2007 ENGINE

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

CRANKSHAFT FRONT OIL SEAL INSTALLATION (RPO LY2/LC9/LY5/LMG)

TOOLS REQUIRED

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

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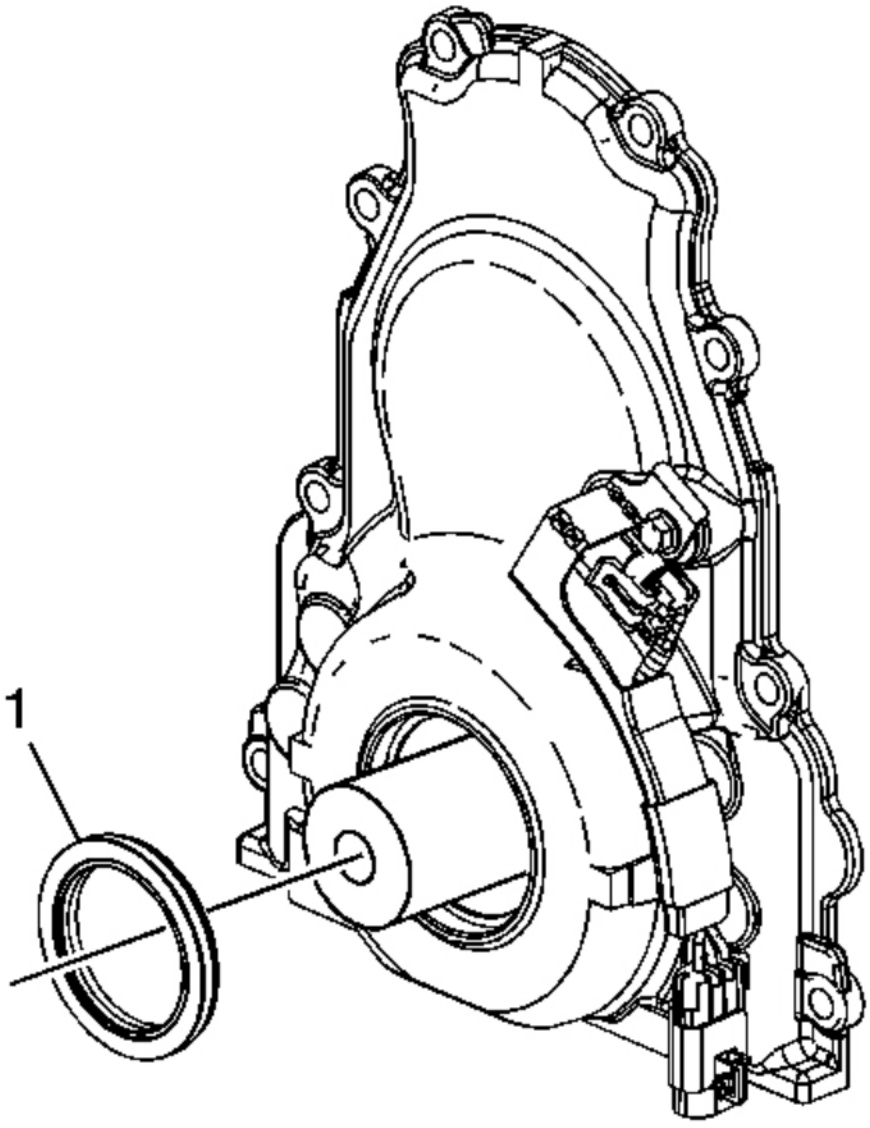


Fig. 1: View Of Crankshaft Front Oil Seal
Courtesy of GENERAL MOTORS CORP.

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

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.

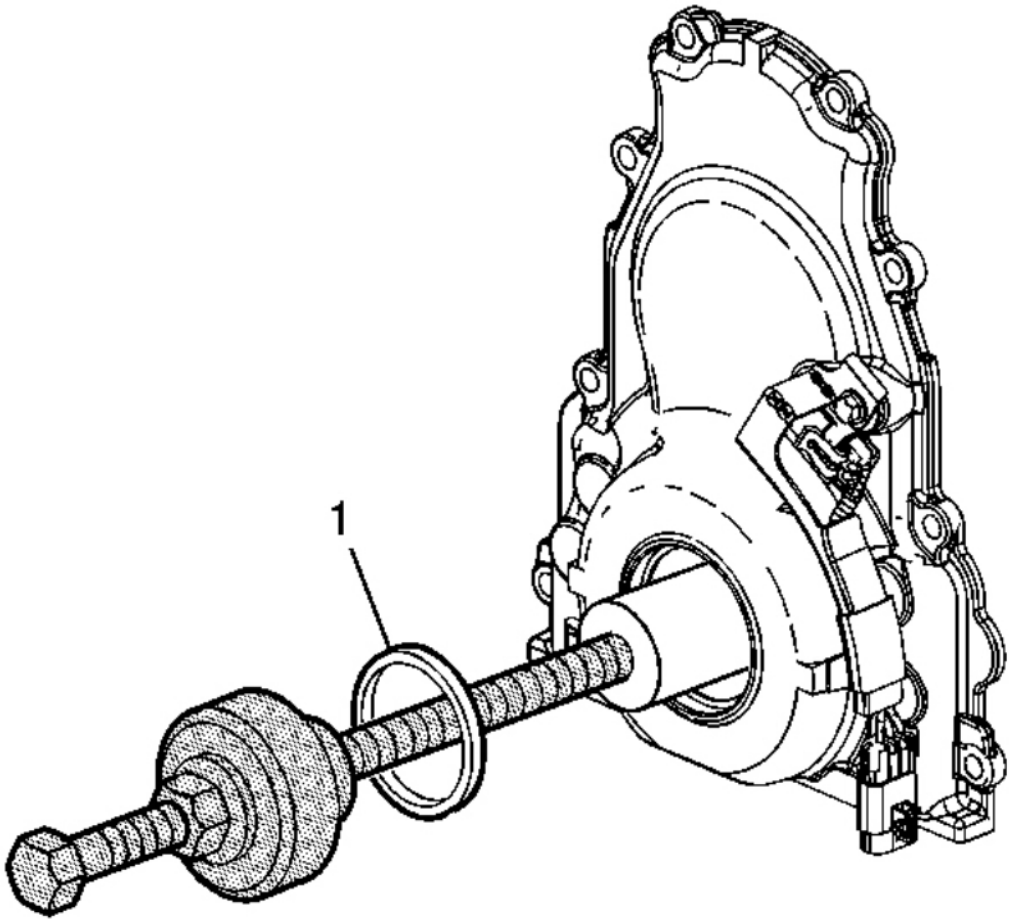


Fig. 2: View Of Crankshaft Front Oil Seal Installation
Courtesy of GENERAL MOTORS CORP.

3. Install the crankshaft front oil seal (1) onto the **J 41478** . 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 tool.

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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.

CRANKSHAFT FRONT OIL SEAL INSTALLATION (RPO LY6/L76/L92)

TOOLS REQUIRED

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

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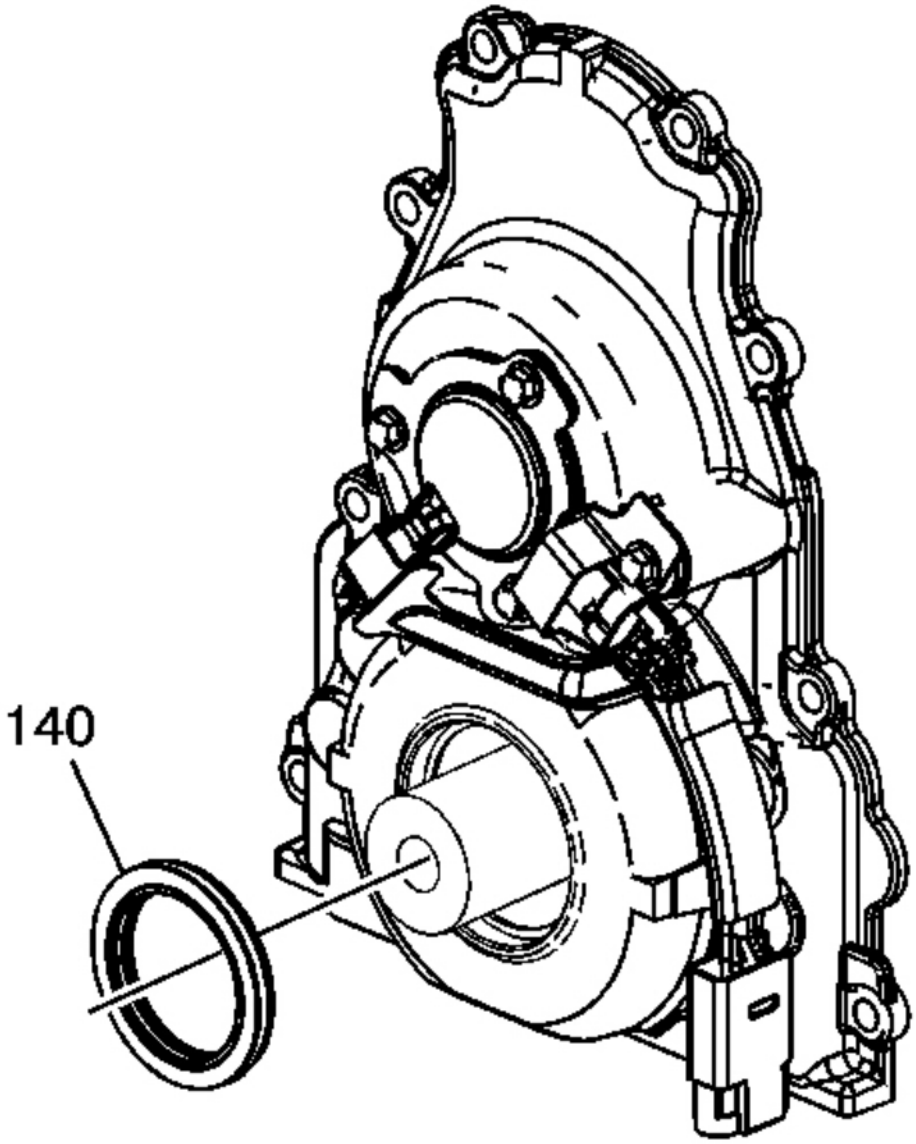


Fig. 3: View Of Outer Edge Of The Oil Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

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

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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.

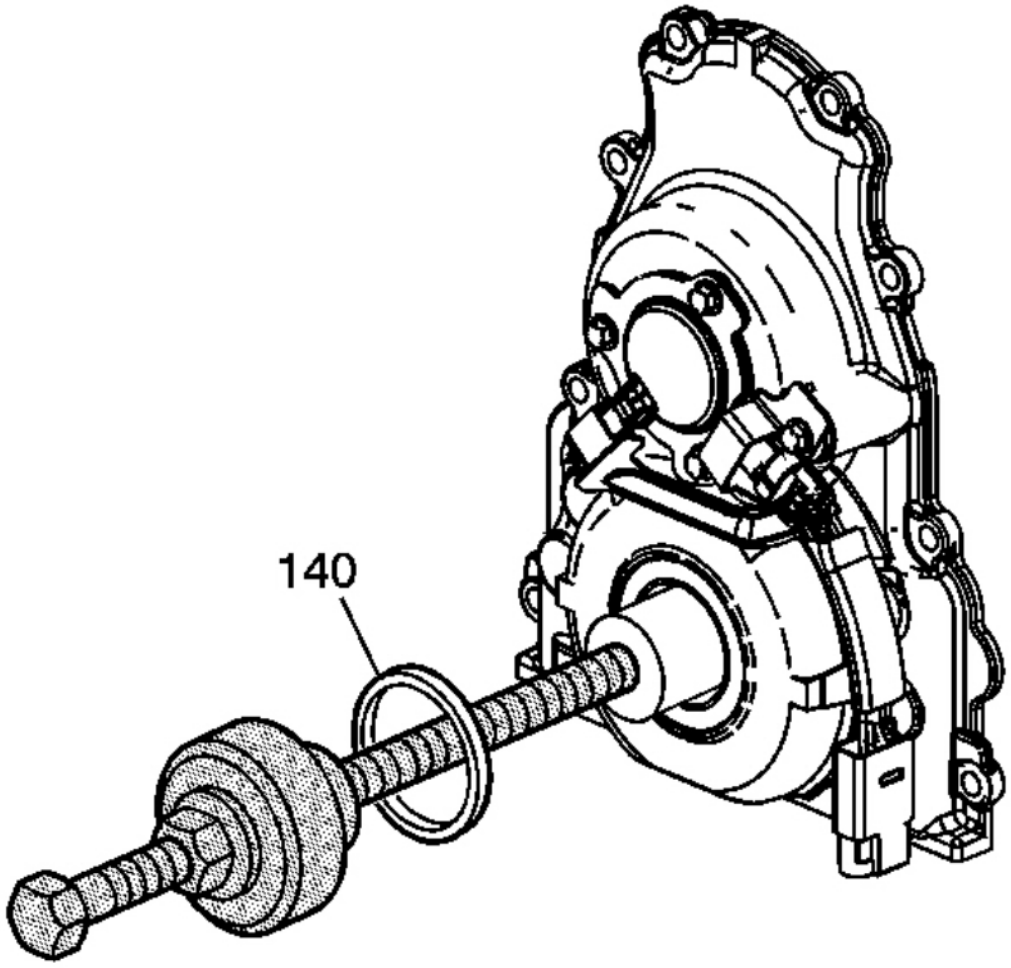


Fig. 4: View Of Front Oil Seal & Special Tool
Courtesy of GENERAL MOTORS CORP.

3. Install the crankshaft front oil seal (140) onto the **J 41478** . 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 tool.
4. Inspect the oil seal for proper installation. The oil seal should be installed evenly and completely into the front cover bore.

OIL PAN INSTALLATION

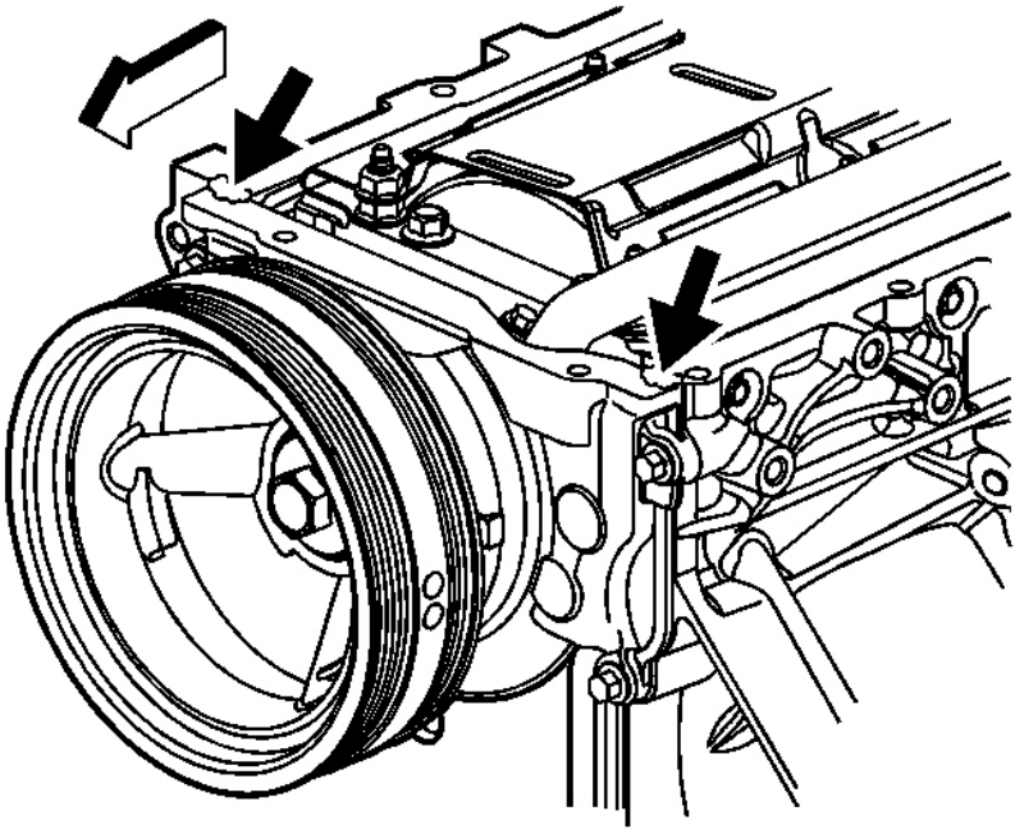


Fig. 5: View Of Sealant On Engine Front Cover Gasket Tabs
Courtesy of GENERAL MOTORS CORP.

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 housing. 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 are flush or even. The rear of the oil pan must NEVER protrude beyond the engine block and transmission housing**

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plane.

- **Do not use the oil pan gasket again.**
- **It is not necessary to rivet the NEW gasket to the oil pan.**
- **It is not necessary to remove the oil level sensor prior to oil pan installation.**

1. Apply a 5 mm (0.2 in) bead of sealant GM P/N 12378521 (Canadian P/N 88901148), or equivalent, 20 mm (0.8 in) long to the engine block. Apply the sealant directly onto the tabs of the front cover gasket that protrude into the oil pan surface. Refer to **Sealers, Adhesives, and Lubricants** .

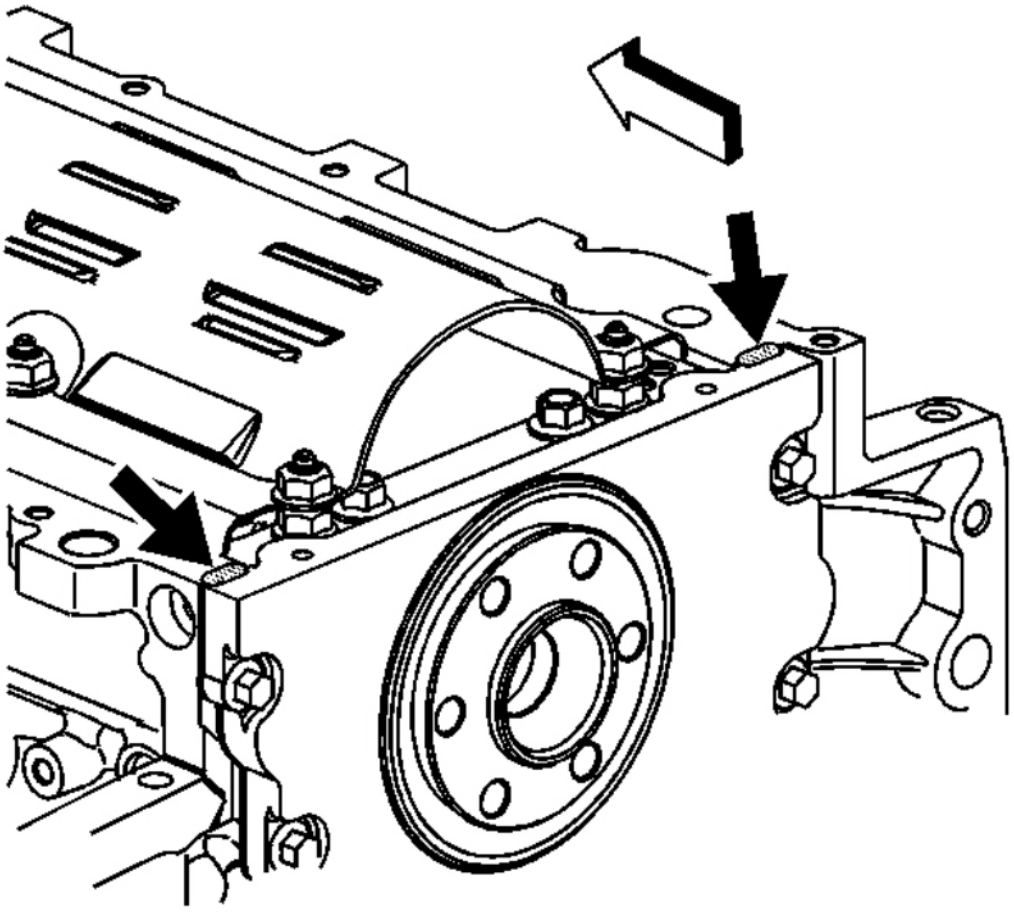


Fig. 6: View Of Sealant On Engine Rear Cover Gasket Tabs
Courtesy of GENERAL MOTORS CORP.

2. Apply a 5 mm (0.2 in) bead of sealant GM P/N 12378521 (Canadian P/N 88901148), or equivalent, 20

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mm (0.8 in) long to the engine block. Apply the sealant directly onto the tabs of the rear housing gasket that protrude into the oil pan surface.

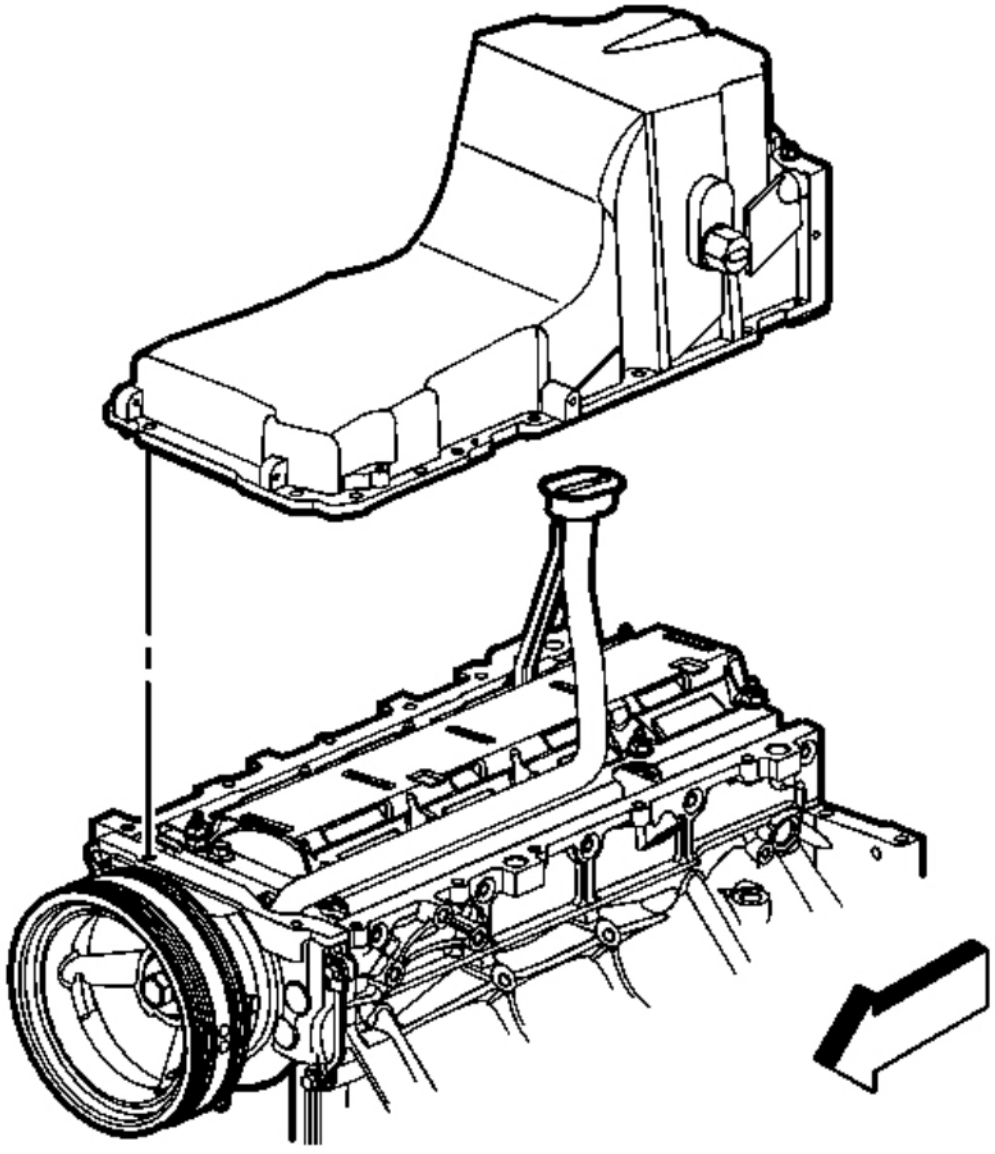


Fig. 7: View Of Oil Pan
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Be sure to align the oil gallery passages in the oil pan and engine block

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properly with the oil pan gasket.

3. Pre-assemble the oil pan gasket to the pan.
    1. Install the gasket onto the oil pan.
    2. Install the oil pan bolts to the pan and through the gasket.
4. Install the oil pan, gasket, and bolts to the engine block.
5. Tighten the bolts finger tight. Do not overtighten.
6. Place a straight edge across the rear of the engine block and the rear of the oil pan at the transmission housing mounting surfaces.

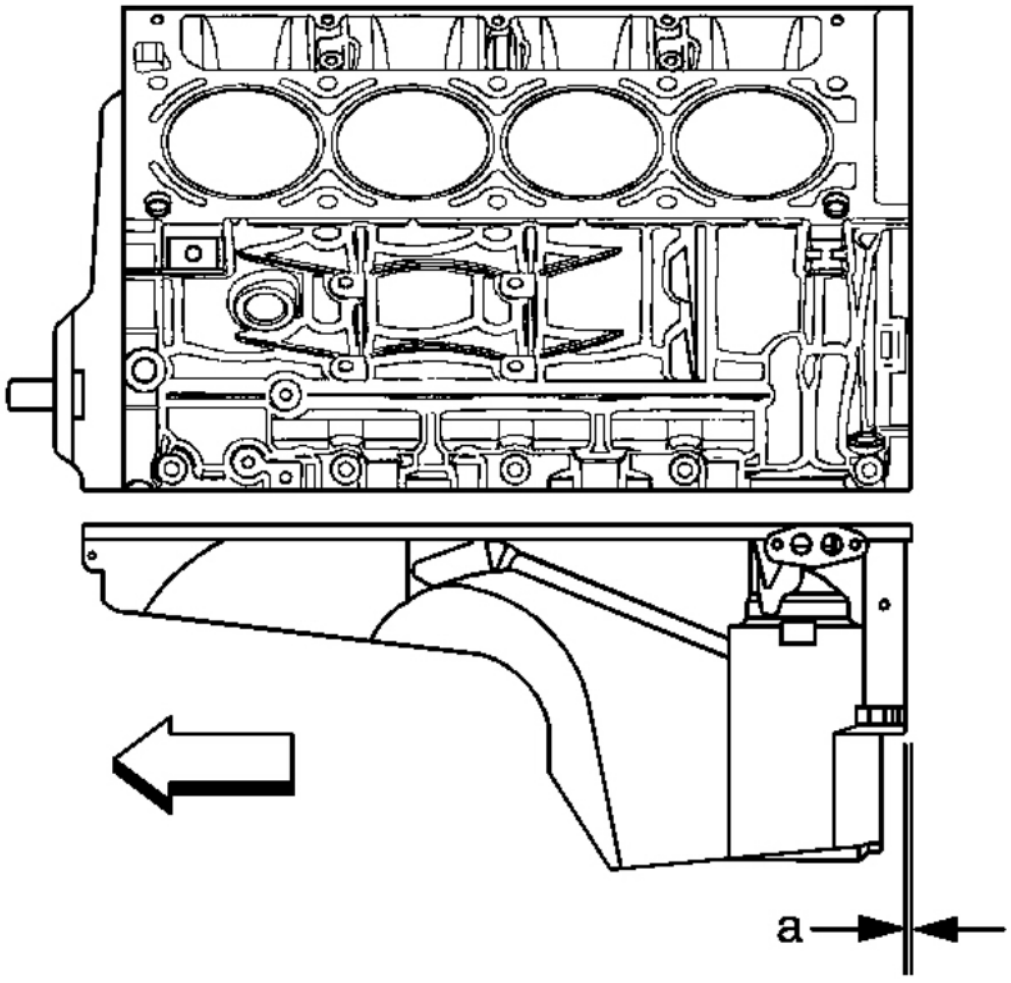


Fig. 8: Align The Oil Pan Until The Rear Of Engine Block And Rear Of Oil Pan Are Flush

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Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

7. Align the oil pan until the rear of engine block and rear of oil pan are flush or even.

Tighten:

1. Tighten the oil pan-to-block and oil pan-to-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).

8. Measure the oil pan-to-engine block alignment (a).
   1. Place a straight edge across the rear of the engine block and rear of oil pan at the transmission housing mounting surfaces.

IMPORTANT: The rear of the oil pan must NEVER protrude beyond the engine block and transmission housing mounting surfaces.

   2. Insert a feeler gage between the straight edge and the oil pan transmission housing mounting surface and measure to ensure that there is no greater than a 0.1 mm (0.004 in) gap between the pan and straight edge.
   3. If the oil pan alignment is not within specifications, remove the oil pan and repeat the above procedure.

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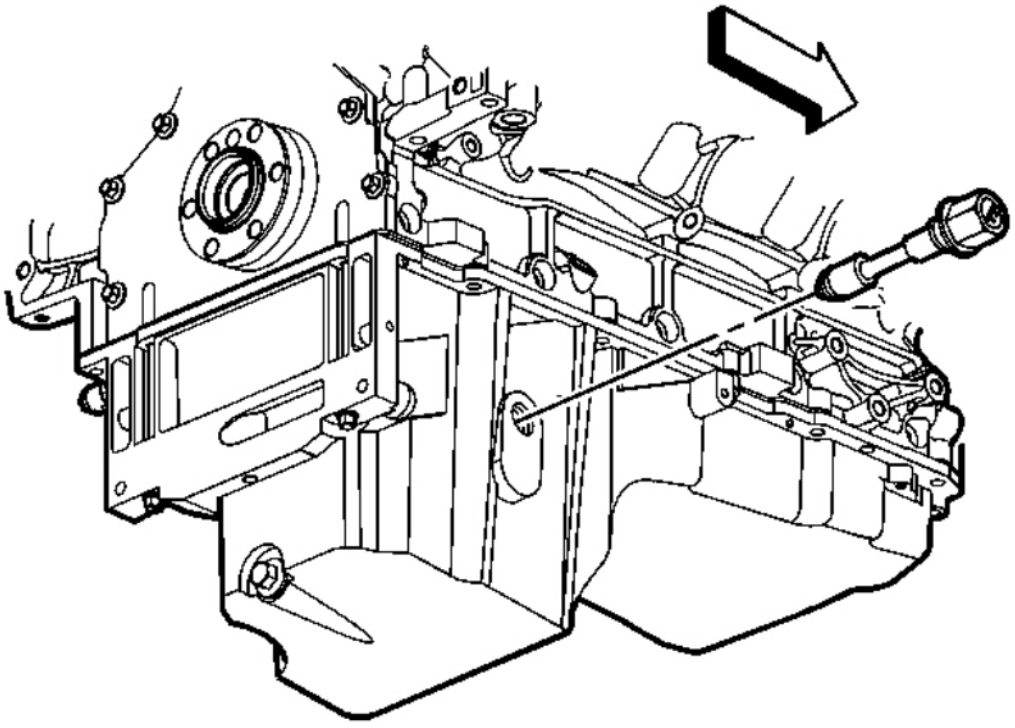


Fig. 9: View Of Oil Level Sensor
Courtesy of GENERAL MOTORS CORP.

9. Install the oil level indicator switch.

   Tighten: Tighten the oil level indicator switch to 20 N.m (15 lb in).

OIL FILTER INSTALLATION

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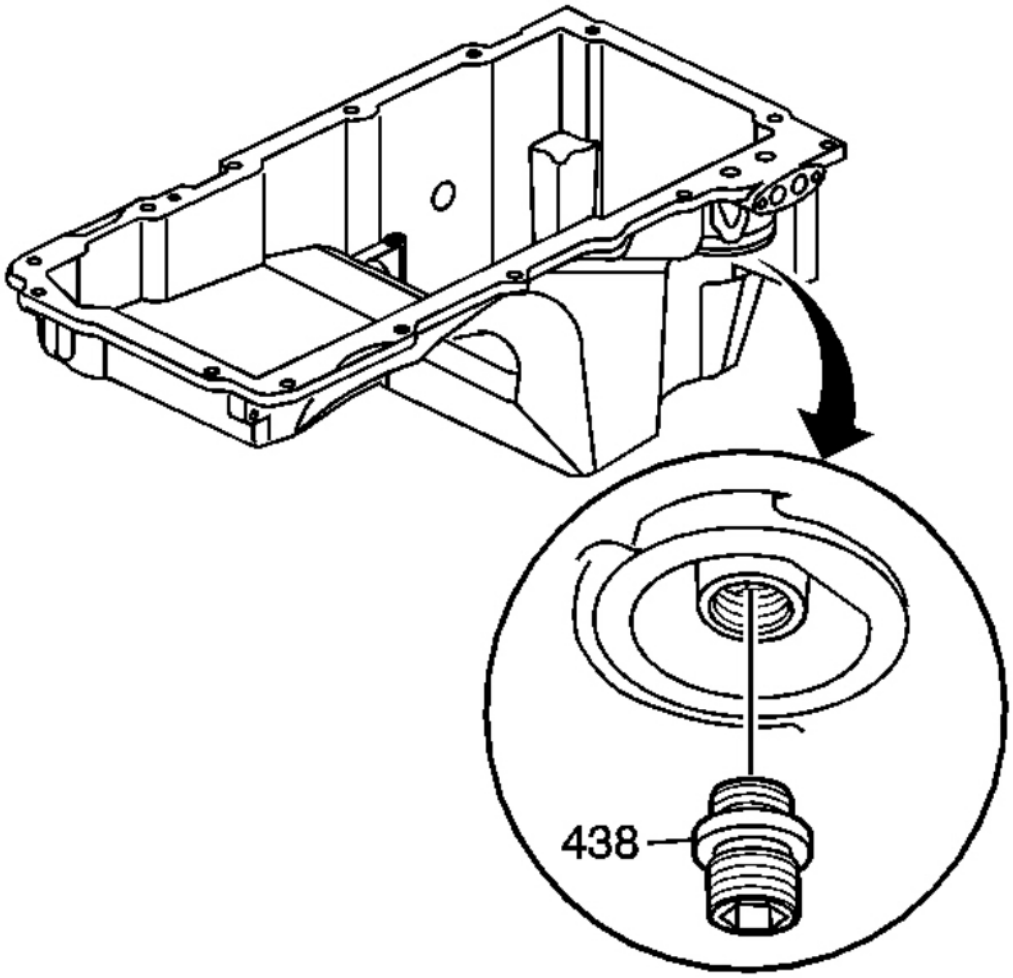


Fig. 10: View Of Oil Filter Fitting
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

1. Install the oil filter fitting (438).

   Tighten: Tighten the oil filter fitting to 55 N.m (40 lb ft).

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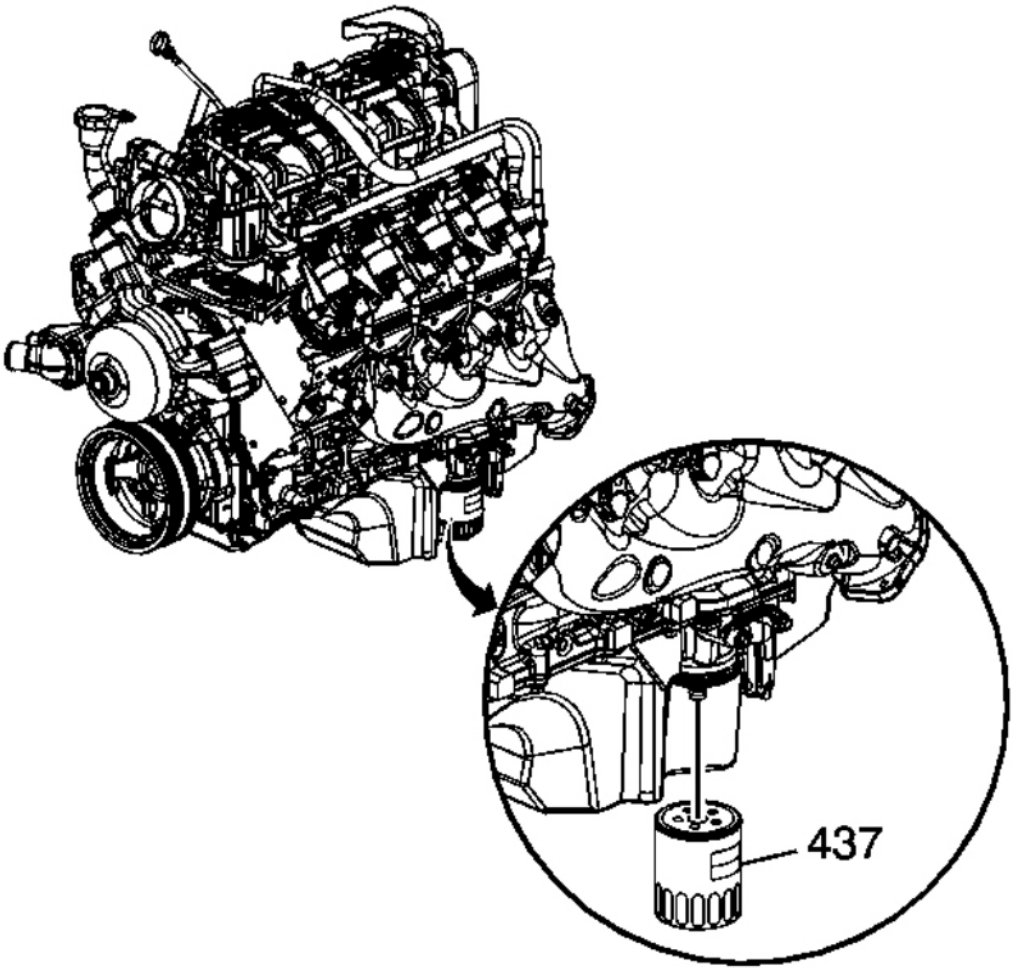


Fig. 11: View Of Engine Oil Filter
Courtesy of GENERAL MOTORS CORP.

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

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

VALVE LIFTER INSTALLATION (RPO LY2/LY6)

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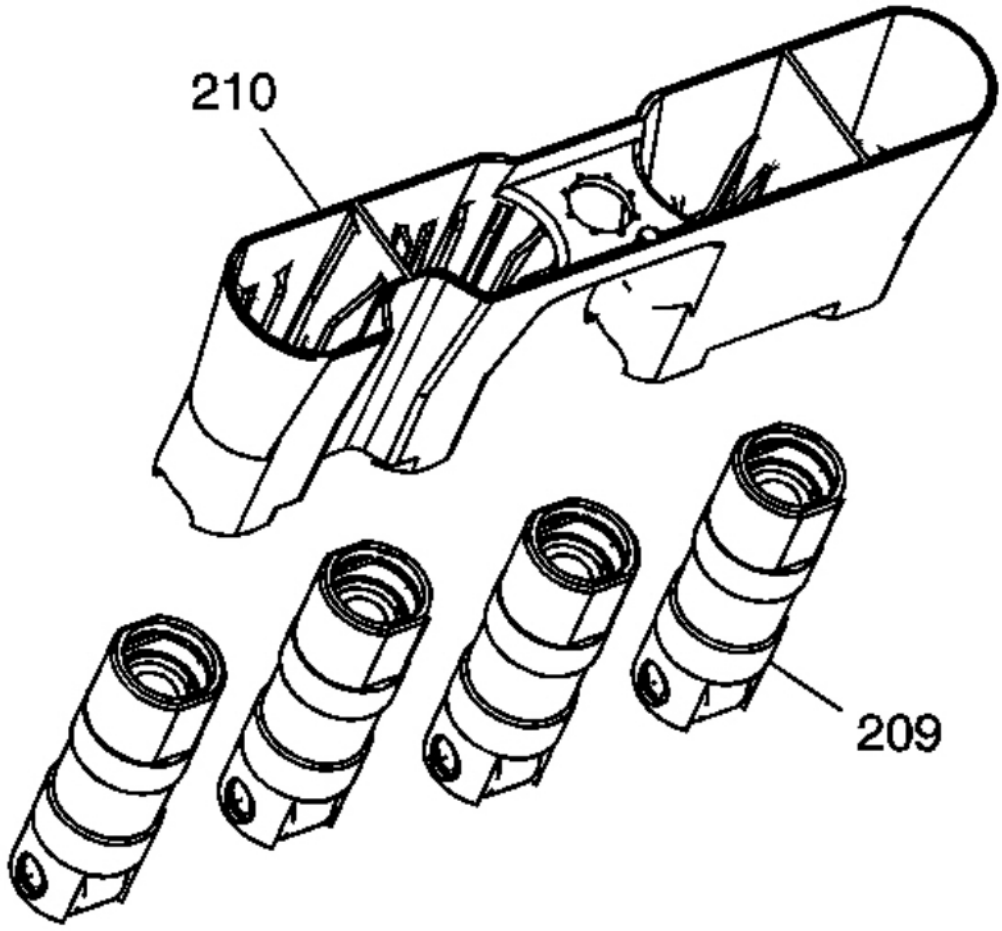


Fig. 12: Valve Lifter Guides & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **When using the valve lifters again, install the lifters to their original locations.**
- **If camshaft replacement is required, the valve lifters must also be replaced.**

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

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completely into the guide bore.

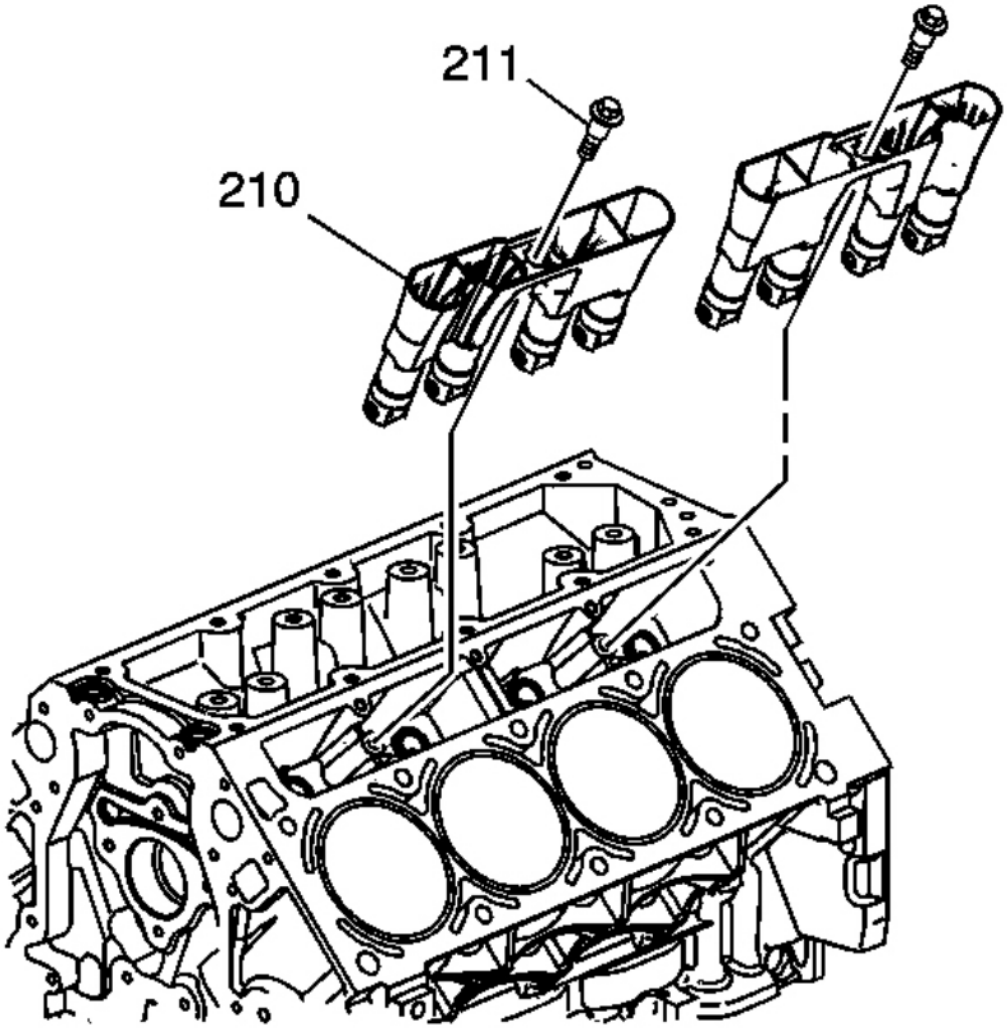


Fig. 13: Valve Lifter Guides, Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

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

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

VALVE LIFTER INSTALLATION (RPO LC9/LY5/LMG/L76)

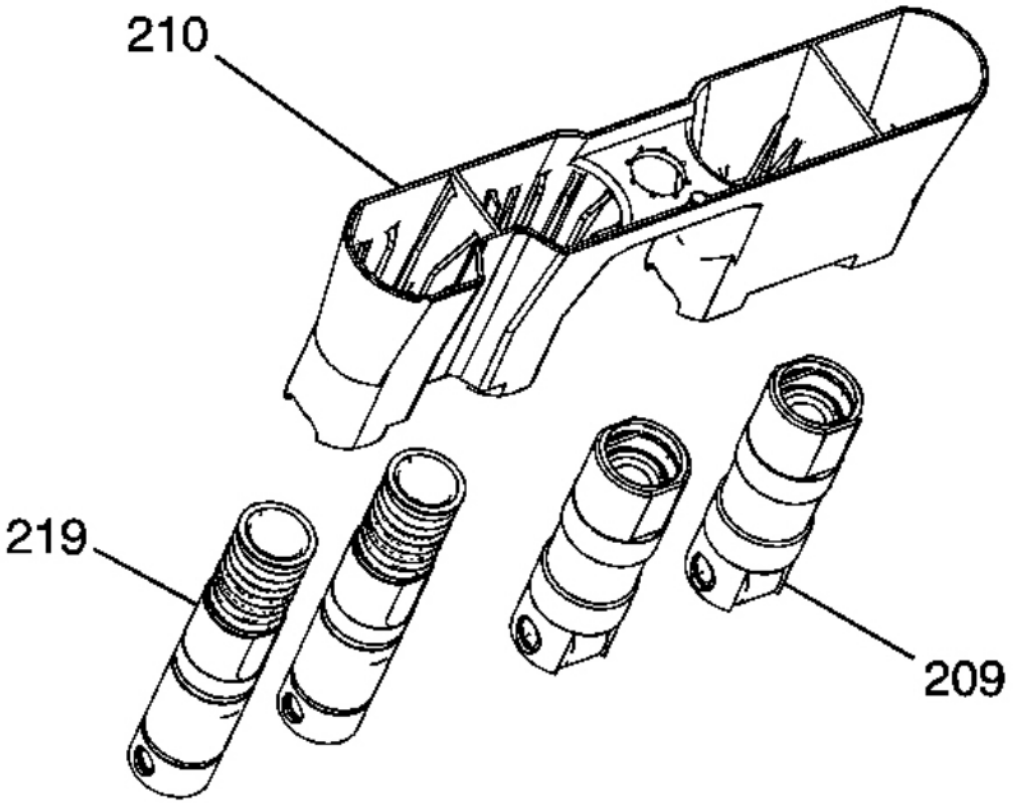


Fig. 14: Exploded View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **When using the valve lifters again, install the lifters to their original locations.**
- **If camshaft replacement is required, the valve lifters must also be replaced.**
- **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.**

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

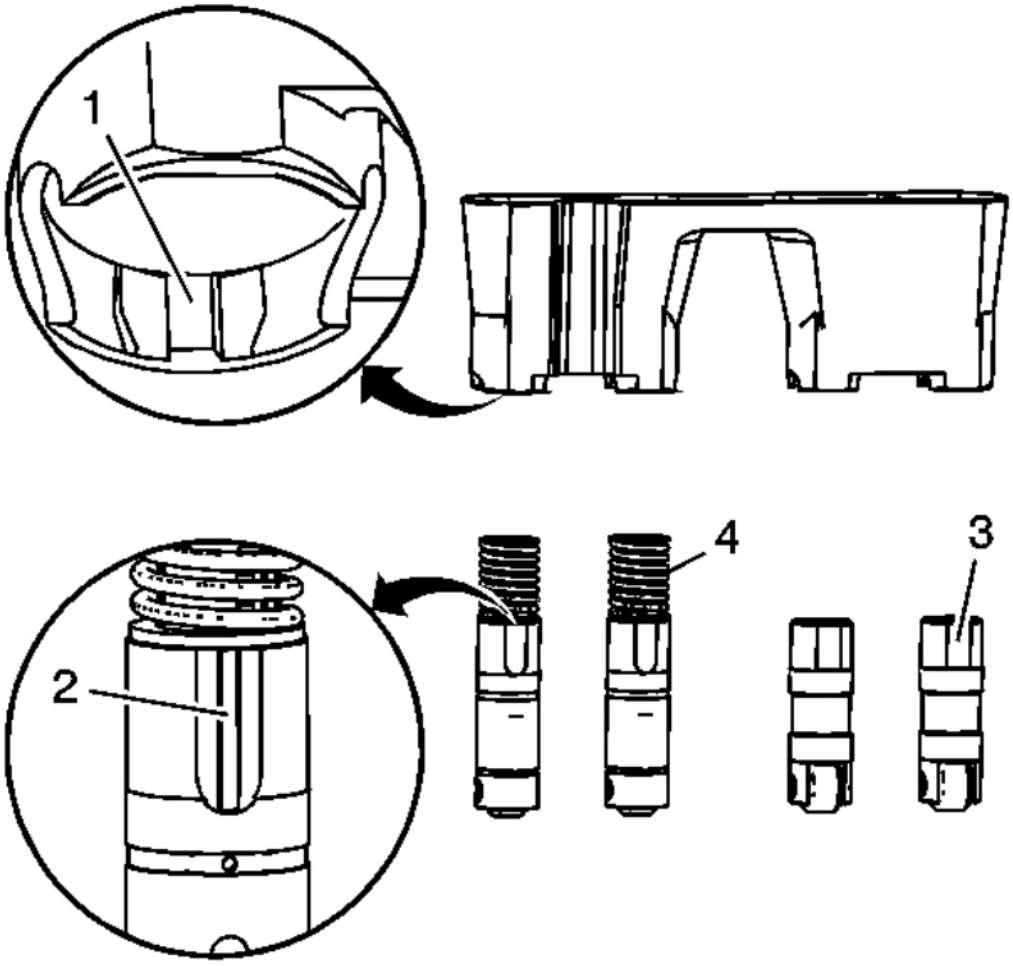


Fig. 15: Inserting Valve Lifters Into Lifter Guides
Courtesy of GENERAL MOTORS CORP.

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 (4) 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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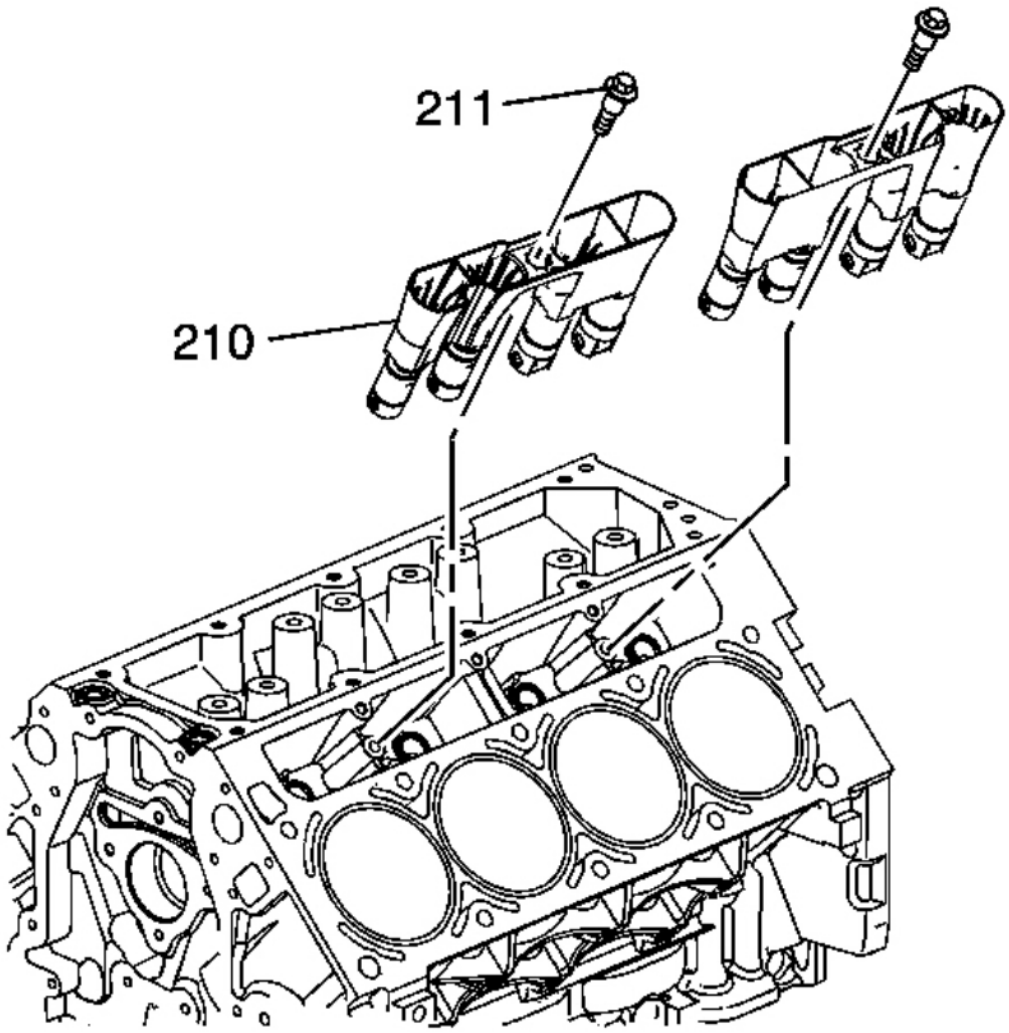


Fig. 16: View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

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

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

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VALVE LIFTER INSTALLATION (RPO L92)

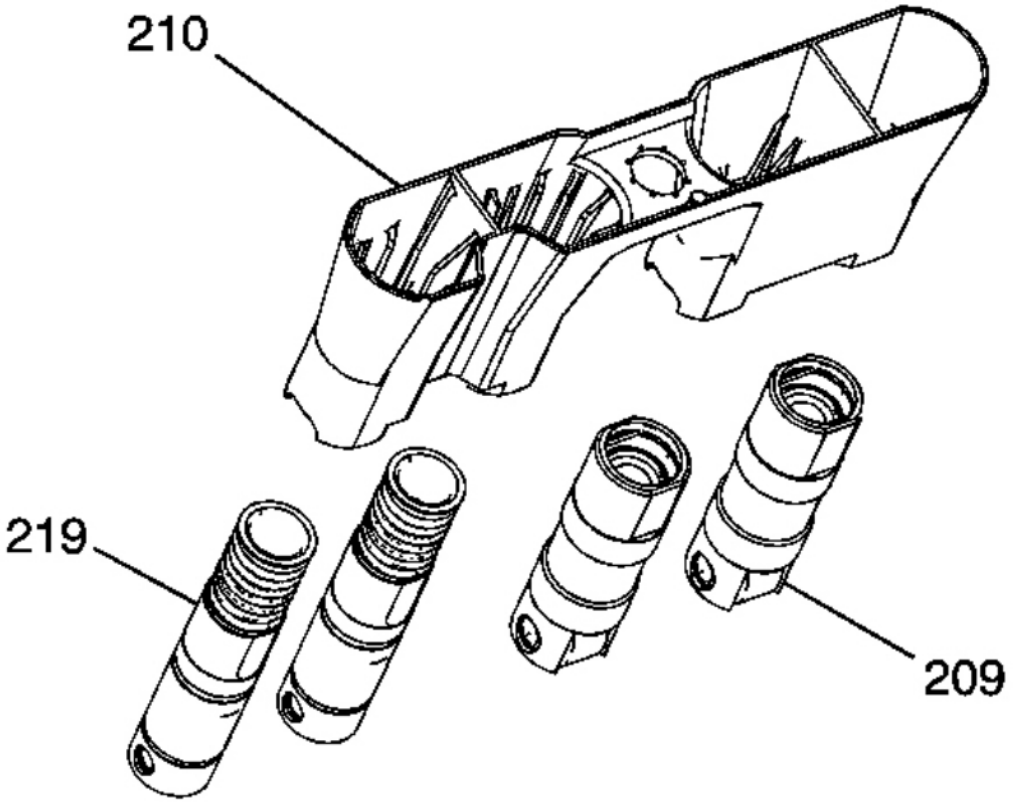


Fig. 17: Exploded View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **When using the valve lifters again, install the lifters to their original locations.**
- **If camshaft replacement is required, the valve lifters must also be replaced.**
- **First design engines have 2 active fuel management valve lifters and 2 non-active fuel management valve lifters per guide.**
- **Second design engines have 4 non-active fuel management valve lifters per guide.**

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

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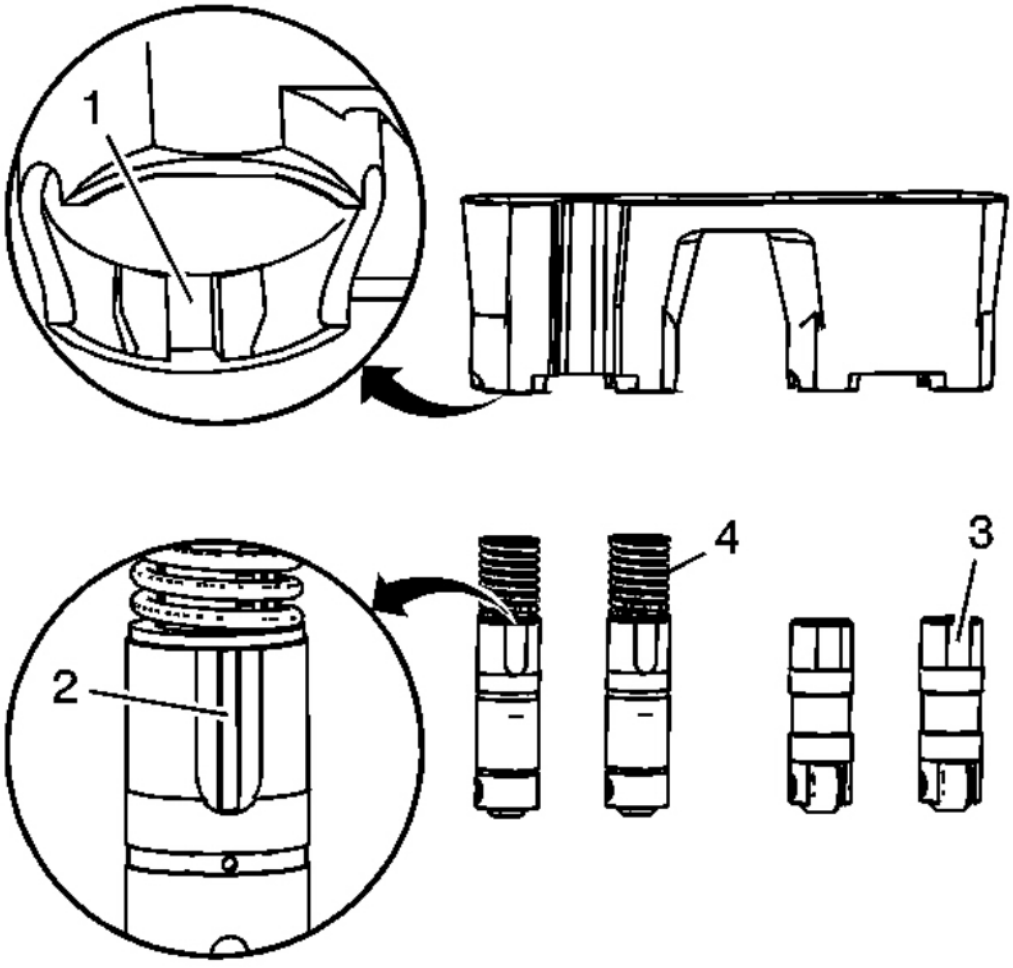


Fig. 18: Inserting Valve Lifters Into Lifter Guides
Courtesy of GENERAL MOTORS CORP.

2. Insert the first design 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 (4) 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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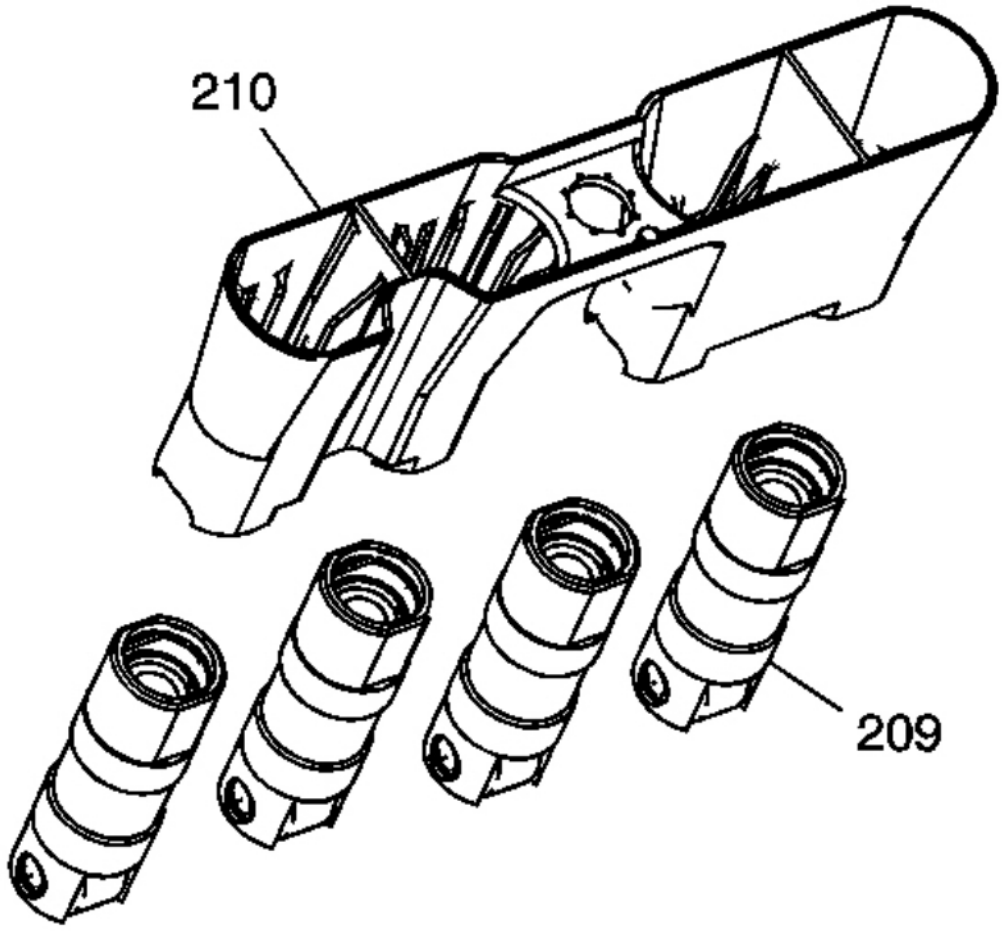


Fig. 19: Valve Lifter Guides & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Lubricate the second design engine valve lifters (209) and engine block valve lifter bores with clean engine oil.
4. Insert the second design engine 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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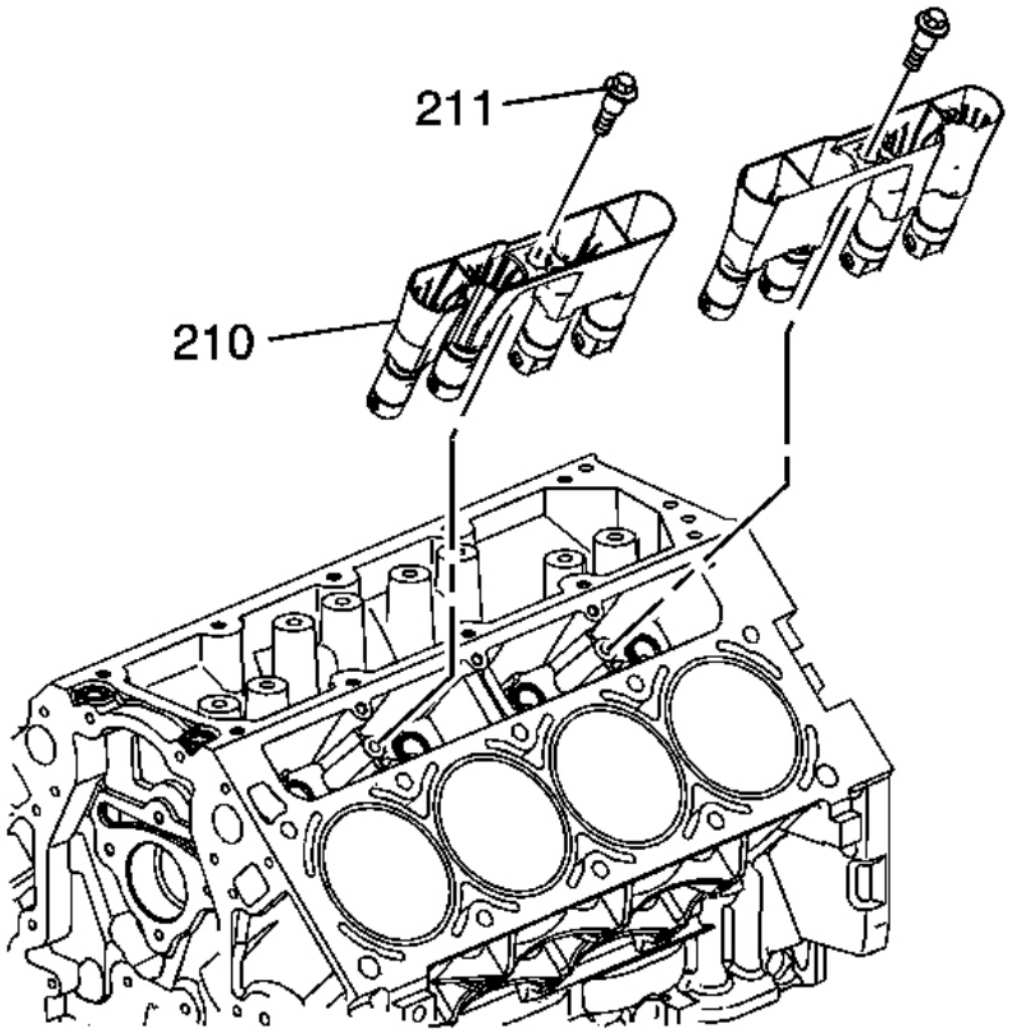


Fig. 20: View Of Lifter Guides & Lifters
Courtesy of GENERAL MOTORS CORP.

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

NOTE: **Refer to Fastener Notice .**

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

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

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CYLINDER HEAD INSTALLATION - LEFT SIDE

Tools Required

- **J 42385-100** Head/Main Bolt Thread Repair Kit. See **Special Tools** .
- **J 45059** Angle Meter. See **Special Tools** .

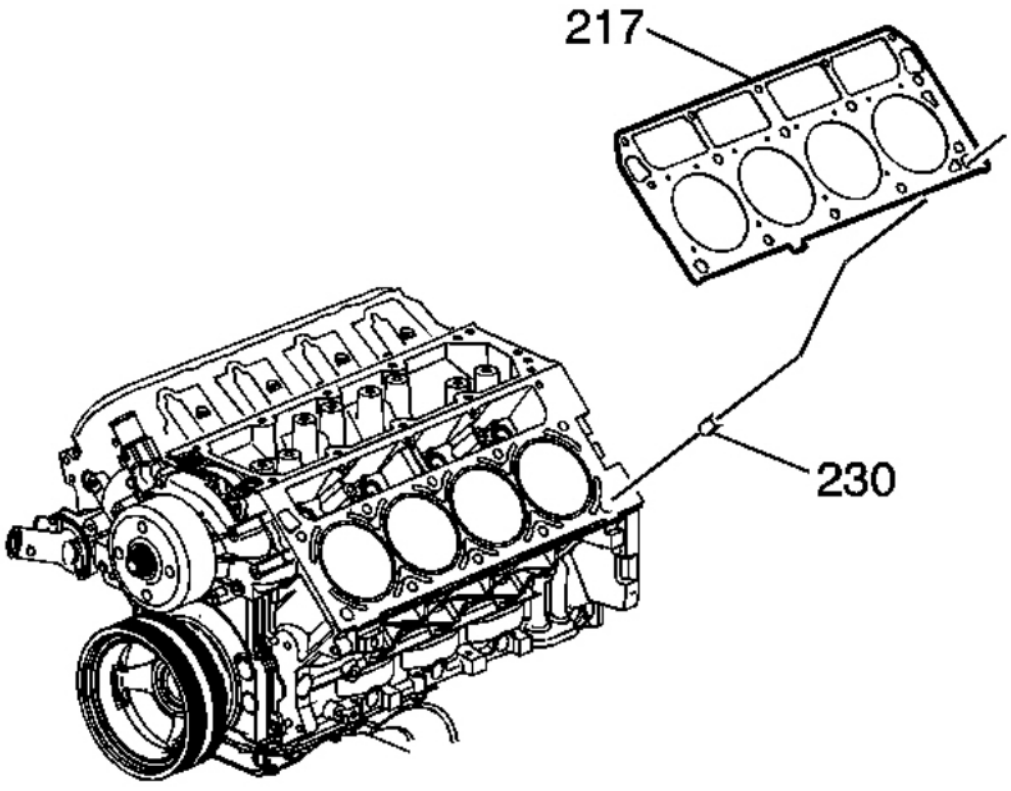


Fig. 21: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Safety Glasses Caution .

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.

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IMPORTANT:

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

1. Clean the engine block cylinder head bolt holes, if required.

   Thread repair tool J 42385-107 may be used to clean the threads of old threadlocking material.

2. Spray cleaner GM P/N 12346139 (Canadian P/N 10953463), GM P/N 12377981 (Canadian P/N 10953463), or equivalent, into the hole.
3. Clean the cylinder head bolt holes with compressed air.
4. Install the cylinder head locating pins (230).

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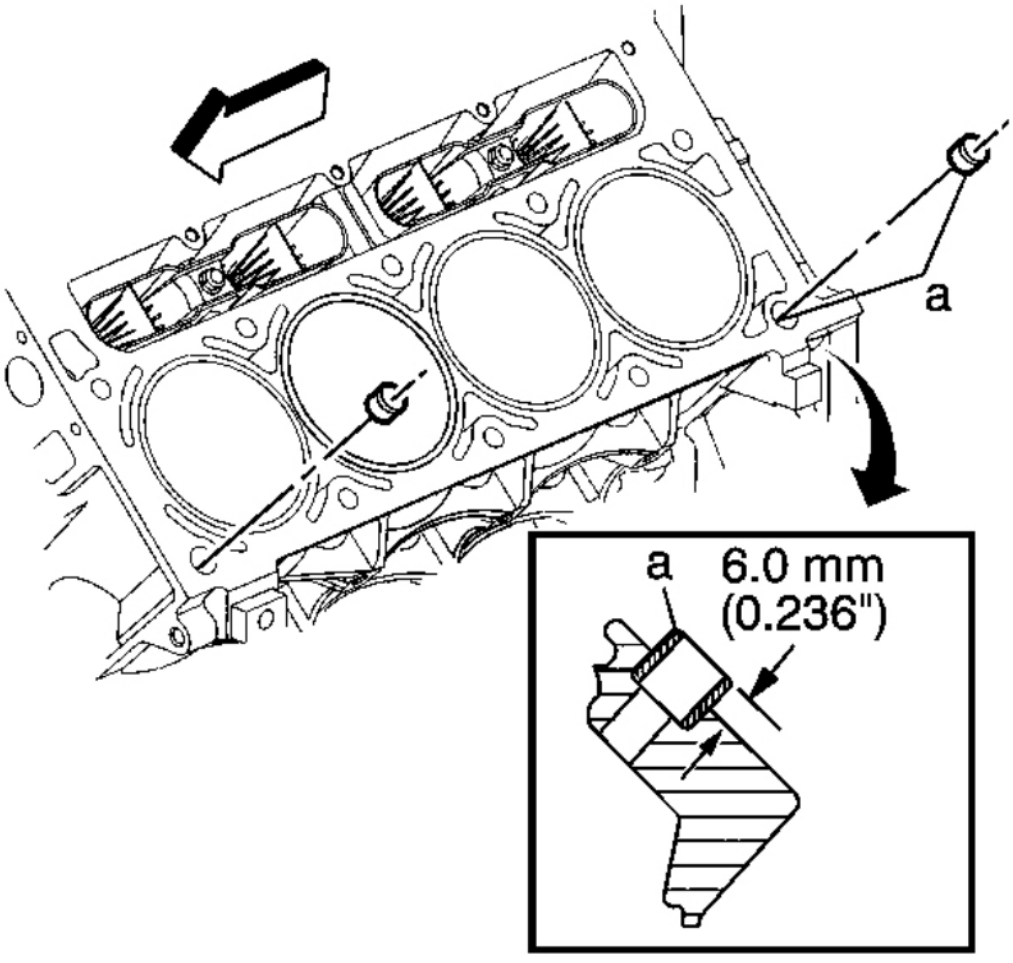


Fig. 22: Identifying Cylinder Head Locating Pins Installation Position
Courtesy of GENERAL MOTORS CORP.

5. Inspect the locating pins for proper installation.

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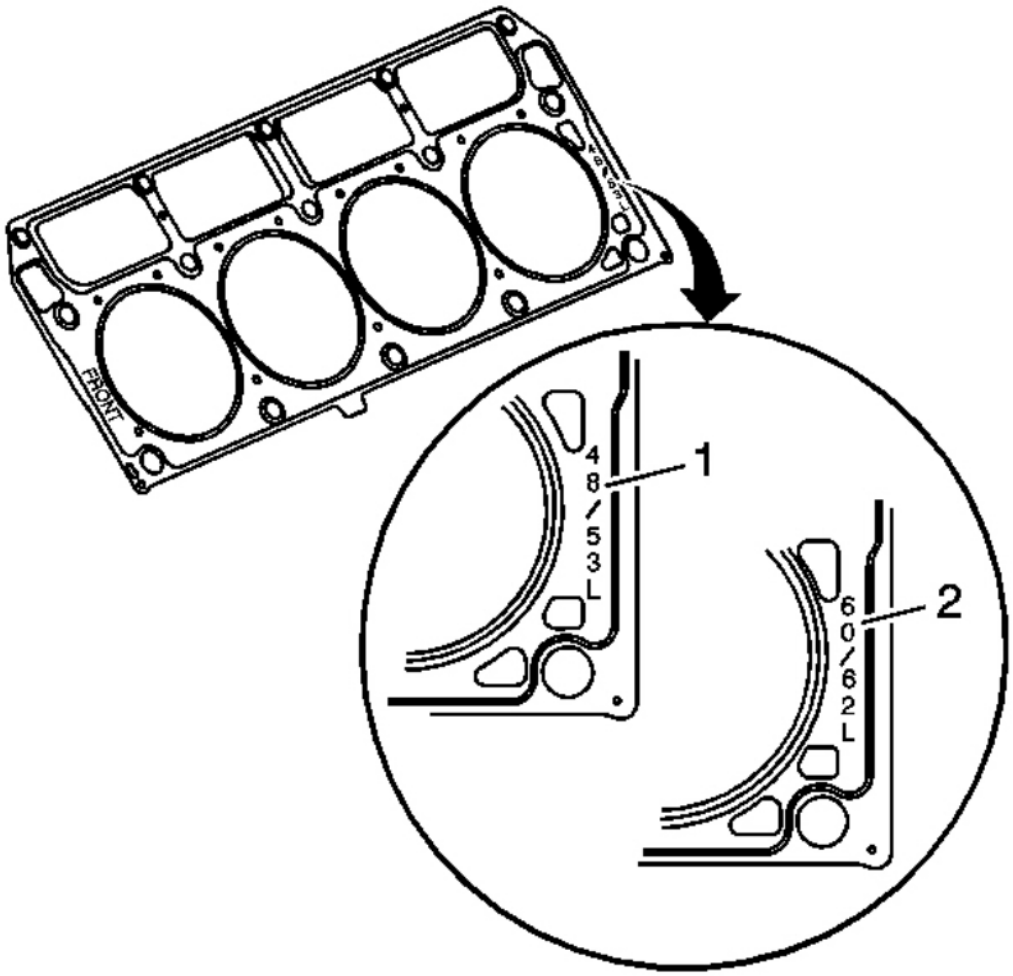


Fig. 23: View Of Displacement Markings On Gasket
Courtesy of GENERAL MOTORS CORP.

6. Inspect the displacement markings (1, 2) on the gasket, for proper usage.

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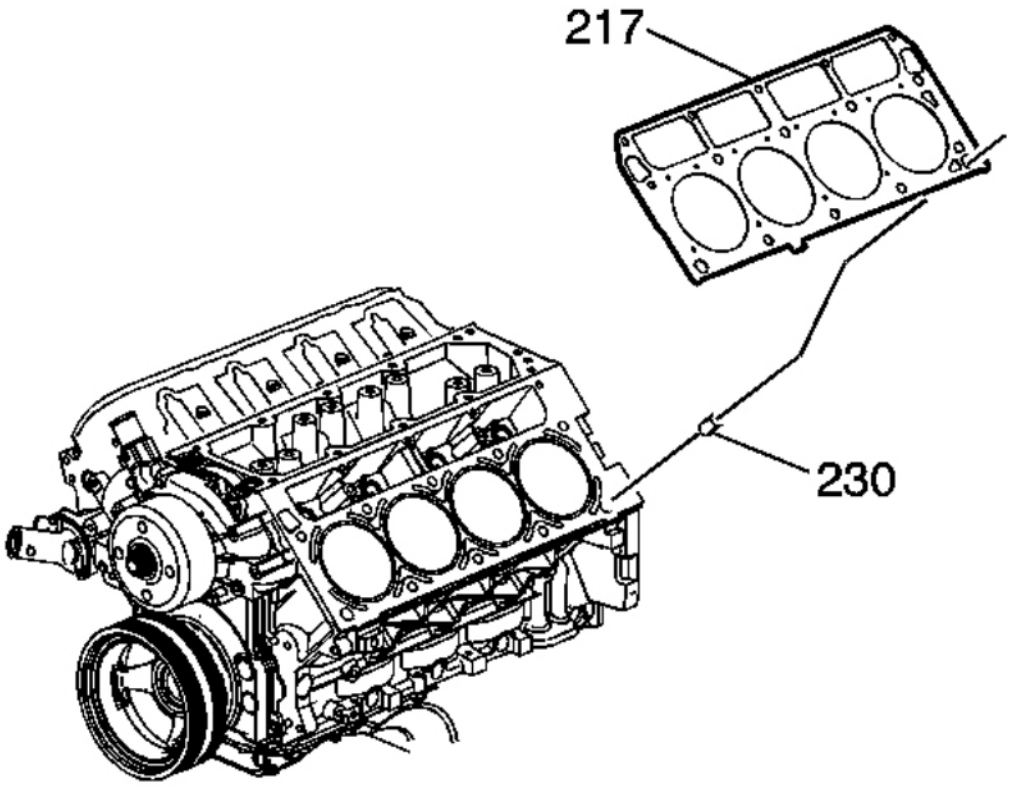


Fig. 24: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

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

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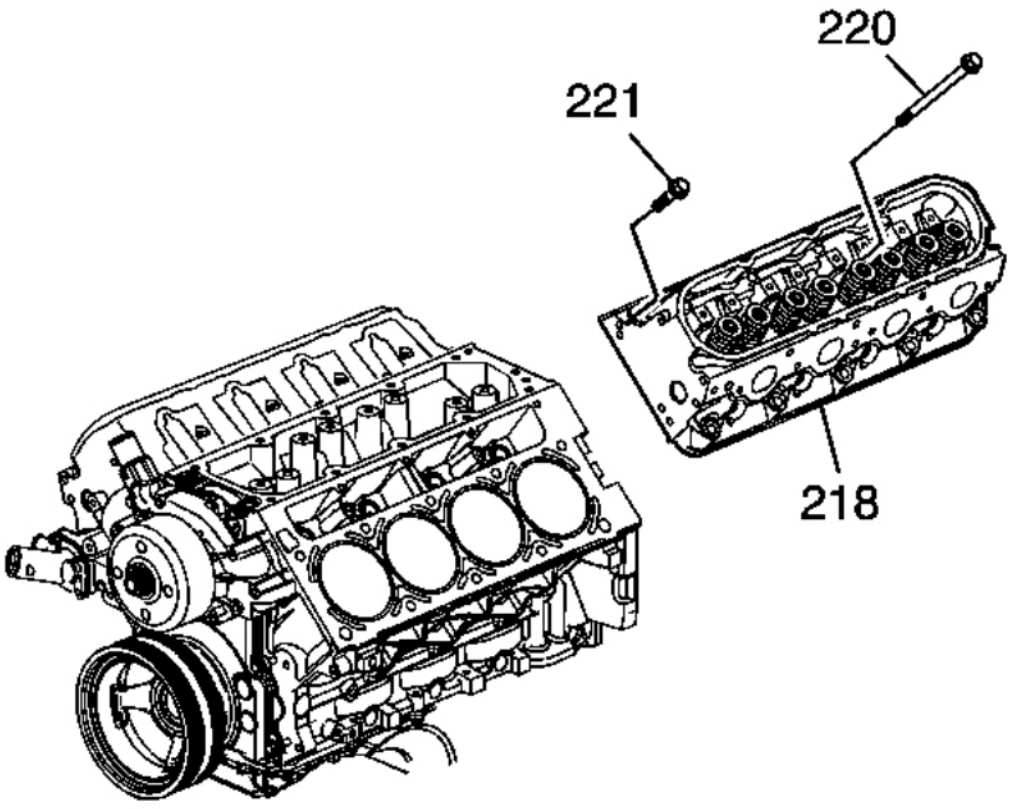


Fig. 25: View Of Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the cylinder head (218) onto the locating pins and the gasket.
9. Install the NEW cylinder head bolts (220, 221).

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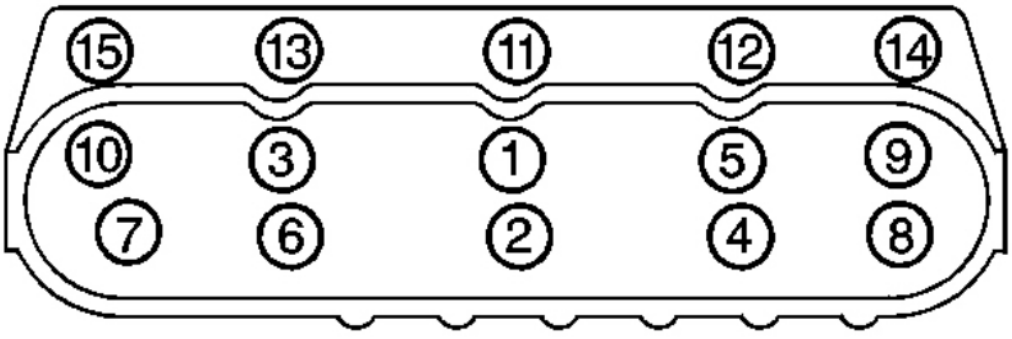


Fig. 26: Cylinder Head Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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

CYLINDER HEAD INSTALLATION - RIGHT SIDE

Tools Required

- **J 42385-100** Head/Main Bolt Thread Repair Kit. See **Special Tools** .
- **J 45059** Angle Meter. See **Special Tools** .

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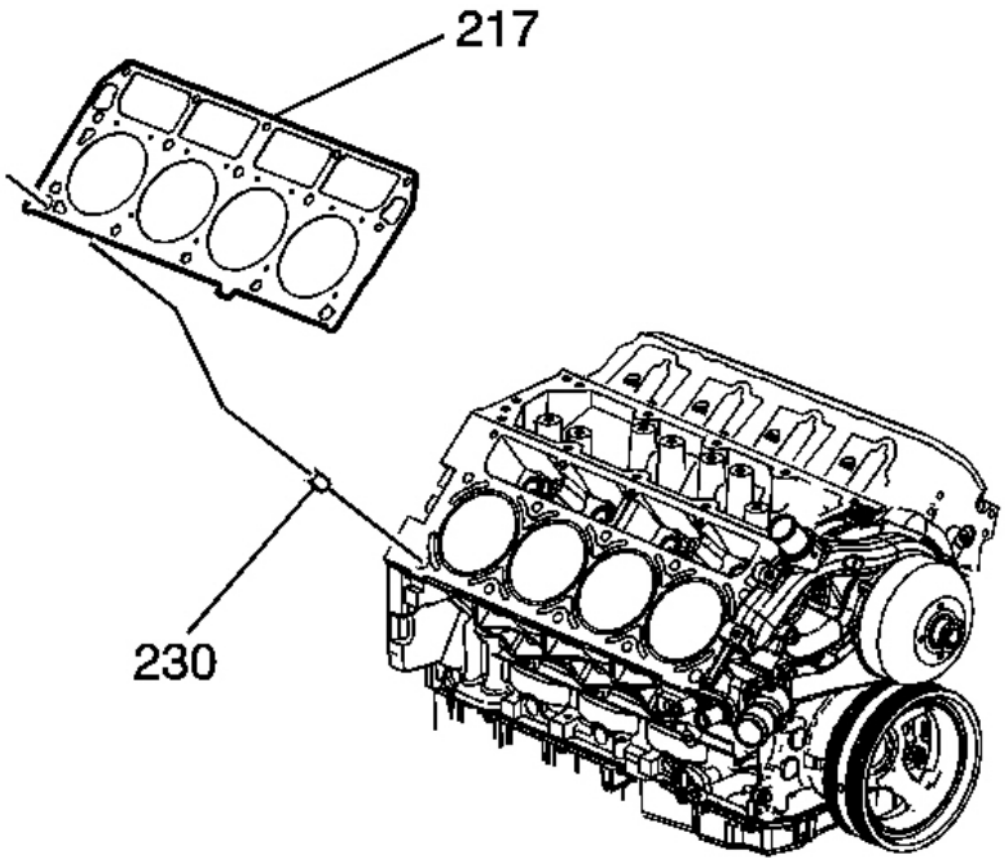


Fig. 27: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Safety Glasses Caution .

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 use the cylinder head bolts again. 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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1. Clean the engine block cylinder head bolt holes, if required.

   Thread repair tool J 42385-107 may be used to clean the threads of old threadlocking material.

2. Spray cleaner GM P/N 12346139 (Canadian P/N 10953463), GM P/N 12377981 (Canadian P/N 10953463), or equivalent, into the hole.
3. Clean the cylinder head bolt holes with compressed air.
4. Install the cylinder head locating pins (230).

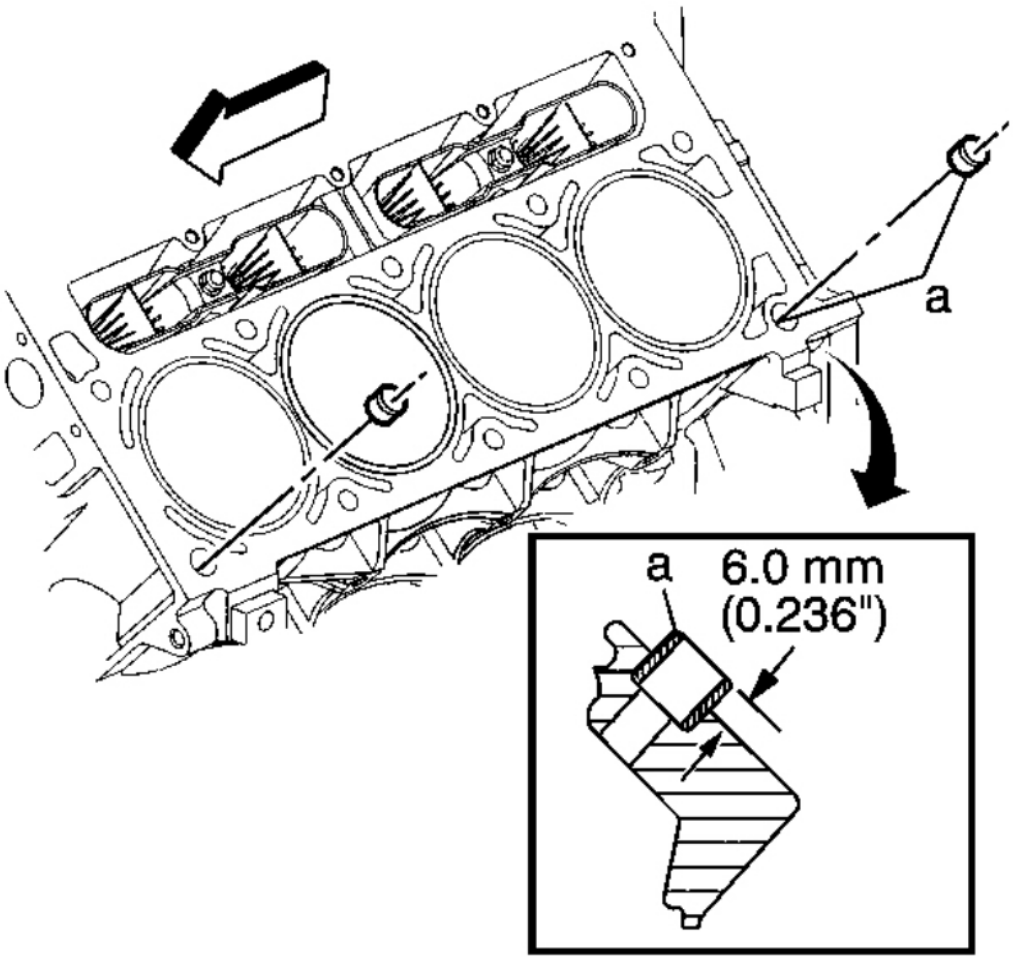


Fig. 28: Identifying Cylinder Head Locating Pins Installation Position
Courtesy of GENERAL MOTORS CORP.

5. Inspect the locating pins for proper installation.

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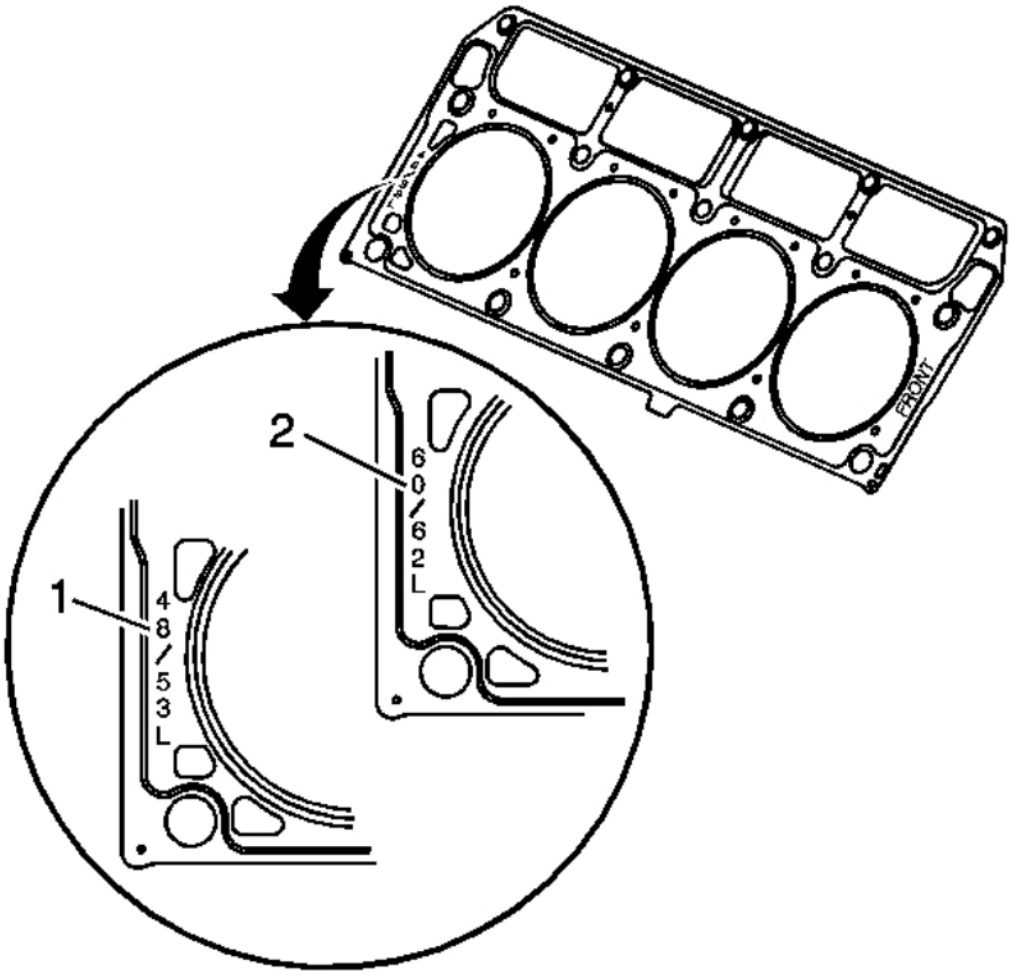


Fig. 29: View Of Displacement Markings On Gasket
Courtesy of GENERAL MOTORS CORP.

6. Inspect the displacement markings (1, 2) on the gasket, for proper usage.

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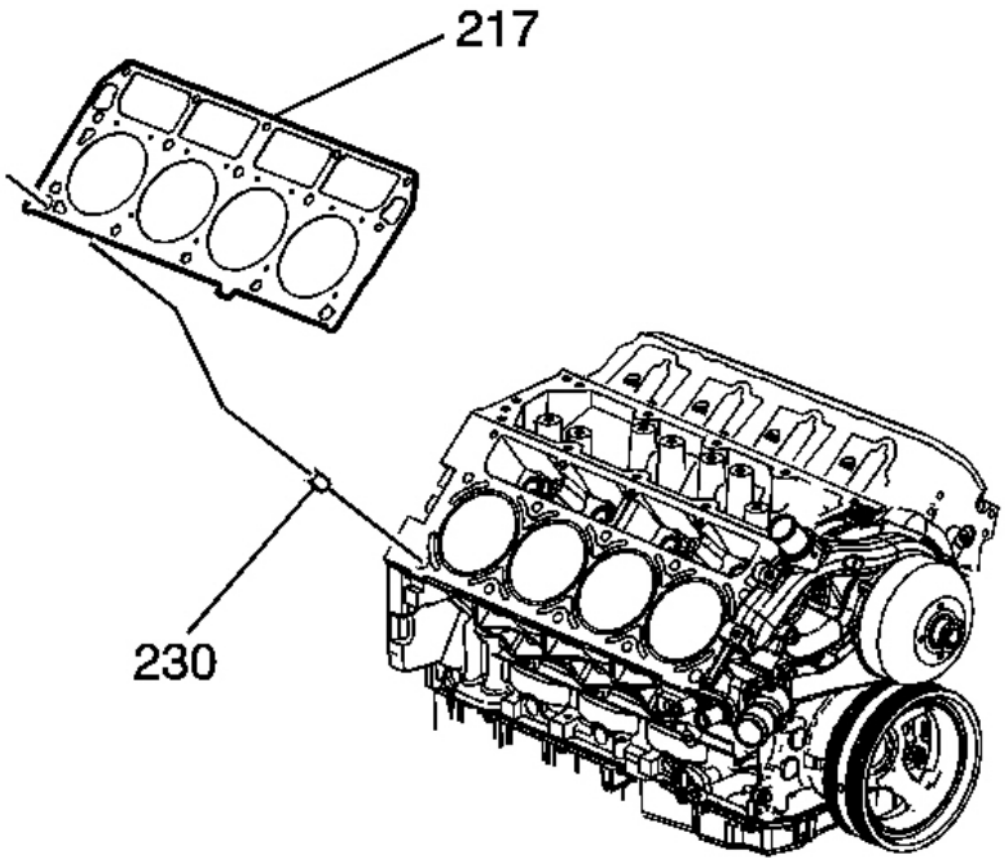


Fig. 30: View Of Cylinder Head Gasket & Locating Pins
Courtesy of GENERAL MOTORS CORP.

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

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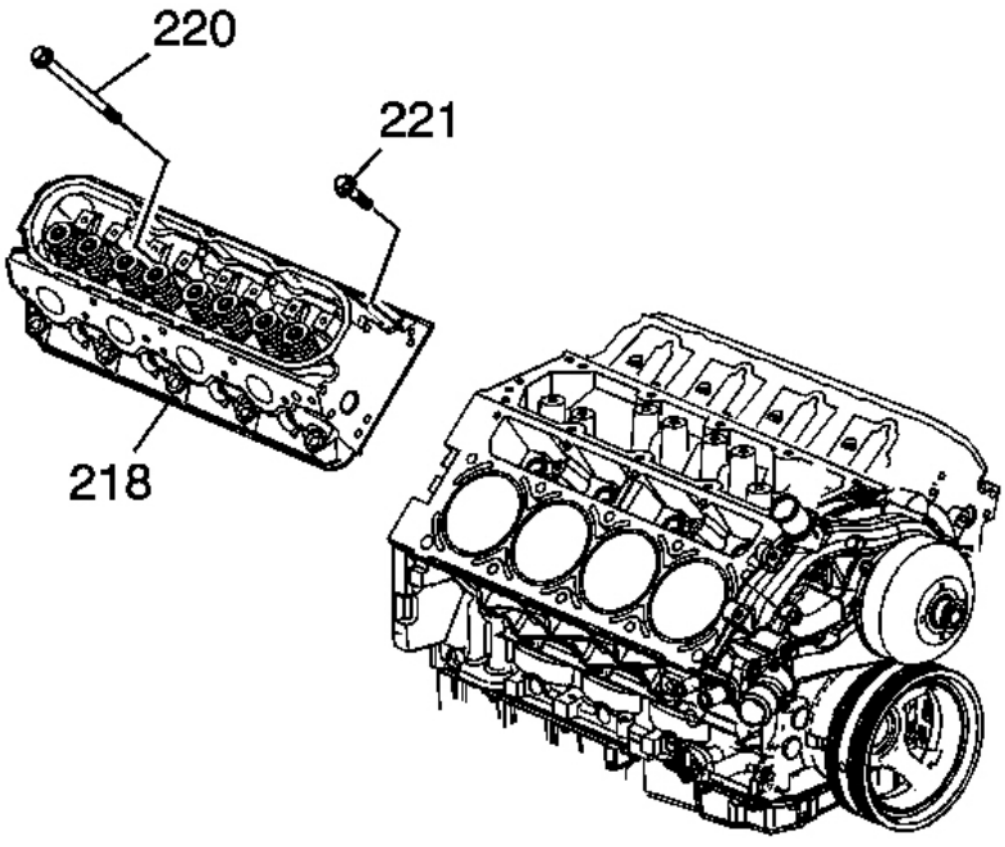


Fig. 31: View Of Cylinder Head & Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the cylinder head (218) onto the locating pins and the gasket.
9. Install the NEW cylinder head bolts (220, 221).

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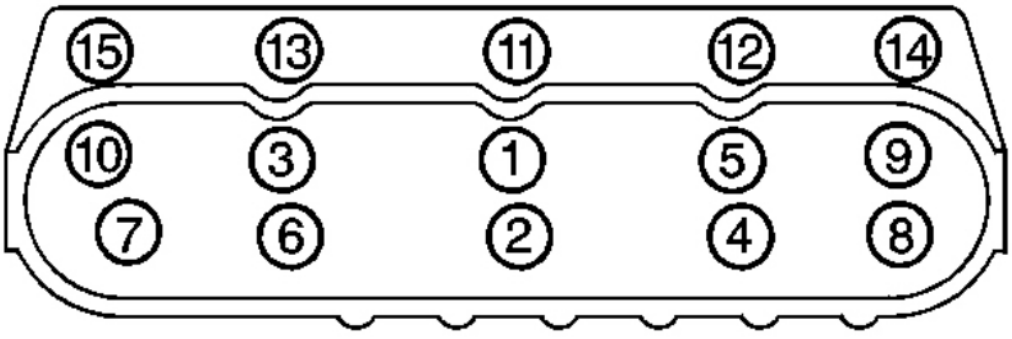


Fig. 32: Cylinder Head Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

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

VALVE ROCKER ARM AND PUSH ROD INSTALLATION (RPO LY2/LC9/LY5/LMG/LY6/L76)

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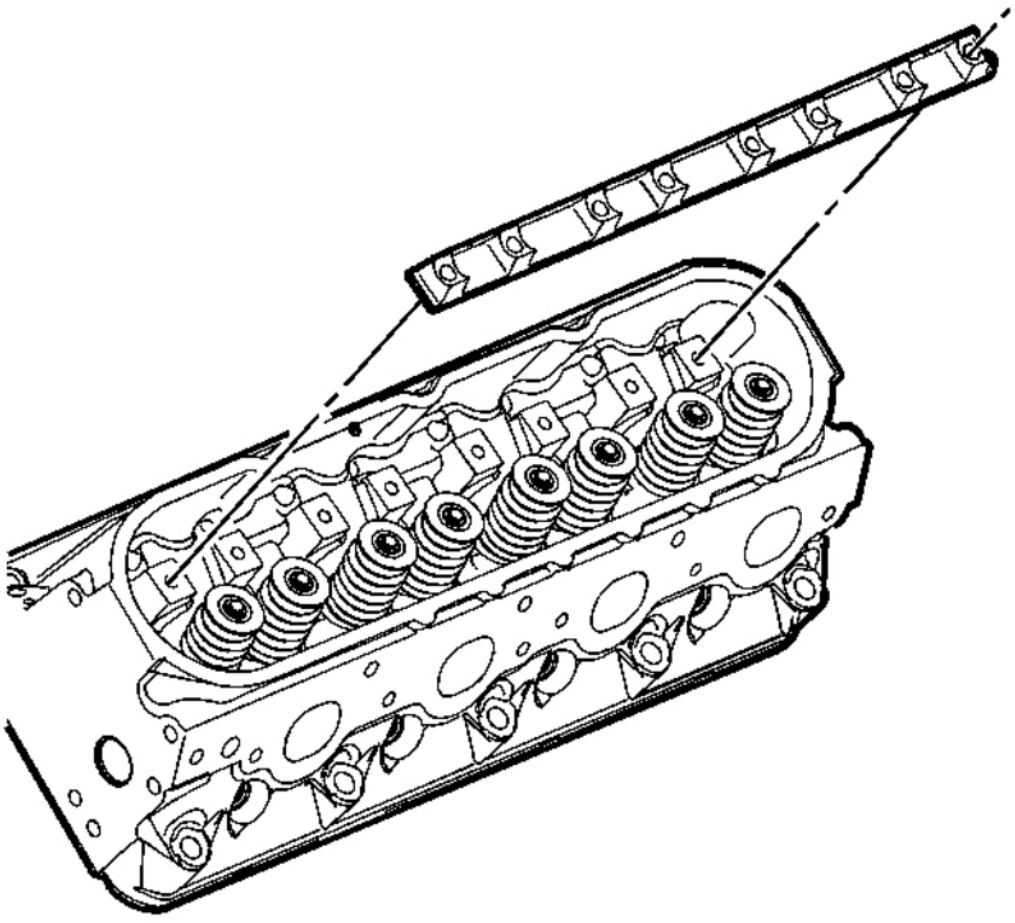


Fig. 33: View Of Valve Rocker Arm Pivot Support
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **When using the valve train components again, always install the components to the original location and position.**
- **Valve lash is net build. No valve adjustment is required.**

1. Lubricate the valve rocker arms and pushrods with clean engine oil.
2. Lubricate the flange of the valve rocker arm bolts with clean engine oil.
3. Install the valve rocker arm pivot support.

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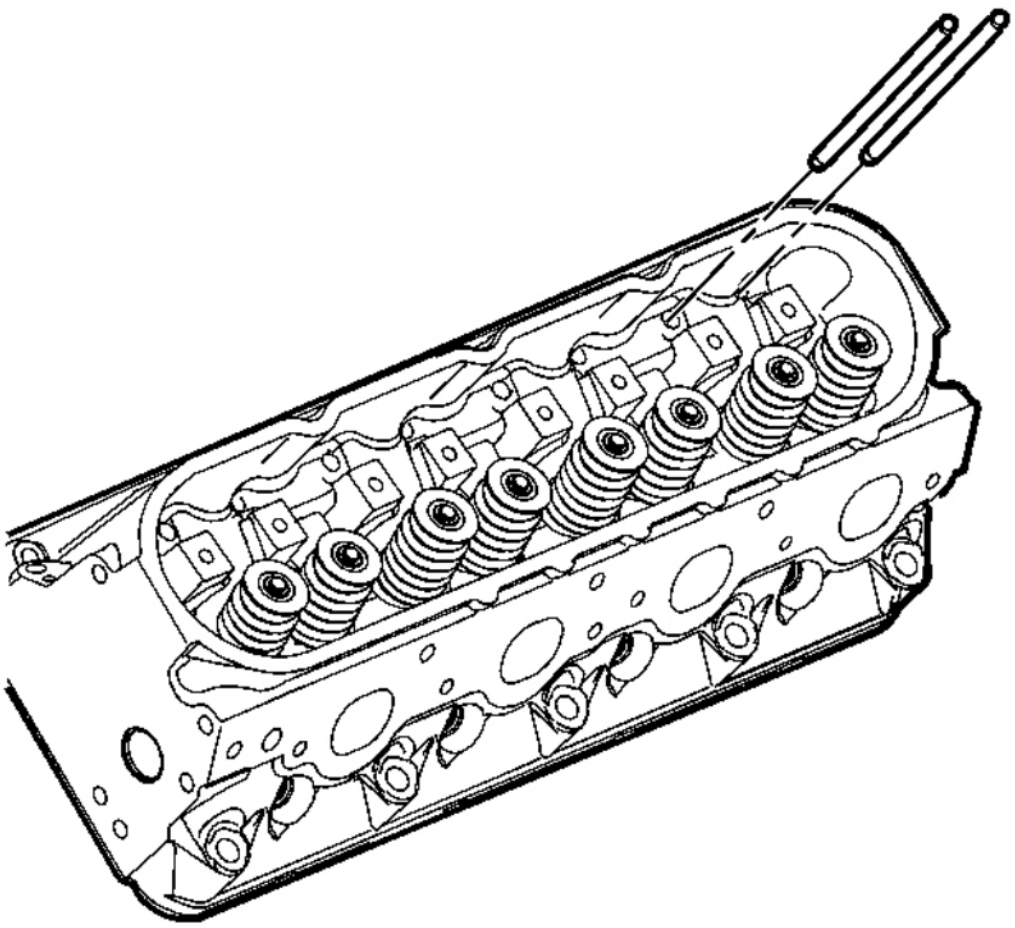


Fig. 34: View Of Pushrods
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the pushrods seat properly to the valve lifter sockets.

4. Install the pushrods.

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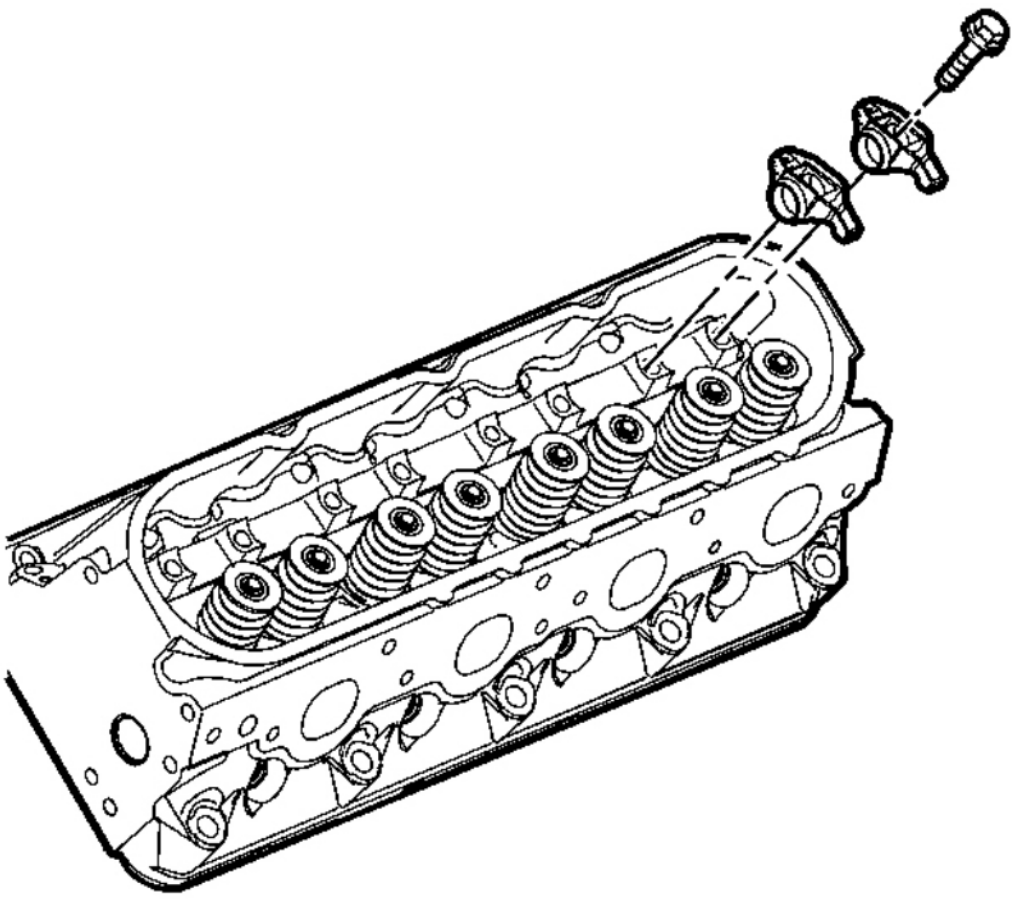


Fig. 35: View Of Rocker Arms & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:
- **Ensure 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.

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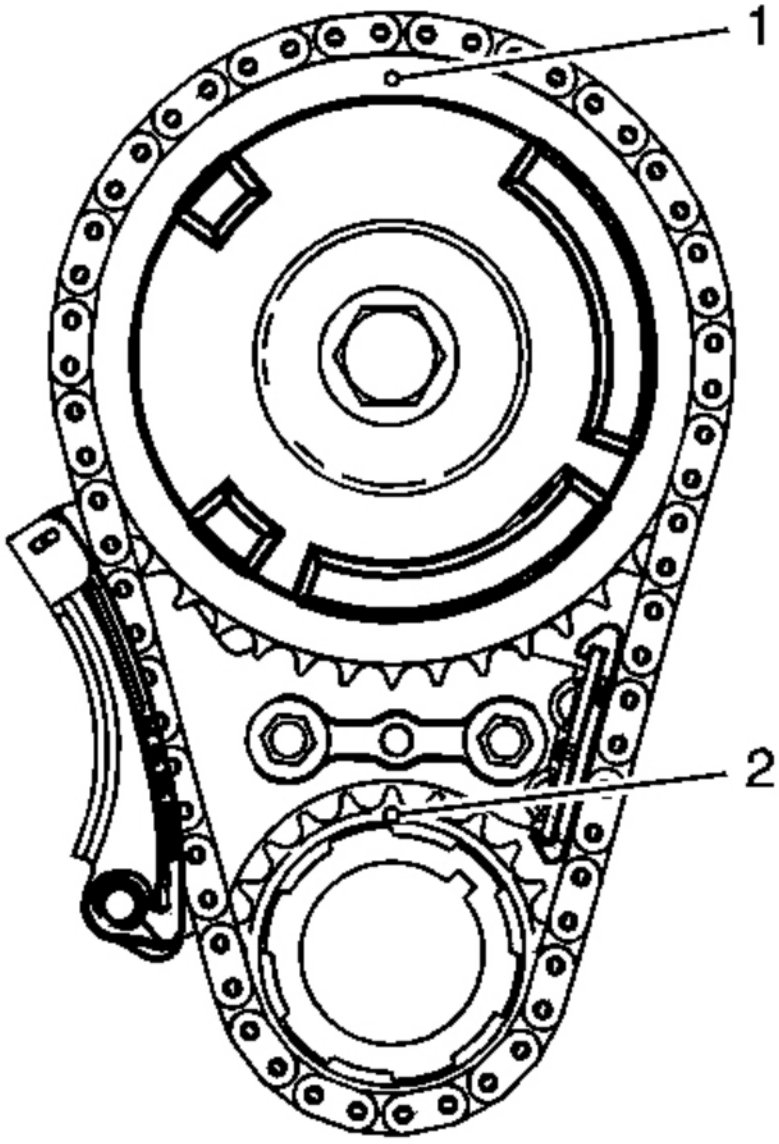


Fig. 36: View Of Camshaft & Crankshaft Sprocket Alignment Marks In 12 O'clock Position
Courtesy of GENERAL MOTORS CORP.

6. Rotate the crankshaft until number 1 piston is at top dead center of compression stroke.

   In this position, cylinder number 1 rocker arms will be off lobe lift, and the crankshaft sprocket key will be at the 1:30 position. The camshaft and crankshaft sprocket alignment marks (1, 2) will be in the 12

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o'clock position. If viewing from the rear of the engine, the additional crankshaft pilot hole, non-threaded, will be in the 10:30 position.

The engine firing order is 1, 8, 7, 2, 6, 5, 4, 3.

Cylinders 1, 3, 5 and 7 are left bank.

Cylinders 2, 4, 6, and 8 are right bank.

NOTE: **Refer to Fastener Notice .**

7. With the engine in the number 1 firing position, tighten the following valve rocker arm bolts:

   Tighten:
   - Tighten the exhaust valve rocker arm bolts 1, 2, 7, and 8 to 30 N.m (22 lb ft).
   - Tighten the intake valve rocker arm bolts 1, 3, 4, and 5 to 30 N.m (22 lb ft).

8. Rotate the crankshaft 360 degrees.
9. Tighten the following valve rocker arm bolts:

   Tighten:
   - Tighten the exhaust valve rocker arm bolts 3, 4, 5, and 6 to 30 N.m (22 lb ft).
   - Tighten the intake valve rocker arm bolts 2, 6, 7, and 8 to 30 N.m (22 lb ft).

VALVE ROCKER ARM AND PUSH ROD INSTALLATION (RPO L92)

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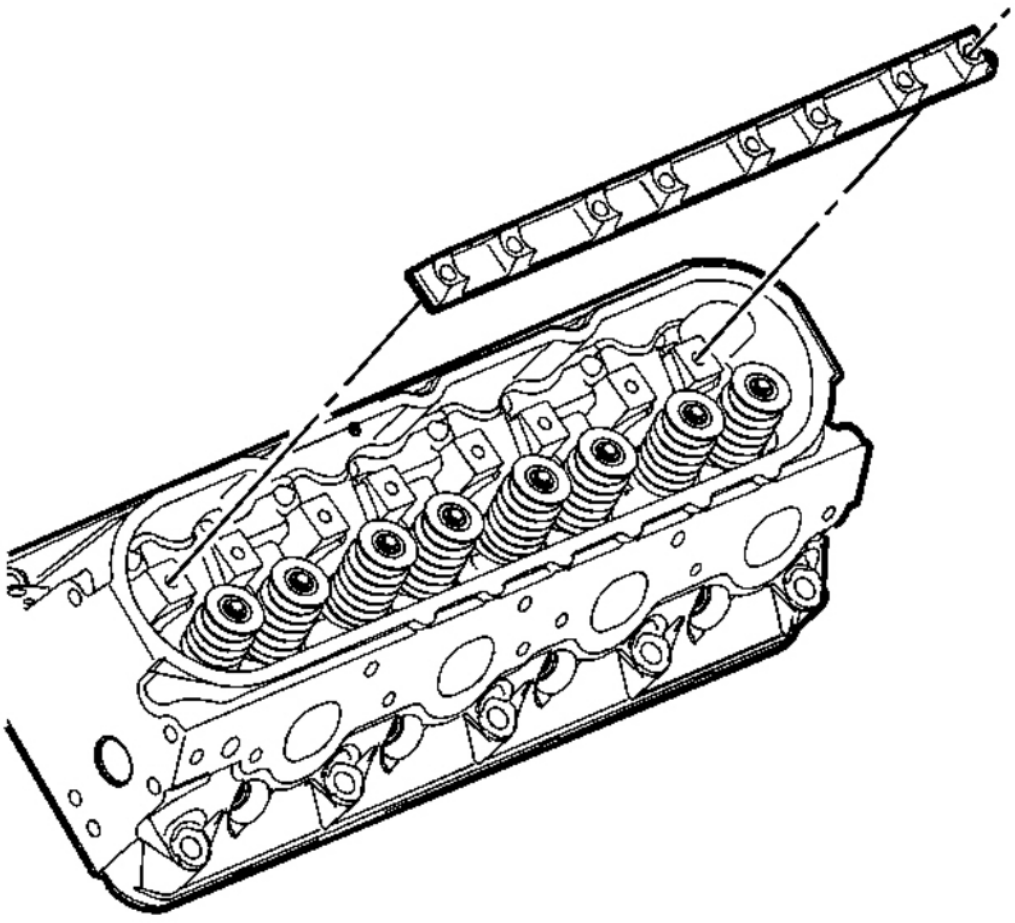


Fig. 37: View Of Valve Rocker Arm Pivot Support
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **When using the valve train components again, always install the components to the original location and position.**
- **Valve lash is net build. No valve adjustment is required.**

1. Lubricate the valve rocker arms and pushrods with clean engine oil.
2. Lubricate the flange of the valve rocker arm bolts with clean engine oil.
3. Install the valve rocker arm pivot support.

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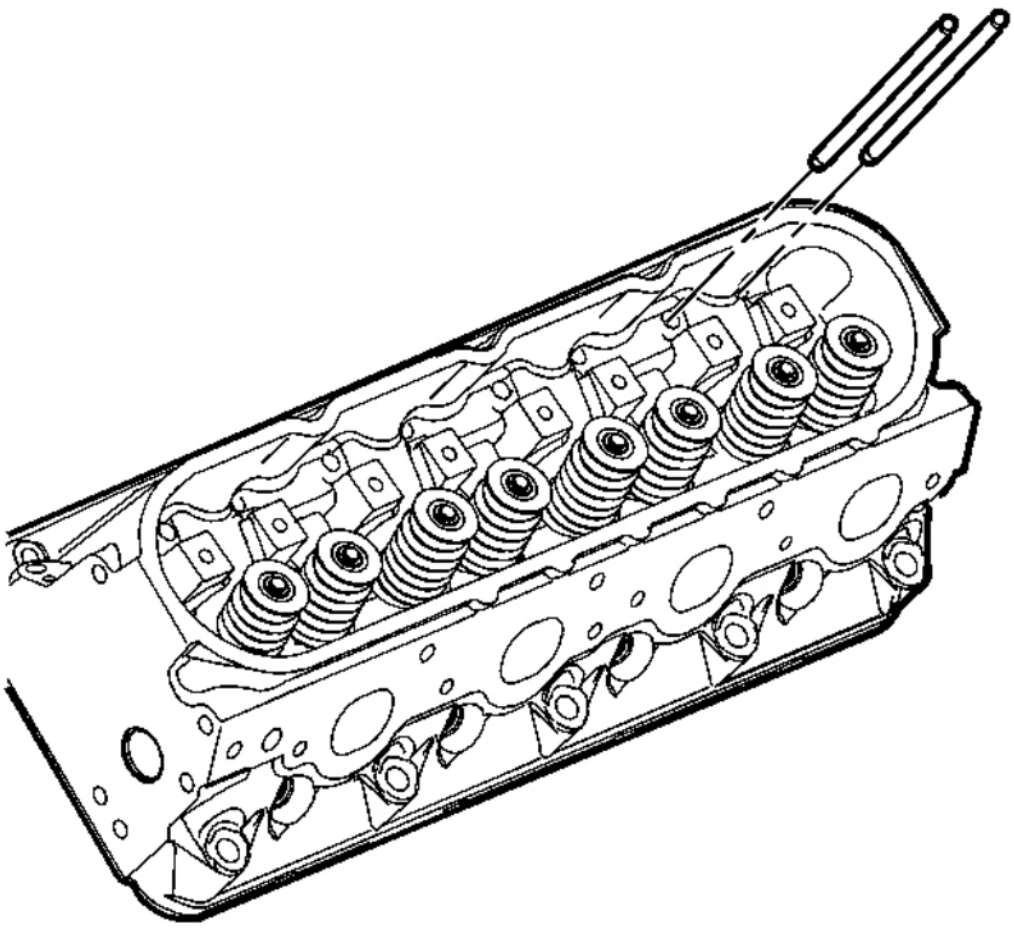


Fig. 38: View Of Pushrods
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Ensure the pushrods seat properly to the valve lifter sockets.

4. Install the pushrods.

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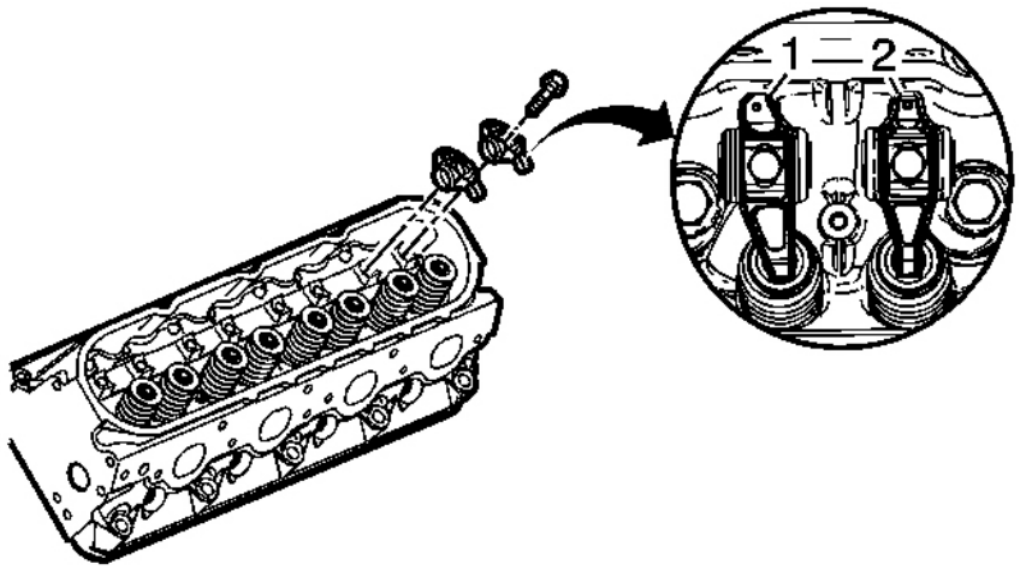


Fig. 39: View Of Offset Intake Rocker Arm & Intake Rocker Arm
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:
- **Ensure 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.

   The intake rocker arms (1) have an offset design.

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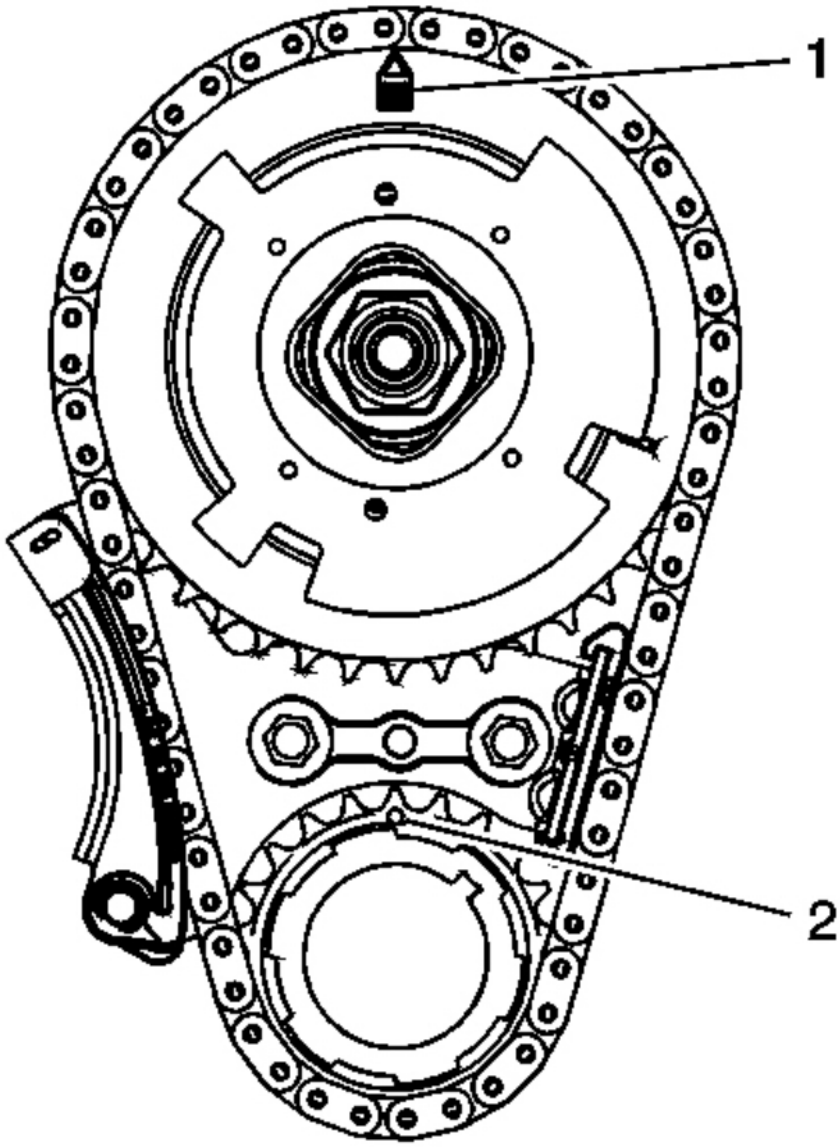


Fig. 40: View Of Camshaft & Crankshaft Sprocket Alignment Marks
Courtesy of GENERAL MOTORS CORP.

6. Rotate the crankshaft until number 1 piston is at top dead center of compression stroke.

   In this position, cylinder number 1 rocker arms will be off lobe lift, and the crankshaft sprocket key will be at the 1:30 position. The camshaft and crankshaft sprocket alignment marks (1, 2) will be in the 12

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o'clock position. If viewing from the rear of the engine, the additional crankshaft pilot hole, non-threaded, will be in the 10:30 position.

The engine firing order is 1, 8, 7, 2, 6, 5, 4, 3.

Cylinders 1, 3, 5 and 7 are left bank.

Cylinders 2, 4, 6, and 8 are right bank.

NOTE: **Refer to Fastener Notice .**

7. With the engine in the number 1 firing position, tighten the following valve rocker arm bolts:

Tighten:

- Tighten the exhaust valve rocker arm bolts 1, 2, 7, and 8 to 30 N.m (22 lb ft).
- Tighten the intake valve rocker arm bolts 1, 3, 4, and 5 to 30 N.m (22 lb ft).

8. Rotate the crankshaft 360 degrees.
9. Tighten the following valve rocker arm bolts:

Tighten:

- Tighten the exhaust valve rocker arm bolts 3, 4, 5, and 6 to 30 N.m (22 lb ft).
- Tighten the intake valve rocker arm bolts 2, 6, 7, and 8 to 30 N.m (22 lb ft).

VALVE ROCKER ARM COVER INSTALLATION - LEFT SIDE

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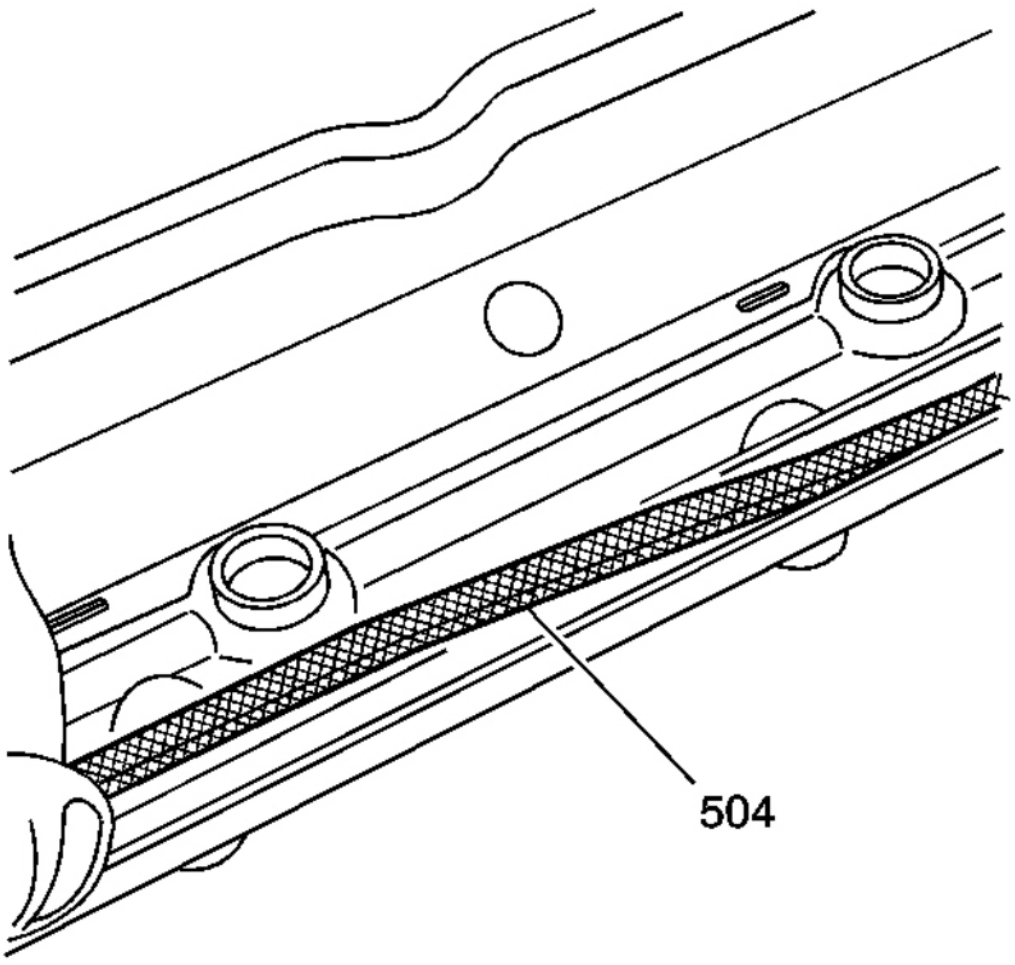


Fig. 41: View Of Valve Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **All gasket surfaces should be free of oil or other foreign material during assembly.**
- **DO NOT use the valve rocker arm cover gasket again.**
- **The valve rocker arm cover bolt grommets may be used again if not damaged.**

1. Install a NEW gasket (504) into the valve rocker arm cover.

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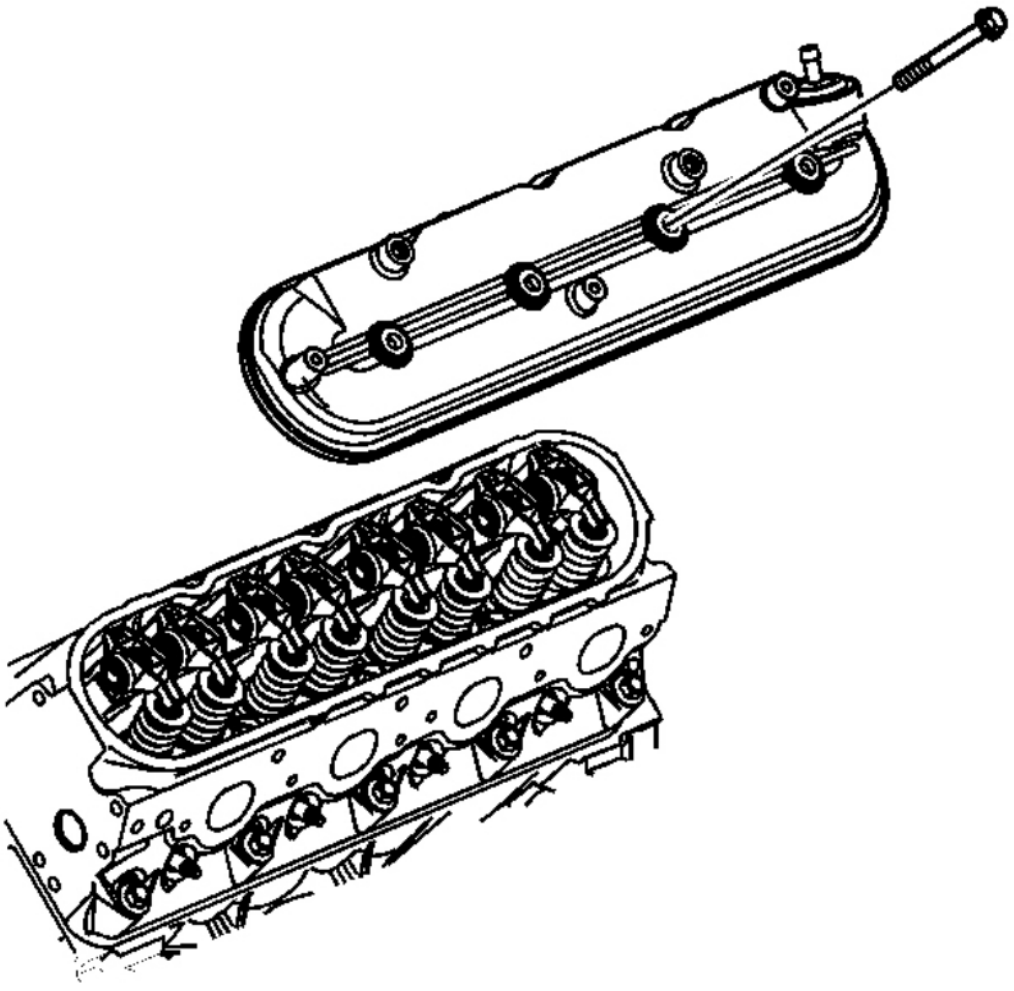


Fig. 42: View Of Valve Rocker Arm Cover
Courtesy of GENERAL MOTORS CORP.

2. Install the valve rocker arm cover onto the cylinder head.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

3. Install the cover bolts with grommets.

Tighten: Tighten the valve rocker arm cover bolts to 12 N.m (106 lb in).

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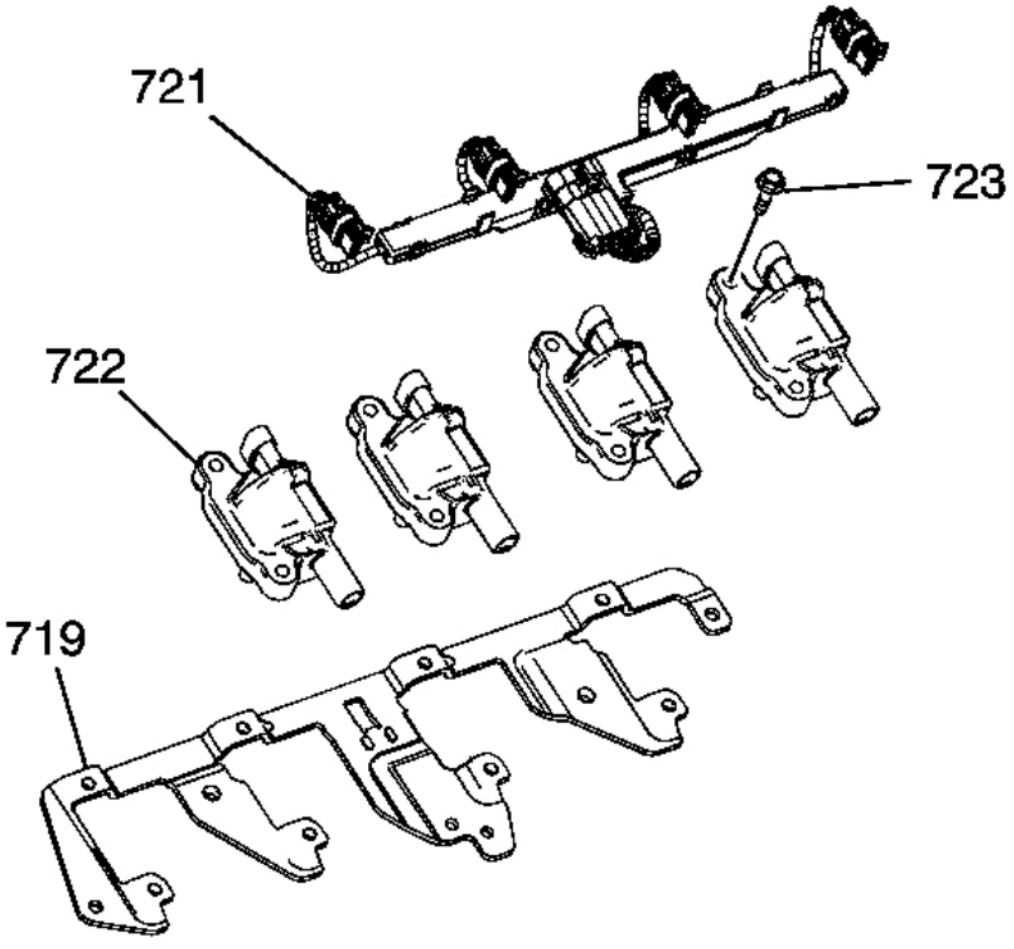


Fig. 43: View Of Bracket, Bolts, Coils & Wire Harness
Courtesy of GENERAL MOTORS CORP.

4. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the ignition coil bolts (723).
5. Install the ignition coils (722), wire harness (721), and bolts (723) to the bracket (719).

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

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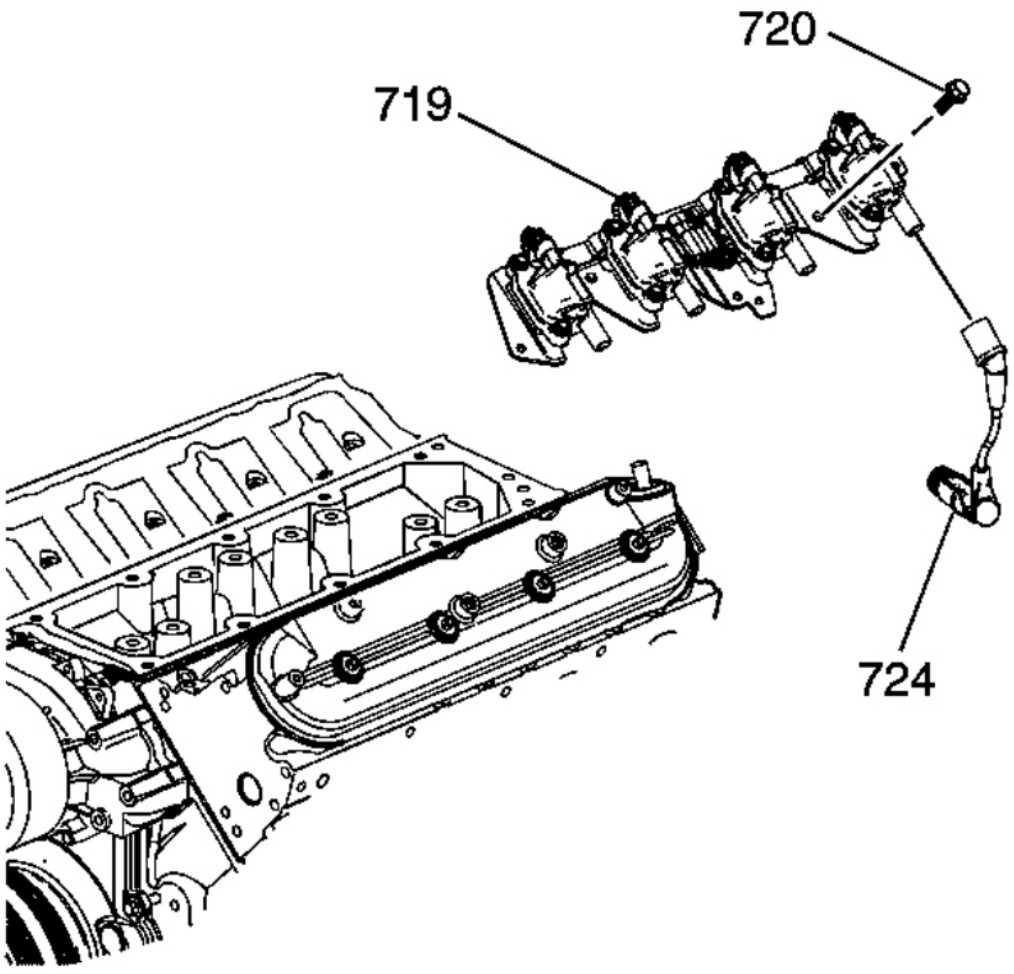


Fig. 44: Ignition Coils & Bracket
Courtesy of GENERAL MOTORS CORP.

6. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the ignition coil bracket studs (720).
7. Install the ignition coil and bracket assembly (719) and studs (720).

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

VALVE ROCKER ARM COVER INSTALLATION - RIGHT SIDE

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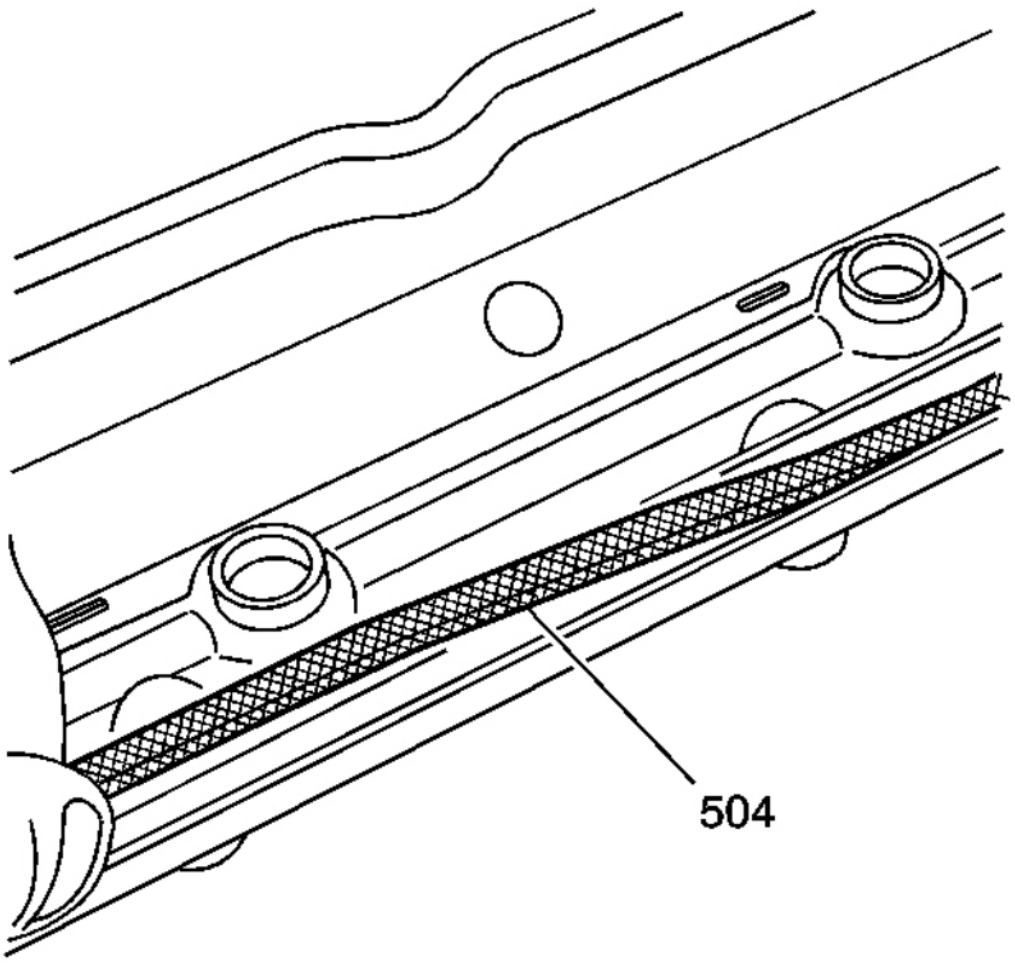


Fig. 45: View Of Valve Rocker Arm Cover Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **All gasket surfaces should be free of oil or other foreign material during assembly.**
- **DO NOT use the valve rocker arm cover gasket again.**
- **The valve rocker arm cover bolt grommets may be used again if not damaged.**

1. Install a NEW gasket (504) into the valve rocker arm cover.

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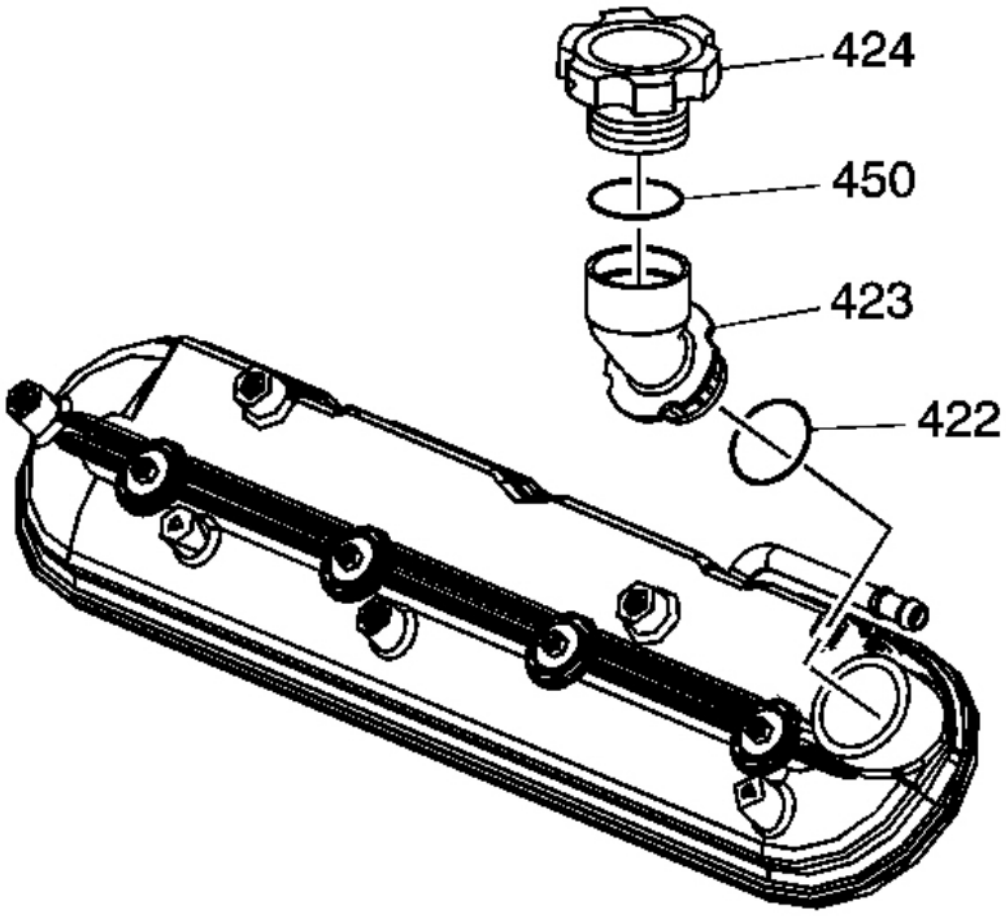


Fig. 46: Oil Fill Cap & Oil Fill Tube
Courtesy of GENERAL MOTORS CORP.

2. Install a NEW oil fill tube (423) to the valve rocker arm cover.
3. Install the oil fill cap (424).

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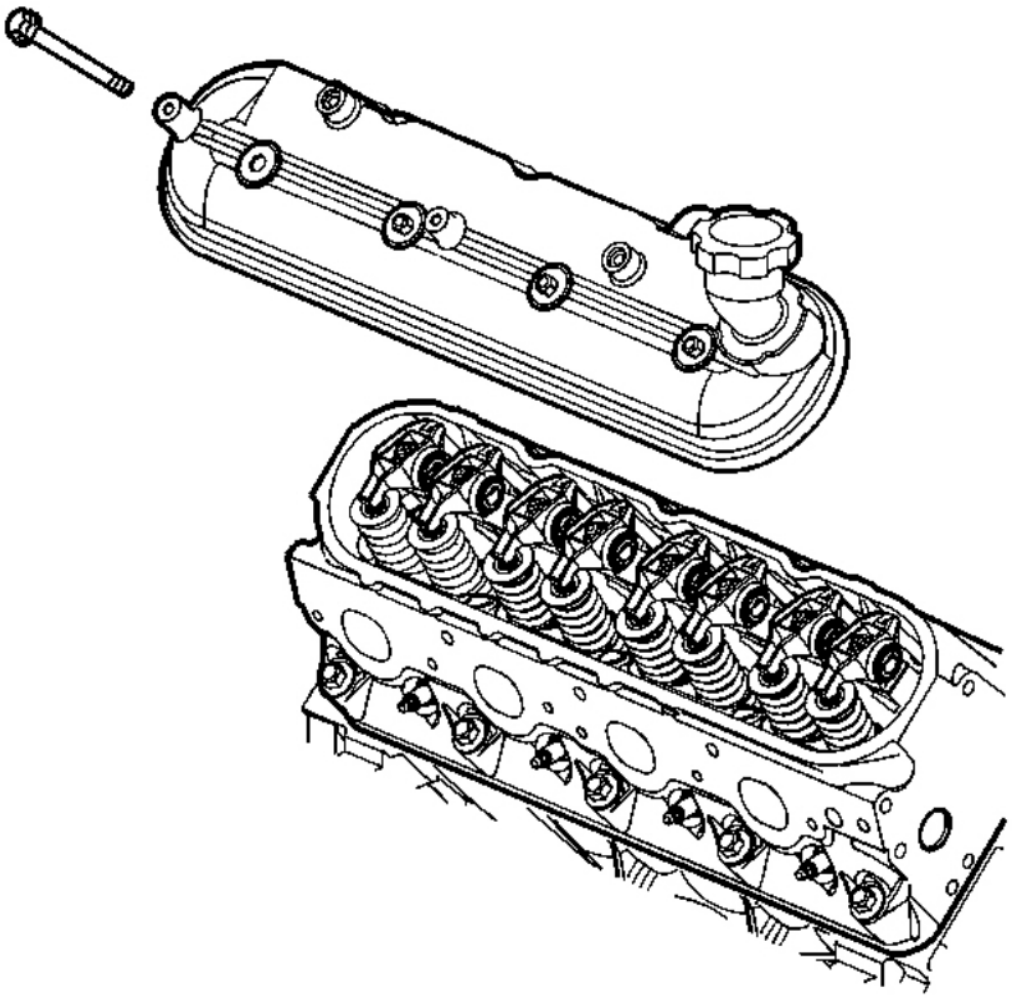


Fig. 47: View Of Valve Rocker Arm Cover & Bolts (Right)
Courtesy of GENERAL MOTORS CORP.

4. Install the valve rocker arm cover onto the cylinder head.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

5. Install the cover bolts with grommets.

Tighten: Tighten the valve rocker arm cover bolts to 12 N.m (106 lb in).

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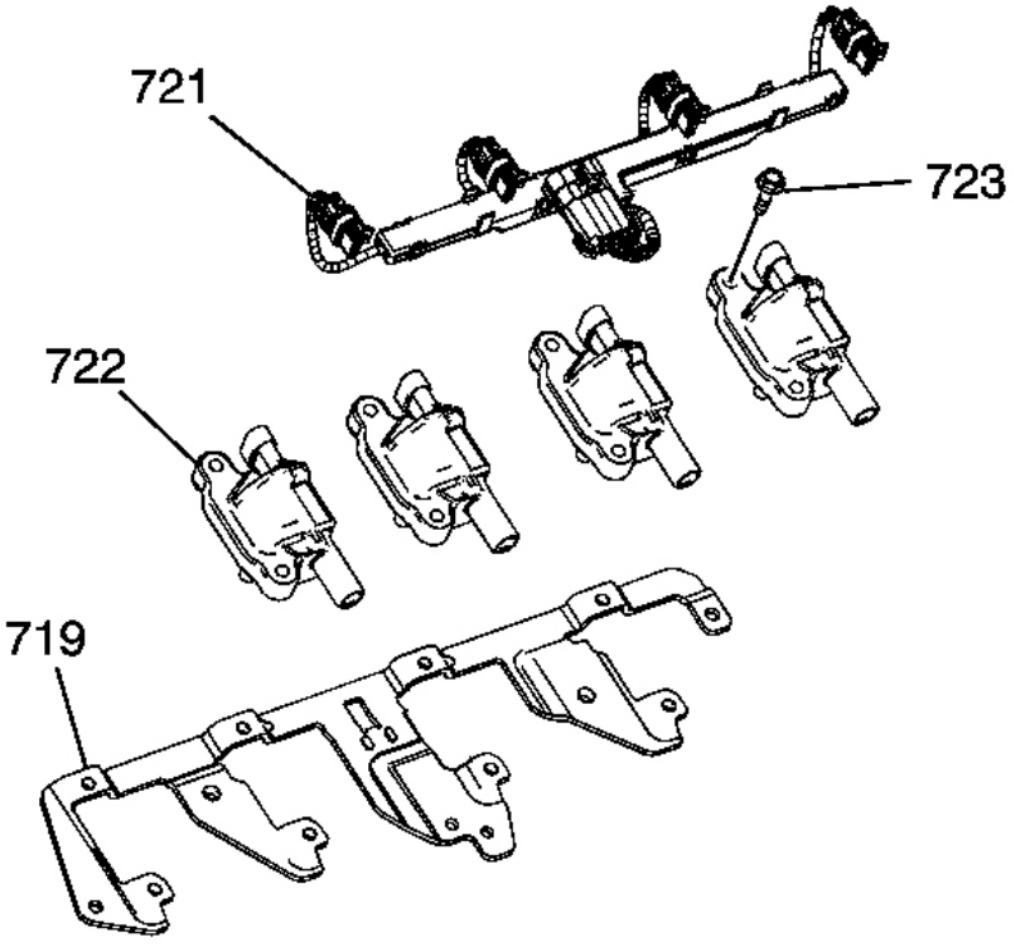


Fig. 48: View Of Bracket, Bolts, Coils & Wire Harness
Courtesy of GENERAL MOTORS CORP.

6. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the ignition coil bolts (723).
7. Install the ignition coils (722), wire harness (721), and bolts (723) to the bracket (719).

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

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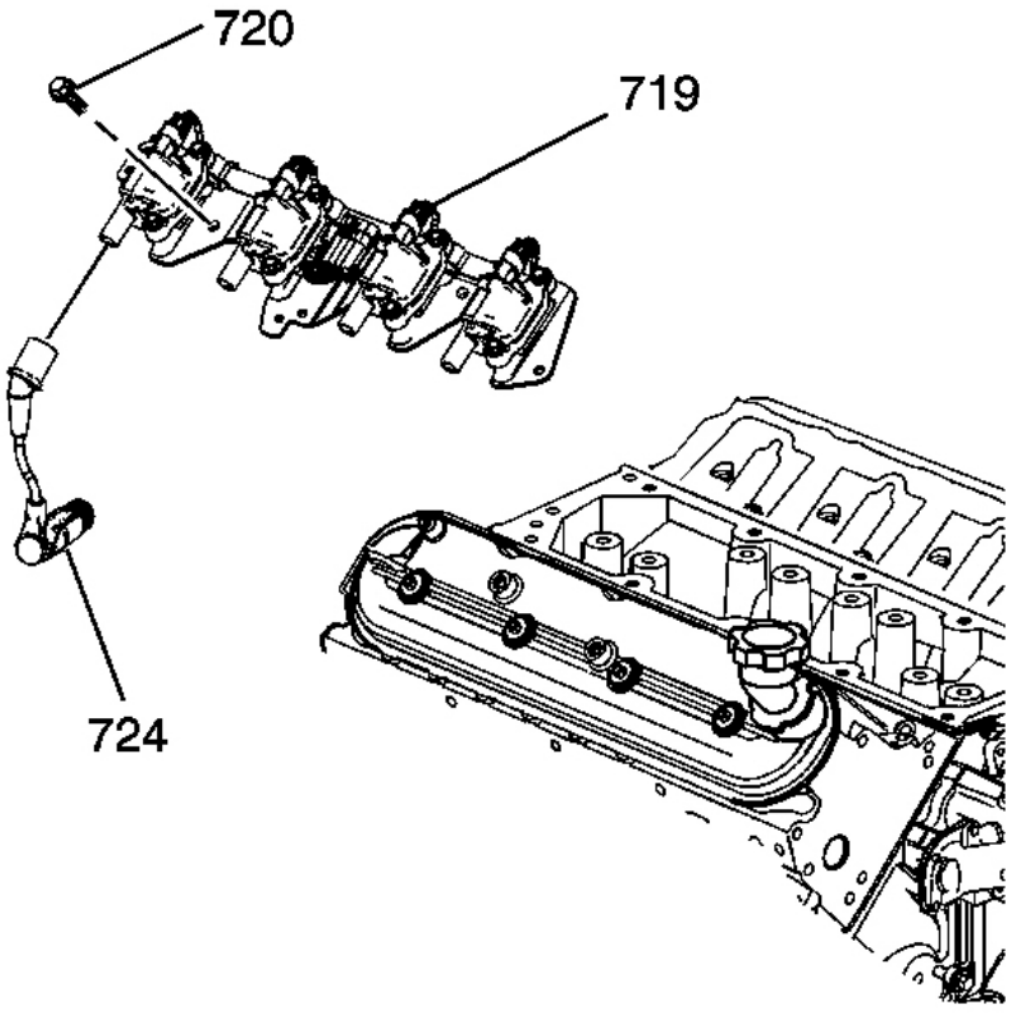


Fig. 49: Ignition Coils & Bracket
Courtesy of GENERAL MOTORS CORP.

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

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

ENGINE VALLEY COVER INSTALLATION

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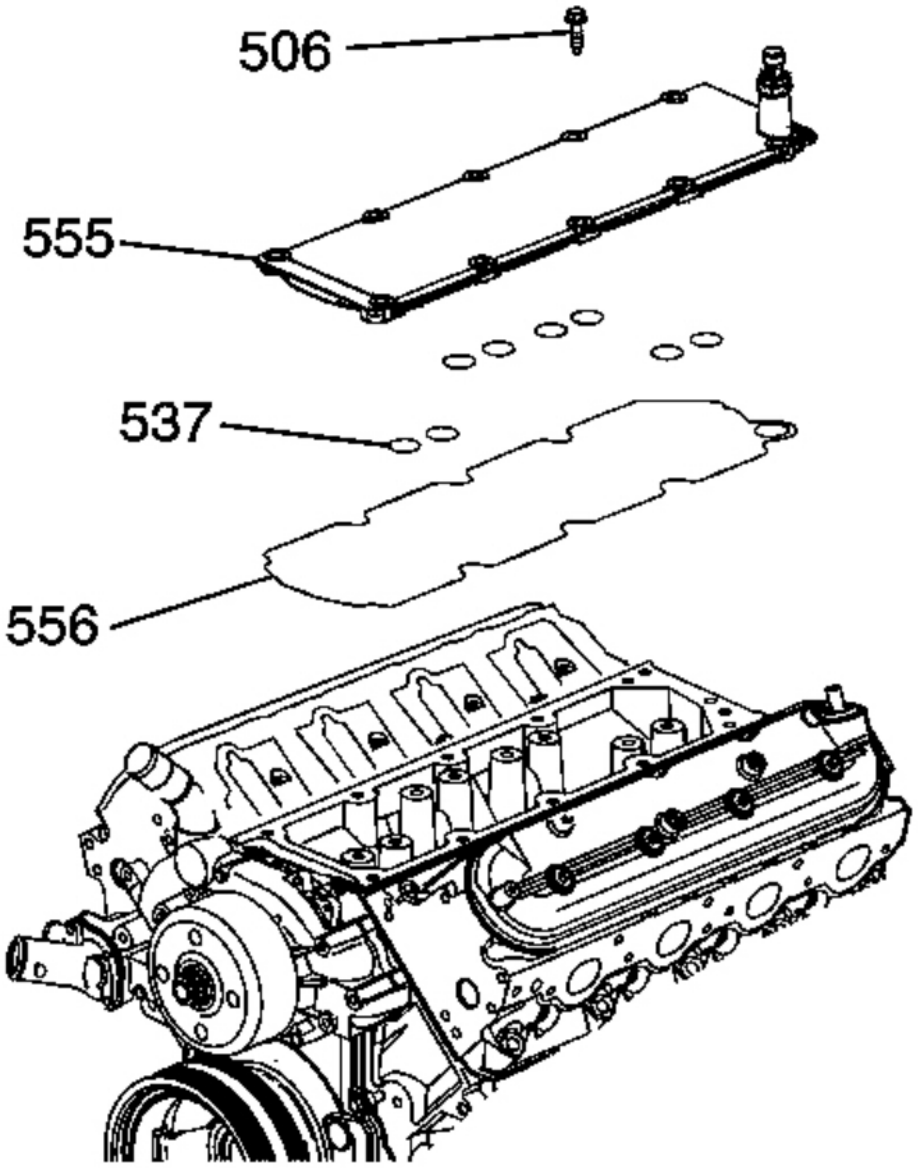


Fig. 50: View Of Engine Valley Cover Components
Courtesy of GENERAL MOTORS CORP.

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

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1. Lubricate the O-ring seals with clean engine oil.
2. Install the O-ring seals (537) to the cover (555).

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the cover (555), gasket (556), and bolts (506).

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

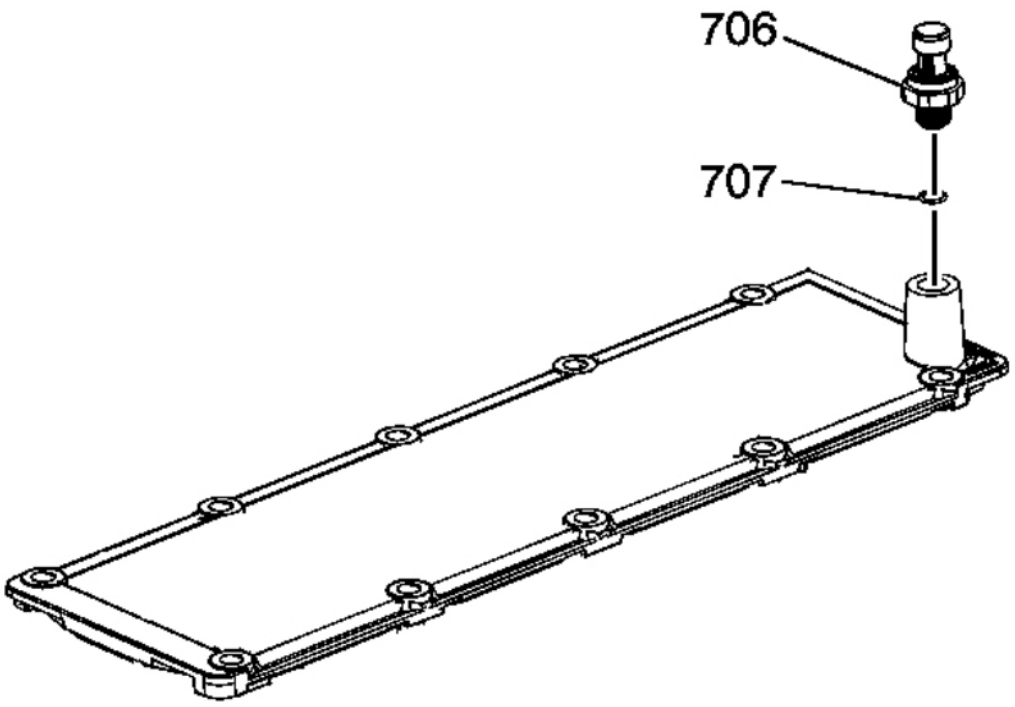


Fig. 51: View Of Oil Pressure Sensor & Washer
Courtesy of GENERAL MOTORS CORP.

4. Apply sealant GM P/N 12346004 (Canadian P/N 10953480), or equivalent, to the threads of the sensor.
5. Install the oil pressure sensor (706) and sealing washer (707).

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

VALVE LIFTER OIL FILTER INSTALLATION

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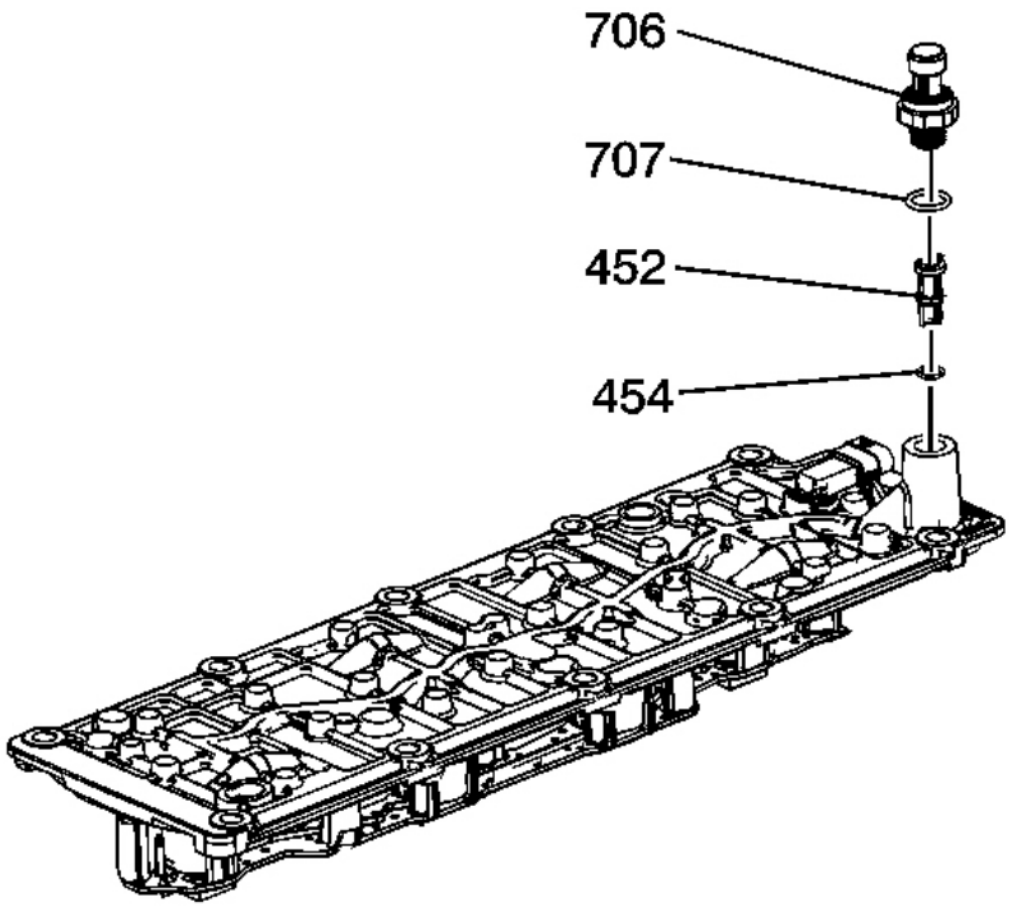


Fig. 52: View Of Oil Pressure Sensor, Washer & Valve Lifter Oil Filter
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not allow dirt or debris to enter the oil passages of the manifold. Plug, as required.

1. Install a NEW oil filter (452) and O-ring (454) assembly.
2. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) to the threads of the sensor.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the oil pressure sensor (706) and washer (707).

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

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VALVE LIFTER OIL MANIFOLD INSTALLATION

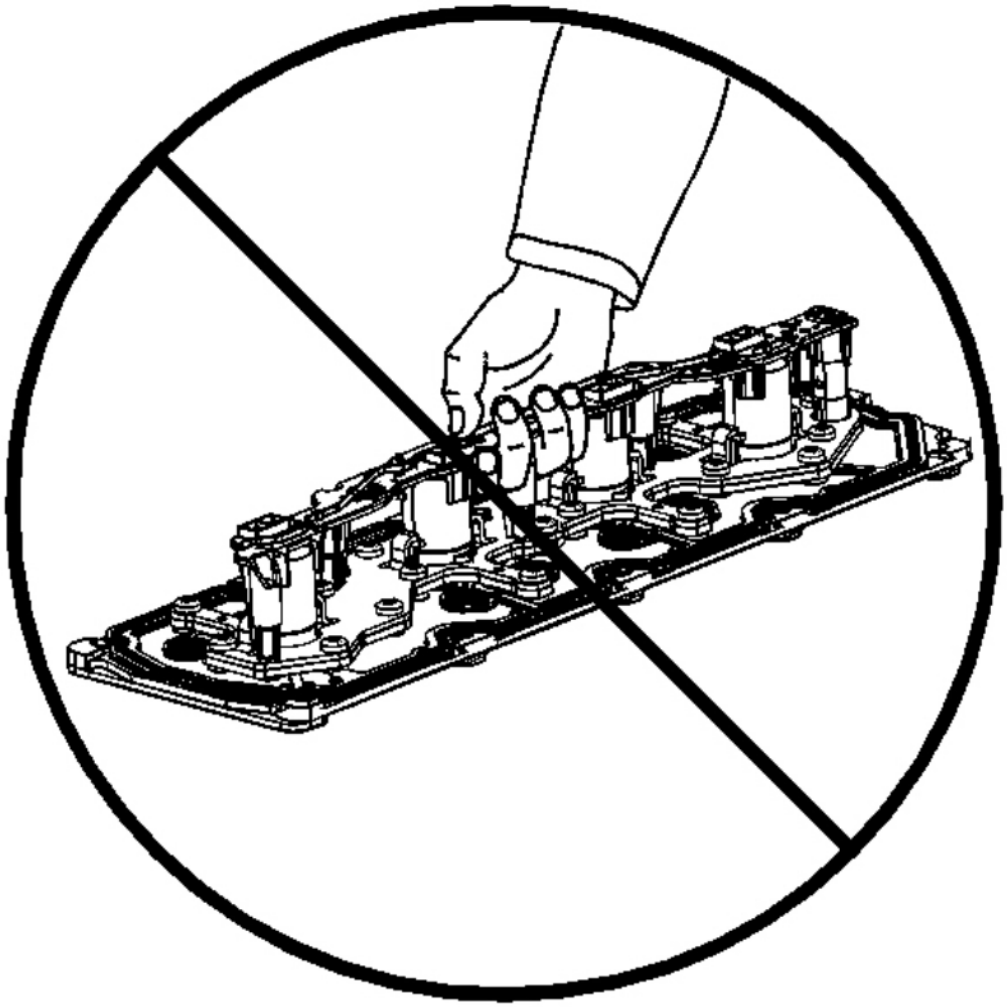


Fig. 53: Valve Lifter Oil Manifold
Courtesy of GENERAL MOTORS CORP.

1. Do not lift the manifold assembly by the electrical lead frame.

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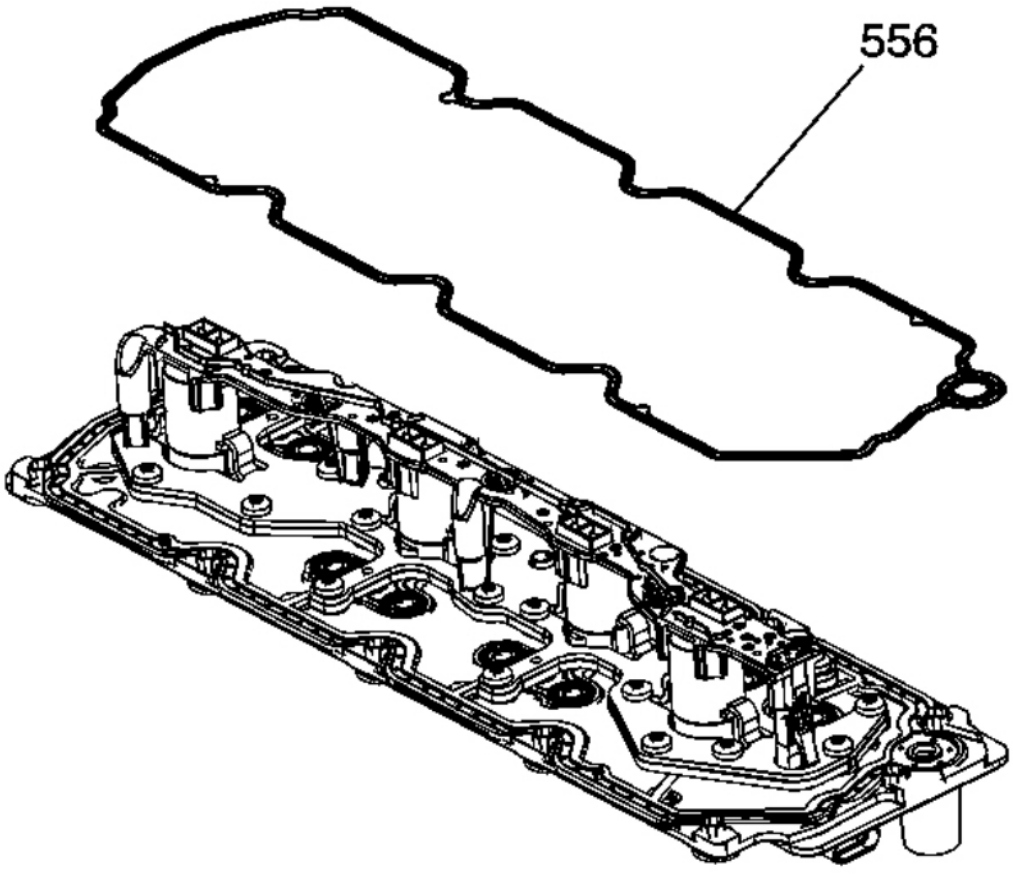


Fig. 54: View Of Outer Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:
- **All gasket surfaces should be free of oil or other foreign material during assembly.**
- **Do not allow dirt or debris to enter the manifold. Plug, as required.**

2. Install the service gasket (556) onto the manifold.

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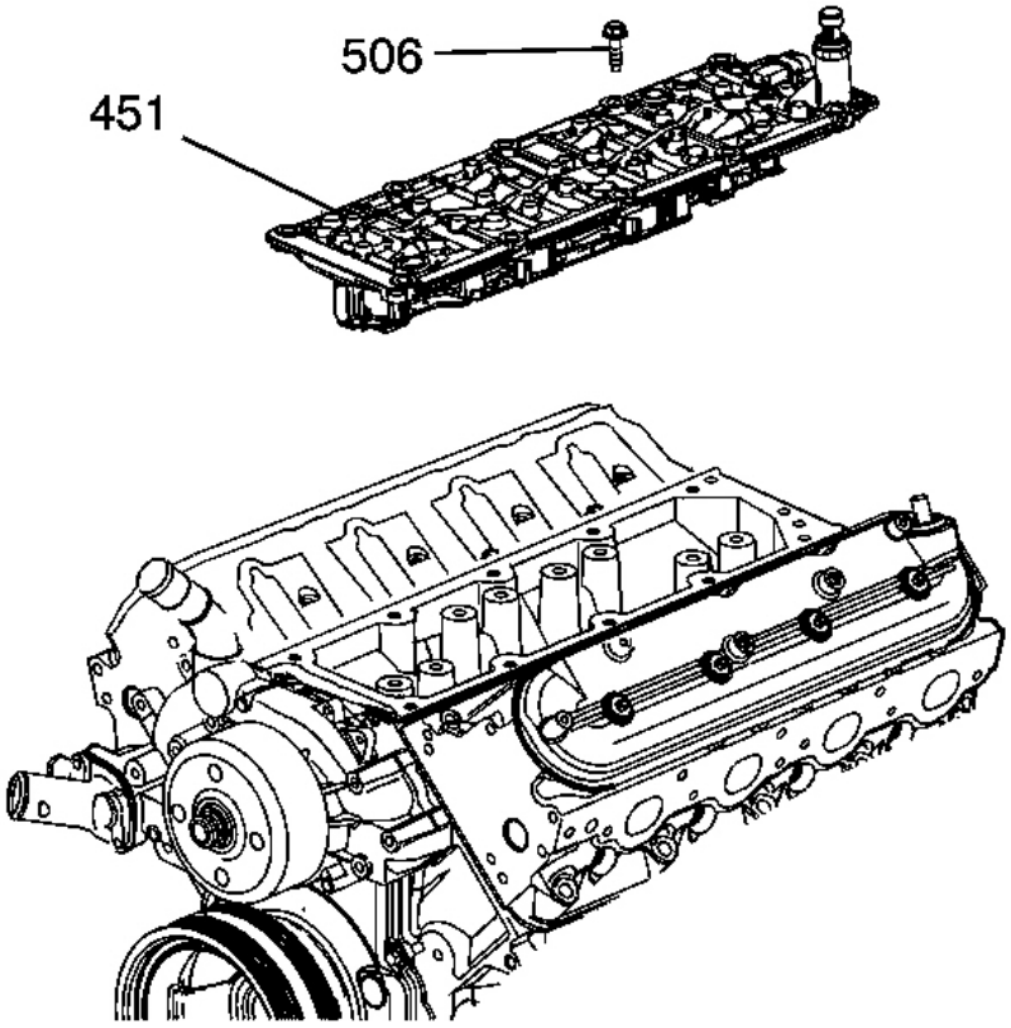


Fig. 55: View Of Valve Lifter Oil Manifold
Courtesy of GENERAL MOTORS CORP.

3. Install the manifold (451) with gasket.

NOTE: **Refer to Fastener Notice in Cautions and Notices.**

4. Install the manifold bolts (506).

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

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ENGINE COOLANT AIR BLEED PIPE AND HOLE COVER INSTALLATION (RPO LY2/LY6)

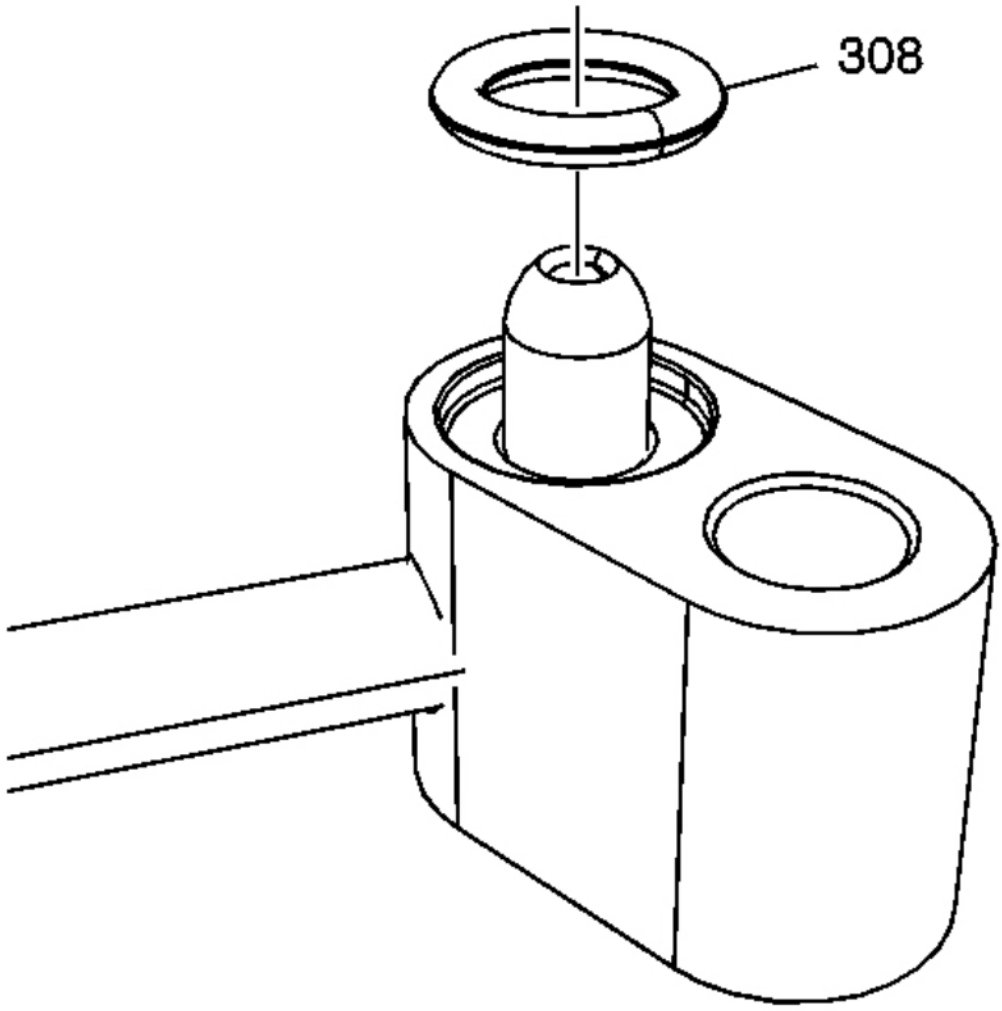


Fig. 56: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Position the gasket O-ring seal (308) onto the nipple portion of the pipe.

1. Install the seals onto the engine coolant air bleed pipe and covers.

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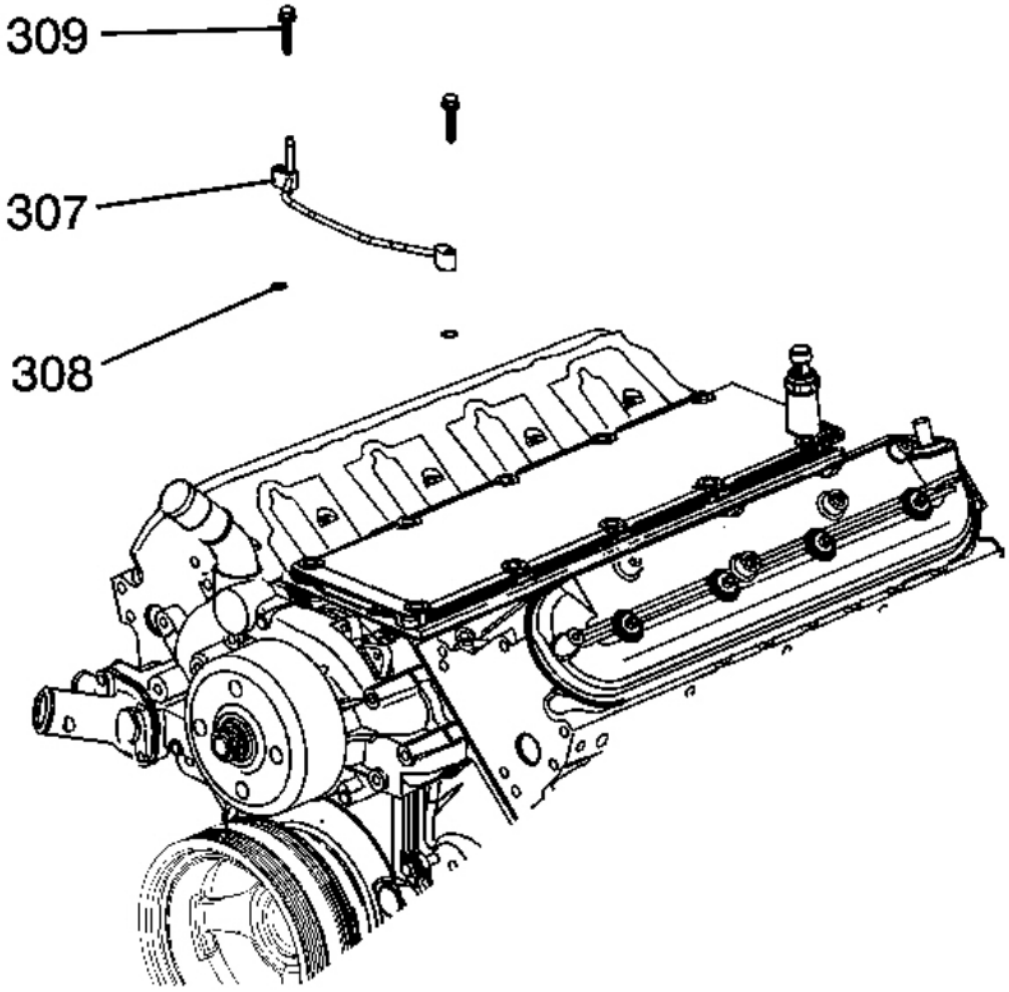


Fig. 57: View Of Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

2. Install the pipe (307) and seals (308).

NOTE: **Refer to Fastener Notice .**

3. Install the bolts (309).

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

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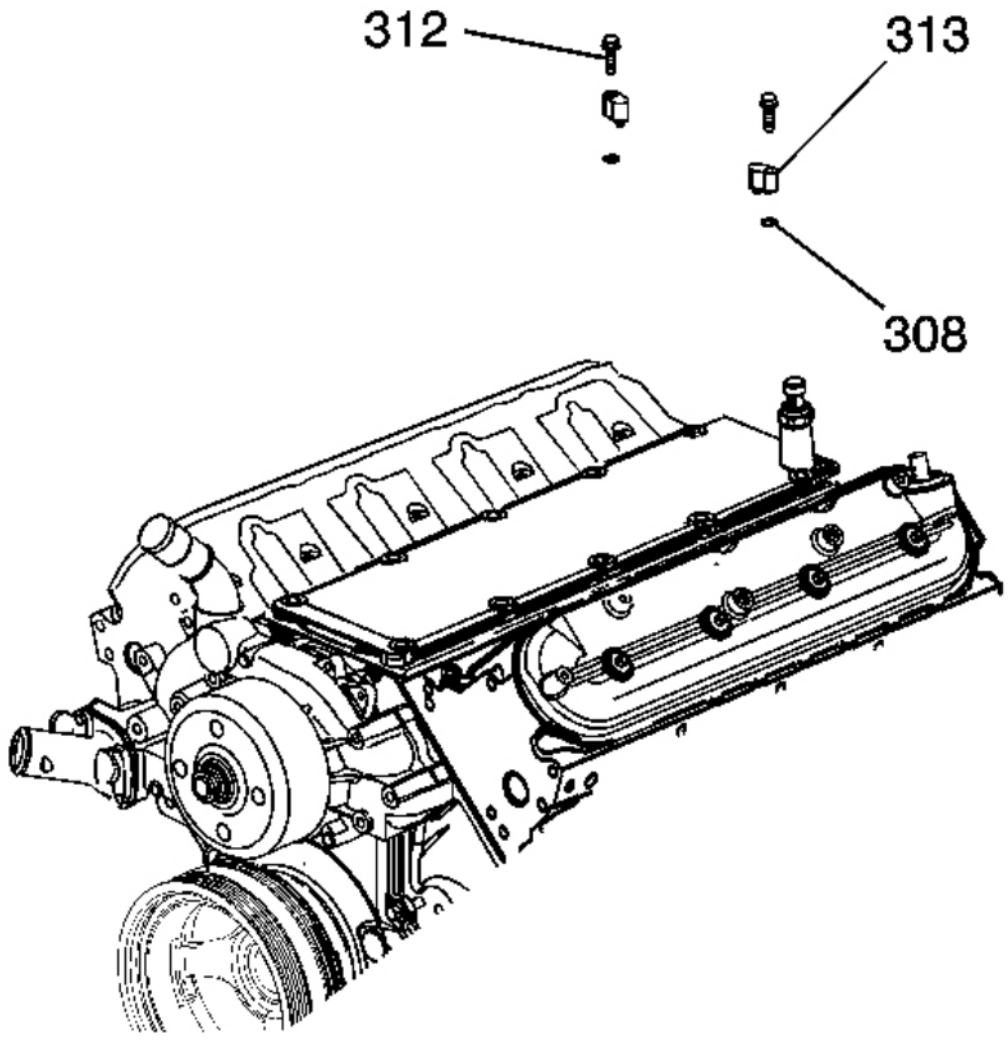


Fig. 58: View Of Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the covers (313) and seals (308).
5. Install the bolts (312).

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

ENGINE COOLANT AIR BLEED PIPE AND HOLE COVER INSTALLATION (RPO LC9/LY5/LMG/L76)

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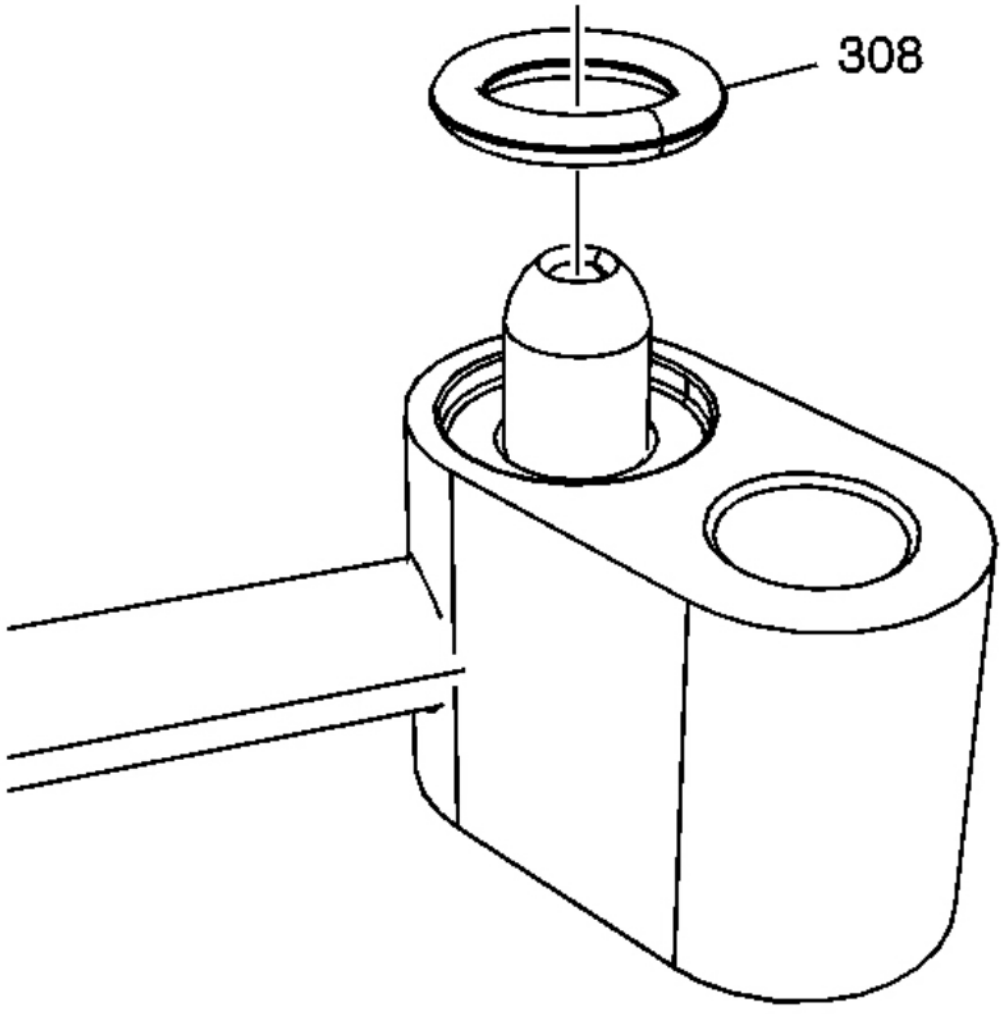


Fig. 59: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Position the O-ring seal onto the nipple portion of the pipe.

1. Install the seals (308) onto the engine coolant air bleed pipe and covers.

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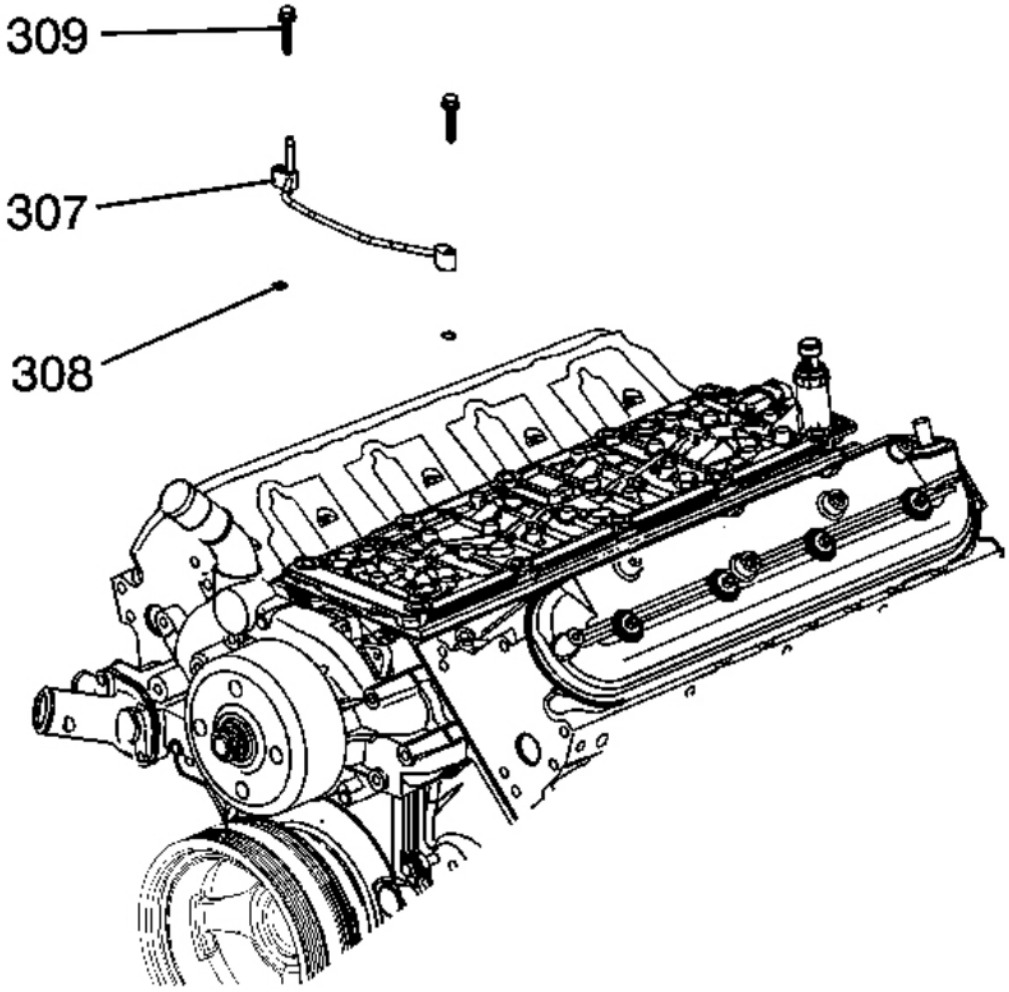


Fig. 60: View Of Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

2. Install the pipe (307) and seals (308).

NOTE: **Refer to Fastener Notice .**

3. Install the bolts (309).

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

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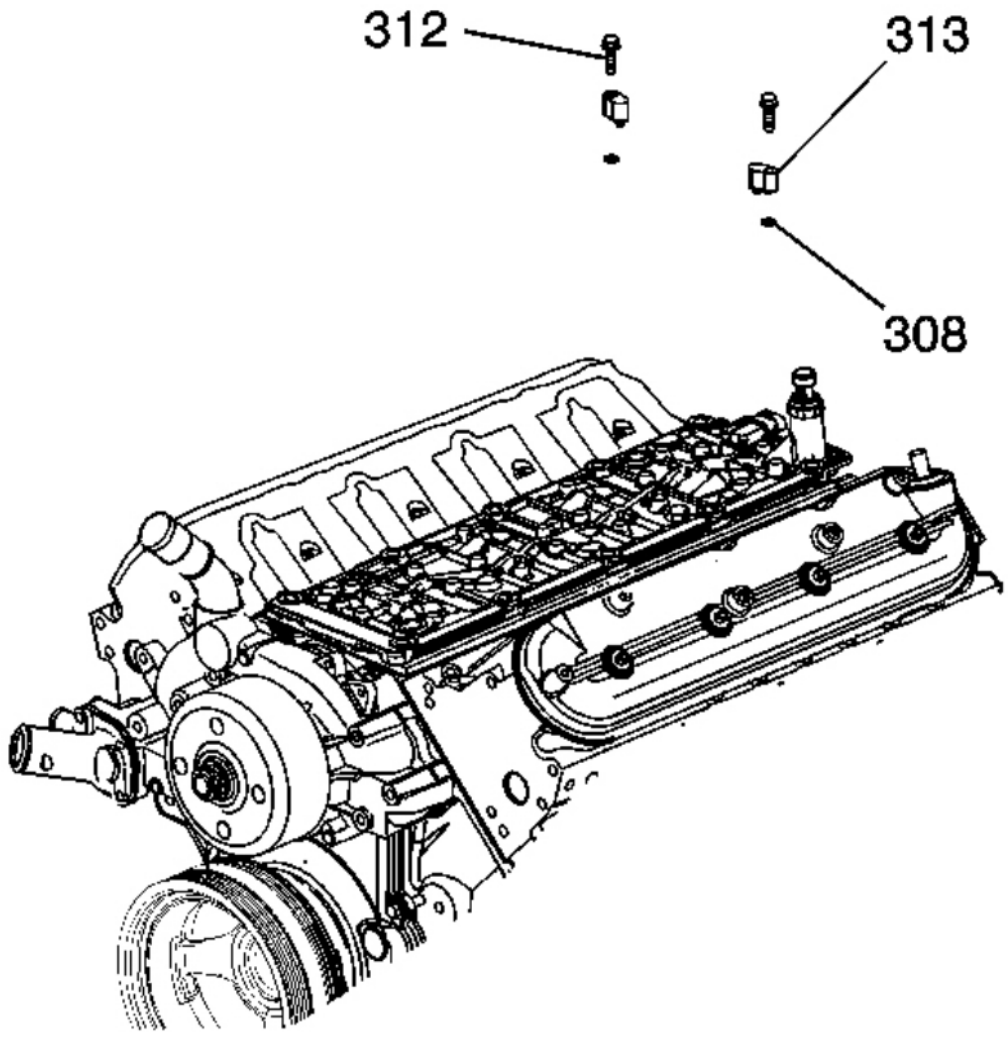


Fig. 61: View Of Engine Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the covers (313) and seals (308).
5. Install the bolts (312).

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

ENGINE COOLANT AIR BLEED PIPE AND HOLE COVER INSTALLATION (RPO L92)

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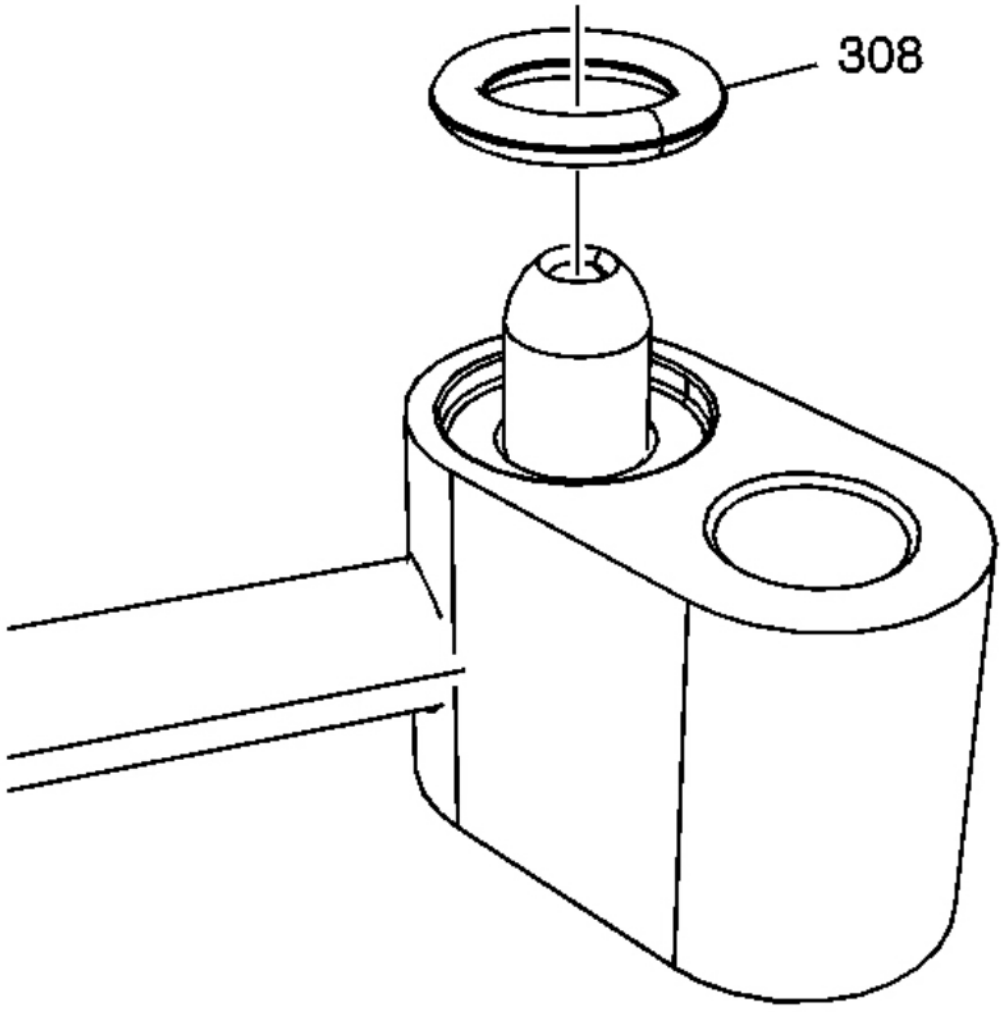


Fig. 62: View Of Coolant Air Bleed Pipe Seal
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Position the O-ring seal onto the nipple portion of the pipe.

1. Install the seals (308) onto the engine coolant air bleed pipe and covers.

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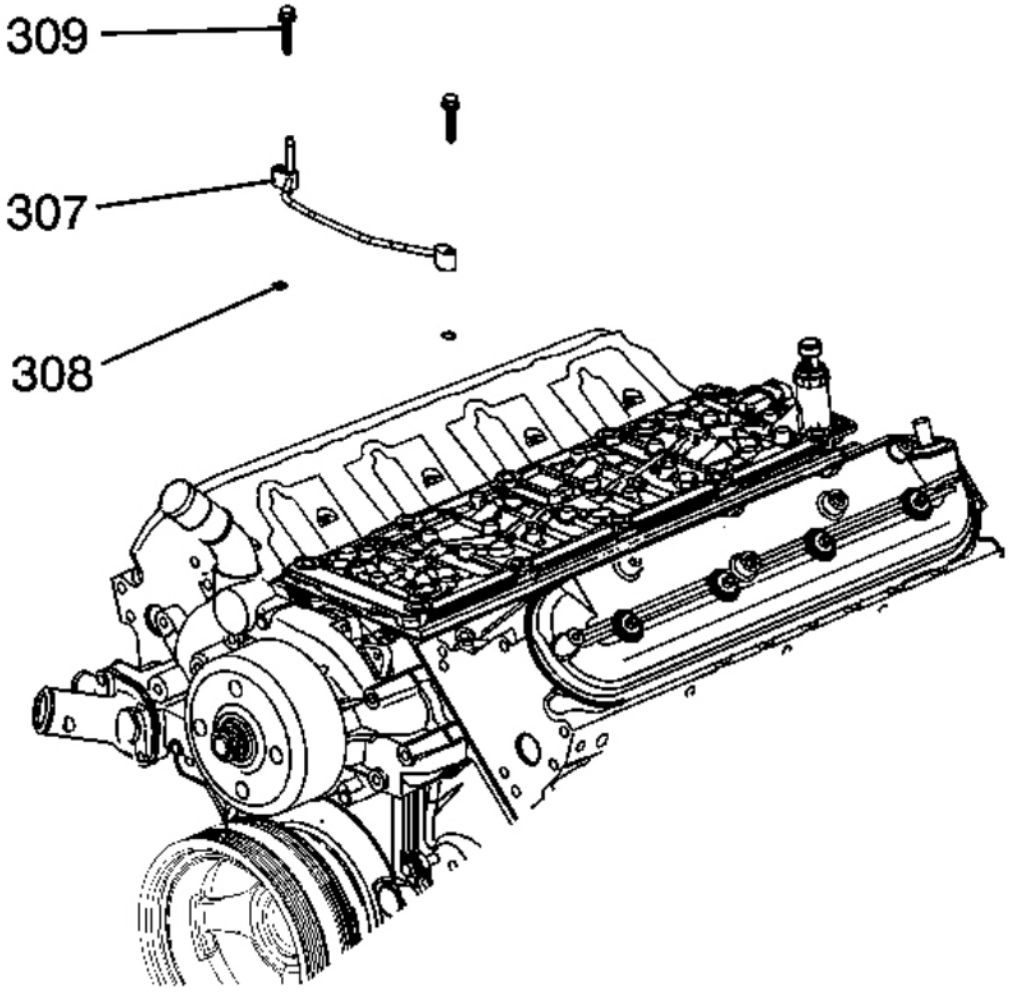


Fig. 63: Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

2. Install the first design pipe (307) and seals (308).

NOTE: **Refer to Fastener Notice .**

3. Install the bolts (309).

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

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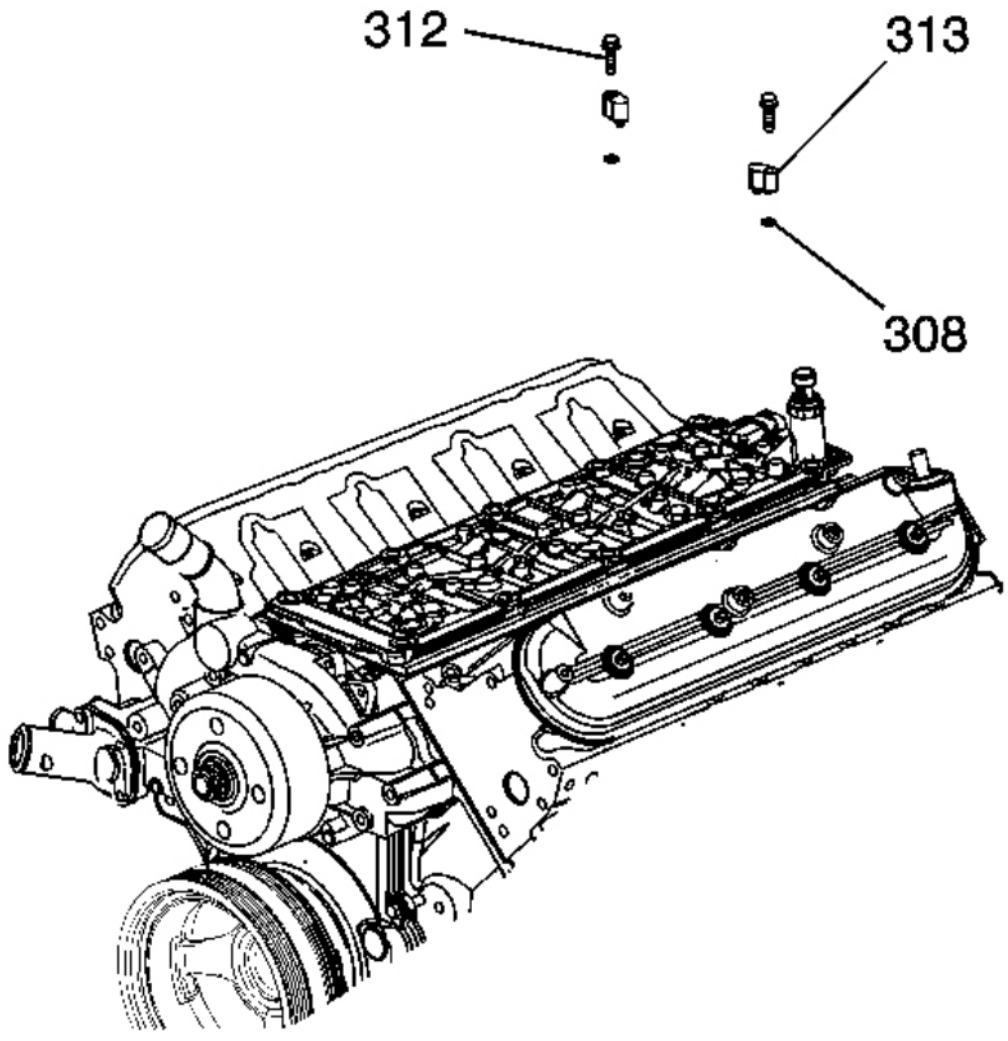


Fig. 64: Engine Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the first design engine covers (313) and seals (308).
5. Install the bolts (312).

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

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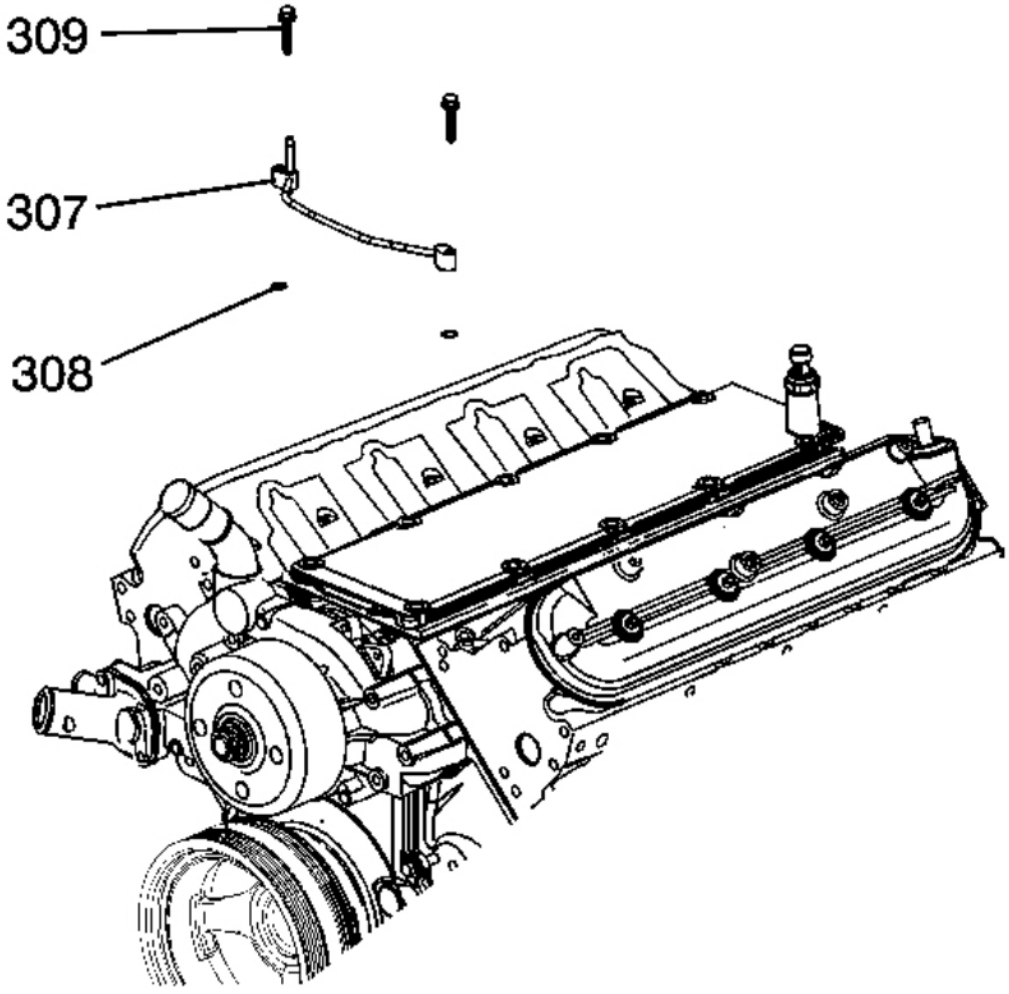


Fig. 65: View Of Engine Coolant Air Bleed Pipe
Courtesy of GENERAL MOTORS CORP.

6. Install the second design pipe (307) and seals (308).
7. Install the bolts (309).

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

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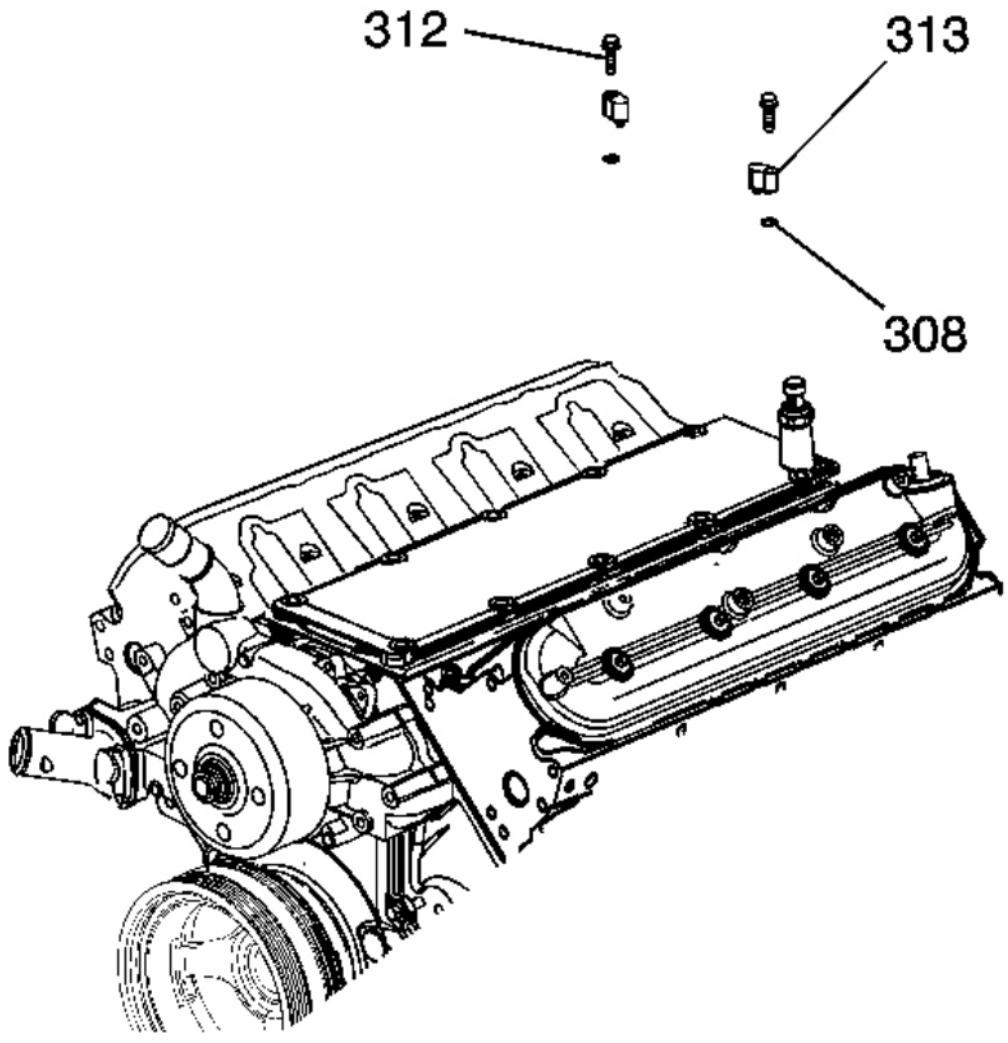


Fig. 66: View Of Coolant Air Bleed Cover Bolts
Courtesy of GENERAL MOTORS CORP.

8. Install the second design engine covers (313) and seals (308).
9. Install the bolts (312).

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

INTAKE MANIFOLD INSTALLATION (RPO LY2/LY6)

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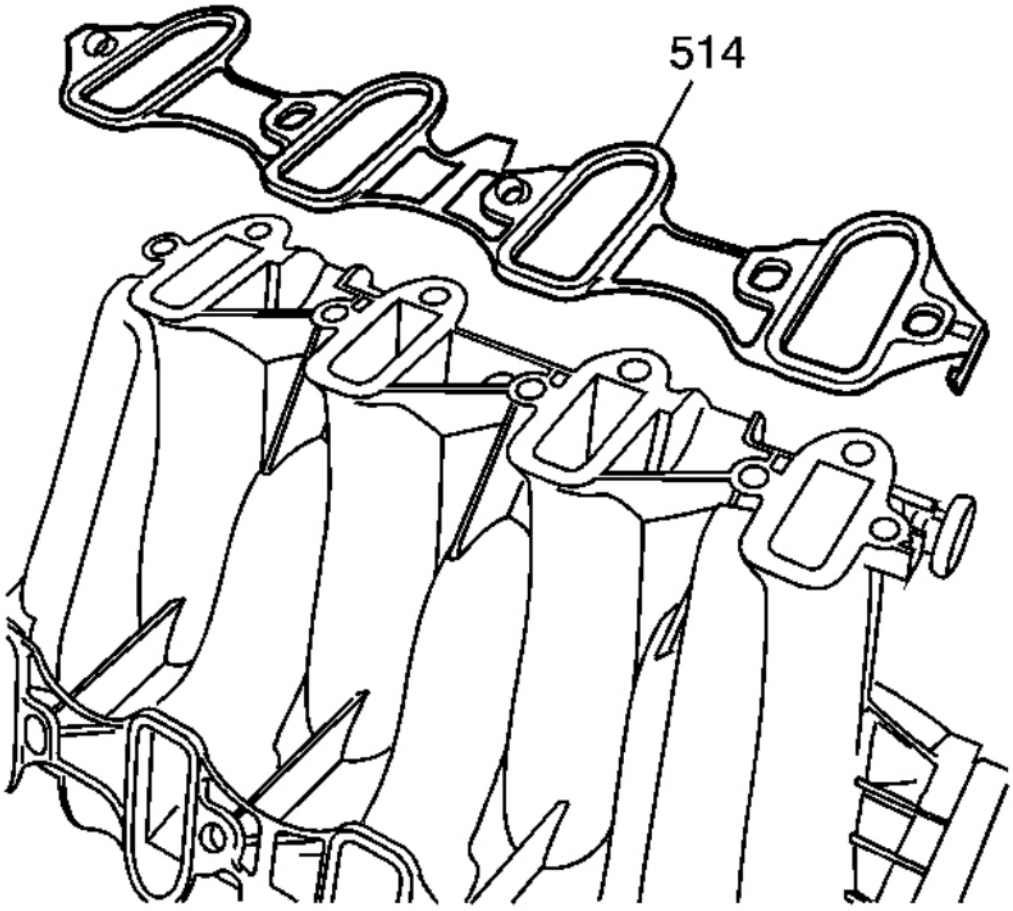


Fig. 67: View Of Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, install the intake manifold as a complete assembly.**
- **DO NOT use the intake manifold gaskets again. Install NEW intake manifold-to-cylinder head gaskets.**

1. Install NEW intake manifold-to-cylinder head gaskets (514).

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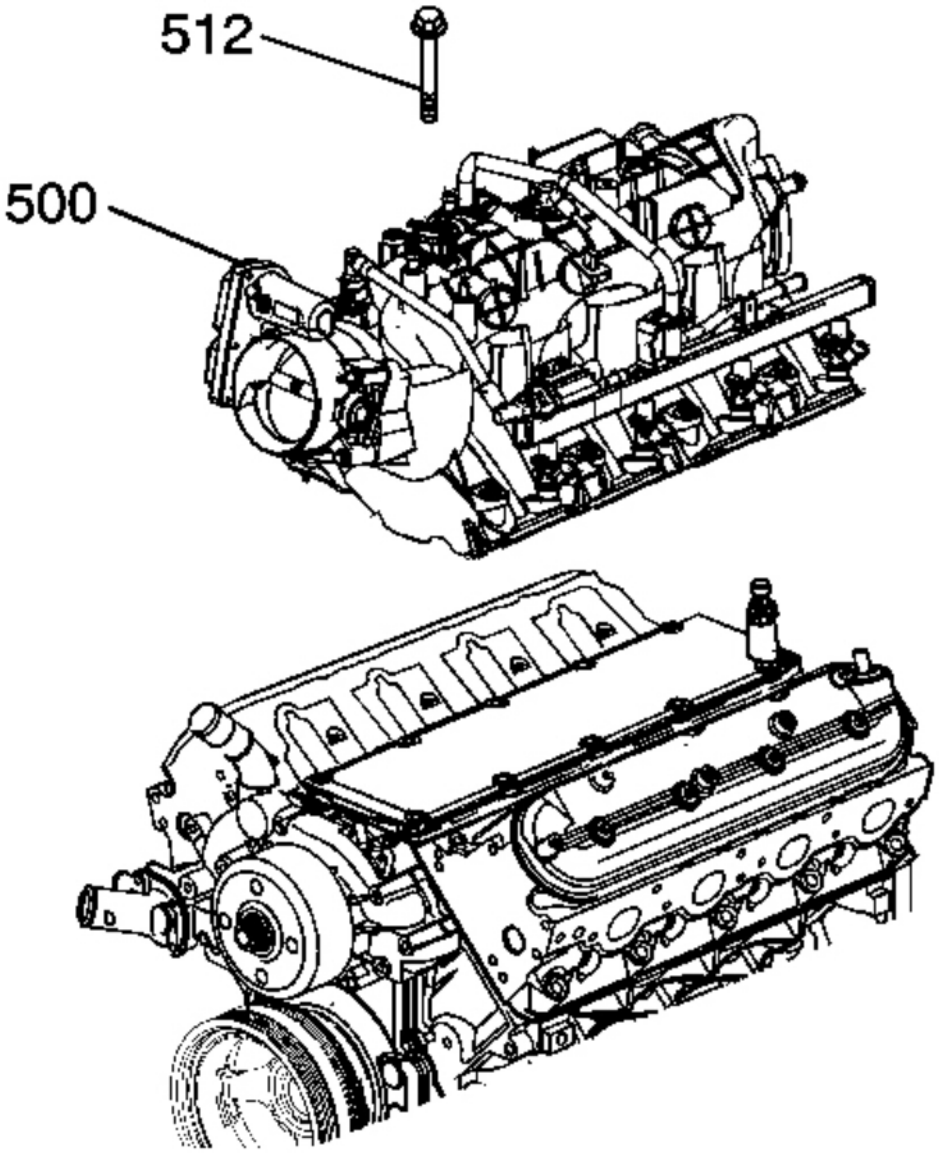


Fig. 68: View Of Intake Manifold & Bolts
Courtesy of GENERAL MOTORS CORP.

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

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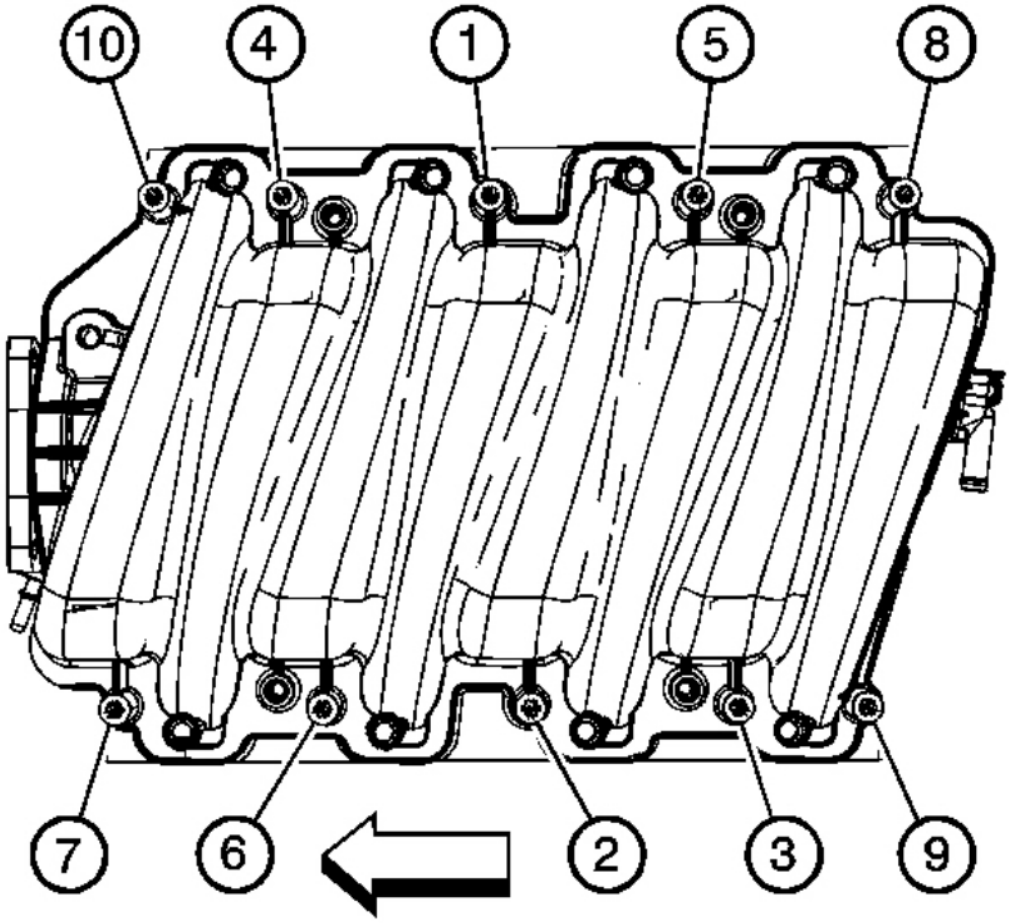


Fig. 69: Intake Manifold Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

4. Install the intake manifold bolts.

Tighten:

1. Tighten the intake manifold bolts (1-10) a first pass in sequence to 5 N.m (44 lb in).
2. Tighten the intake manifold bolts (1-10) a final pass in sequence to 10 N.m (89 lb in).

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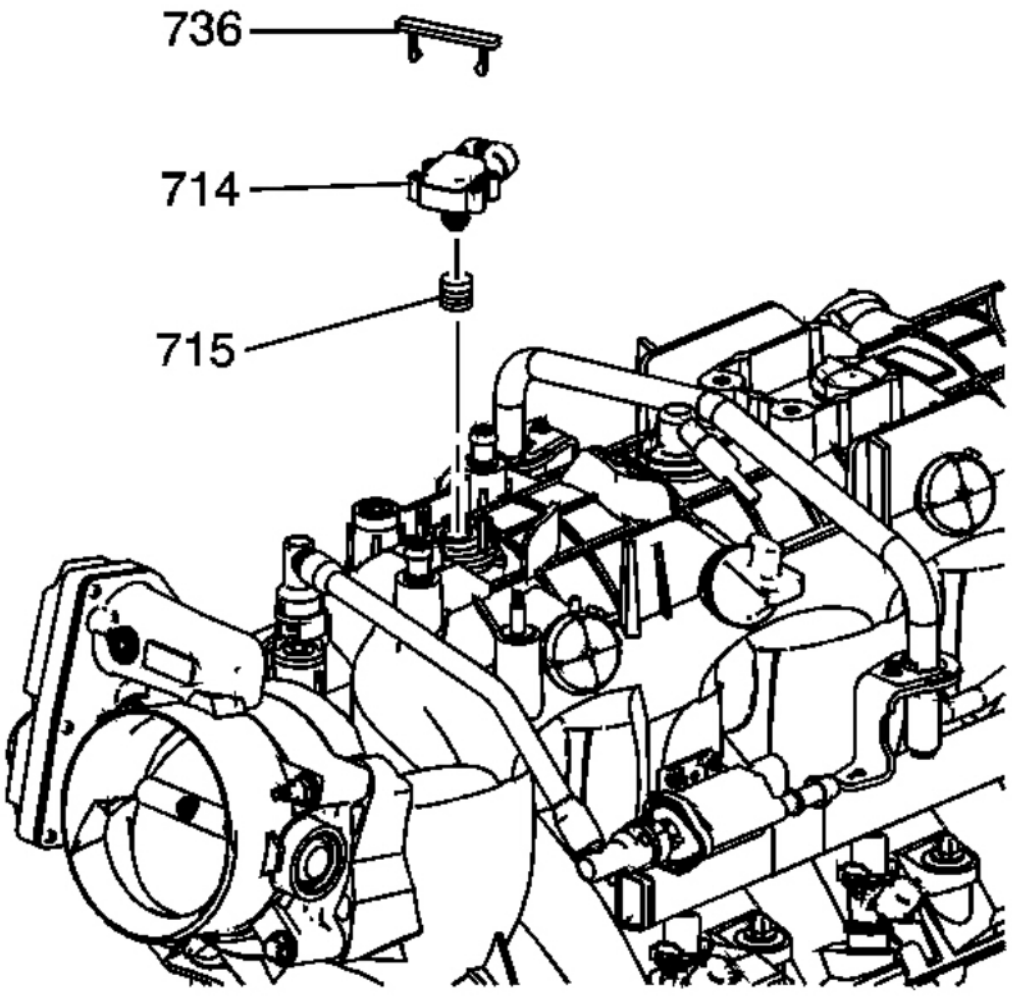


Fig. 70: MAP Sensor
Courtesy of GENERAL MOTORS CORP.

5. Install the fuel rail. Refer to **Fuel Rail and Injectors Installation**.
6. Lubricate the manifold absolute pressure (MAP) sensor grommet (715) with clean engine oil.
7. Install the grommet onto the MAP sensor (714).
8. Install the MAP sensor and retainer (736).

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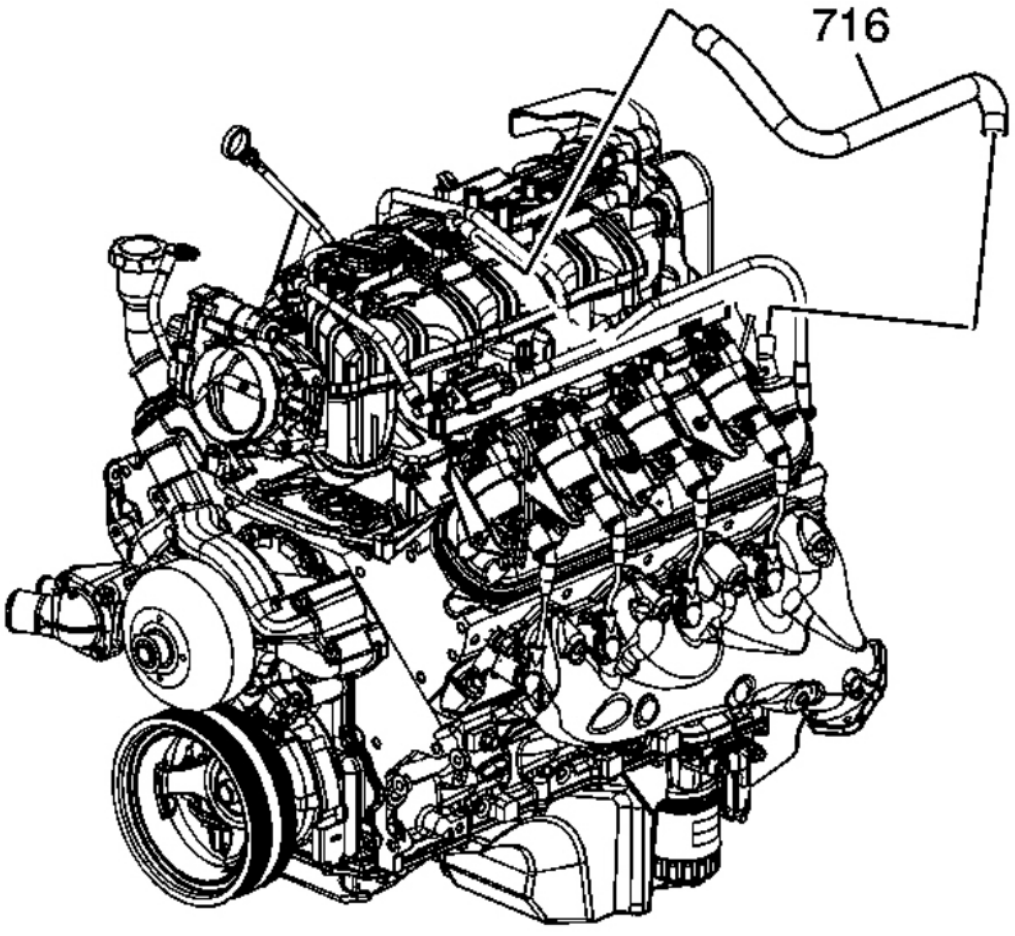


Fig. 71: View Of PCV Dirty-Air Hose
Courtesy of GENERAL MOTORS CORP.

9. Install the positive crankcase ventilation (PCV) hose - dirty air (716).

INTAKE MANIFOLD INSTALLATION (RPO LC9/LY5/LMG/L76)

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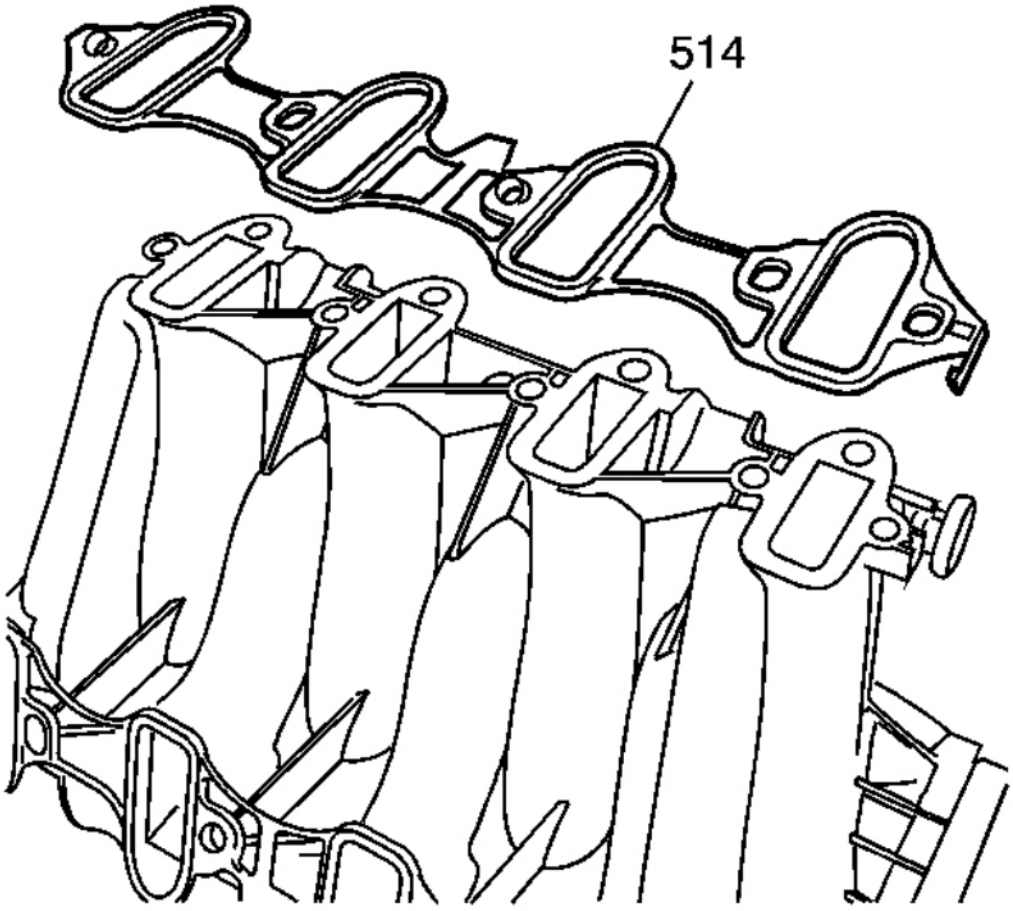


Fig. 72: View Of Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, install the intake manifold as a complete assembly.**
- **DO NOT use the intake manifold gaskets again. Install NEW intake manifold-to-cylinder head gaskets.**

1. Install NEW intake manifold-to-cylinder head gaskets (514).

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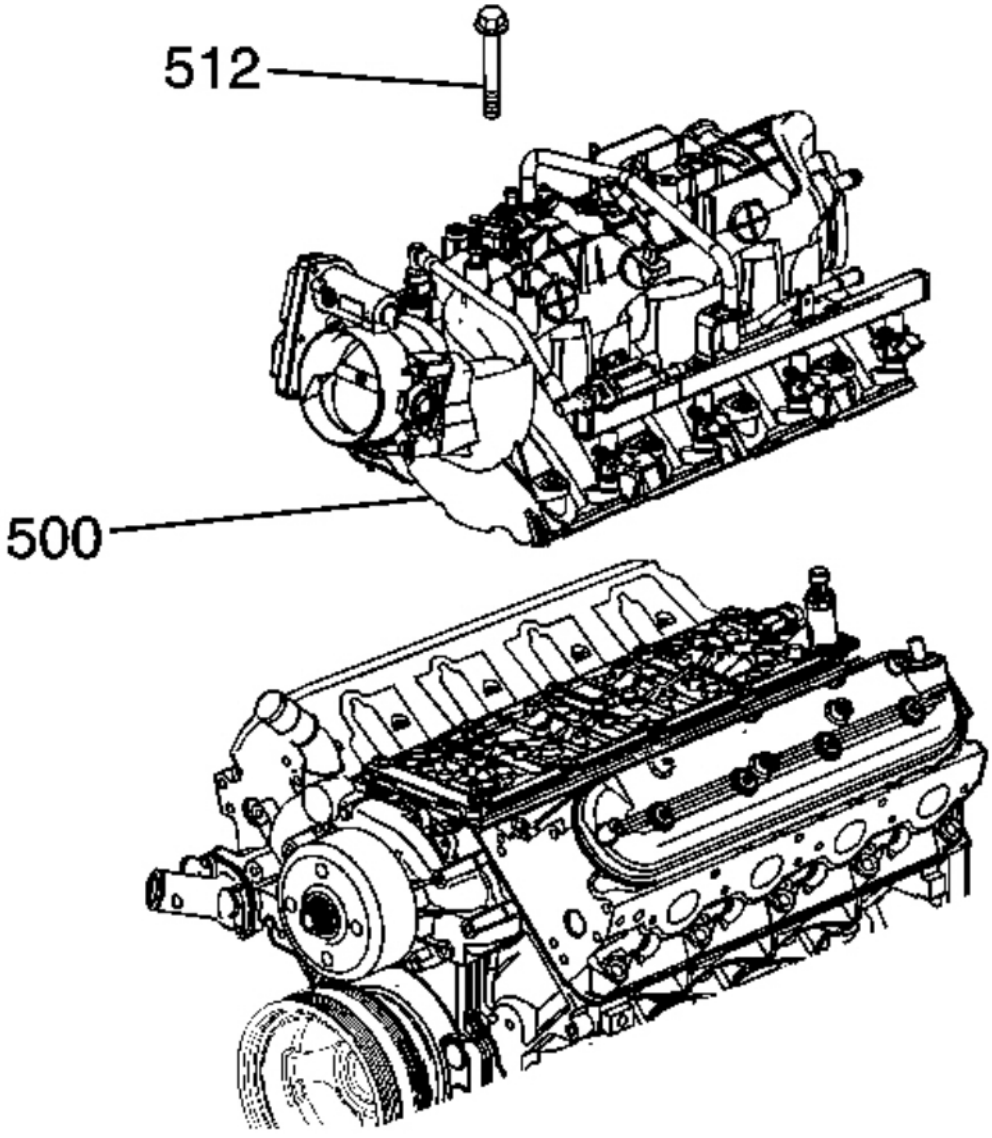


Fig. 73: Intake Manifold
Courtesy of GENERAL MOTORS CORP.

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

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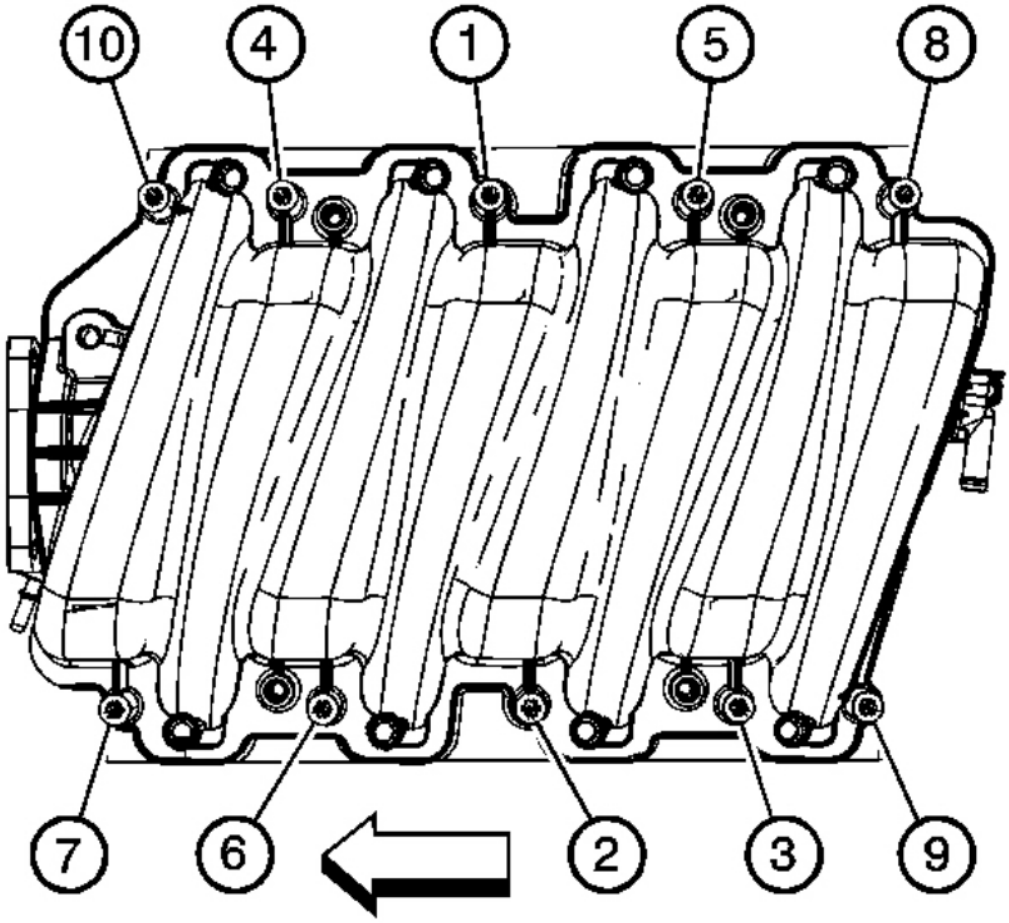


Fig. 74: Intake Manifold Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

4. Install the intake manifold bolts.

Tighten:

1. Tighten the intake manifold bolts (1-10) a first pass in sequence to 5 N.m (44 lb in).
2. Tighten the intake manifold bolts (1-10) a final pass in sequence to 10 N.m (89 lb in).

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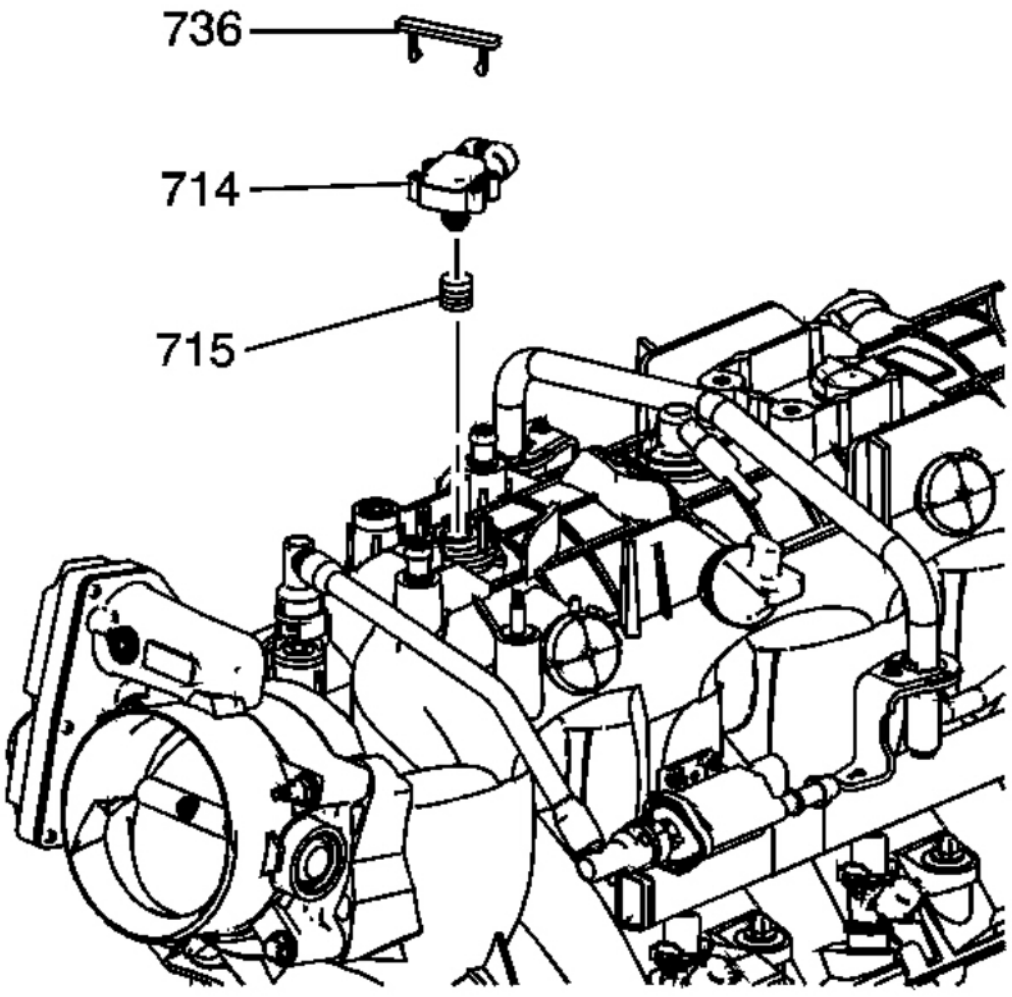


Fig. 75: MAP Sensor
Courtesy of GENERAL MOTORS CORP.

5. Install the fuel rail. Refer to **Fuel Rail and Injectors Installation**.
6. Lubricate the manifold absolute pressure (MAP) sensor grommet (715) with clean engine oil.
7. Install the grommet onto the MAP sensor (714).
8. Install the MAP sensor and retainer (736).

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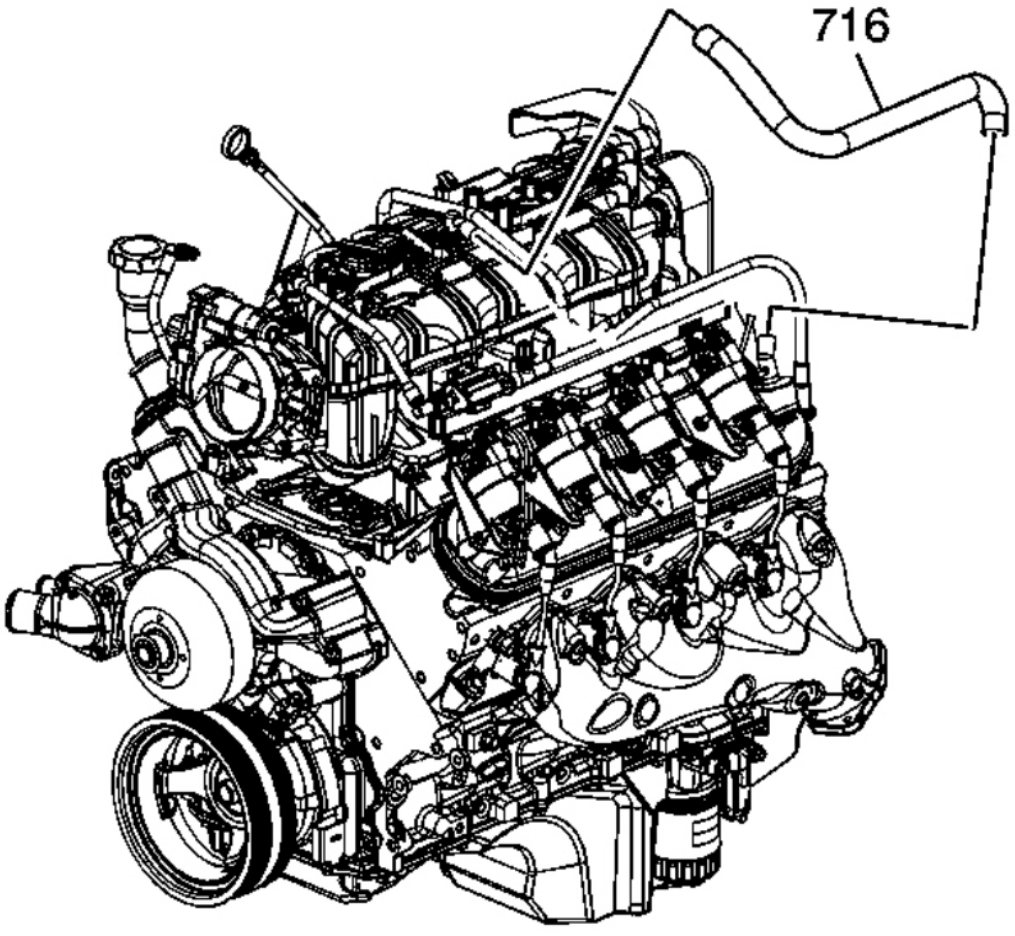


Fig. 76: View Of PCV Dirty-Air Hose
Courtesy of GENERAL MOTORS CORP.

9. Install the positive crankcase ventilation (PCV) hose - dirty air (716).

INTAKE MANIFOLD INSTALLATION (RPO L92)

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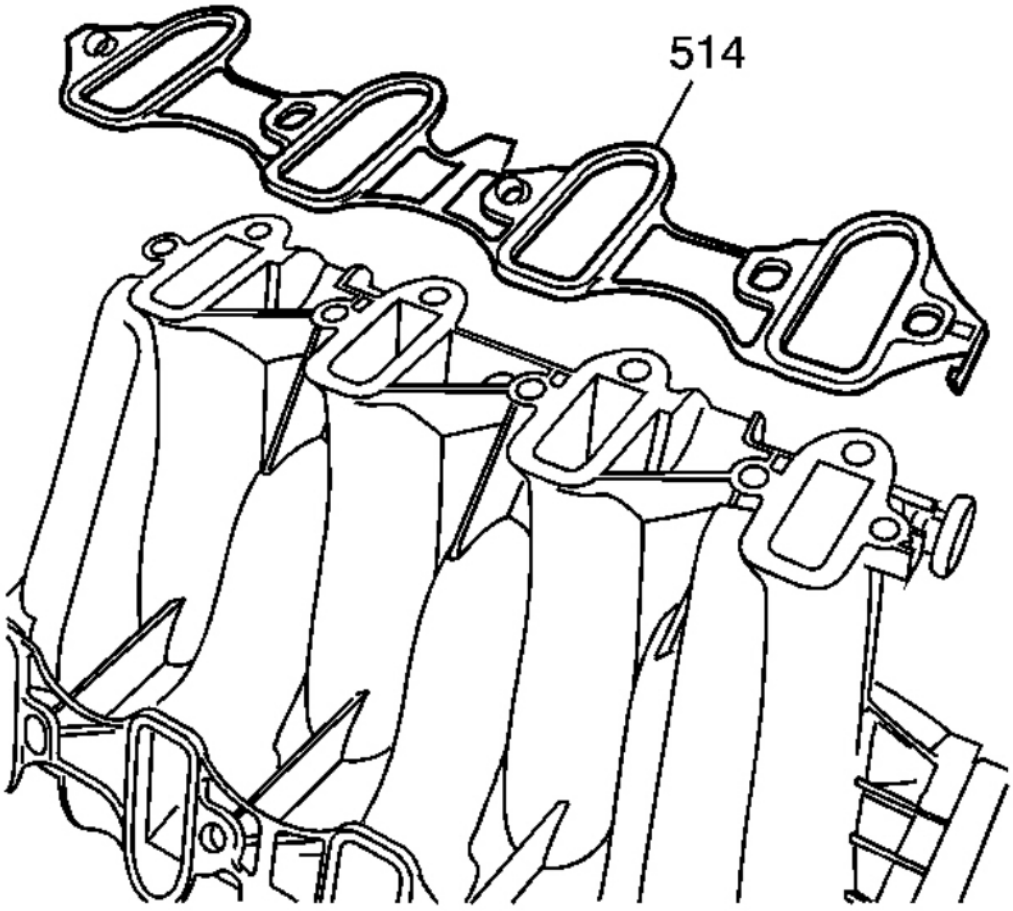


Fig. 77: View Of Intake Manifold-To-Cylinder Head Gasket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT:

- **The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, install the intake manifold as a complete assembly.**
- **DO NOT use the intake manifold gaskets again. Install NEW intake manifold-to-cylinder head gaskets.**

1. Install NEW intake manifold-to-cylinder head gaskets (514).

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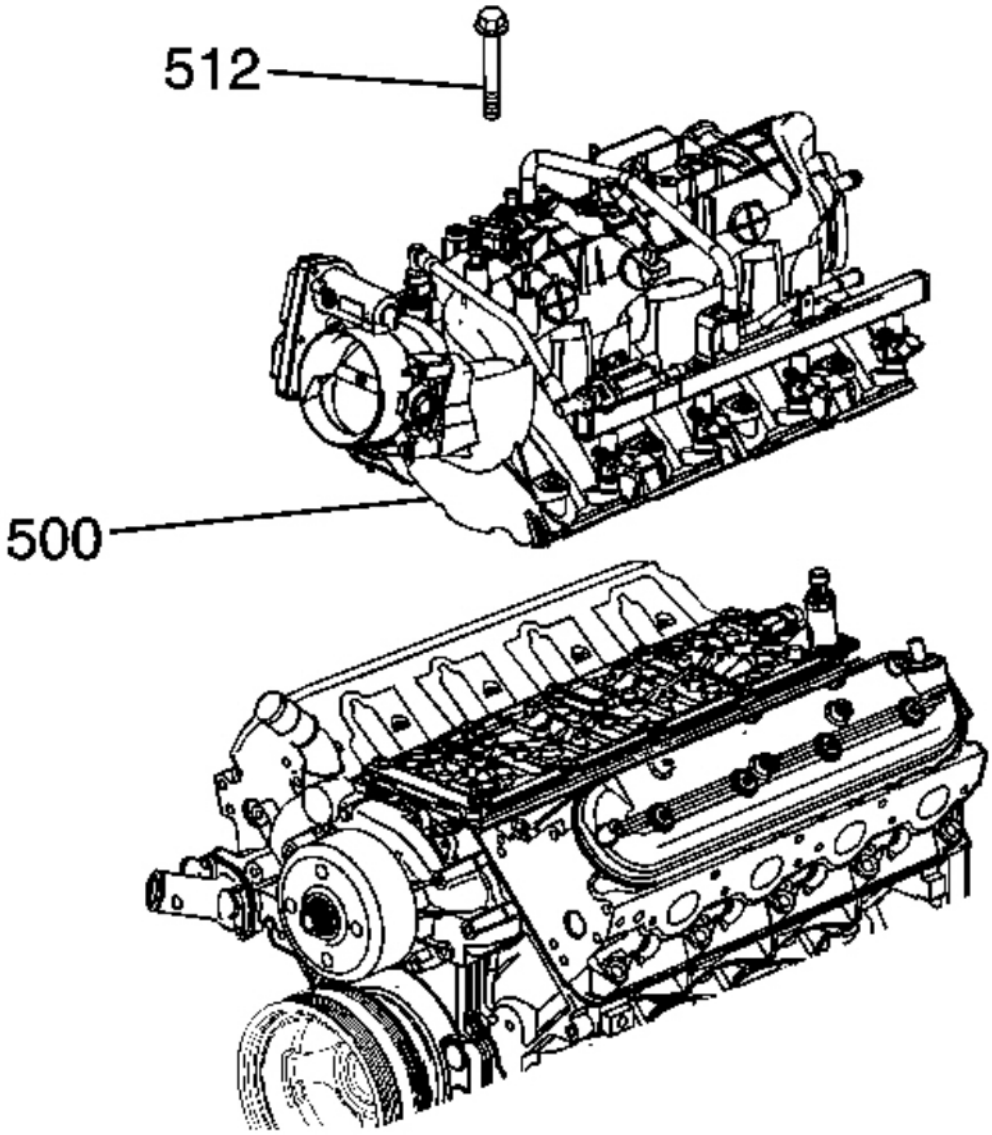


Fig. 78: Intake Manifold
Courtesy of GENERAL MOTORS CORP.

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

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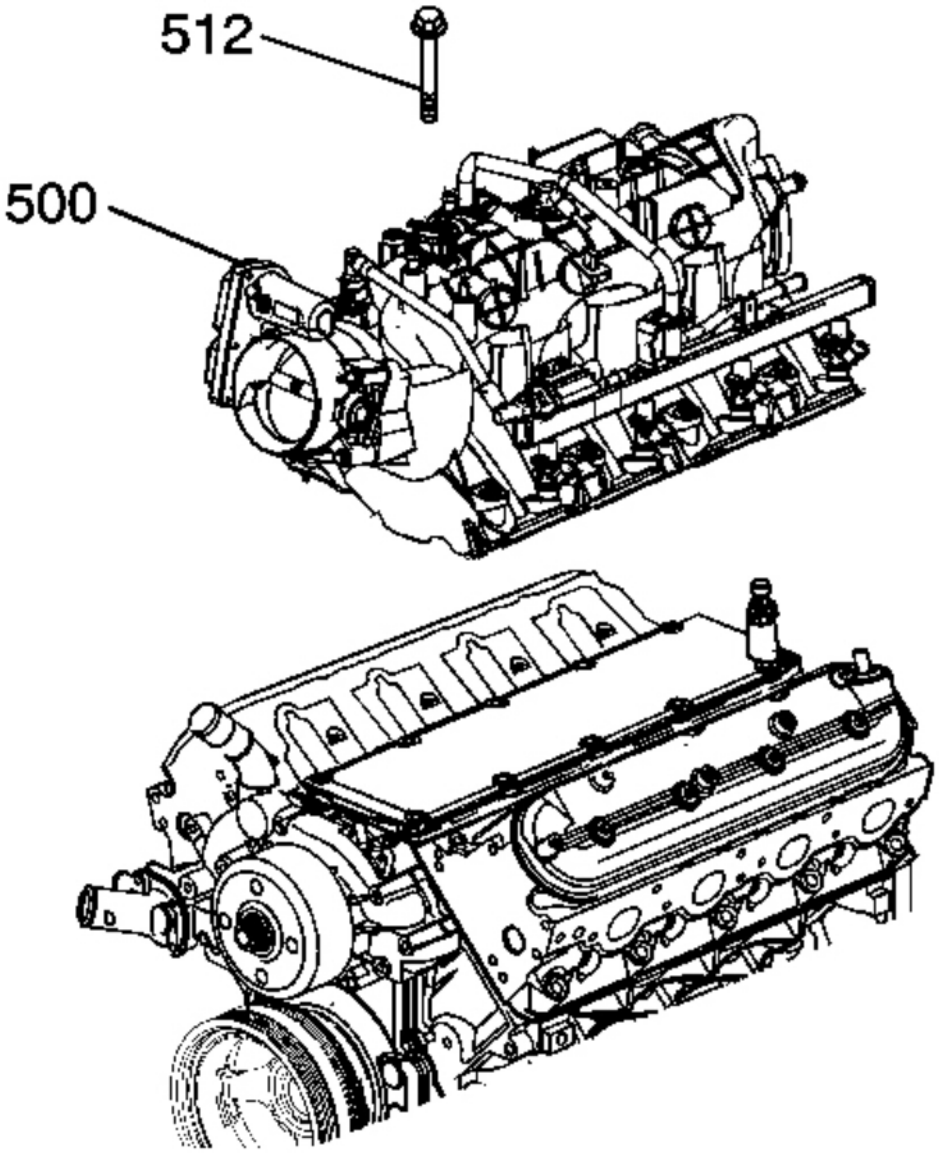


Fig. 79: View Of Intake Manifold & Bolts
Courtesy of GENERAL MOTORS CORP.

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

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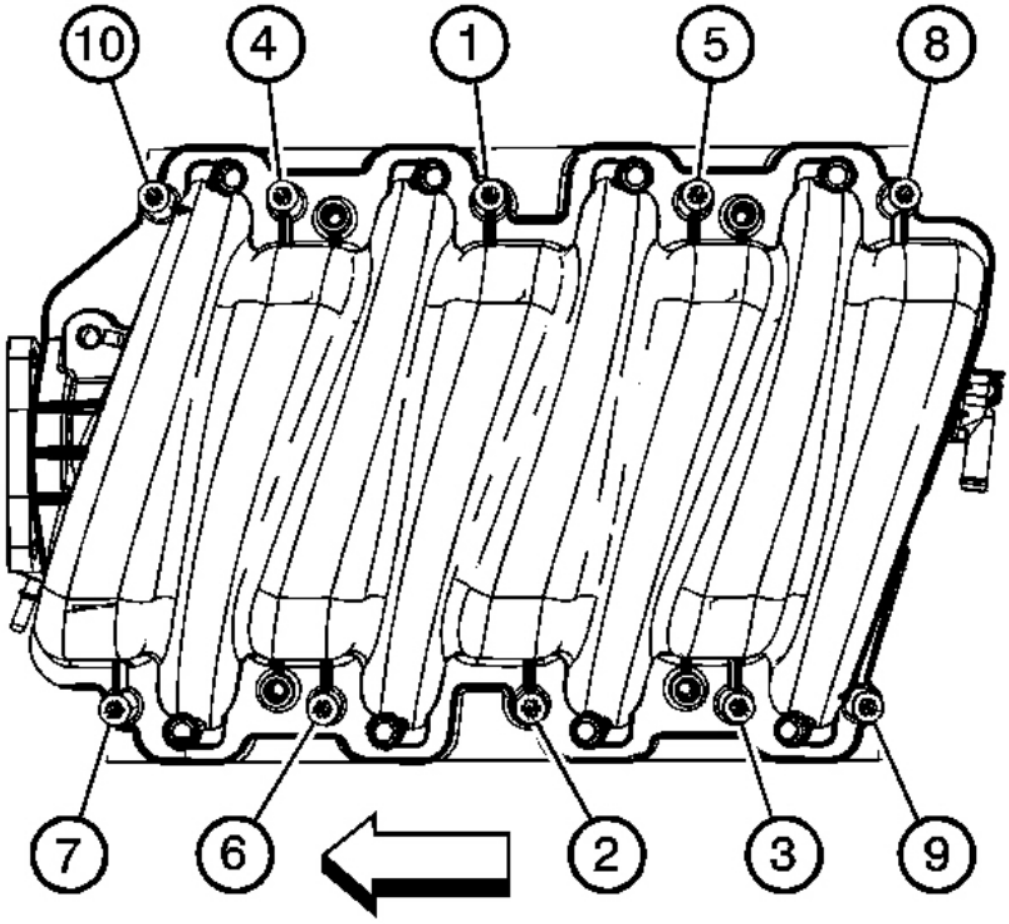


Fig. 80: Intake Manifold Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

6. Install the intake manifold bolts.

Tighten:

1. Tighten the intake manifold bolts (1-10) a first pass in sequence to 5 N.m (44 lb in).
2. Tighten the intake manifold bolts (1-10) a final pass in sequence to 10 N.m (89 lb in).

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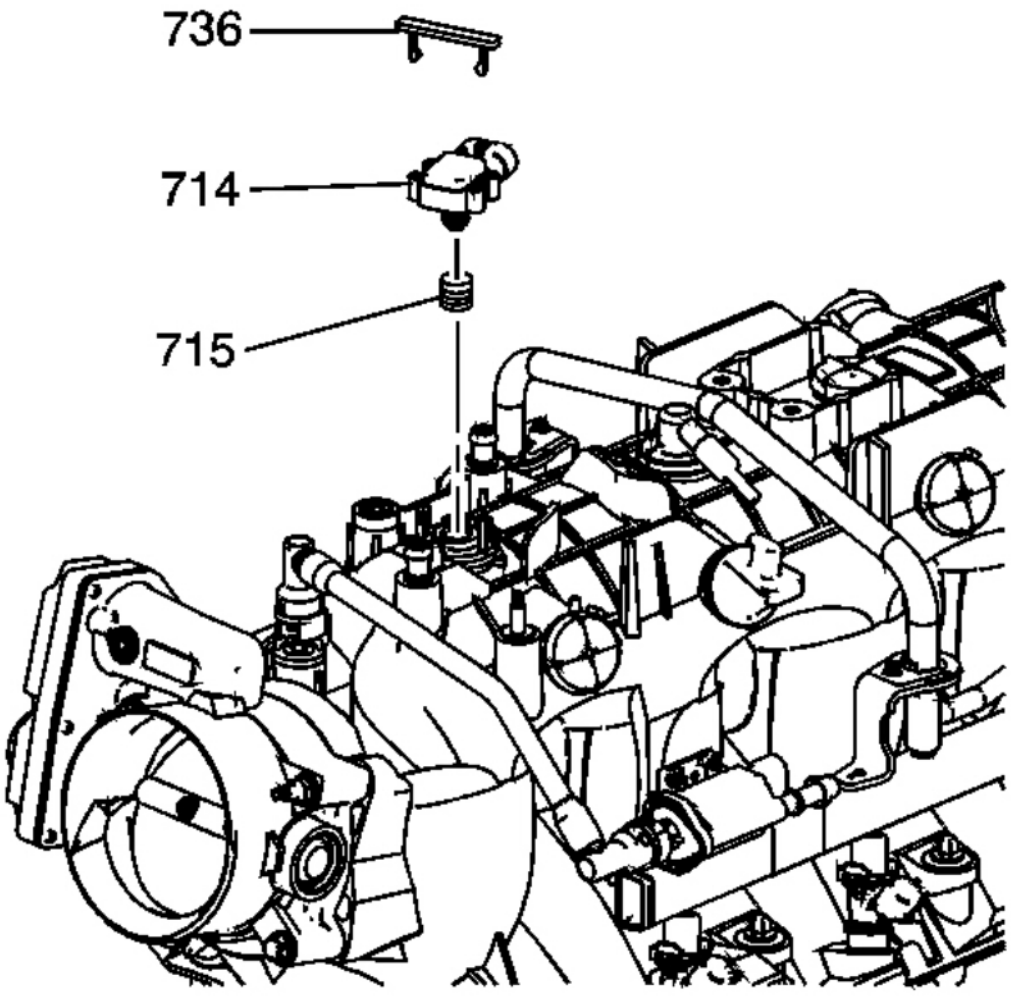


Fig. 81: MAP Sensor
Courtesy of GENERAL MOTORS CORP.

7. Install the fuel rail. Refer to **Fuel Rail and Injectors Installation**.
8. Lubricate the manifold absolute pressure (MAP) sensor grommet (715) with clean engine oil.
9. Install the grommet onto the MAP sensor (714).
10. Install the MAP sensor and retainer (736).

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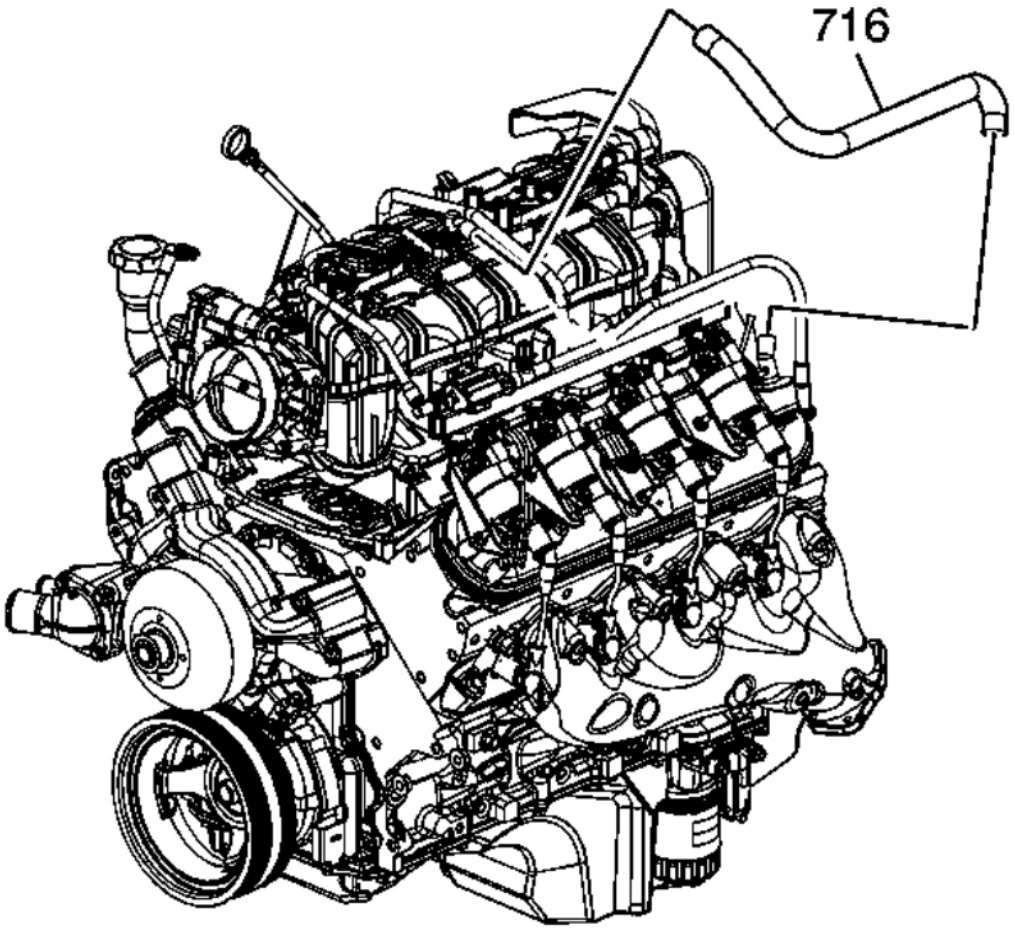


Fig. 82: View Of PCV Dirty-Air Hose
Courtesy of GENERAL MOTORS CORP.

11. Install the positive crankcase ventilation (PCV) hose - dirty air (716).

FUEL RAIL AND INJECTORS INSTALLATION

Removing/Installing

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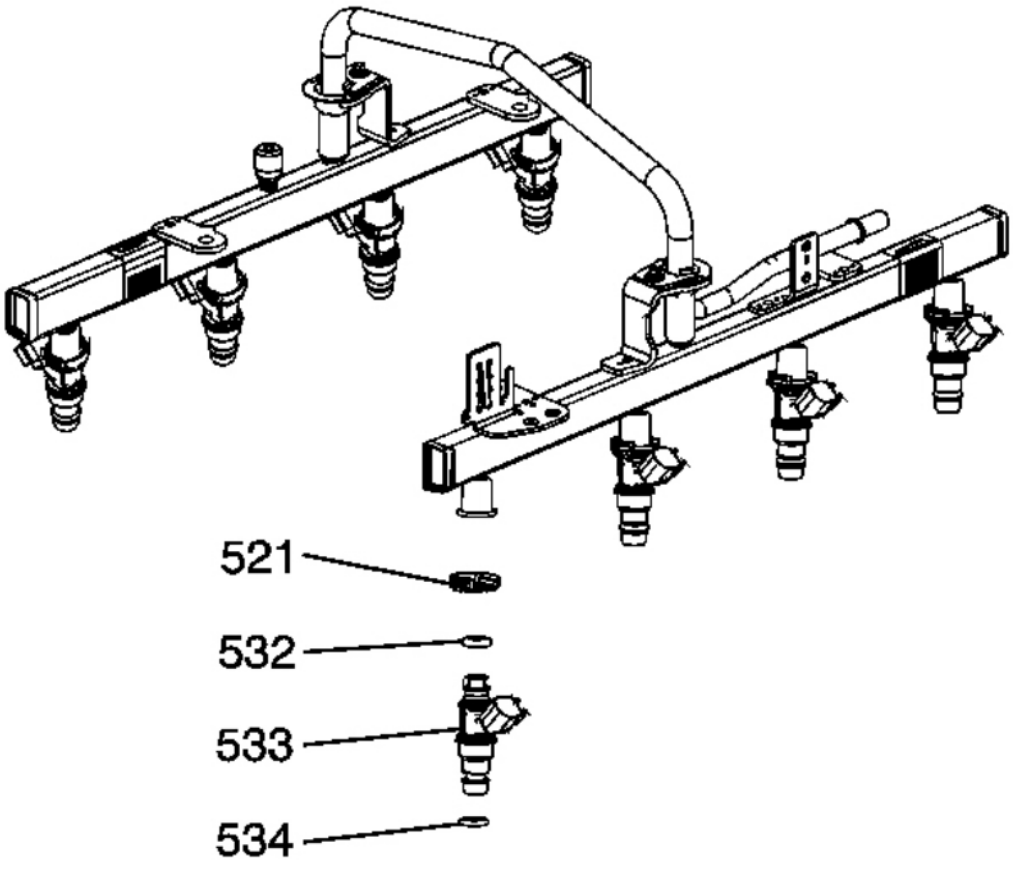


Fig. 83: Fuel Rail & Injectors
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fuel Rail Stop Bracket Installation Caution .

IMPORTANT: DO NOT use the fuel injector O-ring seals again. Install NEW fuel injector O-ring seals during assembly.

1. Lubricate the NEW fuel injector O-ring seals (532, 534) with clean engine oil.
2. Install the O-ring seals to the fuel injectors.
3. Install the fuel injectors (533) and retainers (521).

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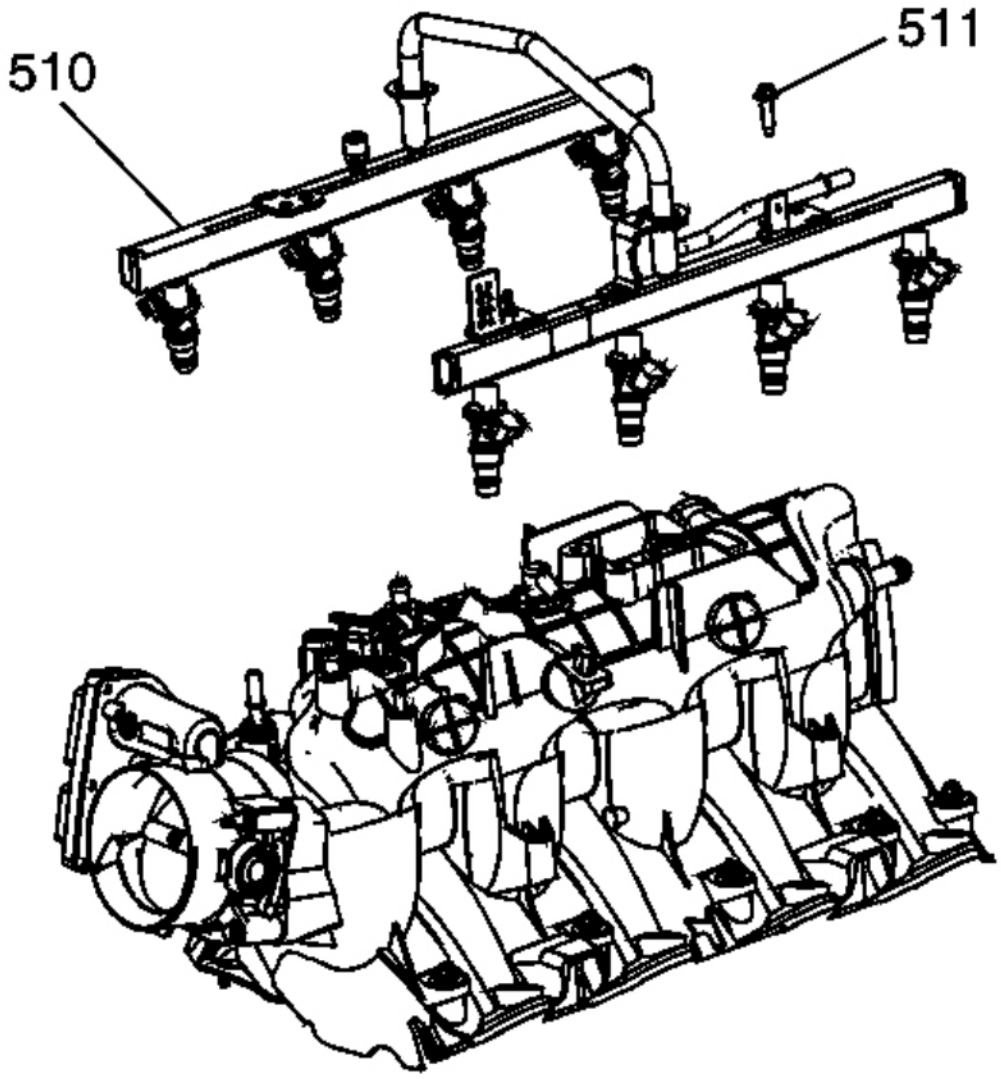


Fig. 84: Fuel Rail Assembly
Courtesy of GENERAL MOTORS CORP.

4. Install the fuel rail assembly (510) to the manifold. Push firmly on both sides of the rail until all the injectors have entered their bores.
5. Apply a 5 mm (0.2 in) band of threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the fuel rail bolts. Refer to **Sealers, Adhesives, and Lubricants** .

NOTE: **Refer to Fastener Notice .**

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6. Install the fuel rail bolts (511).

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

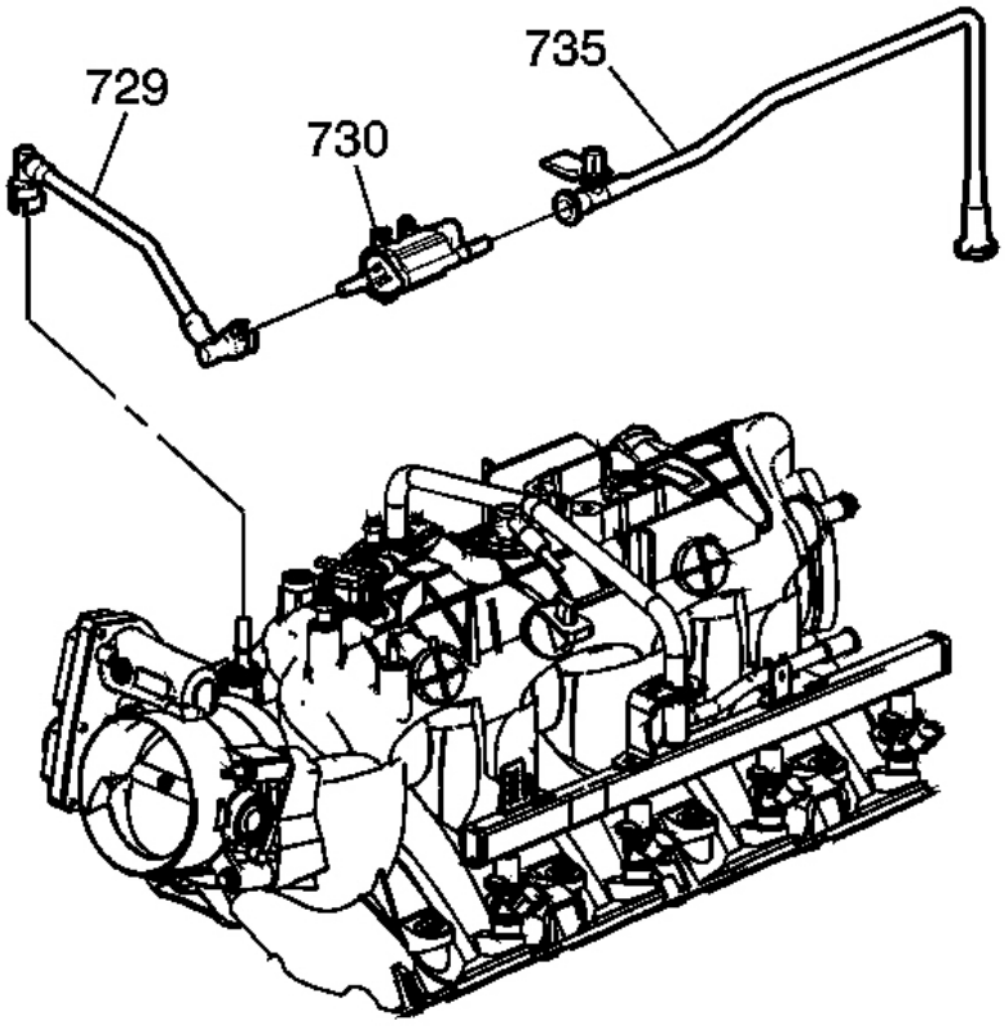


Fig. 85: EVAP Purge Valve & Tubes
Courtesy of GENERAL MOTORS CORP.

7. Install the evaporative emission (EVAP) canister purge solenoid valve (730) and tubes (729, 735).

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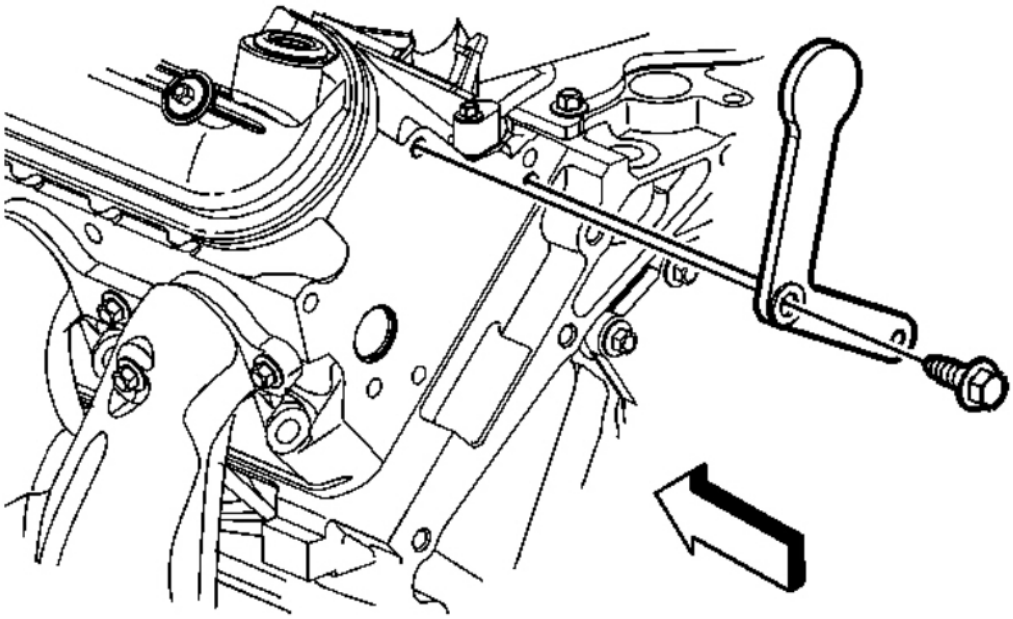


Fig. 86: View Of Fuel Rail Stop Bracket & Bolt
Courtesy of GENERAL MOTORS CORP.

8. Install the fuel rail stop bracket and bolt.

   Tighten: Tighten the fuel rail stop bracket bolt to 50 N.m (37 lb ft).

THROTTLE BODY INSTALLATION

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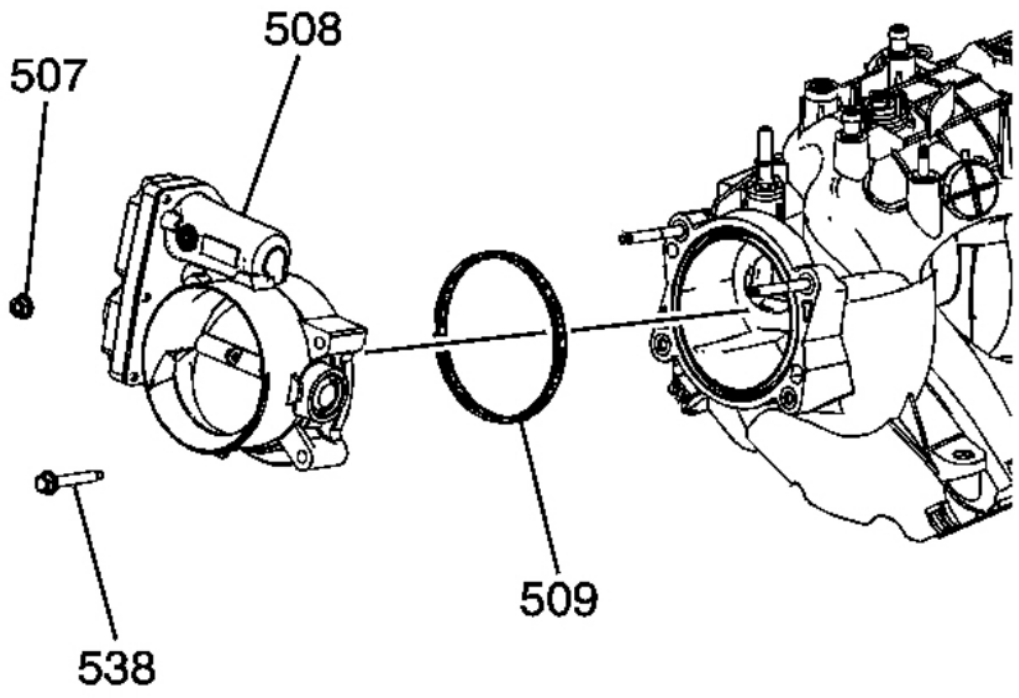


Fig. 87: Throttle Body Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

1. Install the throttle body studs, as required.

   Tighten: Tighten the throttle body studs to 6 N.m (53 lb in).

   IMPORTANT: DO NOT use the throttle body gasket again. Install a NEW gasket during assembly.

2. Install the throttle body gasket (509) to the intake manifold. Align the locating tab of the gasket with the notch in the manifold.
3. Install the throttle body (508), bolts (538), and nuts (507).

   Tighten: Tighten the throttle body nuts and bolts to 10 N.m (89 lb in).

WATER PUMP INSTALLATION (RPO LY2/LC9/LY5/LMG)

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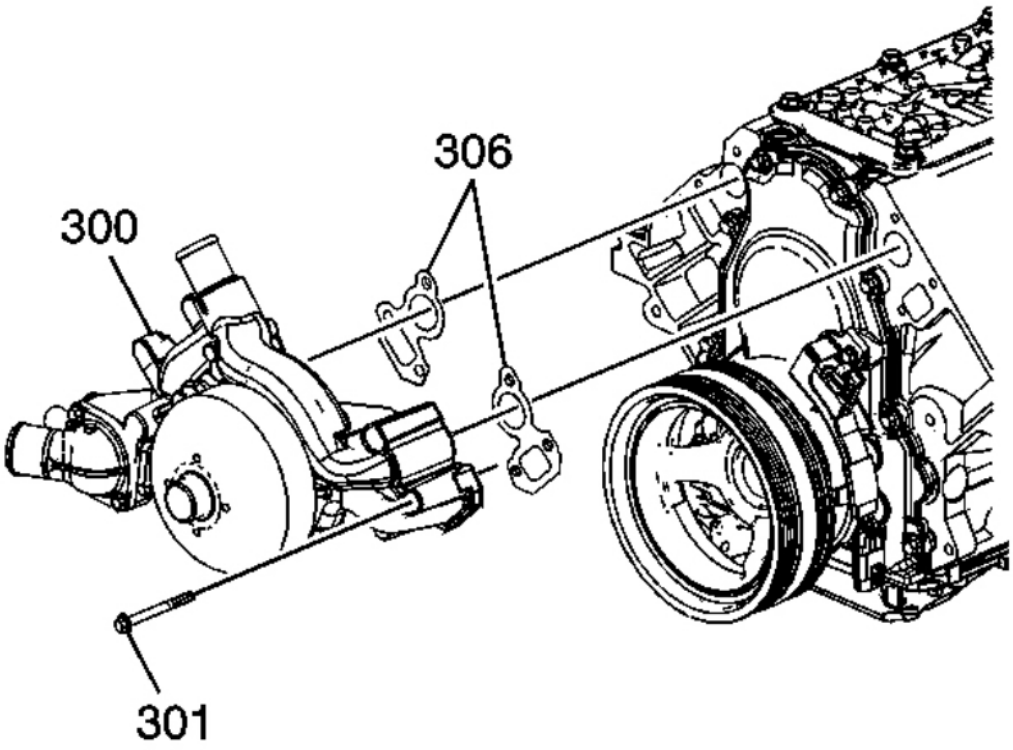


Fig. 88: View Of Water Pump, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

NOTE: **DO NOT use cooling system seal tabs, or similar compounds, unless otherwise instructed. The use of cooling system seal tabs, or similar compounds, may restrict coolant flow through the passages of the cooling system or the engine components. Restricted coolant flow may cause engine overheating and/or damage to the cooling system or the engine components/assembly.**

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

1. Install the water pump (300) and NEW gaskets (306).

NOTE: **Refer to Fastener Notice .**

2. Install the water pump bolts (301).

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Tighten:

1. Tighten the water pump bolts a first pass to 15 N.m (11 lb ft).
2. Tighten the water pump bolts a final pass to 30 N.m (22 lb ft).

WATER PUMP INSTALLATION (RPO LY6/L76/L92)

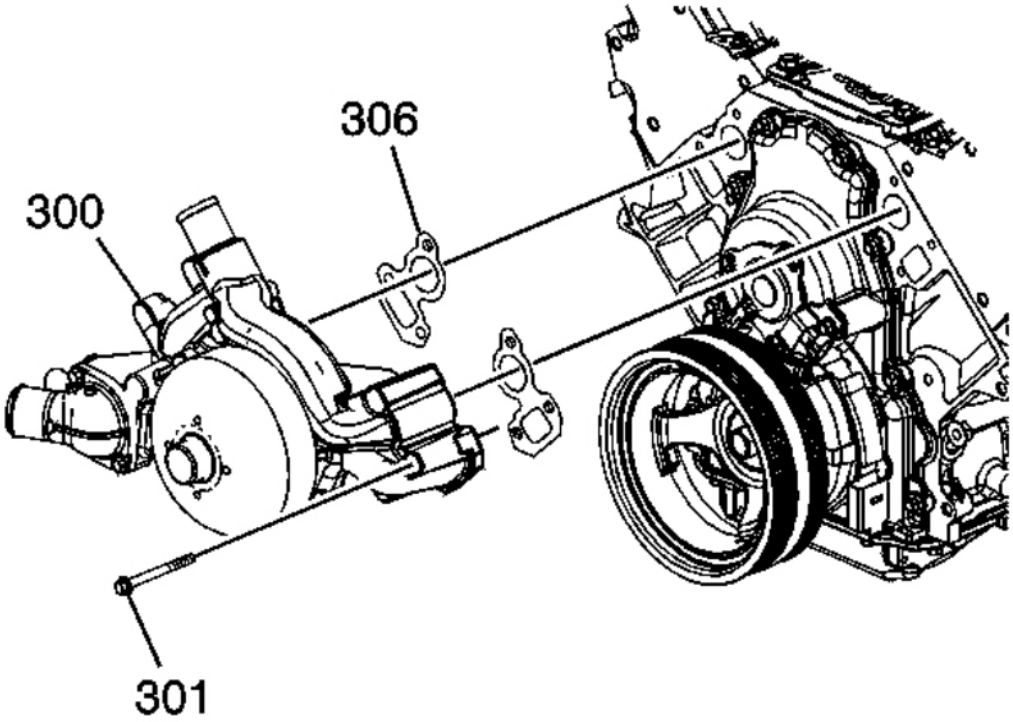


Fig. 89: View Of Water Pump, Bolts & Gaskets
Courtesy of GENERAL MOTORS CORP.

NOTE: **DO NOT use cooling system seal tabs, or similar compounds, unless otherwise instructed. The use of cooling system seal tabs, or similar compounds, may restrict coolant flow through the passages of the cooling system or the engine components. Restricted coolant flow may cause engine overheating and/or damage to the cooling system or the engine components/assembly.**

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

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1. Install the water pump (300) and NEW gaskets (306).

NOTE: **Refer to Fastener Notice .**

2. Install the water pump bolts (301).

Tighten:

1. Tighten the water pump bolts a first pass to 15 N.m (11 lb ft).
2. Tighten the water pump bolts a final pass to 30 N.m (22 lb ft).

EXHAUST MANIFOLD INSTALLATION - LEFT SIDE

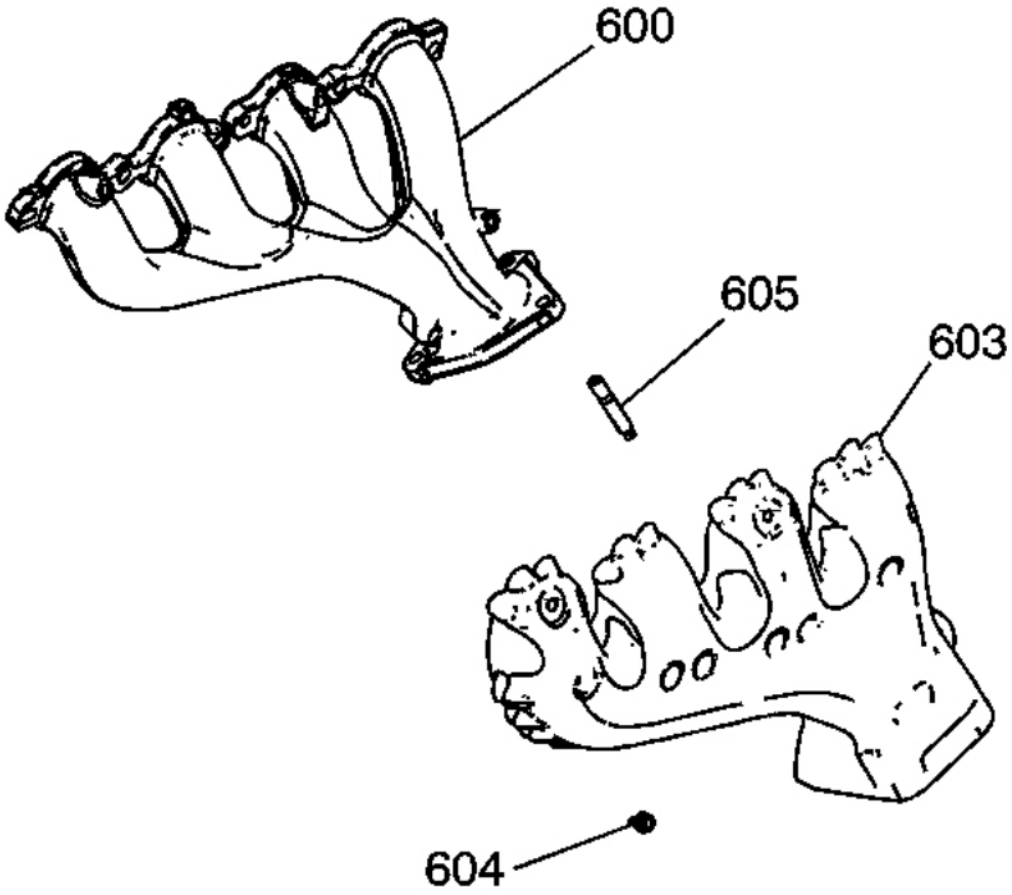


Fig. 90: View Of Exhaust Manifold & Heat Shield
Courtesy of GENERAL MOTORS CORP.

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NOTE: **Refer to Fastener Notice .**

IMPORTANT:

- **Tighten the exhaust manifold bolts as specified in the service procedure. Improperly installed and/or leaking exhaust manifold gaskets may affect vehicle emissions and/or on-board diagnostic (OBD) II system performance.**
- **The cylinder head exhaust manifold bolt hole threads must be clean and free of debris or threadlocking material.**
- **Do not apply sealant to the first 3 threads of the bolt.**

1. Install the heat shield (603) and bolts (604).

   Tighten: Tighten the heat shield bolts to 9 N.m (80 lb in).

2. Install the exhaust pipe studs (605).

   Tighten: Tighten the studs to 20 N.m (15 lb ft).

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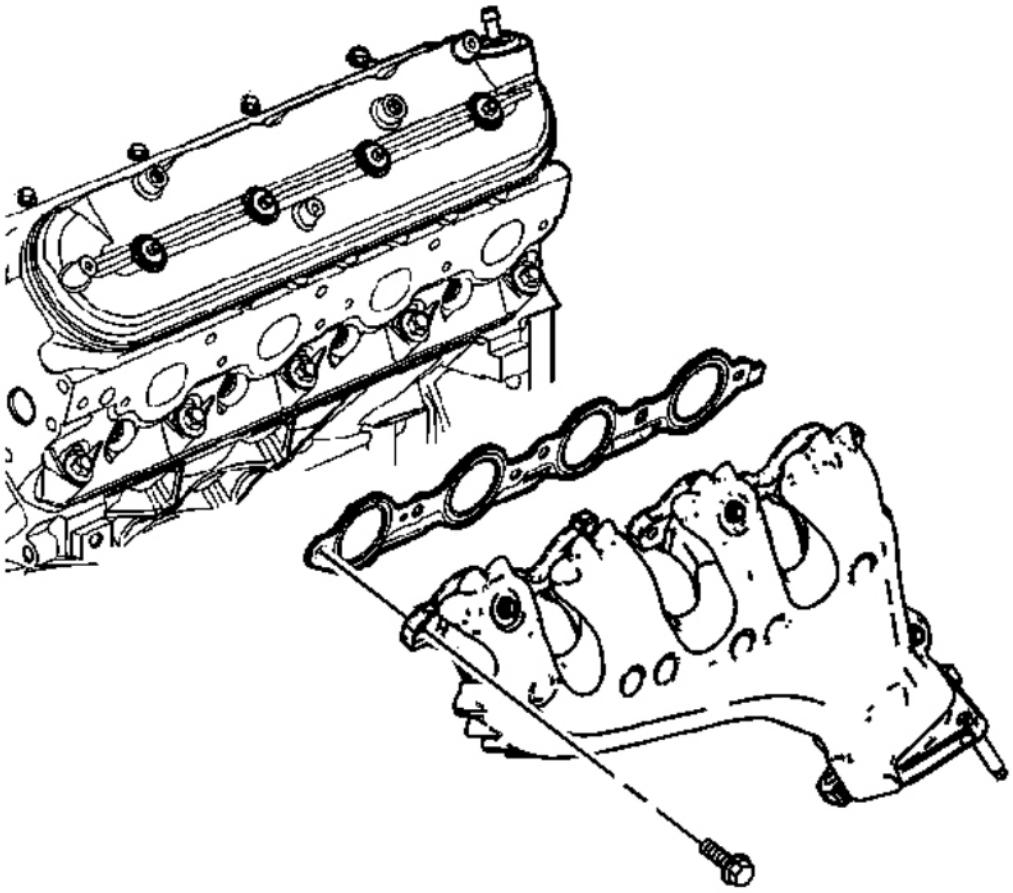


Fig. 91: View Of Exhaust Manifold & Gasket
Courtesy of GENERAL MOTORS CORP.

3. Apply a 5 mm (0.2 in) wide band of threadlock GM P/N 12345493 (Canadian P/N 10953488), or equivalent, to the threads of the exhaust manifold bolts. Refer to **Sealers, Adhesives, and Lubricants** .
4. Install the exhaust manifold, NEW gasket, and bolts.

Tighten:

1. Tighten the exhaust manifold bolts a first pass to 15 N.m (11 lb ft). Tighten the exhaust manifold bolts beginning with the center 2 bolts. Alternate from side-to-side, and work toward the outside bolts.
2. Tighten the exhaust manifold bolts a final pass to 20 N.m (15 lb ft). Tighten the exhaust manifold bolts beginning with the center 2 bolts. Alternate from side-to-side, and work toward the outside bolts.

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5. Using a flat punch, bend over the exposed edge of the exhaust manifold gasket at the rear of the left cylinder head.

EXHAUST MANIFOLD INSTALLATION - RIGHT SIDE

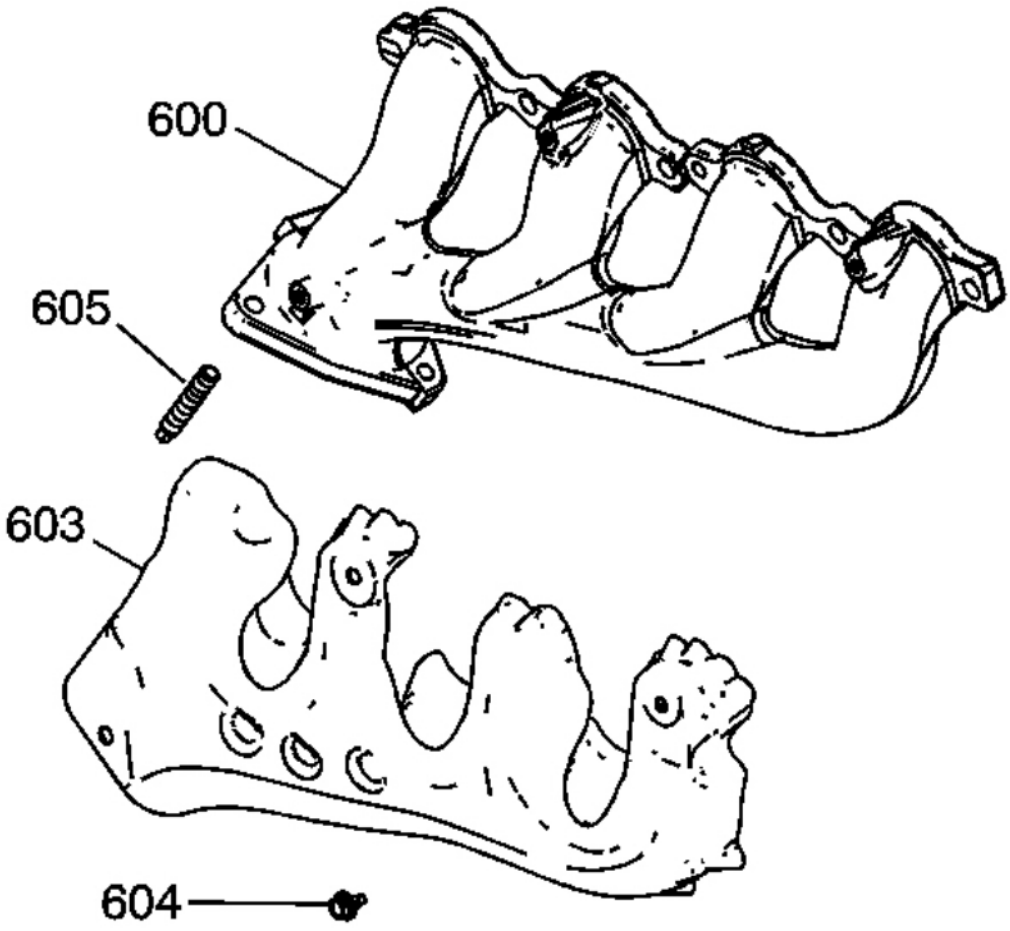


Fig. 92: Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

IMPORTANT:

- **Tighten the exhaust manifold bolts as specified in the service procedure. Improperly installed and/or leaking exhaust manifold gaskets may affect vehicle emissions and/or on-board diagnostic**

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(OBD) II system performance.

- **The cylinder head exhaust manifold bolt hole threads must be clean and free of debris or threadlocking material.**
- **Do not apply sealant to the first 3 threads of the bolt.**

1. Install the heat shield (603) and bolts (604).

   Tighten: Tighten the heat shield bolts to 9 N.m (80 lb in).

2. Install the exhaust pipe studs (605).

   Tighten: Tighten the studs to 20 N.m (15 lb ft).

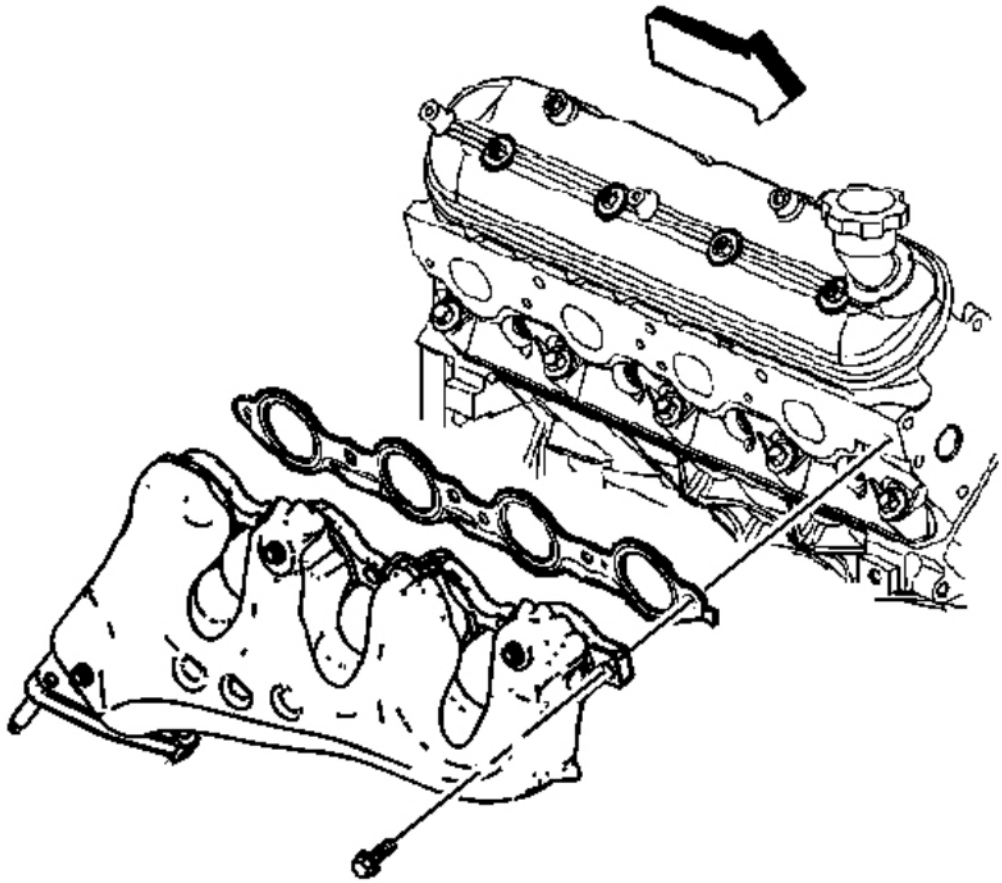


Fig. 93: View Of Right Exhaust Manifold & Gasket

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Courtesy of GENERAL MOTORS CORP.

3. Apply a 5 mm (0.2 in) wide band of threadlock GM P/N 12345493 (Canadian P/N 10953488), or equivalent, to the threads of the exhaust manifold bolts. Refer to **Sealers, Adhesives, and Lubricants** .
4. Install the exhaust manifold, NEW gasket and bolts.

Tighten:

1. Tighten the exhaust manifold bolts a first pass to 15 N.m (11 lb ft). Tighten the exhaust manifold bolts beginning with the center 2 bolts. Alternate from side-to-side, and work toward the outside bolts.
2. Tighten the exhaust manifold bolts a final pass to 20 N.m (15 lb ft). Tighten the exhaust manifold bolts beginning with the center 2 bolts. Alternate from side-to-side, and work toward the outside bolts.

5. Using a flat punch, bend over the exposed edge of the exhaust manifold gasket at the rear of the left cylinder head.

OIL LEVEL INDICATOR AND TUBE INSTALLATION

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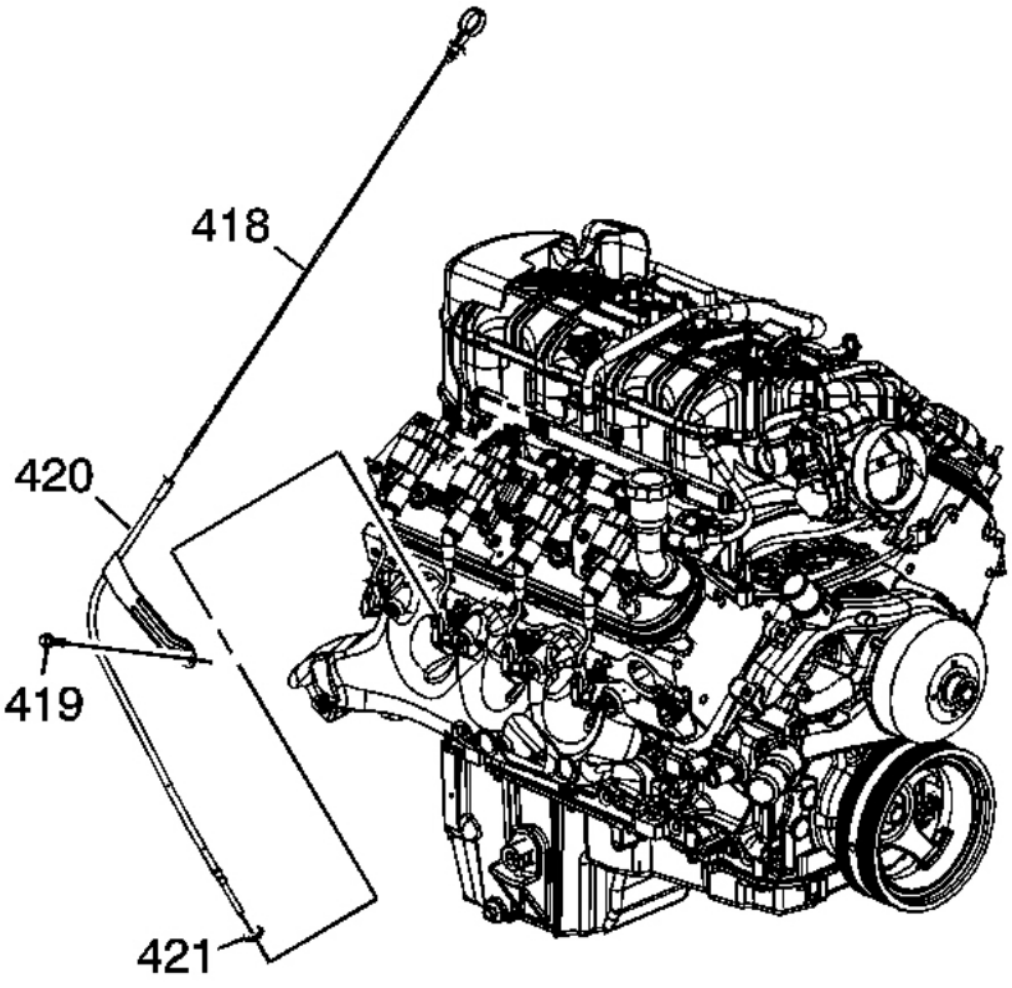


Fig. 94: View Of Oil Level Indicator, Tube Bolt, Indicator Tube & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

1. Inspect the O-ring seal (421) for cuts or damage. If the oil level indicator tube O-ring seal is not cut or damaged, it may be used again.
2. Lubricate the O-ring seal with clean engine oil.
3. Install the O-ring seal onto the oil level indicator tube (420).
4. Install the oil level indicator tube into the engine block and rotate into proper position.

NOTE: **Refer to Fastener Notice .**

5. Install the tube bolt (419).

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Tighten: Tighten the oil level indicator tube bolt to 25 N.m (18 lb ft).

6. Install the oil level indicator (418) into the tube.

AUTOMATIC TRANSMISSION FLEX PLATE INSTALLATION

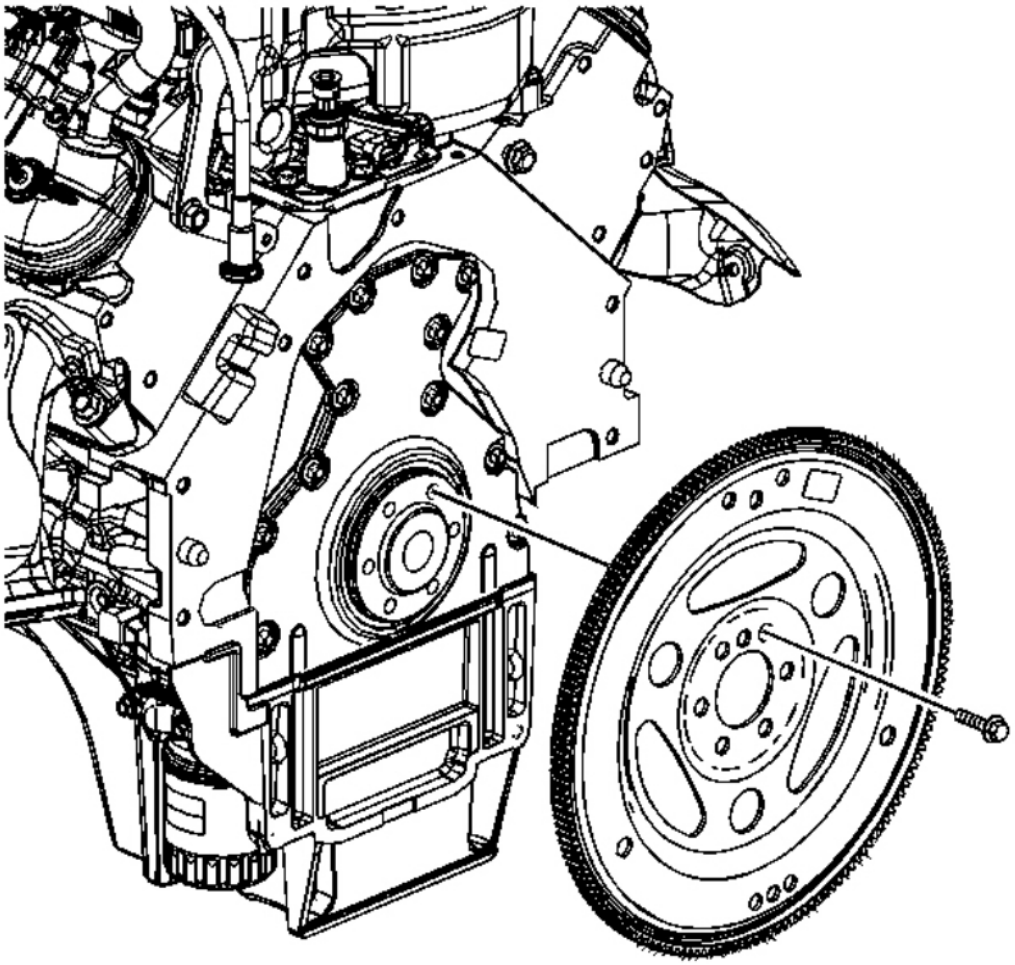


Fig. 95: View Of Flex Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The flex plate does not use a locating pin for alignment and will not initially seat against the crankshaft flange, but will be pulled onto the crankshaft by the engine flex plate bolts. This procedure requires a 3 stage tightening process.

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1. Install the flex plate to the crankshaft.
2. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the flex plate bolts.

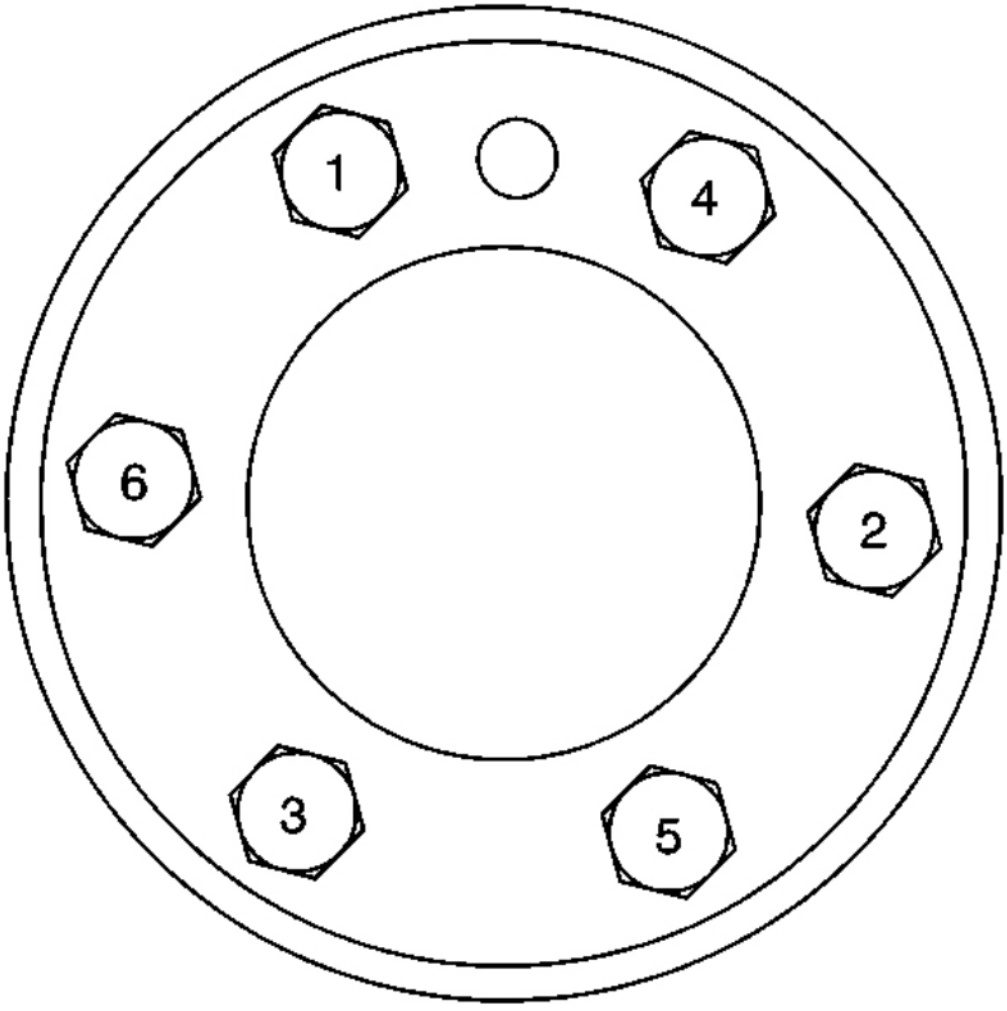


Fig. 96: Identifying Flywheel Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

3. Install the engine flex plate bolts.

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Tighten:

1. Tighten the engine flex plate bolts (1-6) a first pass in sequence to 20 N.m (15 lb ft).
2. Tighten the engine flex plate bolts (1-6) a second pass in sequence to 50 N.m (37 lb ft).
3. Tighten the engine flex plate bolts (1-6) a final pass in sequence to 100 N.m (74 lb ft).

CRANKSHAFT BALANCER INSTALLATION

Tools Required

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

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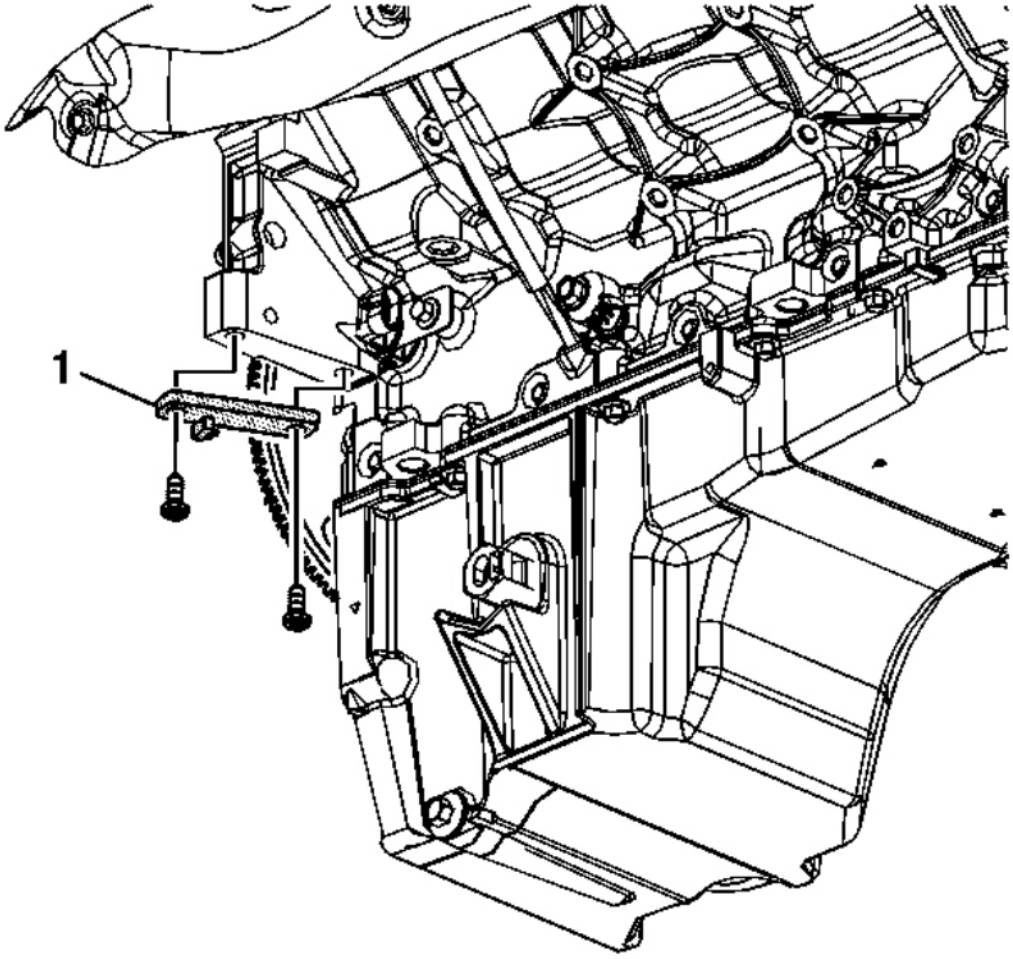


Fig. 97: View Of Special Tool & Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

IMPORTANT:

- **The crankshaft balancer is balanced as an individual component. It is not necessary to mark the balancer prior to removal.**
- **The crankshaft balancer installation and bolt tightening involves a 4 stage tightening process. The first pass ensures that the balancer is installed completely onto the crankshaft. The second, third, and fourth passes tighten the NEW bolt to the proper torque.**
- **The used crankshaft balancer bolt is used only during the first pass**

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of the balancer installation procedure. Install a NEW crankshaft balancer bolt and tighten as described in the second, third, and fourth passes of the balancer bolt tightening procedure.

- **Ensure the teeth of the tool engage the engine flywheel teeth.**

1. Install the **J 42386-A** and bolts. See **Special Tools** .

   Use 1 M10 - 1.5 x 120 mm and 1 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).

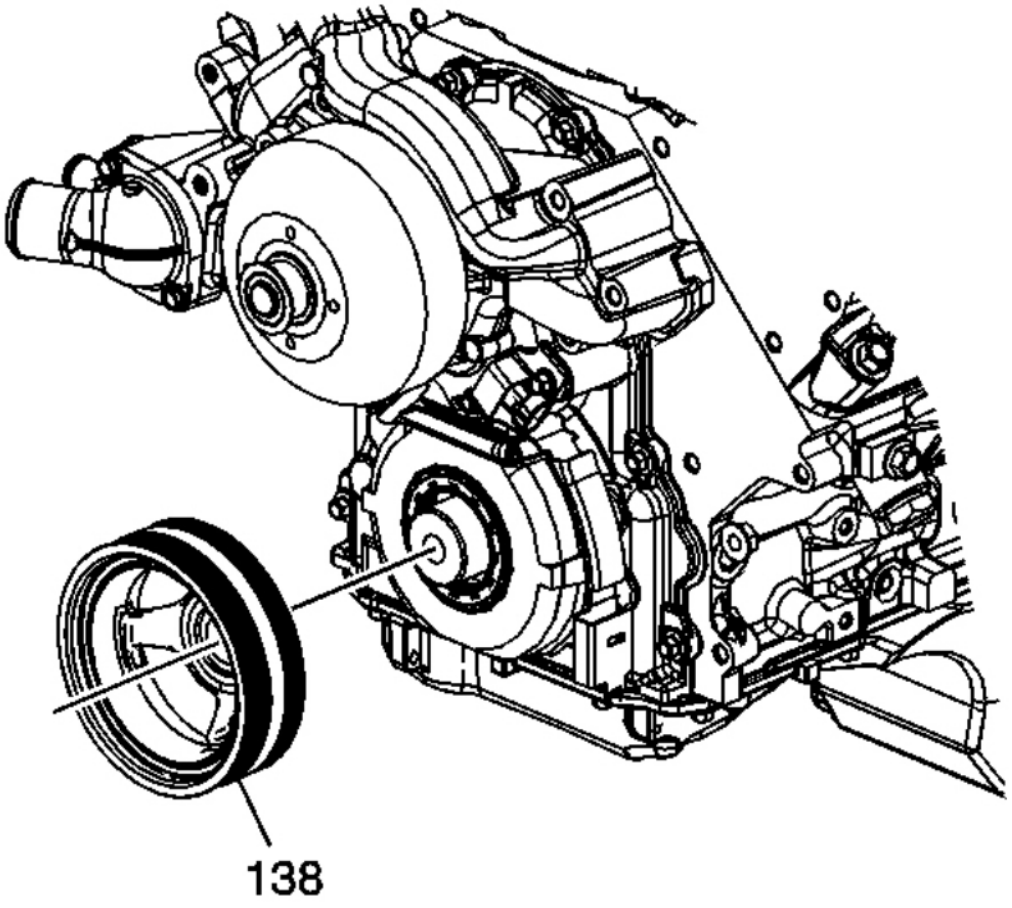


Fig. 98: View Of Crankshaft Balancer
Courtesy of GENERAL MOTORS CORP.

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

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

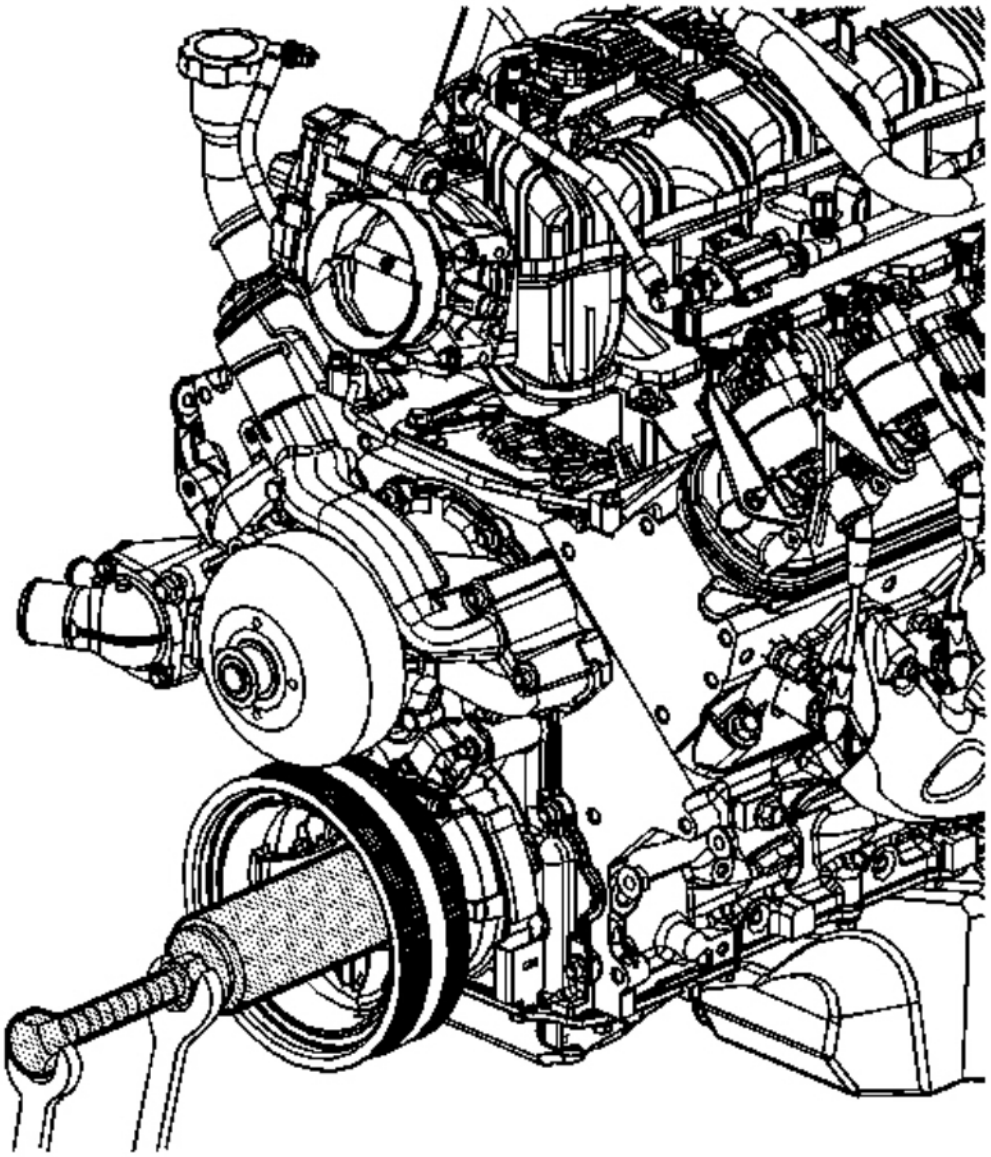


Fig. 99: View Of Balancer Installation Special Tools

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Courtesy of GENERAL MOTORS CORP.

3. Use the **J 41665** and the **J 41478** in order to install the balancer. See **Special Tools** .
    1. Assemble the **J 41478** threaded rod, nut, washer and the **J 41665** installer. See **Special Tools** .

       Insert the smaller end of the installer into the front of the balancer.

    2. Use a wrench and hold the hex end of the threaded rod.
    3. Use a second wrench and rotate the installation tool nut clockwise until the balancer is started onto the crankshaft.
    4. Remove the tool and reverse the installation tool.

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

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

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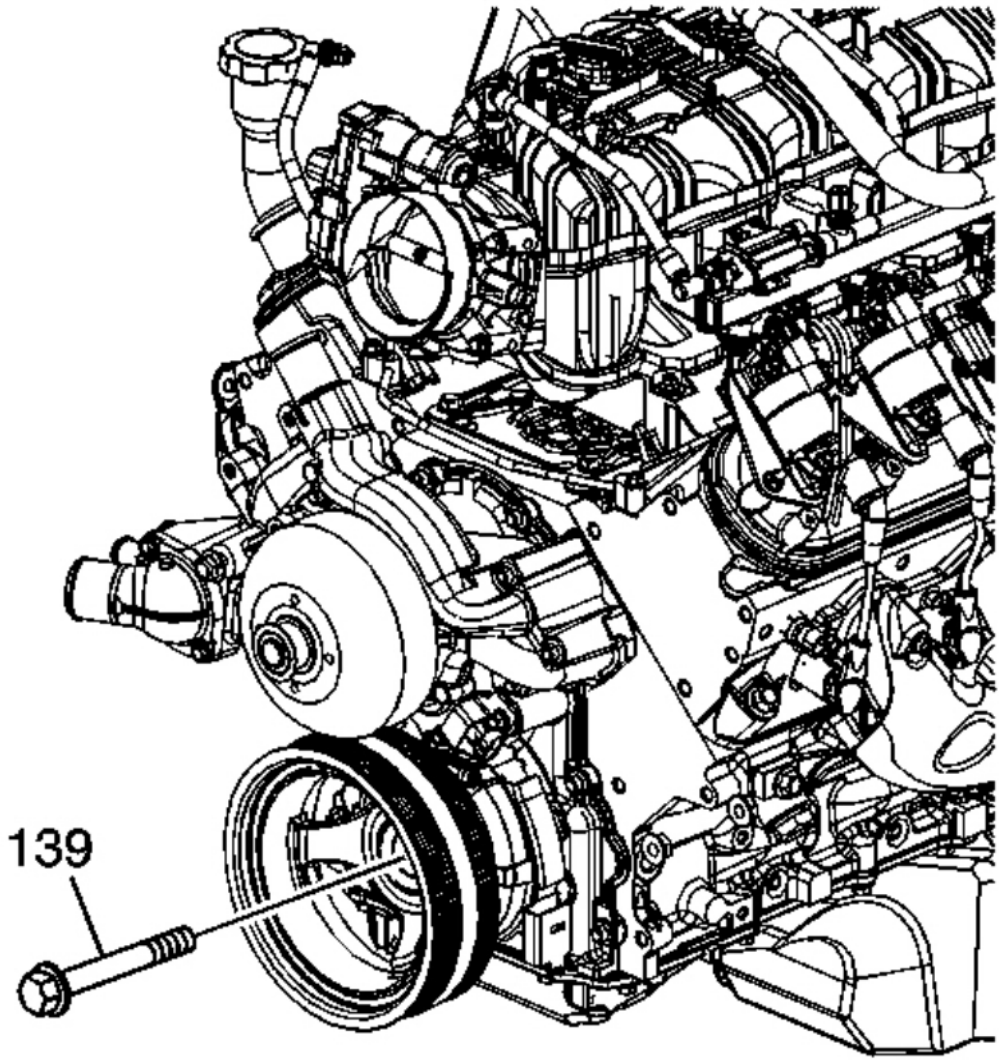


Fig. 100: View Of Used Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

4. Install the used crankshaft balancer bolt (139).

   Tighten: Tighten the crankshaft balancer bolt to 330 N.m (240 lb ft).

5. Remove the used crankshaft balancer bolt.

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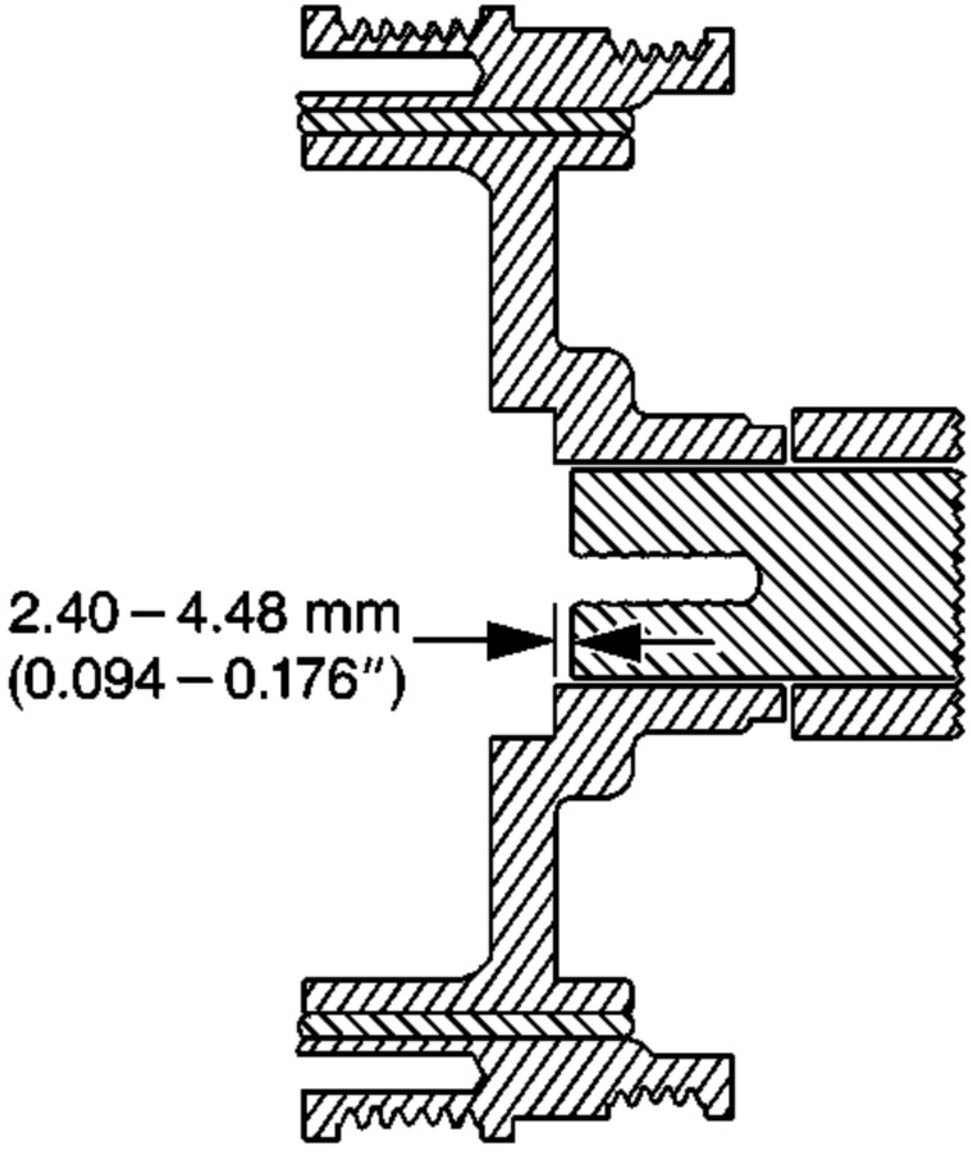


Fig. 101: Identifying Hub To Crankshaft Distance
Courtesy of GENERAL MOTORS CORP.

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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6. Measure for a correctly installed balancer.

   If the balancer is not installed to the proper dimensions, install the **J 41665** and repeat the installation procedure. See **Special Tools** .

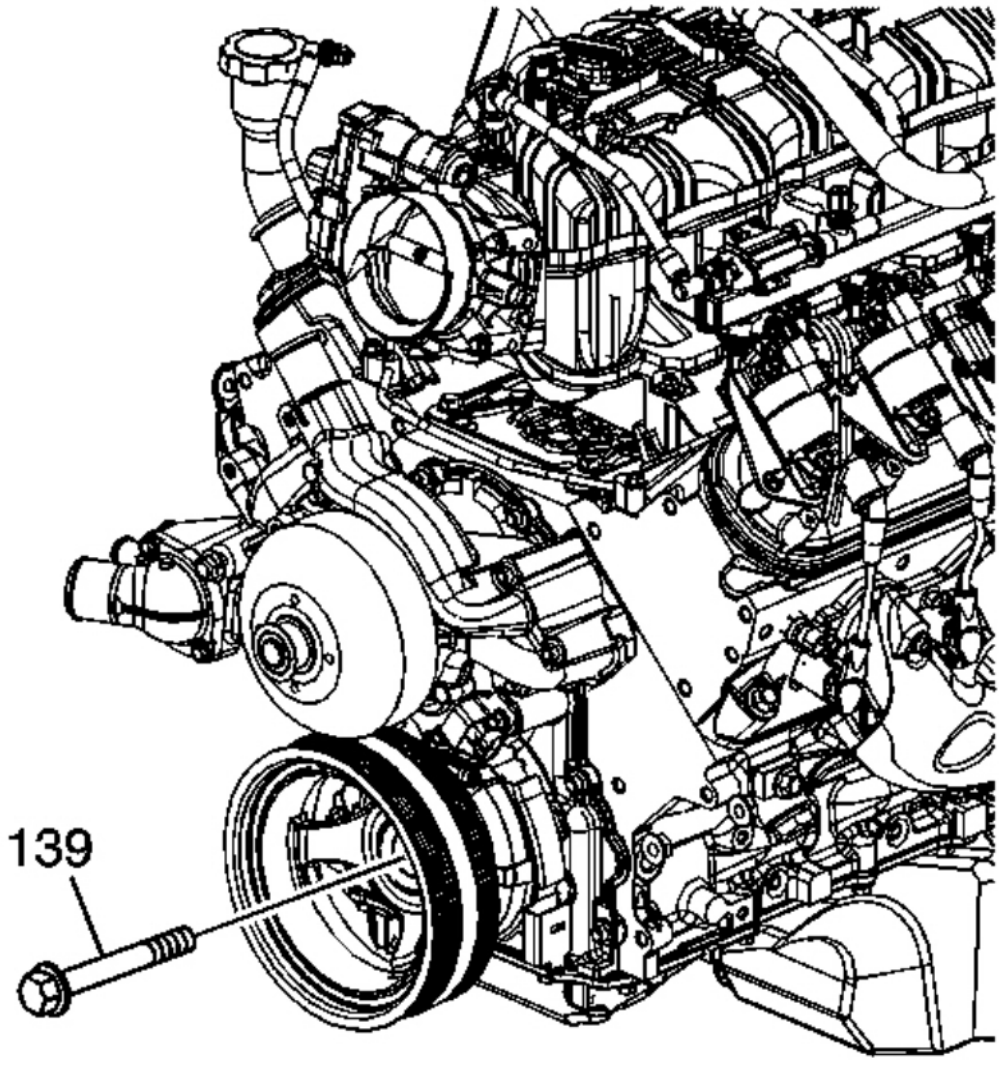


Fig. 102: View Of New Crankshaft Balancer Bolt
Courtesy of GENERAL MOTORS CORP.

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

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Tighten:

1. Tighten the crankshaft balancer bolt a first pass to 50 N.m (37 lb ft).
2. Tighten the crankshaft balancer bolt a second pass to 140 degrees using the **J 45059** . See **Special Tools** .

8. Remove the **J 42386-A** . See **Special Tools** .

ENGINE PRELUBING

TOOLS REQUIRED

J 45299 Engine Preluber. See **Special Tools** .

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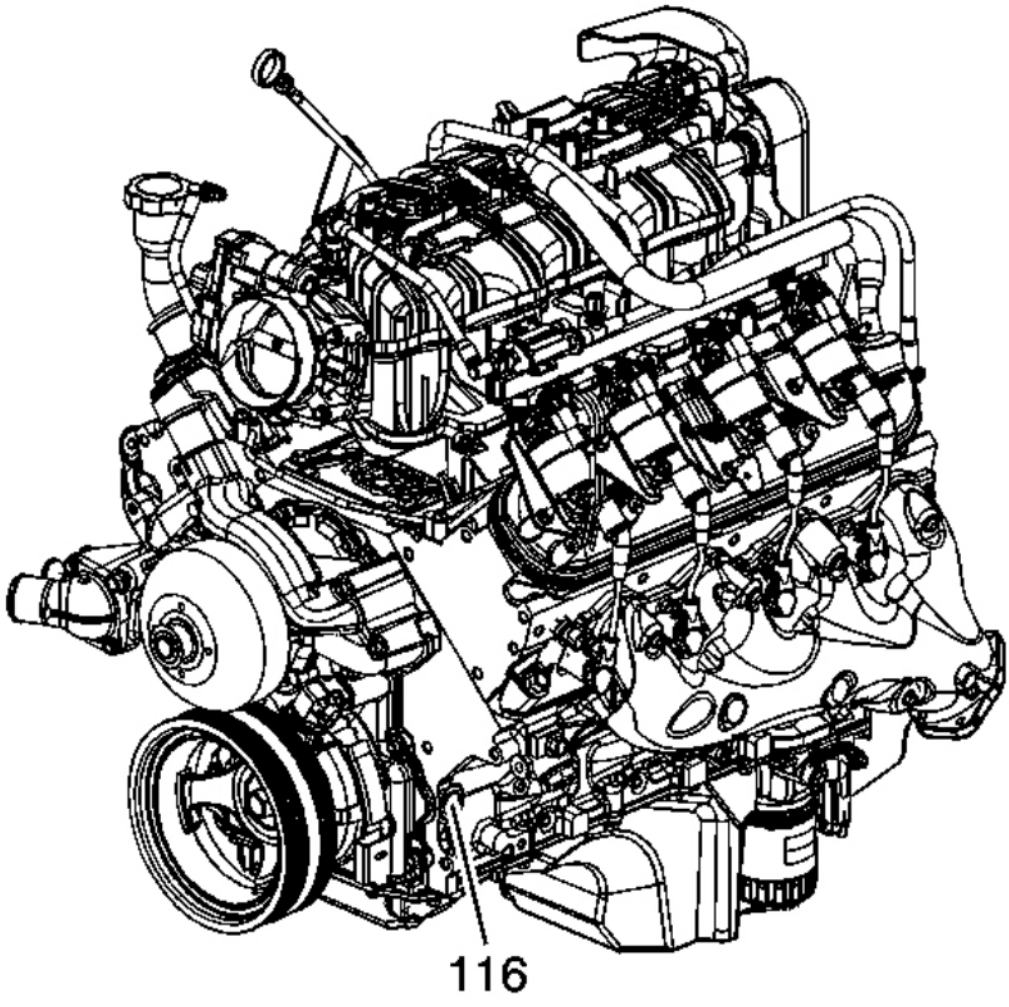


Fig. 103: View Of Engine Block Left Front Oil Gallery Plug
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: A constant and continuous flow of clean engine oil is required in order to properly prime the engine. Be sure to use an approved engine oil as specified in the owners manual.

1. Remove the engine oil filter, and fill with clean engine oil.

NOTE: Refer to Fastener Notice .

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2. Install the oil filter.

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

3. Locate the engine block left front oil gallery plug (116).
4. Install the M16 x 1.5 adapter P/N 509375.

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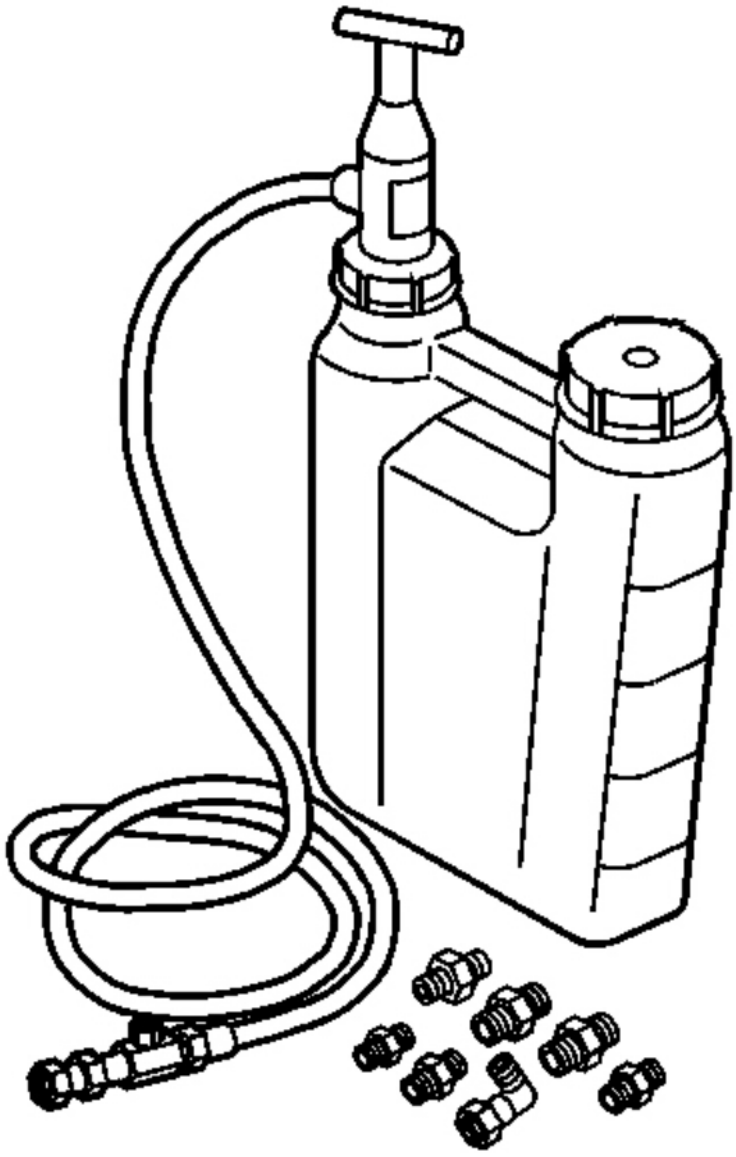


Fig. 104: Identifying Engine Preluber J 45299
Courtesy of GENERAL MOTORS CORP.

5. Install the flexible hose to the adapter and open the valve.
6. Pump the handle on the **J 45299** in order to flow a minimum of 1-1. See **Special Tools** .9 liters (1-2 quarts) engine oil. Observe the flow of engine oil through the flexible hose and into the engine assembly.

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7. Close the valve and remove the flexible hose and adapter from the engine.
8. Install the gallery plug to the engine.

   Tighten: Tighten the oil gallery plug to 60 N.m (44 lb ft).

9. Top-off the engine oil to the proper level.

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