


Fig. 377: View Of Right Side Transmission Cover Bolt
Courtesy of GENERAL MOTORS CORP.

24. Install the right side transmission cover bolt.

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

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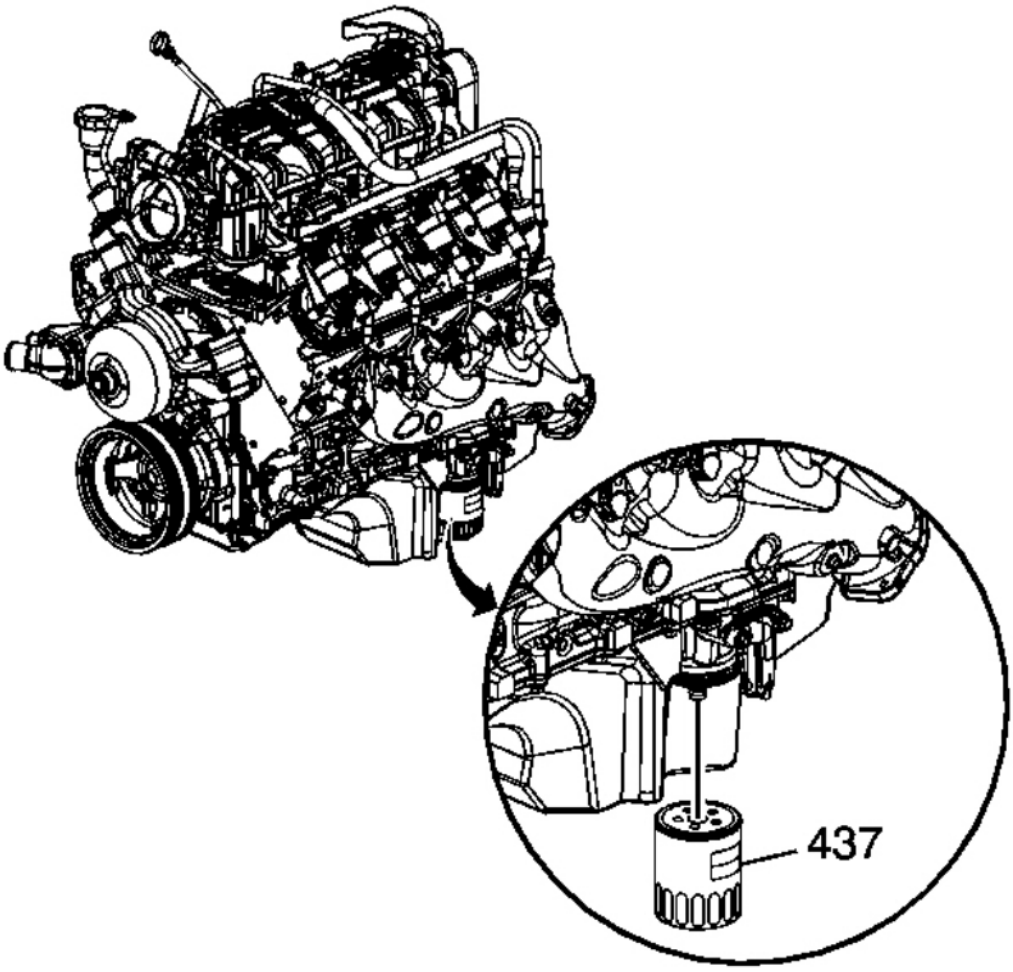


Fig. 378: View Of Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

25. If reusing the old oil pan remove the old oil filter and install a NEW oil filter.
26. Lubricate the NEW oil filter seal with clean engine oil.
27. Install the NEW oil filter (431).

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

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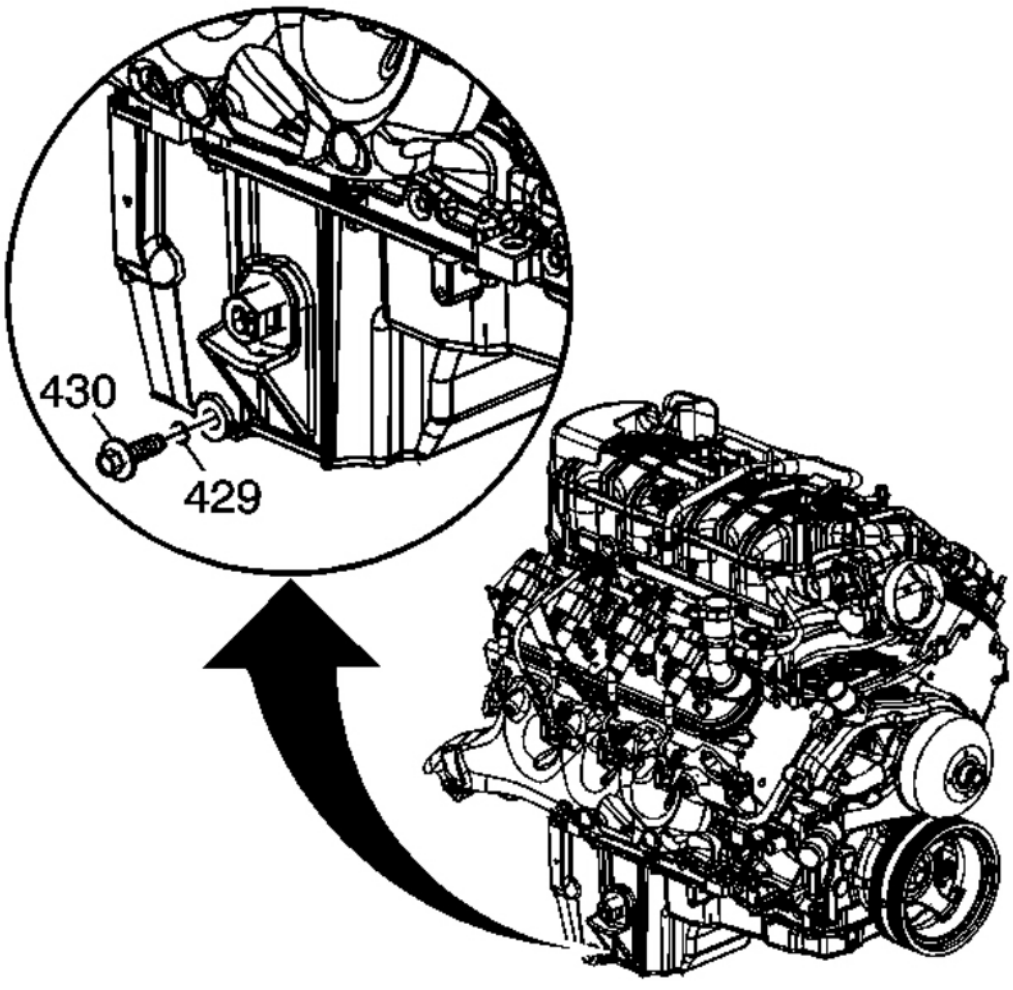


Fig. 379: View Of Oil Pan Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

28. Ensure that the oil pan drain plug (430) is tight.

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

29. Install the front differential carrier. Refer to **Differential Carrier Assembly Replacement (1500 4WD)** or **Differential Carrier Assembly Replacement (2500 4WD)** .

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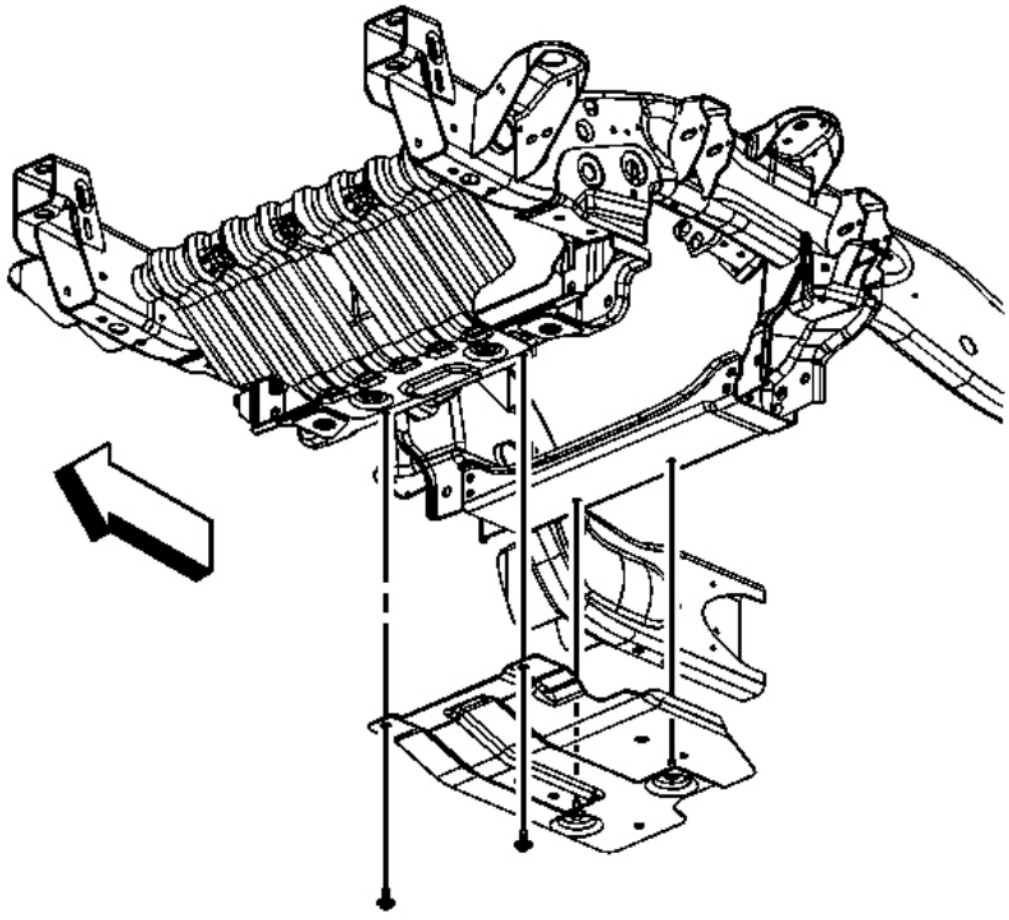


Fig. 380: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

30. 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).

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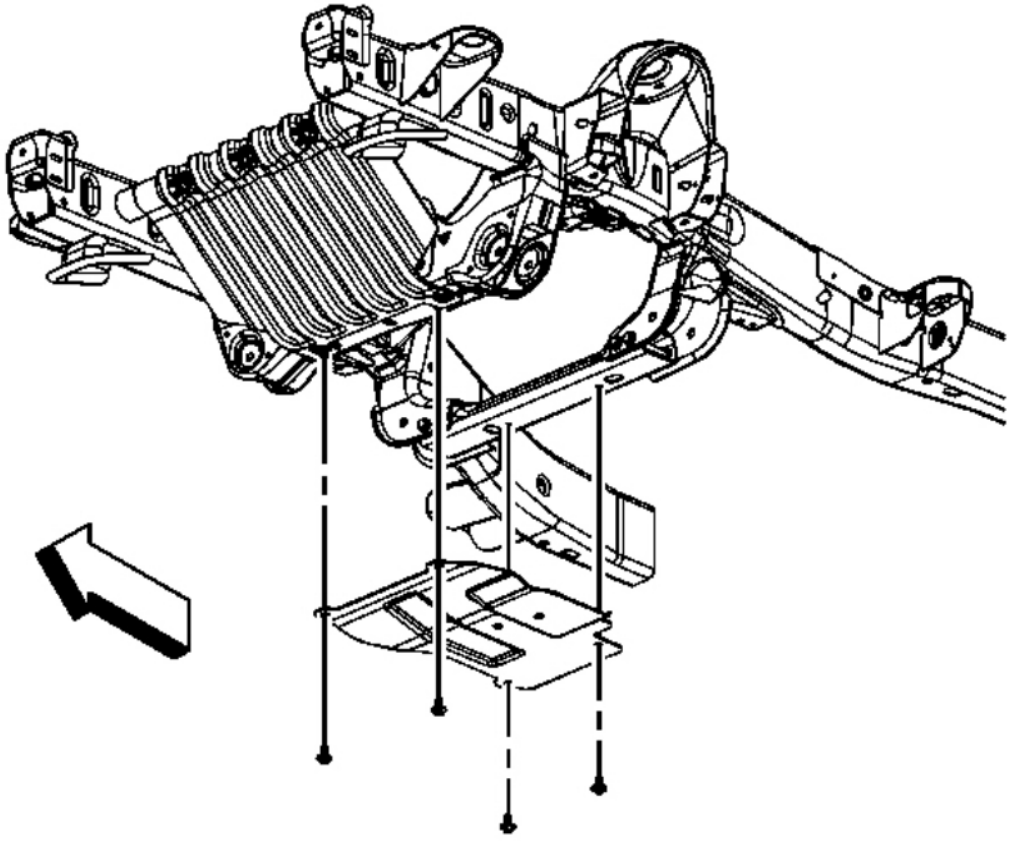


Fig. 381: View Of Oil Pan Skid Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

31. 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).

32. Lower the vehicle.
33. Fill the engine with NEW engine oil. Refer to **Fluid and Lubricant Recommendations** and **Capacities - Approximate Fluid** .
34. Start the engine and inspect for leaks.

OIL PRESSURE RELIEF VALVE REPLACEMENT

REMOVAL PROCEDURE

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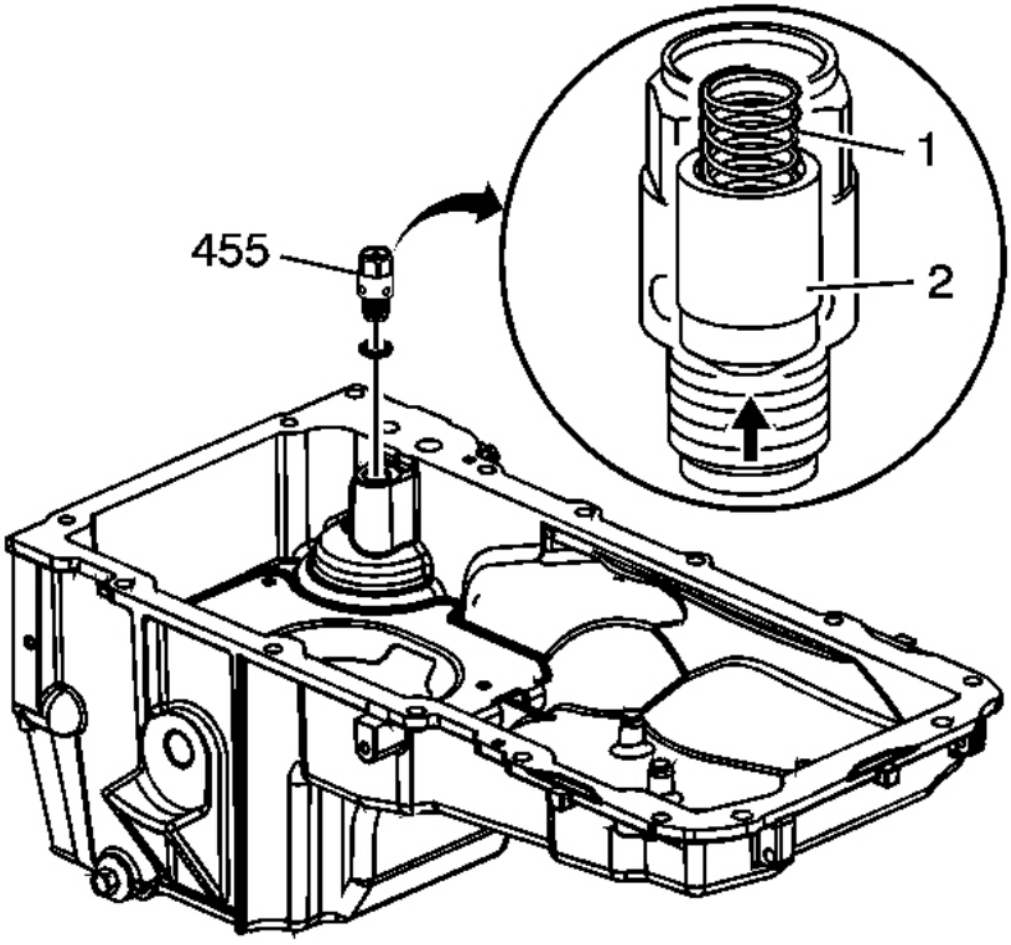


Fig. 382: View Of Oil Pressure Relief Valve Components
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pan. Refer to **Oil Pan Replacement (2WD)** or **Oil Pan Replacement (4WD)**.
2. Place the oil pan on a clean work surface.
3. Remove the oil pressure relief valve (455) and washer.

INSTALLATION PROCEDURE

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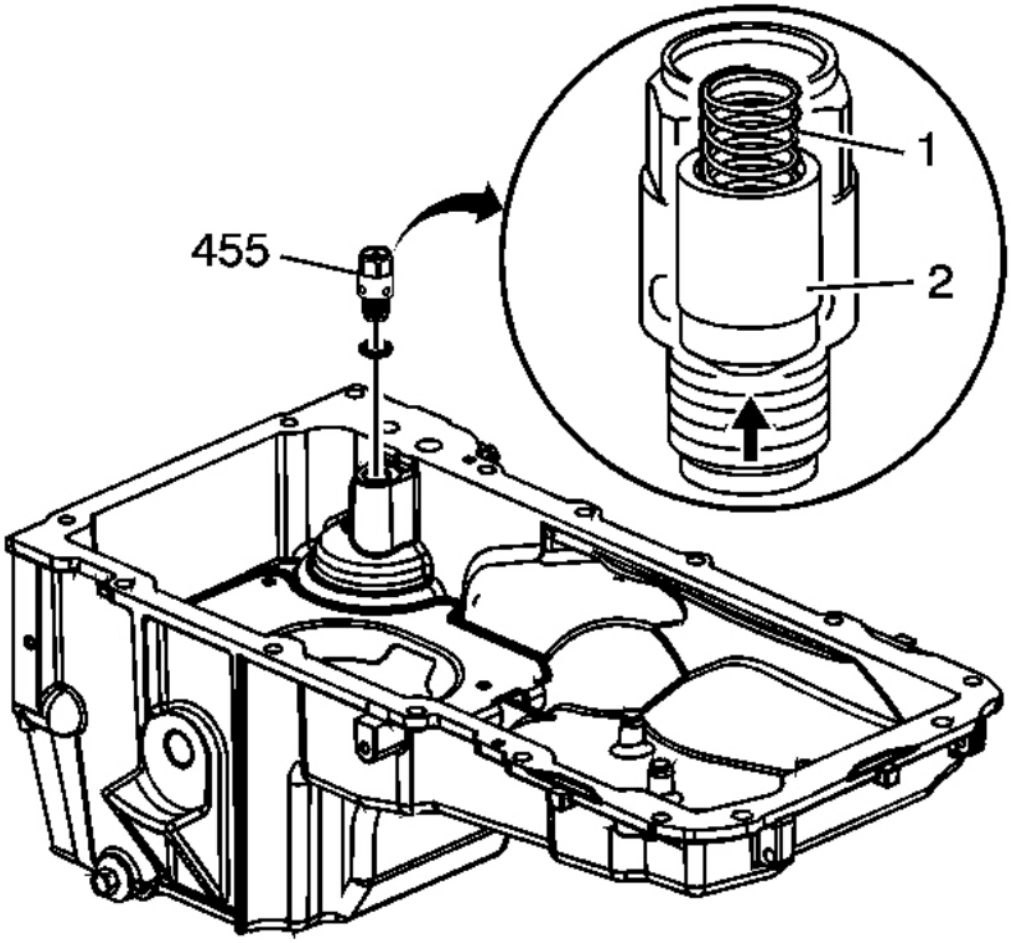


Fig. 383: View Of Oil Pressure Relief Valve Components
Courtesy of GENERAL MOTORS CORP.

1. Inspect the NEW oil pressure relief valve for proper operation. Lightly depress the ball (2). The valve spring (1) should seat the ball to the proper closed position.
2. Install the NEW oil pressure relief valve (455) and washer.
3. Install the oil pan. Refer to **Oil Pan Replacement (2WD)** or **Oil Pan Replacement (4WD)**.

ENGINE OIL PRESSURE SENSOR AND/OR SWITCH REPLACEMENT

TOOLS REQUIRED

J 41712 Oil Pressure Switch Socket. See **Special Tools** .

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REMOVAL PROCEDURE

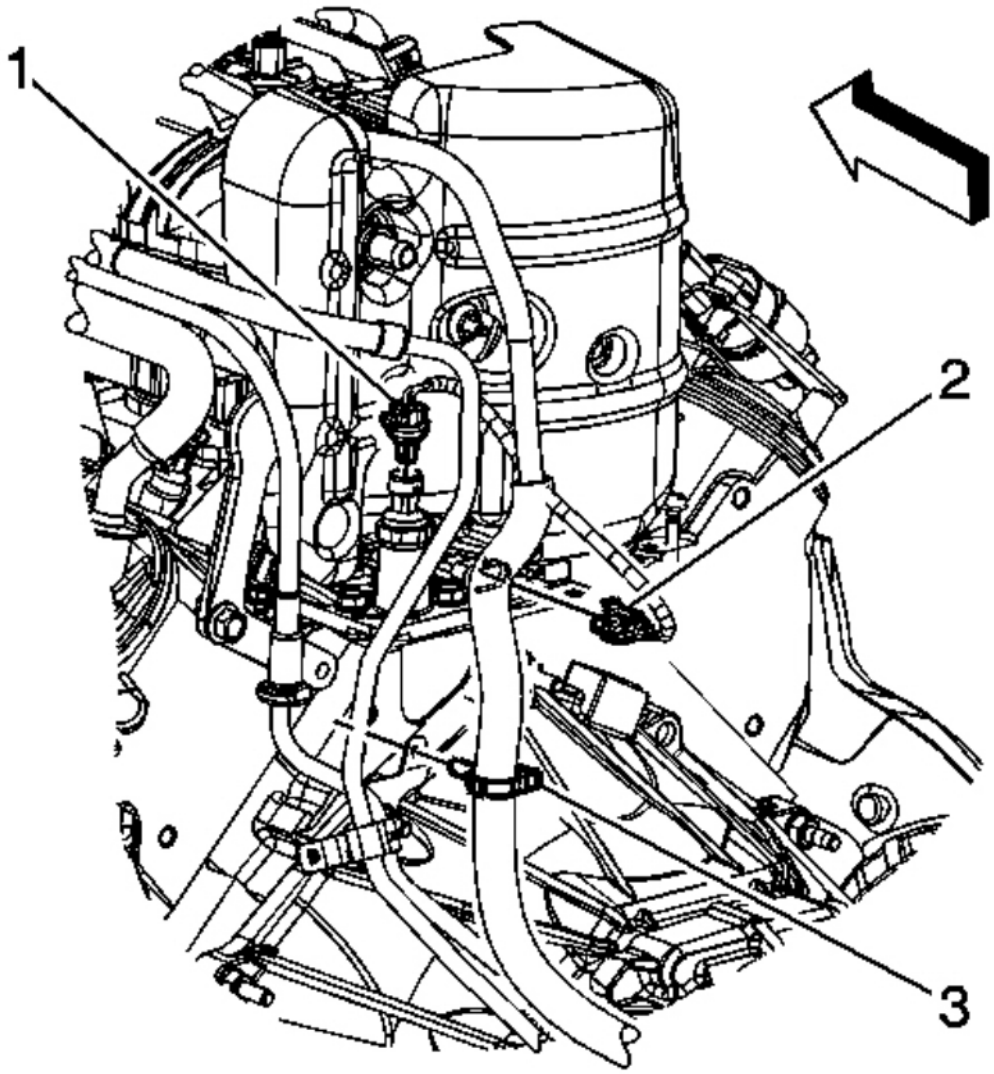


Fig. 384: View Of Engine Harness Electrical Connectors & Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.

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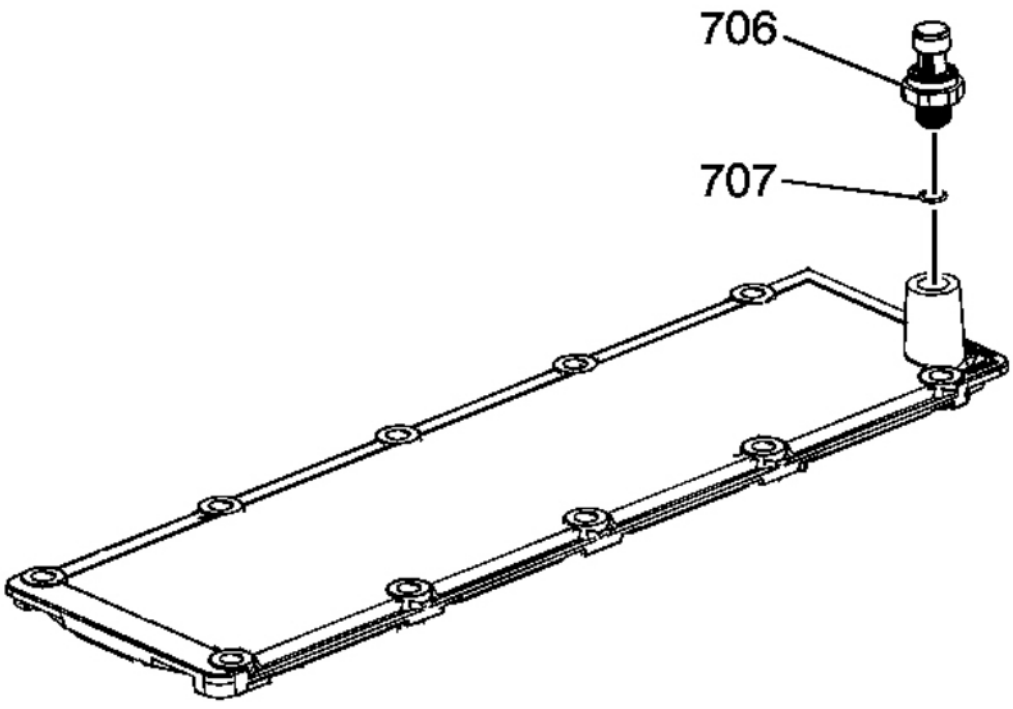


Fig. 385: View Of Oil Pressure Sensor & Washer
Courtesy of GENERAL MOTORS CORP.

3. If not equipped with active fuel management perform the following step, using **J 41712** or equivalent, remove the oil pressure sensor (706) and washer (707). See **Special Tools** .

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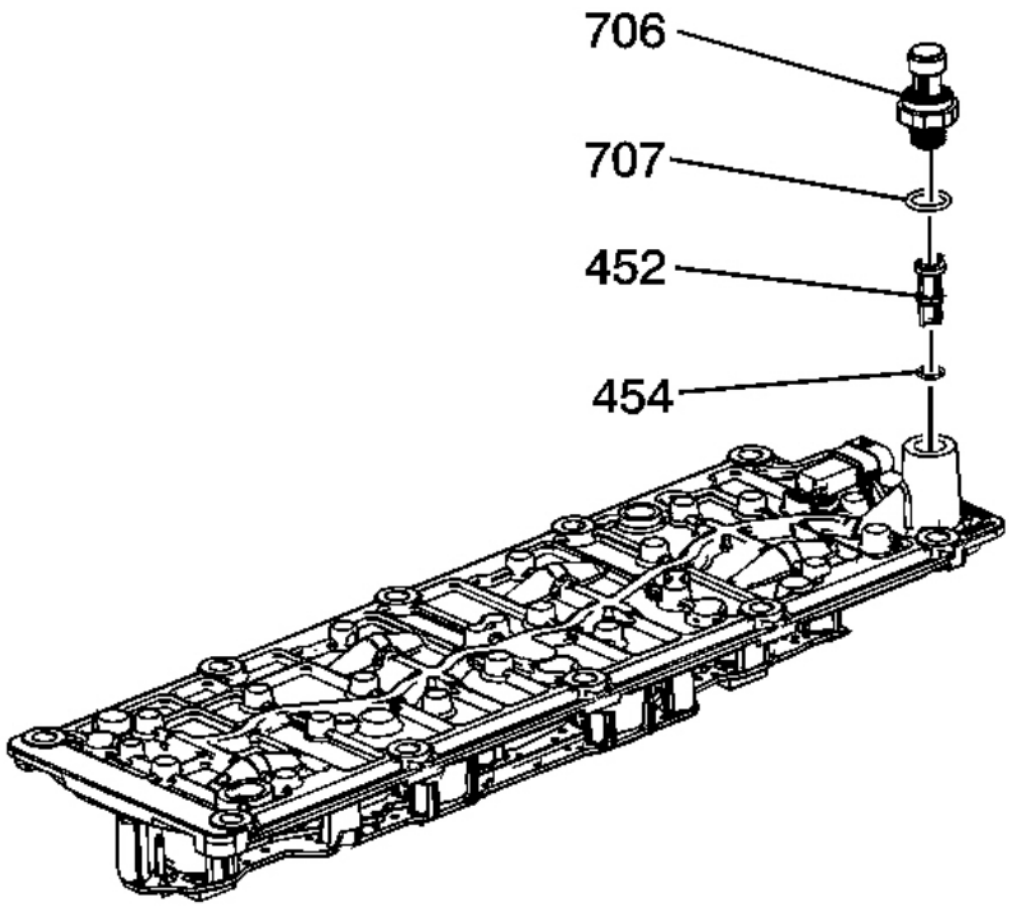


Fig. 386: View Of Oil Pressure Sensor, Washer And Valve Lifter Oil Filter
Courtesy of GENERAL MOTORS CORP.

4. If equipped with active fuel management perform the following step, using **J 41712** or equivalent, remove the oil pressure sensor (706) and washer (707). See **Special Tools** .

INSTALLATION PROCEDURE

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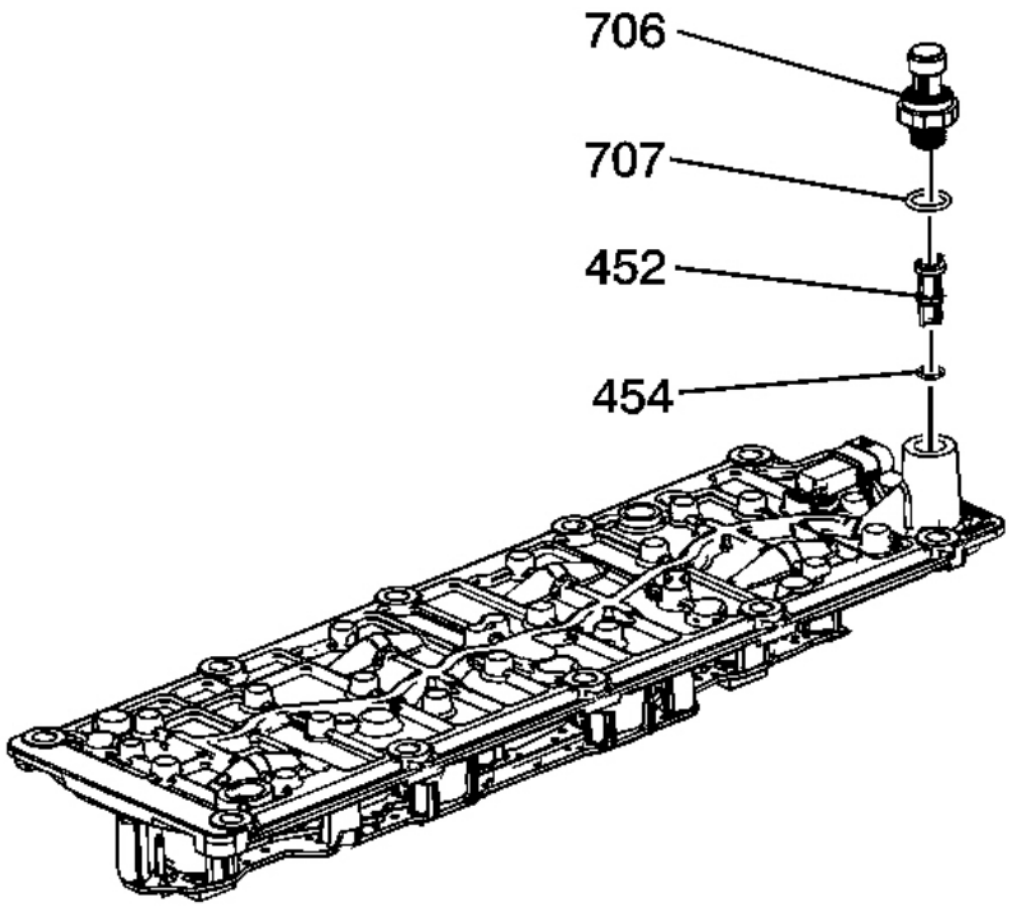


Fig. 387: View Of Oil Pressure Sensor, Washer And Valve Lifter Oil Filter
Courtesy of GENERAL MOTORS CORP.

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

   NOTE: Refer to Fastener Notice .

2. If equipped with active fuel management perform the following step, using **J 41712** or equivalent. See **Special Tools** . Install the oil pressure sensor (706) and washer (707).

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

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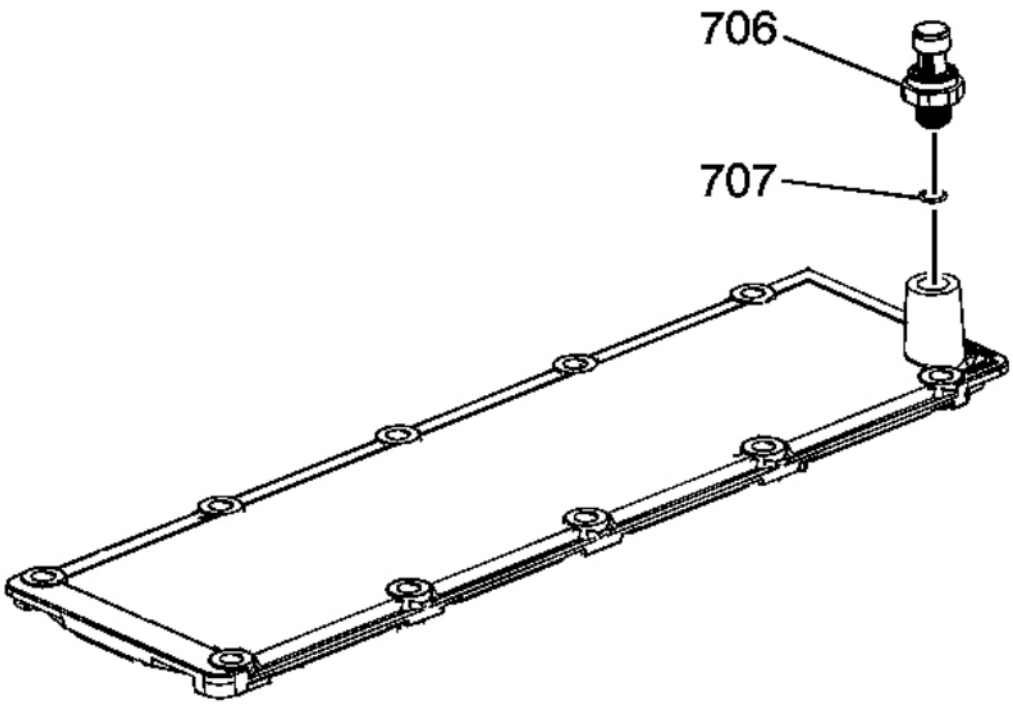


Fig. 388: View Of Oil Pressure Sensor & Washer
Courtesy of GENERAL MOTORS CORP.

3. If not equipped with active fuel management, perform the following step, using **J 41712** or equivalent. See **Special Tools** . Install the oil pressure sensor (706) and washer (707).

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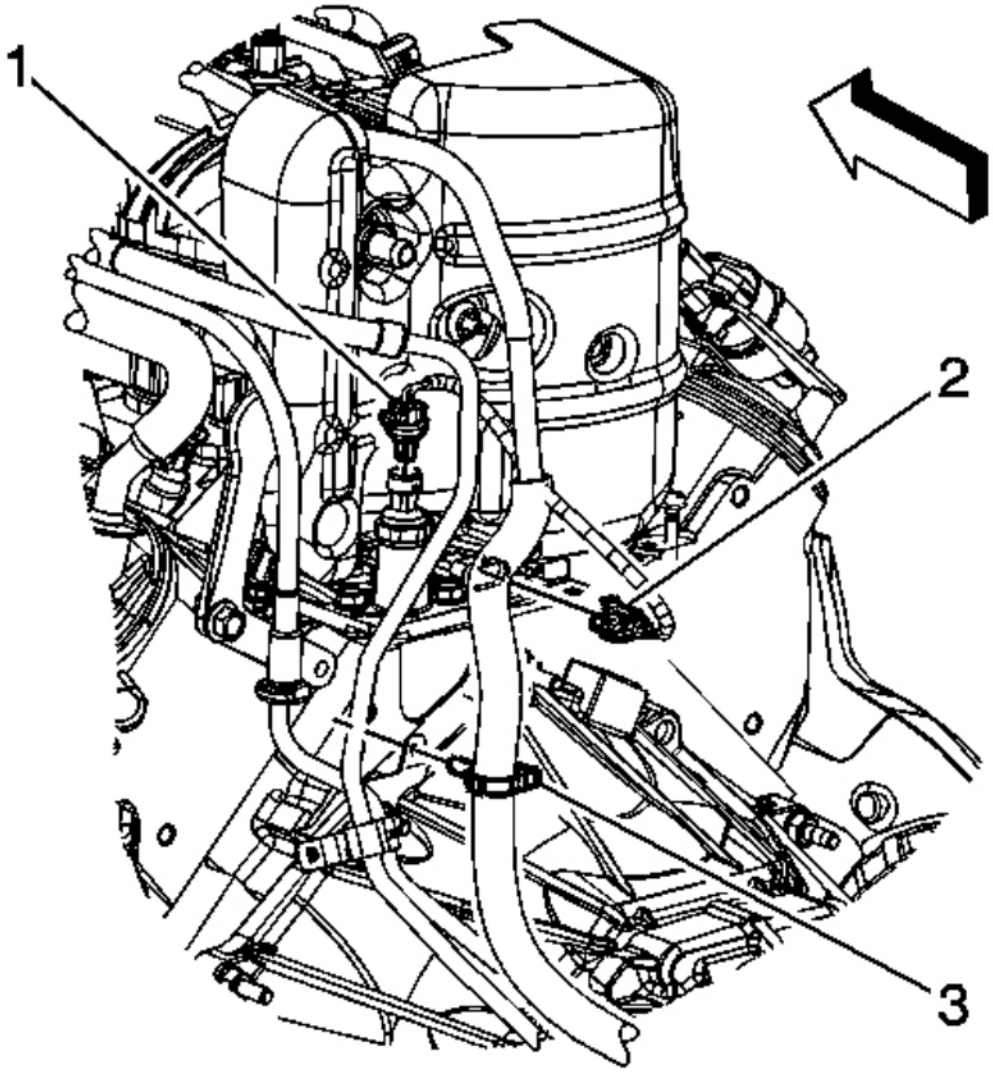


Fig. 389: View Of Engine Harness Electrical Connectors & Inlet Hose Clamp
Courtesy of GENERAL MOTORS CORP.

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

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

5. Install the intake manifold. Refer to **Intake Manifold Replacement (RPOs LC9/LMG/LY5/L76/L92)** or **Intake Manifold Replacement (RPOs LY2/LY6)**.

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ENGINE OIL LEVEL SENSOR AND/OR SWITCH REPLACEMENT

REMOVAL PROCEDURE

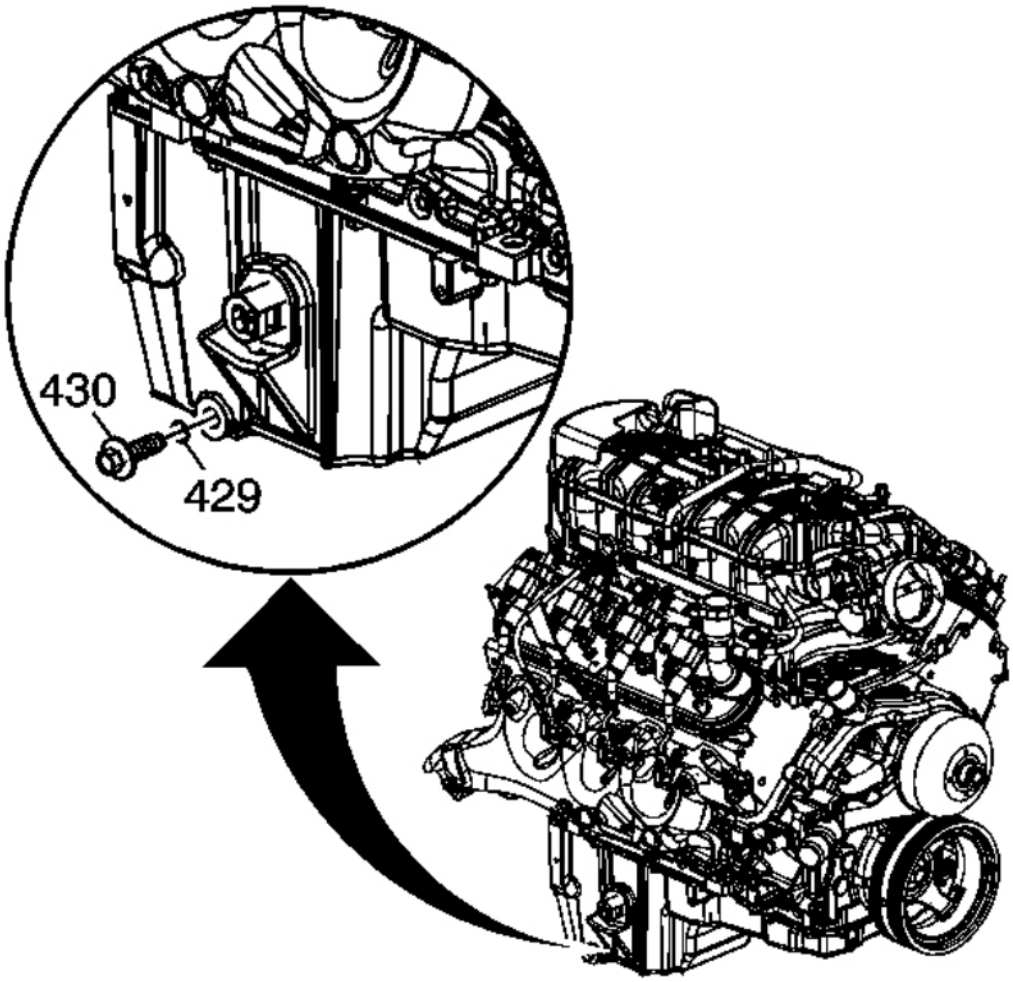


Fig. 390: View Of Oil Pan Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Place a suitable drain pan under the oil pan drain plug.
3. Remove the oil pan drain plug (430).
4. Allow the oil pan to drain completely.

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5. Re-install the oil pan drain plug until snug.
6. Remove the drain pan from under the vehicle.

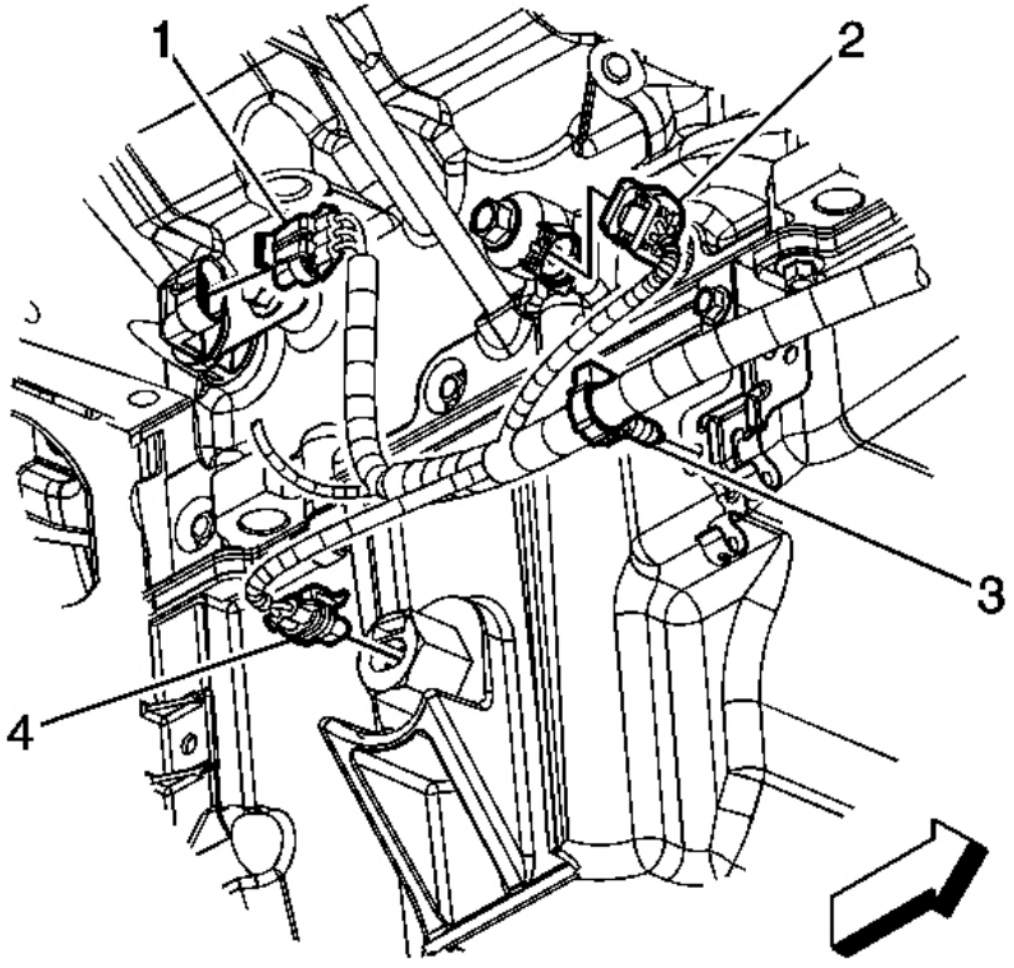


Fig. 391: View Of Electrical Connectors & Clips
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the engine harness electrical connector (4) from the oil level sensor.

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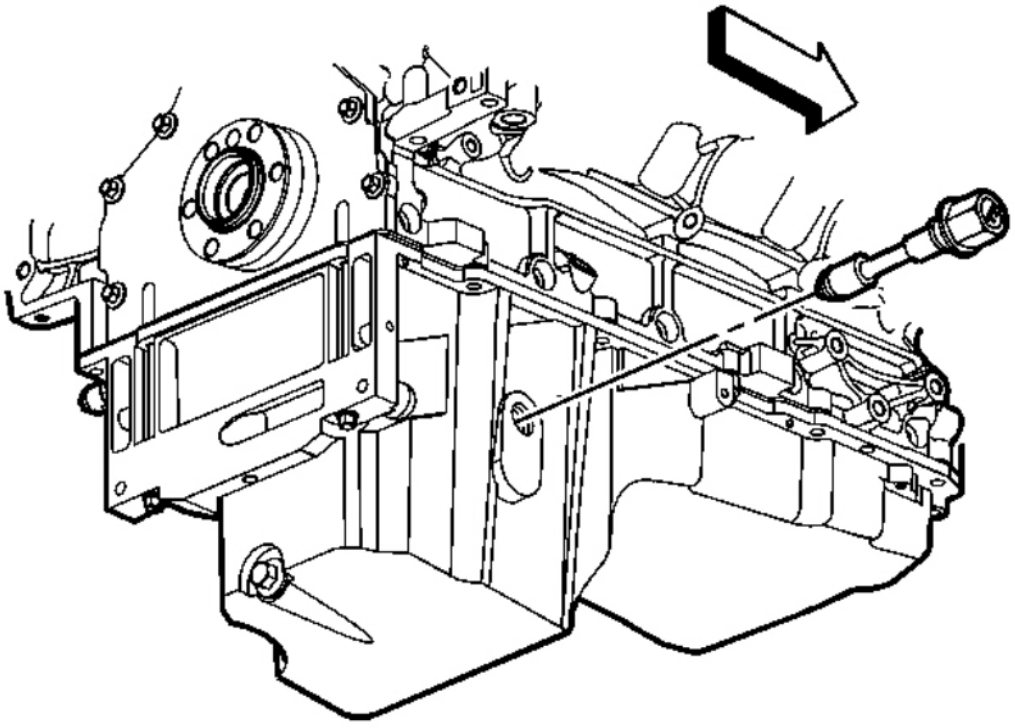


Fig. 392: View Of Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

8. Remove the oil level sensor from the oil pan.

INSTALLATION PROCEDURE

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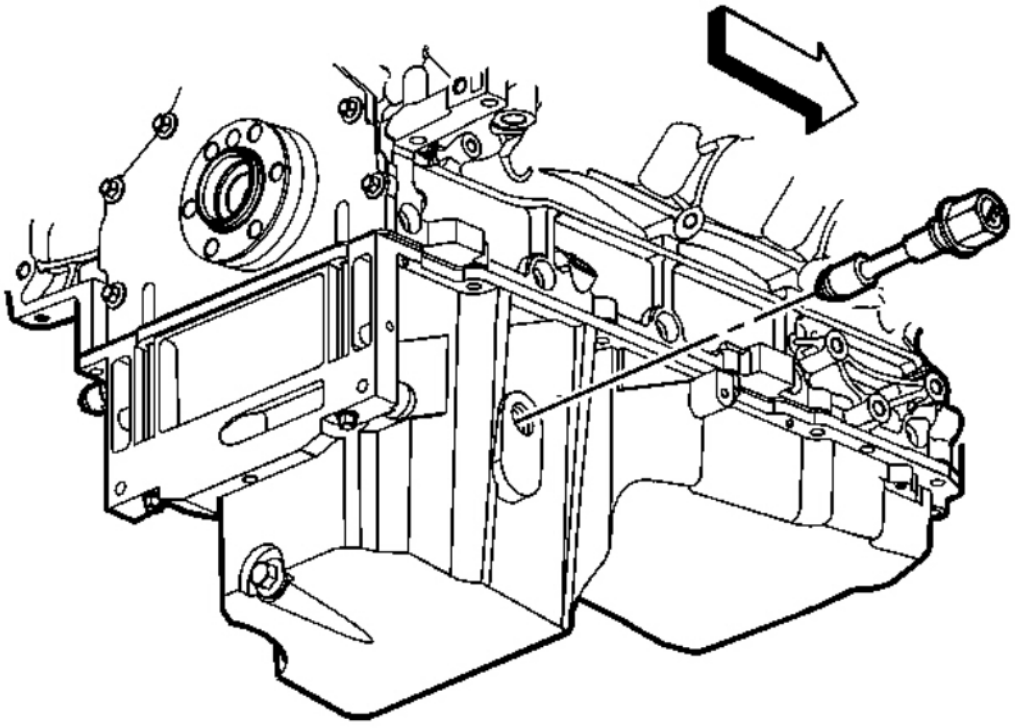


Fig. 393: View Of Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

1. Install the oil level sensor to the oil pan.

   Tighten: Tighten the sensor to 20 N.m (15 lb ft).

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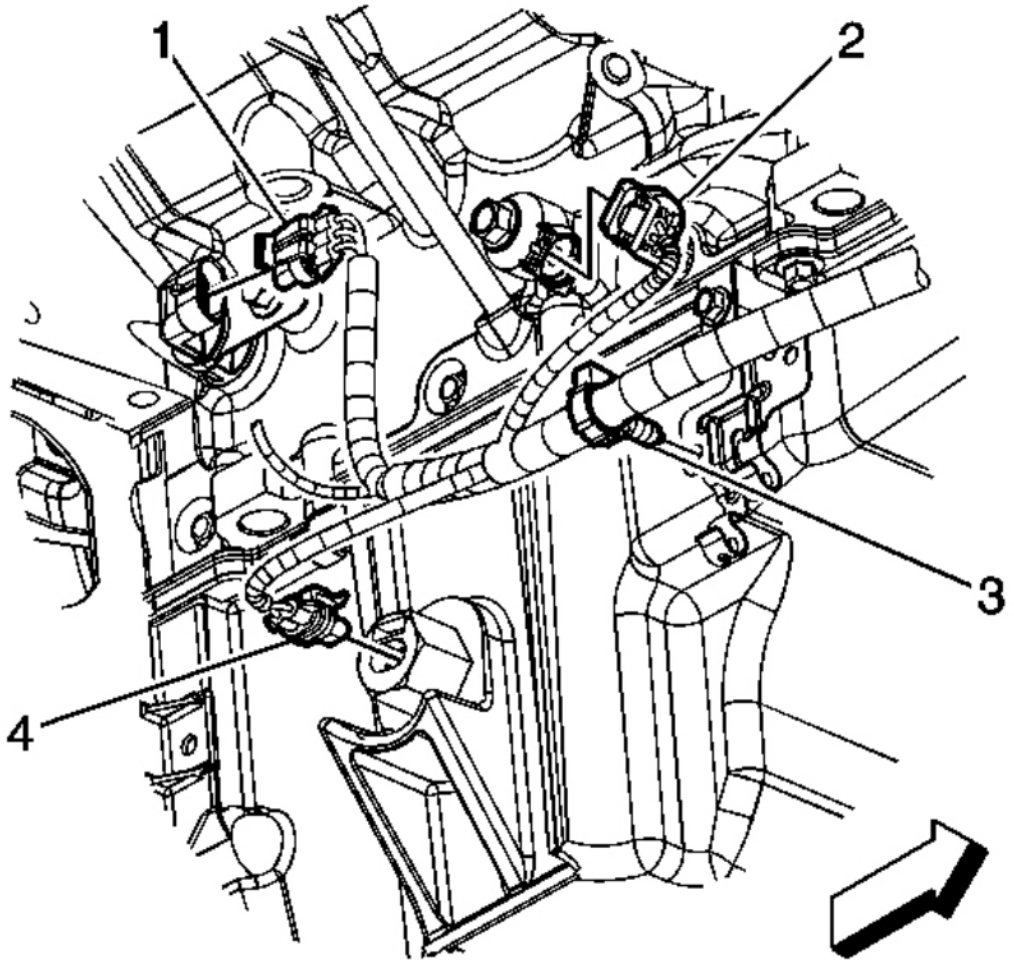


Fig. 394: View Of Electrical Connectors & Clips
Courtesy of GENERAL MOTORS CORP.

2. Connect the engine harness electrical connector (4) to the oil level sensor.

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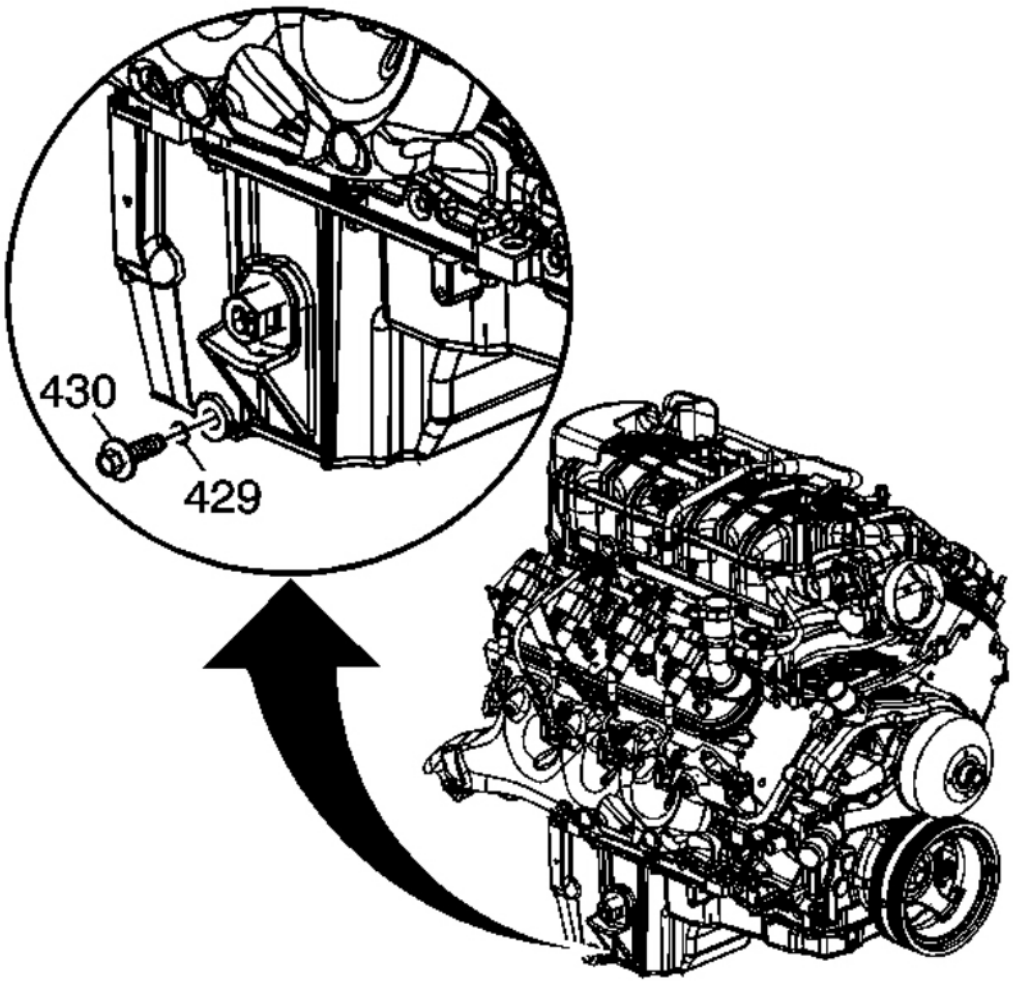


Fig. 395: View Of Oil Pan Drain Plug & Seal
Courtesy of GENERAL MOTORS CORP.

3. Ensure that the oil pan drain plug is tight.

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

4. Lower the vehicle.
5. Fill the engine with NEW engine oil. Refer to **Fluid and Lubricant Recommendations** and **Capacities - Approximate Fluid** .
6. Start the engine and inspect for leaks.

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OIL PUMP, SCREEN AND CRANKSHAFT OIL DEFLECTOR REPLACEMENT (RPOS LC9/LMG/LY2/LY5)

REMOVAL PROCEDURE

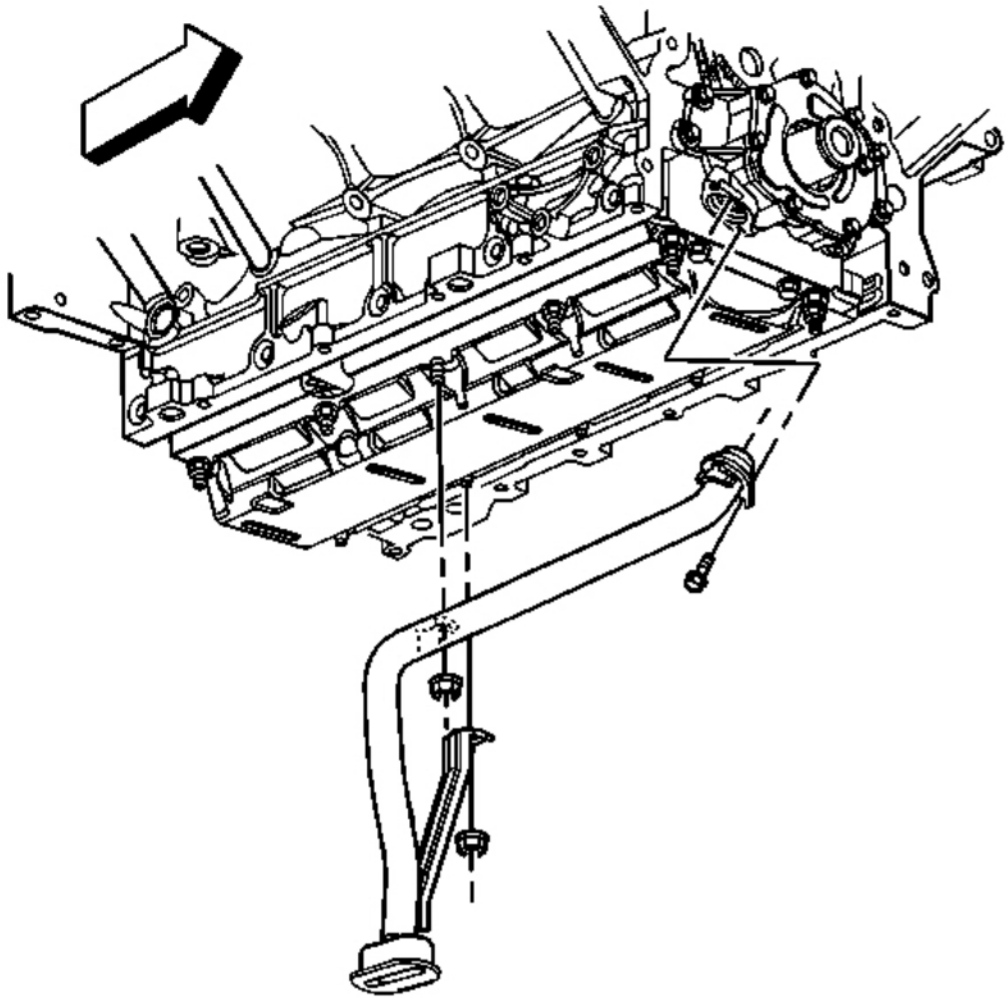


Fig. 396: View Of Oil Pump Screen & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pan. Refer to **Oil Pan Replacement (2WD)** or **Oil Pan Replacement (4WD)**.
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement (RPOs LC9/LMG/LY2/LY5)** or **Engine Front Cover Replacement (RPOs LY6/L76/L92)**.

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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.

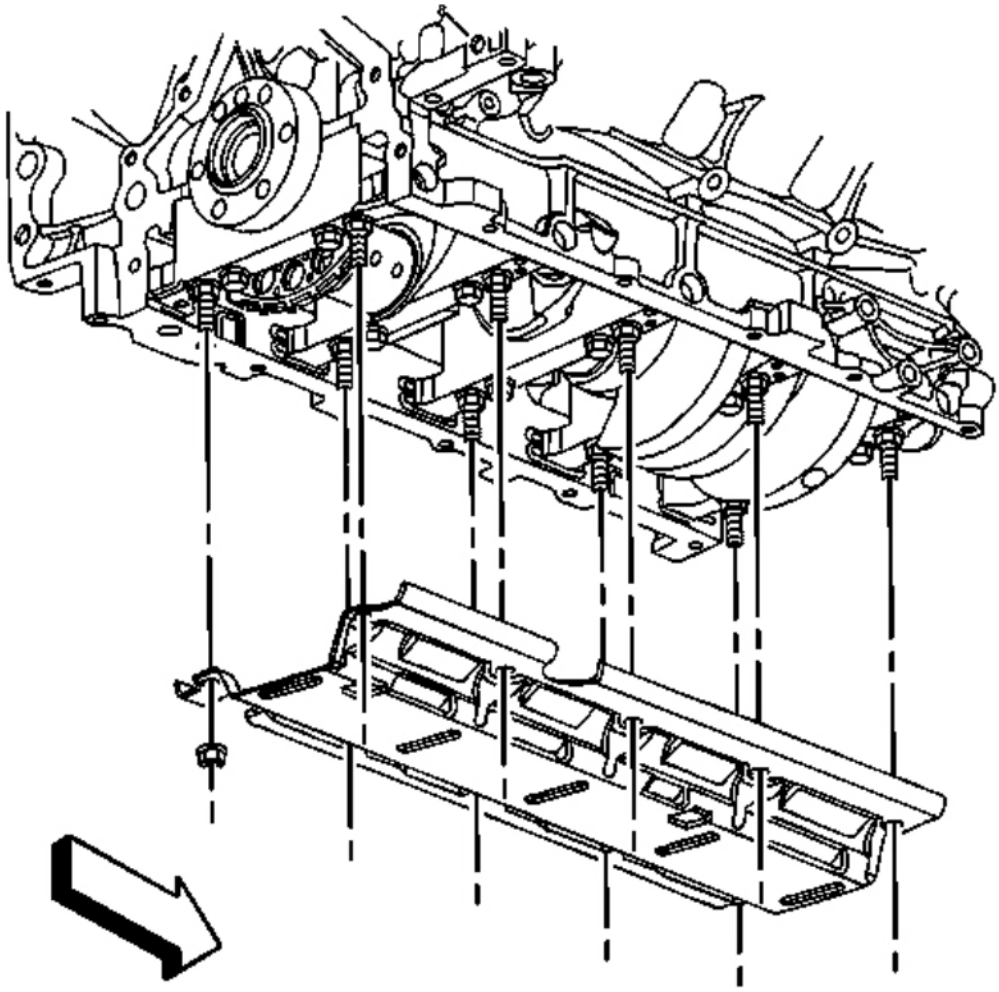


Fig. 397: View Of Crankshaft Oil Deflector & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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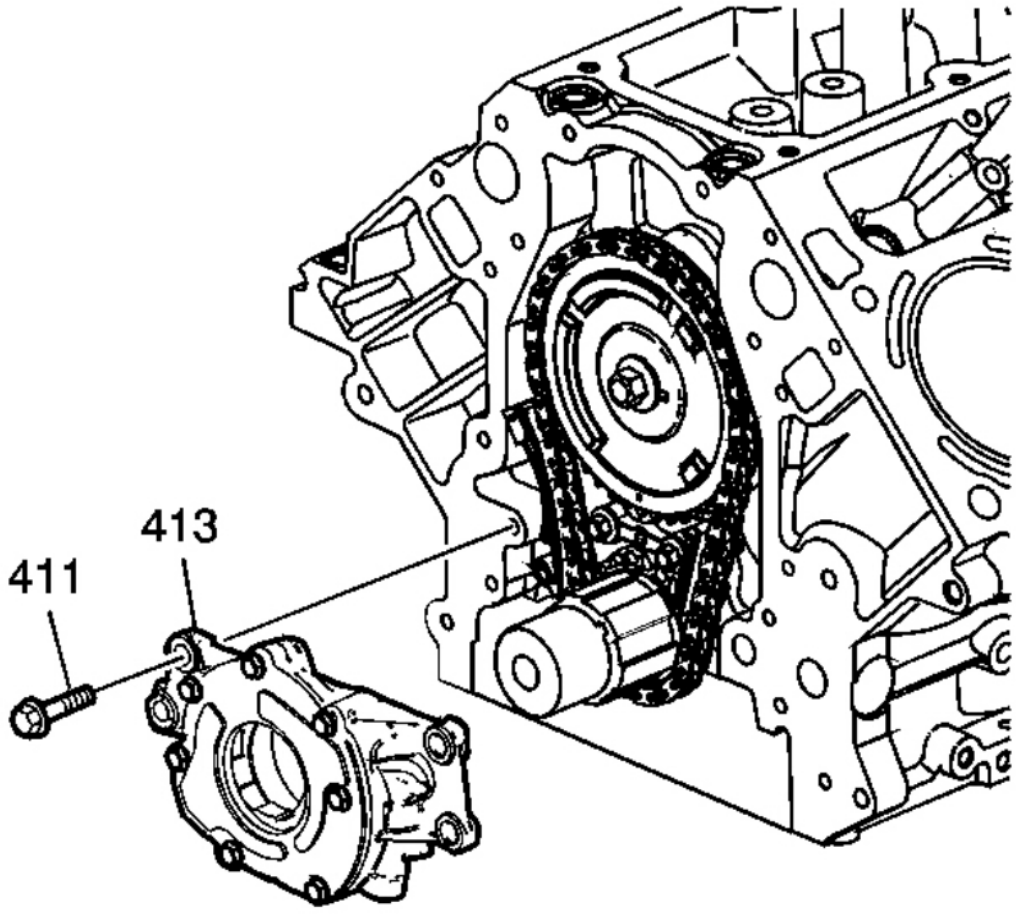


Fig. 398: View Of Oil Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the oil pump bolts (411).

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

10. Remove the oil pump (413).

INSTALLATION PROCEDURE

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

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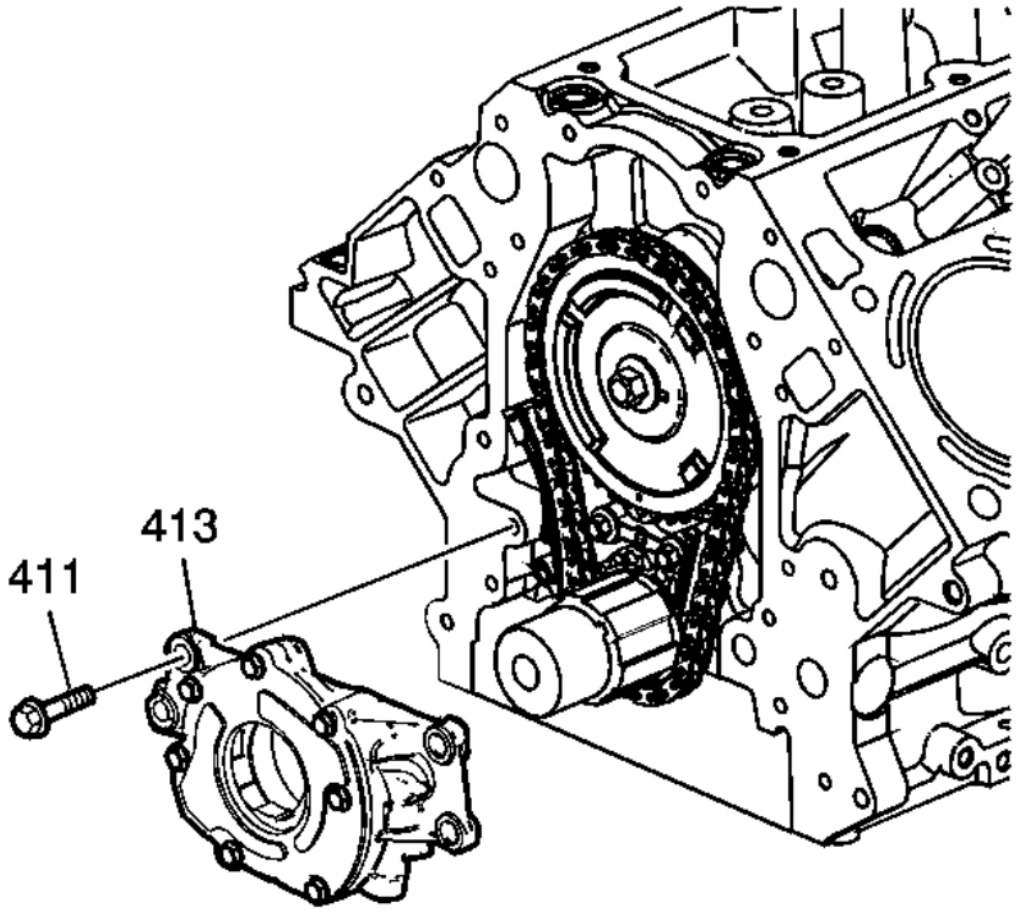


Fig. 399: View Of Oil Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

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.

NOTE: **Refer to Fastener Notice .**

3. Install the oil pump bolts (411).

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

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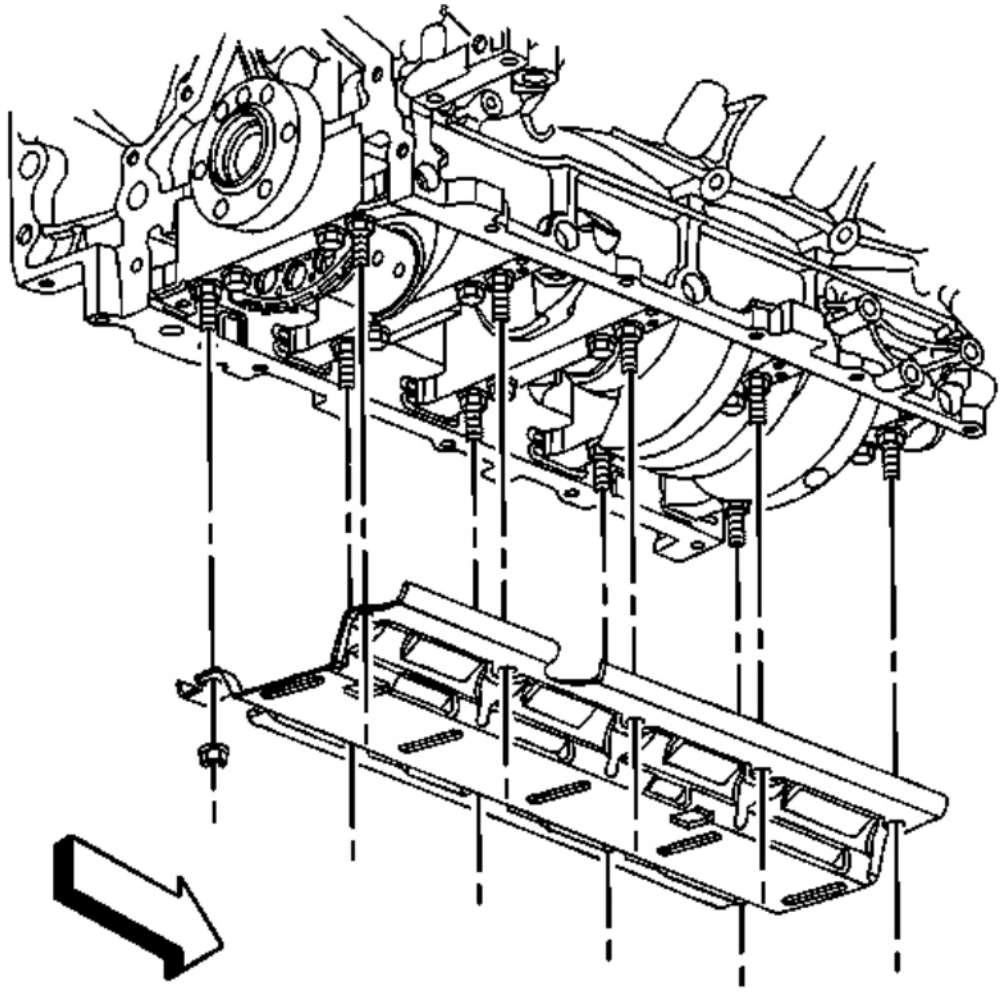


Fig. 400: View Of Crankshaft Oil Deflector & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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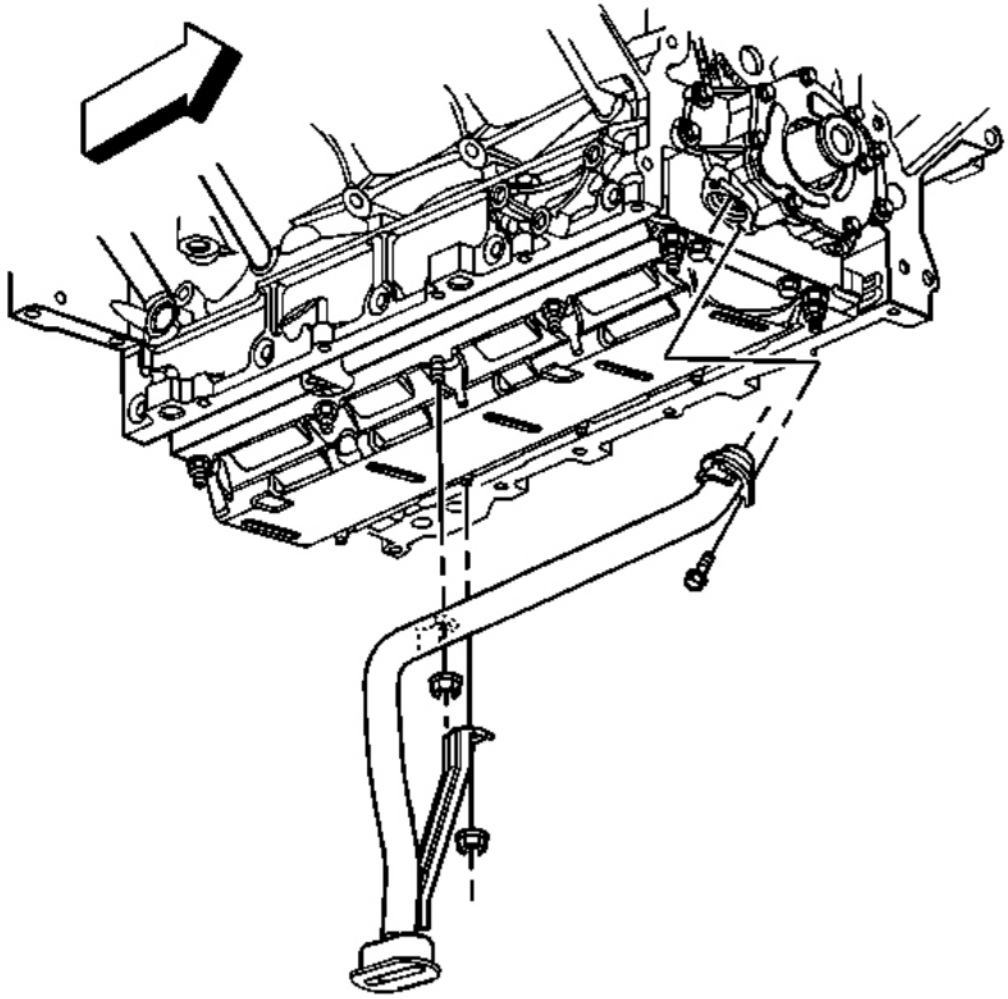


Fig. 401: View Of Oil Pump Screen & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

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.

IMPORTANT: 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.

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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 (RPOs LC9/LMG/LY2/LY5)** or **Engine Front Cover Replacement (RPOs LY6/L76/L92)**.
11. Install the oil pan. Refer to **Oil Pan Replacement (2WD)** or **Oil Pan Replacement (4WD)**.

OIL PUMP, SCREEN AND CRANKSHAFT OIL DEFLECTOR REPLACEMENT (RPOS LY6/L76/L92)

REMOVAL PROCEDURE

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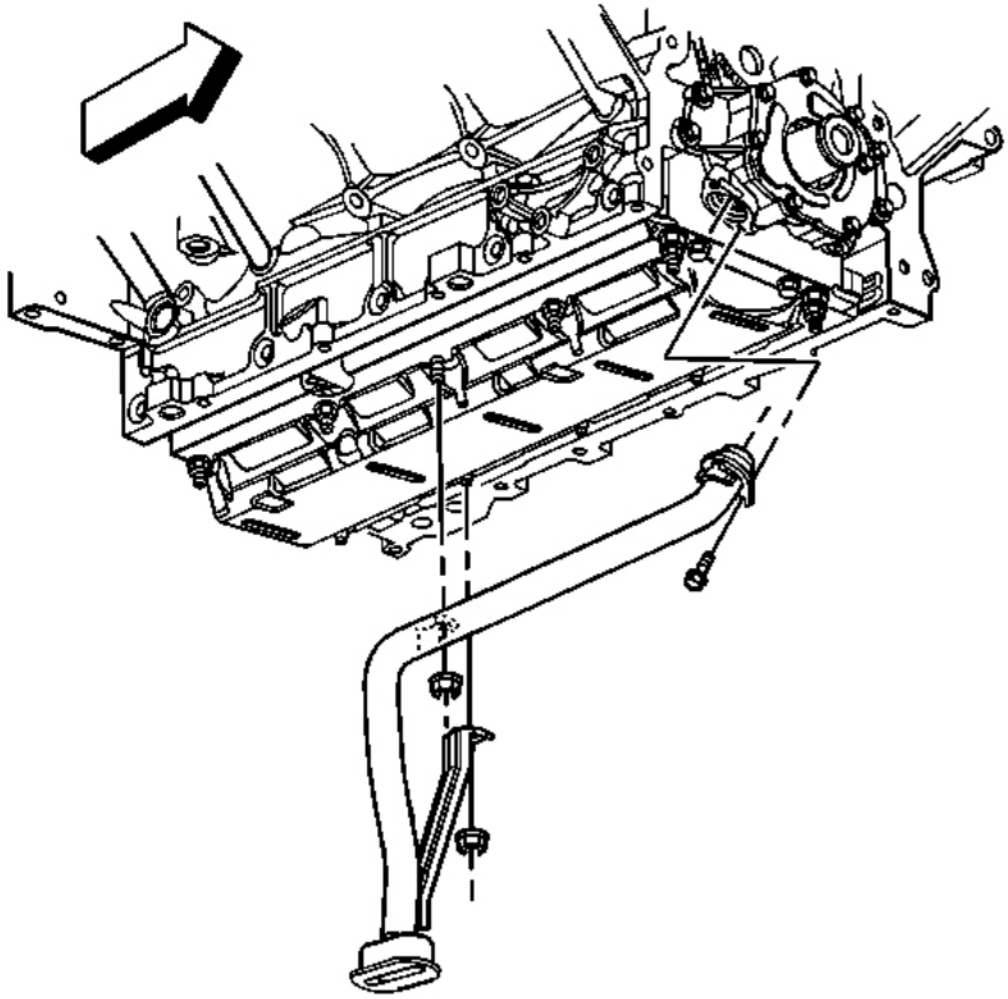


Fig. 402: View Of Oil Pump Screen & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil pan. Refer to **Oil Pan Replacement (2WD)** or **Oil Pan Replacement (4WD)**.
2. Remove the engine front cover. Refer to **Engine Front Cover Replacement (RPOs LC9/LMG/LY2/LY5)** or **Engine Front Cover Replacement (RPOs LY6/L76/L92)**.
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.

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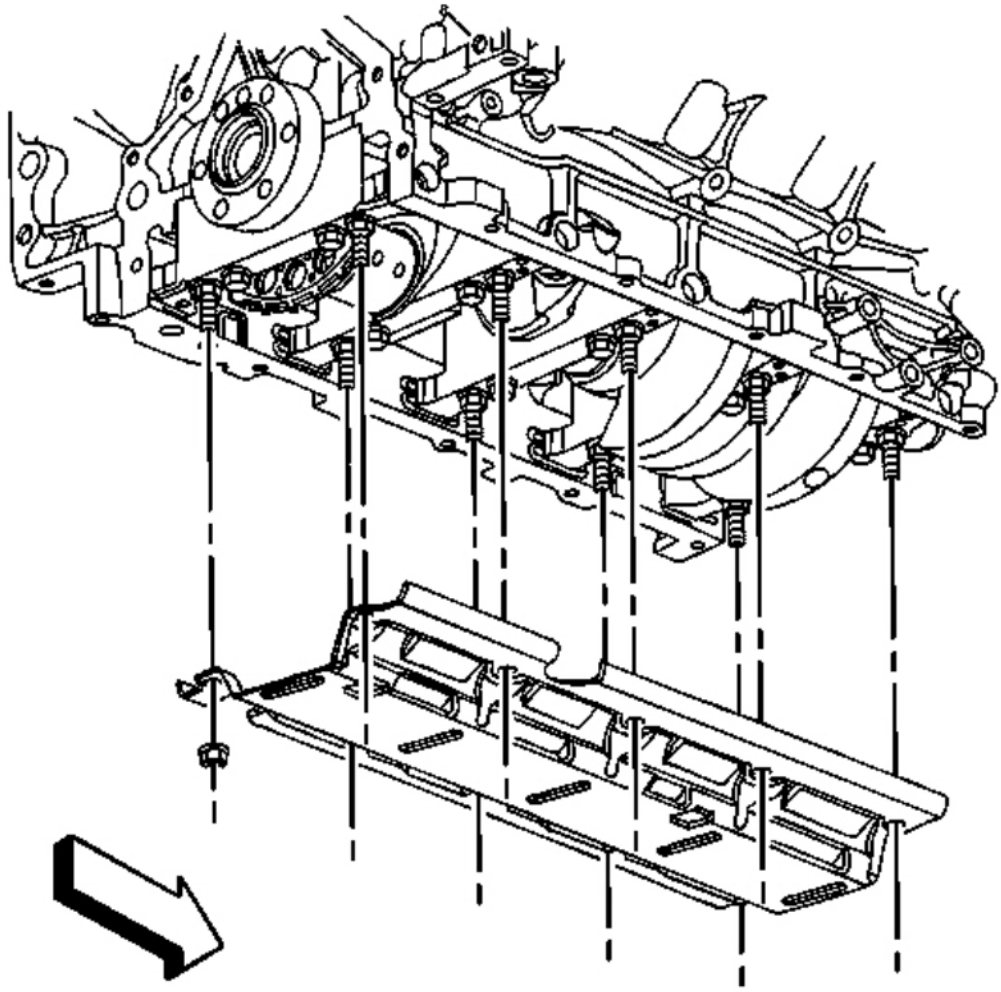


Fig. 403: View Of Crankshaft Oil Deflector & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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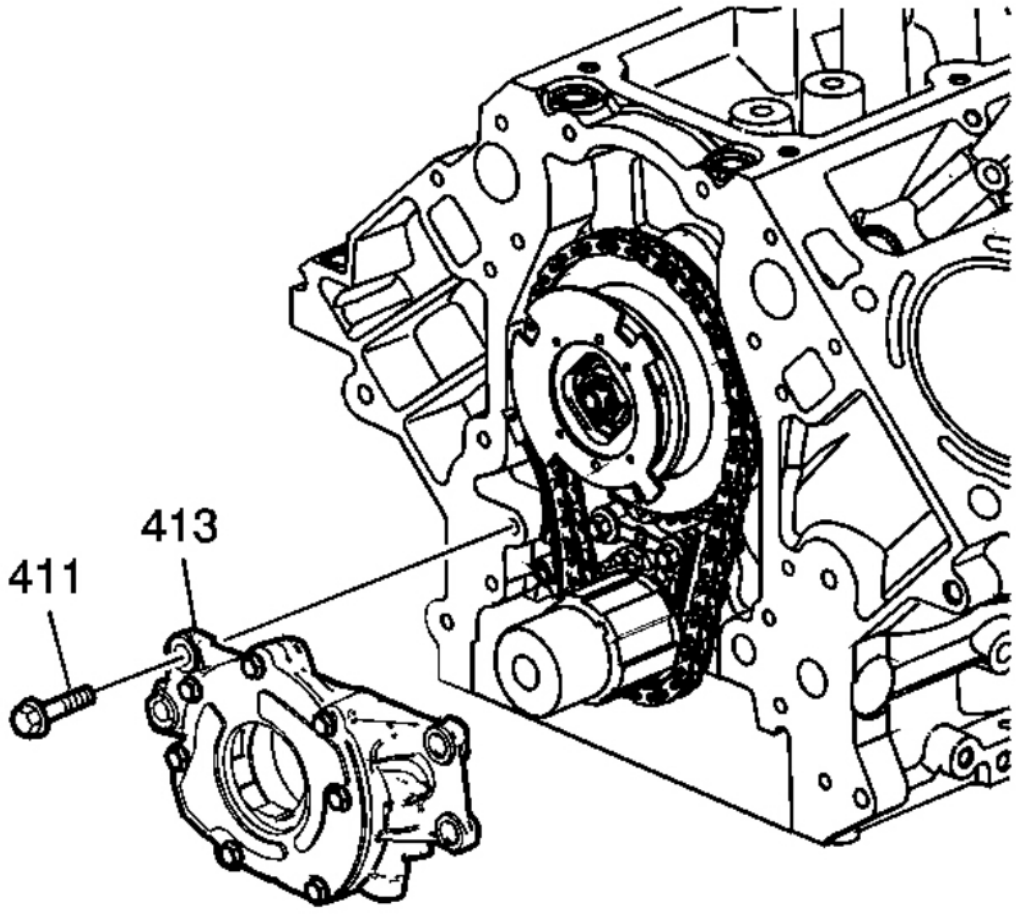


Fig. 404: View Of Oil Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the oil pump bolts (411).

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

10. Remove the oil pump (413)

INSTALLATION PROCEDURE

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

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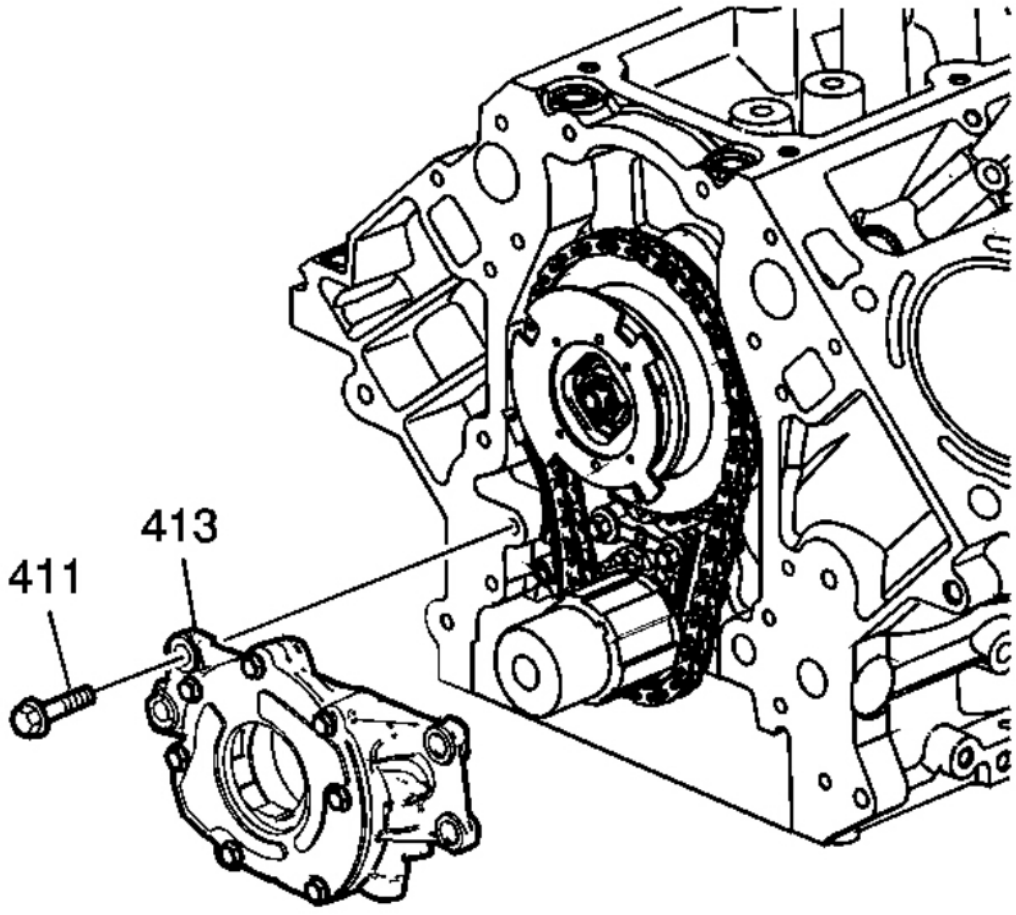


Fig. 405: View Of Oil Pump & Bolts
Courtesy of GENERAL MOTORS CORP.

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.

NOTE: Refer to Fastener Notice.

3. Install the oil pump bolts (411).

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

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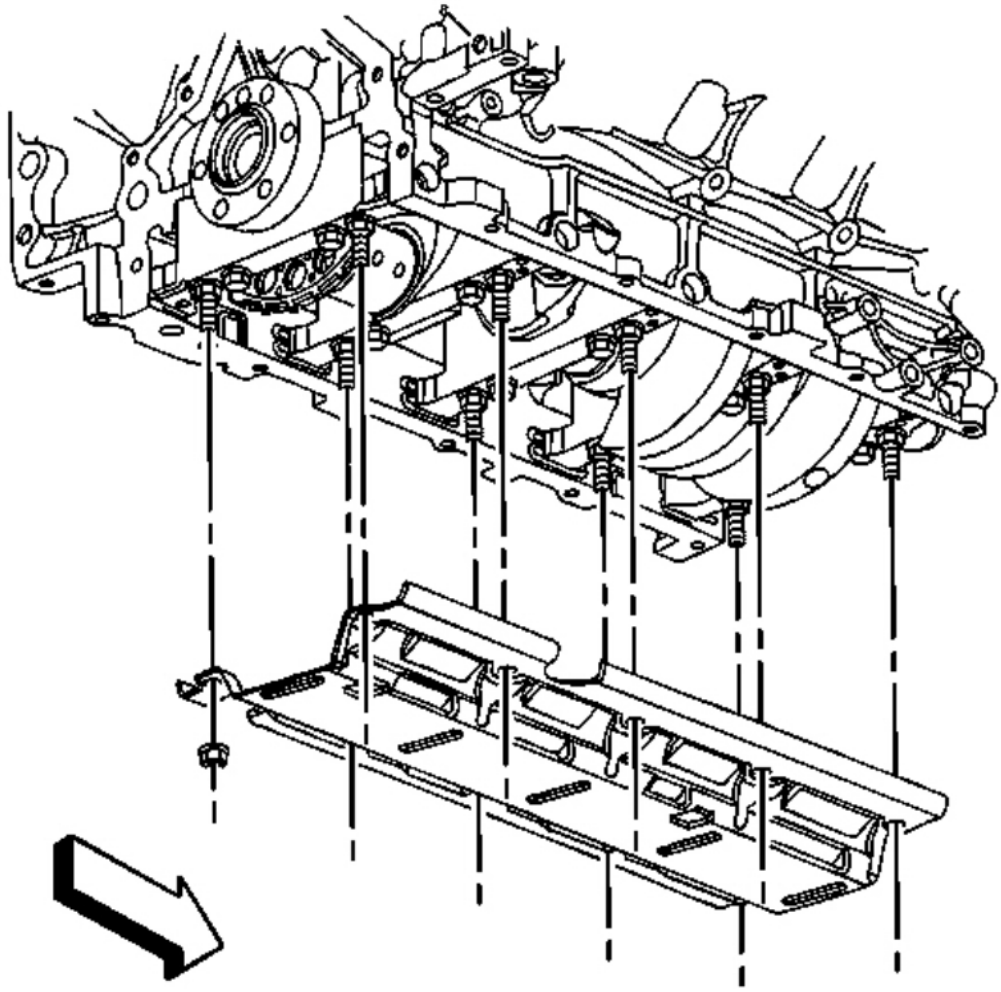


Fig. 406: View Of Crankshaft Oil Deflector & Nuts
Courtesy of GENERAL MOTORS CORP.

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

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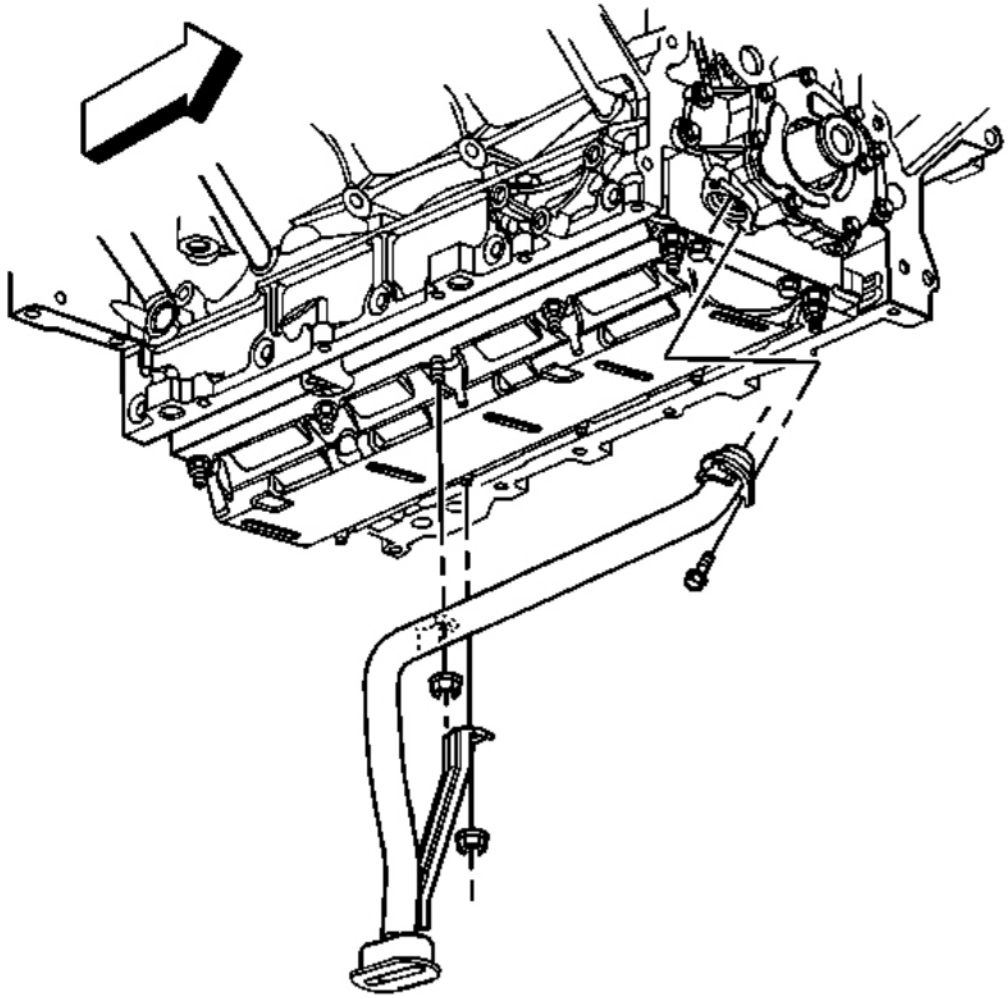


Fig. 407: View Of Oil Pump Screen & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

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.

IMPORTANT: 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.

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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 (RPOs LC9/LMG/LY2/LY5)** or **Engine Front Cover Replacement (RPOs LY6/L76/L92)**.
11. Install the oil pan. Refer to **Oil Pan Replacement (2WD)** or **Oil Pan Replacement (4WD)**.

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