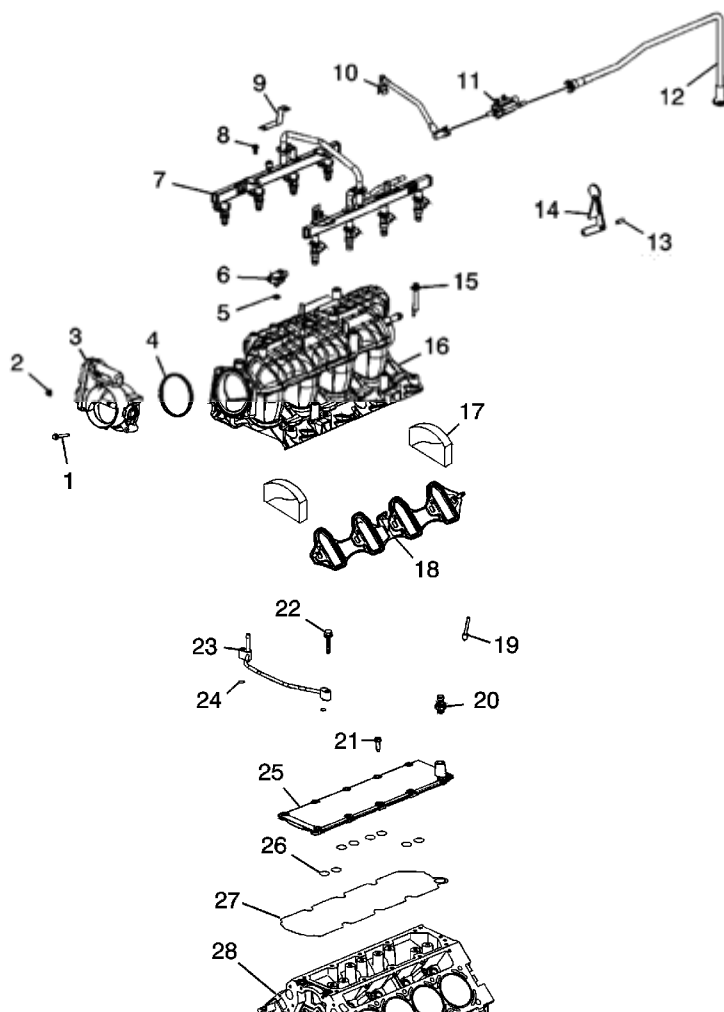


Intake Manifold / Upper Engine - RPO LY2 / LY6 / L9H

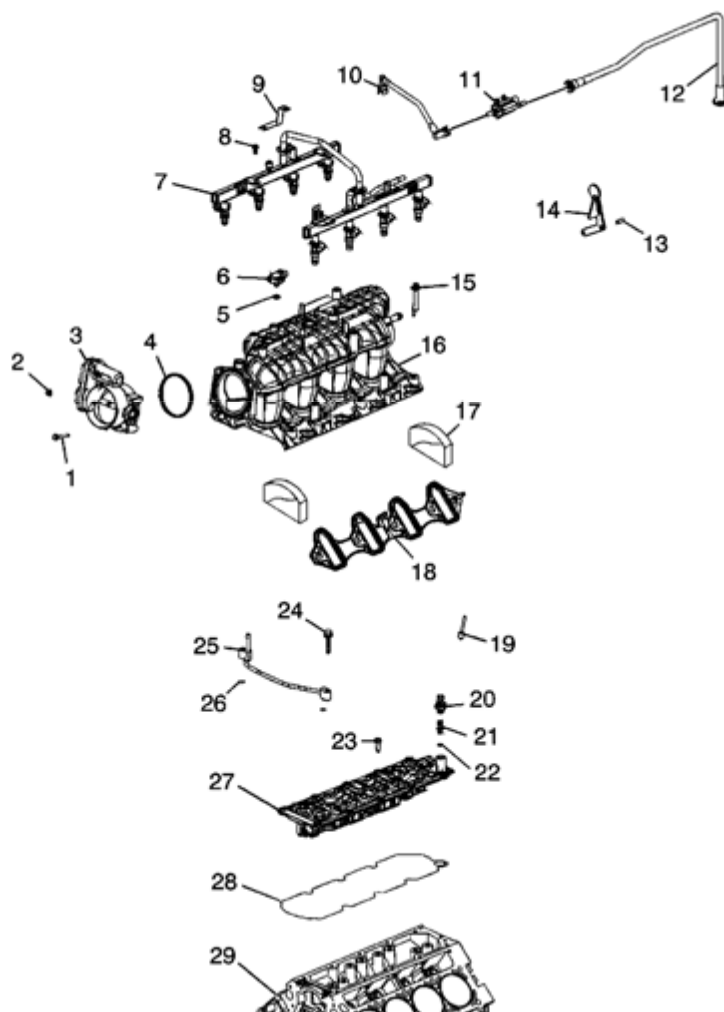


- (1) Bolt
- (2) Nut
- (3) Throttle Body
- (4) Throttle Body Seal
- (5) Manifold Absolute Pressure (MAP) Sensor O-ring Seal
- (6) MAP Sensor
- (7) Sequential Multi-Port Fuel Injector Assembly with Fuel Rail
- (8) Bolt
- (9) Fuel Injection Fuel Rail Bracket
- (10) Evaporative (EVAP) Emission Canister Purge Tube
- (11) EVAP Emission Canister Purge Solenoid Valve

- (12) EVAP Emission Canister Purge Tube
- (13) Bolt
- (14) Fuel Injection Fuel Rail Stop
- (15) Bolt
- (16) Intake Manifold
- (17) Intake Manifold Seal
- (18) Intake Manifold Gasket
- (19) Engine Coolant Air Bleed Plug
- (20) Engine Oil Pressure Sensor
- (21) Bolt
- (22) Bolt
- (23) Engine Coolant Air Bleed Pipe
- (24) Engine Coolant Air Bleed Pipe O-ring Seal
- (25) Engine Valley Cover
- (26) O-ring Seal
- (27) Gasket
- (28) Engine Block

cardiagn.com

Intake Manifold/Upper Engine - RPO LH6/LC9/LY5/LMG/L76

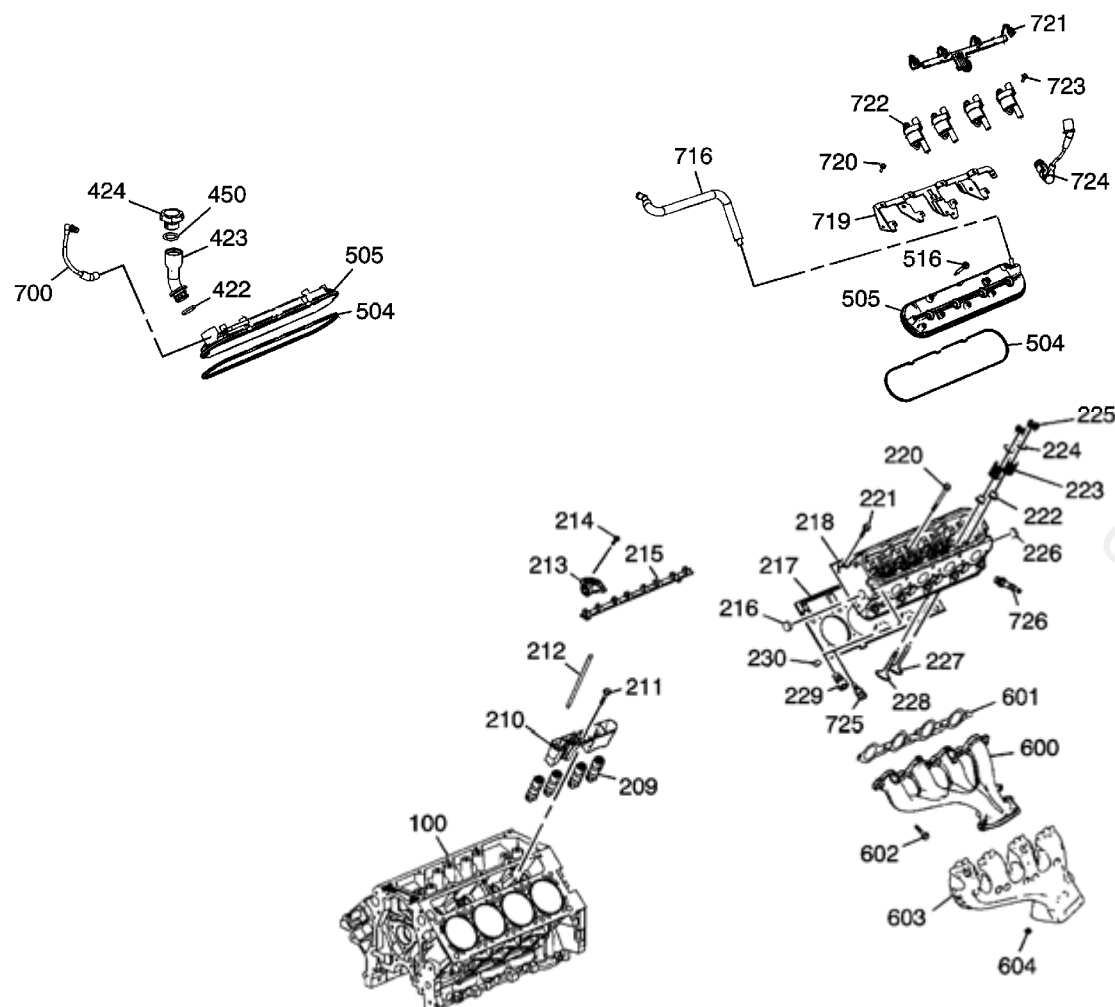


- (1) Bolt
- (2) Nut
- (3) Throttle Body
- (4) Throttle Body Seal
- (5) Manifold Absolute Pressure (MAP) Sensor O-ring Seal
- (6) MAP Sensor
- (7) Sequential Multi-Port Fuel Injector Assembly with Fuel Rail
- (8) Bolt
- (9) Fuel Injection Fuel Rail Bracket
- (10) Evaporative (EVAP) Emission Canister Purge Tube
- (11) EVAP Emission Canister Purge Solenoid Valve

- (12) EVAP Emission Canister Purge Tube
- (13) Bolt
- (14) Fuel Injection Fuel Rail Stop
- (15) Bolt
- (16) Intake Manifold
- (17) Intake Manifold Seal
- (18) Intake Manifold Gasket
- (19) Engine Coolant Air Bleed Plug
- (20) Engine Oil Pressure Sensor
- (21) Valve Lifter Oil Filter
- (22) Valve Lifter Oil Filter Seal
- (23) Bolt
- (24) Bolt
- (25) Engine Coolant Air Bleed Pipe
- (26) Engine Coolant Air Bleed Pipe O-ring Seal
- (27) Engine Valley Cover
- (28) Gasket
- (29) Engine Block

cardiagn.com

Cylinder Head/Upper Engine - RPO LY2/LY6/L9H

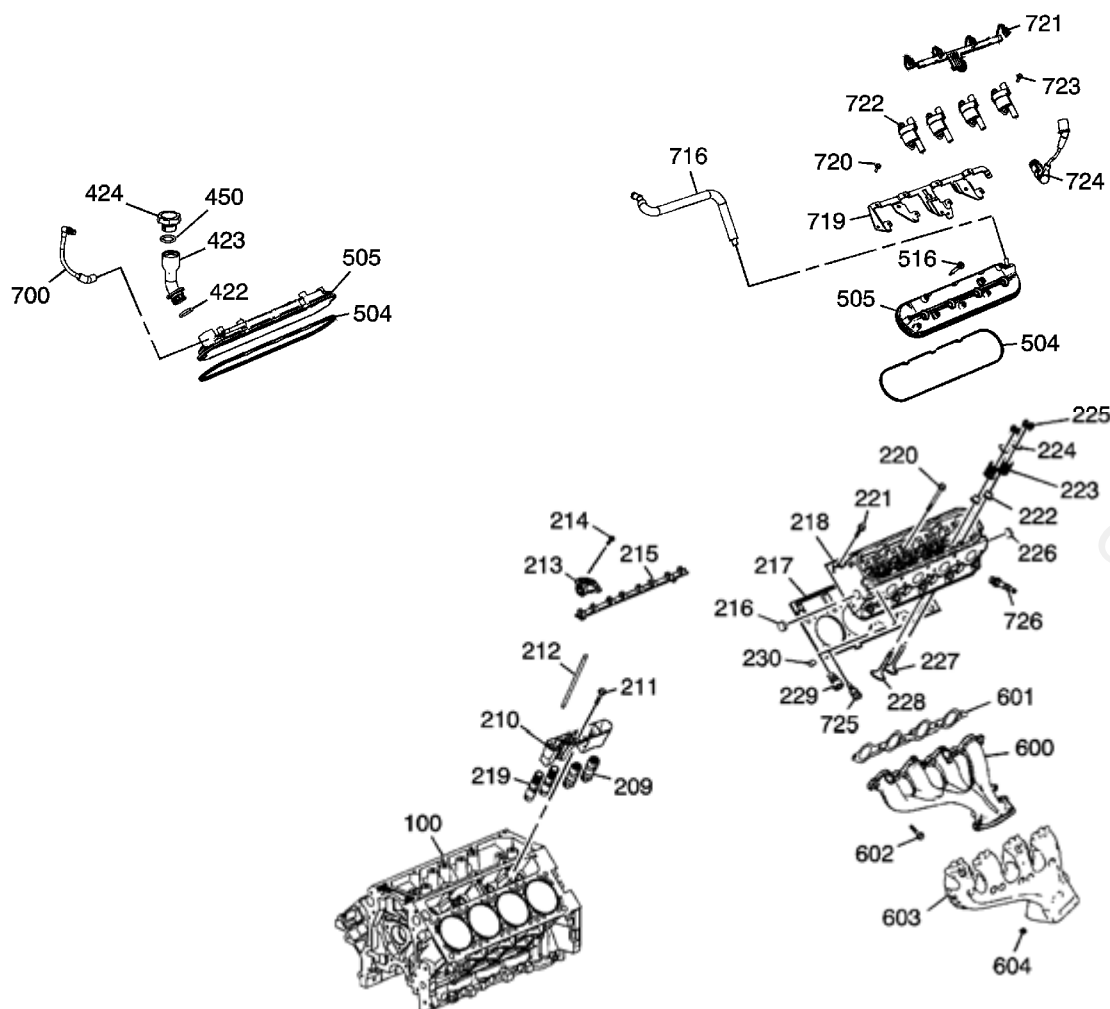


- (100) Engine Block
- (209) Valve Lifter
- (210) Valve Lifter Guide
- (211) Valve Lifter Guide Bolt
- (212) Valve Push Rod
- (213) Valve Rocker Arm
- (214) Valve Rocker Arm Pivot Support Bolt
- (215) Valve Rocker Arm Pivot Support
- (216) Cylinder Head Core Hole Plug
- (217) Cylinder Head Gasket
- (218) Cylinder Head

(220) Cylinder Head Bolt - M10
(221) Cylinder Head Bolt - M8
(222) Valve Stem Oil Seal
(223) Valve Spring
(224) Valve Spring Cap
(225) Valve Stem Key
(226) Cylinder Head Core Hole Plug
(227) Intake Valve
(228) Exhaust Valve
(229) Cylinder Head Plug
(230) Cylinder Head Locating Pin
(422) Oil Fill Tube O-Ring Seal
(423) Oil Fill Tube
(424) Oil Fill Cap
(450) Oil Fill Cap O-Ring Seal
(504) Valve Rocker Arm Cover Gasket
(504) Valve Rocker Arm Cover Gasket
(505) Valve Rocker Arm Cover
(505) Valve Rocker Arm Cover
(516) Valve Rocker Arm Cover Bolt
(600) Exhaust Manifold
(601) Exhaust Manifold Gasket
(602) Exhaust Manifold Flange Bolt
(603) Exhaust Manifold Heat Shield
(604) Exhaust Manifold Heat Shield Bolt
(700) Positive Crankcase Ventilation (PCV) Hose - Fresh Air
(716) PCV Hose - Dirty Air
(719) Ignition Coil Bracket
(720) Ignition Coil Bracket Stud
(721) Ignition Coil Wire Harness Assembly
(722) Ignition Coil
(723) Ignition Coil Bolt
(724) Spark Plug Wire
(725) Engine Coolant Temperature Sensor
(726) Spark Plug

cardiagn.com

Cylinder Head /Upper Engine - RPO LH6 /LMG /LY5 /LC9 /L76

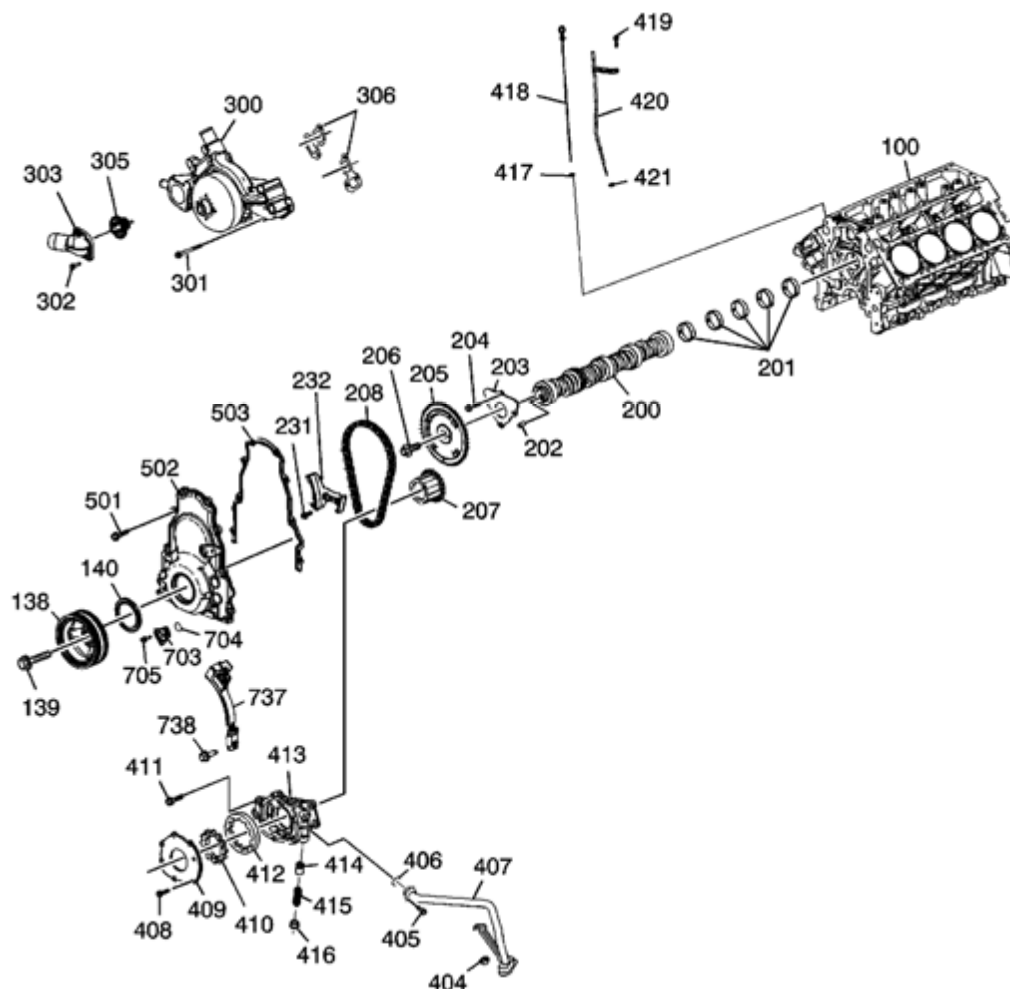


- (100) Engine Block
- (209) Valve Lifter - Non-Active Fuel Management
- (210) Valve Lifter Guide
- (211) Valve Lifter Guide Bolt
- (212) Valve Push Rod
- (213) Valve Rocker Arm
- (214) Valve Rocker Arm Pivot Support Bolt
- (215) Valve Rocker Arm Pivot Support
- (216) Cylinder Head Core Hole Plug
- (217) Cylinder Head Gasket
- (218) Cylinder Head

(219) Valve Lifter - Active Fuel Management
(220) Cylinder Head Bolt - M10
(221) Cylinder Head Bolt - M8
(222) Valve Stem Oil Seal
(223) Valve Spring
(224) Valve Spring Cap
(225) Valve Stem Key
(226) Cylinder Head Core Hole Plug
(227) Intake Valve
(228) Exhaust Valve
(229) Cylinder Head Plug
(230) Cylinder Head Locating Pin
(422) Oil Fill Tube O-Ring Seal
(423) Oil Fill Tube
(424) Oil Fill Cap
(450) Oil Fill Cap O-Ring Seal
(504) Valve Rocker Arm Cover Gasket
(504) Valve Rocker Arm Cover Gasket
(505) Valve Rocker Arm Cover
(505) Valve Rocker Arm Cover
(516) Valve Rocker Arm Cover Bolt
(600) Exhaust Manifold
(601) Exhaust Manifold Gasket
(602) Exhaust Manifold Flange Bolt
(603) Exhaust Manifold Heat Shield
(604) Exhaust Manifold Heat Shield Bolt
(700) Positive Crankcase Ventilation (PCV) Hose - Fresh Air
(716) PCV Hose - Dirty Air
(719) Ignition Coil Bracket
(720) Ignition Coil Bracket Bolt
(721) Ignition Coil Wire Harness Assembly
(722) Ignition Coil
(723) Ignition Coil Bolt
(724) Spark Plug Wire
(725) Engine Coolant Temperature Sensor
(726) Spark Plug

cardiagn.com

Front of Engine - RPO LY2 / LH6 / LMG / LY5 / LC9

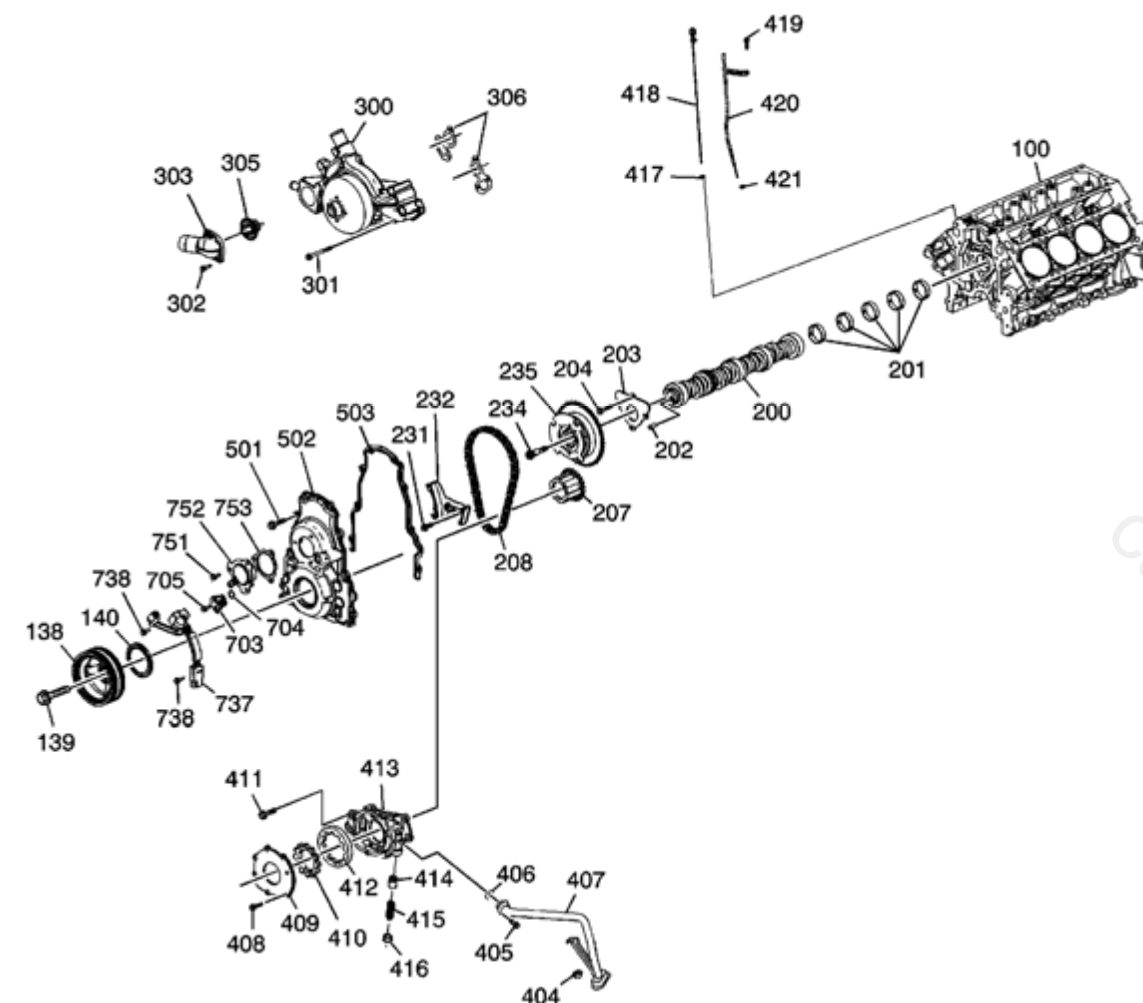


- (100) Engine Block
- (138) Crankshaft Balancer
- (139) Crankshaft Balancer Bolt
- (140) Crankshaft Front Oil Seal
- (200) Camshaft
- (201) Camshaft Bearing
- (202) Camshaft Sprocket Locating Pin
- (203) Camshaft Retainer
- (204) Camshaft Retainer Bolt
- (205) Camshaft Sprocket
- (206) Camshaft Sprocket Bolt

(207) Crankshaft Sprocket
(208) Timing Chain
(231) Timing Chain Tensioner Bolt
(232) Timing Chain Tensioner
(300) Water Pump
(301) Water Pump Bolt
(302) Water Pump Inlet Bolt
(303) Water Pump Inlet
(305) Engine Coolant Thermostat
(306) Water Pump Gasket
(404) Oil Pump Suction Pipe Nut
(405) Oil Pump Suction Pipe Bolt
(406) Oil Pump O-Ring Seal
(407) Oil Pump Suction Pipe
(408) Oil Pump Cover Bolt
(409) Oil Pump Cover
(410) Oil Pump Drive Gear
(411) Oil Pump Bolt
(412) Oil Pump Driven Gear
(413) Oil Pump
(414) Oil Pressure Relief Valve
(415) Oil Pressure Relief Valve Spring
(416) Oil Pressure Relief Valve Bore Plug
(417) Oil Level Indicator O-Ring Seal
(418) Oil Level Indicator
(419) Oil Level Indicator Tube Bolt
(420) Oil Level Indicator Tube
(421) O-Ring
(501) Engine Front Cover Bolt
(502) Engine Front Cover
(503) Engine Front Cover Gasket
(703) Camshaft Position (CMP) Sensor
(704) CMP Sensor O-Ring Seal
(705) CMP Sensor Bolt
(737) CMP Sensor Wire Harness Assembly
(738) CMP Sensor Wire Harness Assembly Bolt

cardiagn.com

Front of Engine - RPO LY6 / L76 / L9H

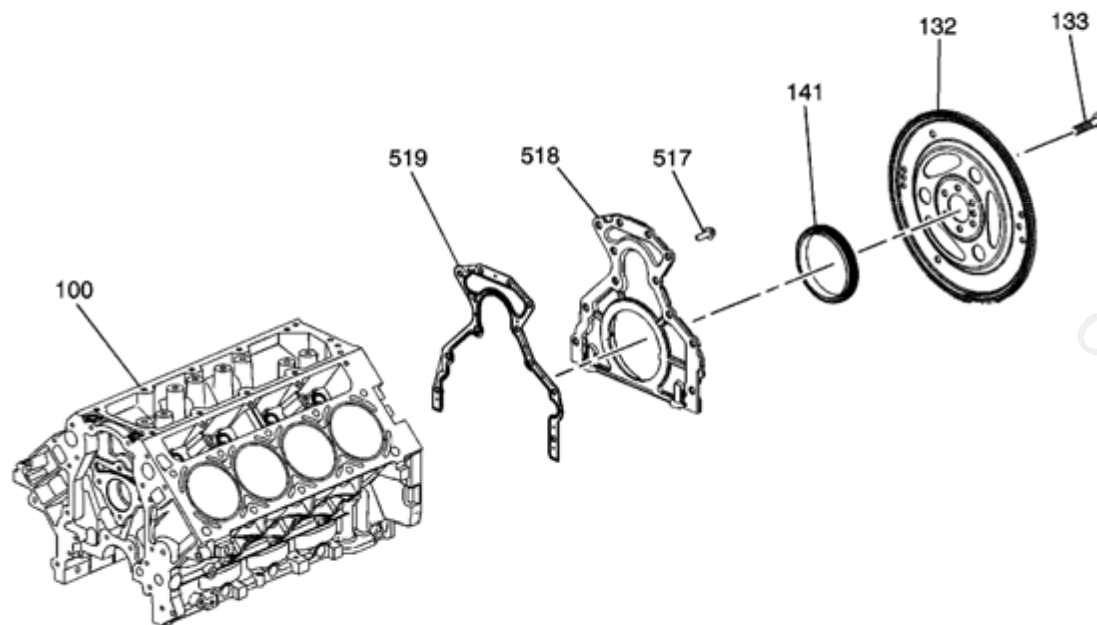


- (100) Engine Block
- (138) Crankshaft Balancer
- (139) Crankshaft Balancer Bolt
- (140) Crankshaft Front Oil Seal
- (200) Camshaft
- (201) Camshaft Bearing
- (202) Camshaft Sprocket Locating Pin
- (203) Camshaft Retainer
- (204) Camshaft Retainer Bolt
- (207) Crankshaft Sprocket
- (208) Timing Chain

(231) Timing Chain Tensioner Bolt
(232) Timing Chain Tensioner
(234) Camshaft Position (CMP) Actuator Solenoid Valve
(235) CMP Actuator
(300) Water Pump
(301) Water Pump Bolt
(302) Water Pump Inlet Bolt
(303) Water Pump Inlet
(305) Engine Coolant Thermostat
(306) Water Pump Gasket
(404) Oil Pump Suction Pipe Nut
(405) Oil Pump Suction Pipe Bolt
(406) Oil Pump O-Ring Seal
(407) Oil Pump Suction Pipe
(408) Oil Pump Cover Bolt
(409) Oil Pump Cover
(410) Oil Pump Drive Gear
(411) Oil Pump Bolt
(412) Oil Pump Driven Gear
(413) Oil Pump
(414) Oil Pressure Relief Valve
(415) Oil Pressure Relief Valve Spring
(416) Oil Pressure Relief Valve Bore Plug
(417) Oil Level Indicator O-Ring Seal
(418) Oil Level Indicator
(419) Oil Level Indicator Tube Bolt
(420) Oil Level Indicator Tube
(421) O-Ring
(501) Engine Front Cover Bolt
(502) Engine Front Cover
(503) Engine Front Cover Gasket
(703) CMP Sensor
(704) CMP Sensor O-Ring Seal
(705) CMP Sensor Bolt
(737) CMP Sensor Wire Harness Assembly
(738) CMP Sensor Wire Harness Assembly Bolt
(738) CMP Sensor Wire Harness Assembly Bolt
(751) CMP Actuator Hub Cover Bolt
(752) CMP Actuator Magnet
(753) CMP Actuator Magnet Gasket

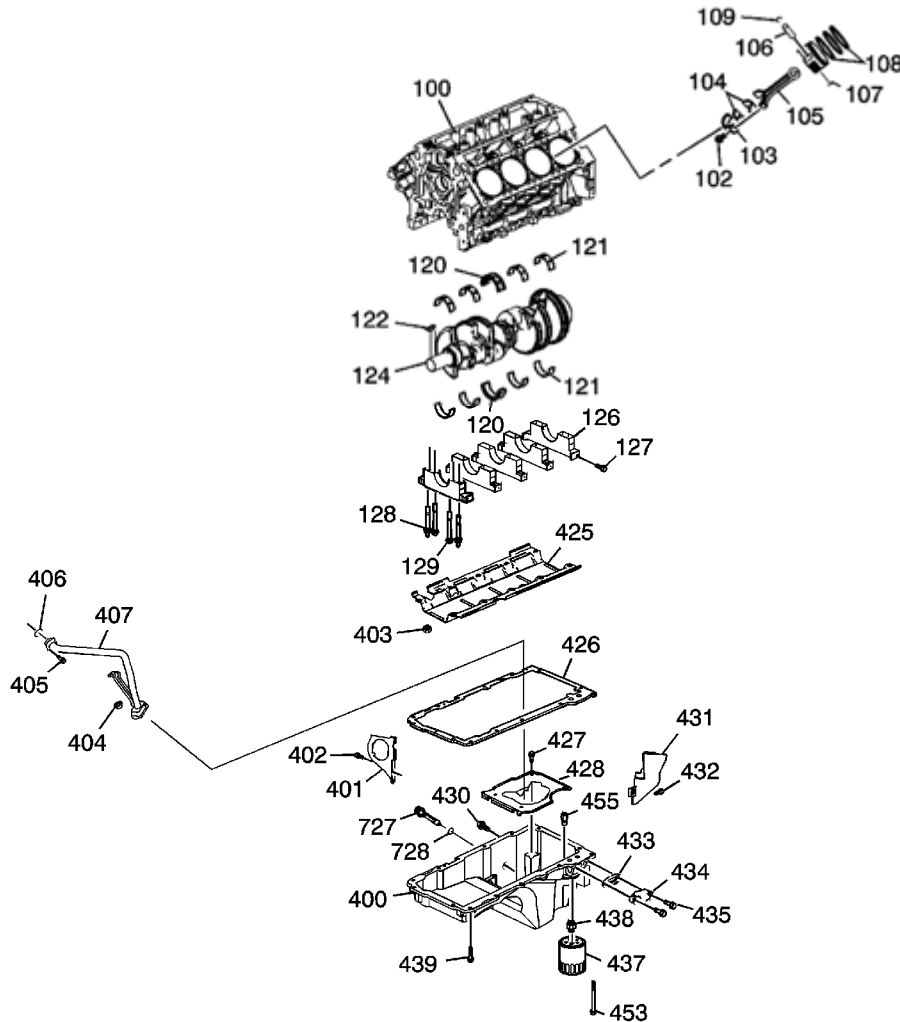
cardiagn.com

Rear of Engine



- (100) Engine Block
- (132) Flex Plate - Automatic Transmission
- (133) Flywheel Bolt
- (141) Crankshaft Rear Oil Seal
- (517) Crankshaft Rear Oil Seal Housing Bolt
- (518) Crankshaft Rear Oil Seal Housing
- (519) Crankshaft Rear Oil Seal Housing Gasket

Lower Engine Assembly

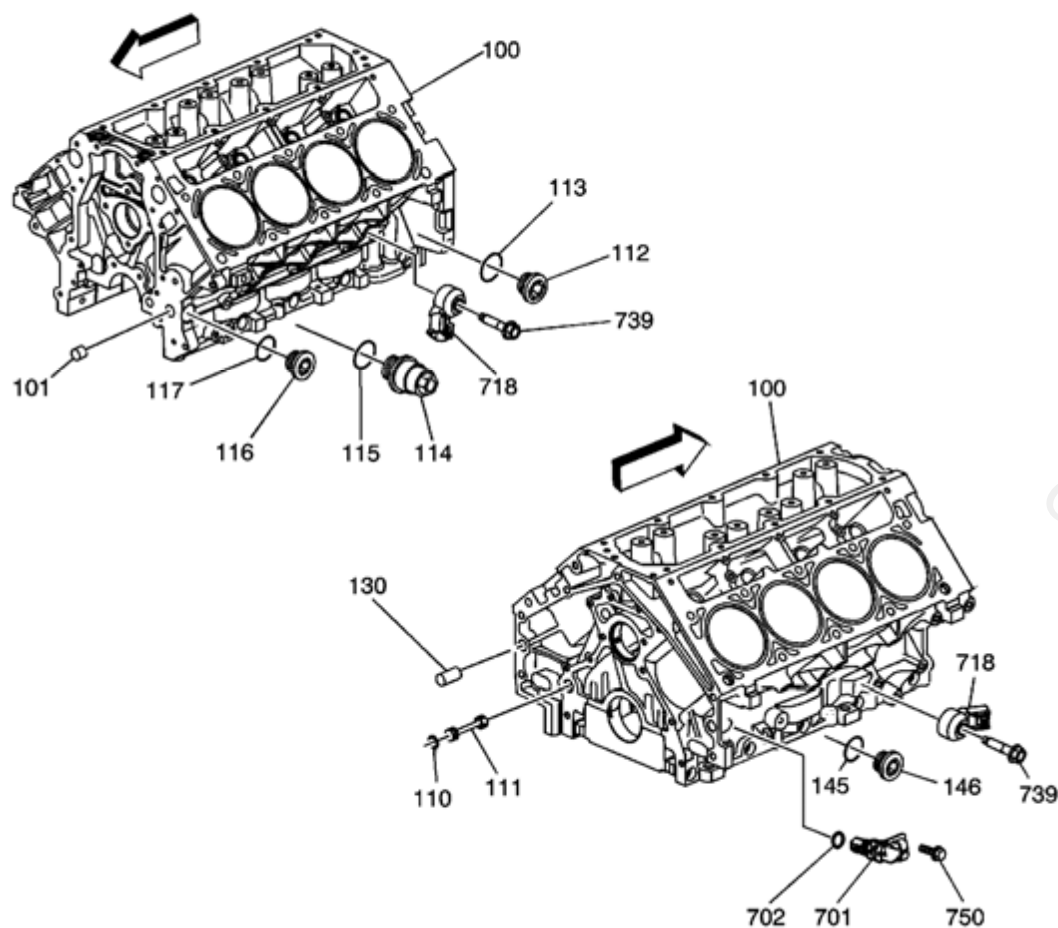


- (100) Engine Block
- (102) Connecting Rod Bolt
- (103) Connecting Rod Cap
- (104) Connecting Rod Bearing
- (105) Connecting Rod
- (106) Piston Pin
- (107) Piston
- (108) Piston Ring Set
- (109) Piston Pin Retainer
- (120) Crankshaft Thrust Bearing
- (120) Crankshaft Thrust Bearing

(121) Crankshaft Bearing
(121) Crankshaft Bearing
(122) Crankshaft Balancer Key
(124) Crankshaft
(126) Crankshaft Bearing Cap
(127) Crankshaft Bearing Cap Bolt - M8
(128) Crankshaft Bearing Cap Stud - M10
(129) Crankshaft Bearing Cap Bolt - M10
(400) Oil Pan
(401) Oil Pan Closeout Cover
(402) Oil Pan Closeout Cover Bolt
(403) Crankshaft Oil Deflector Nut
(404) Oil Pump Suction Pipe Nut
(405) Oil Pump Suction Pipe Bolt
(406) Oil Pump O-Ring Seal
(407) Oil Pump Suction Pipe
(425) Crankshaft Oil Deflector
(426) Oil Pan Gasket
(427) Oil Pan Baffle Bolt
(428) Oil Pan Baffle
(430) Oil Pan Drain Plug
(431) Oil Pan Closeout Cover
(432) Oil Pan Closeout Cover Bolt
(433) Oil Pan Cover Gasket
(434) Oil Pan Cover
(435) Oil Pan Cover Bolt
(437) Oil Filter
(438) Oil Filter Fitting
(439) Oil Pan Bolt
(453) Oil Pan Bolt
(455) Active Fuel Management Oil Pressure Relief Valve
(727) Engine Oil Level Indicator Switch
(728) O-Ring

cardiagn.com

Engine Block Plugs/Sensors

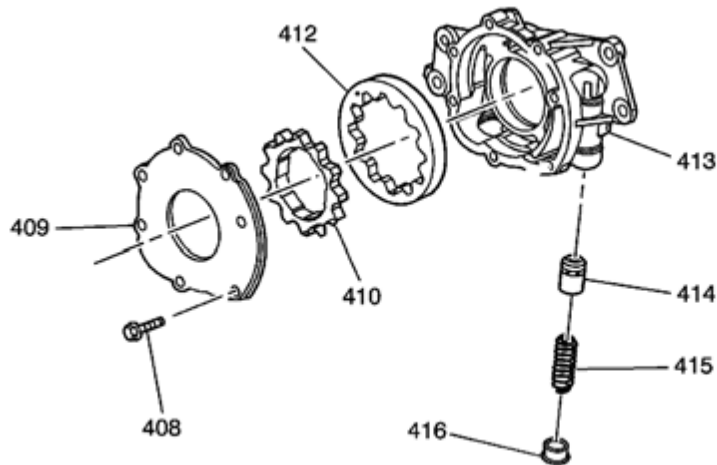


- (100) Engine Block
- (100) Engine Block
- (101) Oil Gallery Plug - Front
- (110) O-Ring
- (111) Oil Gallery Plug - Rear
- (112) Oil Gallery Plug - Side
- (113) Washer
- (114) Engine Coolant Heater
- (115) Washer
- (116) Oil Gallery Plug - Side
- (117) Washer

(130) Transmission Housing Locating Pin
(145) Washer
(146) Engine Block Coolant Drain Hole Plug
(701) Crankshaft Position (CKP) Sensor
(702) O-Ring
(718) Knock Sensor
(718) Knock Sensor
(739) Bolt
(739) Bolt
(750) CKP Sensor Bolt

cardiagn.com

Oil Pump Assembly

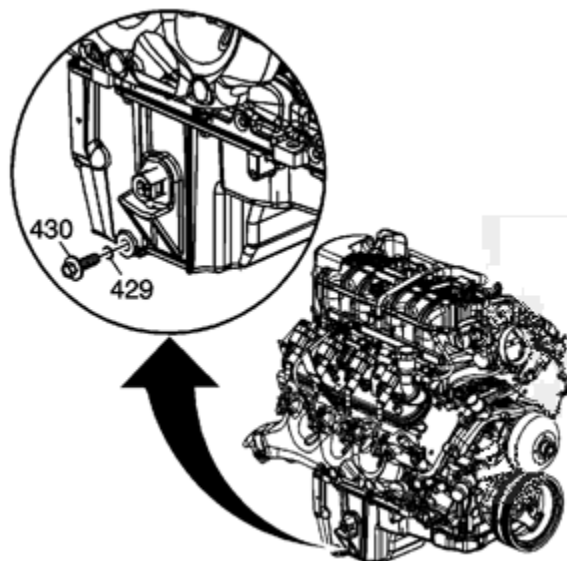


- (408) Bolt
- (409) Oil Pump Housing Cover
- (410) Oil Pump Drive Gear
- (412) Oil Pump Driven Gear
- (413) Oil Pump
- (414) Oil Pump Pressure Relief Valve
- (415) Oil Pump Pressure Relief Valve Spring
- (416) Oil Pump Housing Plug

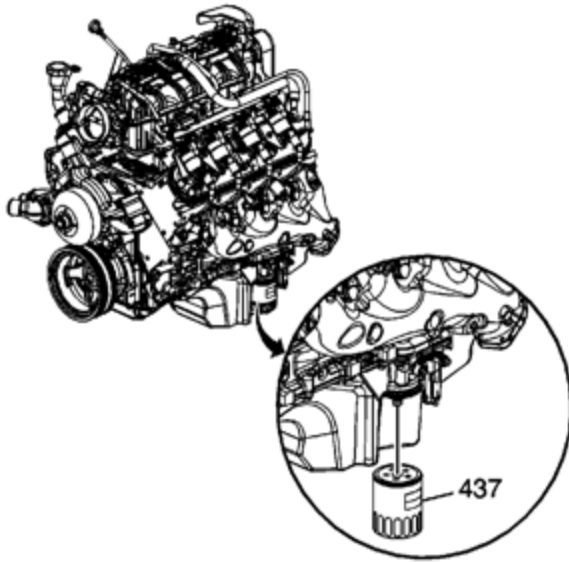
cardiagn.com

Engine Oil and Oil Filter Replacement

Removal Procedure

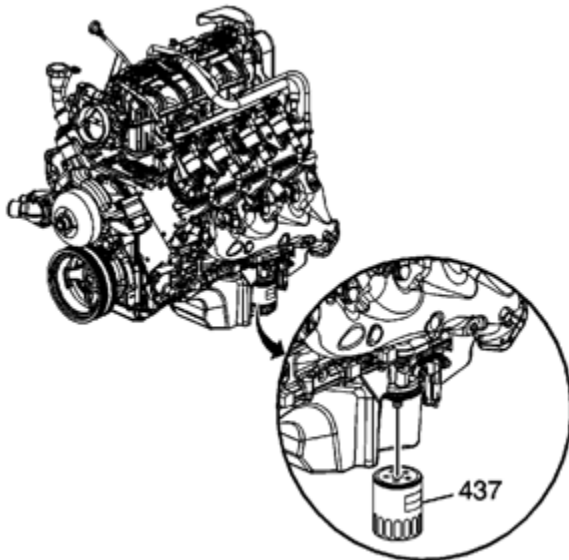


1. Open the hood.
2. Remove the oil fill cap.
3. Raise and suitably support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
4. Place a oil drain pan under the oil pan drain plug.
5. Remove the oil pan drain plug (430).
6. Allow the oil to drain completely.
7. Clean and inspect the oil pan drain plug, replace if necessary.
8. Clean and inspect the oil pan sealing surface, replace the oil pan if necessary.
9. Wipe any remaining oil from the drain plug hole and reinstall the oil pan drain plug until snug.



10. Position the drain pan under the oil filter.
11. Remove the oil filter.
12. Ensure that the oil filter gasket is still on the old filter if not, remove the oil filter gasket from the oil pan.

Installation Procedure



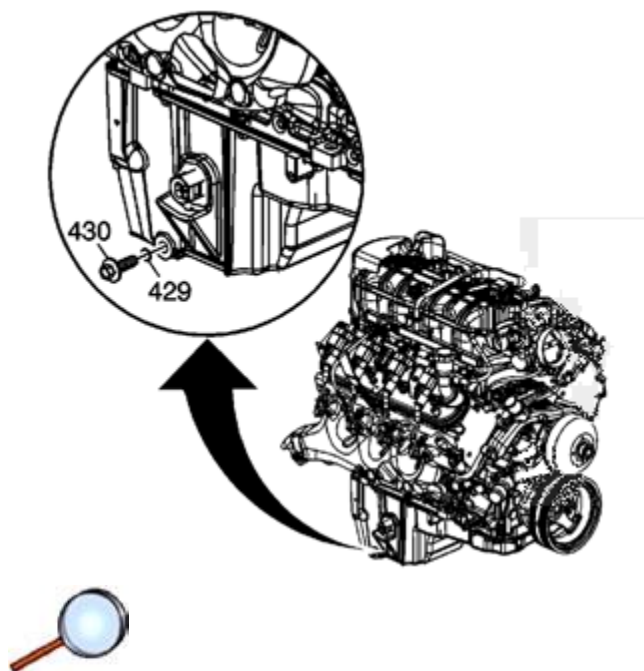
1. Apply clean engine oil to the NEW oil filter seal.

Caution: Refer to Fastener Caution in the Preface section.

2. Install the NEW oil filter (437).

Tighten

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



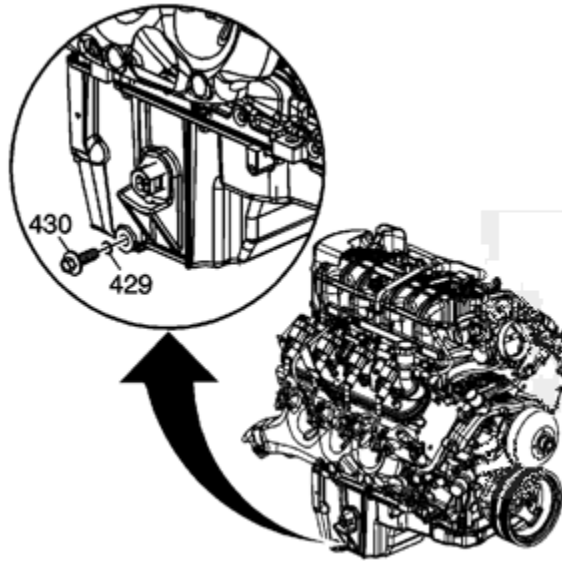
3. Tighten the oil pan drain plug (430).

Tighten

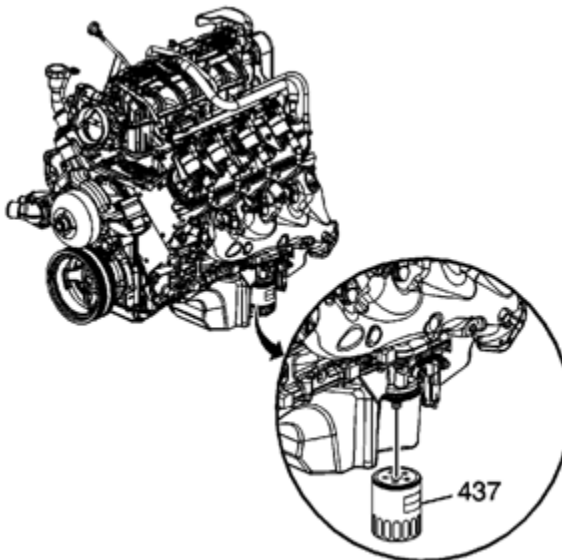
Tighten the drain plug to 25 N·m (18 lb ft).

4. Remove the oil drain pan from under the vehicle.
5. Lower the vehicle.
6. Fill the engine with new engine oil. Refer to [Approximate Fluid Capacities](#) and [Fluid and Lubricant Recommendations](#).
7. Start the engine.
8. Inspect for oil leaks after engine start up.
9. Turn off the engine and allow the oil a few minutes to drain back into the oil pan.
10. Remove the oil level indicator from the indicator tube.
11. Clean off the indicator end of the oil level indicator with a clean paper towel or cloth.
12. Install the oil level indicator into the oil level indicator tube until the oil level indicator handle contacts the top of the oil level indicator tube.
13. Again, remove the oil level indicator from the oil level indicator tube keeping the tip of the oil level indicator down.
14. Check the level of the engine oil on the oil level indicator.
15. If necessary, adjust the oil level by adding or draining oil.
16. Check for oil leaks.
17. Close the hood.

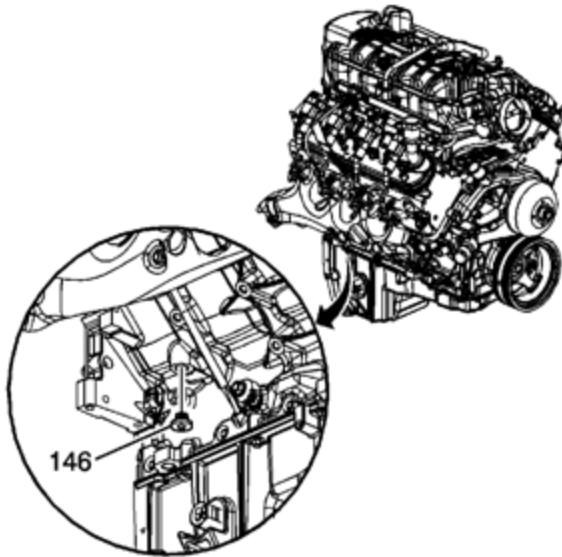
Draining Fluids and Oil Filter Removal



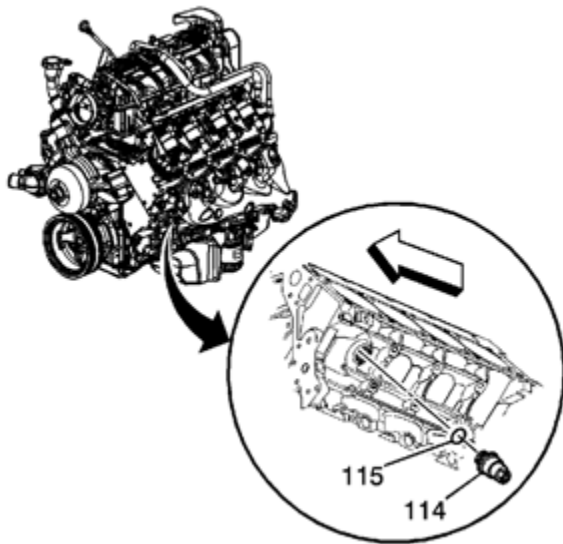
1. Remove the oil pan drain plug (430) and O-ring (429).



2. Remove the engine oil filter (437).



3. Remove the right side engine block coolant drain hole plug (146).



4. Remove the left side engine block coolant heater (114) and washer (115).

cardiagn.com

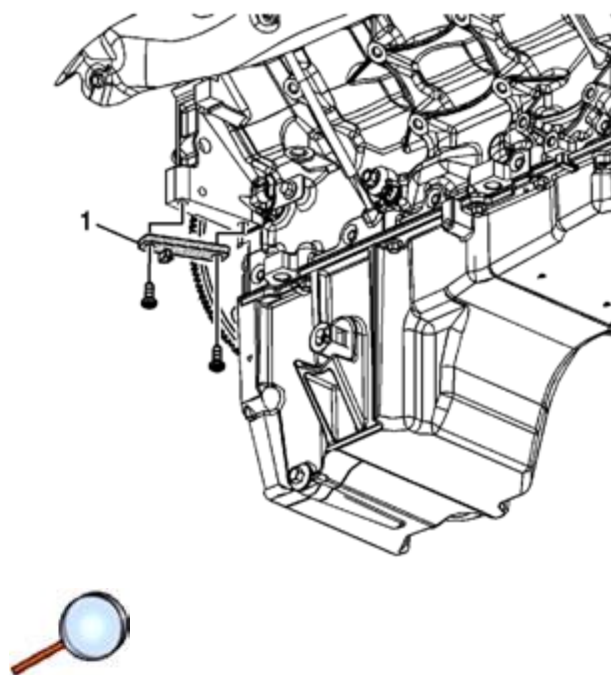
Crankshaft Balancer Removal

Special Tools

- J 41816-A Crankshaft Balancer Remover
- J 41816-2 Crankshaft End Protector
- J 42386-A Flywheel Holding Tool

For equivalent regional tools, refer to [Special Tools](#).

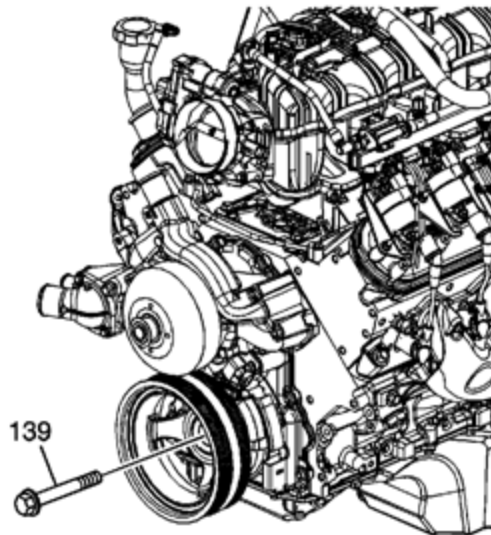
Caution: Refer to [Fastener Caution](#) in the Preface section.



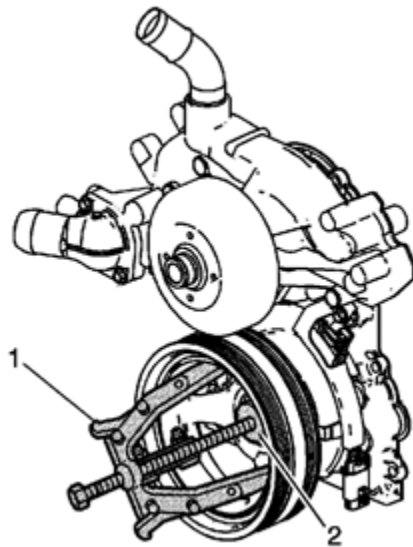
Note: Do not use the crankshaft balancer bolt again. Install a NEW crankshaft balancer bolt during final assembly.

1. Install the J 42386-A tool (1) and bolts.

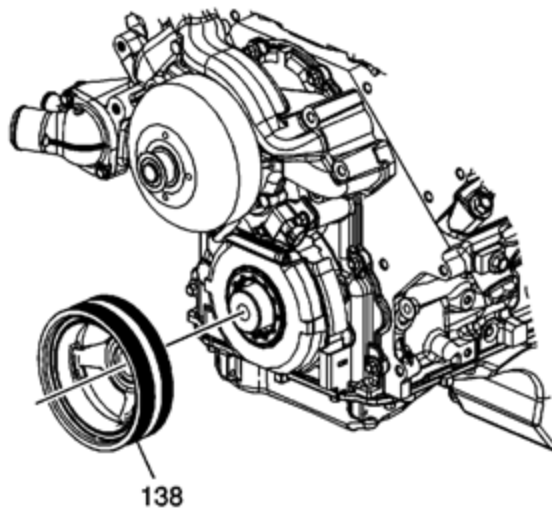
Use 1 M10 - 1.5 x 120 mm and 1 M10 - 1.5 x 45 mm bolt for proper tool operation and tighten the J 42386-A tool bolts to **50 N·m (37 lb ft)**.



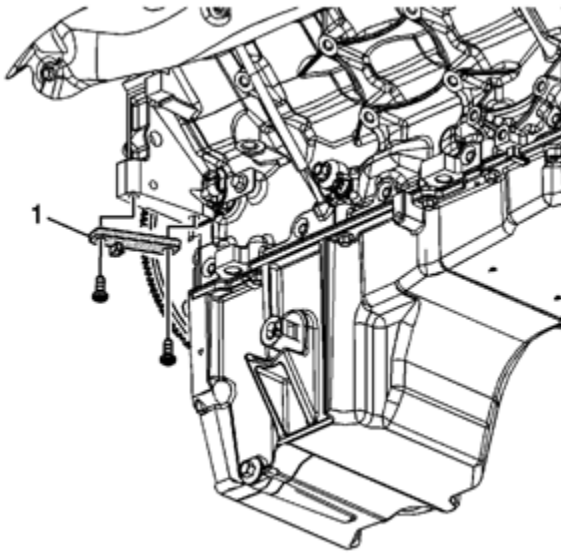
2. Remove the crankshaft balancer bolt (139).



3. Use the J 41816-A remover (1) and the J 41816-2 protector (2) in order to remove the crankshaft balancer.



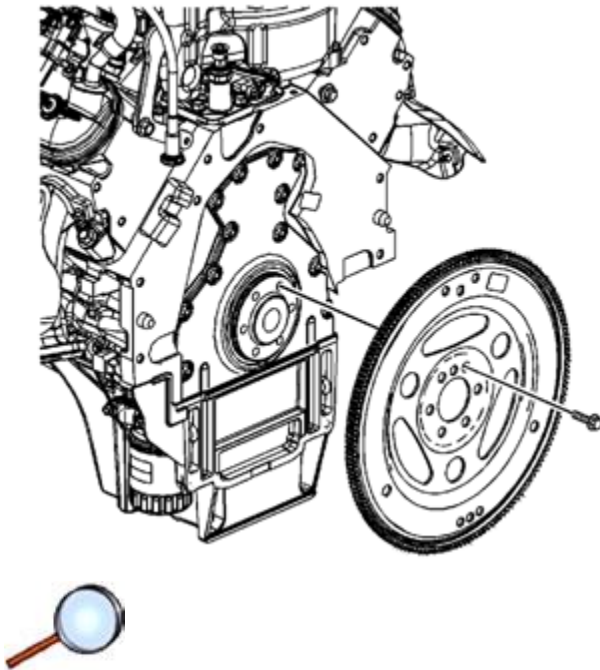
4. Remove the balancer (138).



5. Remove the J 42386-A tool (1) and bolts.

cardiagn.com

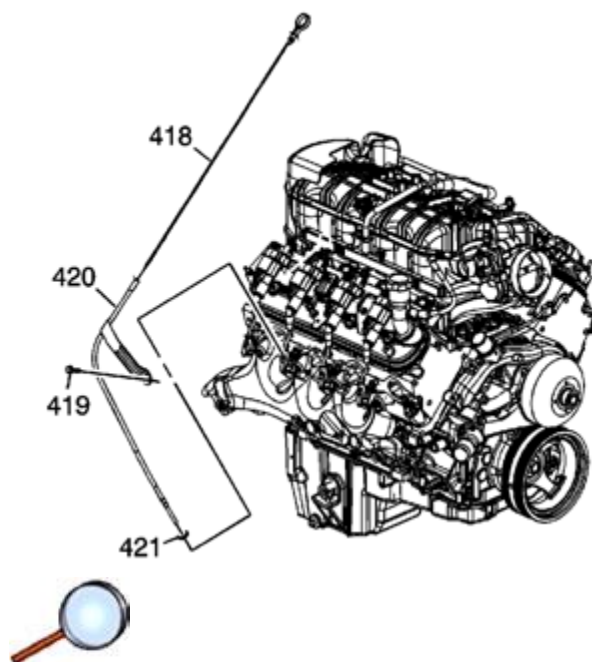
Automatic Transmission Flex Plate Removal



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.

1. Remove the engine flex plate bolts.
2. Remove the flex plate.

Oil Level Indicator and Tube Removal

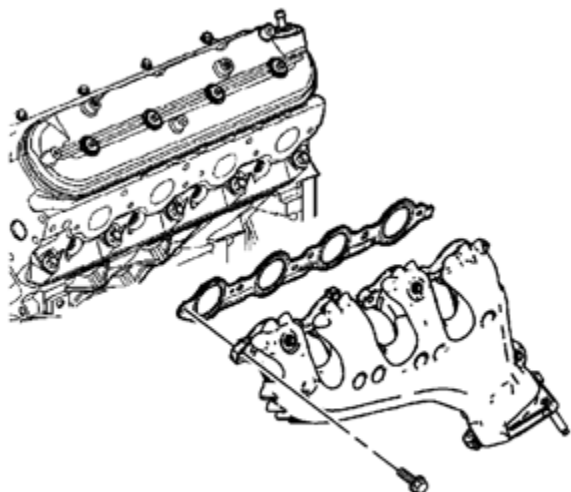


1. Remove the oil level indicator (418) from the tube.
2. Remove the oil level indicator tube bolt (419).
3. Remove the oil level indicator tube (420) from the engine block.

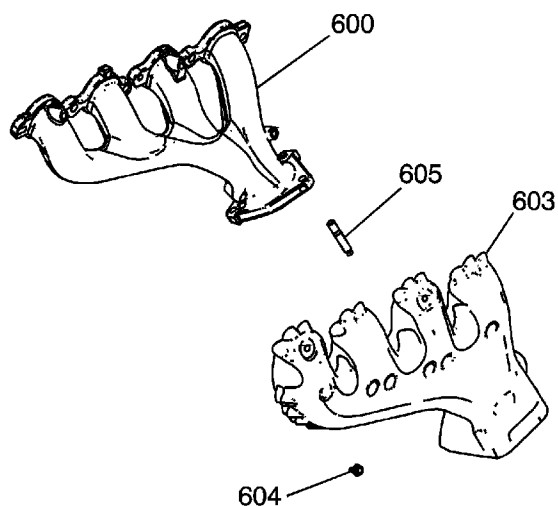
Important: Inspect the O-ring for cuts or damage. The O-ring seal may be used again if it is not cut or damaged.

4. Remove the O-ring (421) from the tube, as required.

Exhaust Manifold Removal - Left Side

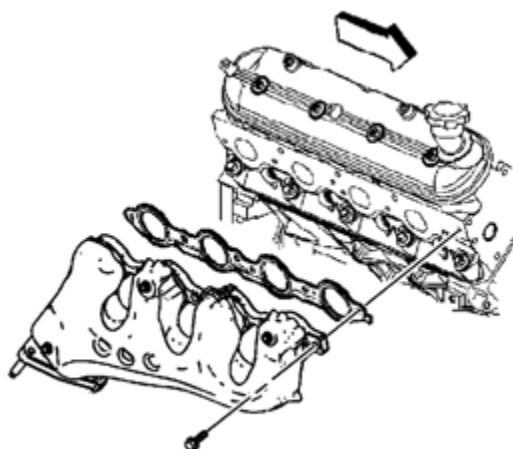


1. Remove the spark plug wires from the spark plugs.
2. Remove the exhaust manifold, bolts, and gasket.
3. Discard the gasket.

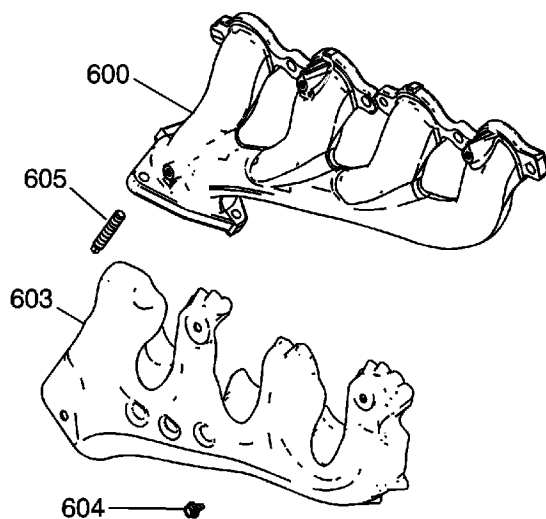


4. Remove the heat shield (603) and bolts (604) from the manifold (600), as required.
5. Remove the studs (605), as required.

Exhaust Manifold Removal - Right Side



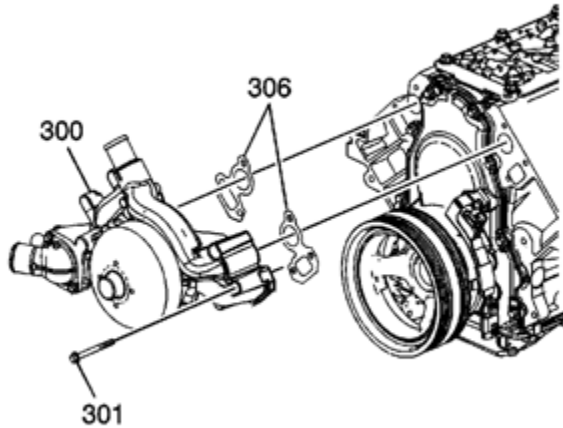
1. Remove the spark plug wires from the spark plugs.
2. Remove the exhaust manifold, bolts, and gasket.
3. Discard the gasket.



4. Remove the heat shield (603) and bolts (604) from the manifold (600), as required.
5. Remove the studs (605), as required.

[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - Off Vehicle](#) | **Document ID: 1789833**

Water Pump Removal (RPO LY2 / LH6 / LMG / LY5 / LC9)

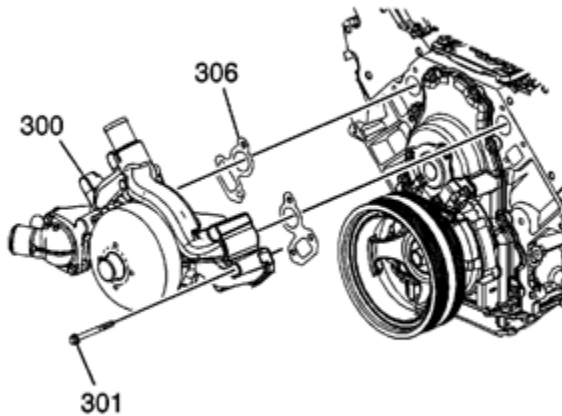


1. Remove the water pump bolts (301).
2. Remove the water pump (300) and gaskets (306).
3. Discard the water pump gaskets.

cardiagn.com

[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - Off Vehicle](#) | **Document ID: 2045737**

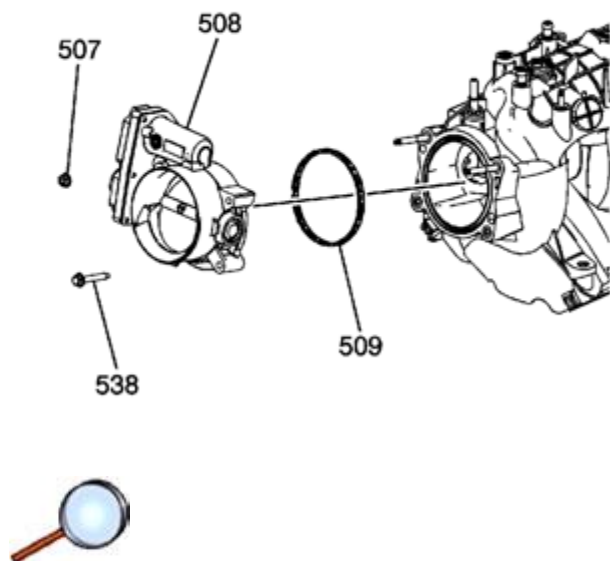
Water Pump Removal (RPO LY6 / L76 / L9H)



1. Remove the water pump bolts (301).
2. Remove the water pump (300) and gaskets (306).
3. Discard the water pump gaskets.

cardiagn.com

Throttle Body Removal

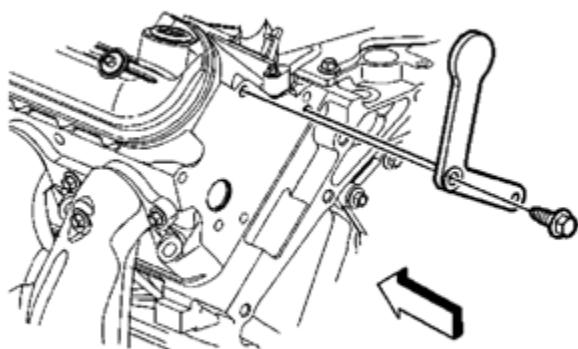


Important: The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, remove the manifold as a complete assembly.

1. Remove the electrical wire harness connectors from the throttle body.
2. Remove the throttle body nuts (507) and bolts (538).
3. Remove the throttle body (508).
4. Remove the throttle body gasket (509).
5. Discard the gasket.

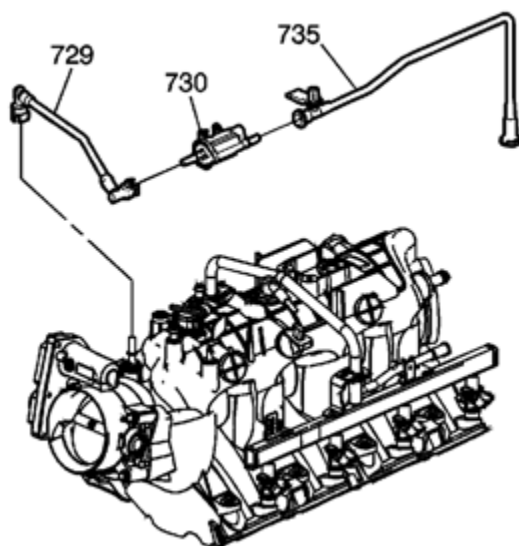
Fuel Rail and Injectors Removal

Warning: Refer to [Fuel Rail Stop Bracket Installation Warning](#) in the Preface section.



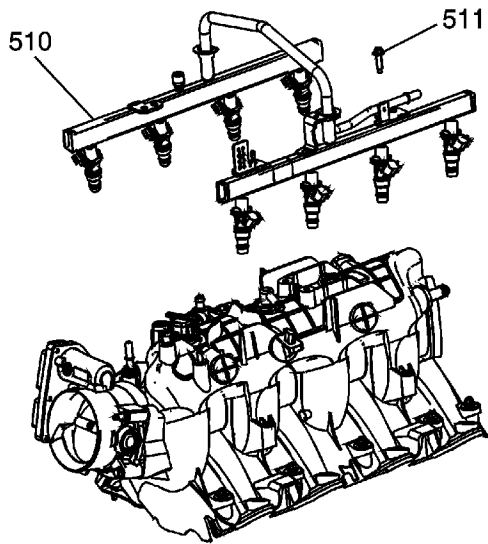
Note: The intake manifold, throttle body, fuel injection rail and fuel injectors may be removed as an assembly. If not servicing the individual components, remove the intake manifold as a complete assembly.

1. Remove the fuel rail stop bracket and bolt, as required.





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

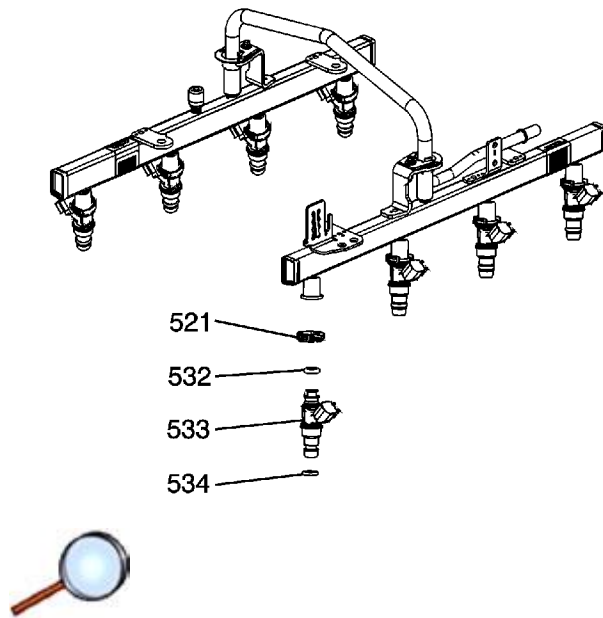


3. Remove the fuel rail bolts (511).

Note:

- Do not separate the fuel injectors from the fuel rail, unless component service is required.
- Use cleanliness and care when handling the fuel system components.
- Do not allow dirt or debris to enter the fuel injectors or fuel rail components. Cap ends, as necessary.

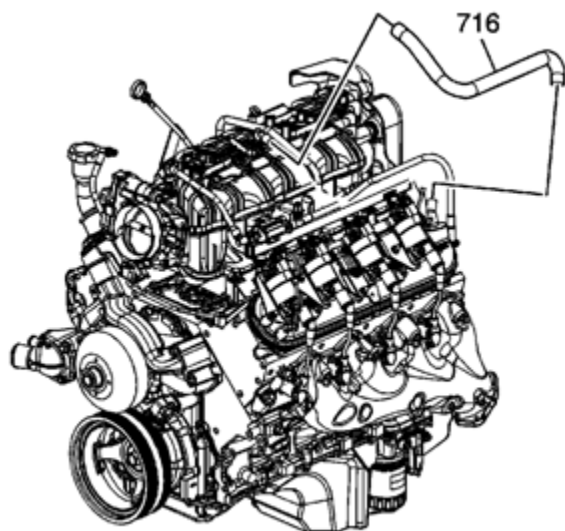
4. Remove the fuel rail (510) with injectors. Lift evenly on both sides of the fuel rail until all the injectors have left their bores.



5. Remove the fuel injector retainers (521) and fuel injectors (533), as required.
6. Remove the O-rings (532, 534) from the injectors, as required.

cardiagn.com

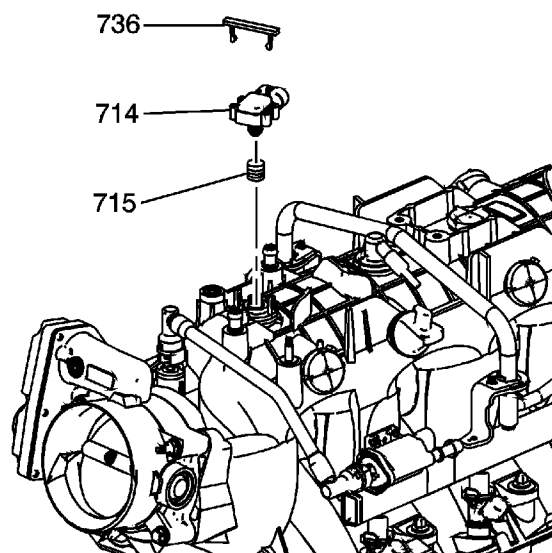
Intake Manifold Removal (RPO LH6 / LMG / LY5 / LC9 / L76)



Important:

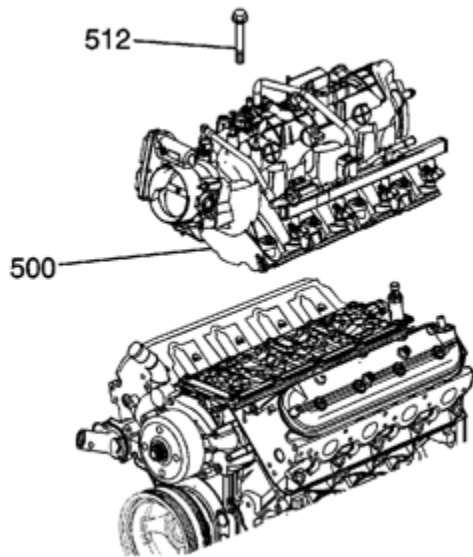
- The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, remove the manifold as a complete assembly.
- DO NOT use the intake manifold-to-cylinder head gaskets again.

1. Remove the positive crankcase ventilation (PCV) hose - dirty air (716).

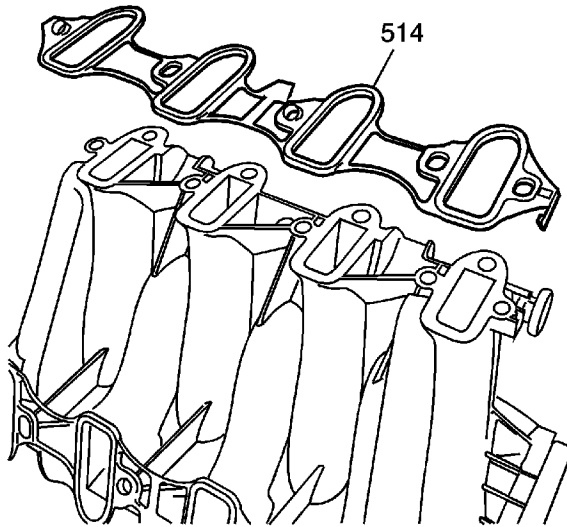




2. Remove the manifold absolute pressure (MAP) sensor (714) and retainer (736), as required.
3. Remove the O-ring (715) from the sensor, as required.

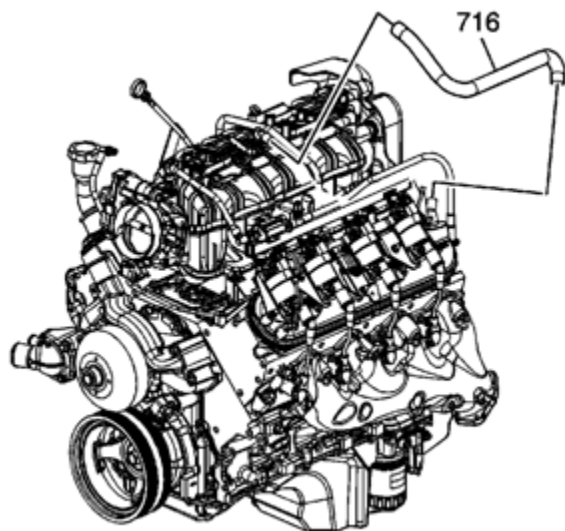


4. Remove the intake manifold bolts (512).
5. Remove the intake manifold (500) with gaskets.



6. Remove the intake manifold gaskets (514).
7. Discard the intake manifold gaskets.

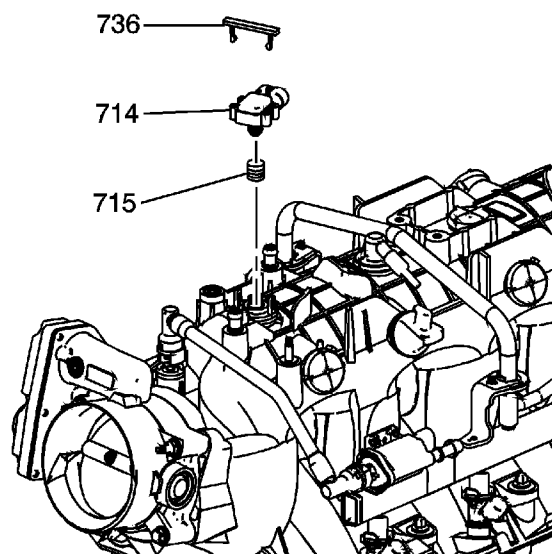
Intake Manifold Removal (RPO LY2 / LY6 / L9H)



Important:

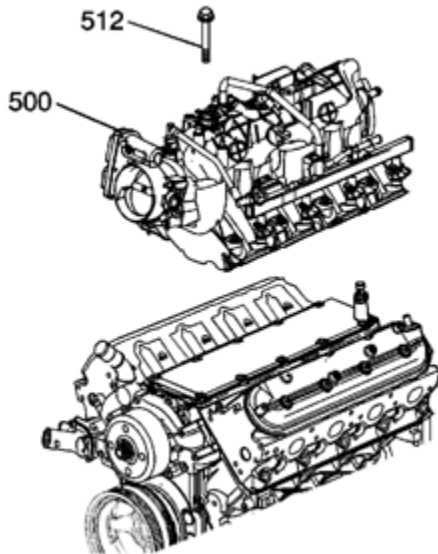
- The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, remove the manifold as a complete assembly.
- DO NOT use the intake manifold-to-cylinder head gaskets again.

1. Remove the positive crankcase ventilation (PCV) hose - dirty air (716).

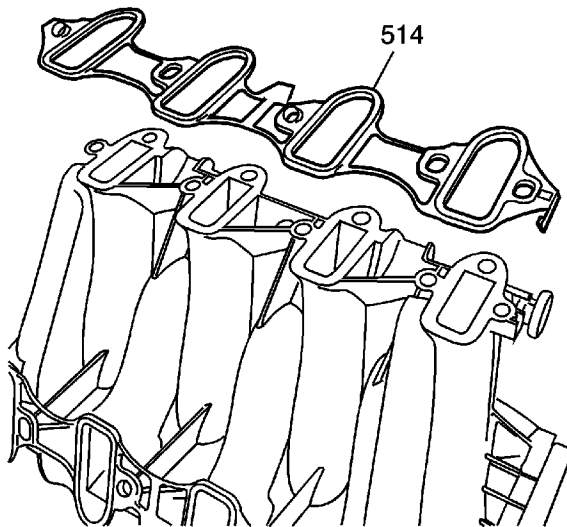




2. Remove the manifold absolute pressure (MAP) sensor (714) and retainer (736), as required.
3. Remove the O-ring (715) from the sensor, as required.



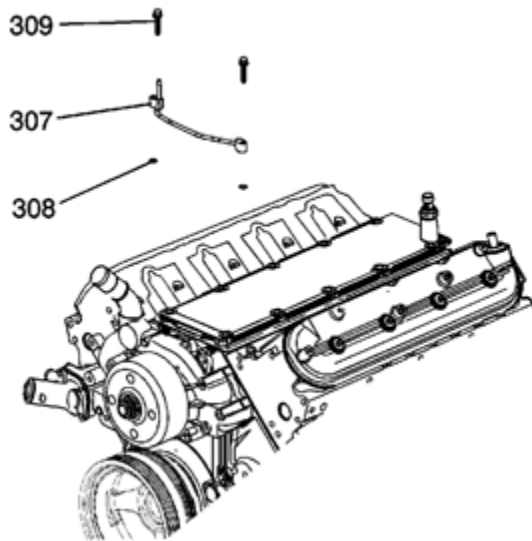
4. Remove the intake manifold bolts (512).
5. Remove the intake manifold (500) with gaskets.



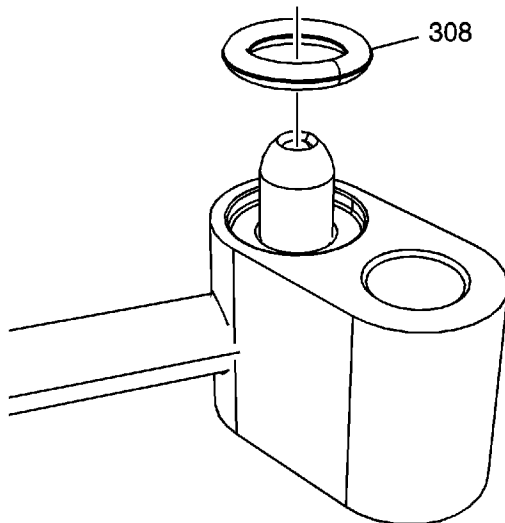
6. Remove the intake manifold gaskets (514).
7. Discard the intake manifold gaskets.

[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - Off Vehicle](#) | **Document ID: 2045238**

Engine Coolant Air Bleed Pipe and Hole Cover Removal (RPO LY2/LY6/L9H)

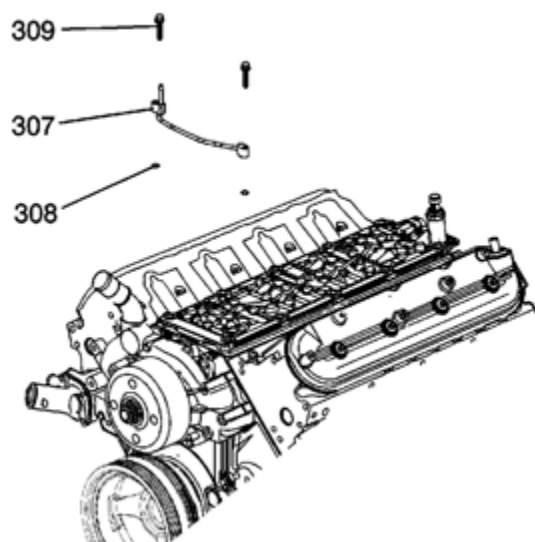


- 
1. Remove the engine coolant air bleed pipe bolts (309).
 2. Remove the pipe (307) with seals (308).

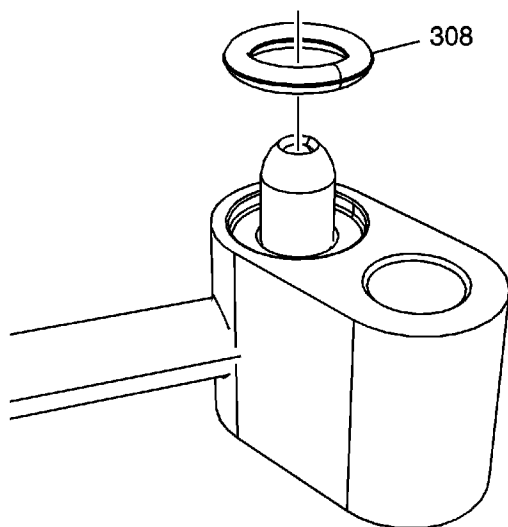


- 
3. Remove the seals (308) from the pipe.
 4. Discard the seals.

Engine Coolant Air Bleed Pipe and Hole Cover Removal (RPO LH6 / LMG / LY5 / LC9 / L76)

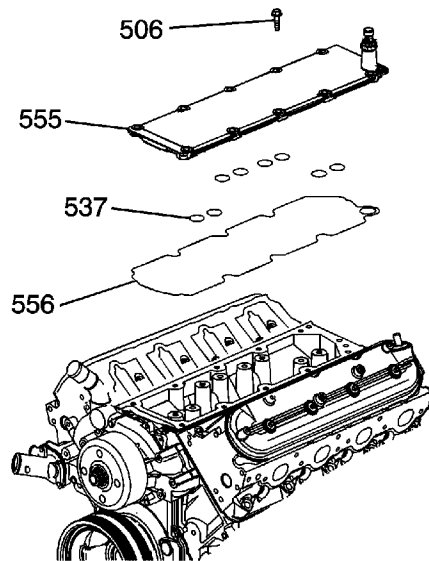


1. Remove the engine coolant air bleed pipe bolts (309).
2. Remove the pipe (307) with seals (308).

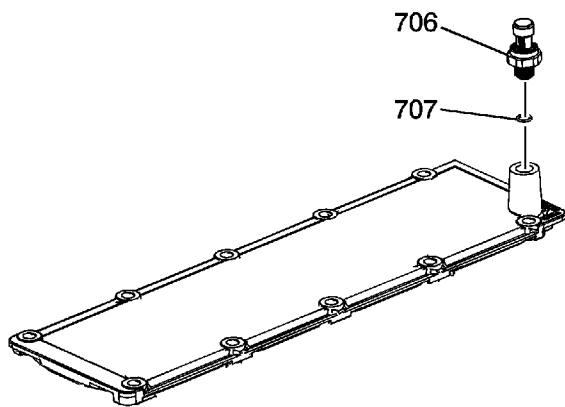


3. Remove the seals (308) from the pipe.
4. Discard the seals.

Engine Block Valley Cover Removal

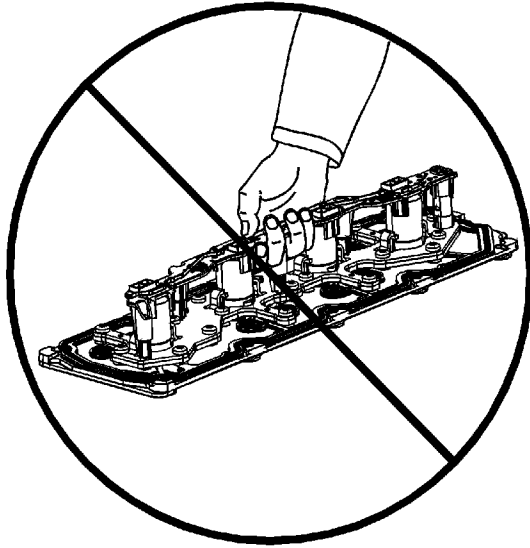


1. Remove the valley cover bolts (506).
2. Remove the valley cover (555) and gasket (556).
3. Remove the O-ring seals (537) from the cover.

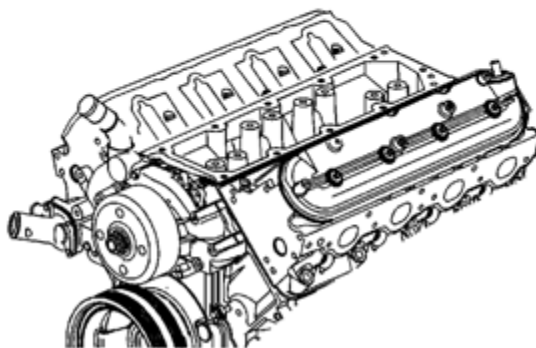
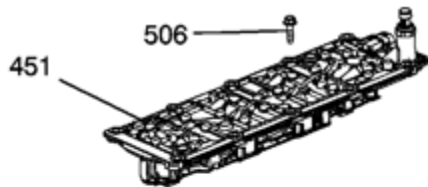


4. Remove the oil pressure sensor (706) and washer (707), as required.

Valve Lifter Oil Manifold Removal



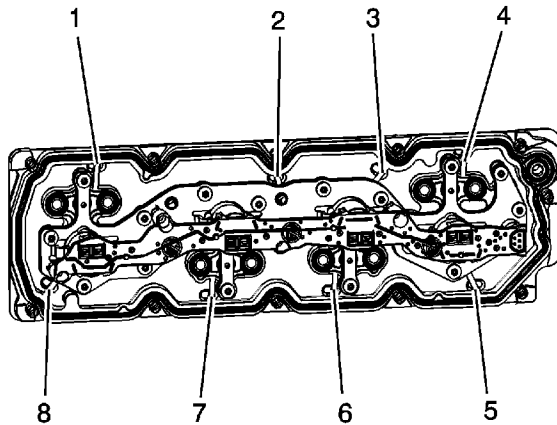
1. Do not lift the manifold by the electrical lead frame.



2. Remove the valve lifter oil manifold bolts (506).

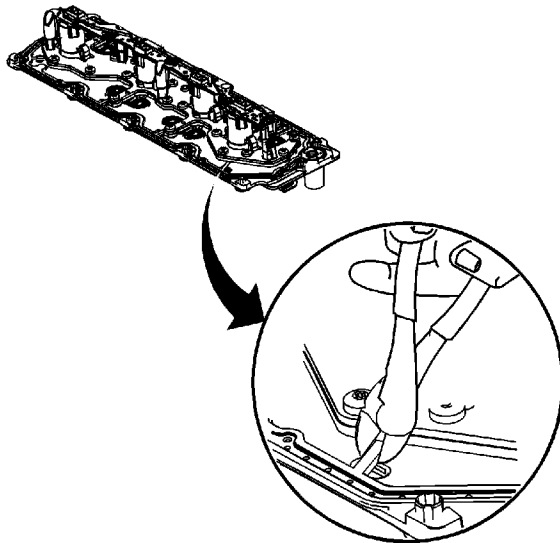
Important: Do not allow dirt or debris to enter the oil passages of the manifold. Plug, as required.

3. Remove the valve lifter oil manifold (451).

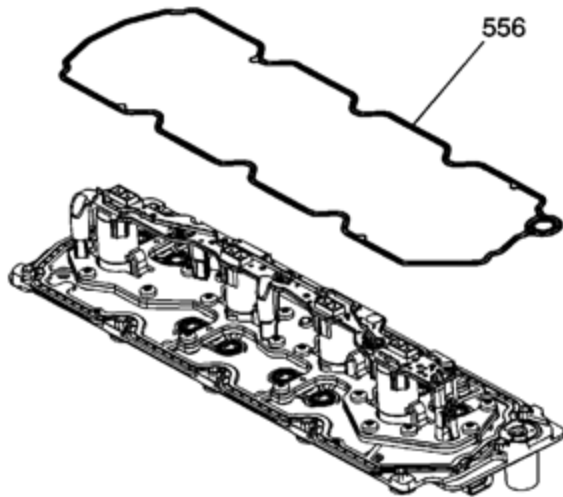


Important: Remove only the outer gasket from the manifold. Do not disassemble any of the internal components of the manifold in an attempt to remove the 8 inner sealing gaskets. If the inner gaskets are cut or damaged, replace the manifold as an assembly. Only use a wire-cutter type tool in order to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

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



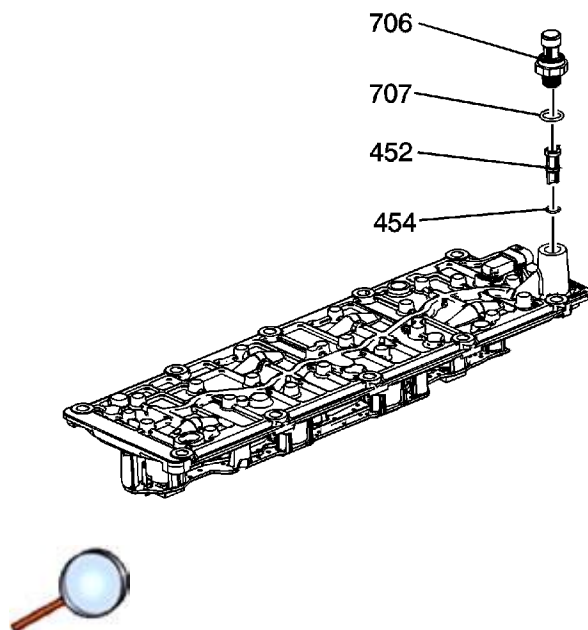
5. Using a wire-cutter type tool, cut the 8 retaining straps.



6. Remove the outer gasket (556) from the manifold.

cardiagn.com

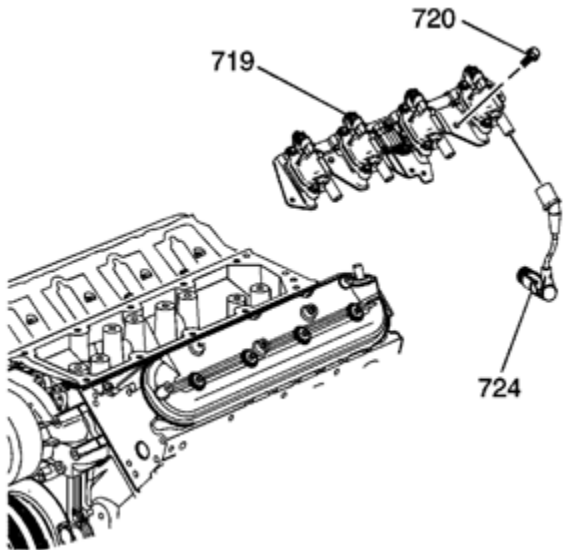
Valve Lifter Oil Filter Removal



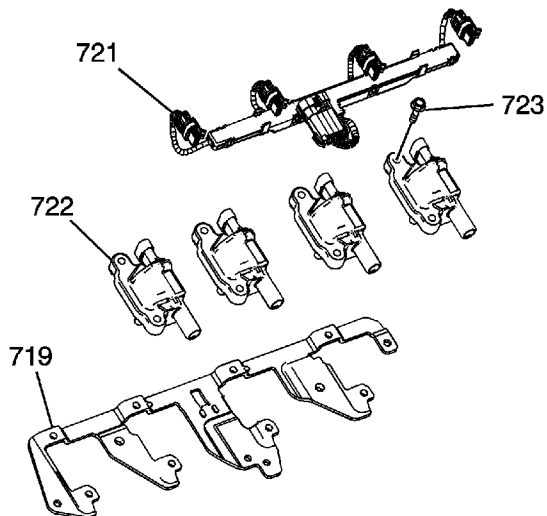
Important: Do not allow dirt or debris to enter the oil passages of the manifold. Plug, as required.

1. Remove the oil pressure sensor (706).
2. Remove the oil filter (452).
3. Inspect the O-ring (454) for cuts or damage. If the filter is plugged or the O-ring is cut or damaged, replace the filter and O-ring as an assembly.

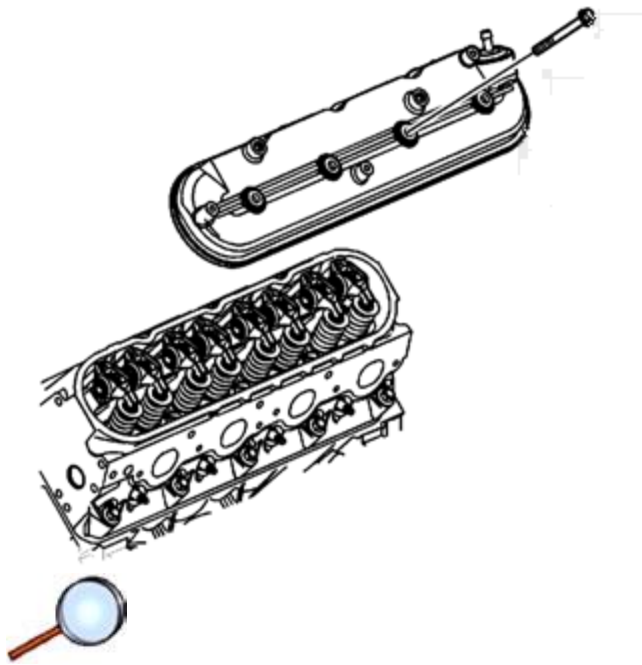
Valve Rocker Arm Cover Removal - Left Side



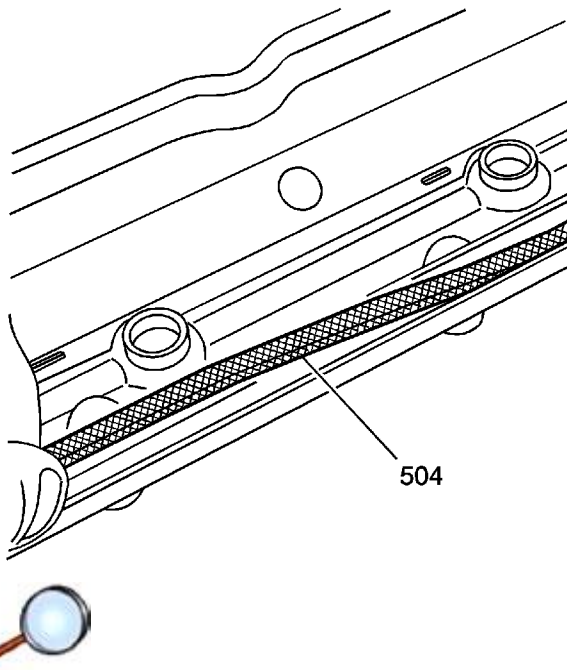
- 
1. Remove the spark plug wires (724).
 2. Remove the ignition coil bracket studs (720).
 3. Remove the ignition coil and bracket assembly (719).



- 
4. Disconnect the ignition coil electrical connectors.
 5. Remove the bolts (723), coils (722), and wire harness (721) from the bracket (719), as required.

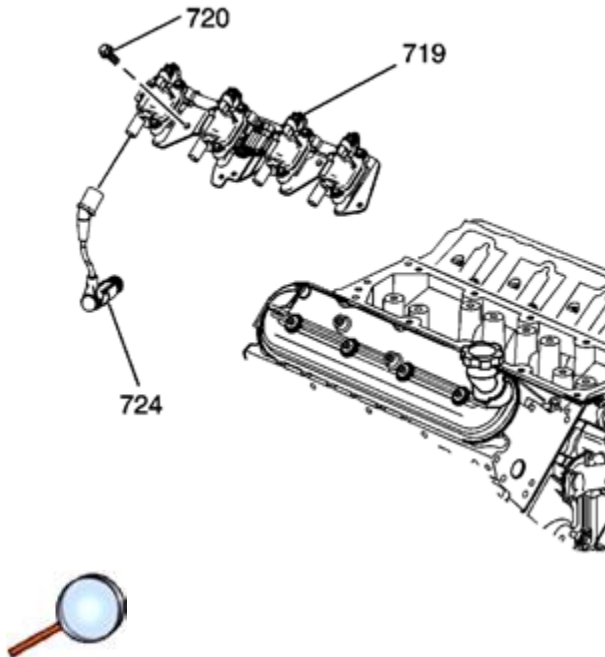


6. Remove the valve rocker arm cover bolts and cover.
7. Remove and discard the valve rocker arm cover gasket, valve rocker arm cover grommets and valve rocker arm cover bolts if they are serviced with the grommet.



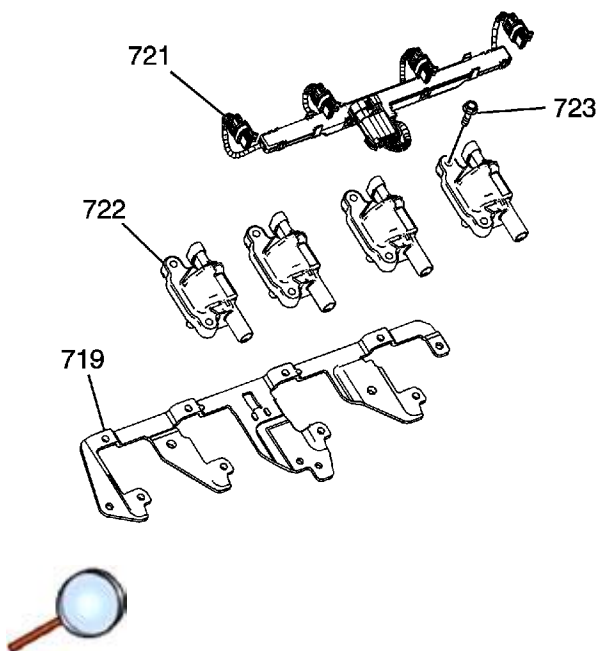
8. Remove the gasket (504) from the cover.

Valve Rocker Arm Cover Removal - Right Side

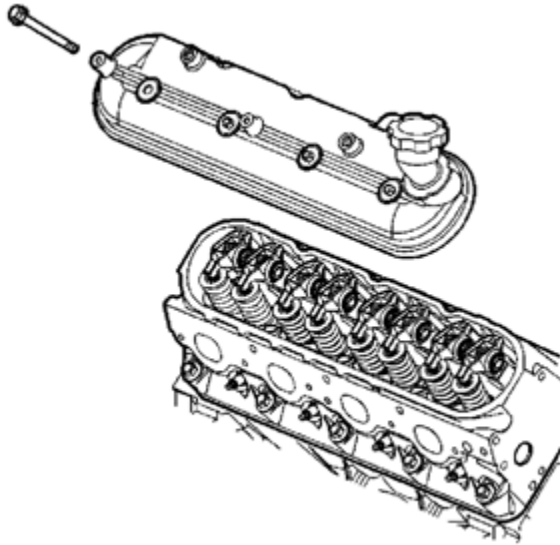


Important: Do not remove the oil fill tube from the cover, unless service is required. If the oil fill tube has been removed from the cover, install a NEW tube during assembly.

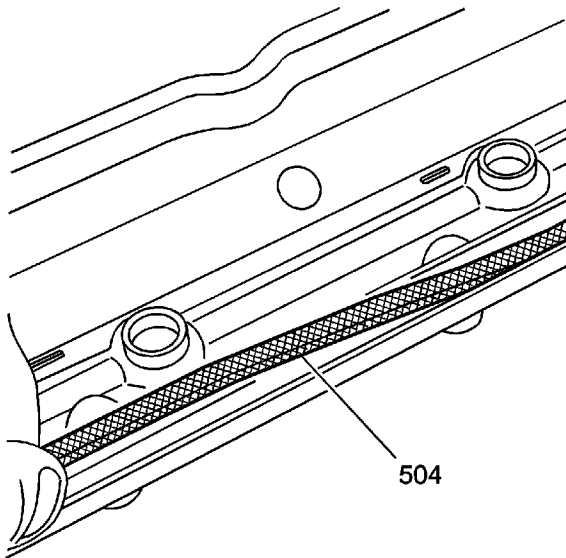
1. Remove the spark plug wires (724).
2. Remove the ignition coil bracket studs (720).
3. Remove the ignition coil and bracket assembly (719).



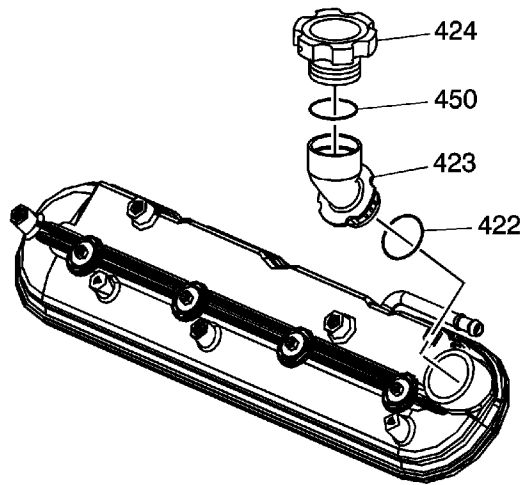
4. Disconnect the ignition coil electrical connectors.
5. Remove the bolts (723), coils (722), and wire harness (721) from the bracket (719), as required.



6. Remove the valve rocker arm cover bolts and cover.
7. Remove and discard the valve rocker arm cover gasket, valve rocker arm cover grommets and valve rocker arm cover bolts if they are serviced with the grommet.



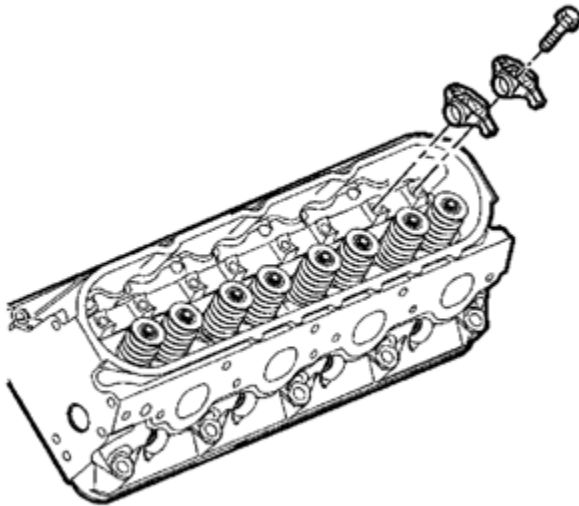
8. Remove the gasket (504) from the cover.



9. Remove the oil fill cap (424) from the oil fill tube (423).
10. Remove the oil fill tube, as required.
11. Discard the oil fill tube.

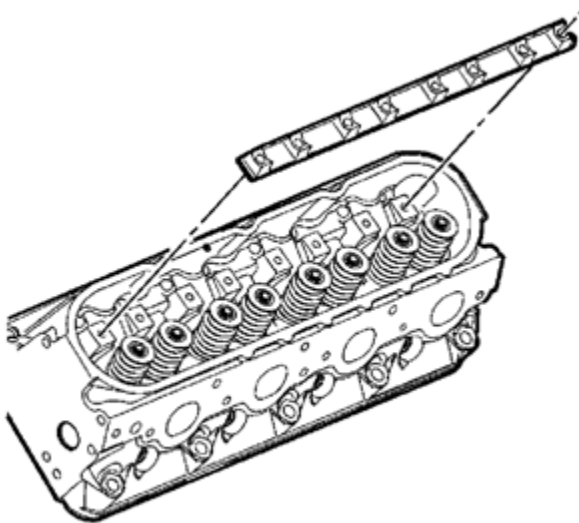
cardiagn.com

Valve Rocker Arm and Push Rod Removal (RPO LY2 / LH6 / LMG / LY5 / LC9)

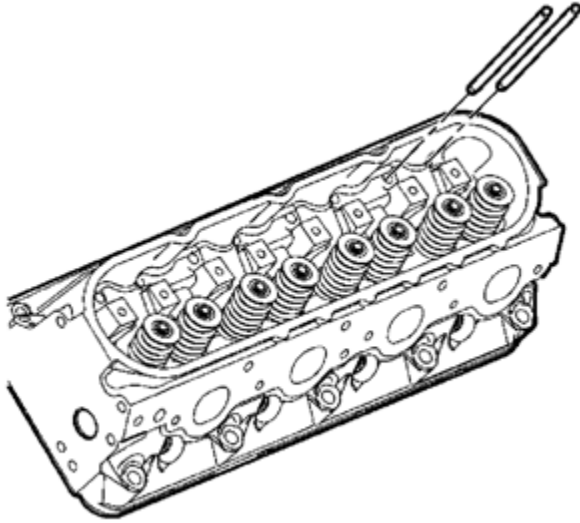


Important: Place the valve rocker arms, valve pushrods, and pivot support, in a rack so they can be installed in the same location from which they were removed.

1. Remove the valve rocker arm bolts.
2. Remove the valve rocker arms.



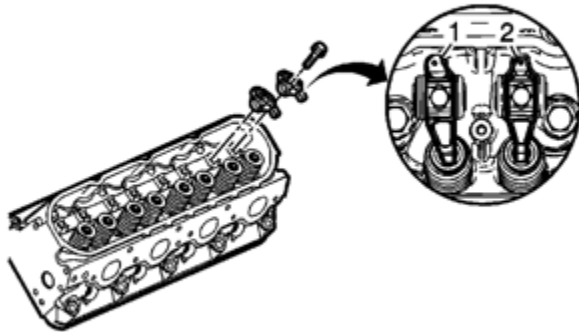
3. Remove the valve rocker arm pivot support.



4. Remove the pushrods.

cardiagn.com

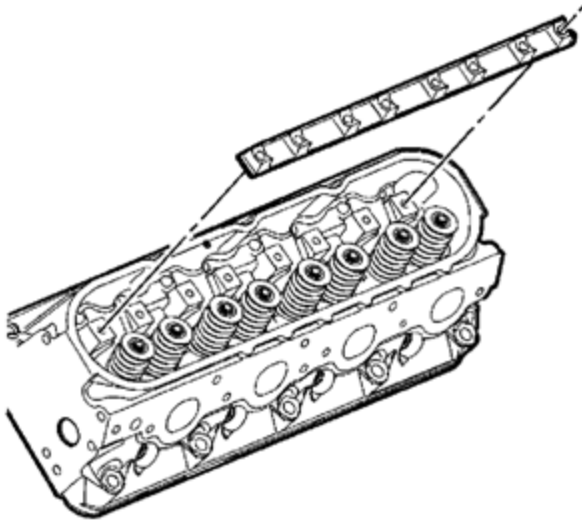
Valve Rocker Arm and Push Rod Removal (RPO LY6 / L76 / L9H)



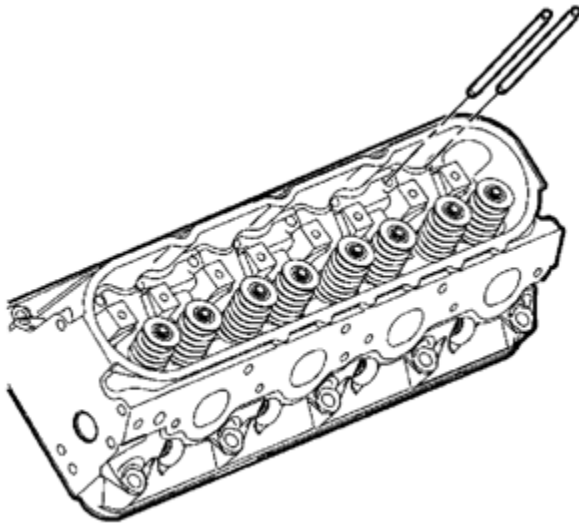
Important: Place the valve rocker arms, valve pushrods, and pivot support, in a rack so they can be installed in the same location from which they were removed.

1. Remove the valve rocker arm bolts.
2. Remove the valve rocker arms.

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



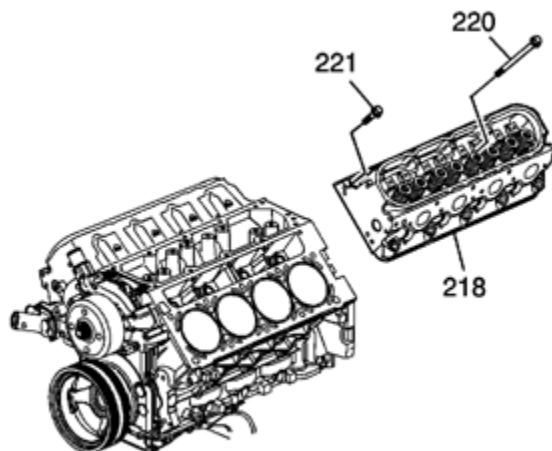
3. Remove the valve rocker arm pivot support.



4. Remove the pushrods.

cardiagn.com

Cylinder Head Removal - Left Side

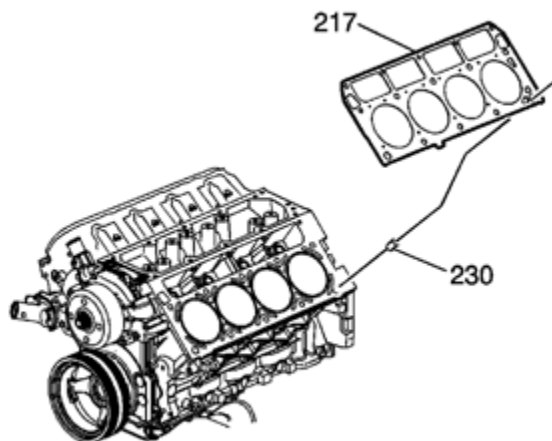


Note: The cylinder head bolts are of a torque-to-yield design and are NOT to be used again. Install NEW cylinder head bolts during assembly.

1. Remove the cylinder head bolts (220, 221).

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

2. Remove the cylinder head (218).

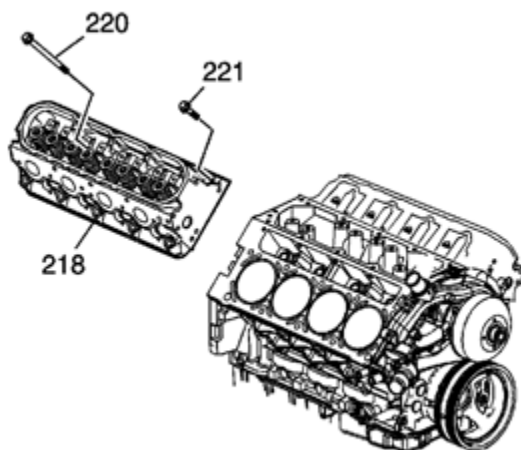




3. Remove the gasket (217) and locating pins (230).
4. Discard the gasket and cylinder head bolts.

cardiagn.com

Cylinder Head Removal - Right Side

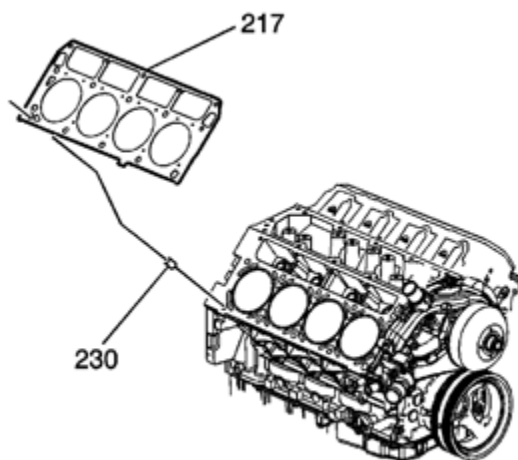


Note: The cylinder head bolts are of a torque-to-yield design and are NOT to be used again. Install NEW cylinder head bolts during assembly.

1. Remove the cylinder head bolts (220, 221).

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

2. Remove the cylinder head (218).

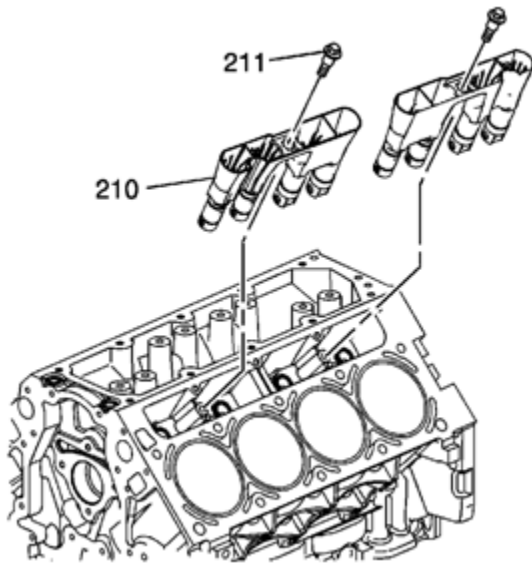




3. Remove the gasket (217) and locating pins (230).
4. Discard the gasket and cylinder head bolts.

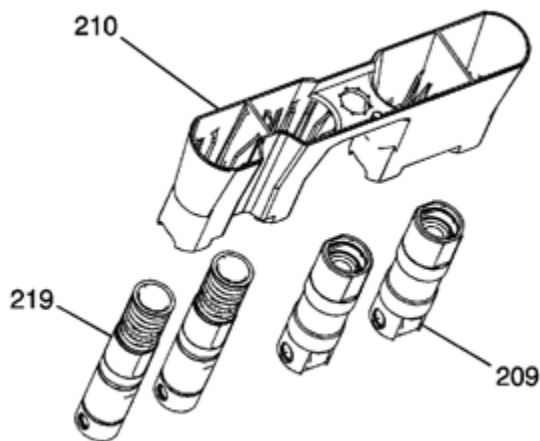
cardiagn.com

Valve Lifter Removal (RPO LH6 / LMG / LY5 / LC9 / L76)

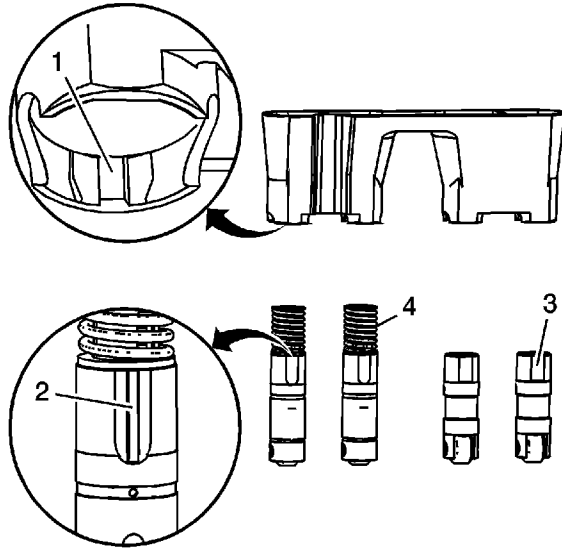


1. Remove the bolts (211).
2. Remove the guides (210) with lifters.

Note the installed position of the guides. The notched area of the guide is to align with the locating tab of the block.

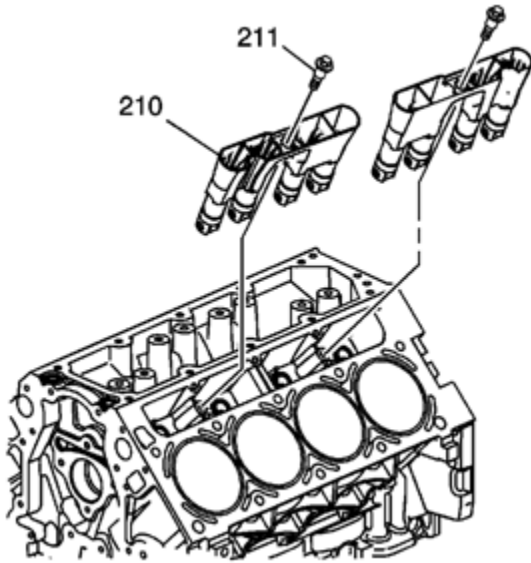


3. Remove the valve lifters (209, 219) from the guide (210).



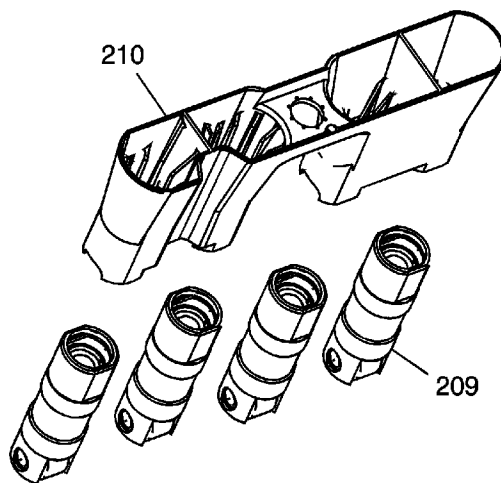
4. Organize or mark the components so they can be installed in the same location from which they were removed. The active fuel management lifters (4) are installed into the guide by aligning the notched area of the guide (1) with the raised surface on the side of the lifter (2). Refer to [Separating Parts](#) .

Valve Lifter Removal (RPO LY2 / LY6 / L9H)



1. Remove the guide bolts (211).
2. Remove the guides (210) with lifters.

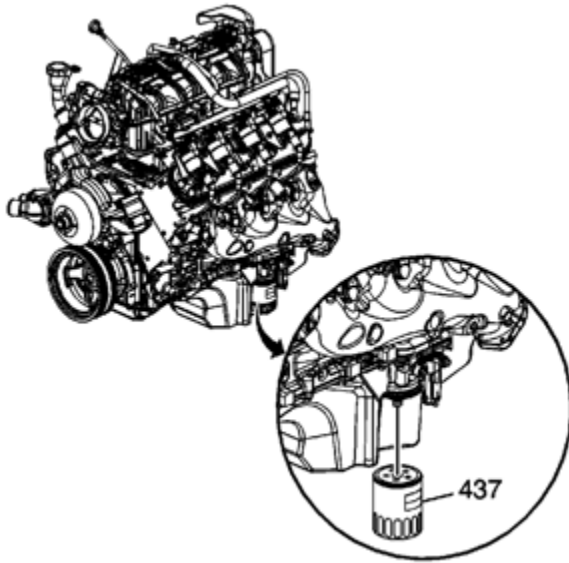
Note the installed position of the guides. The notched area of the guide is to align with the locating tab on the block.



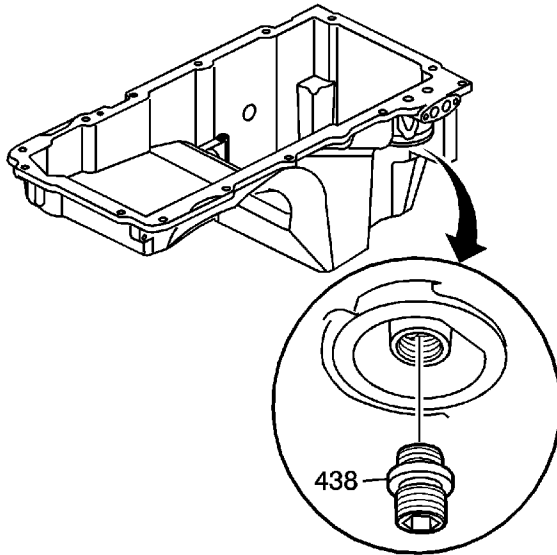
3. Remove the valve lifters (209) from the guide (210).
4. Organize or mark the components so they can be installed in the same location from which they were removed. Refer to [Separating Parts](#).

cardiagn.com

Oil Filter Removal

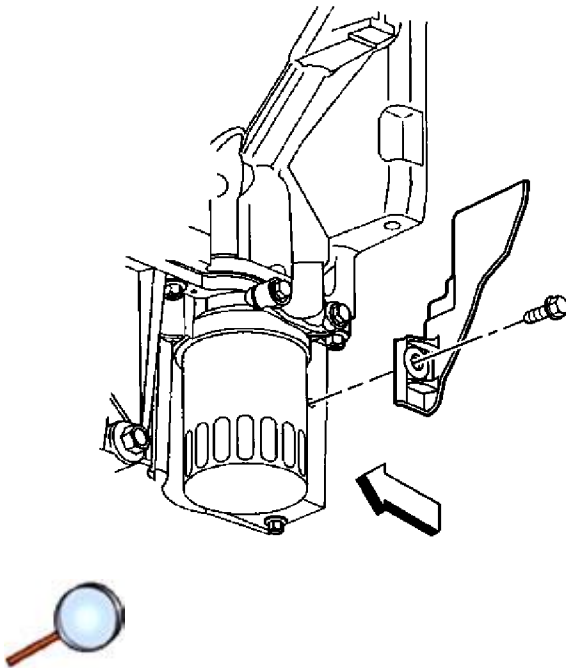


1. Remove the oil filter (437).



2. Remove the oil filter fitting (438).

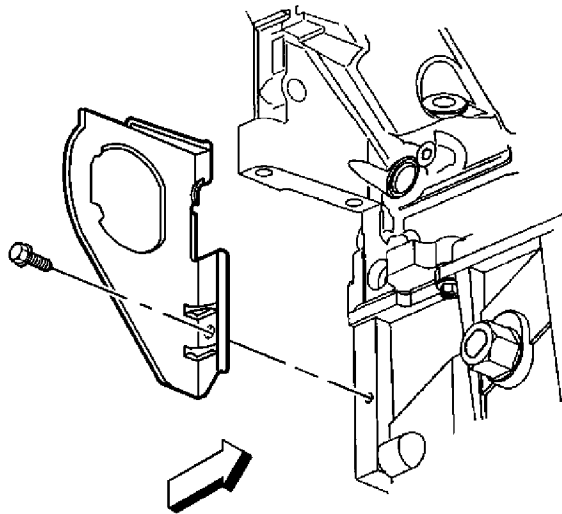
Oil Pan Removal



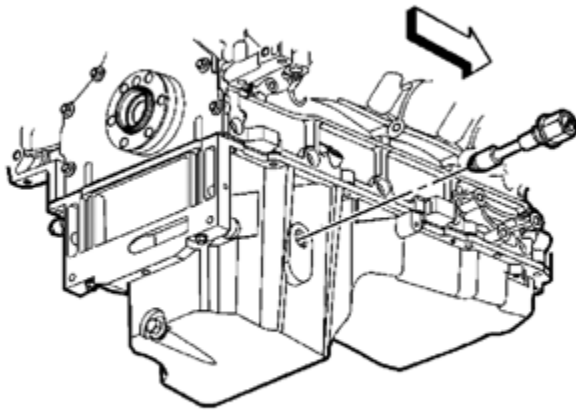
Important:

- The original oil pan gasket is retained and aligned to the oil pan by rivets. When installing a new gasket, it is not necessary to install new oil pan gasket rivets.
- DO NOT use the oil pan gasket again. When installing the oil pan, install a NEW oil pan gasket.
- It is not necessary to remove the oil level indicator switch prior to oil pan removal. Remove the oil level indicator switch, if service is required.

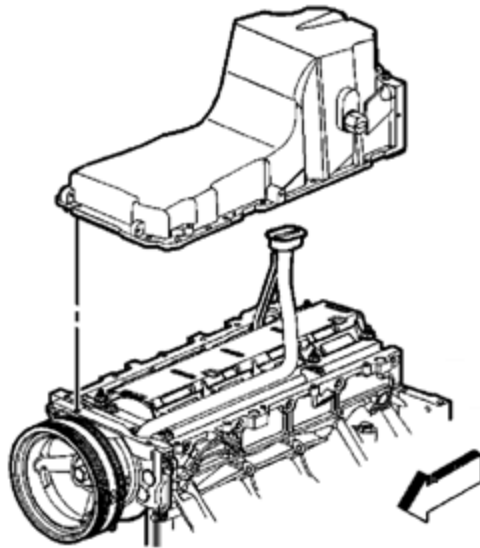
1. Remove the left closeout cover and bolt.



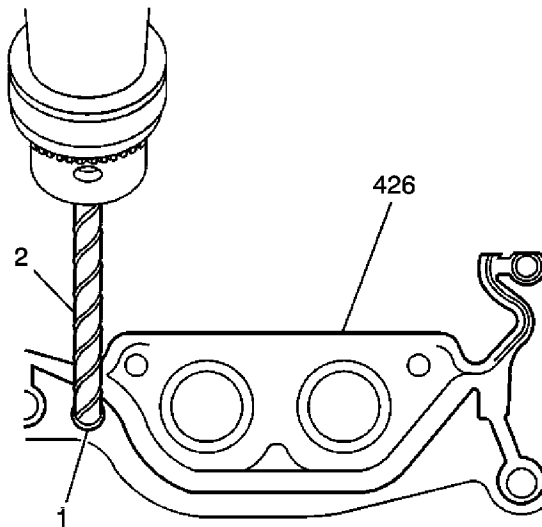
2. Remove the right closeout cover and bolt.



3. Remove the oil indicator switch from the oil pan, if required.



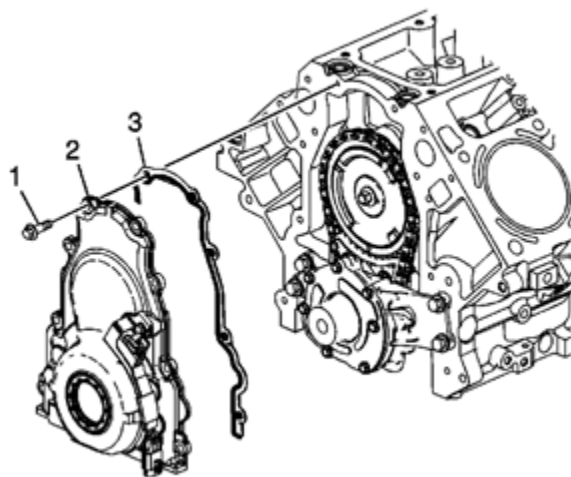
4. Remove the oil pan bolts.
5. Remove the oil pan.

**Important:**

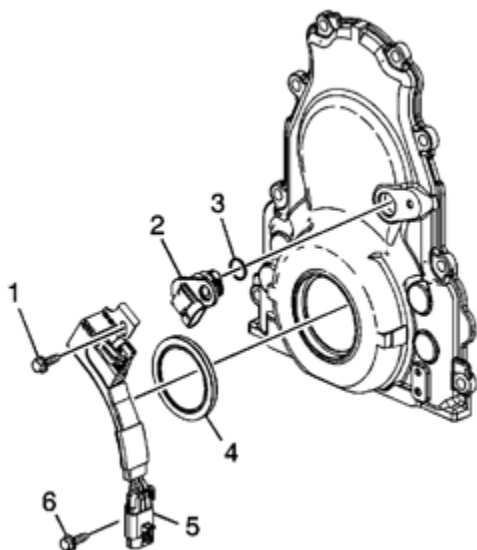
- DO NOT allow foreign material to enter the oil passages of the oil pan. Cap or cover the openings, as required.
- Use care not to gouge, score, or damage the oil pan sealing surface.

6. Drill (2) out the oil pan gasket retaining rivets (1), if required.
7. Remove the gasket (426) from the pan.
8. Discard the gasket and rivets.

Engine Front Cover Removal (RPO LY2 / LH6 / LMG / LY5 / LC9)

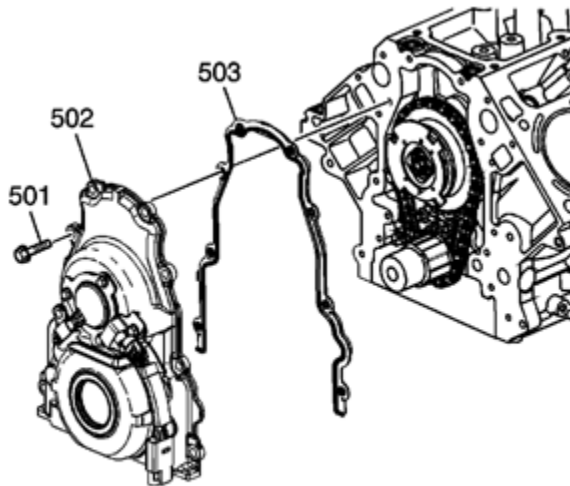


1. Remove the front cover bolts (1).
2. Remove the front cover (2) and gasket (3).
3. Discard the front cover gasket.

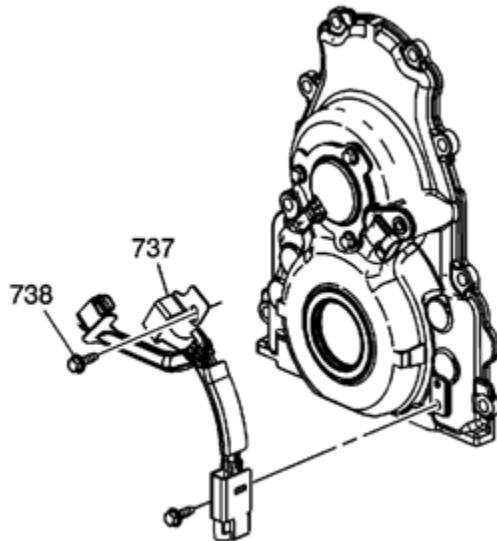


4. Remove the oil seal (4).
5. Remove the bolts (1, 6), camshaft position (CMP) sensor (2), and wire harness (5).
6. Remove the O-ring (3)

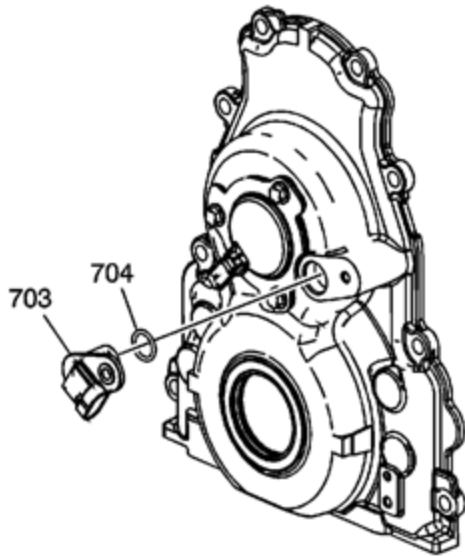
Engine Front Cover Removal (RPO LY6 / L76 / L9H)



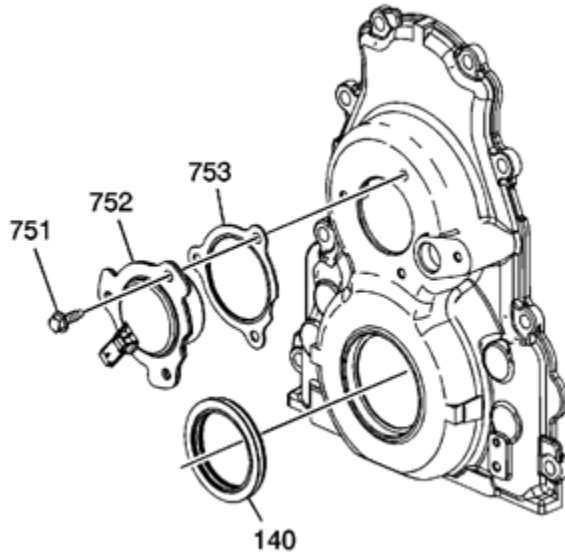
1. Remove the front cover bolts (501).
2. Remove the front cover (502) and gasket (503).
3. Discard the front cover gasket.



4. Remove the camshaft position (CMP) sensor wire harness (737) and bolts (738).

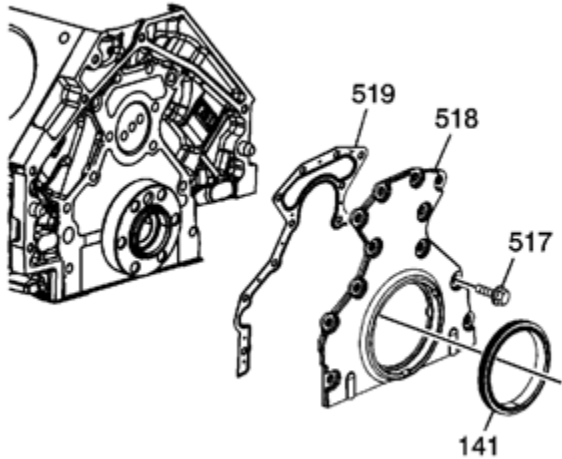


5. Remove the CMP sensor (703).
6. Remove the O-ring (704) from the sensor, as required.



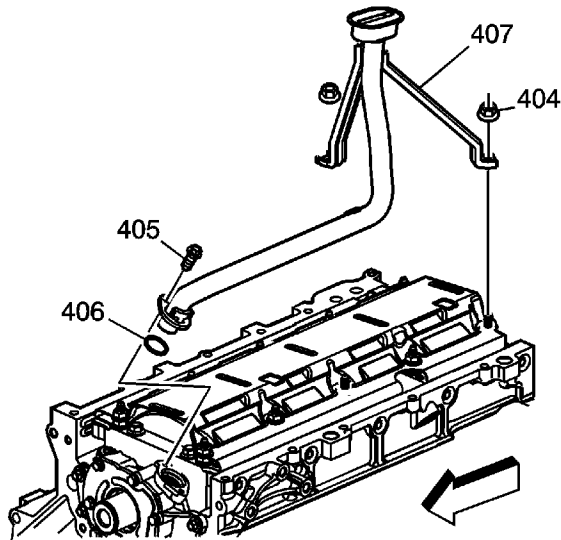
7. Remove the CMP actuator magnet (752), bolts (751), and gasket (753).
8. Remove the oil seal (140).

Crankshaft Rear Oil Seal Housing Removal

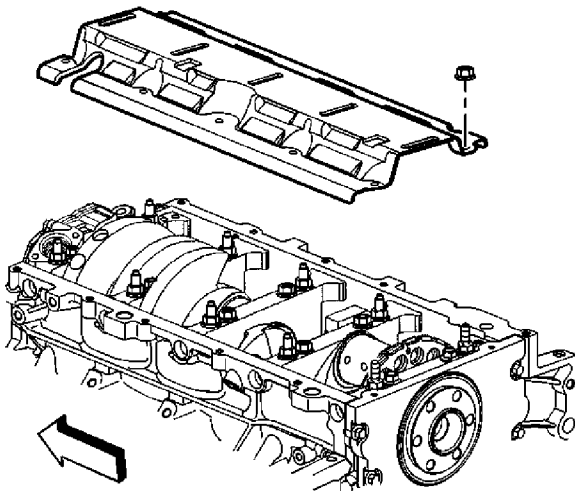


1. Remove the rear oil seal housing bolts (517).
2. Remove the housing (518) and gasket (519).
3. Remove the rear oil seal (141).

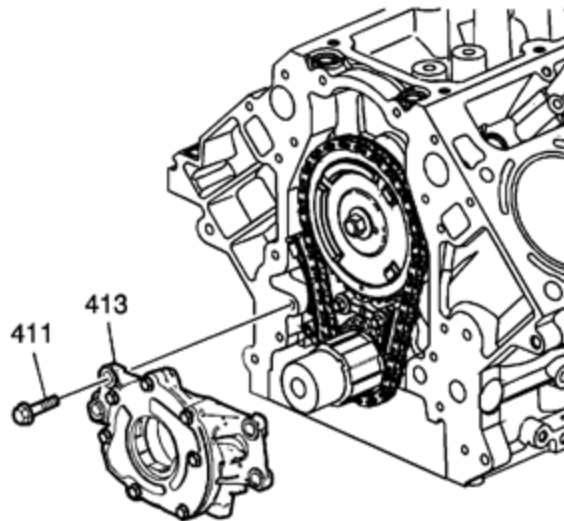
Oil Pump, Screen and Crankshaft Oil Deflector Removal (RPO LY2/LH6/LMG/LY5/LC9)



1. Remove the oil pump screen bolt (405) and nuts (404).
2. Remove the oil pump screen (407) with O-ring seal (406).
3. Remove the O-ring seal from the pump screen.
4. Discard the O-ring seal.



5. Remove the remaining crankshaft oil deflector nuts.
6. Remove the cranksha

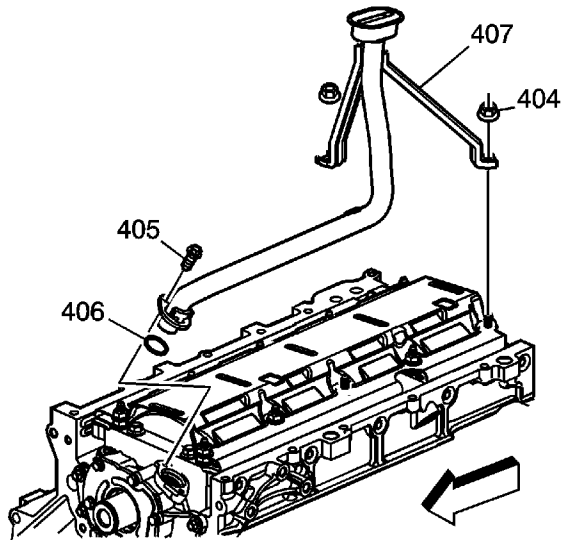


7. Remove the oil pump bolts (411).

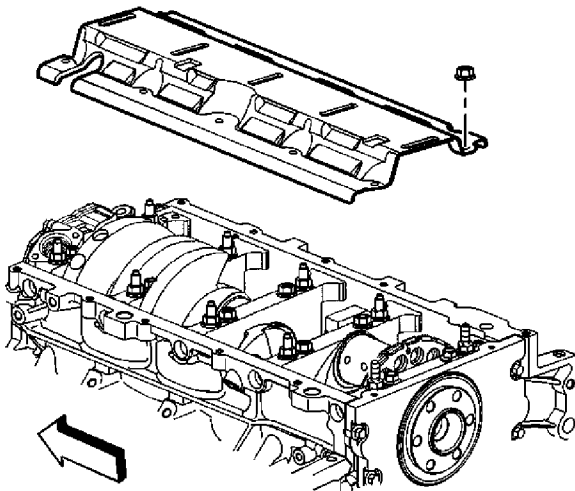
Important: Do not allow dirt or debris to enter the oil pump assembly. Cap ends, as necessary.

8. Remove the oil pump (413).

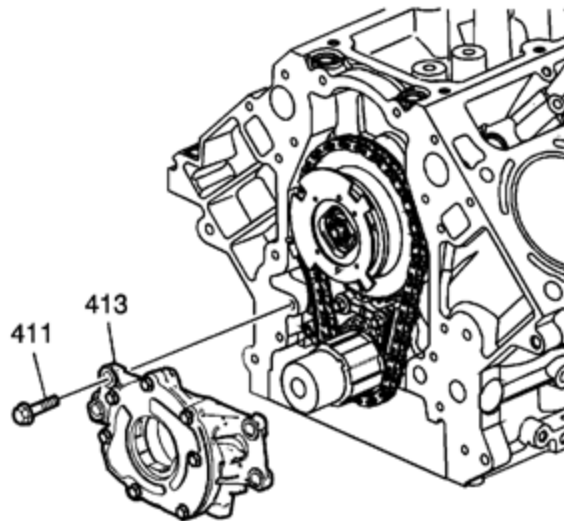
Oil Pump, Screen and Crankshaft Oil Deflector Removal (RPO LY6/L76/L9H)



1. Remove the oil pump screen bolt (405) and nuts (404).
2. Remove the oil pump screen (407) with O-ring seal (406).
3. Remove the O-ring seal from the pump screen.
4. Discard the O-ring seal.



5. Remove the remaining crankshaft oil deflector nuts.
6. Remove the cranksha



7. Remove the oil pump bolts (411).

Important: Do not allow dirt or debris to enter the oil pump assembly. Cap ends, as necessary.

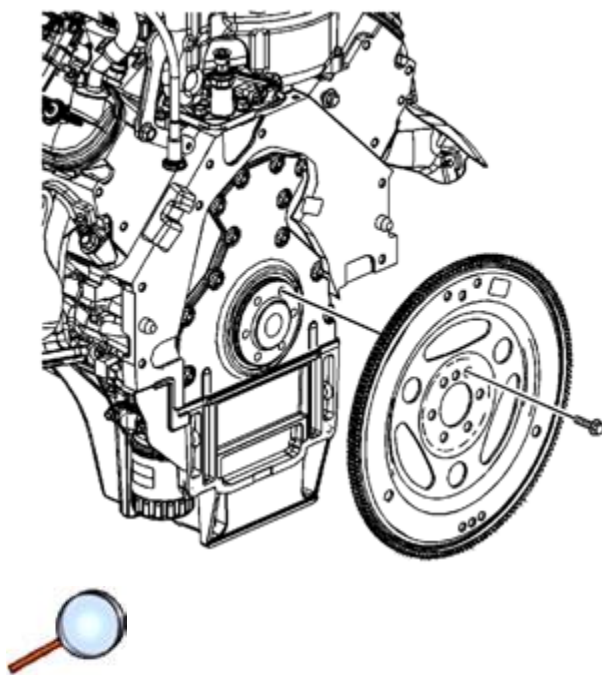
8. Remove the oil pump (413).

Timing Chain and Sprocket Removal

Special Tools

- J 8433 Two Jaw Puller
- J 41558 Crankshaft Sprocket Remover
- J 41816-2 Crankshaft End Protector
- J 42386-A Flywheel Holding Tool

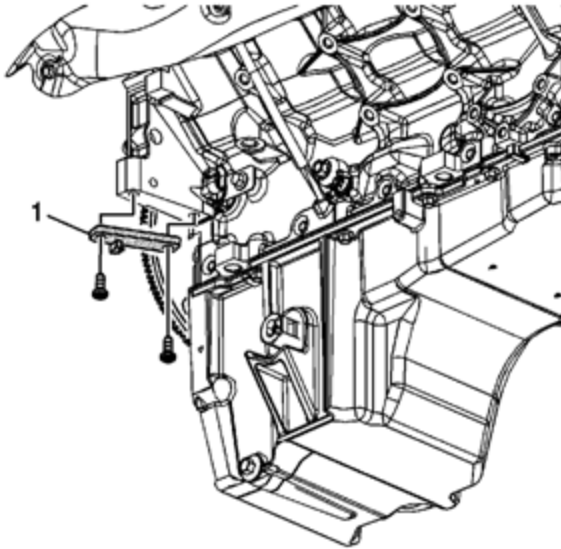
For equivalent regional tools, refer to [Special Tools](#)



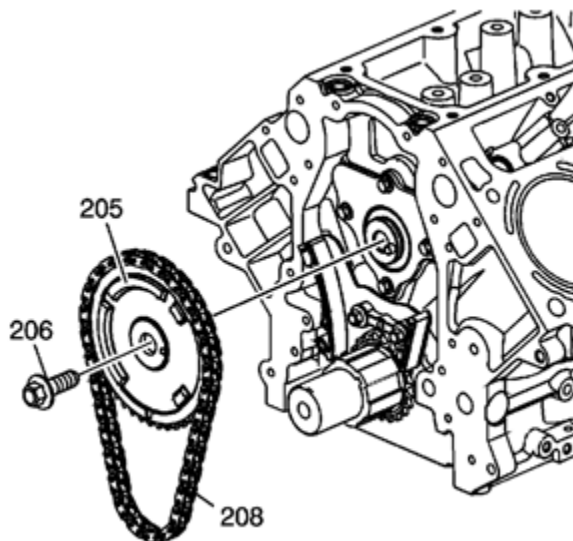
Note: Do not apply threadlock to the flex plate bolts at this time.

1. Temporarily install the automatic transmission flex plate and bolts. Refer to [Automatic Transmission Flex Plate Installation](#).

Caution: Refer to [Fastener Caution](#) in the Preface section.

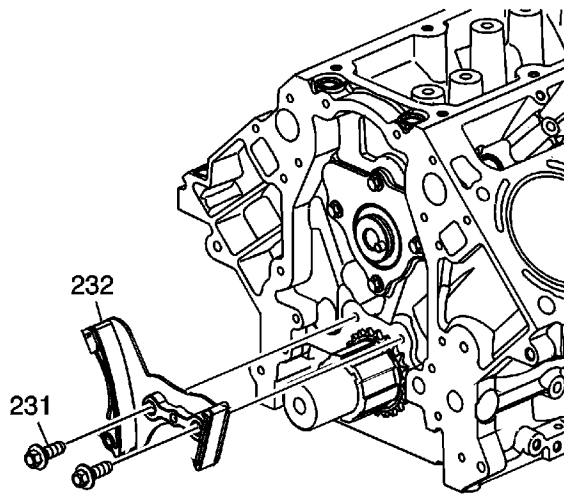


2. Install the J 42386-A tool (1) and bolts. Use 1 M10 - 1.5 x 120 mm and 1 M10 - 1.5 x 45 mm bolt for proper tool operation. Tighten the J 42386-A tool bolts to **50 N·m (37 lb ft)**.

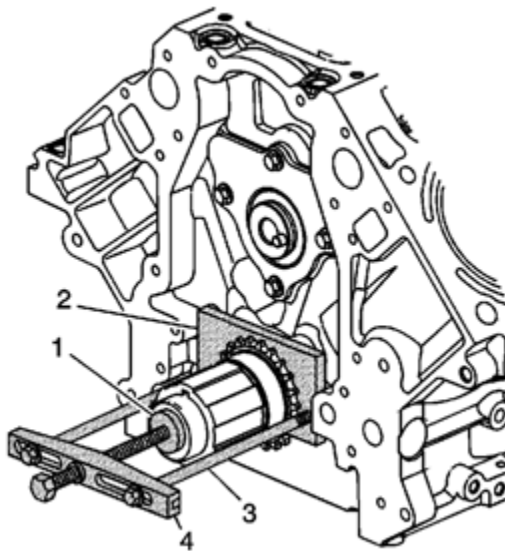


Caution: Do not turn the crankshaft assembly after the timing chain has been removed in order to prevent damage to the piston assemblies or the valves.

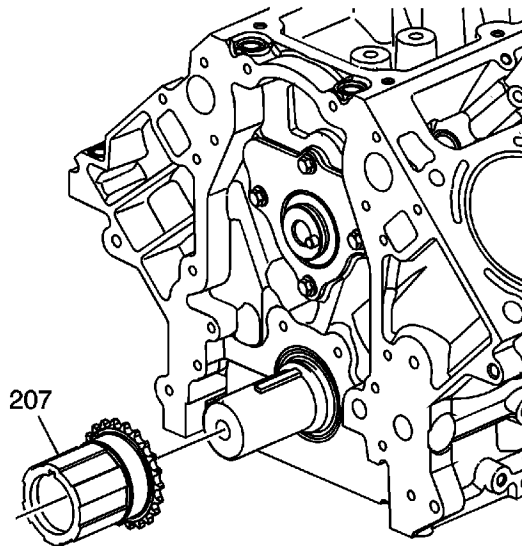
3. Remove and discard the camshaft sprocket bolt (206).
4. Remove the camshaft sprocket (205) and timing chain (208).



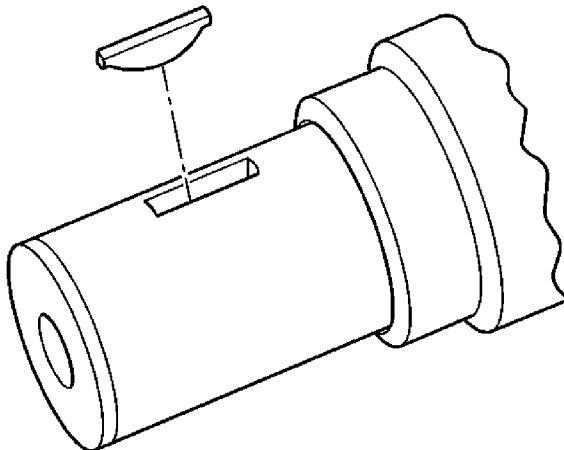
5. Remove the bolts (231) and timing chain tensioner (232).



6. Use the J 41816-2 protector (1), the J 41558 remover (2), bolts (3), and the J 8433 puller J 8433 puller (4) in order to remove the crankshaft sprocket.



7. Remove the crankshaft sprocket (207).



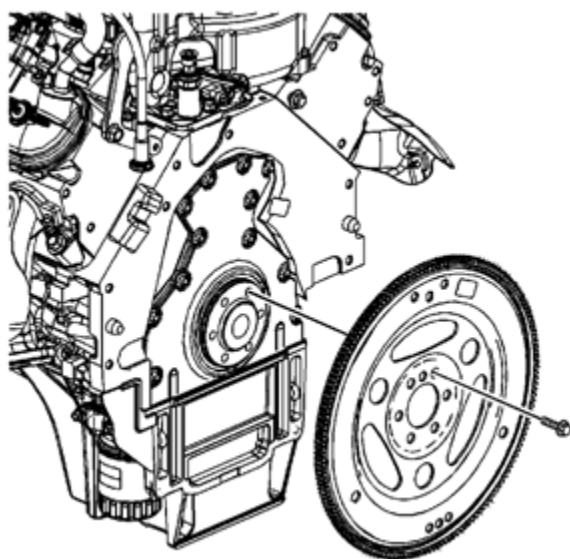
8. Remove the crankshaft sprocket key, as required.
9. Remove the automatic transmission flex plate and bolts. Refer to [Automatic Transmission Flex Plate Removal](#).
10. Remove the J 42386-A tool and bolts.

Camshaft Position Actuator and Solenoid Valve Removal

Special Tools

- J 8433 Two Jaw Puller
- J 41558 Crankshaft Sprocket Remover
- J 41816-2 Crankshaft End Protector
- J 42386-A Flywheel Holding Tool

For equivalent regional tools, refer to [Special Tools](#)

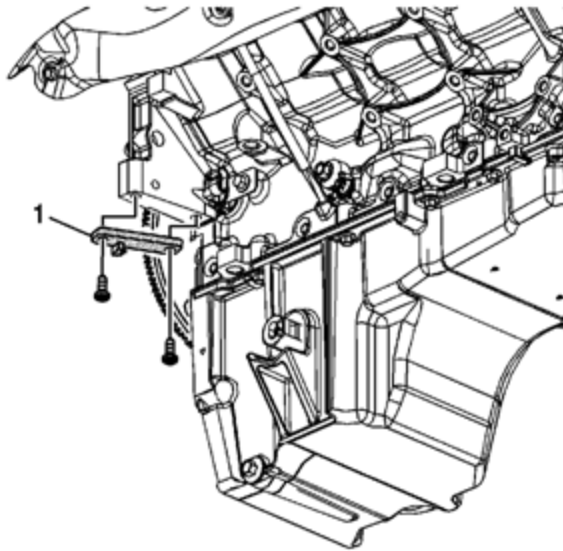


Note:

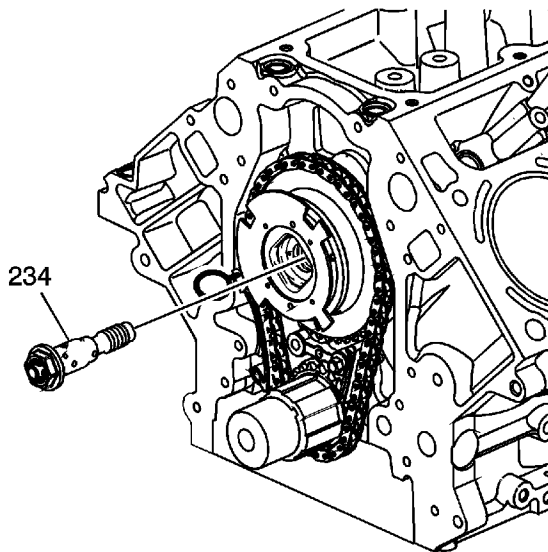
- Do not use the camshaft position (CMP) actuator solenoid valve again. Upon installation of the CMP actuator and timing chain, install a NEW valve.
- Do not apply threadlock to the flex plate bolts at this time.

1. Temporarily install the automatic transmission flex plate and bolts. Refer to [Automatic Transmission Flex Plate Installation](#).

Caution: Refer to [Fastener Caution](#) in the Preface section.

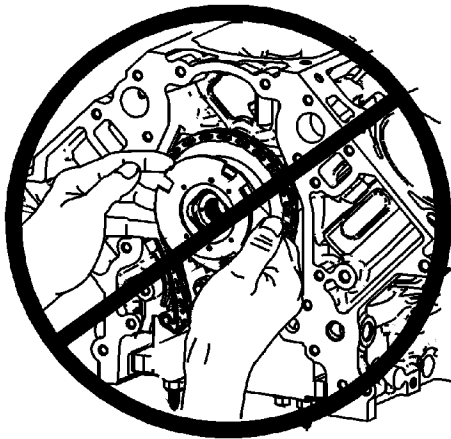
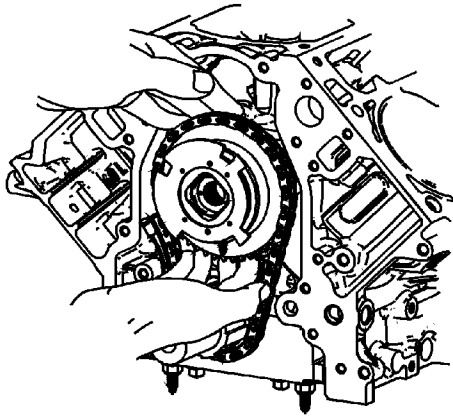


2. Install the J 42386-A tool (1) and bolts. Use 1 M10 - 1.5 x 120 mm and 1 M10 - 1.5 x 45 mm bolt for proper tool operation. Tighten the J 42386-A tool bolts to **50 N·m (37 lb ft)**.

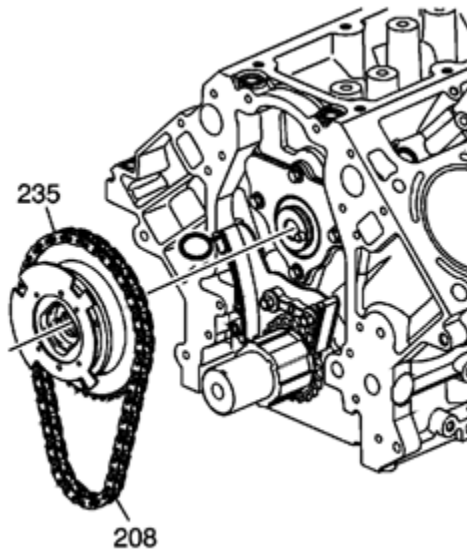


3. Remove the CMP actuator solenoid valve (234).
4. Discard the solenoid valve.

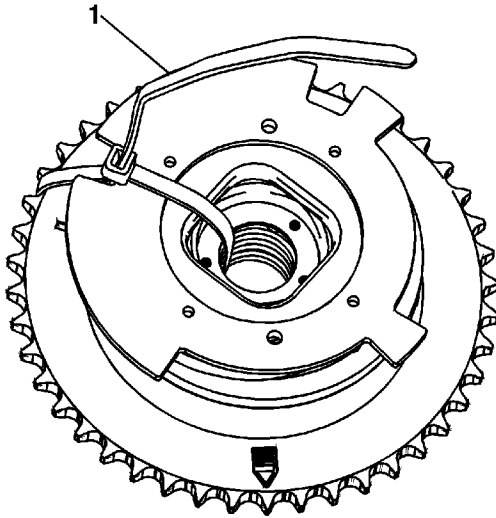
Warning: Refer to [Camshaft Position Actuator Removal and Installation Warning](#) in the Preface section.



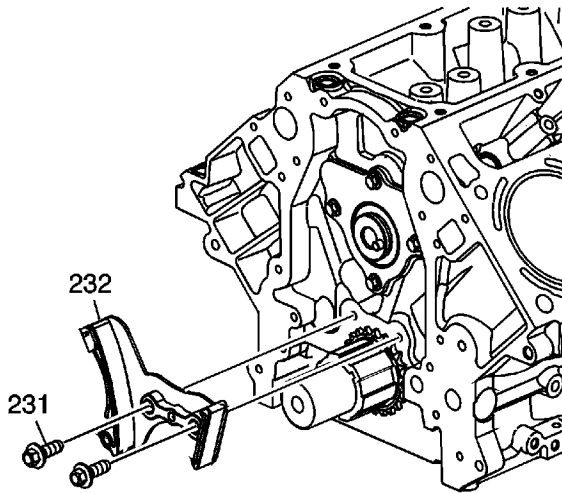
5. Loosen and separate the CMP actuator and timing chain from the camshaft. Position fingers behind the actuator sprocket and pull the actuator away from the front of the camshaft. Never pull on the reluctor wheel when attempting to remove the actuator.



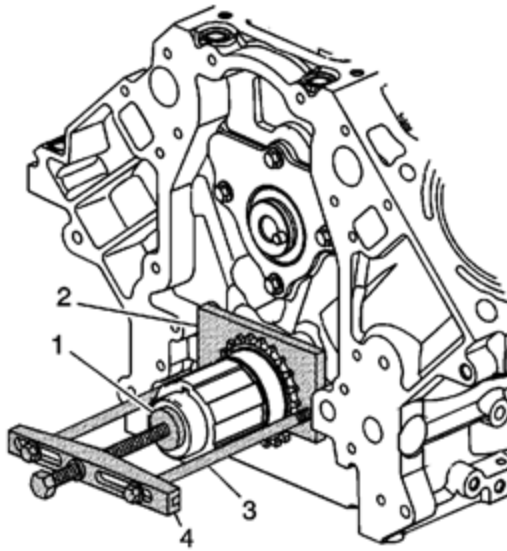
6. Remove the CMP actuator (235) and timing chain (208).



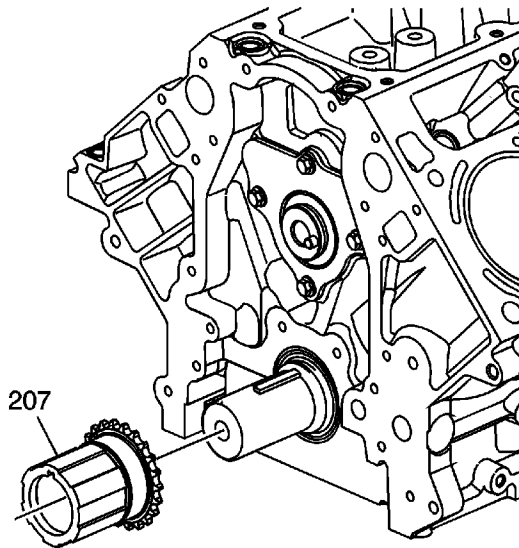
7. Insert a tie strap (1) through the center of the actuator and over the reluctor wheel.



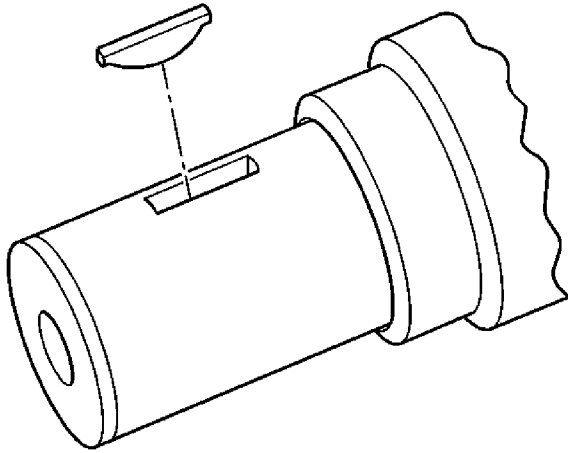
8. Remove the bolts (231) and timing chain tensioner (232).



9. Use the J 41816-2 protector (1), the J 41558 remover (2), bolts (3), and the J 8433 puller (4) in order to remove the crankshaft sprocket.



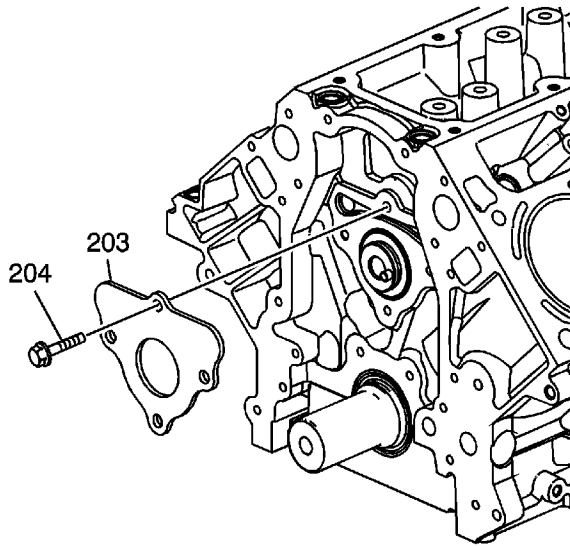
10. Remove the crankshaft sprocket (207).



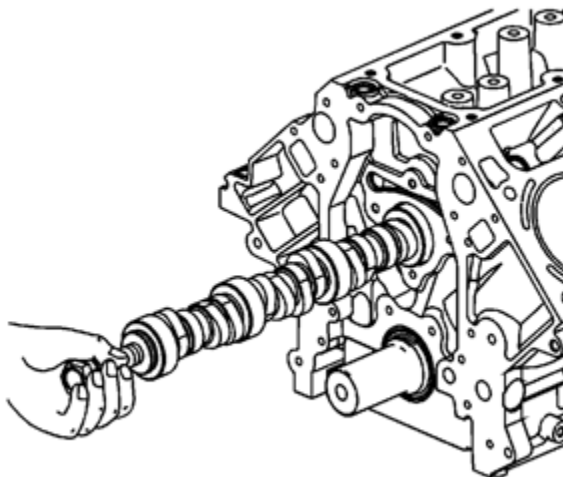
11. Remove the crankshaft sprocket key, as required.
12. Remove the flex plate and bolts. Refer to [Automatic Transmission Flex Plate Removal](#).
13. Remove the J 42386-A tool and bolts.

Cardiagn.com

Camshaft Removal



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



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

2. Remove the camshaft.
 - 2.1. Install the camshaft sprocket bolt into the camshaft front bolt hole.

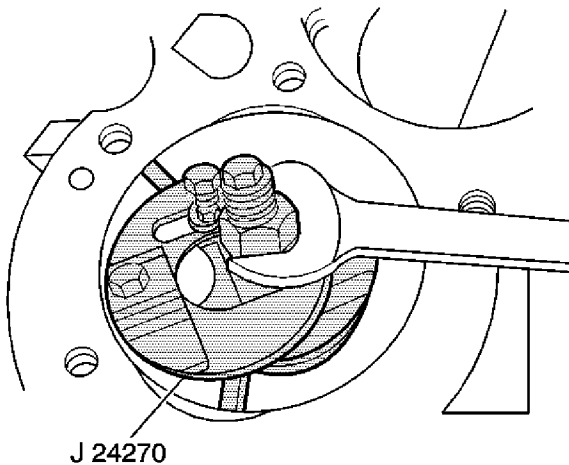
- 2.2. Using the bolt as a handle, carefully rotate and pull the camshaft out of the engine block.
- 2.3. Remove the bolt from the front of the camshaft.

cardiagn.com

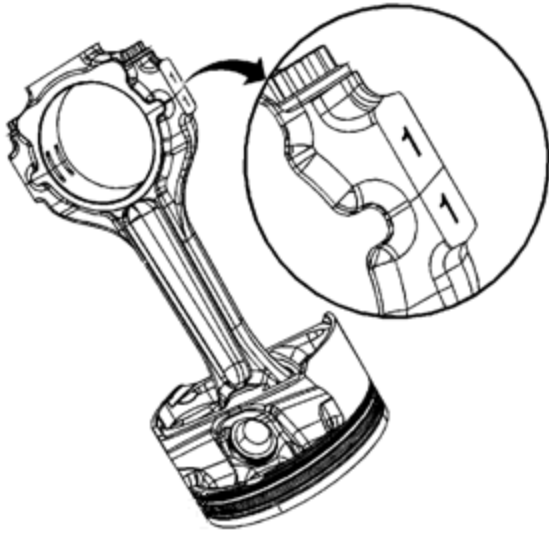
Piston, Connecting Rod, and Bearing Removal

Tools Required

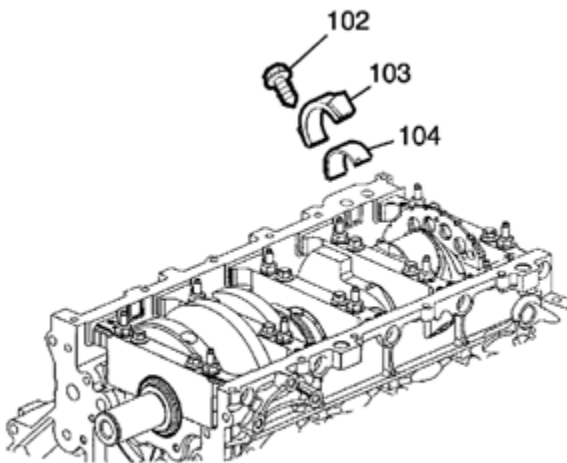
- [J 24270](#) Cylinder Bore Ridge Reamer
- [J 41556](#) Connecting Rod Guide



1. Use the [J 24270](#) in order to remove the cylinder bore ring ridge, if required.
 - 1.1. Turn the crankshaft until the piston is at the bottom of the stroke.
 - 1.2. Place a cloth on top of the piston.
 - 1.3. Use the [J 24270](#) , or equivalent, in order to remove a cylinder ring ridge.
 - 1.4. Turn the crankshaft so the piston is at the top of the stroke.
 - 1.5. Remove the cloth.
 - 1.6. Remove the cutting debris from the cylinder and piston.

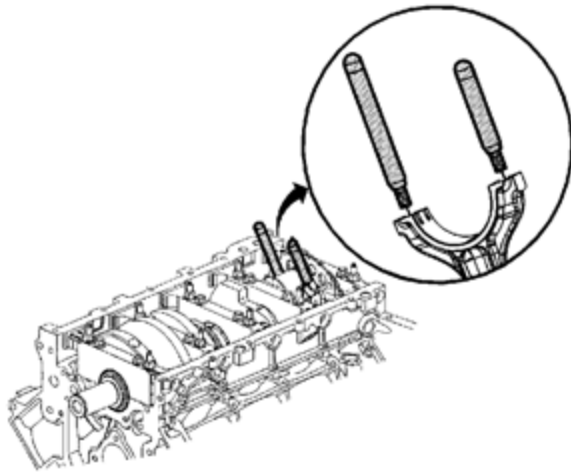


2. Using a paint stick or etching tool, place matchmarks or numbers on the connecting rods and the connecting rod caps. The connecting rods and caps **MUST** be assembled to their original position and direction.
 - A stamping mark on the side of the connecting rod, at the crankshaft journal, may affect component geometry.
 - Mark the top of the piston to the specific cylinder bore.

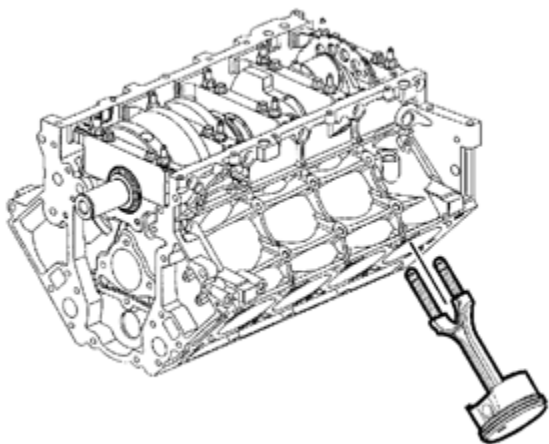


Important: Mark, sort, or organize the connecting rod bearings so they may be installed to their original position and location. The connecting rods and the bearing caps are **NOT** interchangeable. Refer to [Separating Parts](#).

3. Remove the connecting rod bolts (102), cap (103) and bearing (104).

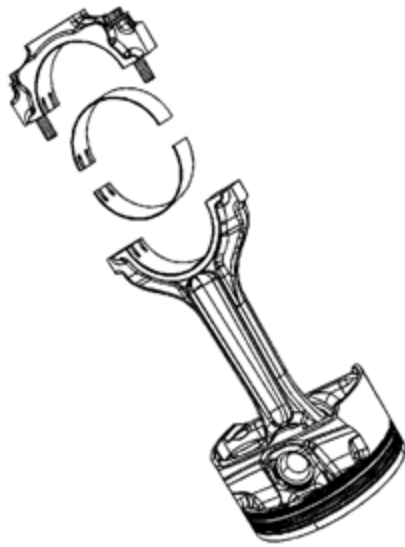


4. Install the [J 41556](#) to the connecting rod.



5. Using a hammer, tap lightly on the end of the [J 41556](#) in order to remove the piston and connecting rod assembly from the cylinder bore.
6. Remove the [J 41556](#).

cardiagn.com



7. Upon removal of the piston and connecting rod assembly, assemble the connecting rod cap and bolts onto the matching connecting rod.

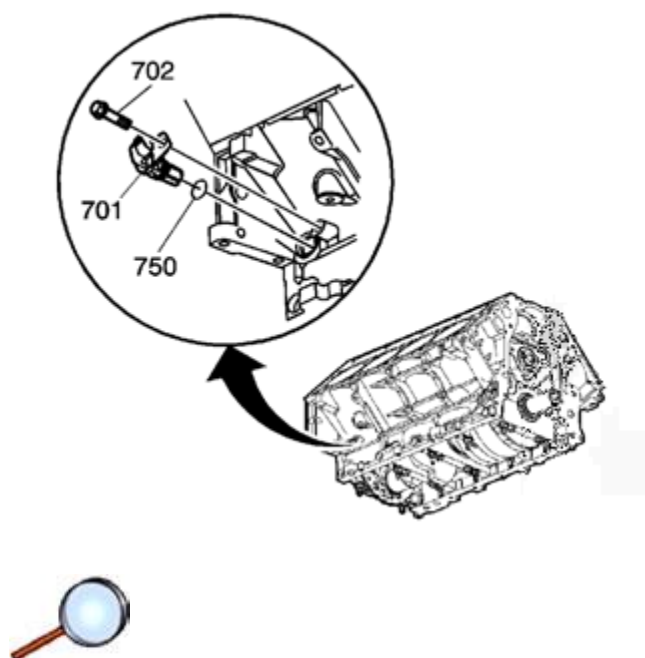
cardiagn.com

Crankshaft and Bearing Removal

Special Tools

- J 6125-1B Slide Hammer
- J 41818 Crankshaft Bearing Cap Remover

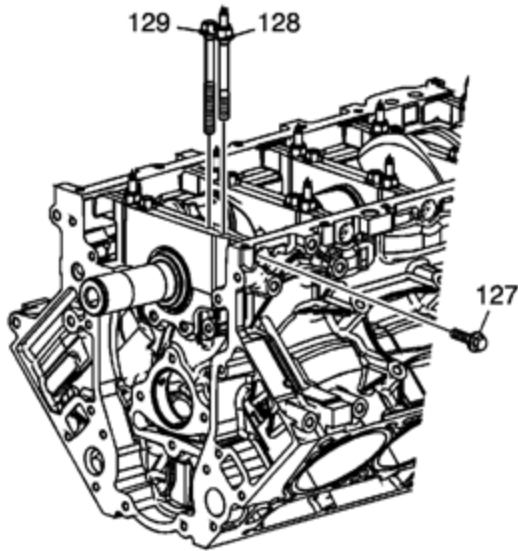
For equivalent regional tools, refer to [Special Tools](#)



Note:

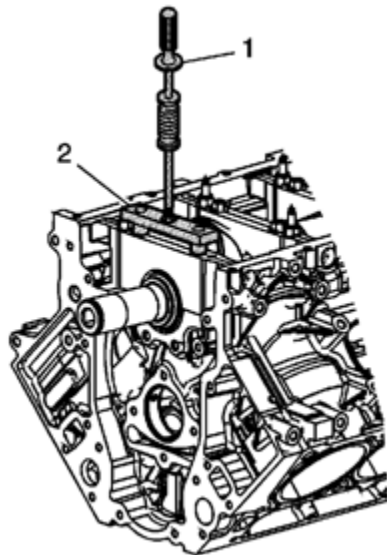
- The crankshaft bearing caps are machined with the engine block, for the proper clearances. Mark or identify each crankshaft bearing cap location and direction before removal. The crankshaft bearing caps **MUST** be installed to their original position and direction.
- Do not use the bearing cap M8 side bolts again.

1. Remove the crankshaft position (CKP) sensor bolt (702).
2. Remove the CKP sensor (701).
3. Remove the O-ring (750) from the sensor, as required.

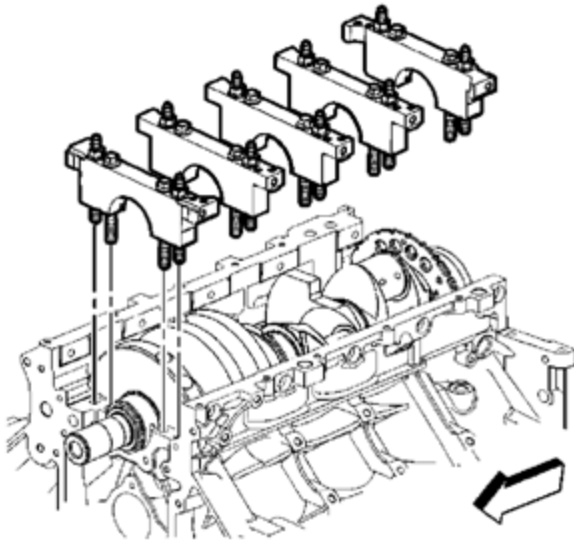


4. Remove the crankshaft bearing cap M8 bolts (127).
5. Remove the bearing cap M10 bolts (129) and studs (128).

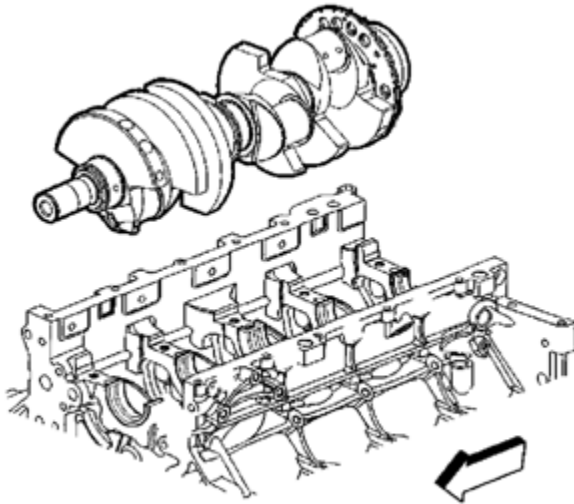
Caution: Refer to [Fastener Caution](#) in the Preface section.



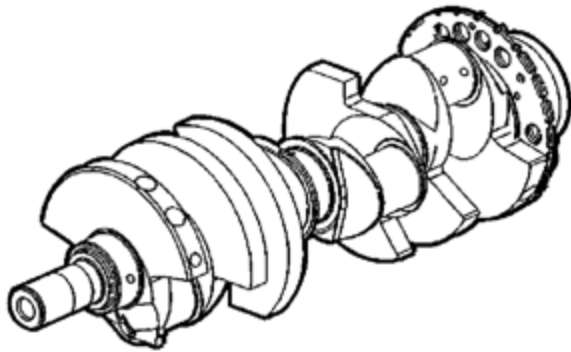
6. Install the J 41818 remover (2). Tighten the J 41818 remover (2) bolts to **11 N·m (100 lb in)**.
7. Install the J 6125-1B hammer (1) to the J 41818 remover (2) in order to remove the crankshaft bearing caps.



8. Remove the bearing caps.

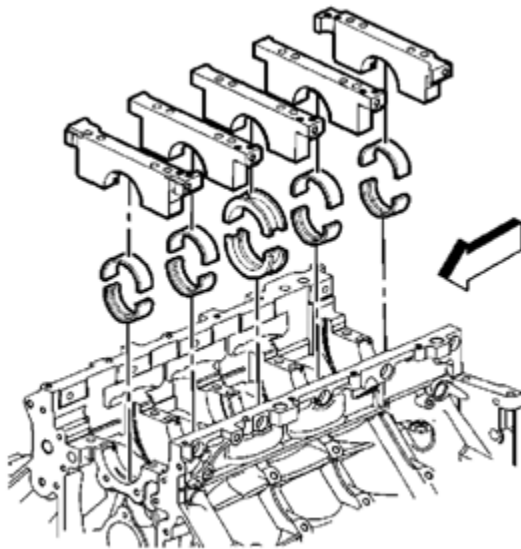


9. Remove the crankshaft.



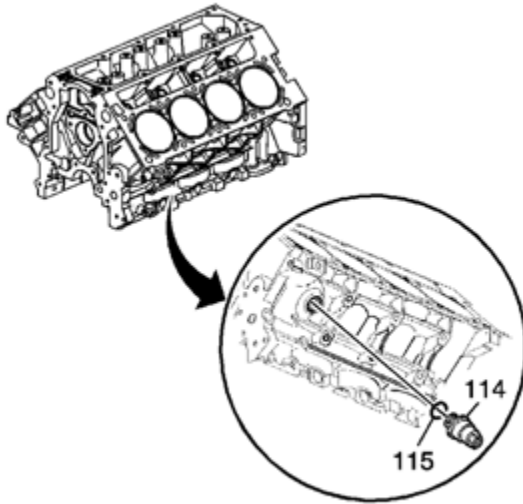
Note: Use care when handling the crankshaft. Avoid damage to the CKP sensor reluctor ring teeth. Nicks, burrs or other damage to the teeth may effect on-board diagnostics (OBD) II system performance.

10. Lay the crankshaft onto 2 wooden V-blocks or other protective surface.

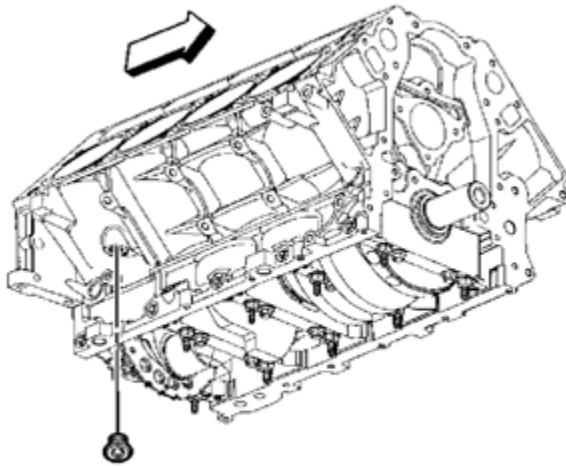


11. Remove the crankshaft bearings from the bearing caps and the engine block.
12. Mark, sort, or organize the crankshaft bearings so they may be installed to their original position and location. Refer to [Separating Parts](#).

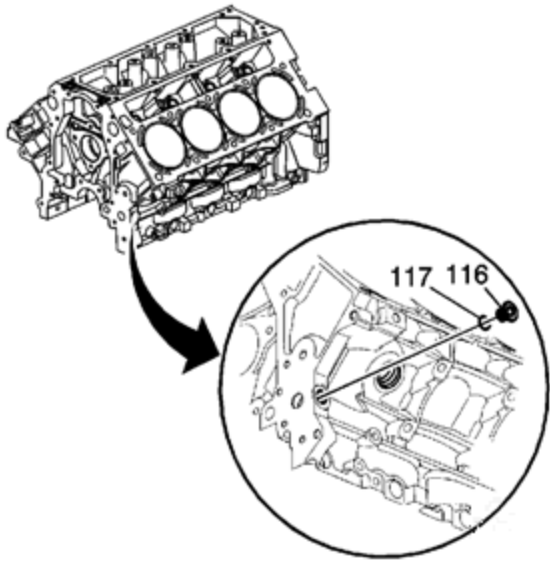
Engine Block Plug Removal



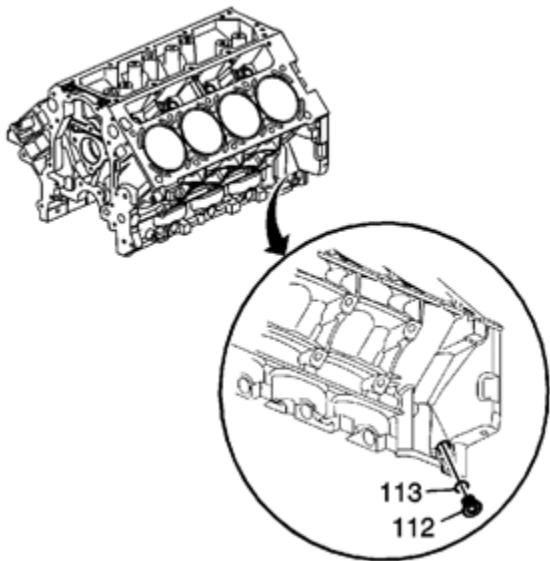
1. Remove the engine block coolant heater (114) and seal (115).



2. Remove the engine block right rear coolant drain hole plug and seal.

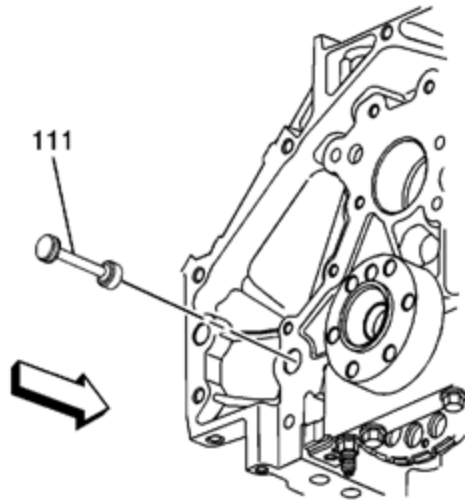


3. Remove the engine block left front oil gallery plug (116) and seal (117).



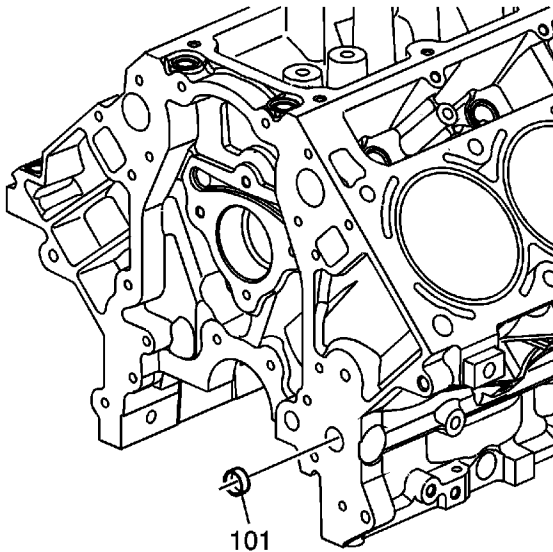
4. Remove the engine block left rear oil gallery plug (112) and seal (113).

If the block plug and coolant heater sealing washers are not damaged, they may be used during assembly.



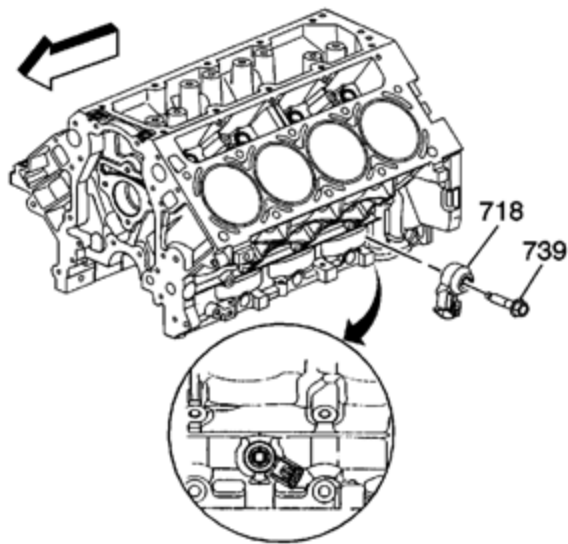
5. Remove the engine block rear oil gallery plug (111) and seal.
6. Inspect the O-ring seal of the rear oil gallery plug.

If the O-ring seal is not cut or damaged, the plug and O-ring seal may be used during assembly.

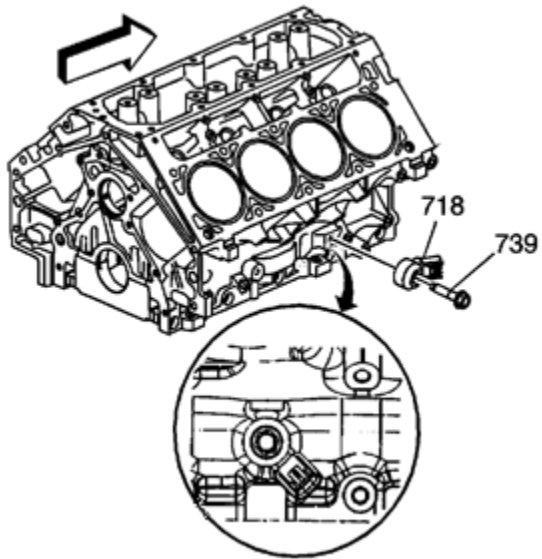


Important: Remove the front oil gallery plug, only if service is required. If the front oil gallery plug is removed, a NEW oil gallery plug must be installed.

7. Remove the engine block front oil gallery plug (101).



8. Remove the left side knock sensor (718) and bolt (739).



9. Remove the right side knock sensor (718) and bolt (739).

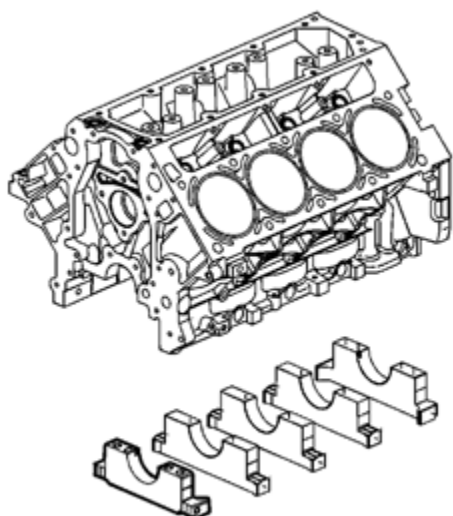
Engine Block Cleaning and Inspection

Special Tools

- J 8087 Cylinder Bore Gage
- 42385-100 Head/Main Bolt Thread Repair Kit

For equivalent regional tools, refer to [Special Tools](#)

Cleaning Procedure



Caution: Do not use a caustic solution to clean the aluminum engine block.

Note: When cleaning the engine block in a thermal type oven, do not exceed 232°C (450°F).

Clean the following components:

- Remove all sludge, dirt, or debris using a cleaning solvent or thermal type oven. Refer to [Cleanliness and Care](#).
- Gasket surfaces
Refer to [Replacing Engine Gaskets](#).
- Coolant passages
- Oil galleries
- Main bearing caps

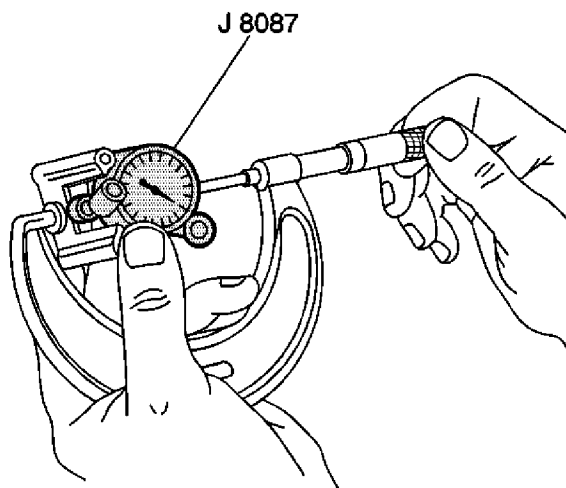
- Cylinder head bolt holes to remove threadlocking material

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

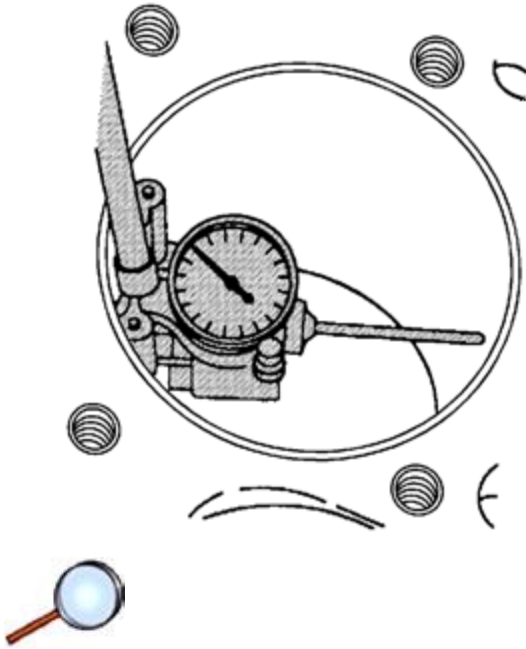
Inspection Procedure

1. Inspect the following components:
 - Cylinder walls for excessive scratches, gouging, or ring ridge
 - Cylinder bores for excessive ring ridge at the top of the cylinder
 - Coolant jacket for cracks
 - Valve lifter bores for excessive scoring or wear
 - Crankshaft bearing webs for cracks
 - Gasket sealing surfaces for excessive scratches or gougingRefer to [Replacing Engine Gaskets](#).
- Oil galleries for restrictions
- Threaded bolt holes for damaged threads
- Cylinder bores for excessive ring ridge at the top of the cylinder
2. Measure the cylinder bores for an oversize condition:

Measuring the Cylinder for Oversize



1. Adjust the micrometer to a dimension slightly smaller than the bore size. Refer to [Engine Mechanical Specifications](#).
2. Insert the J 8087 gage into the micrometer and zero the bore gage dial.



3. Use the J 8087 gage and measure the cylinder bore for oversize.

Slide the bore gage up and down throughout the length of the cylinder bore. Measure the bore, both parallel and perpendicular to the centerline of the crankshaft, at the top, center, and bottom of the bore. A cylinder bore that exceeds the maximum diameter must be serviced with an oversized piston. Refer to [Engine Mechanical Specifications](#).

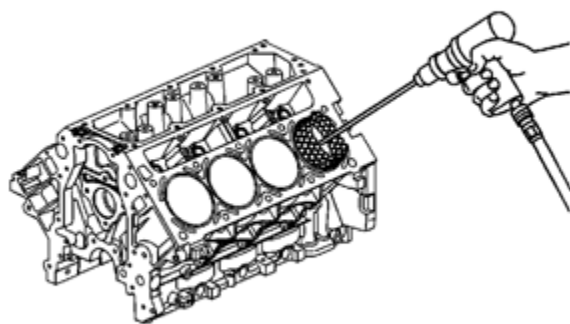
Cylinder Boring and Honing

Boring Procedure

Important: A 0.5 mm (0.02 in) oversize service piston and a piston ring set are available.

1. Measure all pistons with a micrometer to determine the cylinder bore diameter.
2. Before you use any type of boring bar, use a fine file and clean the top of the cylinder block, removing any dirt or burrs. If you do not check the cylinder block, the boring bar may be improperly positioned or tilted and the cylinder bore could be bored at an incorrect angle.
3. Carefully follow the instructions furnished by the manufacturer regarding use of the equipment.
4. When you bore the cylinders, ensure all the crankshaft bearing caps are in place. Tighten the crankshaft bearing caps to the proper torque in order to avoid distortion of the cylinder bores during final assembly.
5. When you take the final cut with a boring bar, leave 0.03 mm (0.001 in) on the cylinder bore diameter for the finish honing and fit of the piston.

Honing Procedure



1. When honing the cylinders, follow the manufacturer's recommendations for equipment use, cleaning, and lubrication. Use only clean, sharp stones of the proper grade for the amount of material you remove. Dull, dirty stones cut unevenly and generate excessive heat. Do not hone to final clearance with a coarse or medium-grade stone. Leave sufficient metal so that all stone marks may be removed with fine-grade stones. Perform final honing with a fine-grade stone, honing the cylinder to the proper clearance.
2. During the honing operation, thoroughly clean the cylinder bore. Repeatedly check the cylinder bore for fit with the selected piston.

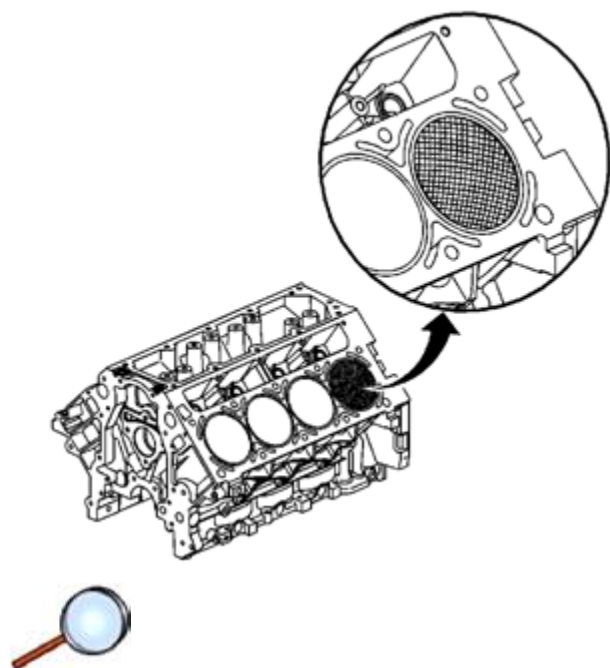
All measurements of the piston or the cylinder bore should be made with the components at normal room temperature.

3. When honing a cylinder for fit to an oversize piston, first perform the preliminary honing with a 100-grit stone.
4. Perform final cylinder honing with a 240-grit stone and obtain a 45 degree cross hatch pattern.

A 240-grit stone is preferred for final honing. If a 240-grit stone is not available, a 220-grit stone may be used as a substitute.

5. The finish marks should be clean but not sharp. The finish marks should also be free from imbedded particles and torn or folded metal.
6. By measuring the selected piston at the sizing point and by adding the average of the clearance specification, you can determine the final cylinder honing dimension required.
7. After final honing and before the piston is checked for fit, clean the cylinder bores with hot water and detergent. Scrub the bores with a stiff bristle brush and rinse the bores thoroughly with hot water. Do not allow any abrasive material to remain in the cylinder bores. This abrasive material may cause premature wear of the new piston rings and the cylinder bores. Abrasive material will also contaminate the engine oil and may cause premature wear of the bearings. After washing the cylinder bore, dry the bore with a clean rag.
8. Perform final measurements of the piston and the cylinder bore.
9. Permanently mark the top of the piston for the specific cylinder to which it has been fitted.
10. Apply clean engine oil to each cylinder bore in order to prevent rusting.

Deglazing Procedure



Using a ball type or self centering honing tool, deglaze the cylinder bore lightly. Deglazing should be done only to remove any deposits that may have formed. Use a 240-grit stone of silicone carbide, or equivalent, material when performing the deglazing procedure.

A 240-grit stone is preferred for final honing. If a 240-grit stone is not available, a 220-grit stone may be used as a substitute.

cardiagn.com

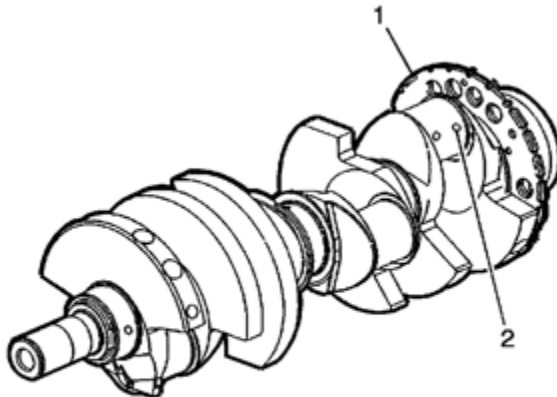
Crankshaft and Bearing Cleaning and Inspection

Special Tools

- J 7872 Magnetic Base Dial Indicator Set
- J 43690 Rod Bearing Checking Tool
- J 43690-100 Rod Bearing Checking Tool - Adapter Kit

For equivalent regional tools, refer to [Special Tools](#)

Cleaning Procedure



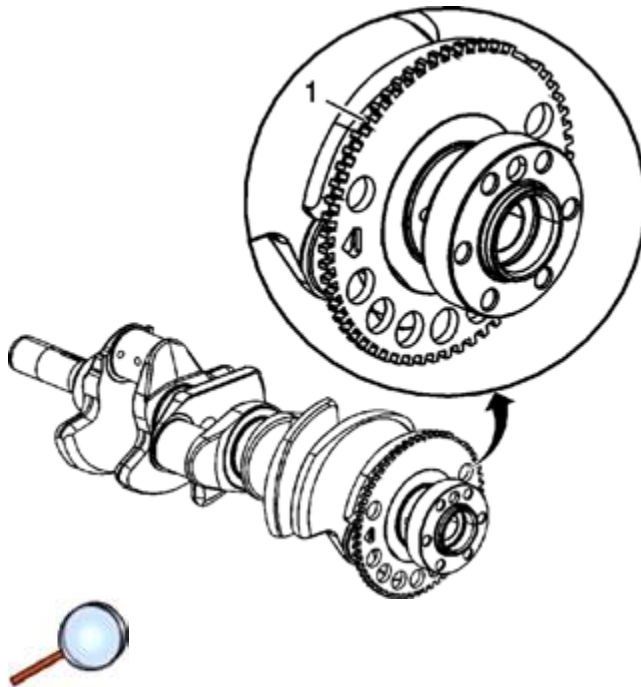
Note: Use care when handling the crankshaft. Avoid damage to the bearing surfaces or the lobes of the crankshaft position (CKP) reluctor ring. Damage to the teeth of the CKP reluctor ring may affect on-board diagnostics (OBD) II system performance.

1. Clean the crankshaft with solvent.
2. Thoroughly clean all oil passages (2) and inspect for restrictions or burrs.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

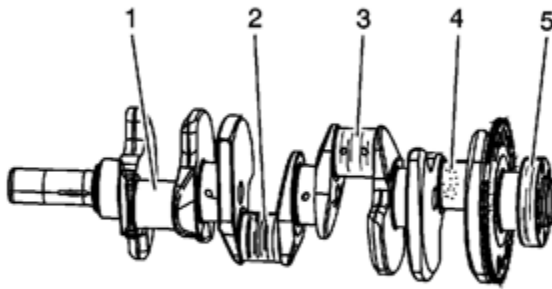
3. Dry the crankshaft with compressed air.

Inspection Procedure



Note: The reluctor ring teeth should not have imperfections on the rising or falling edges. Imperfections of the reluctor ring teeth may affect OBD II system performance.

1. Inspect the CKP reluctor ring teeth (1) for damage.

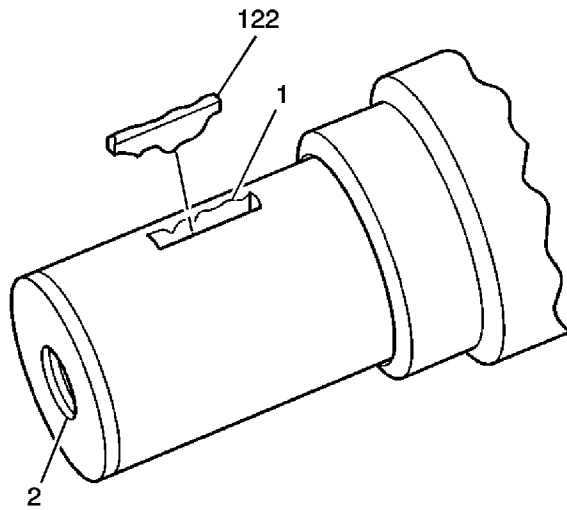


2. Inspect the crankshaft journals for wear.

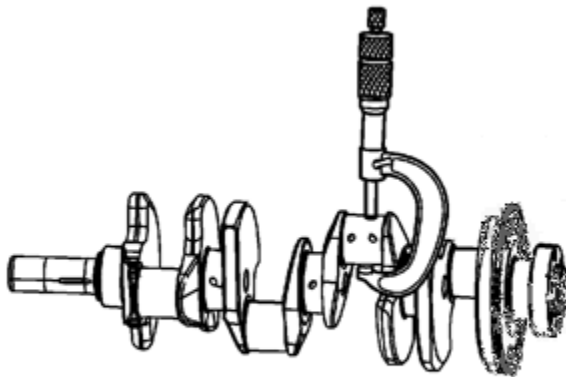
Journals should be smooth (1) with no signs of scoring, wear, or damage.

3. Inspect the crankshaft journals for grooves or scoring (2).
4. Inspect the crankshaft journals for scratches or wear (3).
5. Inspect the crankshaft journals for pitting or imbedded bearing material (4).

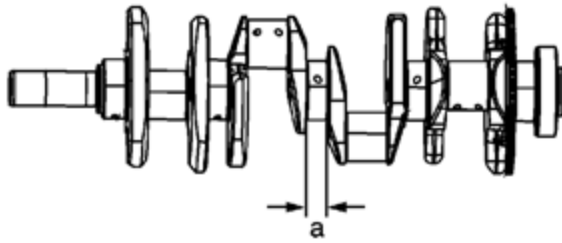
6. Inspect the crankshaft rear oil seal surface (5) for grooves or scoring.



7. Inspect the crankshaft key (122), keyway (1), and threaded hole (2) for damage.

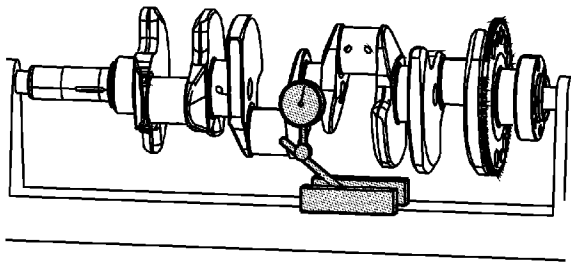


8. Measure the connecting rod journals for out-of-round and taper.



9. Measure the crankshaft thrust wall width.

A crankshaft with a thrust wall width in excess of 26.2 mm (1.0315 in) (a) must be replaced.



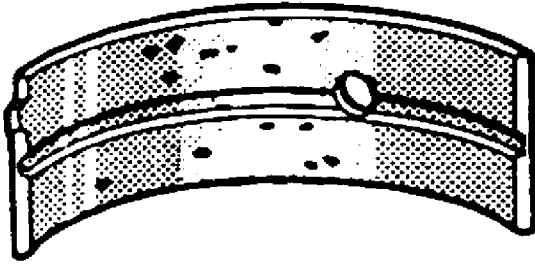
10. Measure the crankshaft runout.

Use wooden V-blocks or a fixture to support the crankshaft on the front and rear journals.

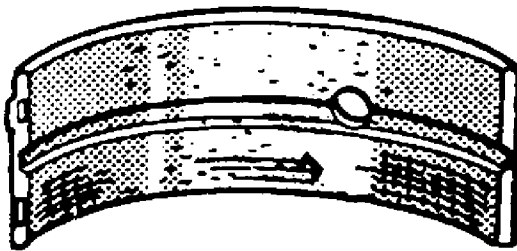
11. Use the J 7872 set in order to measure the crankshaft runout at the front and rear intermediate journals.
12. Use the J 7872 set in order to measure the runout of the crankshaft rear flange.
13. Use the J 7872 set in order to measure the runout of the crankshaft position reluctor ring.

Reluctor ring runout should be measured 1.0 mm (0.04 in) below the ring teeth.

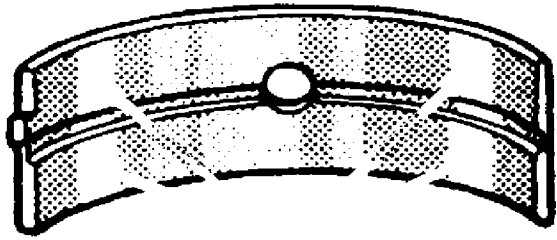
If the reluctor ring has runout in excess of 0.7 mm (0.028 in), replace the crankshaft.



14. Inspect crankshaft bearings for craters or pockets. Flattened sections on the bearing halves also indicate fatigue.



15. Inspect the crankshaft bearings for excessive scoring or discoloration.
16. Inspect the crankshaft bearings for dirt or debris imbedded into the bearing material.

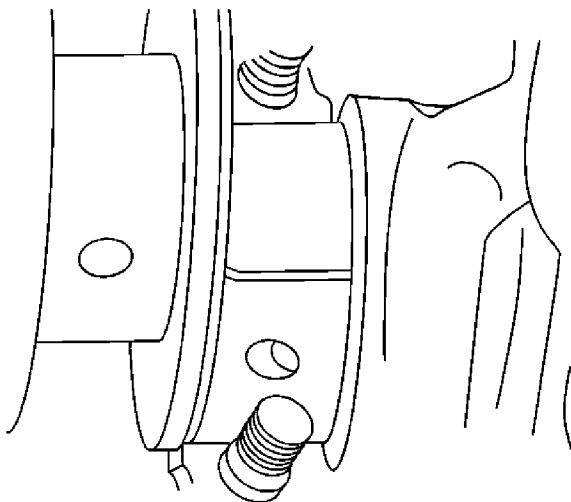


17. Inspect the crankshaft bearings for improper seating, indicated by bright, polished sections of the bearing.

If the lower half of the bearing is worn or damaged, both upper and lower halves should be replaced.

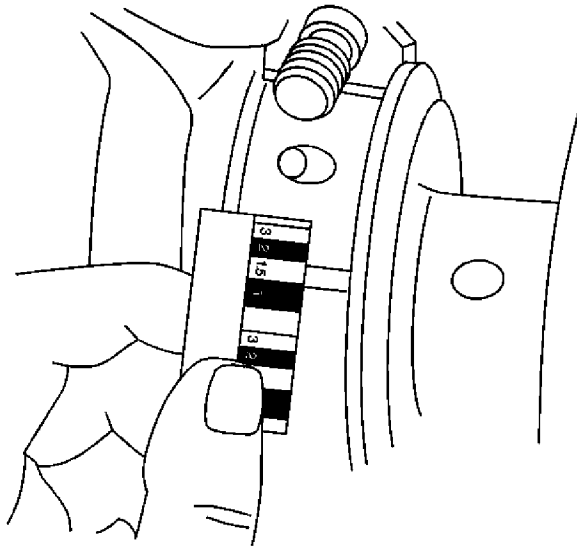
Generally, if the lower half is suitable for use, the upper half should also be suitable for use.

Measuring Main Bearing Clearance - Gaging Plastic Method



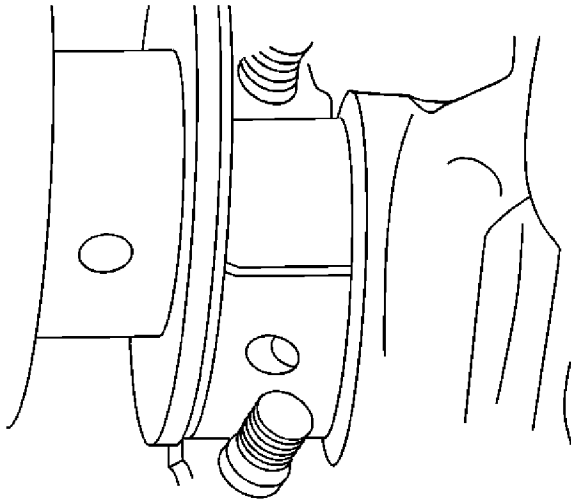
Note:

- The crankshaft main bearings are a precision insert type. Main bearing caps are machined with the engine block, for proper clearance, and cannot be shimmed or filed for bearing fit. If the clearances are found to be excessive, new bearings and/or engine block and cap repair or replacement may be required.
 - Do not rotate the crankshaft while gaging plastic is between the crankshaft journal and the bearing surface.
 - The crankshaft bearing clearances are critical. Excessive bearing clearance may affect crankshaft position sensor signals and may affect OBD II system operation.
 - Remove the bearing cap side bolts prior to cap removal.
1. Remove the bearing caps, bearing half, and bolts. Refer to [Crankshaft and Bearing Removal](#).
 2. Install gaging plastic onto the crankshaft journal. Install the gaging plastic the full width of the crankshaft bearing journal.
 3. Install the bearing caps, bearing half, and bolts. Refer to [Crankshaft and Bearing Installation](#).
 4. Remove the bearing caps, bearing half, and bolts. Refer to [Crankshaft and Bearing Removal](#).



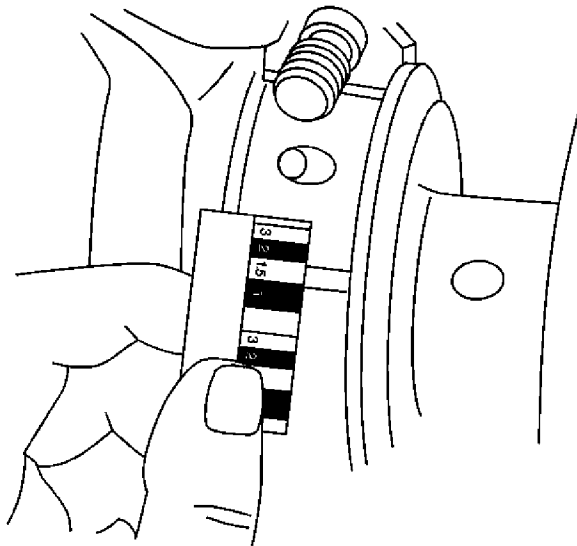
5. Using the scale supplied with the plastic gaging kit, measure the gaging plastic at its widest area.
 - If the gaging plastic shows irregularity in the journal, exceeding 0.025 mm (0.001 in), remove the crankshaft and measure the journal with a micrometer.
 - If clearance cannot be brought to specifications, replace the crankshaft or engine block as required. Refer to [Engine Mechanical Specifications](#).

Measuring Connecting Rod Bearing Clearance - Gaging Plastic Method

**Note:**

- Connecting rod bearings are a precision insert type. Connecting rods are of a powdered metal design and cannot be shimmed or filed for bearing fit. If clearances are found to be excessive, a new bearing and/or connecting rod is required.
- Do not rotate the crankshaft while gaging plastic is between the crankshaft journal and the bearing surface.

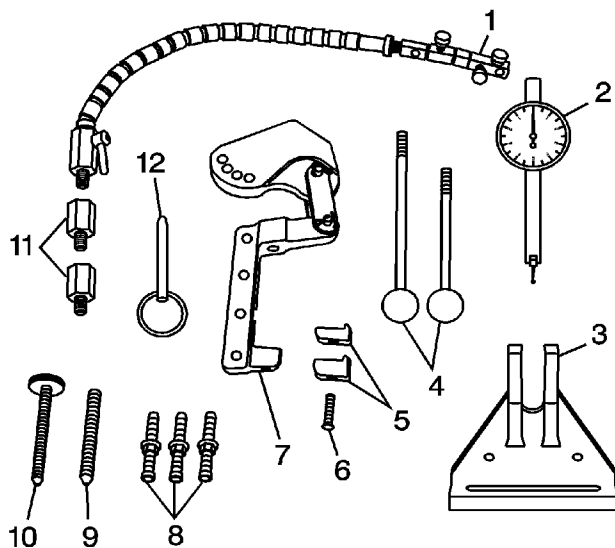
1. Remove the bearing cap, bearing half, and bolts. Refer to [Piston, Connecting Rod, and Bearing Removal](#).
2. Install the gaging plastic onto the connecting rod bearing journal. Install the gaging plastic the full width of the journal.
3. Install the bearing cap, bearing half, and bolts. Refer to [Piston, Connecting Rod, and Bearing Installation](#).
4. Remove the bearing cap, bearing half, and bolts. Refer to [Piston, Connecting Rod, and Bearing Removal](#).



5. Using the scale supplied with the plastic gaging kit, measure the gaging plastic at its widest area. Refer to [Engine Mechanical Specifications](#).

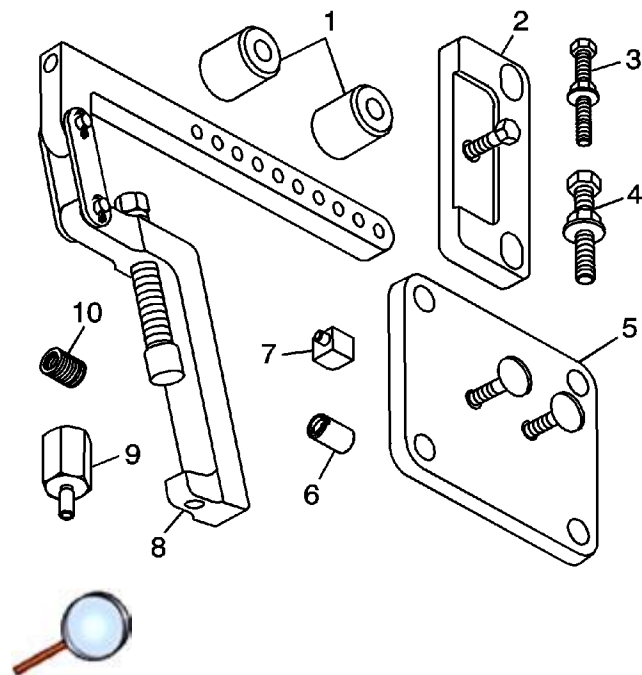
Measuring Connecting Rod Bearing Clearance - Using J 43690 / J 43690-100

J 43690 tool and J 43690-100 kit have been developed as a more accurate method to measure connecting rod bearing clearances. The instructions below provide an overview of tool set-up and usage. For more detailed information, refer to the tool instruction sheets supplied by the tool manufacturer.



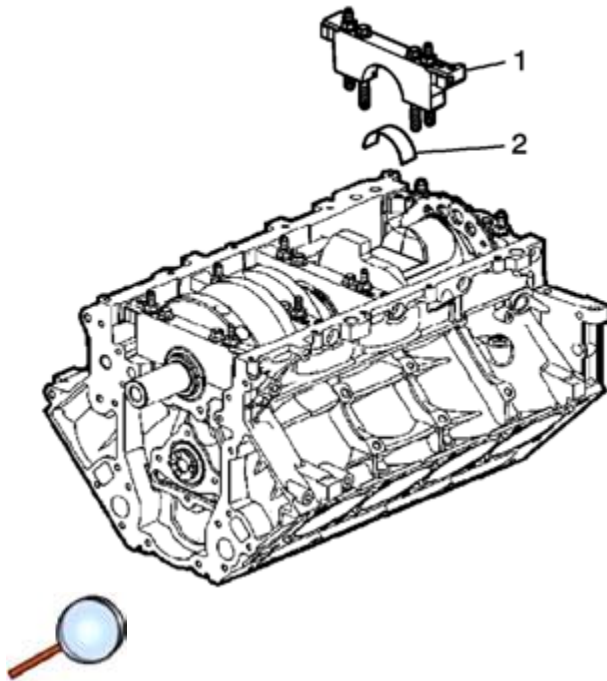
J 43690 tool

- J 43690-20 Swivel Base (1)
- J 43690-19 Dial Indicator (2)
- J 43690-2 Base (3)
- J 43690-5, J 43690-6 Handle (4)
- J 43690-10, J 43690-11 Foot (5)
- 280307 Screw (6)
- J 43690-1 Pivot Arm Assembly (7)
- J 43690-3, J 43690-7, J 43690-8 Screws (8)
- 280319 Screw (9)
- 280311 Screw (10)
- J 43690-17, J 43690-18 Adapter (11)
- 280310 Pin (12)

*J 43690 Rod Bearing Checking Tool*

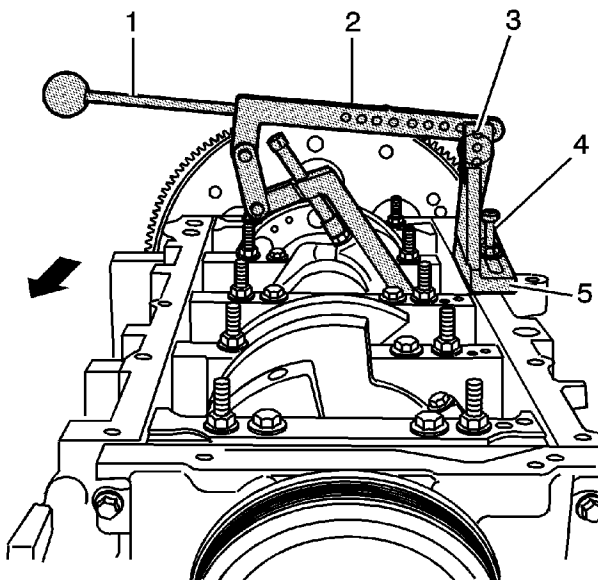
- J 43690-104 Spacer (1)
- J 43690-105 Retainer Plate (2)
- 505478 Bolt (3)
- 511341 Bolt (4)
- J 43690-106 Retainer Plate (5)
- J 43690-107 Cap (6)
- J 43690-102 Foot (7)
- J 43690-101 Pivot Arm Assembly (8)

- J 43690-103 Adapter (9)
- 505439 Adapter (10)



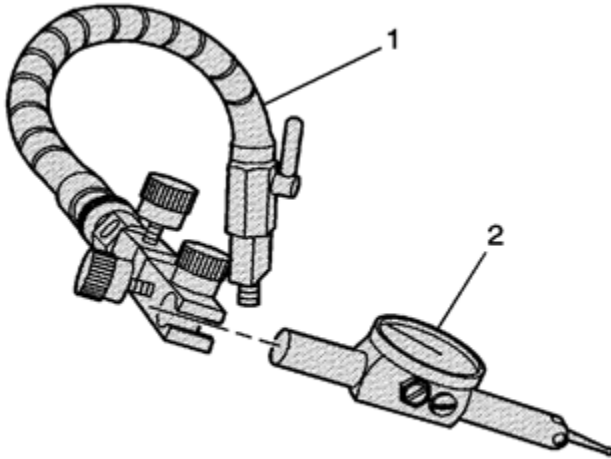
Note: The crankshaft must be secure, with no movement or rotation, in order to obtain an accurate reading.

1. Rotate the crankshaft until the journal/connecting rod to be measured is in the 12 o'clock position.
2. Remove a bearing cap and bolts (1).
3. Remove the bearing half (2).
4. Insert a piece of paper card stock onto the crankshaft journal.
5. Install the bearing half (2) and cap and bolts (1). Refer to [Fastener Tightening Specifications](#).





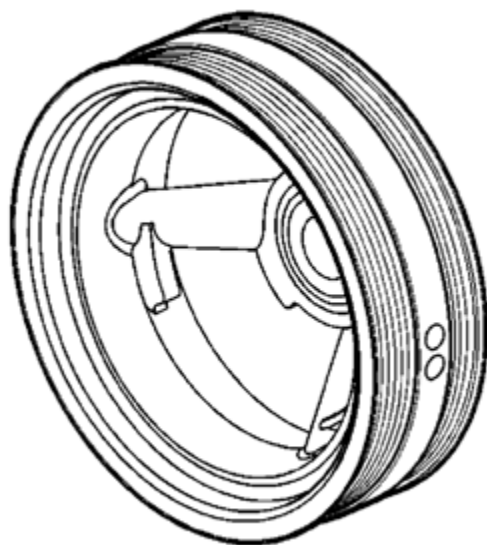
6. Install the following:
 - 6.1. J 43690-2 (5)
 - 6.2. J 43690-3 (4)
 - 6.3. J 43690-101 (2)
 - 6.4. 280310 (3)
 - 6.5. J 43690-5 (1)



7. Install the swivel base (1) and dial indicator (2).
8. Adjust per the manufacturers instructions and measure the connecting rod bearing clearance.

A connecting rod with a clearance in excess of 0.076 mm (0.003 in) is considered excessive.
Service components, as required.

Crankshaft Balancer Cleaning and Inspection

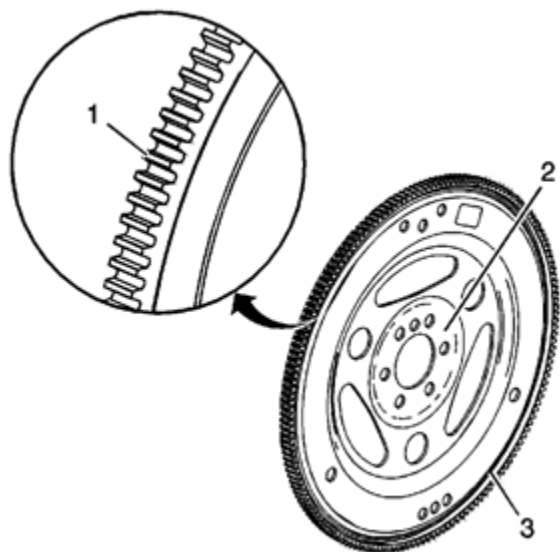


1. Clean the crankshaft balancer in solvent.
2. Clean the belt grooves of all dirt or debris with a wire brush.
3. Dry the crankshaft balancer with compressed air.
4. Inspect the crankshaft balancer for the following conditions:
 - Worn, grooved, or damaged hub seal surface
 - A crankshaft balancer hub seal surface with excessive scoring, grooves, rust or other damage must be replaced.
 - Minor imperfections on the hub seal surface may be removed with polishing compound or fine grade emery cloth.

Important: In order for the belt to track properly, the belt grooves should be free of all dirt or debris.

- Dirty or damaged belt grooves
- The balancer belt grooves should be free of any nicks, gouges, or other damage that may not allow the belt to track properly.
- Minor imperfections may be removed with a fine file.
- Worn, chunking, or deteriorated rubber between the hub and pulley

Automatic Transmission Flex Plate Cleaning and Inspection



1. Clean the flex plate in solvent.

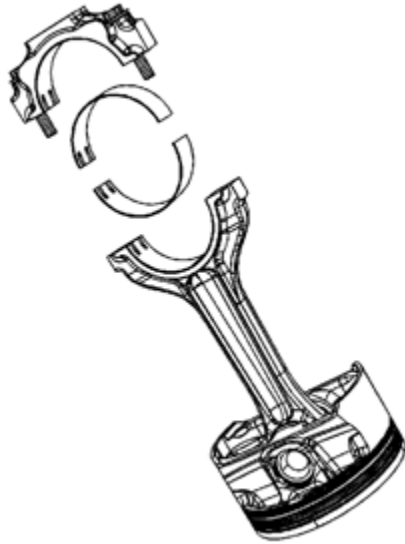
Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

2. Dry the flex plate with compressed air.
3. Inspect the flex plate for the following conditions:
 - Damaged ring gear teeth (1)
 - Stress cracks around the flex plate-to-crankshaft bolt hole locations (2)

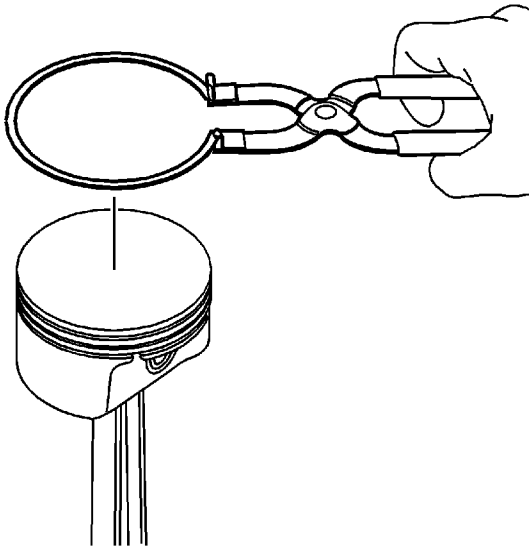
Note: Do not attempt to repair the welded areas that retain the ring gear to the flex plate. Install a new flex plate.

- Welded areas (3) that retain the ring gear onto the flex plate for cracking

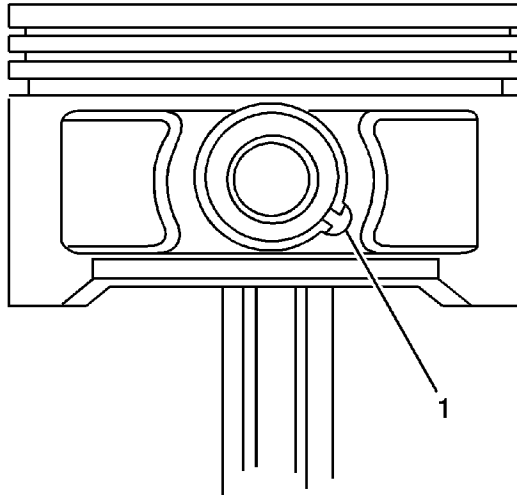
Piston and Connecting Rod Disassemble



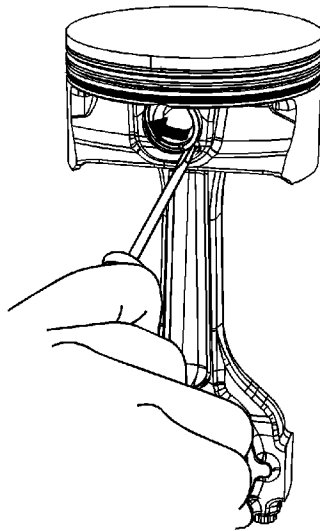
1. Remove the connecting rod bearings from the rod and cap.



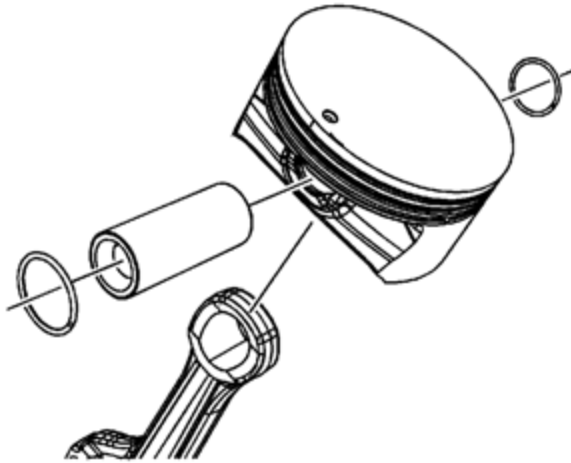
2. Using piston ring pliers, remove the piston rings from the piston.



3. Rotate the piston pin retainers until the ring end gaps are positioned in the cutout area (1) of the pin bore.



4. Remove the retainers starting in the cutout area of the pin bore.



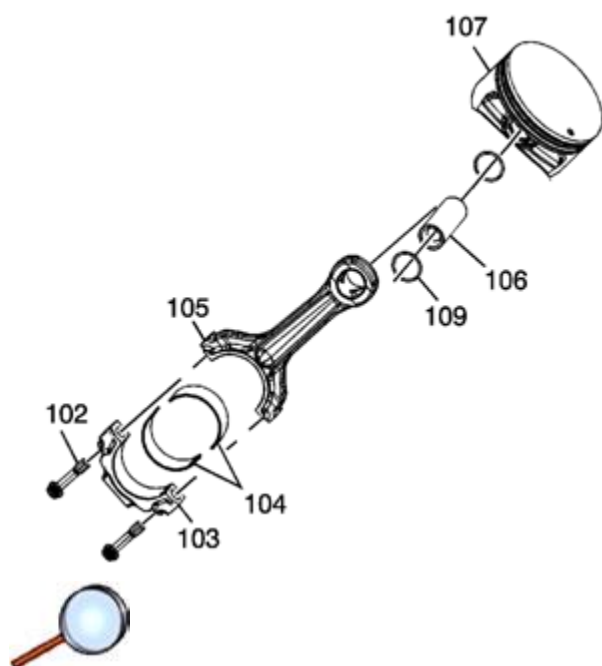
5. Remove the pin from the piston and connecting rod.
6. The piston and pin are a matched set and are not to be serviced separately.

Mark, sort, or organize the piston and the matching piston pin.

cardiagn.com

Piston, Connecting Rod, and Bearing Cleaning and Inspection

Piston, Pin, and Piston Rings



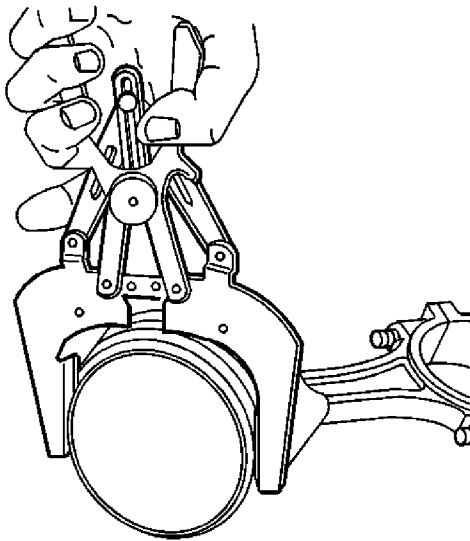
Note:

- Replace pistons, pins, and connecting rods that are damaged or show signs of excessive wear.
- The piston and pin are to be serviced as an assembly.
- Do not wire brush any part of the piston.
- Measurement of the components should be taken with the components at normal room temperature.

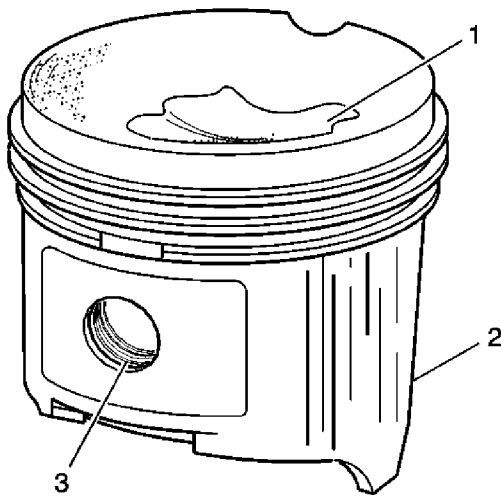
1. Clean the varnish and carbon from the piston (107) using cleaning solvent.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

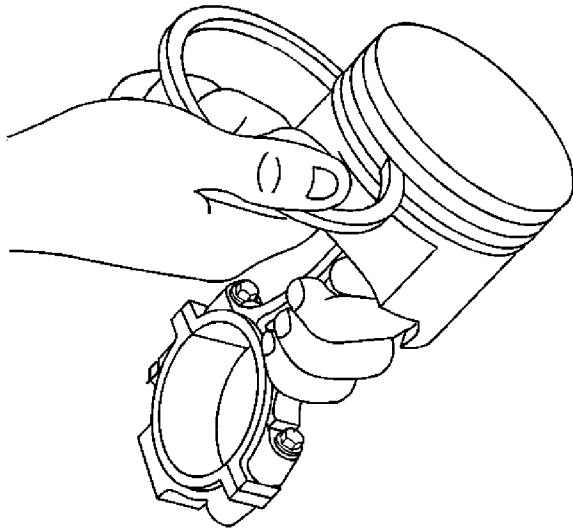
2. Dry the components with compressed air.



3. Clean the piston ring grooves with a suitable ring groove cleaning tool.
4. Clean the oil lubrication holes and slots.

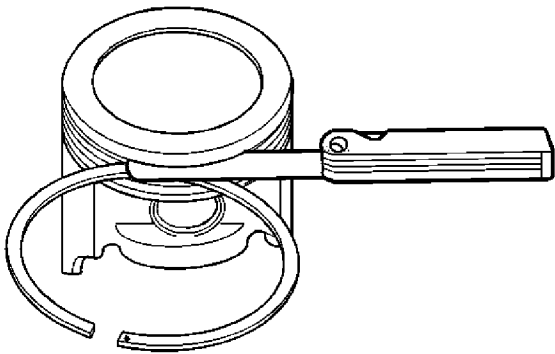


5. Inspect the piston for the following conditions:
 - Cracks in the piston ring lands, the piston skirt, or pin bosses
 - Piston ring grooves for nicks, burrs, or warpage which may cause the piston ring to bind
MINOR imperfections may be removed from the piston with a fine file.
 - Eroded areas at the top of the piston (1)
 - Scuffed or damaged skirts (2)
 - Scoring to the piston pin bore (3) or piston pin

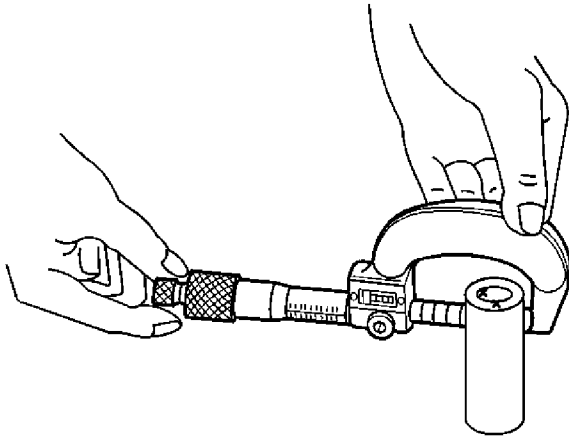


6. Insert the edge of the piston ring into the piston ring groove.

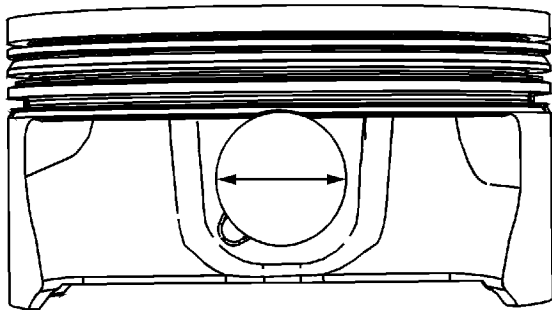
Roll the piston ring completely around the piston. If binding is caused by a distorted ring groove, MINOR imperfections may be removed with a fine file. If binding is caused by a distorted piston ring, replace the rings, as required.



7. Measure the piston ring side clearance with a feeler gage. If side clearance is not within specifications, try another piston ring. If the proper ring-to-groove clearance cannot be obtained, replace the piston and pin as an assembly. Refer to [Engine Mechanical Specifications](#).

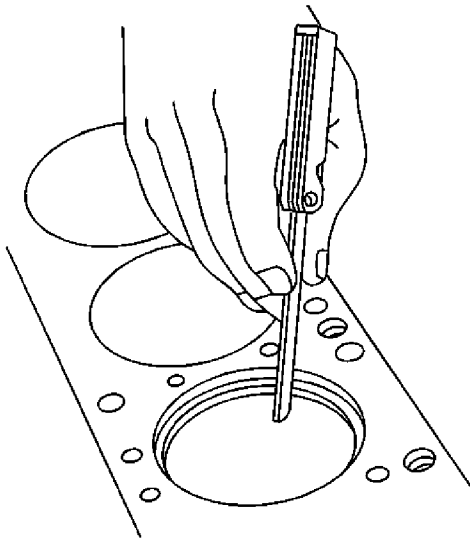


8. To determine piston pin-to-bore clearance, use a micrometer and measure the piston pin outside diameter (OD).



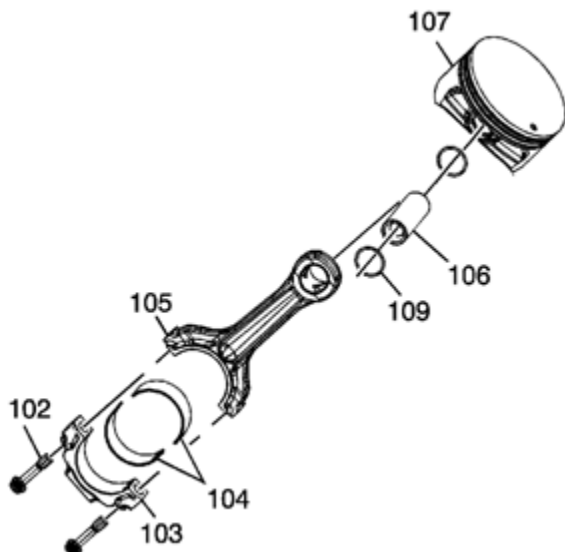
9. To determine the piston pin-to-bore clearance, use an inside micrometer and measure the piston pin bore inside diameter (ID).
10. Subtract the piston pin OD measurement from the piston pin bore ID measurement to determine pin-to-bore clearance. Refer to [Engine Mechanical Specifications](#).

Measuring Piston Ring End Gap

**Note:**

- Do not attempt to file the end of the piston ring to achieve the proper end gap clearance.
 - Measure the piston ring in the cylinder in which it will be used.
1. Place the piston ring into the cylinder bore 6.5 mm (0.25 in) below the top of the ring travel area. Both rings should be installed with the orientation marks facing the top of the piston.
 2. Insert a feeler gage and measure the piston ring end gap. Refer to [Engine Mechanical Specifications](#).

Connecting Rod and Bearings



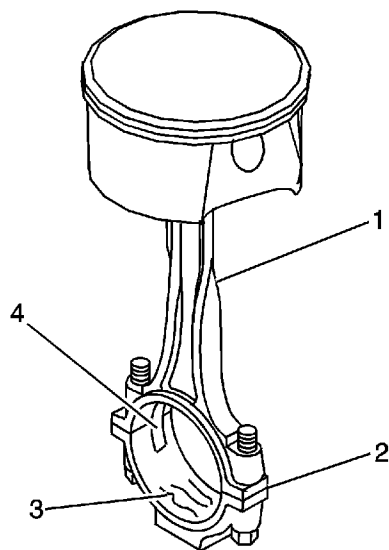
**Note:**

- The powdered metal connecting rod and cap are machined for proper clearances. The connecting rod and cap must be used as an assembly with no repair or modifications to either mating surface. Do not attempt to repair the rod or cap. If service is required, replace the rod and cap as an assembly.
- Do not attempt to repair the bolt hole threads of the connecting rod.

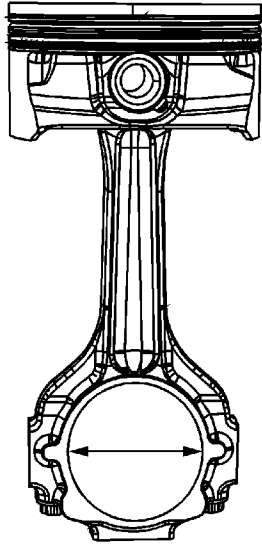
1. Clean the connecting rod (105) and cap (103) in solvent.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

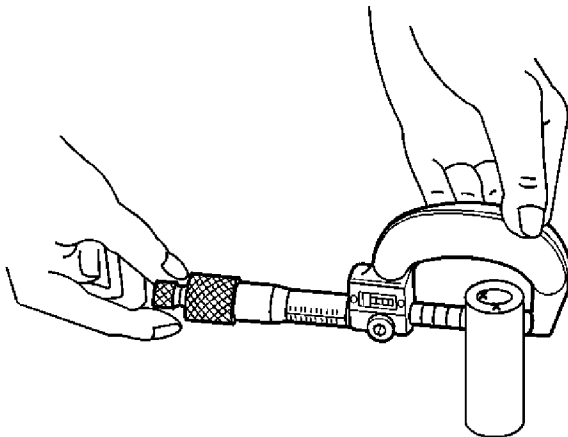
2. Dry the components with compressed air.



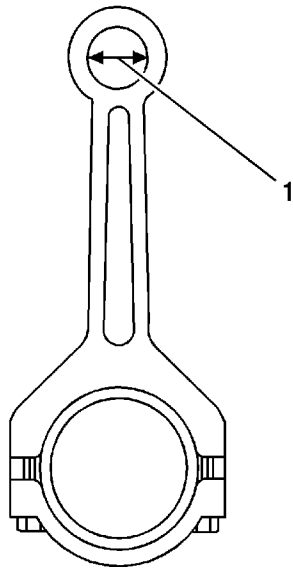
3. Inspect the connecting rod for the following conditions:
 - Twisting (1)
 - Proper fit of the connecting rod and cap mating surfaces (2)
 - Nicks or gouges in the bearing bore (3)
 - Damage to the bearing locating slots (4)



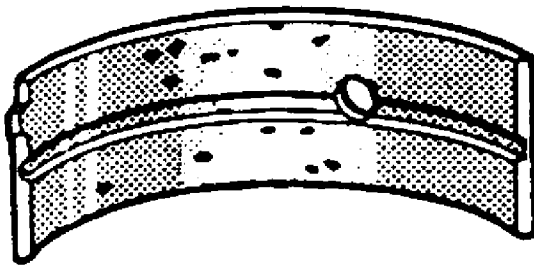
4. Measure the connecting rod bearing bore for an out-of-round condition. Refer to [Engine Mechanical Specifications](#).



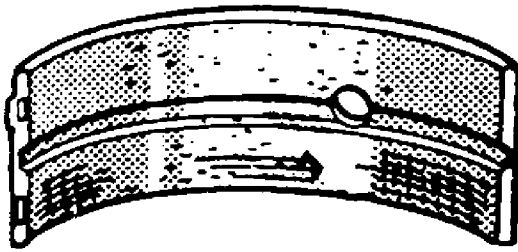
5. To determine piston pin-to-connecting rod bore clearance, use a micrometer and measure the piston pin OD.



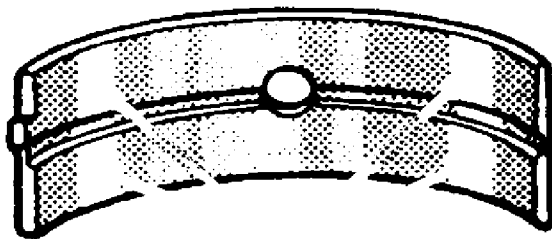
6. To determine the piston pin-to-connecting rod bore clearance, use a micrometer and measure the connecting rod pin bore (1) ID.
7. Subtract the piston pin OD measurement from the connecting rod pin bore ID measurement to determine pin-to-bore clearance. Refer to [Engine Mechanical Specifications](#).



8. Inspect the connecting rod bearings for craters or pockets. Flattened sections on the bearing halves indicate fatigue.

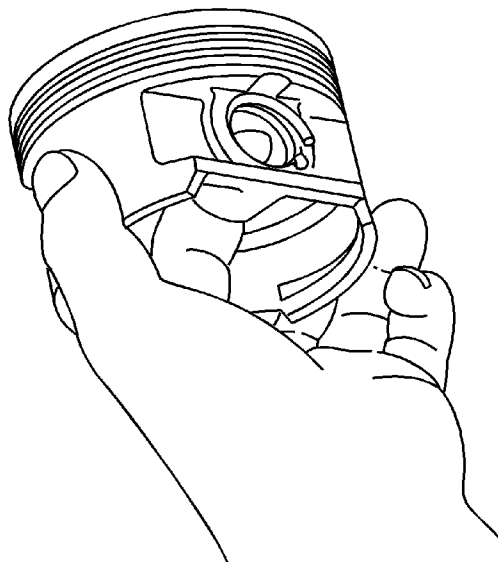


9. Inspect the connecting rod bearings for excessive scoring or discoloration.
10. Inspect the connecting rod bearings for dirt or debris imbedded into the bearing material.

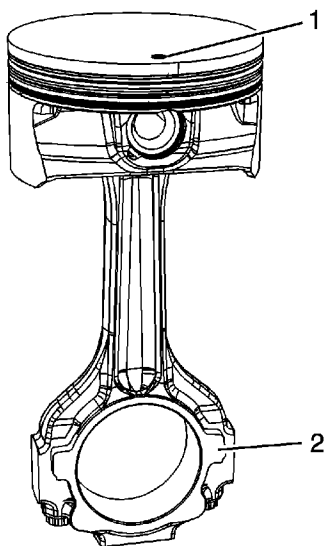


11. Inspect the connecting rod bearings for improper seating indicated by bright, polished sections of the bearing surface.
12. To determine the piston pin-to-bore clearance, use an inside micrometer and measure the piston pin bore ID.
13. Subtract the piston pin OD measurement from the piston pin bore ID measurement to determine pin-to-bore clearance. Refer to [Engine Mechanical Specifications](#).

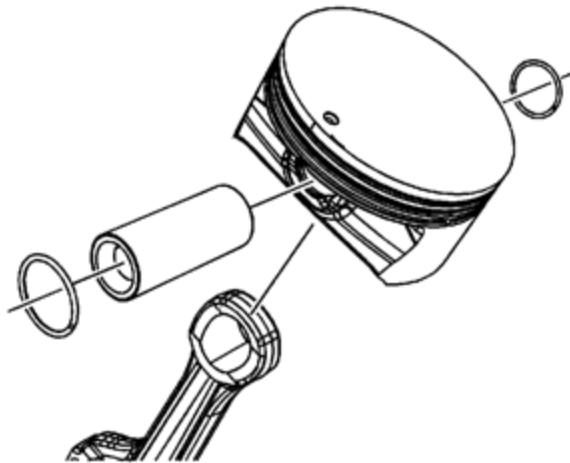
Piston and Connecting Rod Assemble



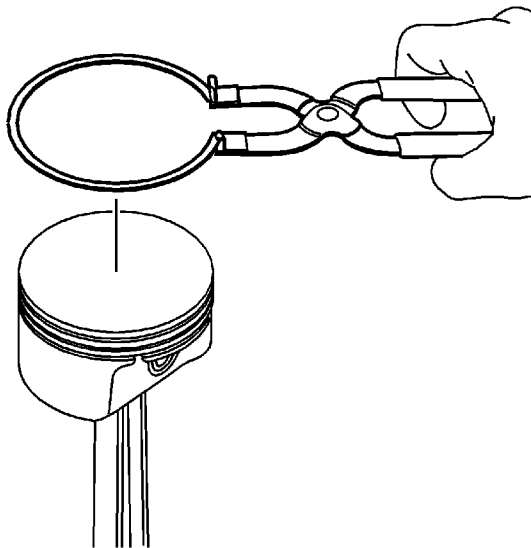
1. Install the retainer. The retainer should be seated in the groove of the pin bore.



2. Assemble the piston and connecting rod. The mark (1) on the top of the piston and the tab (2) on the side of the connecting rod should be facing the same direction.

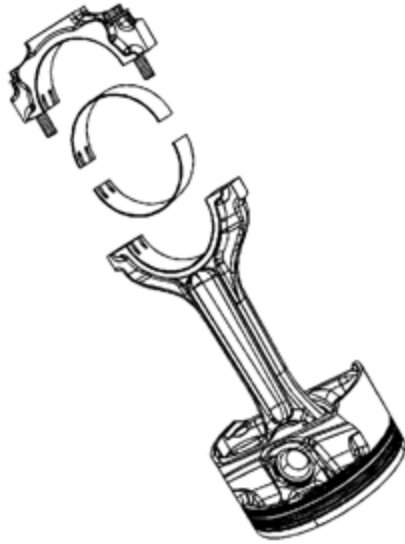


3. Install the piston pin to the piston and connecting rod.
4. Install the retainers. The retainers should be seated in the groove of the pin bore.



Important: When installing piston rings, use a ring expander plier type tool. Do not roll the rings into the grooves of the piston. Use caution and care to expand the rings only slightly larger than the outside diameter (OD) of the piston.

5. Using piston ring pliers, install the piston rings onto the piston. The dimple or mark on the piston ring should face the top of the piston. If no dimple or mark can be found on the top compression ring, it may be installed in either direction.
6. Position the oil control ring end gaps a minimum of 25 mm (1.0 in) from each other.
7. Position the compression ring end gaps 180 degrees opposite each other.



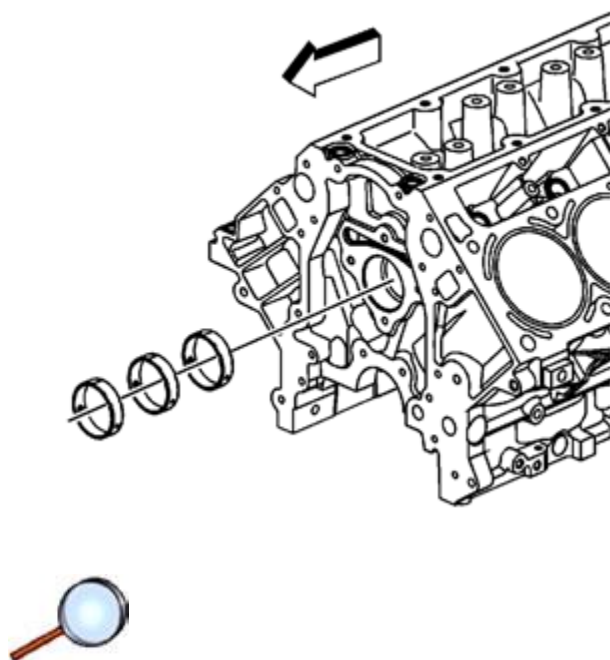
8. Install the connecting rod bearings to the rod and cap.

cardiagn.com

Camshaft Bearing Removal

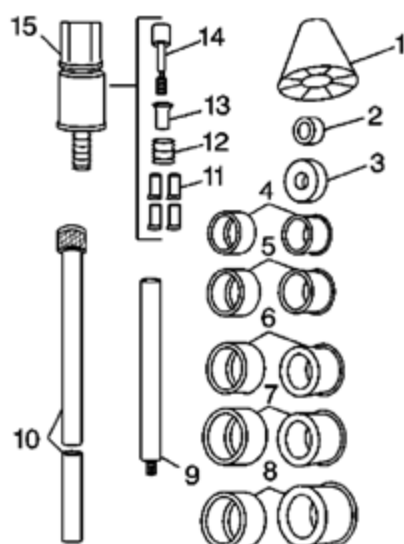
Tools Required

[J 33049](#) Camshaft Bearing Service Set

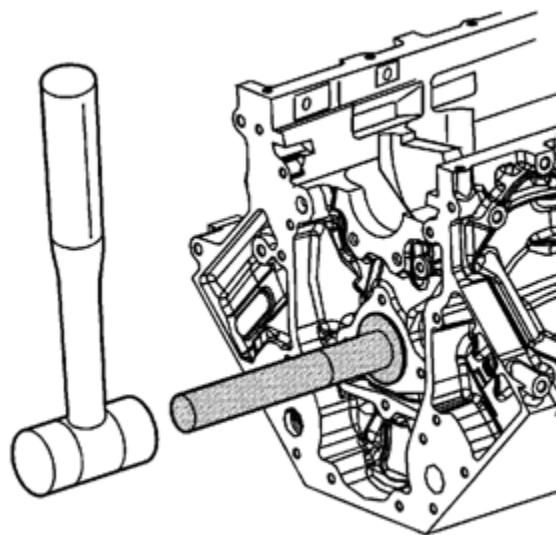


Important: A loose camshaft bearing may be caused by an enlarged, out of round, or damaged engine block bearing bore.

1. Prior to bearing removal, inspect the camshaft bearings for loose fit in the engine block bearing bores. Refer to [Camshaft and Bearings Cleaning and Inspection](#).
2. Repair or replace the components, as required.



3. Select the expanding driver (4-8) and washer (2 or 3) from the [J 33049](#).
4. Assemble the tool.
5. Insert the tool through the front of the engine block and into the bearing.
6. Tighten the expander assembly (15) nut until snug.
7. Push the guide cone (1) into the front camshaft bearing in order to align the tool.



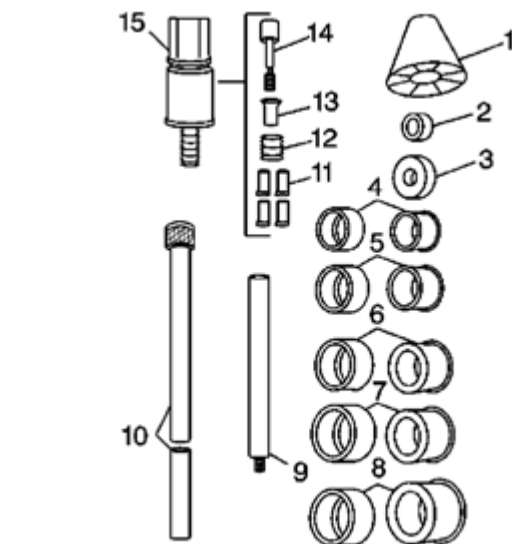
8. Drive the bearing from the block bore.

Important: In order to remove the front camshaft bearing, operate the tool from the rear of the block, using the guide cone in the rear camshaft bearing bore.

9. Repeat the above procedures in order to remove the remaining bearings.

Tool Usage Information

Bearing, Expander, and Expander Driver Information



The tool consists of a guide cone (1), driving washers (2 or 3), expander bearing drivers (4-8), driver bars (9 or 10), expander jaws (11), expander sleeve (12), expander cone (13), expander shaft (14), and expander assembly (15).

- The expander bearing driver number 1 inside diameter is 28.575-37.465 mm (1.125-1.475 in) and is used with the expander assembly and the small washer.
- The expander bearing driver number 2 inside diameter is 37.465-43.18 mm (1.475-1.7 in) and is used with number 1 expanding driver and the small washer.
- The expander bearing driver number 3 inside diameter is 43.18-48.895 mm (1.7-1.925 in) and is used with number 2 expanding driver and the large washer.
- The expander bearing driver number 4 inside diameter is 48.895-54.61 mm (1.925-2.15 in) and is used with number 3 expanding driver and the large washer.
- The expander bearing driver number 5 inside diameter is 54.61-60.325 mm (2.150-2.375 in) and is used with number 4 expanding driver and the large washer.
- The expander bearing driver number 6 inside diameter is 60.325-68.326 mm (2.375-2.69 in) and is used with number 5 expanding driver and the large washer.

Tool Assembly and Operation

1. Select the proper expanding driver and washer from the expanding driver and washer information.

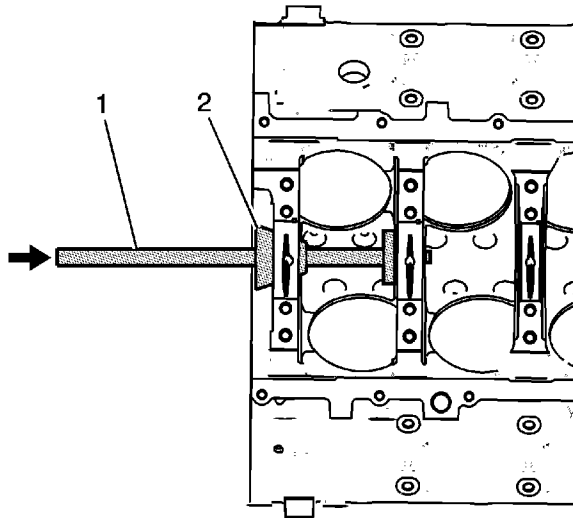
Important: To install or remove the expanding driver, always push on or pull from the ends.

Pressure on the outside diameter may cause a bind against the rubber expanding sleeve.

2. Place the expanding driver onto the expander assembly.
3. Ensure the separation lines between the segments of the expanding driver align with the separation lines of the expander assembly.

4. With the small end of the cone facing the driver assembly, place the guide cone over the driving bar.
5. Place the driving washer over the threaded portion of the expander assembly.
6. Screw the expander assembly, with driving washer, onto the driving bar.

For removal of the inner bearings, it may be necessary to install the driver bar extension.

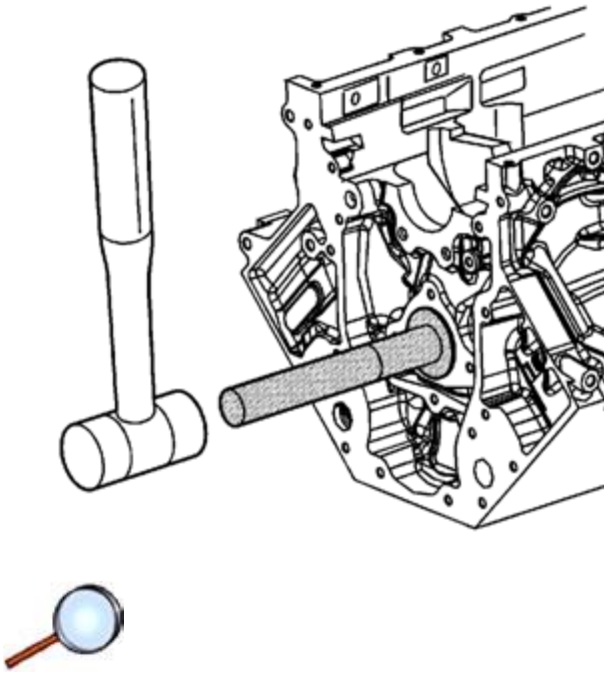


7. Insert the tool into an inner camshaft bearing and tighten until snug.

Operate the tool from the front or rear of the engine block.

On some engine blocks, the nut on the expander assembly is inaccessible, except from either end. In this case, you must use a socket and extension to enlarge and reduce the expander assembly.

8. Slide the nylon cone (2) into the front or rear camshaft bearing. This will properly align the tool.
9. Drive the bearing out of or into the engine block.
10. Repeat the procedure for the additional inner bearings.



11. For the 2 end bearings, front and rear, remove the nylon cone and driver bar extension.
12. Drive the bearings out of or into the engine block.

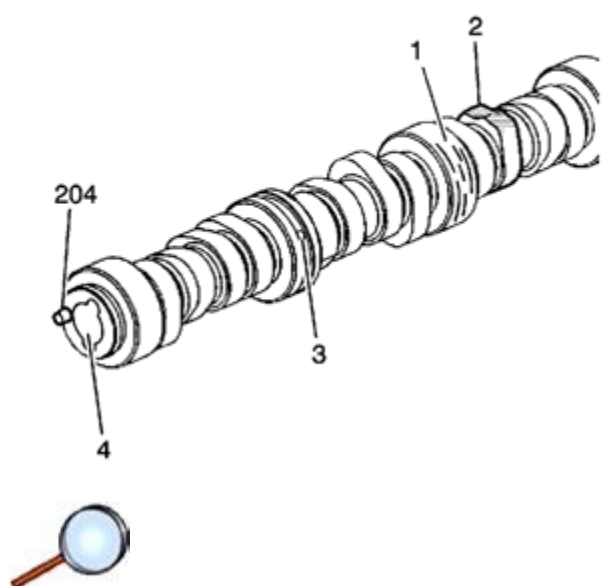
cardiagn.com

Camshaft and Bearings Cleaning and Inspection (RPO LY6 / L76 / L9H)

Special Tools

- J 7872 Magnetic Base Dial Indicator Set
- J 8520 Camshaft Lobe Lift Indicator

For equivalent regional tools, refer to [Special Tools](#)

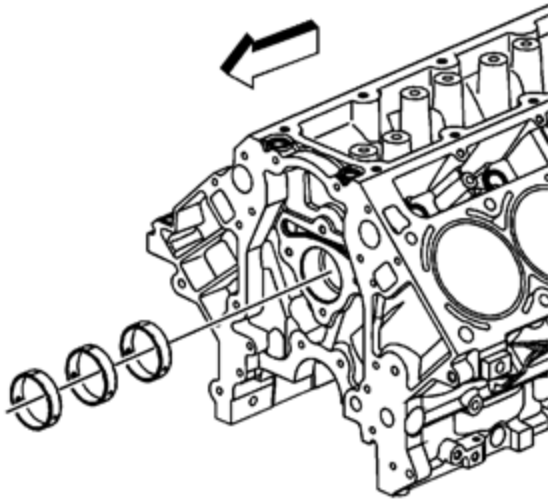


1. Clean the components in solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

2. Dry the components with compressed air.
3. Inspect the camshaft bearing journals (1) for scoring or excessive wear.
4. Inspect the camshaft valve lifter lobes (2) for scoring or excessive wear.
5. Inspect the camshaft position (CMP) actuator oil passages (3) for restrictions.
6. Inspect the threaded bolt hole (4) in the front of the camshaft for damaged threads or debris.
7. Inspect the camshaft sprocket pin (204) for damage.
8. Inspect the camshaft retainer plate for wear or a damaged sealing gasket.

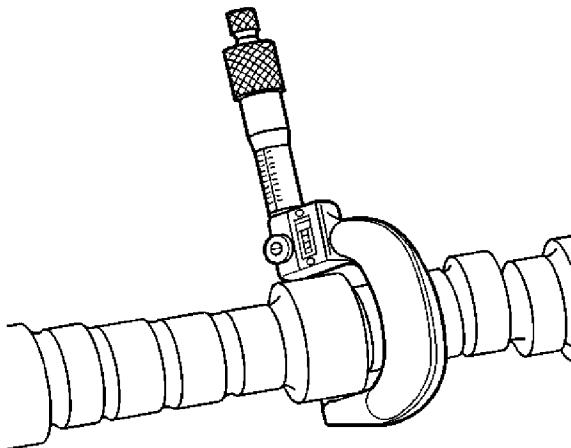
If the camshaft retainer plate sealing gasket is not cut or damaged, it may be used again.



9. Inspect the camshaft bearings for the following:

- Excessive wear or scoring. The presence of the copper color bearing material should be considered normal and not a guideline for bearing replacement. Measure the bearing inside diameter (ID) as required for an over-sized condition. Refer to [Engine Mechanical Specifications](#).
- Proper fit in the engine block. Camshaft bearings have an interference fit to the engine block and should not be loose in the engine block bearing bores.
- Oil lubrication hole plugged by debris.

Bearings with excessive wear or scoring must be replaced.

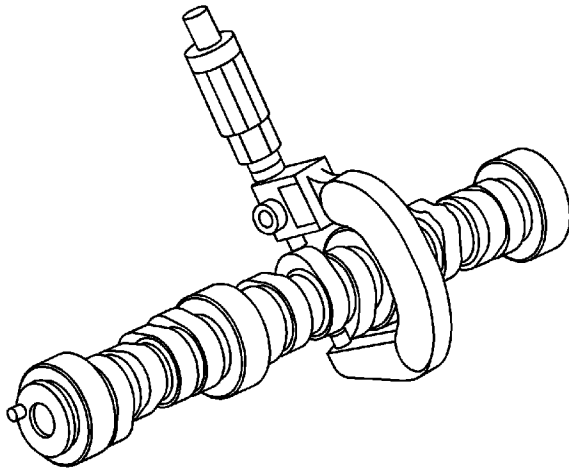


10. Using a micrometer, measure the camshaft journals for wear and out-of-round.

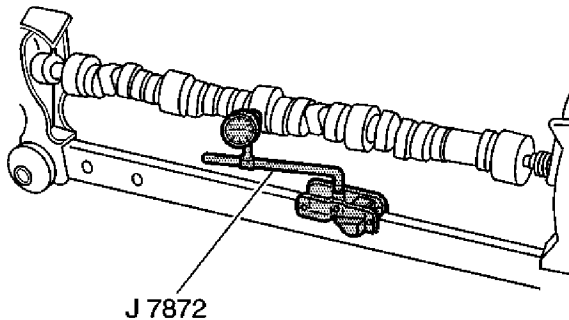
- If the camshaft bearing journals are greater than 0.025 mm (0.001 in) out-of-round,

replace the camshaft.

- If the camshaft bearing journal diameter is less than 54.99 mm (2.164 in), replace the camshaft.

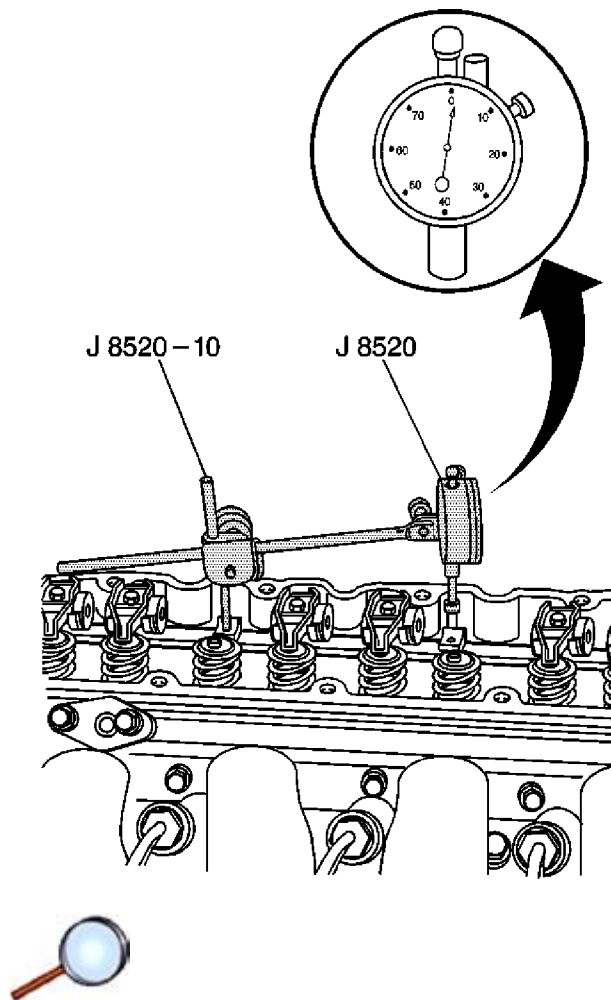


11. Using a micrometer, measure the camshaft lobes for wear. Refer to [Engine Mechanical Specifications](#).



12. Measure the camshaft runout.
- 12.1. Mount the camshaft in wooden V-blocks or between centers on a fixture.
 - 12.2. Using the J 7872 set, measure the runout of the intermediate camshaft bearing journals.
 - 12.3. If camshaft runout exceeds 0.05 mm (0.002 in), the camshaft is bent and should be replaced.

Measuring Camshaft Lobe Lift



Note: Measuring camshaft lobe lift is a procedure used to determine if the camshaft lobes have worn. This test is to be performed prior to engine disassembly and with the camshaft and valve train components installed in the engine.

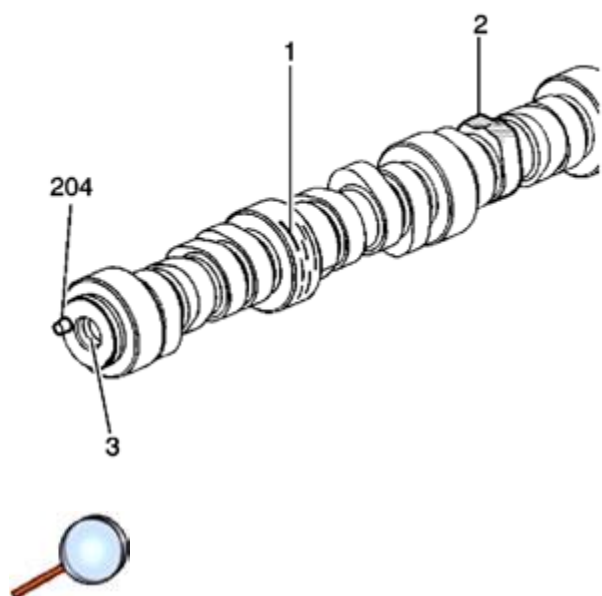
1. Using the J 8520 indicator , measure camshaft lobe lift.
2. Remove the valve rocker arms and bolts.
3. Install the dial indicator mounting stud into the valve rocker arm bolt hole.
4. Assemble the components of the J 8520 indicator and position onto the stud.
5. Position the shaft of the dial indicator onto the end of the pushrod.
6. Rotate the face of the dial indicator to zero.
7. Slowly rotate the crankshaft clockwise, until the dial indicator obtains its highest and lowest readings.
8. Compare the total to specifications. Refer to [Engine Mechanical Specifications](#).

Camshaft and Bearings Cleaning and Inspection (RPO LY2 / LH6 / LMG / LY5 / LC9)

Special Tools

- J 7872 Magnetic Base Dial Indicator Set
- J 8520 Camshaft Lobe Lift Indicator

For equivalent regional tools, refer to [Special Tools](#)

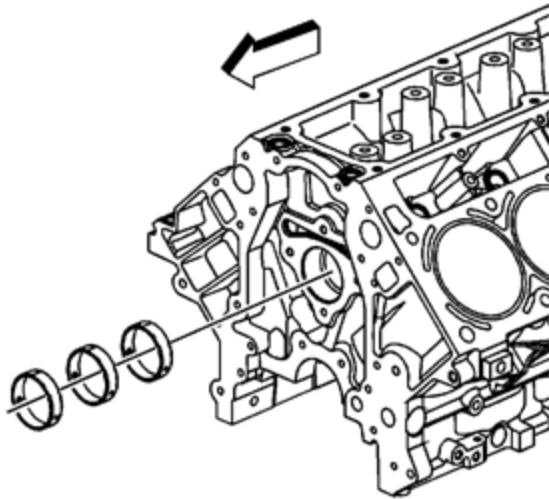


1. Clean the components in solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

2. Dry the components with compressed air.
3. Inspect the camshaft bearing journals (1) for scoring or excessive wear.
4. Inspect the camshaft valve lifter lobes (2) for scoring or excessive wear.
5. Inspect the threaded bolt hole (3) in the front of the camshaft for damaged threads or debris.
6. Inspect the camshaft sprocket pin (204) for damage.
7. Inspect the camshaft retainer plate for wear or a damaged sealing gasket.

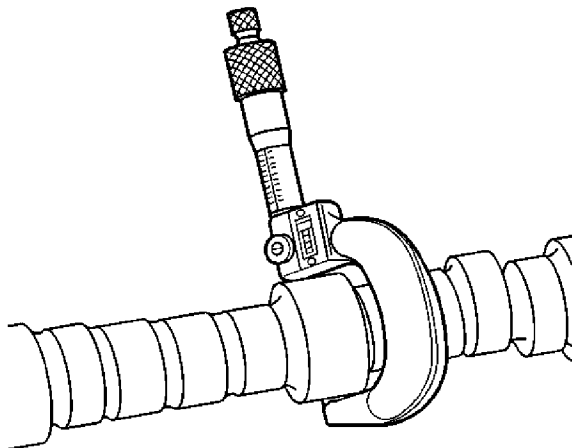
If the camshaft retainer plate sealing gasket is not cut or damaged, it may be used again.



8. Inspect the camshaft bearings for the following:

- Excessive wear or scoring. The presence of the copper color bearing material should be considered normal and not a guideline for bearing replacement. Measure the bearing inside diameter (ID) as required for an over-sized condition. Refer to [Engine Mechanical Specifications](#).
- Proper fit in the engine block. Camshaft bearings have an interference fit to the engine block and should not be loose in the engine block bearing bores.
- Oil lubrication hole plugged by debris.

Bearings with excessive wear or scoring must be replaced.

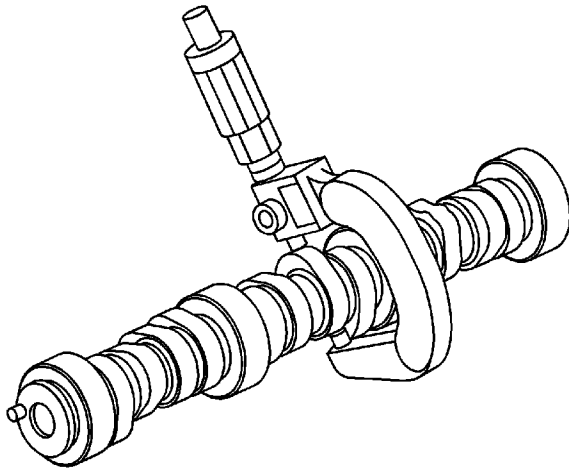


9. Using a micrometer, measure the camshaft journals for wear and out-of-round.

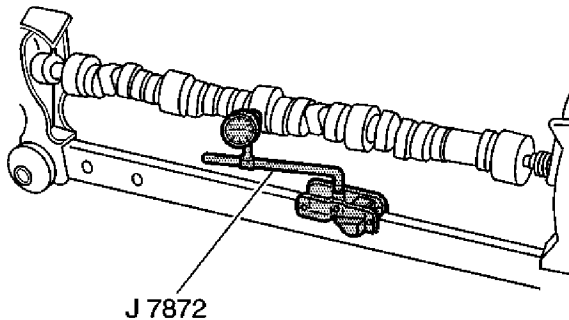
- If the camshaft bearing journals are greater than 0.025 mm (0.001 in) out-of-round,

replace the camshaft.

- If the camshaft bearing journal diameter is less than 54.99 mm (2.164 in), replace the camshaft.

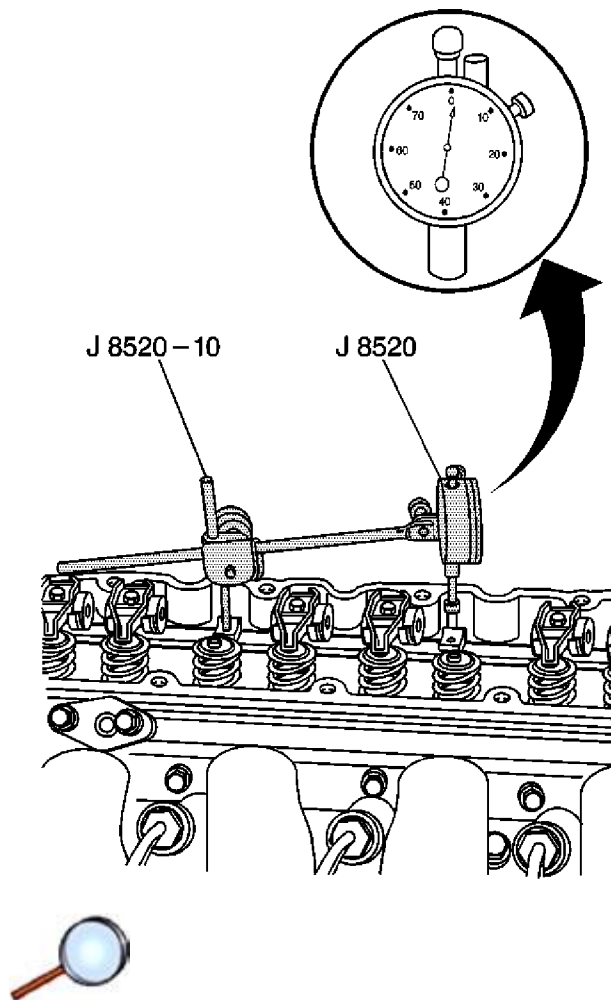


10. Using a micrometer, measure the camshaft lobes for wear. Refer to [Engine Mechanical Specifications](#).



11. Measure the camshaft runout.
- 11.1. Mount the camshaft in wooden V-blocks or between centers on a fixture.
 - 11.2. Using the J 7872 set, measure the runout of the intermediate camshaft bearing journals.
 - 11.3. If camshaft runout exceeds 0.05 mm (0.002 in), the camshaft is bent and should be replaced.

Measuring Camshaft Lobe Lift



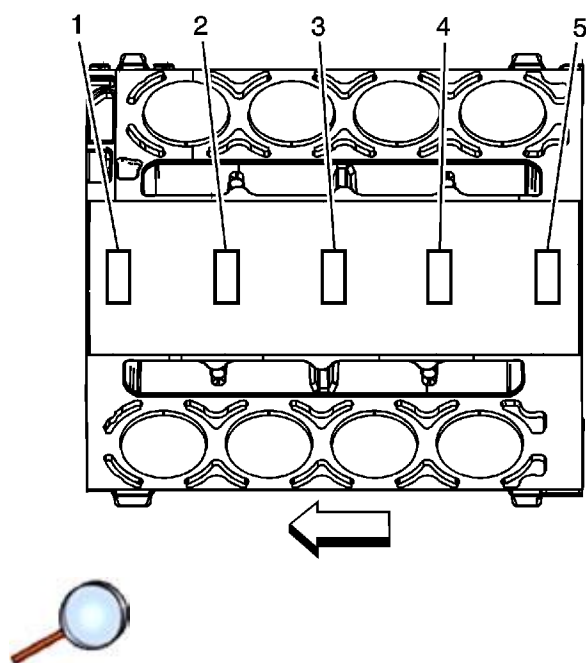
Note: Measuring camshaft lobe lift is a procedure used to determine if the camshaft lobes have worn. This test is to be performed prior to engine disassembly and with the camshaft and valve train components installed in the engine.

1. Using the J 8520 indicator , measure camshaft lobe lift.
2. Remove the valve rocker arms and bolts.
3. Install the dial indicator mounting stud into the valve rocker arm bolt hole.
4. Assemble the components of the J 8520 indicator and position onto the stud.
5. Position the shaft of the dial indicator onto the end of the pushrod.
6. Rotate the face of the dial indicator to zero.
7. Slowly rotate the crankshaft clockwise, until the dial indicator obtains its highest and lowest readings.
8. Compare the total to specifications. Refer to [Engine Mechanical Specifications](#).

Camshaft Bearing Installation

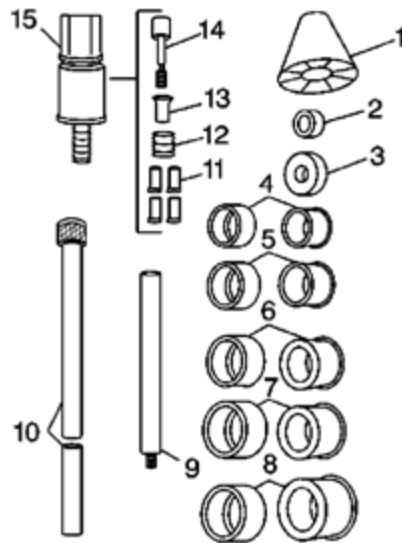
Tools Required

[J 33049](#) Camshaft Bearing Service Set

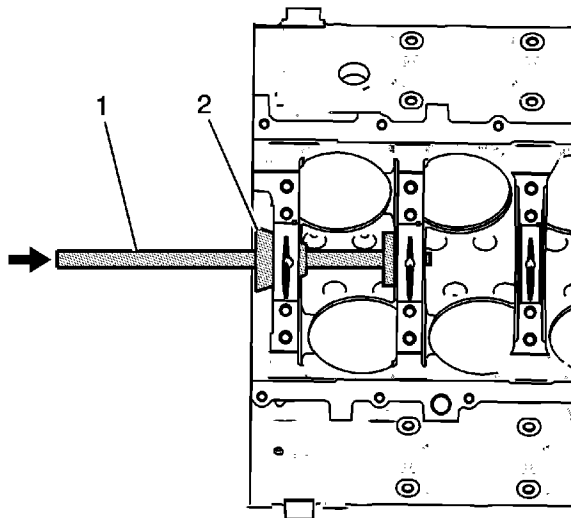


Important: The engine block camshaft bearing bores are machined for 3 different outside diameter (OD) size bearings. Position 1 and 5 are the largest diameter bores. Position 3 is the smallest diameter bore. Position 2 and 4 are the intermediate size bores. The inside diameter (ID) for all camshaft bearings is the same size.

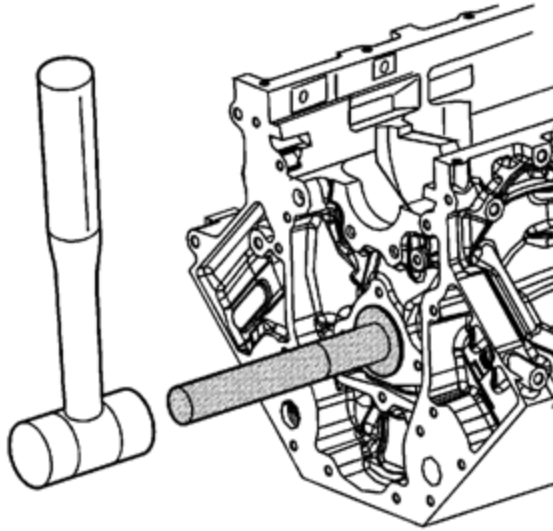
1. Measure the engine block camshaft bearing bores (1-5) in order to identify the correct OD size bearing for each position. Refer to [Engine Mechanical Specifications](#).



2. Select the expanding driver (4-8) and washer (2 or 3) from the [J 33049](#) . Refer to [Piston and Connecting Rod Assemble](#) .
3. Assemble the tool.



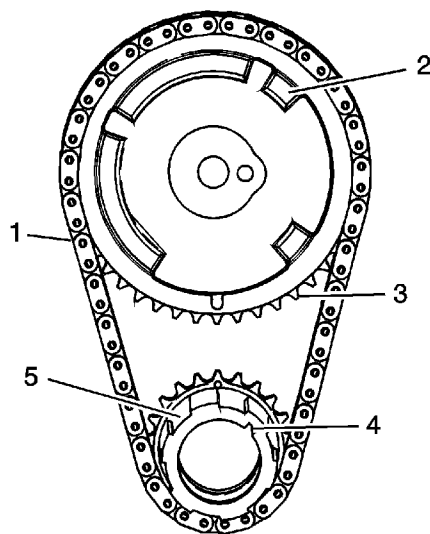
4. Insert the tool (1) through the front of the engine block and into the bearing.
5. Tighten the expander assembly nut until snug.
6. Push the guide cone (2) into the front camshaft bearing in order to align the tool.
7. Drive the bearing into the block bore.



8. Install the front and rear bearings to the block.

cardiagn.com

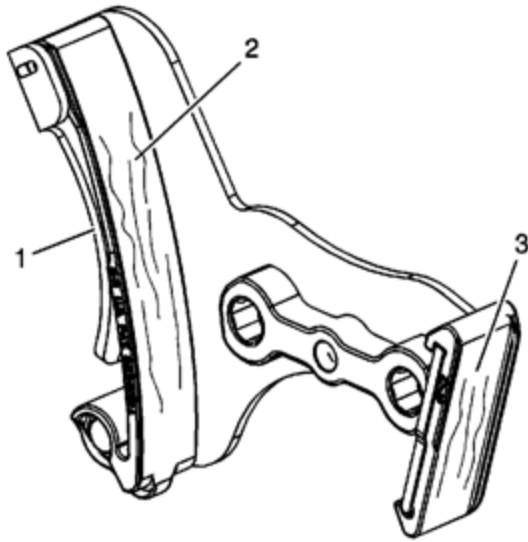
Camshaft Timing Chain and Sprocket Cleaning and Inspection



1. Clean the components with cleaning solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

2. Dry the components with compressed air.
3. Inspect the timing chain (1) for binding or wear.
4. Inspect the camshaft position (CMP) sensor raised areas (2) for nicks or damage.
5. Inspect for worn, damaged, or chipped teeth (3).
6. Inspect for a damaged keyway (4).
7. Inspect for worn oil pump drive splines (5).



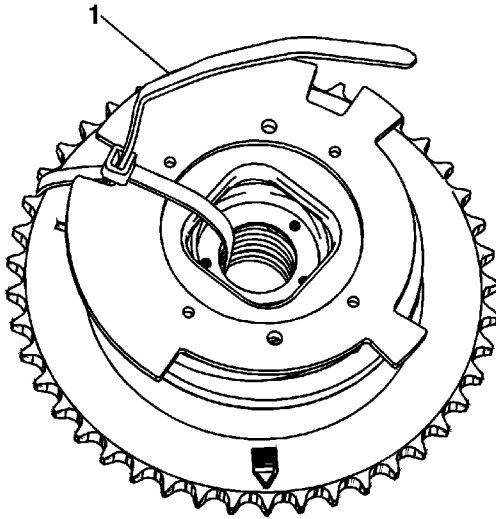
8. Inspect the timing chain tensioner for the following conditions:

- Damaged or broken tension spring (1)
- Excessive wear or scoring on the chain guide surfaces (2, 3)

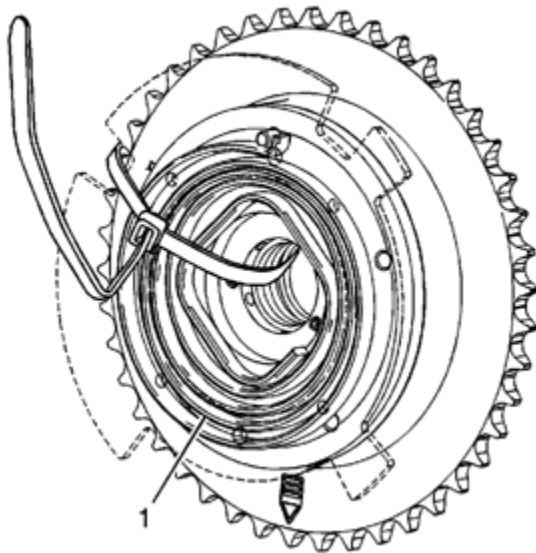
cardiagn.com

Camshaft Position Actuator Cleaning and Inspection

Warning: Refer to [Camshaft Position Actuator Removal and Installation Warning](#) in the Preface section.



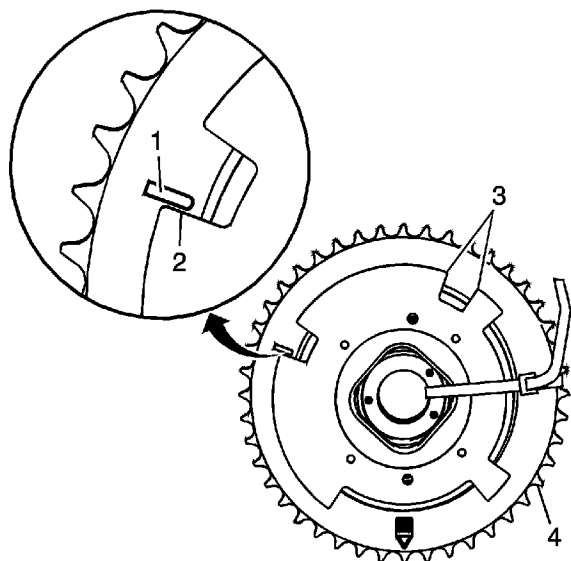
1. Insert a tie strap (1) through the center of the camshaft position (CMP) actuator and over the reluctor wheel.



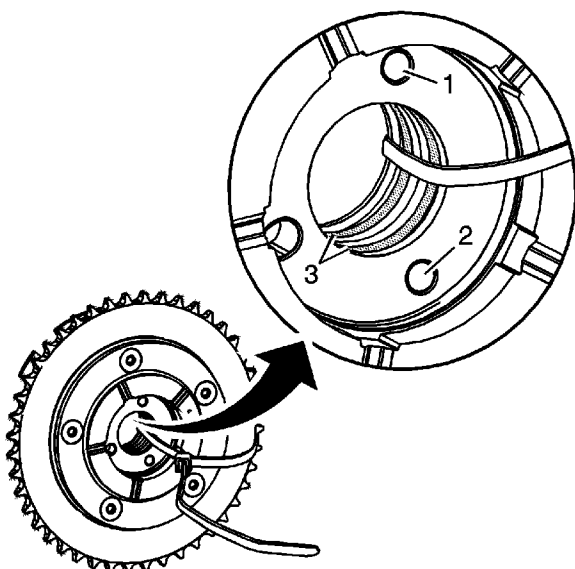
2. Clean the CMP actuator with cleaning solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

3. Dry the components with compressed air.
4. Inspect the CMP actuator for a broken spring (1).

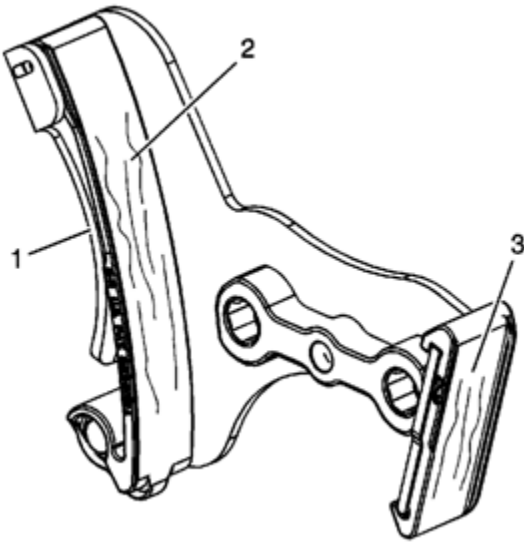


5. Inspect the CMP actuator for the following conditions:
 - Improper positioning of the CMP reluctor wheel. The actuator return spring should reposition the reluctor wheel to the PARK position. Inspect for proper alignment of the mark on the face of the sprocket (1) with the flat edge of the reluctor wheel (2). If the reluctor wheel is not properly positioned, the internal components of the actuator are sticking or the return spring is broken and the actuator should be replaced as an assembly.
 - Nicked or damaged edges (3) on the CMP reluctor wheel
 - Damaged timing chain teeth (4)





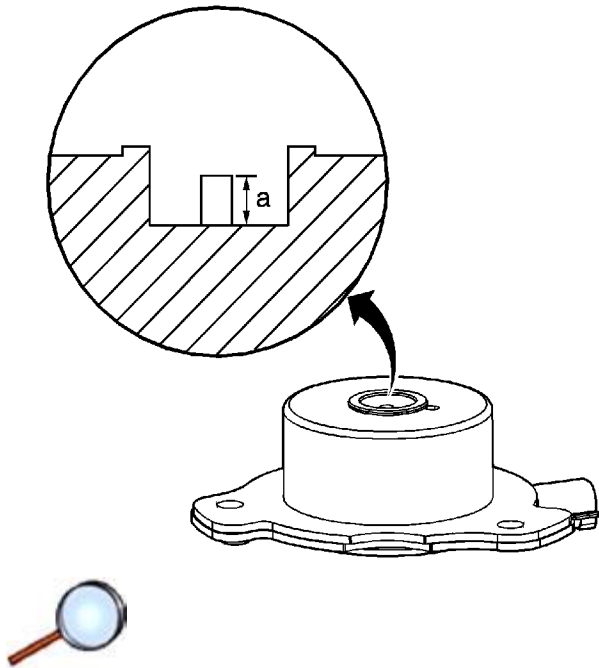
6. Inspect the CMP actuator for dirt, debris, or restrictions within the oil passages (1, 2, 3).



7. Inspect the timing chain tensioner for the following conditions:
- Damaged or broken tension spring (1)
 - Excessive wear or scoring on the chain guide surfaces (2, 3)

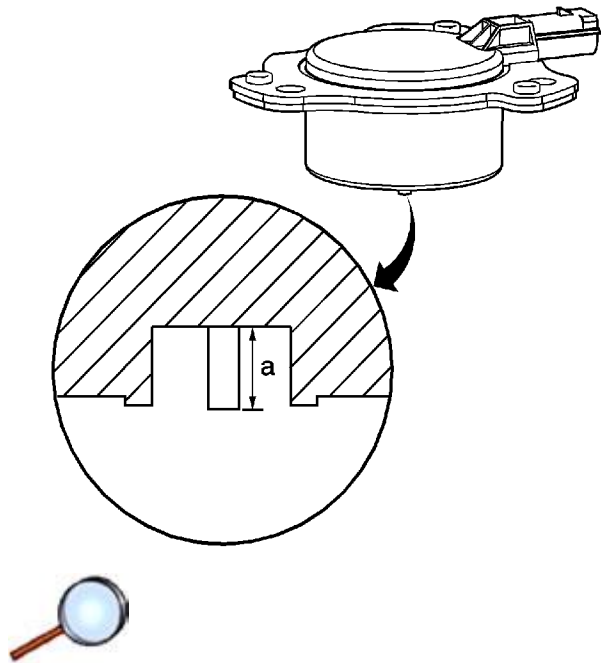
cardiagn.com

Camshaft Position Actuator Magnet Cleaning and Inspection



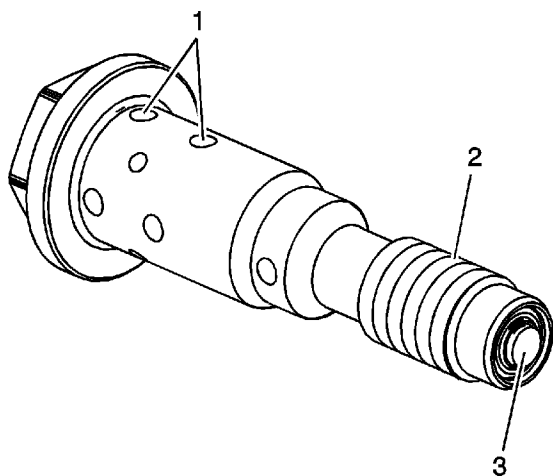
Important: Do not energize the camshaft position (CMP) magnet using a 12-volt power supply.

1. Inspect the CMP magnet for the following conditions:
 - A damaged electrical connector
 - An accumulation of dirt or debris in the recessed area around the pintle
 - A build-up of burnt engine oil on the shaft of the pintle which may cause the pintle to stick and not move freely within the proper range of travel
2. Holding the CMP magnet with the pintle facing upward, measure the pintle retracted position (a). Record the dimension.



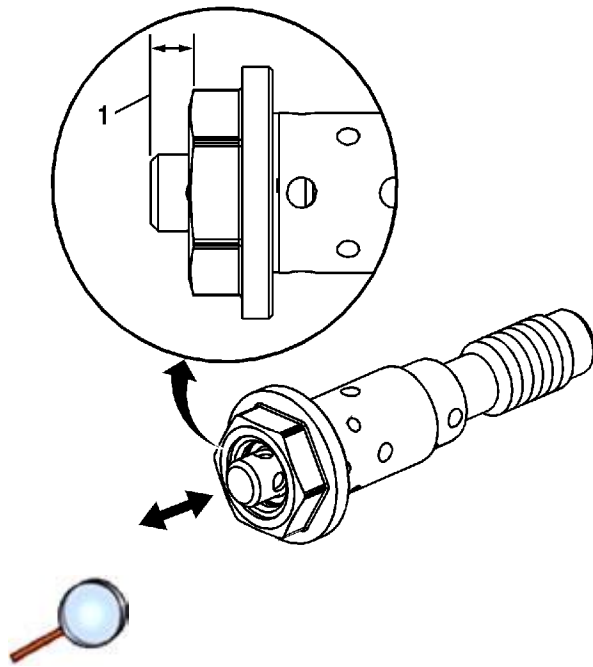
3. Holding the CMP magnet with the pintle facing downward, measure the pintle extended position (a). Record the dimension.
4. Subtract the retracted dimension from the extended dimension to determine pintle travel. A properly moving pintle will travel 3.0-5.5 mm (0.12-0.22 in).
5. If the pintle of the CMP magnet is binding or does not move within the proper range of travel, replace the CMP magnet as an assembly.

Camshaft Position Actuator Solenoid Valve Inspection (Off-Vehicle)



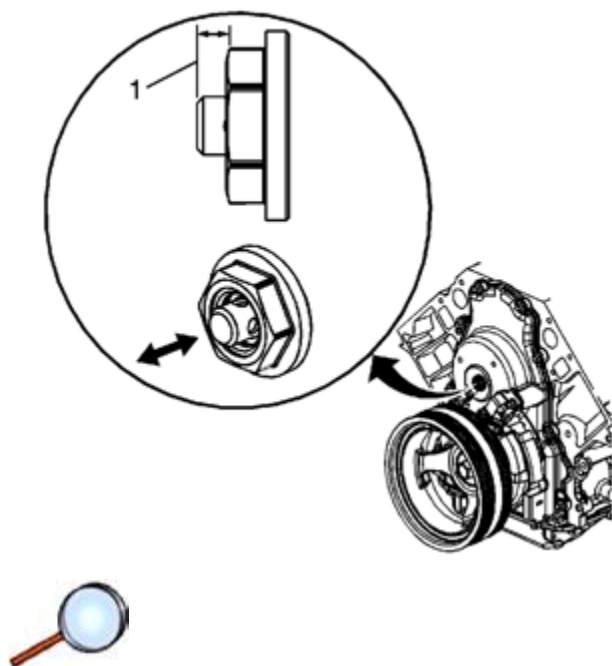
Important: Do not use the camshaft position (CMP) actuator solenoid valve again. Install a NEW valve during assembly. The inspection procedure below is provided for off-vehicle diagnostic purposes only.

1. Inspect the CMP valve for the following conditions:
 - Dirt, debris, or restrictions within the oil passages (1)
 - Damaged threads (2)
 - If the threads of the valve are damaged, also inspect the threads in the front of the camshaft for damage.
 - Dirt, debris, or restrictions within the oil inlet check valve (3)
 - If debris is detected, the engine assembly should be inspected to determine the source of contamination.



2. Inspect for a sticking valve spool or broken valve spool spring.
3. Depress the valve spool into the housing. The valve should move freely with no binding or sticking and minimal resistance inward. When released, the valve spring should return the spool to the proper extended position (1) of 6.08-6.12 mm (0.239-0.241 in).

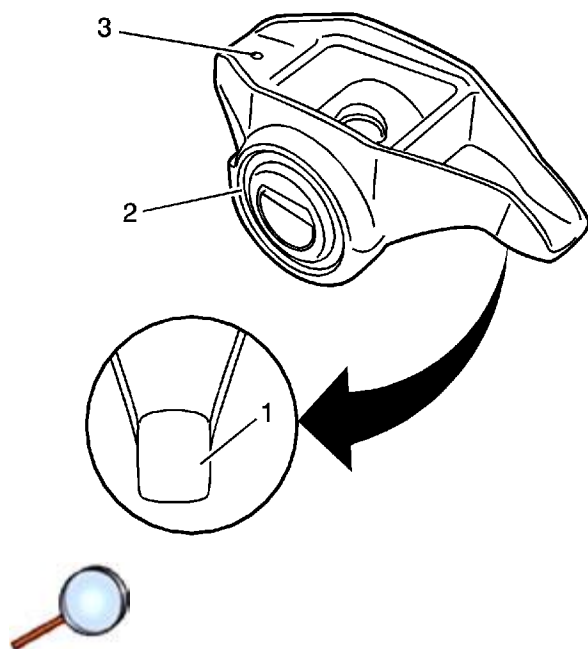
Camshaft Position Actuator Solenoid Valve Inspection (On-Vehicle)



Important: Do not use the camshaft position (CMP) actuator solenoid valve again. Install a NEW valve during assembly. The inspection procedure below is provided for on-vehicle diagnostic purposes only.

1. With the CMP magnet removed, inspect for a sticking valve spool or broken valve spool spring.
2. Depress the valve spool into the housing. The valve should move freely with no binding or sticking and minimal resistance inward. When released, the valve spring should return the spool to the proper extended position (1) of 6.08-6.12 mm (0.239-0.241 in).

Valve Rocker Arm and Push Rod Cleaning and Inspection



Note: Parts that are to be used again must be marked, sorted or organized for assembly.

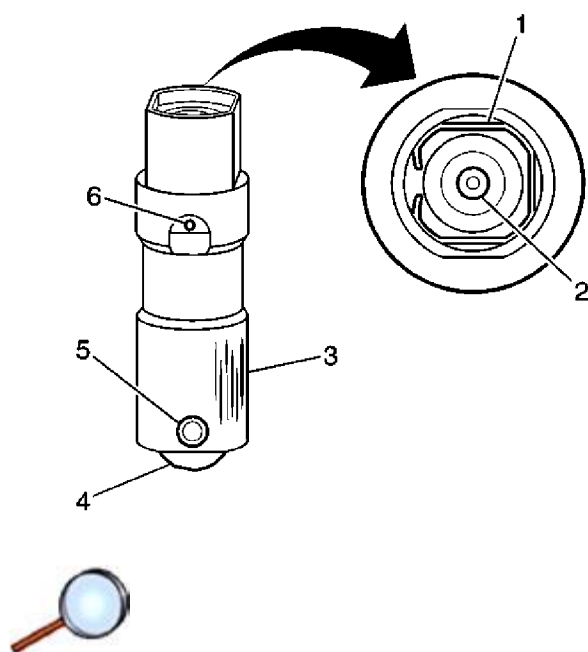
1. Mark, sort, or organize the components for assembly. Refer to [Separating Parts](#).
2. Clean the components with cleaning solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

3. Dry the components with compressed air.
4. Inspect the valve rocker arms bearings (2) for binding or roughness.
5. Inspect the valve rocker arm pushrod sockets (3) and valve stem mating surfaces (1). These surfaces should be smooth with no scoring or exceptional wear.
6. Inspect the pushrods for worn or scored ends. These surfaces should be smooth with no scoring or exceptional wear.
7. Inspect the pushrods for bends. Roll the pushrod on a flat surface to determine if the pushrod is bent.
8. Inspect the pushrod oil passages for restrictions.
9. Inspect the rocker arm pivot supports for cracks, wear, or other damage.

Valve Lifter and Guide Cleaning and Inspection (RPO LY2 / LY6 / L9H)

Valve Lifters



Note: Components that are to be used again must be marked, sorted or organized for assembly.

1. Clean the components in cleaning solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

2. Dry the components with compressed air.
3. Inspect the valve lifters for the following conditions:

- Bent or broken clip (1)
- Worn pushrod socket (2)
- Scuffed or worn sides (3)

If the valve lifter shows wear, inspect the engine block lifter bores for wear or damage.

- Flat spots on the roller (4)
- Loose or damaged pin (5)
- Plugged oil hole (6)
- Worn or damaged roller bearing

The roller should rotate freely with no binding or roughness.

Valve Guides

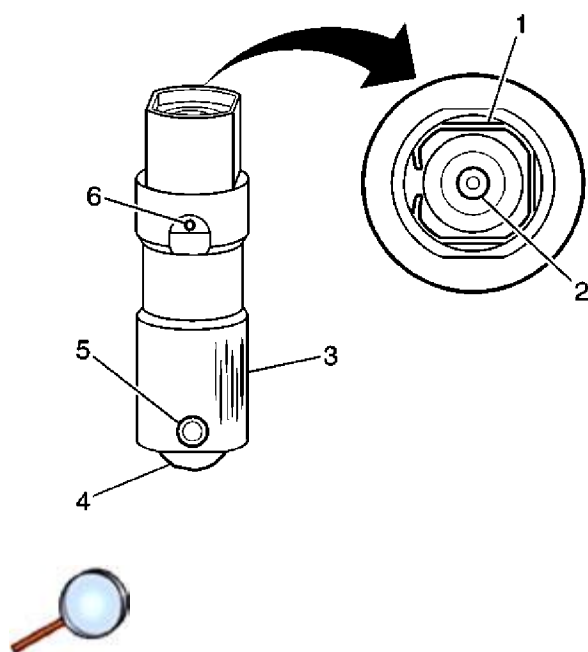
Inspect the valve lifter guides for the following conditions:

- Cracks or damage
- Excessive wear in the lifter mounting bores

cardiagn.com

Valve Lifter and Guide Cleaning and Inspection (RPO LH6 / LMG / LY5 / LC9 / L76)

Non Active Fuel Management Valve Lifters



Note: Components that are to be used again must be marked, sorted or organized for assembly.

1. Clean the components in cleaning solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

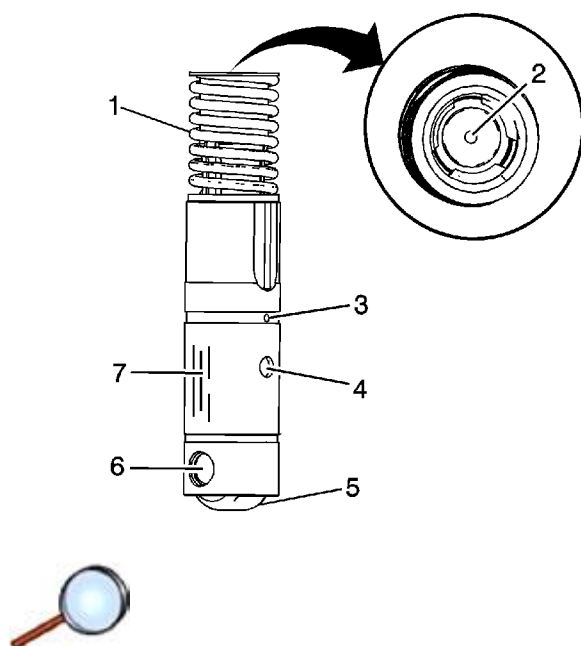
2. Dry the components with compressed air.
3. Inspect the valve lifters for the following conditions:
 - Bent or broken clip (1)
 - Worn pushrod socket (2)
 - Scuffed or worn sides (3)

If the valve lifter shows wear, inspect the engine block lifter bores for wear or damage.

- Flat spots on the roller (4)
- Loose or damaged pin (5)
- Plugged oil hole (6)
- Worn or damaged roller bearing

The roller should rotate freely with no binding or roughness.

Active Fuel Management Valve Lifters



Note: Components that are to be used again must be marked, sorted or organized for assembly.

1. Clean the components in cleaning solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

2. Dry the components with compressed air.
3. Inspect the valve lifters for the following conditions:
 - Broken or collapsed spring (1)
 - Worn pushrod socket (2)
 - Plugged lubrication hole (3)
 - Plugged lifter oil-switching hole (4)
 - Flat spots on the roller (5)
 - Worn or damaged roller bearing (6)
The roller should rotate freely with no binding or roughness.
 - Scuffed or worn sides (7)

Valve Guides

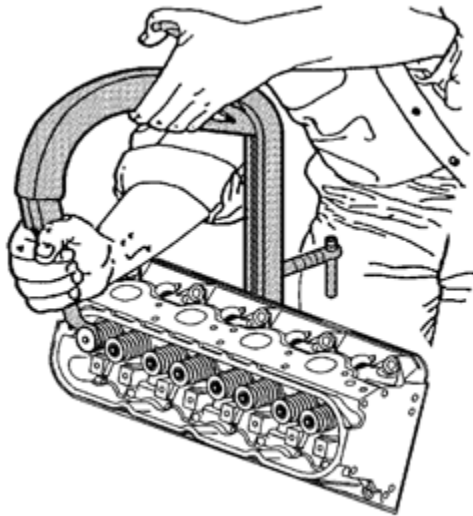
Inspect the valve lifter guides for the following conditions:

- Cracks or damage
- Excessive wear in the lifter mounting bores

Cylinder Head Disassemble

Special Tools

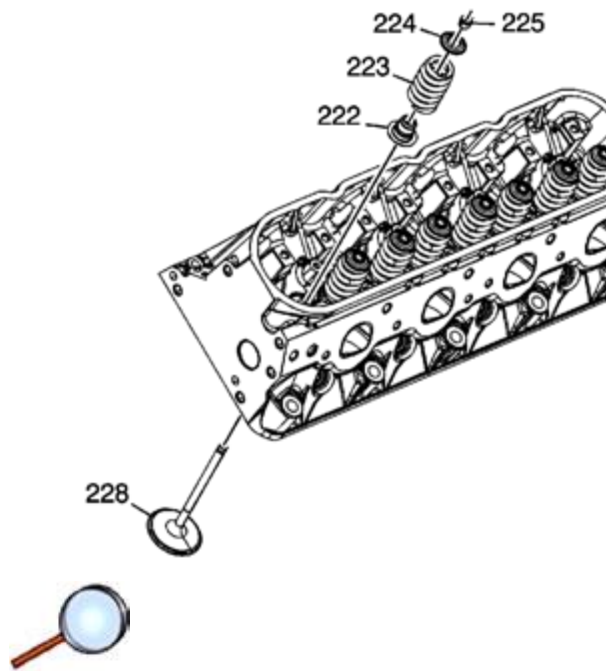
[J 8062](#) Valve Spring Compressor - Head Off



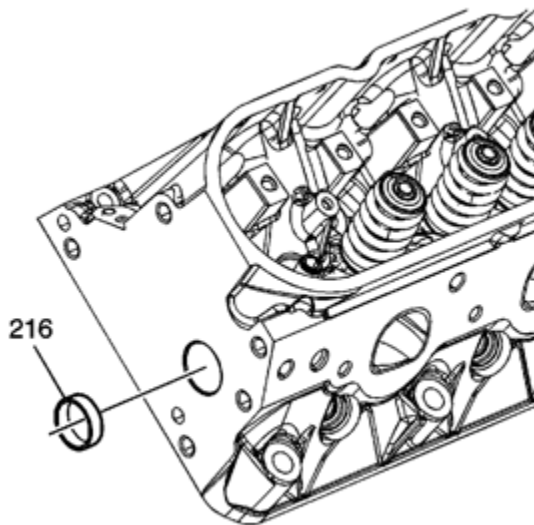
Important:

- With the components at room temperature, remove the spark plugs from the cylinder head.
- Mark, organize, or sort the cylinder head components for assembly. Return the components to their original location during assembly.

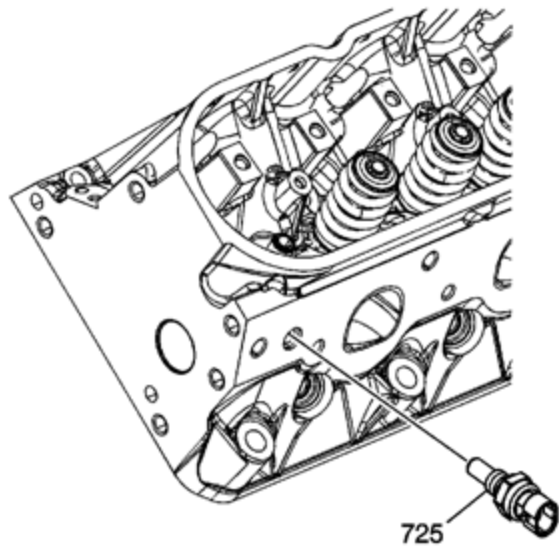
1. Remove the spark plugs from the cylinder heads.
2. Use the [J 8062](#) in order to compress the valve spring.



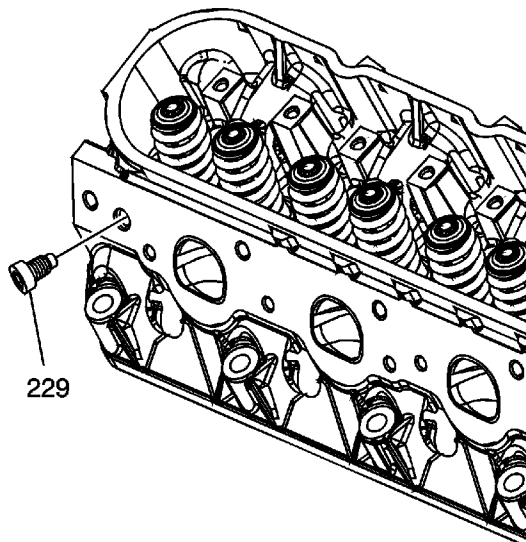
3. Remove the valve stem keys (225).
4. Remove the valve spring cap (224).
5. Remove the valve spring (223).
6. Remove the valves (228).
7. Remove the valve stem oil seal (222). Refer to [Separating Parts](#).



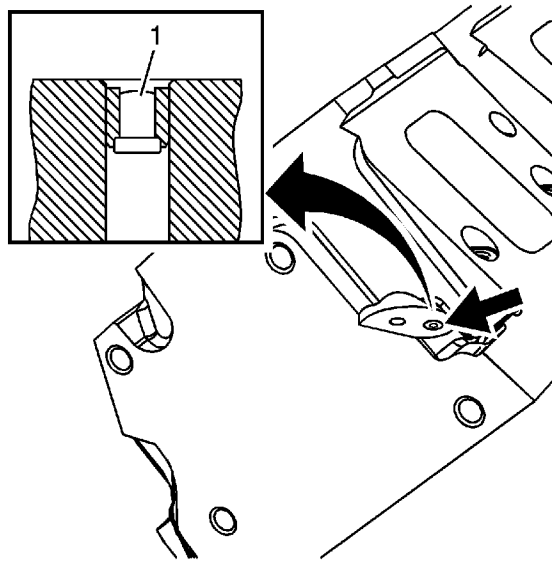
8. Remove the cylinder head core hole plugs (216), as required.



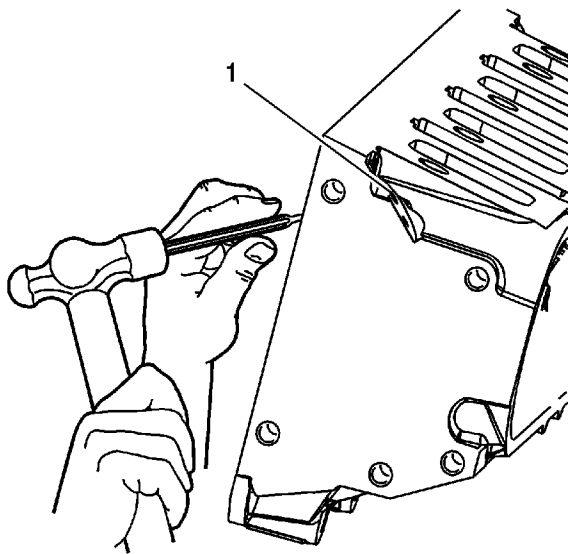
9. Remove the coolant temperature sensor (725) from the left cylinder head.



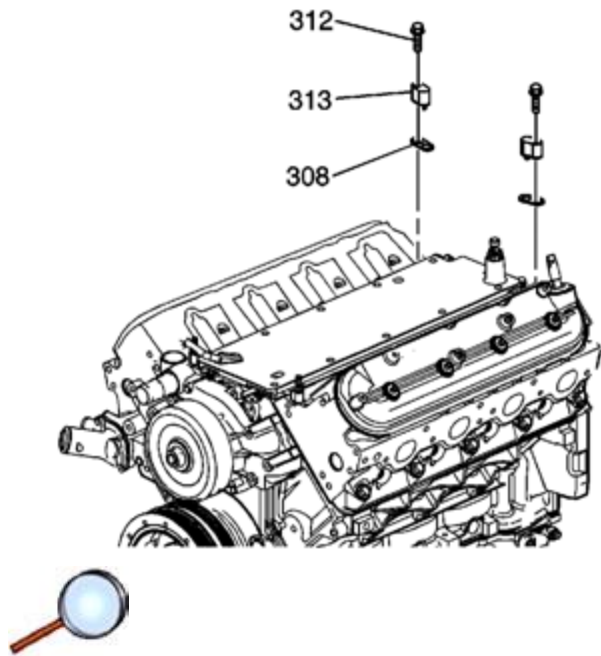
10. Remove the cylinder head plug (229) from the right cylinder head.



11. Inspect for a leaking plug (1). Second design applications use a rivet-type plug at the top rear coolant passage of each cylinder head. If service of a leaking plug is required, it is necessary to remove the cylinder head from the engine to properly remove the plug.



12. Using a 6.43 mm (0.25 in) or smaller punch, remove the plug assembly (1) from the cylinder head.



13. If plug removal is required, install a first design coolant air bleed cover (313), seal (308), and bolt (312) to complete the repair.

cardiagn.com

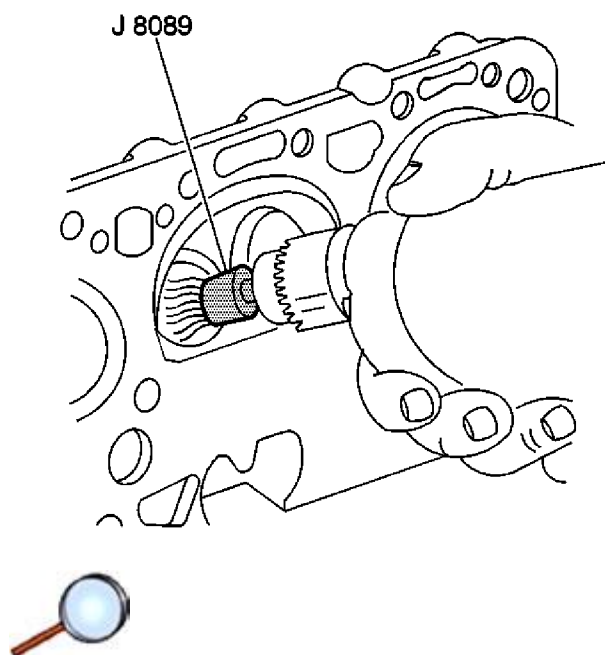
Cylinder Head Cleaning and Inspection

Special Tools

- J 8089 Carbon Removal Brush
- J 9666 Valve Spring Tester

For equivalent regional tools, refer to [Special Tools](#)

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



Note:

- When cleaning a cylinder head in a thermal type oven, do not exceed 204°C (400°F).
- Be careful not to scuff the chamber.

1. Clean the following components:

- Use the J 8089 brush in order to remove the carbon from the combustion chambers.
- Gasket surfaces
Refer to [Replacing Engine Gaskets](#).
- Valve stems and heads on a buffing wheel
- Bolt hole threads

Remove all dirt, debris, or threadlocking material from the bolt holes.

2. Inspect the cylinder head for the following conditions:

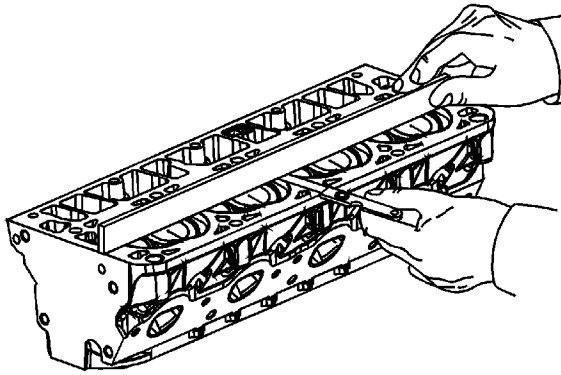
- 2.1. Cracks in the exhaust ports and combustion chambers

- 2.2. External cracks in the water chambers
- 2.3. Gasket surfaces for excessive scratches or gouging

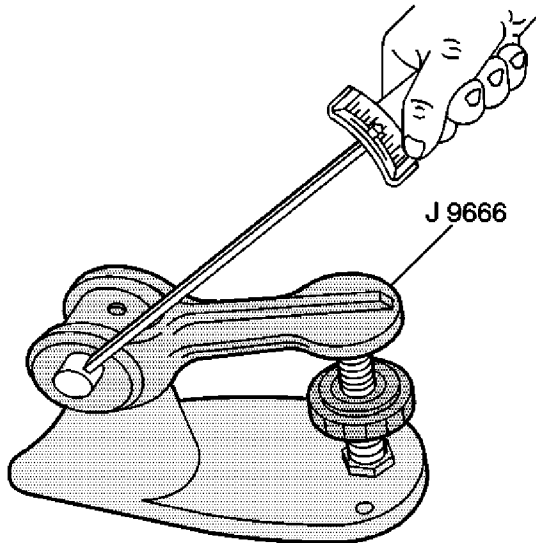
Refer to [Replacing Engine Gaskets](#).

- 2.4. Bolt hole threads for debris or damaged threads

Refer to [Thread Repair](#) or [Thread Repair Specifications](#).

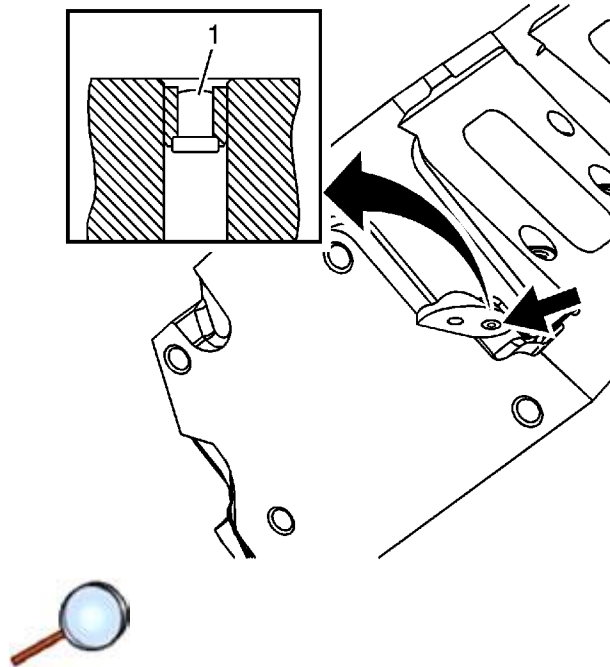


- 3. Inspect the cylinder head for warpage. Refer to [Engine Mechanical Specifications](#).



- 4. Use the J 9666 tester in order to measure the valve spring tension. Refer to [Engine](#)

[Mechanical Specifications.](#)



5. Inspect for a leaking plug (1). Second design applications use a rivet-type plug at the top rear coolant passage of each cylinder head. If service of a leaking plug is required, it is necessary to remove the cylinder head from the engine to properly remove the plug. Refer to [Cylinder Head Disassemble](#).

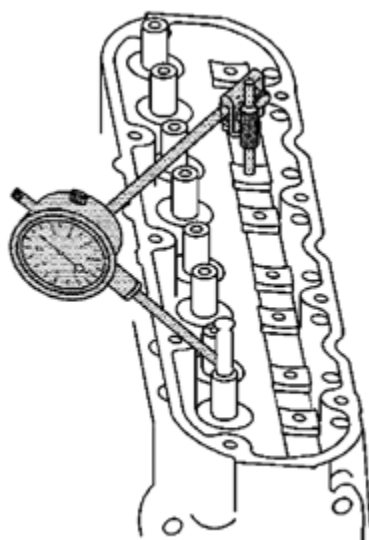
Valve Guide Reaming, and Valve and Seat Grinding

Special Tools

J 37378-1 Valve Guide Reamer

For equivalent regional tools, refer to [Special Tools](#)

Valve Guide Reaming

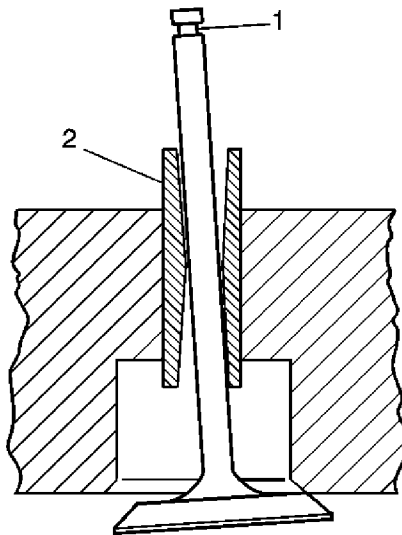


Caution: Excessive valve stem-to-guide clearance may cause a noisy valve train, premature valve stem oil seal wear, component damage, and/or excessive engine oil consumption.

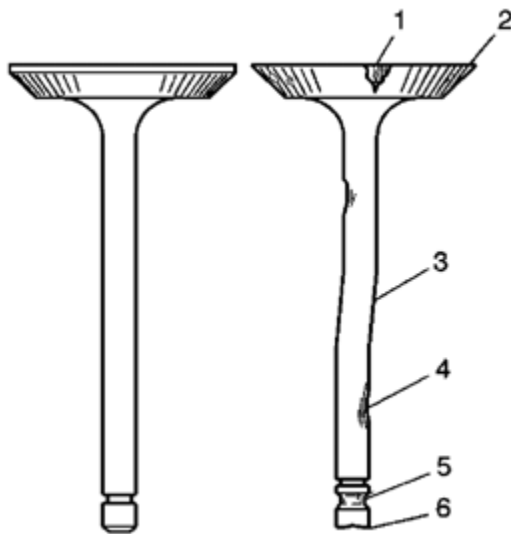
Caution: Insufficient valve stem-to-guide clearance will result in noisy or sticking valves. Valves that are too tight may disturb engine smoothness or lead to component damage.

1. Using a dial indicator, measure the valve stem-to-guide clearance. Position the tip of the dial indicator at the top of the valve guide.

Valve stem-to-guide clearance may also be obtained by using a micrometer to measure the valve stem diameter and a ball type measuring gage to measure the guide bore.



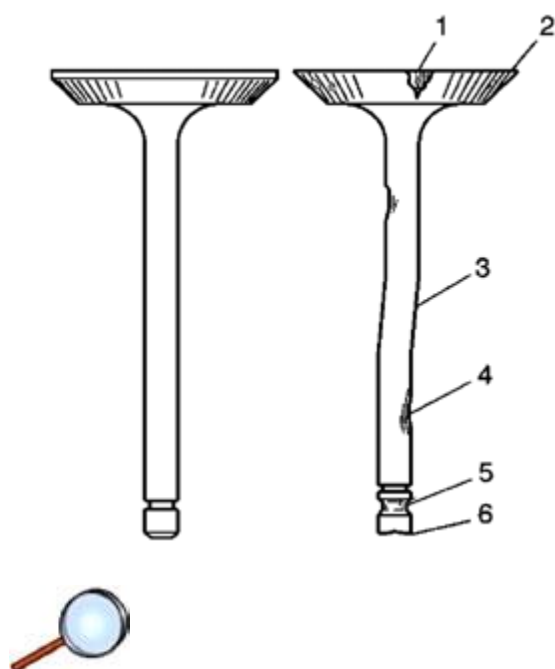
2. A valve stem (1) and guide (2), with excessive clearance, must be replaced or the cylinder head replaced. Refer to [Engine Mechanical Specifications](#).



3. Inspect the valve stems for excessive scoring, wear, or warpage.
- A valve stem that has excessive scoring (3 or 4) or wear (4 or 6) must be replaced.
 - If a valve guide is worn or has excessive stem-to-guide clearance, the cylinder head should be replaced.
4. Measure the valve stem diameter. A valve stem with a diameter less than 7.95 mm (0.313 in) must be replaced.

If the valve stem diameter is within specifications, and the stem-to-guide clearance is excessive, the cylinder head must be replaced.

Valve and Seat Grinding



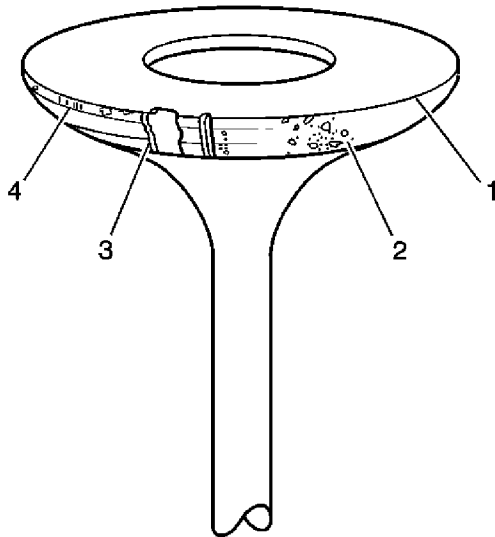
Note:

- Reconditioning the valve seats is very important. The seating of the valves must be perfect for the engine to deliver optimum power and performance. Several different types of equipment are available for grinding valve seats.
- Another important factor is the cooling of the valve head. Good contact between the valve and the seat will ensure that heat will be properly dissipated.
- The recommendations of the equipment manufacturer should be followed carefully to obtain the proper results. Regardless of the type of equipment used, it is essential that valve guide bores be free of carbon or dirt to ensure proper centering of the tool pilot in the guide.
- Valves that are pitted must be refaced to the proper angle. Valve stems that show excessive wear, or valves that are warped excessively must be replaced. When a valve head that is warped excessively is refaced, a knife edge may be ground on part or all of the valve head due to the amount of metal that must be removed. Knife edges lead to breakage, burning or pre-ignition due to heat localizing on this knife edge. If the edge of the valve head is less than 1.25 mm (0.05 in) after grinding, replace the valve.
- Several different types of equipment are available for refacing valves. The recommendation of the equipment manufacturer should be carefully followed to obtain the proper results.
- DO NOT reface intake valves. Intake valves with excessive wear or damage MUST be replaced.

1. Inspect the valve for the following conditions:

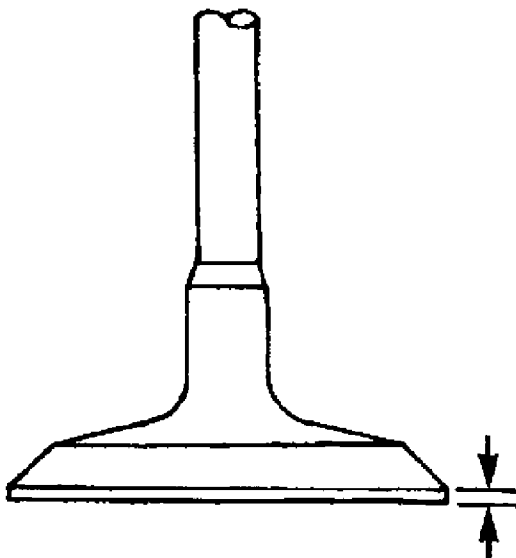
- Burnt or eroded areas (1)
- A worn margin (2)
- A bent stem (3)

- A worn or scored stem (4)
- A worn key groove (5)
- A worn stem tip (6)



2. Inspect the valve face for the following conditions:

- Worn or no margin (1 or 4)
- Pitted surfaces (2)
- Burnt or eroded areas (3)



3. Inspect the valve margin.

The exhaust valve may be refaced if the margin is greater than 1.25 mm (0.05 in) thick before grinding.

4. Reface pitted exhaust valves on a suitable valve refacing machine.
5. Replace the valve if the margin is less than 1.25 mm (0.05 in) thick after grinding.
6. If the valve face has been ground, it may be necessary to shim the valve spring in order to obtain the proper spring installed height. Refer to [Cylinder Head Disassemble](#).
7. Inspect for a loose valve seat in the cylinder head. The valve seat has an interference fit to the cylinder head.
8. Clean the valve guide bores with a suitable tool. Remove all carbon or dirt from the bores.

The valve guide must be clean for the seat grinding tool to obtain proper results.

9. Grind the valve seat.

The recommendations of the equipment manufacturer should be followed carefully to obtain the proper results. Regardless of the type of equipment used, it is essential that valve guide bores be free from carbon or dirt to ensure proper centering of the tool pilot in the guide.

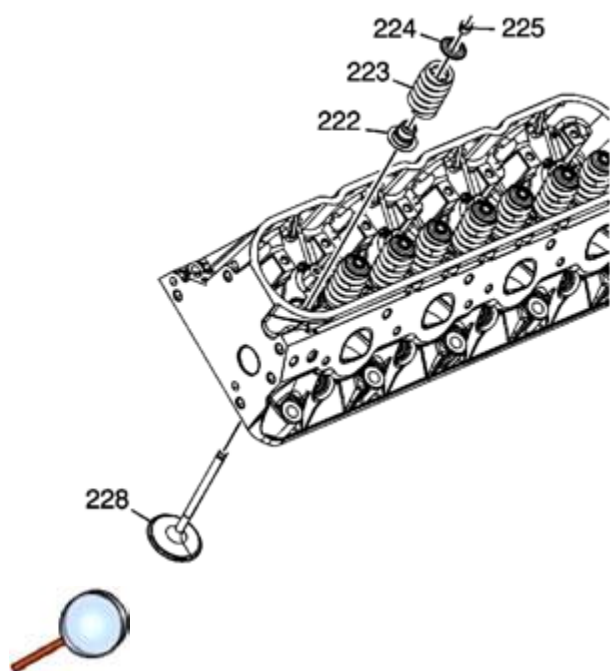
10. Inspect the valve seats.
 - The valve seats should be concentric to within 0.05 mm (0.0021 in) total indicator reading.
 - If the valve seat has been ground, it may be necessary to shim the valve spring in order to attain the proper spring installed height. Refer to [Cylinder Head Disassemble](#).

Cylinder Head Assemble

Special Tools

J 8062 Valve Spring Compressor - Head Off

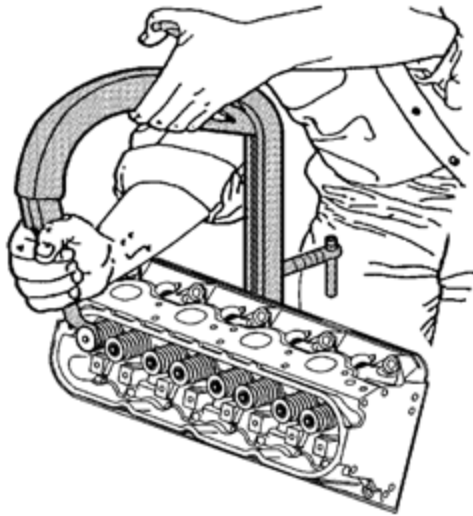
For equivalent regional tools, refer to [Special Tools](#)



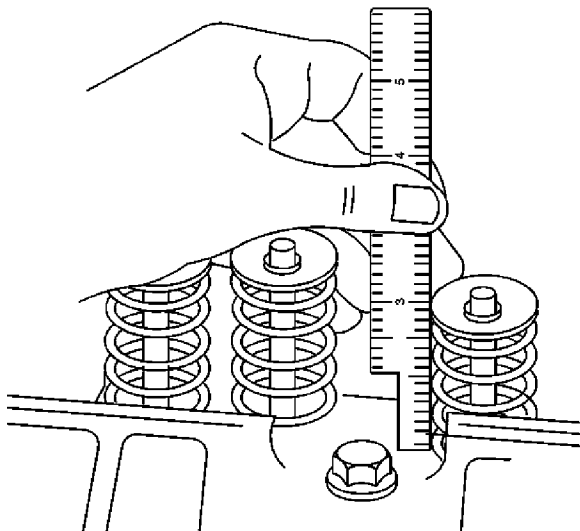
1. Clean the cylinder head valve spring shim area.

Note: When using the valves and related components again, install the parts to their original location.

2. Install the valves (228) into the proper port. Refer to [Separating Parts](#)
3. Install the valve stem oil seal (222).
4. Install the valve spring (223).
5. Install the valve spring cap (224).



6. Using the *J 8062* compressor , compress the valve spring.
7. Install the valve stem keys.
 - 7.1. Use grease in order to hold the keys in place and remove the *J 8062* compressor .
 - 7.2. Ensure the keys seat properly in the groove of the valve stem.
 - 7.3. Tap the end of the valve stem with a plastic face hammer to seat the keys, if necessary.



8. Using a ruler, measure the valve spring installed height.

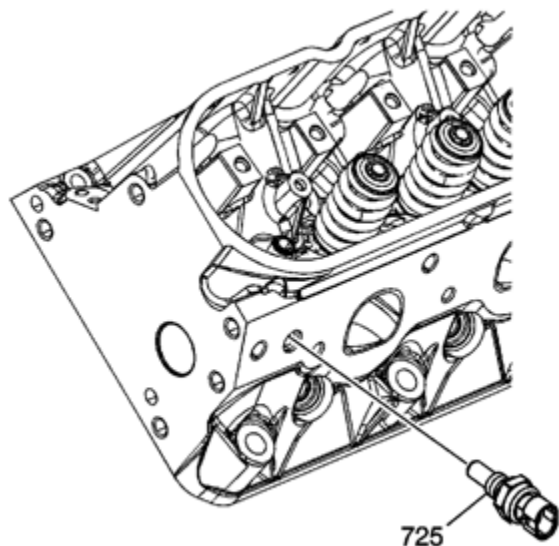
Measure from the base of the valve spring to the top of the valve spring.

Specification

- If the installed height exceeds 46.25 mm (1.82 in), install a valve spring shim of approximately 0.5 mm (0.02 in) thick.
- Do not shim the valve spring to obtain less than the specified height.

Do not assemble the components without a spring shim on the cylinder head.

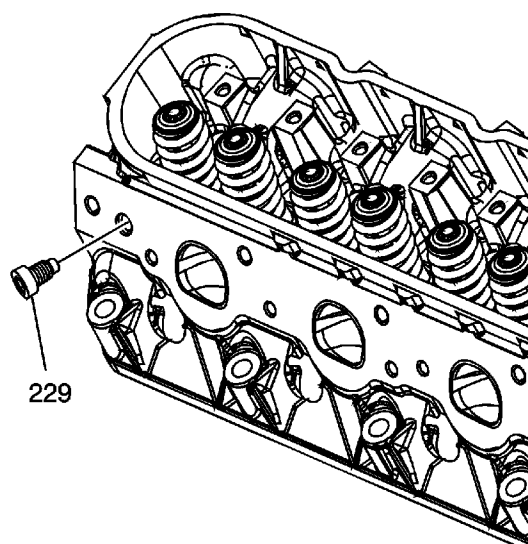
9. Install the remaining valves, springs, and other components.



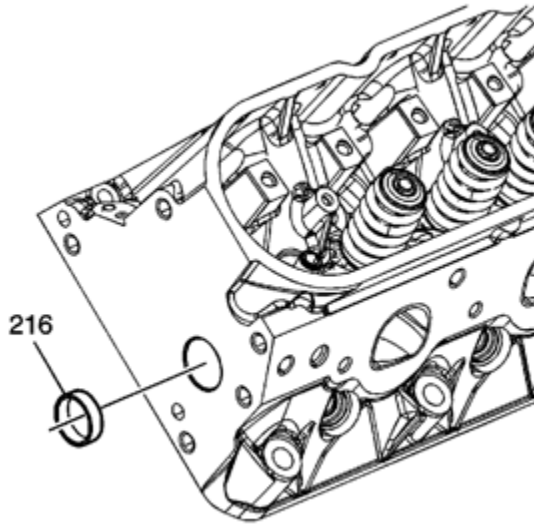
10. Install sealant GM P/N 12346004 (Canadian P/N 10953480), or equivalent, to the threads of the coolant temperature sensor (725).

Caution: Refer to [Fastener Caution](#) in the Preface section.

11. Install the coolant temperature sensor into the left cylinder head and tighten to **20 N·m (15 lb ft)**.

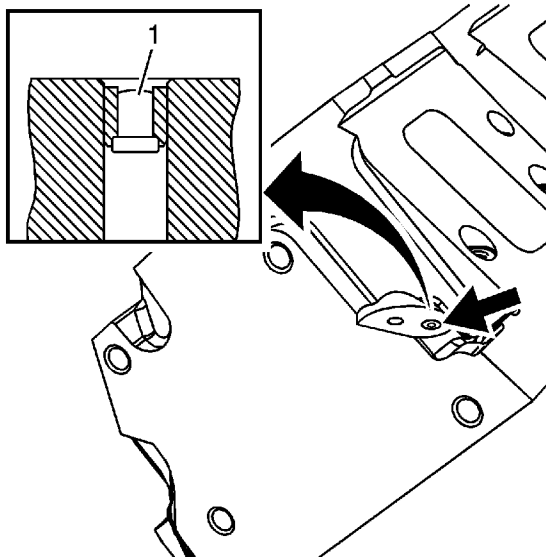


12. Install sealant GM P/N 12346004 (Canadian P/N 10953480), or equivalent, to the threads of the cylinder head plug (229).
13. Install the cylinder head plug to the right cylinder head and tighten to **20 N·m (15 lb ft)**.

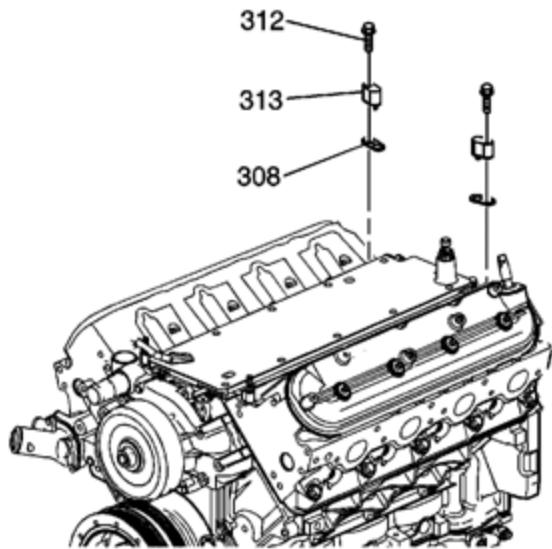


14. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the sides of the cylinder head plugs (216).
15. Install the cylinder head plugs into the cylinder head.

A properly installed plug should be installed 2.5 mm (0.1 in) below the end face of the head.



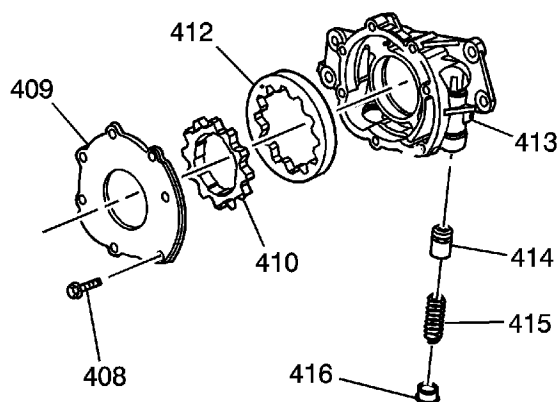
16. Second design applications use a rivet-type plug (1) at the top rear coolant passage of each cylinder head. If service of a leaking plug is required, it is necessary to remove the cylinder head from the engine to properly remove the plug.



17. If plug removal is required, install a first design coolant air bleed cover and bolt to complete the repair.

cardiagn.com

Oil Pump Disassemble



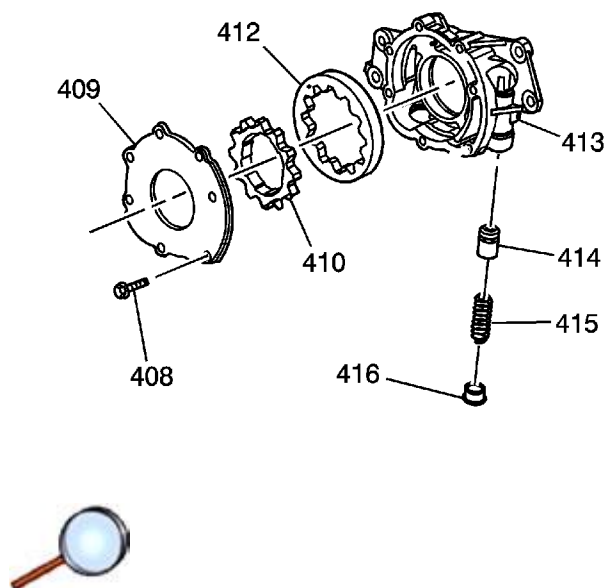
Important: The internal parts of the oil pump assembly are not serviced separately, excluding the spring. If the oil pump components are worn or damaged, replace the oil pump as an assembly.

1. Remove the oil pump cover bolts (408).
2. Remove the oil pump cover (409).

Important: Mark or identify the gears for assembly. Refer to [Separating Parts](#).

3. Remove the drive gear (410).
4. Remove the driven gear (412).
5. Remove the pressure relief valve plug (416).
6. Remove the pressure relief valve spring (415).
7. Remove the pressure relief valve (414).
8. Inspect the oil pump components. Refer to [Oil Pump Cleaning and Inspection](#).

Oil Pump Cleaning and Inspection



Note:

- The internal parts of the oil pump assembly are not serviced separately, excluding the spring. If the oil pump components are worn or damaged, replace the oil pump as an assembly.
- The oil pump pipe and screen are to be serviced as an assembly. Do not attempt to repair the wire mesh portion of the pump and screen assembly.

1. Clean the parts in solvent.

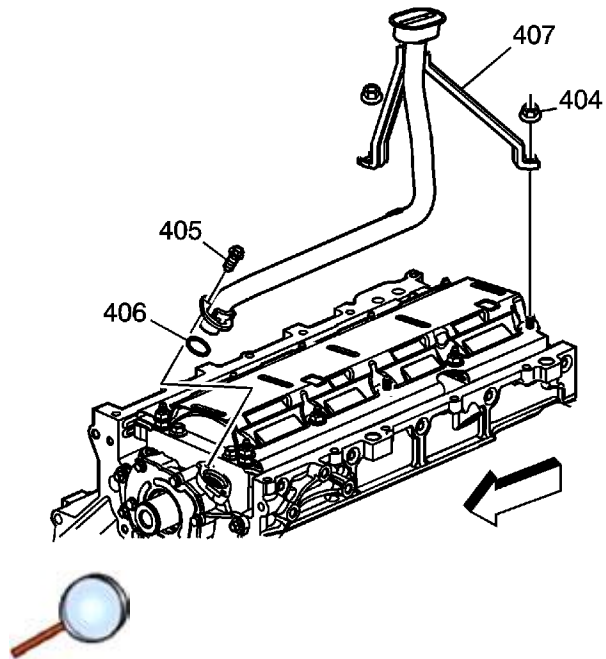
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

2. Dry the parts with compressed air.
3. Inspect the oil pump housing (413) and the cover (409) for cracks, excessive wear, scoring, or casting imperfections.
4. Inspect the oil pump housing-to-engine block oil gallery surface for scratches or gouging.
5. Inspect the oil pump housing for damaged bolt hole threads.
6. Inspect the relief valve plug (416) and plug bore for damaged threads.
7. Inspect the oil pump internal oil passages for restrictions.
8. Inspect the drive gear (410) and driven gear (412) for chipping, galling, or wear.

Minor burrs or imperfections on the gears may be removed with a fine oil stone.

9. Inspect the drive gear splines for excessive wear.
10. Inspect the pressure relief valve (414) and bore for scoring or wear.

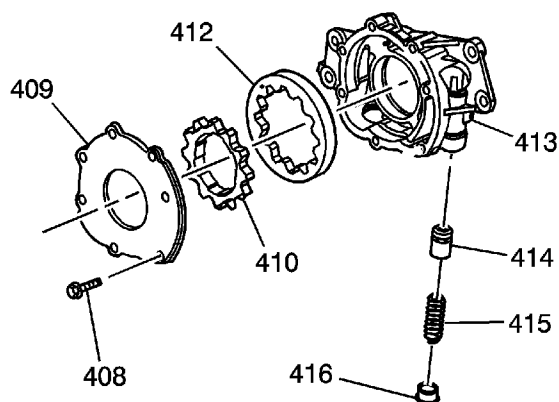
The valve must move



11. Inspect the oil pump screen (407) for debris or restrictions.
12. Inspect the oil pump screen for broken or loose wire mesh.

cardiagn.com

Oil Pump Assemble



Note: Prior to assembling the oil pump, coat all wear or internal surfaces with clean engine oil.

1. Install the driven gear (412) into the pump housing (413).

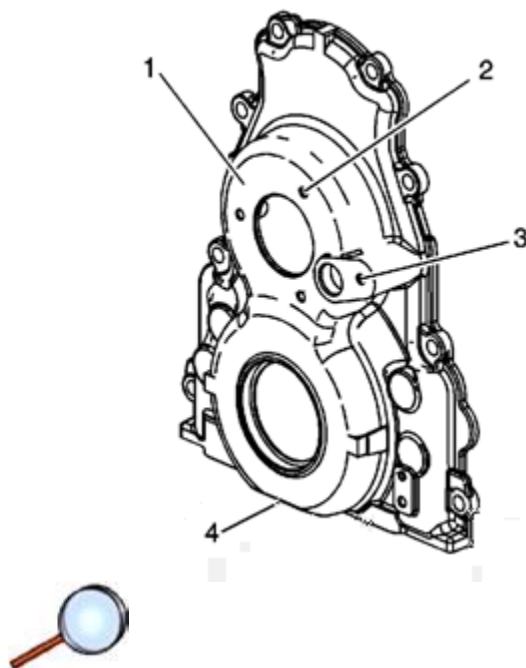
Install the driven gear with the orientation mark facing the pump cover.

2. Install the drive gear (410) into the pump housing.
3. Install the oil pump cover (409).

Caution: Refer to [Fastener Caution](#) in the Preface section.

4. Install the oil pump cover bolts (408) and tighten to **12 N·m (106 lb in)**.
5. Install the relief valve (414).
6. Install the relief valve spring (415).
7. Install the relief valve plug (416) and tighten to **12 N·m (106 lb in)**.
8. Inspect the oil pump for smooth operation by rotating the drive gear.

Engine Front Cover Cleaning and Inspection (RPO LY6 / L76 / L9H)



Note:

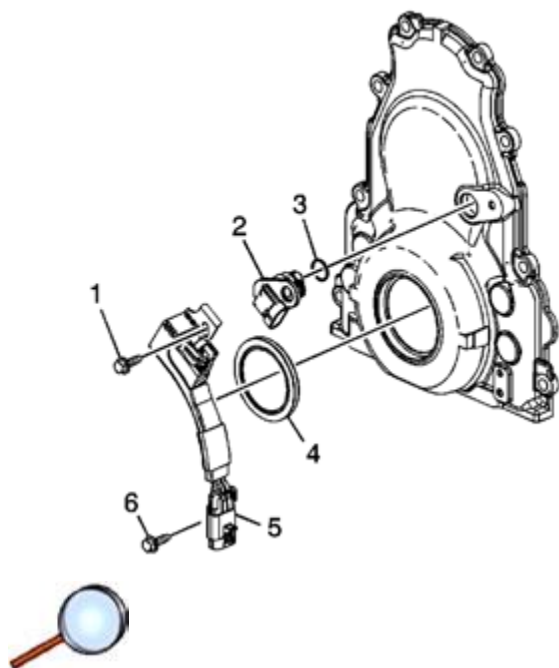
- Do not use the crankshaft front oil seal again. Install a NEW crankshaft front oil seal during assembly.
- Do not use the front cover-to-engine block gasket again. Install a NEW gasket during assembly.
- Do not use the camshaft position (CMP) actuator magnet gasket again. Install a NEW gasket during assembly.

1. Clean the cover in solvent. Remove the sealant from the cover oil pan surface. Refer to [Replacing Engine Gaskets](#).

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

2. Dry the cover with compressed air.
3. Inspect the gasket sealing surfaces (1, 4) for excessive scratches or gouging.
4. Inspect the threaded bolt holes (2, 3) for damaged threads or debris.

Engine Front Cover Cleaning and Inspection (RPO LY2 / LH6 / LMG / LY5 / LC9)



Note:

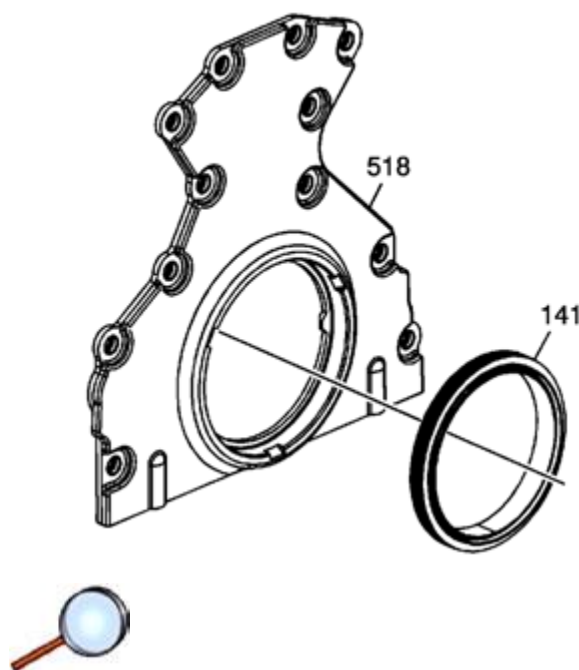
- Do not use the crankshaft front oil seal again. Install a NEW crankshaft front oil seal during assembly.
- Do not use the front cover-to-engine block gasket again. Install a NEW gasket during assembly.

1. Remove the crankshaft front oil seal (140) from the front cover.
2. Clean the cover in solvent. Remove the sealant from the cover oil pan surface. Refer to [Replacing Engine Gaskets](#).

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

3. Dry the cover with compressed air.
4. Inspect the gasket sealing surfaces for excessive scratches or gouging.
5. Inspect the threaded bolt holes for damaged threads or debris.
6. Inspect the crankshaft oil seal and camshaft position (CMP) sensor mounting bore for damage.

Crankshaft Rear Oil Seal Housing Cleaning and Inspection



Note:

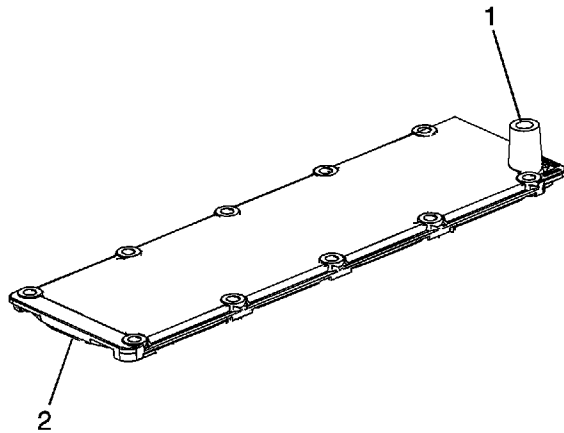
- Do not use the crankshaft rear oil seal again. Install a NEW crankshaft oil seal during assembly.
- Do not use the rear housing-to-engine block gasket again. Install a NEW gasket during assembly.

1. Remove the crankshaft oil seal (141) from the rear housing.
2. Clean the housing in solvent. Remove the sealant from the housing oil pan surface. Refer to [Replacing Engine Gaskets](#).

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

3. Dry the housing with compressed air.
4. Inspect the gasket sealing surfaces for excessive scratches or gouging.
5. Inspect the housing-to-oil pan threaded bolt holes for damaged threads or debris.
6. Inspect the crankshaft oil seal mounting bore for damage.

Engine Block Valley Cover Cleaning and Inspection

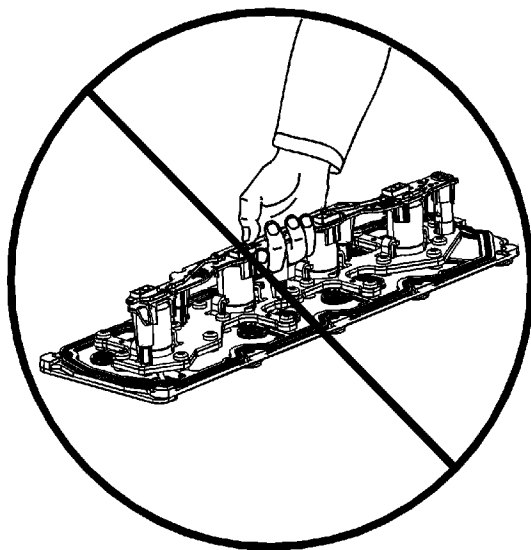


1. Clean the valley cover in solvent.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

2. Dry with compressed air.
3. Inspect for damaged threads (1) and damaged sealing surfaces (2).

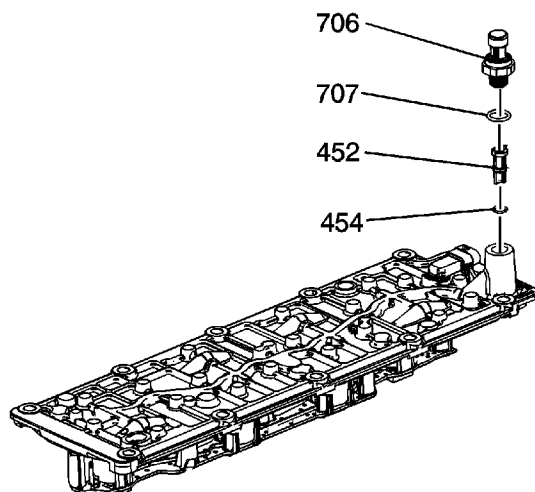
Valve Lifter Oil Manifold Cleaning and Inspection



Note:

- Do not allow dirt or debris to enter the oil passages of the manifold. Plug, as required.
- Do not disassemble the electrical components from the manifold.
- Do not submerge the electrical components in cleaning solvent.
- Do not use the manifold exterior gasket again. Remove the exterior gasket and install a NEW service gasket during assembly.

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

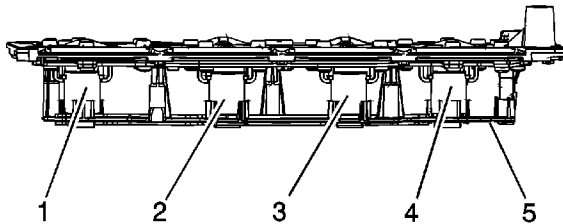




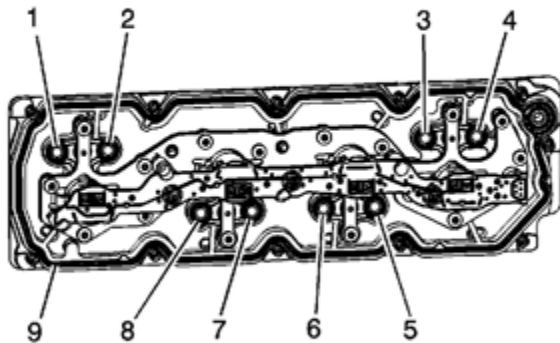
2. Remove the oil pressure sensor (706) and washer (707).
3. Remove the oil screen (452) with O-ring (454).

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

4. Clean the manifold with compressed air.



5. Inspect for loose electrical solenoids (1-4) or loose or missing bolts.
6. Inspect for damage to the electrical lead frame (5).
7. Inspect for a damaged electrical connector, for bent or corroded pins.

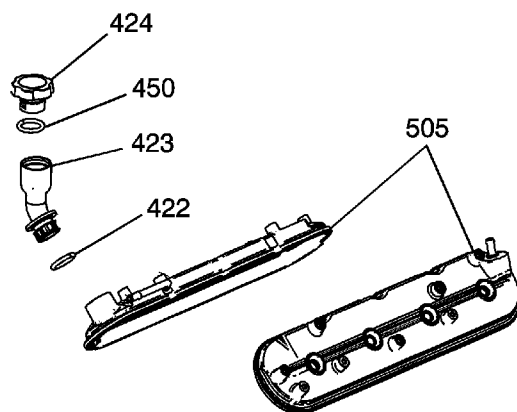


8. Inspect for damaged interior sealing gaskets (1-8). If the interior sealing gaskets are damaged, the manifold must be replaced as an assembly.

9. Inspect for a damaged exterior sealing gasket (9) or scored gasket surfaces.
10. Inspect for debris or restrictions within the oil passages of the manifold. Refer to [Cylinder Deactivation \(Active Fuel Management\) Valve Lifter Oil Manifold Diagnosis and Testing](#).

cardiagn.com

Valve Rocker Arm Cover Cleaning and Inspection

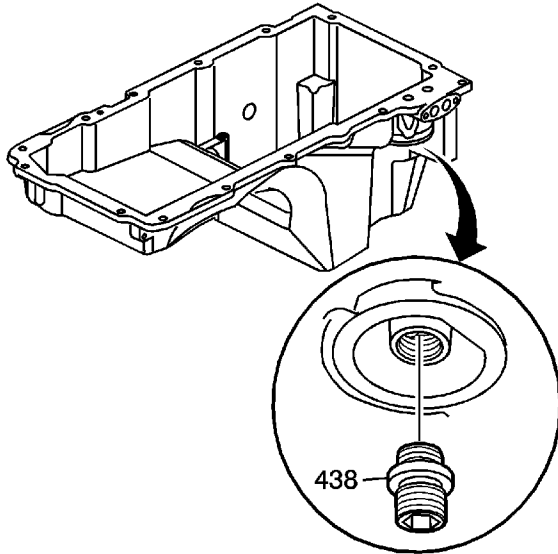


Important:

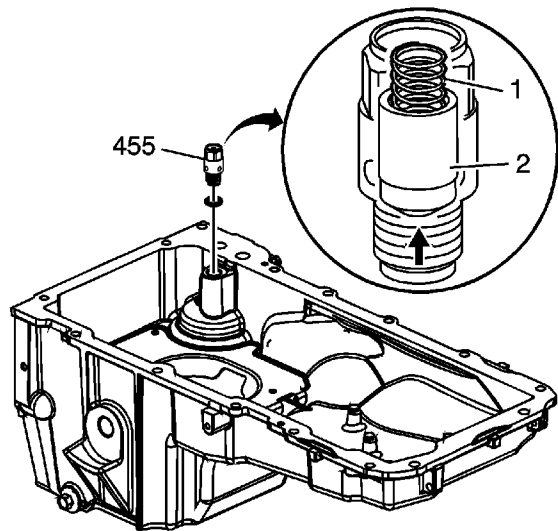
- Do not use the valve rocker arm cover gasket again. Install a NEW gasket during assembly.
- Remove the ignition coils before cleaning the cover in solvent. Do not submerge the ignition coils in solvent.
- Do not remove the oil fill tube from the covers unless service is required. If the tube is removed from the cover, install a NEW tube (423) and seal (422) during assembly.

1. Inspect the oil fill tube (423) for a loose fit or damage.
2. Inspect the covers (505) for the following conditions:
 - Scoring or damage to the gasket surfaces
 - Ventilation system passages for restrictions
 - Threaded bolt holes for damage or debris

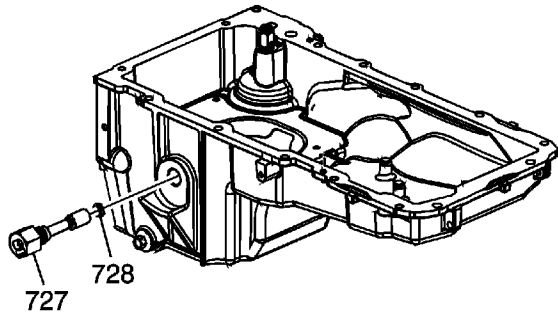
Oil Pan Cleaning and Inspection



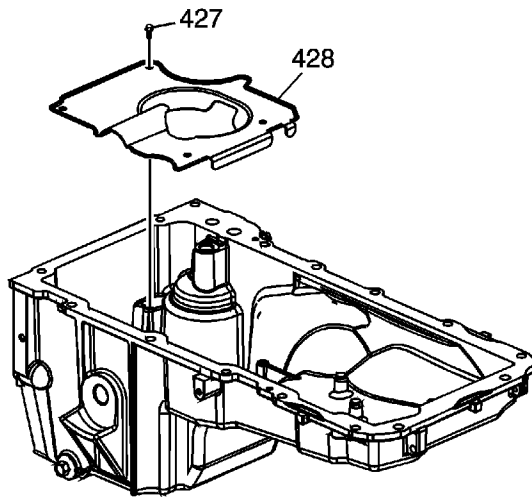
1. Remove the oil filter fitting (438), as required.



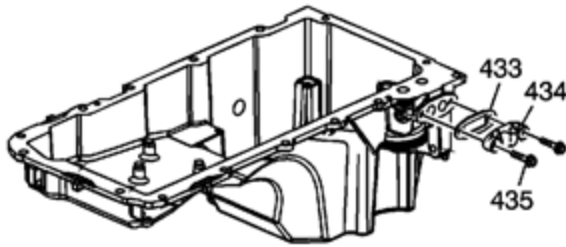
2. Remove the active fuel management oil pressure relief valve (455) and washer.
3. Inspect the oil pressure relief valve for proper operation. Lightly depress the valve (2). The valve spring (1) should seat the valve to the proper closed position.



4. Remove the oil level sensor (727) and O-ring (728).



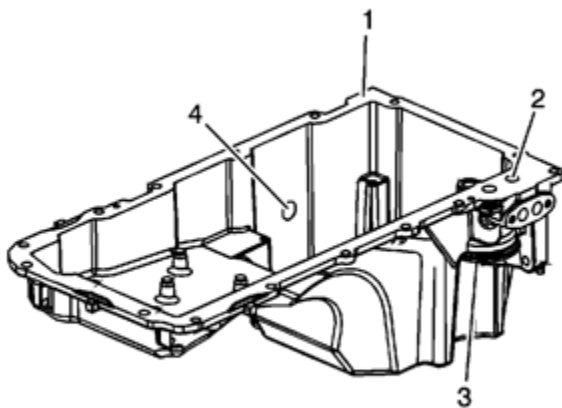
5. Remove the bolts (427) and baffle (428).



6. Remove the oil pan cover (434), bolts (435), and gasket (433).
7. Clean the oil pan in solvent.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

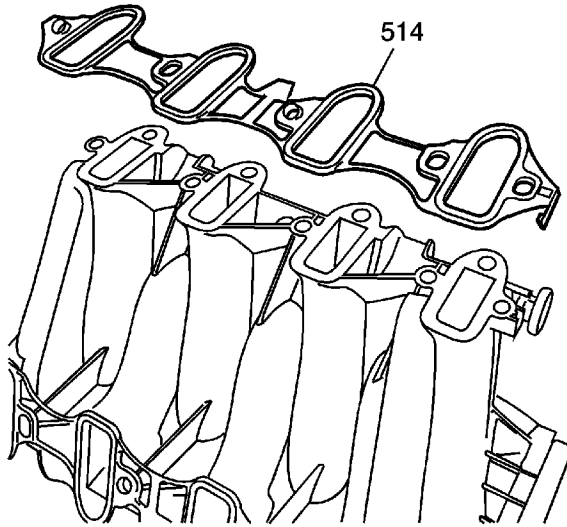
8. Dry the oil pan with compressed air.



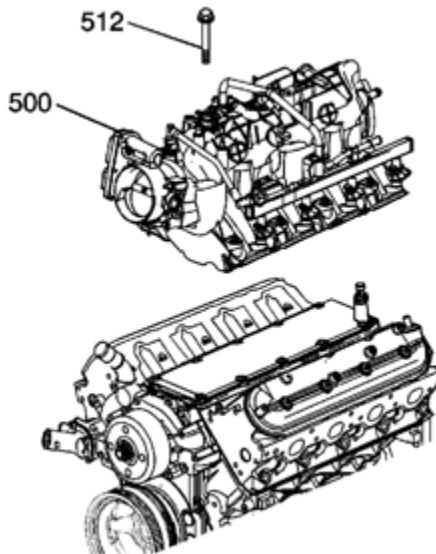
9. Inspect the oil pan for the following conditions:
 - Damaged gasket surfaces (1)
 - Restrictions within the oil passages (2) of the pan
 - Damaged oil filter seal surface (3)
 - Threaded oil level sensor hole (4) for damage

Intake Manifold Cleaning and Inspection

Cleaning Procedure



1. Remove and discard the intake manifold-to-cylinder head gaskets (514).



2. Remove the manifold absolute pressure (MAP) sensor. Refer to [Intake Manifold Removal](#).
3. Remove the evaporative emission (EVAP) canister purge solenoid valve, EVAP tubes, and fuel rail with injectors. Refer to [Fuel Rail and Injectors Removal](#).
4. Remove the throttle body and gasket. Refer to [Throttle Body Removal](#).

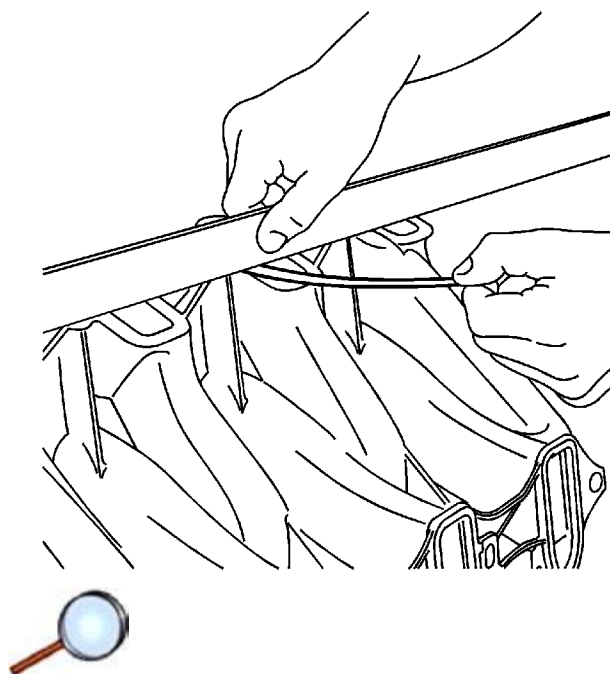
5. Clean the intake manifold (500) in solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

6. Dry the intake manifold with compressed air.

Inspection Procedure

1. Inspect the manifold for the following conditions:
 - Damaged gasket or sealing surfaces
 - Loose threaded inserts or studs
 - Debris or restrictions within the passages of the manifold
 - Damaged or broken vacuum fittings
 - Inspect the composite intake manifold assembly for cracks or other damage.



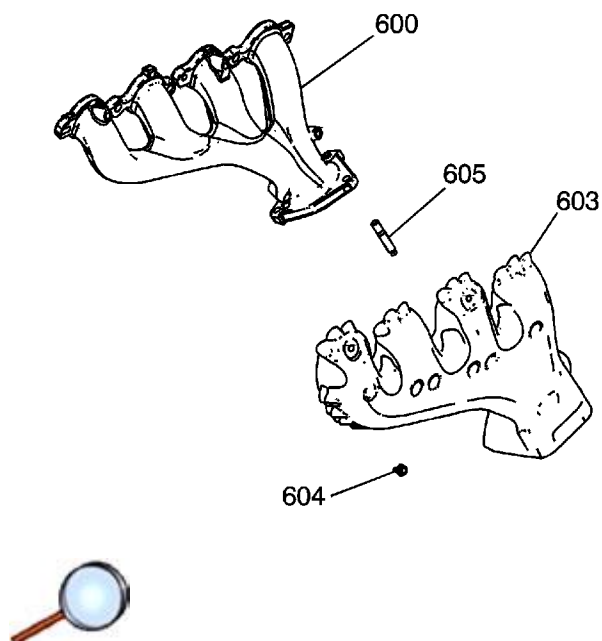
2. Inspect the intake manifold cylinder head deck for warpage.
 - 2.1. Locate a straight edge across the intake manifold cylinder head deck surface.

Position the straight edge across a minimum of two runner port openings.

- 2.2. Insert a feeler gage between the intake manifold and the straight edge.

An intake manifold with warpage in excess of 3 mm (0.118 in) over a 200 mm (7.87 in) area is warped and should be replaced.

Exhaust Manifold Cleaning and Inspection

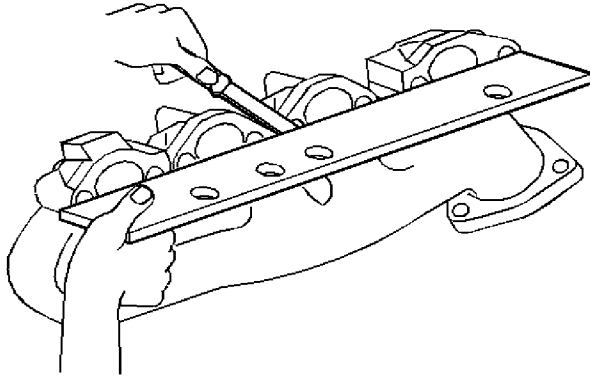


Note: Do not use the exhaust manifold-to-cylinder head gaskets again. Upon installation of the exhaust manifold, install a NEW gasket. An improperly installed gasket or leaking exhaust system may affect on-board diagnostics (OBD) II system performance.

1. Clean the exhaust manifold (600) and heat shield (603) in solvent.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

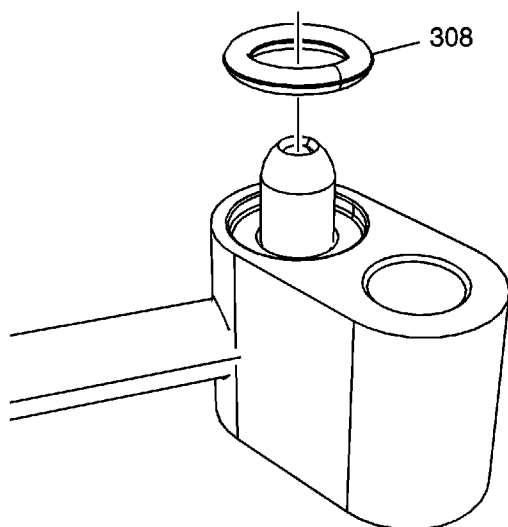
2. Dry the exhaust manifold with compressed air.
3. Inspect the exhaust manifold-to-cylinder head gasket surface for excessive scratches or gouging.
4. Inspect for a loose, damaged, or cracked heat shield (603).
5. Inspect the studs (605) for damaged threads.



6. Use a straight edge and a feeler gage and measure the exhaust manifold cylinder head deck for warpage.

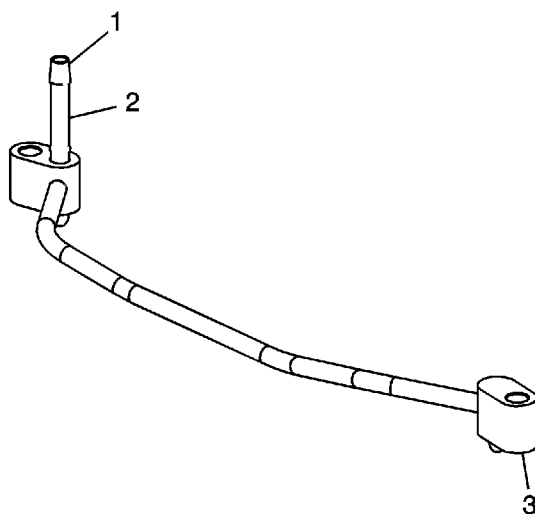
An exhaust manifold deck with warpage in excess of 0.25 mm (0.01 in) within the 2 front or 2 rear runners or 0.5 mm (0.02 in) overall, may cause an exhaust leak and may affect OBD II system performance. Exhaust manifolds not within specifications must be replaced.

Engine Coolant Air Bleed Pipe and Hole Cover Cleaning and Inspection



Note: Do not use the engine coolant air bleed pipe and cover seals again. Upon installation of the pipe and covers, install NEW seals.

1. Remove the seals (308) from the pipe and covers.



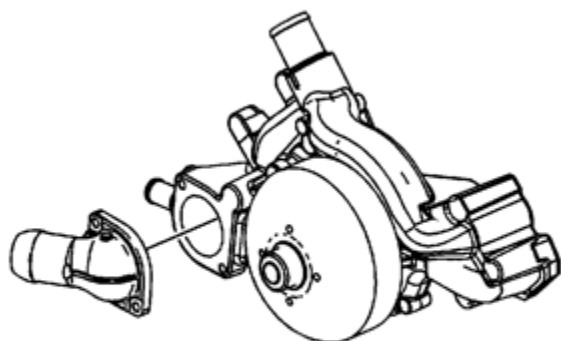
2. Clean the pipe and covers in solvent.

Warning: Refer to [Safety Glasses and Compressed Air Warning](#) in the Preface section.

3. Dry the pipe and covers with compressed air.
4. Inspect the pipe and covers for restrictions within the pipe (1) or damaged sealing surfaces (2, 3).

cardiagn.com

Water Pump Cleaning and Inspection



1. Remove the old gasket from the water pump sealing surfaces. Refer to [Replacing Engine Gaskets](#).
2. Clean all excess dirt and debris from the water pump housing.
3. Inspect the water pump for the following conditions:
 - Gasket and hose sealing surfaces for excessive scratches or gouging
 - Restrictions within the internal coolant passages
 - Excessive side-to-side play in the pulley shaft
 - Leakage at the water inlet housing or rear cover
 - Leakage at the water pump vent hole
 - A stain around the vent hole is acceptable. If leakage, dripping, occurs with the engine running and the cooling system pressurized, replace the water pump.
 - Wear or damage in the belt tracking area of the pulley

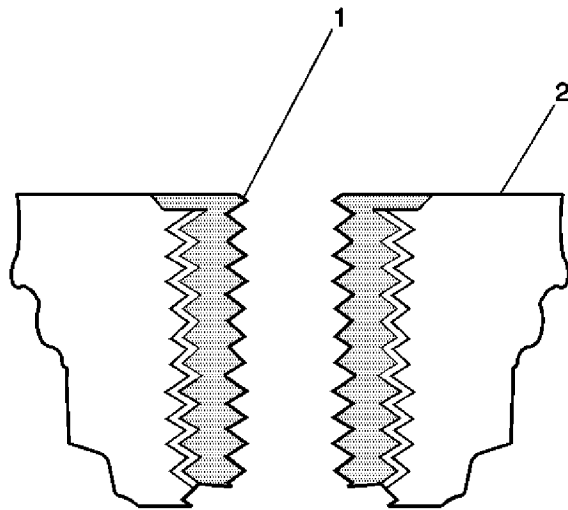
Thread Repair

Special Tools

- J 42385-100 Head/Main Bolt Thread Repair Kit
- J 42385-200 Common Thread Repair Kit
- J 42385-300 Fixtures and Hardware Kit

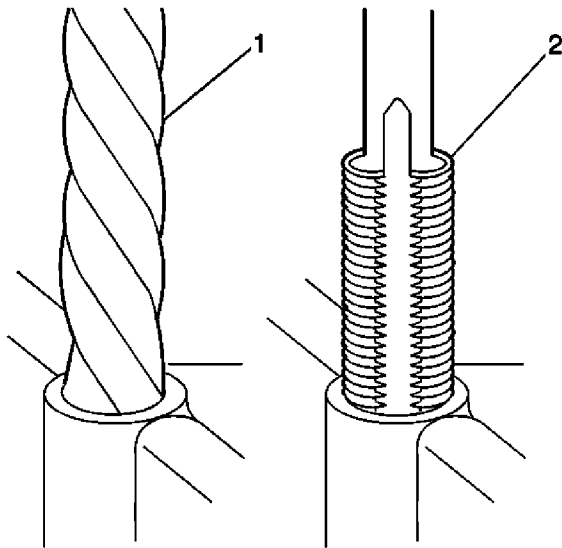
For equivalent regional tools, refer to [Special Tools](#)

General Thread Repair



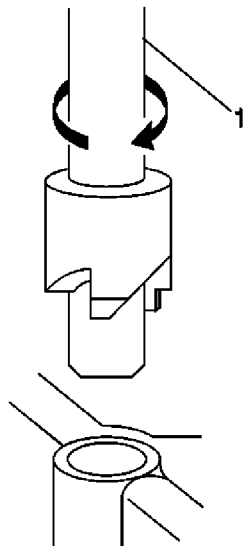
The thread repair process involves a solid, thin walled, self-locking, carbon steel, bushing type insert (1). During the bushing installation process, the driver tool expands the bottom external threads of the insert into the base material (2). This action mechanically locks the insert in place. Also, when installed to the proper depth, the flange of the insert will be seated against the counterbore of the repaired hole.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

**Note:**

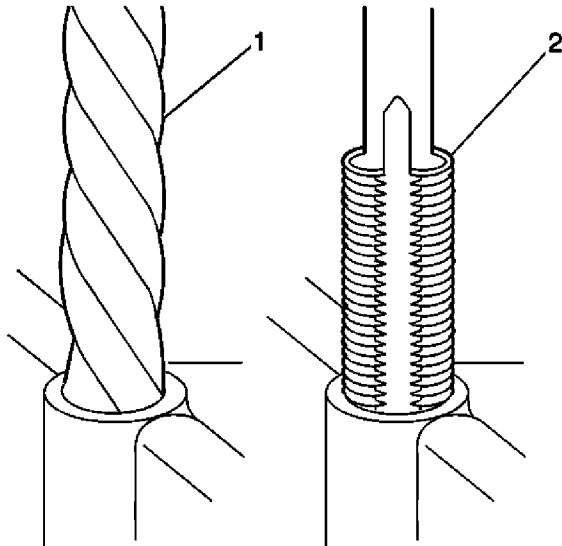
- The use of a cutting type fluid GM P/N 1052864 (Canadian P/N 992881), WD 40®, or equivalent, is recommended when performing the drilling, counterboring, and tapping procedures.
- Driver oil **MUST** be used on the installer driver tool.
- The tool kits are designed for use with either a suitable tap wrench or drill motor.

1. Drill out the threads of the damaged hole (1).
 - M6 inserts require a minimum drill depth of 15 mm (0.59 in).
 - M8 inserts require a minimum drill depth of 20 mm (0.79 in).
 - M10 inserts require a minimum drill depth of 23.5 mm (0.93 in).
2. Using compressed air, clean out any chips.

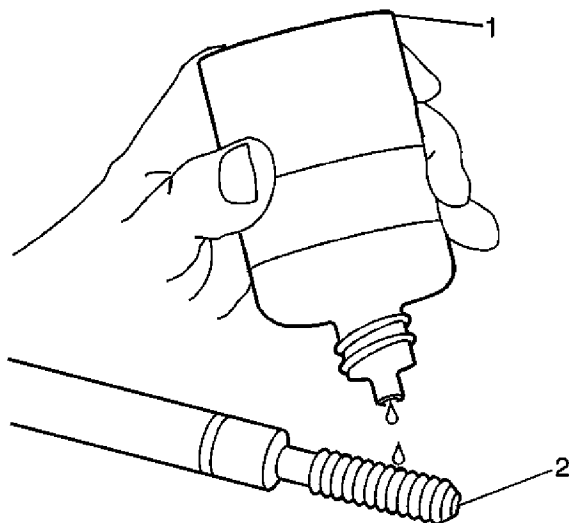




3. Counterbore the hole to the full depth permitted by the tool (1).
4. Using compressed air, clean out any chips.

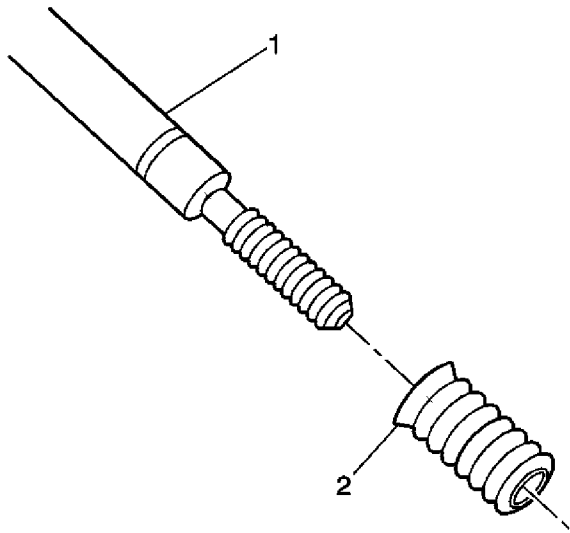


5. Using a tap wrench (2), tap the threads of the drilled hole.
 - M6 inserts require a minimum tap depth of 15 mm (0.59 in).
 - M8 inserts require a minimum tap depth of 20 mm (0.79 in).
 - M10 inserts require a minimum tap depth of 23.5 mm (0.93 in).
6. Using compressed air, clean out any chips.
7. Spray cleaner GM P/N 12346139, GM P/N 12377981 (Canadian P/N 10953463), or equivalent, into the hole.
8. Using compressed air, clean any cutting oil and chips out of the hole.

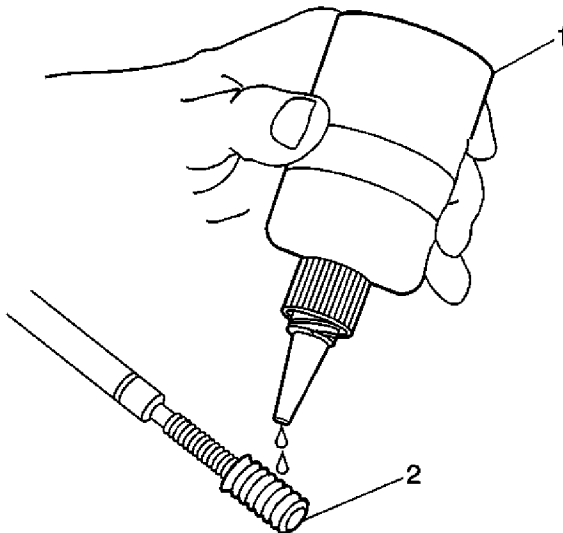


Note: Do not allow oil or other foreign material to contact the outside diameter (OD) of the insert.

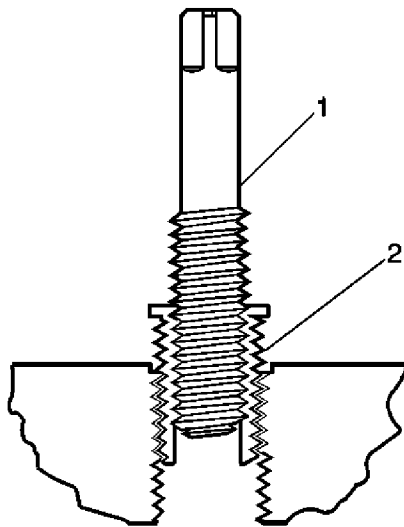
9. Lubricate the threads of the installer tool (2) with the driver oil (1).



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



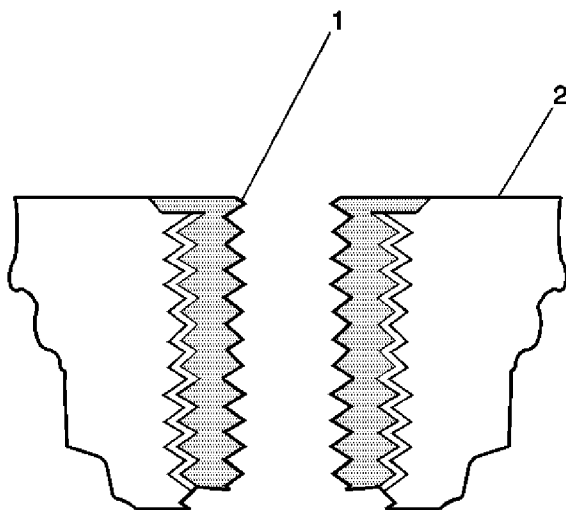
11. Apply threadlock LOCTITE™ 277, J 42385-109 (1), or equivalent, to the insert OD threads (2).



12. Install the insert (2) into the hole.

Install the insert until the flange of the insert contacts the counterbored surface. Continue to rotate the installer tool (1) through the insert.

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.

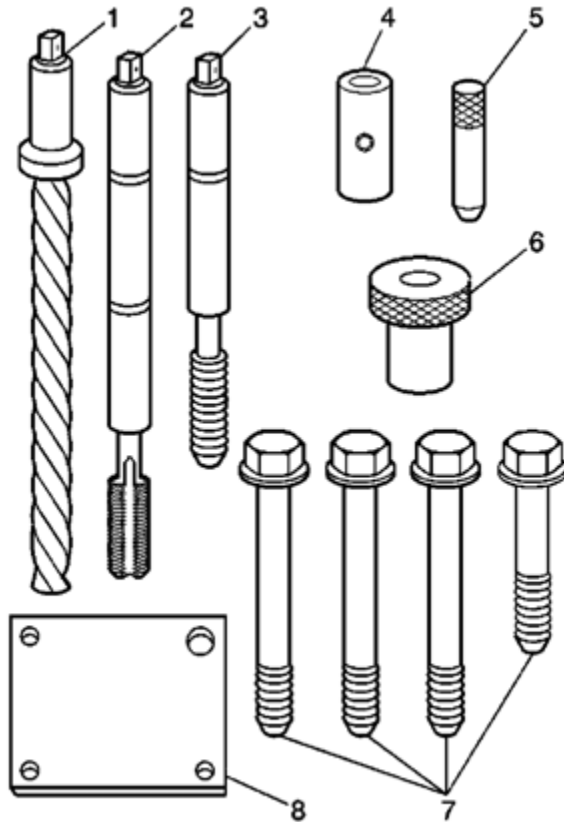


13. Inspect the insert for proper installation into the hole.

A properly installed insert (1) will be either flush or slightly below flush with the surface of

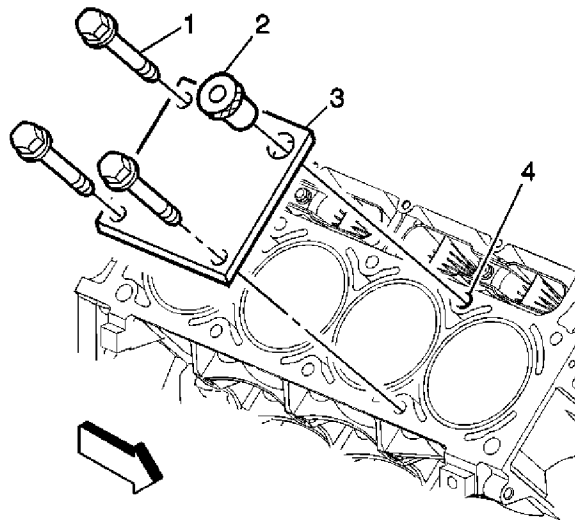
the base material (2).

Cylinder Head Bolt Hole Thread Repair



1. The cylinder head bolt hole thread repair kit consists of the following items:
 - The drill (1)
 - The tap (2)
 - The installer (3)
 - The sleeve (4)
 - The alignment pin (5)
 - The bushing (6)
 - The bolts (7)
 - The fixture plate (8)

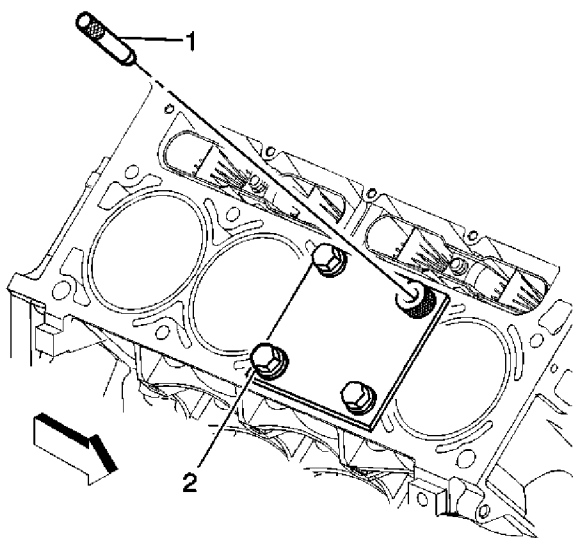
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

**Note:**

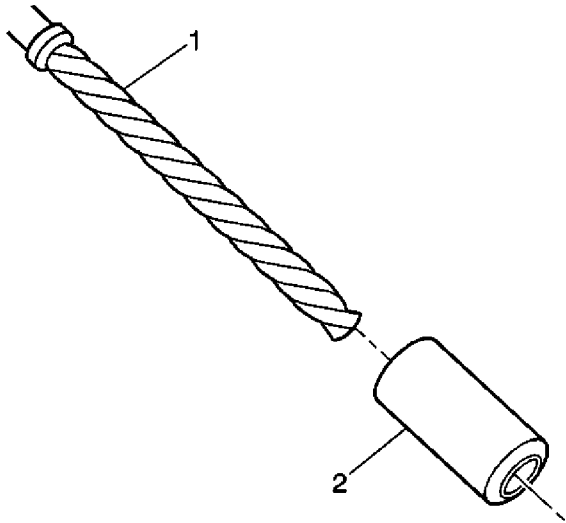
- The use of a cutting type fluid GM P/N 1052864 (Canadian P/N 992881), WD 40®, or equivalent, is recommended when performing the drilling and tapping procedures.
- Driver oil **MUST** be used on the installer driver tool.
- The tool kits are designed for use with either a suitable tap wrench or drill motor.

2. Install the fixture plate (3), bolts (1), and bushing (2) onto the engine block deck.

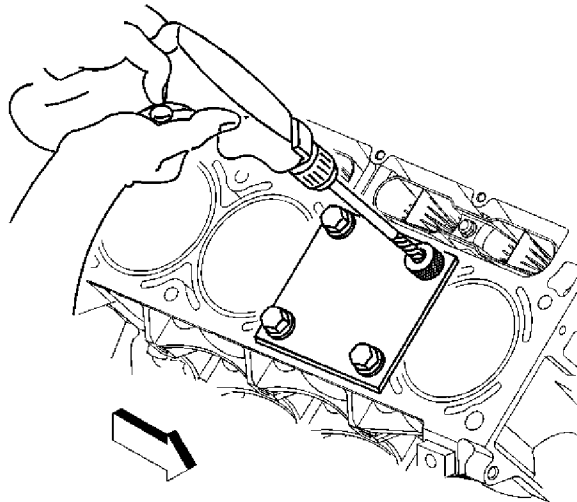
Position the fixture plate and bushing over the hole that is to be repaired (4).



3. Position the alignment pin (1) through the bushing and into the hole.
4. With the alignment pin in the desired hole, tighten the fixture retaining bolts (2).
5. Remove the alignment pin from the hole.



6. Install the sleeve (2) onto the drill (1).

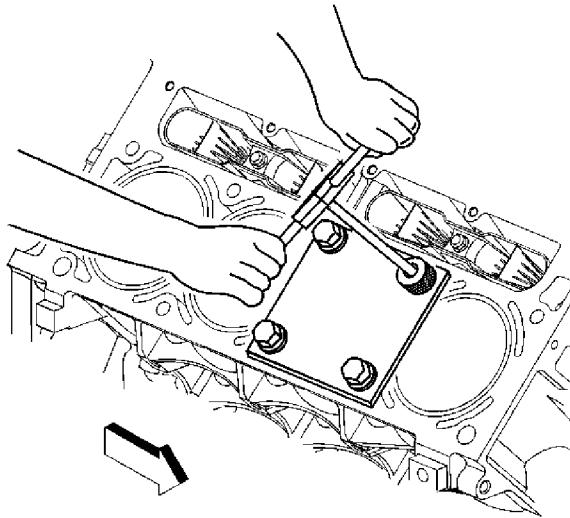


Note: During the reaming process, it is necessary to repeatedly remove the drill and clean the chips from the hole.

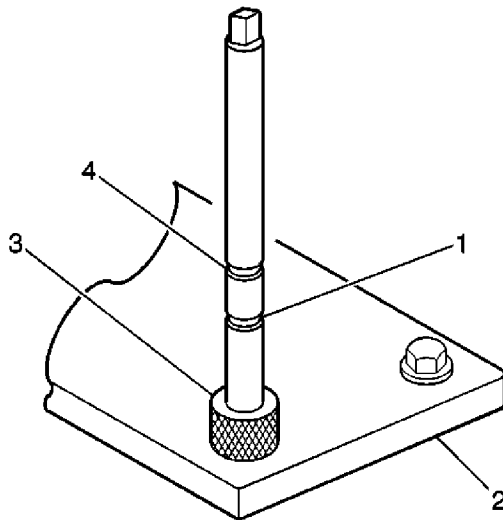
7. Drill out the threads of the damaged hole.

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

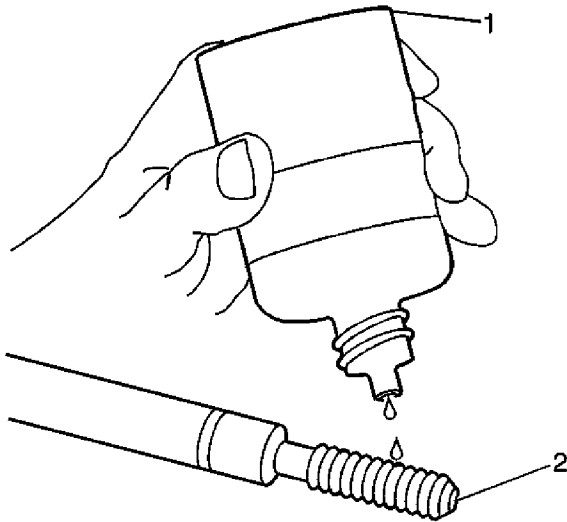
8. Using compressed air, clean out any chips.



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

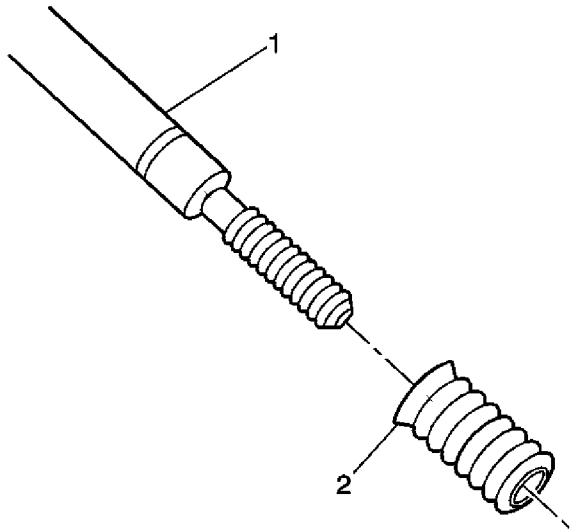


10. In order to tap the new threads to the proper depth, rotate the tap into the hole until the mark (1) on the tap aligns with the top of the drill bushing (3).
11. Remove the fixture plate (2), bushing (3), and bolts.
12. Using compressed air, clean out any chips.
13. Spray cleaner GM P/N 12346139,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

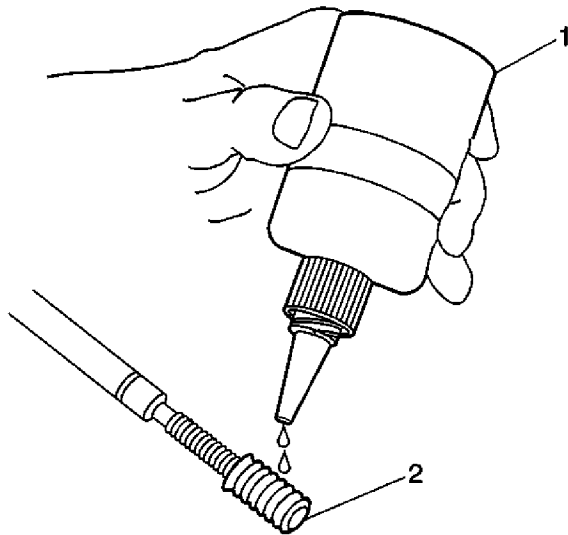


Note: Do not allow oil or foreign material to contact the OD of the insert.

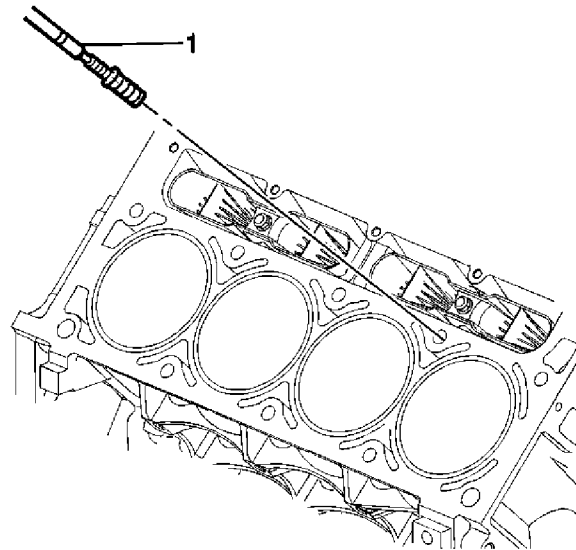
15. Lubricate the threads of the installer tool (2) with the driver oil (1).



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).

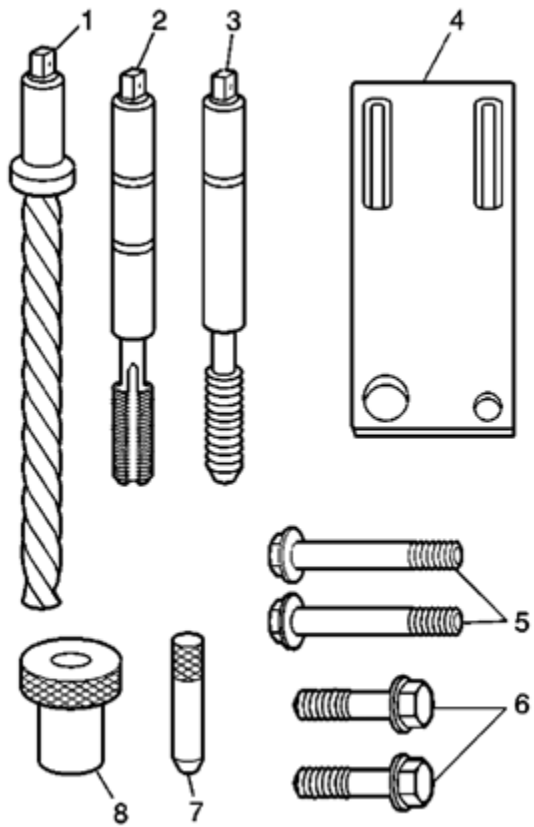


18. Install the insert and driver (1) into the hole.

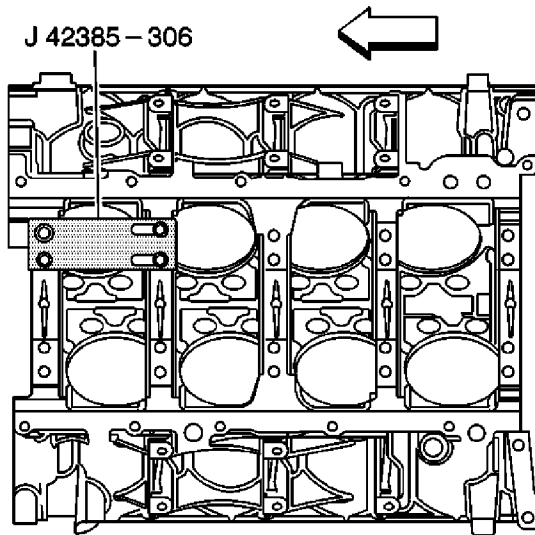
Rotate the driver tool until the mark on the tool aligns with the deck surface of the engine block.

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



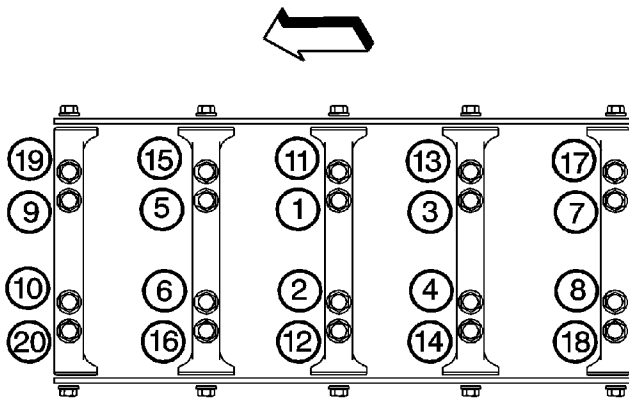
1. The main cap bolt hole thread repair kit consists of the following items:
 - The drill (1)
 - The tap (2)
 - The installer (3)
 - The fixture plate (4)
 - The long bolts (5)
 - The short bolts (6)
 - The alignment pin (7)
 - The bushing (8)



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.

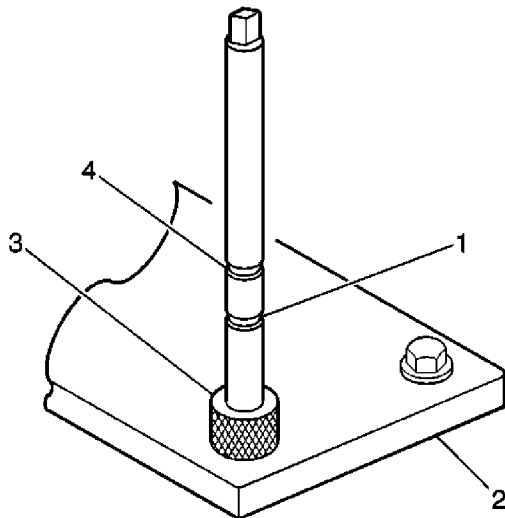


4. Drill out the damaged hole.

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.



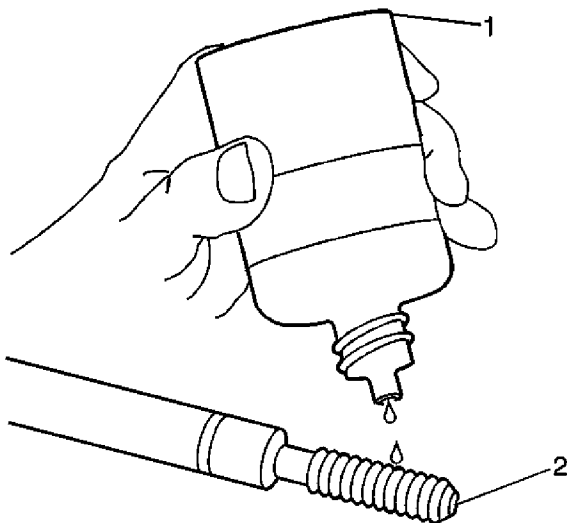
6. Using a tap wrench, tap the threads of the drilled hole.

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).

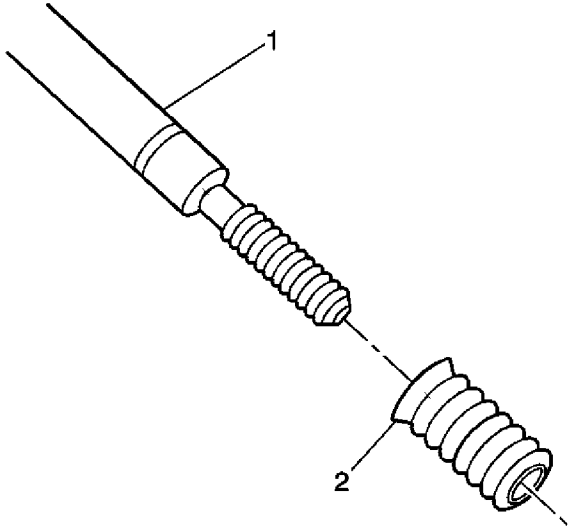
7. Using compressed air, clean out any chips.
 8. Spray cleaner GM P/N 12346139 (Canadian P/N 10953463), or equivalent, into the hole.
 9. Using compressed air, clean any cutting oil and chips out of the hole.



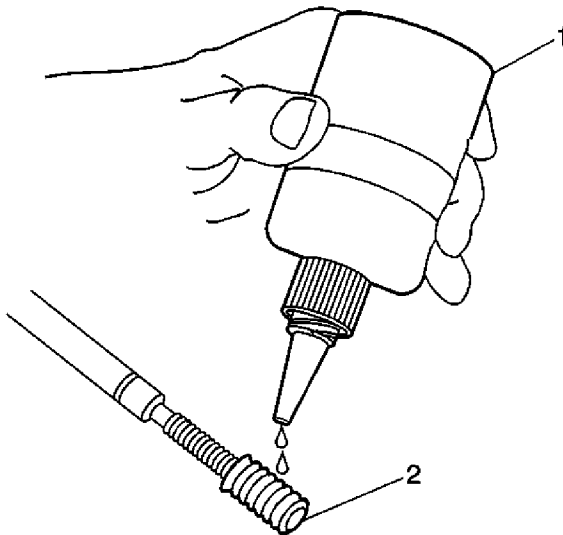


Note: Do not allow oil or foreign material to contact the OD of the insert.

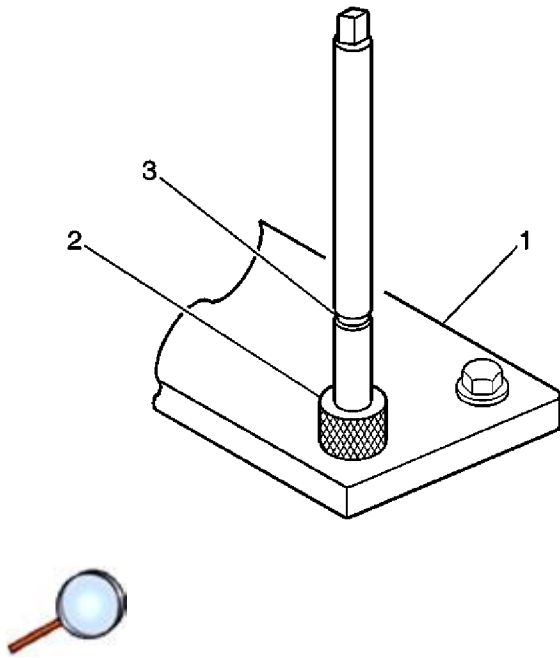
10. Lubricate the threads of the installer tool (2) with the driver oil (1).



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).



Note: 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.

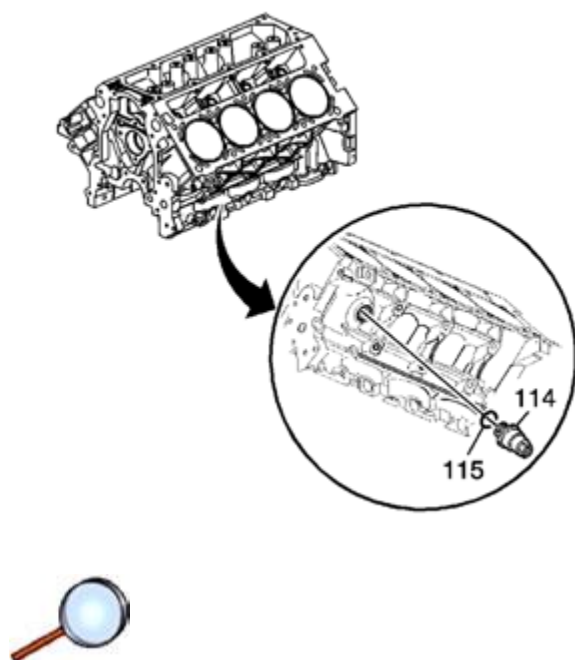
[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - Off Vehicle](#) | **Document ID: 1670679**

Service Prior to Assembly

- Dirt or debris will cause premature wear of the rebuilt engine. Clean all 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 moving parts with clean engine oil. This provides initial lubrication when the engine is first started.

cardiagn.com

Engine Block Plug Installation

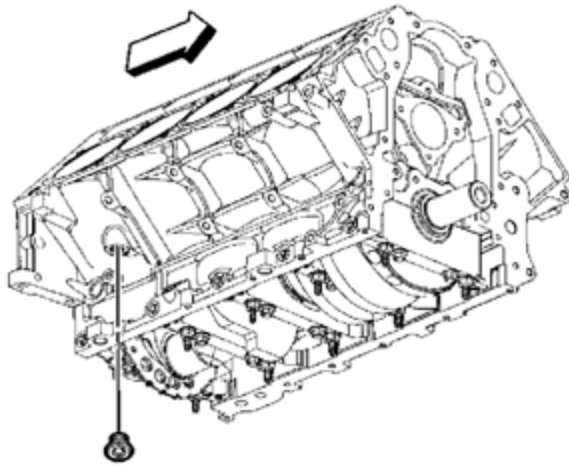


Note: Engine block plug, oil gallery, and coolant sealing washers may be used again if not bent, scored or otherwise damaged.

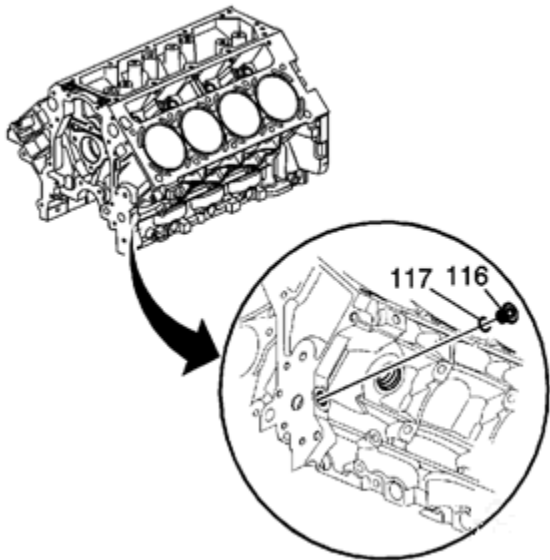
1. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block coolant heater sealing washer (115), if applicable. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

Caution: Refer to [Fastener Caution](#) in the Preface section.

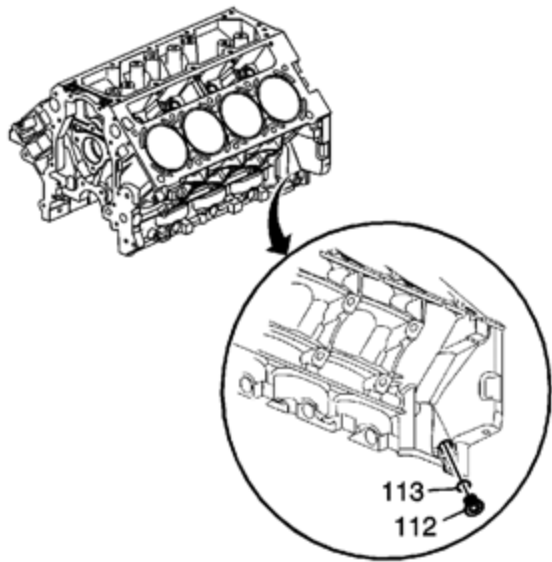
2. Install the engine block coolant heater (114) to the engine block and tighten to **50 N·m (37 lb ft)**.



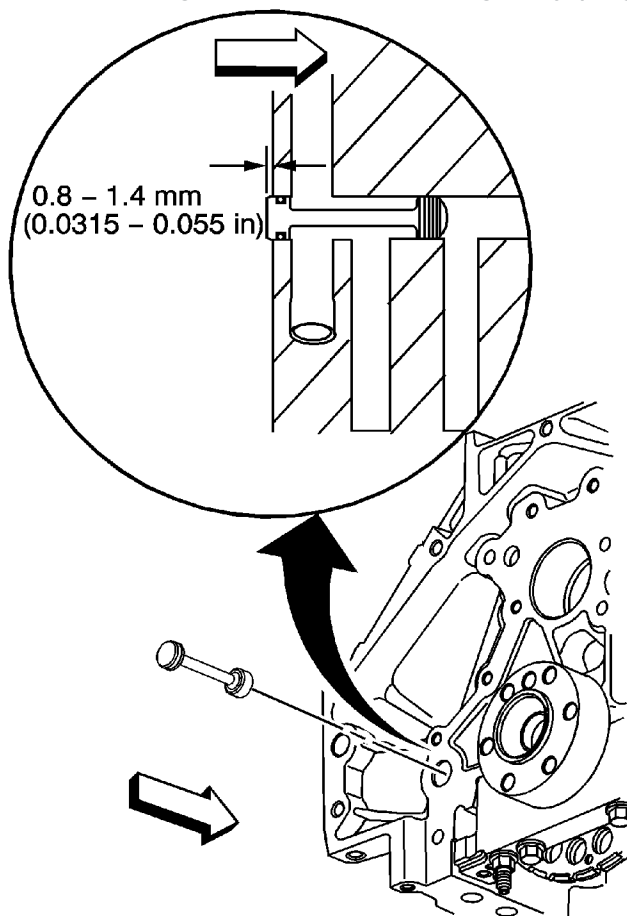
3. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block right rear coolant drain hole plug sealing washer.
4. Install the engine block right rear coolant drain hole plug and tighten to **60 N·m (44 lb ft)**.



5. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block left front oil gallery plug sealing washer (117).
6. Install the engine block left front oil gallery plug (116) and tighten to **60 N·m (44 lb ft)**.



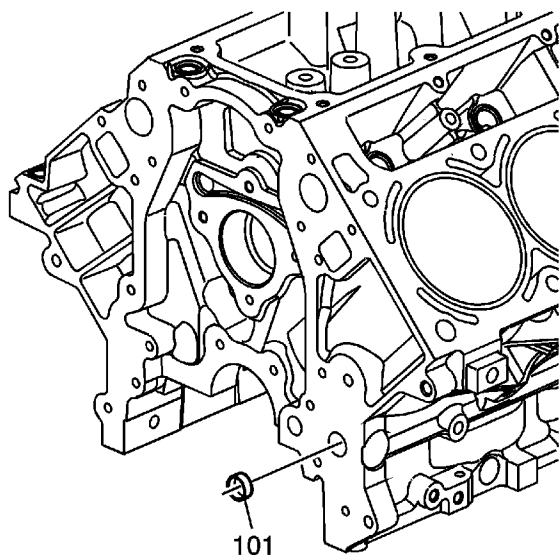
7. Apply a 3.175 mm (0.125 in) bead of sealant GM P/N 12346004 (Canadian P/N 10953480) to the engine block left rear oil gallery plug sealing washer (113).
8. Install the engine block left rear oil gallery plug (112) and tighten to **60 N·m (44 lb ft)**.



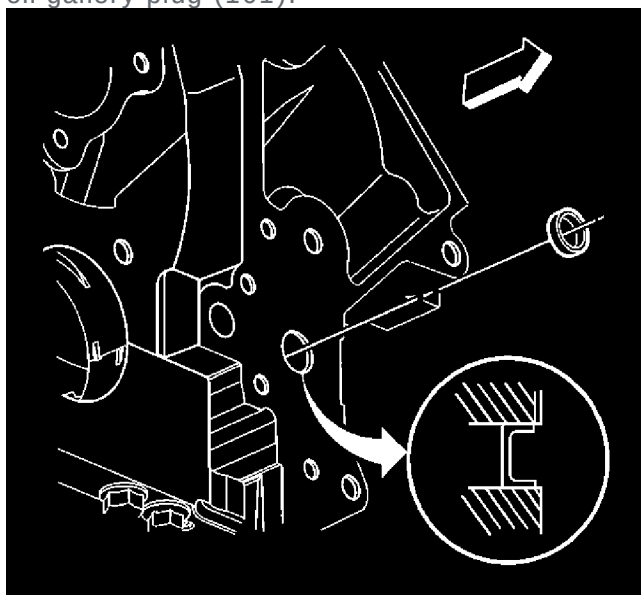
9. Inspect the engine block rear oil gallery plug and O-ring seal. If the O-ring seal on the plug is

not cut or damaged, the rear oil gallery plug may be used again.

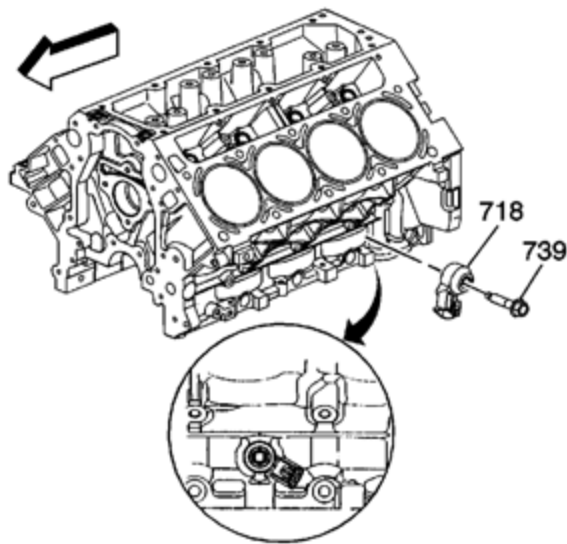
10. Lubricate the O-ring seal with clean engine oil.
11. Install the O-ring seal onto the plug.
12. Install the engine block rear oil gallery plug into the oil gallery bore. A properly installed block plug will protrude 0.8-1.4 mm (0.0315-0.055 in) beyond the rear face of the block.



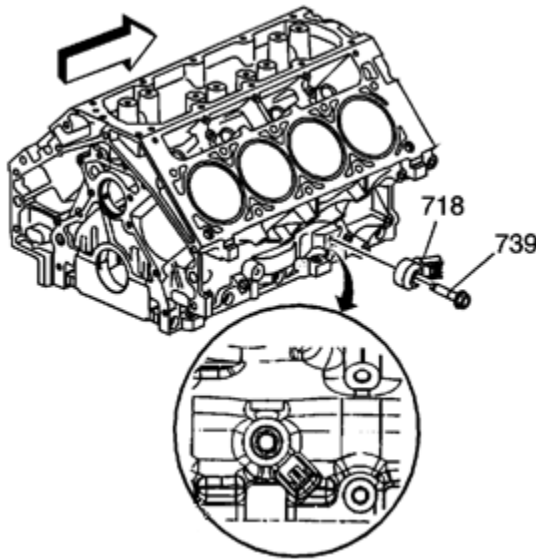
13. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489) to the sides of the NEW front oil gallery plug (101).



14. Install a NEW engine block front oil gallery plug. Install the plug into the oil gallery bore 2.2-2.8 mm (0.0086-0.011 in) below flush.



15. Install the left side knock sensor (718) and bolt (739) and tighten to **20 N·m (15 lb ft)**.



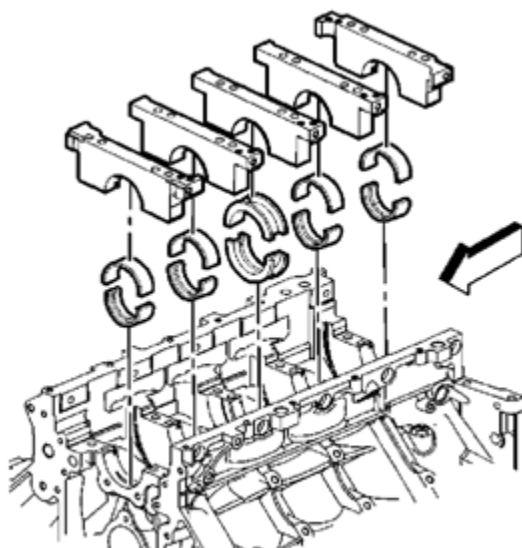
16. Install the right side knock sensor (718) and bolt (739) and tighten to **20 N·m (15 lb ft)**.

Crankshaft and Bearing Installation

Special Tools

J 45059 Angle Meter

For equivalent regional tools, refer to [Special Tools](#)

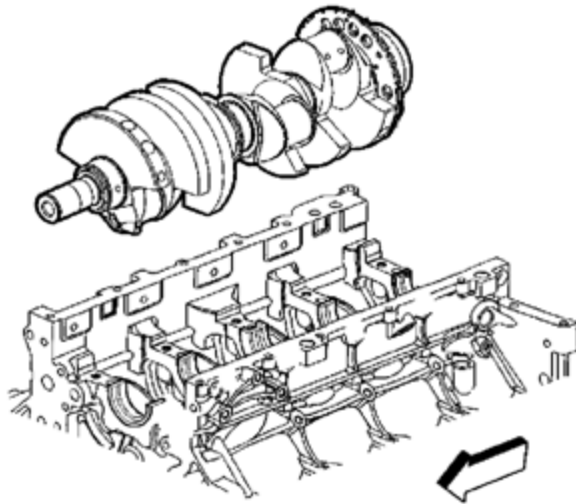


Note:

- Crankshaft bearing clearances are critical. Excessive crankshaft bearing clearance may affect crankshaft position (CKP) sensor signals and/or on-board diagnostic (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.
- In order to prevent engine block oil leakage, install NEW M8 crankshaft bearing cap side bolts.

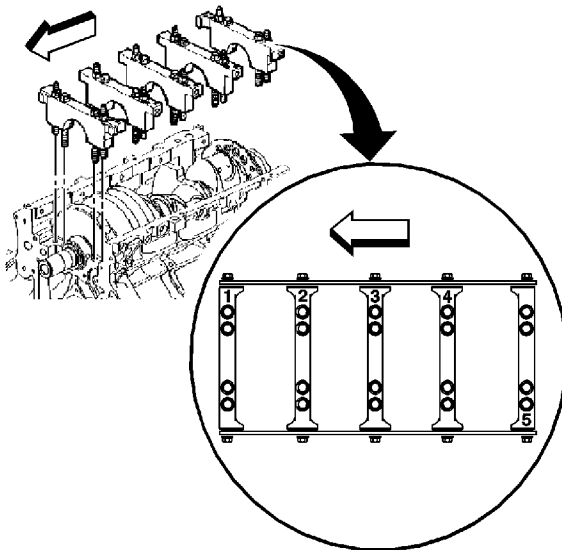
The crankshaft bearing cap M8 side bolts have a pre-applied sealant patch applied to the bolt flange.

1. Install the crankshaft bearings to the engine block and bearing caps. The thrust bearings are to be installed into center journal.
2. Lubricate the bearing surfaces and crankshaft journals with clean engine oil.



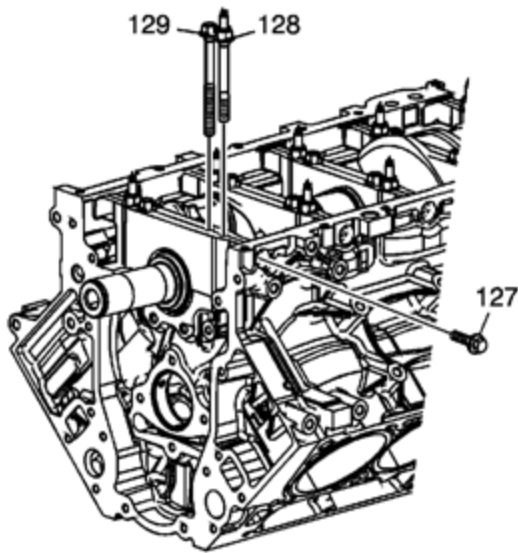
Caution: To maintain proper crankshaft end play, use extreme care during crankshaft installation. Avoid scoring or damaging the thrust bearing.

3. Install the crankshaft.



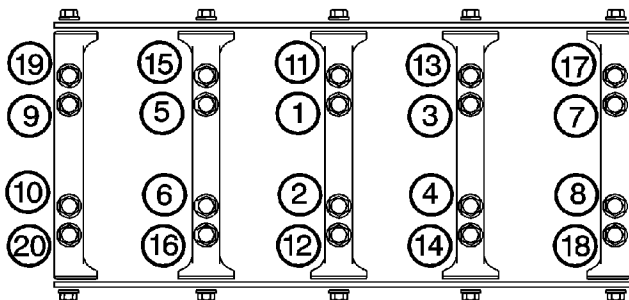
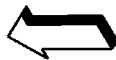
Note: The bearing caps must be installed in the proper location and direction.

4. Install the crankshaft bearing caps, with bearings, into the engine block.



5. Install the M10 bolts (129) and studs (128).
6. Using a plastic-face hammer, tap the bearing caps into place.
7. Install the NEW M8 bearing cap side bolts (127).

Caution: Refer to [Fastener Caution](#) in the Preface section.

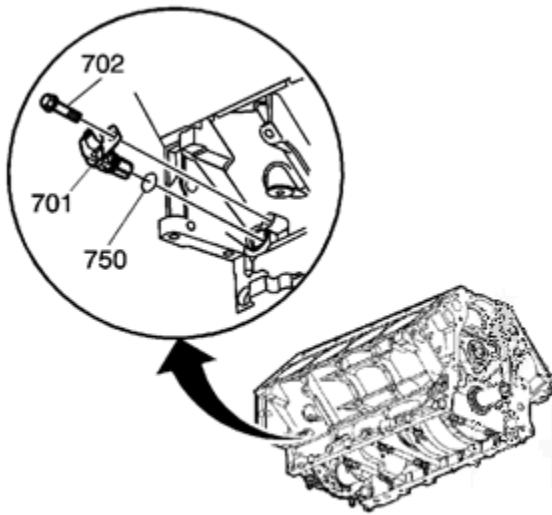


8. Tighten the bearing cap M10 bolts (1-10). Tighten the M10 bearing cap bolts (1-10) a first pass in sequence to **20 N·m (15 lb ft)**.

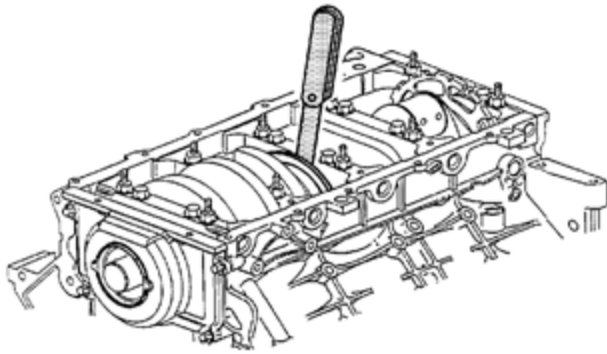
Note: To properly align the crankshaft thrust bearings, the final thrust of the crankshaft **MUST** be in the forward direction.

9. Using a plastic-face hammer, tap the crankshaft rearward, then forward in order to align the thrust bearings.
 - 9.1. Tighten the M10 bolts (1-10) a final pass in sequence **80 degrees** using the J 45059 meter .
 - 9.2. Tighten the M10 studs (11-20) a first pass in sequence to **20 N·m (15 lb ft)**.
 - 9.3. Tighten the M10 studs (11-20) a final pass in sequence **51 degrees** using the J 45059 meter .
 - 9.4. Tighten the bearing cap side M8 bolts to **25 N·m (18 lb ft)**.

Tighten the bolt on 1 side of the bearing cap and then tighten the bolt on the opposite side of the same bearing cap.



10. Install the CKP sensor.
 - 10.1. Inspect the CKP sensor O-ring seal (750). If the O-ring seal is not cut or damaged, it may be used again.
 - 10.2. Coat the O-ring seal with clean engine oil.
 - 10.3. Install the O-ring onto the sensor.
 - 10.4. Install the sensor (701). Rotate the sensor until the locating hole in the bracket aligns with the bolt hole in the block.
 - 10.5. Install the sensor bolt (702) and tighten to **25 N·m (18 lb ft)**.



11. Measure the crankshaft end play.
 - 11.1. Thrust the crankshaft forward or rearward.
 - 11.2. Insert a feeler gage between the center crankshaft bearing and the bearing surface of the crankshaft and measure the bearing clearance.

The proper crankshaft end play clearance is 0.04-0.2 mm (0.0015-0.0078 in).

- 11.3. If the bearing clearance is not within specifications, inspect the thrust surfaces for nicks, gouges or raised metal. Minor imperfections may be removed with a fine stone.

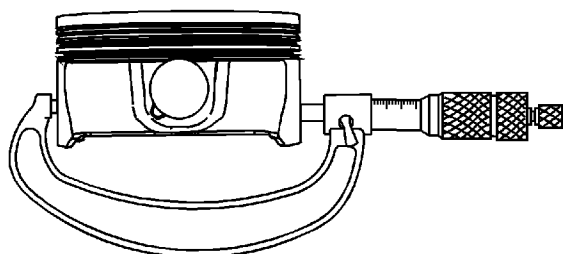
Piston, Connecting Rod, and Bearing Installation

Special Tools

- J 8037 Piston Ring Compressor
- J 8087 Cylinder Bore Gage
- J 41556 Connecting Rod Guide
- J 45059 Angle Meter

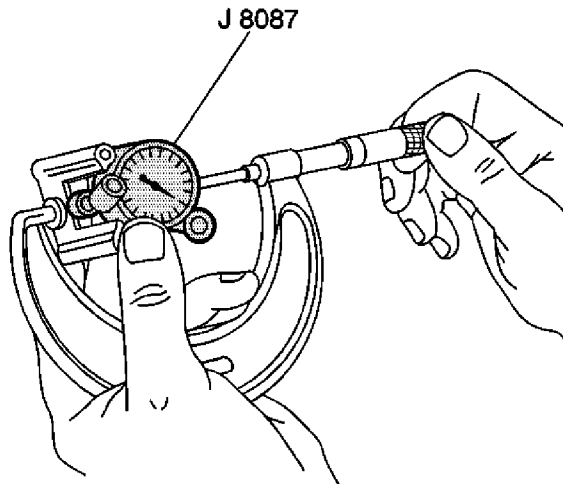
For equivalent regional tools, refer to [Special Tools](#)

Piston Selection

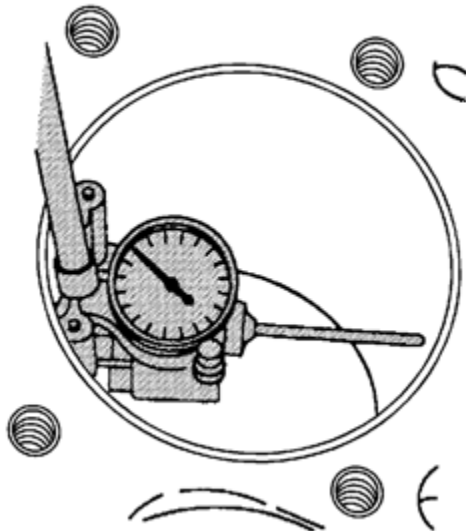


Note: Measurements of all components should be taken with the components at normal room temperature. For proper piston fit, the engine block cylinder bores must not have excessive wear or taper. A used piston, pin, and connecting rod assembly may be installed if, after inspection is within specifications.

1. With a micrometer at a right angle, measure the piston outside diameter (OD). Measure the diameter 43 mm (1.69 in) from the top of the piston. Refer to [Engine Mechanical Specifications](#).
2. Record the piston OD.

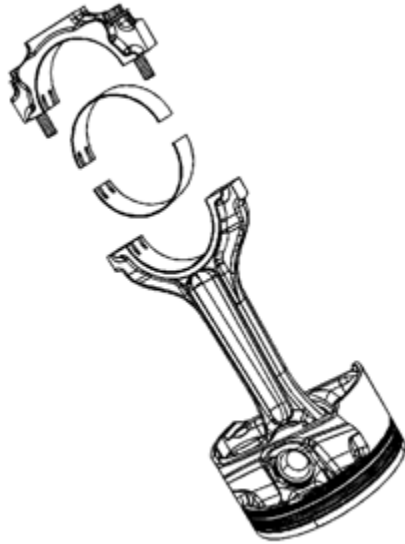


3. Adjust the micrometer to the recorded piston OD.
4. Insert the J 8037 gage into the micrometer and zero the gage dial.

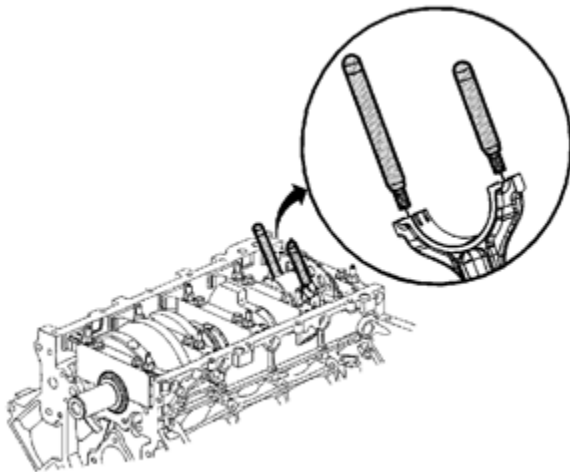


5. Using the J 8037 gage, measure the cylinder bore inside diameter (ID). Measure at a point 64 mm (2.5 in) from the top of the cylinder.
6. Record the cylinder bore ID.
7. Subtract the piston OD from the cylinder bore ID in order to determine the piston-to-bore clearance. Refer to [Engine Mechanical Specifications](#).
8. If the proper clearance cannot be obtained, select another piston and pin assembly and measure the clearances again. If the proper fit cannot be obtained, the cylinder bore may require honing for an oversize piston.

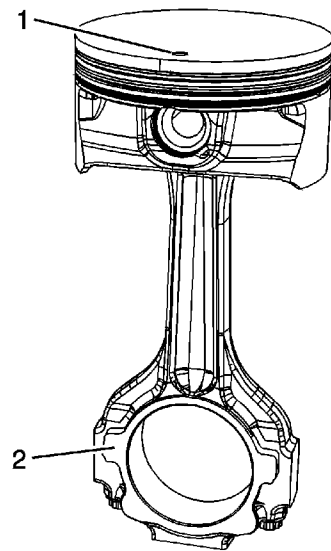
Piston, Pin, and Connecting Rod Installation



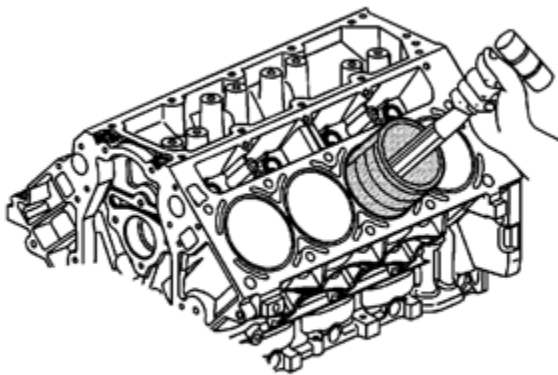
1. Lubricate the following components with clean engine oil:
 - Piston
 - Piston rings
 - Cylinder bore
 - Bearings and bearing surfaces
2. Install the bearings to the connecting rod and cap.
3. Position the oil control ring end gaps a minimum of 25 mm (1.0 in) from each other.
4. Position the compression ring end gaps 180 degrees opposite each other.



5. Install the J 41556 guide to the connecting rod.



6. Identify the proper installation direction of the piston and connecting rod assembly. When installing the piston and connecting rod assembly, the mark on the top of the piston (1) and the tab (2) on the side of the connecting rod should face the front of the engine.

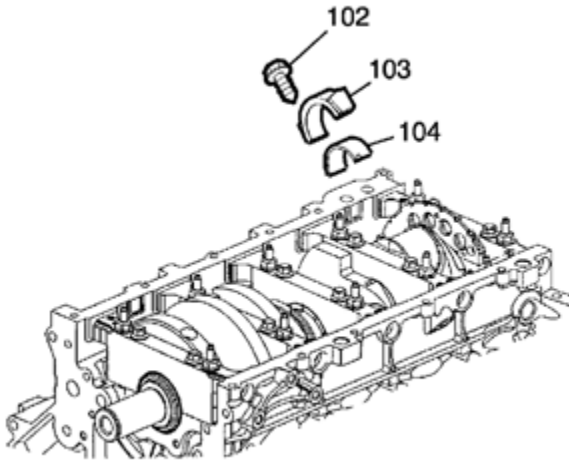


7. Install the J 8037 compressor onto the piston and compress the piston rings.

Note: The piston alignment mark **MUST** face the front of the engine block.

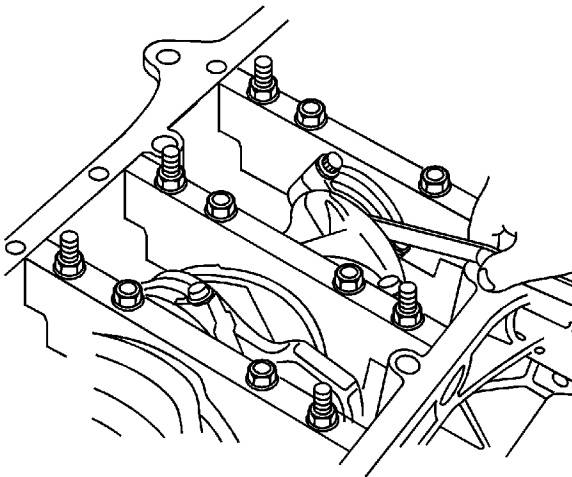
8. Install the piston, pin, and connecting rod assembly into the cylinder bore. Hold the piston ring compressor firmly against the engine block. Using a wooden hammer handle, lightly tap the top of the piston until all piston rings have entered the cylinder bore.
9. Use the J 41556 guide to guide the connecting rod onto the crankshaft journal.
10. Remove the J 41556 guide from the connecting rod.

Caution: Refer to [Fastener Caution](#) in the Preface section.



Note: The connecting rod and cap must be assembled with the mating surfaces properly aligned.

11. Install the bearing cap (103), bearing (104), and bolts (102).
 - 11.1. Tighten the bolts a first pass to **20 N·m (15 lb ft)**.
 - 11.2. Tighten the bolts a final pass to **85 degrees** using the J 45059 meter .

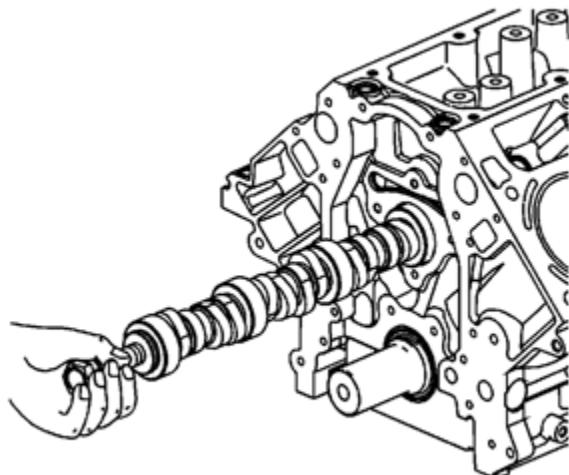


12. Measure the connecting rods for the proper side clearance. Refer to [Engine Mechanical](#)

[Specifications.](#)

cardiagn.com

Camshaft Installation

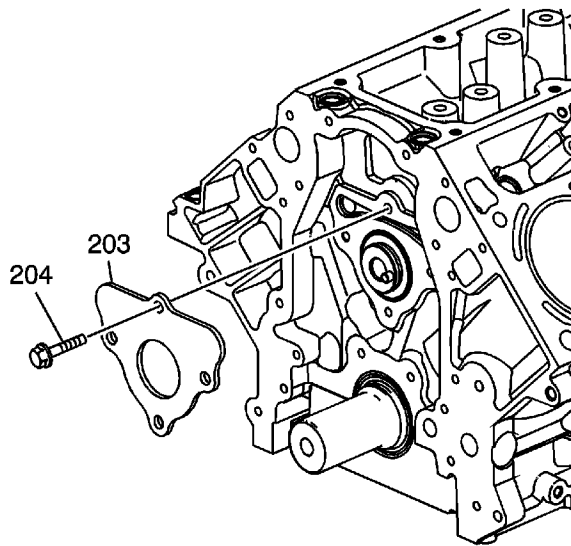


Note: If camshaft replacement is required, the valve lifters must also be replaced.

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

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

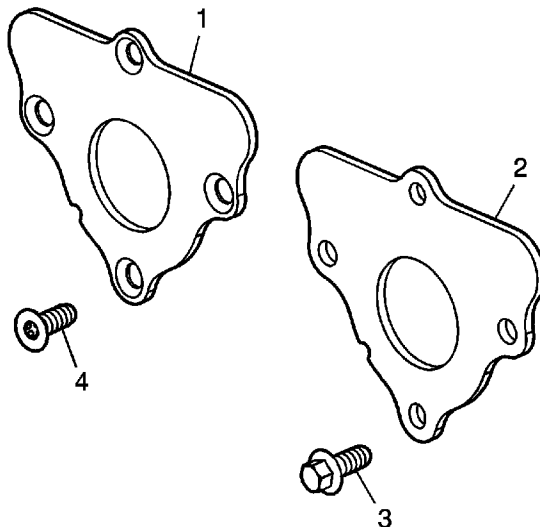
3. Using the bolt as a handle, carefully install the camshaft into the engine block.
4. Remove the bolt from the front of the camshaft.



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

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

Caution: Refer to [Fastener Caution](#) in the Preface section.



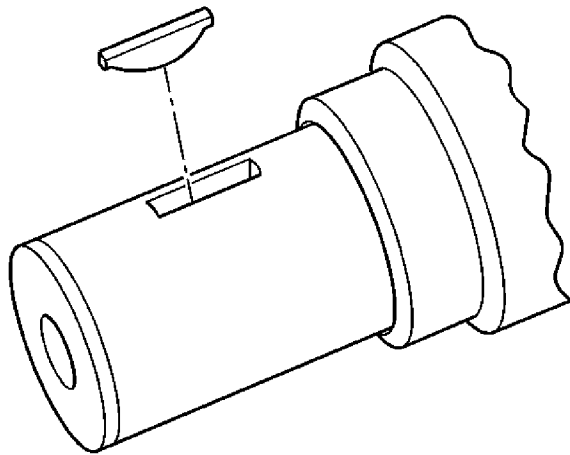
6. Tighten the camshaft retainer bolts.
 - Tighten the first design hex head bolts (3) to **25 N·m (18 lb ft)**.
 - Tighten the second design TORX® head bolts (4) to **15 N·m (11 lb ft)**.

Camshaft Position Actuator and Solenoid Valve Installation

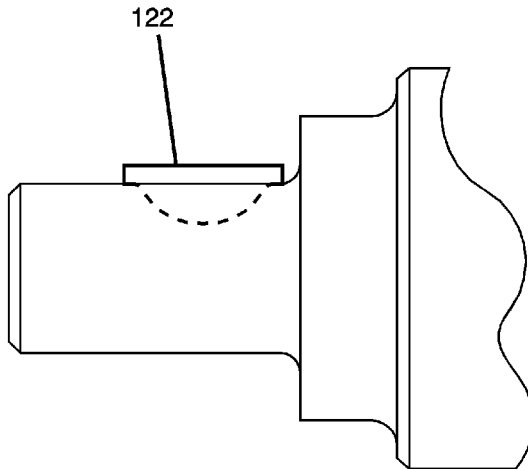
Special Tools

- *EN 46330* Timing Belt Tensioner Retaining Pin
- *J 41478* Crankshaft Front Oil Seal Installer
- *J 41665* Crankshaft Balancer and Sprocket Installer
- *J 42386-A* Flywheel Holding Tool
- *J 45059* Angle Meter

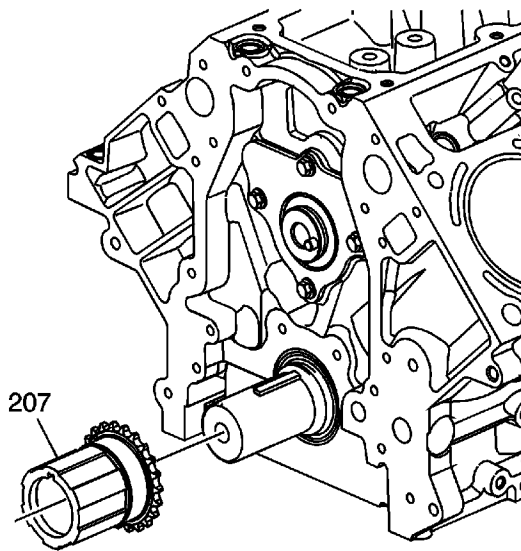
For equivalent regional tools, refer to [Special Tools](#)



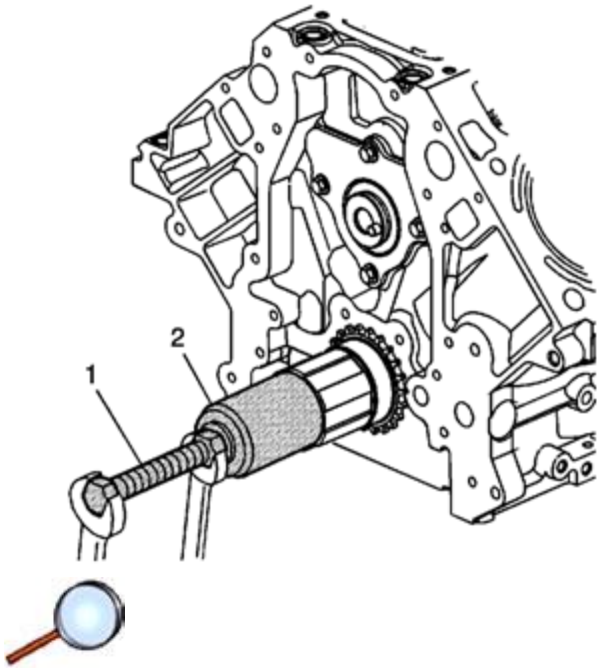
1. Install the key into the crankshaft keyway, if previously removed.



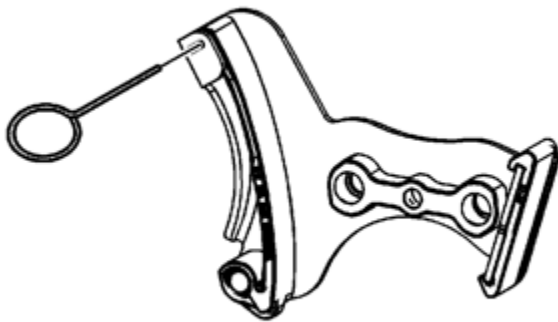
2. Tap the key (122) into the keyway until both ends of the key bottom onto the crankshaft.



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

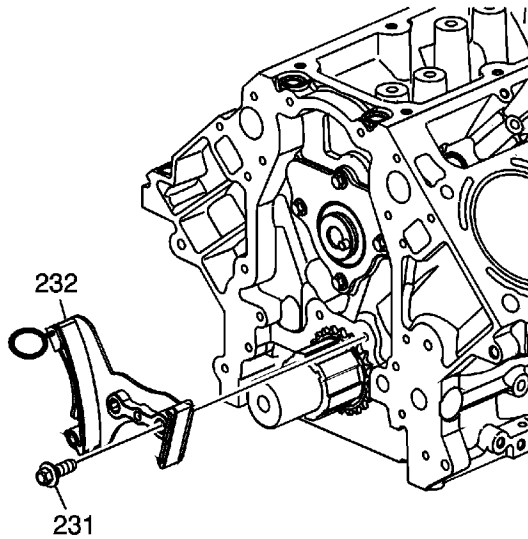


4. Use the *J 41478* installer (1) and the *J 41665* installer (2) in order to install the crankshaft sprocket. Install the sprocket onto the crankshaft until fully seated against the crankshaft flange.
5. Rotate the crankshaft sprocket until the sprocket alignment mark is in the 12 o'clock position.



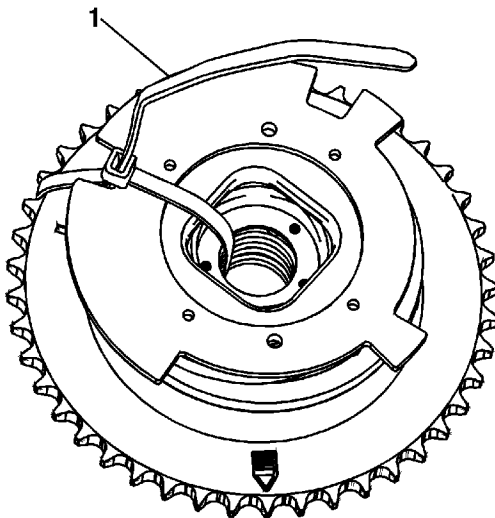
6. Compress the timing chain tensioner guide and install the *EN 46330* pin .

Caution: Refer to [Fastener Caution](#) in the Preface section.

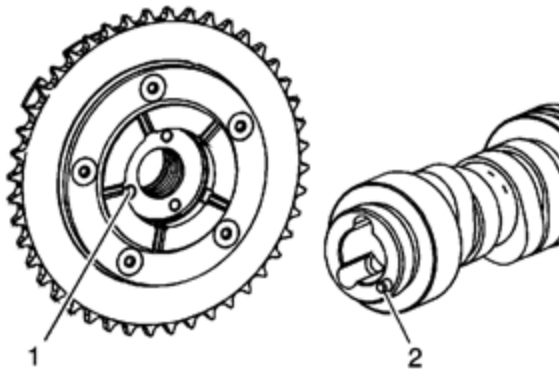


7. Install the timing chain tensioner (232) and left side bolt (231). Do not install the right side bolt at this time. The right side bolt will be installed after the camshaft position (CMP) actuator and chain have been installed onto the engine.

Warning: Refer to [Camshaft Position Actuator Removal and Installation Warning](#) in the Preface section.



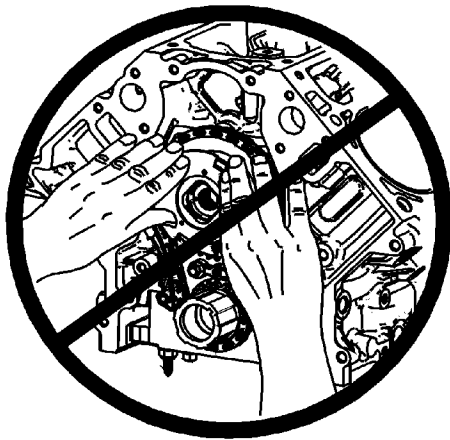
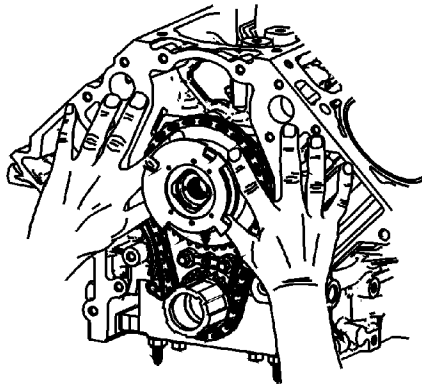
8. Remove the tie strap (1) from the actuator.

**Note:**

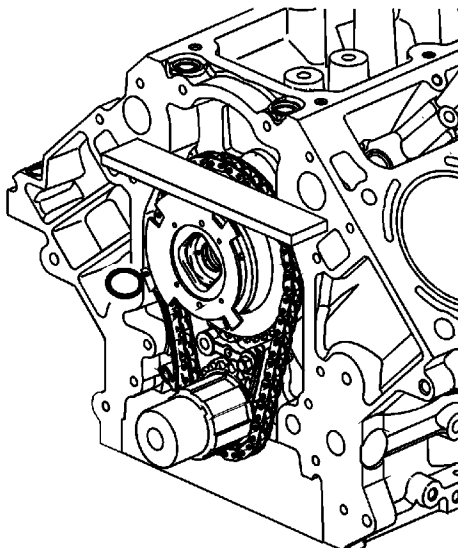
- Properly locate the CMP actuator onto the locating pin of the camshaft.
- The sprocket teeth and timing chain must mesh.
- The camshaft and the crankshaft sprocket alignment marks **MUST** be aligned properly.
- Do not use the CMP solenoid valve again. Install a NEW valve during assembly.

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

Warning: Refer to [Camshaft Position Actuator Removal and Installation Warning](#) in the Preface section.

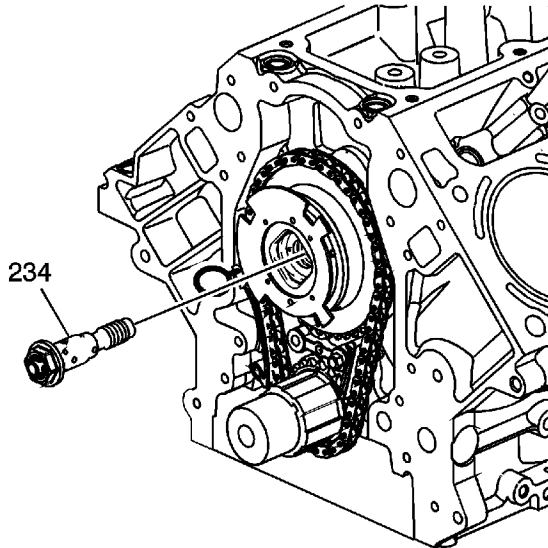


10. Install the CMP actuator and timing chain. Align the hole in the rear face of the CMP actuator with the locating pin on the front face of the camshaft. If necessary, rotate the camshaft or crankshaft sprockets in order to align the timing marks. Use care to install the actuator completely onto the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

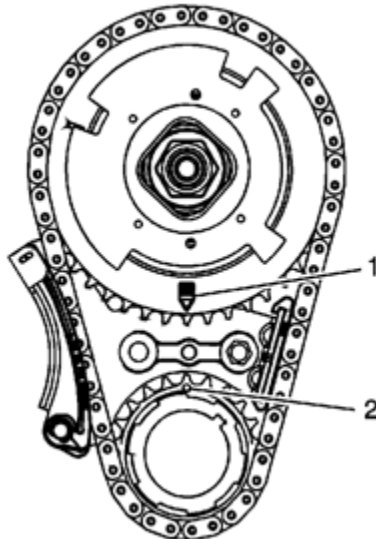




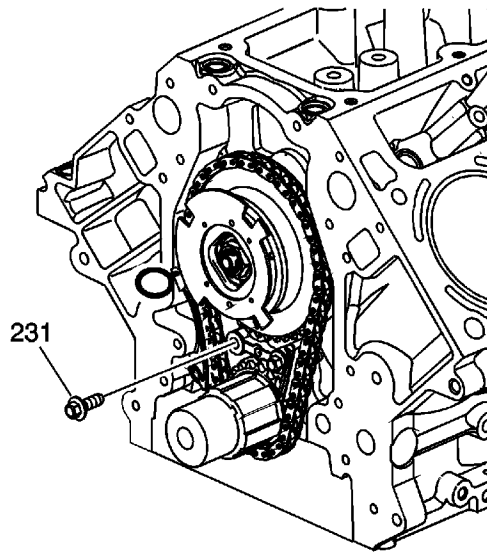
11. Locate a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and completely installed onto the front of camshaft, the timing chain will not protrude beyond the front face of engine block.



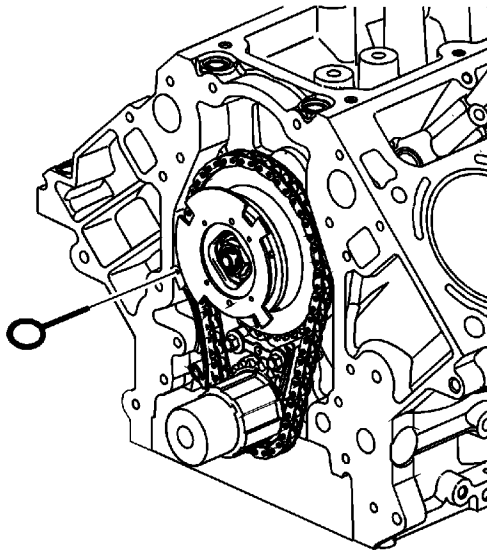
12. Install a NEW CMP actuator solenoid valve (234). With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.



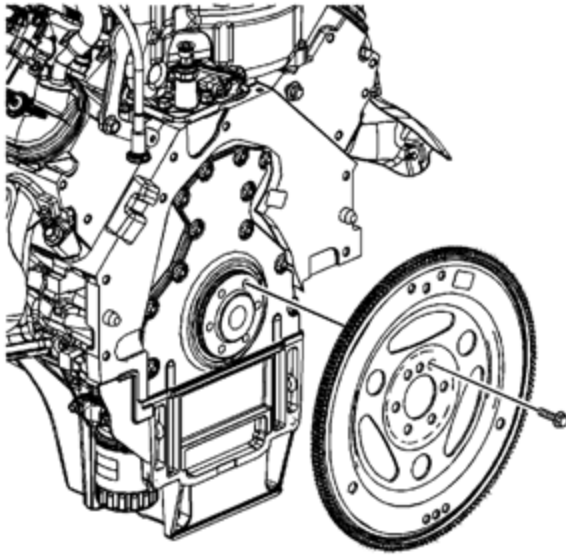
13. Inspect the sprockets for proper alignment. The mark on the CMP actuator sprocket (1) should be located in the 6 o'clock position and the mark on the crankshaft sprocket (2) should be located in the 12 o'clock position.



14. Install the right side bolt (231) into the timing chain tensioner and tighten to **25 N·m (18 lb ft)**.

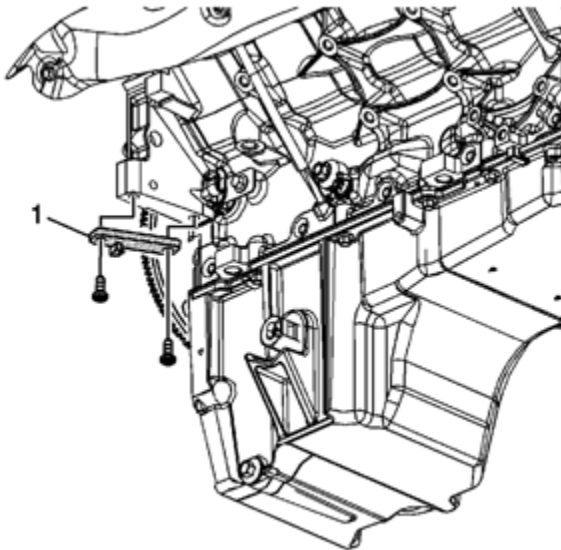


15. Remove the *EN 46330* pin .

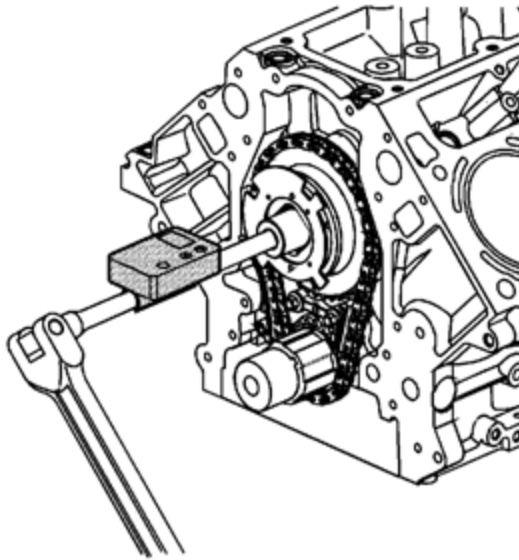


Note: Do not apply threadlock to the flex plate bolts at this time.

16. Temporarily install the automatic transmission flex plate and bolts. Refer to [Automatic Transmission Flex Plate Installation](#).



17. Install the J 42386-A tool (1) and bolts. Use 1 M10 - 1.5 x 120 mm and 1 M10 - 1.5 x 45 mm bolt for proper tool operation. Tighten the J 42386-A tool bolts to **50 N·m (37 lb ft)**.



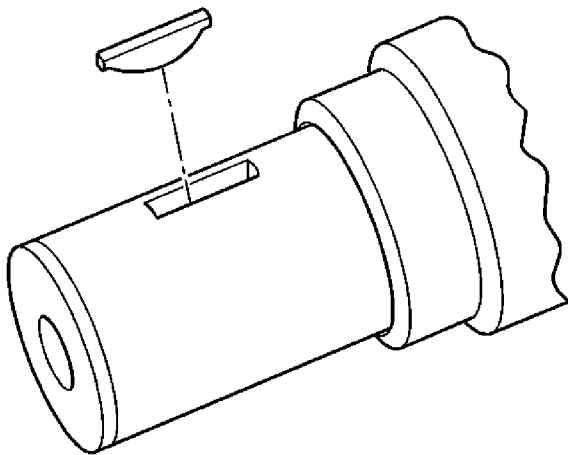
18. Tighten the CMP actuator solenoid valve.
 - 18.1. Tighten the CMP actuator solenoid valve a first pass to **65 N·m (48 lb ft)**.
 - 18.2. Tighten the CMP actuator solenoid valve a final pass an additional **90 degrees** using the *J 45059* meter .
19. Remove the *J 42386-A* tool and bolts.
20. Remove the automatic transmission flex plate and bolts. Refer to [Automatic Transmission Flex Plate Removal](#).

Timing Chain and Sprocket Installation

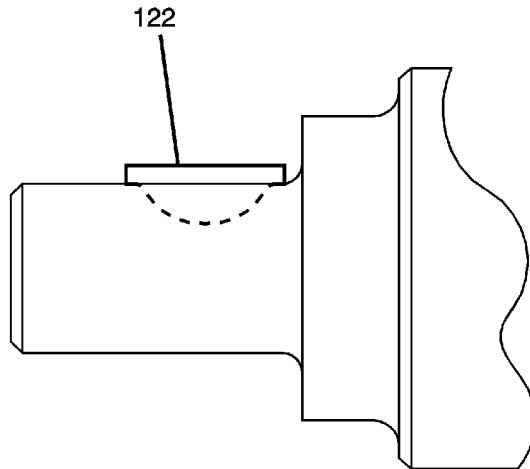
Special Tools

- *EN 46330* Timing Belt Tensioner Retaining Pin
- *J 41478* Crankshaft Front Oil Seal Installer
- *J 41665* Crankshaft Balancer and Sprocket Installer
- *J 42386-A* Flywheel Holding Tool
- *J 45059* Angle Meter

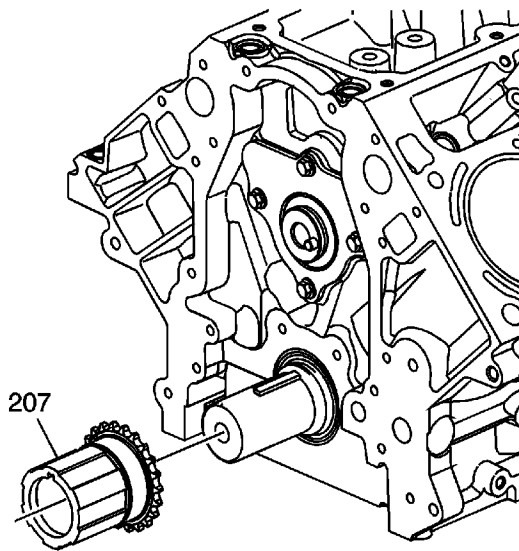
For equivalent regional tools, refer to [Special Tools](#)



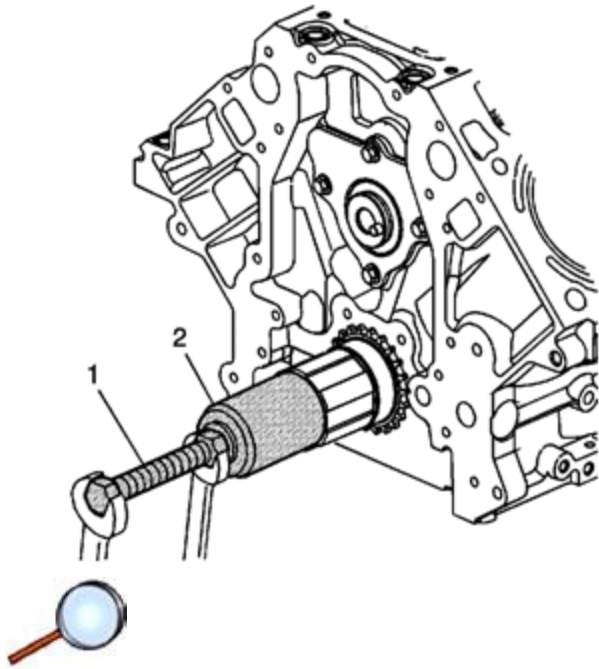
1. Install the key into the crankshaft keyway, if previously removed.



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



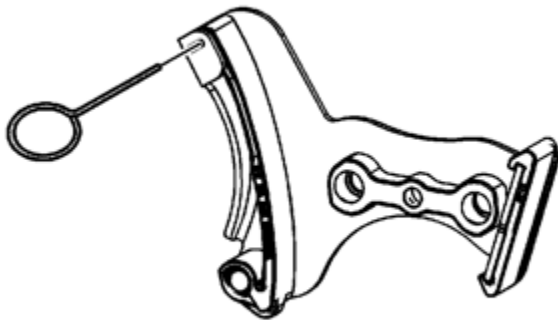
3. Install the crankshaft sprocket (207) onto the front of the crankshaft. Align the crankshaft key with the crankshaft sprocket keyway.



4. Use the J 41478 installer (1) and the J 41665 installer (2) in order to install the crankshaft sprocket.

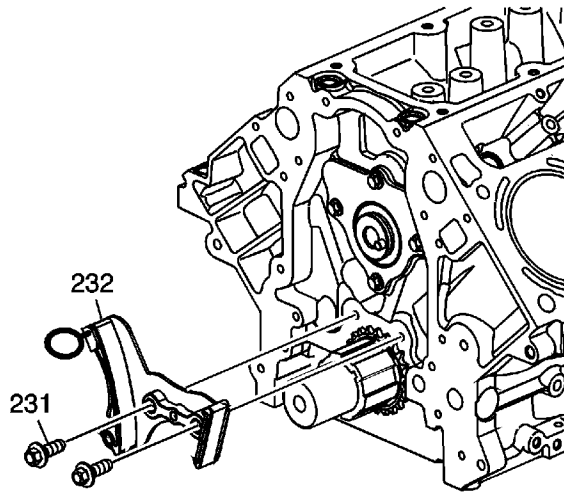
Install the sprocket onto the crankshaft until fully seated against the crankshaft flange.

5. Rotate the crankshaft sprocket until the alignment mark is in the 12 o'clock position.

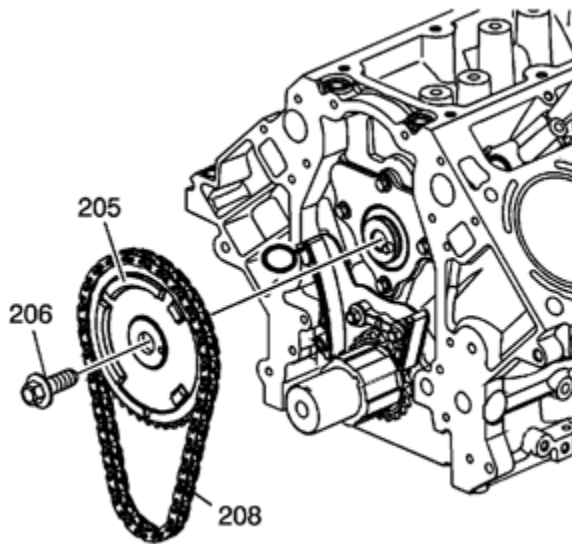


6. Compress the timing chain tensioner guide and install the EN 46330 pin .

Caution: Refer to [Fastener Caution](#) in the Preface section.



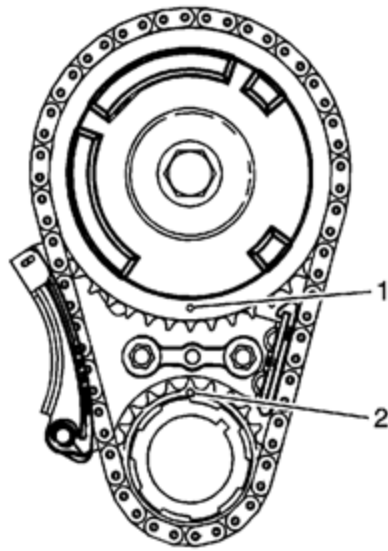
7. Install the timing chain tensioner (232) and bolts (231). Tighten the timing chain tensioner bolts to **25 N·m (18 lb ft)**.



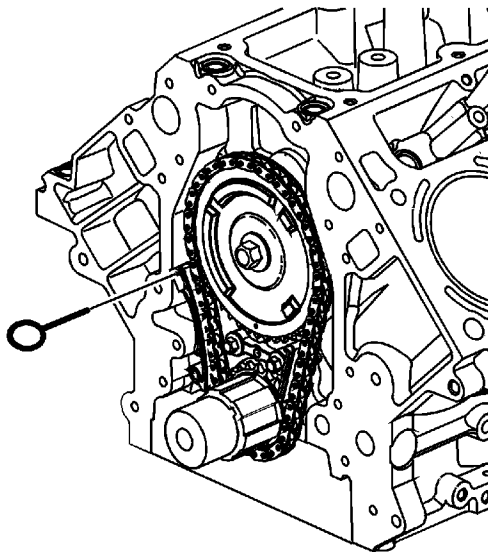
Note:

- Do not use the camshaft sprocket bolt again. Install a NEW bolt during assembly.
- The sprocket teeth and timing chain must mesh.
- The camshaft and the crankshaft sprocket alignment marks **MUST** be aligned properly.

8. Install the camshaft sprocket (205), timing chain (208), and NEW bolt (206).



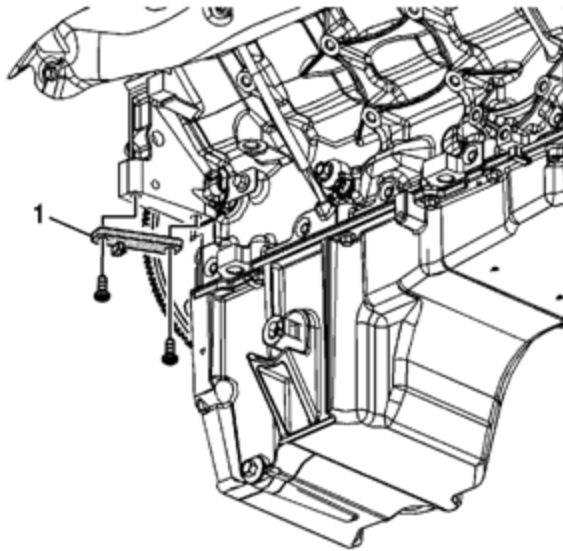
9. Inspect the sprockets for proper alignment. The mark on the camshaft sprocket (1) should be located in the 6 o'clock position and the mark on the crankshaft sprocket (2) should be located in the 12 o'clock position.



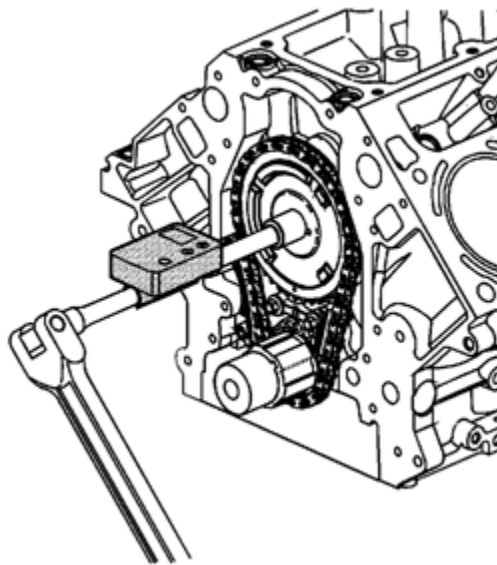
10. Remove the *EN 46330* pin .

Note: Do not apply threadlock to the flex plate bolts at this time.

11. Temporarily install the automatic transmission flex plate and bolts. Refer to [Automatic Transmission Flex Plate Installation](#).

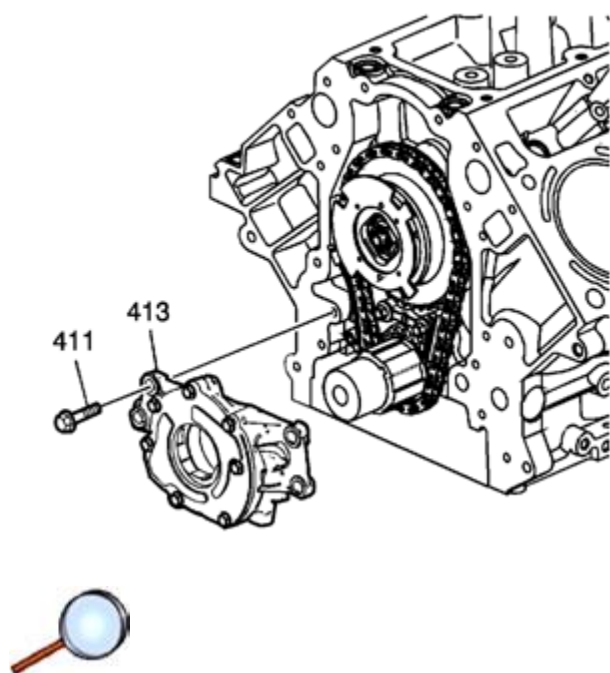


12. Install the J 42386-A tool (1) and bolts. Use 1 M10-1.5 x 120 mm bolt and 1 M10-1.5 x 45 mm bolt for proper tool operation. Tighten the J 42386-A tool bolts to **50 N·m (37 lb ft)**.



13. Tighten the camshaft sprocket bolt.
- 13.1. Tighten the camshaft sprocket bolt a first pass to **75 N·m (55 lb ft)**.
- 13.2. Tighten the camshaft sprocket bolt a final pass an additional **50 degrees** using the J 45059 meter .
14. Remove the J 42386-A tool and bolts.
15. Remove the automatic transmission flex plate and bolt. Refer to [Automatic Transmission Flex Plate Removal](#).

Oil Pump, Screen and Crankshaft Oil Deflector Installation (RPO LY6 / L76 / L9H)

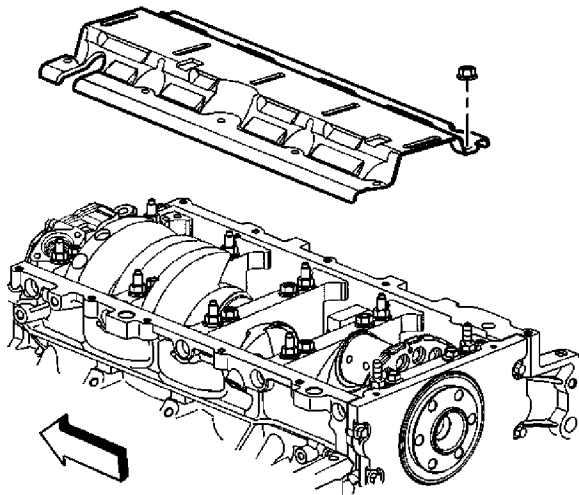


Note: Inspect the oil pump and engine block oil gallery passages. These surfaces must be clear and free of debris or restrictions.

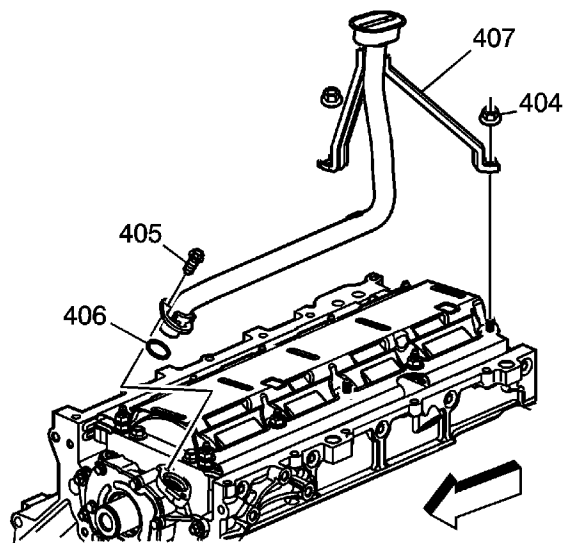
1. Align the splined surfaces of the crankshaft sprocket and the oil pump drive gear and install the oil pump (413).
2. Install the oil pump (413) onto the crankshaft sprocket until the pump housing contacts the face of the engine block.

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the oil pump bolts (411) and tighten to **25 N·m (18 lb ft)**.



4. Install the crankshaft oil deflector (425) and nuts (403).



5. Lubricate a NEW oil pump screen O-ring seal (406) with clean engine oil.
6. Install the NEW O-ring seal onto the oil pump screen.

Note:

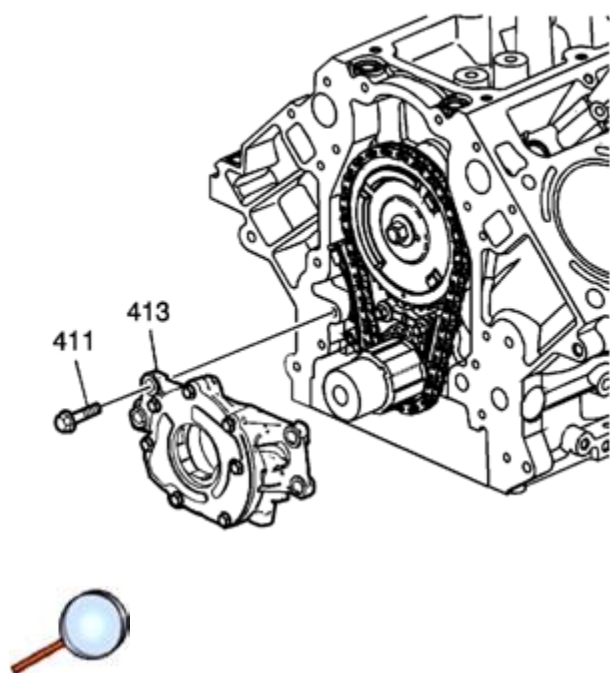
- Push the oil pump screen tube completely into the oil pump prior to tightening the bolt. Do not allow the bolt to pull the tube into the pump.
- Align the oil pump screen mounting brackets with the correct crankshaft bearing cap bolt/studs.

7. Install the oil pump screen (407).
8. Install the oil pump screen bolt (405) and the nut (404).

- 8.1. Tighten the oil pump screen bolt to **12 N·m (106 lb in)**.
- 8.2. Tighten the crankshaft oil deflector nut to **25 N·m (18 lb ft)**.

cardiagn.com

Oil Pump, Screen and Crankshaft Oil Deflector Installation (RPO LY2 / LH6 / LMG / LY5 / LC9)

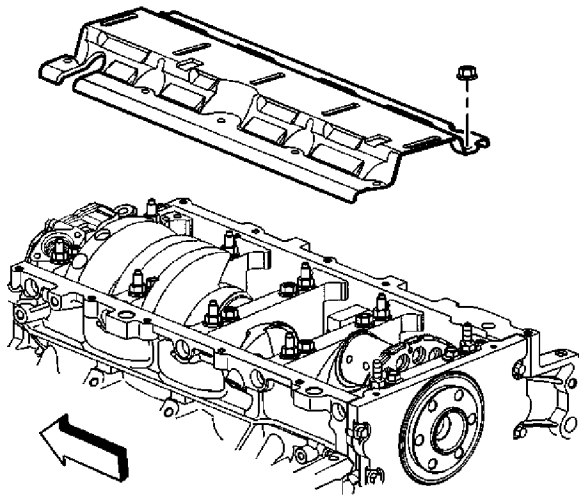


Note: Inspect the oil pump and engine block oil gallery passages. These surfaces must be clear and free of debris or restrictions.

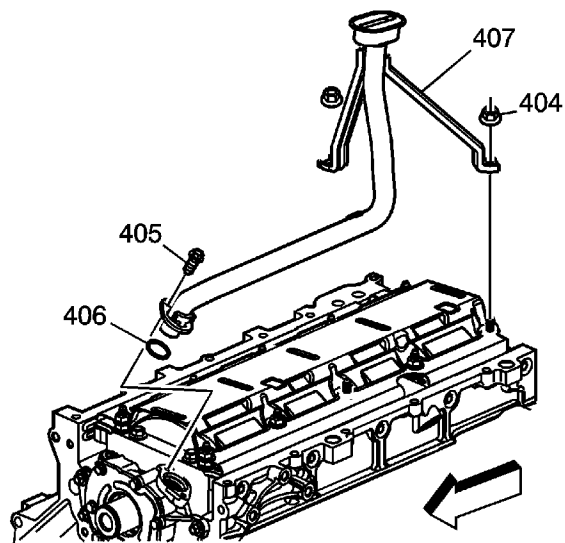
1. Align the splined surfaces of the crankshaft sprocket and the oil pump drive gear and install the oil pump (413).
2. Install the oil pump (413) onto the crankshaft sprocket until the pump housing contacts the face of the engine block.

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the oil pump bolts (411) and tighten to **25 N·m (18 lb ft)**.



4. Install the crankshaft oil deflector (425) and nuts (403).



5. Lubricate a NEW oil pump screen O-ring seal (406) with clean engine oil.
6. Install the NEW O-ring seal onto the oil pump screen.

Note:

- Push the oil pump screen tube completely into the oil pump prior to tightening the bolt. Do not allow the bolt to pull the tube into the pump.
- Align the oil pump screen mounting brackets with the correct crankshaft bearing cap bolt/studs.

7. Install the oil pump screen (407).
8. Install the oil pump screen bolt (405) and the nut (404).

- 8.1. Tighten the oil pump screen bolt to **12 N·m (106 lb in)**.
- 8.2. Tighten the crankshaft oil deflector nut to **25 N·m (18 lb ft)**.

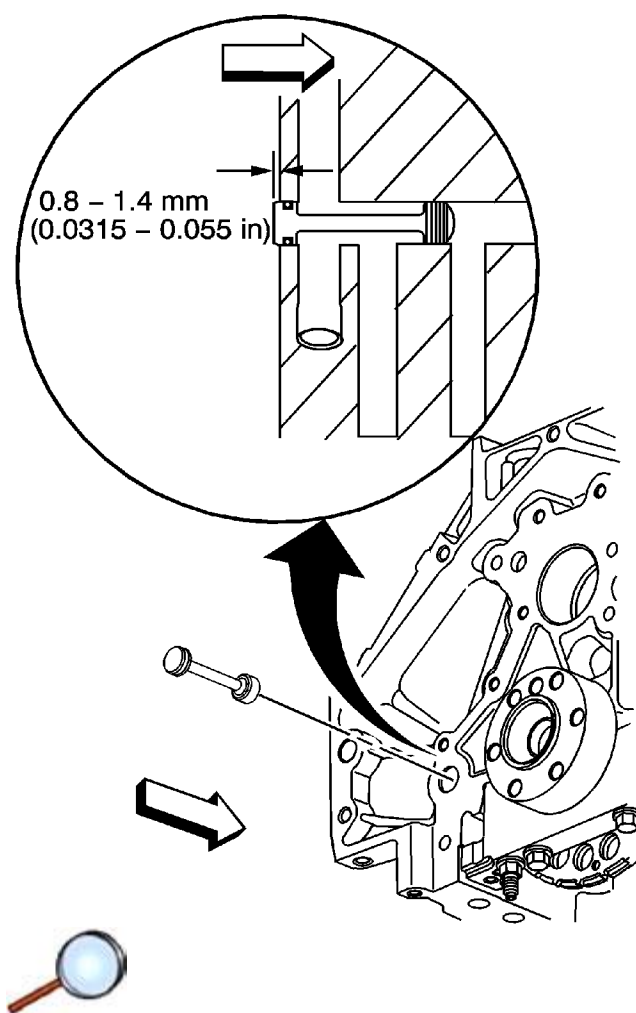
cardiagn.com

Crankshaft Rear Oil Seal Housing Installation (Without Seal in Housing)

Special Tools

- J 41476 Front and Rear Cover Alignment Tool
- J 41480 Front and Rear Cover Alignment

For equivalent regional tools, refer to [Special Tools](#).



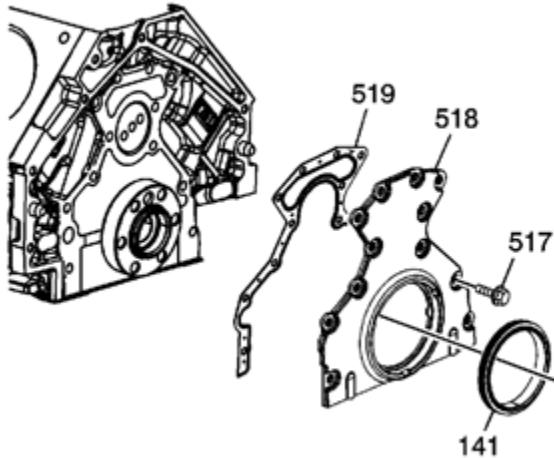
Note:

- Do not use the crankshaft rear oil seal or the engine rear housing gasket again.
- Do not apply any type of sealant to the rear housing gasket, unless specified.
- The special tools in this procedure are used to properly align the engine rear housing at the oil pan surface and to center the crankshaft rear oil seal.
- The crankshaft r sing has been installed

and aligned. Install the rear housing without the crankshaft oil seal.

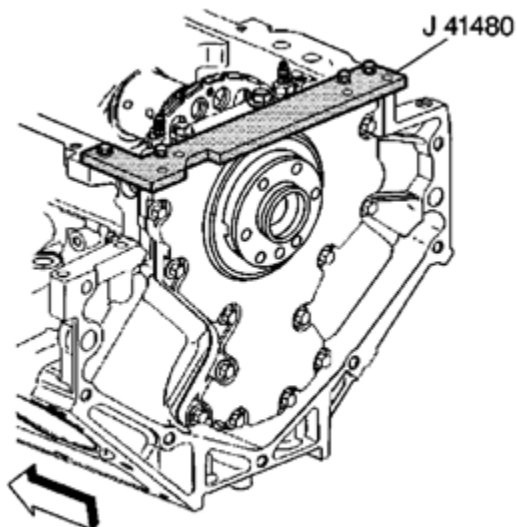
- The crankshaft rear oil seal **MUST** be centered in relation to the crankshaft.
- The oil pan sealing surface at the rear housing, and the engine block, **MUST** be aligned within specifications.
- An improperly aligned rear housing may cause premature rear oil seal wear and/or engine assembly oil leaks.

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



2. Install the rear housing gasket (519), rear housing (518), and bolts (517).
3. Tighten the bolts finger tight. Do not overtighten.

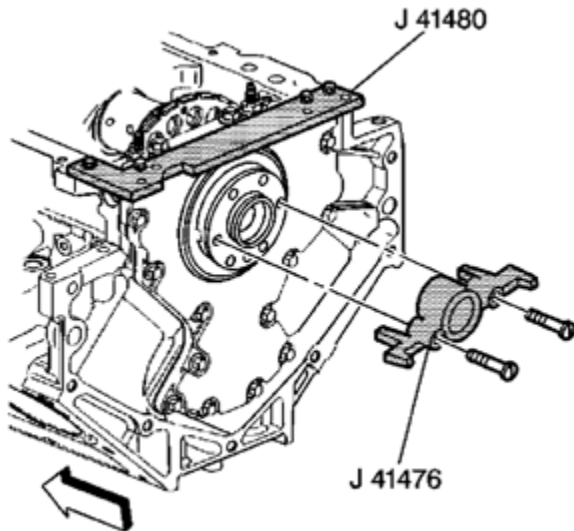
Caution: Refer to [Fastener Caution](#) in the Preface section.





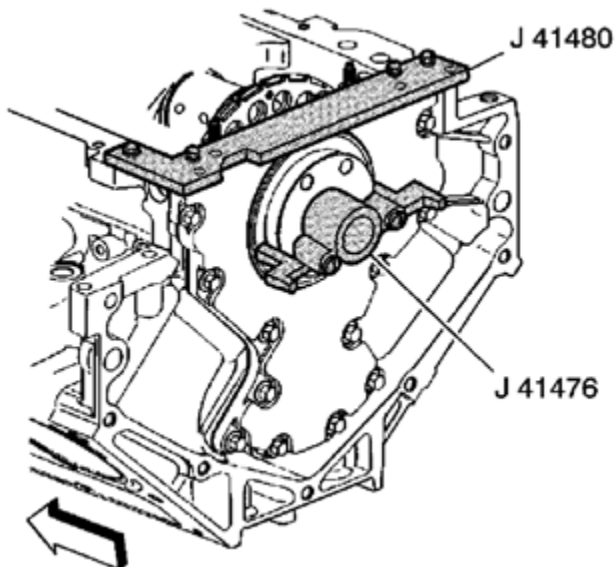
Note: Start the J 41480 alignment tool-to-rear housing bolts. Do not tighten the bolts at this time.

4. Install the J 41480 alignment and bolts. Tighten the tool-to-engine block bolts to **25 N·m (18 lb ft)**.



Note: To properly align the rear housing, the J 41476 tool must be installed onto the rear of the crankshaft with the tool mounting bolts parallel to the oil pan surface.

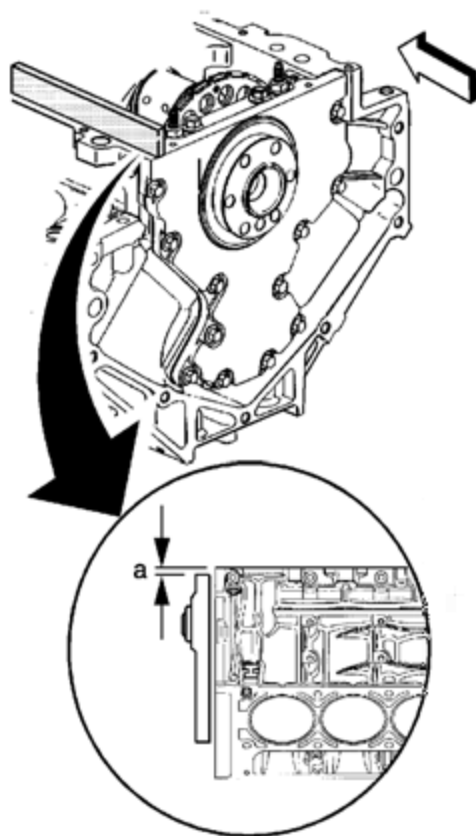
5. Rotate the crankshaft until 2 opposing flywheel bolt holes are parallel to the oil pan surface.





Note: The tapered legs of the alignment tool must enter the rear housing oil seal bore.

6. Install the J 41476 tool and bolts onto the rear of the crankshaft.
 - 6.1. Tighten the tool mounting bolts until snug. Do not overtighten.
 - 6.2. Tighten the J 41480 alignment tool-to-rear housing bolts evenly to **12 N·m (106 lb in)**.
 - 6.3. Tighten the rear housing bolts to **30 N·m (22 lb ft)**.
7. Remove the tools.



8. Measure the rear housing-to-engine block oil pan surface for flatness.
 - 8.1. Place a straight edge onto the engine block and rear housing oil pan sealing surfaces.

Avoid contact with the portion of the gasket that protrudes into the oil pan surface.
 - 8.2. Insert a feeler gage between the rear housing and the straight edge. The housing must be flush with the oil pan or no greater than 0.5 mm (0.02 in) below flush (a).
9. If the rear housing-to-engine block oil pan surface alignment is not within specifications, repeat the housing alignment procedure.
10. If the correct rear housing-to-engine block alignment at the oil pan surface cannot be

obtained, replace the rear housing.

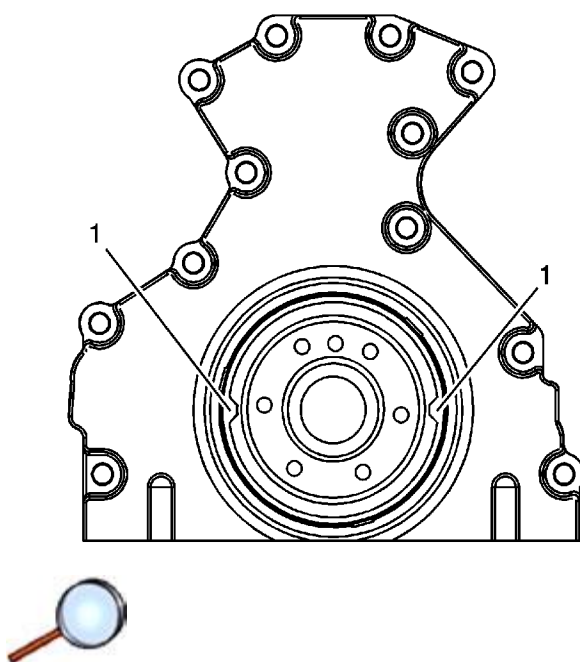
cardiagn.com

Crankshaft Rear Oil Seal Housing Installation (With Seal in Housing)

Special Tools

- J 41479-2A Crankshaft Rear Oil Seal Installation Guide
- J 41480 Front and Rear Cover Alignment

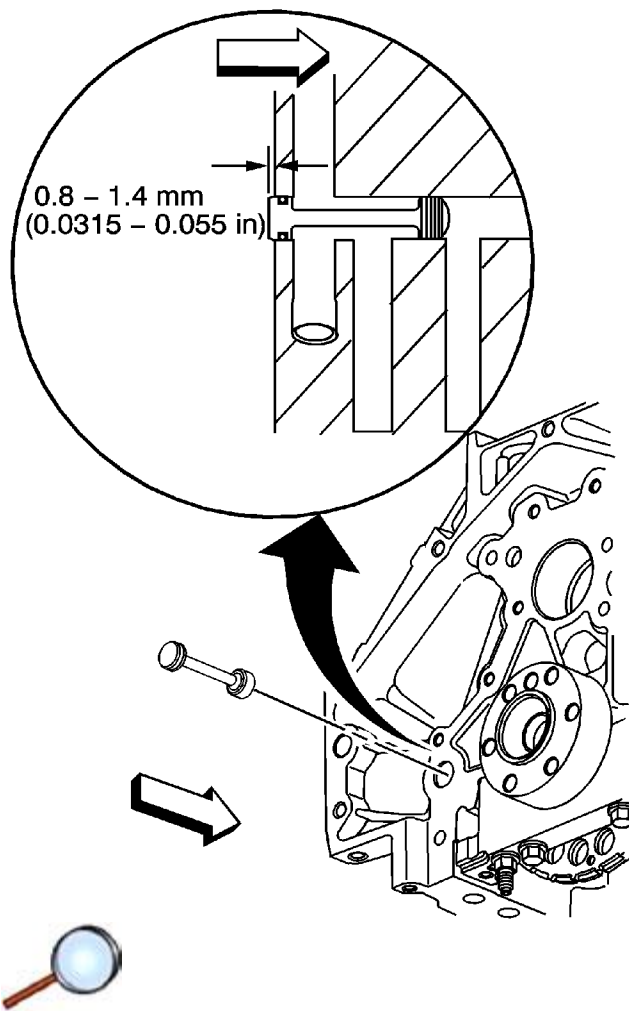
For equivalent regional tools, refer to [Special Tools](#)



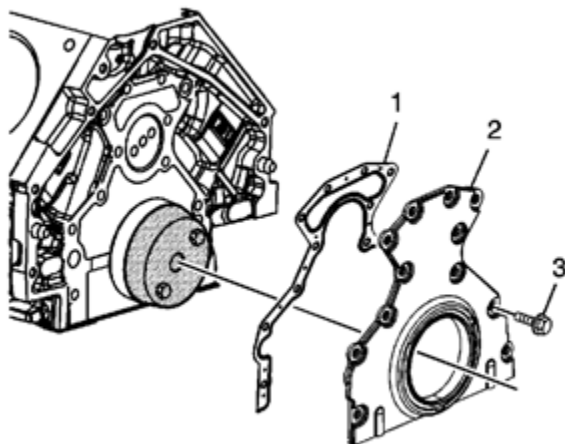
Note:

- Do not use the crankshaft rear oil seal or the engine rear housing gasket again.
- Do not apply any type of sealant to the rear housing gasket, unless specified.
- The special tool in this procedure is used to properly align the engine rear housing at the oil pan surface.
- First design rear housings do not have alignment tabs for alignment of the housing horizontally. J 41476 tool is required to properly align first design rear housings. The rear oil seal must be removed from the housing for proper use of the tool.
- Second design rear housings have alignment tabs for alignment of the housing horizontally. J 41476 tool is not required for proper alignment of second design rear housings. The housing may be installed and aligned with the seal already installed into the housing.

1. Inspect the rear housing to identify for alignment tabs (1).



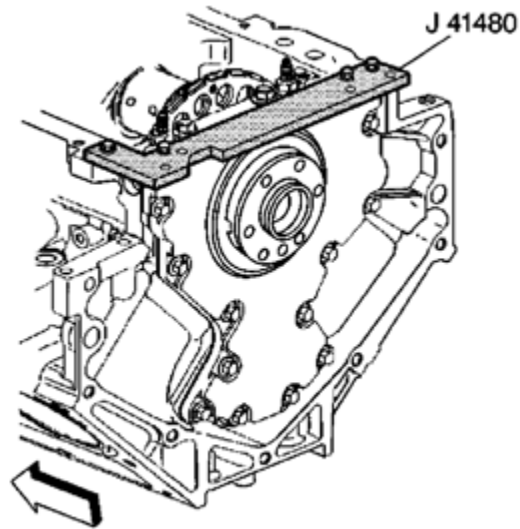
2. Inspect the rear oil gallery plug for proper installation.



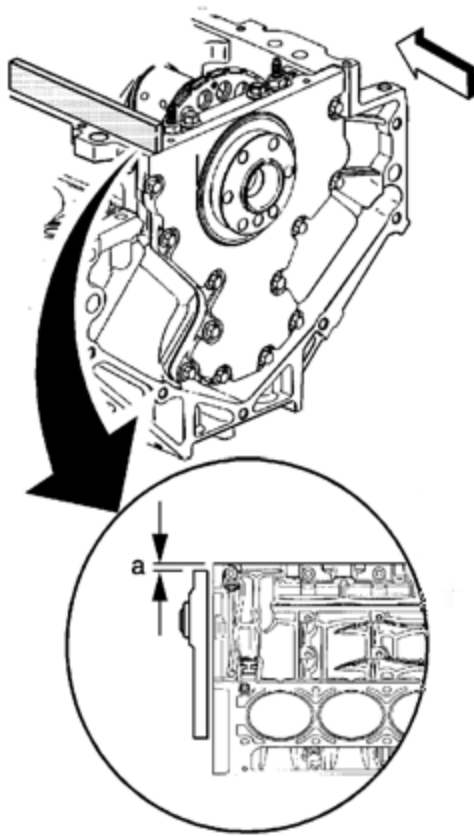
3. Install the J 41479-2A guide cone and bolts onto the rear of the crankshaft.
4. Tighten the bolts until snug. Do not overtighten.
5. Install the rear housing gasket (1), rear housing with seal (2), and bolts (3).

6. Tighten the bolts finger tight. Do not overtighten.
7. Remove the J 41479-2A guide and bolts.

Caution: Refer to [Fastener Caution](#) in the Preface section.



8. Install the J 41480 alignment and bolts.
 - 8.1. Tighten the tool-to-engine block bolts to **25 N·m (18 lb ft)**.
 - 8.2. Tighten the J 41480 alignment tool-to-rear housing bolts evenly to **12 N·m (106 lb in)**.
 - 8.3. Tighten the rear housing-to-engine block bolts to **30 N·m (22 lb ft)**.
9. Remove the J 41480 alignment and bolts.



10. Measure the rear housing-to-engine block oil pan surface for flatness.
 - 10.1. Place a straight edge onto the engine block and rear housing oil pan sealing surfaces.

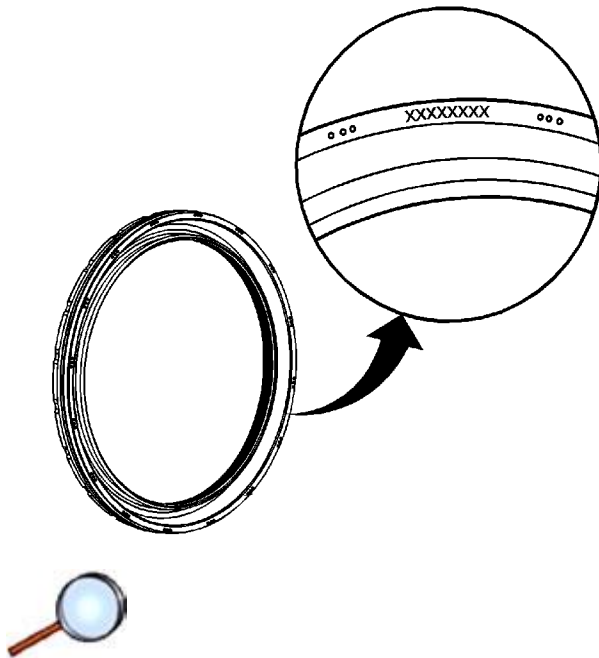
Avoid contact with the portion of the gasket that protrudes into the oil pan surface.

- 10.2. Insert a feeler gage between the rear housing and the straight edge. The housing must be flush with the oil pan or no greater than 0.5 mm (0.02 in) (a) below flush.
11. If the rear housing-to-engine block oil pan surface alignment is not within specifications, repeat the housing alignment procedure.
12. If the correct rear housing-to-engine block alignment at the oil pan surface cannot be obtained, replace the rear housing.

Crankshaft Rear Oil Seal Installation

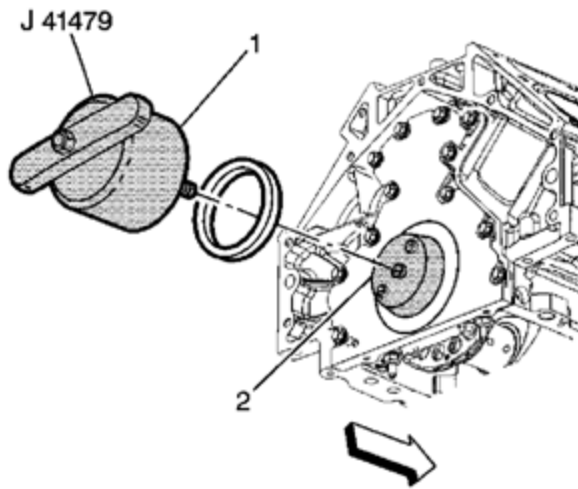
Special Tools

- [J 41479](#) Crankshaft Rear Oil Seal Installer
- [J 41479-2A](#) Crankshaft Rear Oil Seal Installation Guide



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

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



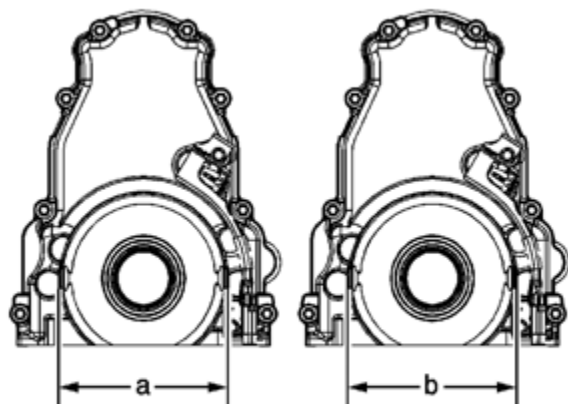
2. Install the [J 41479](#) or the [J 41479-2A](#) cone (2) and bolts onto the rear of the crankshaft. The [J 41479-2A](#) may be required for manual transmission or 5.3L LS4 applications.
3. Tighten the bolts until snug. Do not overtighten.
4. Install the rear oil seal onto the tapered cone (2) and push the seal to the rear seal bore. Install the oil seal with the part number markings facing away from the engine.
5. Thread the [J 41479](#) threaded rod into the tapered cone until the tool (1) contacts the oil seal.
6. Align the oil seal onto the tool (1).
7. Rotate the handle of the tool (1) clockwise until the seal enters the rear housing and bottoms into the seal bore.
8. Remove the tool.

Engine Front Cover Installation (without Camshaft Position Actuator)

Special Tools

- EN-48853 Front Cover Alignment Tool
- J 41480 Front and Rear Cover Alignment

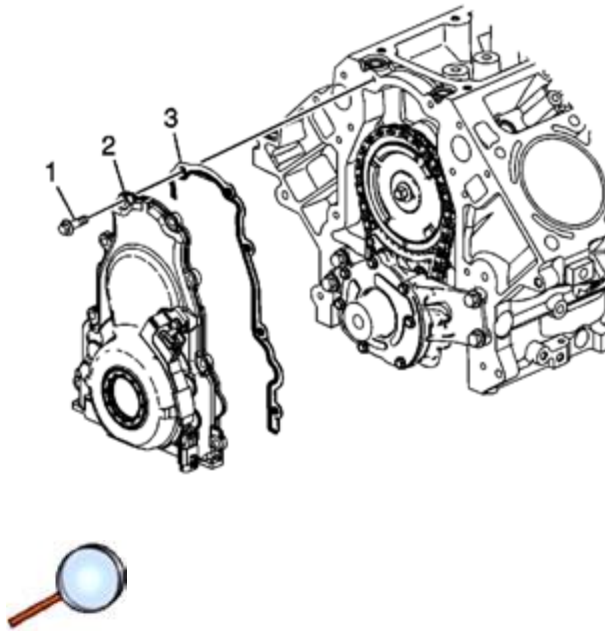
For equivalent regional tools, refer to [Special Tools](#)



1. Measure the alignment tab distance on the front cover.

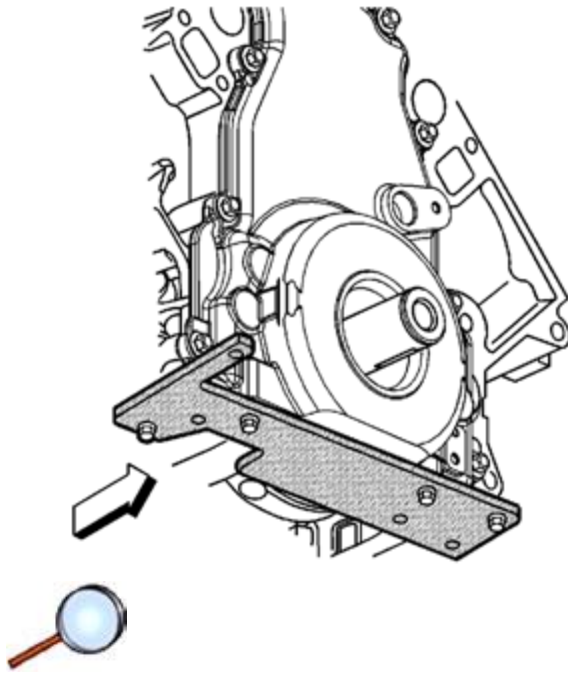
For 2009 model year, the engine front cover may have either a 141 mm (5.55 in) dimension (a) or 159 mm (6.26 in) dimension (b) alignment tab distance. Front cover alignment tool EN-48853 tool is designed to properly align both front covers. For the 141 mm (5.55 in) cover, adapters EN 48853-2 must be used.

Caution: Refer to [Fastener Caution](#) in the Preface section.

**Note:**

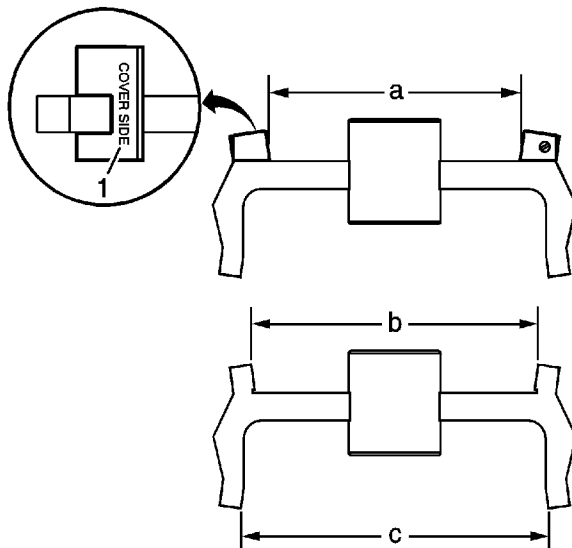
- Do not use the crankshaft oil seal or the engine front cover gasket again.
- Do not apply any type of sealant to the front cover gasket, unless specified.
- The special tools in this procedure are used to properly align the engine front cover at the oil pan surface and to center the crankshaft front oil seal.
 - All gasket surfaces should be free of oil or other foreign material during assembly.
 - The crankshaft front oil seal **MUST** be centered in relation to the crankshaft.
 - The oil pan sealing surface at the front cover and engine block **MUST** be aligned within specifications.
 - An improperly aligned front cover may cause premature front oil seal wear and/or engine assembly oil leaks.

2. Install the front cover gasket (3), front cover (2), and bolts (1).
3. Tighten the cover bolts finger tight. Do not overtighten.

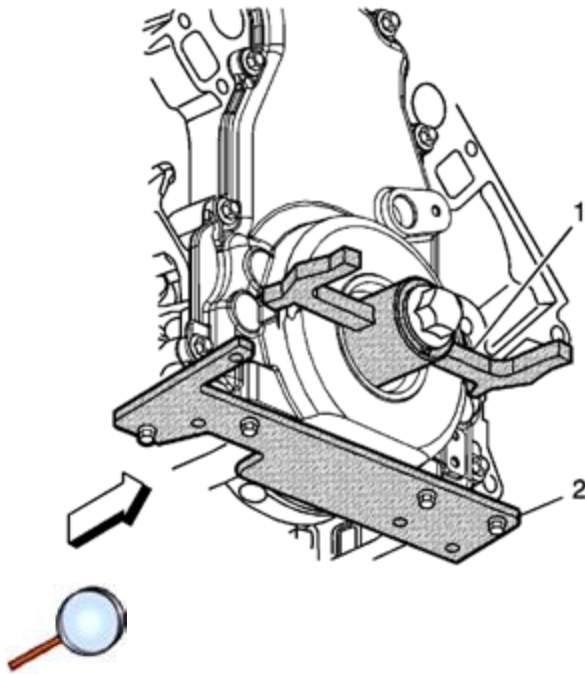


Note: Start the tool-to-front cover bolts. Do not tighten the bolts at this time.

4. Install the *J 41480* cover alignment and tighten the tool-to-engine block bolts to **25 N·m (18 lb ft)**.

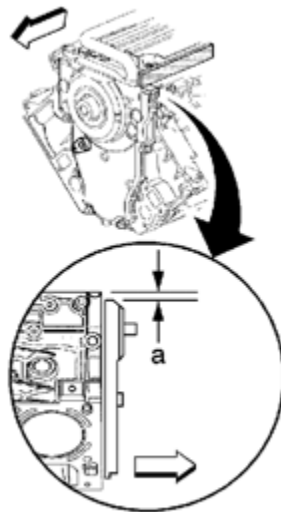


5. Install the *EN 48853-2* adapters as required for usage on the 141 mm (5.55 in) dimension (a) front cover. Position the adapters against the legs of the *EN-48853* tool with the words "cover side" (1) facing away from the tool.



Note: Align the tapered legs of the tool with the machined alignment surfaces on the front cover.

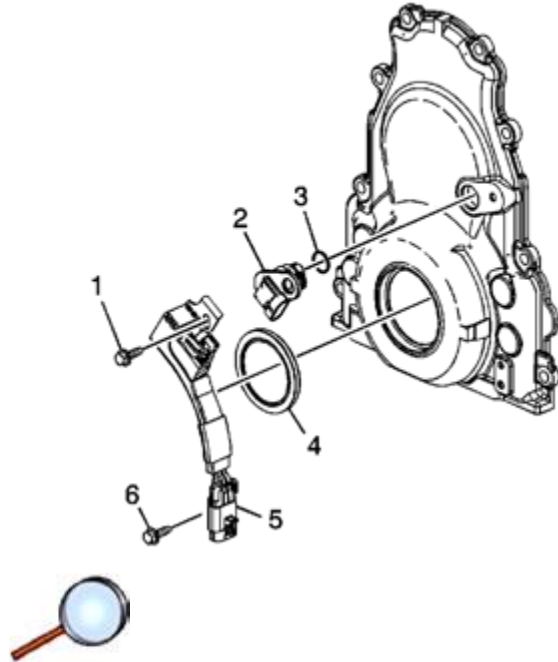
6. Install the EN-48853 tool (1).
7. Install the crankshaft balancer bolt.
8. Tighten the crankshaft balancer bolt by hand until snug. Do not overtighten.
9. Tighten the J 41480 alignment (2).
10. Tighten the engine front cover bolts to **25 N·m (18 lb ft)**.
11. Remove the tools.



12. Measure the oil pan surface flatness, front cover-to-engine block.
 - 12.1. Place a straight edge across the engine block and front cover oil pan sealing surfaces.

Avoid contact with the portion of the gasket that protrudes into the oil pan surface.

- 12.2. Insert a feeler gage between the front cover and the straight edge tool. The cover must be flush with the oil pan surface or no greater than 0.5 mm (0.02 in) (a) below flush.
13. If the front cover-to-engine block oil pan surface alignment is not within specifications, repeat the cover alignment procedure.
14. If the correct front cover-to-engine block alignment cannot be obtained, replace the front cover.



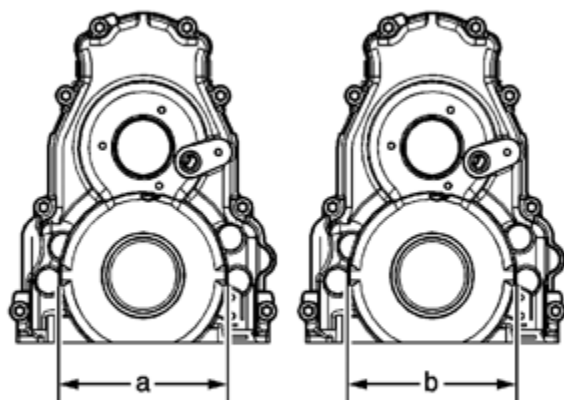
15. Inspect the camshaft position (CMP) sensor O-ring seal (3) for cuts or damage. If the seal is not cut or damaged, it may be used again.
16. Lubricate the O-ring seal with clean engine oil.
17. Install the O-ring seal onto the sensor (2).
18. Install the sensor to the cover.
19. Install the CMP sensor wire harness (5) and bolts (1, 6).

Engine Front Cover Installation (with Camshaft Position Actuator)

Special Tools

- *EN-48853* Front Cover Alignment Tool
- *J 41480* Front and Rear Cover Alignment

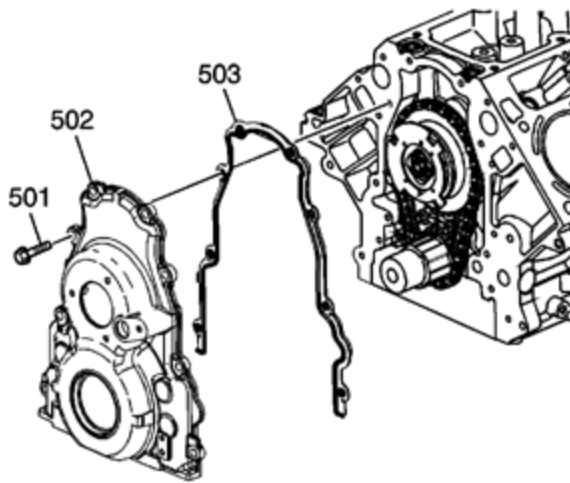
For equivalent regional tools, refer to [Special Tools](#)



1. Measure the alignment tab distance on the front cover.

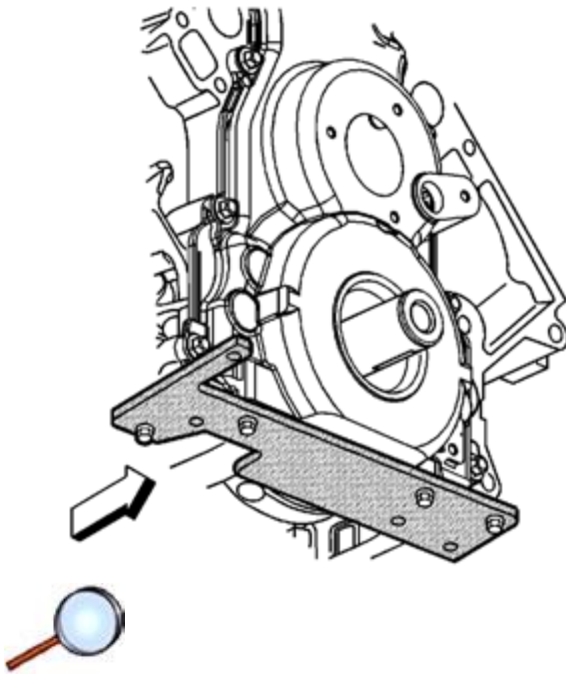
The engine front cover may have either a 141 mm (5.55 in) dimension (a) or 159 mm (6.26 in) dimension (b) alignment tab distance. Front cover alignment tool *EN-48853* tool is designed to properly align both design front covers. For the 141 mm (5.55 in) cover, adapters EN 48853-2 must be used.

Caution: Refer to [Fastener Caution](#) in the Preface section.

**Note:**

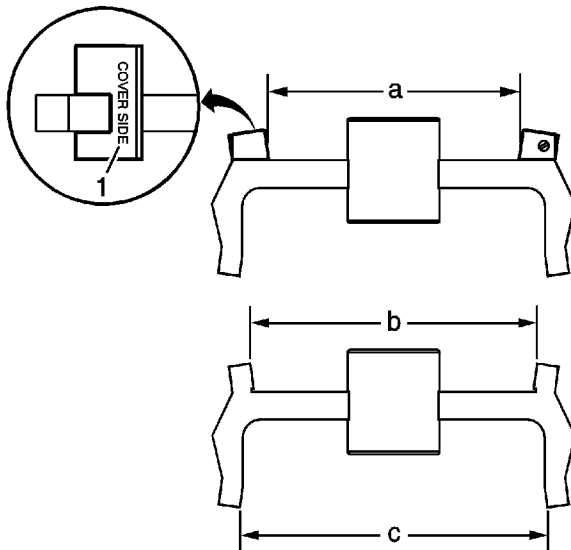
- Do not use the crankshaft oil seal or the engine front cover gasket again.
- Do not apply any type of sealant to the front cover gasket, unless specified.
- The special tools in this procedure are used to properly align the engine front cover at the oil pan surface and to center the crankshaft front oil seal.
 - All gasket surfaces should be free of oil or other foreign material during assembly.
 - The crankshaft front oil seal **MUST** be centered in relation to the crankshaft.
 - The oil pan sealing surface at the front cover and engine block **MUST** be aligned within specifications.
 - An improperly aligned front cover may cause premature front oil seal wear and/or engine assembly oil leaks.

2. Install the front cover gasket (503), front cover (502), and bolts (501).
3. Tighten the cover bolts finger tight. Do not overtighten.

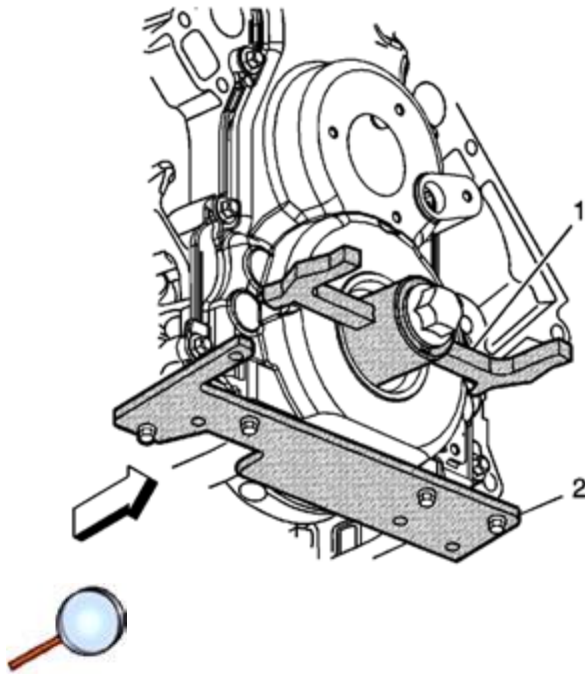


Note: Start the tool-to-front cover bolts. Do not tighten the bolts at this time.

4. Install the J 41480 alignment and tighten to **25 N·m (18 lb ft)**.

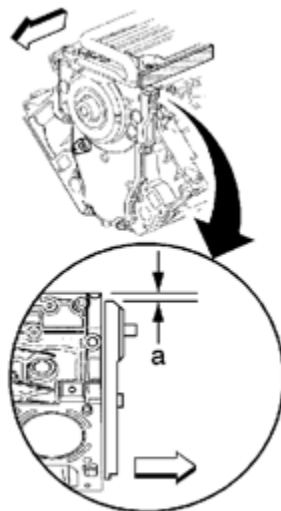


5. Install the EN 48853-2 adapters as required for usage on the 141 mm (5.55 in) dimension (a) front cover. Position the adapters against the legs of the EN-48853 tool with the words "cover side" (1) facing away from the tool.



Note: Align the tapered legs of the tool with the machined alignment surfaces on the front cover.

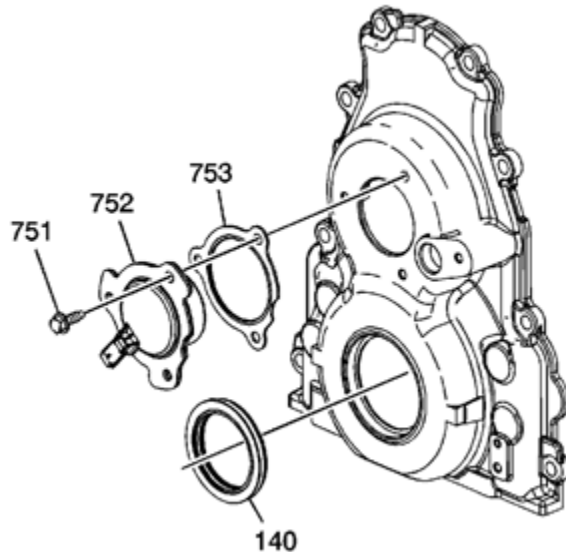
6. Install the EN-48853 tool (1).
7. Install the crankshaft balancer bolt.
 - 7.1. Tighten the crankshaft balancer bolt by hand until snug. Do not overtighten.
 - 7.2. Tighten the J 41480 alignment (2).
 - 7.3. Tighten the engine front cover bolts to **25 N·m (18 lb ft)**.
8. Remove the tools.



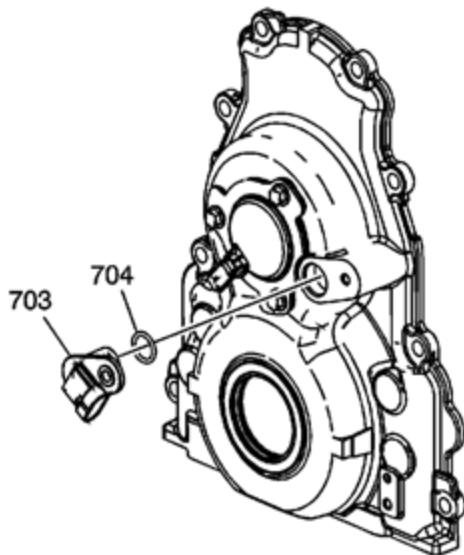
9. Measure the oil pan surface flatness, front cover-to-engine block.
 - 9.1. Place a straight edge across the engine block and front cover oil pan sealing surfaces.

Avoid contact with the portion of the gasket that protrudes into the oil pan surface.

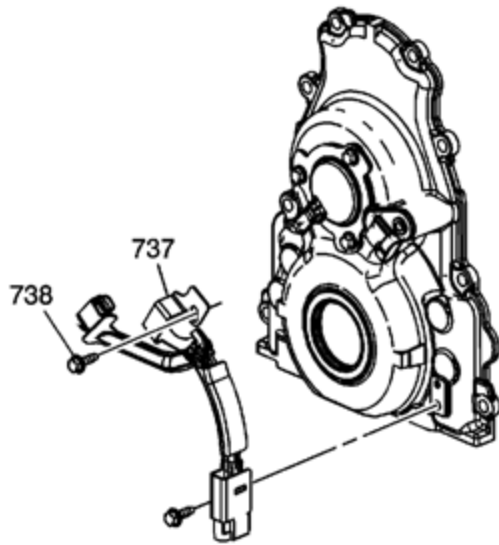
- 9.2. Insert a feeler gage between the front cover and the straight edge tool. The cover must be flush with the oil pan surface or no greater than 0.5 mm (0.02 in) (a) below flush.
10. If the front cover-to-engine block oil pan surface alignment is not within specifications, repeat the cover alignment procedure.
11. If the correct front cover-to-engine block alignment cannot be obtained, replace the front cover.



12. Install the camshaft position (CMP) actuator magnet (752), gasket (753), and bolts (751). Tighten the bolts to **12 N·m (106 lb in)**.



13. Install the CMP sensor (703) and O-ring (704).



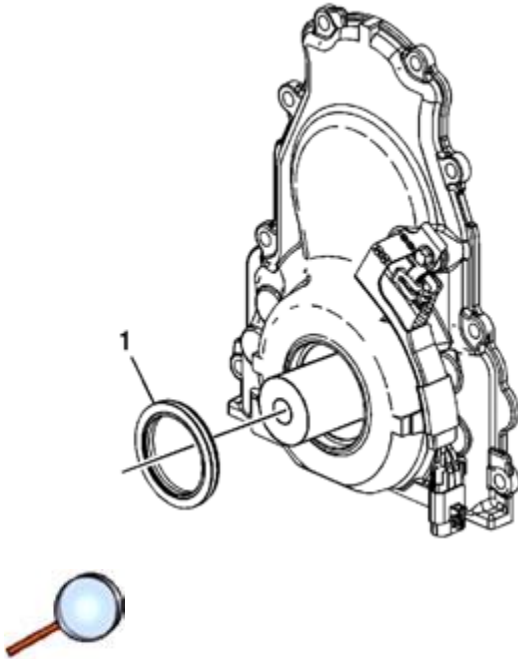
14. Install the CMP sensor wire harness (737) and bolts (738). Tighten the bolts to **12 N·m (106 lb in)**.

cardiagn.com

Crankshaft Front Oil Seal Installation (RPO LY2 / LH6 / LMG / LY5 / LC9)

Tools Required

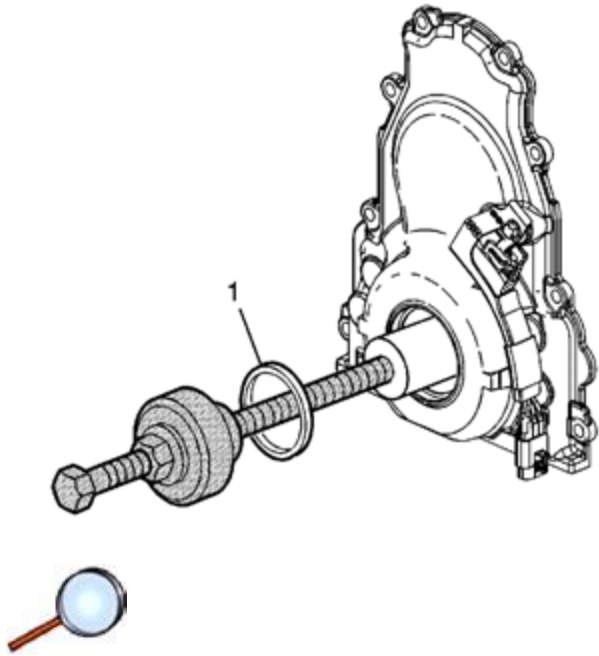
[J 41478](#) Crankshaft Front Oil Seal Installer



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

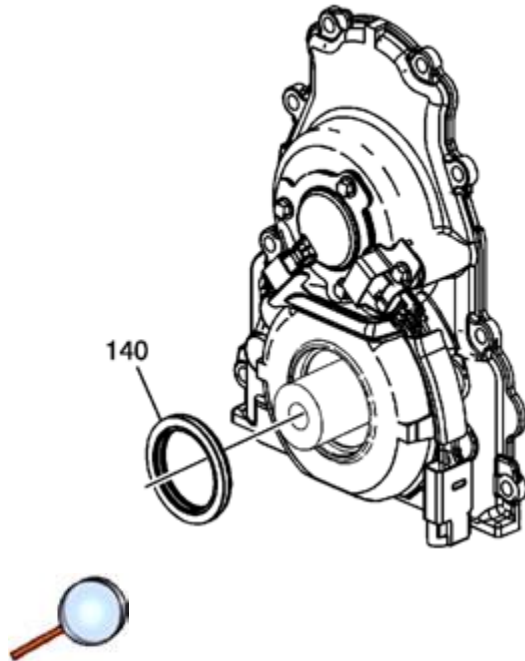


3. Install the crankshaft front oil seal (1) onto the [J 41478](#) .
4. Install the [J 41478](#) threaded rod, with nut, washer, guide, and oil seal, into the end of the crankshaft.
5. Use the [J 41478](#) in order to install the oil seal into the cover bore.
 - 5.1. Use a wrench and hold the hex on the installer bolt.
 - 5.2. Use a second wrench and rotate the installer nut clockwise until the seal bottoms in the cover bore.
 - 5.3. Remove the tool.
 - 5.4. 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 / L9H)

Tools Required

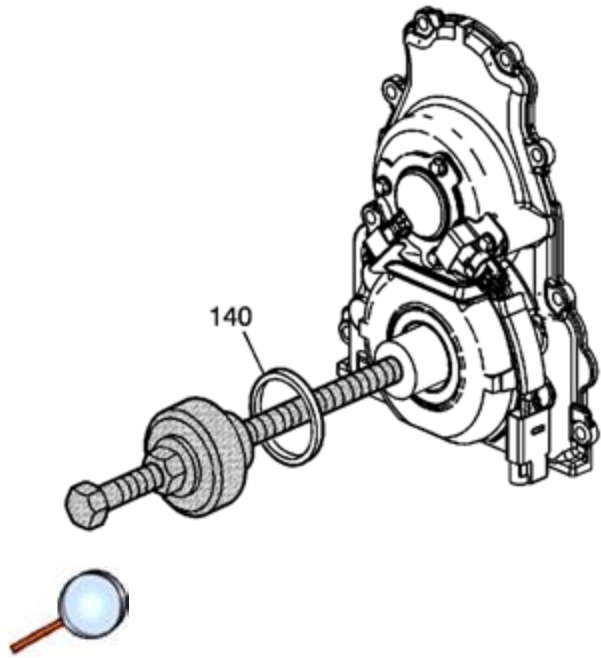
[J 41478](#) Crankshaft Front Oil Seal Installer



Important:

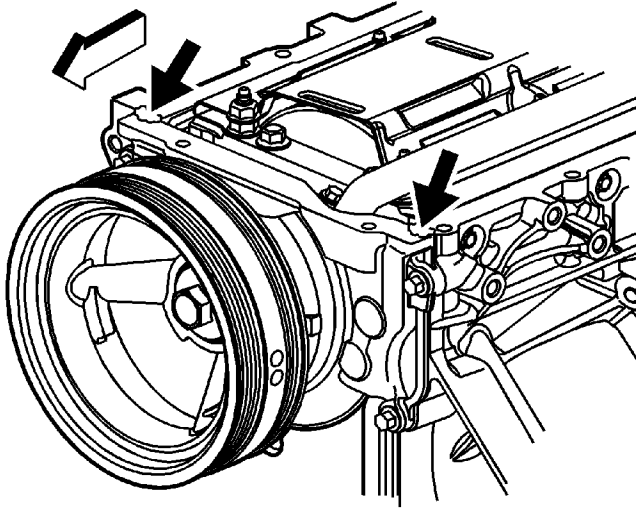
- Do not lubricate the oil seal sealing surface.
- Do not use the crankshaft front oil seal again.

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



3. Install the crankshaft front oil seal (140) onto the [J 41478](#) .
4. Install the [J 41478](#) threaded rod, with nut, washer, guide, and oil seal, into the end of the crankshaft.
5. Use the [J 41478](#) in order to install the oil seal into the cover bore.
 - 5.1. Use a wrench and hold the hex on the installer bolt.
 - 5.2. Use a second wrench and rotate the installer nut clockwise until the seal bottoms in the cover bore.
 - 5.3. Remove the tool.
 - 5.4. Inspect the oil seal for proper installation. The oil seal should be installed evenly and completely into the front cover bore.

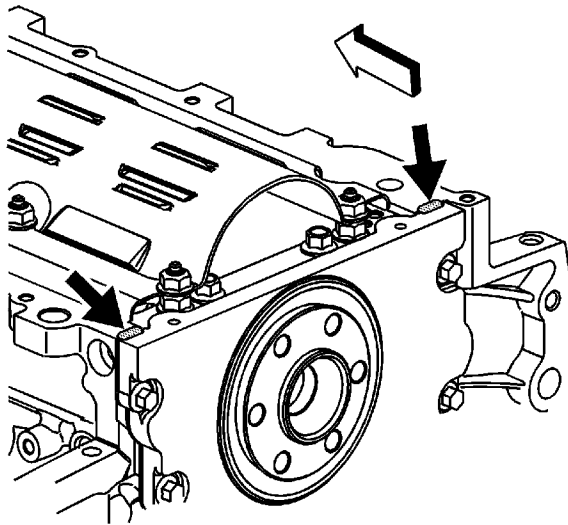
Oil Pan Installation



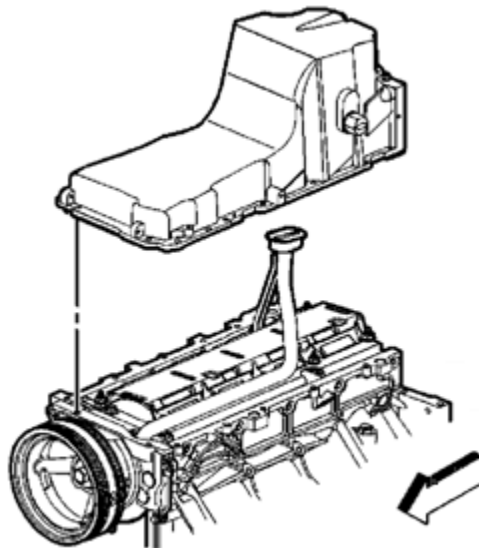
Note:

- The alignment of the structural oil pan is critical. The rear bolt hole locations of the oil pan provide mounting points for the transmission 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 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 [Adhesives, Fluids, Lubricants, and Sealers](#).



2. 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 rear housing gasket that protrude into the oil pan surface.

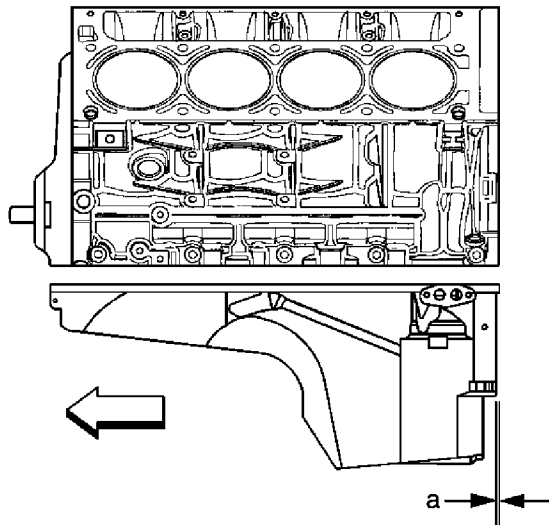


Note: Be sure to align the oil gallery passages in the oil pan and engine block properly with the oil pan gasket.

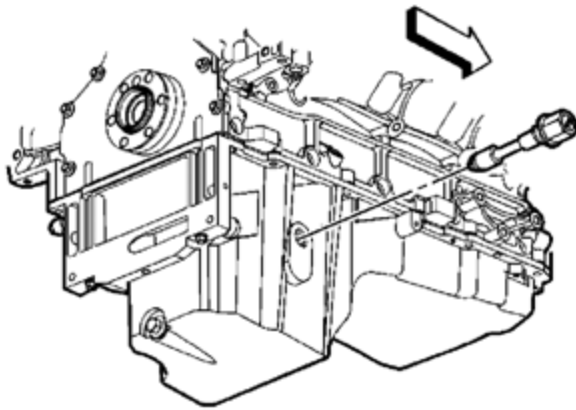
3. Pre-assemble the oil pan gasket to the pan.
 - 3.1. Install the gasket onto the oil pan.
 - 3.2. Install the oil pan bolts to the pan and through the gasket.
4. Install the oil pan, gasket, and bolts to the engine block.
5. Tighten the bolts finger tight. Do not overtighten.
6. Place a straight edge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

transmission housing mounting surfaces.

Caution: Refer to [Fastener Caution](#) in the Preface section.



7. Align the oil pan until the rear of engine block and rear of oil pan are flush or even.
 - Tighten the oil pan-to-block and oil pan-to-front cover bolts to **25 N·m (18 lb ft)**.
 - 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).
 - 8.1. Place a straight edge across the rear of the engine block and rear of oil pan at the transmission housing mounting surfaces.
 - Note:** The rear of the oil pan must NEVER protrude beyond the engine block and transmission housing mounting surfaces.
 - 8.2. 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.
 - 8.3. If the oil pan alignment is not within specifications, remove the oil pan and repeat the above procedure.

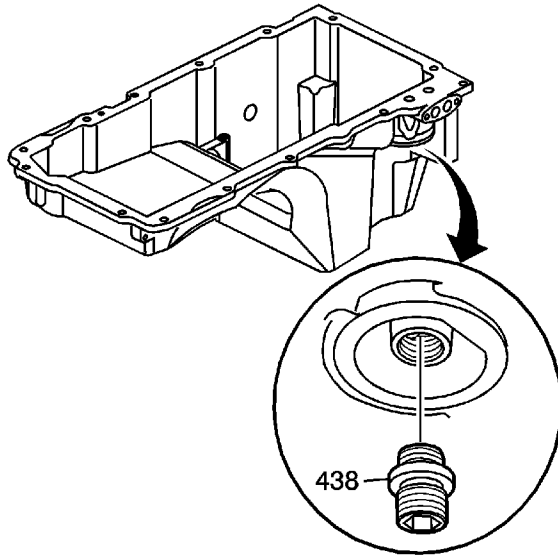


9. Install the oil level indicator switch and tighten to **20 N·m (15 lb in)**.

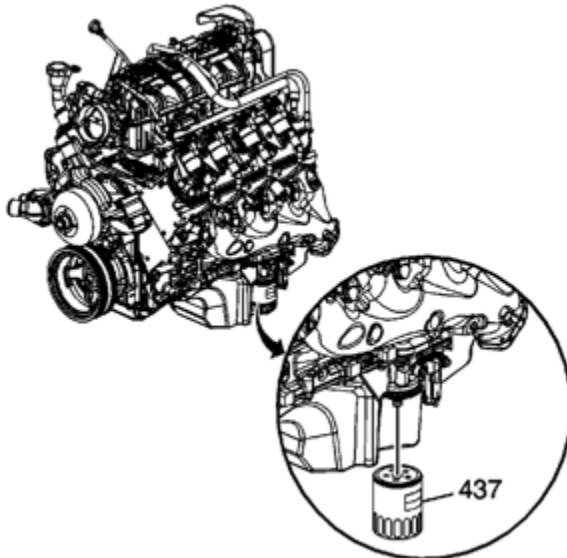
cardiagn.com

Oil Filter Installation

Caution: Refer to [Fastener Caution](#) in the Preface section.

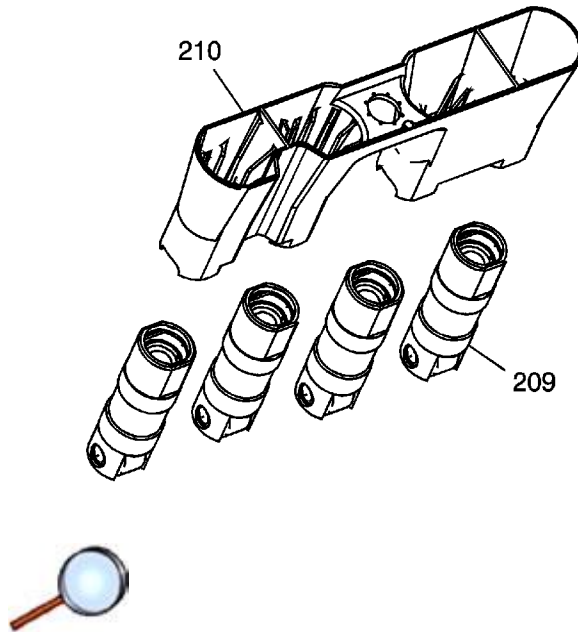


1. Install the oil filter fitting (438) and tighten to **55 N·m (40 lb ft)**.



2. Lubricate the oil filter seal with clean engine oil.
3. Install the oil filter (437) and tighten to **30 N·m (22 lb ft)**.

Valve Lifter Installation (RPO LY2/LY6/L9H)

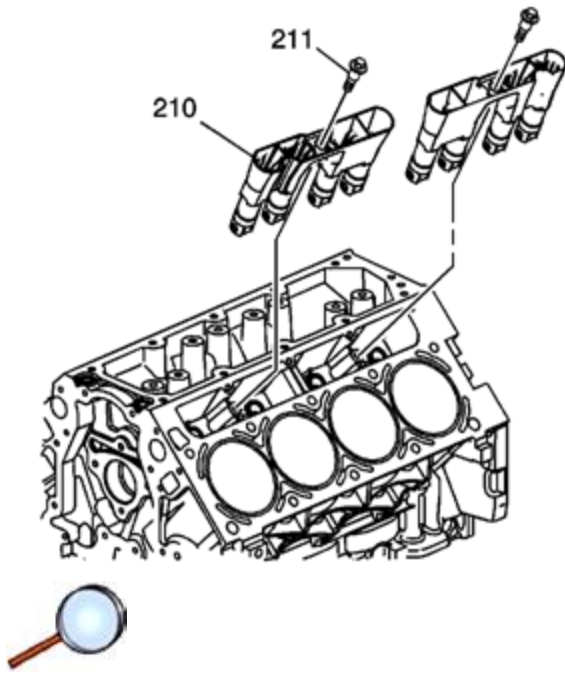


Note:

- 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 completely into the guide bore.



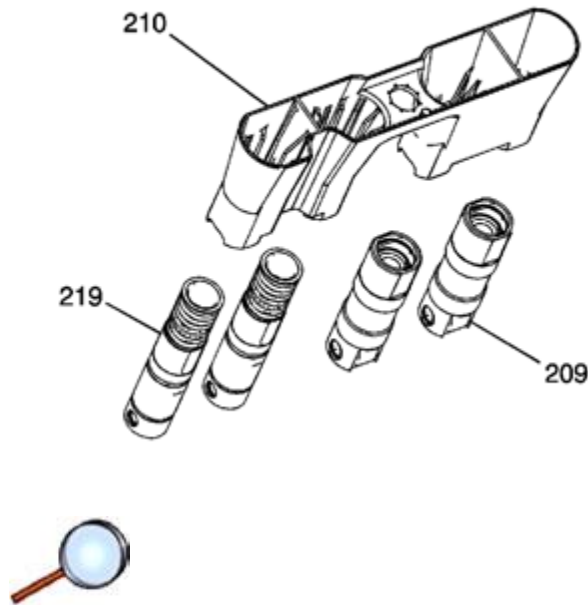
3. Install the valve lifters and guide assembly (210) to the engine block.

Caution: Refer to [Fastener Caution](#) in the Preface section.

4. Install the valve lifter guide bolts (211) and tighten to **12 N·m (106 lb in)**.

cardiagn.com

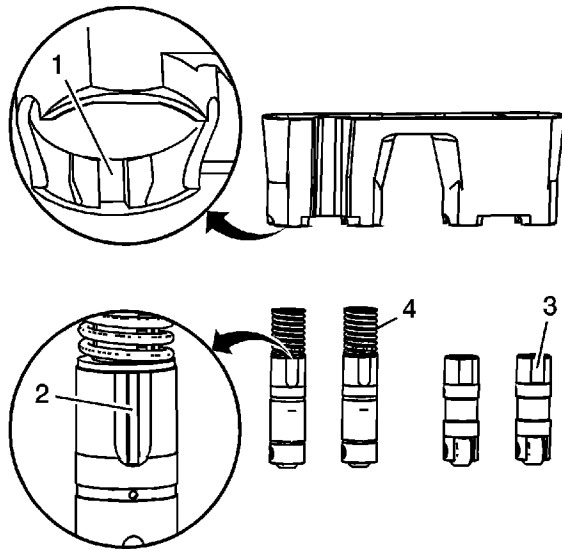
Valve Lifter Installation (RPO LH6 / LMG / LY5 / LC9 / L76)



Note:

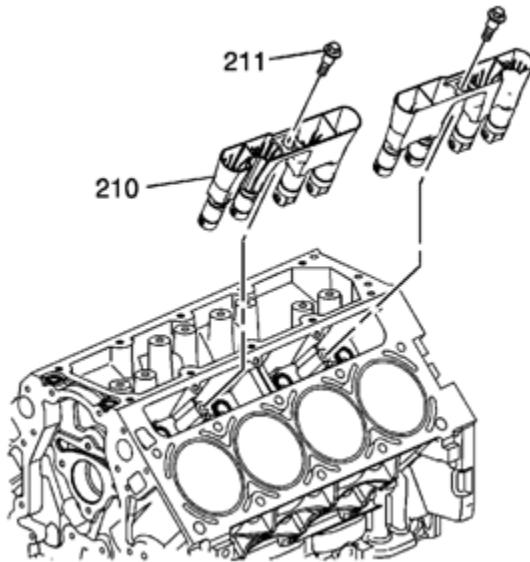
- When using the valve lifters again, install the lifters to their original locations.
- If camshaft replacement is required, the valve lifters must also be replaced.
- Each of the 4 valve guide assemblies will contain 2 active fuel management valve lifters and 2 non-active fuel management valve lifters.
- With the lifters and guides properly installed, cylinders 1, 4, 6, and 7 lifter bores will each contain 2 active fuel management valve lifters.

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



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.



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

Caution: Refer to [Fastener Caution](#) in the Preface section.

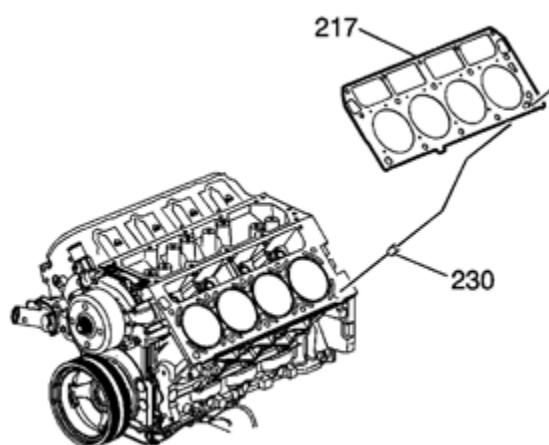
4. Install the valve lifter guide bolts (211) and tighten to **12 N·m (106 lb in)**.

Cylinder Head Installation - Left Side

Tools Required

- [J 42385-100](#) Head/Main Bolt Thread Repair Kit
- [J 45059](#) Angle Meter

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



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

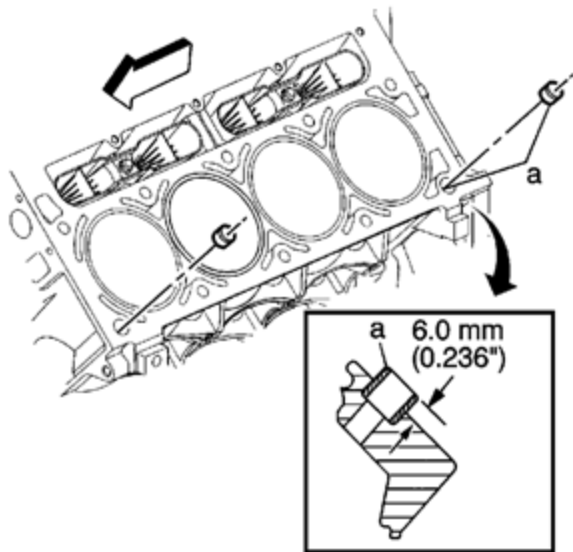
Important:

- 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.

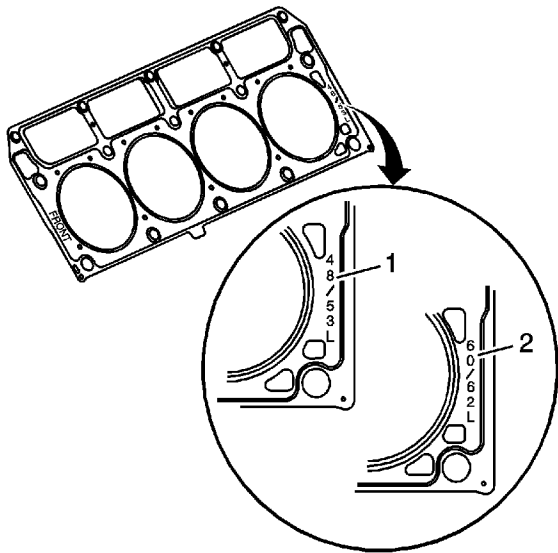
1. Clean the engine block cylinder head bolt holes, if required.

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

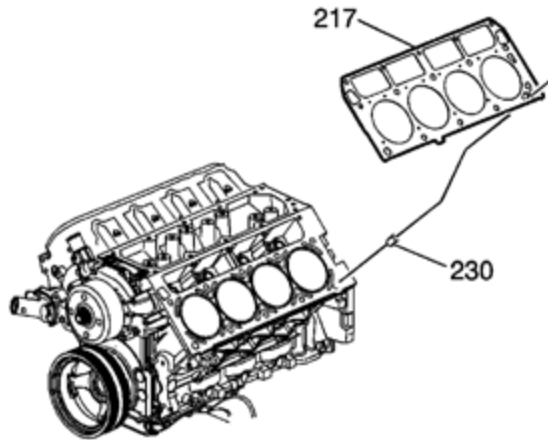
2. Spray cleaner GM P/N 12346139 (Canadian P/N 10953463), GM P/N 12377981 (Canadian P/N 10953463), or equivalent, into the hole.
3. Clean the cylinder head bolt holes with compressed air.
4. Install the cylinder h



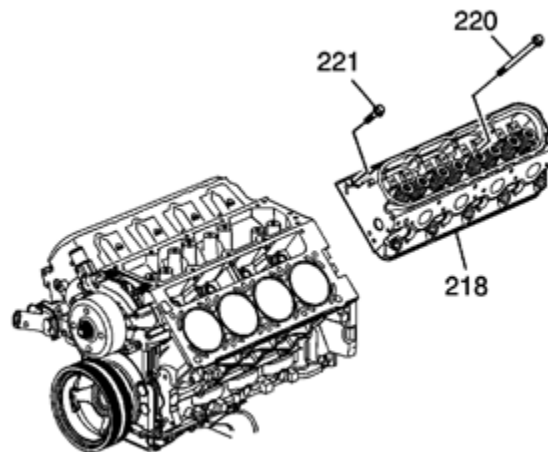
5. Inspect the locating pins for proper installation.



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

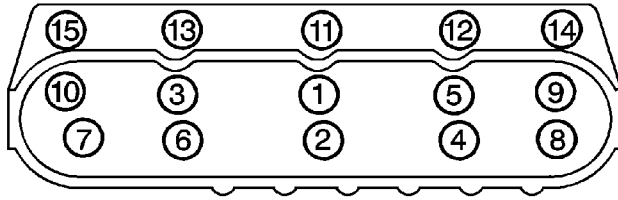


7. Install the NEW cylinder head gasket (217) onto the locating pins.



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

Caution: Refer to [Fastener Caution](#) in the Preface section.



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

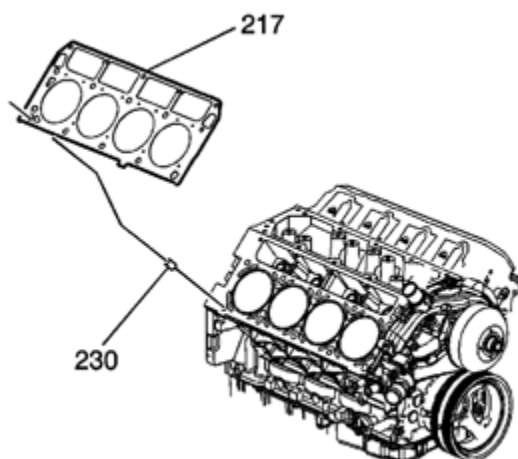
Cylinder Head Installation - Right Side

Special Tools

- J 42385-100 Head/Main Bolt Thread Repair Kit
- J 45059 Angle Meter

For equivalent regional tools refer to [Special Tools](#).

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



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

Note:

- 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.

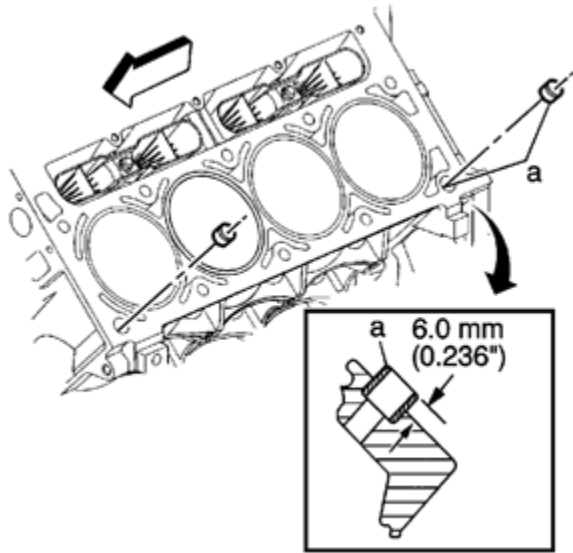
1. Clean the engine block cylinder head bolt holes, if required.

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

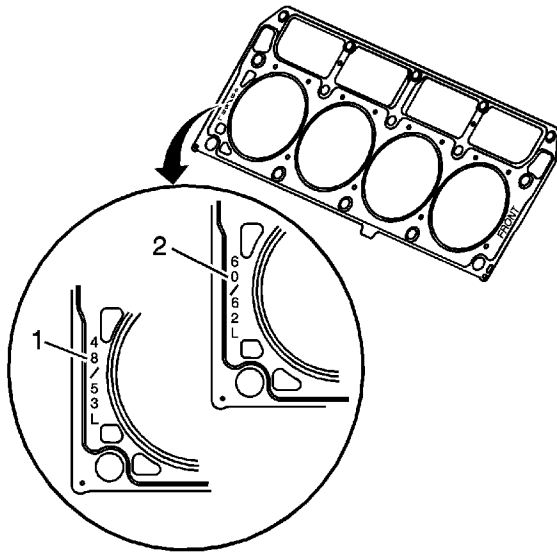
2. Spray cleaner GM P/N 12346139 (Canadian P/N 10953463), GM P/N 12377981

(Canadian P/N 10953463), or equivalent, into the hole.

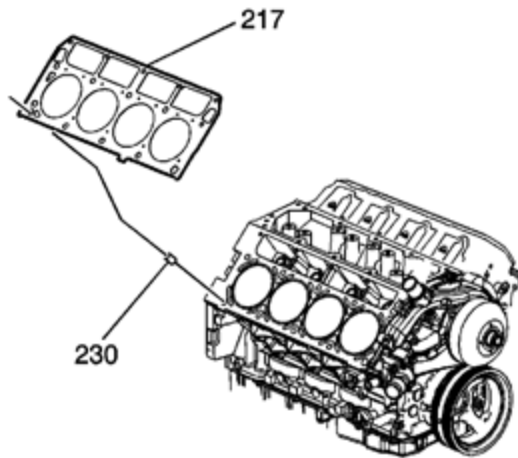
3. Clean the cylinder head bolt holes with compressed air.
4. Install the cylinder head locating pins (230).



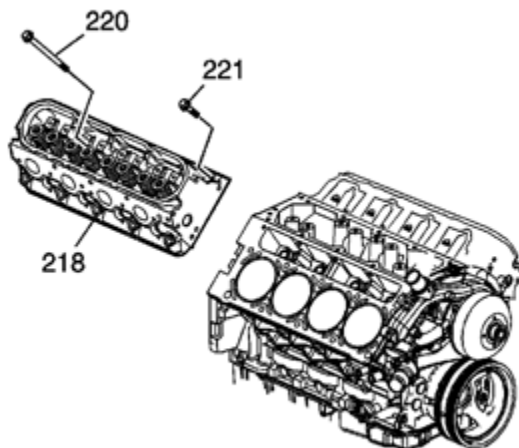
5. Inspect the locating pins for proper installation.



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

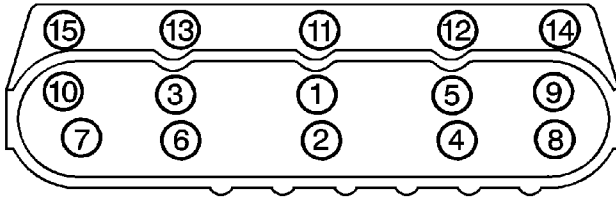


7. Install the NEW cylinder head gasket (217) onto the locating pins.



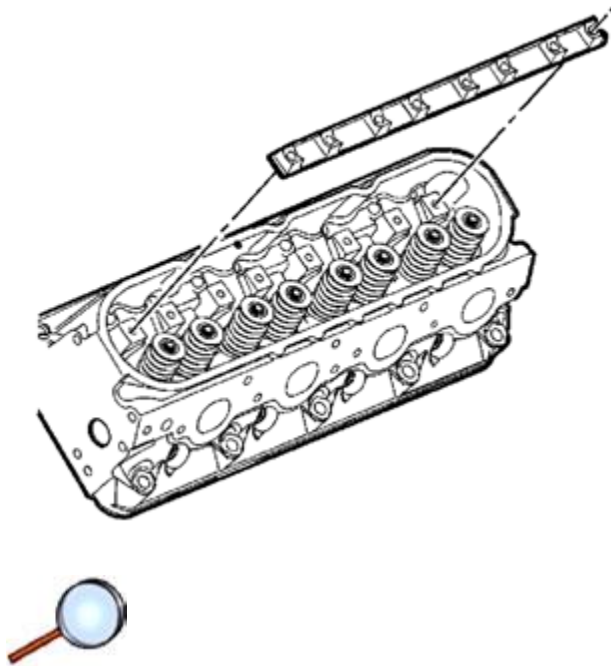
8. Install the cylinder head (218) onto the locating pins and the gasket.
9. Install the NEW cylinder head bolts (220, 221).

Caution: Refer to [Fastener Caution](#) in the Preface section.



10. Tighten the cylinder head bolts.
 - 10.1. Tighten the M11 cylinder head bolts (1-10) a first pass in sequence to **30 N·m (22 lb ft)**.
 - 10.2. Tighten the M11 cylinder head bolts (1-10) a second pass in sequence to **90 degrees** using the *J 45059* angle meter .
 - 10.3. Tighten the M11 cylinder head bolts (1-10) a final pass in sequence to **70 degrees** using the *J 45059* angle meter .
 - 10.4. 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.

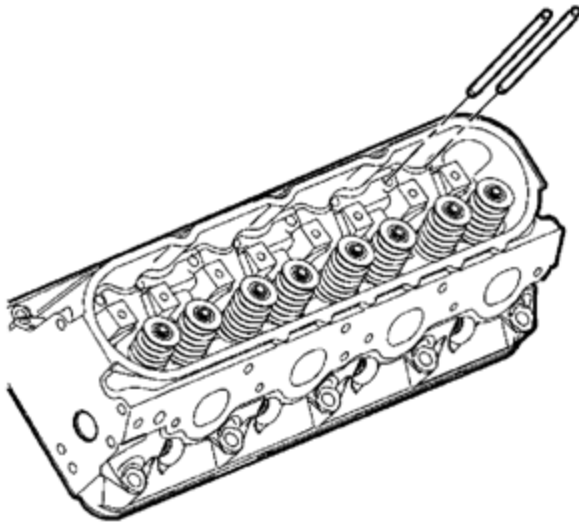
Valve Rocker Arm and Push Rod Installation (RPO LY6 / L76 / L9H)



Note:

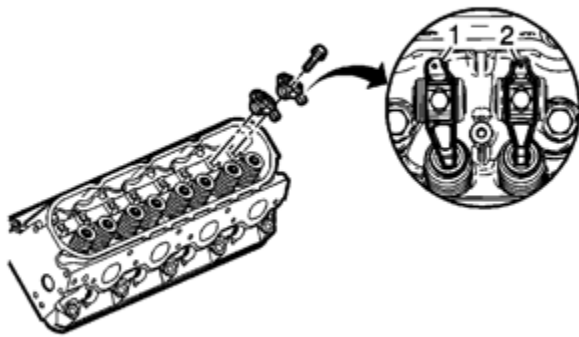
- When using the valve train components again, always install the components to the original location and position.
- Valve lash is net build. No valve adjustment is required.

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.



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

4. Install the pushrods.

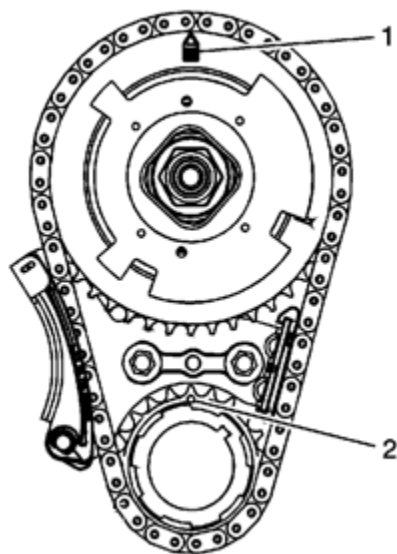


Note:

- 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.



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 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.

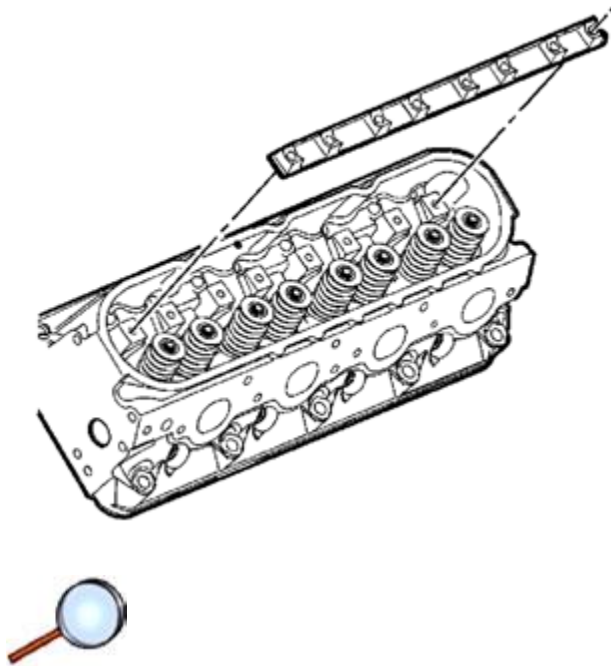
Cylinders 1, 3, 5 and 7 are left bank.

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

7. With the engine in the number 1 firing position, tighten the following valve rocker arm bolts:
 - 7.1. Tighten the exhaust valve rocker arm bolts 1, 2, 7, and 8 to **30 N·m (22 lb ft)**.
 - 7.2. 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 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)**.

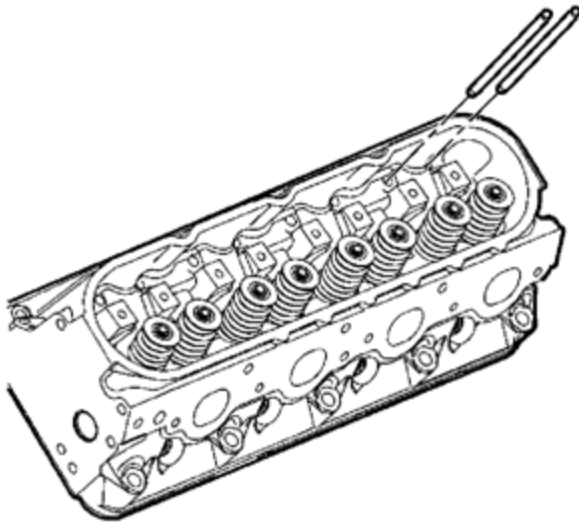
Valve Rocker Arm and Push Rod Installation (RPO LY2 / LH6 / LMG / LY5 / LC9)



Note:

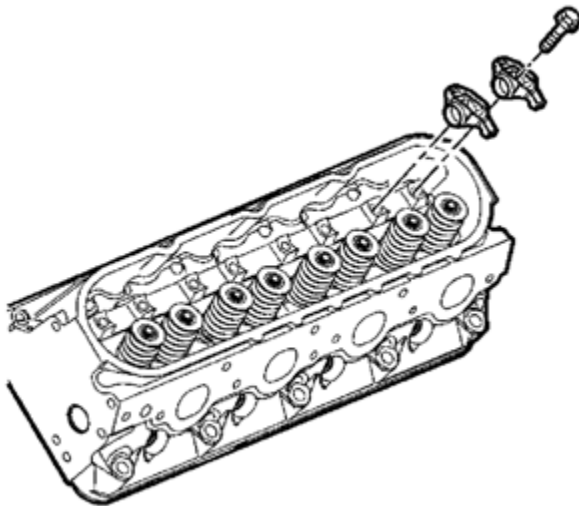
- When using the valve train components again, always install the components to the original location and position.
- Valve lash is net build. No valve adjustment is required.

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.



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

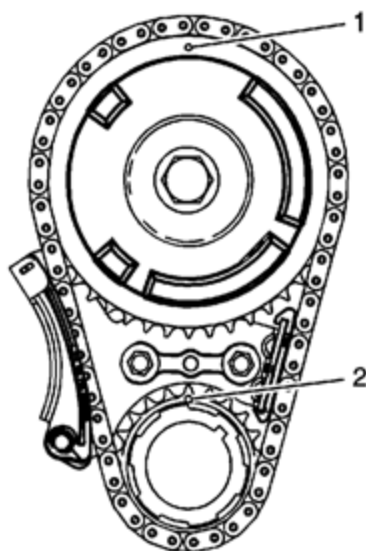
4. Install the pushrods.



Note:

- 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.



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 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.

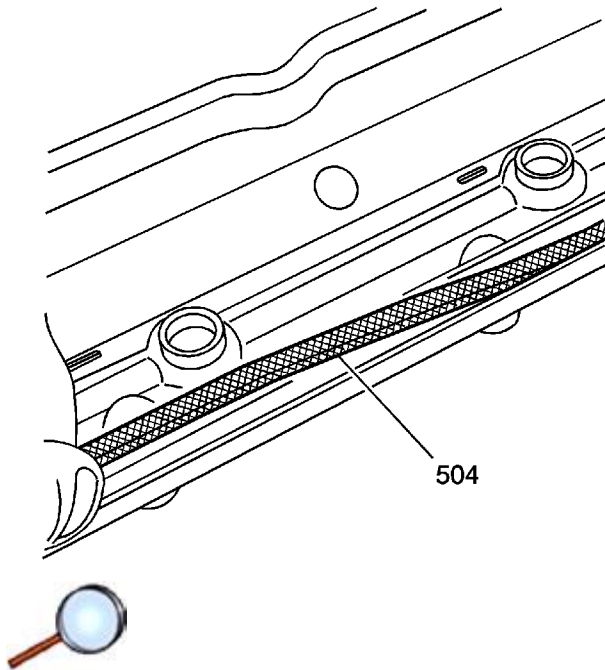
Cylinders 1, 3, 5 and 7 are left bank.

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

7. With the engine in the number 1 firing position, tighten the following valve rocker arm bolts:
 - 7.1. Tighten the exhaust valve rocker arm bolts 1, 2, 7, and 8 to **30 N·m (22 lb ft)**.
 - 7.2. 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:
 - 9.1. Tighten the exhaust valve rocker arm bolts 3, 4, 5, and 6 to **30 N·m (22 lb ft)**.
 - 9.2. Tighten the intake valve rocker arm bolts 2, 6, 7, and 8 to **30 N·m (22 lb ft)**.

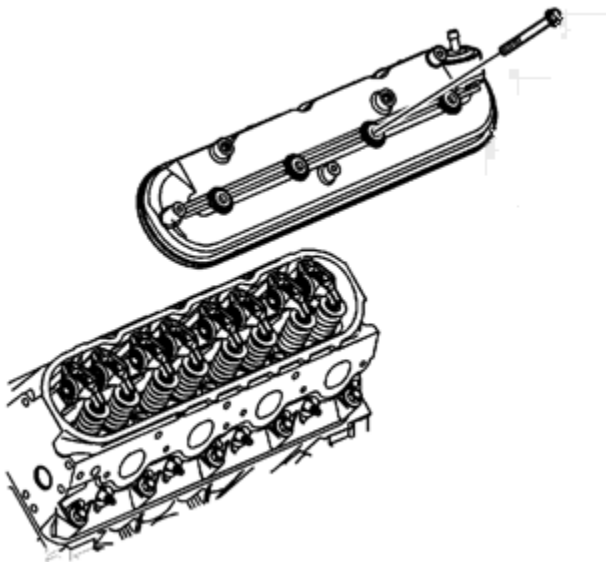
Valve Rocker Arm Cover Installation - Left Side



Note:

- All gasket surfaces should be free of oil or other foreign material during assembly.
- DO NOT use the valve rocker arm cover gasket again.

1. Install NEW valve rocker arm cover grommets and use NEW valve rocker arm cover bolts if they are serviced with the grommet.
2. Install a NEW gasket (504) into the valve rocker arm cover.

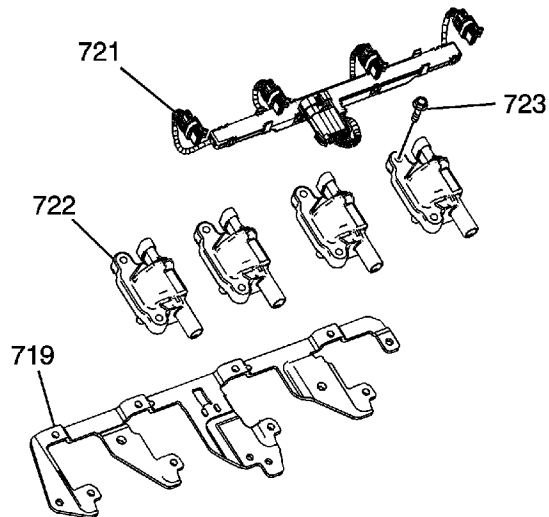




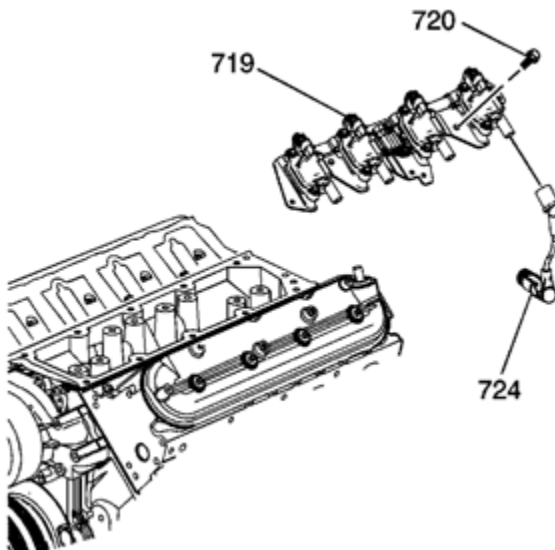
3. Install the valve rocker arm cover onto the cylinder head.

Caution: Refer to [Fastener Caution](#) in the Preface section.

4. Install the cover bolts with grommets and tighten to **12 N·m (106 lb in)**.



5. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the ignition coil bolts (723).
6. Install the ignition coils (722), wire harness (721), and bolts (723) to the bracket (719). Tighten the ignition coil bolts to **10 N·m (89 lb in)**.

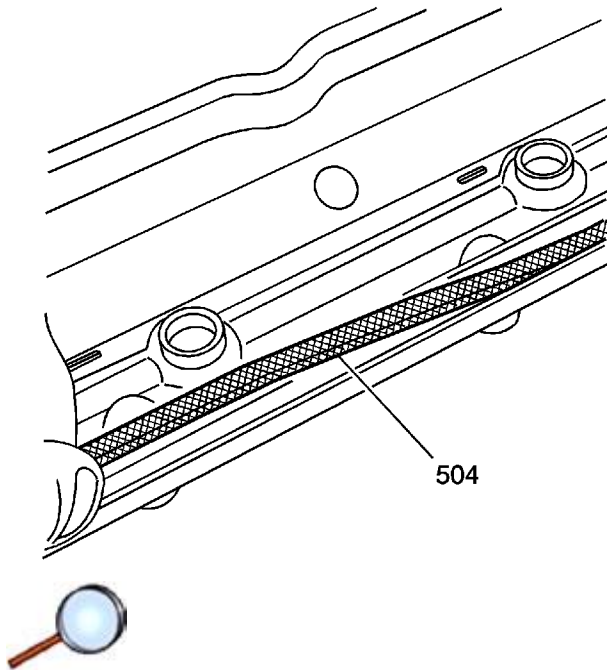


7. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the ignition coil bracket studs (720).

8. Install the ignition coil and bracket assembly (719) and studs (720). Tighten the bracket studs to **12 N·m (106 lb in)**.

cardiagn.com

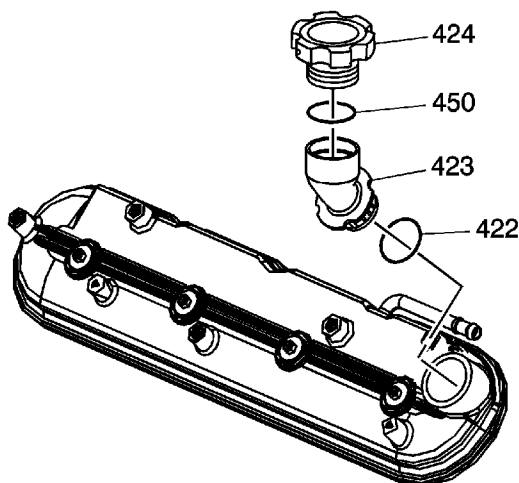
Valve Rocker Arm Cover Installation - Right Side



Note:

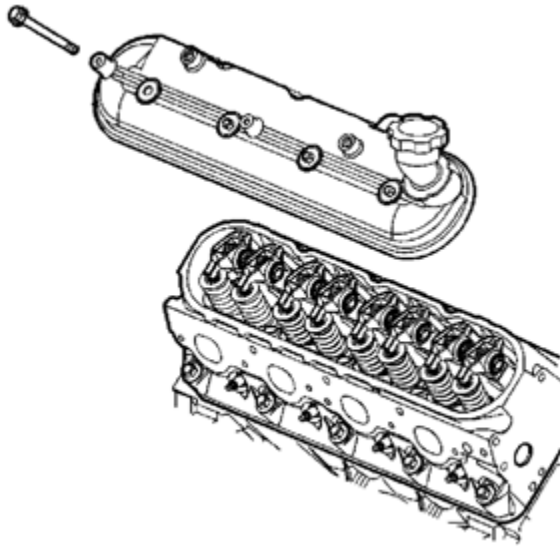
- All gasket surfaces should be free of oil or other foreign material during assembly.
- DO NOT use the valve rocker arm cover gasket again.

1. Install NEW valve rocker arm cover grommets and use NEW valve rocker arm cover bolts if they are serviced with the grommet.
2. Install a NEW gasket (504) into the valve rocker arm cover.





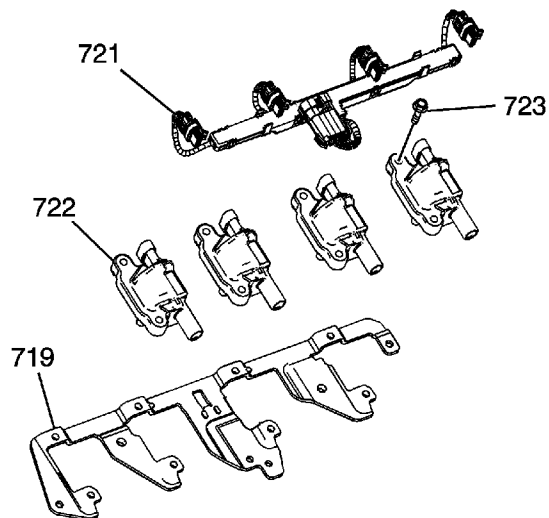
3. Install a NEW oil fill tube (423) to the valve rocker arm cover.
4. Install the oil fill cap (424).



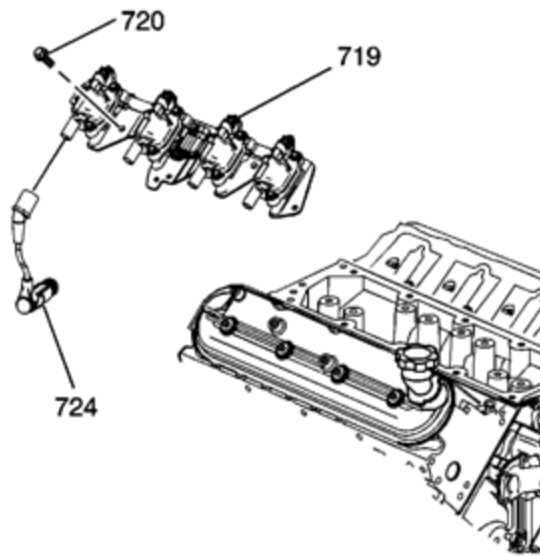
5. Install the valve rocker arm cover onto the cylinder head.

Caution: Refer to [Fastener Caution](#) in the Preface section.

6. Install the cover bolts with grommets and tighten to **12 N·m (106 lb in)**.

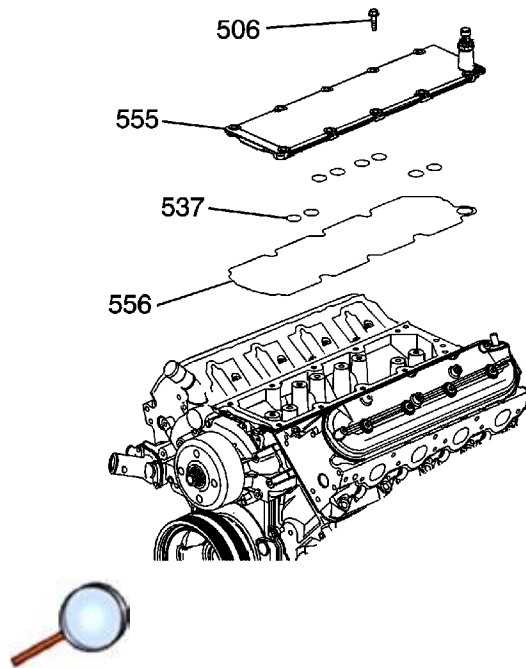


7. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the ignition coil bolts (723).
8. Install the ignition coils (722), wire harness (721), and bolts (723) to the bracket (719). Tighten the ignition coil bolts to **10 N·m (89 lb in)**.



9. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the ignition coil bracket studs (720).
10. Install the ignition coil and bracket assembly (719) and studs (720). Tighten the bracket studs to **12 N·m (106 lb in)**.

Engine Block Valley Cover Installation

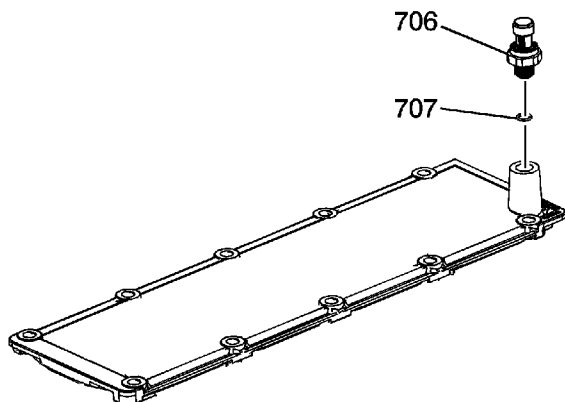


Note: All gasket surfaces should be free of oil or other foreign material during assembly.

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the cover (555), gasket (556), and bolts (506). Tighten the manifold bolts to **25 N·m (18 lb ft)**.

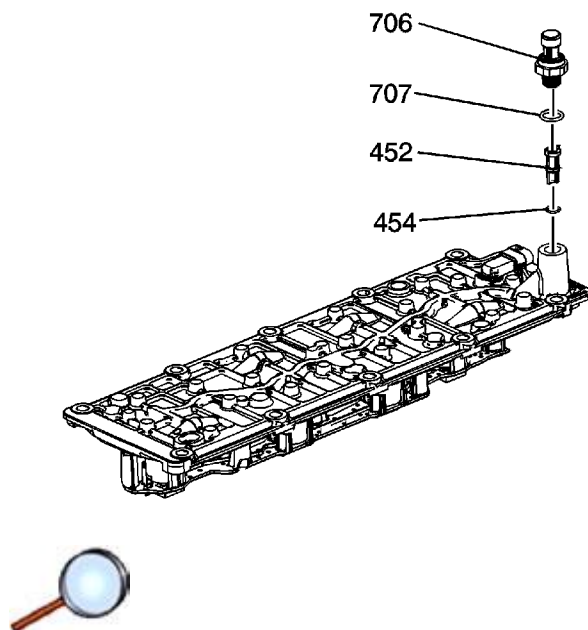




4. Apply sealant GM P/N 12346004 (Canadian P/N 10953480), or equivalent, to the threads of the sensor.
5. Install the oil pressure sensor (706) and sealing washer (707). Tighten the sensor to **35 N·m (26 lb ft)**.

cardiagn.com

Valve Lifter Oil Filter Installation



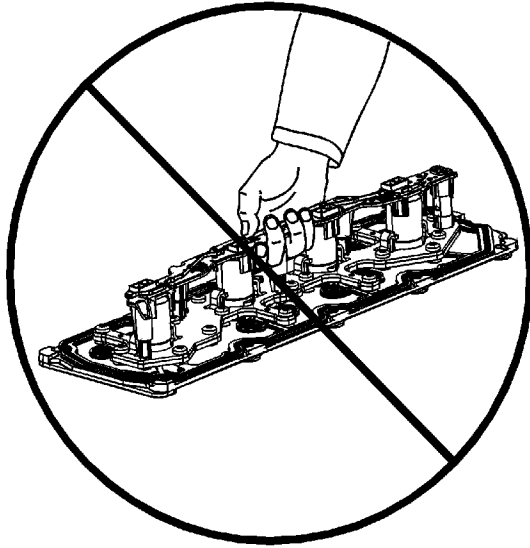
Note: Do not allow dirt or debris to enter the oil passages of the manifold. Plug, as required.

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.

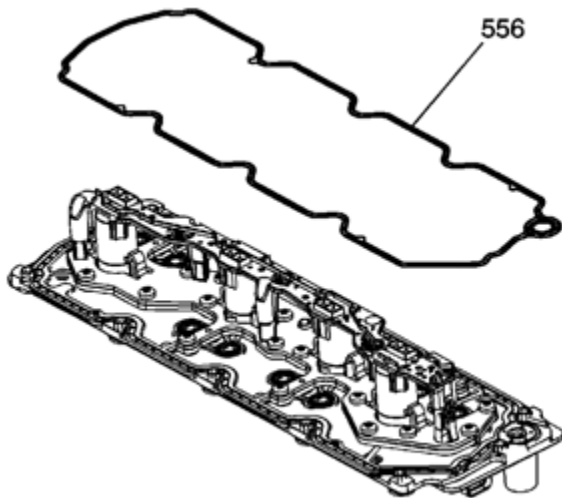
Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the oil pressure sensor (706) and washer (707). Tighten the oil pressure sensor to **35 N·m (26 lb ft)**.

Valve Lifter Oil Manifold Installation



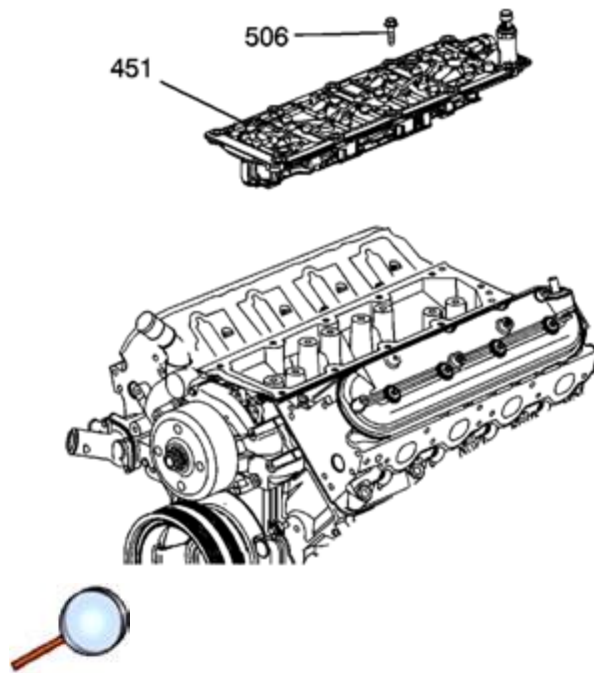
1. Do not lift the manifold assembly by the electrical lead frame.



Note:

- 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 ga



3. Install the manifold (451) with gasket.

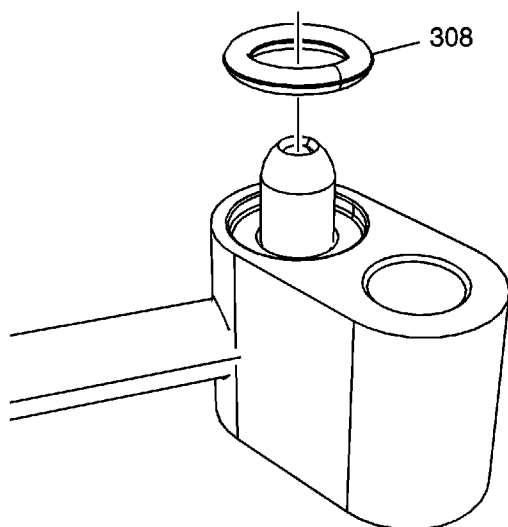
Caution: Refer to [Fastener Caution](#) in the Preface section.

4. Install the manifold bolts (506) and tighten to **25 N·m (18 lb ft)**.

cardiagn.com

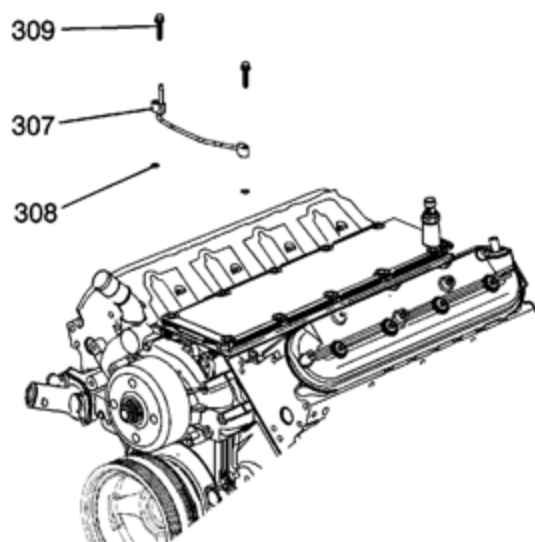
[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - Off Vehicle](#) | **Document ID: 2161783**

Engine Coolant Air Bleed Pipe and Hole Cover Installation (RPO LY2 /LY6 /L9H)



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

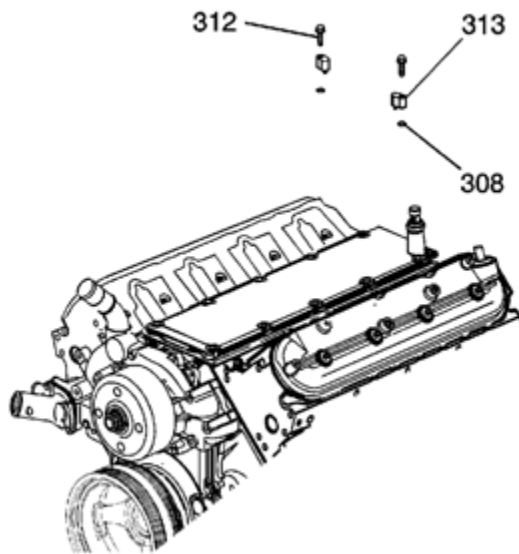
1. Install the seals onto the engine coolant air bleed pipe and covers.



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

Caution: Refer to [Fastener Caution](#) in the Preface section.

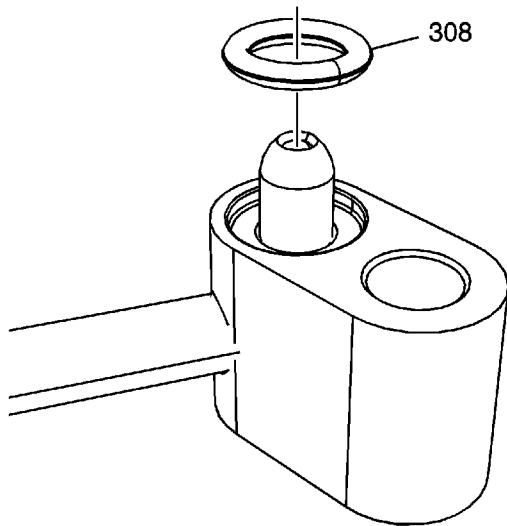
3. Install the bolts (309) and tighten to **12 N·m (106 lb in)**.



4. Install the covers (313) and seals (308).
5. Install the bolts (312) and tighten to **12 N·m (106 lb in)**.

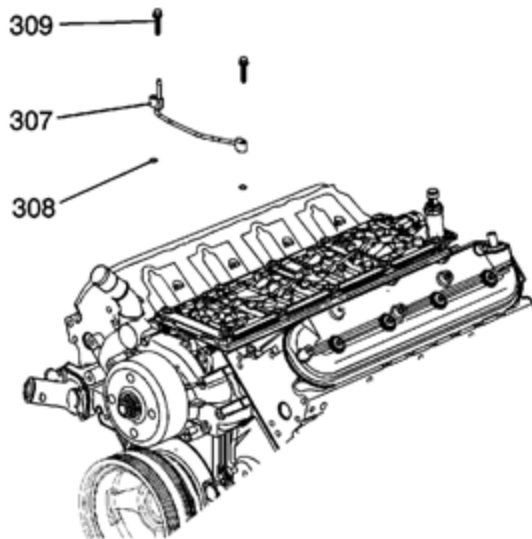
cardiagn.com

Engine Coolant Air Bleed Pipe and Hole Cover Installation (RPO LH6 / LMG / LY5 / LC9 / L76)



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

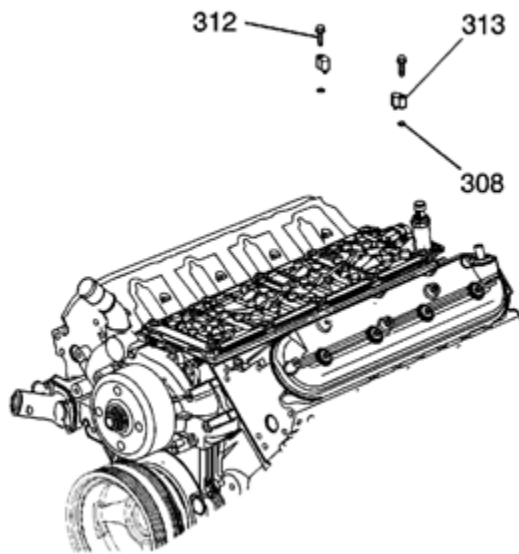
1. Install the seals (308) onto the engine coolant air bleed pipe and covers.



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

Caution: Refer to [Fastener Caution](#) in the Preface section.

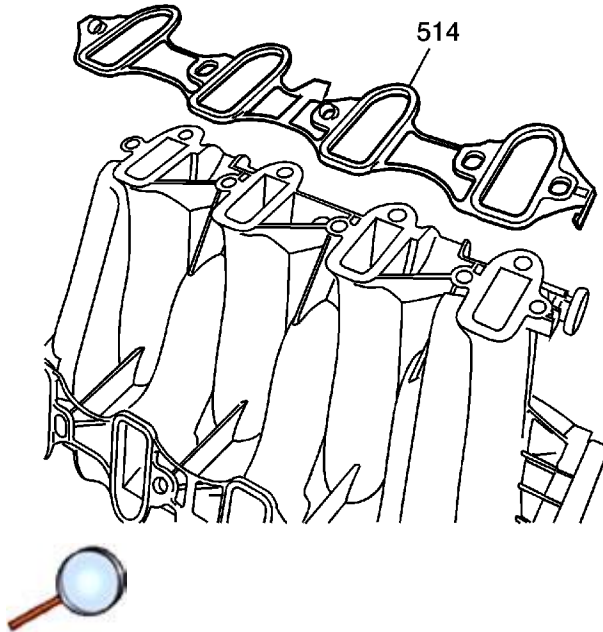
3. Install the bolts (309) and tighten to **12 N·m (106 lb in)**.



4. Install the covers (313) and seals (308).
5. Install the bolts (312) and tighten to **12 N·m (106 lb in)**.

cardiagn.com

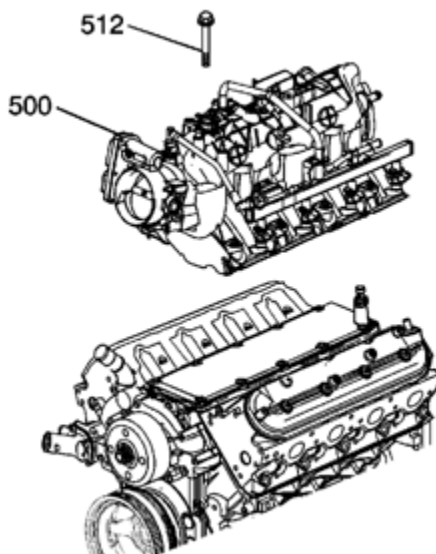
Intake Manifold Installation (RPO LY2 /LY6 /L9H)



Note:

- 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.

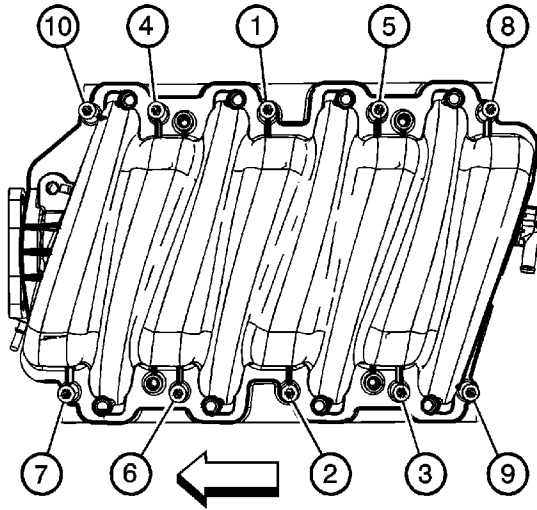
1. Install NEW intake manifold-to-cylinder head gaskets (514).



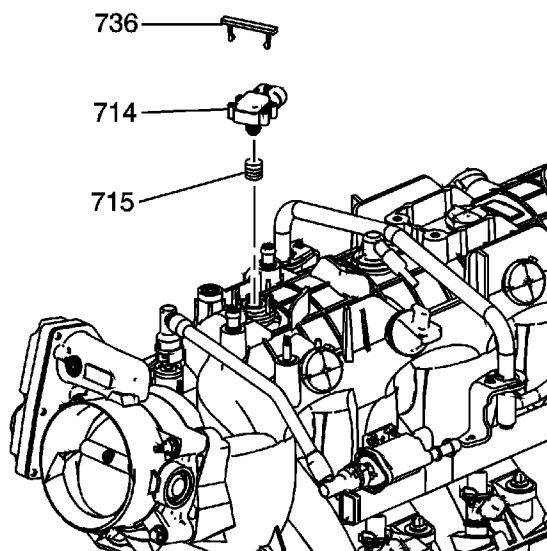


2. Install the intake manifold (500).
3. Apply a 5 mm (0.20 in) band of threadlock GM P/N 12345382 (Canadian P/N 10953489) to the threads of the intake manifold bolts (512). Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

Caution: Refer to [Fastener Caution](#) in the Preface section.

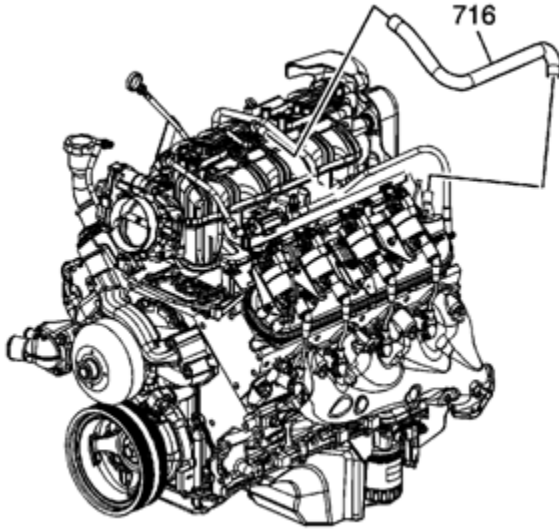


4. Install the intake manifold bolts.
 - 4.1. Tighten the intake manifold bolts (1-10) a first pass in sequence to **5 N·m (44 lb in)**.
 - 4.2. Tighten the intake manifold bolts (1-10) a final pass in sequence to **10 N·m (89 lb in)**.





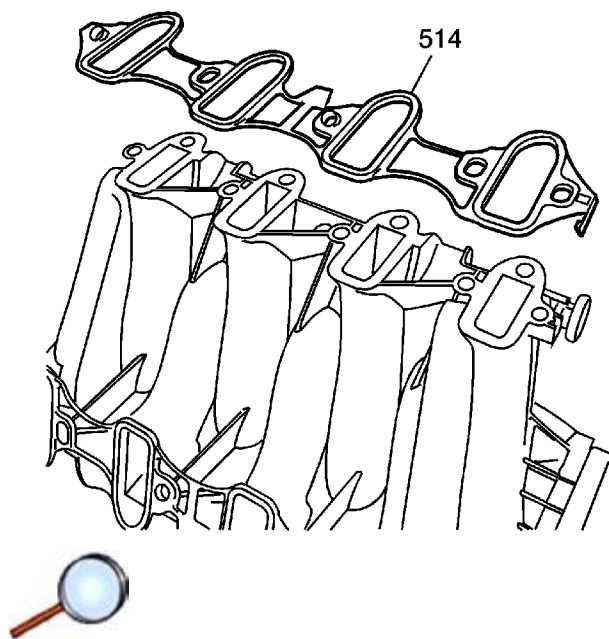
5. Install the fuel rail. Refer to [Fuel Rail and Injectors Installation](#).
6. Lubricate the manifold absolute pressure (MAP) sensor grommet (715) with clean engine oil.
7. Install the grommet onto the MAP sensor (714).
8. Install the MAP sensor and retainer (736).



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

cardiagn.com

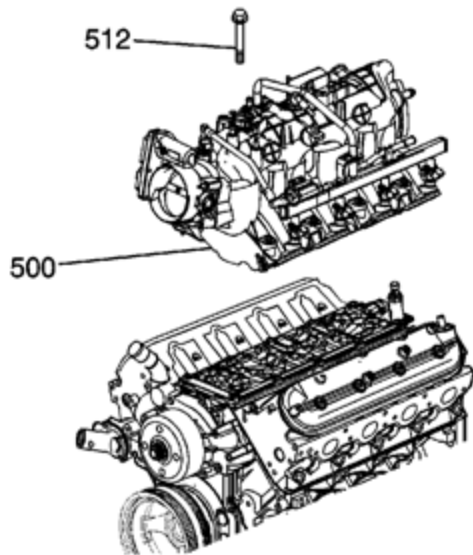
Intake Manifold Installation (RPO LH6 / LMG / LY5 / LC9 / L76)



Note:

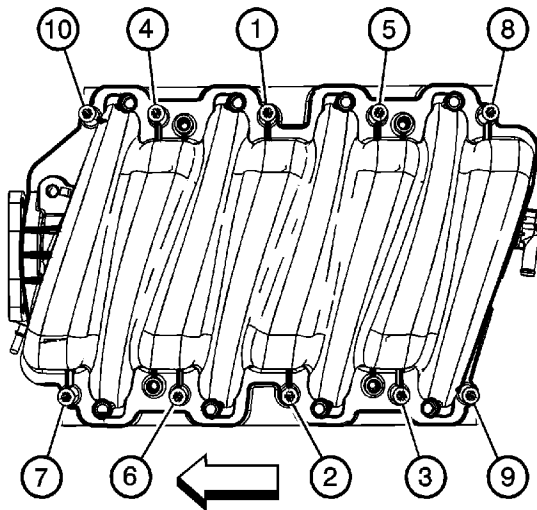
- The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, install the intake manifold as a complete assembly.
- DO NOT use the intake manifold gaskets again. Install NEW intake manifold-to-cylinder head gaskets.

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

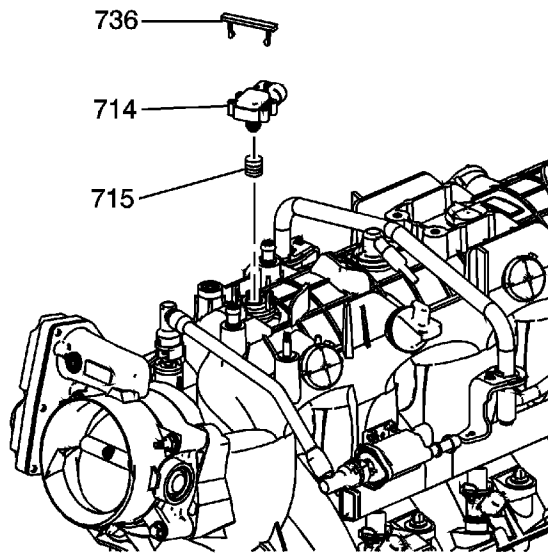


2. Install the intake manifold (500).
3. Apply a 5 mm (0.20 in) band of threadlock GM P/N 12345382 (Canadian P/N 10953489) to the threads of the intake manifold bolts (512). Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

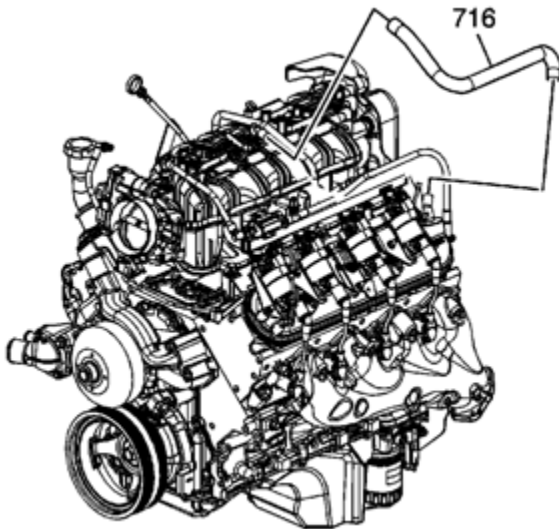
Caution: Refer to [Fastener Caution](#) in the Preface section.



4. Install the intake manifold bolts.
 - 4.1. Tighten the intake manifold bolts (1-10) a first pass in sequence to **5 N·m (44 lb in)**.
 - 4.2. Tighten the intake manifold bolts (1-10) a final pass in sequence to **10 N·m (89 lb in)**.



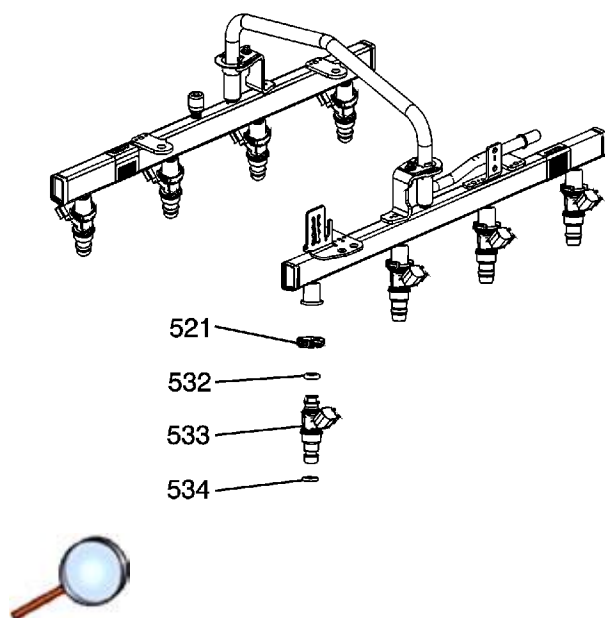
5. Install the fuel rail. Refer to [Fuel Rail and Injectors Installation](#).
6. Lubricate the manifold absolute pressure (MAP) sensor grommet (715) with clean engine oil.
7. Install the grommet onto the MAP sensor (714).
8. Install the MAP sensor and retainer (736).



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

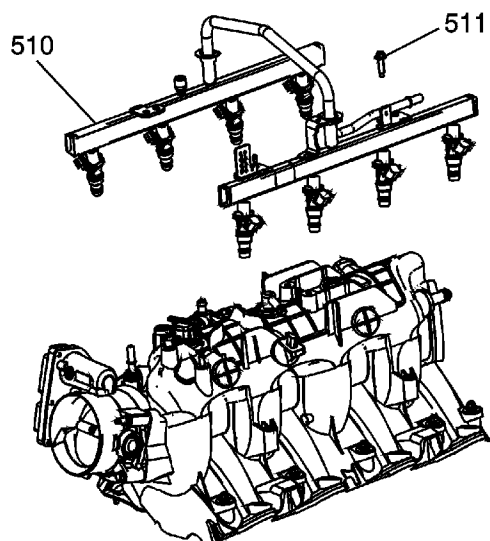
Fuel Rail and Injectors Installation

Warning: Refer to [Fuel Rail Stop Bracket Installation Warning](#) in the Preface section.



Note: 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).

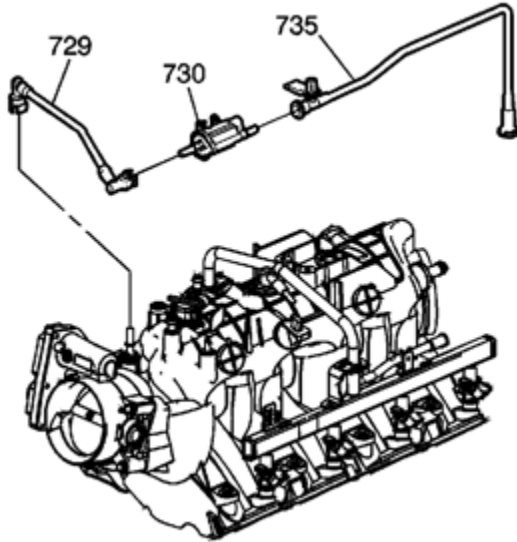




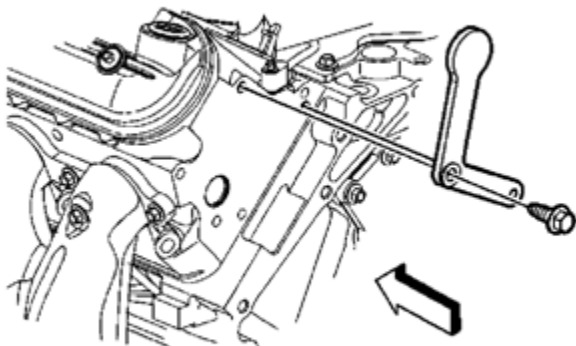
4. Install the fuel rail assembly (510) to the manifold. Push firmly on both sides of the rail until all the injectors have entered their bores.
5. Apply a 5 mm (0.2 in) band of threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent, to the threads of the fuel rail bolts. Refer to [Adhesives,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

Caution: Refer to [Fastener Caution](#) in the Preface section.

6. Install the fuel rail bolts (511) and tighten to **10 N·m (89 lb in)**.



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

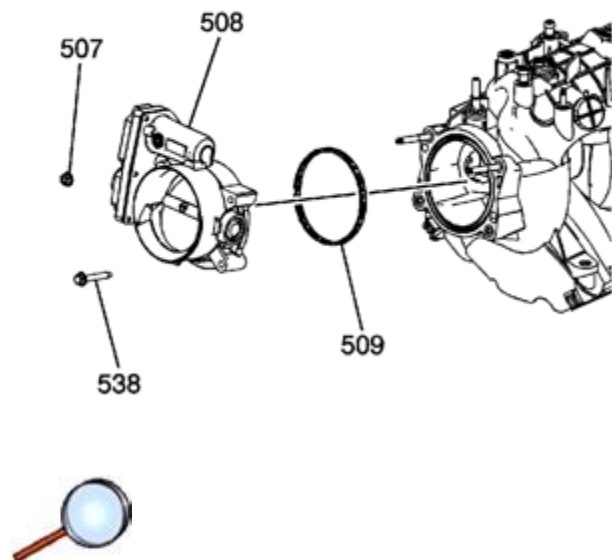


8. Install the fuel rail stop bracket and bolt and tighten to **50 N·m (37 lb ft)**.

cardiagn.com

Throttle Body Installation

Caution: Refer to [Fastener Caution](#) in the Preface section.

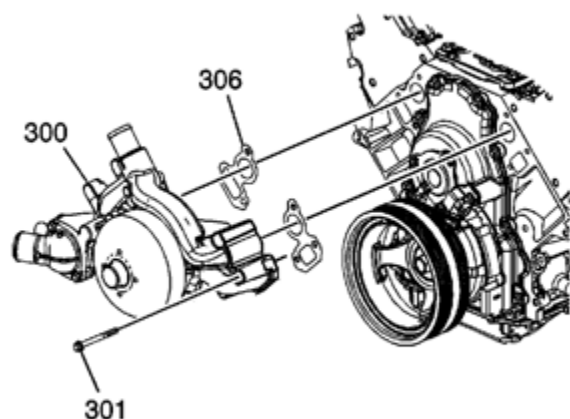


1. Install the throttle body studs, as required. Tighten the throttle body studs to **6 N·m (53 lb in)**.

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

Water Pump Installation (RPO LY6 / L76 / L9H)



Caution: 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.

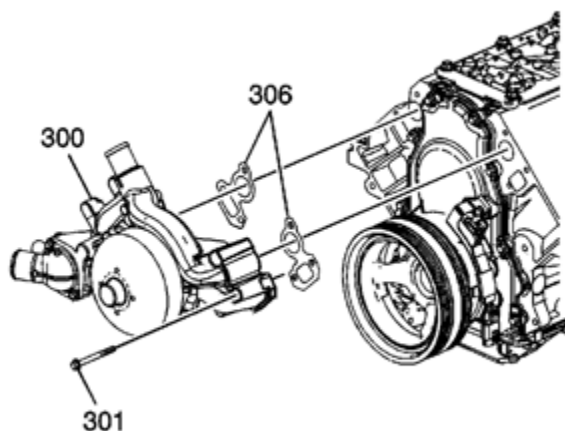
Note: All gasket surfaces are to be free of oil or other foreign material during assembly.

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the water pump bolts (301).
 - 2.1. Tighten the water pump bolts a first pass to **15 N·m (11 lb ft)**.
 - 2.2. Tighten the water pump bolts a final pass to **30 N·m (22 lb ft)**.

Water Pump Installation (RPO LY2 / LH6 / LMG / LY5 / LC9)



Caution: 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.

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

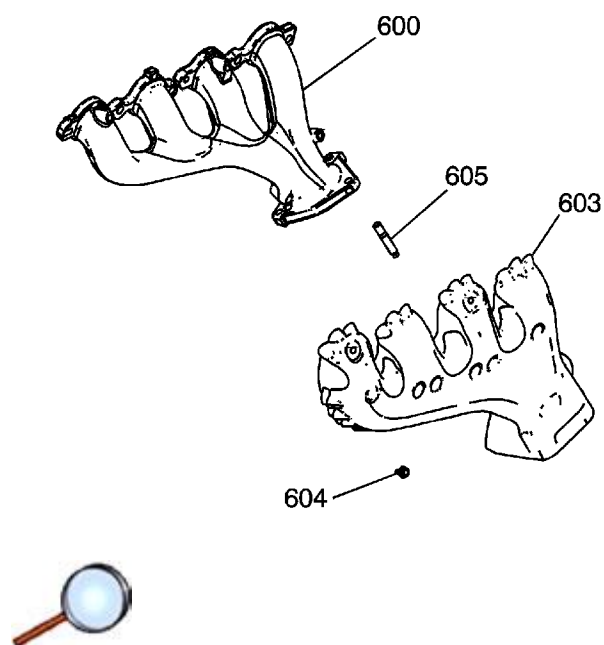
1. Install the water pump (300) and NEW gaskets (306).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the water pump bolts (301).
 - Tighten the water pump bolts a first pass to **15 N·m (11 lb ft)**.
 - Tighten the water pump bolts a final pass to **30 N·m (22 lb ft)**.

Exhaust Manifold Installation - Left Side

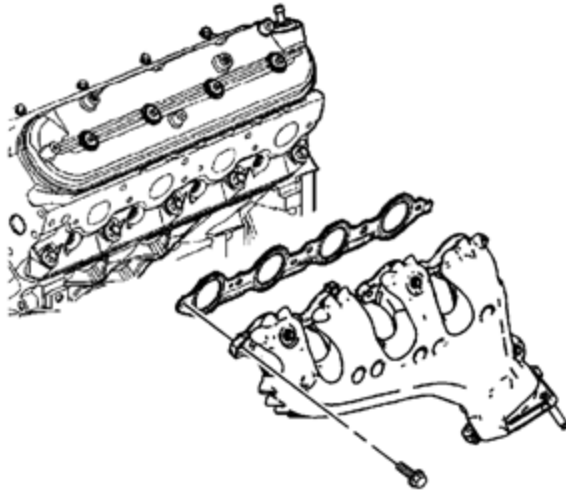
Caution: Refer to [Fastener Caution](#) in the Preface section.



Note:

- 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.

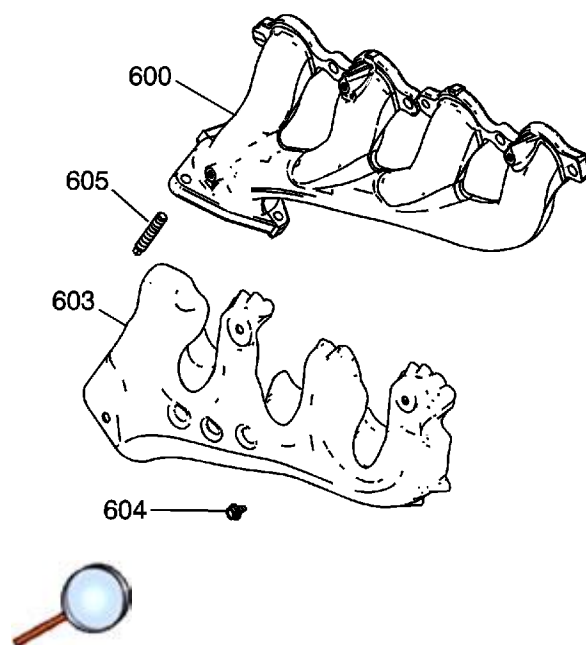
1. Install the heat shield (603) and bolts (604). Tighten the heat shield bolts to **9 N·m (80 lb in)**.
2. Install the exhaust pipe studs (605) and tighten to **20 N·m (15 lb ft)**.



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 [Adhesives, Fluids, Lubricants, and Sealers](#).
4. Install the exhaust manifold, NEW gasket, and bolts.
 - 4.1. 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.
 - 4.2. 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.

Exhaust Manifold Installation - Right Side

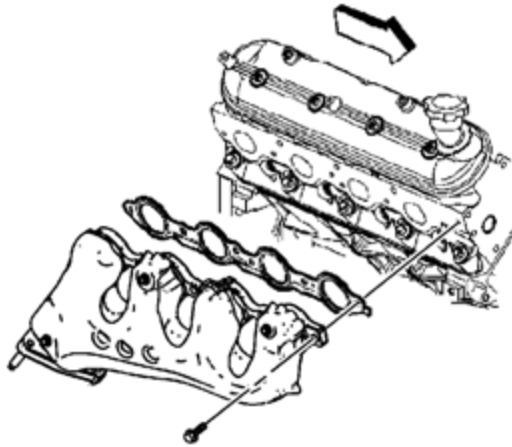
Caution: Refer to [Fastener Caution](#) in the Preface section.



Note:

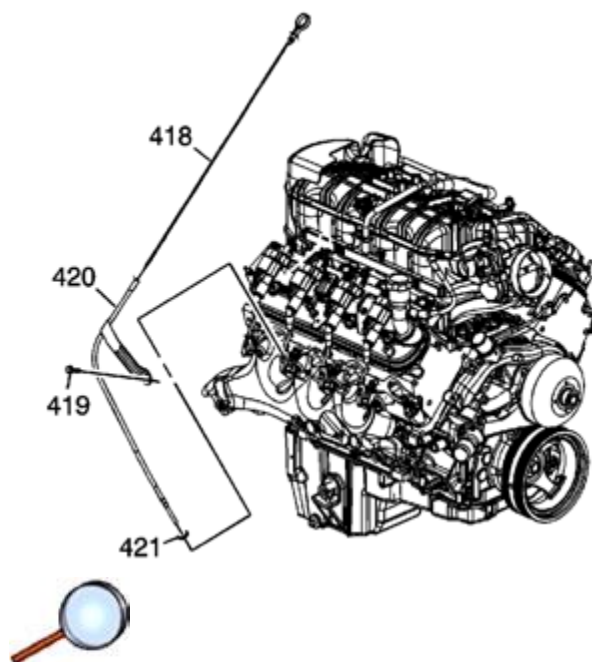
- Tighten the exhaust manifold bolts as specified in the service procedure. Improperly installed and/or leaking exhaust manifold gaskets may affect vehicle emissions and/or on-board diagnostic (OBD) II system performance.
- The cylinder head exhaust manifold bolt hole threads must be clean and free of 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 the heat shield bolts to **9 N·m (80 lb in)**.
2. Install the exhaust pipe studs (605) and tighten to **20 N·m (15 lb ft)**.



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 [Adhesives, Fluids, Lubricants, and Sealers](#).
4. Install the exhaust manifold, NEW gasket and bolts.
 - 4.1. 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.
 - 4.2. 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

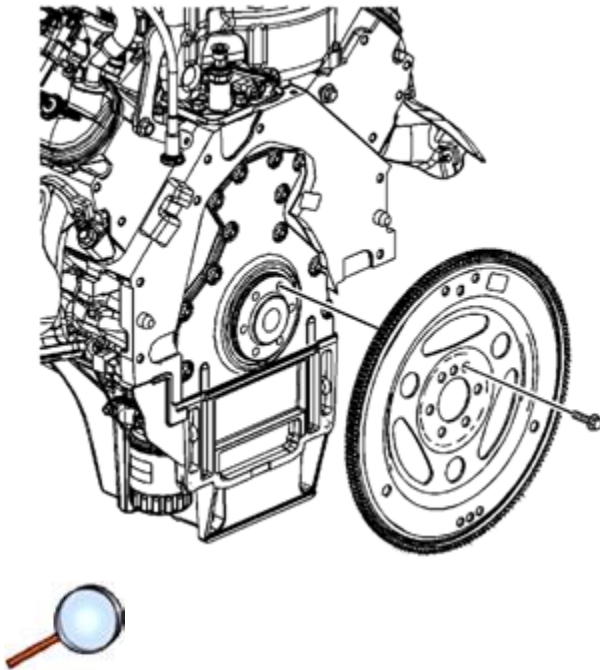


1. Inspect the O-ring seal (421) for cuts or damage. If the oil level indicator tube O-ring seal is not cut or damaged, it may be used again.
2. Lubricate the O-ring seal with clean engine oil.
3. Install the O-ring seal onto the oil level indicator tube (420).
4. Install the oil level indicator tube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

Caution: Refer to [Fastener Caution](#) in the Preface section.

5. Install the tube bolt (419) and tighten to **25 N·m (18 lb ft)**.
6. Install the oil level indicator (418) into the tube.

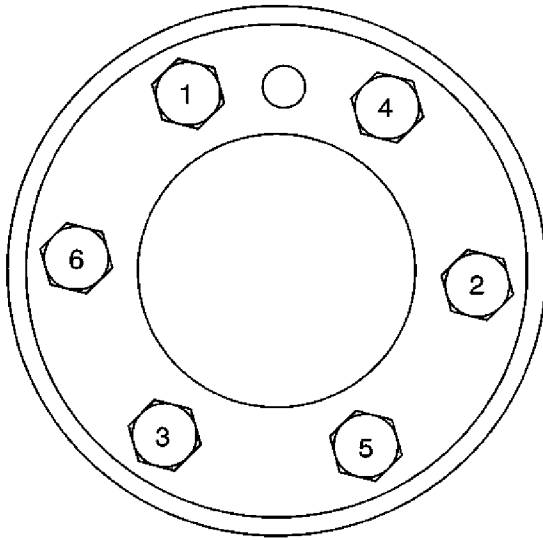
Automatic Transmission Flex Plate Installation



Note: 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.

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.

Caution: Refer to [Fastener Caution](#) in the Preface section.



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

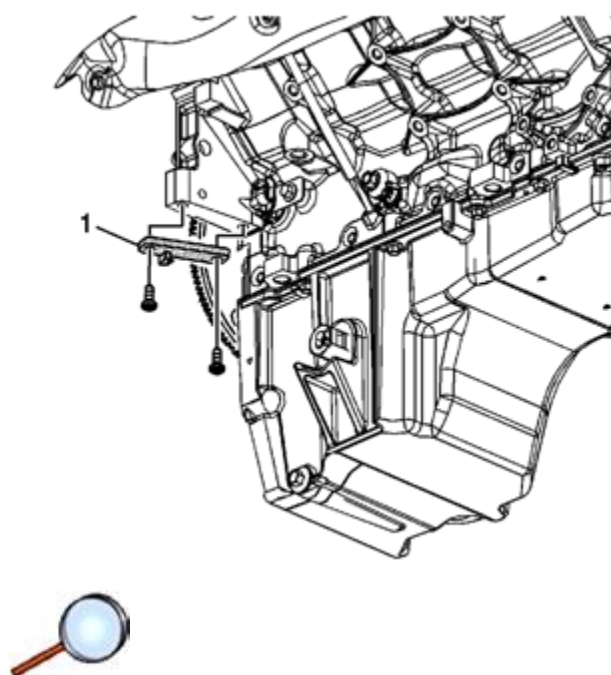
Crankshaft Balancer Installation

Special Tools

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

For equivalent regional tools, refer to [Special Tools](#)

Caution: Refer to [Fastener Caution](#) in the Preface section.

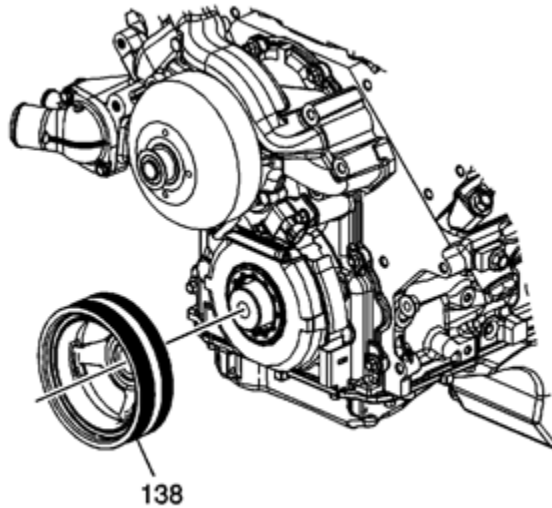


Note:

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

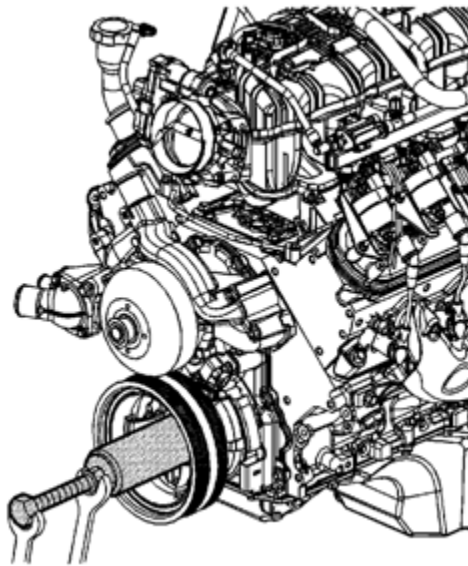
1. Install the J 42386-A tool (1) and bolts.

Use 1 M10 - 1.5 x 120 mm and 1 M10 - 1.5 x 45 mm bolt for proper tool operation and tighten the J 42386-



Note: 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.



3. Use the J 41665 installer and the J 41478 installer in order to install the balancer.
 - 3.1. Assemble the J 41478 installer threaded rod, nut, washer and the J 41665 installer .

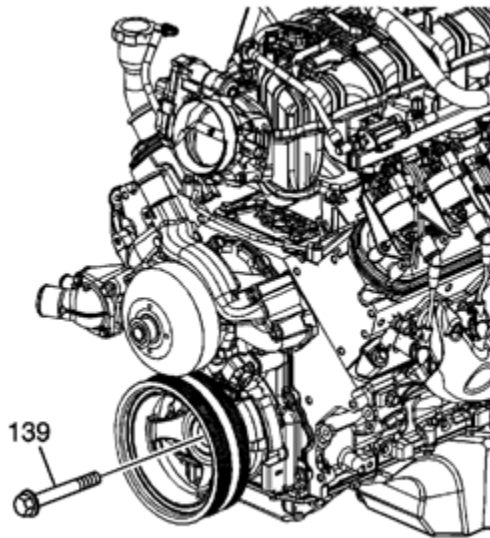
Insert the smaller end of the installer into the front of the balancer.

- 3.2. Use a wrench and hold the hex end of the threaded rod.

- 3.3. Use a second wrench and rotate the installation tool nut clockwise until the balancer is started onto the crankshaft.
- 3.4. Remove the tool and reverse the installation tool.

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

- 3.5. Use a wrench and hold the hex end of the threaded rod.
- 3.6. Use a second wrench and rotate the installation tool nut clockwise until the balancer is installed onto the crankshaft.
- 3.7. Remove the balancer installation tools.



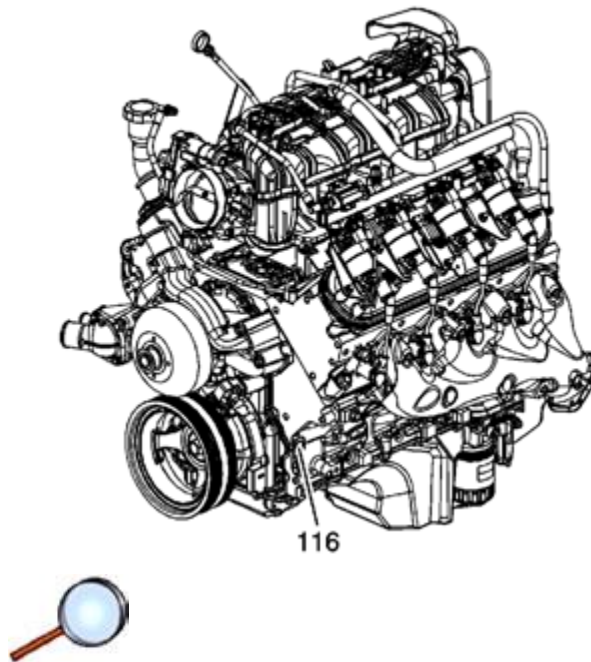
4. Install the NEW crankshaft balancer bolt (139) and
 - 4.1. Tighten the crankshaft balancer bolt a first pass to **150 N·m (110 lb ft)**.
 - 4.2. Loosen the crankshaft balancer bolt a second pass 360 degrees.
 - 4.3. Tighten the crankshaft balancer bolt a third pass to **50 N·m (37 lb ft)**.
 - 4.4. Tighten the crankshaft balancer bolt a final pass 230 degrees using the J 45059 meter .
5. Remove the J 42386-A tool .

Engine Prelubing

Special Tools

J 45299 Engine Preluber

For equivalent regional tools, refer to [Special Tools](#)

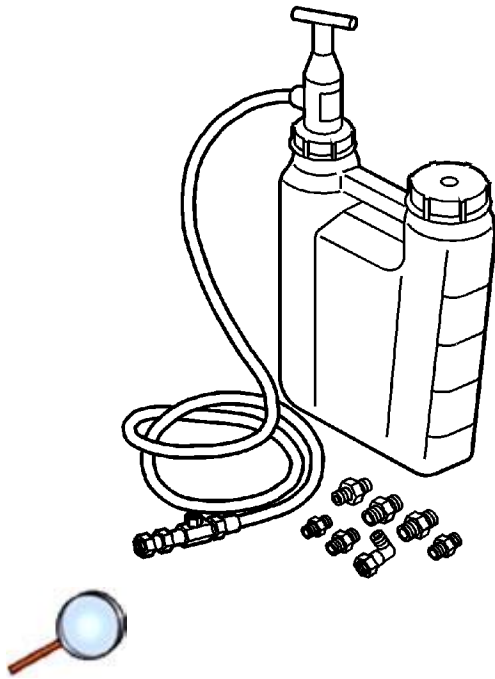


Note: A constant and continuous flow of clean engine oil is required in order to properly prime the engine. Use an approved engine oil as specified in the owners manual.

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

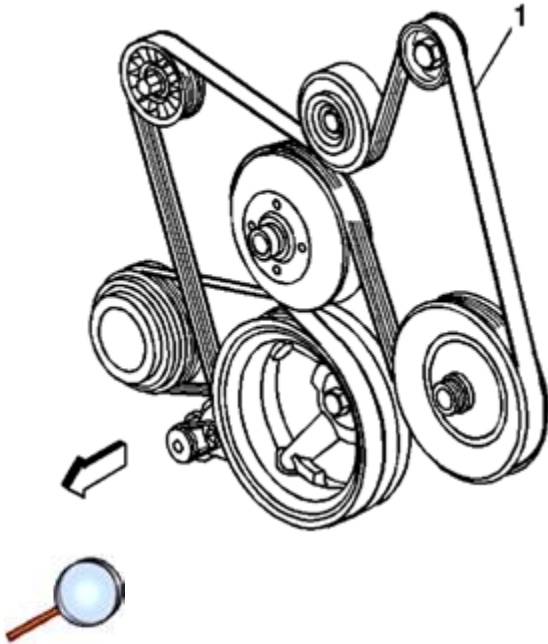
2. Install the oil filter and tighten to **30 N·m (22 lb ft)**.
3. Locate the engine block left front oil gallery plug (116).
4. Install the M16 x 1.5 adapter P/N 509375.



5. Install the flexible hose to the adapter and open the valve.
6. Pump the handle on the *J 45299* preluber in order to flow a minimum of 1-1.9 liters (1-2 quarts) engine oil. Observe the flow of engine oil through the flexible hose and into the engine assembly.
7. Close the valve and remove the flexible hose and adapter from the engine.
8. Install the gallery plug to the engine and tighten to **60 N·m (44 lb ft)**.
9. Top-off the engine oil to the proper level.

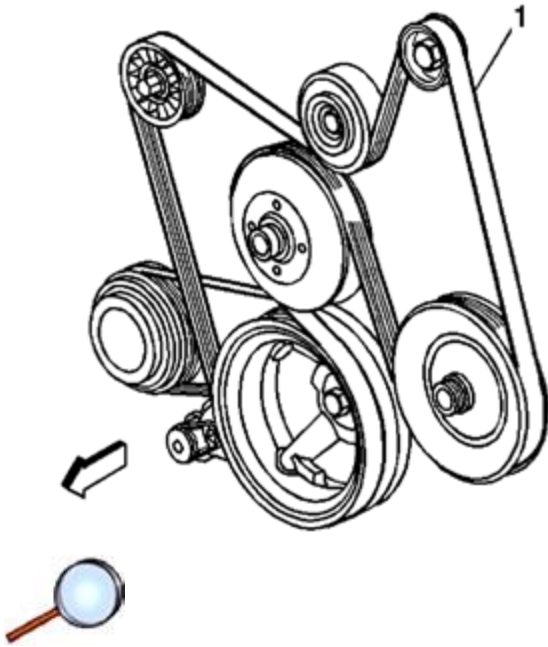
Drive Belt Replacement - Accessory

Removal Procedure



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

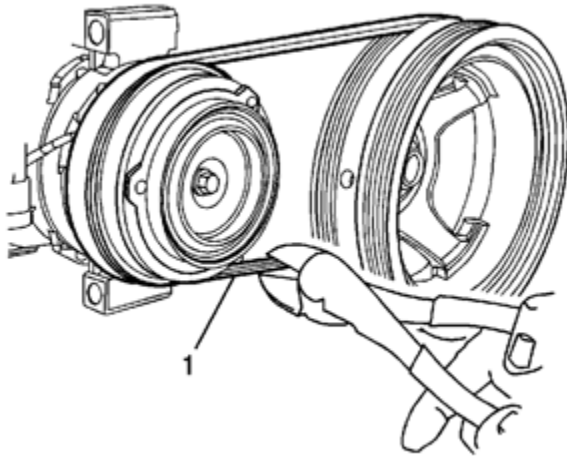
Installation Procedure



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

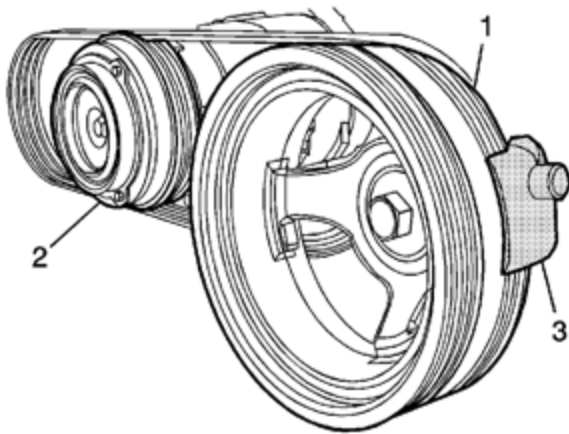
Air Conditioning Compressor Belt Replacement (V8)

Removal Procedure

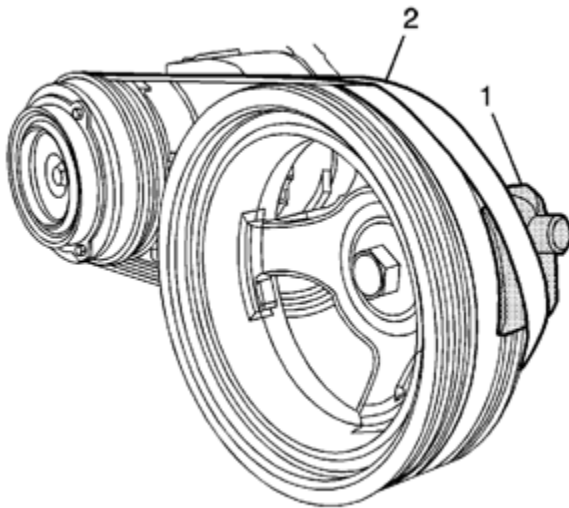


1. Remove the accessory drive belt. Refer to [Drive Belt Replacement - Accessory](#).
2. Remove the skid plate. Refer to [Engine Shield Replacement](#).
3. Cut the belt (1) from air conditioning (A/C) and crankshaft pulleys.

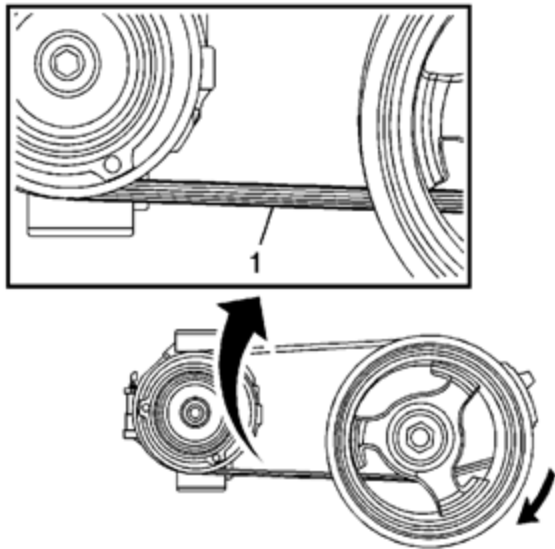
Installation Procedure



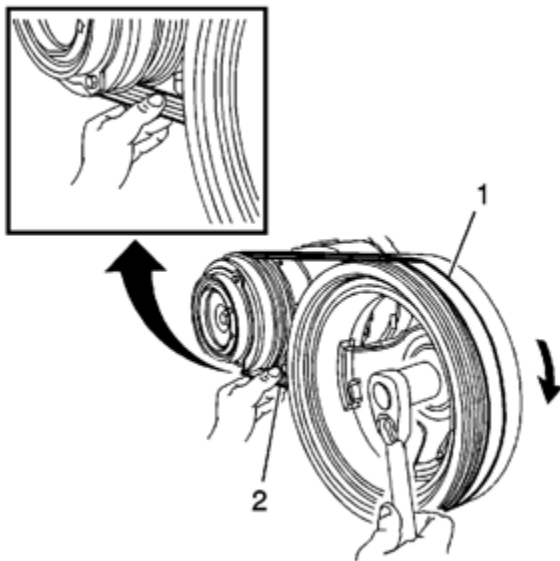
1. Position the belt behind the rear face of the balancer (1) and off of the A/C pulley (2).
2. Install the belt installation tool (3) onto the balancer.



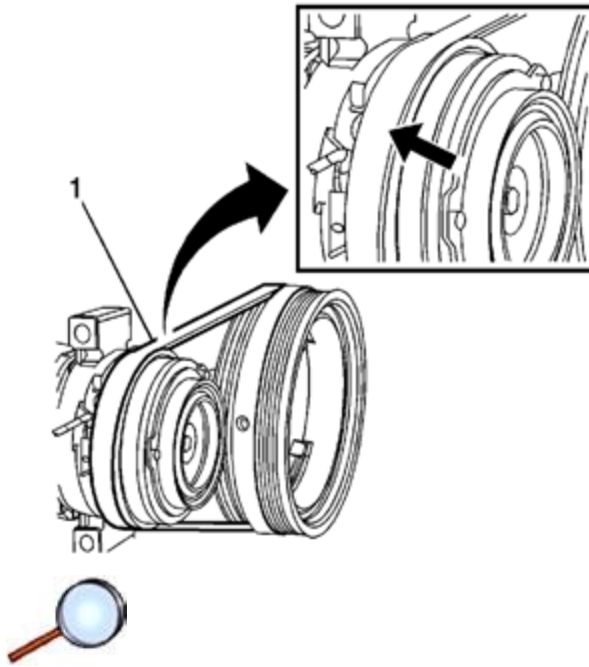
3. Slide the belt installation tool (1) upward, installing the belt (2) onto the belt installation tool.
4. Slide the belt installation tool downward, positioning the belt onto the A/C pulley, applying light tension to the belt.



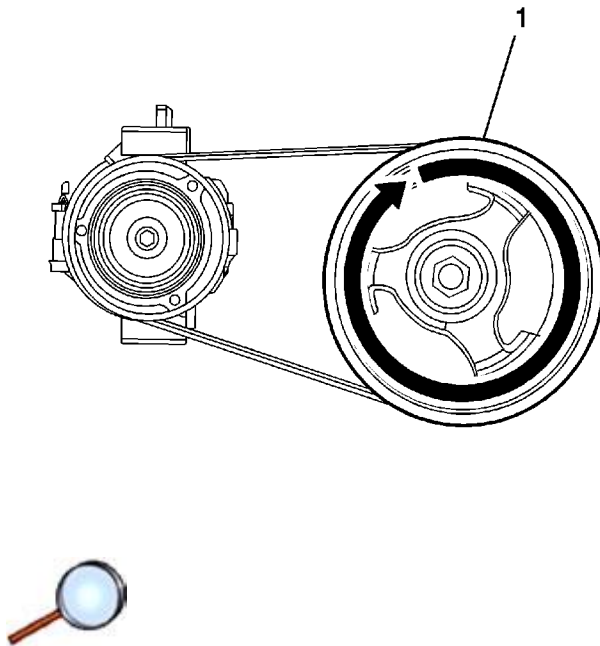
5. Position the lower portion of the belt (1) with the ribbed area facing forward.



6. Slowly rotate the crankshaft pulley (1) in a clockwise direction while using finger pressure to pull the belt (2) forward. Ensure that the ribbed area of the belt remains facing forward and the belt aligns properly to the A/C pulley.



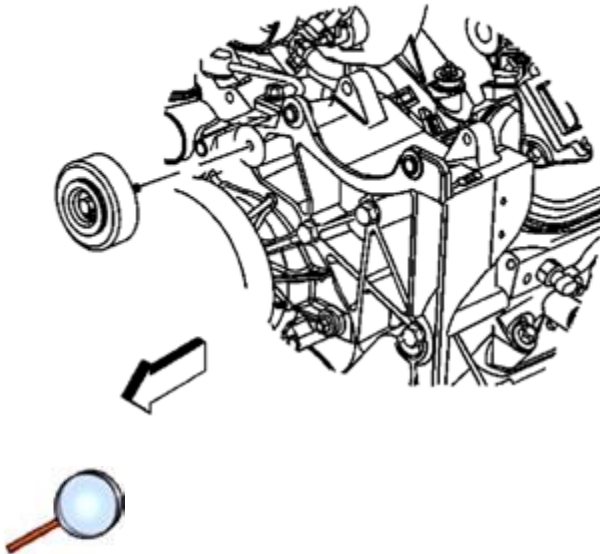
7. Inspect the drive belt (1) for proper installation and alignment.



8. Rotate the balancer (1) and additional 360 degrees to ensure proper belt installation.
9. Install the skid plate. Refer to [Engine Shield Replacement](#).
10. Install the accessory drive belt. Refer to [Drive Belt Replacement - Accessory](#).

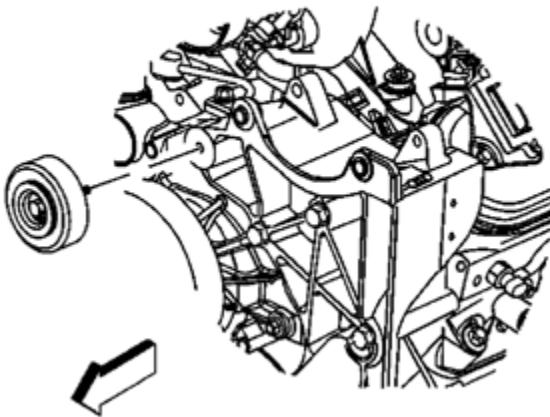
Drive Belt Idler Pulley Replacement

Removal Procedure



1. Remove the accessory drive belt. Refer to [Drive Belt Replacement - Accessory](#).
2. Loosen the drive belt idler pulley bolt and remove the idler pulley.

Installation Procedure





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

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Tighten the drive belt idler pulley bolt.

Tighten

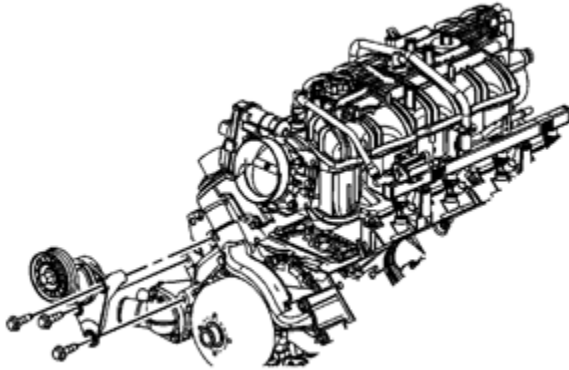
Tighten the bolt to 50 N·m (37 lb ft).

3. Install the accessory drive belt. Refer to [Drive Belt Replacement - Accessory](#).

cardiagn.com

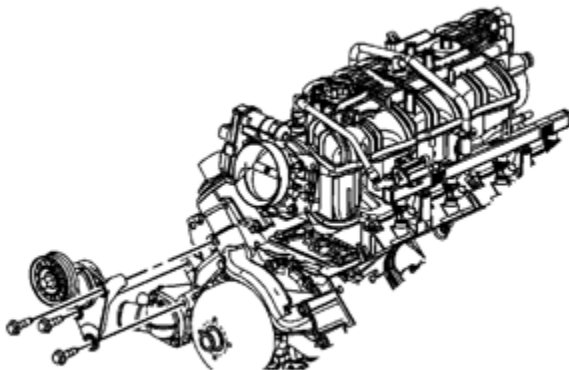
Drive Belt Tensioner Replacement - Accessory

Removal Procedure



1. Remove the accessory drive belt. Refer to [Drive Belt Replacement - Accessory](#).
2. Remove the drive belt tensioner bolts.
3. Remove the drive belt tensioner.

Installation Procedure





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

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install and tighten the drive belt tensioner bolts.

Tighten

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

3. Install the accessory drive belt. Refer to [Drive Belt Replacement - Accessory](#).

cardiagn.com

Engine Mount Inspection

Caution: Broken or deteriorated mounts can cause misalignment and destruction of certain drive train components. When a single mount breaks, the remaining mounts are subjected to abnormally high stresses.

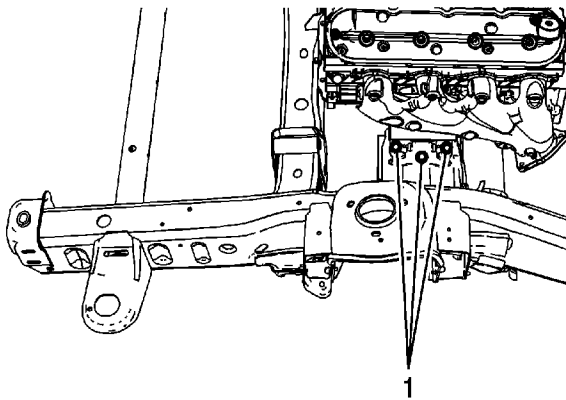
Caution: When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Due to the small clearance between the oil pan and the oil pump screen, jacking against the oil pan may cause the pan to be bent against the pump screen. This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

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

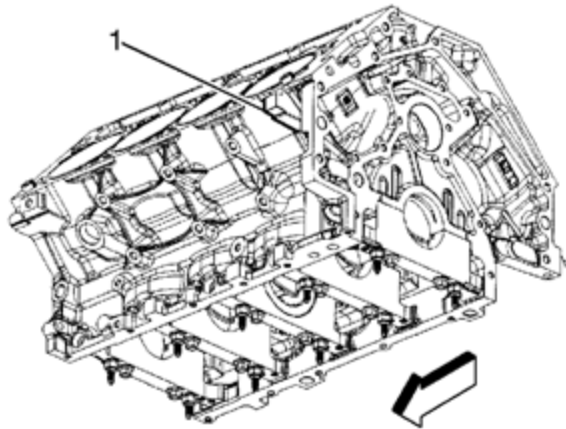
Engine Mount Replacement - Left Side (1500 LY2)

Removal Procedure

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

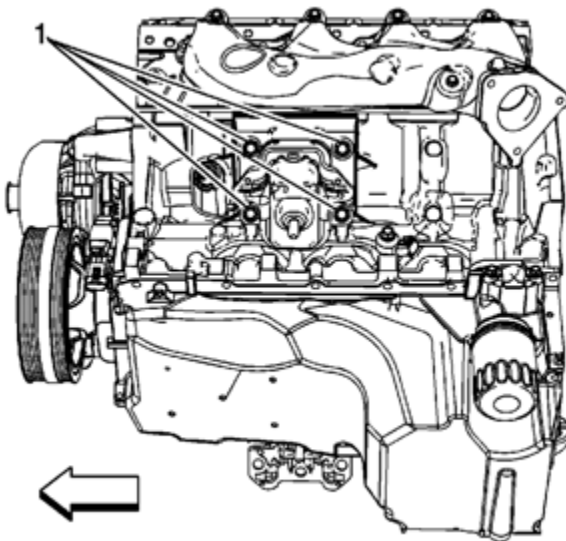


1. If the vehicle is equipped with four wheel drive (4WD), remove the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
2. Lower the vehicle.
3. Remove the left wheelhouse liner. Refer to [Front Wheelhouse Liner Replacement - Left Side](#).
4. Remove the engine mount to frame bolts (1).
5. Raise and support the vehicle halfway. Refer to [Lifting and Jacking the Vehicle](#).

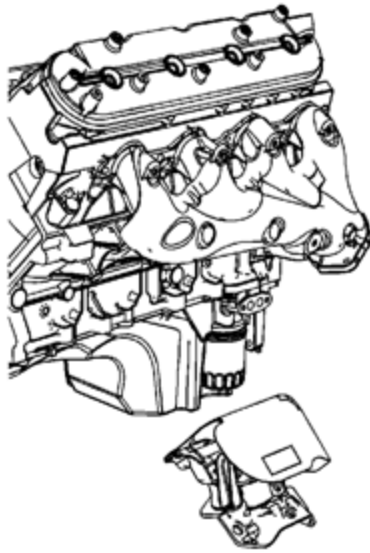


Note: DO NOT raise and/or support the engine by the crankshaft balancer, or the oil pan.

6. Place an adjustable (screw type) jack to the tab (1) located on the engine block.
7. Remove the left side exhaust manifold heatshield. Refer to [Exhaust Manifold Heat Shield Replacement - Left Side](#).

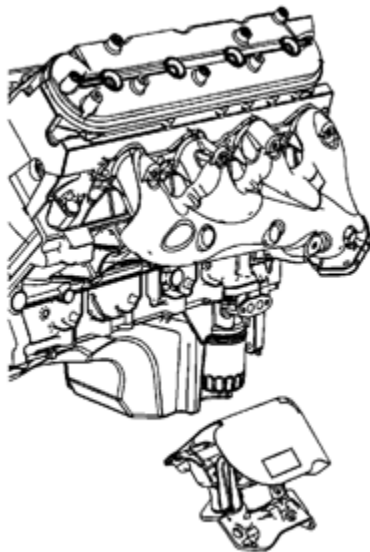


8. Remove the engine mount to engine bolts (1).
9. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.



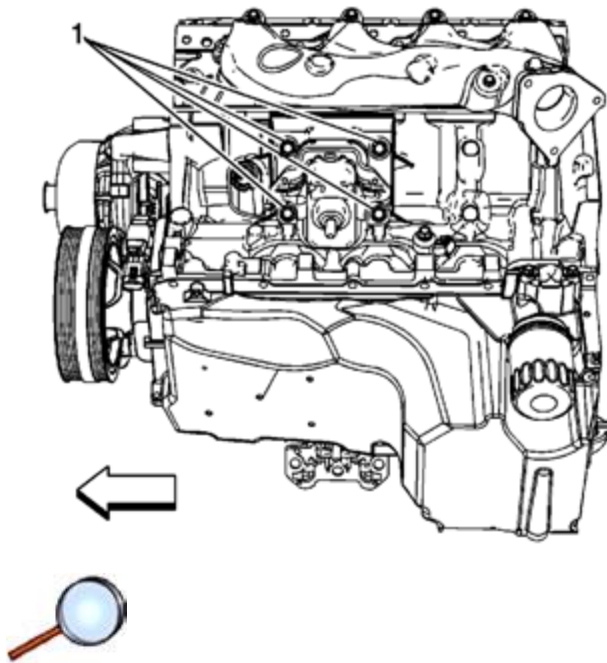
10. Remove the engine mount.

Installation Procedure



1. Position the engine mount to the engine.

Caution: Refer to [Fastener Caution](#) in the Preface section.

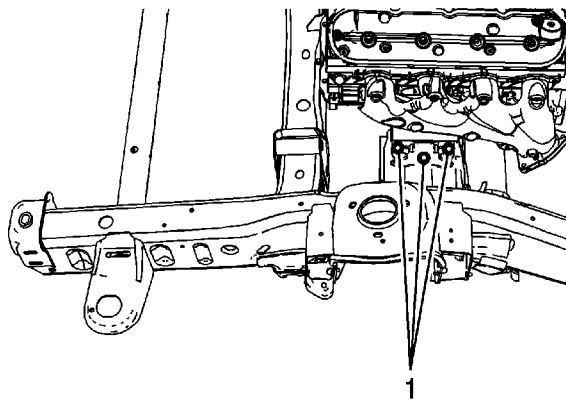


2. Install the engine mount to engine bolts (1).

Tighten

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

3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block.
5. Install the left side exhaust manifold heatshield. Refer to [Exhaust Manifold Heat Shield Replacement - Left Side](#).



6. Lower the vehicle.
7. Install the engine mount to frame bolts (1).

Tighten

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

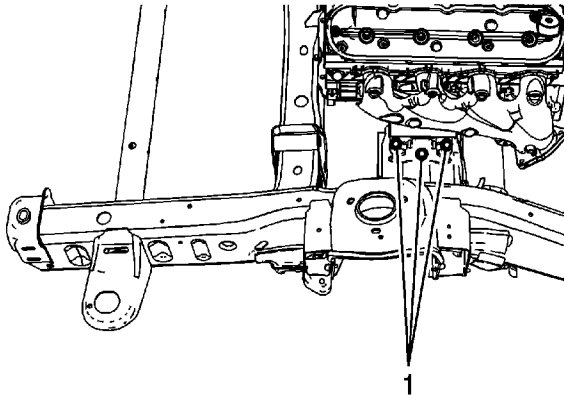
8. Install the left wheelhouse liner. Refer to [Front Wheelhouse Liner Replacement - Left Side](#).
9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).

cardiagn.com

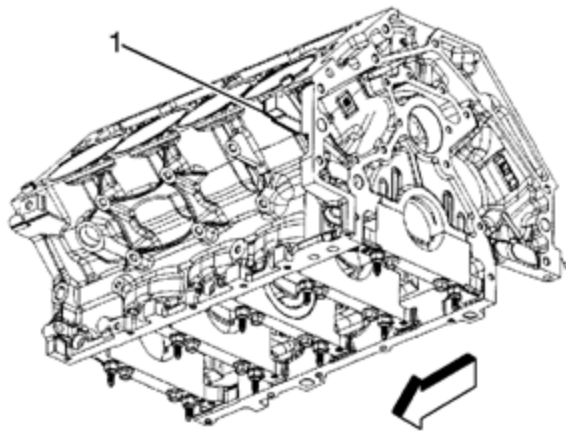
Engine Mount Replacement - Left Side (1500 Except RPOs LY6, LY2)

Removal Procedure

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

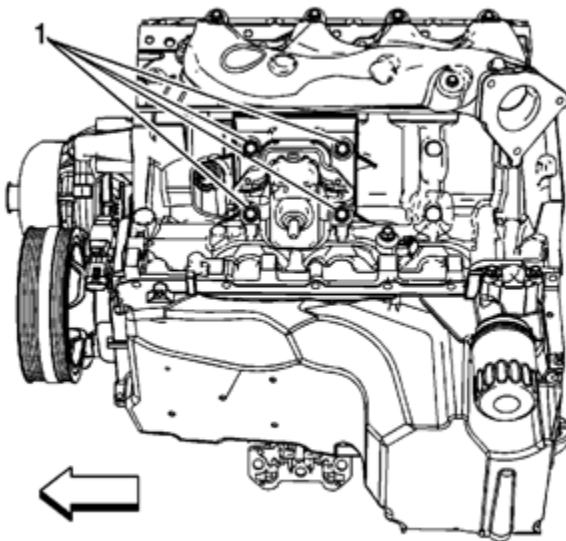


1. If the vehicle is equipped with four wheel drive (4WD), remove the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
2. Lower the vehicle.
3. Remove the left wheelhouse liner. Refer to [Front Wheelhouse Liner Replacement - Left Side](#).
4. Remove the engine mount to frame bolts (1).
5. Raise and support the vehicle halfway. Refer to [Lifting and Jacking the Vehicle](#).

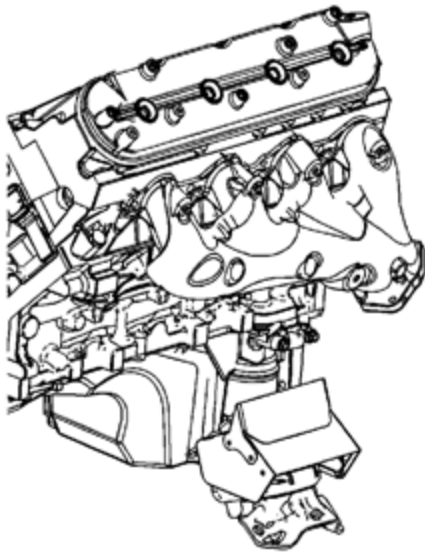


Note: DO NOT raise and/or support the engine by the crankshaft balancer, or the oil pan.

6. Place an adjustable (screw type) jack to the tab (1) located on the engine block.
7. Remove the left side exhaust manifold heatshield. Refer to [Exhaust Manifold Heat Shield Replacement - Left Side](#).

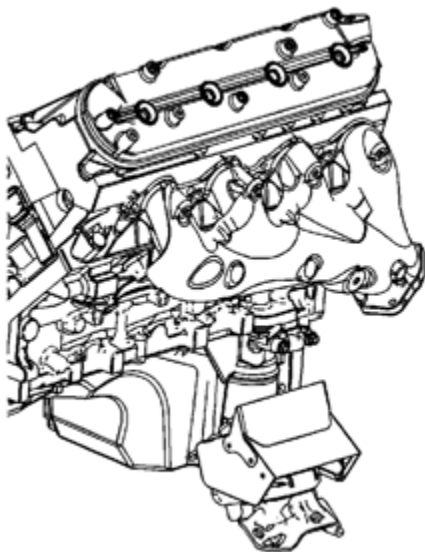


8. Remove the engine mount to engine bolts (1).
9. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.



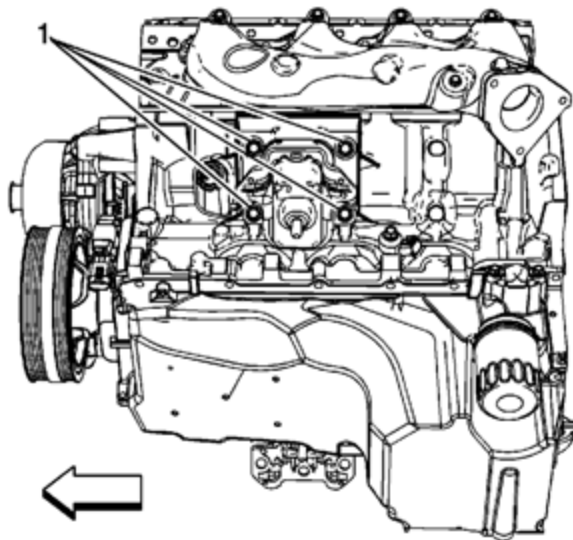
10. Remove the engine mount.

Installation Procedure



1. Position the engine mount to the engine.

Caution: Refer to Fastener Caution in the Preface section.

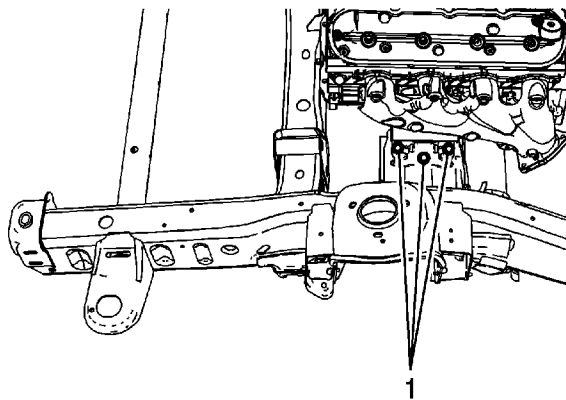


2. Install the engine mount to engine bolts (1).

Tighten

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

3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block.
5. Install the left side exhaust manifold heatshield. Refer to [Exhaust Manifold Heat Shield Replacement - Left Side](#).



6. Lower the vehicle.
7. Install the engine mount to frame bolts (1).

Tighten

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

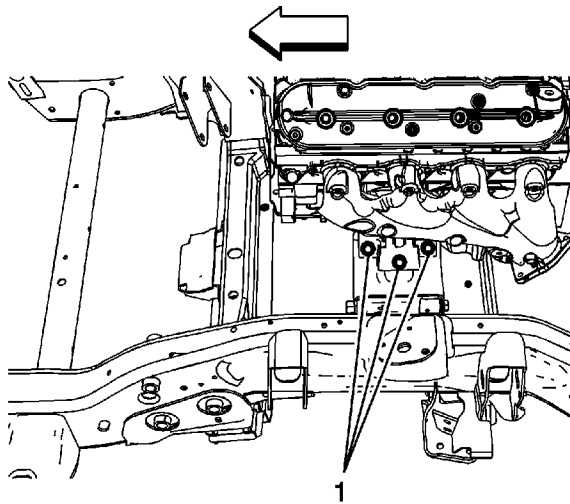
8. Install the left wheelhouse liner. Refer to [Front Wheelhouse Liner Replacement - Left Side](#).
9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).

cardiagn.com

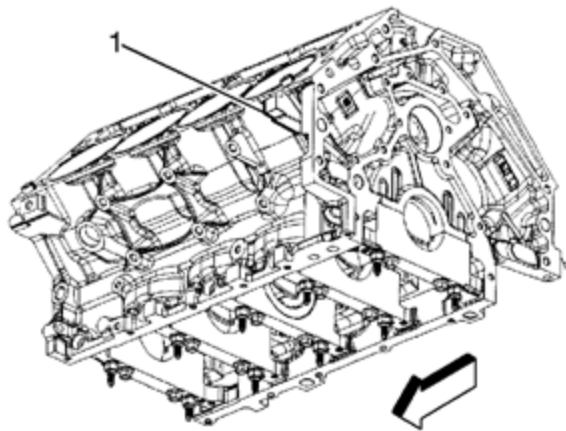
Engine Mount Replacement - Left Side (2500 LY6)

Removal Procedure

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

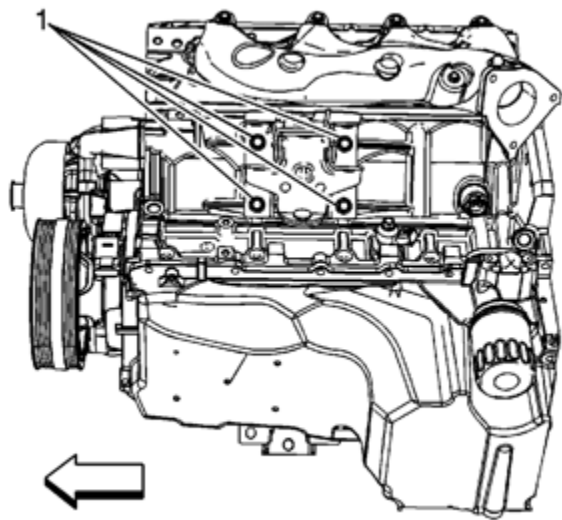


1. If the vehicle is equipped with four wheel drive (4WD), remove the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
2. Lower the vehicle.
3. Remove the left wheelhouse liner. Refer to [Front Wheelhouse Liner Replacement - Left Side](#).
4. Remove the engine mount to frame bolts (1).
5. Raise and support the vehicle halfway. Refer to [Lifting and Jacking the Vehicle](#).

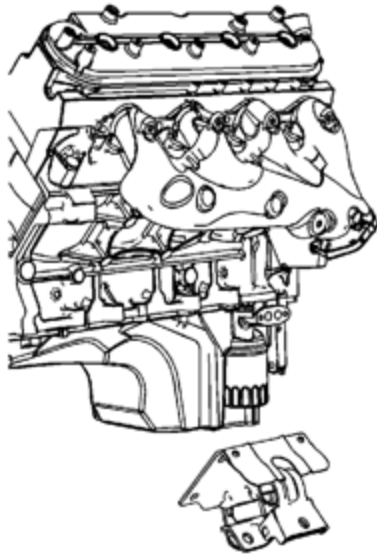


Note: DO NOT raise and/or support the engine by the crankshaft balancer, or the oil pan.

6. Place an adjustable (screw type) jack to the tab (1) located on the engine block.
7. Remove the left side exhaust manifold heatshield. Refer to [Exhaust Manifold Heat Shield Replacement - Left Side](#).

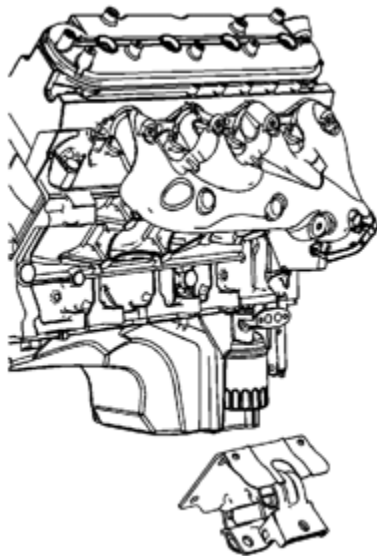


8. Remove the engine mount to engine bolts (1).
9. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.



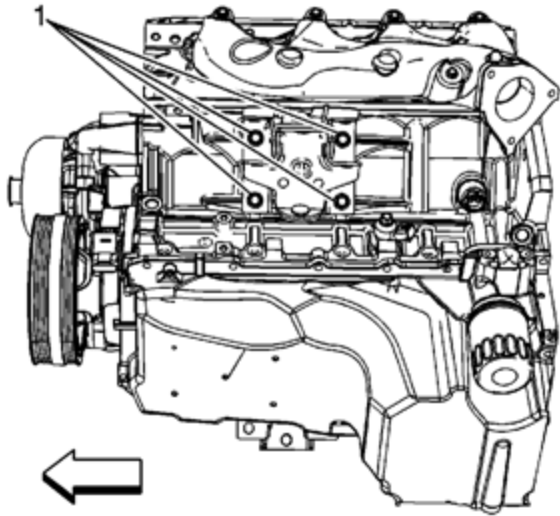
10. Remove the engine mount.

Installation Procedure



1. Position the engine mount to the engine.

Caution: Refer to [Fastener Caution](#) in the Preface section.

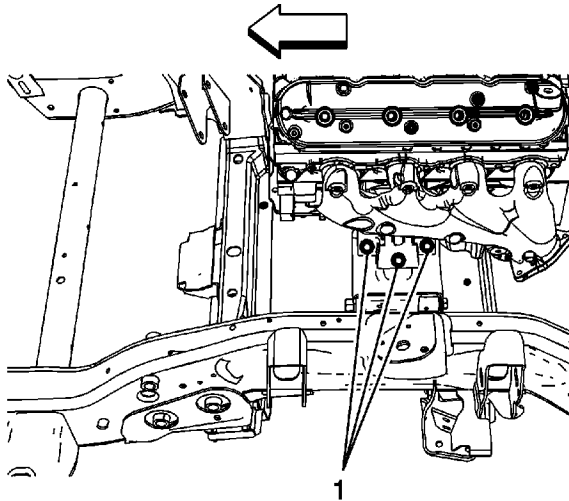


2. Install the engine mount to engine bolts (1).

Tighten

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

3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block.
5. Install the left side exhaust manifold heatshield. Refer to [Exhaust Manifold Heat Shield Replacement - Left Side](#).



6. Lower the vehicle.
7. Install the engine mount to frame bolts (1).

Tighten

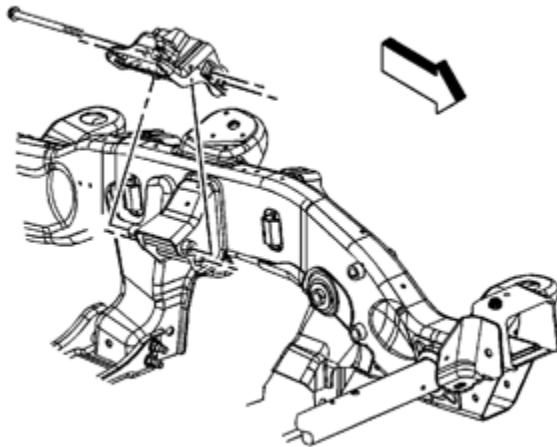
Tighten the bolts to 65 N·m (48 lb ft) starting with the middle bolt then either side bolt.

8. Install the left wheelhouse liner. Refer to [Front Wheelhouse Liner Replacement - Left Side](#).
9. If the vehicle is equipped with 4WD, install the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).

cardiagn.com

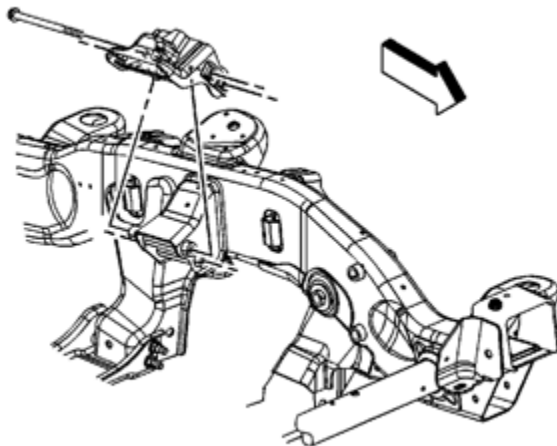
Engine Mount Bracket Replacement - Left Side

Removal Procedure



1. Remove the engine mount. Refer to [Engine Mount Replacement - Left Side](#).
2. Remove the engine mount bracket bolts.
3. Remove the engine mount bracket.

Installation Procedure





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

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the engine mount bracket bolts.

Tighten

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

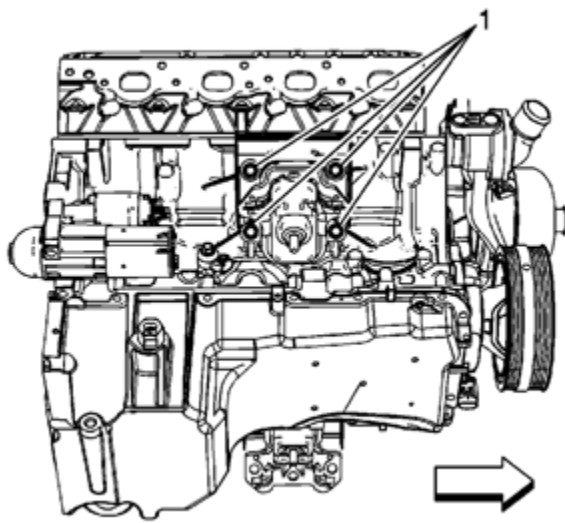
4. Install the engine mount. Refer to [Engine Mount Replacement - Left Side](#).

cardiagn.com

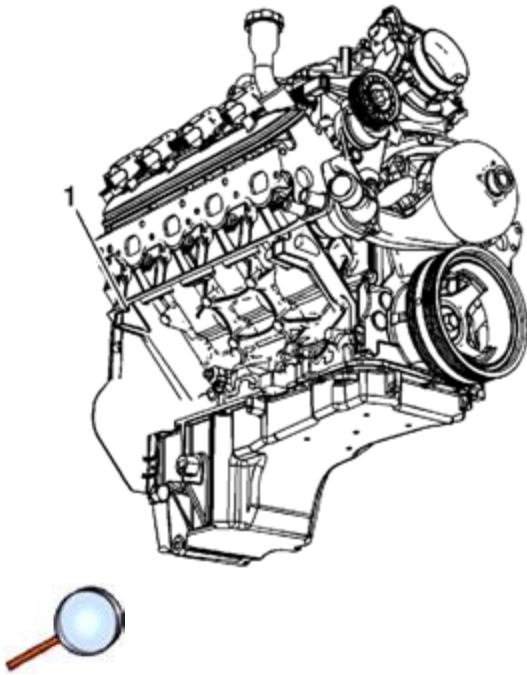
Engine Mount Replacement - Right Side (1500 LY2)

Removal Procedure

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

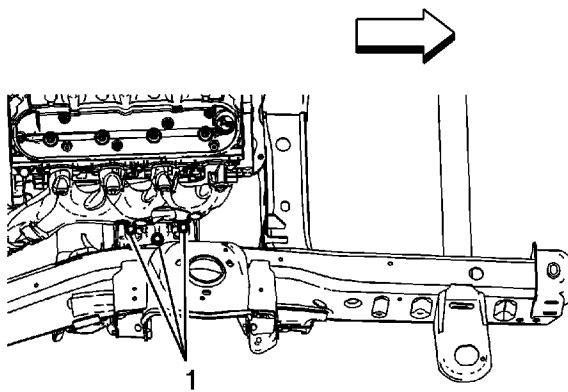


1. Remove the upper intake manifold sight shield. Refer to [Upper Intake Manifold Cover Replacement](#).
2. If the vehicle is equipped with four wheel drive (4WD), remove the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
3. Remove the two lower engine mount to engine bolts (1).
4. Remove the starter motor. Refer to [Starter Motor Replacement](#).

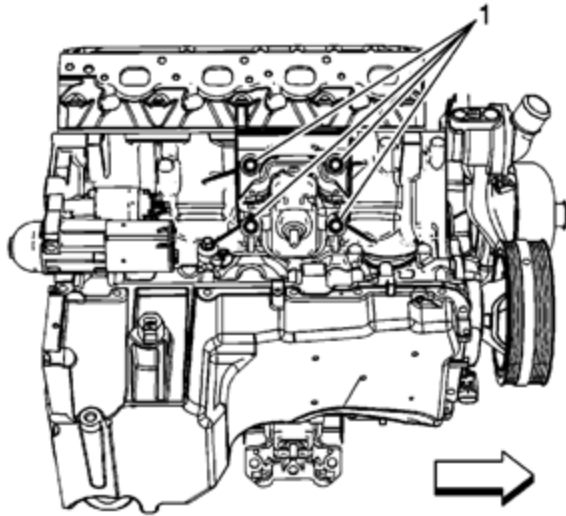


Note: DO NOT raise and/or support the engine by the crankshaft balancer or oil pan.

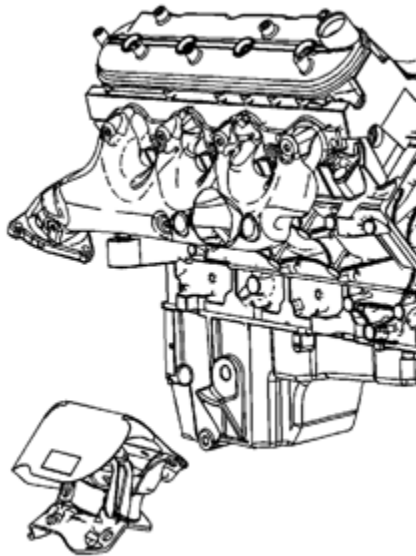
5. Place an adjustable (screw type) jack to the tab (1) located on the engine block.



6. Remove the engine mount to frame bolts (1).

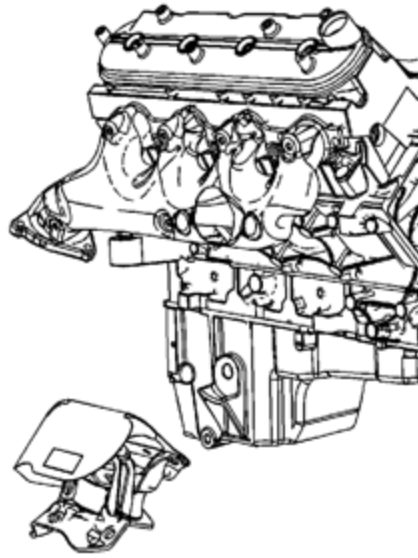


7. Remove the two top engine mount to engine bolts (1).
8. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.



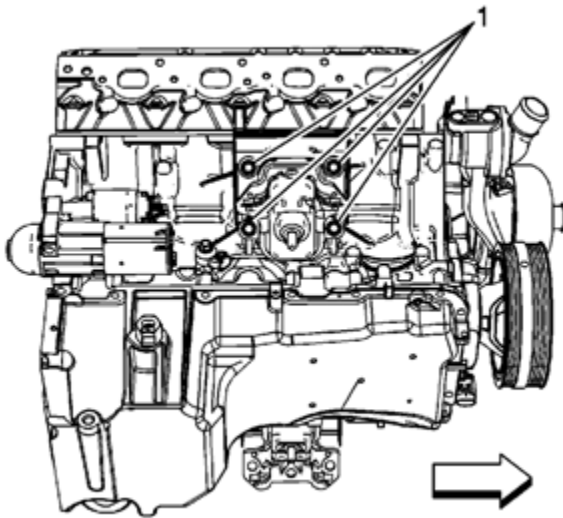
9. Remove the engine mount.

Installation Procedure



1. Position the engine mount to the engine.

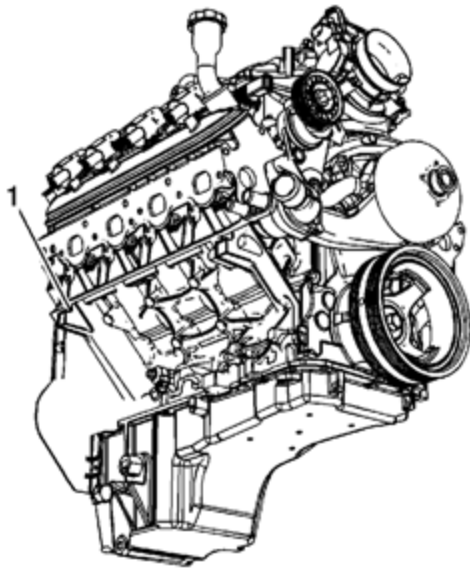
Caution: Refer to [Fastener Caution](#) in the Preface section.



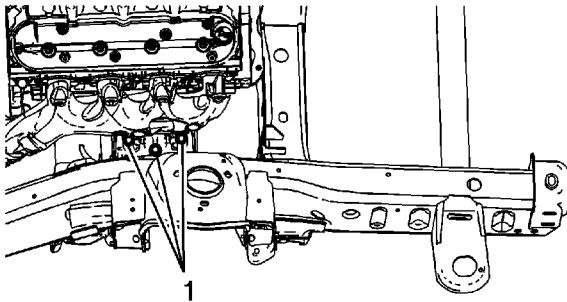
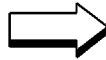
2. Install the two top engine mount to engine bolts (1).

Tighten

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



3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block lifting tab (1).

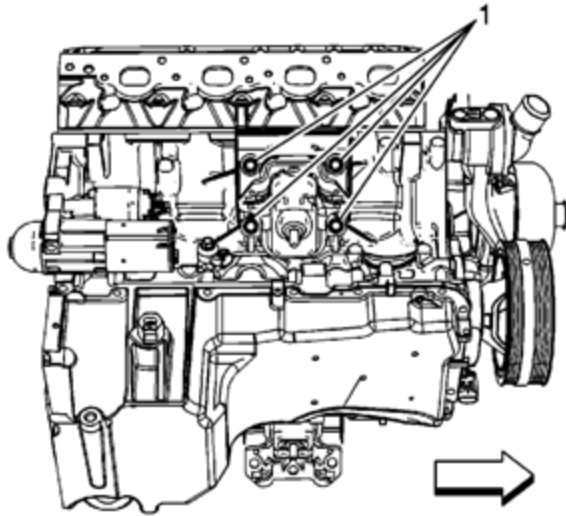


5. Install the engine mount to frame bolts (1).

Tighten

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

6. Install the starter motor. Refer to [Starter Motor Replacement](#).



7. Install the two lower engine mount to engine bolts (1).

Tighten

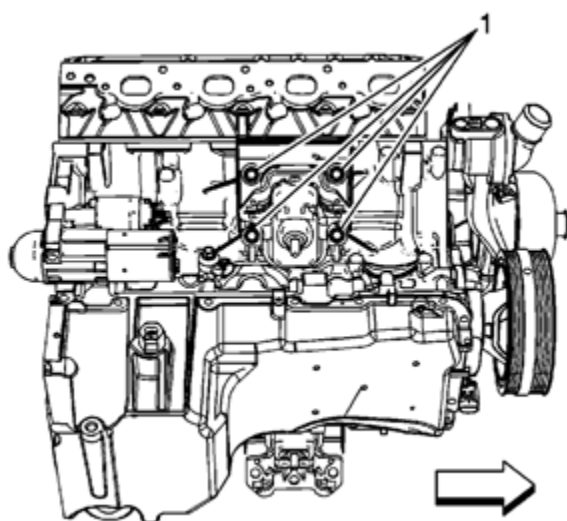
Tighten the bolts to 50 N·m (37 lb ft).

8. If the vehicle is equipped with 4WD, Install the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
9. Install the upper intake manifold sight shield. Refer to [Upper Intake Manifold Cover Replacement](#).

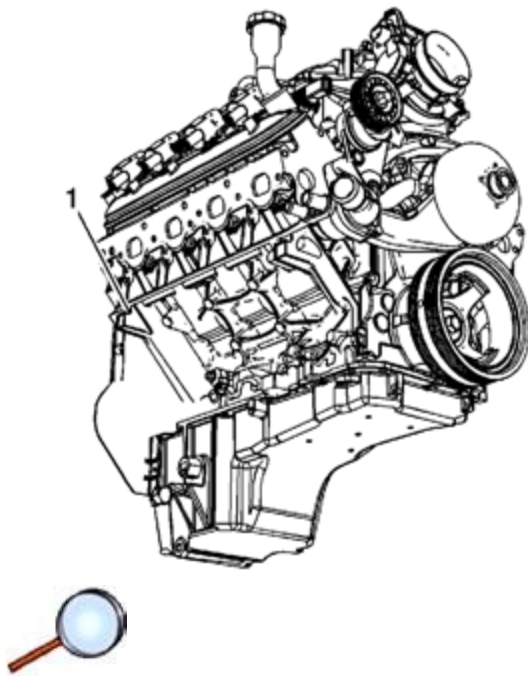
Engine Mount Replacement - Right Side (1500 Except RPOs LY6, LY2)

Removal Procedure

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

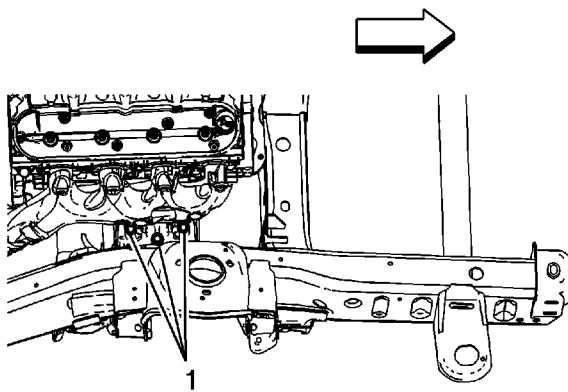


1. Remove the upper intake manifold sight shield. Refer to [Upper Intake Manifold Cover Replacement](#).
2. If the vehicle is equipped with four wheel drive (4WD), remove the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
3. Remove the two lower engine mount to engine bolts (1).
4. Remove the starter motor. Refer to [Starter Motor Replacement](#).

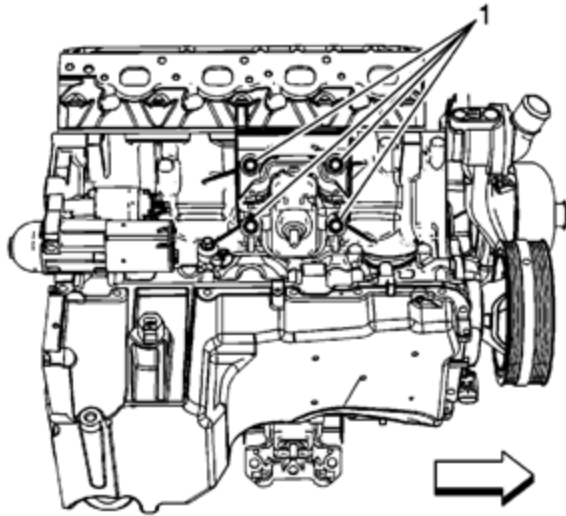


Note: DO NOT raise and/or support the engine by the crankshaft balancer or oil pan.

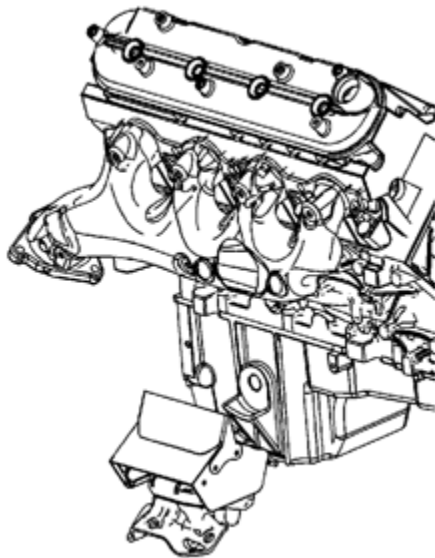
5. Place an adjustable (screw type) jack to the tab (1) located on the engine block.



6. Remove the engine mount to frame bolts (1).

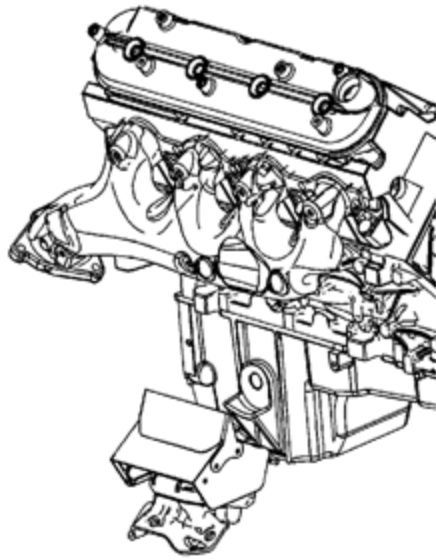


7. Remove the two top engine mount to engine bolts (1).
8. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.



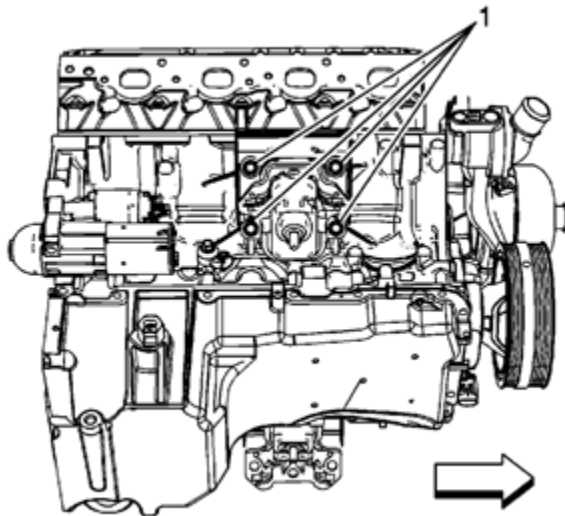
9. Remove the engine mount.

Installation Procedure



1. Position the engine mount to the engine.

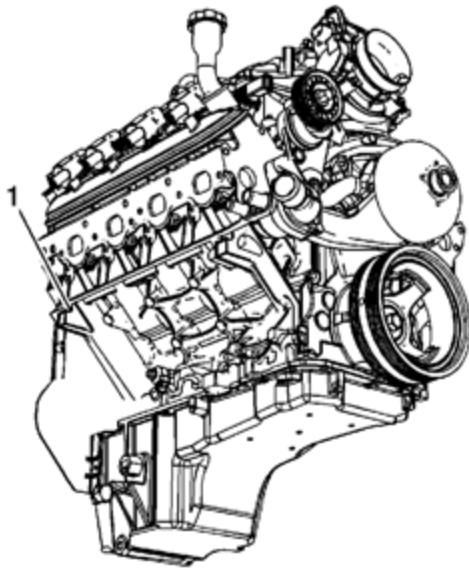
Caution: Refer to [Fastener Caution](#) in the Preface section.



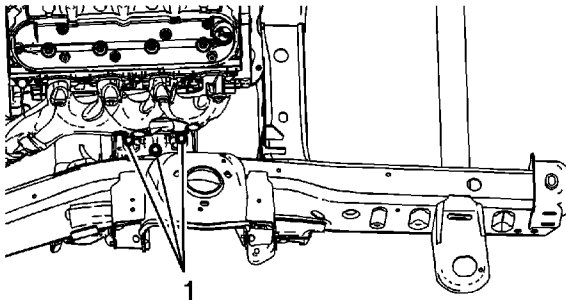
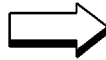
2. Install the two top engine mount to engine bolts (1).

Tighten

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



3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block lifting tab (1).

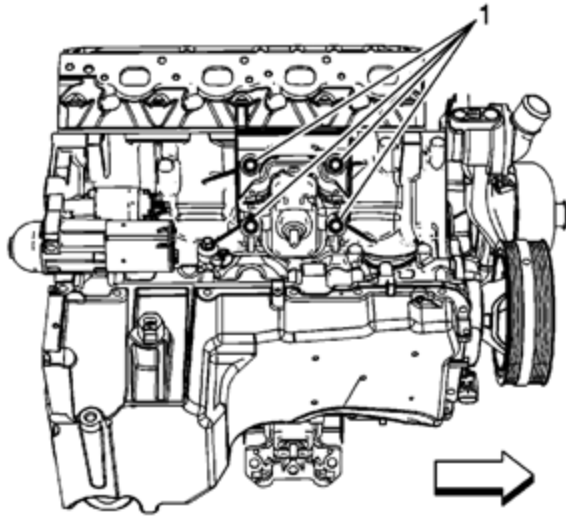


5. Install the engine mount to frame bolts (1).

Tighten

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

6. Install the starter motor. Refer to [Starter Motor Replacement](#).



7. Install the two lower engine mount to engine bolts (1).

Tighten

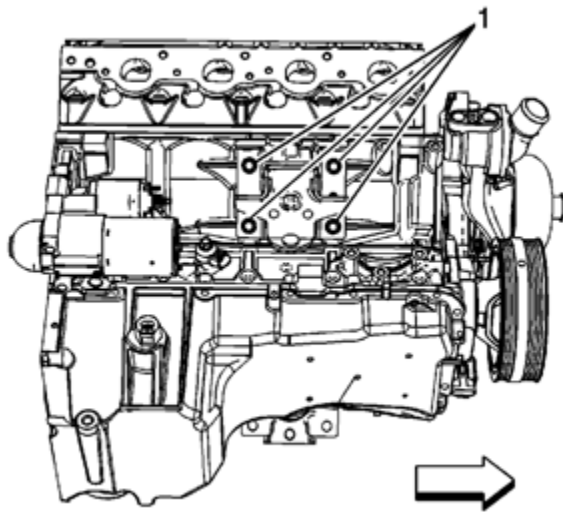
Tighten the bolts to 50 N·m (37 lb ft).

8. If the vehicle is equipped with 4WD, Install the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
9. Install the upper intake manifold sight shield. Refer to [Upper Intake Manifold Cover Replacement](#).

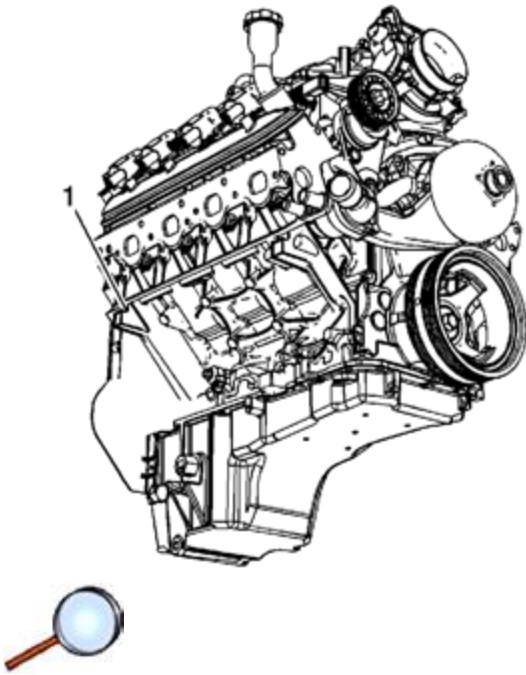
Engine Mount Replacement - Right Side (2500 LY6)

Removal Procedure

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

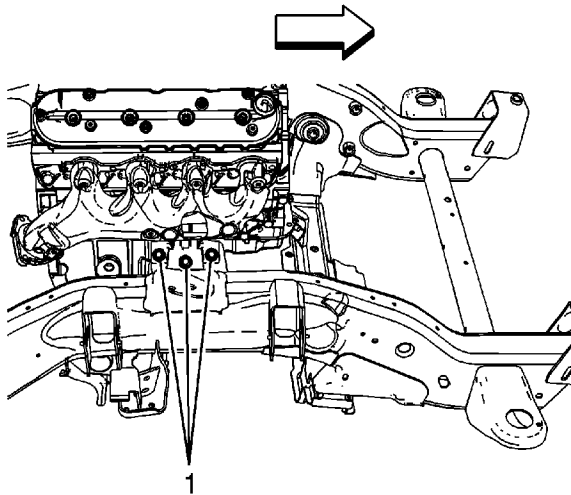


1. Remove the upper intake manifold sight shield. Refer to [Upper Intake Manifold Cover Replacement](#).
2. If the vehicle is equipped with four wheel drive (4WD), remove the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
3. Remove the two lower engine mount to engine bolts (1).
4. Remove the starter motor. Refer to [Starter Motor Replacement](#).

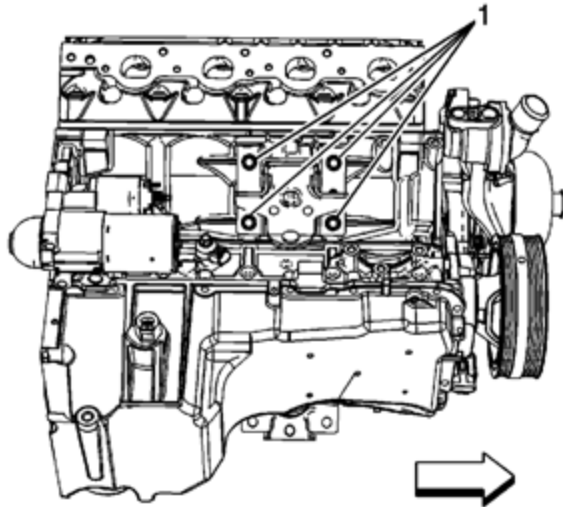


Note: DO NOT raise and/or support the engine by the crankshaft balancer or oil pan.

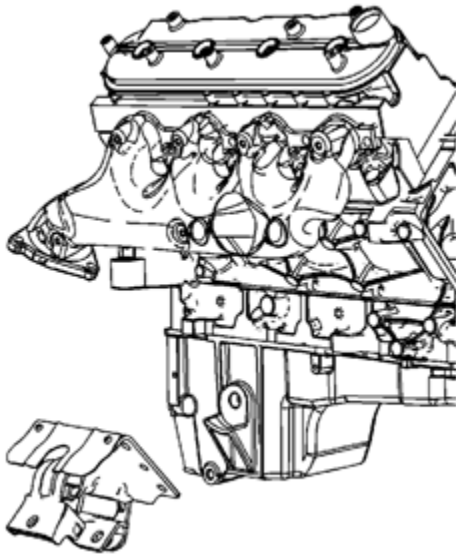
5. Place an adjustable (screw type) jack to the tab (1) located on the engine block.



6. Remove the engine mount to frame bolts (1).

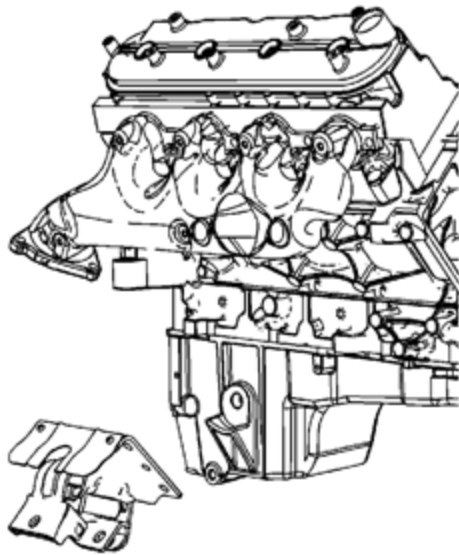


7. Remove the two top engine mount to engine bolts (1).
8. Using the adjustable jack, raise the engine slightly until there is enough clearance to remove the engine mount.



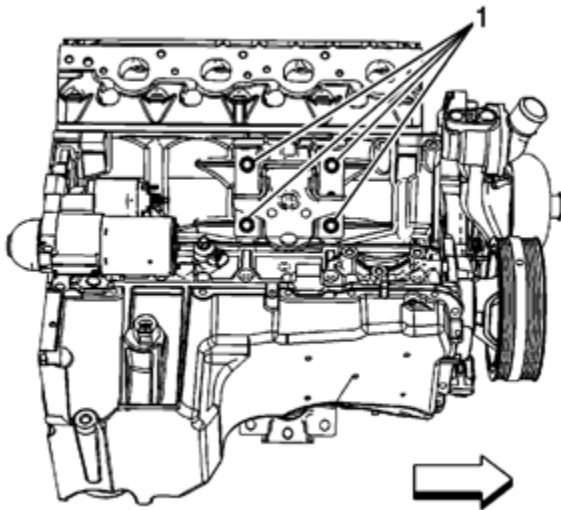
9. Remove the engine mount.

Installation Procedure



1. Position the engine mount to the engine.

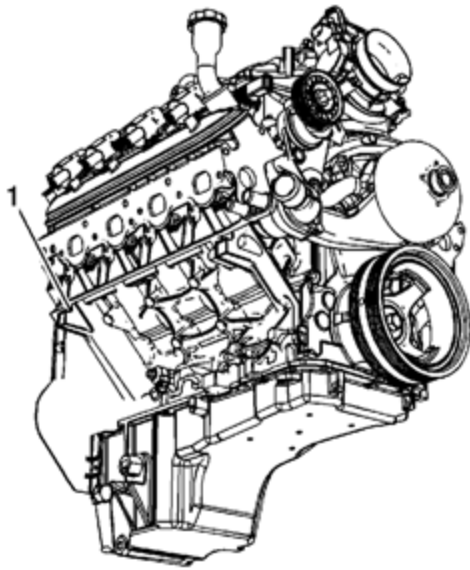
Caution: Refer to [Fastener Caution](#) in the Preface section.



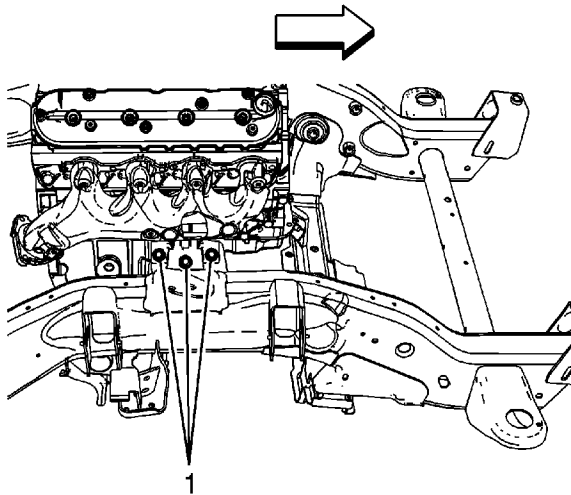
2. Install the two top engine mount to engine bolts (1).

Tighten

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



3. Using the adjustable jack, lower the engine until the engine mount is sitting flush on the frame.
4. Remove the adjustable jack from the engine block lifting tab (1).

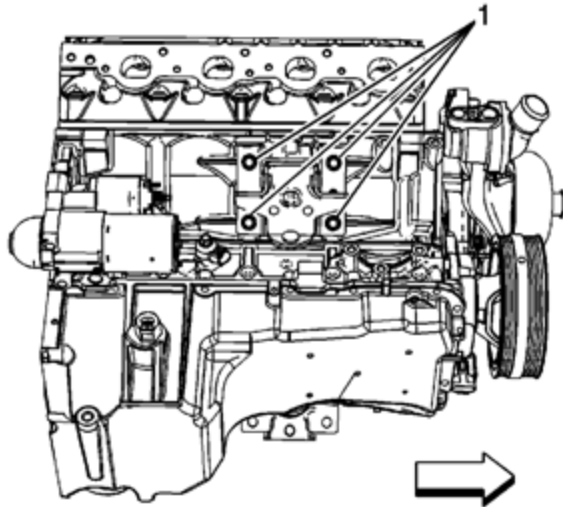


5. Install the engine mount to frame bolts (1).

Tighten

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

6. Install the starter motor. Refer to [Starter Motor Replacement](#).



7. Install the two lower engine mount to engine bolts (1).

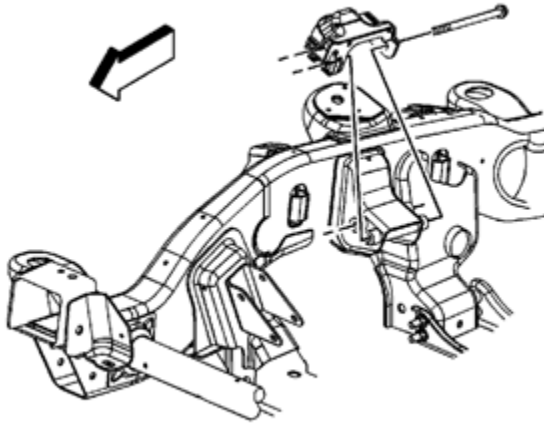
Tighten

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

8. If the vehicle is equipped with 4WD, Install the front drive axle. Refer to [Differential Carrier Assembly Replacement](#).
9. Install the upper intake manifold sight shield. Refer to [Upper Intake Manifold Cover Replacement](#).

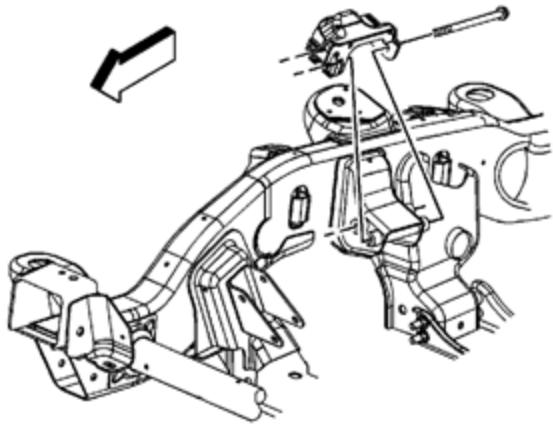
Engine Mount Bracket Replacement - Right Side (2500 LY6)

Removal Procedure



1. Remove the engine mount. Refer to [Engine Mount Replacement - Right Side](#).
2. Remove the engine mount bracket bolts.
3. Remove the engine mount bracket.

Installation Procedure



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

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the engine mount bracket bolts.

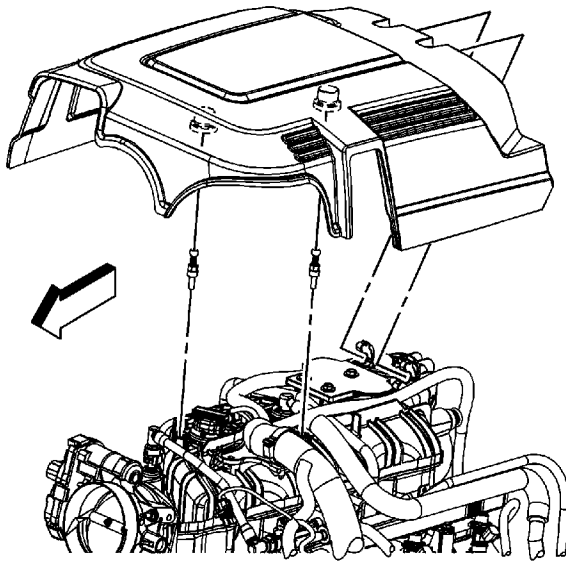
Tighten

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

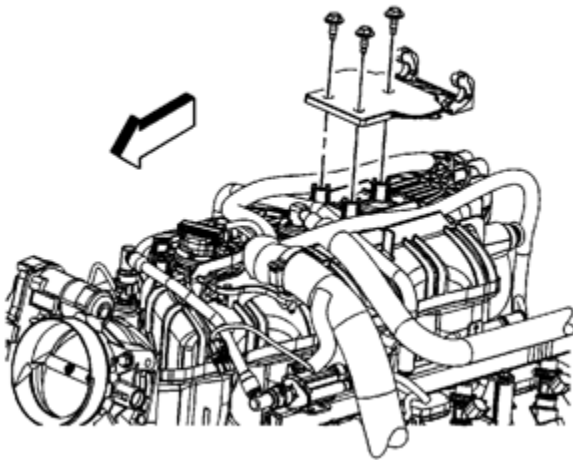
4. Install the engine mount. Refer to [Engine Mount Replacement - Right Side](#).

Upper Intake Manifold Sight Shield Replacement

Removal Procedure



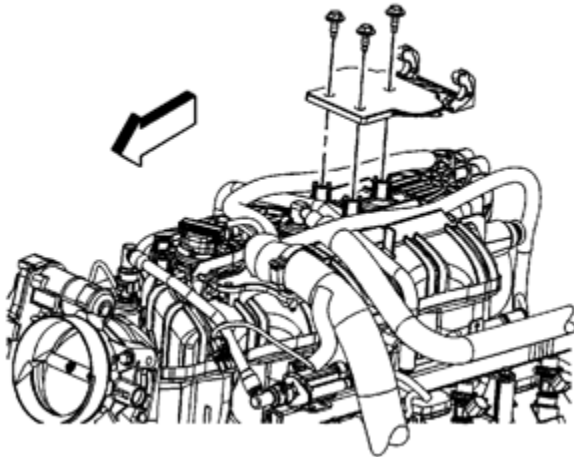
1. Open the hood.
2. Grasp the front of the intake manifold sight shield and lift up disengaging the grommets from the studs.
3. Remove the intake manifold sight shield from the retainer slots.



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

Installation Procedure

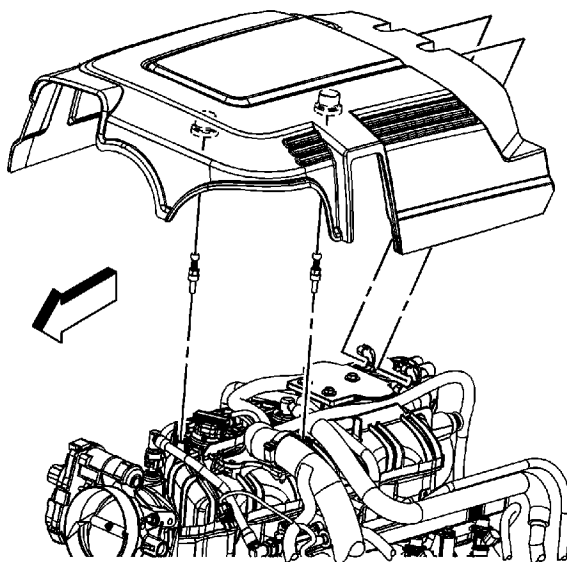
Caution: Refer to [Fastener Caution](#) in the Preface section.



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

Tighten

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

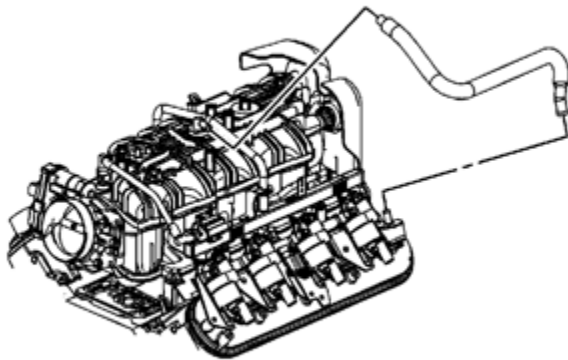


3. Install the intake manifold sight shield tabs into the slots in the retainer.
4. Align the intake manifold sight shield grommets with the studs.
5. Gently push down on the intake manifold sight shield over the grommets, seating the intake manifold sight shield.
6. Close the hood.

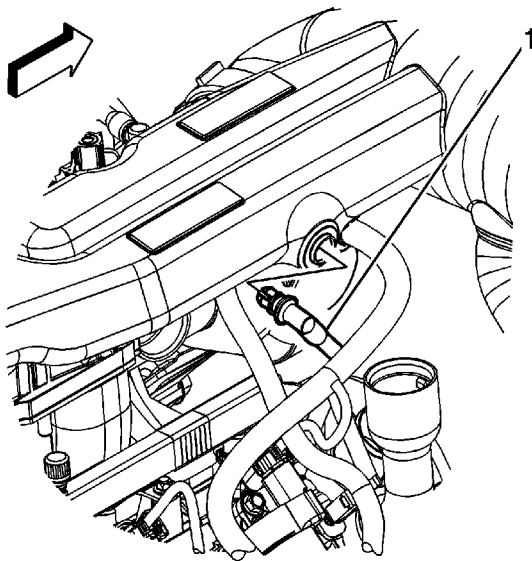
cardiagn.com

Positive Crankcase Ventilation Hose / Pipe / Tube Replacement

Removal Procedure

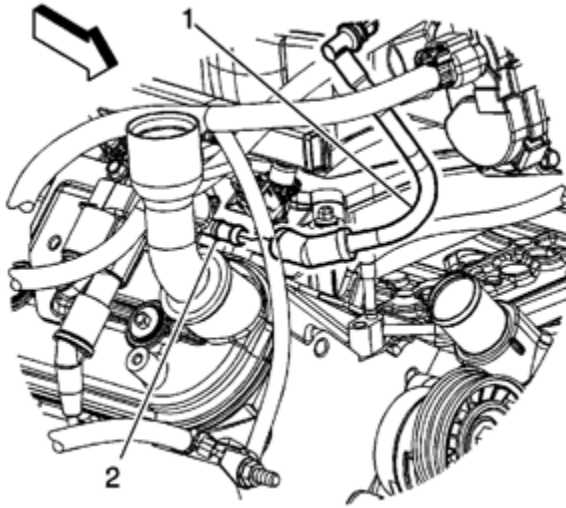


1. Remove the intake manifold sight shield. Refer to [Upper Intake Manifold Sight Shield Replacement](#) .
2. Remove the positive crankcase ventilation (PCV) hose from the intake manifold fitting and left valve rocker arm cover, if required.



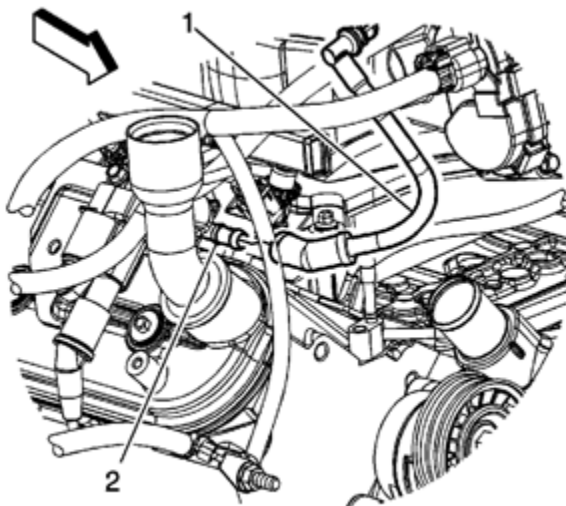


3. Remove the PCV tube (1) from the air cleaner outlet duct, if required.

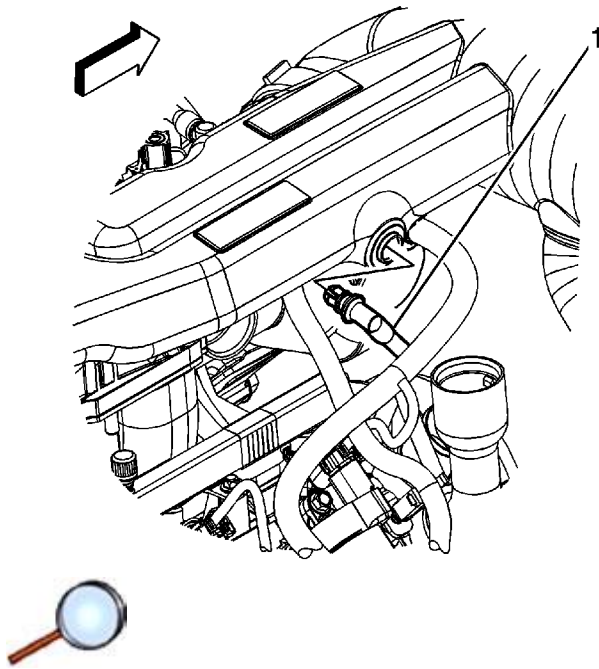


4. Remove the PCV tube (1) from the right valve rocker arm cover fitting (2), if required.
5. Remove the appropriate PCV hose/tube from the vehicle.

Installation Procedure

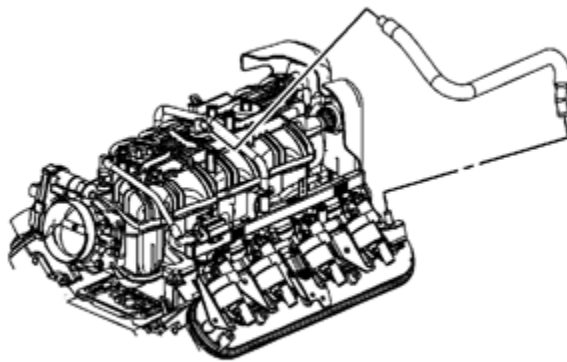


1. Install the appropriate PCV hose/tube to the vehicle.
2. Install the PCV tube (1) to the right valve rocker arm cover fitting (2), if required.



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

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

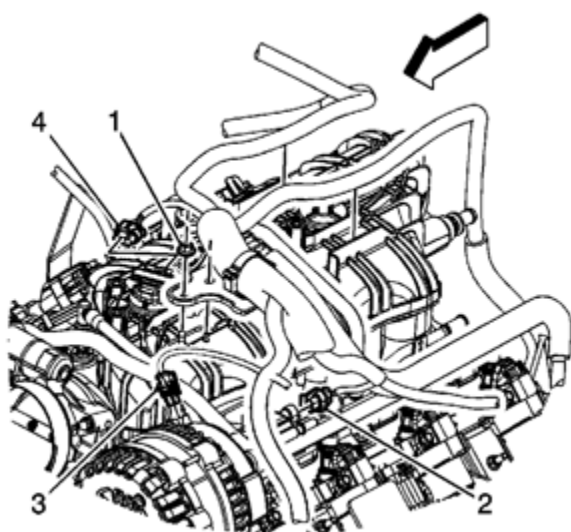


4. Install the PCV hose to the intake manifold fitting and left valve rocker arm cover, if required.
5. Install the intake manifold sight shield. Refer to [Upper Intake Manifold Sight Shield Replacement](#).

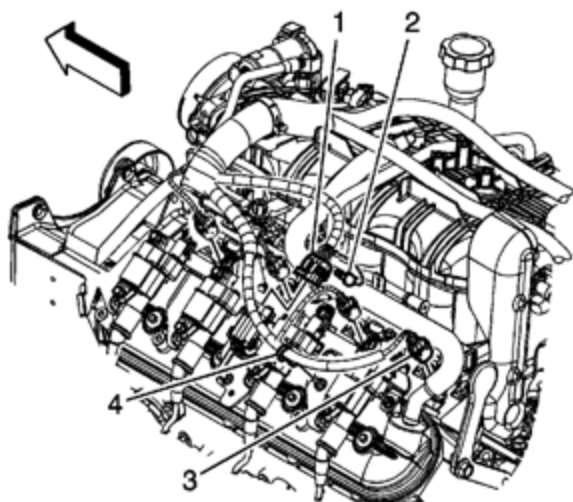
[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - On Vehicle](#) | **Document ID: 2150920**

Intake Manifold Replacement (Except LH6, LMG, LY5, L76, LY2, LY6)

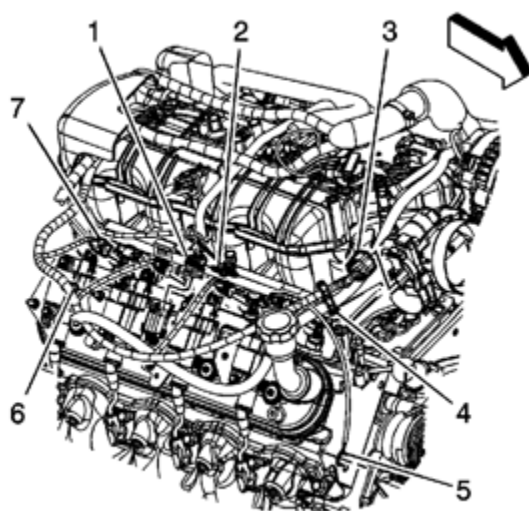
Removal Procedure



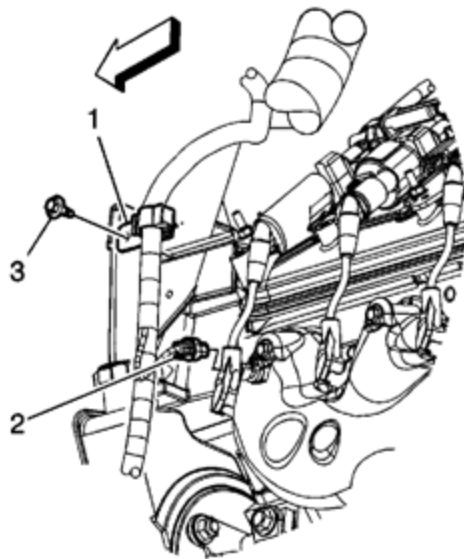
1. Remove the air cleaner outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#).
2. Remove the generator. Refer to [Generator Replacement](#).
3. Remove the engine harness retainer nut (1).
4. Remove the engine harness retainer from the stud and locator pin.
5. Disconnect the engine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



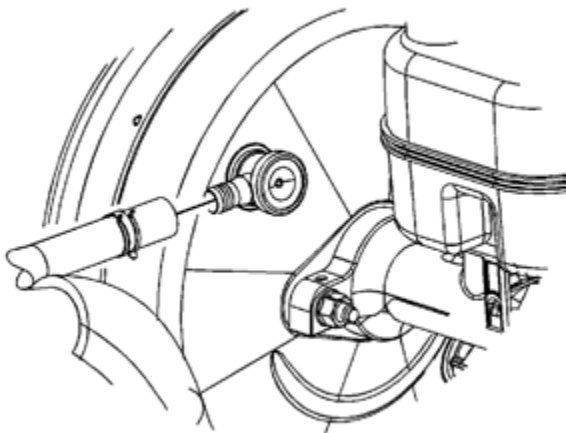
7. Remove the connector position assurance (CPA) retainer (1).
8. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
9. Disconnect the engine harness electrical connectors (3) from the left side fuel injectors.
10. Remove the engine harness clip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



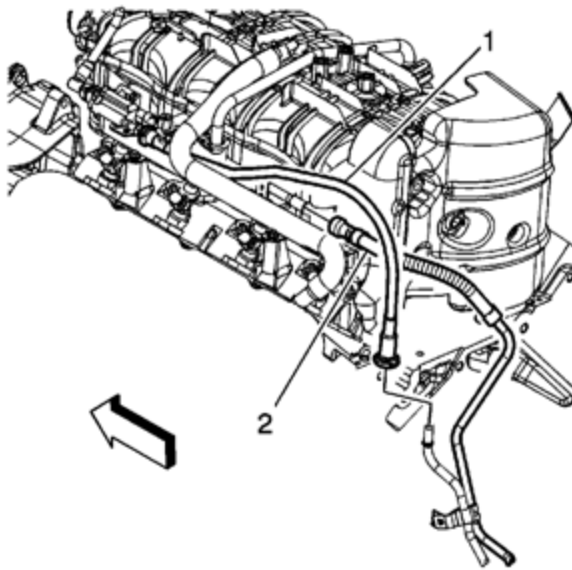
11. Remove the CPA retainer (2).
12. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
13. Disconnect the engine harness electrical connector (3) from the throttle actuator.
14. Remove the engine harness clip (4) from the generator battery jumper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



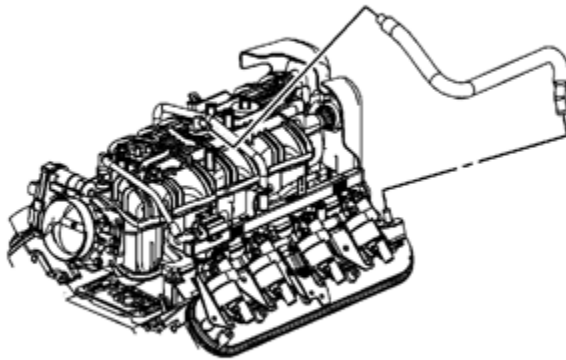
17. Remove the engine harness clip (1) bolt (3).
18. Disconnect the engine harness electrical connector (2) from the engine coolant temperature (ECT) sensor.
19. Gather the engine harness branches and tie the harness up out of the way to the cowl panel.



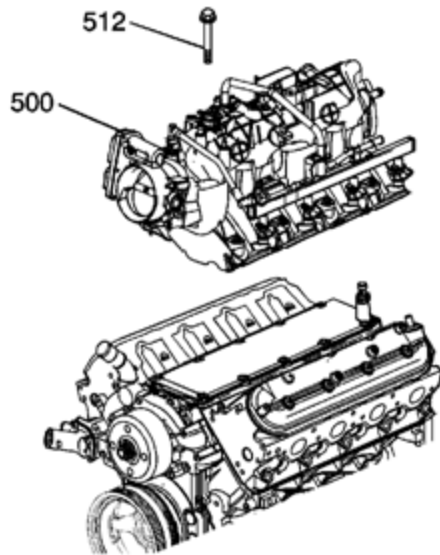
20. Reposition the brake booster vacuum hose clamp at the booster.
21. Remove the brake booster vacuum hose from the booster fitting.
22. Secure the brake booster vacuum hose to the intake manifold.



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



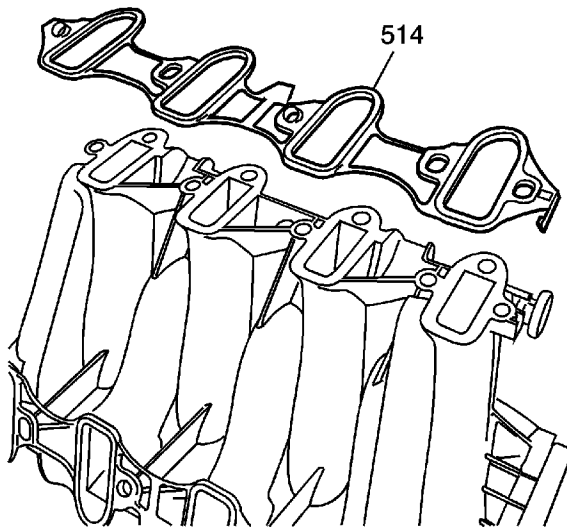
25. Remove the positive crankcase ventilation (PCV) hose from the intake manifold fitting.
26. Position the hose out of the way.



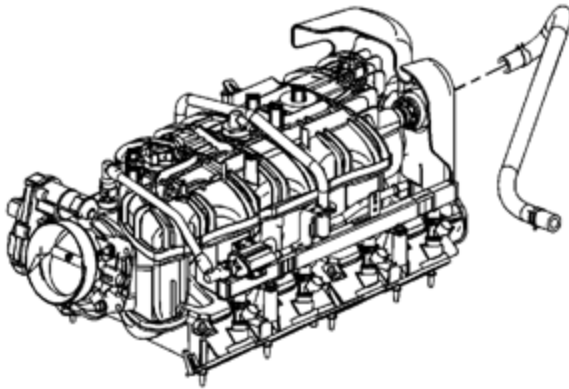
27. Loosen the intake manifold bolts (512).

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

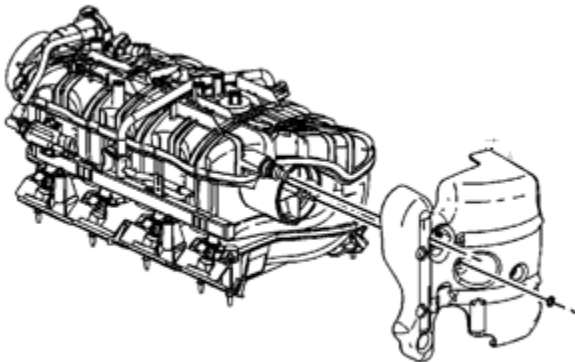
28. Remove the intake manifold (500).
29. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.



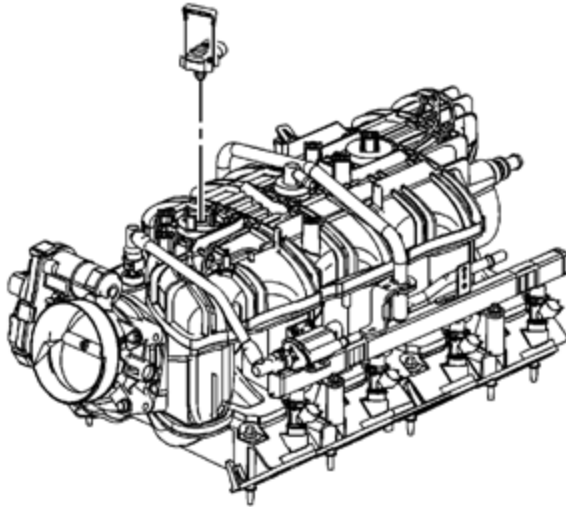
30. Remove and discard the intake manifold gaskets (514).



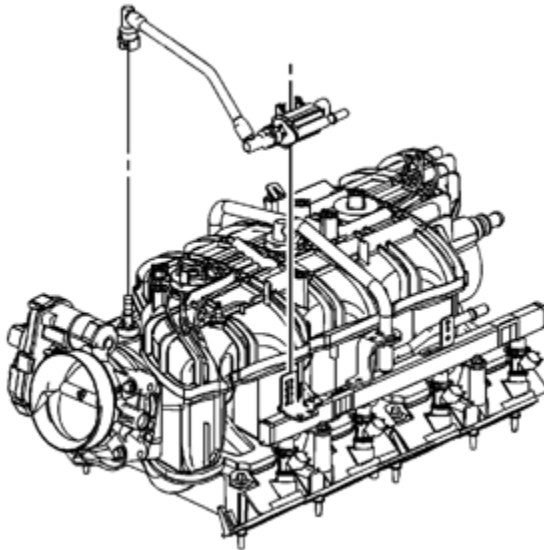
31. If replacing the intake manifold, perform the following steps, otherwise proceed to step 21 of the installation procedure.
32. Place the intake manifold on a clean work surface.
33. Reposition the brake booster vacuum hose clamp at the intake manifold.
34. Remove the brake booster vacuum hose from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



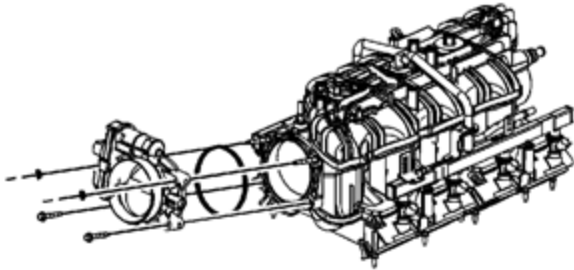
35. Remove the upper intake manifold cover nut.
36. Remove the upper intake manifold cover.



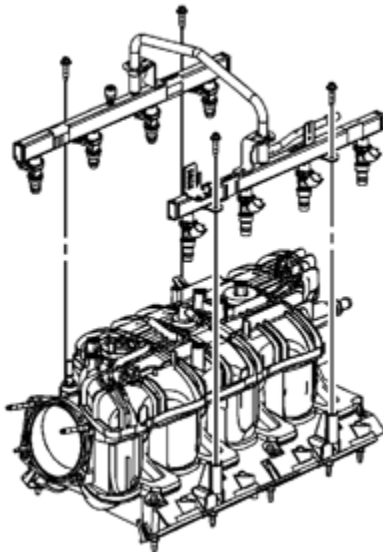
37. Remove the manifold absolute pressure (MAP) sensor retainer.
38. Remove the MAP sensor.



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



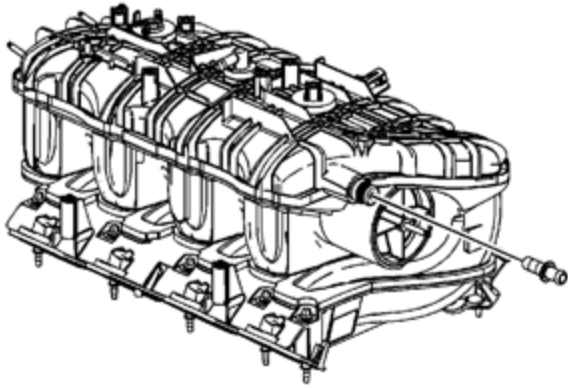
42. Remove the throttle body bolts/nuts.
43. Remove the throttle body.
44. Remove and discard the throttle body gasket.



45. Remove the fuel rail bolts.

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

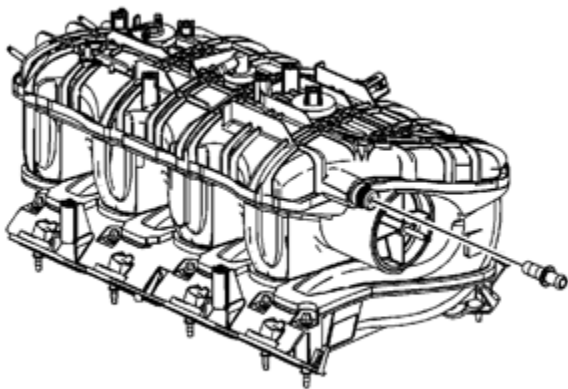
46. Remove the fuel rail.
47. Remove and discard the fuel injector lower O-ring seals.



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

48. Remove the brake booster vacuum hose nipple.

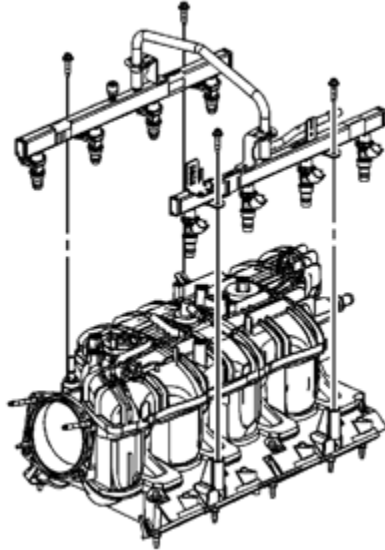
Installation Procedure



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

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

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



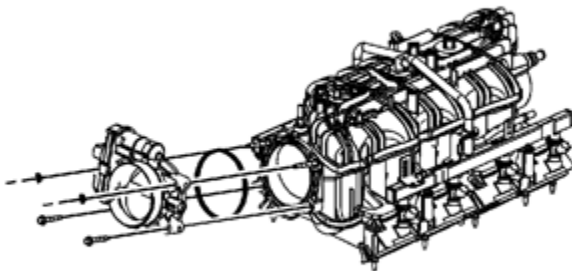
3. Install NEW fuel injector lower O-ring seals onto the injectors.
4. Lubricate the NEW O-ring seals with clean engine oil.

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

5. Install the fuel rail.

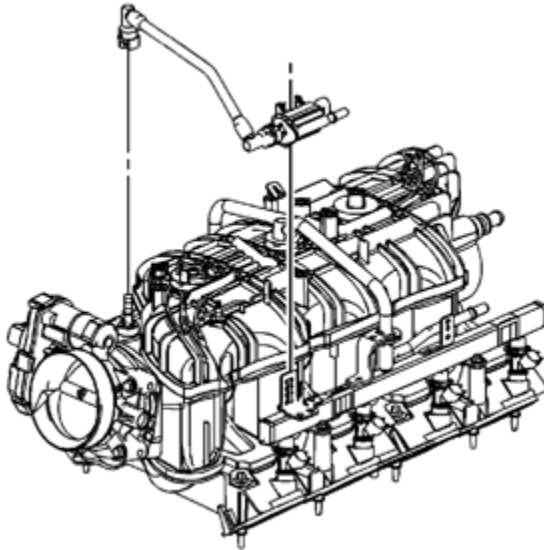
Caution: Refer to [Fastener Caution](#) in the Preface section.

6. Install the fuel rail bolts and tighten to **10 N·m (89 lb in)**.

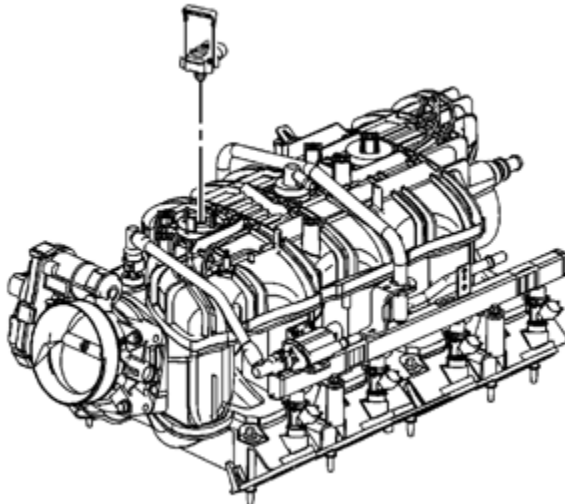


7. Install a NEW throttle body gasket to the intake manifold.

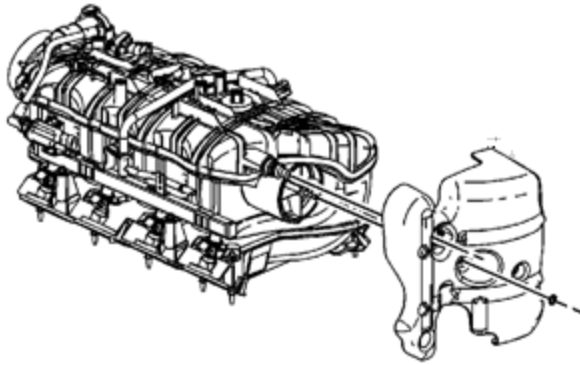
8. Install the throttle body.
9. Install the throttle body bolts/nuts and tighten to **10 N·m (89 lb in)**.



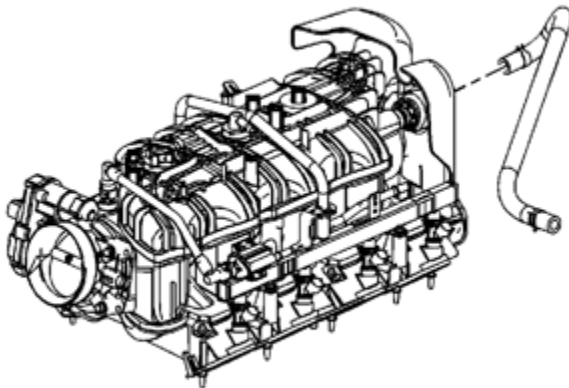
10. Install the EVAP tube and purge solenoid.
11. Install the EVAP canister purge solenoid to the fuel rail bracket and engage the retainer.
12. Connect the EVAP tube quick connect fitting at the intake manifold. Refer to [Plastic Collar Quick Connect Fitting Service](#).



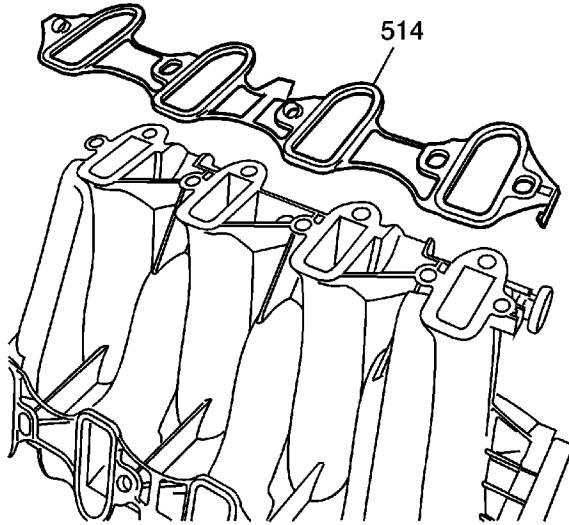
13. Lubricate the MAP sensor seal with clean engine oil.
14. Install the MAP sensor.
15. Install the MAP sensor retainer.



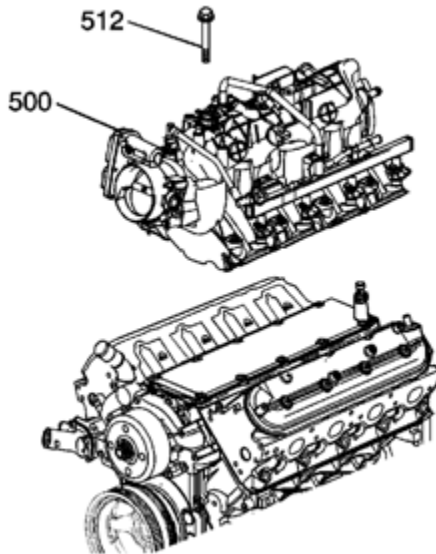
16. Install the upper intake manifold cover.
17. Install the upper intake manifold cover nut until snug



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



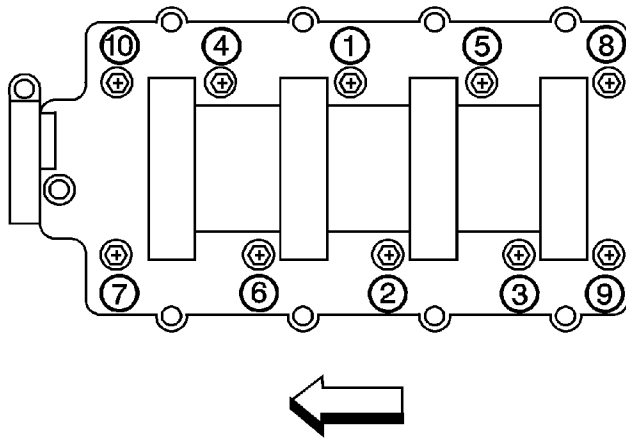
21. Install NEW intake manifold gaskets (514) to the intake manifold.
22. Remove the covers from the cylinder head passages.



23. Install the intake manifold (500).

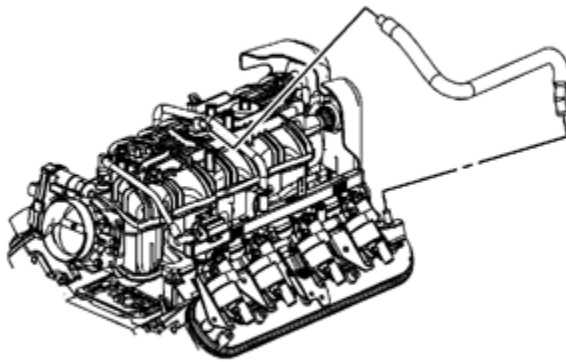
Note: The aid of an assistant may be helpful in holding the engine harness up out of the way so the upper intake manifold cover does not get caught against the engine harness.

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

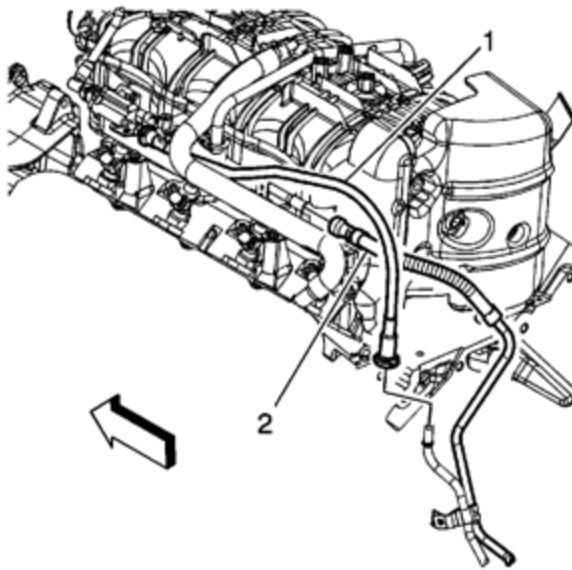


25. Tighten the intake manifold bolts to specifications.

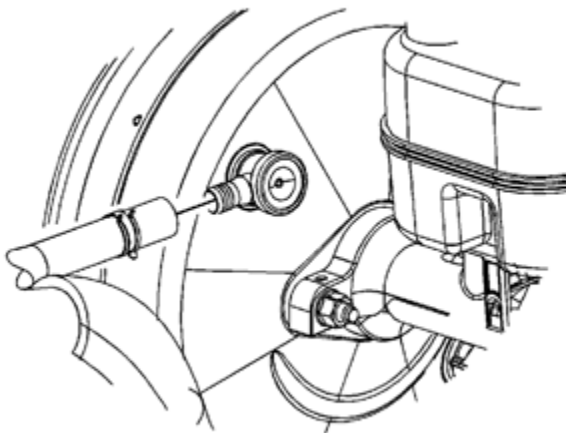
- Tighten the bolts a first pass in the sequence shown to **5 N·m (44 lb in)**.
- Tighten the bolts a final pass in the sequence shown to **10 N·m (89 lb in)**.



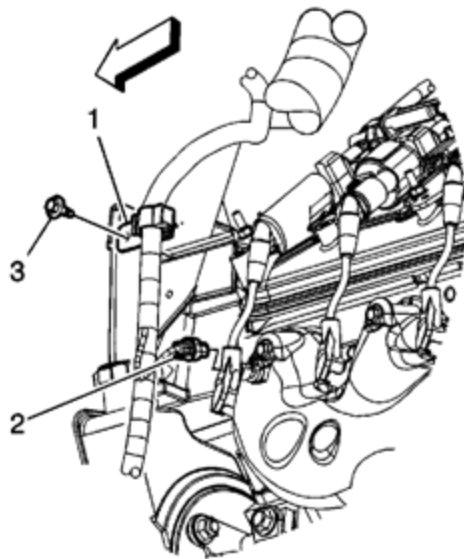
26. Position and install the PCV hose to the intake manifold fitting.



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

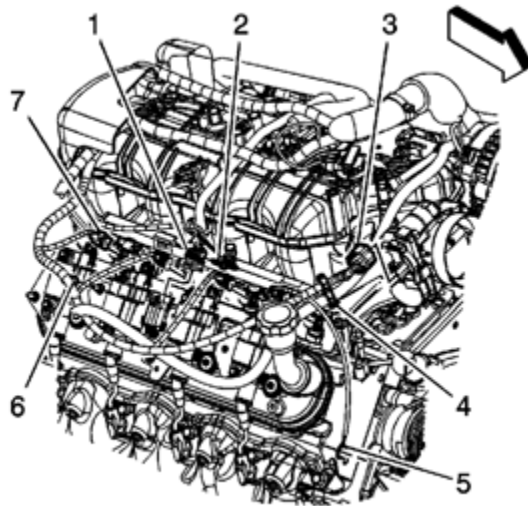


29. Unsecure the brake booster vacuum hose from the intake manifold.
30. Install the brake booster vacuum hose to the booster fitting.
31. Position the brake booster vacuum hose clamp at the booster.



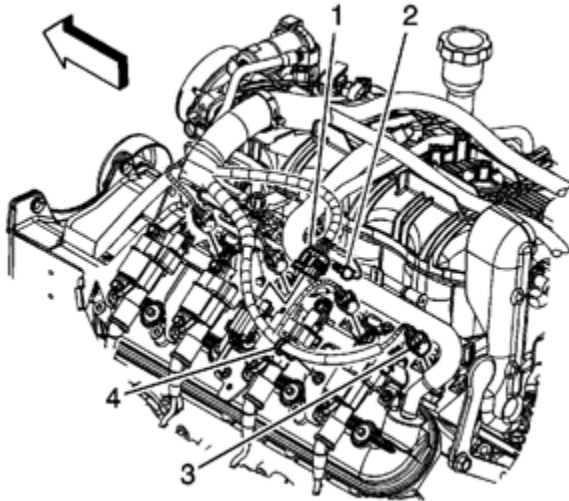
32. Untie the engine harness branches from the cowl panel and position over the engine.
33. Connect the engine harness electrical connector (2) to the ECT sensor.
34. Position the engine harness clip (1) to the generator bracket and install the bolt (3).

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

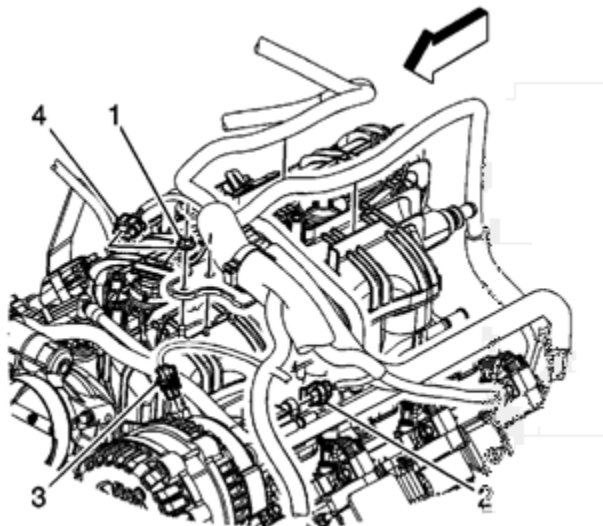


35. Connect the engine harness electrical connectors (7) to the right side fuel injectors.
36. Install the engine harness clip (6) to the ignition coil bracket stud.
37. Install the engine harness clip (4) to the generator battery jumper cable.
38. Connect the engine harness electrical connector (3)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

40. Install the CPA retainer (2).



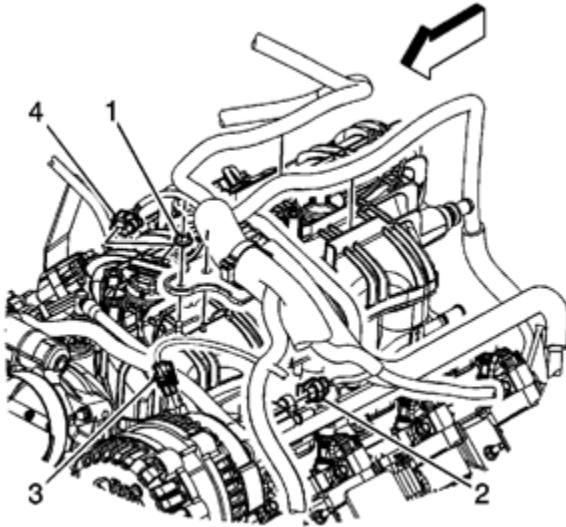
41. Install the engine harness clip (4) to the ignition coil bracket stud.
 42. Connect the engine harness electrical connectors (3) to the left side fuel injectors.
 43. Connect the engine harness electrical connector (1) to the ignition coil harness electrical connector.
 44. Install the CPA retainer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



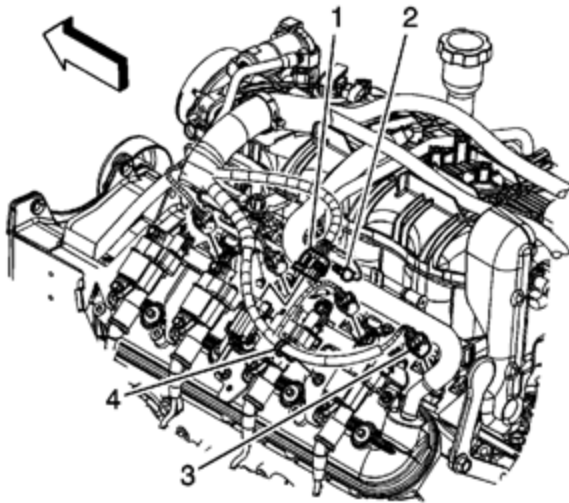
45. Connect the engine wiring harness electrical connector (4) to the MAP sensor.
 46. Connect the engine harness electrical connector (2) to the EVAP canister purge solenoid.
 47. Install the engine harness retainer to the stud and locator pin.
 48. Install the engine harness retainer nut (1) and tighten to **5 N·m (44 lb in)**.
 49. Install the generator. Refer to [Generator Replacement](#).
 50. Install the air cleaner outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#).

Intake Manifold Replacement (LH6, LMG, LY5 and L76)

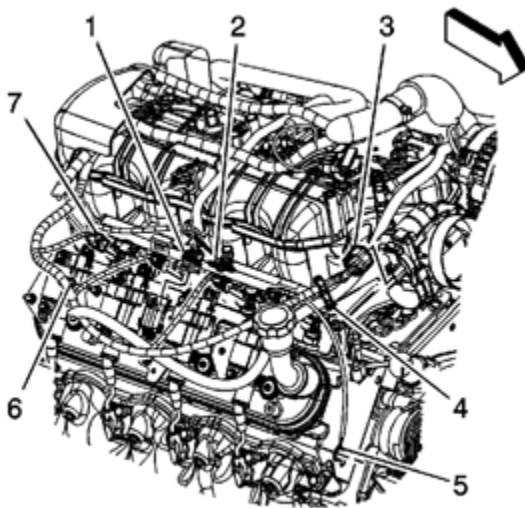
Removal Procedure



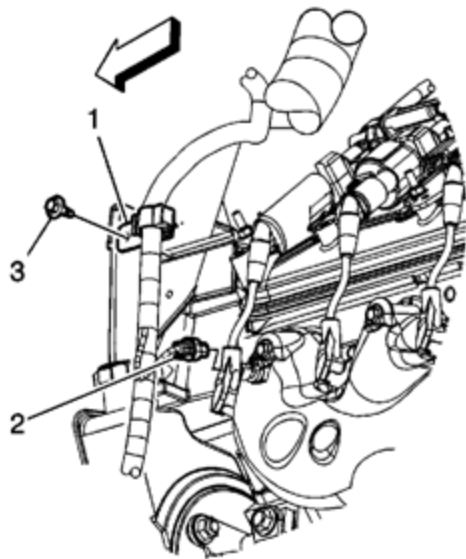
1. Remove the air cleaner outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#).
2. Remove the generator. Refer to [Generator Replacement](#).
3. Remove the engine harness retainer nut (1).
4. Remove the engine harness retainer from the stud and locator.
5. Disconnect the engine harness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



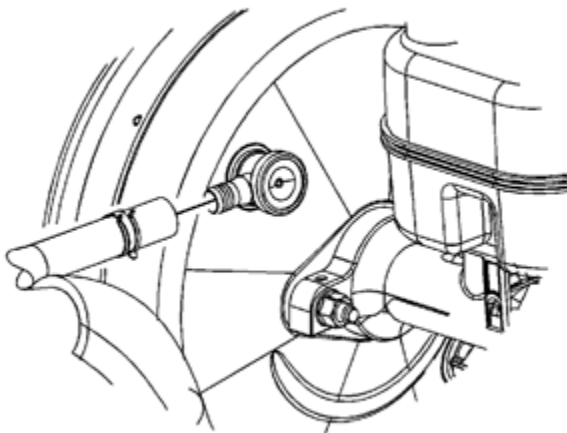
7. Remove the connector position assurance (CPA) retainer (1).
8. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
9. Disconnect the engine harness electrical connectors (3) from the left side fuel injectors.
10. Remove the engine harness clip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



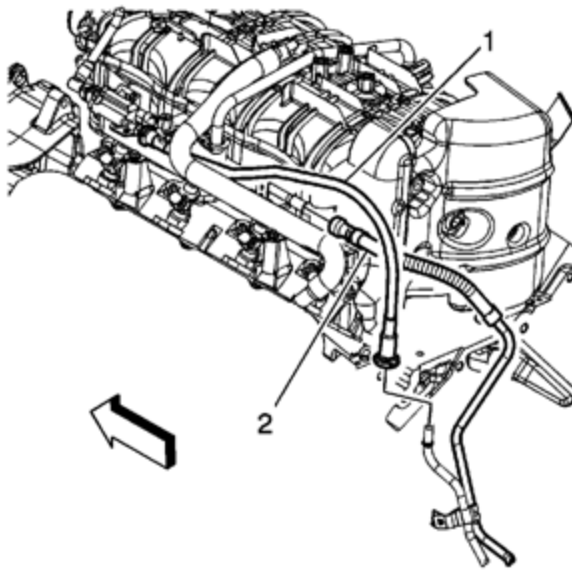
11. Remove the CPA retainer (2).
12. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
13. Disconnect the engine harness electrical connector (3) from the throttle actuator.
14. Remove the engine harness clip (4) from the generator battery jumper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



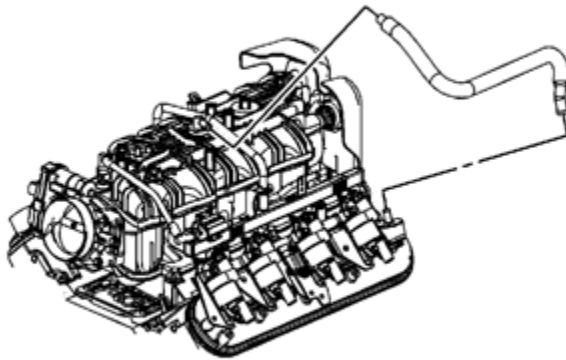
17. Remove the engine harness clip (1) bolt (3).
18. Disconnect the engine harness electrical connector (2) from the engine coolant temperature (ECT) sensor.
19. Gather the engine harness branches and tie the harness up out of the way to the cowl panel.



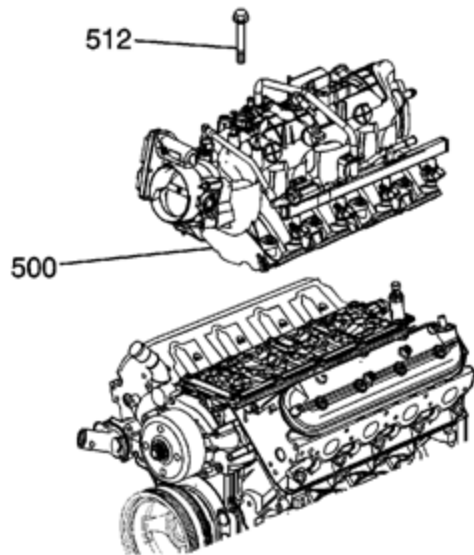
20. Reposition the brake booster vacuum hose clamp at the booster, if necessary.
21. Remove the brake booster vacuum hose from the booster fitting, if necessary.
22. Secure the brake booster vacuum hose to the intake manifold if necessary.



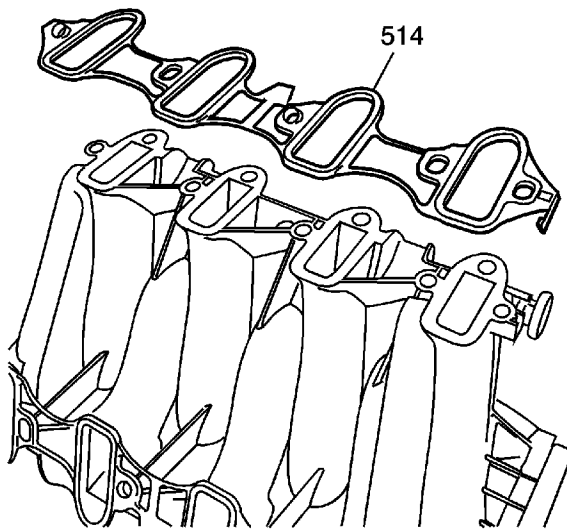
23. Disconnect the EVAP canister purge tube (1) quick connect fitting from the EVAP canister purge solenoid. Refer to [Plastic Collar Quick Connect Fitting Service](#).
24. Disconnect the fuel feed line quick connect fitting (2) from the fuel rail. Refer to [Metal Collar Quick Connect Fitting Service](#).



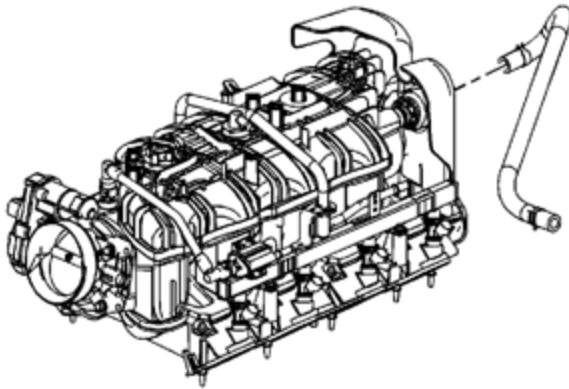
25. Remove the positive crankcase ventilation (PCV) hose from the intake manifold fitting.



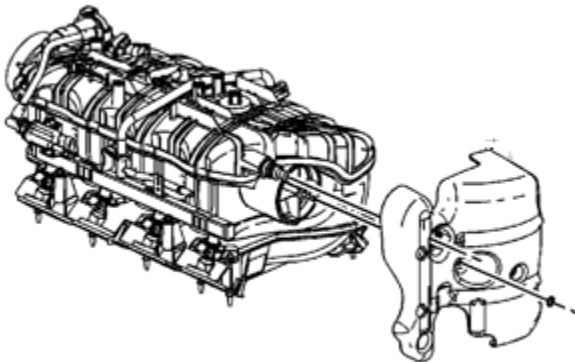
26. Loosen the intake manifold bolts.
27. Remove the intake manifold (500).



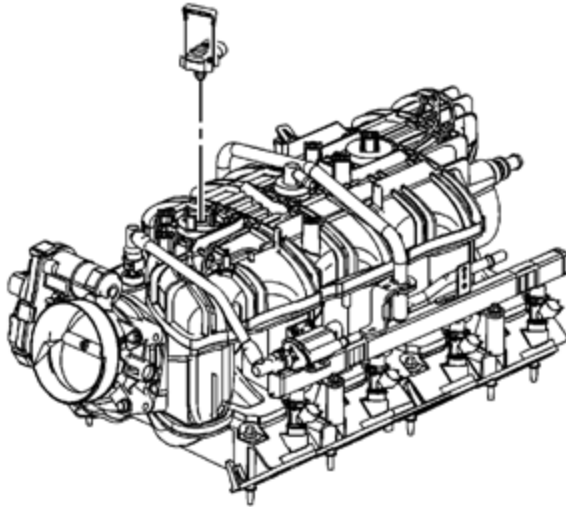
28. Remove and discard the intake manifold gaskets (514).
29. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.



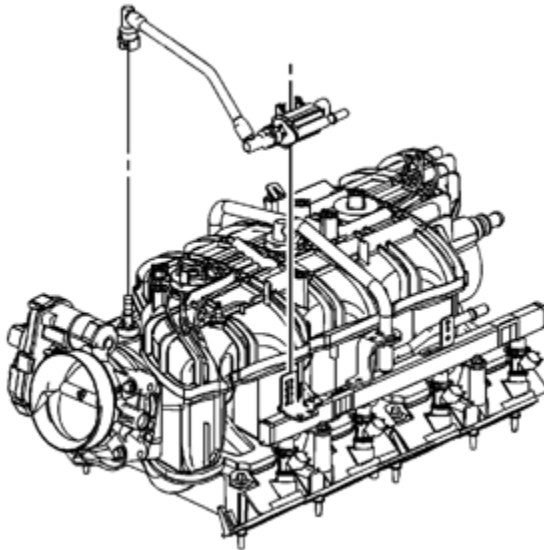
30. If replacing the intake manifold, perform the following steps, otherwise proceed to step 21 of the installation procedure.
31. Place the intake manifold on a clean work surface.
32. Reposition the brake booster vacuum hose clamp at the intake manifold.
33. Remove the brake booster vacuum hose from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



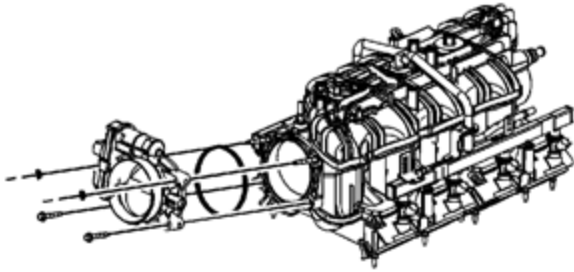
34. Remove the upper intake manifold cover nut.
35. Remove the upper intake manifold cover.



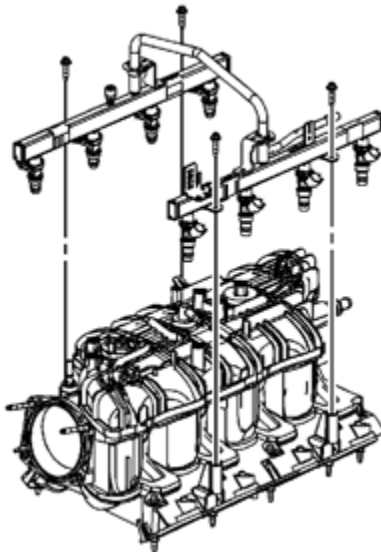
36. Remove the manifold absolute pressure (MAP) sensor retainer.
37. Remove the MAP sensor.



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



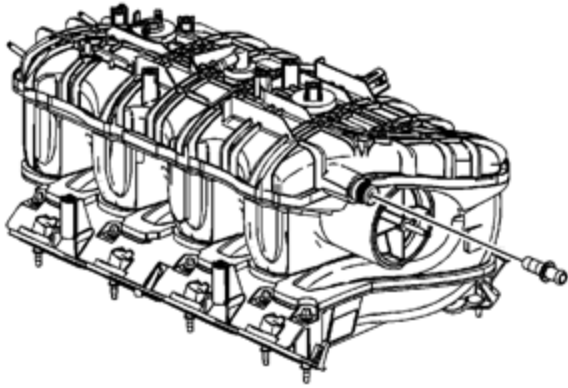
41. Remove the throttle body bolts/nuts.
42. Remove the throttle body.
43. Remove and discard the throttle body gasket.



44. Remove the fuel rail bolts.

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

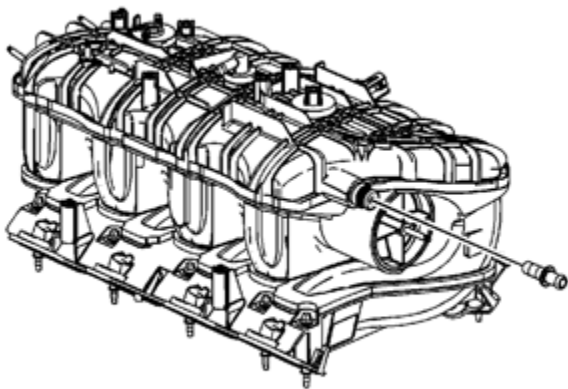
45. Remove the fuel rail.
46. Remove and discard the fuel injector lower O-ring seals.



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

47. Remove the brake booster vacuum hose nipple.

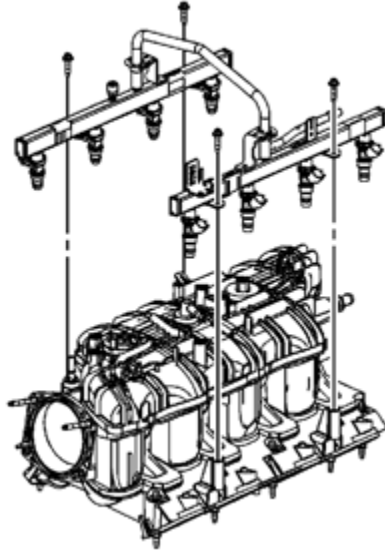
Installation Procedure



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

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

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



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

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

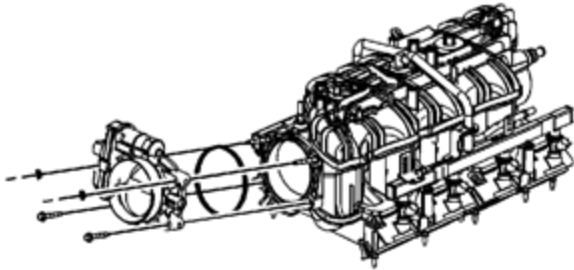
5. Install the fuel rail.

Caution: Refer to [Fastener Caution](#) in the Preface section.

6. Install the fuel rail bolts.

Tighten

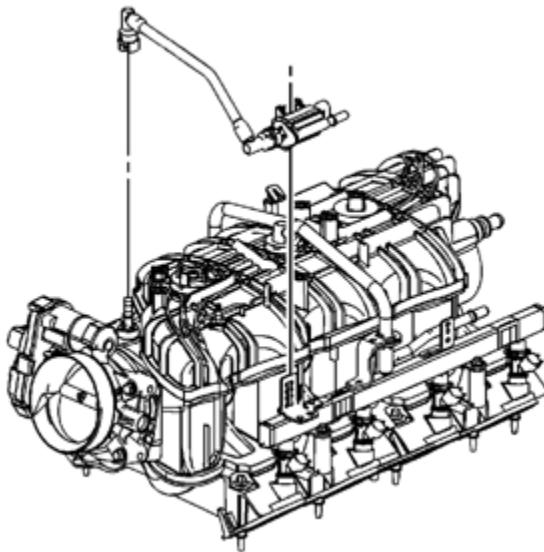
Tighten the bolts to 10 N·m (89 lb in).



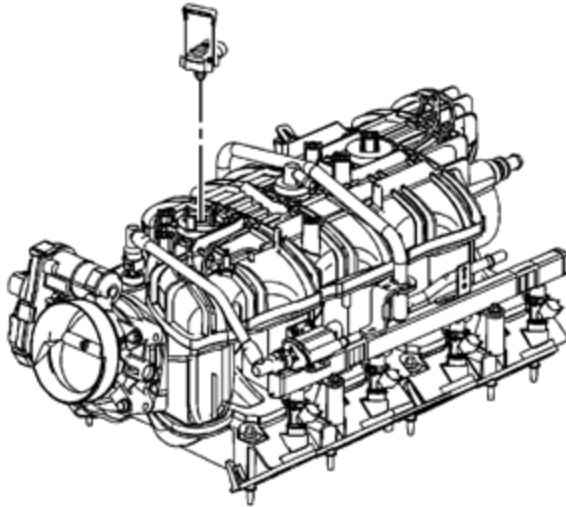
7. Install a NEW throttle body gasket to the intake manifold.
8. Install the throttle body.
9. Install the throttle body bolts/nuts.

Tighten

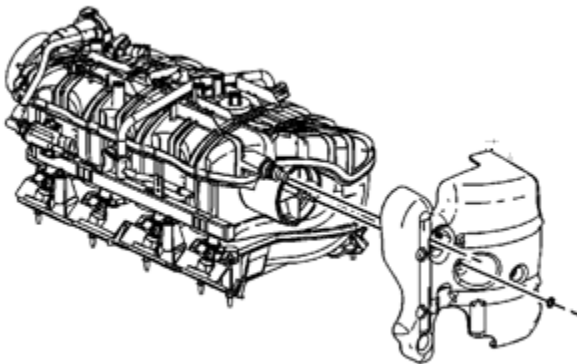
Tighten the bolts/nuts to 10 N·m (89 lb in).



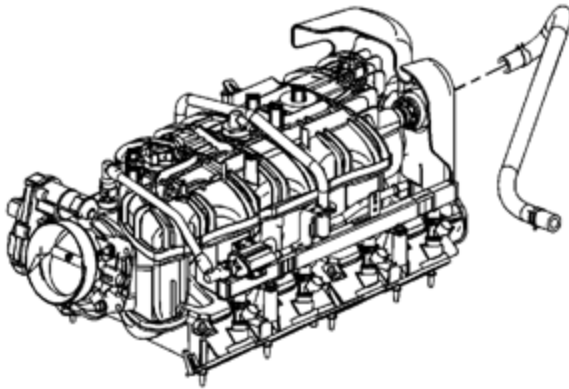
10. Install the EVAP tube and purge solenoid.
11. Install the EVAP canister purge solenoid to the fuel rail bracket and engage the retainer.
12. Connect the EVAP tube quick connect fitting at the intake manifold. Refer to [Plastic Collar Quick Connect Fitting Service](#).



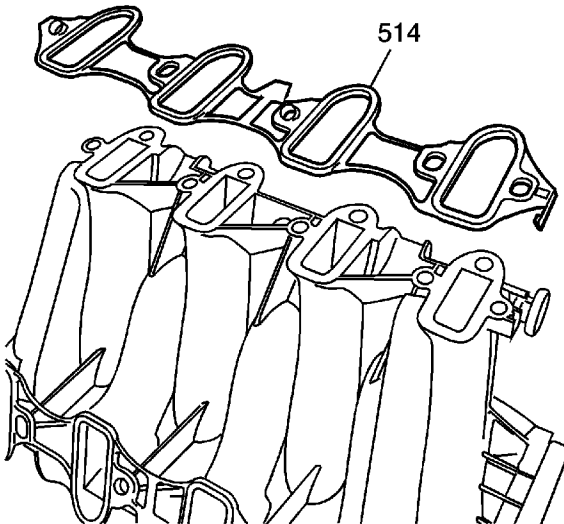
13. Lubricate the MAP sensor seal with clean engine oil.
14. Install the MAP sensor.
15. Install the MAP sensor retainer.



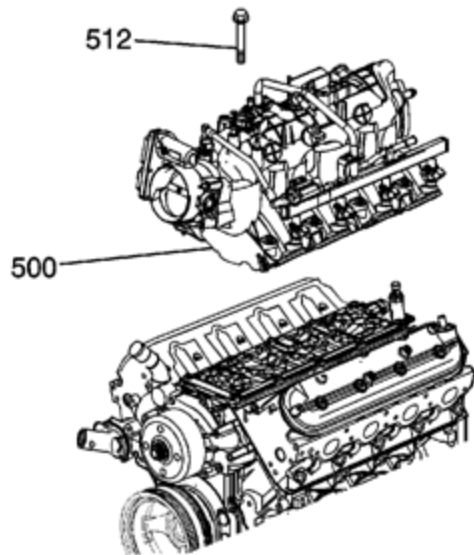
16. Install the upper intake manifold cover.
17. Install the upper intake manifold cover nut until snug



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



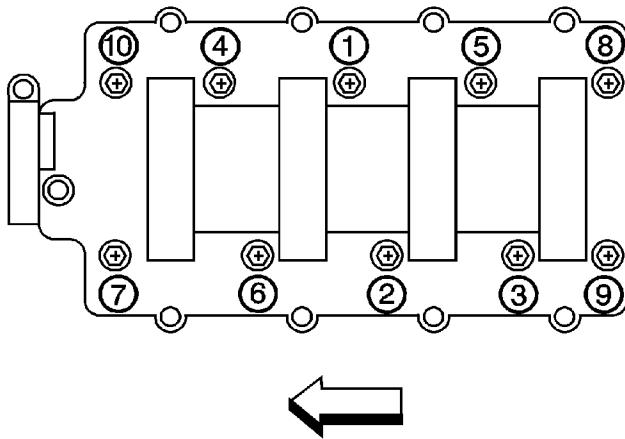
21. Install NEW intake manifold gaskets (514) to the intake manifold.
22. Remove the covers from the cylinder head passages.



23. Install the intake manifold (500).

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

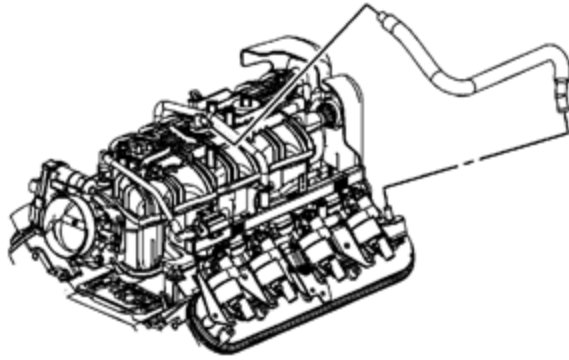
24. Tighten the intake manifold bolts (512) until snug.



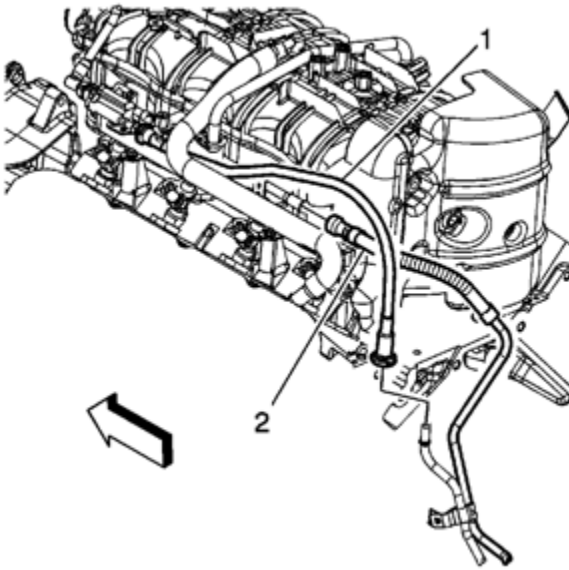
25. Tighten the intake manifold bolts to specifications.

Tighten

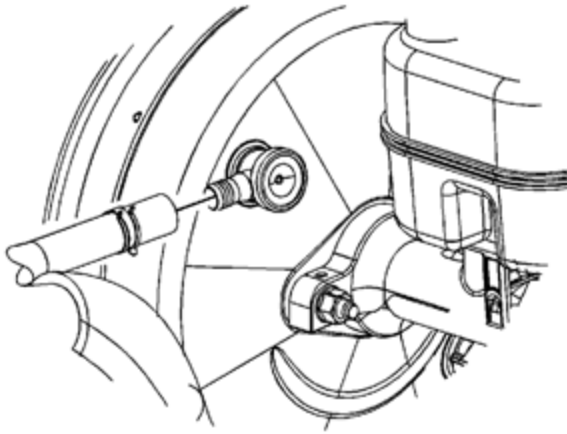
- Tighten the bolts a first pass in the sequence shown to 5 N·m (44 lb in).
- Tighten the bolts a final pass in the sequence shown to 10 N·m (89 lb in).



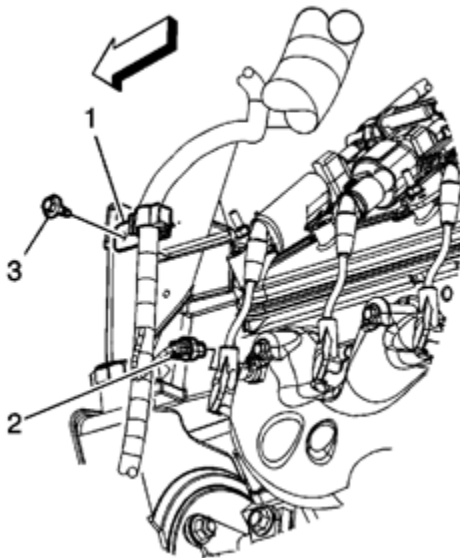
26. Position and install the PCV hose to the intake manifold fitting.



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



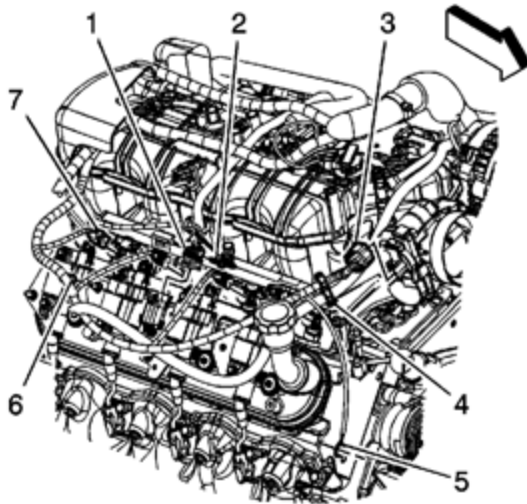
29. Unsecure the brake booster vacuum hose from the intake manifold, if removed.
30. Install the brake booster vacuum hose to the booster fitting, if removed.
31. Position the brake booster vacuum hose clamp at the booster, if removed.



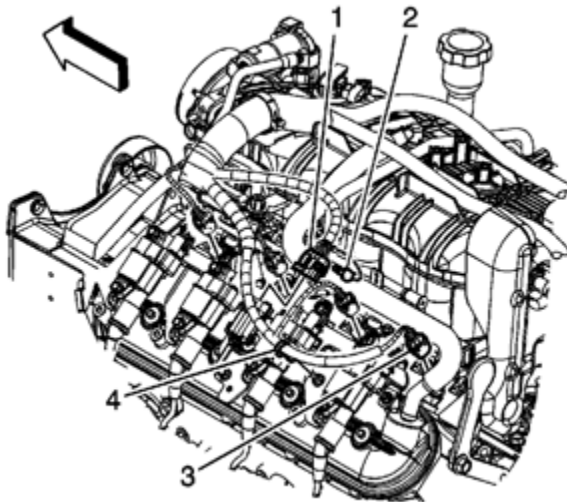
32. Untie the engine harness branches from the cowl panel and position over the engine.
33. Connect the engine harness electrical connector (2) to the ECT sensor.
34. Position the engine harness clip (1) to the generator bracket and install the bolt (3).

Tighten

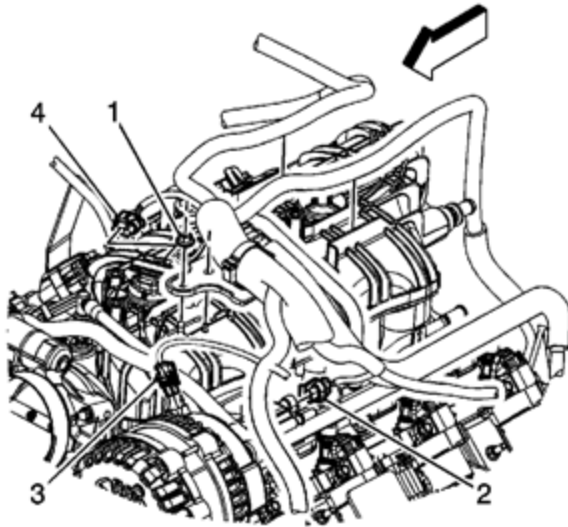
Tighten the bolt to 9 N·m (80 lb in).



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



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



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

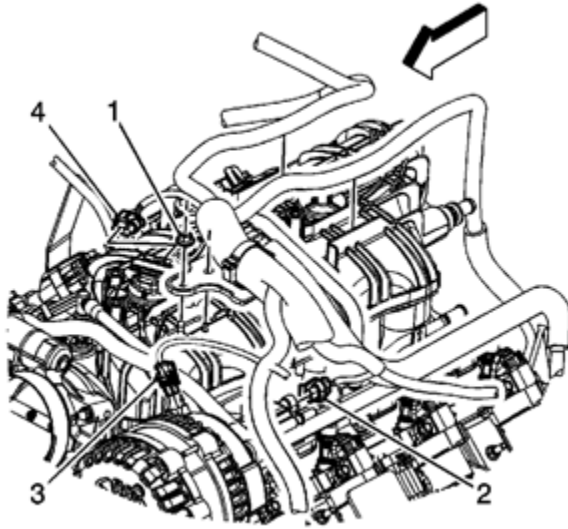
Tighten

Tighten the nut to 5 N·m (44 lb in).

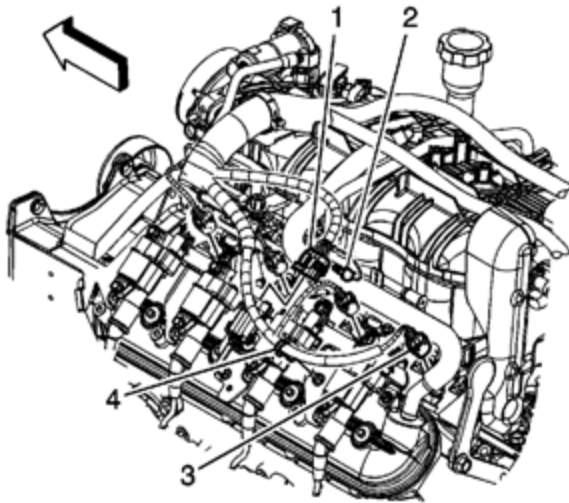
49. Install the generator. Refer to [Generator Replacement](#).
50. Install the air cleaner outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#).

Intake Manifold Replacement (LY2 and LY6)

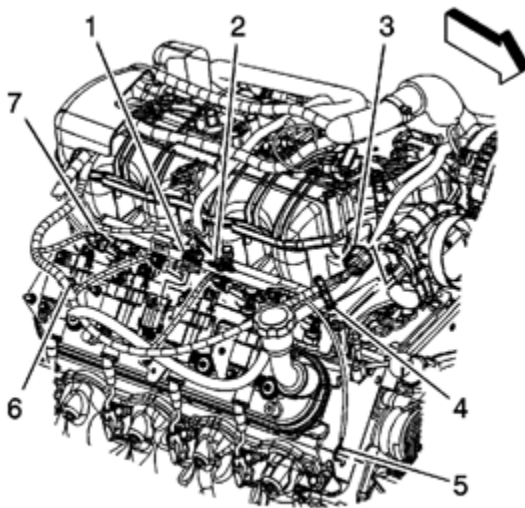
Removal Procedure



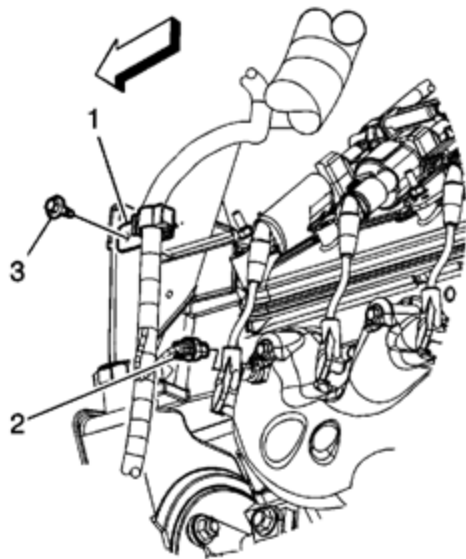
1. Remove the air cleaner outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#).
2. Remove the generator. Refer to [Generator Replacement](#).
3. Remove the engine harness retainer nut (1).
4. Remove the engine harness retainer from the stud and locator pin.
5. Disconnect the engine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



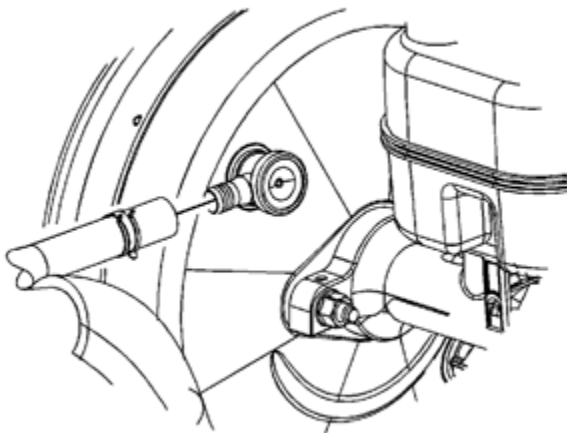
7. Remove the connector position assurance (CPA) retainer (1).
8. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
9. Disconnect the engine harness electrical connectors (3) from the left side fuel injectors.
10. Remove the engine harness clip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



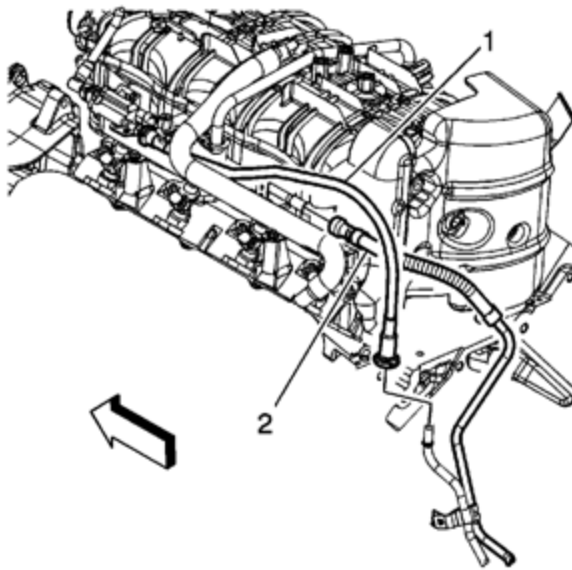
11. Remove the CPA retainer (2).
12. Disconnect the engine harness electrical connector (1) from the ignition coil harness electrical connector.
13. Disconnect the engine harness electrical connector (3) from the throttle actuator.
14. Remove the engine harness clip (4) from the generator battery jumper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



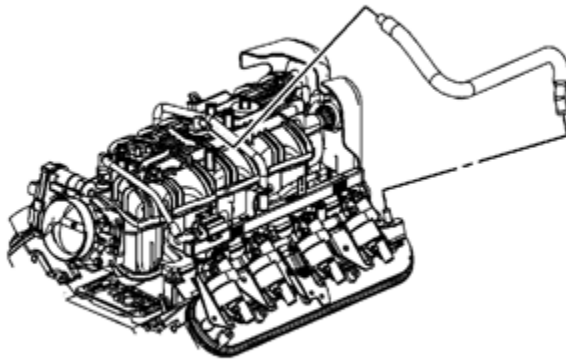
17. Remove the engine harness clip (1) bolt (3).
18. Disconnect the engine harness electrical connector (2) from the engine coolant temperature (ECT) sensor.
19. Gather the engine harness branches and tie the harness up out of the way to the cowl panel.



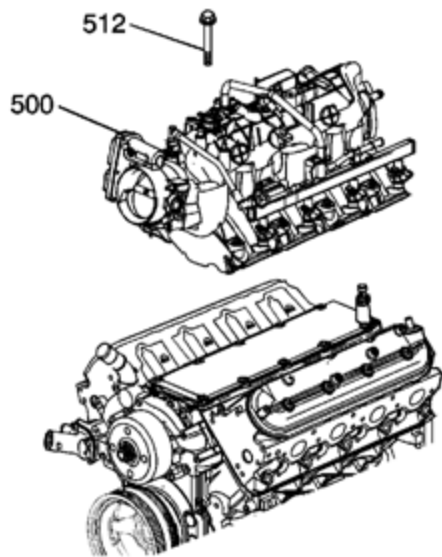
20. Reposition the brake booster vacuum hose clamp at the booster.
21. Remove the brake booster vacuum hose from the booster fitting.
22. Secure the brake booster vacuum hose to the intake manifold.



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



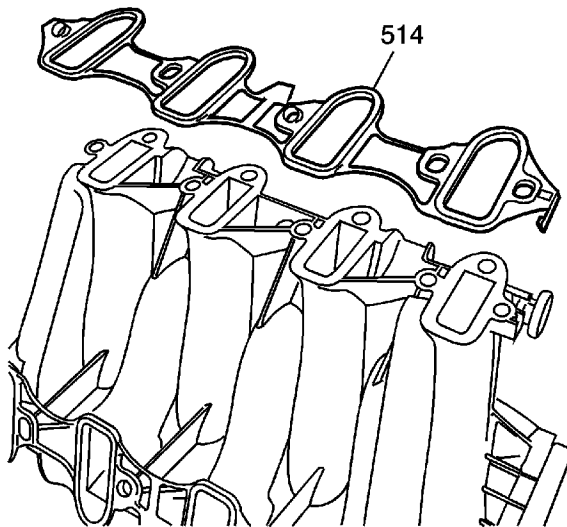
25. Remove the positive crankcase ventilation (PCV) hose from the intake manifold fitting.
26. Position the hose out of the way.



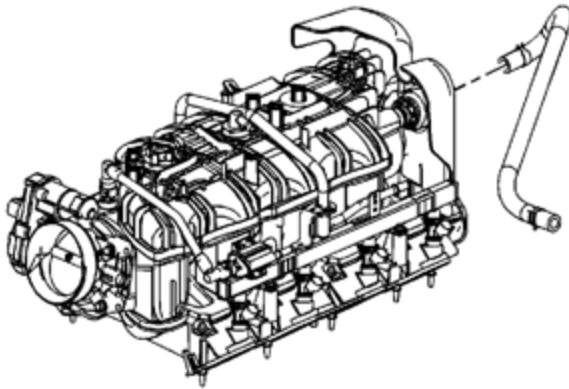
27. Loosen the intake manifold bolts (512).

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

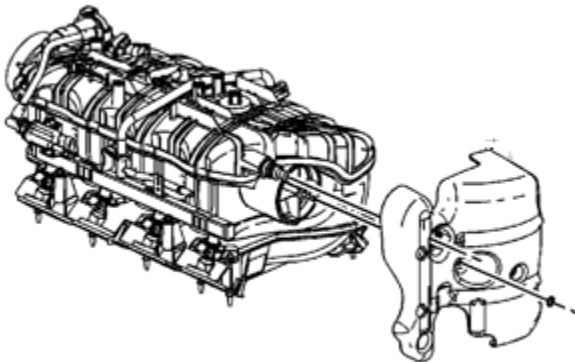
28. Remove the intake manifold (500).
29. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.



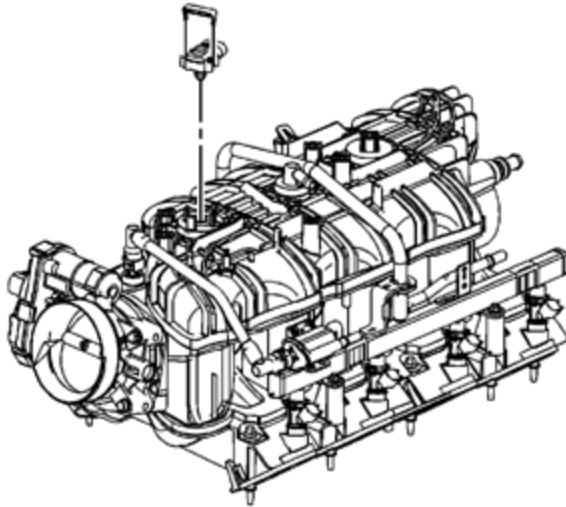
30. Remove and discard the intake manifold gaskets (514).



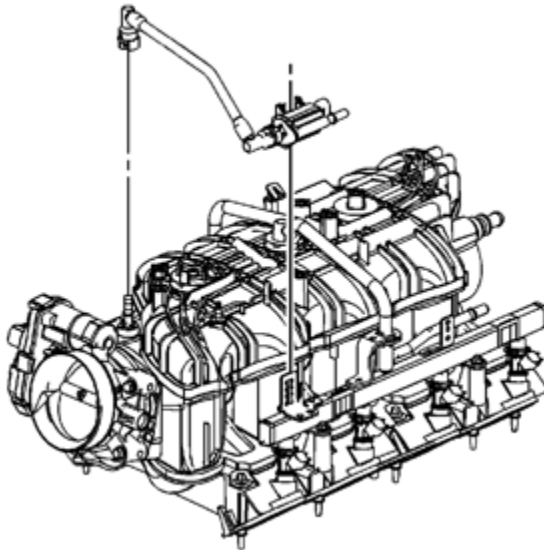
31. If replacing the intake manifold, perform the following steps, otherwise proceed to step 21 of the installation procedure.
32. Place the intake manifold on a clean work surface.
33. Reposition the brake booster vacuum hose clamp at the intake manifold.
34. Remove the brake booster vacuum hose from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



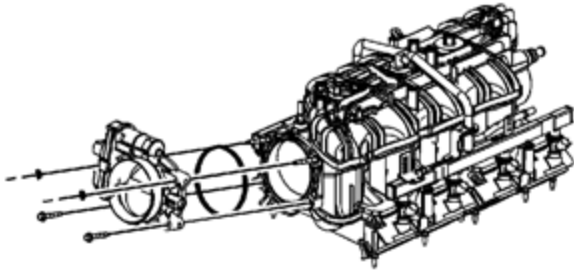
35. Remove the upper intake manifold cover nut.
36. Remove the upper intake manifold cover.



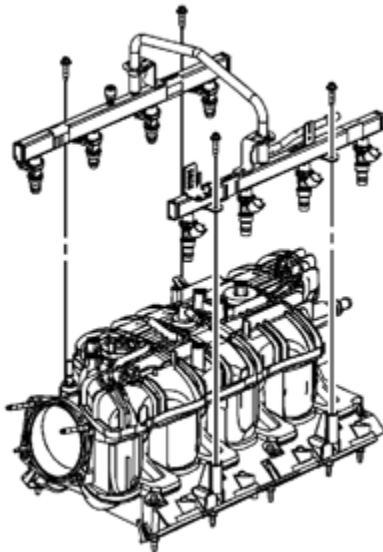
37. Remove the manifold absolute pressure (MAP) sensor retainer.
38. Remove the MAP sensor.



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



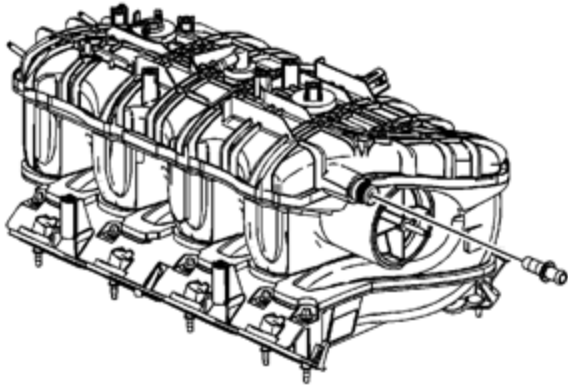
42. Remove the throttle body bolts/nuts.
43. Remove the throttle body.
44. Remove and discard the throttle body gasket.



45. Remove the fuel rail bolts.

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

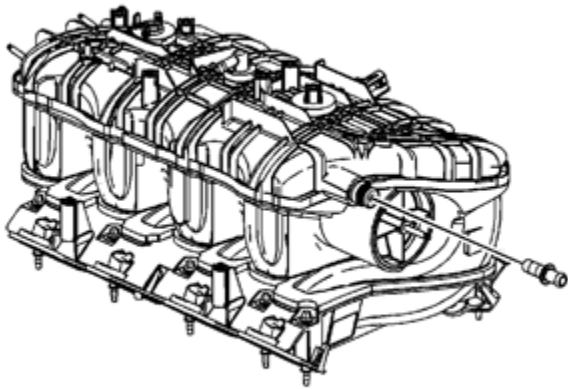
46. Remove the fuel rail.
47. Remove and discard the fuel injector lower O-ring seals.



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

48. Remove the brake booster vacuum hose nipple.

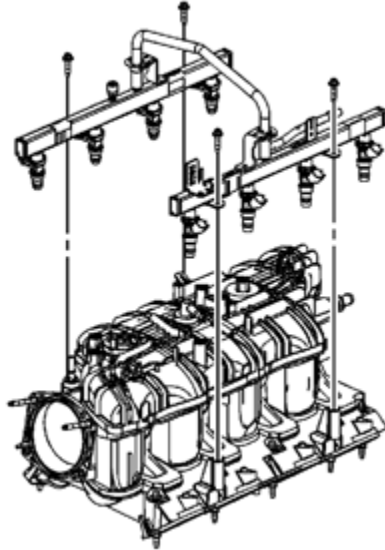
Installation Procedure



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

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

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



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

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

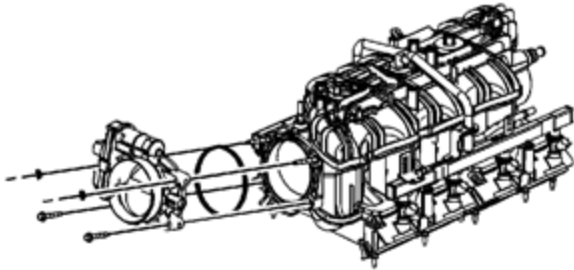
5. Install the fuel rail.

Caution: Refer to [Fastener Caution](#) in the Preface section.

6. Install the fuel rail bolts.

Tighten

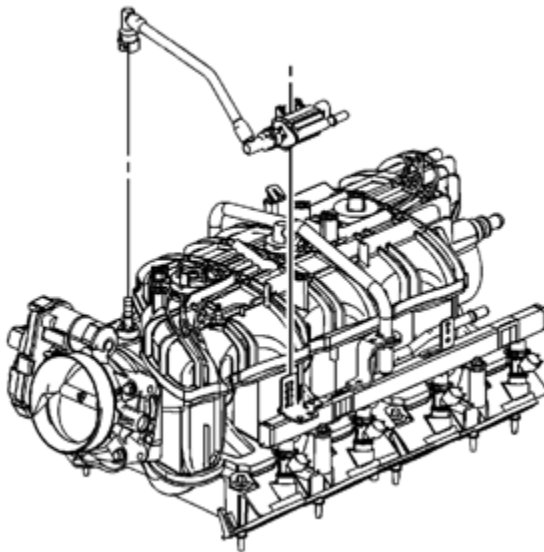
Tighten the bolts to 10 N·m (89 lb in).



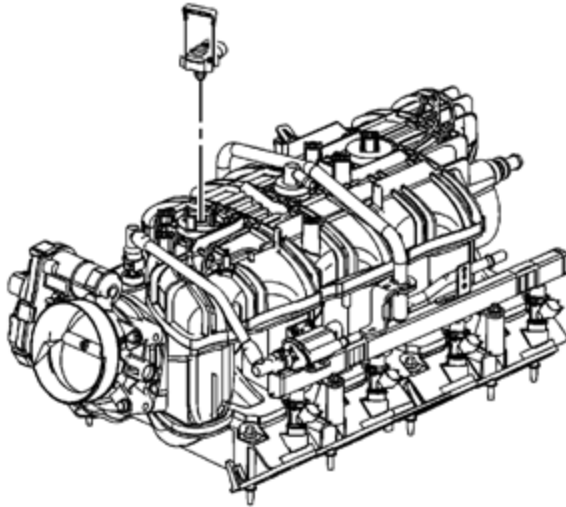
7. Install a NEW throttle body gasket to the intake manifold.
8. Install the throttle body.
9. Install the throttle body bolts/nuts.

Tighten

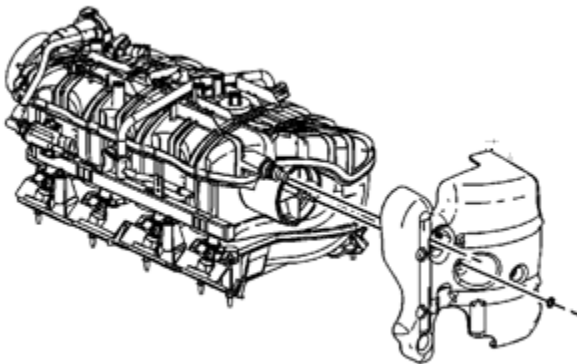
Tighten the bolts/nuts to 10 N·m (89 lb in).



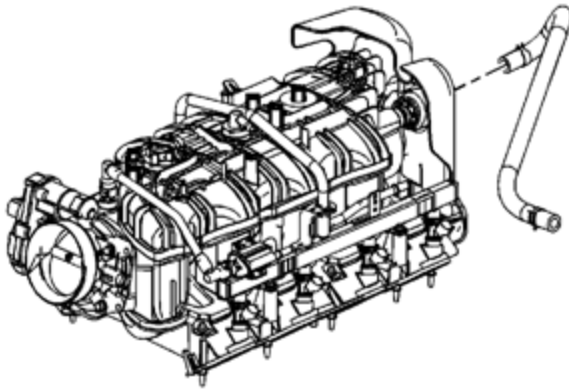
10. Install the EVAP tube and purge solenoid.
11. Install the EVAP canister purge solenoid to the fuel rail bracket and engage the retainer.
12. Connect the EVAP tube quick connect fitting at the intake manifold. Refer to [Plastic Collar Quick Connect Fitting Service](#).



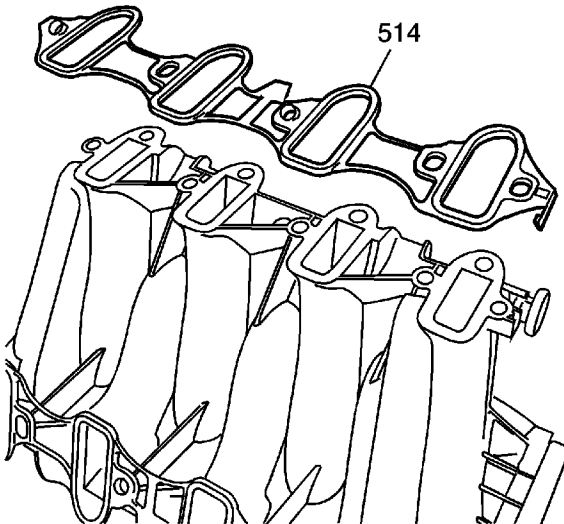
13. Lubricate the MAP sensor seal with clean engine oil.
14. Install the MAP sensor.
15. Install the MAP sensor retainer.



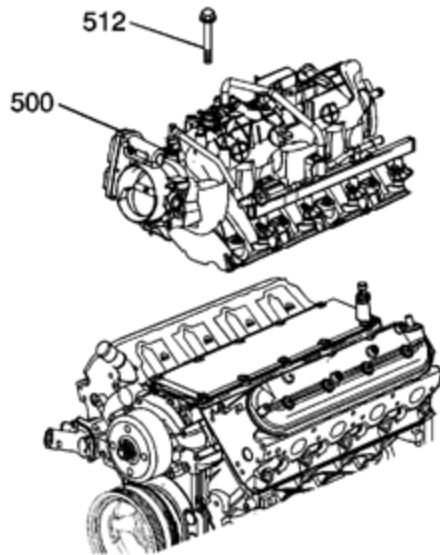
16. Install the upper intake manifold cover.
17. Install the upper intake manifold cover nut until snug



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



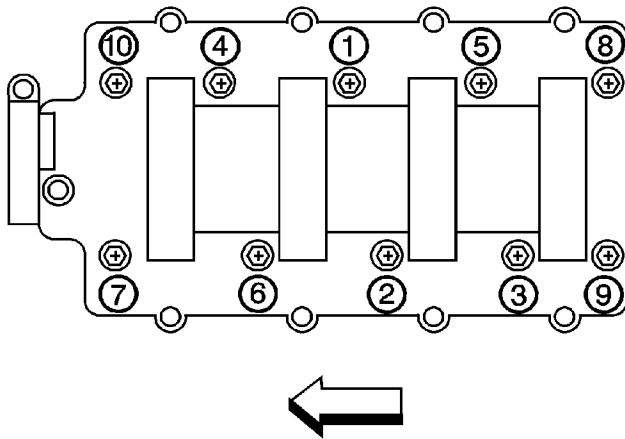
21. Install NEW intake manifold gaskets (514) to the intake manifold.
22. Remove the covers from the cylinder head passages.



23. Install the intake manifold (500).

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

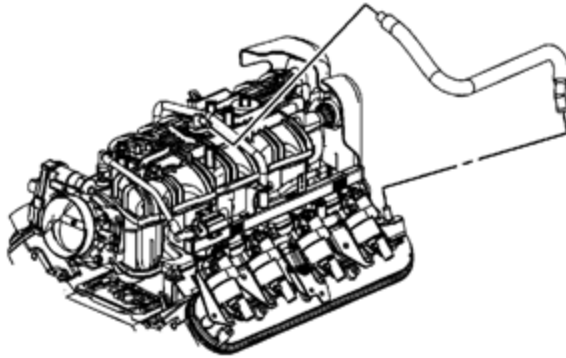
24. Tighten the intake manifold bolts (512) until snug.



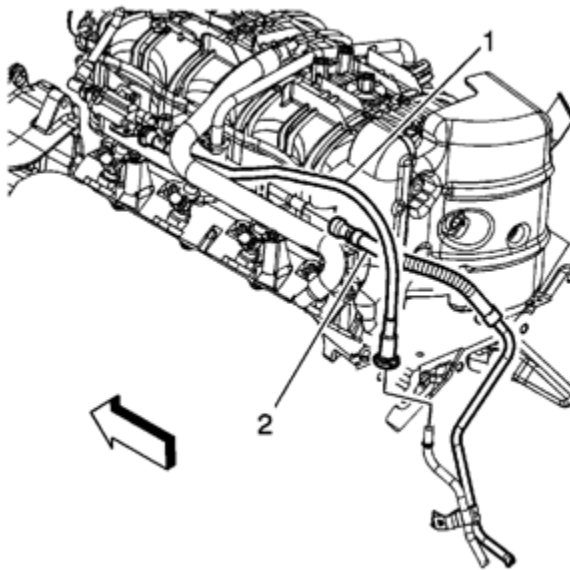
25. Tighten the intake manifold bolts to specifications.

Tighten

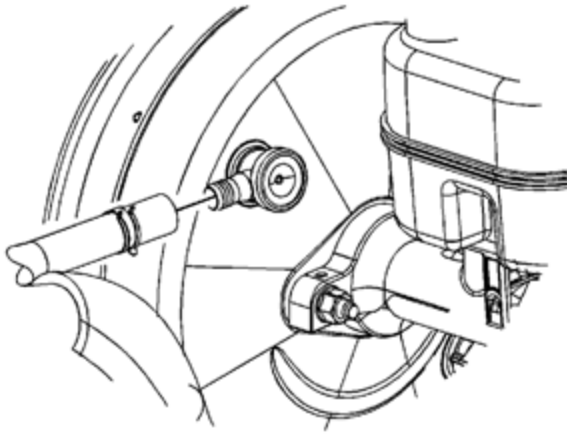
- Tighten the bolts a first pass in the sequence shown to 5 N·m (44 lb in).
- Tighten the bolts a final pass in the sequence shown to 10 N·m (89 lb in).



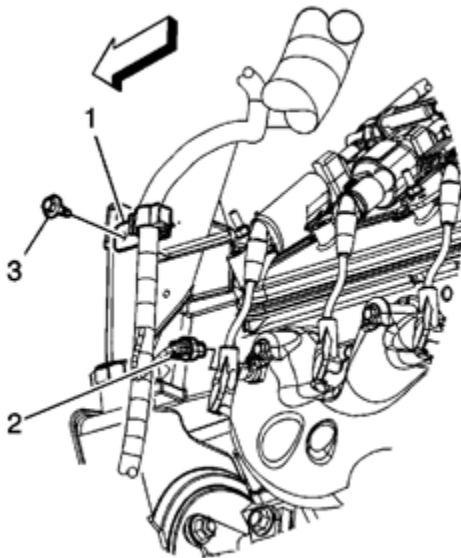
26. Position and install the PCV hose to the intake manifold fitting.



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



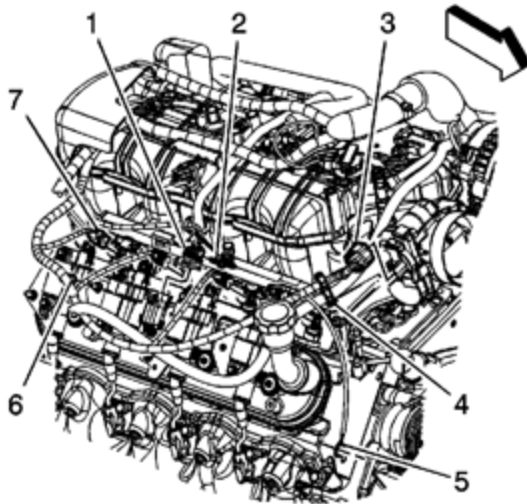
29. Unsecure the brake booster vacuum hose from the intake manifold.
30. Install the brake booster vacuum hose to the booster fitting.
31. Position the brake booster vacuum hose clamp at the booster.



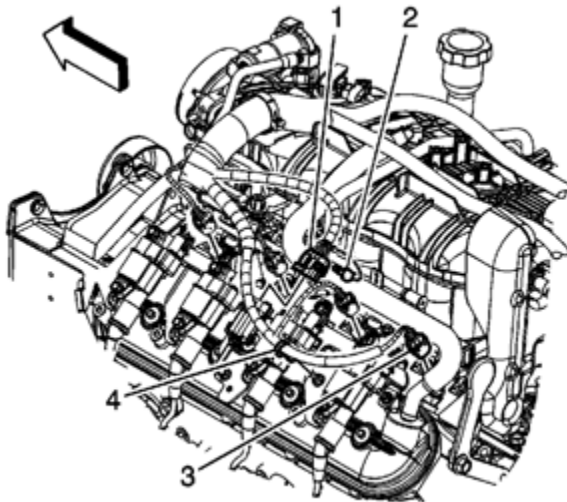
32. Untie the engine harness branches from the cowl panel and position over the engine.
33. Connect the engine harness electrical connector (2) to the ECT sensor.
34. Position the engine harness clip (1) to the generator bracket and install the bolt (3).

Tighten

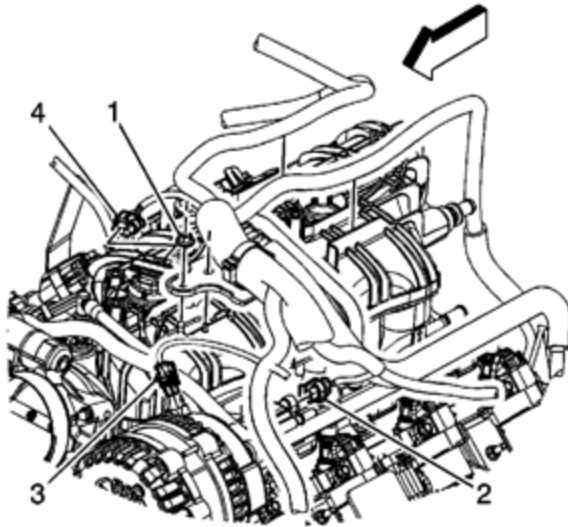
Tighten the bolt to 9 N·m (80 lb in).



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



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



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

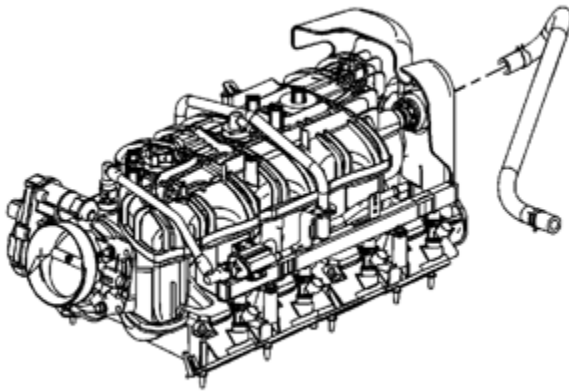
Tighten

Tighten the nut to 5 N·m (44 lb in).

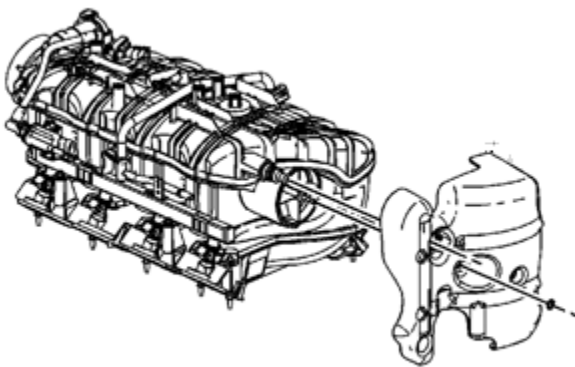
49. Install the generator. Refer to [Generator Replacement](#).
50. Install the air cleaner outlet duct. Refer to [Air Cleaner Resonator Outlet Duct Replacement](#).

Upper Intake Manifold Cover Replacement

Removal Procedure

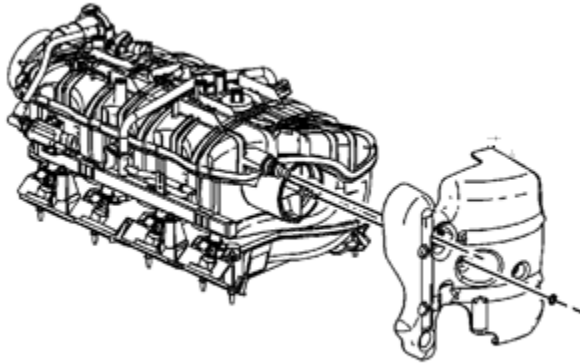


1. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
2. Reposition the brake booster vacuum hose clamp at the intake manifold.
3. Remove the brake booster vacuum hose from the intake manifold nipple.

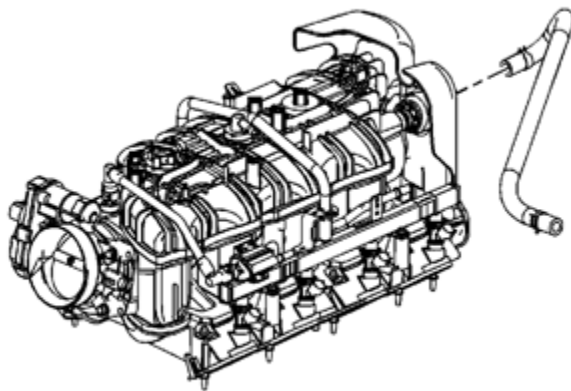


4. Remove the upper intake manifold cover nut.
5. Remove the upper intake manifold cover.

Installation Procedure



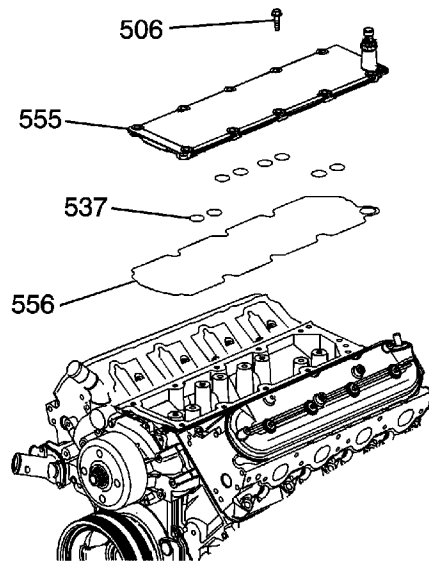
1. Install the upper intake manifold cover.
2. Install the upper intake manifold cover nut until snug



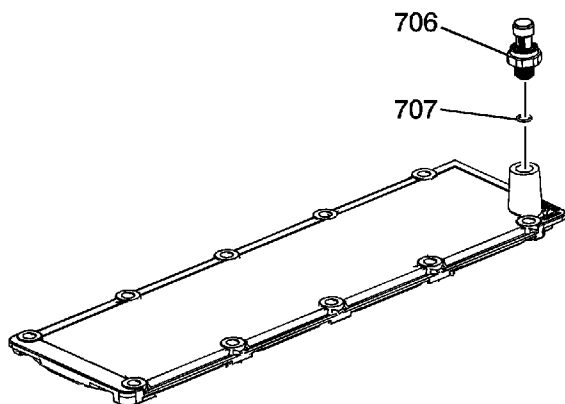
3. Install the brake booster vacuum hose to the intake manifold nipple.
4. Position the brake booster vacuum hose clamp at the intake manifold.
5. Install the intake manifold. Refer to [Intake Manifold Replacement](#).

Engine Block Valley Cover Replacement

Removal Procedure



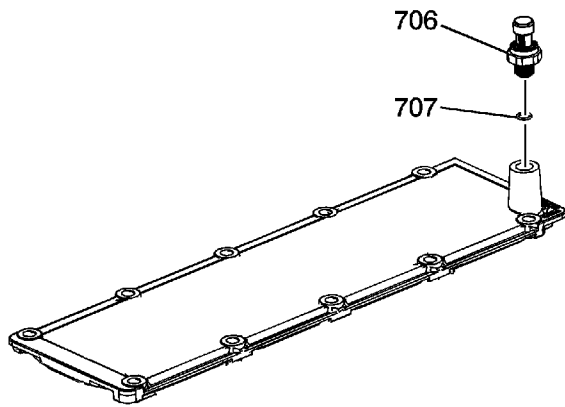
1. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
2. Remove the engine valley cover bolts (506).
3. Remove the engine valley cover (555) and gasket (556).
4. Remove the O-ring seals (537) from the cover.



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

Installation Procedure

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



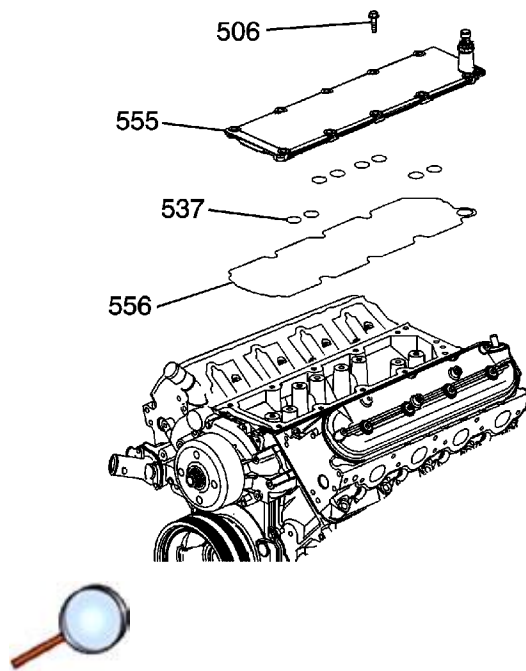
1. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent, to the threads of the oil pressure sensor.

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

Tighten

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



3. Lubricate the O-ring seals with clean engine oil.
4. Install the O-ring seals (537) to the cover.
5. Set the engine valley cover (555) onto the engine.
6. Install the engine valley cover bolts (506).

Tighten

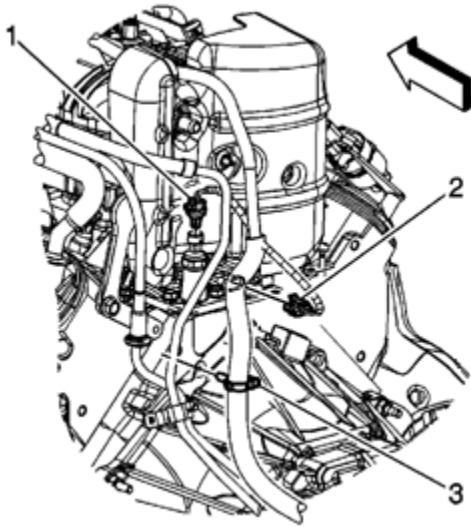
Tighten the bolts to 25 N·m (18 lb ft).

7. Install the intake manifold. Refer to [Intake Manifold Replacement](#).

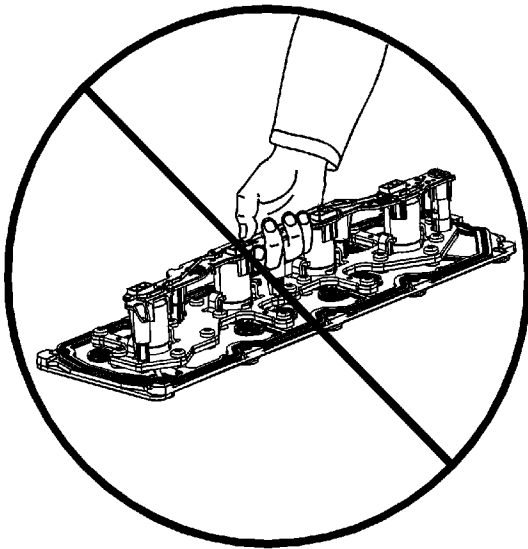
cardiagn.com

Valve Lifter Oil Manifold Replacement

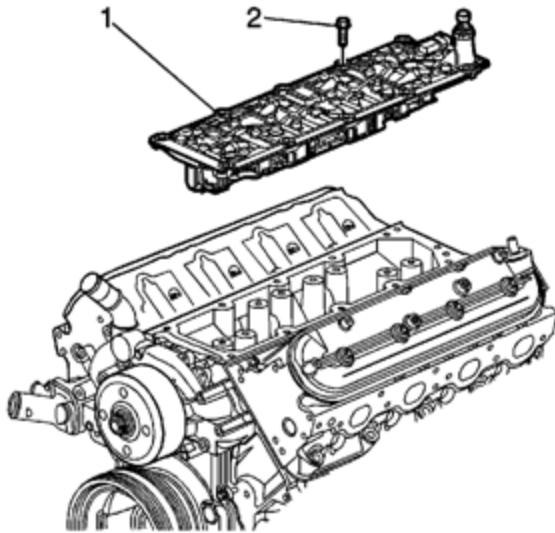
Removal Procedure



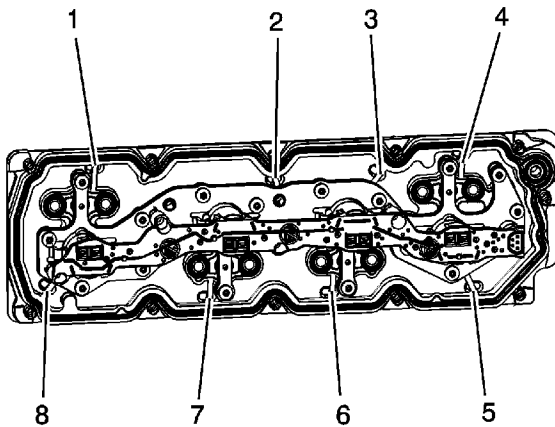
1. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.



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

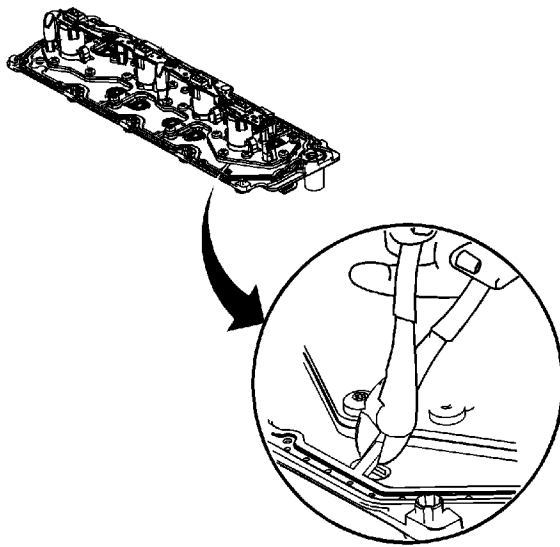


4. Remove the valve lifter oil manifold bolts (2).
5. Remove the valve lifter oil manifold (1).

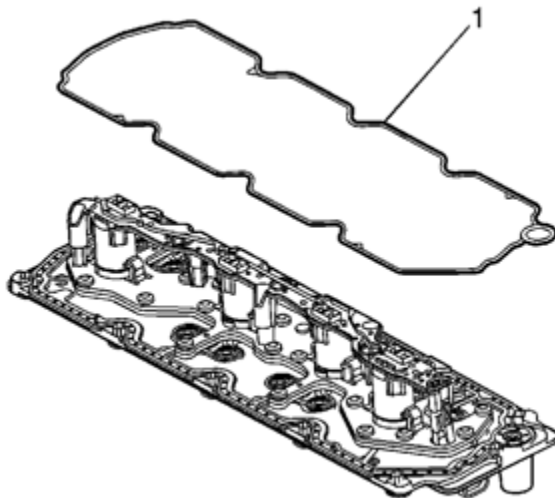


Note: Remove only the outer gasket from the manifold. Do not disassemble any of the internal components of the manifold in an attempt to remove the 8 inner sealing gaskets. If the inner gaskets are cut or damaged, replace the manifold as an assembly. Only use a wire-cutter type tool in order to minimize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

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



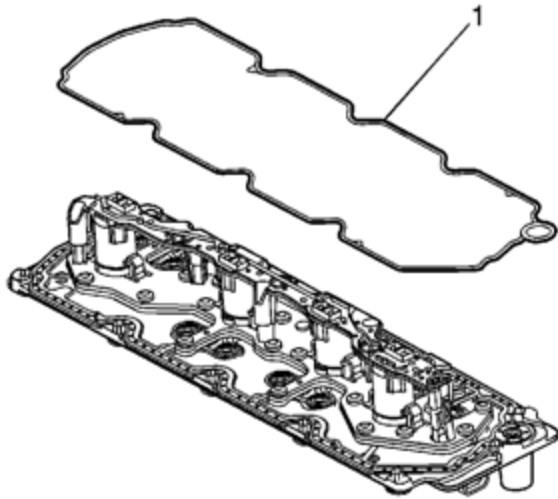
7. Using a cutter type tool, cut the 8 retaining straps.



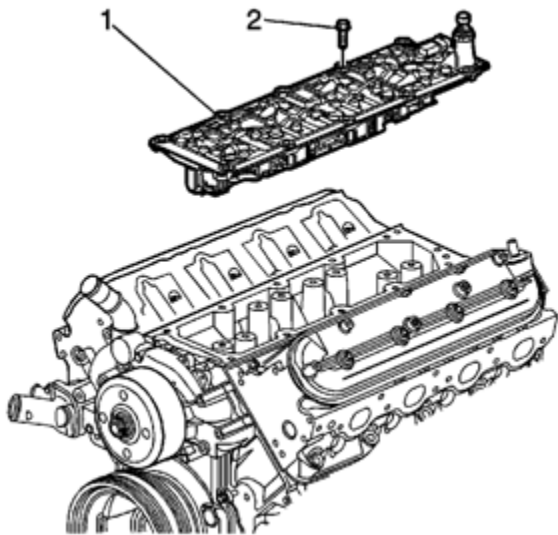
8. Remove the outer gasket (1) from the valve lifter oil manifold.

Installation Procedure

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



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



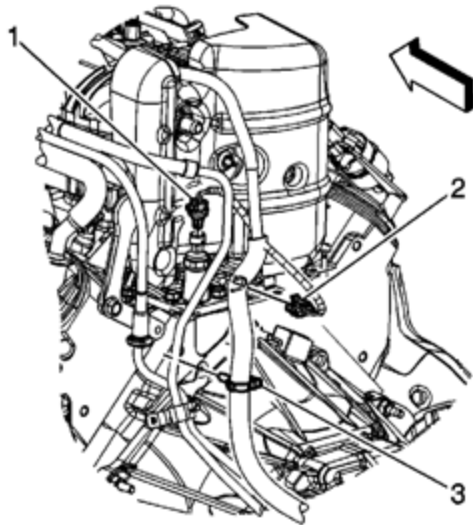
2. Install the valve lifter oil manifold (1) to the engine.

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

Tighten

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

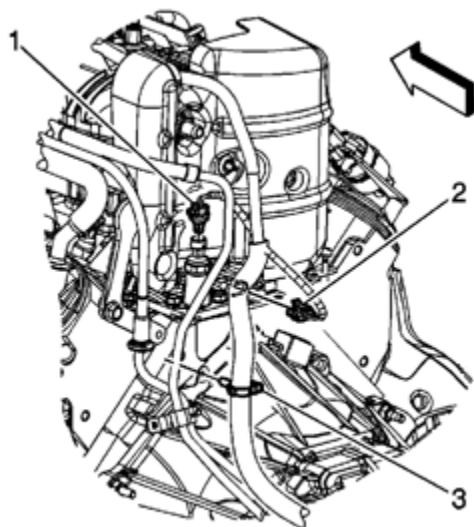


4. Connect the engine harness electrical connector (1) to the oil pressure sensor.
5. Install the intake manifold. Refer to [Intake Manifold Replacement](#).

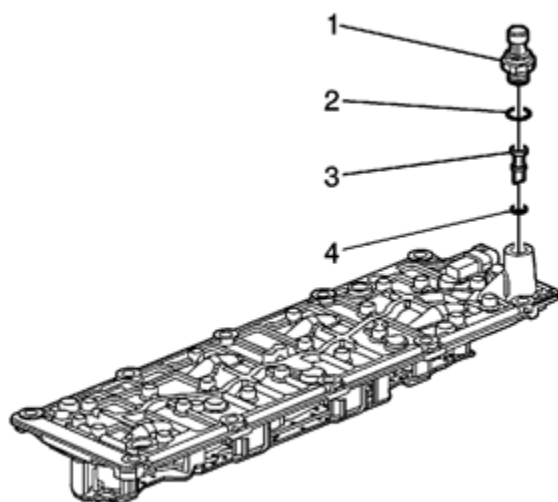
cardiagn.com

Valve Lifter Oil Filter Replacement

Removal Procedure

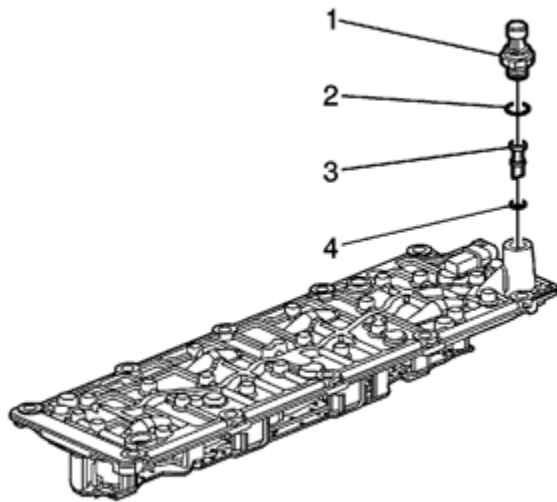


1. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.



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

Installation Procedure



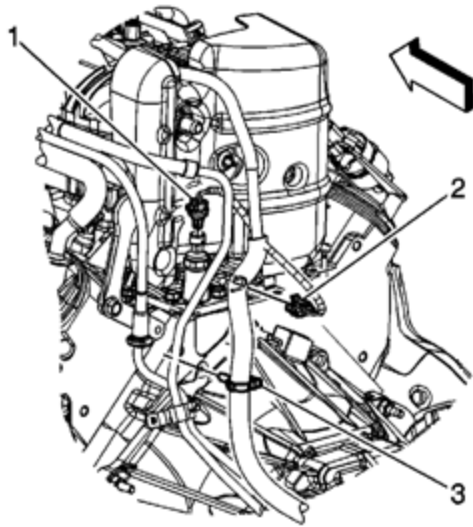
1. Install a NEW valve lifter oil filter O-ring seal (4) into the valve lifter oil manifold.
2. Install the NEW valve lifter oil filter (3).
3. Apply sealant GM P/N 12346004 (Canadian P/N 10953480) or equivalent to the threads of the oil pressure sensor.

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

Tighten

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

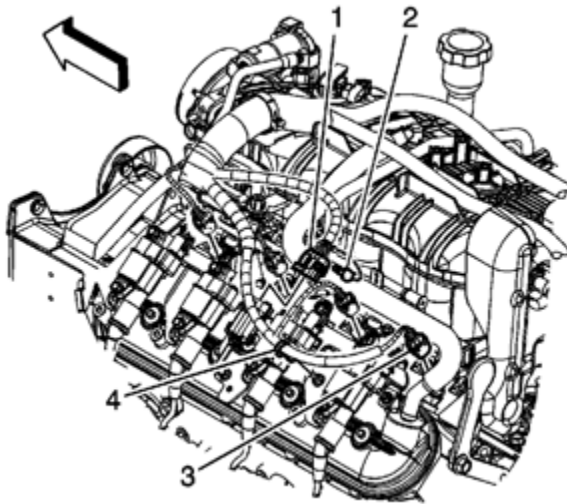


5. Connect the engine harness electrical connector (1) to the oil pressure sensor.
6. Install the intake manifold. Refer to [Intake Manifold Replacement](#).

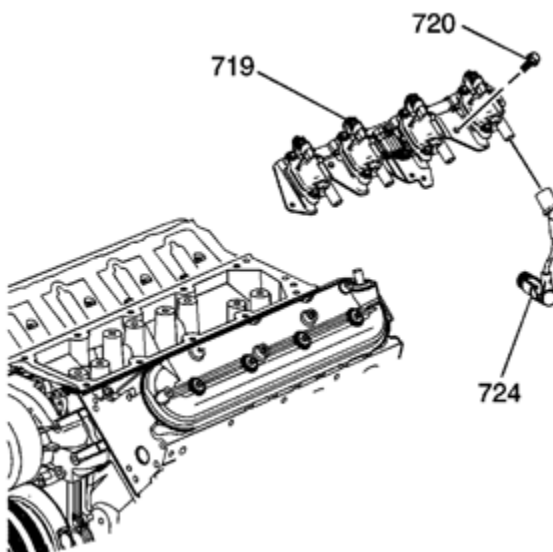
cardiagn.com

Valve Rocker Arm Cover Replacement - Left Side

Removal Procedure

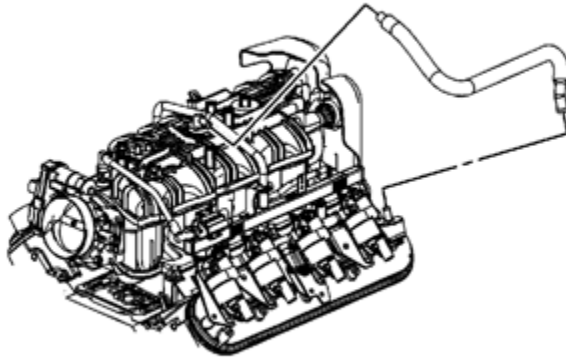


1. Remove the intake manifold cover. Refer to [Upper Intake Manifold Sight Shield Replacement](#).
2. Remove the connector position assurance (CPA) retainer (2).
3. Disconnect the engine harness electrical connector (1) from the ignition coil wire harness.
4. Remove the engine harness clip (4) from the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

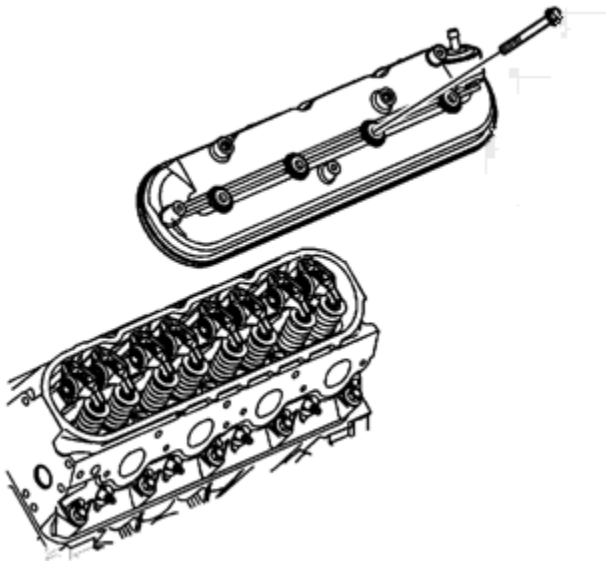




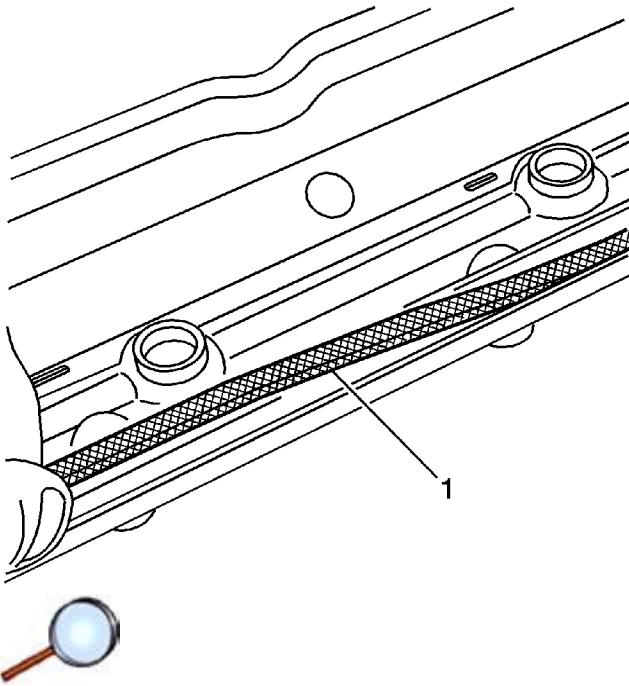
6. Remove the spark plug wires (724) from the ignition coils.
 - Twist each plug wire 1/2 turn.
 - Pull only on the boot in order to remove the wire from the ignition coil.
7. Remove the ignition coil bracket studs (720).
8. Remove the ignition coil bracket (719).



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



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

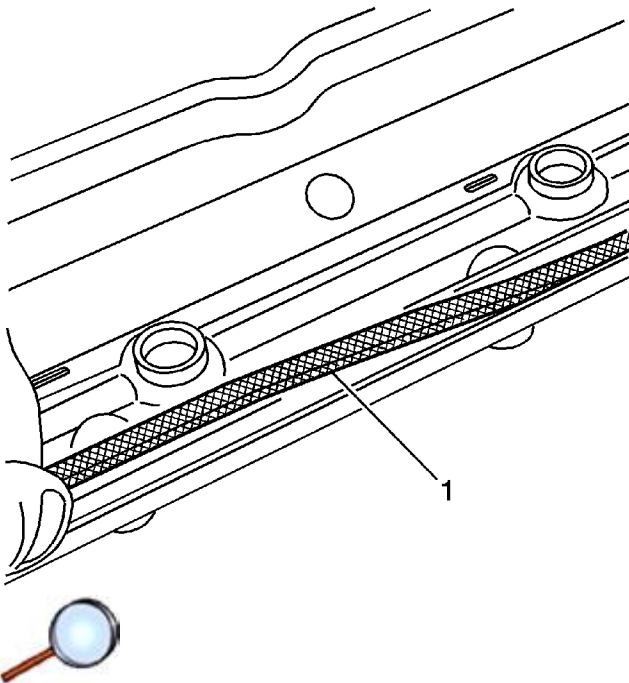


12. Remove and discard the old gasket (1).

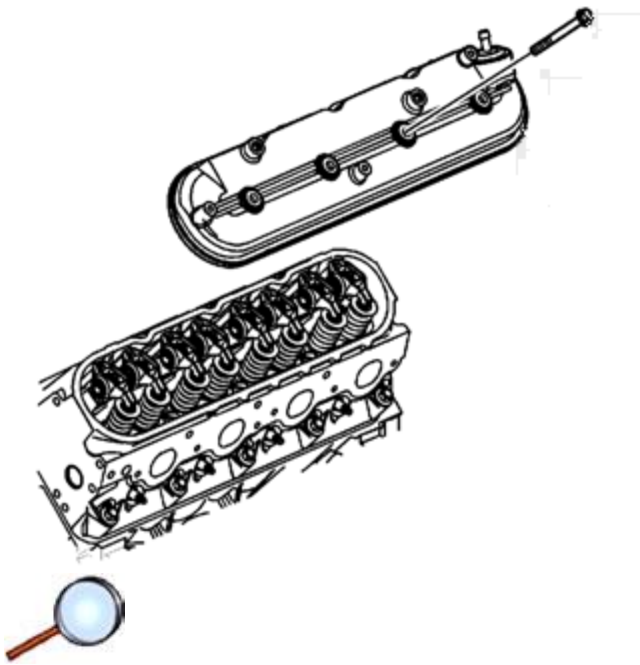
Installation Procedure

Note:

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



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



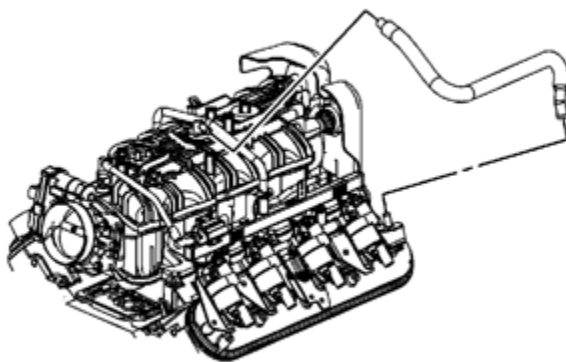
2. Install the valve rocker arm cover.

Caution: Refer to [Fastener Caution](#) in the Preface section.

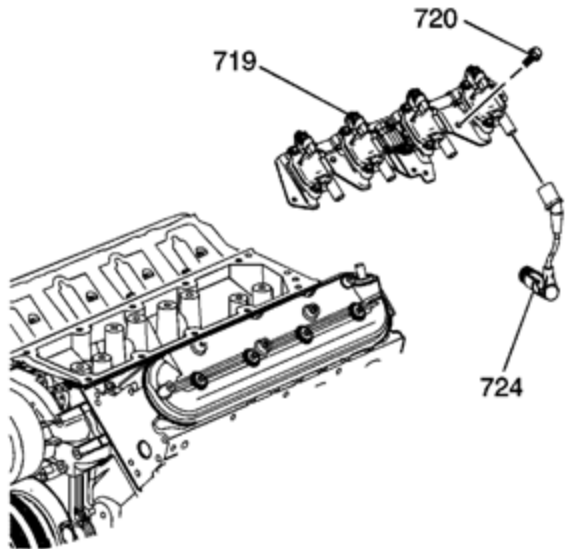
3. Tighten the rocker arm cover bolts.

Tighten

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



4. Install the PCV hose.

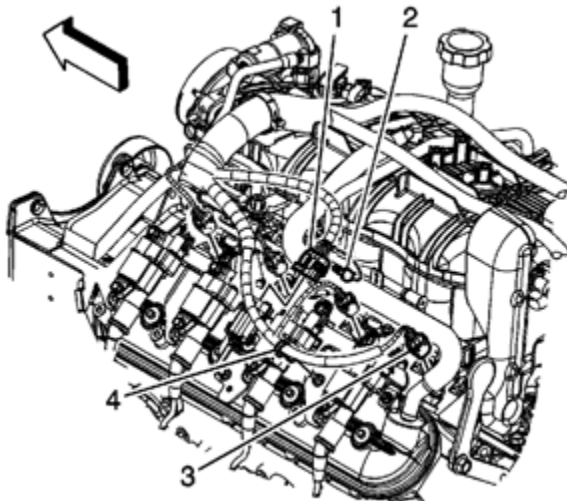


5. Apply threadlock to the threads of the ignition coil bracket studs. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).
6. Position the ignition coil bracket (719) onto the rocker cover.
7. Install the ignition coil bracket studs (720).

Tighten

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

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



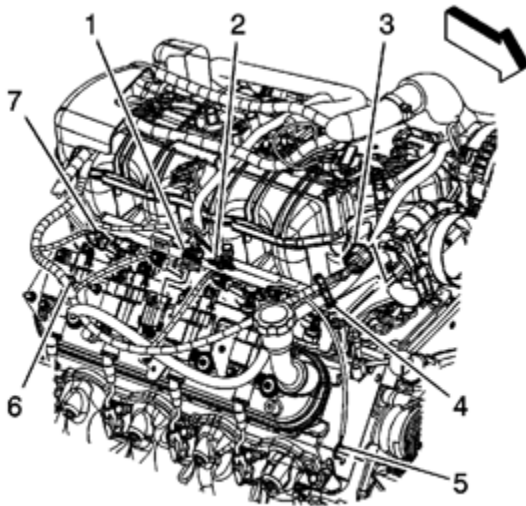
9. Position the engine harness, as necessary.
10. Install the engine harness clip (4) to the ignition coil bracket stud.
11. Connect the engine harness electrical connector (1) to the ignition coil wire harness.
12. Install the CPA retainer (2).

13. Install the intake manifold cover. Refer to [Upper Intake Manifold Sight Shield Replacement](#).

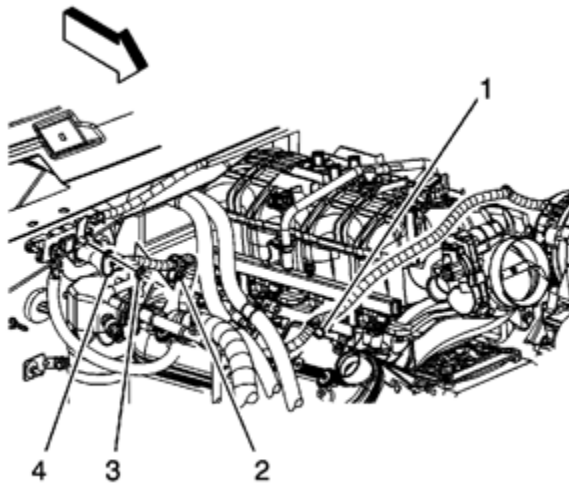
cardiagn.com

Valve Rocker Arm Cover Replacement - Right Side

Removal Procedure

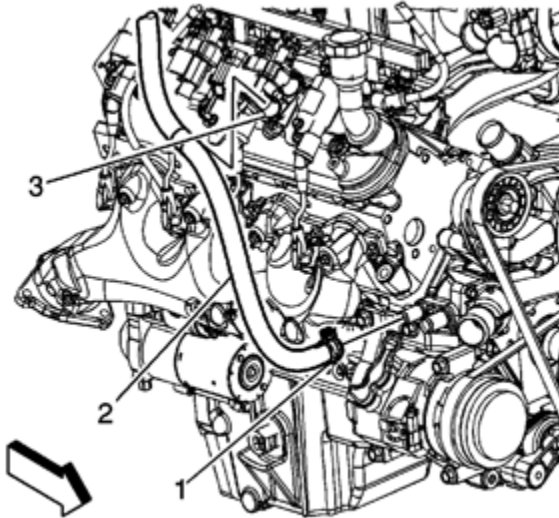


1. Remove the intake manifold cover. Refer to [Upper Intake Manifold Sight Shield Replacement](#).
2. Remove the connector position assurance (CPA) retainer (2).
3. Disconnect the engine harness electrical connector (1) from the ignition coil wire harness.
4. Remove the engine wiring harness (electronic throttle control branch) clip (6) from the ignition coil bracket stud.
5. Reposition the engine wiring harness (electronic throttle control branch) as necessary.

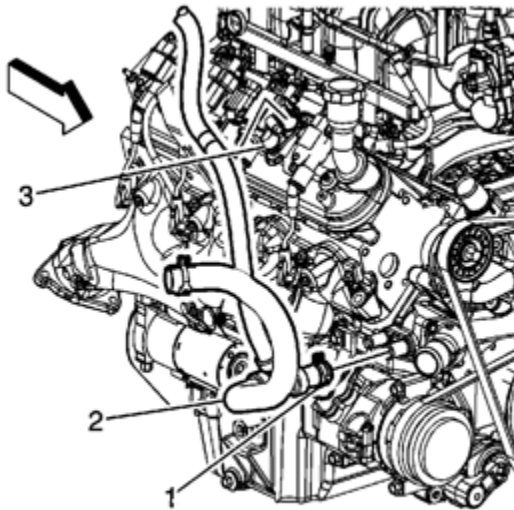




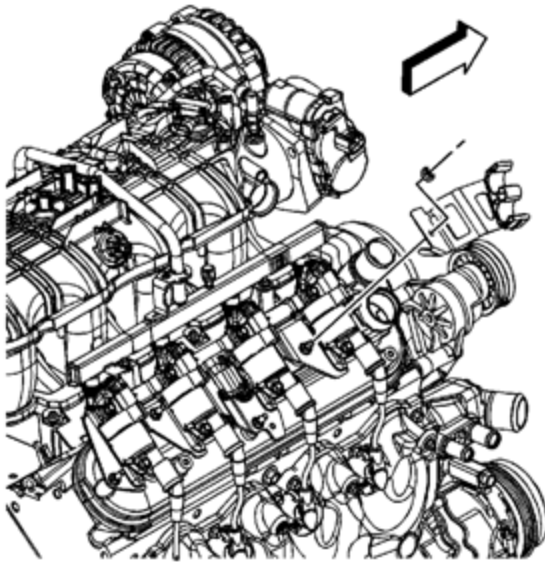
6. Remove the generator battery cable clip (1) from the ignition coil bracket stud.
7. Reposition the generator battery cable as necessary.



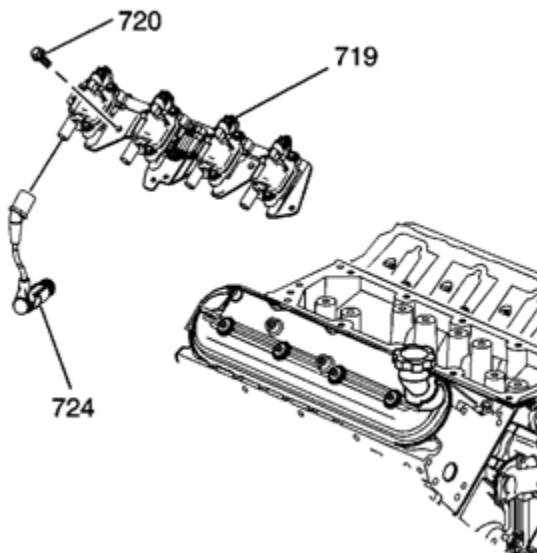
8. Remove the heater inlet hose (2) from the heater hose bracket (3).



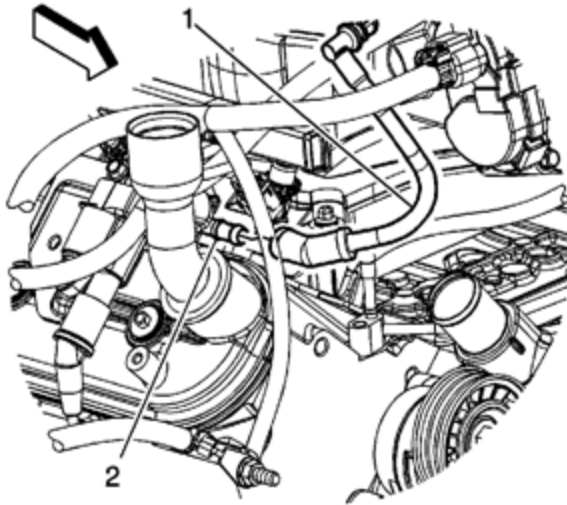
9. Remove the surge tank outlet hose (2) from the heater hose bracket (3).



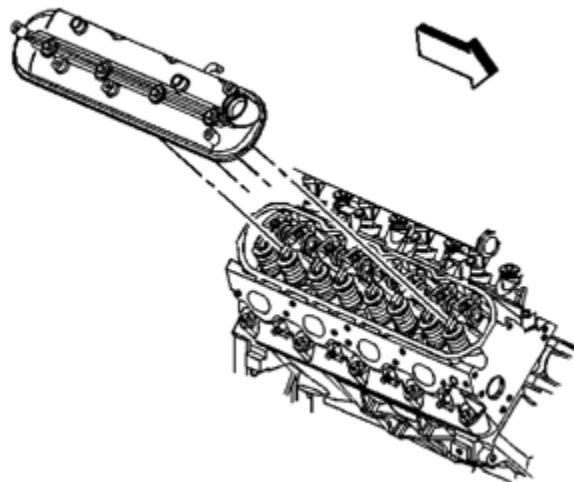
10. Remove the heater hose bracket nut and bracket



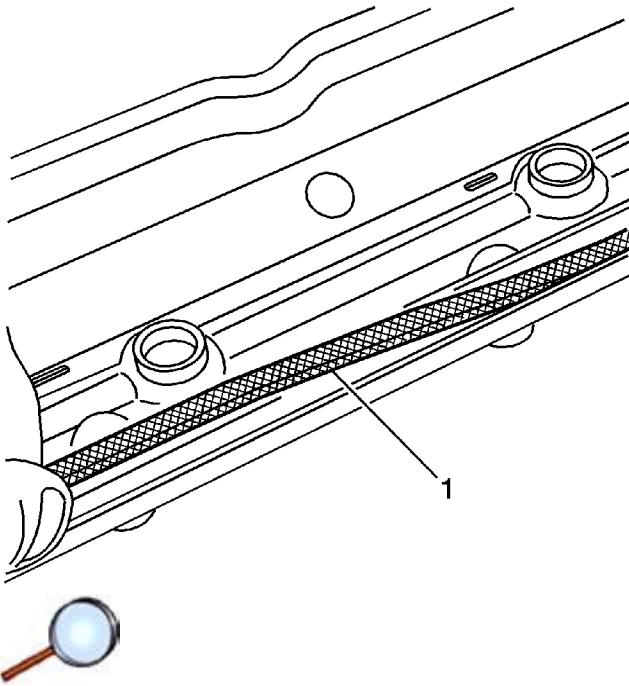
11. Remove the spark plug wires (724) from the ignition coils.
- Twist each plug wire 1/2 turn.
 - Pull only on the boot in order to remove the wire from the ignition coil.
12. Remove the ignition coil bracket studs (720).
13. Remove the ignition coil bracket (719).



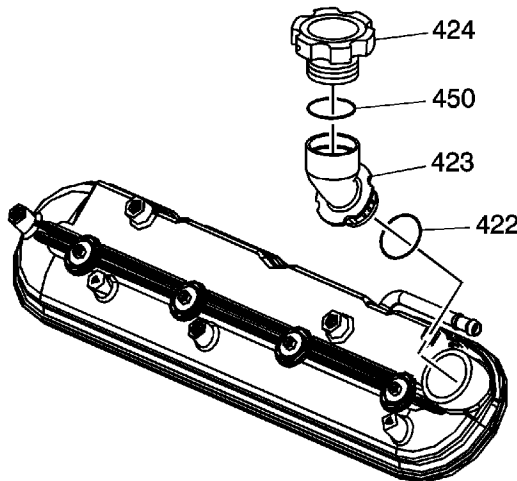
14. Remove the positive crankcase ventilation (PCV) tube (1) from the valve rocker cover (2).



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



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



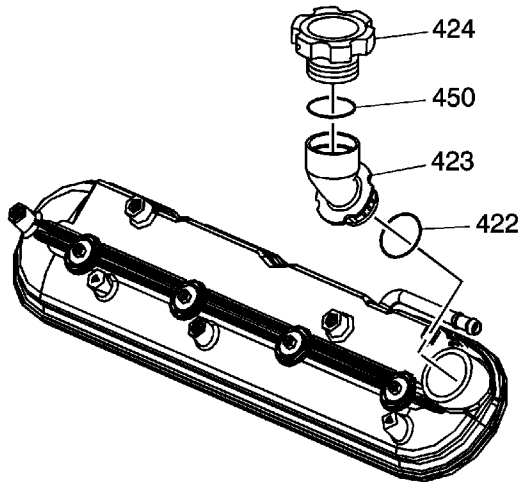
18. Remove the oil fill cap (424) from the oil fill tube (423), if necessary.

19. Remove and discard the oil fill tube, if necessary.

Installation Procedure

Note:

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

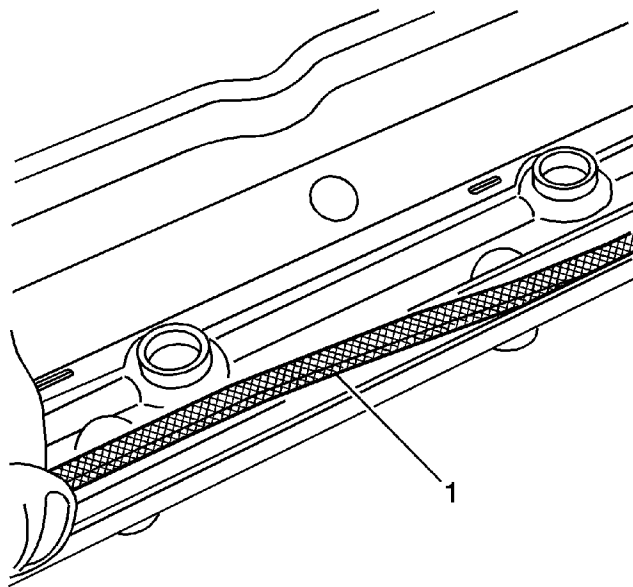


1. Lubricate the O-ring seal (422) of the NEW oil fill tube with clean engine oil.
2. Insert the NEW oil fill tube (423) into the rocker arm cover.

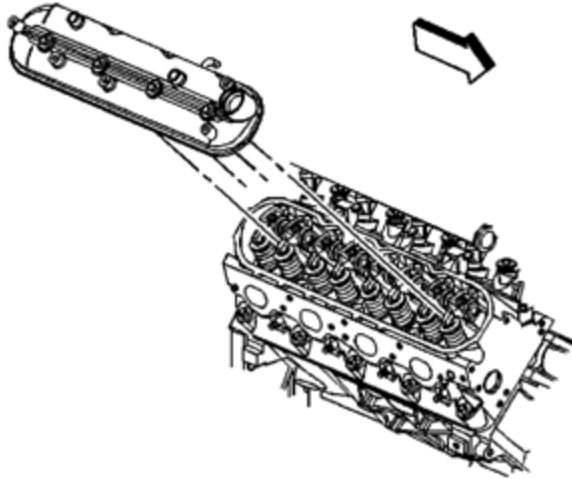
Rotate the tube clockwise until locked in the proper position.

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

Rotate the cap clockwise until locked in the proper position.



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



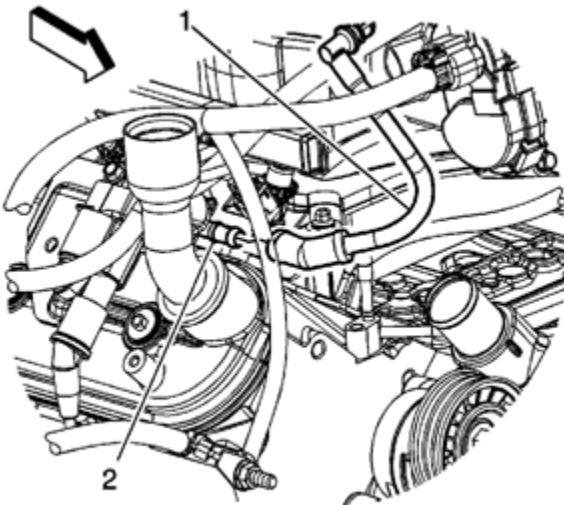
5. Install the valve rocker arm cover.

Caution: Refer to [Fastener Caution](#) in the Preface section.

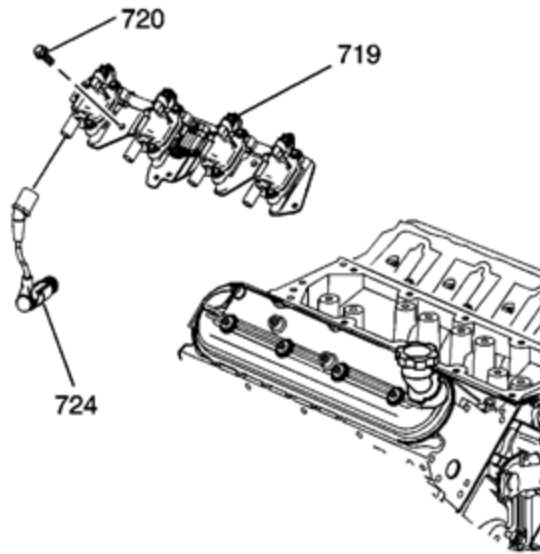
6. Tighten the rocker arm cover bolts.

Tighten

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



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

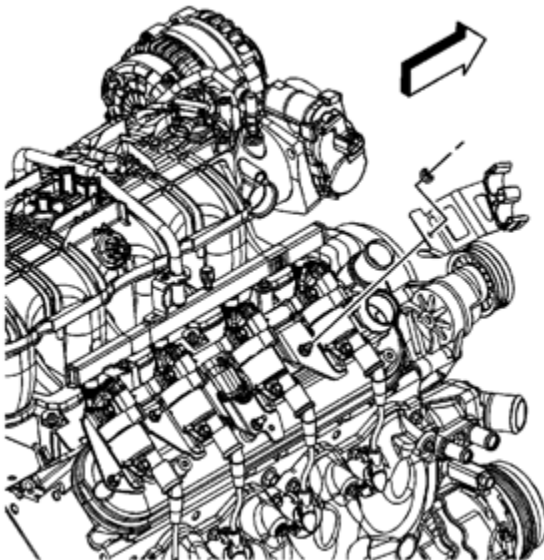


8. Apply threadlock GM P/N 12345382 (Canadian P/N 10953489), or equivalent to the threads of the ignition coil bracket studs.
9. Position the ignition coil bracket (719) onto the rocker cover.
10. Install the ignition coil bracket studs (720).

Tighten

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

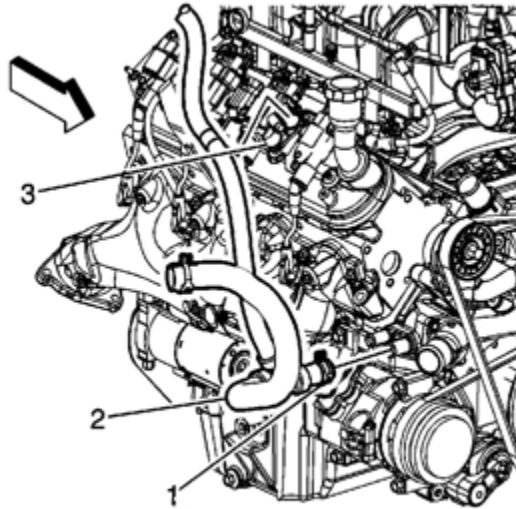
11. Install the spark plug wires (724) to the ignition coils.



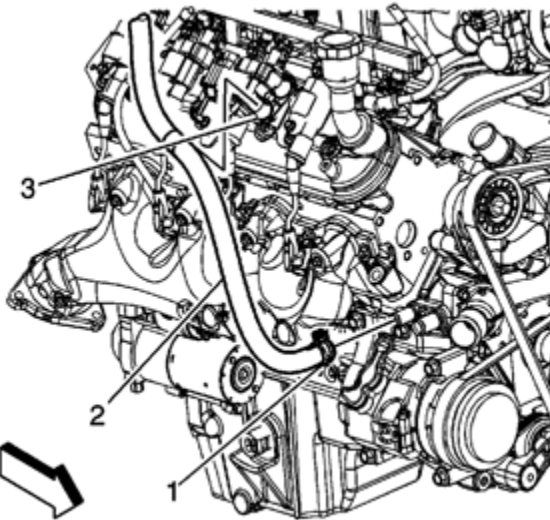
12. Install the heater hose bracket and nut.

Tighten

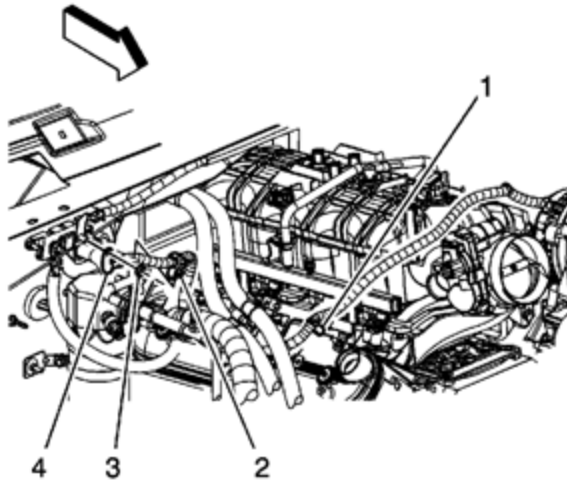
Tighten the nut to 9 N·m (80 lb in).



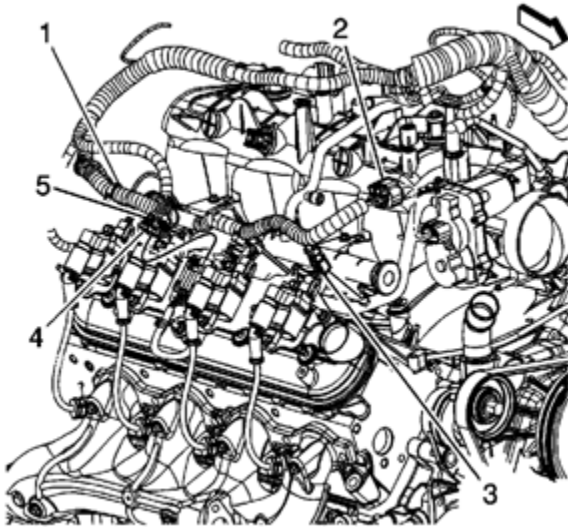
13. Install the surge tank outlet hose (2) to the heater hose bracket (3).



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



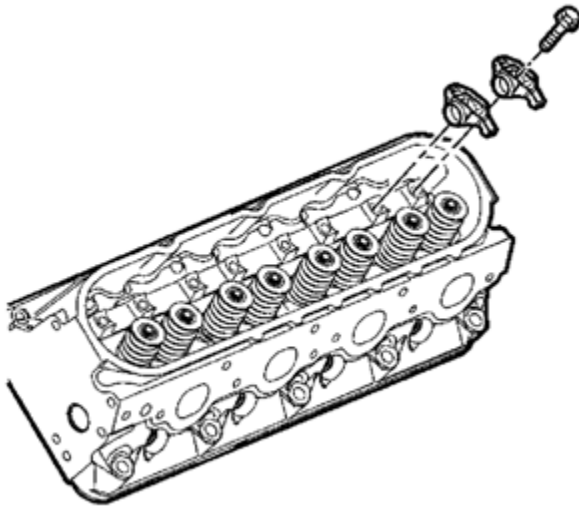
15. Position the generator battery cable as necessary.
16. Install the generator battery cable clip (1) to the ignition coil bracket stud.



17. Position the engine wiring harness (electronic throttle control branch) as necessary.
18. Install the engine wiring harness (electronic throttle control branch) clip (6) to the ignition coil bracket stud.
19. Connect the engine harness electrical connector (1) to the ignition coil wire harness.
20. Install the CPA retainer (2).
21. Install the intake manifold cover. Refer to [Upper Intake Manifold Sight Shield Replacement](#).

Valve Rocker Arm and Push Rod Replacement

Removal Procedure



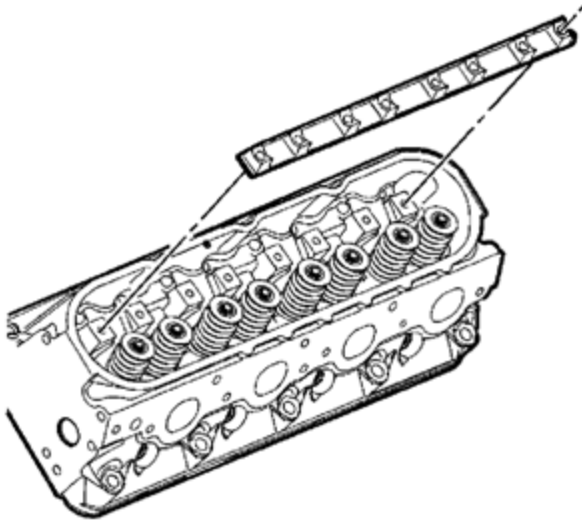
1. Remove the rocker arm cover. Refer to [Valve Rocker Arm Cover Replacement - Left Side](#) or [Valve Rocker Arm Cover Replacement - Right Side](#).

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

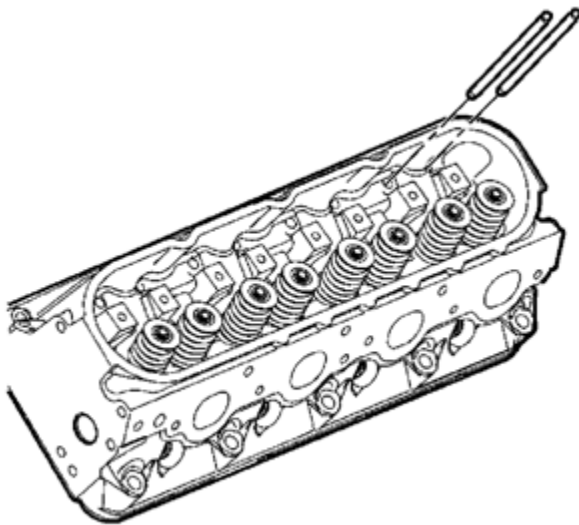
2. Remove the number one cylinder spark plug. Refer to [Spark Plug Replacement](#).

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

3. Remove the rocker arm bolts.
4. Remove the rocker arms.



5. Remove the rocker arm pivot support.

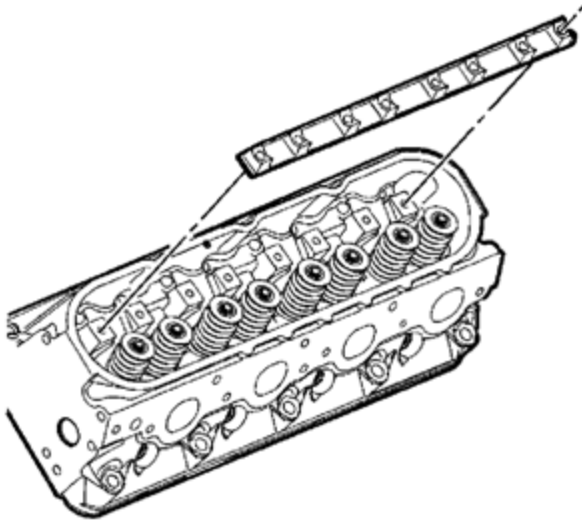


6. Remove the pushrods.
7. Clean and inspect the rocker arms and pushrods, if required. Refer to [Valve Rocker Arm and Push Rod Cleaning and Inspection](#).

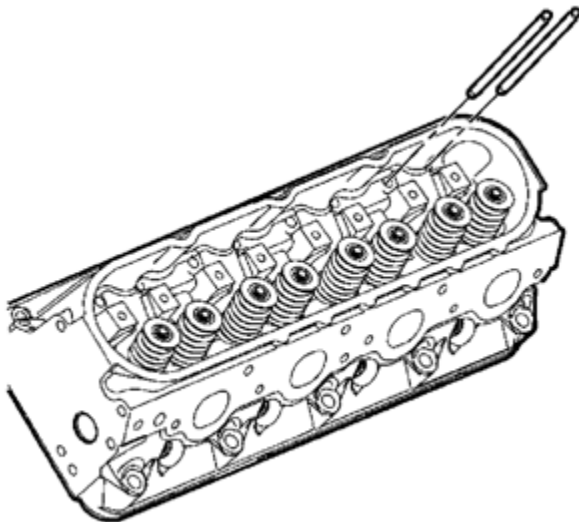
Installation Procedure

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

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

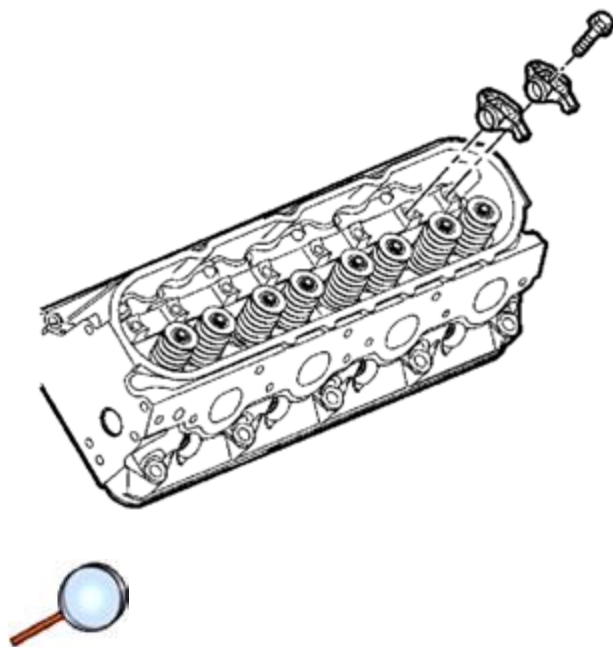


1. Lubricate the rocker arms and pushrods with clean engine oil.
2. Lubricate the flange of the rocker arm bolts with clean engine oil. Lubricate the flange or washer surface of the bolt that will contact the rocker arm.
3. Install the rocker arm pivot support.



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

4. Install the pushrods.



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

5. Install the rocker arms and bolts.

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

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

Tighten

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

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

Tighten

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

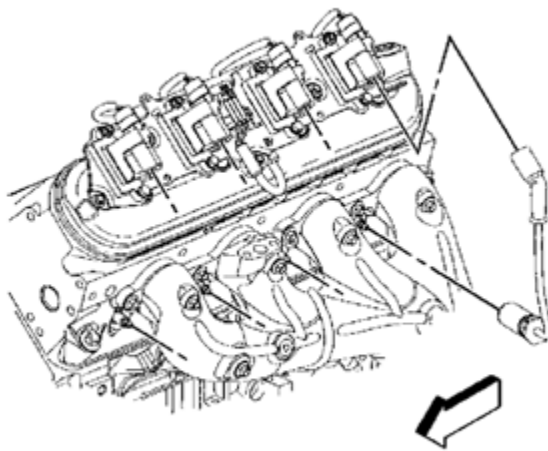
10. Install the number one cylinder spark plug. Refer to [Spark Plug Replacement](#).
11. Install the rocker arm cover. Refer to [Valve Rocker Arm Cover Replacement - Left Side](#) or [Valve Rocker Arm Cover Replacement - Right Side](#).

Valve Stem Oil Seal and Valve Spring Replacement

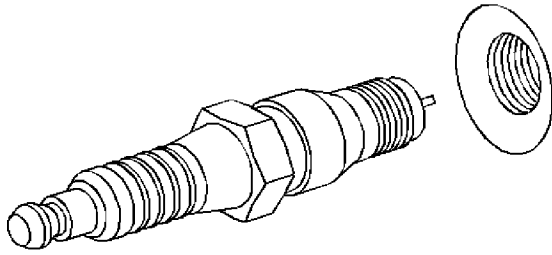
Special Tools

- [J 22794](#) Spark Plug Port Adapter
- [J 38606](#) Valve Spring Compressor

Removal Procedure

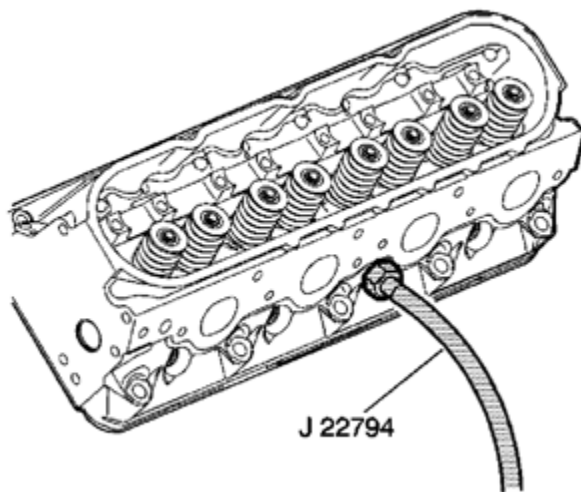


1. Remove the rocker arm. Refer to [Valve Rocker Arm and Push Rod Replacement](#).
2. Disconnect the spark plug wire at the spark plug.
 - Twist each plug wire boot 1/2 turn.
 - Pull only on the boot in order to remove the wire from the spark plug.

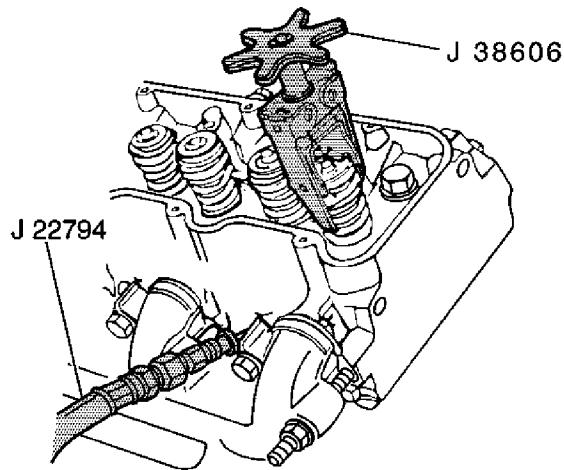


Note: Remove the spark plugs from the cylinder head with the engine at room temperature.

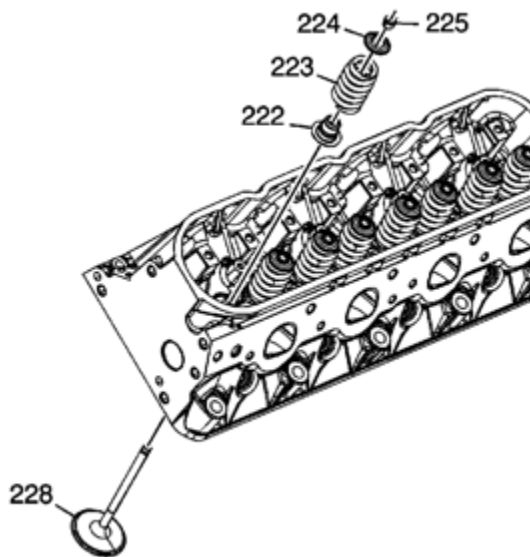
3. Loosen the spark plug 1 or 2 turns.
4. Brush or air blast away any dirt or debris from around the spark plug.
5. Remove the spark plug.



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

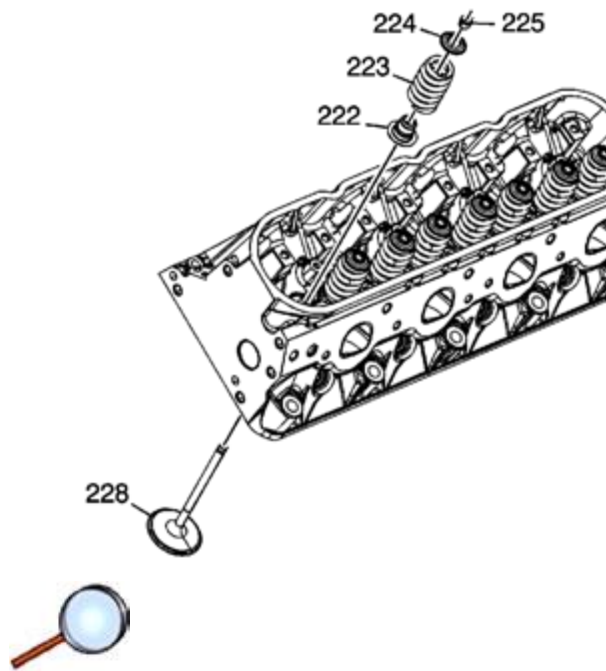


9. Use the [J 38606](#) in order to compress the valve spring.

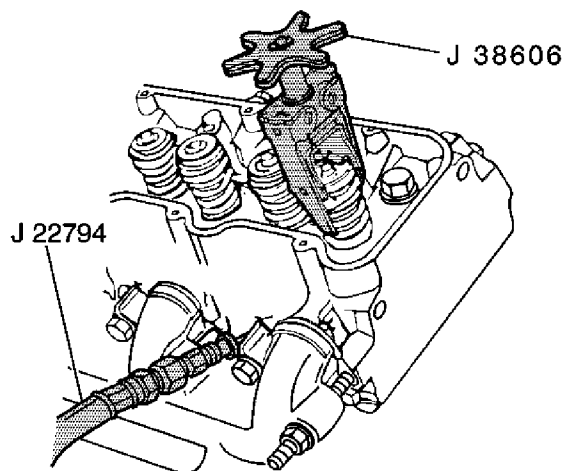


10. Remove the valve stem keys (225).
11. Carefully release the valve spring tension.
12. Remove the [J 38606](#).
13. Remove the valve spring cap (224).
14. Remove the valve spring (223).
15. Remove the valve stem oil seal (222).
16. Remove the valve (228).

Installation Procedure

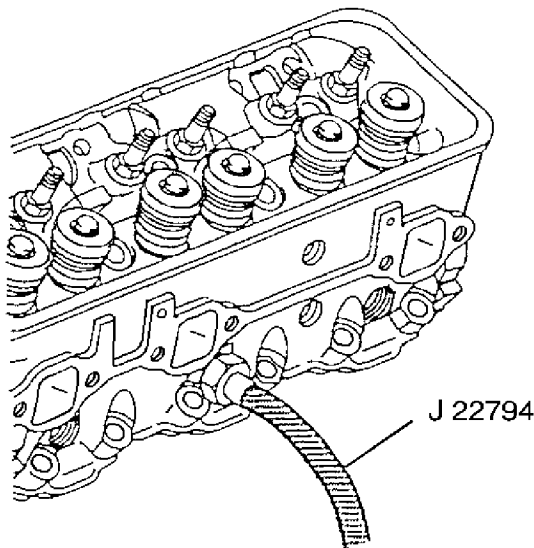


1. Clean the cylinder head valve spring seat area.
2. Lubricate the valve guide and valve stem oil seal with clean engine oil.
3. Install the valves (228) into the proper port.
4. Install the valve stem oil seal (222).
5. Install the valve spring (223).
6. Install the valve spring cap (224).



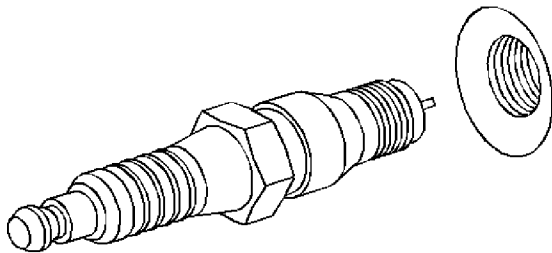
7. Compress the valve spring using the [J 38606](#).
8. Install the valve keys.
 - Use grease in order to hold the valve keys in place.
 - Make sure the keys seat properly in the groove of the valve stem.
 - Carefully release the valve spring pressure, making sure the valve keys stay in place.
 - Remove the [J 38606](#).

- Tap the end of the valve stem with a plastic faced hammer to seat the keys, if necessary.



9. Remove the [J 22794](#) from the spark plug port.

Caution: Refer to [Fastener Caution](#) in the Preface section.



10. Hand start the spark plug.

Tighten

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

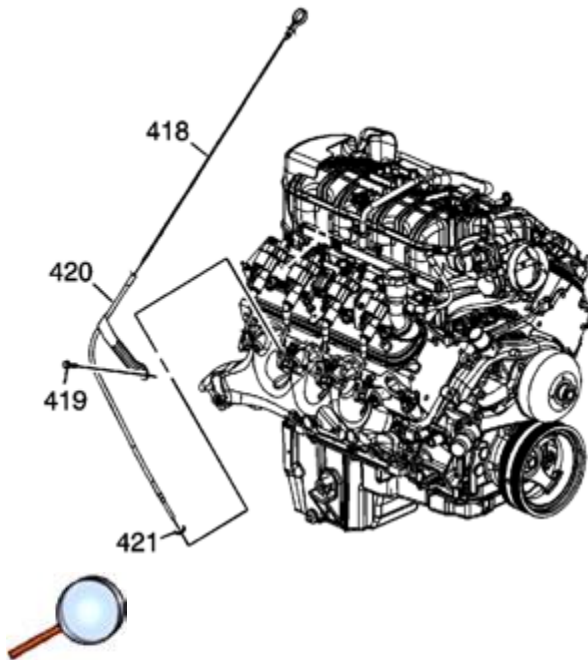
11. Install the spark plug wires at the ignition coil.

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

cardiagn.com

Oil Level Indicator Tube Replacement

Removal Procedure

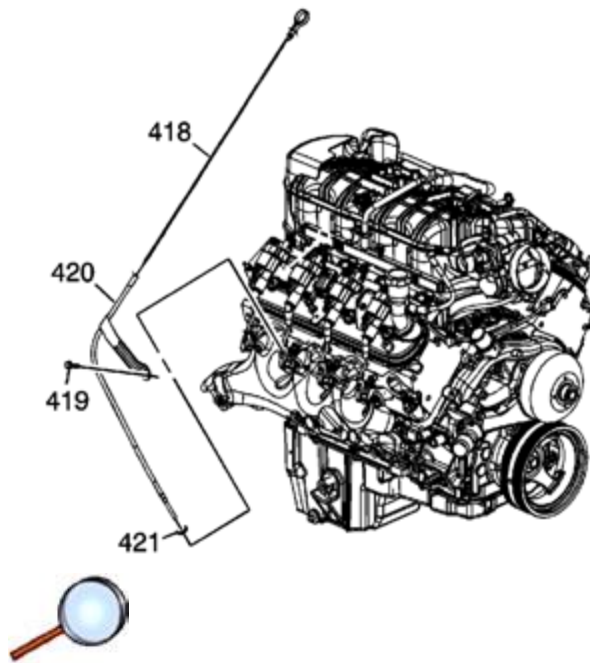


1. Remove the oil level indicator (418).
2. Remove the oil level indicator tube bolt (419).
3. Remove the oil level indicator tube (420) from the engine block.

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

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

Installation Procedure



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

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

Tighten

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

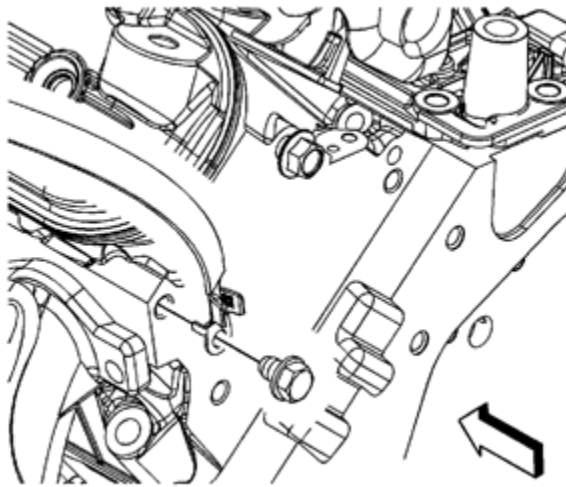
8. Install the oil level indicator (418).

Cylinder Head Replacement - Left Side

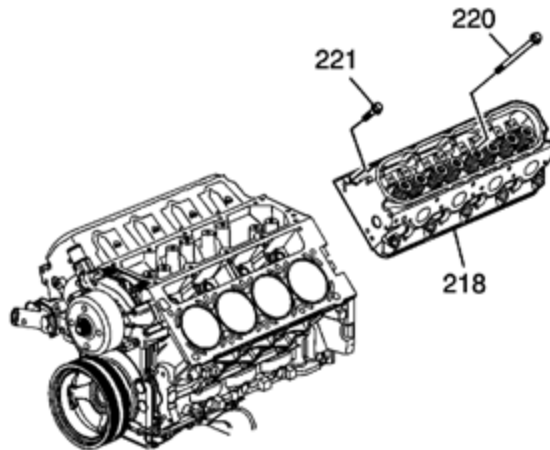
Special Tools

- [J 45059](#) Angle Meter
- [J 42385-200](#) Common Thread Repair Kit

Removal Procedure



1. Remove the generator bracket. Refer to [Generator Replacement](#).
2. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
3. Remove the coolant air bleed pipe. Refer to [Coolant Air Bleed Pipe Assembly Replacement](#).
4. Remove the left exhaust manifold. Refer to [Exhaust Manifold Replacement - Left Side](#).
5. Remove the pushrods. Refer to [Valve Rocker Arm and Push Rod Replacement](#).
6. Remove the engine ground strap bolt from the rear of the cylinder head.
7. Remove the ground strap from the cylinder head.

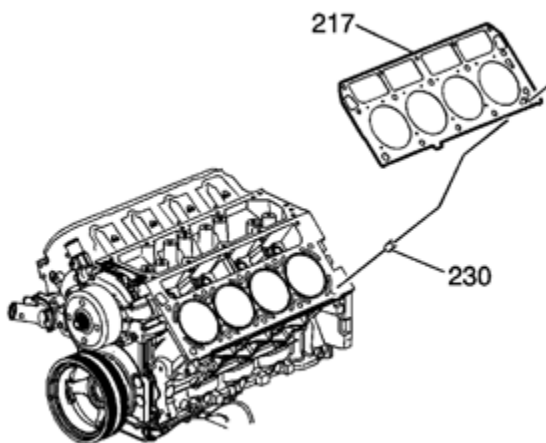


Note: The cylinder head bolts are of a torque-to-yield design and are NOT to be reused.

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

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

9. Remove the cylinder head (218).



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

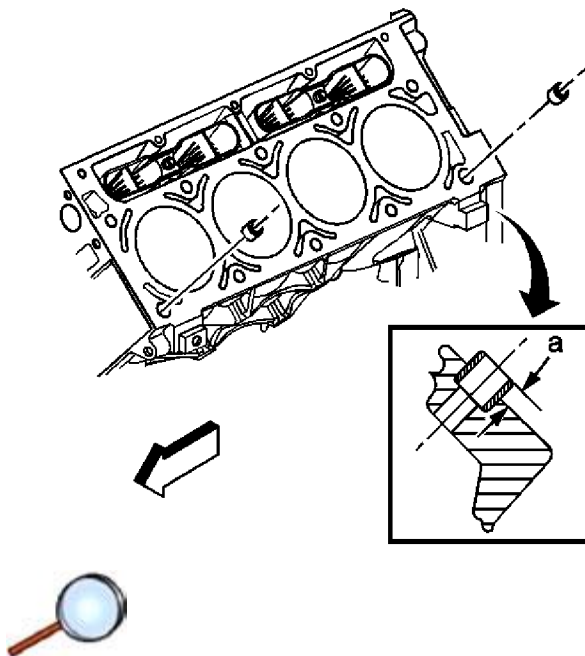
Installation Procedure

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

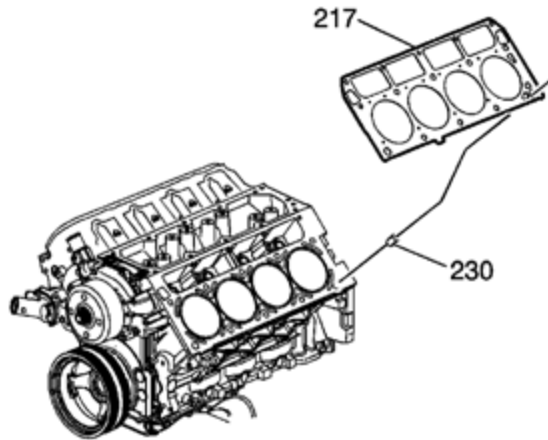
Caution: Clean all dirt, debris, and coolant from the engine block cylinder head bolt holes. Failure to remove all foreign material may result in damaged threads, improperly tightened fasteners or damage to components.

Note:

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

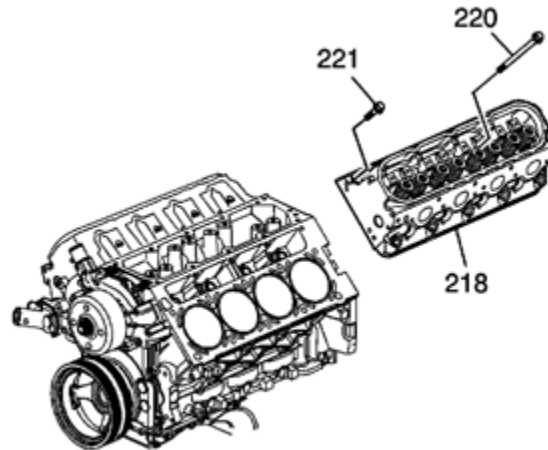


1. Clean the engine block cylinder head bolt holes, if required. Thread repair tool J 42385-107, found in [J 42385-200](#) may be used to clean the threads of old threadlocking material.
2. Spray cleaner GM P/N 12346139, P/N 12377981 (Canadian P/N 10953463), or equivalent into the hole.
3. Clean the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



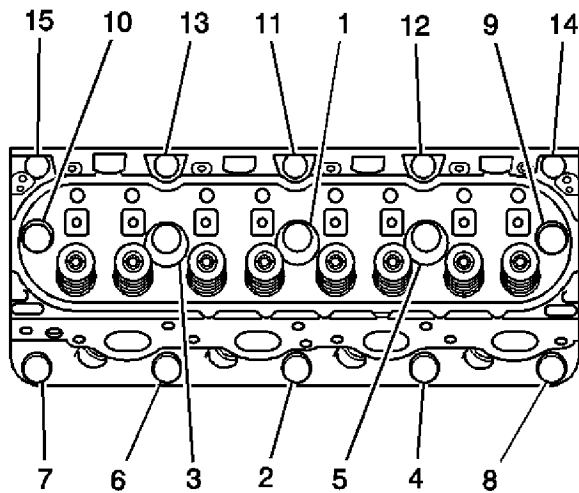
Note: When properly installed, with FRONT on the left side, the tab on the cylinder head gasket should be located left of center.

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



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

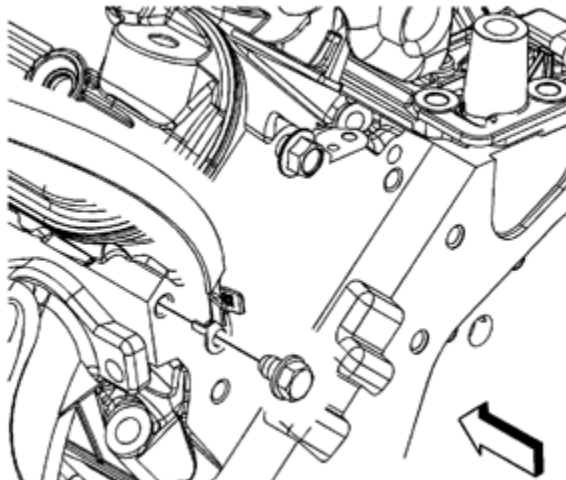
Caution: Refer to [Fastener Caution](#) in the Preface section.



8. Tighten the cylinder head bolts.

Tighten

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



9. Position the ground strap to the rear of the left cylinder head.
10. Install the engine ground strap bolt to the rear of the left cylinder head.

Tighten

Tighten the bolt to 16 N·m (12 lb ft).

11. Install the pushrods. Refer to [Valve Rocker Arm and Push Rod Replacement](#).
12. Install the left exhaust manifold. Refer to [Exhaust Manifold Replacement - Left Side](#).
13. Install the coolant air bleed pipe. Refer to [Coolant Air Bleed Pipe Assembly Replacement](#).
14. Install the intake manifold. Refer to [Intake Manifold Replacement](#).
15. Install the generator bracket. Refer to [Generator Replacement](#).

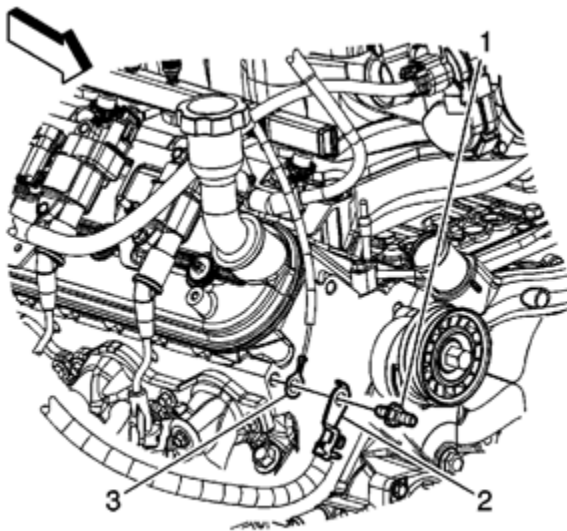
cardiagn.com

Cylinder Head Replacement - Right Side

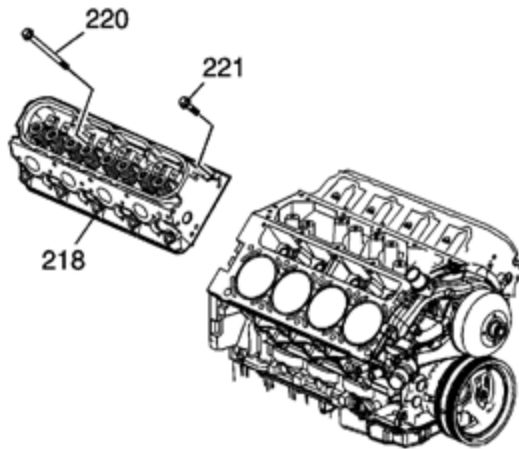
Special Tools

- [J 45059](#) Angle Meter
- [J 42385-200](#) Common Thread Repair Kit

Removal Procedure



1. Remove the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).
2. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
3. Remove the coolant air bleed pipe. Refer to [Coolant Air Bleed Pipe Assembly Replacement](#).
4. Remove the right exhaust manifold. Refer to [Exhaust Manifold Replacement - Right Side](#).
5. Remove the pushrods. Refer to [Valve Rocker Arm and Push Rod Replacement](#).
6. Remove the negative battery cable stud (1) from the front of the right cylinder head.
7. Remove the negative battery cable terminal (2) and the engine harness terminal (3) from the cylinder head.

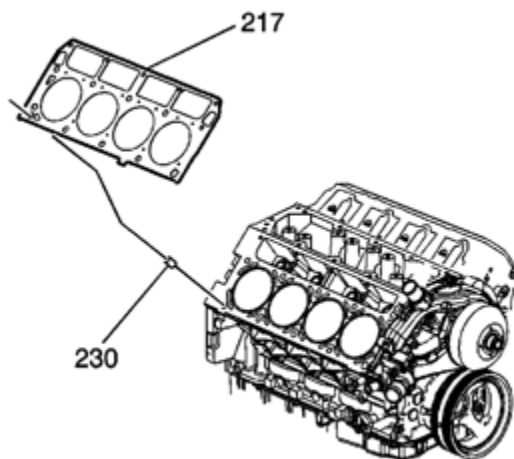


Note: The cylinder head bolts are of a torque-to-yield design and are NOT to be reused.

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

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

9. Remove the cylinder head (218).



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

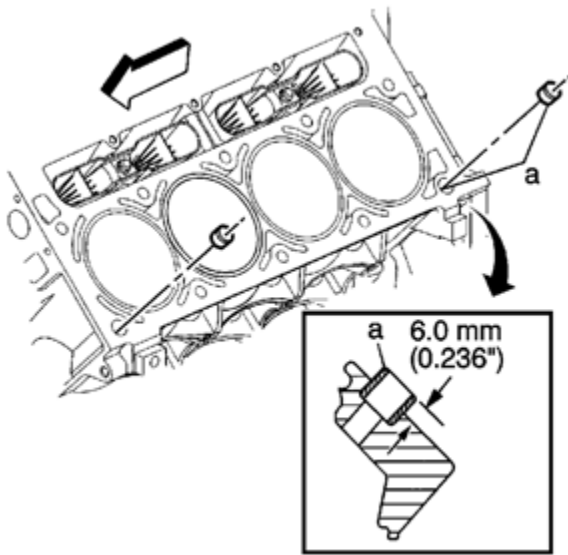
Installation Procedure

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

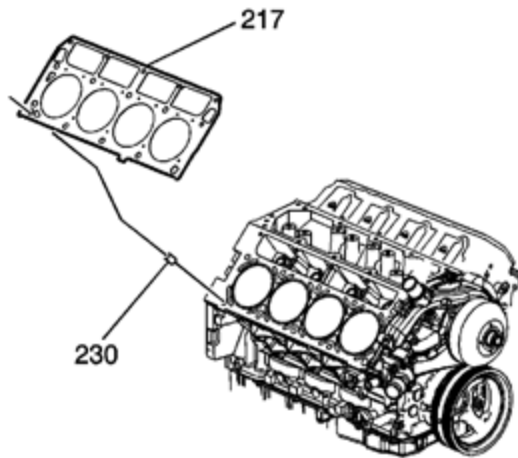
Caution: Clean all dirt, debris, and coolant from the engine block cylinder head bolt holes. Failure to remove all foreign material may result in damaged threads, improperly tightened fasteners or damage to components.

Note:

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

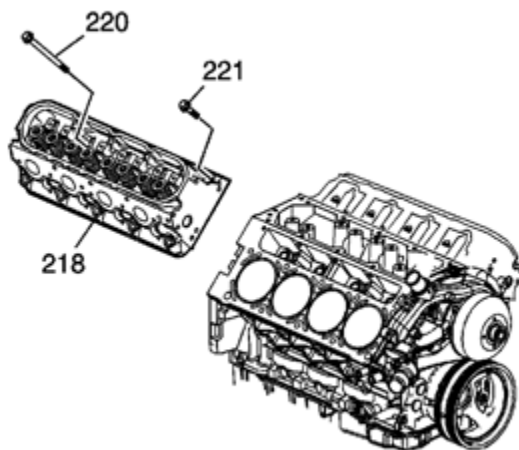


1. Clean the engine block cylinder head bolt holes, if required. Thread repair tool J 42385-107, found in [J 42385-200](#) may be used to clean the threads of old threadlocking material.
2. Spray cleaner GM P/N 12346139, P/N 12377981 (Canadian P/N 10953463), or equivalent into the hole.
3. Clean the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



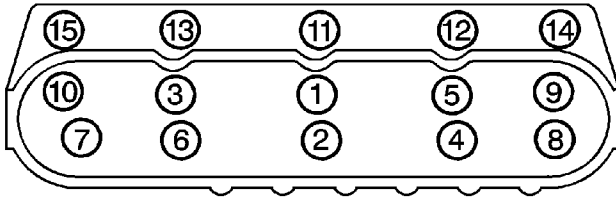
Note: When properly installed, with FRONT on the right side, the tab on the cylinder head gasket should be located right of center.

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



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

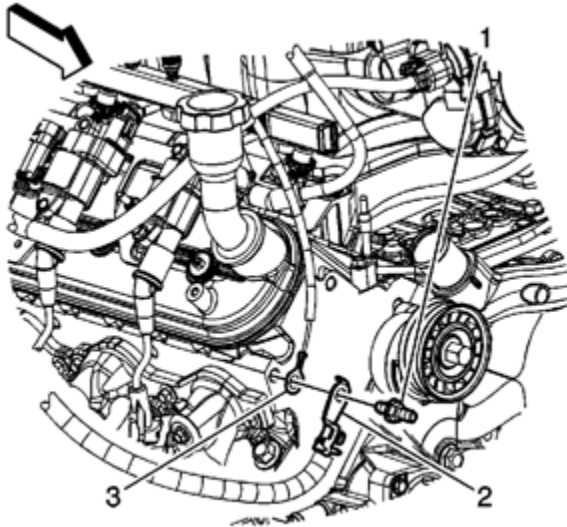
Caution: Refer to [Fastener Caution](#) in the Preface section.



8. Tighten the cylinder head bolts.

Tighten

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



9. Ensure that the engine harness terminal (3) is positioned behind the negative battery cable terminal (2).

10. Position the negative battery cable terminal (2) to the cylinder head.
11. Install the negative battery cable stud (1) to the front of the right cylinder head.

Tighten

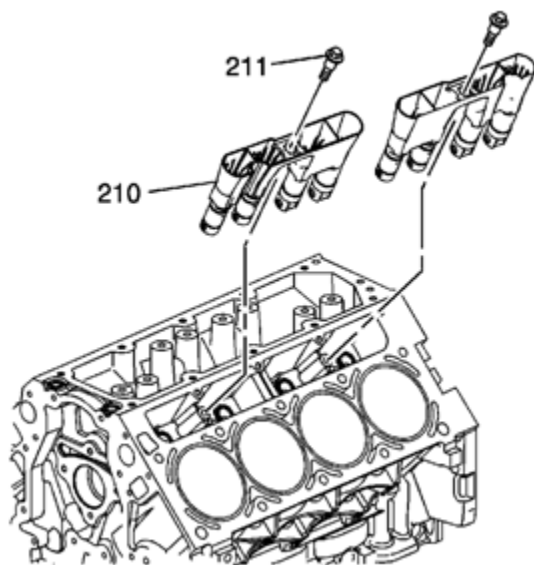
Tighten the stud to 25 N·m (18 lb ft).

12. Install the pushrods. Refer to [Valve Rocker Arm and Push Rod Replacement](#).
13. Install the right exhaust manifold. Refer to [Exhaust Manifold Replacement - Right Side](#).
14. Install the coolant air bleed pipe. Refer to [Coolant Air Bleed Pipe Assembly Replacement](#).
15. Install the intake manifold. Refer to [Intake Manifold Replacement](#).
16. Install the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).

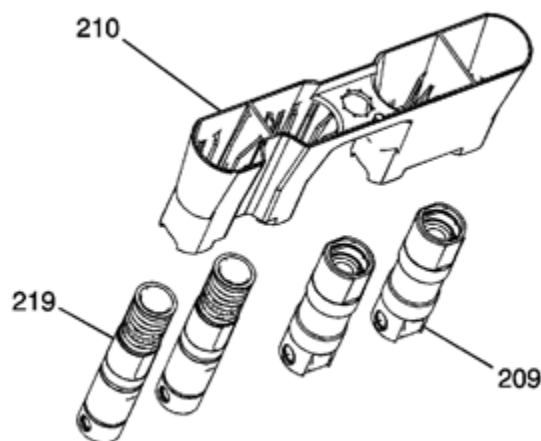
cardiagn.com

Valve Lifter Replacement (LH6, LMG, LY5 and L76)

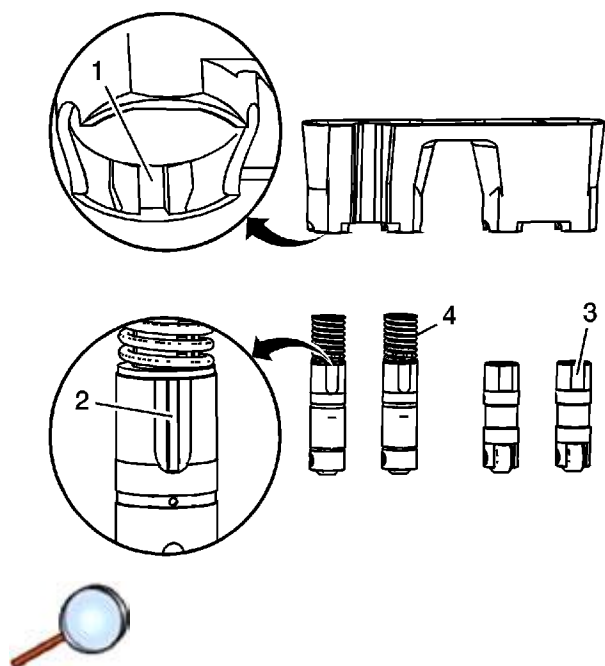
Removal Procedure



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



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



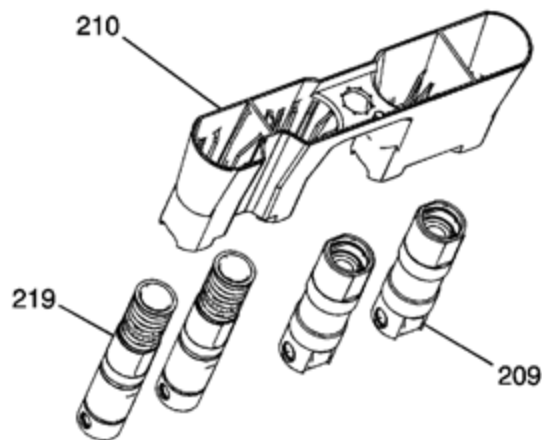
Note: The active fuel management lifters are installed into the guide by aligning the notched area of the guide (1) with the raised surface on the side of the lifter (2).

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

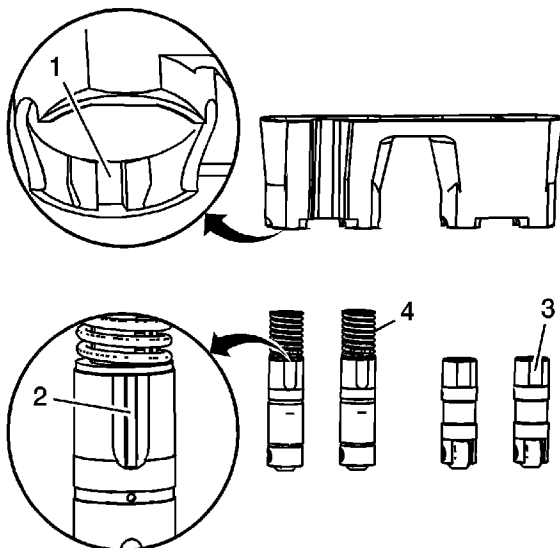
Installation Procedure

Note:

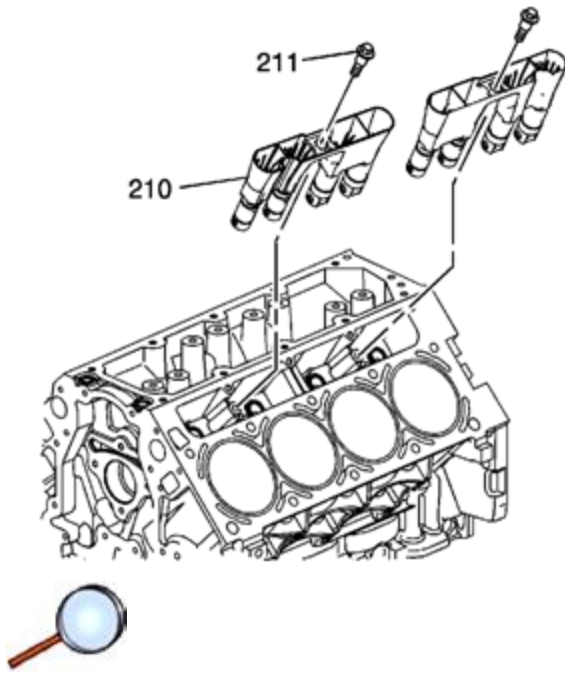
- When reusing valve lifters, install the lifters to their original locations.
- Each of the 4 valve guide assemblies will contain 2 active fuel management valve lifters and 2 non active fuel management valve lifters.
- With the lifters and guides properly installed, cylinders 1, 4, 6, and 7 lifter bores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



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



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



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

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

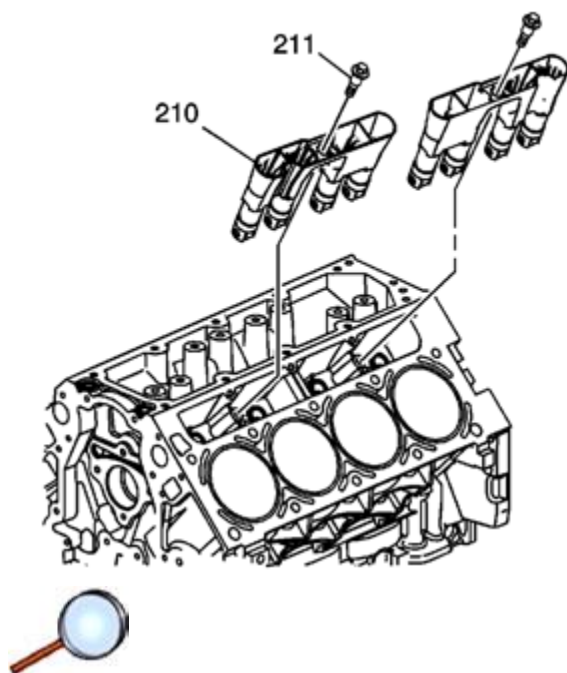
Tighten

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

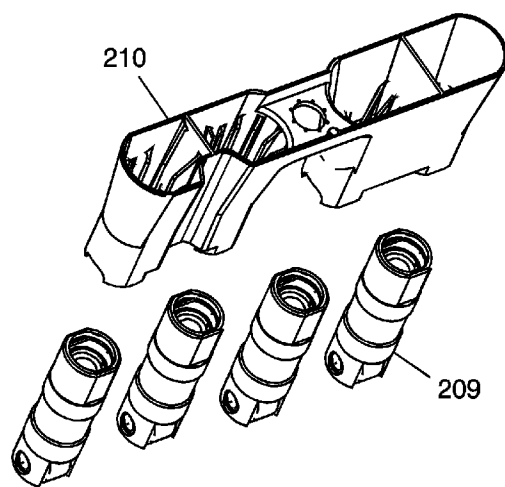
5. Install the cylinder head and gasket. Refer to [Cylinder Head Replacement - Left Side](#) or [Cylinder Head Replacement - Right Side](#).

Valve Lifter Replacement (Except LH6, LMG, LY5 and L76)

Removal Procedure



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

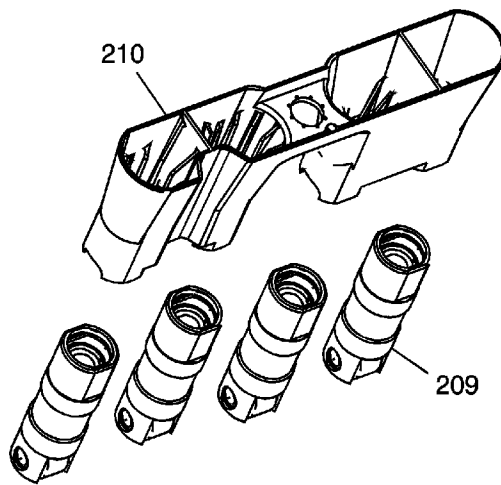




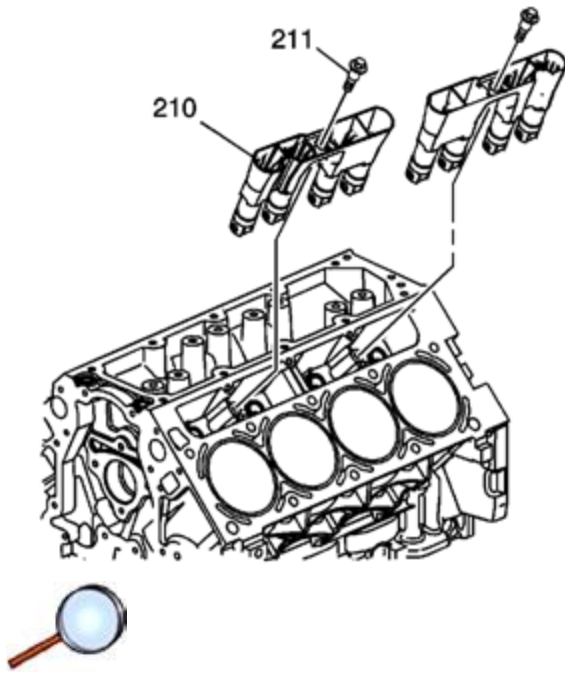
4. Remove the valve lifters (209) from the guide (210).
5. Organize or mark the components so that they can be installed in the same location from which they were removed, if required.
6. Clean and inspect the valve lifters, if required. Refer to [Valve Lifter and Guide Cleaning and Inspection](#).

Installation Procedure

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



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



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

Caution: Refer to [Fastener Caution](#) in the Preface section.

4. Install the valve lifter guide bolts.

Tighten

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

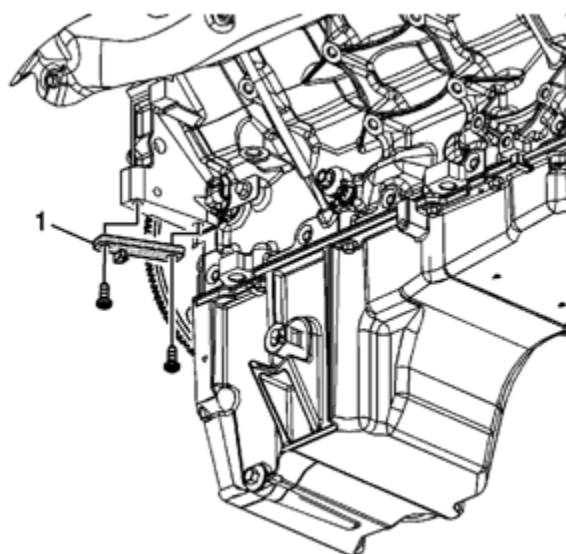
5. Install the cylinder head and gasket. Refer to [Cylinder Head Replacement - Left Side](#) or [Cylinder Head Replacement - Right Side](#).

Crankshaft Balancer Replacement

Special Tools

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

Removal Procedure



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

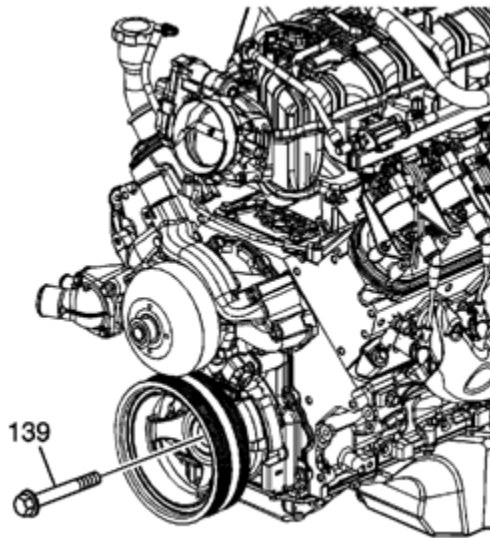
Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Ensure that the teeth of the [J 42386-A](#) mesh with the teeth of the engine flywheel.

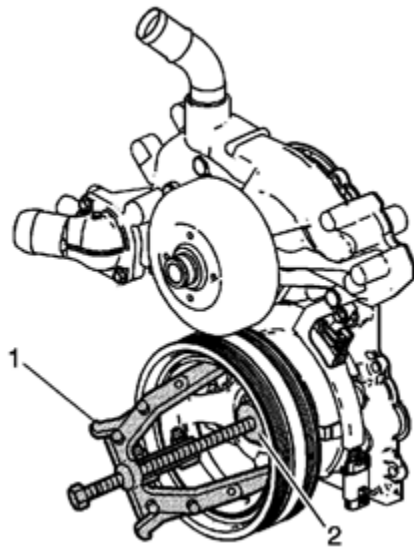
4. Install the [J 42386-A](#) (1) and bolts. Use one M10-1.5 x 120 mm and one M10-1.5 x 45 mm bolt for proper tool operation.

Tighten

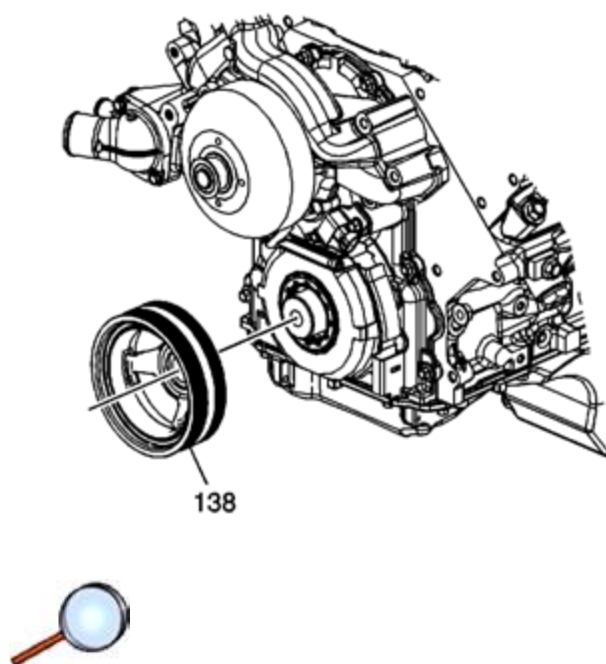
Tighten the [J 42386-A](#) bolts to 50 N·m (37 lb ft).



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



6. Install the [J 41816](#) (1) and [J 41816-2](#) (2) to the crankshaft balancer.



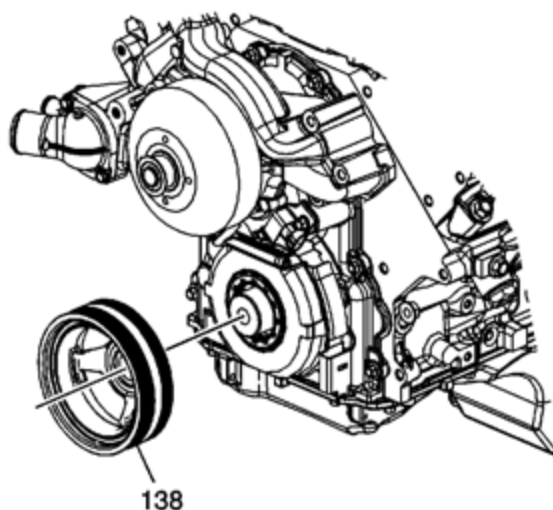
Note: The crankshaft balancer is balanced as an individual component. It is not necessary to mark the balancer prior to removal.

7. Use the [J 41816](#) and the [J 41816-2](#) to remove the crankshaft balancer (138).
8. Remove the [J 41816](#) and the [J 41816-2](#) from the crankshaft balancer.

Installation Procedure

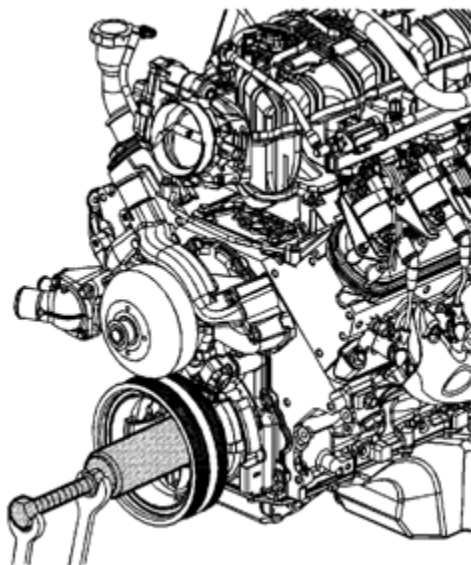
Note:

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



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

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



2. Install the [J 41665](#) and the threaded rod from the [J 41478](#) to crankshaft balancer and install the balancer.
 - 2.1. Assemble the threaded rod, nut, washer and installer. Insert the smaller end of the installer into the front of the balancer.
 - 2.2. Use a wrench and hold the hex end of the threaded rod.
 - 2.3. Use a second wrench and rotate the installation tool nut clockwise until the balancer is started onto the crankshaft.

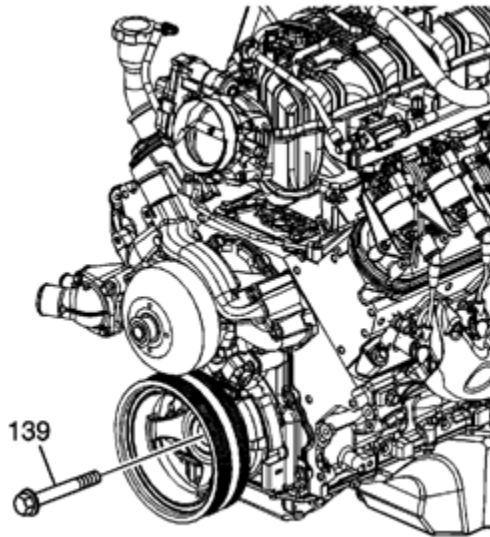
2.4. Remove the tool and reverse the installation tool.

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

2.5. Use a wrench and hold the hex end of the threaded rod.

2.6. Use a second wrench and rotate the installation tool nut clockwise until the balancer is installed onto the crankshaft.

2.7. Remove the [J 41665](#) and the threaded rod.

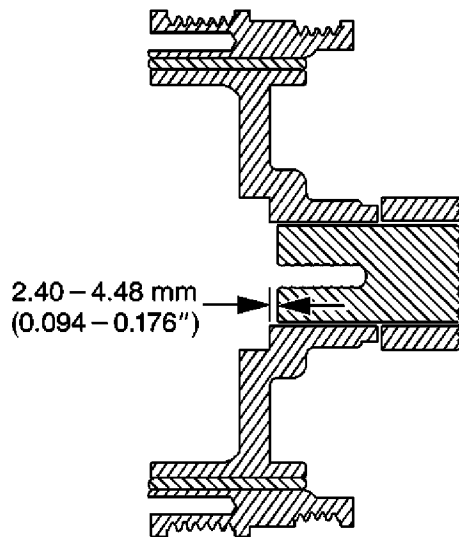


3. Install the USED crankshaft balancer bolt (139).

Tighten

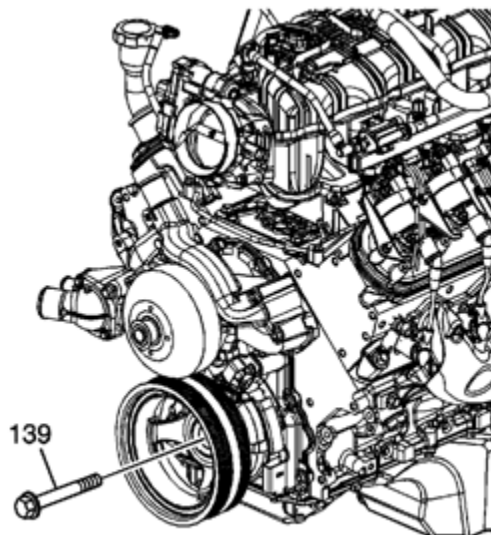
Tighten the USED bolt to 330 N·m (240 lb ft).

4. Remove the USED crankshaft balancer bolt.



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

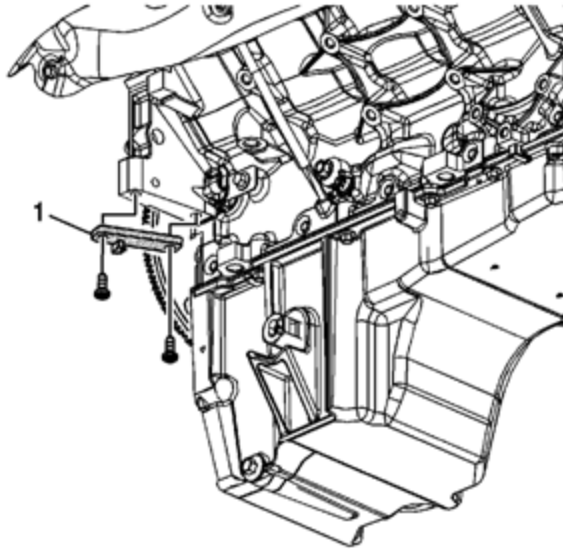
5. Measure for a correctly installed balancer. If the balancer is not installed to the proper dimension, install the [J 41665](#) and repeat the installation procedure.



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

Tighten

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



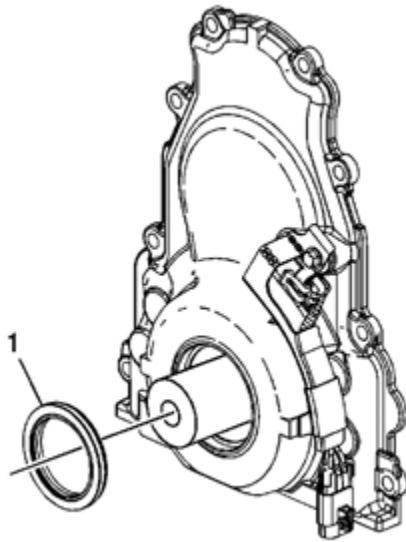
7. Remove the [J 42386-A](#) (1) and bolts.
8. Install the starter motor. Refer to [Starter Motor Replacement](#).
9. Install the cooling fan and shroud. Refer to [Cooling Fan and Shroud Replacement](#).
10. Install the A/C drive belt. Refer to [Air Conditioning Compressor Belt Replacement](#).
11. Perform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

Crankshaft Front Oil Seal Replacement (LMG, LY2 and LY5)

Tools Required

[J 41478](#) Crankshaft Front Oil Seal Installer

Removal Procedure

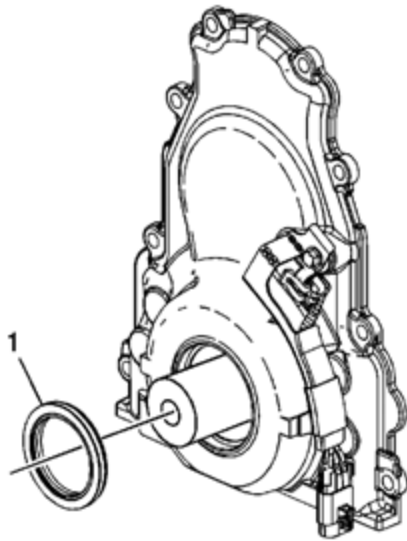


1. Remove the crankshaft balancer. Refer to [Crankshaft Balancer Replacement](#) .
2. Remove the crankshaft front oil seal (1) from the front cover.

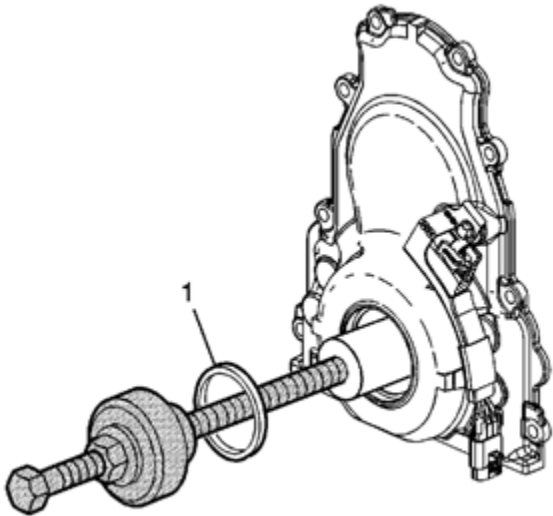
Installation Procedure

Important:

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



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



3. Install the crankshaft front oil seal (1) onto the [J 41478](#) guide.
4. Install the [J 41478](#) threaded rod (with nut, washer, guide, and oil seal) into the end of the crankshaft.
5. Use the [J 41478](#) in order to install the oil seal into the cover bore.
 - 5.1. Use a wrench and hold the hex on the installer bolt.
 - 5.2. Use a second wrench and rotate the installer nut clockwise until the seal bottoms in the cover bore.
 - 5.3. Remove the [J 41478](#) .
 - 5.4. Inspect the oil seal for proper installation. The oil seal should be installed evenly and completely into the front cover bore.

6. Install the crankshaft balancer. Refer to [Crankshaft Balancer Replacement](#) .

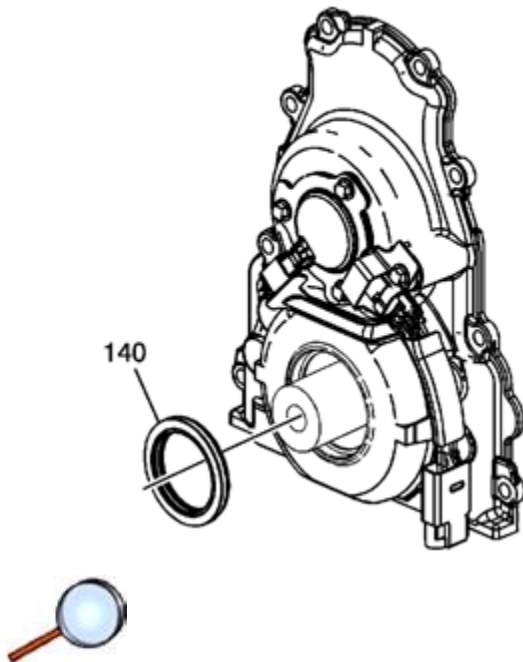
cardiagn.com

Crankshaft Front Oil Seal Replacement (Except LMG, LY2 and LY5)

Tools Required

[J 41478](#) Crankshaft Front Oil Seal Installer

Removal Procedure

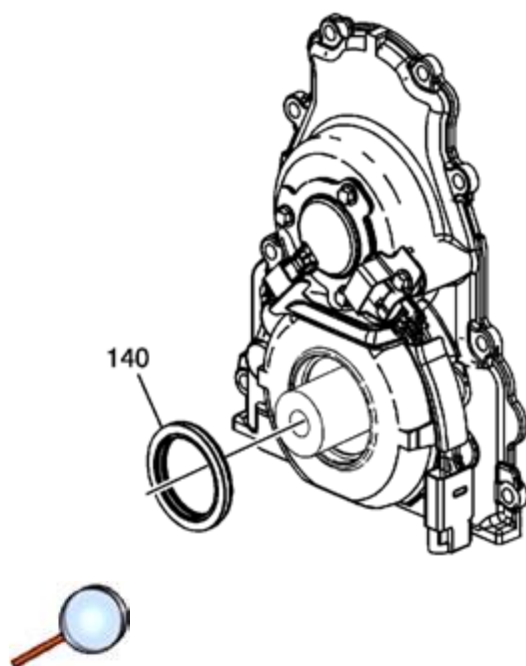


1. Remove the crankshaft balancer. Refer to [Crankshaft Balancer Replacement](#).
2. Remove the crankshaft front oil seal (140) from the front cover.

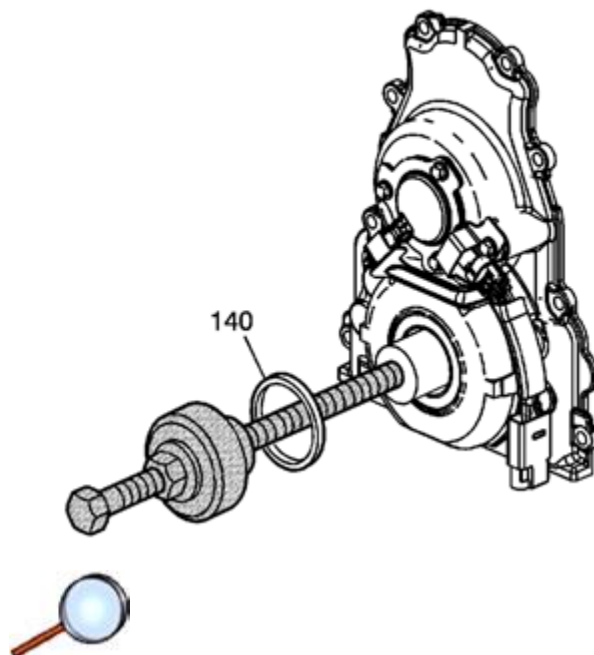
Installation Procedure

Important:

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



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.



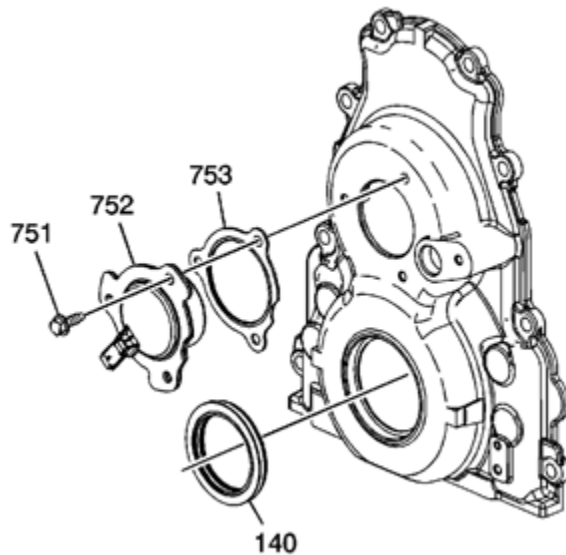
3. Install the crankshaft front oil seal (140) onto the [J 41478](#) guide.
4. Install the [J 41478](#) threaded rod (with nut, washer, guide, and oil seal) into the end of the crankshaft.
5. Use the [J 41478](#) in order to install the oil seal into the cover bore.
 - 5.1. Use a wrench and hold the hex on the installer bolt.
 - 5.2. Use a second wrench and rotate the installer nut clockwise until the seal bottoms in the cover bore.
 - 5.3. Remove the [J 41478](#) .
 - 5.4. Inspect the oil seal for proper installation. The oil seal should be installed evenly and completely into the front cover bore.

6. Install the crankshaft balancer. Refer to [Crankshaft Balancer Replacement](#).

cardiagn.com

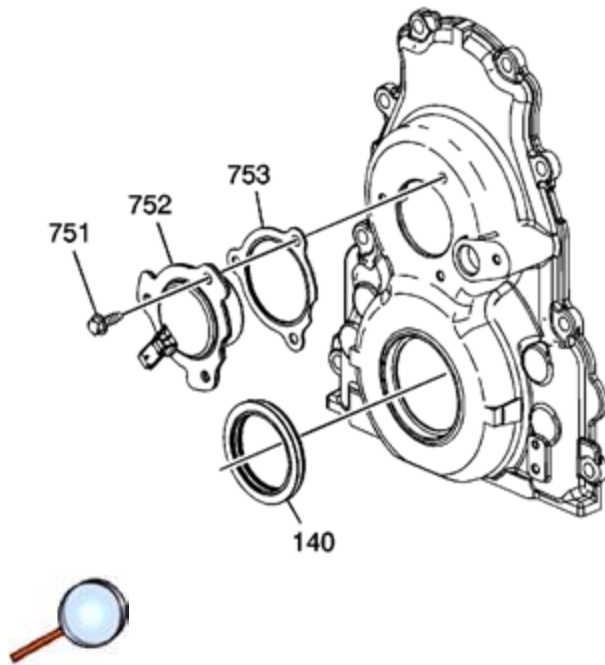
Camshaft Position Actuator Magnet Replacement

Removal Procedure



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

Installation Procedure



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

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

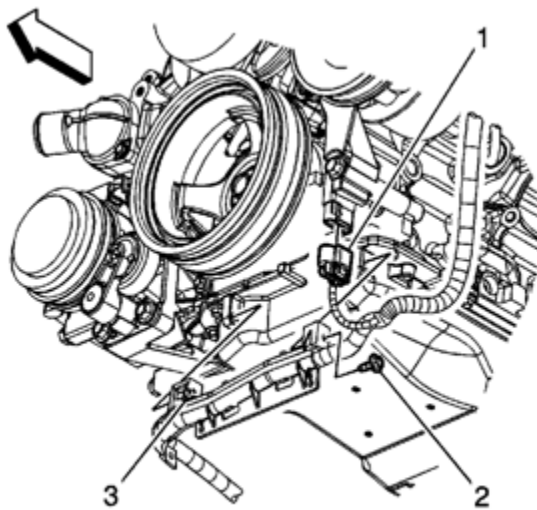
3. Install the CMP actuator magnet bolts (751) and tighten to **12 N·m (106 lb in)**.
4. Connect the engine harness electrical connector to the CMP actuator magnet.
5. Install the water pump. Refer to [Water Pump Replacement](#).

Engine Front Cover Replacement (Except RPOs LC9, LH6, LMG, LY2, LY5)

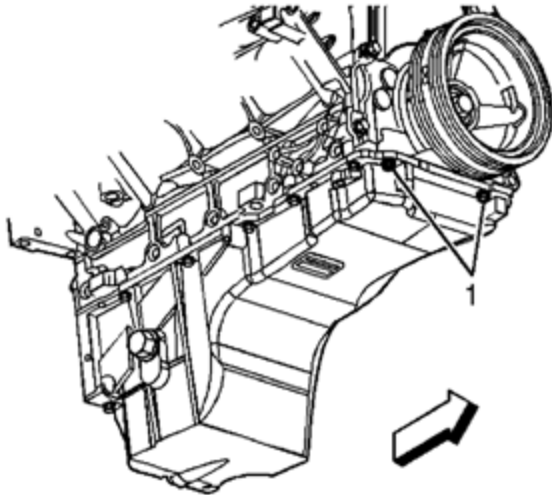
Special Tools

[J 41476](#) Front and Rear Cover Alignment Tool

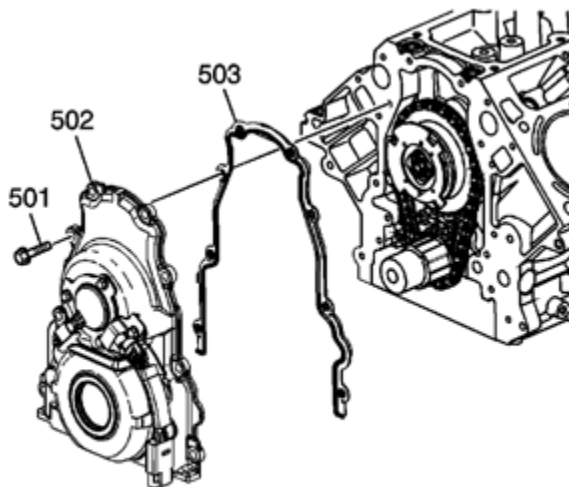
Removal Procedure



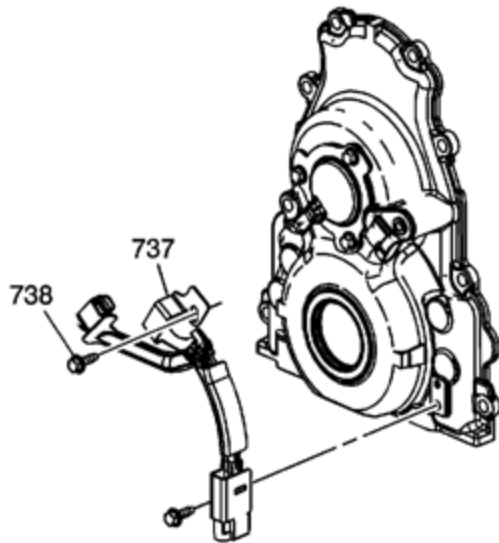
1. Remove the water pump. Refer to [Water Pump Replacement](#).
2. Remove the crankshaft balancer. Refer to [Crankshaft Balancer Replacement](#).
3. Disconnect the engine harness electrical connector (1) from the camshaft position (CMP) sensor wire harness electrical connector.



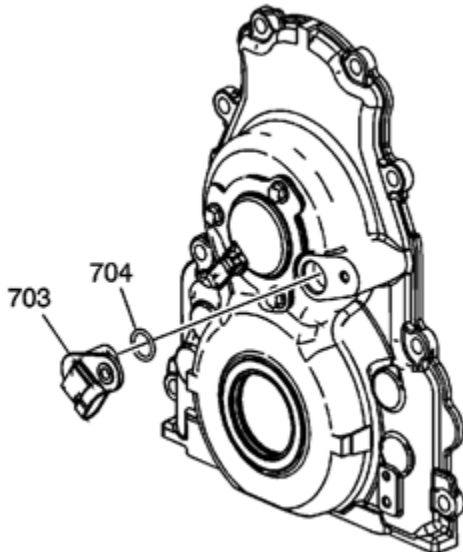
4. Remove the oil pan-to-front cover bolts (1).



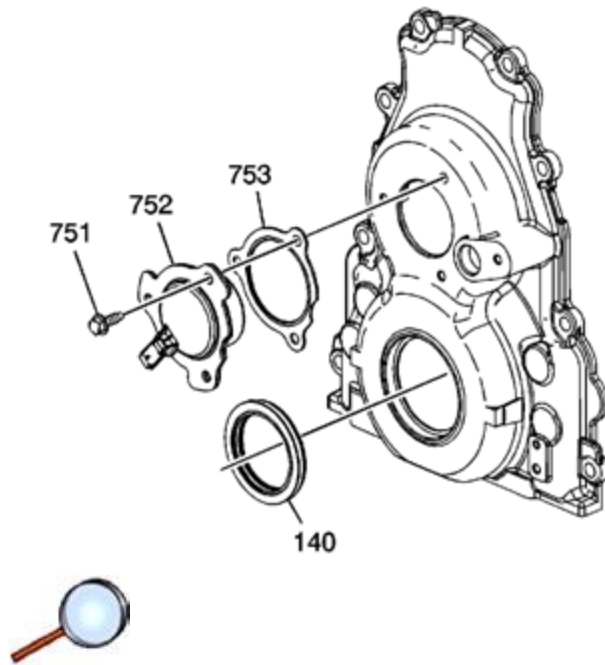
5. Remove the front cover bolts (501).
6. Remove the front cover (502) and gasket (503).
7. Discard the front cover gasket.
8. Remove the crankshaft front oil seal.



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



13. Remove the CMP sensor (703).

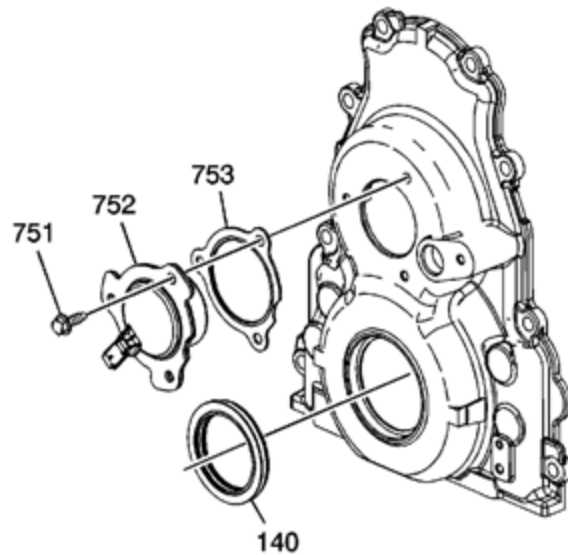


14. Remove the CMP actuator magnet bolts (751), and magnet (752).
15. Remove and discard the CMP actuator magnet gasket (753).

Installation Procedure

Note:

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



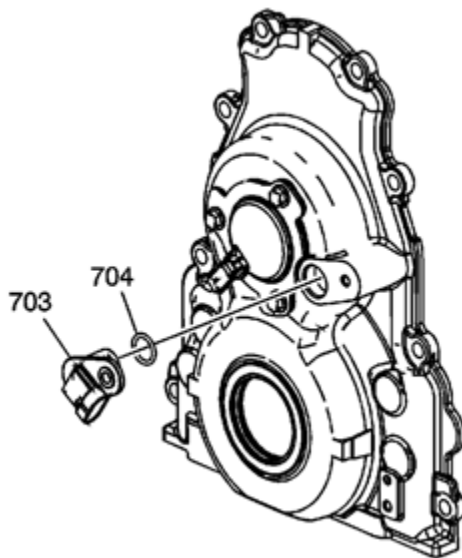
1. If replacing the front cover perform the following steps, otherwise proceed to step 10.
2. Install a NEW CMP actuator magnet gasket (753) onto the magnet.

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

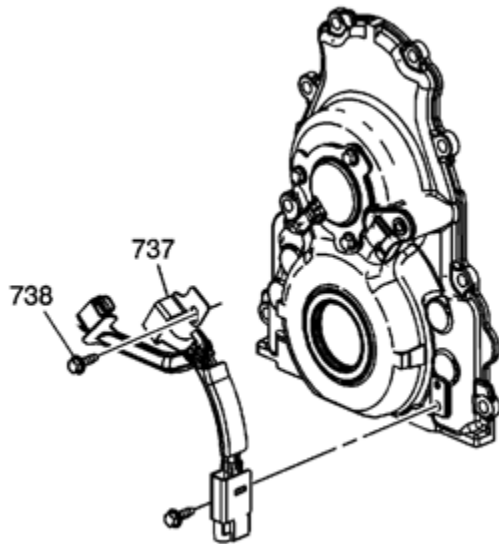
Tighten

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



4. Inspect the CMP sensor O-ring seal for cuts or damage. If the seal is not cut or damaged, it may be reused.

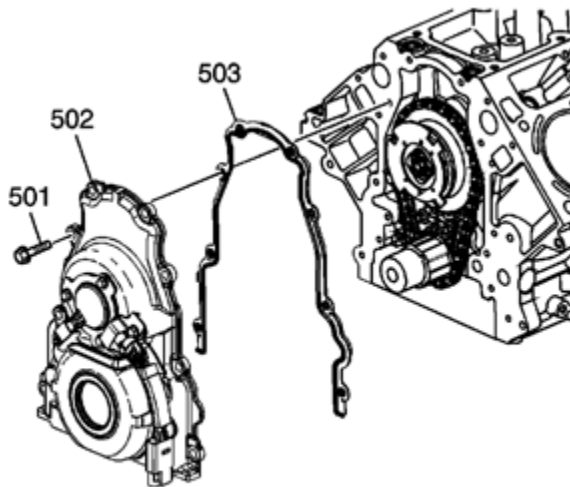
5. Lubricate the O-ring seal (704) with clean engine oil.
6. Install the CMP sensor (703).



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

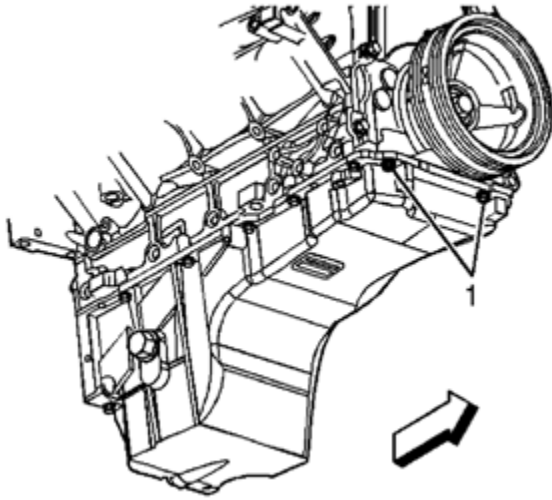
Tighten

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

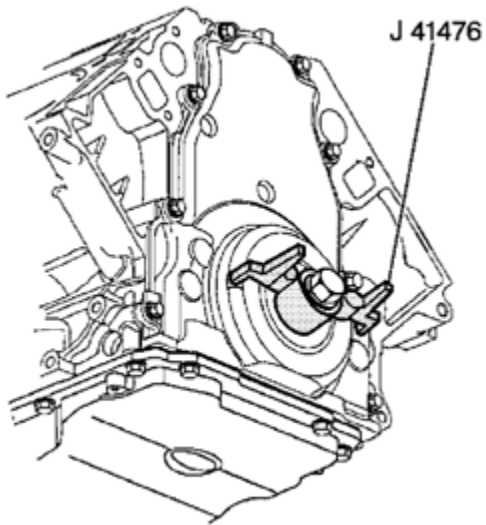


10. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.80 in) long to the oil pan to engine block junction. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).
11. Position the NEW engine front cover gasket (503) and front cover (502) to the engine.

12. Install the front cover bolts (501) until snug. Do not overtighten.



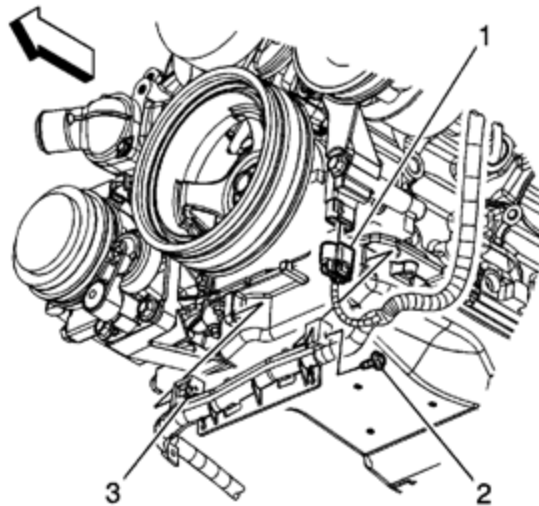
13. Install the oil pan-to-front cover bolts (1) until snug. Do not over tighten.



14. Install [J 41476](#) to the front cover.
15. Align the tapered legs of the [J 41476](#) with the machined alignment surfaces on the front cover.
16. Install the crankshaft balancer bolt until snug. Do not overtighten.

Tighten

1. Tighten the oil pan to front cover bolts to 25 N·m (18 lb ft).
 2. Tighten the engine front cover bolts to 25 N·m (18 lb ft).
17. Remove the [J 41476](#) .



18. Connect the engine harness electrical connector (1) to the CMP sensor wire harness electrical connector.
19. Install a NEW crankshaft front oil seal. Refer to [Crankshaft Front Oil Seal Replacement](#).
20. Install the water pump. Refer to [Water Pump Replacement](#).

cardiagn.com

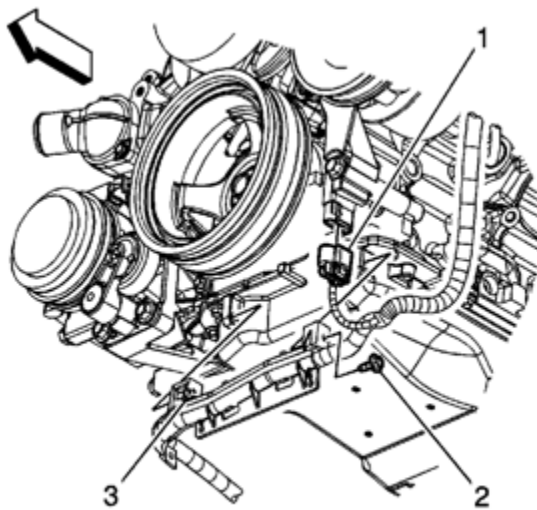
[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - On Vehicle](#) | **Document ID: 2159265**

Engine Front Cover Replacement (RPOs LC9, LH6, LMG, LY2 and LY5)

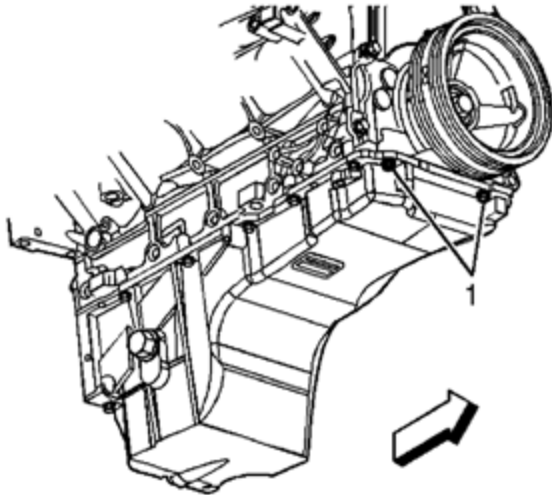
Special Tools

[J 41476](#) Front and Rear Cover Alignment Tool

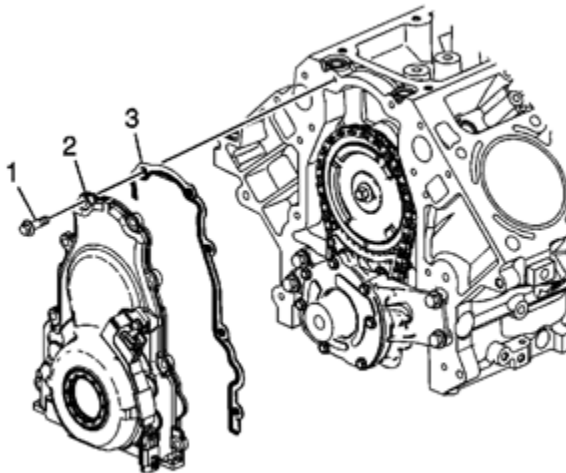
Removal Procedure



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

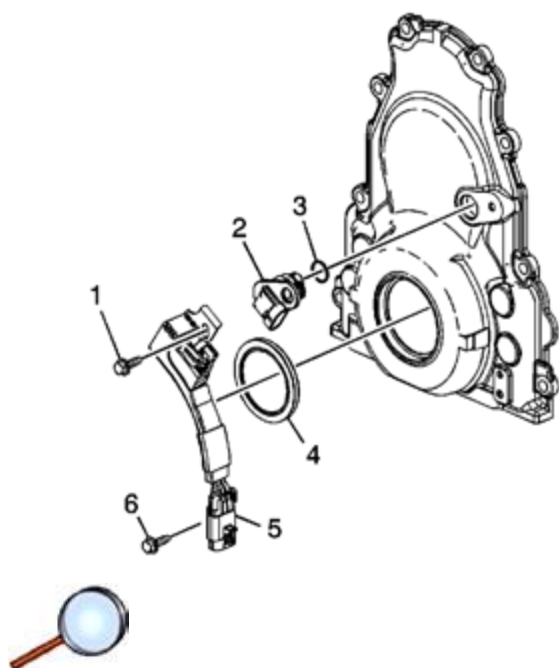


4. Remove the oil pan-to-front cover bolts (1).



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

cardiagn.com

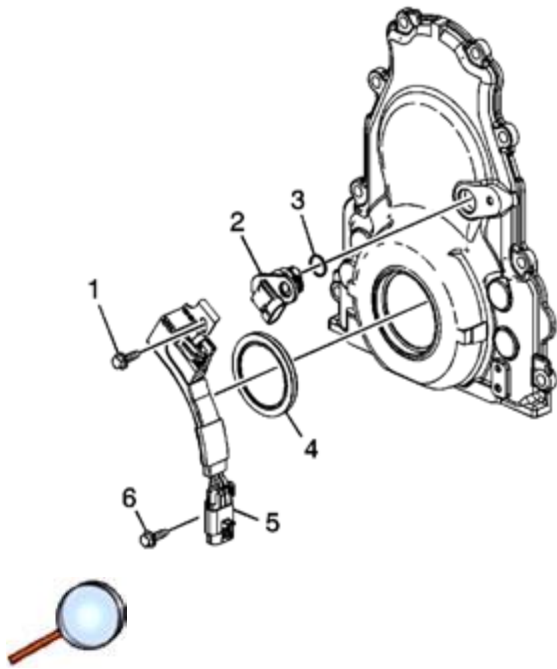


8. Remove the crankshaft front oil seal (4).
9. If replacing the engine front cover perform the following steps, otherwise proceed to step 8 of the installation procedure.
10. Remove the CMP sensor wire harness bolts (1 and 6).
11. Disconnect the CMP sensor wire harness from the CMP sensor.
12. Remove the CMP sensor wire harness (5).
13. Remove the CMP sensor (2).

Installation Procedure

Note:

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



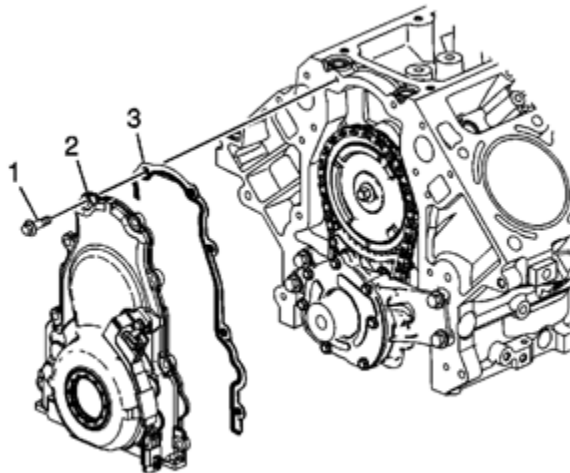
1. If replacing the front cover perform the following steps, otherwise proceed to step 8.
2. Inspect the CMP sensor O-ring seal for cuts or damage. If the seal is not cut or damaged, it may be reused.
3. Lubricate the O-ring seal (3) with clean engine oil.
4. Install the CMP sensor (2).
5. Position the CMP sensor wire harness (5) to the front cover.
6. Connect the CMP sensor wire harness to the CMP sensor.

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

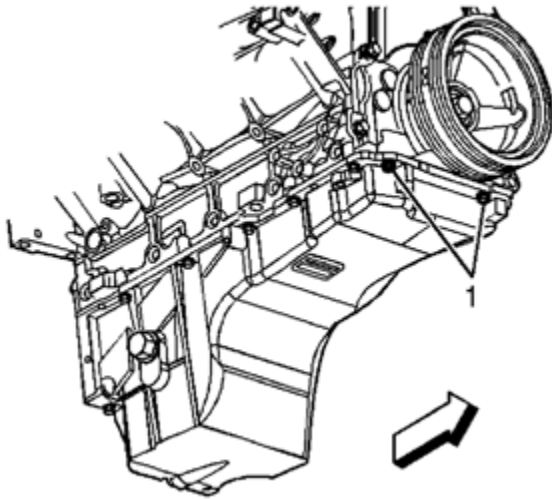
Tighten

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

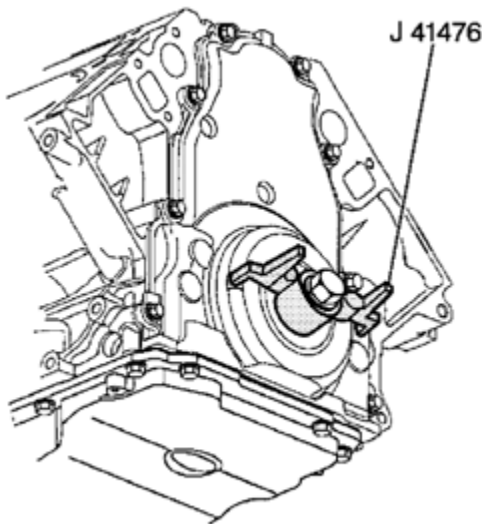




8. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.80 in) long to the oil pan to engine block junction. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).
9. Position the NEW engine front cover gasket (3) and front cover (2) to the engine.
10. Install the front cover bolts (1) until snug. Do not overtighten.



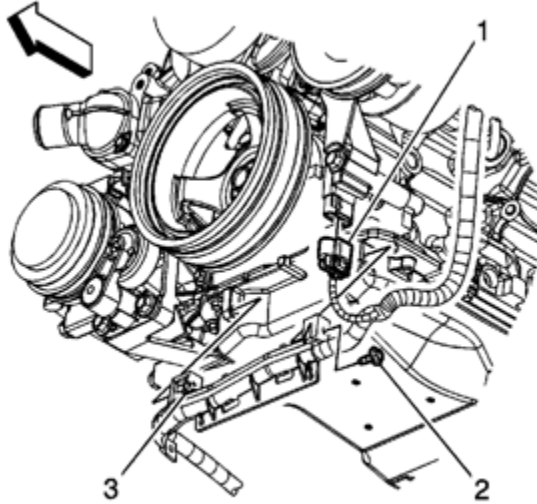
11. Install the oil pan-to-front cover bolts (1) until snug. Do not over tighten.



12. Install [J 41476](#) to the front cover.
13. Align the tapered legs of the [J 41476](#) with the machined alignment surfaces on the front cover.
14. Install the crankshaft balancer bolt until snug. Do not overtighten.

Tighten

1. Tighten the oil pan to front cover bolts to 25 N·m (18 lb ft).
2. Tighten the engine front cover bolts to 25 N·m (18 lb ft).
15. Remove the [J 41476](#).



16. Connect the engine harness electrical connector (1) to the CMP sensor wire harness electrical connector.
17. Install a NEW crankshaft front oil seal. Refer to [Crankshaft Front Oil Seal Replacement](#).
18. Install the water pump. Refer to [Water Pump Replacement](#).

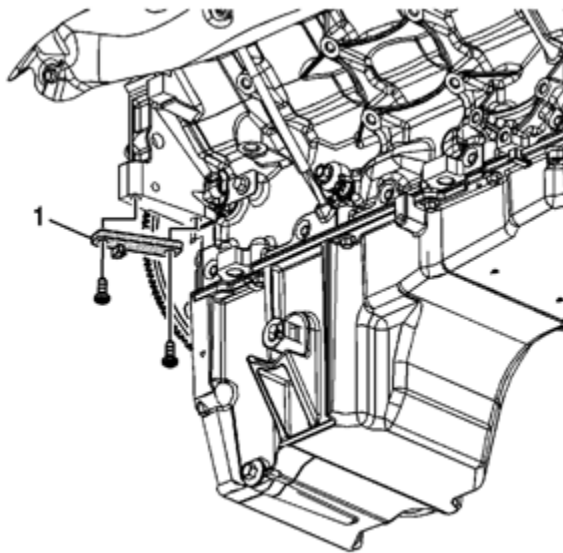
Camshaft Position Actuator Solenoid Valve Replacement

Special Tools

- [J 42386-A](#) Flywheel Holding Tool
- [J 45059](#) Angle Meter

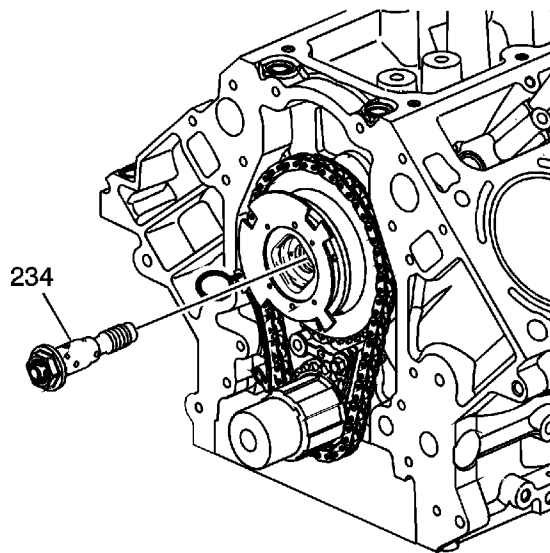
Removal Procedure

Caution: Refer to [Fastener Caution](#) in the Preface section.



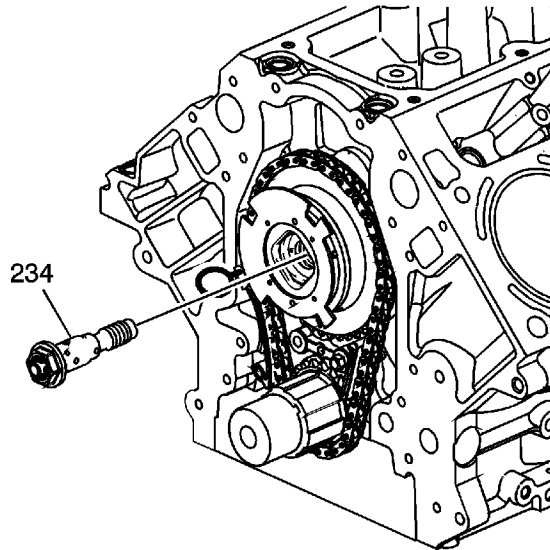
1. Install the [J 42386-A](#) (1) and bolts. Use 1 M10 - 1.5 x 120 mm and 1 M10 - 1.5 x 45 mm bolt for proper tool operation. Tighten the [J 42386-A](#) bolts to **50 N·m (37 lb ft)**.
2. Remove the camshaft position (CMP) actuator magnet. Refer to [Camshaft Position Actuator Magnet Replacement](#).

Warning: Refer to [Camshaft Position Actuator Removal and Installation Warning](#) in the Preface section.



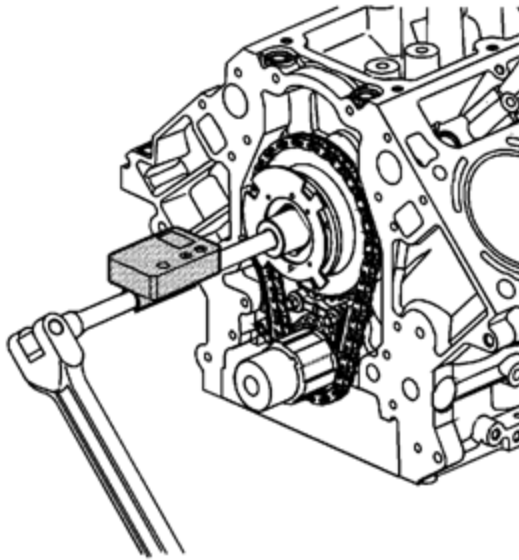
3. Remove the CMP actuator solenoid valve (234).
4. Discard the solenoid valve.

Installation Procedure

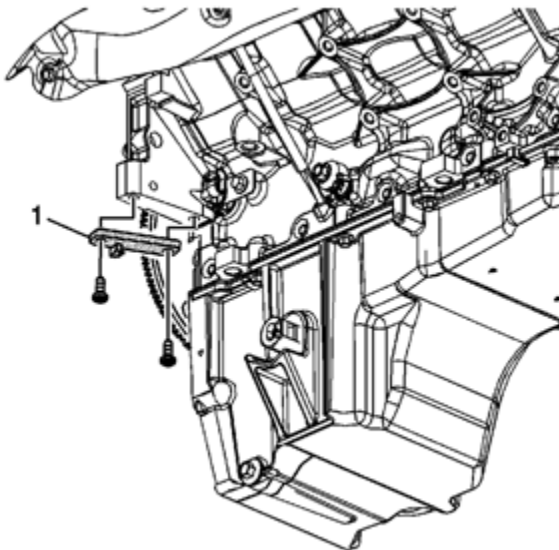


1. Install a NEW CMP actuator solenoid valve (234).

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



2. Tighten the CMP actuator solenoid valve.
 - 2.1. Tighten the CMP actuator solenoid valve a first pass to **65 N·m (48 lb ft)**.
 - 2.2. Tighten the CMP actuator solenoid valve a final pass an additional 90 degrees using the [J 45059](#).



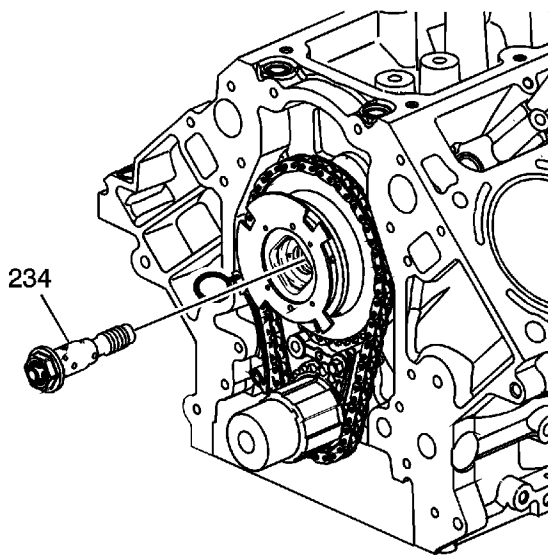
3. Remove the [J 42386-A](#) (1).
4. Install the CMP actuator magnet. Refer to [Camshaft Position Actuator Magnet Replacement](#).

Camshaft Position Actuator Replacement

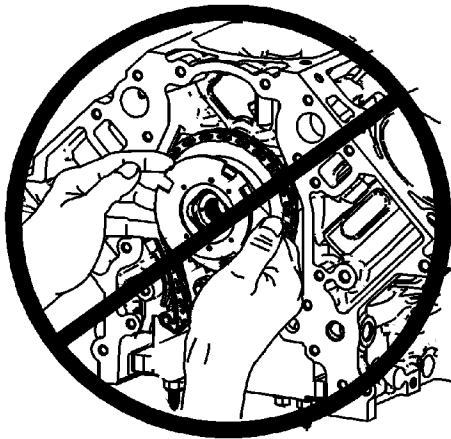
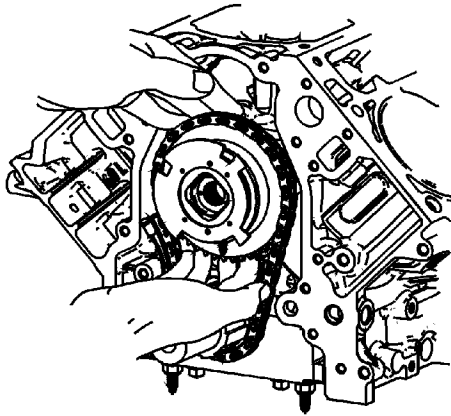
Special Tools

- [EN 46330](#) Timing Belt Tensioner Retaining Pin
- [J 45059](#) Angle Meter

Removal Procedure

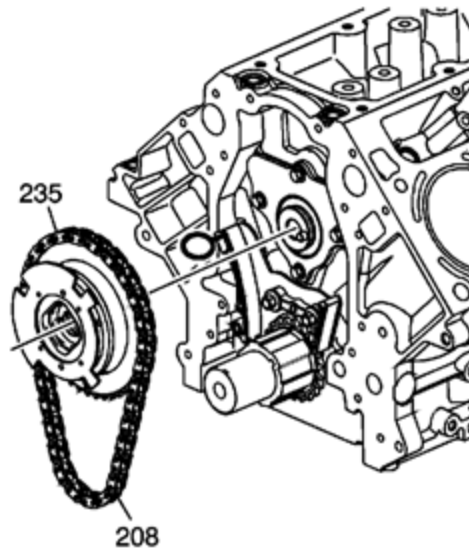


1. Remove the oil pump. Refer to [Oil Pump, Screen, and Crankshaft Oil Deflector Replacement](#).
2. Remove and discard the camshaft position (CMP) actuator solenoid valve (234).

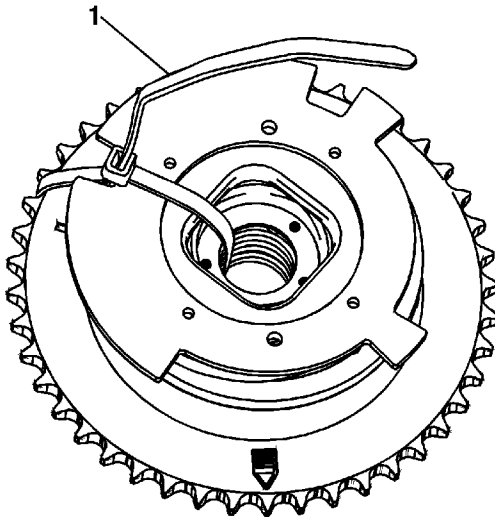


Warning: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator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

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

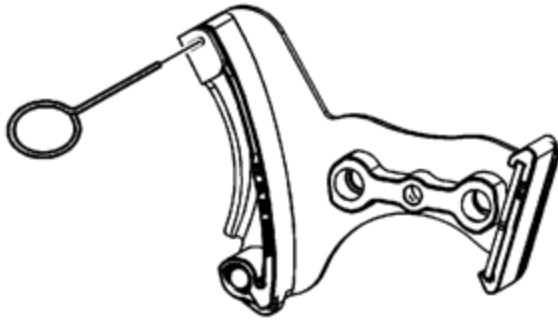


4. Remove the CMP actuator (235) and timing chain (208).

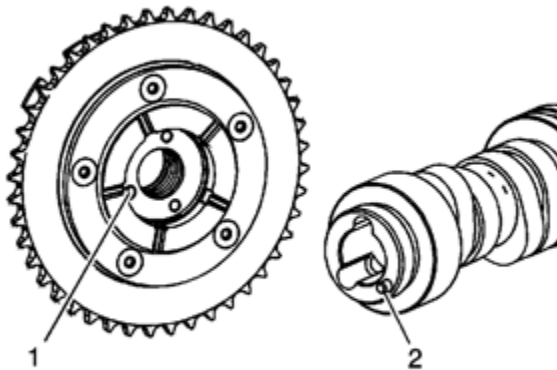


5. Insert and secure a tie strap (1) through the center of the actuator and over the reluctor wheel.

Installation Procedure



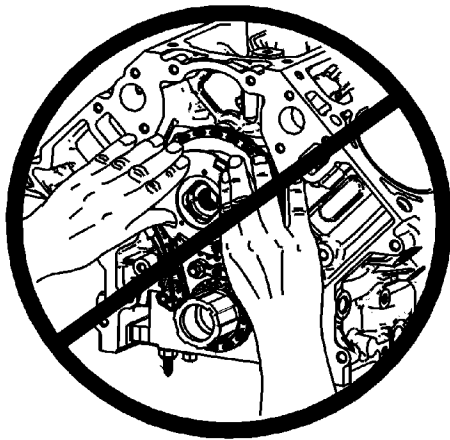
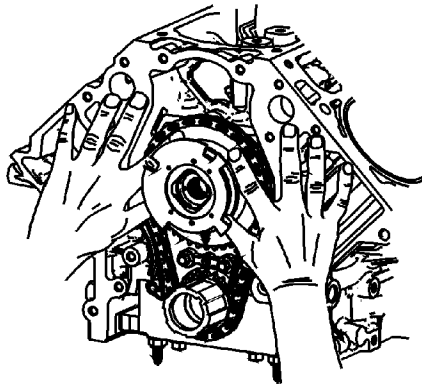
1. Compress the timing chain tensioner guide and install the [EN 46330](#) .



Note:

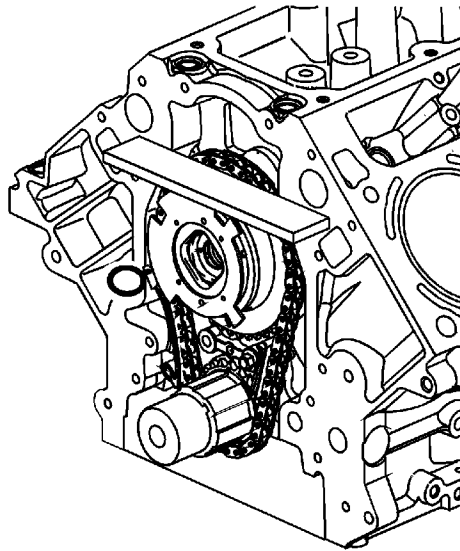
- Properly locate the CMP actuator on the locating pin of the camshaft.
- The sprocket teeth and timing chain must mesh.
- The camshaft and the crankshaft sprocket alignment marks **MUST** be aligned properly.
- **DO NOT** use the CMP solenoid valve again. Install a **NEW** valve during assembly.

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

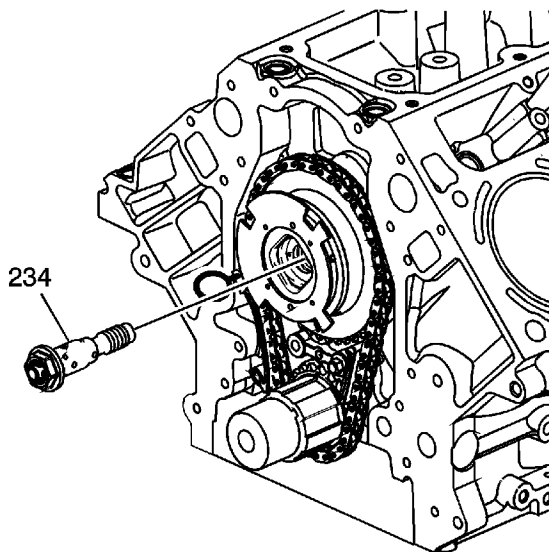


Warning: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator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

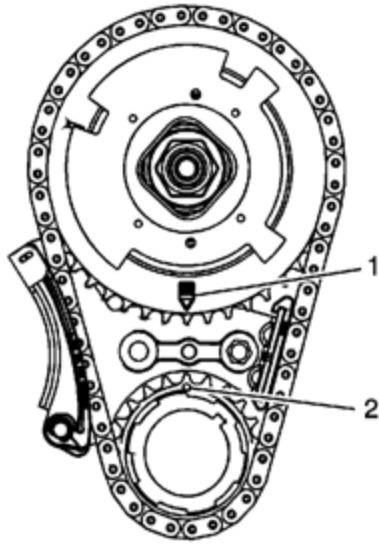
3. Install the CMP actuator and timing chain. Align the hole in the rear face of the CMP actuator with the locating pin on the front face of the camshaft. If necessary, rotate the camshaft or crankshaft sprockets in order to align the timing marks. Use care to install the actuator completely onto the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



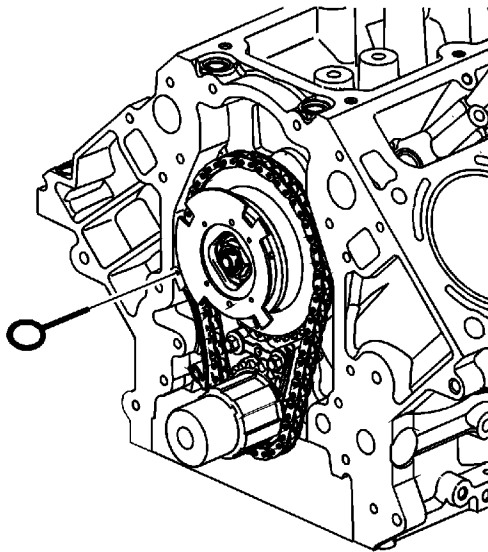
4. Place a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and completely installed onto the front of the camshaft, the timing chain will not protrude beyond the front face of the engine block.



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

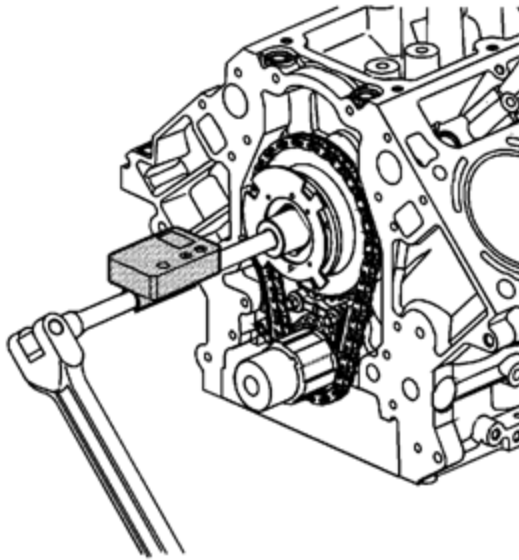


6. Inspect the sprockets for proper alignment. The mark on the CMP actuator sprocket (1) should be located in the 6 o'clock position and the mark on the crankshaft sprocket (2) should be located in the 12 o'clock position.



7. Remove the [EN 46330](#).

Caution: Refer to [Fastener Caution](#) in the Preface section.



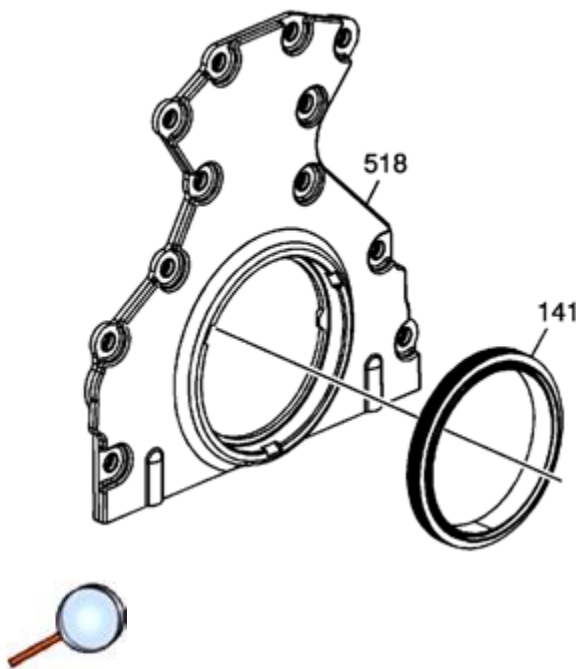
8. Tighten the CMP actuator solenoid valve.
 - 8.1. Tighten the valve a first pass to **65 N·m (48 lb ft)**.
 - 8.2. Tighten the valve a final pass and additional **90 degrees** using [J 45059](#).
9. Install the oil pump. Refer to [Oil Pump, Screen, and Crankshaft Oil Deflector Replacement](#).

Crankshaft Rear Oil Seal Replacement

Tools Required

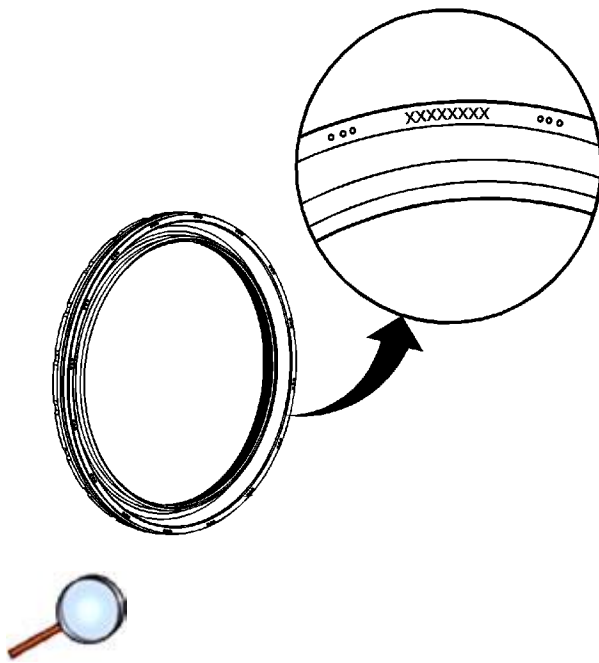
[J 41479](#) Crankshaft Rear Oil Seal Installer

Removal Procedure



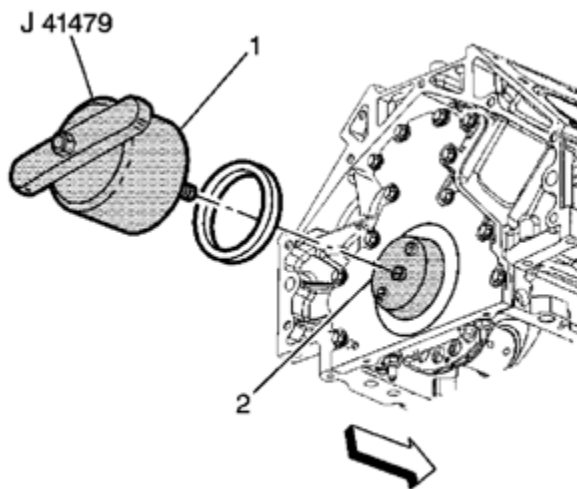
1. Remove the automatic transmission flexplate, refer to [Automatic Transmission Flex Plate Replacement](#).
2. Remove and discard the crankshaft rear oil seal (141).

Installation Procedure



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

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



2. Install the [J 41479](#) cone (2) and bolts onto the rear of the crankshaft.
3. Tighten the bolts until snug. Do not overtighten.
4. Install the rear oil seal onto the tapered cone (2) and push the seal to the rear seal bore. Install the oil seal with the part number markings facing away from the engine.
5. Thread the [J 41479](#) threaded rod into the tapered cone until the tool (1) contacts the oil seal.
6. Align the oil seal into the tool (1).
7. Rotate the handle of the tool (1) clockwise until the seal enters the rear cover and bottoms into the cover bore.

8. Remove the [J 41479](#) .
9. Install the automatic transmission flexplate, refer to [Automatic Transmission Flex Plate Replacement](#).

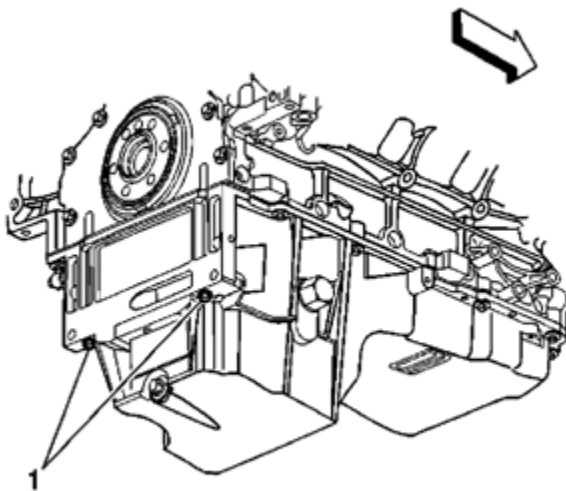
cardiagn.com

Crankshaft Rear Oil Seal Housing Replacement

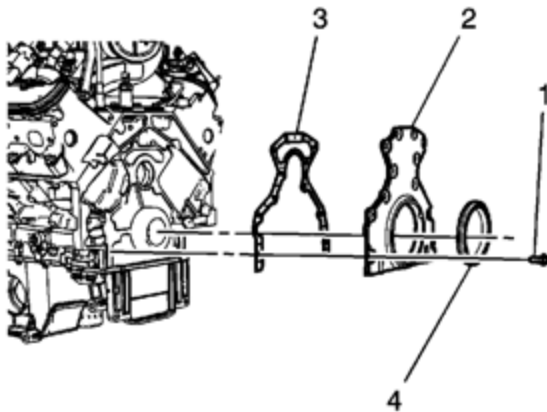
Special Tools

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

Removal Procedure



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

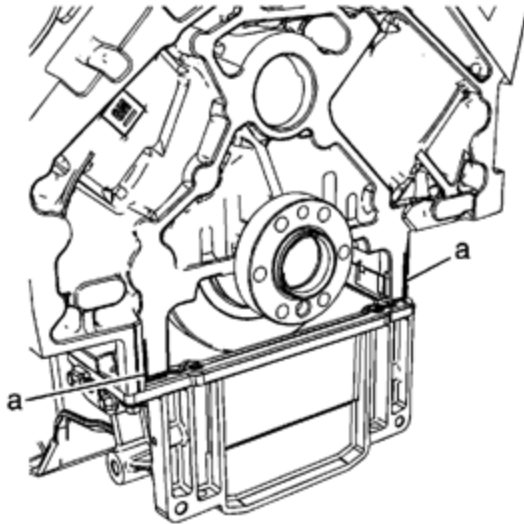


3. Remove the rear oil seal housing bolts (1).
4. Remove the rear oil seal housing (2) and gasket (3). Discard the gasket.
5. Remove and discard the rear oil seal (4).

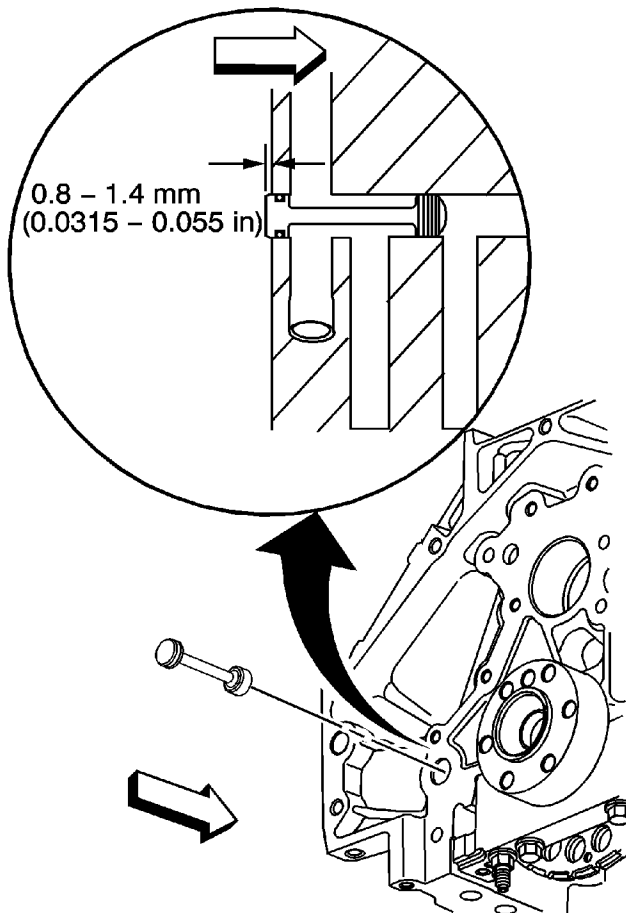
Installation Procedure

Note:

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



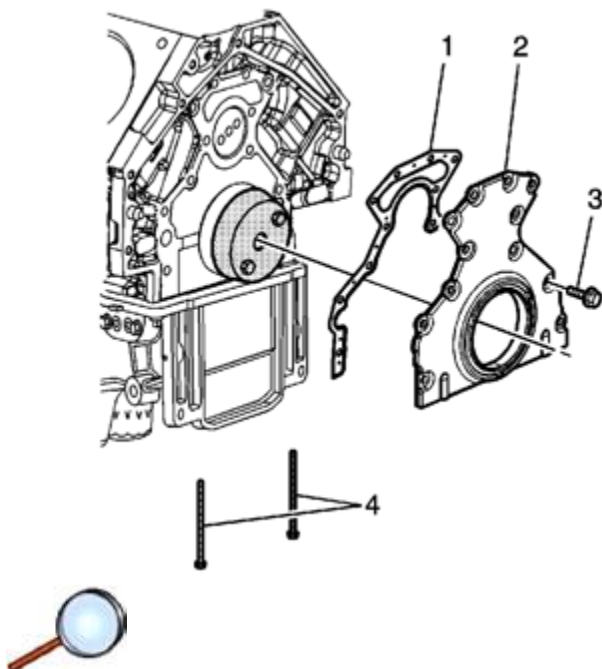
1. Apply a 5 mm (0.2 in) bead of sealant, 20 mm (0.8 in) to the 2 joints (a) at the rear of the block/pan. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).



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

Installation Procedure - Cover with Seal

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

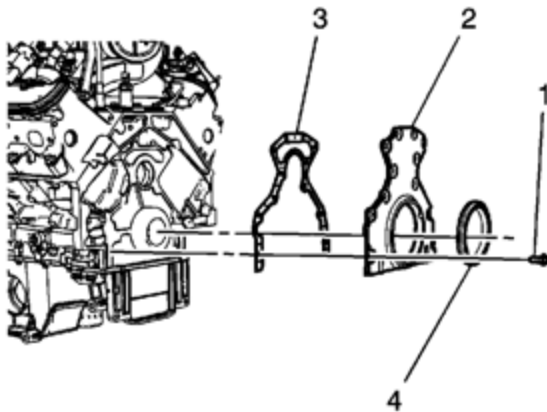


2. Install the NEW rear housing gasket (1), rear housing with seal (2), rear housing-to-engine bolts (3) and oil pan-to-rear housing bolts (4).

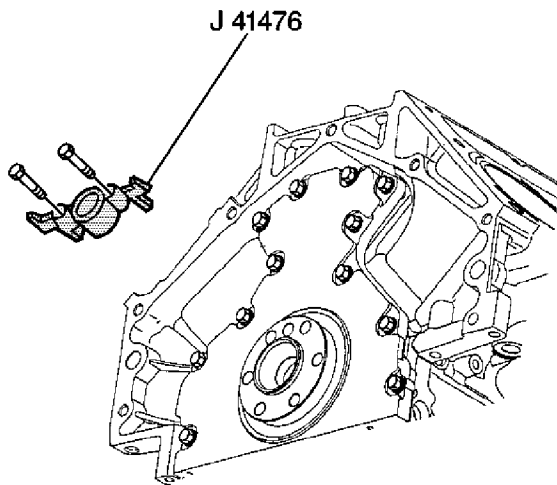
Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Tighten the rear housing-to-engine bolts (3) until snug. Do not overtighten.
4. Tighten the oil pan-to-rear housing bolts (4) to **12 N·m (106 lb in)**.
5. Tighten the rear housing-to-engine bolts (3) to **30 N·m (22 lb ft)**.
6. Remove the J-41479-2A guide .
7. Install the automatic transmission flexplate. Refer to [Automatic Transmission Flex Plate Replacement](#).

Installation Procedure - Cover without Seal

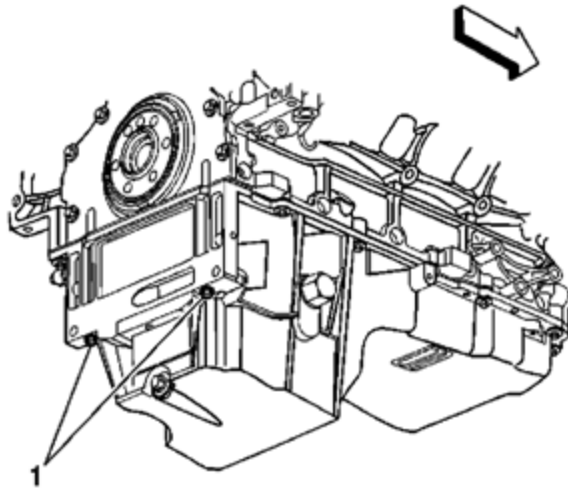


1. Position a NEW rear oil seal housing gasket (3) and the housing (2) to the engine.
2. Install the rear oil seal housing bolts (1) until snug. Do not overtighten.
3. Rotate the crankshaft until 2 opposing flywheel bolts holes are parallel to the oil pan surface.



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

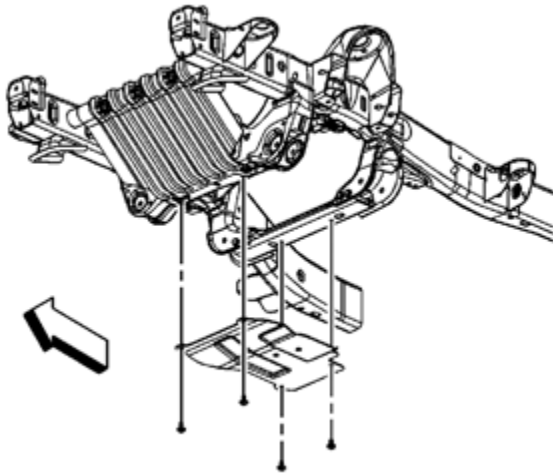
4. Install the J-41476 tool and bolts onto the rear of the crankshaft.
5. Tighten the J-41476 tool bolts until snug. Do not overtighten.



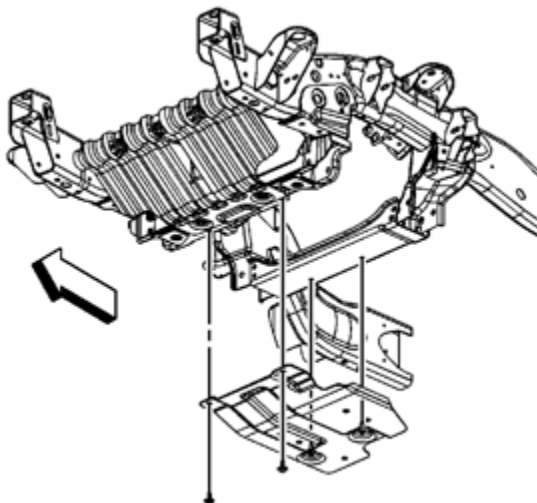
6. Install the oil pan-to-rear oil seal housing bolts (1).
 - 6.1. Tighten the oil pan-to-rear cover bolts to **12 N·m (106 lb in)**.
 - 6.2. Tighten the rear oil seal housing-to-engine bolts to **30 N·m (22 lb ft)**.
7. Remove the J-41476 tool .
8. Install a NEW crankshaft rear oil seal. Refer to [Crankshaft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

Oil Filter Adapter Replacement

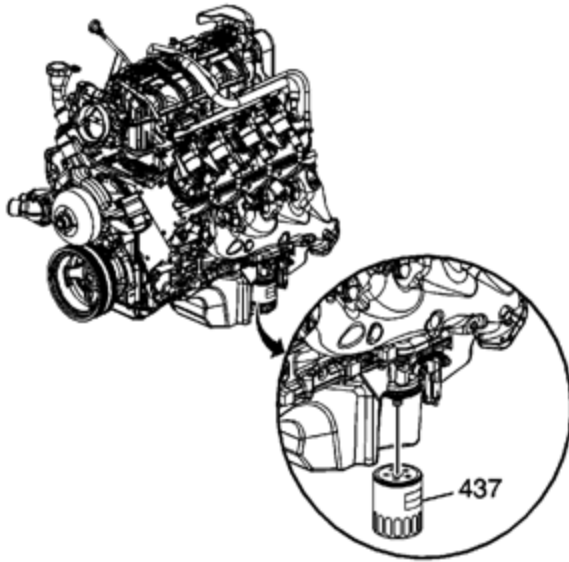
Removal Procedure



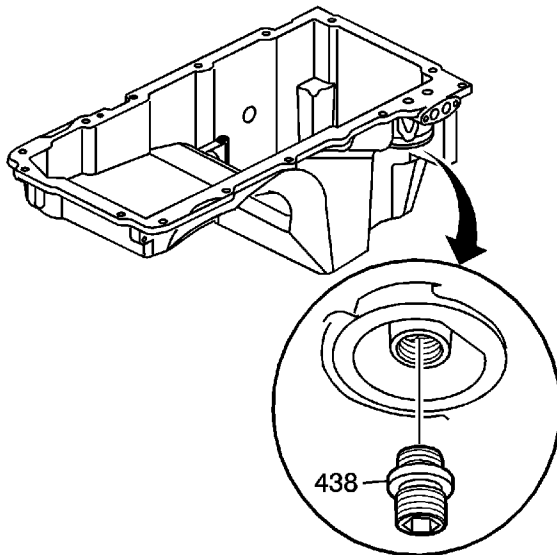
1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. For 1500 series vehicles, remove the oil pan skid plate bolts and skid plate, if equipped.



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



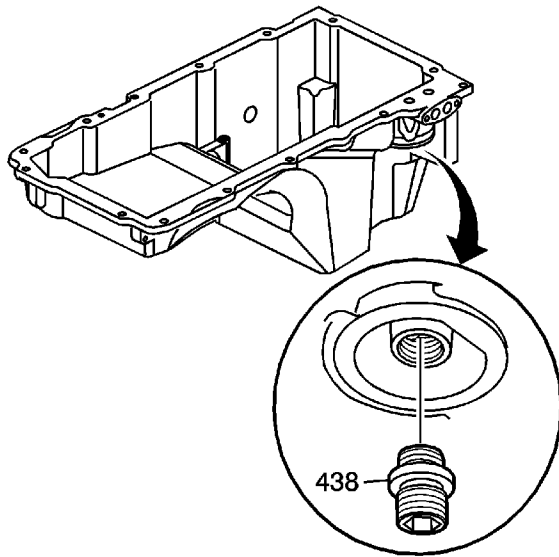
4. Place a suitable drain pan under the oil filter.
5. Remove the oil filter (437).



6. Remove the oil filter adapter (438).

Installation Procedure

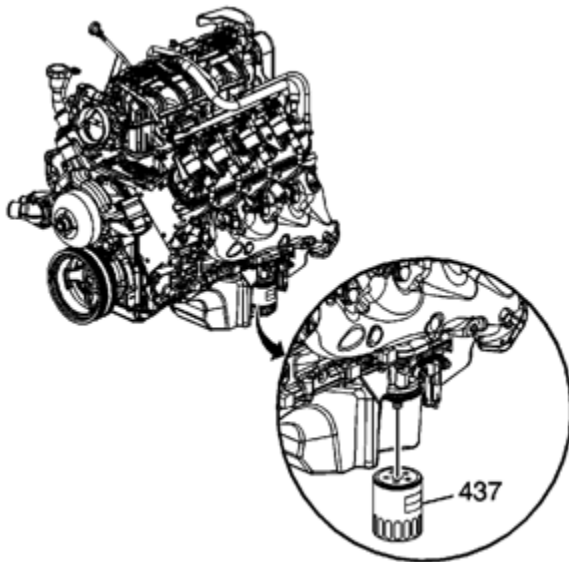
Caution: Refer to [Fastener Caution](#) in the Preface section.



1. Install the oil filter adapter (438).

Tighten

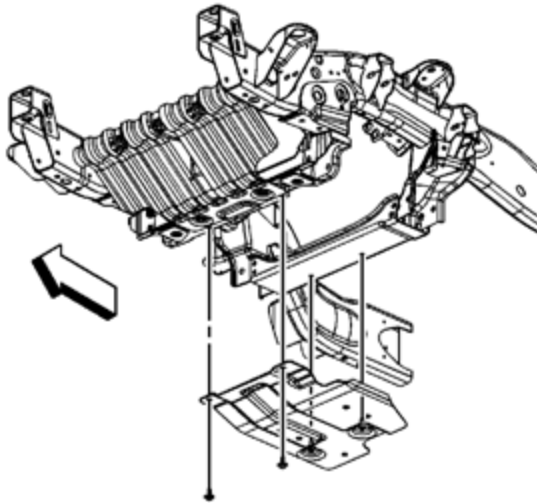
Tighten the adapter to 55 N·m (40 lb ft).



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

Tighten

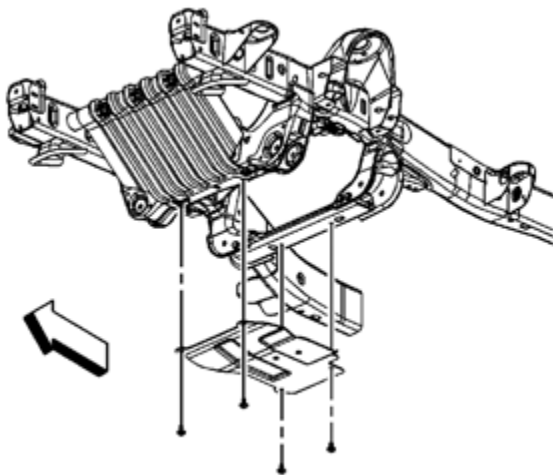
Tighten the filter to 30 N·m (22 lb ft).



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

Tighten

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



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

Tighten

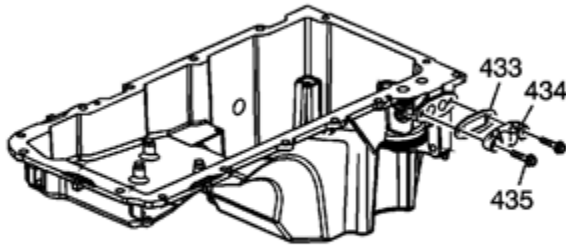
Tighten the bolts to 28 N·m (21 lb ft).

6. Lower the vehicle.
7. Refill the engine oil. Refer to [Approximate Fluid Capacities](#) and/or [Fluid and Lubricant Recommendations](#).
8. Start the engine and inspect for leaks.

cardiagn.com

Oil Pan Cover Replacement

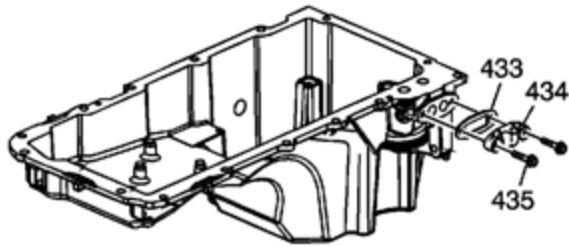
Removal Procedure



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

Installation Procedure

Caution: Refer to [Fastener Caution](#) in the Preface section.

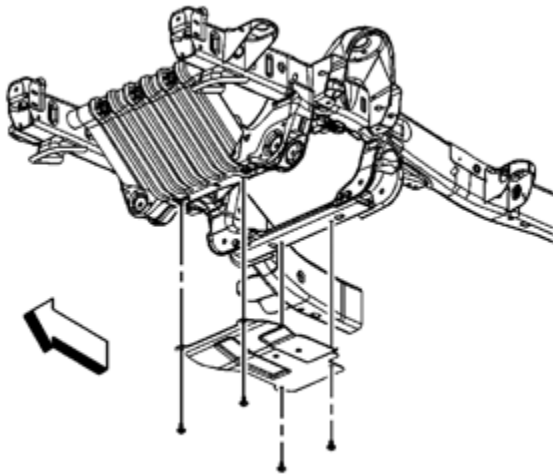


1. Position a NEW oil pan cover gasket (433) and the cover (434) to the oil pan and install the bolts (435). Tighten the bolts to **12 N·m (106 lb in)**.
2. Lower the vehicle.

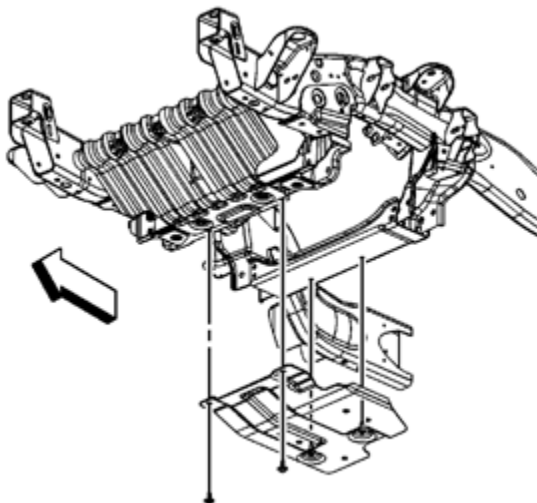
cardiagn.com

Oil Pan Replacement (4WD)

Removal Procedure

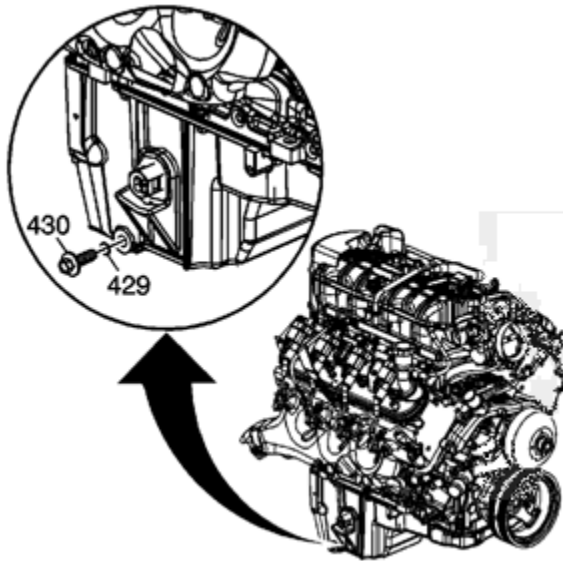


1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. For 1500 series vehicles, remove the oil pan skid plate bolts and skid plate, if equipped.

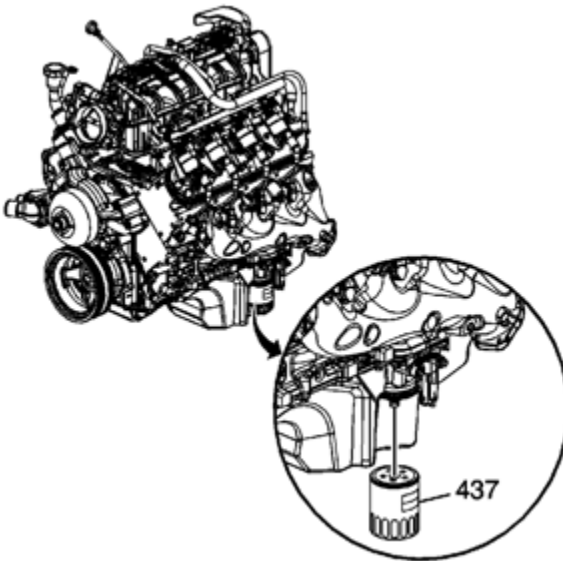


3. For 2500 series vehicles, loosen the 2 rear oil pan skid plate bolts, remove the 2 front oil pan skid plate bolts and skid plate, if equipped.

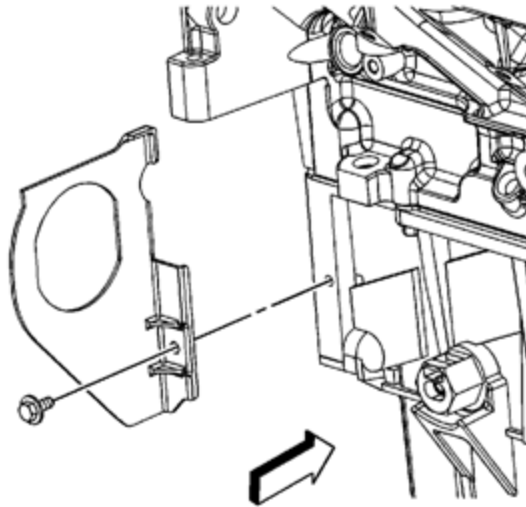
4. Remove the front differential carrier. Refer to [Differential Carrier Assembly Replacement](#).
5. Unbolt the steering rack and hang downward.



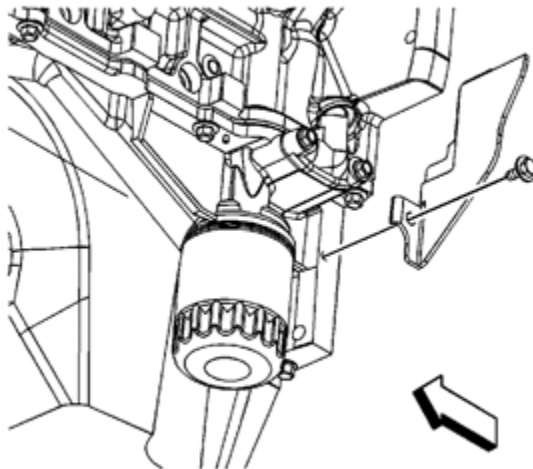
6. Place a suitable drain pan under the oil pan drain plug.
7. Remove the oil pan drain plug (430).
8. Allow the oil pan to drain completely.
9. Re-install the oil pan drain plug until snug.



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

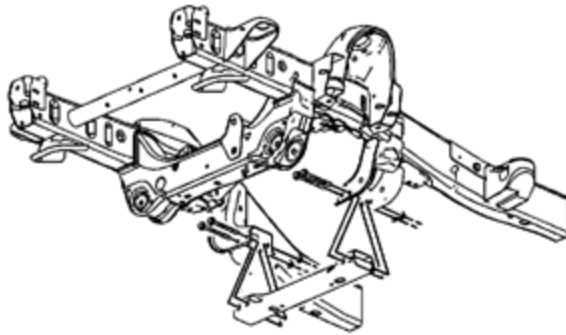


14. Remove the right side transmission cover bolt.

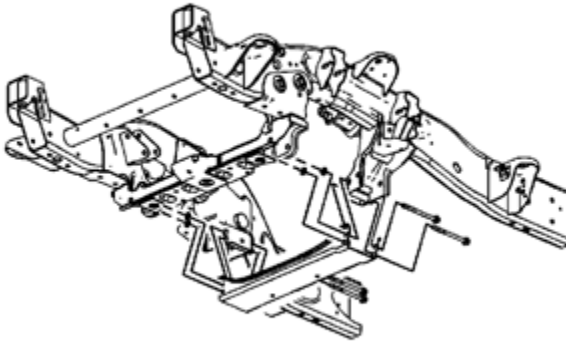


15. Remove the left side transmission cover bolt and cover.

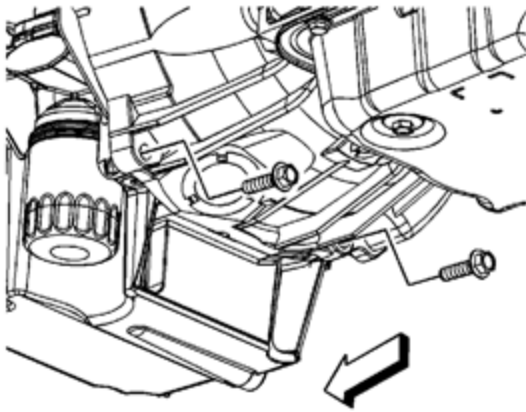
cardiagn.com



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



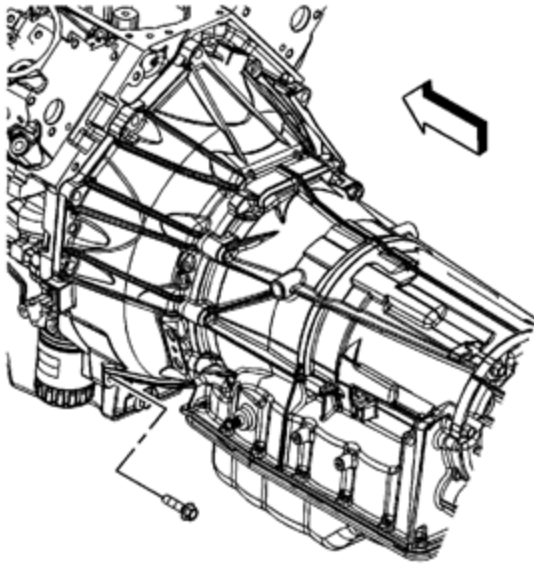
17. For 2500 series vehicles, remove the crossbar bolts/nuts and crossbar.



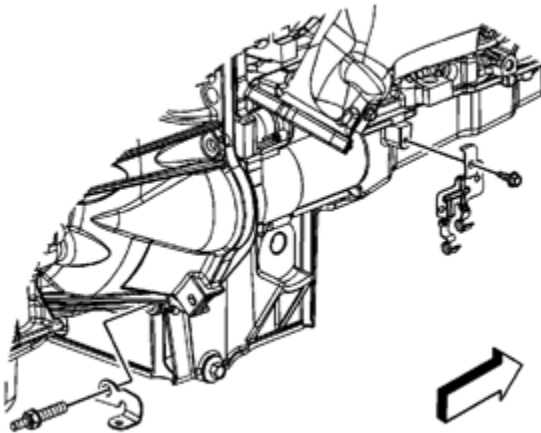
18. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the 2 lower transmission bolts.



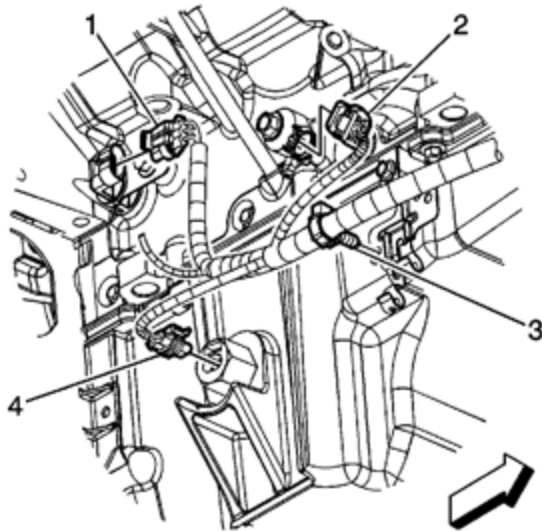
19. For vehicles with a 4L80-E automatic transmission, remove the 2 lower transmission bolts.



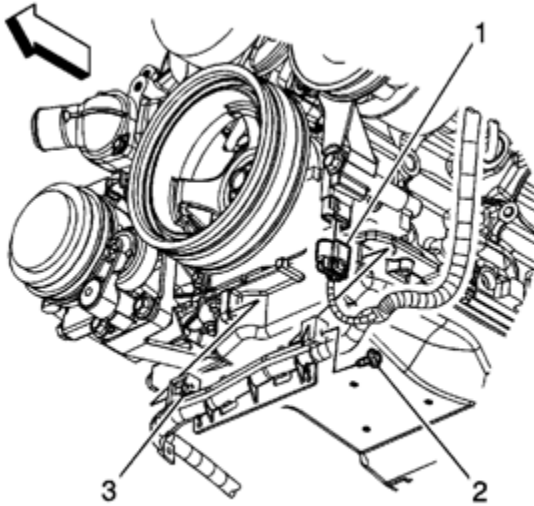
20. For vehicles with a 6L80-E automatic transmission, remove the lower left transmission bolt.



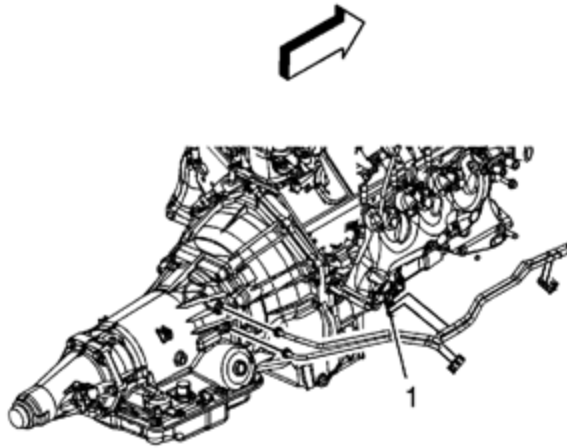
21. For vehicles with a 6L80-E automatic transmission, remove the lower right transmission stud.



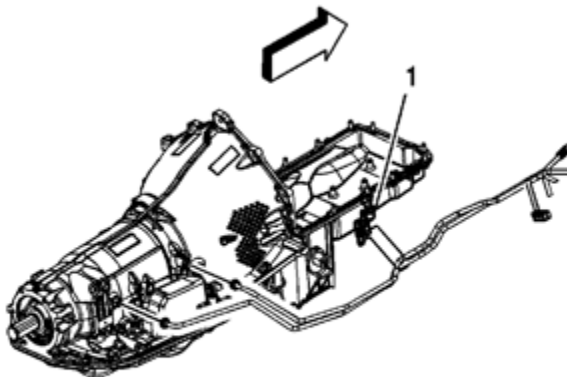
- 22. Disconnect the engine harness electrical connector (4) from the oil level sensor.
- 23. Remove the engine harness clip (3) from the transmission oil cooler line bracket.



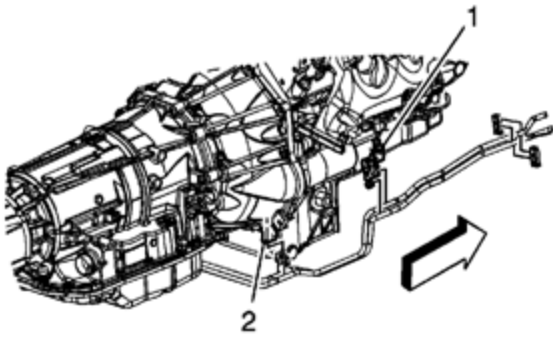
- 24. Remove the battery cable channel bolt (2).
- 25. Slide the channel pin (3) out of the oil pan tab.



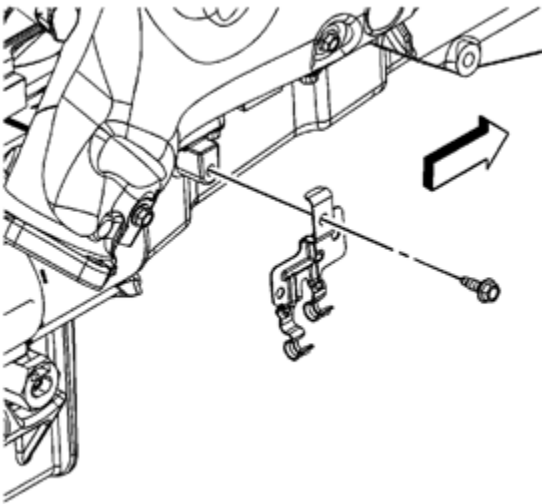
26. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.



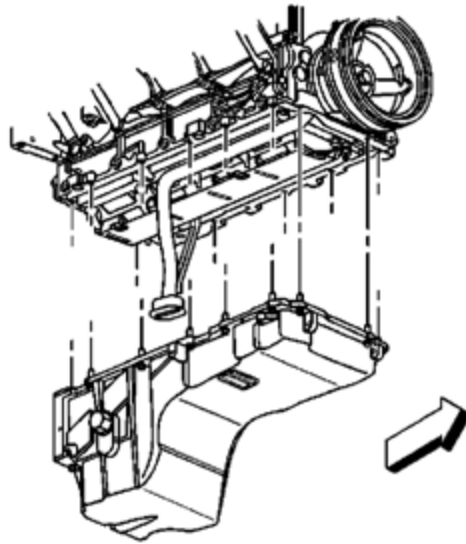
27. For vehicles with a 4L80-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.



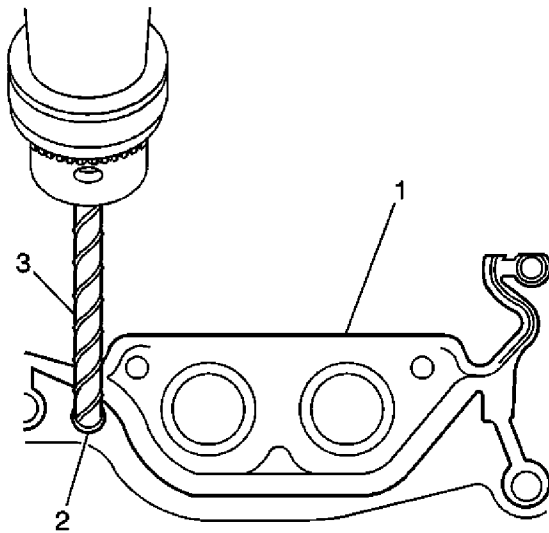
28. For vehicles with a 6L80-E automatic transmission, remove the oil cooler lines from the clip (1).



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



- 30. Remove the oil pan bolts.
- 31. Remove the oil pan.



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

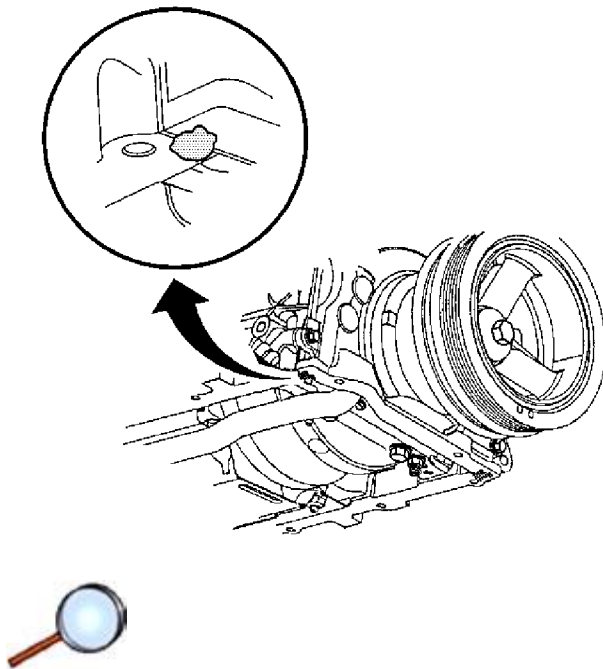
Note: DO NOT allow foreign material to enter the oil passages of the oil pan, cap or cover the openings as required.

- 33. Drill out the oil pan gasket rivets (2), if necessary.
- 34. Remove the oil pan gasket (1) from the pan.
- 35. Discard the oil pan gasket.
- 36. Discard the rivets, if necessary.

Installation Procedure

Note:

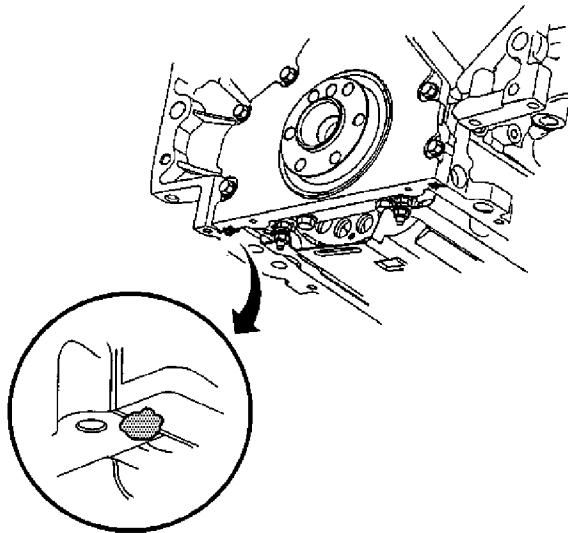
- The alignment of the structural oil pan is critical. The rear bolt hole locations of the oil pan provide mounting points for the transmission bellhousing. To ensure the rigidity of the powertrain and correct transmission alignment, it is important that the rear of the block and the rear of the oil pan must NEVER protrude beyond the engine block and transmission bellhousing plane.
- Do not reuse the oil pan gasket.
- It is not necessary to rivet the NEW gasket to the oil pan.



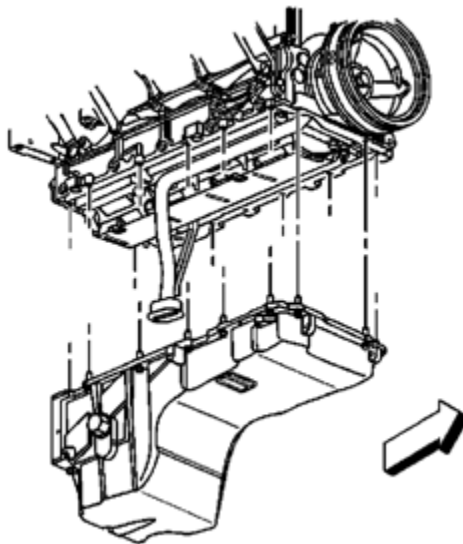
1. If reusing the oil pan perform the following step, otherwise proceed to step 3.

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

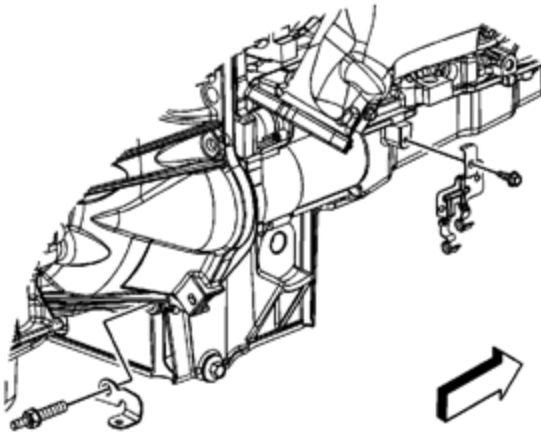
2. Place a NEW oil pan gasket onto the oil pan.
3. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.80 in) long to the engine block. Apply the sealant directly onto the tabs of the front cover gasket that protrudes into the oil pan surface. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) .



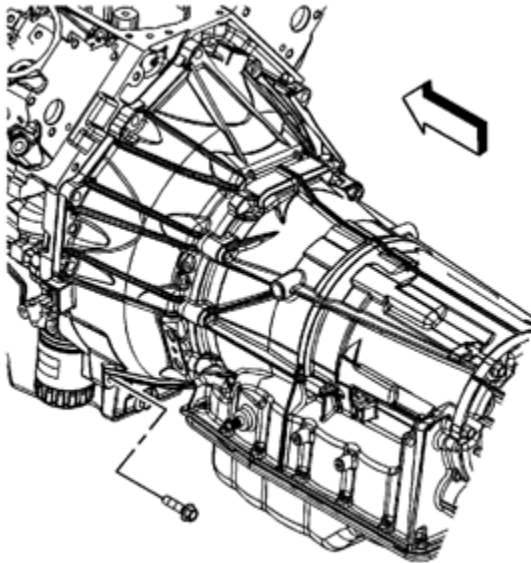
4. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.8 in) long to the engine block. Apply the sealant directly onto the tabs of the rear cover gasket that protrudes into the oil pan surface. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).



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



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

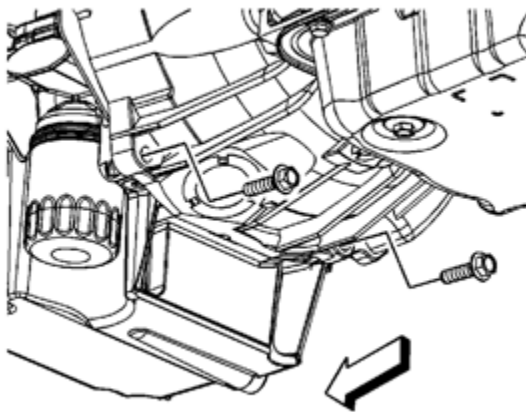


-  9. For vehicles with a 6L80-E automatic transmission, install the lower left transmission bolt until snug.



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

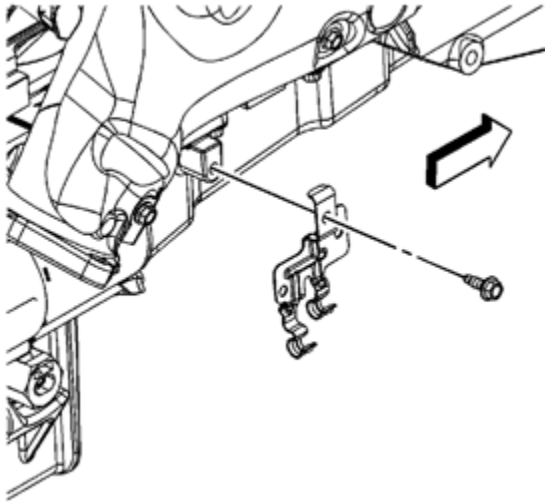
Caution: Refer to [Fastener Caution](#) in the Preface section.



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

Tighten

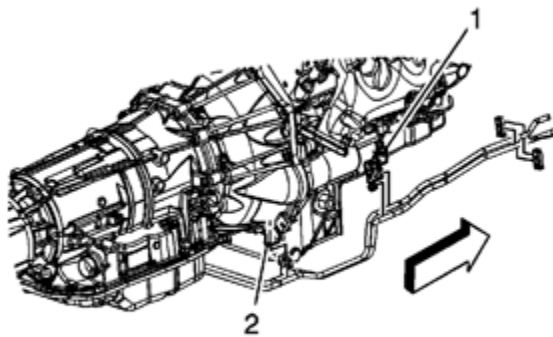
1. Tighten the oil pan and oil pan-to-oil pan front cover bolts to 25 N·m (18 lb ft).
2. Tighten the oil pan-to-rear cover bolts to 12 N·m (106 lb in).
3. Tighten the transmission bolts/stud to 50 N·m (37 lb ft).



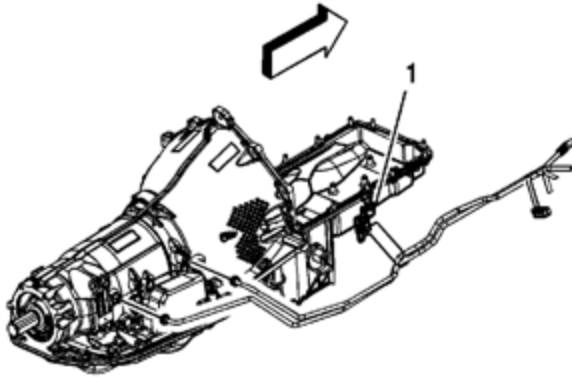
12. Position the transmission oil cooler line clip and install the bolt to the oil pan.

Tighten

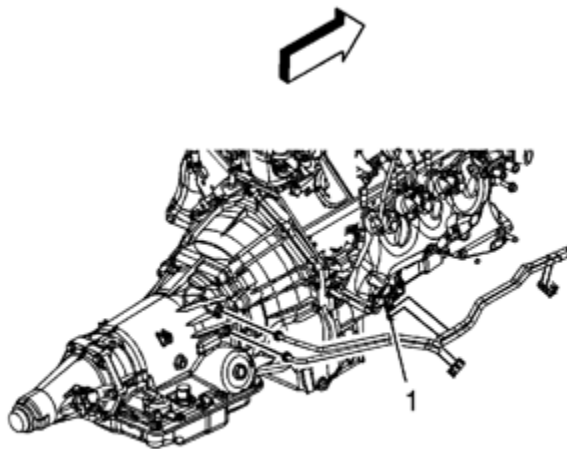
Tighten the bolt to 9 N·m (80 lb in).



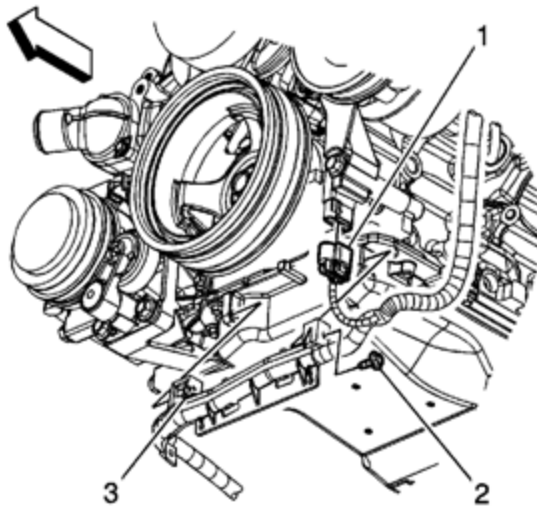
13. For vehicles with a 6L80-E automatic transmission, install the oil cooler lines to the clip (1).



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



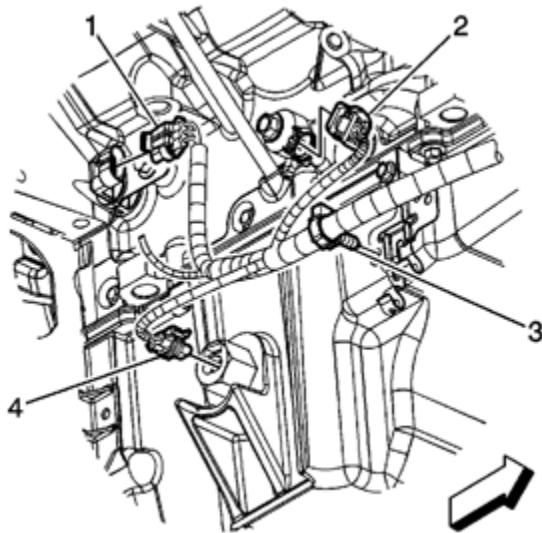
15. For vehicles with a 4L60-E/4L70-E automatic transmission, install the oil cooler lines to the clip (1), if equipped.



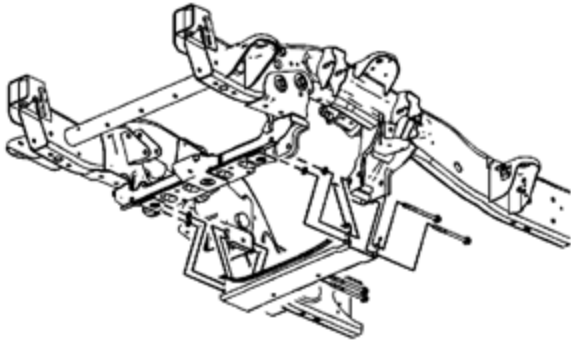
16. Position the channel and slide the channel pin (3) into the oil pan tab.
17. Install the battery cable channel bolt (2).

Tighten

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



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

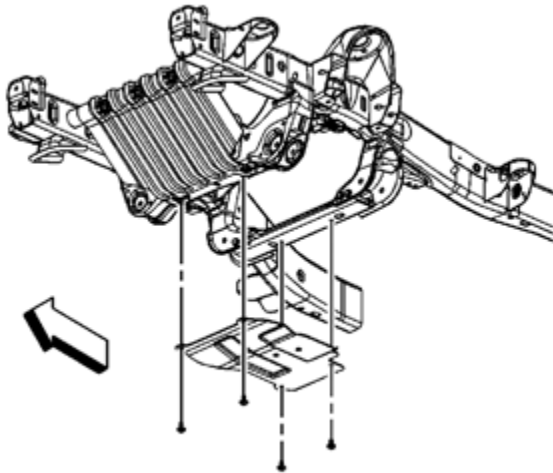


20. For both the 1500 and 2500 series, perform the following steps prior to installing the crossbar bolts.
 - 20.1. Remove all traces of the original adhesive patch.

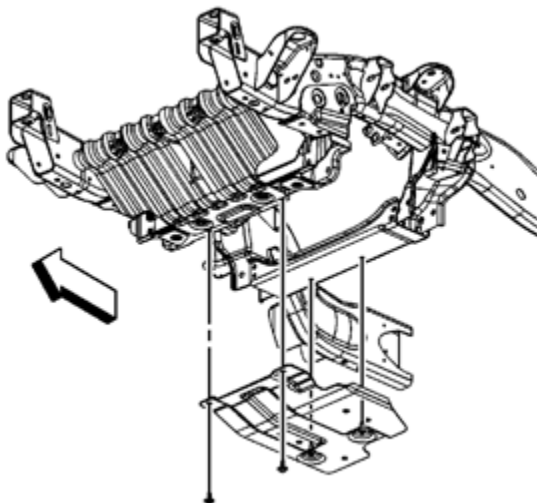
cardiagn.com

Oil Pan Replacement (2WD)

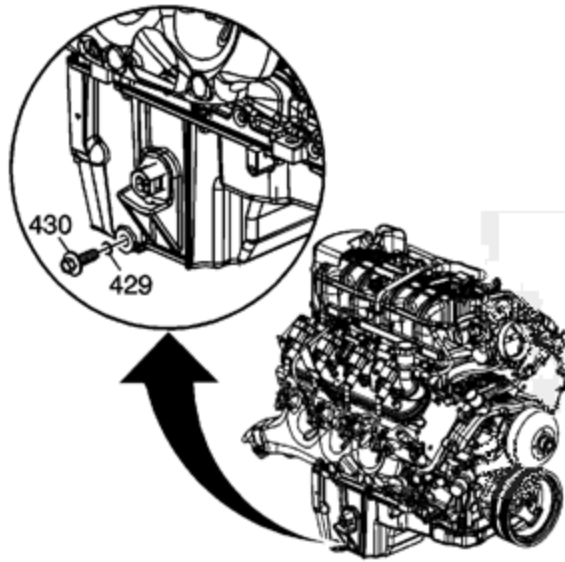
Removal Procedure



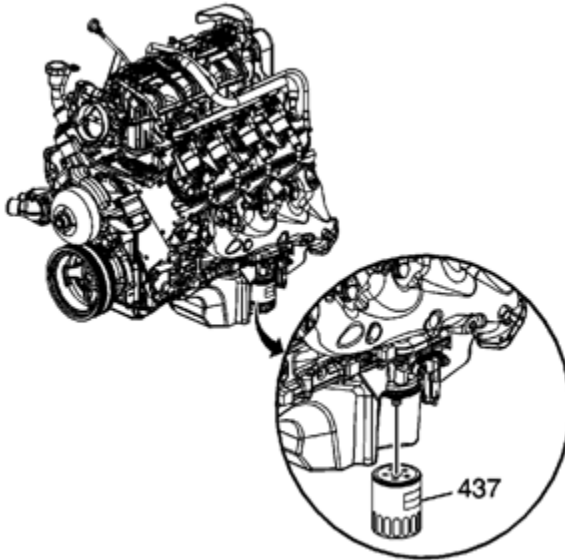
1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. For 1500 series vehicles, remove the oil pan skid plate bolts and skid plate, if equipped.



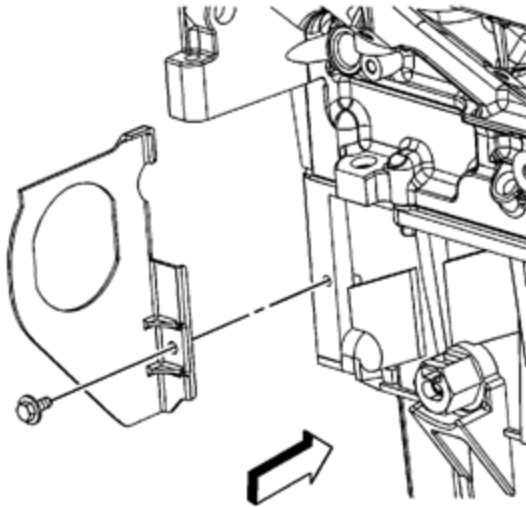
3. For 2500 series vehicles, loosen the 2 rear oil pan skid plate bolts, remove the 2 front oil pan skid plate bolts and skid plate, if equipped.
4. Unbolt the steering rack and hang downward.



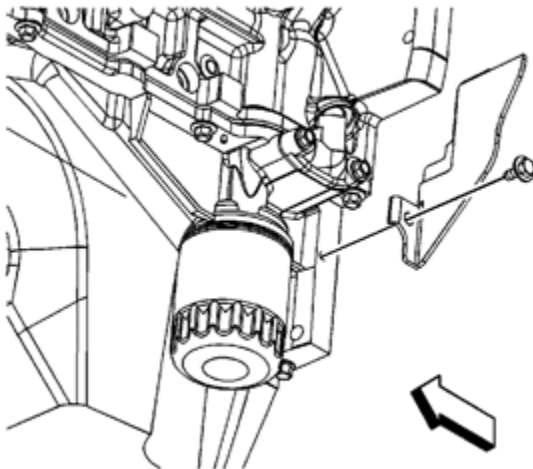
5. Place a suitable drain pan under the oil pan drain plug.
6. Remove the oil pan drain plug (430).
7. Allow the oil pan to drain completely.
8. Re-install the oil pan drain plug until snug.



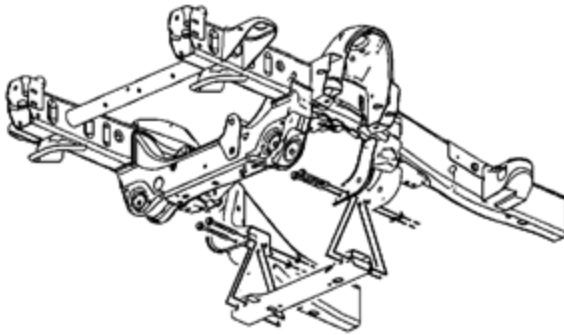
9. Place the drain pan under the oil filter.
10. Remove the oil filter (437).
11. Allow the oil to drain completely.
12. Re-install the oil filter until snug.



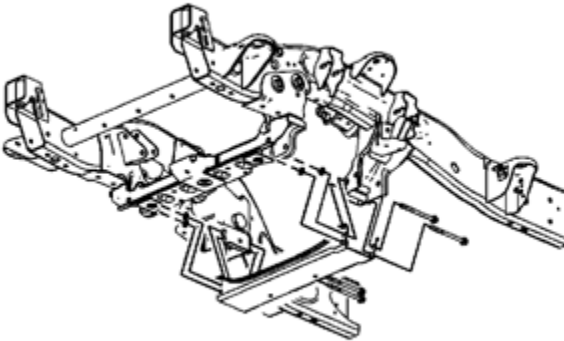
13. Remove the right side transmission cover bolt.



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

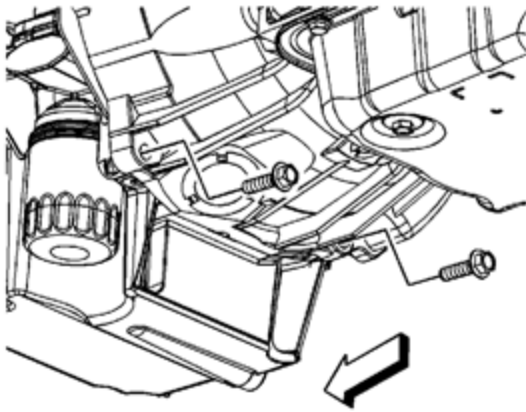


15. For 1500 series vehicles, remove the crossbar bolts/nuts and crossbar.



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

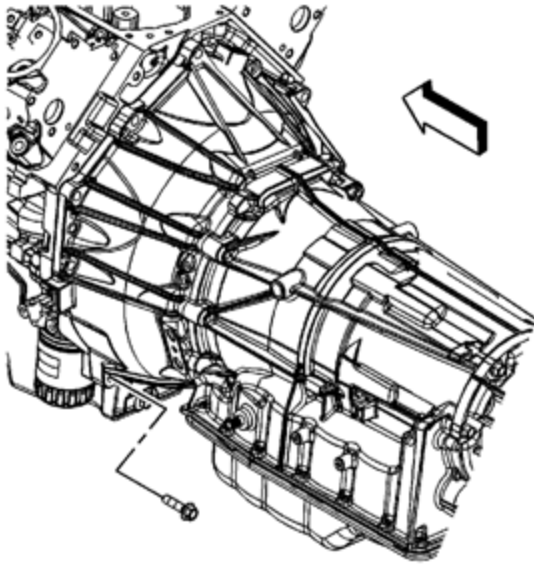
cardiagn.com



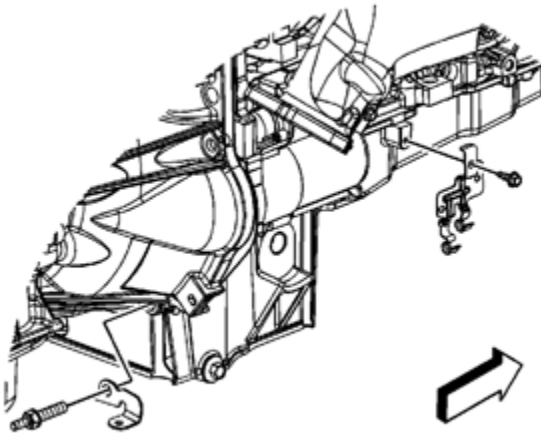
17. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the 2 lower transmission bolts.



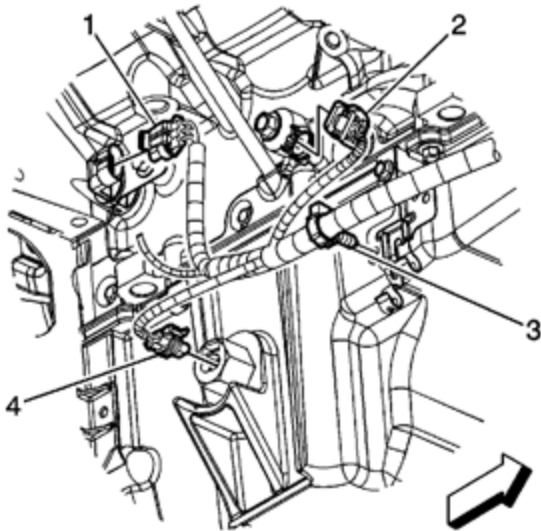
18. For vehicles with a 4L80-E automatic transmission, remove the 2 lower transmission bolts.



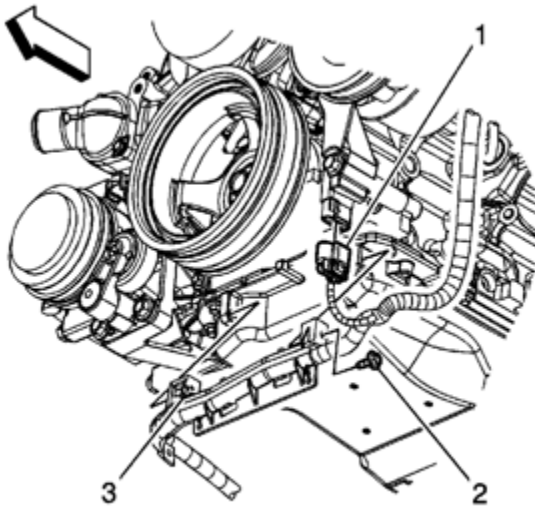
19. For vehicles with a 6L80-E automatic transmission, remove the lower left transmission bolt.



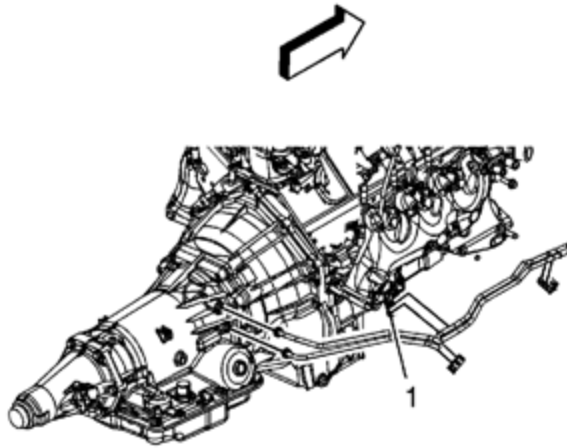
20. For vehicles with a 6L80-E automatic transmission, remove the lower right transmission stud.



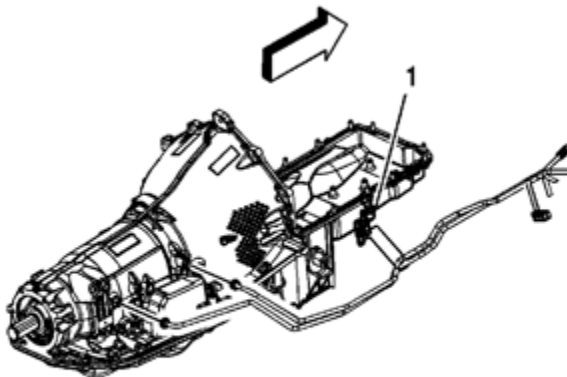
21. Disconnect the engine harness electrical connector (4) from the oil level sensor.
22. Remove the engine harness clip (3) from the transmission oil cooler line bracket.



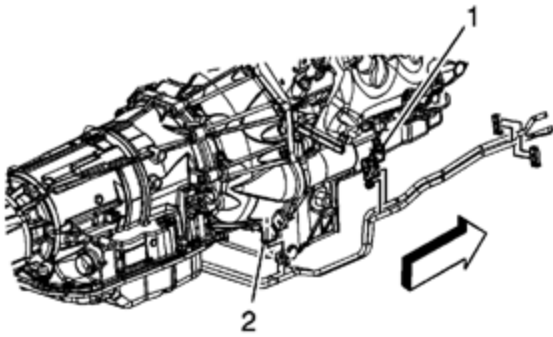
23. Remove the battery cable channel bolt (2).
24. Slide the channel pin (3) out of the oil pan tab.



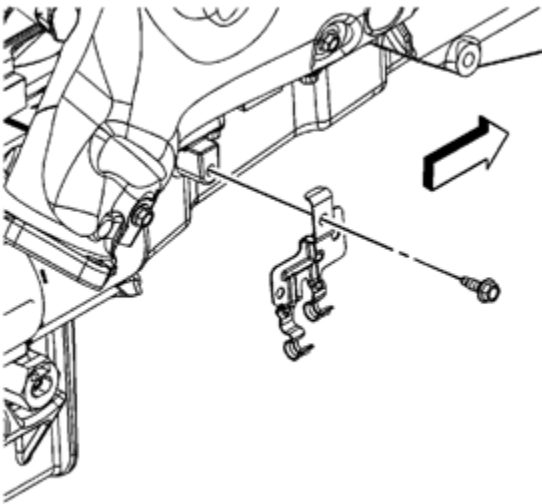
25. For vehicles with a 4L60-E/4L70-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.



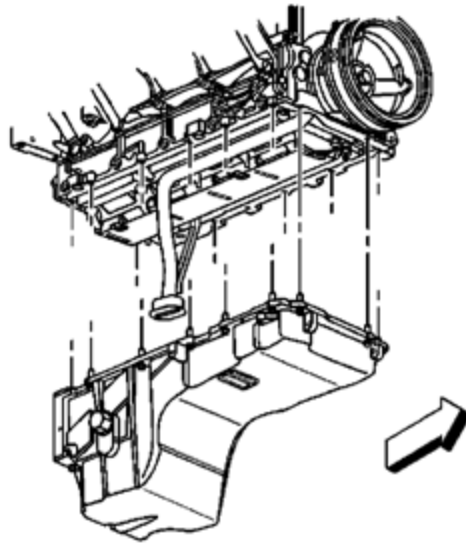
26. For vehicles with a 4L80-E automatic transmission, remove the oil cooler lines from the clip (1), if equipped.



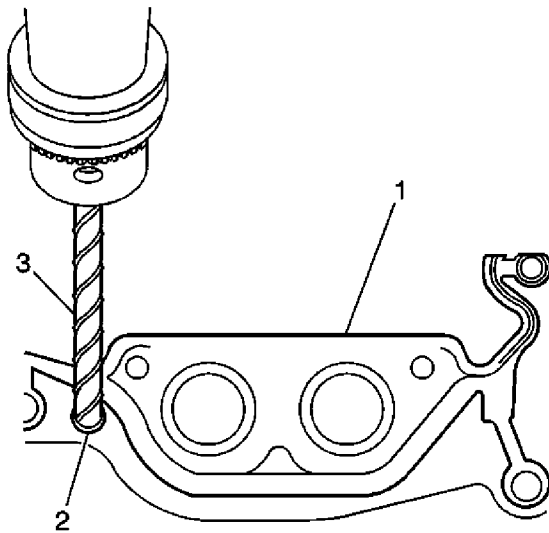
27. For vehicles with a 6L80-E automatic transmission, remove the oil cooler lines from the clip (1).



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



29. Remove the oil pan bolts.
30. Remove the oil pan.



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

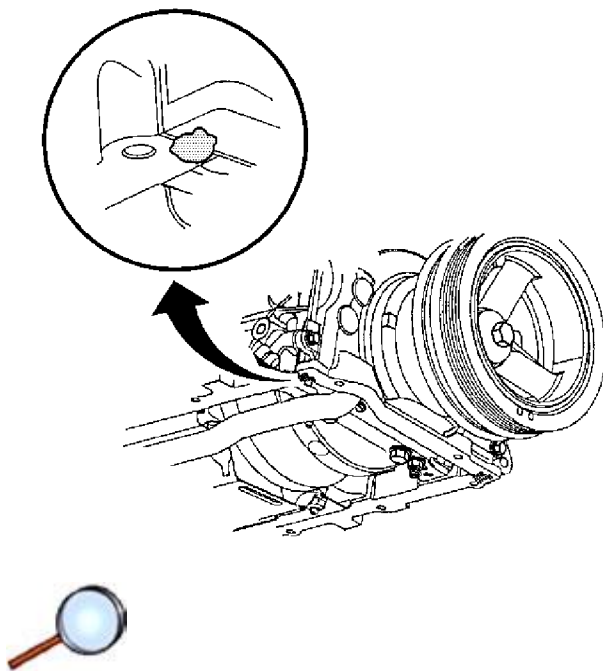
Note: DO NOT allow foreign material to enter the oil passages of the oil pan, cap or cover the openings as required.

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

Installation Procedure

Note:

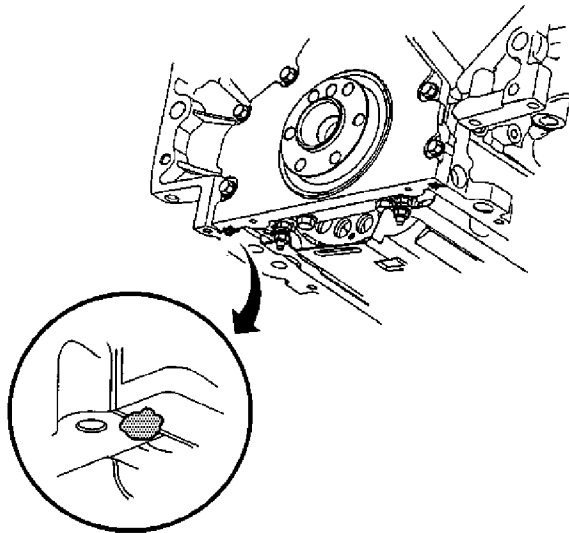
- The alignment of the structural oil pan is critical. The rear bolt hole locations of the oil pan provide mounting points for the transmission bellhousing. To ensure the rigidity of the powertrain and correct transmission alignment, it is important that the rear of the block and the rear of the oil pan must NEVER protrude beyond the engine block and transmission bellhousing plane.
- Do not reuse the oil pan gasket.
- It is not necessary to rivet the NEW gasket to the oil pan.



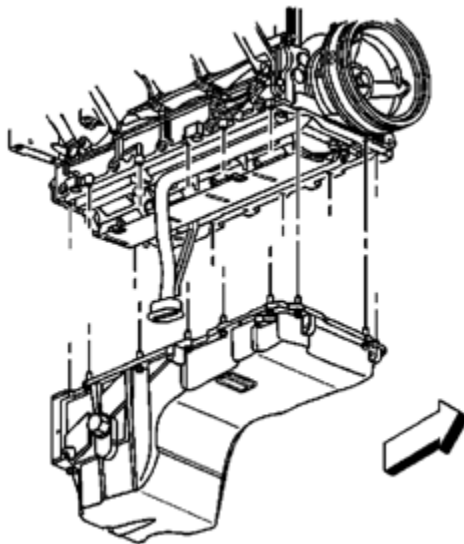
1. If reusing the oil pan perform the following step, otherwise proceed to step 3.

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

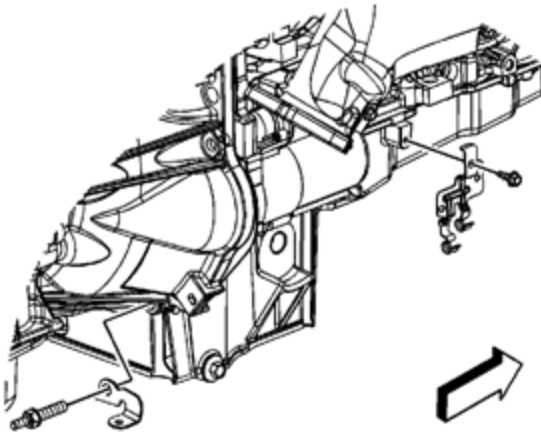
2. Place a NEW oil pan gasket onto the oil pan.
3. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.80 in) long to the engine block. Apply the sealant directly onto the tabs of the front cover gasket that protrudes into the oil pan surface. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) .



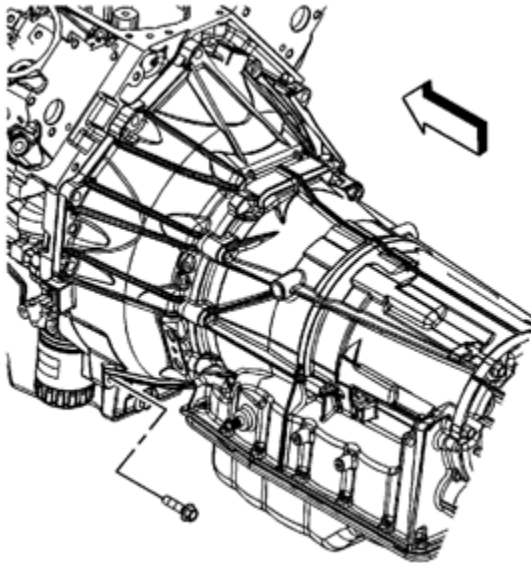
4. Apply a 5 mm (0.20 in) bead of sealant, 20 mm (0.8 in) long to the engine block. Apply the sealant directly onto the tabs of the rear cover gasket that protrudes into the oil pan surface. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).



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



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

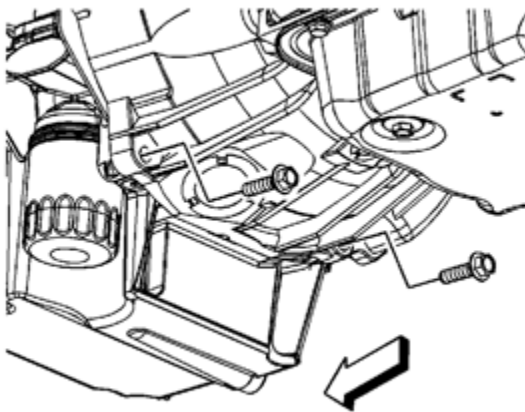


-  9. For vehicles with a 6L80-E automatic transmission, install the lower left transmission bolt until snug.



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

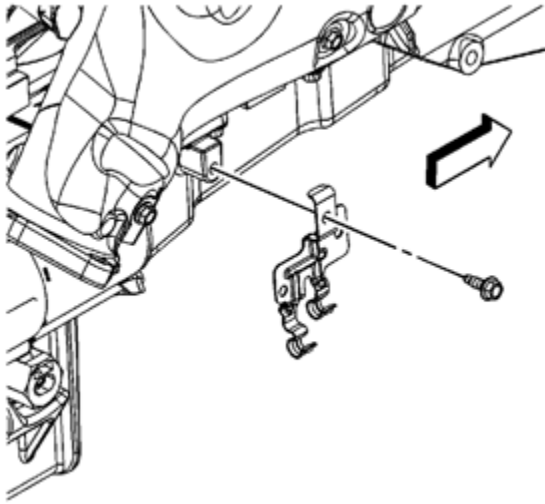
Caution: Refer to [Fastener Caution](#) in the Preface section.



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

Tighten

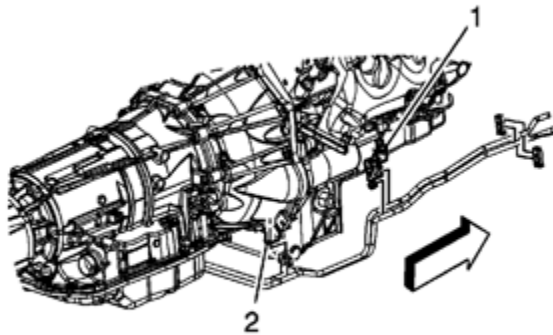
1. Tighten the oil pan and oil pan-to-oil pan front cover bolts to 25 N·m (18 lb ft).
2. Tighten the oil pan-to-rear cover bolts to 12 N·m (106 lb in).
3. Tighten the transmission bolts/stud to 50 N·m (37 lb ft).



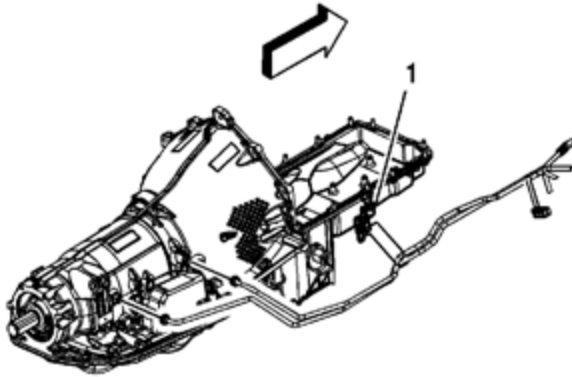
12. Position the transmission oil cooler line clip and install the bolt to the oil pan.

Tighten

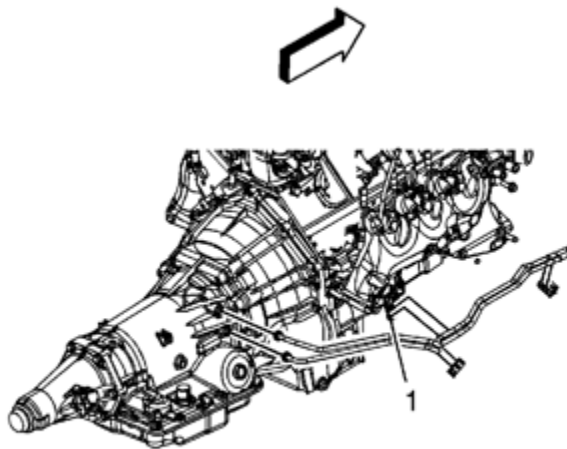
Tighten the bolt to 9 N·m (80 lb in).



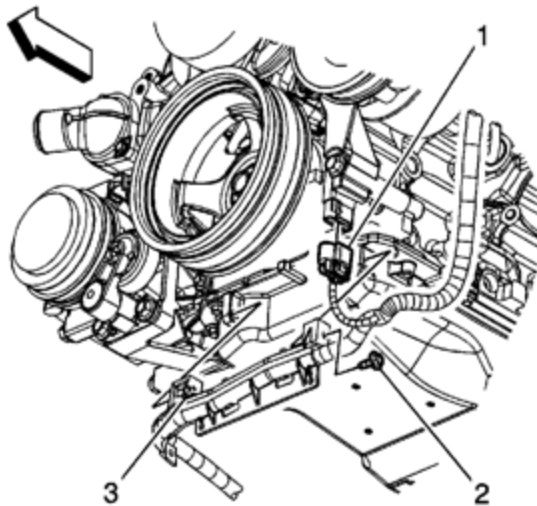
13. For vehicles with a 6L80-E automatic transmission, install the oil cooler lines to the clip (1).



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



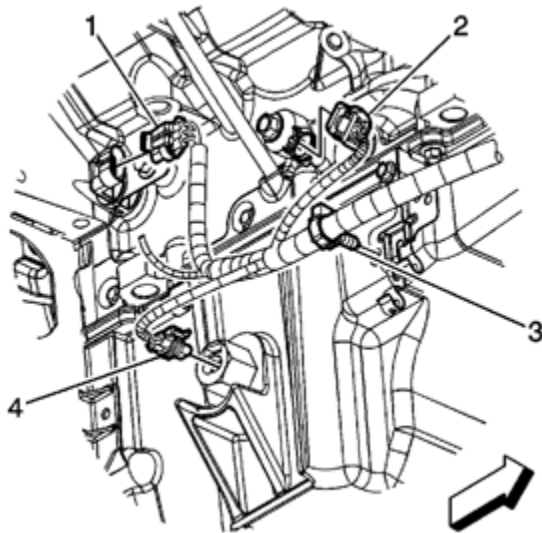
15. For vehicles with a 4L60-E/4L70-E automatic transmission, install the oil cooler lines to the clip (1), if equipped.



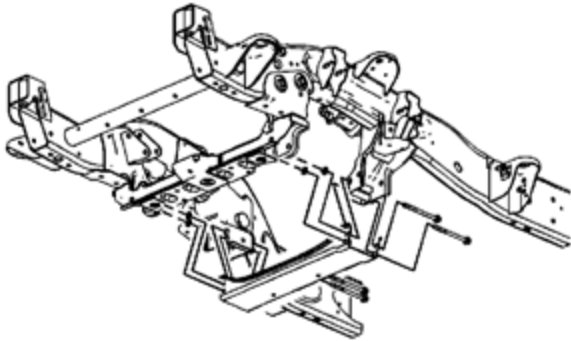
16. Position the channel and slide the channel pin (3) into the oil pan tab.
17. Install the battery cable channel bolt (2).

Tighten

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



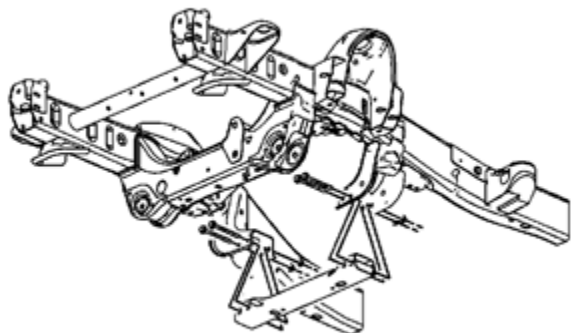
18. Connect the engine harness electrical connector (4) to the oil level sensor.
19. Install the engine harness clip (3) to the transmission oil cooler line bracket.



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

Tighten

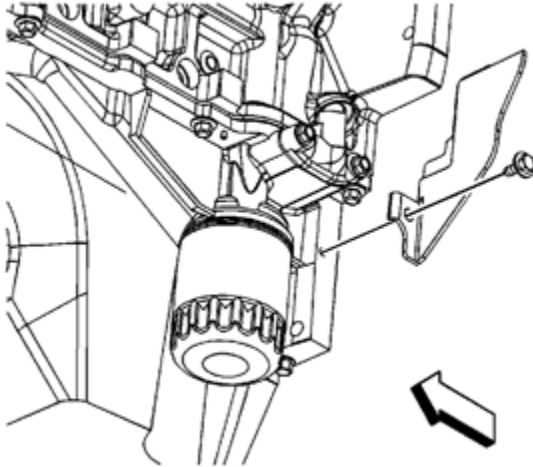
Tighten the nuts to 120 N·m (89 lb ft).



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

Tighten

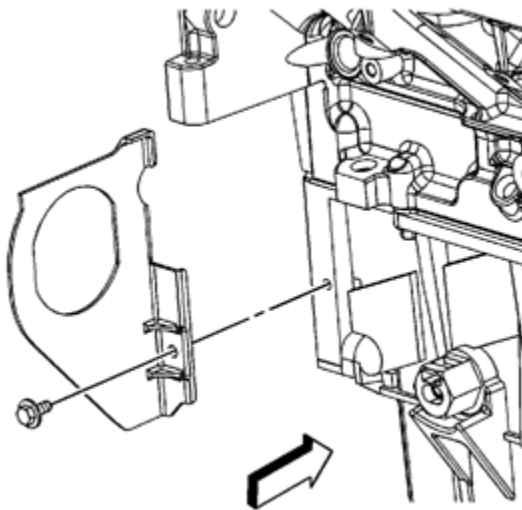
Tighten the nuts to 100 N·m (74 lb ft).



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

Tighten

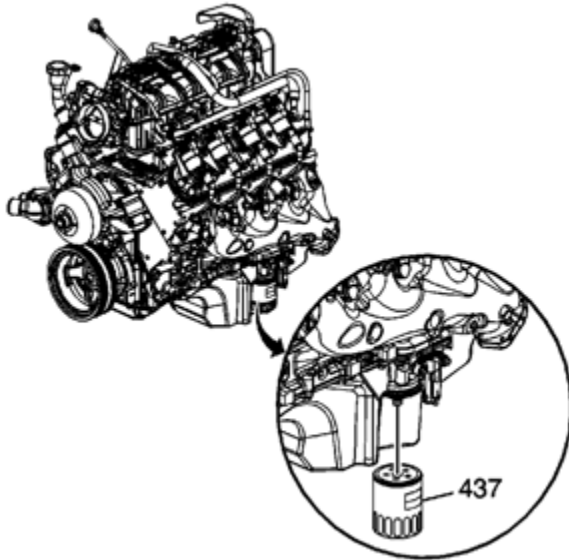
Tighten the bolt to 12 N·m (106 lb in).



24. Install the right side transmission cover bolt.

Tighten

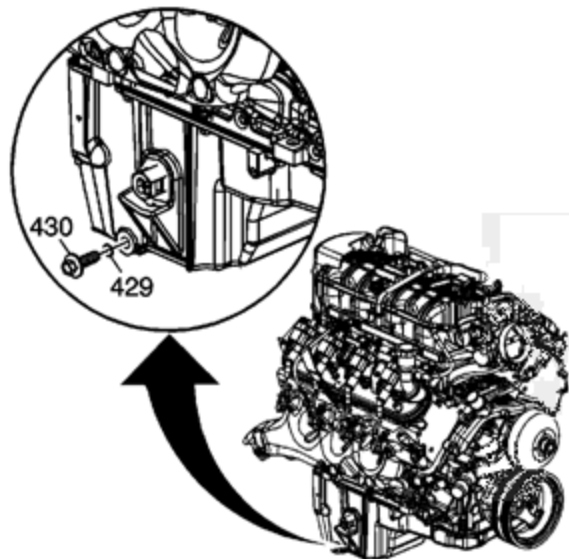
Tighten the bolt to 12 N·m (106 lb in).



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

Tighten

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



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

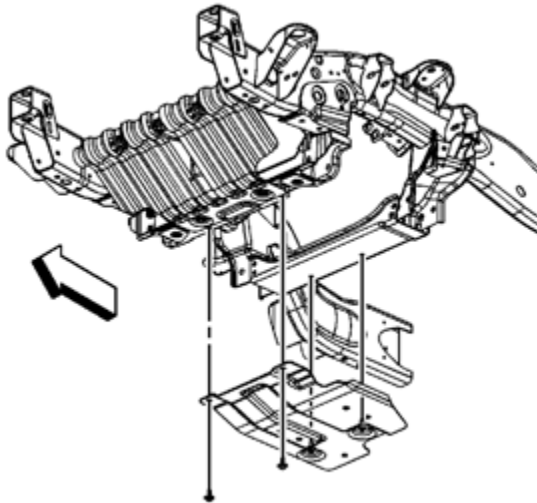
Tighten

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

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

Tighten

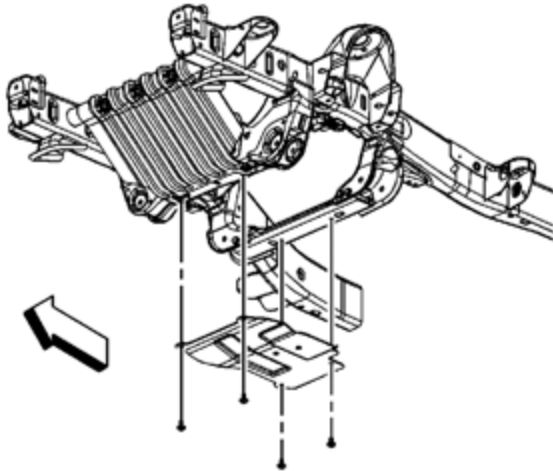
- Tighten the left side steering rack bolts to 200 N·m (148 lb ft).
- Tighten the right side steering rack bolts to 100 N·m (74 lb ft).



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

Tighten

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



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

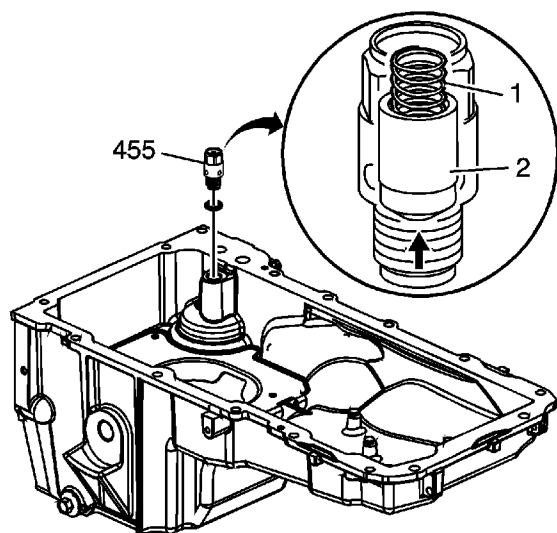
Tighten

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

32. Lower the vehicle.
33. Fill the engine with NEW engine oil. Refer to [Fluid and Lubricant Recommendations](#) and [Approximate Fluid Capacities](#).
34. Start the engine and inspect for leaks.

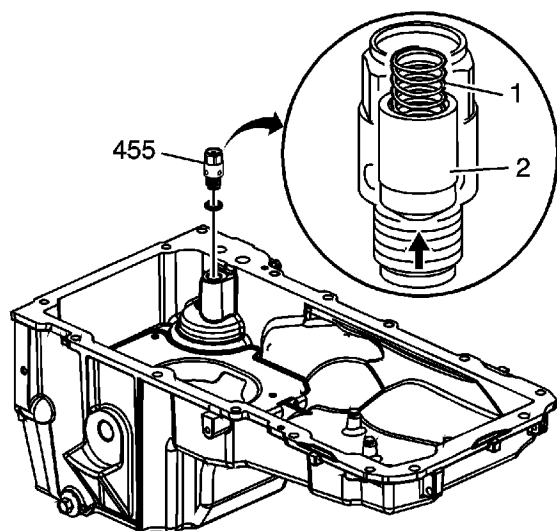
Oil Pressure Relief Valve Replacement

Removal Procedure



1. Remove the oil pan. Refer to [Oil Pan Replacement](#).
2. Place the oil pan on a clean work surface.
3. Remove the oil pressure relief valve (455) and washer.

Installation Procedure





1. Inspect the NEW oil pressure relief valve for proper operation. Lightly depress the ball (2). The valve spring (1) should seat the ball to the proper closed position.
2. Install the NEW oil pressure relief valve (455) and washer.
3. Install the oil pan. Refer to [Oil Pan Replacement](#).

cardiagn.com

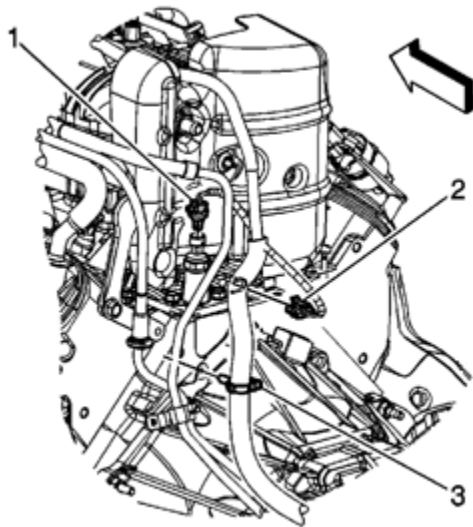
[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - On Vehicle](#) | **Document ID: 2155181**

Engine Oil Pressure Sensor and/or Switch Replacement

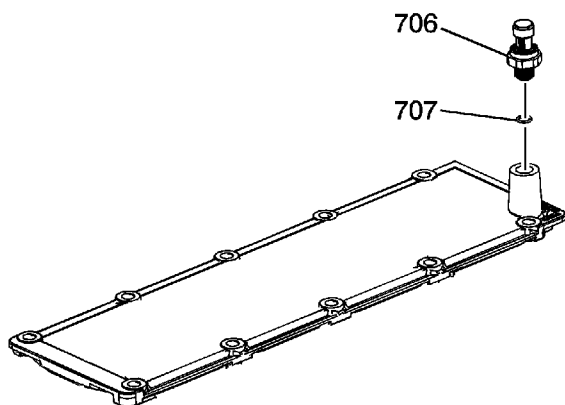
Special Tools

[J 41712](#) Oil Pressure Switch Socket

Removal Procedure

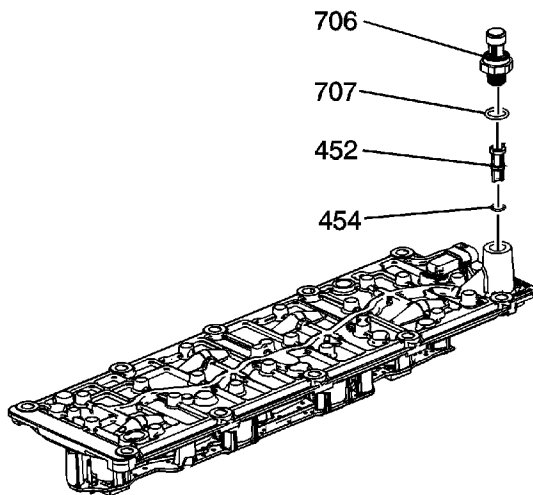


1. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
2. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.



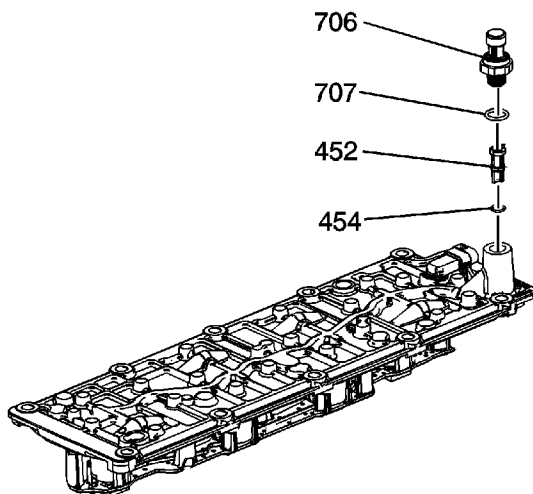


3. If not equipped with active fuel management perform the following step, using [J 41712](#) or equivalent, remove the oil pressure sensor (706) and washer (707).



4. If equipped with active fuel management perform the following step, using [J 41712](#) or equivalent, remove the oil pressure sensor (706) and washer (707).

Installation Procedure

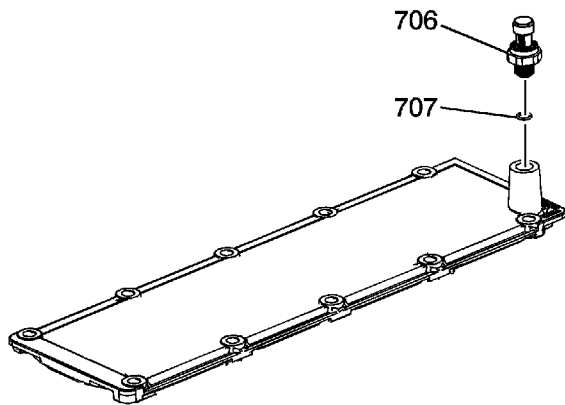


1. Apply sealant to the threads of the NEW oil pressure sensor. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).

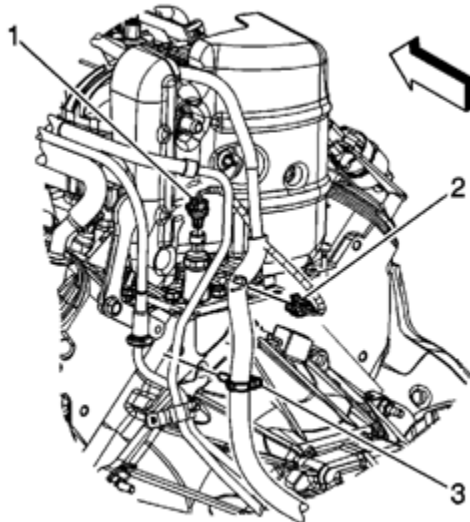
Caution: Refer to [Fastener Caution](#) in the Preface section.

- If equipped with active fuel management perform the following step, using [J 41712](#) or equivalent. Install the oil pressure sensor (706) and washer (707).

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



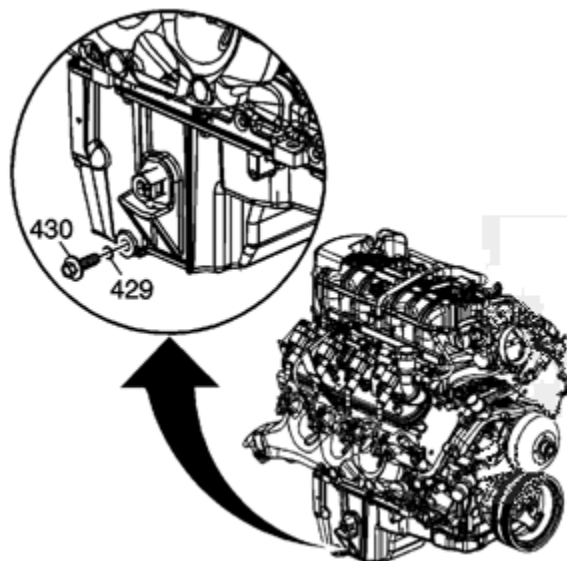
- If not equipped with active fuel management, perform the following step, using [J 41712](#) or equivalent. Install the oil pressure sensor (706) and washer (707).



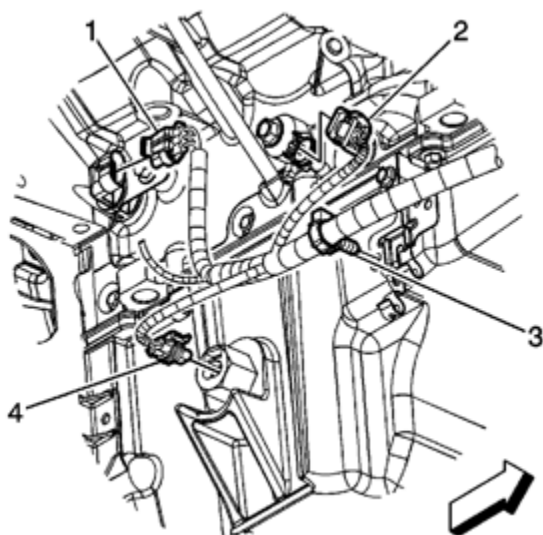
- Connect the engine harness electrical connector (1) to the oil pressure sensor. Tighten the sensor to **35 N·m (26 lb ft)**.
- Install the intake manifold. Refer to [Intake Manifold Replacement](#).

Engine Oil Level Sensor and/or Switch Replacement

Removal Procedure

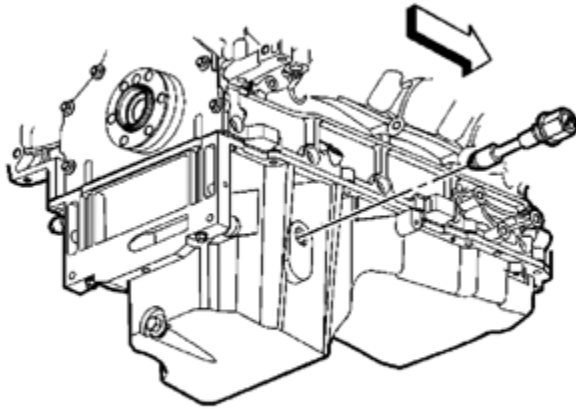


1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
2. Place a suitable drain pan under the oil pan drain plug.
3. Remove the oil pan drain plug (430).
4. Allow the oil pan to drain completely.
5. Re-install the oil pan drain plug until snug.
6. Remove the drain pan from under the vehicle.





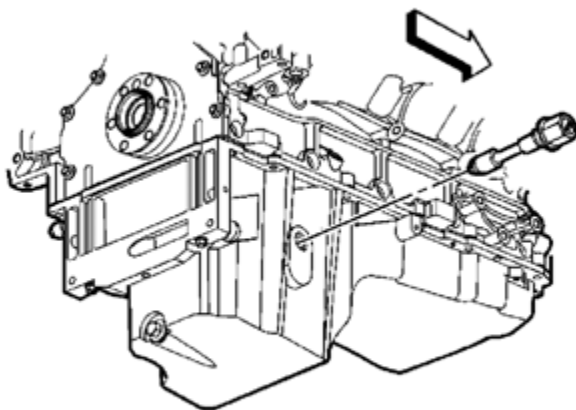
7. Disconnect the engine harness electrical connector (4) from the oil level sensor.



8. Remove the oil level sensor from the oil pan.

Installation Procedure

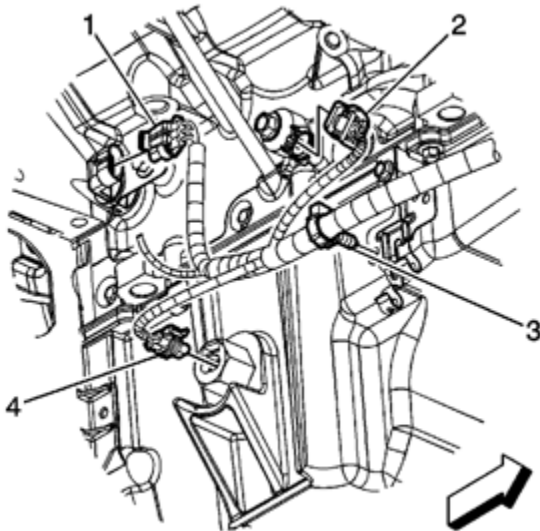
Caution: Refer to [Fastener Caution](#) in the Preface section.



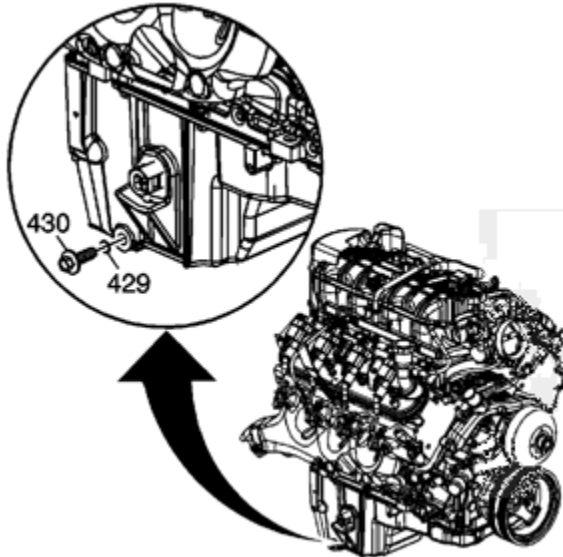
1. Install the oil level sensor to the oil pan.

Tighten

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



2. Connect the engine harness electrical connector (4) to the oil level sensor.



3. Ensure that the oil pan drain plug is tight.

Tighten

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

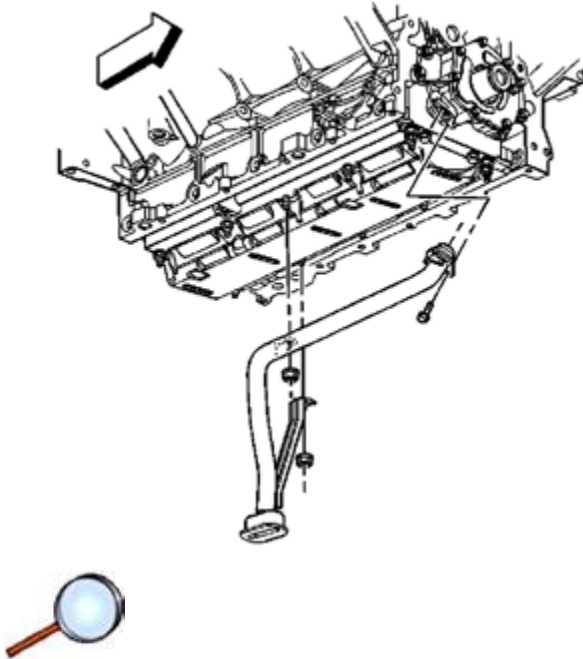
4. Lower the vehicle.
5. Fill the engine with NEW engine oil. Refer to [Fluid and Lubricant Recommendations](#) and [Approximate Fluid Capacities](#).

6. Start the engine and inspect for leaks.

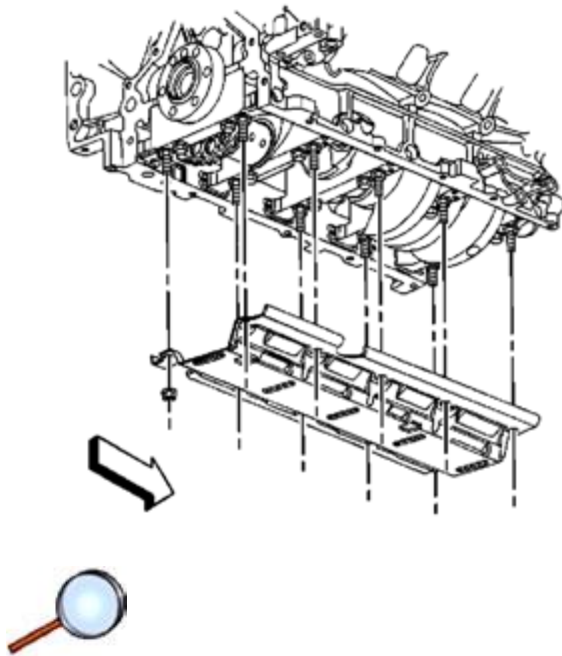
cardiagn.com

Oil Pump, Screen, and Crankshaft Oil Deflector Replacement (LH6, LMG, LY2 and LY5)

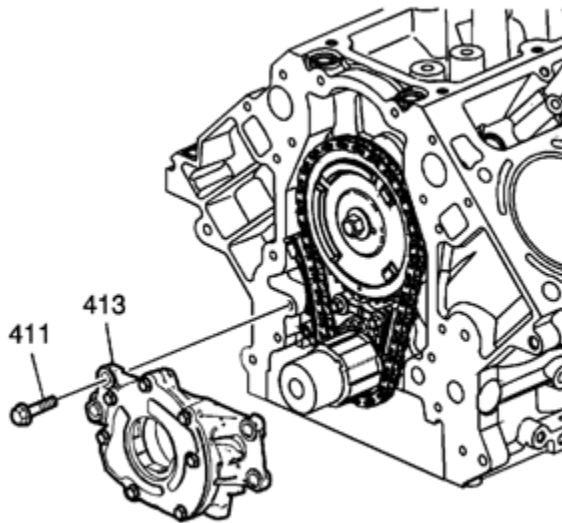
Removal Procedure



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



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



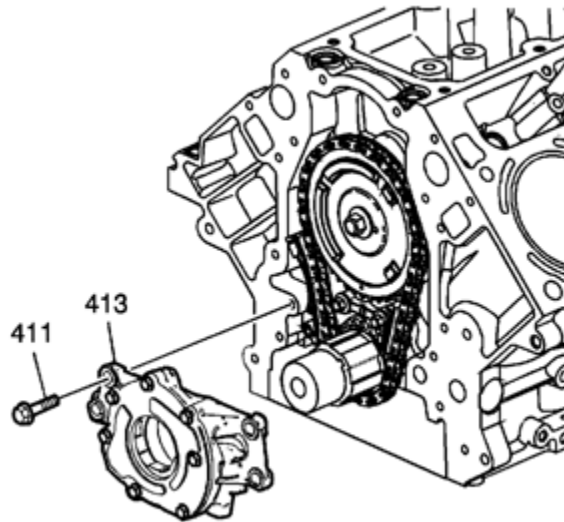
9. Remove the oil pump bolts (411).

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

10. Remove the oil pump (413).

Installation Procedure

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



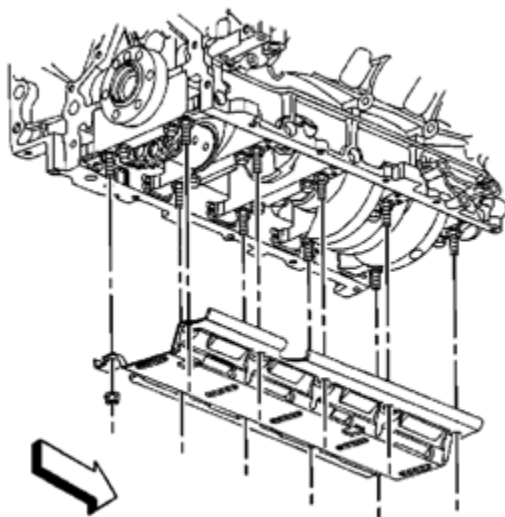
1. Align the splined surfaces of the crankshaft sprocket and the oil pump drive gear and install the oil pump (413).

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the oil pump (413) onto the crankshaft sprocket until the pump housing contacts the face of the engine block.
3. Install the oil pump bolts (411).

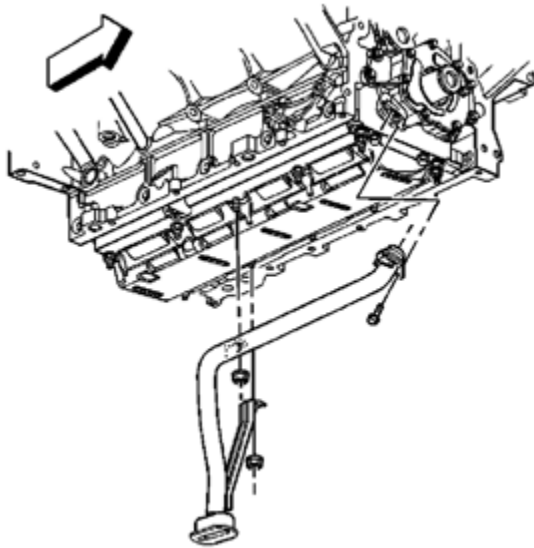
Tighten

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





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



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

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

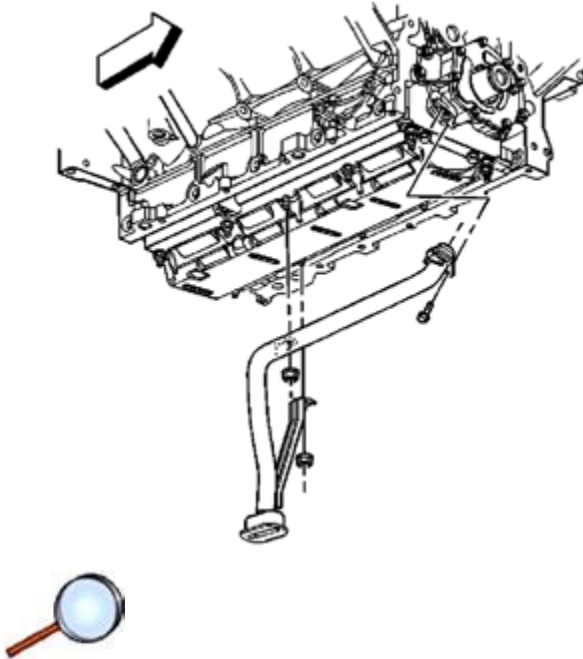
7. Align the oil pump screen mounting brackets with the correct crankshaft bearing cap studs.
8. Install the oil pump screen.
9. Install the oil pump screen bolt and nuts.

Tighten

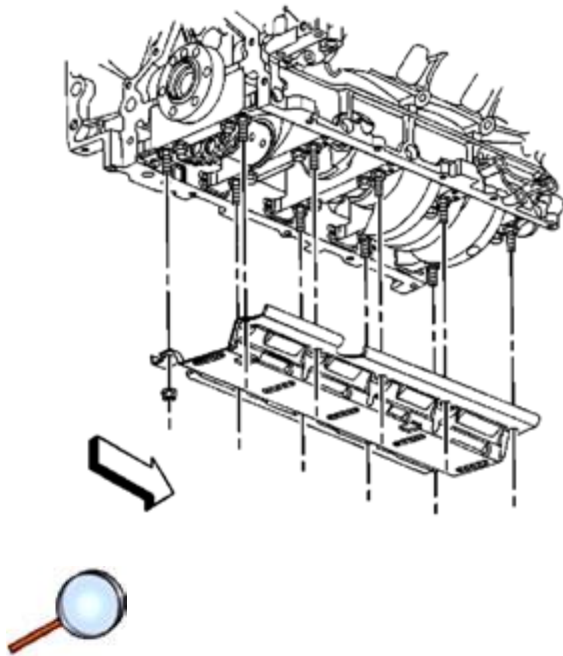
1. Tighten the bolt to 12 N·m (106 lb in).
 2. Tighten the nuts to 25 N·m (18 lb ft).
10. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).
 11. Install the oil pan. Refer to [Oil Pan Replacement](#).

Oil Pump, Screen, and Crankshaft Oil Deflector Replacement (Except LH6, LMG, LY2 and LY5)

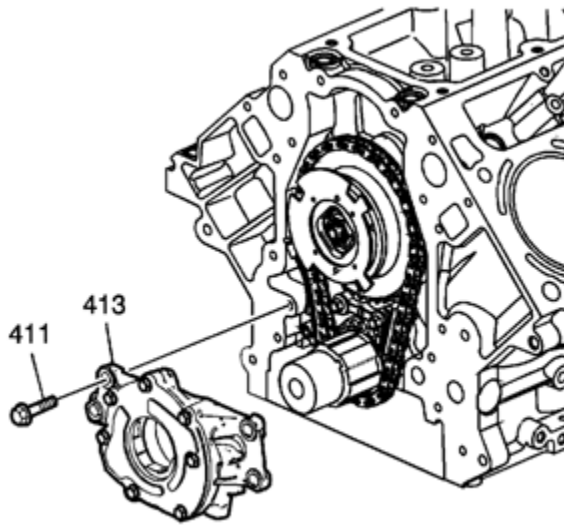
Removal Procedure



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



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



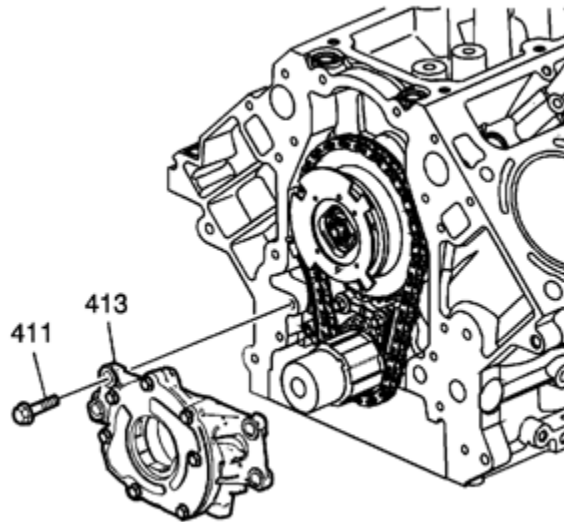
9. Remove the oil pump bolts (411).

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

10. Remove the oil pump (413)

Installation Procedure

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



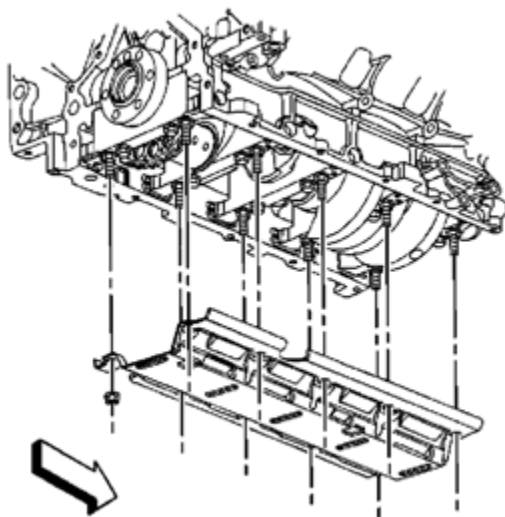
1. Align the splined surfaces of the crankshaft sprocket and the oil pump drive gear and install the oil pump (413).
2. Install the oil pump (413) onto the crankshaft sprocket until the pump housing contacts the face of the engine block.

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the oil pump bolts (411).

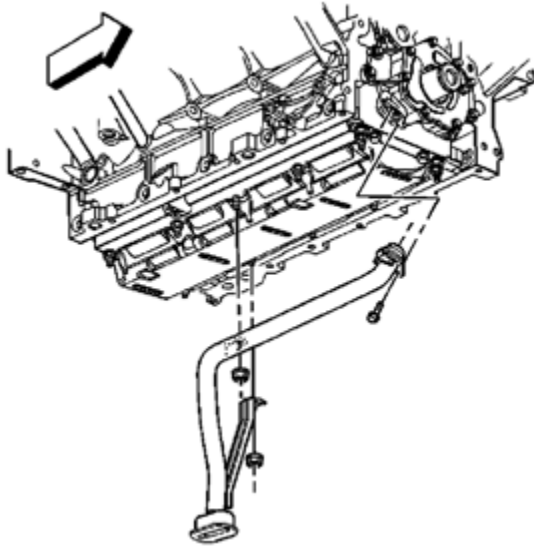
Tighten

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





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



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

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

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

Tighten

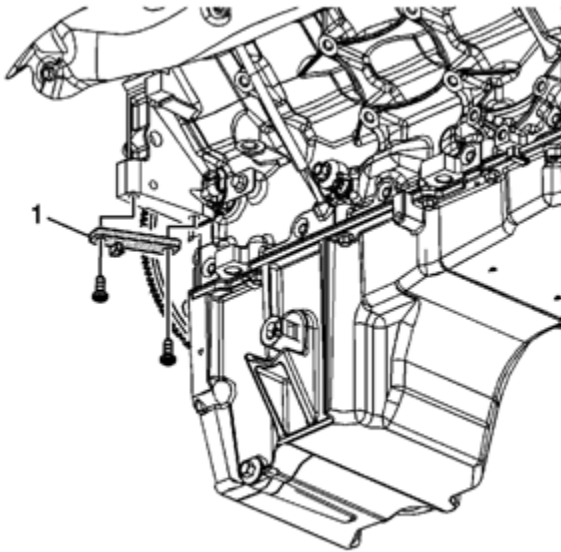
1. Tighten the bolt to 12 N·m (106 lb in).
 2. Tighten the nuts to 25 N·m (18 lb ft).
10. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).
 11. Install the oil pan. Refer to [Oil Pan Replacement](#).

Timing Chain, Crankshaft Sprocket, Camshaft Position Actuator and Solenoid Valve Replacement

Special Tools

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

Removal Procedure



1. Remove the oil pump. Refer to [Oil Pump, Screen, and Crankshaft Oil Deflector Replacement](#).
2. Remove the starter motor. Refer to [Starter Motor Replacement](#).

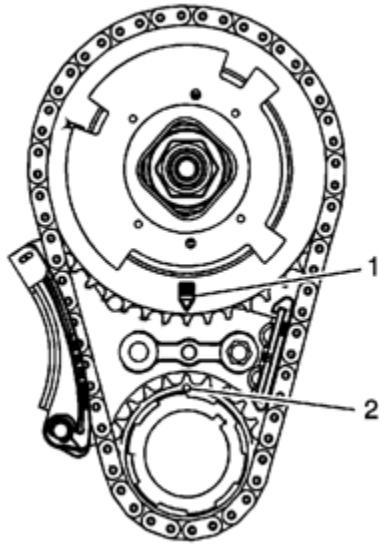
Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Ensure that the teeth of the [J 42386-A](#) mesh with the teeth of the engine flywheel.

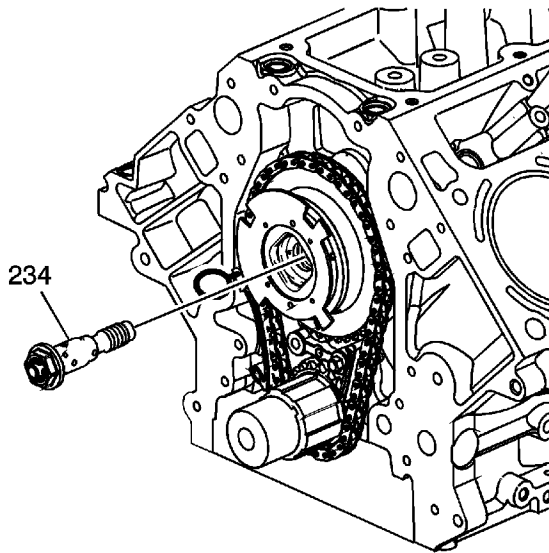
3. Install the [J 42386-A](#) (1) and bolts. Use one M10-1.5 x 120 mm and one M10-1.5 x 45 mm bolt for proper tool operation.

Tighten

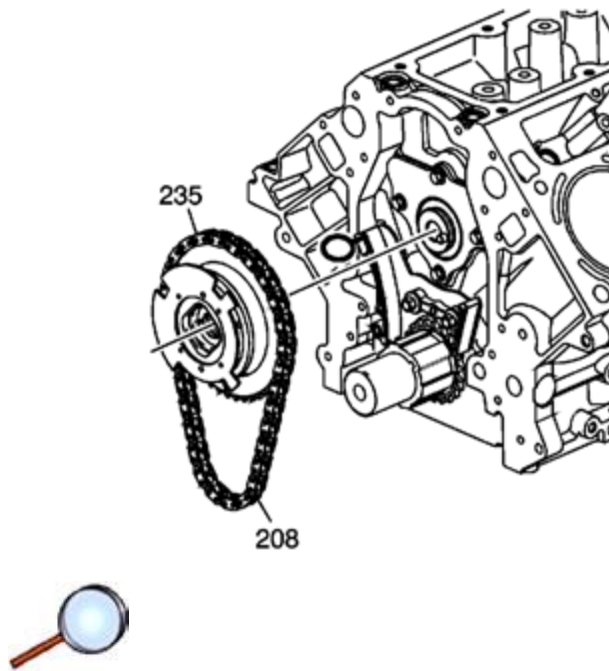
Tighten the [J 42386-A](#) bolts to 50 N·m (37 lb ft).



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

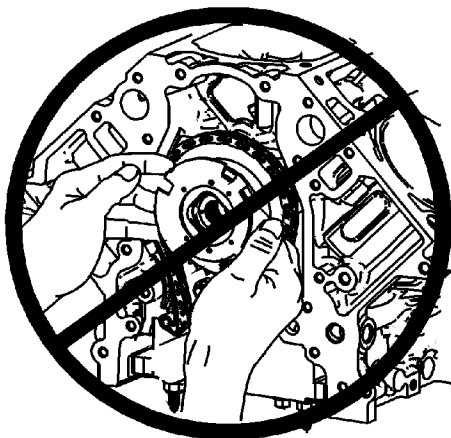
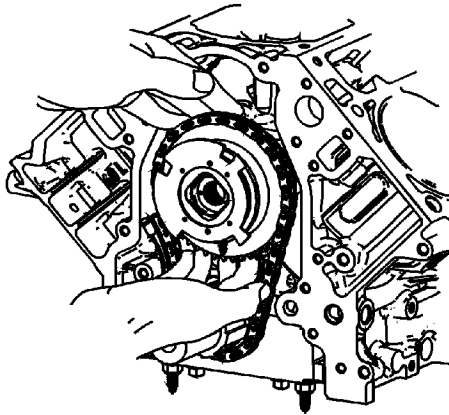


5. Remove and discard the CMP actuator solenoid valve (234).



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

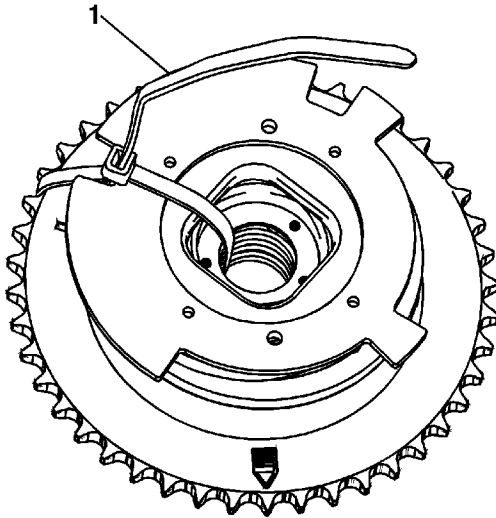
6. Remove the CMP actuator (235) and timing chain (208).



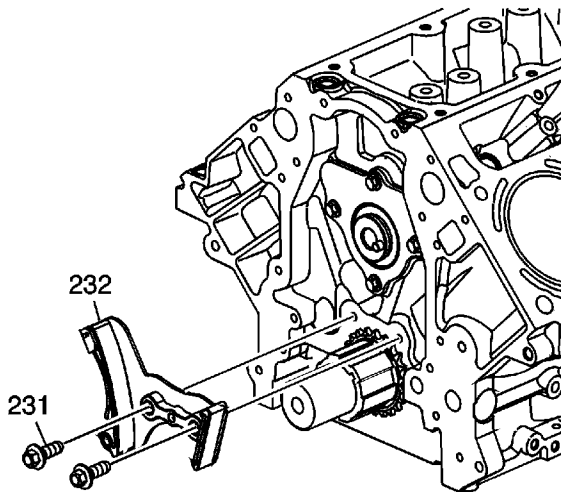


Warning: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator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

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

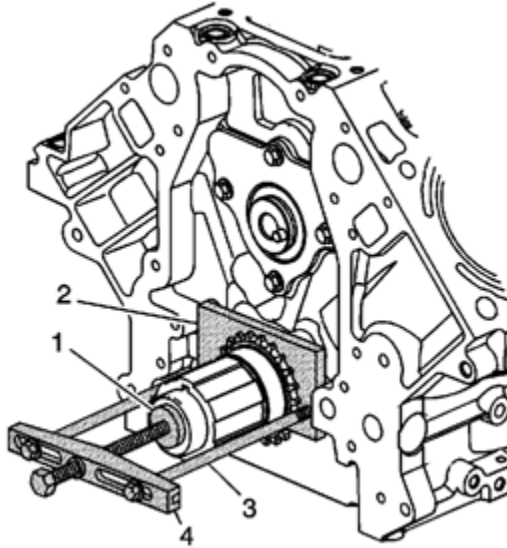


8. Insert and secure a tie strap (1) through the center of the actuator and over the reluctor wheel.

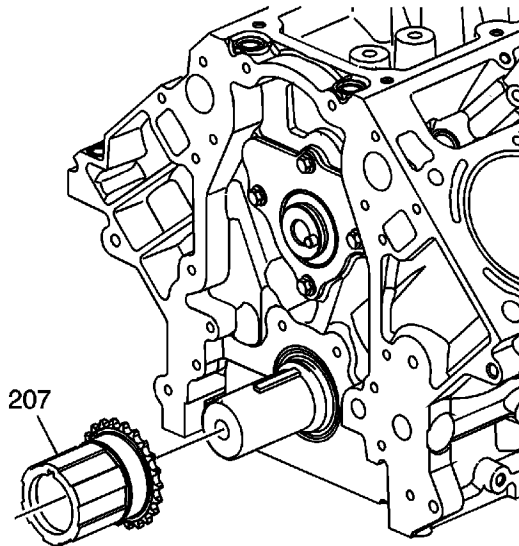




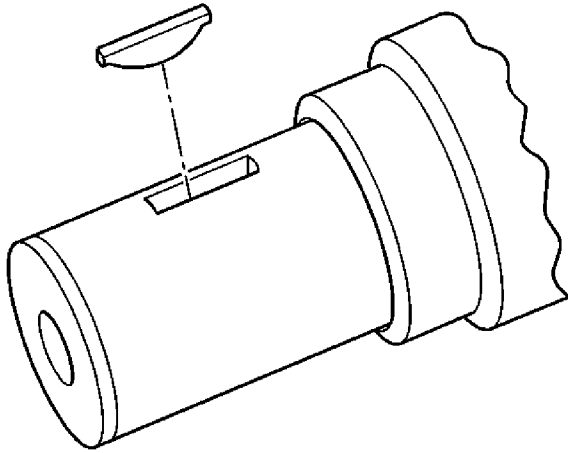
9. Remove the timing chain tension bolts (231) and tensioner (232).



10. Using the [J 41816-2](#) (1), the [J 41558](#) (2), bolts (3) and the [J 8433](#) (4) in order to remove the crankshaft sprocket.

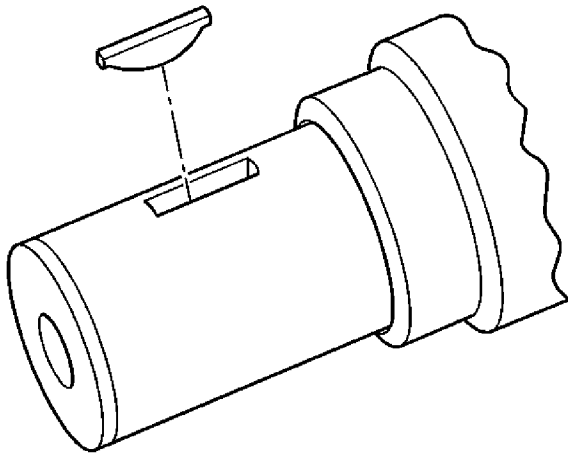


11. Remove the crankshaft sprocket (207).

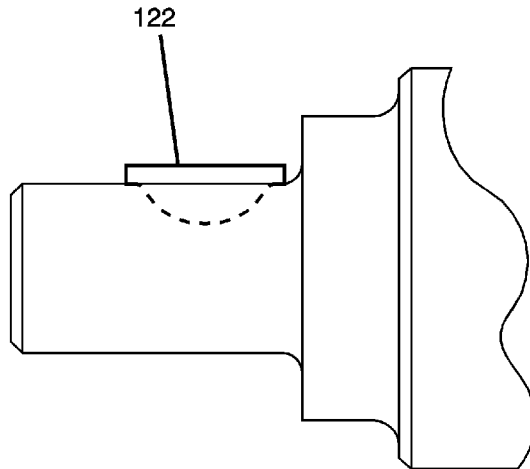


12. Remove the crankshaft sprocket key, if required.

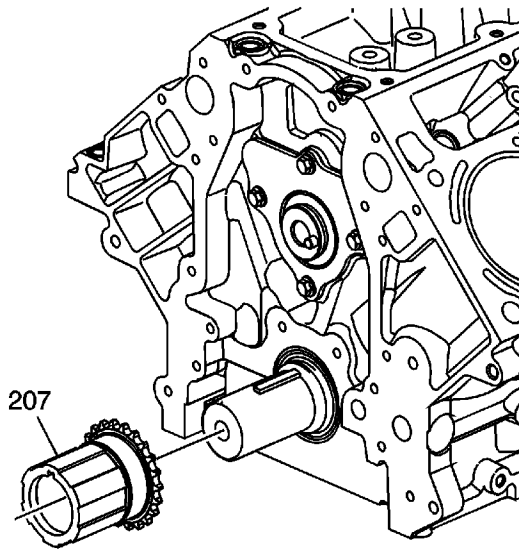
Installation Procedure



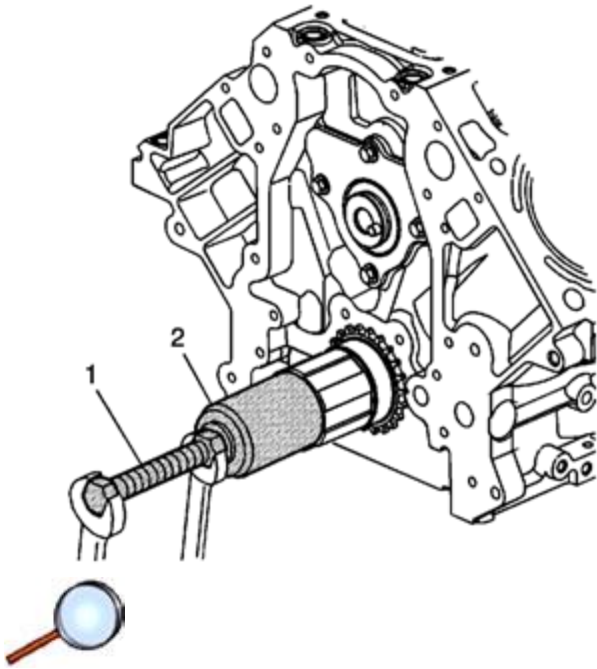
1. Install the key into the crankshaft keyway, if previously removed.



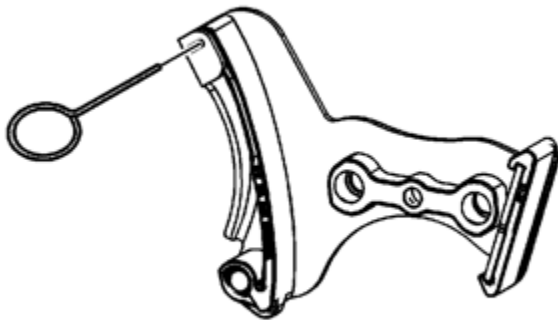
2. Tap the key (122) into the keyway until both ends of the key bottom onto the crankshaft.



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

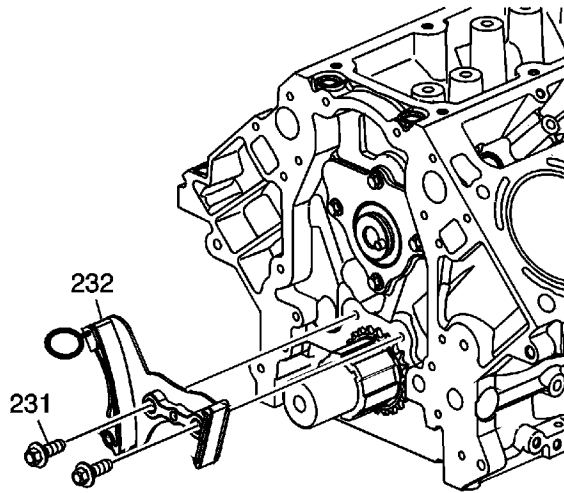


4. Use the [J 41478](#) (1) and the [J 41665](#) (2) in order to install the crankshaft sprocket. Install the sprocket onto the crankshaft until fully seated against the crankshaft flange.



5. Compress the timing chain tensioner guide and install the [EN 46330](#).

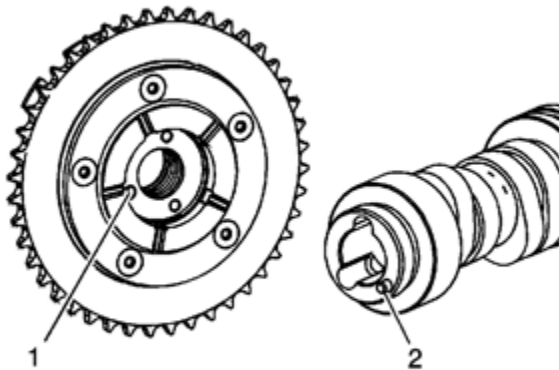
Caution: Refer to [Fastener Caution](#) in the Preface section.



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

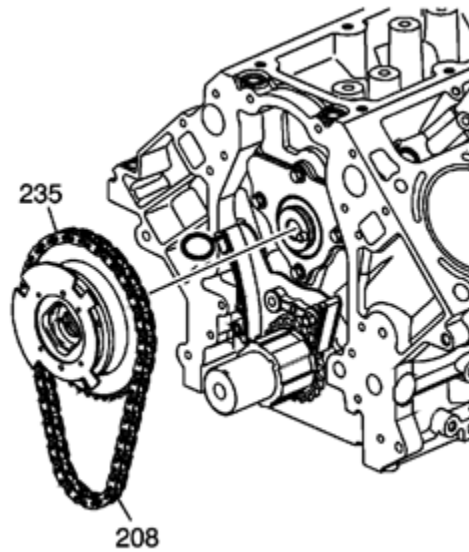
Tighten

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

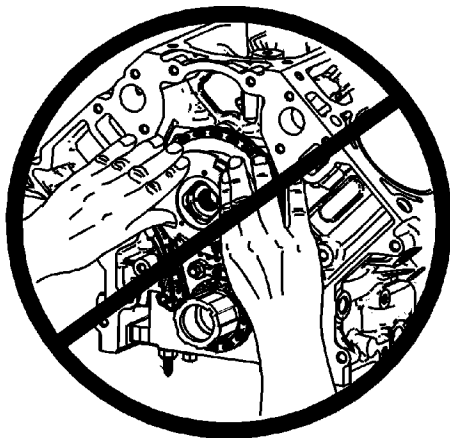
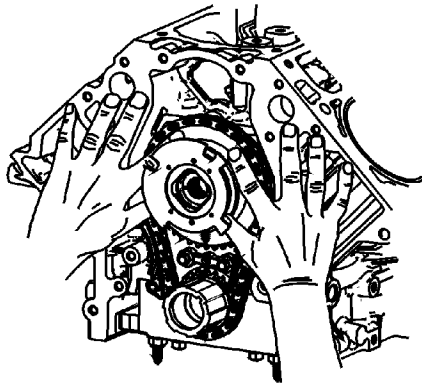
**Note:**

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

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



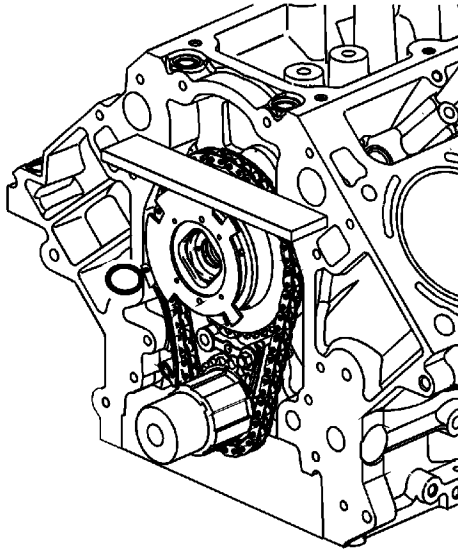
8. Align the CMP actuator so the timing mark is in the 6 o'clock position.
9. Install the CMP actuator (235) and timing chain (208). Align the hole in the face of the CMP actuator with the locating pin on the front face of the camshaft.



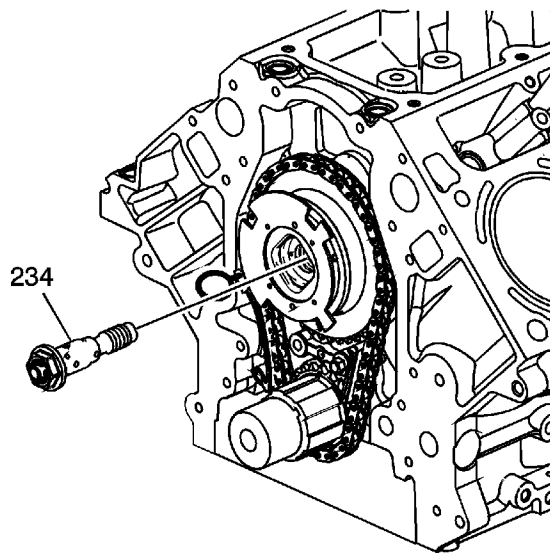


Warning: Do not push or pull on the reluctor wheel of the camshaft position (CMP) actuator during removal or installation. The reluctor wheel is retained to the front of the CMP actuator by 3 roll pins. Pushing or pulling on the wheel may dislodge the wheel from the front of the actuator. The actuator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

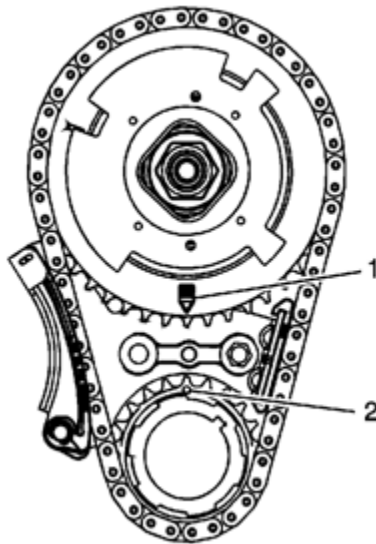
10. Use care to install the actuator completely onto the front of the camshaft. Position your fingers onto the face of the actuator sprocket and push the actuator onto the front of the camshaft. Never push on the reluctor wheel when attempting to install the actuator.



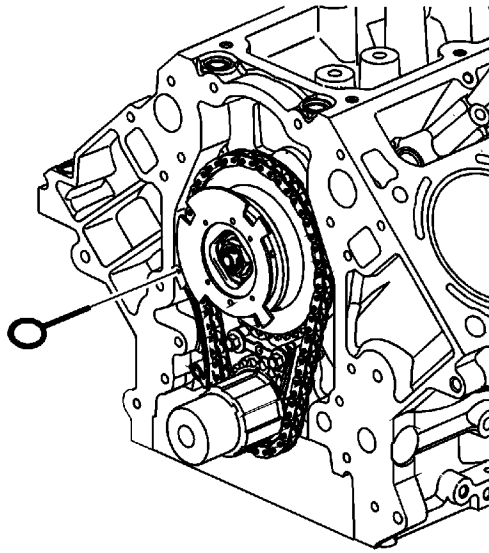
11. Place a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and completely installed onto the front of the camshaft, the timing chain will not protrude beyond the front face of the engine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



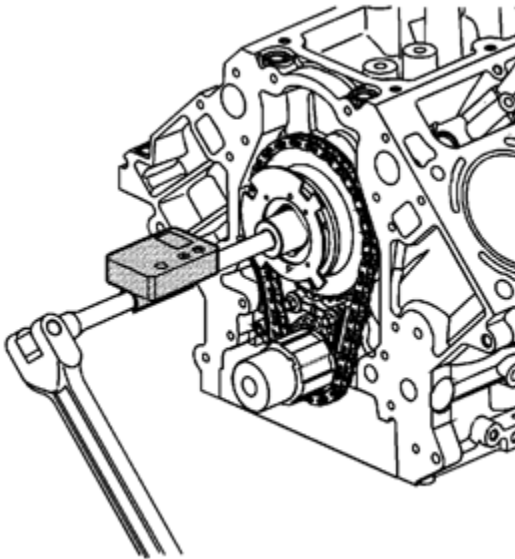
12. Install a NEW CMP actuator valve (234). With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.



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



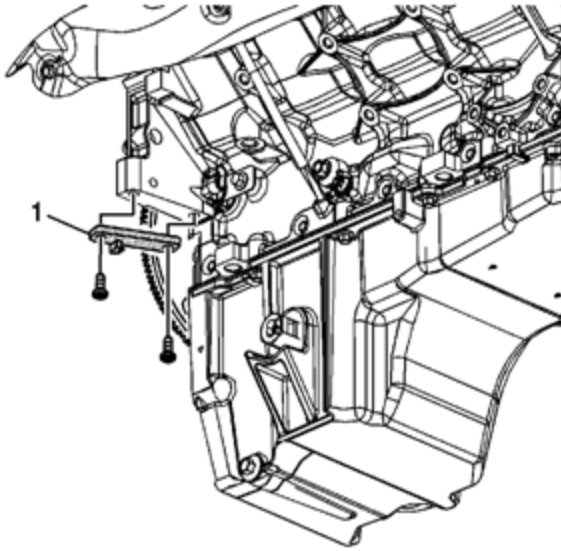
14. Remove the [EN 46330](#) .



15. Tighten the CMP actuator solenoid valve.

Tighten

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



16. Remove the [J 42386-A](#) (1) and bolts.
17. Install the starter motor. Refer to [Starter Motor Replacement](#).
18. Install the oil pump. Refer to [Oil Pump, Screen, and Crankshaft Oil Deflector Replacement](#).

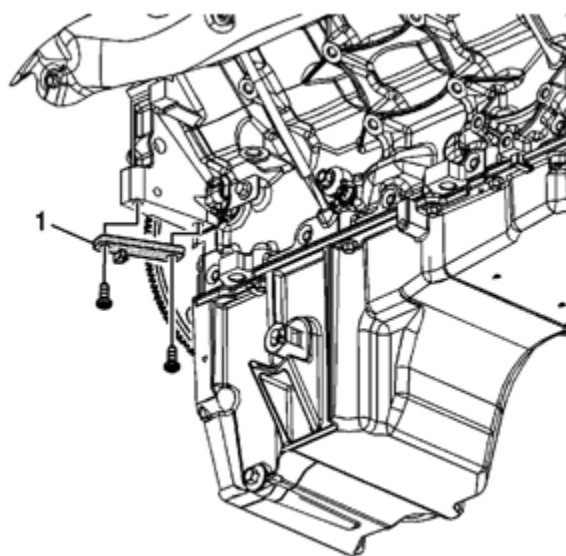
cardiagn.com

Camshaft Timing Chain and Sprocket Replacement

Special Tools

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

Removal Procedure



1. Remove the oil pump. Refer to [Oil Pump, Screen, and Crankshaft Oil Deflector Replacement](#).
2. Remove the starter motor. Refer to [Starter Motor Replacement](#).

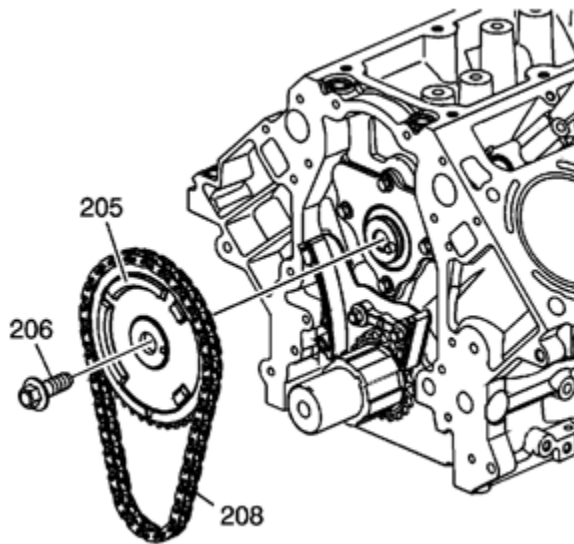
Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Ensure that the teeth of the [J 42386-A](#) mesh with the teeth of the engine flywheel.

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

Tighten

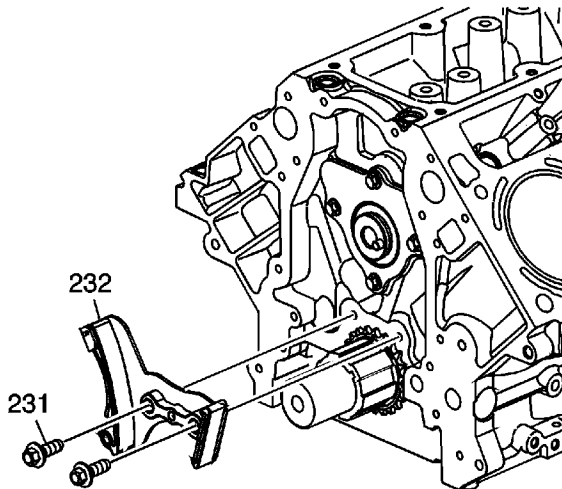
Tighten the [J 42386-A](#) bolts to 50 N·m (37 lb ft).



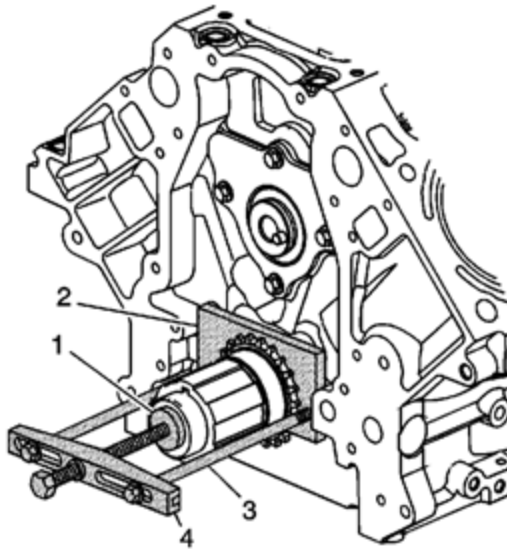
4. Rotate the crankshaft until the timing marks on the crankshaft and the camshaft sprockets are aligned.

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

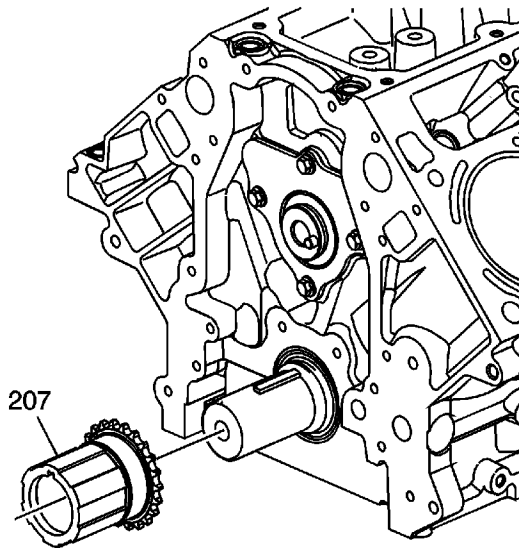
5. Remove the camshaft sprocket bolt (206).
6. Remove the camshaft sprocket (205) and timing chain (208).



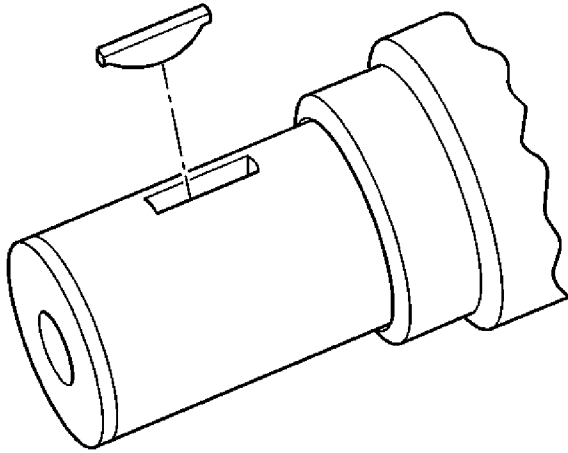
7. Remove the timing chain tension bolts (231) and tensioner (232).



8. Using the [J 41816-2](#) (1), the [J 41558](#) (2), bolts (3) and the [J 8433](#) (4) in order to remove the crankshaft sprocket.

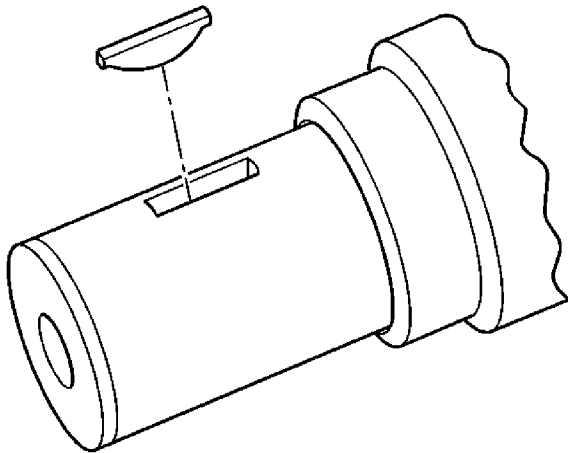


9. Remove the crankshaft sprocket (207).

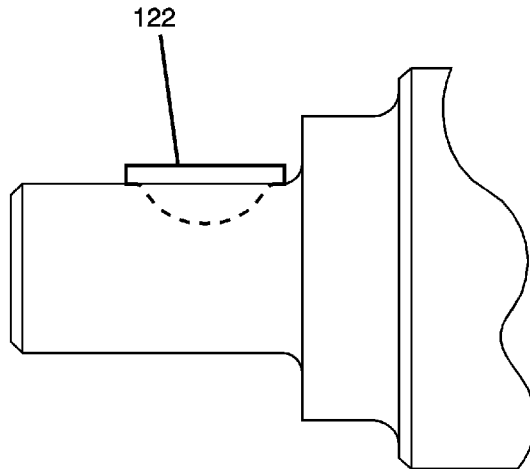


10. Remove the crankshaft sprocket key, if required.

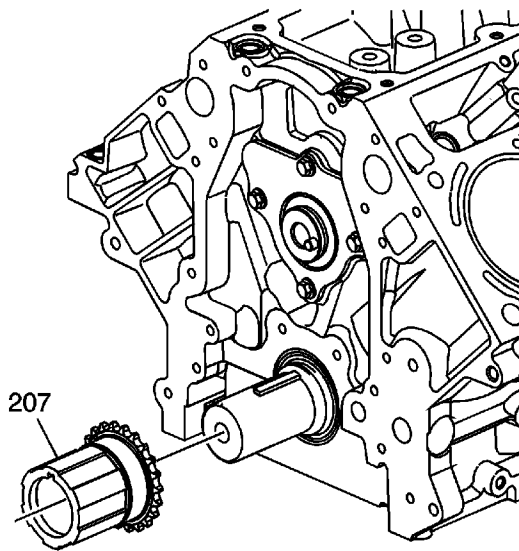
Installation Procedure



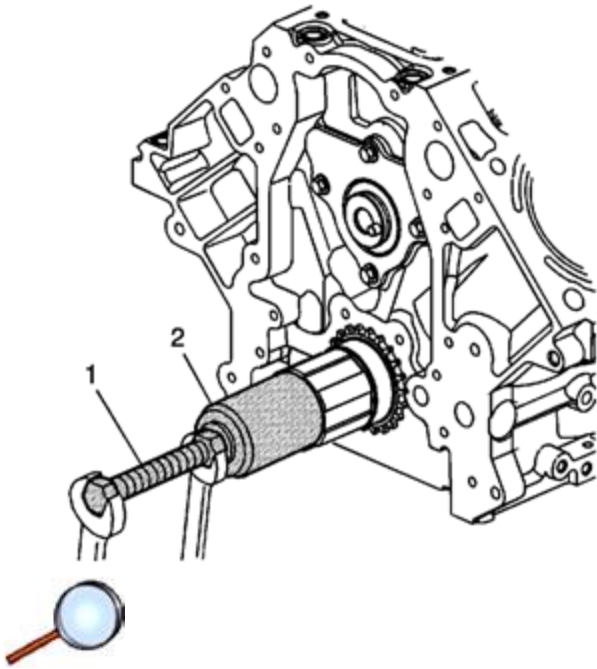
1. Install the key into the crankshaft keyway, if previously removed.



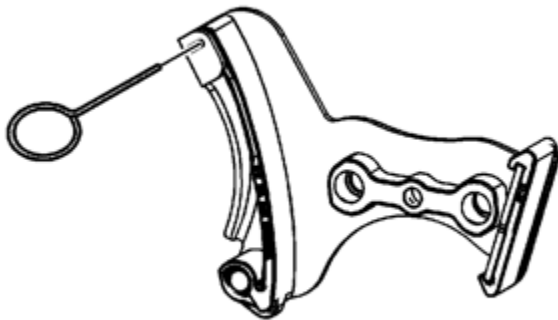
2. Tap the key (122) into the keyway until both ends of the key bottom onto the crankshaft.



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

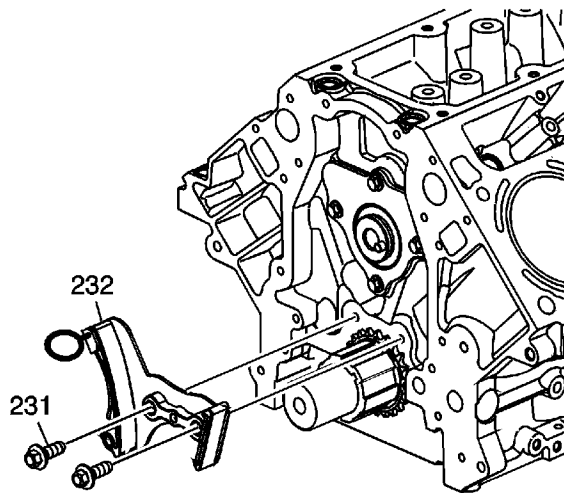


4. Use the [J 41478](#) (1) and the [J 41665](#) (2) in order to install the crankshaft sprocket. Install the sprocket onto the crankshaft until fully seated against the crankshaft flange.



5. Compress the timing chain tensioner guide and install the [EN 46330](#).

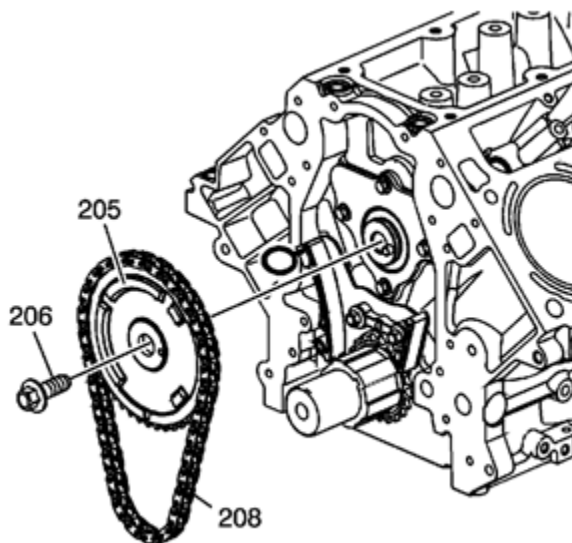
Caution: Refer to [Fastener Caution](#) in the Preface section.



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

Tighten

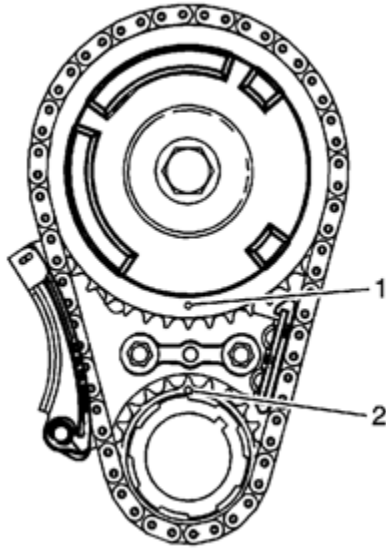
Tighten the bolts to 25 N·m (18 lb ft).

**Note:**

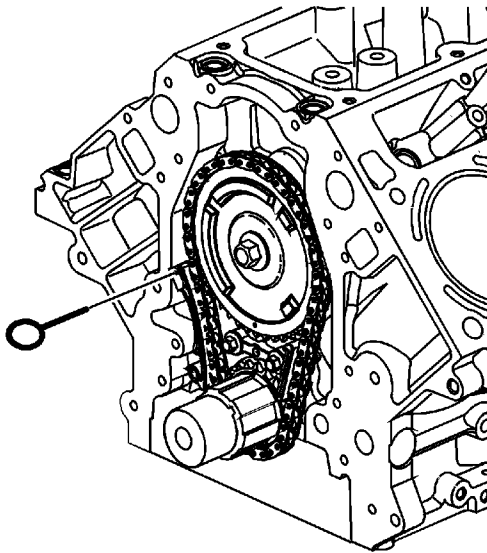
- The sprocket teeth and timing chain must mesh.
- The camshaft and the crankshaft sprocket alignment marks **MUST** be aligned properly.

7. Position the camshaft sprocket (205) so the timing mark is in the 6 o'clock position.

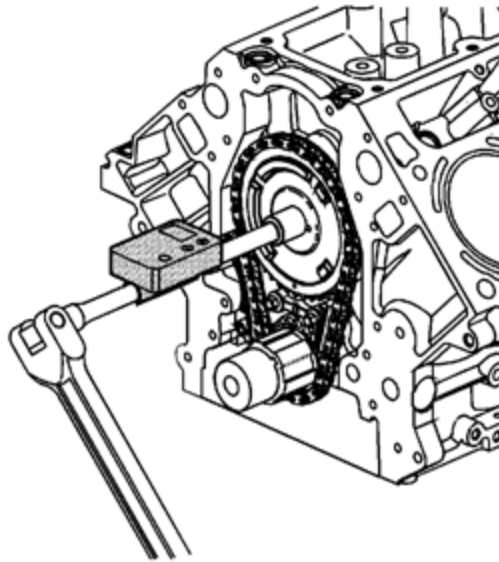
8. Install the camshaft sprocket (205), timing chain (208), and bolt (206).



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



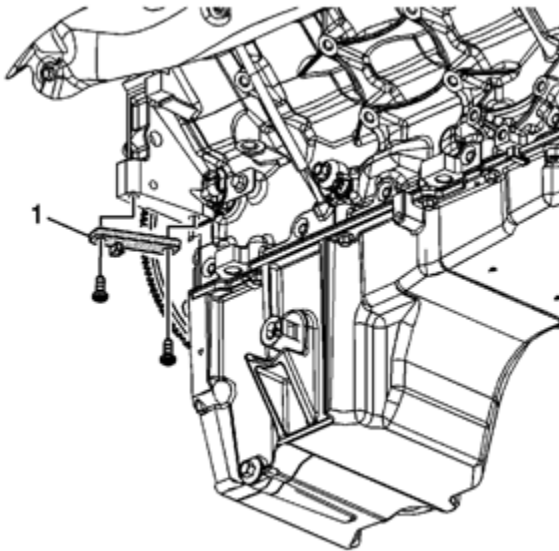
10. Remove the [EN 46330](#) .



11. Tighten the camshaft sprocket bolt

Tighten

1. Tighten the bolt a first pass to 75 N·m (55 lb ft).
2. Tighten the bolt a final pass an additional 50 degrees using [J 45059](#) .



12. Remove the [J 42386-A](#) (1) and bolts.
13. Install the starter motor. Refer to [Starter Motor Replacement](#).
14. Install the oil pump. Refer to [Oil Pump, Screen, and Crankshaft Oil Deflector Replacement](#).

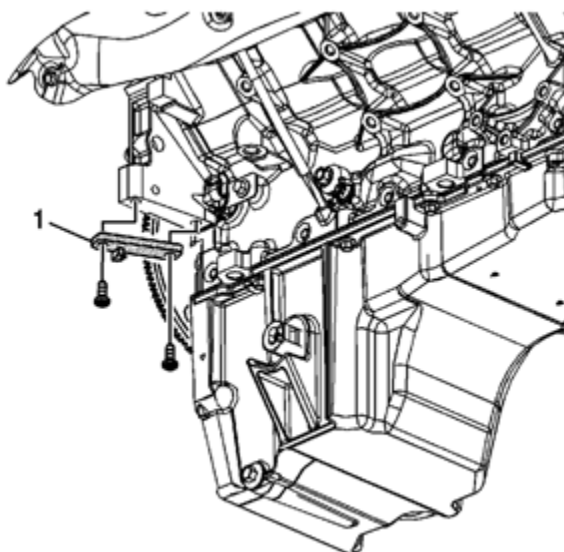
Camshaft Replacement (LH6, LMG, LY2 and LY5)

Special Tools

- [EN 46330](#) Timing Belt Tensioner Retaining Pin
- [J 42386-A](#) Flywheel Holding Tool
- [J 45059](#) Angle Meter

Removal Procedure

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



1. Remove the radiator support. Refer to [Radiator Support Replacement](#).
2. Remove the valve lifters. Refer to [Valve Lifter Replacement](#).
3. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).
4. Remove the starter motor. Refer to [Starter Motor Replacement](#).

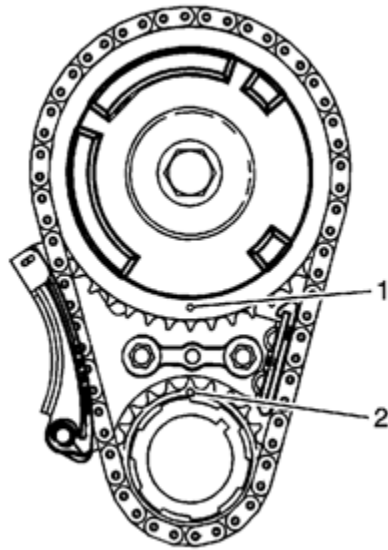
Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Ensure that the teeth of the [J 42386-A](#) mesh with the teeth of the engine flywheel.

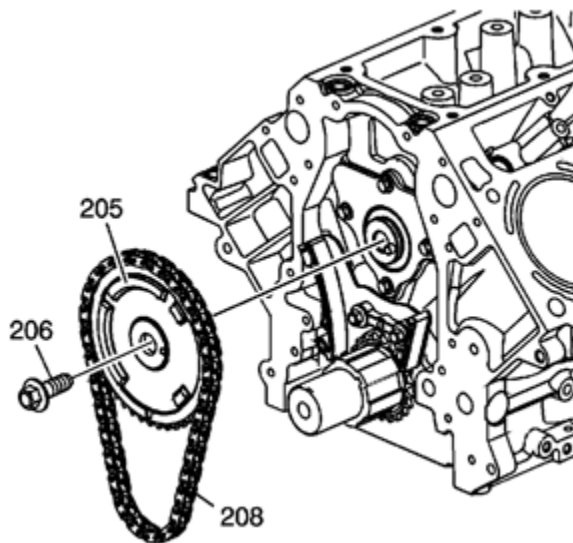
5. Install the [J 42386-A](#) (1) and bolts. Use one M10-1.5 x 120 mm and one M10-1.5 x 45 mm bolt for proper tool operation.

Tighten

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

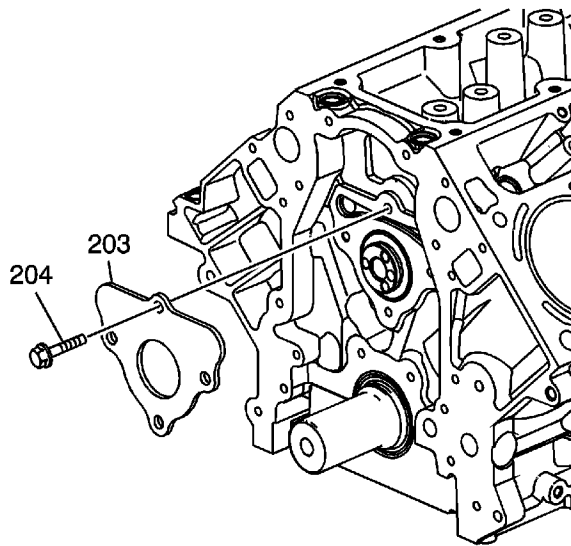


6. Rotate the crankshaft sprocket until the camshaft sprocket alignment mark (1) and the crankshaft sprocket alignment mark (2) are aligned.

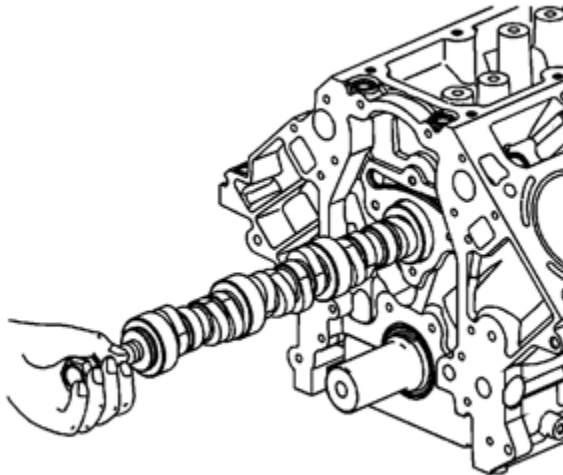


Caution: Do not turn the crankshaft assembly after the timing chain has been removed in order to prevent damage to the piston assemblies or the valves.

7. Remove the camshaft sprocket bolt (206).
8. Remove the camshaft sprocket (205) and timing chain (208).



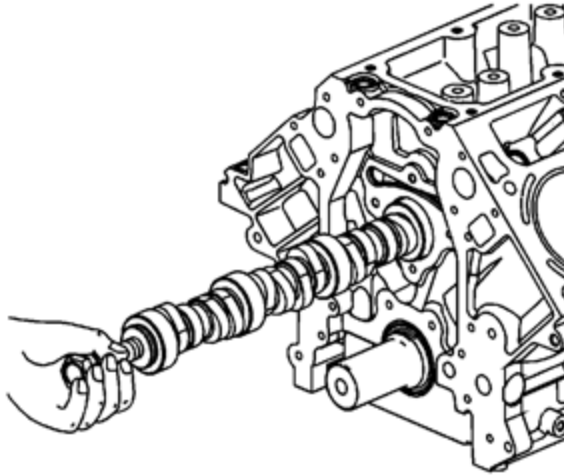
9. Remove the camshaft retainer bolts (204) and retainer (203).



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

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

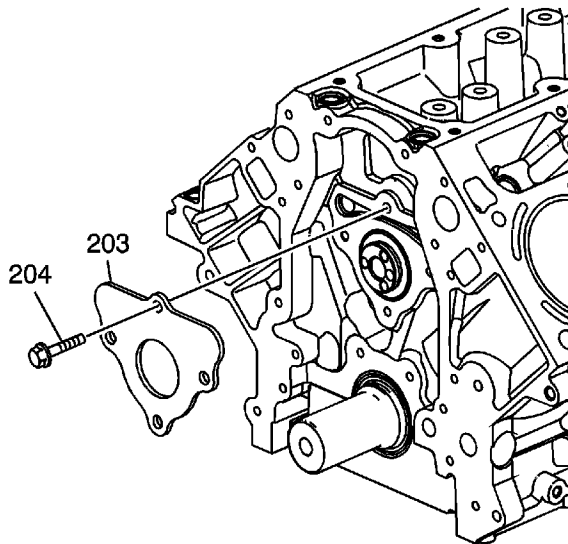
Installation Procedure



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

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

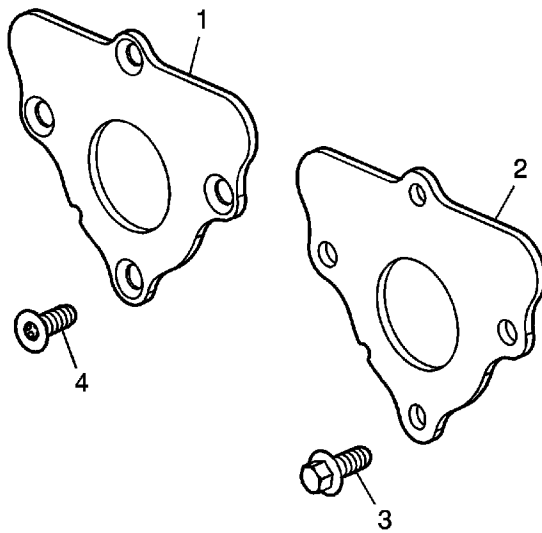
3. Using the bolt as a handle, carefully install the camshaft into the engine block.
4. Remove the bolt from the front of the camshaft.



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

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

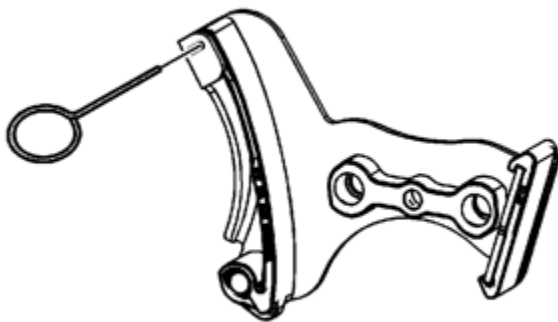
Caution: Refer to [Fastener Caution](#) in the Preface section.



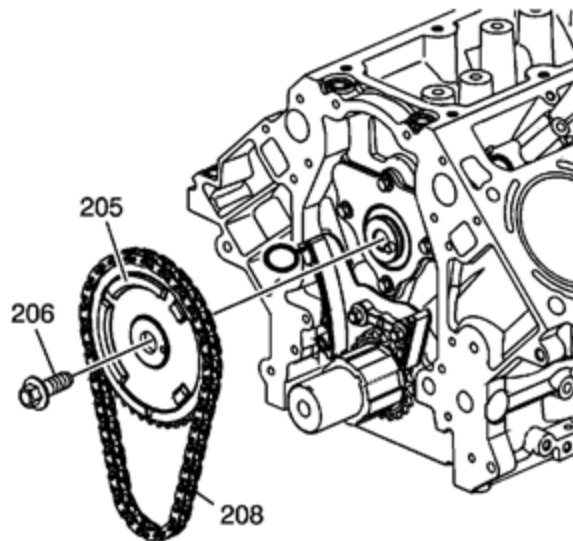
6. Tighten the camshaft retainer bolts.

Tighten

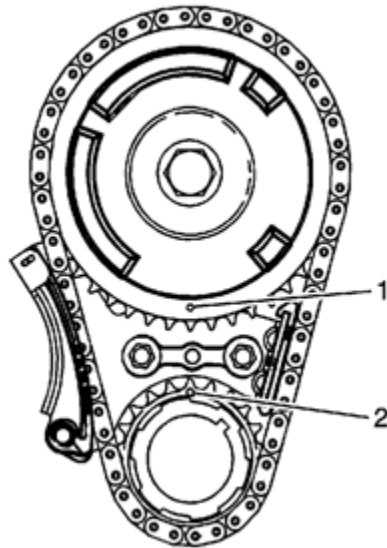
- Tighten the first design hex head bolts (3) to 25 N·m (18 lb ft).
- Tighten the second design TORX® head bolts (4) to 15 N·m (11 lb ft).



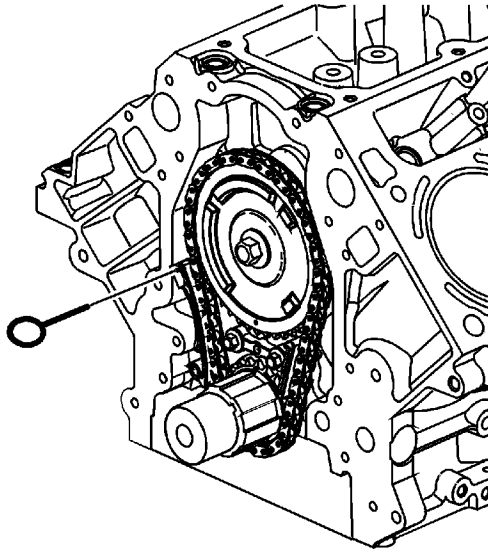
7. Compress the timing chain tensioner guide and install the [EN 46330](#).



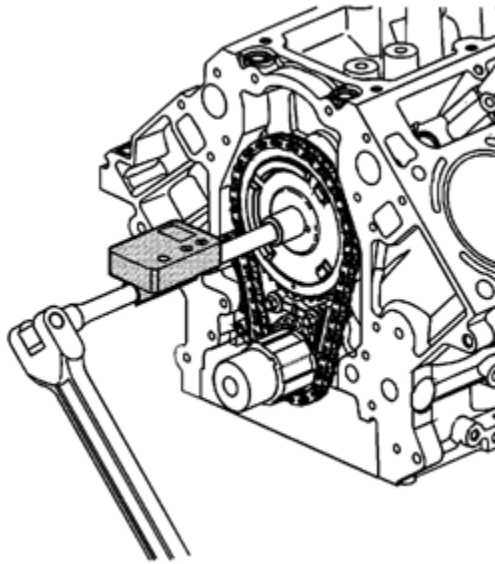
8. Align the camshaft sprocket so the timing mark is in the 6 o'clock position.
9. Install the camshaft sprocket (205), timing chain (208), and bolt (206).



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



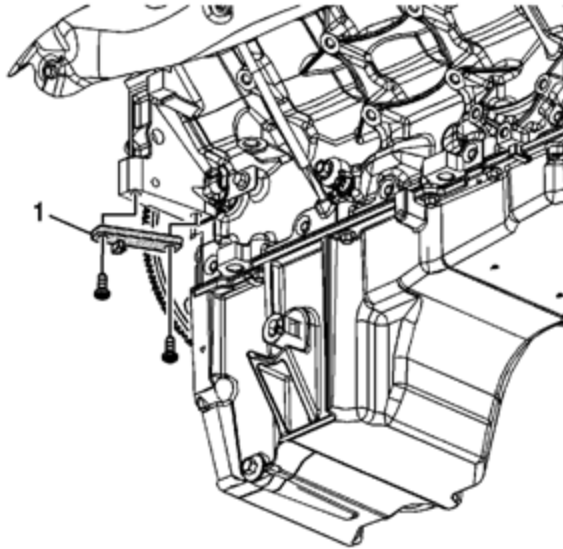
11. Remove the [EN 46330](#) .



12. Tighten the camshaft sprocket bolt.

Tighten

1. Tighten the bolt a first pass to 90 N·m (66 lb ft).
2. Tighten the bolt a final pass to 40 degrees using [J 45059](#) .



13. Remove the [J 42386-A](#) (1) and bolts.
14. Install the starter motor. Refer to [Starter Motor Replacement](#).
15. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).
16. Install the valve lifters. Refer to [Valve Lifter Replacement](#).
17. Install the radiator support. Refer to [Radiator Support Replacement](#).

cardiagn.com

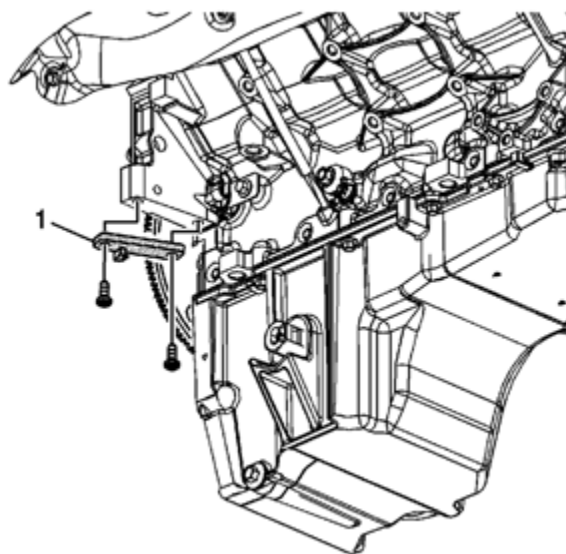
Camshaft Replacement (Except LH6, LMG, LY2 and LY5)

Special Tools

- [EN 46330](#) Timing Belt Tensioner Retaining Pin
- [J 42386-A](#) Flywheel Holding Tool
- [J 45059](#) Angle Meter

Removal Procedure

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



1. Remove the radiator support. Refer to [Radiator Support Replacement](#).
2. Remove the valve lifters. Refer to [Valve Lifter Replacement](#).
3. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).
4. Remove the starter motor. Refer to [Starter Motor Replacement](#).

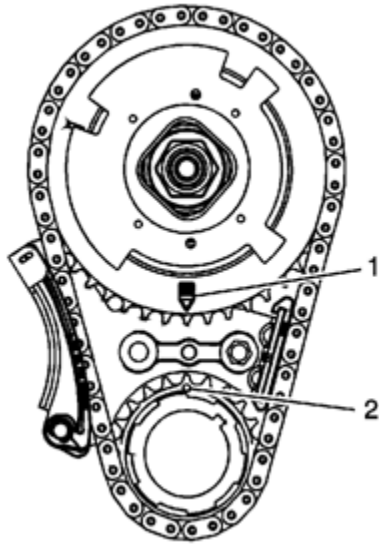
Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Ensure that the teeth of the [J 42386-A](#) mesh with the teeth of the engine flywheel.

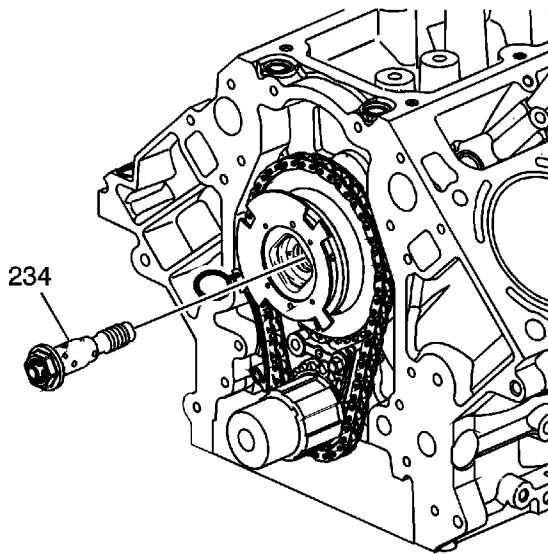
5. Install the [J 42386-A](#) (1) and bolts. Use one M10-1.5 x 120 mm and one M10-1.5 x 45 mm bolt for proper tool operation.

Tighten

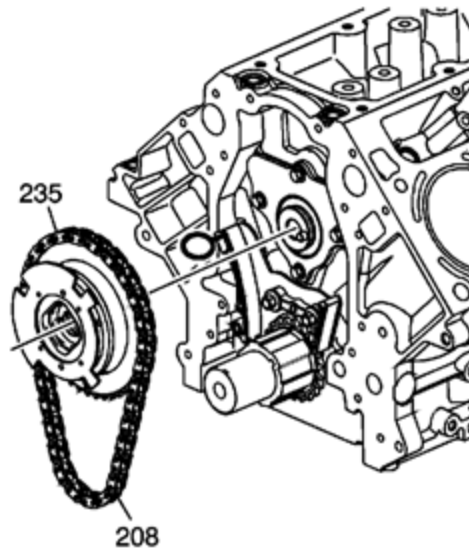
Tighten the [J 42386-A](#) bolts to 50 N·m (37 lb ft).



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

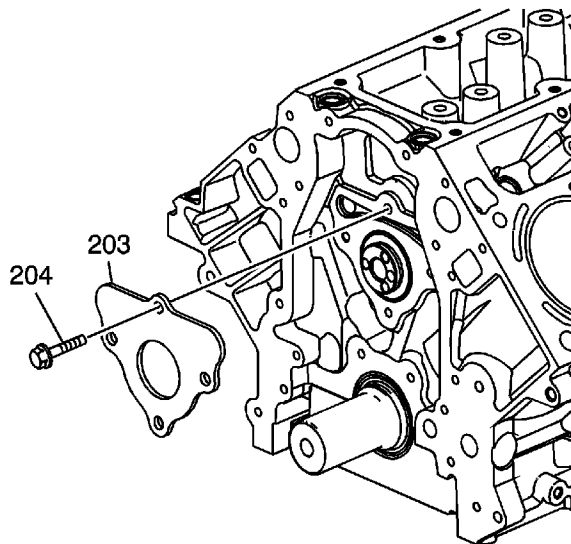


7. Remove and discard the CMP actuator solenoid valve (234).

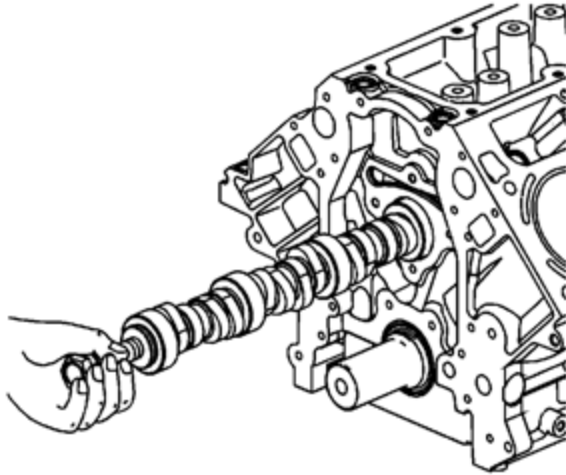


Caution: Do not turn the crankshaft assembly after the timing chain has been removed in order to prevent damage to the piston assemblies or the valves.

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



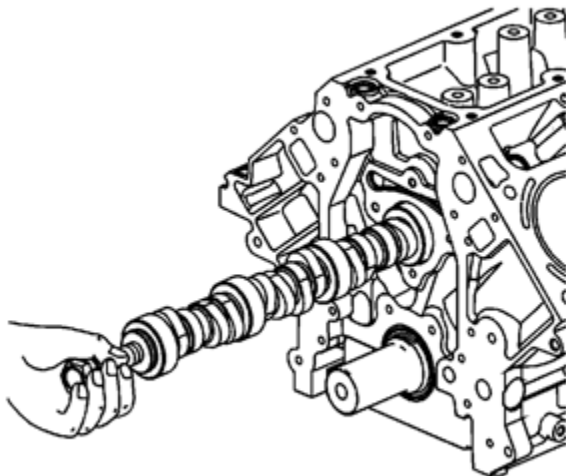
9. Remove the camshaft retainer bolts (204) and retainer (203).



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

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

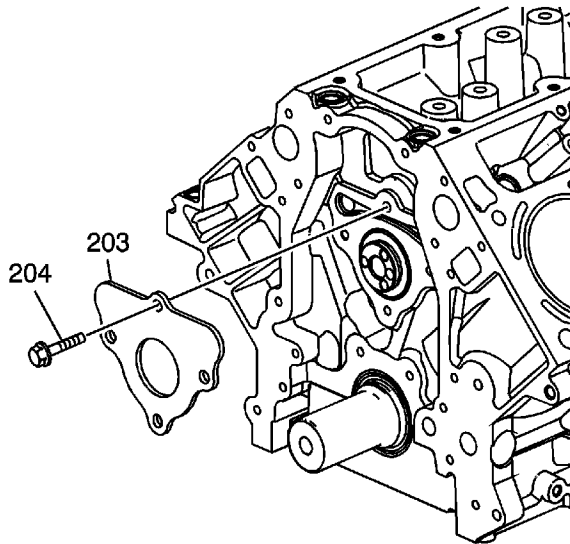
Installation Procedure



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

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

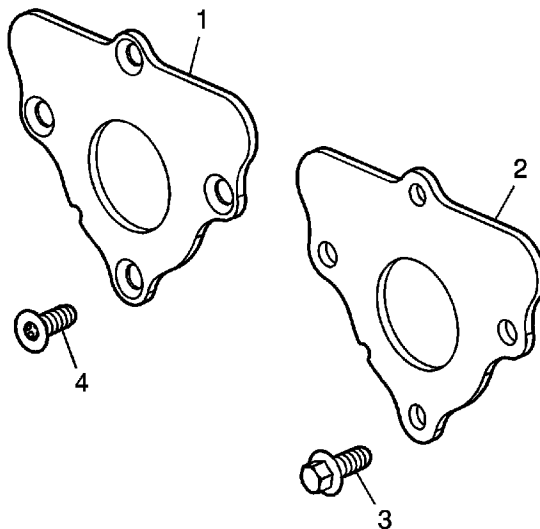
3. Using the bolt as a handle, carefully install the camshaft into the engine block.
4. Remove the bolt from the front of the camshaft.



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

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

Caution: Refer to [Fastener Caution](#) in the Preface section.

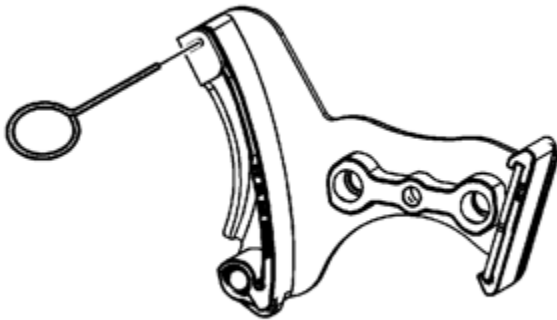




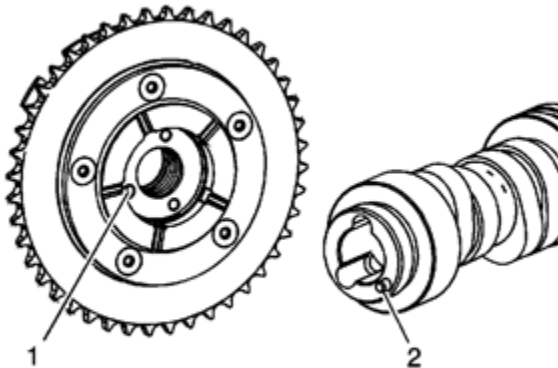
6. Tighten the camshaft retainer bolts.

Tighten

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



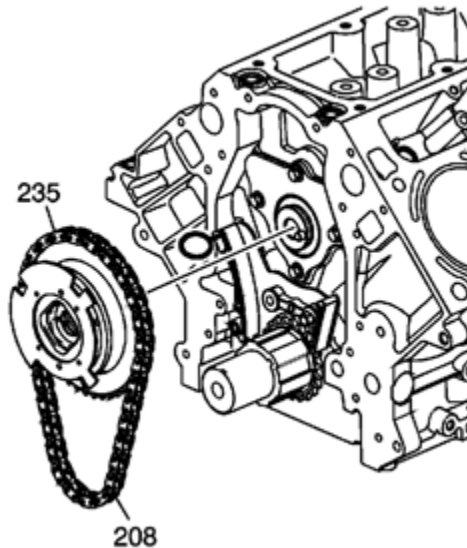
7. Compress the timing chain tensioner guide and install the [EN 46330](#) .



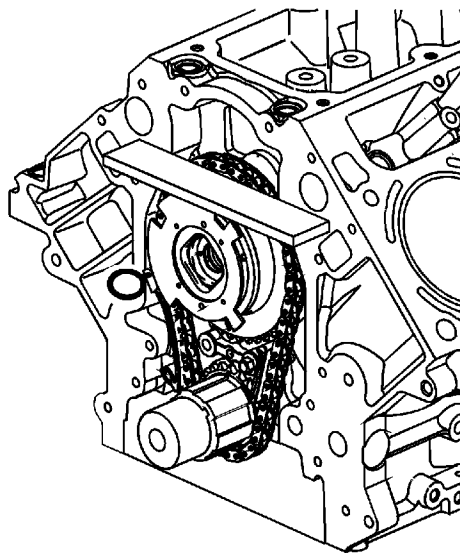
Note:

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

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

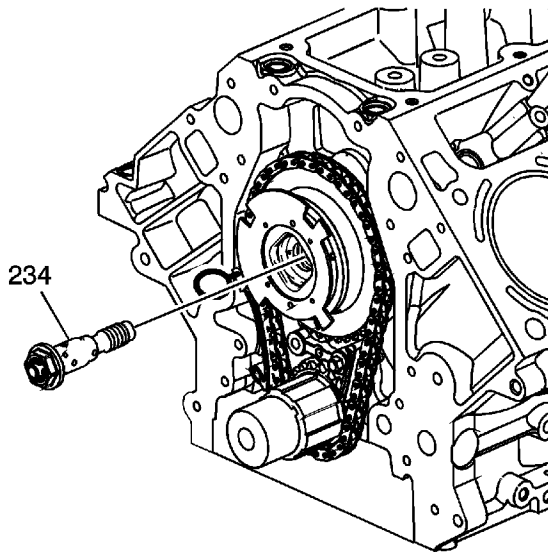


9. Align the CMP actuator so the timing mark is in the 6 o'clock position.
10. Install the CMP actuator (235) and timing chain (208). Align the hole in the face of the CMP actuator with the locating pin on the front face of the camshaft.

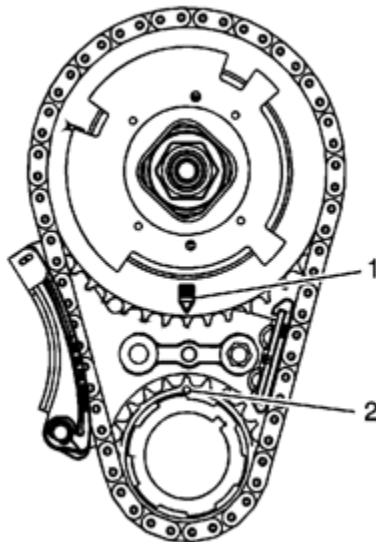


11. Place a straight edge across the front face of the engine block and inspect for proper installation of the CMP actuator and timing chain. With the CMP actuator properly and

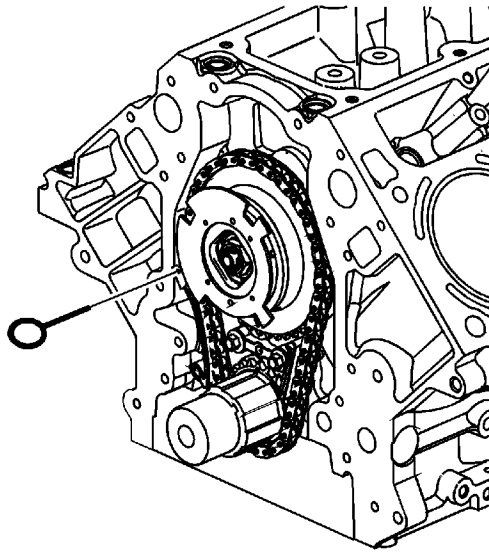
completely installed onto the front of the camshaft, the timing chain will not protrude beyond the front face of the engine block.



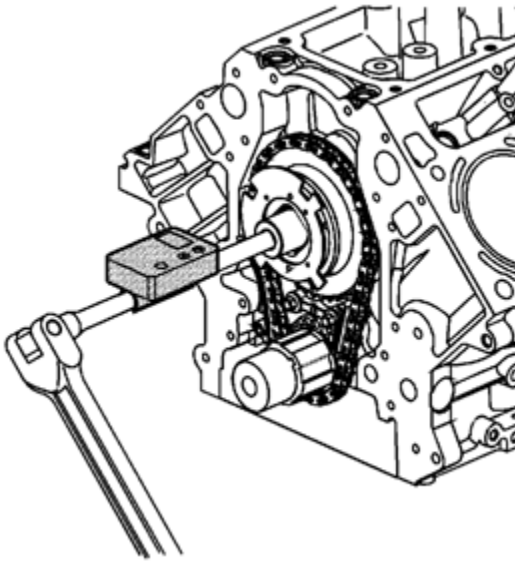
12. Install a NEW CMP actuator solenoid valve (234). With the CMP actuator properly positioned onto the camshaft, the CMP actuator solenoid valve can be threaded completely into the camshaft using light hand pressure. Tighten by hand until snug.



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



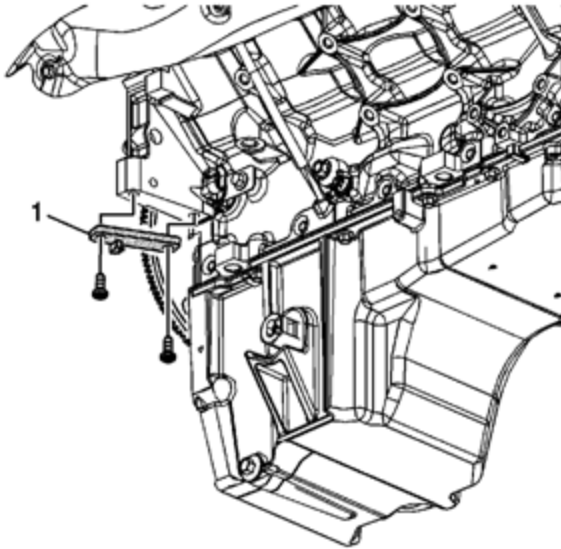
14. Remove the [EN 46330](#) .



15. Tighten the CMP actuator solenoid valve.

Tighten

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

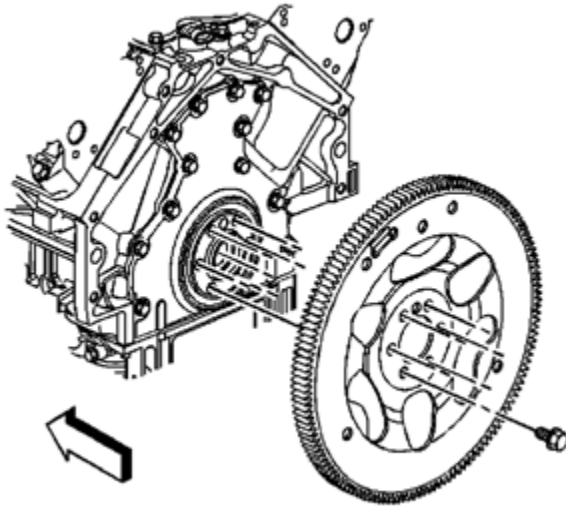


16. Remove the [J 42386-A](#) (1) and bolts.
17. Install the starter motor. Refer to [Starter Motor Replacement](#).
18. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).
19. Install the valve lifters. Refer to [Valve Lifter Replacement](#).
20. Install the radiator support. Refer to [Radiator Support Replacement](#).

cardiagn.com

Automatic Transmission Flex Plate Replacement

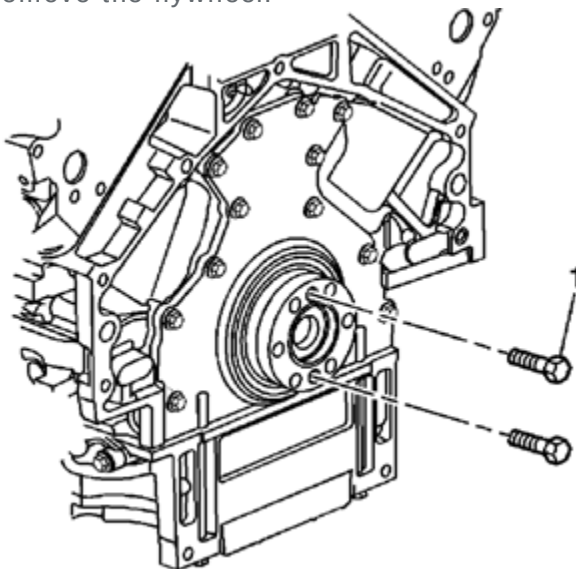
Removal Procedure



1. Remove the automatic transmission. Refer to [Transmission Replacement](#) for the 4L60-E.

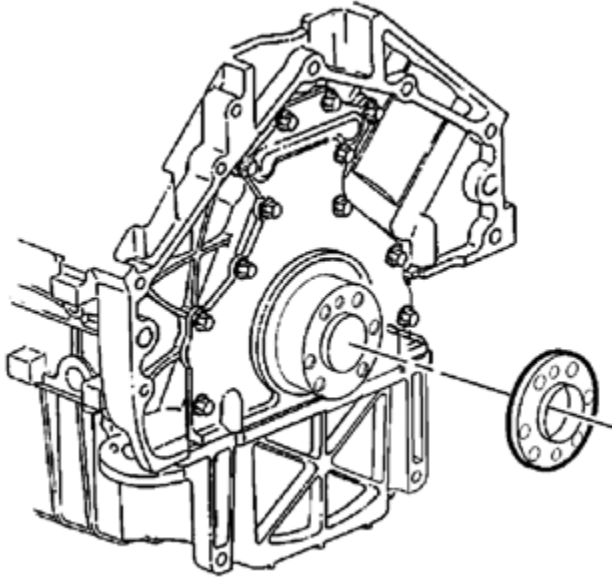
Important: Note the position and direction of the engine flywheel before removal.

2. Remove the flywheel bolts.
3. Remove the flywheel.





4. Install two M11x1.5 mm bolts (1) to the threaded holes of the spacer, if applicable.
5. Rotate the bolts clockwise to remove the spacer.

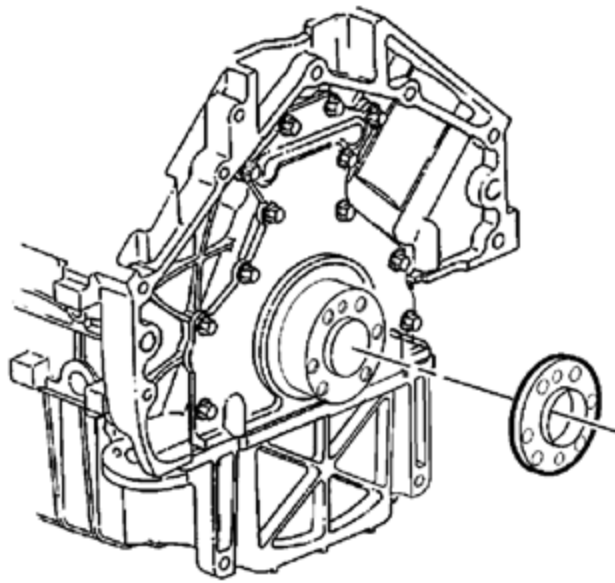


6. Remove the spacer from the rear of the crankshaft, if applicable.

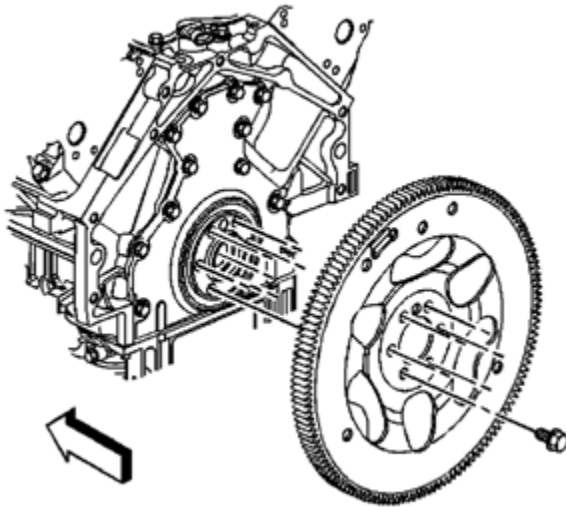
Installation Procedure

Note:

- The flywheel does not use a locating pin for alignment and will not initially seat against the crankshaft flange or spacer, if applicable, but will be pulled onto the crankshaft by the engine flywheel bolts. This procedure requires a three stage tightening process.
- Certain applications (6.0L) require a spacer and longer bolts for proper flywheel position.



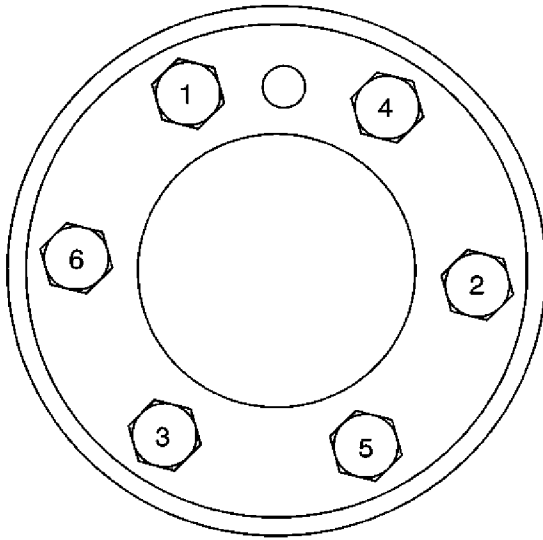
1. Install the spacer, if applicable, onto the rear of the crankshaft.



Note: Longer flywheel bolts must be used on applications using a flywheel spacer.

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

Caution: Refer to [Fastener Caution](#) in the Preface section.



4. Tighten the flywheel bolts.
 - Tighten the bolts (1-6) a first pass in sequence to **20 N·m (15 lb ft)**.
 - Tighten the bolts (1-6) a second pass in sequence to **50 N·m (37 lb ft)**.
 - Tighten the bolts (1-6) a final pass in sequence to **100 N·m (74 lb ft)**.
5. Install the automatic transmission. Refer to [Transmission Replacement](#) for the 4L60-E.

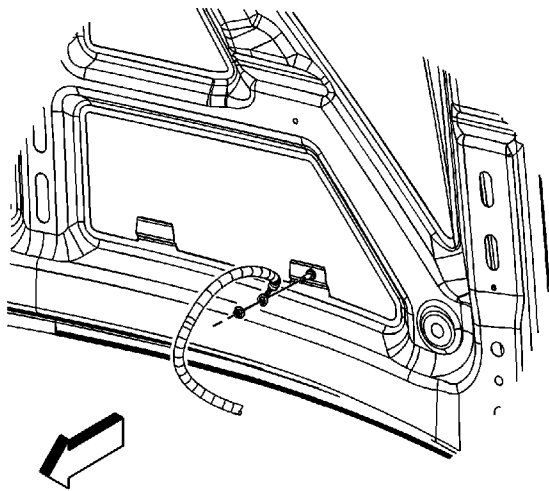
[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Repair Instructions - On Vehicle](#) | **Document ID: 2171732**

Engine Replacement

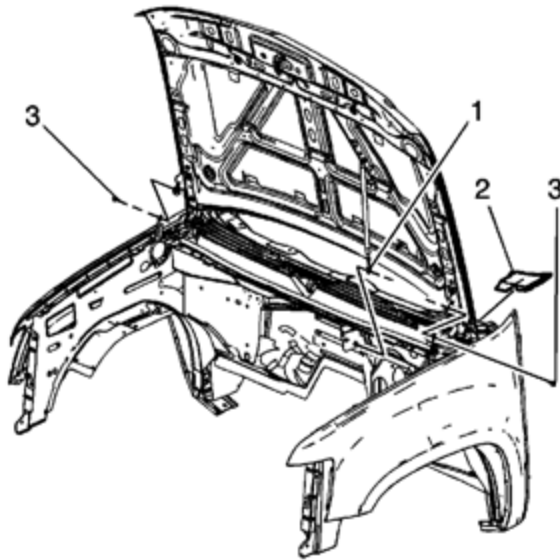
Special Tools

- [J 21366](#) Converter Holding Strap
- [J 41798](#) Engine Lifting Brackets

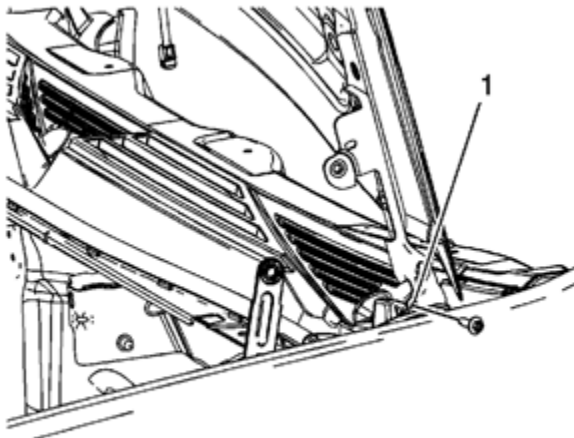
Removal Procedure



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



4. Assemble 2 sets of the following: an M6 bolt, 2 each 19.05 mm (0.75 in) flat washers and an M6 nut.
5. Release the retainer securing the hood strut rod to the hood strut bracket stud.
6. Remove the hood strut rod (1) from the stud.
7. Remove the air inlet grille end caps (2), lift the end cap up in order to disengage the retainers. (left side shown, right side similar).
8. Have an assistant support the hood.
9. Remove the hood hinge bolts (3) and set aside.



Note: There is a positive stop which limits the hood from being opened too far.

10. Raise the hood until the service position notch (1) in the upper hinge is reached.
11. Install the 2 sets of the M6 bolts to both the left and right side service notches and tighten

finger tight.

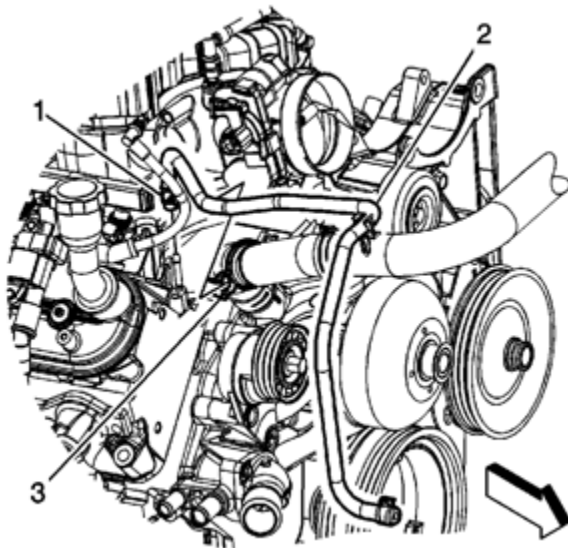
Caution: Refer to [Fastener Caution](#) in the Preface section.

12. Lower the hood until the bolts rest against the lower hinge, tighten the bolts to secure the hood.

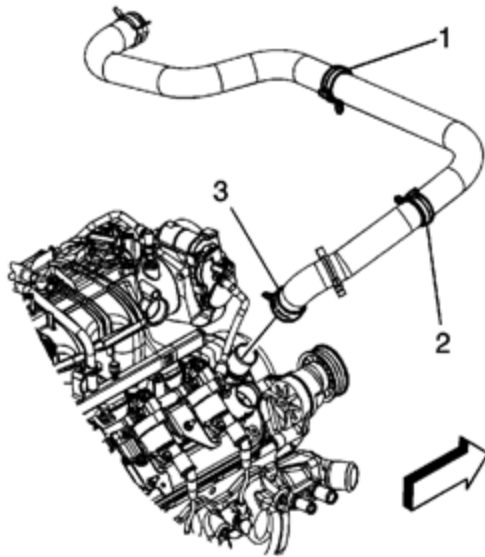
Tighten

Tighten the bolts to 20 N·m (15 lb ft).

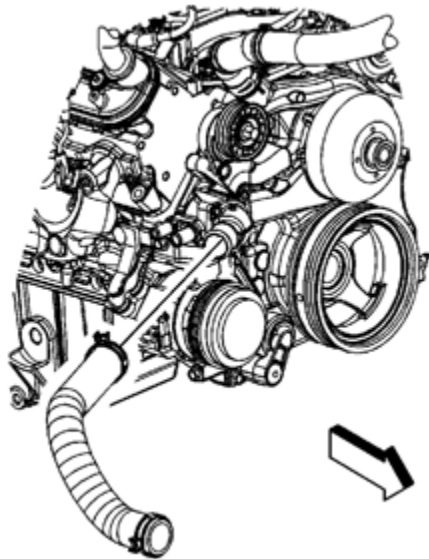
13. The hood is now set in the service position.
14. Remove the hood latch. Refer to [Hood Primary and Secondary Latch Replacement](#).
15. Remove the front end upper tie bar. Refer to [Front End Upper Tie Bar Replacement](#).
16. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).



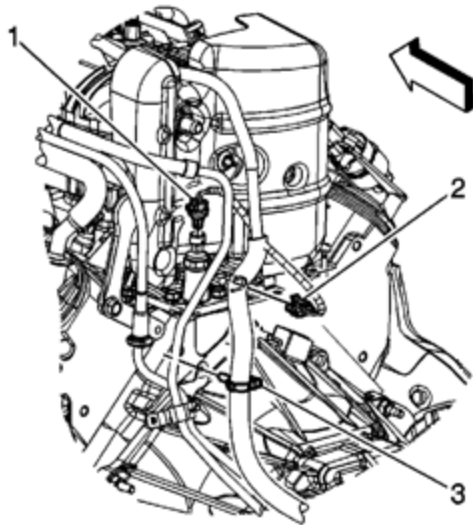
17. Remove the radiator vent inlet hose (2) from the radiator inlet hose clip (3).
18. Reposition the radiator vent inlet hose clamp (1) at the air bleed pipe.
19. Remove the radiator vent inlet hose (2) from the air bleed pipe and reposition.



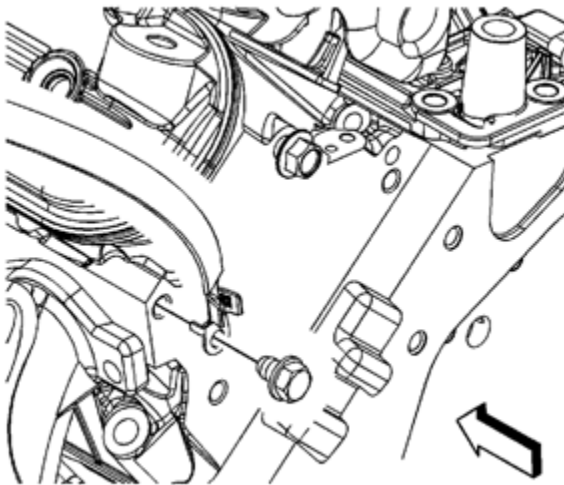
20. Reposition the radiator inlet hose clamp (3) at the water pump.
21. Remove the radiator inlet hose from the water pump.



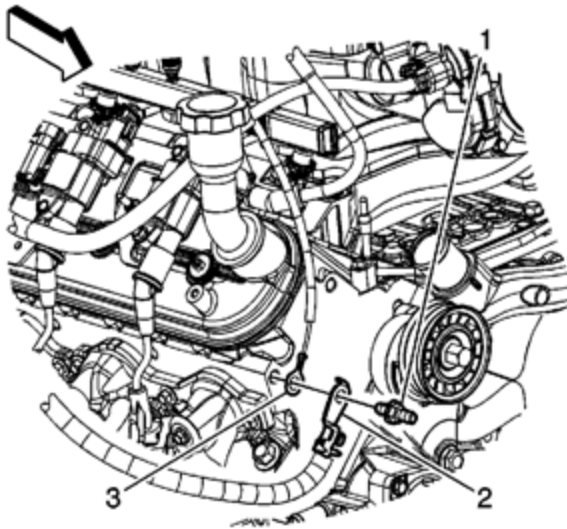
22. Reposition the radiator outlet hose clamp at the water pump.
23. Remove the radiator outlet hose from the water pump.
24. Remove the heater hoses. Refer to [Heater Inlet Hose Replacement](#) and [Heater Outlet Hose Replacement](#).



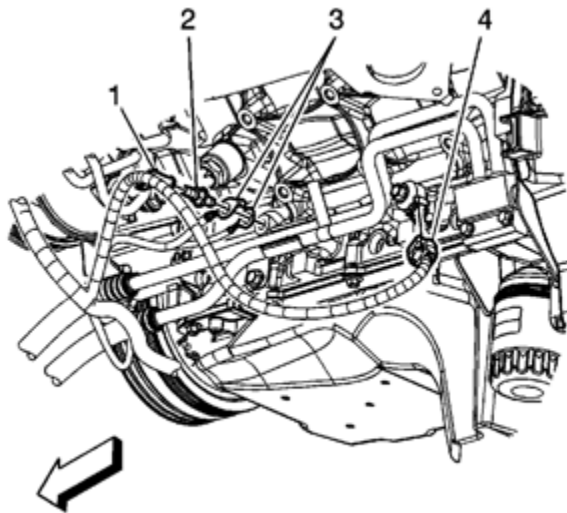
25. Disconnect the engine harness electrical connector (1) from the oil pressure sensor.
26. Disconnect the engine harness electrical connector (2) from the lifter oil manifold.



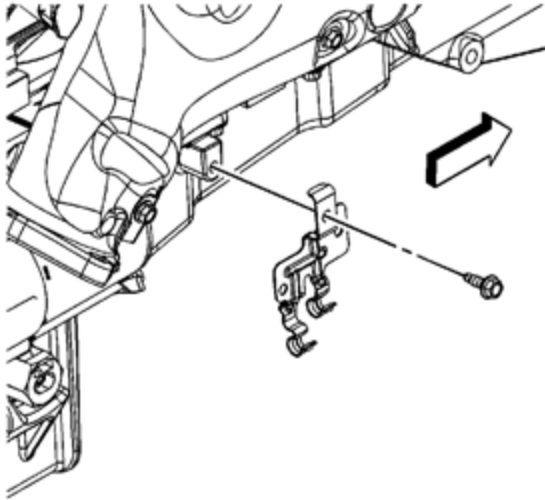
27. Remove the engine ground strap bolt from the rear of the left cylinder head and cowl and reposition.



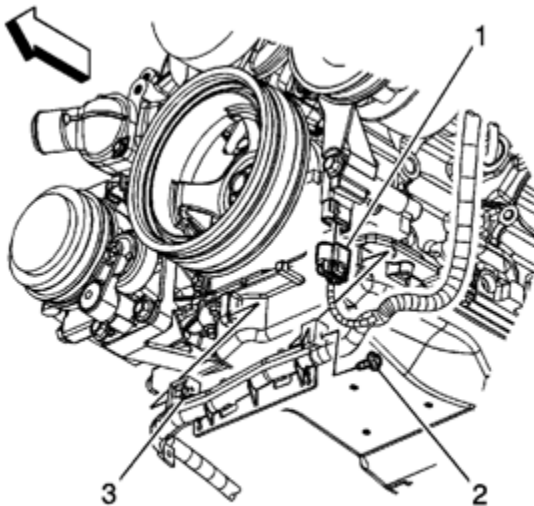
28. Remove the negative battery cable stud (1) from the right cylinder head.
29. Remove the negative battery cable terminal (2) and the engine harness ground (3) from the right cylinder head.
30. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).



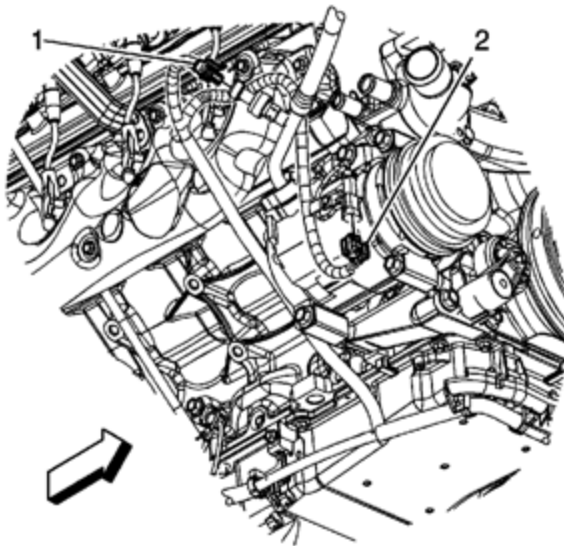
31. Remove the engine harness clip (1) from the ground stud.
32. Remove the engine harness ground stud (2) from the engine block.
33. Remove the engine harness grounds (3) from the engine block.
34. Disconnect the engine harness electrical connector (4) from the knock sensor.



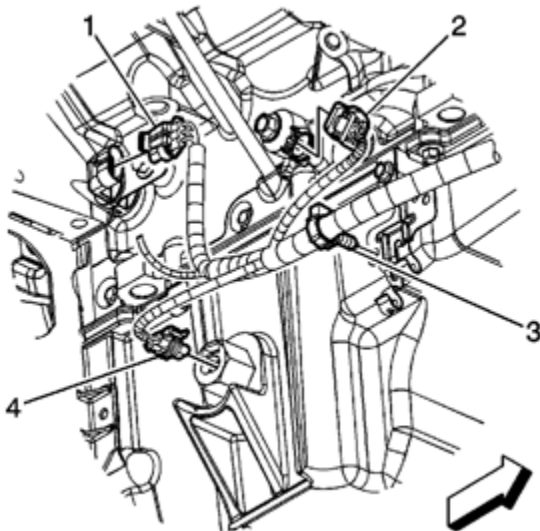
35. Remove the transmission oil cooler line clip bolt from the oil pan, if equipped.



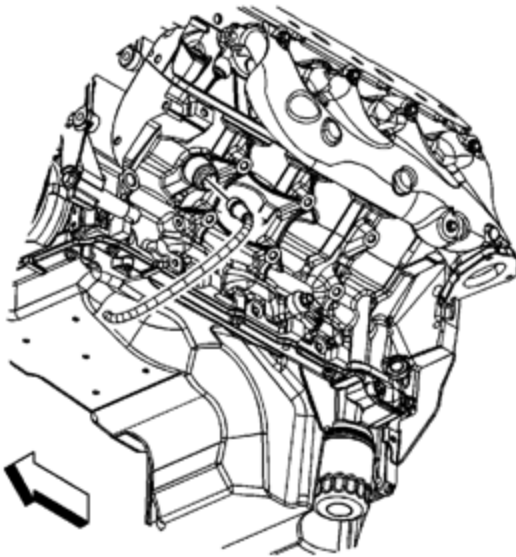
36. Disconnect the engine harness electrical connector (1) from the camshaft position (CMP) sensor wire harness.
37. Remove the battery cable channel bolt (2).
38. Slide the channel pin (3) out of the oil pan tab.



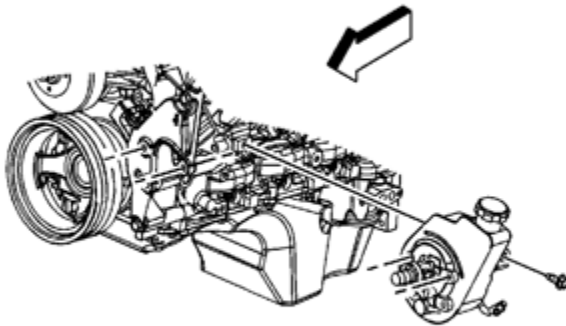
39. Disconnect the engine harness electrical connector (1) from the A/C refrigerant pressure sensor.
40. Remove the starter motor. Refer to [Starter Motor Replacement](#).



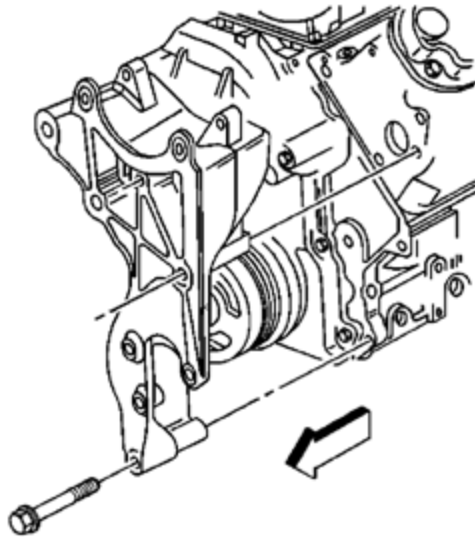
41. Disconnect the engine harness electrical connector (1) from the crankshaft position (CKP) sensor.
42. Disconnect the engine harness electrical connector (2) from the knock sensor.
43. Disconnect the engine harness electrical connector (4) from the oil level sensor.
44. Remove the engine harness clip (3) from the transmission oil cooler line bracket.



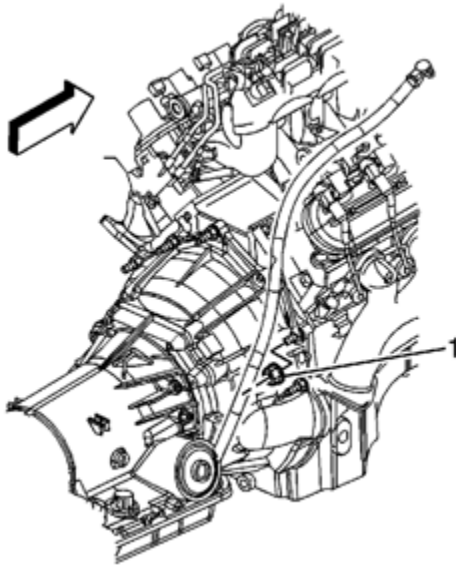
45. Disconnect the coolant heater cord from the coolant heater, if equipped.
46. Lower the vehicle.



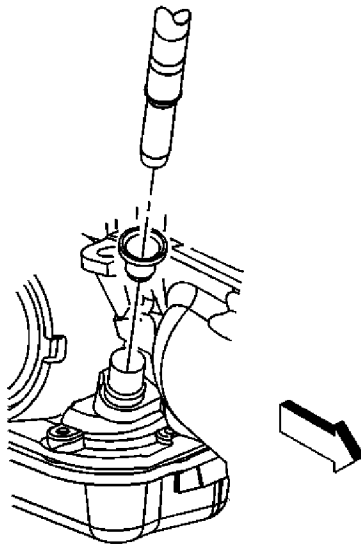
47. Remove the rear power steering pump-to-engine block bolt (1500 series shown, 2500 series similar).



48. Remove the generator bracket bolts.
49. Position the generator bracket (with power steering pump) aside.
50. Remove the ignition coil, as required for the proper fit of the [J 41798](#) before lifting the engine. Refer to [Ignition Coil Replacement](#).

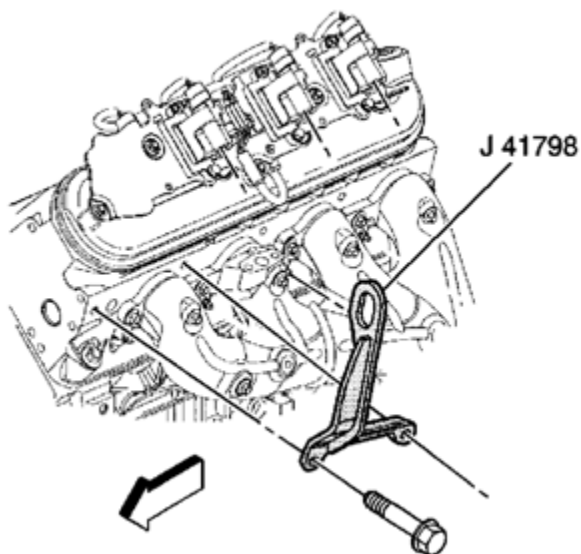


51. Remove the transmission oil level indicator tube nut (1).



52. Remove the transmission oil level indicator tube.

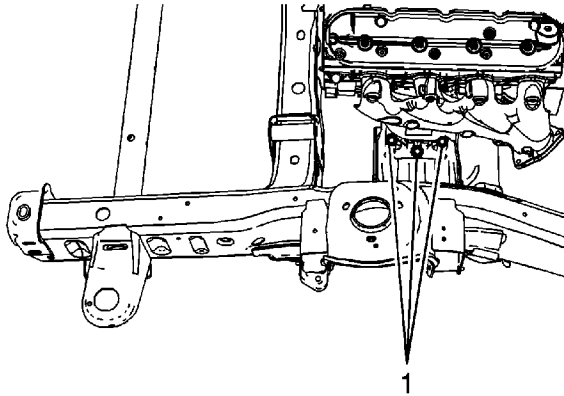
Caution: Refer to [Fastener Caution](#) in the Preface section.



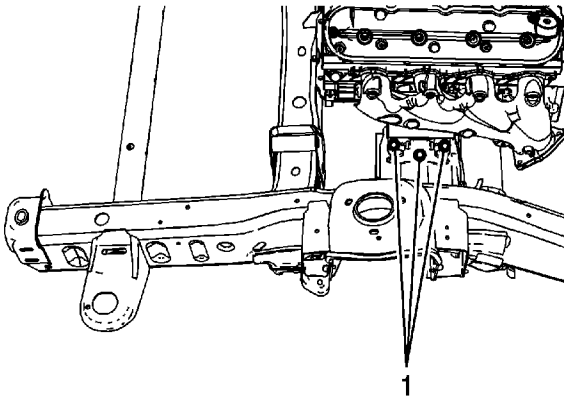
53. Install the [J 41798](#) to the cylinder heads.

Tighten

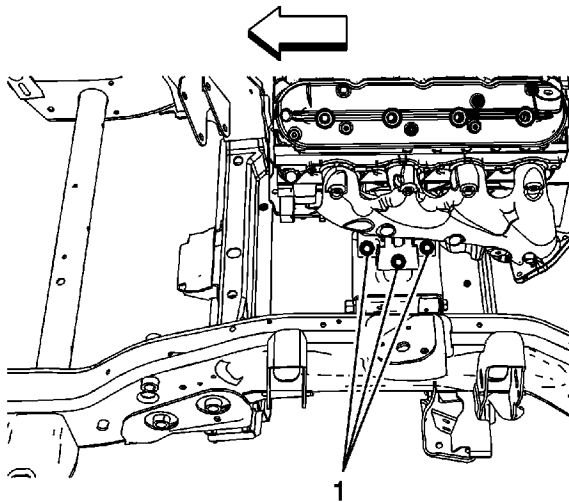
- Tighten the M8 engine lift bracket bolts to 25 N·m (18 lb ft).
- Tighten the M10 engine lift bracket bolts to 50 N·m (37 lb ft).



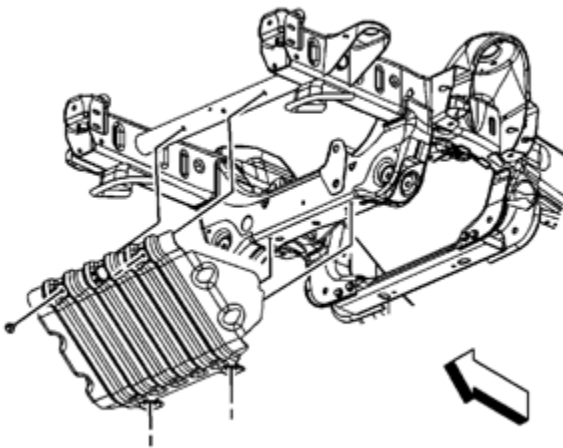
54. For 1500 series vehicles with a 4.8L engine, remove the left and right engine mount to frame bolts (1).



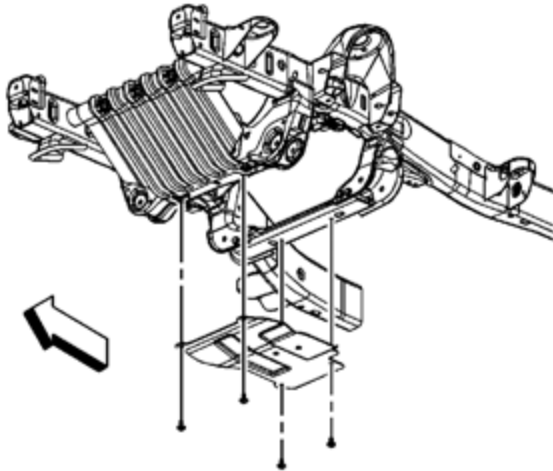
55. For 1500 series vehicles with a 5.3L, 6.0L, or 6.2L engines, remove the left and right engine mount to frame bolts (1).



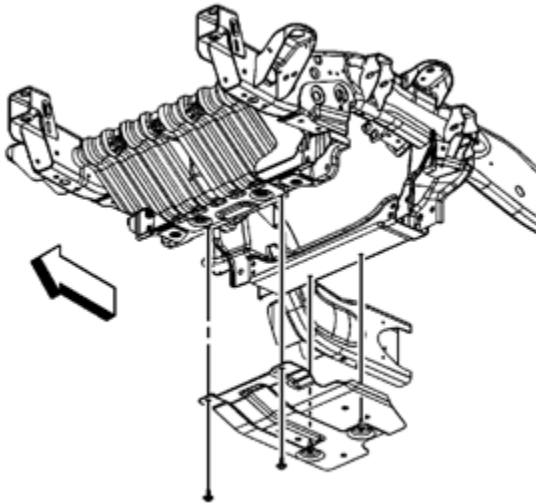
56. For 2500 series vehicles with a 5.3L, 6.0L, or 6.2L engines, remove the left and right engine mount to engine mount bracket bolts (1).
57. Raise the vehicle.



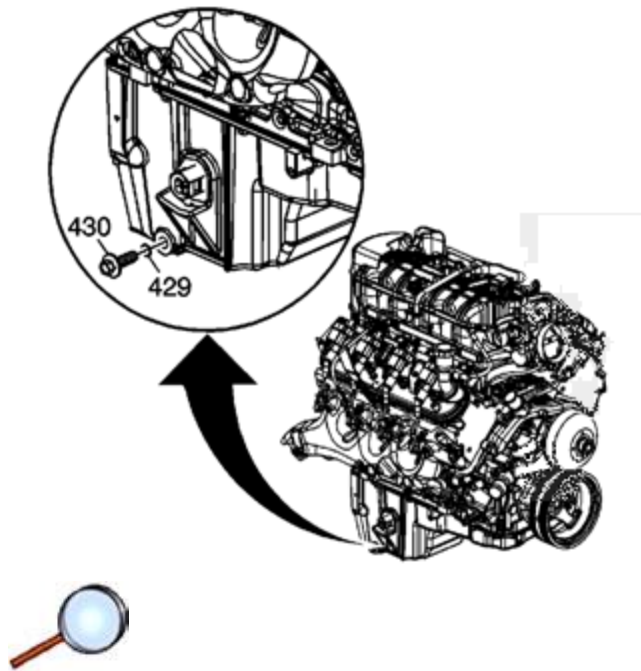
58. Remove the engine shield bolts and shield.



59. For 1500 series vehicles, remove the oil pan skid plate bolts and plate, if equipped.



60. For 2500 series vehicles, remove the oil pan skid plate bolts and plate, if equipped.



61. Place a suitable drain pan under the oil pan drain plug.
62. Remove the oil pan drain plug (430).
63. Allow the oil to drain completely.

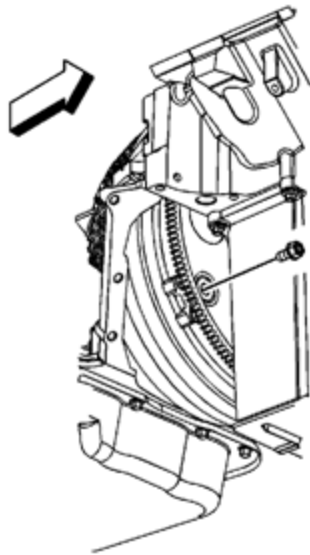
Caution: Refer to [Fastener Caution](#) in the Preface section.

64. Reinstall and tighten the oil pan drain plug.

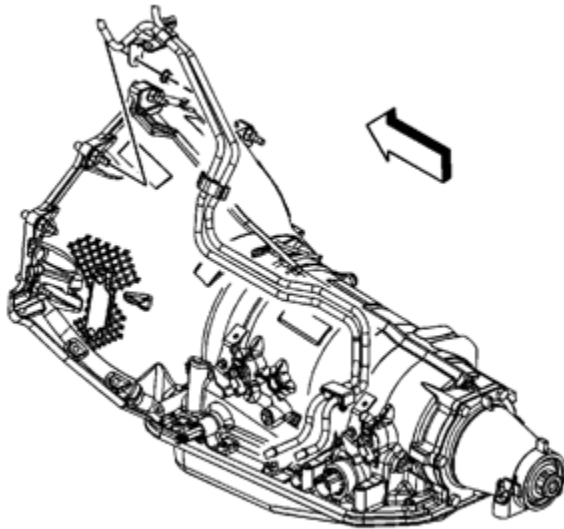
Tighten

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

65. Remove the catalytic converter. Refer to one of the following procedures:
 - [Catalytic Converter Replacement](#) for 1500 series
 - [Catalytic Converter Replacement - Left Side](#) for the 2500 series
 - [Exhaust Manifold Pipe Replacement](#) for the 2500 series

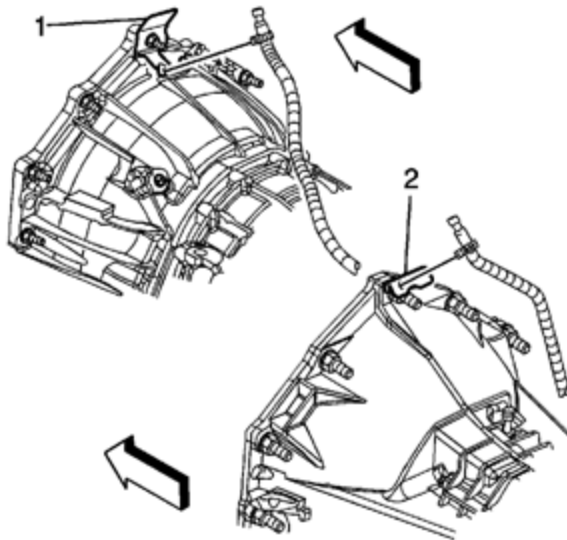


66. Remove the flywheel to torque converter bolts.

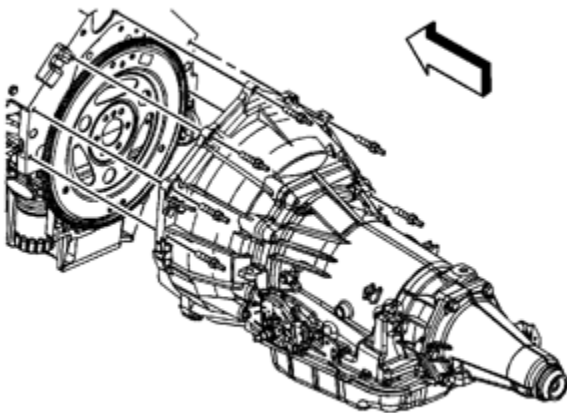


67. Remove the fuel/evaporative emission (EVAP) pipe bracket nut from the transmission stud (typical installation shown).

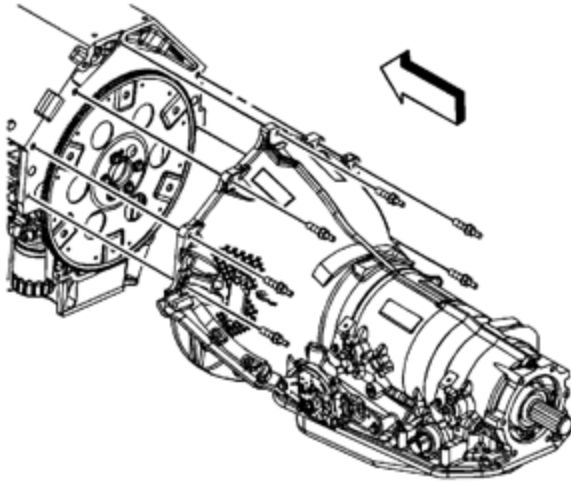
68. Remove the fuel/EVAP pipe bracket from the stud. Reposition the bracket out of the way.



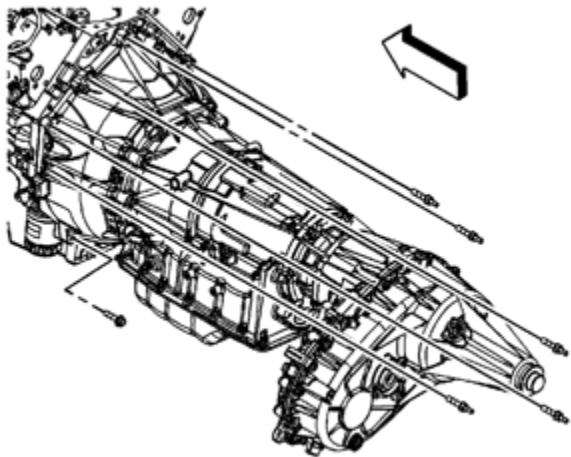
69. For the 4L80-E automatic transmission, remove the transfer case vent hose bracket (1) nut from the stud, if equipped.
70. For the 4L60-E/4L70-E/6L80-E automatic transmission, remove the transfer case vent hose bracket (2) nut from the stud, if equipped.
71. Reposition the transfer case vent hose bracket and hose out of the way, if equipped.



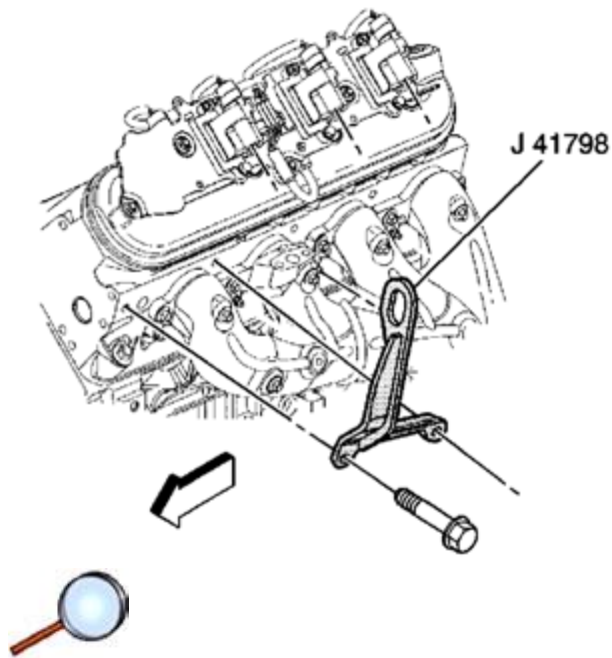
72. If equipped with the 4L60-E/4L70-E automatic transmission, remove the transmission bolts/studs.



73. If equipped with the 4L80-E automatic transmission, remove the transmission bolts/studs.



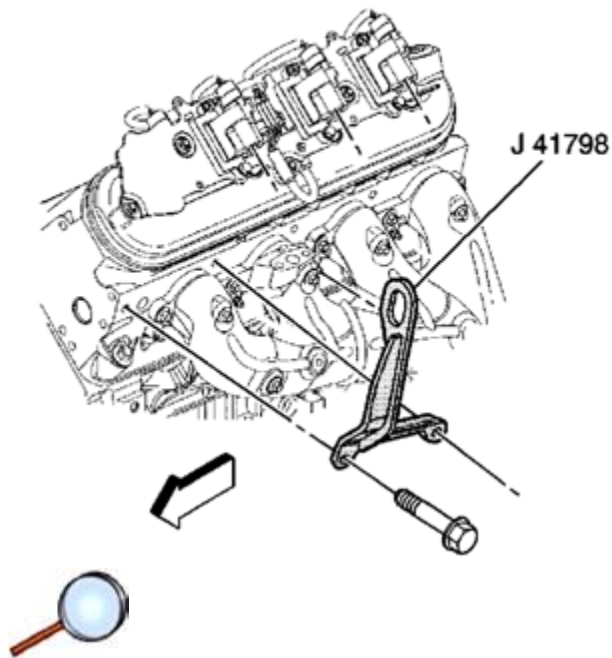
74. If equipped with the 6L80-E automatic transmission, remove the transmission bolts/studs.
 75. Lower the vehicle.
 76. Position and install an engine hoist to the [J 41798](#) .
 77. Install a floor jack under the transmission for support.
 78. Remove the engine from the vehicle.
 79. Install the [J 21366](#) to the transmission in order to hold the torque converter.
 80. Position and install the engine onto an engine stand.
 81. Remove the engine hoist. from the [J 41798](#) .



82. Remove the [J 41798](#) from the engine.

Installation Procedure

Caution: Refer to [Fastener Caution](#) in the Preface section.

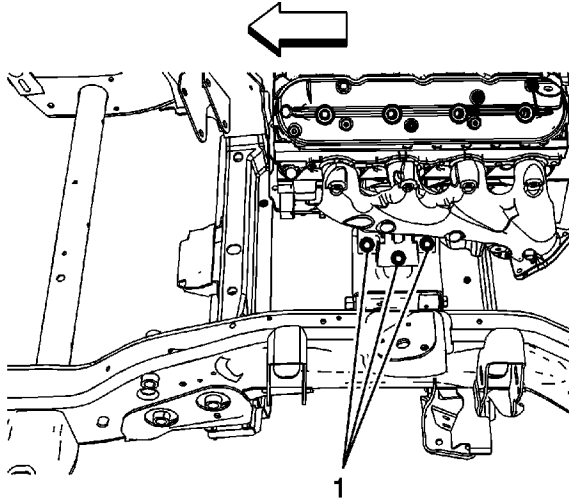


1. Install the [J 41798](#) to the engine.

Tighten

- Tighten the M8 engine lift bracket bolts to 25 N·m (18 lb ft).
- Tighten the M10 engine lift bracket bolts to 50 N·m (37 lb ft).

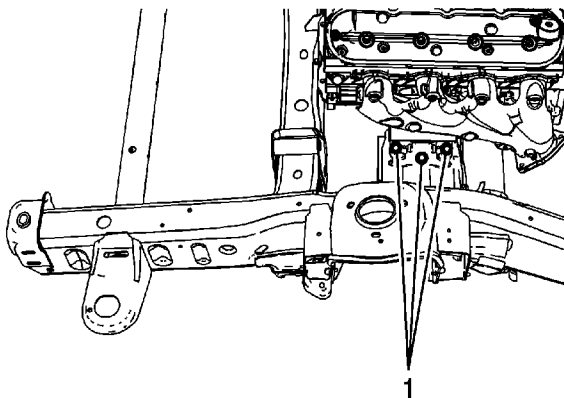
2. Position and install the engine hoist to the [J 41798](#).
3. Remove the engine from the engine stand.
4. Remove the [J 21366](#) from the transmission.
5. Install the engine to the vehicle.
6. Align and install the engine to the transmission. Raise or lower the transmission as required using the floor jack.
7. Once aligned and mated together completely lower and remove the engine hoist.



8. For 2500 series vehicles with a 5.3L, 6.0L, or 6.2L engine, install the left and right engine mount to engine mount bracket bolts (1).

Tighten

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

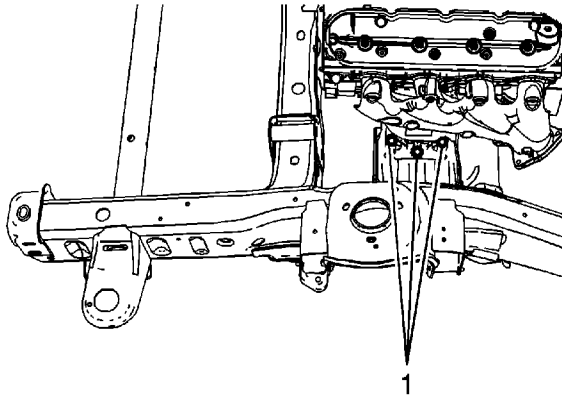




9. For 1500 series vehicles with a 5.3L, 6.0L, or 6.2L engine, install the left and right engine mount to frame bolts (1).

Tighten

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

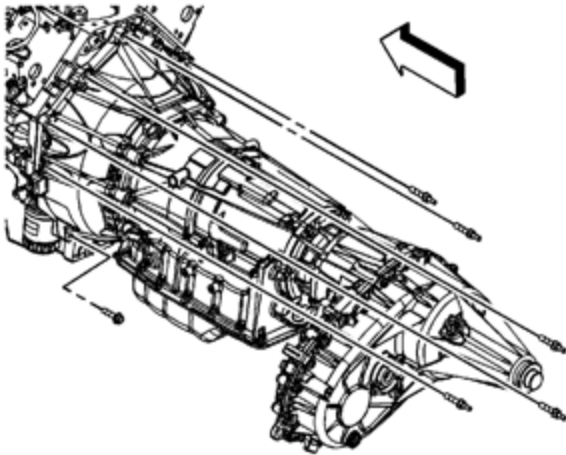


10. For 1500 series vehicles with a 4.8L engine, install the left and right engine mount to frame bolts (1).

Tighten

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

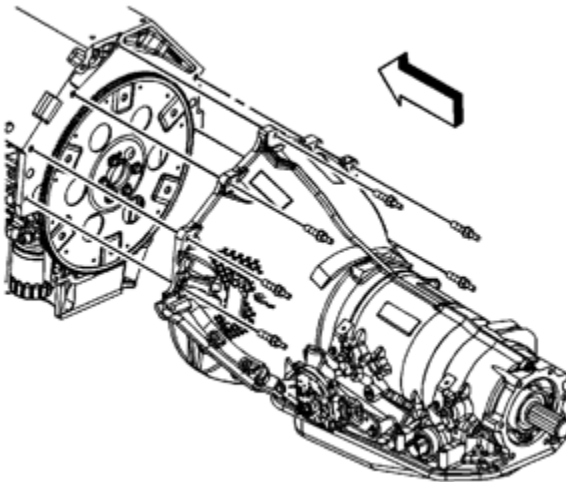
11. Remove the floor jack from under the transmission.
12. Raise the vehicle.



13. If equipped with the 6L80-E automatic transmission, install the transmission bolts/studs.

Tighten

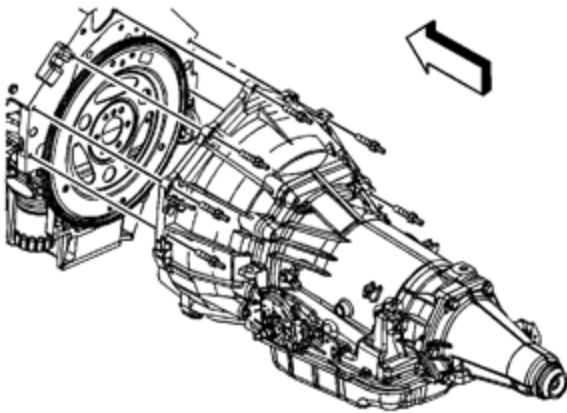
Tighten the bolts/studs to 50 N·m (37 lb ft).



14. If equipped with the 4L80-E automatic transmission, install the transmission bolts/studs.

Tighten

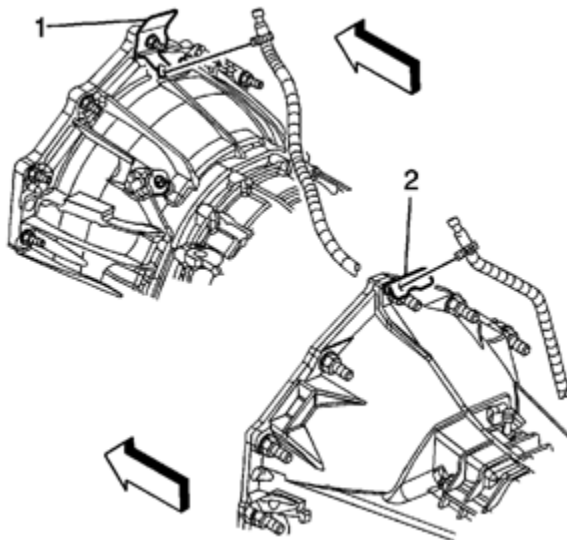
Tighten the bolts/studs to 50 N·m (37 lb ft).



15. If equipped with the 4L60-E/4L70-E automatic transmission, install the transmission bolts/studs.

Tighten

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



16. Position the transfer case vent hose bracket and hose and install the bracket to the stud, if equipped.
17. For the 4L60-E/4L70-E/6L80-E automatic transmission, install the transfer case vent hose bracket (2) nut to the stud, if equipped.

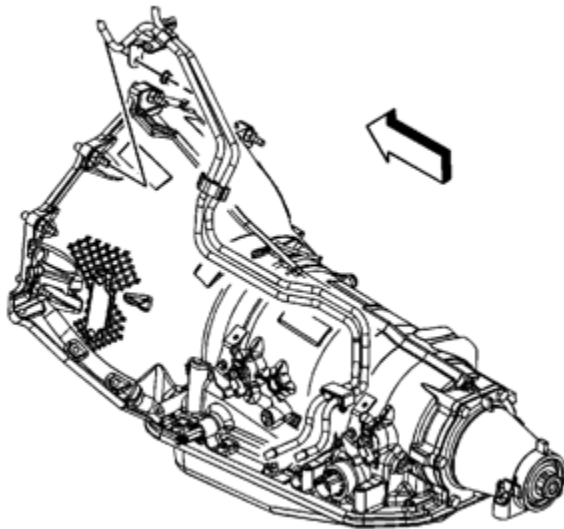
Tighten

Tighten the nut to 20 N·m (15 lb ft).

18. For the 4L80-E automatic transmission, install the transfer case vent hose bracket (1) nut to the stud, if equipped.

Tighten

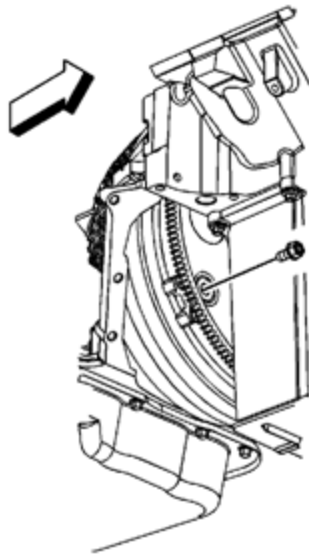
Tighten the nut to 20 N·m (15 lb ft).



19. Position the fuel/EVAP pipe bracket and install the bracket to the stud. (typical installation shown).
20. Install the fuel/EVAP pipe bracket nut to the transmission stud

Tighten

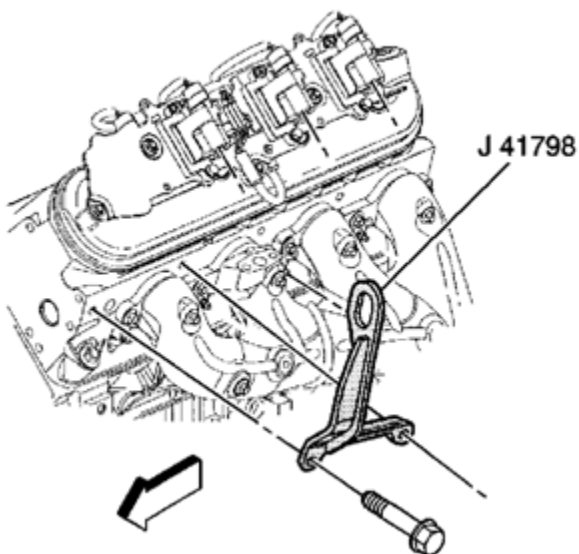
Tighten the nut to 20 N·m (15 lb ft).



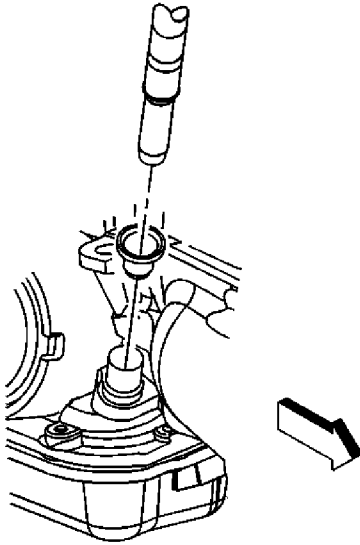
21. Align the torque converter bolt holes to the flywheel bolt holes.
22. Install the flywheel to torque converter bolts.

Tighten

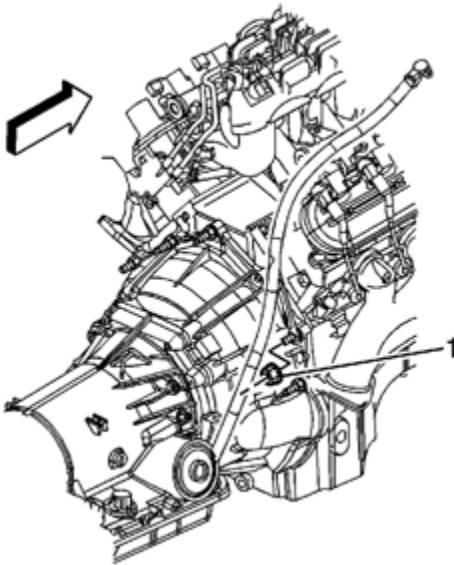
- For the 4L60-E/4L70-E/6L80-E automatic transmission, tighten the bolts to 63 N·m (47 lb ft).
 - For the 4L80-E automatic transmission, tighten the bolts to 60 N·m (44 lb ft).
23. Install the catalytic converter. Refer to one of the following procedures:
 - [Catalytic Converter Replacement](#) for 1500 series
 - [Catalytic Converter Replacement - Left Side](#) for the 2500 series
 - [Exhaust Manifold Pipe Replacement](#) for the 2500 series
 24. Lower the vehicle.



25. Remove the [J 41798](#) from the cylinder heads.
26. Install the ignition coil(s) and spark plug wire(s), as required. Refer to [Ignition Coil Replacement](#).



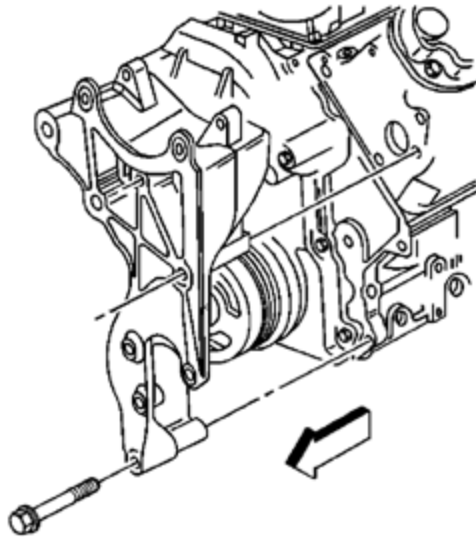
27. Install the transmission oil level indicator tube.



28. Install the transmission oil level indicator tube nut (1).

Tighten

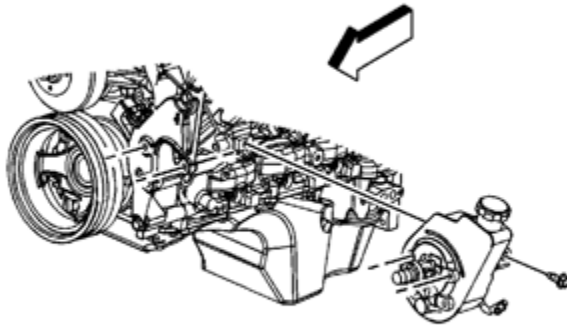
Tighten the nut to 18 N·m (13 lb ft).



29. Position the generator bracket (with power steering pump) to the engine.
30. Install the generator bracket bolts.

Tighten

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

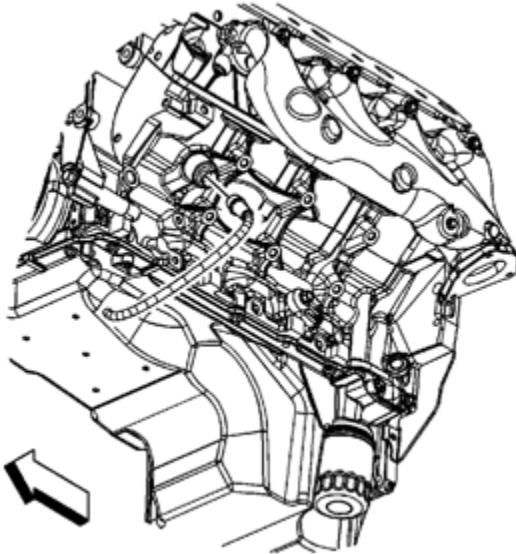


31. Install the rear power steering pump-to-engine block bolt (1500 series shown, 2500 series similar).

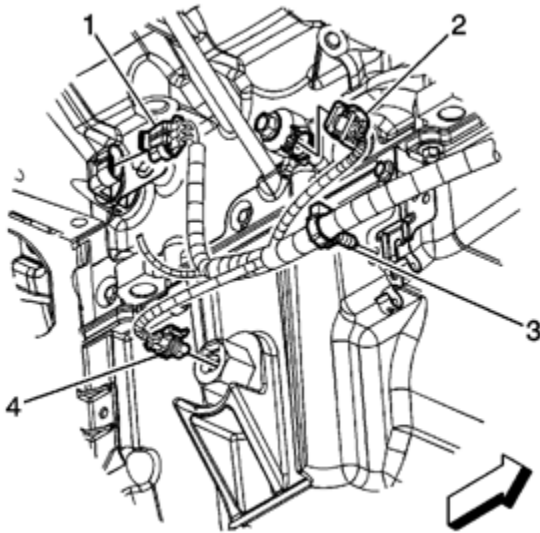
Tighten

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

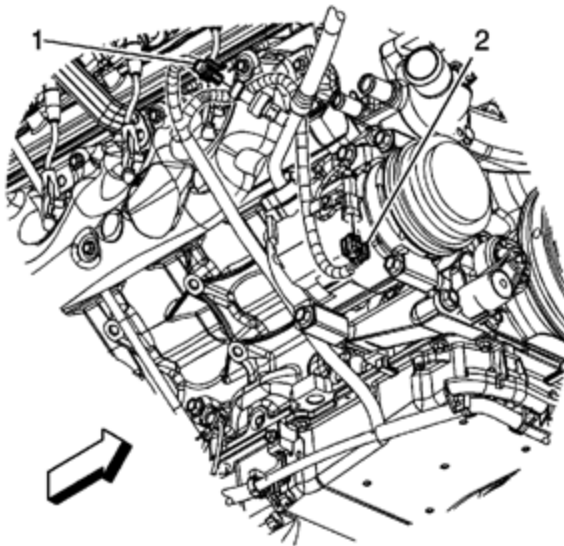
32. Raise the vehicle.



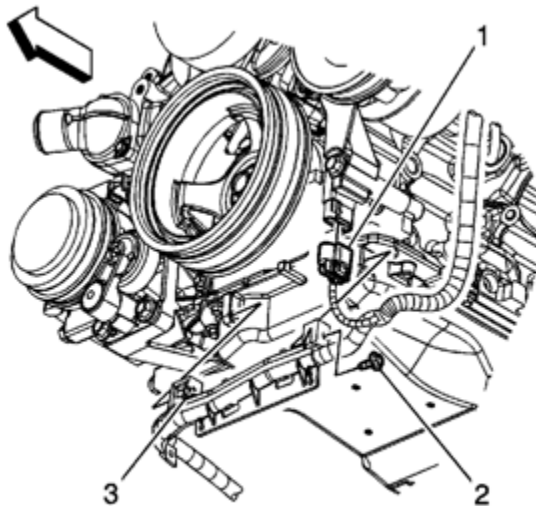
33. Connect the coolant heater cord to the coolant heater, if equipped.



34. Connect the engine harness electrical connector (1) to the CKP sensor.
35. Connect the engine harness electrical connector (2) to the knock sensor.
36. Connect the engine harness electrical connector (4) to the oil level sensor.
37. Install the engine harness clip (3) to the transmission oil cooler line bracket.
38. Install the starter motor. Refer to [Starter Motor Replacement](#).



39. Connect the engine harness electrical connector (1) to the A/C refrigerant pressure sensor.

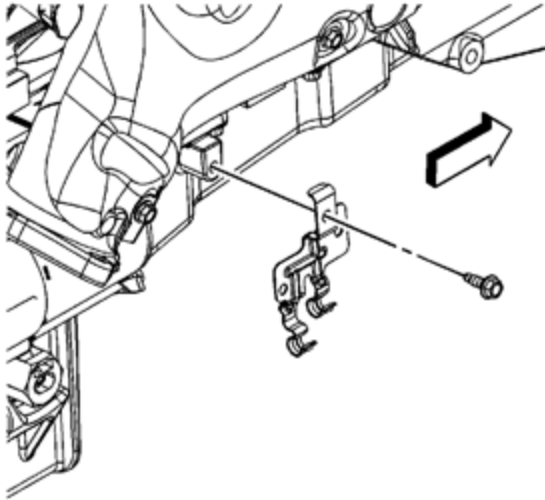


40. Slide the channel pin (3) into the oil pan tab.
41. Install the battery cable channel bolt (2).

Tighten

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

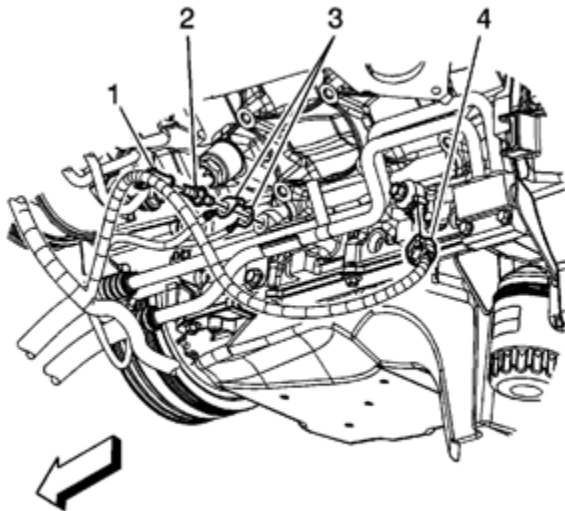
42. Connect the engine harness electrical connector (1) to the CMP sensor wire harness.



43. Position the transmission oil cooler line clip to the oil pan and install the bolt, if equipped.

Tighten

Tighten the bolt to 9 N·m (80 lb in).

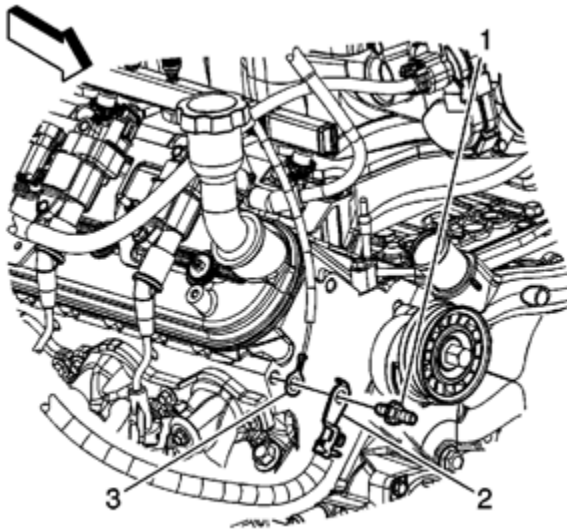


44. Connect the engine harness electrical connector (4) to the knock sensor.
45. Position the engine harness grounds (3) to the engine block.
46. Install the engine harness ground stud (2) to the engine block.

Tighten

Tighten the stud to 16 N·m (12 lb ft).

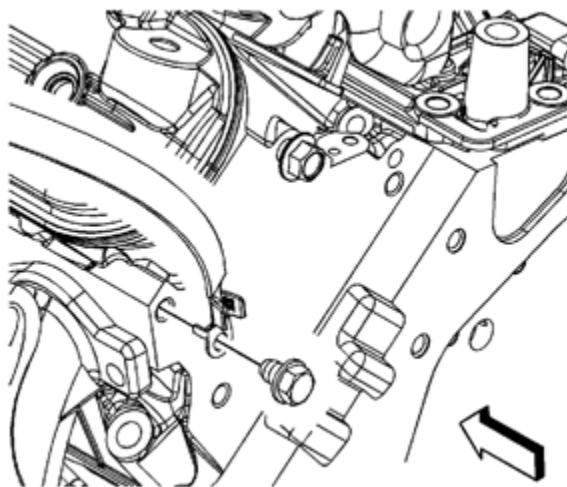
47. Install the engine harness clip (1) to the ground stud.
48. Lower the vehicle.



49. Position the negative battery cable terminal (2) and the engine harness ground (3) to the right cylinder head.
50. Install the negative battery cable stud (1) to the right cylinder head.

Tighten

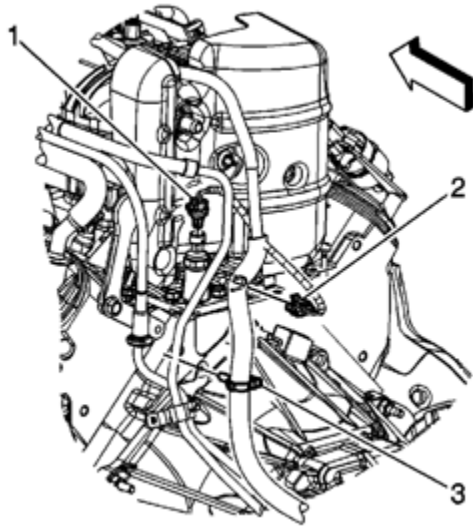
Tighten the stud to 25 N·m (18 lb ft).



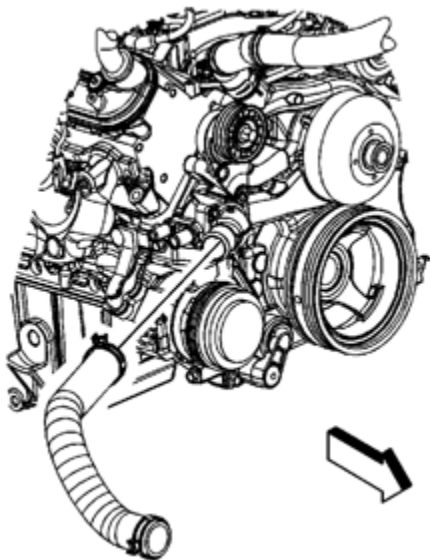
51. Position the engine ground strap to the cylinder head and cowl.
52. Install the engine ground strap bolt to the rear of the left cylinder head and cowl.

Tighten

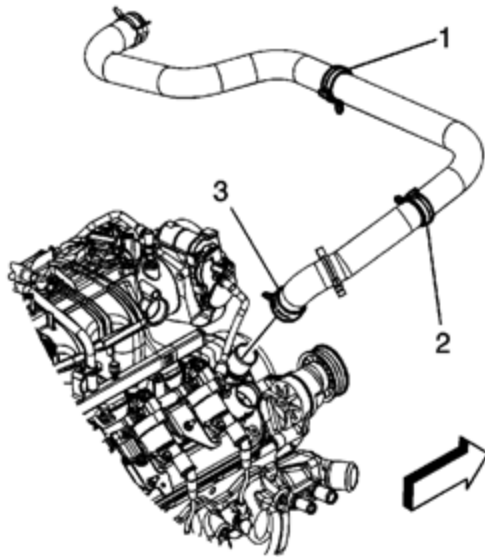
Tighten the bolt to 16 N·m (12 lb ft).



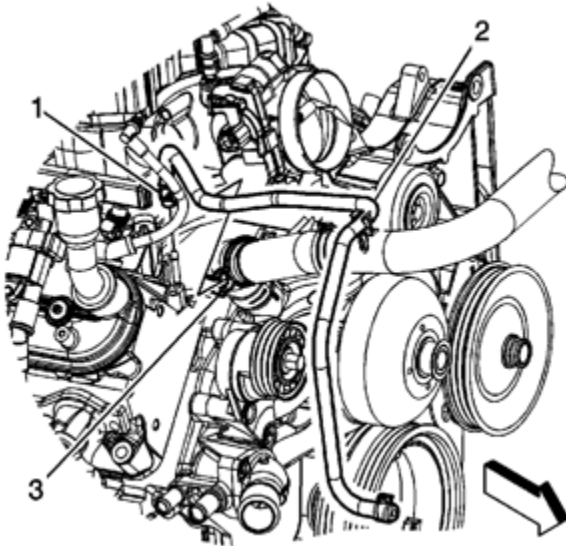
- 53. Connect the engine harness electrical connector (1) to the oil pressure sensor.
- 54. Connect the engine harness electrical connector (2) to the lifter oil manifold.
- 55. Install the heater hoses. Refer to [Heater Inlet Hose Replacement](#) and [Heater Outlet Hose Replacement](#).



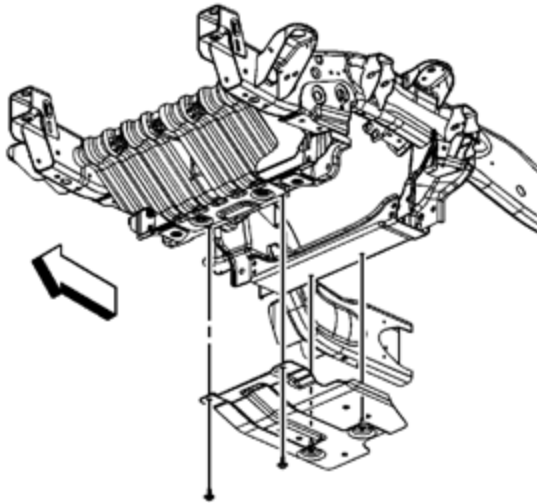
- 56. Install the radiator outlet hose to the water pump.
- 57. Position the radiator outlet hose clamp at the water pump.



- 58. Install the radiator inlet hose to the water pump.
- 59. Position the radiator inlet hose clamp (3) at the water pump.



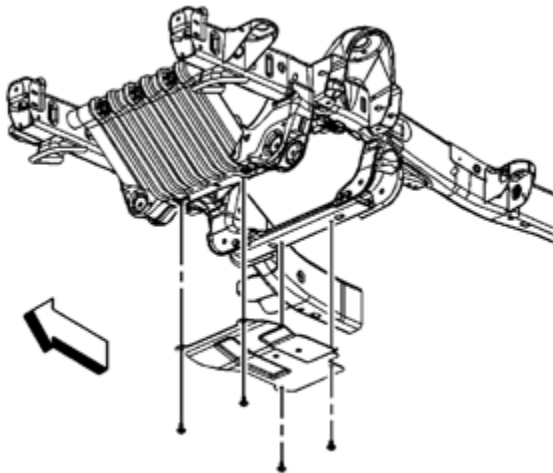
- 60. Position and install the radiator vent inlet hose (2) to the air bleed pipe.
- 61. Position the radiator vent inlet hose clamp (1) at the air bleed pipe.
- 62. Install the radiator vent inlet hose (2) to the radiator inlet hose clip (3).
- 63. Position the generator battery jumper to the engine.
- 64. Install the intake manifold. Refer to [Intake Manifold Replacement](#).



65. For 2500 series vehicles, install the oil pan skid plate and bolts, if equipped.

Tighten

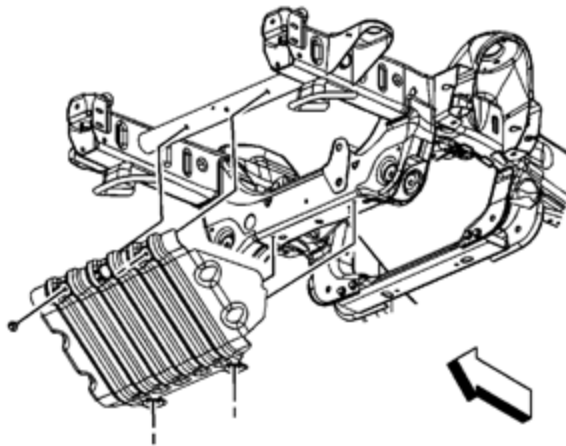
Tighten the bolts to 28 N·m (21 lb ft).



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

Tighten

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

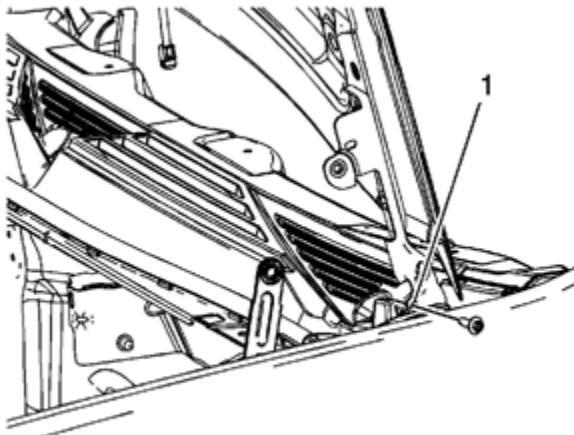


67. Install the engine shield and bolts.

Tighten

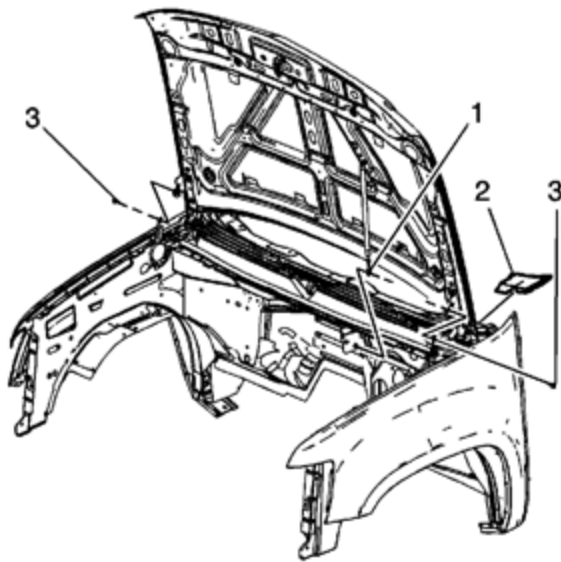
Tighten the bolts to 20 N·m (15 lb ft).

68. Lower the vehicle.
69. Install the front end upper tie bar. Refer to [Front End Upper Tie Bar Replacement](#).
70. Install the hood latch. Refer to [Hood Primary and Secondary Latch Replacement](#).



Note: There is a positive stop which limits the hood from being opened too far.

71. With the aid of the assistant raise the hood slightly until the hood hinge bolts can be removed from the service position notch (1).

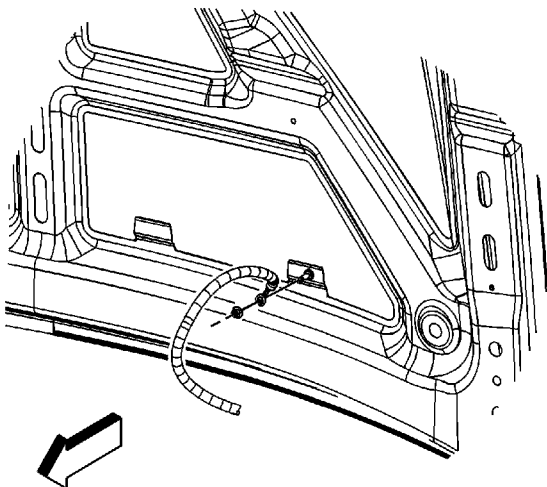


72. With the aid of an assistant lower the hood and install the hood hinge bolts (3) to the hood hinges.

Tighten

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

73. Install the hood strut rod (1) to the hood strut bracket stud.
74. Install the air inlet grille end caps (2), push down the end cap in order to engage the retainers. (left side shown, right side similar).



75. Install the ground strap to the hood stud.
76. Install the ground strap nut at the hood stud.

Tighten

Tighten the nut to 9 N·m (80 lb in).

77. Prelube the engine. Refer to [Engine Prelubing](#).
78. Perform the CKP system variation learn procedure. Refer to [Crankshaft Position System Variation Learn](#).

Note: After an overhaul the engine should be tested. Use the following procedure after the engine is installed in the vehicle.

- Disable the ignition system.
 - Crank the engine several times. Listen for any unusual noises or evidence that parts are binding.
 - Enable the ignition system.
 - Start the engine and listen for unusual noises.
 - Check the vehicle oil pressure gauge or light and confirm that the engine has acceptable oil pressure.
 - Run the engine speed at about 1,000 RPM until the engine has reached normal operating temperature.
 - Listen for sticking lifters or other unusual noises.
 - Inspect for fuel, oil and/or coolant leaks while the engine is running.
 - Perform a final inspection for the proper oil and coolant levels.
79. Close the hood.

cardiagn.com

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accessory Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Accessory Drive Belt Tensioner Bolts	50 N·m	37 lb ft
Active Fuel Management Oil Pressure Relief Valve	27 N·m	20 lb ft
Air Conditioning Drive Belt Tensioner Bolts	50 N·m	37 lb ft
Automatic Transmission Flex Plate Bolts - First Pass	20 N·m	15 lb ft
Automatic Transmission Flex Plate Bolts - Second Pass	50 N·m	37 lb ft
Automatic Transmission Flex Plate Bolts - Final Pass	100 N·m	74 lb ft
Battery Cable Channel Bolt	12 N·m	106 lb in
Camshaft Position (CMP) Actuator Magnet Bolts	12 N·m	106 lb in
Camshaft Position (CMP) Actuator Solenoid Valve - First Pass	65 N·m	48 lb ft
Camshaft Position (CMP) Actuator Solenoid Valve - Final Pass	90 degrees	
Camshaft Position (CMP) Sensor Bolt	12 N·m	106 lb in
Camshaft Position (CMP) Sensor Wire Harness Bolt	12 N·m	106 lb ft
Camshaft Retainer Bolts - Hex Head Bolts	25 N·m	18 lb ft
Camshaft Retainer Bolts - TORX Head Bolts	15 N·m	11 lb ft
Camshaft Sprocket Bolt - First Pass	75 N·m	55 lb ft
Camshaft Sprocket Bolt - Final Pass	50 degrees	
Connecting Rod Bolts - First Pass	20 N·m	15 lb ft
Connecting Rod Bolts - Final Pass	85 degrees	
Coolant Air Bleed Pipe and Cover Bolts	12 N·m	106 lb in
Coolant Temperature Sensor	20 N·m	15 lb ft
Crankshaft Balancer Bolt - First Pass	150 N·m	110 lb ft
Crankshaft Balancer Bolt - Second Pass	Loosen 360 degrees	
Crankshaft Balancer Bolt - Third Pass	50 N·m	37 lb ft
Crankshaft Balancer Bolt - Final Pass	230 degrees	
Crankshaft Bearing Cap M8 Bolts	25 N·m	18 lb ft
Crankshaft Bearing Cap M10 Bolts - First Pass in Sequence	20 N·m	15 lb ft
Crankshaft Bearing Cap M10 Bolts - Final Pass in Sequence	80 degrees	
Crankshaft Bearing Cap M10 Studs - First Pass in Sequence	20 N·m	15 lb ft
Crankshaft Bearing Cap M10 Studs - Final Pass in Sequence	51 degrees	
Crankshaft Oil Deflector Nuts	25 N·m	18 lb ft
Crankshaft Position (CKP) Sensor Bolt	25 N·m	18 lb ft
Crankshaft Rear Oil Seal Housing Bolts	30 N·m	22 lb ft
Crossbar Bolts/Nuts - 1500 Series	100 N·m	74 lb ft

Crossbar Bolts/Nuts - 2500 Series	120 N·m	89 lb ft
Cylinder Head M8 Bolts - in Sequence	30 N·m	22 lb ft
Cylinder Head M11 Bolts - First Pass in Sequence	30 N·m	22 lb ft
Cylinder Head M11 Bolts - Second Pass in Sequence	90 degrees	
Cylinder Head M11 Bolts - Final Pass in Sequence	70 degrees	
Cylinder Head Plug	20 N·m	15 lb ft
Differential Carrier-to-Crossbar Nuts	100 N·m	74 lb ft
Engine Block Coolant Drain Hole Plug	60 N·m	44 lb ft
Engine Block Coolant Heater	50 N·m	37 lb ft
Engine Block Oil Gallery Plugs	60 N·m	44 lb ft
Engine Harness Ground Strap Bolt/Stud	16 N·m	12 lb ft
Engine Harness-to-Generator Bracket Bolt	9 N·m	80 lb in
Engine Harness Retainer-to-Intake Manifold Nut	5 N·m	44 lb in
Engine Mount Bracket Through Bolt	100 N·m	74 lb ft
Engine Mount-to-Engine Block Bolts	50 N·m	37 lb ft
Engine Mount-to-Frame Bolts	65 N·m	48 lb ft
Engine Shield-to-Crossbar Bolts	20 N·m	15 lb ft
Evaporative (EVAP) Emission Pipe Bracket Nut	20 N·m	15 lb ft
Exhaust Manifold Bolts - First Pass	15 N·m	11 lb ft
Exhaust Manifold Bolts - Final Pass	20 N·m	15 lb ft
Exhaust Manifold Heat Shield Bolts	9 N·m	80 lb in
Exhaust Manifold Studs	20 N·m	15 lb ft
Flex Plate-to-Torque Converter Bolts - 4L60-E/4L70-E/6L80 Transmission	63 N·m	47 lb ft
Flex Plate-to-Torque Converter Bolts - 4L80-E Transmission	60 N·m	44 lb ft
Front Cover Bolts	25 N·m	18 lb ft
Front Drive Axle Bracket Bolts	90 N·m	67 lb ft
Fuel Injection Fuel Rail Bolts	10 N·m	89 lb in
Fuel Injection Fuel Rail Crossover Tube Bolts	3.8 N·m	34 lb in
Fuel Rail Stop Bracket Bolt	50 N·m	37 lb ft
Generator Bracket Bolts	50 N·m	37 lb ft
Heater Hose Bracket Nut	9 N·m	80 lb in
Ignition Coil Bracket-to-Valve Rocker Arm Cover Studs	12 N·m	106 lb in
Ignition Coil-to-Bracket Bolts	10 N·m	89 lb in
Intake Manifold Bolts - First Pass in Sequence	5 N·m	44 lb in
Intake Manifold Bolts - Final Pass in Sequence	10 N·m	89 lb in
Intake Manifold Sight Shield Retainer Bolts	5 N·m	44 lb in
J 41798 M8 Bolt	25 N·m	18 lb ft
J 41798 M10 Bolts	50 N·m	37 lb ft
Knock Sensor Bolts	25 N·m	18 lb ft
Negative Battery Cable Stud	25 N·m	18 lb ft

Oil Filter	30 N·m	22 lb ft
Oil Filter Fitting	55 N·m	40 lb ft
Oil Level Indicator Switch	13 N·m	10 lb ft
Oil Level Indicator Tube Bolt	25 N·m	18 lb ft
Oil Pan Baffle Bolts	9 N·m	80 lb in
Oil Pan Closeout Cover Bolt - Left Side	9 N·m	80 lb in
Oil Pan Closeout Cover Bolt - Right Side	9 N·m	80 lb in
Oil Pan Cover Bolts	9 N·m	80 lb in
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan M6 Bolts - Oil Pan-to-Rear Housing	12 N·m	106 lb in
Oil Pan M8 Bolts - Oil Pan-to-Engine Block and Oil Pan-to-Front Cover	25 N·m	18 lb ft
Oil Pan Skid Plate Bolts	28 N·m	21 lb ft
Oil Pressure Sensor	35 N·m	26 lb ft
Oil Pump Cover Bolts	12 N·m	106 lb in
Oil Pump Relief Valve Plug	12 N·m	106 lb in
Oil Pump Screen Nuts	25 N·m	18 lb ft
Oil Pump Screen-to-Oil Pump Bolts	12 N·m	106 lb in
Oil Pump-to-Engine Block Bolts	25 N·m	18 lb ft
Power Steering Pump-to-Engine Block Bolts	50 N·m	37 lb ft
Spark Plugs	15 N·m	11 lb ft
Throttle Body Bolts	10 N·m	89 lb in
Throttle Body Nuts	10 N·m	89 lb in
Throttle Body Studs	6 N·m	53 lb in
Timing Chain Tensioner Bolts	25 N·m	18 lb ft
Transfer Case Vent Hose Bracket Nut	20 N·m	15 lb ft
Transmission Housing-to-Engine Bolts/Studs	50 N·m	37 lb ft
Transmission Oil Cooler Line Clip Bolt	9 N·m	80 lb in
Transmission Oil Level Indicator Tube Nut	18 N·m	13 lb ft
Valley Cover Bolts	25 N·m	18 lb ft
Valve Lifter Guide Bolts	12 N·m	106 lb in
Valve Lifter Oil Manifold Bolts	25 N·m	18 lb ft
Valve Rocker Arm Bolts	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolts	12 N·m	106 lb in
Water Inlet Housing Bolts	15 N·m	11 lb ft
Water Pump Bolts - First Pass	15 N·m	11 lb ft
Water Pump Bolts - Final Pass	30 N·m	22 lb ft

[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Specifications](#) | **Document ID: 2041733**

Engine Mechanical Specifications (RPO LY2 VIN C)

Application	Specification	
	Metric	English
General		
Bore	96.0- 96.018 mm	3.779-3.78 in
Compression Ratio	9.08:1	
Displacement	4.8L	293 CID
Engine Type	V8	
Firing Order	1-8-7-2-6-5-4-3	
RPO	LY2	
Stroke	83.0 mm	3.27 in
VIN	C	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58- 59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08- 59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58- 58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871- 69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	96.0- 96.018 mm	3.779-3.78 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57- 234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417- 21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025- 0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99- 55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063- 55.088 mm	2.1678- 2.1688 in

Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Exhaust	7.2 mm	0.283 in
Camshaft Lobe Lift - Intake	7.2 mm	0.283 in
Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in
Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
Crankshaft Rear Flange Runout	0.05 mm	0.002 in
Crankshaft Reluctor Ring Runout - Measured	0.7 mm	0.028 in

1.0 mm (0.04 in) Below Tooth Diameter		
Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes 2 Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
Oil Capacity - with Filter	5.68 liters	6.0 quarts
Oil Capacity - without Filter	5.2 liters	5.5 quarts
Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Active Fuel Management Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		
Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in

Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.23-0.5 mm	0.009-0.0196 in
Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.44-0.76 mm	0.0173-0.03 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.04-0.085 mm	0.00157-0.00335 in
Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.04-0.085 mm	0.00157-0.00335 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.04-0.078 mm	0.00157-0.0031 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.04-0.078 mm	0.00157-0.0031 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.0005-0.0078 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.0005-0.0078 in
Pistons and Pins		
Pin - Piston Pin Clearance-to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.7796-3.7809 in
Piston - Piston to Bore Clearance - Production	-0.036 to +0.016 mm	-0.0014 to +0.0006 in
Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0.071 mm	0.0028 in
Valve System		
Valves - Valve Face Angle	45 degrees	
Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valve Lift - Exhaust	12.2 mm	0.48 in
Valve Lift - Intake	12.2 mm	0.48 in
Valves - Valve Seat Angle	46 degrees	

Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955- 7.976 mm	0.313-0.314 in
Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

2009 Chevrolet Silverado - 4WD | Sierra, Silverado (VIN C/K) Service Manual | Engine |
 Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L | Specifications | Document ID: 2041734

Engine Mechanical Specifications (RPO LMG VIN 0)

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	5.3L	325 CID
RPO	LMG	
VIN	0	
Bore	96.0-96.018 mm	3.779-3.78 in
Stroke	92.0 mm	3.622 in
Compression Ratio	9.95:1	
Firing Order	1-8-7-2-6-5-4-3	
Active Fuel Management Cylinders	1-4-6-7	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58-59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08-59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58-58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	96.0-96.018 mm	3.779-3.78 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063 mm	2.1678-

© 2010 General Motors Corporation. All rights reserved.

	55.088 mm	2.1688 in
Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Exhaust - Non Active Fuel Management Cylinders	7.2 mm	0.283 in
Camshaft Lobe Lift - Exhaust - Active Fuel Management Cylinders	7.33 mm	0.289 in
Camshaft Lobe Lift - Intake - Non Active Fuel Management Cylinders	7.2 mm	0.283 in
Camshaft Lobe Lift - Intake - Active Fuel Management Cylinders	7.33 mm	0.289 in
Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in

┆ Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
┆ Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
┆ Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
┆ Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
┆ Crankshaft Rear Flange Runout	0.05 mm	0.002 in
┆ Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
┆ Crankshaft Thrust Surface - Production	26.14- 26.22 mm	1.029-1.0315 in
┆ Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
┆ Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
┆ Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
┆ Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
┆ Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
┆ Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
┆ Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
┆ Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
┆ Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes 2 Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
┆ Oil Capacity - with Filter	5.68 liters	6.0 quarts
┆ Oil Capacity - without Filter	5.2 liters	5.5 quarts
┆ Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
┆ Active Fuel Management Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
┆ Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in

┆ Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.23-0.5 mm	0.009-0.0196 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.44-0.76 mm	0.0173-0.03 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.04-0.085 mm	0.00157-0.00335 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.04-0.085 mm	0.00157-0.00335 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.04-0.078 mm	0.00157-0.0031 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.04-0.078 mm	0.00157-0.0031 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.0005-0.0078 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.0005-0.0078 in
Pistons and Pins		
┆ Pin - Piston Pin Clearance-to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
┆ Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
┆ Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
┆ Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.7796-3.7809 in
┆ Piston - Piston to Bore Clearance - Production	-0.036 to +0.016 mm	-0.0014 to +0.0006 in
┆ Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0.071 mm	0.0028 in

Valve System		
Valves - Valve Face Angle	45 degrees	
Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valve Lift - Exhaust - Non Active Fuel Management	12.24 mm	0.488 in
Valve Lift - Exhaust - Active Fuel Management	12.46 mm	0.491 in
Valve Lift - Intake - Non Active Fuel Management	12.24 mm	0.488 in
Valve Lift - Intake - Active Fuel Management	12.46 mm	0.491 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955- 7.976 mm	0.313-0.314 in
Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

2009 Chevrolet Silverado - 4WD | Sierra, Silverado (VIN C/K) Service Manual | Engine |
 Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L | Specifications | Document ID: 2041735

Engine Mechanical Specifications (RPO LY5 VIN J)

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	5.3L	325 CID
RPO	LY5	
VIN	J	
Bore	96.0-96.018 mm	3.779-3.78 in
Stroke	92.0 mm	3.622 in
Compression Ratio	9.95:1	
Firing Order	1-8-7-2-6-5-4-3	
Active Fuel Management Cylinders	1-4-6-7	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58-59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08-59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58-58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	96.0-96.018 mm	3.779-3.78 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063 mm	2.1678-

© 2010 General Motors Corporation. All rights reserved.

	55.088 mm	2.1688 in
Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Exhaust - Non Active Fuel Management Cylinders	7.2 mm	0.283 in
Camshaft Lobe Lift - Exhaust - Active Fuel Management Cylinders	7.33 mm	0.289 in
Camshaft Lobe Lift - Intake - Non Active Fuel Management Cylinders	7.2 mm	0.283 in
Camshaft Lobe Lift - Intake - Active Fuel Management Cylinders	7.33 mm	0.289 in
Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in

┆ Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
┆ Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
┆ Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
┆ Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
┆ Crankshaft Rear Flange Runout	0.05 mm	0.002 in
┆ Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
┆ Crankshaft Thrust Surface - Production	26.14- 26.22 mm	1.029-1.0315 in
┆ Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
┆ Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
┆ Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
┆ Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
┆ Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
┆ Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
┆ Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
┆ Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
┆ Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes 2 Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
┆ Oil Capacity - with Filter	5.68 liters	6.0 quarts
┆ Oil Capacity - without Filter	5.20 liters	5.5 quarts
┆ Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
┆ Active Fuel Management Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
┆ Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in

┆ Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.23-0.5 mm	0.009-0.0196 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.44-0.76 mm	0.0173-0.03 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.04-0.085 mm	0.00157-0.00335 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.04-0.085 mm	0.00157-0.00335 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.04-0.078 mm	0.00157-0.0031 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.04-0.078 mm	0.00157-0.0031 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.0005-0.0078 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.0005-0.0078 in
Pistons and Pins		
┆ Pin - Piston Pin Clearance-to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
┆ Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
┆ Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
┆ Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.7796-3.7809 in
┆ Piston - Piston to Bore Clearance - Production	-0.036 to +0.016 mm	-0.0014 to +0.0006 in
┆ Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0.071 mm	0.0028 in

Valve System		
Valves - Valve Face Angle	45 degrees	
Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valve Lift - Exhaust - Non Active Fuel Management	12.24 mm	0.488 in
Valve Lift - Exhaust - Active Fuel Management	12.46 mm	0.491 in
Valve Lift - Intake - Non Active Fuel Management	12.24 mm	0.488 in
Valve Lift - Intake - Active Fuel Management	12.46 mm	0.491 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955- 7.976 mm	0.313-0.314 in
Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

2009 Chevrolet Silverado - 4WD | Sierra, Silverado (VIN C/K) Service Manual | Engine |
 Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L | Specifications | Document ID: 2041736

Engine Mechanical Specifications (RPO LC9 VIN 3)

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	5.3L	325 CID
RPO	LC9	
VIN	3	
Bore	96.0-96.018 mm	3.779-3.78 in
Stroke	92.0 mm	3.622 in
Compression Ratio	9.95:1	
Firing Order	1-8-7-2-6-5-4-3	
Active Fuel Management Cylinders	1-4-6-7	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58-59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08-59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58-58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	96.0-96.018 mm	3.779-3.78 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063 mm	2.1678-

© 2010 General Motors Corporation. All rights reserved.

	55.088 mm	2.1688 in
Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Exhaust - Non Active Fuel Management Cylinders	7.2 mm	0.283 in
Camshaft Lobe Lift - Exhaust - Active Fuel Management Cylinders	7.33 mm	0.289 in
Camshaft Lobe Lift - Intake - Non Active Fuel Management Cylinders	7.2 mm	0.283 in
Camshaft Lobe Lift - Intake - Active Fuel Management Cylinders	7.33 mm	0.289 in
Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in

┆ Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
┆ Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
┆ Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
┆ Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
┆ Crankshaft Rear Flange Runout	0.05 mm	0.002 in
┆ Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
┆ Crankshaft Thrust Surface - Production	26.14- 26.22 mm	1.029-1.0315 in
┆ Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
┆ Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
┆ Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
┆ Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
┆ Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
┆ Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
┆ Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
┆ Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
┆ Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes 2 Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
┆ Oil Capacity - with Filter	5.68 liters	6.0 quarts
┆ Oil Capacity - without Filter	5.20 liters	5.5 quarts
┆ Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
┆ Active Fuel Management Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
┆ Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in

┆ Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.23-0.5 mm	0.009-0.0196 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.44-0.76 mm	0.0173-0.03 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.04-0.085 mm	0.00157-0.00335 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.04-0.085 mm	0.00157-0.00335 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.04-0.078 mm	0.00157-0.0031 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.04-0.078 mm	0.00157-0.0031 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.0005-0.0078 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.0005-0.0078 in
Pistons and Pins		
┆ Pin - Piston Pin Clearance-to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
┆ Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
┆ Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
┆ Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.7796-3.7809 in
┆ Piston - Piston to Bore Clearance - Production	-0.036 to +0.016 mm	-0.0014 to +0.0006 in
┆ Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0.071 mm	0.0028 in

Valve System		
Valves - Valve Face Angle	45 degrees	
Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valve Lift - Exhaust - Non Active Fuel Management	12.24 mm	0.488 in
Valve Lift - Exhaust - Active Fuel Management	12.46 mm	0.491 in
Valve Lift - Intake - Non Active Fuel Management	12.24 mm	0.488 in
Valve Lift - Intake - Active Fuel Management	12.46 mm	0.491 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955- 7.976 mm	0.313-0.314 in
Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

2009 Chevrolet Silverado - 4WD | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Specifications](#) | **Document ID: 2041739**

Engine Mechanical Specifications (RPO LY6 VIN K)

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	6.0L	364 CID
RPO	LY6	
VIN	K	
Bore	101.618-101.636 mm	4.0007-4.0017 in
Stroke	92.0 mm	3.622 in
Compression Ratio	9.67:1	
Firing Order	1-8-7-2-6-5-4-3	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58-59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08-59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58-58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	101.618-101.636 mm	4.0007-4.0017 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063-55.088 mm	2.1678-2.1688 in
Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Exhaust	7.13 mm	0.281 in

┆ Camshaft Lobe Lift - Intake	6.96 mm	0.274 in
┆ Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Camshaft Position Actuator		
┆ Range of Authority	52 degrees	
┆ Park Position	7 degrees Advanced	
Connecting Rod		
┆ Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
┆ Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
┆ Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
┆ Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
┆ Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
┆ Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
┆ Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
┆ Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
┆ Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
┆ Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
┆ Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
┆ Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
┆ Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
┆ Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
┆ Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
┆ Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
┆ Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in
┆ Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
┆ Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
┆ Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
┆ Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
┆ Crankshaft Rear Flange Runout	0.05 mm	0.002 in
┆ Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
┆ Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in

┆ Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
┆ Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
┆ Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
┆ Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
┆ Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
┆ Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
┆ Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
┆ Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
┆ Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes 2 Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
┆ Oil Capacity - with Filter	5.68 liters	6.0 quarts
┆ Oil Capacity - without Filter	5.20 liters	5.5 quarts
┆ Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
┆ Active Fuel Management Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
┆ Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.20-0.41 mm	0.0079-0.0161 in
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.20-0.46 mm	0.0079-0.0181 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.37-0.69 mm	0.0146-0.0272 in
┆ Piston Ring End Gap - Second Compression Ring -		0.0146-

Measured in Cylinder Bore - Service	0.37-0.75 mm	0.0295 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.22-0.79 mm	0.0086-0.0311 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.22-0.84 mm	0.0086-0.0331 in
Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.04-0.083 mm	0.0016-0.0033 in
Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.04-0.083 mm	0.0016-0.0033 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.035-0.078 mm	0.0014-0.0031 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.035-0.078 mm	0.0014-0.0031 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.013-0.201 mm	0.0005-0.0079 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.013-0.201 mm	0.0005-0.0079 in
Pistons and Pins		
Pin - Piston Pin Clearance-to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
Piston - Piston Diameter - Measured Over Skirt Coating	101.615-101.649 mm	4.0006-4.0019 in
Piston - Piston-to-Bore Clearance - Production	-0.031 to +0.021 mm	-0.0012 to +0.0008 in
Piston - Piston-to-Bore Clearance - Service Limit with Skirt Coating Worn Off	0.071 mm	0.0028 in
Valve System		
Valves - Valve Face Angle	45 degrees	
Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valve Lift - Exhaust	12.12 mm	0.477 in
Valve Lift - Intake	11.83 mm	0.466 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in

Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

cardiagn.com

Engine Mechanical Specifications (RPO LH6 VIN M)

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	5.3L	325 CID
RPO	LH6	
VIN	M	
Bore	96.0-96.018 mm	3.779-3.78 in
Stroke	92.0 mm	3.622 in
Compression Ratio	9.95:1	
Firing Order	1-8-7-2-6-5-4-3	
Displacement-on-Demand Cylinders	1-4-6-7	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58-59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08-59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58-58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	96.0-96.018 mm	3.779-3.78 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063	2.1678-

© 2010 General Motors Corporation. All rights reserved.

	55.088 mm	2.1688 in
Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Intake - Non Displacement-on-Demand Cylinders	7.20 mm	0.283 in
Camshaft Lobe Lift - Intake - Displacement-on-Demand Cylinders	7.33 mm	0.289 in
Camshaft Lobe Lift - Exhaust - Non Displacement-on-Demand Cylinders	7.20 mm	0.283 in
Camshaft Lobe Lift - Exhaust - Displacement-on-Demand Cylinders	7.33 mm	0.289 in
Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in

┆ Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
┆ Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
┆ Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
┆ Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
┆ Crankshaft Rear Flange Runout	0.05 mm	0.002 in
┆ Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
┆ Crankshaft Thrust Surface - Production	26.14- 26.22 mm	1.029-1.0315 in
┆ Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
┆ Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
┆ Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
┆ Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
┆ Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
┆ Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
┆ Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
┆ Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
┆ Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
┆ Oil Capacity - with Filter	5.68 liters	6.0 quarts
┆ Oil Capacity - without Filter	5.20 liters	5.5 quarts
┆ Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
┆ Displacement-on-Demand Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
┆ Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in

Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		
Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in
Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.23-0.5 mm	0.009-0.0196 in
Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.44-0.76 mm	0.0173-0.03 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.04-0.085 mm	0.00157-0.00335 in
Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.04-0.085 mm	0.00157-0.00335 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.04-0.078 mm	0.00157-0.0031 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.04-0.078 mm	0.00157-0.0031 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.0005-0.0078 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.0005-0.0078 in
Pistons and Pins		
Pin - Piston Pin Clearance-to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.7796-3.7809 in
Piston - Piston-to-Bore Clearance - Production	-0.036 to +0.016 mm	-0.0014 to +0.0006 in
Piston - Piston-to-Bore Clearance - Service Limit with Skirt Coating Worn Off	0.071 mm	0.0028 in
Valve System		
Valves - Valve Face Angle	45 degrees	

Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valve Lift - Intake - Non Displacement on Demand	12.24 mm	0.482 in
Valve Lift - Intake - Displacement on Demand	12.41 mm	0.489 in
Valve Lift - Exhaust - Non Displacement on Demand	12.24 mm	0.482 in
Valve Lift - Exhaust - Displacement on Demand	12.41 mm	0.489 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955- 7.976 mm	0.313-0.314 in
Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025- 0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

2009 Chevrolet Silverado - 4WD | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Specifications](#) | **Document ID: 2045478**

Engine Mechanical Specifications (RPO L9H)

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	6.2L	376 CID
RPO	L9H	
VIN	2	
Bore	103.241-103.259 mm	4.065-4.065 in
Stroke	92.0 mm	3.622 in
Compression Ratio	10.5:1	
Firing Order	1-8-7-2-6-5-4-3	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58-59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08-59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58-58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	103.241-103.259 mm	4.065-4.065 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063-55.088 mm	2.1678-2.1688 in
Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Exhaust	7.48 mm	0.294 in

┆ Camshaft Lobe Lift - Intake	7.48 mm	0.294 in
┆ Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Camshaft Position Actuator		
┆ Range of Authority	52 degrees	
┆ Park Position	7 degrees Advanced	
Connecting Rod		
┆ Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
┆ Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
┆ Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
┆ Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
┆ Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
┆ Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
┆ Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
┆ Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
┆ Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
┆ Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
┆ Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
┆ Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
┆ Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
┆ Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
┆ Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
┆ Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
┆ Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in
┆ Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
┆ Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
┆ Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
┆ Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
┆ Crankshaft Rear Flange Runout	0.05 mm	0.002 in
┆ Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
┆ Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in

┆ Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
┆ Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
┆ Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
┆ Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
┆ Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
┆ Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
┆ Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
┆ Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
┆ Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes 2 Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
┆ Oil Capacity - with Filter	5.68 liters	6.0 quarts
┆ Oil Capacity - without Filter	5.20 liters	5.5 quarts
┆ Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
┆ Active Fuel Management Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
┆ Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.17-0.38 mm	0.0067-0.0150 in
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.17-0.44 mm	0.0067-0.0173 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.32-0.63 mm	0.0126-0.0248 in
┆ Piston Ring End Gap - Second Compression Ring -		0.0126-

Measured in Cylinder Bore - Service	0.32-0.69 mm	0.0272 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.22-0.79 mm	0.0086-0.0311 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.22-0.85 mm	0.0086-0.0335 in
Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.030-0.083 mm	0.0012-0.0033 in
Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.030-0.083 mm	0.0012-0.0033 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.040-0.083 mm	0.0016-0.0033 in
Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.040-0.083 mm	0.0016-0.0033 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.013-0.201 mm	0.0005-0.0079 in
Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.013-0.201 mm	0.0005-0.0079 in
Pistons and Pins		
Pin - Piston Pin Clearance-to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
Piston - Piston Diameter - Measured Over Skirt Coating	103.258-103.289 mm	4.0653-4.0665 in
Piston - Piston to Bore Clearance - Production	-0.048 to +0.001 mm	-0.0019 to +0.000 in
Piston - Piston to Bore Clearance - Service Limit With Skirt Coating Worn Off	0.055 mm	0.0022 in
Valve System		
Valves - Valve Face Angle	45 degrees	
Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valve Lift - Exhaust	12.72 mm	0.501 in
Valve Lift - Intake	12.72 mm	0.501 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in

Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

cardiagn.com

2009 Chevrolet Silverado - 4WD | Sierra, Silverado (VIN C/K) Service Manual | Engine |
 Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L | Specifications | Document ID: 2089670

Engine Mechanical Specifications (RPO L76 VIN Y)

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	6.0L	364 CID
RPO	L76	
VIN	Y	
Bore	101.618-101.636 mm	4.0007-4.0017 in
Stroke	92.0 mm	3.622 in
Compression Ratio	9.67:1	
Firing Order	1-8-7-2-6-5-4-3	
Active Fuel Management Cylinders	1-4-6-7	
Spark Plug Gap	1.02 mm	0.04 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter	59.58-59.63 mm	2.345-2.347 in
Camshaft Bearing Bore 2 and 4 Diameter	59.08-59.13 mm	2.325-2.327 in
Camshaft Bearing Bore 3 Diameter	58.58-58.63 mm	2.306-2.308 in
Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
Cylinder Bore Diameter	101.618-101.636 mm	4.0007-4.0017 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Bearing Diameter	55.063-55.088 mm	2.1678-2.1688 in
Camshaft Journal-to-Bearing Clearance	0.023-0.098 mm	0.0009-0.0038 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in

⌋ Camshaft Lobe Lift - Exhaust - Non Active Fuel Management Cylinders	7.47 mm	0.294 in
⌋ Camshaft Lobe Lift - Exhaust - Active Fuel Management Cylinders	7.61 mm	0.299 in
⌋ Camshaft Lobe Lift - Intake - Non Active Fuel Management Cylinders	7.47 mm	0.294 in
⌋ Camshaft Lobe Lift - Intake - Active Fuel Management Cylinders	7.61 mm	0.299 in
⌋ Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Camshaft Position Actuator		
⌋ Range of Authority	52 degrees	
⌋ Park Position	7 degrees Advanced	
Connecting Rod		
⌋ Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
⌋ Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
⌋ Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
⌋ Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
⌋ Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
⌋ Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
⌋ Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
⌋ Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
⌋ Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
⌋ Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
⌋ Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
⌋ Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
⌋ Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
⌋ Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
⌋ Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
⌋ Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
⌋ Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in
⌋ Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
⌋ Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in

┆ Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
┆ Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
┆ Crankshaft Rear Flange Runout	0.05 mm	0.002 in
┆ Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
┆ Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
┆ Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
┆ Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
┆ Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
┆ Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
┆ Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
┆ Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
┆ Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
┆ Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
┆ Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes 2 Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
┆ Oil Capacity - with Filter	5.68 liters	6.0 quarts
┆ Oil Capacity - without Filter	5.20 liters	5.5 quarts
┆ Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
┆ Active Fuel Management Relief Valve Oil Pressure - as Measured at Oil Pressure Sensor Location	379-517 kPa Maximum	55-75 psig Maximum
Oil Pan		
┆ Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Crankshaft Rear Oil Seal Housing Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
┆ Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.1 mm	0.0-0.004 in
Piston Rings		

┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.20-0.41 mm	0.0079-0.0161 in
┆ Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.20-0.46 mm	0.0079-0.0181 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.37-0.69 mm	0.0146-0.0272 in
┆ Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.37-0.75 mm	0.0146-0.0295 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.22-0.79 mm	0.0086-0.0311 in
┆ Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.22-0.84 mm	0.0086-0.0331 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Production	0.04-0.083 mm	0.0016-0.0033 in
┆ Piston Ring-to-Groove Clearance - First Compression Ring - Service	0.04-0.083 mm	0.0016-0.0033 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Production	0.035-0.078 mm	0.0014-0.0031 in
┆ Piston Ring-to-Groove Clearance - Second Compression Ring - Service	0.035-0.078 mm	0.0014-0.0031 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Production	0.013-0.201 mm	0.0005-0.0079 in
┆ Piston Ring-to-Groove Clearance - Oil Control Ring - Service	0.013-0.201 mm	0.0005-0.0079 in
Pistons and Pins		
┆ Pin - Piston Pin Clearance- to-Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
┆ Pin - Piston Pin Clearance-to-Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
┆ Pin - Piston Pin Diameter	23.952-23.955 mm	0.9430-0.9431 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
┆ Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
┆ Piston - Piston Diameter - Measured Over Skirt Coating	101.615-101.649 mm	4.0006-4.0019 in
┆ Piston - Piston to Bore Clearance - Production	-0.031 to +0.021 mm	-0.0012 to +0.0008 in
┆ Piston - Piston to Bore Clearance - Service Limit With Skirt Coating Worn Off	0.071 mm	0.0028 in
Valve System		
┆ Valves - Valve Face Angle	45 degrees	
┆ Valves - Valve Face Width	1.25 mm	0.05 in
┆ Valves - Valve Lash	Net Lash - No Adjustment	
┆ Valve Lift - Exhaust - Non Active Fuel Management	12.61 mm	0.496 in

Valve Lift - Exhaust - Active Fuel Management	12.93 mm	0.509 in
Valve Lift - Intake - Non Active Fuel Management	12.61 mm	0.496 in
Valve Lift - Intake - Active Fuel Management	12.93 mm	0.509 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

[2009 Chevrolet Silverado - 4WD](#) | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Specifications](#) | **Document ID: 2045941**

Engine Content Specifications

RPO	VIN	Displacement	Camshaft Position (CMP) Actuator Control System	Active Fuel Management Control System	E85 Capable	Block Material
LY2	C	4.8L	No	No	No	Iron
LH6	M	5.3L	No	Yes	No	Aluminum
LMG	0	5.3L	No	Yes	Yes	Iron
LC9	3	5.3L	No	Yes	Yes	Aluminum
LY5	J	5.3L	No	Yes	No	Iron
LY6	K	6.0L	Yes	No	No	Iron
L76	Y	6.0L	Yes	Yes	No	Aluminum
L9H	2	6.2L	Yes	No	Yes	Aluminum

cardiagn.com

2009 Chevrolet Silverado - 4WD | [Sierra, Silverado \(VIN C/K\) Service Manual](#) | [Engine](#) |
[Engine Mechanical - 4.8L, 5.3L, 6.0L, 6.2L, or 7.0L](#) | [Specifications](#) | **Document ID: 1406760**

Adhesives, Fluids, Lubricants, and Sealers

Application	Type of Material	GM Part Number	
		United States	Canada
Coolant Temperature Sensor Threads	Sealant	12346004	10953480
Cylinder Head Core Hole Plug	Threadlock	12345382	10953489
Cylinder Head Plug	Threadlock	12345382	10953489
Engine Block Coolant Drain Hole Plug Sealing Washer	Sealant	12346004	10953480
Engine Block Front Oil Gallery Plug	Threadlock	12345382	10953489
Engine Block Oil Gallery Plug Sealing Washers	Sealant	12346004	10953480
Engine Oil Pressure Sensor Threads	Sealant	12346004	10953480
Engine Oil Supplement	Fluorescent Dye	12345795	10953470
Exhaust Manifold Bolts	Threadlock	12345493	10953488
Flywheel/Flex Plate Bolts	Threadlock	12345382	10953489
Fuel Injection Fuel Rail Bolts	Threadlock	12345382	10953489
Ignition Coil Bracket-to-Valve Cover Studs	Threadlock	12345382	10953489
Ignition Coil-to-Bracket Bolts	Threadlock	12345382	10953489
Intake Manifold Bolts	Threadlock	12345382	10953489
Oil Pan Oil Gallery Plug Threads	Sealant	12346004	10953480
Oil Pan Surface at Front Cover and Rear Housing	Sealant	12378521	88901148
Thread Repair Component Cleaner	Cleaner	12346139	10953463
Thread Repair Component Cleaner	Cleaner	12377981	10953463
Thread Repair Cutting Oil	Lubricant	1052864	992881

Thread Repair Specifications

Table 1: [Engine Block - Front/Rear Views](#)

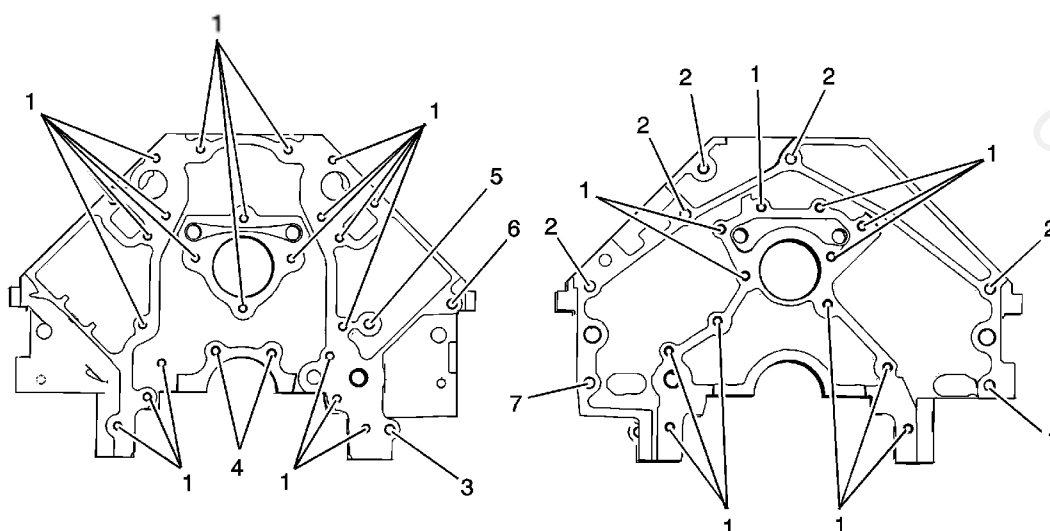
Table 2: [Engine Block - Left/Right Side Views](#)

Table 3: [Engine Block - Top/Bottom Views](#)

Table 4: [Cylinder Head - Top/End Views](#)

Table 5: [Cylinder Head - Intake/Exhaust Side Views](#)

Engine Block - Front/Rear Views



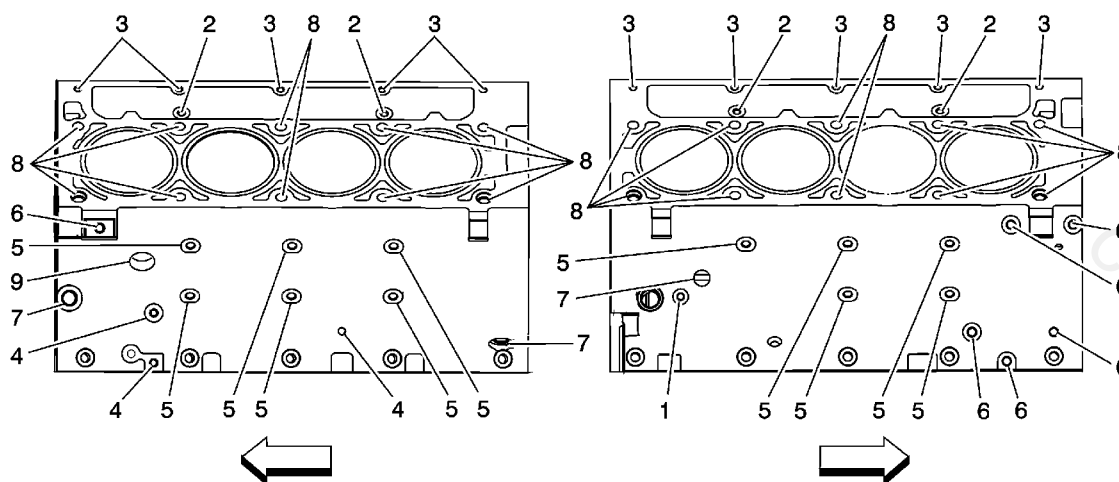
Engine Block - Front/Rear Views

Hole	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth - Maximum mm (in)	Tap Depth - Maximum mm (in)
J 42385-								
1	M8 x 1.25	210	206	207	208	209	22.5 (0.885)	17.5 (0.688)
2	M10 x 1.5	215	211	212	213	214	27.5 (1.08)	22.0 (0.866)
3	M10 x 1.5	215	211	212	213	214	Thru	Thru

4	M8 x 1.25	210	206	207	208	209	Thru	Thru
5	M10 x 1.5	215	211	212	213	214	25.0 (0.984)	19.5 (0.767)
6	M10 x 1.5	215	211	212	213	214	32.5 (1.279)	25.0 (0.984)
7	M10 x 1.5	215	211	212	213	214	Thru	Thru

Bolt hole 6 is drilled and tapped for aluminum block applications only.

Engine Block - Left / Right Side Views



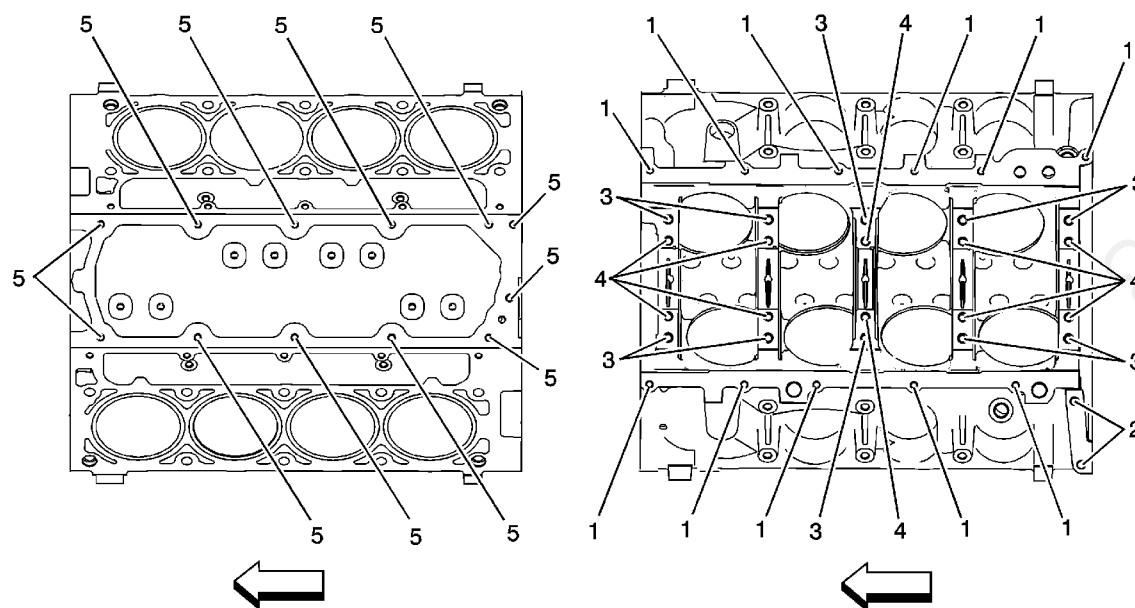
Engine Block - Left / Right Side Views

Hole	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth - Maximum mm (in)	Tap Depth - Maximum mm (in)
J 42385-								
1	M8 x 1.25	210	206	207	208	209	22.5 (0.885)	17.5 (0.688)
2	M6 x 1.0	205	201	202	203	204	22.5 (0.885)	15.0 (0.688)
3	M8 x 1.25	210	206	207	208	209	28.5 (1.122)	23.0 (0.905)
4	M8 x 1.25	210	206	207	208	209	21.5 (0.846)	16.0 (0.629)
5	M10 x 1.25	215	211	212	213	214	29.0 (1.141)	23.0 (0.905)
6	M10 x 1.5	215	211	212	213	214	27.0 (1.062)	21.5 (0.846)
7	M16 x 1.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A

8	M11 x 2.0	108	105	N/A	106	107	69.0 (2.72)	60.0 (2.36)
9	M28 x 1.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Bolt hole 8 has a 30 mm (1.18 in) counterbore included in the 69.0 mm (2.72 in) drill depth.
Use sleeve J 42385-315 with the drill and tap.

Engine Block - Top/Bottom Views

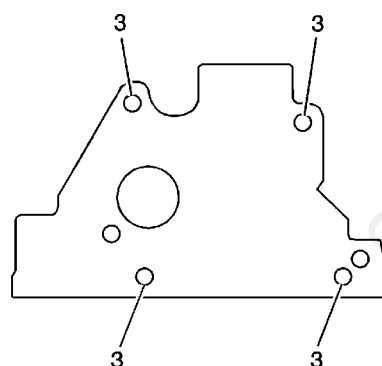
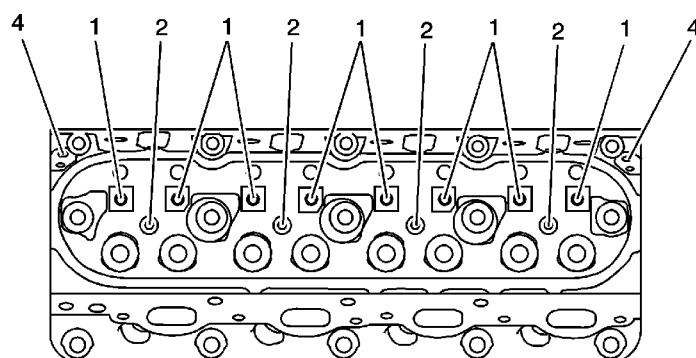


Engine Block - Top/Bottom Views

Hole	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth - Maximum mm (in)	Tap Depth - Maximum mm (in)
J 42385-								
1	M8 x 1.25	210	206	207	208	209	22.5 (0.885)	17.5 (0.688)
2	M10 x 1.5	215	211	212	213	214	42.5 (1.67)	37.0 (1.45)
3	M10 x 2.0	104	101	N/A	102	103	31.0 (1.22)	25.5 (1.0)
4	M10 x 2.0	104	101	N/A	102	103	53.5 (2.10)	44.0 (1.73)
5	M8 x	210	206	207	208	209	26.5 (1.043)	19.0 (0.748)

1.25							
- Bolt hole 2 has an 11.5 mm (0.452 in) counterbore included in the 42.5 mm (1.67 in) drill depth. Use sleeve J 42385-311 with the drill and tap. - Bolt hole 3 has a 1.5 mm (0.059 in) counterbore included in the 31.0 mm (1.22 in) drill depth. Use sleeve J 42385-316 with the drill and tap. - Bolt hole 4 has a 20.5 mm (0.807 in) counterbore included in the 53.5 mm (2.10 in) drill depth.							

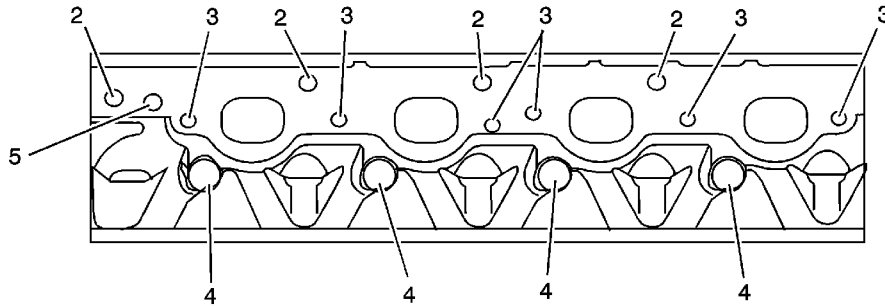
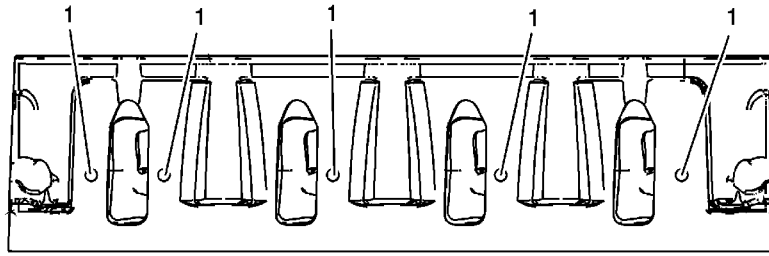
Cylinder Head - Top/End Views



Cylinder Head - Top/End Views

Hole	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth - Maximum mm (in)	Tap Depth - Maximum mm (in)
J 42385-								
1	M8 x 1.25	210	206	207	208	209	26.5 (1.04)	19.0 (0.784)
2	M6 x 1.0	205	201	202	203	204	20.05 (0.789)	16.05 (0.632)
3	M10 x 1.5	215	211	212	213	214	28.0 (1.10)	20.0 (0.787)
4	M6 x 1.0	205	201	202	203	204	22.5 (0.885)	15.0 (0.688)

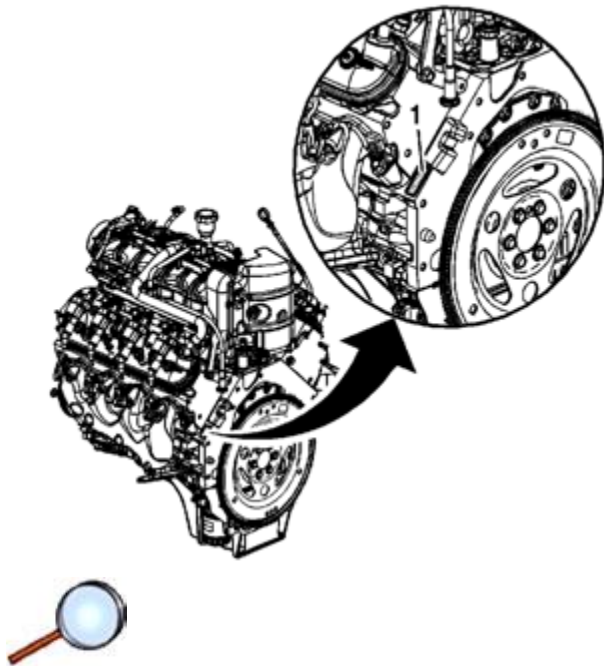
Cylinder Head - Intake/Exhaust Side Views



Cylinder Head - Intake /Exhaust Side Views

Hole	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth - Maximum mm (in)	Tap Depth - Maximum mm (in)
J 42385-								
1	M6 x 1.0	205	201	202	203	204	Thru	Thru
2	M10 x 1.5	215	211	212	213	214	28.0 (1.10)	20.0 (0.787)
3	M8 x 1.25	210	206	207	208	209	21.0 (0.826)	16.0 (0.629)
4	M14 x 1.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	M12 x 1.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Engine Identification



The vehicle identification number (VIN) is located on the left side rear of the engine block (1) and is typically a 9 digit number stamped or laser-etched onto the engine at the vehicle assembly plant.

- The first digit identifies the division.
- The second digit identifies the model year.
- The third digit identifies the assembly plant.
- The fourth through ninth digits are the last 6 digits of the VIN.