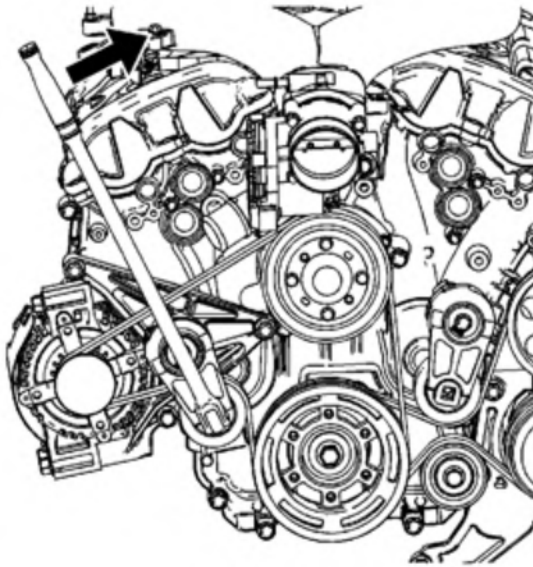


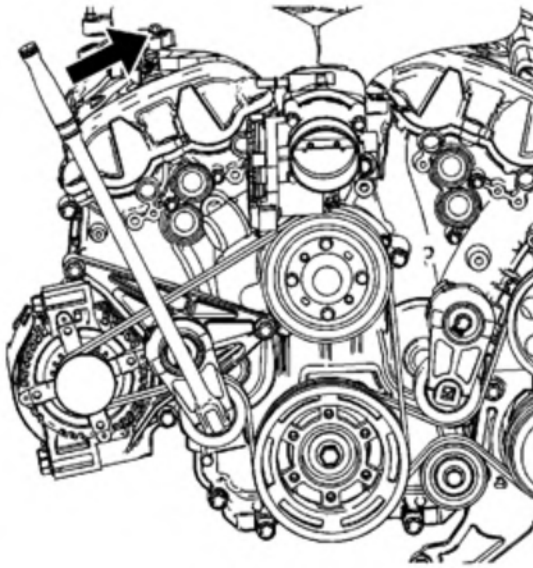
Water Pump and Generator Belt Replacement

Removal Procedure



1. Remove the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#).
2. Rotate the drive belt tensioner clockwise to release the drive belt tension.
3. Slide the drive belt off of the water pump pulley.
4. Slowly release the drive belt tensioner.
5. Remove the drive belt from the accessory drive pulleys.

Installation Procedure



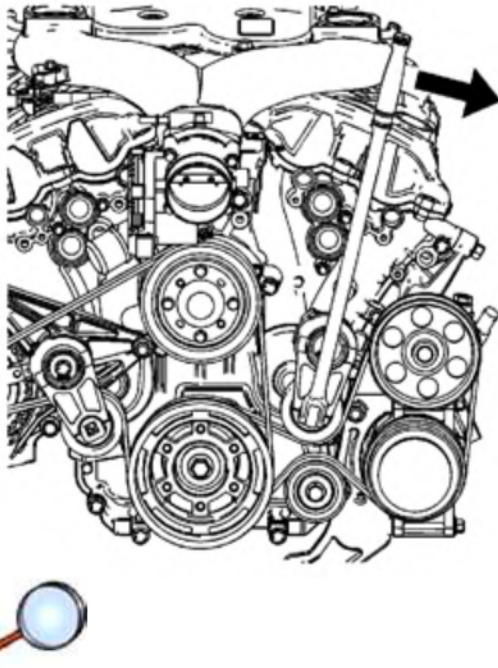
1. Install the drive belt to the crankshaft pulley, the tensioner and the generator.
2. Rotate the drive belt tensioner clockwise.
3. Install the drive belt to the water pump.

Important: Ensure the drive belt is properly aligned and seated into the grooves of the accessory drive pulleys.

4. Slowly release the drive belt tensioner.
5. Install the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#) .

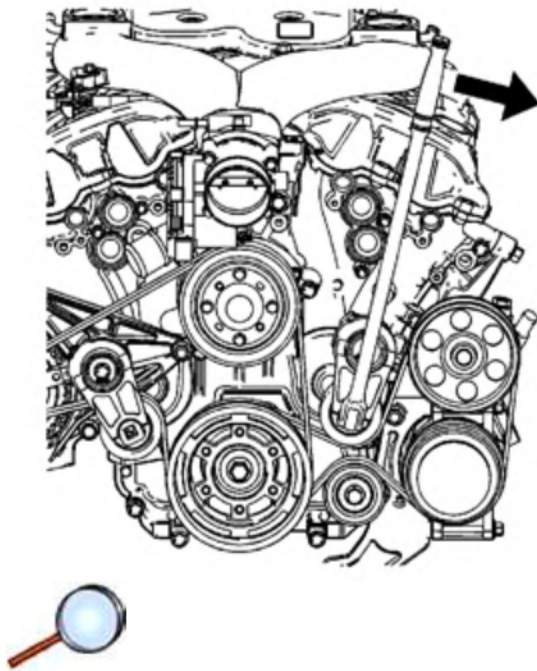
Air Conditioning Compressor and Power Steering Pump Belt Replacement

Removal Procedure



1. Remove the generator and water pump drive belt. Refer to [Water Pump and Generator Belt Replacement](#) .
2. Remove the air cleaner outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
3. Rotate the drive belt tensioner clockwise in order to release the drive belt tension.
4. Remove the drive belt from the power steering pulley.
5. Slowly release the drive belt tensioner.
6. Remove the drive belt from the accessory drive pulleys.

Installation Procedure



1. Install the drive belt to the crankshaft pulley, the idler pulley and the A/C compressor.
2. Rotate the drive belt tensioner clockwise.
3. Install the drive belt to the power steering pulley.
4. Slowly release the drive belt tensioner.

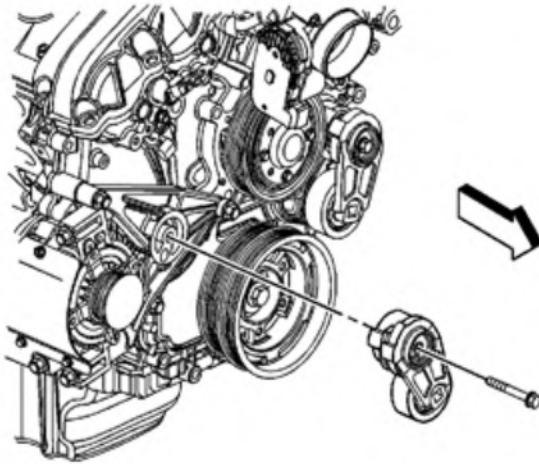
Important: Ensure the drive belt is properly aligned and seated into the grooves of the accessory drive pulleys.

5. Install the air cleaner outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
6. Install the generator and water pump drive belt. Refer to [Water Pump and Generator Belt Replacement](#).

Water Pump and Generator Belt Tensioner Replacement

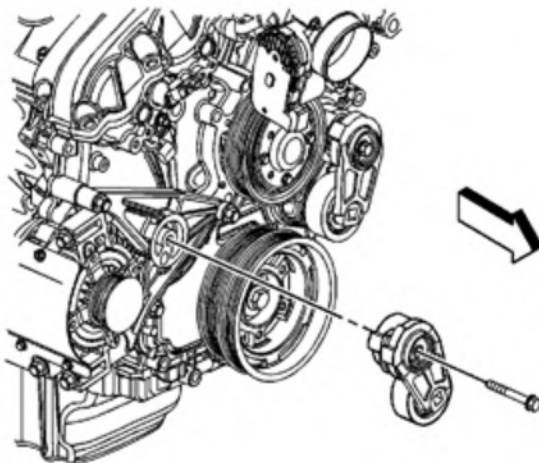
Removal Procedure

1. Remove the generator and water pump drive belt. Refer to [Water Pump and Generator Belt Replacement](#).



2. Loosen the drive belt tensioner bolt.
3. Remove the drive belt tensioner and bolt from the engine.

Installation Procedure





1. Position the drive belt tensioner and bolt to the engine as an assembly.
2. Ensure that the alignment pin on the rear of the tensioner assembly is aligned with the locating hole on the engine.

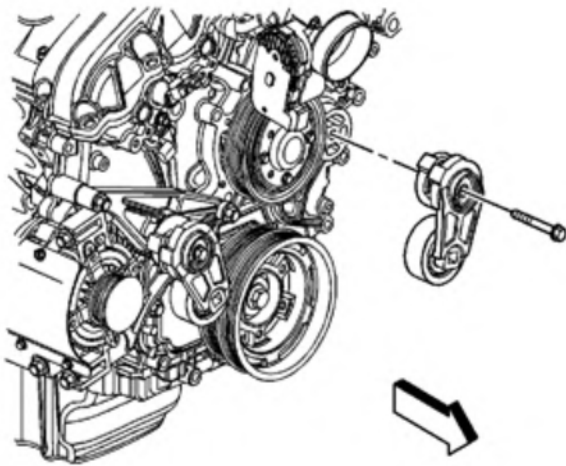
Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the drive belt tensioner bolt and tighten to **50 N·m (37 lb ft)**.
4. Install the generator and water pump drive belt. Refer to [Water Pump and Generator Belt Replacement](#).

Air Conditioning Compressor and Power Steering Pump Belt Tensioner Replacement

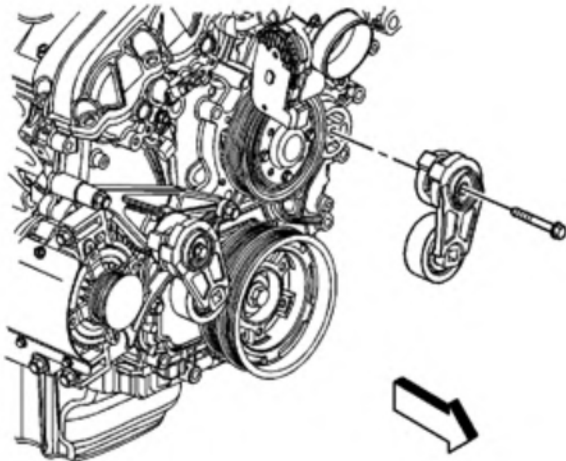
Removal Procedure

1. Remove the generator and water pump drive belt. Refer to [Water Pump and Generator Belt Replacement](#).
2. Remove the power steering and air conditioning drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).



3. Loosen the drive belt tensioner bolt.
4. Remove the drive belt tensioner and bolt from the engine.

Installation Procedure



1. Position the drive belt tensioner and bolt to the engine as an assembly.
2. Ensure that the alignment pin on the rear of the tensioner assembly is aligned with the locating hole on the engine.

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

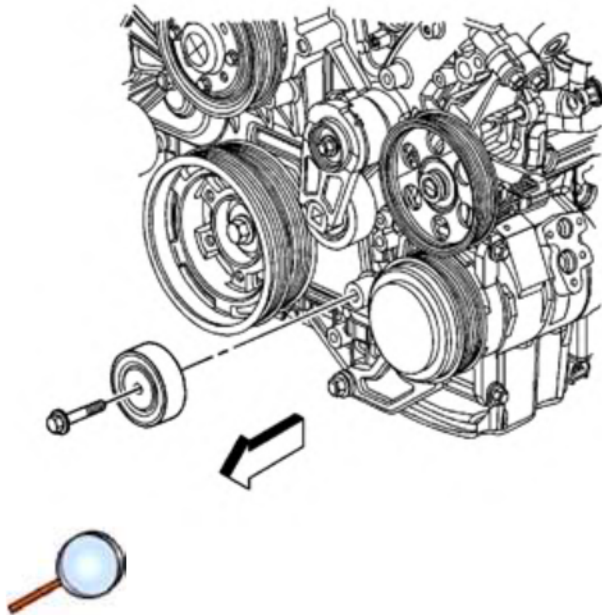
3. Install the drive belt tensioner bolt and tighten to **50 N·m (37 lb ft)**.
4. Install the power steering and air conditioning drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).
5. Install the generator and water pump drive belt. Refer to [Water Pump and Generator Belt Replacement](#).

Drive Belt Idler Pulley Replacement

Removal Procedure

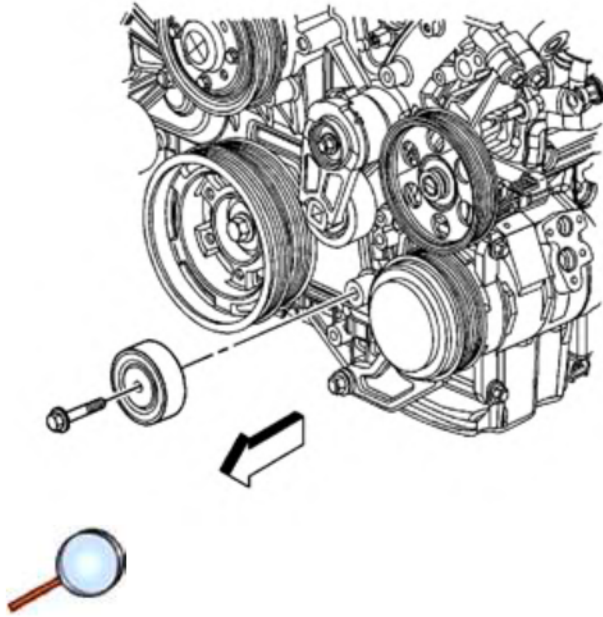
Note: Do not remove the generator and water pump belt.

1. Remove the power steering and air conditioning drive belt from the power steering pump. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).



2. Remove the drive belt idler pulley bolt.
3. Remove the drive belt idler pulley.

Installation Procedure



1. Install the drive belt idler pulley.

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

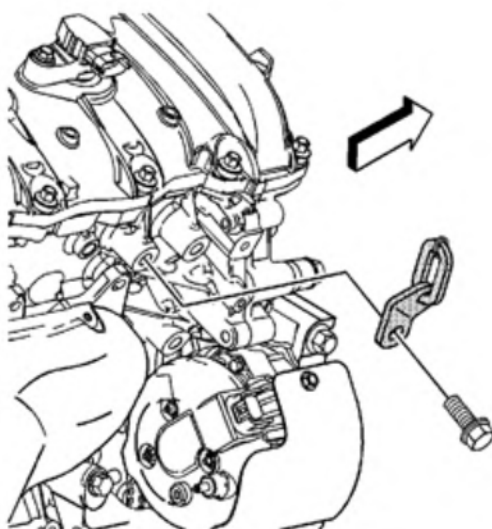
2. Install the drive belt idler pulley bolt and tighten to **50 N·m (37 lb ft)**.
3. Install the drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).

Engine Support Fixture

Special Tools

- [J 28467-B](#) Universal Engine Support Fixture
- [J-28467-550](#) Engine Support Beam Adapter
- [J 36857](#) Engine Lift Bracket

Installation Procedure



1. Remove the engine compartment sight shields. Refer to [Front Compartment Sight Shields Replacement](#).
2. Remove the cross vehicle brace. Refer to [Cross Vehicle Brace Replacement](#).
3. Remove the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).

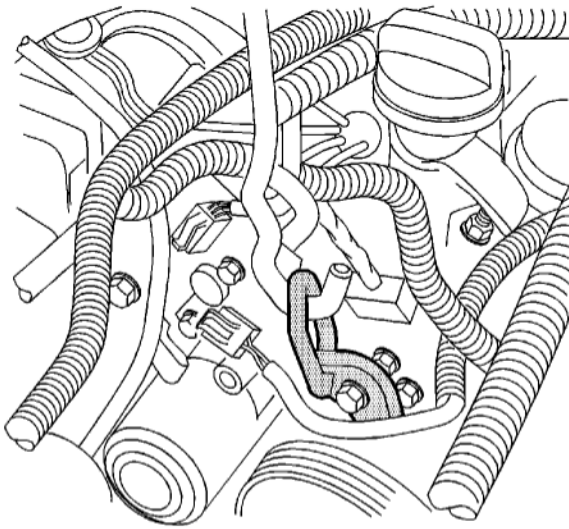
Caution: Refer to [Fastener Caution](#) in the Preface section.

4. Use a grade 10.9, M10 X 1.5 X 35 bolt, GM P/N 11519182 or equivalent, in order to install an engine lift bracket (OTC #7100, [J 36857](#) or equivalent) to the right cylinder head in the location shown. Tighten the bolt to **65 N·m (48 lb ft)**.
5. Remove the air cleaner outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
6. Remove the vacuum pump and position aside, if equipped.

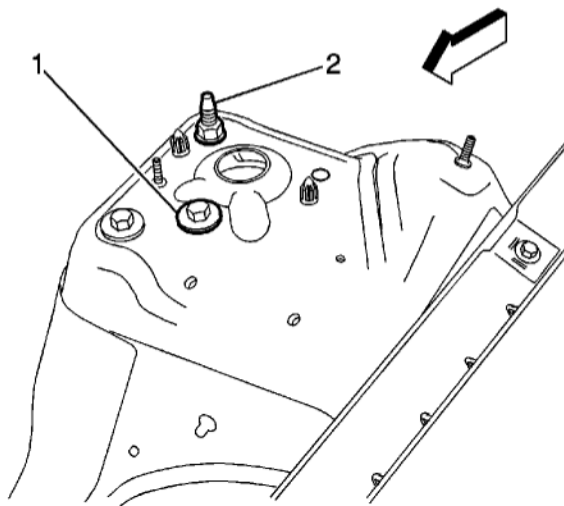
Note: It is not necessary to remove the hoses from the power steering reservoir.

7. Remove the power steering reservoir and position aside. Refer to [Remote Power Steering Fluid Reservoir Replacement](#).
8. Remove the Bank 2 (Refer to [Camshaft Position](#)

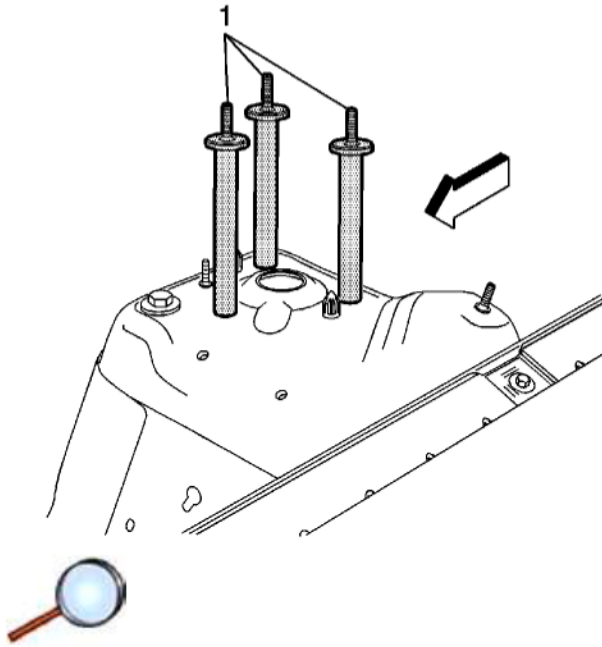
Sensor Replacement - Bank 2 (Left Side) Exhaust.



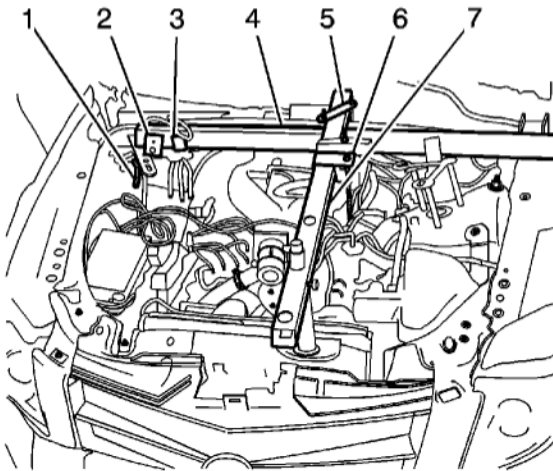
9. Use a grade 10.9, M10 X 1.5 X 35 bolt, GM P/N 11519182 or equivalent, in order to install an engine lift bracket (OTC #7100, [J 36857](#) or equivalent) to the front of the left cylinder head in the location shown. Tighten the bolt to **65 N·m (48 lb ft)**.



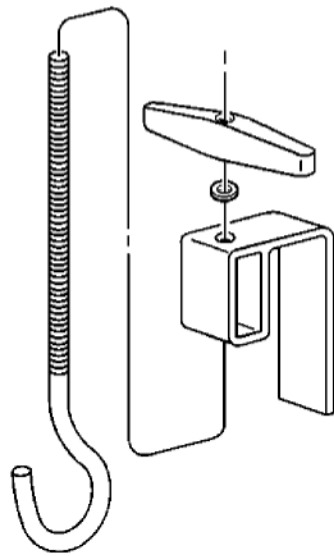
10. Remove the shock module mounting stud (2) and bolt (1) from the left and right shock tower.



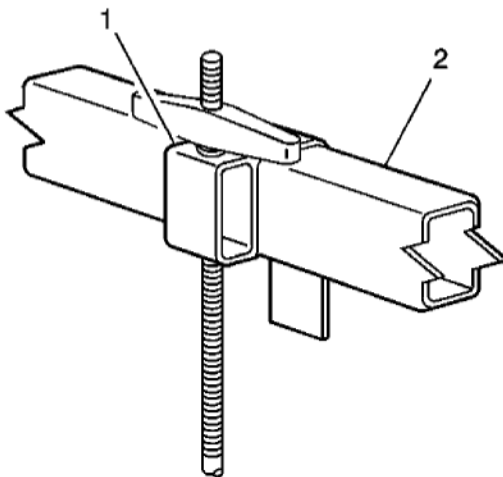
11. Install the [J-28467-550](#) (1) in the location shown on the left and right shock towers.



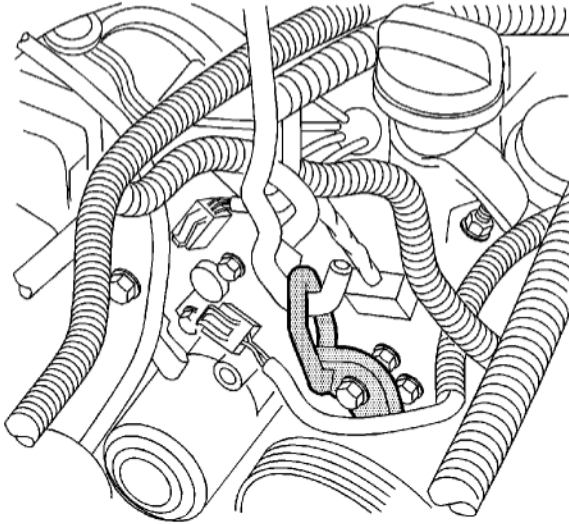
12. Ensure the strut tower support assemblies (2) are secured to the engine support beam adapters (1) with wing nuts.
13. Secure the strut tower tube (4) to the strut tower support (2) with quick release pins.
14. Secure the strut tower tube (4) to the radiator shelf tube (7) with the cross bracket assembly (5).
15. Tighten the cross bracket wing nuts.



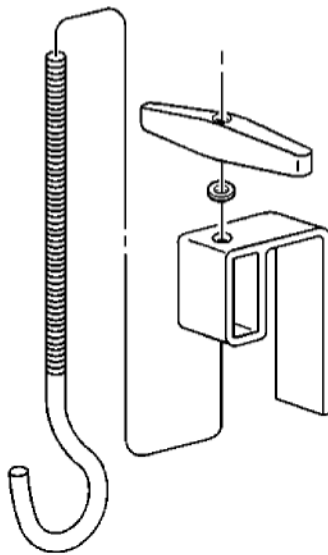
16. Assemble the lift hook wing nut and the lift hook bracket to the lift hook.



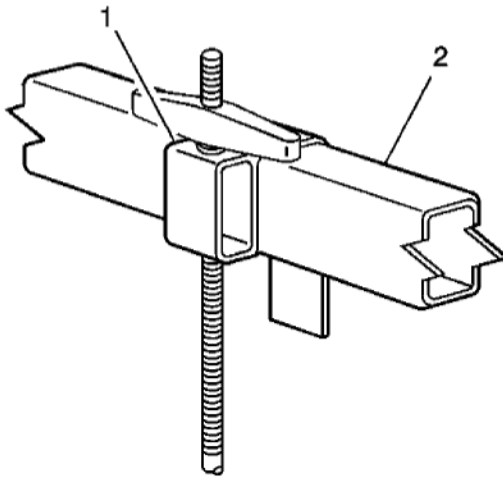
17. Install lift hook assembly (1) to the radiator shelf tube (2).



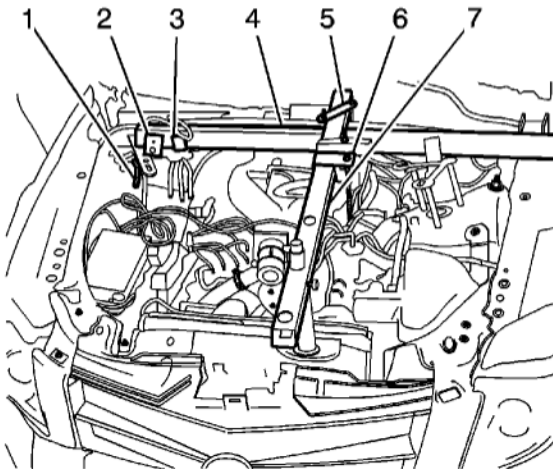
18. Install lift hook assembly to left side engine lift hook bracket.



19. Assemble the lift hook wing nut and the lift hook bracket to the lift hook.



20. Install lift hook assembly (1) to the strut tower tube (2).

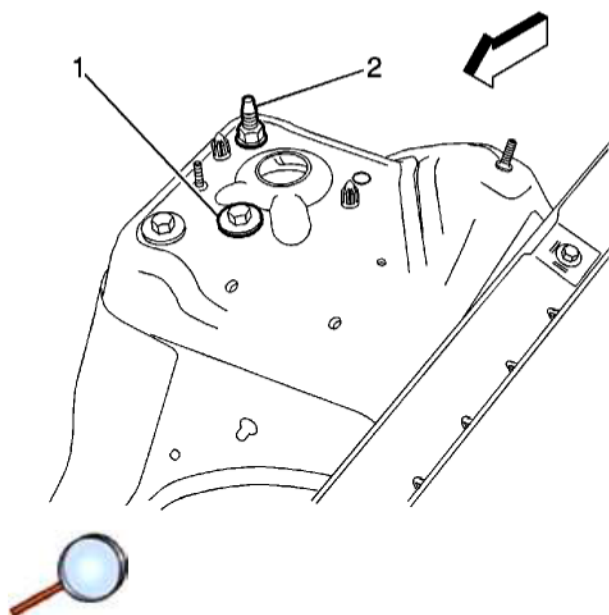


21. Hand tighten the lift hooks (3, 6) in order to remove all slack from the engine support fixture.

Removal Procedure

1. Remove the [J 28467-B](#) .
2. Remove the [J-28467-550](#) .

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



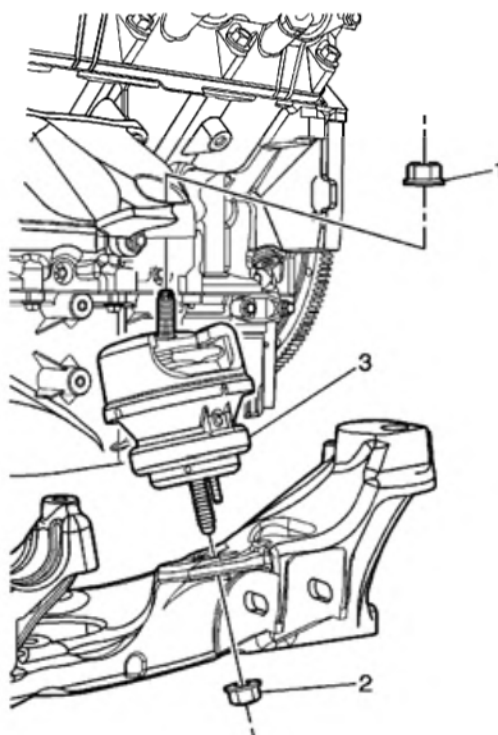
3. Install the shock module mounting stud (2) and bolt (1) to the left and right shock towers then tighten to **112 N·m (83 lb ft)**.
4. Remove the right and left engine lift brackets from the engine.
5. Install the Bank 2 (Left Side) exhaust camshaft position sensor. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#).
6. Install the power steering reservoir. Refer to [Remote Power Steering Fluid Reservoir Replacement](#).
7. Install the vacuum pump, if equipped.
8. Install the air cleaner outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
9. Install the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).
10. Install the cross vehicle brace. Refer to [Cross Vehicle Brace Replacement](#).
11. Install the engine compartment sight shields. Refer to [Front Compartment Sight Shields Replacement](#).

Engine Mount Inspection

Important: Before replacing any engine mount due to suspected fluid loss, verify that the source of the fluid is the engine mount, not the engine or accessories.

1. Install the engine support fixture. Refer to [Engine Support Fixture](#) . Raising the engine removes the weight from the engine mount and creates slight tension in the rubber.
2. Observe the engine mount while raising the engine. Replace the engine mount if the engine mount exhibits any of the following conditions:
 - The hard rubber surface is covered with heat check cracks.
 - The rubber is separated from the metal plate of the engine mount.
 - The rubber is split through the center of the engine mount.
 - The GLYCOL™ fluid is leaking from the engine mount.
3. If there is movement between the metal plate of the engine mount and its attaching points, lower the engine on the engine mount. Tighten the bolts or nuts attaching the engine mount to the frame or engine mount bracket. Refer to [Engine Mount Replacement - Left Side](#) or [Engine Mount Replacement - Right Side](#) .

Engine Mount Replacement - Left Side (RWD)



Callout	Component Name
Preliminary Procedures	
1. Discharge the air conditioning (A/C) system. Refer to Refrigerant Recovery and Recharging. 2. Remove the tower brace. Refer to Cross Vehicle Brace Replacement. 3. Raise the vehicle. Refer to Lifting and Jacking the Vehicle. 4. Remove the suction hose from the A/C compressor. Refer to Suction Hose Replacement. 5. Position the hose aside to gain access to the engine mount top nut. 6. Lower the vehicle.	
1	Engine Mount Fastener Caution: Refer to Component Fastener Tightening Caution in the Preface section. Procedure 1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle. 2. Position a screw jack and a block of wood under the engine oil pan. Tighten

	100 N·m (74 lb ft)
2	Engine Mount Fastener Procedure The engine mount nuts must be replaced once loosened or removed. Tighten 100 N·m (74 lb ft)
3	Engine Mount Procedure 1. Using the screw jack, raise the engine enough to remove the engine mount. 2. Install the new right and left engine mount lower nut first.

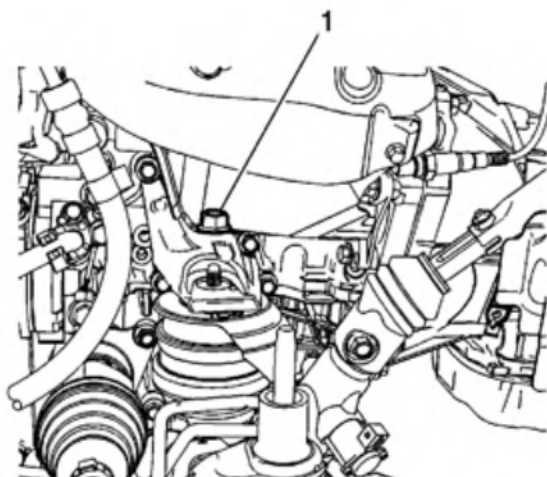
Engine Mount Replacement - Left Side (AWD)

Removal Procedure

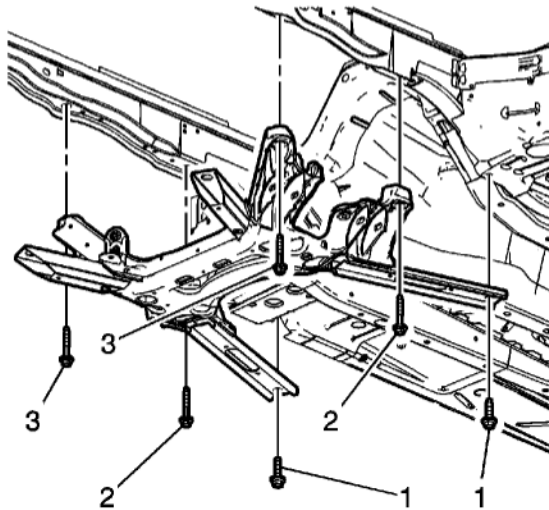
Caution: Secure the steering wheel utilizing a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must be secured in position before disconnecting the following components:

- The steering column
- The intermediate shaft
- The steering gear

After disconnecting these components, do not move the front tires and wheels. Failure to follow these procedures may cause improper alignment of some components during installation and result in possible damage to the SIR coil.

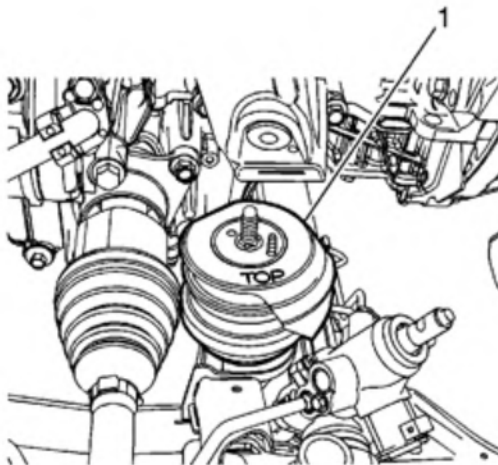


1. Disconnect the battery ground cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Remove the cross vehicle brace. Refer to [Cross Vehicle Brace Replacement](#).
3. Remove the exhaust system. Refer to [Exhaust System Replacement](#).
4. Remove the right and left lower engine mount retaining nuts.
5. Disconnect the lower intermediate steering shaft from the steering gear and position the shaft aside. Refer to [Intermediate Steering Shaft Replacement](#).
6. Remove the upper engine mount retaining nut (1).



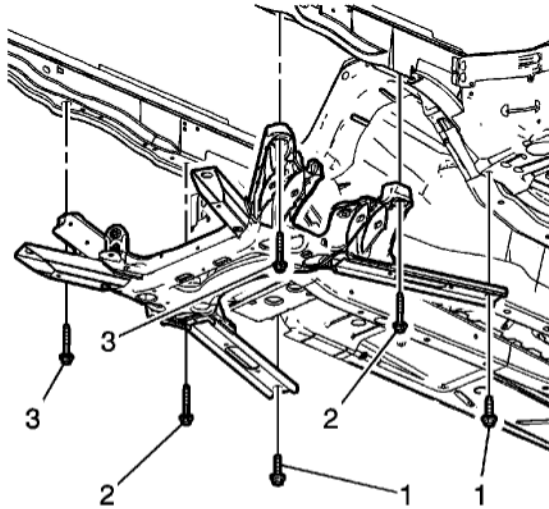
7. Install a screw jack with a block of wood under the oil pan for support.
8. Support the rear of the front frame with a screw jack.
9. Remove the frame rear (1) and center (2) mounting bolts.
10. Loosen the front frame bolts (3) 12.7 mm (0.5 in) to 25.4 mm (1 in).
11. Lower the rear section of the frame.
12. Raise the engine using the screw jack until the weight is removed from the mount.
13. Lower the screw jack under the frame.
14. Remove the engine mount (1) from the vehicle.

Installation Procedure



1. Install the engine mount (1).

2. Raise the rear section of the frame.

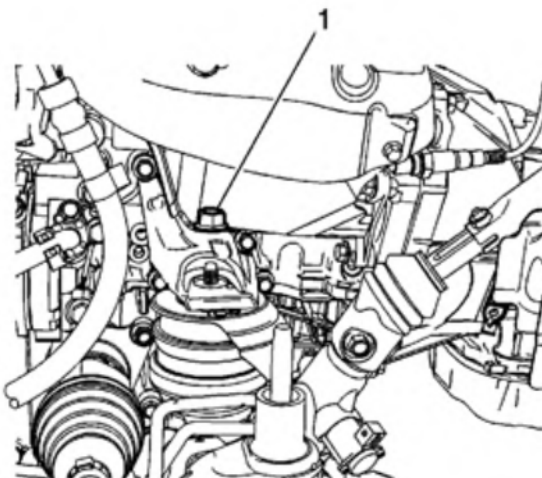


3. Install but do not tighten the frame rear (1) and center (2) mounting bolts.

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

Note: Ensure to tighten the frame bolts in sequence.

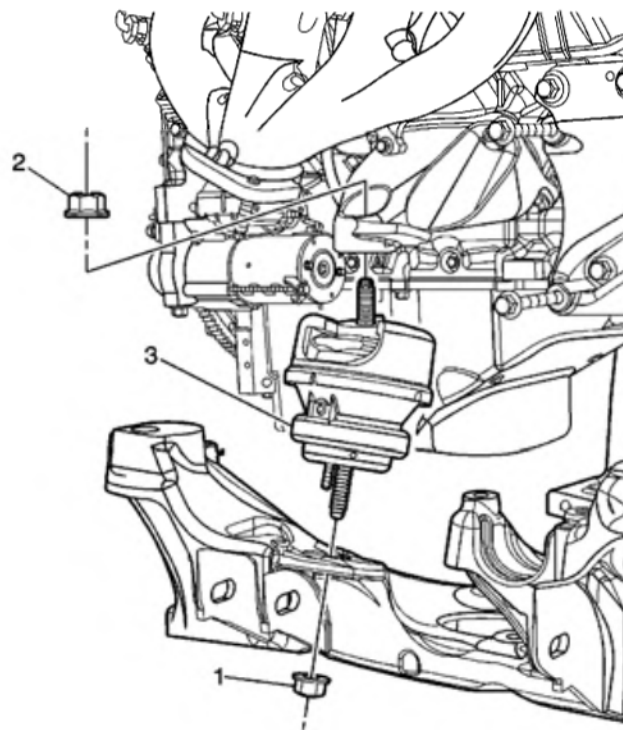
4. Tighten the frame bolts.
 - 4.1. Tighten the left front frame bolt to **191 N·m (141 lb ft)**.
 - 4.2. Tighten the right front frame bolt to **191 N·m (141 lb ft)**.
 - 4.3. Tighten the center front frame bolts to **191 N·m (141 lb ft)**.
 - 4.4. Tighten the rear front frame bolts to **191 N·m (141 lb ft)**.
5. Remove the screw jack from the rear of the front frame.
6. Remove the screw jack and block of wood from under the oil pan.





7. Install the upper engine mount retaining nut (1) and tighten to **80 N·m (59 lb ft)**.
8. Install the right and left lower engine mount retaining nuts and tighten to **80 N·m (59 lb ft)**.
9. Connect the lower intermediate steering shaft to the steering gear. Refer to [Intermediate Steering Shaft Replacement](#).
10. Install the exhaust system. Refer to [Exhaust System Replacement](#).
11. Lower the vehicle.
12. Install the cross vehicle brace. Refer to [Cross Vehicle Brace Replacement](#).
13. Connect the battery ground cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

Engine Mount Replacement - Right Side (RWD)

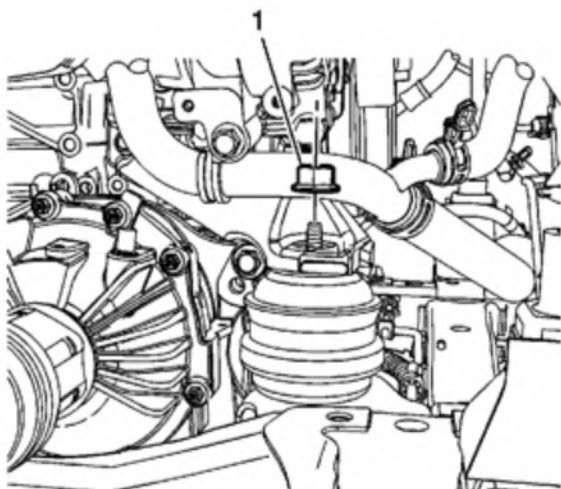


Callout	Component Name
Preliminary Procedures	
1. Discharge the air conditioning (A/C) system. Refer to Refrigerant Recovery and Recharging. 2. Remove the tower brace. Refer to Cross Vehicle Brace Replacement. 3. Raise the vehicle. Refer to Lifting and Jacking the Vehicle. 4. Remove the suction hose from the A/C compressor. Refer to Suction Hose Replacement. 5. Position the hose aside to gain access to the engine mount top nut. 6. Lower the vehicle.	
1	Engine Mount Fastener Caution: Refer to Component Fastener Tightening Caution in the Preface section. Procedure 1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle. 2. Position a screw jack and a block of wood under the engine oil pan. Tighten

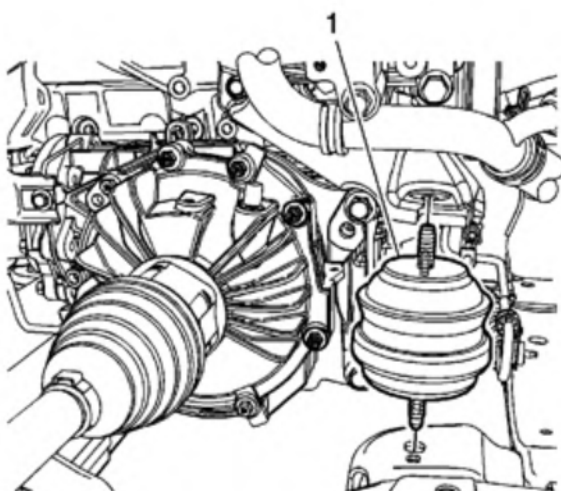
	100 N·m (74 lb ft)
2	Engine Mount Fastener Procedure The engine mount nuts must be replaced once loosened or removed. Tighten 100 N·m (74 lb ft)
3	Engine Mount Procedure 1. Using the screw jack, raise the engine enough to remove the engine mount. 2. Install the new right and left engine mount lower nut first.

Engine Mount Replacement - Right Side (AWD)

Removal Procedure



1. Disconnect the battery ground cable. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Remove the cross vehicle brace. Refer to [Cross Vehicle Brace Replacement](#).
3. Remove the exhaust system. Refer to [Exhaust System Replacement](#).
4. Remove the upper engine mount retaining nut (1).

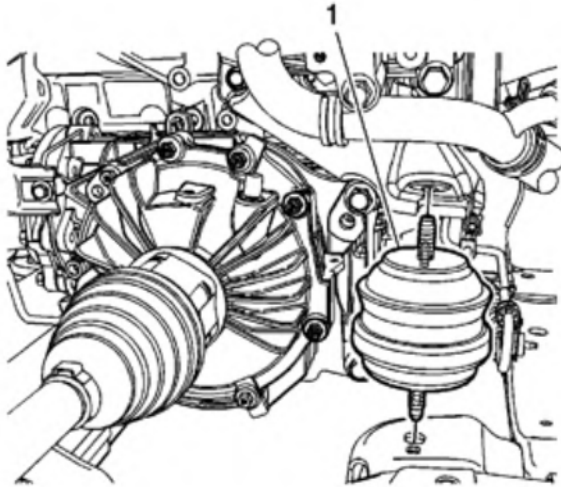


5. Remove the lower engine mount retaining nuts.
6. Install a screw jack with a block of wood under the oil pan for support.

Note: Note position of the engine mount prior to removing mount.

7. Using the screw jack, raise the engine enough to remove the engine mount.
8. Remove the engine mount from the vehicle.

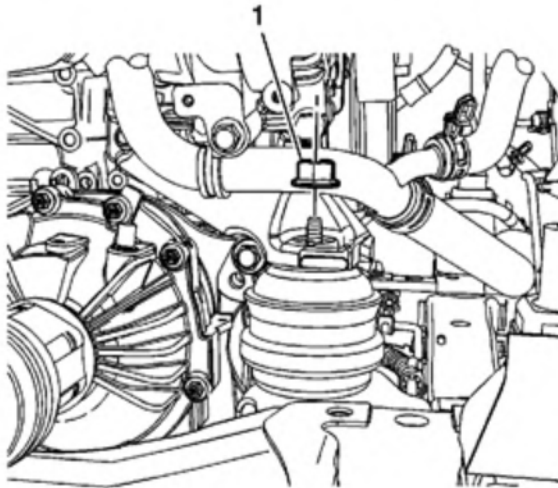
Installation Procedure



Note: Ensure the engine mount is positioned correctly.

1. Install the engine mount to the vehicle.
2. Using the screw jack, lower the engine.
3. Remove the screw jack and block of wood supporting the engine.

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



4. Install the upper engine mount retaining nut (1) and tighten to **80 N·m (59 lb ft)**.
5. Install the right and left lower engine mount retaining nuts and tighten to **80 N·m (59 lb ft)**.
6. Install the exhaust system. Refer to [Exhaust System Replacement](#).
7. Install the cross vehicle brace. Refer to [Cross Vehicle Brace Replacement](#).
8. Connect the battery ground cable. Refer to [Battery Negative Cable Disconnection and Connection](#).

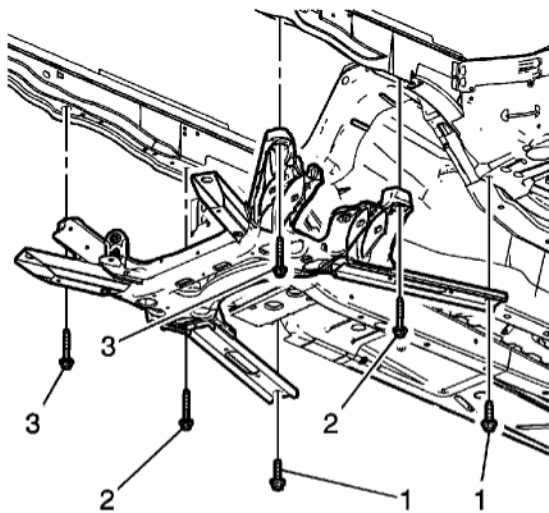
Engine Mount Bracket Replacement - Left Side (RWD)

Removal Procedure

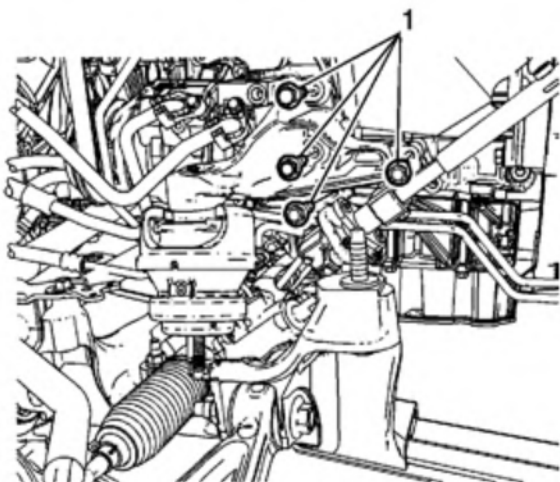
Caution: Secure the steering wheel utilizing a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must be secured in position before disconnecting the following components:

- The steering column
- The intermediate shaft
- The steering gear

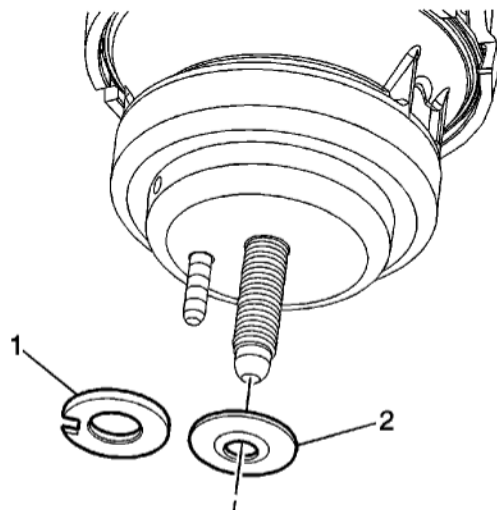
After disconnecting these components, do not move the front tires and wheels. Failure to follow these procedures may cause improper alignment of some components during installation and result in possible damage to the SIR coil.



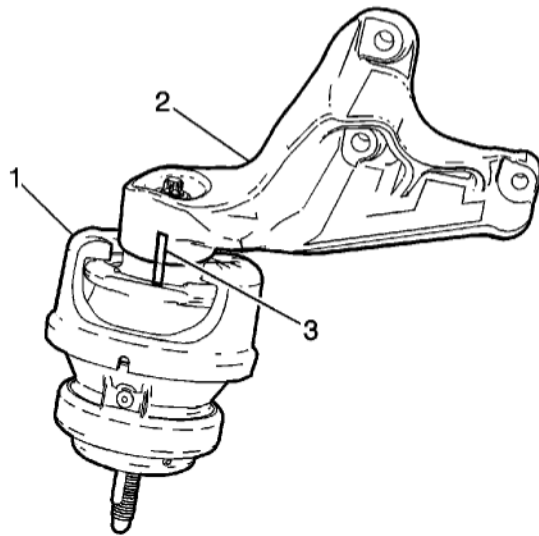
1. Remove the tower brace. Refer to [Cross Vehicle Brace Replacement](#).
2. Secure the steering wheel in place.
3. Remove the lower section of the steering intermediate shaft. Refer to [Lower Intermediate Steering Shaft Replacement](#).
4. Remove the left and right lower engine mount nuts.
5. Install a screw jack with a block of wood under the oil pan for support.
6. Support the rear of the front frame with a screw jack.
7. Remove the frame rear (1) and center (2) mounting bolts.
8. Loosen the front frame bolts (3) 12.7 mm (0.5 in) to 25.4 mm (1 in).
9. Lower the rear section of the frame.



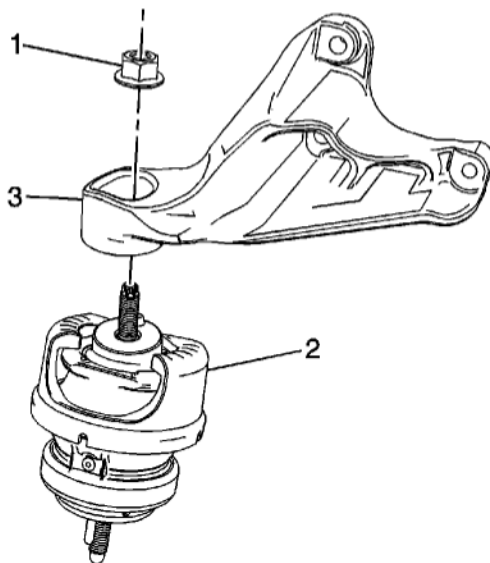
10. Remove the engine mount bracket bolts (1).
11. Remove the engine mount and engine mount bracket as an assembly.



12. Remove the washer (1) or (2) located between the engine mount and the frame.

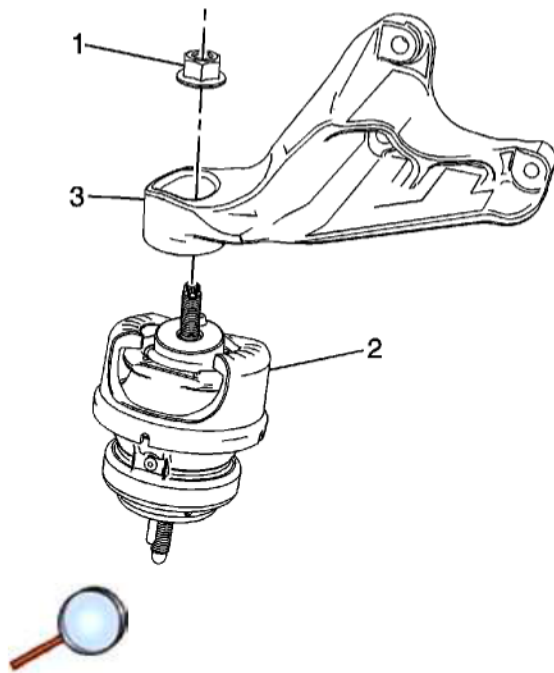


13. Mark the location of the engine mount (1) to the engine mount bracket (2).

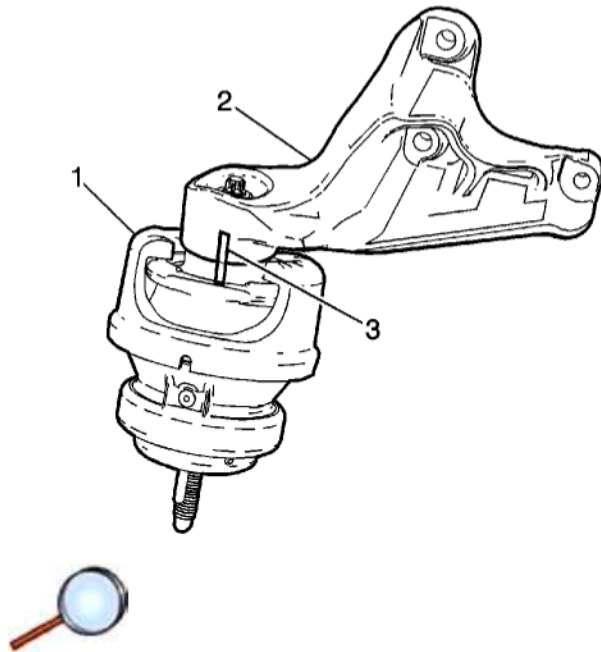


14. Remove the upper engine mount retaining nut (1).
15. Separate the engine mount (2) from the engine mount bracket (3).

Installation Procedure



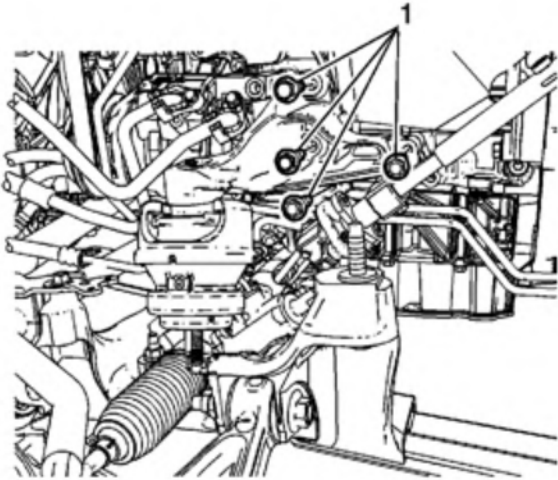
1. Position the engine mount bracket (3) to the engine mount (2).



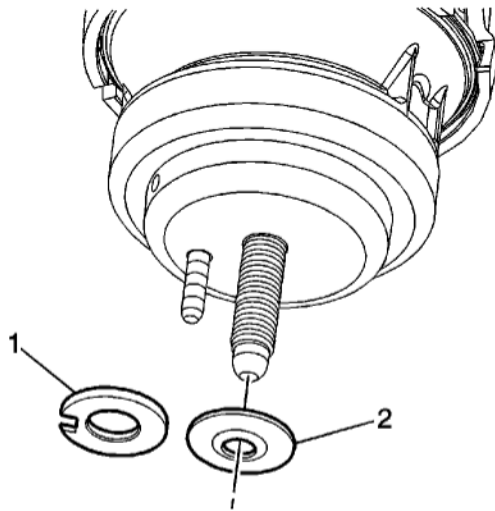
2. Align the location mark (3) of the engine mount (1) to the engine mount bracket (2).

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

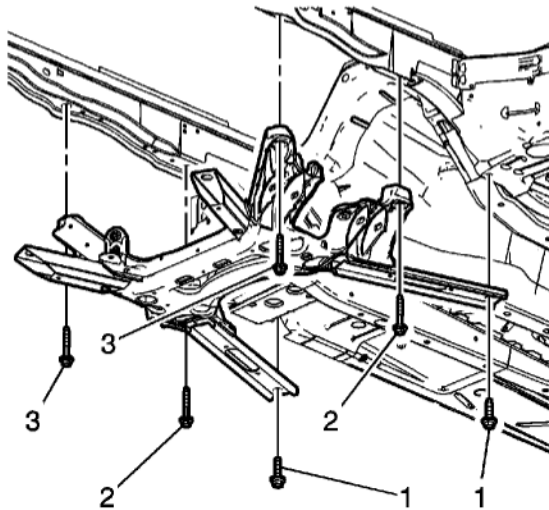
3. Install the upper engine mount retaining nut and tighten to **80 N·m (59 lb ft)**.



4. Install the engine mount and engine mount bracket as an assembly.
5. Install the engine mount bracket bolts (1) and tighten to **60 N·m (44 lb ft)**.



6. Ensure the slotted washer (1) or the plastisol insert washer (2) is properly installed between the engine mount and the frame.
7. Raise the rear section of the frame.



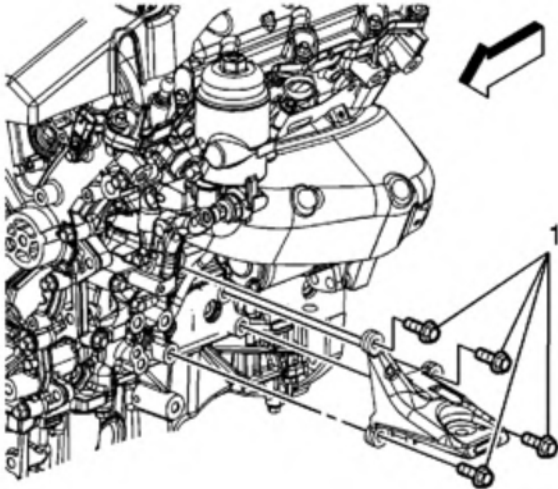
8. Install but do not tighten the frame rear (1) and center (2) mounting bolts. Tighten the bolts to **191 N·m (141 lb ft)**.

Note: Ensure to tighten the frame bolts in sequence.

9. Tighten the frame bolts.
 - 9.1. Tighten the left front frame bolt to **191 N·m (141 lb ft)**.
 - 9.2. Tighten the right front frame bolt to **191 N·m (141 lb ft)**.
 - 9.3. Tighten the center front frame bolts to **191 N·m (141 lb ft)**.
 - 9.4. Tighten the rear front frame bolts to **191 N·m (141 lb ft)**.
10. Remove the screw jack from the rear of the front frame.
11. Remove the screw jack and block of wood from under the oil pan.
12. Install the left and right lower engine mount nuts and tighten to **80 N·m (59 lb ft)**.
13. Install the lower section of the steering intermediate shaft. Refer to [Lower Intermediate Steering Shaft Replacement](#).
14. Unsecure the steering wheel.
15. Install the tower brace. Refer to [Cross Vehicle Brace Replacement](#).

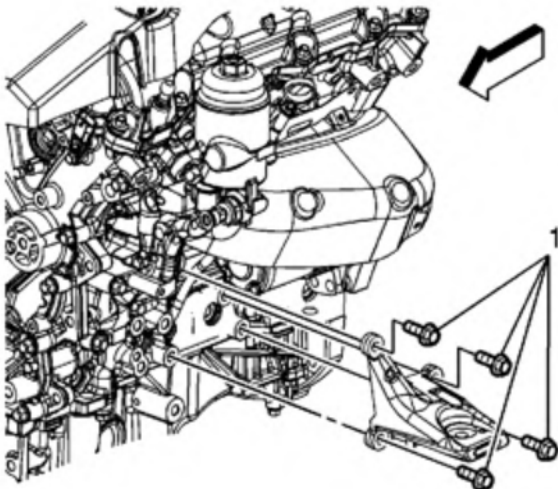
Engine Mount Bracket Replacement - Left Side (AWD)

Removal Procedure



1. Remove the engine mount. Refer to [Engine Mount Replacement - Left Side](#).
2. Remove the left engine mount bracket retaining bolts.
3. Remove the left engine mount bracket.

Installation Procedure





1. Install the left engine mount bracket assembly.

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

2. Install the left engine mount bracket retaining bolts.

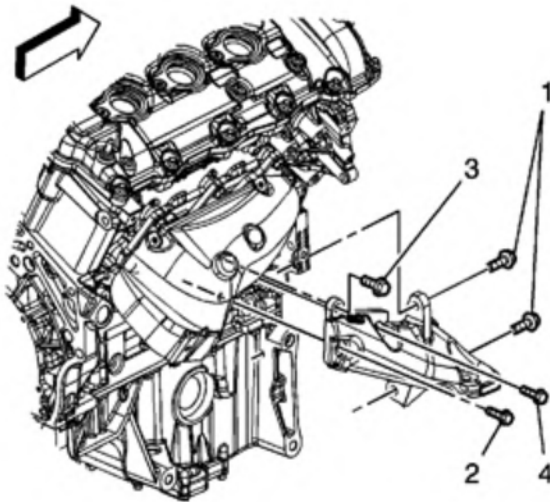
Tighten

Tighten the bolts to 60 N·m (44 lb ft).

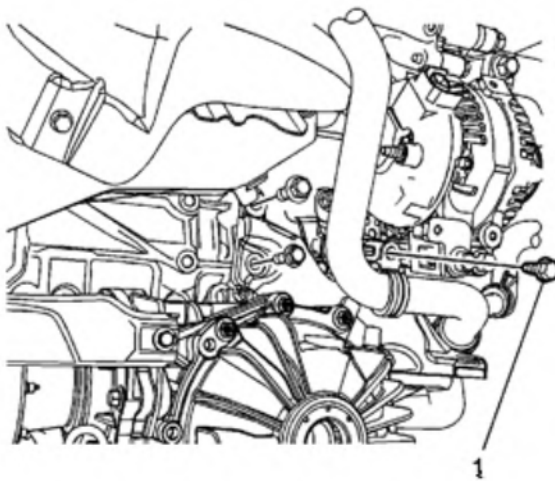
3. Install the engine mount. Refer to [Engine Mount Replacement - Left Side](#).

Engine Mount Bracket Replacement - Right Side (w / AWD)

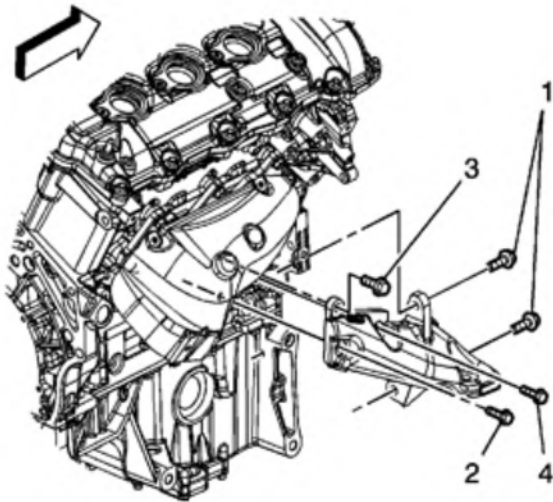
Removal Procedure



1. Remove the right side engine mount. Refer to [Engine Mount Replacement - Right Side](#).
2. Remove the front engine mount bracket mounting bolts (1).
3. Remove the rear engine mount bracket mounting bolts (2, 3).

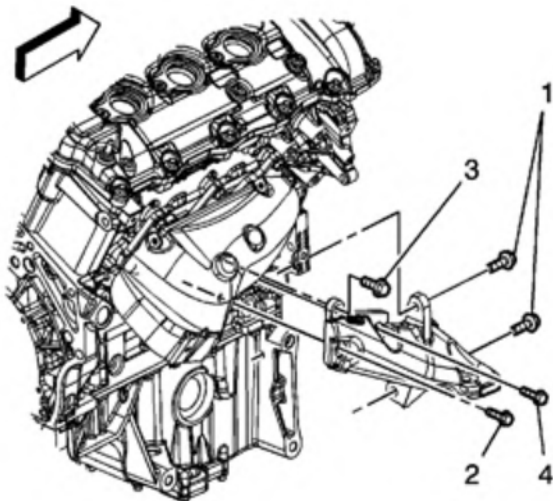


4. Remove the coolant tube retaining clamp bolt (1).
5. Reposition the coolant tube aside.



6. Remove the engine mount bracket retaining bolt (4) behind the engine coolant tube.
7. Remove the engine mount bracket from the vehicle.

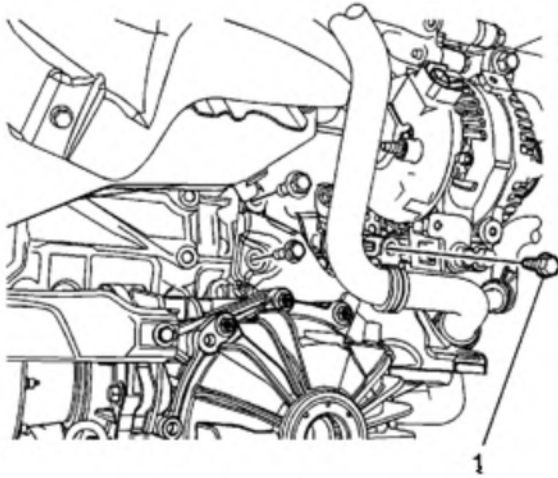
Installation Procedure



1. Install the engine mount bracket to the vehicle.
2. Install but do not tighten the rear engine mount bracket retaining bolts (3, 2).
3. Install but do not tighten the front engine mount bracket retaining bolts (1).

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

4. Install the engine mount bracket retaining bolt behind the engine coolant tube (4) and tighten to **38 N·m (28 lb ft)**.
5. Tighten the upper rear engine mount bracket retaining bolt (3) to **60 N·m (42 lb ft)**.
6. Tighten the rear lower engine mount bracket retaining bolts (2) to **38 N·m (28 lb ft)**.
7. Tighten the front engine mount bracket retaining bolts (1) to **60 N·m (42 lb ft)**.



8. Install the coolant tube retaining clamp bolt (1) and tighten to **10 N·m (87 in ft)**.
9. Install the right side engine mount. Refer to [Engine Mount Replacement - Right Side](#).

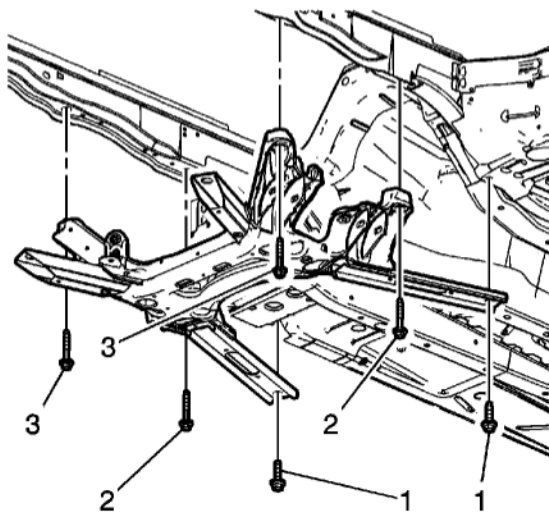
Engine Mount Bracket Replacement - Right Side (w / RWD)

Removal Procedure

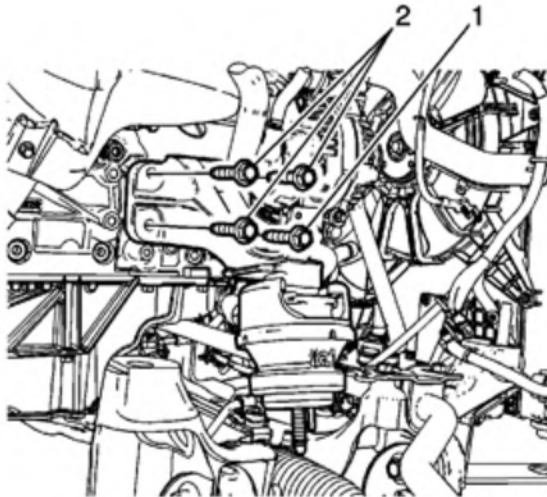
Caution: Secure the steering wheel utilizing a strap to prevent rotation. Locking of the steering column will prevent damage and a possible malfunction of the SIR system. The steering wheel must be secured in position before disconnecting the following components:

- The steering column
- The intermediate shaft
- The steering gear

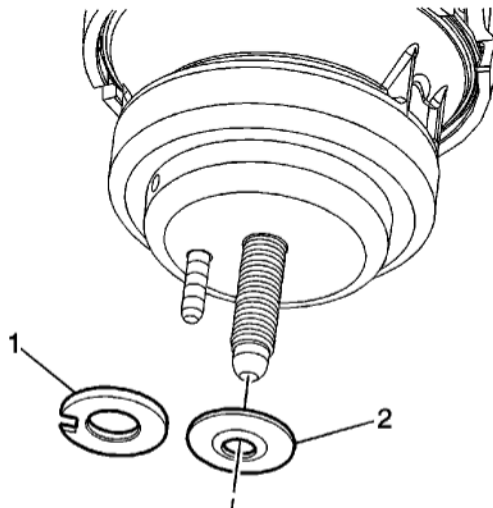
After disconnecting these components, do not move the front tires and wheels. Failure to follow these procedures may cause improper alignment of some components during installation and result in possible damage to the SIR coil.



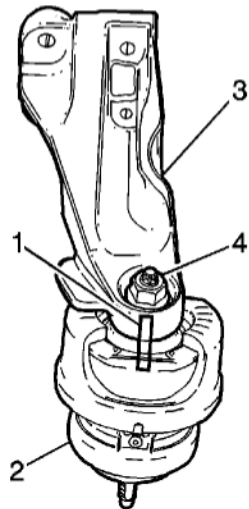
1. Remove the tower brace. Refer to [Cross Vehicle Brace Replacement](#).
2. Secure the steering wheel in place.
3. Remove the lower section of the steering intermediate shaft. Refer to [Lower Intermediate Steering Shaft Replacement](#).
4. Remove the left and right lower engine mount nuts.
5. Install a screw jack with a block of wood under the oil pan for support.
6. Support the rear of the front frame with a screw jack.
7. Remove the frame rear (1) and center (2) mounting bolts.
8. Loosen the front frame bolts (3) 12.7 mm (0.5 in) to 25.4 mm (1 in).
9. Lower the rear section of the frame.



10. Remove the engine mount bracket bolts (1).
11. Remove the engine mount and engine mount bracket as an assembly.

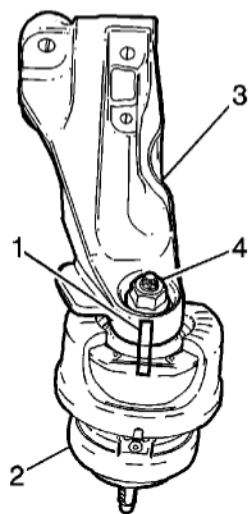


12. Remove the washer (1) or (2) located between the engine mount and the frame.



13. Place a location mark (1) on the engine mount (2) and the engine mount bracket (3).
14. Remove the upper engine mount retaining nut (4).
15. Separate the engine mount (2) from the engine mount bracket (3).

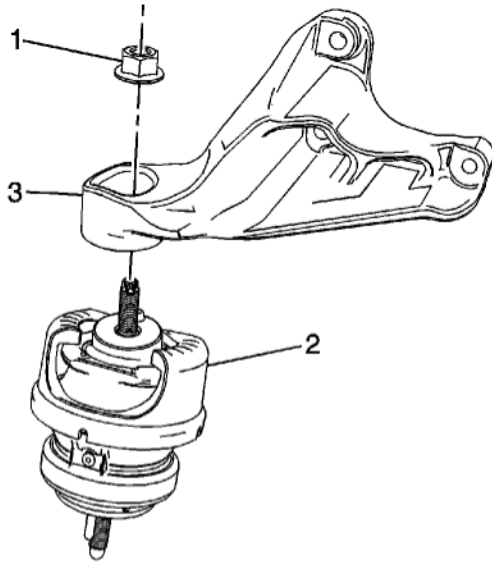
Installation Procedure



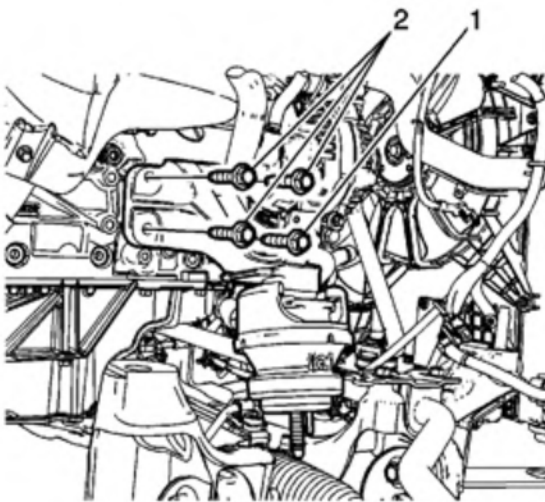
1. Position the engine mount bracket (3) to the engine mount (2).
2. Ensure to align the location mark (1) of the engine mount (2) to the engine mount bracket (3).

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

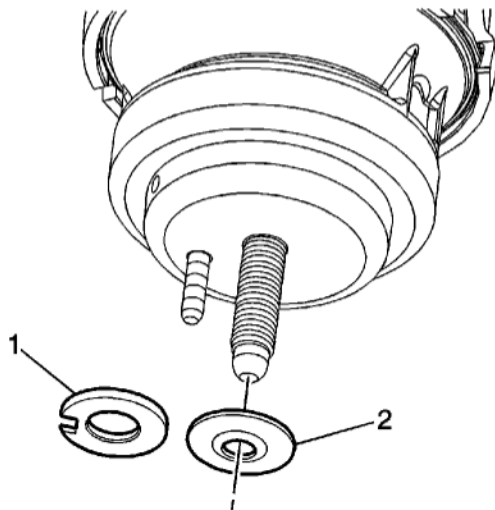
3. Install the upper engine mount retaining nut (4) and tighten to **80 N·m (59 lb ft)**.



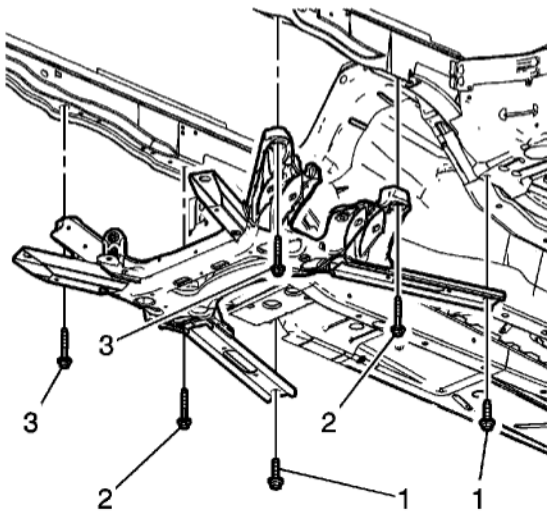
4. Position the engine mount bracket (3) to the engine mount (2).



5. Install the engine mount and engine mount bracket as an assembly.
6. Install the engine mount bracket bolts (1) and tighten to **22 N·m (16 lb ft)** and tighten (2) Bolt to **60 N·m (44 lb ft)**



7. Ensure the slotted washer (1) or plastisol insert washer (2) is properly installed between the engine mount and the frame.
8. Raise the rear section of the frame.



9. Install but do not tighten the frame rear (1) and center (2) mounting bolts. Tighten the bolts to **191 N·m (141 lb ft)**.

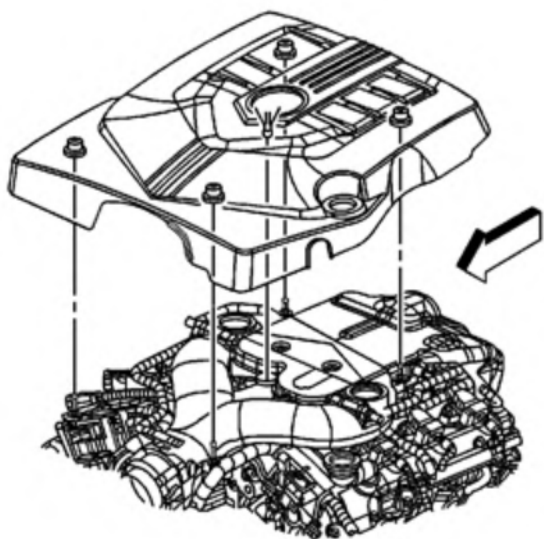
Note: Ensure to tighten the frame bolts in sequence.

10. Tighten the frame bolts.
 - 10.1. Tighten the left front frame bolt to **191 N·m (141 lb ft)**.
 - 10.2. Tighten the right front frame bolt to **191 N·m (141 lb ft)**.
 - 10.3. Tighten the center front frame bolts to **191 N·m (141 lb ft)**.

- 10.4. Tighten the rear front frame bolts to **191 N·m (141 lb ft)**.
11. Remove the screw jack from the rear of the front frame.
12. Remove the screw jack and block of wood from under the oil pan.
13. Install the left and right lower engine mount nuts and tighten to **80 N·m (59 lb ft)**.
14. Install the lower section of the steering intermediate shaft. Refer to [Lower Intermediate Steering Shaft Replacement](#).
15. Unsecure the steering wheel.
16. Install the tower brace. Refer to [Cross Vehicle Brace Replacement](#).

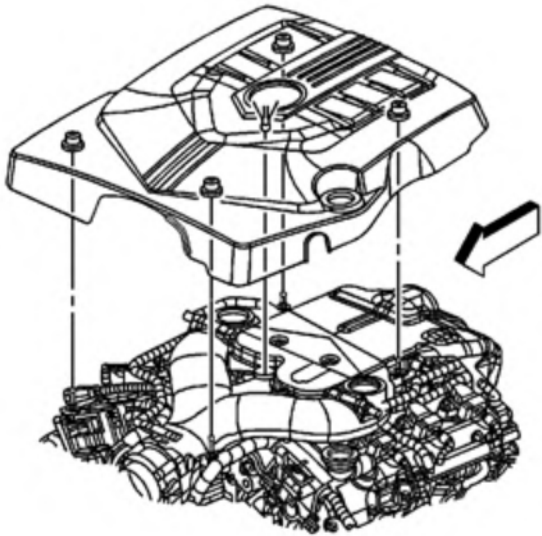
Fuel Injector Sight Shield Replacement (LP1, LY7)

Removal Procedure



1. Remove the cross car brace, if necessary. Refer to [Cross Vehicle Brace Replacement](#) .
2. Remove the oil fill cap.
3. Disengage the cover/shield from the ball studs by pulling up firmly on the right rear and left front of the engine cover.
4. Remove the engine cover/sight shield.
5. Remove the front compartment sight shield, if necessary. Refer to [Front Compartment Sight Shields Replacement](#) .

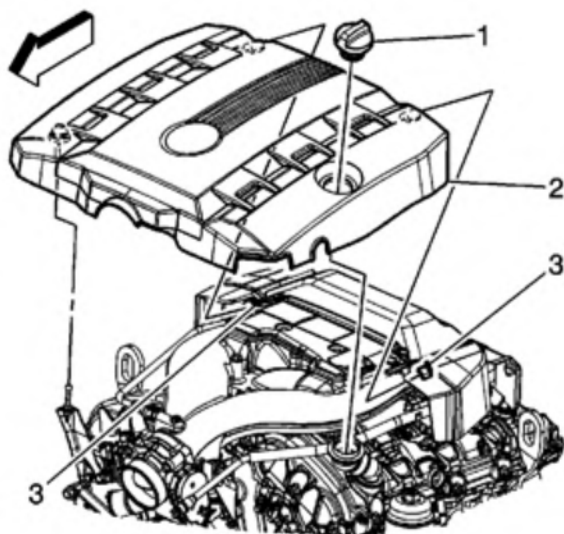
Installation Procedure



1. Install the front compartment sight shield, if necessary. Refer to [Front Compartment Sight Shields Replacement](#) .
2. Position the engine cover/sight shield over the intake manifold so the grommets are aligned with the ball studs.
3. Press the engine cover/sight shield down firmly near the ball studs in order to install the engine cover/sight shield.
4. Install the oil fill cap.
5. Install the cross car brace, if necessary. Refer to [Cross Vehicle Brace Replacement](#) .

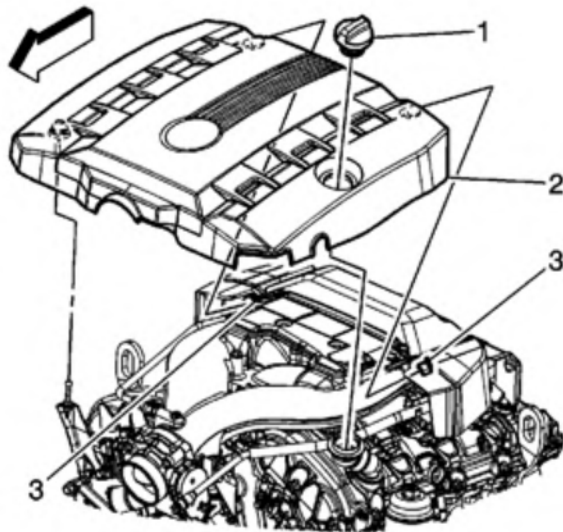
Fuel Injector Sight Shield Replacement (LLT)

Removal Procedure



1. Remove the cross car brace, if necessary. Refer to [Cross Vehicle Brace Replacement](#) .
2. Remove the oil fill cap (1).
3. Disengage the cover/shield (2) from the ball studs by pulling up firmly on the right and left front of the engine cover.
4. Pull the engine cover/sight shield forward to remove from the rear tabs (3).
5. Remove the engine cover/sight shield .
6. Remove the front compartment sight shield, if necessary. Refer to [Front Compartment Sight Shields Replacement](#) .

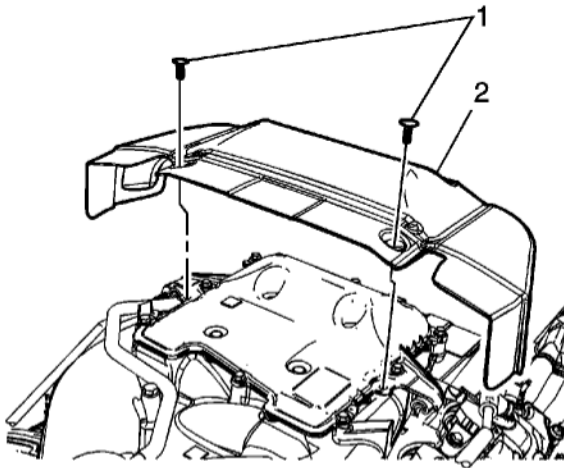
Installation Procedure



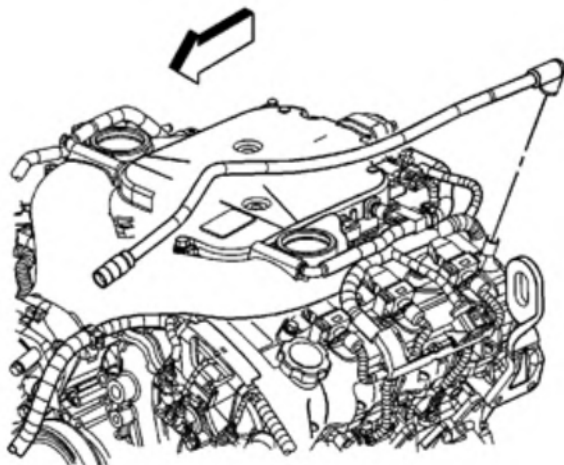
1. Install the front compartment sight shield, if necessary. Refer to [Front Compartment Sight Shields Replacement](#) .
2. Raise the front edge of the cover (2) while inserting the rear tabs (3).
3. Lower the front edge of the cover and slide cover rearward so that the rear tabs slide under the retainers.
4. Align the cover over the oil fill tube.
5. Press the cover down firmly on the ball stud at the right front corner.
6. Install the oil fill cap (1).
7. Install the cross car brace, if necessary. Refer to [Cross Vehicle Brace Replacement](#) .

Positive Crankcase Ventilation Hose / Pipe / Tube Replacement (LLT)

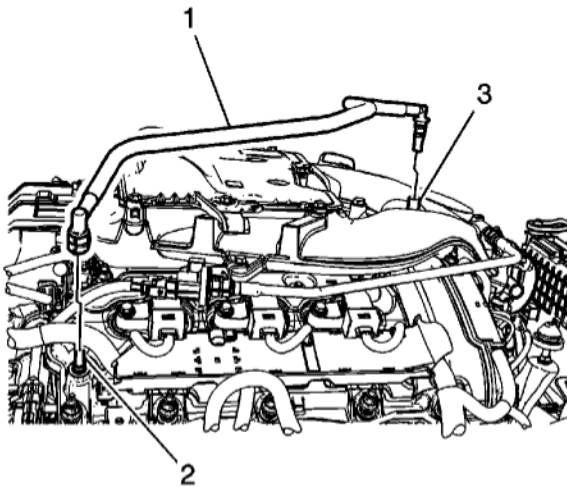
Removal Procedure



1. Remove the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#) .
2. Remove two intake manifold insulator retaining pins (1)
3. Remove the intake manifold insulator (2)

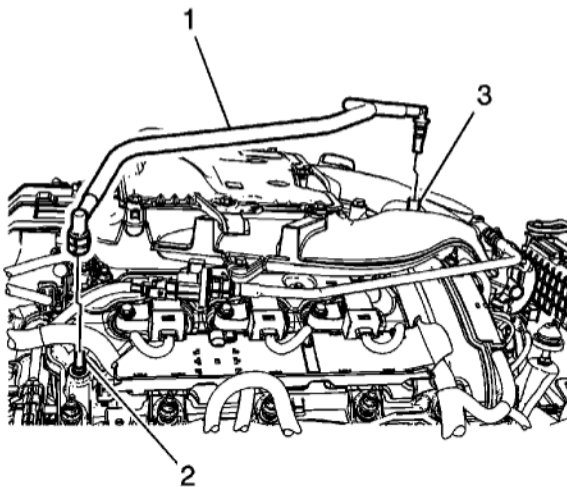


4. Remove the positive crankcase ventilation (PCV) fresh air tube from the left camshaft cover.
5. Remove the PCV fresh air tube from the air inlet.

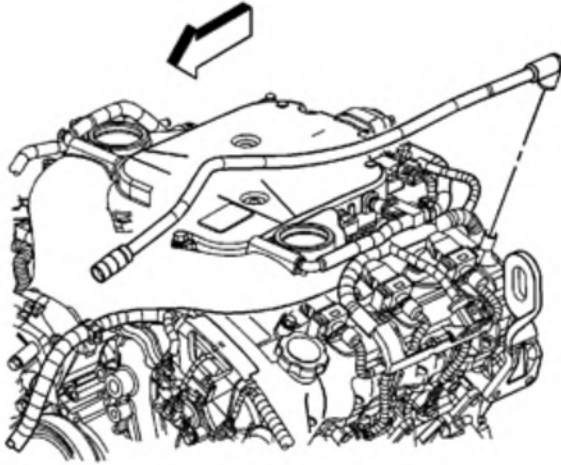


6. Remove the PCV dirty air tube (1) from the right camshaft cover (2).
7. Remove the PCV dirty air tube (1) from the intake manifold (3).

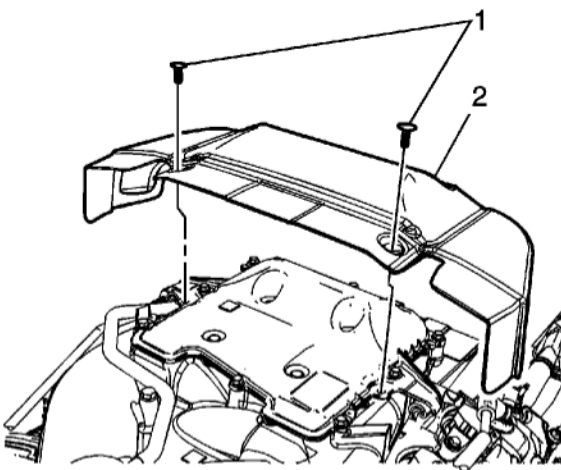
Installation Procedure



1. Install the PCV dirty air tube (1) to the intake manifold (3).
2. Install the PCV dirty air tube (1) to the right camshaft cover (2).



3. Install the PCV fresh air tube to the air inlet.
4. Install the PCV fresh air tube to the left camshaft cover.

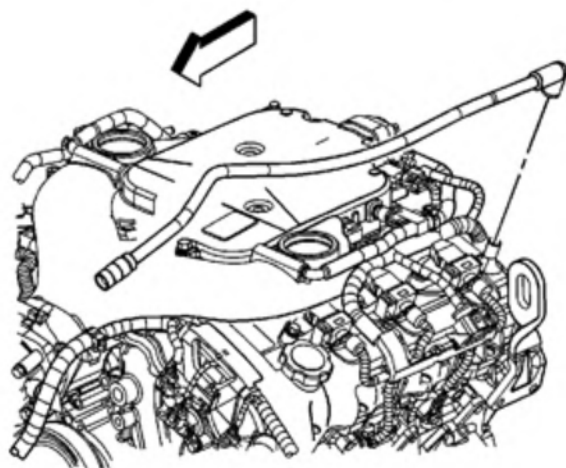


5. Install the intake manifold insulator (2)
6. Install two intake manifold insulator retaining pins (1)
7. Install the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#) .

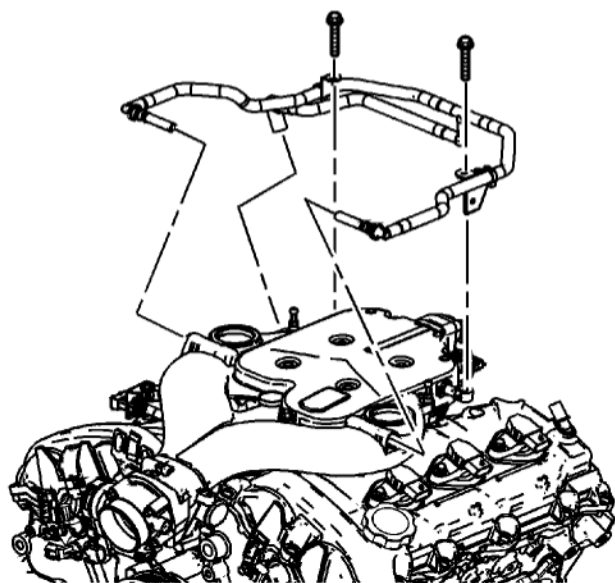
Positive Crankcase Ventilation Hose / Pipe / Tube Replacement (LP1, LY7)

Removal Procedure

1. Remove the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).



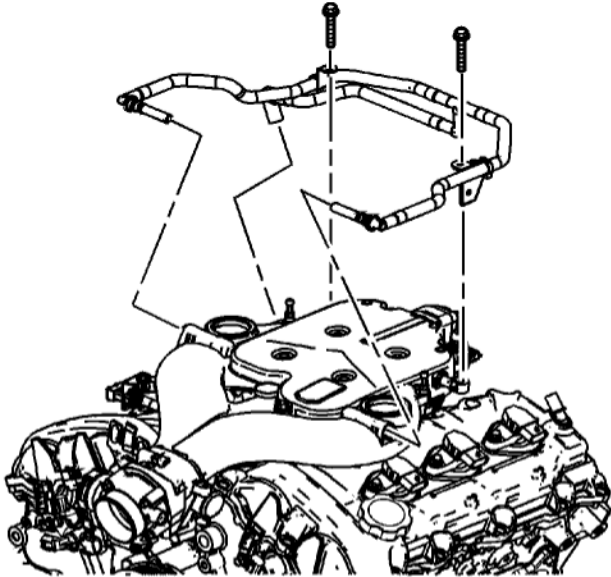
2. Remove the positive crankcase ventilation (PCV) fresh air tube from the left camshaft cover.
3. Remove the PCV fresh air tube from the air inlet.



4. Remove the PCV tube bracket bolts.

5. Remove the PCV dirty air tube from the right camshaft cover.
6. Remove the PCV dirty air tube from the intake manifold.

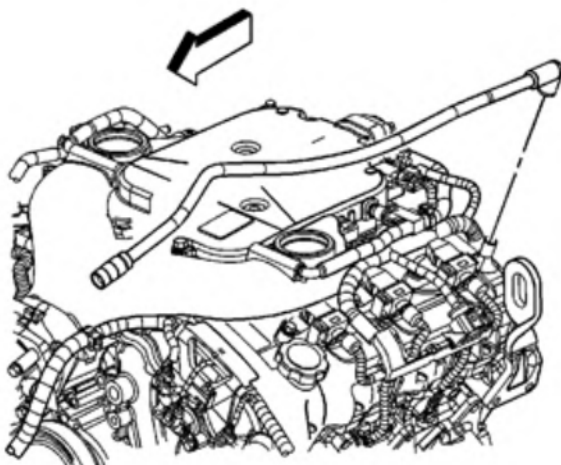
Installation Procedure



1. Install the PCV dirty air tube to the intake manifold.
2. Install the PCV dirty air tube to the right camshaft cover.

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

3. Install the PCV tube bracket bolts and tighten to **10 N·m (89 lb in)**.



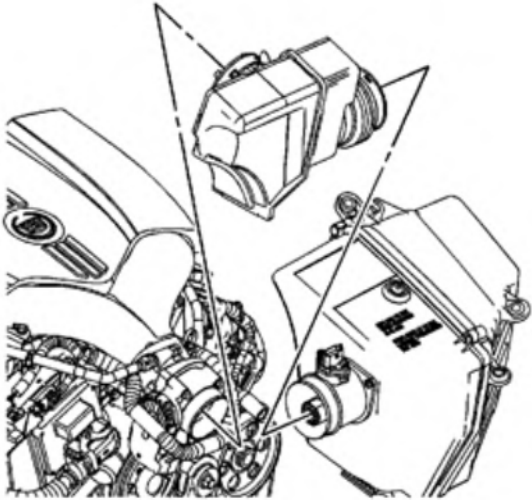
4. Install the PCV fresh air tube to the air inlet.

5. Install the PCV fresh air tube to the left camshaft cover.
6. Install the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).

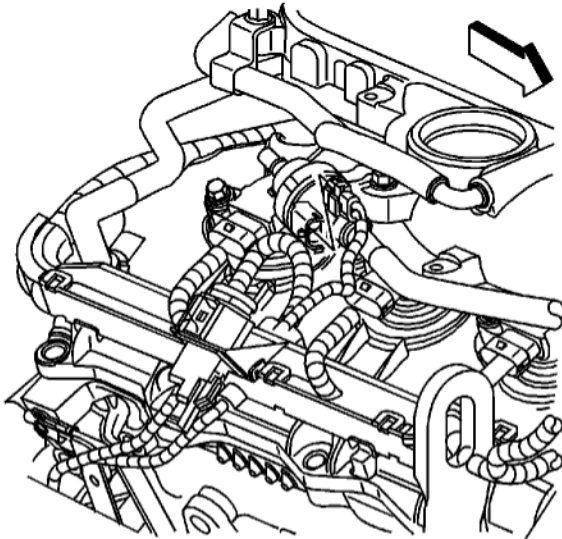
Intake Manifold Replacement (LY7)

Removal Procedure

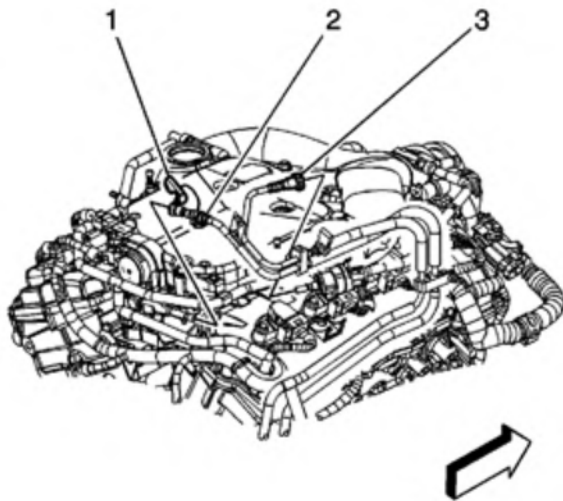
1. Turn the ignition OFF.
2. Remove the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).



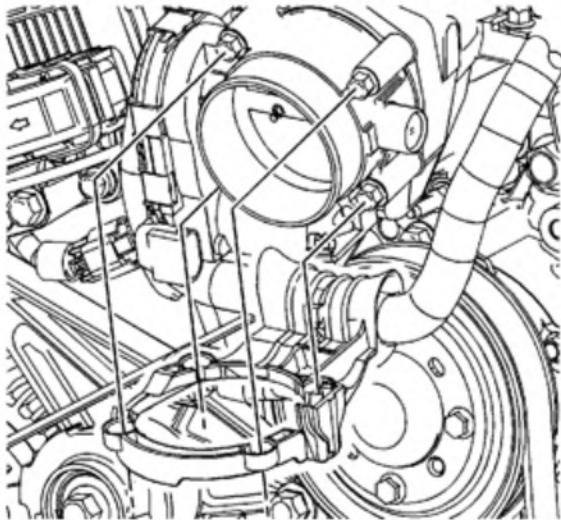
3. Remove the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
4. Disconnect the brake booster vacuum hose from the intake manifold.



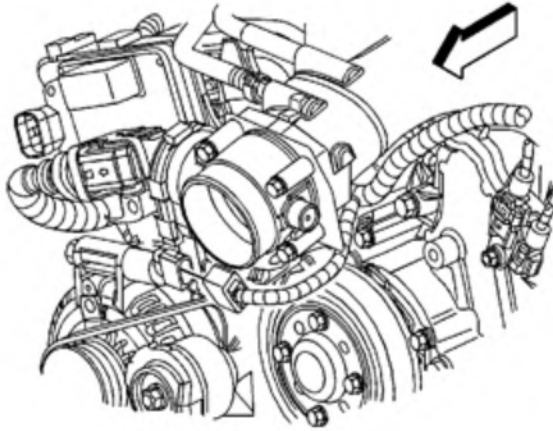
5. Disconnect the purge



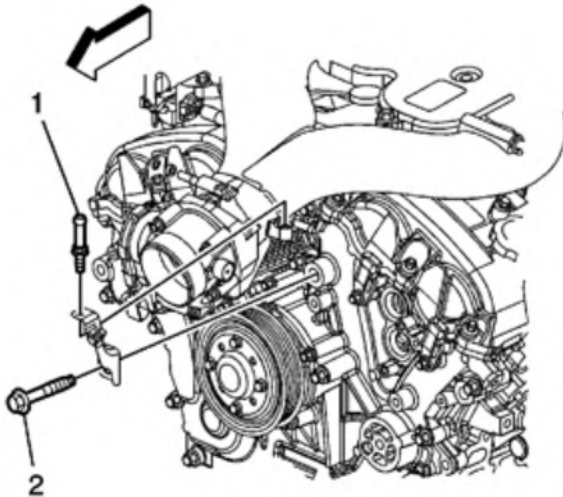
6. Disconnect the purge line (3) from the purge solenoid valve.



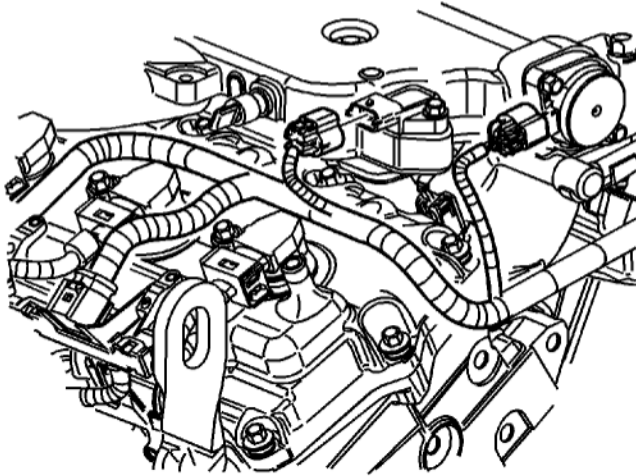
7. Remove the wiring harness retainer.



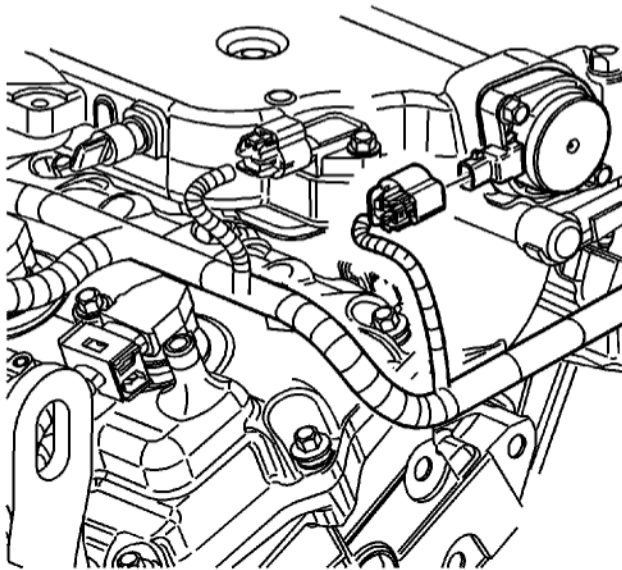
8. Disconnect the throttle body electrical connector.



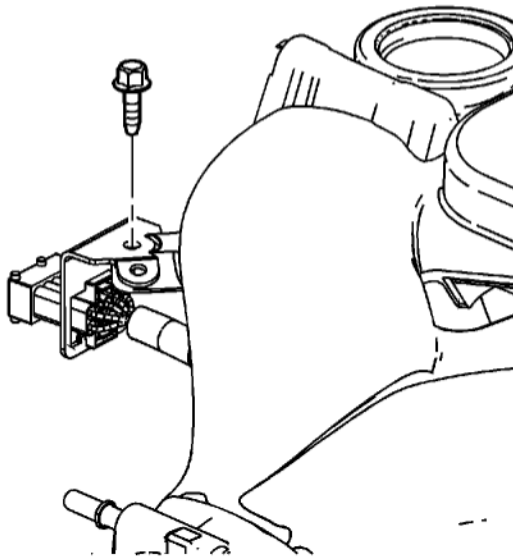
9. Remove the upper intake manifold brace stud (1), bolt (2), and brace.
10. Disconnect the positive crankcase ventilation (PCV) hose from the right bank camshaft cover.



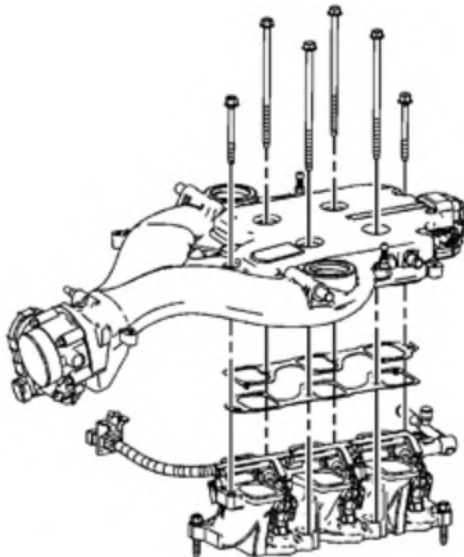
11. Disconnect the barometric pressure sensor electrical connector.



12. Disconnect the intake manifold runner control solenoid electrical connector.



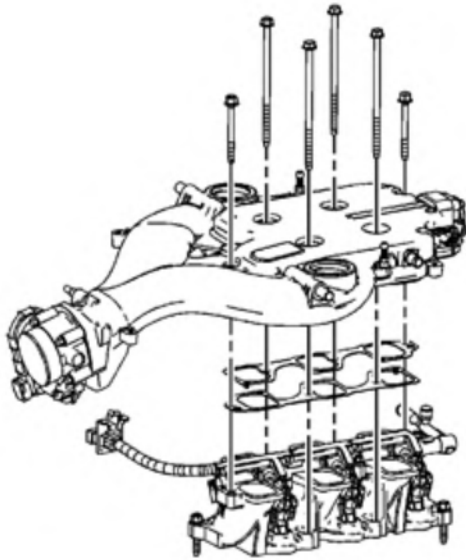
13. Remove the injector harness bracket bolt.
14. Remove the left bank ignition coil wiring harness from the bracket.



15. Remove the upper intake manifold bolts. Some deflection of the cowl panel may be necessary to extract the right rear bolt.
16. Remove the upper intake manifold with the throttle body.
17. If the upper intake manifold is being replaced, disassemble the intake manifold. Refer to [Intake Manifold Disassemble](#).
18. Clean and inspect the intake manifold. Refer to [Intake Manifold Cleaning and Inspection](#).

Installation Procedure

1. If the upper intake manifold is being replaced, assemble the intake manifold. Refer to [Intake Manifold Assemble](#).

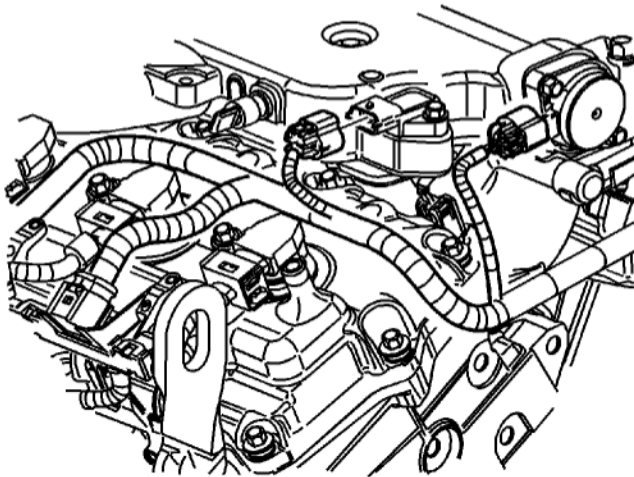


2. Install a NEW upper intake manifold gasket.
3. Install the upper intake manifold.

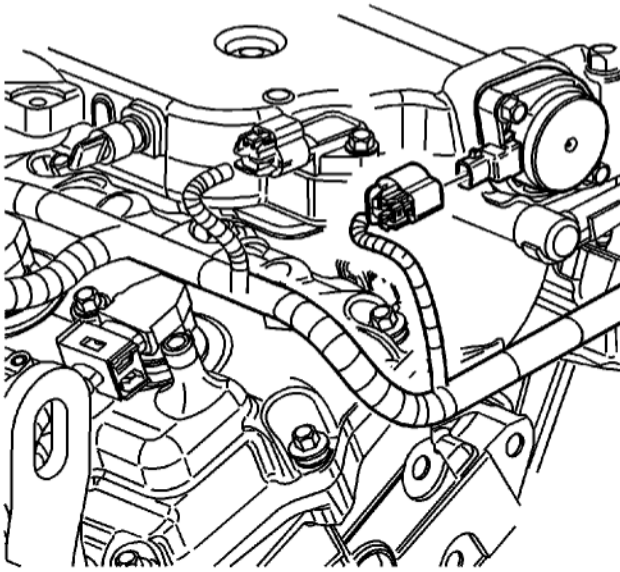
Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Tighten the intake manifold bolts in a circular pattern starting at the center (long bolts) and moving outward.

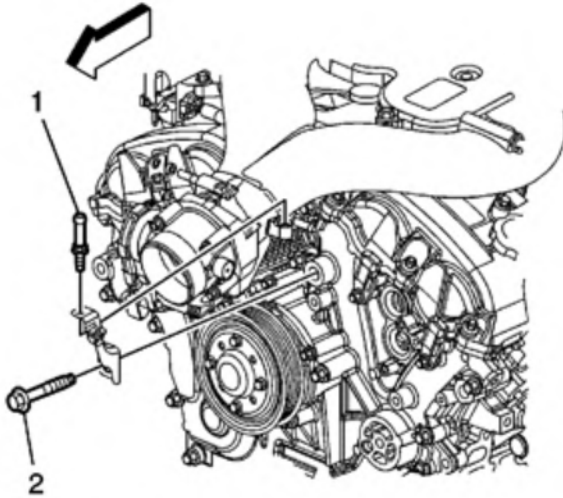
4. Install the upper intake manifold bolts and tighten to **23 N·m (17 lb ft)**.



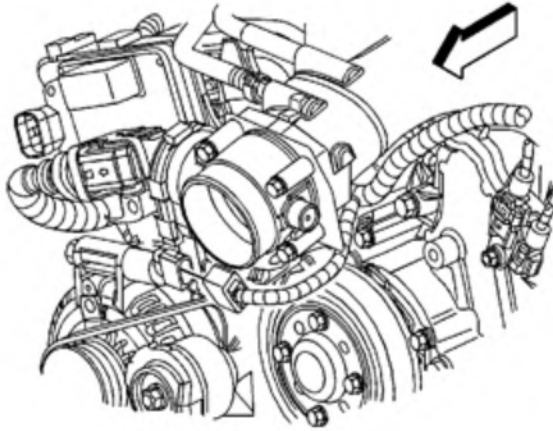
5. Connect the barometric pressure sensor electrical connector.



6. Connect the intake manifold runner control solenoid electrical connector.
7. Connect the PCV hose to the right bank camshaft cover.

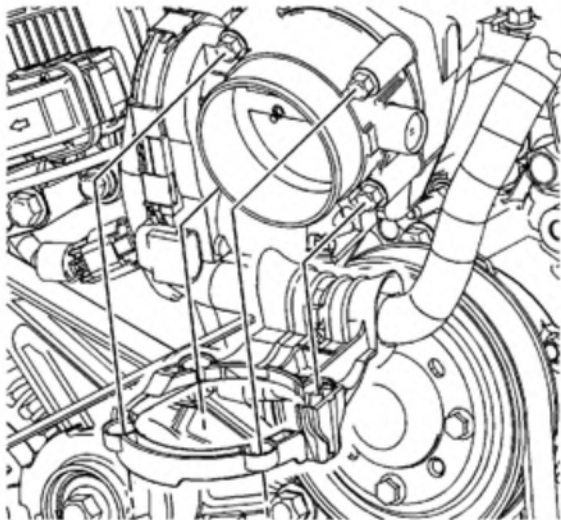


8. Install the upper intake manifold brace, stud (1) and bolt (2).
 - 8.1. Tighten the intake manifold brace bolt (2) to **65 N·m (48 lb ft)**.
 - 8.2. Tighten the intake manifold brace stud (1) to **10 N·m (89 lb in)**.

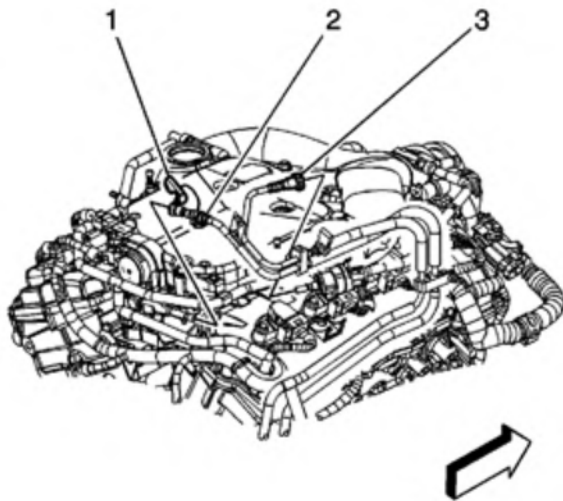


Caution: Ensure proper engagement of the wiring harness connector. The wiring harness connector must be installed straight onto the component connector and firmly seated. Visually inspect the connector to ensure that the connector latches are engaged and locked. Any damage to the connector or wiring must be repaired. Failure to follow this procedure can lead to an intermittent electrical connection, driveability concerns, and/or wiring harness or wiring harness connector damage or failure.

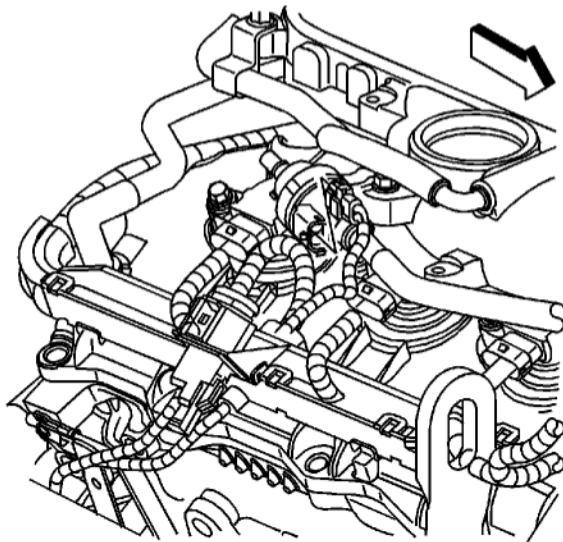
9. Connect the electrical connector to the throttle body.



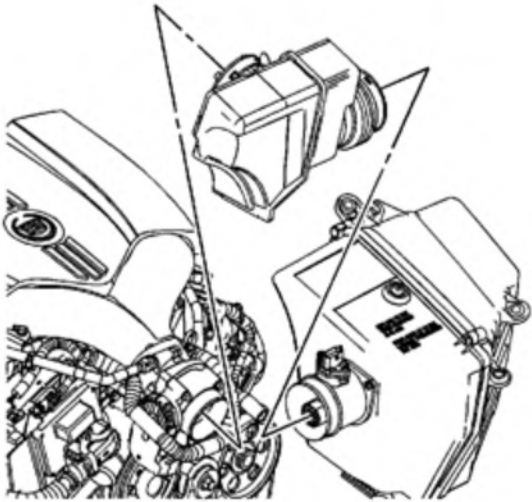
10. Install the wiring harness retainer.



11. Connect the purge line (3) to the purge solenoid valve.



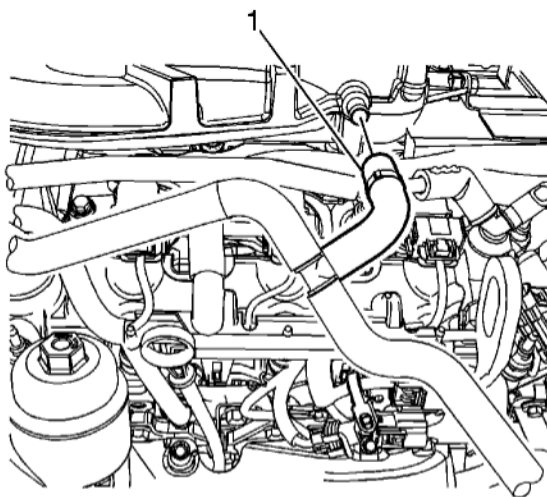
12. Connect the purge solenoid valve electrical connector.
13. Connect the brake booster vacuum hose to the intake manifold.



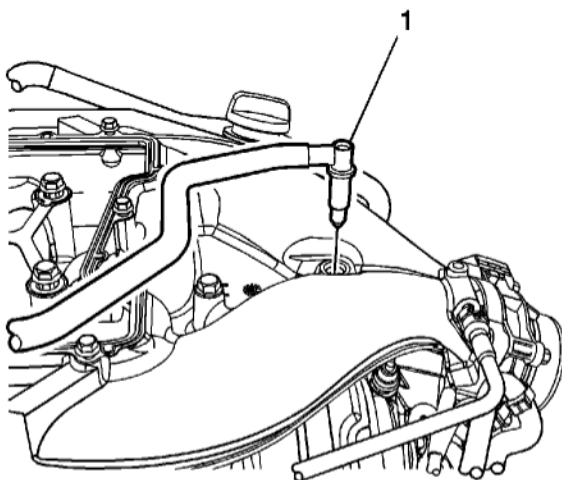
14. Install the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
15. Install the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).

Intake Manifold Replacement (LLT)

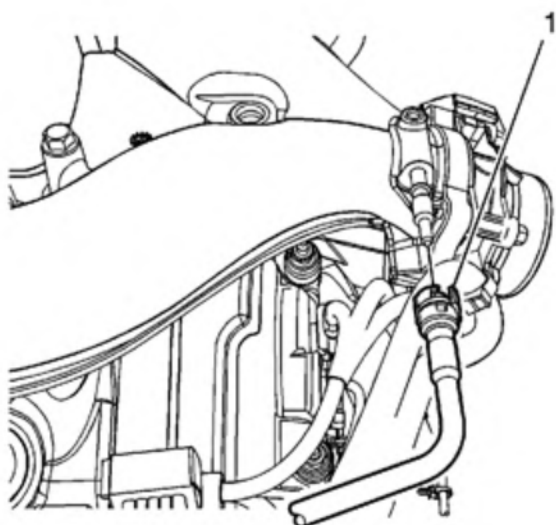
Removal Procedure



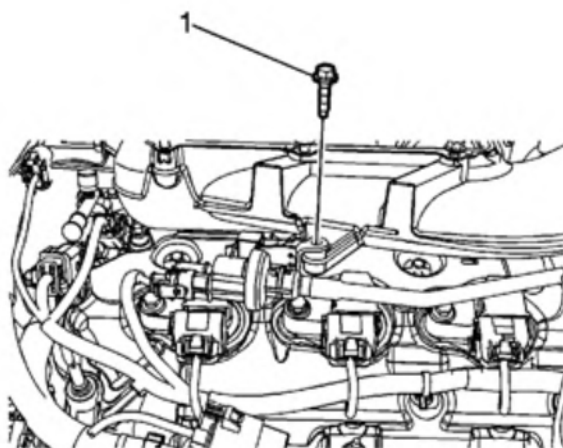
1. Remove the fuel pipe shield. Refer to [Fuel Pipe Shield Replacement](#).
2. Remove the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
3. Disconnect the brake booster vacuum hose (1) from the intake manifold.



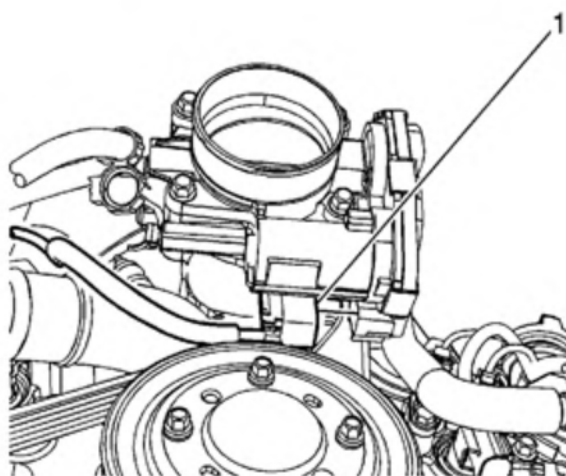
4. Disconnect the positive crankcase ventilation (PCV) valve (1) from the intake manifold.



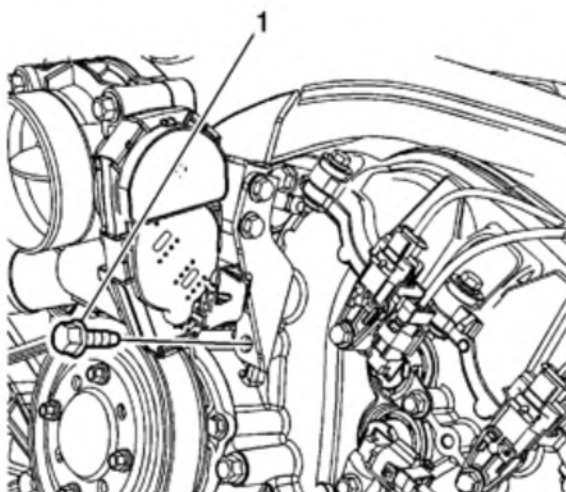
5. Disconnect the purge line (1) from the intake manifold.



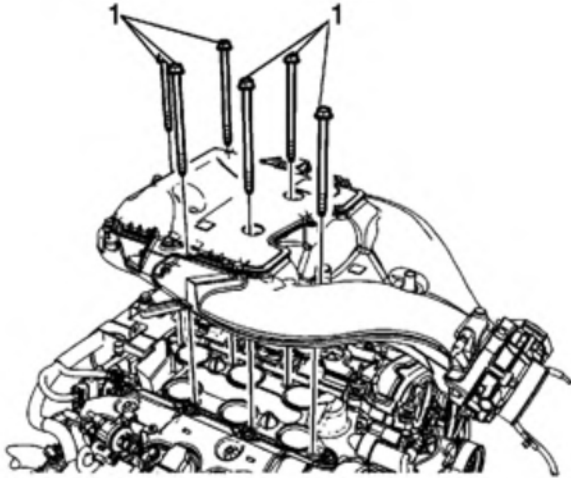
6. Remove the purge solenoid bolt (1) from the intake manifold and set the purge solenoid aside.



7. Disconnect the throttle body electrical connector (1).

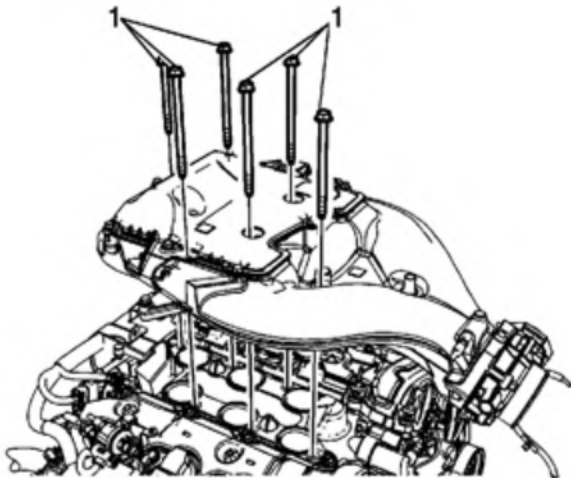


8. Remove the intake manifold bracket bolt (1).
9. Unclip the engine wiring harness from the intake manifold.



10. Remove the intake manifold bolts (1).
11. Remove the intake manifold and gasket.
12. If replacing the intake manifold, disassemble the intake manifold. Refer to [Intake Manifold Disassemble](#).

Installation Procedure



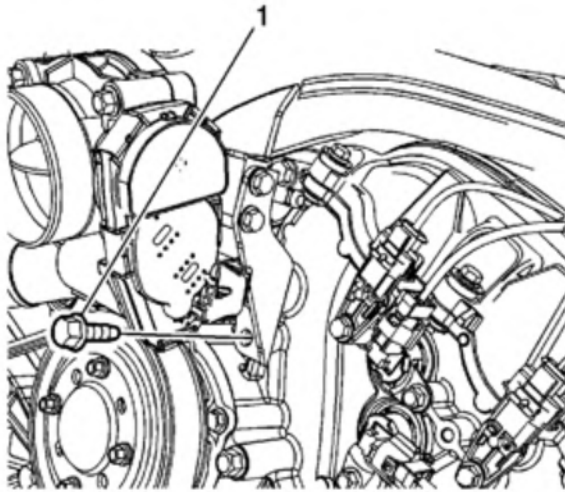
1. If installing a new intake manifold, assemble the intake manifold. Refer to [Intake Manifold Assemble](#).

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

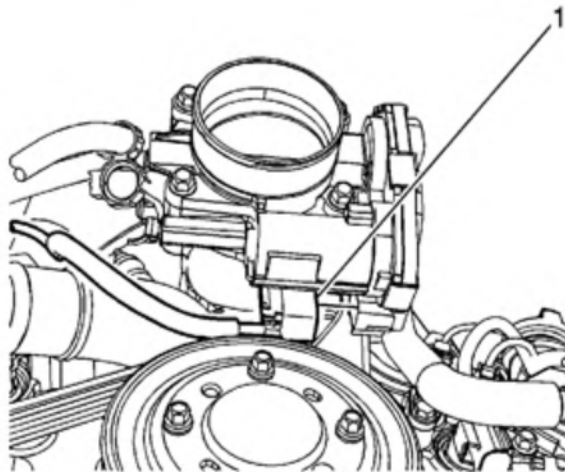
2. Install the NEW intake manifold gasket.

Note: Tighten the intake manifold bolts in a circular pattern starting at the center (long bolts) and moving outward.

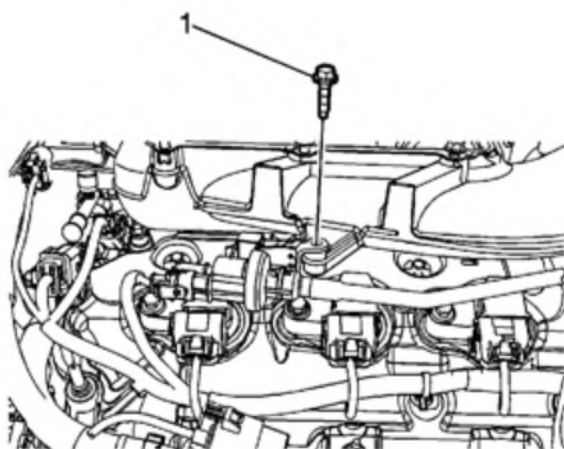
3. Install the intake manifold.
4. Install the intake manifold bolts (1) and tighten to **23 N·m (17 lb ft)**.



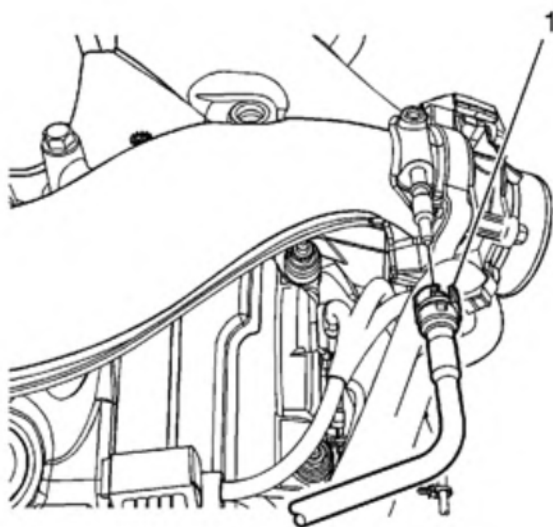
5. Clip the engine wiring harness from the intake manifold.
6. Install the intake manifold bracket bolt (1) and tighten to **23 N·m (17 lb ft)**.



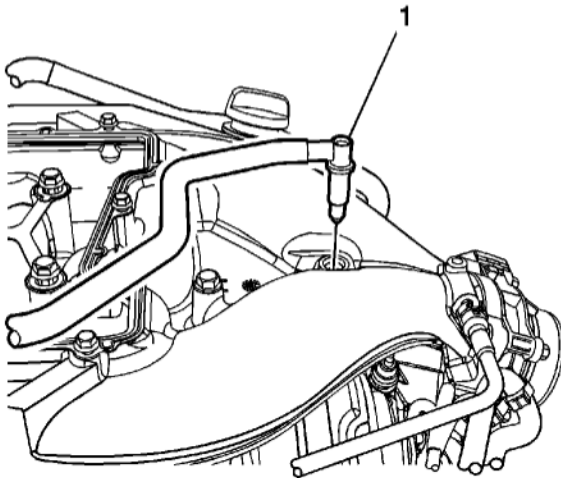
7. Connect the throttle body electrical connector (1).



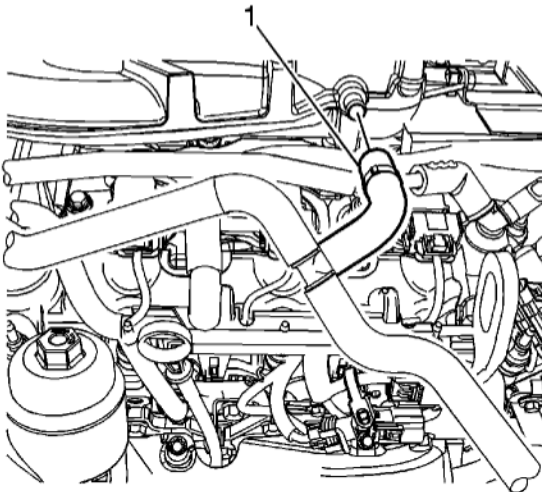
8. Install the purge solenoid bolt (1) to the intake manifold.



9. Connect the purge line (1) to the intake manifold.



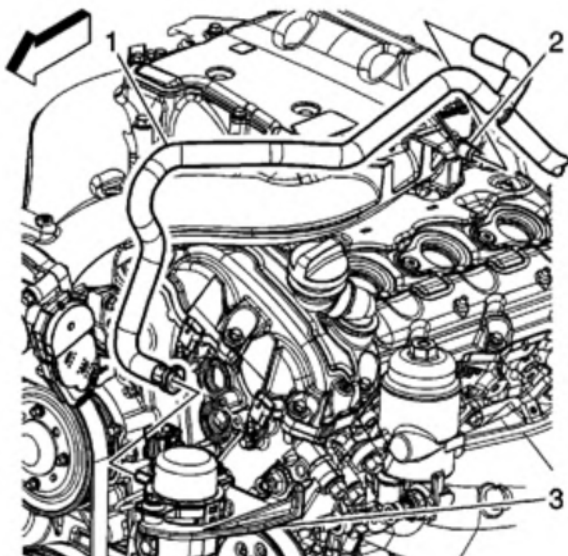
10. Connect the positive crankcase ventilation (PCV) hose (1) to the intake manifold.



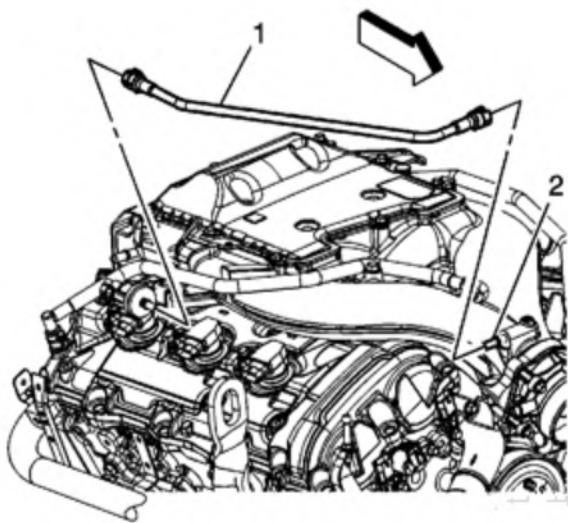
11. Connect the brake booster vacuum hose (1) from the intake manifold.
12. Install Remove the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
13. Install the fuel pipe shield. Refer to [Fuel Pipe Shield Replacement](#).

Upper Intake Manifold Replacement (LP1, LY7)

Removal Procedure

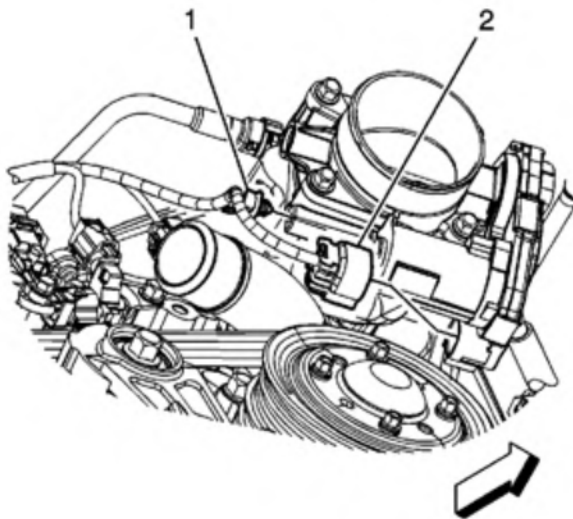


1. Turn the ignition OFF.
2. Remove the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).
3. Remove the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
4. Disconnect the brake booster vacuum hose (1) from the intake manifold (2) and the power steering booster pump (3).

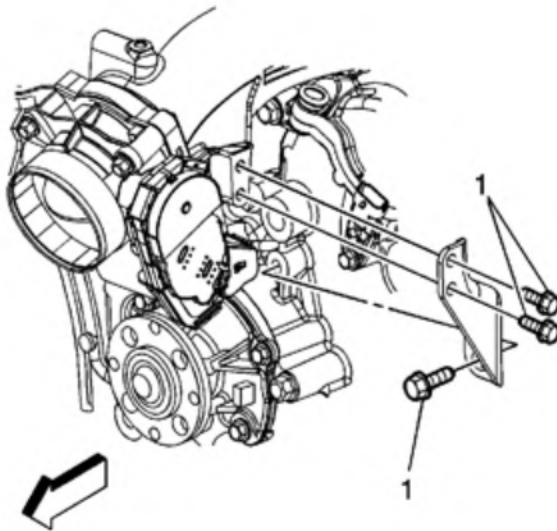




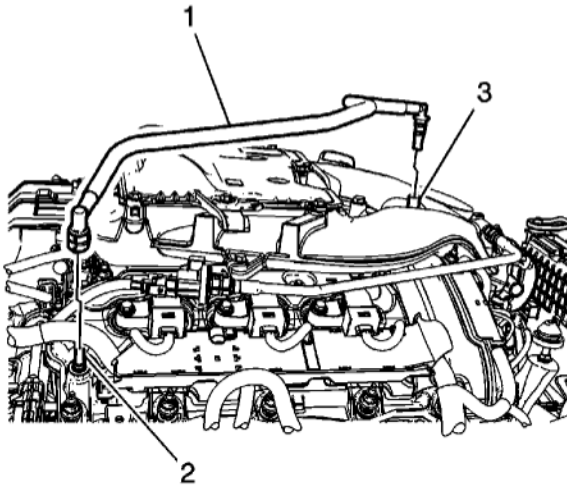
5. Remove the purge solenoid valve bracket.
6. Disconnect the purge line (1) from the intake manifold (2).



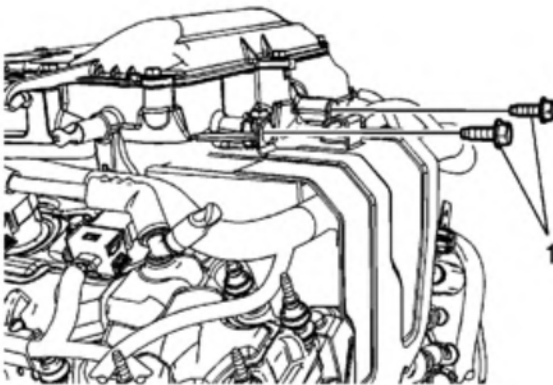
7. Remove the throttle body harness electrical harness retainer (1).
8. Disconnect the throttle body electrical connector (2).



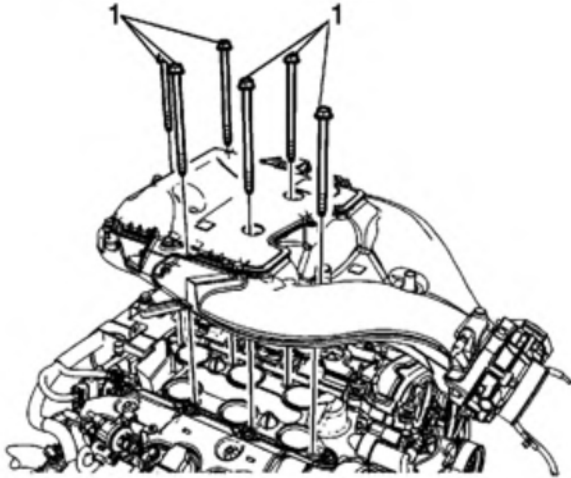
9. Remove the intake manifold brace bolts (1).
10. Remove the intake manifold brace.



11. Disconnect the positive crankcase ventilation (PCV) hose (1) from the intake manifold (3).

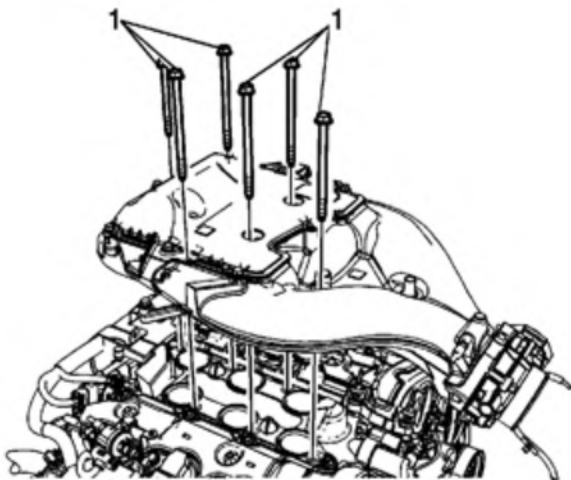


12. Unclip the engine harness from the left side of the intake manifold.
13. Remove the intake manifold rear heat shield bolts (1).



14. Remove the intake manifold bolts (1). Some deflection of the cowl panel may be necessary to extract the right rear bolt.
15. Remove the intake manifold with the throttle body.
16. If the intake manifold is being replaced, disassemble the intake manifold. Refer to [Intake Manifold Disassemble](#).
17. Clean and inspect the intake manifold. Refer to [Intake Manifold Cleaning and Inspection](#).

Installation Procedure



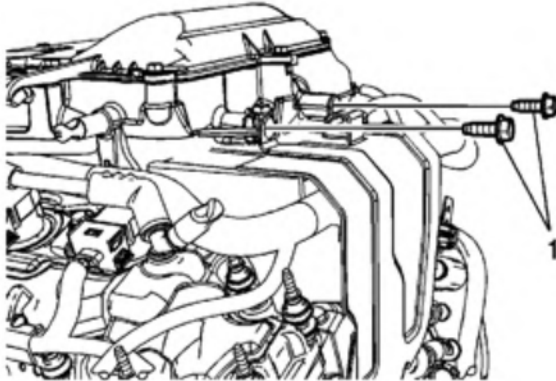
1. If the intake manifold is being replaced, assemble the intake manifold. Refer to [Intake Manifold Assemble](#).
2. Install a NEW intake manifold gasket.

3. Install the intake manifold.

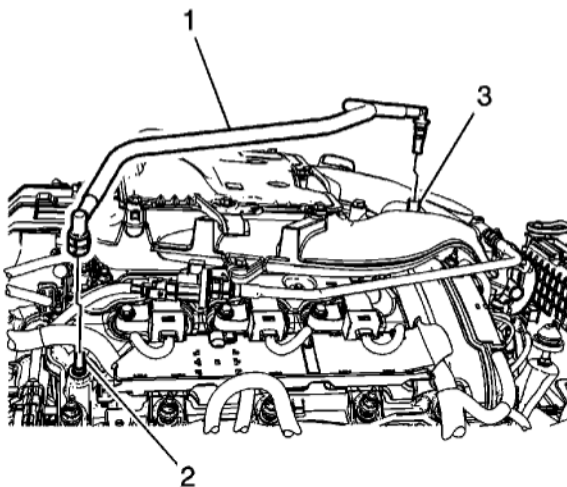
Caution: Refer to [Fastener Caution](#) in the Preface section.

Note: Tighten the intake manifold bolts in a circular pattern starting at the center (long bolts) and moving outward.

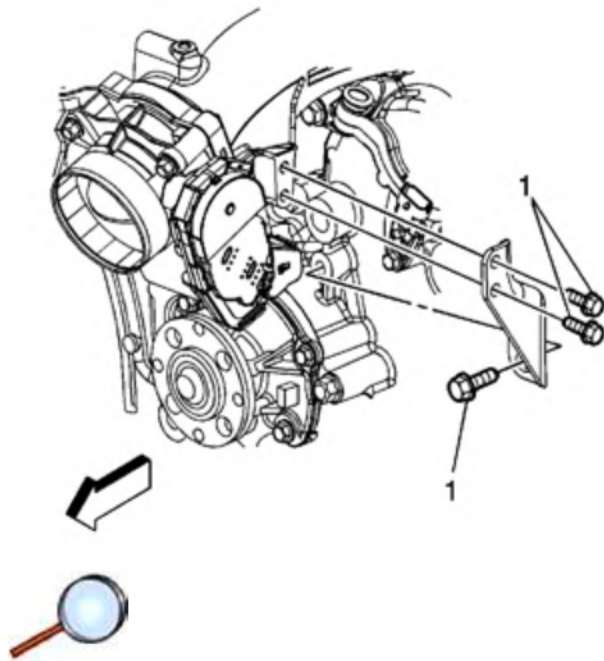
4. Install the intake manifold bolts (1) and tighten to **23 N·m (17 lb ft)**.



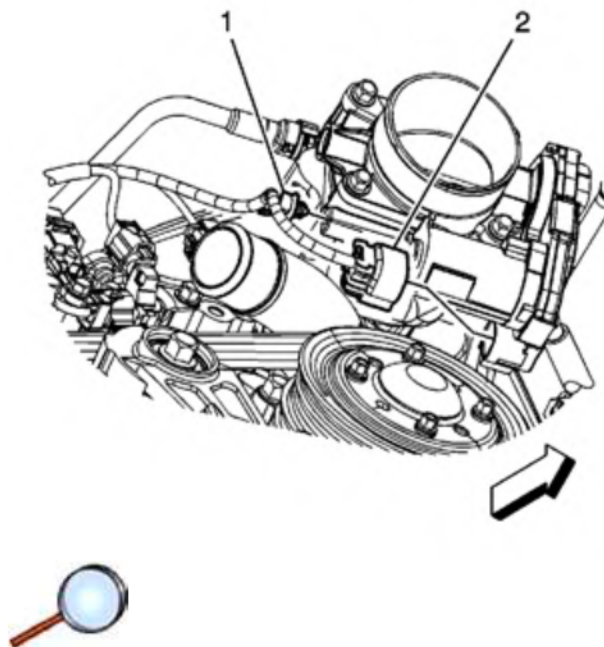
5. Install the intake manifold rear heat shield bolts (1) and tighten to **23 N·m (17 lb ft)**.
6. Clip the engine harness from the left side of the intake manifold.



7. Connect the positive crankcase ventilation (PCV) hose (1) to the intake manifold (3).

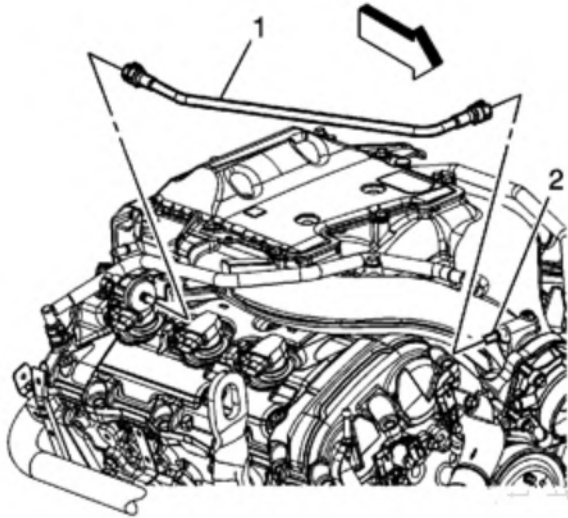


8. Position the intake manifold brace.
9. Install the intake manifold brace bolts (1) and tighten to **23 N·m (17 lb ft)**.

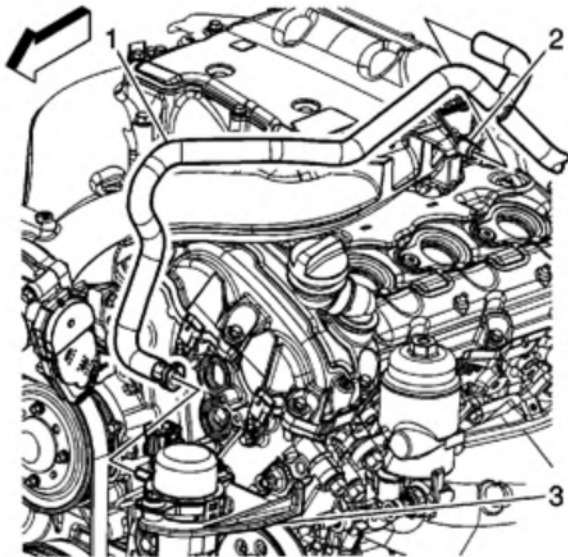


Caution: Ensure proper engagement of the wiring harness connector. The wiring harness connector must be installed straight onto the component connector and firmly seated. Visually inspect the connector to ensure that the connector latches are engaged and locked. Any damage to the connector or wiring must be repaired. Failure to follow this procedure can lead to an intermittent electrical connection, driveability concerns, and/or wiring harness or wiring harness connector damage or failure.

10. Connect the electrical connector (2) to the throttle body.
11. Install the throttle body harness electrical harness retainer (1).



12. Connect the purge line (1) to the intake manifold (2).
13. Install the purge solenoid valve bracket and bolts to tighten to **23 N·m (17 lb ft)**.



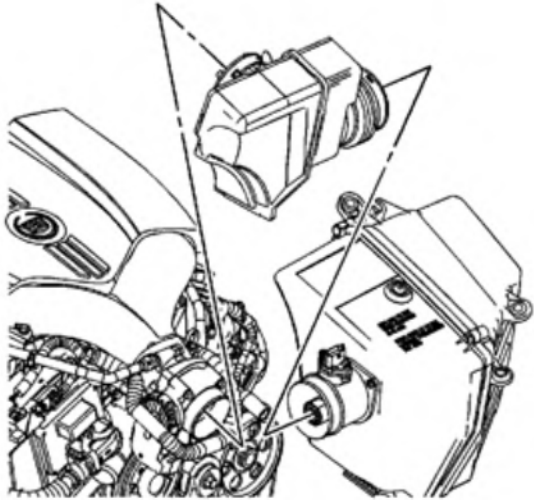
14. Connect the brake booster vacuum hose (1) to the power steering booster pump (3) and the intake manifold (2).
15. Install the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).

Install the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).

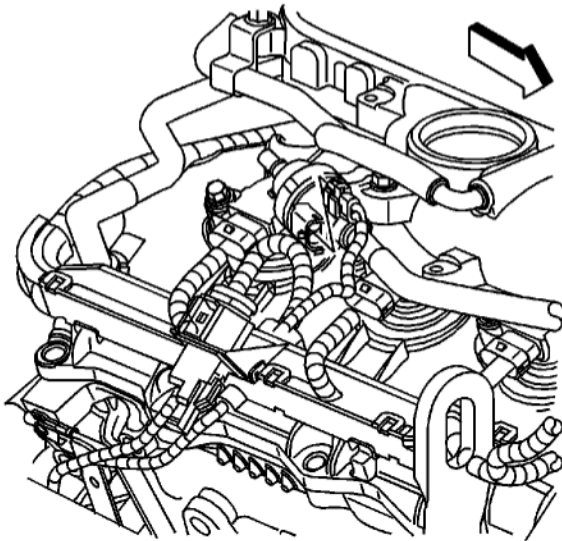
Lower Intake Manifold Replacement (LP1, LY7)

Removal Procedure

1. Turn the ignition OFF.
2. Remove the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).

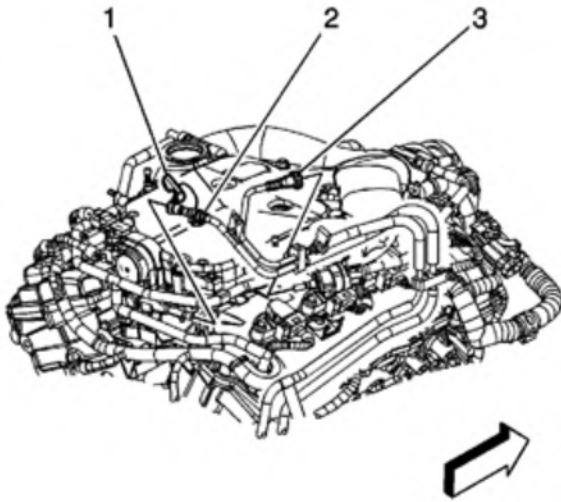


3. Remove the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
4. Note the booster hose routing. Disconnect the brake booster check valve and hose from the brake booster.
5. Reposition the brake booster hose to the intake manifold.

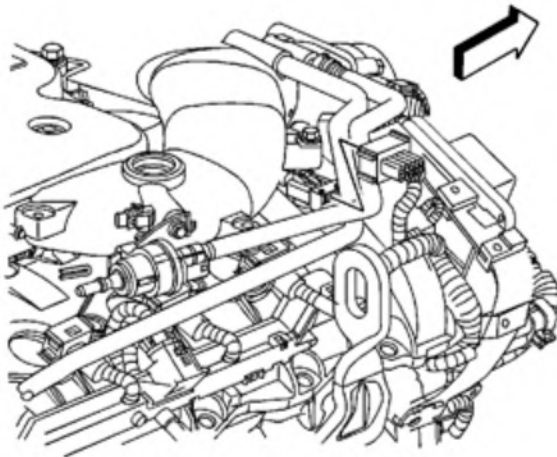




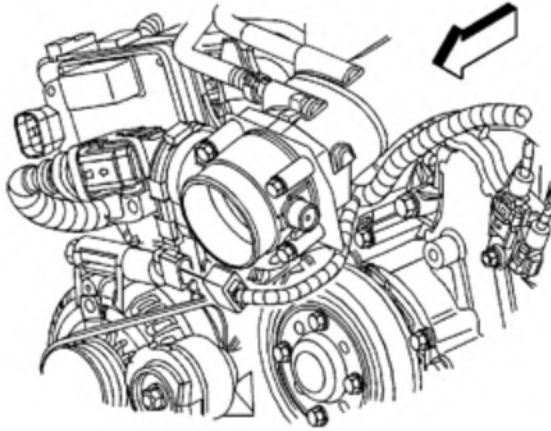
6. Disconnect the purge solenoid valve electrical connector.



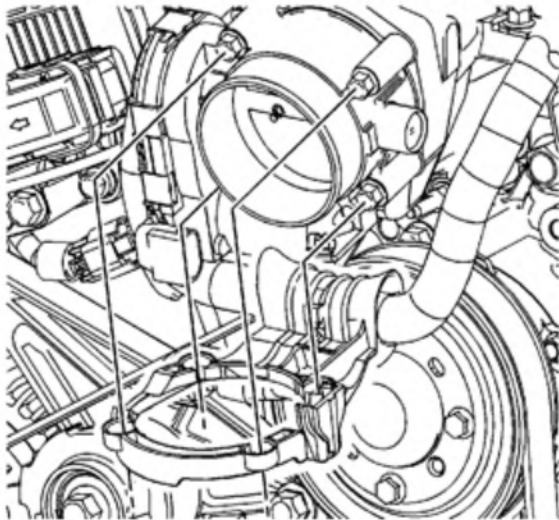
7. Disconnect the purge line (3) from the purge solenoid valve.



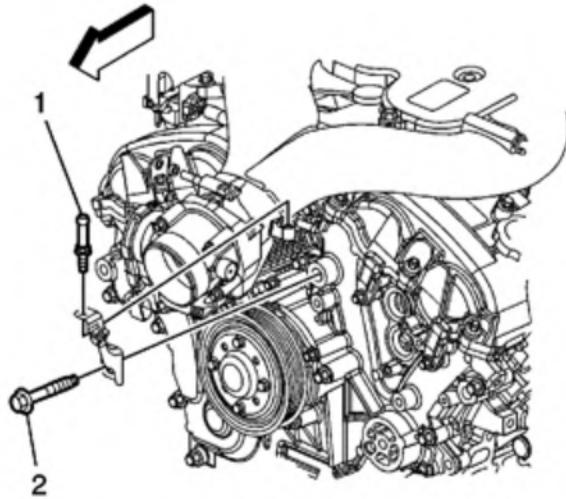
8. Disconnect the fuel injector harness electrical connector.



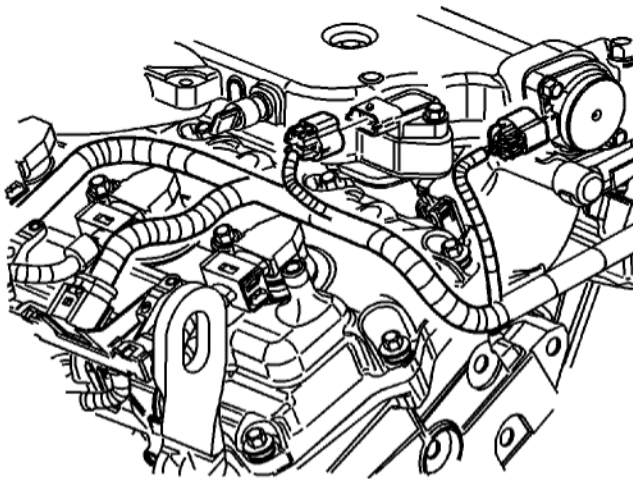
9. Disconnect the throttle body electrical connector.



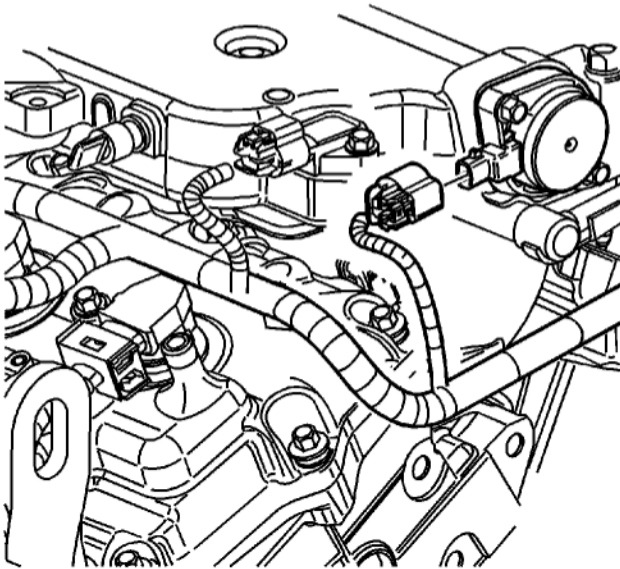
10. Remove the wiring harness retainer.



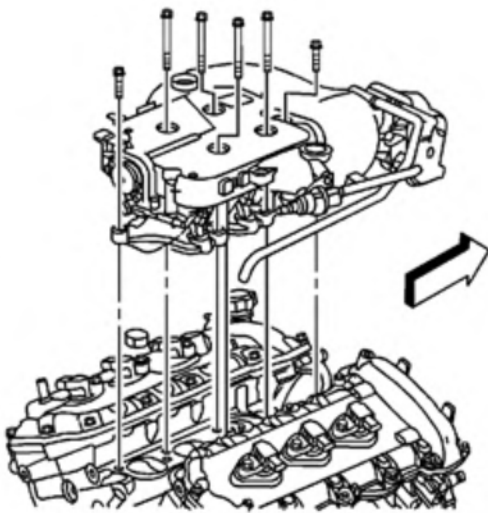
11. Remove the upper intake manifold brace stud (1) and bolt (2), reposition the brace with the wiring harness.
12. Remove the wiring harness retainer from the right side of the throttle body.
13. Disconnect the positive crankcase ventilation (PCV) hose from the right bank camshaft cover.



14. Disconnect the barometric pressure sensor electrical connector.



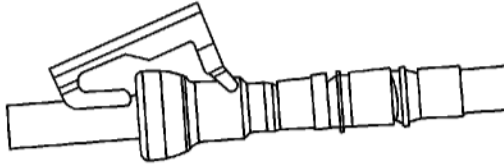
15. Disconnect the intake manifold runner control solenoid electrical connector.
16. Remove the left bank ignition coil wiring harness from the bracket.



Note:

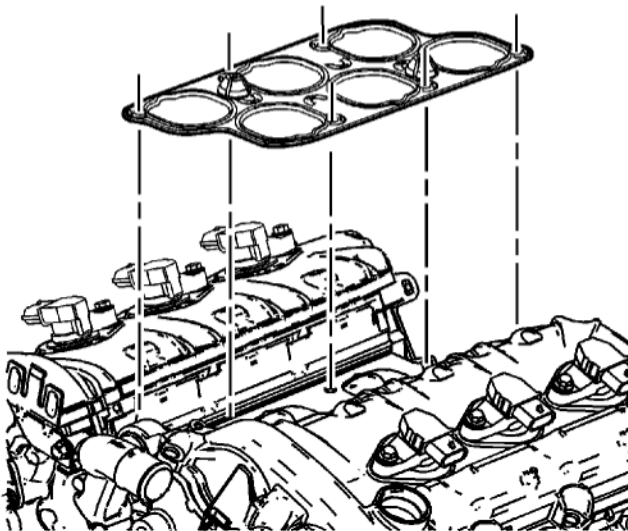
- Do not remove the upper to lower intake manifold bolts.
- DO NOT kink or damage the fuel pipe.

17. Remove the intake manifold bolts.
18. Reposition the intake manifold to gain access to the fuel pipe connector.



19. Remove the fuel feed pipe retainer.
20. Disconnect the fuel feed pipe from the fuel rail. Refer to [Metal Collar Quick Connect Fitting Service](#).
21. Disassemble the intake manifold as necessary. Refer to [Intake Manifold Disassemble](#).
22. Clean and inspect the intake manifold and the sealing surfaces. Refer to [Intake Manifold Cleaning and Inspection](#).

Installation Procedure

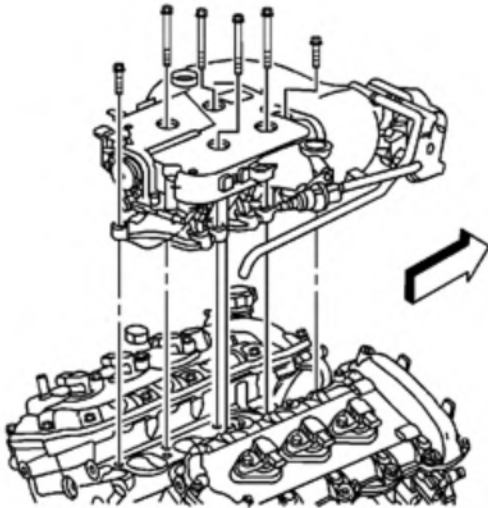


1. Assemble the intake manifold as necessary. Refer to [Intake Manifold Assemble](#).

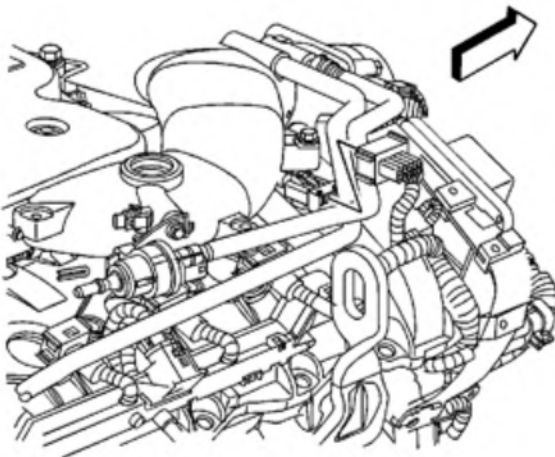
Note: Inspect and replace the lower intake manifold gasket only if the gasket is worn or

damaged.

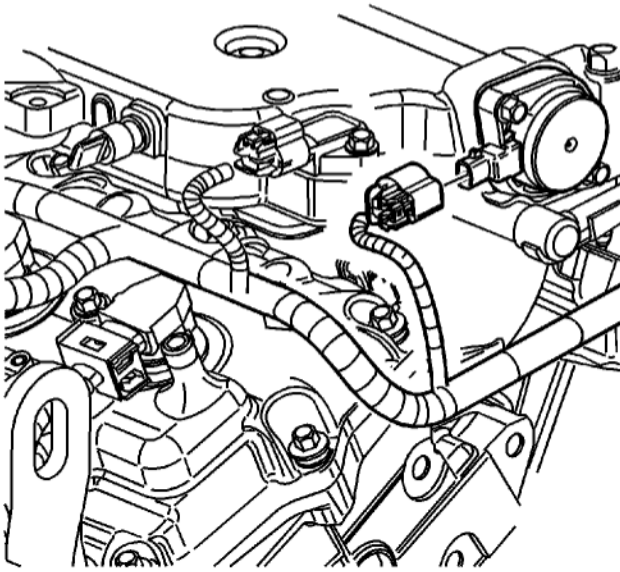
2. Install the lower intake manifold gasket.



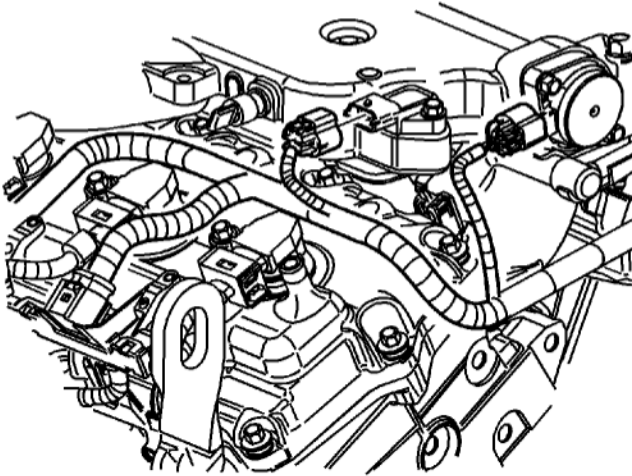
3. Install the intake manifold. Refer to [Intake Manifold Installation](#).



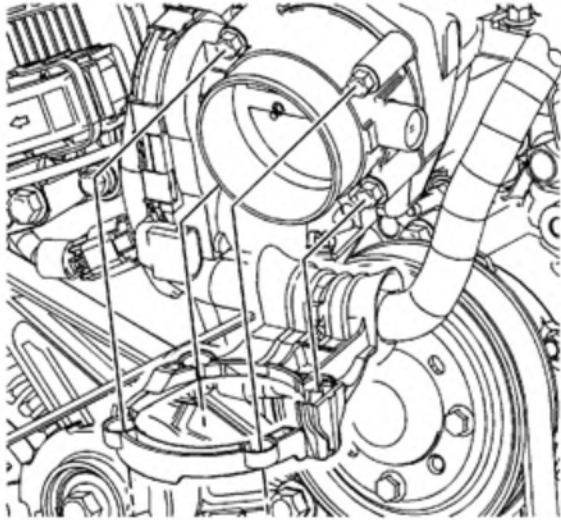
4. Connect the fuel injector harness electrical connector.



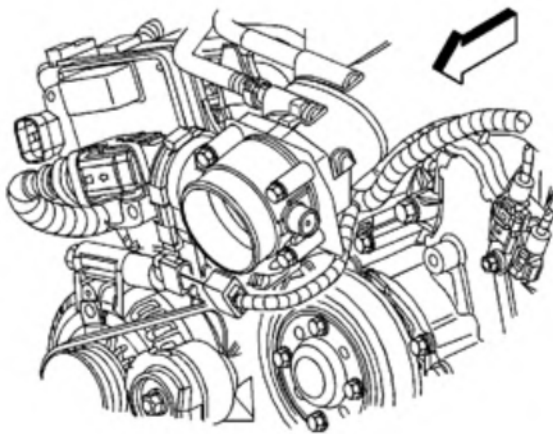
5. Connect the intake manifold runner control solenoid electrical connector.



6. Connect the barometric pressure sensor electrical connector.
7. Connect the PCV hose from the right bank camshaft cover.

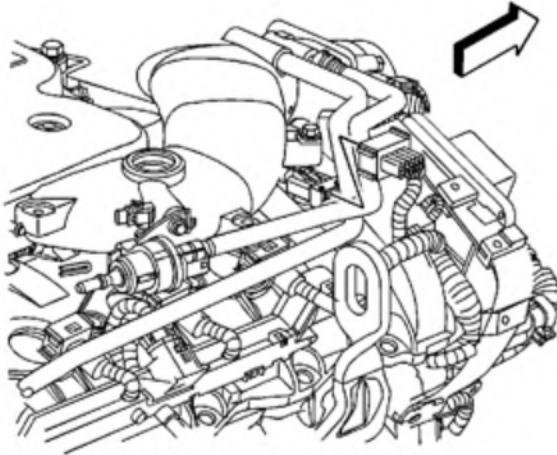


8. Install the wiring harness retainer.

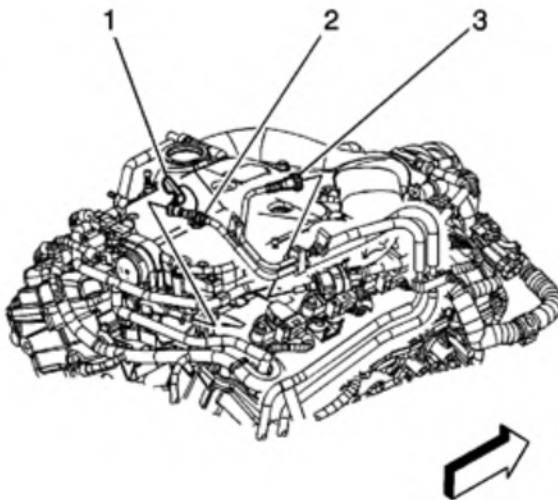


Caution: Ensure proper engagement of the wiring harness connector. The wiring harness connector must be installed straight onto the component connector and firmly seated. Visually inspect the connector to ensure that the connector latches are engaged and locked. Any damage to the connector or wiring must be repaired. Failure to follow this procedure can lead to an intermittent electrical connection, driveability concerns, and/or wiring harness or wiring harness connector damage or failure.

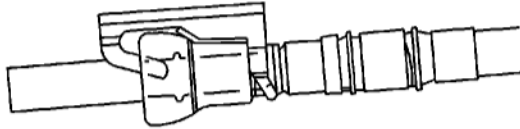
9. Connect the throttle body electrical connector.



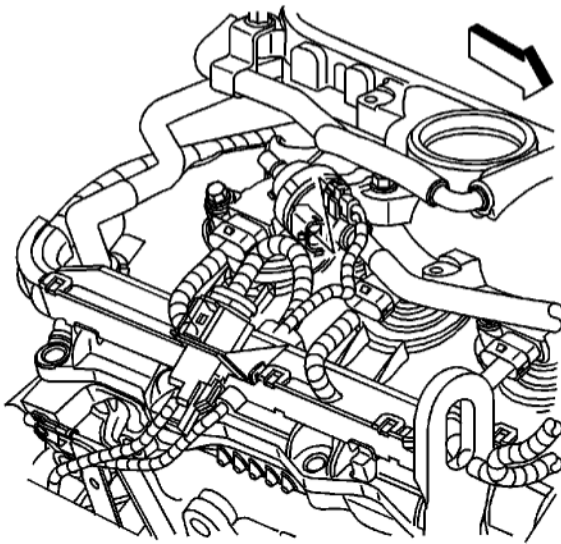
10. Connect the fuel injector harness electrical connector.



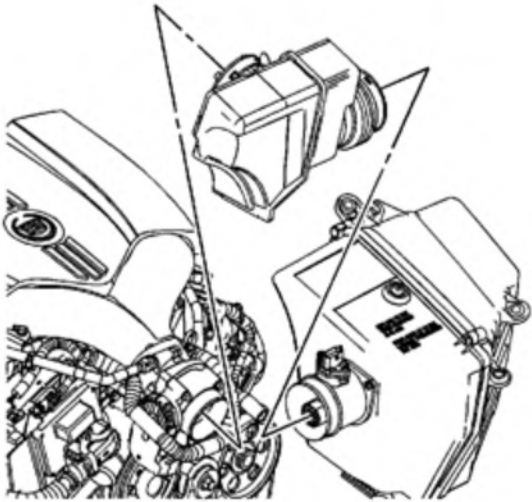
11. Connect the fuel feed pipe (1) to the fuel rail. Refer to [Metal Collar Quick Connect Fitting Service](#).
12. Connect the purge line (3) to the purge solenoid valve.



13. Install the fuel pipe retainer.



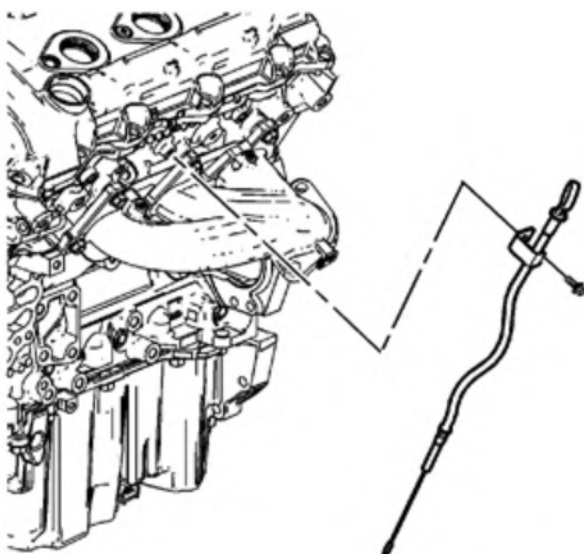
14. Connect the purge solenoid valve electrical connector.
15. Install the brake booster hose and check valve to the brake booster.



16. Install the air outlet duct. Refer to [Air Cleaner Outlet Duct Replacement](#).
17. Install the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).

Oil Level Indicator Tube Replacement (LP1, LY7)

Removal Procedure

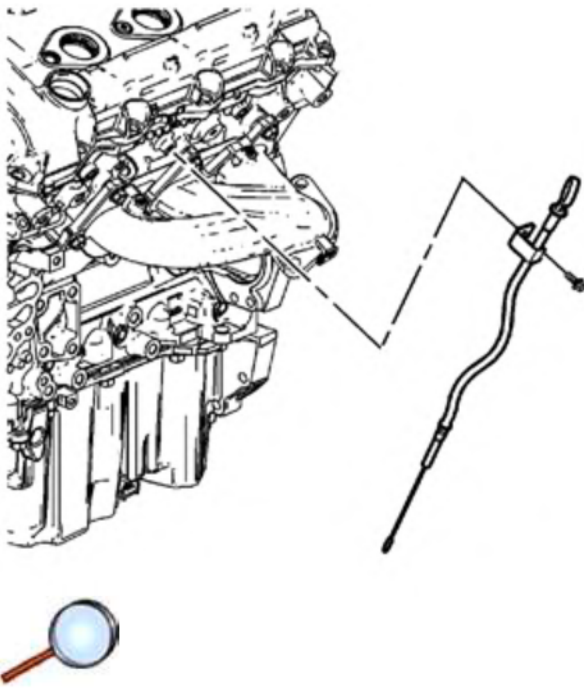


1. Turn the ignition OFF.
2. Remove the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#).
3. Remove the oil level indicator from the oil level indicator tube.
4. Remove the oil level indicator tube bolt.
5. Raise the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
6. Remove the knock sensor. Refer to [Knock Sensor Replacement - Bank 2](#).
7. Remove the heat shield clip from the oil level indicator tube.
8. Lower the vehicle.

Important: Note the location and orientation of the secondary (small square) heat shield.

9. Remove the oil level indicator tube up through the exhaust manifold.
10. If you are replacing only the oil level indicator tube seal, remove and discard the old seal.

Installation Procedure

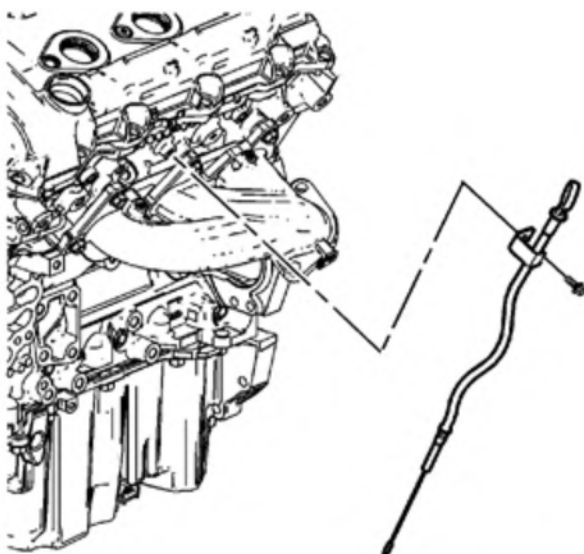


Important: Ensure that the secondary (small square) heat shield is properly installed to the oil level indicator tube as noted during removal.

1. Install the oil level indicator and tube. Refer to [Oil Level Indicator and Tube Installation](#) .
2. Raise the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
3. Install the knock sensor. Refer to [Knock Sensor Replacement - Bank 2](#) .
4. Install the heat shield clip to the oil level indicator tube as noted during removal.
5. Lower the vehicle.
6. Install the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#) .

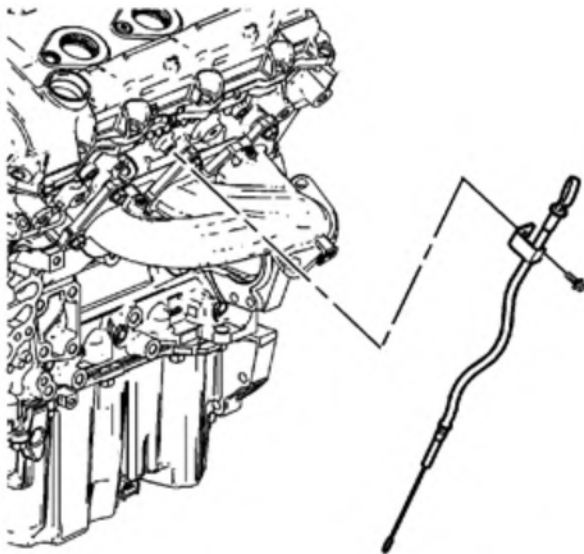
Oil Level Indicator Tube Replacement (LLT)

Removal Procedure



1. Remove the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#).
2. Remove the oil level indicator from the oil level indicator tube.
3. Remove the oil level indicator tube bolt.
4. Remove the engine splash shield. Refer to [Engine Splash Shield Replacement](#).
5. Lower the vehicle.
6. Remove the oil level indicator tube up through the exhaust manifold.
7. If you are replacing only the oil level indicator tube seal, remove and discard the old seal.

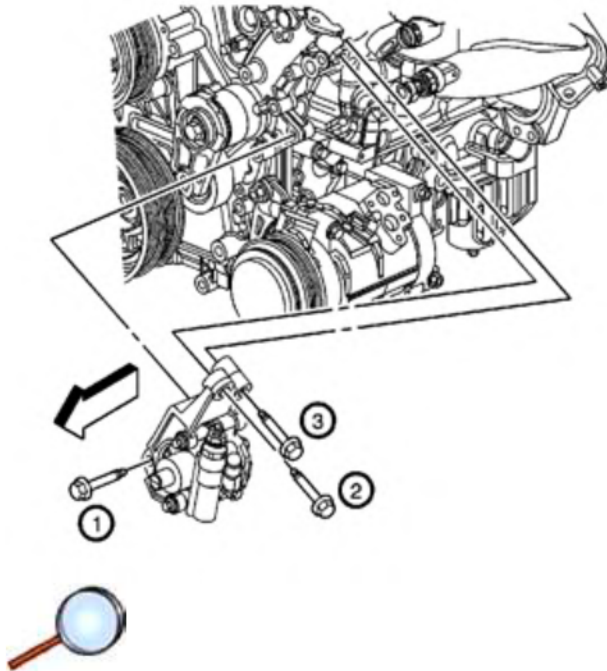
Installation Procedure



1. Install the oil level indicator and tube. Refer to [Oil Level Indicator and Tube Installation](#).
2. Install the engine splash shield. Refer to [Engine Splash Shield Replacement](#).
3. Lower the vehicle.
4. Install the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#).

Oil Filter Adapter Replacement

Removal Procedure



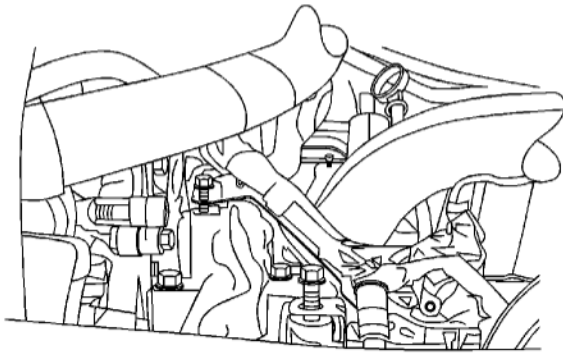
1. Disconnect the battery. Refer to [Battery Negative Cable Disconnection and Connection](#).
2. Remove the oil filter. Refer to [Engine Oil and Oil Filter Replacement](#).
3. Remove the A/C compressor and power steering drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).
4. Disconnect the oil pressure sensor electrical connector.

Note: Do not disconnect the power steering lines from the power steering pump.

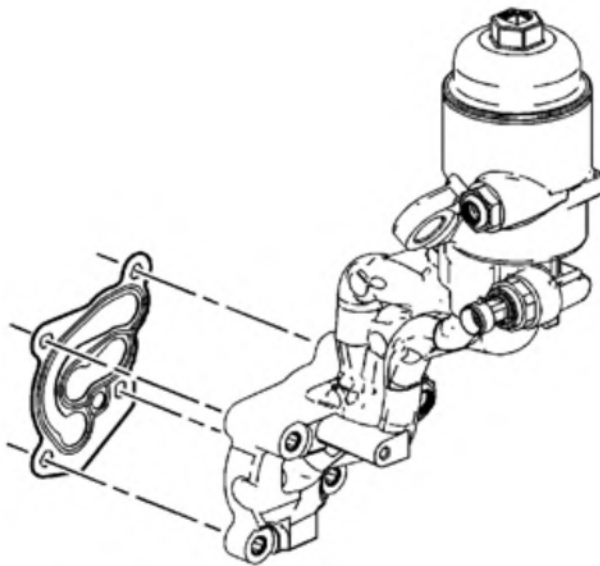
5. Remove the power steering pump bolts (1-3) and position the pump aside in order to gain access to the oil filter adapter fasteners. Refer to [Power Steering Pump Replacement](#).
6. Raise the vehicle. Refer to [Lifting and Jacking the Vehicle](#).

Note: Do not disconnect the A/C pipes from the A/C compressor.

7. Remove the A/C compressor bolts and reposition the A/C compressor in order to gain access to the oil filter adapter fasteners. Refer to [Air Conditioning Compressor Replacement](#).

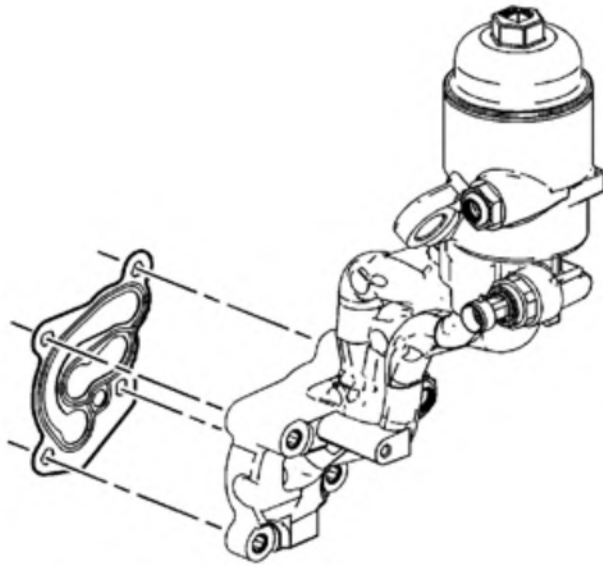


8. Remove the bolts (1) securing the wire harness bracket to the oil filter adapter.



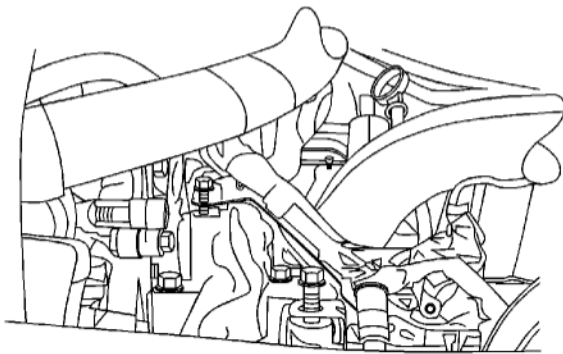
9. Place a drain pan under the vehicle.
10. Remove the oil filter adapter bolts.
11. Lower the vehicle.
12. Remove the oil filter adapter.

Installation Procedure

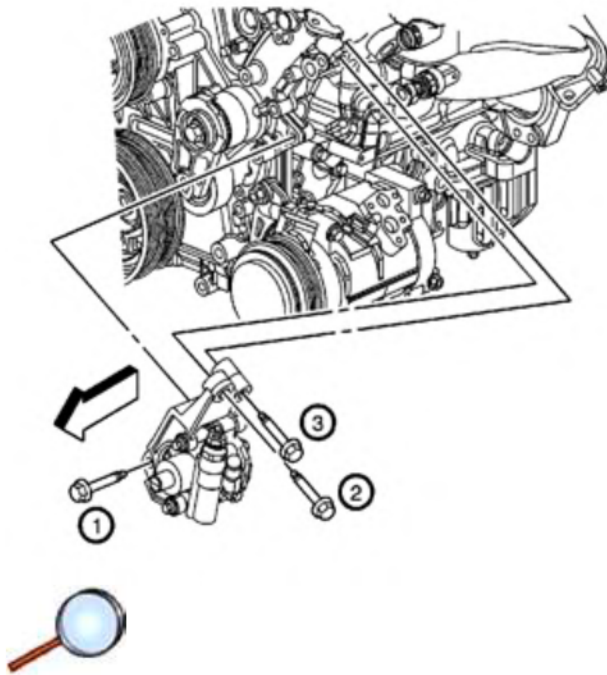


1. Install the oil filter adapter.

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



2. Install the bolts (1) securing the wire harness bracket to the oil filter adapter.
 - 2.1. Tighten the large wire harness bracket bolt to **23 N·m (17 lb ft)**.
 - 2.2. Tighten the small wire harness bracket bolt to **10 N·m (89 lb in)**.
3. Install the A/C compressor with the A/C pipes to the engine. Refer to [Air Conditioning Compressor Replacement](#).
4. Lower the vehicle.



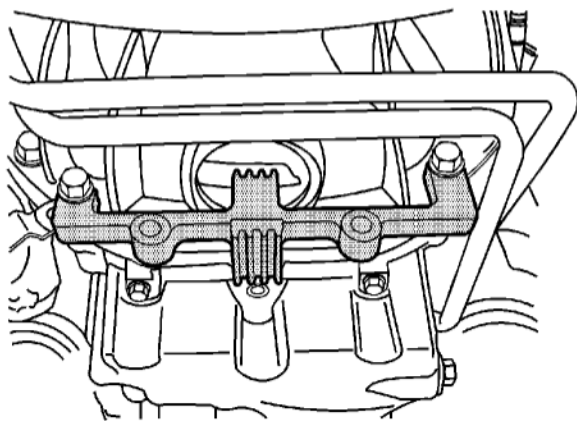
5. Install the power steering pump bolts (1-3). Refer to [Power Steering Pump Replacement](#).
6. Connect the oil pressure sensor electrical connector.
7. Install the A/C compressor and power steering drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).
8. Install the oil filter. Refer to [Engine Oil and Oil Filter Replacement](#).
9. Connect the battery. Refer to [Battery Negative Cable Disconnection and Connection](#).
10. Check and add engine oil as necessary.

Crankshaft Balancer Replacement

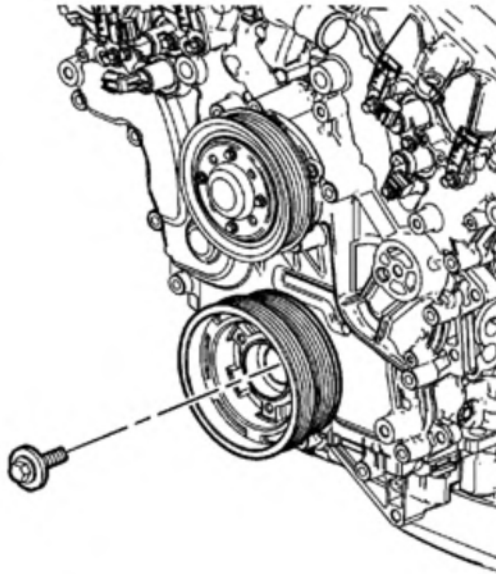
Tools Required

[EN-48018](#) Flywheel Holding Tool

Removal Procedure

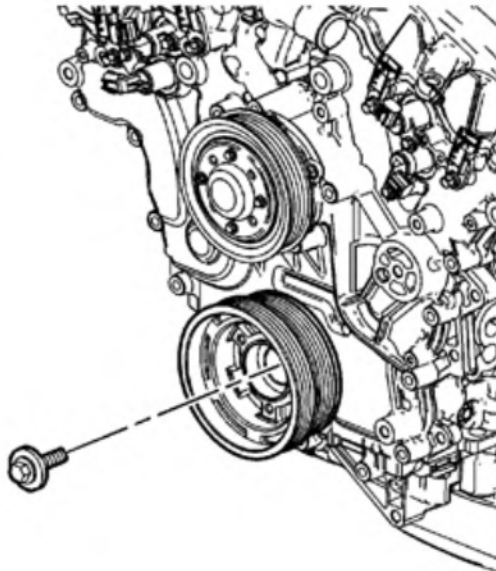


1. Remove the A/C compressor and power steering pump drive belt. Refer to [Water Pump and Generator Belt Tensioner Replacement](#) .
2. Remove the generator and water pump drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Tensioner Replacement](#) .
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
4. Remove the transmission bell housing inspection hole cover.
5. Install the [EN-48018](#) flywheel holding tool as shown.
6. Remove the front air deflector. Refer to [Front Air Deflector Replacement](#) .

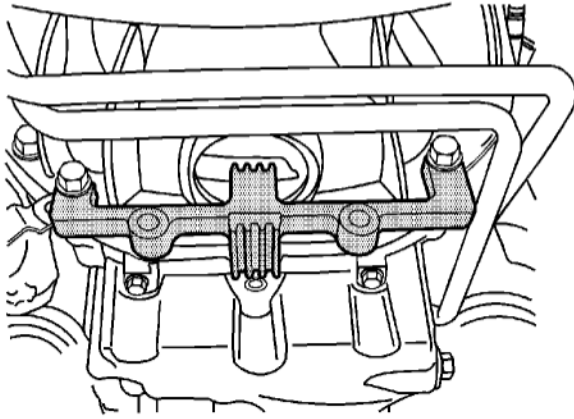


7. Remove the crankshaft balancer. Refer to [Crankshaft Balancer Removal](#) .

Installation Procedure



1. Install the crankshaft balancer. Refer to [Crankshaft Balancer Installation](#) .



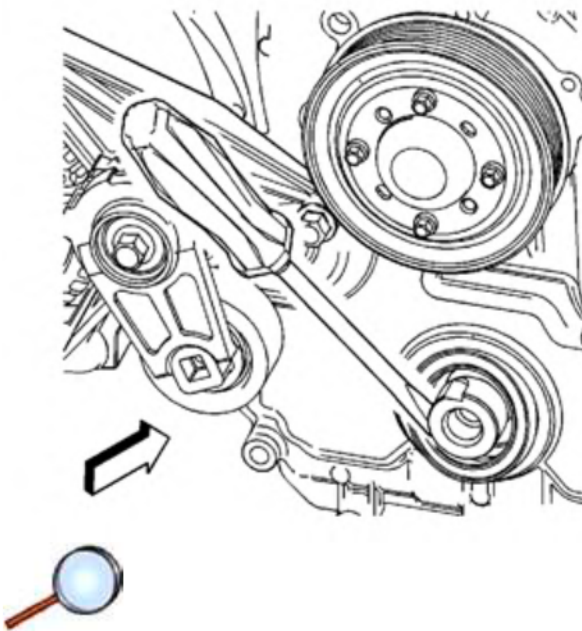
2. Install the front air deflector. Refer to [Front Air Deflector Replacement](#) .
3. Remove the [EN-48018](#) flywheel holding tool.
4. Install the transmission bell housing inspection hole cover.
5. Install the generator and water pump drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Tensioner Replacement](#) .
6. Install the A/C compressor and power steering pump drive belt. Refer to [Water Pump and Generator Belt Tensioner Replacement](#) .

Crankshaft Front Oil Seal Replacement

Tools Required

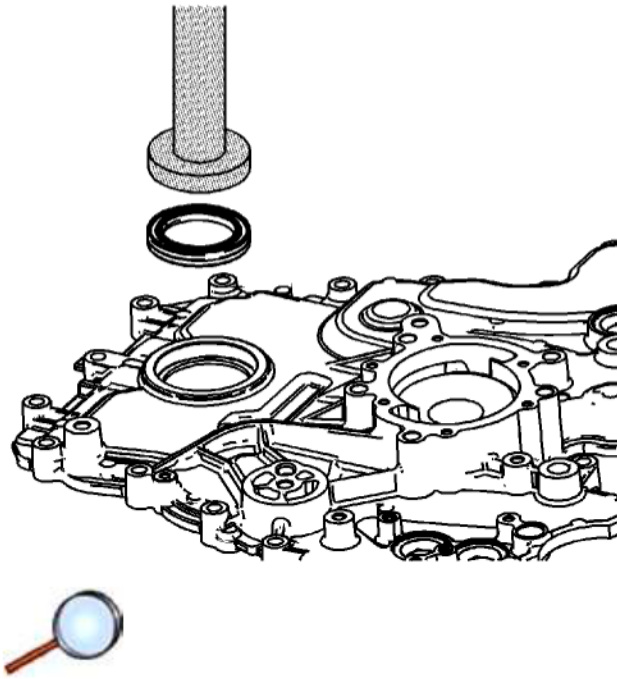
[J 29184](#) Oil Seal Installer

Removal Procedure



1. Remove the A/C compressor and power steering pump drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#) .
2. Remove the generator and water pump drive belt. Refer to [Water Pump and Generator Belt Replacement](#) .
3. Remove the crankshaft balancer. Refer to [Crankshaft Balancer Removal](#) .
4. Use a flat-bladed tool in order to remove the crankshaft oil seal.

Installation Procedure



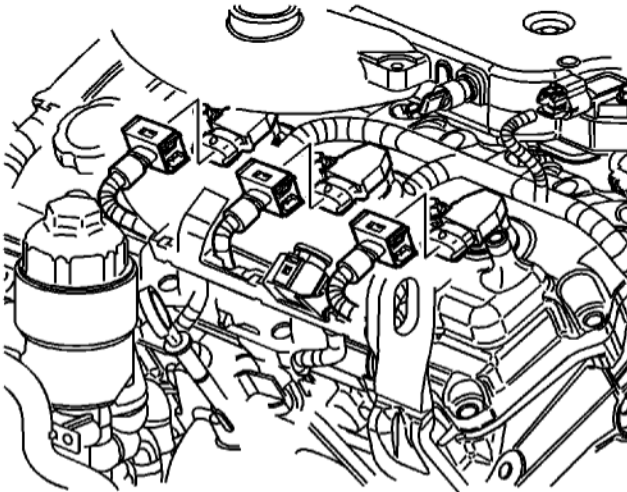
Important: Do not lubricate the crankshaft front oil seal or the crankshaft balancer sealing surfaces.

1. Use the [J 29184](#) or equivalent to install the crankshaft front oil seal.
2. Install the crankshaft balancer. Refer to [Crankshaft Balancer Installation](#) .
3. Install the generator and water pump drive belt. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Tensioner Replacement](#) .
4. Install the A/C compressor and power steering pump drive belt. Refer to [Water Pump and Generator Belt Tensioner Replacement](#) .

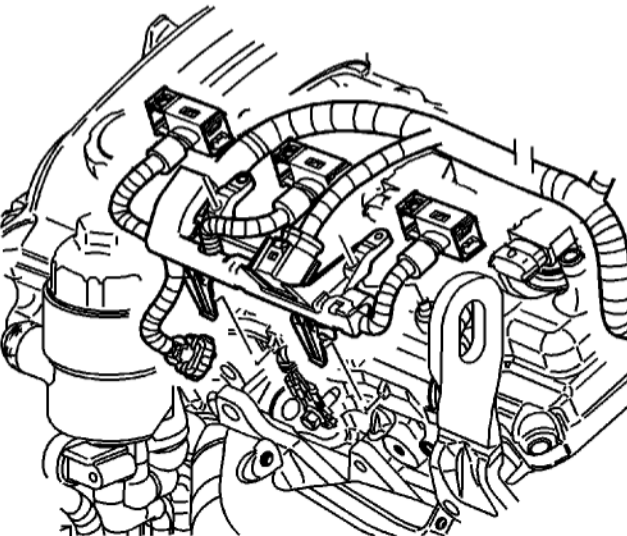
Camshaft Cover Replacement - Left Side (LP1, LY7)

Removal Procedure

1. Remove the engine cover. Refer to [Fuel Injector Sight Shield Replacement](#) .
2. Remove the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#) .

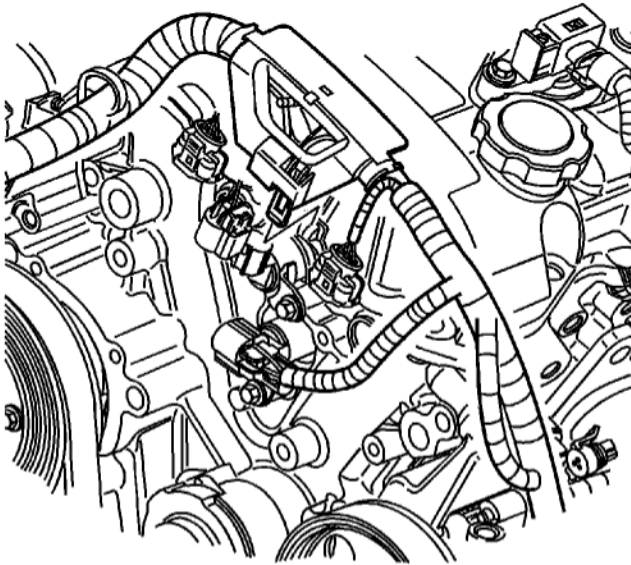


3. Disconnect the ignition coil electrical connectors.



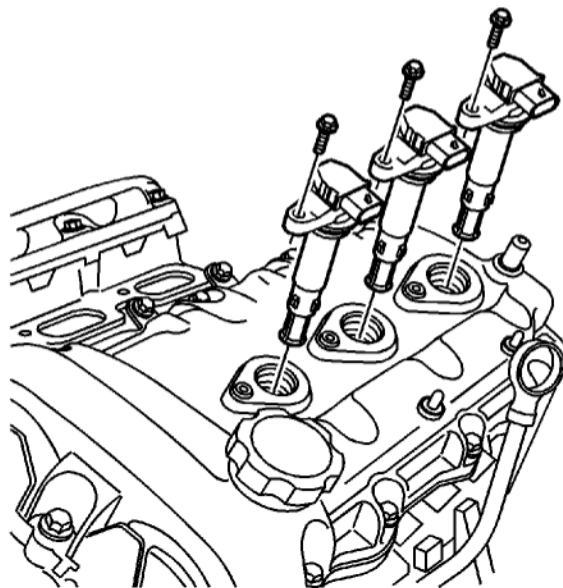
4. Remove the wiring harness from the side of the camshaft cover by sliding the conduit down and outboard.

5. Remove the wiring conduit retainers from the camshaft cover by rotating the wiring harness conduit retainers counterclockwise.

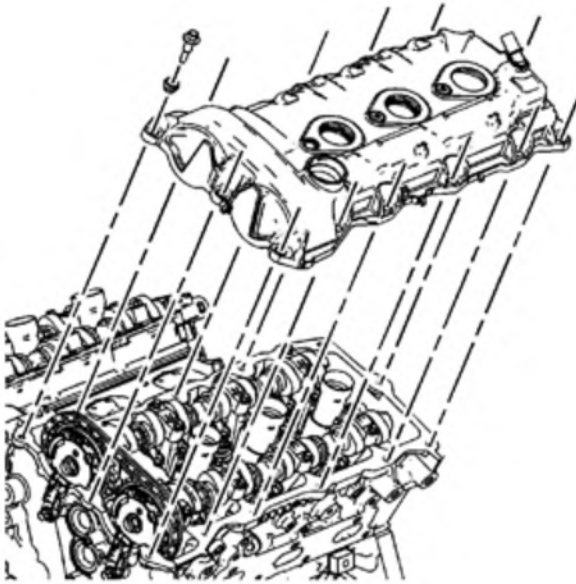


Important: It is not necessary to disconnect the engine front cover electrical connectors.

6. Remove the wiring harness from the front of the camshaft cover.
7. Reposition and secure the wiring harnesses away from the camshaft cover in order to provide clearance.



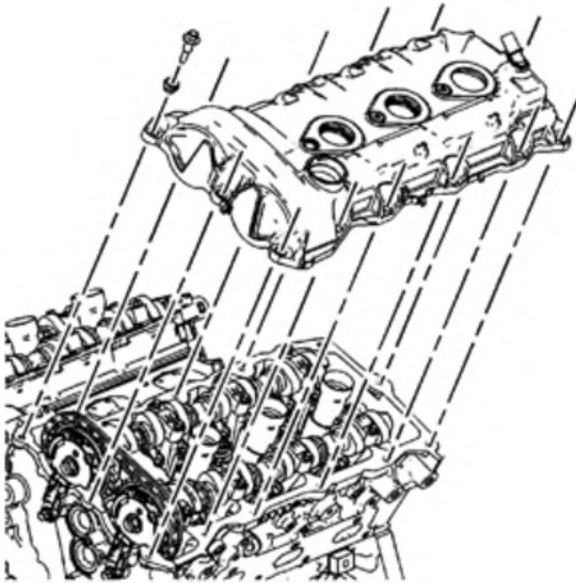
8. Remove the ignition coils.



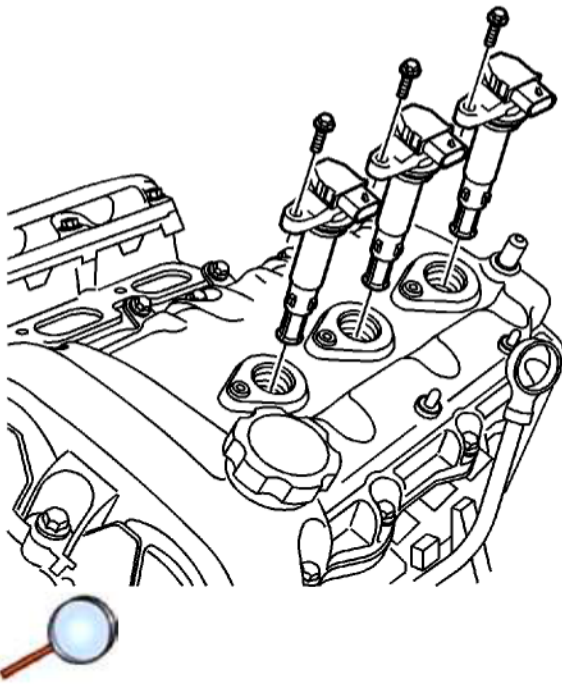
9. Remove the camshaft cover.
10. Remove and discard the camshaft cover seal and grommets.

Installation Procedure

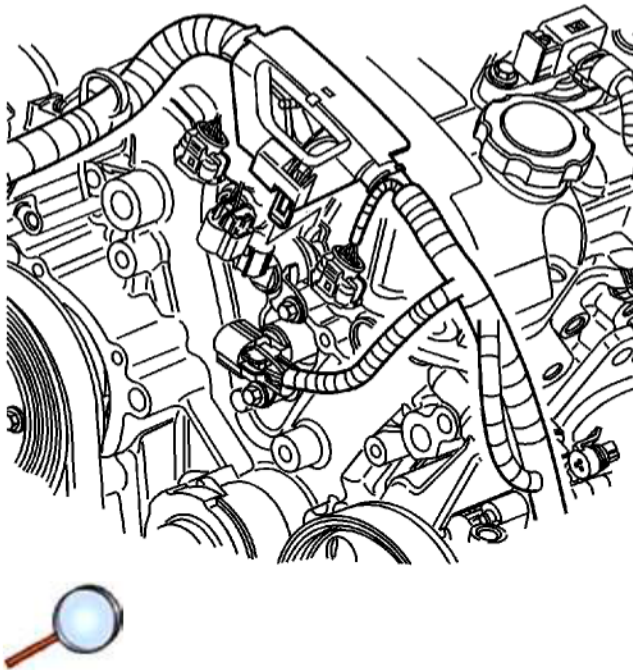
1. Install a NEW camshaft cover seal and NEW grommets.



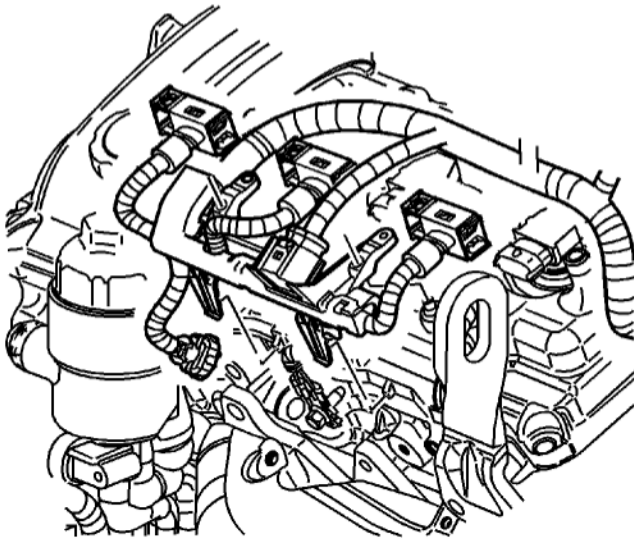
2. Install the camshaft cover. Refer to [Camshaft Cover Installation - Left Side](#) .



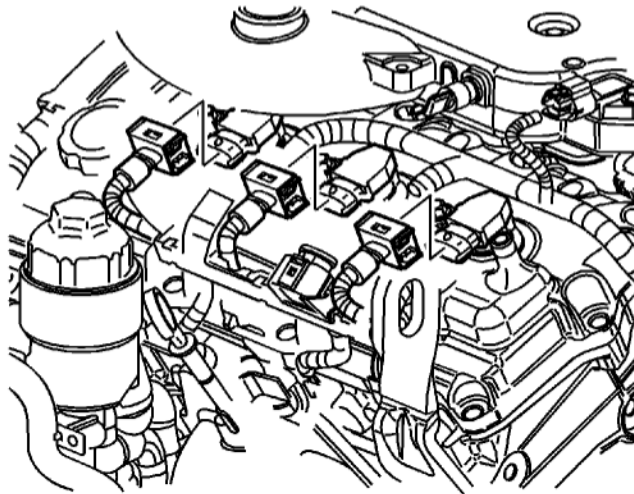
3. Install the ignition coils.



4. Install the wiring harness to the front of the camshaft cover.
5. Install the wiring harness conduit retainers to the wiring harness conduit.



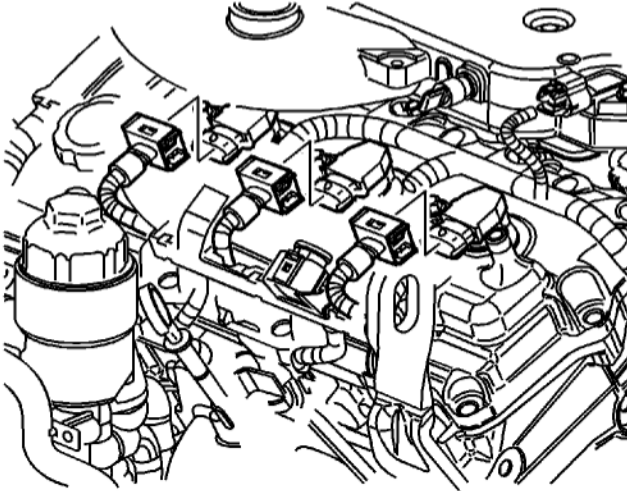
6. Install the wiring harness to the side of the camshaft cover.



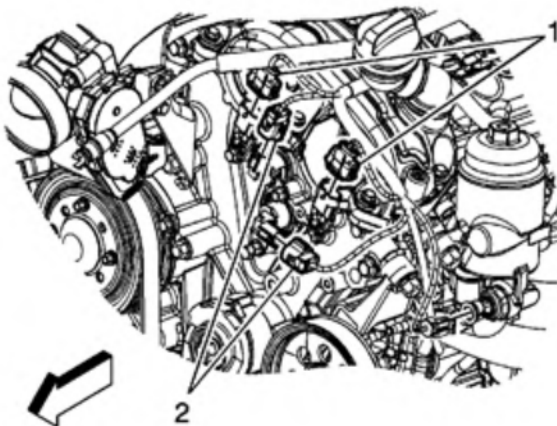
7. Connect the ignition coil electrical connectors.
8. Install the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#) .
9. Install the engine cover. Refer to [Fuel Injector Sight Shield Replacement](#) .

Camshaft Cover Replacement - Left Side (LLT)

Removal Procedure



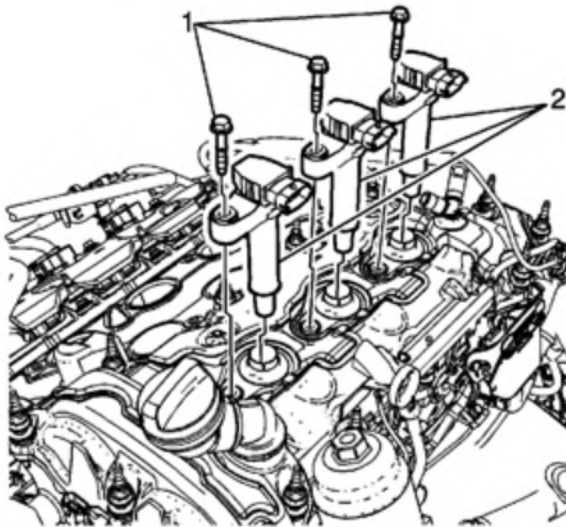
1. Remove the intake manifold. Refer to [Intake Manifold Replacement](#).
2. Remove the fuel pipe shield. Refer to [Fuel Pipe Shield Replacement](#).
3. Remove the crankcase ventilation pipe. Refer to [Positive Crankcase Ventilation Hose/Pipe/Tube Replacement](#).
4. Disconnect the ignition coil electrical connectors.



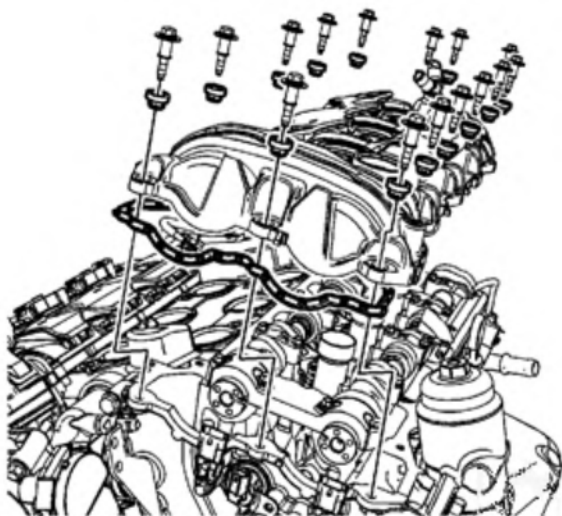
5. Remove the wiring harness from the side of the camshaft cover by sliding the conduit down and outboard.
6. Remove the wiring conduit retainers from the camshaft cover by rotating the wiring harness conduit retainers counterclockwise.

Note: It is not necessary to disconnect the engine front cover electrical connectors.

7. Disconnect the camshaft position sensors (1) and camshaft actuator valve (2) electrical connectors.
8. Reposition and secure the wiring harnesses away from the camshaft cover in order to provide clearance.

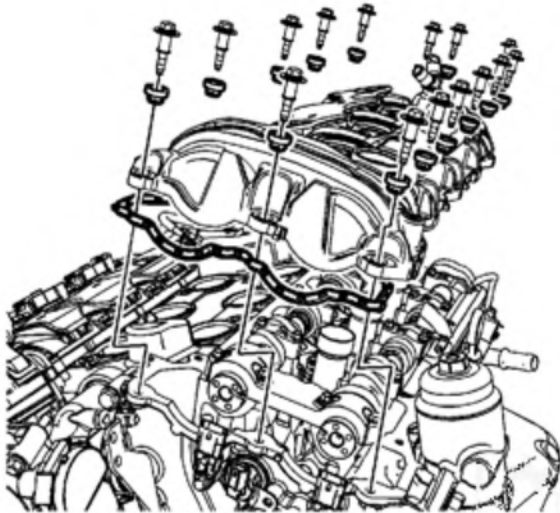


9. Remove the ignition coil bolts (1).
10. Remove the ignition coils (2).

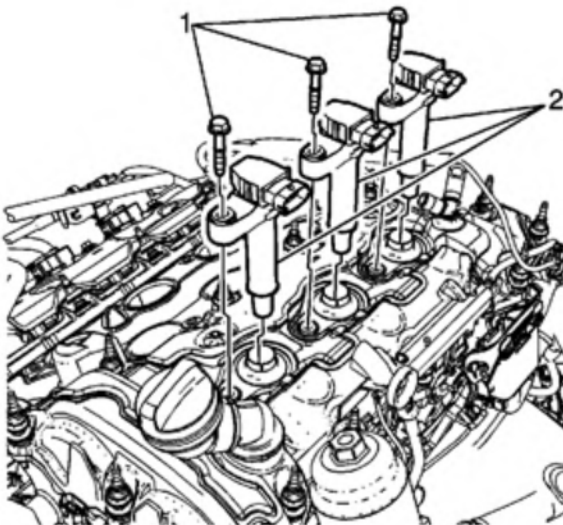


11. Remove the camshaft cover.
12. Remove and discard the camshaft cover seal (1) and grommets (2).

Installation Procedure



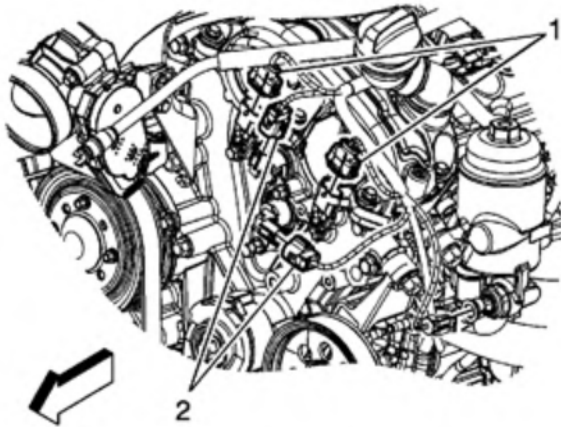
1. Install a NEW camshaft cover seal (1) and NEW grommets (2).
2. Install the camshaft cover. Refer to [Camshaft Cover Installation - Left Side](#).



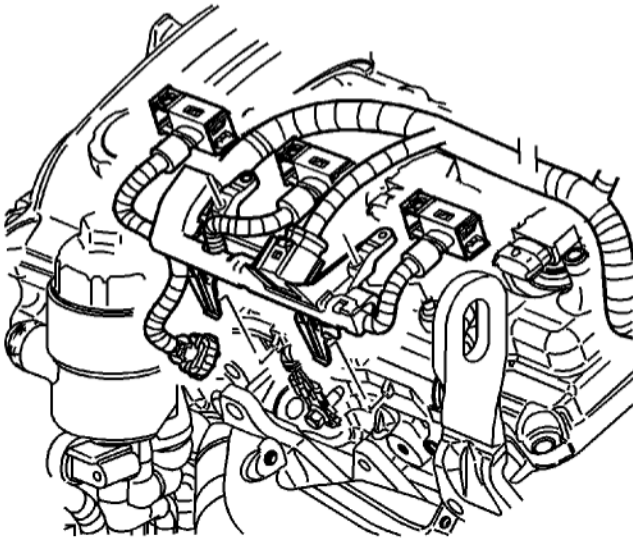
3. Install the ignition coils (2).

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

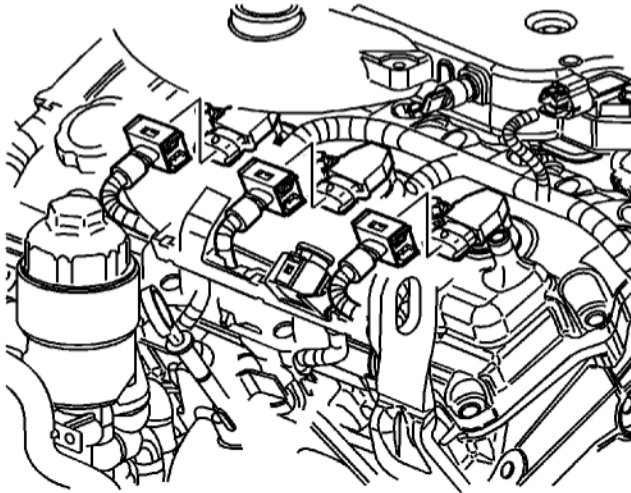
4. Install the ignition coil bolts (1) and tighten to **10 N·m (89 lb in)**.



5. Connect the camshaft actuator valves (2) and the camshaft position sensor (1) electrical connectors.
6. Install the wiring harness conduit retainers to the wiring harness conduit.



7. Install the wiring harness to the side of the camshaft cover.

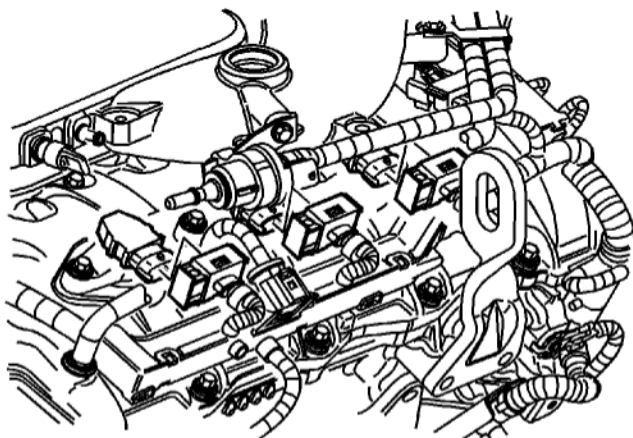


8. Connect the ignition coil electrical connectors.
9. Install the crankcase ventilation pipe. Refer to [Positive Crankcase Ventilation Hose/Pipe/Tube Replacement](#).
10. Install the fuel pipe shield. Refer to [Fuel Pipe Shield Replacement](#).
11. Install the intake manifold. Refer to [Intake Manifold Replacement](#).

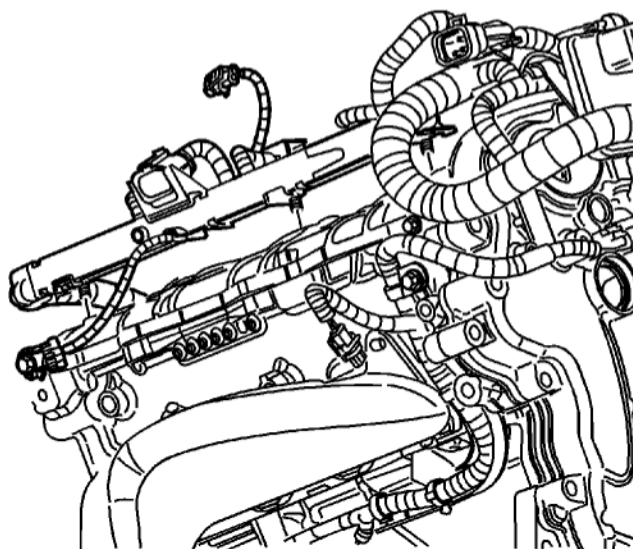
Camshaft Cover Replacement - Right Side

Removal Procedure

1. Remove the engine cover. Refer to [Fuel Injector Sight Shield Replacement](#).
2. Remove the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#).

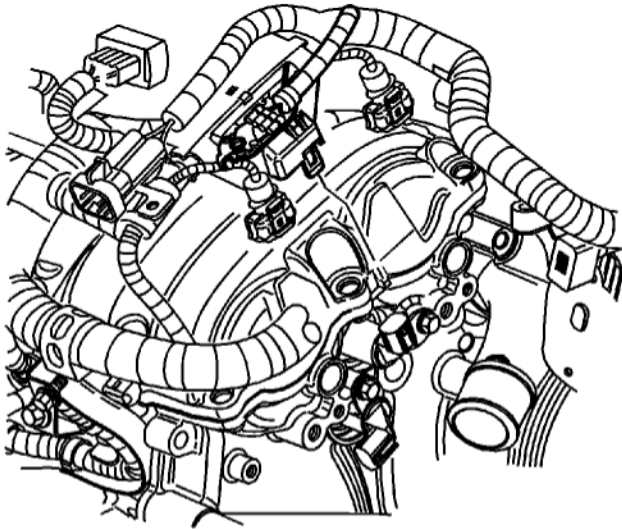


3. Disconnect the ignition coil electrical connectors.



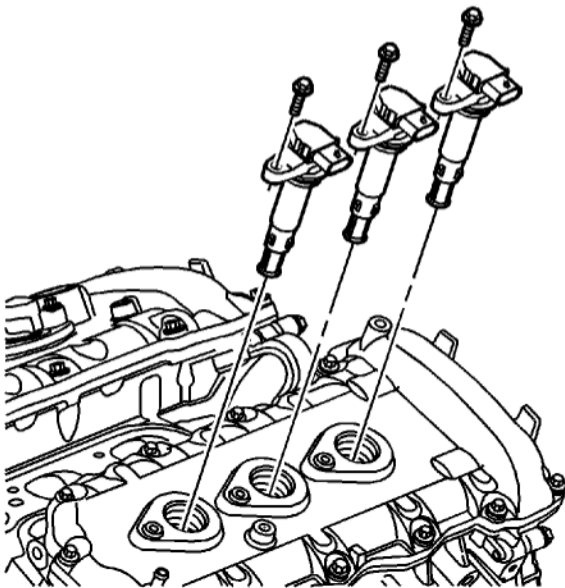
4. Remove the wiring harness from the side of the camshaft cover by sliding the conduit down and outboard.

5. Remove the wiring conduit retainers from the camshaft cover by rotating the wiring harness conduit retainers counterclockwise.

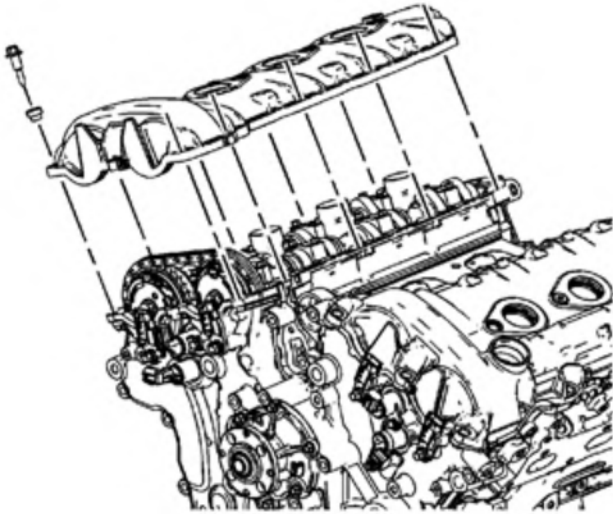


Important: It is not necessary to disconnect the engine front cover electrical connectors.

6. Remove the wiring harness from the front of the camshaft cover.
7. Reposition and secure the wiring harnesses away from the camshaft cover in order to provide clearance.



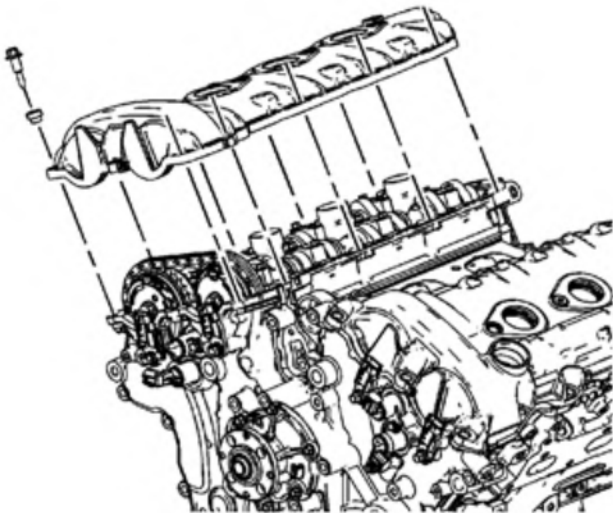
8. Remove the ignition coils.



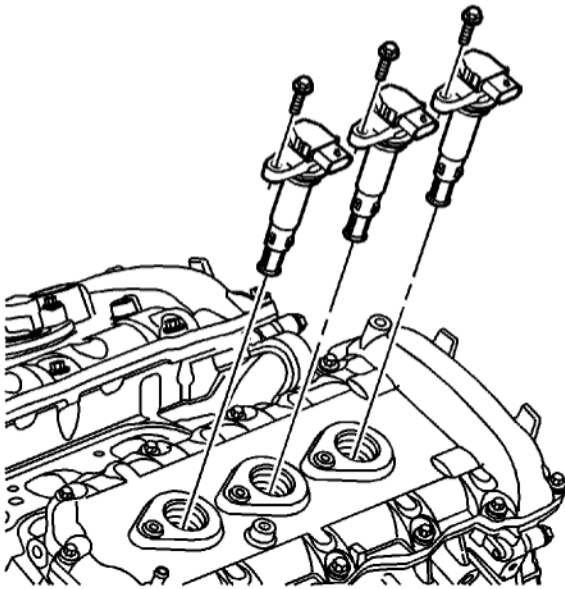
9. Remove the camshaft cover.
10. Remove and discard the camshaft cover seal and grommets.

Installation Procedure

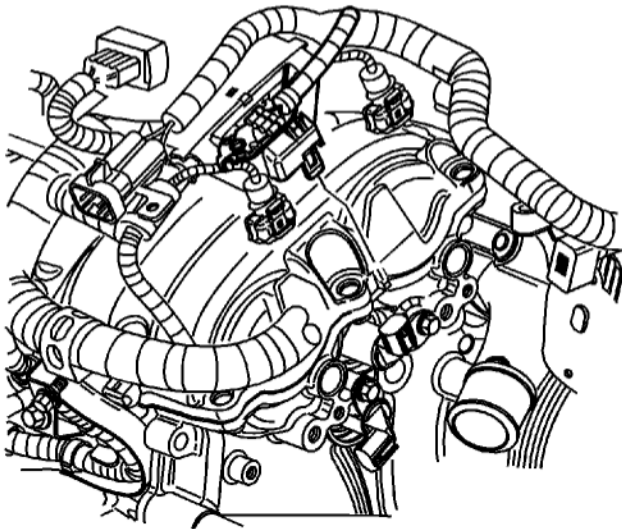
1. Install a NEW camshaft cover seal and NEW grommets.



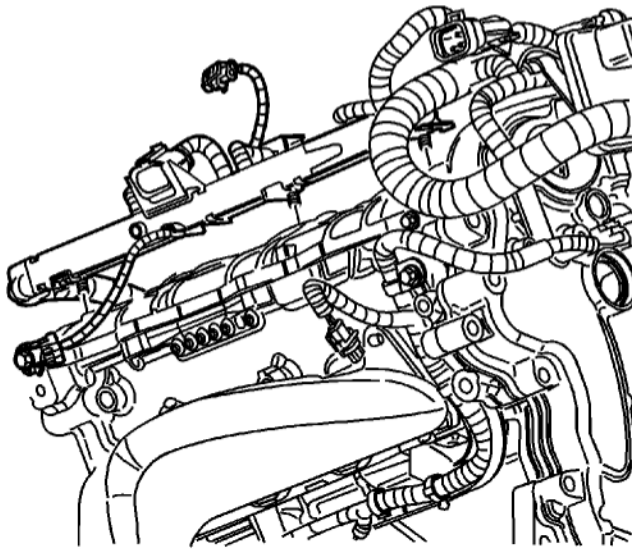
2. Install the camshaft cover. Refer to [Camshaft Cover Installation - Right Side](#) .



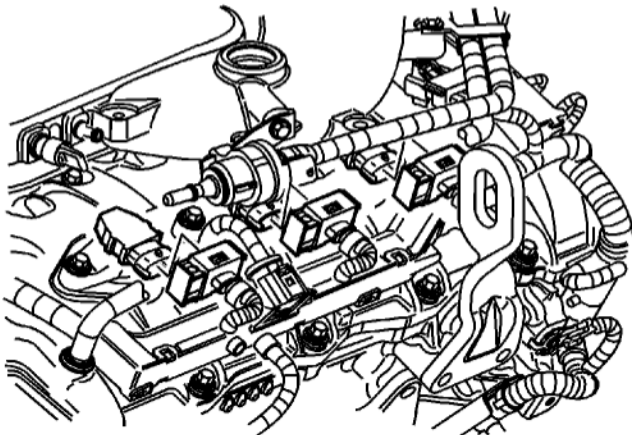
3. Install the ignition coils.



4. Install the wiring harness to the front of the camshaft cover.
5. Install the wiring harness conduit retainers to the wiring harness conduit.



6. Install the wiring harness to the side of the camshaft cover.



7. Connect the ignition coil electrical connectors.
8. Install the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#) .
9. Install the engine cover. Refer to [Fuel Injector Sight Shield Replacement](#) .

Engine Front Cover Replacement

Special Tools

[EN 46109](#) Engine Front Cover Installation Guide Pins

Removal Procedure

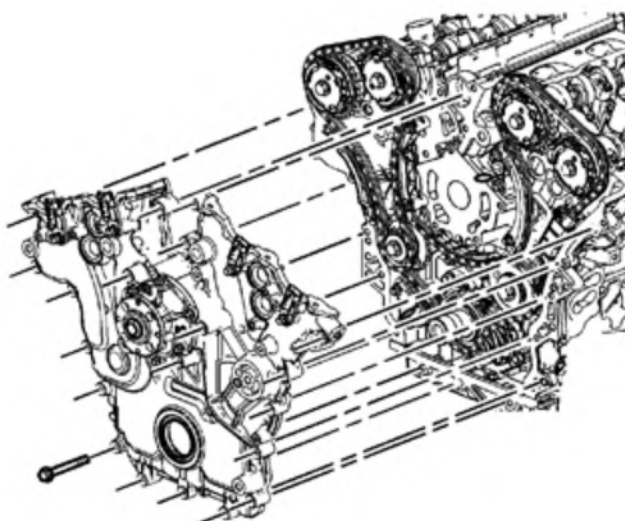
1. Remove the engine cover. Refer to [Fuel Injector Sight Shield Replacement](#) .
2. On models equipped with LP1 and LY7 engines, remove the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#) .
3. On models equipped with LLT engines, remove the intake manifold. Refer to [Intake Manifold Replacement](#) .
4. On all models remove the camshaft covers. Refer to [Camshaft Cover Replacement - Left Side](#) and [Camshaft Cover Replacement - Right Side](#) .
5. Drain the engine coolant. Refer to [Cooling System Draining and Filling](#) .
6. Disconnect the purge vent hose from the water outlet.
7. Remove the water outlet with the radiator hose and reposition aside. Refer to [Water Outlet Housing Replacement](#) .
8. Remove the accessory drive belts. Refer to [Water Pump and Generator Belt Replacement](#) and [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#) .
9. Remove the A/C compressor and power steering belt tensioner. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Tensioner Replacement](#) .
10. Remove the generator bracket with the generator and the belt tensioner. Refer to [Generator Bracket Replacement](#) .

Important: Do not disconnect the power steering pipes or drain the power steering fluid.

11. Remove the power steering fluid reservoir and reposition the power steering fluid reservoir in order to provide access.
12. Remove the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#) .

Important: Do not disconnect the power steering pipes/hoses.

13. Remove the power steering pump upper front bolt and loosen the remaining two bolts. Refer to [Power Steering Pump Pulley Replacement](#) .
14. Remove the crankshaft balancer. Refer to [Crankshaft Balancer Removal](#) .
15. Remove the camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#) , [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Intake](#) , [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#) and [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#) .
16. Remove the camshaft position actuator solenoid valves from the front cover. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#) , [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Exhaust](#) , [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Intake](#) , and [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Exhaust](#) .



17. Remove the engine front cover with the water pump. Refer to [Engine Front Cover Removal](#) .
18. Disassemble the engine front cover. Refer to [Engine Front Cover Disassemble](#) .

Important: Do NOT use sharp and/or metal gasket scrapers in order to clean the sealing surfaces.

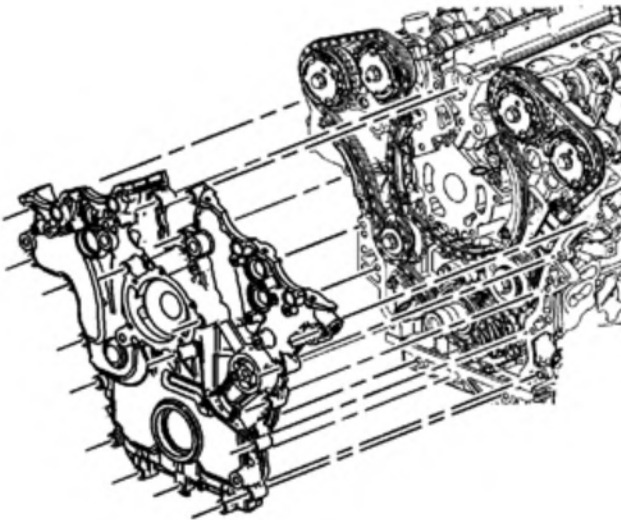
19. Carefully clean the engine front cover sealing surfaces. Refer to [Engine Front Cover Cleaning and Inspection](#) .

Important: Insert a piece of cardboard between the oil pan front and the oil pump in order to prevent any contaminants from falling into the oil pan.

20. Carefully clean the engine front cover sealing surfaces. Refer to [Engine Front Cover Cleaning and Inspection](#) .
21. Use compressed air in order to remove any engine coolant from the engine cooling passages and from the top of the oil pan scraper (windage tray).

Installation Procedure

1. Assemble the engine front cover. Refer to [Engine Front Cover Assemble](#) .

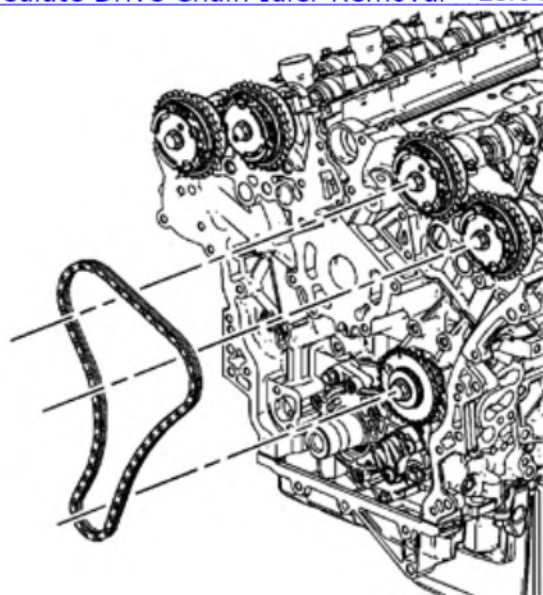


2. Use the [EN 46109](#) in order to install the engine front cover. Refer to [Engine Front Cover Installation](#) .
3. Install the camshaft position actuator solenoid valves to the front cover. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#) , [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Exhaust](#) , [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Intake](#) , and [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Exhaust](#) .
4. Install the camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#) , [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Intake](#) , [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#) and [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#) .
5. Install the crankshaft balancer. Refer to [Crankshaft Balancer Installation](#) .
6. Install the power steering pump. Refer to [Power Steering Pump Pulley Replacement](#) .
7. Install the power steering pump pulley. Refer to [Power Steering Pump Pulley Replacement](#) .
8. Install the power steering fluid reservoir. Refer to [Remote Power Steering Fluid Reservoir Replacement](#) .
9. Install the generator bracket with the generator and the belt tensioner. Refer to [Generator Bracket Replacement](#) .
10. Install the A/C compressor and power steering belt tensioner. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Tensioner Replacement](#) .
11. Install the accessory drive belts. Refer to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#) and [Water Pump and Generator Belt Replacement](#) .
12. Install the water outlet. Refer to [Water Outlet Housing Replacement](#) .
13. Install the purge vent hose to the water outlet.
14. Fill the cooling system. Refer to [Cooling System Draining and Filling](#) .
15. Install the camshaft covers. Refer to [Camshaft Cover Replacement - Left Side](#) and [Camshaft Cover Replacement - Right Side](#) .
16. On models equipped with LLT engines, install the intake manifold. Refer to [Intake Manifold Replacement](#) .
17. On models equipped with LP1 and LY7 engines, install the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#) .
18. On all models, install the engine cover. Refer to [Fuel Injector Sight Shield Replacement](#) .
19. Fill the cooling system. Refer to [Cooling System Draining and Filling](#) .

Secondary Camshaft Drive Chain Replacement - Left Side

Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Right Side](#).
3. Remove the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Removal - Right Side](#).
4. Remove the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Right Side](#).
5. Remove the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Removal - Right Side](#).
6. Remove the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Removal](#).
7. Remove the primary upper camshaft drive chain guide. Refer to [Primary Camshaft Drive Chain Guide Removal - Upper](#).
8. Remove the primary camshaft drive chain. Refer to [Primary Camshaft Drive Chain Removal](#).
9. Remove the right bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Removal - Right Side](#).
10. Remove the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Left Side](#).
11. Remove the left bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Removal - Left Side](#).
12. Remove the left bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Left Side](#).
13. Remove the left bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Removal - Left Side](#).

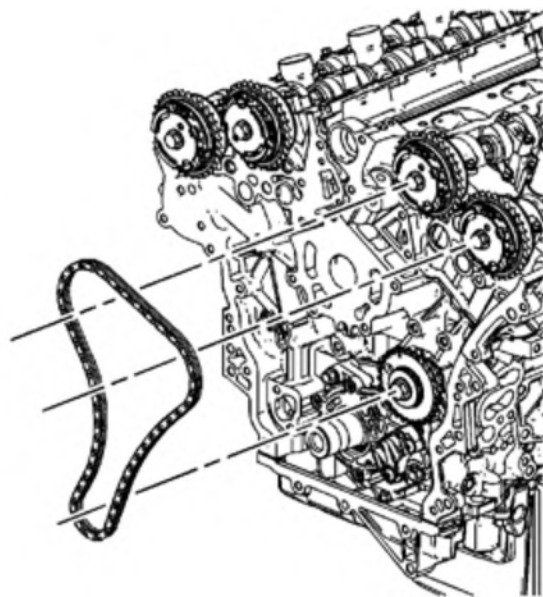


14. Remove the left bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Removal - Left Side](#).

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15. Clean and inspect all of the camshaft timing drive components. Refer to [Camshaft Timing Drive Components Cleaning and Inspection](#) . Replace components as necessary.

Installation Procedure

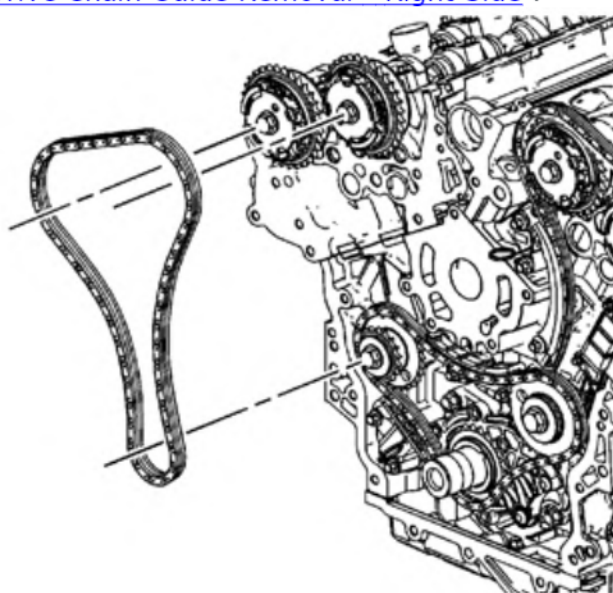


1. Install the left bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Installation - Left Side](#) .
2. Install the left bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Installation - Left Side](#) .
3. Install the left bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Left Side](#) .
4. Install the left bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Installation - Left Side](#) .
5. Install the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Left Side](#) .
6. Install the right bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Installation - Right Side](#) .
7. Install the primary camshaft drive chain. Refer to [Primary Camshaft Drive Chain Installation](#) .
8. Install the primary upper camshaft drive chain guide. Refer to [Primary Camshaft Drive Chain Guide Installation - Upper](#) .
9. Install the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Installation](#) .
10. Install the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Installation - Right Side](#) .
11. Install the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Right Side](#) .
12. Install the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Installation - Right Side](#) .
13. Install the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Right Side](#) .
14. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Secondary Camshaft Drive Chain Replacement - Right Side

Removal Procedure

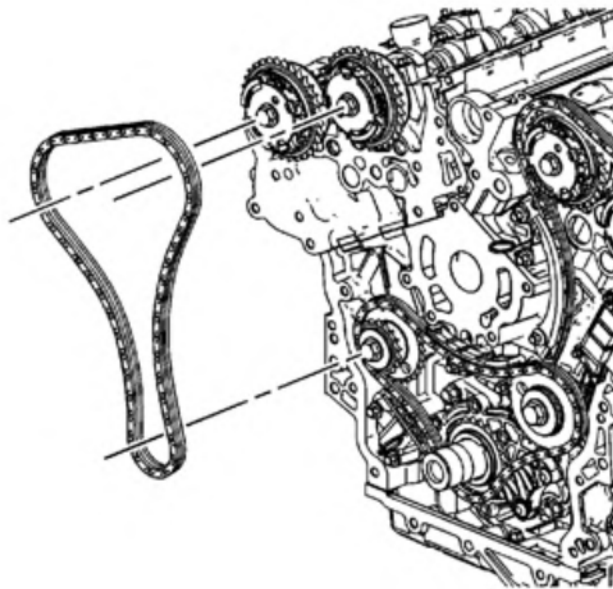
1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#) .
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Right Side](#) .
3. Remove the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Removal - Right Side](#) .
4. Remove the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Right Side](#) .



5. Remove the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Removal - Right Side](#) .

Installation Procedure

1. Ensure the stage 1 camshaft timing is correct. Refer to [Setting Camshaft Timing](#) .

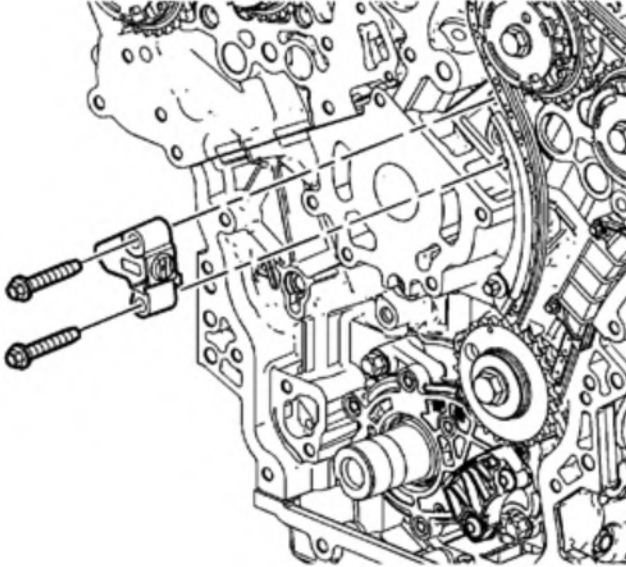


2. Install the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Installation - Right Side](#) .
3. Install the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Right Side](#) .
4. Install the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Installation - Right Side](#) .
5. Install the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Right Side](#) .
6. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Secondary Camshaft Drive Chain Tensioner Replacement - Left Side

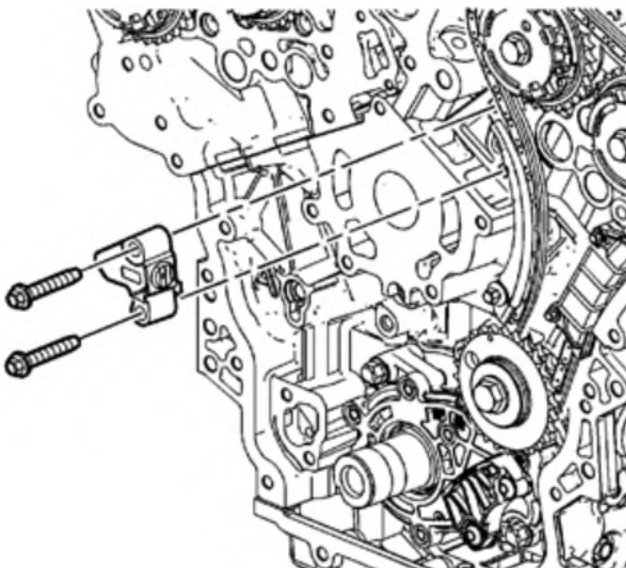
Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).



2. Remove the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Left Side](#).

Installation Procedure



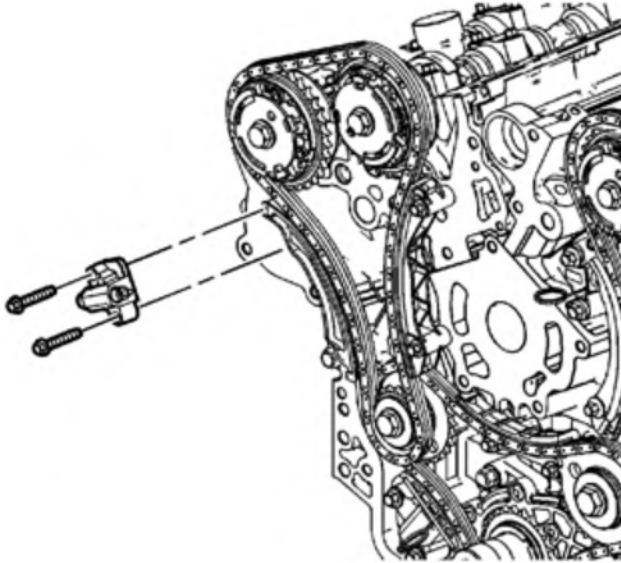


1. Install the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Left Side](#) .
2. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Secondary Camshaft Drive Chain Tensioner Replacement - Right Side

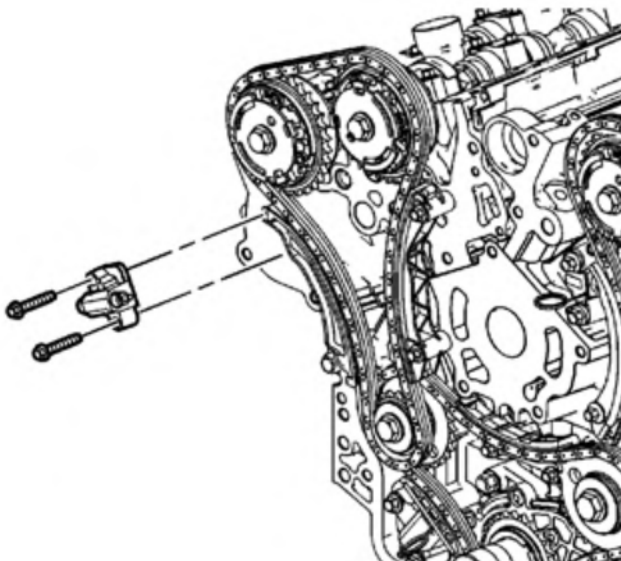
Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).



2. Remove the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Right Side](#).

Installation Procedure



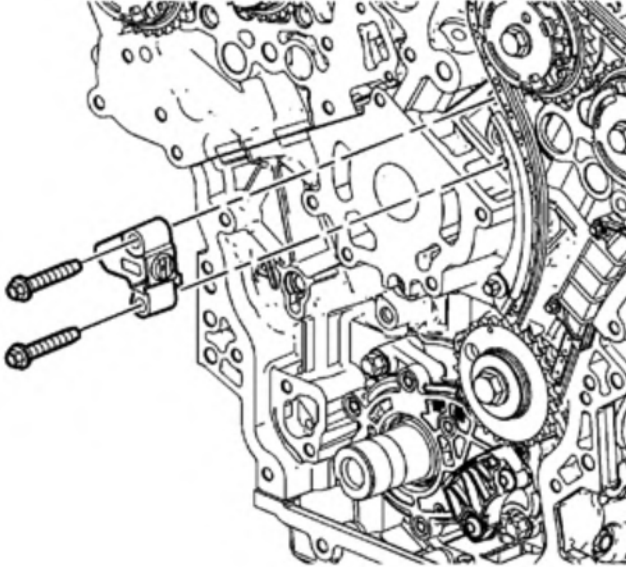


1. Install the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Right Side](#) .
2. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Secondary Camshaft Drive Chain Shoe Replacement - Left Side

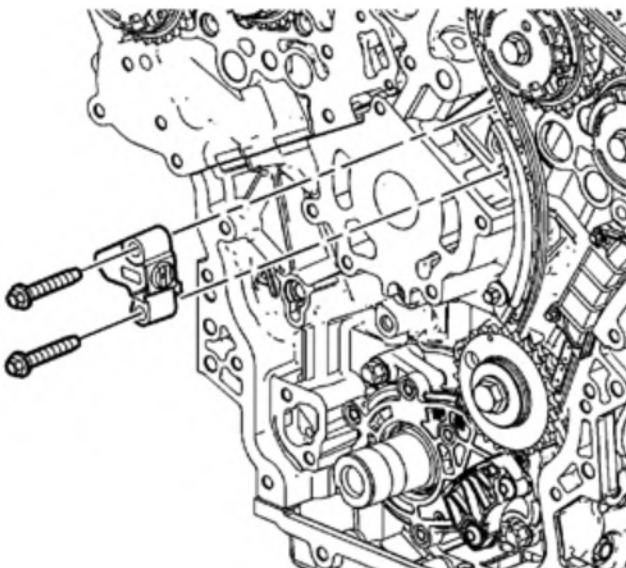
Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).



2. Remove the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Left Side](#).

Installation Procedure

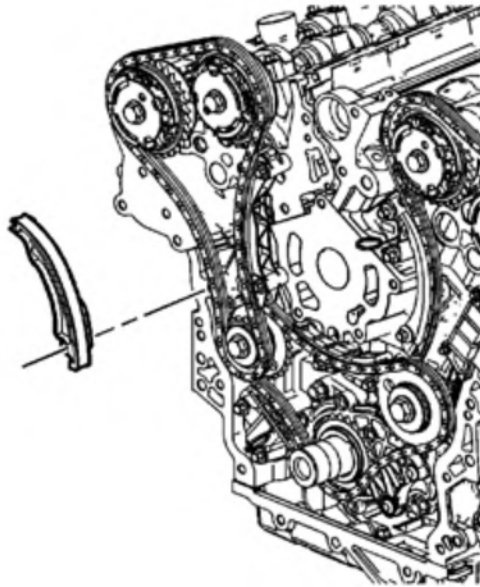




1. Install the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Left Side](#) .
2. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

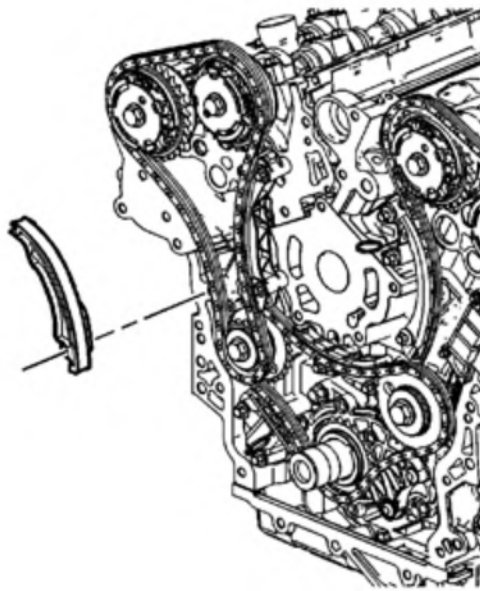
Secondary Camshaft Drive Chain Shoe Replacement - Right Side

Removal Procedure



1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#) .
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Right Side](#) .
3. Remove the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Removal - Right Side](#) .

Installation Procedure

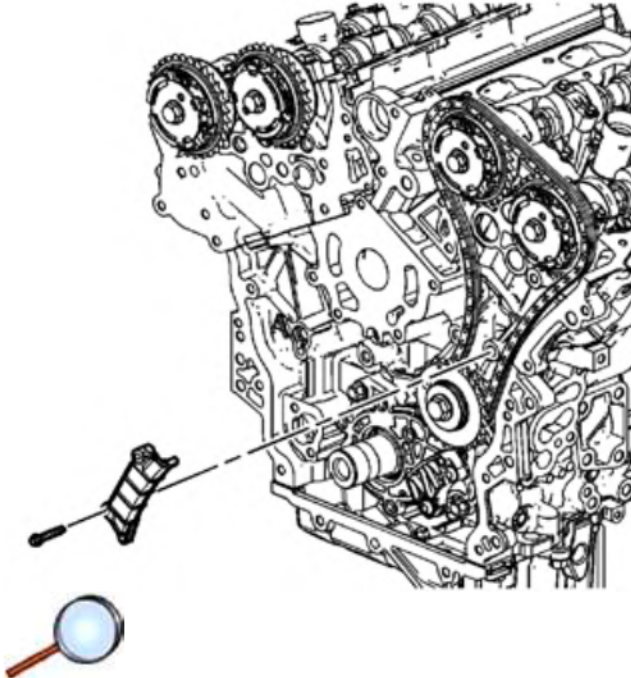


1. Install the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Installation - Right Side](#) .
2. Install the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Right Side](#) .
3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Secondary Camshaft Drive Chain Guide Replacement - Left Side

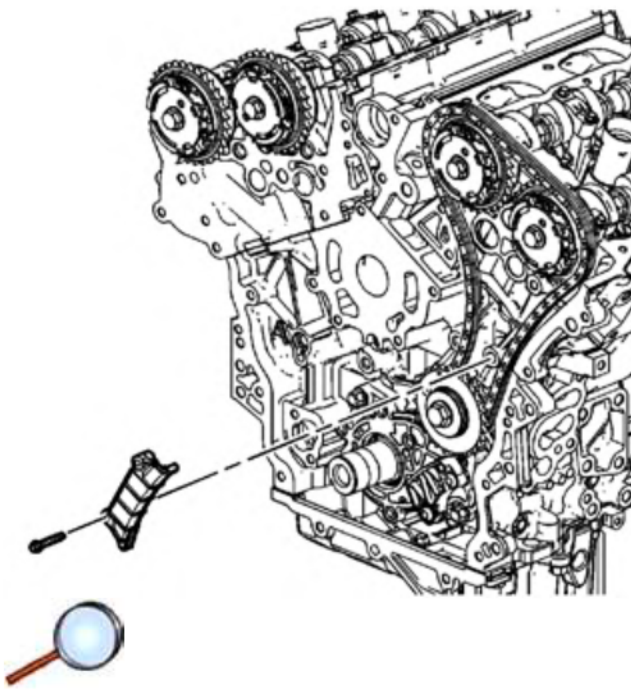
Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).
2. Remove the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Left Side](#).



3. Remove the left bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Left Side](#).

Installation Procedure

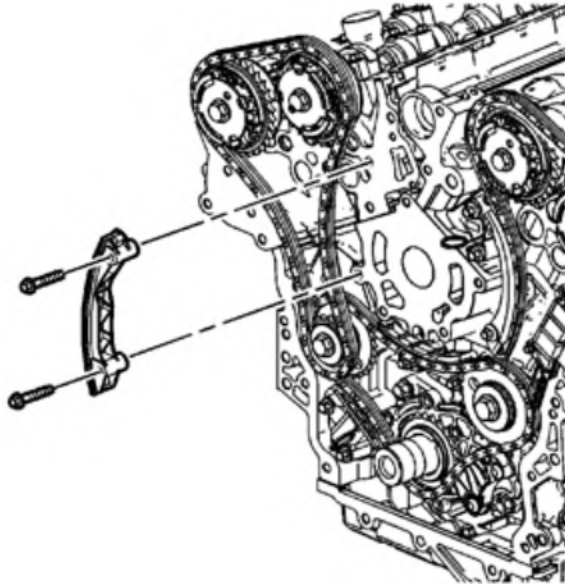


1. Install the left bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Left Side](#) .
2. Install the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Left Side](#) .
3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Secondary Camshaft Drive Chain Guide Replacement - Right Side

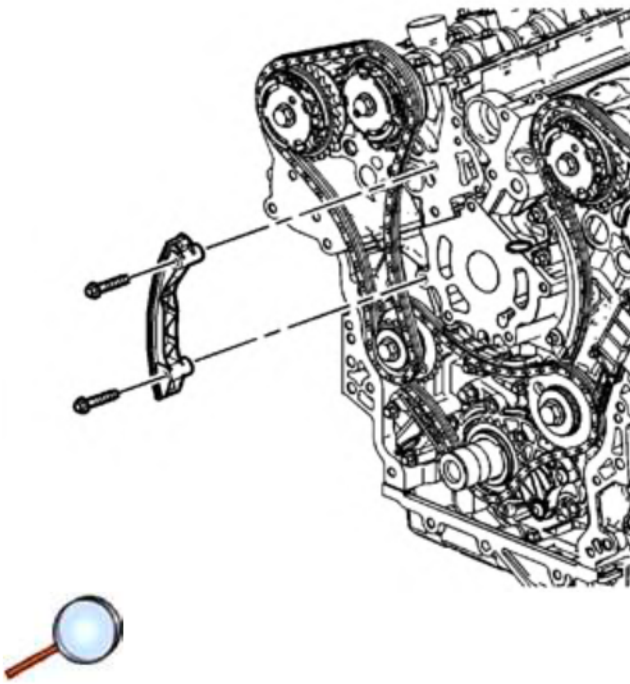
Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#) .
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Right Side](#) .



3. Remove the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Right Side](#) .

Installation Procedure

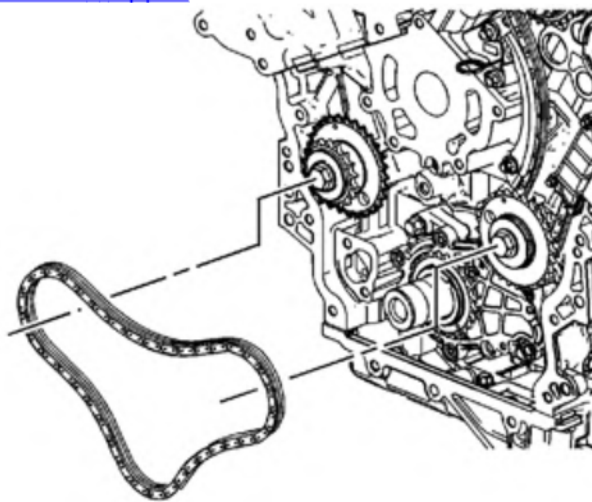


1. Install the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Right Side](#) .
2. Install the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Right Side](#) .
3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Primary Camshaft Drive Chain and Sprockets Replacement

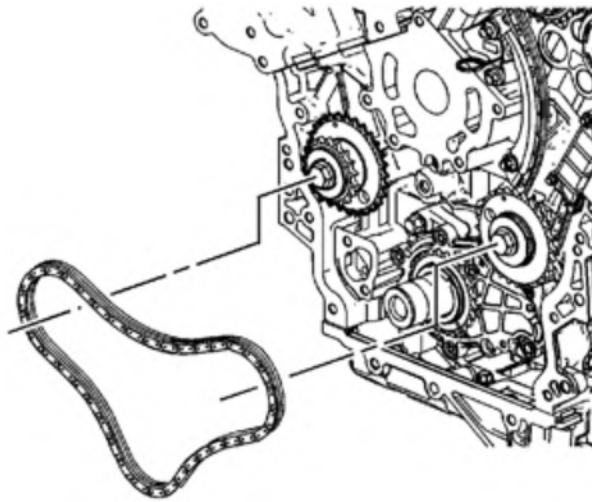
Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Right Side](#).
3. Remove the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Removal - Right Side](#).
4. Remove the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Right Side](#).
5. Remove the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Removal - Right Side](#).
6. Remove the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Removal](#).
7. Remove the primary camshaft drive chain upper guide. [Primary Camshaft Drive Chain Guide Removal - Upper](#).



8. Remove the primary camshaft timing chain. Refer to [Secondary Camshaft Drive Chain Removal - Right Side](#).

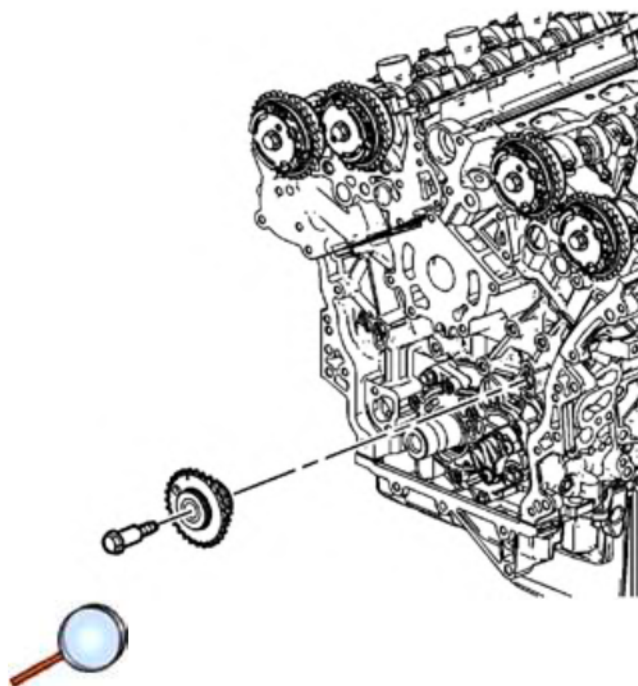
Installation Procedure



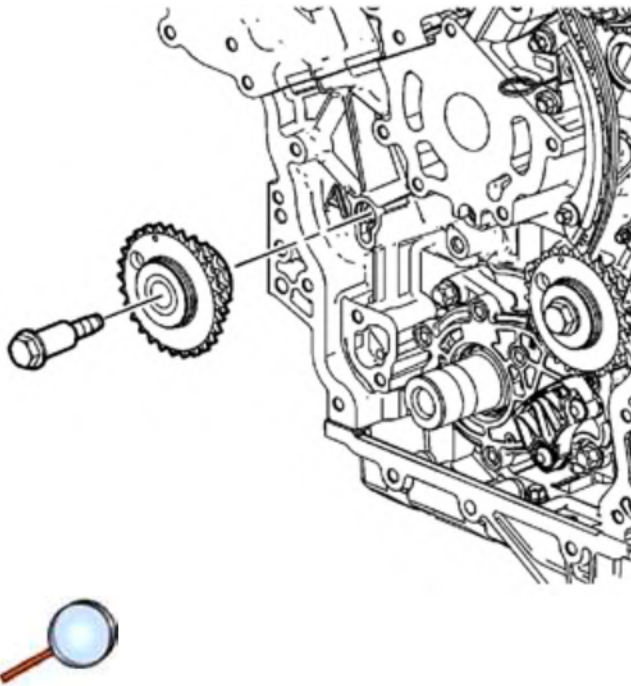
1. Install the primary camshaft timing chain. Refer to [Primary Camshaft Drive Chain Installation](#) .
2. Install the primary upper camshaft drive chain guide. Refer to [Primary Camshaft Drive Chain Guide Installation - Upper](#) .
3. Install the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Installation](#) .
4. Install the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Installation - Right Side](#) .
5. Install the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Right Side](#) .
6. Install the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Installation - Right Side](#) .
7. Install the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Right Side](#) .
8. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Timing Chain Idler Sprocket Replacement - Left Side

Removal Procedure

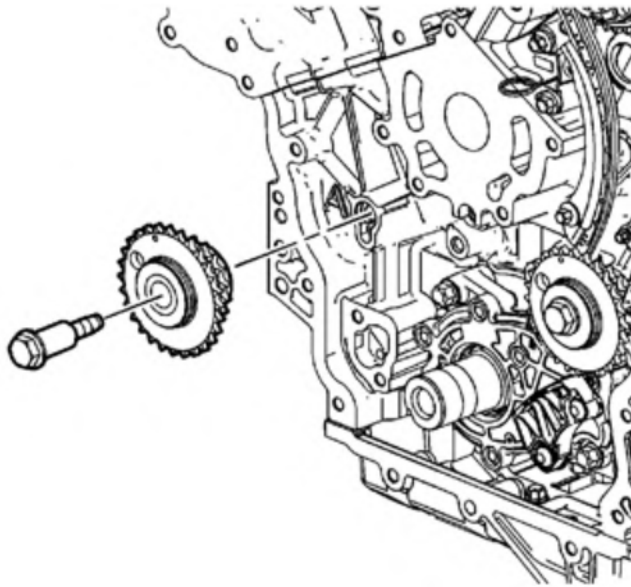


1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#) .
2. Remove the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Right Side](#) .
3. Remove the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Removal - Right Side](#) .
4. Remove the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Right Side](#) .
5. Remove the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Removal - Right Side](#) .
6. Remove the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Removal](#) .
7. Remove the primary upper camshaft drive chain guide. Refer to [Primary Camshaft Drive Chain Guide Removal - Upper](#) .
8. Remove the primary camshaft drive chain. Refer to [Primary Camshaft Drive Chain Removal](#) .
9. Remove the right bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Removal - Right Side](#) .

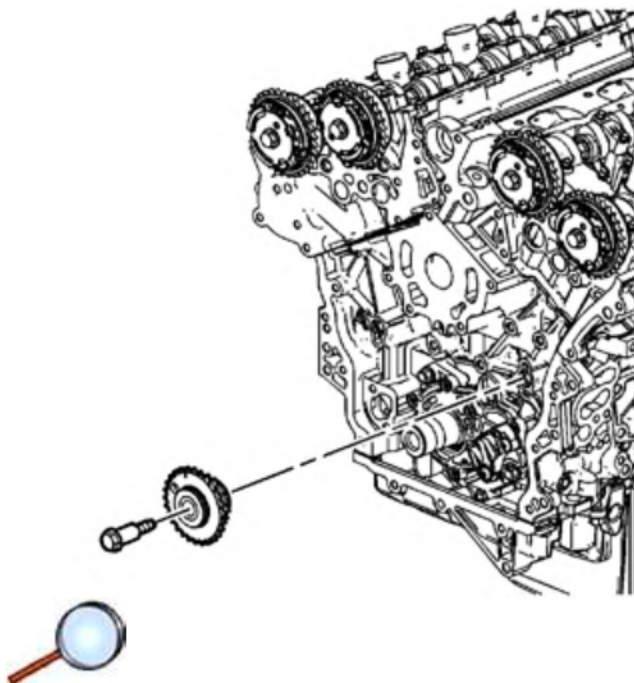


10. If you are servicing the left bank camshaft intermediate drive chain idler, perform the following steps:
 - 10.1. Remove the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Removal - Left Side](#) .
 - 10.2. Remove the left bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Removal - Left Side](#) .
 - 10.3. Remove the left bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Removal - Left Side](#) .
 - 10.4. Remove the left bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Removal - Left Side](#) .
 - 10.5. Remove the left bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Removal - Left Side](#) .

Installation Procedure



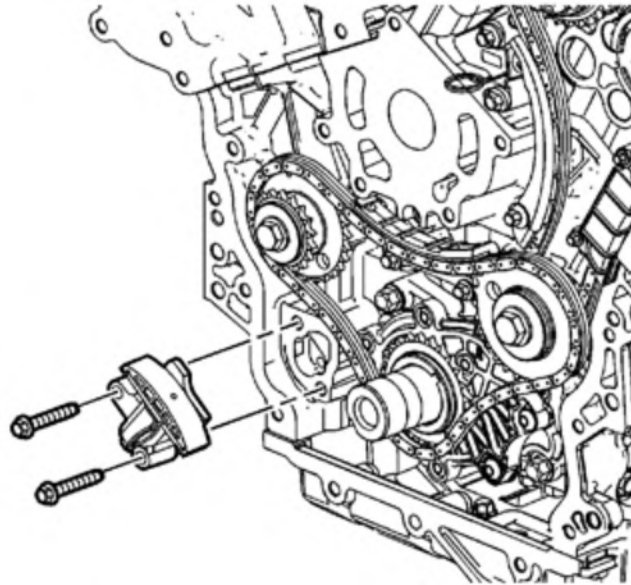
1. If you are servicing the left bank idler sprocket, perform the following steps:
 - 1.1. Install the left bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Installation - Left Side](#) .
 - 1.2. Install the left bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Installation - Left Side](#) .
 - 1.3. Install the left bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Left Side](#) .
 - 1.4. Install the left bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Installation - Left Side](#) .
 - 1.5. Install the left bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Left Side](#) .



2. Install the right bank camshaft intermediate drive chain idler. Refer to [Camshaft Intermediate Drive Chain Idler Installation - Right Side](#) .
3. Install the primary camshaft drive chain. Refer to [Primary Camshaft Drive Chain Installation](#) .
4. Install the primary upper camshaft drive chain guide. Refer to [Primary Camshaft Drive Chain Guide Installation - Upper](#) .
5. Install the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Installation](#) .
6. Install the right bank secondary camshaft drive chain. Refer to [Secondary Camshaft Drive Chain Installation - Right Side](#) .
7. Install the right bank secondary camshaft drive chain guide. Refer to [Secondary Camshaft Drive Chain Guide Installation - Right Side](#) .
8. Install the right bank secondary camshaft drive chain shoe. Refer to [Secondary Camshaft Drive Chain Shoe Installation - Right Side](#) .
9. Install the right bank secondary camshaft drive chain tensioner. Refer to [Secondary Camshaft Drive Chain Tensioner Installation - Right Side](#) .
10. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Primary Camshaft Drive Chain Tensioner Replacement

Removal Procedure

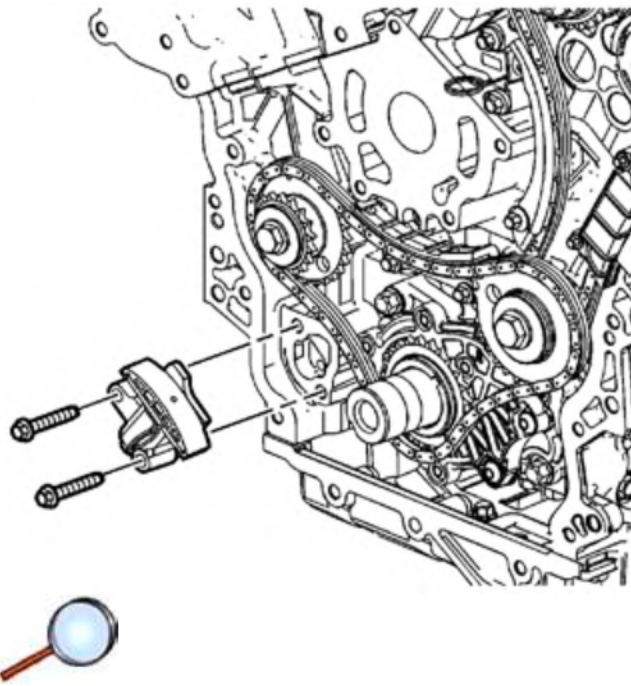


1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Important: If the entire camshaft timing system is not in Stage 2, [Camshaft Timing Drive Chain Alignment Diagram](#) , mark the timing chain and sprockets in order to ensure proper reassembly.

2. Remove the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Removal](#) .

Installation Procedure

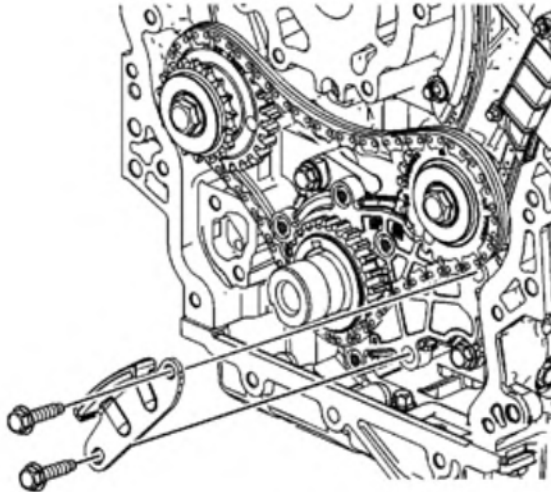


1. Install the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Installation](#) .
2. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Primary Camshaft Drive Chain Guide Replacement - Lower

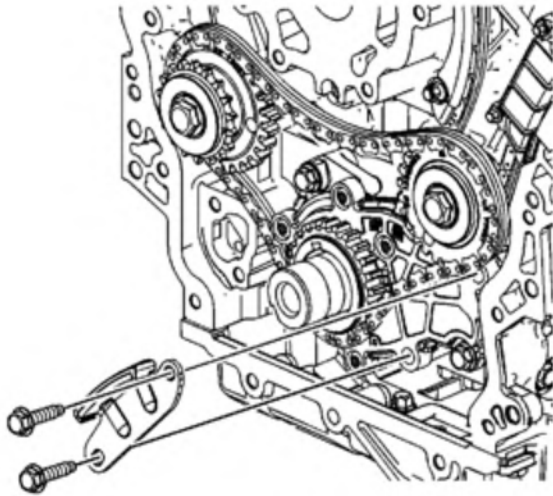
Removal Procedure

1. Remove the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Replacement](#).



2. Remove the primary camshaft drive chain lower guide bolts.
3. Remove the primary camshaft drive chain lower guide.

Installation Procedure



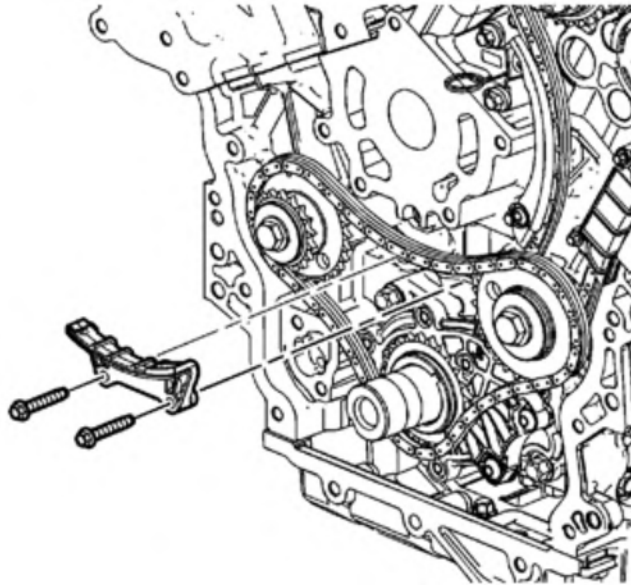
1. Position the primary camshaft drive chain lower guide to the oil pump.

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

2. Install the primary camshaft drive chain lower guide bolts and tighten to **23 N·m (17 lb ft)**.
3. Install the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Replacement](#).

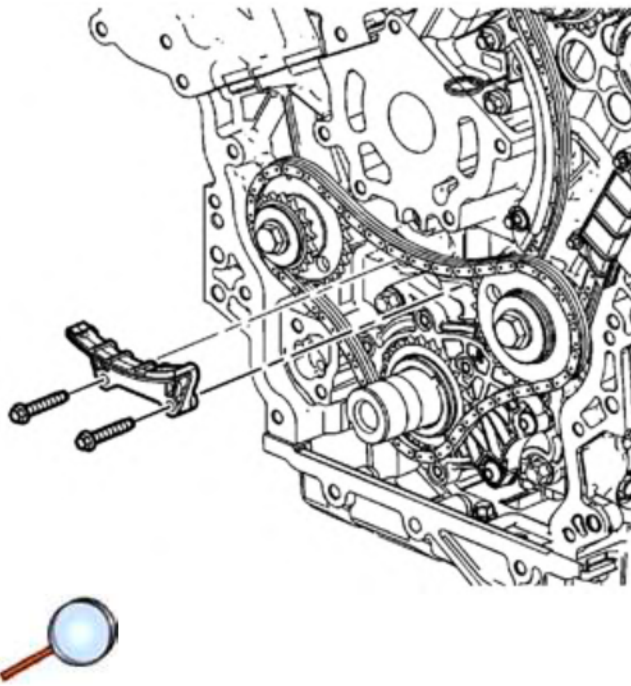
Primary Camshaft Drive Chain Guide Replacement - Upper

Removal Procedure



1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#) .
2. Remove the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Removal](#) .
3. Remove the primary upper camshaft drive chain guide. Refer to [Primary Camshaft Drive Chain Guide Removal - Upper](#) .

Installation Procedure



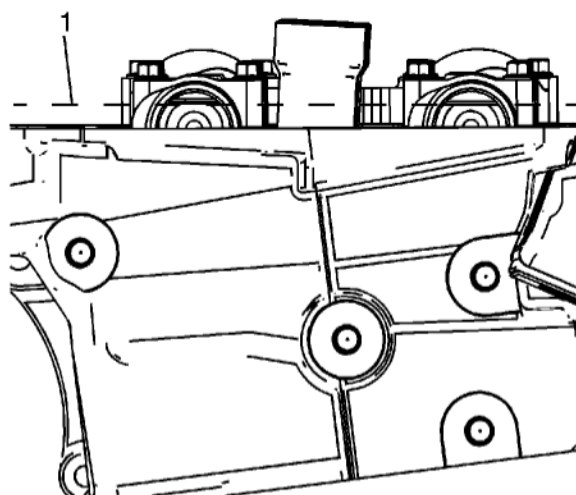
1. Install the primary upper camshaft drive chain guide. Refer to [Primary Camshaft Drive Chain Guide Installation - Upper](#) .
2. Install the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Drive Chain Tensioner Installation](#) .
3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

Camshaft Position Actuator Replacement - Bank 2 (Left Side) Exhaust

Special Tools

[EN-48313](#) Timing Chain Retention Tool

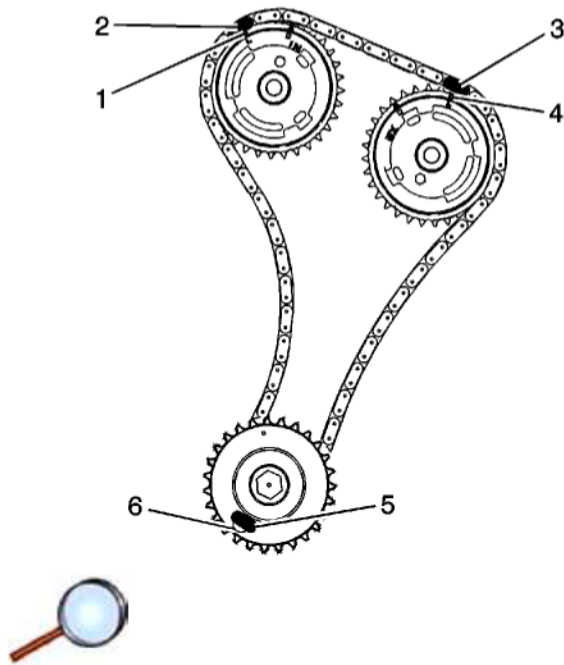
Removal Procedure



1. On LP1 and LY7 engines, remove the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#).
2. On LLT engines, remove the intake manifold. Refer to [Intake Manifold Replacement](#).
3. Remove the left camshaft cover. Refer to [Camshaft Cover Replacement - Left Side](#).
4. Remove the left intake and exhaust camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Intake](#) and [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#).
5. Remove the left intake and exhaust camshaft position actuator solenoid. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Intake](#) and [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Exhaust](#).

Note: Rotate the crankshaft balancer bolt in a clockwise direction ONLY.

6. Rotate the crankshaft balancer using the balancer bolt until the camshafts are in a neutral (low tension) position. The camshafts will be parallel with the camshaft cover rail (1).

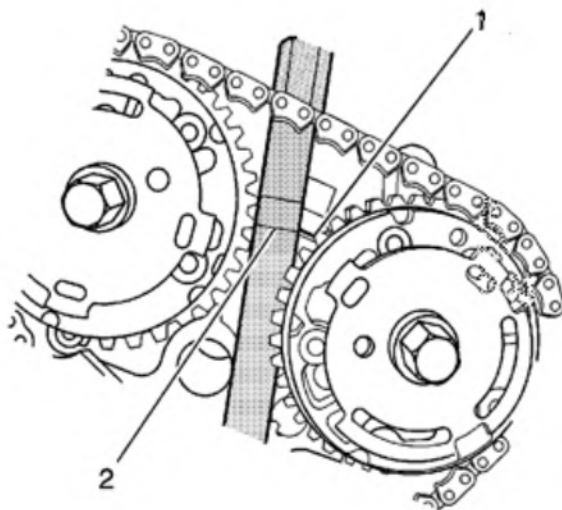


Note: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

7. Use a paint stick to create an alignment mark on one of the timing chain links (2) and the adjacent tooth on the exhaust camshaft position actuator (1).
8. Use a paint stick to create an alignment mark on one of the timing chain links (3) and the adjacent tooth on the intake camshaft position actuator (4).

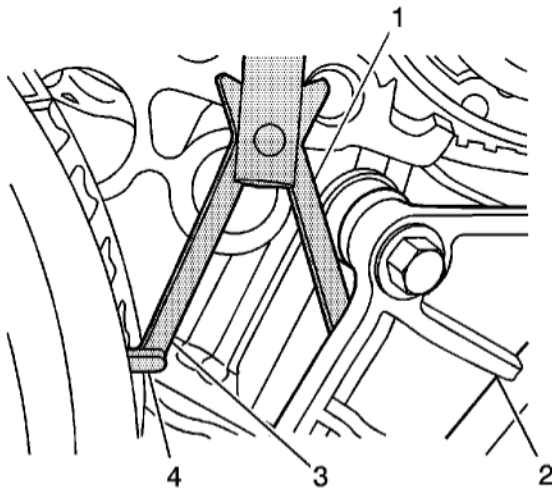
Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.

9. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.



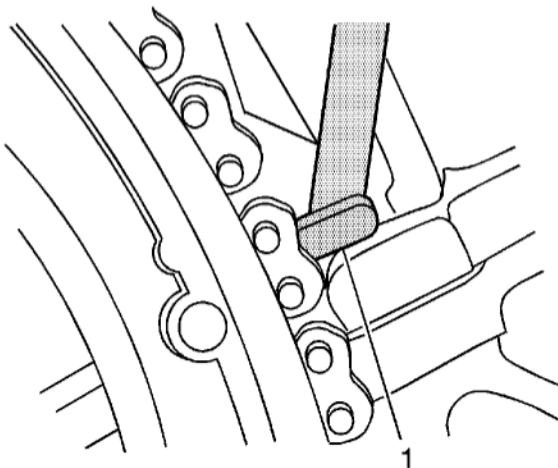


10. Unscrew the [EN-48313](#) so that the legs of the tool are retracted.
11. Insert the [EN-48313](#) between the camshaft actuators, rearward of the timing chain until the bottom line that is scribed in the body of the tool (2) is adjacent to the top surface of the cylinder head (1). This is the approximate installed position.



Note: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

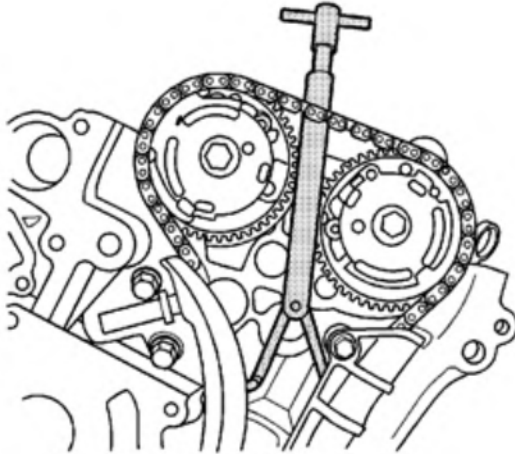
12. Ensure that the feet (4) on the legs of the tool are facing the front of the engine.
13. Partially expand the legs (1, 3) of the [EN-48313](#) by turning the T-shaped handle clockwise.
14. Insert the leg of the tool (1) behind the timing chain guide (2).
15. Continue expanding the [EN-48313](#) until the legs (1, 3) contact the timing chain. Do not tighten at this time.



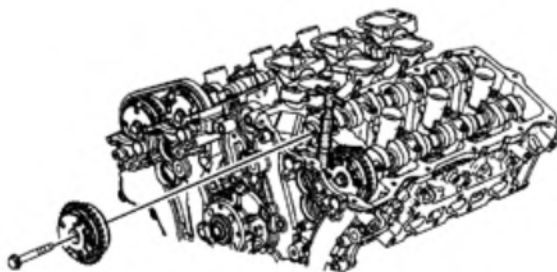


Note: Ensure that the foot (1) of the [EN-48313](#) is engaged into one of the link pockets to prevent tool slippage during tightening of the [EN-48313](#) .

16. Hand tighten the [EN-48313](#) .
17. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.



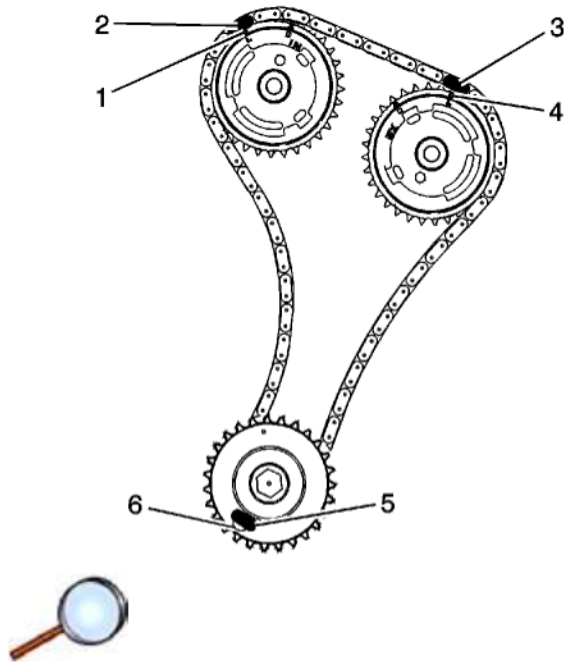
18. The [EN-48313](#) is now properly installed to hold the timing chain in position.



19. Use an open end wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.

20. Remove the left exhaust camshaft position actuator bolt.
21. Remove the left exhaust camshaft position actuator. When removing the actuator, place the chain on the engine cover side of the actuators.
22. Rotate the actuator in order to align the opening in the actuator reluctor wheel with the cam sensor boss in the front cover, to allow actuator removal.
23. If removing both the exhaust and intake camshaft actuators, the timing chain can be draped over the [EN-48313](#) once the actuators have been removed.

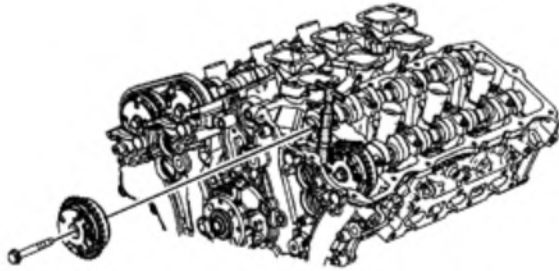
Installation Procedure



Note: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

1. Align the exhaust camshaft actuator alignment mark (1) to the timing chain alignment mark (2) made during disassembly.
2. Ensure that the intake camshaft actuator alignment mark (4) and the timing chain alignment mark (3) are also aligned.
3. Position the exhaust camshaft actuator to the camshaft and install the actuator bolt hand tight.
4. Remove the [EN-48313](#) .

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



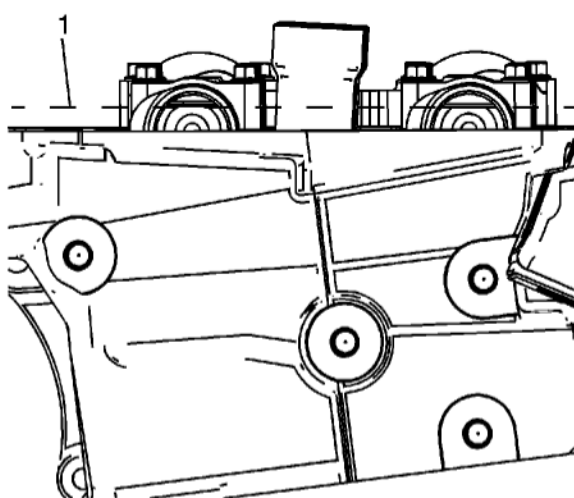
5. Tighten the exhaust camshaft position actuator bolt to **58 N·m (43 lb ft)**.
6. Install the left intake and exhaust camshaft position actuator solenoids. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Intake](#) and [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Exhaust](#).
7. Install the left intake and exhaust camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Intake](#) and [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#).
8. Install the left camshaft cover. Refer to [Camshaft Cover Replacement - Left Side](#).
9. On LLT engines, remove the intake manifold. Refer to [Intake Manifold Replacement](#).
10. On LP1 and LY7 engines, install the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#).

Camshaft Position Actuator Replacement - Bank 1 (Right Side) Exhaust

Special Tools

[EN-48313](#) Timing Chain Retention Tool

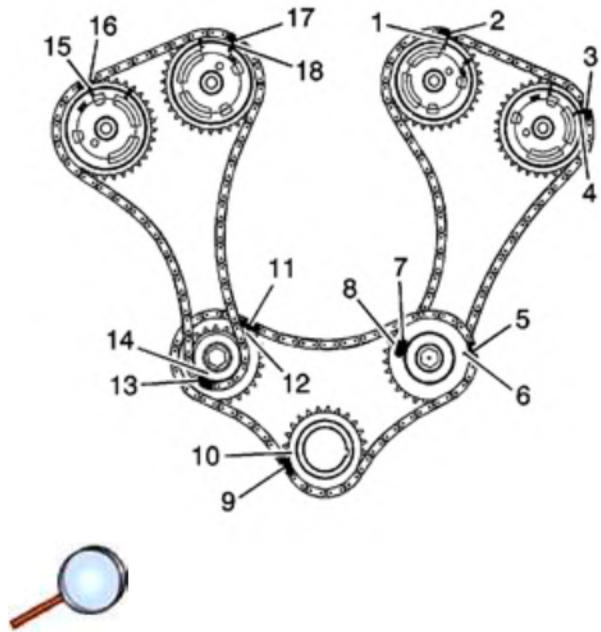
Removal Procedure



1. On LP1 and LY7 engines, remove the lower intake manifold with the upper manifold. Refer to [Lower Intake Manifold Replacement](#).
2. On LLT engines, remove the intake manifold. Refer to [Intake Manifold Replacement](#).
3. Remove the right camshaft cover. Refer to [Camshaft Cover Replacement - Right Side](#).
4. Remove the right intake and exhaust camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#) and [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#).
5. Remove the right intake and exhaust camshaft position actuator solenoids. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#) and [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Exhaust](#).

Note: Rotate the crankshaft balancer bolt in a clockwise direction ONLY.

6. Rotate the crankshaft balancer using the balancer bolt until the camshafts are in a neutral (low tension) position. The camshafts will be parallel with the camshaft cover rail (1).

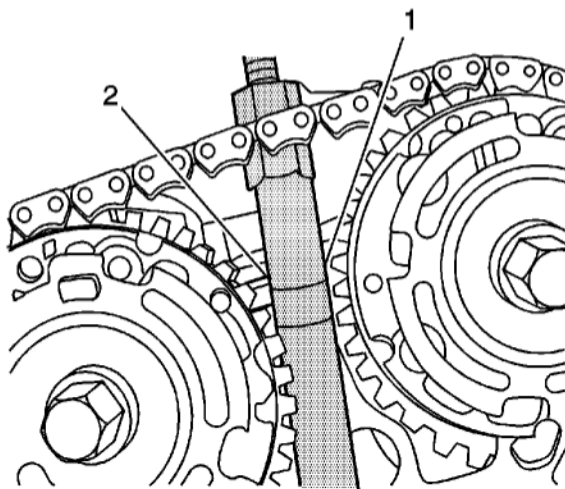


Note: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

7. Use a paint stick to create an alignment mark (17) on one of the timing chain links and the adjacent tooth on the exhaust camshaft position actuator (18).
8. Use a paint stick to create an alignment mark (16) on one of the timing chain links and the adjacent tooth on the intake camshaft position actuator (15).

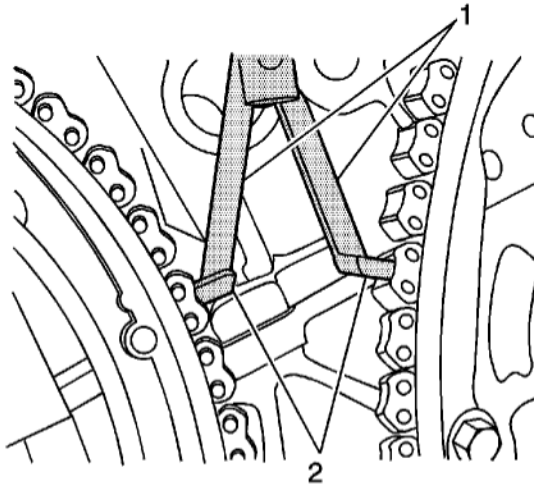
Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.

9. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.



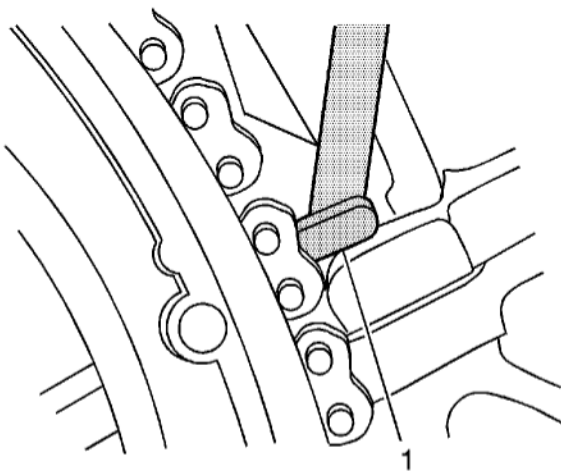


10. Unscrew the [EN-48313](#) so that the legs of the tool are retracted.
11. Insert the [EN-48313](#) between the camshaft actuators, rearward of the timing chain until the top line that is scribed in the body of the tool (1) is adjacent to the top surface of the cylinder head (2). This is the approximate installed position.



Note: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

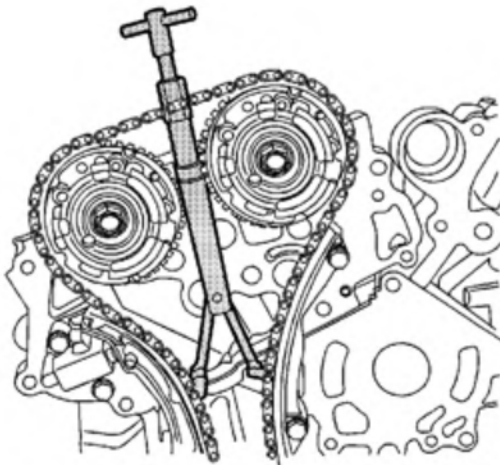
12. Ensure that the feet (2) on the legs of the tool are facing the front of the engine.
13. Partially expand the legs (1) of the [EN-48313](#) by turning the T-shaped handle clockwise.
14. Continue expanding the [EN-48313](#) until the feet (1) contact the timing chain. Do not tighten at this time.



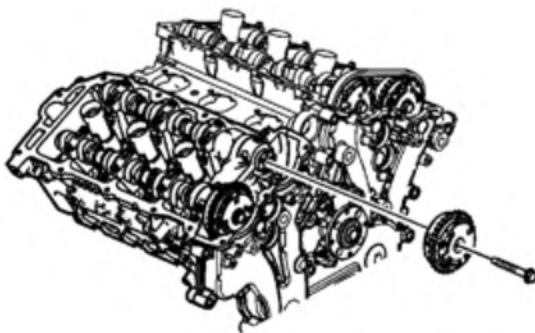
**Note:**

- Ensure that the foot (1) of the [EN-48313](#) is engaged into one of the link pockets to prevent chain slippage during tightening of the [EN-48313](#) .
- Do not allow the body of the [EN-48313](#) to rotate when tightening the T-handle.

15. Hand tighten the [EN-48313](#) .
16. Use an open end wrench on the hex cast into the body of the [EN-48313](#) and hand tighten the T-handle.
17. Use an open end wrench on the hex cast into the right intake and exhaust camshafts and rotate the camshafts towards each other in order to create slack in the chain between the actuators.



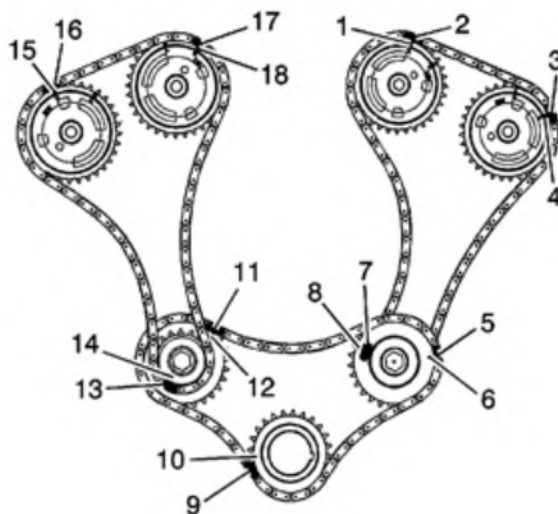
18. The [EN-48313](#) is now properly installed to hold the timing chain in position.





19. Use an open end wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.
20. Remove the right exhaust camshaft position actuator bolt.
21. Remove the right exhaust camshaft position actuator. When removing the actuator, place the chain on the engine block side of the actuators.
22. Rotate the actuator in order to align the opening in the actuator reluctor wheel with the cam sensor boss in the front cover, to allow actuator removal.
23. If removing both the exhaust and intake camshaft actuators, the timing chain can be draped over the [EN-48313](#) once the actuators have been removed.

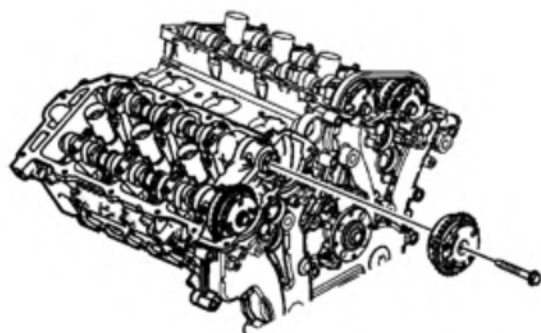
Installation Procedure



Note: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

1. Align the exhaust camshaft actuator alignment mark (18) to the timing chain alignment mark (17) made during disassembly.
2. Ensure that the intake camshaft actuator alignment mark (15) and the timing chain alignment mark (16) are also aligned.
3. Position the exhaust camshaft actuator to the camshaft and install the actuator bolt hand tight.
4. Remove the [EN-48313](#).

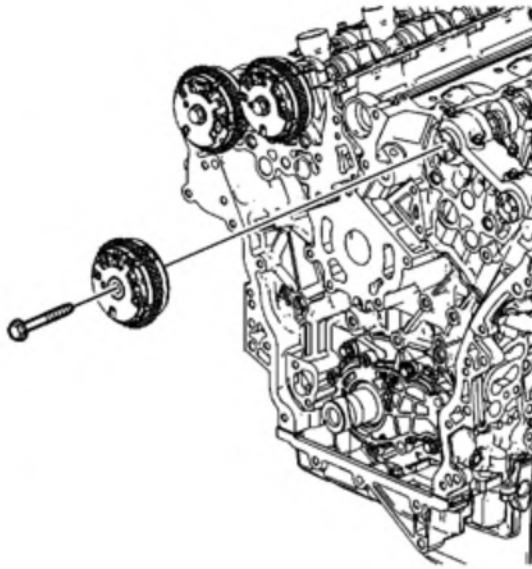
Caution: Refer to [Fastener Caution](#) in the Preface section.



5. Tighten the right exhaust camshaft position actuator bolt to **58 N·m (43 lb ft)**.
6. Install the right intake and exhaust camshaft position actuator solenoids. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#) and [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Exhaust](#).
7. Install the right intake and exhaust camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#) and [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#).
8. Install the right camshaft cover. Refer to [Camshaft Cover Replacement - Right Side](#).
9. On LLT engines, install the intake manifold. Refer to [Intake Manifold Replacement](#).
10. On LP1 and LY7 engines, install the lower intake manifold with the upper manifold. Refer to [Lower Intake Manifold Replacement](#).

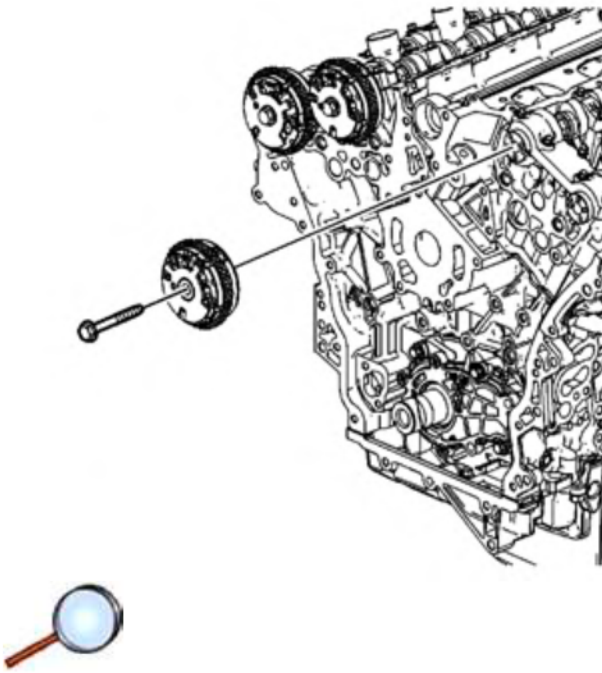
Camshaft Position Actuator Replacement - Bank 2 (Left Side) Intake

Removal Procedure



1. Remove the left exhaust camshaft actuator. Refer to [Camshaft Position Actuator Replacement - Bank 2 \(Left Side\) Exhaust](#).
2. Remove the intake camshaft position actuator bolt.
3. Remove the left intake camshaft position actuator.

Installation Procedure



1. Locate the intake camshaft position actuator to the camshaft and loosely install the bolt.

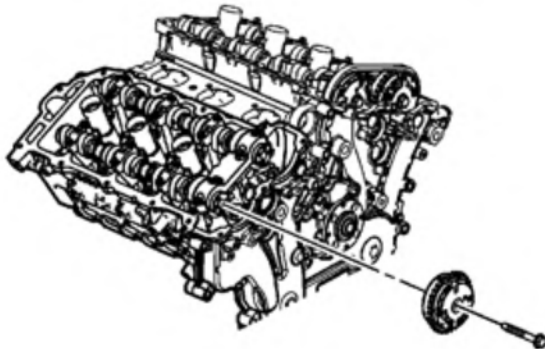
Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.

Note: Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

2. Tighten the camshaft position actuator bolt. Refer to [Camshaft Position Actuator Installation - Left Side Intake](#).
3. Install the left exhaust camshaft actuator. Refer to [Camshaft Position Actuator Replacement - Bank 2 \(Left Side\) Exhaust](#).

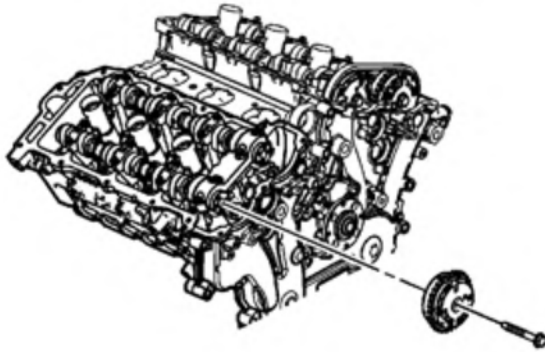
Camshaft Position Actuator Replacement - Bank 1 (Right Side) Intake

Removal Procedure



1. Remove the right exhaust camshaft actuator. Refer to [Camshaft Position Actuator Replacement - Bank 1 \(Right Side\) Exhaust](#).
2. Remove the intake camshaft position actuator bolt.
3. Remove the right intake camshaft position actuator.

Installation Procedure



1. Locate the intake camshaft position actuator to the camshaft and loosely install the bolt.

Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.

Note: Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

2. Tighten the camshaft position actuator bolt. Refer to [Camshaft Position Actuator Installation - Right Side Intake](#).
3. Install the right exhaust camshaft actuator. Refer to [Camshaft Position Actuator Replacement - Bank 1 \(Right Side\) Exhaust](#).

Setting Camshaft Timing

Important: Setting the camshaft timing is necessary whenever the camshaft drive system has been disturbed such that the relationship between any chain and sprocket has been lost. Even when only one sprocket is involved, multiple crankshaft rotations will not produce conditions where correct timing can be confirmed.

Follow the left bank secondary camshaft drive chain replacement procedures to reset the camshaft timing. Refer to [Secondary Camshaft Drive Chain Replacement - Left Side](#) .

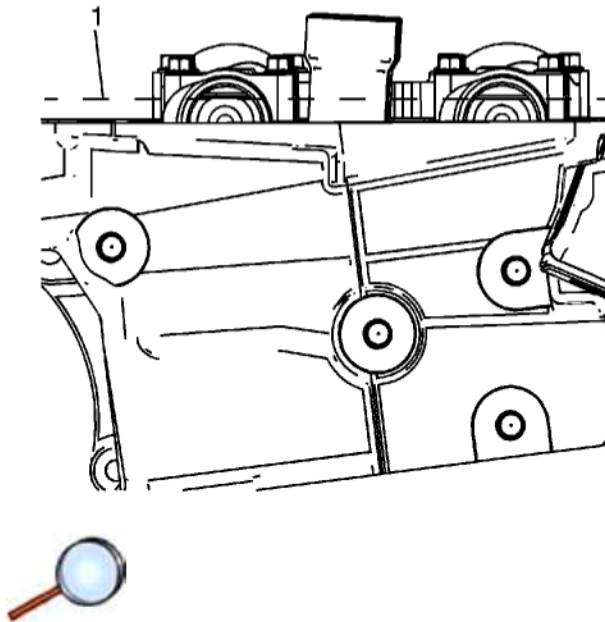
Camshaft Replacement - Left Side

Special Tools

[EN-48313](#) Timing Chain Retention Tool

Removal Procedure

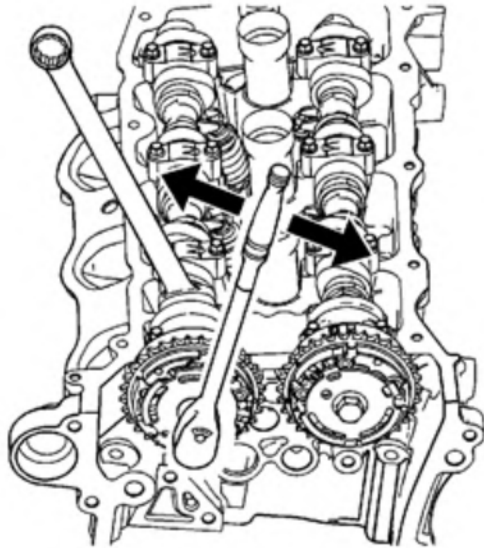
1. Remove the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#).
2. Remove the left bank camshaft cover. Refer to [Camshaft Cover Replacement - Left Side](#).
3. Remove the camshaft sensors. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#) and [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Intake](#).
4. Remove the camshaft position actuator solenoid. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Intake](#).



Note: Rotate the crankshaft balancer in a clockwise rotation ONLY.

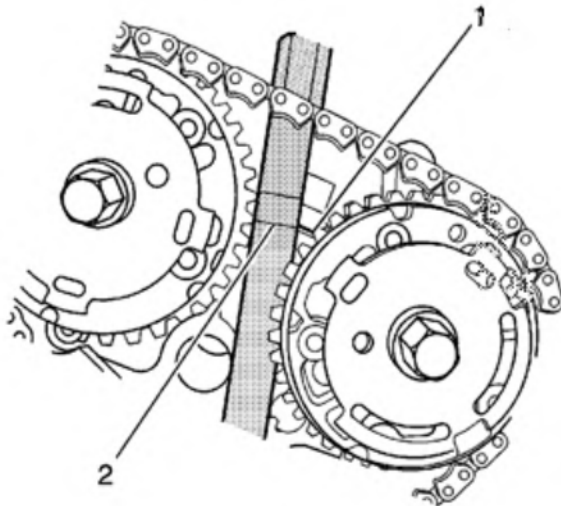
5. Rotate the crankshaft using the crankshaft balancer bolt until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.

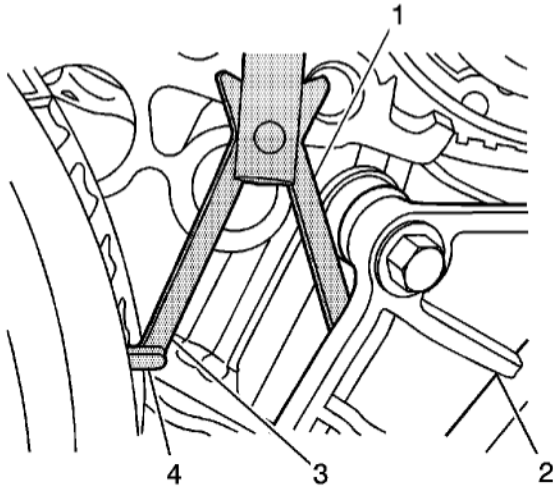
**Note:**

- Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.
- DO NOT remove the camshaft position actuator bolt at this time.

6. Loosen the camshaft position actuator bolt.

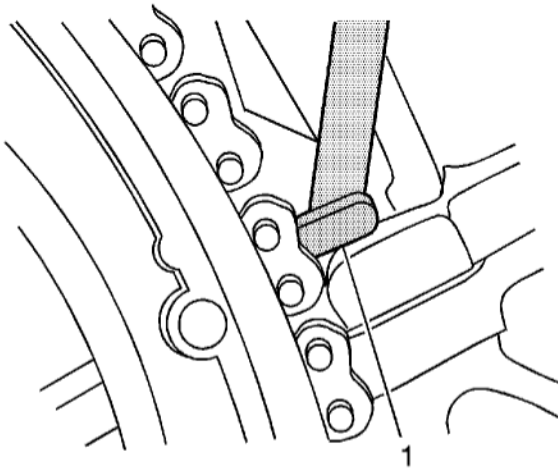


7. Unscrew the [EN-48313](#) so that the legs of the tool are retracted.
8. Insert the [EN-48313](#) between the camshaft actuators, rearward of the timing chain until the bottom line that is scribed in the body of the tool (2) is adjacent to the top surface of the cylinder head (1). This is the approximate installed position.



Note: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

9. Ensure that the feet (4) on the legs of the tool are facing the front of the engine.
10. Partially expand the legs (1, 3) of the [EN-48313](#) by turning the T-shaped handle clockwise.
11. Insert the leg of the tool (1) behind the timing chain guide (2).
12. Continue expanding the [EN-48313](#) until the legs (1, 3) contact the timing chain. Do not tighten at this time.

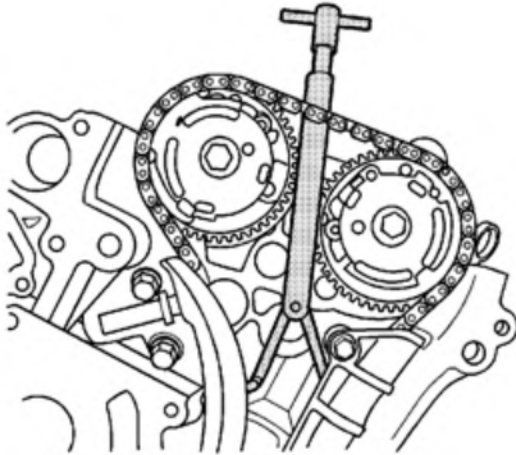


Note: Ensure that the foot (1) of the [EN-48313](#) is engaged into one of the link pockets to prevent tool slippage during tightening of the [EN-48313](#).

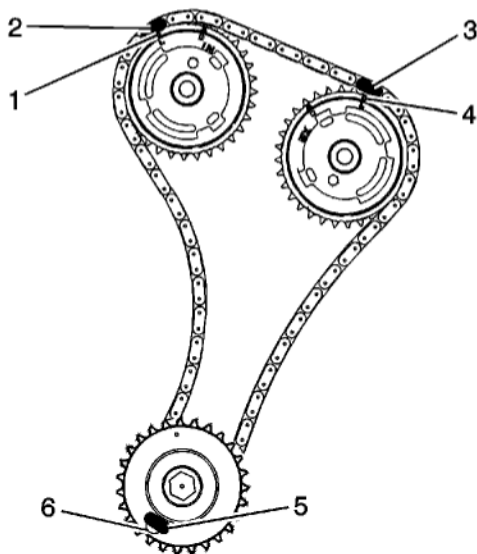
13. Hand tighten the [EN-48313](#) .

Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.

14. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.



15. The [EN-48313](#) is now properly installed to hold the timing chain in position.

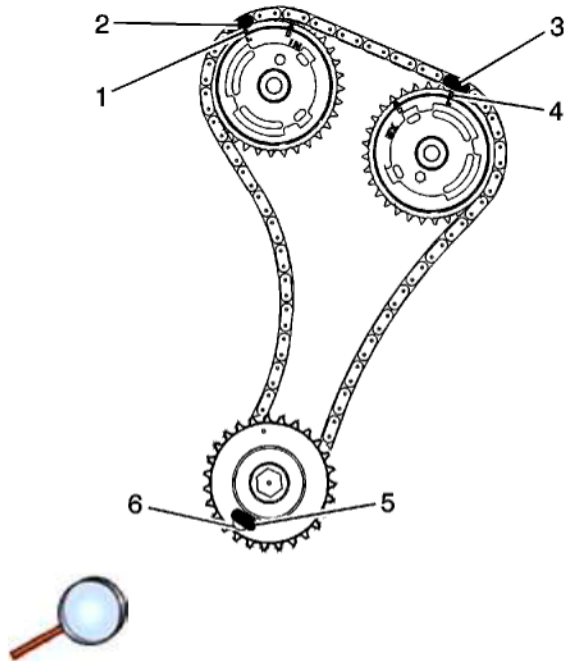


Note: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

16. Mark the timing chain and the respective locations on the camshaft position actuators (1-4).

17. Remove the camshaft position actuator bolt.
18. Remove the camshafts. Refer to [Camshaft Removal - Left Side](#).

Installation Procedure

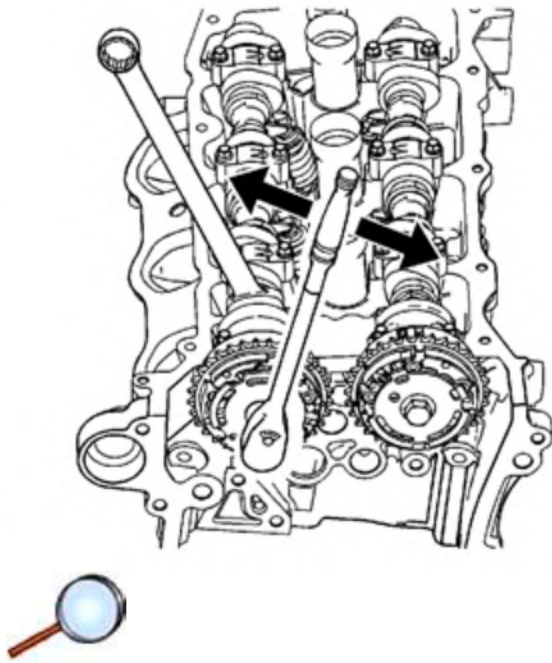


Note:

- Ensure that the marks on the camshaft position actuator and the timing chain (1-4) are aligned.
- DO NOT tighten the camshaft position actuator bolt at this time.

1. Locate the camshafts to the cylinder head and assemble the camshaft actuators to the camshafts.
2. Install the camshafts and the camshaft bearing caps. Refer to [Camshaft Installation - Left Side](#).
3. Remove the [EN-48313](#).

Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.



Note: Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

4. Install and tighten the camshaft position actuators. Refer to [Camshaft Position Actuator Installation - Left Side Intake](#) and [Camshaft Position Actuator Installation - Left Side Exhaust](#).
5. Install the intake camshaft position actuator solenoid. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 \(Left Side\) Intake](#).
6. Install the camshaft sensors. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#) and [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Intake](#).
7. Install the camshaft cover. Refer to [Camshaft Cover Replacement - Left Side](#).
8. Install the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#).

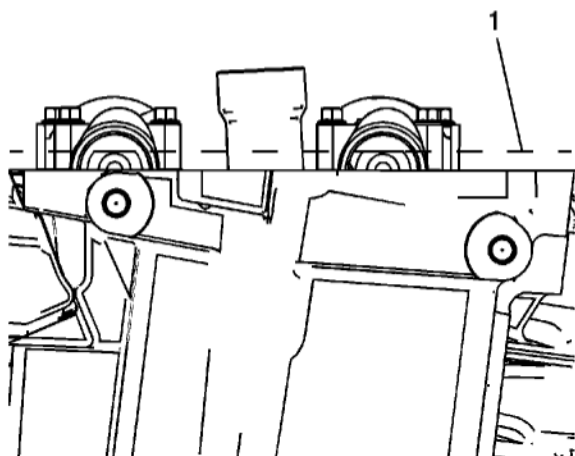
Camshaft Replacement - Right Side (LP1, LY7)

Special Tools

[EN-48313](#) Timing Chain Retention Tool

Removal Procedure

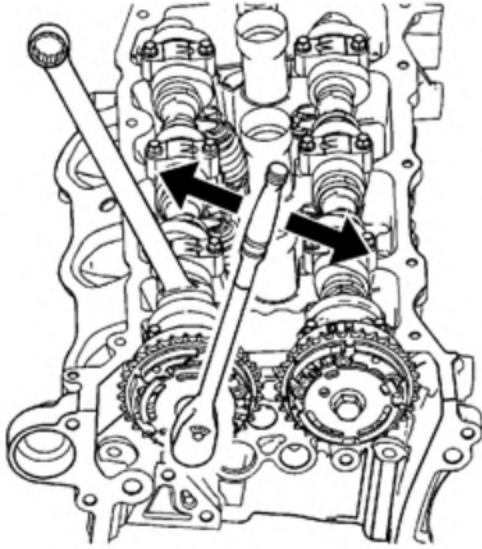
1. Remove the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#).
2. Remove the camshaft cover. Refer to [Camshaft Cover Replacement - Right Side](#).
3. Remove the camshaft sensors. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#) and [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#).
4. Remove the intake camshaft position actuator solenoid. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#).



Note: Rotate the crankshaft balancer in a clockwise rotation **ONLY**.

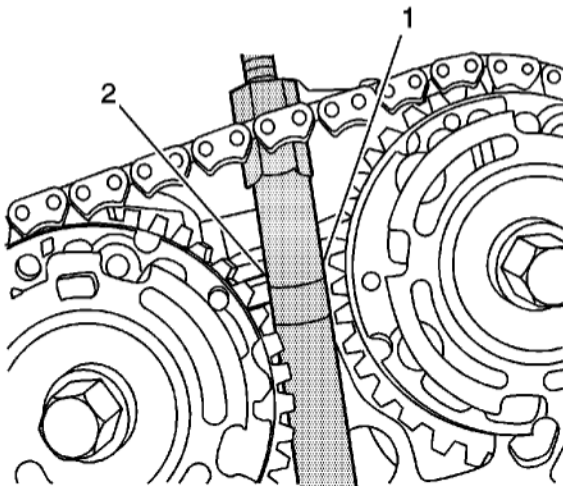
5. Rotate the crankshaft using the crankshaft balancer bolt until the camshafts are in a neutral (low tension) position. The camshaft flats will be parallel with the camshaft cover rail (1).

Caution: Refer to [Torque Reaction Against Timing Drive Chain Caution](#) in the Preface section.

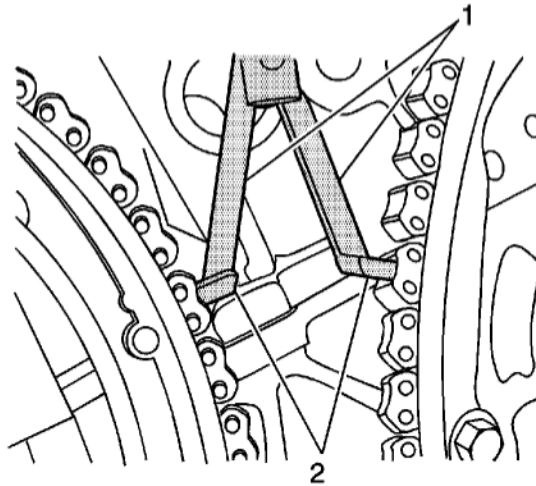
**Note:**

- Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.
- DO NOT remove the camshaft position actuator bolt at this time.

6. Loosen the camshaft position actuator bolt.

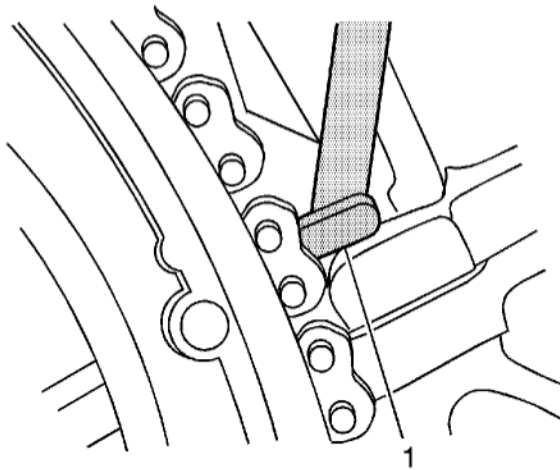


7. Unscrew the [EN-48313](#) so that the legs of the tool are retracted.
8. Insert the [EN-48313](#) between the camshaft actuators, rearward of the timing chain until the top line that is scribed in the body of the tool (1) is adjacent to the top surface of the cylinder head (2). This is the approximate installed position.



Note: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

9. Ensure that the feet (2) on the legs of the tool are facing the front of the engine.
10. Partially expand the legs (1) of the [EN-48313](#) by turning the T-shaped handle clockwise.
11. Continue expanding the [EN-48313](#) until the feet (1) contact the timing chain. Do not tighten at this time.

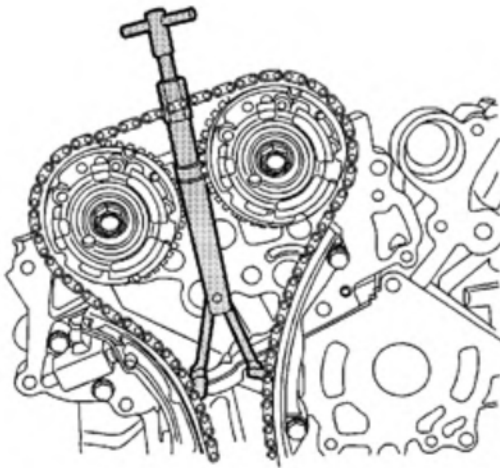


Note:

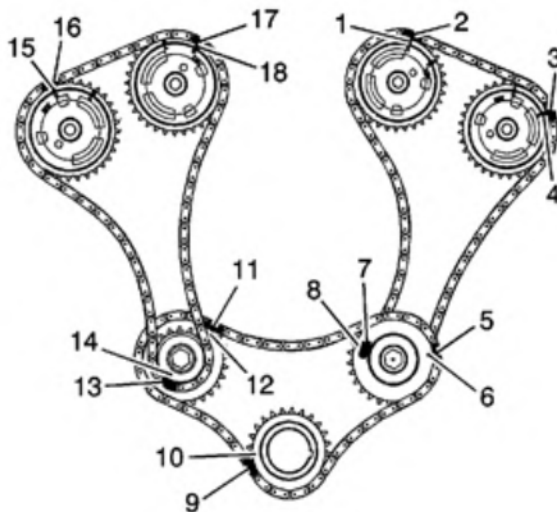
- Ensure that the foot (1) of the [EN-48313](#) is engaged into one of the link pockets to prevent chain slippage during tightening of the [EN-48313](#).

- Do not allow the body of the [EN-48313](#) to rotate when tightening the T-handle.

12. Hand tighten the [EN-48313](#) .
13. Use an open end wrench on the hex cast into the body of the [EN-48313](#) and hand tighten the T-handle.
14. Use an open end wrench on the hex cast into the right intake and exhaust camshafts and rotate the camshafts towards each other in order to create slack in the chain between the actuators.



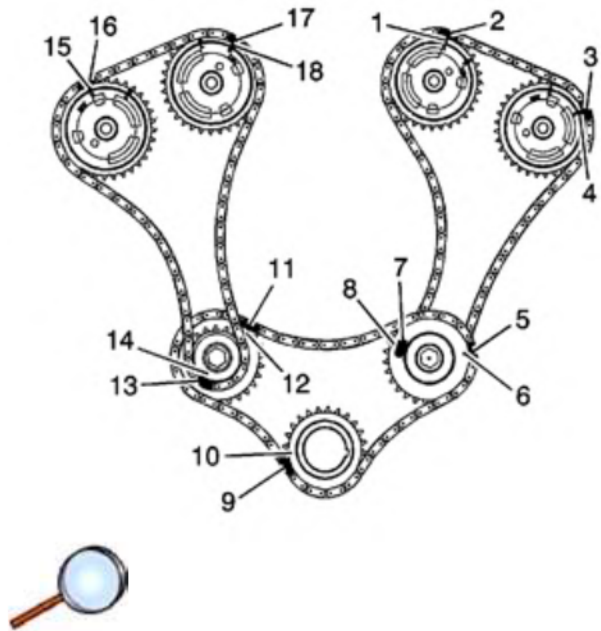
15. The [EN-48313](#) is now properly installed to hold the timing chain in position.



Note: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

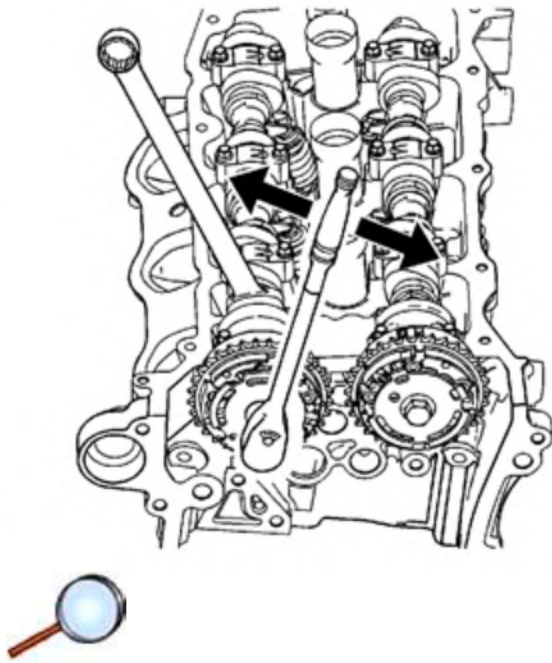
16. Mark the timing chain and the respective locations on camshaft position actuators (15-18).
17. Remove the camshaft position actuator bolt.
18. Remove the camshaft bearing caps and the camshaft. Refer to [Camshaft Removal - Right Side](#).

Installation Procedure



Note:

- Ensure that the marks on the camshaft position actuators and the timing chain (15-18) are aligned.
 - DO NOT tighten the camshaft position actuator bolt at this time.
1. Locate the camshafts to the cylinder head and assemble the camshaft actuators to the camshafts.
 2. Install the camshafts and the camshaft bearing caps. Refer to [Camshaft Installation - Right Side](#).
 3. Remove the [EN-48313](#).



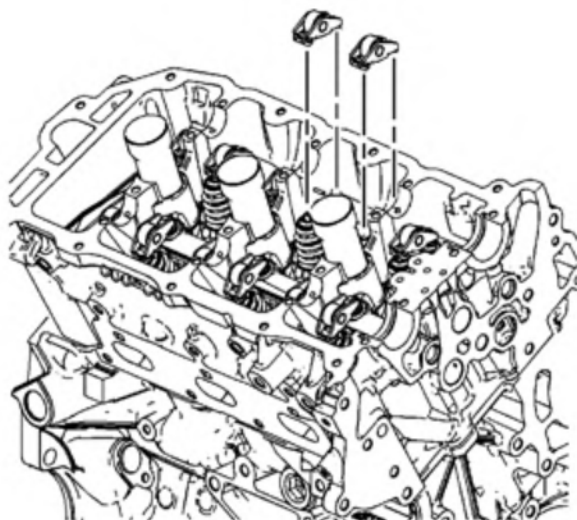
Note: Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

4. Install and tighten the camshaft position actuators. Refer to [Camshaft Position Actuator Installation - Right Side Intake](#) and [Camshaft Position Actuator Installation - Right Side Exhaust](#).
5. Install the intake camshaft position actuator solenoid. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#).
6. Install the camshaft sensors. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#) and [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#).
7. Install the camshaft cover. Refer to [Camshaft Cover Replacement - Right Side](#).
8. Install the upper intake manifold with the lower intake manifold. Refer to [Lower Intake Manifold Replacement](#).

Valve Rocker Arm Replacement - Left Side

Removal Procedure

1. Remove the applicable camshaft(s). Refer to [Camshaft Replacement - Left Side](#) .



2. Remove the rocker arms. Refer to [Valve Rocker Arm Removal - Left Side](#) .
3. Clean and inspect the camshaft(s) and the rocker arm(s). Repair or replace as necessary. Refer to [Camshaft Cleaning and Inspection](#) and [Valve Lifters Cleaning and Inspection](#) .

Installation Procedure



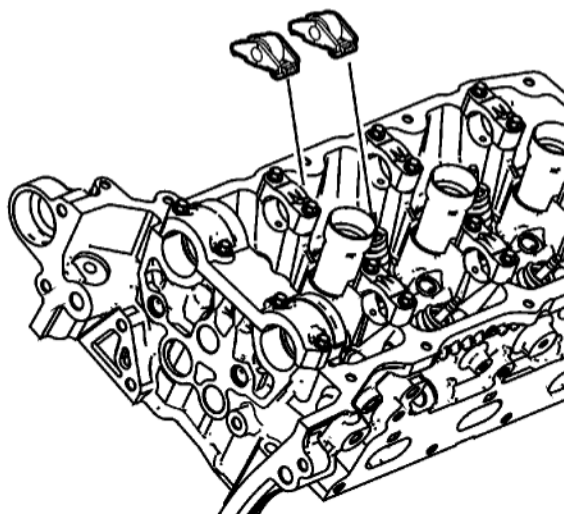


1. Install the rocker arms. Refer to [Valve Rocker Arm Installation - Left Side](#) .
2. Install the applicable camshaft(s). Refer to [Camshaft Replacement - Left Side](#) .

Valve Rocker Arm Replacement - Right Side

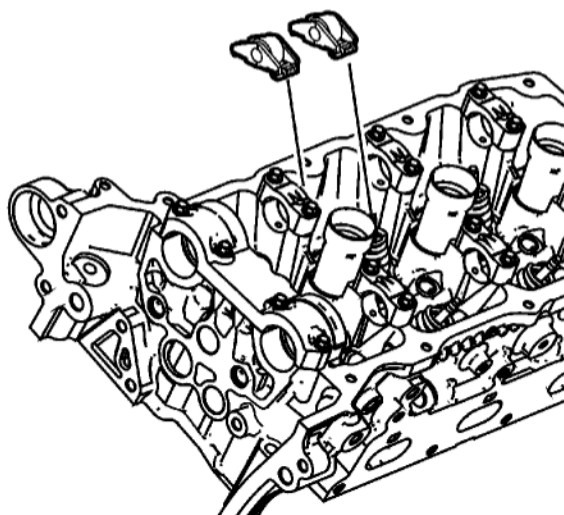
Removal Procedure

1. Remove the applicable camshaft(s). Refer to [Camshaft Replacement - Left Side](#) .



2. Remove the rocker arms. Refer to [Valve Rocker Arm Removal - Right Side](#) .
3. Clean and inspect the camshaft(s) and the rocker arm(s). Repair or replace as necessary. Refer to [Camshaft Cleaning and Inspection](#) and [Valve Lifters Cleaning and Inspection](#) .

Installation Procedure

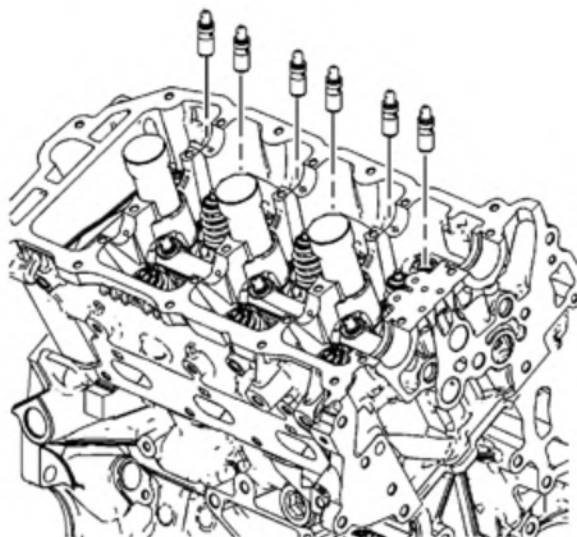




1. Install the rocker arms.
2. Install the applicable camshaft(s). Refer to [Valve Rocker Arm Installation - Right Side](#) .

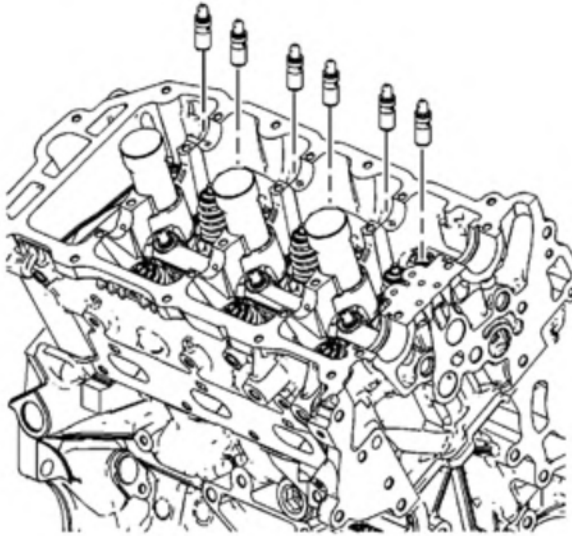
Valve Lifter Replacement - Left Side

Removal Procedure



1. Remove the applicable camshafts. Refer to [Camshaft Replacement - Left Side](#).
2. Remove the rocker arms. Refer to [Valve Rocker Arm Replacement - Left Side](#).
3. Remove the lifters. Refer to [Valve Lifter Replacement - Left Side](#).
4. Clean and inspect the camshafts, rocker arms and lifters. Repair or replace as necessary. Refer to [Camshaft Cleaning and Inspection](#) , [Valve Rocker Arm Cleaning and Inspection](#) and [Valve Lifters Cleaning and Inspection](#) .

Installation Procedure

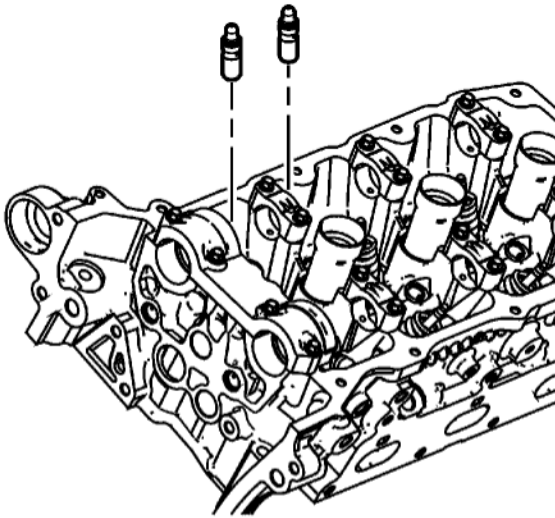


1. Install the lifters. Refer to [Valve Lifter Replacement - Left Side](#).
2. Install the rocker arms. Refer to [Valve Rocker Arm Replacement - Left Side](#).
3. Install the applicable camshafts. Refer to [Camshaft Replacement - Left Side](#).

Valve Lifter Replacement - Right Side

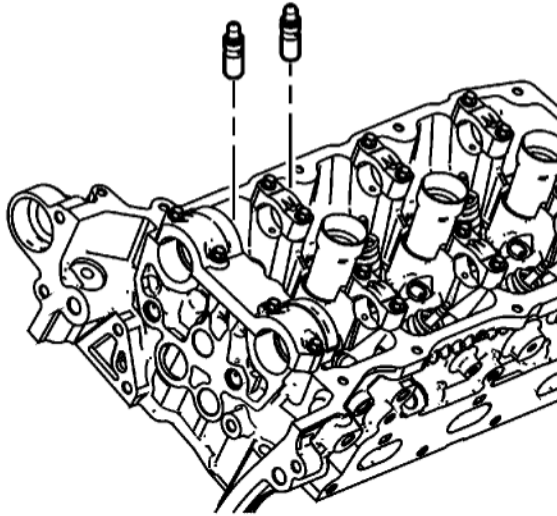
Removal Procedure

1. Remove the applicable camshaft(s). Refer to [Camshaft Replacement - Right Side](#) .
2. Remove the rocker arms. Refer to [Valve Rocker Arm Removal - Right Side](#) .



3. Remove the lifters. Refer to [Valve Lifter Removal - Left Side](#) .
4. Clean and inspect the camshaft(s) and the rocker arm(s). Repair or replace as necessary. Refer to [Camshaft Cleaning and Inspection](#) and [Valve Lifters Cleaning and Inspection](#) .

Installation Procedure



1. Install the lifters. Refer to [Valve Lifter Installation - Right Side](#) .
2. Install the rocker arms. Refer to [Valve Rocker Arm Installation - Right Side](#) .
3. Install the applicable camshaft(s). Refer to [Camshaft Replacement - Right Side](#) .

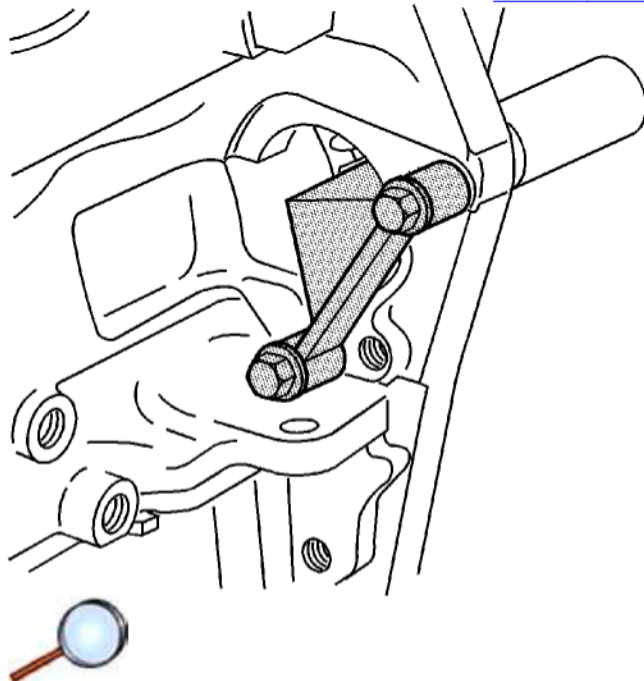
Valve Stem Oil Seal and Valve Spring Replacement - Left Side

Special Tools

- [J 39313](#) Spark Plug Port Adapter
- [EN 46106](#) Flywheel Holding Tool
- [EN 46108](#) Timing Chain Retention Tool
- [EN 46110](#) On-Vehicle Valve Spring Compressor
- [EN 46116](#) Valve Stem Seal Remover/Installer

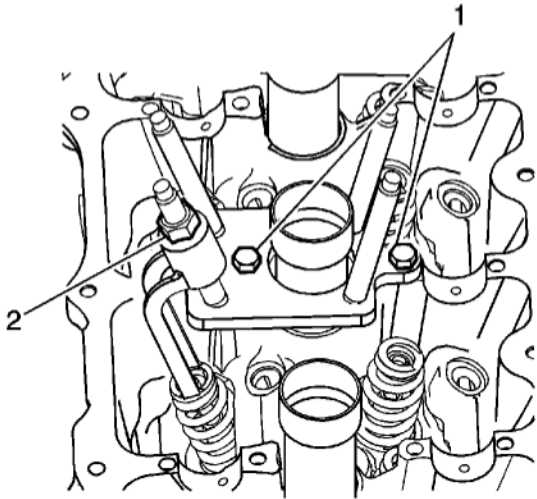
Removal Procedure

1. Remove the starter motor. Refer to [Starter Motor Replacement](#) .

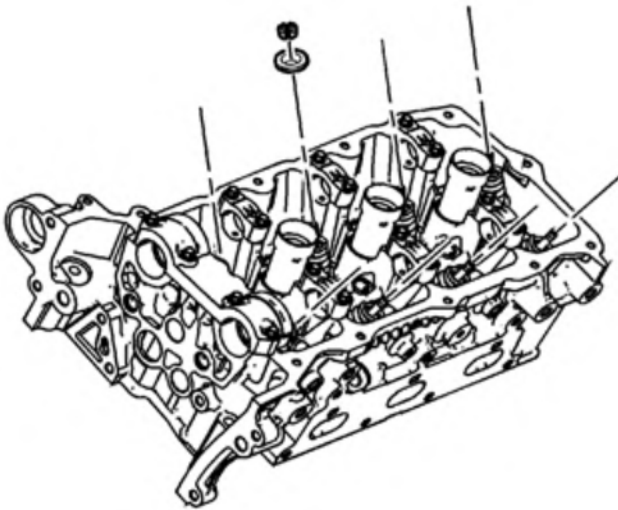


Important: If the [EN 46106](#) is not installed, the crankshaft may rotate. If the crankshaft rotates, disassembly and reassembly of the entire camshaft timing system may be required.

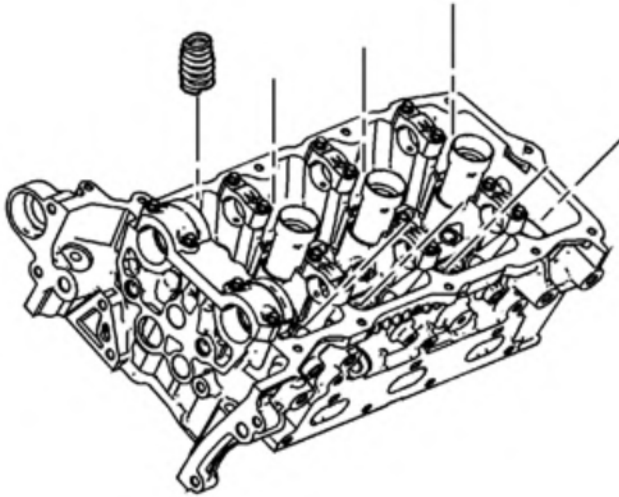
2. Install the [EN 46106](#) in order to prevent crankshaft rotation.
3. Remove the camshafts and rocker arms. Refer to [Camshaft Replacement - Left Side](#) .
4. Remove the spark plug from the applicable cylinder. Refer to [Spark Plug Replacement](#) .
5. Install the [J 39313](#) to the applicable cylinder.
6. Connect the [J 39313](#) to a compressed air source.



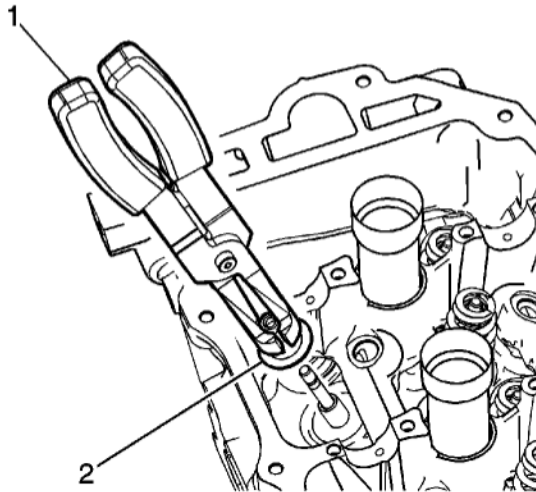
7. Install the [EN 46110](#) above the applicable cylinder as shown.
8. Tighten the [EN 46110](#) valve spring compressor nut (2).



9. Remove the valve keepers.
10. Loosen the [EN 46110](#) valve spring compressor nut.
11. Remove the valve spring retainer.

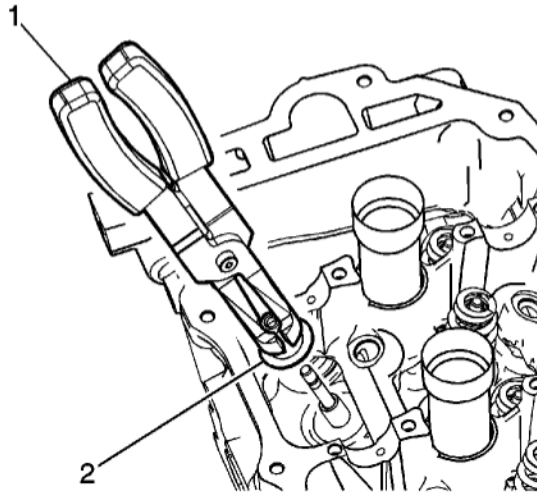


12. Remove the valve spring.

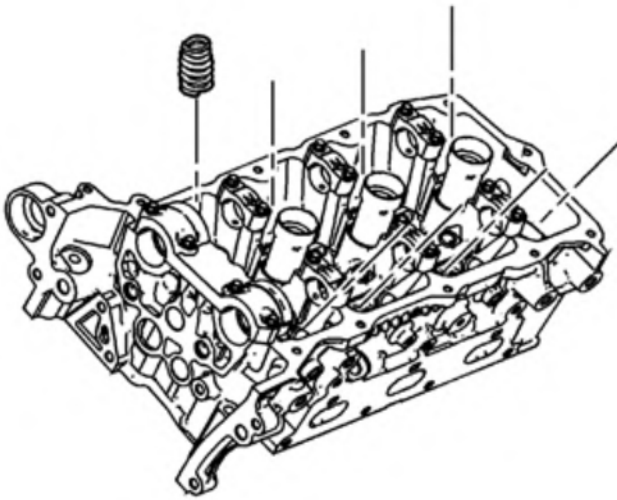


13. Use the [EN 46116](#) (1) in order to remove the valve stem seal (2).

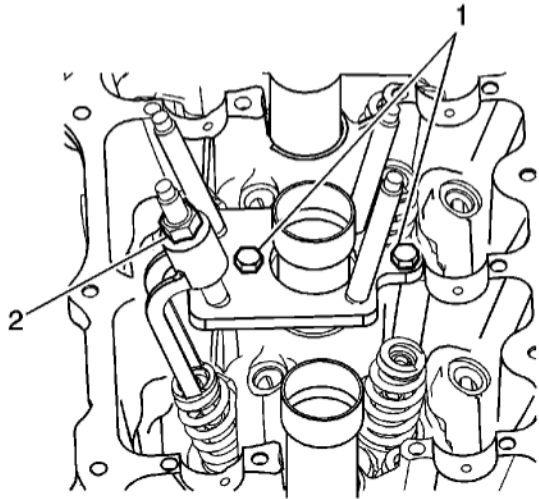
Installation Procedure



1. Use the [EN 46116](#) (1) in order to install the valve stem seal (2).

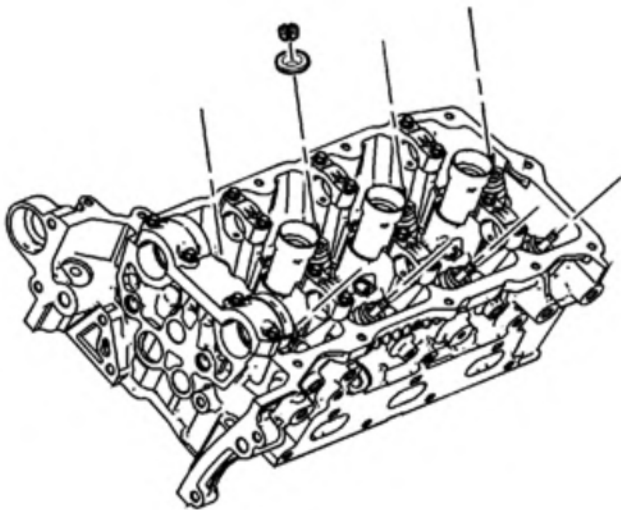


2. Install the valve spring.
3. Install the valve spring retainer.



4. Install the [EN 46110](#) above the applicable valve spring as shown.

Tighten the [EN 46110](#) valve spring compressor nut (2).



5. Install the valve spring keepers.
6. Remove the [EN 46110](#).
7. Disconnect the [J 39313](#) from the compressed air source.
8. Remove the [J 39313](#).
9. Install the spark plugs. Refer to [Spark Plug Replacement](#).
10. Install the rocker arms and camshafts. Refer to [Camshaft Replacement - Left Side](#).
11. Remove the [EN 46106](#) in order to prevent crankshaft rotation.
12. Install the starter motor. Refer to [Starter Motor Replacement](#).

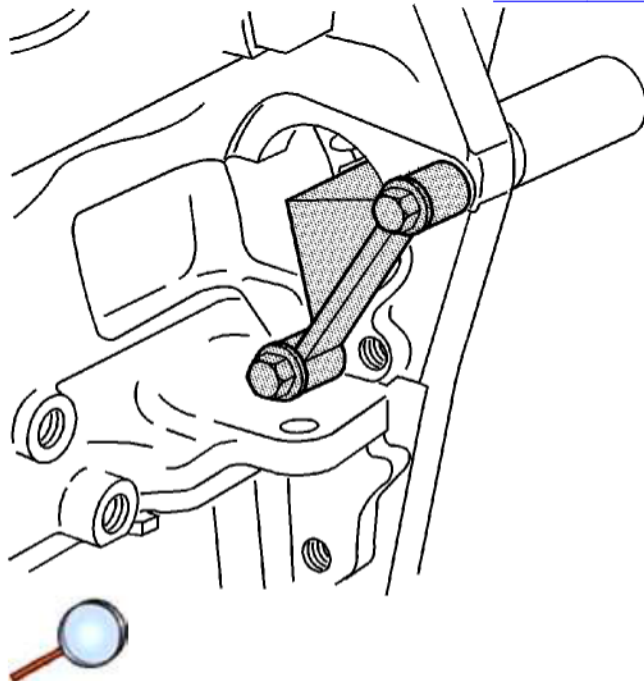
Valve Stem Oil Seal and Valve Spring Replacement - Right Side

Special Tools

- [EN 46106](#) Flywheel Holding Tool
- [EN 46108](#) Timing Chain Retention Tool
- [EN 46110](#) On-Vehicle Valve Spring Compressor
- [EN 46116](#) Valve Stem Seal Remover/Installer
- [J 39313](#) Spark Plug Port Adapter

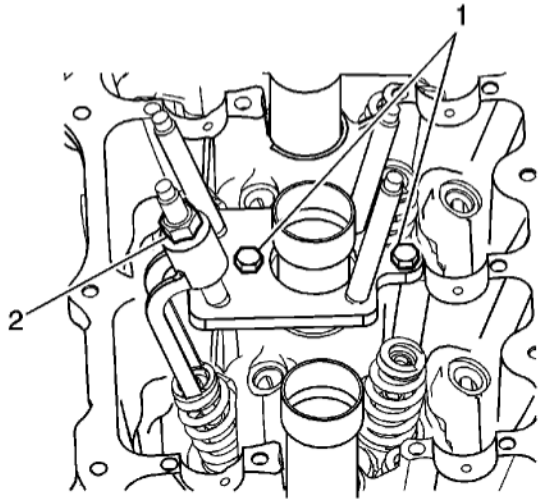
Removal Procedure

1. Remove the starter motor. Refer to [Starter Motor Replacement](#) .

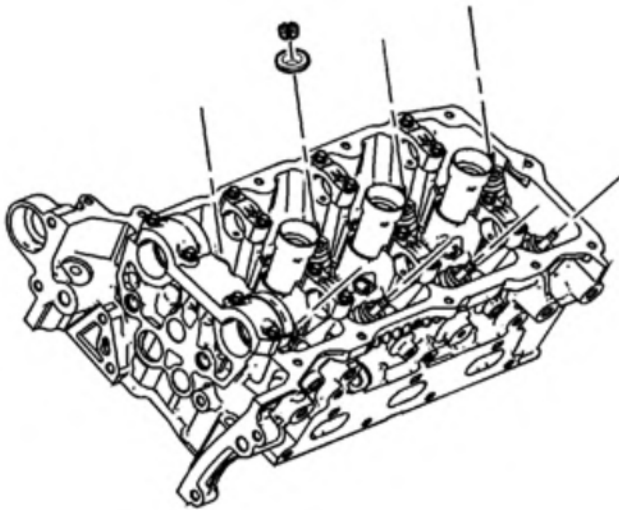


Important: If the [EN 46106](#) is not installed, the crankshaft may rotate. If the crankshaft rotates, disassembly and reassembly of the entire camshaft timing system may be required.

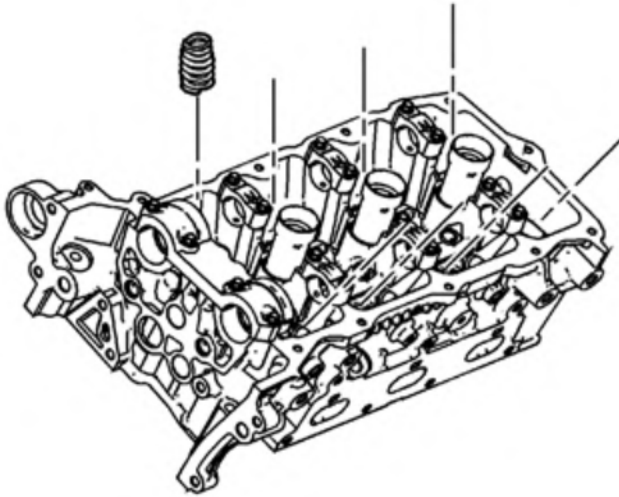
2. Install the [EN 46106](#) in order to prevent crankshaft rotation.
3. Remove the camshafts and rocker arms. Refer to [Camshaft Replacement - Right Side](#) .
4. Remove the spark plug from the applicable cylinder. Refer to [Spark Plug Replacement](#) .
5. Install the [J 39313](#) to the applicable cylinder.
6. Connect the [J 39313](#) to a compressed air source.



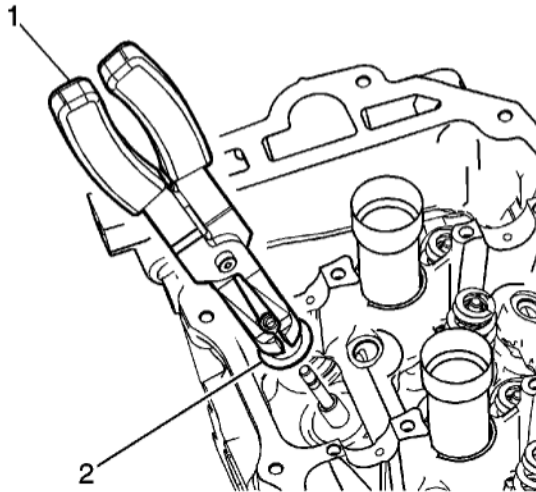
7. Install the [EN 46110](#) above the applicable cylinder as shown.
8. Tighten the [EN 46110](#) valve spring compressor nut (2).



9. Remove the valve keepers.
10. Loosen the [EN 46110](#) valve spring compressor nut.
11. Remove the valve spring retainer.

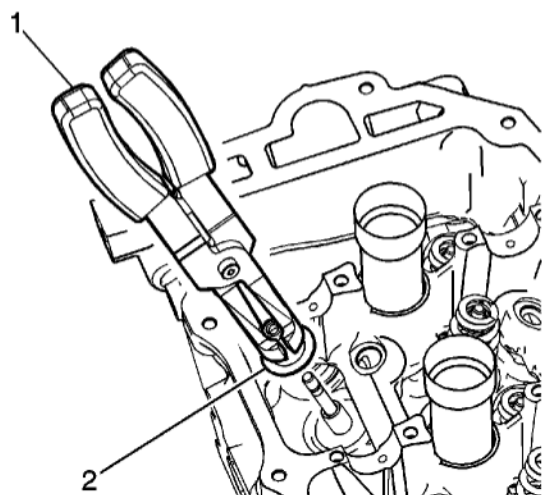


12. Remove the valve springs.

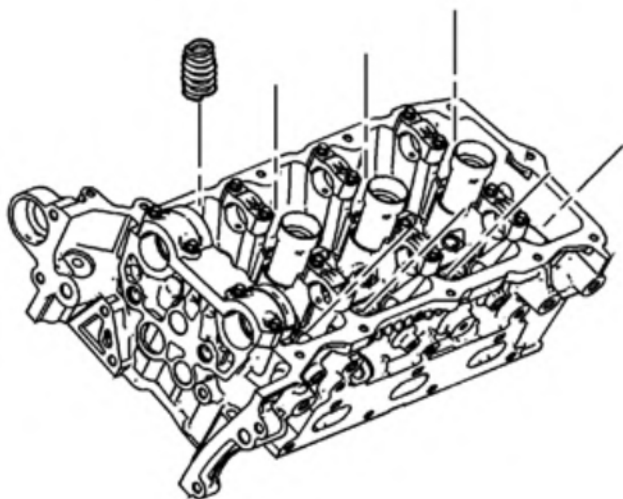


13. Use the [EN 46116](#) (1) in order to remove the valve stem seal (2).

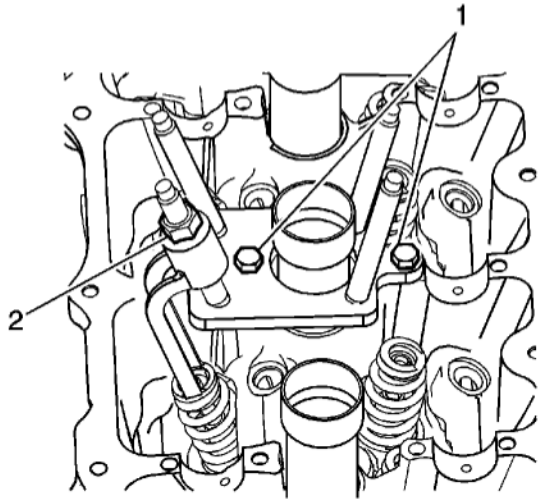
Installation Procedure



1. Use the [EN 46116](#) (1) in order to install the valve stem seals (2).

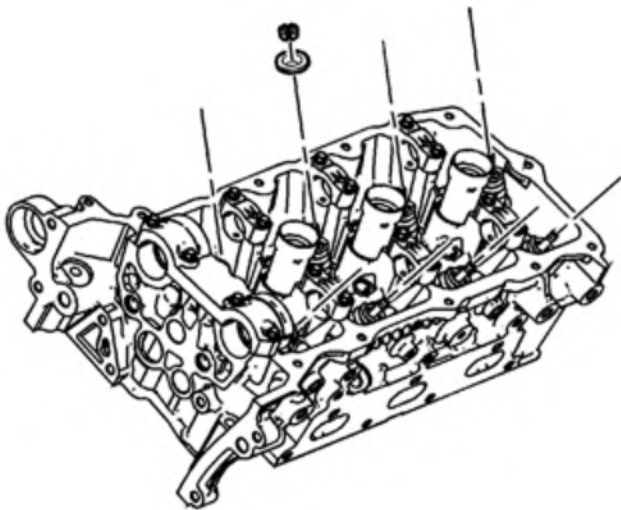


2. Install the valve spring.
3. Install the valve spring retainer.



4. Install the [EN 46110](#) above the applicable valve spring as shown.

Tighten the [EN 46110](#) valve spring compressor nut (2).

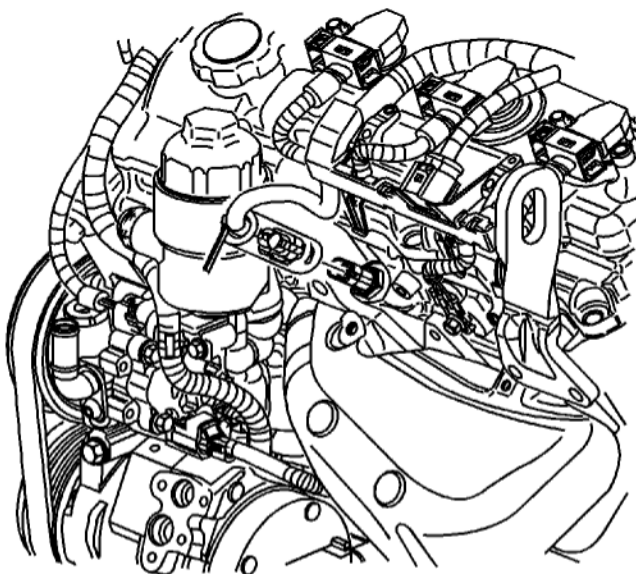


5. Install the valve spring keepers.
6. Remove the [EN 46110](#).
7. Disconnect the [J 39313](#) from the compressed air source.
8. Remove the [J 39313](#).
9. Install the spark plugs. Refer to [Spark Plug Replacement](#).
10. Install the rocker arms and camshafts. Refer to [Camshaft Replacement - Right Side](#).
11. Remove the [EN 46106](#).
12. Install the starter motor. Refer to [Starter Motor Replacement](#).

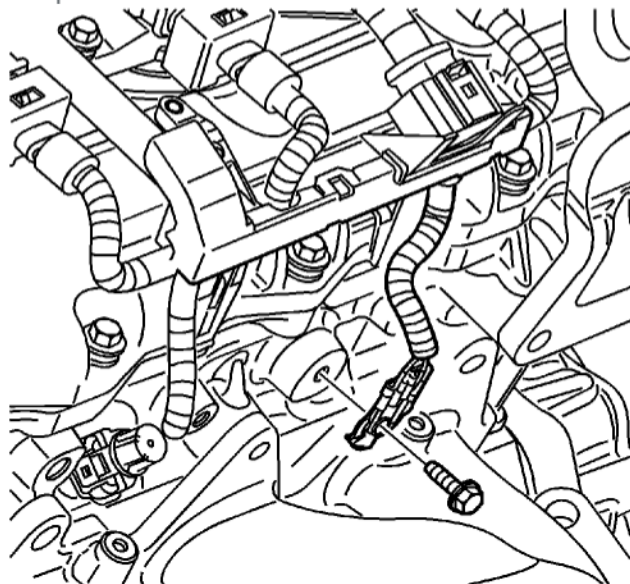
Cylinder Head Replacement - Left Side (LP1, LY7)

Removal Procedure

1. Remove the left bank secondary timing chain. Refer to [Secondary Camshaft Drive Chain Replacement - Left Side](#).
2. Remove the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).



3. Remove the heat shield from the coolant temperature sensor and disconnect the coolant temperature sensor electrical connector.



4. Remove the wiring harness ground from the cylinder head.

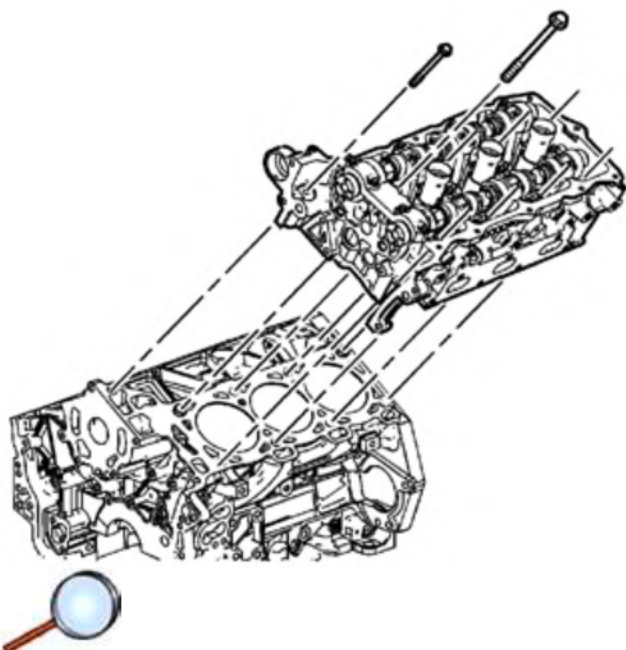
5. Disconnect the wiring harness electrical connector located at the side of the cylinder head.
6. Remove the wiring harness connector bracket from the side of the cylinder head.

Note: DO NOT disconnect the power steering pipes and/or hoses.

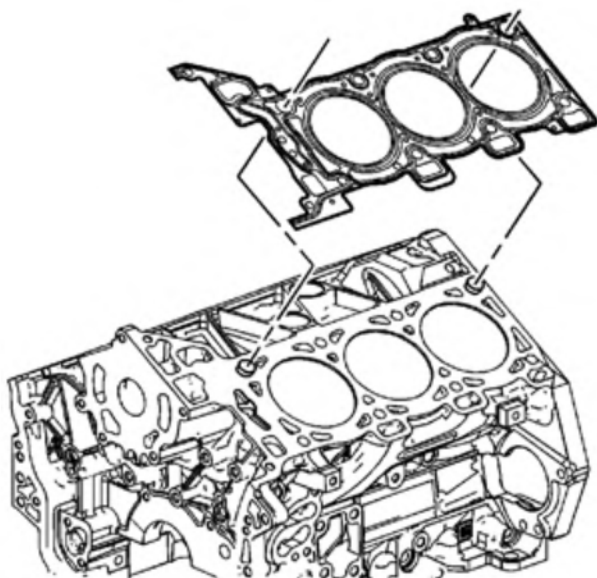
7. Remove the power steering pump bolts. Refer to [Power Steering Pump Replacement](#).
8. Remove the surge tank hose from the bracket at the rear of the cylinder head.
9. Remove the wiring harness bracket from the rear of the cylinder head.
10. Remove the catalytic converter. Refer to [Catalytic Converter Replacement - Left Side](#).
11. Remove the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).

Note: Do not remove the oil filter adapter.

12. Remove the oil filter adapter upper bolt.



13. Remove the cylinder head with the exhaust manifold. Refer to [Cylinder Head Removal - Right Side](#).

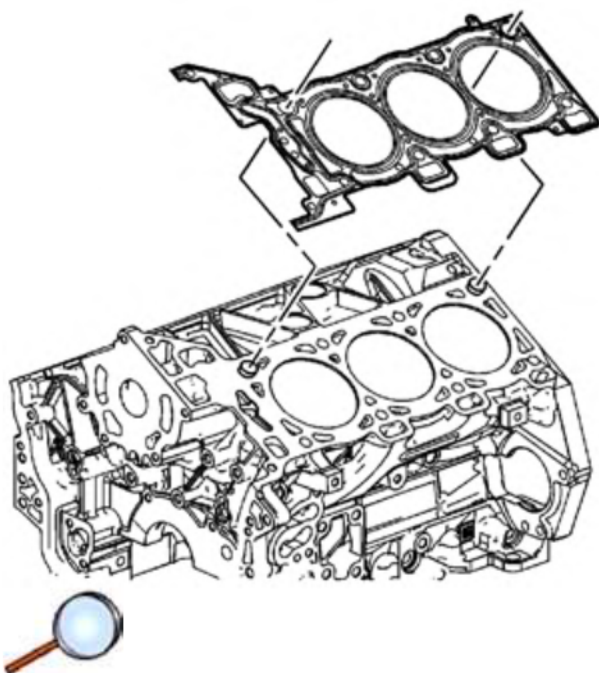




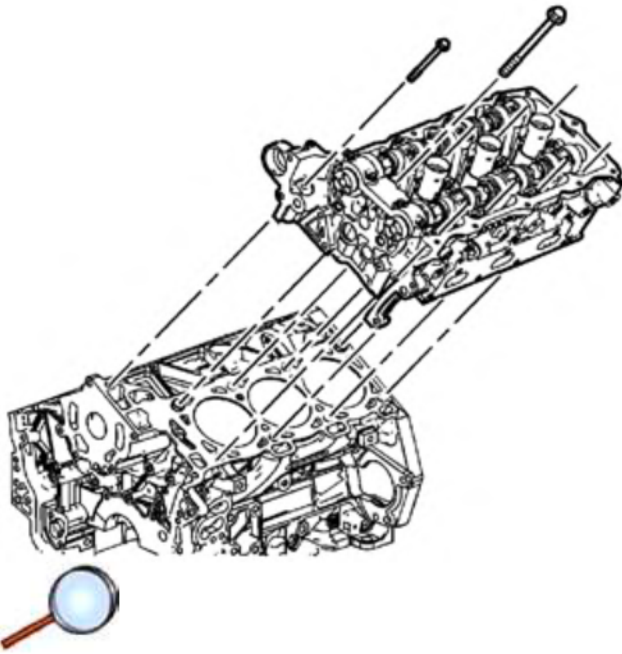
14. Remove and discard the cylinder head gasket.
15. Clean and inspect the cylinder head and the engine block sealing surfaces. Refer to [Cylinder Head Cleaning and Inspection](#) and [Engine Block Cleaning and Inspection](#).
16. If necessary, perform the following steps:
 - Remove the exhaust manifold from the cylinder head. Refer to [Exhaust Manifold Removal - Left Side](#).
 - Disassemble the cylinder head. Refer to [Cylinder Head Disassemble](#).

Installation Procedure

1. If necessary, perform the following steps:
 - Assemble the cylinder head. Refer to [Cylinder Head Assemble](#).
 - Install the exhaust manifold to the cylinder head. Refer to [Exhaust Manifold Installation - Left Side](#).

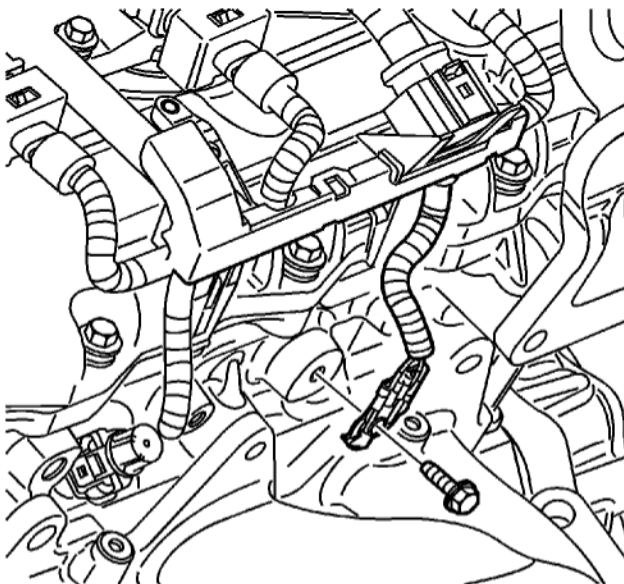


2. Install a NEW cylinder head gasket.



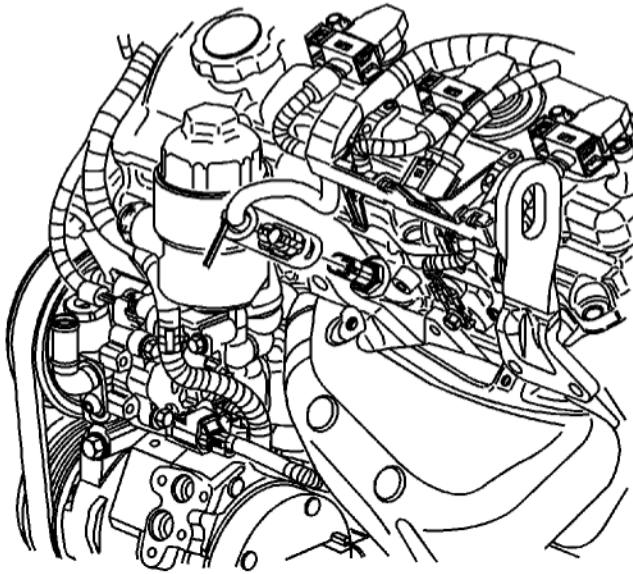
3. Carefully install the cylinder head with the exhaust manifold to the engine. Refer to [Cylinder Head Installation - Left Side](#).
4. Install the oil filter adapter upper bolt. Refer to [Oil Filter Adapter Installation](#).
5. Install the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).
6. Install the catalytic converter to the exhaust manifold. Refer to [Catalytic Converter Replacement - Left Side](#).
7. Install the wiring harness bracket to the rear of the cylinder head.
8. Install the surge tank hose to the bracket at the rear of the cylinder head.
9. Install the power steering pump bolts. Refer to [Power Steering Pump Replacement](#).
10. Install the wiring harness connector bracket from the side of the cylinder head.
11. Disconnect the wiring harness electrical connector located at the side of the cylinder head.

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





12. Install the wiring harness ground to the cylinder head and tighten the bolt to **10 N·m (89 lb in)**.

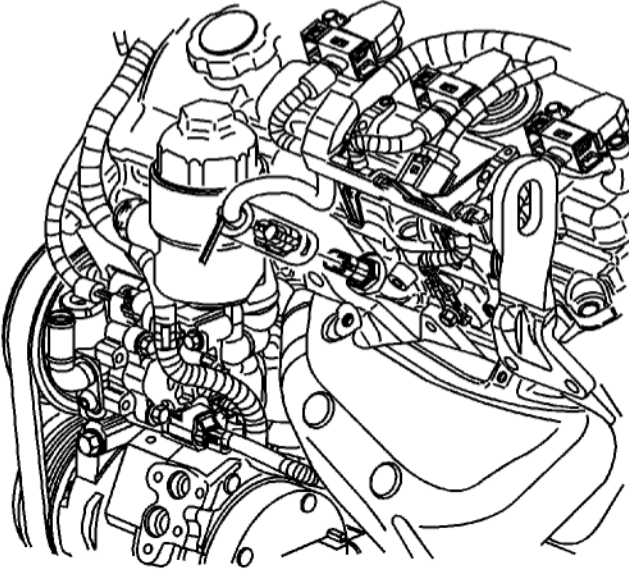


13. Install the coolant temperature sensor electrical connector heat shield.
14. Install the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).
15. Install the left bank secondary timing chain. Refer to [Secondary Camshaft Drive Chain Replacement - Left Side](#).

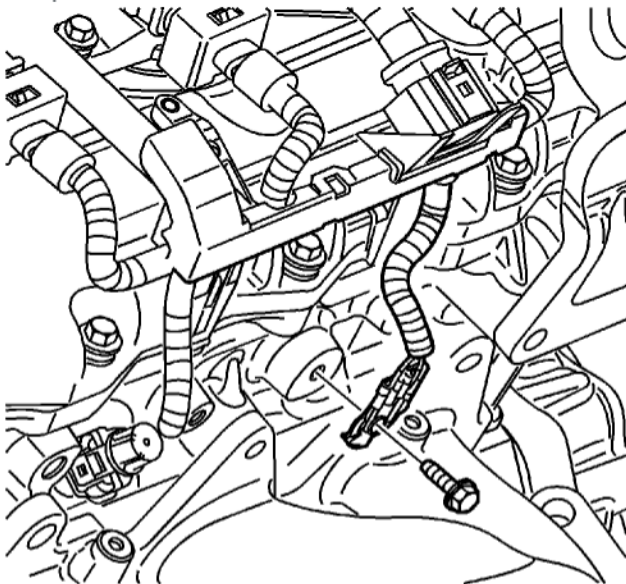
Cylinder Head Replacement - Left Side (LLT)

Removal Procedure

1. Remove the left bank secondary timing chain. Refer to [Secondary Camshaft Drive Chain Replacement - Left Side](#).
2. Remove the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).
3. Remove the fuel pump. Refer to [Fuel Pump Replacement](#).



4. Remove the heat shield from the coolant temperature sensor and disconnect the coolant temperature sensor electrical connector.



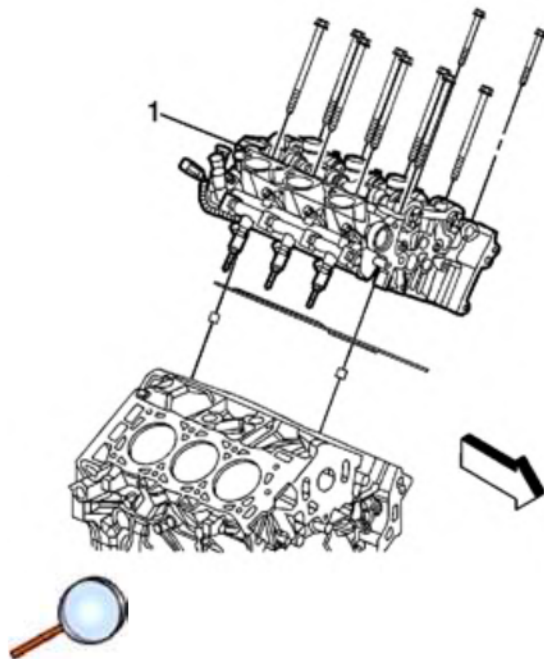
5. Remove the wiring harness ground from the cylinder head.
6. Disconnect the wiring harness electrical connector located at the side of the cylinder head.
7. Remove the wiring harness connector bracket from the side of the cylinder head.

Note: DO NOT disconnect the power steering pipes and/or hoses.

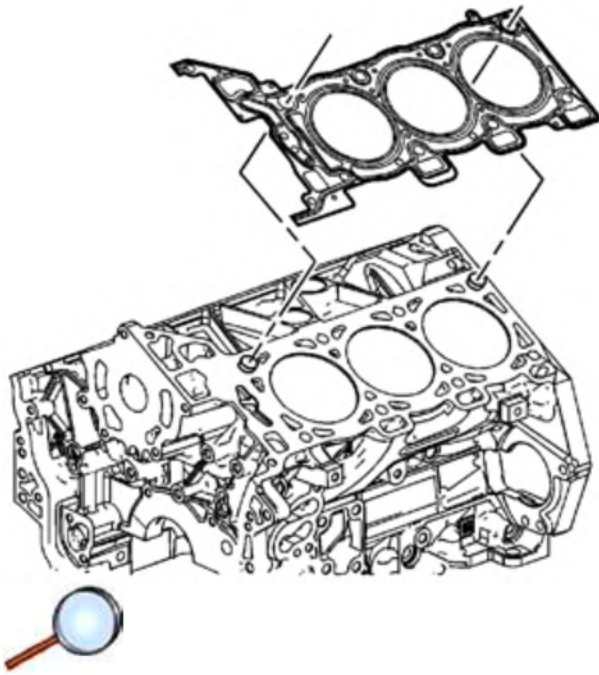
8. Remove the power steering pump bolts. Refer to [Power Steering Pump Replacement](#).
9. Remove the surge tank hose from the bracket at the rear of the cylinder head.
10. Remove the wiring harness bracket from the rear of the cylinder head.
11. Remove the catalytic converter. Refer to [Catalytic Converter Replacement - Left Side](#).
12. Remove the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).

Note: Do not remove the oil filter adapter.

13. Remove the oil filter adapter upper bolt.



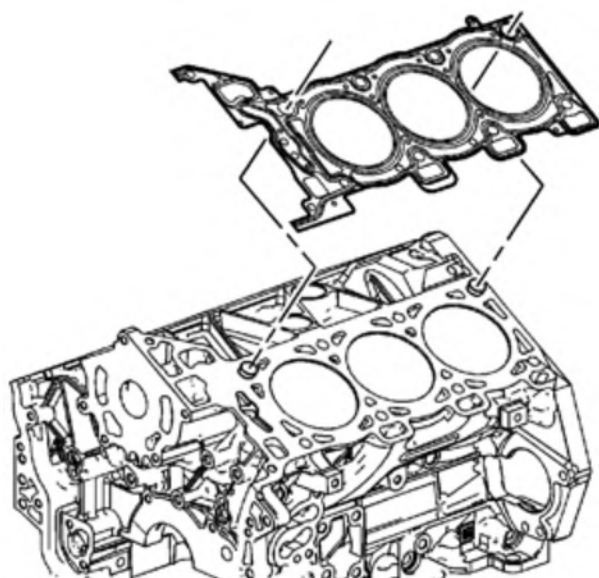
14. Remove the cylinder head (1) with the exhaust manifold. Refer to [Cylinder Head Removal - Right Side](#).



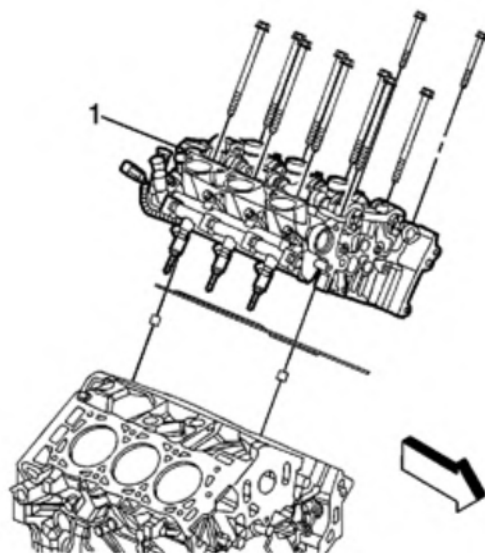
15. Remove and discard the cylinder head gasket.
16. Clean and inspect the cylinder head and the engine block sealing surfaces. Refer to [Cylinder Head Cleaning and Inspection](#) and [Engine Block Cleaning and Inspection](#).
17. If necessary, perform the following steps:
 - 17.1. Remove the exhaust manifold from the cylinder head. Refer to [Exhaust Manifold Removal - Left Side](#).
 - 17.2. Disassemble the cylinder head. Refer to [Cylinder Head Disassemble](#).

Installation Procedure

1. If necessary, perform the following steps:
 - 1.1. Assemble the cylinder head. Refer to [Cylinder Head Assemble](#).
 - 1.2. Install the exhaust manifold to the cylinder head. Refer to [Exhaust Manifold Installation - Left Side](#).

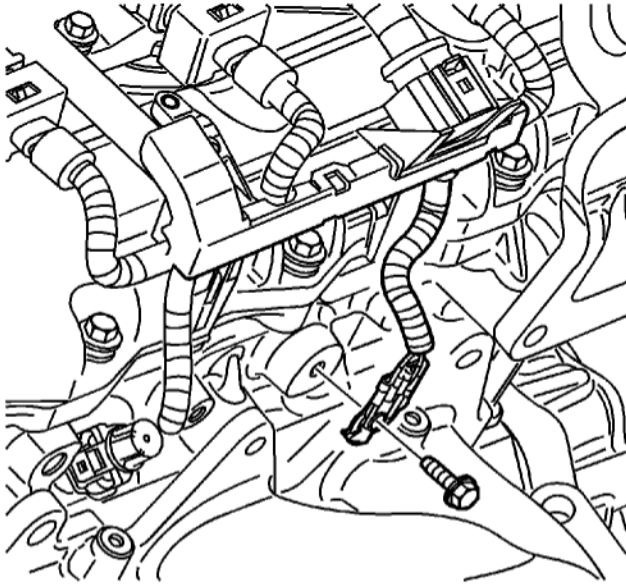


2. Install a NEW cylinder head gasket.

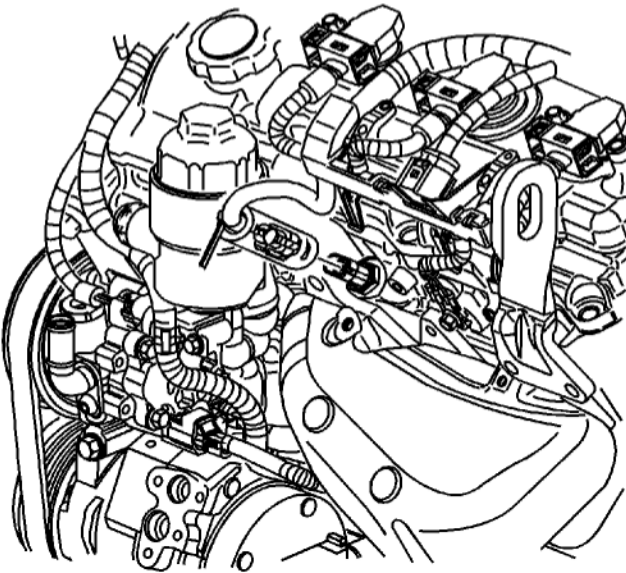


3. Carefully install the cylinder head (1) with the exhaust manifold to the engine. Refer to [Cylinder Head Installation - Left Side](#).
4. Install the oil filter adapter upper bolt. Refer to [Oil Filter Adapter Installation](#).
5. Install the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).
6. Install the catalytic converter to the exhaust manifold. Refer to [Catalytic Converter Replacement - Left Side](#).
7. Install the wiring harness bracket to the rear of the cylinder head.
8. Install the surge tank hose to the bracket at the rear of the cylinder head.
9. Install the power steering pump bolts. Refer to [Power Steering Pump Replacement](#).
10. Install the wiring harness connector bracket from the side of the cylinder head.
11. Disconnect the wiring harness electrical connector located at the side of the cylinder head.

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



12. Install the wiring harness ground to the cylinder head and tighten the bolt to **10 N·m (89 lb in)**.

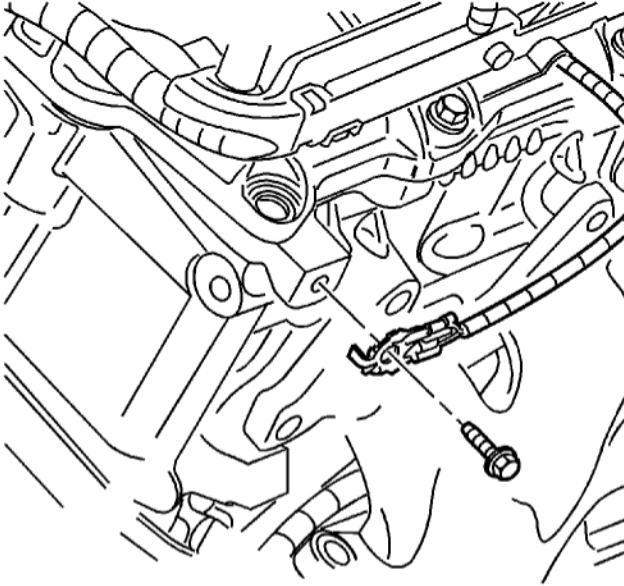


13. Install the coolant temperature sensor electrical connector heat shield.
14. Install the fuel pump. Refer to [Fuel Pump Replacement](#).
15. Install the oil level indicator. Refer to [Oil Level Indicator and Tube Replacement](#).
16. Install the left bank secondary timing chain. Refer to [Secondary Camshaft Drive Chain Replacement - Left Side](#).

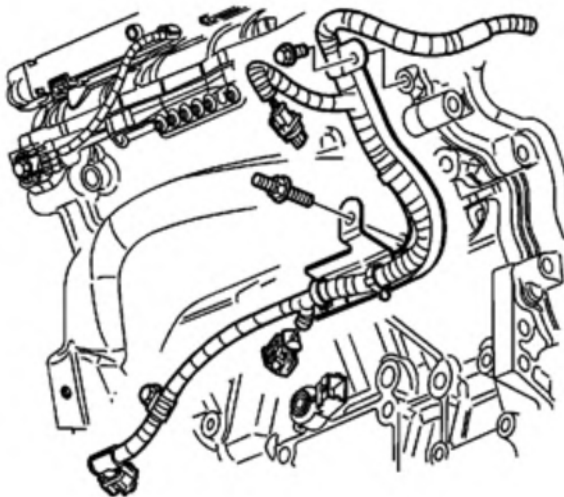
Cylinder Head Replacement - Right Side

Removal Procedure

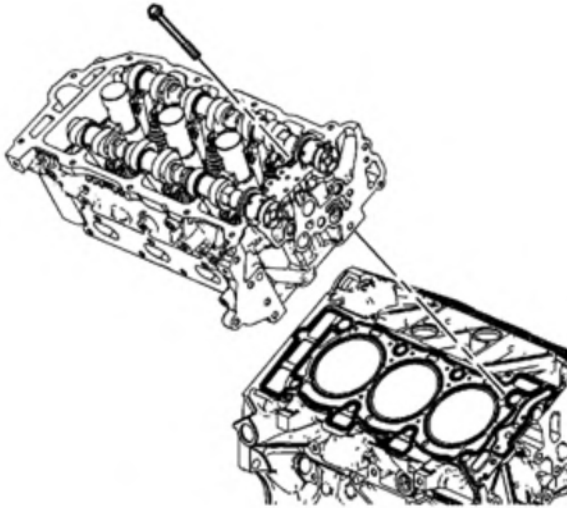
1. Remove the right bank secondary timing chain. Refer to [Secondary Camshaft Drive Chain Replacement - Right Side](#).
2. Remove the coolant inlet pipe bolts and reposition the coolant inlet pipe to provide access. Refer to [Engine Coolant Inlet Pipe Replacement](#).
3. Remove the catalytic converter. Refer to [Catalytic Converter Replacement - Right Side](#).



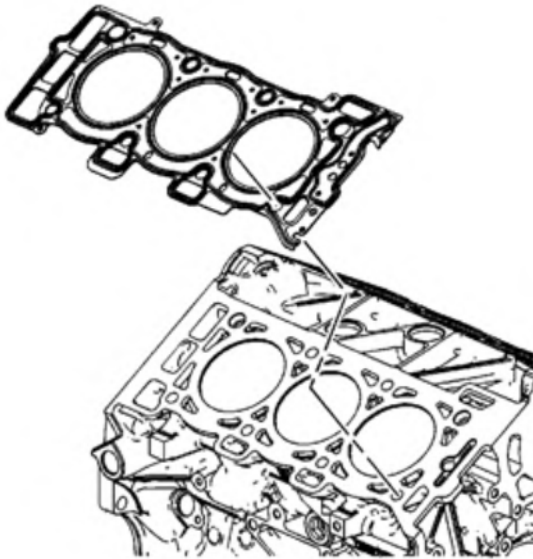
4. Remove the wiring harness ground from the side of the cylinder head.



5. Remove the wiring harness conduit upper bolt from the cylinder head and reposition the conduit to provide access.
6. Remove the battery cable from the cylinder head. Refer to [Battery Negative Cable Replacement](#).



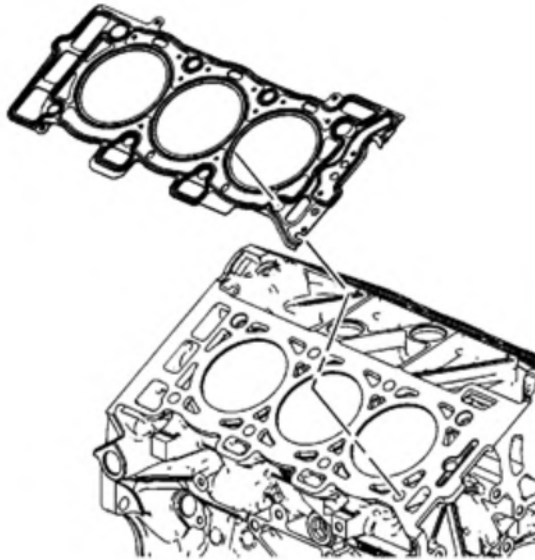
7. Remove the cylinder head with the exhaust manifold. Refer to [Cylinder Head Removal - Right Side](#).



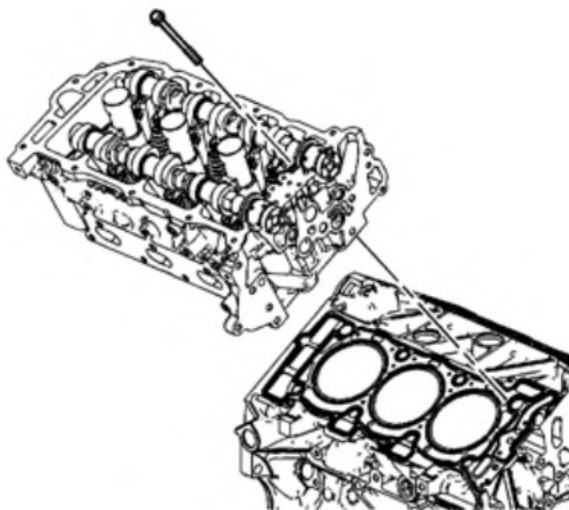
8. Remove and discard the cylinder head gasket.
9. Clean and inspect the cylinder head and the engine block sealing surfaces. Refer to [Cylinder Head Cleaning and Inspection](#) and [Engine Block Cleaning and Inspection](#).
10. If necessary, perform the following steps:
 - Remove the exhaust manifold from the cylinder head. Refer to [Exhaust Manifold Removal - Right Side](#).
 - Disassemble the cylinder head. Refer to [Cylinder Head Disassemble](#).

Installation Procedure

1. If necessary, perform the following steps:
 - Assemble the cylinder head. Refer to [Cylinder Head Assemble](#).
 - Install the exhaust manifold to the cylinder head. Refer to [Exhaust Manifold Installation - Right Side](#).



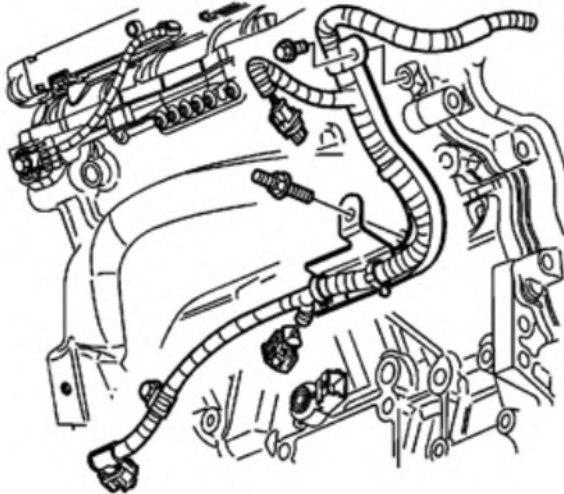
2. Install a NEW cylinder head gasket.



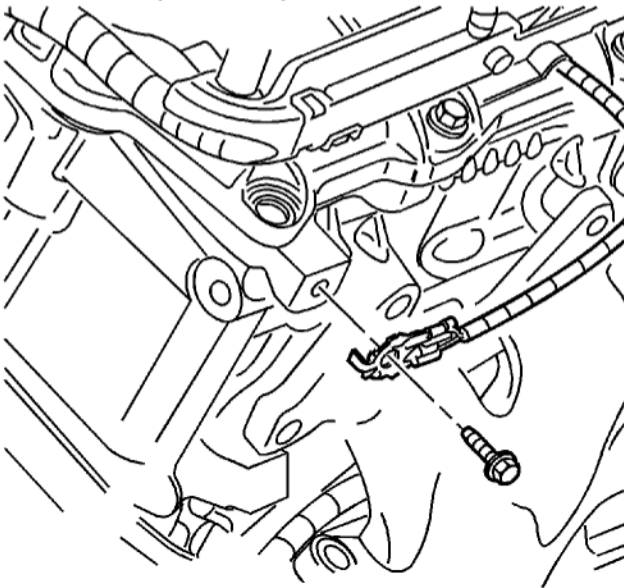
3. Carefully install the cylinder head with the exhaust manifold to the engine. Refer to [Cylinder Head Installation - Right Side](#).
4. Connect the catalytic converter to the exhaust manifold.
5. Install the battery negative cable to the cylinder head. Refer to [Battery Negative Cable](#)

[Replacement.](#)

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



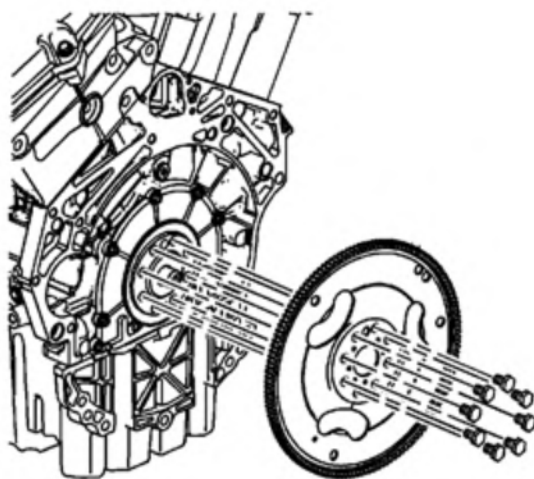
6. Install the wiring harness conduit to the cylinder head. Tighten the wiring harness upper bolt to 10 N·m (89 lb in).



7. Install the wiring harness ground to the side of the cylinder head. Tighten the wiring harness ground bolt to 10 N·m (89 lb in).
8. Install the catalytic converter. Refer to [Catalytic Converter Replacement - Right Side](#).
9. Install the coolant inlet pipe. Refer to [Engine Coolant Inlet Pipe Replacement](#).
10. Install the right bank secondary timing chain. Refer to [Secondary Camshaft Drive Chain Replacement - Right Side](#).

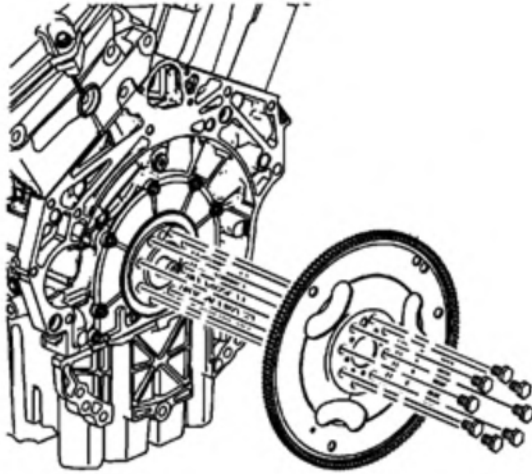
Engine Flywheel Replacement

Removal Procedure



1. Remove the transmission. Refer to [Transmission Replacement](#).
2. Remove the engine flywheel bolts and the flywheel. Refer to [Engine Flywheel Removal](#).
3. Clean and inspect the flywheel. Refer to [Engine Flywheel Cleaning and Inspection](#). If the flywheel teeth are damaged, inspect the starter for proper operation. Replace the starter if you find excessive wear or damage to the starter drive. Refer to [Starter Replacement](#).

Installation Procedure

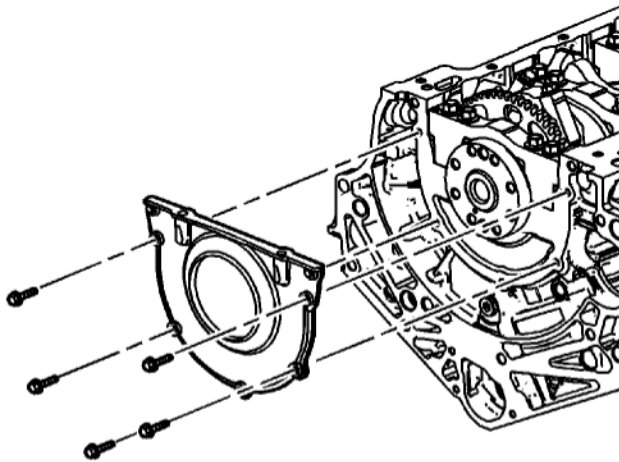


1. Install the engine flywheel. Refer to [Engine Flywheel Installation](#).
2. Install the transmission. Refer to [Transmission Replacement](#).

Crankshaft Rear Oil Seal and Housing Replacement

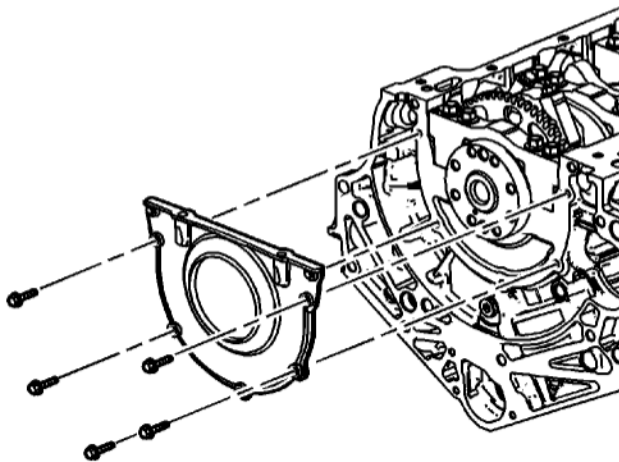
Removal Procedure

1. Remove the engine flywheel. Refer to [Engine Flywheel Replacement](#) .
2. Remove the oil pan. Refer to [Oil Pan Replacement](#) .



3. Remove the crankshaft rear oil seal and housing. Refer to [Crankshaft Rear Oil Seal and Housing Removal](#) .

Installation Procedure

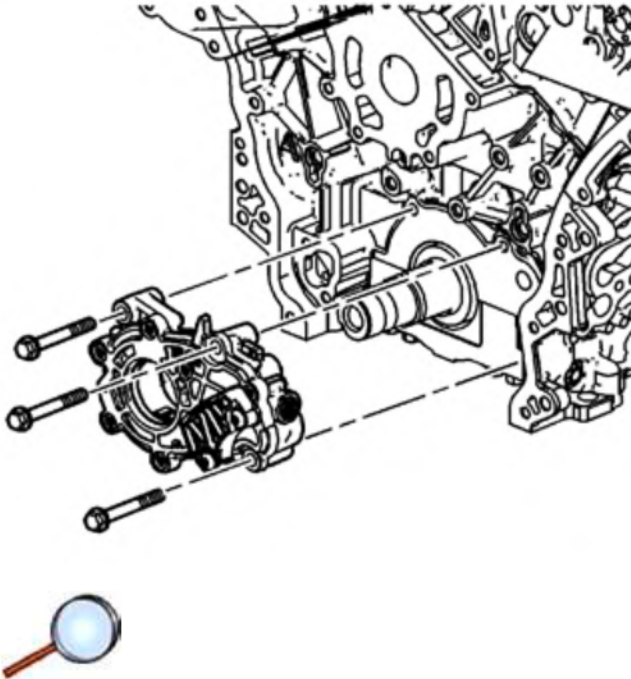




1. Install the crankshaft rear oil seal and housing. Refer to [Crankshaft Rear Oil Seal and Housing Installation](#) .
2. Install the oil pan. Refer to [Oil Pan Replacement](#) .
3. Install the engine flywheel. Refer to [Engine Flywheel Replacement](#) .

Oil Pump Replacement

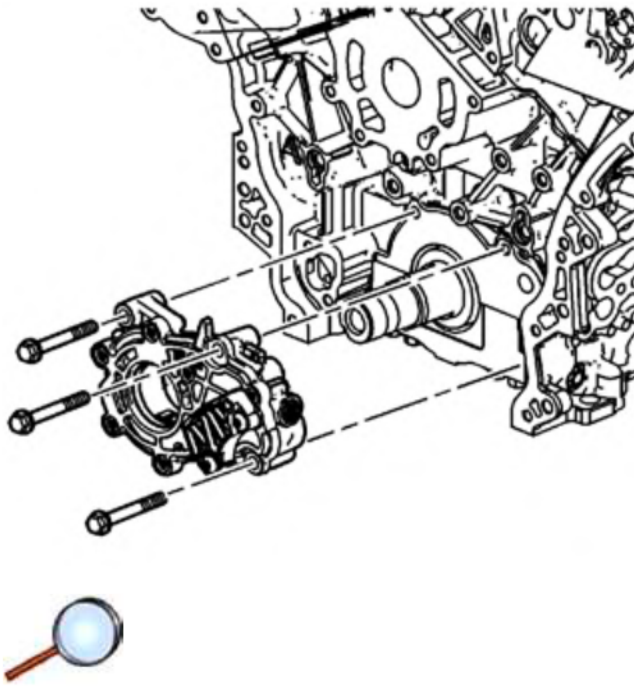
Removal Procedure



Important: Do not remove the left bank idler sprocket.

1. Remove the primary timing chain. Refer to [Primary Camshaft Drive Chain and Sprockets Replacement](#) .
2. Remove the crankshaft sprocket. Refer to [Crankshaft Sprocket Removal](#) .
3. Remove the oil pump bolts and the oil pump. Refer to [Oil Pump Removal](#) .

Installation Procedure

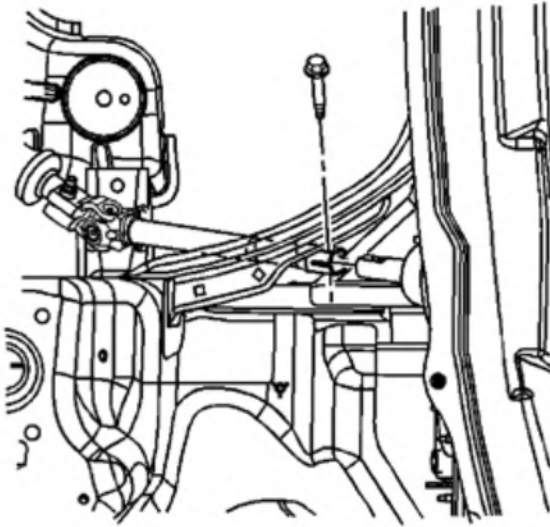


1. Install the oil pump. Refer to [Oil Pump Installation](#) .
2. Install the crankshaft sprocket. Refer to [Crankshaft Sprocket Installation](#) .
3. Install the primary timing chain. Refer to [Primary Camshaft Drive Chain and Sprockets Replacement](#) .

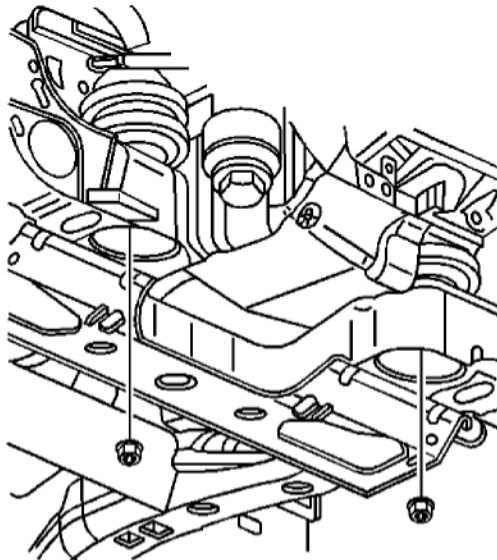
Oil Pan Replacement

Removal Procedure

1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#) .
2. Remove the power steering hose retainer from the A/C compressor bracket.



3. Disconnect the intermediate steering shaft.



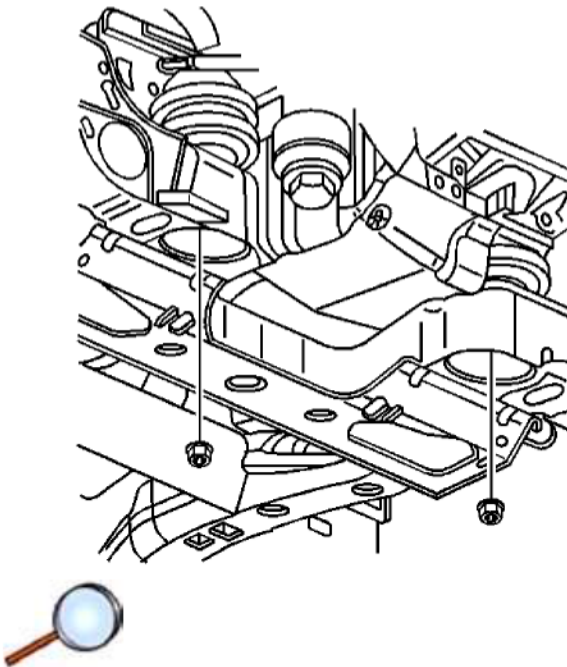
4. Remove the engine mount lower nuts.

Important: Do NOT

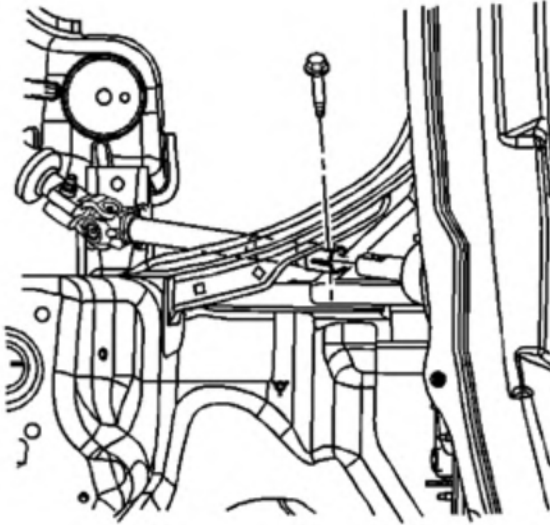
5. Remove the A/C compressor bracket bolts and reposition aside. Refer to [Air Conditioning Compressor Replacement](#) .
6. Drain the engine oil. Refer to [Engine Oil and Oil Filter Replacement](#) .
7. Remove the transmission oil cooler pipe retainer from the engine right side.
8. Install the engine support fixture. Refer to [Engine Support Fixture](#) .
9. Tighten the support fixture wing nuts in order to provide clearance for the oil pan.
10. Remove the front differential carrier, if equipped. Refer to [Differential Carrier Assembly Replacement](#) .
11. Remove the oil pan. Refer to [Oil Pan Removal](#) .
12. Perform the following steps as necessary:
 - 12.1. Disassemble the oil pan. Refer to [Oil Pan Disassemble](#)
 - 12.2. Clean and inspect the oil pan. Refer to [Oil Pan Cleaning and Inspection](#) .

Installation Procedure

1. Assemble the oil pan as necessary. Refer to [Oil Pan Assemble](#) .
2. Install the oil pan. Refer to [Oil Pan Installation](#) .
3. Install the front differential carrier, if equipped. Refer to [Differential Carrier Assembly Replacement](#) .
4. Loosen the engine support fixture wing nuts in order to lower the engine and engage the engine mounts to the frame.
5. Remove the engine support fixture. Refer to [Engine Support Fixture](#) .
6. Remove the transmission oil cooler pipe retainer from the engine right side.
7. Fill the engine with new engine oil. Refer to [Engine Oil and Oil Filter Replacement](#) .
8. Install the A/C compressor bracket with the A/C compressor. Refer to [Air Conditioning Compressor Replacement](#) .



9. Install the engine mount lower nuts. Refer to [Engine Mount Replacement - Left Side](#) and [Engine Mount Replacement - Right Side](#) .

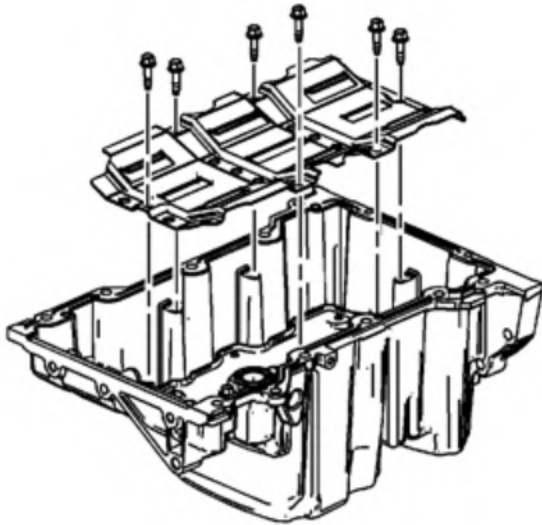


10. Connect the intermediate steering shaft. Refer to [Upper Intermediate Steering Shaft Replacement](#) .
11. Install the power steering hose retainer to the A/C compressor bracket.
12. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

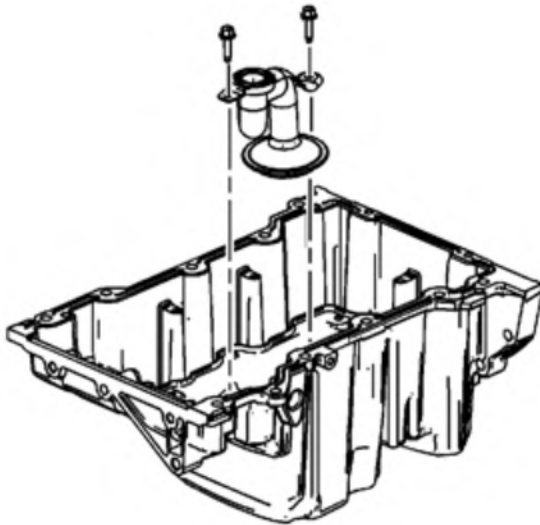
Oil Pump Suction Pipe and Screen Assembly Replacement

Removal Procedure

1. Remove the oil pan. Refer to [Oil Pan Replacement](#).

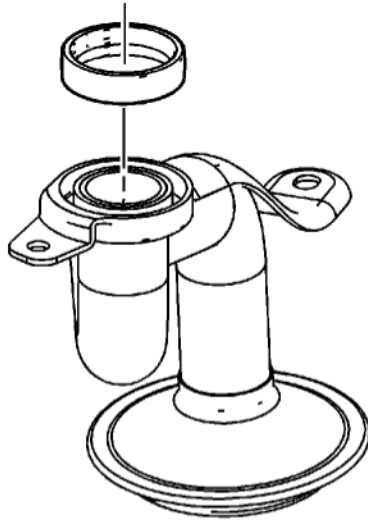


2. Remove the oil pan scraper bolts.
3. Remove the oil pan scraper.



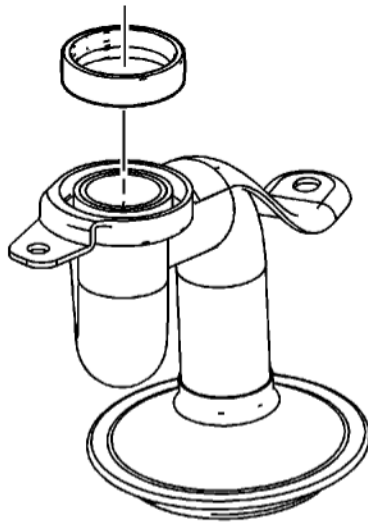
4. Remove the oil suction pipe bolts.

5. Remove the oil suction pipe.

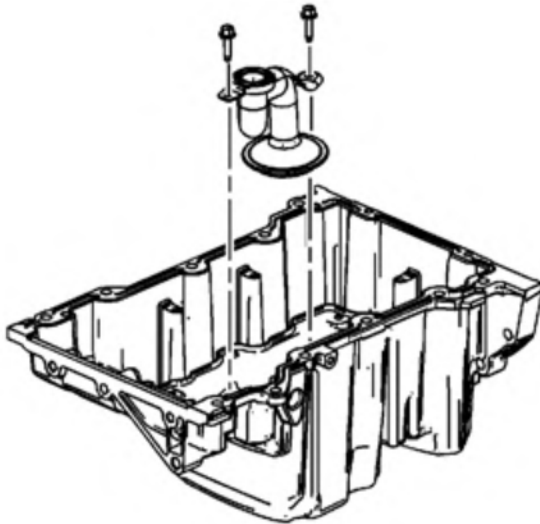


6. Remove the oil suction tube seal from the oil suction tube. Discard the oil suction tube seal.

Installation Procedure



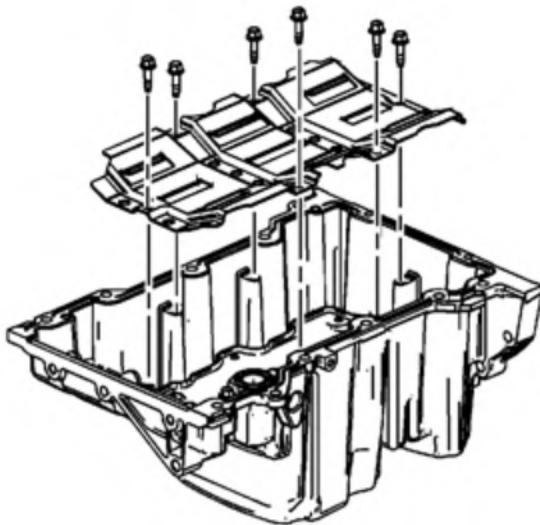
1. Install a NEW oil suction tube seal onto the oil suction tube. DO NOT reuse the old oil suction tube seal.



2. Install the oil suction pipe.

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

3. Install the oil suction pipe bolts and tighten to **10 N·m (89 lb in)**.



4. Install the oil pan scraper.
5. Install the oil pan scraper bolts and tighten to **10 N·m (89 lb in)**.
6. Install the oil pan. Refer to [Oil Pan Replacement](#).

Engine Replacement

Special Tools

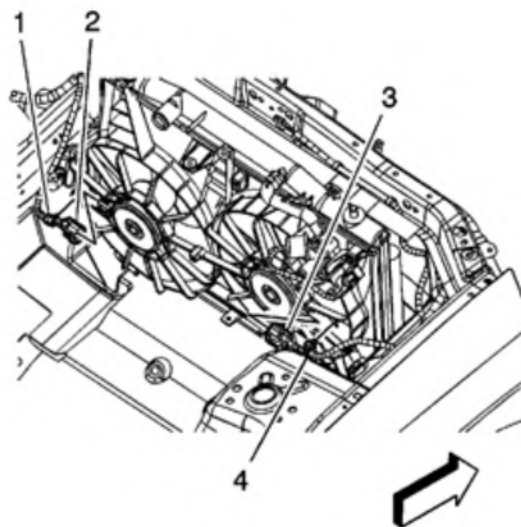
[EN 46114](#) Engine Lift Brackets

Removal Procedure

1. Turn the ignition OFF.

Note: Do NOT disconnect the battery cables from the engine.

2. Disconnect the negative cable from the battery and the body on the right strut tower. Refer to [Battery Negative Cable Replacement](#).
3. Position and secure the battery cables to the engine.
4. Remove the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).
5. Remove the air cleaner duct. Refer to [Air Cleaner Outlet Duct Replacement](#).



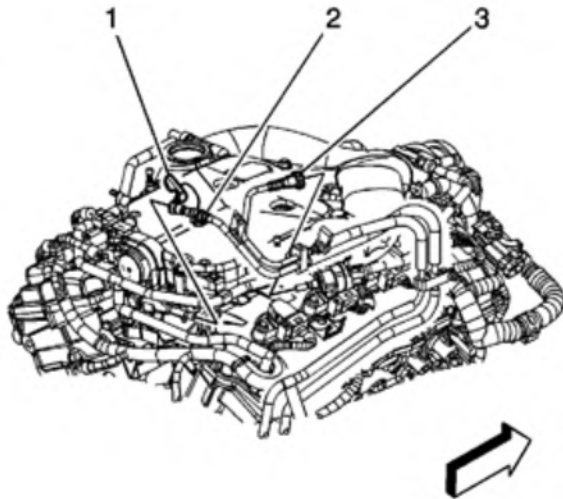
6. Disconnect the cooling fan electrical connectors (2, 3).
7. Remove the cooling fan wiring harnesses (1, 4) from the fan shroud.
8. Secure the wiring harnesses to the vehicle.
9. Drain the cooling system. Refer to [Cooling System Draining and Filling](#).

Note: Do NOT disconnect the surge hoses from the engine or the radiator.

10. Disconnect the surge tank outlet hose from the surge tank. Refer to [Radiator Surge Tank Inlet Hose/Pipe Replacement](#).
11. Position and secure the surge hose to the engine.
12. Disconnect the surge tank inlet hose from the water outlet housing and the radiator. Refer to [Radiator Surge Tank Outlet Hose/Pipe Replacement](#).

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13. Position and secure the surge tank inlet hose to the vehicle.
14. Disconnect the heater hoses from the heater core. Refer to [Heater Inlet Hose Replacement](#) and to [Heater Outlet Hose Replacement](#).



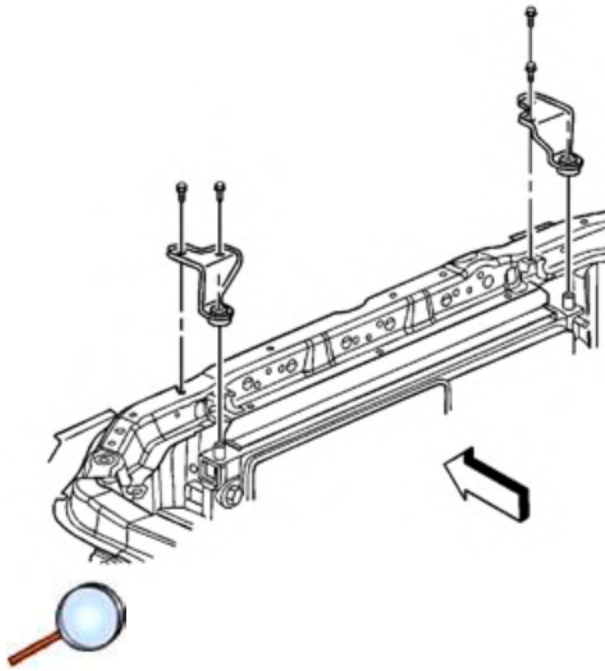
15. Disconnect the purge line (3) from the purge solenoid.
16. Disconnect the fuel pipe (2) from the fuel rail. Refer to [Metal Collar Quick Connect Fitting Service](#).
17. Plug the fuel pipe and cap the fuel rail to prevent fuel loss or contamination.
18. Evacuate the air conditioning system. Refer to [Refrigerant Recovery and Recharging](#).
19. Remove the wiper module. Refer to [Windshield Wiper Transmission Replacement](#).

Note: Do NOT disconnect the suction hose from the A/C compressor.

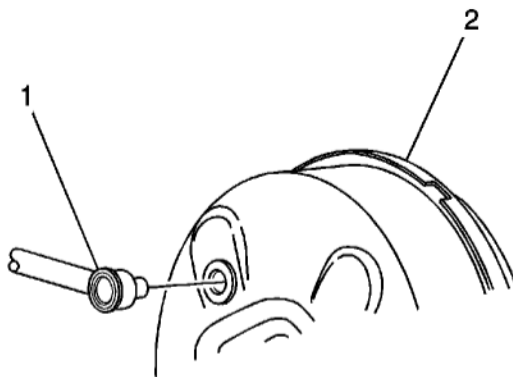
20. Disconnect the air conditioning suction hose from the evaporator and remove the suction hose bracket from the shock tower. Refer to [Suction Hose Replacement](#).
21. Position and secure the suction hose to the engine.

Note: Do NOT disconnect the liquid line from the condenser.

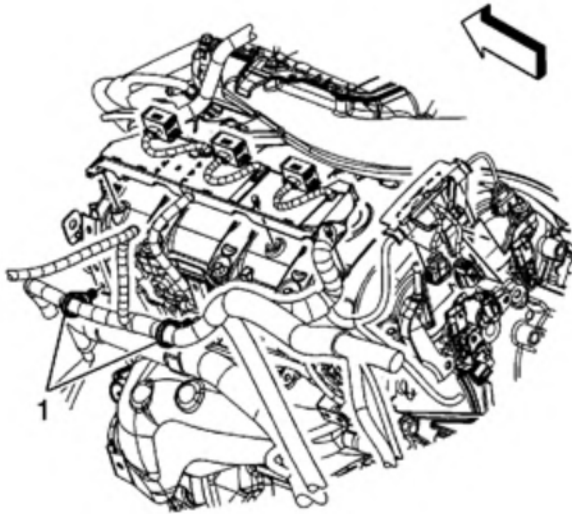
22. Disconnect the air conditioning pressure switch electrical connector and remove the liquid line. Refer to [Liquid Line Replacement](#).



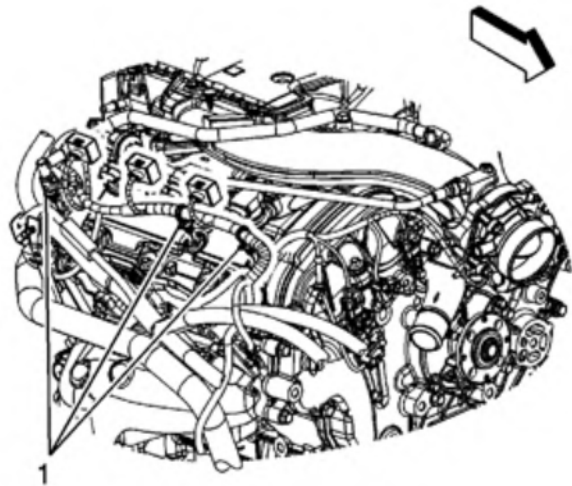
23. Remove the radiator support bolts.
24. Remove the radiator support brackets.



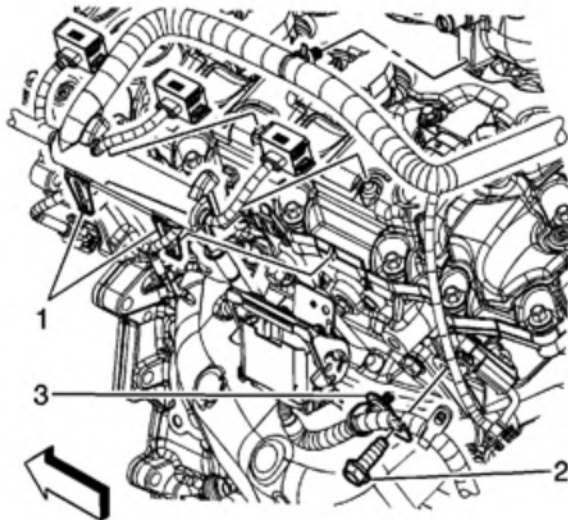
25. Disconnect the brake booster check valve and vacuum hose (1) from the brake booster (2).
26. Position and secure the brake booster hose to the engine.
27. Disconnect all engine harness electrical connectors. Refer to [Powertrain Component Views](#) and [Harness Routing Views](#).



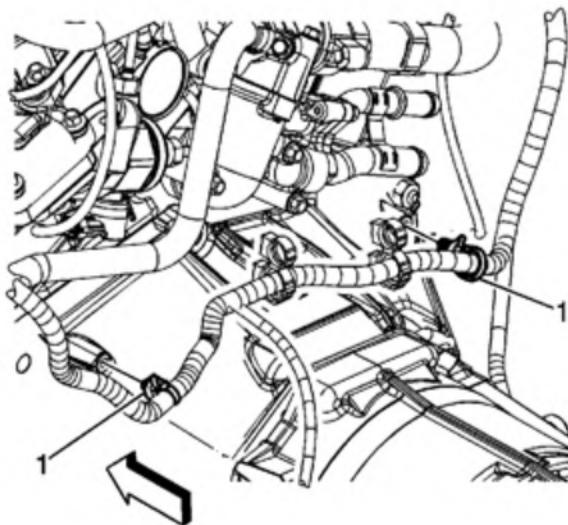
28. Remove the right side engine harness retaining clips (1).



29. Remove the right side engine harness to valve cover retaining clips (1).



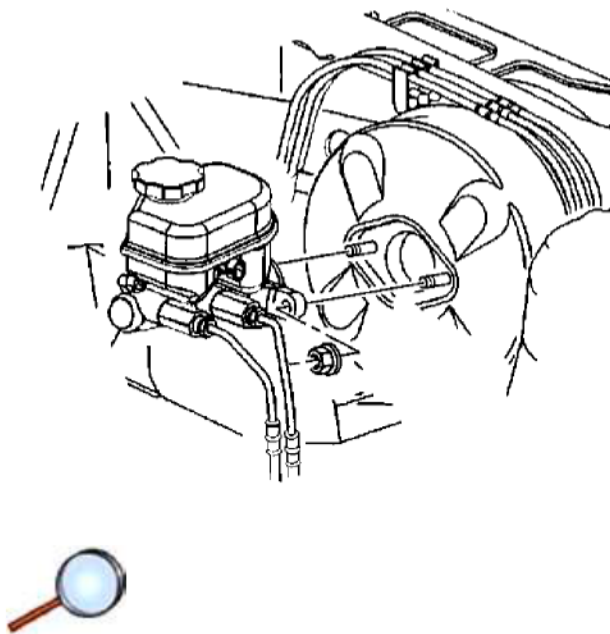
- 30. Remove the left side engine harness retaining clips (1).
- 31. Remove the bolt (2) from the engine harness retainer (3).



- 32. Remove the engine harness to transmission retaining clips (1).

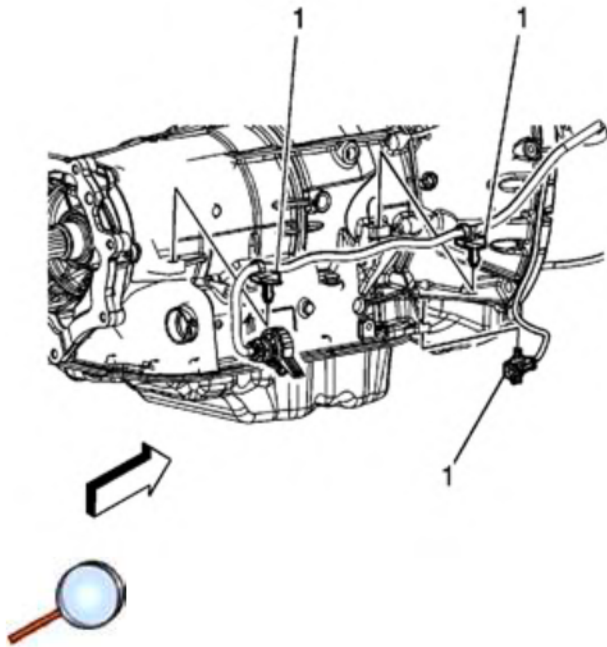


33. Remove the ground bolt and wire from the longitudinal rail.



Note: Do NOT disconnect the brake pipes from the master cylinder.

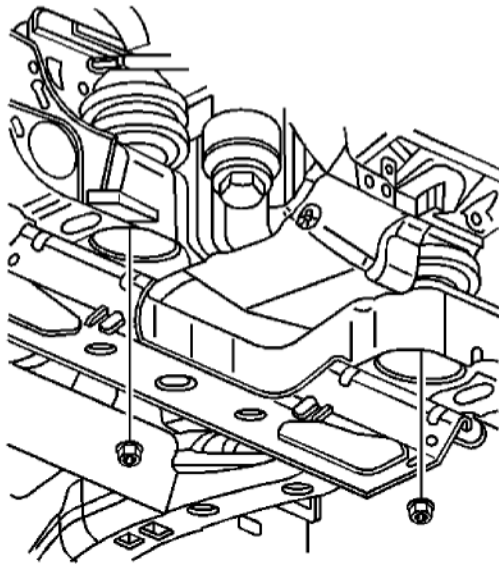
34. Remove the master cylinder nuts.
35. Reposition and secure the master cylinder to the engine.
36. Relieve the fuel system pressure. Refer to [Fuel Pressure Relief](#).



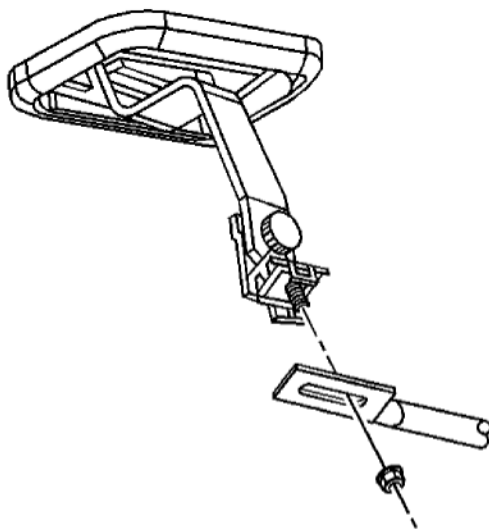
37. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
38. Remove the engine harness to transmission retaining clips (1).
39. Remove the muffler assembly. Refer to [Exhaust System Replacement](#).
40. Remove the propeller shaft. Refer to [Rear Propeller Shaft Replacement](#).
41. Remove the transfer case, if equipped. Refer to [Transfer Case Assembly Replacement](#).
42. Remove the air deflector. Refer to [Front Air Deflector Replacement](#).

Note: DO NOT remove the water bottle.

43. Remove the washer bottle bracket. Refer to [Windshield Washer Solvent Container Replacement](#).
44. Disconnect the side air baffles from the radiator.
45. Disconnect the left front brake pipe retainer along with the brake pipe from the longitudinal rail.
46. Remove the right front brake pipe from the brake pipe bundle retainer.
47. Disconnect the rear brake pipes from the brake pressure modulator valve (BPMV). Refer to [Brake Pressure Modulator Valve Replacement](#).
48. Plug the brake pipes and the brake modulator valve in order to minimize brake fluid loss.
49. Remove the front tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#).
50. Remove the lower intermediate steering shaft. Refer to [Lower Intermediate Steering Shaft Replacement](#).



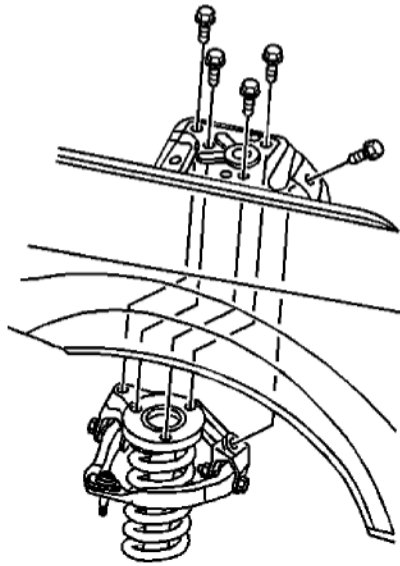
51. Remove the lower engine mount nuts. Refer to [Engine Mount Replacement - Left Side](#) and to [Engine Mount Replacement - Right Side](#).



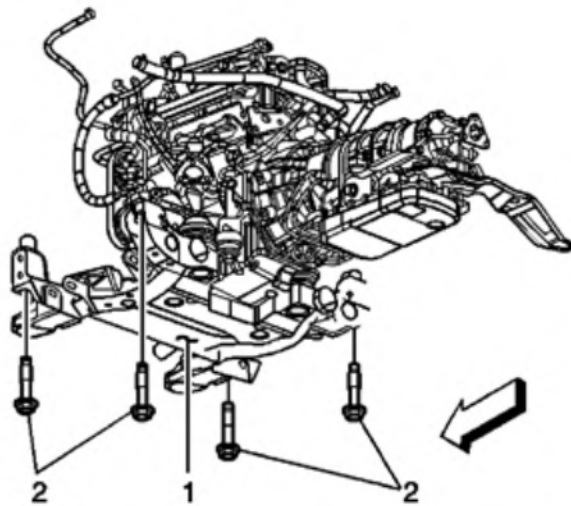
52. Disconnect the transmission shift linkage from the transmission.
53. Disconnect the electrical connector to the low oil level sensor.

Secure the electrical connector and the harness to the engine mount bracket.

54. Remove the headlamp leveling sensors. Refer to [Headlamp Leveling Front Suspension Height Sensor Replacement](#).
55. Secure the shock modules to the lower control arms with a suitable strap in order to prevent damage to the front brake hoses.



56. Remove the upper mounting bolts from the right and left shock module. Refer to [Shock Absorber and Spring Assembly Replacement](#).
57. Raise the vehicle enough to place a suitable lift table under the engine, transmission, front frame and front suspension assembly.
58. Position a suitable powertrain or engine lift table below the frame, engine and transmission.
59. Raise the lift table or lower the vehicle to support the frame, engine and transmission.
60. Remove the bolts which secure the transmission brace to the underbody. Refer to [Transmission Support Replacement](#).



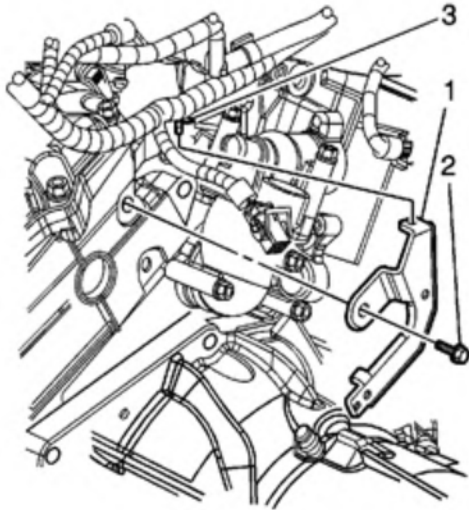
61. Remove the front frame bolts (2).

Note: Ensure that all the hoses, wires, pipes and shock modules clear the vehicle during the removal process.

62. With the aid of an assistant, lower the table or raise the vehicle to remove the engine, transmission, front frame and front suspension assembly from the vehicle.

Note: Do NOT remove the oxygen sensors.

63. Remove the catalytic converters with the oxygen sensors. Refer to [Catalytic Converter Replacement - Left Side](#) and to [Catalytic Converter Replacement - Right Side](#).
64. Remove the thermostat housing with the heater pipes, heater hoses and surge tank outlet hose. Refer to [Engine Coolant Thermostat Housing Removal](#).
65. Remove the starter motor. Refer to [Starter Motor Replacement](#).
66. Remove the flywheel bolts.



67. Remove the heated oxygen sensor (HO2S) connector bracket (1) from the left cylinder head.
68. Remove the engine wiring harness and related components.
69. Disconnect the transmission oil cooler pipes from the engine, radiator and the transmission. Refer to [Transmission Fluid Auxiliary Cooler Inlet Pipe Replacement](#) and to [Transmission Fluid Cooler Hose/Pipe Replacement](#) and to [Transmission Fluid Auxiliary Cooler Outlet Hose Replacement](#).
70. Disconnect the radiator hoses from the water outlet housing and the coolant inlet pipe. Refer to [Radiator Inlet Hose Replacement](#).
71. Disconnect the power steering cooler hoses from the condenser radiator and fan module (CRFM). Refer to [Power Steering Cooler Pipe/Hose Replacement](#).
72. Plug the power steering hoses and pipes in order to prevent fluid loss and contamination.
73. Remove the CRFM with the radiator hoses from the frame.
74. Install [EN 46114](#) to the engine. Refer to [Engine Support Fixture](#).
75. Connect a floor crane to the engine lift brackets and raise the floor crane to partially support the engine.
76. Position a second powertrain lift table below the transmission.
77. Remove the bolts that secure the transmission to the engine.
78. Remove the transmission from the engine. Refer to [Transmission Replacement](#).
79. Remove the drive belts. Refer to [Water Pump and Generator Belt Replacement](#) and to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).
80. Remove the generator and water pump drive belt tensioner. Refer to [Drive Belt Tensioner Removal - Right Side](#).
81. Remove the A/C compressor and power steering drive belt tensioner. Refer to [Drive Belt](#)

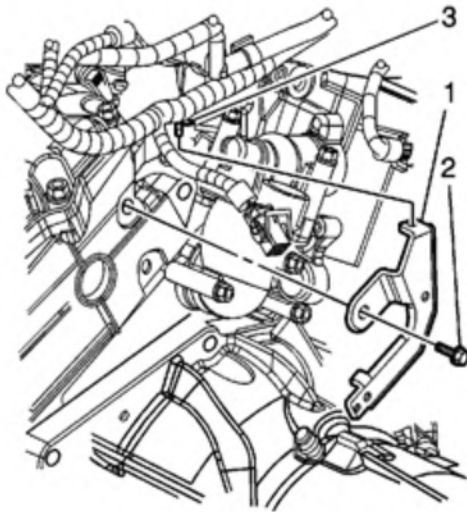
Tensioner Removal - Left Side.

82. Remove the generator and the generator bracket. Refer to [Starter Motor Replacement](#) and [Generator Bracket Replacement](#).
83. Remove the A/C compressor. Refer to [Air Conditioning Compressor Replacement](#).
84. Remove the power steering pump. Refer to [Power Steering Pump Replacement](#).
85. Remove the power steering reservoir from the engine. Refer to [Remote Power Steering Fluid Reservoir Replacement](#).
86. Remove the oil level indicator. Refer to [Oil Level Indicator and Tube Removal](#).
87. Remove the left exhaust manifold. Refer to [Exhaust Manifold Removal - Left Side](#).
88. Remove the oil filter adapter. Refer to [Oil Filter Adapter Removal](#).
89. Remove the right exhaust manifold. Refer to [Exhaust Manifold Removal - Right Side](#).
90. Remove the crankshaft balancer. Refer to [Crankshaft Balancer Removal](#).
91. Remove the flywheel. Refer to [Engine Flywheel Removal](#).
92. Remove the intake manifold. Refer to [Intake Manifold Removal](#).
93. Remove the water outlet. Refer to [Water Outlet Removal](#).
94. Remove the block heater. Refer to [Coolant Heater Replacement](#).
95. Remove the ECM with the ECM bracket. Refer to [Engine Control Module Replacement](#).
96. Remove the front drive shafts, if equipped. Refer to [Front Wheel Drive Shaft Replacement - Left Side](#) and [Front Wheel Drive Shaft Replacement - Right Side](#).
97. Use a floor crane in order to remove the engine from the frame.
98. Remove the front drive axle intermediate shaft bearing, if equipped. Refer to [Front Wheel Drive Intermediate Shaft Bearing Replacement](#).
99. Remove the front differential, if equipped. Refer to [Differential Carrier Assembly Replacement](#).
100. Remove the engine mount brackets with the engine mounts. Refer to [Engine Mount Bracket Replacement - Left Side](#) and to [Engine Mount Bracket Replacement - Right Side](#).

Installation Procedure

1. Install the engine mount brackets with the engine mounts. Refer to [Engine Mount Bracket Replacement - Left Side](#) and to [Engine Mount Bracket Replacement - Right Side](#).
2. Install the front differential, if equipped. Refer to [Differential Carrier Assembly Replacement](#).
3. Install the front drive axle intermediate shaft bearing, if equipped. Refer to [Front Wheel Drive Intermediate Shaft Bearing Replacement](#).
4. Use a floor crane in order to install the engine to the frame.
5. Install the front drive shafts, if equipped. Refer to [Front Wheel Drive Shaft Replacement - Left Side](#) and [Front Wheel Drive Shaft Replacement - Right Side](#).
6. Install the ECM with the ECM bracket. Refer to [Engine Control Module Replacement](#).
7. Install the water outlet. Refer to [Water Outlet Installation](#).
8. Install the block heater. Refer to [Coolant Heater Replacement](#).
9. Install the flywheel. Refer to [Engine Flywheel Installation](#).
10. Install the intake manifold. Refer to [Intake Manifold Installation](#).
11. Install the crankshaft balancer. Refer to [Crankshaft Balancer Installation](#).
12. Install the right exhaust manifold. Refer to [Exhaust Manifold Installation - Right Side](#).
13. Install the oil filter adapter. Refer to [Oil Filter Adapter Installation](#).
14. Install the left exhaust manifold. Refer to [Exhaust Manifold Installation - Left Side](#).
15. Install the oil level indicator. Refer to [Oil Level Indicator and Tube Installation](#).
16. Install the generator and the generator bracket. Refer to [Starter Motor Replacement](#) and [Generator Bracket Replacement](#).
17. Install the power steering pump. Refer to [Power Steering Pump Replacement](#).
18. Install the power steering reservoir to the engine. Refer to [Remote Power Steering Fluid Reservoir Replacement](#).
19. Install the A/C compressor. Refer to [Air Conditioning Compressor Replacement](#).
20. Install the A/C compressor and power steering drive belt tensioner. Refer to [Drive Belt Tensioner Installation - Left Side](#).

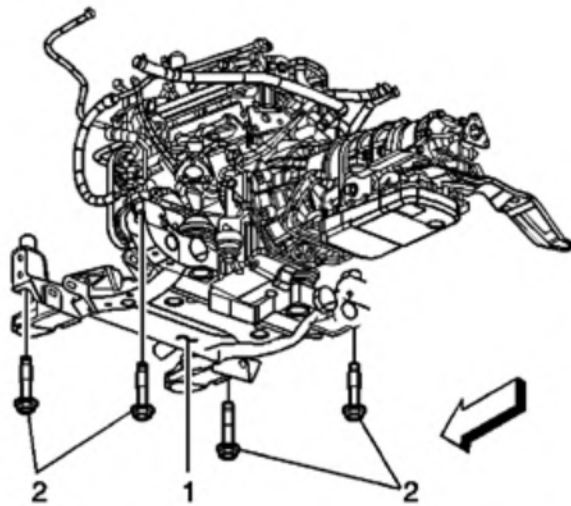
21. Install the generator and water pump drive belt tensioner. Refer to [Drive Belt Tensioner Installation - Right Side](#).
22. Install the drive belts. Refer to [Water Pump and Generator Belt Replacement](#) and to [Air Conditioning Compressor and Power Steering Pump Belt Replacement](#).
23. Install the bolts that secure the transmission to the engine. Refer to [Transmission Replacement](#).
24. Install the starter motor. Refer to [Starter Motor Replacement](#).
25. Remove [EN 46114](#) from the engine. Refer to [Engine Support Fixture](#).
26. Install the CRFM with the radiator hoses to the frame.
27. Connect the power steering cooler hoses to the CRFM. Refer to [Power Steering Cooler Pipe/Hose Replacement](#).
28. Connect the radiator hoses to the water outlet housing and the coolant inlet pipe. Refer to [Radiator Inlet Hose Replacement](#).
29. Install the transmission oil cooler pipes to the engine, radiator and the transmission. Refer to [Transmission Fluid Auxiliary Cooler Inlet Pipe Replacement](#) and to [Transmission Fluid Cooler Hose/Pipe Replacement](#) and to [Transmission Fluid Auxiliary Cooler Outlet Hose Replacement](#).
30. Install the engine wiring harness and related components.



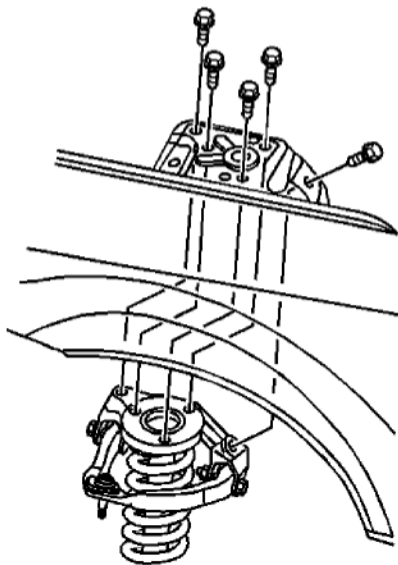
31. Install the HO2S connector bracket (1) to the left cylinder head.
32. Install the thermostat housing with the heater pipes, heater hoses and surge tank outlet hose. Refer to [Engine Coolant Thermostat Housing Removal](#).
33. Install the catalytic converters with the oxygen sensors. Refer to [Catalytic Converter Replacement - Left Side](#) and to [Catalytic Converter Replacement - Right Side](#).
34. Install the fuel lines to the fuel rail and the EVAP purge solenoid. Refer to [Metal Collar Quick Connect Fitting Service](#).

Note: Ensure that all the hoses, wires, pipes and shock modules clear the vehicle during the installation process.

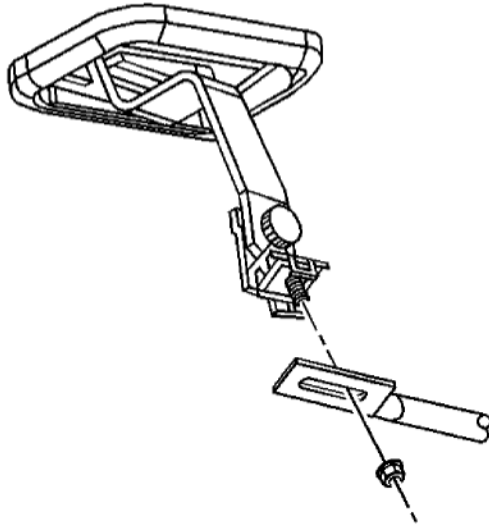
35. With the aid of an assistant, raise the table or lift the vehicle to install the engine, transmission, front frame and front suspension assembly to the vehicle.



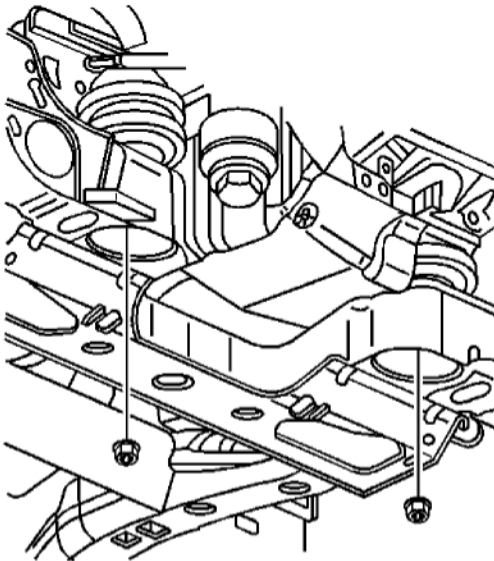
36. Install the front frame bolts (2). Refer to [Front Frame Replacement](#).
37. Install the transmission support to underbody bolts. Refer to [Transmission Support Replacement](#).
38. Remove the powertrain lift/support table.



39. Install the upper mounting bolts to the right and left shock module. Refer to [Shock Absorber and Spring Assembly Replacement](#).
40. Secure the shock modules to the front frame with mechanics wire to avoid stretching the front brake hoses.
41. Install the headlamp leveling sensors. Refer to [Headlamp Leveling Front Suspension Height Sensor Replacement](#).

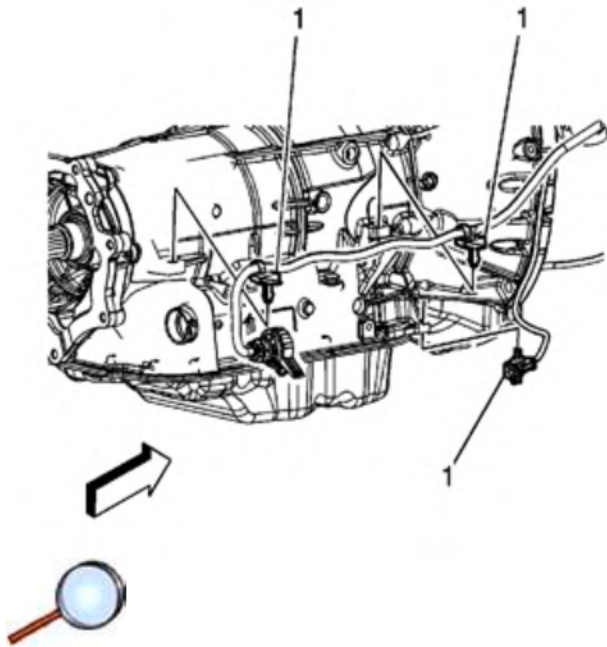


42. Connect the transmission shift linkage to the transmission.
43. Connect electrical connector to the low oil level sensor.

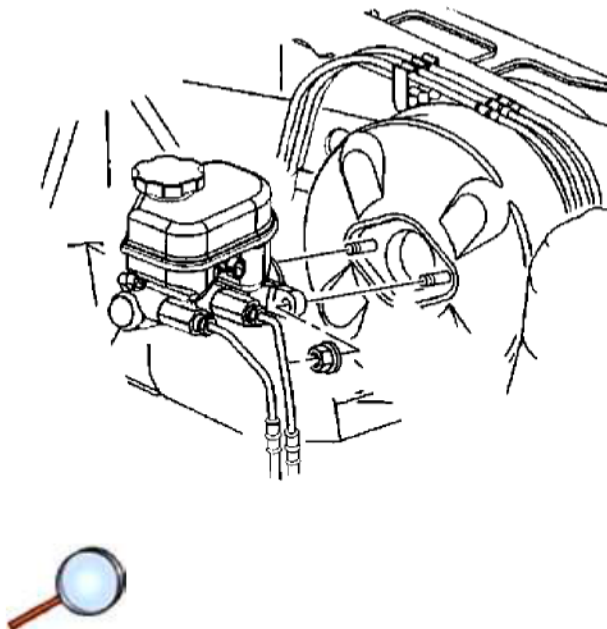


44. Install the lower engine mount nuts. Refer to [Engine Mount Replacement - Left Side](#) and to [Engine Mount Replacement - Right Side](#).
45. Install the lower intermediate steering shaft. Refer to [Lower Intermediate Steering Shaft Replacement](#).
46. Install the front tire and wheel assemblies. Refer to [Tire and Wheel Removal and Installation](#).
47. Install the front brake pipes and retainers to the underbody.
48. Connect the rear brake pipes to the BPMV. Refer to [Brake Pressure Modulator Valve Replacement](#).
49. Connect the side air baffles to the radiator.
50. Install the washer bottle bracket. Refer to [Windshield Washer Solvent Container Replacement](#).
51. Install the air deflector. Refer to [Front Air Deflector Replacement](#).

- 52. Install the transfer case, if equipped. Refer to [Transfer Case Assembly Replacement](#).
- 53. Install the propeller shaft. Refer to [Rear Propeller Shaft Replacement](#).
- 54. Install the muffler assembly. Refer to [Exhaust System Replacement](#).



- 55. Install the engine harness to transmission retaining clips (1).

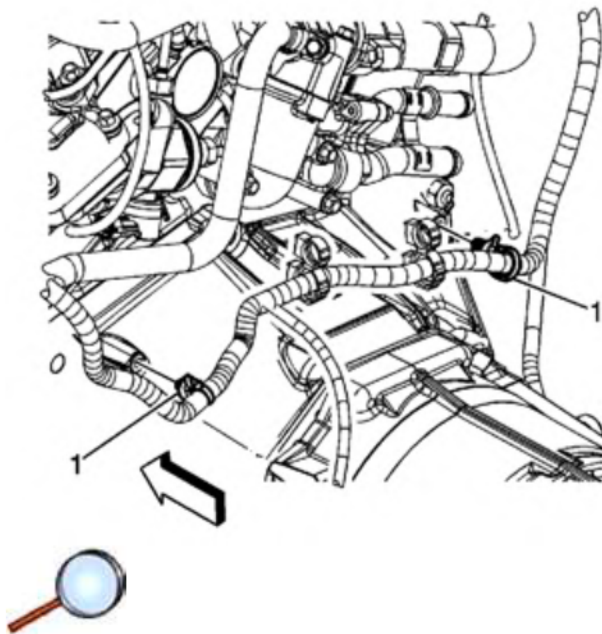


- 56. Install the master cylinder. Refer to [Master Cylinder Replacement](#).

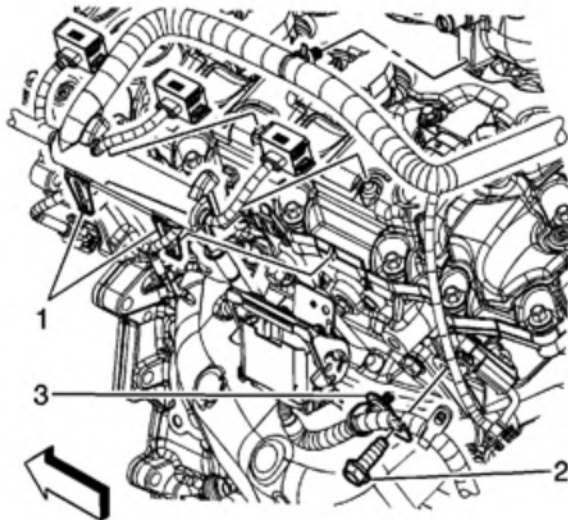
Caution: Refer to [Fastener Caution](#) in the Preface section.



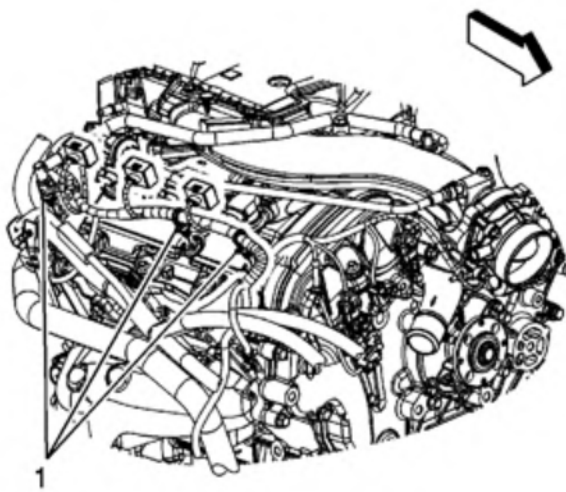
57. Install the ground wire and bolt to the longitudinal rail. Tighten the bolt to **10 N·m** (89 lb in).



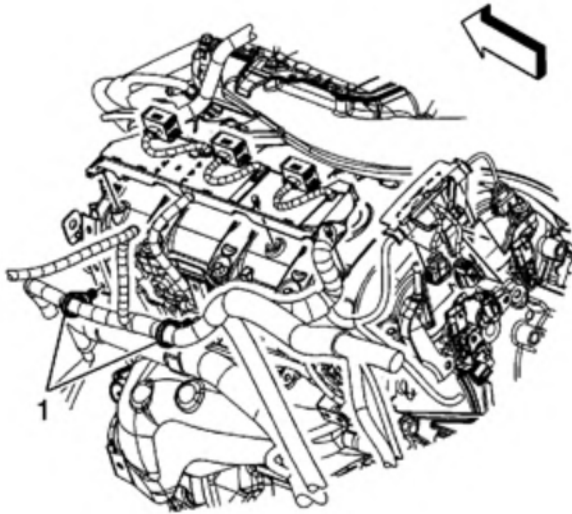
58. Install the engine harness to transmission retaining clips (1).



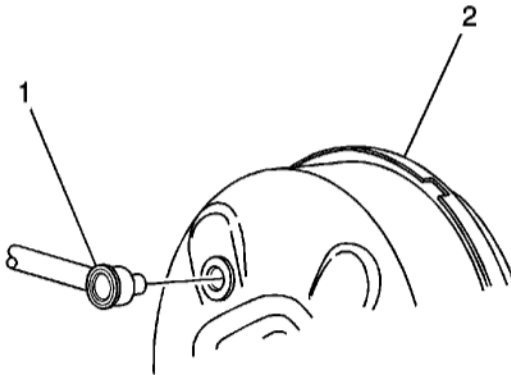
- 59. Install the left side engine harness retaining clips (1).
- 60. Install the bolt (2) to the engine harness retainer (3) and tighten to **10 N·m (89 lb in)**.



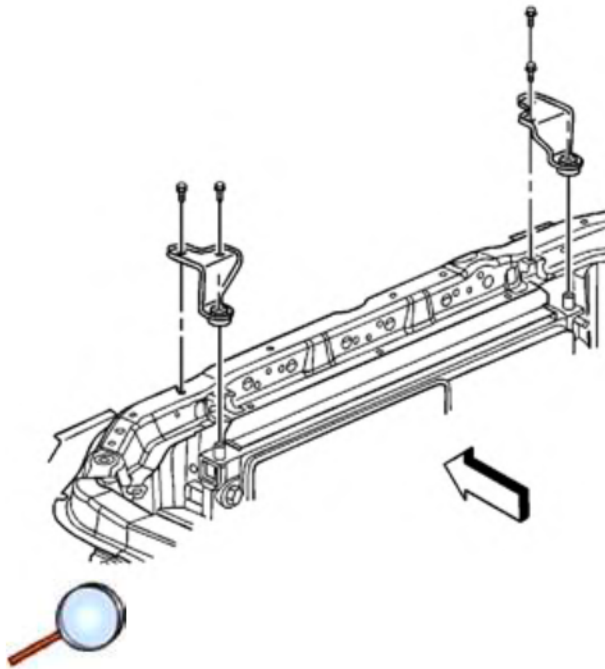
- 61. Install the right side engine harness to valve cover retaining clips (1).



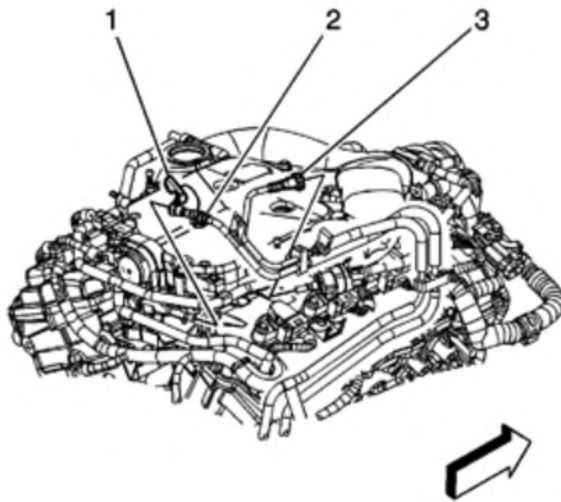
62. Install the right side engine harness retaining clips (1).
63. Connect all engine harness electrical connectors. Refer to [Powertrain Component Views](#) and [Harness Routing Views](#).



64. Connect the brake booster vacuum hose (1) to the brake booster (2).



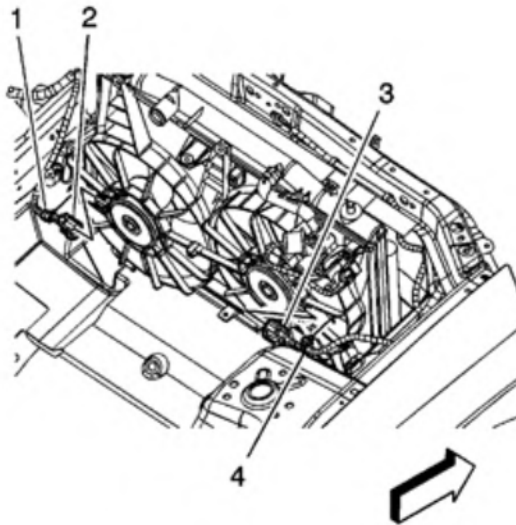
65. Install the radiator support brackets.
66. Install the radiator support bolts and tighten to **9 N·m (80 lb in)**.



67. Connect the purge line (3) to the purge solenoid.
68. Connect the fuel pipe (2) to the fuel rail. Refer to [Metal Collar Quick Connect Fitting Service](#).
69. Connect the heater hoses to the heater core. Refer to [Heater Inlet Hose Replacement](#) and to [Heater Outlet Hose Replacement](#).
70. Position and secure the surge tank inlet hose to the vehicle.
71. Connect the surge tank inlet hose to the water outlet housing and to the radiator. Refer to [Radiator Surge Tank Outlet Hose/Pipe Replacement](#).
72. Connect the outlet hose to the surge tank. Refer to [Radiator Surge Tank Inlet Hose/Pipe Replacement](#).
73. Connect the electrical connector for the air conditioning pressure switch and the liquid line to the evaporator. Refer to [Liquid Line Replacement](#).
74. Connect the air conditioning suction hose to the evaporator and install the suction hose

bracket to the shock tower. Refer to [Suction Hose Replacement](#).

75. Install the air cleaner duct. Refer to [Air Cleaner Outlet Duct Replacement](#).



76. Install the cooling fan wiring harnesses (1, 4) to the fan shroud.
77. Install the cooling fan electrical connectors (2, 3).
78. Install the wiper module. Refer to [Windshield Wiper Transmission Replacement](#).
79. Install the fuel injector sight shield. Refer to [Fuel Injector Sight Shield Replacement](#).
80. Connect the negative cable from the battery and the body at the top of the right strut tower. Refer to [Battery Negative Cable Replacement](#).
81. Fill the cooling system. Refer to [Cooling System Draining and Filling](#).
82. Charge the air conditioning system. Refer to [Refrigerant Recovery and Recharging](#).
83. Bleed the brake rear circuits. Refer to [Hydraulic Brake System Bleeding](#).

Engine Oil and Oil Filter Replacement

Removal Procedure



1. Turn the ignition OFF.
2. Remove the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#).

Note: Use a 6-point socket to remove the oil filter cap.

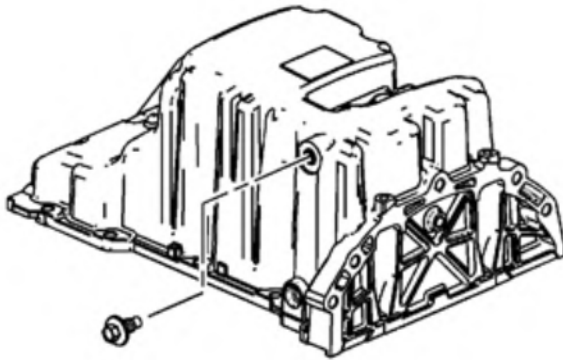
3. Remove the oil filter cap.





Note: It is normal for oil to drain from the oil filter chamber in the oil filter adapter housing. Do NOT replace the oil filter adapter for this condition.

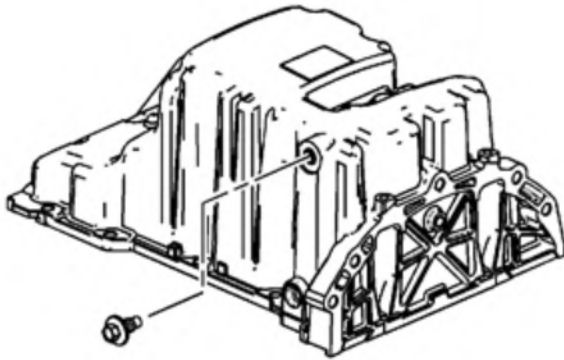
4. Remove and discard the oil filter cartridge.
5. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#).
6. Place a suitable drain below the oil pan drain plug.



7. Remove the oil pan drain plug.
8. Allow the oil to drain completely.

Installation Procedure

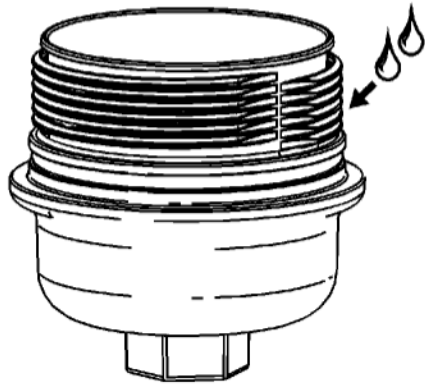
Caution: Refer to [Fastener Caution](#) in the Preface section.



1. Install the oil pan drain plug and NEW O-ring seal and tighten to **20 N·m (15 lb ft)**.
2. Lower the vehicle.



3. Install the NEW oil filter cartridge.



Caution: Lubrication must be applied to the threads of the oil filter cap prior to installation. Failure to lubricate the oil filter cap threads can hinder later removal and cause possible oil filter cap damage.

4. Lubricate the oil filter cap threads with clean engine oil.



Caution: Proper oil filter cap tightening is mandatory. Failure to tighten the oil filter cap to the proper specification can hinder later removal and cause possible oil filter cap damage.

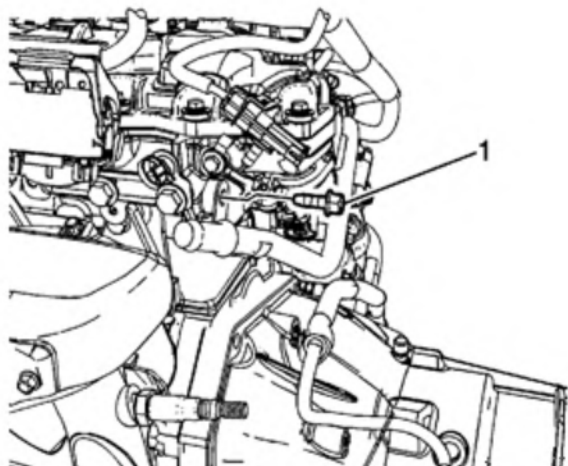
Note: Use a 6-point socket to install the oil filter cap.

5. Install the oil filter cap and tighten to **25 N·m (18 lb in)**.

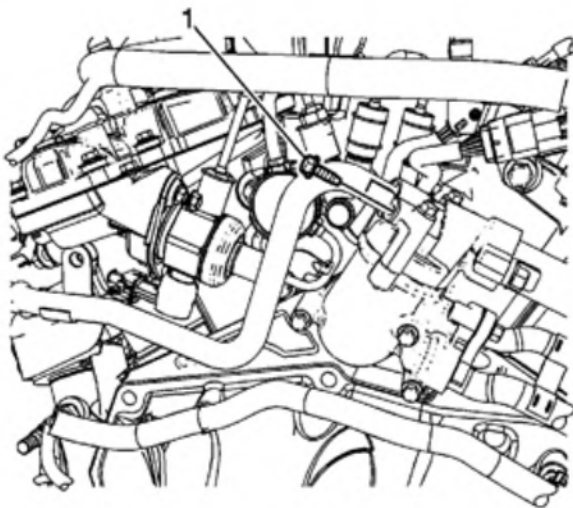
6. Install the oil fill cap.
7. Fill the engine with the appropriate oil type and quantity. Refer to [Fluid and Lubricant Recommendations](#) and [Approximate Fluid Capacities](#).
8. Install the front compartment sight shield as necessary. Refer to [Front Compartment Sight Shields Replacement](#).

Radiator Surge Tank Outlet Hose / Pipe Replacement

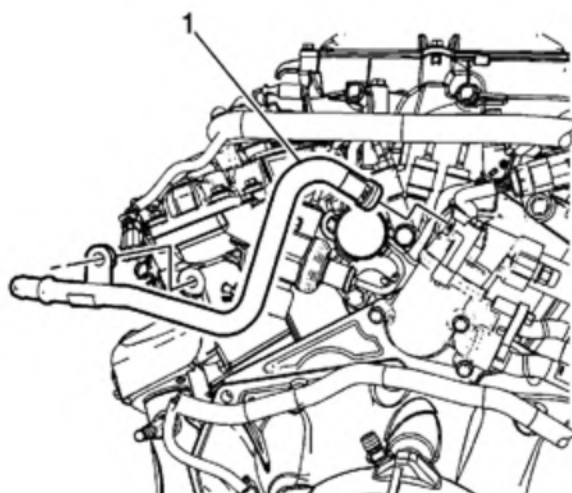
Removal Procedure



1. Partially drain the cooling system. Refer to [Cooling System Draining and Filling](#).
2. Remove the fuel pipe shield. Refer to [Fuel Pipe Shield Replacement](#).
3. Disconnect the surge tank hose from the surge tank outlet pipe.
4. Remove the surge tank outlet pipe bolt (1) from the cylinder head.

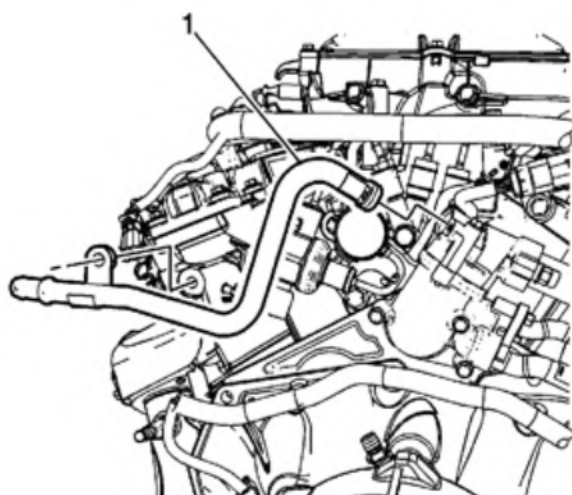


5. Remove the surge tank outlet pipe bolt (1) from the thermostat housing.



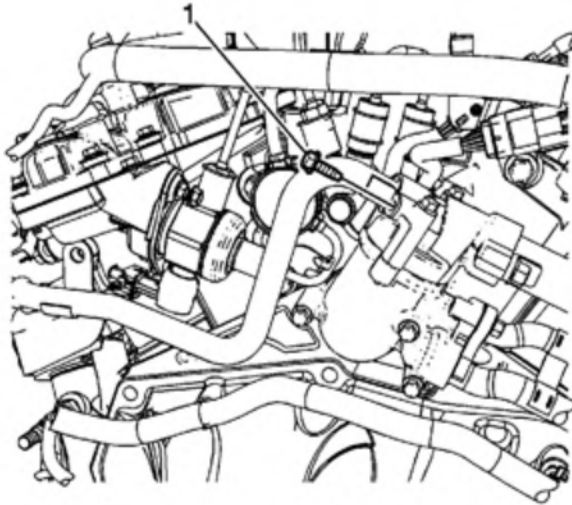
6. Remove the surge tank outlet pipe (1) from the thermostat housing.

Installation Procedure

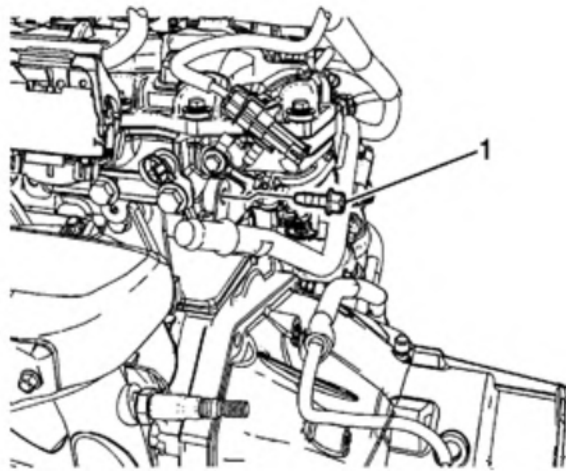


1. Position the surge tank outlet pipe (1) with a NEW O-ring seal to the thermostat housing.

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



2. Install the surge tank outlet pipe bolt (1) to the thermostat housing. Tighten the thermostat bolts to **15 N·m (11 lb ft)**.



3. Install the surge tank outlet pipe bolt (1) to the cylinder head. Tighten the thermostat bolts to **15 N·m (11 lb ft)**.
4. Install the surge tank hose to the surge tank outlet pipe.
5. Install the fuel pipe shield. Refer to [Fuel Pipe Shield Replacement](#).
6. Fill the cooling system. Refer to [Cooling System Draining and Filling](#).