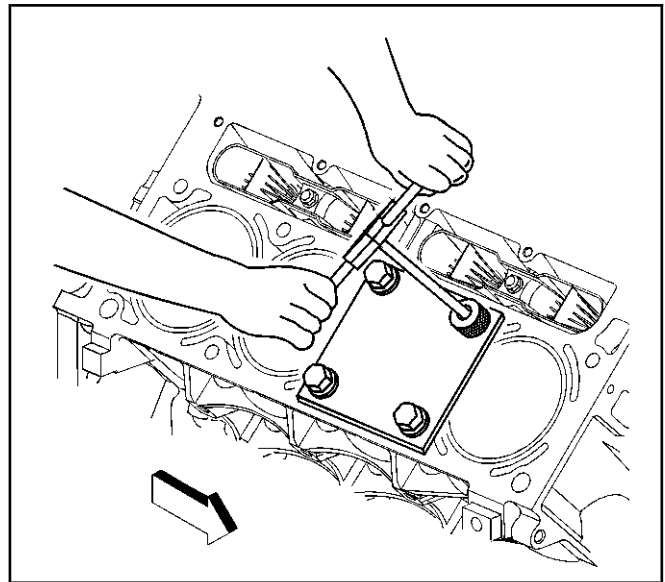
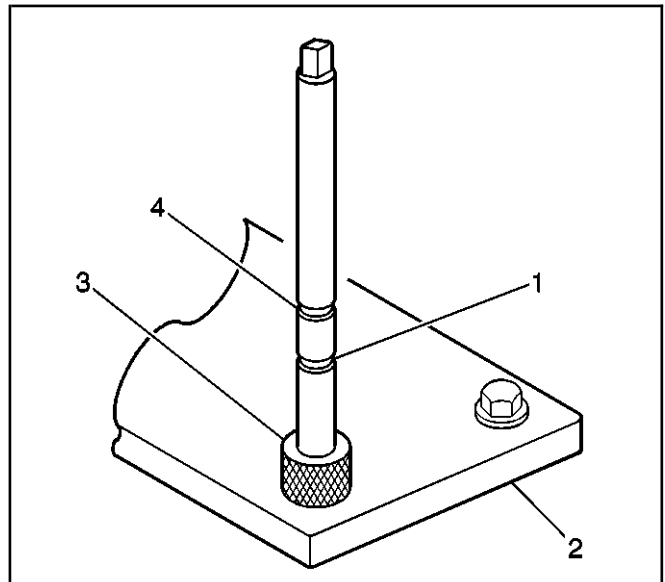


9. Using a tap wrench, tap the threads of the drilled hole.

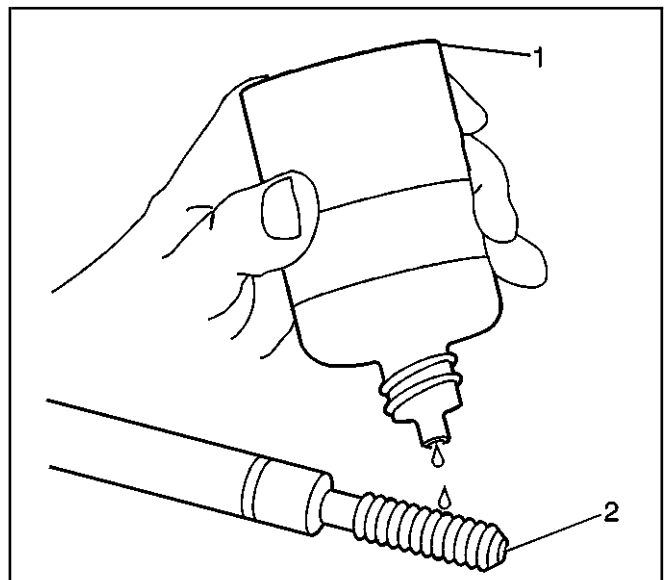


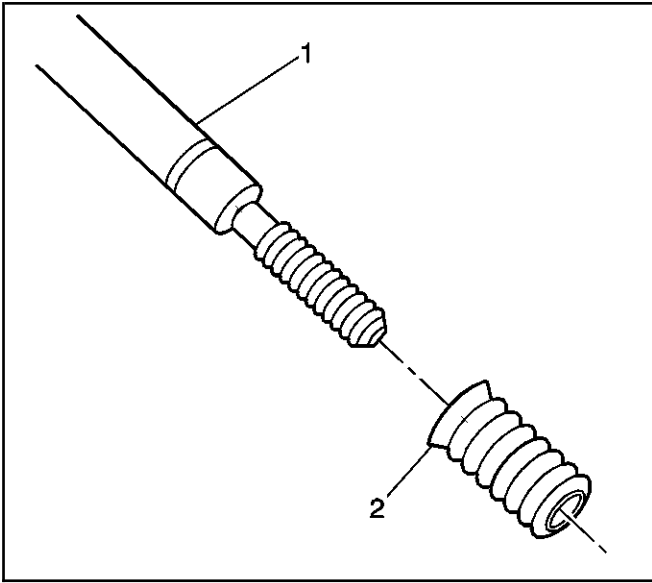
10. In order to tap the new threads to the proper depth, rotate the tap into the hole until the mark (1) on the tap aligns with the top of the drill bushing (3).
11. Remove the fixture plate (2), bushing (3), and bolts.
12. Using compressed air, clean out any chips.
13. Spray cleaner GM P/N 12346139, GM P/N 12377981 (Canadian P/N 10953463) or equivalent into the hole.
14. Using compressed air, clean any cutting oil and chips out of the hole.



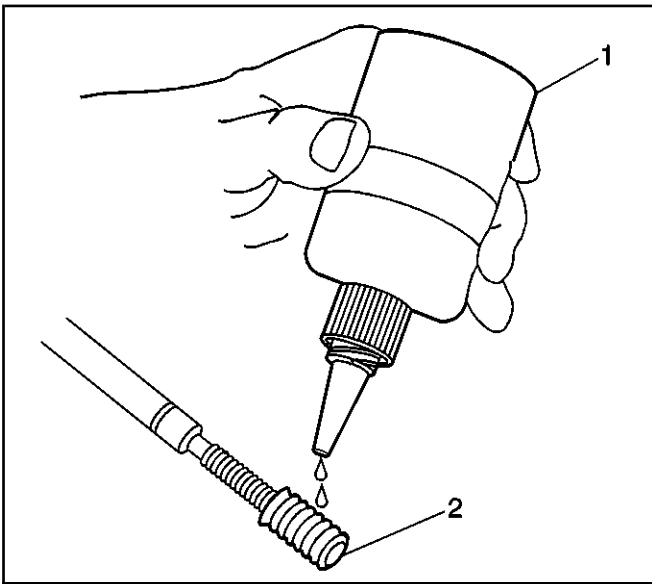
**Important:** Do not allow oil or other foreign material to contact the outside diameter (OD) of the insert.

15. Lubricate the threads of the installer tool (2) with the driver oil (1).

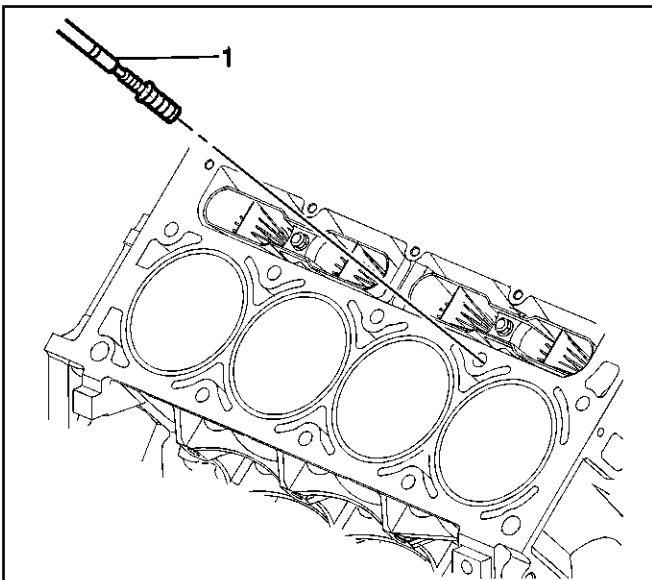




16. Install the insert (2) onto the driver tool (1).



17. Apply threadlock LOCTITE™ 277, J 42385-109 (1), or equivalent to the insert OD threads (2).

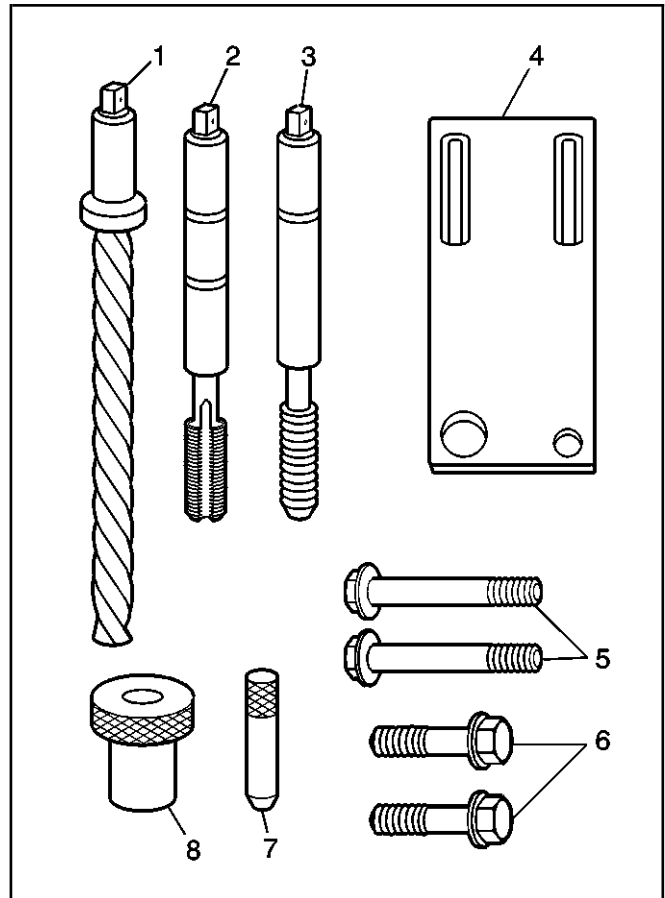


18. Install the insert and driver (1) into the hole. Rotate the driver tool until the mark on the tool aligns with the deck surface of the engine block. The installer tool will tighten up before screwing completely through the insert. This is acceptable. You are forming the bottom threads of the insert and mechanically locking the insert to the base material threads.

**Main Cap Bolt Hole Thread Repair**

1. The main cap bolt hole thread repair kit consists of the following items:

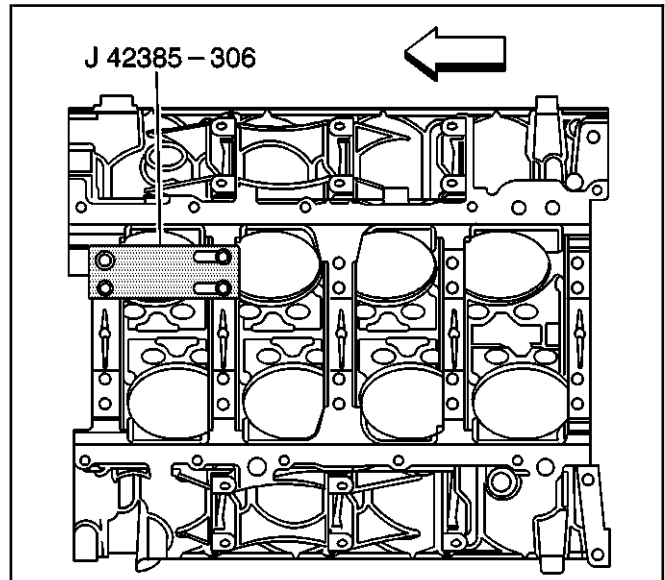
- The drill (1)
- The tap (2)
- The installer (3)
- The fixture plate (4)
- The long bolts (5)
- The short bolts (6)
- The alignment pin (7)
- The bushing (8)

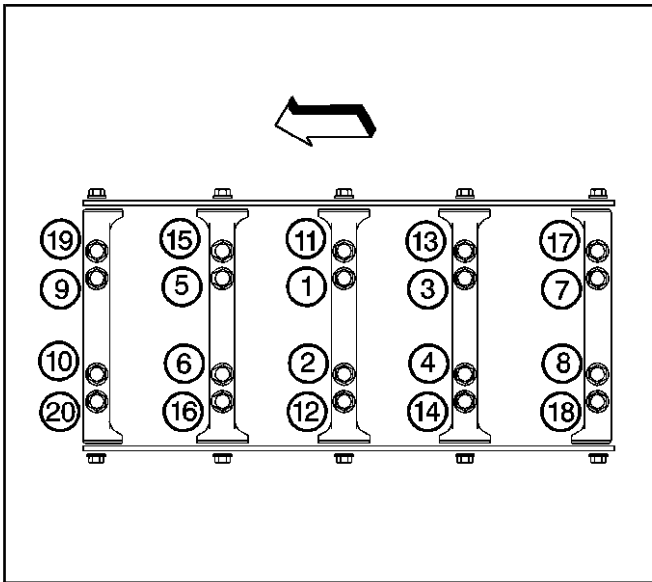


2. Install the fixture plate, bolt, and bushing, onto the engine block.

Position the fixture plate and bushing over the hole that is to be repaired.

3. Position the alignment pin in the desired hole and tighten the fixture retaining bolts.



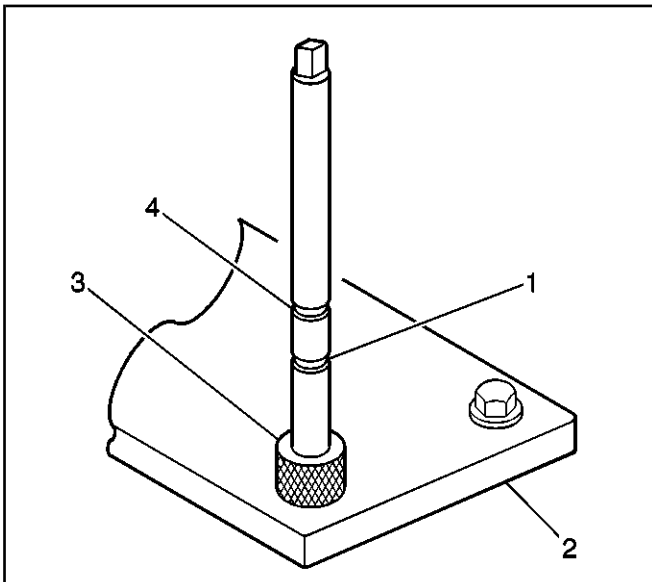


4. Drill out the damaged hole.

The outer bolt hole locations 11–20 have the shallower counterbores. Use sleeve J 42385-316 with the drill.

Drill until the stop collar of the drill bit or the sleeve contacts the bushing.

5. Using compressed air, clean out any chips.



6. Using a tap wrench, tap the threads of the drilled hole.

In order to tap the new threads to the proper depth, rotate the tap into the hole until the mark on the tap aligns with the top of the bushing.

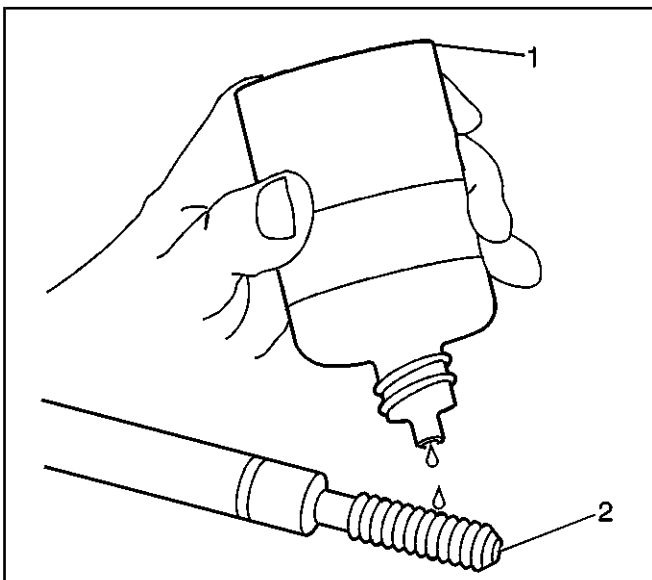
For the deeper main cap holes 1–10, rotate the tap until the upper mark (4) on the tap aligns with the top of the bushing (3).

For the shallower main cap holes 11–20, rotate the tap until the lower mark (1) on the tap aligns with top of the bushing (3).

7. Using compressed air, clean out any chips.

8. Spray cleaner GM P/N 12346139 (Canadian P/N 10953463) or equivalent into the hole.

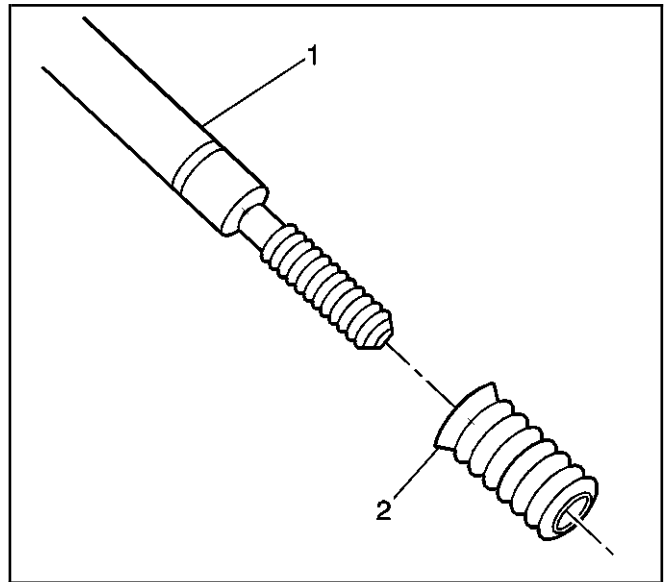
9. Using compressed air, clean any cutting oil and chips out of the hole.



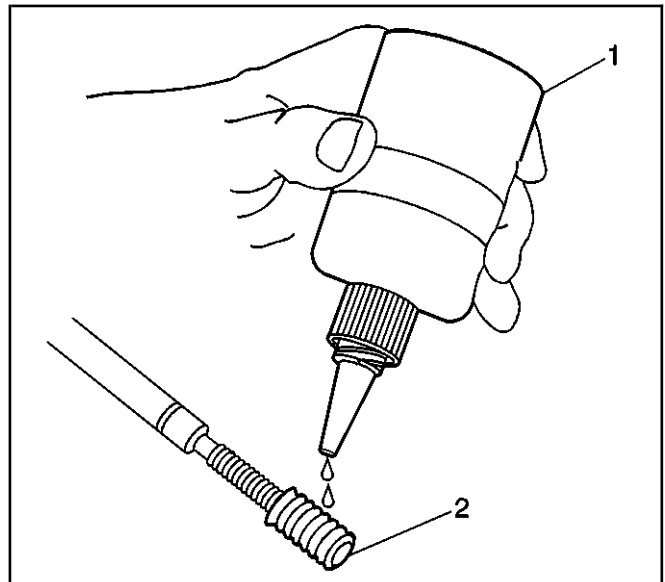
**Important:** Do not allow oil or other foreign material to contact the outside diameter (OD) of the insert.

10. Lubricate the threads of the installer tool (2) with the driver oil (1).

11. Install the insert (2) onto the driver tool (1).

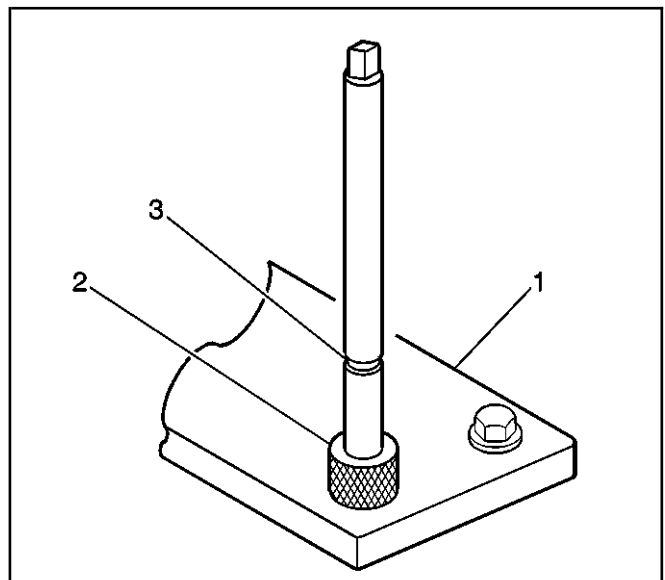


12. Apply threadlock LOCTITE™ 277, J 42385-109 (1), or equivalent to the insert OD threads (2).



**Important:** The fixture plate and bushing remains installed onto the engine block during the insert installation procedure.

13. Install the insert and driver (1) through the fixture plate and bushing and into the hole.  
 Rotate the driver tool until the mark on the tool (3) aligns with the top of the bushing (2).  
 The installer tool will tighten up before screwing completely through the insert. This is acceptable. You are forming the bottom threads of the insert and mechanically locking the insert to the base material threads.



**Service Prior to Assembly**

- Dirt or debris will cause premature wear of the rebuilt engine. Clean all the components. Refer to *Cleanliness and Care*.
- Use the proper tools to measure components when inspecting for excessive wear. Components that are not within the manufacturers specifications must be repaired or replaced.
- When the components are installed into an engine, return the components to their original location, position and direction. Refer to *Separating Parts*.
- During assembly, lubricate all the moving parts with clean engine oil. This will provide initial lubrication when the engine is first started.

## Engine Block Plug Installation

### Tools Required

J 41712 Oil Pressure Switch Socket or equivalent

### Important:

- Engine block plug, oil gallery and coolant, sealing washers may be used again if not bent, scored or otherwise damaged.
  - Apply the proper amount and type of sealant to the sealing washer as recommended in the service procedure.
1. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block coolant heater sealing washer, if applicable. Refer to *Sealers, Adhesives, and Lubricants*.

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

2. Install the engine block coolant heater to the engine block, if applicable.

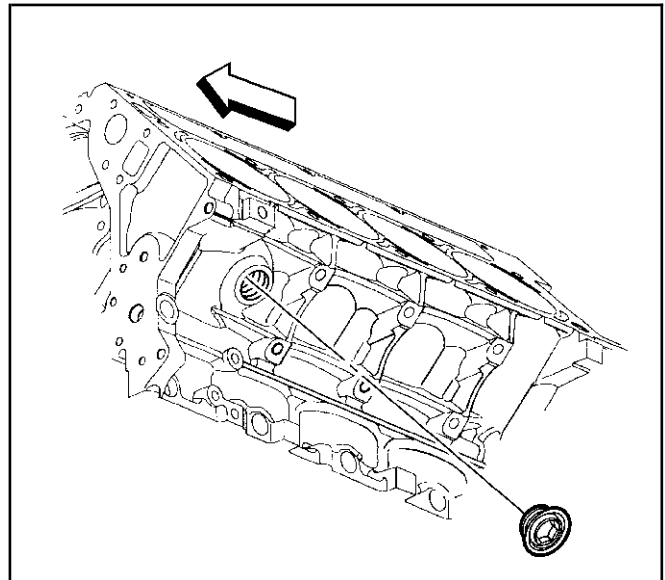
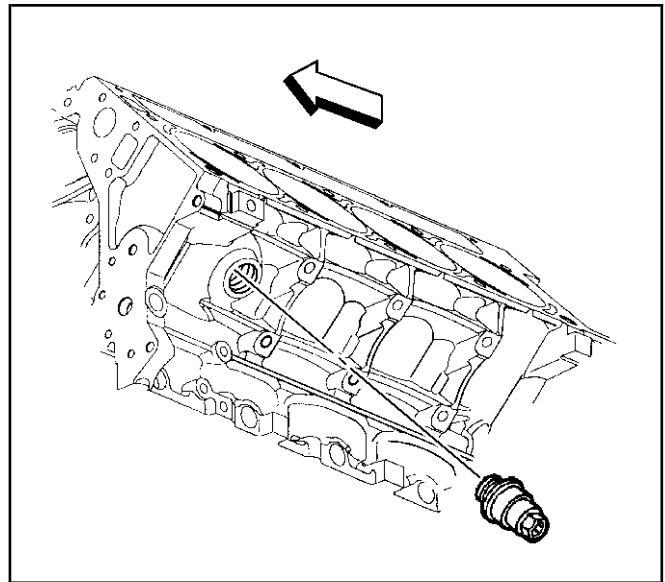
### Tighten

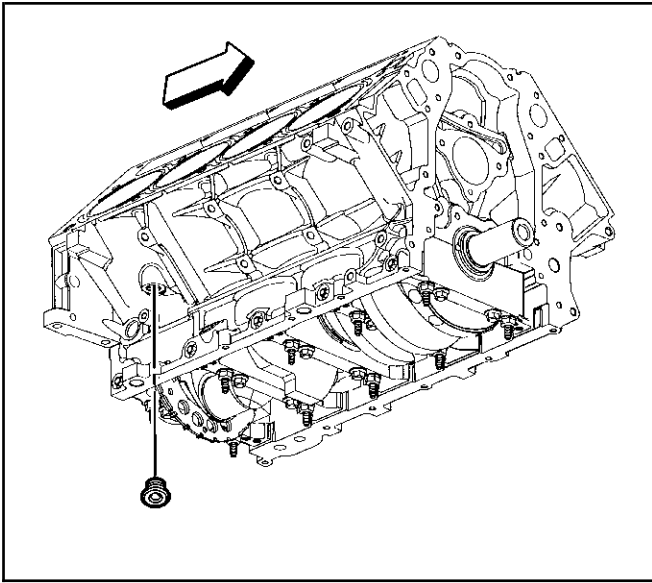
Tighten the block coolant heater to 40 N·m (30 lb ft).

3. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block left front coolant drain plug sealing washer, if applicable.
4. Install the engine block left front coolant drain plug, if applicable.

### Tighten

Tighten the block left front coolant drain plug to 60 N·m (44 lb ft).

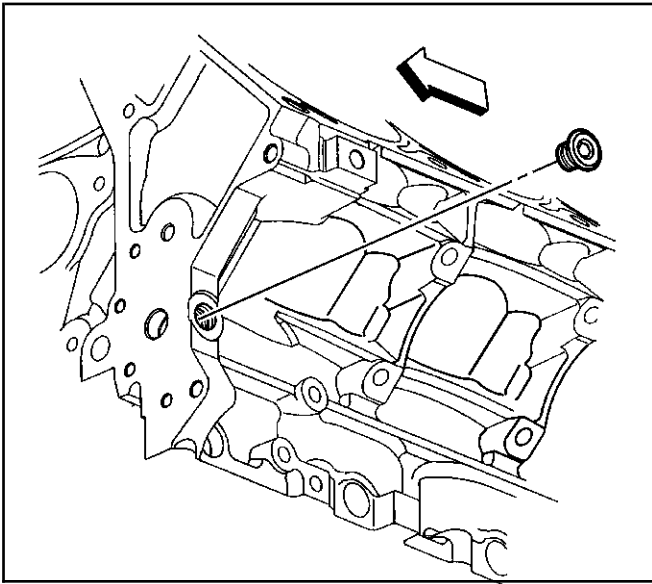




5. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block right rear coolant drain plug sealing washer.
6. Install the engine block right rear coolant drain plug.

**Tighten**

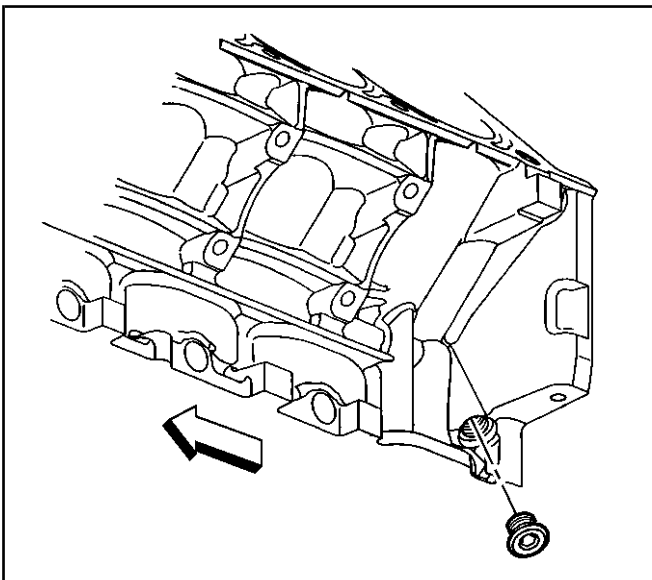
Tighten the block right rear coolant drain plug to 60 N·m (44 lb ft).



7. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block left front oil gallery plug sealing washer.
8. Install the engine block left front oil gallery plug.

**Tighten**

Tighten the block left front oil gallery plug to 60 N·m (44 lb ft).



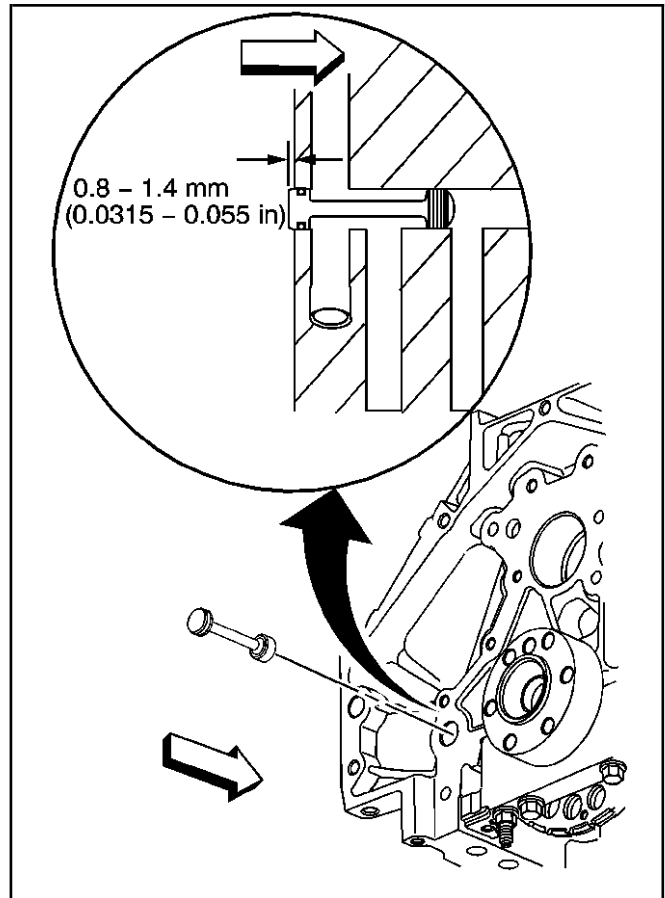
9. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block left rear oil gallery plug sealing washer.
10. Install the engine block left rear oil gallery plug.

**Tighten**

Tighten the block left rear oil gallery plug to 60 N·m (44 lb ft).

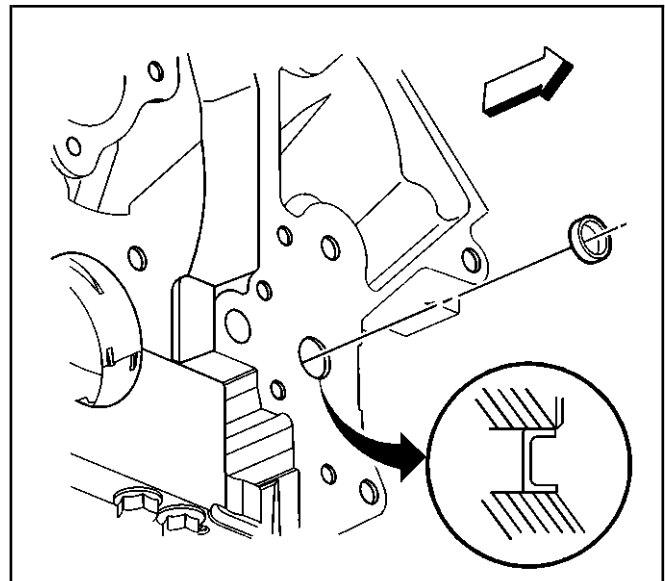


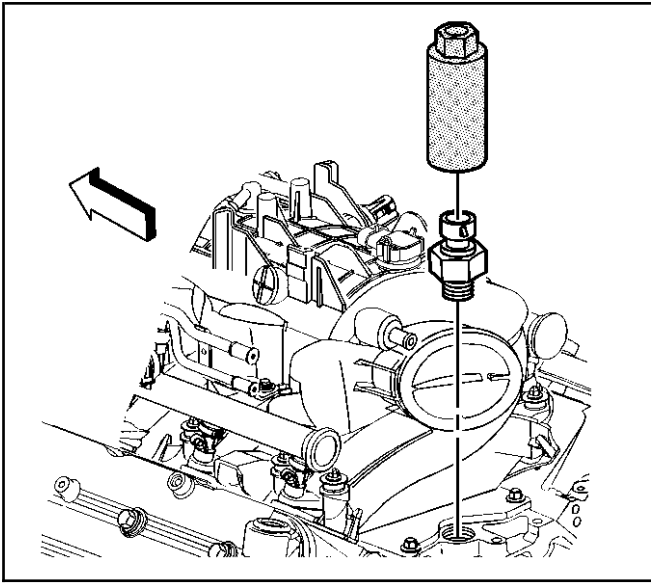
11. Inspect the engine block rear oil gallery plug and O-ring seal. If the O-ring seal on the plug is not cut or damaged, the rear oil gallery plug may be used again.
12. Lubricate the O-ring seal with clean engine oil.
13. Install the block rear oil gallery plug into the oil gallery bore. A properly installed block plug will protrude 0.8–1.4 mm (0.0315–0.055 in) beyond the rear face of the block.



**Important:** The engine block front oil gallery plug should not be removed unless service is required.

14. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489) to the sides of the NEW front oil gallery plug.
15. Install a NEW engine block front oil gallery plug, if required. Install the front oil gallery plug into the oil gallery bore 2.2–2.8 mm (0.0086–0.011 in) below flush.

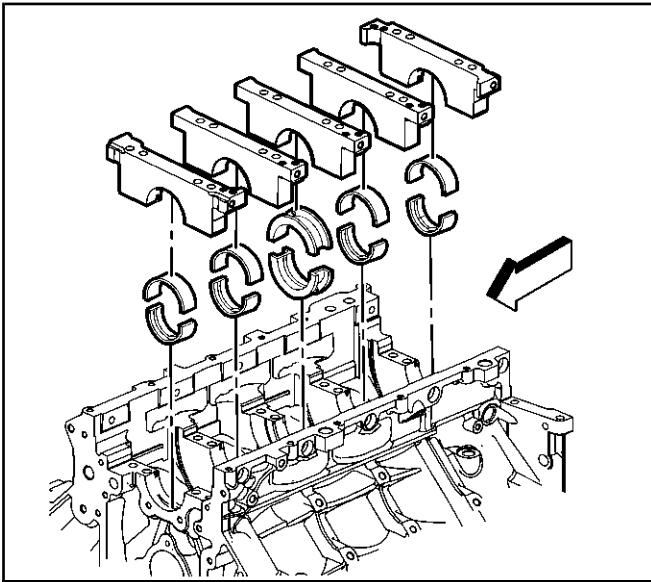




16. Apply sealant to the threads of the oil pressure sensor.
17. Use the *J 41712* or equivalent in order to install the oil pressure sensor.

**Tighten**

Tighten the oil pressure sensor to 20 N·m (15 lb ft).



### Crankshaft and Bearings Installation

**Tools Required**

*J 45059* Angle Meter

**Important:**

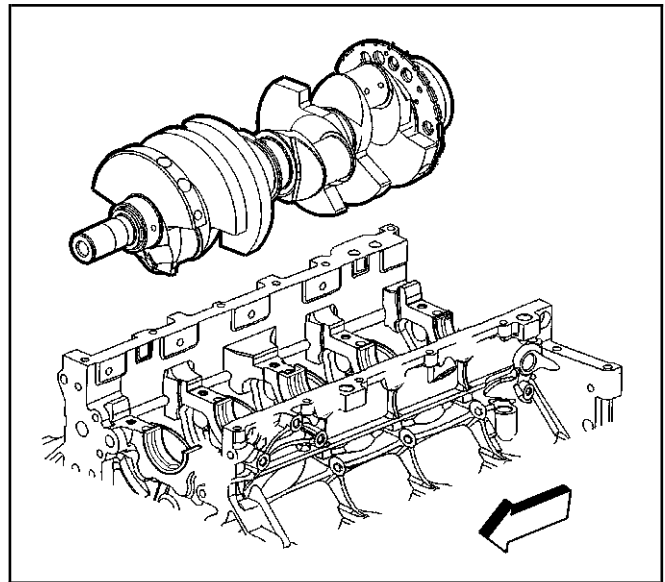
- Crankshaft bearing clearances are critical. Excessive crankshaft bearing clearance may effect crankshaft position sensor signals and/or On-Board Diagnostics (OBD) II system performance.
- Crankshaft bearing caps must be installed to the proper location and direction.
- When installing the crankshaft bearings, align the locating tabs on the bearings with the locating notches in the engine block journal bore and the bearing cap.
- Always install crankshaft bearings with their machined partner. Do not file bearings or mix bearing halves.
- To prevent engine block oil leakage, install NEW M8 crankshaft bearing cap side bolts.

The crankshaft bearing cap M8 side bolts have a sealant patch applied to the bolt flange.

1. Install the crankshaft thrust bearings to the engine block and center bearing cap.
2. Install the remaining crankshaft bearings to the engine block and bearing caps.
3. Lubricate the bearing surfaces and crankshaft journals with clean engine oil.

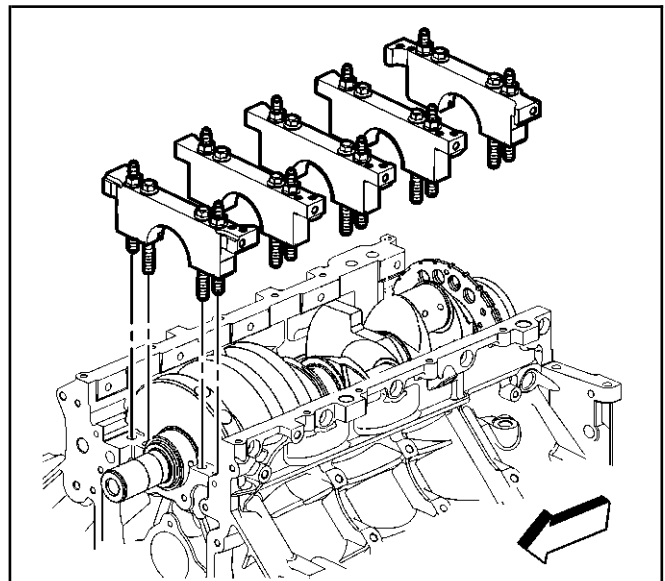
**Notice:** To maintain proper crankshaft end play, use extreme care during crankshaft installation. Avoid scoring or damaging the thrust bearing.

4. Install the crankshaft.



**Important:** The bearing caps must be installed in the proper location and direction.

5. Install the crankshaft bearing caps, with bearings, into the engine block.
6. Start the M10 bolts and bolt/studs.
7. Tap the bearing caps into place with a plastic-face hammer.



8. Install the NEW M8 bearing cap side bolts.

