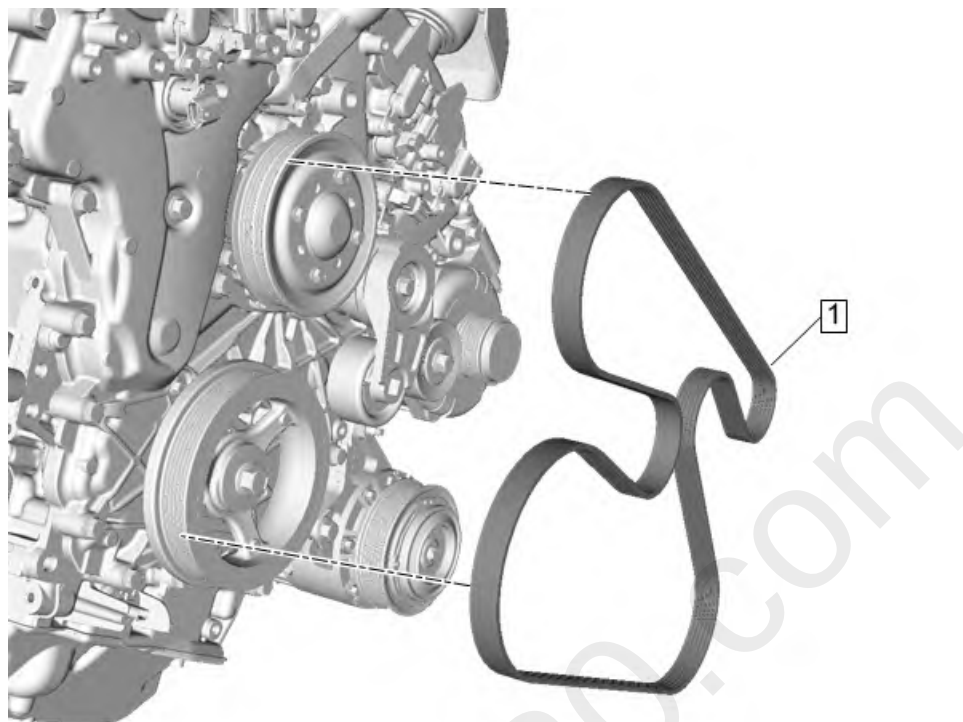


2018 ENGINE**Engine Mechanical - 3.6L (LFY) - Repair Instructions - On Vehicle - Traverse****REPAIR INSTRUCTIONS - ON VEHICLE****DRIVE BELT REPLACEMENT****Fig. 1: Drive Belt Routing****Courtesy of GENERAL MOTORS COMPANY**

Callout	Component Name
Preliminary Procedure <u>Front Wheelhouse Liner Replacement</u>	
1	Drive Belt Procedure 1. Rotate the drive belt tensioner clockwise to release the drive belt tension. 2. Slide the drive belt off of the belt idler pulley. 3. Slowly release the drive belt tensioner.

DRIVE BELT TENSIONER REPLACEMENT

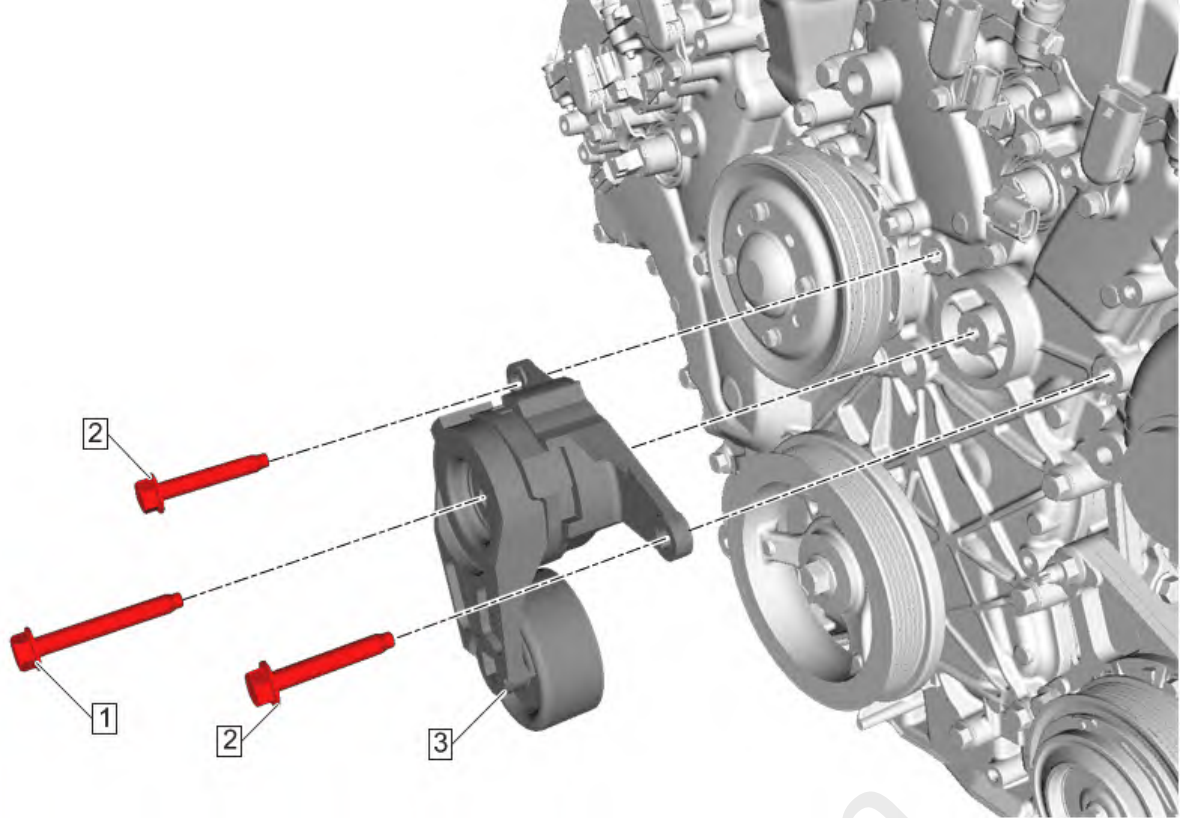
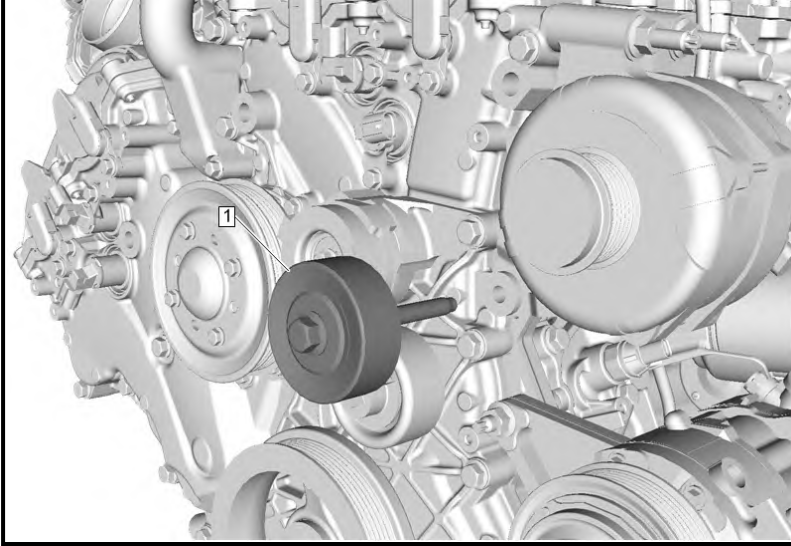


Fig. 2: Exploded View Of Drive Belt Tensioner
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Belt Idler Pulley Replacement</u>	
1	Drive Belt Tensioner Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 25 N.m (18 lb ft)
2	Engine Front Cover Bolt [2x] Tighten • First Pass: 20 N.m (15 lb ft) • Final Pass: 60 degrees
3	Drive Belt Tensioner

BELT IDLER PULLEY REPLACEMENT

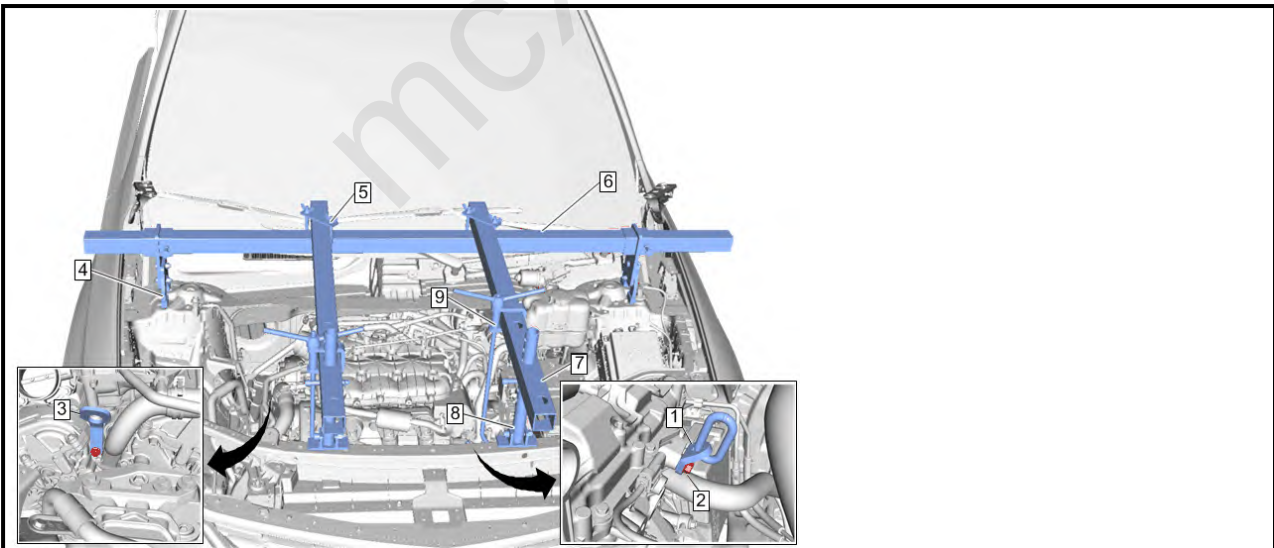




Callout	Component Name
Preliminary Procedures Drive Belt Replacement Engine Mount Replacement - Right Side	
1	Drive Belt Idler Pulley CAUTION: Refer to Fastener Caution . Tighten 58 N.m (43 lb ft)

ENGINE SUPPORT FIXTURE

Engine Support Fixture Installation - Engine Mount and Engine Mount Bracket Procedures

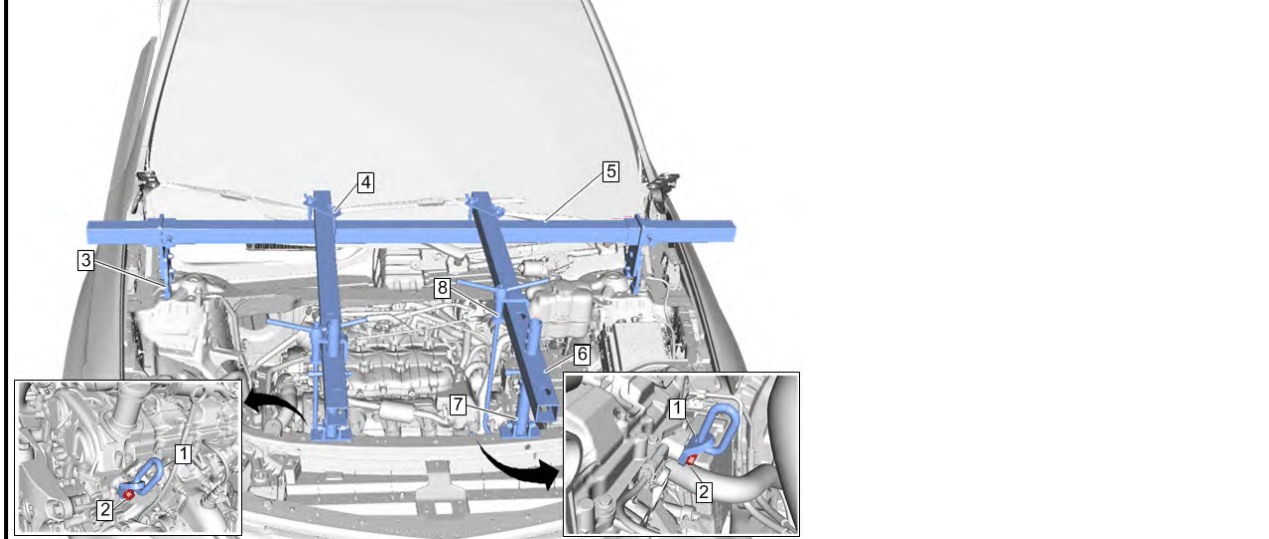


Engine Support Fixture Installation - Engine Mount and Engine Mount Bracket Procedures

Callout	Component Name
Empty table body for the second table	

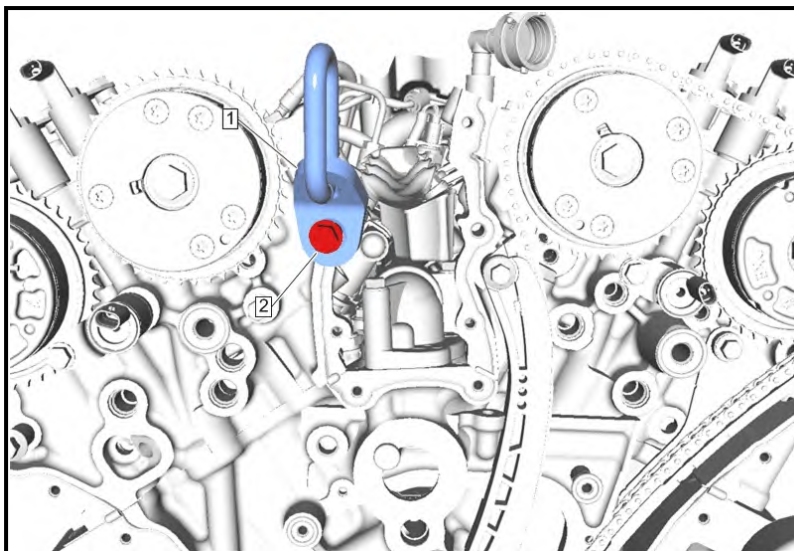
Callout	Component Name
Preliminary Procedures 1. Dash Panel Upper Extension Panel Extension Replacement 2. Intake Air Splash Shield Replacement 3. Air Cleaner Outlet Duct Replacement Special Tools • EN-36857 Engine Lift Bracket • EN-51007 Engine Support Fixture • EN-51007-1 Main Support Beam • EN-51007-3 Radiator Support Beam • EN-51007-4 Clamp • EN-51007-5 Support Leg, Front • EN-51007-6 Hook • EN-51007-7 Engine Support Fixture Adapters • EN-51768 Engine Support Fixture Adapter Bolt - M8 • EN-52059 Engine Support Fixture Adapter Bolt - M10 • J-41803 - 10 Engine Support Bracket	
Equivalent regional tools: Special Tools	
1	EN-36857 Engine Lift Bracket Procedure Install EN-36857 Engine Lift Brackets as shown.
2	EN-52059 Engine Support Fixture Adapter Bolt - M10
3	J-41803 - 10 Engine Support Bracket Procedure 1. Remove the front cover bolt. Engine Front Cover Replacement 2. Using the removed front cover bolt, install EN-36857 Engine Lift Bracket. 3. Hand-tighten the lift hook wing nuts securely to remove all slack from the engine support fixture assembly.
4	EN-51007-7 Engine Support Fixture Adapters Procedure Install EN-51007-7 Engine Support Fixture Adapters to frame.
5	EN-51007-4 Clamp
6	EN-51007-1 Main Support Beam
7	EN-51007-3 Radiator Support Beam
8	EN-51007-5 Support Leg, Front
9	EN-51007-6 Hook Procedure Hand-tighten the lift hook wing nuts securely to remove all slack from the engine support fixture assembly.

Engine Support Fixture Installation - Engine Front Cover and Bank One Cylinder Head Procedures



Engine Support Fixture Installation - Engine Mount, Engine Mount Bracket, Engine Front Cover and Bank One Cylinder Head Procedures

Callout	Component Name
Preliminary Procedures 1. Generator Replacement (LFY) 2. Dash Panel Upper Extension Panel Extension Replacement 3. Intake Air Splash Shield Replacement 4. Air Cleaner Outlet Duct Replacement	
Special Tools • EN-36857 Engine Lift Bracket • EN-51007 Engine Support Fixture • EN-51007-1 Main Support Beam • EN-51007-3 Radiator Support Beam • EN-51007-4 Clamp • EN-51007-5 Support Leg, Front • EN-51007-6 Hook • EN-51007-7 Engine Support Fixture Adapters • EN-51768 Engine Support Fixture Adapter Bolt - M8 • EN-52059 Engine Support Fixture Adapter Bolt - M10 • J-41803 - 10 Engine Support Bracket	
Equivalent regional tools: Special Tools	
1	EN-36857 Engine Lift Bracket Procedure Install EN-36857 Engine Lift Brackets as shown.
2	EN-52059 Engine Support Fixture Adapter Bolt - M10
3	EN-51007-7 Engine Support Fixture Adapters Procedure Install EN-51007-7 Engine Support Fixture Adapters to frame as shown.
4	EN-51007-4 Clamp
5	EN-51007-1 Main Support Beam
6	EN-51007-3 Radiator Support Beam
7	EN-51007-5 Support Leg, Front
8	EN-51007-6 Hook Procedure Hand-tighten the lift hook wing nuts securely to remove all slack from the engine support fixture assembly.



Engine Support Fixture Installation - Bank Two Cylinder Head Procedure

Callout	Component Name
Preliminary Procedures Engine Front Cover Replacement - Relocate the left side engine lift bracket. Special Tools EN-36857 Engine Lift Bracket Equivalent regional tools: Special Tools	
1	EN-36857 Engine Lift Bracket Procedure - Install the EN-36857 Engine Lift Bracket. - Hand-tighten the lift hook wing nuts securely to remove all slack from the engine support fixture assembly.
2	EN-51768 Engine Support Fixture Adapter Bolt - M8

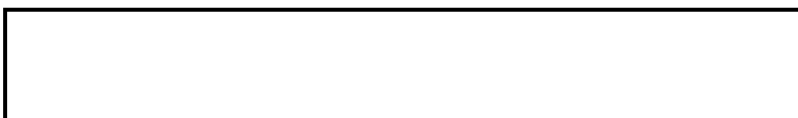
ENGINE MOUNT INSPECTION

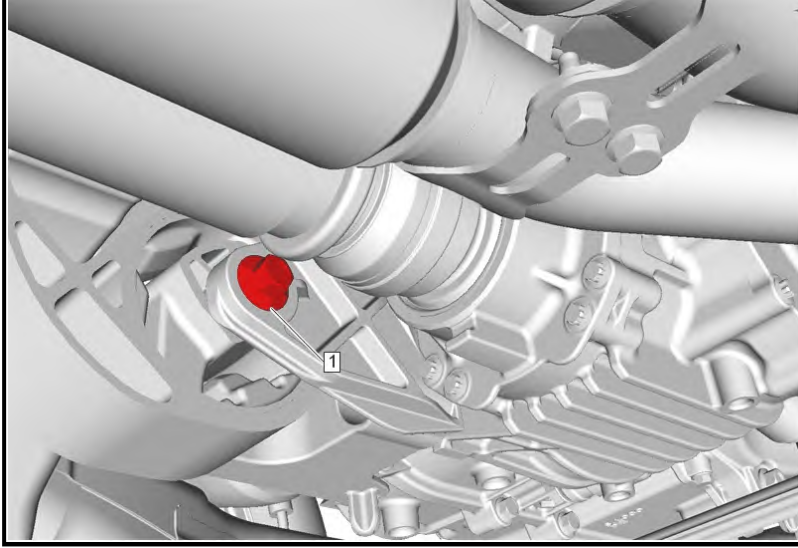
- Install the engine support fixture. [Engine Support Fixture](#)
- Raise the engine to remove the weight from the engine mount and create a slight tension on the rubber.
- Replace the engine mount if the engine mount exhibits any of the following conditions:
 - The hard rubber is covered with cracks.
 - The rubber is separated from the metal plate of the engine mount.
 - The rubber is split through the center of the engine mount.
- For engine mount replacement, refer to [Engine Mount Replacement - Right Side](#).

POWERTRAIN MOUNT BALANCING

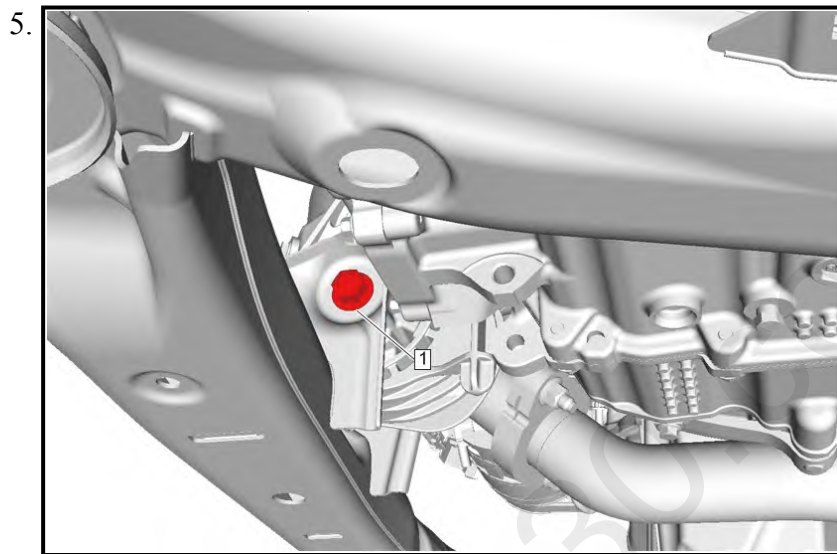
- Air Cleaner Assembly - Remove - [Air Cleaner Assembly Replacement](#)
- Engine Support Fixture - Install - [Engine Support Fixture](#)
- Raise the vehicle. [Lifting and Jacking the Vehicle](#)

4.



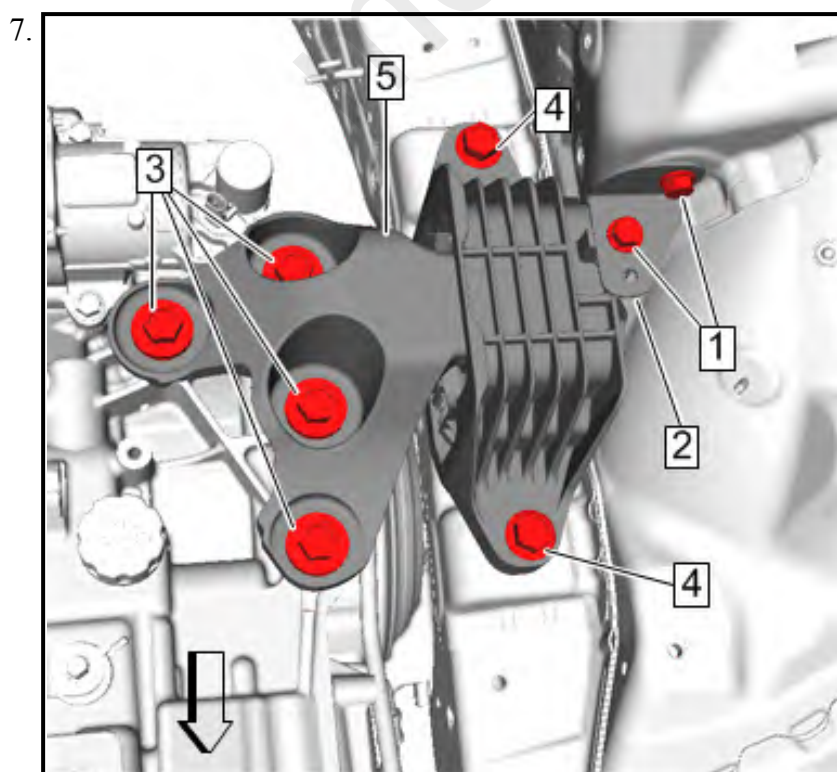


Rear Transmission Mount Through Bolt (1) - Loosen



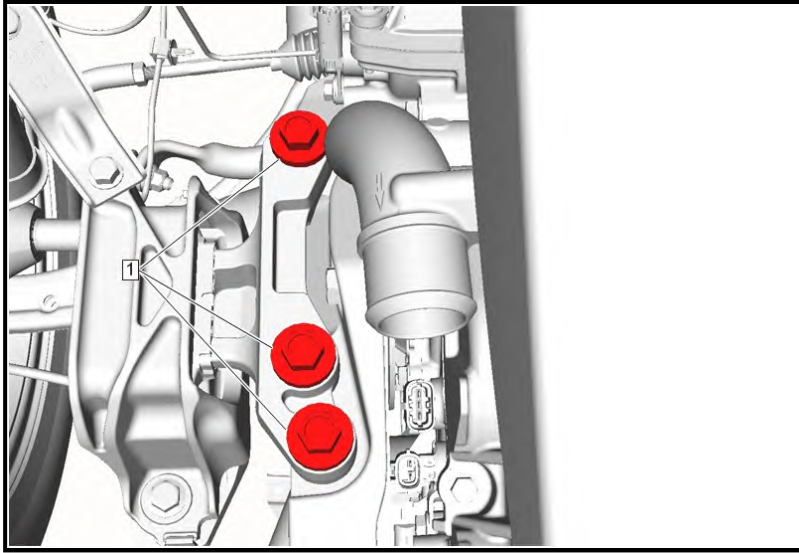
Front Transmission Mount Through Bolt (1) - Loosen

6. Lower the vehicle.



Transmission Mount Bolt (3) - Loosen [4x]

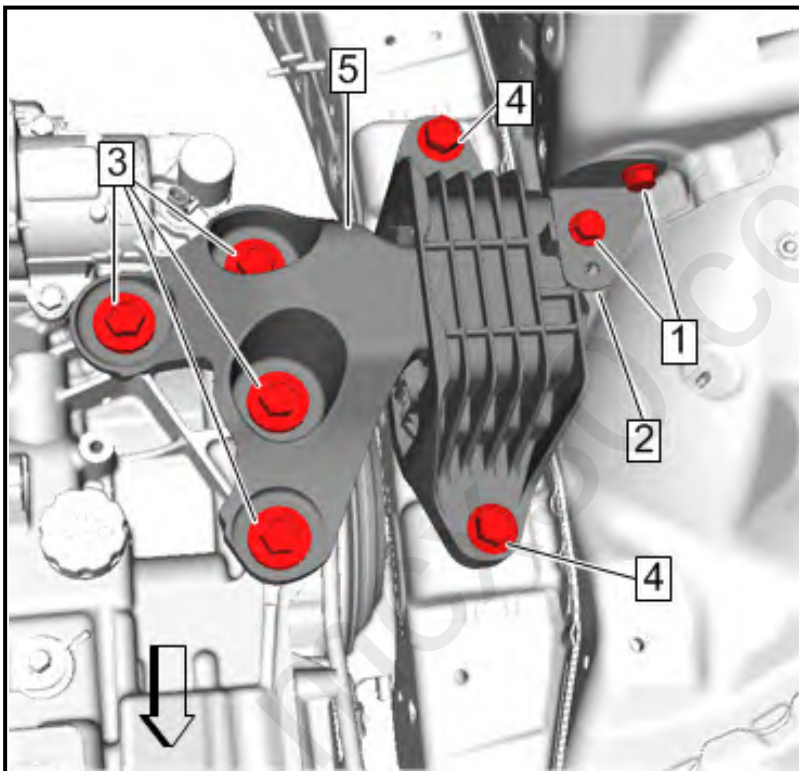
8.



Engine Mount Fastener (1) - Loosen [3x]

9. Adjust the engine support fixture in order to allow a 1/8 inch gap between the mount and bracket.

10.

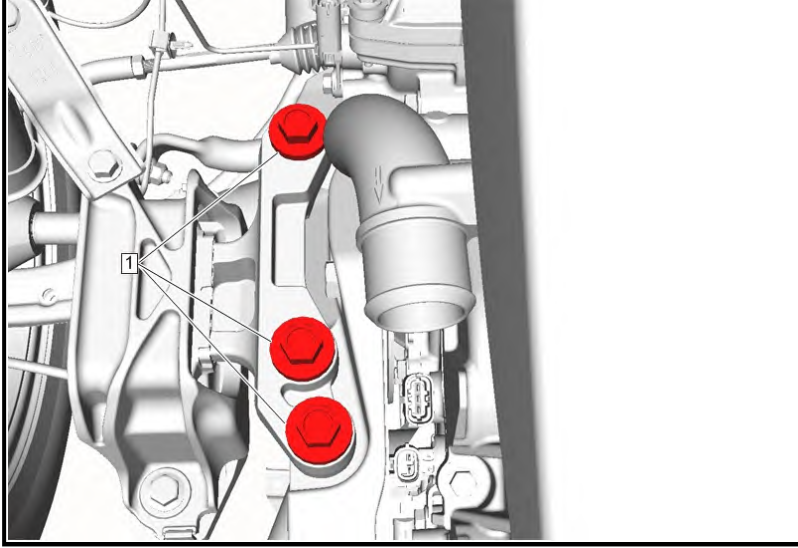


CAUTION: Refer to [Fastener Caution](#) .

Transmission Mount Bolt (3) - Tighten [4x] - [Transmission Mount Replacement \(Left\)](#)
[Transmission Mount Replacement \(Front\)](#).

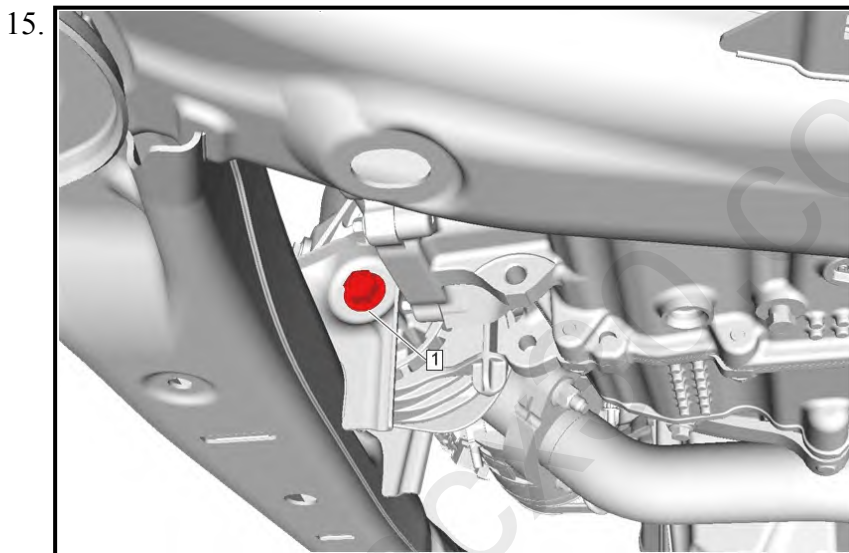
11.



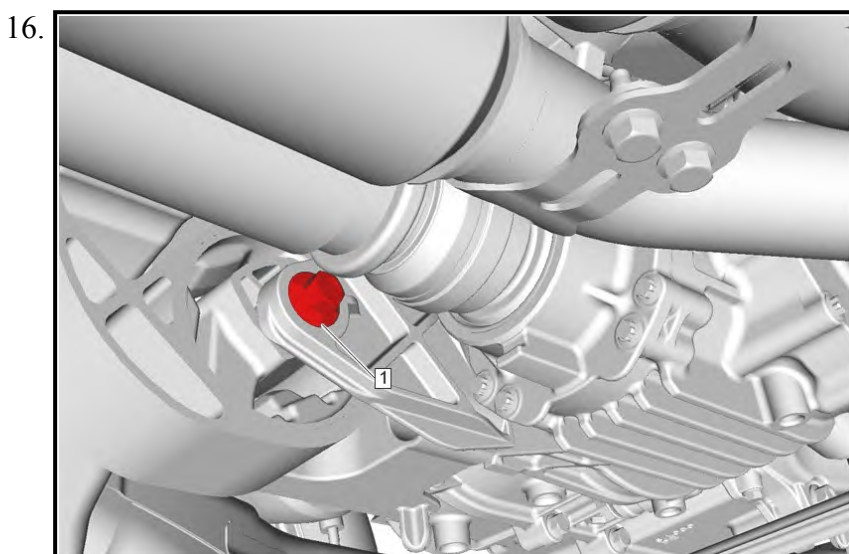


Engine Mount Fastener (1) - Tighten [3x] 100 N.m (74 lb ft)

12. Engine Support Fixture - Remove - [Engine Support Fixture](#)
13. Shake the powertrain vigorously from front to rear and allow the powertrain to settle.
14. Raise the vehicle.



Front Transmission Mount Through Bolt (1) - Tighten - [Transmission Mount Replacement \(Left\)](#), [Transmission Mount Replacement \(Front\)](#)



Transmission Mount Strut Bolt (1) - Tighten - [Transmission Mount Strut Replacement \(All Wheel Drive\)](#), [Transmission Mount Strut Replacement \(Front Wheel Drive\)](#)

17. Lower the vehicle.

18. Engine Support Fixture - Remove - [Engine Support Fixture](#)

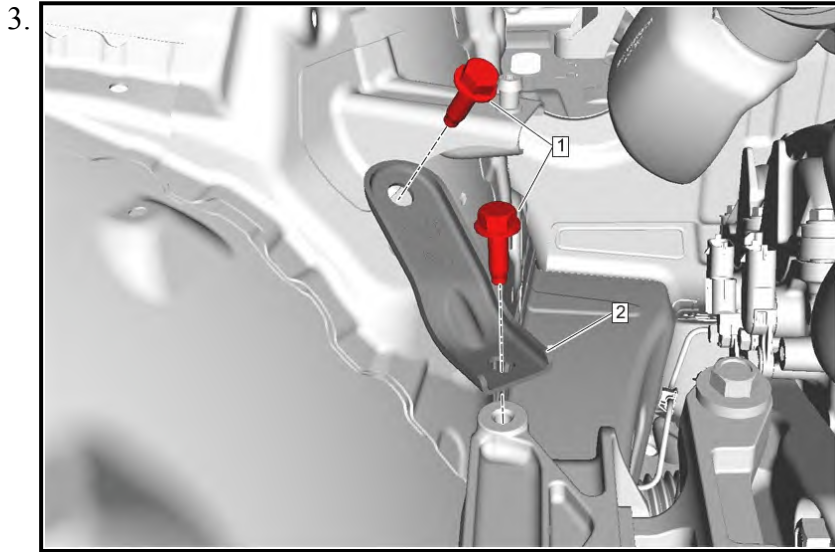
19. Air Cleaner Assembly - Install - [Air Cleaner Assembly Replacement](#)

ENGINE MOUNT REPLACEMENT - RIGHT SIDE

Removal Procedure

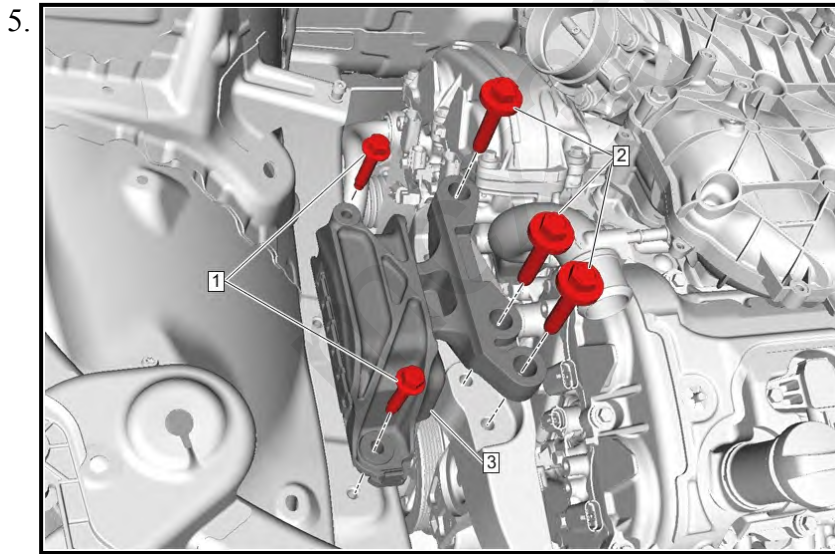
1. Air Cleaner Assembly - Remove - [Air Cleaner Assembly Replacement](#)

2. Engine Support Fixture - Install - [Engine Support Fixture](#)



Engine Mount Brace Bolt (1) - Remove [2x]

4. Engine Mount Brace (2) - Remove



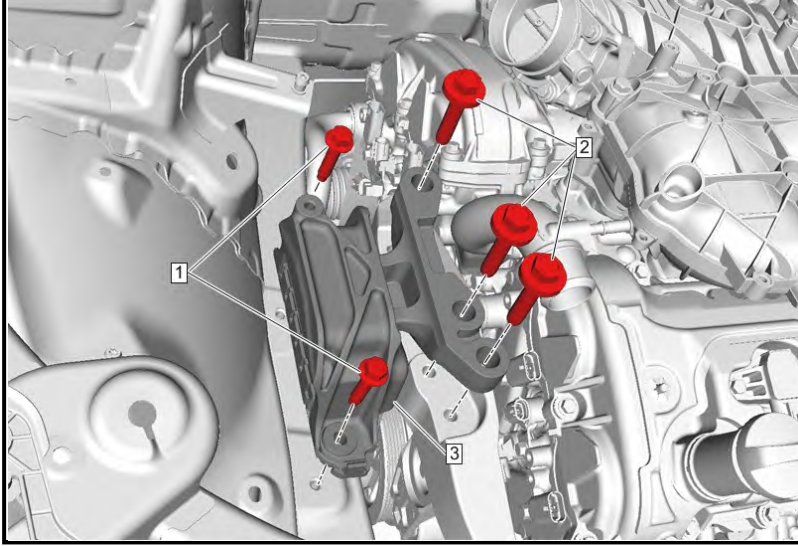
Engine Mount Fastener - (1) - Remove

6. Engine Mount Fastener - (2) - Remove

7. Engine Mount - (3) - Remove

Installation Procedure





Engine Mount - (3) - Install

NOTE: Do not tighten the engine mount fasteners at this time.

2. Engine Mount Fastener - (2) - Install

NOTE: Do not tighten the engine mount fasteners at this time.

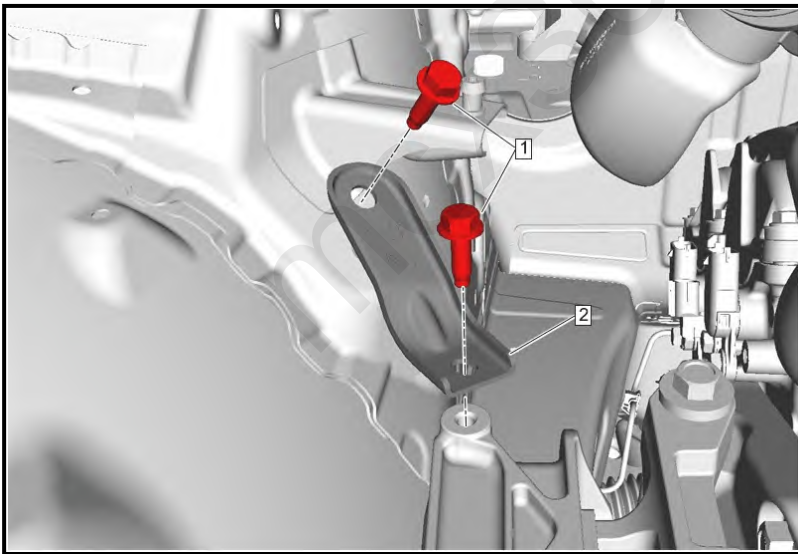
3. Engine Mount Fastener - (1) - Install

4. Perform the powertrain mount balance procedure. [Powertrain Mount Balancing](#)

CAUTION: Refer to [Fastener Caution](#) .

5. Tighten the engine mount-to-body bolts (1) to 58 N.m (43 lb ft)

6.



Engine Mount Brace (2) - Install

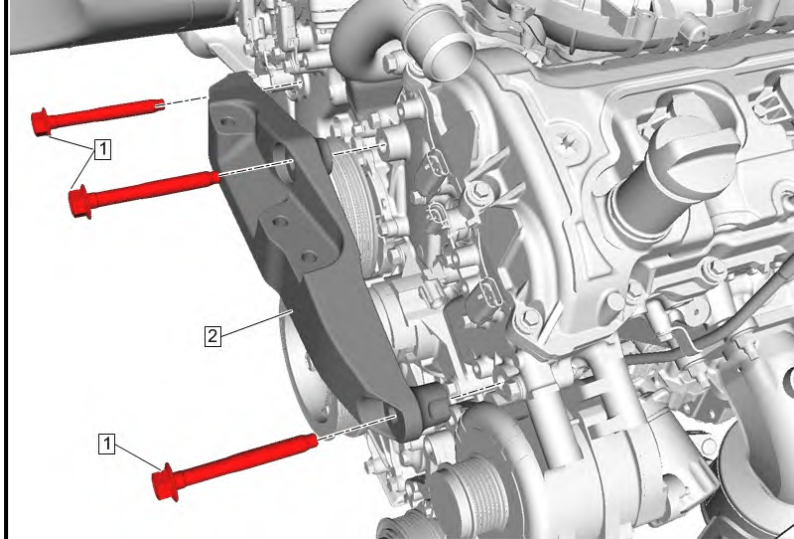
7. Engine Mount Brace Bolt (1) - Install and tighten [2x] 22 N.m (16 lb ft)

8. Engine Support Fixture - Remove - [Engine Support Fixture](#)

9. Air Cleaner Assembly - Install - [Air Cleaner Assembly Replacement](#)

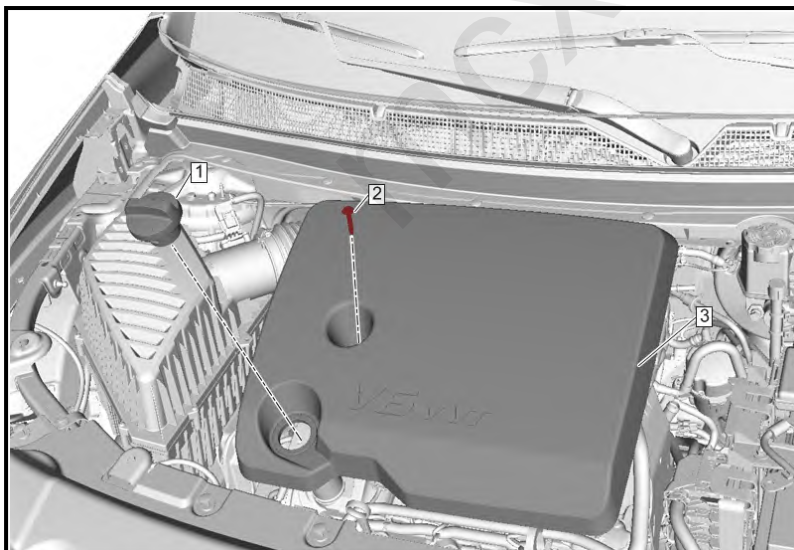
ENGINE MOUNT BRACKET REPLACEMENT - RIGHT SIDE





Callout	Component Name
Preliminary Procedures Air Cleaner Assembly Replacement Engine Mount Replacement - Right Side	
1	Engine Mount Bracket Fastener [3x] CAUTION: Refer to Fastener Caution . Tighten 100 N.m (74 lb ft)
2	Engine Mount Bracket

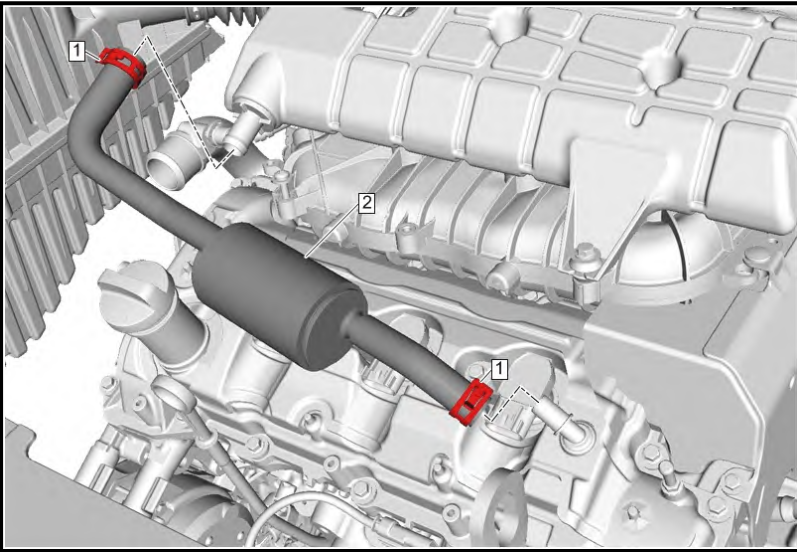
INTAKE MANIFOLD COVER REPLACEMENT



Callout	Component Name
1	Oil Cap
2	Intake Manifold Cover Fastener CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)

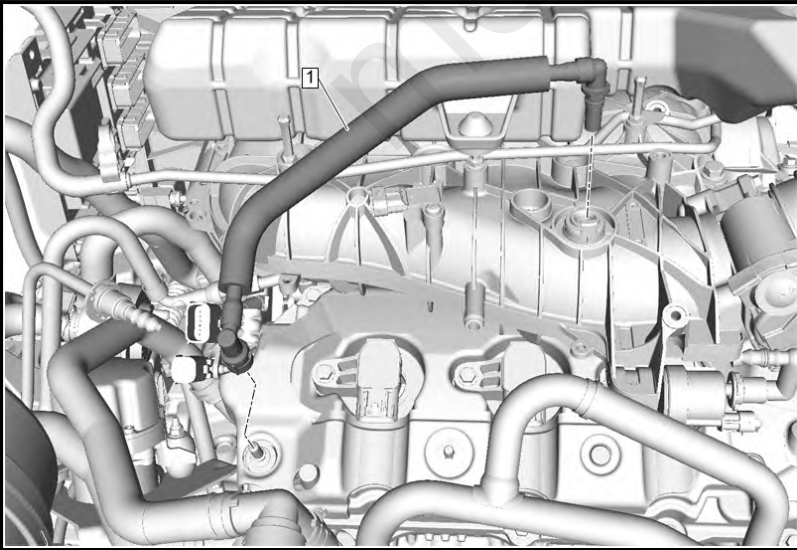
Callout	Component Name
3	Intake Manifold Cover Procedure Pull the intake manifold cover upward to remove.

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT (AIR CLEANER OUTLET DUCT TO CAMSHAFT COVER)



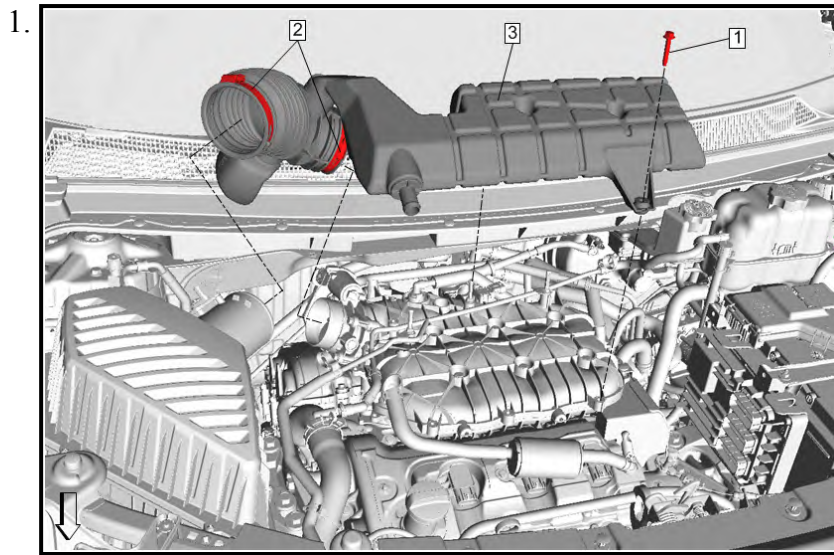
Callout	Component Name
Preliminary Procedure <u>Intake Manifold Cover Replacement</u>	
1	Hose Clamp Procedure Hose Clamp (1) - Disengage [2x] - <u>Hose Clamp Replacement Guidelines - Spring Type</u>
2	Positive Crankcase Ventilation Tube

POSITIVE CRANKCASE VENTILATION HOSE/PIPE/TUBE REPLACEMENT (INTAKE MANIFOLD TO CAMSHAFT COVER)



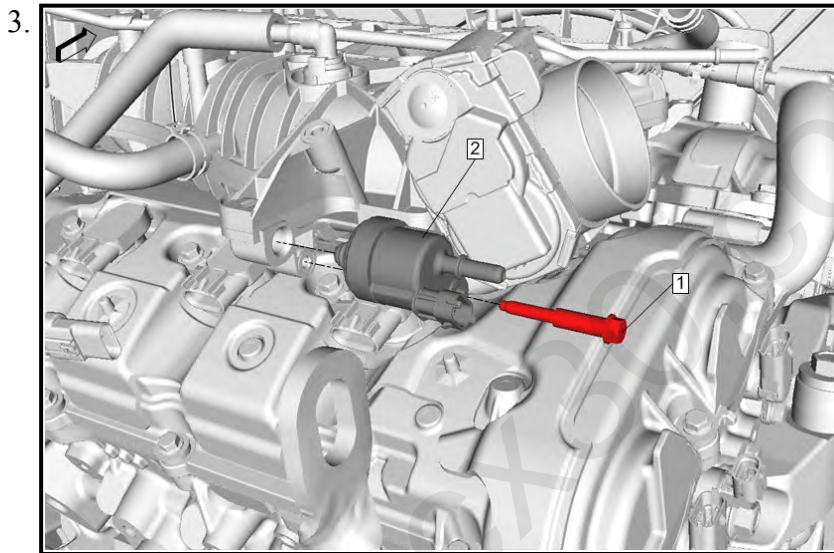
Callout	Component Name
Preliminary Procedure <u>Intake Manifold Cover Replacement</u>	
1	Positive Crankcase Ventilation Tube Procedure Disconnect the PCV tube from the camshaft cover and the intake manifold.

UPPER INTAKE MANIFOLD REPLACEMENT



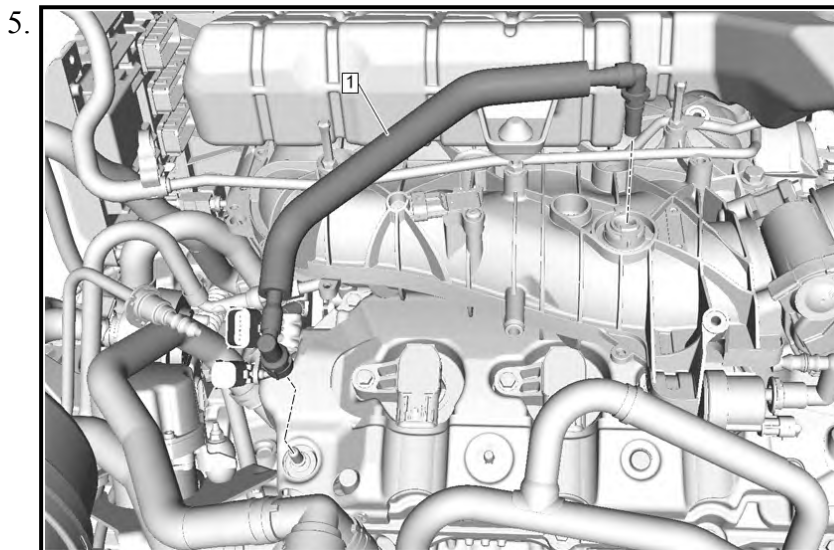
Air Cleaner Outlet Duct (3) - Remove - [Air Cleaner Outlet Duct Replacement](#)

2. Throttle Body Assembly - Remove - [Throttle Body Assembly Replacement](#)



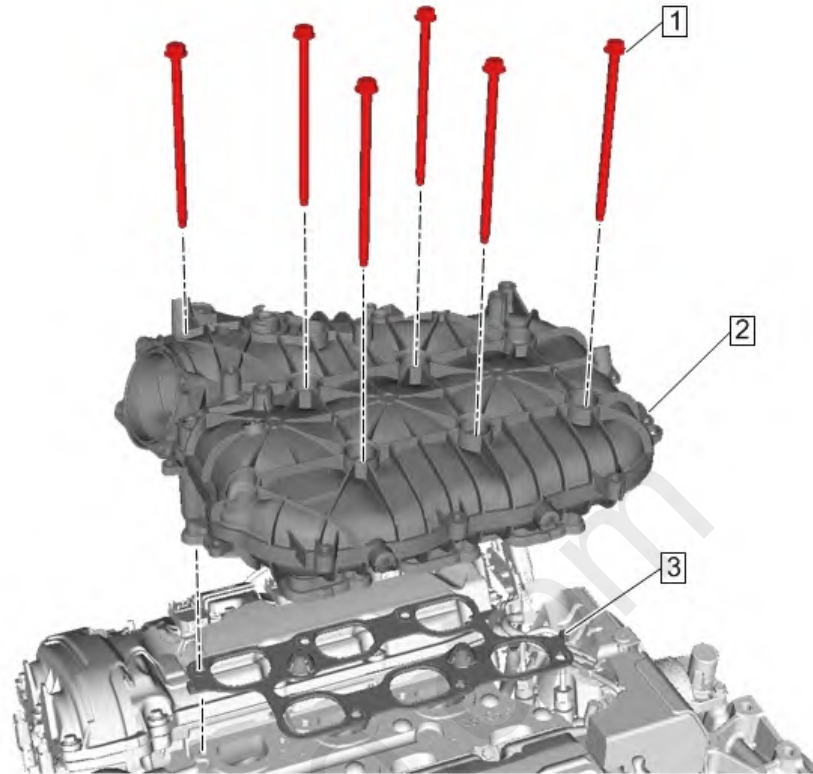
Evaporative Emission Canister Purge Solenoid Valve (2) - Remove - [Evaporative Emission Canister Purge Solenoid Valve Replacement](#)

4. Engine Coolant Air Bleed Pipe - Remove - [Engine Coolant Air Bleed Pipe Replacement \(LFY\)](#)



Positive Crankcase Ventilation Tube (1)@ Intake Manifold to Camshaft Cover - Remove - [Positive Crankcase Ventilation Hose/Pipe/Tube Replacement \(Intake Manifold to Camshaft Cover\)](#)

6. Power Brake Booster Vacuum Pipe @ Intake Manifold - Disconnect - [Power Brake Booster Vacuum Hose Replacement \(LFY\)](#)
7. Manifold Absolute Pressure Sensor - Remove - [Manifold Absolute Pressure Sensor Replacement](#)
8. Engine Rear Noise Shield - Remove - [Engine Rear Noise Shield Replacement](#)
9. Detach wiring harness and position aside as needed.



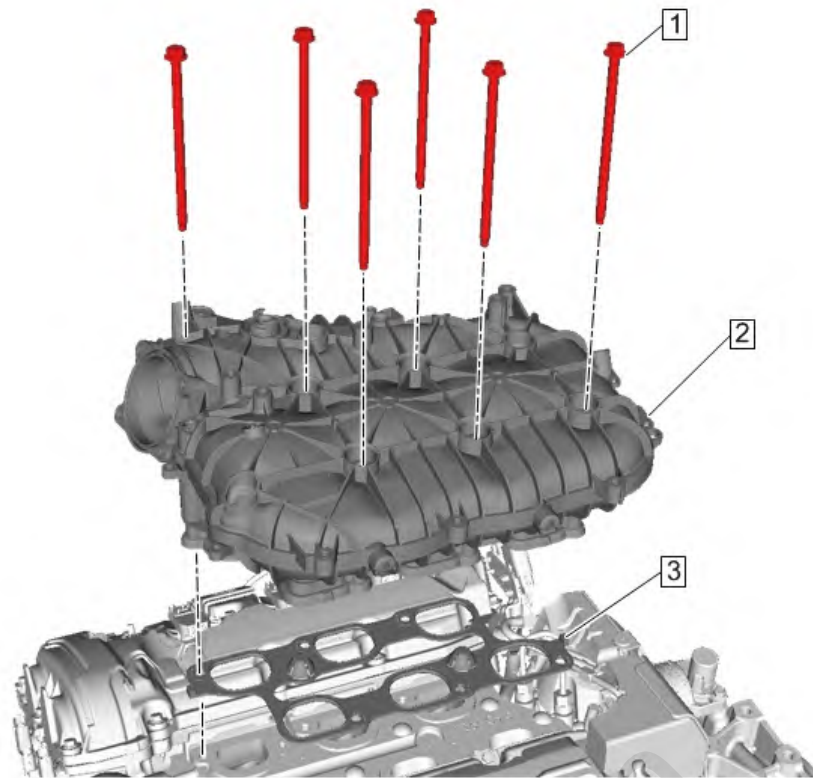
10.

Fig. 3: Exploded View Of Intake Manifold
Courtesy of GENERAL MOTORS COMPANY

Intake Manifold Bolt (1) - Remove [6x]

11. Intake Manifold (2) - Remove
12. Intake Manifold Gasket (3) - Remove and DISCARD
13. Cover the cylinder head passages in order to prevent dirt or debris from entering the passages.
14. Intake Manifold - Clean and inspect - [Intake Manifold Cleaning and Inspection](#)
15. Transfer components as necessary.

Installation Procedure



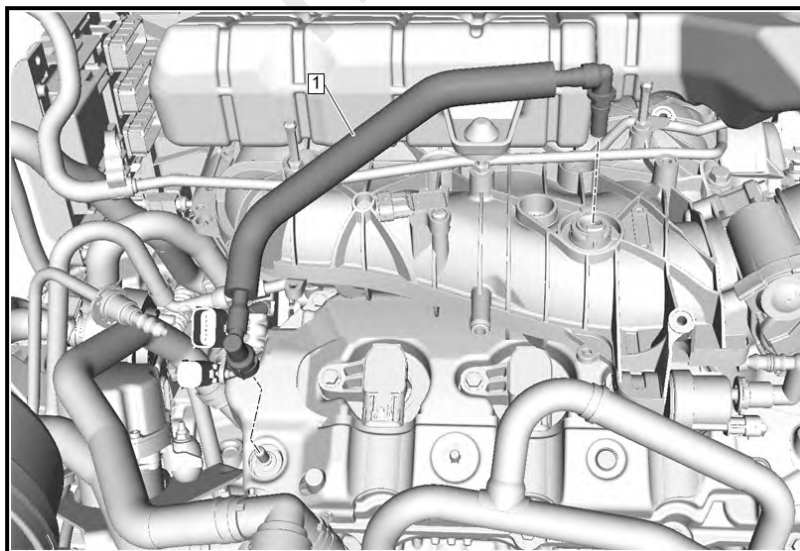
1.

Fig. 4: Exploded View Of Intake Manifold
Courtesy of GENERAL MOTORS COMPANY

Intake Manifold Gasket (3) - Install NEW

2. Apply a 5 mm (0.20 in) band of threadlock to the threads of the intake manifold bolts. [Adhesives, Fluids, Lubricants, and Sealers](#) .
3. Remove the covers from the cylinder head passages.
4. Intake Manifold (2) - Install - [Intake Manifold Installation](#)
5. Position and attach wiring harness.
6. Engine Rear Noise Shield - Install - [Engine Rear Noise Shield Replacement](#)
7. Manifold Absolute Pressure Sensor - Install - [Manifold Absolute Pressure Sensor Replacement](#)
8. Power Brake Booster Vacuum Pipe @ Intake Manifold - Connect - [Power Brake Booster Vacuum Hose Replacement \(LFY\)](#).

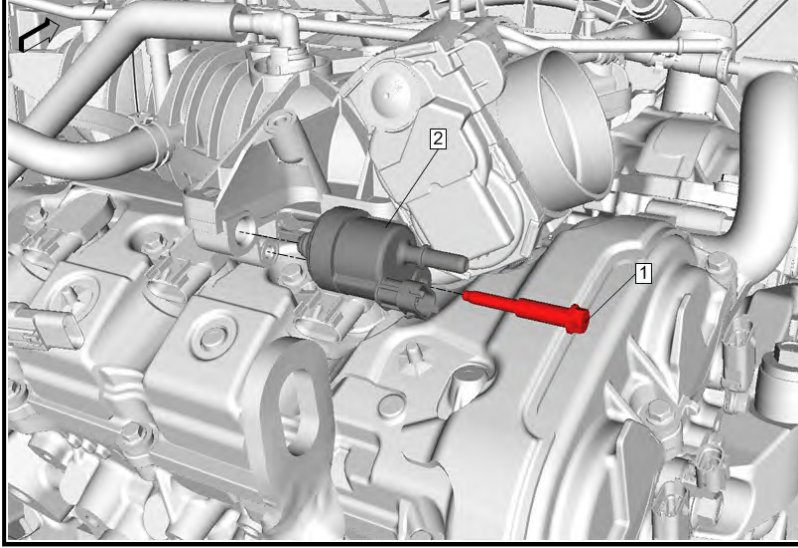
9.



Positive Crankcase Ventilation Tube (1) @ Intake Manifold to Camshaft Cover - Install - [Positive Crankcase Ventilation Hose/Pipe/Tube Replacement \(Intake Manifold to Camshaft Cover\)](#).

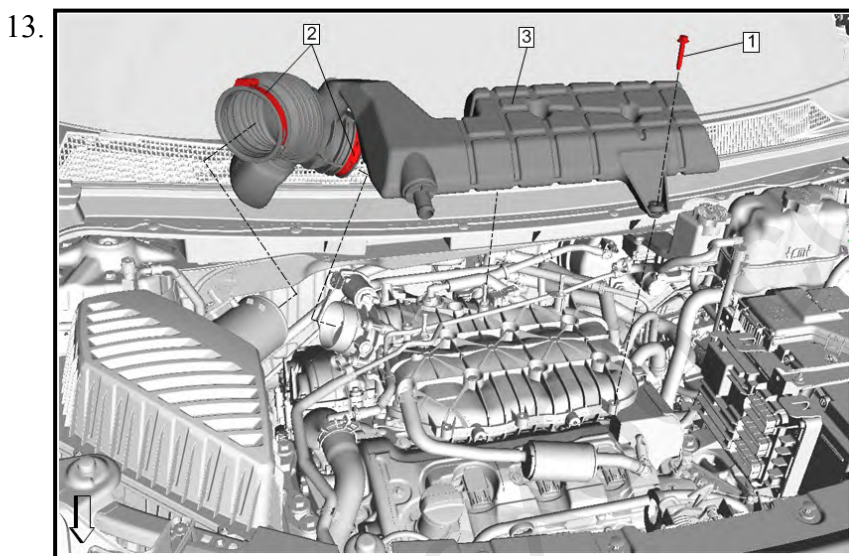
10. Engine Coolant Air Bleed Pipe - Install - [Engine Coolant Air Bleed Pipe Replacement \(LFY\)](#).

11.



Evaporative Emission Canister Purge Solenoid Valve (2) - Install - [Evaporative Emission Canister Purge Solenoid Valve Replacement](#)

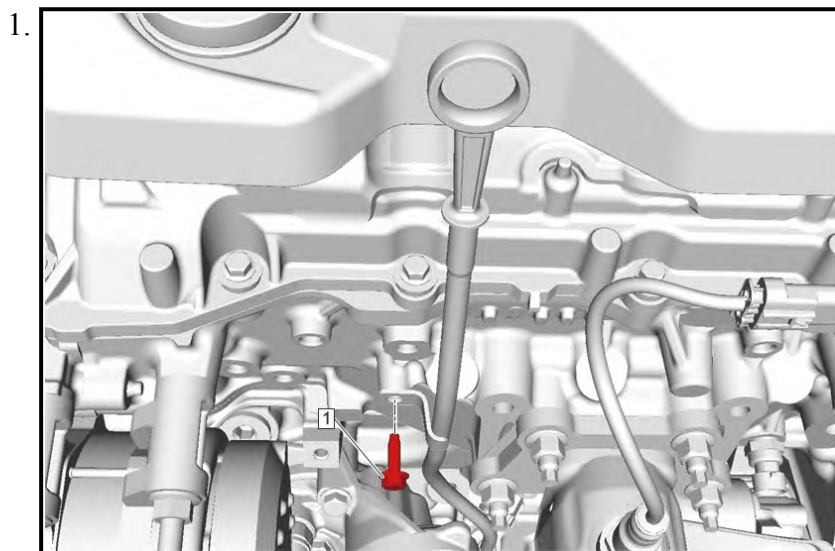
12. Throttle Body Assembly - Install - [Throttle Body Assembly Replacement](#)



Air Cleaner Outlet Duct (3) - Install - [Air Cleaner Outlet Duct Replacement](#)

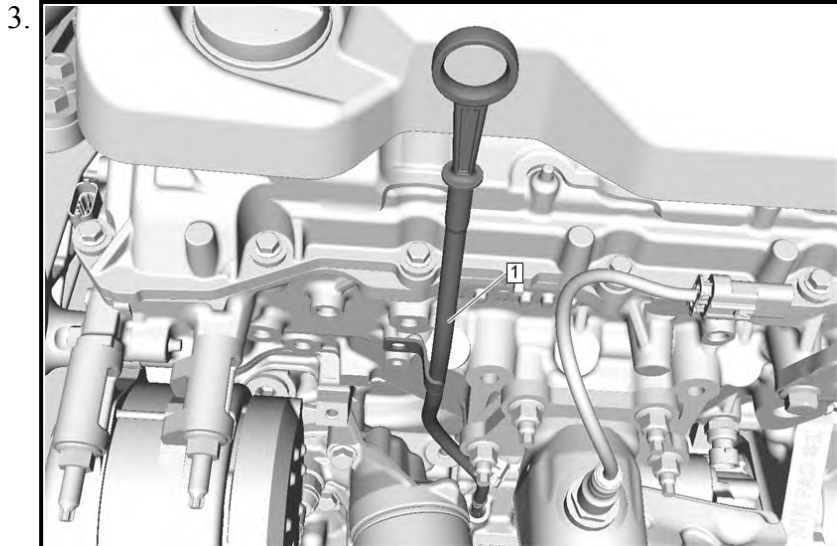
OIL LEVEL INDICATOR TUBE REPLACEMENT

Removal Procedure

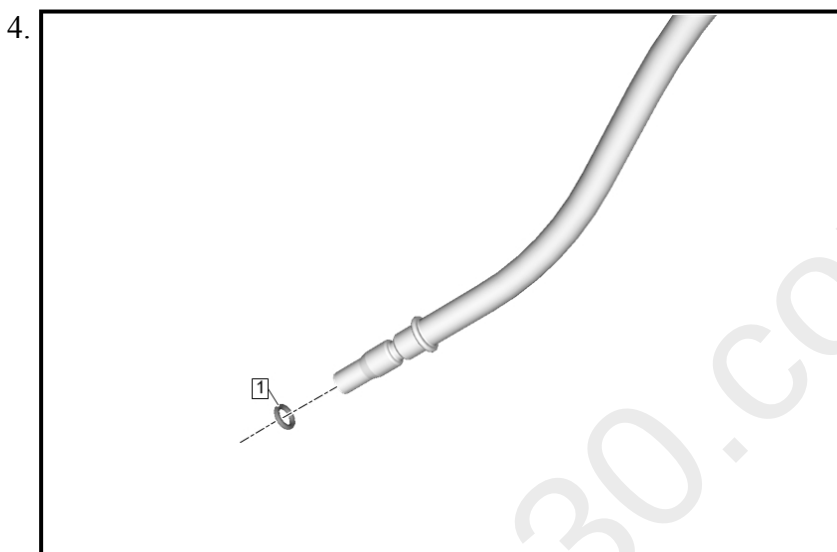


Oil Level Indicator Tube Bracket Bolt (1) - Remove

2. Detach wiring harness retainers as necessary.



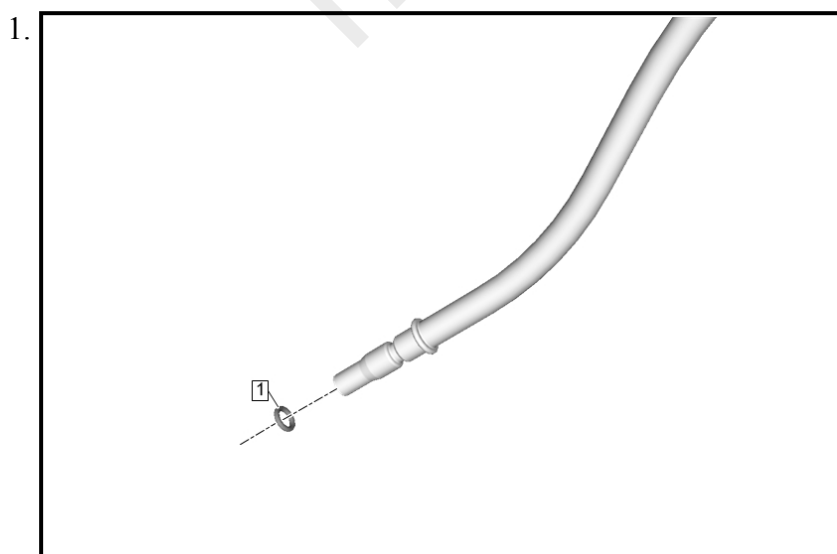
Oil Level Indicator Tube (1) - Remove



NOTE: The oil level indicator tube seal is a single use item.

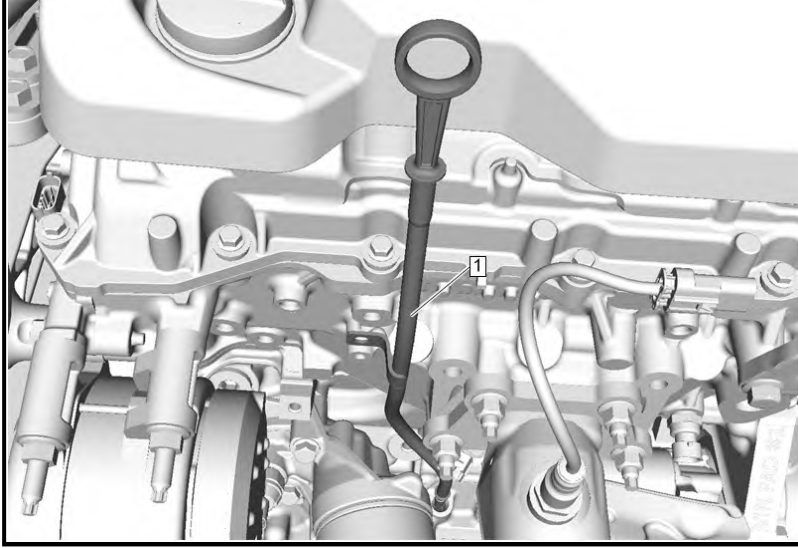
Remove the O-ring (1) from the oil level indicator tube and DISCARD.

Installation Procedure



Install the NEW O-ring (1) on the oil level indicator tube.

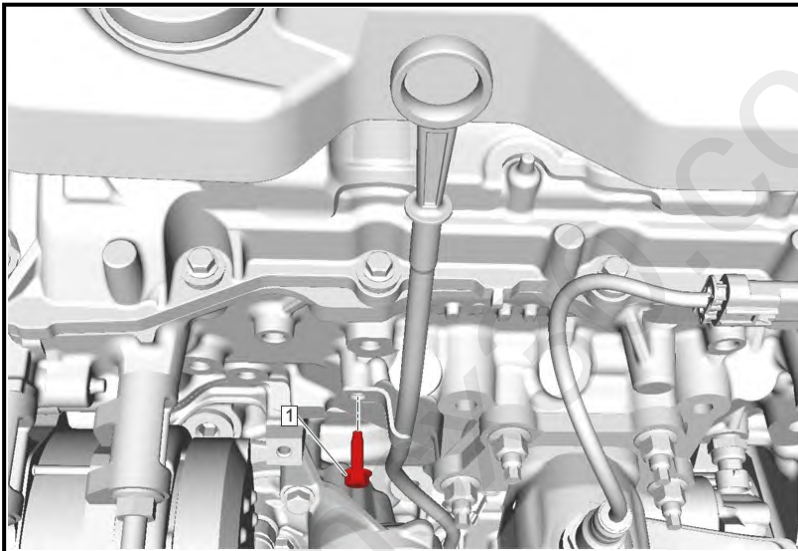




Position the oil level indicator tube (1) by sliding the tube down and in to the approximate location of the lower crankcase hole.

3. Guide the lower portion of the oil level indicator tube into the lower crankcase hole and seat the oil level indicator tube in place.
4. Attach wiring harness retainers as necessary.

5.



CAUTION: Refer to [Fastener Caution](#) .

Oil Level Indicator Tube Bracket Bolt (1) - Install and tighten 10 N.m (89 lb in)

OIL FILTER ADAPTER REPLACEMENT

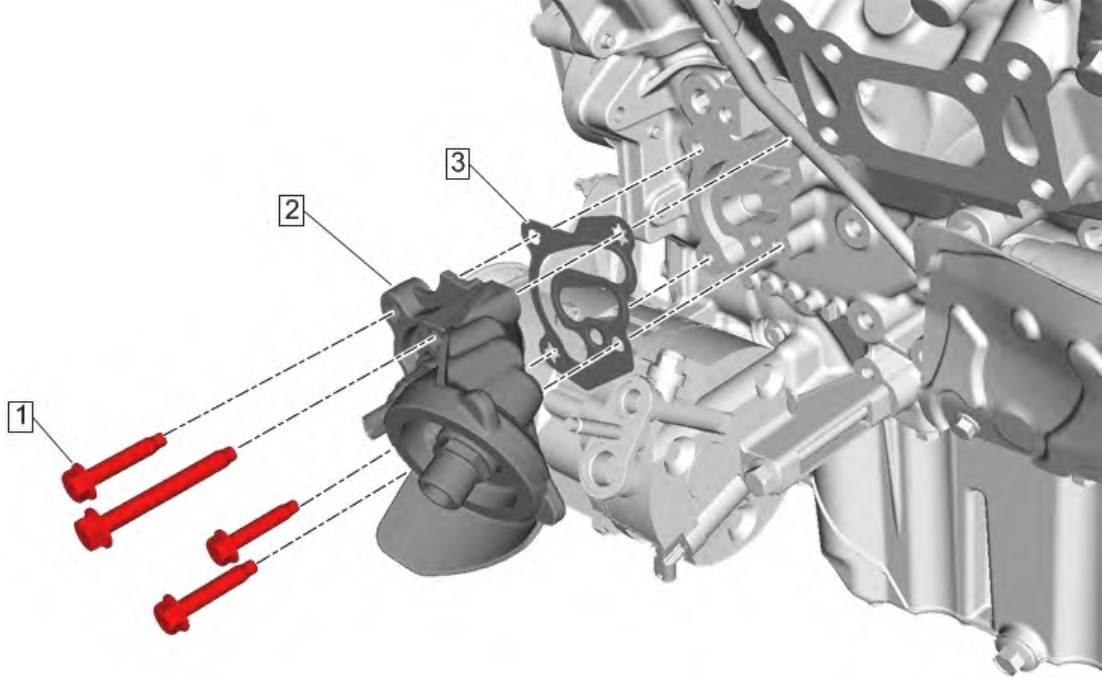


Fig. 5: Exploded View Of Oil Filter Adapter
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Generator Replacement (LFY) Engine Oil and Oil Filter Replacement	
1	Oil Filter Adapter Fastener (Qty: 4) CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
2	Oil Filter Adapter Procedure - Disconnect electrical connector. - Transfer components as necessary.
3	Oil Filter Adapter Gasket Procedure DISCARD and replace with NEW gasket.

CRANKSHAFT BALANCER REPLACEMENT

Special Tools

- EN-46106 Flywheel Holding Tool
- EN-38416-2 Crankshaft Button
- EN-41816 Crankshaft Balancer Remover
- EN-41998-B Crankshaft Balancer Installer

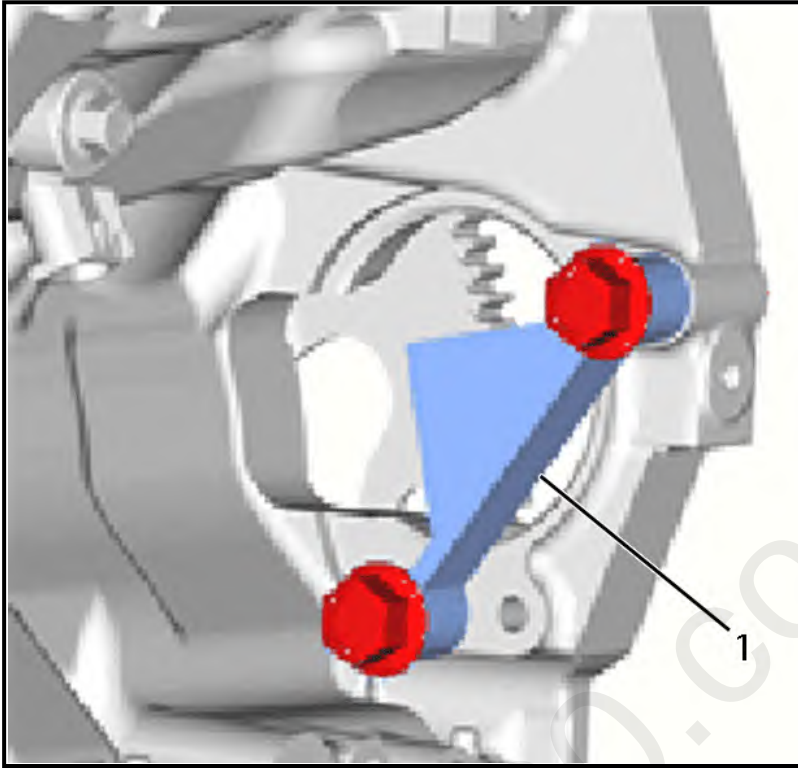
- EN-45059 Angle Meter

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

Removal Procedure

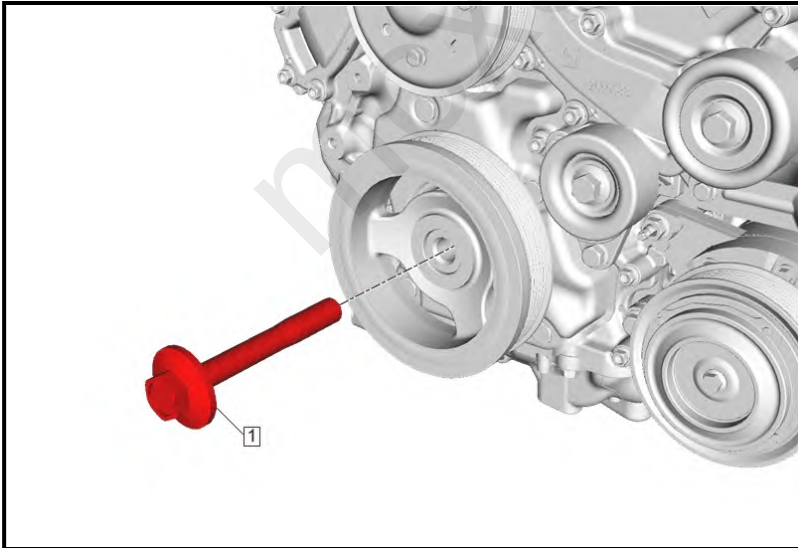
1. Remove the right front wheelhouse liner. [Front Wheelhouse Liner Replacement](#)
2. Remove the drive belt. [Drive Belt Replacement](#)
3. Remove the starter. [Starter Replacement \(LFY\)](#).

4.



Install the **EN-46106** tool (1) through the starter mounting hole.

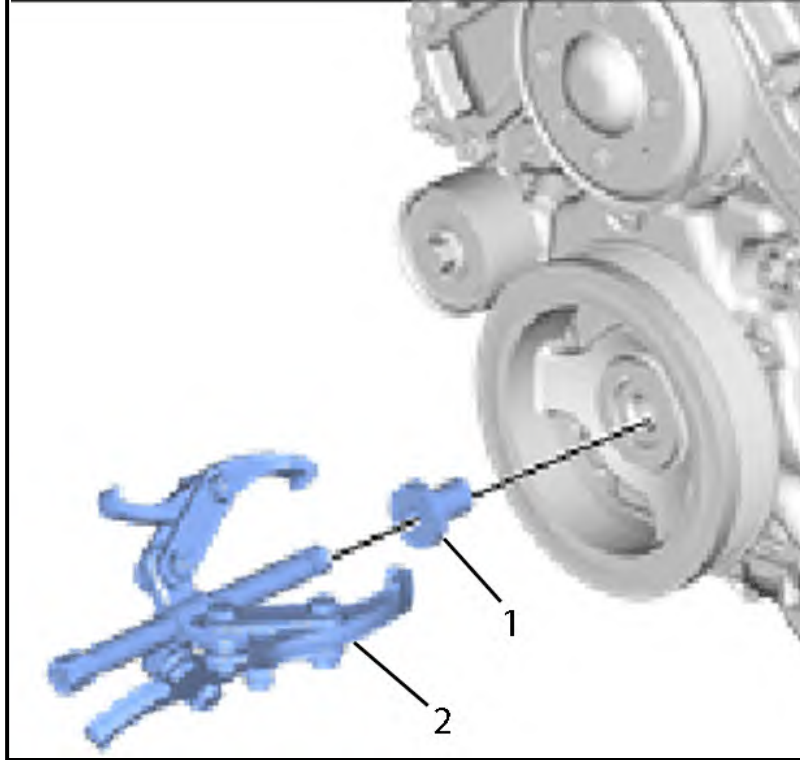
5.



Remove the crankshaft balancer bolt (1). DISCARD the bolt.

6.



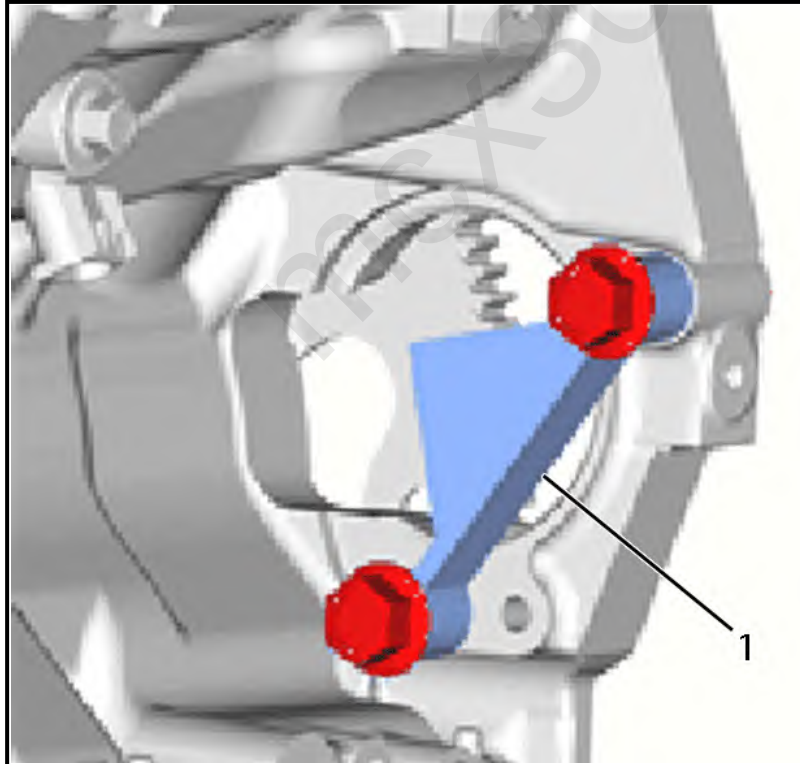


Install the **J-38416-2** button (1) in the nose of the crankshaft.

7. Install the **J-41816** remover (2) to the crankshaft balancer.
8. Tighten the center bolt of the **J-41816** remover to pull the crankshaft balancer off of the crankshaft.
9. Remove the **J-41816** remover from the crankshaft balancer.

Installation Procedure

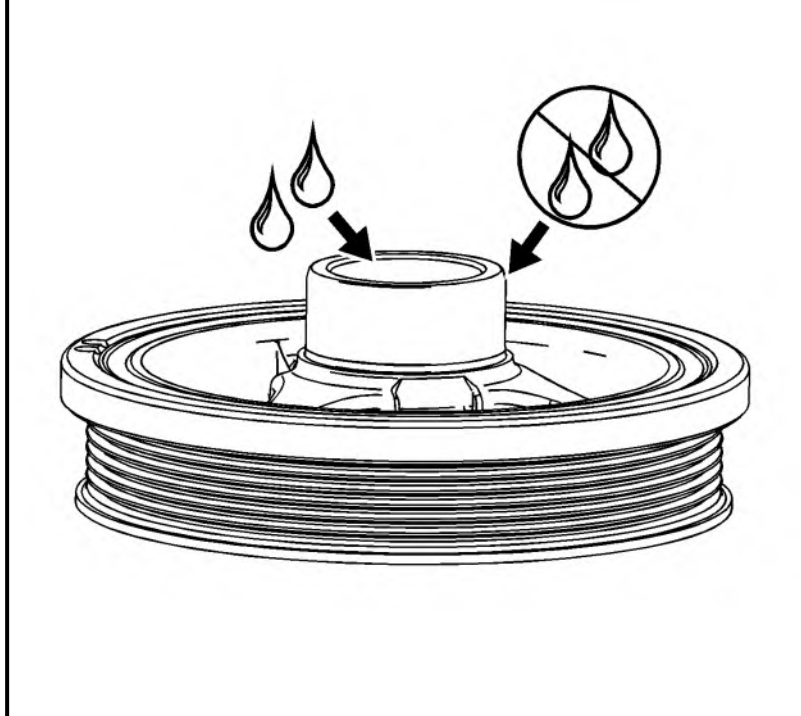
1.



The **EN-46106** tool (1) must be installed onto the flywheel.

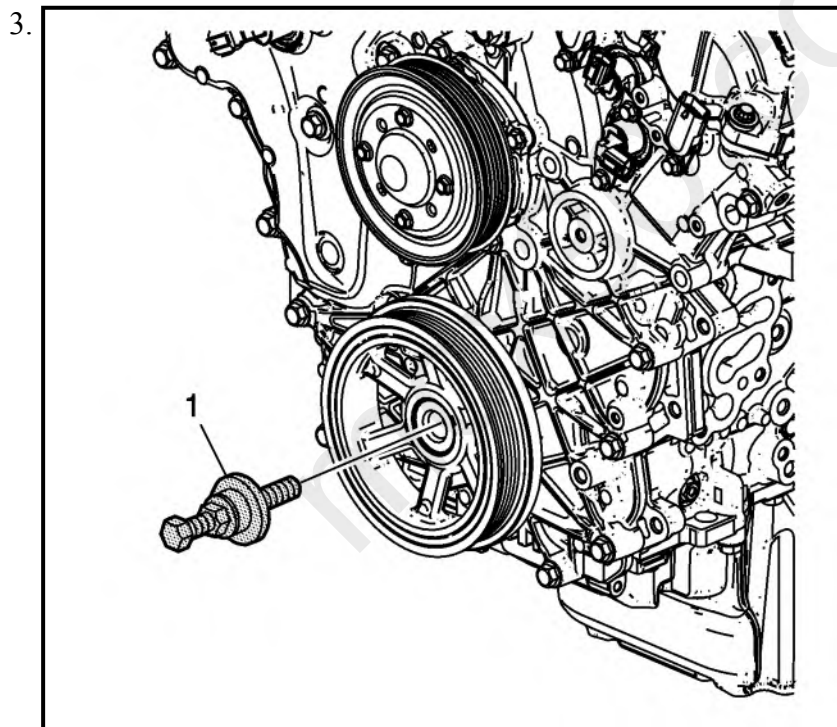
2.





NOTE: Do not lubricate the crankshaft front oil seal or crankshaft balancer sealing surfaces. The crankshaft balancer is installed into a dry seal.

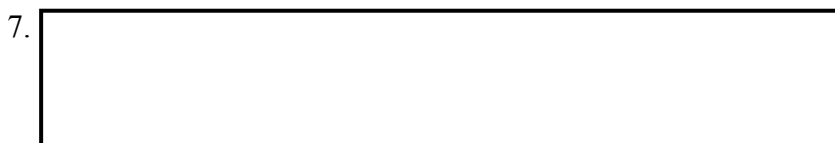
Apply lubricant to the inside of the crankshaft balancer hub bore.

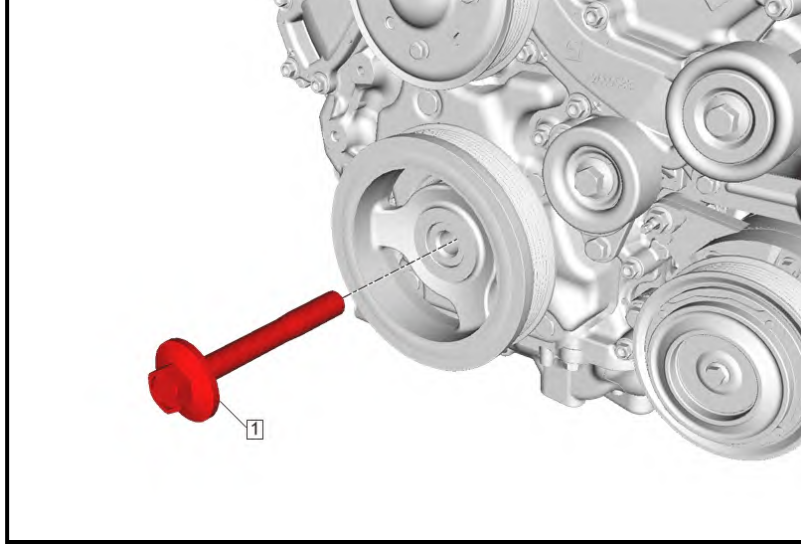


Place the crankshaft balancer in position on the crankshaft.

NOTE: Use the J-41998-B installer, nut, bearing and washer to install the crankshaft balancer.

4. Thread the **J-41998-B** installer (1) into the crankshaft. Ensure you engage at least 10 threads of the **J-41998-B** installer before pressing the crankshaft balancer in place.
5. Push the crankshaft balancer into position by tightening the nut on the **J-41998-B** installer until the large washer bottoms out on the crankshaft end.
6. Remove the **J-41998-B** installer.





NOTE: Always install a **NEW** crankshaft balancer retaining bolt and washer.

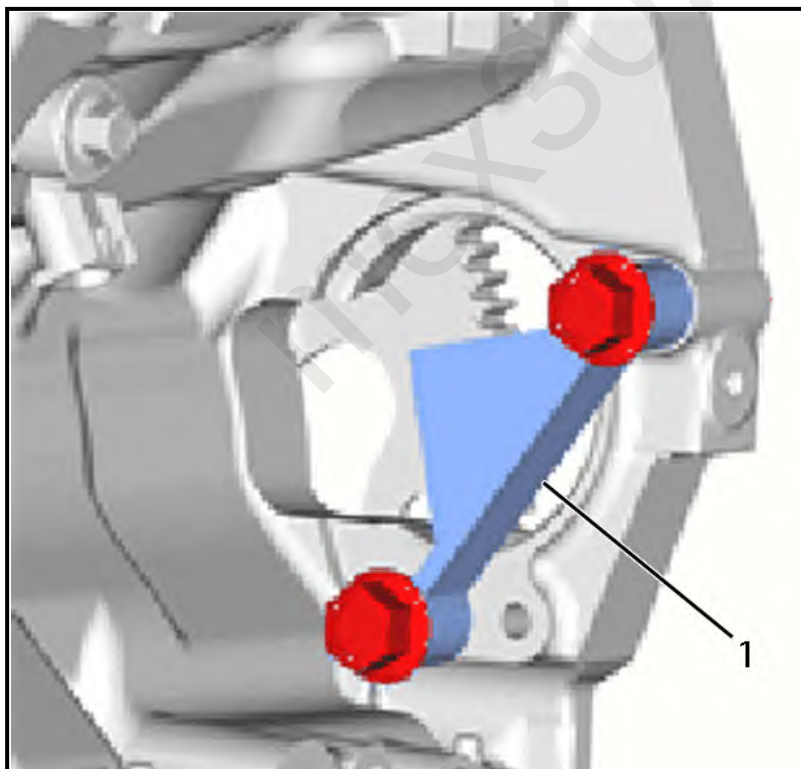
Install the **NEW** crankshaft balancer bolt (1).

CAUTION: Refer to [Fastener Caution](#) .

CAUTION: This vehicle is equipped with torque-to-yield or single use fasteners. Install a **NEW** torque-to-yield or single use fastener when installing this component. Failure to replace the torque-to-yield or single use fastener could cause damage to the vehicle or component.

8. Tighten the crankshaft balancer bolt using the **J-45059** meter to 100 N.m (74 lb ft) plus an additional 150 degrees.

9.



Remove the **EN-46106** tool (1).

10. Install the starter. [Starter Replacement \(LFY\)](#)
11. Install the drive belt. [Drive Belt Replacement](#)
12. Install the right front wheelhouse liner. [Front Wheelhouse Liner Replacement](#)
13. If replacing, perform the Crankshaft Position Variation Learn. [Crankshaft Position Variation Learn](#)

Special Tools

EN-29184 Oil Seal Installer

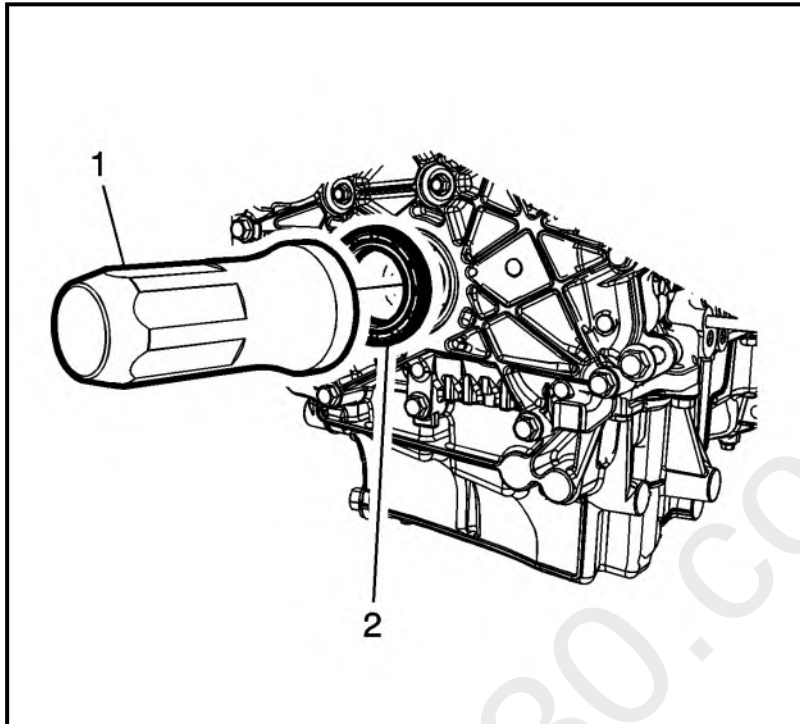
For equivalent regional tools, refer to [Special Tools](#) .

Removal Procedure

1. Crankshaft Balancer - Remove - [Crankshaft Balancer Replacement](#)
2. Remove the crankshaft front cover oil seal with a suitable tool.

Installation Procedure

1.



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

Use the **EN-29184** installer (1) or equivalent to install the crankshaft front oil seal (2).

2. Crankshaft Balancer - Install - [Crankshaft Balancer Replacement](#)

CAMSHAFT COVER REPLACEMENT - LEFT SIDE

Special Tools

EN-46101 Spark Plug Tube Seal Guide

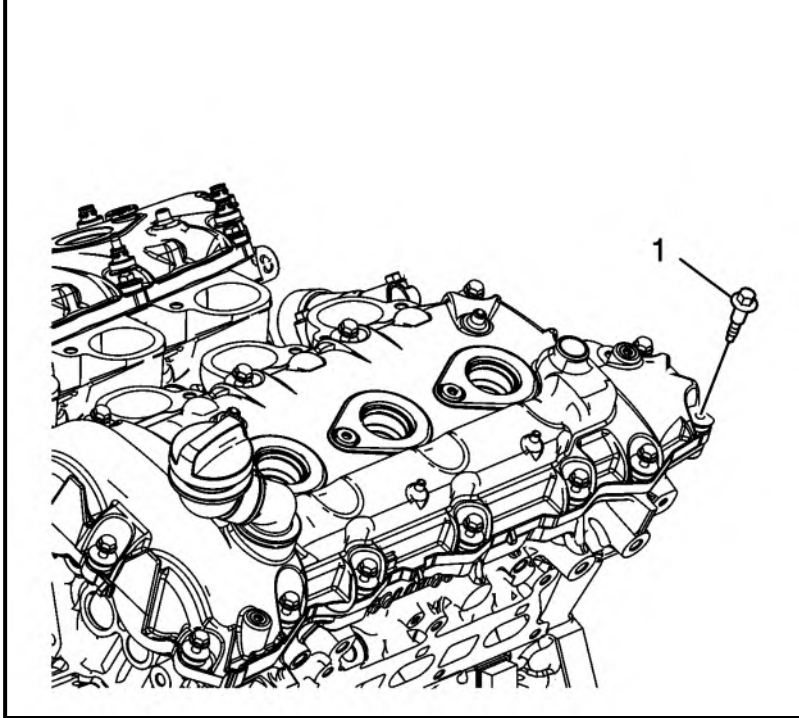
For equivalent regional tools, refer to [Special Tools](#) .

Removal Procedure

1. Remove the ignition coils. [Ignition Coil Replacement - Bank 2](#)
2. Disconnect and remove the engine harness from the camshaft cover.
3. Remove the upper intake manifold. [Upper Intake Manifold Replacement](#)

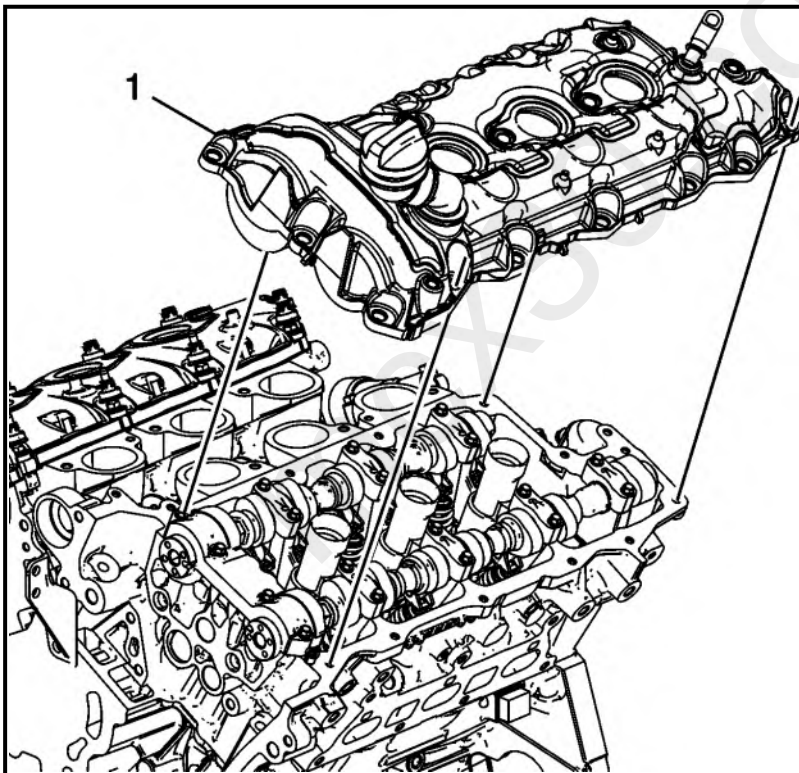
4.





Remove the left camshaft cover bolts (1).

5. Remove and discard the camshaft cover grommets and camshaft cover bolts if they are serviced with the grommet.
- 6.



Remove the left camshaft cover (1) from the left cylinder head.

7. Disassemble the camshaft cover as needed. [Camshaft Cover Disassemble](#)
8. Clean the mating surfaces of the cylinder head and the camshaft cover. [Camshaft Cover Cleaning and Inspection](#)

Installation Procedure

1. Assemble the camshaft cover as needed. [Camshaft Cover Assemble](#)
2. Install the camshaft cover. [Camshaft Cover Installation - Left Side](#)
3. Connect and install the engine harness to the camshaft cover.
4. Install the upper intake manifold. [Upper Intake Manifold Replacement](#)
5. Install the ignition coils. [Ignition Coil Replacement - Bank 2](#)

Special Tools

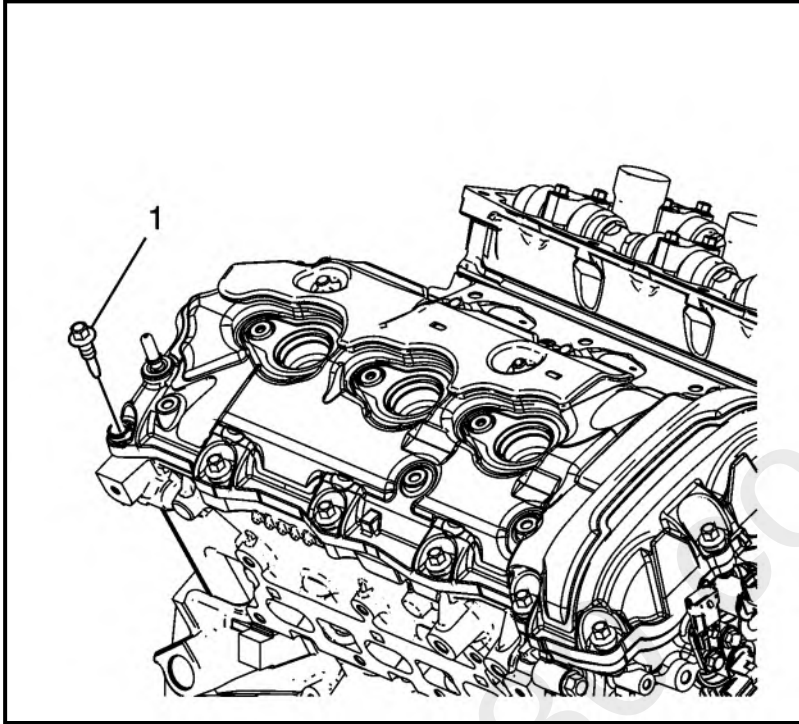
EN-46101 Spark Plug Tube Seal Guide

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

Removal Procedure

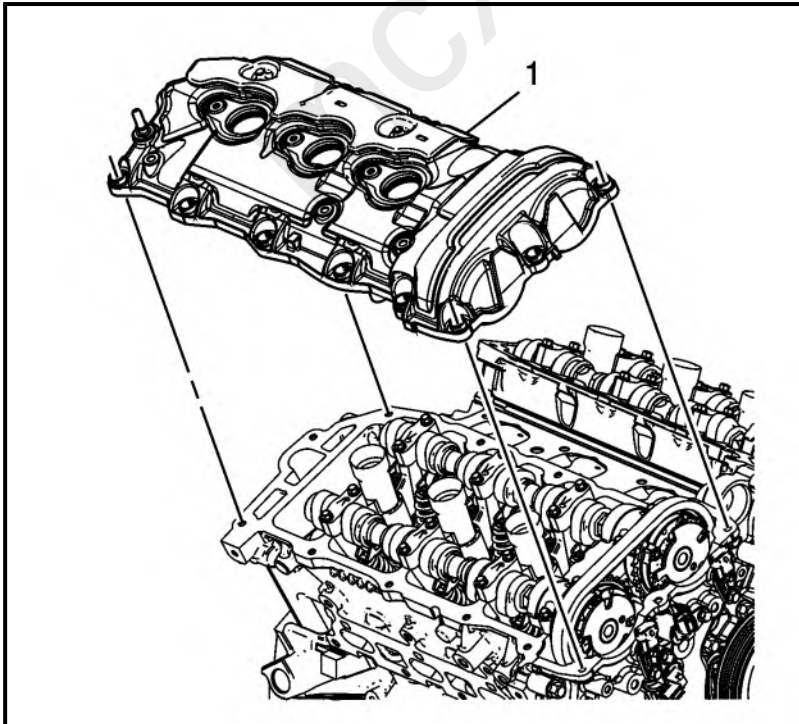
1. Remove the ignition coils. [Ignition Coil Replacement - Bank 1](#)
2. Disconnect and remove the engine harness from the camshaft cover.

3.



Remove the right camshaft cover bolts (1).

4.



Remove the right camshaft cover (1) from the right cylinder head.

5. Remove and discard the camshaft cover grommets and camshaft cover bolts if they are serviced with the grommet.
6. Disassemble the camshaft cover as needed. [Camshaft Cover Disassemble](#)

7. Clean the mating surfaces of the cylinder head and the camshaft cover. [Camshaft Cover Cleaning and Inspection](#)

Installation Procedure

1. Assemble the camshaft cover as needed. [Camshaft Cover Assemble](#)
2. Install the camshaft cover. [Camshaft Cover Installation - Right Side](#)
3. Connect and install the engine harness to the camshaft cover.
4. Install the ignition coils. [Ignition Coil Replacement - Bank 1](#)

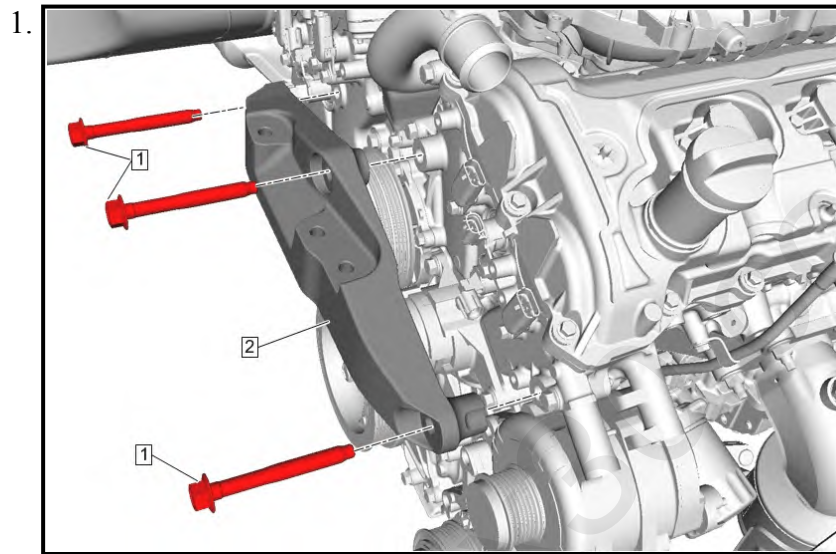
ENGINE FRONT COVER REPLACEMENT

Special Tools

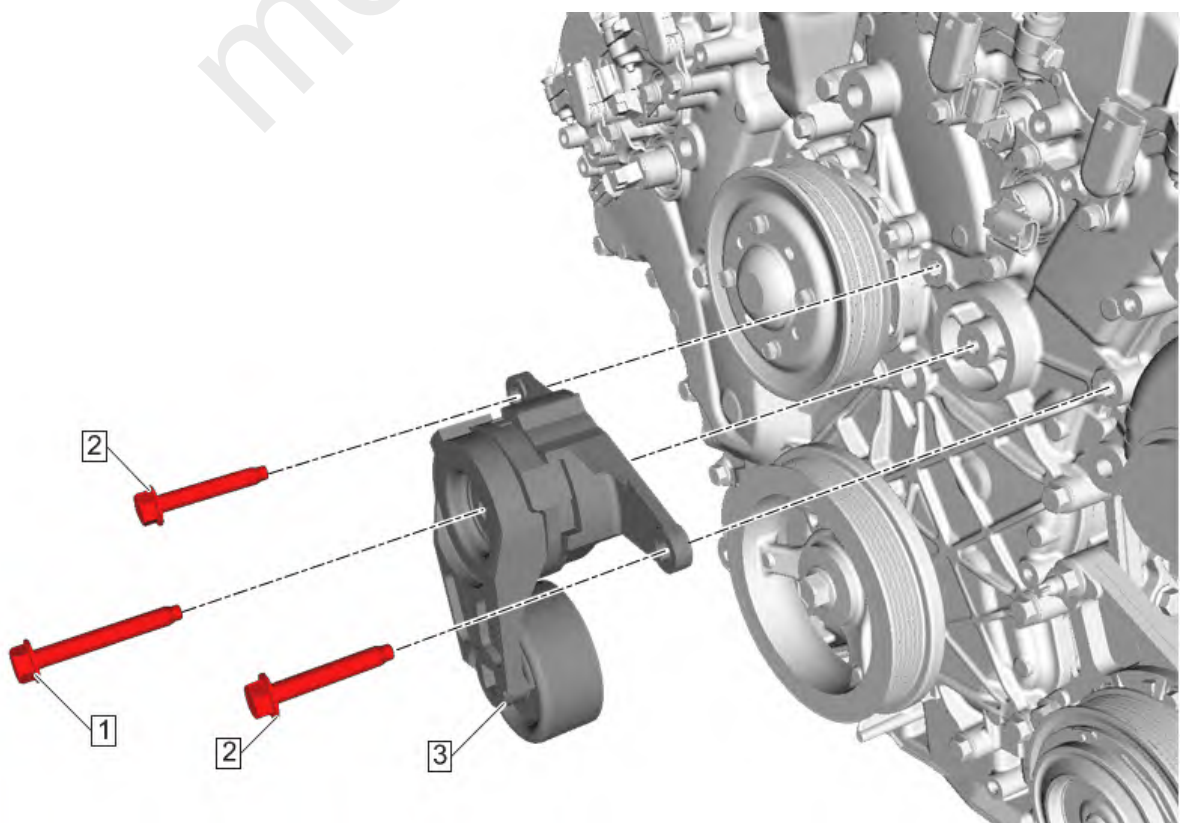
EN-46109 Engine Front Cover Installation Guide Pins

Equivalent regional tools: [Special Tools](#)

Removal Procedure

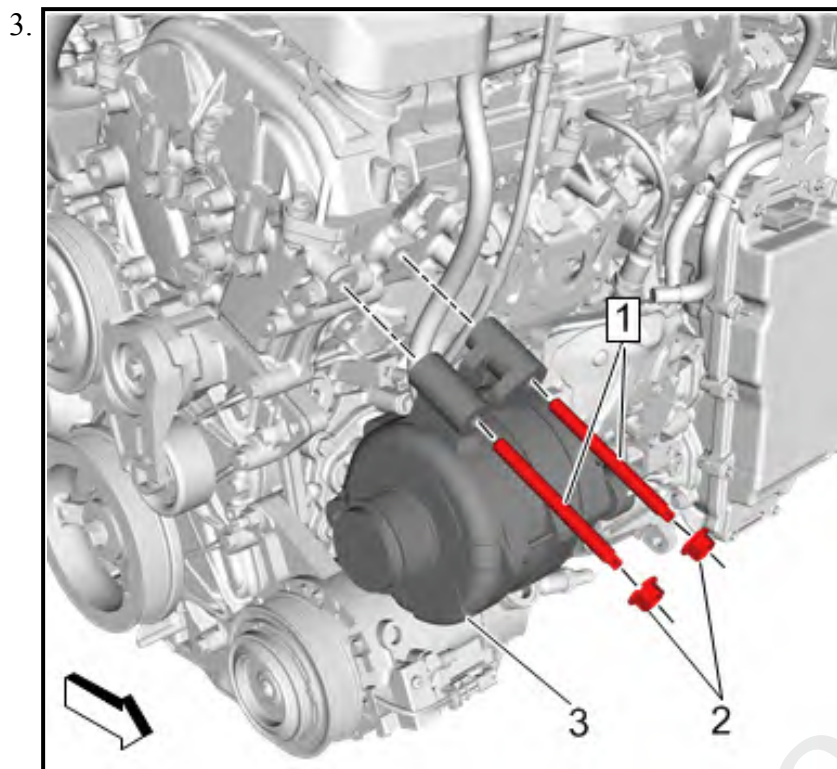


Engine Mount Bracket (3) - Remove - [Engine Mount Bracket Replacement - Right Side](#)

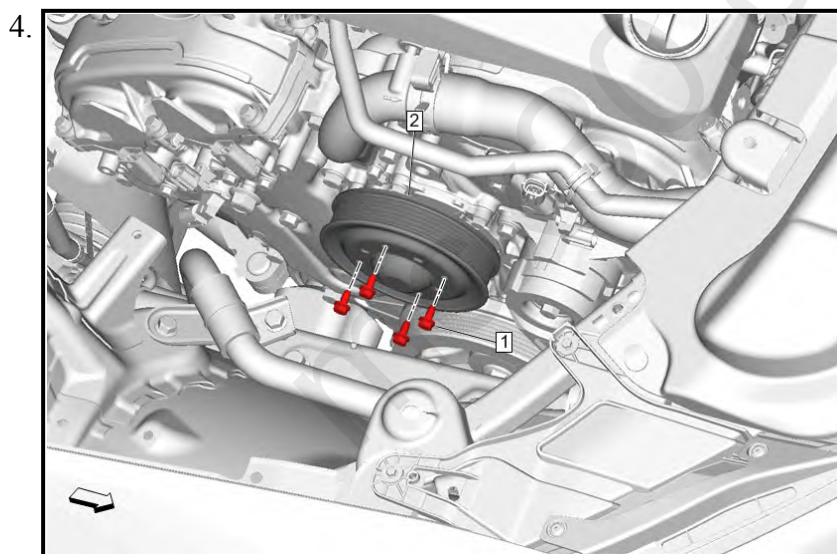


2.

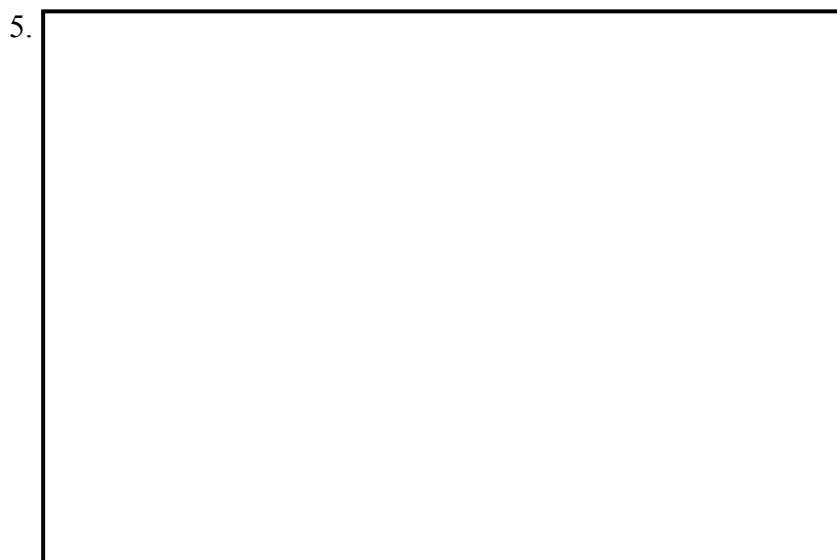
Drive Belt Tensioner (3) - Remove - [**Drive Belt Tensioner Replacement**](#)

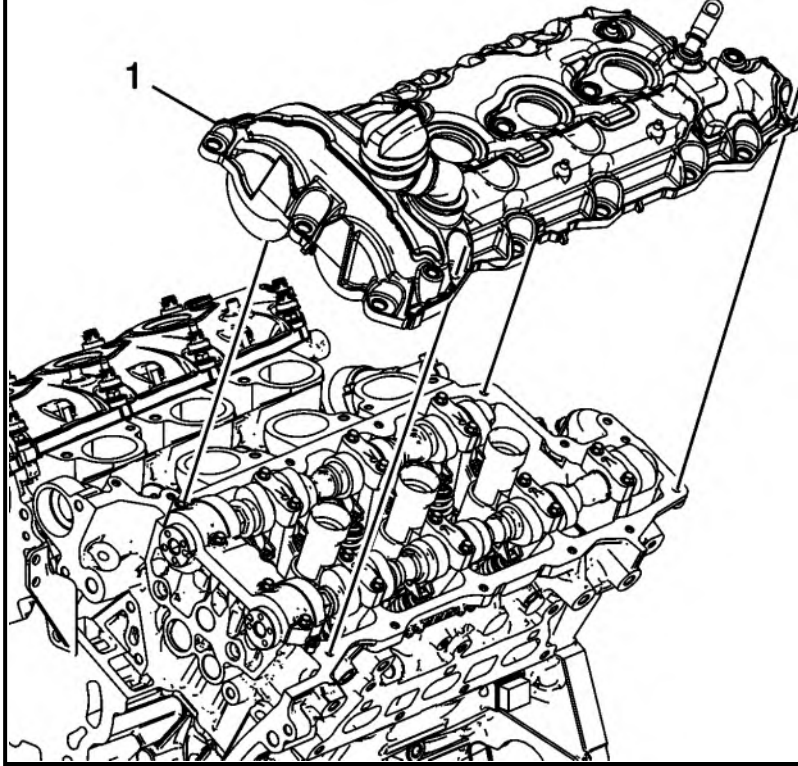


Generator (3) - Remove - [**Generator Replacement \(LFY\)**](#)

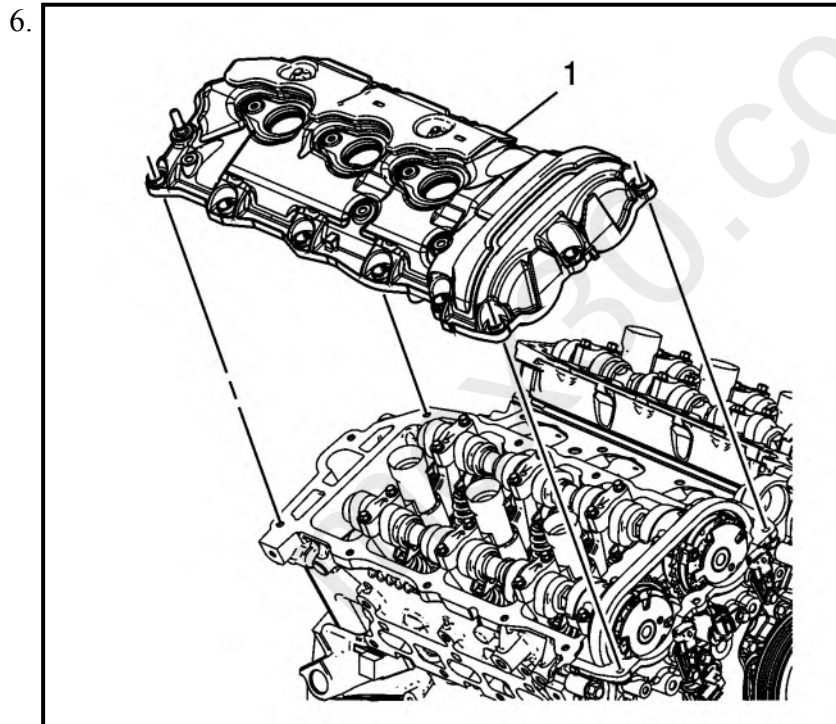


Water Pump Pulley (2) - Remove - [**Water Pump Pulley Replacement \(LFY\)**](#)





Camshaft Cover - Left Side (1) - Remove - [Camshaft Cover Replacement - Left Side](#)

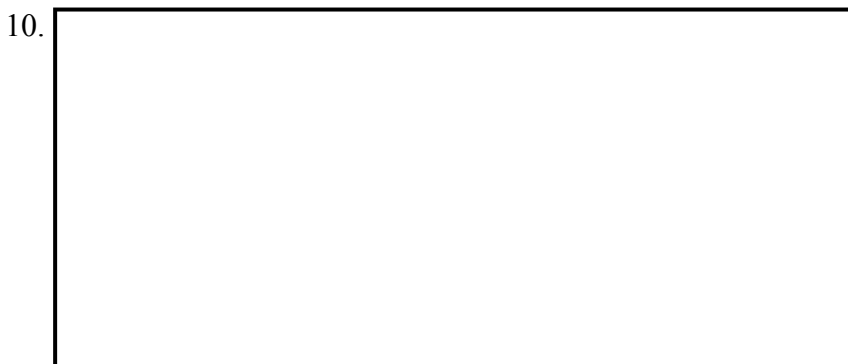


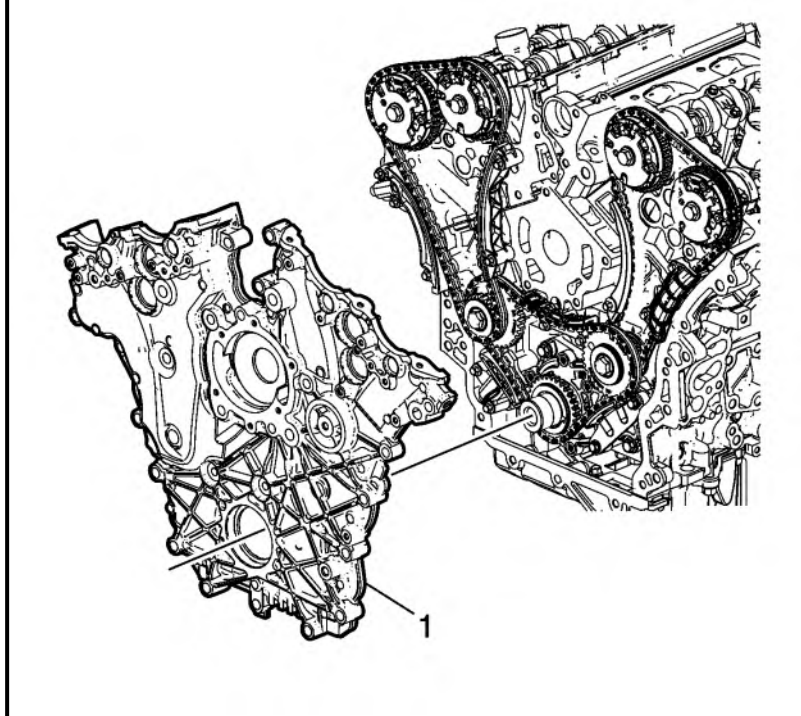
Camshaft Cover - Right Side (1) - Remove - [Camshaft Cover Replacement - Right Side](#)

7. Drain the cooling system. [Cooling System Draining and Filling \(GE 47716\)](#), [Cooling System Draining and Filling \(Static Fill\)](#)

8. Crankshaft Balancer - Remove - [Crankshaft Balancer Replacement](#)

9. Water Outlet - Remove - [Water Outlet Replacement \(LFY\)](#)





Remove the engine front cover. [Engine Front Cover Removal](#)

11. Disassemble the engine front cover. [Engine Front Cover Disassemble](#)

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

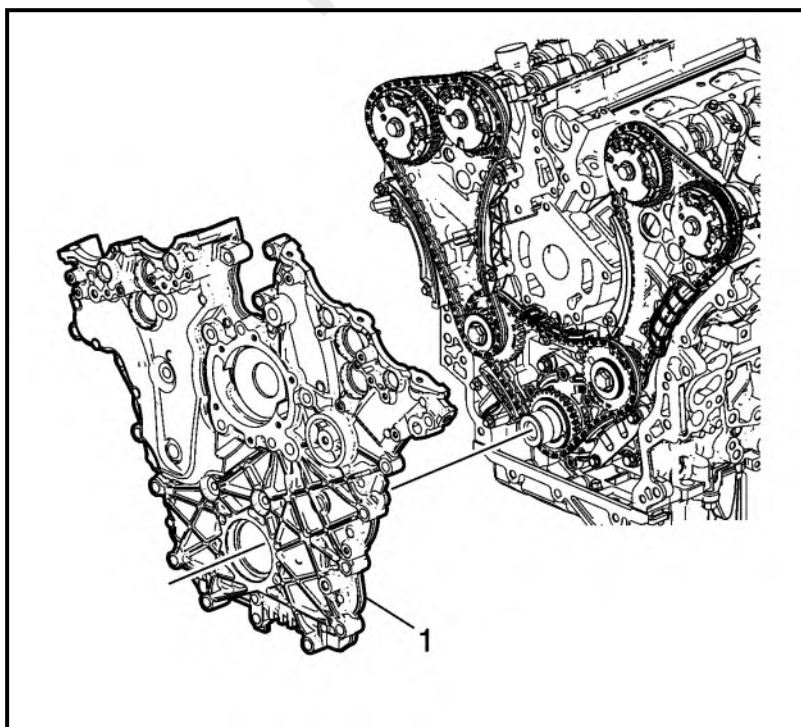
NOTE: Insert a piece of cardboard between the oil pan front and the oil pump in order to prevent any contaminants from falling into the oil pan.

12. Carefully clean the engine front cover sealing surfaces. [Engine Front Cover Cleaning and Inspection](#)
13. 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. [Engine Front Cover Assemble](#)

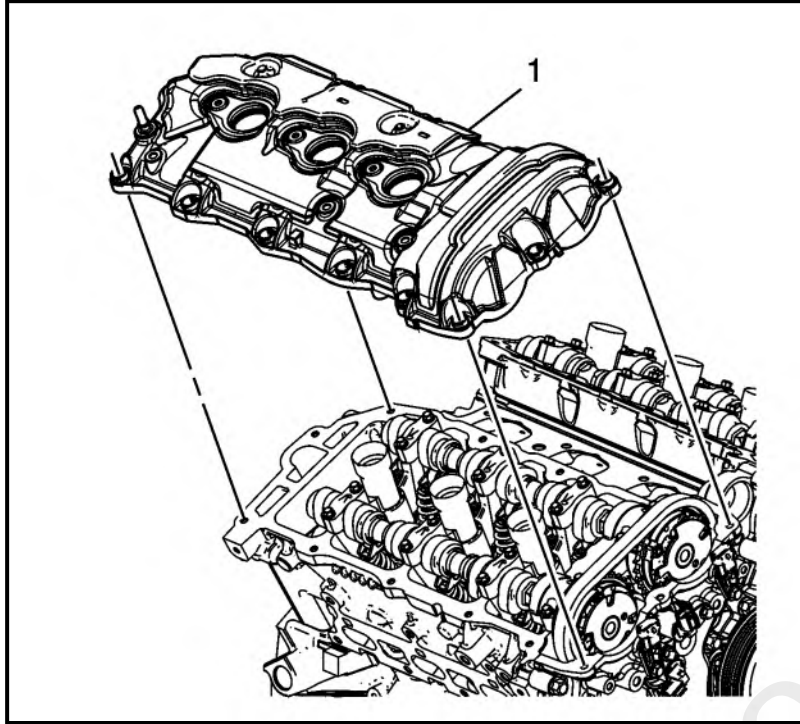
2.



Use the **EN-46109** pins in order to install the engine front cover. [Engine Front Cover Installation](#)

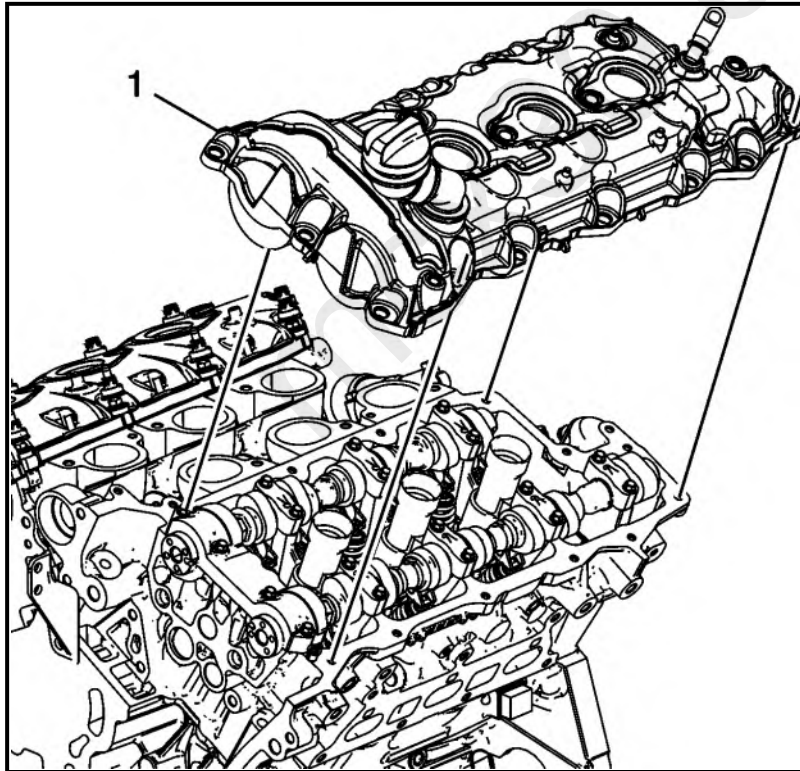
3. Water Outlet - Install - [Water Outlet Replacement \(LFY\)](#)
4. Crankshaft Balancer - Install - [Crankshaft Balancer Replacement](#)

5.



Camshaft Cover - Right Side (1) - Install - [Camshaft Cover Replacement - Right Side](#)

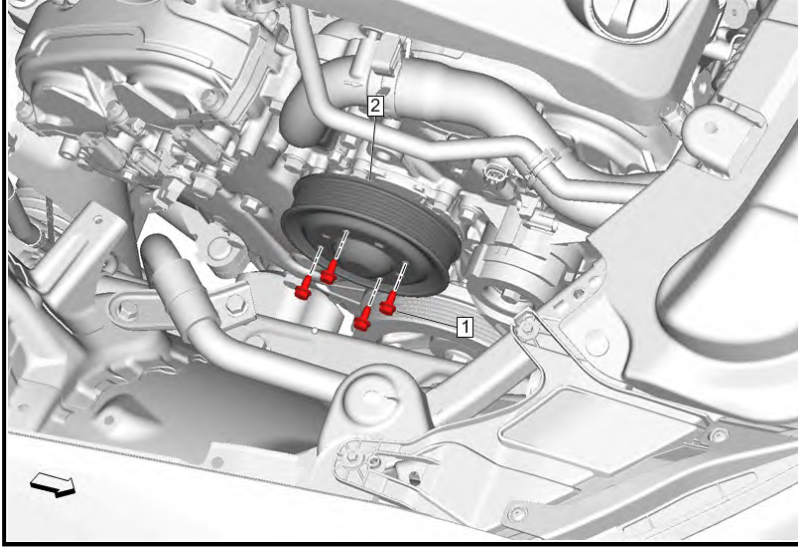
6.



Camshaft Cover - Left Side (1) - Install - [Camshaft Cover Replacement - Left Side](#)

7.

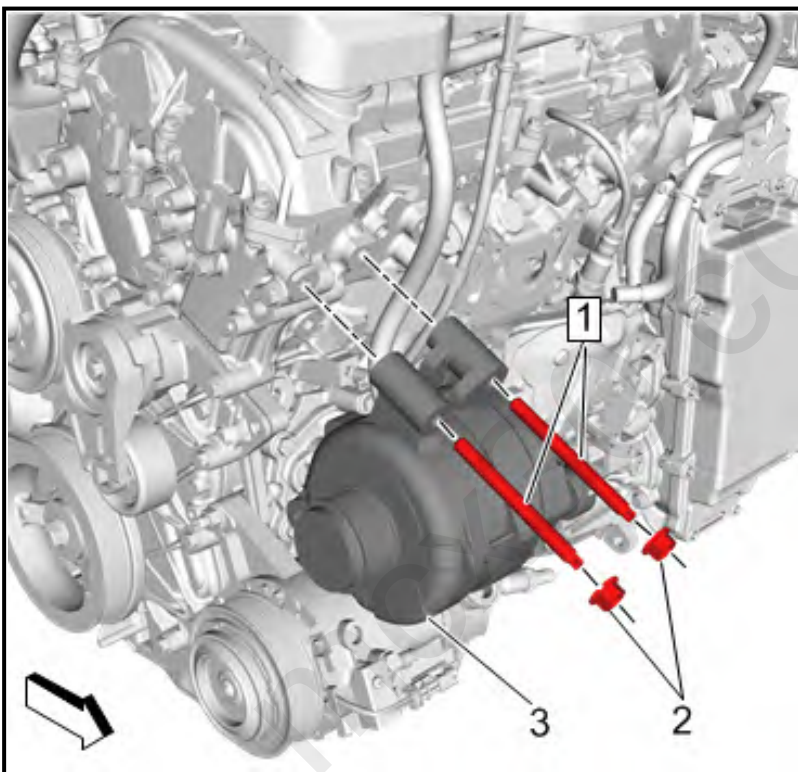




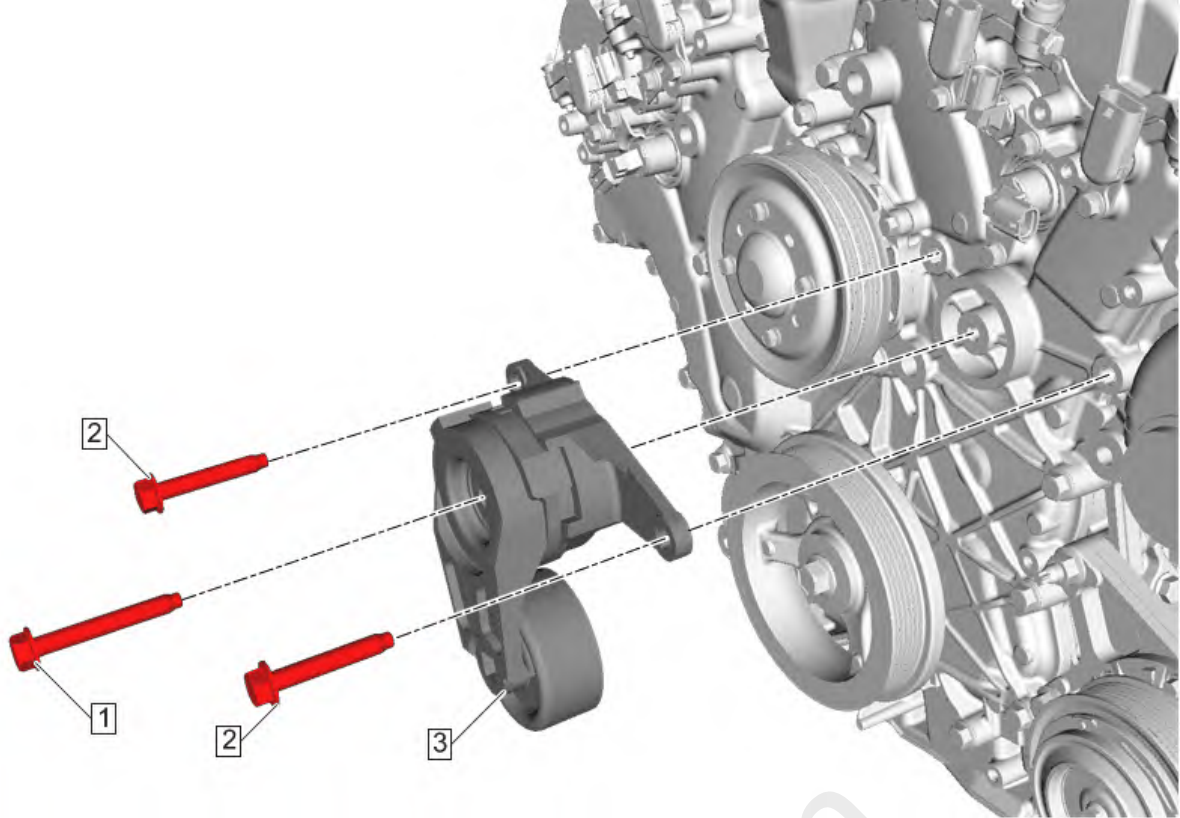
Water Pump Pulley (2) - Install - [Water Pump Pulley Replacement \(LFY\)](#)

8. Air Cleaner Assembly - Install - [Air Cleaner Assembly Replacement](#)

9.



Generator (3) - Install - [Generator Replacement \(LFY\)](#)

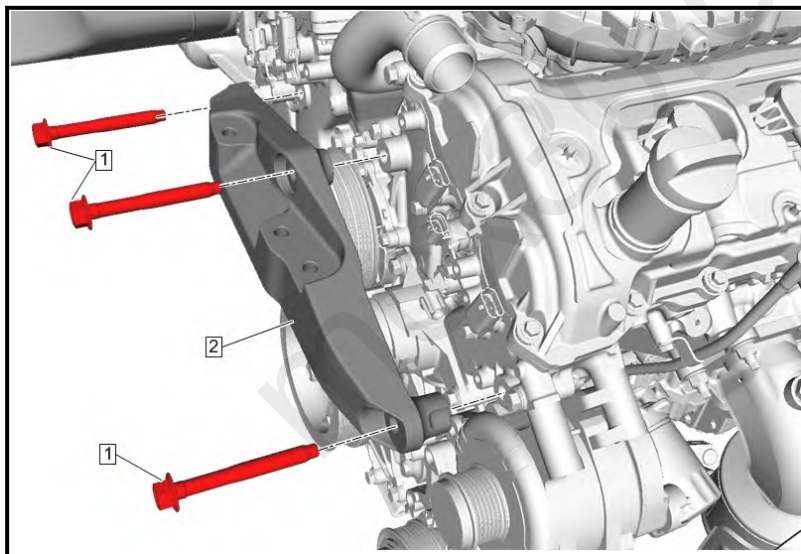


10.

Fig. 7: Exploded View Of Drive Belt Tensioner
Courtesy of GENERAL MOTORS COMPANY

Drive Belt Tensioner (3) - Install - [Drive Belt Tensioner Replacement](#)

11.



Engine Mount Bracket (3) - Install - [Engine Mount Bracket Replacement - Right Side](#)

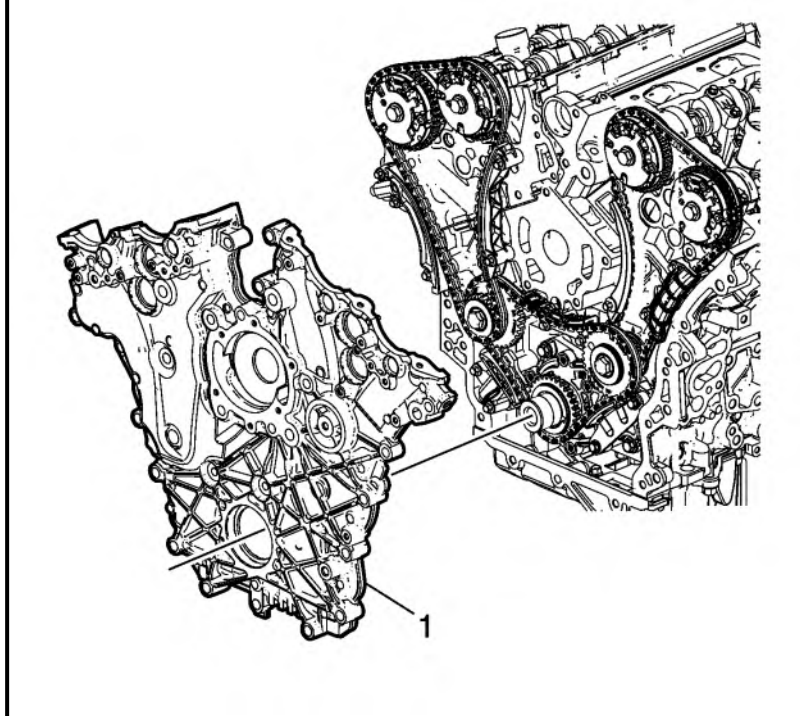
12. Fill the cooling system. [Cooling System Draining and Filling.\(GE 47716\)](#) [Cooling System Draining and Filling.\(Static Fill\)](#).

SECONDARY CAMSHAFT INTERMEDIATE DRIVE CHAIN REPLACEMENT - LEFT SIDE

Removal Procedure

1.



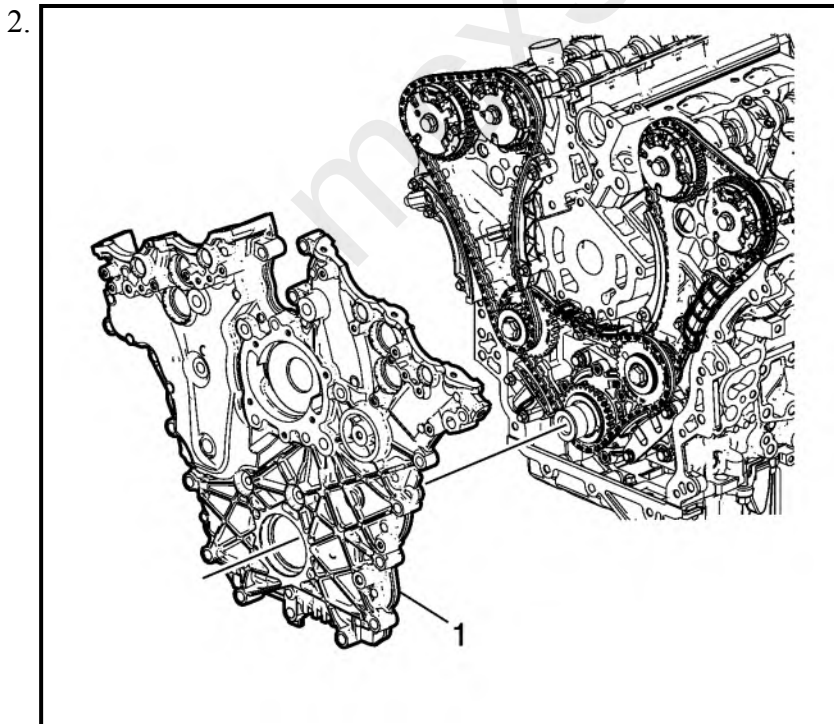


Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the left side secondary camshaft intermediate drive chain. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. Refer to [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the left side secondary camshaft intermediate drive chain. [Camshaft Timing Chain Components Installation](#)

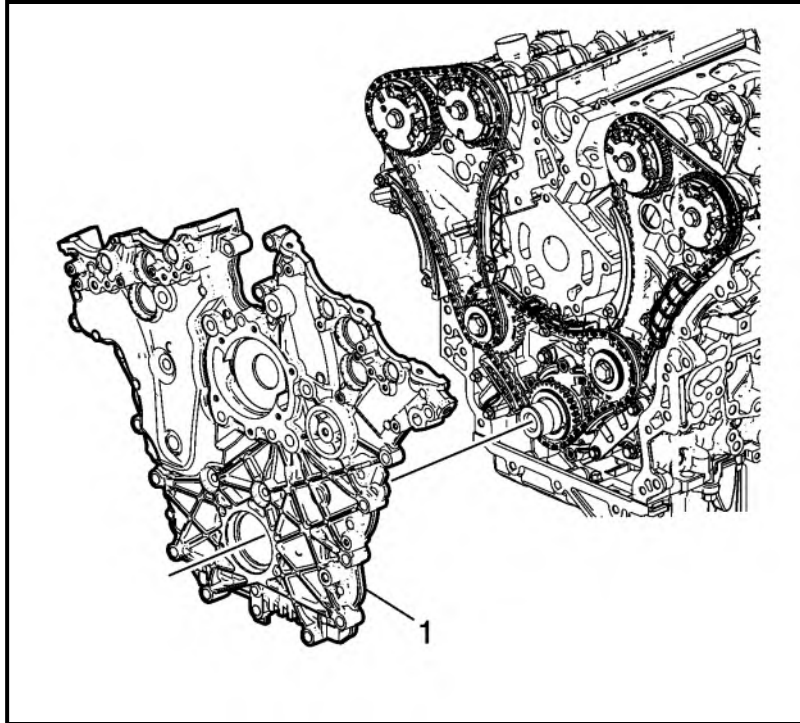


Install the engine front cover (1). [Engine Front Cover Replacement](#)

SECONDARY CAMSHAFT INTERMEDIATE DRIVE CHAIN REPLACEMENT - RIGHT SIDE

Removal Procedure

1.



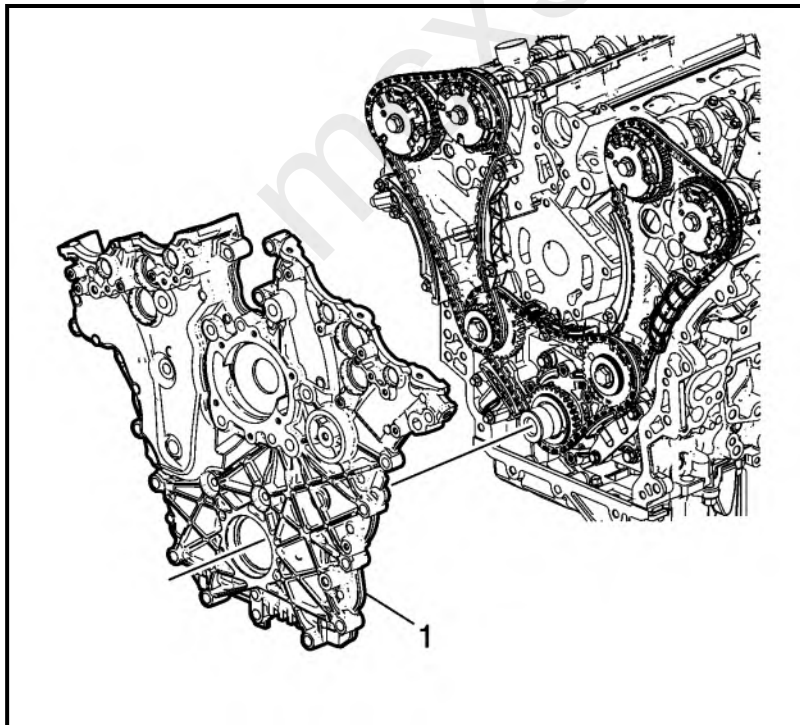
Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the right side secondary camshaft intermediate drive chain. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. Refer to [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the right side secondary camshaft intermediate drive chain. [Camshaft Timing Chain Components Installation](#)

2.

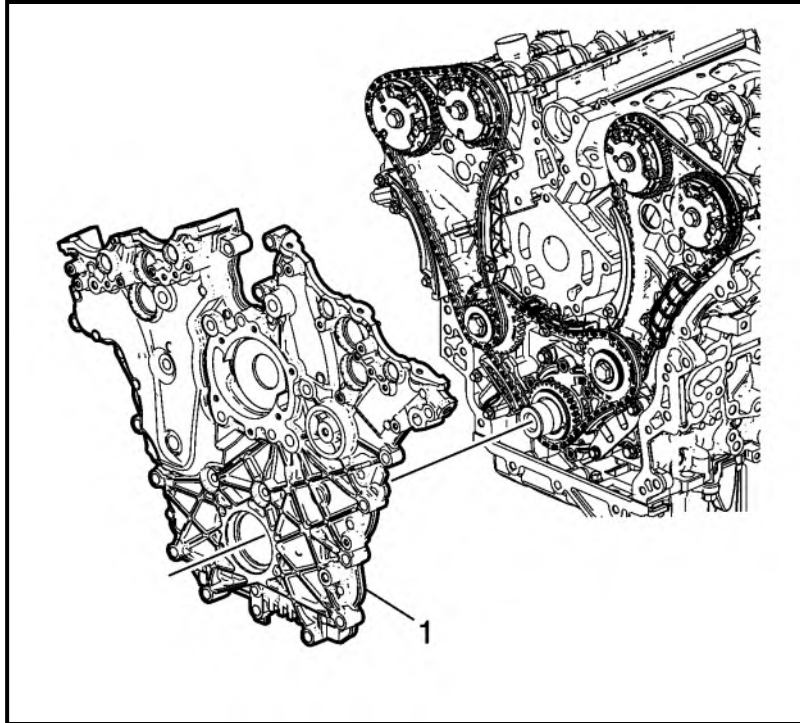


Install the engine front cover (1). [Engine Front Cover Replacement](#)

SECONDARY CAMSHAFT INTERMEDIATE DRIVE CHAIN TENSIONER REPLACEMENT - LEFT SIDE

Removal Procedure

1.



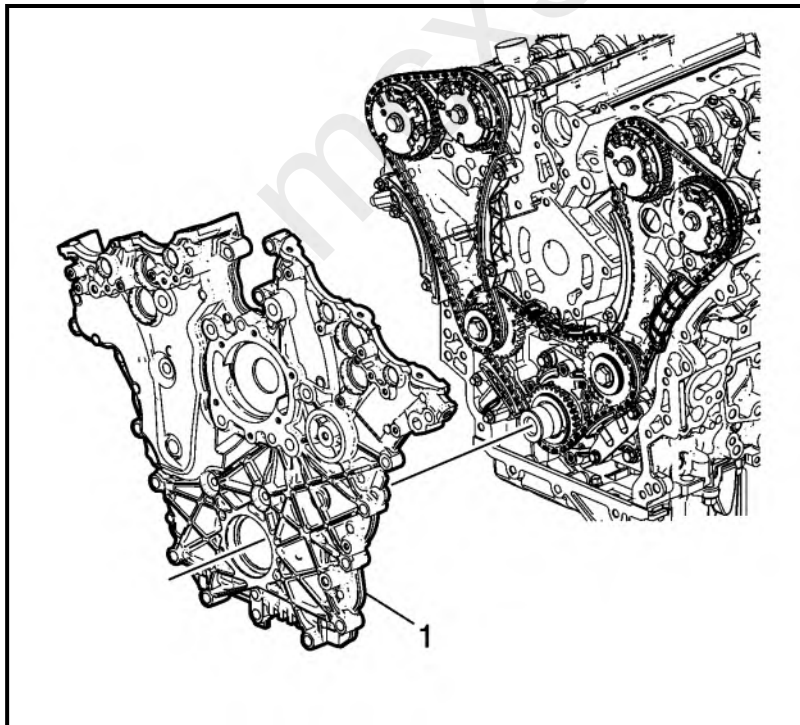
Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the left bank secondary camshaft drive chain tensioner. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. Refer to [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the left bank secondary camshaft drive chain tensioner. [Camshaft Timing Chain Components Installation](#)

2.

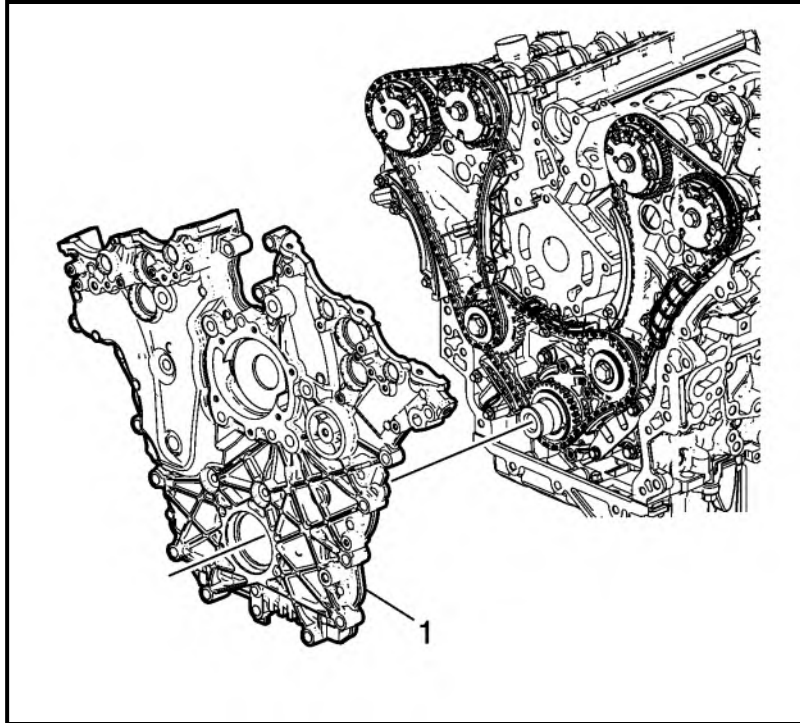


Install the engine front cover (1). [Engine Front Cover Replacement](#)

SECONDARY CAMSHAFT INTERMEDIATE DRIVE CHAIN TENSIONER REPLACEMENT - RIGHT SIDE

Removal Procedure

1.



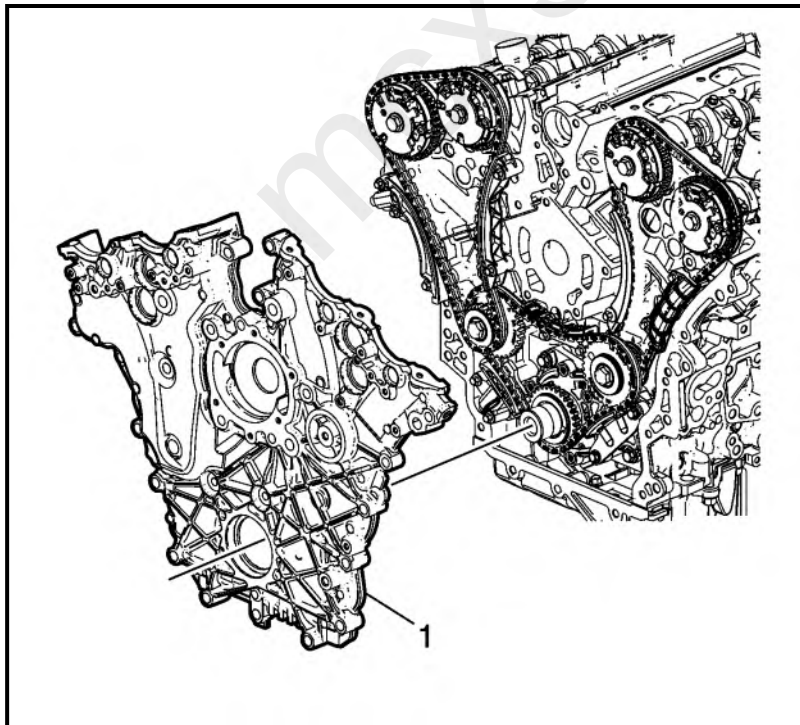
Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the right bank secondary camshaft drive chain tensioner. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. Refer to [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the right bank secondary camshaft drive chain tensioner. [Camshaft Timing Chain Components Installation](#)

2.



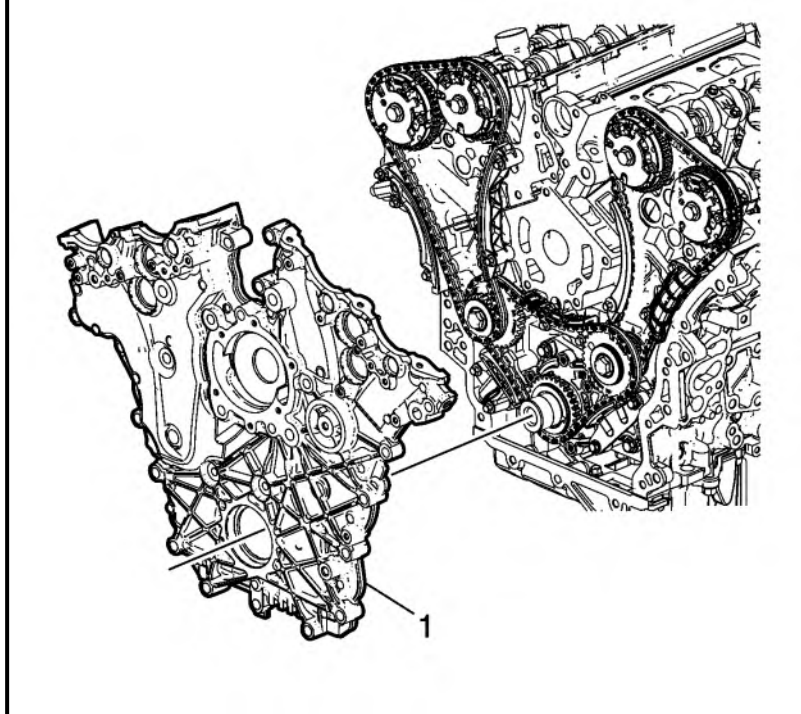
Install the engine front cover (1). [Engine Front Cover Replacement](#)

SECONDARY TIMING CHAIN TENSIONER SHOE REPLACEMENT - LEFT SIDE

Removal Procedure

1.



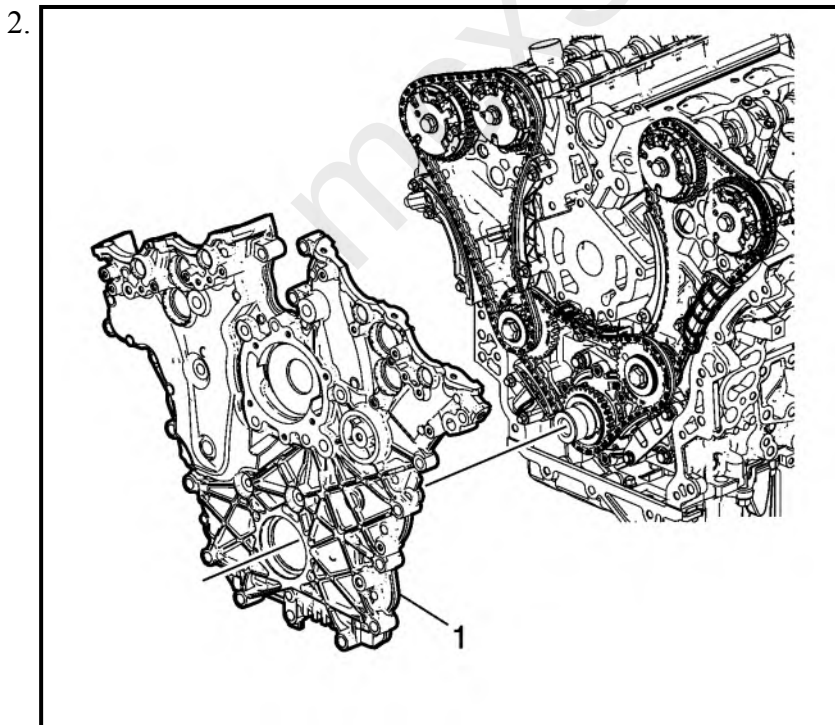


Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the left side secondary camshaft drive chain tensioner, shoe, and guide. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. Refer to [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the left side secondary camshaft drive chain shoe, guide, and tensioner. [Camshaft Timing Chain Components Installation](#)

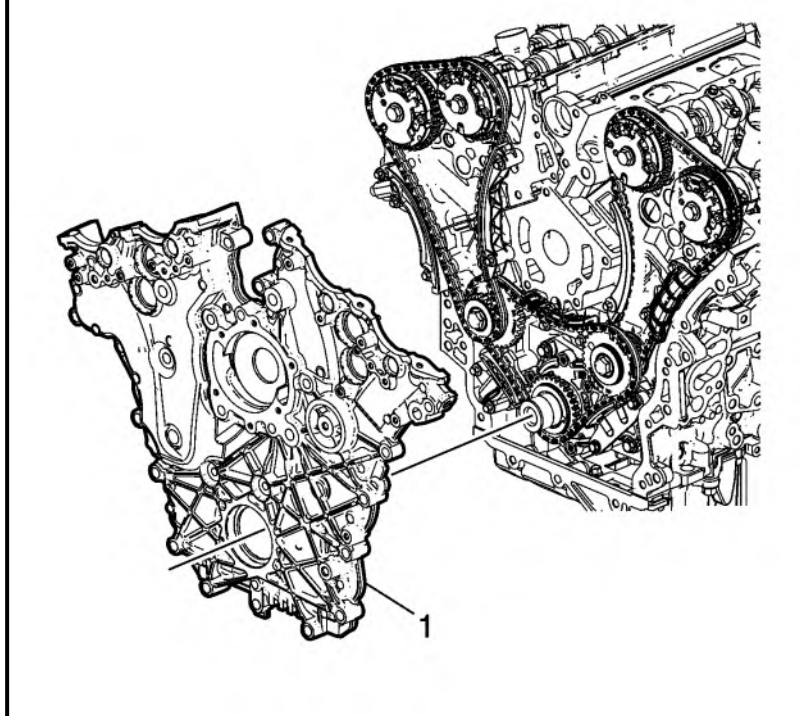


Install the engine front cover (1). [Engine Front Cover Replacement](#)

SECONDARY TIMING CHAIN TENSIONER SHOE REPLACEMENT - RIGHT SIDE

Removal Procedure

1. 

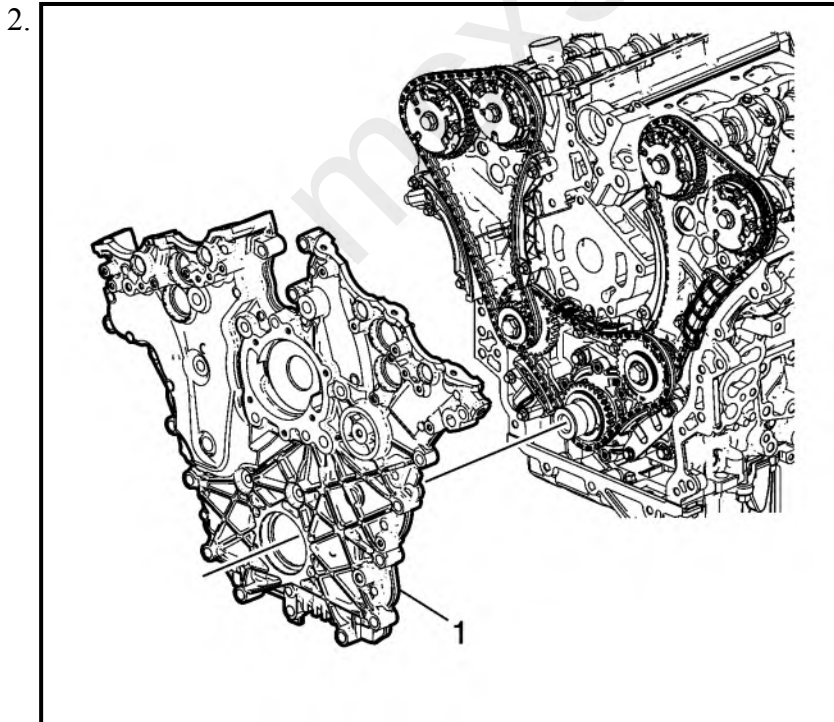


Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the right side secondary camshaft drive chain tensioner, shoe, and guide. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. Refer to [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the right side secondary camshaft drive chain shoe, guide, and tensioner. [Camshaft Timing Chain Components Installation](#)

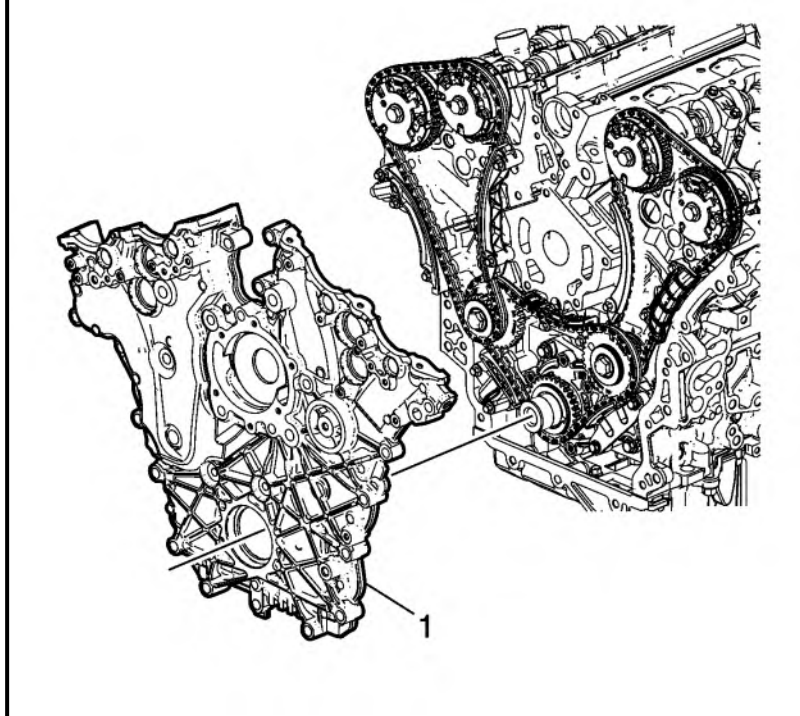


Install the engine front cover (1). [Engine Front Cover Replacement](#)

SECONDARY TIMING CHAIN GUIDE REPLACEMENT - LEFT SIDE

Removal Procedure

- 1.

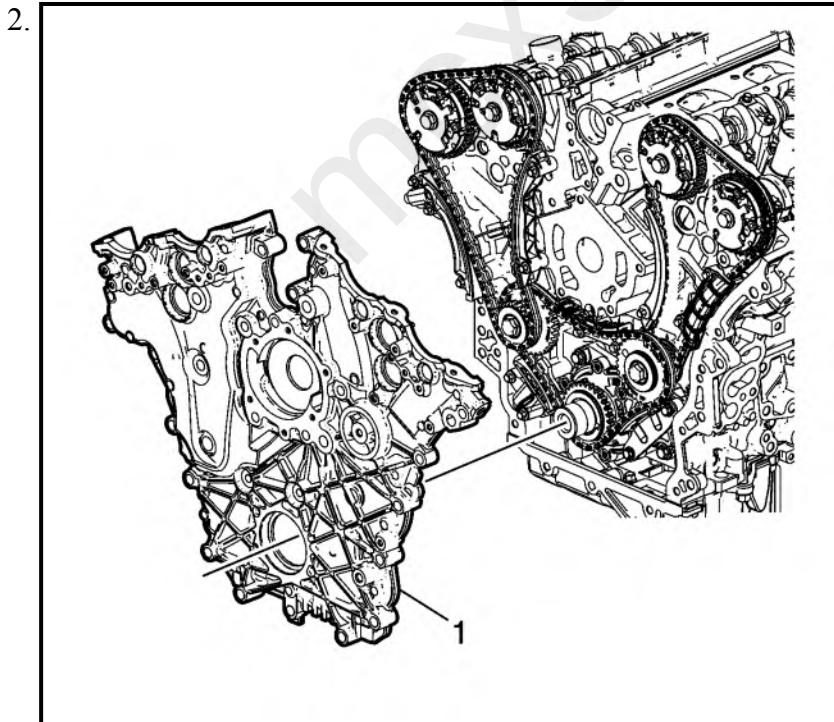


Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the left side secondary camshaft drive chain tensioner, shoe, and guide. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the left side secondary camshaft drive chain shoe, guide, and tensioner. [Camshaft Timing Chain Components Installation](#)

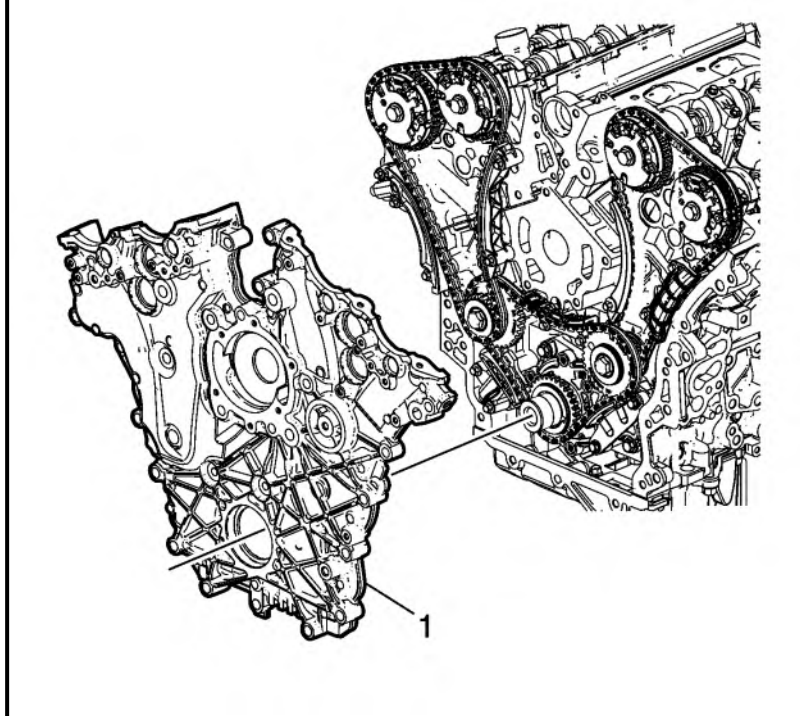


Install the engine front cover (1). [Engine Front Cover Replacement](#)

SECONDARY TIMING CHAIN GUIDE REPLACEMENT - RIGHT SIDE

Removal Procedure

- 1.

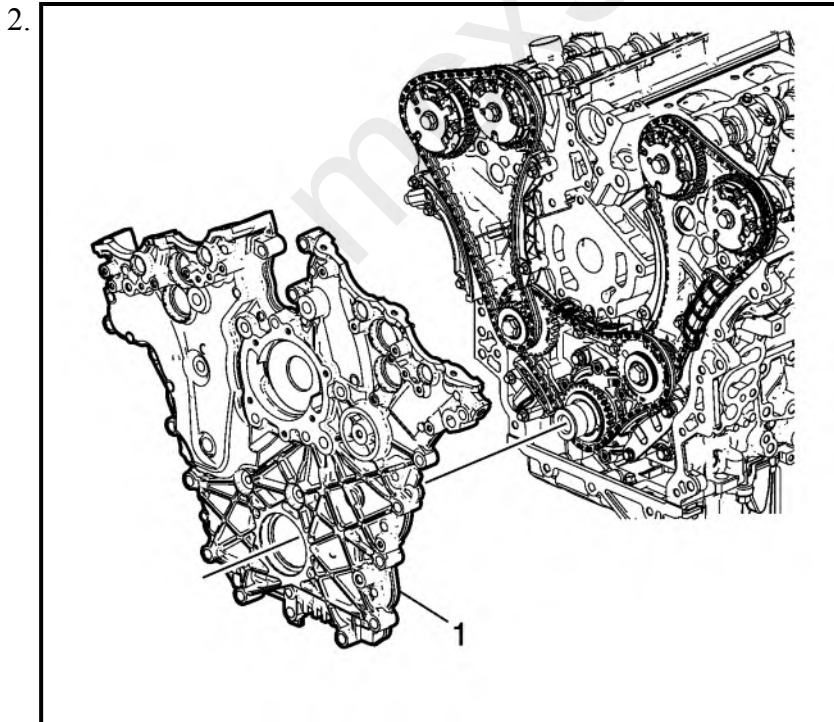


Remove the engine front cover (1). [Engine Front Cover Replacement](#)

2. Remove the right side secondary camshaft drive chain tensioner, shoe, and guide. [Camshaft Timing Chain Components Removal](#)
3. Clean and inspect all of the camshaft timing drive components. [Camshaft Timing Drive Components Cleaning and Inspection](#)
4. Replace components as necessary.

Installation Procedure

1. Install the right side secondary camshaft drive chain shoe, guide, and tensioner. [Camshaft Timing Chain Components Installation](#)



Install the engine front cover (1). [Engine Front Cover Replacement](#)

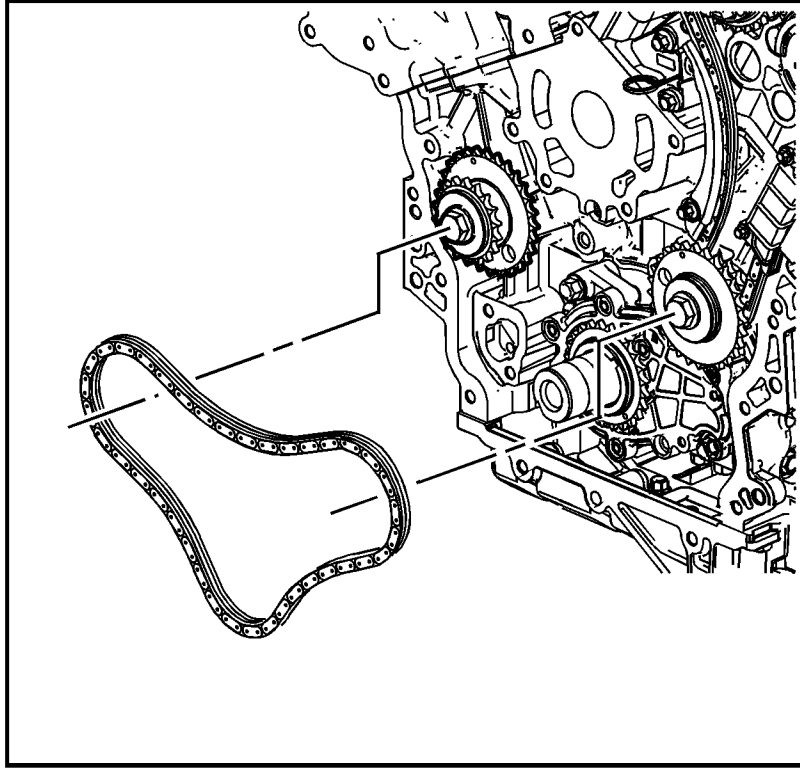
PRIMARY CAMSHAFT DRIVE CHAIN AND SPROCKETS REPLACEMENT

Removal Procedure

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

2. Remove the right side camshaft timing chain components. Refer to [Camshaft Timing Chain Components Removal](#).

3.

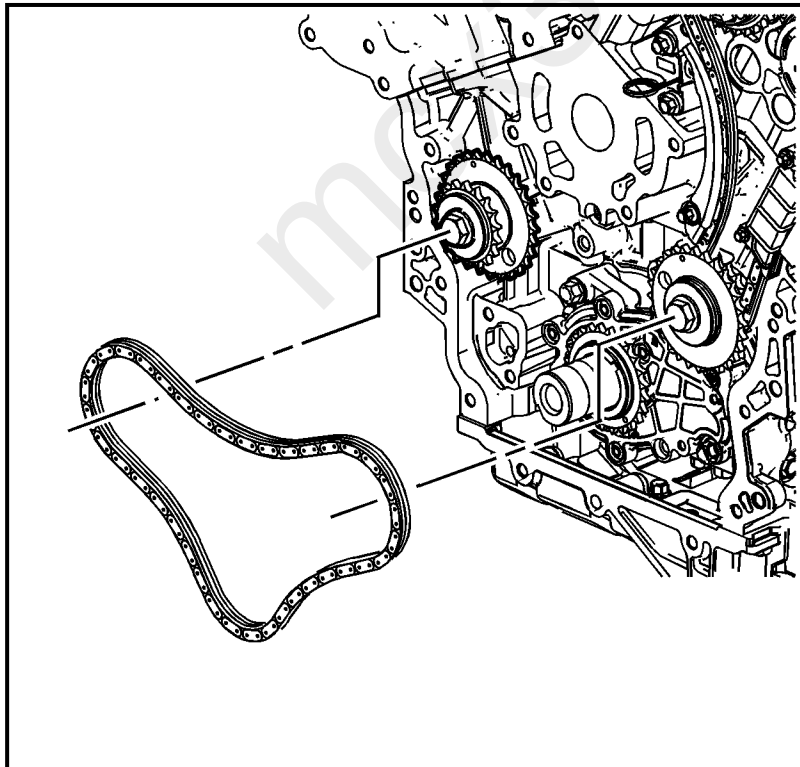


Remove the primary camshaft drive chain. Refer to [Camshaft Timing Chain Components Removal](#).

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

Installation Procedure

1.



Install the primary camshaft timing chain. Refer to [Camshaft Timing Chain Components Installation](#).

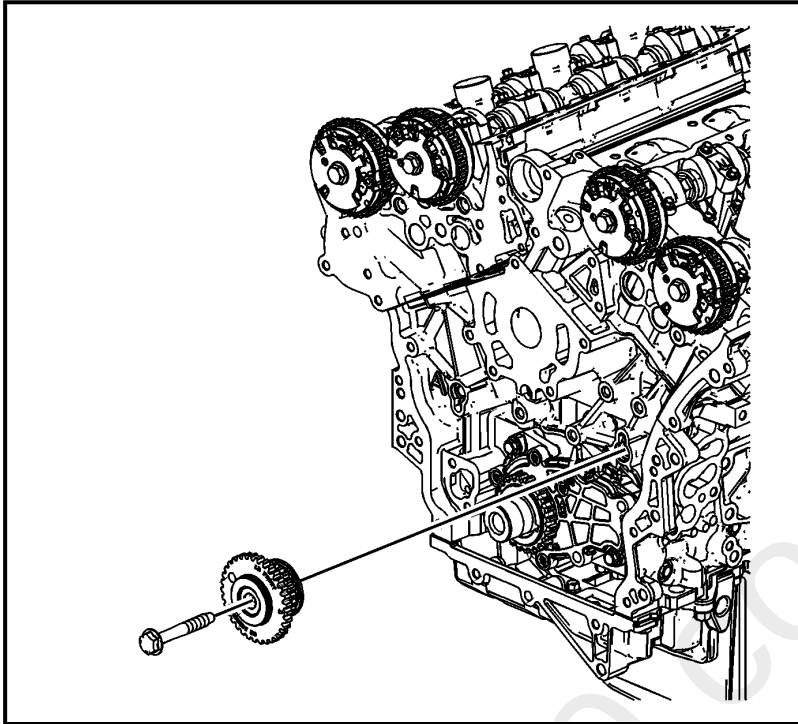
2. Install the camshaft timing chain components. Refer to [Camshaft Timing Chain Components Installation](#).
3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).

TIMING CHAIN IDLER SPROCKET REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove spark plugs. Refer to [Spark Plug Replacement \(Bank 1\)](#), [Spark Plug Replacement \(Bank 2\)](#).
2. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).
3. Remove the camshaft timing chain components. Refer to [Camshaft Timing Chain Components Removal](#).

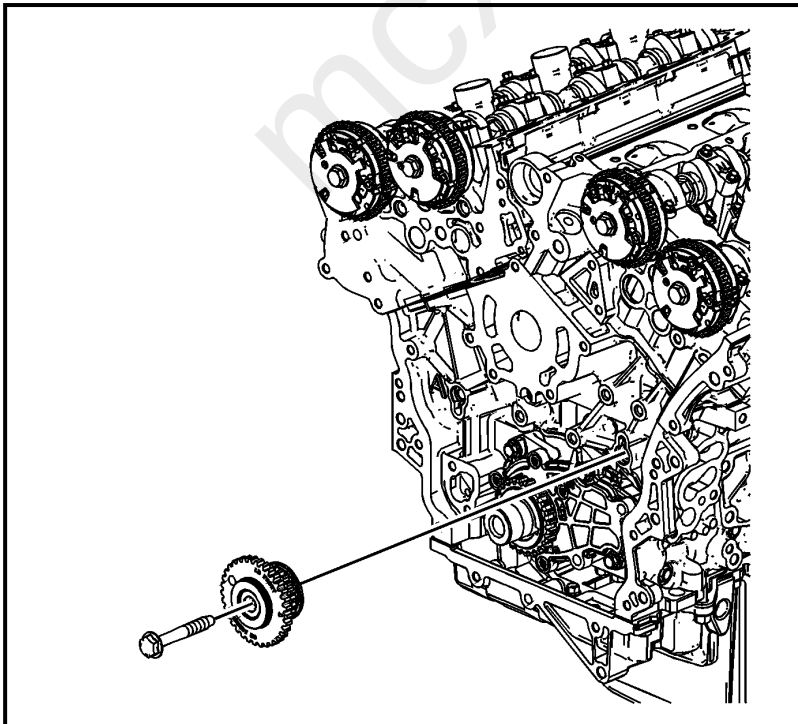
4.



Remove the left intermediate drive chain idler sprocket. Refer to [Timing Chain Idler Sprocket Removal - Left Side](#).

Installation Procedure

1.



Install the left intermediate drive chain idler sprocket. Refer to [Timing Chain Idler Sprocket Installation - Left Side](#).

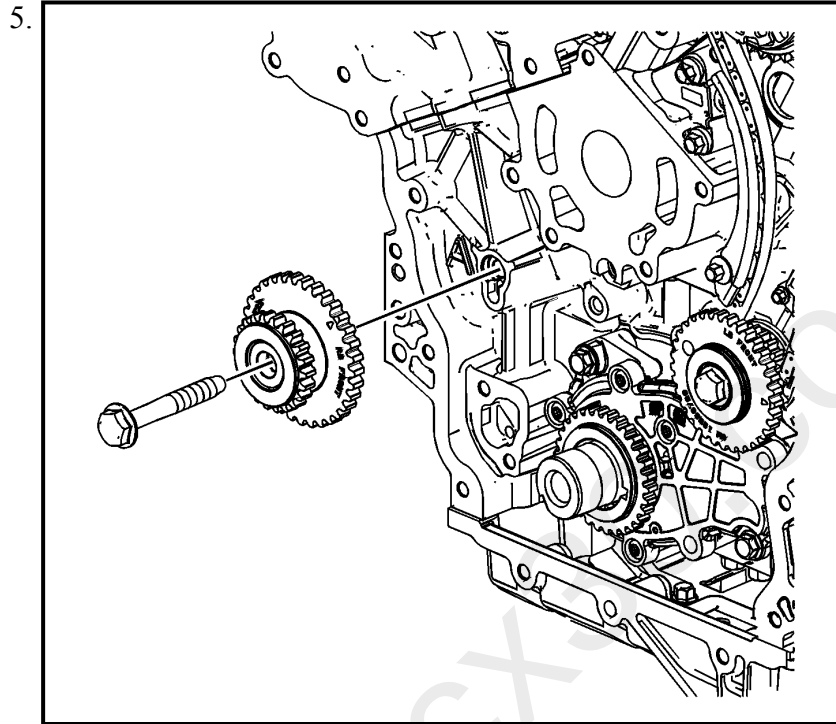
2. Install the camshaft timing chain components. Refer to [Camshaft Timing Chain Components Installation](#).

3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).
4. Install spark plugs. Refer to [Spark Plug Replacement \(Bank 1\)](#). [Spark Plug Replacement \(Bank 2\)](#).

TIMING CHAIN IDLER SPROCKET REPLACEMENT - RIGHT SIDE

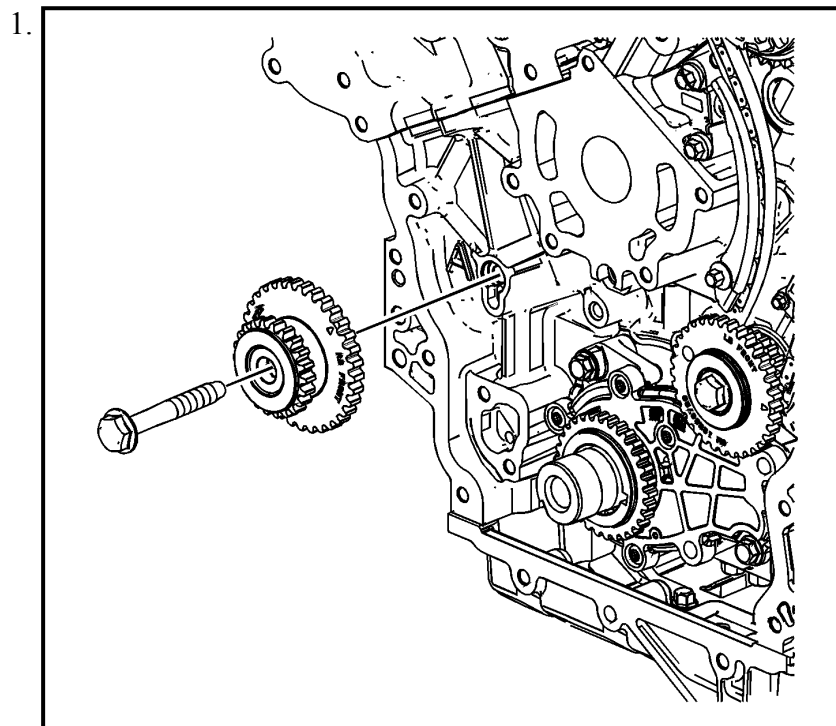
Removal Procedure

1. Remove spark plugs. Refer to [Spark Plug Replacement \(Bank 1\)](#). [Spark Plug Replacement \(Bank 2\)](#).
2. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).
3. Remove the right side secondary camshaft drive chain components. Refer to [Camshaft Timing Chain Components Removal](#).
4. Remove the primary camshaft drive chain components. Refer to [Camshaft Timing Chain Components Removal](#).



Remove the right intermediate drive chain idler sprocket. Refer to [Timing Chain Idler Sprocket Removal - Right Side](#).

Installation Procedure



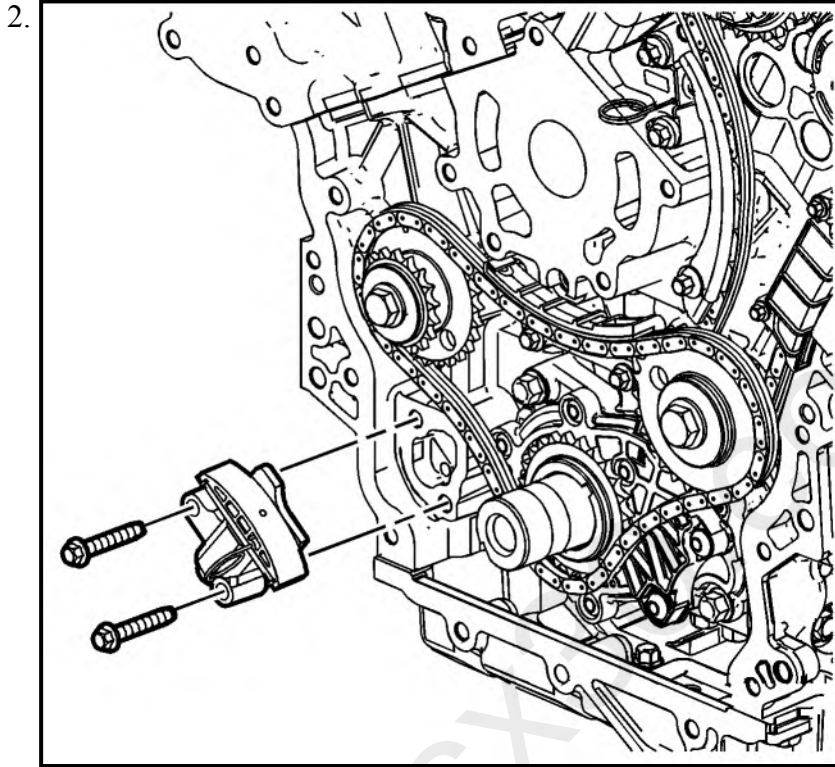
Install the left intermediate drive chain idler sprocket. Refer to [Timing Chain Idler Sprocket Installation - Right Side](#) .

2. Install the camshaft timing chain components. Refer to [Camshaft Timing Chain Components Installation](#) .
3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .
4. Install spark plugs. Refer to [Spark Plug Replacement \(Bank 1\)](#), [Spark Plug Replacement \(Bank 2\)](#) .

PRIMARY CAMSHAFT INTERMEDIATE DRIVE CHAIN TENSIONER REPLACEMENT

Removal Procedure

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

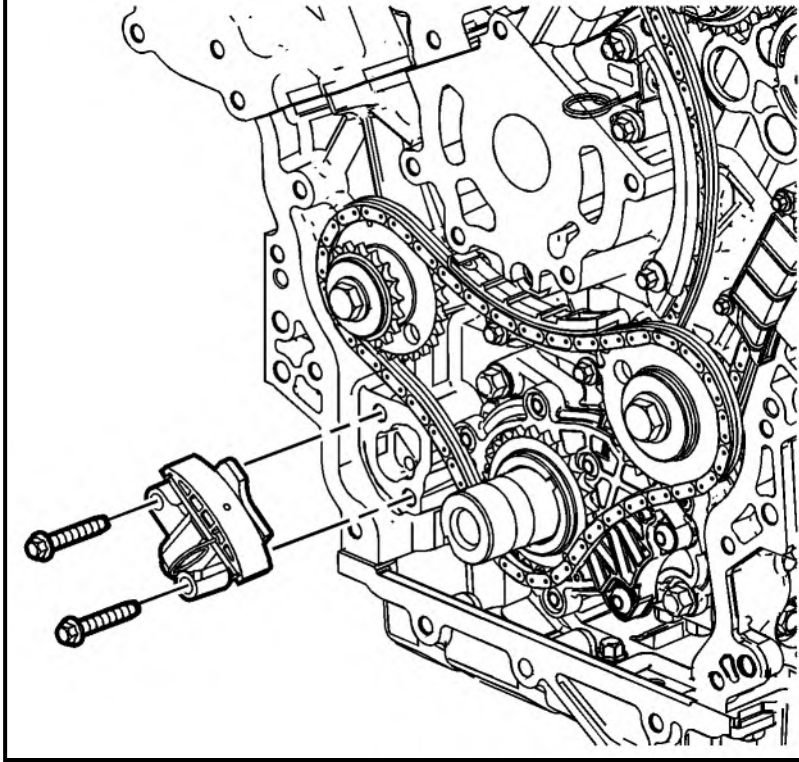


NOTE: If the entire camshaft timing system is not in Stage 2, [Timing Chain Alignment Diagram](#) , mark the timing chain and sprockets in order to ensure proper reassembly.

Remove the primary camshaft drive chain tensioner. Refer to [Camshaft Timing Chain Components Removal](#) .

Installation Procedure





Install the primary camshaft drive chain tensioner. Refer to [Camshaft Timing Chain Components Installation](#) .

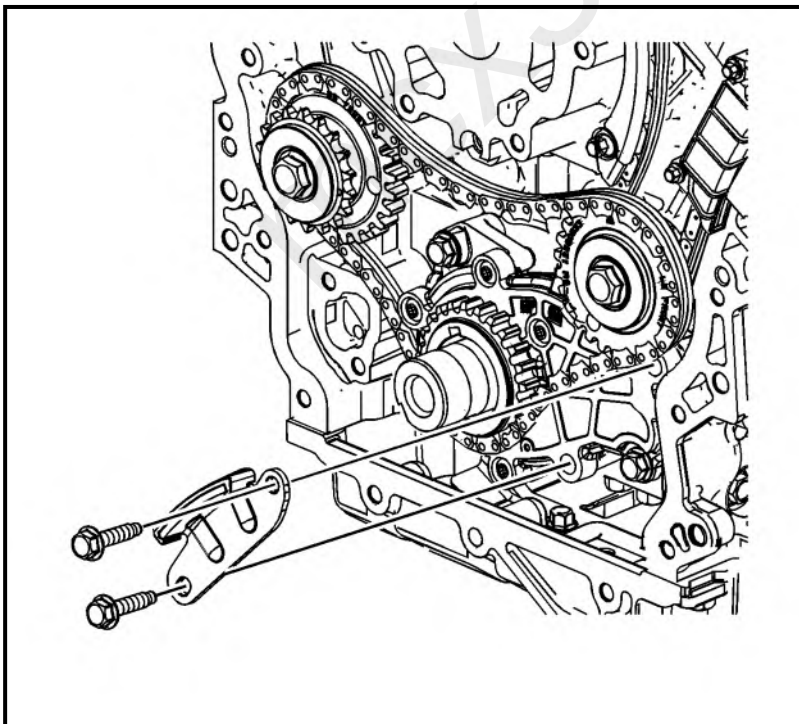
2. Install the engine front cover. Refer to [Engine Front Cover Replacement](#).

PRIMARY TIMING CHAIN GUIDE REPLACEMENT - LOWER

Removal Procedure

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

2.

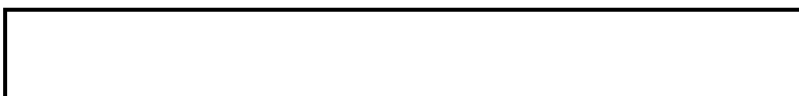


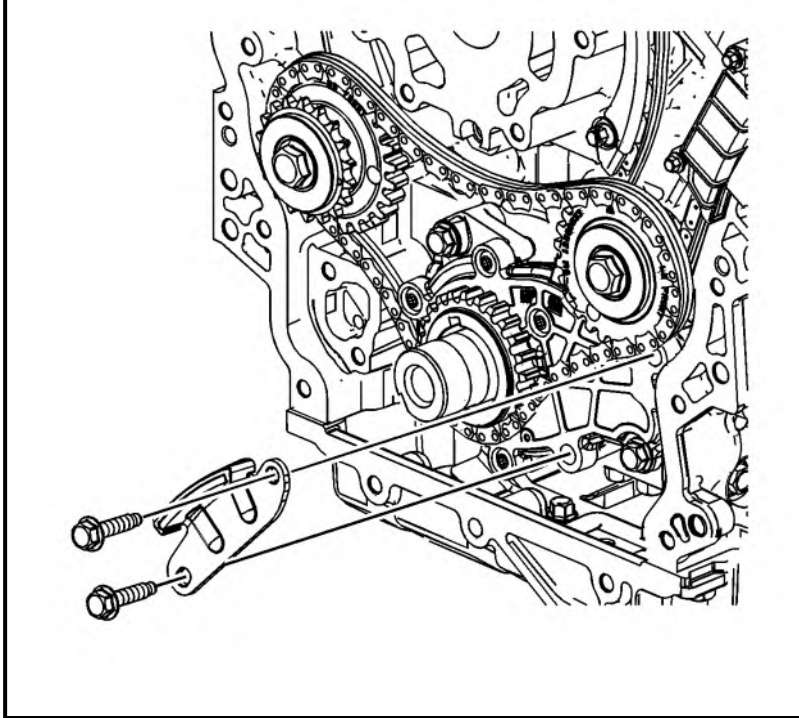
Remove the primary camshaft drive chain lower guide bolts.

3. Remove the primary camshaft drive chain lower guide.

Installation Procedure

1.





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

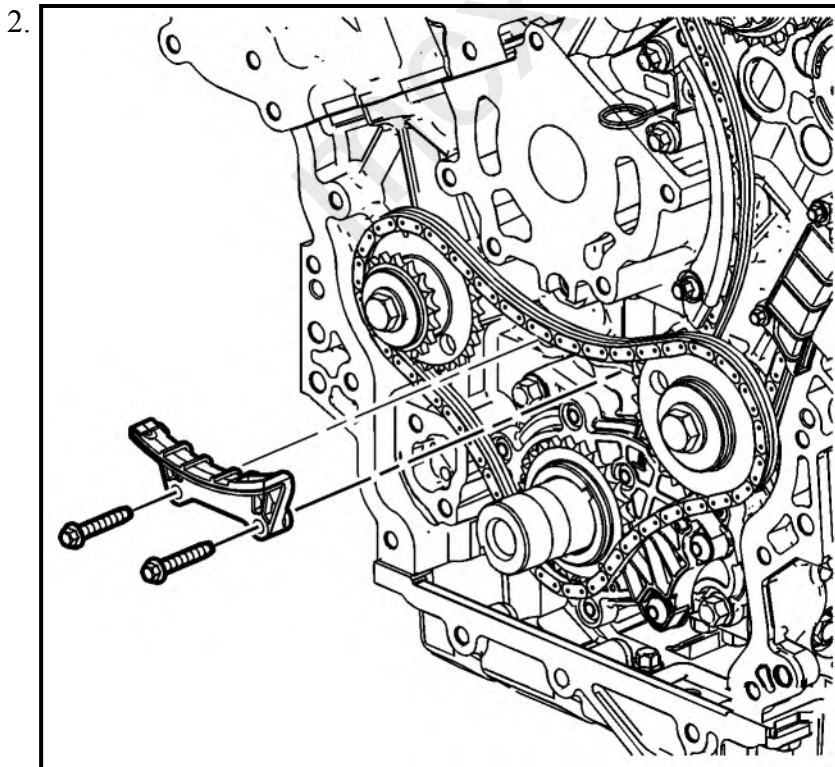
CAUTION: Refer to [Fastener Caution](#) .

2. Install the primary camshaft drive chain lower guide bolts and tighten to 25 N.m (18 lb ft).
3. Install the primary camshaft drive chain tensioner. Refer to [Primary Camshaft Intermediate Drive Chain Tensioner Replacement](#).

PRIMARY TIMING CHAIN GUIDE REPLACEMENT - UPPER

Removal Procedure

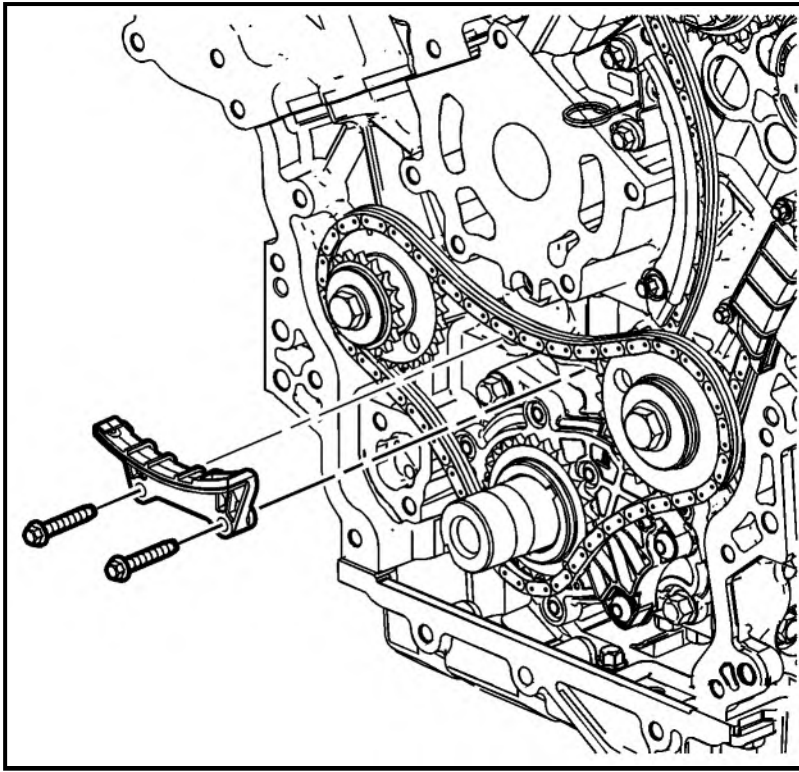
1. Remove the engine front cover. Refer to [Engine Front Cover Replacement](#).



Remove the primary camshaft drive chain tensioner. Refer to [Camshaft Timing Chain Components Removal](#) .

3. Remove the primary upper camshaft drive chain guide. Refer to [Camshaft Timing Chain Components Removal](#) .

1.



Install the primary upper camshaft drive chain guide. Refer to [Camshaft Timing Chain Components Installation](#) .

2. Install the primary camshaft drive chain tensioner. Refer to [Camshaft Timing Chain Components Installation](#) .
3. Install the engine front cover. Refer to [Engine Front Cover Replacement](#) .

CAMSHAFT POSITION ACTUATOR REPLACEMENT - BANK 1

Special Tools

- EN49982-1 Timing Chain Retainer
- EN49982-2 Timing Chain Retainer

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

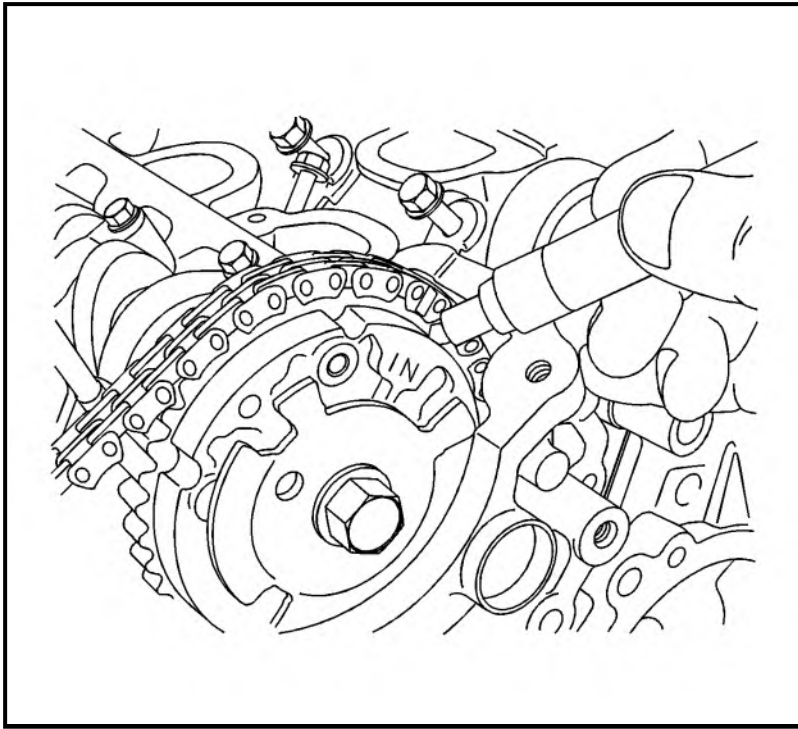
Removal Procedure

1. Remove the camshaft cover. Refer to [Camshaft Cover Replacement - Right Side](#) .
2. Remove the camshaft position actuator solenoid valve solenoid - intake. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#) .
3. Remove the intake camshaft position sensor. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#) .
4. Remove the exhaust camshaft position sensor. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#) .
5. Remove the camshaft position actuator solenoid valve solenoid - exhaust. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Exhaust](#) .
6. Rotate engine clockwise using crankshaft dampener retaining bolt until the flats at the rear ends of the camshafts are pointing up. This puts the camshafts on "base circle" and will reduce their tendency to rotate from valve spring pressure when the camshaft position actuators/drive chains are removed.

NOTE: Do NOT remove or back out the camshaft position actuator bolt (s) significantly, simply break them loose from their fully-torqued position. The position actuators must stay firmly attached until the retaining tools are in place, but they should be broken loose while the chain is still tight and in position.

7. Loosen intake and/or exhaust camshaft position actuator retaining bolts, depending on which camshaft position actuator and/or camshaft you will be servicing. If servicing both camshaft position actuators and/or camshafts, loosen both bolts.

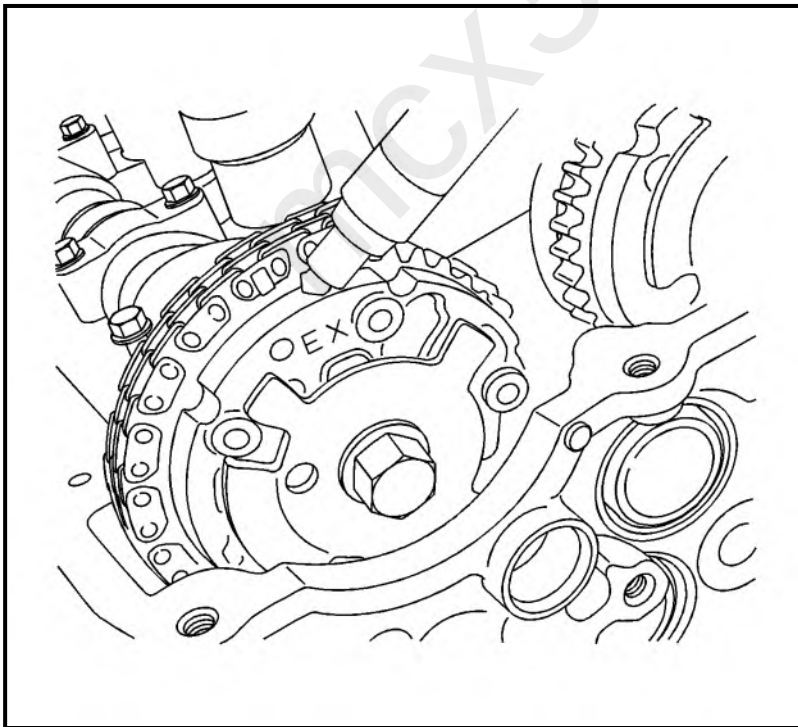
8.



NOTE: Be certain to clearly mark the position of the chain to the camshaft position actuator (s). Though the engine does not need to be set to a specific timing mark before starting the procedure, the relationship of the chain to the actuator (s) is critical and must be reestablished on assembly.

Mark the position of the chain to the camshaft position actuator - intake.

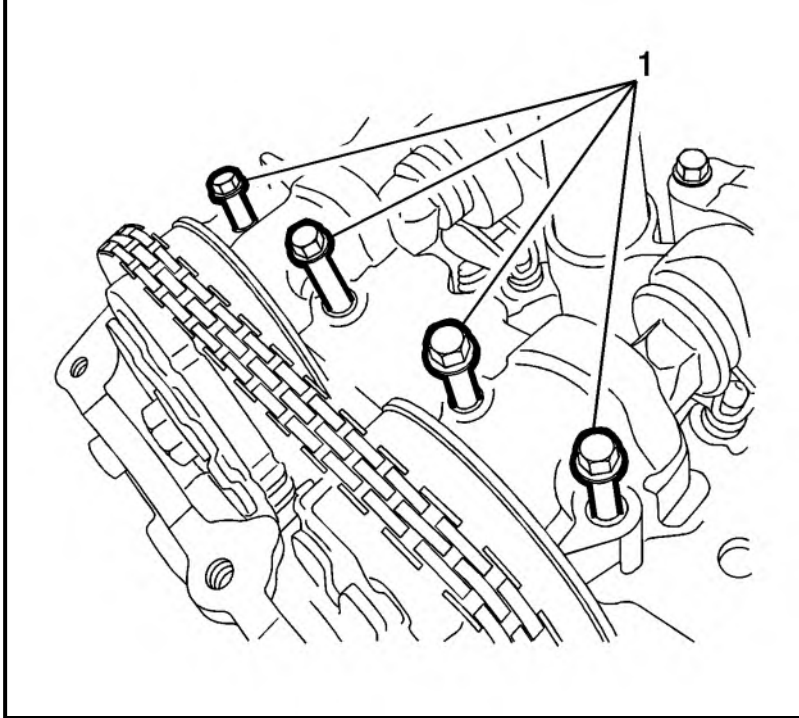
9.



Mark the position of the chain to the camshaft position actuator - exhaust.

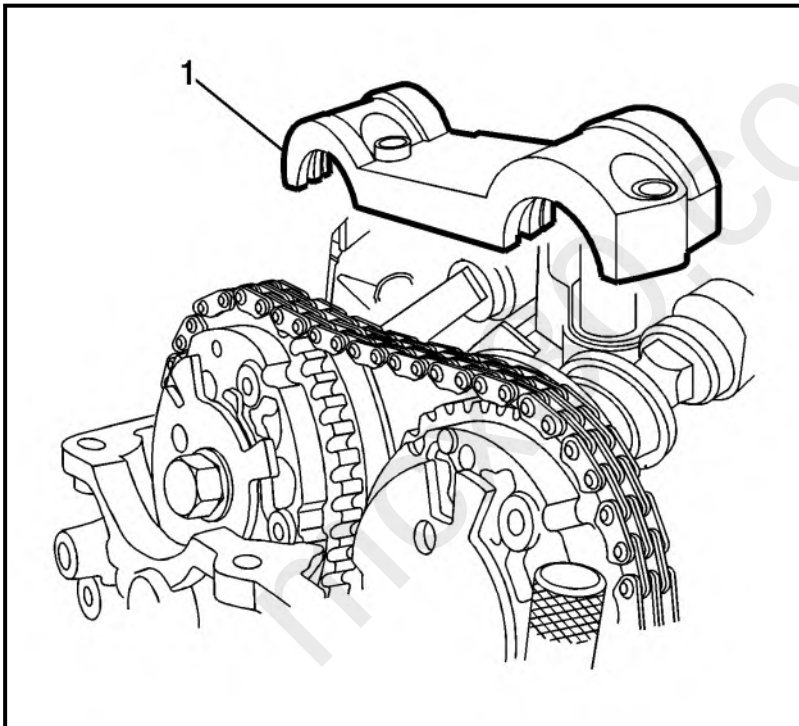
10.





Remove camshaft front cap bolts (1).

11.

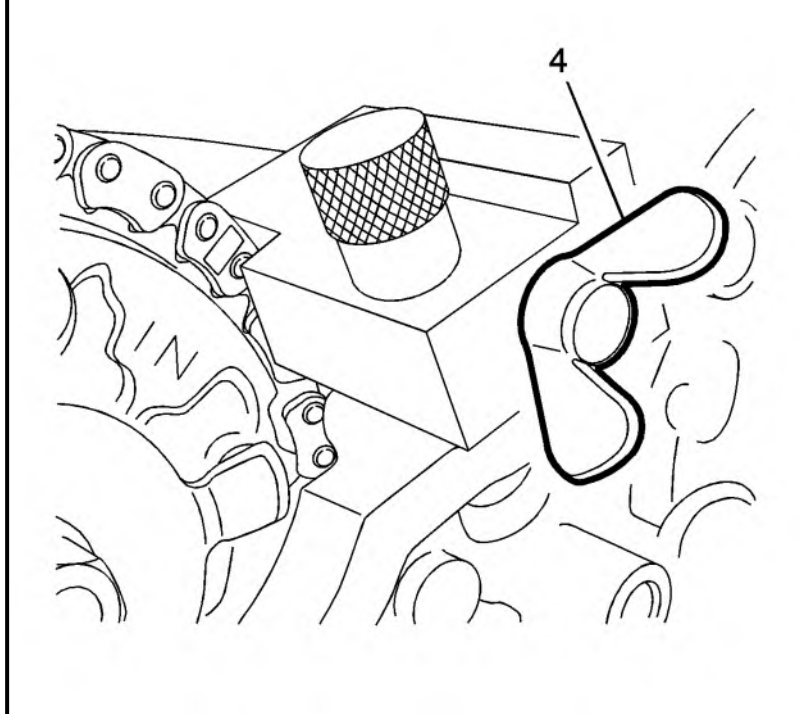


NOTE: Do NOT remove or loosen any other camshaft bearing caps at this time, even if you intend to eventually remove the camshaft.

Remove the camshaft front cap (1).

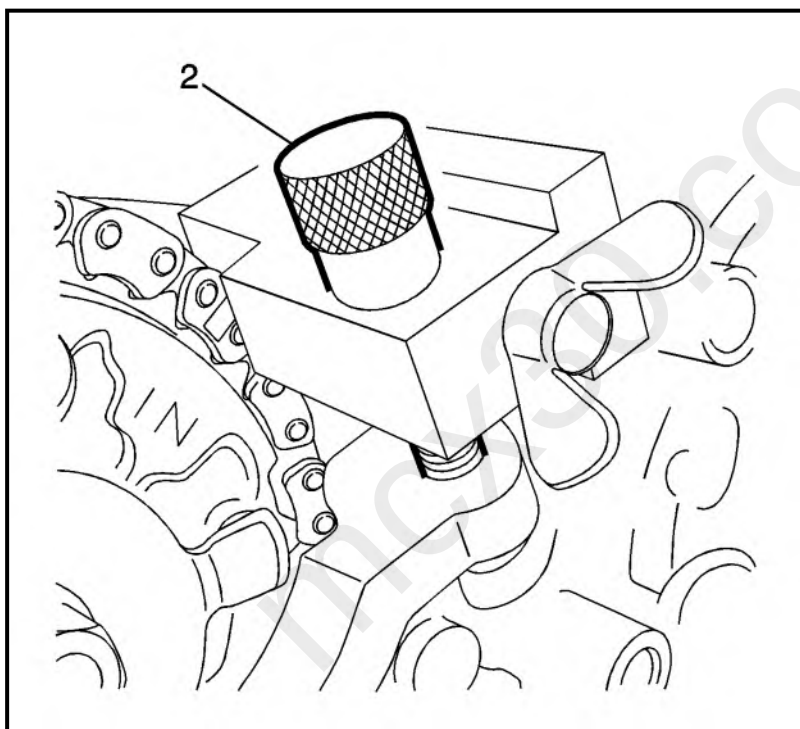
12.





Loosen wingnut (4) to open the clamping area of EN49982-1 retainer.

13.

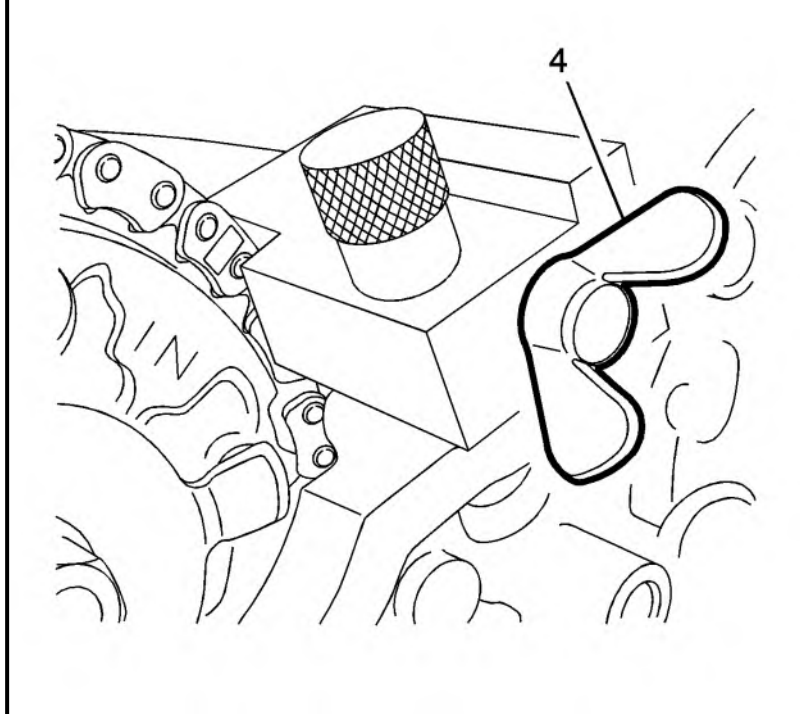


NOTE: Do NOT overtighten the thumbscrew. The EN49982-1 retainer should be able to slide slightly via the slot the screw goes through. This fore/aft movement will allow easier removal and installation of the chain later.

Install EN49982-1 retainer intake side chain holder onto front cover by screwing in the thumbscrew (2) on the EN49982-1 retainer finger-tight.

14.

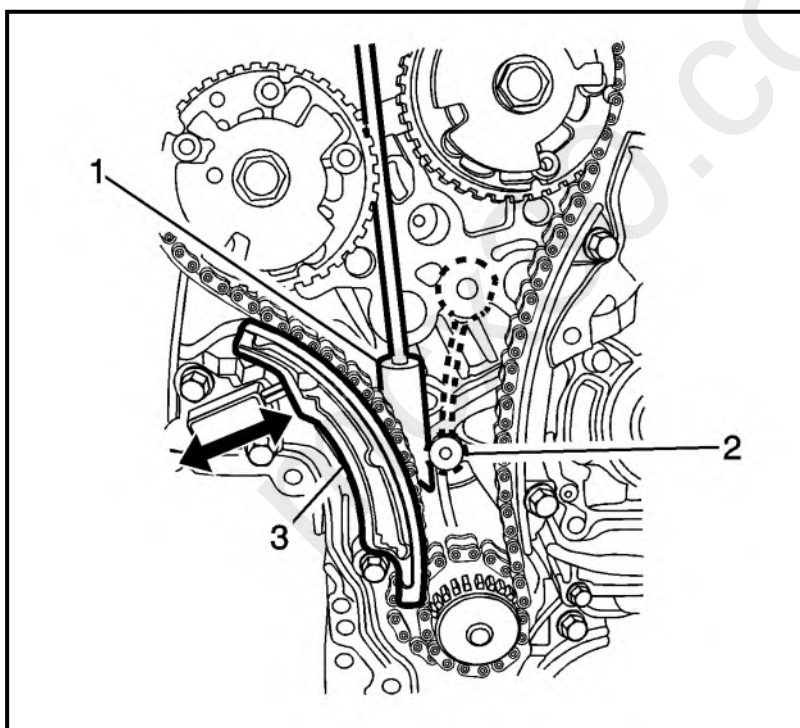




NOTE: Do NOT tighten the wingnut with a tool of any kind. Firm finger-tightening is sufficient.

Tighten wingnut (4) so EN49982-1 retainer closes over and firmly grasps timing chain.

15.

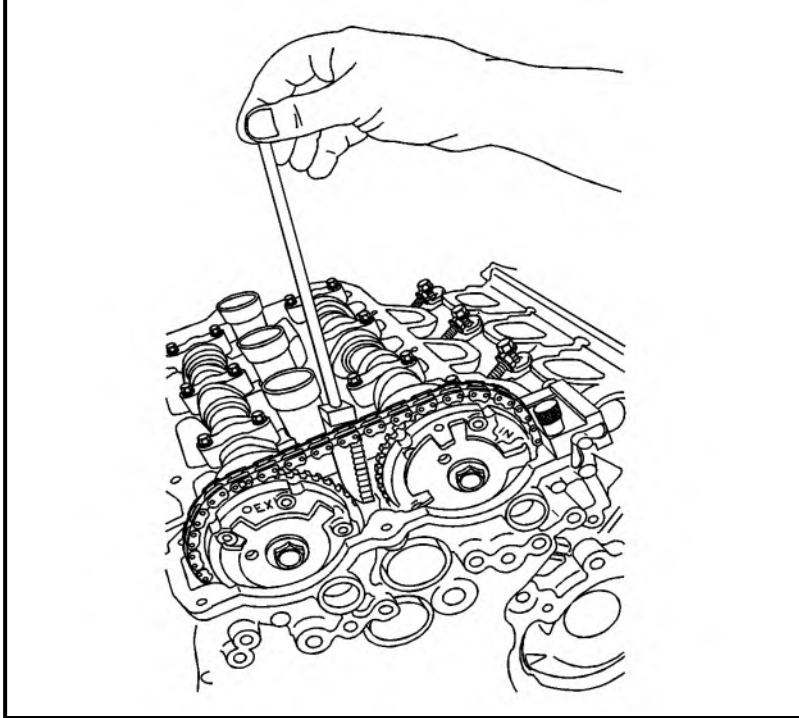


NOTE: The engine front cover is removed for clarity in the following graphics, but is NOT required to be removed to perform the procedure.

EN49982-2 retainer (1) will be installed in the following steps such that it wedges between an internal rib (2) that is cast into the inside of the front cover (shown in dotted line above) and the timing chain and spring-loaded tensioner shoe (3), holding the chain in position. The wedge will be left in place during the cam position actuator and/or camshaft service.

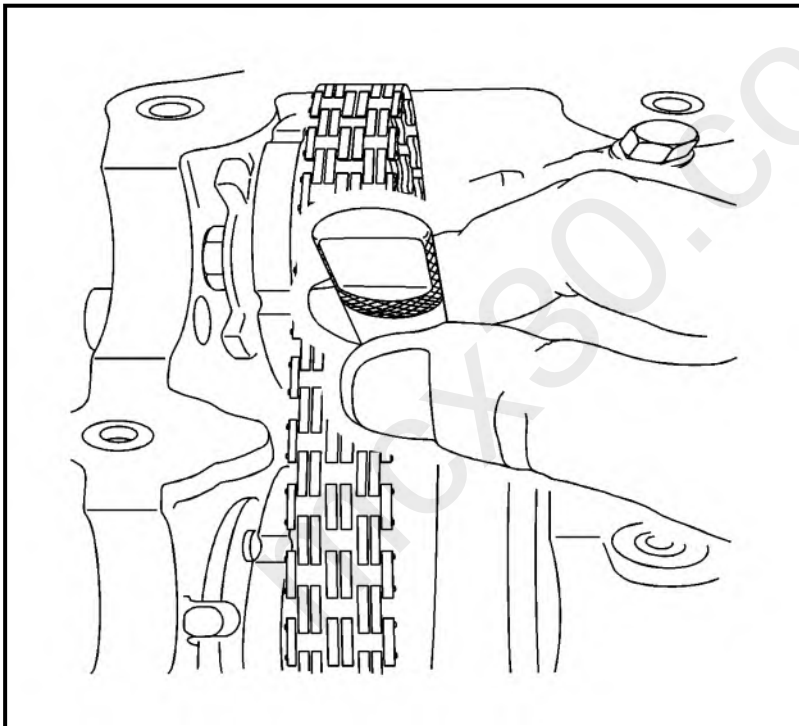
16.





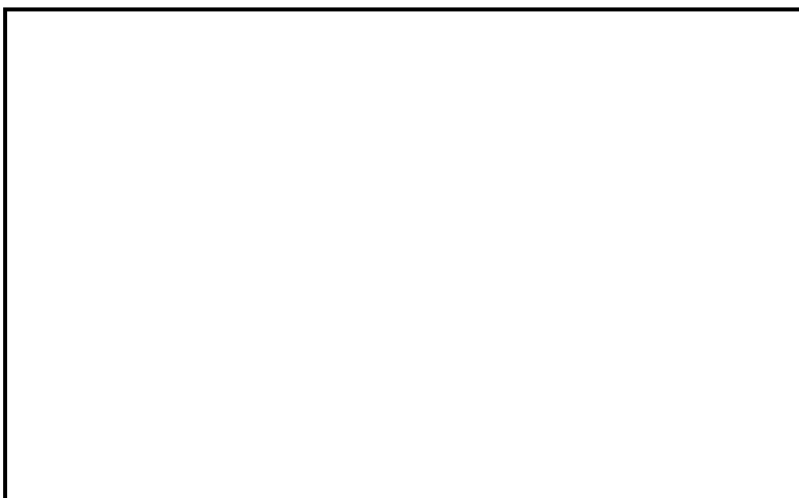
Insert the **EN49982-2** retainer between the two camshaft position actuators with the "teeth" on the **EN49982-2** retainer facing toward the front cover.

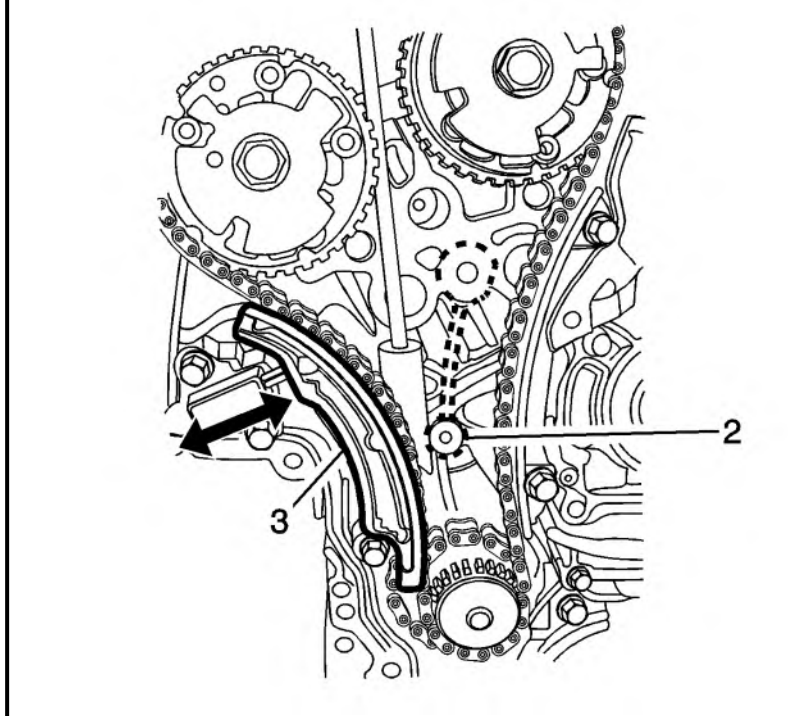
17.



Once the wedge portion of **EN49982-2** retainer is below the camshaft position actuators, rotate the **EN49982-2** retainer until the flat in the handle faces toward the intake camshaft position actuator. This orients the "teeth" toward the chain.

18.

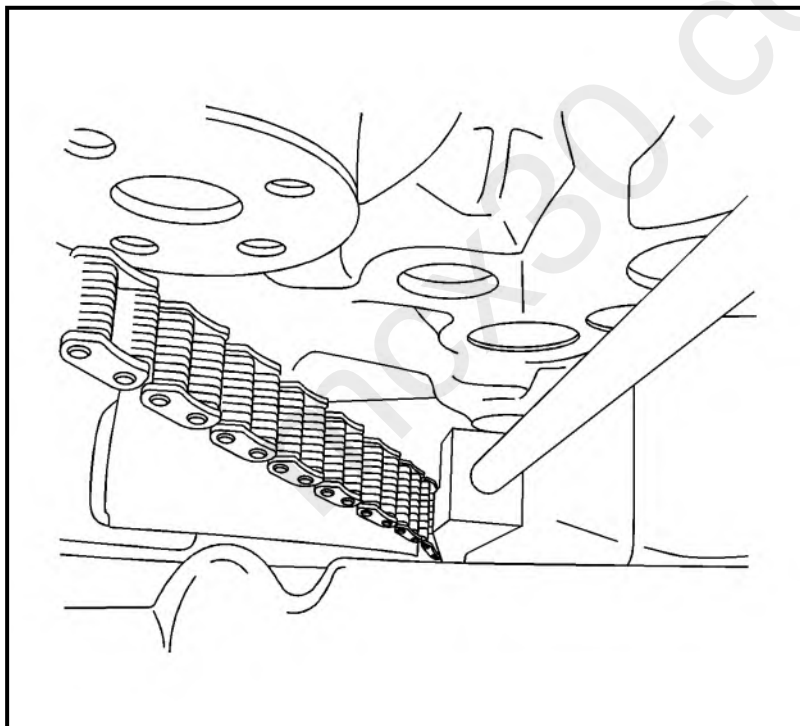




NOTE: Do not try to force the wedge into position, simply ensure it is loosely engaged in the timing chain and in the correct overall position.

Drop the wedge down until it begins to engage the timing chain and the belt casting (2).

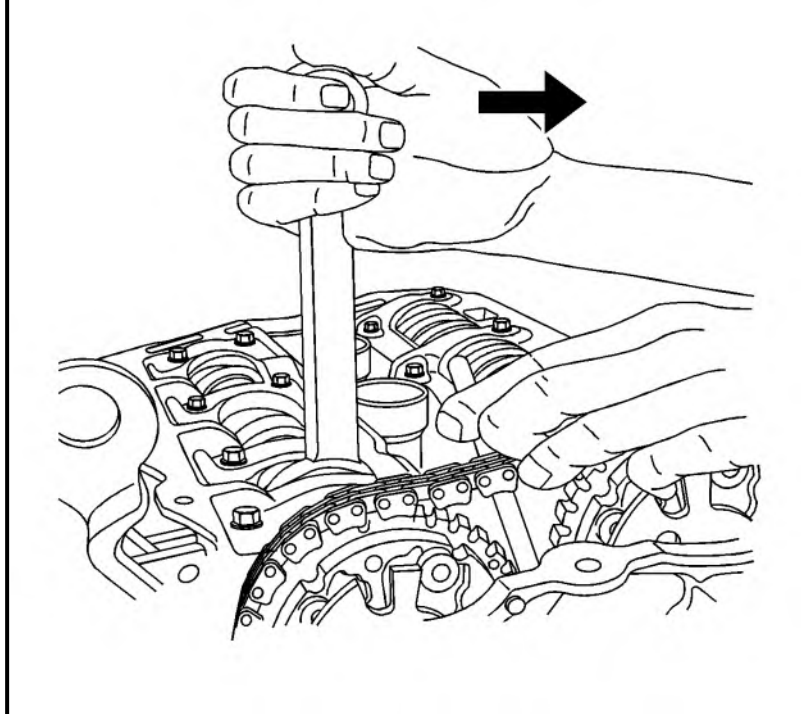
19.



If possible shine a strong light down from above, between the camshaft position actuators, and see the wedge in overall position as shown in the above graphic.

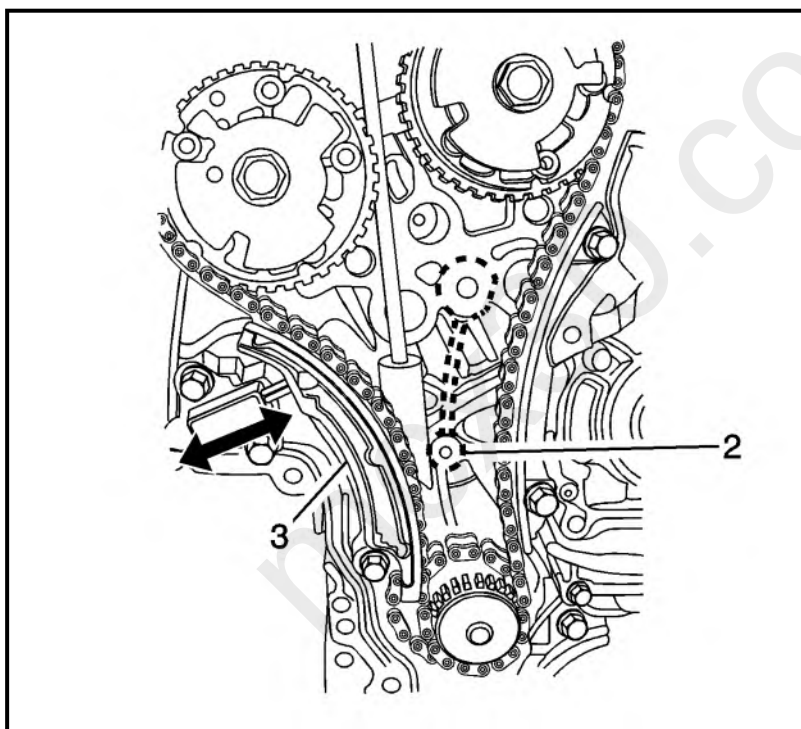
20.





Using a 20 mm wrench on the cast hexagonal portion of the exhaust camshaft, rotate the camshaft toward the intake camshaft while pushing down on the handle of the **EN49982-2** retainer.

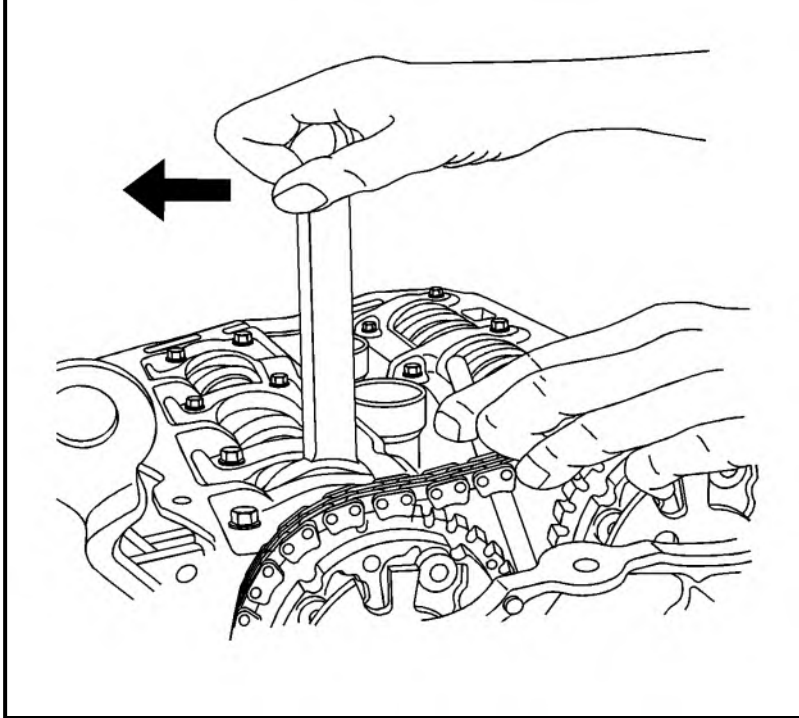
21.



This rotation of the camshaft will compress the tensioner shoe (3) against the spring force of the tensioner, opening up a gap between the chain and the internal rib in the front cover. The wedge will then drop into this gap. You will feel a distinct click as the teeth engage the chain.

22.

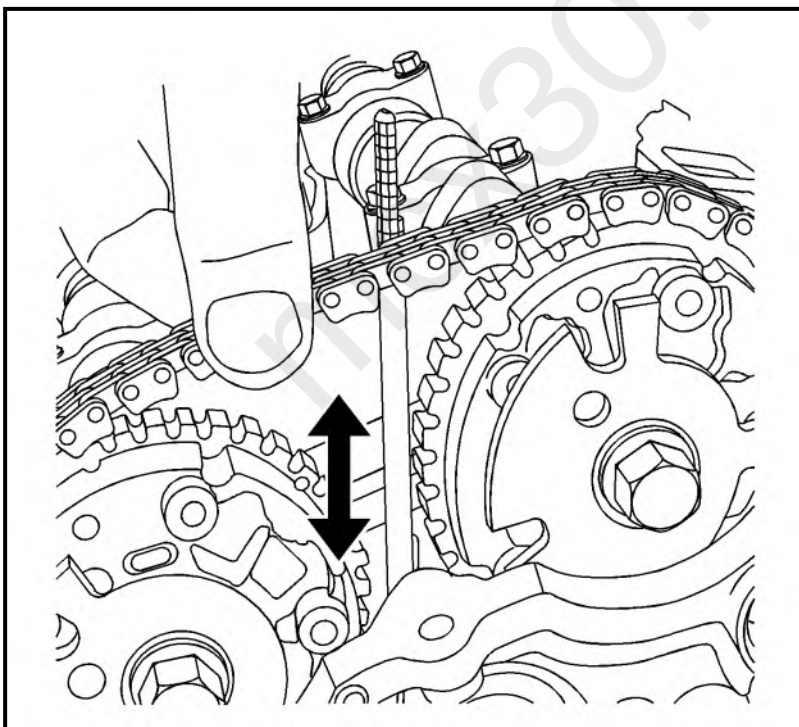




CAUTION: Be sure the EN49982-2 is captured firmly as described before continuing. This is critical to ensuring the camshaft drive chains stay properly timed.

Release the force on the wrench, allowing the spring tension to close the tensioner shoe against the wedge portion of EN49982-2 retainer. You should be able to lightly tug on the EN49982-2 retainer and it should stay in position. Repeat Steps 20 and 21 if necessary to re-insert the EN49982-2 retainer until you are certain it is in position and will stay in position.

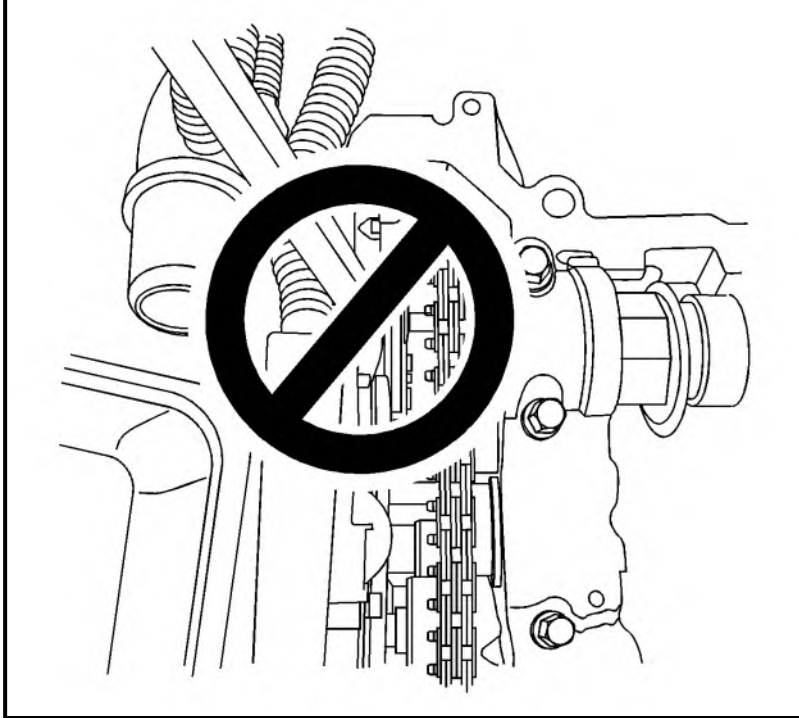
23.



With EN49982-2 retainer in position and with the 20 mm wrench removed, there should now be some slack in the timing drive chain as indicated in the graphics shown.

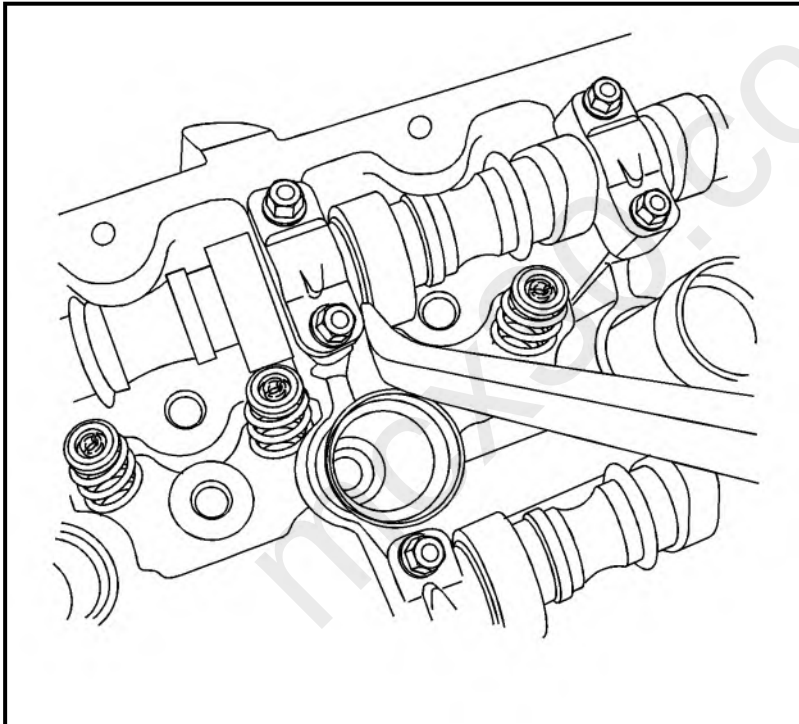
24.





Do not pry against the face of the camshaft position actuators or the position actuator retaining bolt.

25.

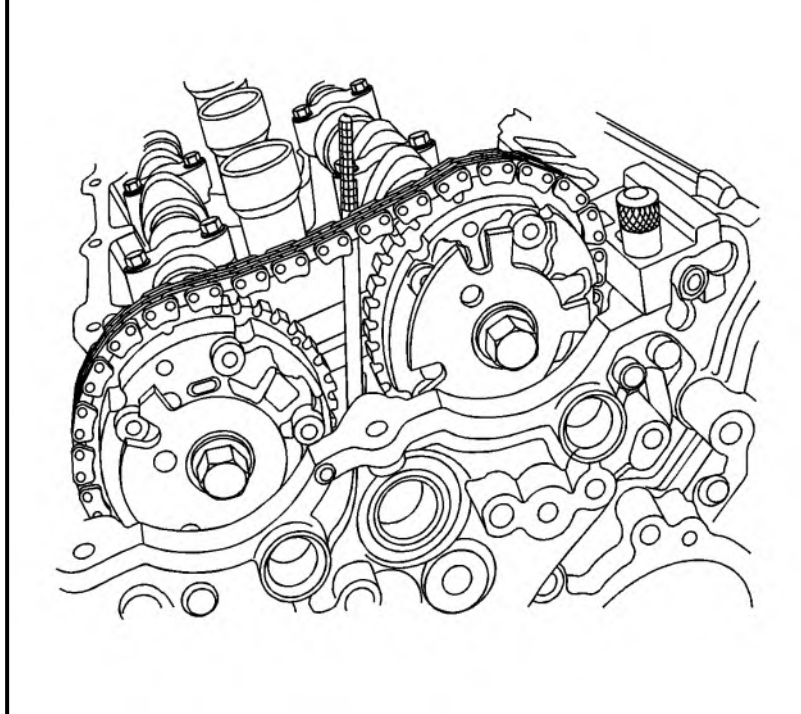


CAUTION: Do not pry against the face of the camshaft position actuators or the position actuator retaining bolts as the position actuators will be damaged.

Position a screwdriver or small pry bar between a camshaft cap and camshaft lobe. Carefully move/pry the camshafts as far as possible toward the rear/flywheel end of the engine.

26.

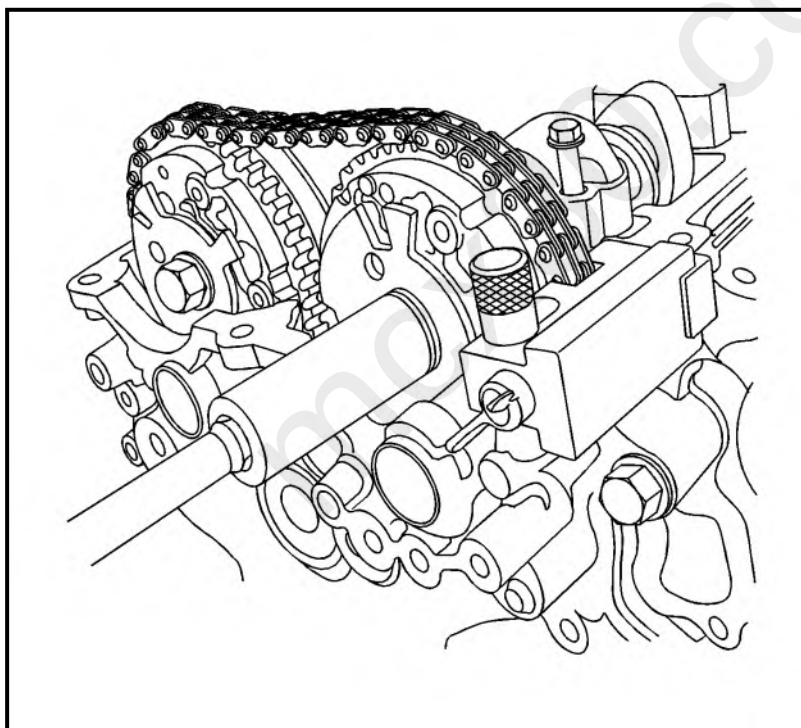




NOTE: Do not move or disturb the EN49982 retainer components after their installation or the timing chains may be lost inside the front cover.

The EN49982-1 retainer and EN49982-2 retainer should be in position as shown, they must be left in position during the servicing of the camshaft position actuator (s) and/or camshaft (s).

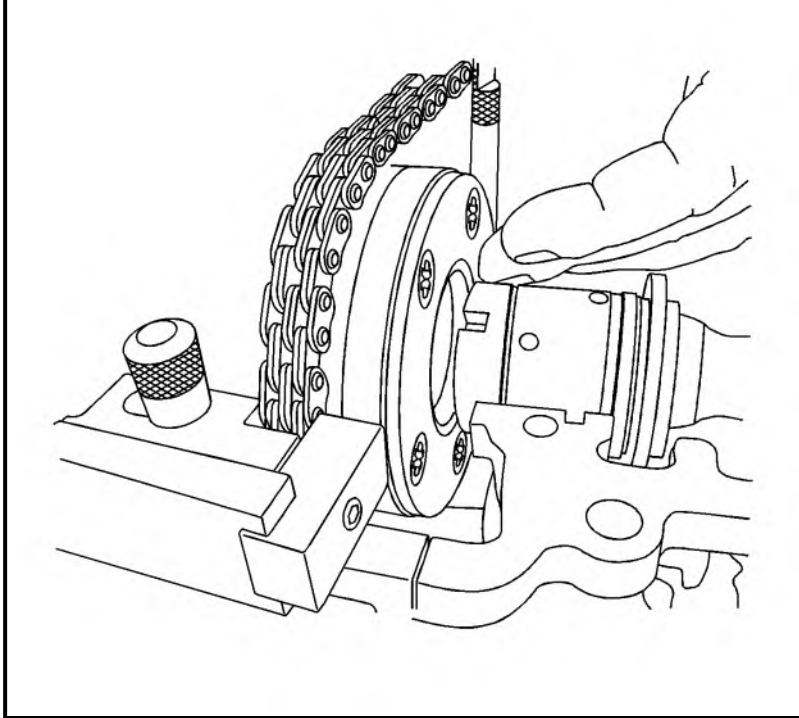
27.



To remove the intake camshaft position actuator, remove the loosened retaining bolt. To remove only the exhaust camshaft position actuator, skip the steps for removing the intake camshaft position actuator. However, the EN49982-1 retainer **MUST** be installed as discussed even if the intake side will not be serviced or the timing of the camshaft chains will be lost.

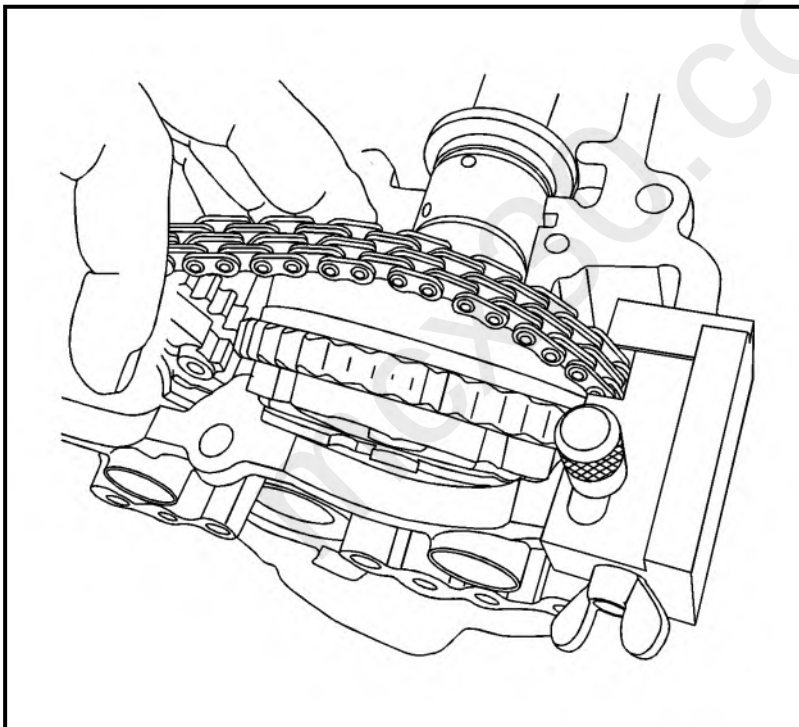
28.





Slide the camshaft position actuator forward and off the end of the intake camshaft. The slot in the **EN49982-1** retainer will allow the tool to move forward enough to disengage the camshaft position actuator from the front of the camshaft. Remove the plastic thrust washer when removing the camshaft position actuator from the end of the camshaft.

29.



Tilt the camshaft position actuator forward and out/away from the engine.

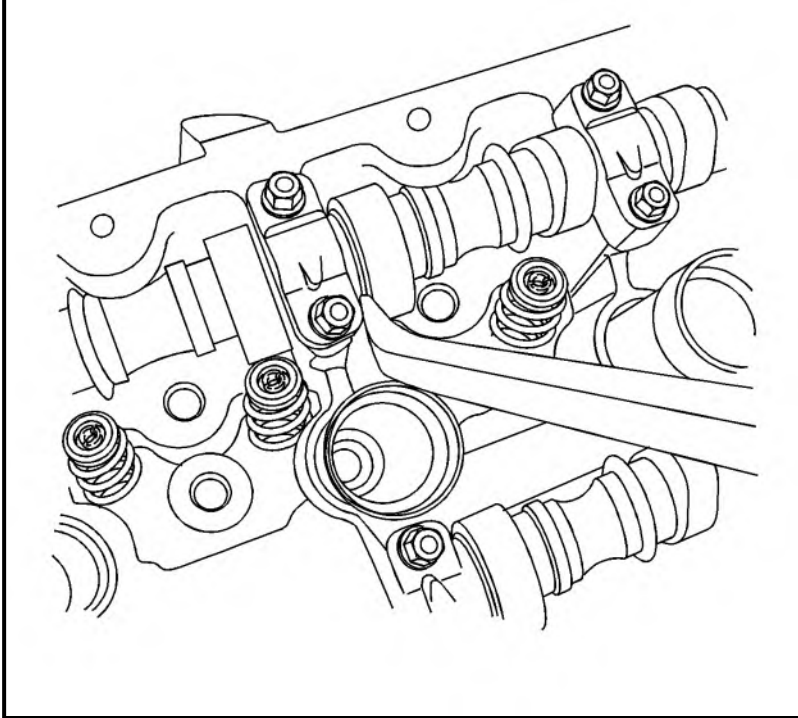
NOTE: **DO NOT** remove the **EN49982** retainers. They are holding the cam chains to maintain their properly-timed positions.

30. Allow the chain to rest on the **EN49982-1** retainer and **EN49982-2** retainer in position during service.

Installation Procedure

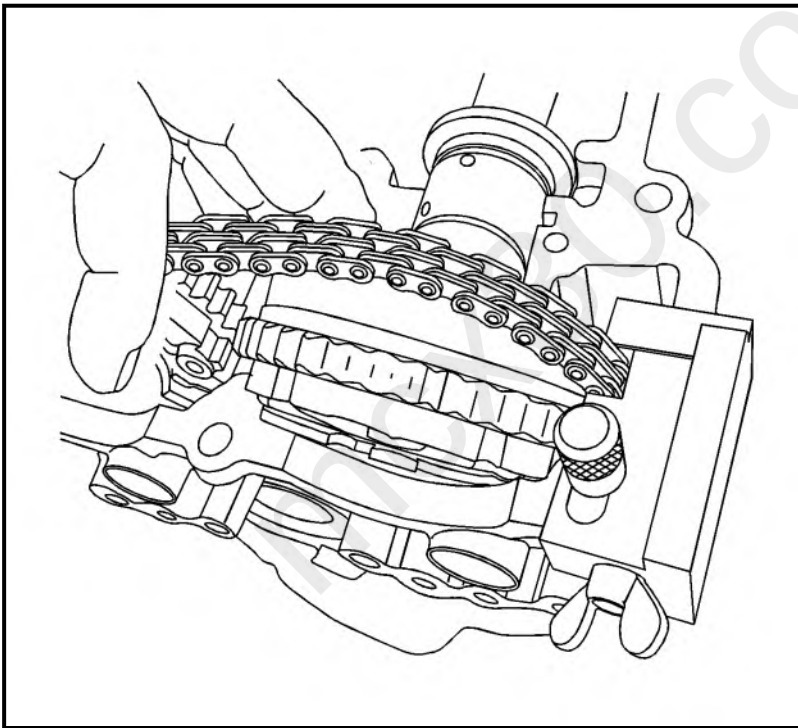
1.





It may help to carefully pry the camshaft forward and to move the **EN49982-1** retainer backward via the slot to reengage the position actuator to the camshaft. The dowel pin on the camshaft position actuator must be aligned with the slot in the camshaft nose for reassembly.

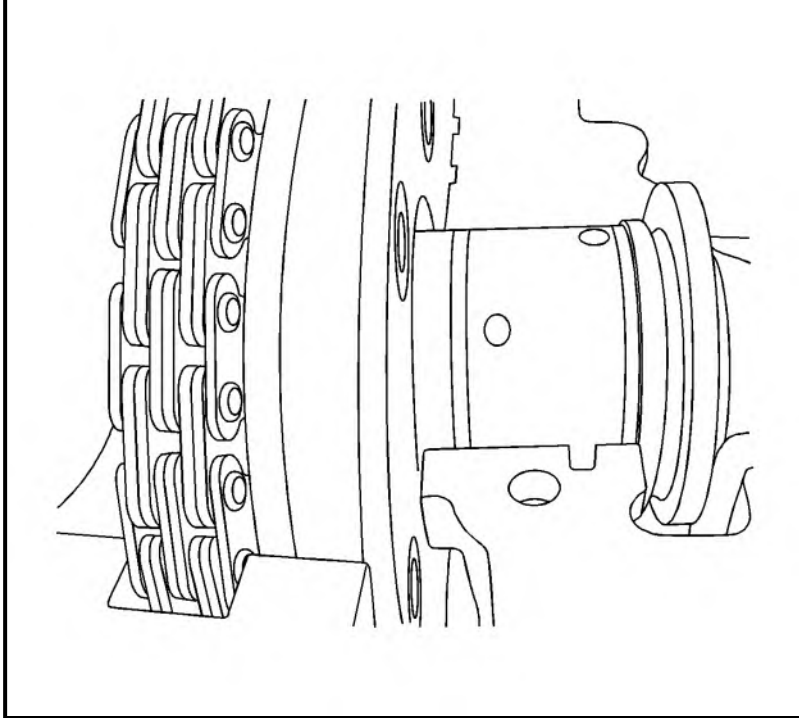
2.



Install the intake camshaft position actuator first by inserting the actuator between the timing chain and front cover. Tilt the actuator in and engage the chain while aligning the marks you made on the chain and position actuator.

3.



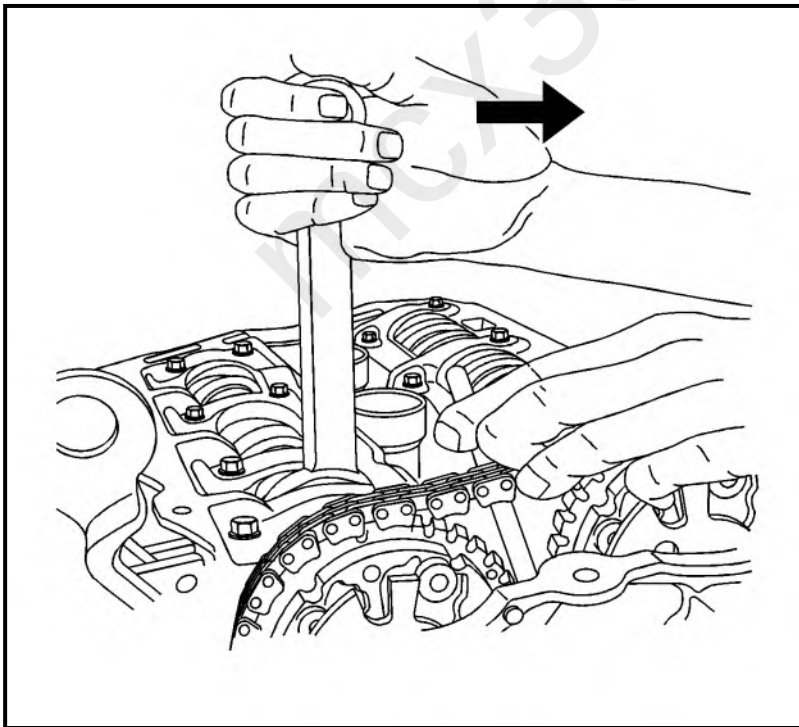


Ensure the camshaft position actuator fits snugly to the end of the camshaft.

CAUTION: Refer to **Fastener Caution** .

4. Install the intake camshaft position actuator retaining bolt, and lightly tighten the bolt to hold the camshaft actuator in place. DO NOT torque at this time.
5. Install the exhaust camshaft position actuator retaining bolt, and lightly tighten the bolt to hold the camshaft actuator in place. DO NOT torque at this time.
6. Double-check that the marks on both the intake and exhaust camshaft position actuators to ensure that they are aligned with their respective paint marks on the chain.

7.



Using a 20 mm wrench on the cast hexagonal portion of the exhaust camshaft, rotate the camshaft clockwise while pulling up on the handle of the **EN49982-2** retainer.

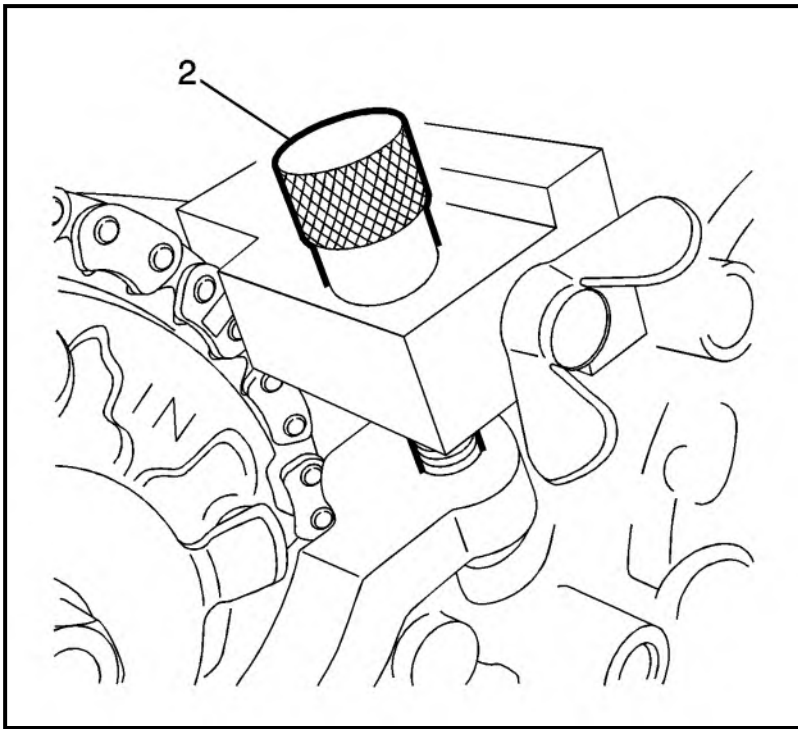
8. Remove EN49982-2 retainer.
9. Release the pressure on the wrench. The timing chain should now be tight and should lose the slack the wedge was providing.

NOTE: Double-check the marks on the camshaft position actuators and

chains to ensure they are correct.

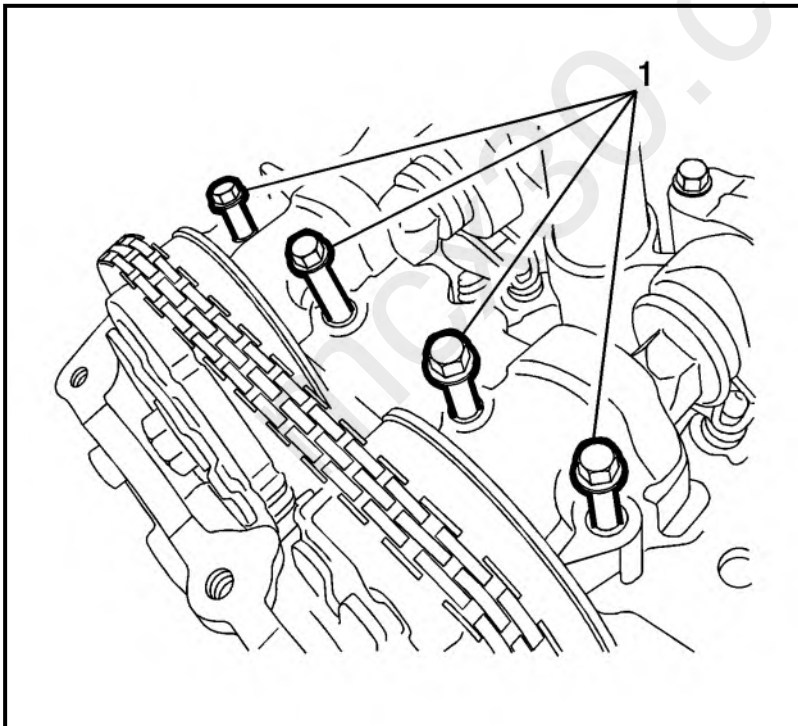
10. Torque one or both camshaft position actuator retaining bolts to 58 N.m (43 lb ft).

11.



Unscrew the wingnut on **EN49982-1** retainer to release timing chain, and then remove **EN49982-1** retainer from the front cover by unscrewing the thumbscrew (2).

12.



Install camshaft front cap and bolts (1).

13. Tighten the camshaft front cap outer bolts to 10 N.m (89 lb in).

14. Tighten the camshaft front cap inner bolts to 10 N.m (89 lb in).

15. Install the camshaft position actuator solenoid valve solenoid - exhaust. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Exhaust](#) .

16. Install the camshaft position actuator solenoid valve solenoid-intake. Refer to [Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 \(Right Side\) Intake](#) .

17. Install the intake camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Intake](#) .

18. Install the exhaust camshaft position sensor. Refer to [Camshaft Position Sensor Replacement - Bank 1 \(Right Side\) Exhaust](#) .

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

CAMSHAFT POSITION ACTUATOR REPLACEMENT - BANK 2

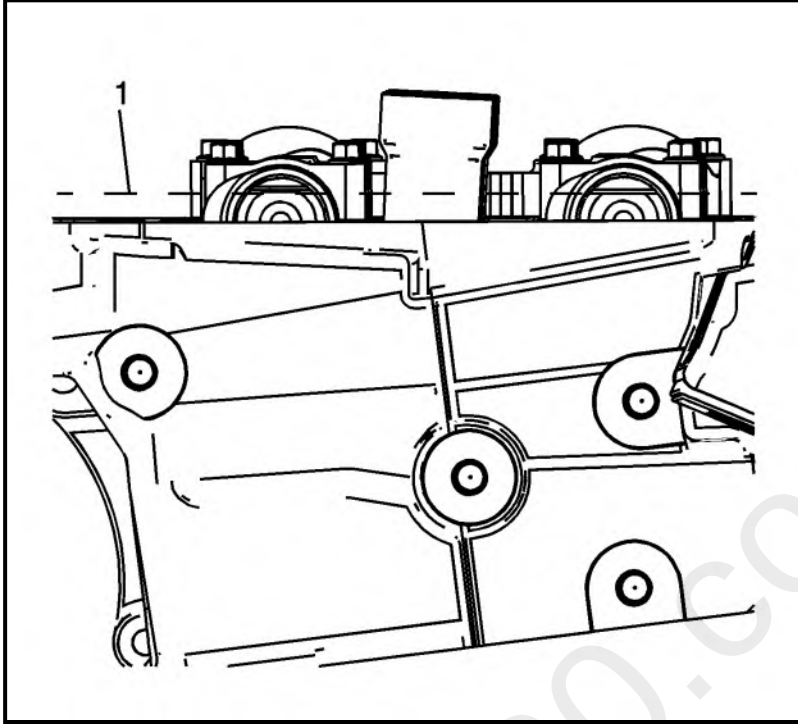
Special Tools

EN-48313 Timing Chain Retention Tool

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

Removal Procedure

1.



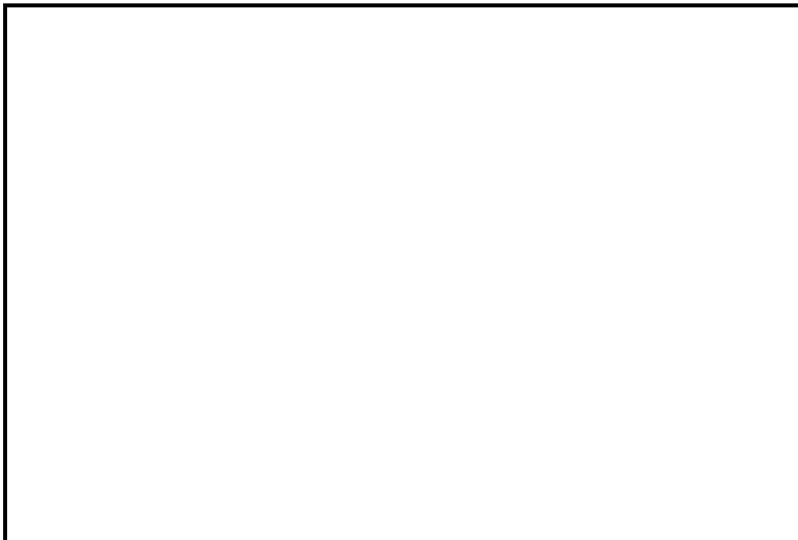
Remove the left camshaft cover. Refer to [Camshaft Cover Replacement - Left Side](#).

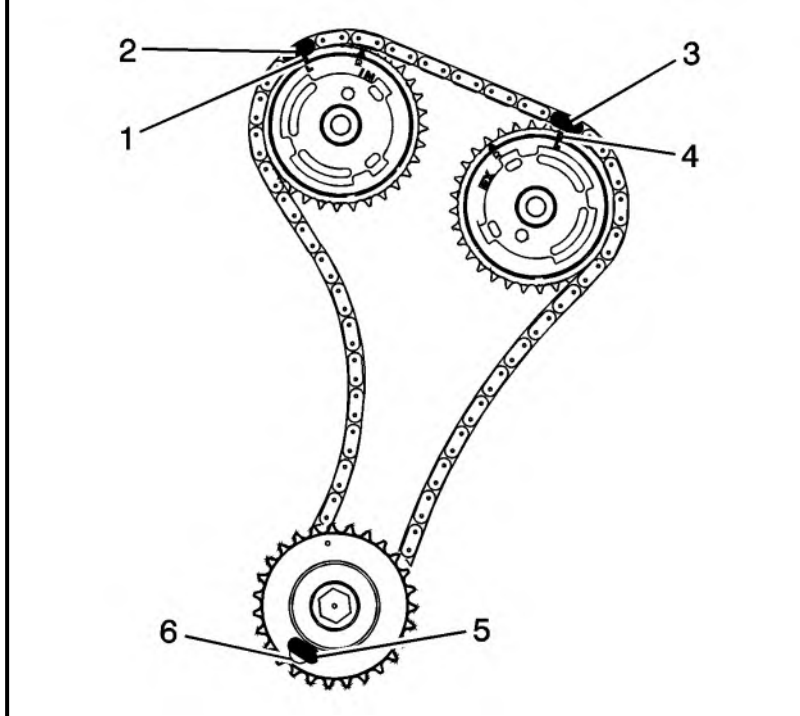
2. Remove the left intake and exhaust camshaft position sensors. Refer to [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Intake](#), and [Camshaft Position Sensor Replacement - Bank 2 \(Left Side\) Exhaust](#).
3. Remove the left intake and exhaust camshaft position actuator solenoids. 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](#).

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

4. 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).

5.





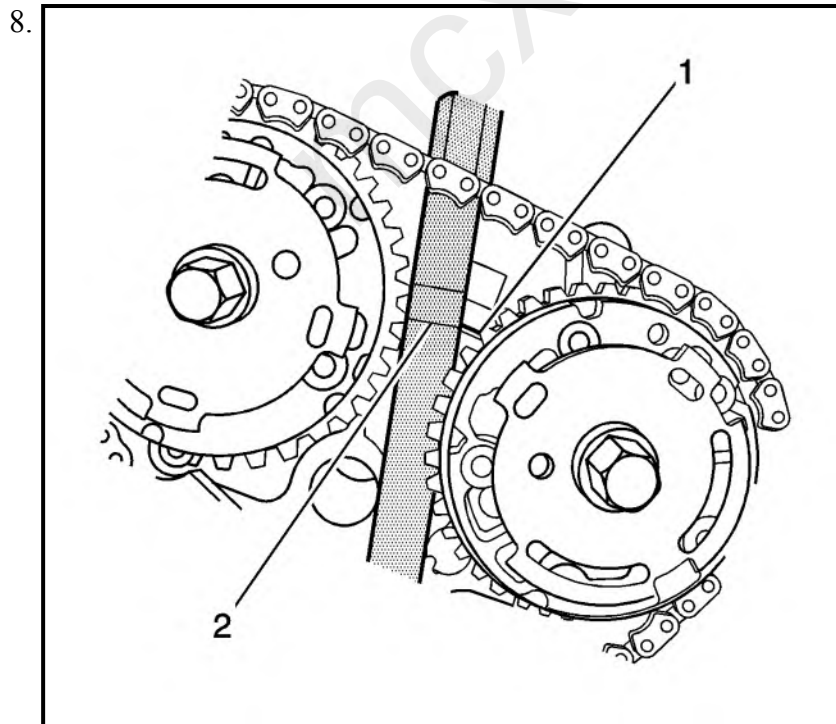
NOTE: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

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).

6. 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](#) .

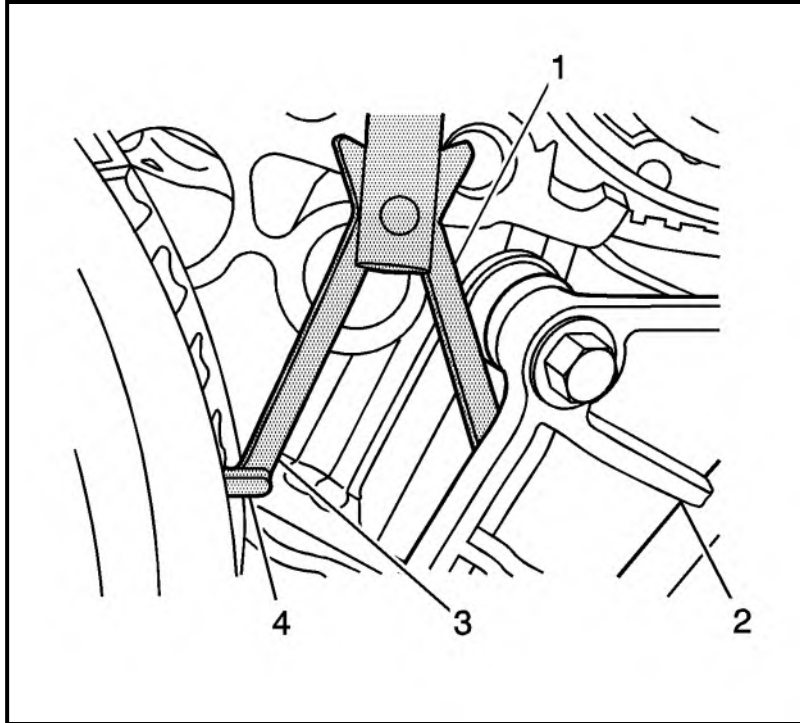
7. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.



Unscrew the **EN-48313** tool so that the legs of the tool are retracted.

9. Insert the **EN-48313** tool 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.

10.

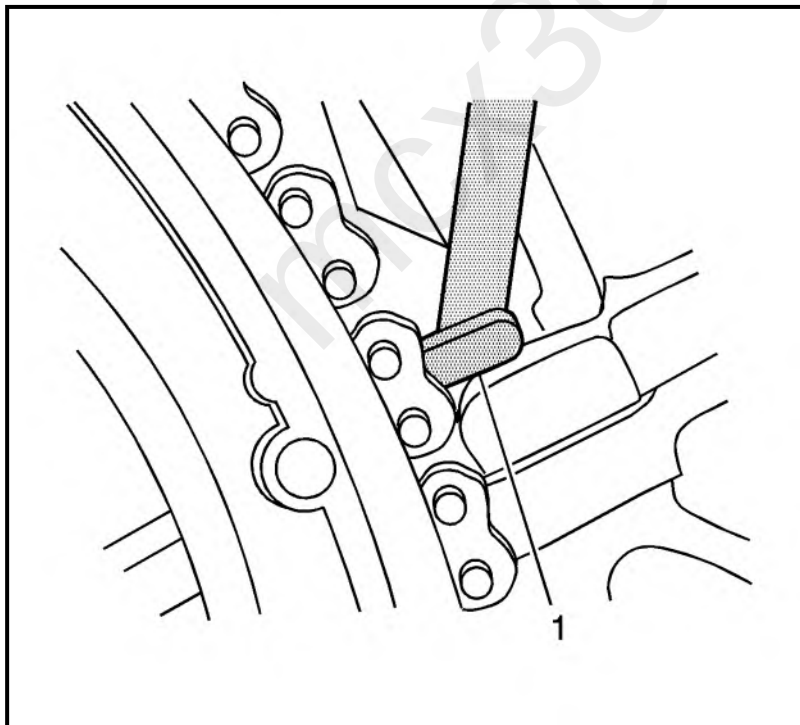


NOTE: The engine front cover is removed for clarity in the following graphics, but NOT required to perform the procedure.

Ensure that the feet (4) on the legs of the tool are facing the front of the engine.

11. Partially expand the legs (1, 3) of the **EN-48313** tool by turning the T-shaped handle clockwise.
12. Insert the leg of the tool (1) behind the timing chain guide (2).
13. Continue expanding the **EN-48313** tool until the legs (1, 3) contact the timing chain. Do not tighten at this time.

14.

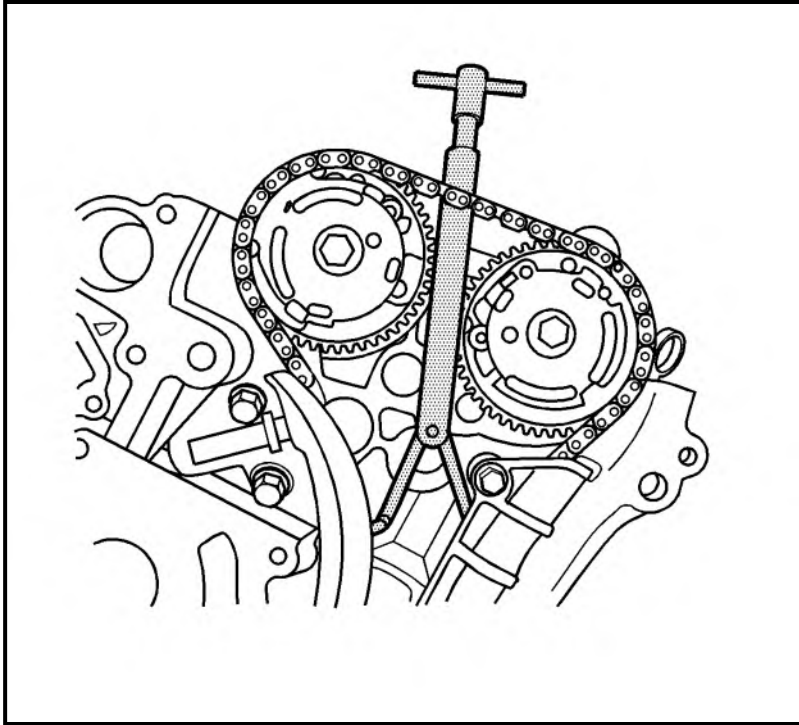


NOTE: Ensure that the foot (1) of the EN-48313 tool is engaged into one of the link pockets to prevent tool slippage during tightening of the EN-48313 tool.

Hand tighten the **EN-48313** tool.

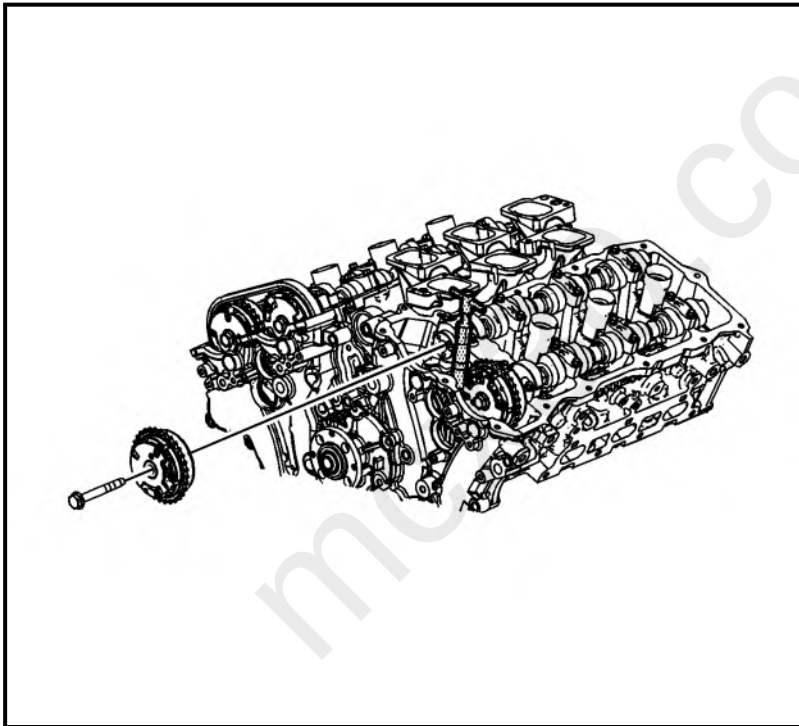
15. Use an open end wrench on the hex cast into the left intake and exhaust camshafts and rotate the camshafts toward each other in order to create slack in the chain between the actuators.

16.



The **EN-48313** tool is now properly installed to hold the timing chain in position.

17.



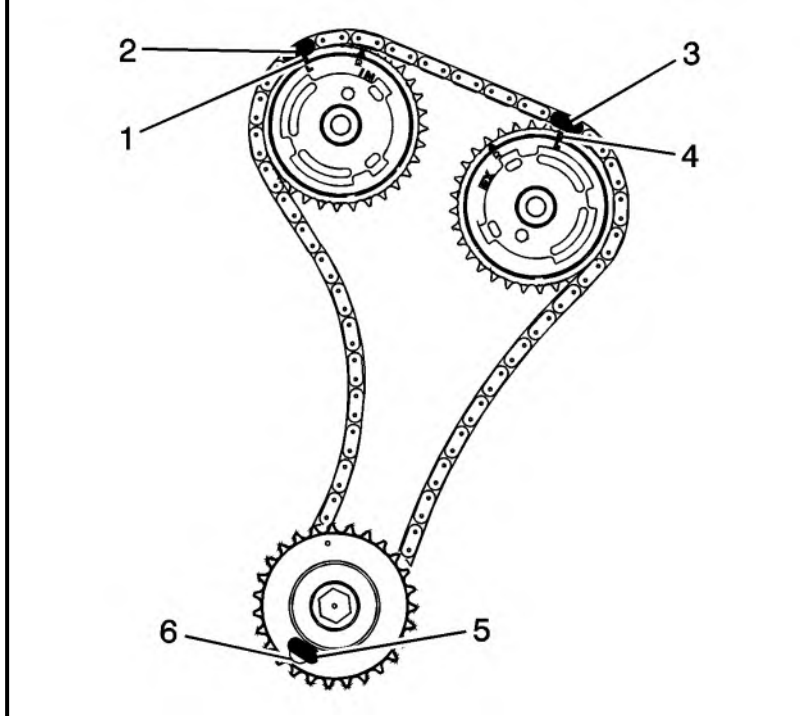
Use an open end wrench on the hex cast into the camshaft in order to prevent engine rotation when loosening the camshaft position actuator bolt.

18. If replacing the exhaust camshaft position actuator, then remove the bolt and the actuator.
19. If replacing the intake camshaft position actuator, then remove the bolt and the actuator.
20. If removing both the exhaust and intake camshaft actuators, the timing chain can be draped over the **EN-48313** tool once the actuators have been removed.
21. 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.
22. Remove the camshaft thrust washer.

Installation Procedure

1.

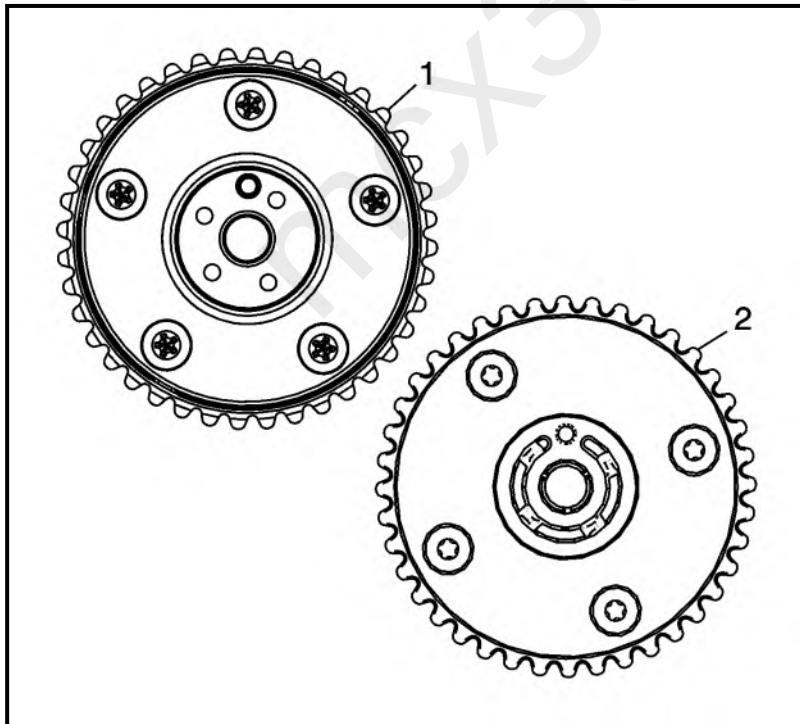




NOTE: Ensure that the camshaft timing chain and the camshaft position actuators are marked for proper assembly.

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 tool.
- 5.



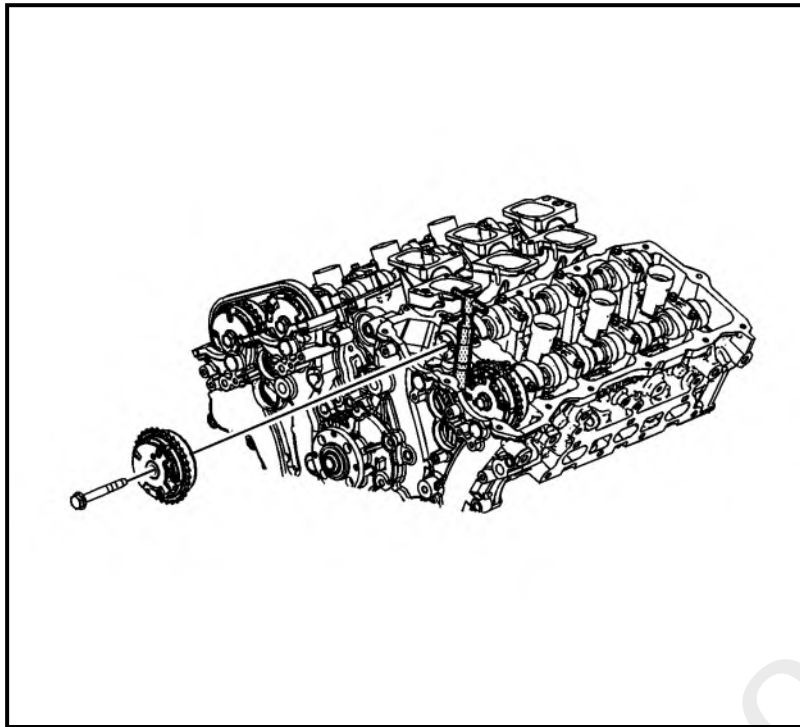
NOTE:

- The camshaft position actuator will vary depending on application.
- Camshaft thrust washers must only be installed on applications that had thrust washers present during removal of the camshaft position actuators. Do not install washers on applications if they are not already present.

If equipped, ensure the proper camshaft thrust washer is used. Use a 1.6 mm (0.063 in) thrust washer on applications that have 5 attaching screws on the back side of the camshaft position actuator (1). Use a 1.1 mm (0.043 in) thick thrust washer with yellow speckles on applications that have 4 attaching screws on the back side of the camshaft position actuator (2).

6. Install the thrust washer, if applicable.

7.



CAUTION: Refer to [Fastener Caution](#) .

If the exhaust camshaft position actuator has been replaced, then tighten the bolt to 58 N.m (43 lb ft).

8. If the intake camshaft position actuator has been replaced, then tighten the bolt to 58 N.m (43 lb ft).
9. If both the exhaust and intake has been replaced, then tighten bolt to 58 N.m (43 lb ft).
10. 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](#) .
11. 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](#) .
12. Install the left camshaft cover. Refer to [Camshaft Cover Replacement - Left Side](#).

SETTING CAMSHAFT TIMING

NOTE: 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 Intermediate Drive Chain Replacement - Left Side](#).

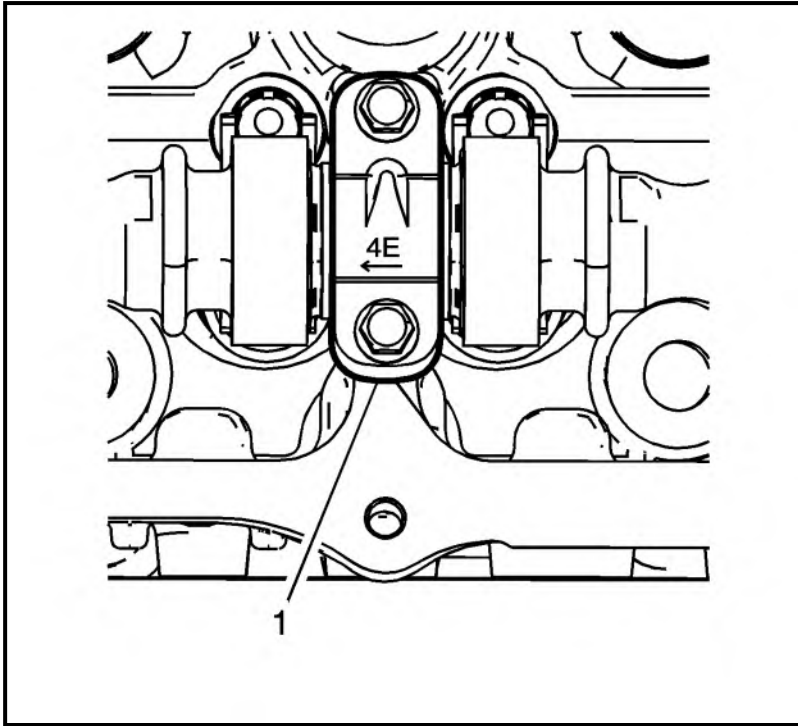
CAMSHAFT REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the fuel pump. Refer to [Fuel Pump Replacement](#) .

2. Remove the camshaft position actuators. Refer to [Camshaft Position Actuator Replacement - Bank 2](#).

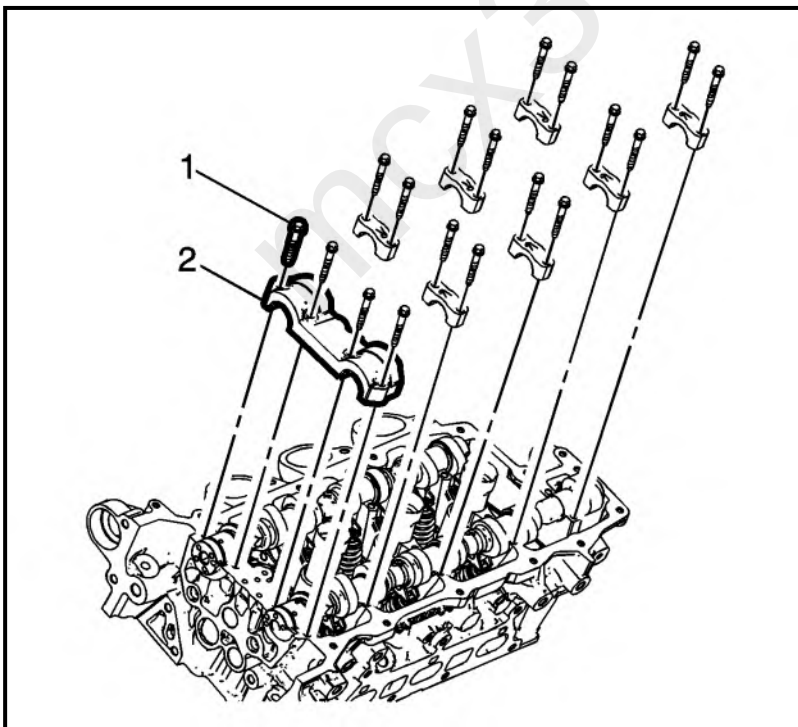
3.



Observe the markings on the bearing caps (1). Each bearing cap is marked in order to identify its location. The markings have the following meanings:

- The raised feature must always be oriented toward the center of the cylinder head.
- The I indicates the intake camshaft.
- The E indicates the exhaust camshaft.
- The number indicates the journal position from the front of the engine.

4.

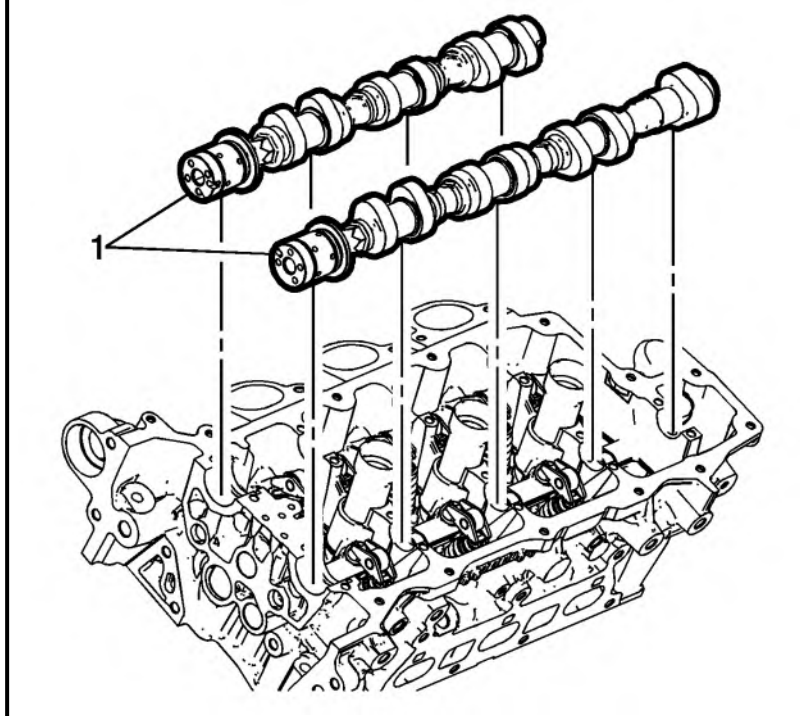


Remove the camshaft bearing cap bolts (1).

5. Remove the camshaft bearing caps (2).

6.

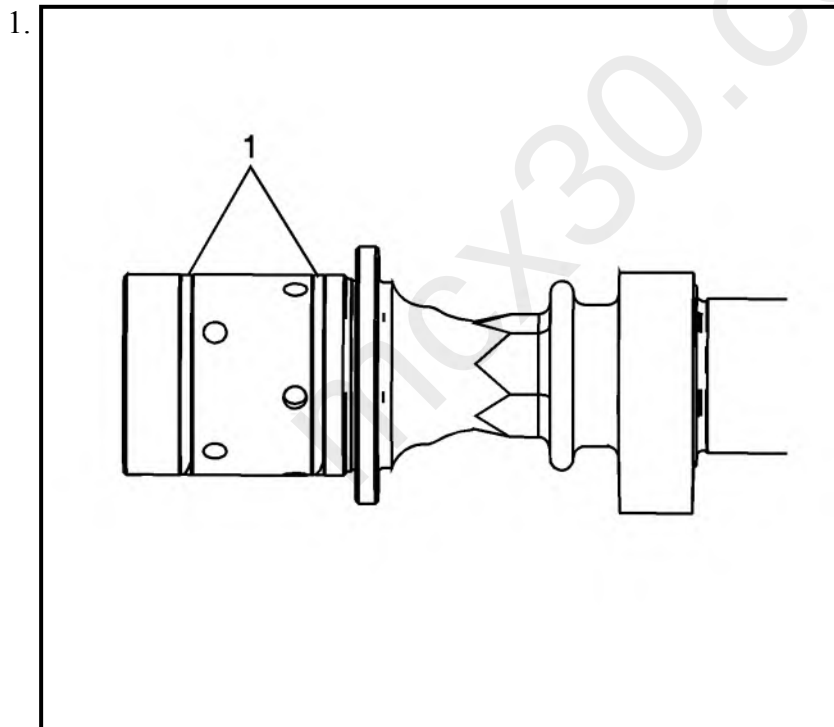




NOTE: Mark the camshafts upon removal to ensure installation is in the correct position.

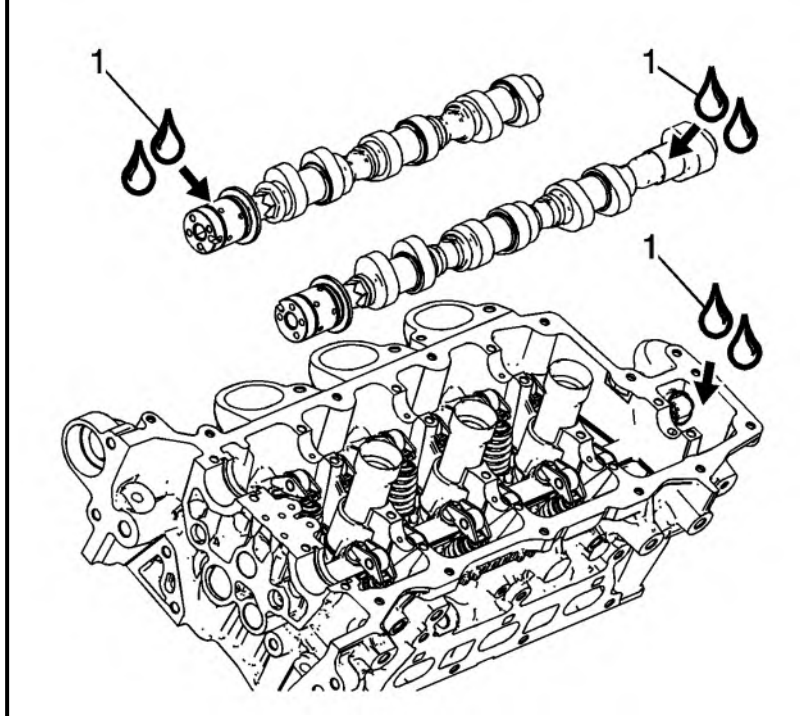
Remove the camshafts (1).

Installation Procedure

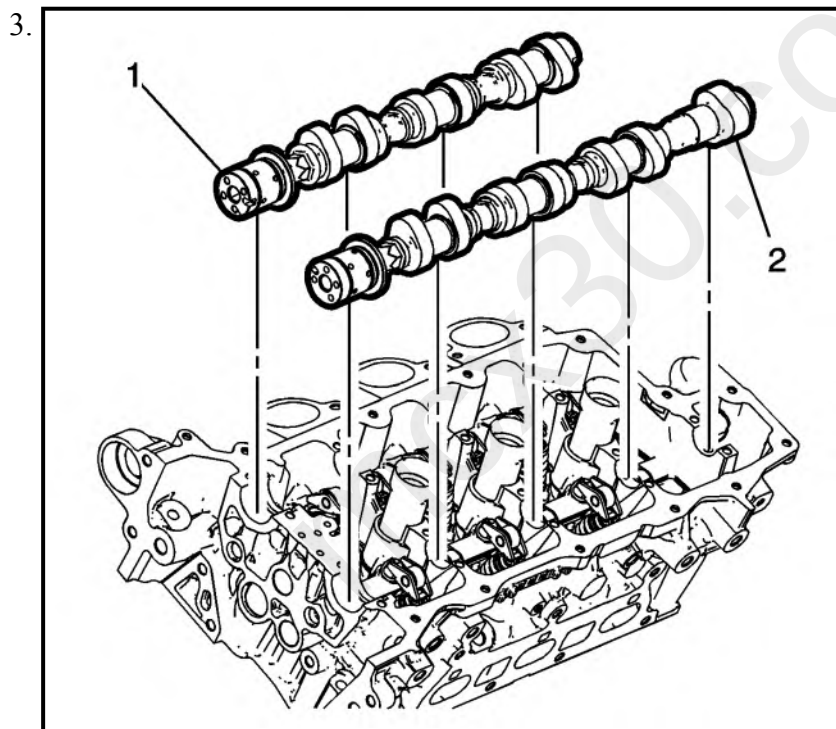


Ensure that the camshaft sealing rings (1) are in place in the camshaft grooves. Camshaft sealing rings must be in place below the surface of the camshaft journal in order to avoid being pinched between the cylinder head and the camshaft caps.



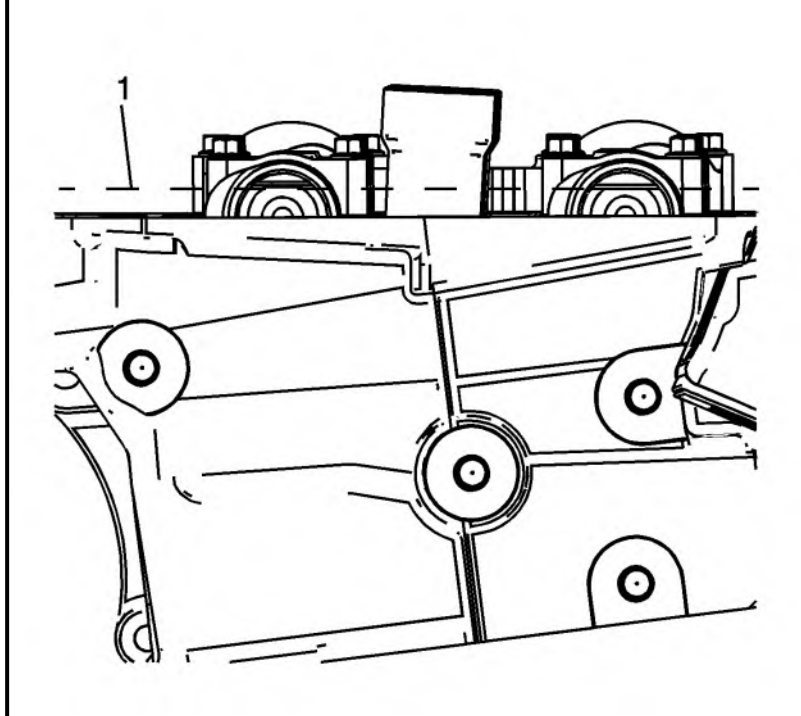


Apply a liberal amount of lubricant (1) to the camshaft journals and the left cylinder head camshaft carriers. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) for recommended lubricant.

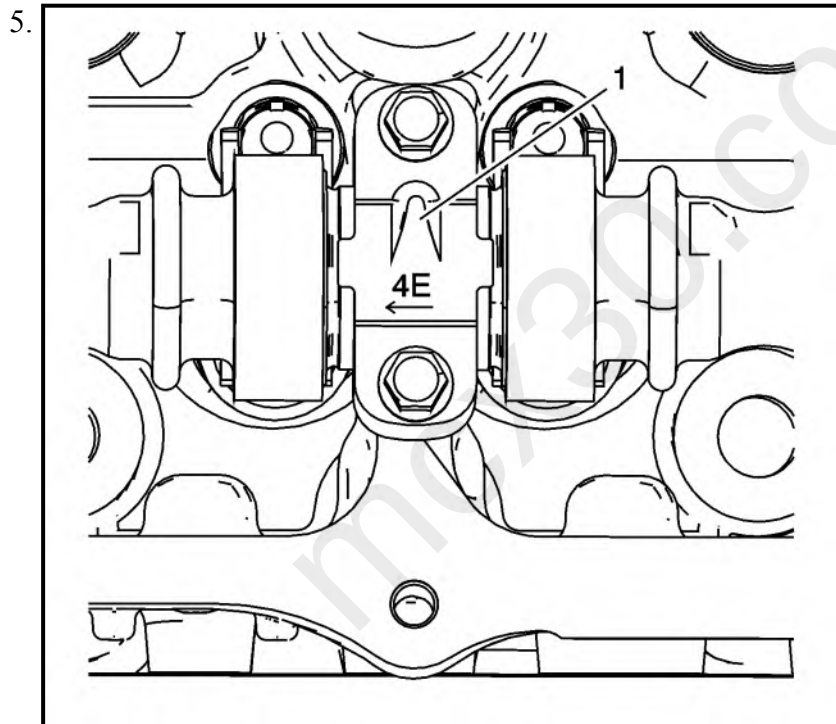


Place the left intake (1) and left exhaust (2) camshafts in position in the left cylinder head.





Position the camshaft lobes in a neutral position with the flats on the back of the camshafts up and parallel (1) with the left cylinder head camshaft cover rail.



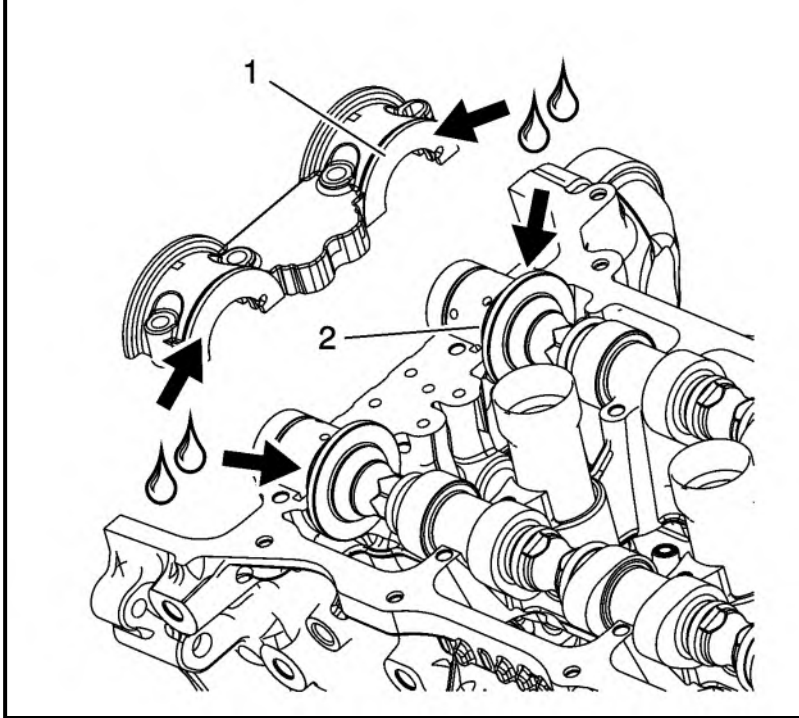
Observe the markings on the left cylinder head camshaft bearing caps. Each bearing cap is marked in order to identify its location. The markings have the following meanings:

- The raised feature (1) must always be oriented toward the center of the cylinder head.
- The I indicates the intake camshaft.
- The E indicates the exhaust camshaft.
- The number 2, 4, 6 indicates the cylinder position from the front of the engine.

6. Apply a liberal amount of lubricant to the camshaft bearing caps. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) for recommended lubricant.

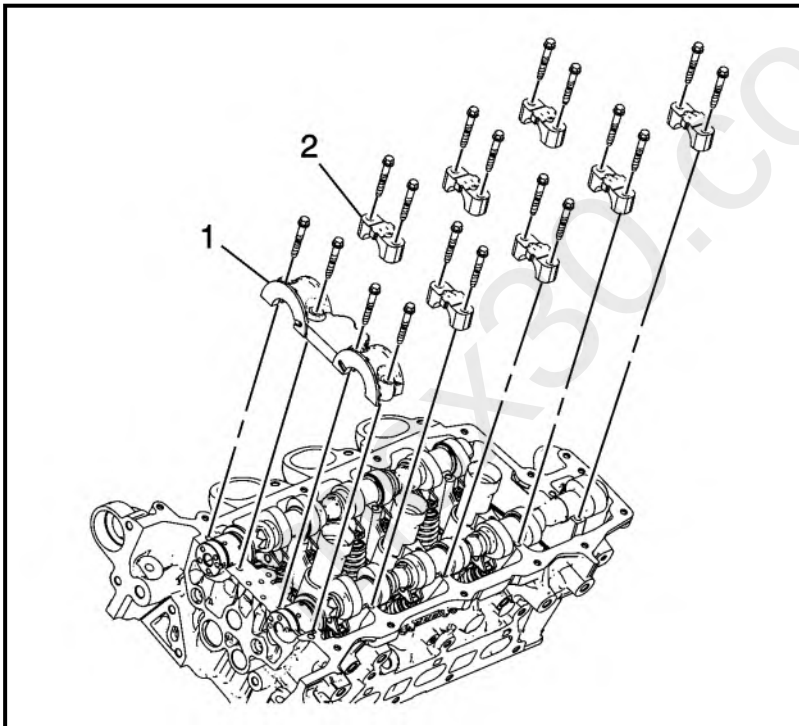
7.





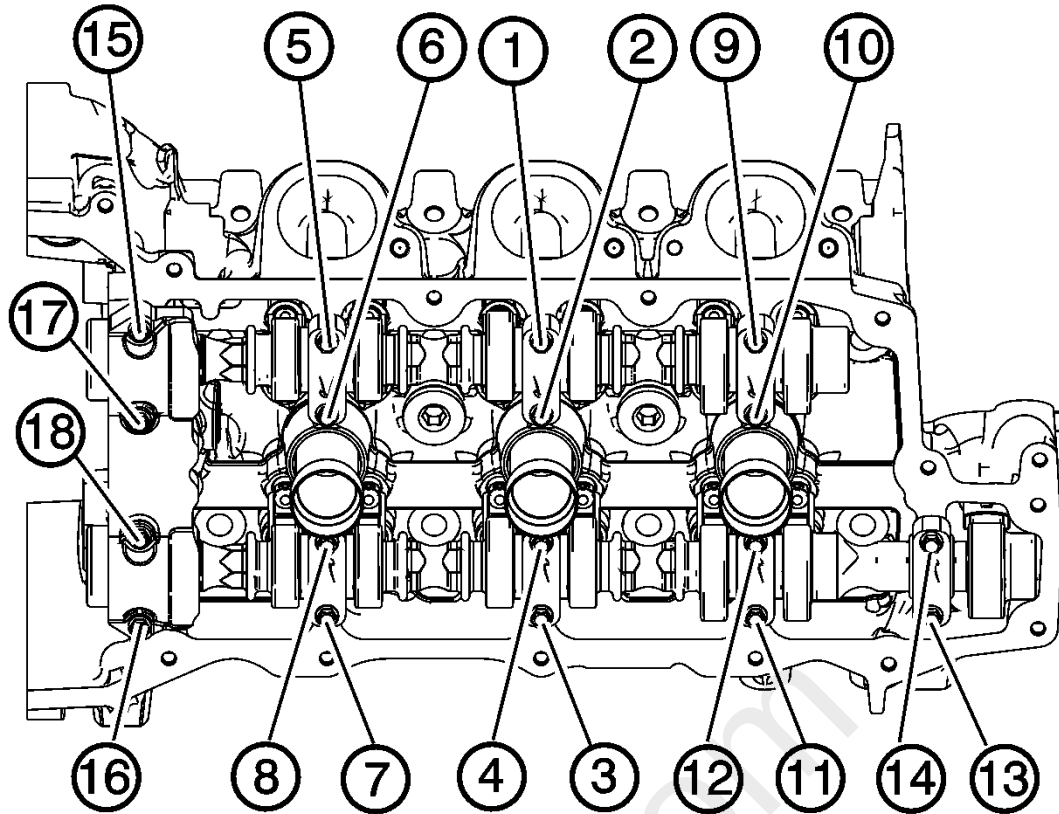
Apply a liberal amount of lubricant to the camshaft bearing cap (1) and camshaft thrust surface (2). Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) for recommended lubricant.

8.



Install the camshaft bearing thrust cap (1) in the first journal of the left cylinder head.

9. Install the remaining bearing caps (2) with their orientation mark toward the center of the cylinder head.
10. Hand start all the camshaft bearing cap bolts.



11.

Fig. 8: Camshaft Bearing Cap Bolt Tightening Sequence

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

Tighten the camshaft bearing cap bolts in the sequence shown and tighten to 10 N.m (89 lb in).

12. Loosen the center intake camshaft bearing cap bolts 1, 2 and the center exhaust camshaft bearing cap bolts 3, 4.
13. Retighten the center camshaft bearing cap bolts 1, 2, 3, 4 and retighten the camshaft bearing cap bolts to 10 N.m (89 lb in).
14. Install the camshaft position actuators. Refer to [Camshaft Position Actuator Replacement - Bank 2](#).
15. Install the fuel pump. Refer to [Fuel Pump Replacement](#) .

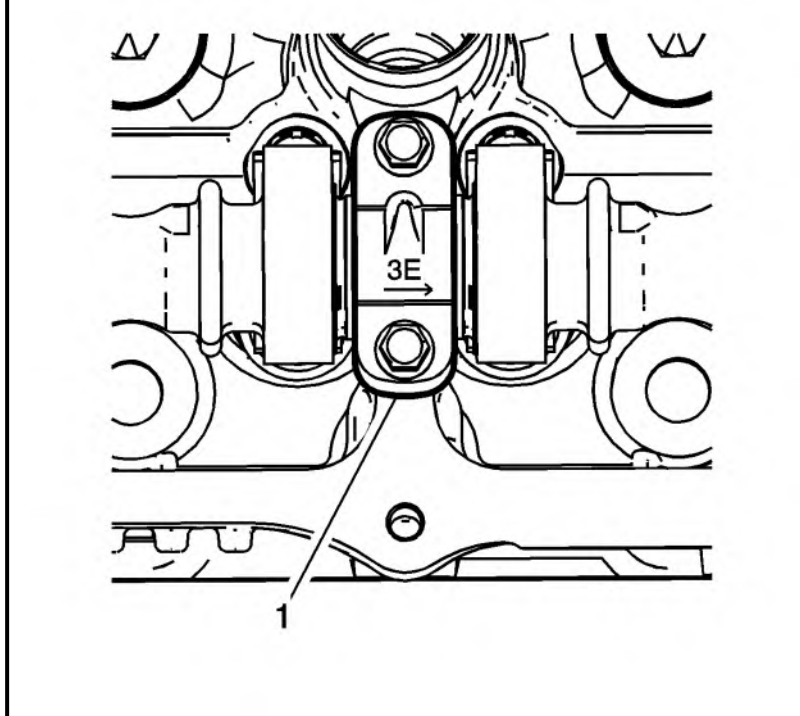
CAMSHAFT REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Remove the camshaft position actuators. Refer to [Camshaft Position Actuator Replacement - Bank 1](#).

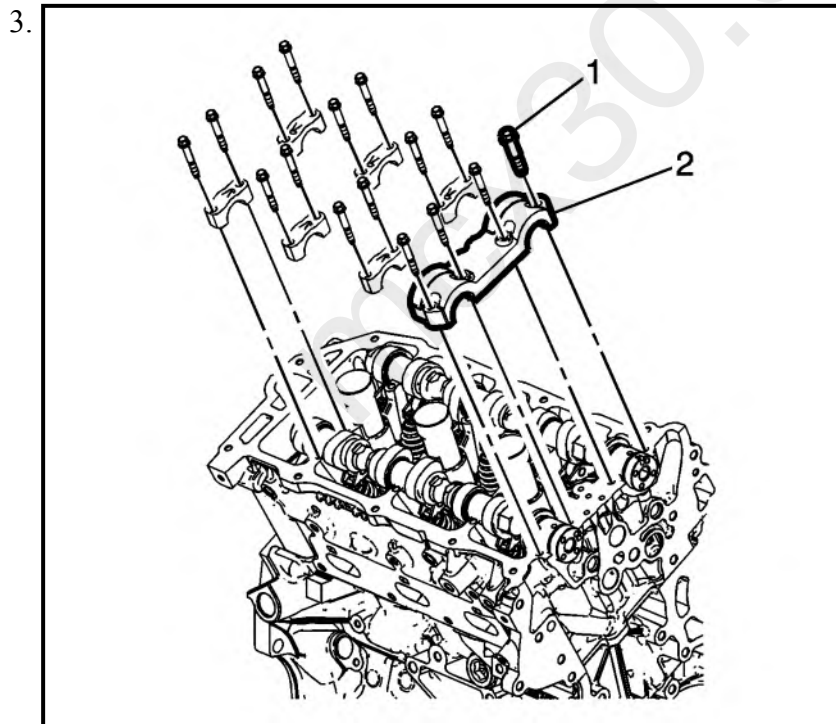
2.





Observe the markings on the bearing caps (1). Each bearing cap is marked in order to identify its location. The markings have the following meanings:

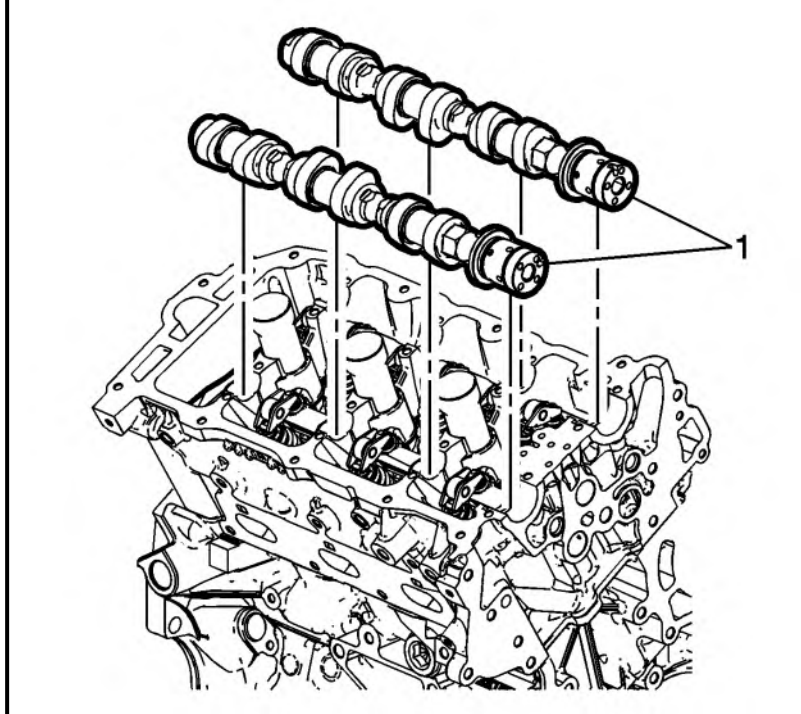
- The raised feature must always be oriented toward the center of the cylinder head.
- The I indicates the intake camshaft.
- The E indicates the exhaust camshaft.
- The number indicates the journal position from the front of the engine.



Remove the camshaft bearing cap bolts (1).

4. Remove the camshaft bearing caps (2).

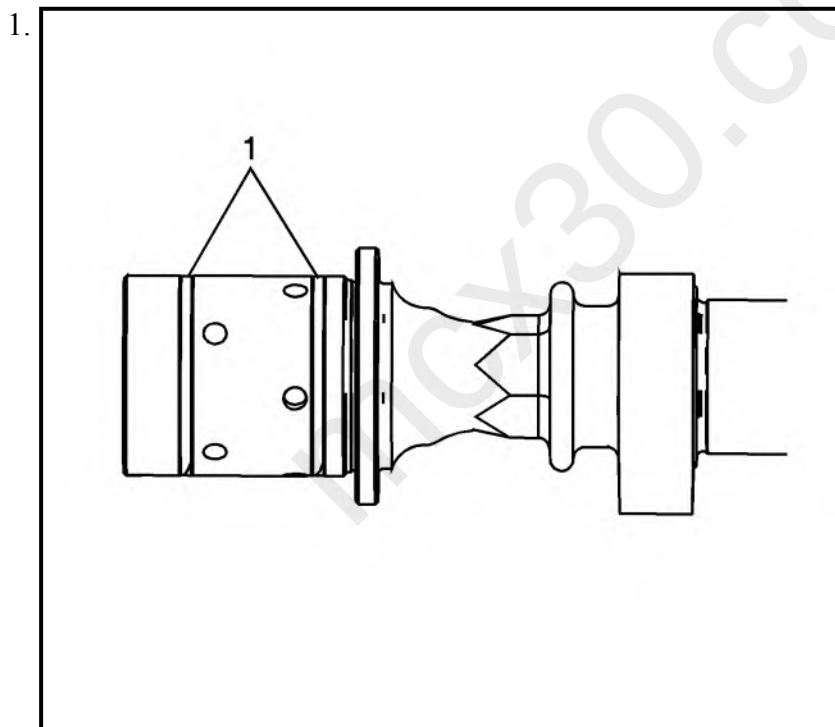




IMPORTANT: Mark the camshafts upon removal to ensure installation is in the correct position.

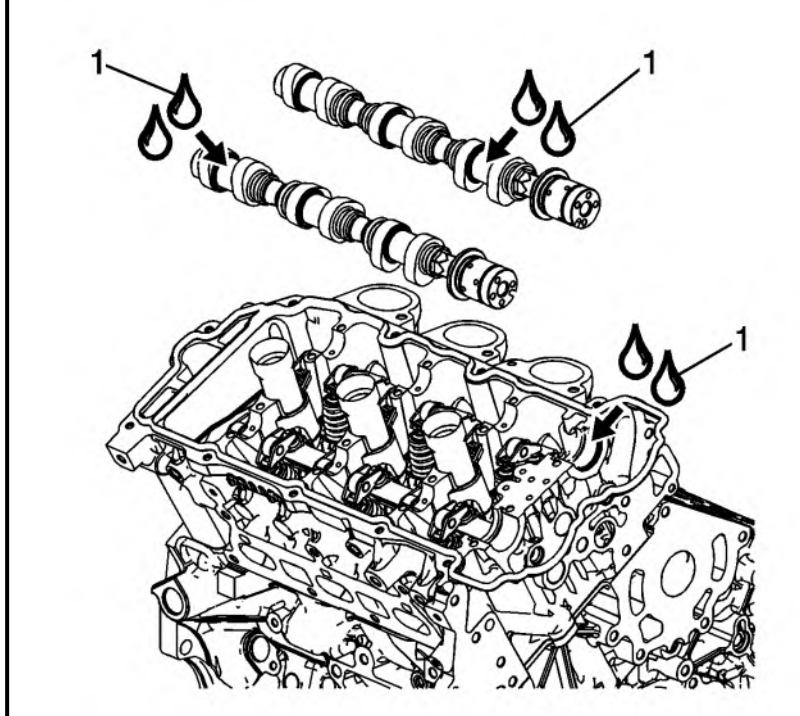
Remove the camshafts (1).

Installation Procedure

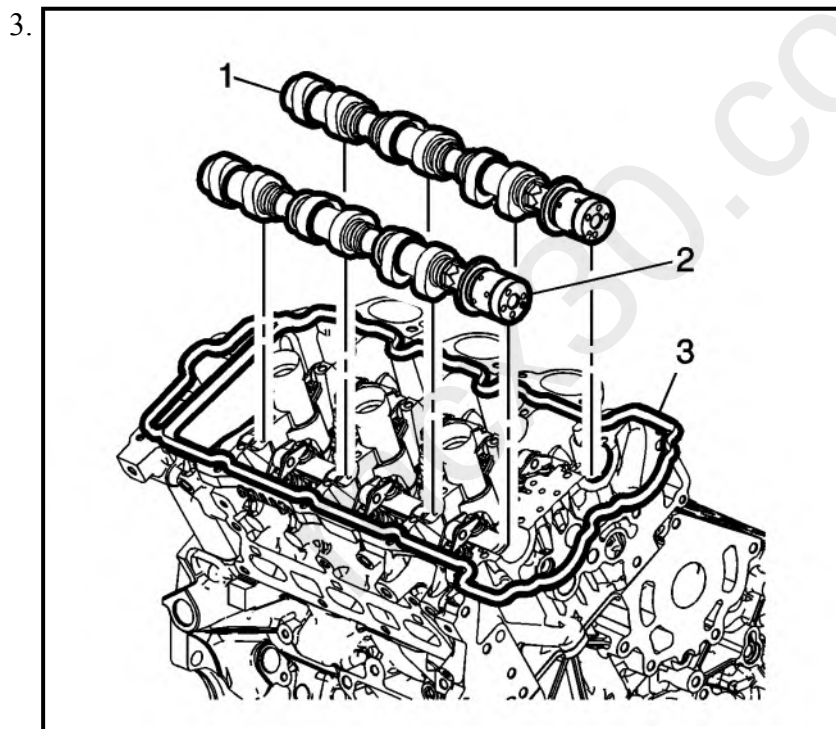


Ensure that the camshaft sealing rings (1) are in place in the camshaft grooves. Camshaft sealing rings must be in place below the surface of the camshaft journal in order to avoid being pinched between the cylinder head and the camshaft caps.



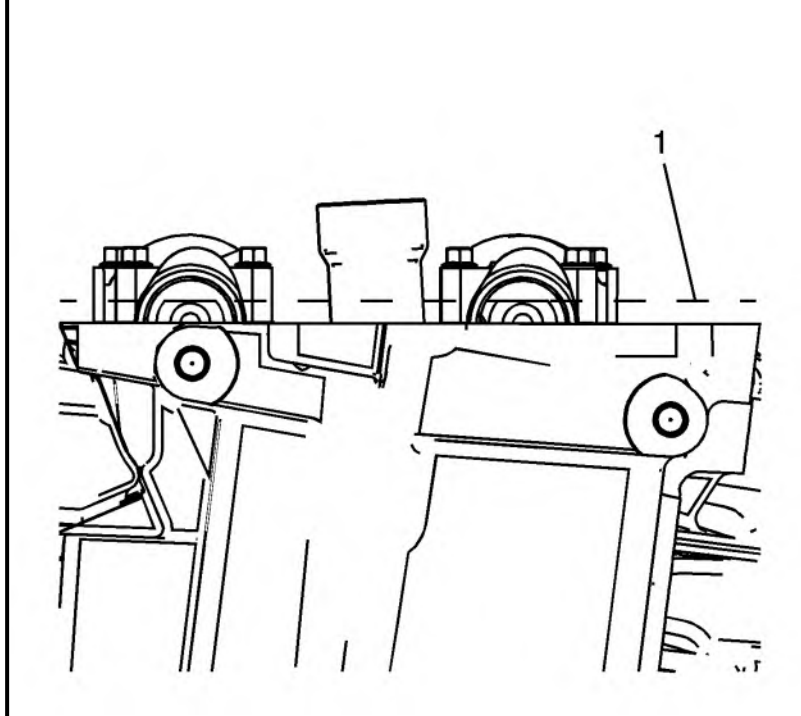


Apply a liberal amount of lubricant (1) to the camshaft journals and the right cylinder head camshaft carriers. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) for recommended lubricant.

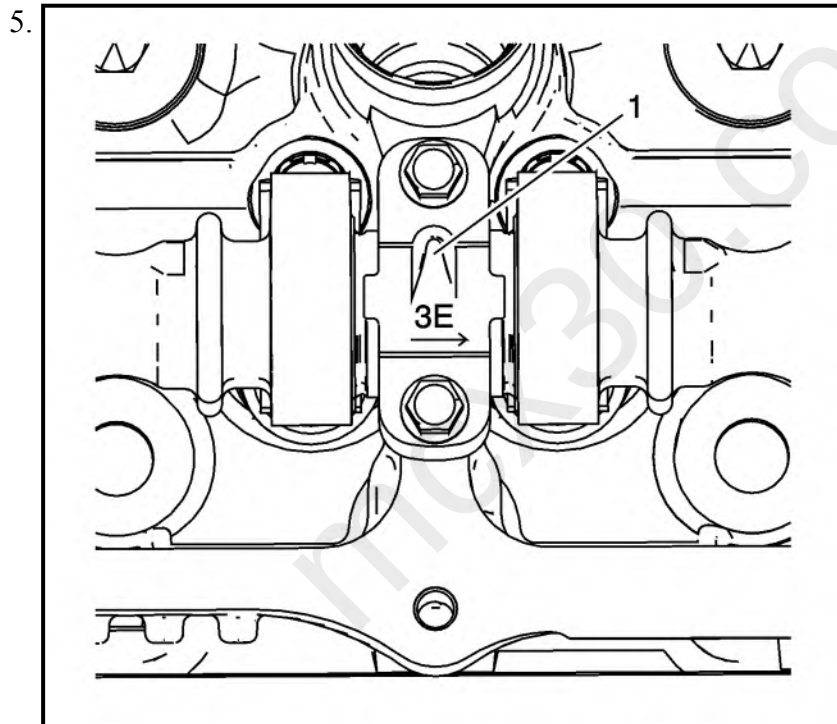


Place the right intake (1) and right exhaust (2) camshafts in position in the right cylinder head (3).





Position the camshaft lobes in a neutral position with the flats on the back of the camshafts up and parallel (1) with the right cylinder head camshaft cover rail.

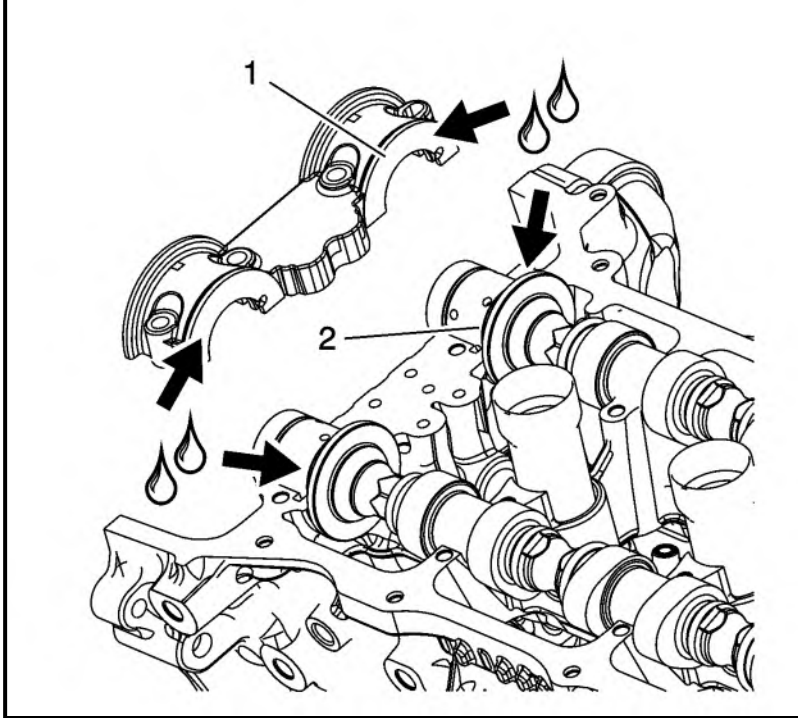


Observe the markings on the right cylinder head camshaft bearing caps. Each bearing cap is marked in order to identify its location. The markings have the following meanings:

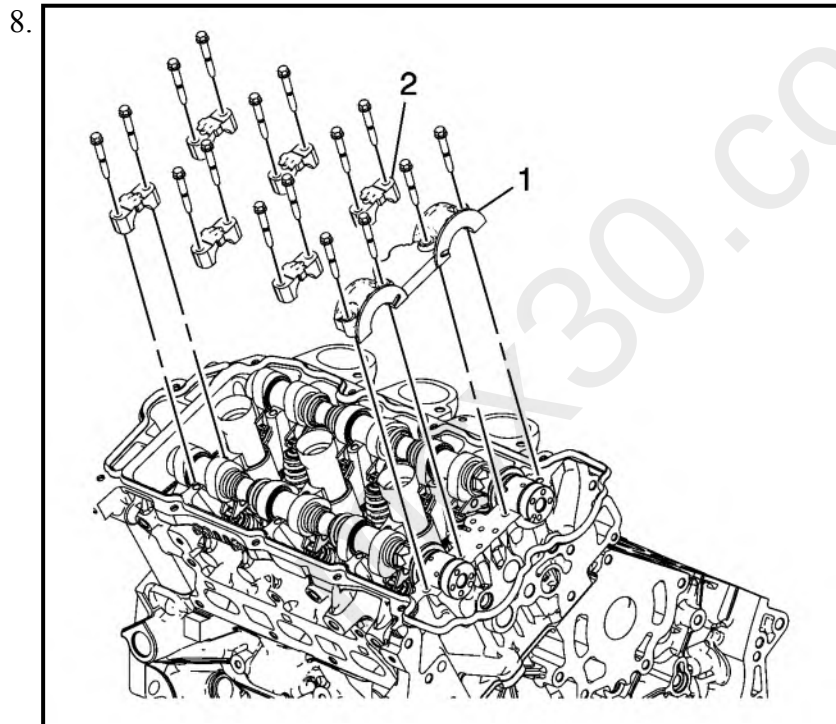
- The raised feature (1) must always be oriented toward the center of the cylinder head.
- The I indicates the intake camshaft.
- The E indicates the exhaust camshaft.
- The number 1, 3, 5 indicates the cylinder position from the front of the engine.

6. Apply a liberal amount of lubricant to the camshaft bearing caps. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) for recommended lubricant.



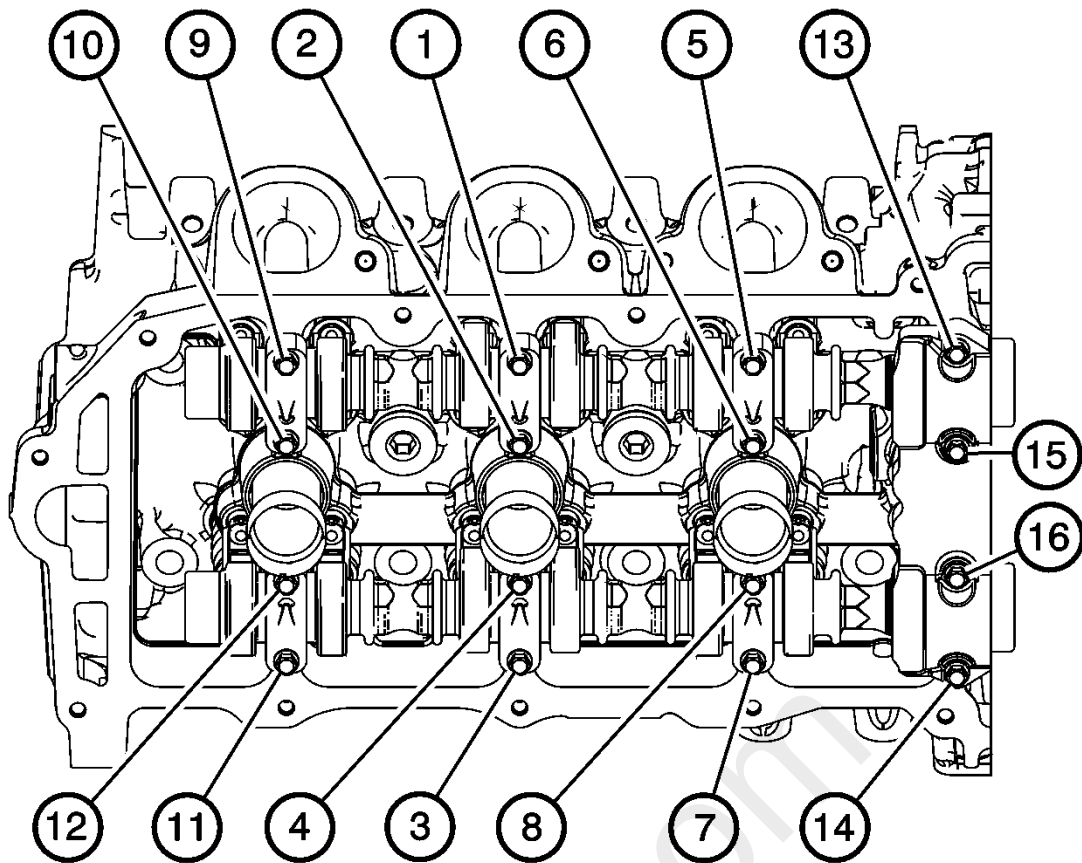


Apply a liberal amount of lubricant to the camshaft bearing cap (1) and camshaft thrust surface (2). Refer to [Adhesives, Fluids, Lubricants, and Sealers](#) for recommended lubricant.



Install the camshaft bearing thrust caps (1) in the first journal of the right cylinder head.

9. Install the remaining bearing caps (2) with their orientation mark toward the center of the cylinder head.
10. Hand start all the camshaft bearing cap bolts.



11.

Fig. 9: Camshaft Bearing Cap Bolt Tightening Sequence

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

Tighten the camshaft bearing cap bolts in the sequence shown and tighten to 10 N.m (89 lb in).

12. Loosen the center intake camshaft bearing cap bolts (1, 2) and the center exhaust camshaft bearing cap bolts (3, 4).
13. Retighten the center camshaft bearing cap bolts (1, 2, 3, 4) and retighten the camshaft bearing cap bolts to 10 N.m (89 lb in).
14. Install the camshaft position actuators. Refer to Camshaft Position Actuator Replacement - Bank 1.

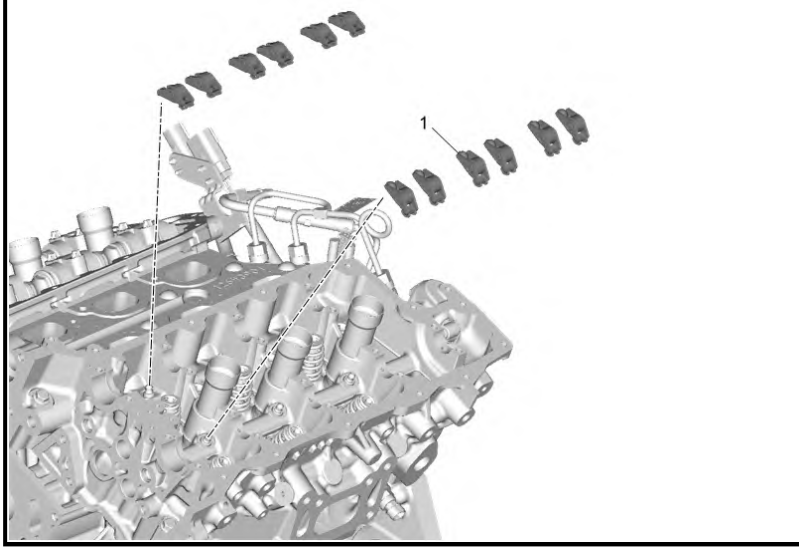
VALVE ROCKER ARM REPLACEMENT - LEFT SIDE

Removal Procedure

1. Camshaft - Remove - Camshaft Replacement - Left Side

2.



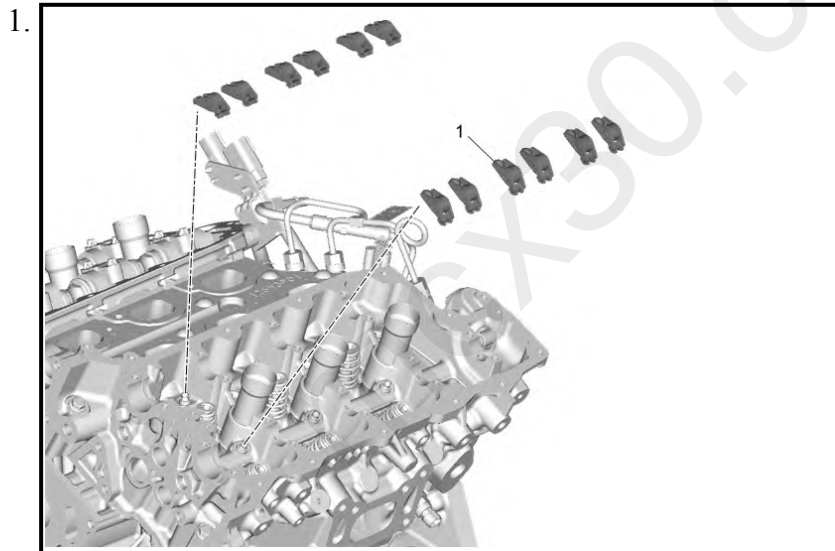


NOTE: If the rocker arms are to be reused, keep in order so they can be reinstalled in the same position.

Valve Rocker Arm (1) - Remove [12x]

3. Clean and inspect the camshafts and the rocker arms. Replace as necessary. [Camshaft Cleaning and Inspection](#) , and [Valve Rocker Arm Cleaning and Inspection](#)
4. Clean and inspect the valve lifters and replace as necessary. [Valve Lifter Cleaning and Inspection](#)

Installation Procedure



Valve Rocker Arm (1) - Install [Valve Rocker Arm Installation - Left Side](#) [12x]

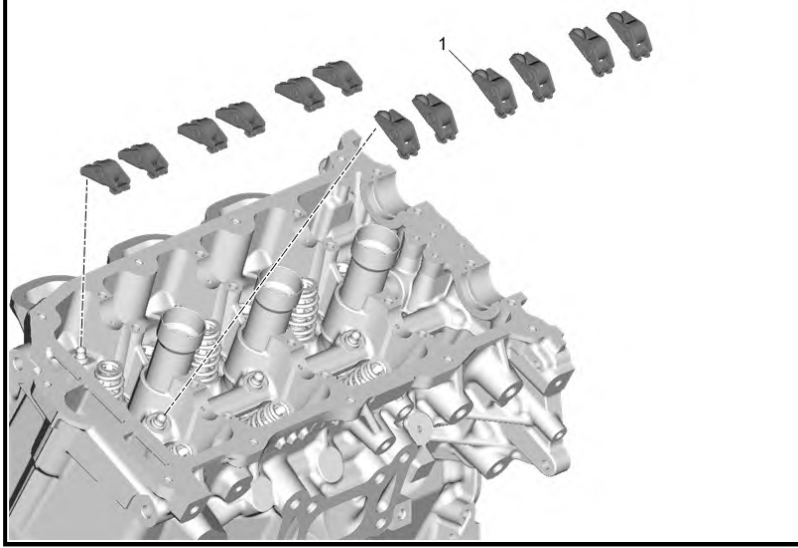
2. Camshaft - Install - [Camshaft Replacement - Left Side](#)

VALVE ROCKER ARM REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Camshaft - Remove - [Camshaft Replacement - Right Side](#)



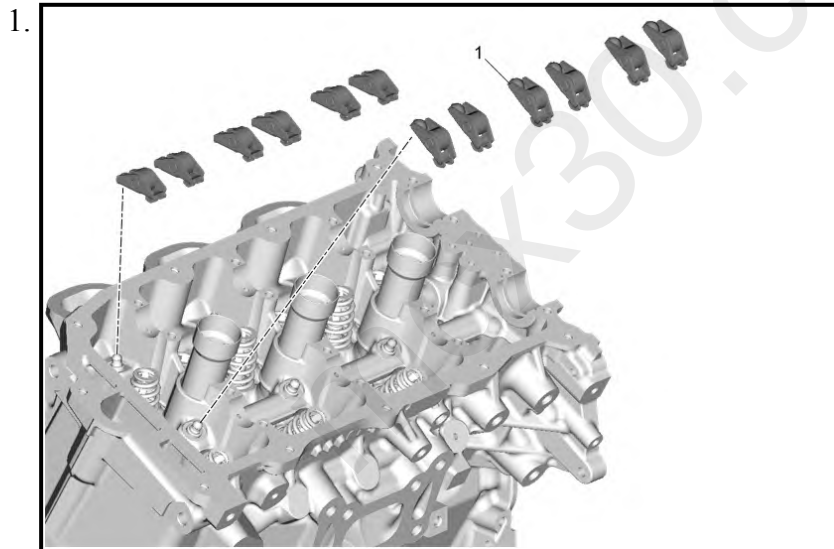


NOTE: If the rocker arms are to be reused, keep in order so they can be reinstalled in the same position.

Valve Rocker Arm (1) - Remove [12x]

3. Clean and inspect the camshafts and the rocker arms. Replace as necessary. [Camshaft Cleaning and Inspection](#) , and [Valve Rocker Arm Cleaning and Inspection](#)
4. Clean and inspect the valve lifters and replace as necessary. [Valve Lifter Cleaning and Inspection](#)

Installation Procedure



Valve Rocker Arm (1) - Install - [Valve Rocker Arm Installation - Right Side](#) [12x]

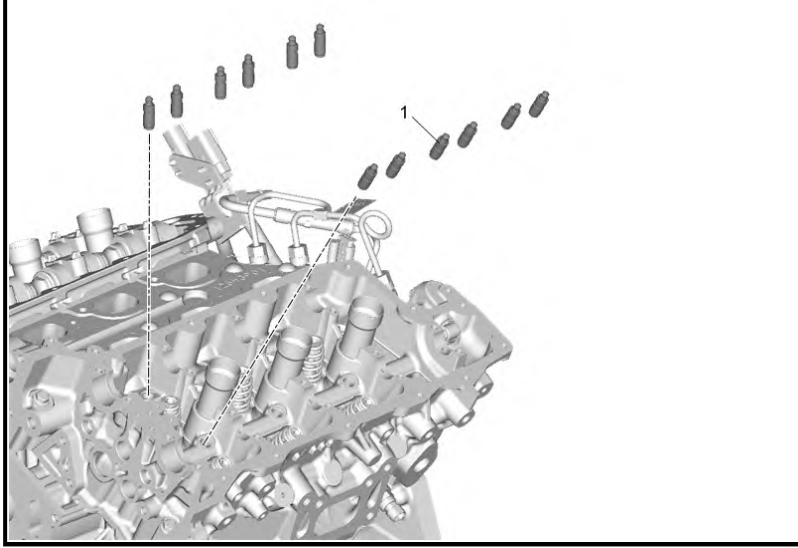
2. Camshaft - Install - [Camshaft Replacement - Right Side](#)

VALVE LIFTER REPLACEMENT - LEFT SIDE

Removal Procedure

1. Remove the camshafts. [Camshaft Replacement - Left Side](#)
2. Remove the rocker arms. [Valve Rocker Arm Replacement - Left Side](#)

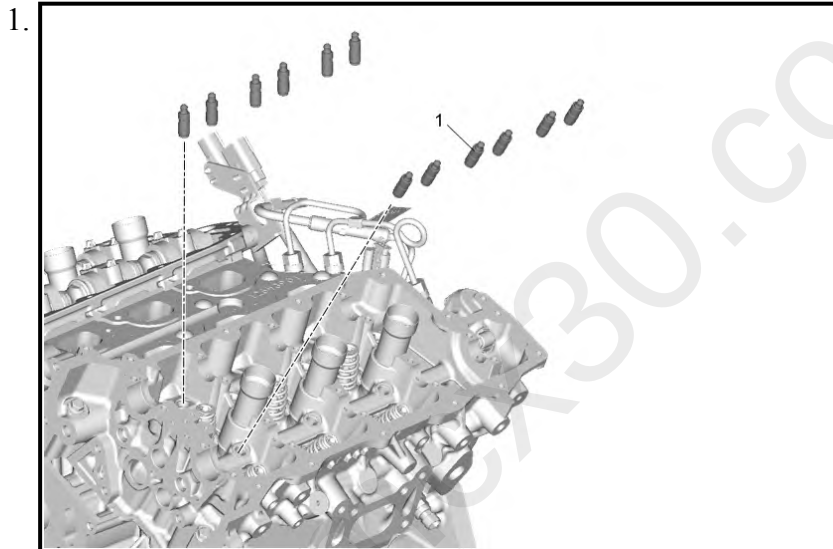




Remove the lifters (1). [Valve Lifter Removal - Left Side](#)

4. Clean and inspect the camshafts, rocker arms and lifters. Repair or replace as necessary. Refer to [Camshaft Cleaning and Inspection](#) , and [Valve Lifter Cleaning and Inspection](#) .
5. Clean and inspect the rocker arm. [Valve Rocker Arm Cleaning and Inspection](#)

Installation Procedure



Install the lifters.

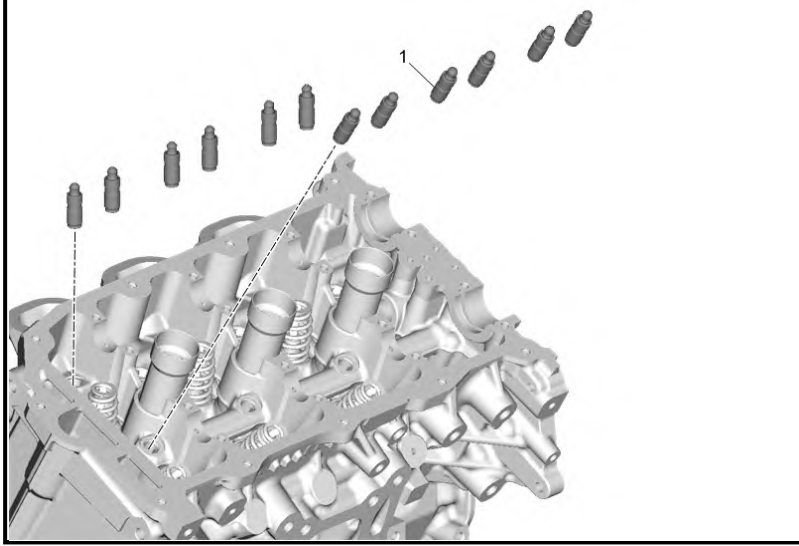
2. Install the rocker arms. [Valve Rocker Arm Replacement - Left Side](#)
3. Install the camshafts. [Camshaft Replacement - Left Side](#)

VALVE LIFTER REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Remove the camshafts. [Camshaft Replacement - Right Side](#)
2. Remove the rocker arms. [Valve Rocker Arm Removal - Right Side](#)

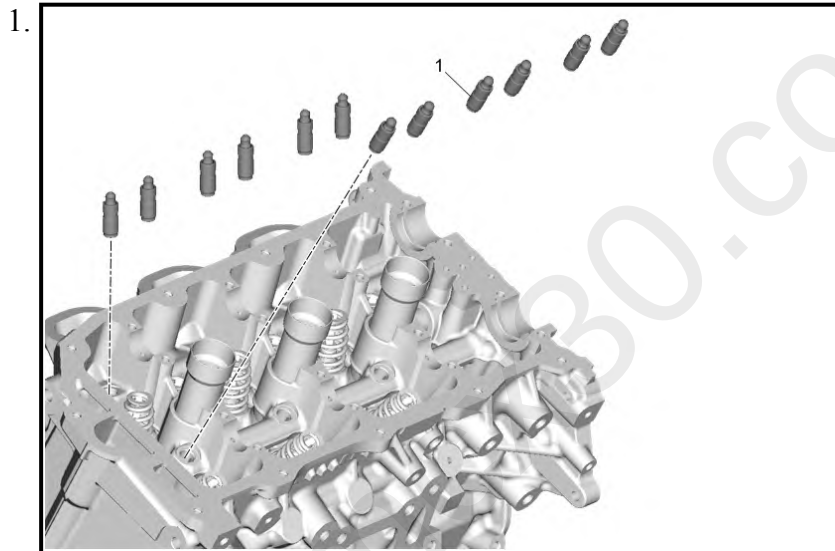




Remove the lifters (1). [Valve Lifter Removal - Right Side](#)

4. Clean and inspect the camshaft (s) and the rocker arm (s) and lifter. Repair or replace as necessary. [Camshaft Cleaning and Inspection](#) , [Valve Lifter Cleaning and Inspection](#) , and [Valve Rocker Arm Cleaning and Inspection](#)

Installation Procedure



Install the lifters (1). [Valve Lifter Installation - Right Side](#)

2. Install the rocker arms. [Valve Rocker Arm Installation - Right Side](#)
3. Install the applicable camshafts. [Camshaft Replacement - Right Side](#)

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT - LEFT SIDE

Special Tools

- EN-39313 Spark Plug Port Adapter
- EN-46106 Flywheel Holding Tool
- EN-46110 On-Vehicle Valve Spring Compressor
- EN-46116 Valve Stem Seal Remover/Installer

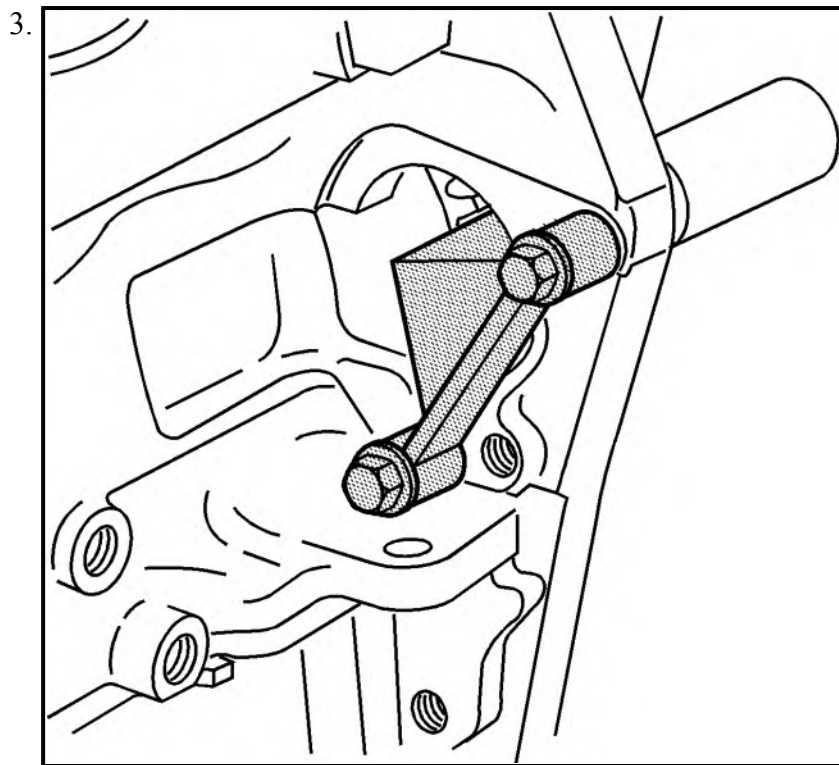
For equivalent regional tools, refer to [Special Tools](#) .

Removal Procedure

NOTE: This procedure is not used in Brazil.

1. Remove the rocker arms. Refer to [Valve Rocker Arm Replacement - Left Side](#).

2. Remove the starter motor. Refer to [Starter Replacement \(LFY\)](#).



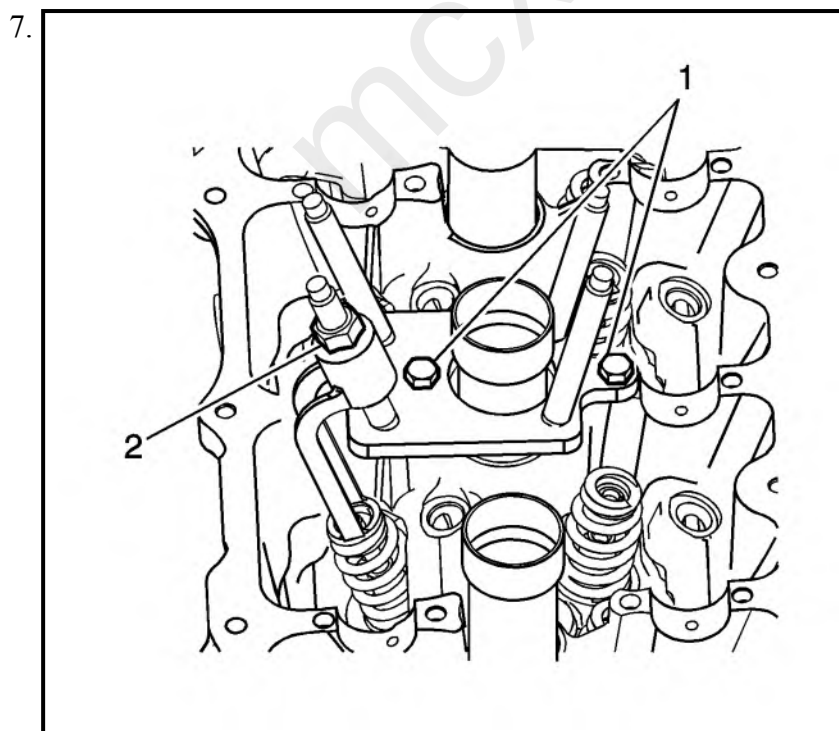
NOTE: If the EN-46106 tool is not installed, the crankshaft may rotate. If the crankshaft rotates, disassembly and reassembly of the entire camshaft timing system may be required.

Install the **EN-46106** tool in order to prevent crankshaft rotation.

4. Remove the spark plug from the applicable cylinder. Refer to [Spark Plug Replacement \(Bank 1\)](#).
[Spark Plug Replacement \(Bank 2\)](#).

5. Install the **EN-39313** adapter to the applicable cylinder.

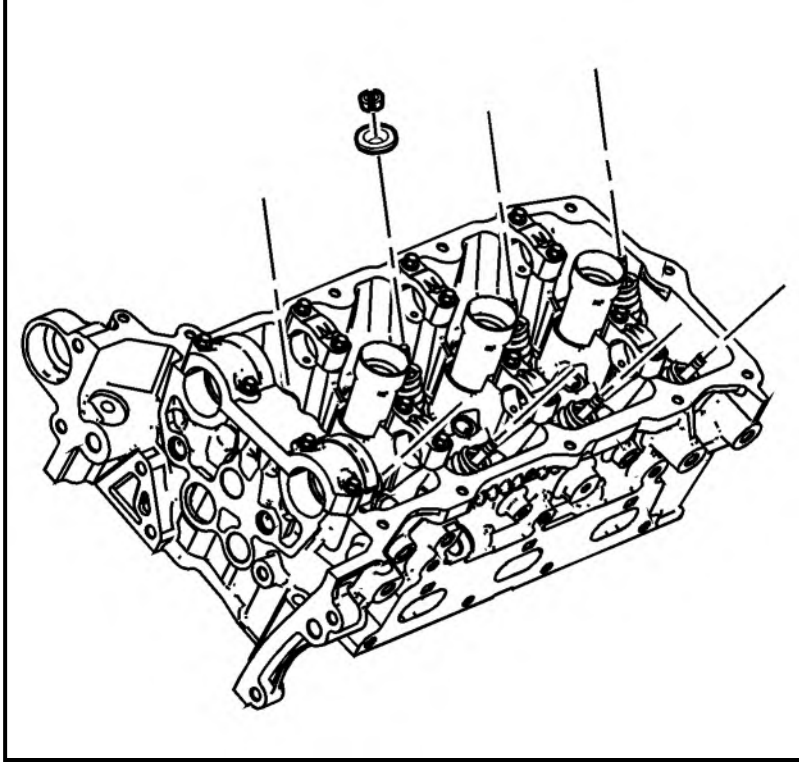
6. Connect the **EN-39313** adapter to a compressed air source.



Install the **EN-46110** compressor above the applicable cylinder as shown.

8. Tighten the **EN-46110** compressor nut (2).



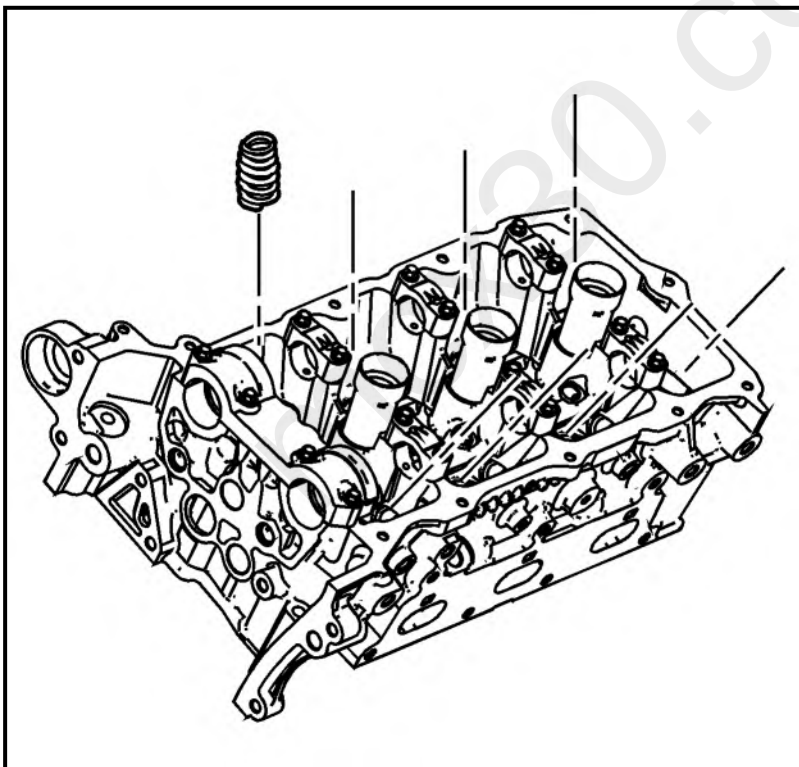


Remove the valve keepers.

10. Loosen the **EN-46110** compressor nut.

11. Remove the valve spring retainer.

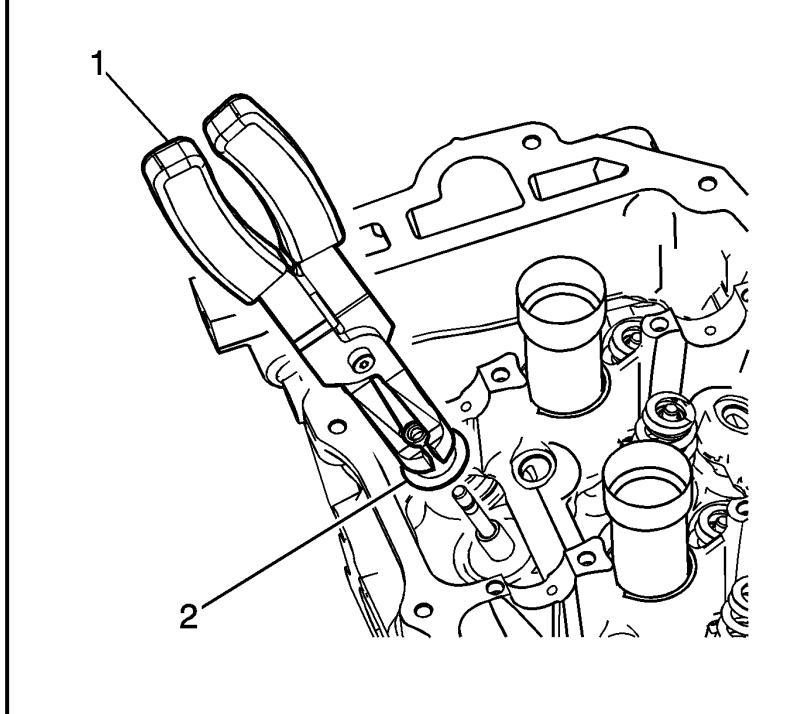
12.



Remove the valve spring.

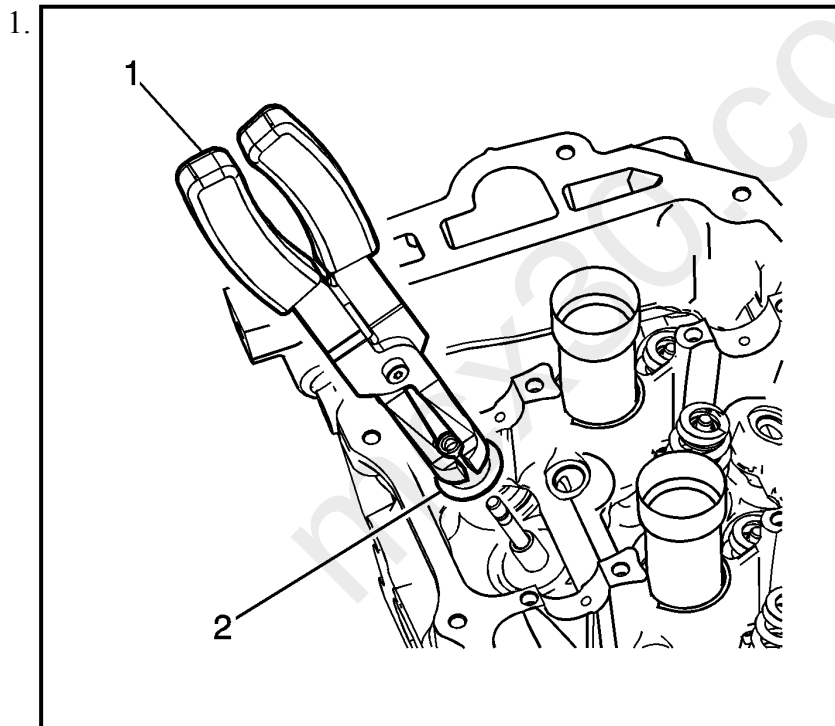
13.





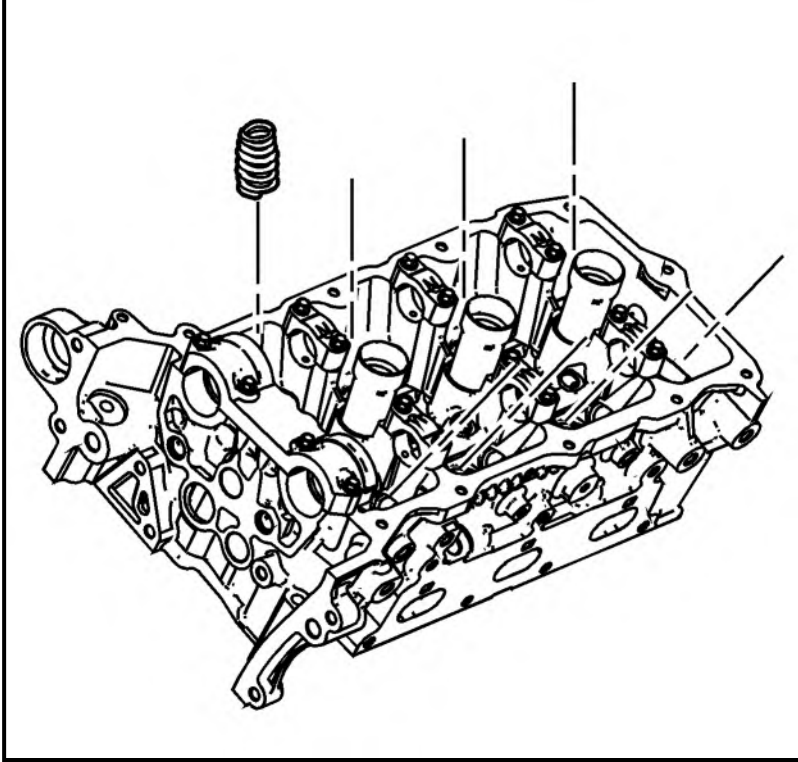
Use the **EN-46116** remover/installer (1) in order to remove the valve stem seal (2).

Installation Procedure



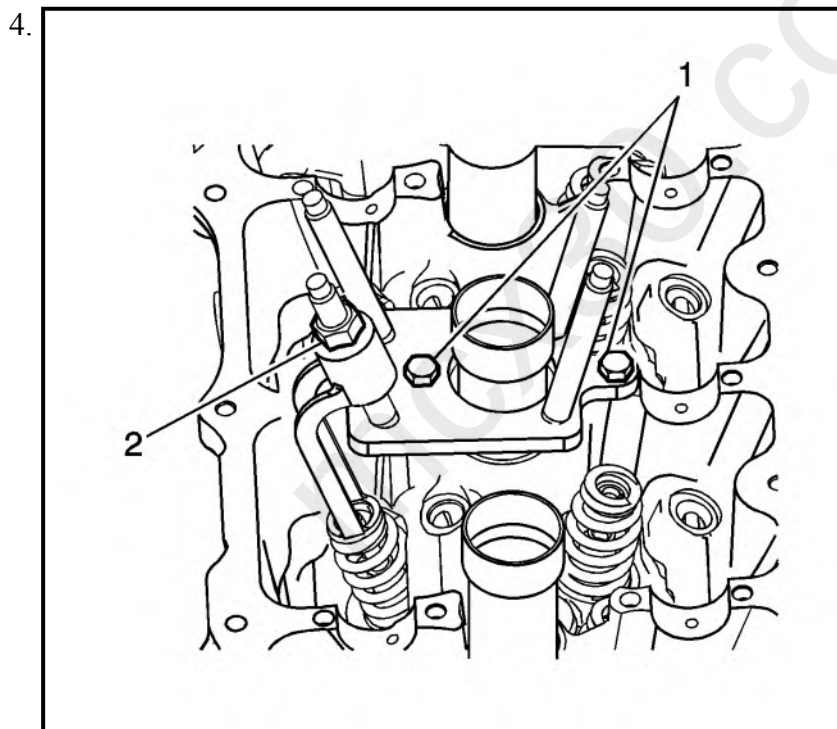
Use the **EN-46116** remover/installer (1) in order to install the valve stem seal (2).





Install the valve spring.

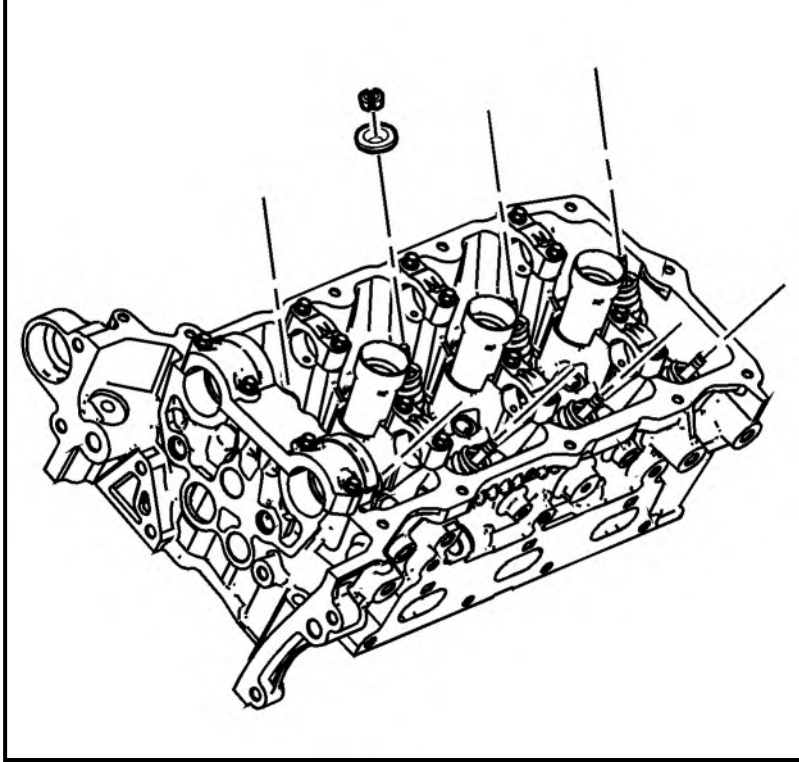
3. Install the valve spring retainer.



Install the **EN-46110** compressor above the applicable valve spring as shown.

Tighten the **EN-46110** compressor nut (2).





Install the valve spring keepers.

6. Remove the **EN-46110** compressor.
7. Disconnect the **EN-39313** adapter from the compressed air source.
8. Remove the **EN-39313** adapter.
9. Install the spark plugs. Refer to [Spark Plug Replacement \(Bank 1\)](#), [Spark Plug Replacement \(Bank 2\)](#).
10. Install the rocker arms. Refer to [Valve Rocker Arm Replacement - Left Side](#).
11. Remove the **EN-46106** tool in order to prevent crankshaft rotation.
12. Install the starter motor. Refer to [Starter Replacement \(LFY\)](#).

VALVE STEM OIL SEAL AND VALVE SPRING REPLACEMENT - RIGHT SIDE

Special Tools

- **EN-39313** Spark Plug Port Adapter
- **EN-46106** Flywheel Holding Tool
- **EN-46110** On-Vehicle Valve Spring Compressor
- **EN-46116** Valve Stem Seal Remover/Installer

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

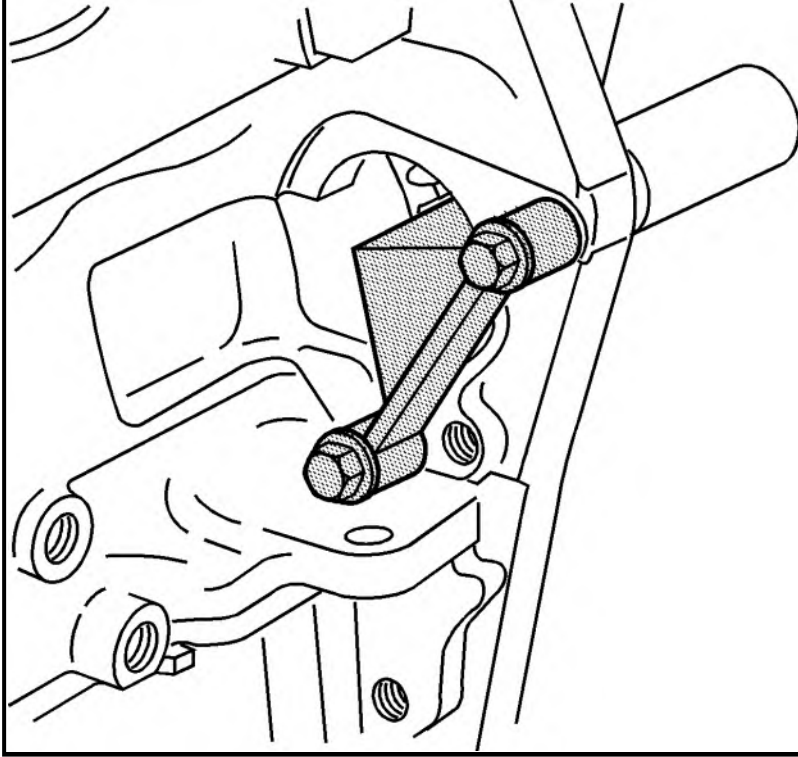
Removal Procedure

NOTE: This procedure is not used in Brazil.

1. Remove the rocker arms. Refer to [Valve Rocker Arm Replacement - Right Side](#).
2. Remove the starter motor. Refer to [Starter Replacement \(LFY\)](#).

3.



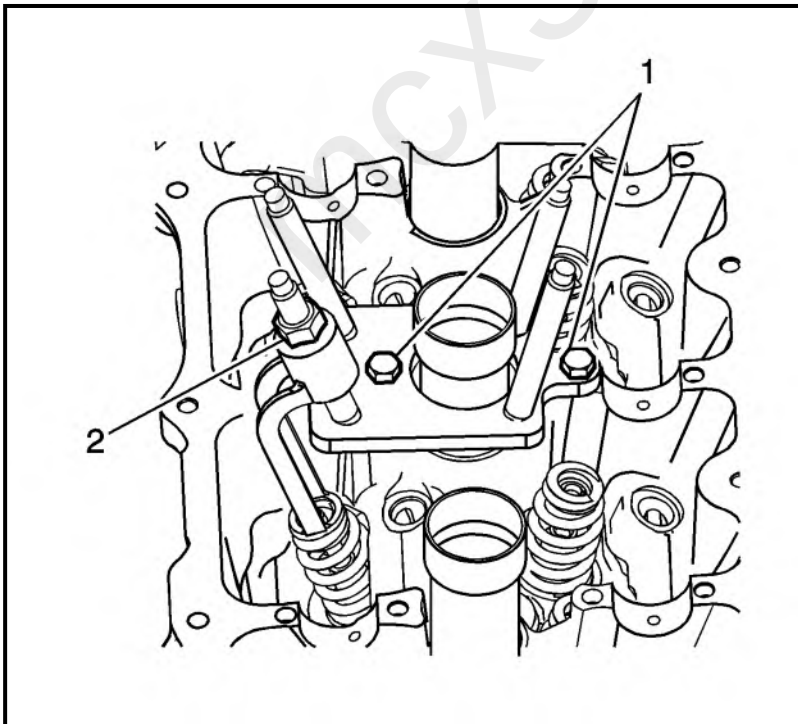


NOTE: If the EN-46106 tool is not installed, the crankshaft may rotate. If the crankshaft rotates, disassembly and reassembly of the entire camshaft timing system may be required.

Install the **EN-46106** tool in order to prevent crankshaft rotation.

4. Remove the spark plug from the applicable cylinder. Refer to [Spark Plug Replacement \(Bank 1\)](#) [Spark Plug Replacement \(Bank 2\)](#) .
5. Install the **EN-39313** adapter to the applicable cylinder.
6. Connect the **EN-39313** adapter to a compressed air source.

7.

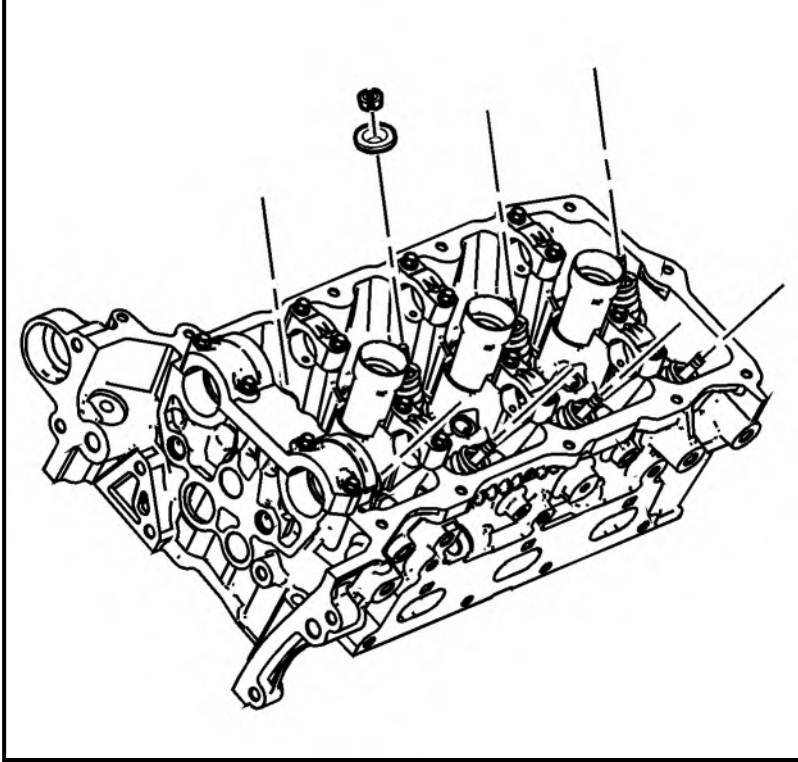


Install the **EN-46110** compressor above the applicable cylinder as shown.

8. Tighten the **EN-46110** compressor nut (2).

9.



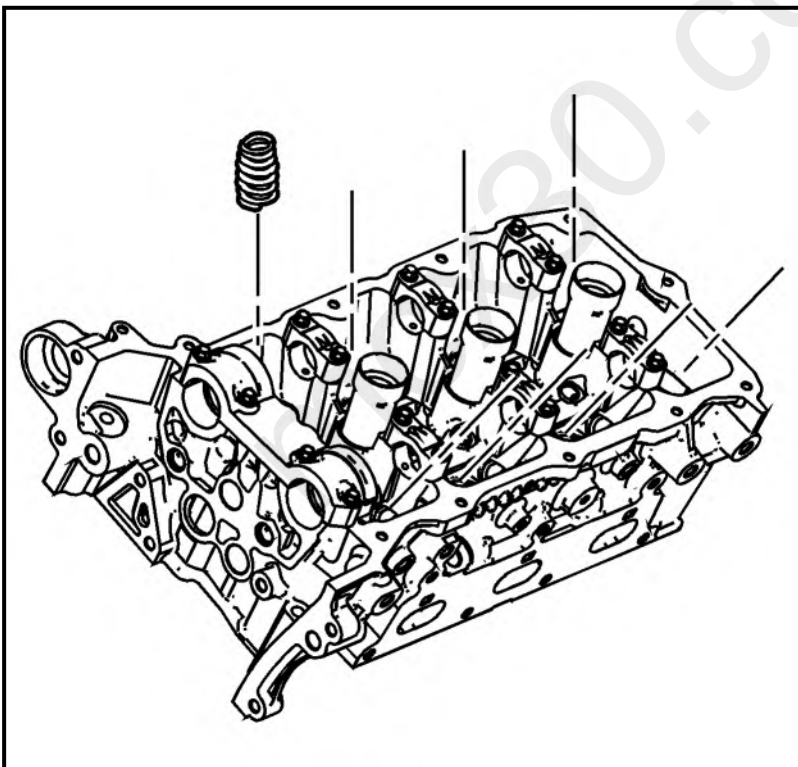


Remove the valve keepers.

10. Loosen the **EN-46110** compressor nut.

11. Remove the valve spring retainer.

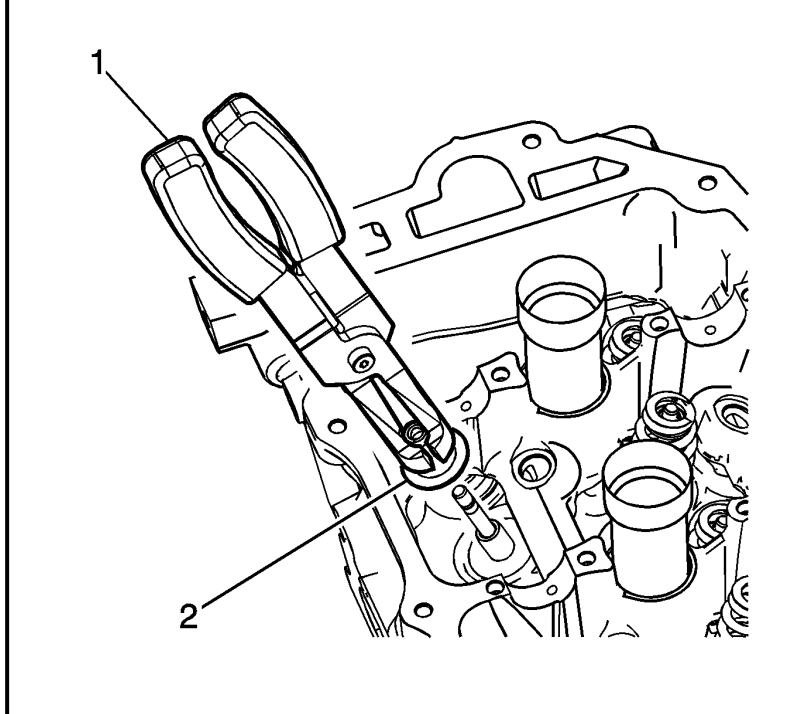
12.



Remove the valve spring.

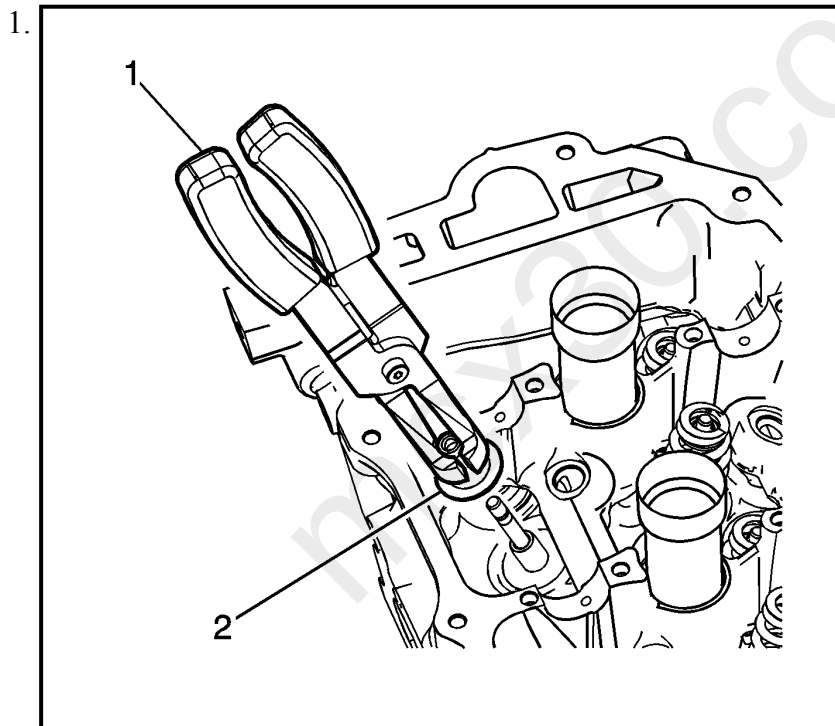
13.





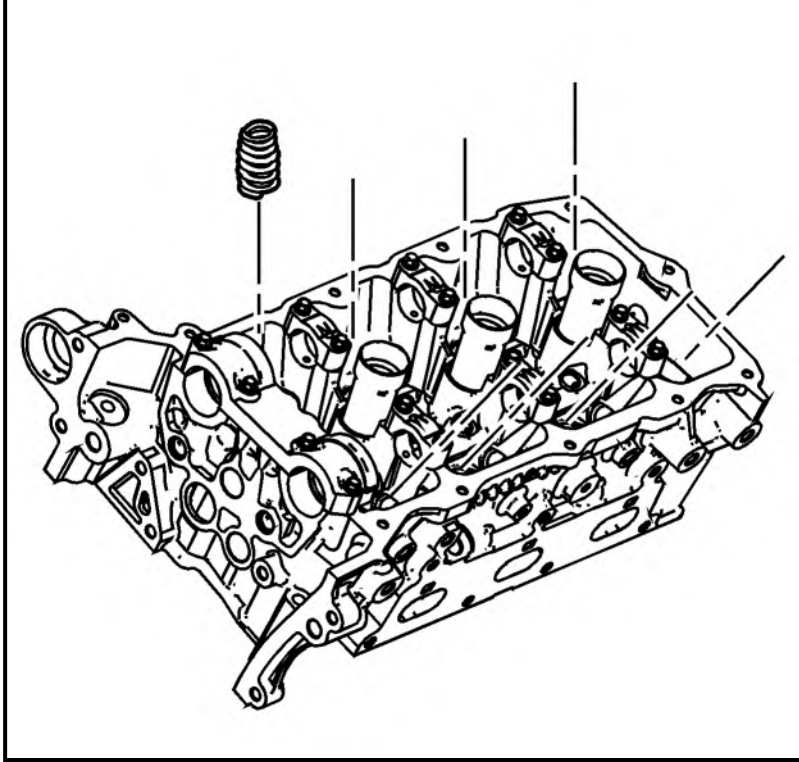
Use the **EN-46116** remover/installer (1) in order to remove the valve stem seal (2).

Installation Procedure



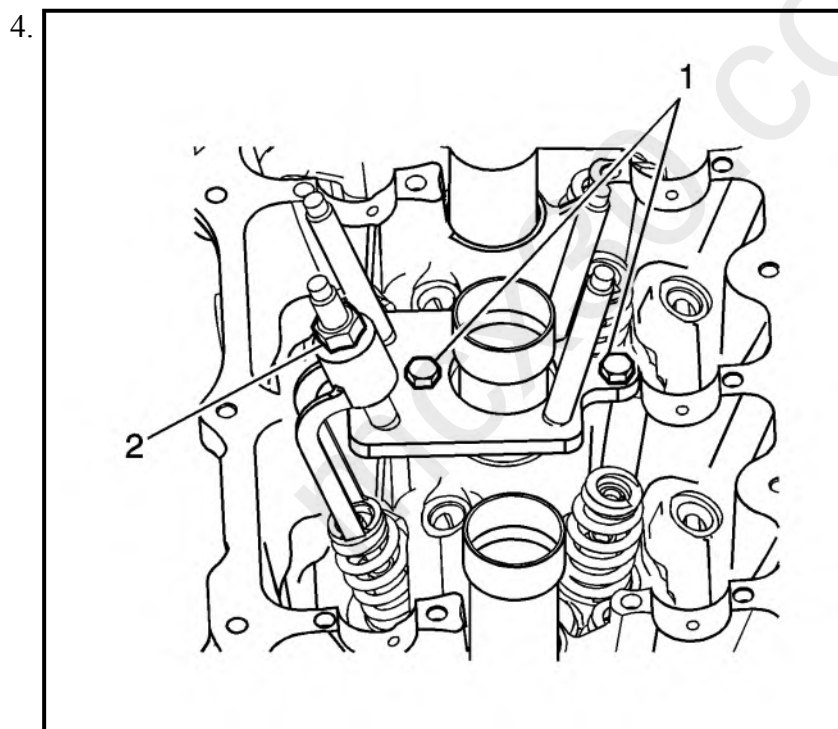
Use the **EN-46116** remover/installer (1) in order to install the valve stem seals (2).





Install the valve spring.

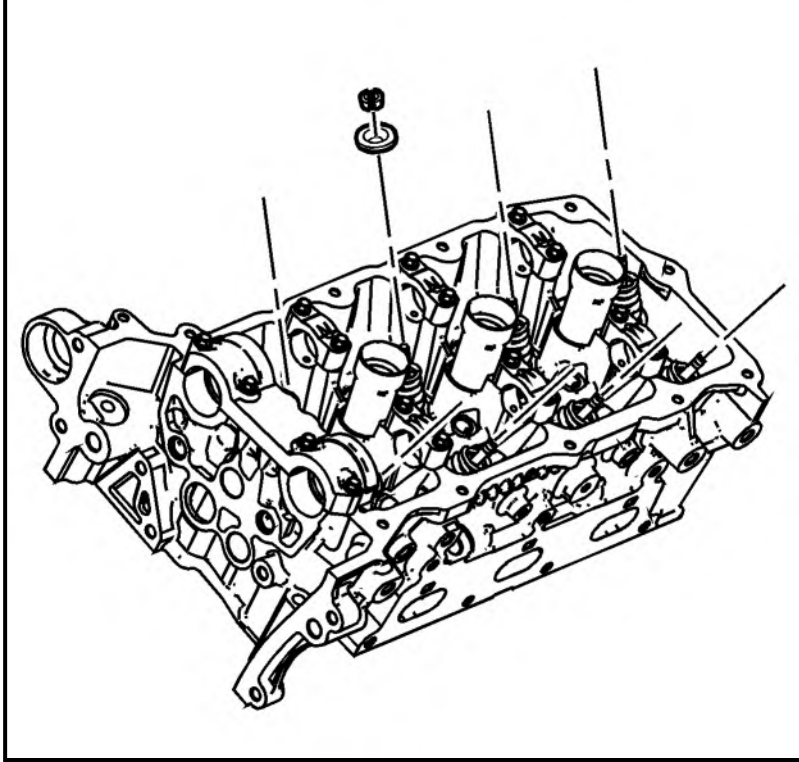
3. Install the valve spring retainer.



Install the **EN-46110** compressor above the applicable valve spring as shown.

Tighten the **EN-46110** compressor nut (2).





Install the valve spring keepers.

6. Remove the **EN-46110** compressor.
7. Disconnect the **EN-39313** adapter from the compressed air source.
8. Remove the **EN-39313** adapter.
9. Install the spark plugs. Refer to [Spark Plug Replacement \(Bank 1\)](#), [Spark Plug Replacement \(Bank 2\)](#).
10. Install the rocker arms. Refer to [Valve Rocker Arm Replacement - Right Side](#).
11. Remove the **EN-46106** tool.
12. Install the starter motor. Refer to [Starter Replacement \(LFY\)](#).

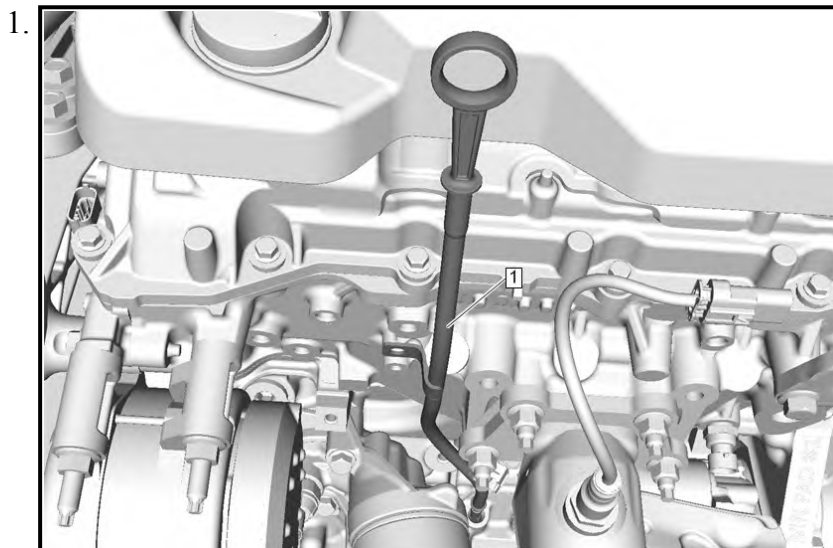
CYLINDER HEAD REPLACEMENT - LEFT SIDE

Special Tools

EN-45059 Angle Meter

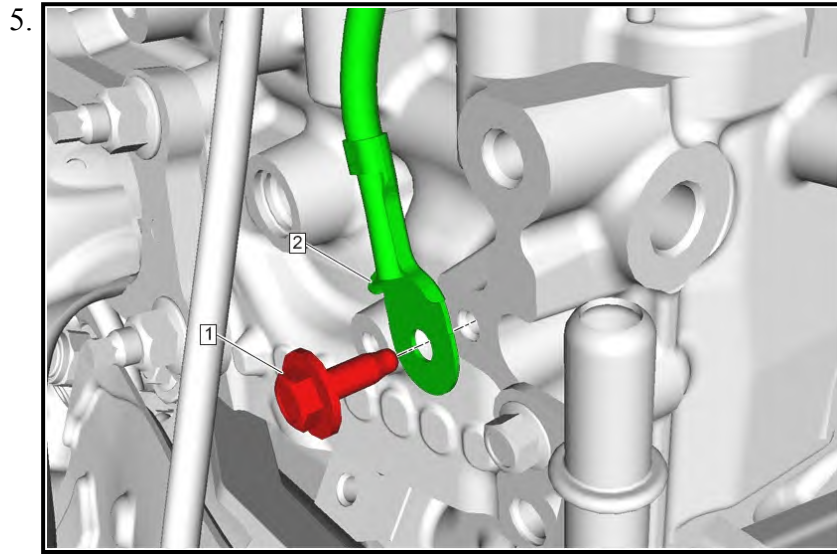
Equivalent regional tools: [Special Tools](#)

Removal Procedure

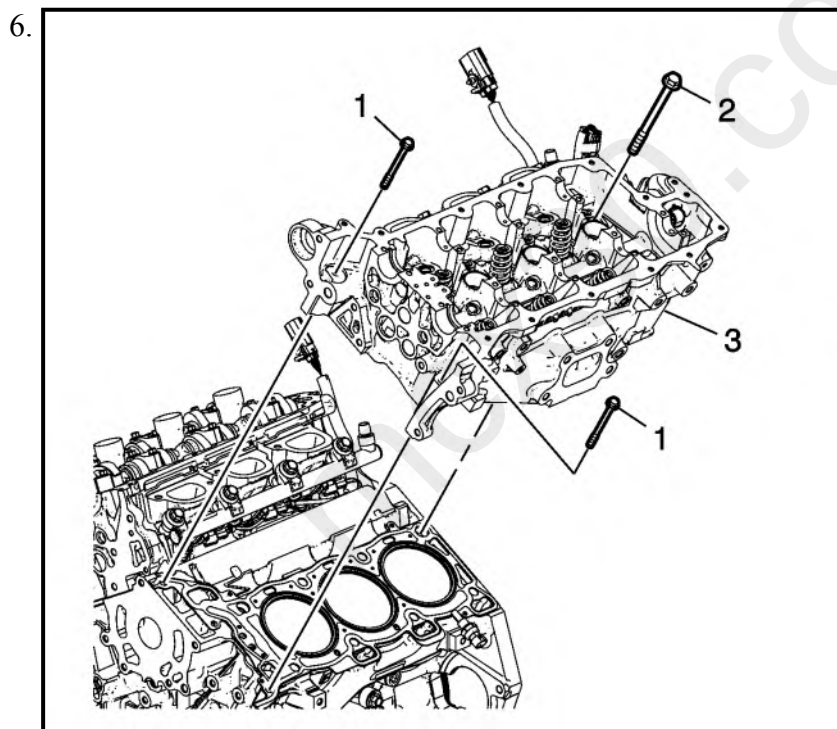


Oil Level Indicator and Tube (1) - Remove - [Oil Level Indicator Tube Replacement](#)

2. Camshaft-Left Side - Remove - [Camshaft Replacement - Left Side](#)
3. Fuel Injection Fuel Rail Noise Shield - Remove - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#) [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#)
4. Catalytic Converter - Remove - [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 2\)](#) [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 AWD\)](#) [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 2WD\)](#)



Remove the ground strap bolt (1) and ground strap (2).

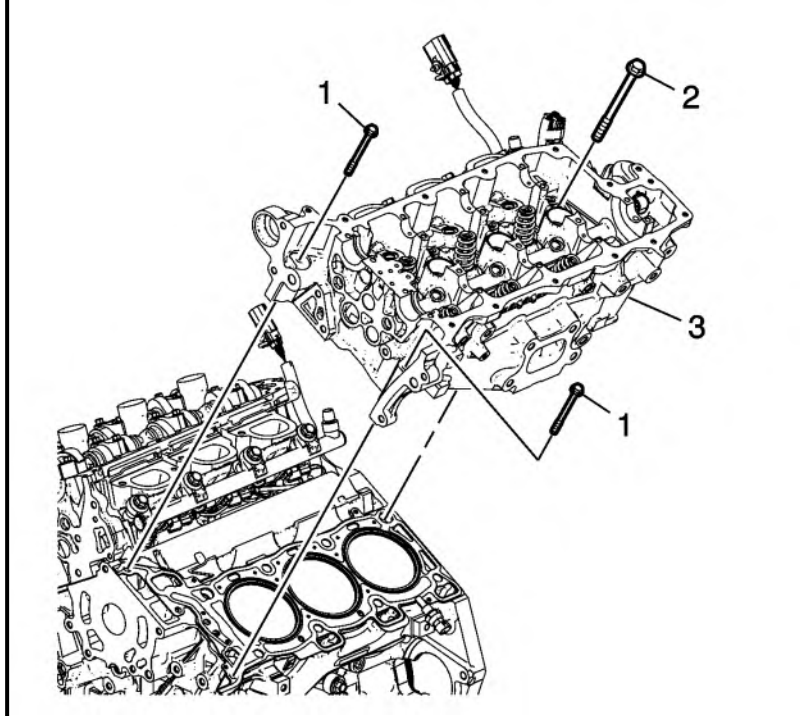


Cylinder Head Assembly (3) - Remove - [Cylinder Head Removal - Left Side](#)

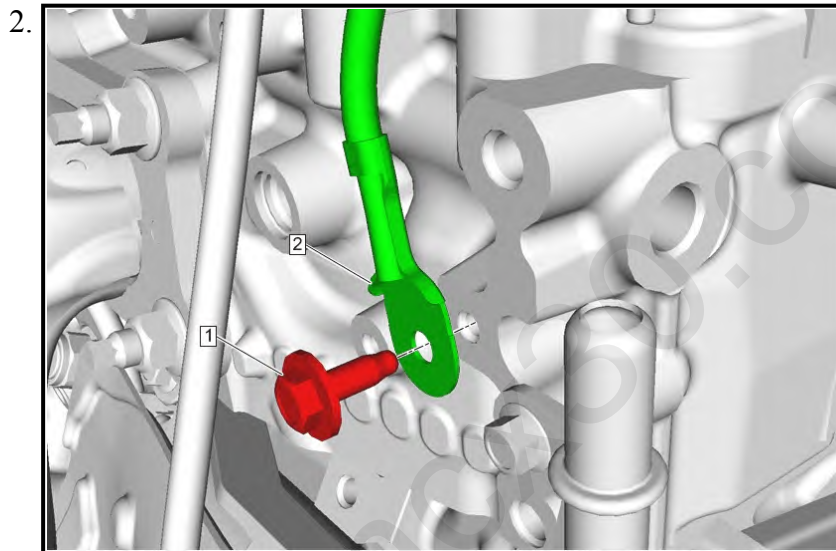
7. Clean and inspect the cylinder head and the engine block sealing surfaces. [Cylinder Head Cleaning and Inspection](#) , and [Engine Block Cleaning and Inspection](#)
8. Disassemble the cylinder head if needed. [Cylinder Head Disassemble](#)

Installation Procedure





Cylinder Head Assembly (3) - Install - [Cylinder Head Installation - Left Side](#)

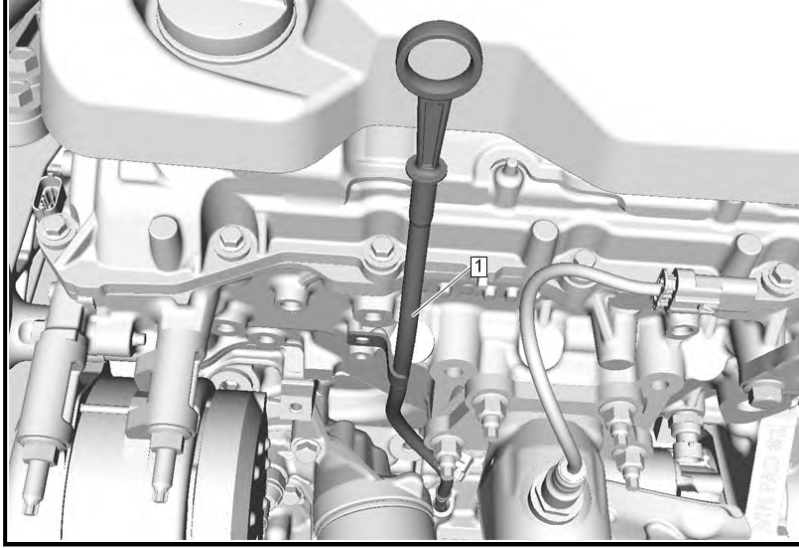


CAUTION: Refer to [Fastener Caution](#) .

Install ground wire (2) and ground wire bolt (1). Tighten bolt to 12 N.m (106 lb in)

3. Catalytic Converter - Install - [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 2\)](#), [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 AWD\)](#), [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 2WD\)](#).
4. Fuel Injection Fuel Rail Noise Shield - Install - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#), [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#).
5. Camshaft-Left Side - Install - [Camshaft Replacement - Left Side](#)





Oil Level Indicator and Tube (1) - Install - [Oil Level Indicator Tube Replacement](#)

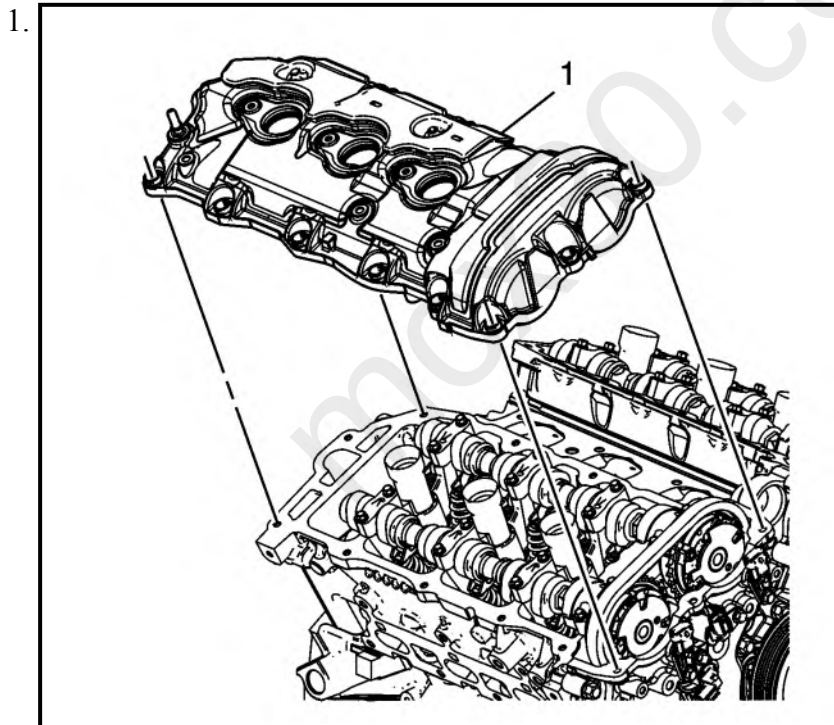
CYLINDER HEAD REPLACEMENT - RIGHT SIDE

Special Tools

EN-45059 Angle Meter

Equivalent regional tools: [Special Tools](#)

Removal Procedure

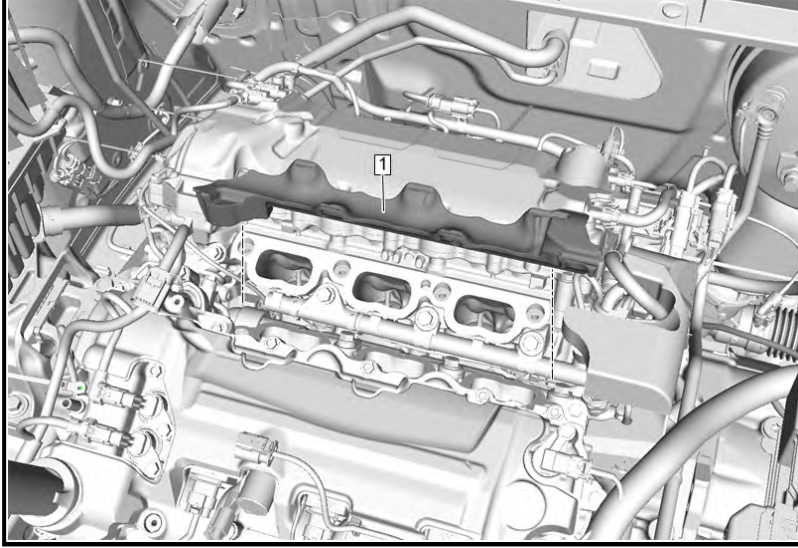


Camshaft Cover (1) - Remove - [Camshaft Cover Replacement - Right Side](#)

2. Fuel Feed Pipe - Remove - [Fuel Feed Pipe Replacement \(AWD\)](#), [Fuel Feed Pipe Replacement \(FWD\)](#), [Fuel Feed Pipe Replacement \(AWD/FWD, At Engine\)](#).

3. Fuel Feed Intermediate Pipe - Remove - [Fuel Feed Intermediate Pipe Replacement](#)

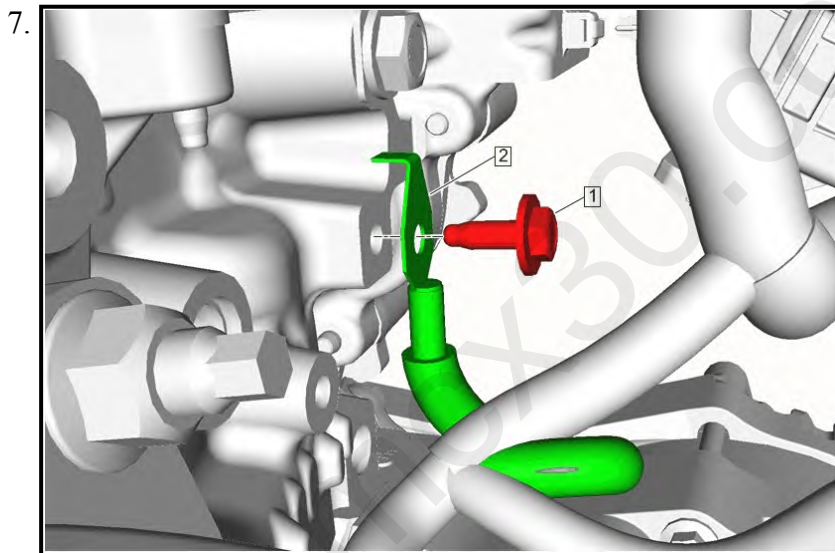




Fuel Injection Fuel Rail Noise Shield (1) - Remove - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#). [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#)

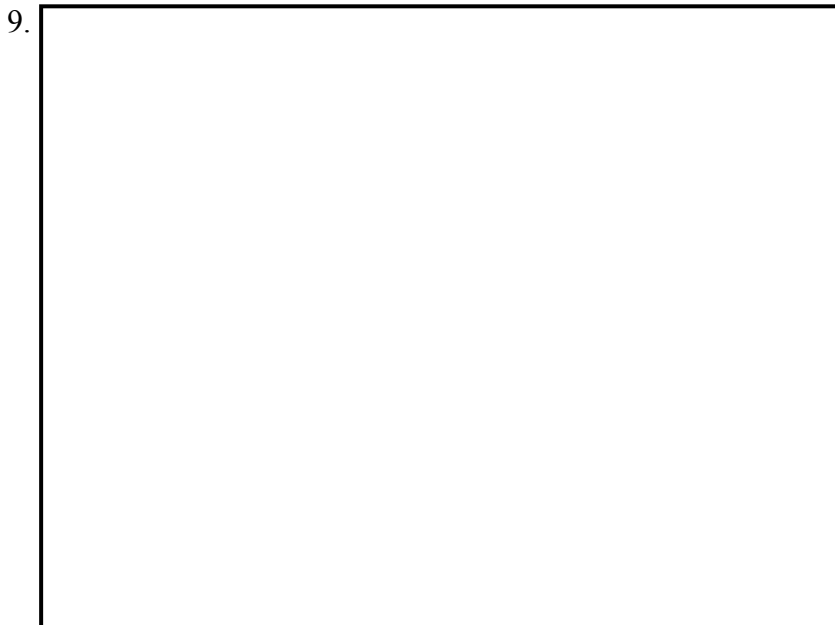
5. Remove the right bank secondary timing chain. [Secondary Camshaft Intermediate Drive Chain Replacement - Right Side](#)

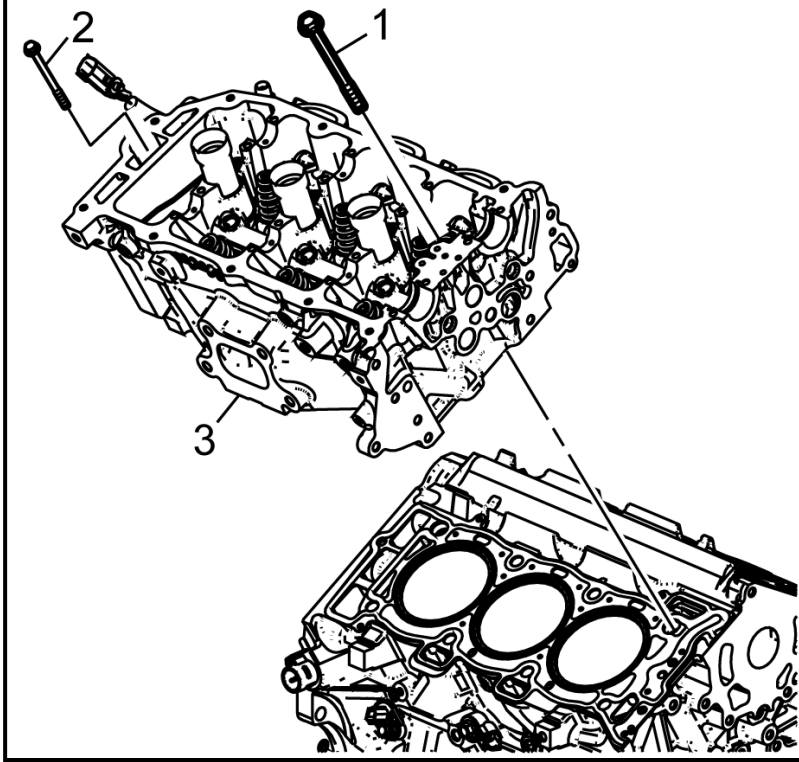
6. Catalytic Converter - Remove - [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 2\)](#). [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 AWD\)](#). [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 2WD\)](#).



Remove the ground wire bolt (1) and ground wire (2).

8. Disconnect and reposition harness as necessary.

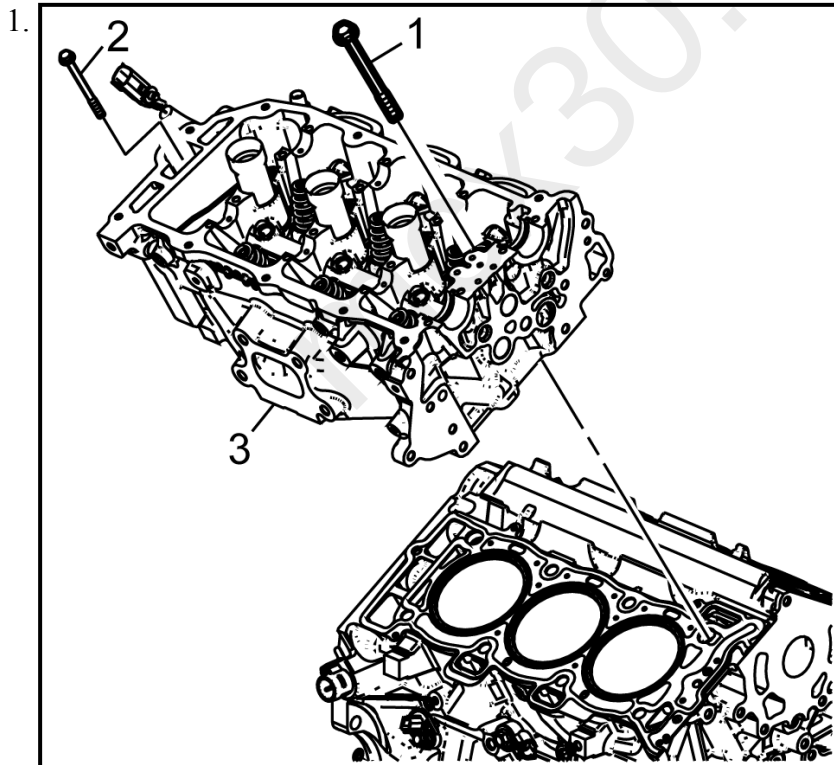




Cylinder Head Assembly (2) - Remove - [Cylinder Head Removal - Right Side](#)

10. Clean and inspect the cylinder head and the engine block sealing surfaces. [Cylinder Head Cleaning and Inspection](#) , and [Engine Block Cleaning and Inspection](#)
11. Disassemble the cylinder head if needed. [Cylinder Head Disassemble](#)

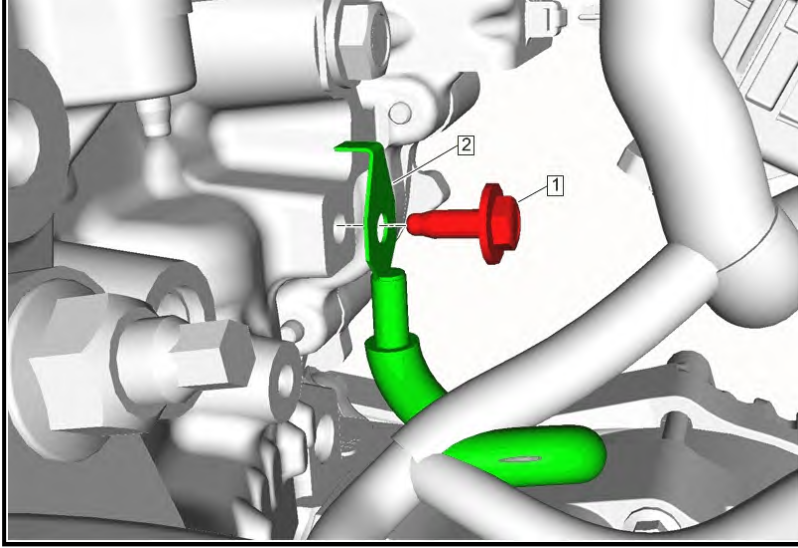
Installation Procedure



Cylinder Head Assembly (2) - Install - [Cylinder Head Installation - Right Side](#)

2. Position wire harness and connect as necessary.

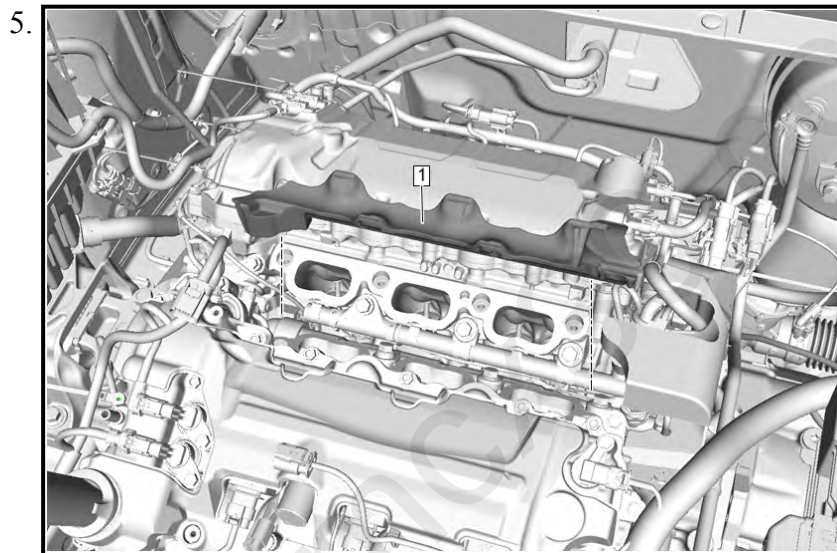




CAUTION: Refer to [Fastener Caution](#) .

Install ground wire (2) and ground wire bolt (1). Tighten bolt to 12 N.m (106 lb in)

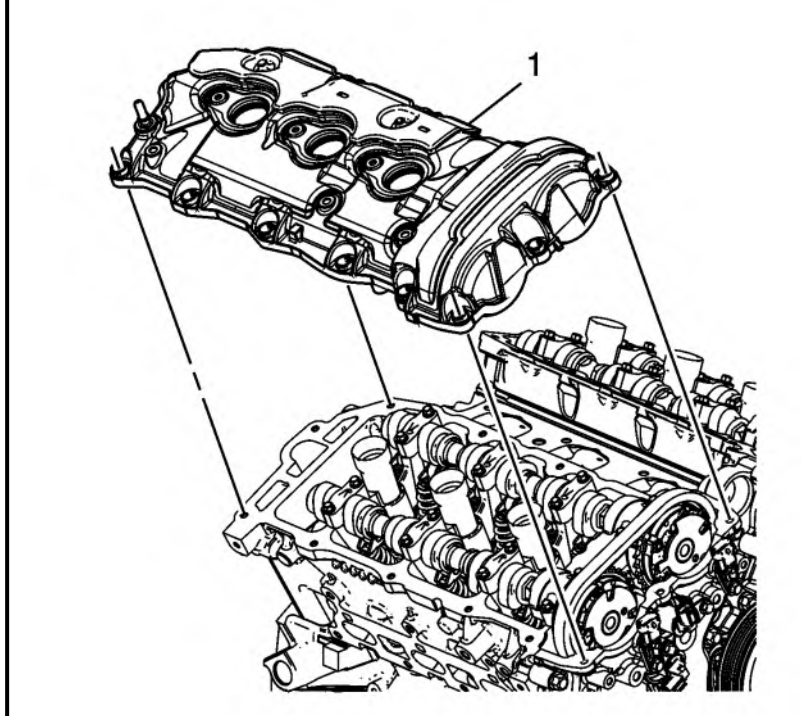
4. Catalytic Converter - Install - [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 2\)](#), [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 AWD\)](#), [Warm Up Three-Way Catalytic Converter Replacement \(LFY Bank 1 2WD\)](#).



Fuel Injection Fuel Rail Noise Shield (1) - Install - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#), [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#).

6. Fuel Feed Intermediate Pipe - Install - [Fuel Feed Intermediate Pipe Replacement](#)
7. Fuel Feed Pipe - Install - [Fuel Feed Pipe Replacement \(AWD\)](#), [Fuel Feed Pipe Replacement \(FWD\)](#), [Fuel Feed Pipe Replacement \(AWD/FWD, At Engine\)](#).





Camshaft Cover (1) - Install - [Camshaft Cover Replacement - Right Side](#)

AUTOMATIC TRANSMISSION FLEX PLATE REPLACEMENT

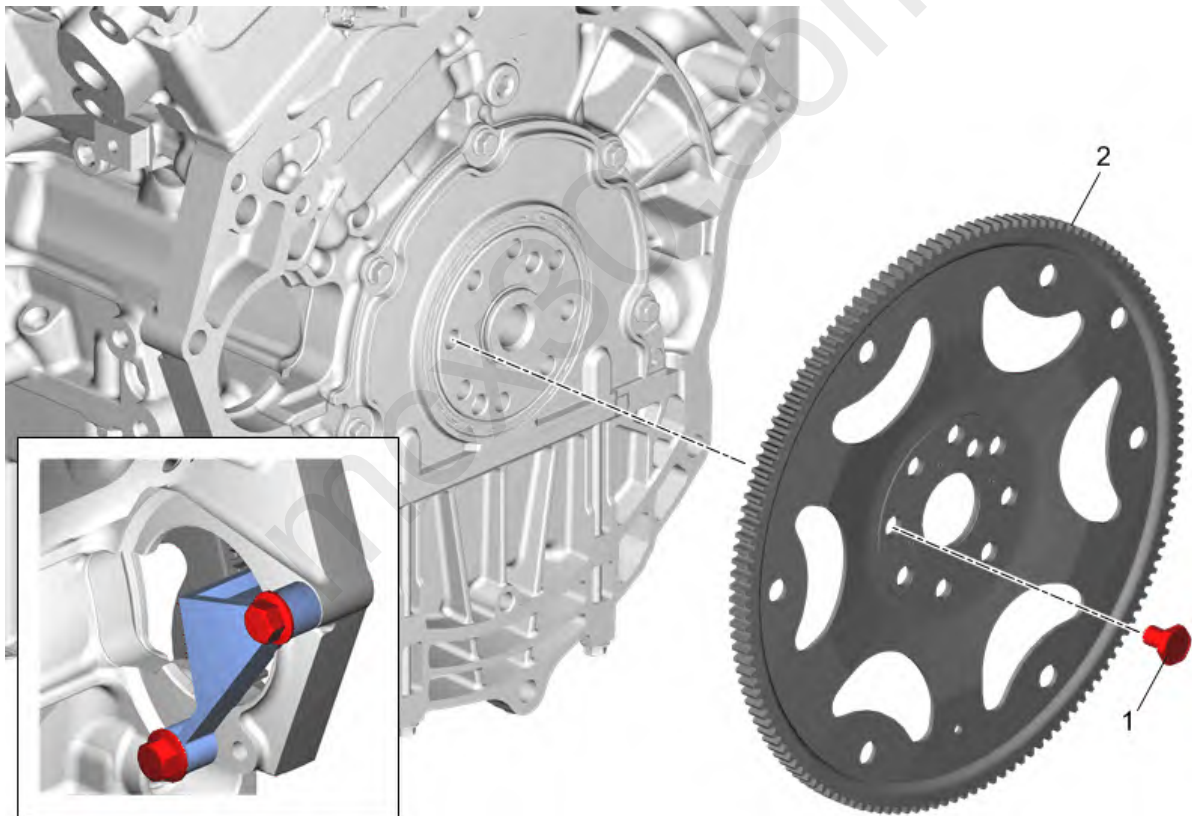


Fig. 10: Exploded View Of Automatic Transmission Flex Plate
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

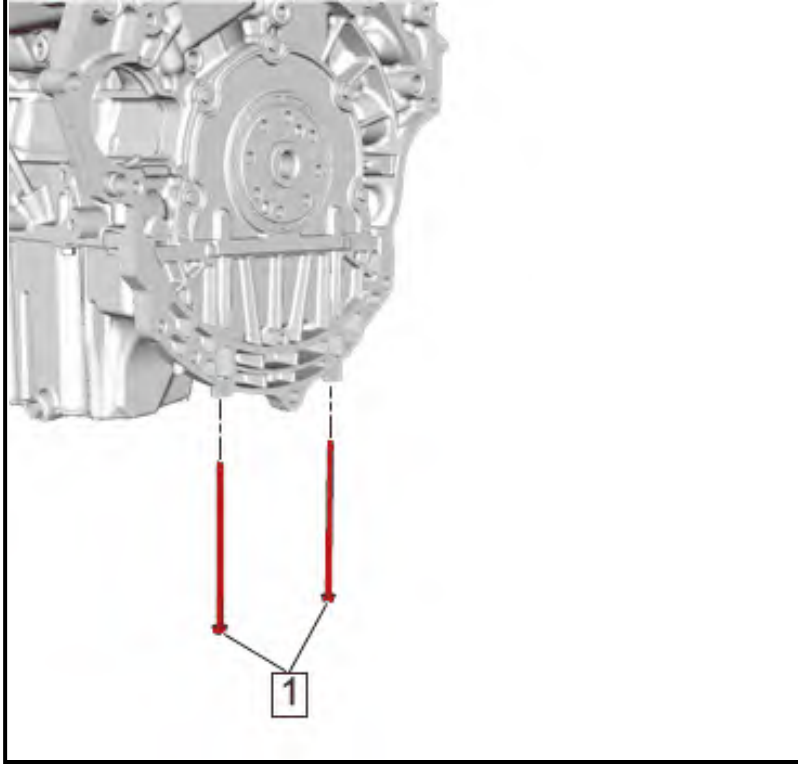
Callout	Component Name
Preliminary Procedure <u>Transmission Replacement (Front Wheel Drive with LFY Engine)</u> , <u>Transmission Replacement (All Wheel Drive)</u>	
Special Tools • EN 45059 Angle Meter • EN 46106 Flywheel Holding Tool	
Equivalent regional tools: <u>Special Tools</u> .	
1	Automatic Transmission Flex Plate Fastener (Qty: 8) CAUTION: Refer to <u>Fastener Caution</u> . NOTE: NEW bolts must be used whenever removing the automatic transmission flex plate. Procedure 1. Install the EN-46106 Flywheel Holding Tool through the starter mounting hole. 2. Remove the flex plate bolts (1) and DISCARD Tighten 30 N.m (22 lb ft) plus 45 degrees
2	Automatic Transmission Flex Plate Procedure Clean and inspect the flex plate. <u>Automatic Transmission Flex Plate Cleaning and Inspection</u>

CRANKSHAFT REAR OIL SEAL AND HOUSING REPLACEMENT

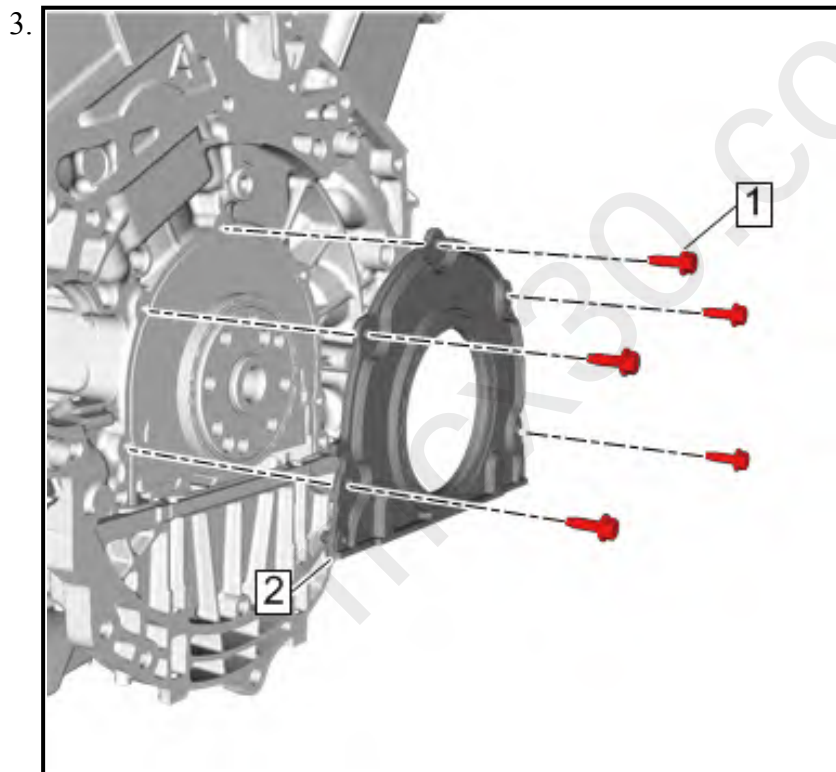
Removal Procedure

1. Automatic Transmission Flex Plate - Remove - Automatic Transmission Flex Plate Replacement

2.



Remove the oil pan to crankshaft rear oil seal and housing bolts (1).



Remove the crankshaft rear oil seal housing bolts. (1) [5x]

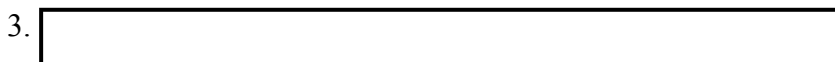
4. Remove and DISCARD the crankshaft rear oil seal housing. (2)

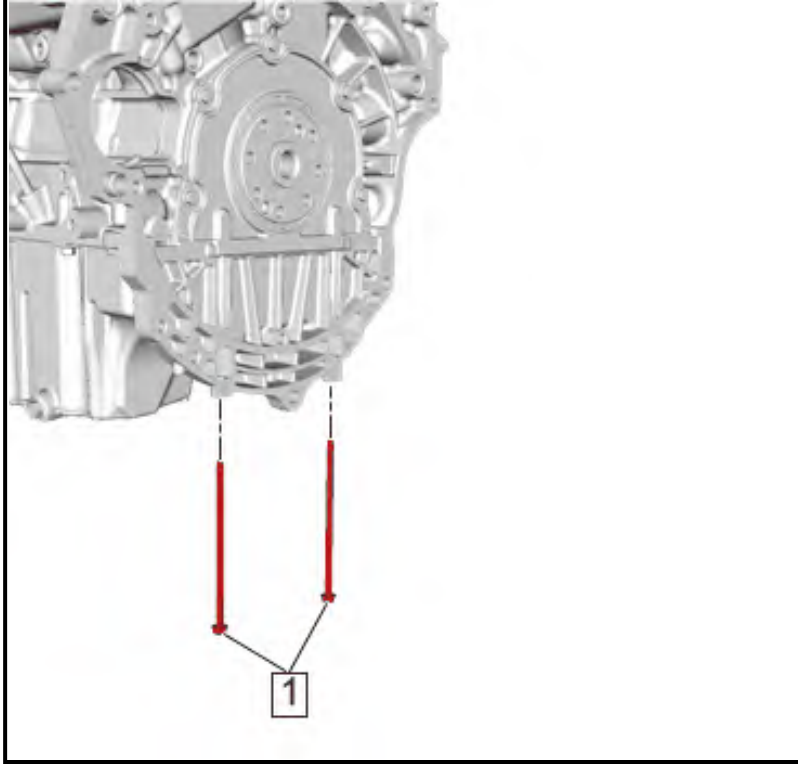
Installation Procedure

1. Place a 3 mm (0.118 in) bead of RTV sealant to the oil pan to crankshaft rear oil seal housing surface. [Adhesives, Fluids, Lubricants, and Sealers](#)

NOTE: DO NOT allow any engine oil on the area where the crankshaft rear oil seal housing is to be installed.

2. Install the NEW crankshaft rear oil seal housing to the engine block. [Crankshaft Rear Oil Seal and Housing Installation](#)





Install the oil pan to crankshaft rear oil seal and housing bolts (1).

CAUTION: Refer to [Fastener Caution](#) .

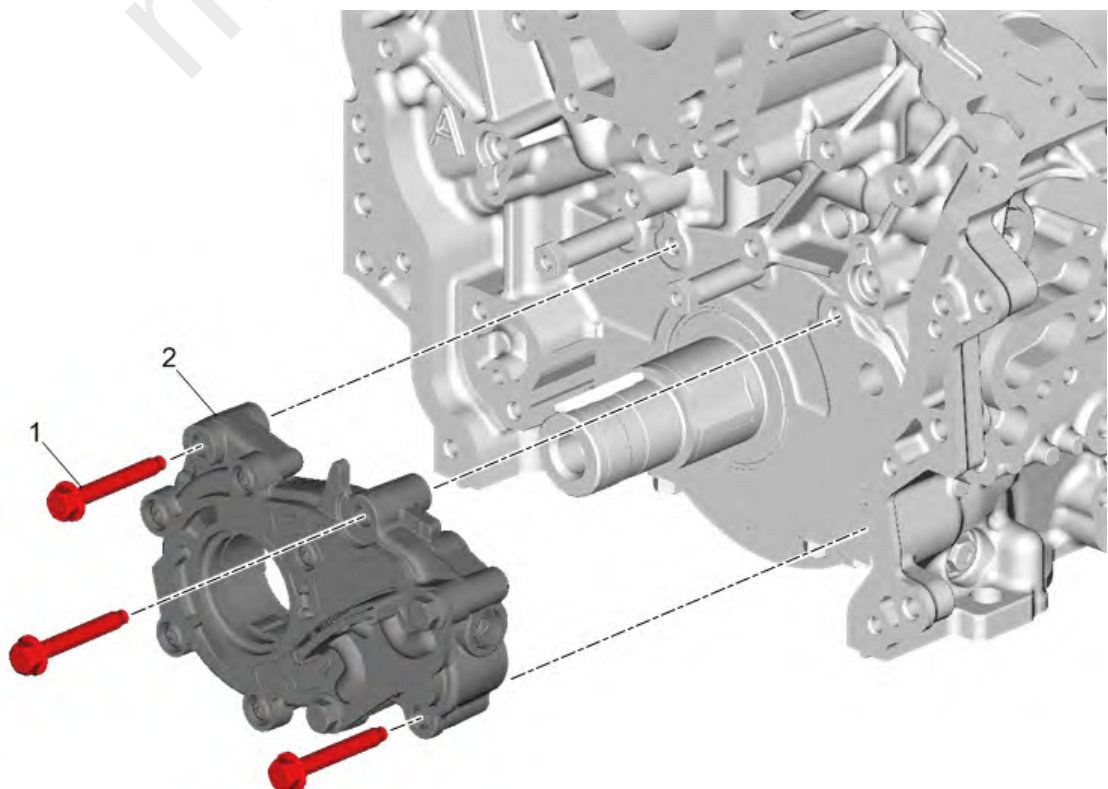
4. Tighten the oil pan to crankshaft rear oil seal and housing bolts to 10 N.m (89 lb in).
5. Automatic Transmission Flex Plate - Install - [Automatic Transmission Flex Plate Replacement](#)

OIL PUMP REPLACEMENT

Removal Procedure

NOTE: Do not remove the left bank idler sprocket.

1. Primary Timing Drive Chain - Remove - [Primary Camshaft Drive Chain and Sprockets Replacement](#)
2. Crankshaft Sprocket - Remove - [Crankshaft Sprocket Removal](#)



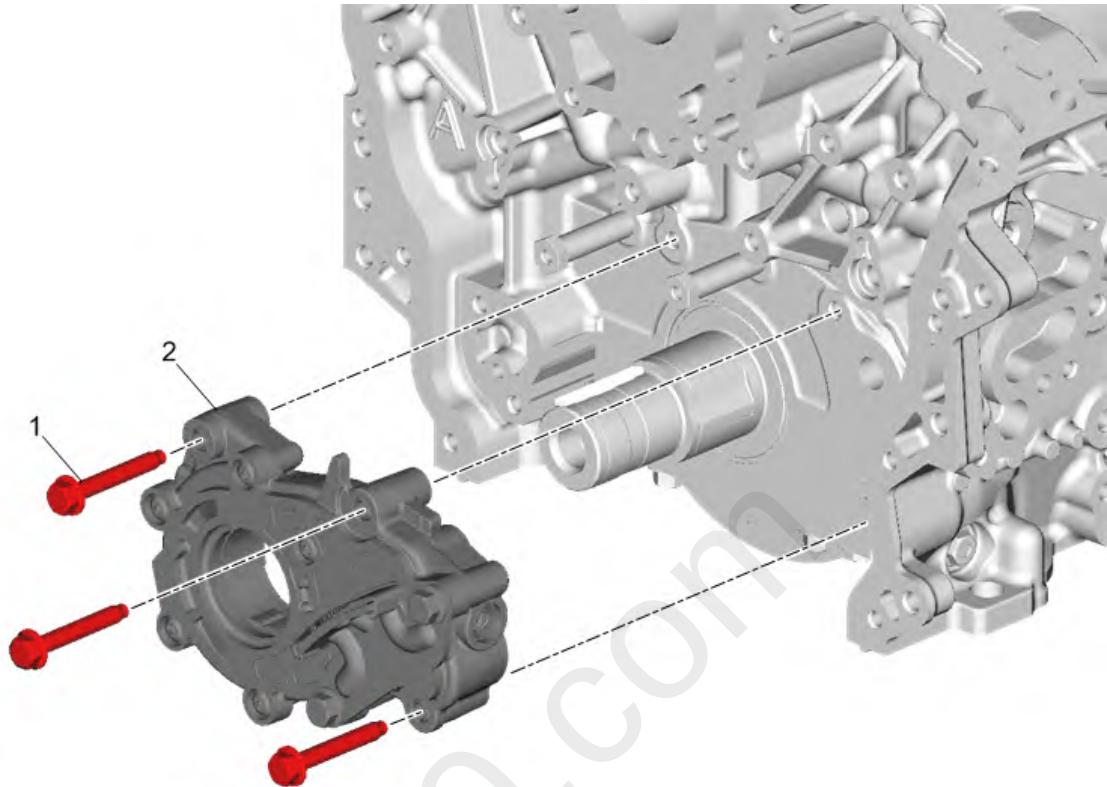
3.

Fig. 11: Exploded View Of Oil Pump
Courtesy of GENERAL MOTORS COMPANY

Oil Pump Bolt (1) - Remove [3x]

4. Oil Pump (2) - Remove

Installation Procedure



1.

Fig. 12: Exploded View Of Oil Pump
Courtesy of GENERAL MOTORS COMPANY

Oil Pump (2) - Install - [Oil Pump Installation](#)

2. Crankshaft Sprocket - Install - [Crankshaft Sprocket Removal](#)

3. Primary Timing Drive Chain - Install - [Primary Camshaft Drive Chain and Sprockets Replacement](#)

OIL PAN REPLACEMENT (AWD)

Special Tools

EN-46109 Guide Pin Set

Equivalent regional tools: [Special Tools](#) .

Removal Procedure

1. Power Transfer Unit Case - Remove - [Power Transfer Unit Case Replacement](#)

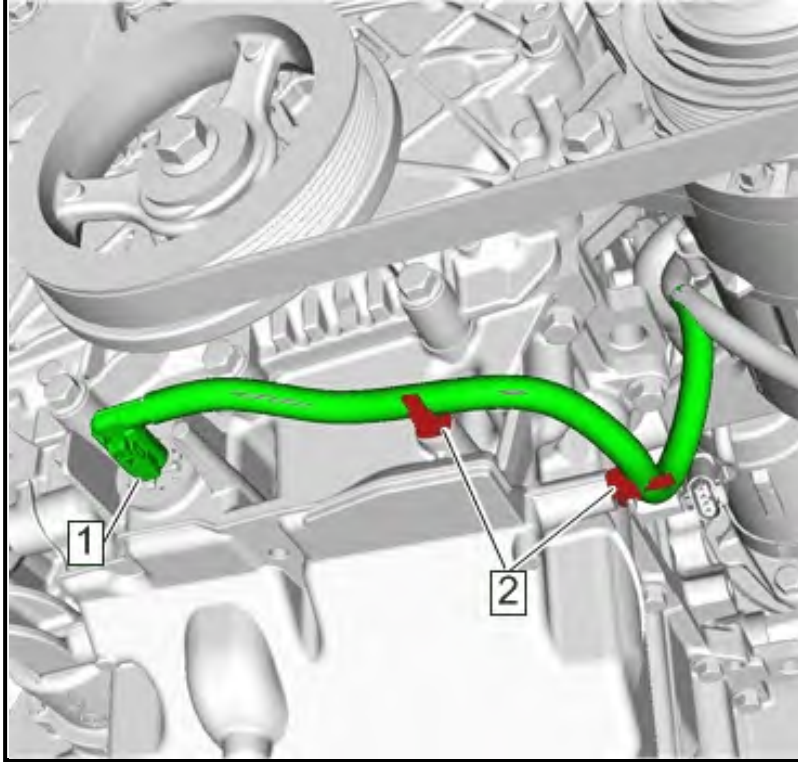
2. Exhaust Front Pipe - Remove - [Exhaust Front Pipe Replacement \(LFY\)](#)

3. Drain the engine oil. [Engine Oil and Oil Filter Replacement](#)

4. Engine Front Cover - Remove - [Engine Front Cover Replacement](#)

5.

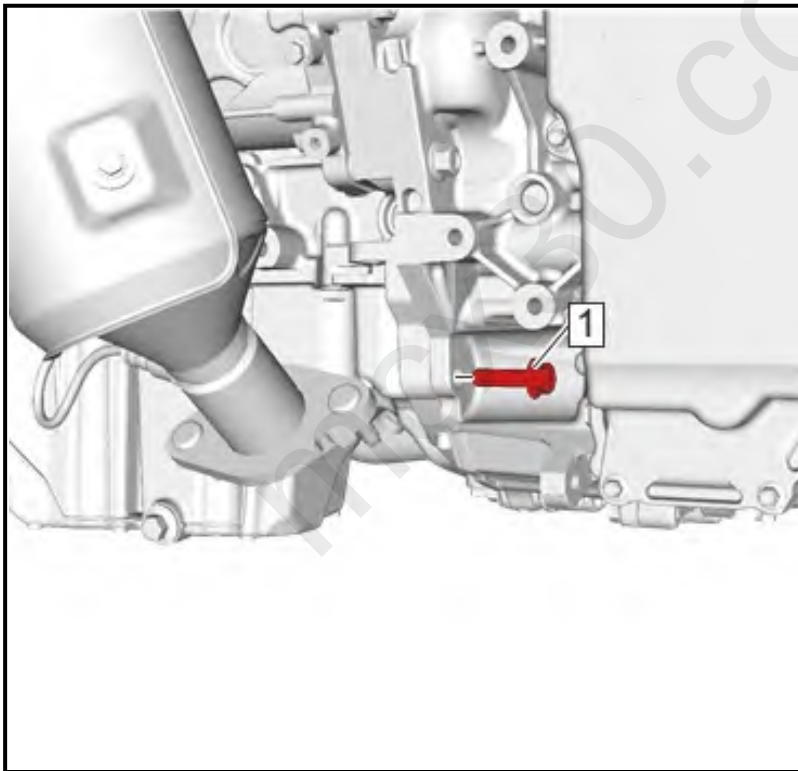




Engine Oil Level Indicator Switch (1) - Disconnect the electrical connector.

6. Harness Connector (2) - Disconnect [2x]

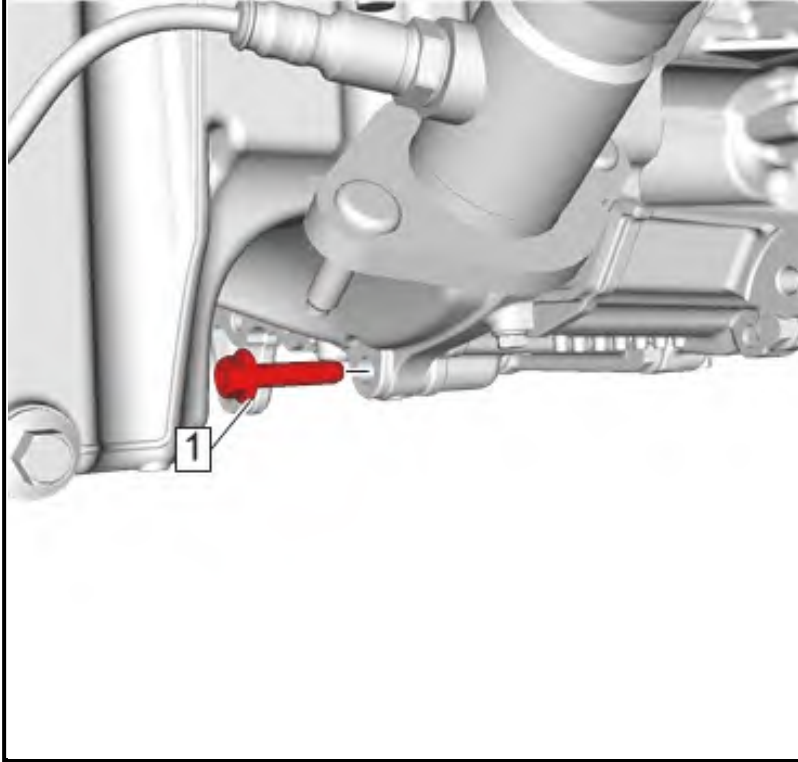
7.



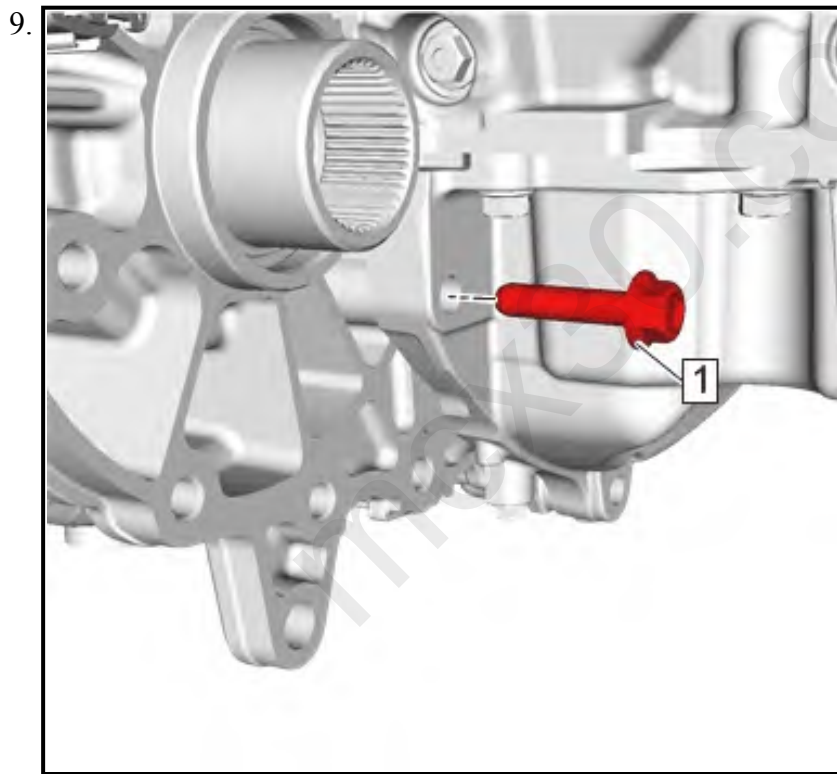
Transmission Bolt (1) - Remove

8.



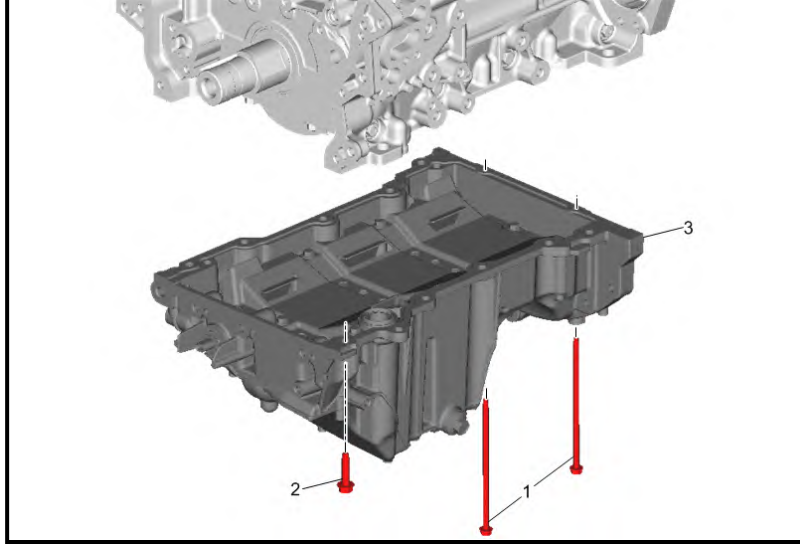


Transmission Bolt (1) - Remove



Transmission Bolt (1) - Remove





Oil Pan Bolt (1) - Remove [2x]

11. Oil Pan Bolt (2) - Remove [11x]

12. Oil Pan (3) - Remove

13. Clean and inspect the oil pan. [Oil Pan Cleaning and Inspection](#)

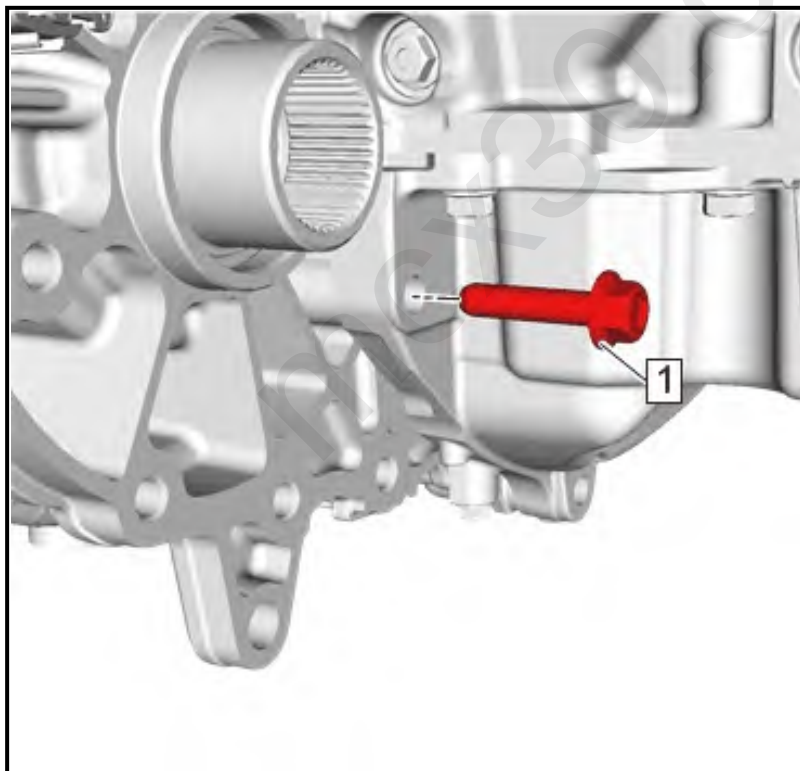
14. Disassemble the oil pan as necessary. [Oil Pan Disassemble](#)

Installation Procedure

1. Assemble the oil pan as necessary. [Oil Pan Assemble](#)

2. Oil Pan - Install - [Oil Pan Installation](#)

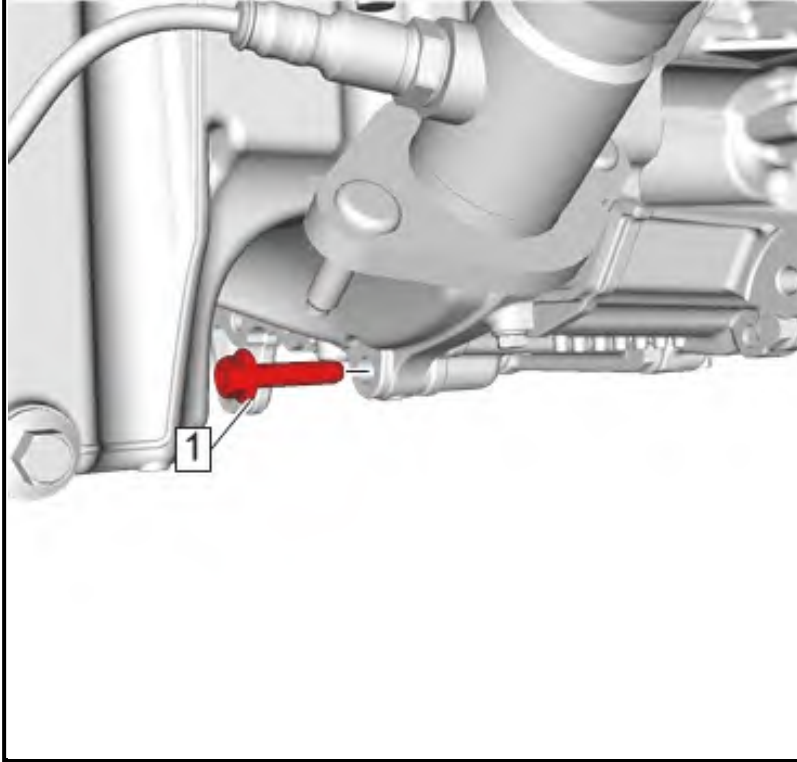
3.



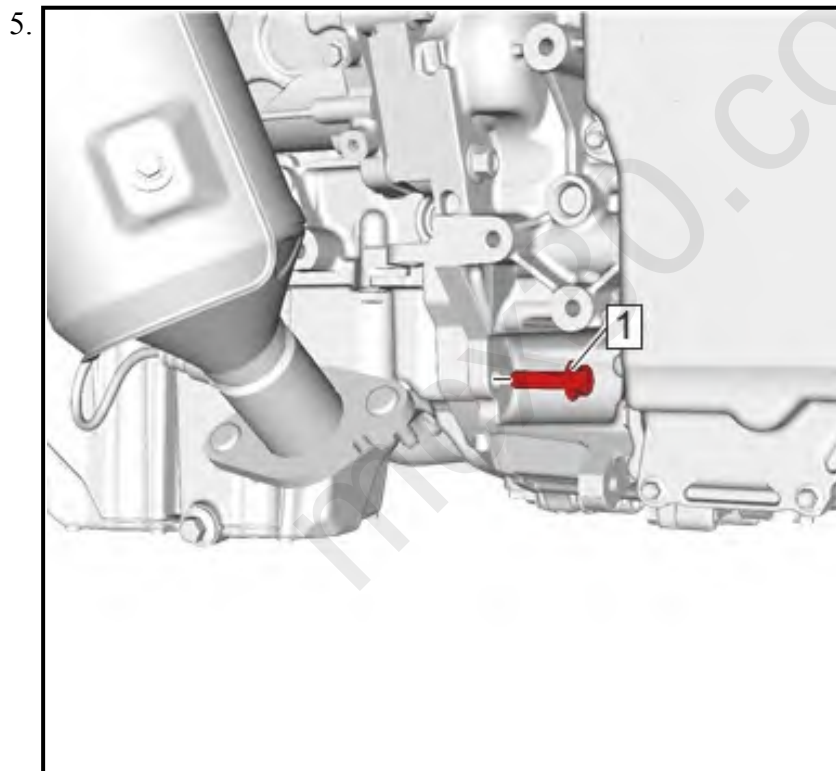
Transmission Bolt (1) - Install - [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#) [Transmission Replacement \(All Wheel Drive\)](#)

4.



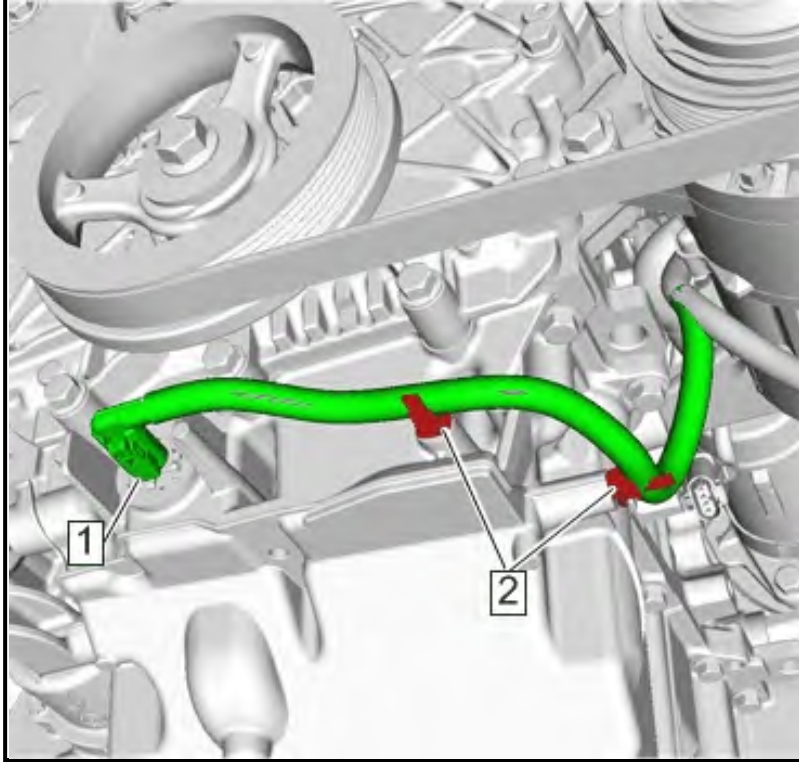


Transmission Bolt (1) - Install - [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#) [Transmission Replacement \(All Wheel Drive\)](#).



Transmission Bolt (1) - Install - [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#) [Transmission Replacement \(All Wheel Drive\)](#).





Harness Connector (2) - Connect [2x]

7. Engine Oil Level Indicator Switch (1) - Connect the electrical connector.
8. Engine Front Cover - Install - [Engine Front Cover Replacement](#)
9. Exhaust Front Pipe - Install - [Exhaust Front Pipe Replacement \(LFY\)](#)
10. Power Transfer Unit Case - Install - [Power Transfer Unit Case Replacement](#)
11. Fill the engine oil to the proper level with NEW engine oil. [Approximate Fluid Capacities](#) , and [Adhesives, Fluids, Lubricants, and Sealers](#)
12. Start the engine and inspect for leaks.

OIL PAN REPLACEMENT (FWD)

Special Tools

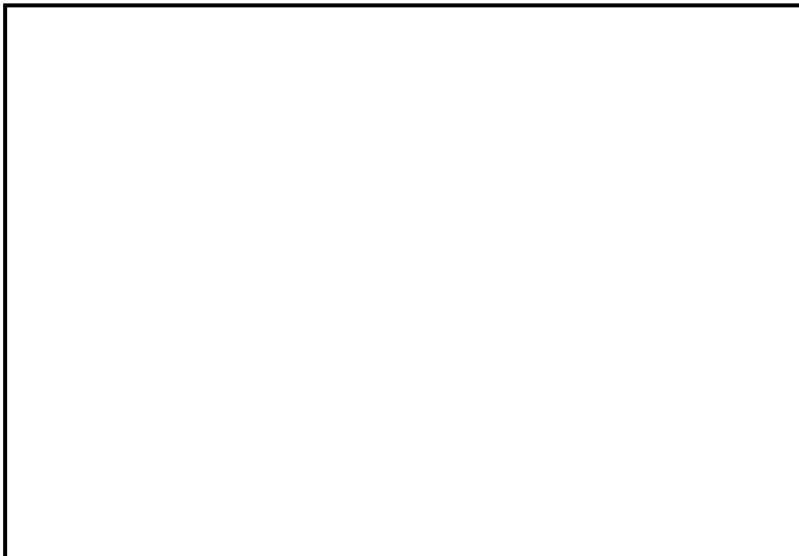
EN-46109 Guide Pin Set

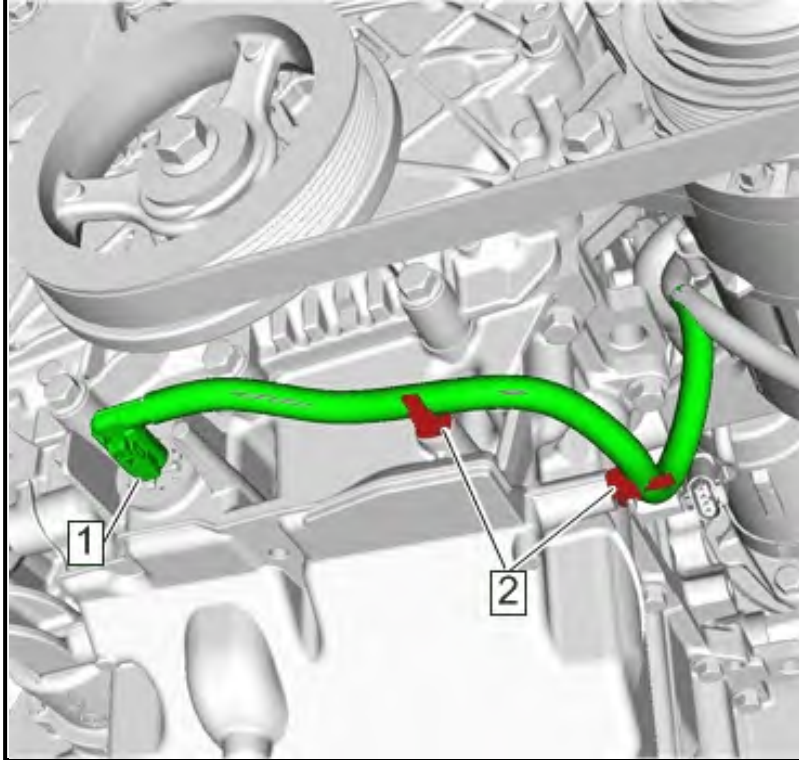
Equivalent regional tools: [Special Tools](#) .

Removal Procedure

1. Exhaust Front Pipe - Remove - [Exhaust Front Pipe Replacement \(LFY\)](#)
2. Drain the engine oil. [Engine Oil and Oil Filter Replacement](#)
3. Engine Front Cover - Remove - [Engine Front Cover Replacement](#)

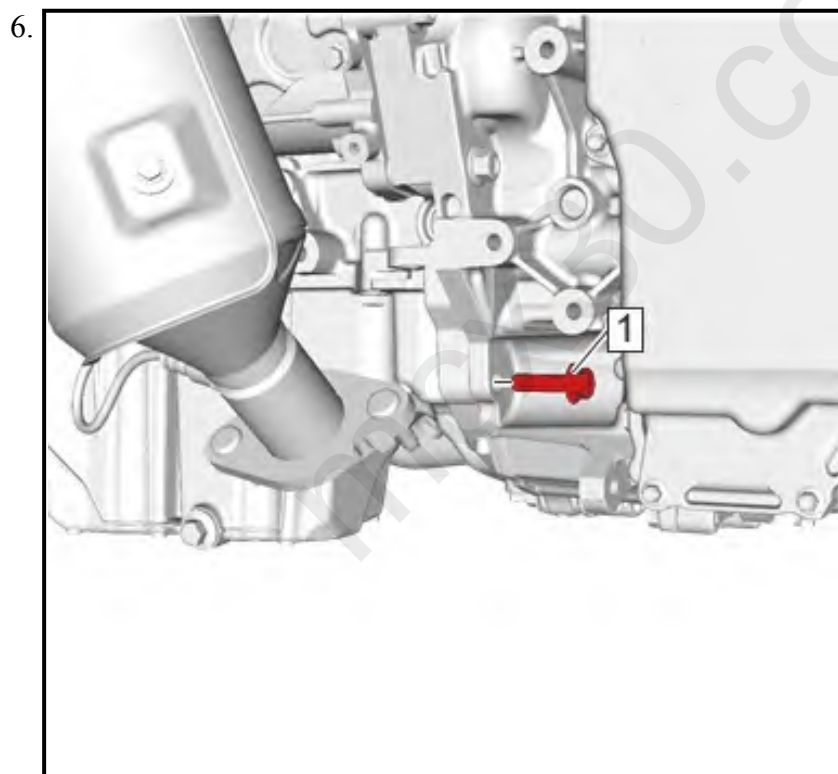
4.





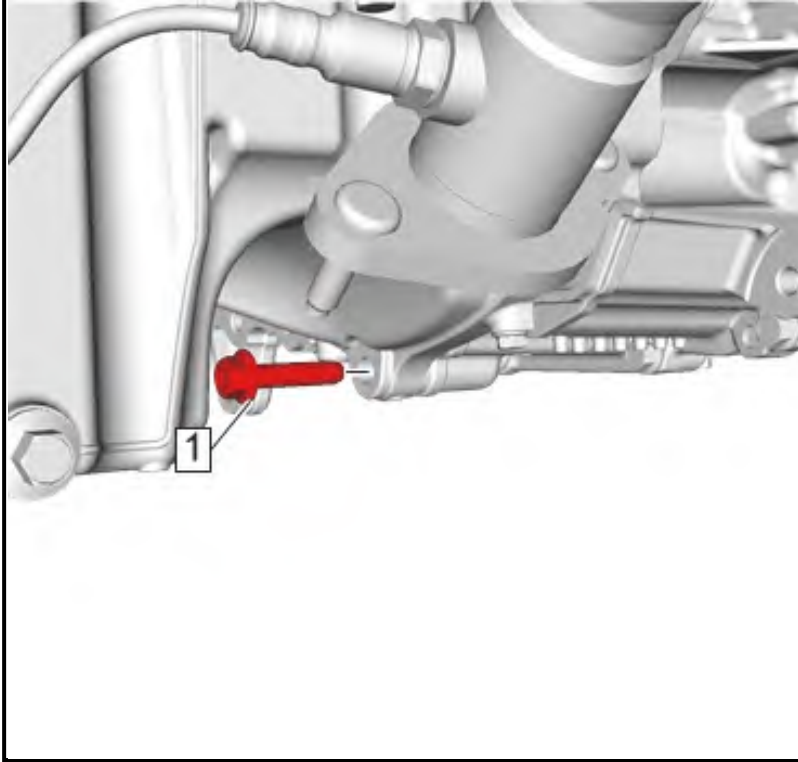
Engine Oil Level Indicator Switch (1) - Disconnect the electrical connector.

5. Harness Connector (2) - Disconnect [2x]

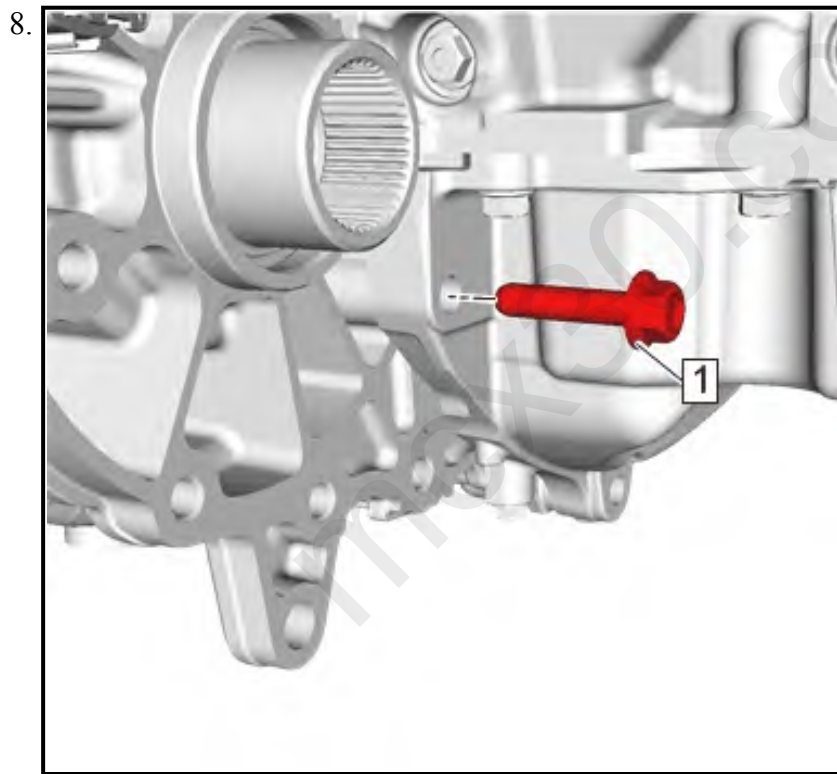


Transmission Bolt (1) - Remove



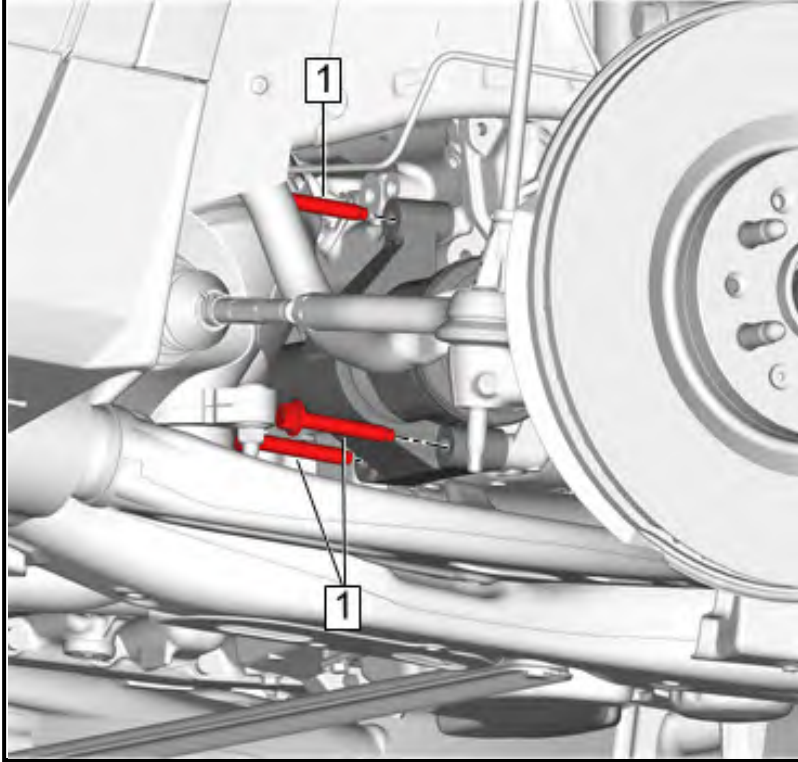


Transmission Bolt (1) - Remove



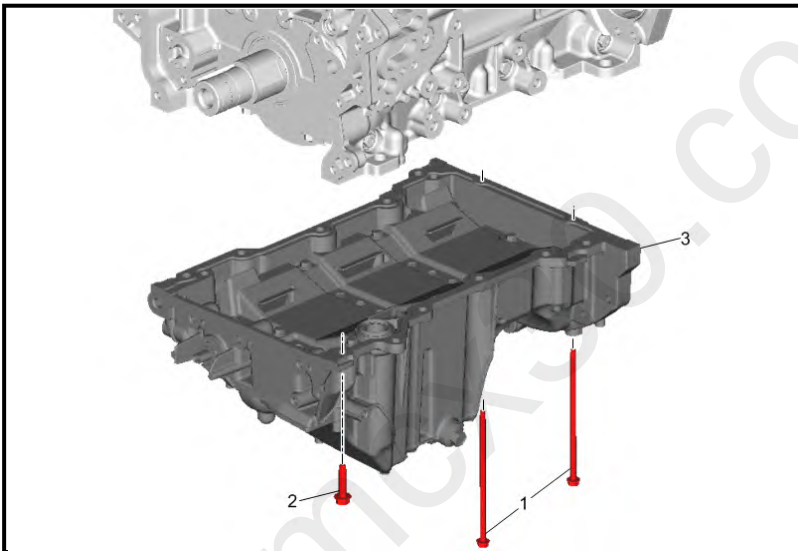
Transmission Bolt (1) - Remove





Front Wheel Drive Intermediate Shaft Bracket Bolt (1) - Remove [3x]

10.



Oil Pan Bolt (1) - Remove [2x]

11. Oil Pan Bolt (2) - Remove [11x]

12. Oil Pan (3) - Remove

13. Clean and inspect the oil pan. [Oil Pan Cleaning and Inspection](#)

14. Disassemble the oil pan as necessary. [Oil Pan Disassemble](#)

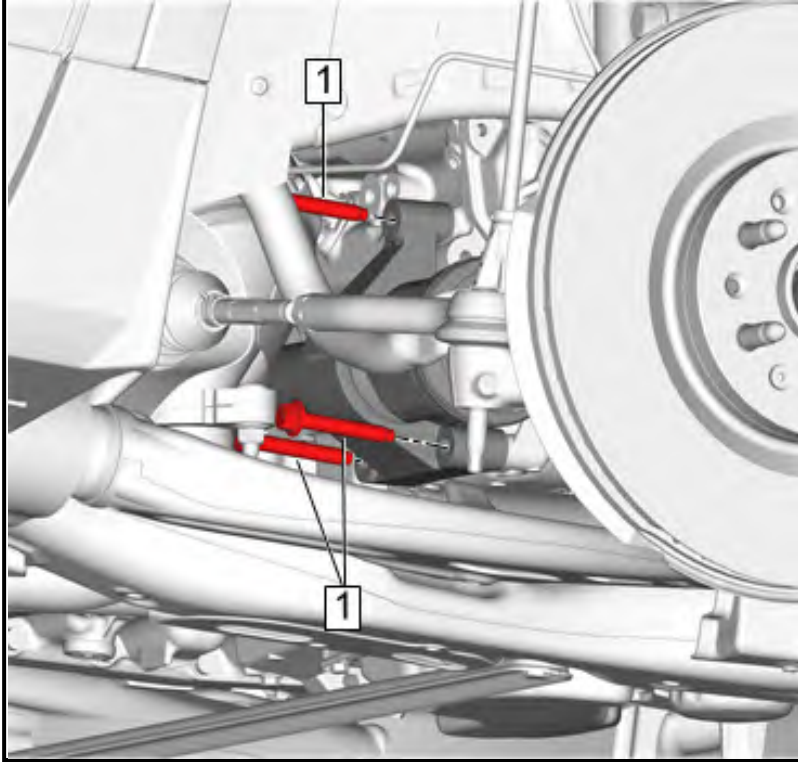
Installation Procedure

1. Assemble the oil pan as necessary. [Oil Pan Assemble](#)

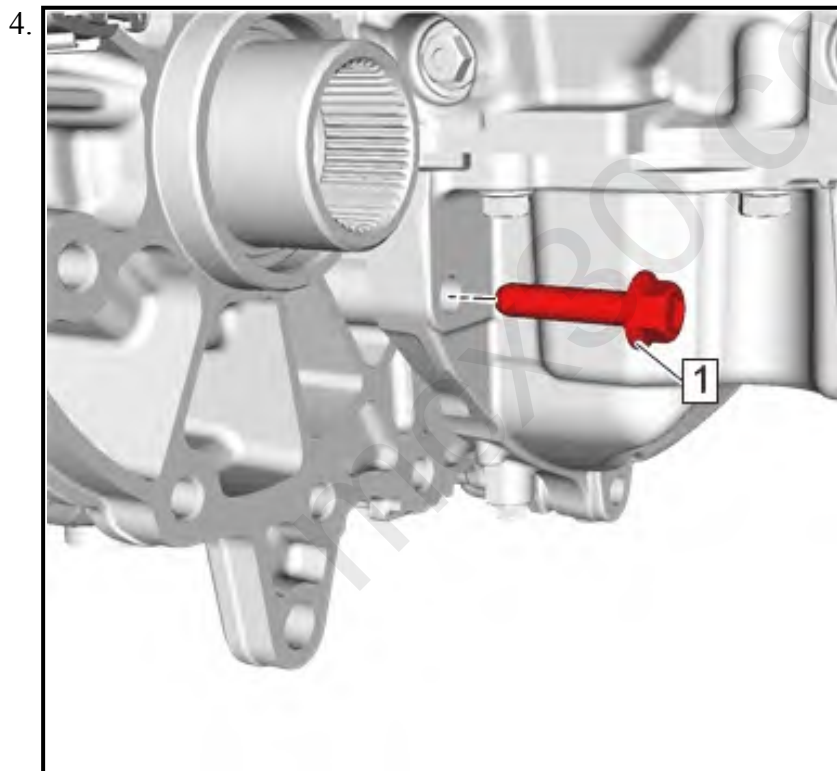
2. Oil Pan - Install - [Oil Pan Installation](#)

3.



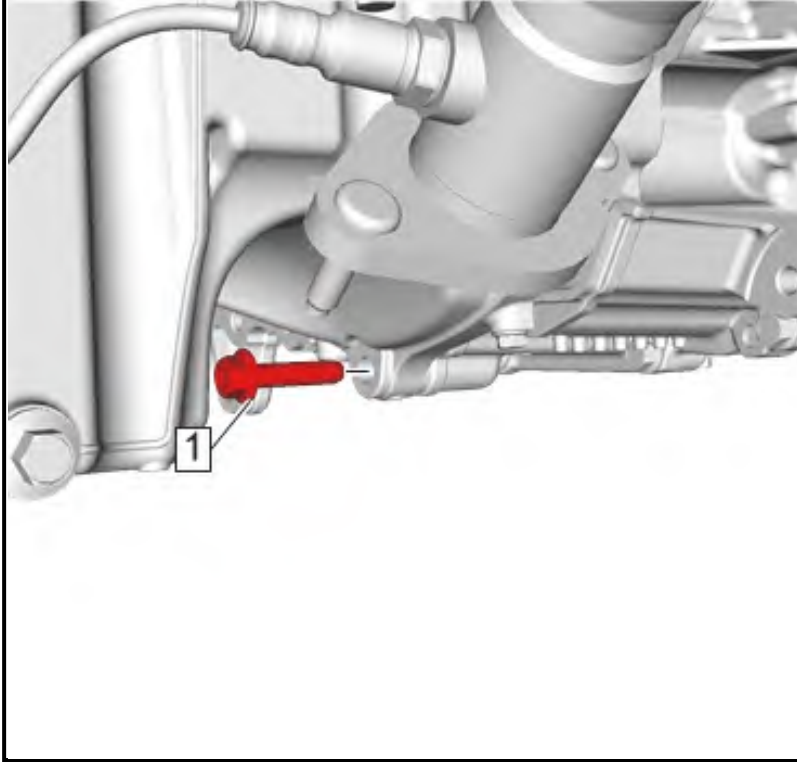


Front Wheel Drive Intermediate Shaft Bracket Bolt (1) - Install and tighten [3x] - [Front Wheel Drive Shaft Replacement - Right Side \(LFY with FWD\)](#)

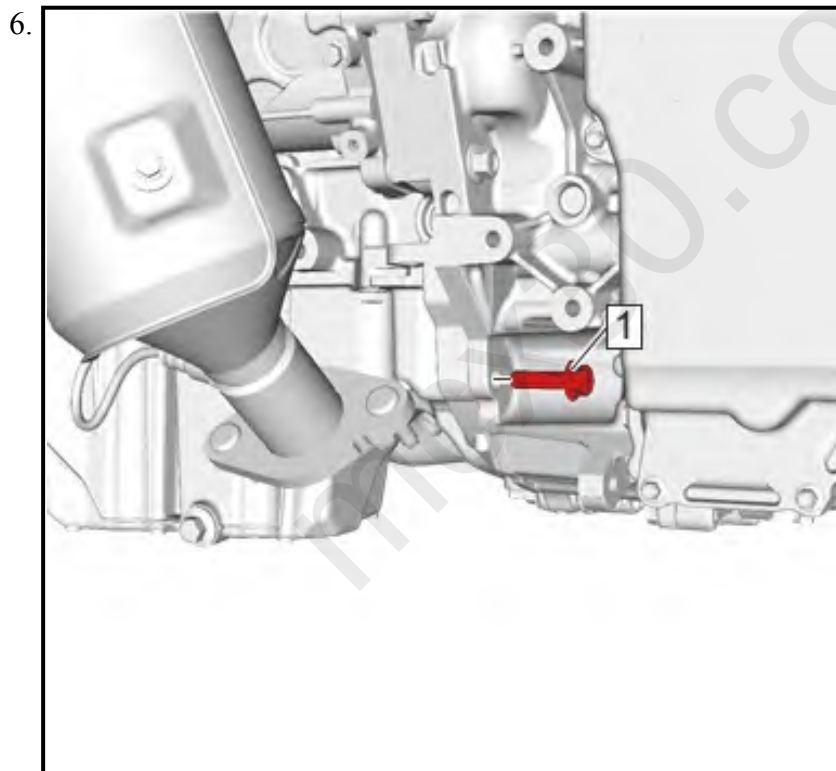


Transmission Bolt (1) - Install - [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#) [Transmission Replacement \(All Wheel Drive\)](#)



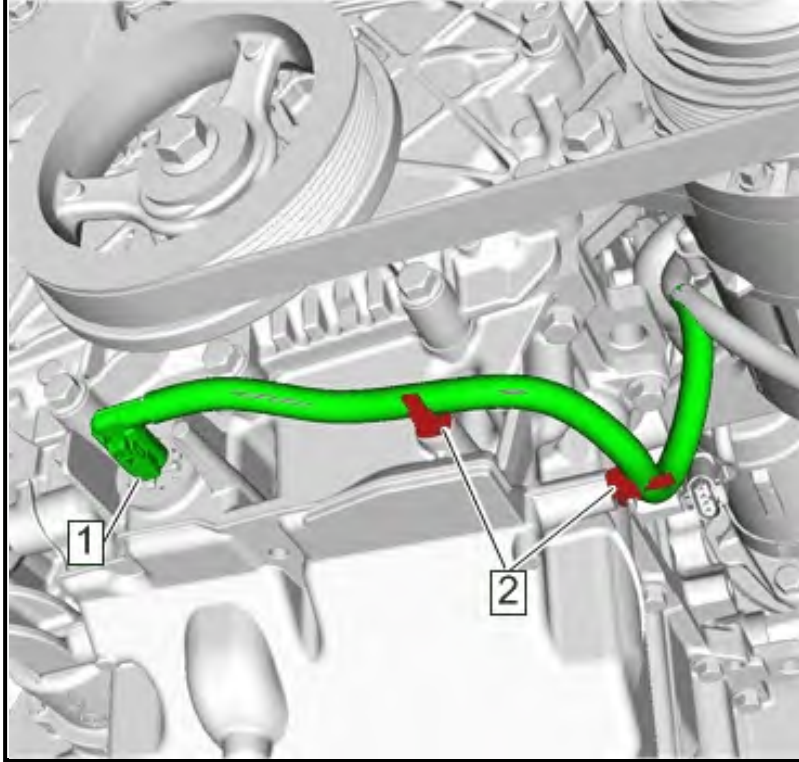


Transmission Bolt (1) - Install - [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#) [Transmission Replacement \(All Wheel Drive\)](#).



Transmission Bolt (1) - Install - [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#) [Transmission Replacement \(All Wheel Drive\)](#).

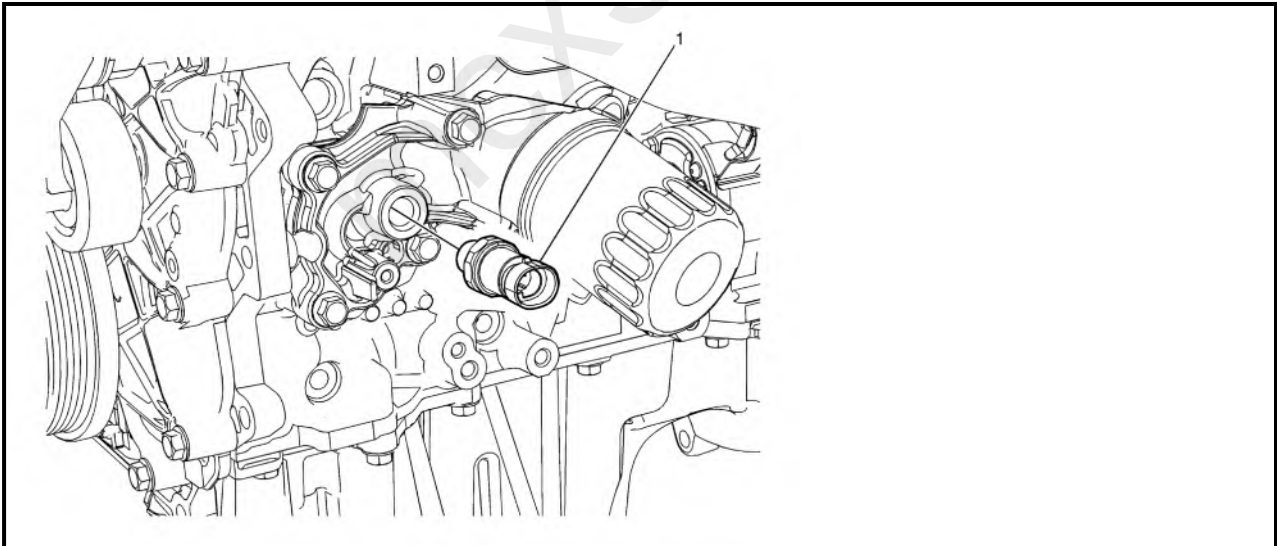




Harness Connector (2) - Connect [2x]

8. Engine Oil Level Indicator Switch (1) - Connect the electrical connector.
9. Engine Front Cover - Install - [Engine Front Cover Replacement](#)
10. Exhaust Front Pipe - Install - [Exhaust Front Pipe Replacement \(LFY\)](#)
11. Fill the engine oil to the proper level with NEW engine oil. [Approximate Fluid Capacities](#) , and [Adhesives, Fluids, Lubricants, and Sealers](#)
12. Start the engine and inspect for leaks.

ENGINE OIL PRESSURE SENSOR AND/OR SWITCH REPLACEMENT



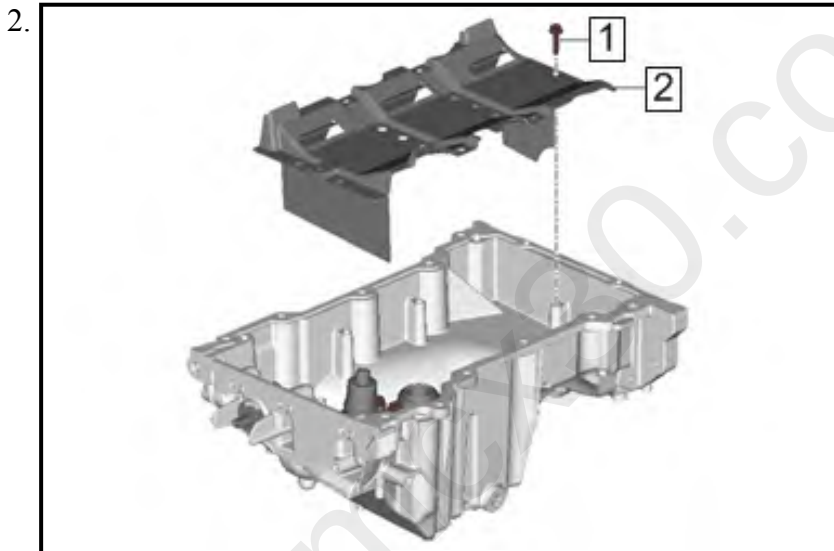
Callout	Component Name
Preliminary Procedure	
Generator Replacement (LFY)	

Callout	Component Name
1	Engine Oil Pressure Sensor and/or Switch CAUTION: Refer to Component Fastener Tightening Caution . Procedure 1. Disconnect the oil pressure sensor electrical connector. 2. Transfer components as necessary. Tighten 20 N.m (15 lb ft) Special Tools EN-41712 Oil Pressure Switch Socket For equivalent regional tools, refer to Special Tools .

ENGINE OIL LEVEL INDICATOR SWITCH REPLACEMENT

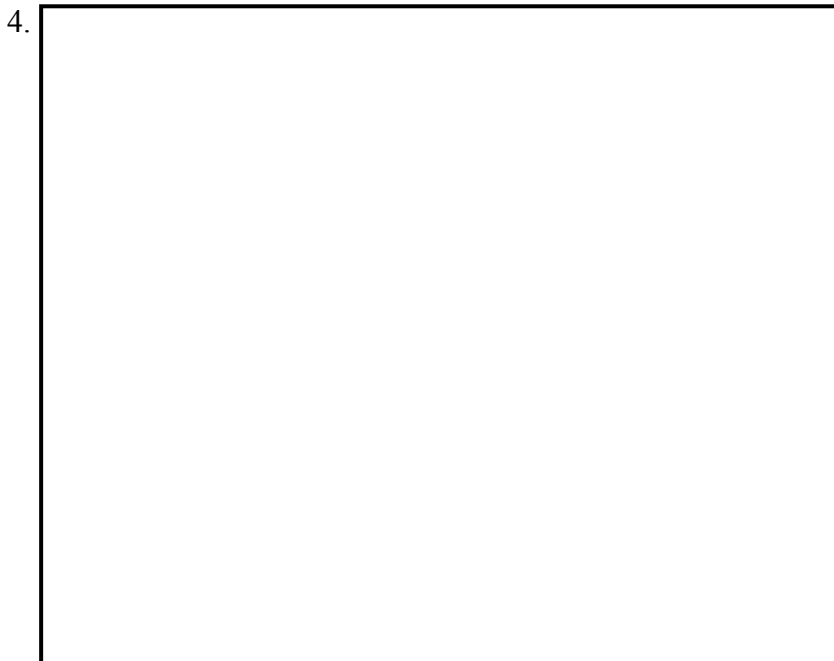
Removal Procedure

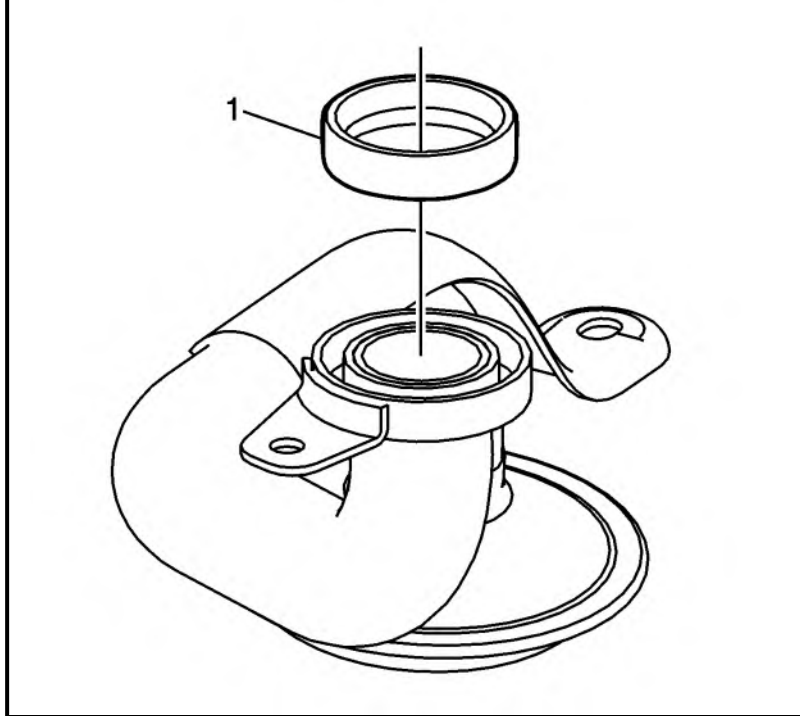
1. Remove the oil pan. [Oil Pan Replacement \(AWD\)](#)[Oil Pan Replacement \(FWD\)](#).



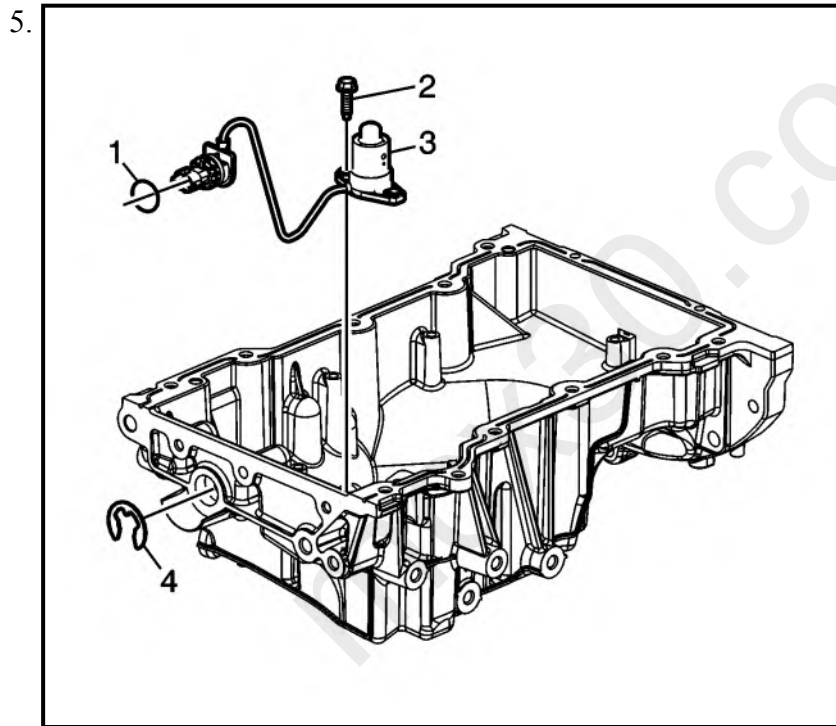
Remove the oil pan scraper bolts (1).

3. Remove the oil pan scraper (2).





Remove the oil suction pipe seal (1) and discard.



Remove the engine oil level switch clip (4)

6. Remove the engine oil level switch bolts (2).

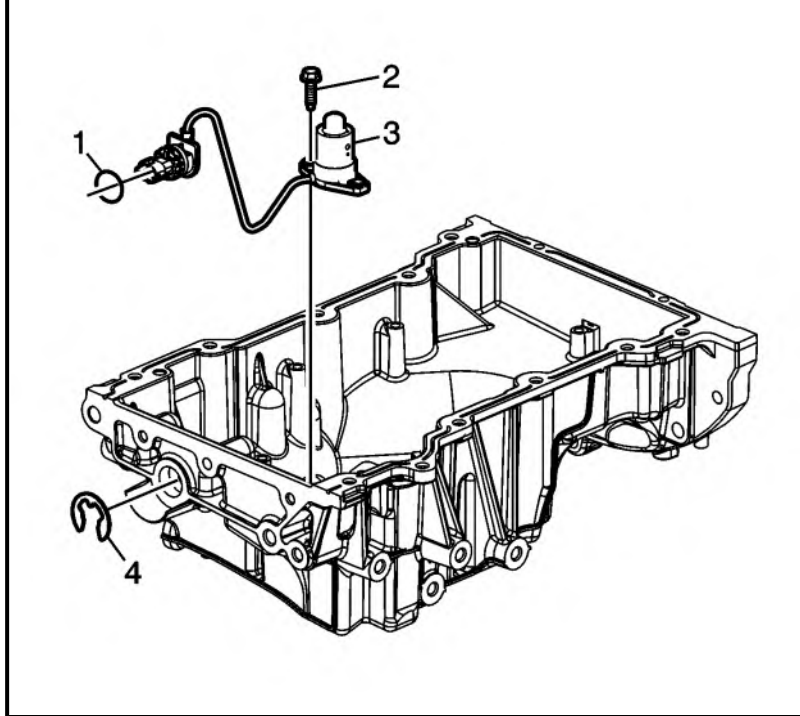
7. Remove the engine oil level switch (3).

8. Remove the engine oil level switch seal (1).

Installation Procedure

1.

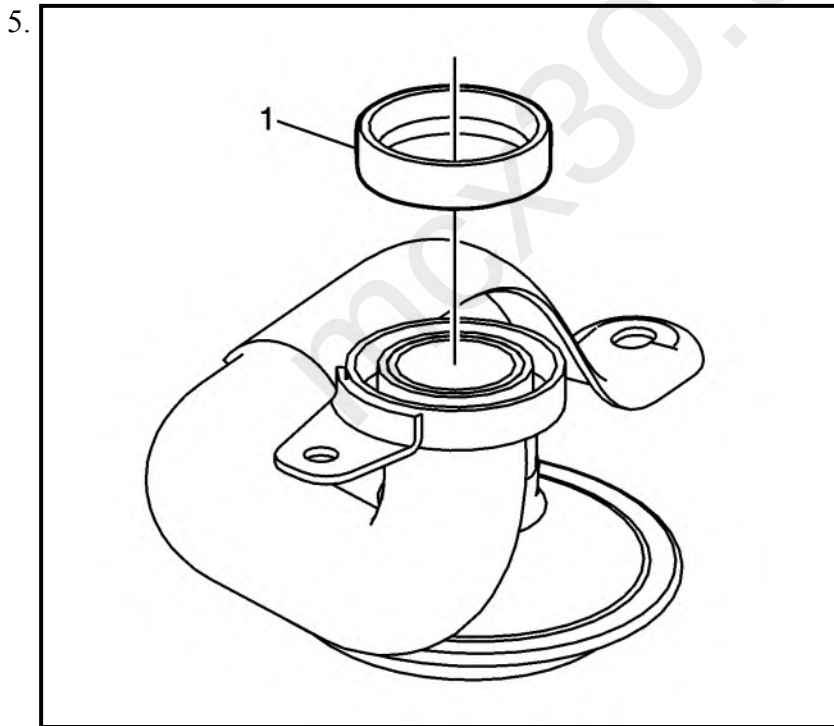




CAUTION: Refer to [Fastener Caution](#) .

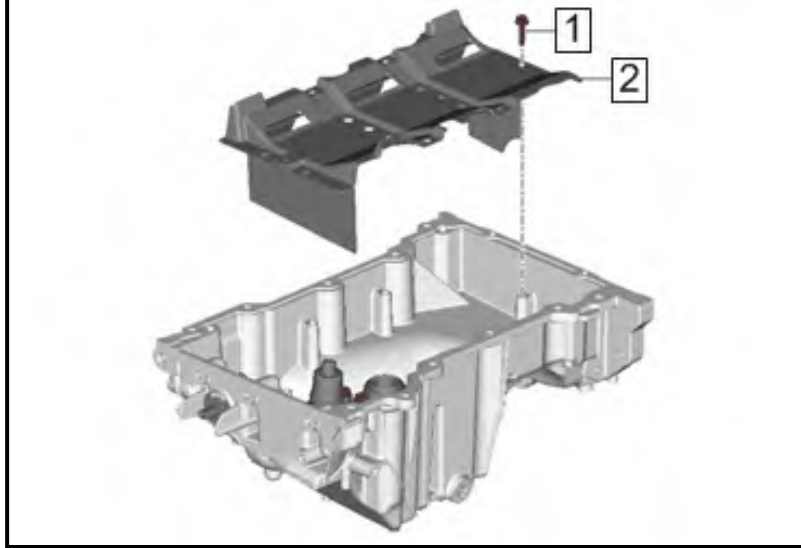
Install the NEW engine oil level switch seal (1).

2. Install the engine oil level switch (3).
3. Install the engine oil level switch bolts (2) and tighten to 10 N.m (89 lb in).
4. Install NEW engine oil level switch clip (4).



Install NEW oil suction pipe seal (1).





Install the oil pan scraper (2).

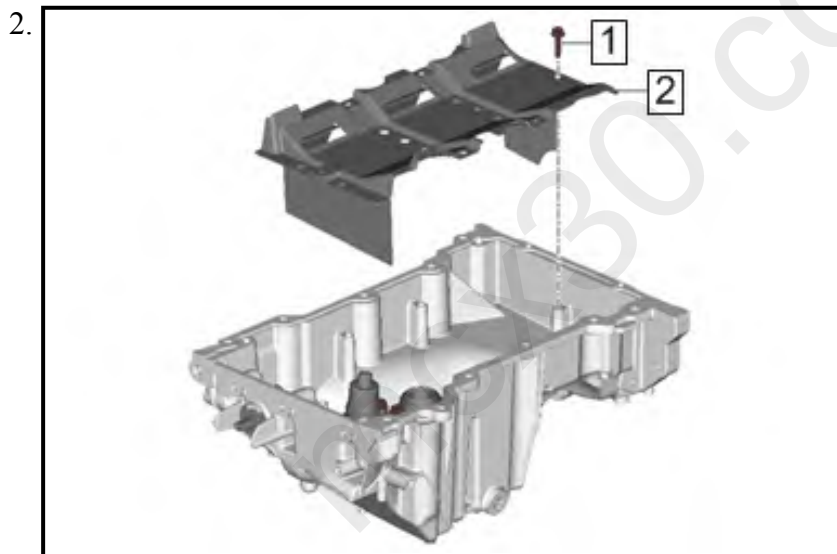
7. Install the oil pan scraper bolts (1) and tighten to 10 N.m (89 lb in).

8. Install the oil pan. [Oil Pan Replacement \(AWD\)](#)[Oil Pan Replacement \(FWD\)](#)

OIL PUMP SUCTION PIPE AND SCREEN ASSEMBLY REPLACEMENT

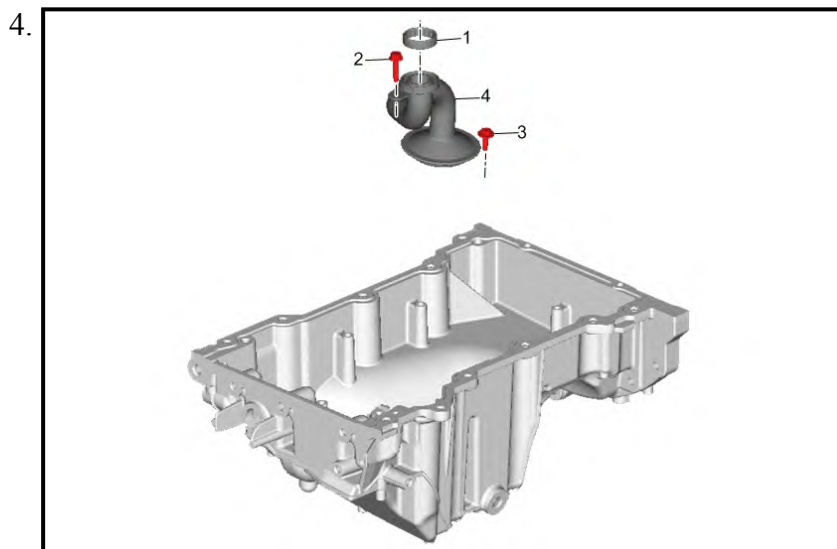
Removal Procedure

1. Remove the oil pan. [Oil Pan Replacement \(AWD\)](#)[Oil Pan Replacement \(FWD\)](#)



Remove the oil pan scraper bolts (1).

3. Remove the oil pan scraper (2).

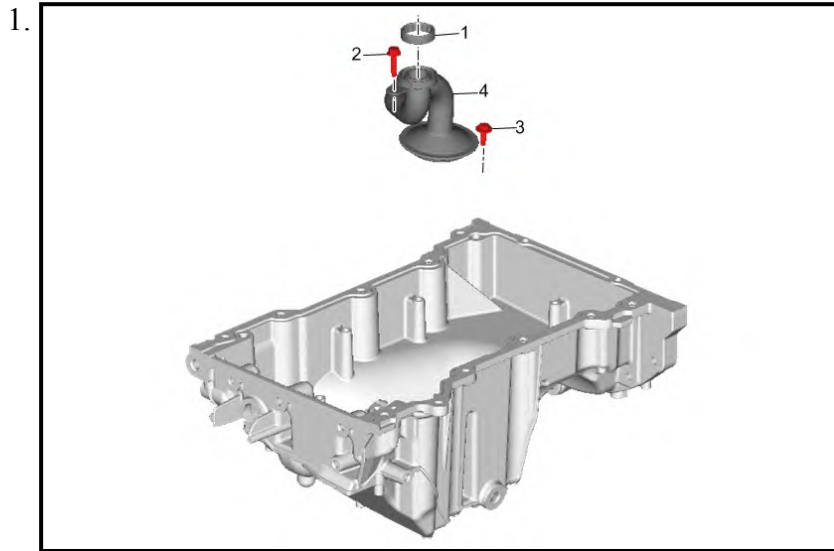


Remove the oil suction pipe seal (1).

5. Remove the oil suction pipe bolts (2 and 3).

6. Remove the oil suction pipe (4).

Installation Procedure

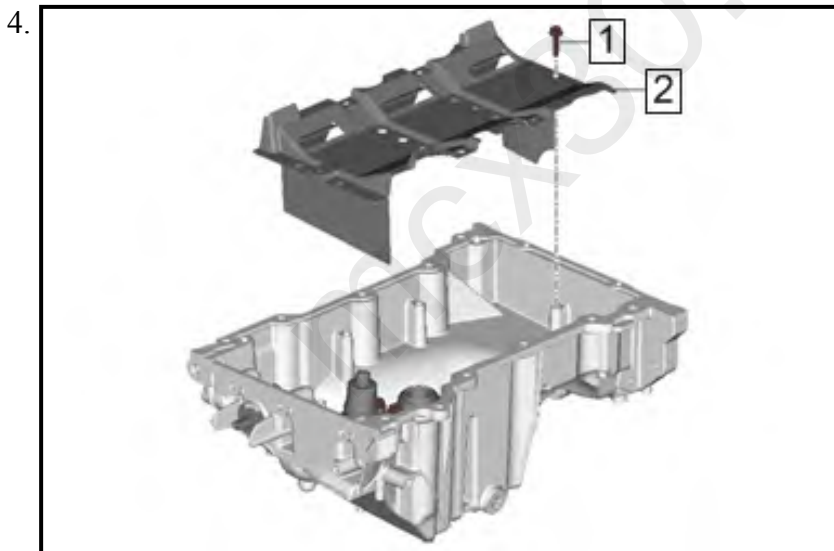


Install the NEW oil suction pipe seal (1).

CAUTION: Refer to [Fastener Caution](#) .

2. Install the oil suction pipe (4).

3. Install the oil suction pipe bolts (2 and 3) and tighten to 10 N.m (89 lb in).



Install the oil pan scraper (2).

5. Install the oil pan scraper bolts (1) and tighten to 10 N.m (89 lb in).

6. Install the oil pan. [Oil Pan Replacement \(AWD\)](#)[Oil Pan Replacement \(FWD\)](#)

ENGINE REPLACEMENT (AWD)

Special Tools

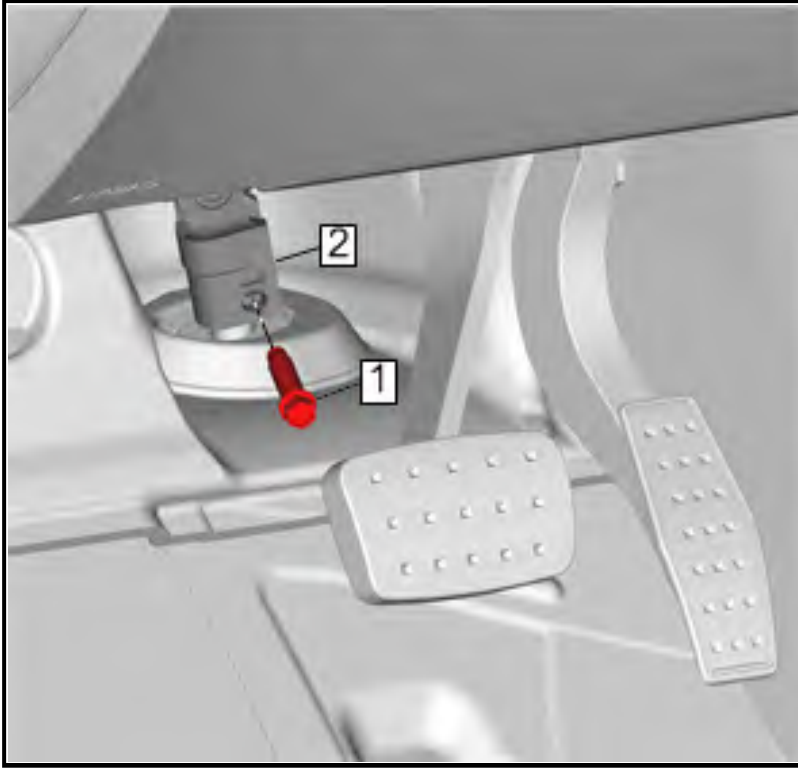
EN-48244 Engine Assembly Remove/Install Pallet Supporter

Equivalent regional tools: [Special Tools](#)

Removal Procedure

1. Disconnect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)

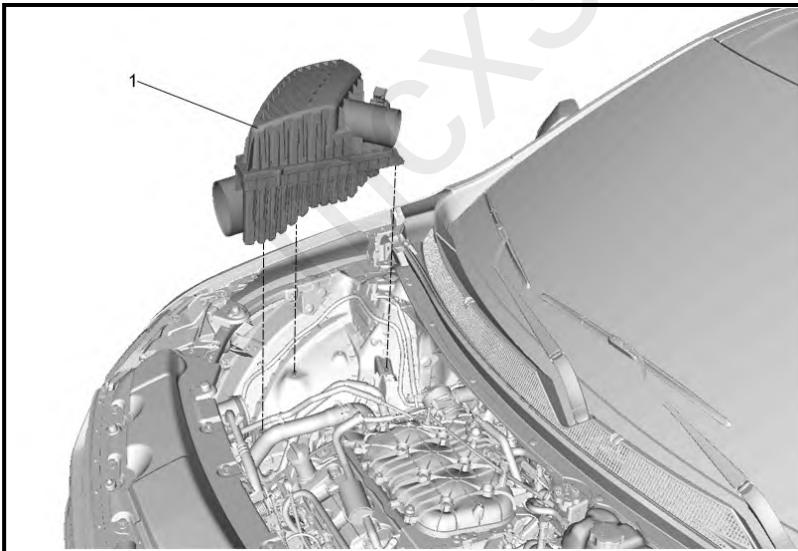
2.



Intermediate Steering Shaft (2) @ Steering Gear - Separate - [Intermediate Steering Shaft Replacement](#)

3. Recover the refrigerant. [Refrigerant Recovery and Recharging \(R-134a\)](#) [Refrigerant Recovery and Recharging \(R-1234yf\)](#)
4. Drain the cooling system. [Cooling System Draining and Filling \(GE 47716\)](#) [Cooling System Draining and Filling \(Static Fill\)](#)

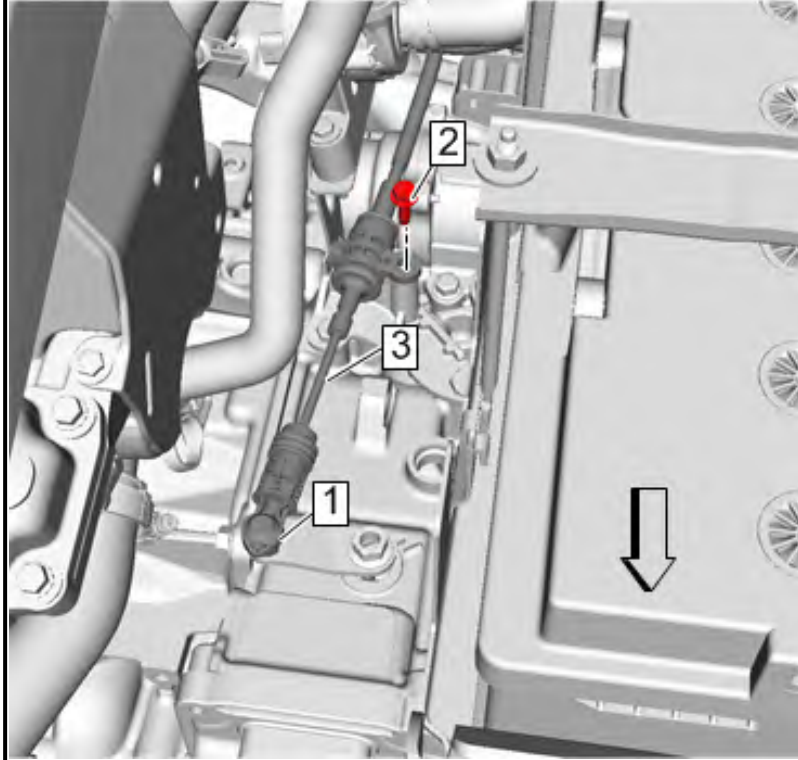
5.



Air Cleaner Assembly (1) - Remove - [Air Cleaner Assembly Replacement](#)

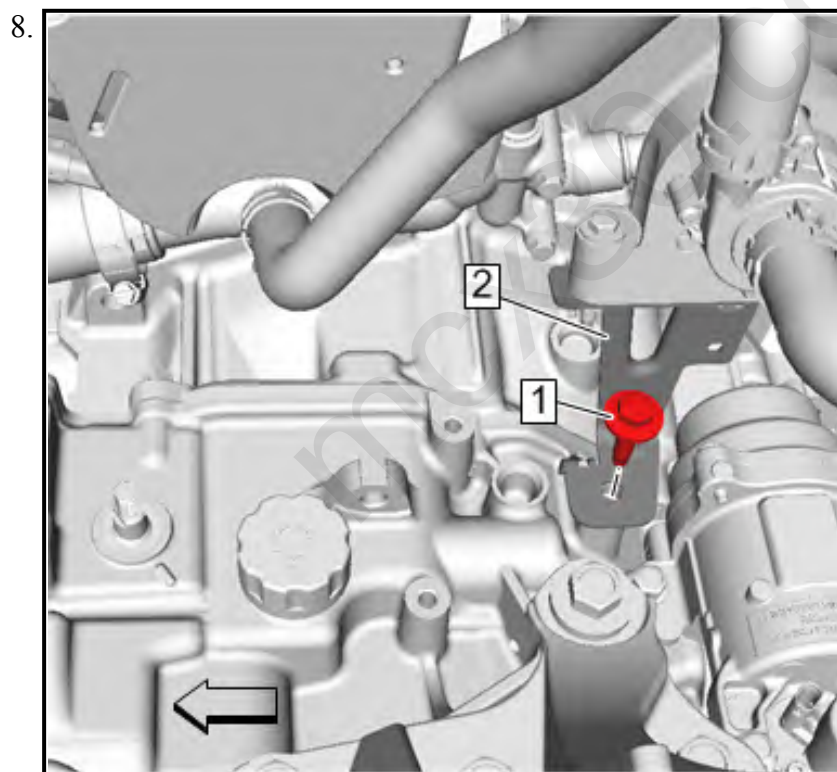
6.





Remove the automatic transmission range selector lever cable retaining bolt (2).

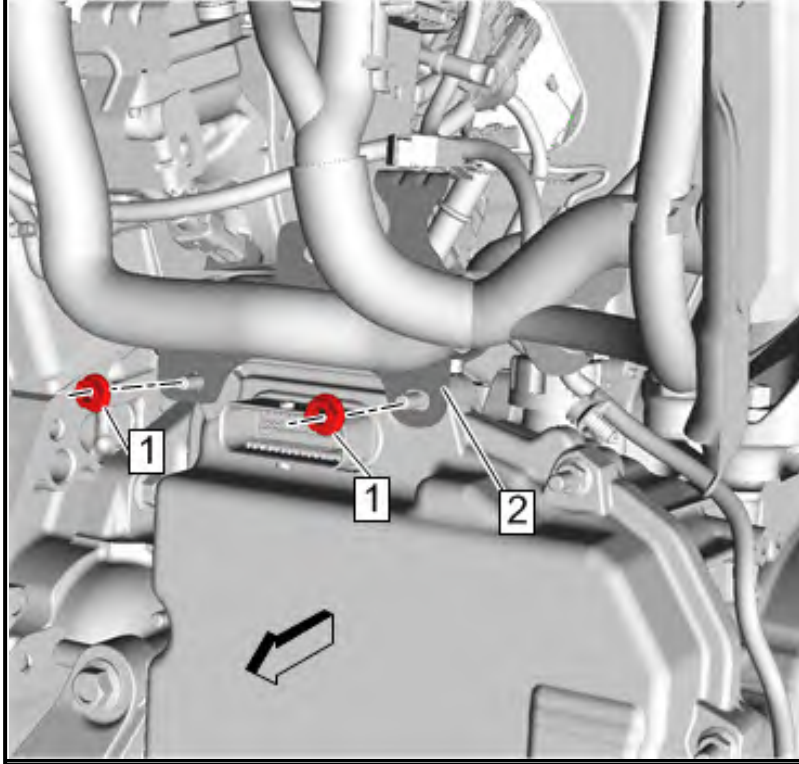
7. Disconnect the automatic transmission range selector lever cable terminal (1) from the transmission manual shift lever pin.



Remove the heater water auxiliary pump bolt (1).

9. Position the heater water auxiliary pump (2) out of the way.

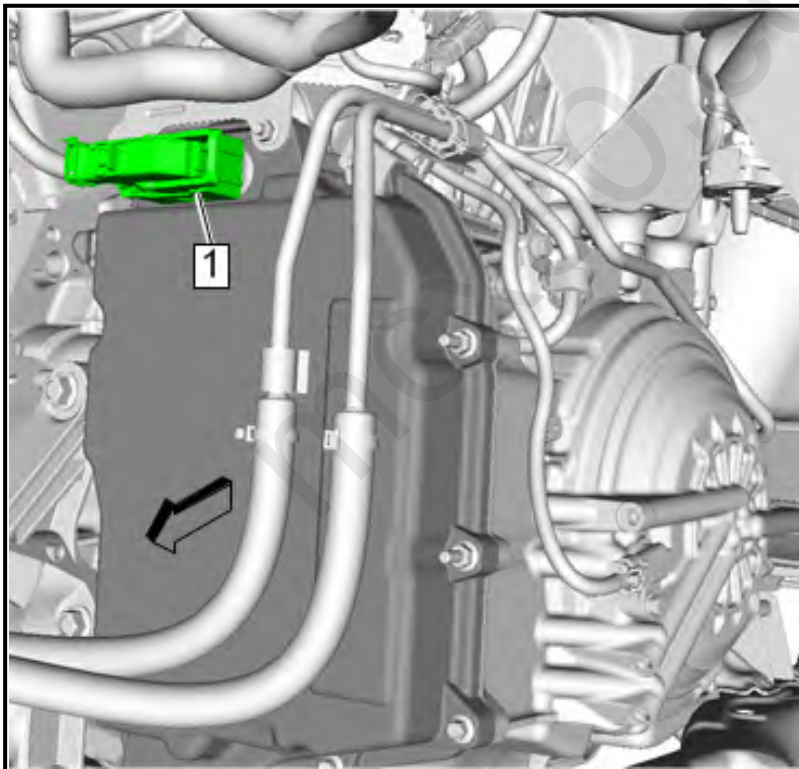




Remove the electrical harness bracket nuts (1).

11. Remove the electrical harness bracket (2) from the control valve body cover and position out of the way.

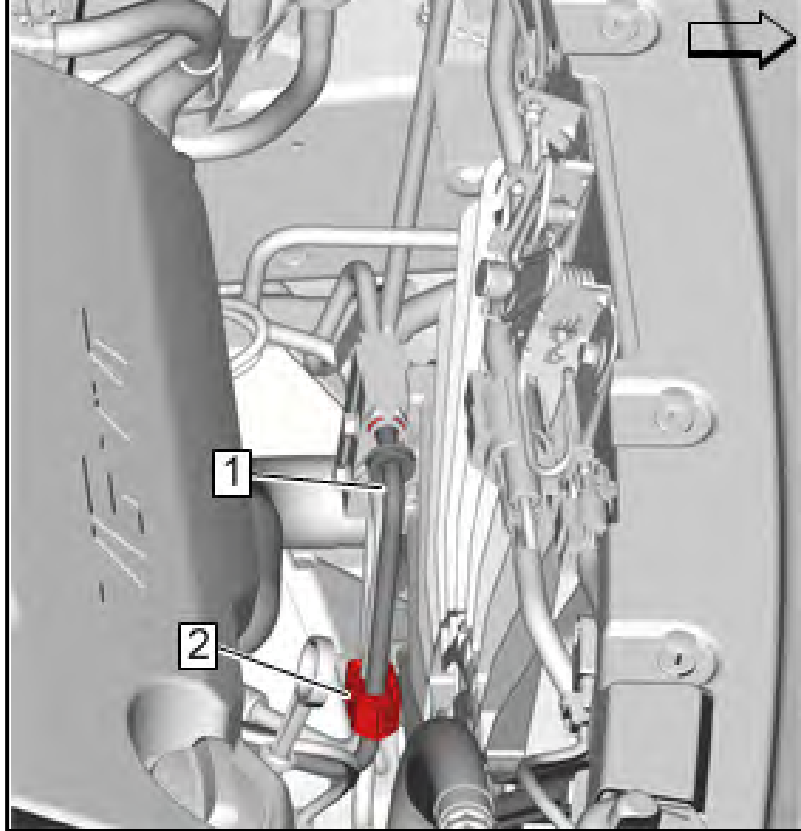
12.



Disconnect the control valve body transmission control module electrical connector (1), then unclip the wiring harness from the cover.

13.

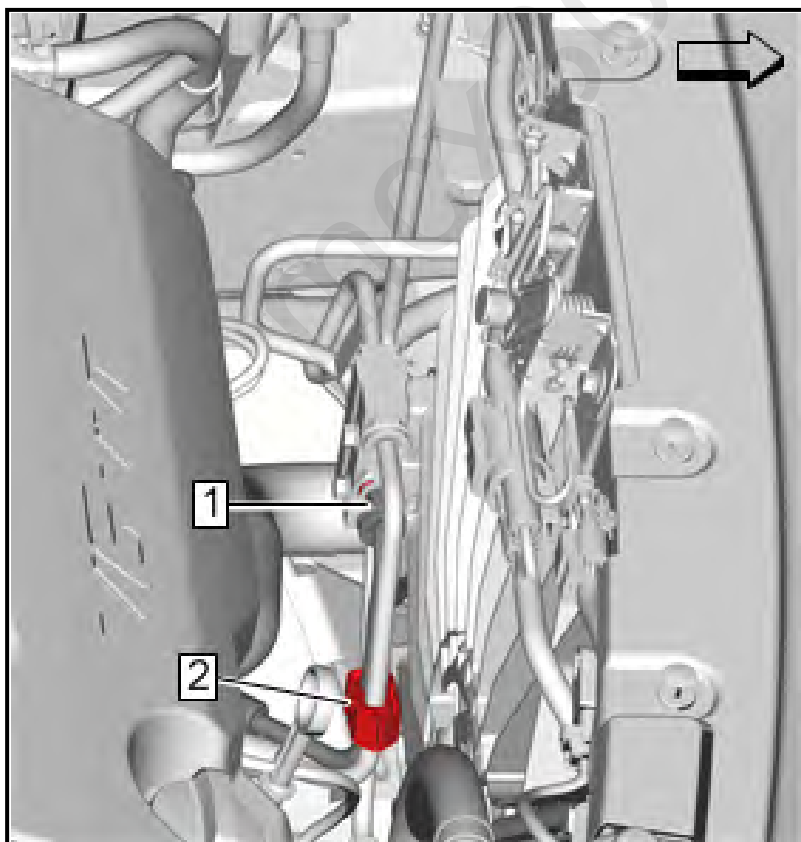




NOTE: Cover or plug all open transmission fluid cooler pipe connection points to help avoid any accidental contamination.

Transmission Fluid Cooler Outlet Pipe (1) @ Transmission Fluid Cooler Thermal Bypass Valve - Disconnect - [Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection](#)

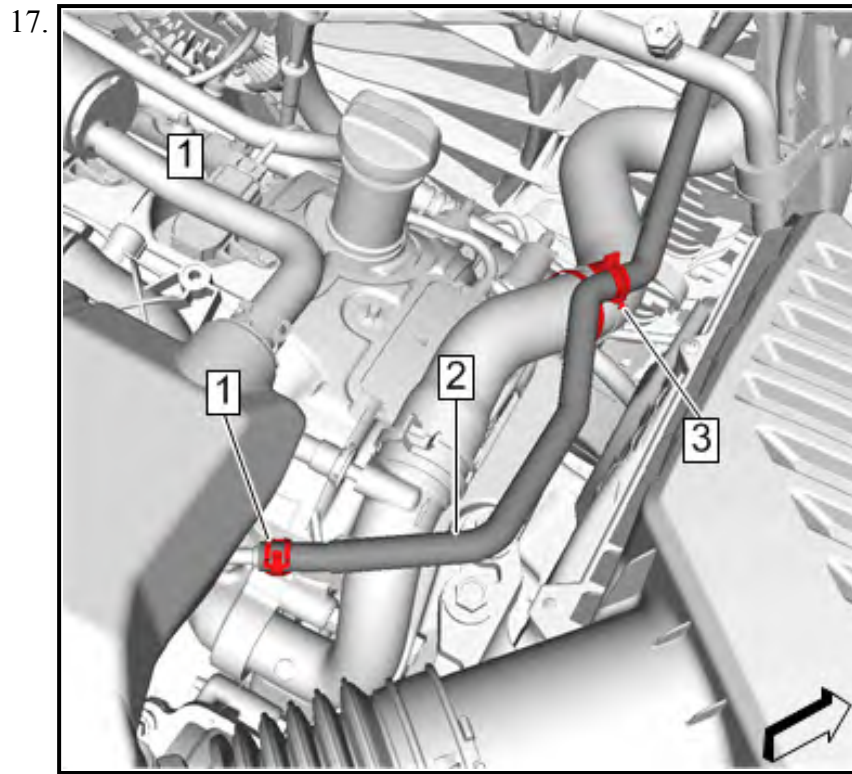
14.



Transmission Fluid Cooler Inlet Pipe (1) @ Transmission Fluid Cooler Thermal Bypass Valve - Disconnect - [Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection](#)

15. Plug and/or cap the pipes and the transmission to prevent contamination.

16. Remove the body ground cable and wiring harness assembly mounting bolt at front of transmission and position ground cable and harness out of the way.

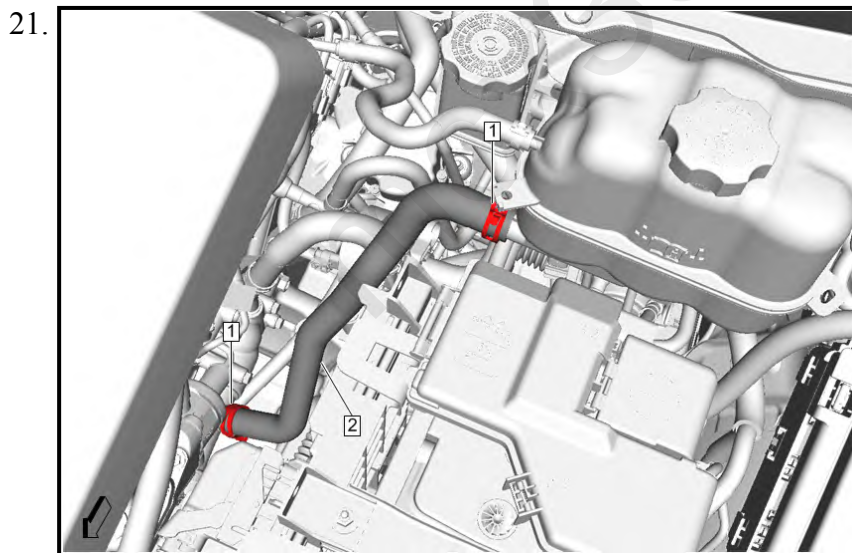


Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Remove

18. Radiator Surge Tank Overflow Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

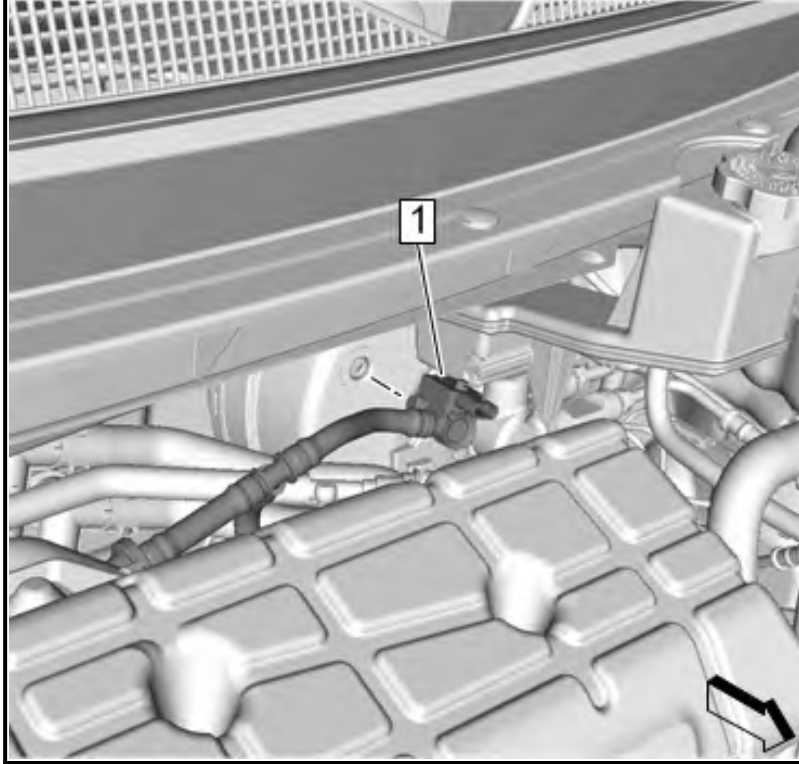
19. Radiator Surge Tank Overflow Hose (2) @ Engine Coolant Air Bleed Pipe - Remove

20. Radiator Surge Tank Inlet Hose (2) @ Radiator Surge Tank - Remove



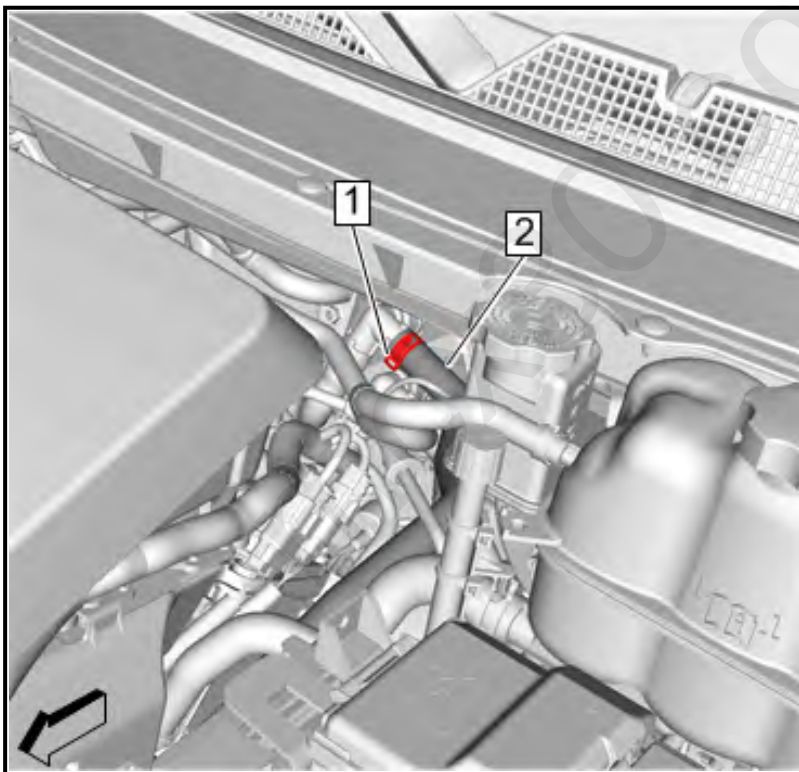
Radiator Surge Tank Outlet Hose (2) @ Radiator Surge Tank - Remove - [Hose Clamp Replacement Guidelines - Spring Type](#)





Power Brake Booster Vacuum Sensor (1) @ Power Brake Booster - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

23.

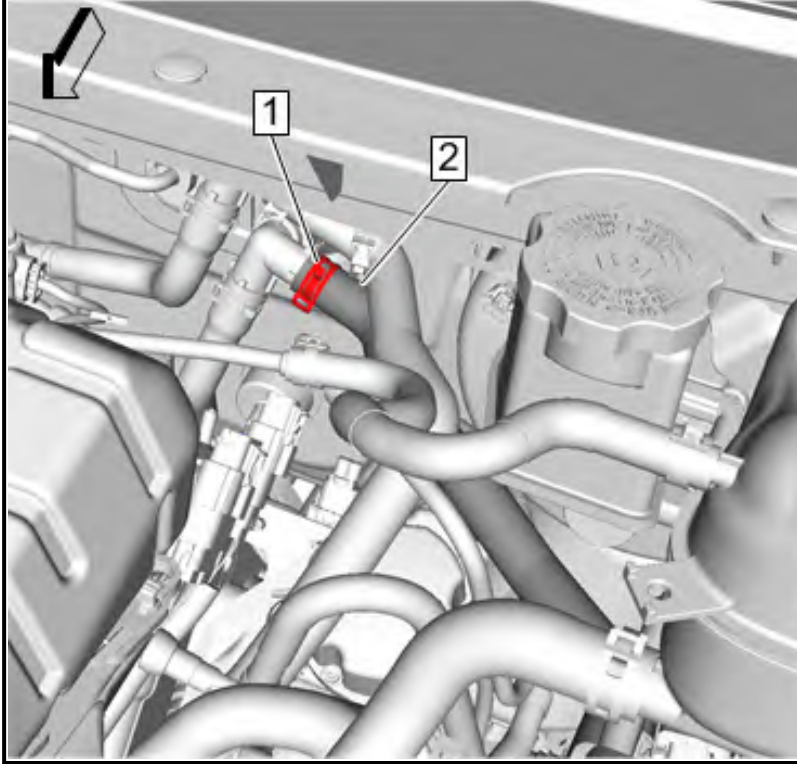


Heater Inlet Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

24. Heater Inlet Hose (2) @ Heater Outlet Hose Connector - Remove

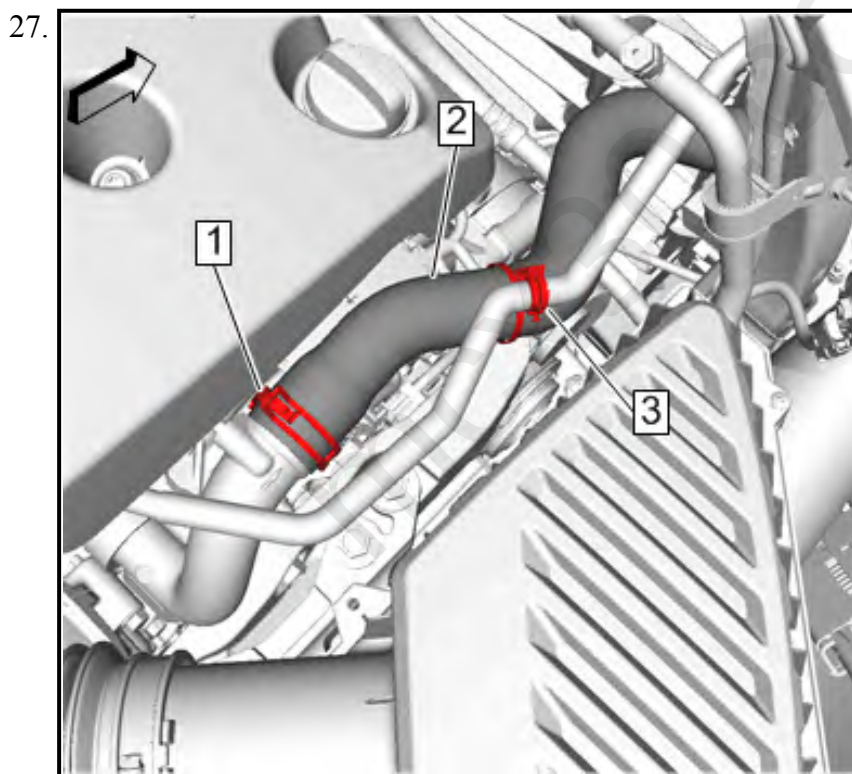
25.





Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

26. Heater Outlet Hose (2) @ Heater Outlet Hose Connector - Remove

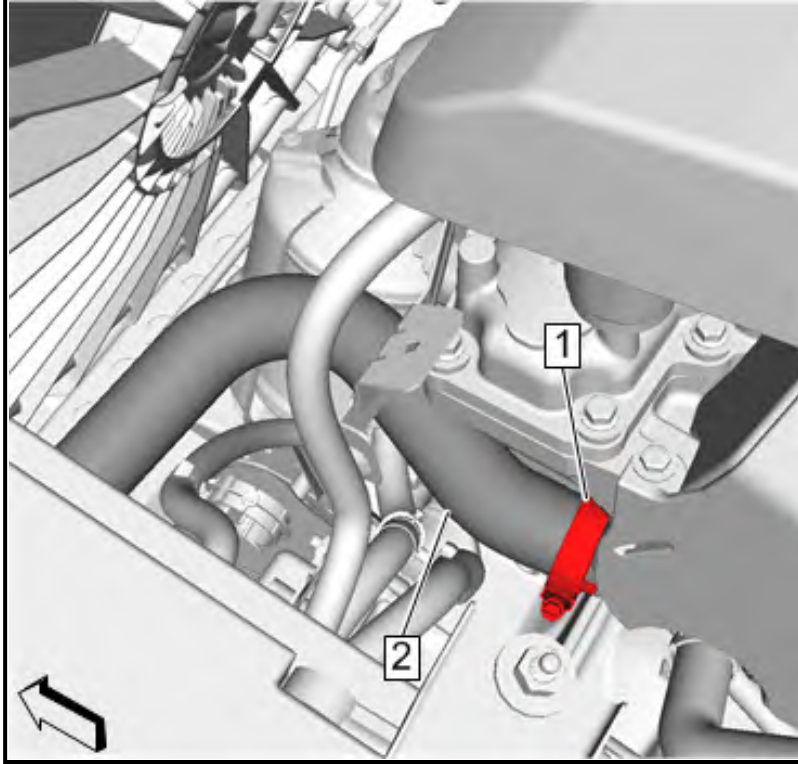


Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Remove

28. Radiator Inlet Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

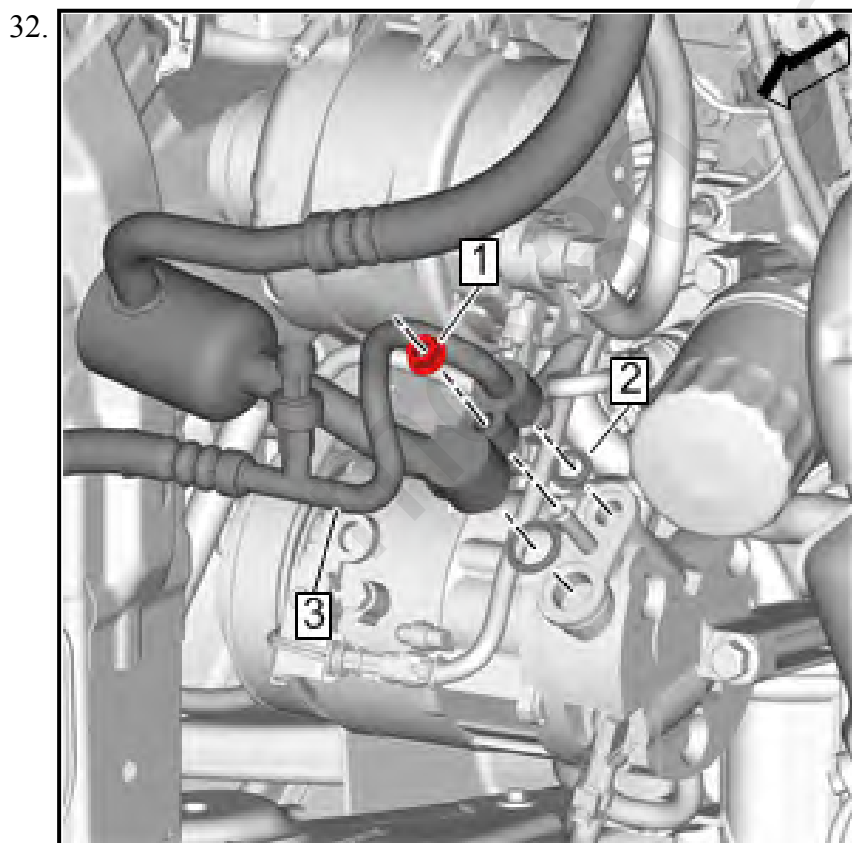
29. Radiator Inlet Hose (2) @ Water Outlet - Remove





Radiator Outlet Hose Clamp (1) - Remove

31. Radiator Outlet Hose (2) @ Engine Coolant Thermostat Housing - Remove

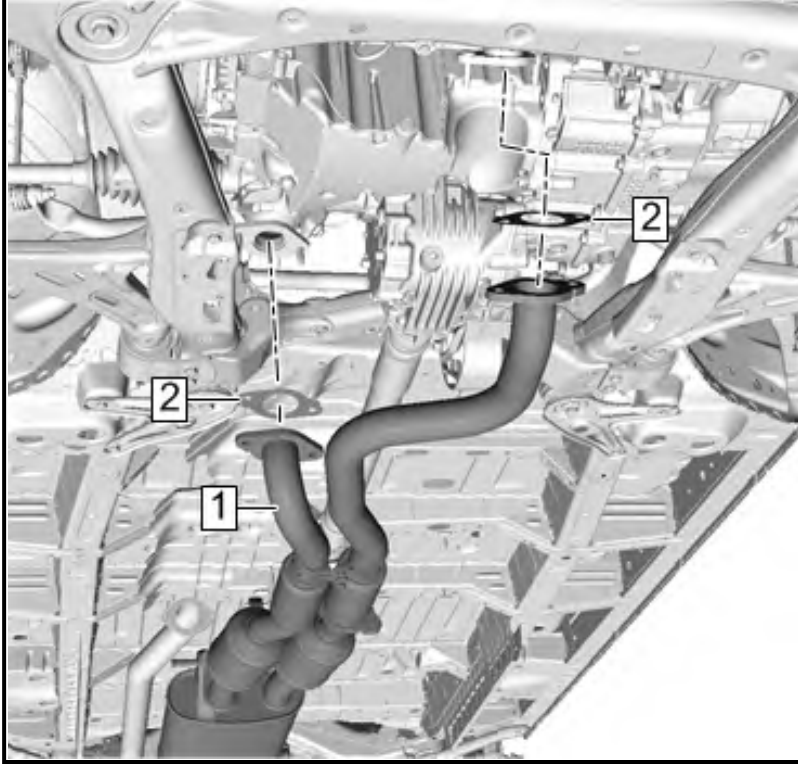


Air Conditioning Compressor and Condenser Hose (3) @ Air Conditioning Compressor - Remove
- [Air Conditioning Compressor and Condenser Hose Replacement \(LFY\)](#).

33. Remove the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)

34. Remove both front wheelhouse liners. [Front Wheelhouse Liner Replacement](#)

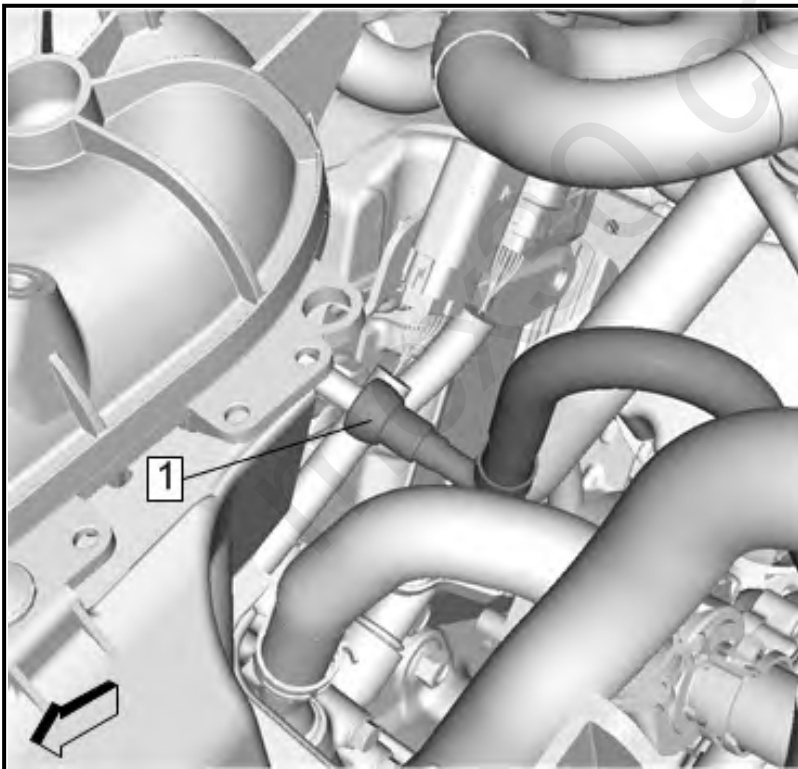




Exhaust Front Muffler (1) - Remove [Exhaust Front Muffler Replacement \(LFY\)](#)

36. Power Transfer Unit Case - Remove - [Power Transfer Unit Case Replacement](#)

37.



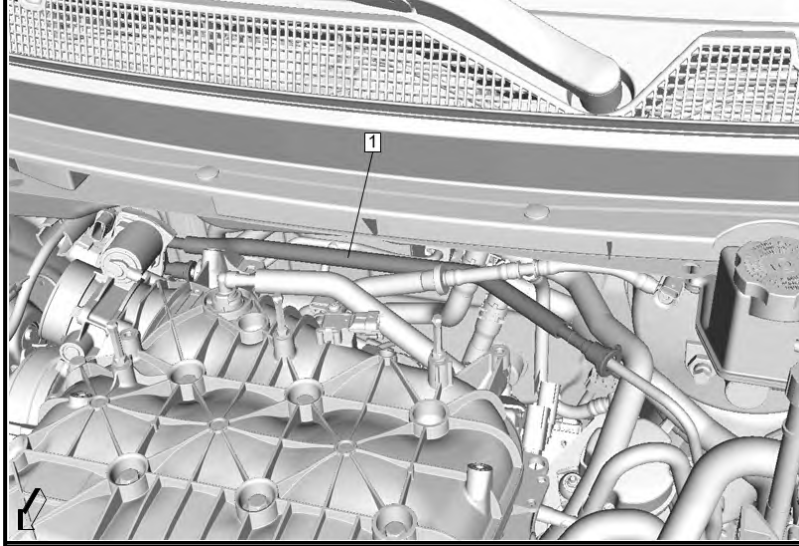
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

WARNING: Refer to [Safety Glasses Warning](#) .

Fuel Feed Pipe (1) @ Engine - Disconnect [Metal Collar Quick Connect Fitting Service](#)

38.





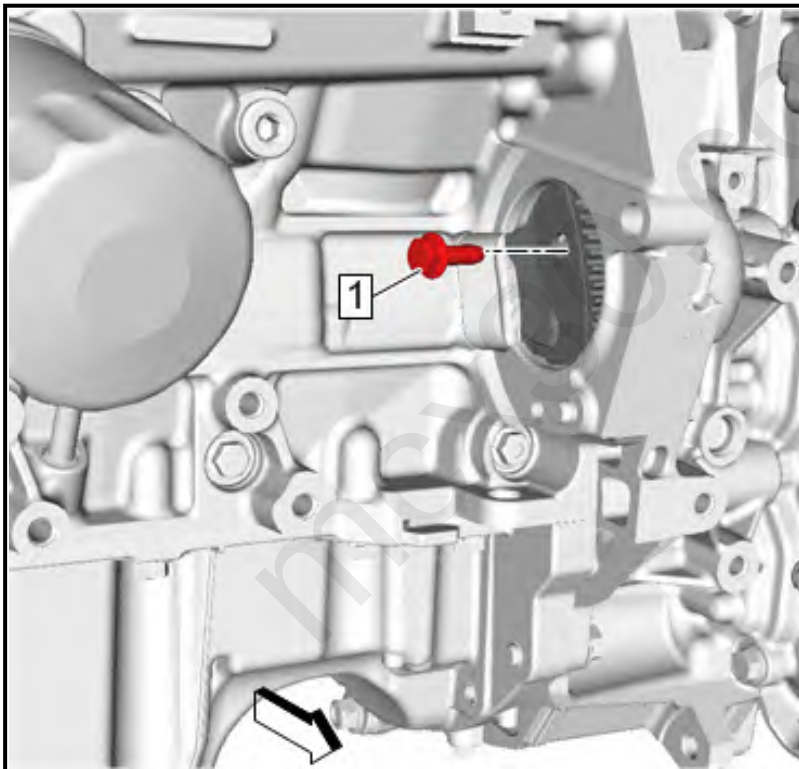
Evaporative Emission Front Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

39. Transmission Fluid Cooler Inlet Pipe (1) @ Transmission Fluid Cooler Inlet Pipe Clip (3) - Unclip

40. Starter - Remove - [Starter Replacement \(LEY\)](#)

41. Mark the relationship of the flex plate to the torque converter for reassembly.

42.



NOTE: Rotate engine clockwise using the crankshaft balancer bolt to gain access to each bolt.

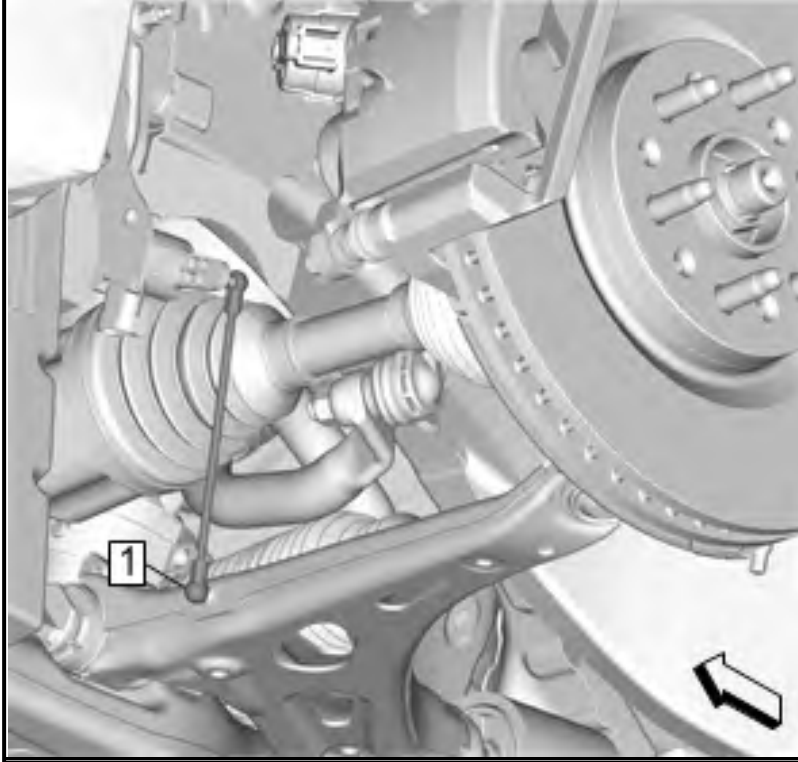
Remove the torque converter to flex plate bolts (1).

43. Front Wheel Drive Half Shaft @ Front Wheel Bearing and Hub Assembly - Separate - [Front Wheel Drive Half Shaft Replacement - Left Side](#)

44. Disconnect and reposition harnesses as required.

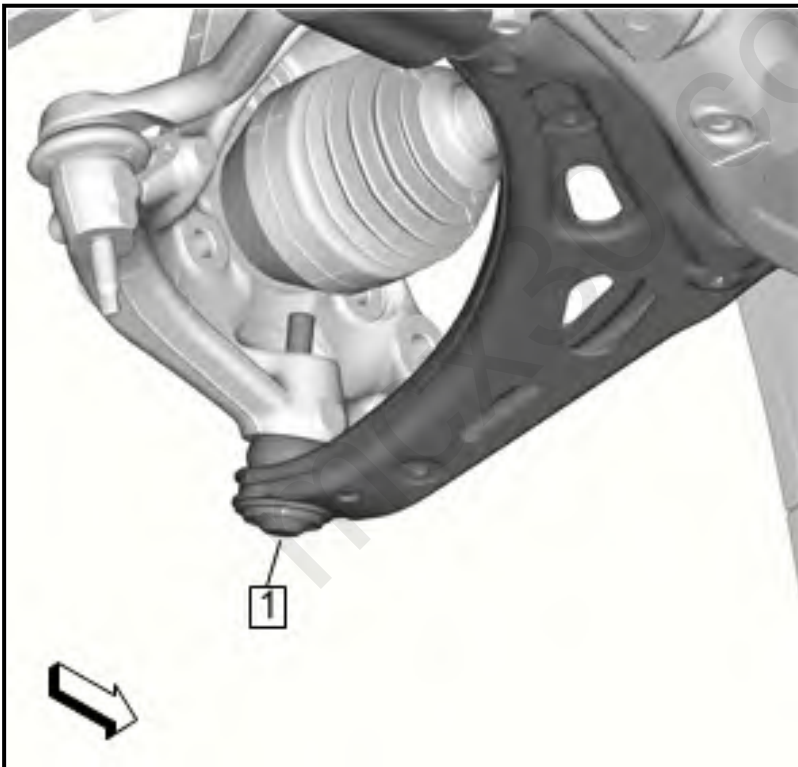
45.





{ If equipped } Front Suspension Automatic Forward Lighting Position Sensor (1) @ Front Lower Control Arm - Separate

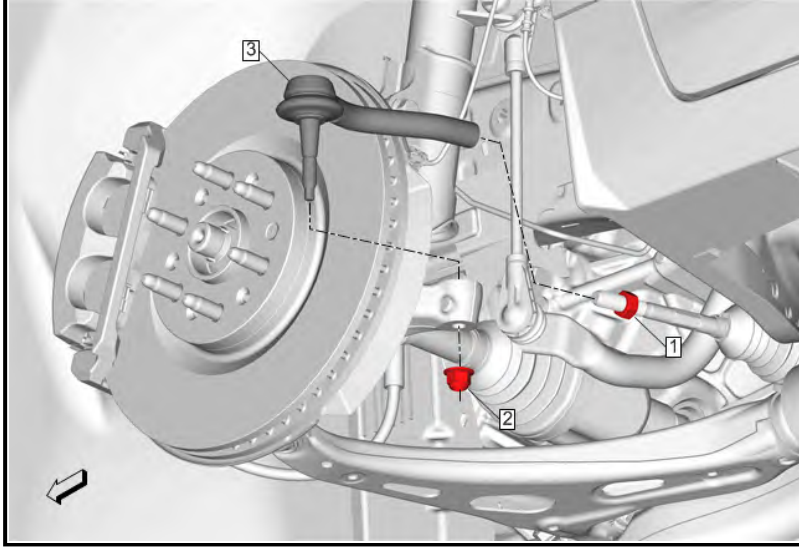
46.



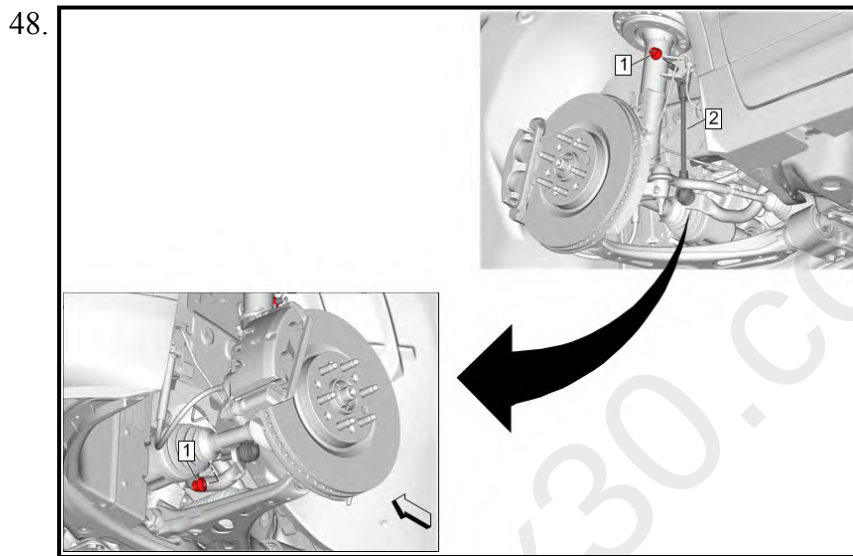
Front Lower Control Arm (1) @ Steering Knuckle - Separate - **Lower Control Arm Replacement**

47.

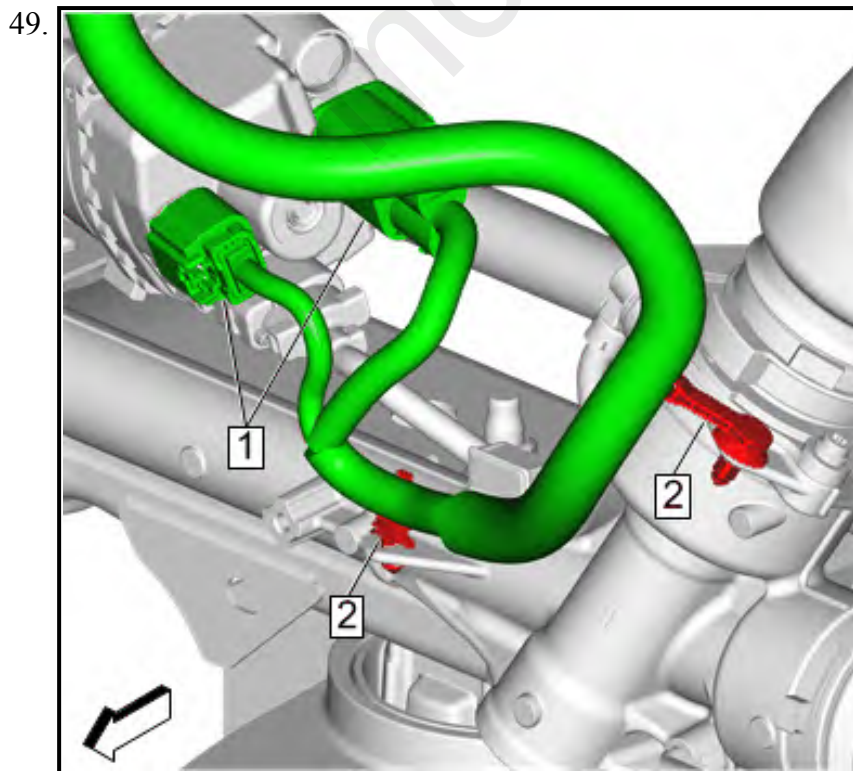




Steering Linkage Outer Tie Rod (3) @ Steering Knuckle - Separate - [Steering Linkage Outer Tie Rod Replacement](#)



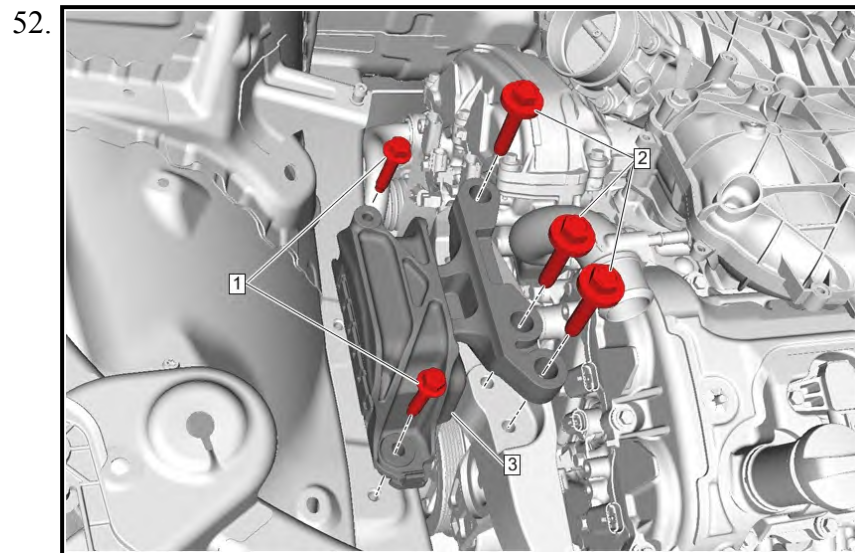
Stabilizer Shaft Link (2) @ Stabilizer Shaft - Separate - [Stabilizer Shaft Link Replacement](#)



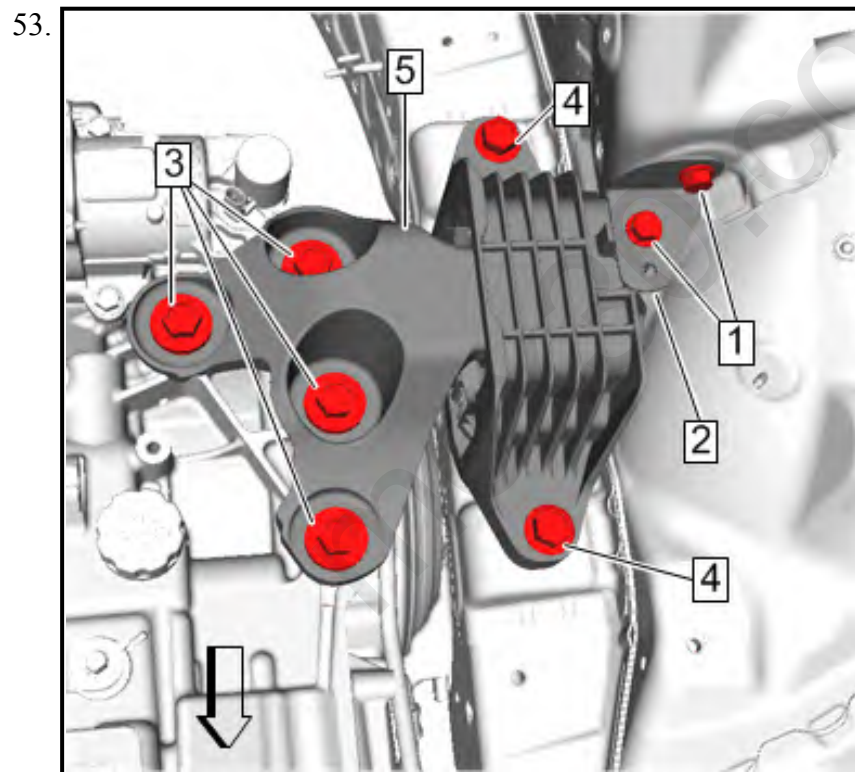
Disconnect the electrical connector on the steering gear and disconnect the wiring harness clip from the steering gear housing. (1)

50. Install **EN-48244** Engine Assembly Remove/Install Pallet Supporter under the drivetrain and front suspension cradle.

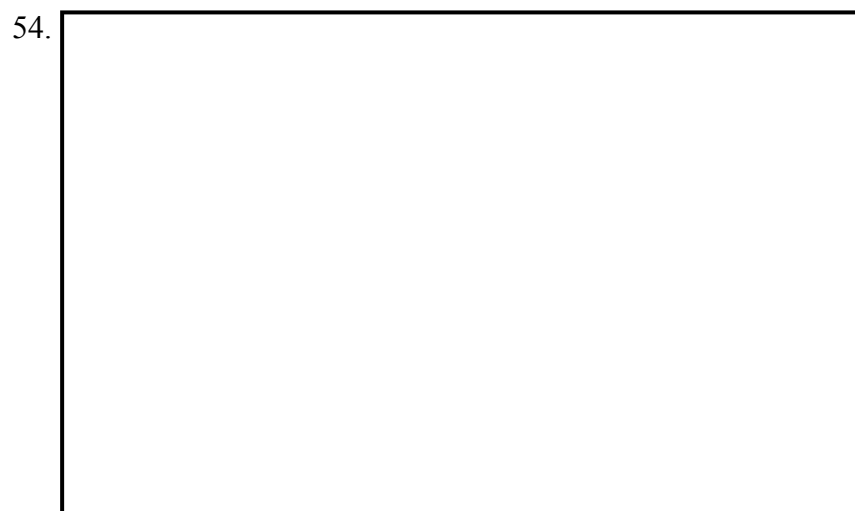
51. Lower the vehicle until the drivetrain and front suspension frame is resting lightly on the support table.

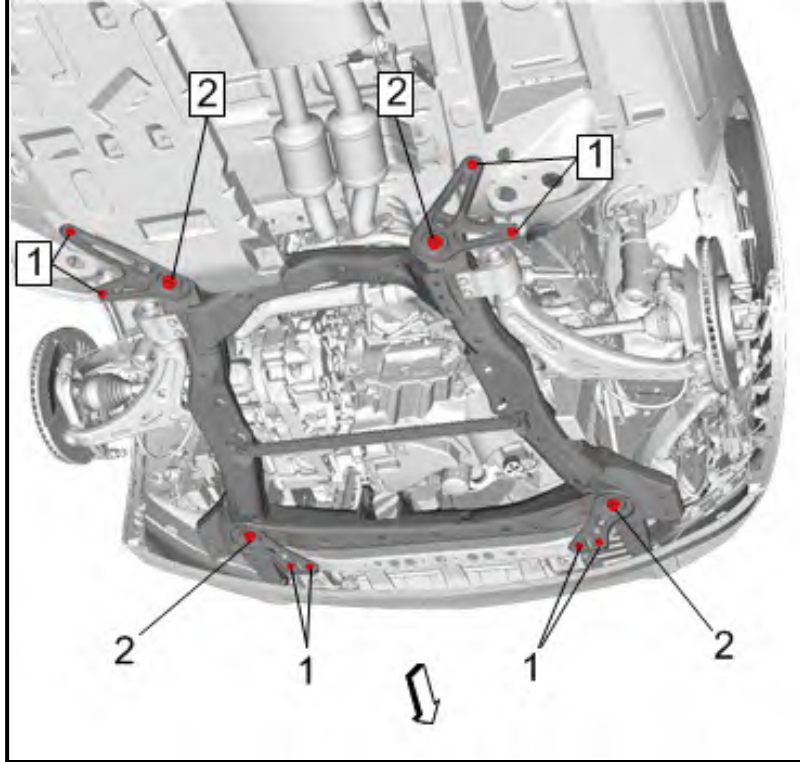


Engine Mount Fastener (2) - Remove and DISCARD [3x] - [Engine Mount Replacement - Right Side](#)



Transmission Mount Bolt (3) - Remove and DISCARD the bolts. [4x]





Drivetrain and Front Suspension Support Bolt (1) - Remove [8X]

55. Drivetrain and Front Suspension Support Bolt (2) - Remove and DISCARD [4x]

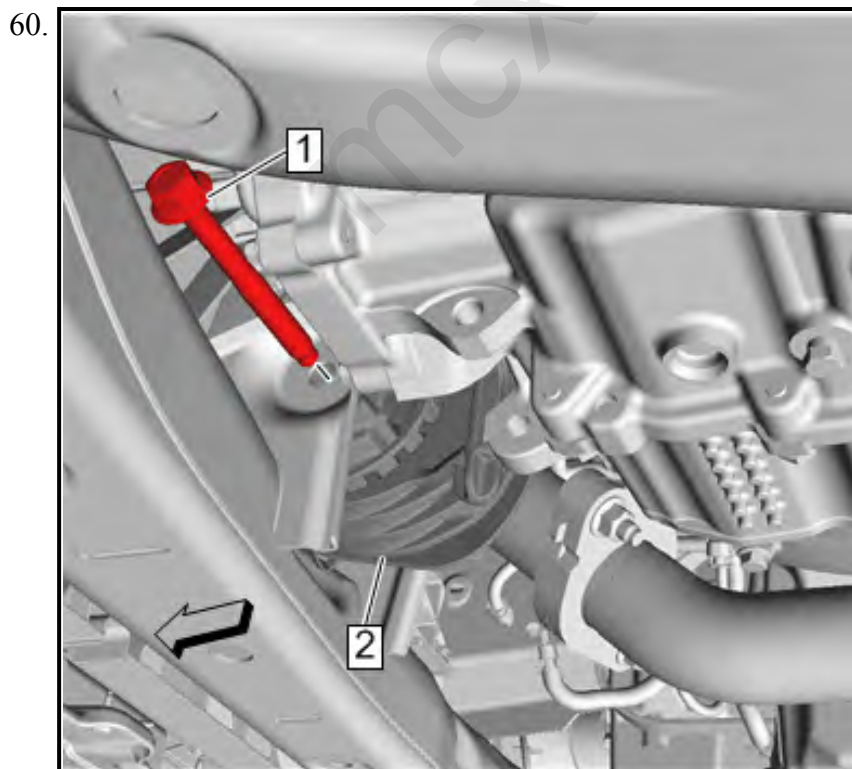
56. With the aid of an assistant, carefully raise the body from the frame.

57. Ensure when raising the body the following items are clear from the frame:

- Vacuum lines
- Steering knuckles
- Electrical wiring harnesses

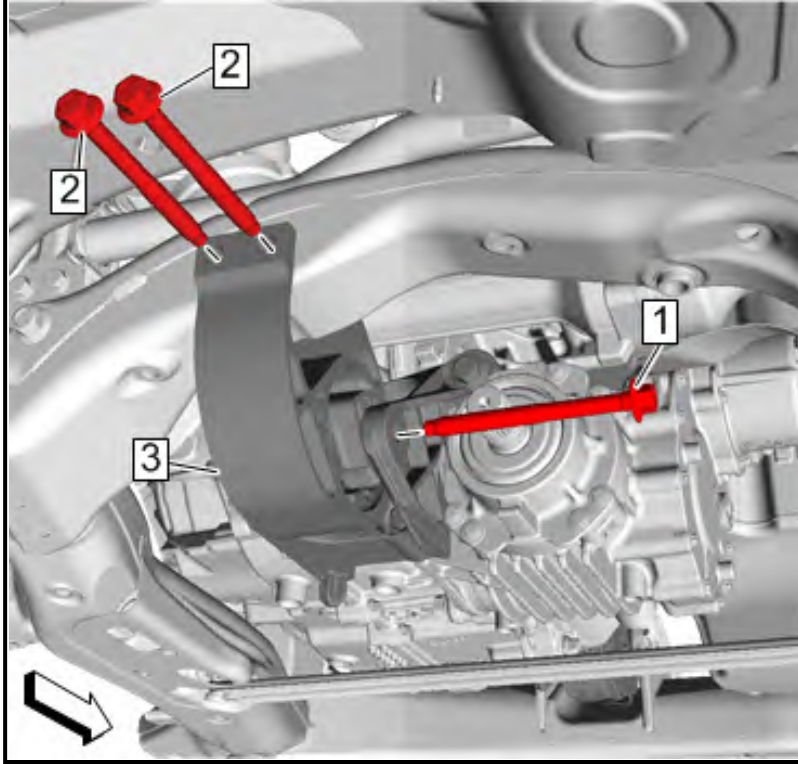
58. Remove the drivetrain and front suspension frame.

59. Install a suitable lifting device to the powertrain assembly.



Transmission Front Mount (2) - Remove - [Transmission Mount Replacement \(Left\)](#)
[Transmission Mount Replacement \(Front\)](#)

61.

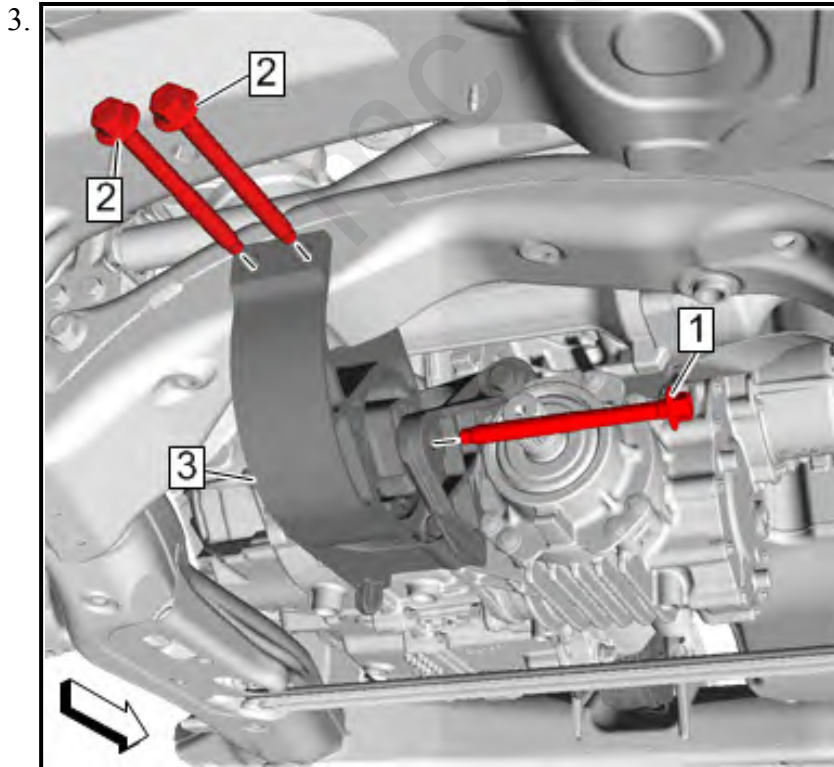


Transmission Mount Strut (3) - Remove - [Transmission Mount Strut Replacement \(All Wheel Drive\)](#) [Transmission Mount Strut Replacement \(Front Wheel Drive\)](#)

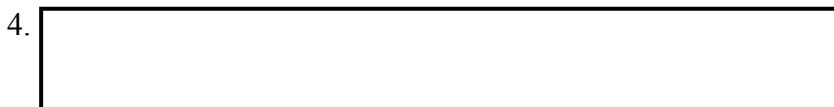
62. Lift the powertrain assembly off the frame and place on the floor.
63. Separate the engine from the transmission. [Transmission Replacement \(All Wheel Drive\)](#)
64. Transfer components as necessary.

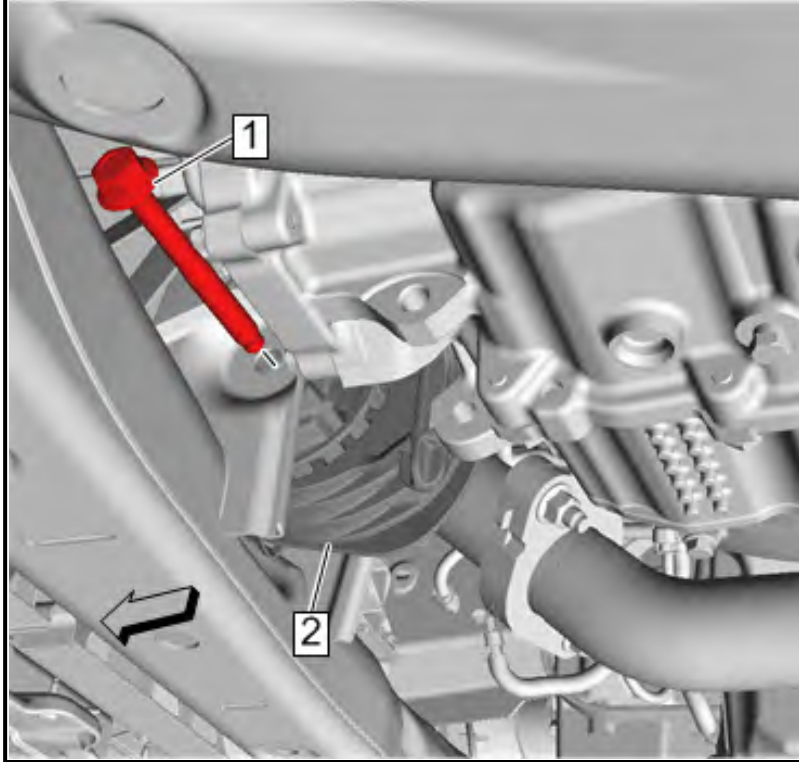
Installation Procedure

1. Install the engine to the transmission. [Transmission Replacement \(All Wheel Drive\)](#)
2. Place the powertrain assembly on the frame.



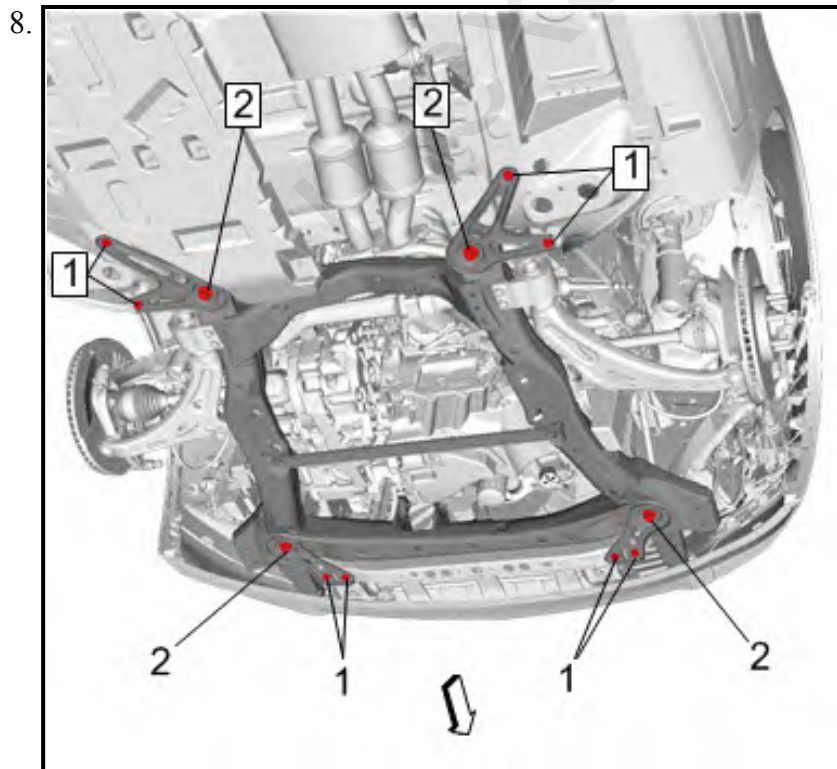
Transmission Mount Strut (3) - Install - [Transmission Mount Strut Replacement \(All Wheel Drive\)](#)





Transmission Front Mount (2) - Install - [Transmission Mount Replacement \(Left\)](#).
[Transmission Mount Replacement \(Front\)](#).

5. Place the powertrain and frame assembly on the engine support table, and position the powertrain under the vehicle.
6. With the aid of an assistant, carefully lower the body to the frame. (1)
7. Ensure the following components are clear from the frame:
 - Vacuum lines
 - Steering knuckles
 - Electrical wiring harnesses

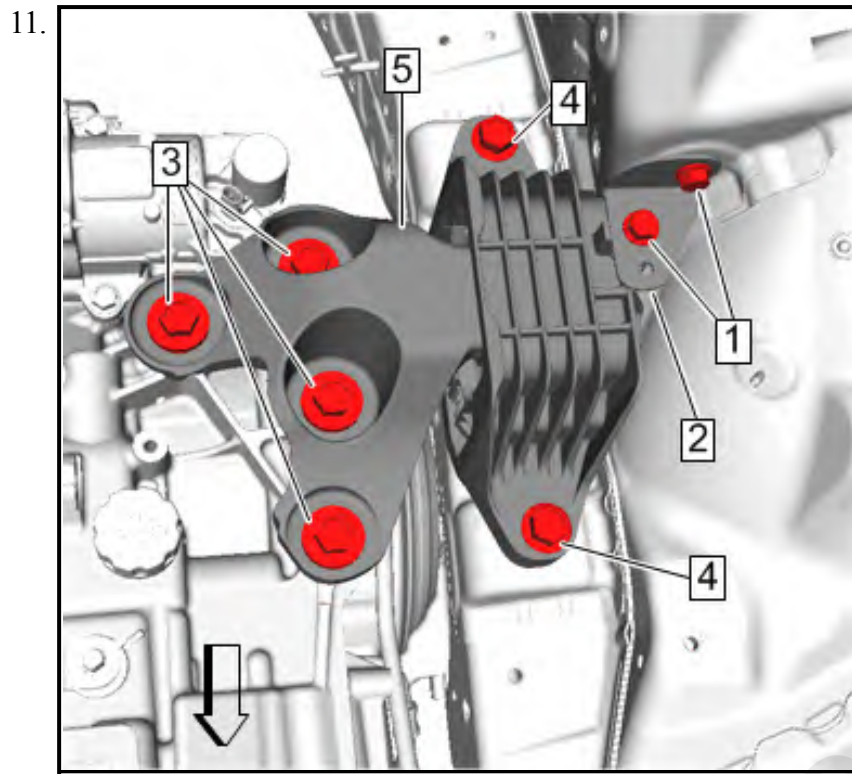


CAUTION: Refer to [Fastener Caution](#)

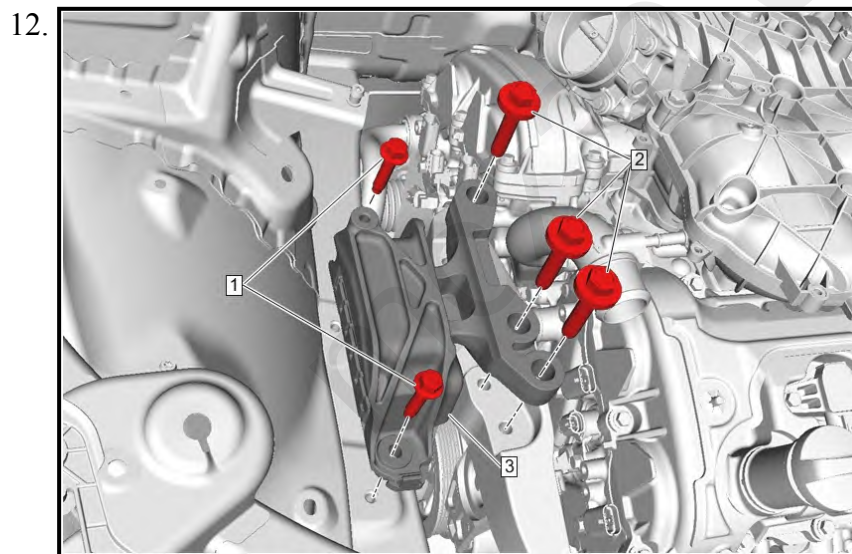
Drivetrain and Front Suspension Support Bolt (2) - Install and tighten the NEW bolt. [4X] - [Drivetrain and Front Suspension Cradle Replacement \(All Wheel Drive\)](#).

9. Drivetrain and Front Suspension Support Bolt (1) - Install and tighten [8X] - [Drivetrain and Front Suspension Cradle Replacement \(All Wheel Drive\)](#).

10. Remove the engine support table from the drivetrain.

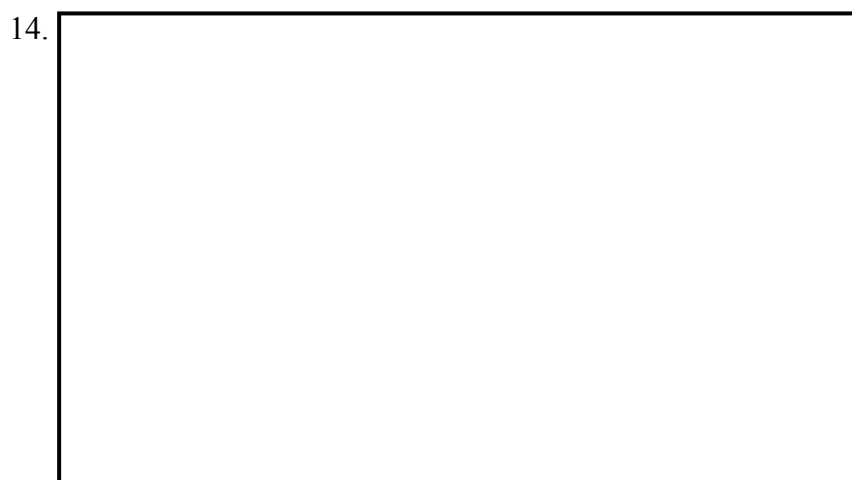


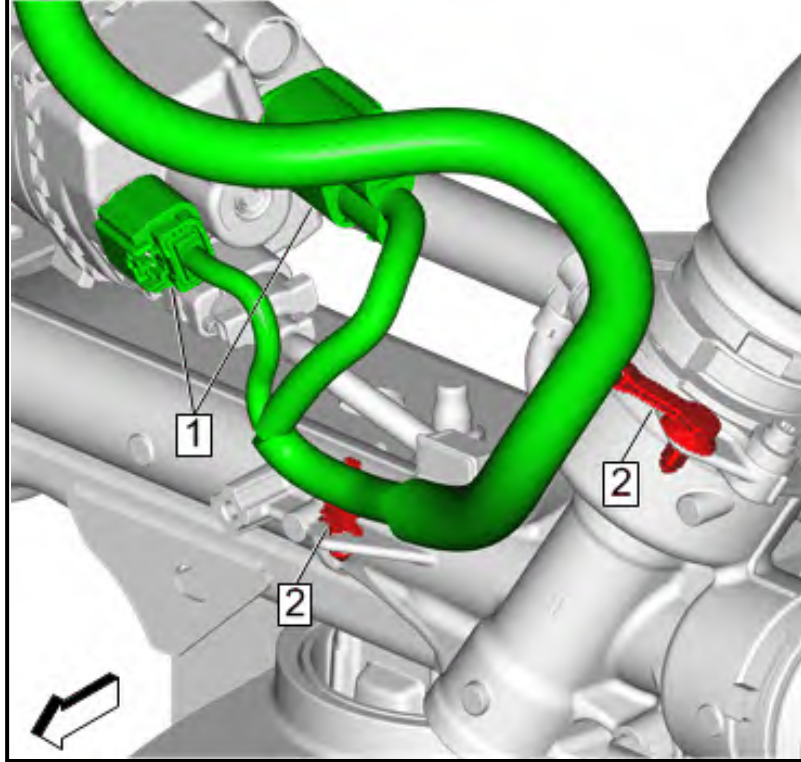
Transmission Mount Bolt (3) - Install NEW [4x] - [Transmission Mount Replacement \(Left\)](#).
[Transmission Mount Replacement \(Front\)](#).



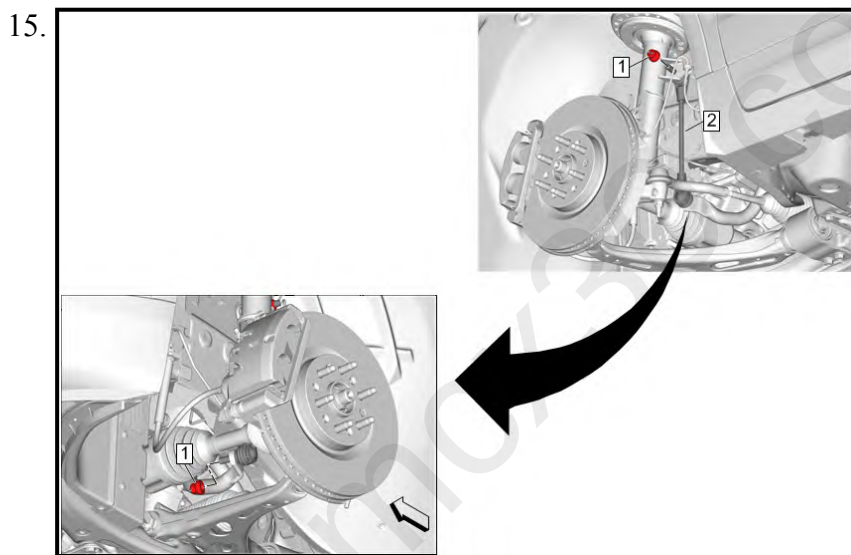
Engine Mount Fastener (2) - Install NEW [3x] - [Engine Mount Replacement - Right Side](#)

13. Remove the **EN-48244** Engine Assembly Remove/Install Pallet Supporter from under the vehicle.

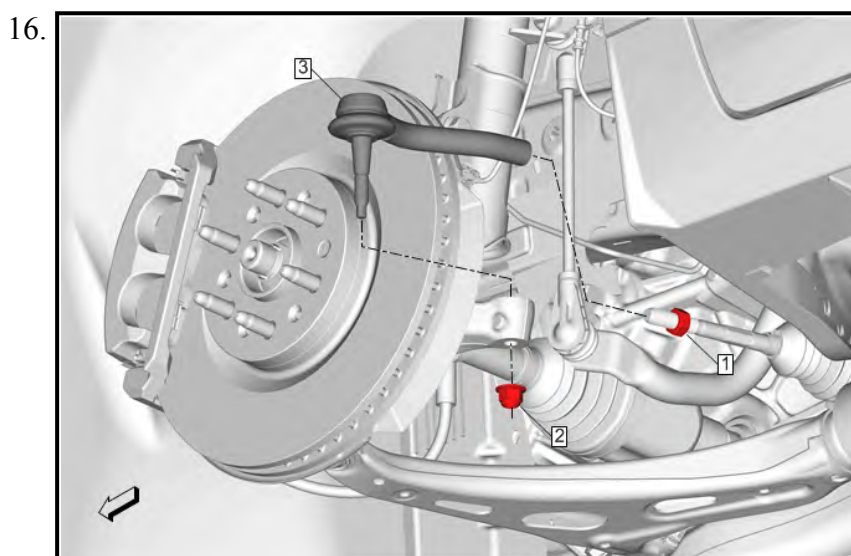




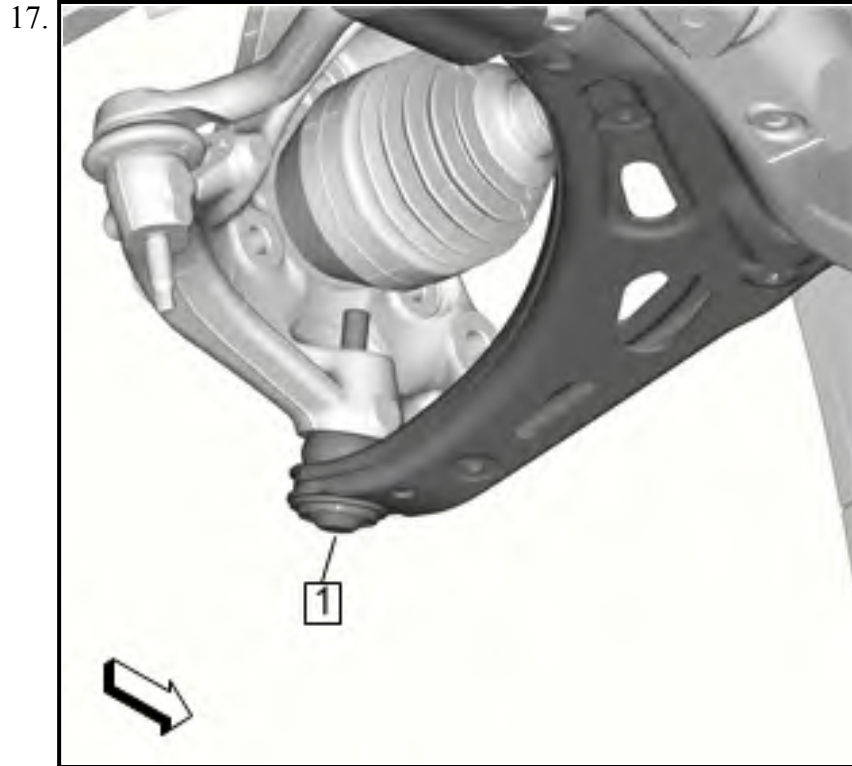
Connect the electrical connector on the steering gear and connect the wiring harness clip on the steering gear housing. (1)



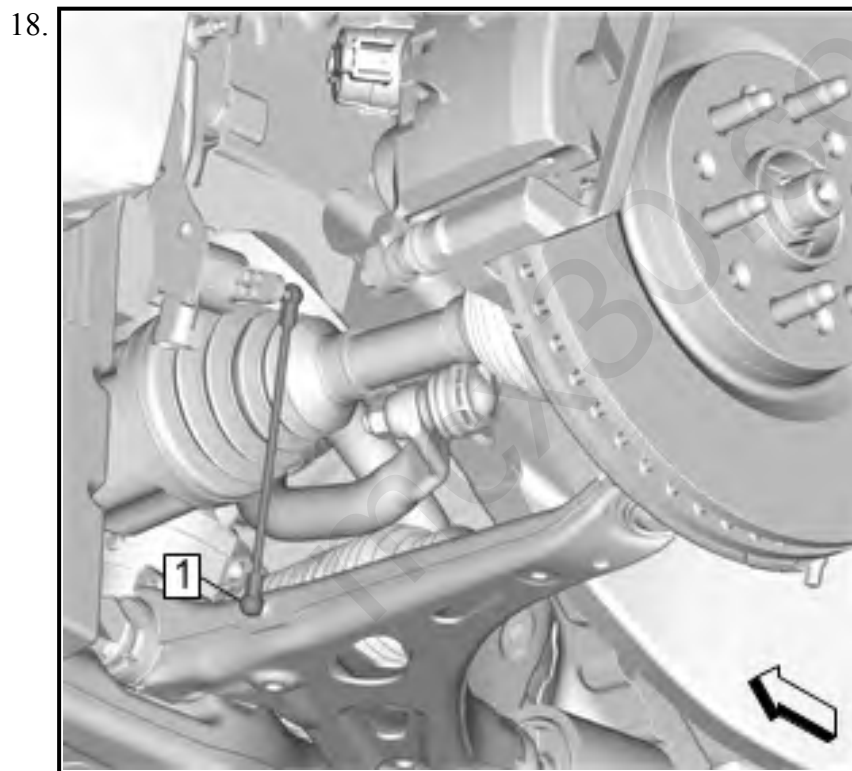
Stabilizer Shaft Link (2) @ Stabilizer Shaft - Install - [Stabilizer Shaft Link Replacement](#)



Steering Linkage Outer Tie Rod (3) @ Steering Knuckle - Install - [Steering Linkage Outer Tie Rod Replacement](#)



Front Lower Control Arm (1) @ Steering Knuckle - Install - [Lower Control Arm Replacement](#)

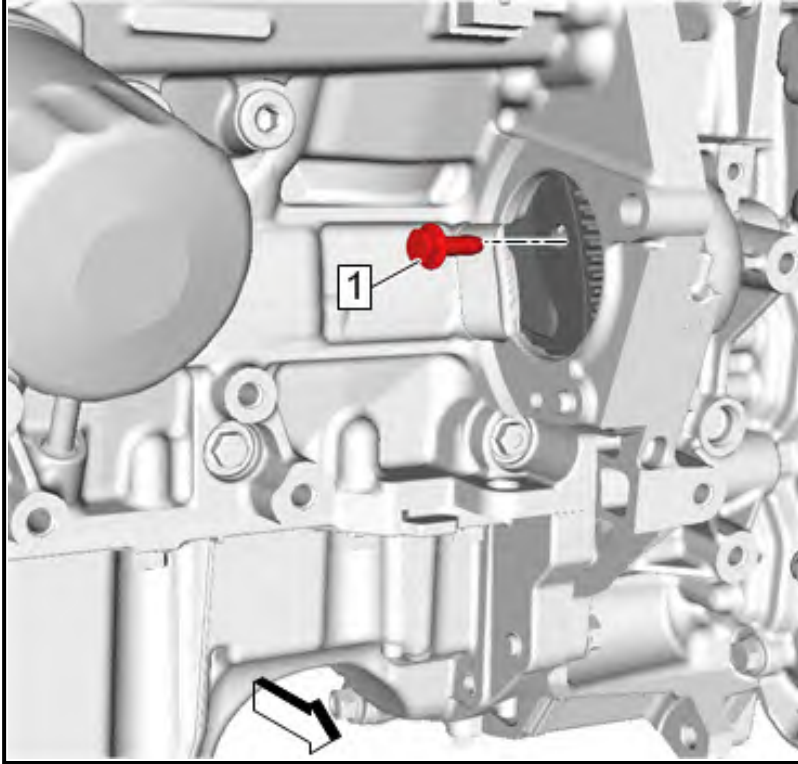


{ If equipped } Front Suspension Automatic Forward Lighting Position Sensor (1) @ Front Lower Control Arm - Connect

19. Position and connect harnesses as required.

20. Front Wheel Drive Half Shaft @ Front Wheel Bearing and Hub Assembly - Install - [Front Wheel Drive Half Shaft Replacement - Left Side](#)



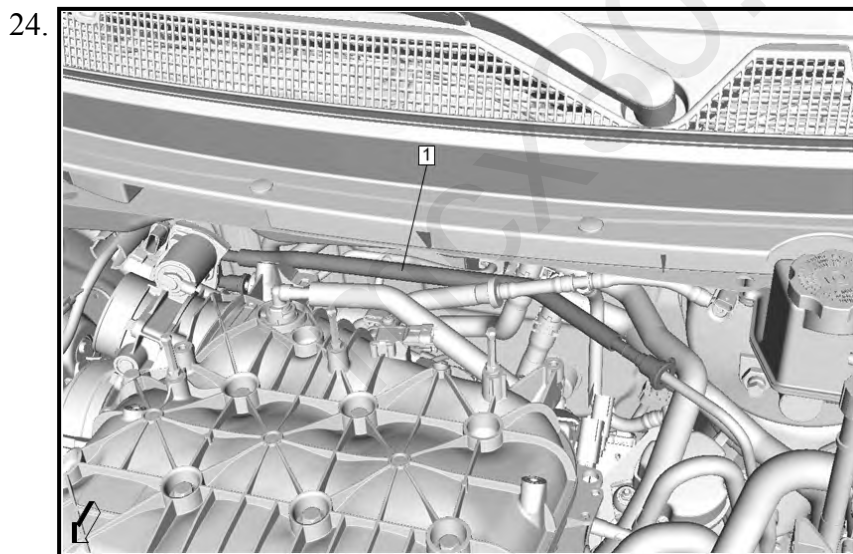


NOTE: Rotate engine clockwise using the crankshaft balancer bolt to gain access to each bolt.

Install the torque converter to flex plate bolts (1). [Transmission Replacement \(All Wheel Drive\)](#)

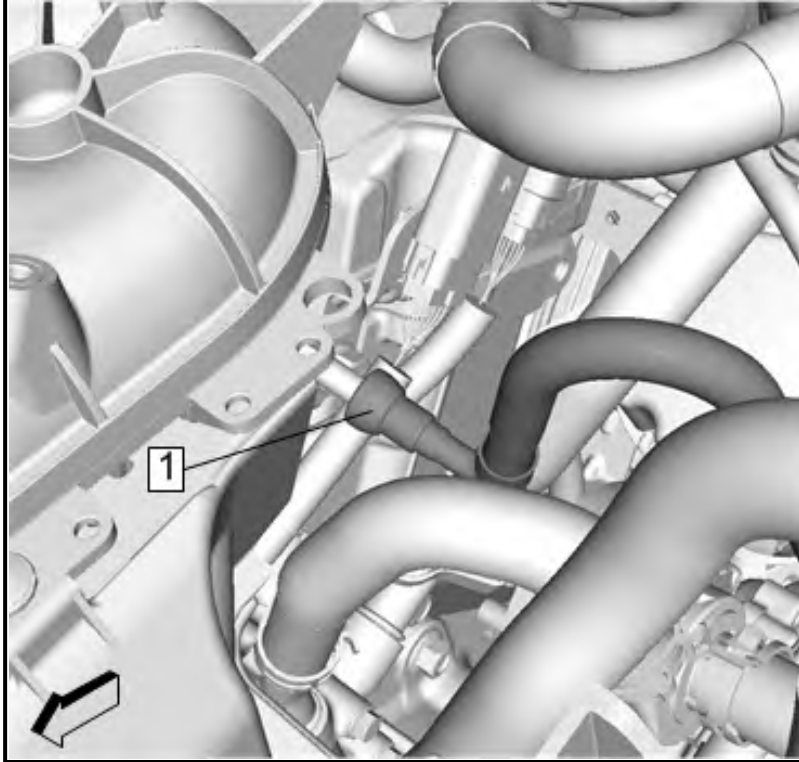
22. Starter - Install - [Starter Replacement \(LFY\)](#)

23. Wiring Harness - Connect as necessary



Evaporative Emission Front Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve - Connect - [Plastic Collar Quick Connect Fitting Service](#)





WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

WARNING: Refer to [Safety Glasses Warning](#) .

Fuel Feed Pipe (1) @ Engine - Connect [Metal Collar Quick Connect Fitting Service](#)

26. Power Transfer Unit Case - Install - [Power Transfer Unit Case Replacement](#)

27.



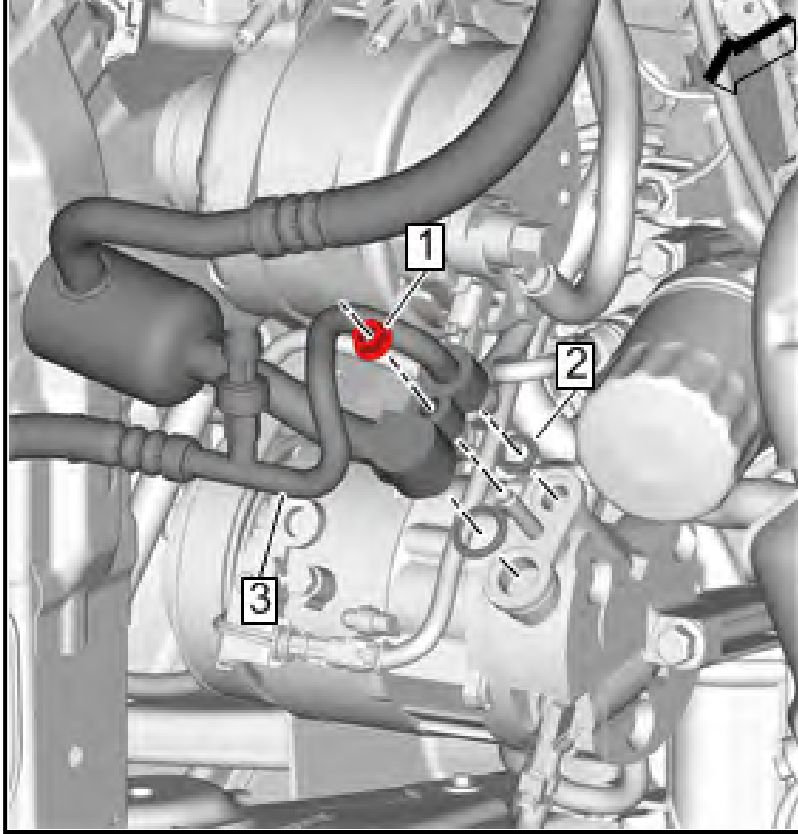
Exhaust Front Muffler (1) - Install [Exhaust Front Muffler Replacement \(LFY\)](#)

28. Install both front wheelhouse liners. [Front Wheelhouse Liner Replacement](#)

29. Install the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)

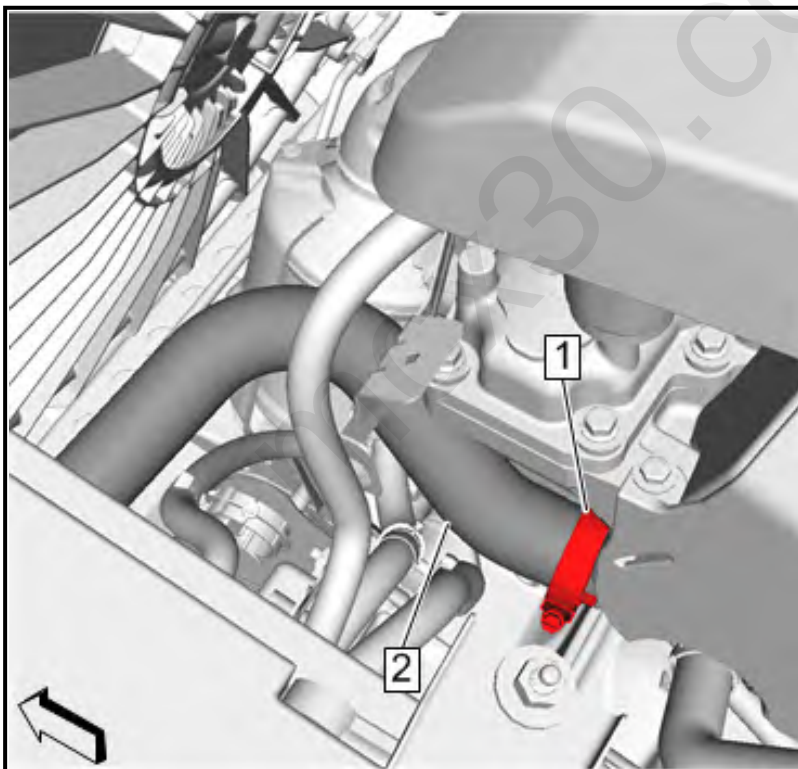
30.





Air Conditioning Compressor and Condenser Hose (2) @ Air Conditioning Compressor - Install - [Air Conditioning Compressor and Condenser Hose Replacement \(LFY\)](#).

31.

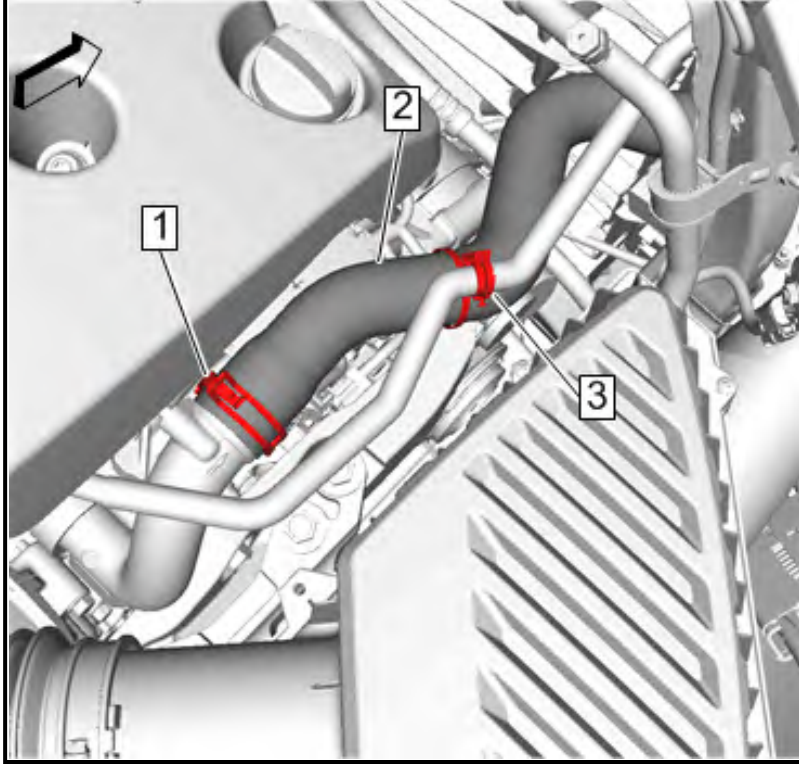


Radiator Outlet Hose (2) @ Engine Coolant Thermostat Housing - Install

32. Radiator Outlet Hose Clamp (1) - Install

33.



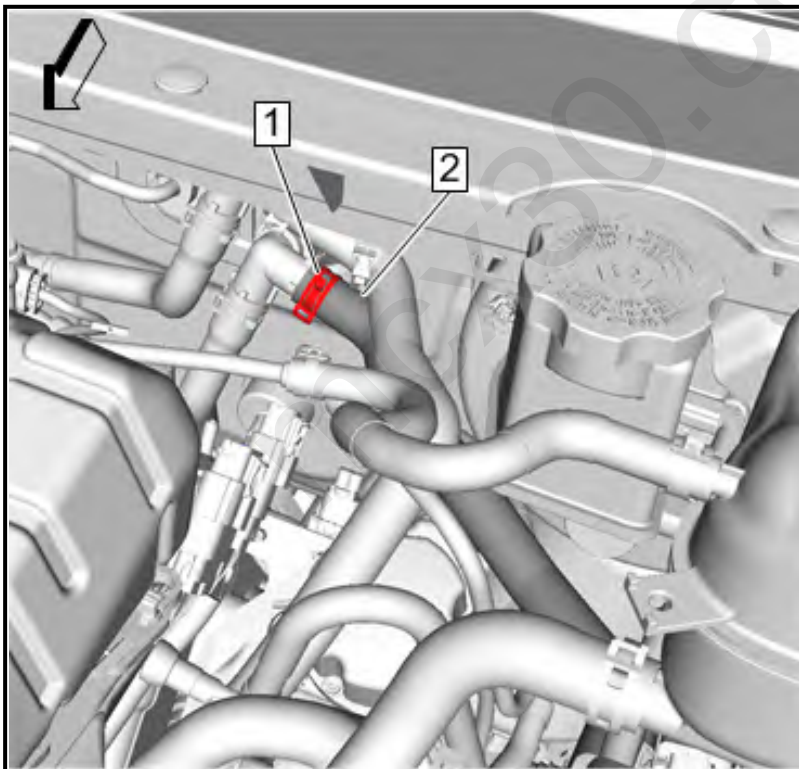


Radiator Inlet Hose (2) @ Water Outlet - Install

34. Radiator Inlet Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)

35. Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Install

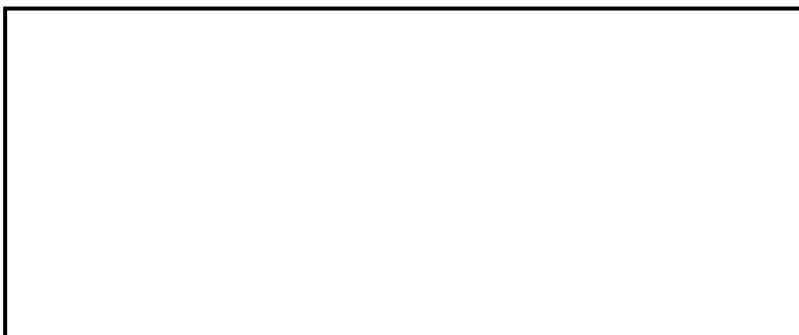
36.

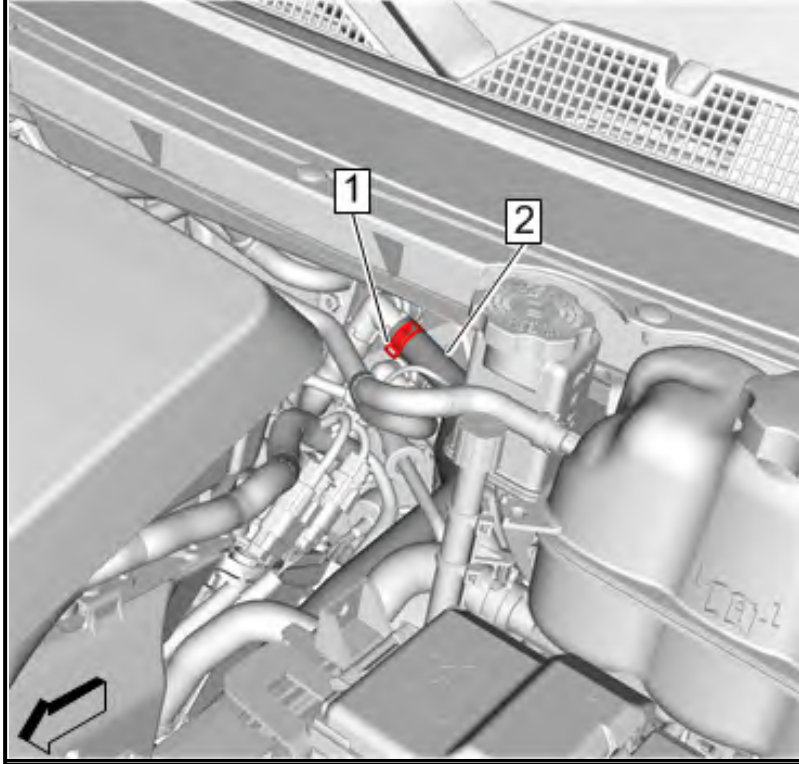


Heater Outlet Hose (2) @ Heater Outlet Hose Connector - Install

37. Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)

38.

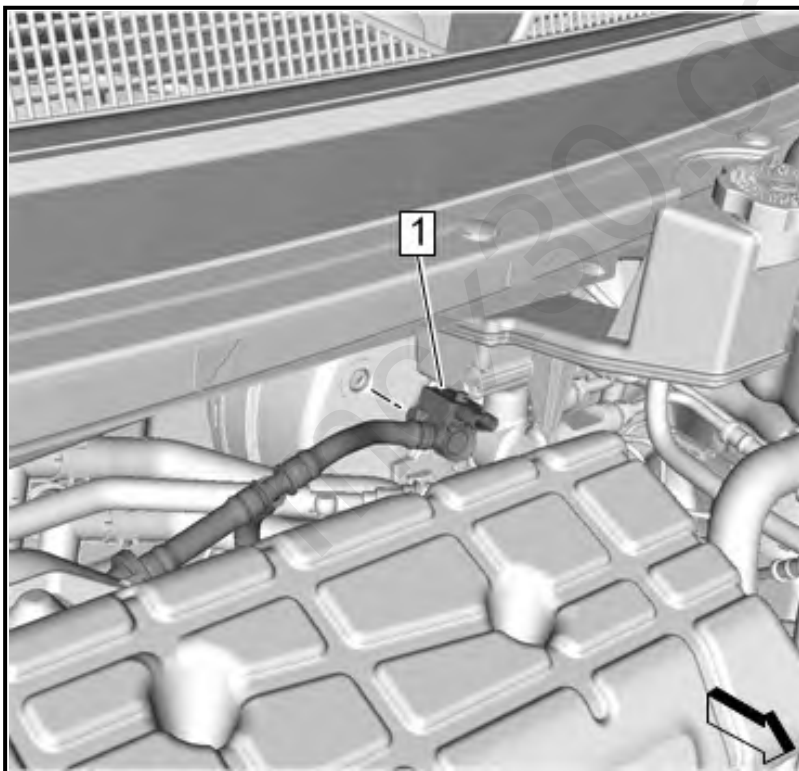




Heater Inlet Hose (2) @ Heater Outlet Hose Connector - Install

39. Heater Inlet Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)

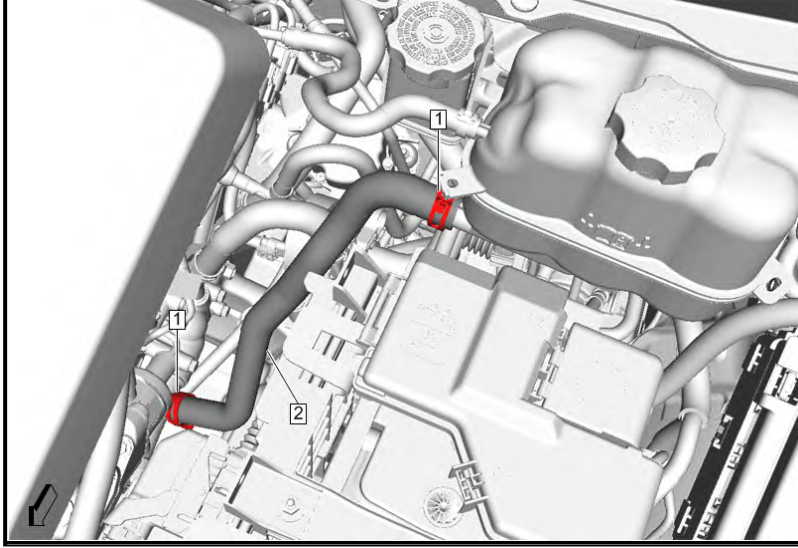
40.



Power Brake Booster Vacuum Sensor (1) @ Power Brake Booster - Install

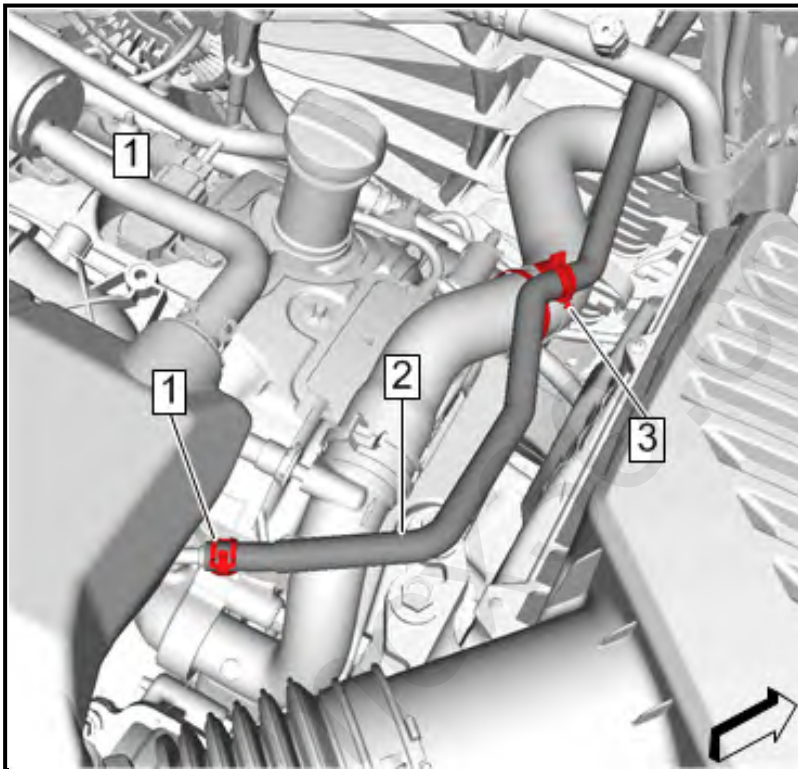
41.





Radiator Surge Tank Outlet Hose (3) @ Radiator Surge Tank - Install - [Hose Clamp Replacement Guidelines - Spring Type](#)

42.



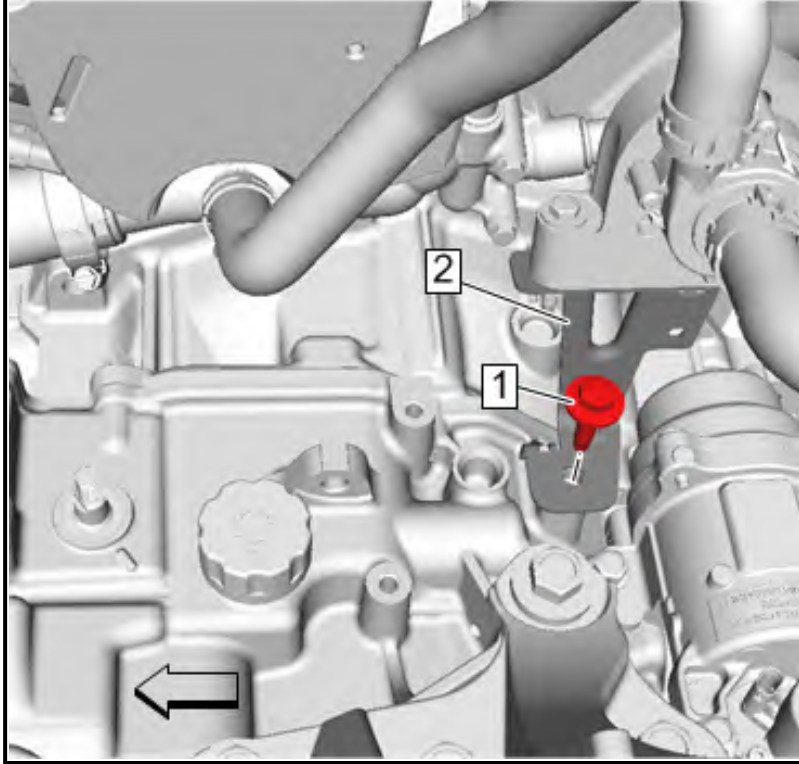
Radiator Surge Tank Overflow Hose (2) @ Engine Coolant Air Bleed Pipe - Install

43. Radiator Surge Tank Overflow Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)

44. Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Install

45.



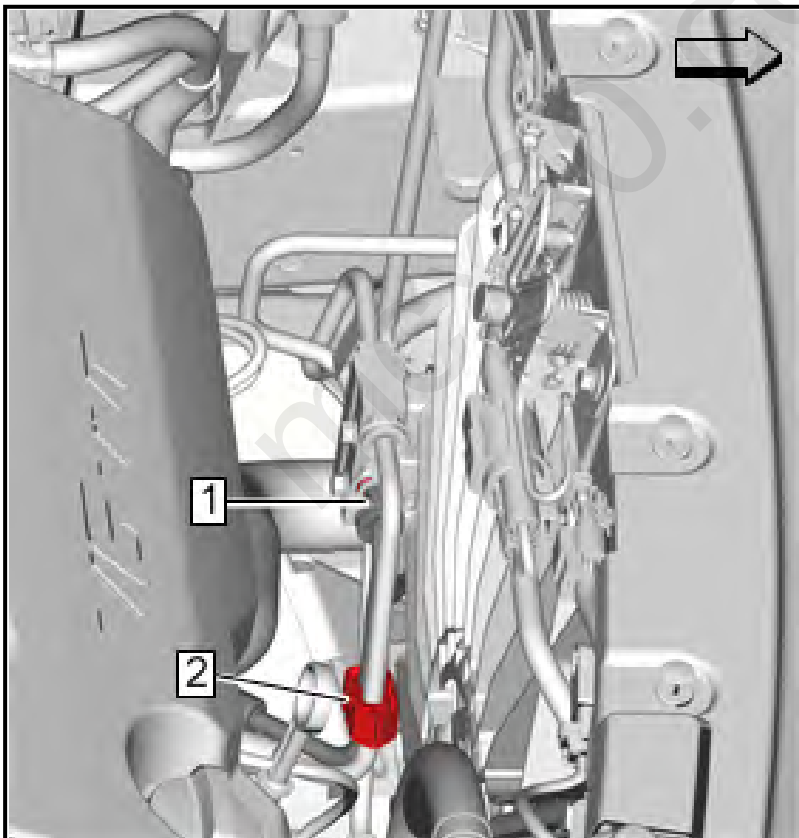


Position the heater water auxiliary pump (2) to it's original position.

46. Install the heater water auxiliary pump bolt (1). [Transmission Replacement \(All Wheel Drive\)](#)

47. Install the body ground cable and wiring harness assembly to the front of transmission.

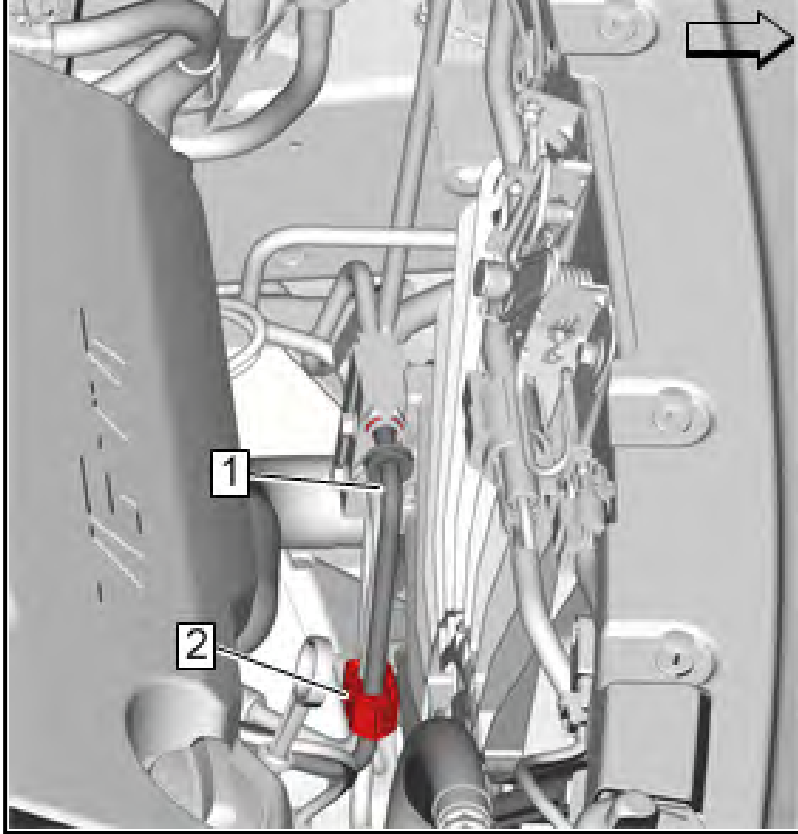
48.



Transmission Fluid Cooler Inlet Pipe (1) @ Transmission Fluid Cooler Thermal Bypass Valve - Connect - [Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection](#)

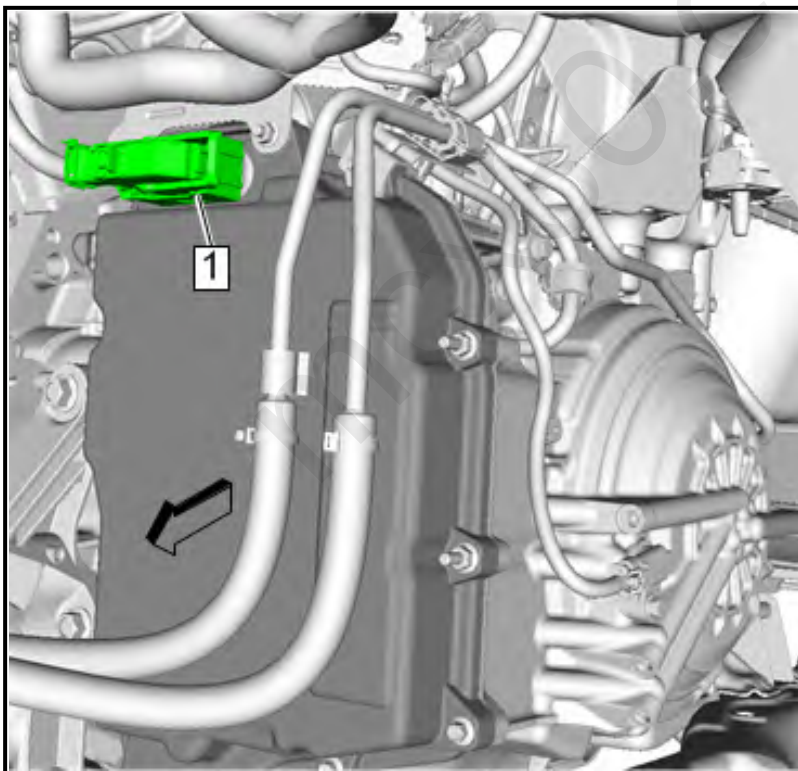
49.





Transmission Fluid Cooler Outlet Pipe (1) @ Transmission Fluid Cooler Thermal Bypass Valve - Connect - Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection

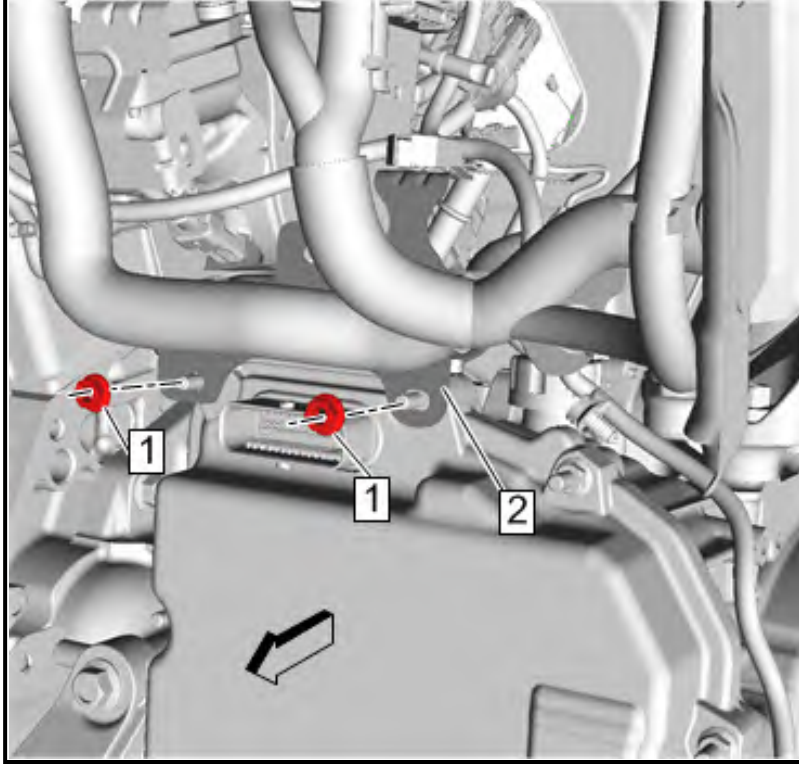
50.



Connect the control valve body transmission control module electrical connector (1), then clip the wiring harness to the cover.

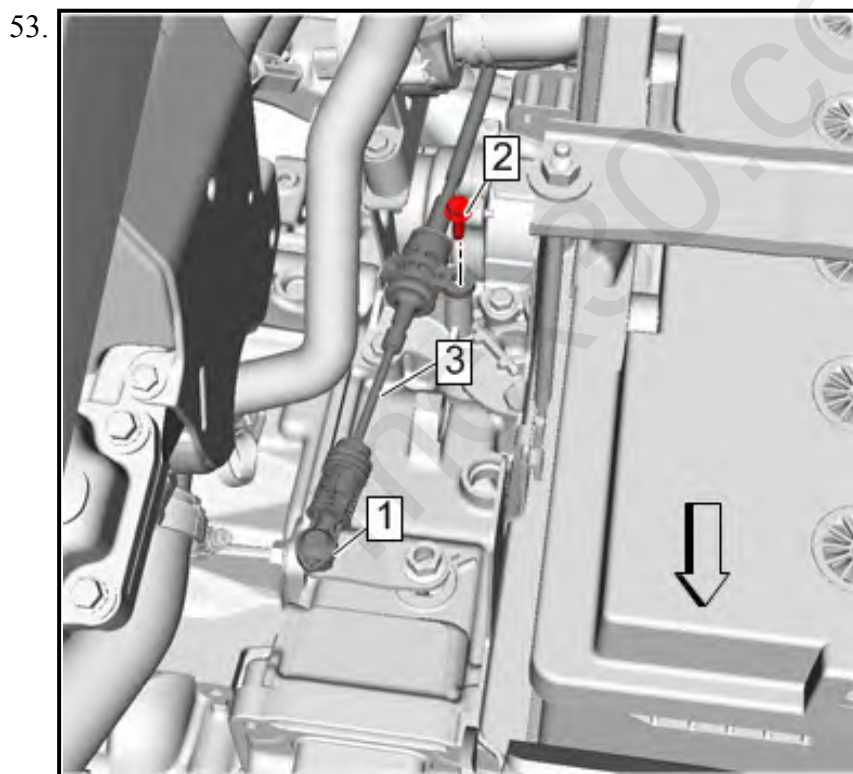
51.





Install the electrical harness bracket (2) to the control valve body cover.

52. Install the electrical harness bracket nuts (1). [Transmission Replacement \(All Wheel Drive\)](#)



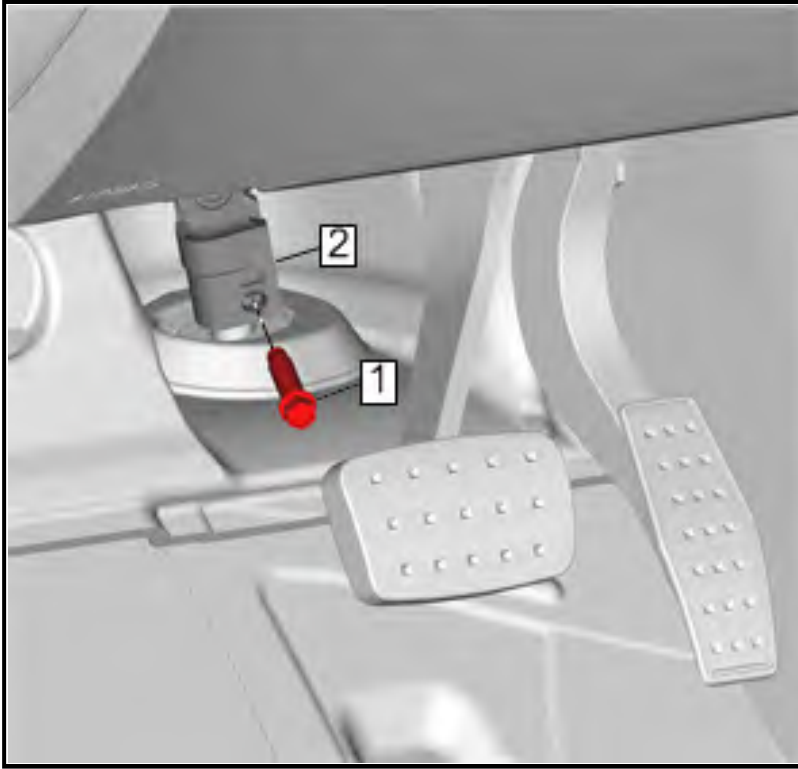
WARNING: After installing the transmission range selector shift cable, pull up and push down on ALL connections to verify that the connections are fully seated and properly engaged. Failure to perform this task can result in the vehicle not being able to shift into PARK causing potential vehicle damage and bodily injury.

Connect the automatic transmission range selector lever cable (3) to the transmission manual shift lever pin.

54. Install the automatic transmission range selector lever cable retaining bolt (2). [Automatic Transmission Range Selector Lever Cable Replacement](#)

55. Air Cleaner Assembly - Install - [Air Cleaner Assembly Replacement](#)

56.



Intermediate Steering Shaft (2) @ Steering Gear - Connect - [Intermediate Steering Shaft Replacement](#)

57. Connect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)

NOTE: Prelube is necessary if the engine is replaced or overhauled.

58. If the engine is replaced with a new engine or has been overhauled, perform the Engine Prelubing procedure. [Engine Prelubing](#)
59. Fill the engine oil to the proper level with NEW engine oil. [Engine Oil and Oil Filter Replacement](#)
60. Fill the cooling system. [Cooling System Draining and Filling \(GE 47716\)](#). [Cooling System Draining and Filling \(Static Fill\)](#)
61. Perform the crankshaft position variation learn procedure. [Crankshaft Position Variation Learn](#)
62. Recharge the refrigerant. [Refrigerant Recovery and Recharging \(R-134a\)](#). [Refrigerant Recovery and Recharging \(R-1234yf\)](#)

ENGINE REPLACEMENT (FWD)

Special Tools

EN-48244 Engine Assembly Remove/Install Pallet Supporter

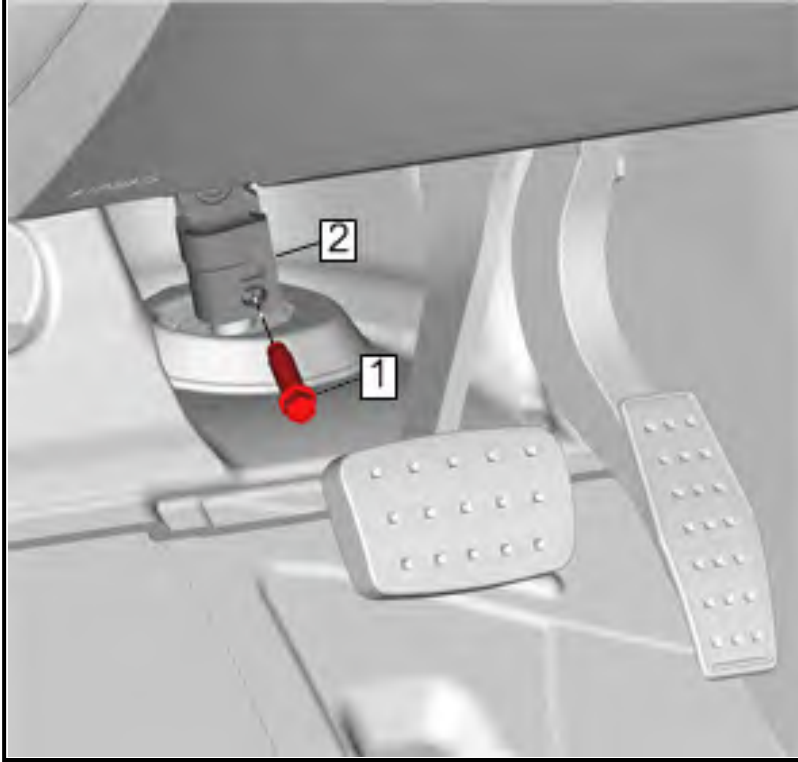
Equivalent regional tools: [Special Tools](#)

Removal Procedure

1. Disconnect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)

2.

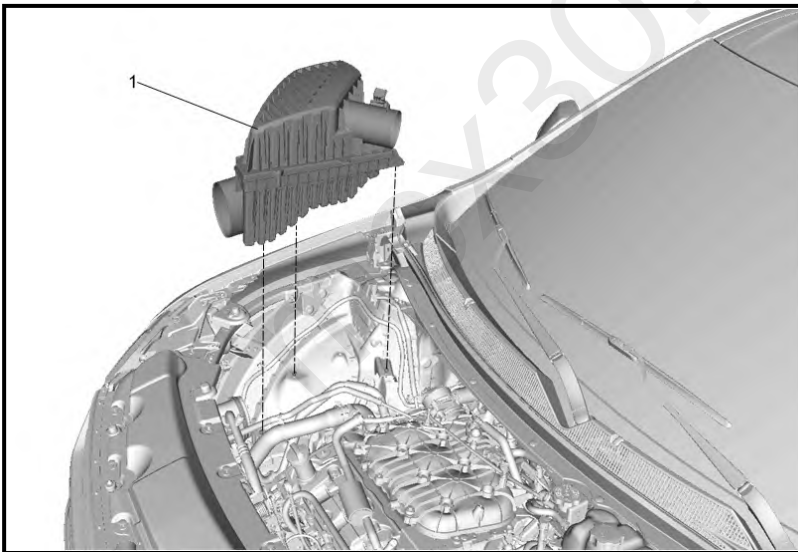




Intermediate Steering Shaft (2) @ Steering Gear - Separate - [Intermediate Steering Shaft Replacement](#)

3. Recover the refrigerant. [Refrigerant Recovery and Recharging \(R-134a\)](#). [Refrigerant Recovery and Recharging \(R-1234yf\)](#)
4. Drain the cooling system. [Cooling System Draining and Filling \(GE 47716\)](#). [Cooling System Draining and Filling \(Static Fill\)](#).

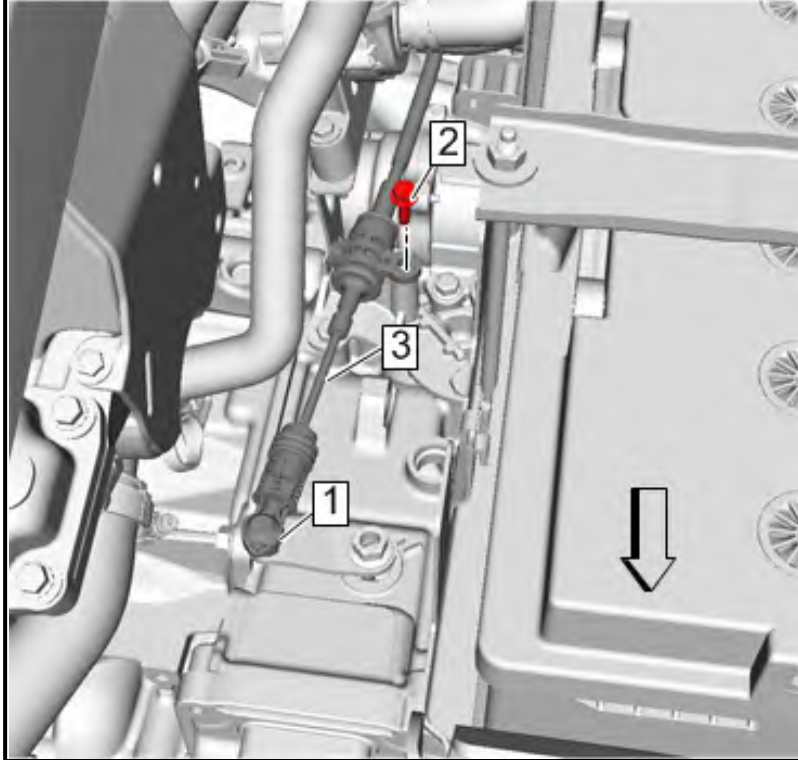
5.



Air Cleaner Assembly (1) - Remove - [Air Cleaner Assembly Replacement](#)

6.

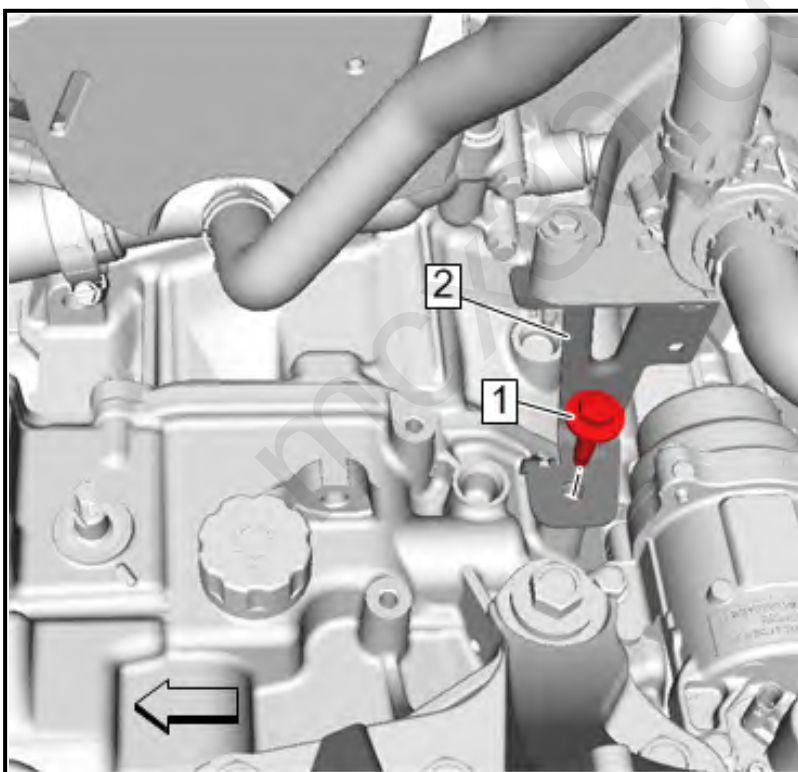




Remove the automatic transmission range selector lever cable retaining bolt (2).

7. Disconnect the automatic transmission range selector lever cable terminal (1) from the transmission manual shift lever pin.

8.

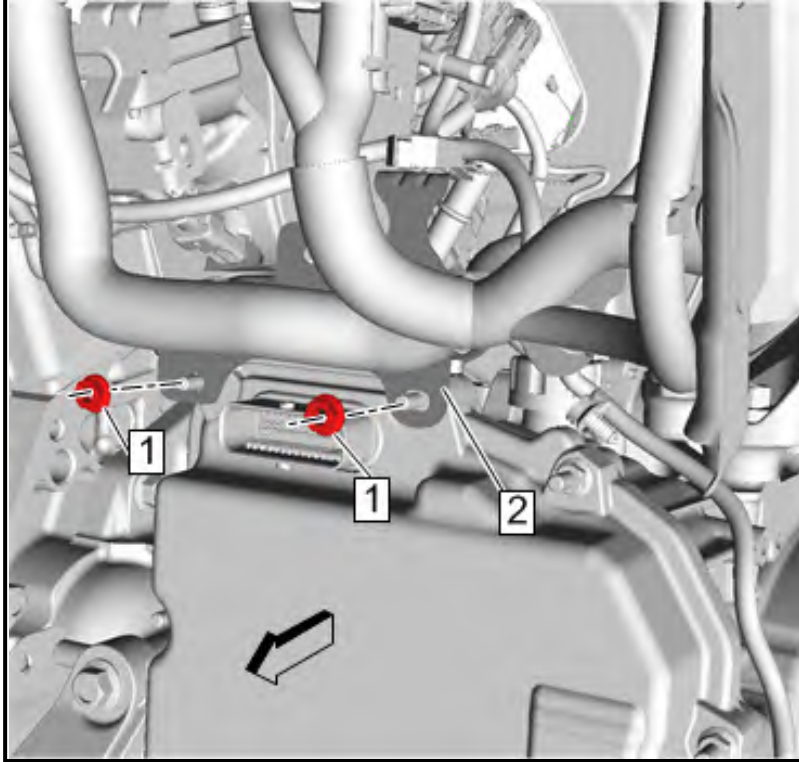


Remove the heater water auxiliary pump bolt (1).

9. Position the heater water auxiliary pump (2) out of the way.

10.

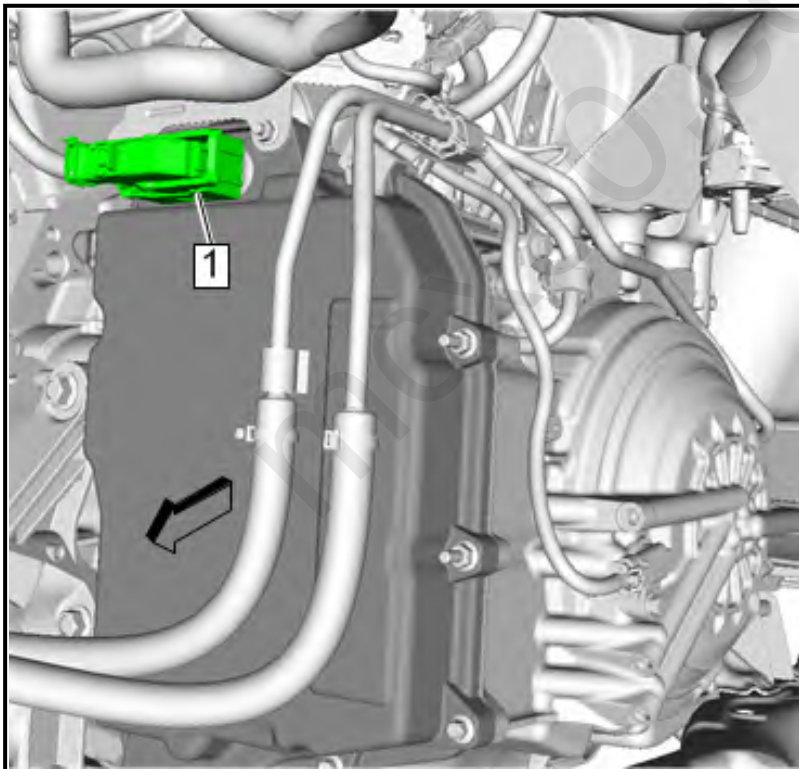




Remove the electrical harness bracket nuts (1).

11. Remove the electrical harness bracket (2) from the control valve body cover and position out of the way.

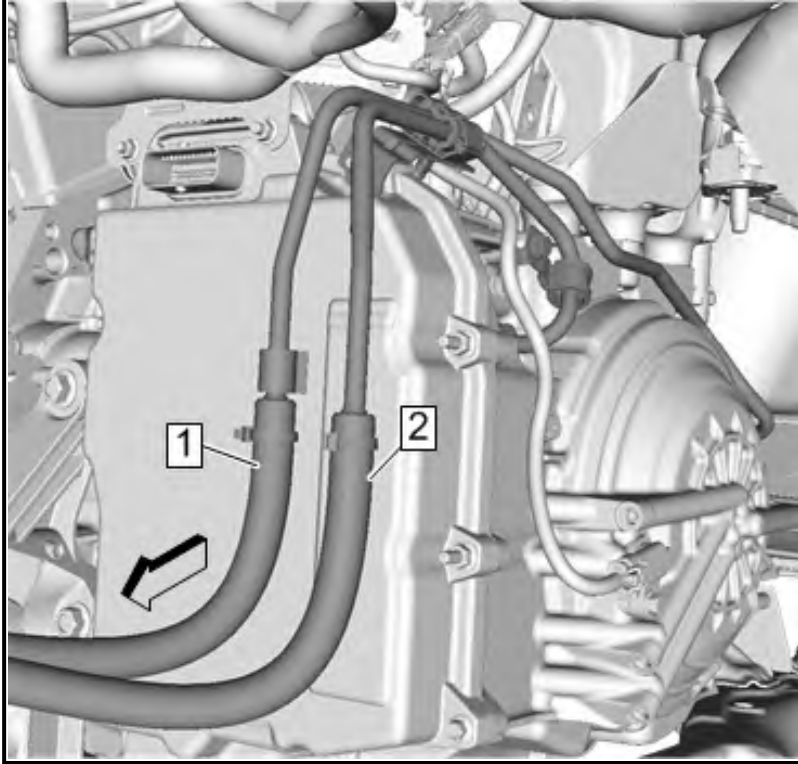
12.



Disconnect the control valve body transmission control module electrical connector (1), then unclip the wiring harness from the cover.

13.

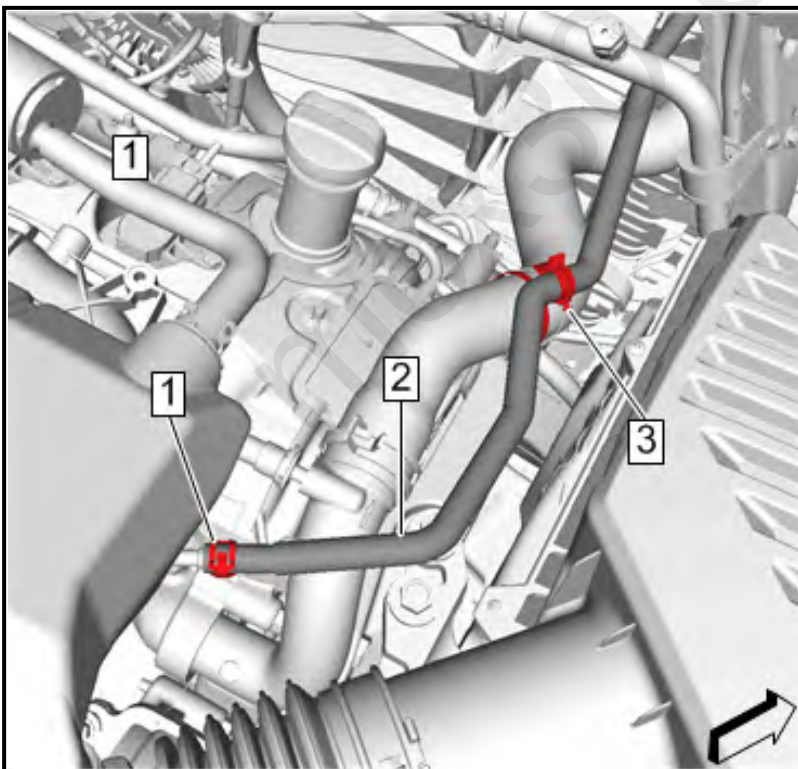




Disconnect the transmission fluid cooler outlet pipe (1, 2) from the transmission. [Transmission Fluid Cooler Pipe Replacement \(with V08\)](#)

14. Plug and/or cap the pipes and the transmission to prevent contamination.
15. Remove the body ground cable and wiring harness assembly mounting bolt at front of transmission and position ground cable and harness out of the way.

16.

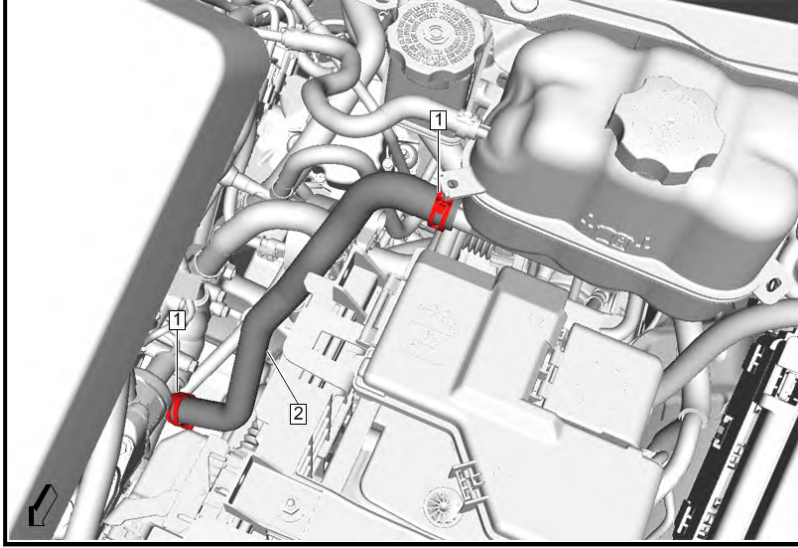


Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Remove

17. Radiator Surge Tank Overflow Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)
18. Radiator Surge Tank Overflow Hose (2) @ Engine Coolant Air Bleed Pipe - Remove
19. Radiator Surge Tank Inlet Hose (2) @ Radiator Surge Tank - Remove

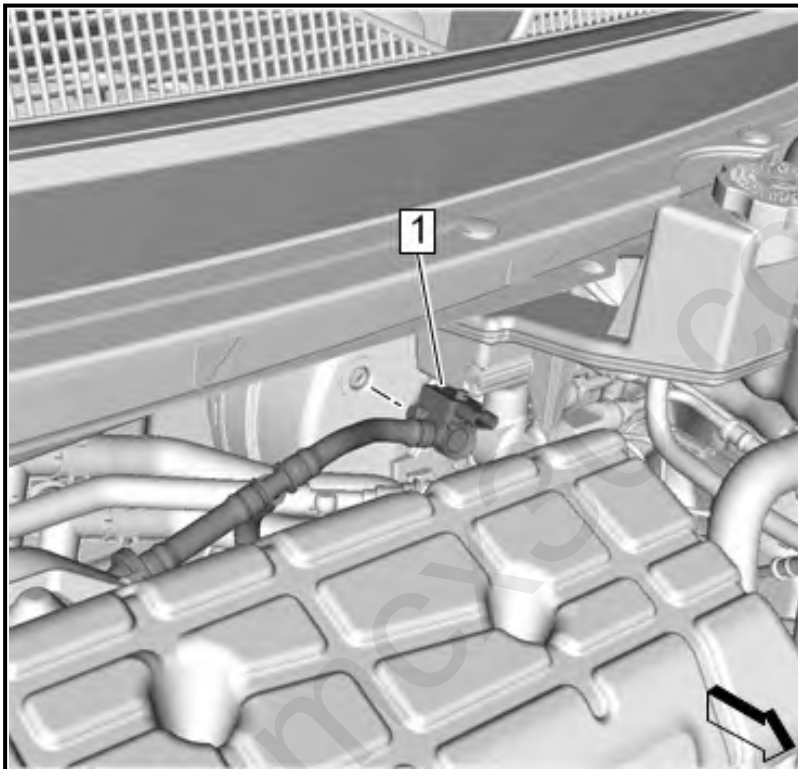
20.





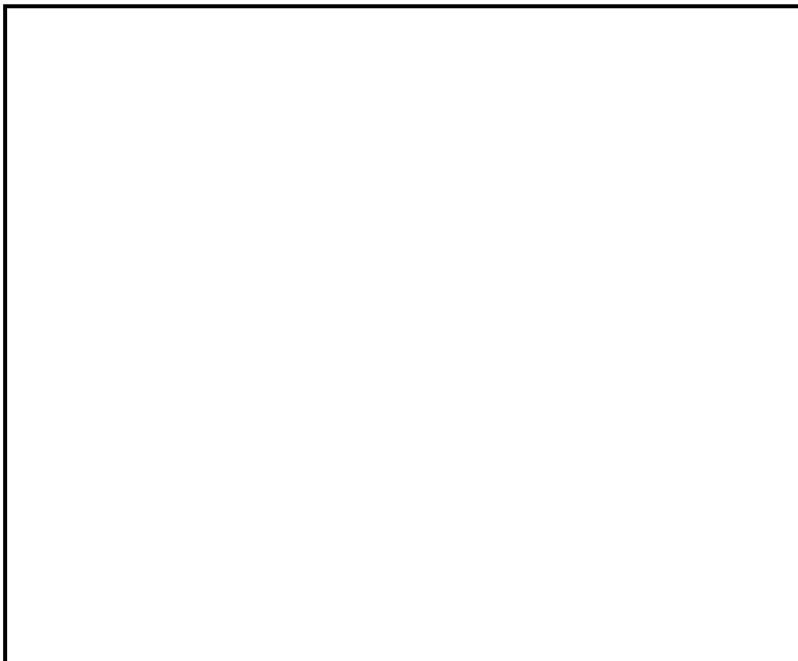
Radiator Surge Tank Outlet Hose (3) @ Radiator Surge Tank - Remove - [Hose Clamp Replacement Guidelines - Spring Type](#)

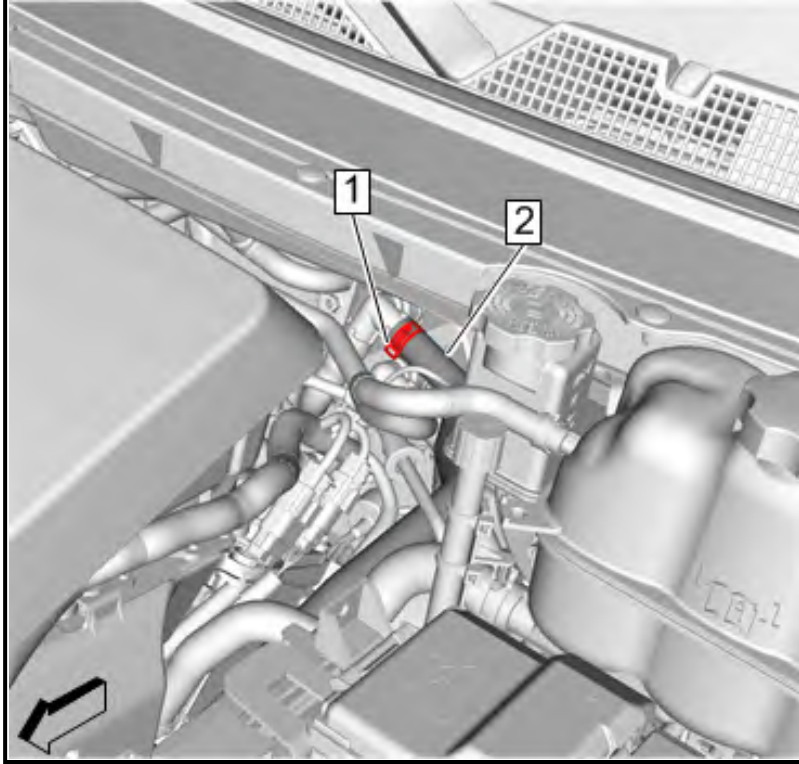
21.



Power Brake Booster Vacuum Sensor (1) @ Power Brake Booster - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

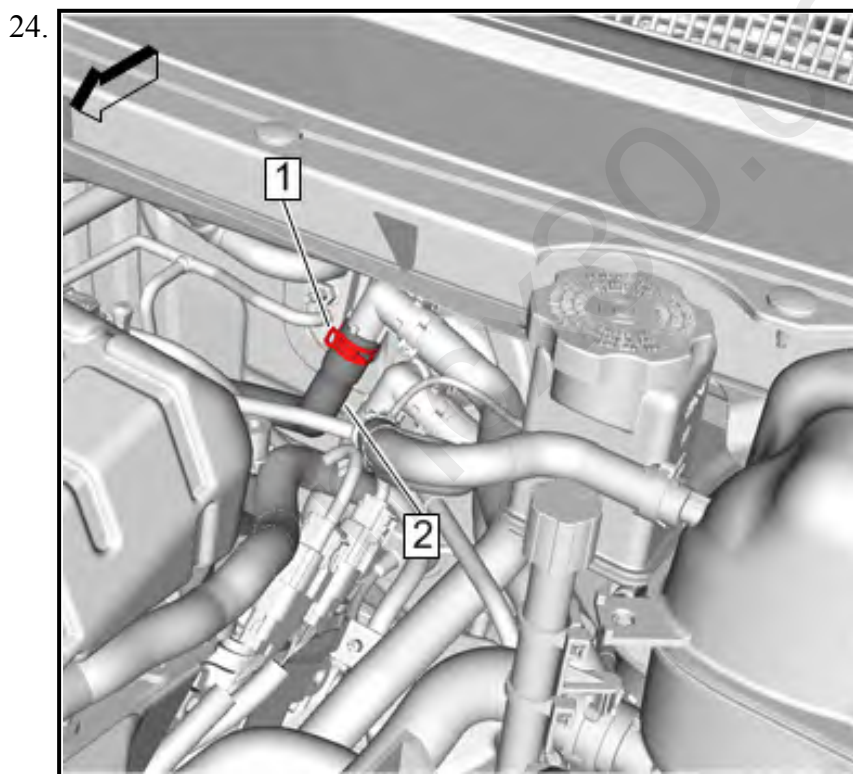
22.





Heater Inlet Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

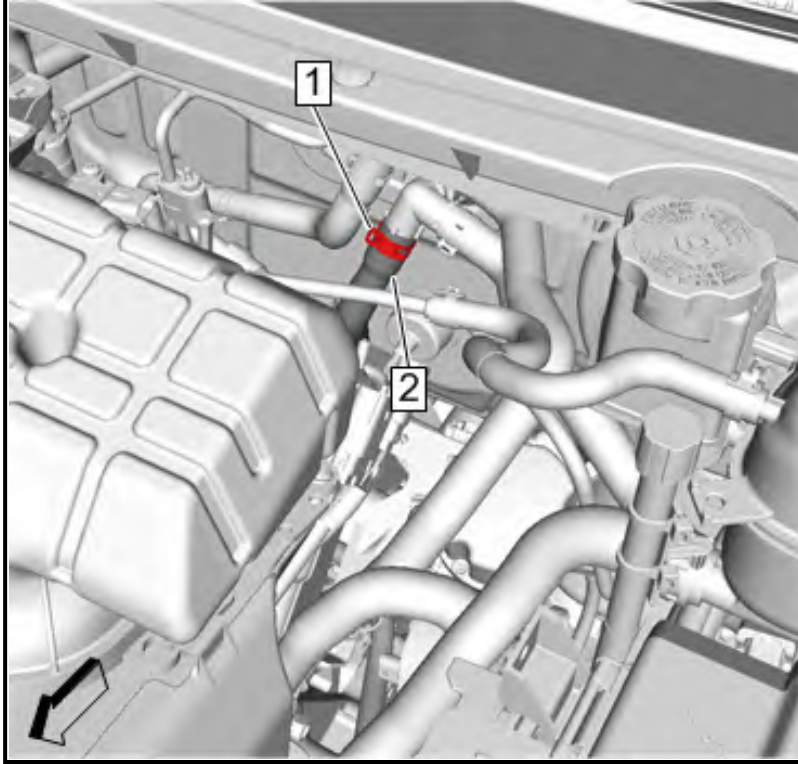
23. Heater Inlet Hose (2) @ Heater Outlet Hose Connector - Remove



Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

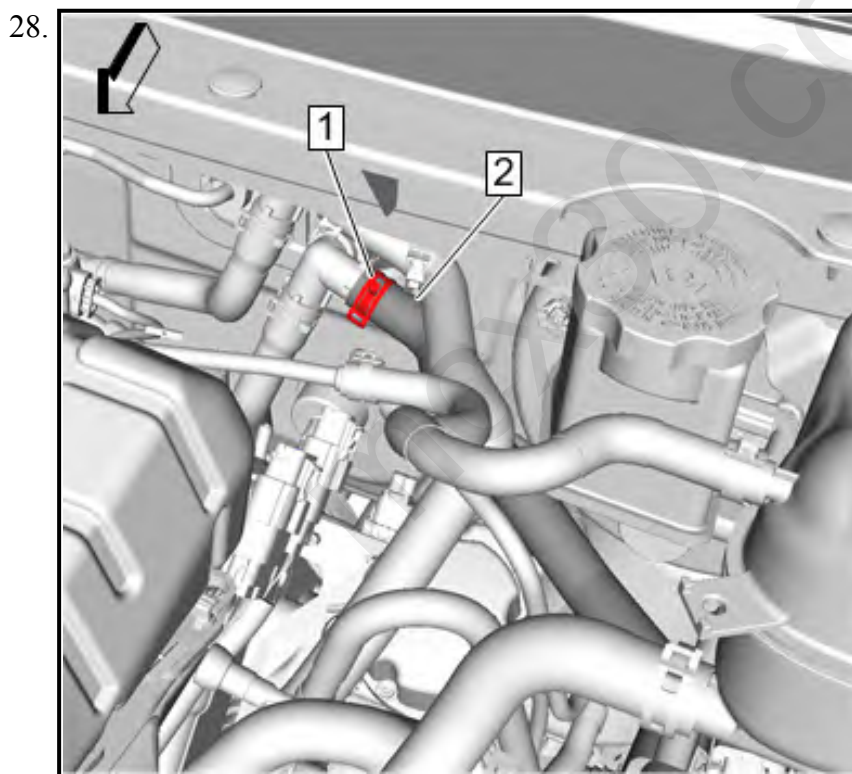
25. Heater Water Bypass Outlet Hose (2) @ Heater Outlet Hose Connector - Remove





Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

27. Heater Water Bypass Inlet Hose (2) @ Heater Outlet Hose Connector - Remove

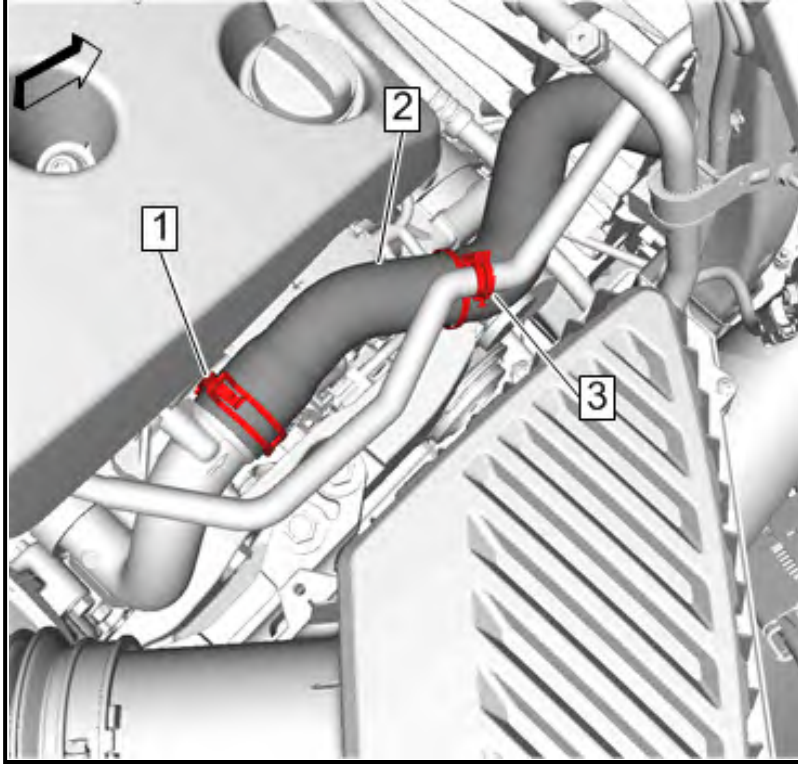


Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)

29. Heater Outlet Hose (2) @ Heater Outlet Hose Connector - Remove

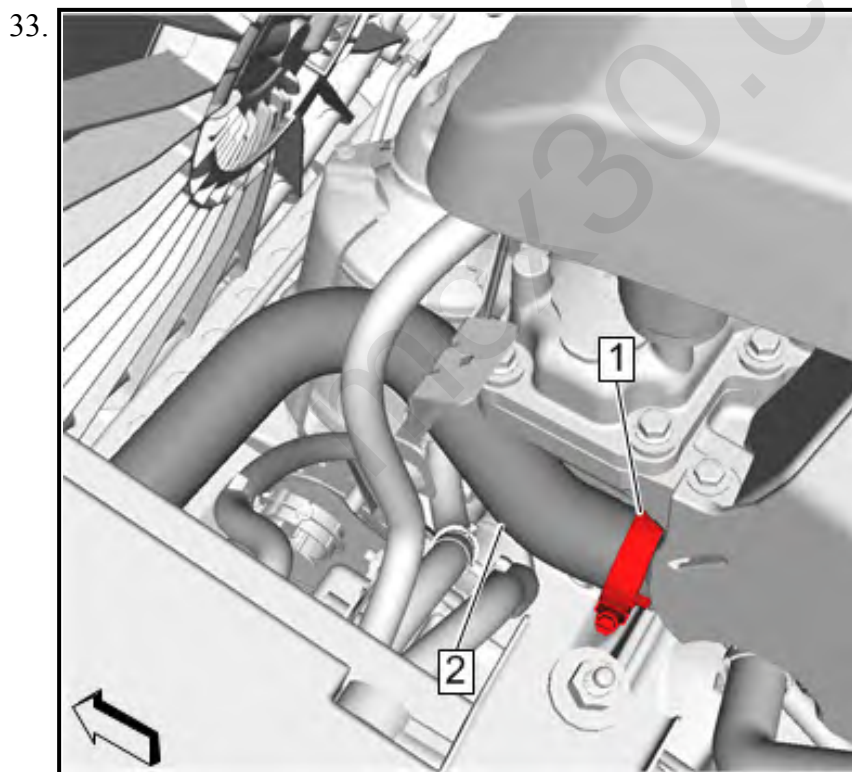


30.



Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Remove

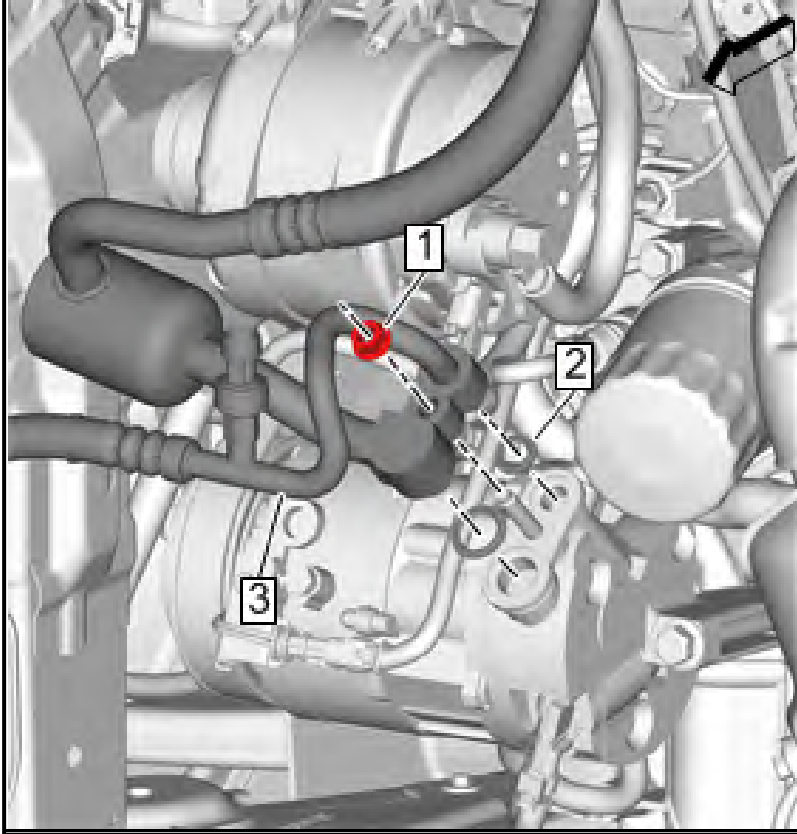
31. Radiator Inlet Hose Clamp (1) - Disengage - [Hose Clamp Replacement Guidelines - Spring Type](#)
32. Radiator Inlet Hose (2) @ Water Outlet - Remove



Radiator Outlet Hose Clamp (1) - Remove

34. Radiator Outlet Hose (2) @ Engine Coolant Thermostat Housing - Remove





Air Conditioning Compressor and Condenser Hose (3) @ Air Conditioning Compressor - Remove - [Air Conditioning Compressor and Condenser Hose Replacement \(LFY\)](#).

36. Remove the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)

37. Remove both front wheelhouse liners. [Front Wheelhouse Liner Replacement](#)

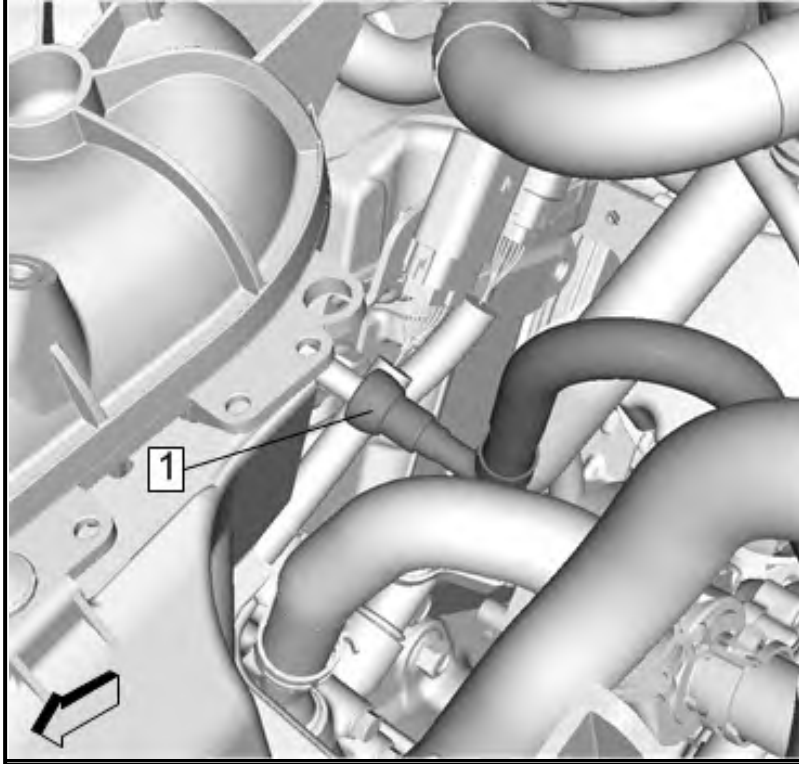
38.



Exhaust Front Muffler (1) - Remove [Exhaust Front Muffler Replacement \(LFY\)](#).

39.



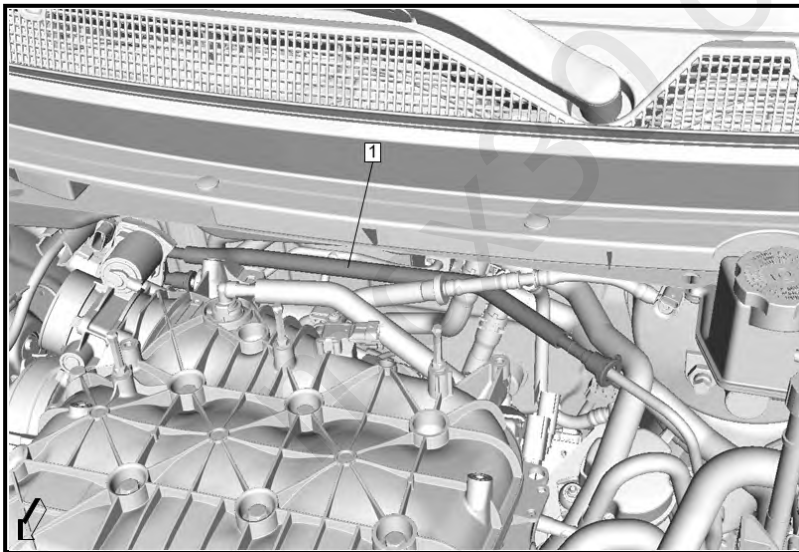


WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

WARNING: Refer to [Safety Glasses Warning](#) .

Fuel Feed Pipe (1) @ Engine - Disconnect [Metal Collar Quick Connect Fitting Service](#)

40.



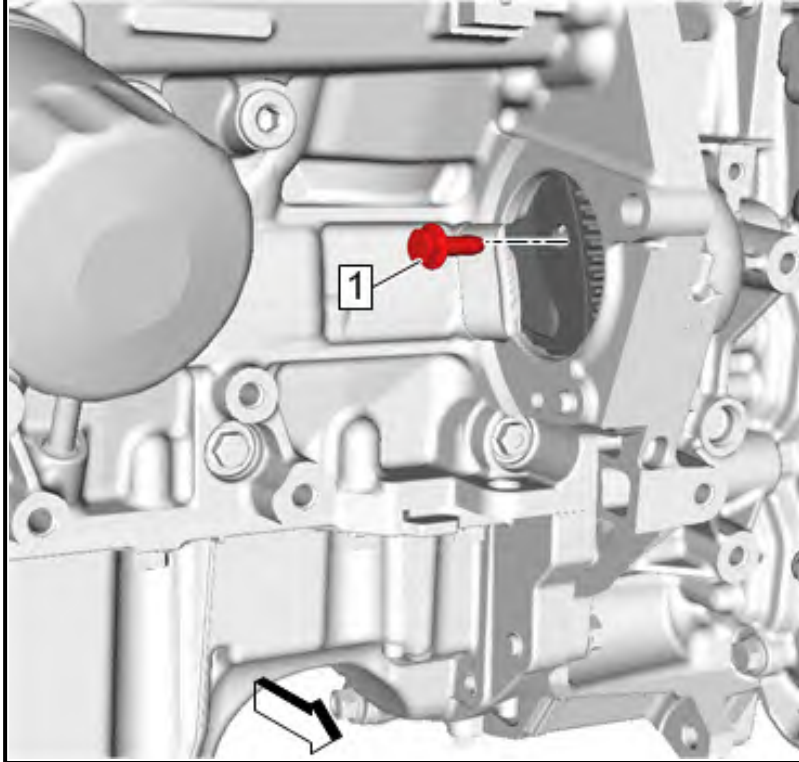
Evaporative Emission Front Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

41. Starter - Remove - [Starter Replacement \(LFY\)](#)

42. Mark the relationship of the flex plate to the torque converter for reassembly.

43.



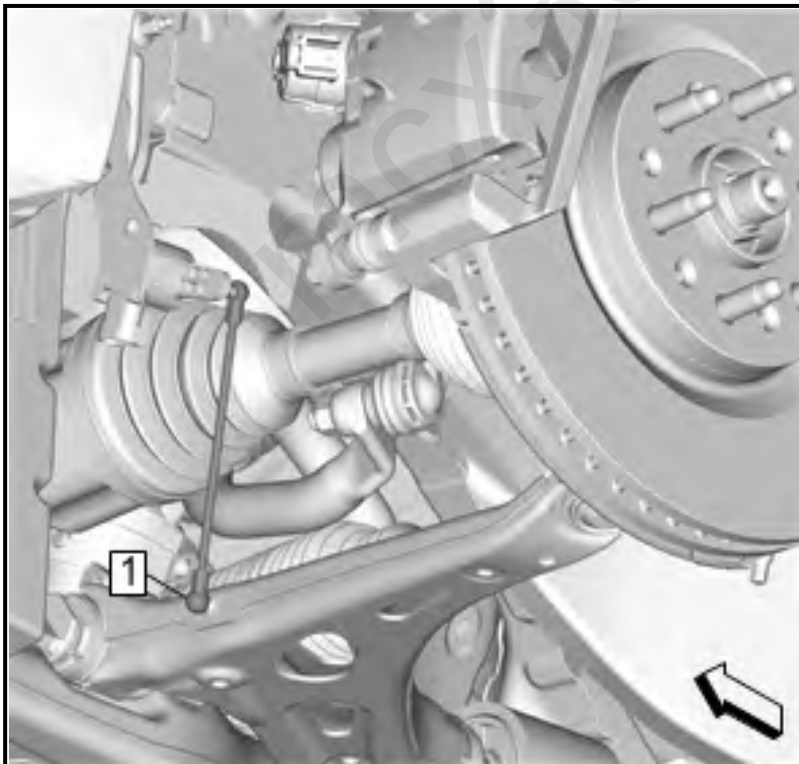


NOTE: Rotate engine clockwise using the crankshaft balancer bolt to gain access to each bolt.

Remove the torque converter to flex plate bolts (1).

44. Disconnect the wheel drive shafts from the transmission. [Front Wheel Drive Half Shaft Replacement - Left Side](#) , and [Front Wheel Drive Shaft Replacement - Right Side \(LFY with FWD\)](#).
45. Disconnect and reposition harnesses as required.

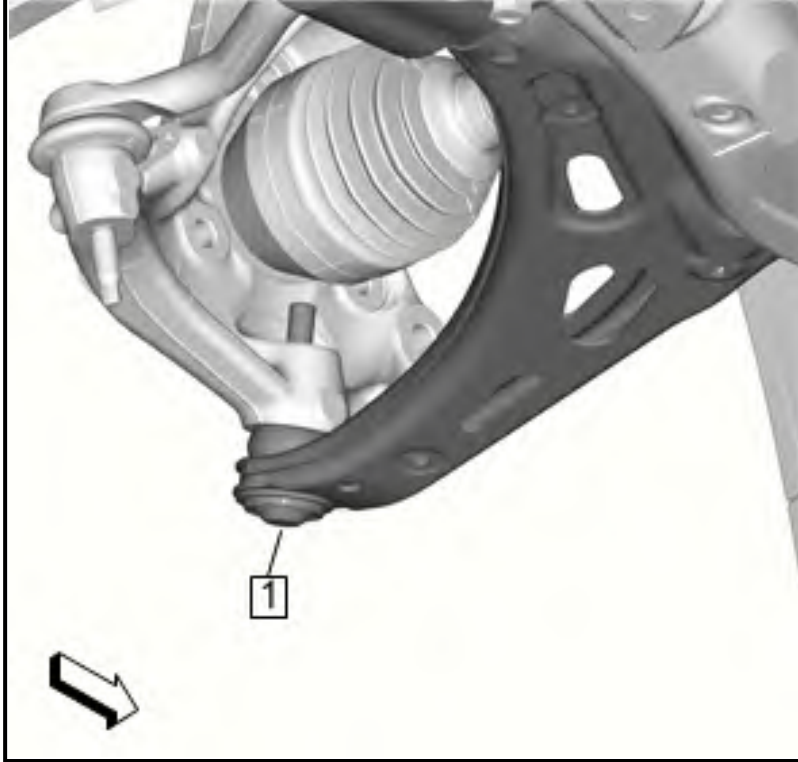
46.



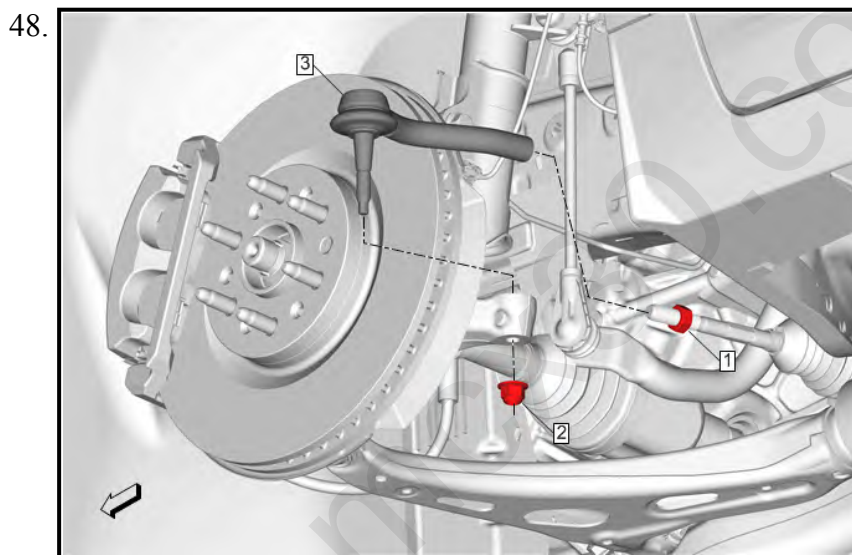
{ If equipped } Front Suspension Automatic Forward Lighting Position Sensor (1) @ Front Lower Control Arm - Separate

47.

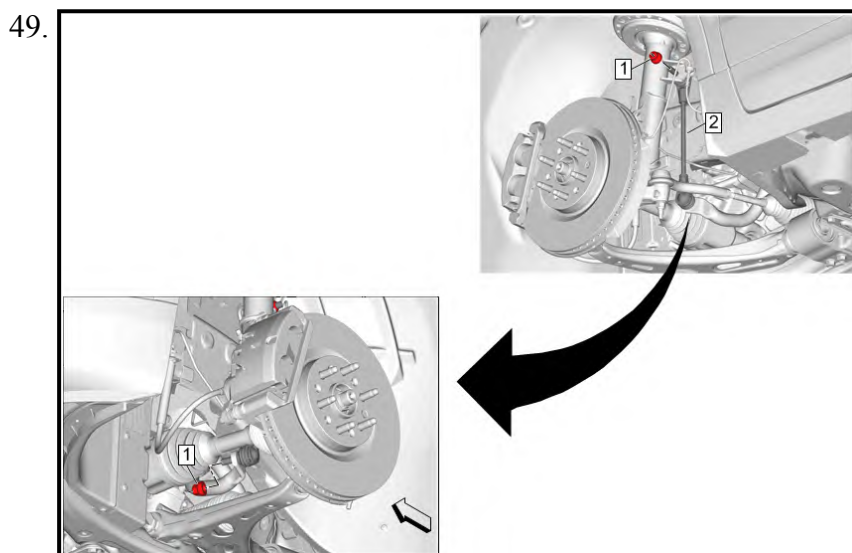




Front Lower Control Arm (1) @ Steering Knuckle - Separate - [Lower Control Arm Replacement](#)

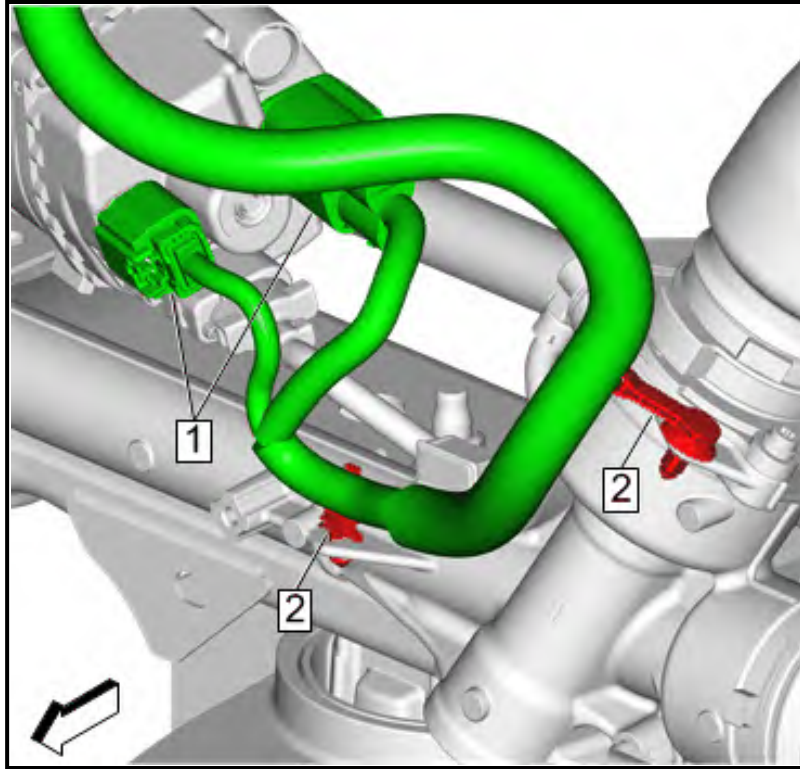


Steering Linkage Outer Tie Rod (3) @ Steering Knuckle - Separate - [Steering Linkage Outer Tie Rod Replacement](#)



Stabilizer Shaft Link (2) @ Stabilizer Shaft - Separate - [Stabilizer Shaft Link Replacement](#)

50.

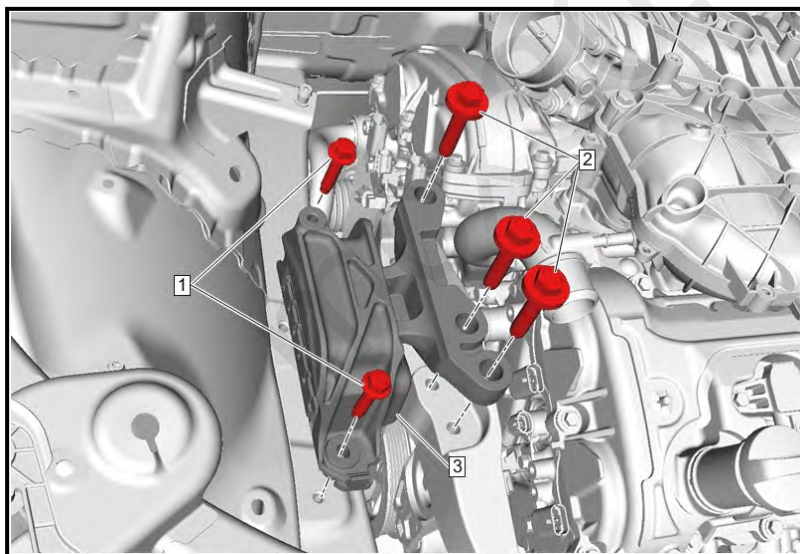


Disconnect the electrical connector on the steering gear and disconnect the wiring harness clip from the steering gear housing. (1)

51. Install **EN-48244** Engine Assembly Remove/Install Pallet Supporter under the drivetrain and front suspension cradle.

52. Lower the vehicle until the drivetrain and front suspension frame is resting lightly on the support table.

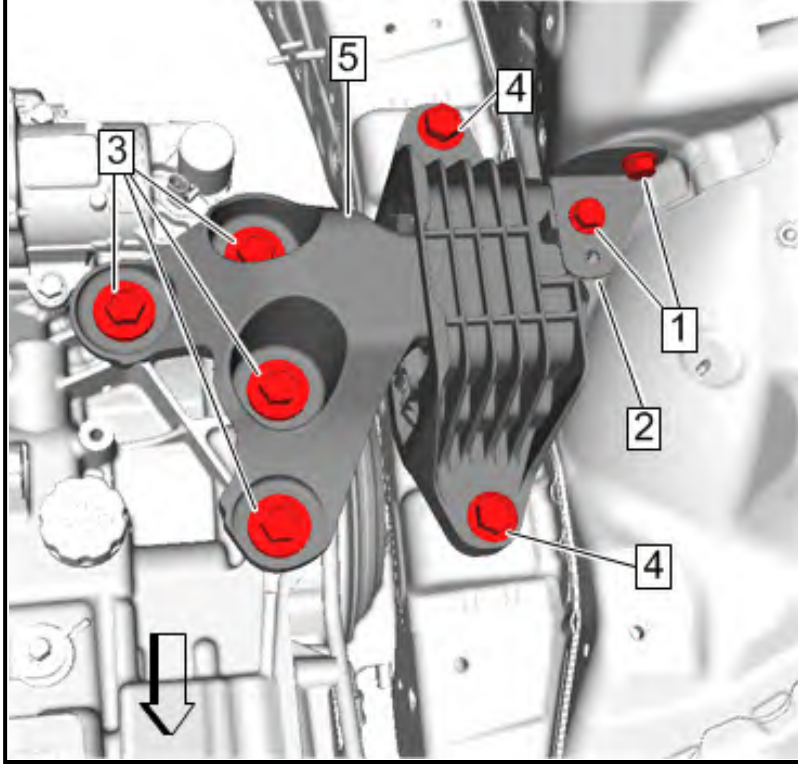
53.



Engine Mount Fastener (2) - Remove and DISCARD [3x] - **Engine Mount Replacement - Right Side**

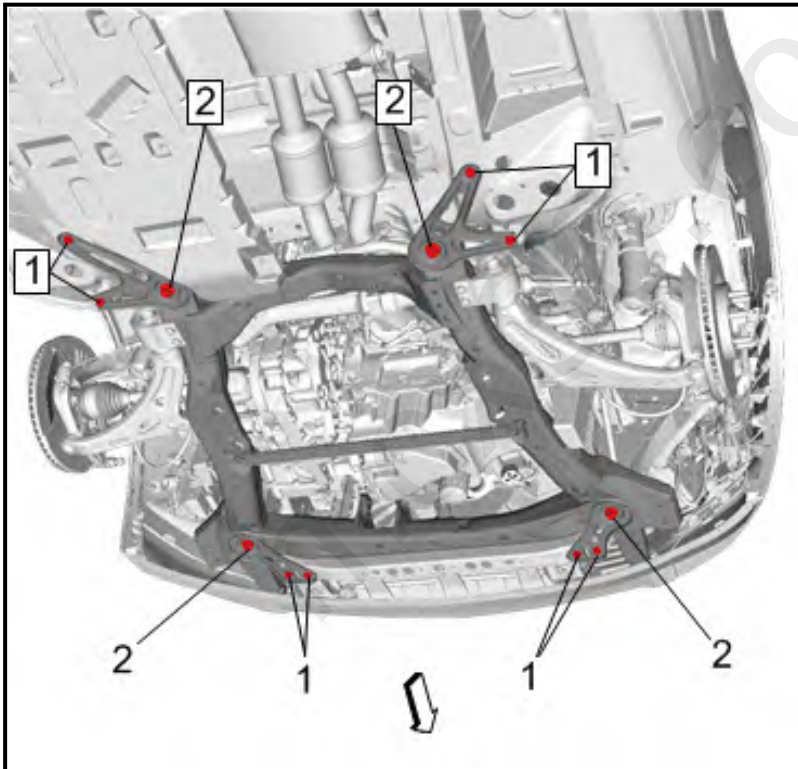
54.





Transmission Mount Bolt (3) - Remove and DISCARD the bolts. [4x]

55.



Drivetrain and Front Suspension Support Bolt (1) - Remove [8X]

56. Drivetrain and Front Suspension Support Bolt (2) - Remove and DISCARD [4x]

57. With the aid of an assistant, carefully raise the body from the frame.

58. Ensure when raising the body the following items are clear from the frame:

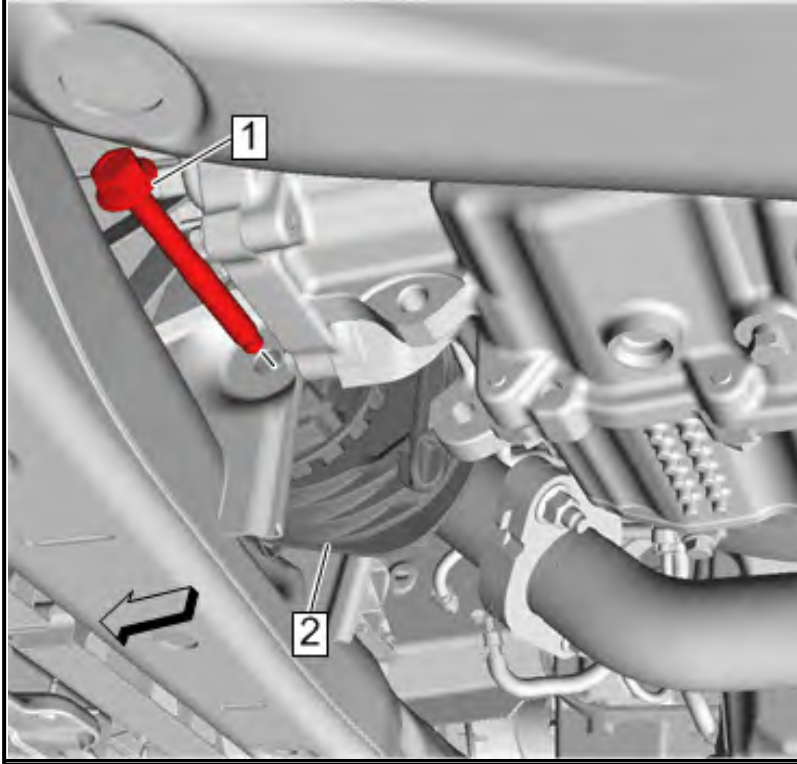
- Vacuum lines
- Steering knuckles
- Electrical wiring harnesses

59. Remove the drivetrain and front suspension frame.

60. Install a suitable lifting device to the powertrain assembly.

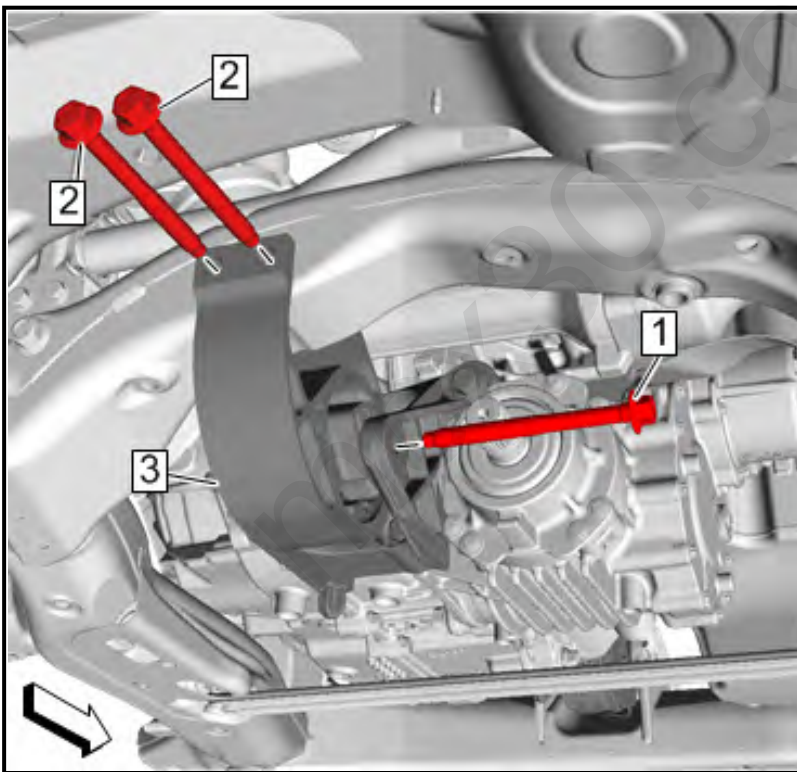
61.





Transmission Front Mount (2) - Remove - [Transmission Mount Replacement \(Left\)](#)
[Transmission Mount Replacement \(Front\)](#)

62.



Transmission Mount Strut (3) - Remove - [Transmission Mount Strut Replacement \(Front Wheel Drive\)](#)

63. Lift the powertrain assembly off the frame and place on the floor.

64. Separate the engine from the transmission. [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#)

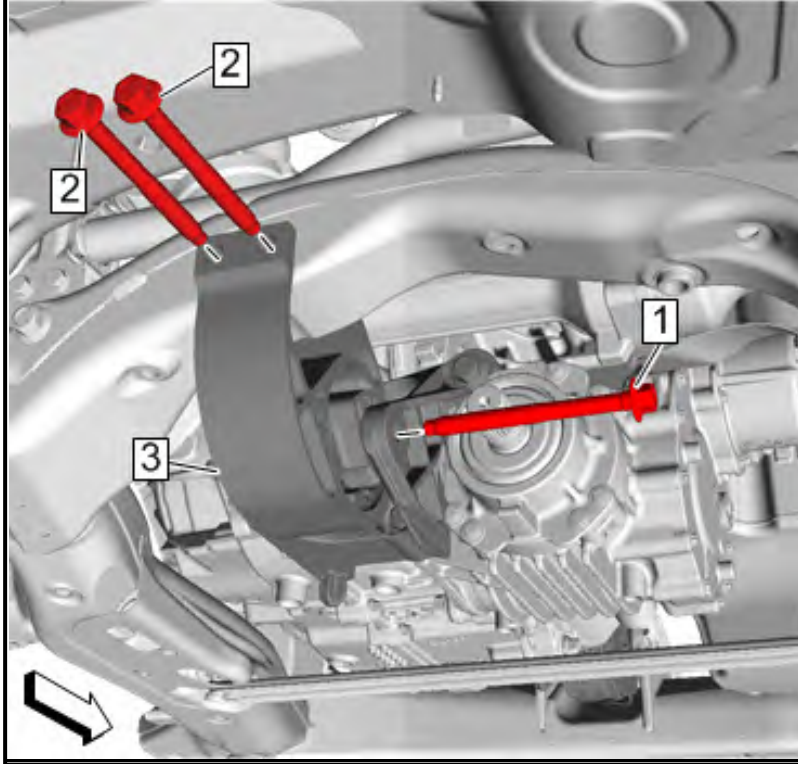
Installation Procedure

1. Install the engine to the transmission. [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#)

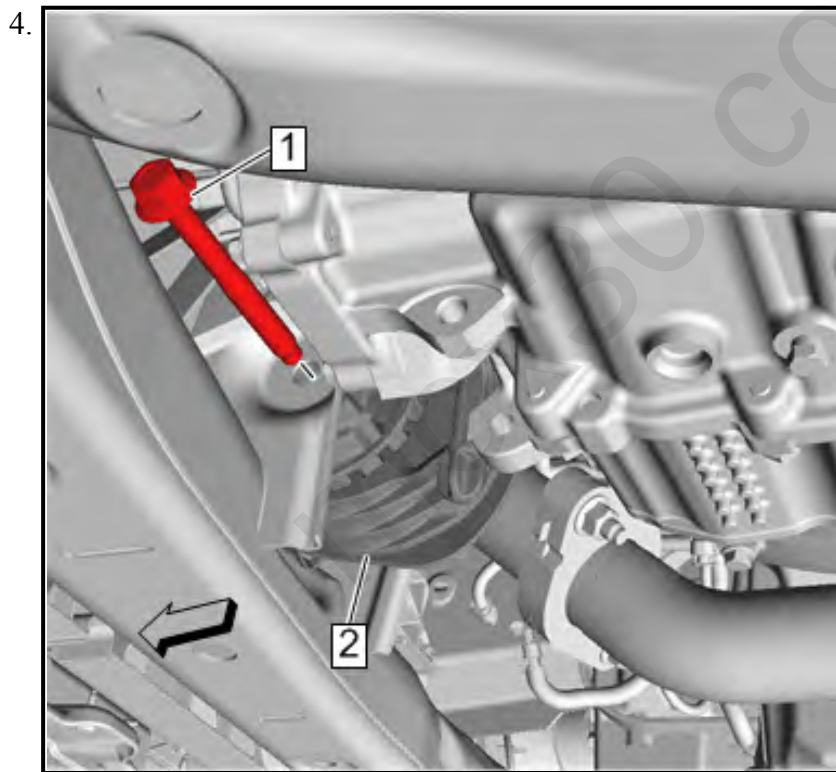
2. Place the powertrain assembly on the frame.

3.





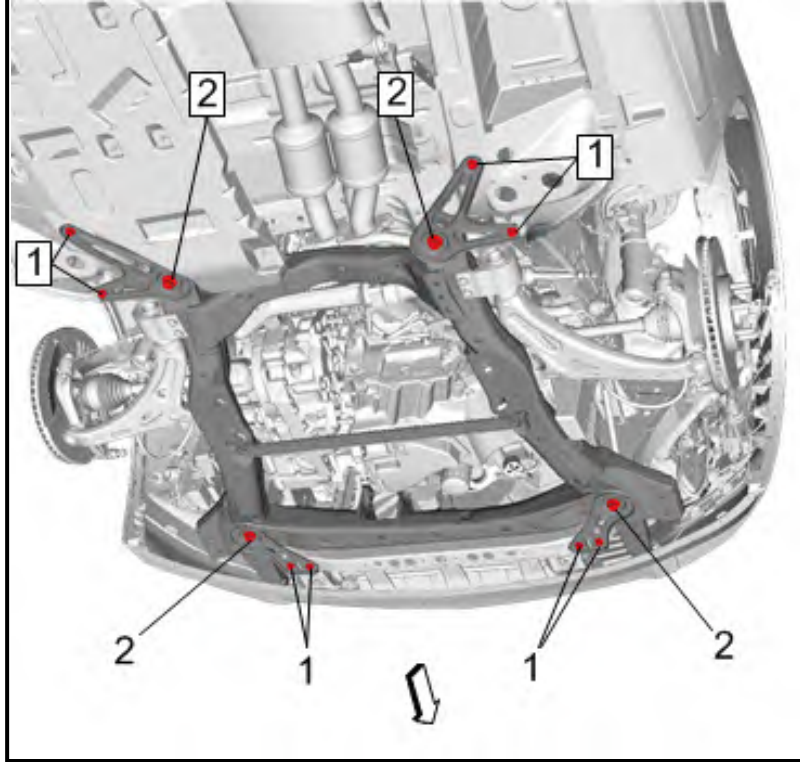
Transmission Mount Strut (3) - Install - [Transmission Mount Strut Replacement \(Front Wheel Drive\)](#).



Transmission Front Mount (2) - Install - [Transmission Mount Replacement \(Left\)](#).
[Transmission Mount Replacement \(Front\)](#).

5. Place the powertrain and frame assembly on the engine support table.
6. With the aid of an assistant, carefully lower the body to the frame. (1)
7. Ensure the following components are clear from the frame:
 - Vacuum lines
 - Steering knuckles
 - Electrical wiring harnesses

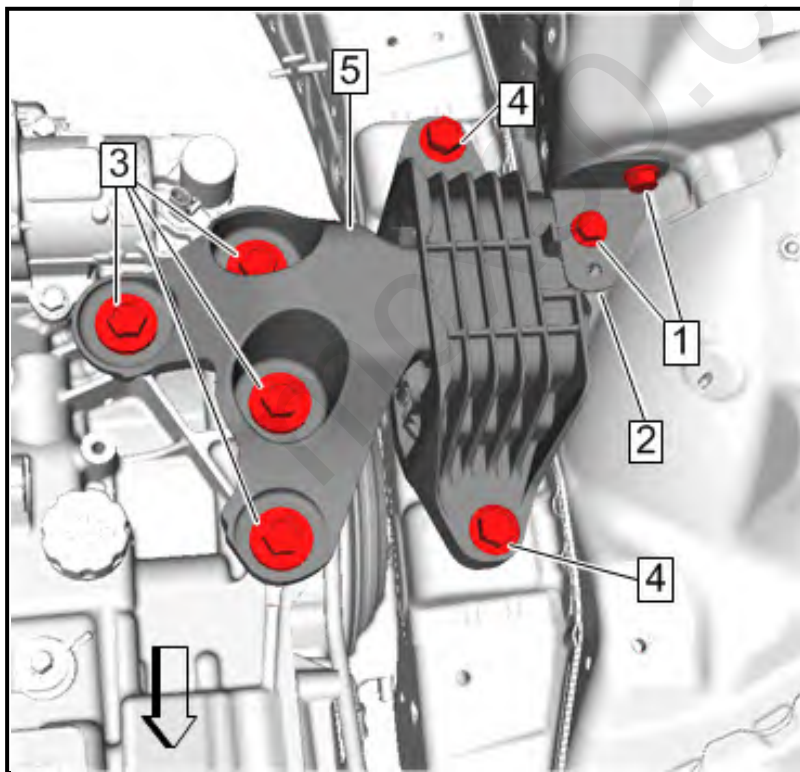




Drivetrain and Front Suspension Support Bolt (2) - Install and tighten the NEW bolt. [4X] - [Drivetrain and Front Suspension Cradle Replacement \(Front Wheel Drive\)](#).

9. Drivetrain and Front Suspension Support Bolt (1) - Install and tighten [8X] - [Drivetrain and Front Suspension Cradle Replacement \(Front Wheel Drive\)](#).

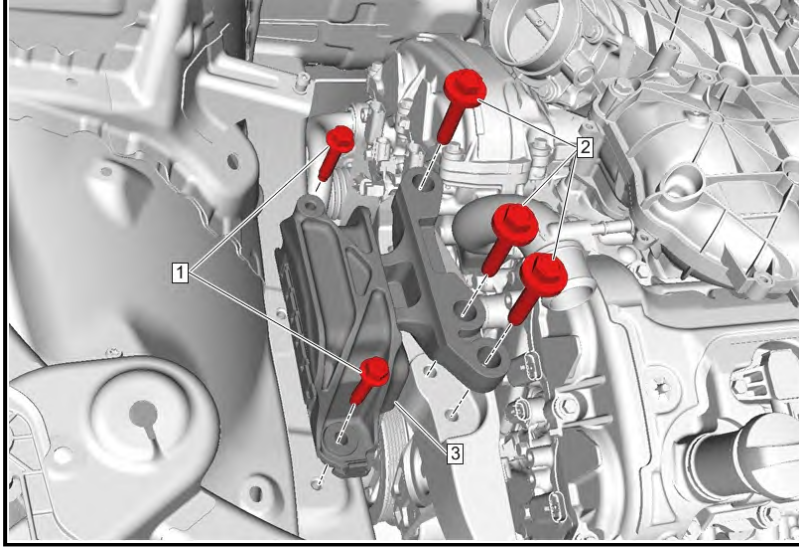
10.



Transmission Mount Bolt (3) - Install NEW [4x] - [Transmission Mount Replacement \(Left\)](#), [Transmission Mount Replacement \(Front\)](#).

11.

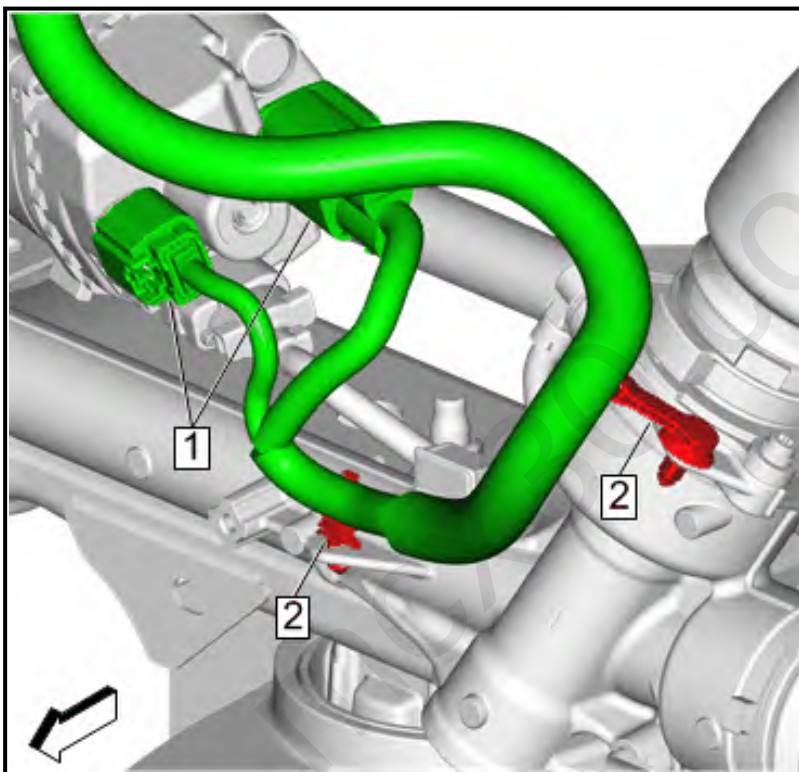




Engine Mount Fastener (2) - Install NEW [3x] - [Engine Mount Replacement - Right Side](#)

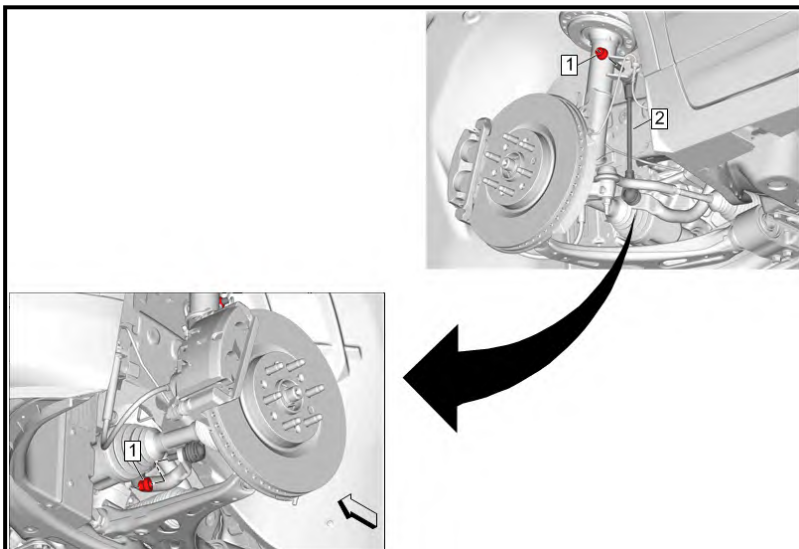
12. Remove the **EN-48244** Engine Assembly Remove/Install Pallet Supporter from under the vehicle.

13.

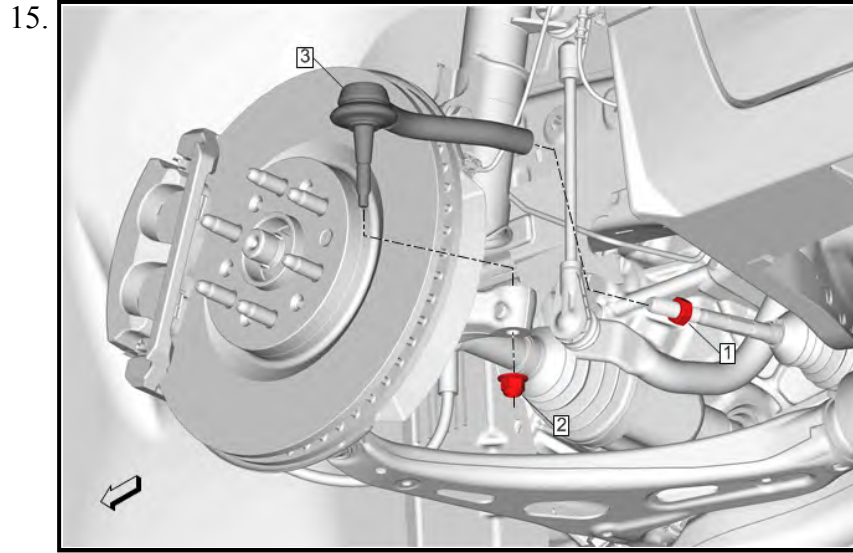


Connect the electrical connector on the steering gear and connect the wiring harness clip on the steering gear housing. (1)

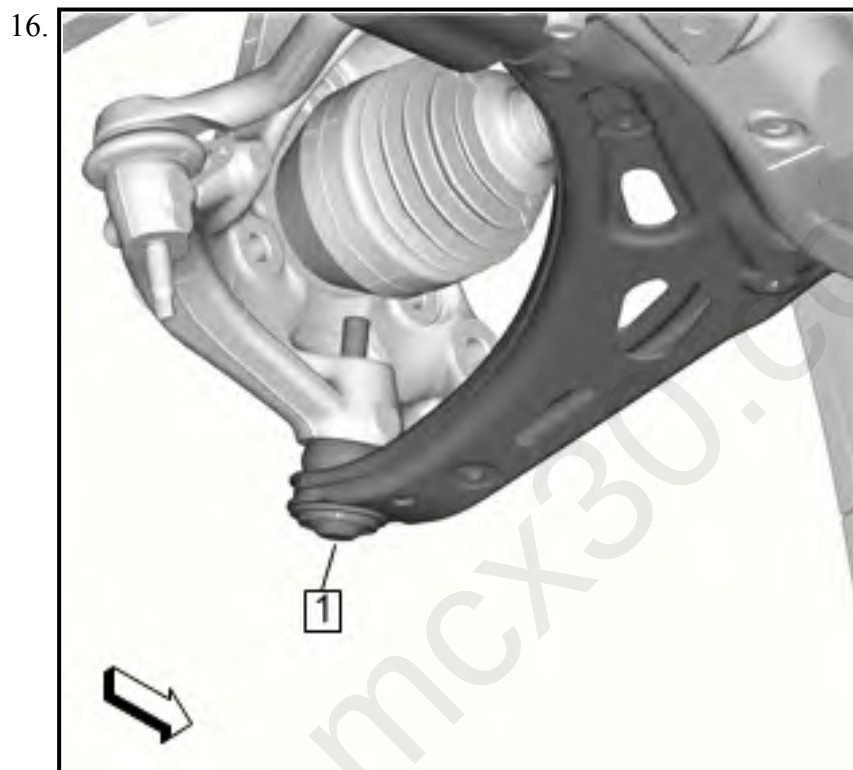
14.



Stabilizer Shaft Link (2) @ Stabilizer Shaft - Install - [Stabilizer Shaft Link Replacement](#)

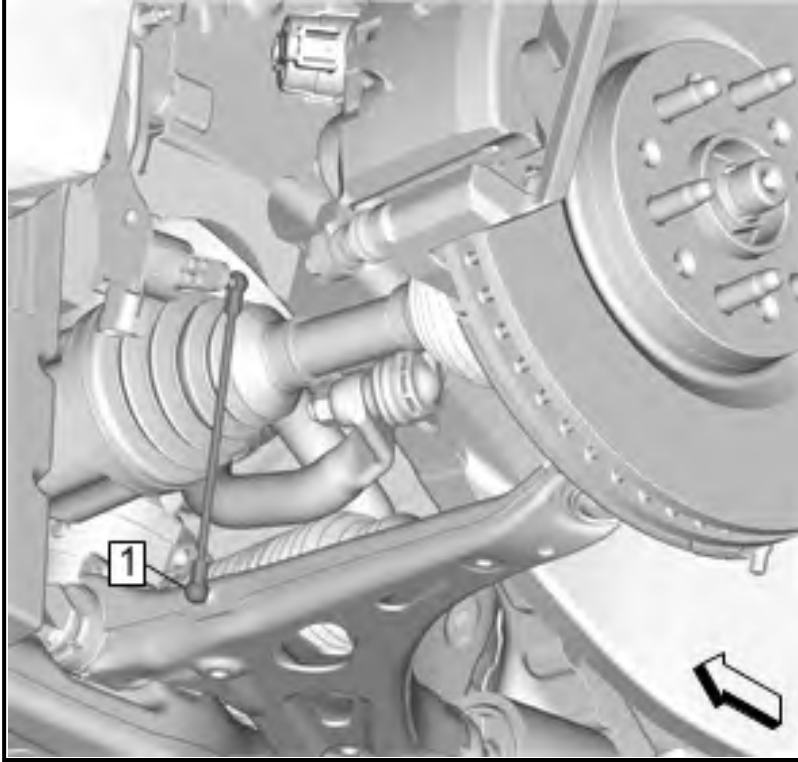


Steering Linkage Outer Tie Rod (3) @ Steering Knuckle - Install - [Steering Linkage Outer Tie Rod Replacement](#)



Front Lower Control Arm (1) @ (3) @ Steering Knuckle - Install - [Lower Control Arm Replacement](#)



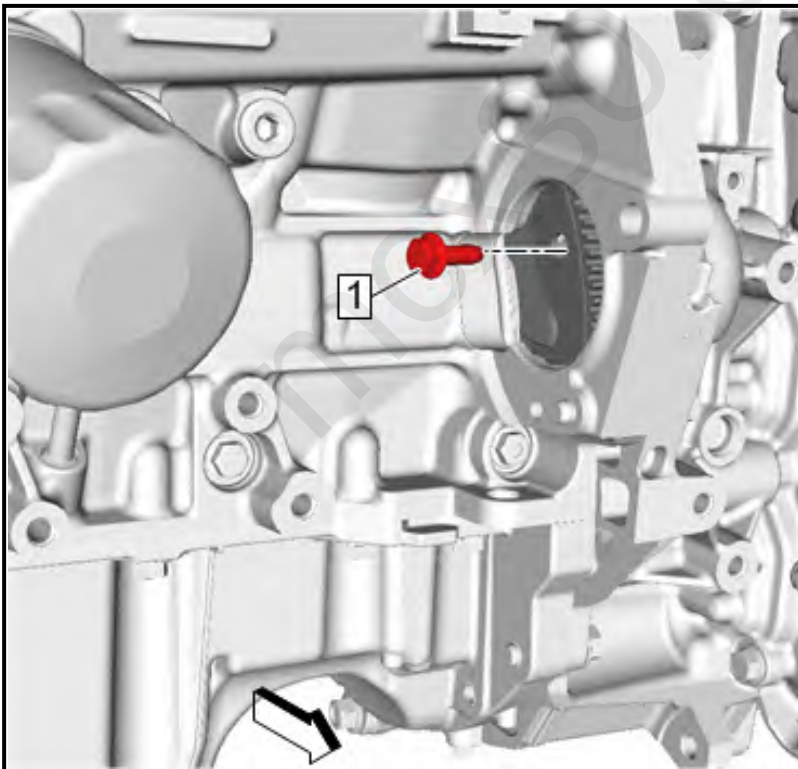


{ If equipped } Front Suspension Automatic Forward Lighting Position Sensor (1) @ Front Lower Control Arm - Connect

18. Position and connect harnesses as required.

19. Install the wheel drive shafts to the transmission. [Front Wheel Drive Half Shaft Replacement - Left Side](#) , and [Front Wheel Drive Shaft Replacement - Right Side \(LFY with FWD\)](#).

20.

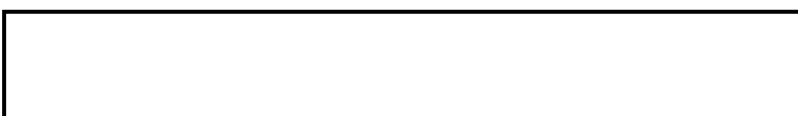


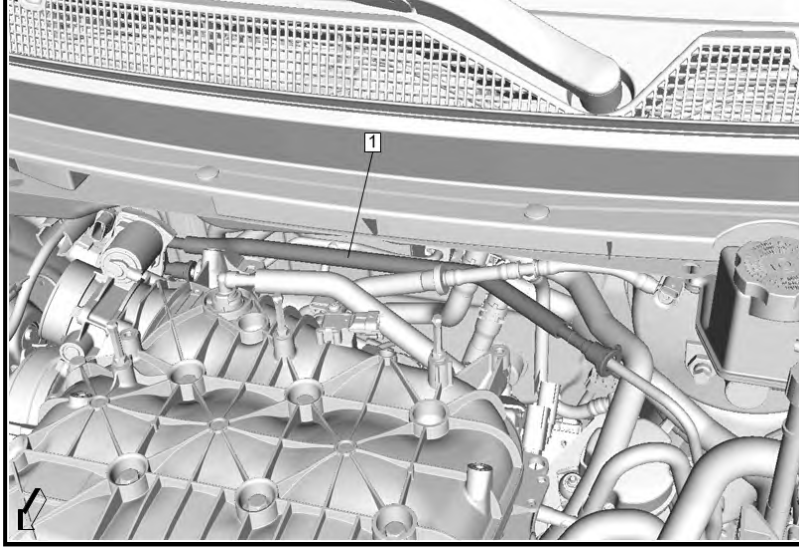
NOTE: Rotate engine clockwise using the crankshaft balancer bolt to gain access to each bolt.

Install the torque converter to flex plate bolts (1). [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#).

21. Starter - Install - [Starter Replacement \(LFY\)](#).

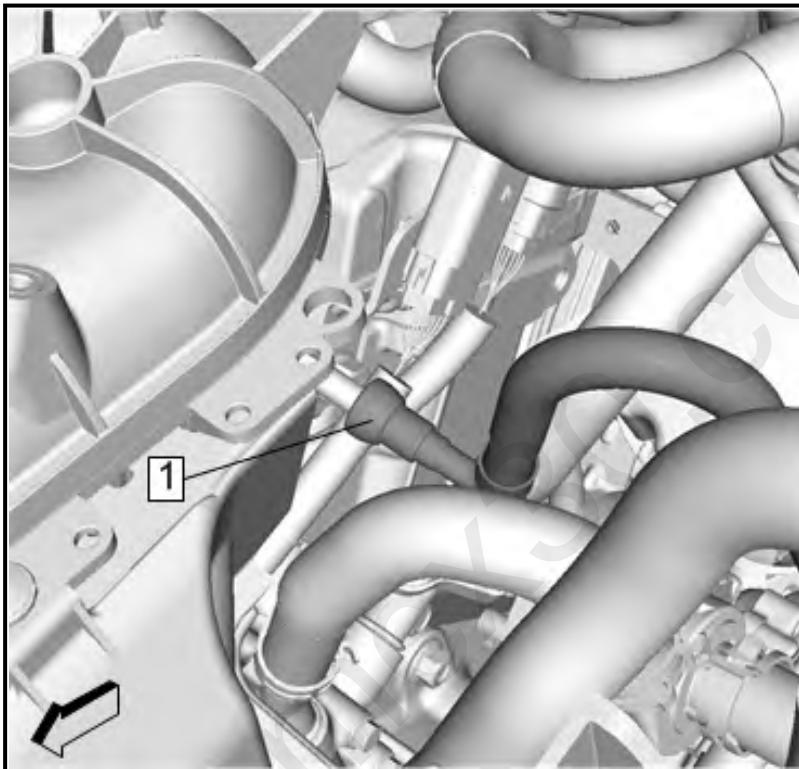
22.





Evaporative Emission Front Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve - Connect - [Plastic Collar Quick Connect Fitting Service](#)

23.



WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

WARNING: Refer to [Safety Glasses Warning](#) .

Fuel Feed Pipe (1) @ Engine - Connect [Metal Collar Quick Connect Fitting Service](#)

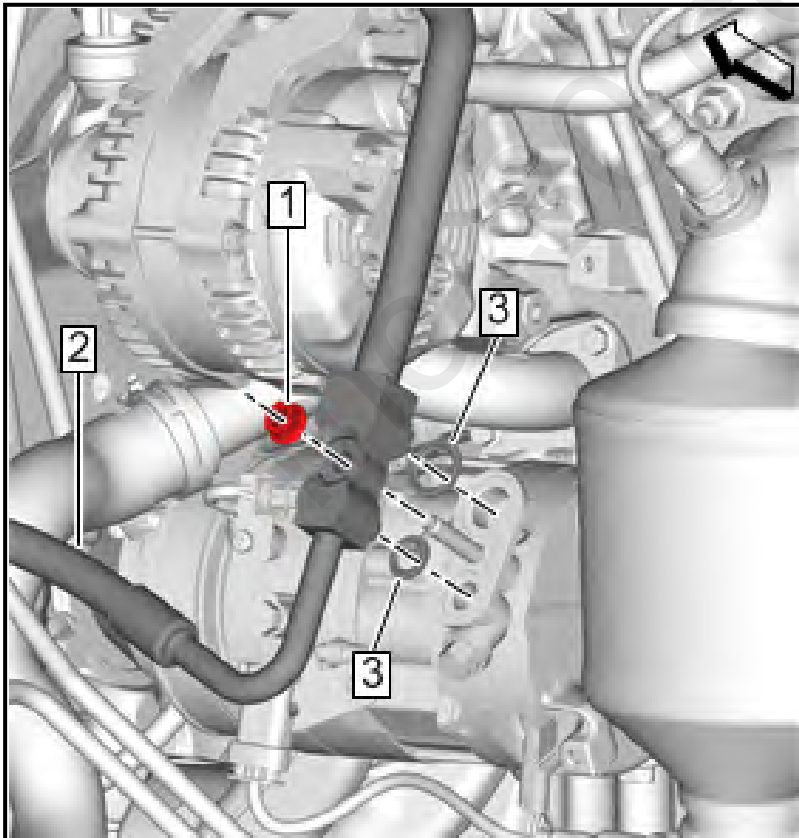
24.





Exhaust Front Muffler (1) - Install [Exhaust Front Muffler Replacement \(LEF\)](#).

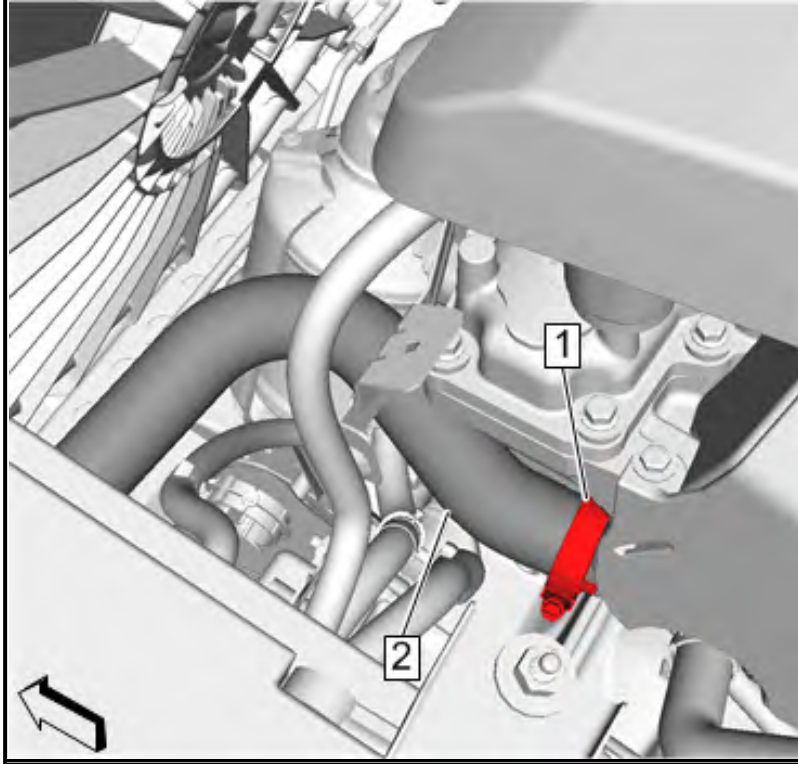
25. Install both front wheelhouse liners. [Front Wheelhouse Liner Replacement](#)
26. Install the front tire and wheel assemblies. [Tire and Wheel Removal and Installation](#)
- 27.



Air Conditioning Compressor and Condenser Hose (2) @ Air Conditioning Compressor - Install - [Air Conditioning Compressor and Condenser Hose Replacement \(LEF\)](#).

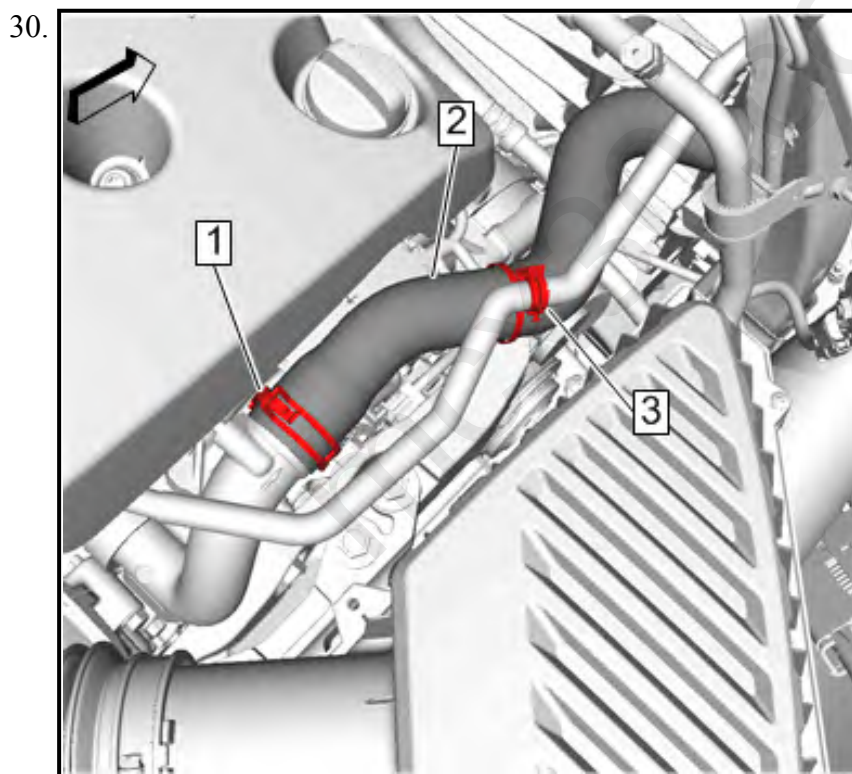
- 28.





Radiator Outlet Hose (2) @ Engine Coolant Thermostat Housing - Install

29. Radiator Outlet Hose Clamp (1) - Install

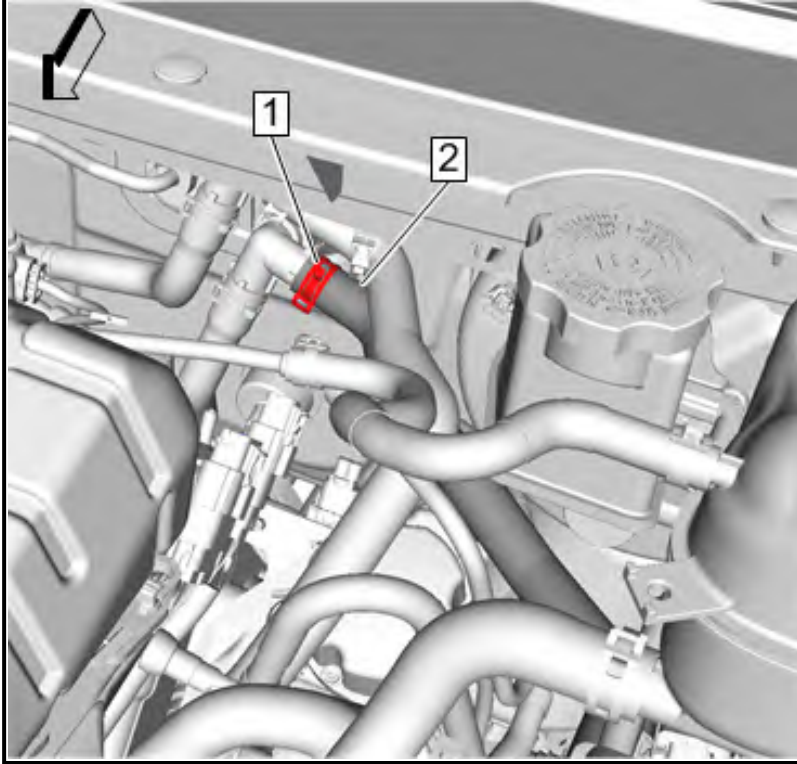


Radiator Inlet Hose (2) @ Water Outlet - Install

31. Radiator Inlet Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)

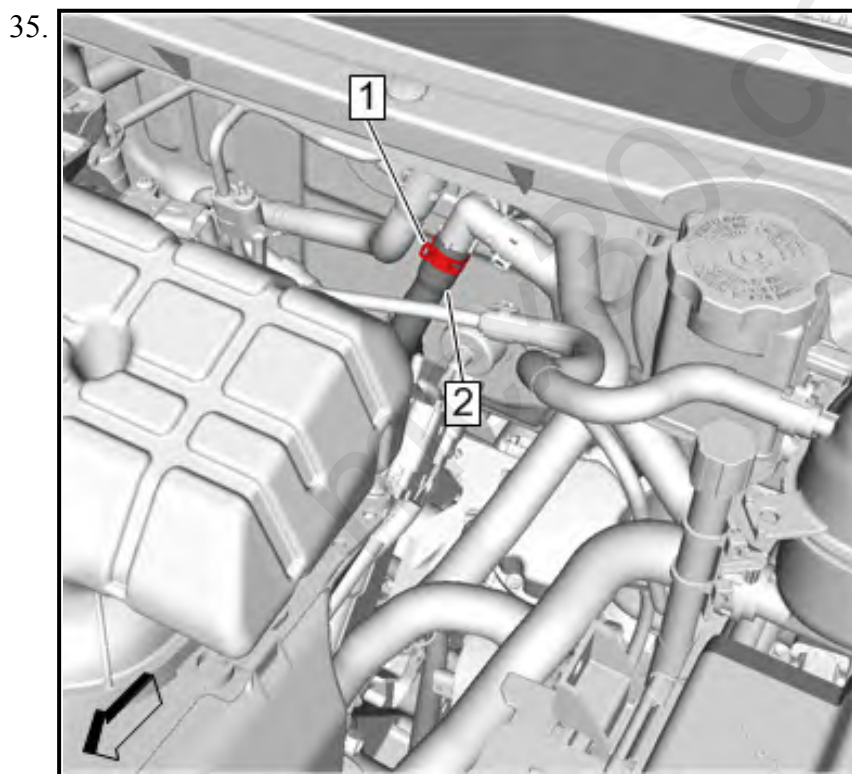
32. Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Install





Heater Outlet Hose (2) @ Heater Outlet Hose Connector - Install

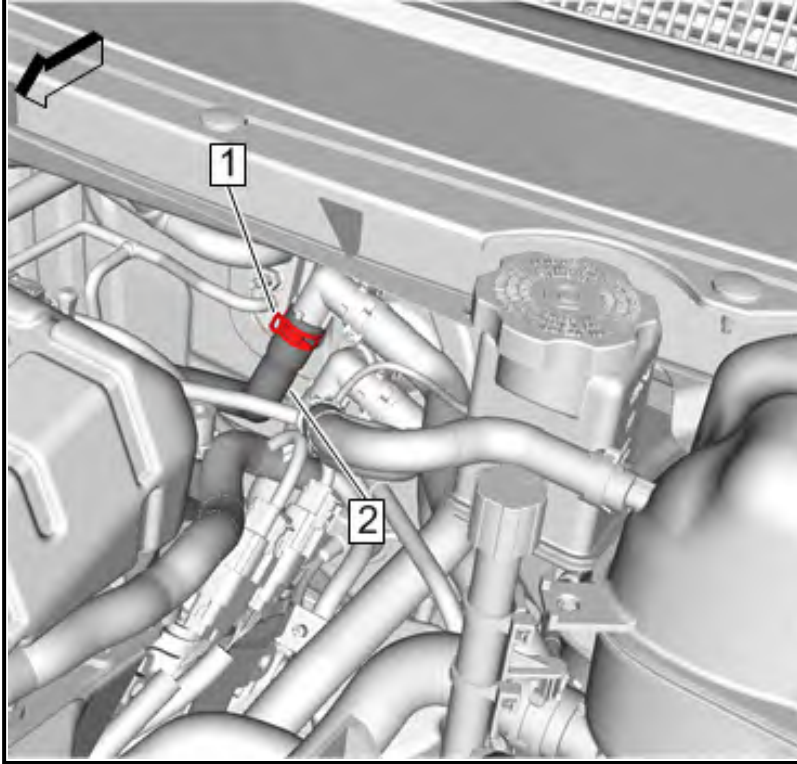
34. Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)



Heater Water Bypass Inlet Hose (2) @ Heater Outlet Hose Connector - Install

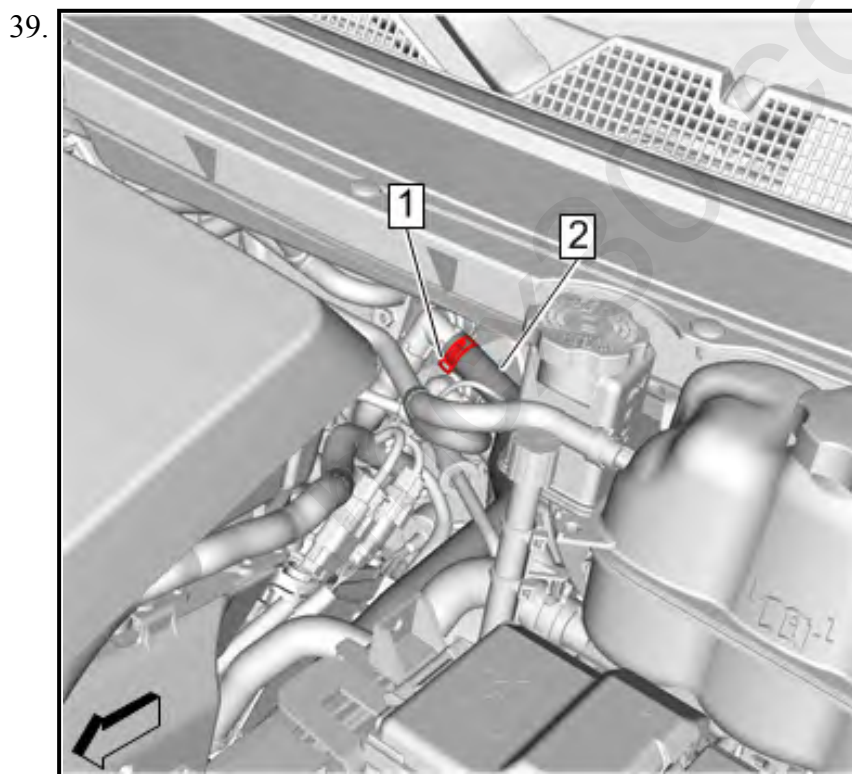
36. Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)





Heater Water Bypass Outlet Hose (2) @ Heater Outlet Hose Connector - Install

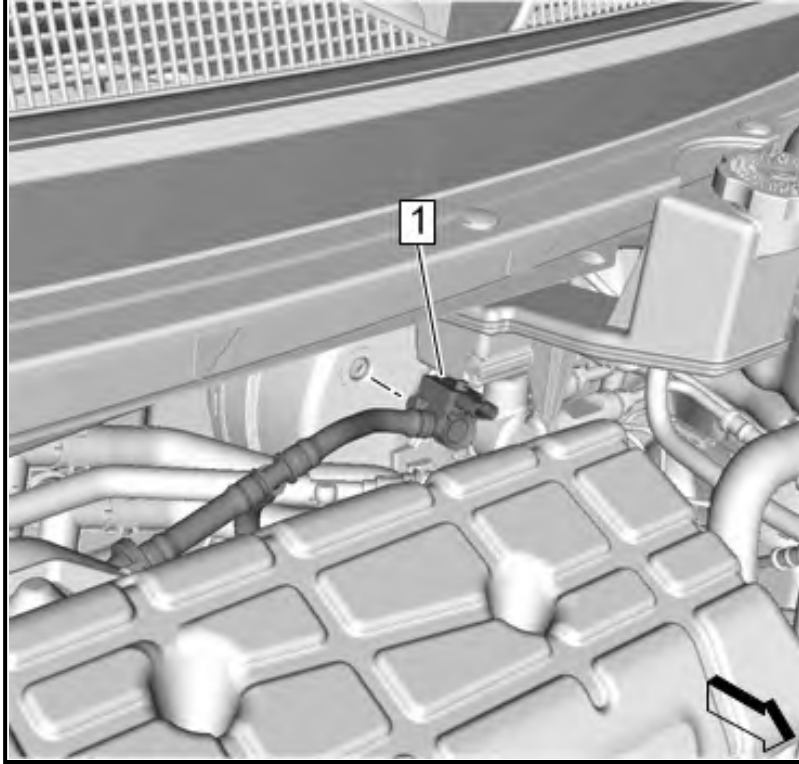
38. Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)



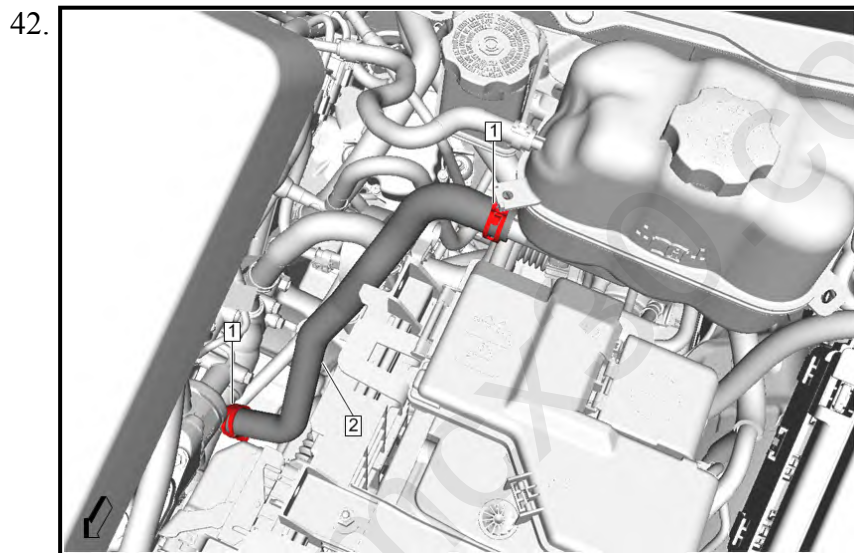
Heater Inlet Hose (2) @ Heater Outlet Hose Connector - Install

40. Heater Inlet Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)



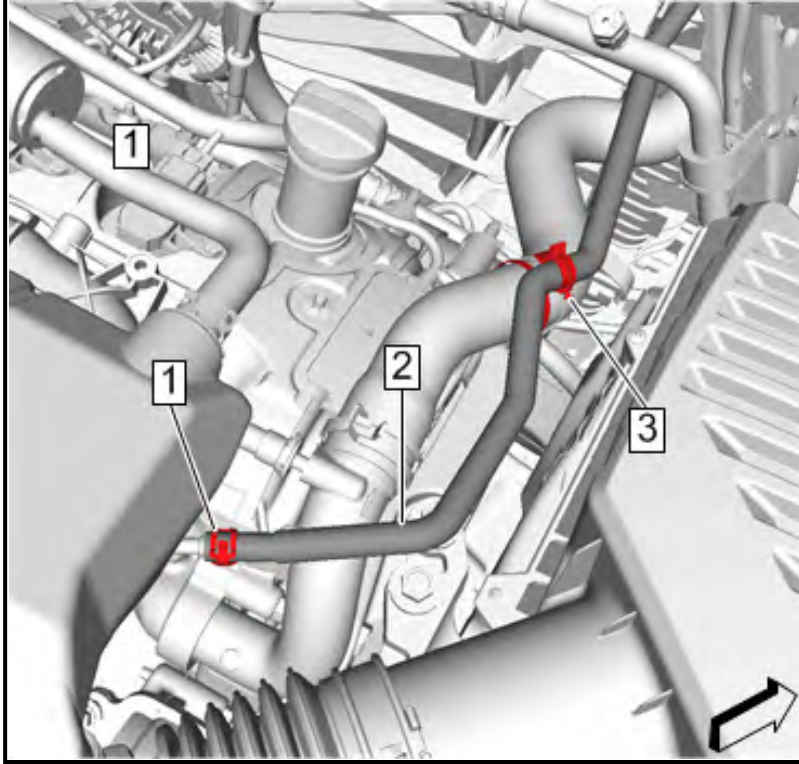


Power Brake Booster Vacuum Sensor (1) @ Power Brake Booster - Install



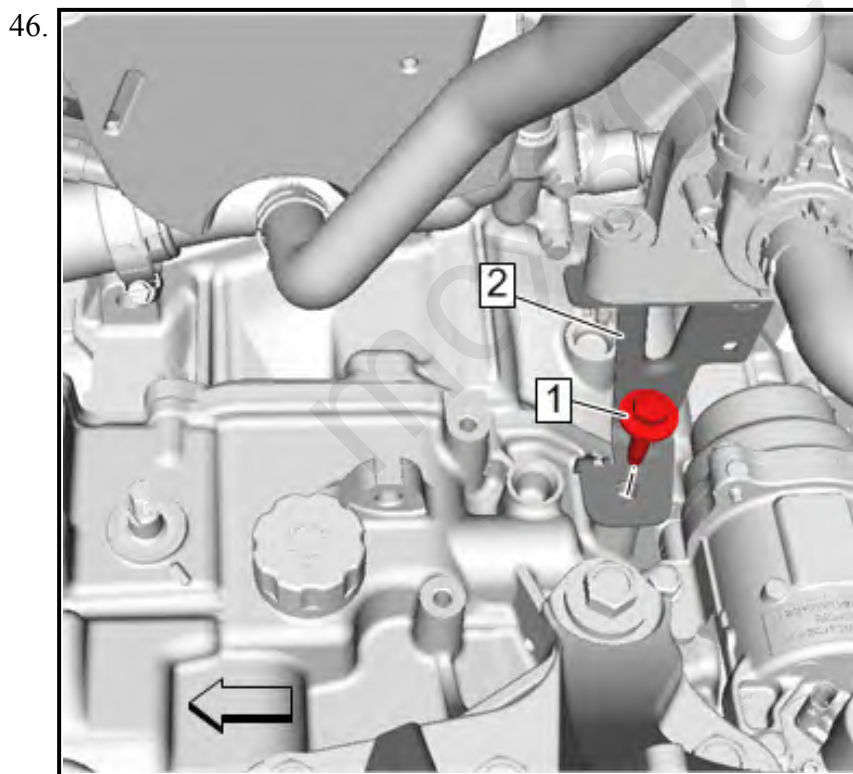
Radiator Surge Tank Outlet Hose (3) @ Radiator Surge Tank - Install - [Hose Clamp Replacement Guidelines - Spring Type](#)





Radiator Surge Tank Overflow Hose (2) @ Engine Coolant Air Bleed Pipe - Install

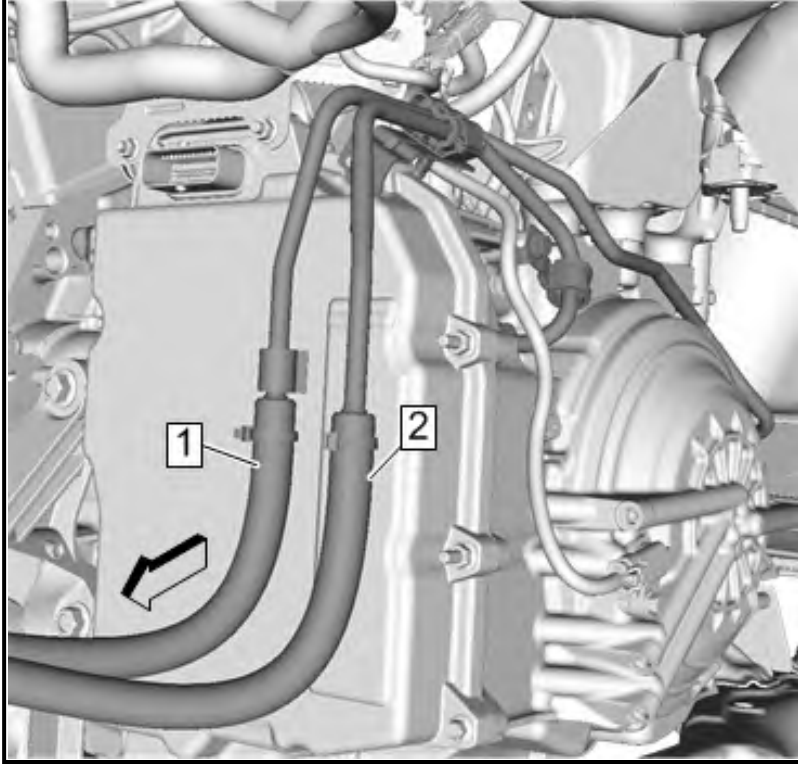
44. Radiator Surge Tank Overflow Hose Clamp (1) - Engage - [Hose Clamp Replacement Guidelines - Spring Type](#)
45. Radiator Outlet Hose Strap (3) @ Radiator Surge Tank Overflow Hose - Install



Position the heater water auxiliary pump (2) to it's original position.

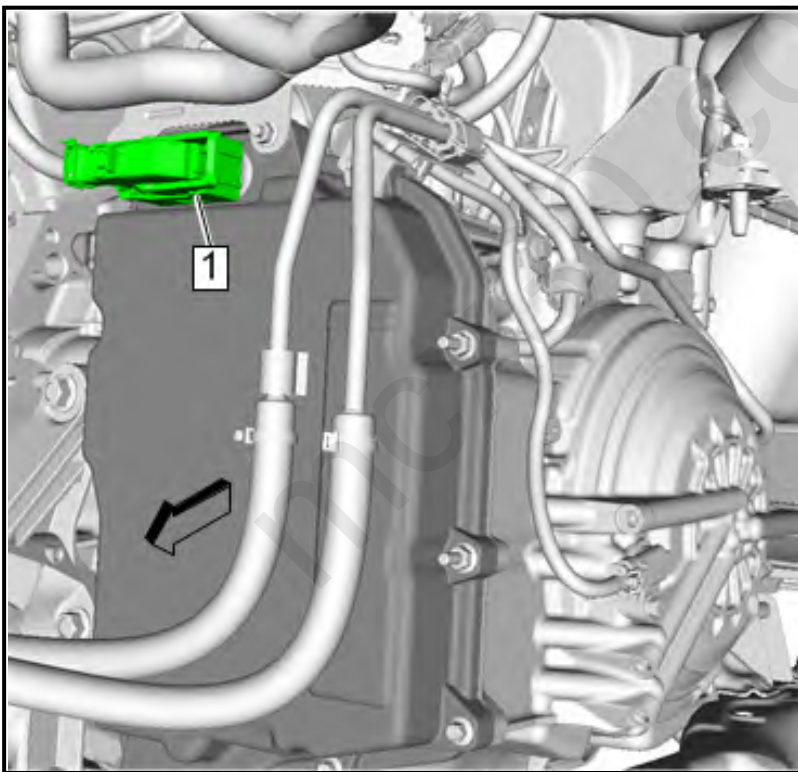
47. Install the heater water auxiliary pump bolt (1). [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#)
48. Install the body ground cable and wiring harness assembly to the front of transmission.





Connect the transmission fluid cooler outlet pipe (1, 2) to the transmission. [Transmission Fluid Cooler Pipe Replacement \(with V08\)](#)

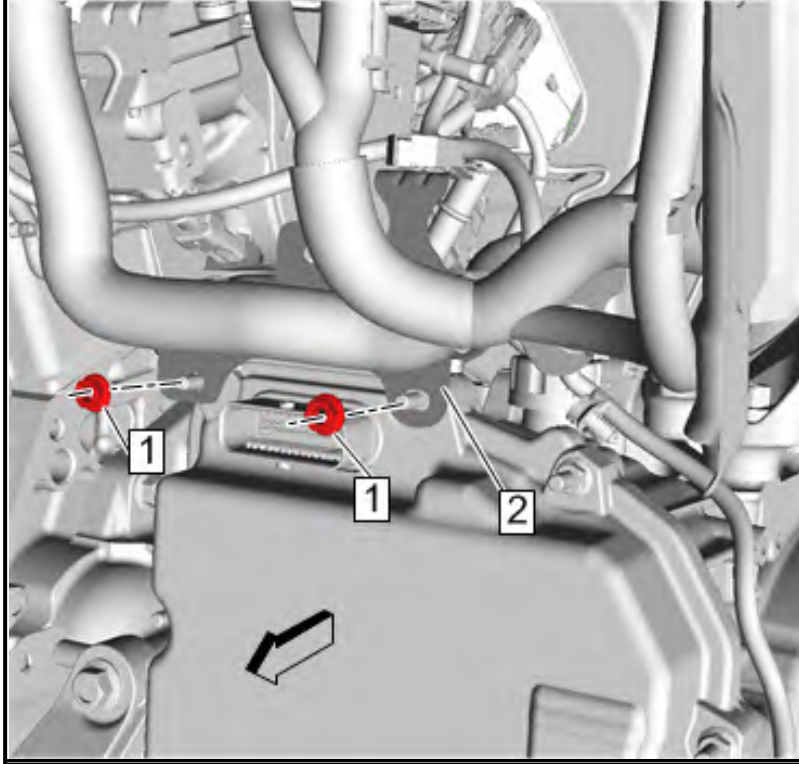
50.



Connect the control valve body transmission control module electrical connector (1), then clip the wiring harness to the cover.

51.

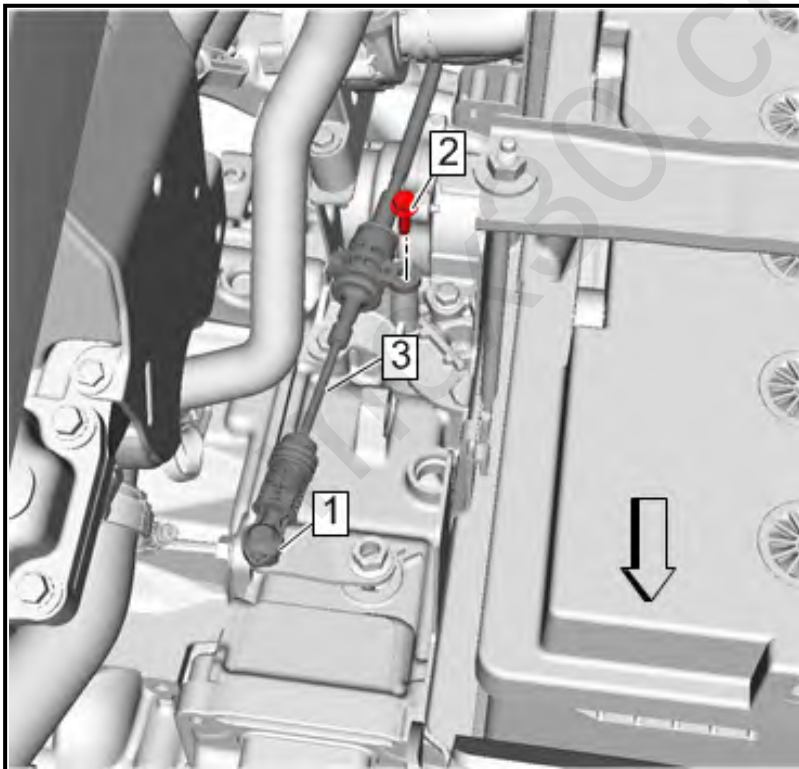




Install the electrical harness bracket (2) to the control valve body cover.

52. Install the electrical harness bracket nuts (1). [Transmission Replacement \(Front Wheel Drive with LFY Engine\)](#).

53.

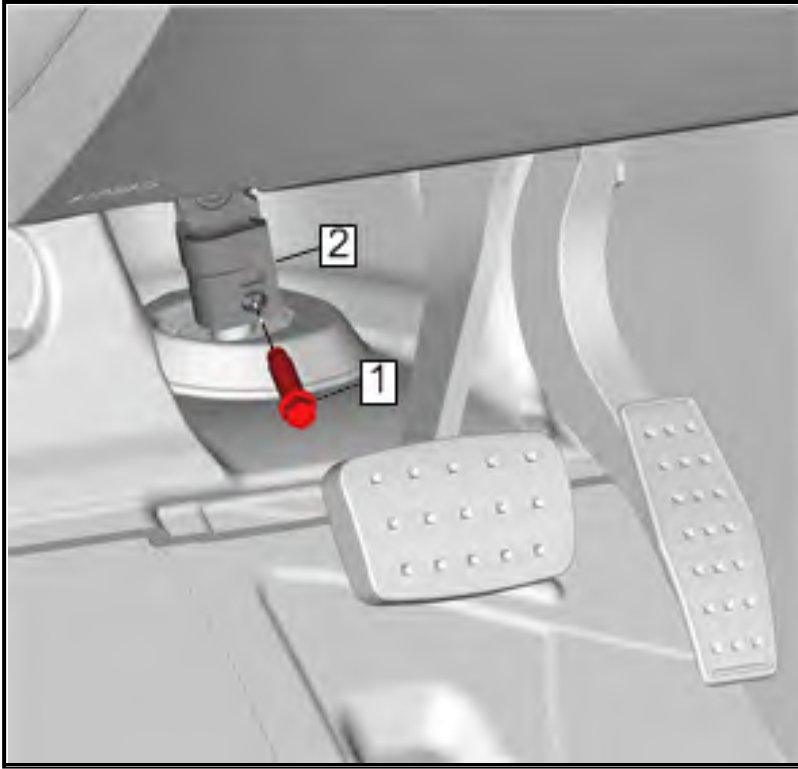


WARNING: After installing the transmission range selector shift cable, pull up and push down on ALL connections to verify that the connections are fully seated and properly engaged. Failure to perform this task can result in the vehicle not being able to shift into PARK causing potential vehicle damage and bodily injury.

Connect the automatic transmission range selector lever cable (3) to the transmission manual shift lever pin.

54. Install the automatic transmission range selector lever cable retaining bolt (2). [Automatic Transmission Range Selector Lever Cable Replacement](#)
55. Air Cleaner Assembly - Install - [Air Cleaner Assembly Replacement](#)

56.



Intermediate Steering Shaft (2) @ Steering Gear - Connect - [Intermediate Steering Shaft Replacement](#)

57. Connect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)

NOTE: Prelube is necessary if the engine is replaced or overhauled.

58. If the engine is replaced with a new engine or has been overhauled, perform the Engine Prelubing procedure. [Engine Prelubing](#)
59. Fill the engine oil to the proper level with NEW engine oil. [Engine Oil and Oil Filter Replacement](#)
60. Fill the cooling system. [Cooling System Draining and Filling \(GE 47716\)](#). [Cooling System Draining and Filling \(Static Fill\)](#).
61. Perform the crankshaft position variation learn procedure. [Crankshaft Position Variation Learn](#)
62. Recharge the refrigerant. [Refrigerant Recovery and Recharging \(R-134a\)](#). [Refrigerant Recovery and Recharging \(R-1234yf\)](#).

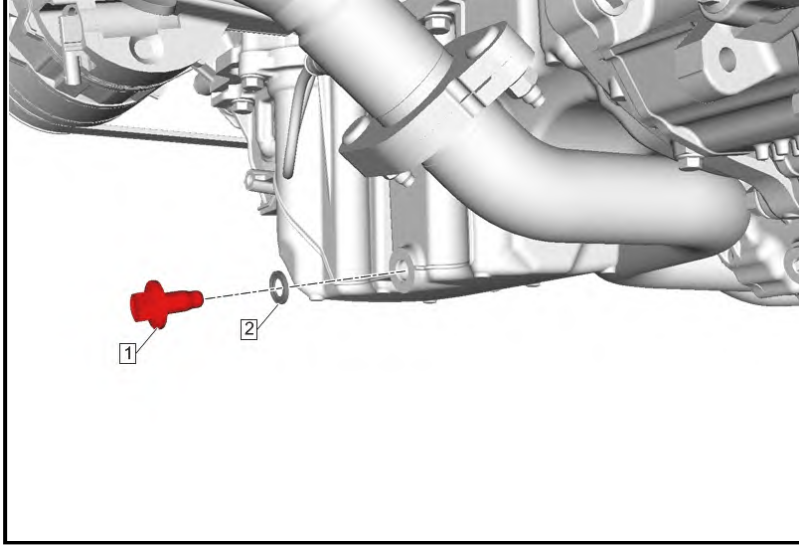
ENGINE OIL AND OIL FILTER REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)
2. Place a drain pan under the vehicle.

3.





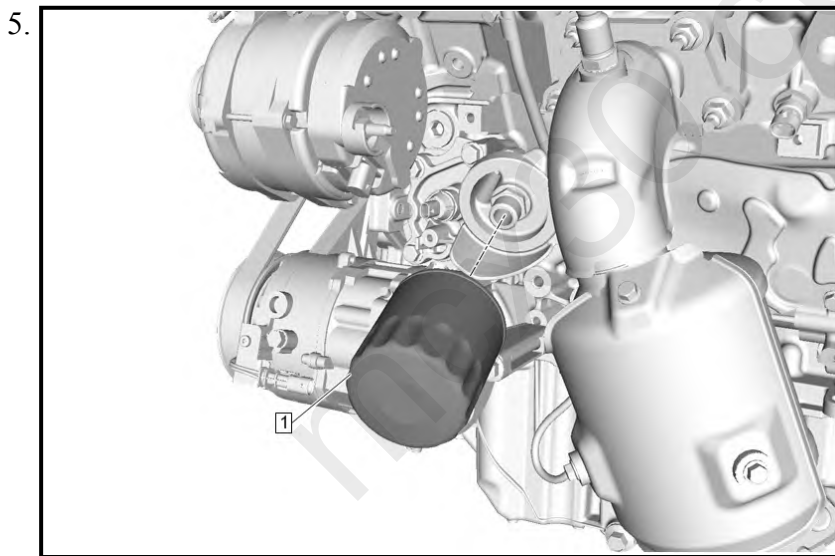
NOTE: Allow the oil to drain completely.

Remove the oil pan drain plug (1) and seal (2).

CAUTION: Refer to [Component Fastener Tightening Caution](#) .

NOTE: Clean and inspect the oil pan drain plug (1) and seal (2) and replace if damaged.

4. Install the oil pan drain plug (1) and seal (2), and tighten to 25 N.m (18 lb ft)



WARNING: [Hot Exhaust System Warning](#)

NOTE: Allow the oil to drain completely.

Oil Filter (1) - Remove and DISCARD

Installation Procedure

1. Lubricate the NEW oil filter gasket with clean engine oil.
2. Install a NEW oil filter and tighten 3/4 to 1 full turn after the gasket makes contact with the sealing surface on the filter mounting flange.
3. Lower the vehicle.
4. Fill the engine oil to the proper level with NEW engine oil. [Approximate Fluid Capacities](#) , and [Adhesives, Fluids, Lubricants, and Sealers](#)
5. Start the engine and inspect for leaks.
6. Reset the service interval indicator. [GM Oil Life System Resetting.\(Without Scan Tool\)](#). [GM Oil Life System Resetting.\(With Scan Tool\)](#).

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