

2021 ENGINE PERFORMANCE

Engine Controls And Fuel - 3.6L (LGZ) - Repair Instructions - Canyon, Colorado

REPAIR INSTRUCTIONS

CRANKSHAFT POSITION VARIATION LEARN

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

The crankshaft position sensor variation or reluctor ring learn is used to calculate reference period errors caused by slight tolerance variations in the crankshaft and the crankshaft position sensor. The calculated error allows the ECM to accurately compensate for reference period variations. This enhances the ability of the ECM to detect misfire events over a wider range of engine speed and load. The compensation values are stored in ECM memory after a learn procedure has been performed.

When to Perform the Procedure

NOTE: Failure to perform this procedure may result in poor system performance, DTCs being set, or customer dissatisfaction.

Perform this procedure when the following component has been serviced:

- B26 Crankshaft Position Sensor
- Any repair which disturbs the alignment between the components: B26 Crankshaft Position Sensor & Crankshaft
- Crankshaft
- Crankshaft Balancer
- Engine Assembly

Conditions for Running the Procedure

- DTC P0117, P0118, P0335, P0336 = Not set
- ECT = Greater than 60B°C (140B°F)
- Ignition Voltage = Greater than 11 V

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition - On / Vehicle - In Service Mode
2. Verify there are no other DTCs set, except for DTC P0300-P0308, P0315.

- If any other DTCs are set

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- Go to next step: If no other DTCs are set

3. Select: Module Diagnostics
4. Select: Body Control Module
5. Select: Configuration/Reset Functions
6. Select: Brake Pedal Position Sensor Learn
7. Follow the instructions on the scan tool.

Verify the scan tool parameter: Brake Pedal Position Sensor Learn = Yes

- **If not the specified state**

Repeat step 6

- **Go to next step: If the specified state**

8. Select: Module Diagnostics
9. Select: Engine Control Module
10. Select: Configuration/Reset Functions
11. Select: Learn Functions
12. Select: Crankshaft Position Variation Learn
13. Follow the instructions on the scan tool.

Verify the scan tool procedure was successful.

- **If the procedure was not successful and first time here**

1. Ignition/Vehicle - Off
2. Verify the following conditions do not exist:
 - B26 Crankshaft Position Sensor & Reluctor Ring - Foreign material passing between the components/Incorrect air gap
 - Battery Voltage - Low
 - Crankshaft Bearing - Worn
 - Crankshaft - Excessive runout/Visible Damage
 - Reluctor Ring - Misaligned/Visible Damage
 - Signal circuit @ B26 Crankshaft Position Sensor - Electromagnetic Interference
 - If a condition exists - Repair or replace as necessary
 - If no condition exists - Repeat step 8

- **If the procedure was not successful and performed 4 times or less**

Repeat step 12

- **If the procedure was not successful and performed 5 times**

Replace the component: K20 Engine Control Module

- **Go to next step: If the procedure was successful**

14. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming, and setup refer to [Control Module References](#)

FUEL COMPOSITION RESET

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

This procedure resets the control module learned values of the component/system: Fuel Alcohol Content

When to Perform the Procedure

NOTE: Failure to perform this procedure may result in poor system performance, DTCs being set, or customer dissatisfaction.

Perform this procedure when the following component has been serviced: Fuel - Replaced

Conditions for Running the Procedure

Ignition = On

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition - On / Vehicle - In Service Mode
2. Select: Module Diagnostics
3. Select: Engine Control Module
4. Select: Configuration/Reset Functions
5. Select: Reset Functions
6. Select: Fuel Composition Reset
7. Follow the instructions on the scan tool. - The procedure will complete within 10 s
8. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

FUEL PUMP TRIM RESET

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

This procedure resets the control module learned values of the component/system: Fuel Alcohol Content

When to Perform the Procedure

NOTE: Failure to perform this procedure may result in poor system performance, DTCs being set, or customer dissatisfaction.

Perform this procedure when the following component has been serviced: Fuel - Replaced

Conditions for Running the Procedure

Ignition = On

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition - On / Vehicle - In Service Mode
2. Select: Module Diagnostics
3. Select: Engine Control Module
4. Select: Configuration/Reset Functions
5. Select: Reset Functions
6. Select: Fuel Composition Reset
7. Follow the instructions on the scan tool. - The procedure will complete within 10 s
8. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

HO2S HEATER RESISTANCE LEARNED VALUES RESET

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

This procedure resets the control module learned values of the component/system: B52 Heated Oxygen Sensor - Resistance

When to Perform the Procedure

NOTE:

- This procedure is only required when the component is replaced for a mechanical issue with no DTC set.
- Failure to perform this procedure may result in poor system performance, DTCs being set, or customer dissatisfaction.

Perform this procedure when the following component has been serviced: B52 Heated Oxygen Sensor - Replaced

Conditions for Running the Procedure

Ignition Switch = Run/Crank

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition - On / Vehicle - In Service Mode
2. Select: Module Diagnostics
3. Select: Engine Control Module
4. Select: Configuration/Reset Functions
5. Select: Reset Functions
6. Select: HO2S Heater Resistance Learned Values Reset

NOTE: The scan tool does not display the learn/reset status.

7. Follow the instructions on the scan tool. - The procedure will complete within 10 s
8. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

THROTTLE BODY IDLE AIR FLOW COMPENSATION RESET

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)

Description

For an overview of the component/system, refer to [Throttle Actuator Control \(TAC\) System Description](#)

This procedure triggers the control module to learn the values of the component: Q38 Throttle Body - Airflow Adaptive Values

When to Perform the Procedure

NOTE: Failure to perform this procedure may result in poor system performance, DTCs being set, or customer dissatisfaction.

Perform this procedure when the following component has been serviced: Q38 Throttle Body - Cleaned/Replaced

Conditions for Running the Procedure

- DTC P0068, P0101, P0102, P010B, P0103, P010C, P010D, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0122, P0123, P0128, P0171, P0172, P0174, P0175, P0201 - P0208, P0220, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P0300 - P0308, P0351 - P0358, P0496, P0601, P0604, P0606, P060D, P0641, P0651, P0697, P06A3, P06D2, P1248, P1249, P124A, P124B, P1516, P16A0 - P16A2, P2101, P2119, P2120, P2122, P2123, P2125, P2127, P2128, P2135, P2138, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P216B, P216C, P216E, P216F, P217B, P217C, P217E, P217F, P2176, P2300, P2301, P2303, P2304, P2306, P2307, P2309, P2310, P2312, P2313, P2315, P2316, P2318, P2319, P2321, P2322 = Not set
- Ignition = On
- Vehicle Speed Sensor = 0 km/h (0 MPH)

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition - On / Vehicle - In Service Mode
2. Select: Module Diagnostics
3. Select: Engine Control Module
4. Select: Configuration/Reset Functions
5. Select: Learn Functions or Reset Functions
6. Select: Idle Learn or Throttle Body Idle Air Flow Compensation
7. Follow the instructions on the scan tool.
8. Verify the scan tool parameter: Throttle Body Idle Air Flow Compensation = 0%
 - **If greater than 0**

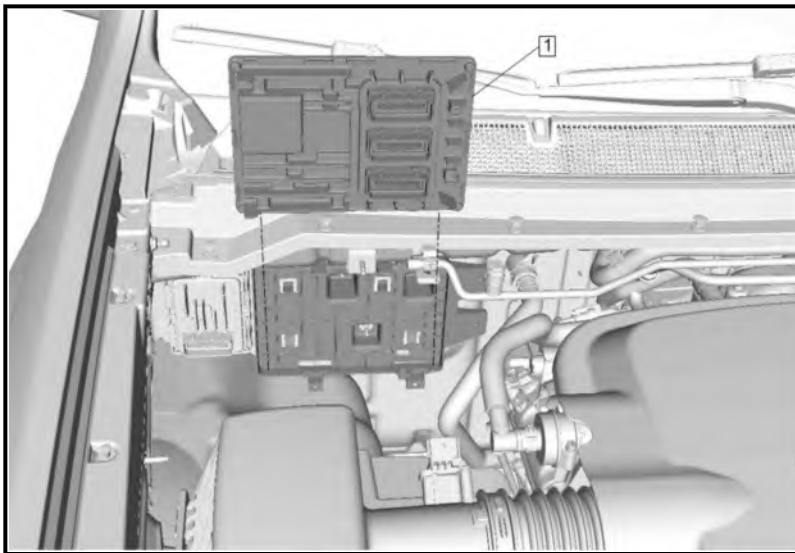
Repeat step 1
 - **Go to next step: If 0**
9. Engine - Idling - At normal operating temperature
10. Verify the scan tool parameter: Engine Speed = -100 to +200 RPM of the Desired Idle Speed
 - **{Test failed 1 time(s)} If not in the specified range**
 1. Engine idling. - For greater than 3 min
 2. Ignition/Vehicle - Off - For greater than 1 min
 3. Engine idling. - For greater than 3 min
 4. Repeat step 9
 - **{Test failed 2 time(s)} If not in the specified range**
 1. Perform the following action: Road test the vehicle.
 2. Vehicle Speed - Greater than 70 km/h (44 MPH)
 3. Decelerate - For 2 s
 4. Repeat step 10.2 - 3 times
 5. Engine idling. - For greater than 3 min
 6. Repeat step 9
 - **{Test failed 3 time(s)} If not in the specified range**

Refer to [Diagnostic System Check - Vehicle](#)
 - **Go to next step: If in the specified range**
11. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

ENGINE CONTROL MODULE REPLACEMENT



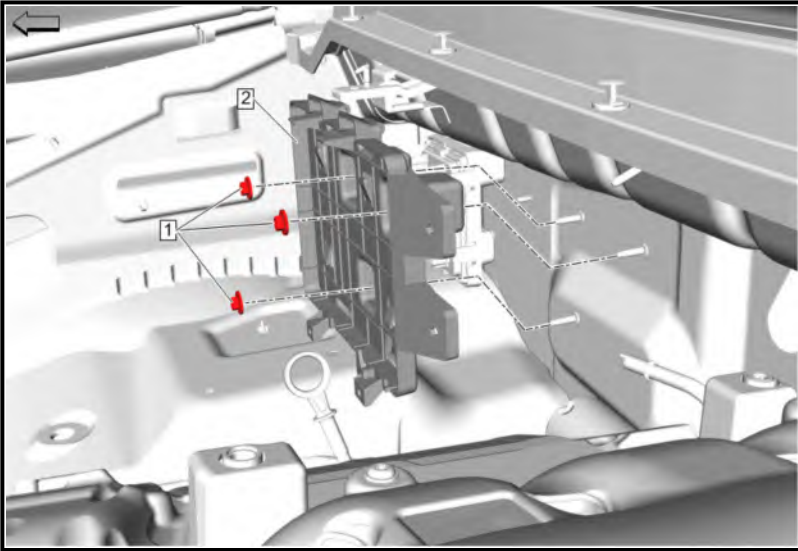
NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Disconnect the negative battery cable. Battery Negative Cable Disconnection and Connection 2. Air Cleaner Outlet Duct Replacement	
1	Engine Control Module WARNING: Refer to Safety Glasses Warning . CAUTION: Always turn the ignition off when installing or removing the ECM connectors in order to prevent damage to the components. CAUTION: • Turn the ignition OFF when installing or removing the control module connectors and disconnecting or reconnecting

Callout	Component Name
	the power to the control module (battery cable, powertrain control module (PCM)/engine control module (ECM)/transaxle control module (TCM) pigtail, control module fuse, jumper cables, etc.) in order to prevent internal control module damage. • Control module damage may result when the metal case contacts battery voltage. DO NOT contact the control module metal case with battery voltage when servicing a control module, using battery booster cables, or when charging the vehicle battery. • In order to prevent any possible electrostatic discharge damage to the control module, do not touch the connector pins or the soldered components on the circuit board. • Remove any debris from around the control module connector surfaces before servicing the

Callout	Component Name
	control module. Inspect the control module connector gaskets when diagnosing or replacing the control module. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the control module. • The replacement control module must be programmed. Procedure 1. Disconnect the electrical connectors from the engine control module. Located in the engine compartment, to the right of the engine, under the coolant reservoir. 2. Use a suitable tool to pry back the locking tabs and remove the engine control module from the bracket. 3. If replacing the engine control module, it is necessary to reprogram the replacement module. Control Module References NOTE: Before removing the engine control module (ECM), record the oil life percentage remaining. Use the scan tool to reset the Engine Oil Life remaining back to the original percentage recorded.

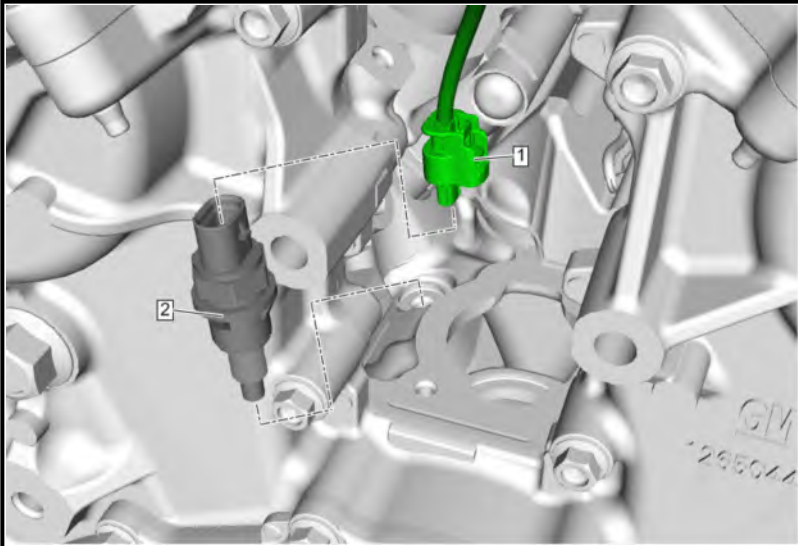
ENGINE CONTROL MODULE BRACKET REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Engine Control Module Replacement</u>	
1	Engine Control Module Bracket Nut [3x] CAUTION: Refer to <u>Fastener</u> <u>Caution</u> . Tighten 9 N.m (80 lb in)
2	Engine Control Module Bracket Procedure Remove the wiring harness from the engine control module bracket.

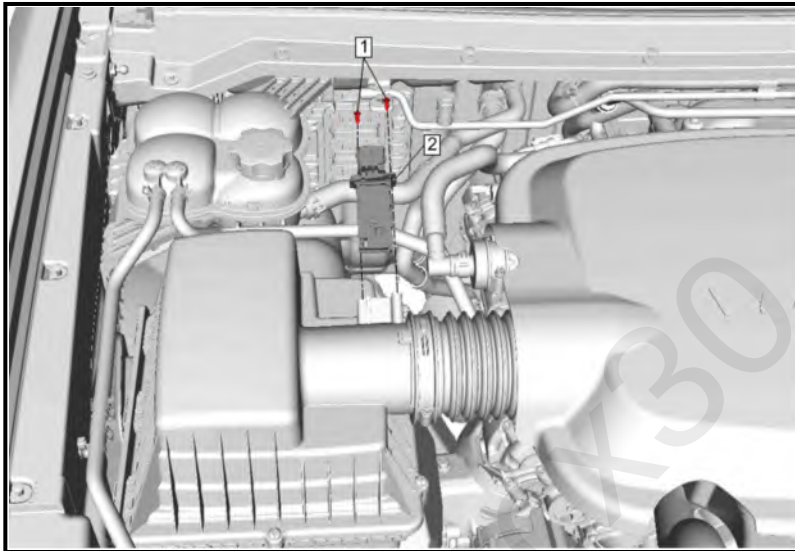
ENGINE COOLANT TEMPERATURE SENSOR REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Engine Coolant Thermostat Housing Replacement (LGZ)</u>	
1	Electrical Connector
2	Engine Coolant Temperature Sensor CAUTION: Refer to <u>Component</u> <u>Fastener</u> <u>Tightening</u> <u>Caution</u> . Tighten 9 N.m (80 lb in)

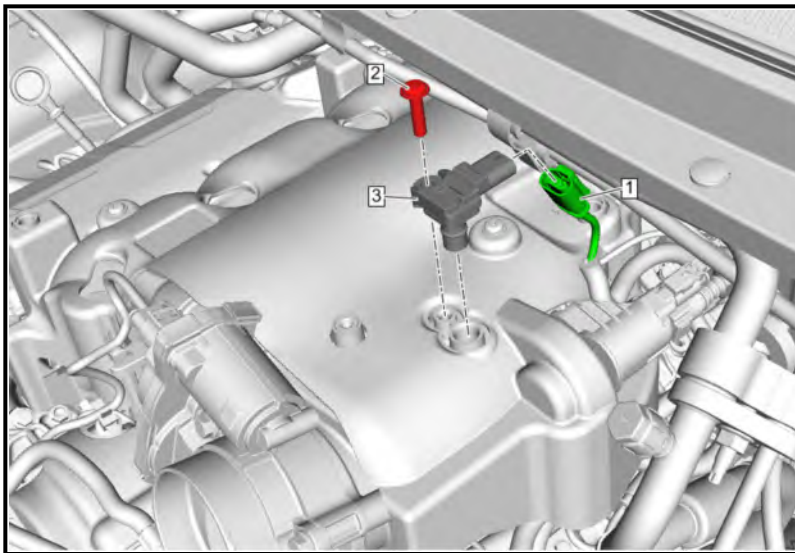
MASS AIRFLOW SENSOR WITH INTAKE AIR TEMPERATURE SENSOR REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
1	Mass Airflow Sensor Bolt [2x] CAUTION: Refer to <u>Fastener</u> <u>Caution</u> . Tighten 1.5 N.m (13 lb in)
2	Mass Airflow Sensor Procedure Disconnect the electrical connector.

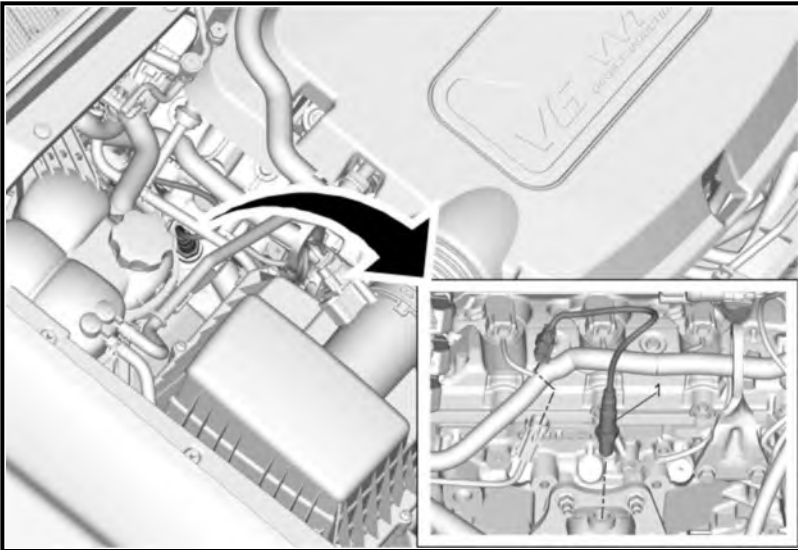
MANIFOLD ABSOLUTE PRESSURE SENSOR REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Air Cleaner Outlet Duct Replacement</u>	
1	Electrical Connector
2	Manifold Absolute Pressure Sensor Fastener CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 4 N.m (35 lb in)
3	Manifold Absolute Pressure Sensor NOTE: Always install the seal supplied with the manifold absolute pressure sensor.

HEATED OXYGEN SENSOR REPLACEMENT - BANK 1 SENSOR 1



NOTE: Callouts in the following chart represent components shown in graphic above.

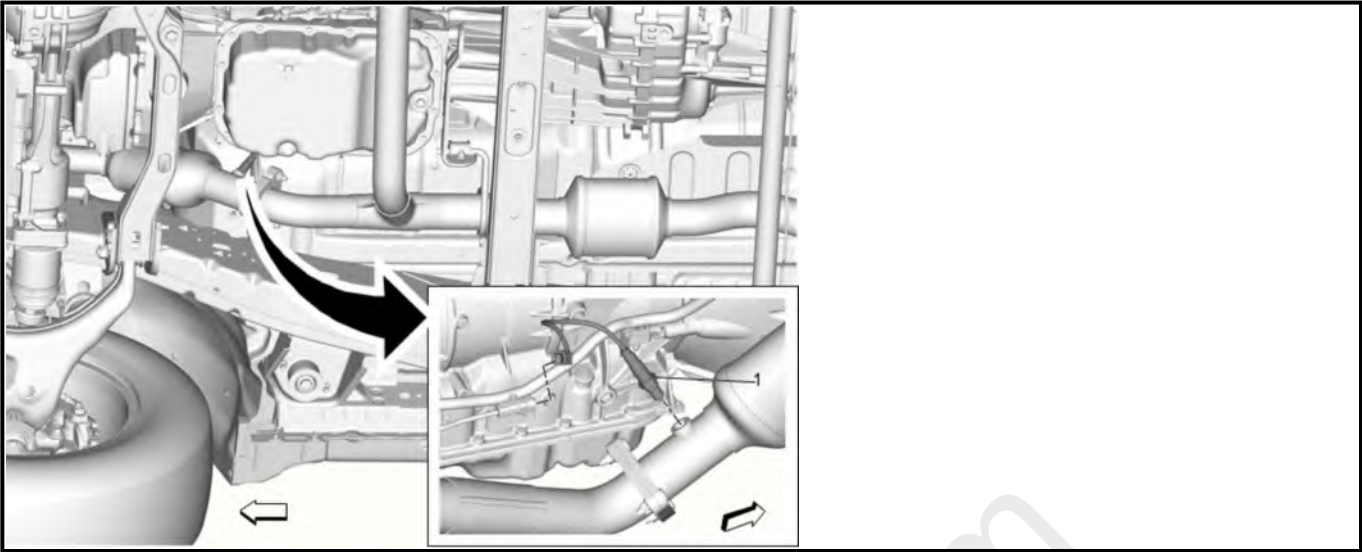
Callout	Component Name
1	Heated Oxygen Sensor WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury. CAUTION: Refer to Component Fastener Tightening Caution . CAUTION:

Callout	Component Name
	Refer to Heated Oxygen and Oxygen Sensor Caution . CAUTION: Refer to Heated Oxygen Sensor Resistance Learn Reset Caution . CAUTION: The use of excessive force may damage the threads in the exhaust manifold/pipe. Procedure 1. Disconnect the electrical connector. 2. If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to

Callout	Component Name
	remove when the engine temperature is less than 48B°C (120B°F). • A special anti-seize compound is used on the heated oxygen sensor threads. The compound consists of liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will have the compound already applied to the threads. IF a sensor is removed and is to be reinstalled, the threads MUST have an anti-seize compound applied before installation. <u>Adhesives,</u> <u>Fluids,</u> <u>Lubricants,</u> <u>and Sealers</u> Tighten 42 N.m (31 lb ft) Special Tools

Callout	Component Name
	J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools

HEATED OXYGEN SENSOR REPLACEMENT - BANK 1 SENSOR 2



NOTE: Callouts in the following chart represent components shown in graphic above.

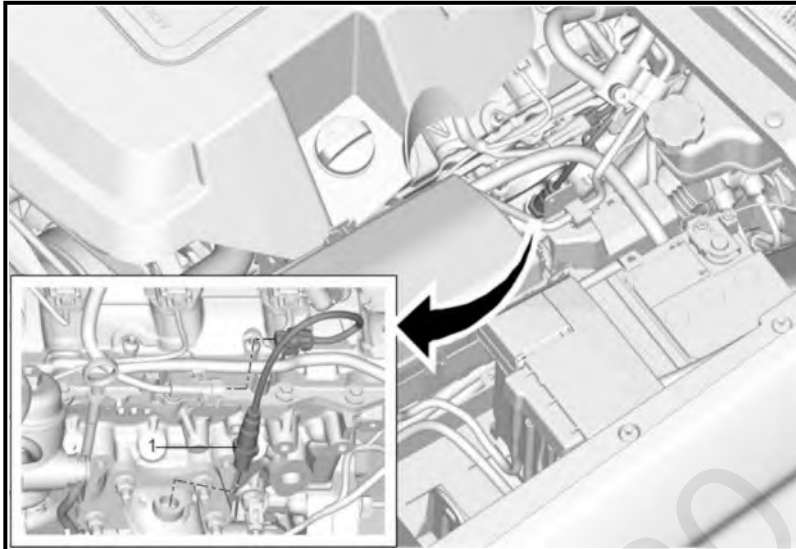
Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury. Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Heated Oxygen Sensor CAUTION:

Callout	Component Name
	Refer to Component Fastener Tightening Caution . CAUTION: Refer to Heated Oxygen and Oxygen Sensor Caution . CAUTION: Refer to Heated Oxygen Sensor Resistance Learn Reset Caution . CAUTION: The use of excessive force may damage the threads in the exhaust manifold/pipe. Procedure 1. Disconnect the electrical connector. 2. If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or

Callout	Component Name
	roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48B°C (120B°F). • A special anti-seize compound is used on the heated oxygen sensor threads. The compound consists of liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will have the compound already applied to the threads. IF a sensor is removed and is to be reinstalled, the threads MUST have an anti-seize compound applied before installation. <u>Adhesives,</u> <u>Fluids,</u>

Callout	Component Name
	<u>Lubricants, and Sealers</u> Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: <u>Special Tools</u>

HEATED OXYGEN SENSOR REPLACEMENT - BANK 2 SENSOR 1



NOTE: Callouts in the following chart represent components shown in graphic above.

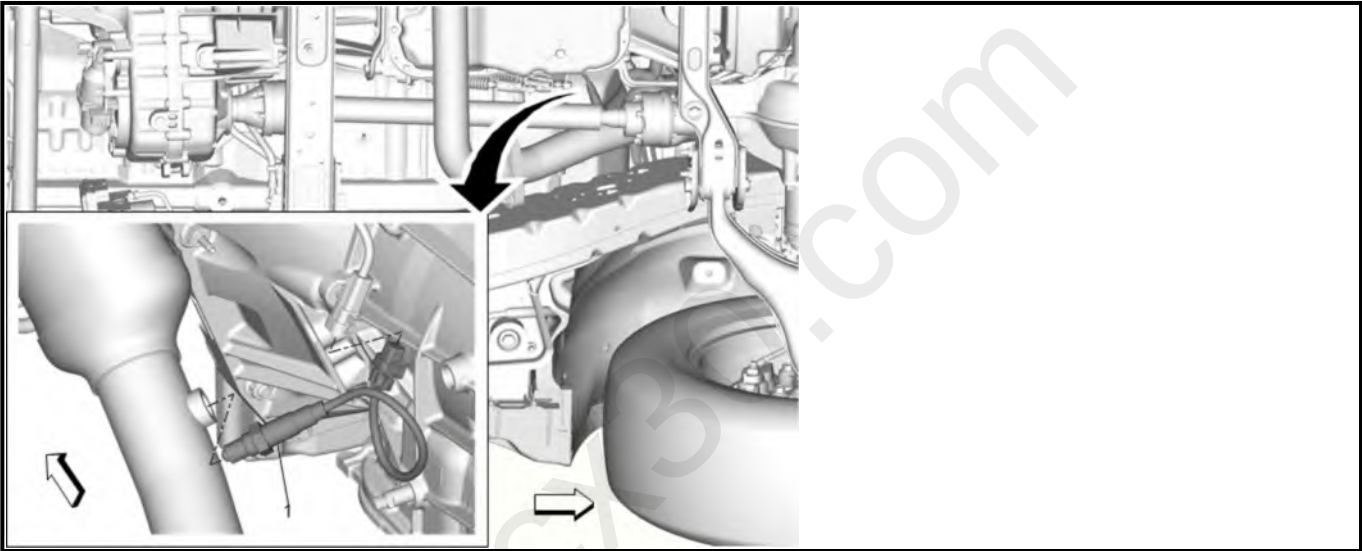
Callout	Component Name
1	Heated Oxygen Sensor WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective

Callout	Component Name
	gloves to avoid personal injury. CAUTION: Refer to Component Fastener Tightening Caution . CAUTION: Refer to Heated Oxygen and Oxygen Sensor Caution . CAUTION: Refer to Heated Oxygen Sensor Resistance Learn Reset Caution . CAUTION: The use of excessive force may damage the threads in the exhaust manifold/pipe. Procedure 1. Disconnect the electrical connector. 2. If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other

Callout	Component Name
	contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48B°C (120B°F). • A special anti-seize compound is used on the heated oxygen sensor threads. The compound consists of liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will have the compound already applied to the threads. IF a sensor is removed and is to be reinstalled, the threads MUST have an anti-seize compound

Callout	Component Name
	applied before installation. <u>Adhesives,</u> <u>Fluids,</u> <u>Lubricants,</u> <u>and Sealers</u> Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: <u>Special Tools</u>

HEATED OXYGEN SENSOR REPLACEMENT - BANK 2 SENSOR 2



NOTE: Callouts in the following chart represent components shown in graphic above.

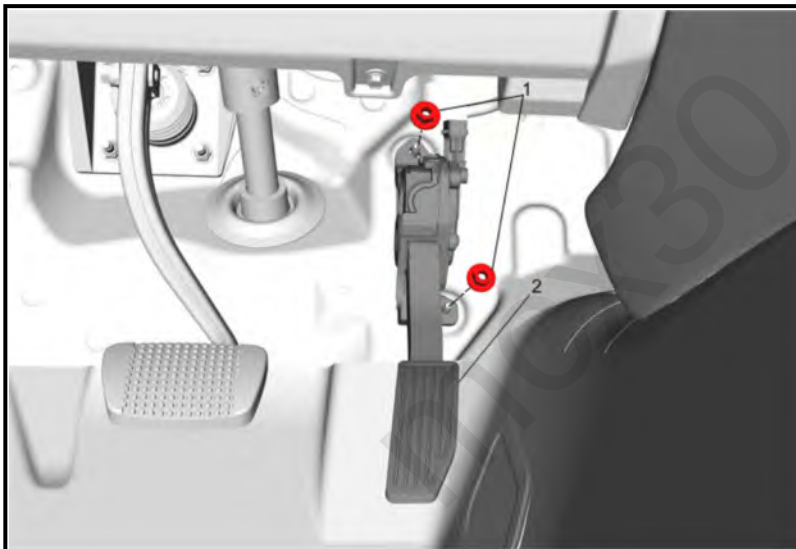
Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components.	

Callout	Component Name
Wear safety glasses and protective gloves to avoid personal injury.	
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Heated Oxygen Sensor CAUTION: Refer to Component Fastener Tightening Caution . CAUTION: Refer to Heated Oxygen and Oxygen Sensor Caution . CAUTION: Refer to Heated Oxygen Sensor Resistance Learn Reset Caution . CAUTION: The use of excessive force may damage the threads in the exhaust manifold/pipe. Procedure 1. Disconnect the electrical connector. 2. If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line

Callout	Component Name
	connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48B°C (120B°F). • A special anti-seize compound is used on the heated oxygen sensor threads. The compound consists of liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will have the compound already applied to the threads. IF a sensor is removed and

Callout	Component Name
	is to be reinstalled, the threads MUST have an anti-seize compound applied before installation. <u>Adhesives,</u> <u>Fluids,</u> <u>Lubricants,</u> <u>and Sealers</u> Tighten 42 N.m (31 lb ft) Special Tools EN-6179 Oxygen Sensor Wrench Equivalent regional tools: <u>Special Tools</u>

ACCELERATOR PEDAL POSITION SENSOR REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

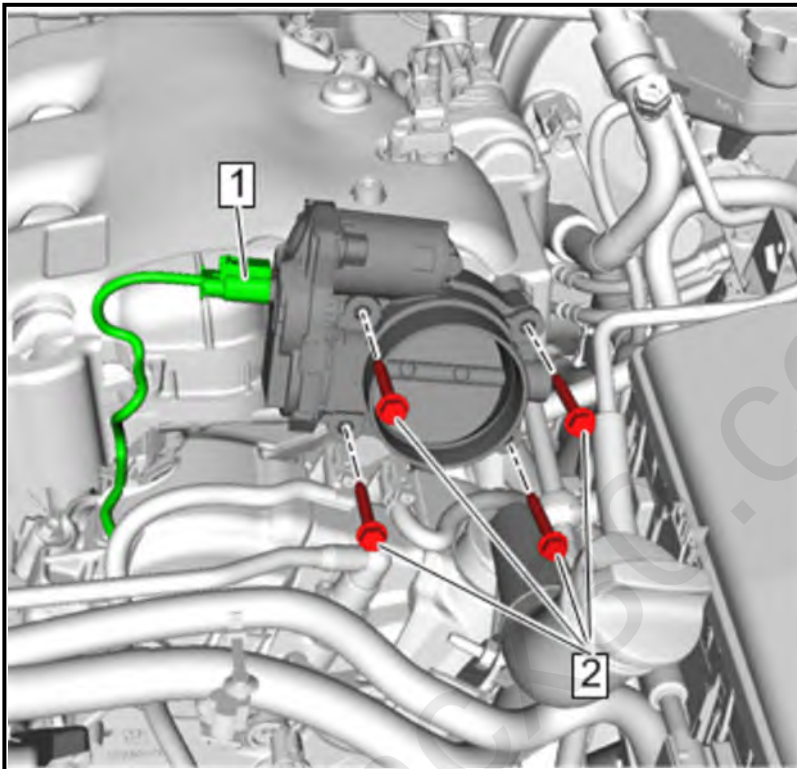
Callout	Component Name
Preliminary Procedure Disconnect the negative battery cable. Refer to <u>Battery Negative Cable Disconnection and Connection</u> .	
1	Accelerator Pedal Position Sensor Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten

Callout	Component Name
	9 N.m (80 lb in)
2	Accelerator Pedal Position Sensor Procedure Disconnect the electrical wiring harness connector from the accelerator pedal position sensor.

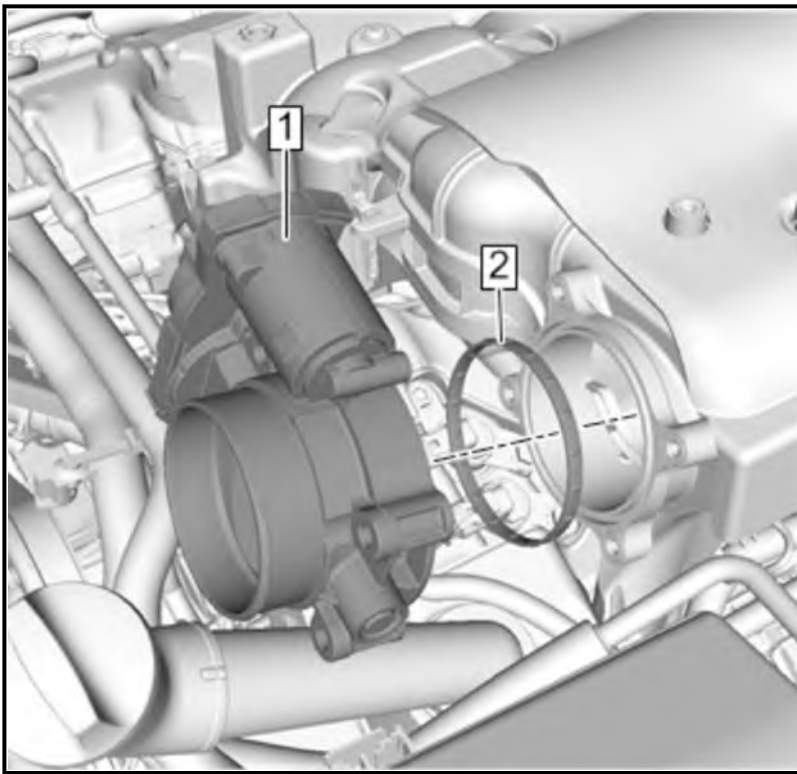
THROTTLE BODY ASSEMBLY REPLACEMENT

Removal Procedure

1. Air Cleaner Outlet Duct - Remove - [Air Cleaner Outlet Duct Replacement](#)
2. Electrical Connector (1) - Disconnect



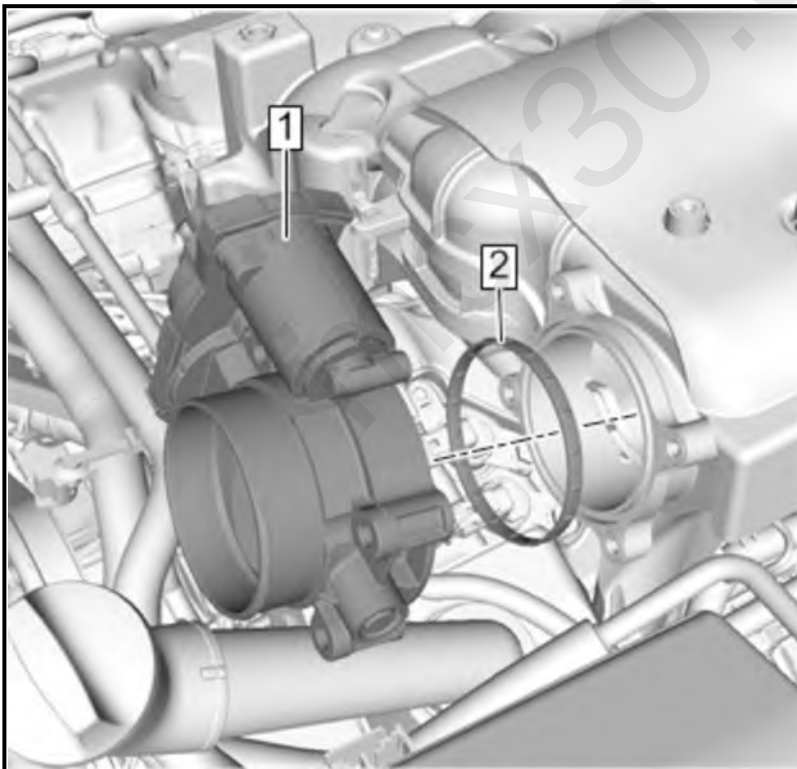
3. Throttle Body Bolt (2) - Remove [4x]
4. Throttle Body (1) - Remove



5. Throttle Body Gasket (2) - Remove and DISCARD

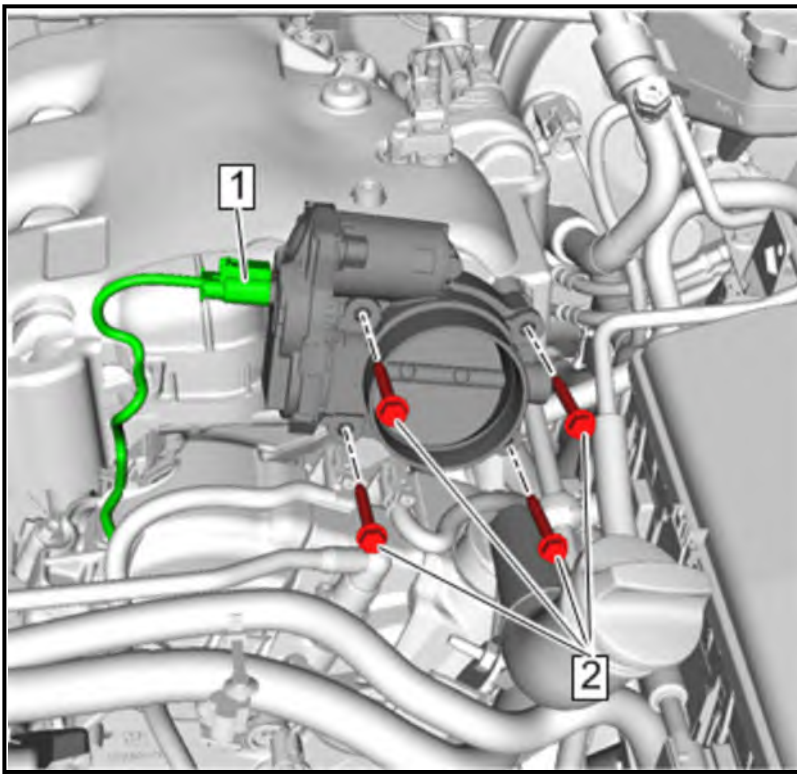
Installation Procedure

1. Throttle Body Gasket (2) - Install NEW



2. Throttle Body (1) - Install

3. Throttle Body Bolt (2) - Install and tighten [4x] 10 N.m (89 lb in)



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

4. Electrical Connector (1) - Connect
5. Air Cleaner Outlet Duct - Install - [Air Cleaner Outlet Duct Replacement](#)
6. Perform the throttle body idle air flow compensation reset. [Throttle Body Idle Air Flow Compensation Reset](#)

THROTTLE BODY INSPECTION AND CLEANING

1. Air Cleaner Outlet Duct - Remove - [Air Cleaner Outlet Duct Replacement](#)
2. Disconnect the electrical connector.
3. Fully open the throttle valve to inspect the throttle body bore and the throttle valve plate for any deposits.

CAUTION: Do not subject a throttle body assembly which contains the following components to an immersion cleaner or a strong solvent:

- Throttle position (TP) sensor
- Throttle actuator control components
- Sealed throttle shaft bearings

The cleaners will damage the electric components or sensors.

The cleaners will damage some of these components that contain seals or O-rings.

Solvents can wash away or break down the grease used on non-serviceable throttle shaft bearings.

Never use a wire brush or scraper to clean the throttle body. A wire brush or sharp tools may damage the throttle body components.

Do not use a cleaner that contains methyl ethyl ketone. This extremely strong solvent may damage components and is not necessary for this type of cleaning.

4. Use a clean shop towel and Top Engine Cleaner or equivalent product to clean the throttle body bore and the throttle valve plate. [Adhesives, Fluids, Lubricants, and Sealers](#)

If necessary, use a Non- Abrasive parts cleaning brush to remove heavy deposits.

5. Connect the electrical connector.
6. Air Cleaner Outlet Duct - Install - [Air Cleaner Outlet Duct Replacement](#)
7. Perform the diagnostic repair verification. [Diagnostic Repair Verification](#)
8. Perform the Throttle/Idle Learn procedure. [Throttle Body Idle Air Flow Compensation Reset](#)

FUEL PRESSURE RELIEF

WARNING: Fuel that flows out at high pressure can cause serious injury to the skin and eyes. ALWAYS depressurize the fuel system before removing components that are under high fuel pressure.

WARNING: Remove the fuel tank cap and relieve the fuel system pressure before servicing the fuel system in order to reduce the risk of personal injury. After you relieve the fuel system pressure, a small amount of fuel may be released when servicing the fuel lines, the fuel injection pump, or the connections. In order to reduce the risk of personal injury, cover the fuel system components with a shop towel before disconnection. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.

Scan Tool Method - Preferred

1. Install a scan tool and turn the ignition ON.
2. Using the scan tool, command the fuel pump OFF allowing the low pressure fuel pump to shut off.
3. Start the vehicle and allow the engine to idle until the engine stops. The engine will stop in approximately 5-20 seconds.
4. Repeat step 3. Using the scan tool, verify pressure has dropped to a minimal level.
5. Turn the ignition OFF.

Alternate Method - If a scan tool is not available

1. Disable the fuel pump by removing the B+ fuel pump control module fuse. Refer to [ELECTRICAL CENTER IDENTIFICATION VIEWS](#) .
2. Start the vehicle and allow the engine to idle until the engine stops. The engine will stop in approximately 5-20 seconds.
3. Attempt to restart the vehicle to ensure pressure has dropped to a minimal level.
4. Turn the ignition OFF.

FUEL PRESSURE GAUGE INSTALLATION AND REMOVAL

Special Tools

- CH-47831 Fuel Line Disconnect Tool
- CH-37287-1A Fuel Pressure Gauge Adapter 3/8"
- CH-42982 Fuel Pressure Gauge Adapter

Equivalent regional tools: [Special Tools \(Mechanical Tools\)](#)

Installation Procedure

WARNING:

Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

WARNING:

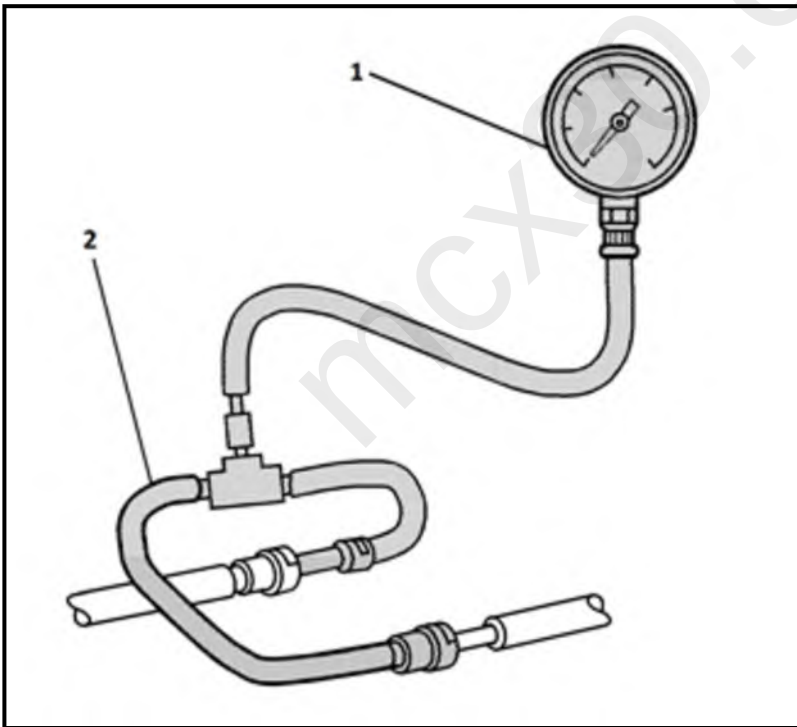
Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

CAUTION:

Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system:

- The fuel pipe connections
- The hose connections
- The areas surrounding the connections

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Disconnect the quick connect coupling of the fuel feed hose from the fuel feed pipe of the fuel rail. Use a shop towel in order to catch any remaining fuel that may leak.
3. Install the **CH-42982** adapter (2) between the fuel feed pipe of the fuel rail and of the fuel feed hose.
4. Install the **CH-37287-1A** gauge (1) to the **CH-42982** adapter (2), and tighten securely.

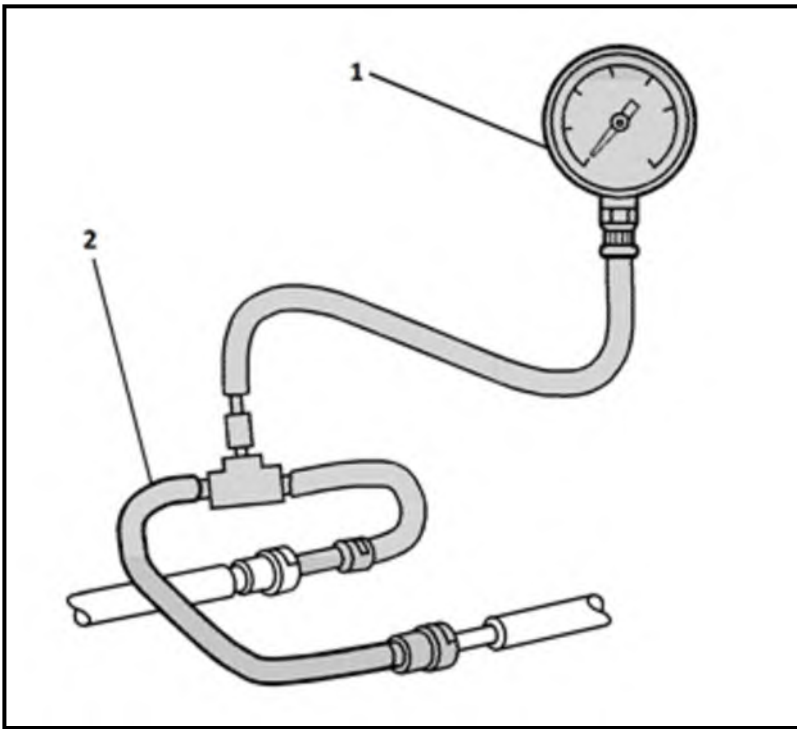
**CAUTION:**

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

5. Turn ON the ignition in order to pressurize the fuel system.
6. Turn OFF the ignition.
7. Check for any fuel leaks.

Removal Procedure

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)



2. Remove the **CH-37287-1A** gauge (1) from the **CH-42982** adapter (2).
3. Using the **CH-47831** tool, disconnect the quick connect coupling of the **CH-42982** adapter from the fuel feed pipe of the fuel rail. Use a shop towel in order to catch any remaining fuel that may leak.
4. Disconnect the quick connect coupling of the fuel feed hose from the **CH-42982** adapter (2), and remove the adapter. Use a shop towel in order to catch any remaining fuel that may leak.
5. Connect the quick-connect fitting of the fuel feed hose to the fuel feed pipe of the fuel rail.
6. Turn ON the ignition in order to pressurize the fuel system.
7. Turn OFF the ignition.
8. Check for any fuel leaks.

METAL COLLAR QUICK CONNECT FITTING SERVICE

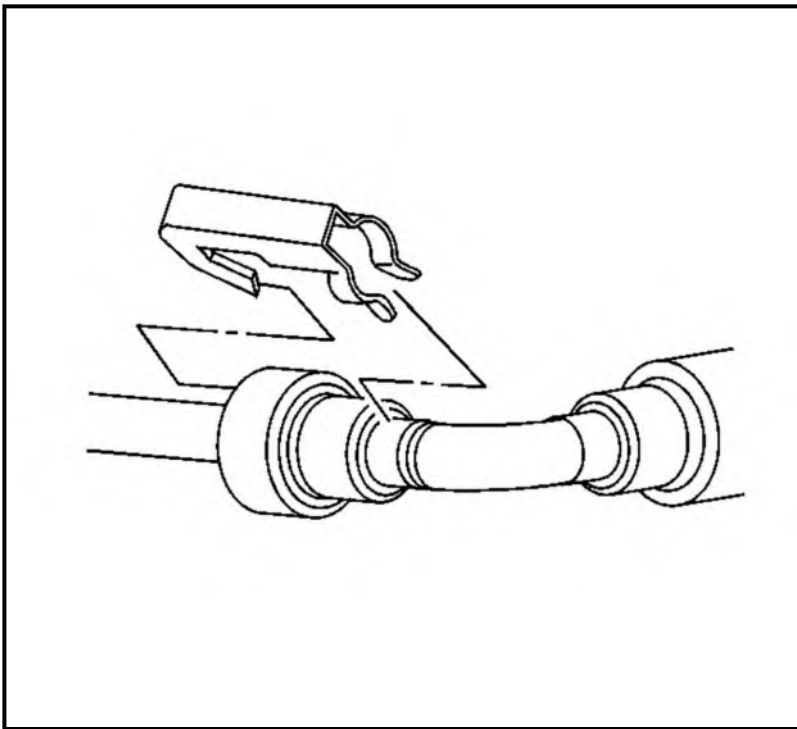
Special Tools

J-41769-1 Fuel Line Disconnect Tool Set

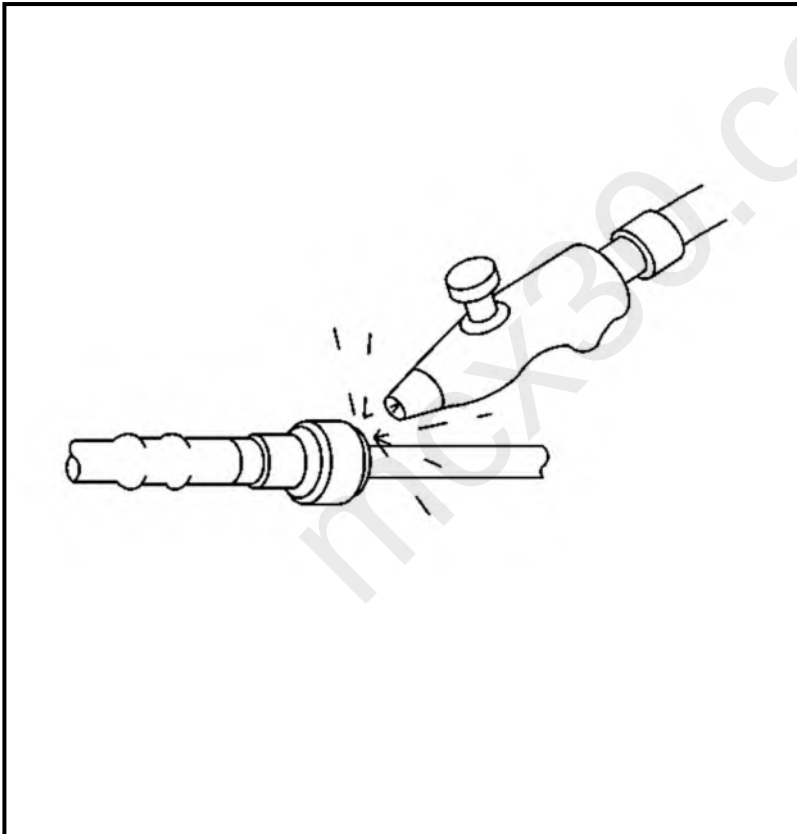
Removal Procedure

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

1. Relieve the fuel system pressure before servicing any fuel system connection.
2. Remove the retainer from the quick-connect fitting.

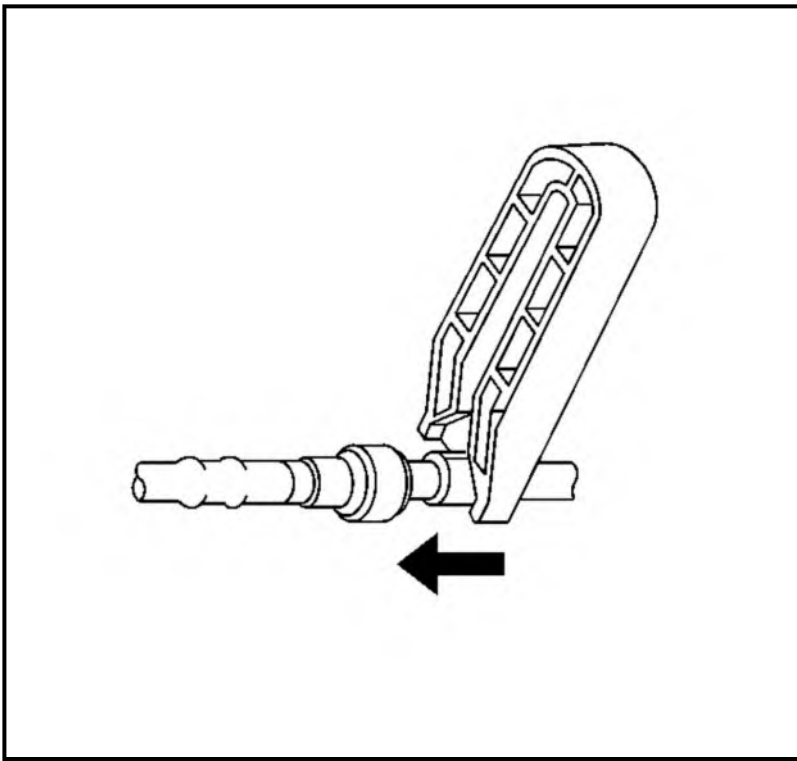


3. Blow dirt out of the fitting using compressed air.

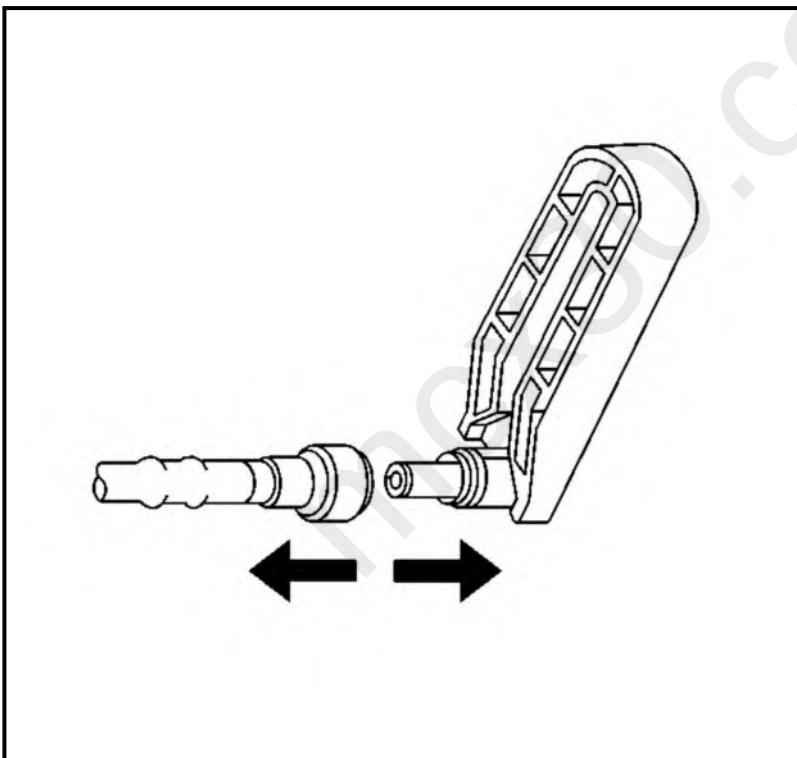


WARNING: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

4. Choose the correct **J-41769-1** fuel line disconnect tool set for the size of the fitting. Insert the **J-41769-1** fuel line disconnect tool set into the female connector, then push inward in order to release the locking tabs.



5. Pull the connection apart.



CAUTION: If necessary, remove rust or burrs from the fuel pipes with an emery cloth. Use a radial motion with the fuel pipe end in order to prevent damage to the O-ring sealing surface. Use a clean shop towel in order to wipe off the male tube ends. Inspect all the connections for dirt and burrs. Clean or replace the components and assemblies as required.

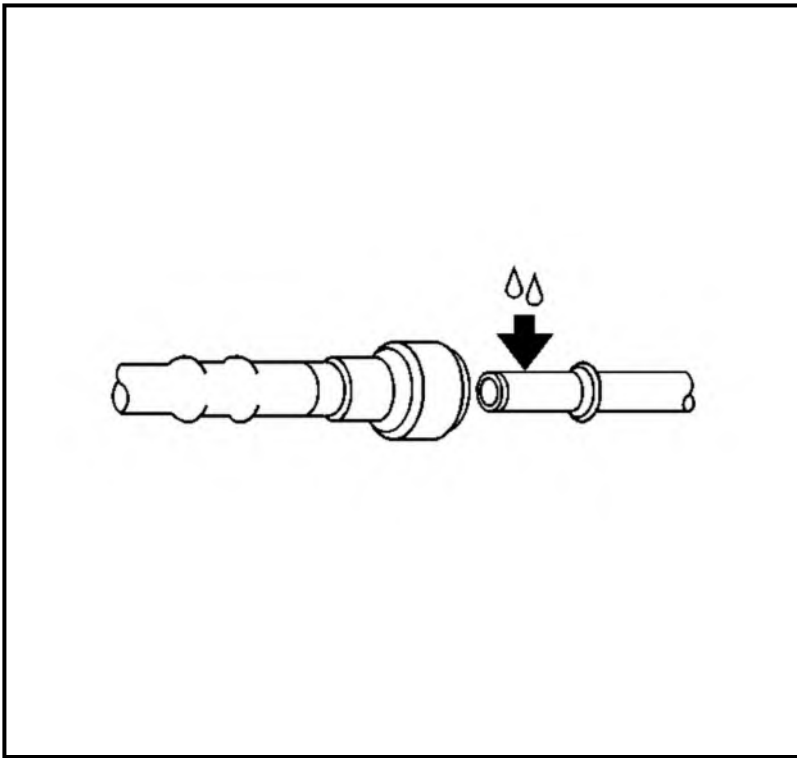
6. Using a clean shop towel, wipe off the male pipe end.

7. Inspect both ends of the fitting for dirt and burrs.

Clean or replace the components as required.

Installation Procedure

1. Apply a few drops of clean engine oil to the male pipe end.

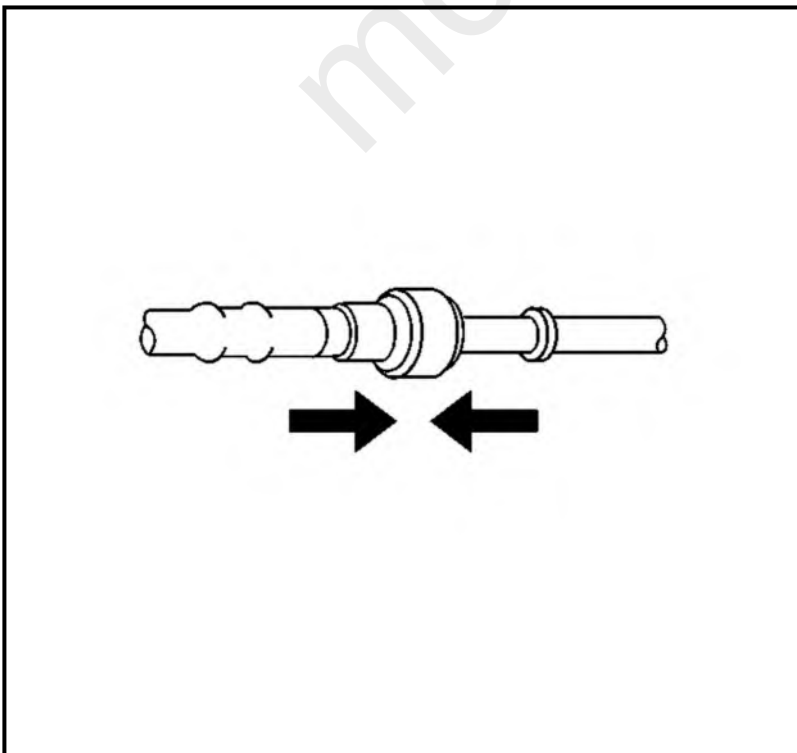


WARNING: In order to reduce the risk of fire and personal injury, before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends.

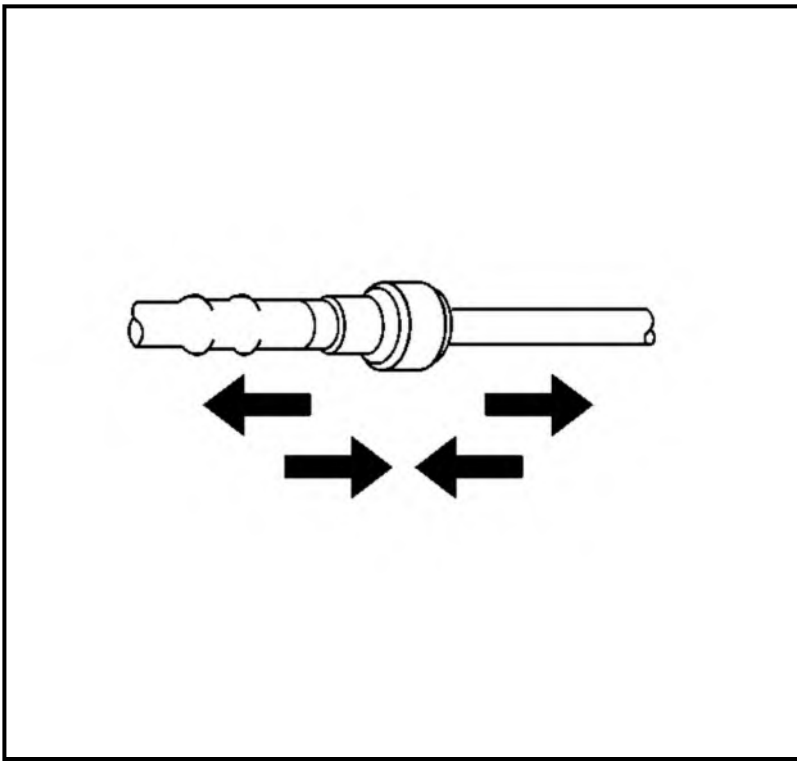
This will ensure proper reconnection and prevent a possible fuel leak.

During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

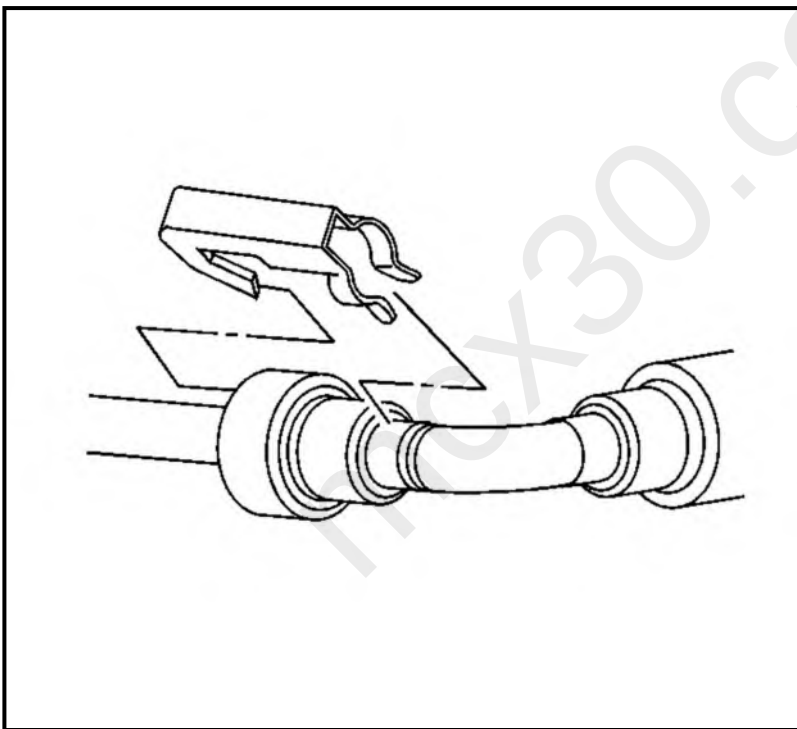
2. Push both sides of the quick-connect fitting together in order to snap the retaining tabs into place.



3. Pull on both sides of the quick-connect fitting to make sure the connection is secure.



4. Install the retainer to the quick-connect fitting.



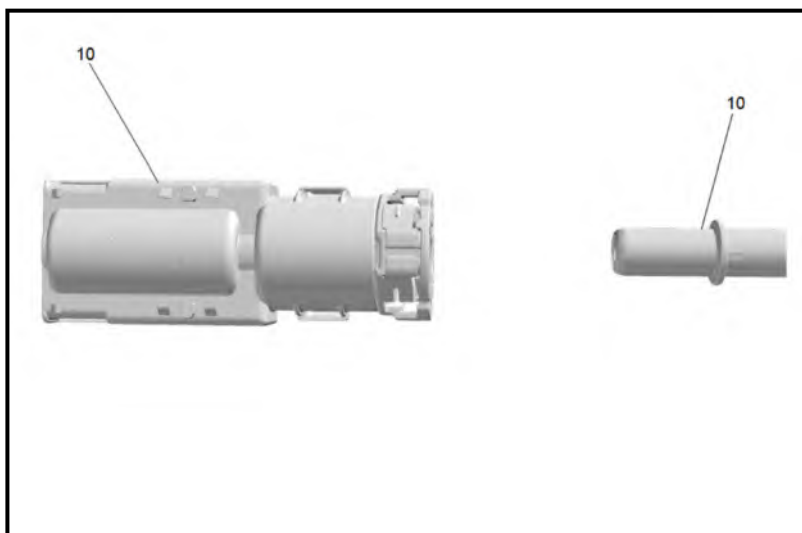
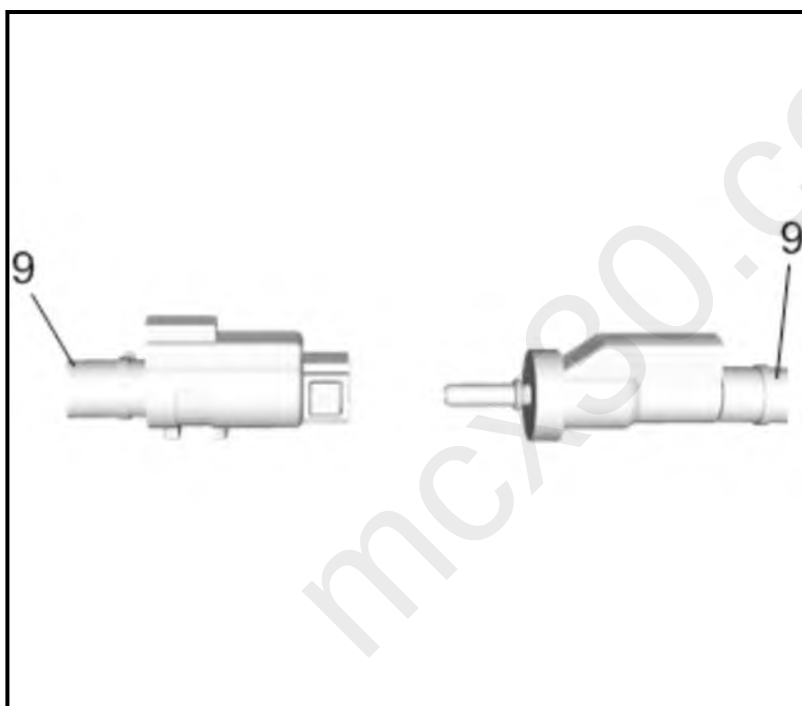
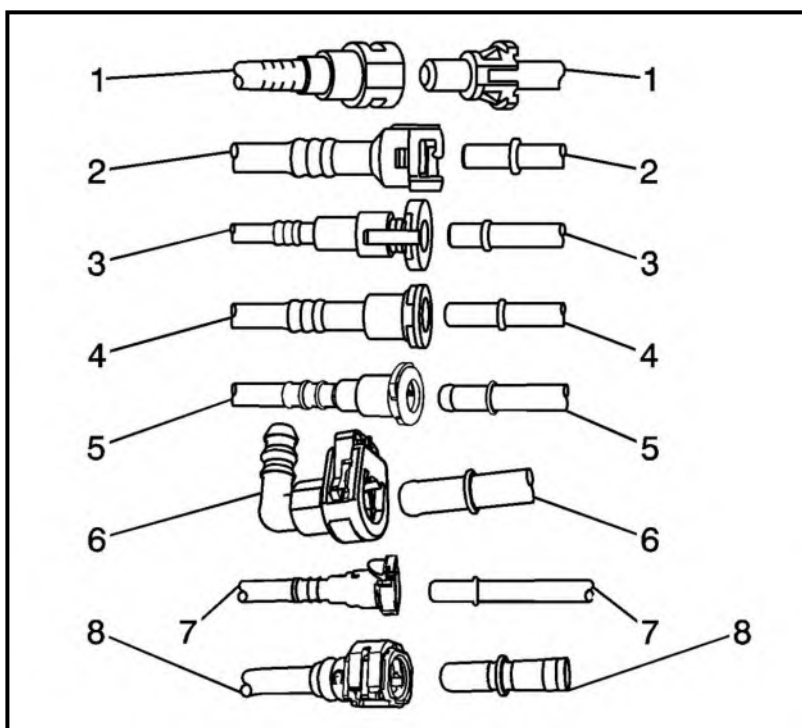
5. Inspect for leaks using the following procedure:

1. Turn the ignition ON, with the engine OFF for 2 seconds.
2. Turn the ignition OFF, for 10 seconds.
3. Turn the ignition ON, with the engine OFF for 2 seconds.
4. Turn the ignition OFF.
5. Inspect for leaks.

PLASTIC COLLAR QUICK CONNECT FITTING SERVICE

Removal Procedure

1. Relieve the fuel system pressure before servicing any fuel system connection.



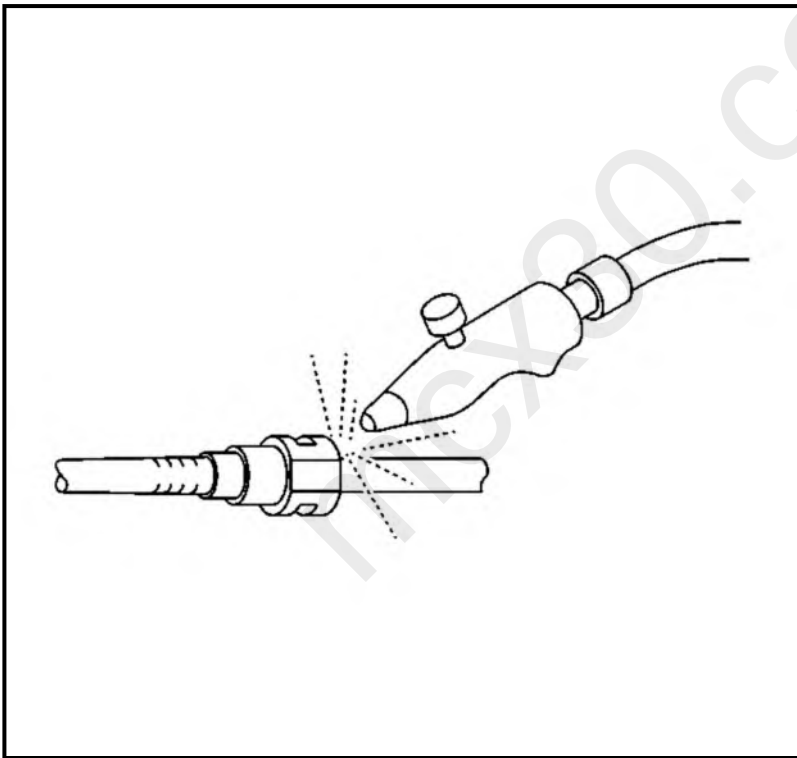
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

NOTE: There are several types of Plastic Collar Fuel and Evaporative Emission Quick Connect Fittings used on this vehicle.

- Bartholomew (1)
- Q Release (2)
- Squeeze to Release (3)
- Sliding Retainer (4)
- Global Connect (5)
- TI Loc (6)
- Safe Lock (7)
- Plastic Connector (8)
- DEF System Connector (9)
- DEF System Connector (10)

The following instructions apply to all of these types of Plastic Collar Quick Connect Fittings except where indicated.

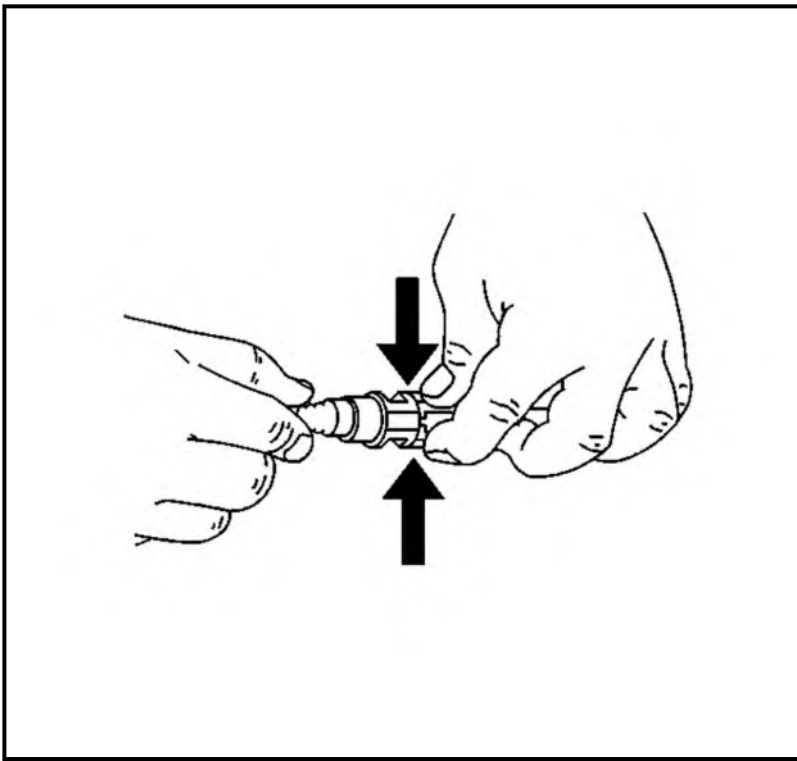
2. Using compressed air, blow any dirt out of the quick-connect fitting.



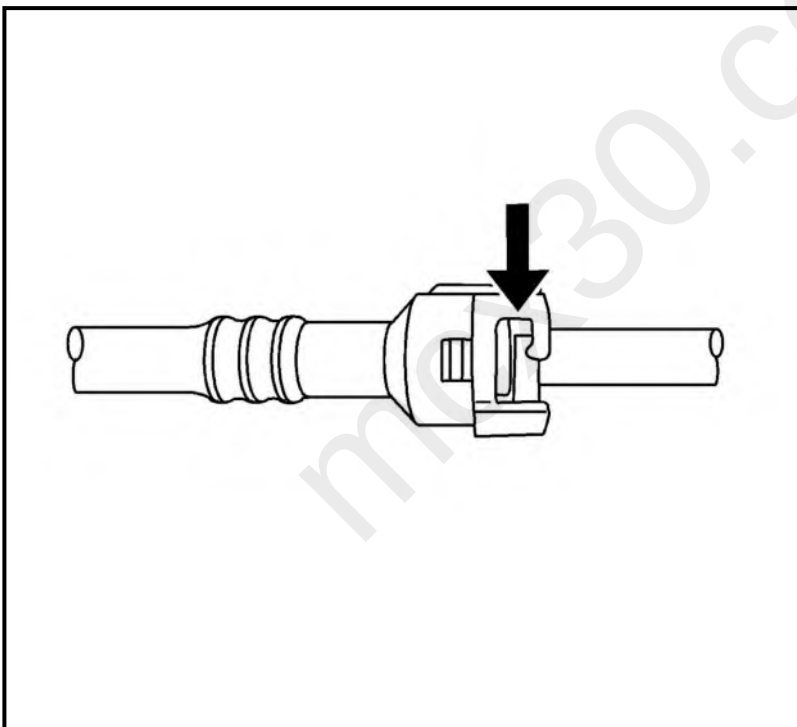
WARNING: Refer to [Safety Glasses and Compressed Air Warning](#) .

CAUTION: Refer to [Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Caution](#) .

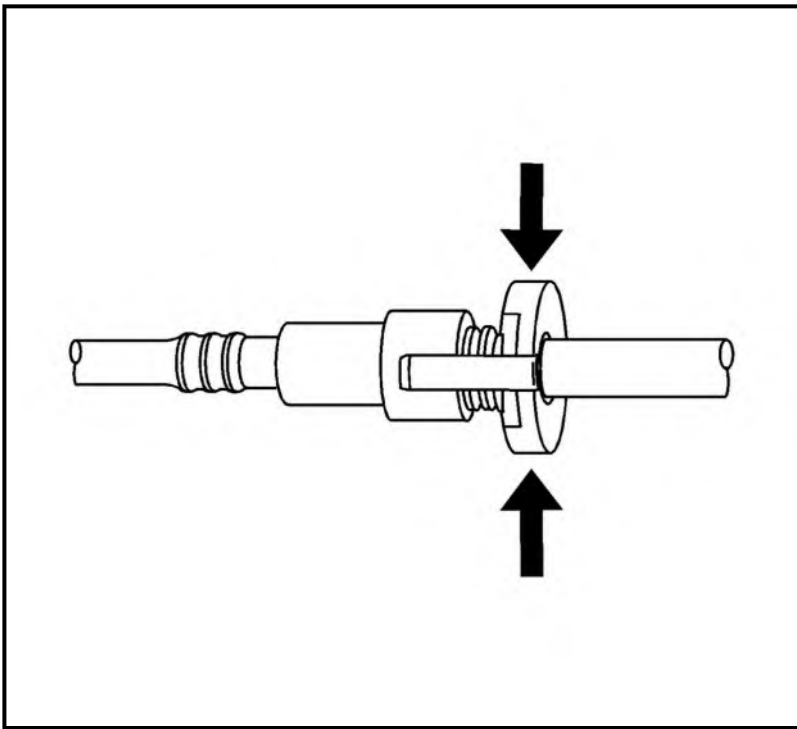
3. This step applies to Bartholomew style connectors ONLY. Squeeze the plastic quick-connect fitting release tabs.



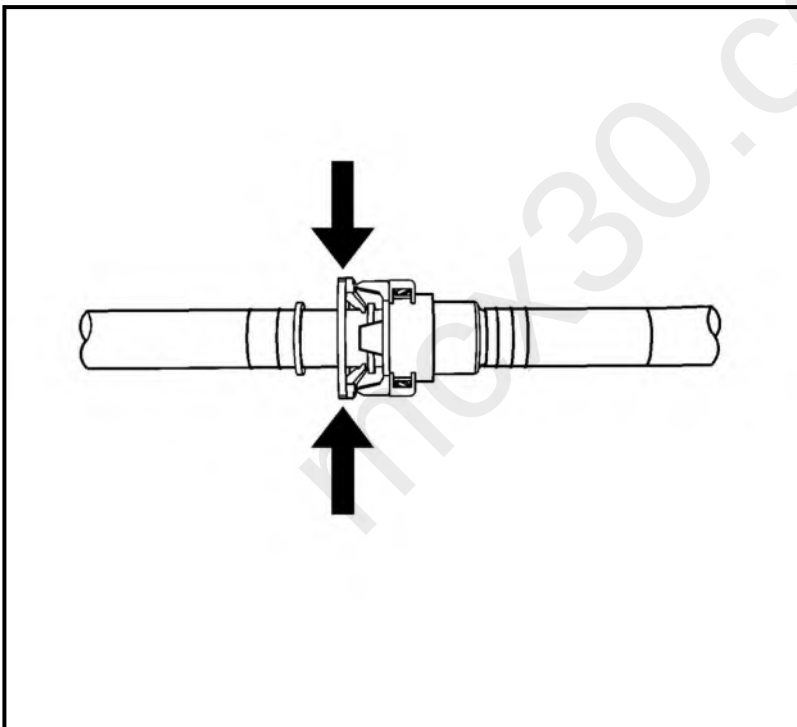
4. This step applies to Q Release style connectors ONLY. Release the fitting by Pushing the tab toward the other side of the slot in the fitting.



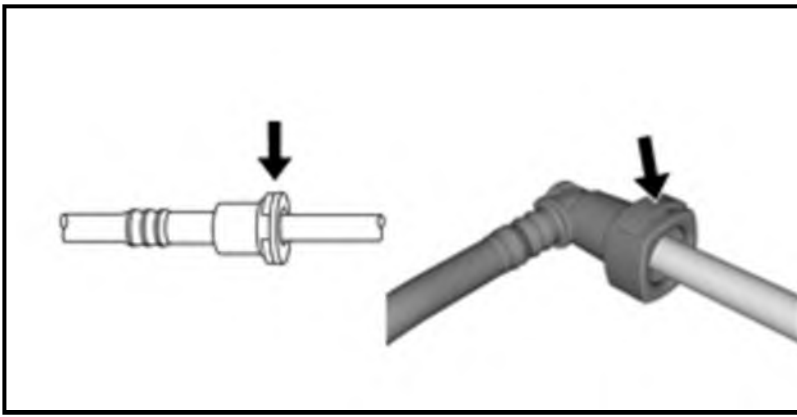
5. This step applies to Squeeze to Release style connectors ONLY. Squeeze where indicated by arrows on both sides of the plastic ring surrounding the quick-connect fitting.



6. This step applies to Squeeze to Release style connectors ONLY. Push in the male side slightly in order to slide the retainer away from the retainers, squeeze where indicated by arrows on both sides of the plastic ring surrounding the quick-connect fitting.

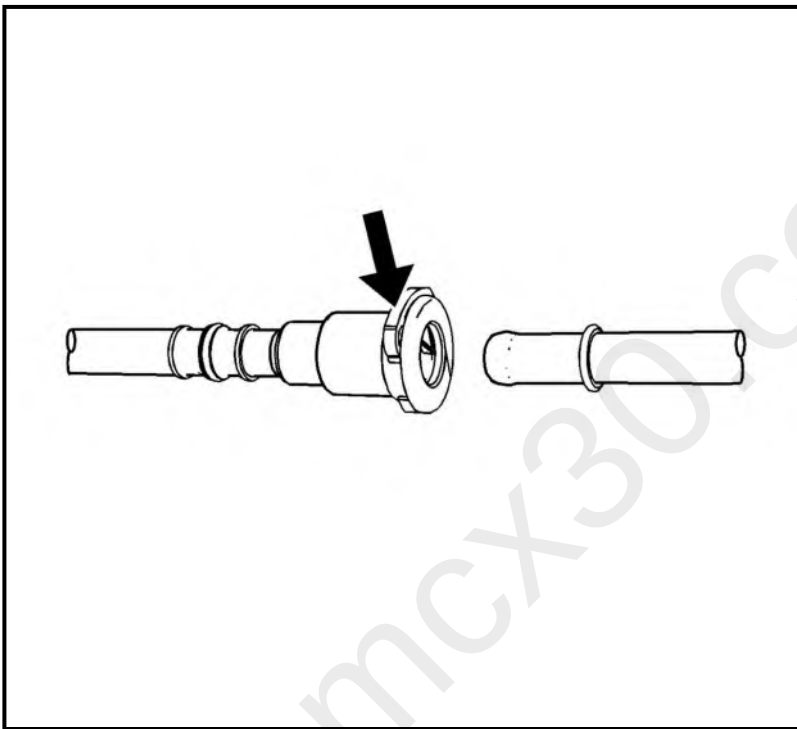


7. This step applies to Sliding Retainer style connectors ONLY. Release the fitting by pressing on one side of the release tab causing it to push in slightly. If the tab doesn't move try pressing the tab in from the opposite side. The tab will only move in one direction.

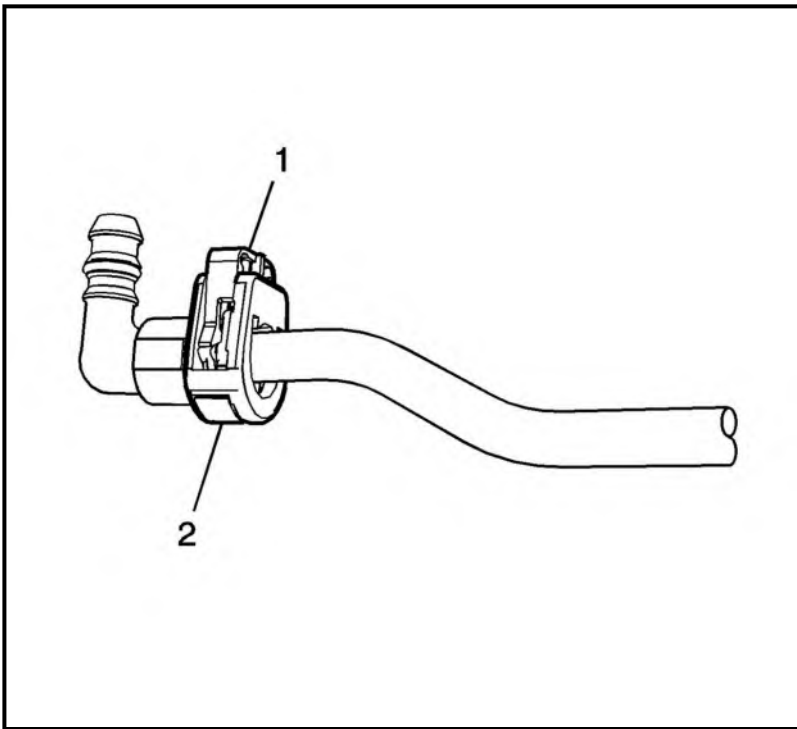


NOTE: There are two variants of sliding retainer style connectors shown above, both have the same release and installation procedure.

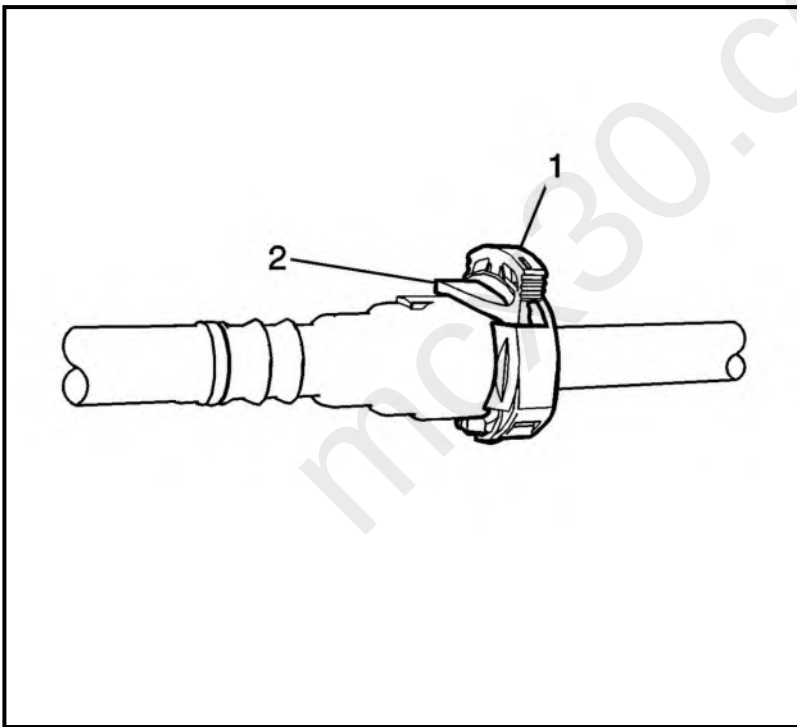
8. This step applies to the Global Connector style only. Push the connector toward the tube in order to release the pressure. Press and hold down the release mechanism, and pull the connector straight out.



9. This step applies to the TI Loc style only. Push the connector toward the tube in order to release the pressure. Release the redundant latch (1) with two fingers or a flat bladed tool. Then press and hold down the bottom release mechanism (2) and pull the connector straight out.

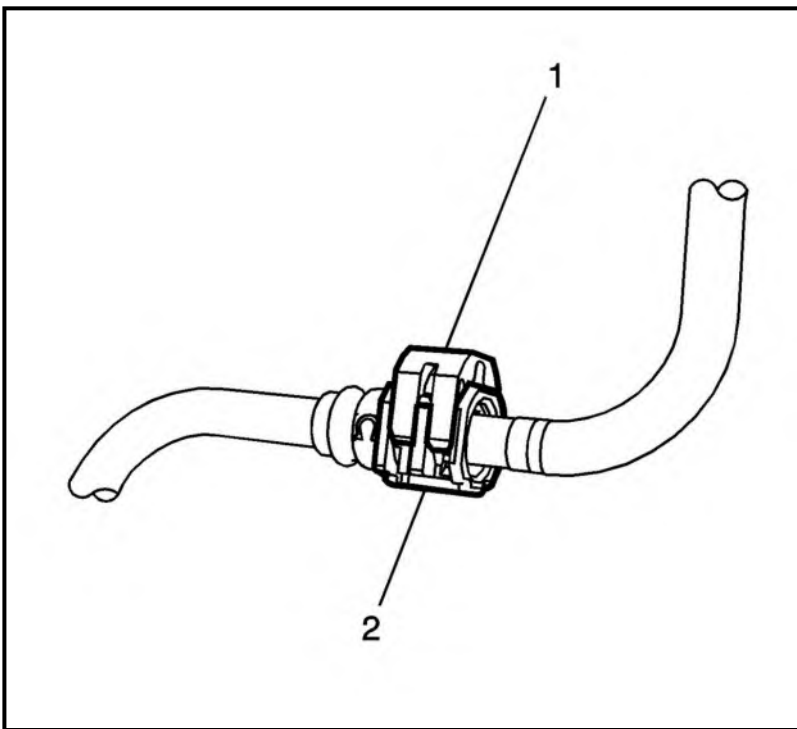


10. This step applies to the Safe Lock style only. Push the connector toward the tube in order to release the pressure. Release the second latch (1) with two fingers. Then press and hold down the bottom release mechanism (2) and pull the connector straight out.

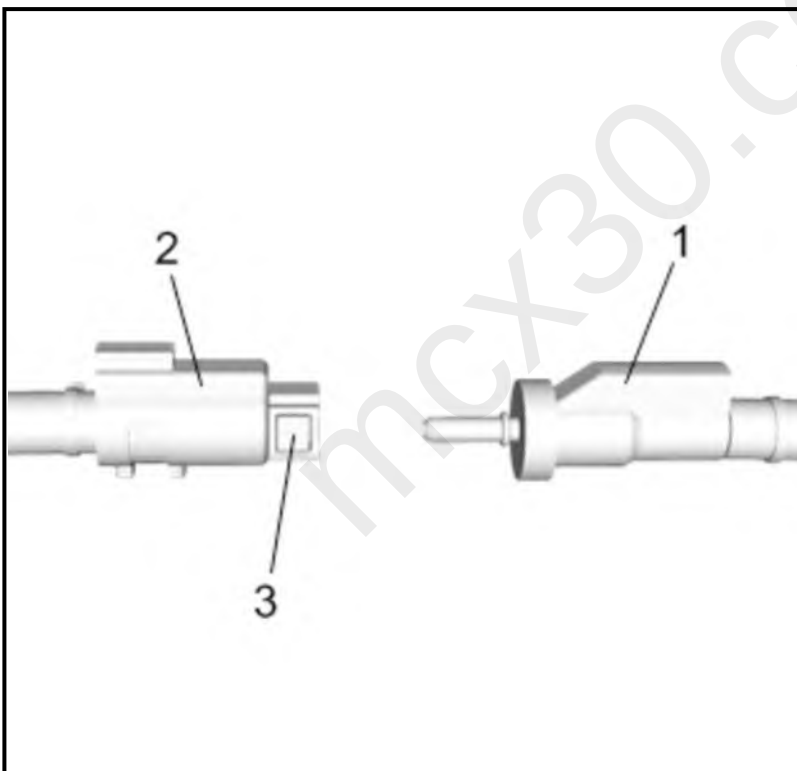


WARNING: Refer to [Relieving Fuel Pressure Warning](#) .

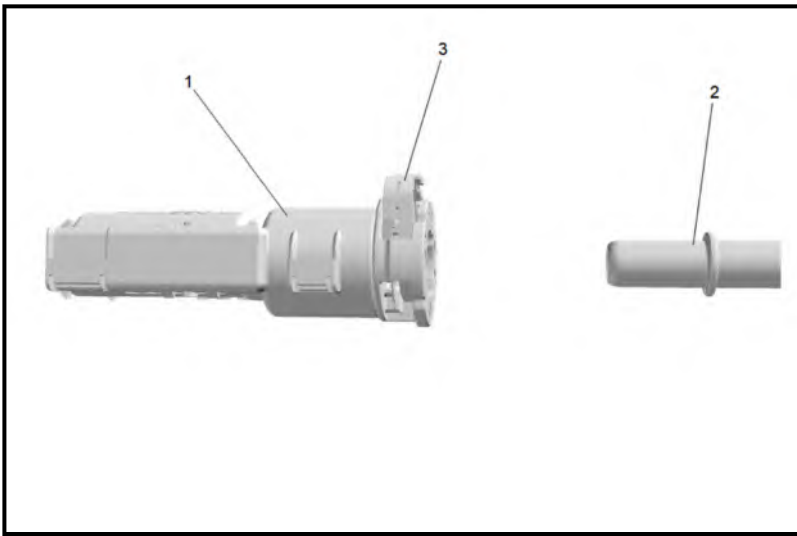
11. This step applies to the Plastic Connector style 8, push the connector toward the tube in order to release the pressure. Press the latch (1) inward in order to release the pipe, while pulling the connector (2) straight out.



12. This step applies to the DEF Connector style only. Push the male side (1) towards connector (2) in order to release the pressure on the connector. Squeeze the tabs on both sides of the connector (3) to release the connector then pull male side (1) straight out.



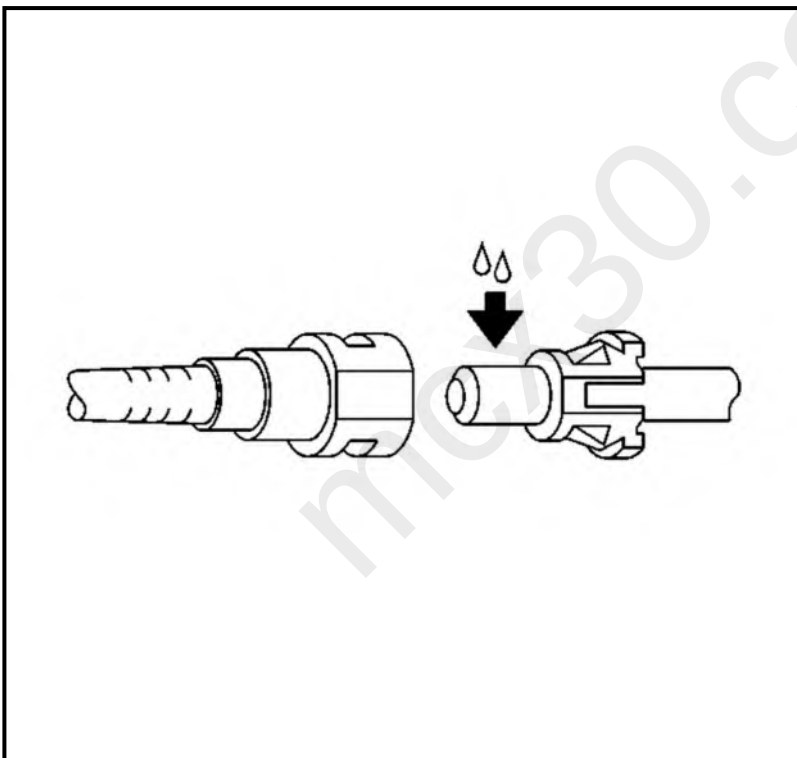
13. Using a clean shop towel, wipe off the male pipe end.
14. Inspect both ends of the fitting for dirt and burrs.
15. Clean or replace components as necessary.
16. For the DEF Connector style only. Push the female side (1) towards connector (2) in order to release the pressure on the connector. Squeeze the tabs on female side of the connector (3) to release the connector then pull male side (2) straight out.



17. Using a clean shop towel, wipe off the male pipe end.
18. Inspect both ends of the fitting for dirt and burrs.
19. Clean or replace components as necessary.

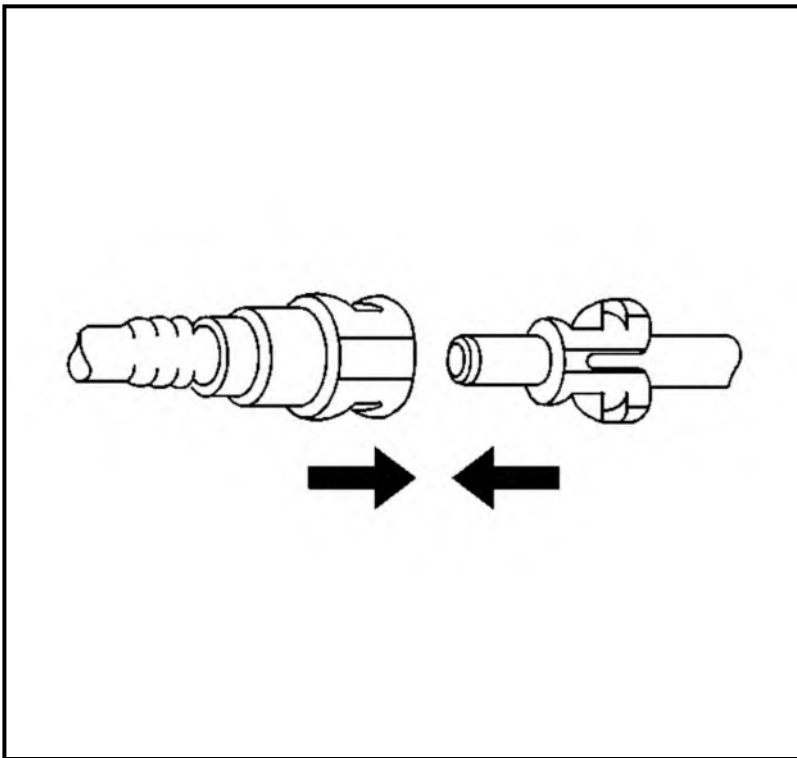
Installation Procedure

1. Apply a few drops of clean engine oil to the male pipe end.

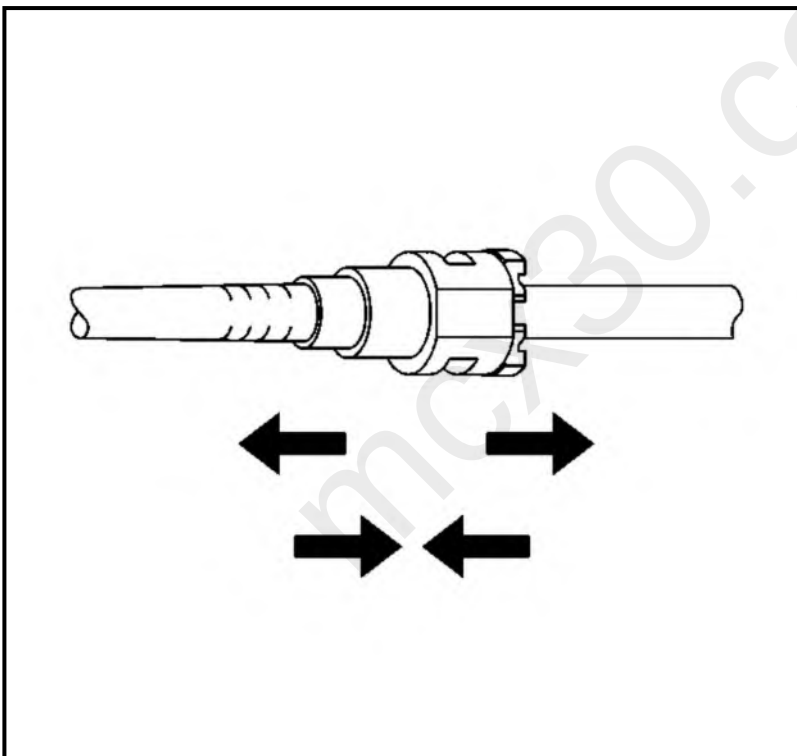


WARNING: Refer to [Fuel Pipe Fitting Warning](#) .

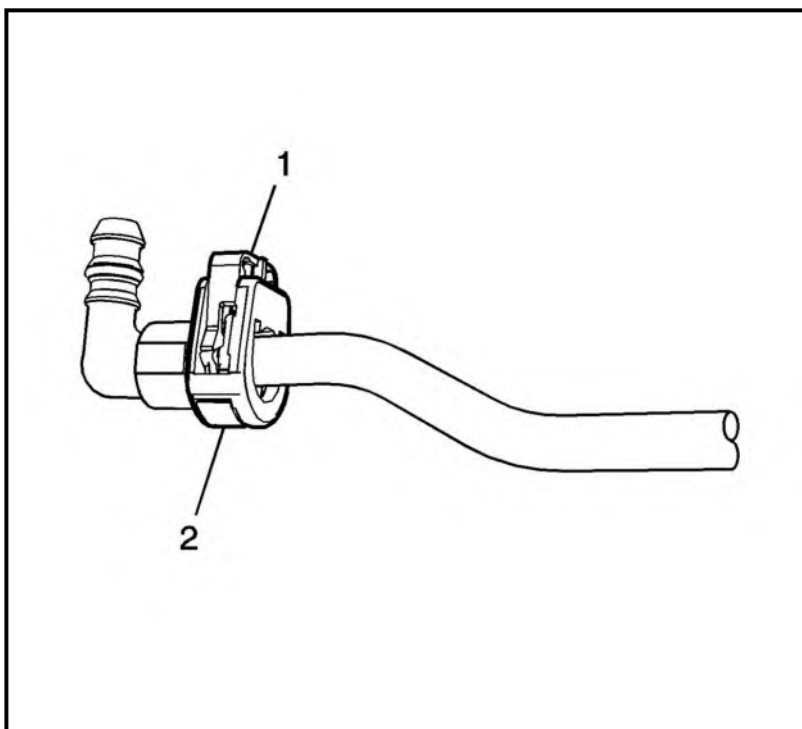
2. Push both sides of the quick-connect fitting together in order to cause the retaining feature to snap into place.



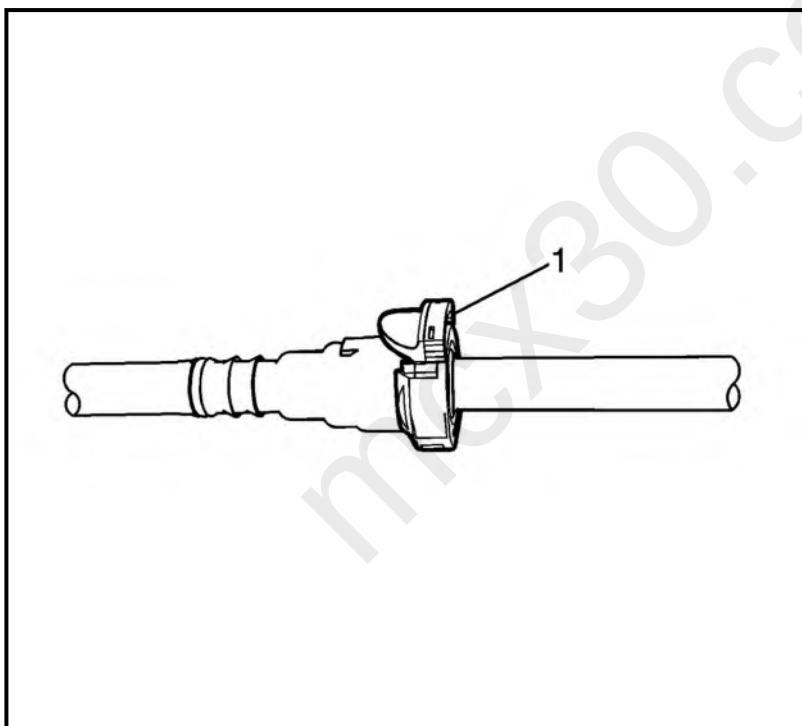
3. Pull on both sides of the quick-connect fitting to make sure the connection is secure.



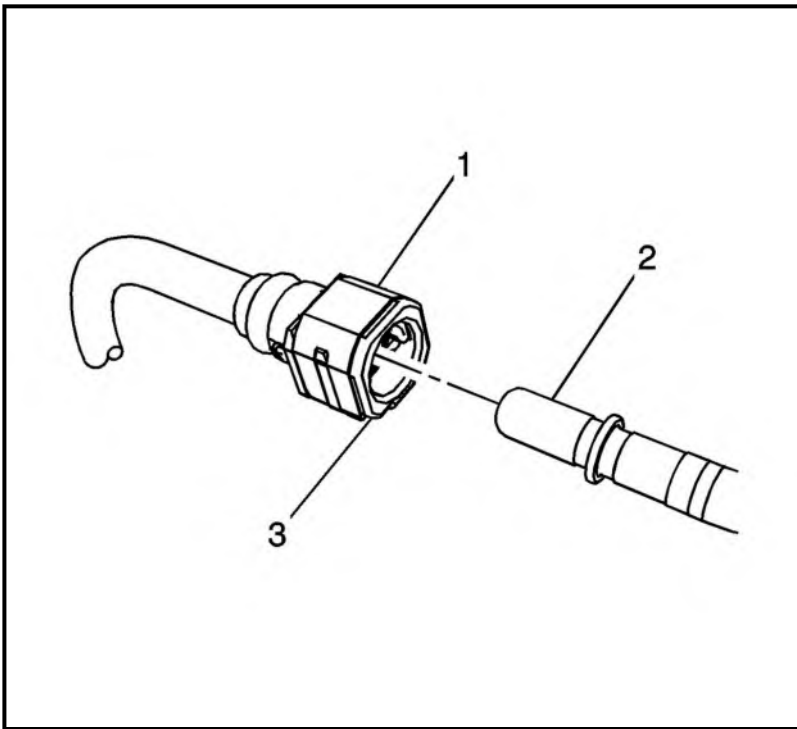
4. Insert the tube in the connector until the retainer snaps in place.



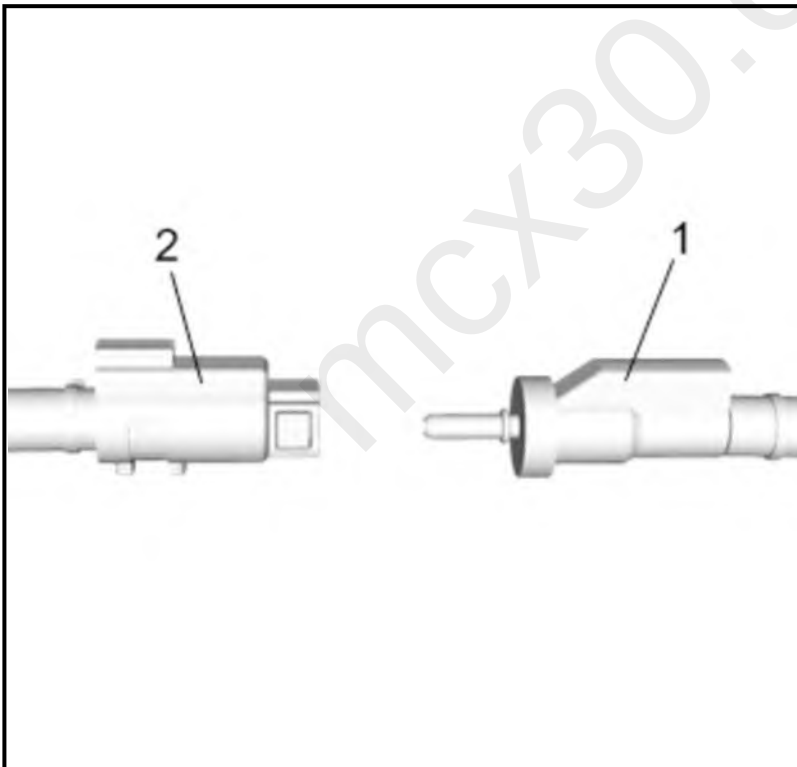
5. Push down on the redundant latch (1) until it is fully engaged and snapped into position.
6. Insert the tube in the connector until the retainer snaps in place.



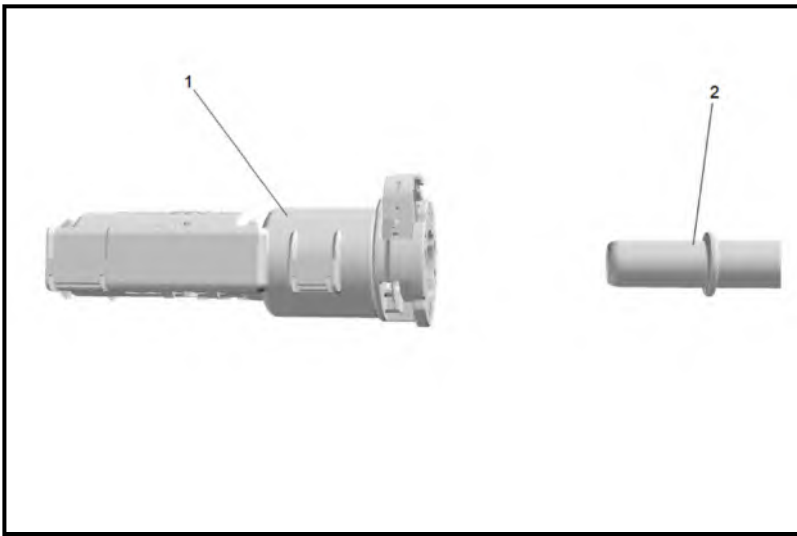
7. Push down on the second latch (1) in order to secure the connection.
8. For the plastic connector type 8, depress the latch (1) while inserting the connector (3) on to the pipe (2).



9. Move the latch (1) upward in order to secure the connection.
10. For the DEF Connector type 9, wipe off male side of line (1) to insure there is no contamination on the line prior to installation. Inspect inside connector side line (2) to insure there is no contamination in the connector prior to installation. Push the male side (1) inwards to connector (2) until connector latches. Once latched, pull on male line (1) outward to insure connection is made.



11. For the DEF Connector style only. Push the female side (1) towards connector (2). Push female line on the male connector until the tab latches. Once latched, pull on the female line outward to ensure connection is made.



12. Inspect for leaks using the following procedure:

1. Turn the ignition ON, with the engine OFF for 2 seconds.
2. Turn the ignition OFF, for 10 seconds.
3. Turn the ignition ON, with the engine OFF for 2 seconds.
4. Turn the ignition OFF.
5. Inspect for leaks.

FUEL TANK DRAINING

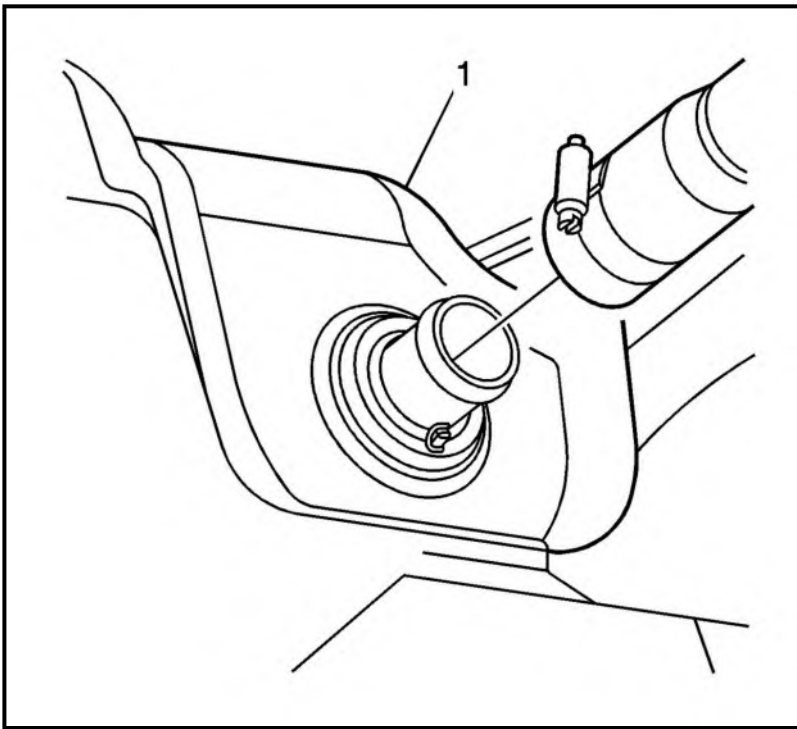
Special Tools

- DT 36850 Transjel Lubricant
- CH 45004 Fuel Tank Drain Hose

WARNING: Never drain or store fuel in an open container. Always use an approved fuel storage container in order to reduce the chance of fire or explosion.

WARNING: Place a dry chemical (Class B) fire extinguisher nearby before performing any on-vehicle service procedures. Failure to follow these precautions may result in personal injury.

1. Raise and Support the Vehicle. Refer to [Lifting and Jacking the Vehicle](#)
2. Loosen the lower fill hose clamp in order to separate the fill hose from the fuel tank (1).



NOTE: Lubricate the fuel drain hose with DT 36850 Transjel Lubricant or equivalent to aid in hose insertion. Do not use an unapproved lubricant.

3. Insert the **CH 45004** Fuel Tank Drain Hose into the fuel tank (1) until the hose reaches the bottom of the fuel tank.
4. Use a hand or air operated pump device in order to drain as much fuel from the fuel tank as possible.

FUEL TANK REPLACEMENT

Removal Procedure

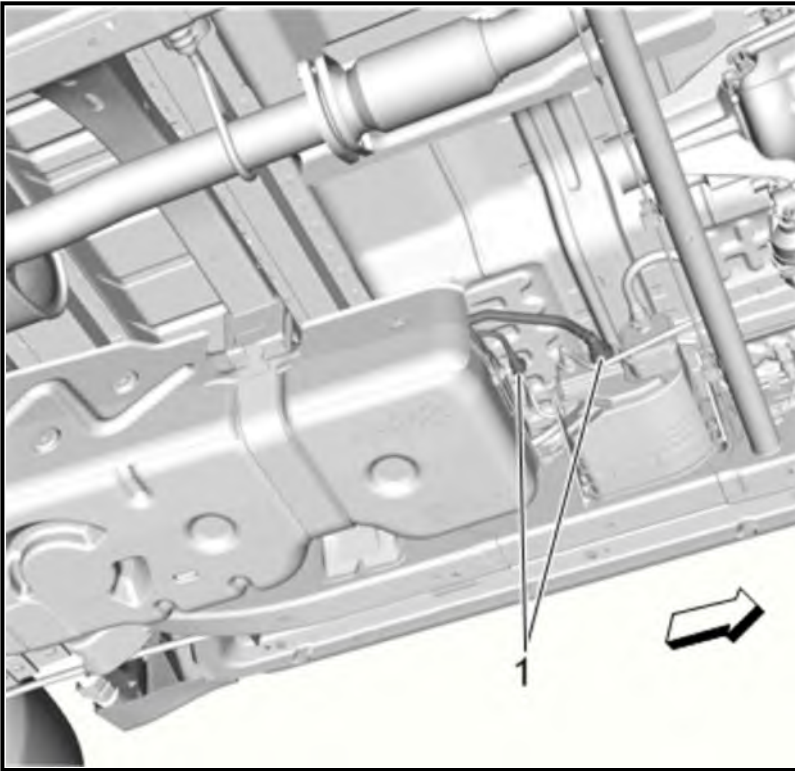
WARNING: To avoid any vehicle damage, serious personal injury or death:

- When major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.
- When performing work in the engine compartment or under the vehicle, ensure that the hood is fully open, or opened to its secondary latch. When the hood is opened to the secondary latch, the vehicle will disable the remote start features from the key fob and OnStar mobile app. Failure to open the hood, or open the hood to the secondary latch while doing a repair in the engine compartment or under the vehicle can result in inadvertent vehicle starting which could result in personal injury or damage to a vehicle.

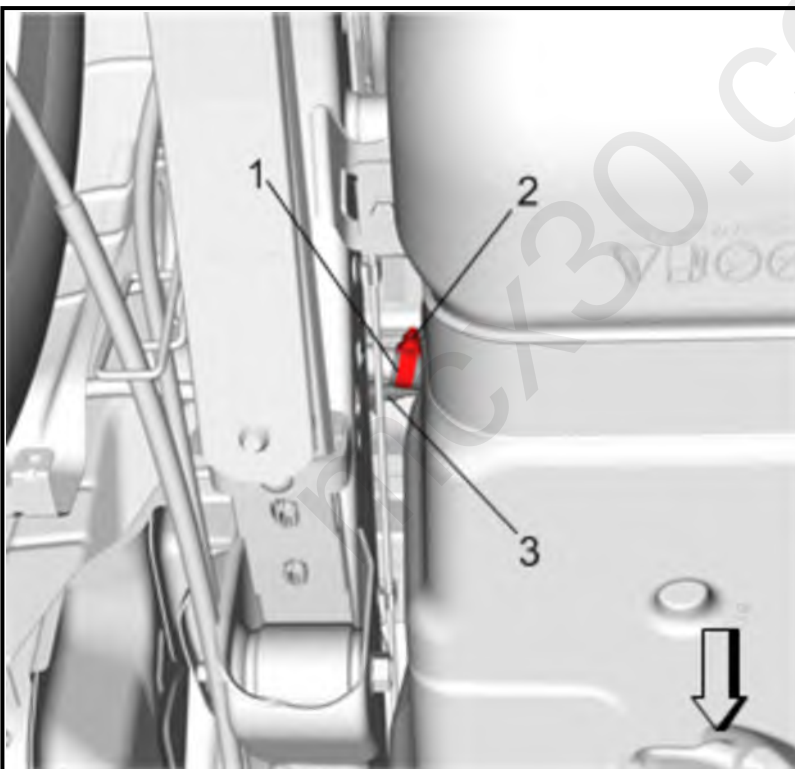
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

1. Relieve the system fuel pressure. [Fuel Pressure Relief](#)
2. Drain the fuel tank. [Fuel Tank Draining](#)
3. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)
4. {If equipped} Remove the fuel tank shield. [Fuel Tank Shield Replacement](#)
5. Disconnect the evaporative emission and fuel pipes (1). [Plastic Collar Quick Connect Fitting Service](#)

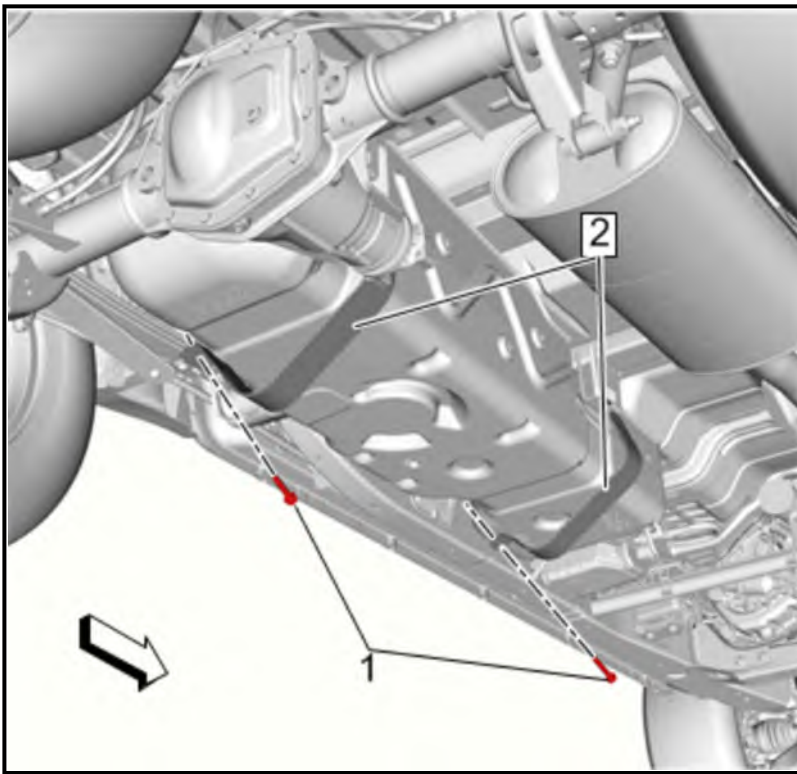


6. Loosen the hose clamps (2) and remove the filler hose (1).

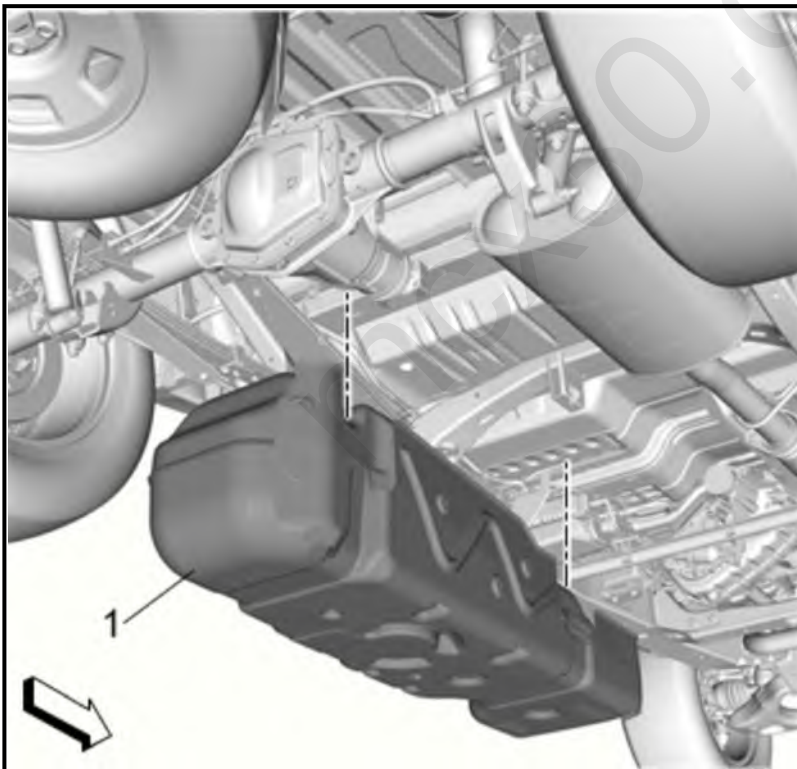


7. Disconnect the evaporative emission line (3) from the filler pipe assembly. [Plastic Collar Quick Connect Fitting Service](#)

8. Support the fuel tank with a suitable jack.



9. Remove the fuel tank strap bolts (1).
10. Remove the fuel tank straps (2).
11. Remove the following components if replacing just the fuel tank.



Disconnect the fuel tank harness electrical connector.

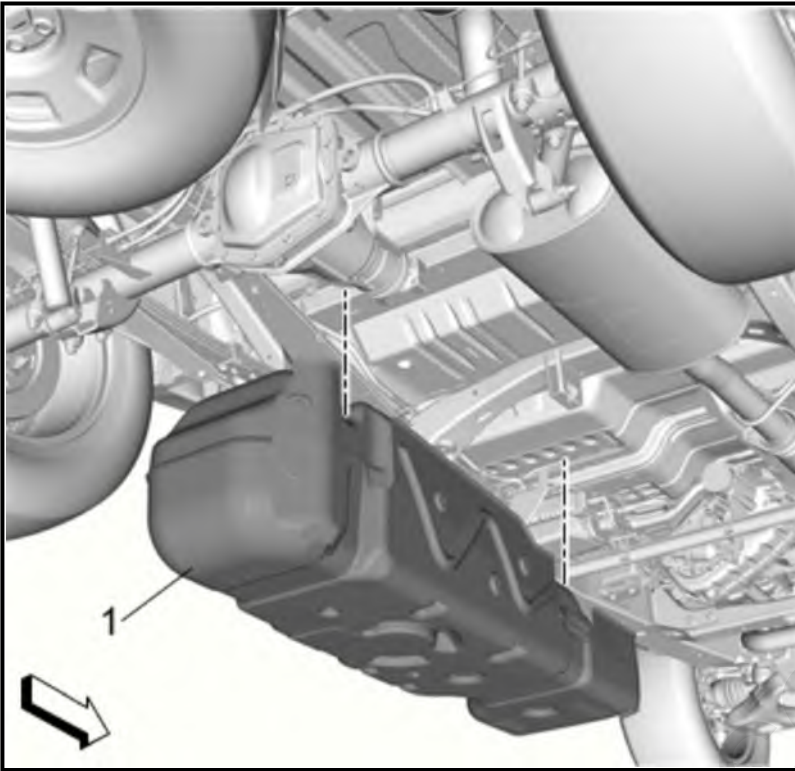
12. Remove the fuel tank (1).
13.
 1. Fuel tank fuel pump module. [Fuel Tank Fuel Pump Module Replacement](#)
 2. Transfer components as necessary.

Installation Procedure

1. Install the following components if fuel tank replacement was necessary:

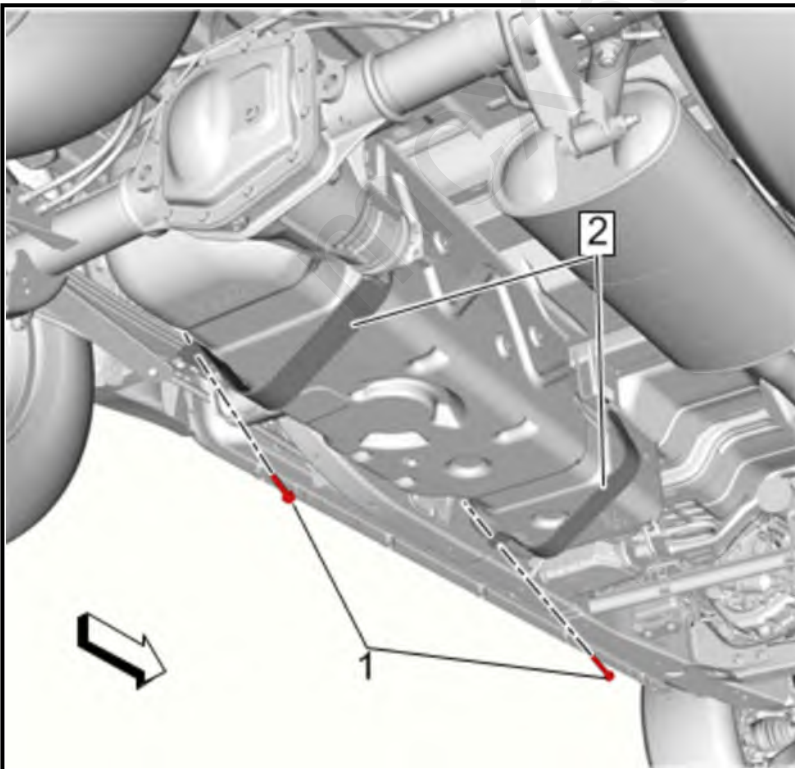
1. Fuel tank fuel pump module. [Fuel Tank Fuel Pump Module Replacement](#)

2. Use a suitable jack and install the fuel tank (1).



3. Connect the fuel tank harness electrical connector.

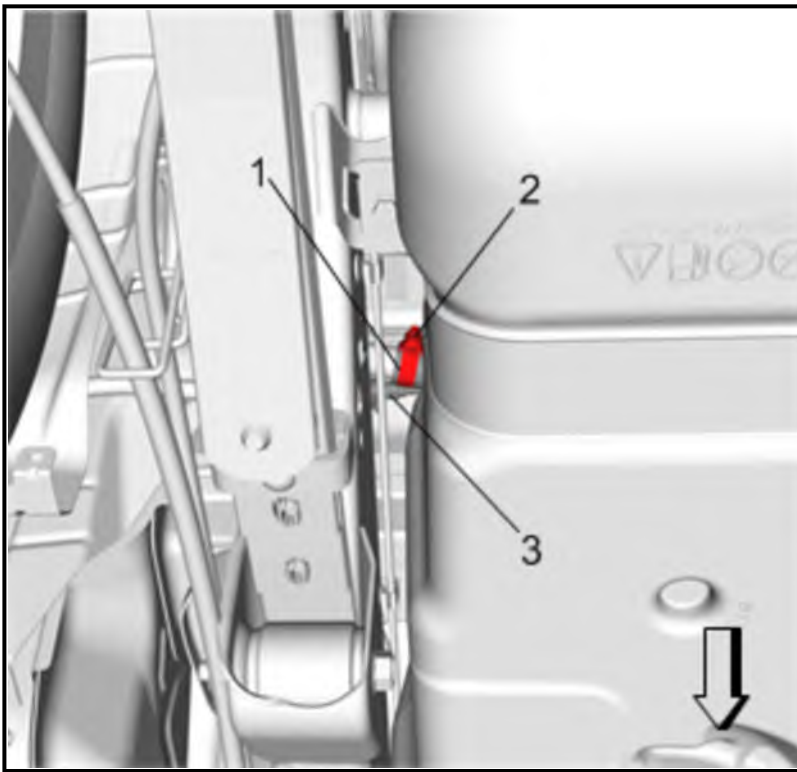
4. Install the fuel tank straps (2).



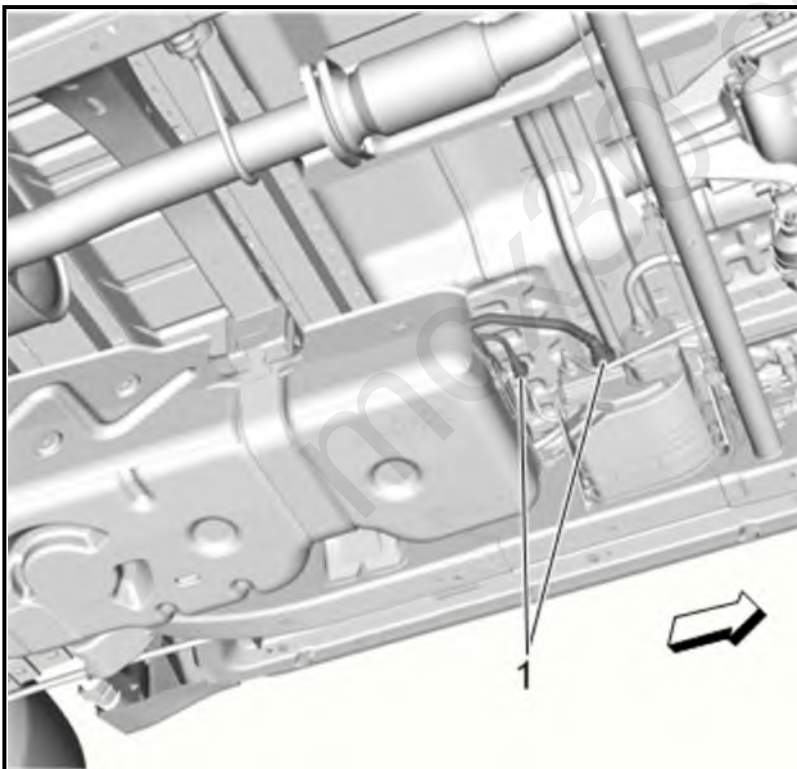
CAUTION: Refer to [Fastener Caution](#) .

5. Install the fuel tank strap bolts (1) and tighten to 45 N.m (33 lb ft).

6. Install the filler hose (1) and tighten the hose clamp (2) to 4 N.m (35 lb in).

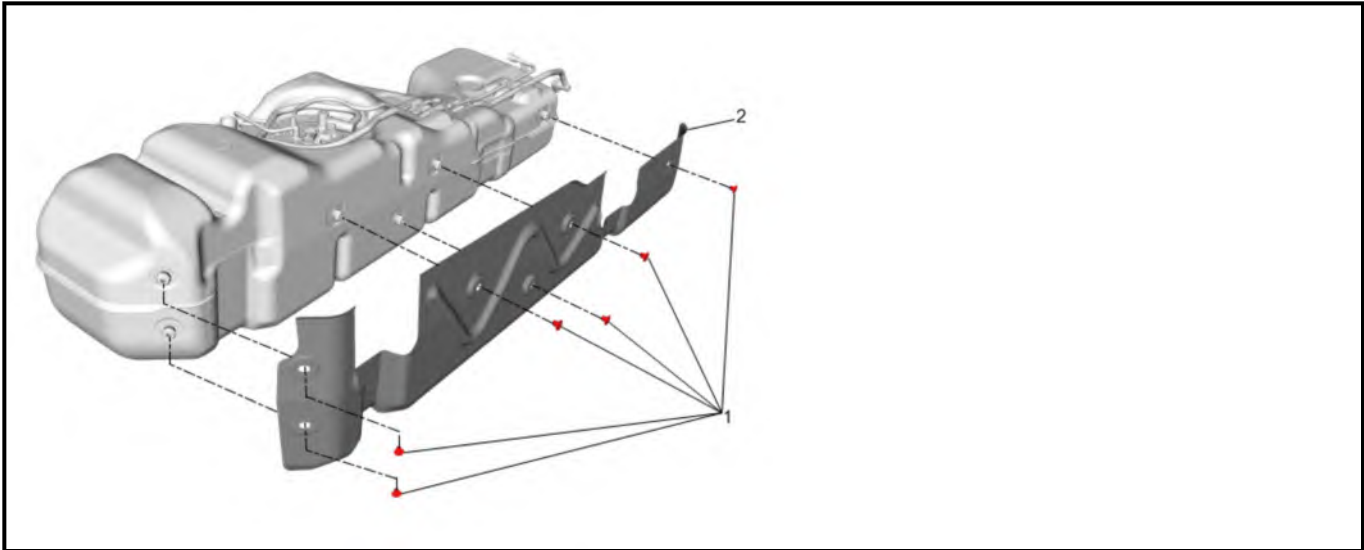


7. Connect the evaporative emission line (3). [Plastic Collar Quick Connect Fitting Service](#)
8. Connect the evaporative emission and fuel pipes (1). [Plastic Collar Quick Connect Fitting Service](#)



9. {If equipped} Install the fuel tank shield. [Fuel Tank Shield Replacement](#)
10. Lower the vehicle.
11. Refill the fuel tank.
12. Inspect for fuel leaks.

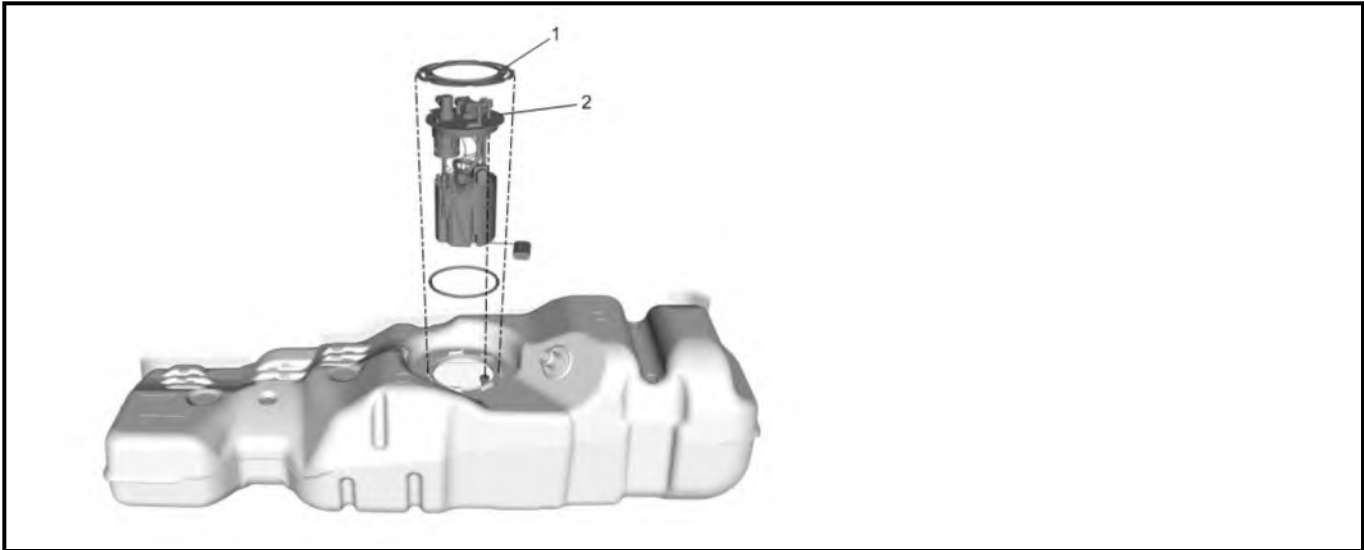
FUEL TANK SHIELD REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Support the fuel tank with a suitable jack. 2. Remove the fuel tank straps. Fuel Tank Replacement	
NOTE: Fuel tank does not have to be removed to remove the fuel tank shield.	
1	Fuel Tank Shield Retainers (Qty: 6) CAUTION: Refer to Fastener Caution .
2	Fuel Tank Shield

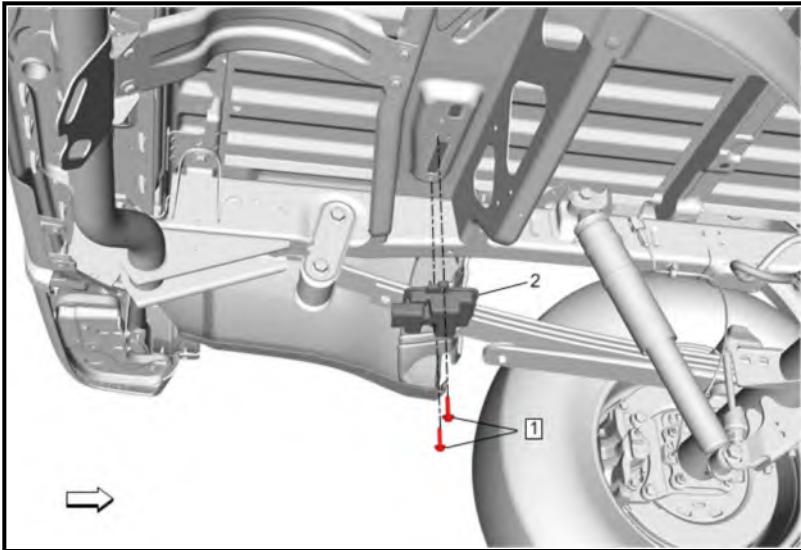
FUEL TANK FUEL PUMP MODULE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure 1. Remove the fuel tank. Refer to Fuel Tank Replacement . 2. Disconnect the fuel and EVAP lines from the fuel tank fuel pump module. Refer to Plastic Collar Quick Connect Fitting Service . 3. Disconnect the electrical wiring harness connector from the fuel tank fuel pump module.	
1	Fuel Tank Fuel Pump Module Lock Ring CAUTION: Refer to Fastener Caution . Special Tools J-45722 Fuel Sender Lock Ring Wrench For equivalent regional tools, refer to Special Tools (Mechanical Tools)
2	Fuel Tank Fuel Pump Module Procedure 1. Disconnect the vent pipe. Refer to Plastic Collar Quick Connect Fitting Service . 2. Replace the O-ring seal.

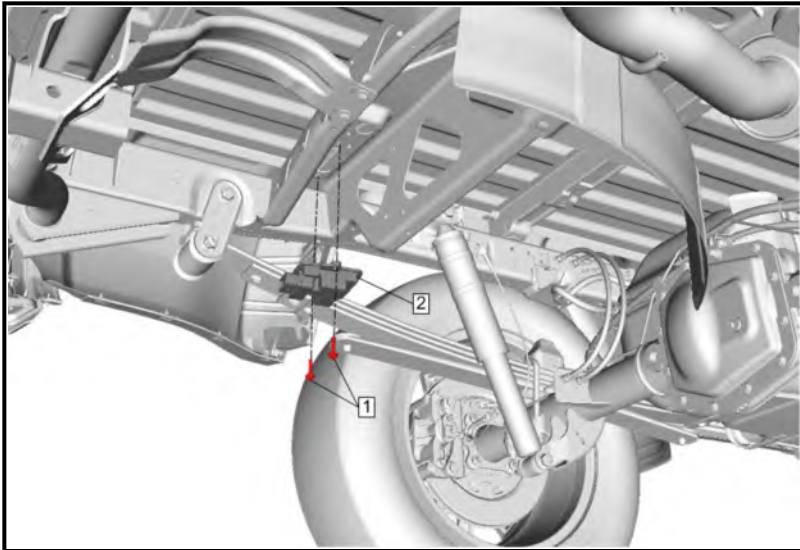
FUEL PUMP POWER CONTROL MODULE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Remove the spare tire.	
1	Fuel Pump Power Control Module Fastener (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)
2	Fuel Pump Power Control Control Module Procedure 1. Disconnect the electrical connector. 2. If replacing, reprogram the module. Refer to Control Module References .

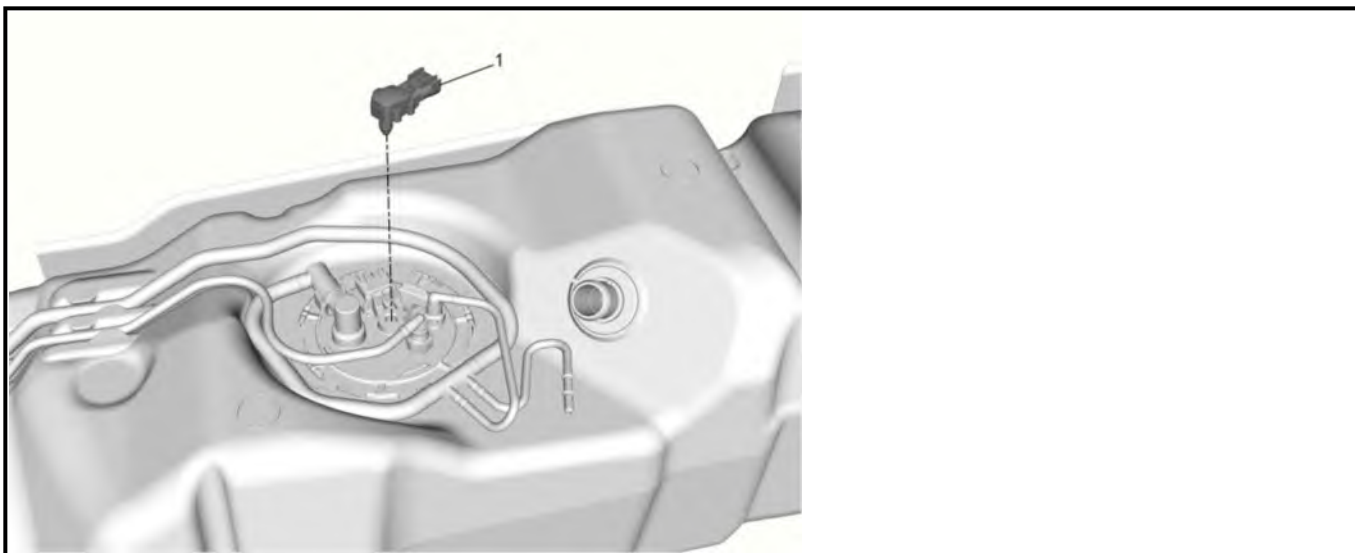
CHASSIS CONTROL MODULE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Lifting and Jacking the Vehicle 2. Remove the spare tire.	
1	Chassis Control Module Bolt [2x] CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)
2	Chassis Control Module Procedure 1. Disconnect the electrical connector. 2. If replacing, reprogram the module. Control Module References

FUEL TANK PRESSURE SENSOR REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Remove the fuel tank. Refer to Fuel Tank Replacement .	
1	Fuel Tank Pressure Sensor Procedure 1. Disconnect the electrical connector. 2. Release the retaining tab.

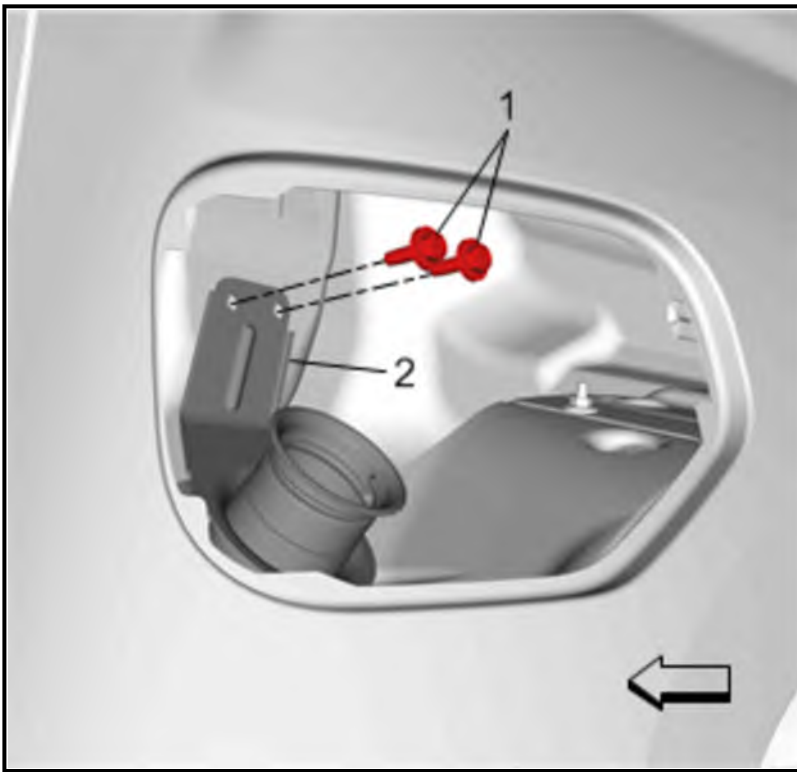
FUEL TANK FILLER PIPE REPLACEMENT

Removal Procedure

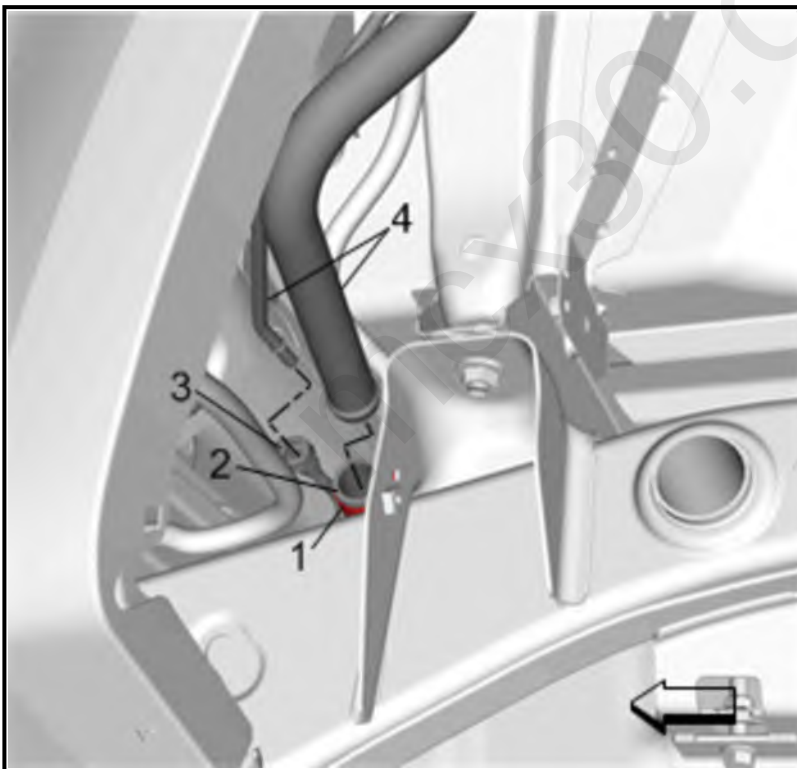
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

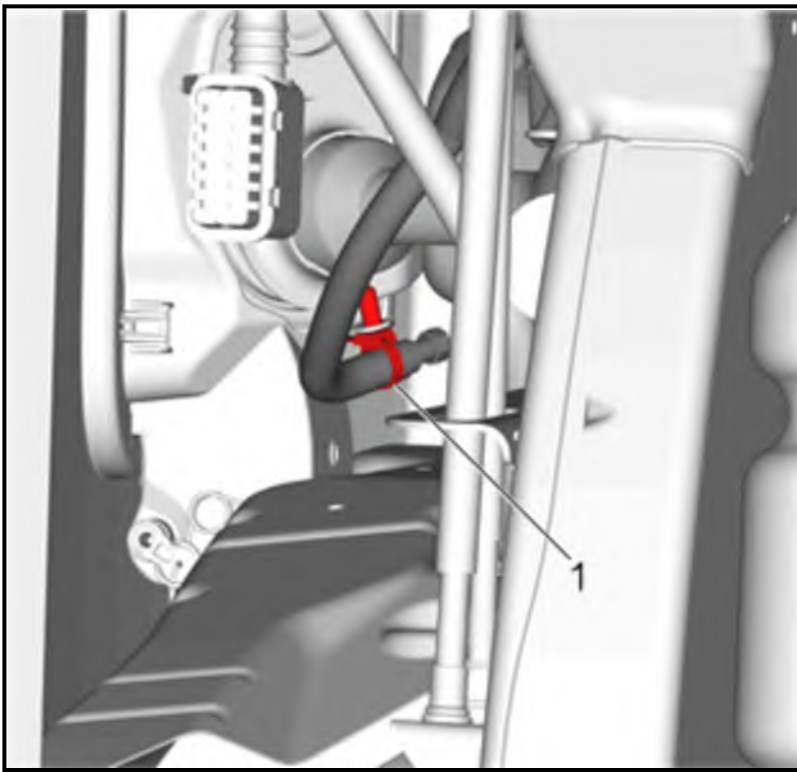
- 1. Remove the fuel tank filler pipe housing. Refer to [Fuel Tank Filler Pipe Housing Replacement](#) .
- 2. Remove the fuel tank filler pipe bolts (1) from the fuel tank filler pipe (2).



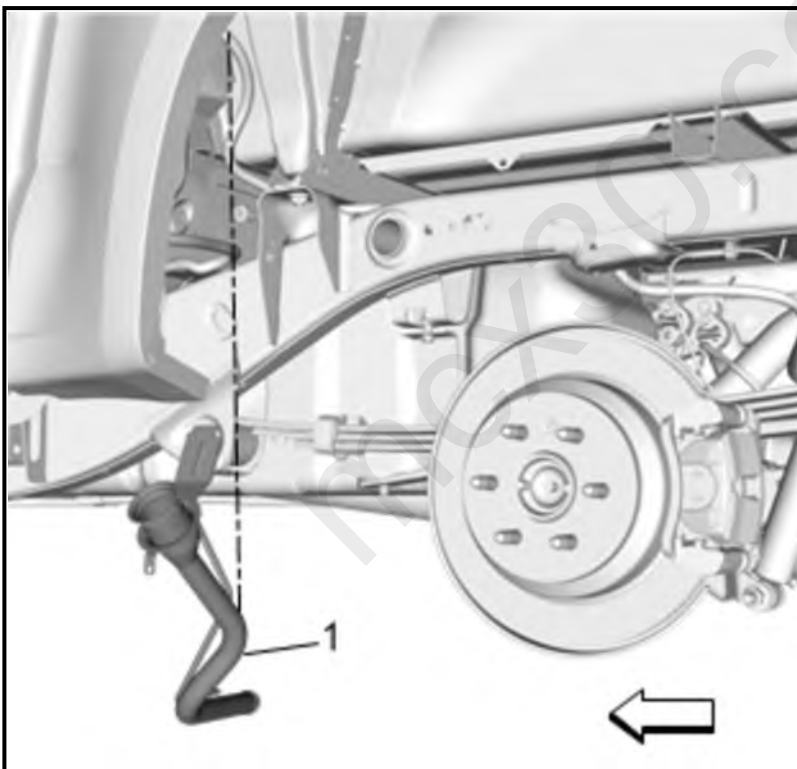
3. Remove the evaporative emission system vacuum leak pump filter assembly. Refer to [Evaporative Emission System Vacuum Leak Pump Filter Replacement](#).
4. Remove the fuel tank filler hose clamp (1).



5. Remove the fuel tank filler hose (2) from the fuel tank filler pipe (4).
6. Disconnect the fuel tank vent hose (3) from the fuel tank filler pipe (4). Refer to [Plastic Collar Quick Connect Fitting Service](#).
7. Remove the vent hose clip (1) from the back of the fuel tank filler pipe bracket.

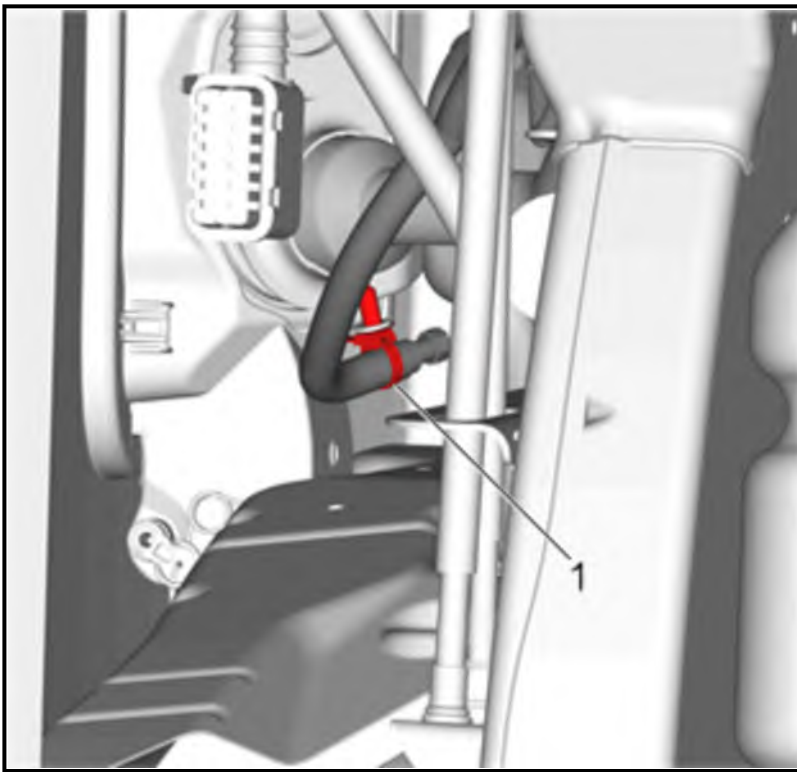


8. Remove the fuel tank filler pipe (1) from the vehicle.

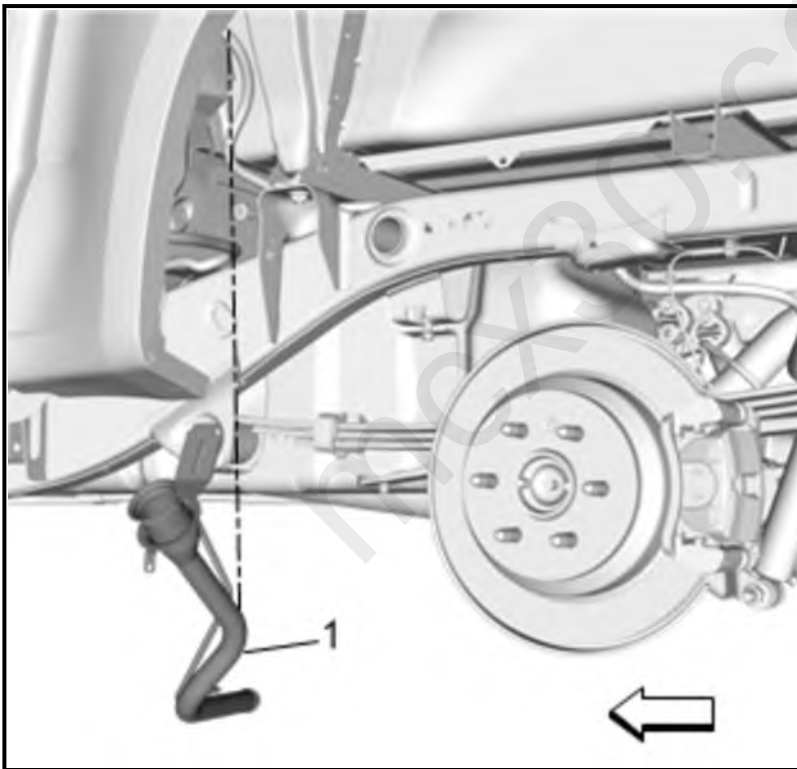


Installation Procedure

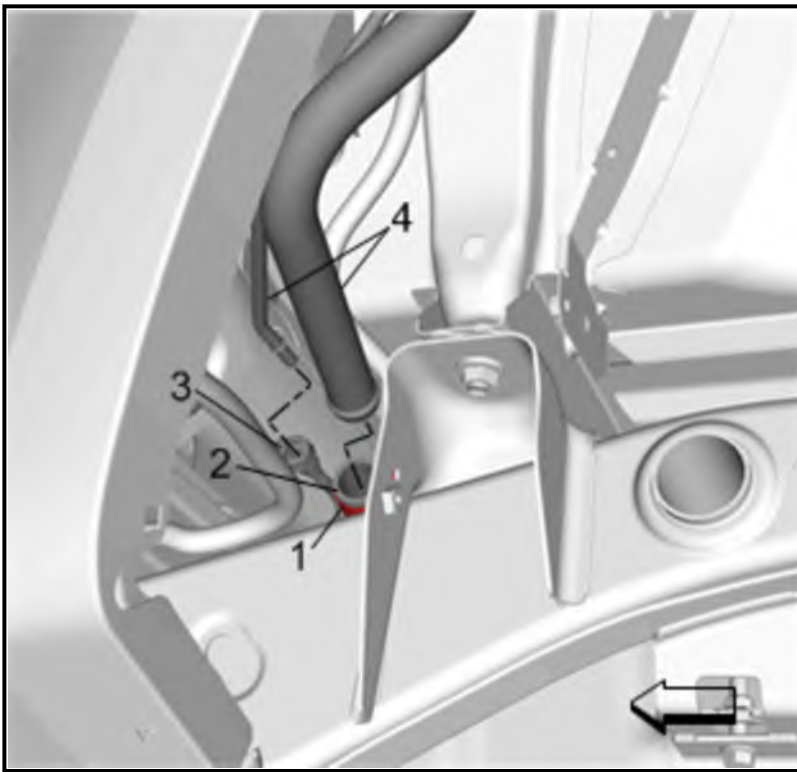
1. Install the vent hose clip (1) to the back of the fuel tank filler pipe bracket.



2. Install the fuel tank filler pipe (1) to the vehicle.



3. Connect the fuel tank vent hose (3) to the fuel tank filler pipe (4). Refer to [Plastic Collar Quick Connect Fitting Service](#).



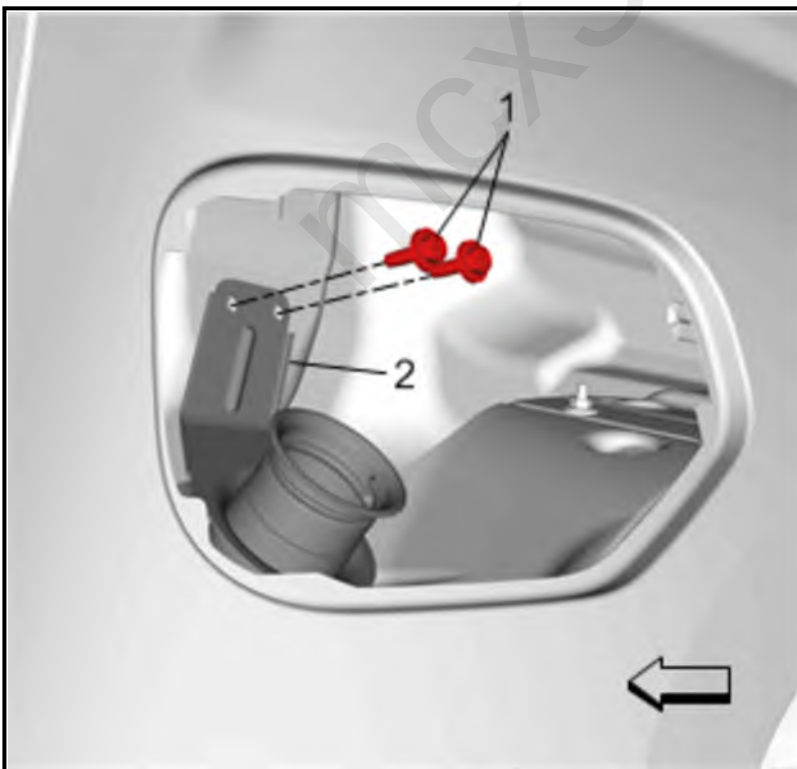
4. Install the fuel tank filler hose (2) to the fuel tank filler pipe (4).

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

5. Install the fuel tank filler hose clamp (1).

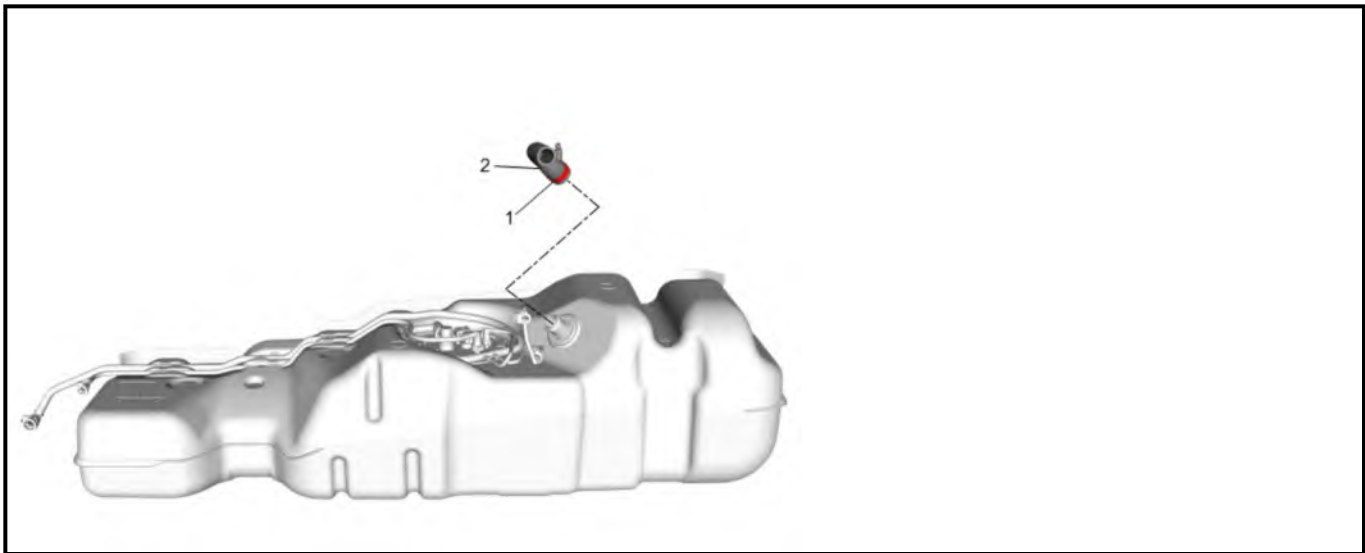
6. Install the evaporative emission system vacuum leak pump filter assembly. Refer to [Evaporative Emission System Vacuum Leak Pump Filter Replacement](#).

7. Install the fuel tank filler pipe bolts (1) to the fuel tank filler pipe (2) and tighten to 9 N.m (80 lb in).



8. Install the fuel tank filler pipe housing. Refer to [Fuel Tank Filler Pipe Housing Replacement](#) .

FUEL TANK FILLER HOSE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Remove the fuel tank. Refer to Fuel Tank Replacement .	
1	Fuel Tank Filler Hose Clamp CAUTION: Refer to Fastener Caution .
2	Fuel Tank Filler Hose

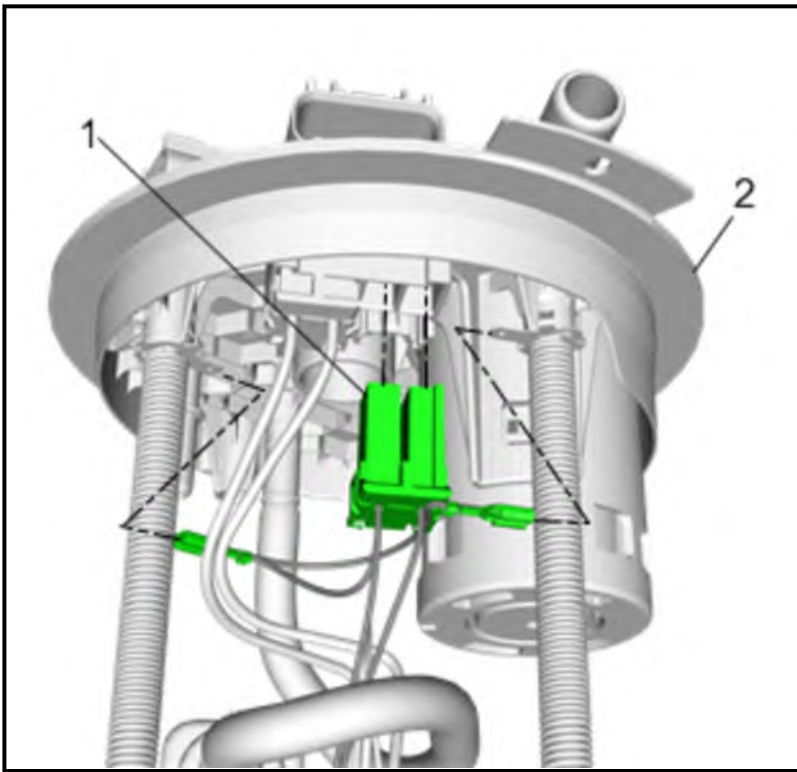
FUEL TANK FUEL PUMP MODULE FUEL LEVEL SENSOR REPLACEMENT

Removal Procedure

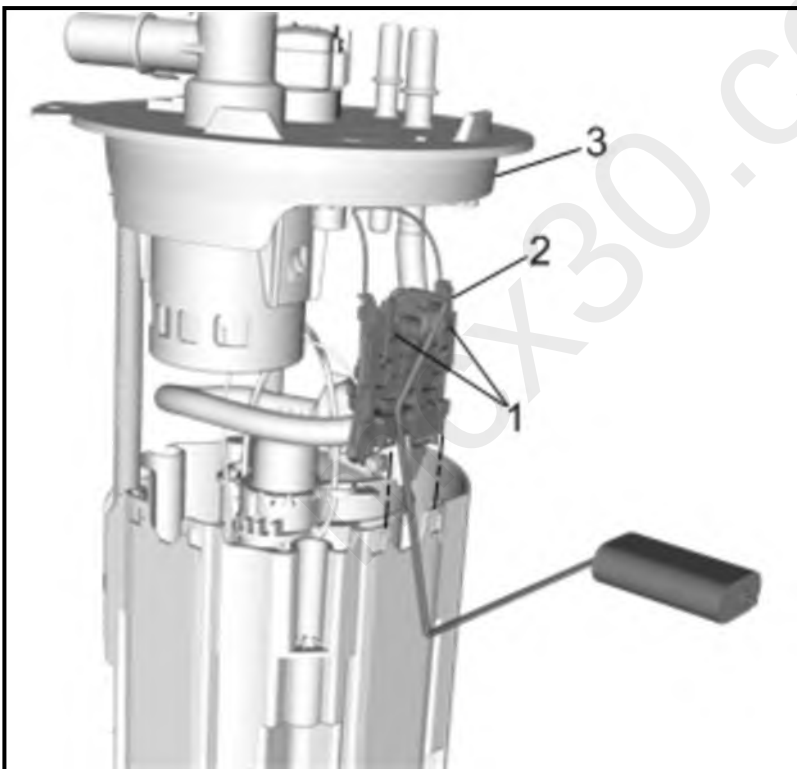
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

1. Remove the fuel tank fuel pump module. Refer to [Fuel Tank Fuel Pump Module Replacement](#).
2. Disconnect the fuel tank fuel pump module fuel level sensor electrical connectors (1) from the fuel tank fuel pump module (2).



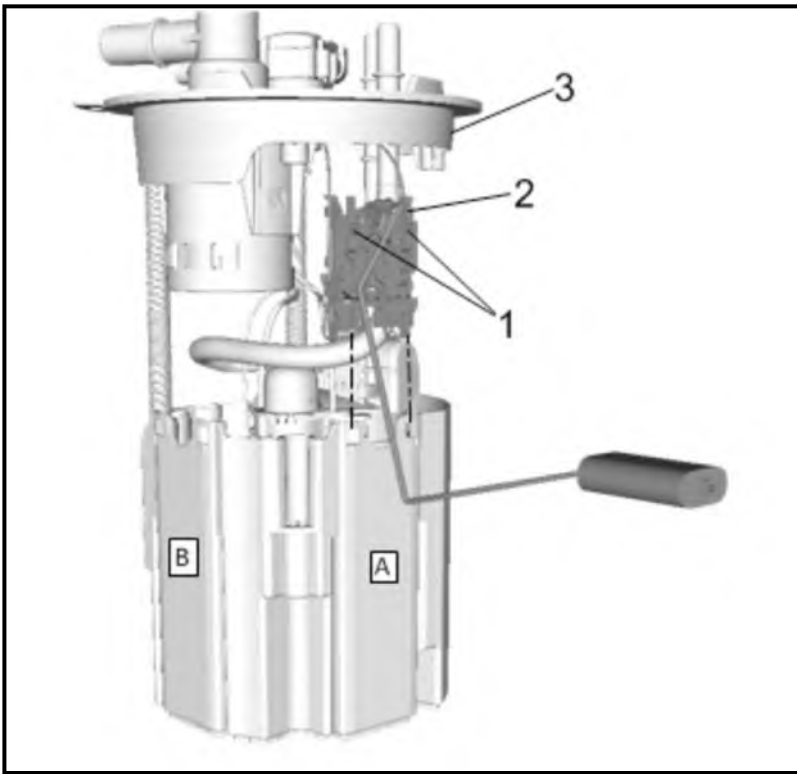
3. Depress the fuel tank fuel pump module fuel level sensor locking tabs (1).



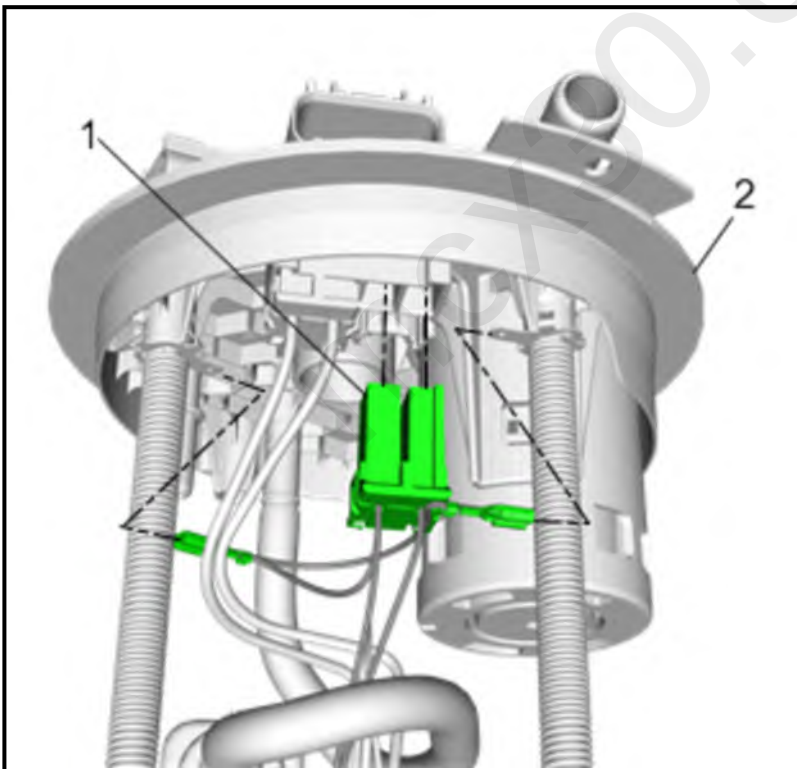
4. Remove the fuel tank fuel pump module fuel level sensor (2) from the fuel tank fuel pump module (3).

Installation Procedure

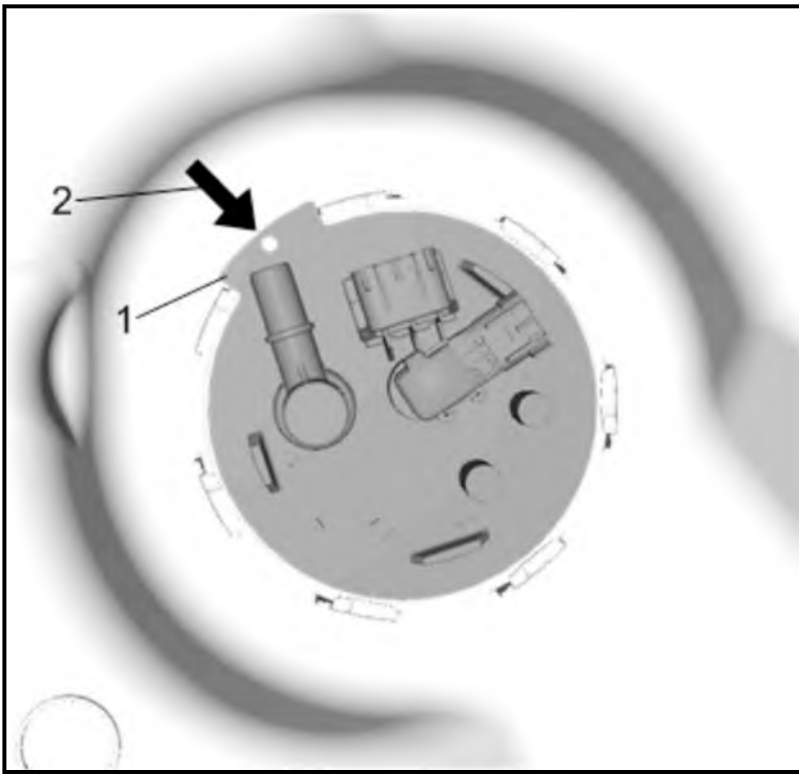
1. Install the fuel tank fuel pump module fuel level sensor (2) in slot (A) of the fuel tank fuel pump module (3).



2. Carefully insert the fuel tank fuel pump module fuel level sensor until the locking tabs (1) snap into the locking position.
3. Connect the fuel tank fuel pump module fuel level sensor electrical connectors (1) to the fuel tank fuel pump module (2).

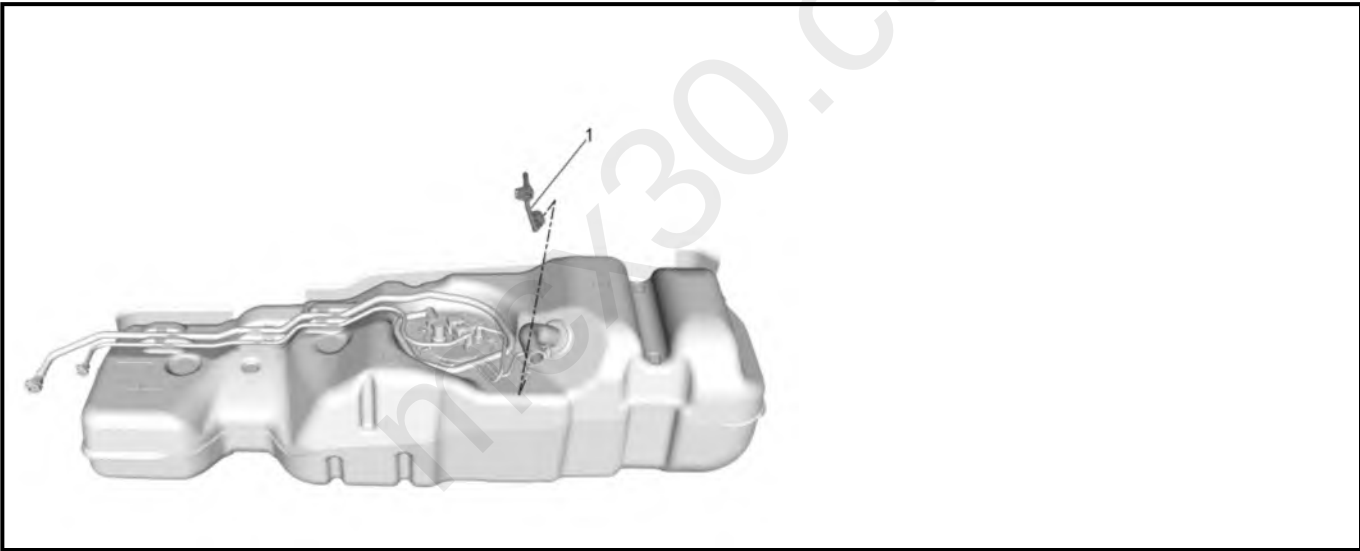


4. Align fuel tank fuel pump module (1) with arrow (2) on the fuel tank.



5. Install the fuel tank fuel pump module. Refer to [Fuel Tank Fuel Pump Module Replacement](#).

FUEL TANK FILLER VENT HOSE REPLACEMENT

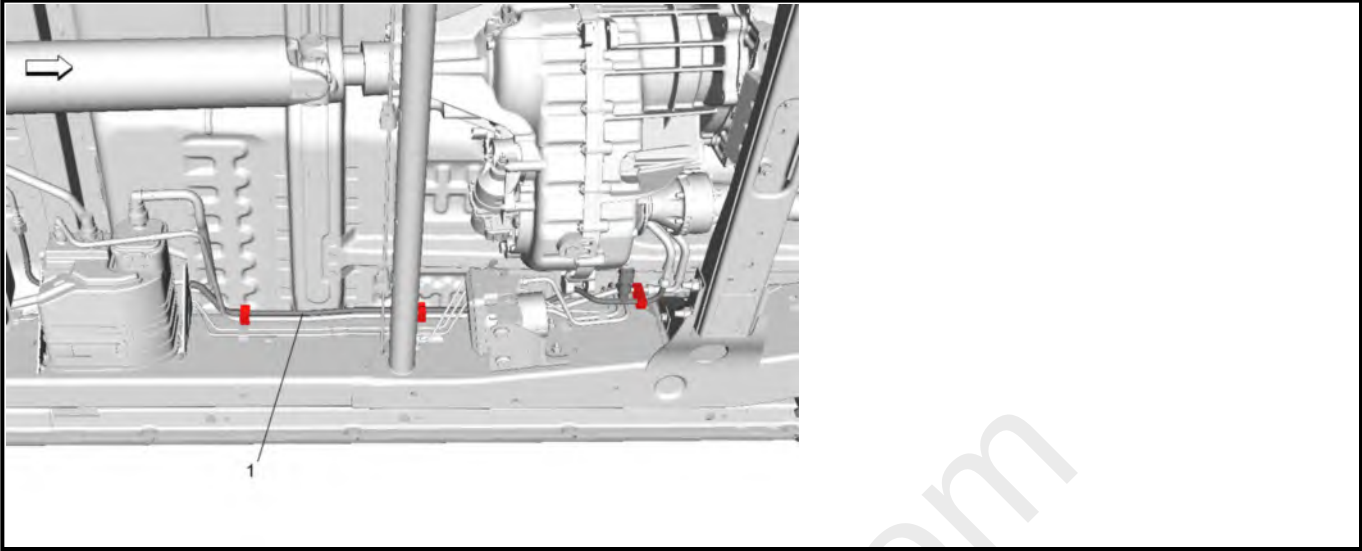


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	

Callout	Component Name
Preliminary Procedure Remove the fuel tank. Refer to Fuel Tank Replacement .	
1	Fuel Tank Filler Vent Hose Procedure Disconnect the quick disconnect. Refer to Plastic Collar Quick Connect Fitting Service .

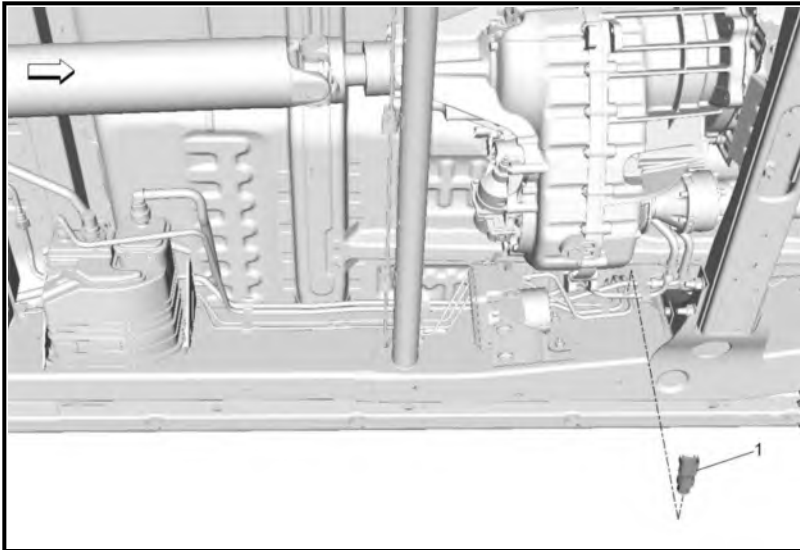
FUEL FEED REAR PIPE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning . Preliminary Procedures 1. Relieve the system fuel pressure. Fuel Pressure Relief 2. Raise and support the vehicle. Lifting and Jacking the Vehicle 3. Disconnect the fuel pressure sensor electrical connector.	
1	Fuel Feed Rear Pipe Procedure Disconnect the quick disconnects and remove from retainers. Plastic Collar Quick Connect Fitting Service , or Metal Collar Quick Connect Fitting Service

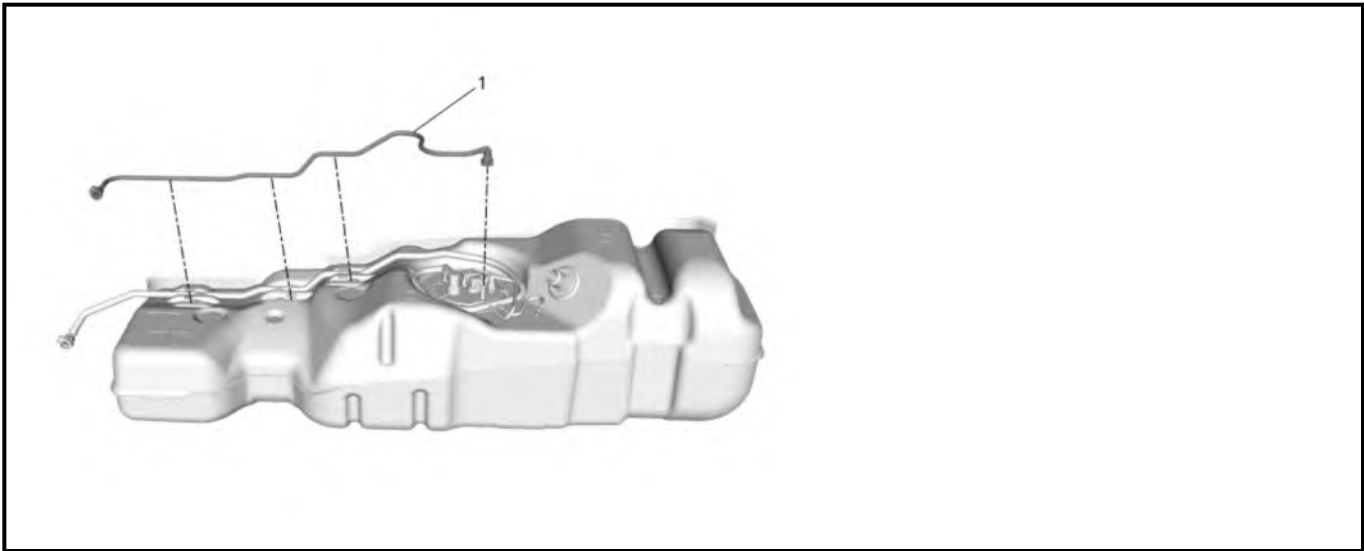
FUEL PRESSURE SENSOR REPLACEMENT - FUEL FEED PIPE



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Relieve the fuel system pressure. Fuel Pressure Relief 2. Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Fuel Pressure Sensor CAUTION: Refer to Component Fastener Tightening Caution . Procedure Disconnect the fuel pressure sensor electrical connector. Tighten 15 N.m (11 lb ft)

FUEL FEED PIPE REPLACEMENT (FUEL TANK)



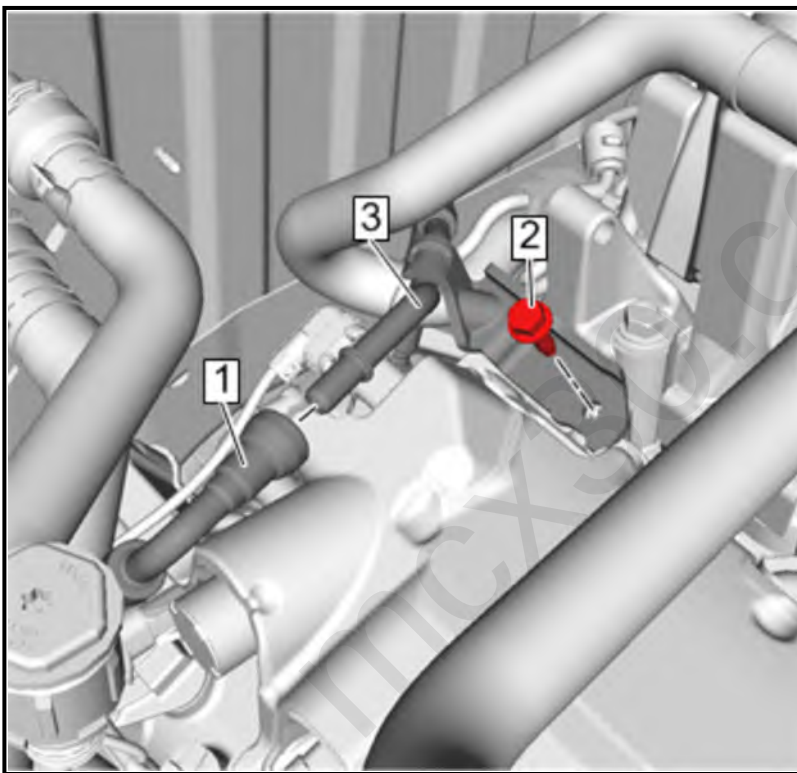
NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Remove the fuel tank. Refer to Fuel Tank Replacement .	
1	Fuel Feed Pipe Procedure Disconnect the quick disconnect. Refer to Plastic Collar Quick Connect Fitting Service .

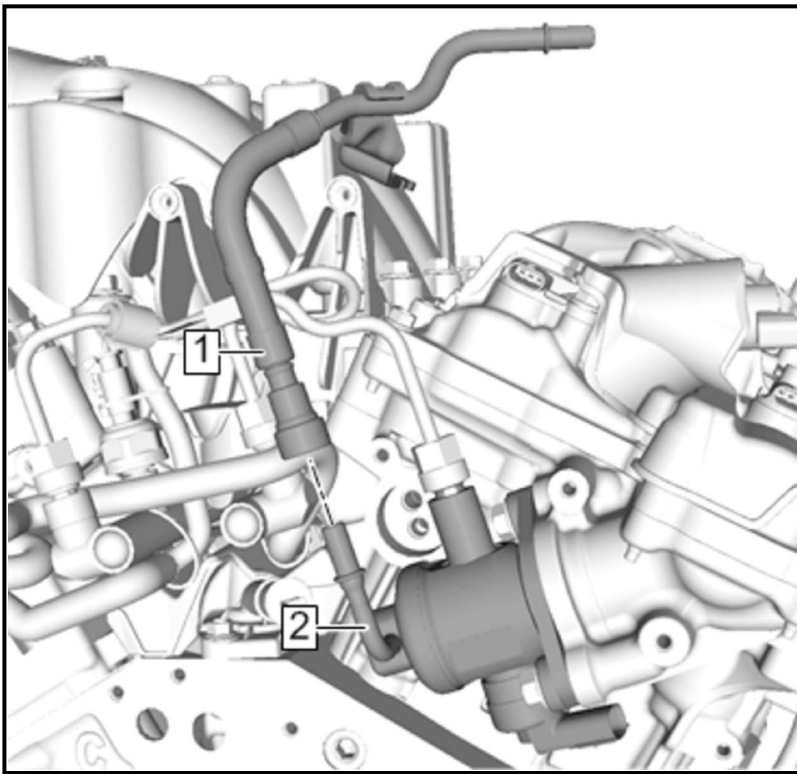
FUEL FEED PIPE REPLACEMENT (ENGINE)

Removal Procedure

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Engine Rear Noise Shield - Remove - [Engine Rear Noise Shield Replacement](#)
3. Fuel Feed Pipe-Engine to Tank (1) @ Fuel Feed Pipe-Engine (3) - Disconnect - [Fuel Feed Pipe Replacement \(Engine\)](#), or [Fuel Feed Pipe Replacement \(Engine to Tank\)](#).

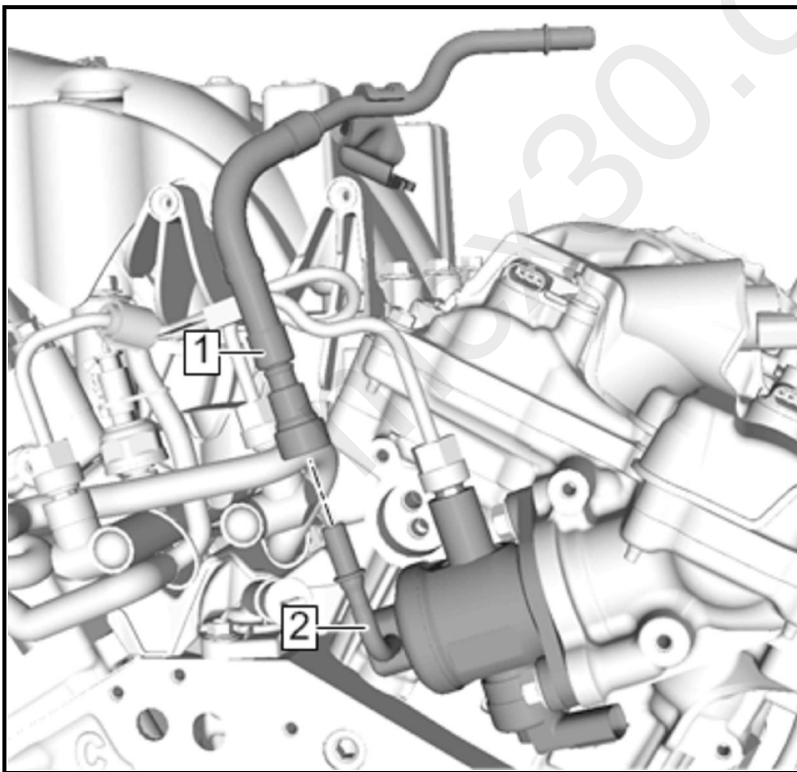


4. Fuel Feed Pipe Bracket Bolt (2) - Remove
5. Fuel Feed Pipe (1) @ Fuel Pump (2) - Disconnect - [Metal Collar Quick Connect Fitting Service](#)



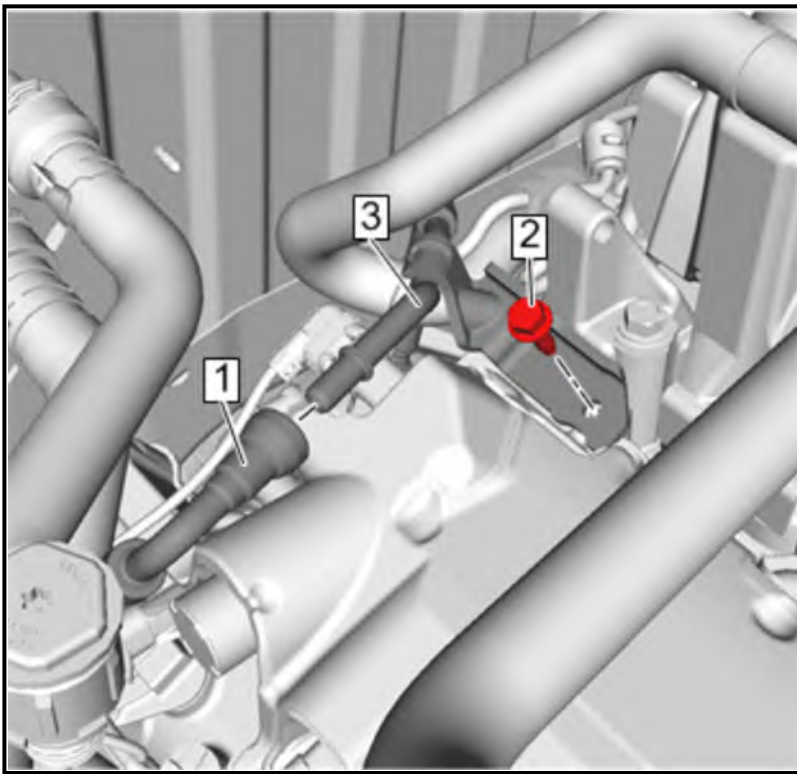
Installation Procedure

1. Fuel Feed Pipe (1) @ Fuel Pump (2) - Connect



NOTE: Ensure that the high pressure fuel pipe, and fuel pump fittings are clean and dry prior to assembly.

2. Fuel Feed Front Pipe Bracket Bolt (1) - Install and tighten 10 N.m (89 lb in)



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

3. Fuel Feed Pipe-Engine to Tank (1) @ Fuel Feed Pipe-Engine (3) - Connect - [Fuel Feed Pipe Replacement \(Engine\)](#), or [Fuel Feed Pipe Replacement \(Engine to Tank\)](#).
4. Inspect for leaks using the following procedure:
 1. Turn ON the ignition with the engine OFF for 2 seconds.
 2. Turn OFF the ignition for 10 seconds.
 3. Turn ON the ignition with the engine OFF.
 4. Inspect for fuel leaks.
5. Engine Rear Noise Shield - Install - [Engine Rear Noise Shield Replacement](#)

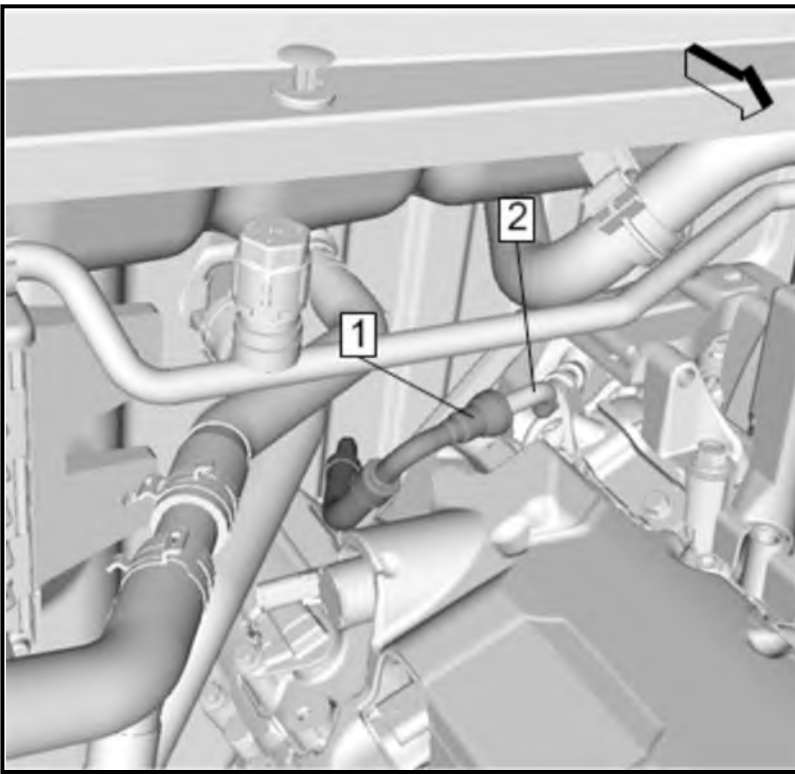
FUEL FEED PIPE REPLACEMENT (ENGINE TO TANK)

Removal Procedure

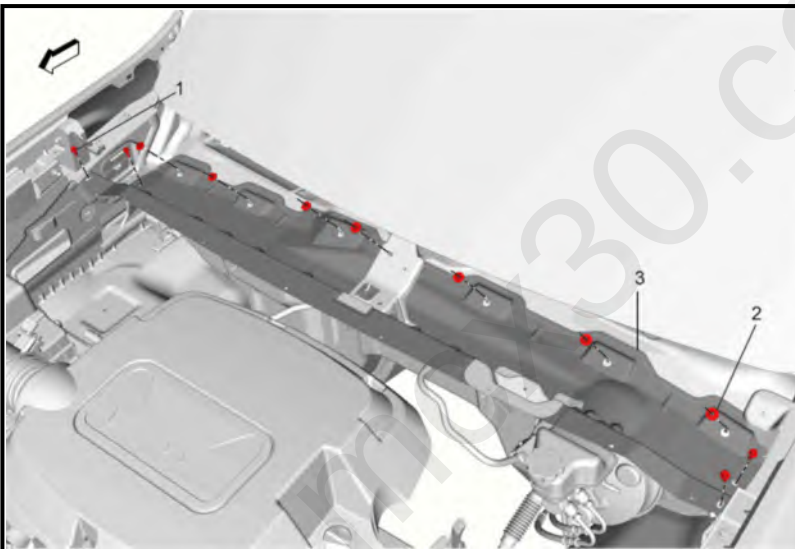
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

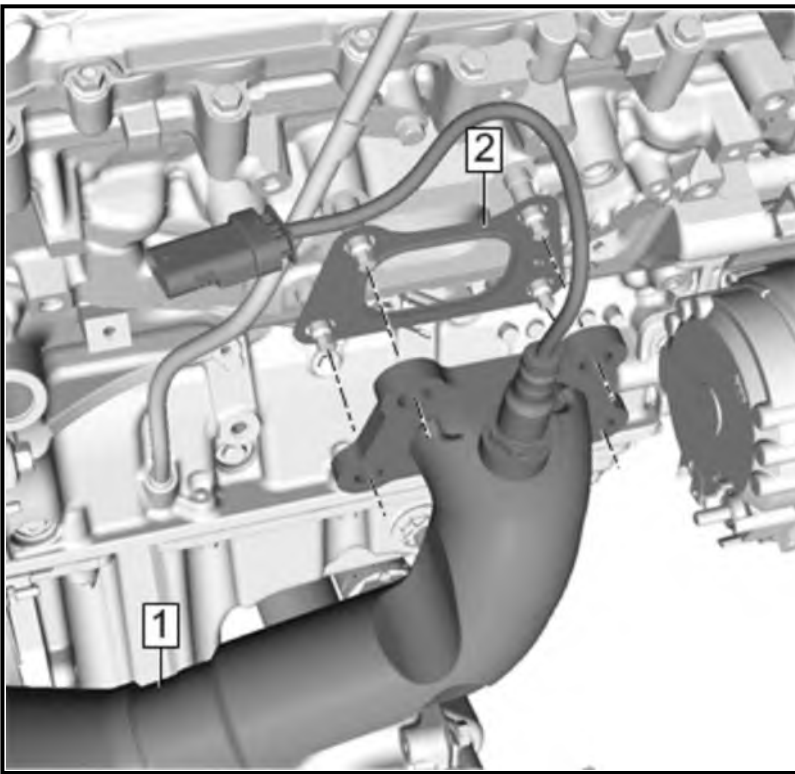
1. Air Cleaner Outlet Duct - Remove - [Air Cleaner Outlet Duct Replacement](#)
2. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
3. Fuel Feed Pipe (1) @ Fuel Feed Pipe (2) - Disconnect - [Metal Collar Quick Connect Fitting Service](#)



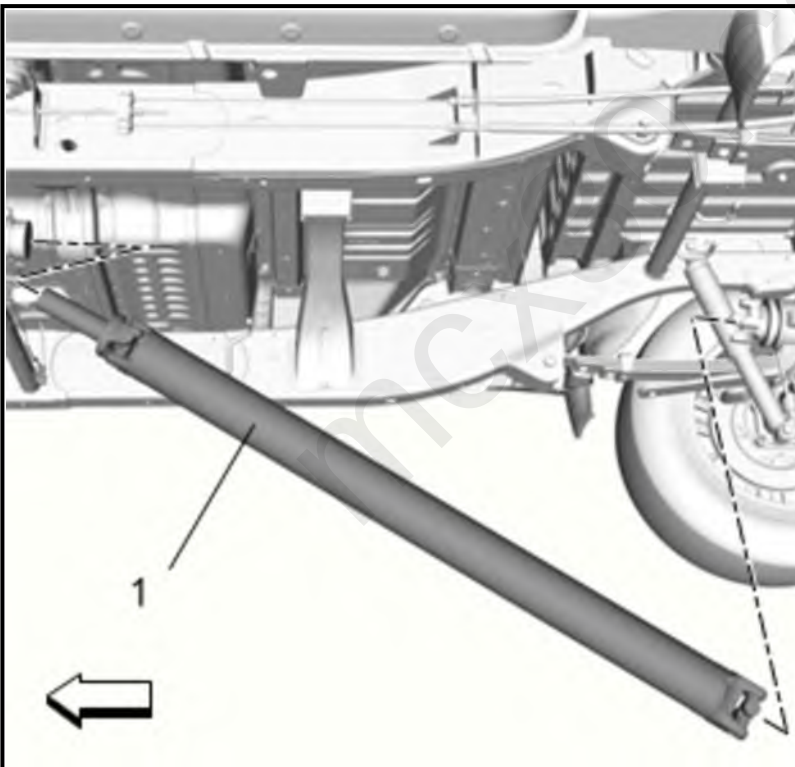
4. Plenum Front Panel (3) - Remove - [Plenum Front Panel Replacement](#)



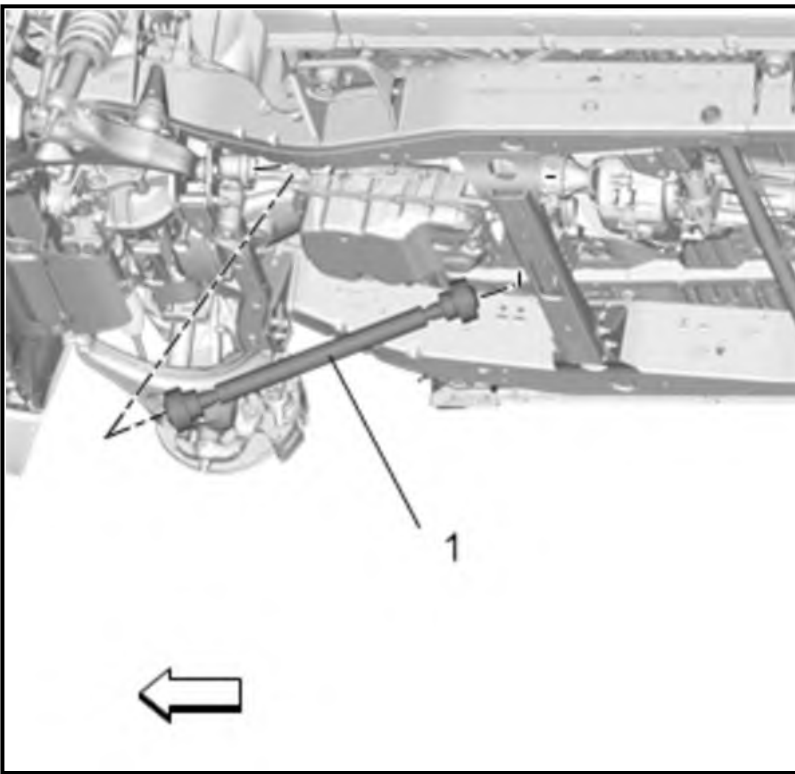
5. Warm Up Three-Way Catalytic Converter - Right Side (1) - Remove - [Warm Up Three-Way Catalytic Converter Replacement \(Right Side, LGZ\)](#) , or [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 2WD\)](#) , or [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 4WD\)](#)



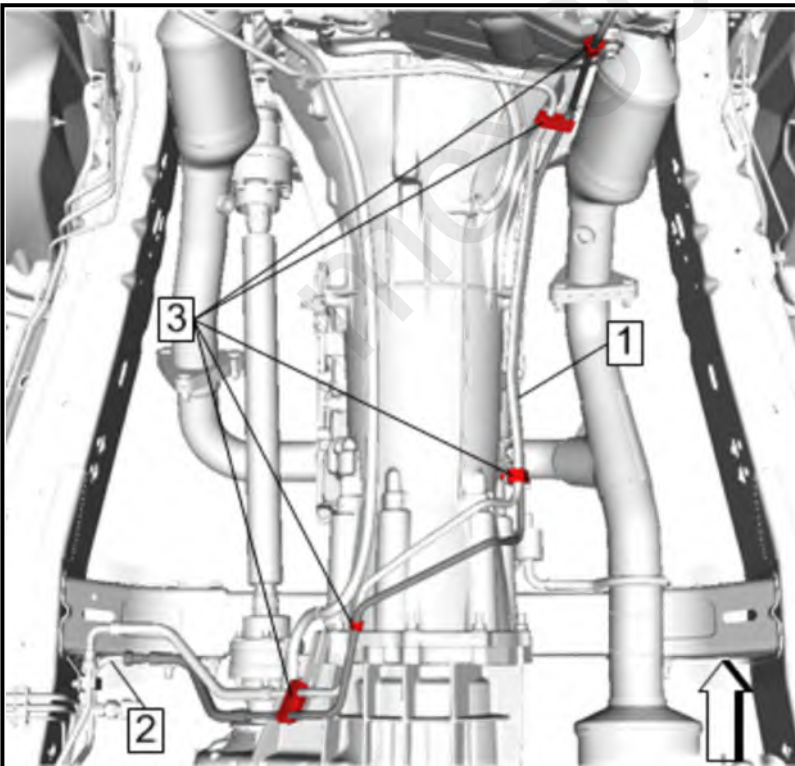
6. Propeller Shaft (1) - Remove - [Propeller Shaft Replacement \(M5T with 2WD\)](#) , or [Propeller Shaft Replacement \(M5T with 4WD\)](#).



7. {If equipped} Front Propeller Shaft (1) - Remove - [Front Axle Propeller Shaft Replacement \(Without Bison\)](#) , or [Front Axle Propeller Shaft Replacement \(With Bison\)](#).



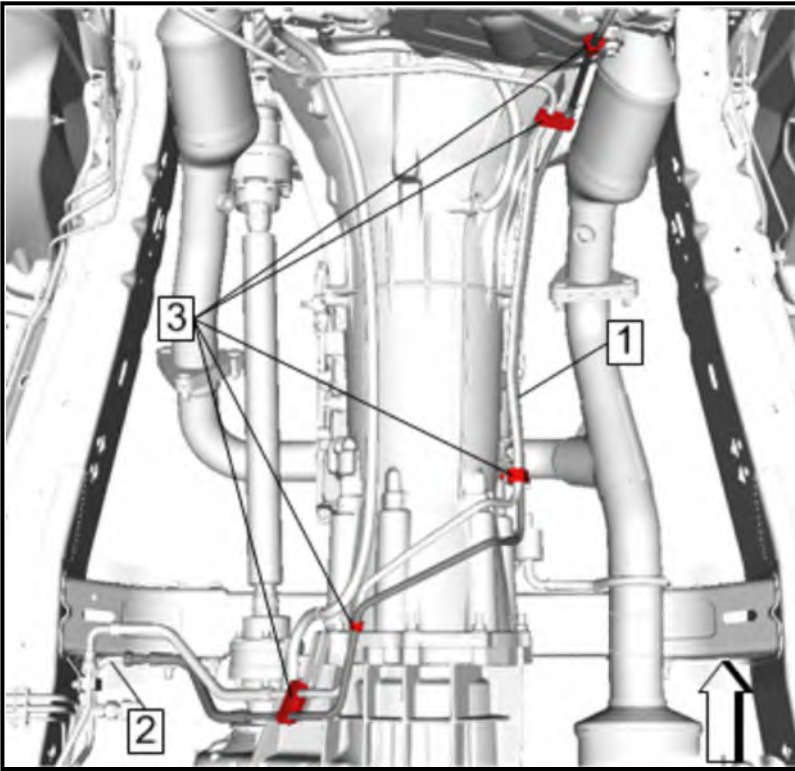
8. Transmission Support Crossmember - Remove - [Transmission Support Crossmember Replacement \(4 Wheel Drive\)](#) , or [Transmission Support Crossmember Replacement \(2 Wheel Drive\)](#).
9. Using the transmission jack, lower the rear of the transmission enough for access to remove the fuel feed pipe.
10. Fuel Feed Pipe (1) @ Fuel Feed Rear Pipe (2) - Disconnect - [Metal Collar Quick Connect Fitting Service](#)



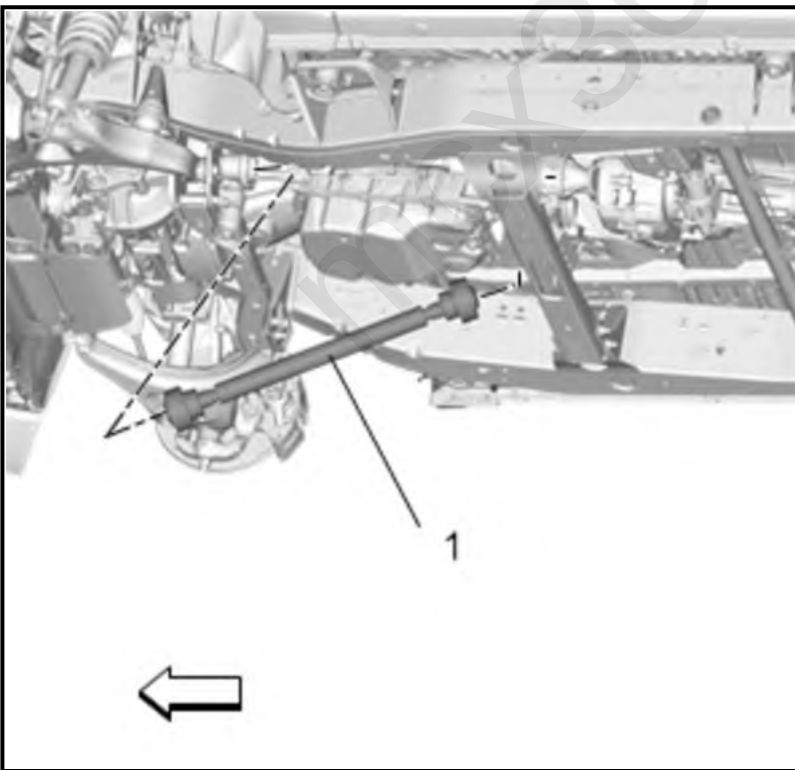
11. Fuel Feed Pipe (1) @ Retainer (3) - Remove [5x]

Installation Procedure

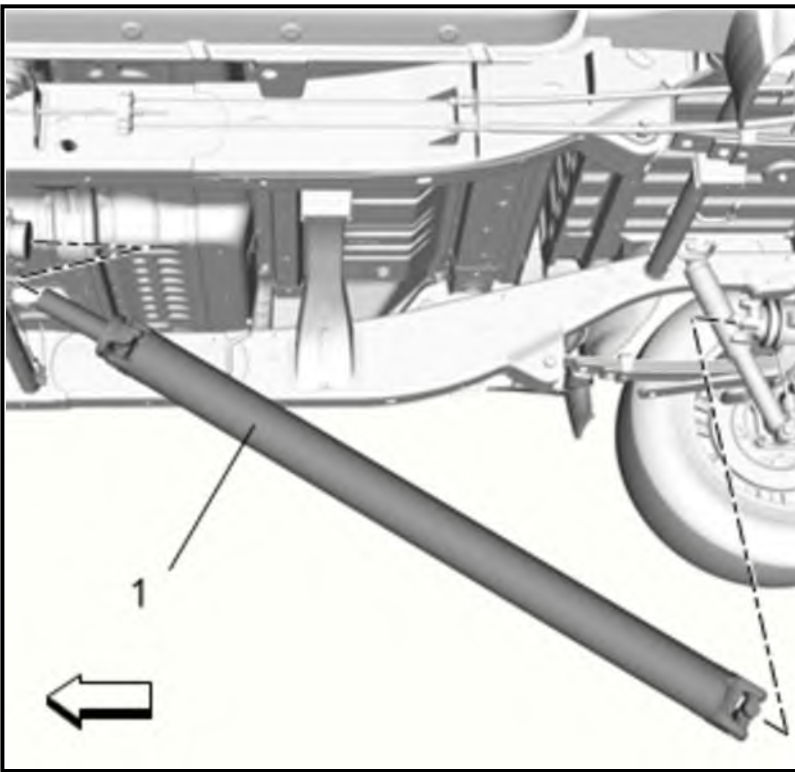
1. Fuel Feed Pipe (1) @ Retainer (3) - Install [5x]



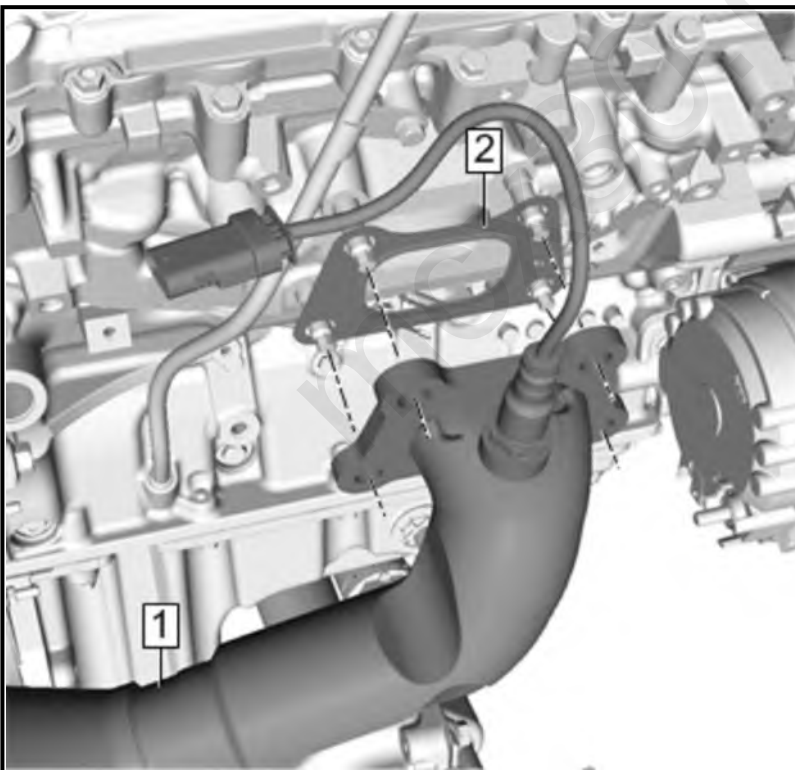
2. Fuel Feed Pipe (1) @ Fuel Feed Rear Pipe (2) - Connect - [Metal Collar Quick Connect Fitting Service](#)
3. Using the transmission jack, raise the rear of the transmission into place.
4. Transmission Support Crossmember - Install - [Transmission Support Crossmember Replacement \(4 Wheel Drive\)](#), or [Transmission Support Crossmember Replacement \(2 Wheel Drive\)](#).
5. {If equipped} Front Propeller Shaft (1) - Install - [Front Axle Propeller Shaft Replacement \(Without Bison\)](#), or [Front Axle Propeller Shaft Replacement \(With Bison\)](#).



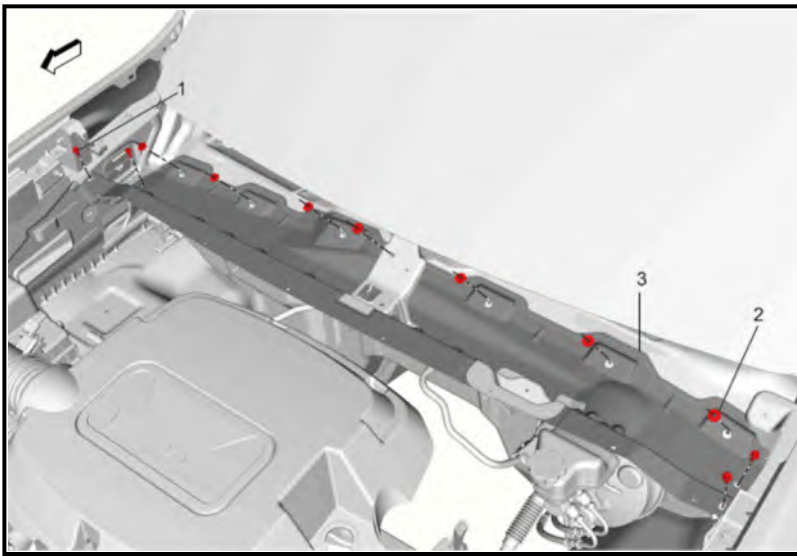
6. Propeller Shaft (1) - Install - [Propeller Shaft Replacement \(M5T with 2WD\)](#), or [Propeller Shaft Replacement \(M5T with 4WD\)](#).



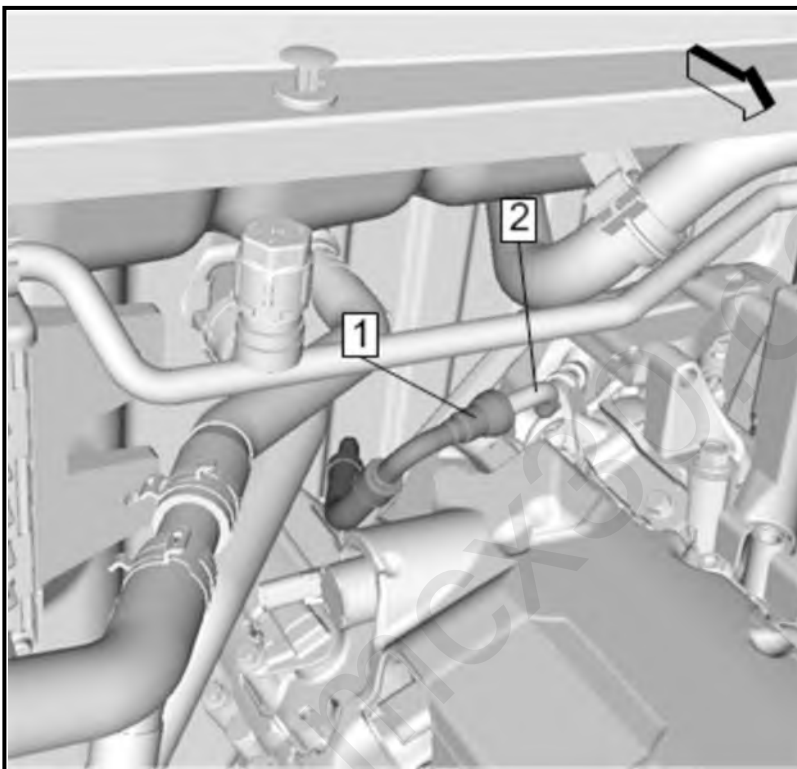
7. Warm Up Three-Way Catalytic Converter - Right Side (1) - Install - [Warm Up Three-Way Catalytic Converter Replacement \(Right Side, LGZ\)](#) , or [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 2WD\)](#) , or [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 4WD\)](#)



8. Plenum Front Panel (3) - Install - [Plenum Front Panel Replacement](#)



9. Fuel Feed Pipe (1) @ Fuel Feed Pipe (2) - Connect - [Metal Collar Quick Connect Fitting Service](#)



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

FUEL SYSTEM CLEANING

NOTE: When flushing the fuel tank, treat the fuel and water mixture as a hazardous material. Handle the material in accordance with all local, state and federal laws and regulations.

NOTE: Whenever the fuel tank is cleaned, inspect the fuel pump fuel strainer. If the fuel pump fuel strainer is contaminated, replace the fuel pump fuel strainer and inspect the fuel pump.

NOTE: Always maintain cleanliness when servicing fuel system components.

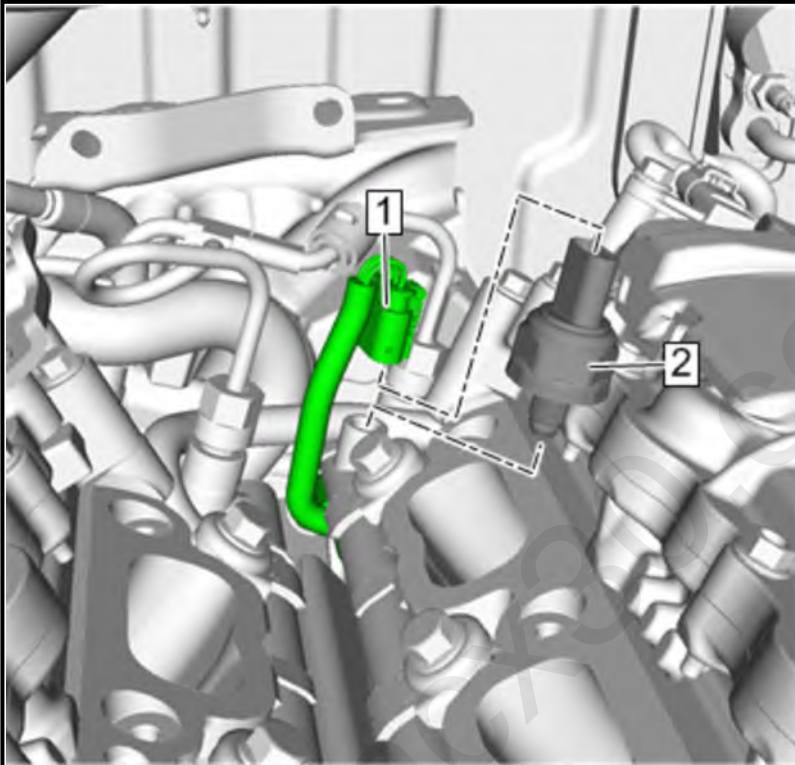
1. Remove the fuel tank fuel pump module. Refer to [Fuel Tank Fuel Pump Module Replacement](#).
2. Inspect the fuel pump inlet for dirt and debris. If dirt and debris are found, replace the fuel pump.
3. Flush fuel tank with hot water.

4. Pour the water out of the fuel sender assembly opening in the fuel tank. Rock the fuel tank in order to ensure that the removal of the water from the fuel tank is complete.
5. Allow tank to dry completely before reassembly.
6. Install the fuel tank fuel pump module. Refer to [Fuel Tank Fuel Pump Module Replacement](#).

FUEL PRESSURE SENSOR REPLACEMENT - FUEL INJECTION FUEL RAIL

Removal Procedure

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Fuel Injection Fuel Rail Noise Shield - Remove - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#), or [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#).
3. Electrical Connector (1) @ Fuel Injection Fuel Rail Fuel Pressure Sensor (2) - Disconnect



CAUTION: Refer to [Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Caution](#) .

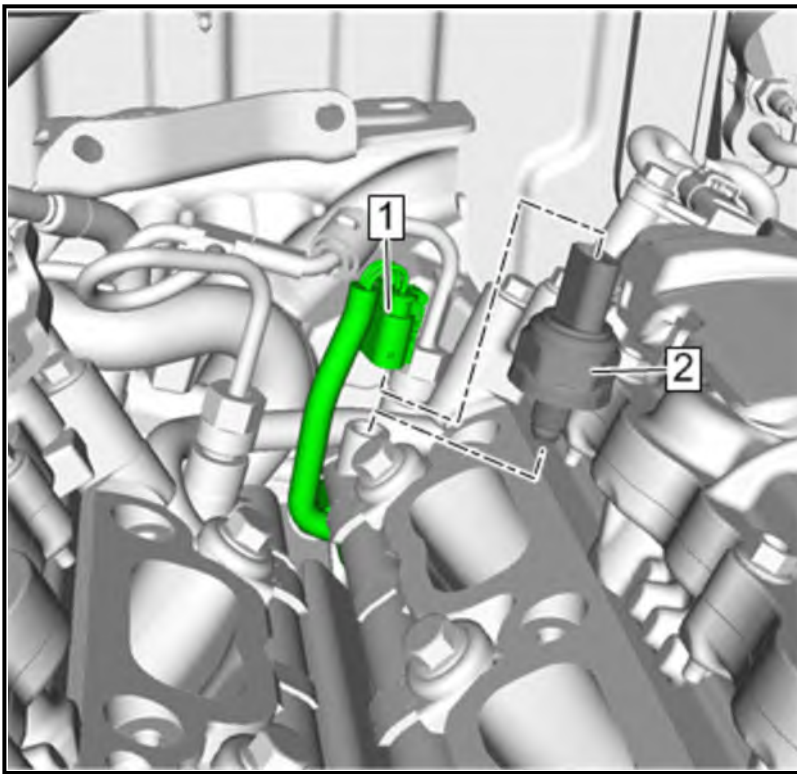
NOTE: Applying force to the plastic housing of the sensor may damage the sensor. To tighten or loosen, apply force only to the attached hexagon.

NOTE: Some fuel may leak from the fuel injection fuel rail fuel pressure sensor orifice after the sensor is removed. Dry the area around this orifice after the removal of the sensor using a lint free cloth and inspect the fuel injection fuel rail fuel pressure sensor sealing surface. The surface should be free of fuel, debris, and burrs.

4. Fuel Injection Fuel Rail Fuel Pressure Sensor (2) - Remove and DISCARD

Installation Procedure

1. Lubricate the threads and sealing surface of the NEW fuel injection fuel rail fuel pressure sensor with one drop of clean engine oil.



NOTE: Applying force to the plastic housing of the sensor may damage the sensor. To tighten or loosen, apply force only to the attached hexagon.

NOTE: Ensure the fuel rail threads are clean and free of any excess fuel, or the fuel injection fuel rail fuel pressure sensor will NOT seal properly.

2. Install the NEW fuel injection fuel rail fuel pressure sensor (2) and hand tighten.
3. Fuel Injection Fuel Rail Fuel Pressure Sensor (2) - Remove and re-lubricate with one drop of clean engine oil.

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

4. Fuel Injection Fuel Rail Fuel Pressure Sensor (2) - Install and tighten 33 N.m (24 lb ft)
5. Electrical Connector (1) @ Fuel Injection Fuel Rail Fuel Pressure Sensor (2) - Connect

NOTE: If a fuel leak occurs at the fuel rail, the fuel rail will need to be replaced.

6. Pressurize the fuel system and inspect for leaks.
7. Fuel Injection Fuel Rail Noise Shield - Install - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#), or [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#).

FUEL INJECTION FUEL RAIL ASSEMBLY REPLACEMENT - BANK 1

Special Tools

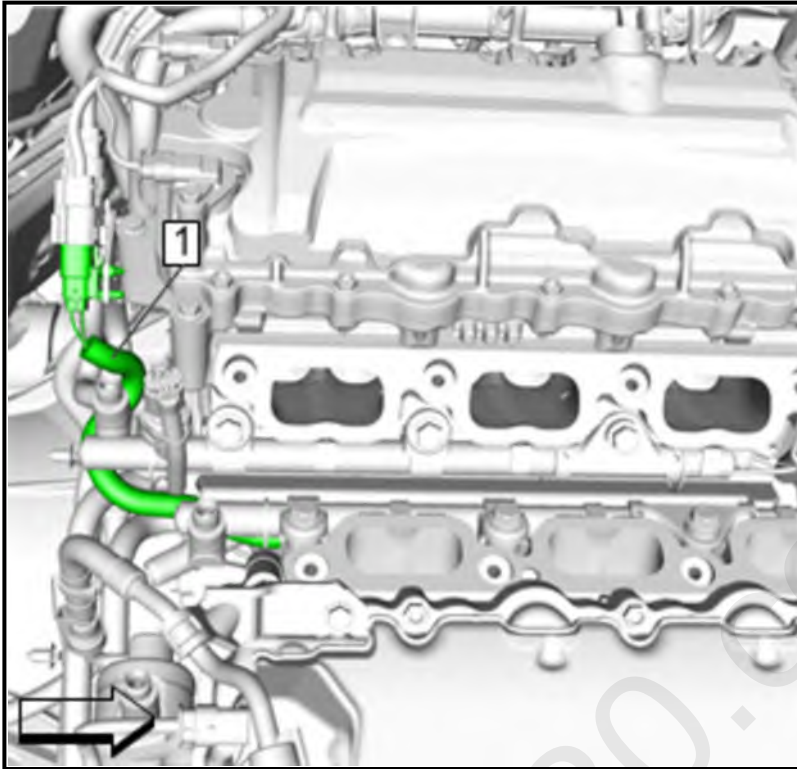
- EN-49245 Injector Seal Installer Kit
- EN-49248 Injector Rail Assembly Remover
- EN-49248-3 Injector Rail Assembly Remover Curved Hook

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

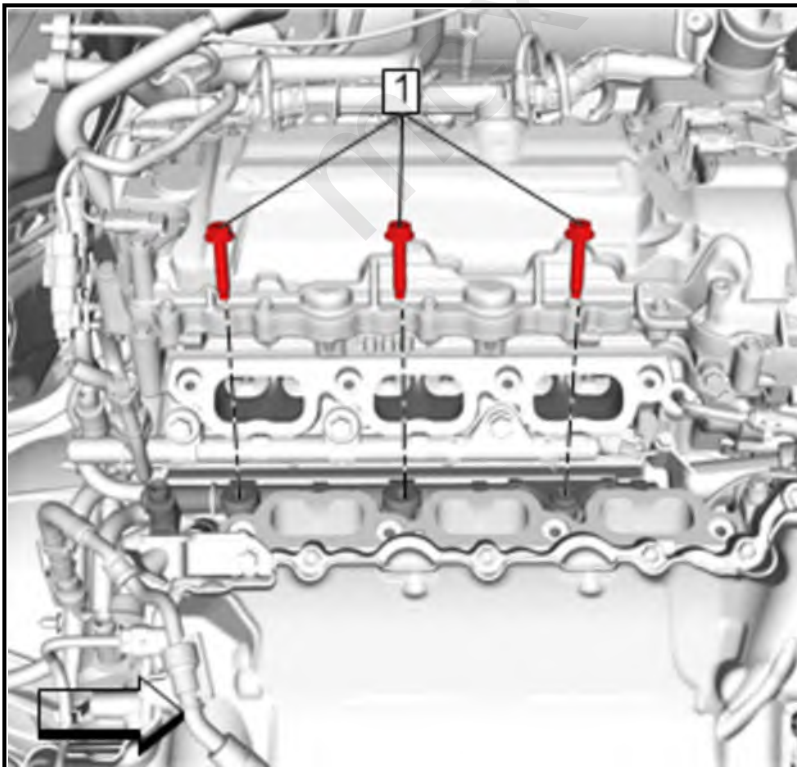
Removal Procedure

NOTE: High pressure fuel feed pipes are one time use only. ALWAYS install a NEW high pressure fuel feed pipe if the pipe is removed OR the fittings are loosened.

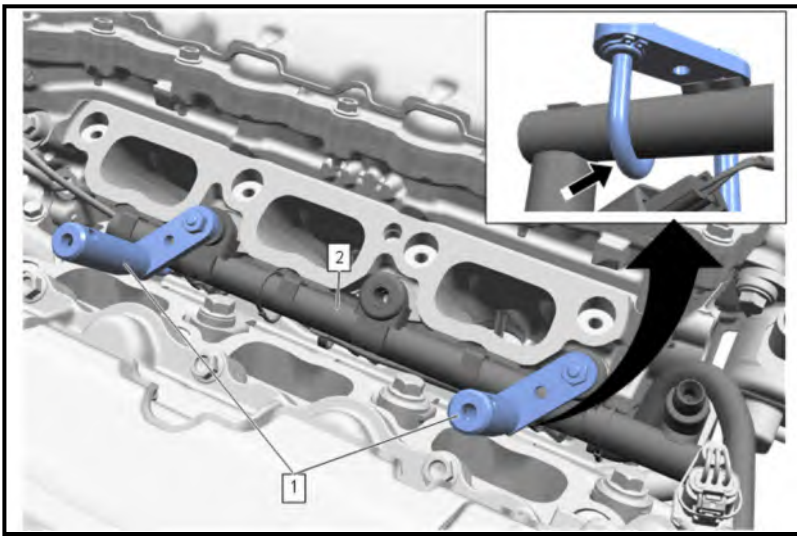
1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Fuel Injection Fuel Rail Noise Shield- Upper - Remove - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#), or [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#)
3. Engine Rear Noise Shield - Remove - [Engine Rear Noise Shield Replacement](#)
4. Fuel Feed Intermediate Pipe - Remove and DISCARD - [Fuel Feed Intermediate Pipe Replacement](#)
5. Electrical Connector (1) - Disconnect



6. Fuel Injection Fuel Rail Fastener (1) - Remove [3x]



7. Install the **EN-49248** remover components (1) and slowly work the fuel injection fuel rail (2) upwards in small, even increments. Use suitable tool to rotate **EN-49248 - 3** remover hooks.



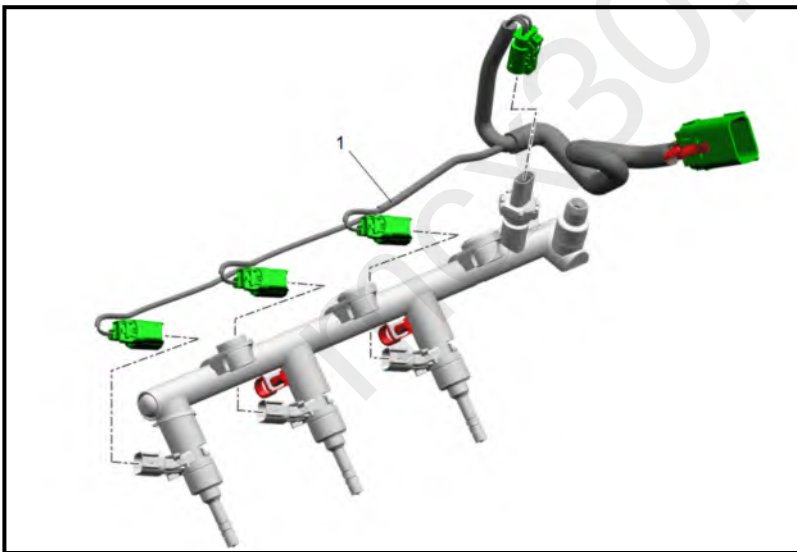
NOTE: If tool EN-49248 - 3 remover hooks still has roll pin T-handle installed, remove with suitable tool.

NOTE: The EN-49248 - 3 remover hooks **MUST** be properly seated on the underside of the fuel injection fuel rail. The flat EN-49248 - 4 remover hooks will **NOT** work for this application.

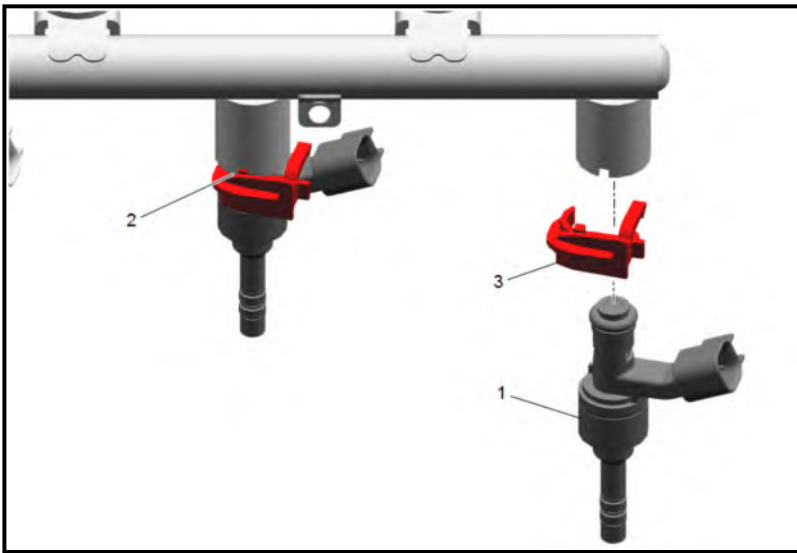
8. Once the fuel injection fuel rail (2) is free, remove the **EN-49248** remover components (1).

Cleaning Procedure

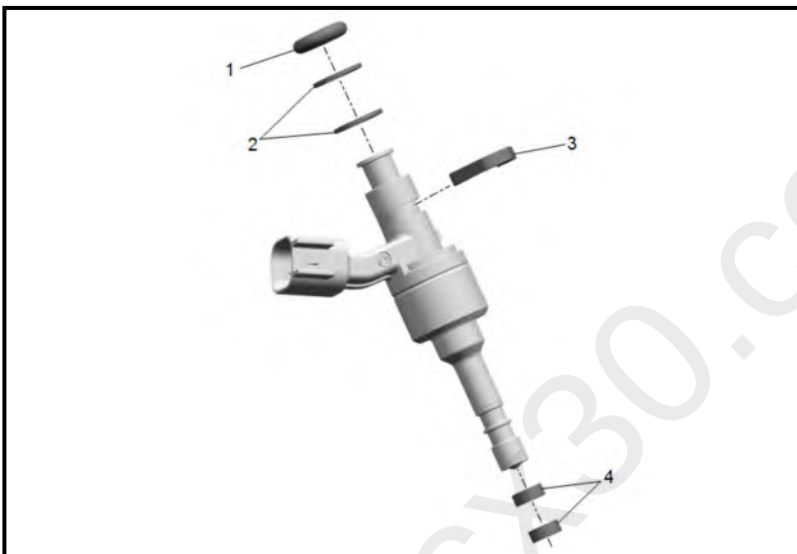
1. Fuel Injector Wiring Harness (1) - Disconnect



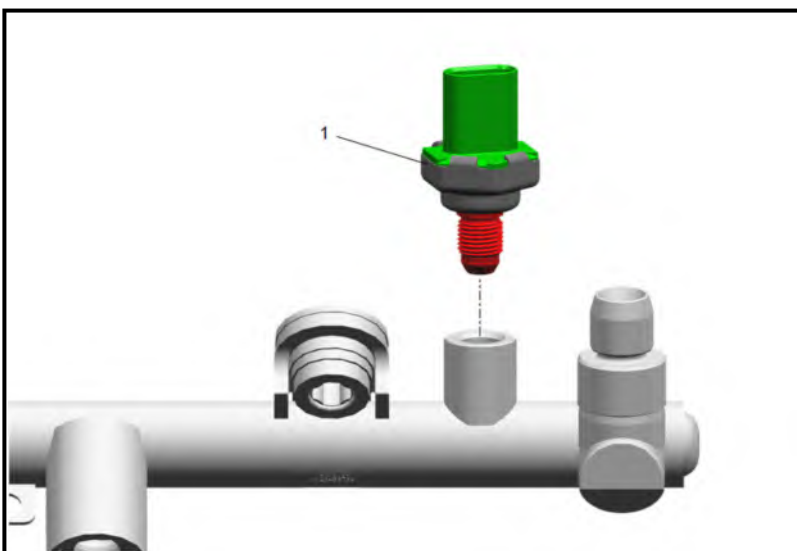
2. Taking care not to touch or apply force to the injector tip or electrical connector, remove the fuel injector (1) by pressing down on the retainer lever to release the tab (2) and simultaneously rotating the injector 45 degrees and pulling straight out from the fuel rail.



3. Remove and DISCARD the fuel injector retainer (3) from the fuel injector.
4. Using pliers, remove and DISCARD the fuel injector bushing (3) straight out from injector body.



5. Remove and DISCARD the fuel injector O-ring (1) and plastic spacers (2).
6. Fuel Injector Seal (4) - Remove and DISCARD (x2).
7. Fuel Pressure Sensor (1) - Remove



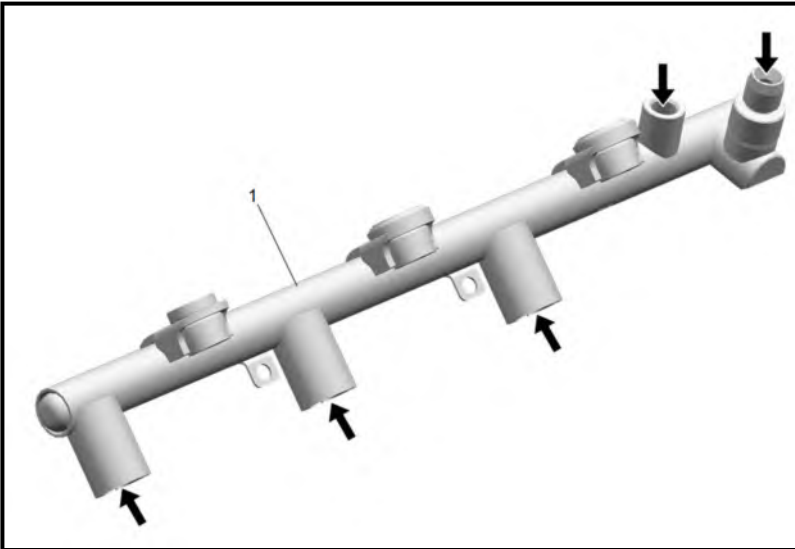
NOTE: Applying force to the plastic housing of the sensor will destroy the sensor. To tighten or loosen, only apply force to the attached hexagon.

NOTE: Do not soak or submerge the fuel rail or injectors in solvent.

8. Clean the exterior of the fuel rail and injectors with solvent.

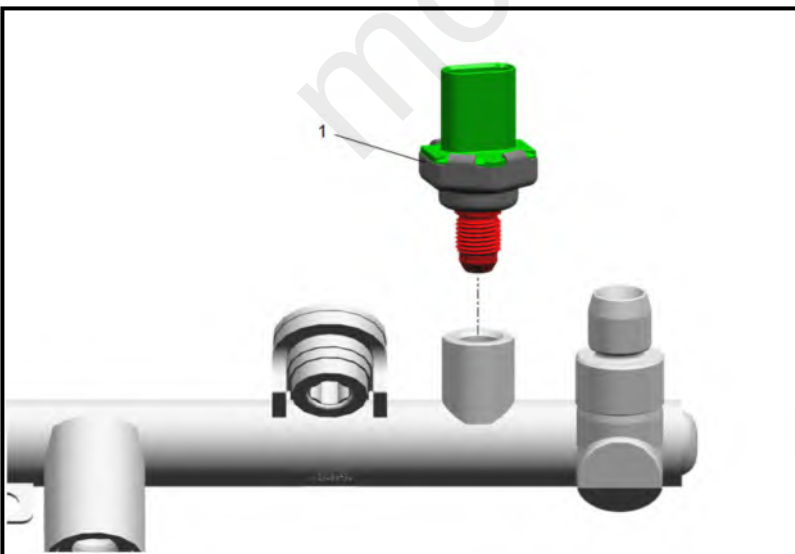
Inspection Procedure

1. Inspect the fuel rail (1) and components for the following conditions:



- Damage, debris or restrictions to the fuel rail
- Damage, debris or restrictions to the fuel ports in the fuel rail
- Damage to the mounting area for the fuel rail
- Damage to the fuel rail mounting bolts or mounting bolt grommets/isolators
- Damage to the threads on the fuel rail feed fitting
- Damage to the threads in the fuel pressure sensor bore
- Damage to the fuel pressure sensor connector, threads, or sealing face

2. Install the fuel pressure sensor (1).



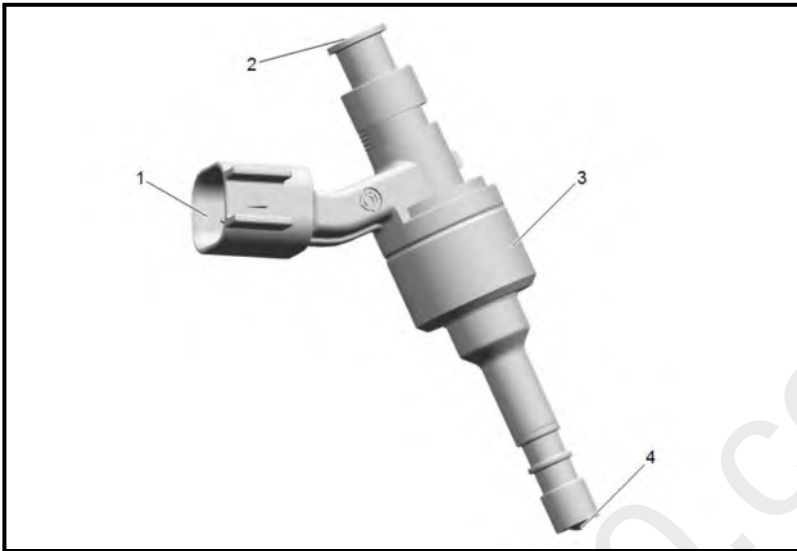
NOTE: Applying force to the plastic housing of the sensor will destroy the sensor. To tighten or loosen, only apply force to the attached hexagon.

NOTE: Ensure that the fuel rail threads have been cleaned of any excess fuel or the fuel pressure sensor will NOT seal properly.

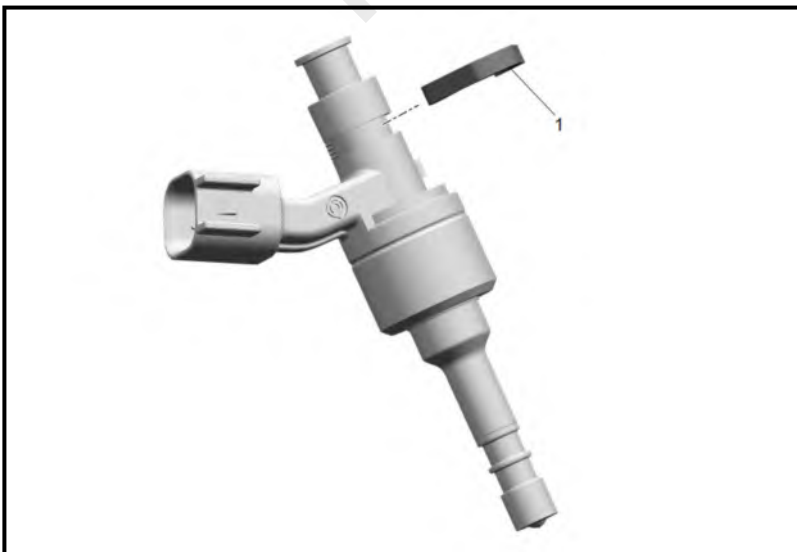
1. Lubricate the threads and the sealing area in the fuel rail with silicon free engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)
2. Lubricate the threads and the sealing area on the fuel pressure sensor with silicon free engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)
3. Fuel Pressure Sensor (1) - Install and hand tighten
4. Fuel Pressure Sensor (1) - remove and re-lubricate.

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

5. Fuel Pressure Sensor (1) - Install and tighten 33 N.m (25 lb ft).
3. Inspect the fuel injectors for the following conditions:

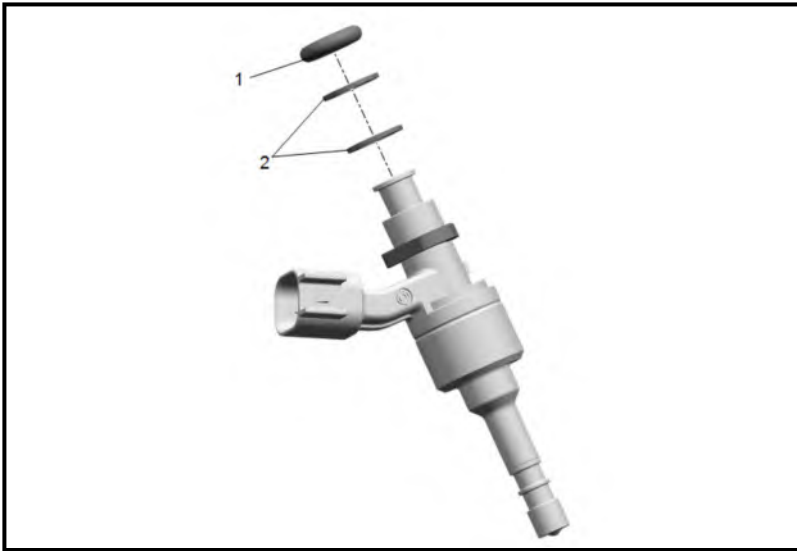


- Damage to the fuel injector connector (1)
 - Damage to the fuel inlet cone (2)
 - Damage to the fuel injector body (3)
 - Damage to the fuel injector tip (4)
4. Replace the fuel rail or injector if any damage is found. Do not attempt to repair a fuel rail or injector.
 5. Install NEW fuel injector bushing (1) onto injector body. Bushing should seat with a distinct "snap" sound and feel. Ensure bushing is fully seated.



NOTE: The fuel injector bushing (1) is to be installed BEFORE O-ring or backup rings are installed.

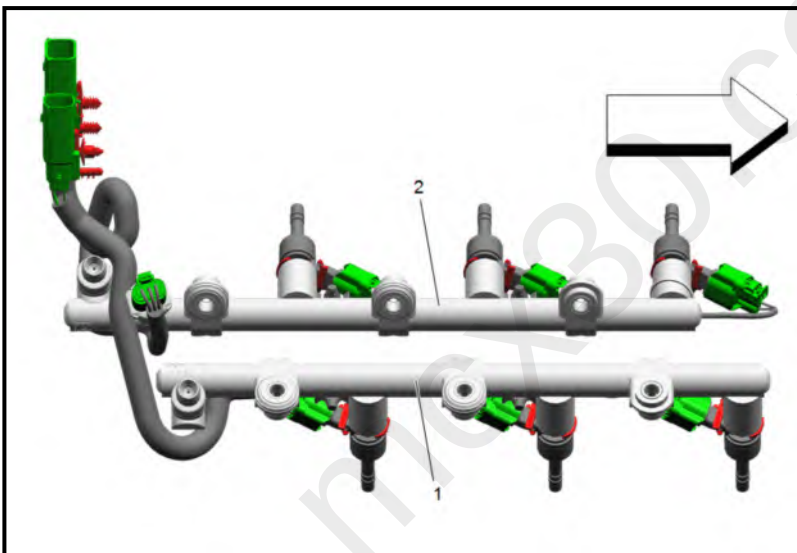
6. Install a NEW white plastic spacer (3) on the fuel injector first.



7. Install a NEW brown plastic spacer (2) second.

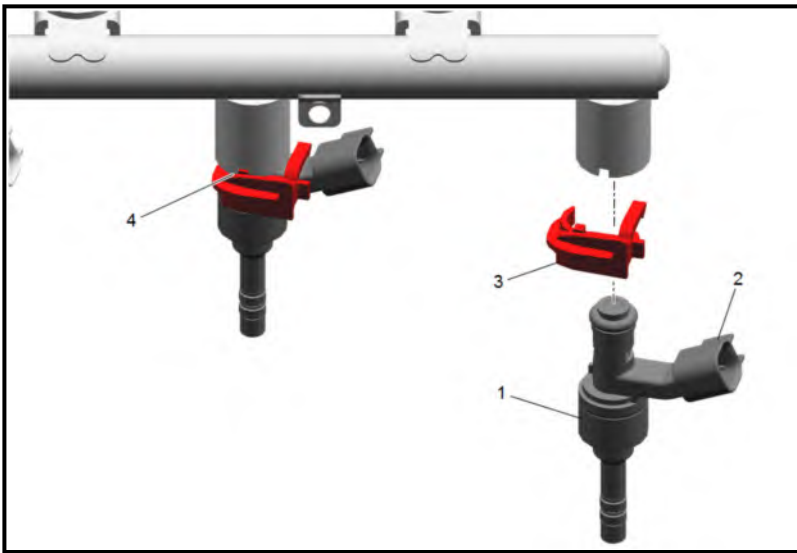
8. Lubricate the NEW O-ring (1) with one drop of clean engine oil.

9. The right side (bank 1) fuel injector wiring harness connectors (1) should point to the rear of the engine.
The left side (bank 2) fuel injector wiring harness connectors (2) should point to the front of the engine.

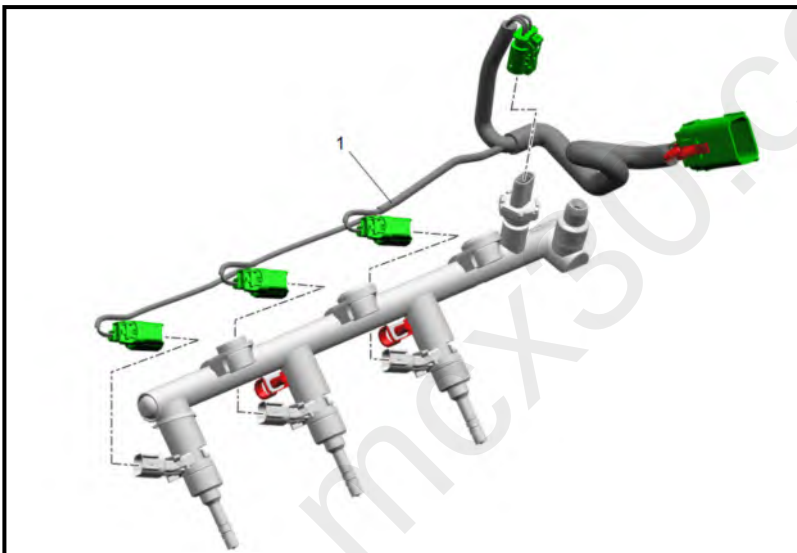


CAUTION: Ensure the fuel injectors are installed in the correct orientation. Improper orientation of the fuel injectors may result in engine misfire and possible engine damage.

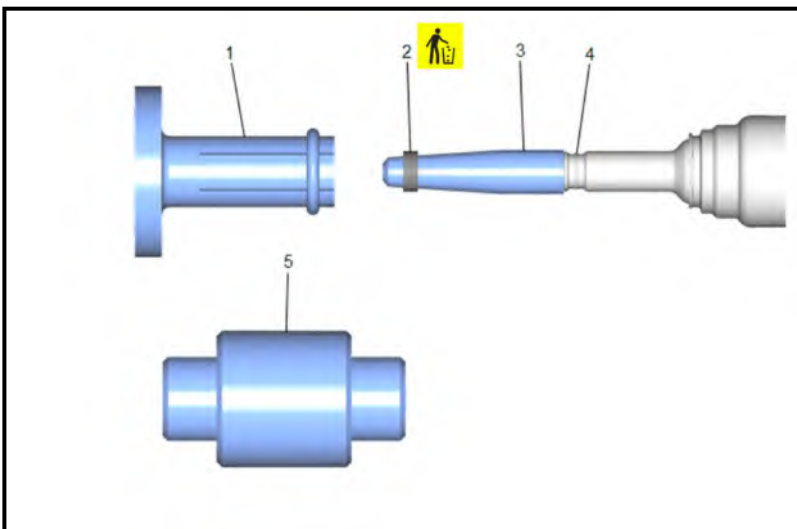
10. Install NEW fuel injector retainer (3) onto the fuel injector.



11. Holding the largest diameter/body of the injector only, indicated by arrow in graphic, insert the injector assembly (1) into the fuel rail. Ensure correct orientation of the electrical connector (2).
12. Rotate the fuel injector approximately 45 degrees until the tab on the retainer (4) locks into the notch on the fuel rail.
13. Repeat for remaining injectors until all are installed and retained in fuel rail.
14. Fuel Injector Wiring Harness (1) - Install



15. Install **EN 49245-1** long protector (3) onto the fuel injector tip, covering the first recessed area closest to the tip. Place a **NEW** seal (2) on **EN-49245-1** long protector.



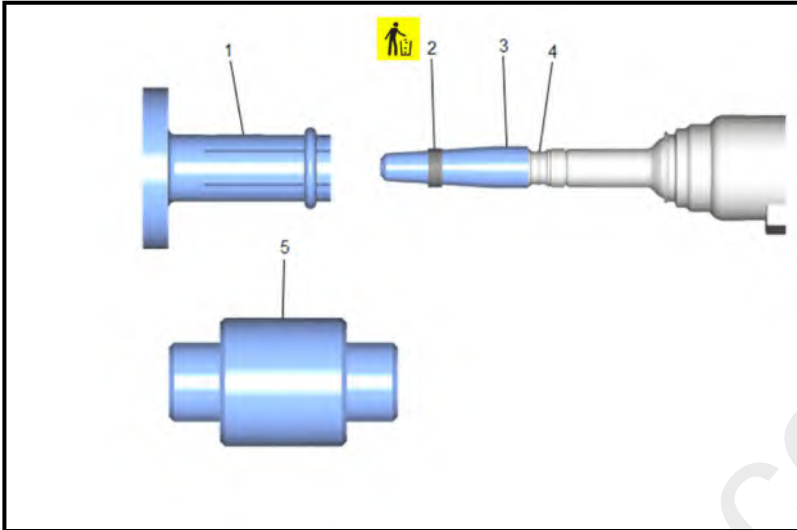
NOTE: Do not use any type of lubricant when installing the NEW seals (2) on the fuel injector tip.

16. Using EN-49245-3 pusher (1), install the seal into the second recessed area (4) of the fuel injector.

NOTE: The EN-49245-4 sizer is two sided, and either direction will size the seal correctly.

17. Compress the seal with your fingers, then resize the seal using the EN-49245-4 sizer (5).

18. Install EN-49245-2 short protector (3) onto the fuel injector tip. Place a NEW seal (2) on EN-49245-2 short protector.



NOTE: Do not use any type of lubricant when installing the NEW seals (2) on the fuel injector tip.

19. Using EN-49245-3 pusher (1), install the seal into the first recessed area (4) of the fuel injector.

NOTE: The EN-49245-4 sizer is two sided, and either direction will size the seal correctly.

20. Compress the seal with your fingers, then resize the seal using the EN-49245-4 sizer (5).

Installation Procedure

1. Position the fuel injection fuel rail assembly into the cylinder head as evenly as possible.
2. To install the fuel injection fuel rail bolts, perform the following steps:

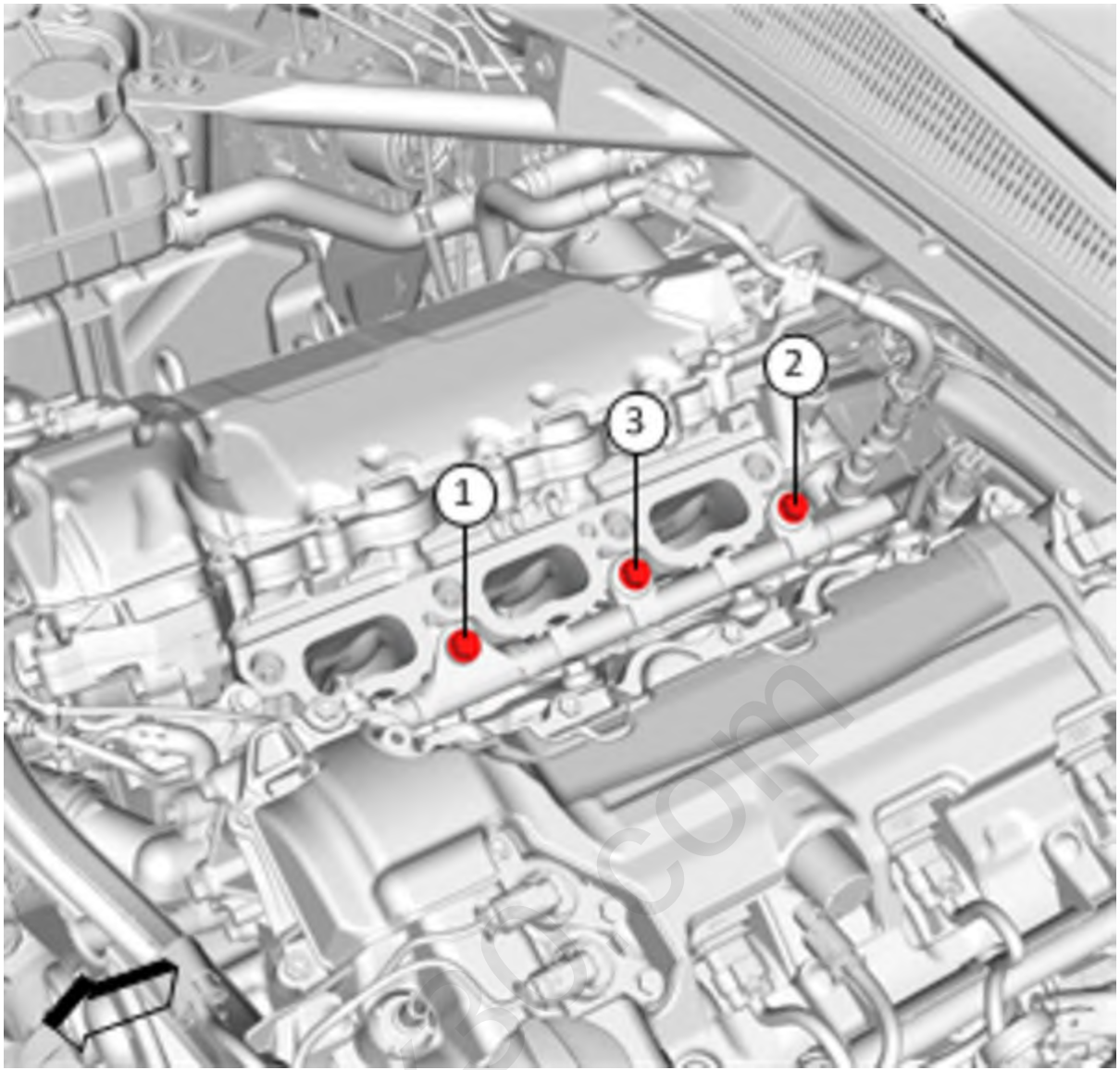
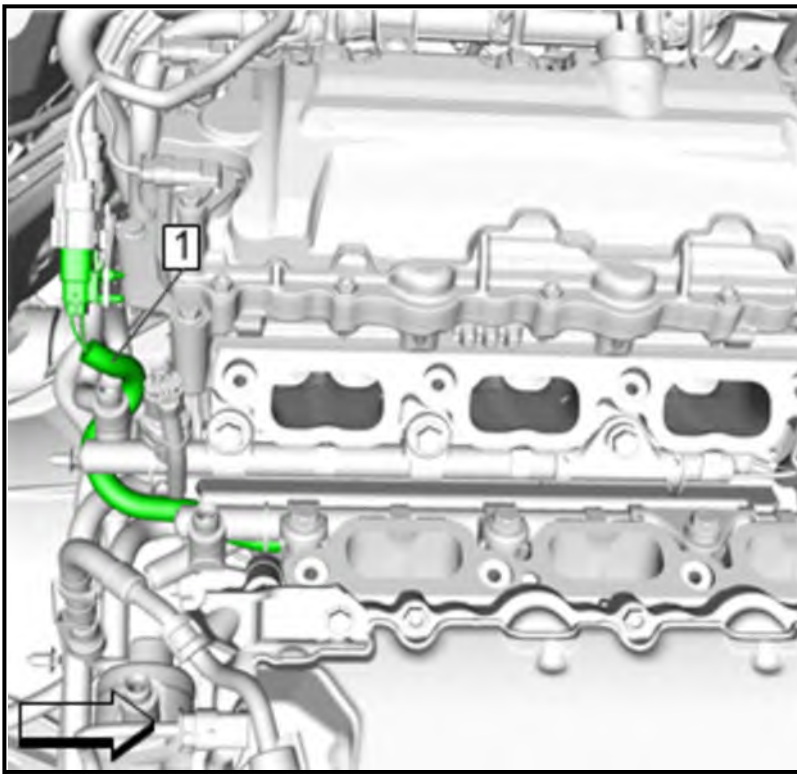


Fig. 1: Fuel Injection Fuel Rail Bolts Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

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

NOTE: The final pass should be performed in the sequence shown in the graphic.

1. First Pass: Start ALL bolts by hand, but do NOT tighten.
 2. Second Pass: Tighten the outer two bolts by hand.
 3. Third Pass: Tighten the inner bolt by hand.
 4. Final Pass: 25 N.m (18 lb ft)
3. Fuel Feed Intermediate Pipe - Install NEW - [Fuel Feed Intermediate Pipe Replacement](#)
 4. Electrical Connector (1) - Connect



5. Inspect for leaks using the following procedure:

1. Turn ON the ignition with the engine OFF for 2 seconds.
2. Turn OFF the ignition for 10 seconds.
3. Turn ON the ignition with the engine OFF.
4. Inspect for fuel leaks.

6. Engine Rear Noise Shield - Install - [Engine Rear Noise Shield Replacement](#)

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

FUEL INJECTION FUEL RAIL ASSEMBLY REPLACEMENT - BANK 2

Special Tools

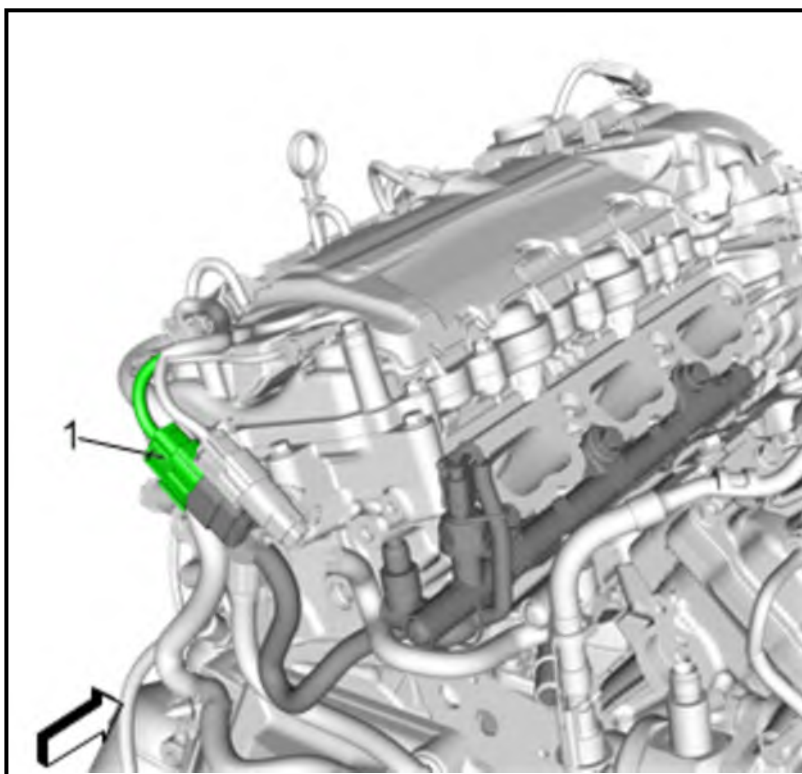
- EN-49245 Injector Seal Installer Kit
- EN-49248 Injector Rail Assembly Remover
- EN-49248-3 Injector Rail Assembly Remover Curved Hook

Equivalent regional tools: [Special Tools \(Mechanical Tools\)](#)

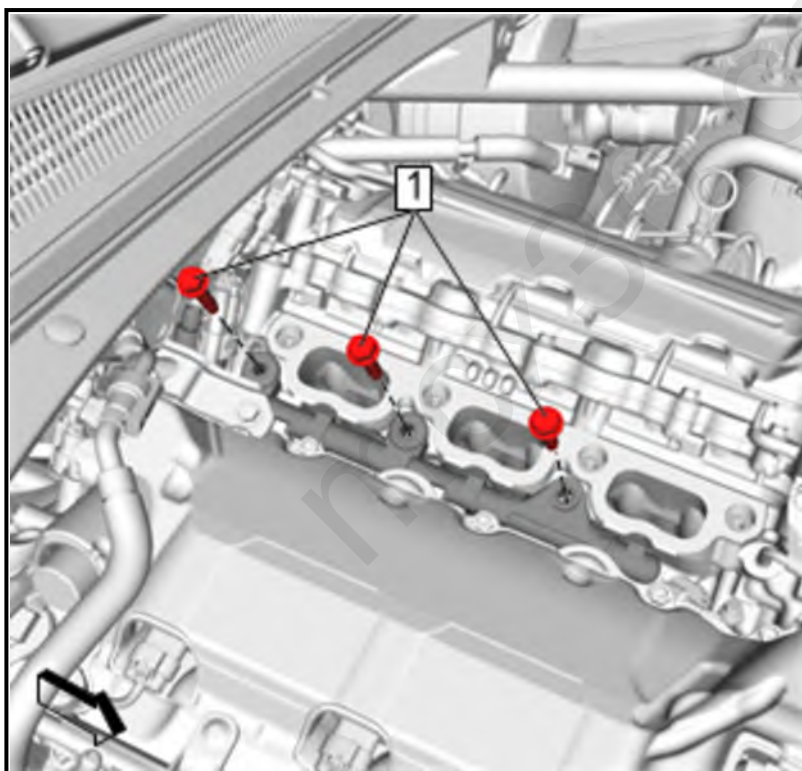
Removal Procedure

NOTE: High pressure fuel feed pipes are one time use only. ALWAYS install a NEW high pressure fuel feed pipe if the pipe is removed OR the fittings are loosened.

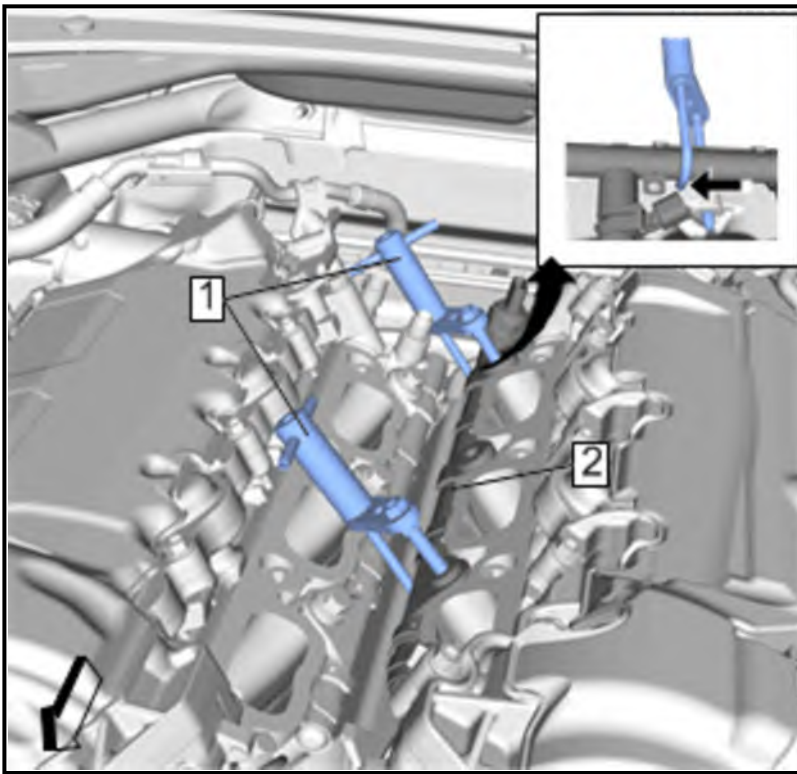
1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Fuel Injection Fuel Rail Noise Shield- Upper - Remove - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#), or [Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#)
3. Engine Rear Noise Shield - Remove - [Engine Rear Noise Shield Replacement](#)
4. Fuel Feed Intermediate Pipe - Remove and DISCARD - [Fuel Feed Intermediate Pipe Replacement](#)
5. Electrical Connector (1) - Disconnect



6. Fuel Injection Fuel Rail Fastener (1) - Remove [3x]



7. Install the **EN-49248** remover components (1) and slowly work the fuel injection fuel rail (2) upwards in small, even increments.

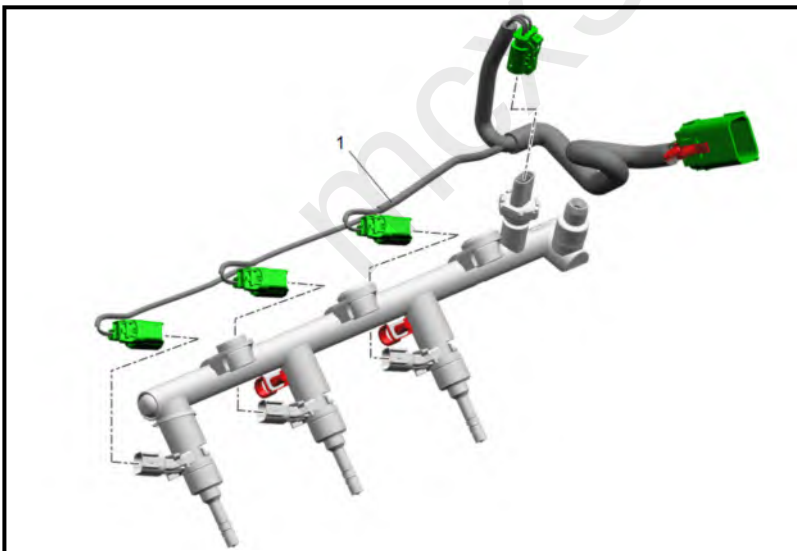


NOTE: The EN-49248 - 3 remover hooks **MUST** be properly seated on the underside of the fuel injection fuel rail. The flat EN-49248 - 4 remover hooks will **NOT** work for this application.

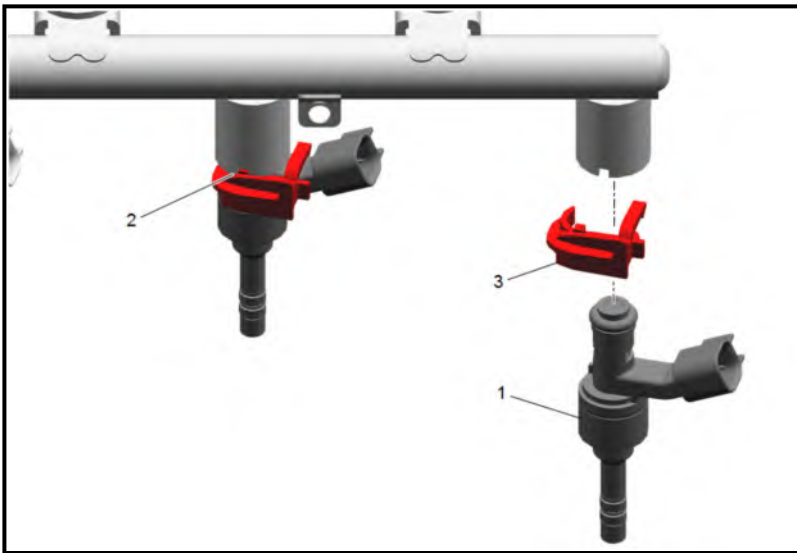
8. Once the fuel injection fuel rail (2) is free, remove the **EN-49248** remover components (1).

Cleaning Procedure

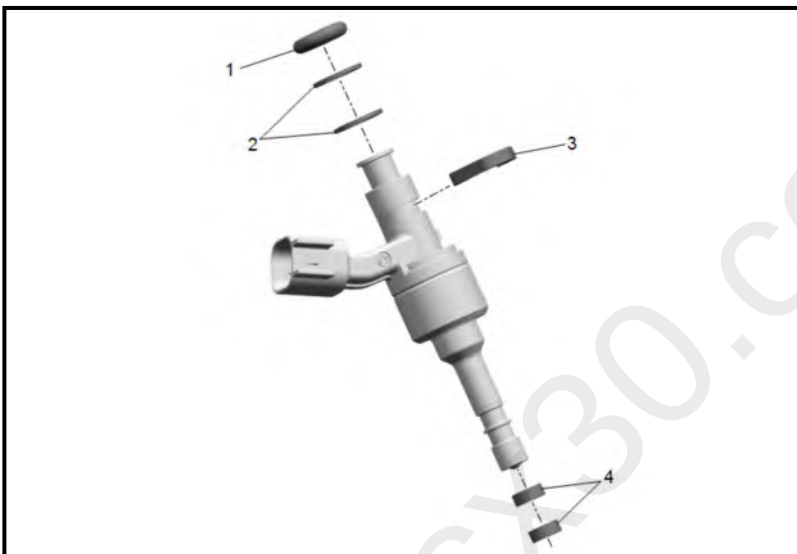
1. Fuel Injector Wiring Harness (1) - Disconnect



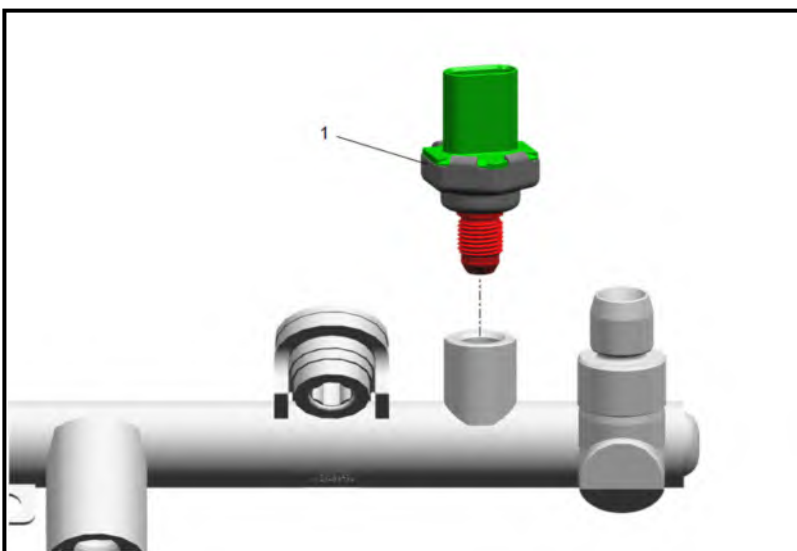
2. Taking care not to touch or apply force to the injector tip or electrical connector, remove the fuel injector (1) by pressing down on the retainer lever to release the tab (2) and simultaneously rotating the injector 45 degrees and pulling straight out from the fuel rail.



3. Remove and DISCARD the fuel injector retainer (3) from the fuel injector.
4. Using pliers, remove and DISCARD the fuel injector bushing (3) straight out from injector body.



5. Remove and DISCARD the fuel injector O-ring (1) and plastic spacers (2).
6. Fuel Injector Seal (4) - Remove and DISCARD (x2).
7. Fuel Pressure Sensor (1) - Remove



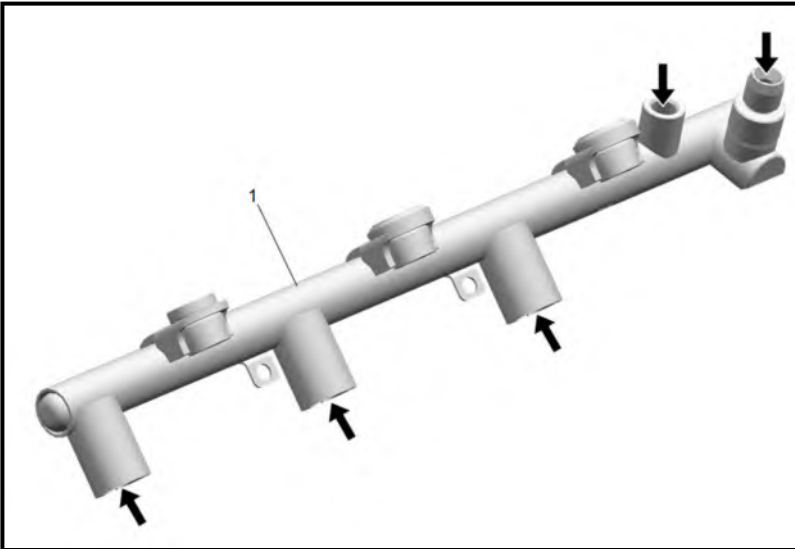
NOTE: Applying force to the plastic housing of the sensor will destroy the sensor. To tighten or loosen, only apply force to the attached hexagon.

NOTE: Do not soak or submerge the fuel rail or injectors in solvent.

8. Clean the exterior of the fuel rail and injectors with solvent.

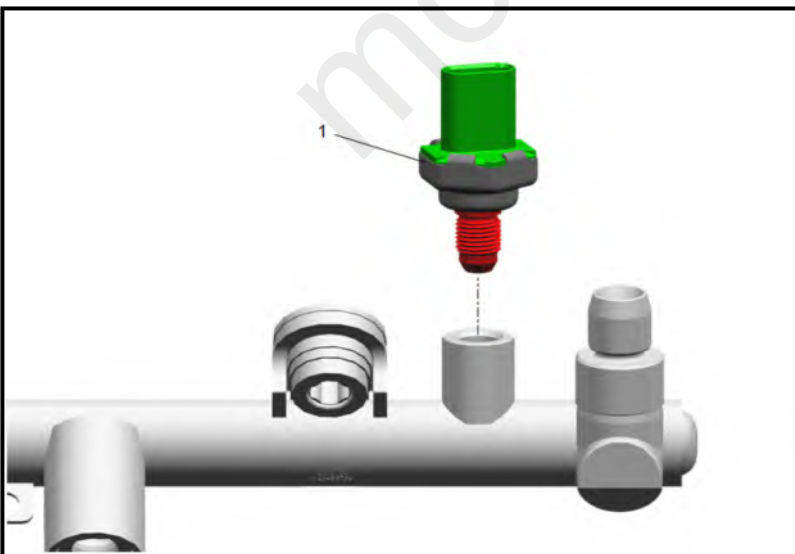
Inspection Procedure

1. Inspect the fuel rail (1) and components for the following conditions:



- Damage, debris or restrictions to the fuel rail
- Damage, debris or restrictions to the fuel ports in the fuel rail
- Damage to the mounting area for the fuel rail
- Damage to the fuel rail mounting bolts or mounting bolt grommets/isolators
- Damage to the threads on the fuel rail feed fitting
- Damage to the threads in the fuel pressure sensor bore
- Damage to the fuel pressure sensor connector, threads, or sealing face

2. Install the fuel pressure sensor (1).



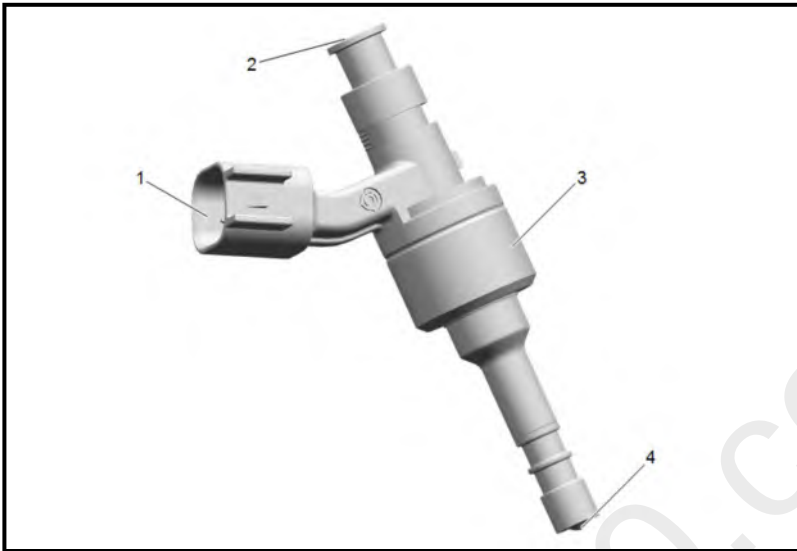
NOTE: Applying force to the plastic housing of the sensor will destroy the sensor. To tighten or loosen, only apply force to the attached hexagon.

NOTE: Ensure that the fuel rail threads have been cleaned of any excess fuel or the fuel pressure sensor will NOT seal properly.

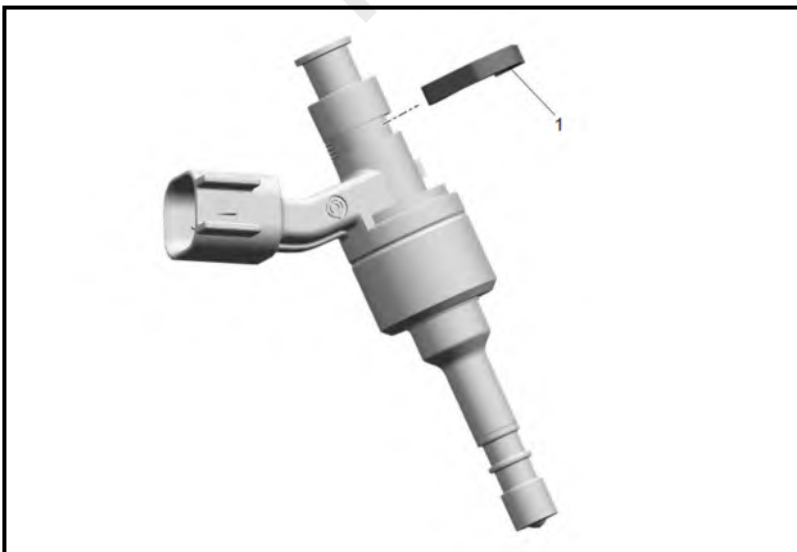
1. Lubricate the threads and the sealing area in the fuel rail with silicon free engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)
2. Lubricate the threads and the sealing area on the fuel pressure sensor with silicon free engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)
3. Fuel Pressure Sensor (1) - Install and hand tighten
4. Fuel Pressure Sensor (1) - remove and re-lubricate.

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

5. Fuel Pressure Sensor (1) - Install and tighten 33 N.m (25 lb ft).
3. Inspect the fuel injectors for the following conditions:

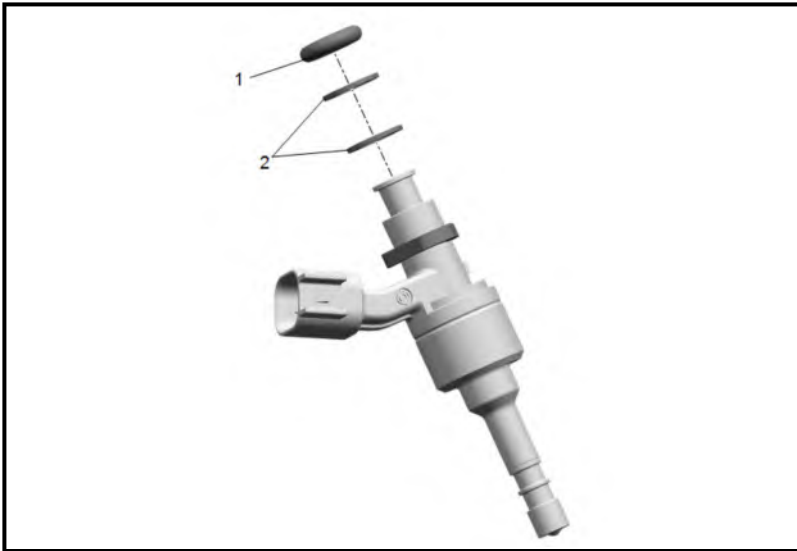


- Damage to the fuel injector connector (1)
 - Damage to the fuel inlet cone (2)
 - Damage to the fuel injector body (3)
 - Damage to the fuel injector tip (4)
4. Replace the fuel rail or injector if any damage is found. Do not attempt to repair a fuel rail or injector.
 5. Install NEW fuel injector bushing (1) onto injector body. Bushing should seat with a distinct "snap" sound and feel. Ensure bushing is fully seated.



NOTE: The fuel injector bushing (1) is to be installed BEFORE O-ring or backup rings are installed.

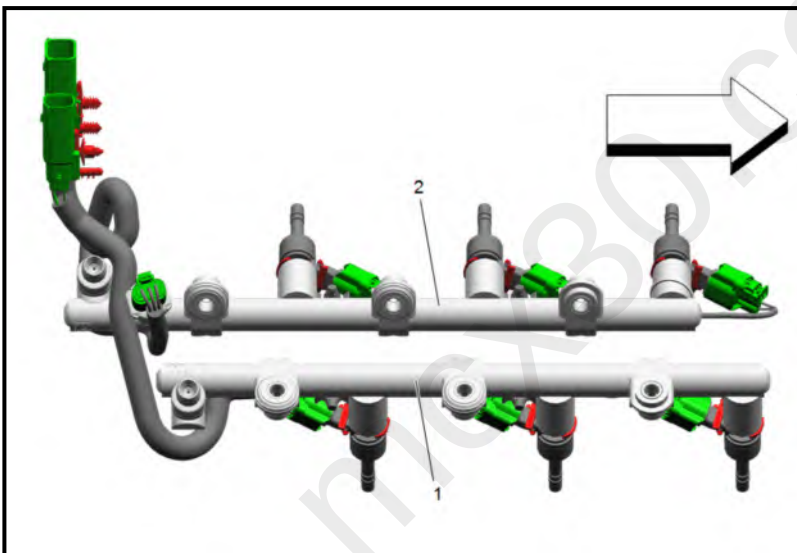
6. Install a NEW white plastic spacer (3) on the fuel injector first.



7. Install a NEW brown plastic spacer (2) second.

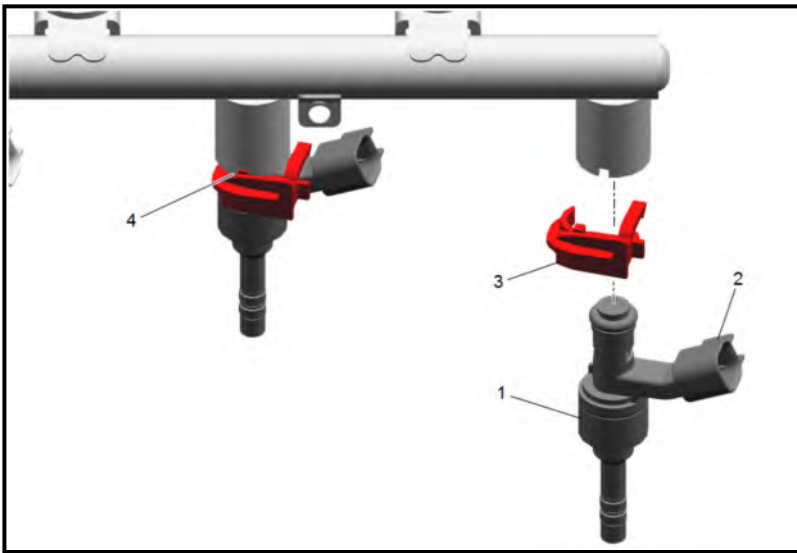
8. Lubricate the NEW O-ring (1) with one drop of clean engine oil.

9. The right side (bank 1) fuel injector wiring harness connectors (1) should point to the rear of the engine. The left side (bank 2) fuel injector wiring harness connectors (2) should point to the front of the engine.

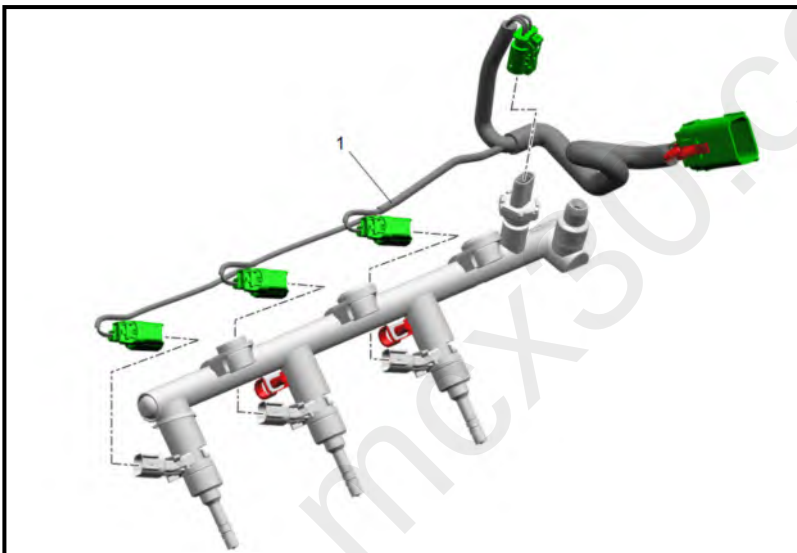


CAUTION: Ensure the fuel injectors are installed in the correct orientation. Improper orientation of the fuel injectors may result in engine misfire and possible engine damage.

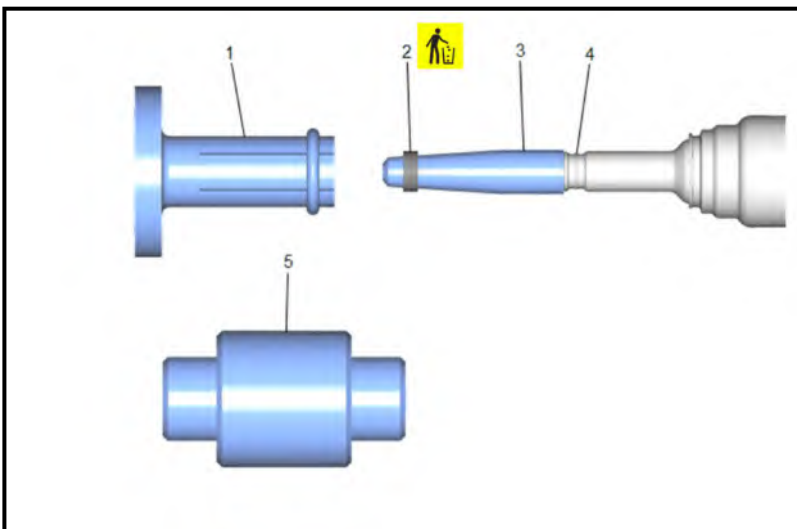
10. Install NEW fuel injector retainer (3) onto the fuel injector.



11. Holding the largest diameter/body of the injector only, indicated by arrow in graphic, insert the injector assembly (1) into the fuel rail. Ensure correct orientation of the electrical connector (2).
12. Rotate the fuel injector approximately 45 degrees until the tab on the retainer (4) locks into the notch on the fuel rail.
13. Repeat for remaining injectors until all are installed and retained in fuel rail.
14. Fuel Injector Wiring Harness (1) - Install



15. Install **EN 49245-1** long protector (3) onto the fuel injector tip, covering the first recessed area closest to the tip. Place a **NEW** seal (2) on **EN-49245-1** long protector.



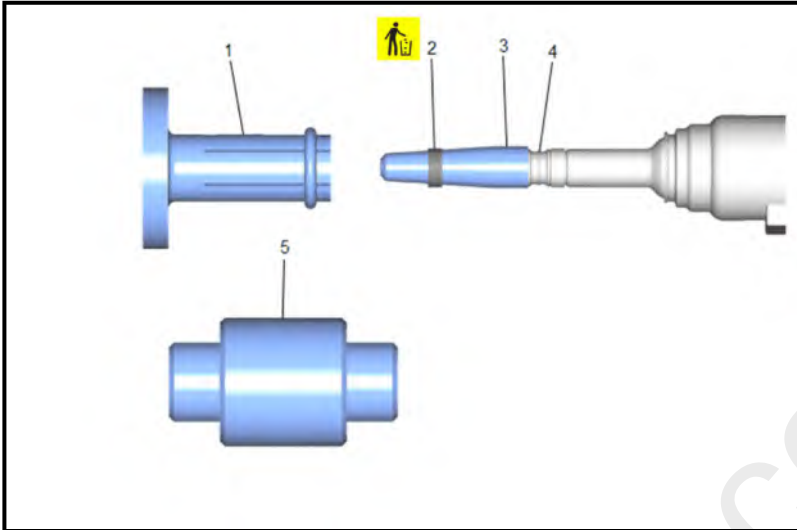
NOTE: Do not use any type of lubricant when installing the NEW seals (2) on the fuel injector tip.

16. Using EN-49245-3 pusher (1), install the seal into the second recessed area (4) of the fuel injector.

NOTE: The EN-49245-4 sizer is two sided, and either direction will size the seal correctly.

17. Compress the seal with your fingers, then resize the seal using the EN-49245-4 sizer (5).

18. Install EN-49245-2 short protector (3) onto the fuel injector tip. Place a NEW seal (2) on EN-49245-2 short protector.



NOTE: Do not use any type of lubricant when installing the NEW seals (2) on the fuel injector tip.

19. Using EN-49245-3 pusher (1), install the seal into the first recessed area (4) of the fuel injector.

NOTE: The EN-49245-4 sizer is two sided, and either direction will size the seal correctly.

20. Compress the seal with your fingers, then resize the seal using the EN-49245-4 sizer (5).

Installation Procedure

1. Position the fuel injection fuel rail assembly into the cylinder head as evenly as possible.
2. To install the fuel injection fuel rail bolts, perform the following steps:

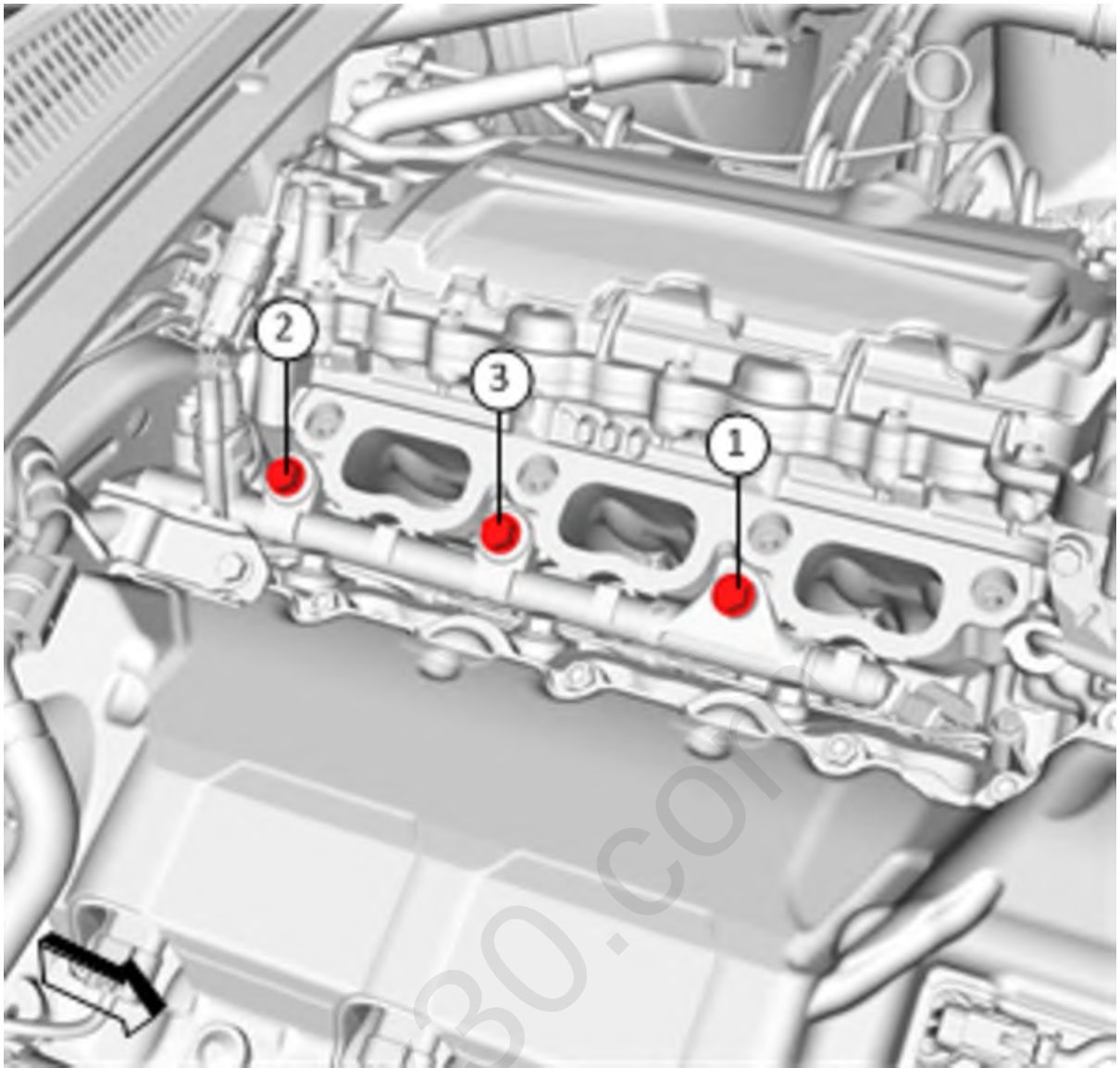
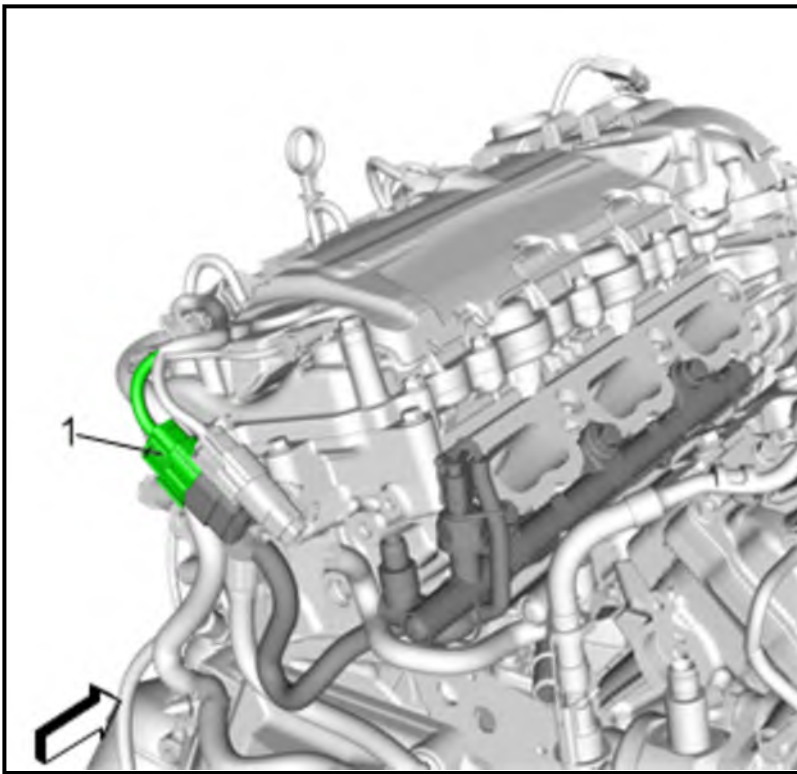


Fig. 2: Fuel Injection Fuel Rail Bolts Tightening Sequence
Courtesy of GENERAL MOTORS COMPANY

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

NOTE: The final pass should be performed in the sequence shown in the graphic.

1. First Pass: Start ALL bolts by hand, but do NOT tighten.
 2. Second Pass: Tighten the outer two bolts by hand.
 3. Third Pass: Tighten the inner bolt by hand.
 4. Final Pass: 25 N.m (18 lb ft)
3. Fuel Feed Intermediate Pipe - Install NEW - [Fuel Feed Intermediate Pipe Replacement](#)
 4. Electrical Connector (1) - Connect



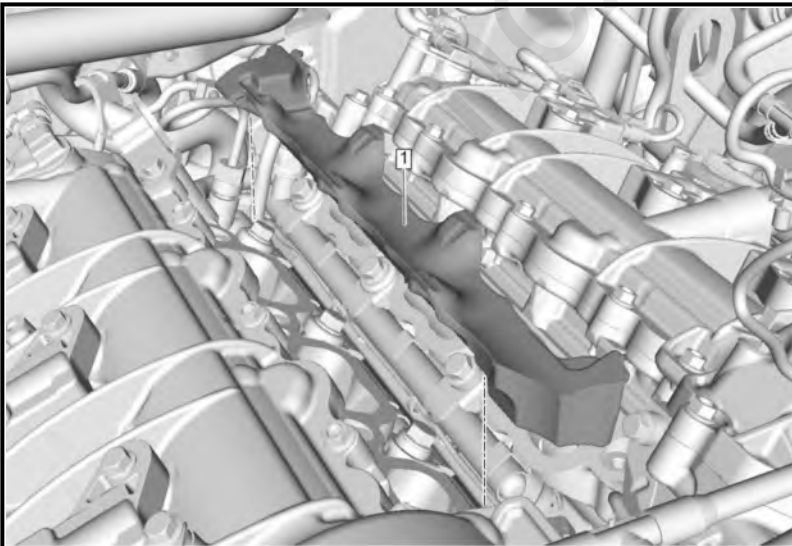
5. Inspect for leaks using the following procedure:

1. Turn ON the ignition with the engine OFF for 2 seconds.
2. Turn OFF the ignition for 10 seconds.
3. Turn ON the ignition with the engine OFF.
4. Inspect for fuel leaks.

6. Engine Rear Noise Shield - Install - [Engine Rear Noise Shield Replacement](#)

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

FUEL INJECTION FUEL RAIL NOISE SHIELD REPLACEMENT (UPPER)

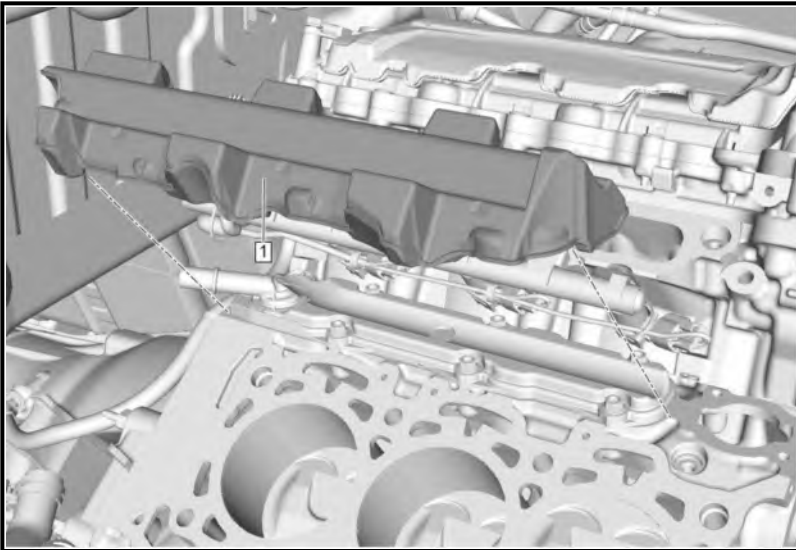


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Intake Manifold Replacement	
1	Fuel Injection Fuel Rail Noise Shield

Callout	Component Name
	WARNING: The noise cancelling foam component MUST be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death. NOTE: The fuel injection fuel rail noise shield snaps into place.

FUEL INJECTION FUEL RAIL NOISE SHIELD REPLACEMENT (LOWER)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures	
1. Fuel Injection Fuel Rail Assembly Replacement - Bank 1 2. Fuel Injection Fuel Rail Assembly Replacement - Bank 2	
1	Fuel Injection Fuel Rail Noise Shield WARNING: The noise cancelling foam component MUST be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible

Callout	Component Name
	injury or death.

FUEL FEED INTERMEDIATE PIPE REPLACEMENT

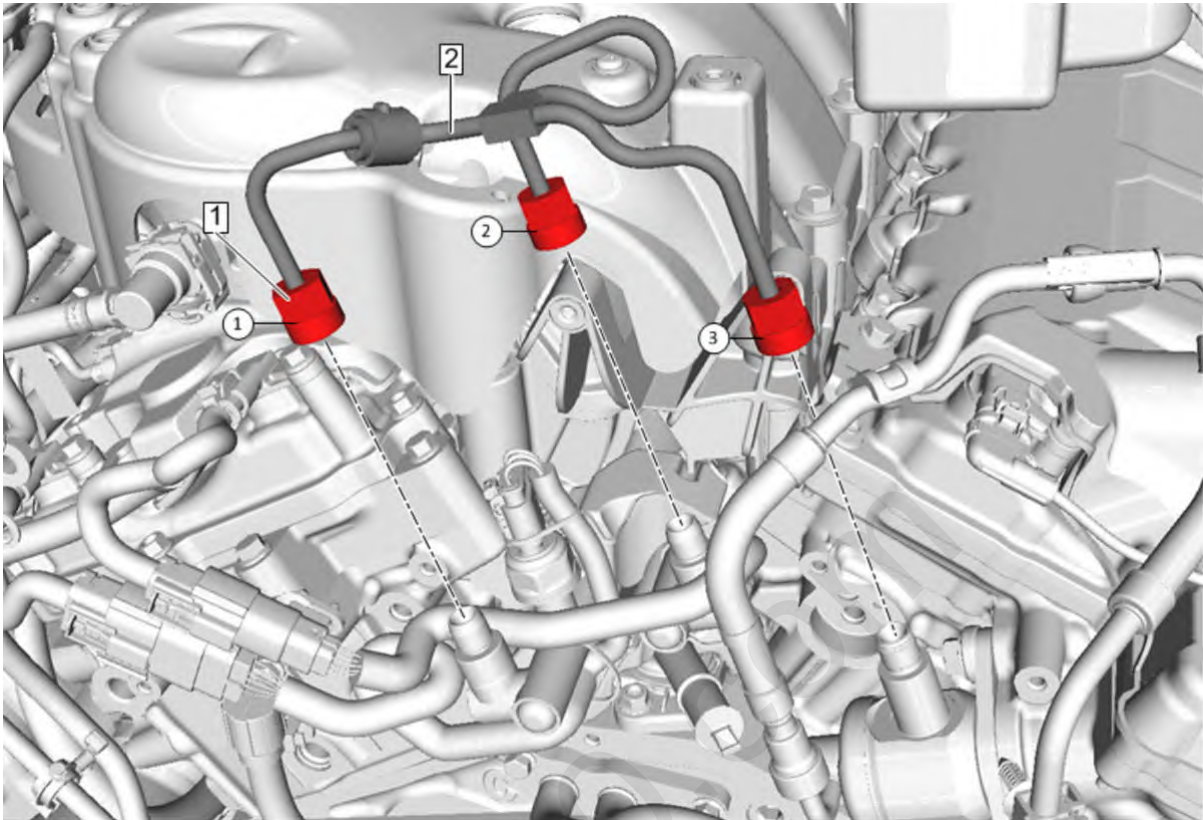


Fig. 3: Fuel Feed Intermediate Pipe Components With Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
NOTE: High pressure fuel feed pipes are one time use only. ALWAYS install a NEW high pressure fuel feed pipe if the pipe is removed OR the fittings are loosened.	
Preliminary Procedures	

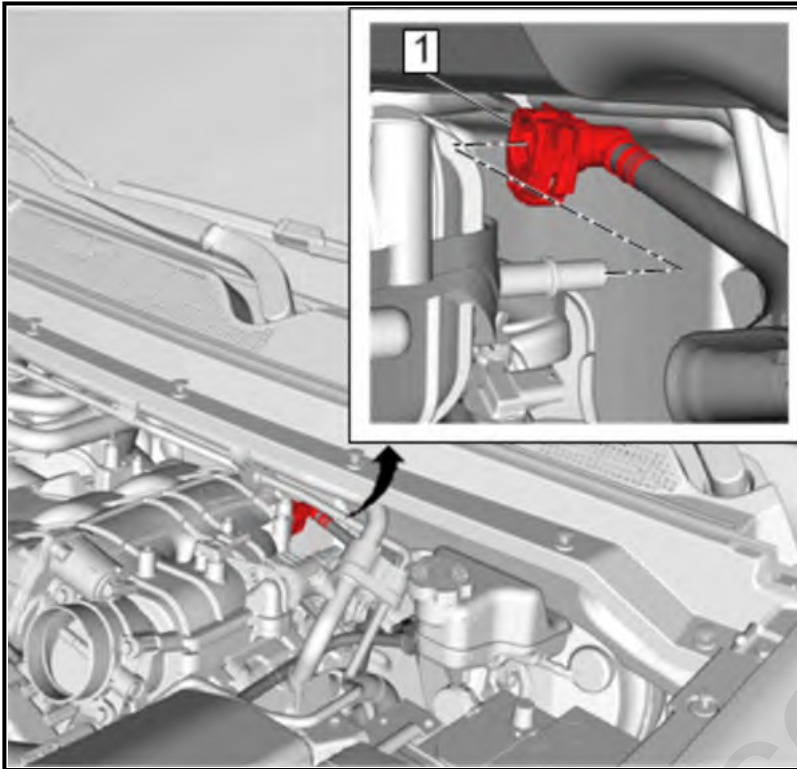
Callout	Component Name
	1. Relieve the fuel system pressure. Fuel Pressure Relief 2. Engine Rear Noise Shield Replacement
1	Fuel Feed Intermediate Pipe Fitting [3x] CAUTION: Refer to Component Fastener Tightening Caution . Procedure 1. Ensure ALL fittings are clean and dry prior to assembly. 2. Lubricate the fuel feed intermediate pipe fittings with silicon free engine oil. Adhesives, Fluids, Lubricants, and Sealers 3. Tighten the fuel feed intermediate pipe fittings in the sequence shown in the graphic. Tighten 28 N.m (21 lb ft)
2	Fuel Feed Intermediate Pipe Procedure 1. Remove and DISCARD the pipe. 2. Inspect for leaks using the following procedure: 1. Turn ON the ignition with the engine OFF for 2 seconds. 2. Turn OFF the ignition for 10 seconds. 3. Turn ON the ignition with the engine OFF. 4. Inspect for fuel leaks. NOTE: If a fuel leak occurs at the fuel pump or the fuel injection fuel rail fittings, the corresponding component will need to be replaced.

FUEL PIPE SHIELD REPLACEMENT

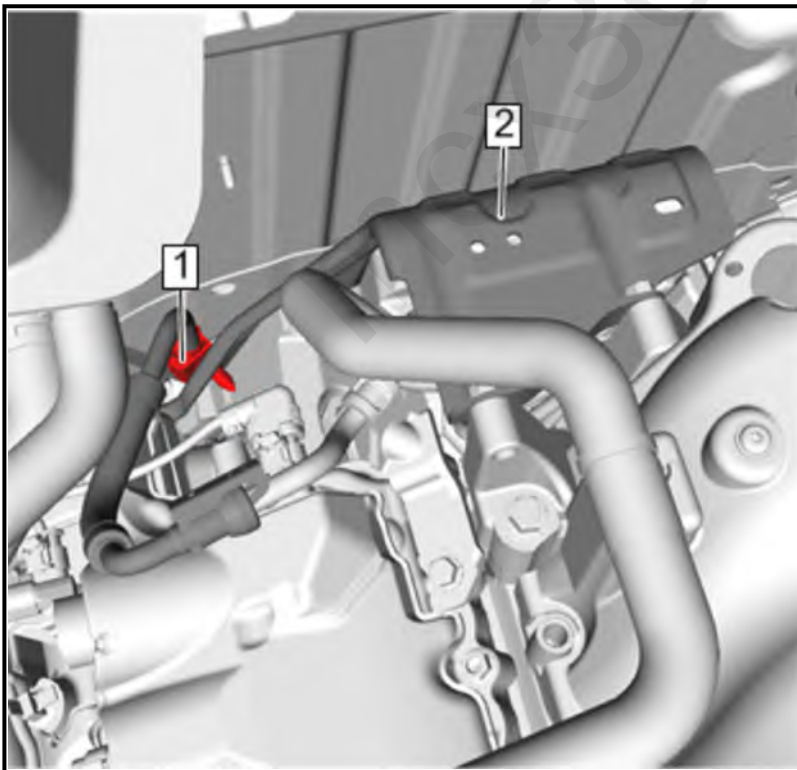
Removal Procedure

1. Plenum Front Panel - Remove - [Plenum Front Panel Replacement](#)
2. Remove the engine control module from the engine control module bracket without disconnecting the electrical connectors. [Engine Control Module Replacement](#)

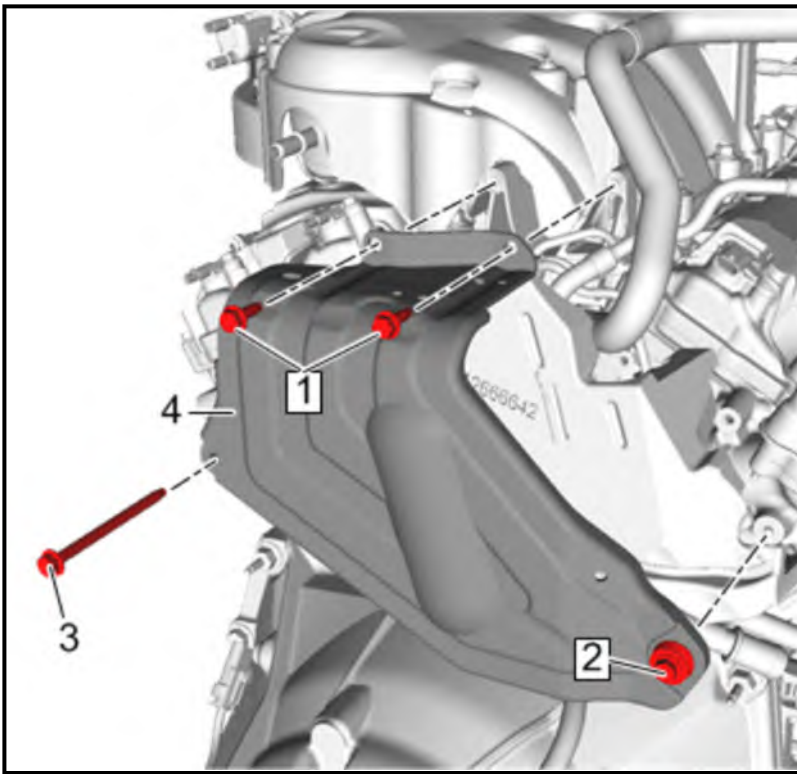
3. Remove the 3 nuts retaining the engine control module bracket to the front of the dash and position aside without removing harness retainers from the bracket. [Engine Control Module Bracket Replacement](#)
4. Disconnect the quick connect fitting (1) at the intake manifold.



5. Disconnect the intake camshaft position sensor connector.
6. Retainer (1) @ Fuel Pipe Shield (2) - Unclip



7. Fuel Pipe Shield Bolt (2) - Loosen



Fuel Pipe Shield Bolt (1) - Remove

NOTE: The fuel pipe shield bolt (2) is retained in the fuel pipe shield, loosen it enough to disengage it from the cylinder head.

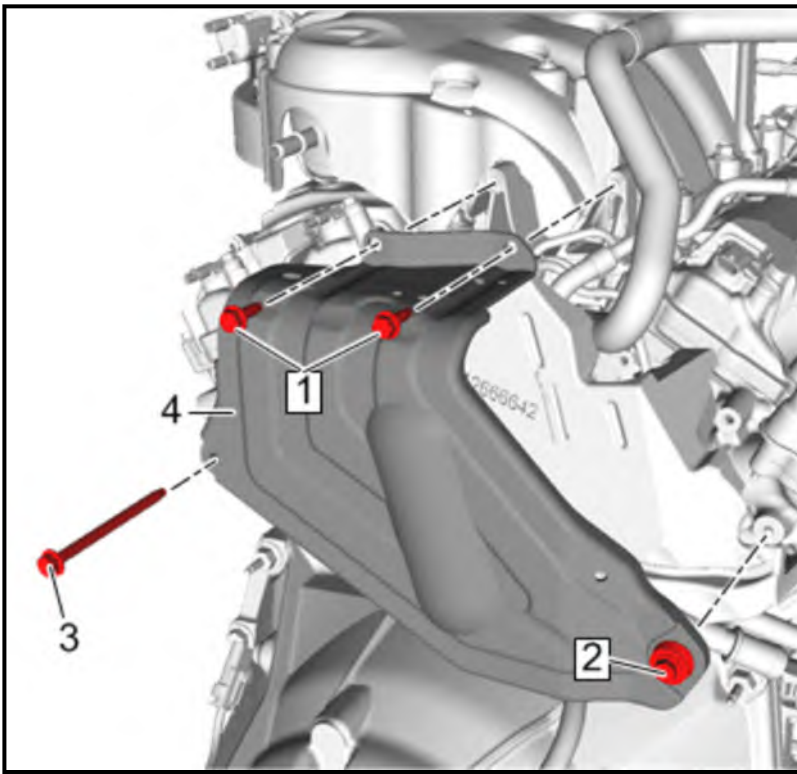
NOTE: Clearance is not sufficient to completely remove the fuel pipe shield bolt (3) from the fuel pipe shield, loosen it enough to disengage it from the cylinder head.

8. Fuel Pipe Shield Bolt (3) - Loosen

9. Fuel Pipe Shield (4) - Remove

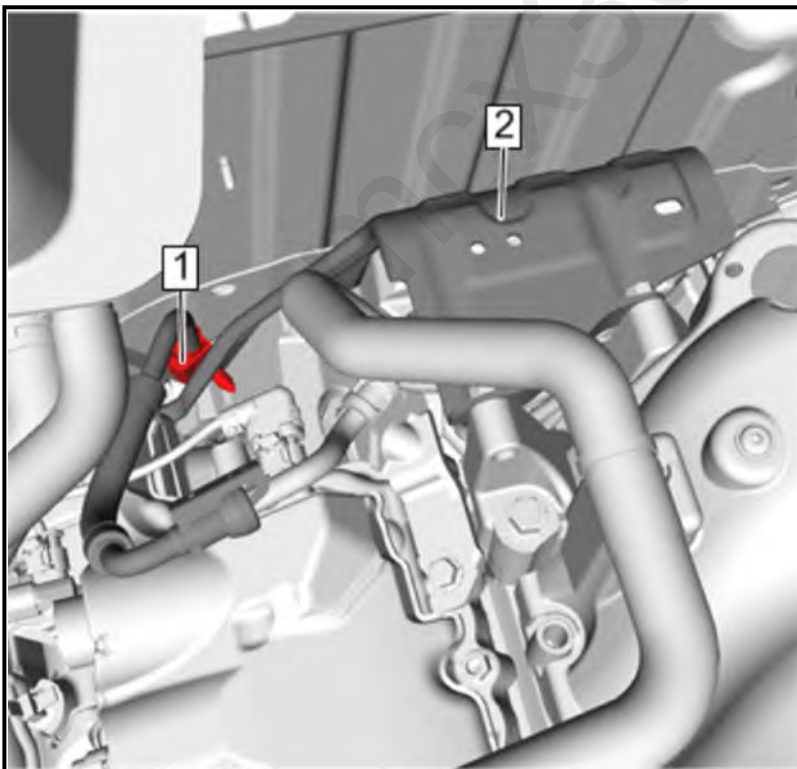
Installation Procedure

1. Fuel Pipe Shield (4) - Install

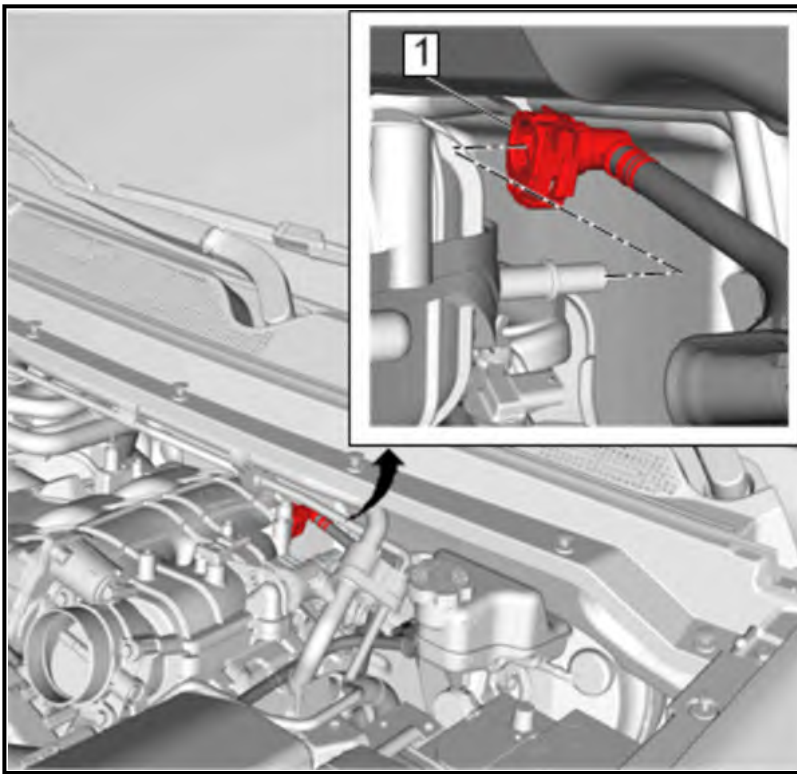


CAUTION: Refer to [Fastener Caution](#) .

2. Fuel Pipe Shield Bolt (3) - Install and tighten 9 N.m (80 lb in)
3. Fuel Pipe Shield Bolt (2) - Install and tighten 9 N.m (80 lb in)
4. Fuel Pipe Shield Bolt (1) - Remove Install and tighten 9 N.m (80 lb in)
5. Retainer (1) @ Fuel Pipe Shield (2) - Install

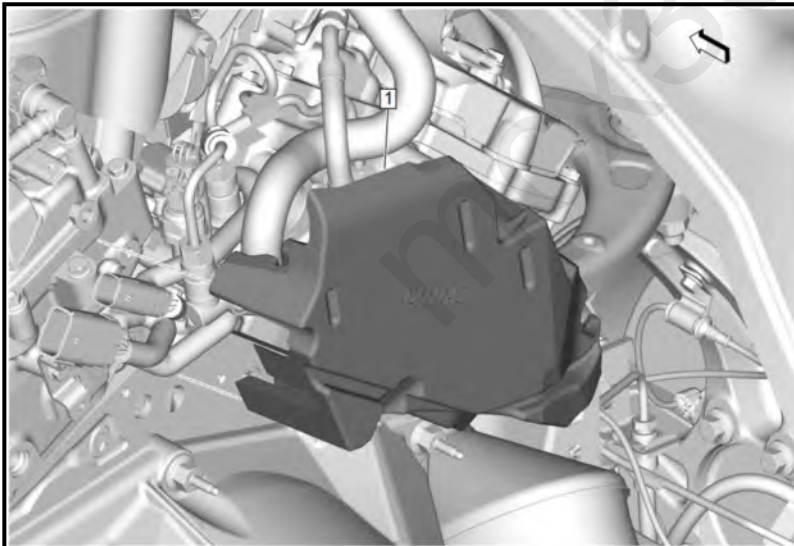


6. Connect the intake camshaft position sensor connector.
7. Connect the quick connect fitting (1) at the intake manifold.



8. Install the 3 nuts retaining the engine control module bracket to the front of the dash and position into place. [Engine Control Module Bracket Replacement](#)
9. Install the engine control module to the engine control module bracket. [Engine Control Module Replacement](#)
10. Plenum Front Panel - Install - [Plenum Front Panel Replacement](#)

ENGINE REAR NOISE SHIELD REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Heater Inlet And Outlet Pipe Replacement	
1	Engine Rear Noise Shield WARNING: The noise cancelling

Callout	Component Name
	foam component MUST be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death. Unsnap the engine noise shield from the rear of the engine. NOTE: The engine noise shield snaps into place.

FUEL PUMP REPLACEMENT

Special Tools

EN-48896 High Pressure Fuel Pump Installation Alignment Gauge

Equivalent regional tools: [Special Tools \(Mechanical Tools\)](#)

Removal Procedure

WARNING: The noise cancelling foam component **MUST** be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death.

WARNING: Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open

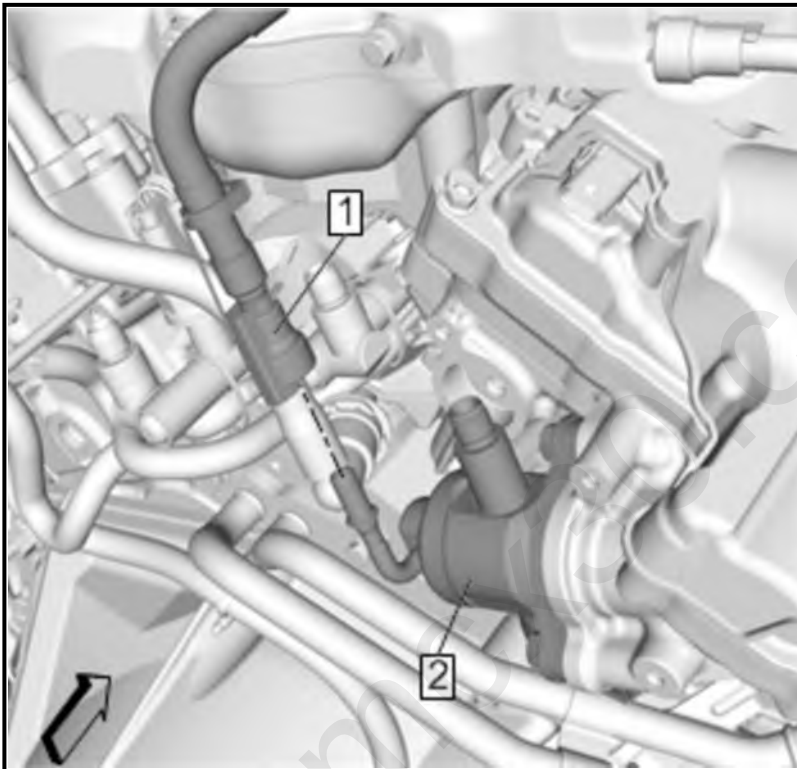
container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

WARNING: Wear safety glasses in order to avoid eye damage.

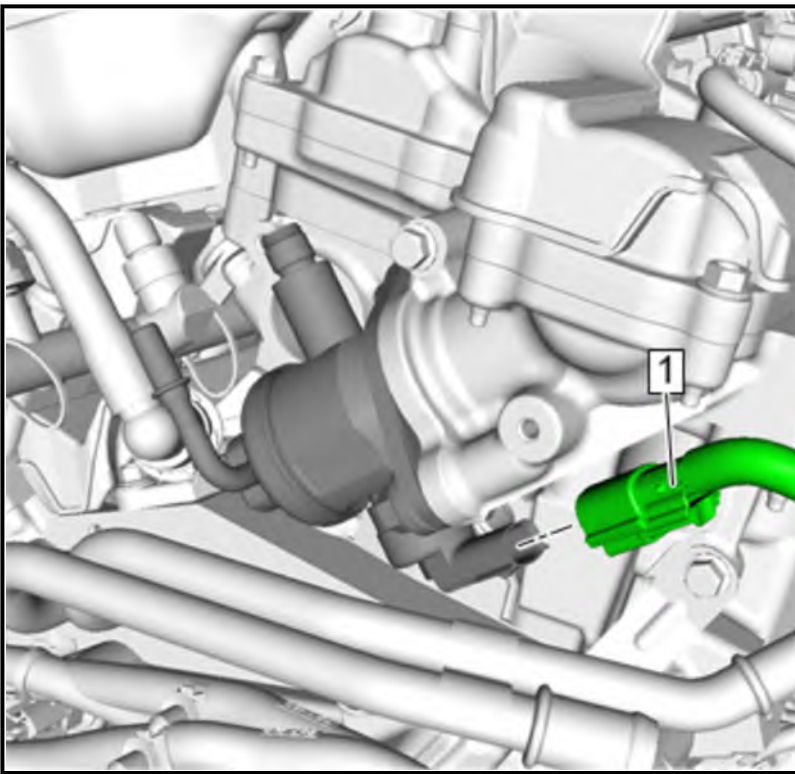
CAUTION: Refer to [Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Caution](#) .

NOTE: High pressure fuel feed pipes are one time use only. ALWAYS install a NEW high pressure fuel feed pipe if the pipe is removed OR the fittings are loosened.

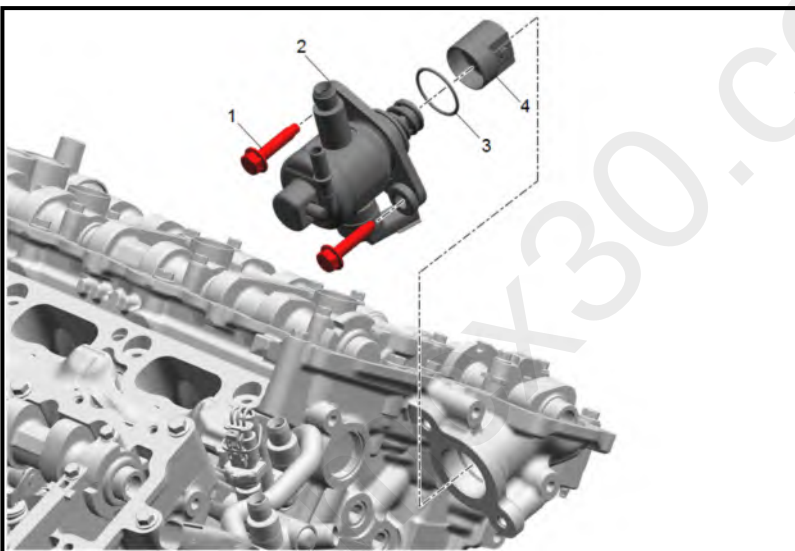
1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Remove and DISCARD the fuel feed intermediate pipe. [Fuel Feed Intermediate Pipe Replacement](#)
3. Disconnect the fuel feed line quick connect fitting (1). [Metal Collar Quick Connect Fitting Service](#)



4. Disconnect the electrical connector (1) from the fuel pump.



5. Fuel Pump Bolt (1) - Remove and DISCARD [2x]

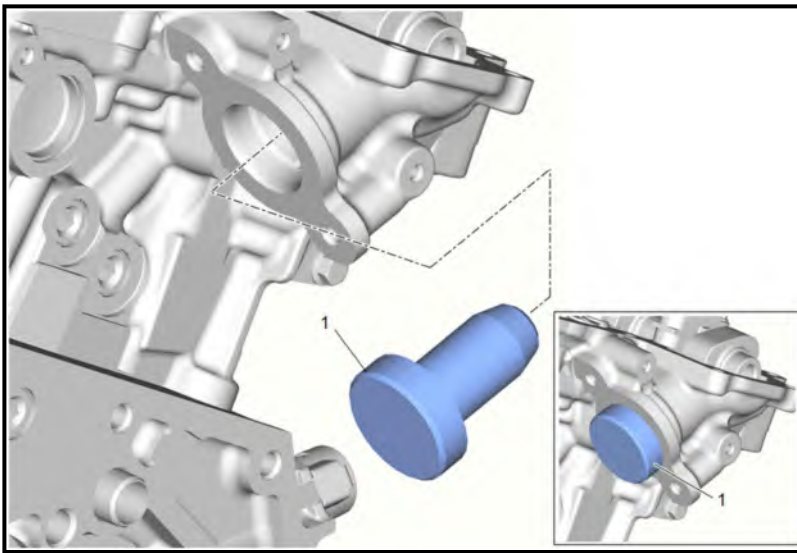


CAUTION: Alternately loosen the fuel pump bolts one turn at a time until the pump is fully disengaged from fuel pump lifter follower. Trying to remove the pump bolts without even side-to-side loosening may result in pump plunger damage

- 6. Fuel Pump (2) - Remove
- 7. Fuel Pump O-Ring (3) - Remove and DISCARD
- 8. Valve Lifter Follower (4) - Remove

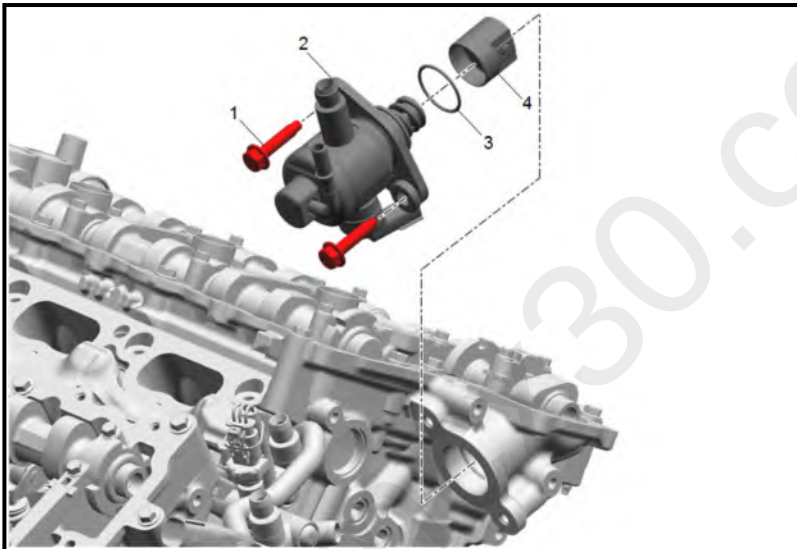
Installation Procedure

- 1. Use the **EN-48896** High Pressure Fuel Pump Installation Alignment Gauge (1) to ensure that the camshaft lobe is in the base circle position. At base circle position, the tool will be flush with the head.



NOTE: The camshaft must be in the base circle position before the fuel pump is installed.

2. Lubricate the fuel pump cylinder head bore with clean engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)



NOTE: Ensure that the fuel pump roller lifter is oriented properly, the camshaft is at base circle and the number 1 piston is at top dead center (TDC) on the exhaust stroke.

3. Lubricate the fuel pump roller lifter with clean engine oil and install into the cylinder head bore.
4. Install the valve lifter follower (4).
5. Lubricate NEW fuel pump O-ring (3) with one drop of clean engine oil and install.
6. Install the fuel pump (2).

NOTE: Ensure the plastic bolt retainers are installed in the fuel pump mounting holes before installing.

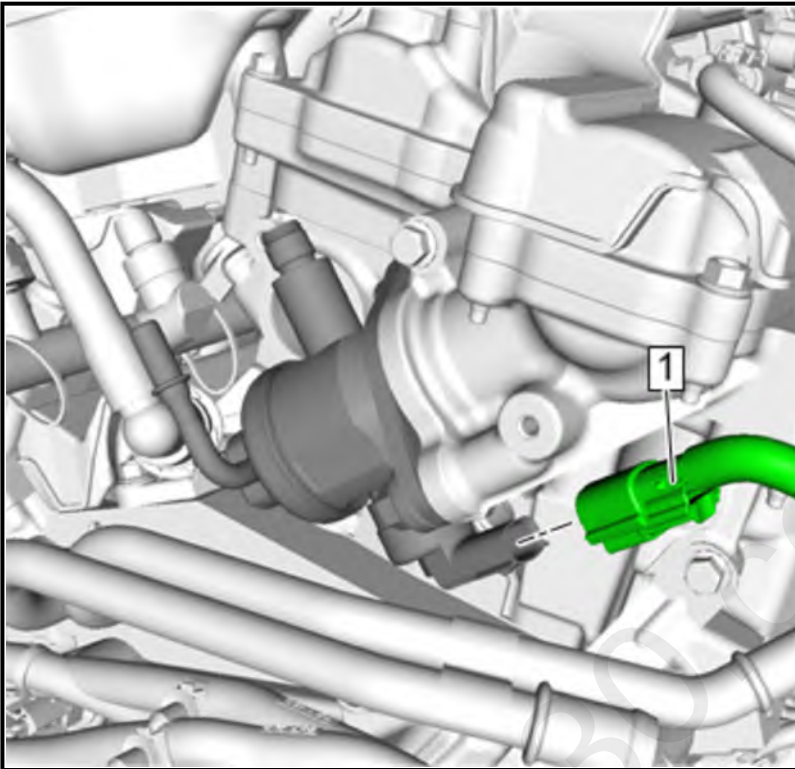
CAUTION: Refer to [Fastener Caution](#) .

CAUTION: Alternately hand-tighten the fuel pump bolts one turn at a time until the pump is fully seated. Trying to draw down the pump without even side-to-side tightening may result in pump plunger damage.

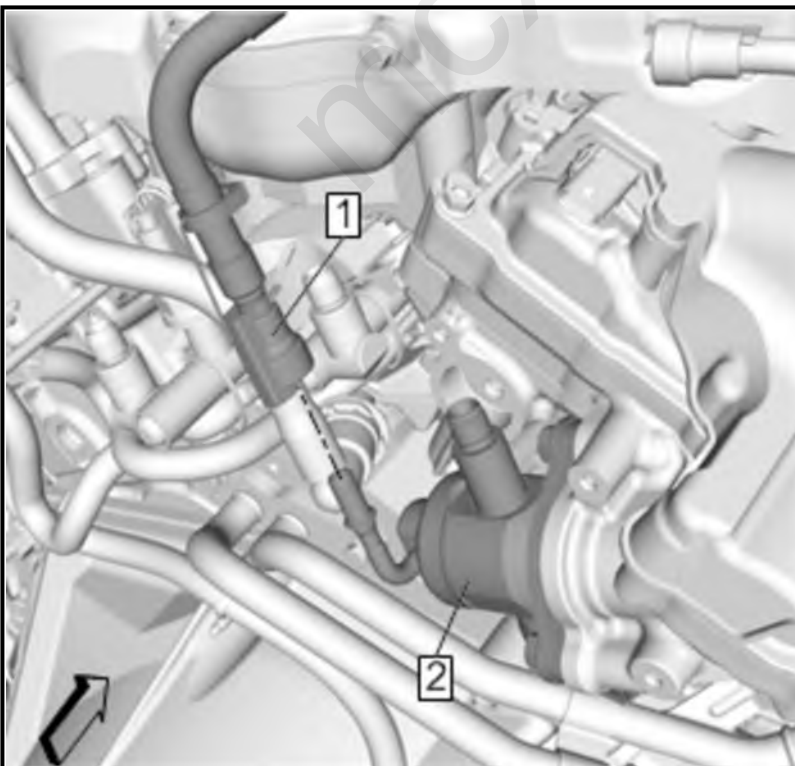
CAUTION:

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.

7. Start and hand-tighten the NEW fuel pump bolts (1) evenly.
8. Tighten the fuel pump bolts (1) to 25 N.m (18 lb ft).
9. Connect the electrical connector (1) to the fuel pump.



10. Connect the fuel feed line quick connect fitting (1). [Metal Collar Quick Connect Fitting Service](#)



11. Install a NEW fuel feed intermediate pipe. [Fuel Feed Intermediate Pipe Replacement](#)

12. Inspect for leaks using the following procedure:

1. Turn ON the ignition with the engine OFF for 2 seconds.
2. Turn OFF the ignition for 10 seconds.
3. Turn ON the ignition with the engine OFF.
4. Inspect for fuel leaks.

FUEL INJECTOR REPLACEMENT

Special Tools

EN-49245 Injector Seal Installer Kit

Equivalent regional tools: Special Tools (Mechanical Tools)

Removal Procedure

WARNING: Wear safety glasses in order to avoid eye damage.

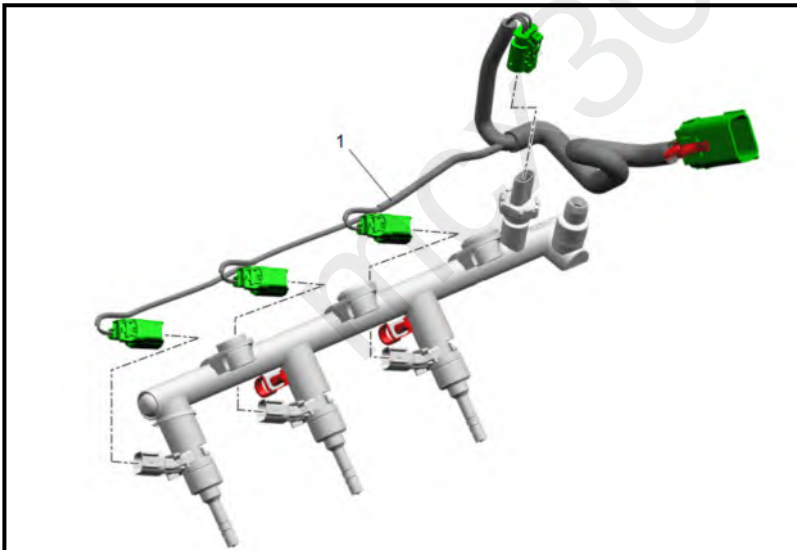
1. Relieve the high side fuel system pressure. Fuel Pressure Relief

NOTE: The fuel injectors have an alignment feature, note the position of the injectors alignment for installation.

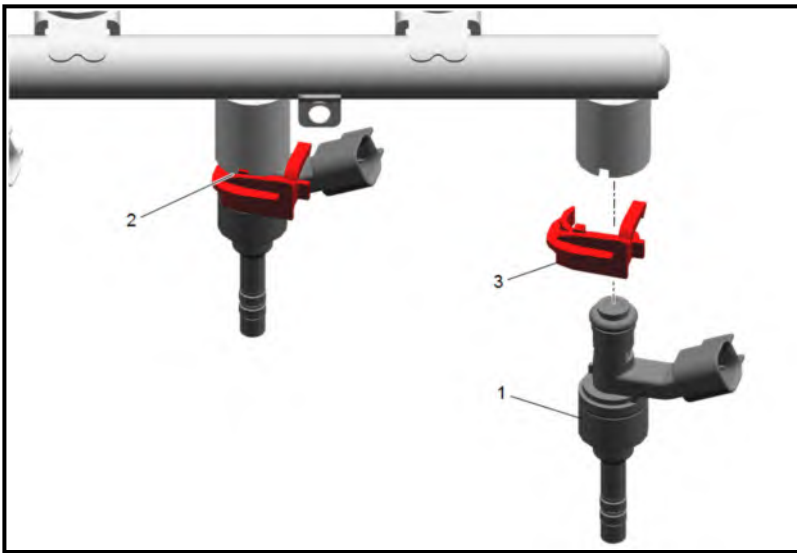
2. Remove the fuel injection fuel rail assembly.

- Fuel Injection Fuel Rail Assembly Replacement - Bank 1
- Fuel Injection Fuel Rail Assembly Replacement - Bank 2

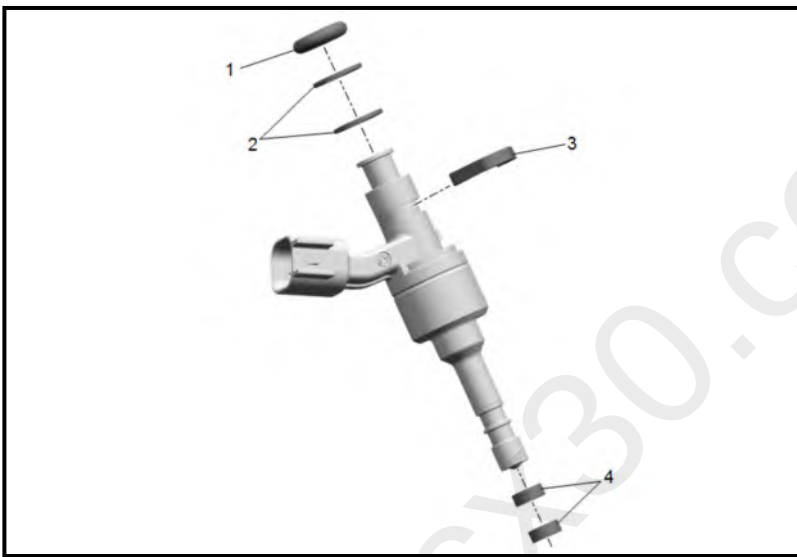
3. Fuel Injector Wiring Harness (1) - Disconnect



4. Taking care not to touch or apply force to the injector tip or electrical connector, remove the fuel injector (1) by pressing down on the retainer lever to release the tab (2) and simultaneously rotating the injector 45 degrees and pulling straight out from the fuel rail.



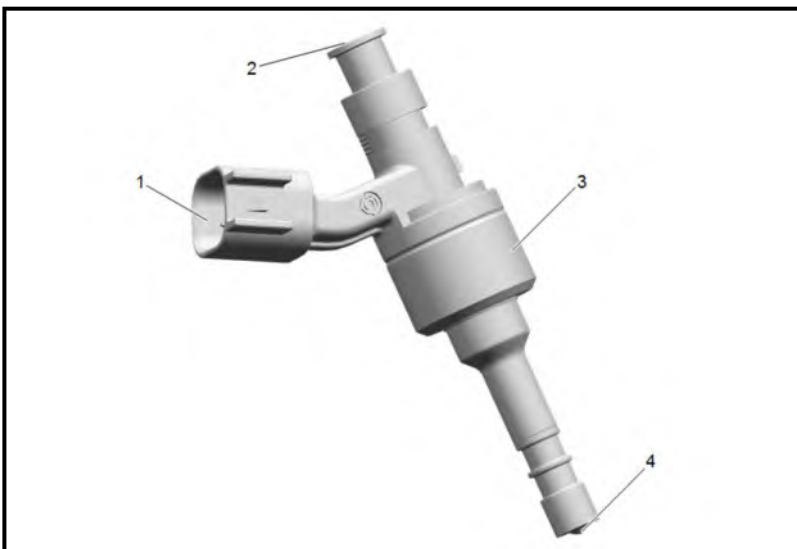
5. Remove and DISCARD the fuel injector retainer (3) from the fuel injector.
6. Using pliers, remove and DISCARD the fuel injector bushing (3) straight out from injector body.



7. Remove and DISCARD the fuel injector O-ring (1) and plastic spacers (2).
8. Fuel Injector Seal (4) - Remove and DISCARD [2x]

Inspection Procedure

1. Inspect the fuel injectors for the following conditions:

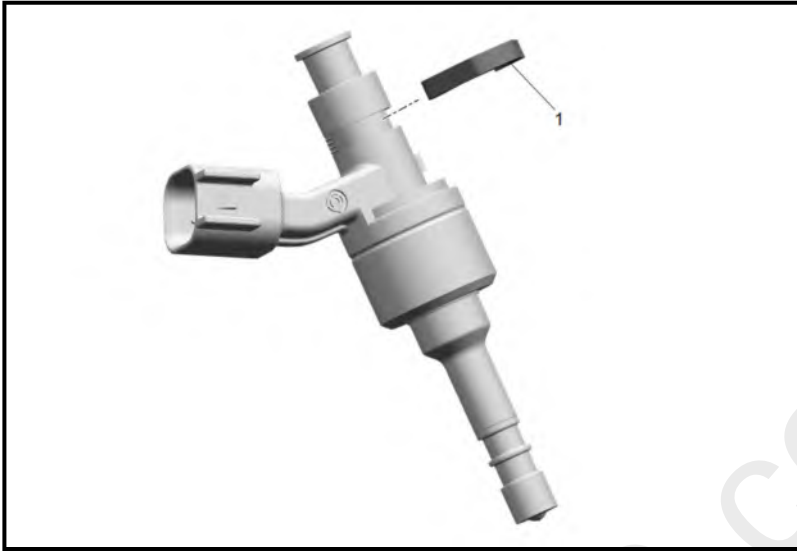


- Damage to the fuel injector connector (1)
- Damage to the fuel inlet cone (2)
- Damage to the fuel injector body (3)
- Damage to the fuel injector tip (4)

2. Replace the fuel rail or injector if any damage is found. Do not attempt to repair a fuel rail or injector.

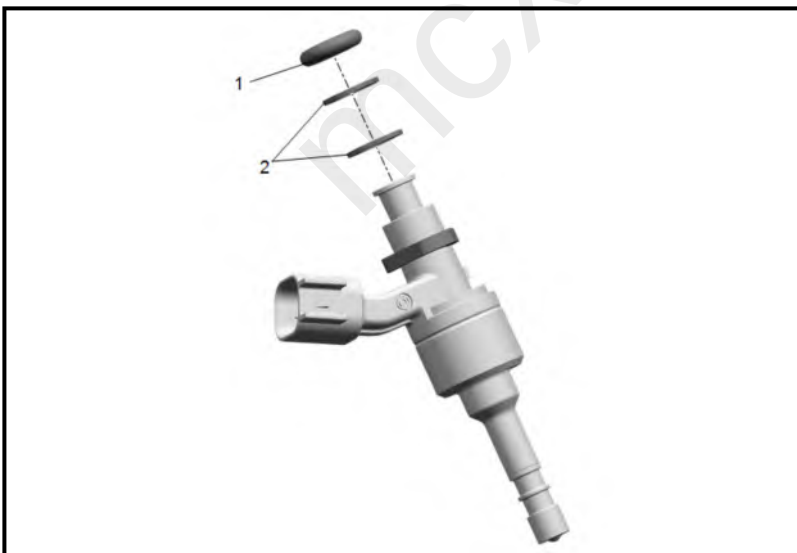
Installation Procedure

1. Install NEW fuel injector bushing (1) onto injector body. Bushing should seat with a distinct "snap" sound and feel. Ensure bushing is fully seated.

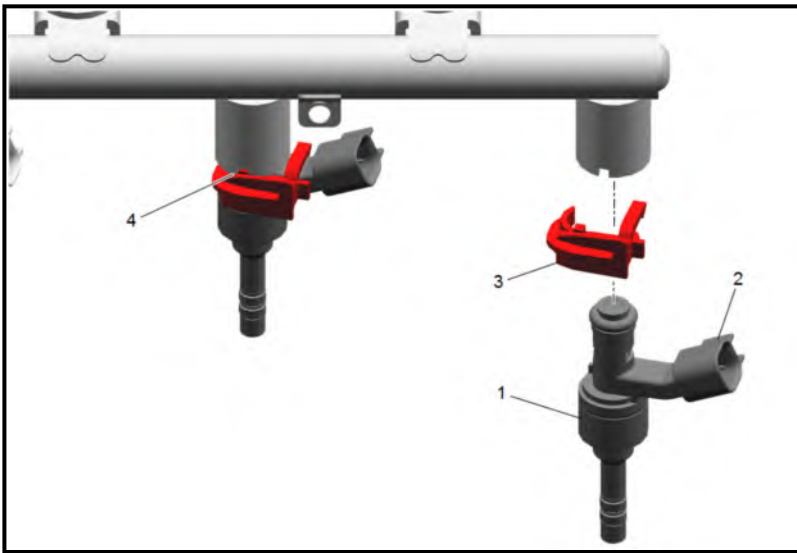


NOTE: The fuel injector bushing (1) is to be installed **BEFORE** O-ring or backup rings are installed.

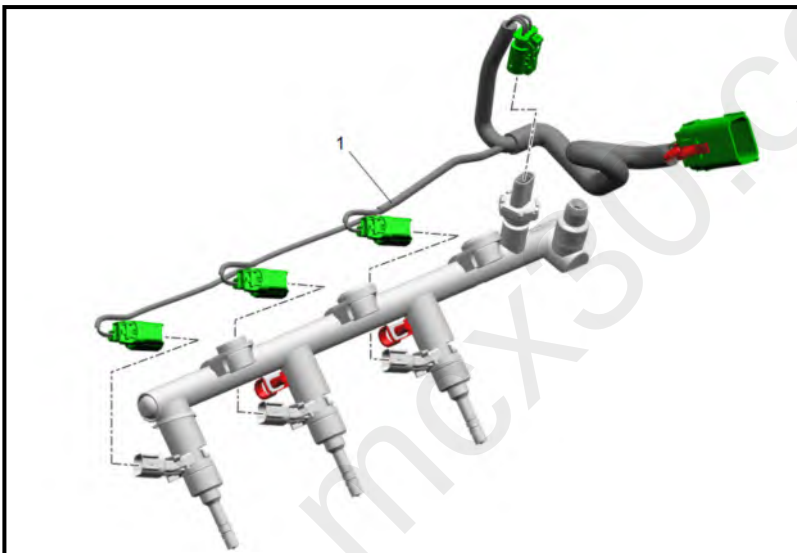
2. Install a NEW white plastic spacer (3) on the fuel injector first.



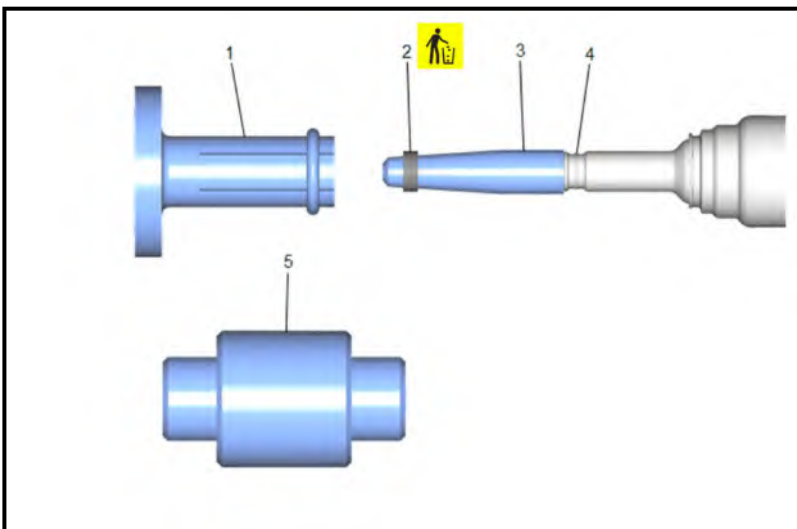
3. Install a NEW brown plastic spacer (2) second.
4. Lubricate the NEW O-ring (1) with one drop of clean engine oil.
5. Install NEW fuel injector retainer (3) onto the fuel injector.



6. Holding the largest diameter/body of the injector only, indicated by arrow in graphic, insert the injector assembly (1) into the fuel rail. Ensure correct orientation of the electrical connector (2).
7. Rotate the fuel injector approximately 45 degrees until the tab on the retainer (4) locks into the notch on the fuel rail.
8. Repeat for remaining injectors until all are installed and retained in fuel rail.
9. Fuel Injector Wiring Harness (1) - Install



10. Install **EN 49245-1** long protector (3) onto the fuel injector tip, covering the first recessed area closest to the tip. Place a **NEW** seal (2) on **EN-49245-1** long protector.



NOTE:

- Do not use any type of lubricant when installing the NEW seals (2) on the fuel injector tip.
- If an injector is reused, the injector tips seals must be replaced with NEW.

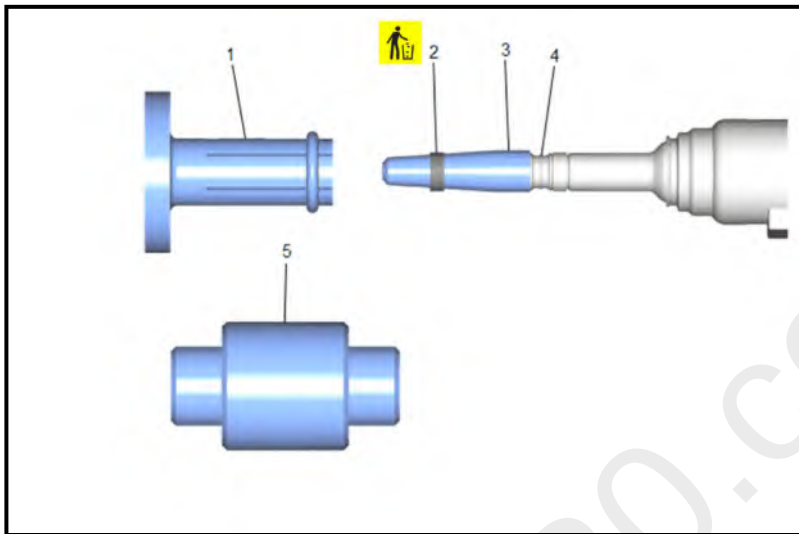
11. Using EN-49245-3 pusher (1), install the seal into the second recessed area (4) of the fuel injector.

NOTE:

The EN-49245-4 sizer is two sided, and either direction will size the seal correctly.

12. Compress the seal with your fingers, then resize the seal using the EN-49245-4 sizer (5).

13. Install EN-49245-2 short protector (3) onto the fuel injector tip. Place a NEW seal (2) on EN-49245-2 short protector.



NOTE:

Do not use any type of lubricant when installing the NEW seals (2) on the fuel injector tip.

14. Using EN-49245-3 pusher (1), install the seal into the first recessed area (4) of the fuel injector.

NOTE:

The EN-49245-4 sizer is two sided, and either direction will size the seal correctly.

15. Compress the seal with your fingers, then resize the seal using the EN-49245-4 sizer (5).

NOTE:

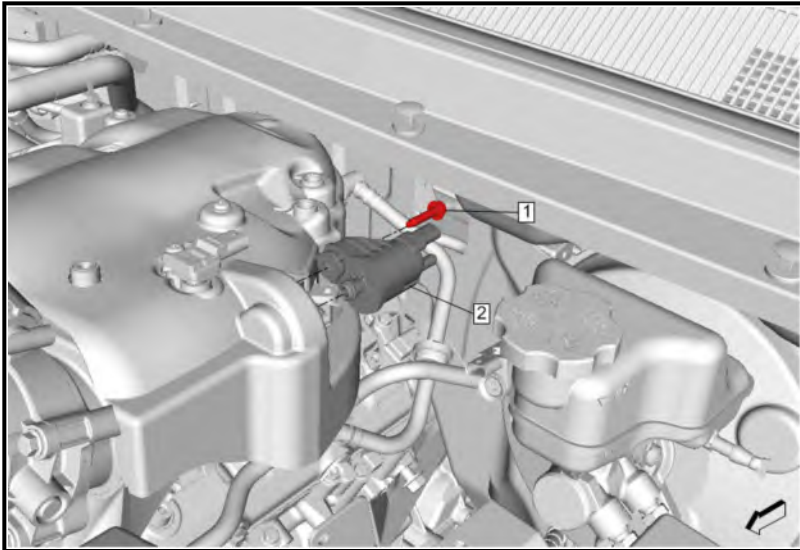
The fuel injectors have an alignment feature and must be reinstalled as noted during removal.

16. Install the fuel injection fuel rail assembly.

- [Fuel Injection Fuel Rail Assembly Replacement - Bank 1](#)
- [Fuel Injection Fuel Rail Assembly Replacement - Bank 2](#)

17. Pressure up the fuel system and check for leaks.

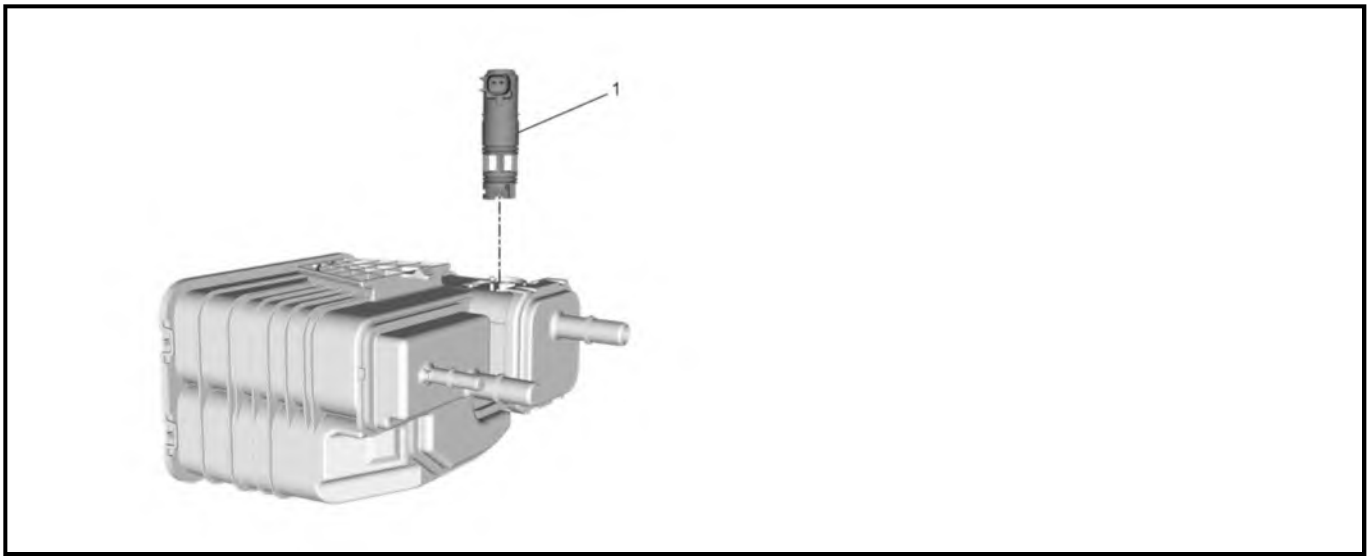
EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Evaporative Emission Pipe @ Evaporative Emission Canister Purge Solenoid Valve - Disconnect - Plastic Collar Quick Connect Fitting Service	
1	Evaporative Emission Canister Purge Solenoid Valve Bolt CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Evaporative Emission Canister Purge Solenoid Valve Procedure Disconnect the electrical connector.

EVAPORATIVE EMISSION CANISTER VENT SOLENOID VALVE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure	
Remove the evaporative emission canister. Refer to Evaporative Emission Canister Replacement .	
1	Evaporative Emission Canister Vent Solenoid Valve Procedure Disconnect the electrical connector.

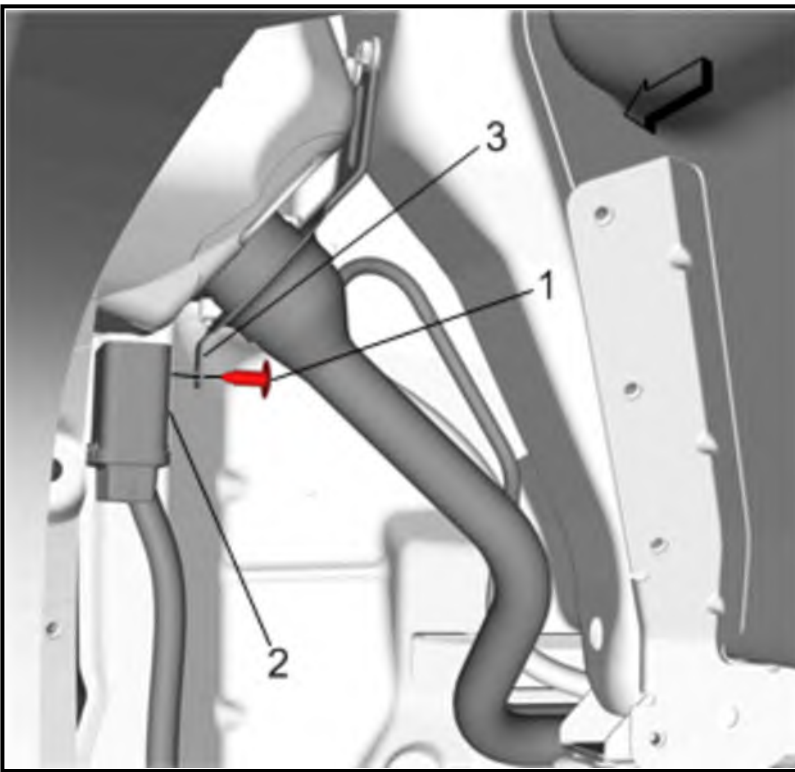
EVAPORATIVE EMISSION SYSTEM VACUUM LEAK PUMP FILTER REPLACEMENT

Removal Procedure

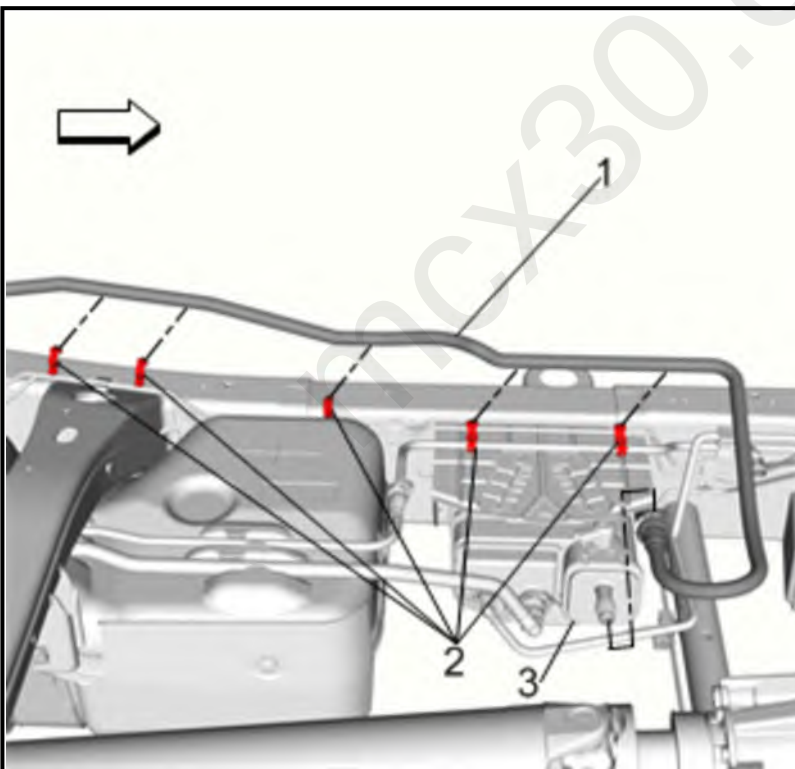
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the fuel tank. Refer to [Fuel Tank Replacement](#).
3. Remove the evaporative emission system vacuum leak pump filter assembly retainer (1) from the evaporative emission system vacuum leak pump filter assembly (2).



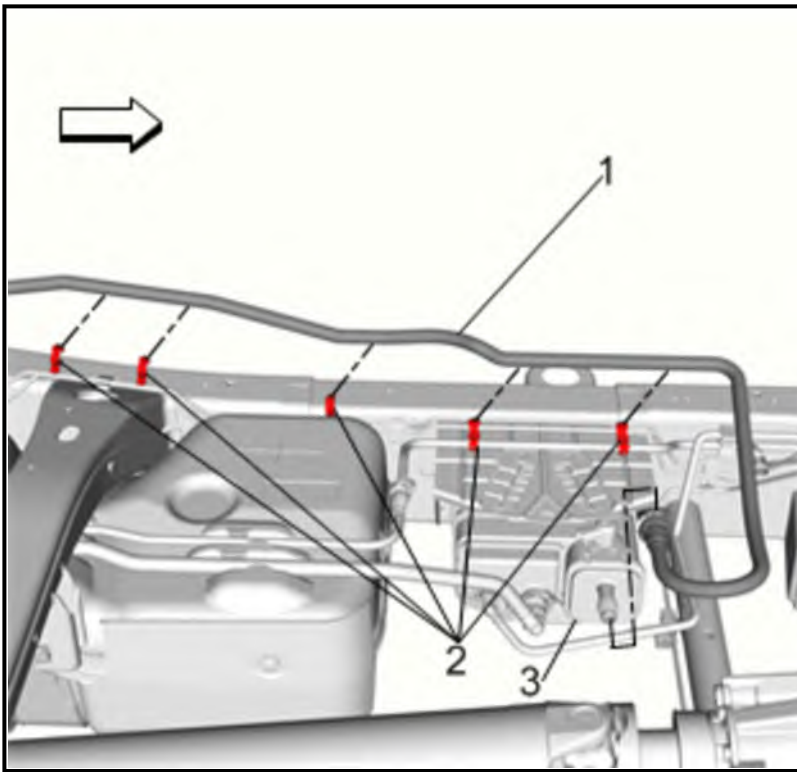
4. Remove the evaporative emission system vacuum leak pump filter assembly (2) from the fuel tank filler pipe (3).
5. Disconnect the evaporative emission system vacuum leak pump filter assembly (1) from the evaporative emission canister (3).



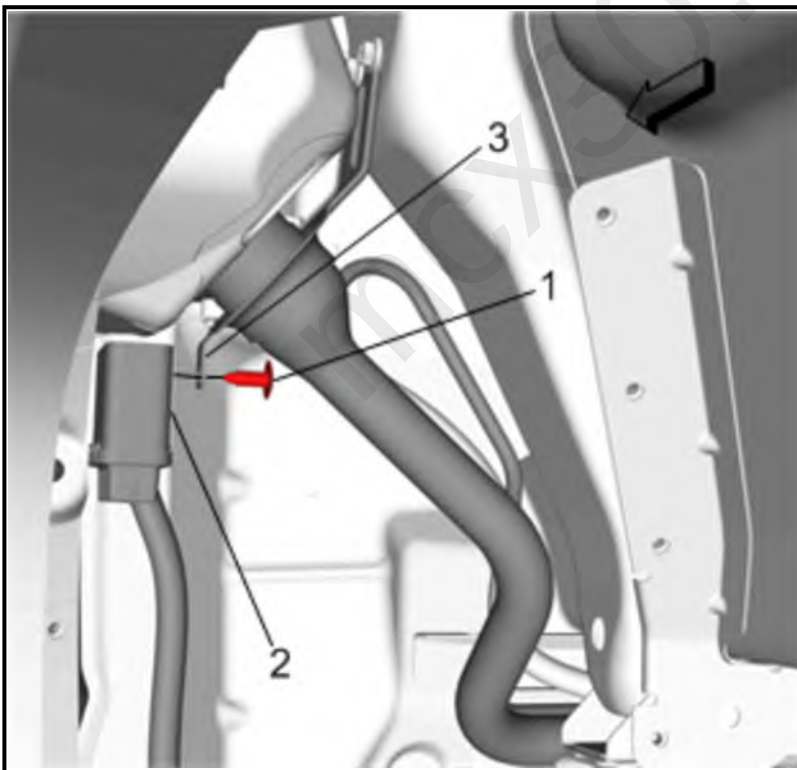
6. Remove the evaporative emission system vacuum leak pump filter assembly (1) from the retainers (2).
7. Remove the evaporative emission system vacuum leak pump filter assembly (1) from the vehicle.

Installation Procedure

1. Install the evaporative emission system vacuum leak pump filter assembly (1) to the vehicle.

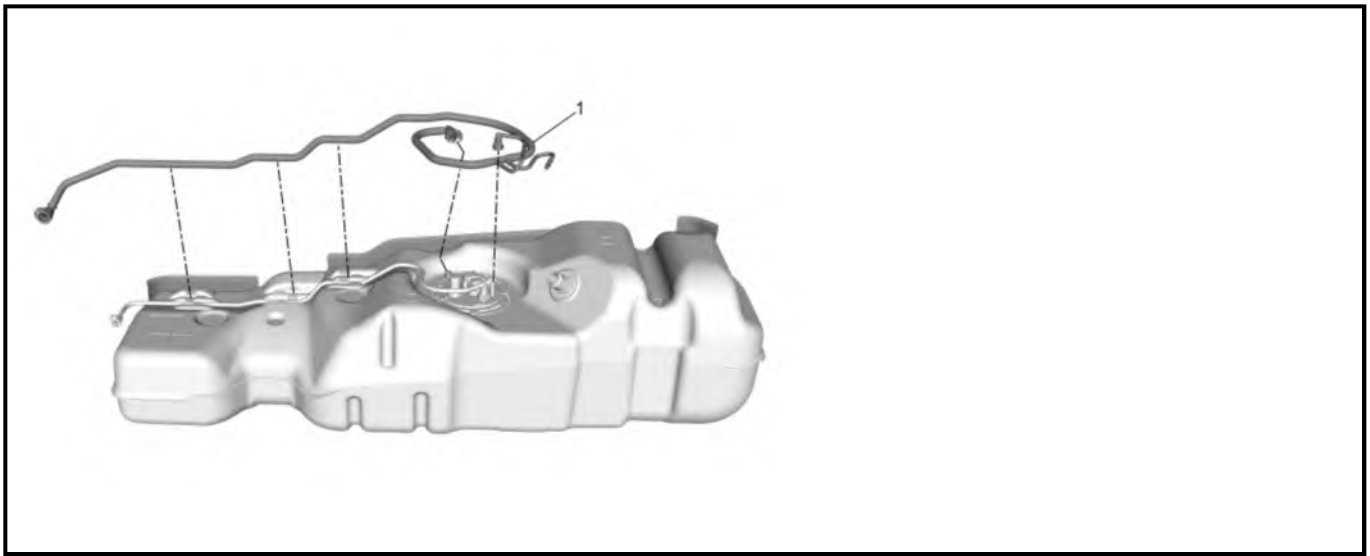


2. Install the evaporative emission system vacuum leak pump filter assembly (1) to the retainers (2).
3. Connect the evaporative emission system vacuum leak pump filter assembly (1) to the evaporative emission canister (3).
4. Install the evaporative emission system vacuum leak pump filter assembly (2) to the fuel tank filler pipe (3).



5. Install the evaporative emission system vacuum leak pump filter assembly retainer (1) to the evaporative emission system vacuum leak pump filter assembly (2).
6. Install the fuel tank. Refer to [Fuel Tank Replacement](#).
7. Lower the vehicle.

EVAPORATIVE EMISSION HOSE REPLACEMENT (AT TANK)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Remove the fuel tank. Refer to Fuel Tank Replacement .	
1	EVAP Emission Hose Procedure Disconnect the quick disconnect. Refer to Plastic Collar Quick Connect Fitting Service .

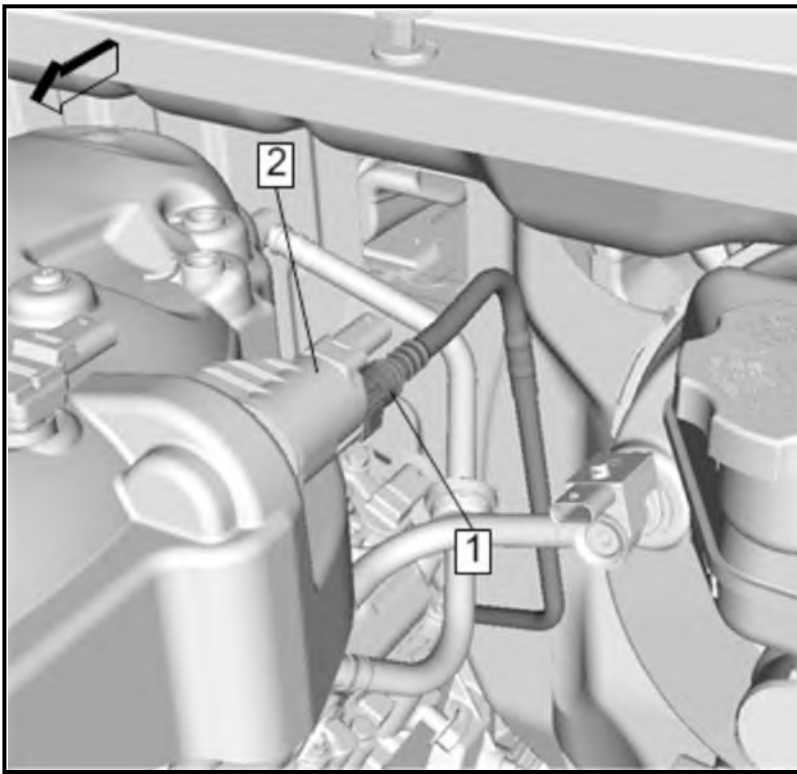
EVAPORATIVE EMISSION PIPE REPLACEMENT

Removal Procedure

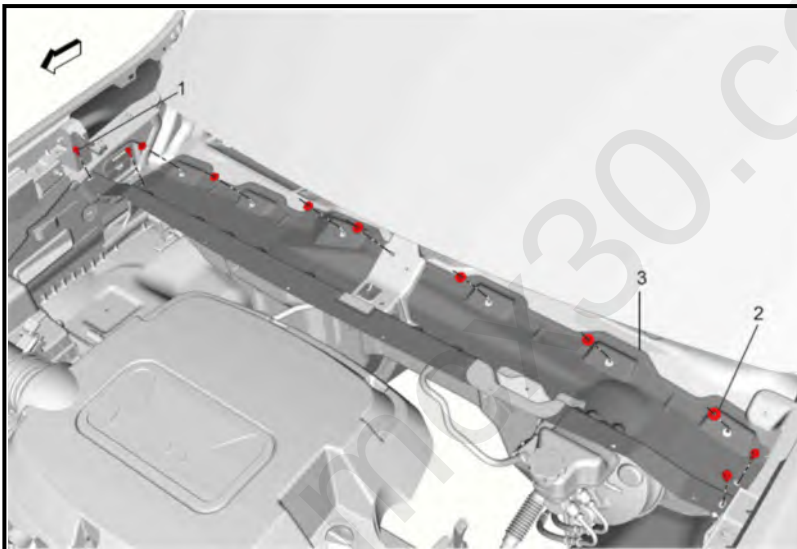
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

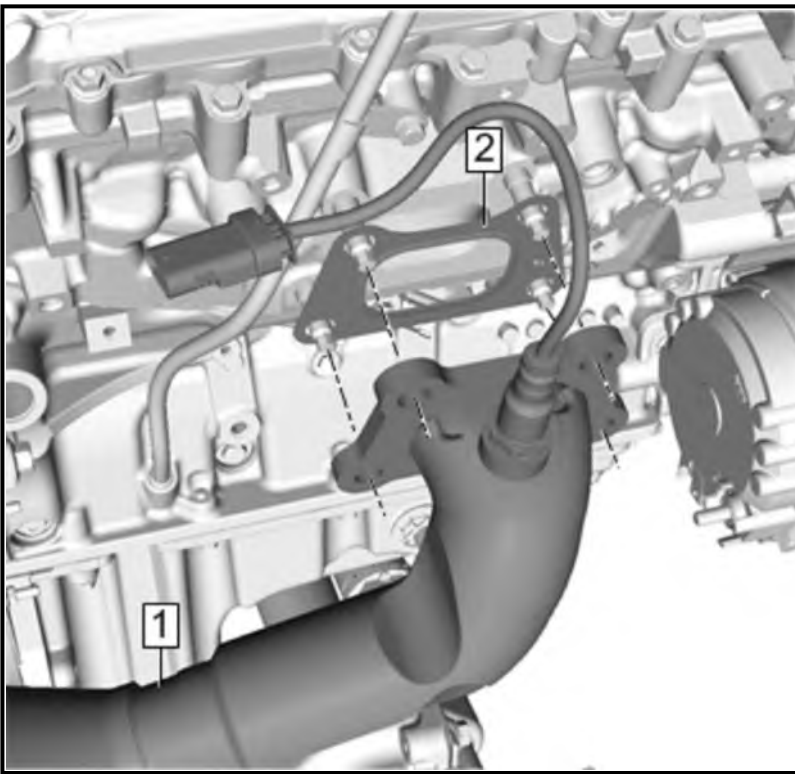
- 1. Air Cleaner Outlet Duct - Remove - [Air Cleaner Outlet Duct Replacement](#)
- 2. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)



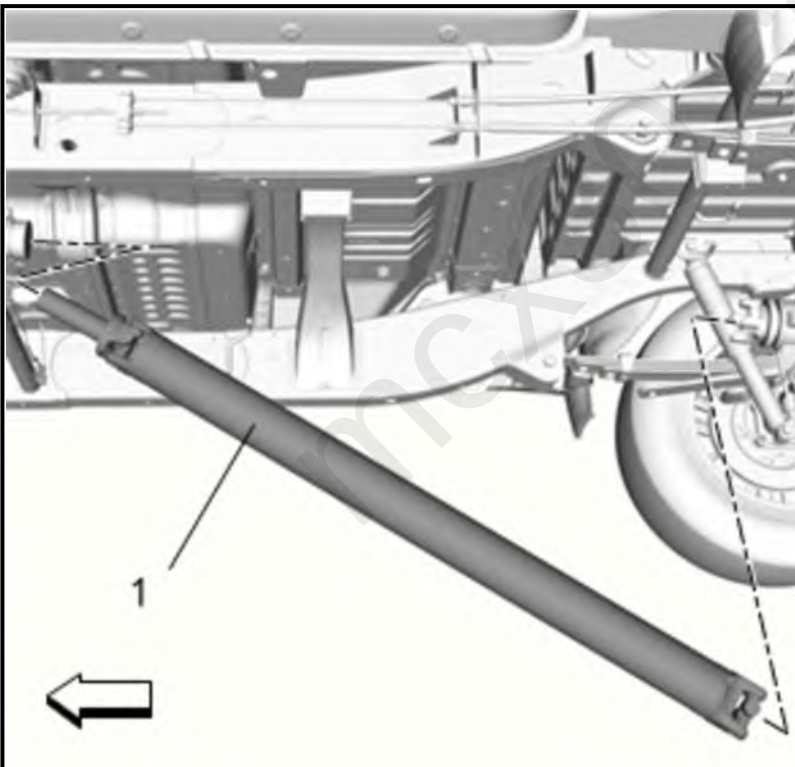
3. Plenum Front Panel (3) - Remove - [Plenum Front Panel Replacement](#)



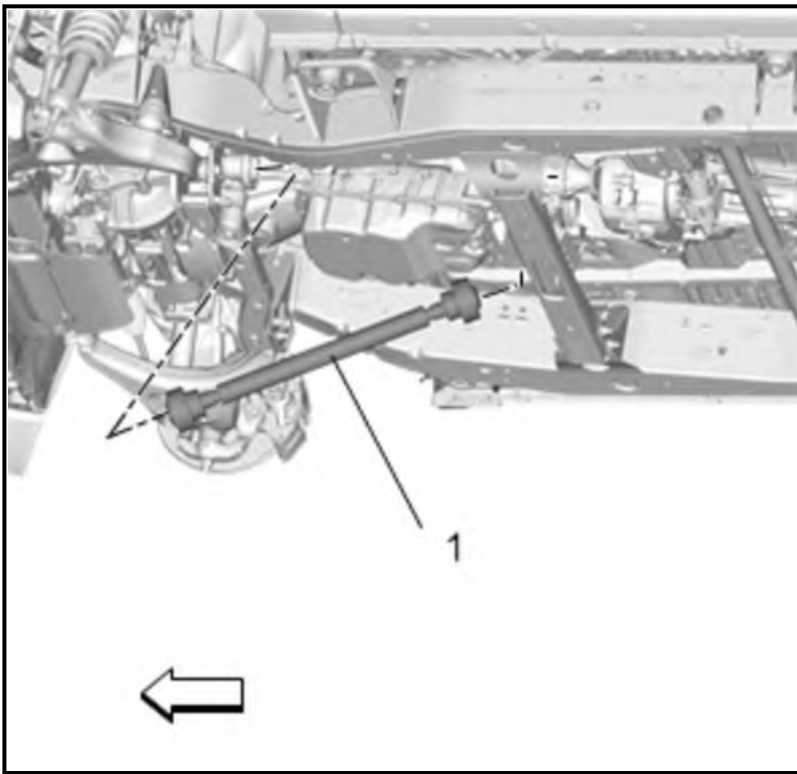
4. Warm Up Three-Way Catalytic Converter - Left Side (1) - Remove - [Warm Up Three-Way Catalytic Converter Replacement \(Right Side, LGZ\)](#) , or [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 2WD\)](#) , or [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 4WD\)](#)



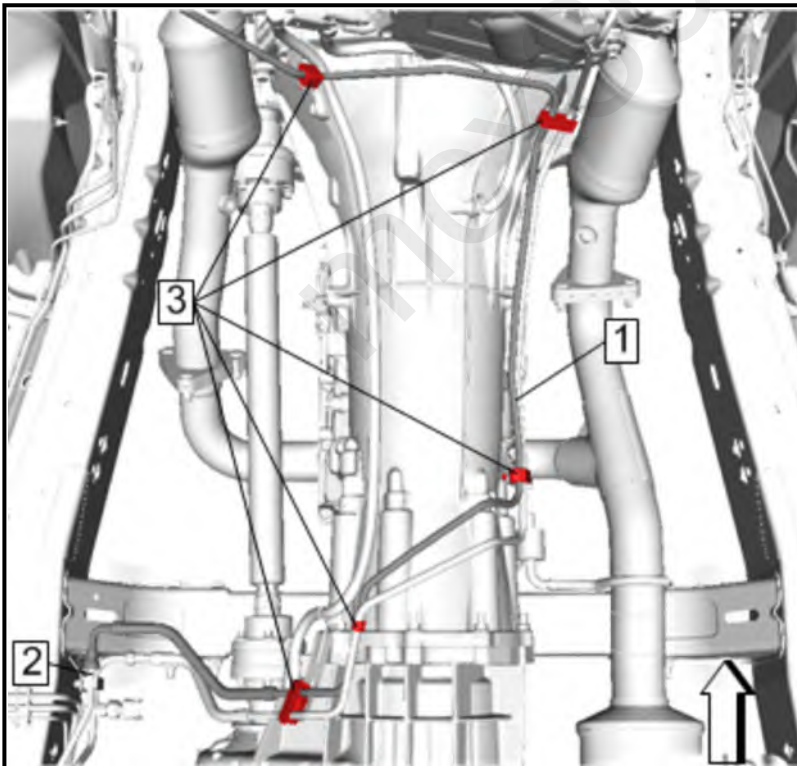
5. Propeller Shaft (1) - Remove - [Propeller Shaft Replacement \(M5T with 2WD\)](#) , or [Propeller Shaft Replacement \(M5T with 4WD\)](#).



6. {If equipped} Front Propeller Shaft (1) - Remove - [Front Axle Propeller Shaft Replacement \(Without Bison\)](#) , or [Front Axle Propeller Shaft Replacement \(With Bison\)](#).



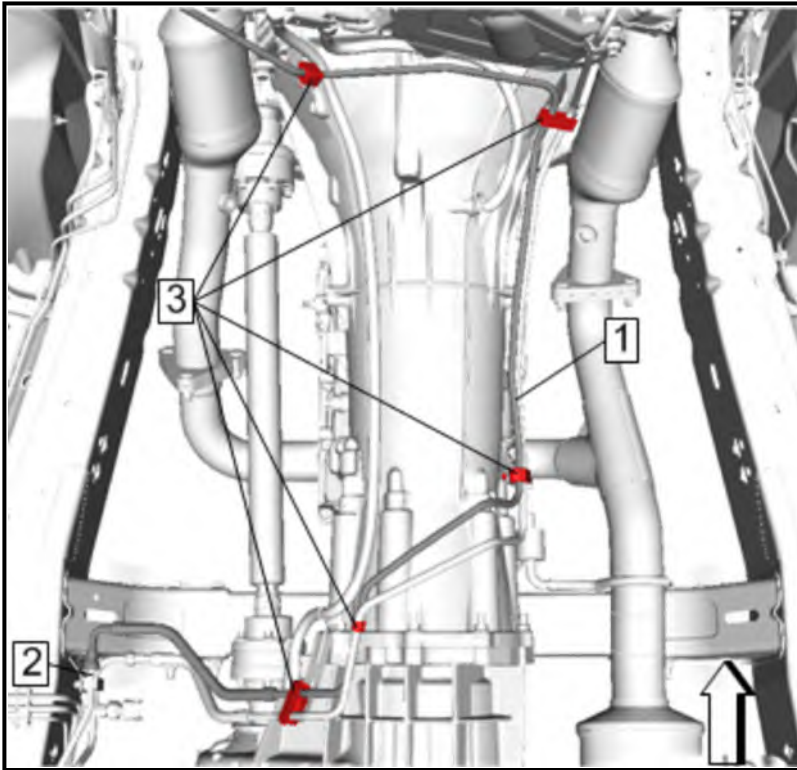
7. Transmission Support Crossmember - Remove - [Transmission Support Crossmember Replacement \(4 Wheel Drive\)](#) , or [Transmission Support Crossmember Replacement \(2 Wheel Drive\)](#).
8. Using the transmission jack, lower the rear of the transmission enough for access to remove the evaporative emission pipe.
9. Evaporative Emission Pipe @ Evaporative Emission Rear Pipe (2) - Disconnect - [Metal Collar Quick Connect Fitting Service](#)



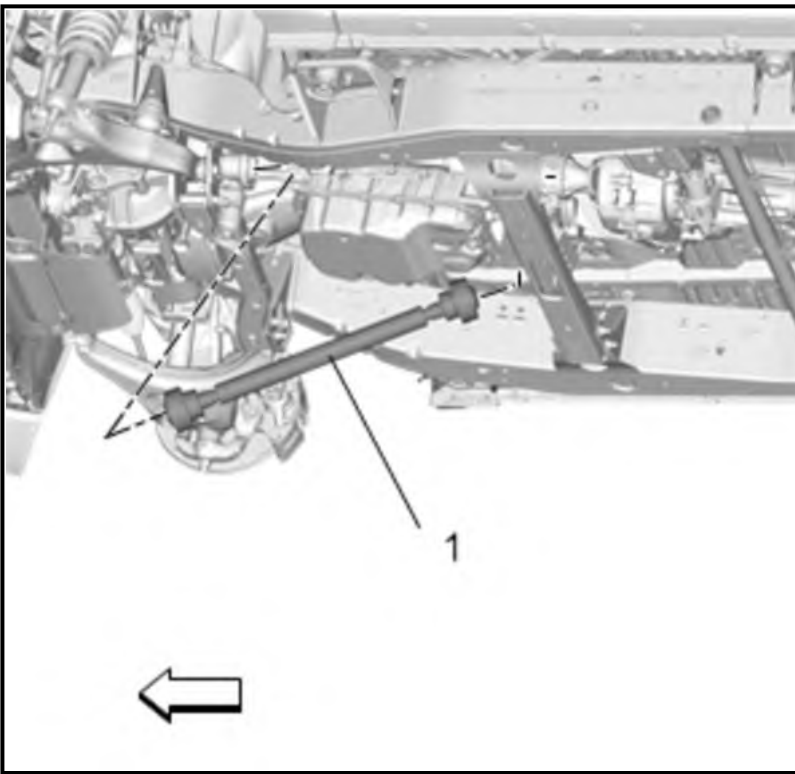
10. Evaporative Emission Pipe (1) @ Retainer (3) - Remove [4x]
11. Range Selector Lever Cable - Disconnect - [Range Selector Lever Cable Replacement \(First Design\)](#) , or [Range Selector Lever Cable Replacement \(Second Design\)](#).
12. Evaporative Emission Pipe (1) - Remove

Installation Procedure

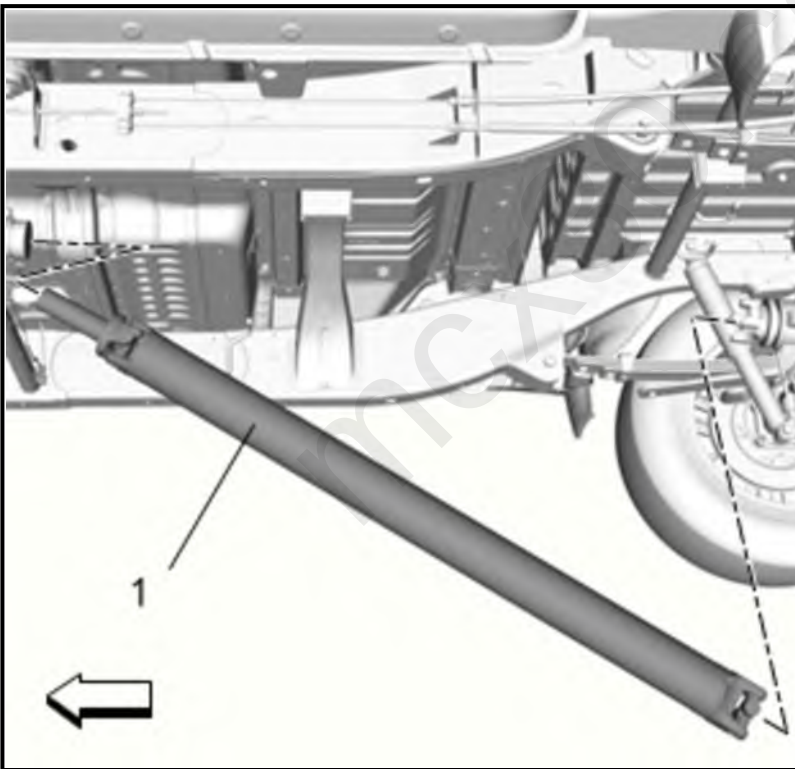
1. Evaporative Emission Pipe (1) - Install



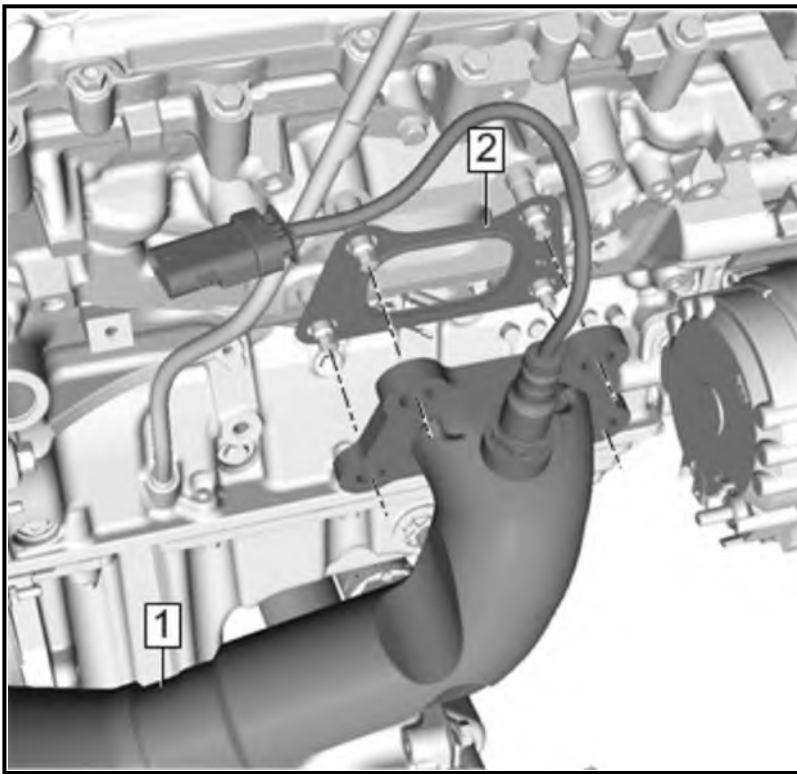
2. Range Selector Lever Cable - Connect - [Range Selector Lever Cable Replacement \(First Design\)](#) , or [Range Selector Lever Cable Replacement \(Second Design\)](#).
3. Evaporative Emission Pipe (1) @ Retainer (3) - Install [4x]
4. Evaporative Emission Pipe @ Evaporative Emission Rear Pipe (2) - Connect - [Metal Collar Quick Connect Fitting Service](#)
5. Using the transmission jack, raise the rear of the transmission into place.
6. Transmission Support Crossmember - Install - [Transmission Support Crossmember Replacement \(4 Wheel Drive\)](#) , or [Transmission Support Crossmember Replacement \(2 Wheel Drive\)](#).
7. {If equipped} Front Propeller Shaft (1) - Install - [Front Axle Propeller Shaft Replacement \(Without Bison\)](#) , or [Front Axle Propeller Shaft Replacement \(With Bison\)](#).



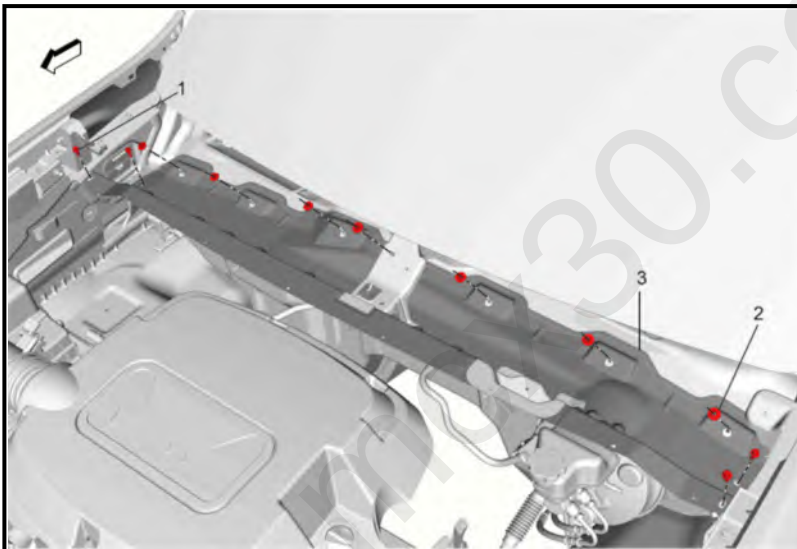
8. Propeller Shaft (1) - Install - [Propeller Shaft Replacement \(M5T with 2WD\)](#) , or [Propeller Shaft Replacement \(M5T with 4WD\)](#) , or [Propeller Shaft Replacement \(With Bison\)](#).



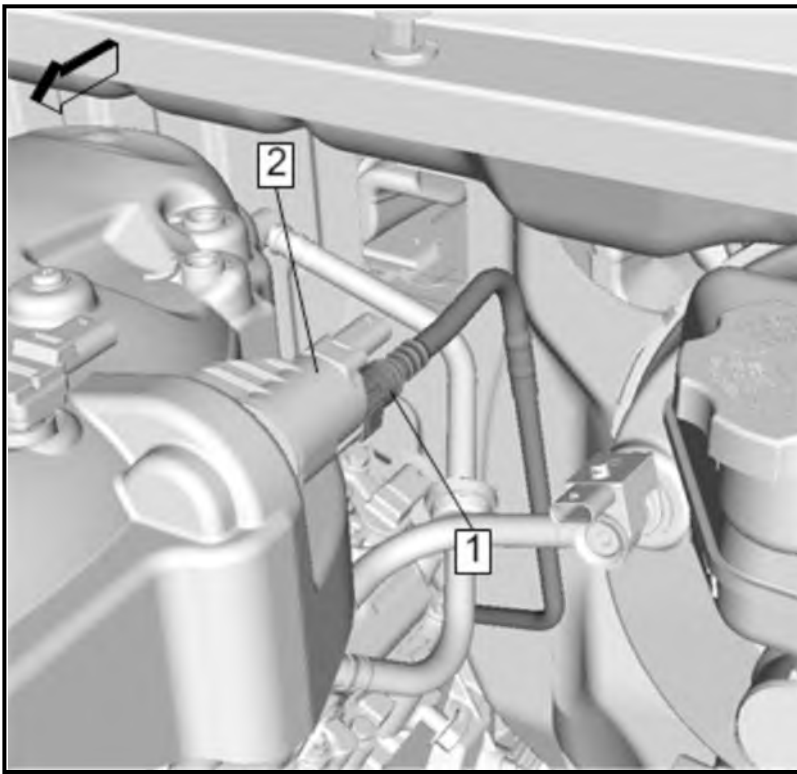
9. Warm Up Three-Way Catalytic Converter - Left Side (1) - Install - [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 2WD\)](#) , or [Warm Up Three-Way Catalytic Converter Replacement \(Left Side, LGZ 4WD\)](#).



10. Plenum Front Panel (3) - Install - [Plenum Front Panel Replacement](#)

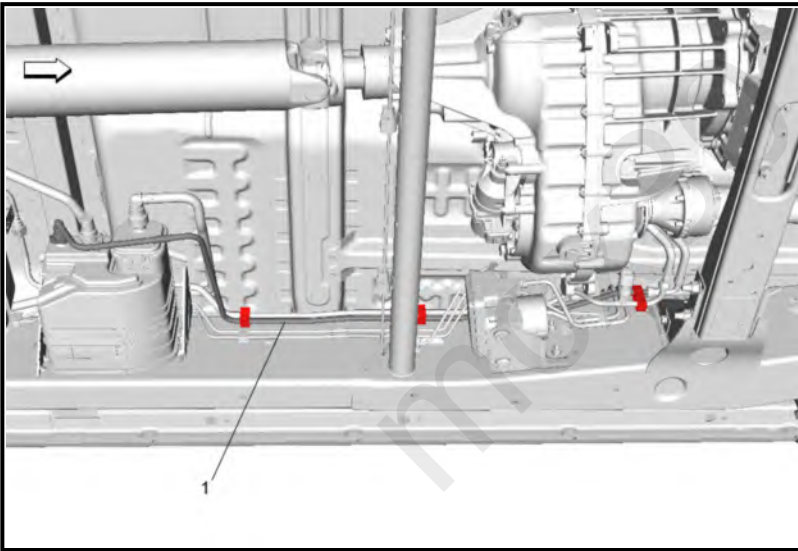


11. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)



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

EVAPORATIVE EMISSION REAR PIPE REPLACEMENT

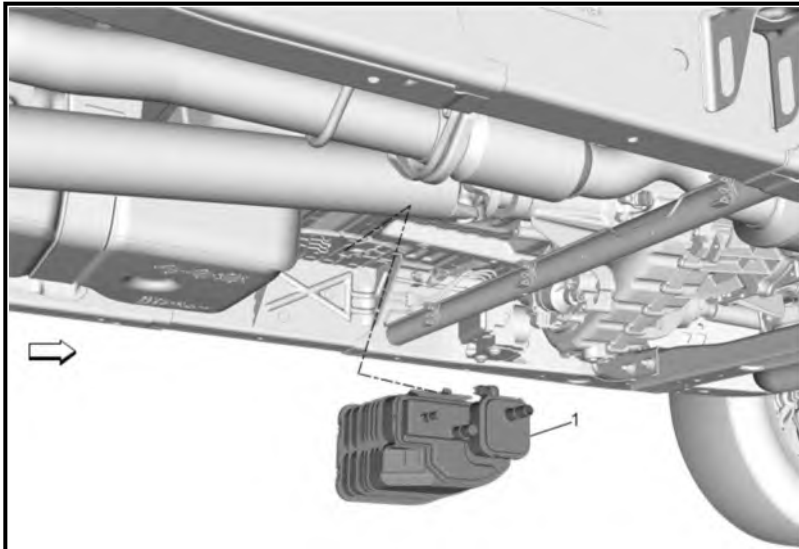


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Evaporative Emission Rear Pipe Procedure Disconnect the quick disconnects and remove from retainers. Plastic Collar Quick Connect Fitting Service , or Metal Collar Quick Connect Fitting Service

EVAPORATIVE EMISSION CANISTER REPLACEMENT



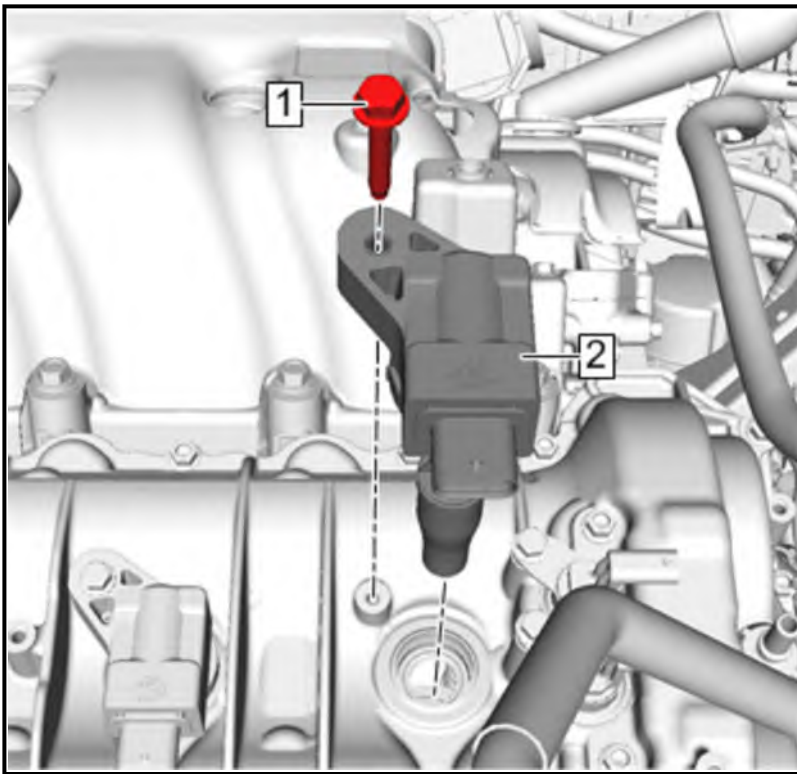
NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . Preliminary Procedure 1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle 2. Disconnect the evaporative emission canister pipes. Refer to Plastic Collar Quick Connect Fitting Service. 3. Disconnect the electrical connector.	
1	Evaporative Emission Canister Procedure Depress retaining tab on canister to remove.

IGNITION COIL REPLACEMENT - BANK 1

Removal Procedure

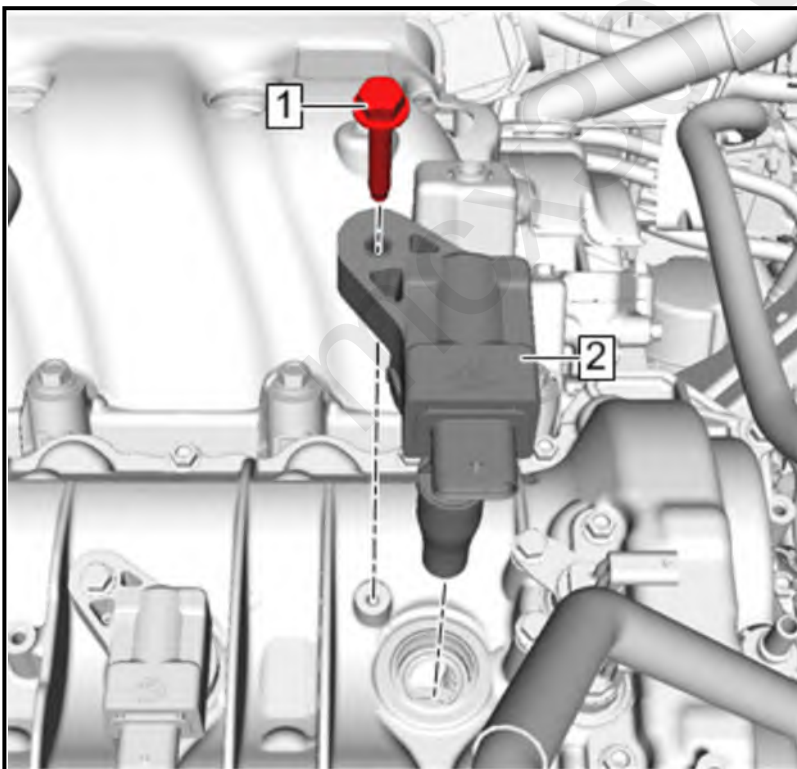
1. Camshaft Housing Cover Insulator - Remove - [Camshaft Housing Cover Insulator Replacement - Right Side](#)
2. Ignition Coil Bolt (1) - Remove



3. Ignition Coil (2) - Remove

Installation Procedure

1. Ignition Coil (2) - Install



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

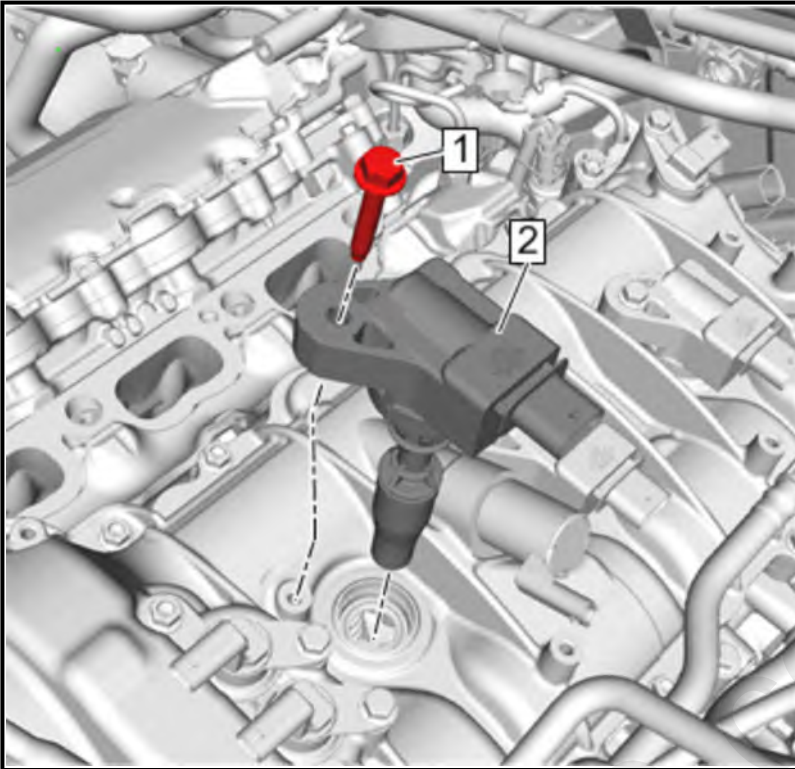
2. Ignition Coil Bolt (1) - Install and tighten 10 N.m (89 lb in).

3. Camshaft Housing Cover Insulator - Install - [Camshaft Housing Cover Insulator Replacement - Right Side](#)

IGNITION COIL REPLACEMENT - BANK 2

Removal Procedure

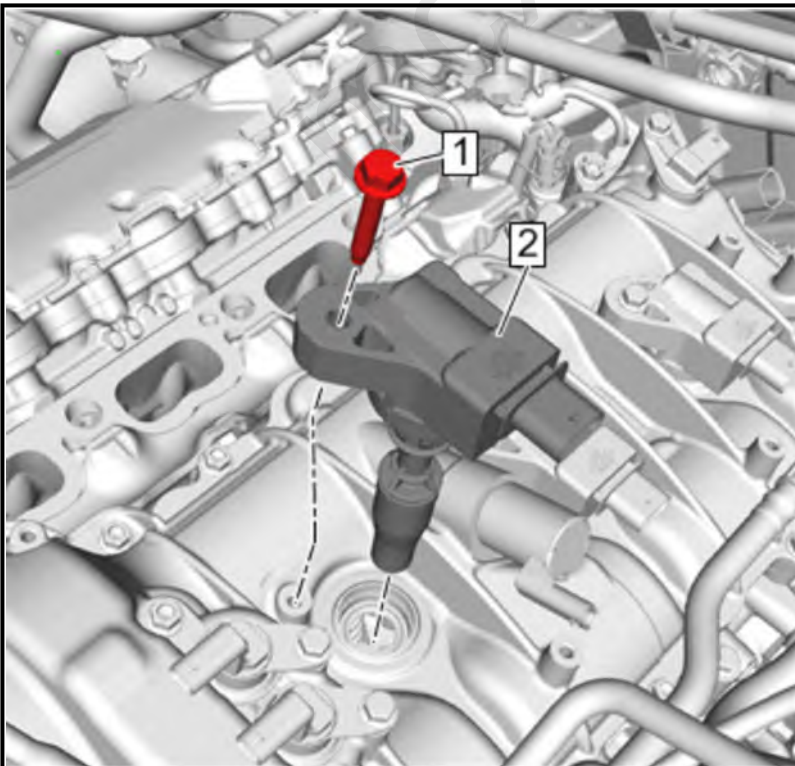
1. Camshaft Housing Cover Insulator - Remove - [Camshaft Housing Cover Insulator Replacement - Left Side](#)
2. Ignition Coil Bolt (1) - Remove



3. Ignition Coil (2) - Remove

Installation Procedure

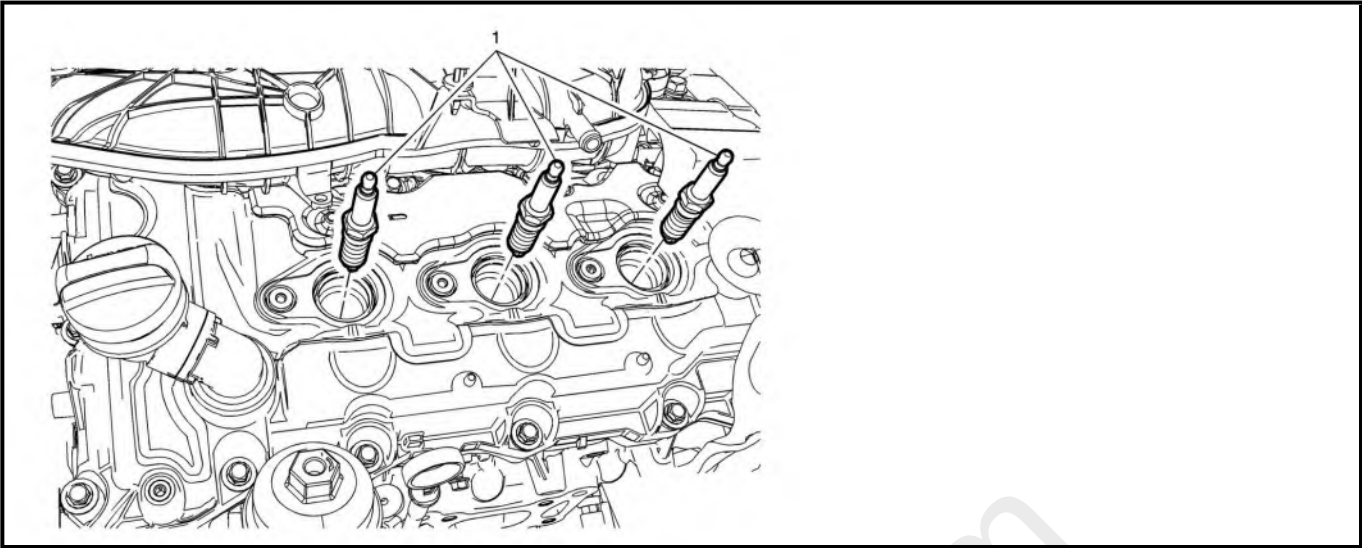
1. Ignition Coil (2) - Install



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

- 2. Ignition Coil Bolt (1) - Install and tighten 10 N.m (89 lb in).
- 3. Camshaft Housing Cover Insulator - Install - [Camshaft Housing Cover Insulator Replacement - Left Side](#)

GAS ENGINE IGNITION SPARK PLUG REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Remove the ignition coil. Refer to Ignition Coil Replacement - Bank 1 , or Ignition Coil Replacement - Bank 2 .	
1	Spark Plugs CAUTION: Refer to Component Fastener Tightening Caution Procedure Inspect the spark plug and verify the gap. Refer to ENGINE MECHANICAL SPECIFICATIONS Tighten 25 N.m (18 lb ft)

CRANKSHAFT POSITION SENSOR REPLACEMENT

Removal Procedure

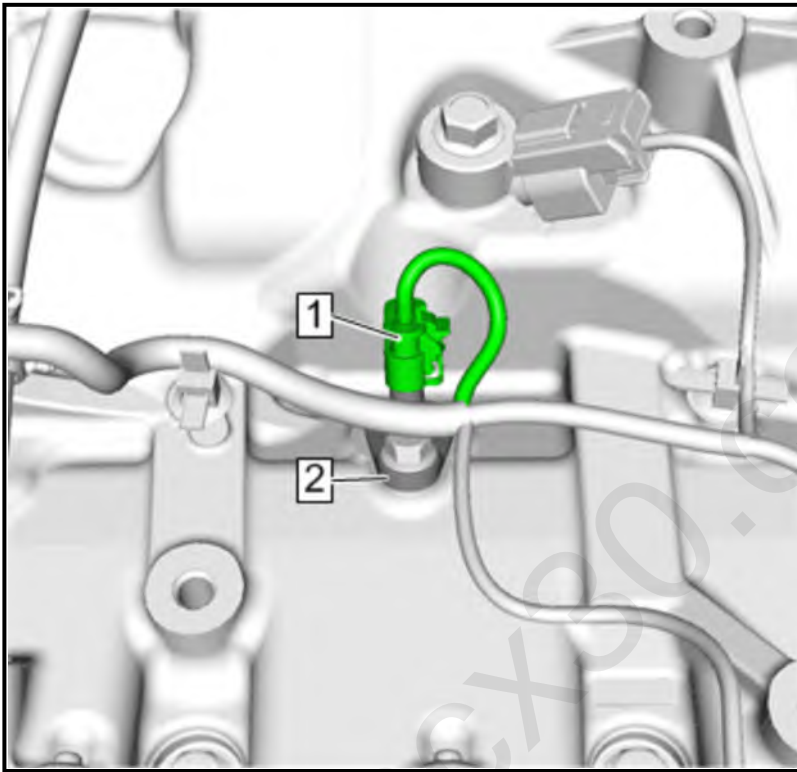
WARNING: To avoid any vehicle damage, serious personal injury or death:

- When major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.
- When performing work in the engine compartment or under the vehicle, ensure that the hood is fully open, or opened to its

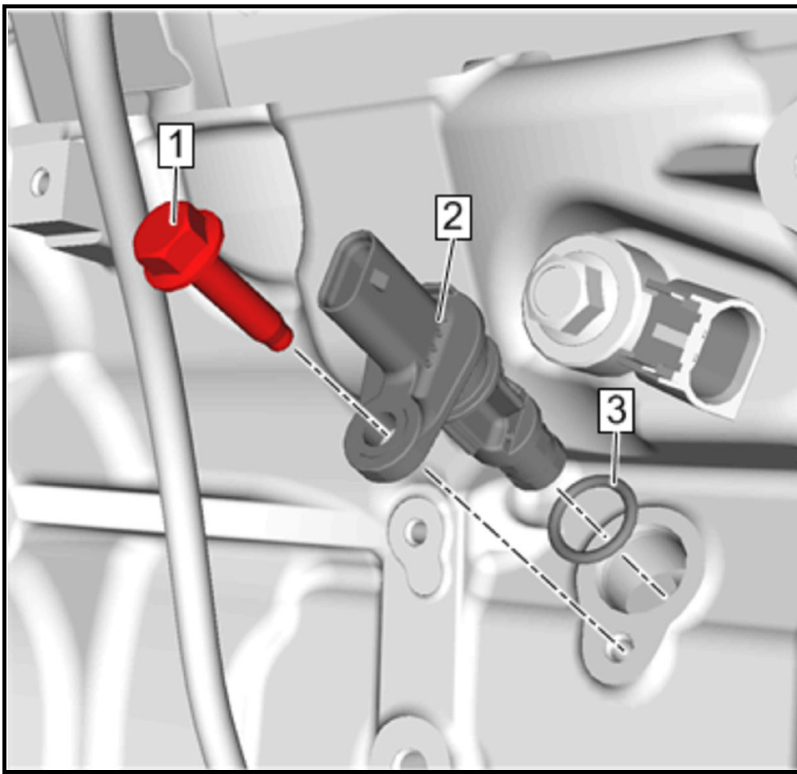
secondary latch. When the hood is opened to the secondary latch, the vehicle will disable the remote start features from the key fob and OnStar mobile app. Failure to open the hood, or open the hood to the secondary latch while doing a repair in the engine compartment or under the vehicle can result in inadvertent vehicle starting which could result in personal injury or damage to a vehicle.

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

1. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)
2. Engine Mount-Right Side - Remove - [Engine Mount Replacement - Right Side](#)
3. Electrical Connector (1) @ Crankshaft Position Sensor (2) - Disconnect



4. Crankshaft Position Sensor Bolt (1) - Remove

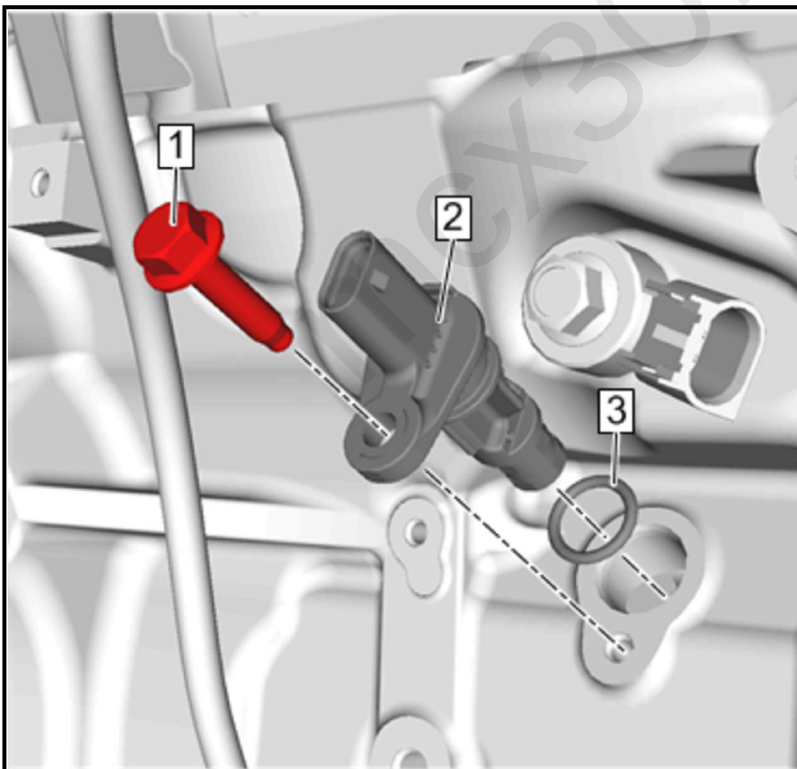


5. Crankshaft Position Sensor (2) - Remove

6. Crankshaft Position Sensor Seal (3) - Remove and DISCARD

Installation Procedure

1. Crankshaft Position Sensor Seal (3) - Install a NEW seal.

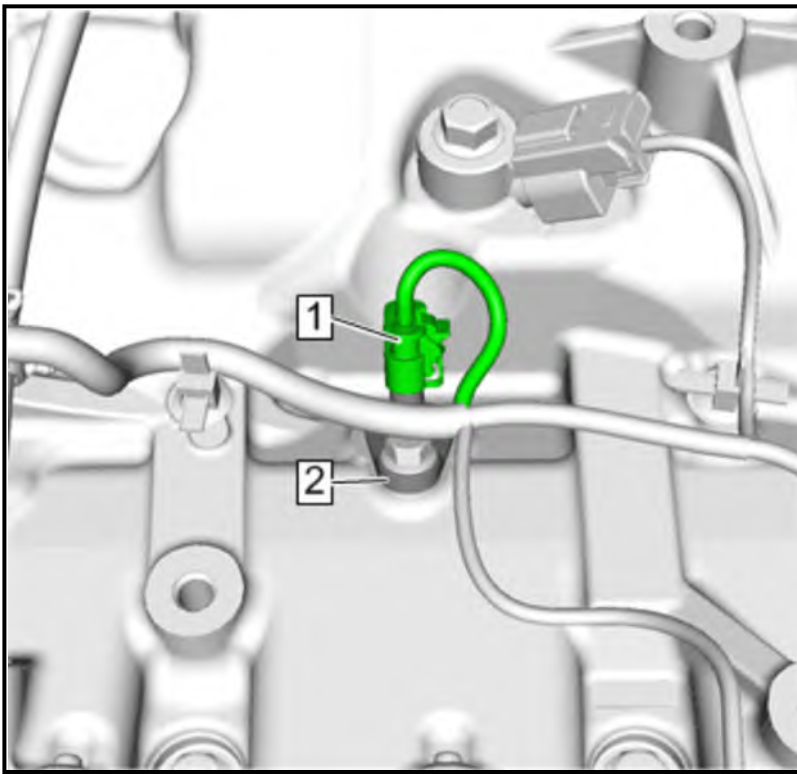


2. Crankshaft Position Sensor (2) - Install

CAUTION: Refer to **Fastener Caution** .

3. Crankshaft Position Sensor Bolt (1) - Install and tighten 10 N.m (89 lb in)

4. Electrical Connector (1) @ Crankshaft Position Sensor (2) - Connect

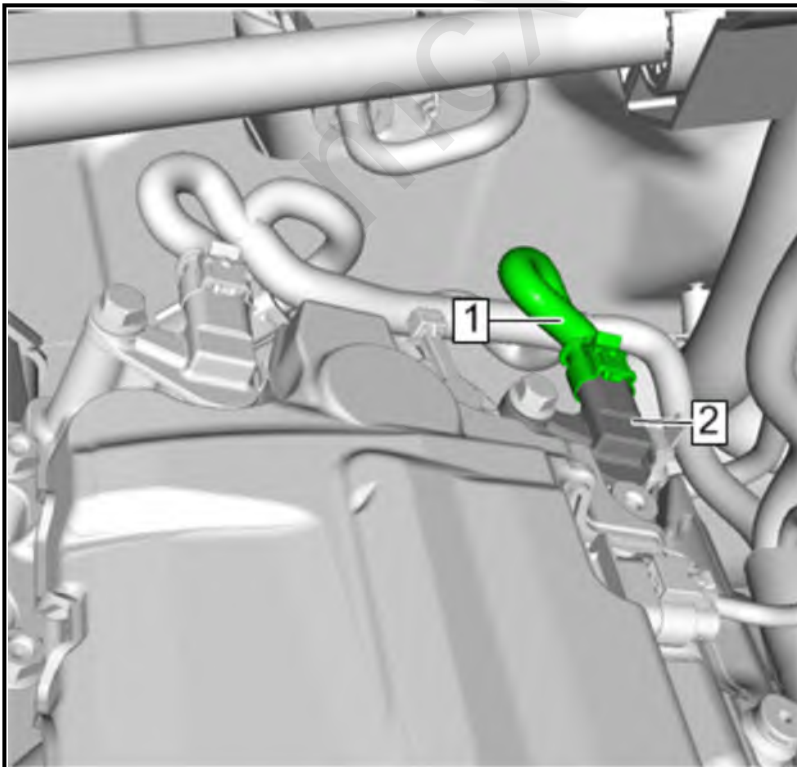


5. Engine Mount-Right Side - Install - [Engine Mount Replacement - Right Side](#)
6. Lower the vehicle.
7. Perform the crankshaft position variation learn. [Crankshaft Position Variation Learn](#)

CAMSHAFT POSITION SENSOR REPLACEMENT - BANK 2 (LEFT SIDE) EXHAUST

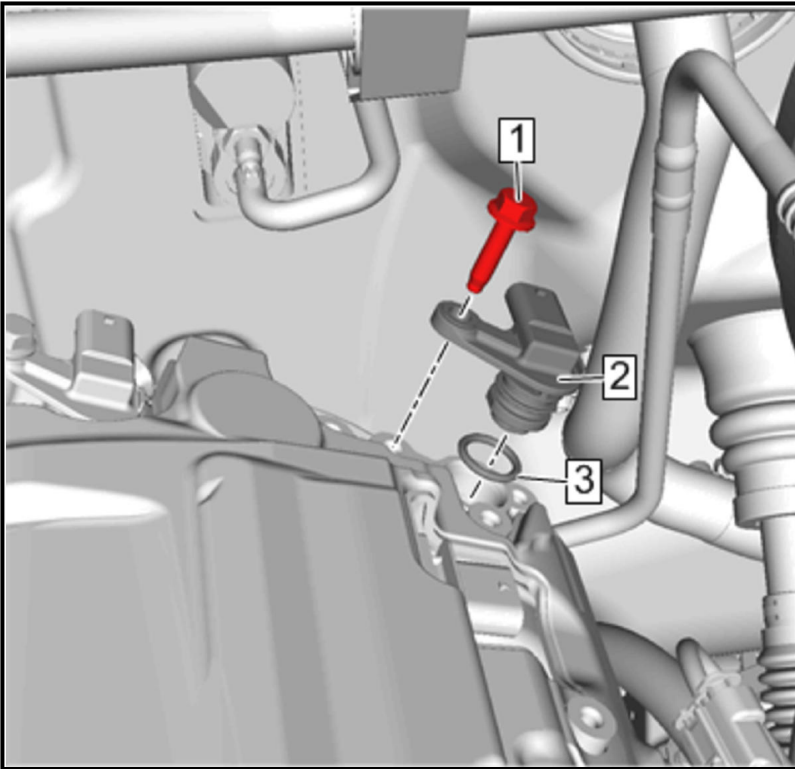
Removal Procedure

1. Intake Manifold - Remove - [Intake Manifold Replacement](#)
2. Use compressed air to remove debris from the Camshaft Position Sensor and surrounding cavities.



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

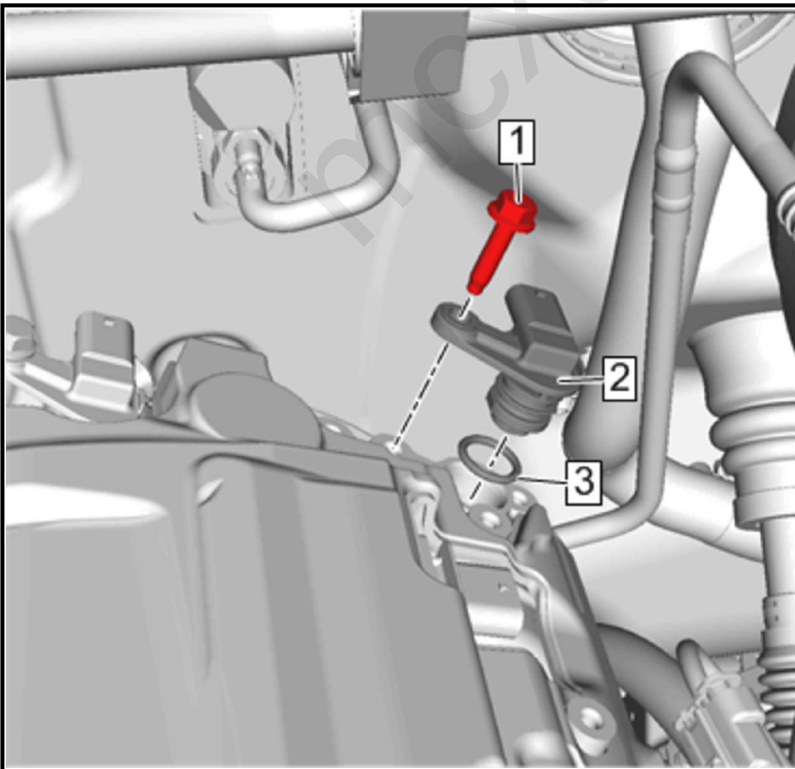
3. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Disconnect
4. Camshaft Position Sensor Bolt (1) - Remove



5. Camshaft Position Sensor (2) - Remove
6. Camshaft Position Sensor Seal (3) - Remove and DISCARD

Installation Procedure

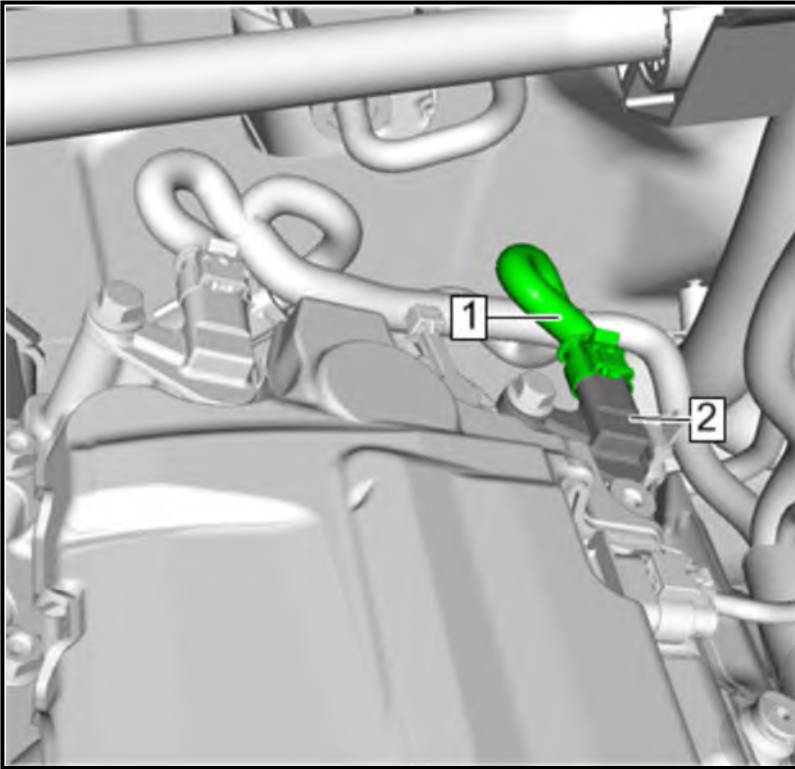
1. Lubricate the NEW camshaft position sensor O-ring seal with clean engine oil.



2. Camshaft Position Sensor Seal (3) - Install a NEW seal.
3. Camshaft Position Sensor (2) - Install

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

4. Camshaft Position Sensor Bolt (1) - Install and tighten 10 N.m (89 lb in).
5. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Connect

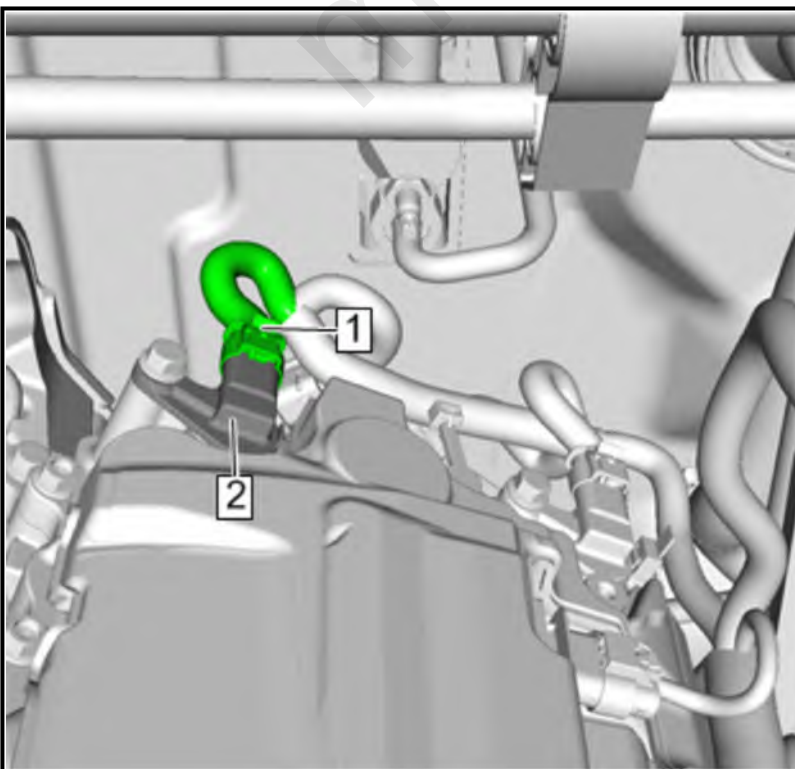


6. Intake Manifold - Install - [Intake Manifold Replacement](#)

CAMSHAFT POSITION SENSOR REPLACEMENT - BANK 2 (LEFT SIDE) INTAKE

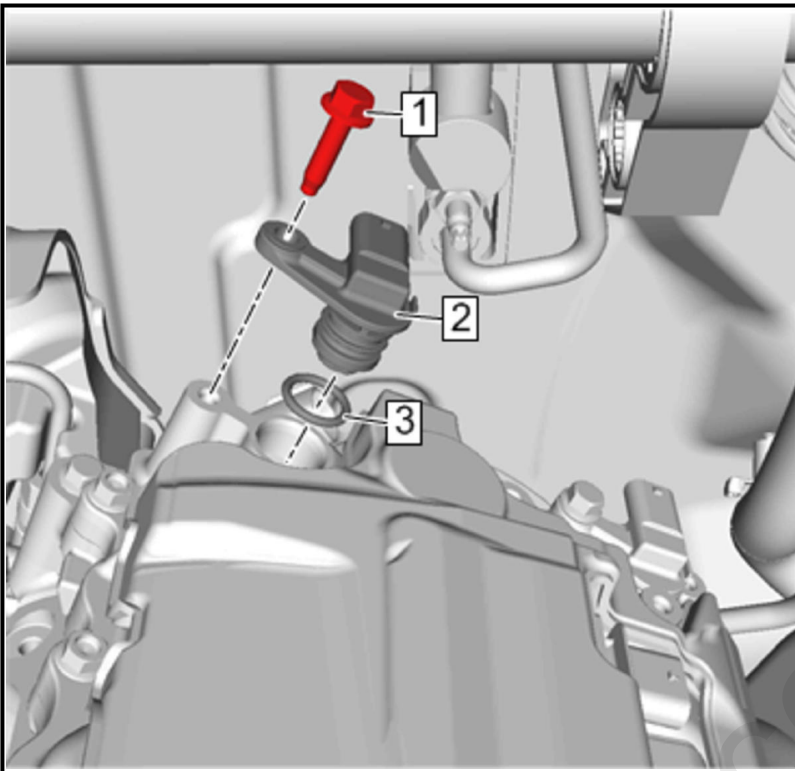
Removal Procedure

1. Intake Manifold - Remove - [Intake Manifold Replacement](#)
2. Use compressed air to remove debris from the Camshaft Position Sensor and surrounding cavities.



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

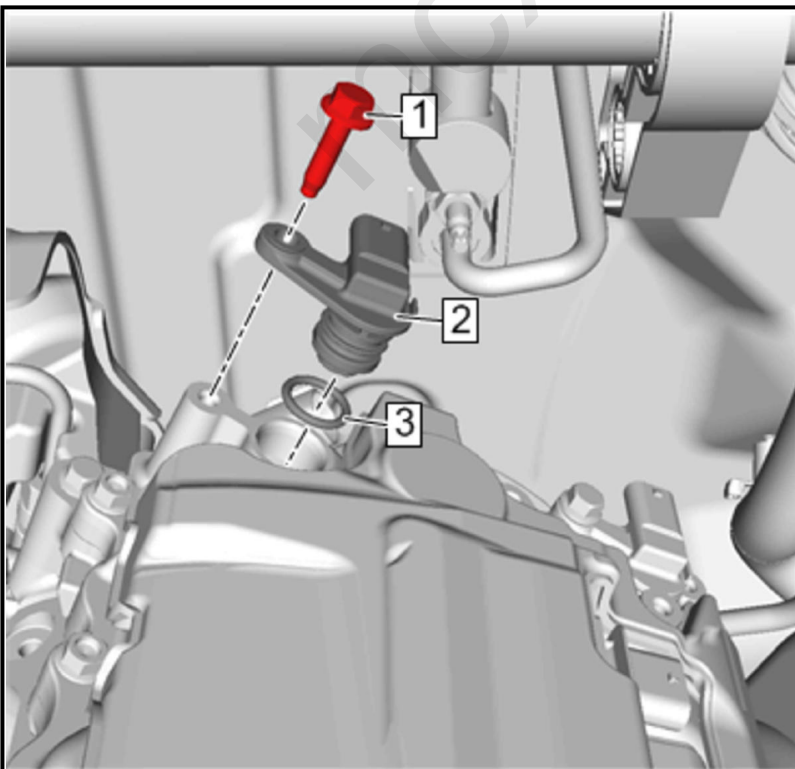
3. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Disconnect
4. Camshaft Position Sensor Bolt (1) - Remove



5. Camshaft Position Sensor (2) - Remove
6. Camshaft Position Sensor Seal (3) - Remove and DISCARD

Installation Procedure

1. Lubricate the NEW camshaft position sensor O-ring seal with clean engine oil.



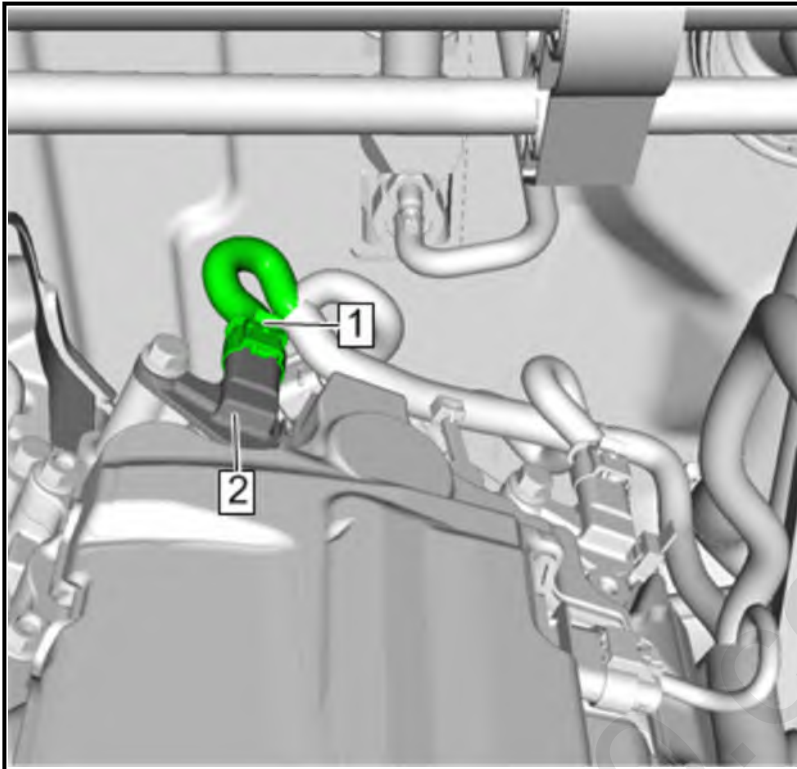
2. Camshaft Position Sensor Seal (3) - Install NEW

3. Camshaft Position Sensor (2) - Install

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

4. Camshaft Position Sensor Bolt (1) - Install and tighten 10 N.m (89 lb in).

5. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Connect

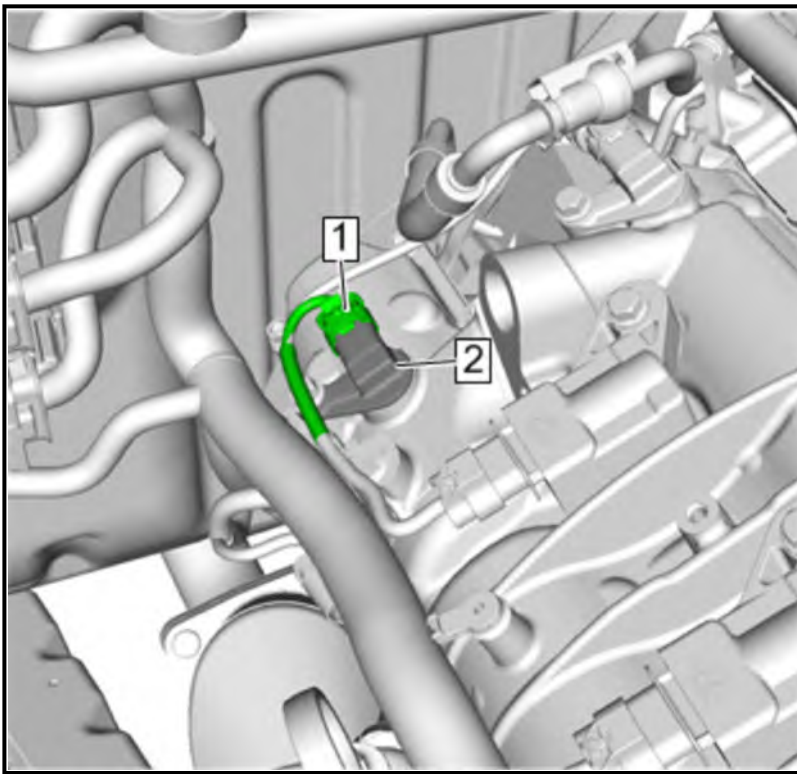


6. Intake Manifold - Remove - [Intake Manifold Replacement](#)

CAMSHAFT POSITION SENSOR REPLACEMENT - BANK 1 (RIGHT SIDE) EXHAUST

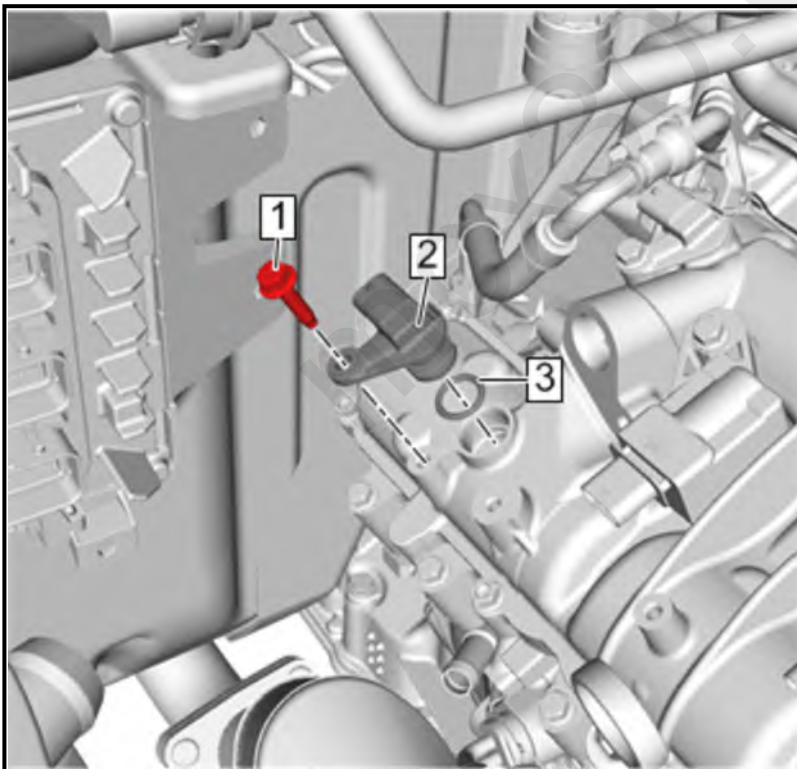
Removal Procedure

1. Camshaft Housing Cover Insulator-Right Side - Remove - [Camshaft Housing Cover Insulator Replacement - Right Side](#)
2. Use compressed air to remove debris from the Camshaft Position Sensor and surrounding cavities.



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

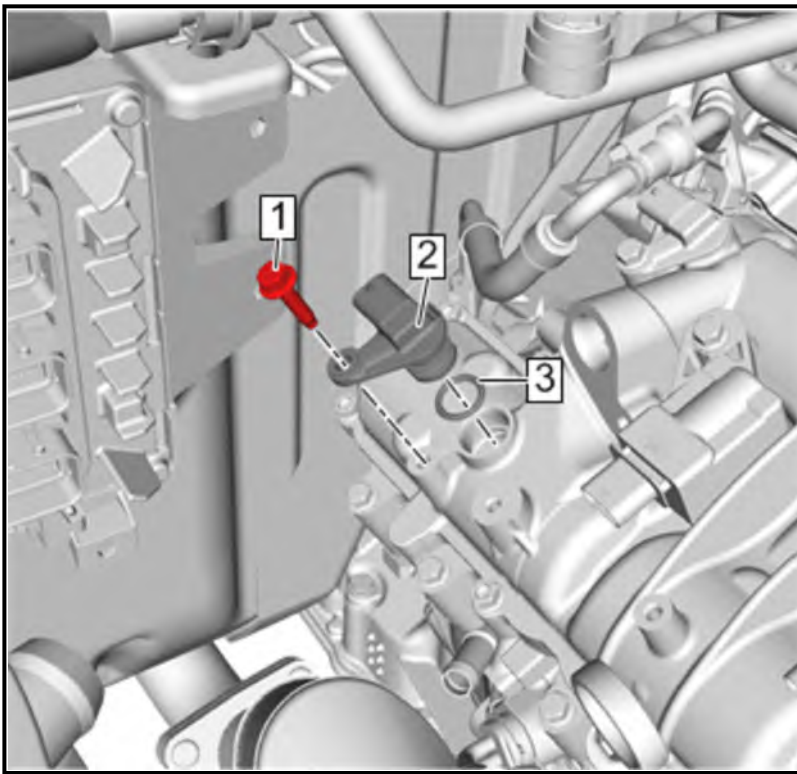
3. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Disconnect
4. Camshaft Position Sensor Bolt (1) - Remove



5. Camshaft Position Sensor (2) - Remove

Installation Procedure

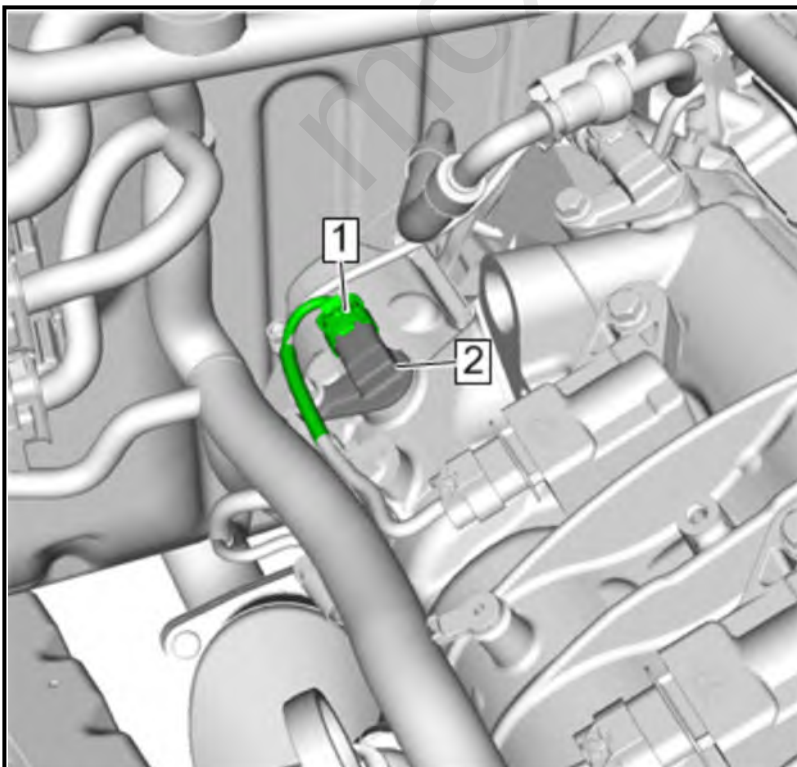
1. Camshaft Position Sensor (2) - Install



NOTE: Always install the camshaft position sensor O-ring (3) supplied with the **NEW** camshaft position sensor. If reinstalling the sensor, inspect the camshaft position sensor O-ring (3) and replace as necessary. Lubricate the camshaft position sensor O-ring (3) with clean engine oil prior to installing the camshaft position sensor.

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

2. Camshaft Position Sensor Bolt (1) - Install and tighten 10 N.m (89 lb in).
3. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Connect

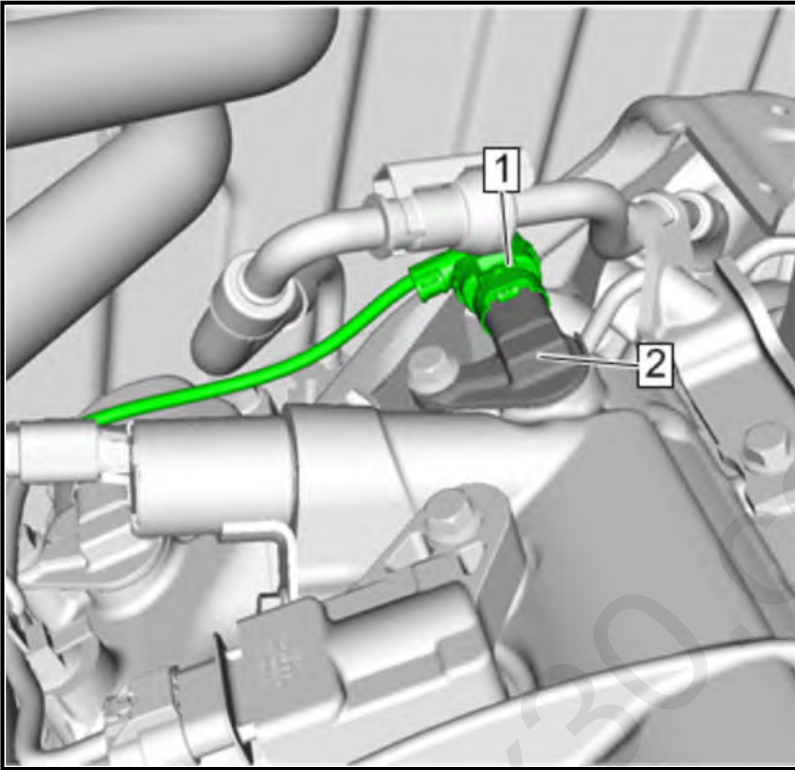


4. Camshaft Housing Cover Insulator-Right Side - Install - [Camshaft Housing Cover Insulator Replacement - Right Side](#)

CAMSHAFT POSITION SENSOR REPLACEMENT - BANK 1 (RIGHT SIDE) INTAKE

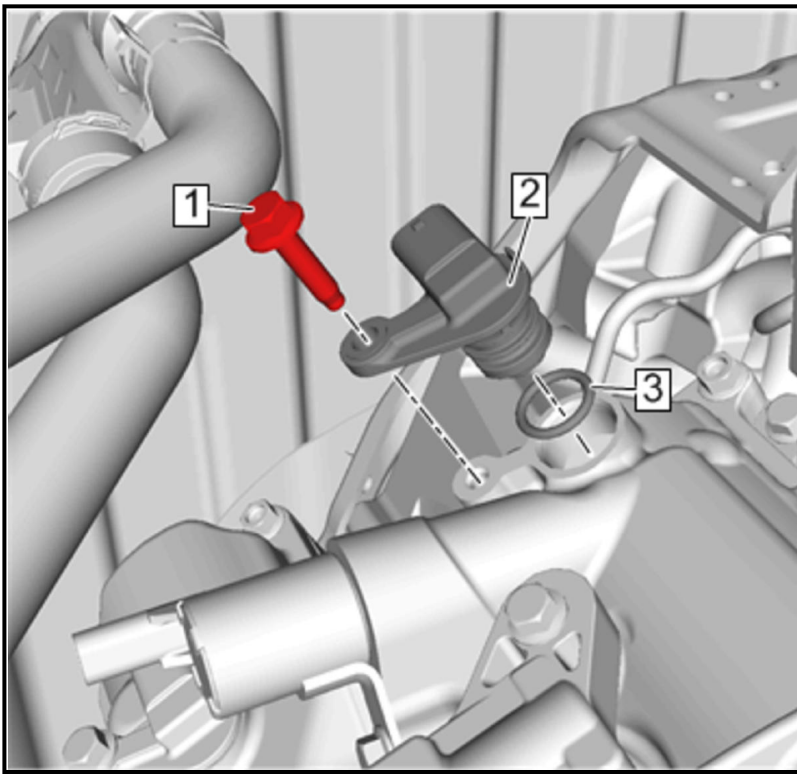
Removal Procedure

1. Camshaft Housing Cover Insulator-Right Side - Remove - [Camshaft Housing Cover Insulator Replacement - Right Side](#)
2. Use compressed air to remove debris from the Camshaft Position Sensor and surrounding cavities.



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

3. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Disconnect
4. Camshaft Position Sensor Bolt (1) - Remove

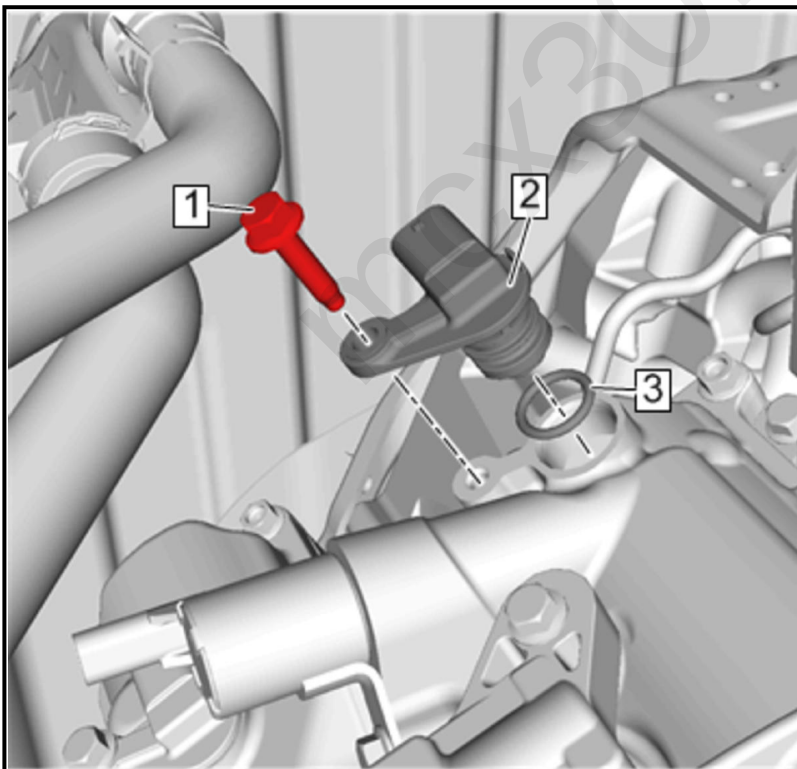


5. Camshaft Position Sensor (2) - Remove

6. Camshaft Position Sensor Oil Seal Ring (3) - Remove and DISCARD

Installation Procedure

1. Camshaft Position Sensor Oil Seal Ring (3) - Install NEW

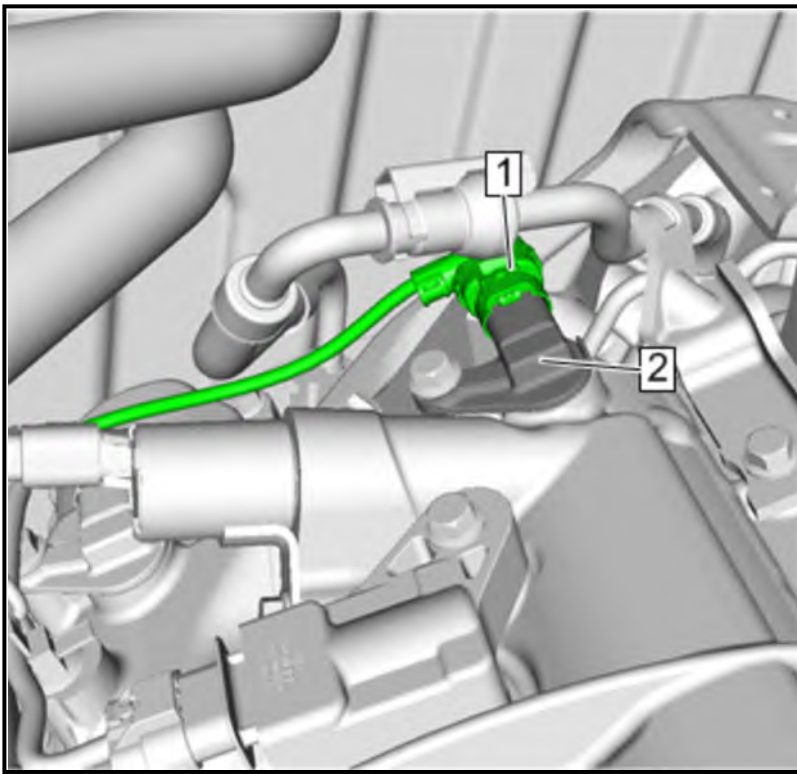


2. Camshaft Position Sensor (2) - Install

CAUTION: Refer to **Fastener Caution** .

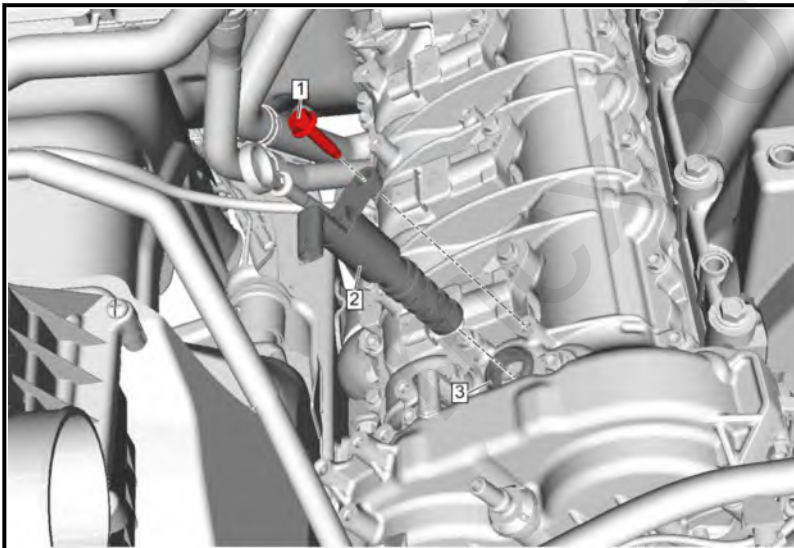
3. Camshaft Position Sensor Bolt (1) - Install and tighten 10 N.m (89 lb in).

4. Camshaft Position Sensor Electrical Connector (1) @ Camshaft Position Sensor (2) - Connect



5. Camshaft Housing Cover Insulator-Right Side - Install - [Camshaft Housing Cover Insulator Replacement - Right Side](#)

CAMSHAFT POSITION ACTUATOR VALVE SOLENOID REPLACEMENT - BANK 1 (RIGHT SIDE) INTAKE

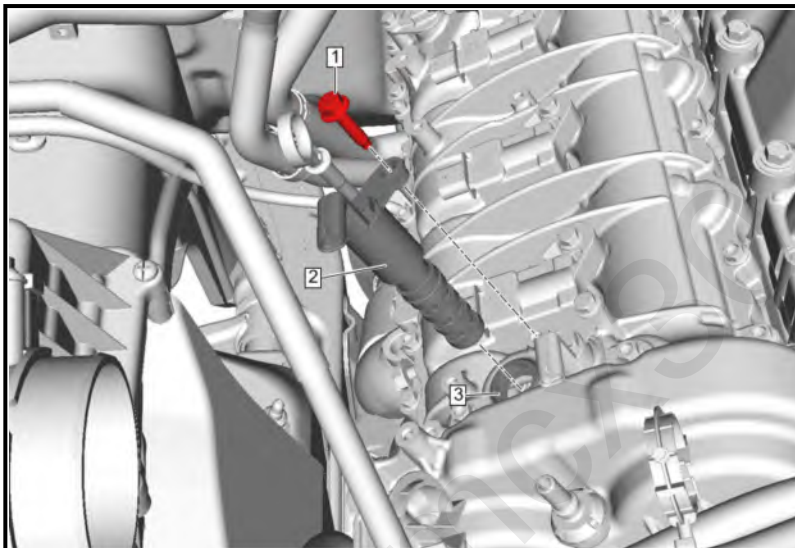


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Camshaft Housing Cover Insulator Replacement - Right Side	
1	Camshaft Position Actuator Solenoid Valve Bolt CAUTION: Refer to Fastener Caution .

Callout	Component Name
	Tighten 10 N.m (89 lb in)
2	Camshaft Position Actuator Solenoid Valve
3	Camshaft Position Actuator Solenoid Valve Seal NOTE: Inspect the camshaft position actuator solenoid valve seal and replace as necessary.

CAMSHAFT POSITION ACTUATOR VALVE SOLENOID REPLACEMENT - BANK 1 (RIGHT SIDE) EXHAUST

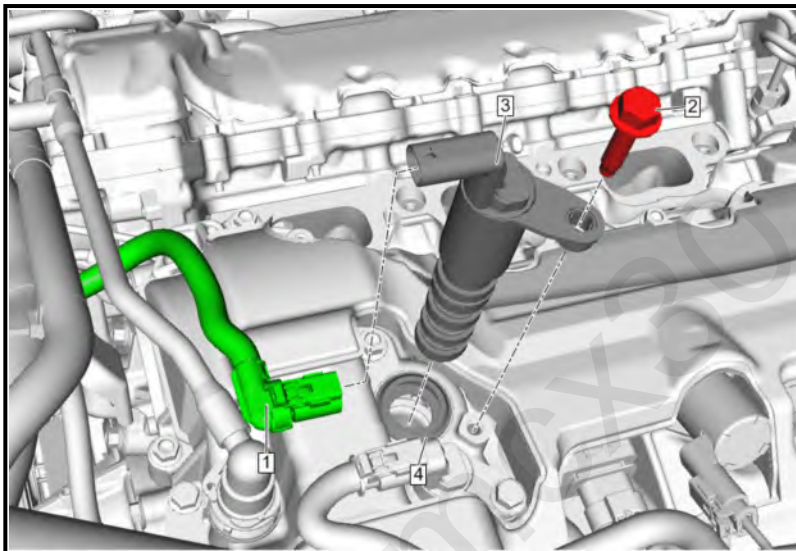


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Camshaft Housing Cover Insulator Replacement - Right Side	
1	Camshaft Position Actuator Solenoid Valve Bolt CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Camshaft Position Actuator Solenoid Valve NOTE:

Callout	Component Name
	Inspect the O-ring and replace if necessary.
3	Camshaft Position Actuator Solenoid Valve Seal NOTE: Inspect the camshaft position actuator solenoid valve seal and replace as necessary.

CAMSHAFT POSITION ACTUATOR VALVE SOLENOID REPLACEMENT - BANK 2 (LEFT SIDE) INTAKE

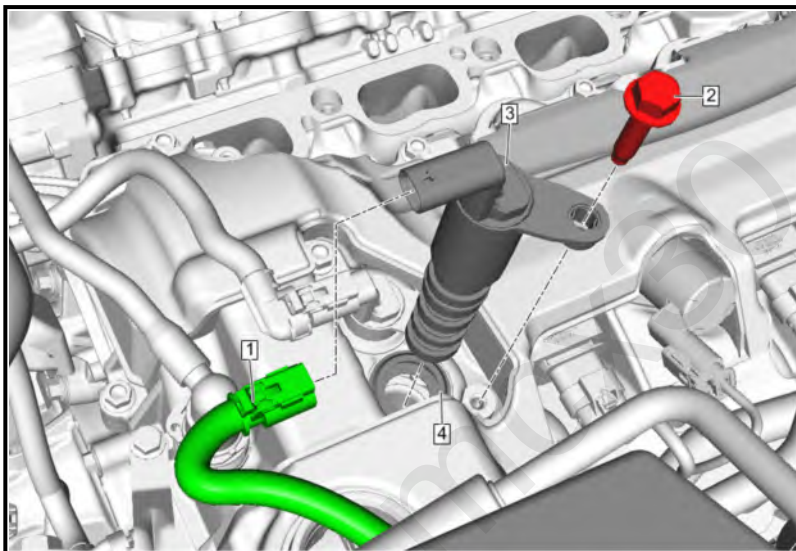


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Intake Manifold Replacement</u>	
1	Electrical Connector
2	Camshaft Position Actuator Solenoid Valve Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
3	Camshaft Position Actuator Solenoid Valve

Callout	Component Name
	NOTE: Inspect the O-ring and replace if necessary.
4	Camshaft Position Actuator Solenoid Valve Seal NOTE: Inspect the camshaft position actuator solenoid valve seal and replace as necessary.

CAMSHAFT POSITION ACTUATOR VALVE SOLENOID REPLACEMENT - BANK 2 (LEFT SIDE) EXHAUST

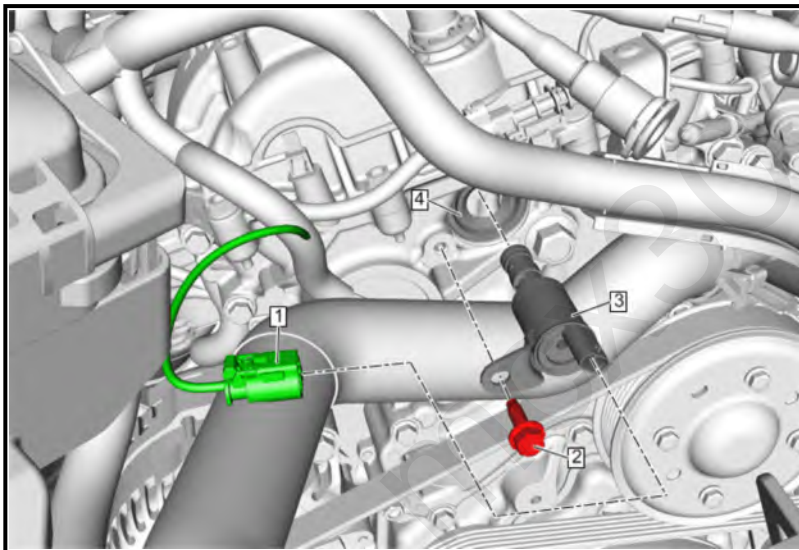


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Intake Manifold Replacement</u>	
1	Electrical Connector
2	Camshaft Position Actuator Solenoid Valve Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
3	Camshaft Position Actuator Solenoid Valve

Callout	Component Name
	NOTE: Inspect the O-ring and replace if necessary.
4	Camshaft Position Actuator Solenoid Valve Seal NOTE: Inspect the camshaft position actuator solenoid valve seal and replace as necessary.

CAMSHAFT POSITION ACTUATOR LOCATING PIN CONTROL VALVE REPLACEMENT - BANK 1



NOTE: Callouts in the following chart represent components shown in graphic above.

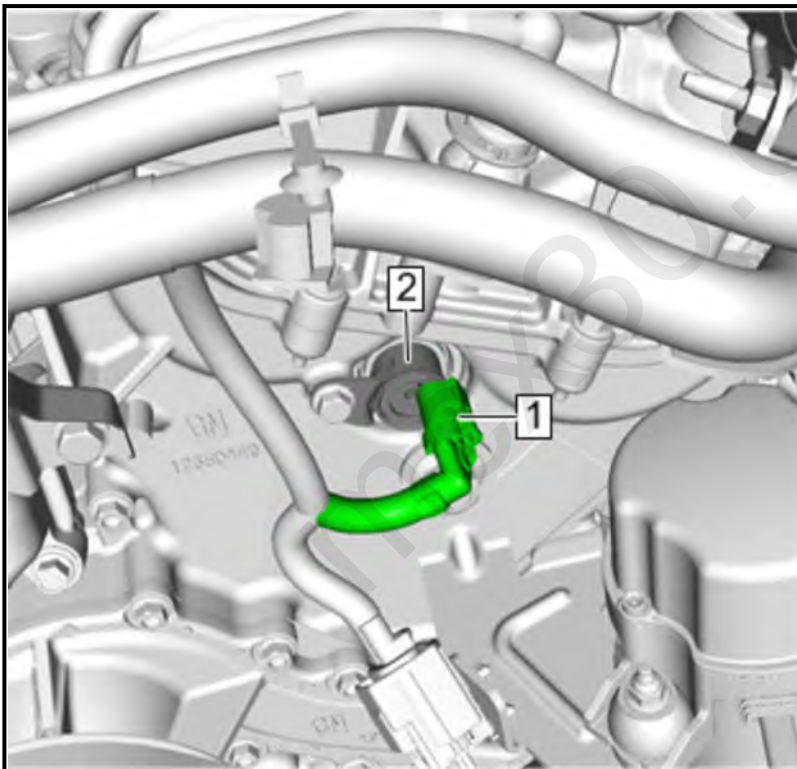
Callout	Component Name
Preliminary Procedure <u>Air Cleaner Outlet Duct Replacement</u>	
1	Electrical Connector
2	Camshaft Position Actuator Locating Pin Control Valve Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)

Callout	Component Name
3	Camshaft Position Actuator Locating Pin Control Valve
4	Camshaft Position Actuator Solenoid Valve Seal Procedure Inspect the Camshaft Position Actuator Solenoid Valve Seal and replace as necessary. NOTE: The seal is reusable, inspect the seal and replace if damaged.

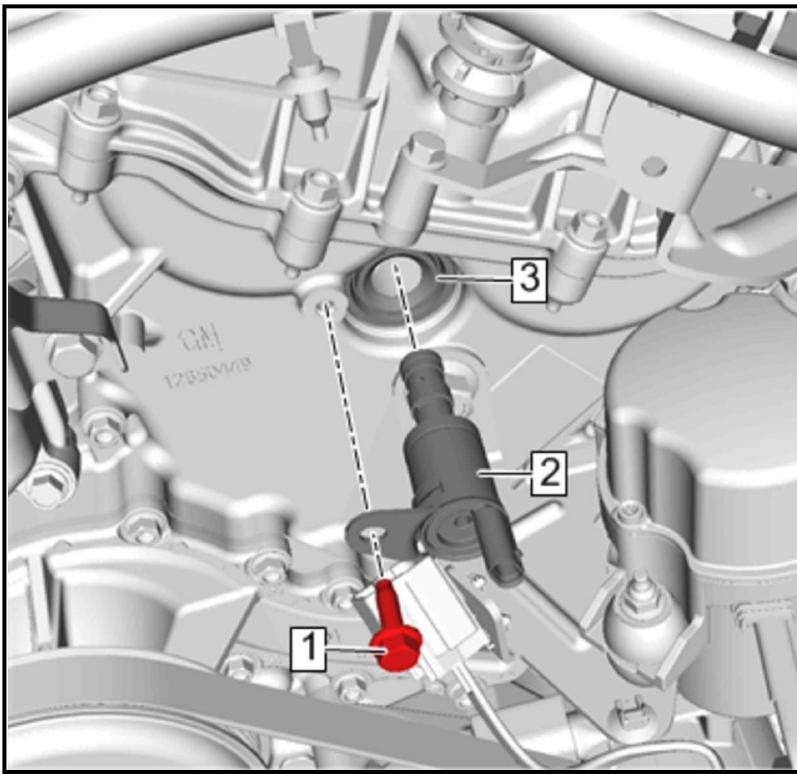
CAMSHAFT POSITION ACTUATOR LOCATING PIN CONTROL VALVE REPLACEMENT - BANK 2

Removal Procedure

1. Air Cleaner Outlet Duct - Remove - [Air Cleaner Outlet Duct Replacement](#)
2. Electrical Connector (1) @ Camshaft Position Actuator Locating Pin Control Valve (2) - Disconnect



3. Camshaft Position Actuator Locating Pin Control Valve Bolt (1) - Remove



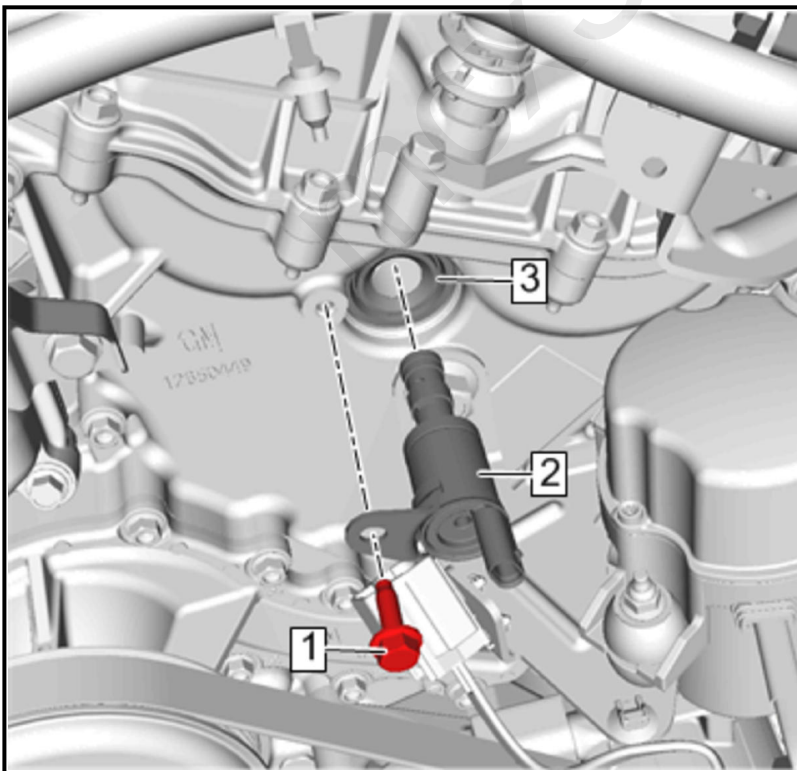
4. Camshaft Position Actuator Locating Pin Control Valve (2) - Remove

NOTE: The seal is reusable, inspect the seal and replace if damaged.

5. Camshaft Position Actuator Solenoid Valve Seal (3) - Remove

Installation Procedure

1. Camshaft Position Actuator Solenoid Valve Seal (3) - Install

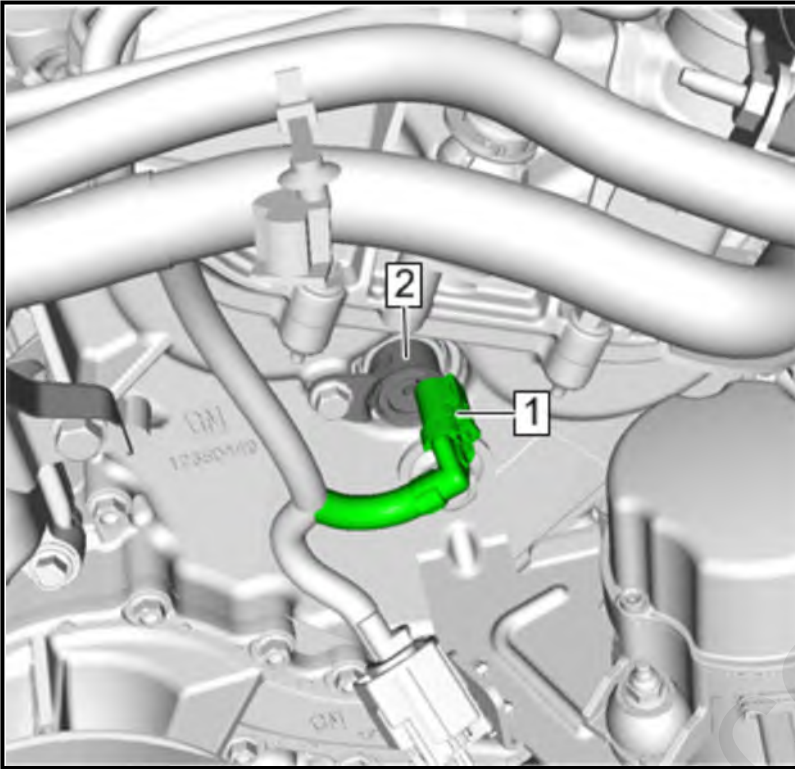


NOTE: The seal is reusable, inspect the seal and replace if damaged.

2. Camshaft Position Actuator Locating Pin Control Valve (2) - Install

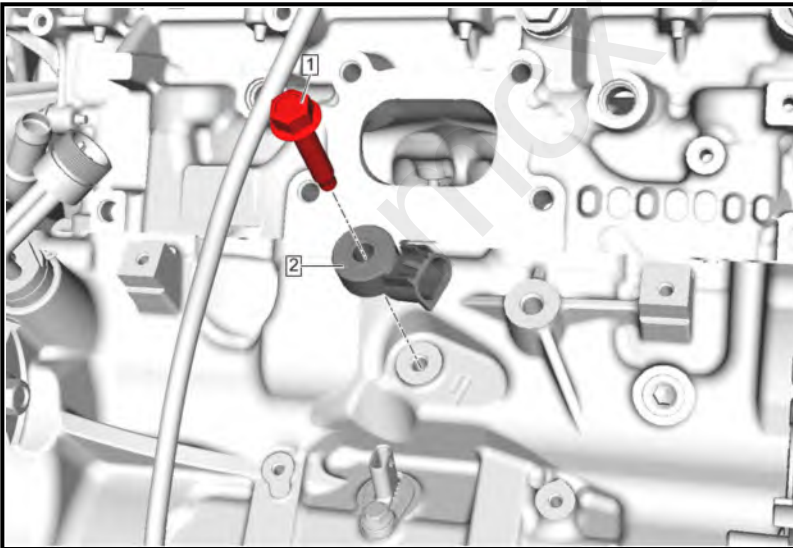
CAUTION: Refer to [Fastener Caution](#) .

3. Camshaft Position Actuator Locating Pin Control Valve Bolt (1) - Install and tighten 10 N.m (89 lb in)
4. Electrical Connector (1) @ Camshaft Position Actuator Locating Pin Control Valve (2) - Connect



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

KNOCK SENSOR REPLACEMENT - BANK 1

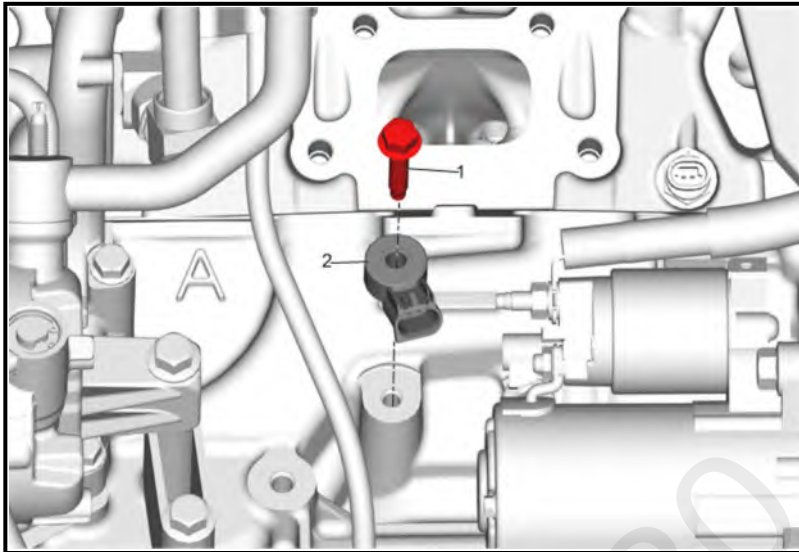


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Engine Mount Replacement - Right Side	
1	Knock Sensor Bolt CAUTION:

Callout	Component Name
	Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
2	Knock Sensor Procedure Disconnect the knock sensor electrical connector.

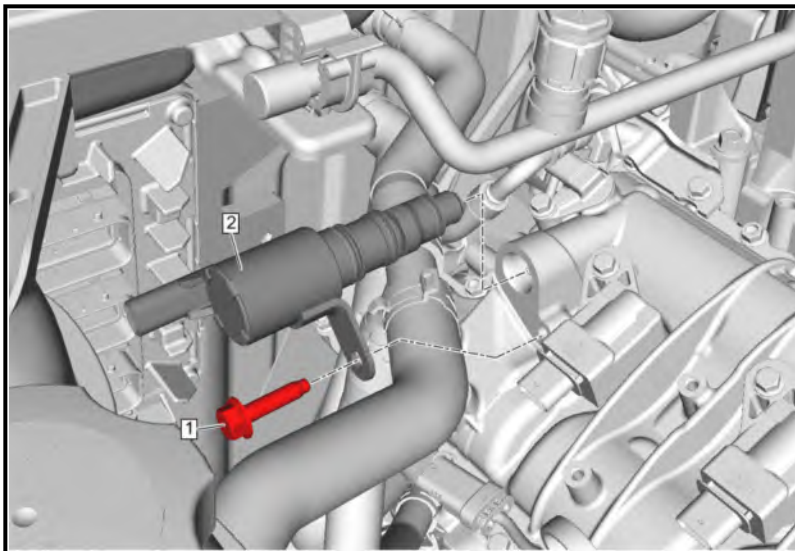
KNOCK SENSOR REPLACEMENT - BANK 2



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Remove the left side engine mount bracket. Engine Mount Bracket Replacement - Left Side .	
1	Knock Sensor Fastener CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
2	Knock Sensor Procedure Disconnect the knock sensor electrical connector.

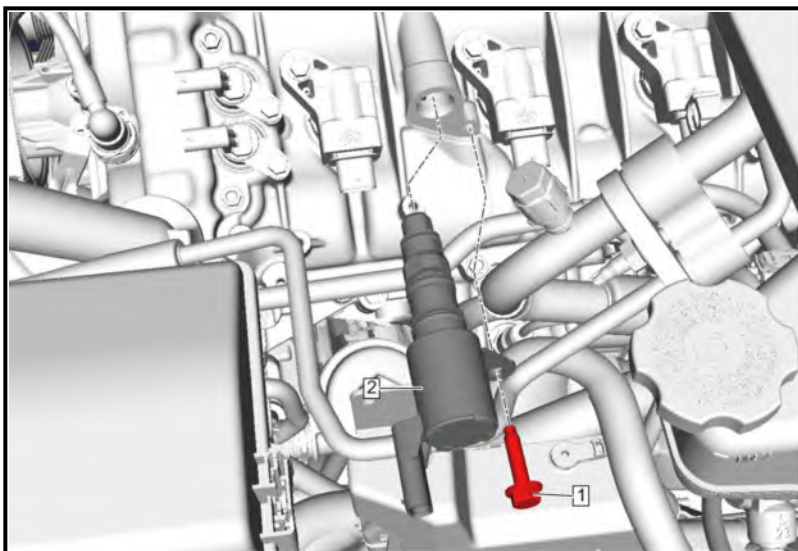
VALVE ROCKER ARM OIL CONTROL VALVE REPLACEMENT - BANK 1



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Camshaft Housing Cover Insulator Replacement - Right Side</u>	
1	Valve Rocker Arm Oil Control Valve Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
2	Valve Rocker Arm Oil Control Valve NOTE: Inspect the O-ring and replace if necessary.

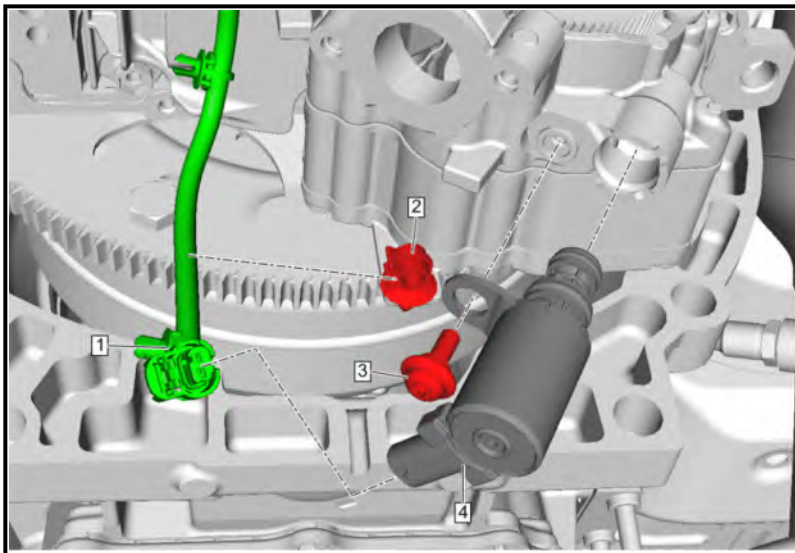
VALVE ROCKER ARM OIL CONTROL VALVE REPLACEMENT - BANK 2



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Camshaft Housing Cover Insulator Replacement - Left Side</u>	
1	Valve Rocker Arm Oil Control Valve Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
2	Valve Rocker Arm Oil Control Valve NOTE: Inspect the O-ring and replace if necessary.

OIL PUMP FLOW CONTROL VALVE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

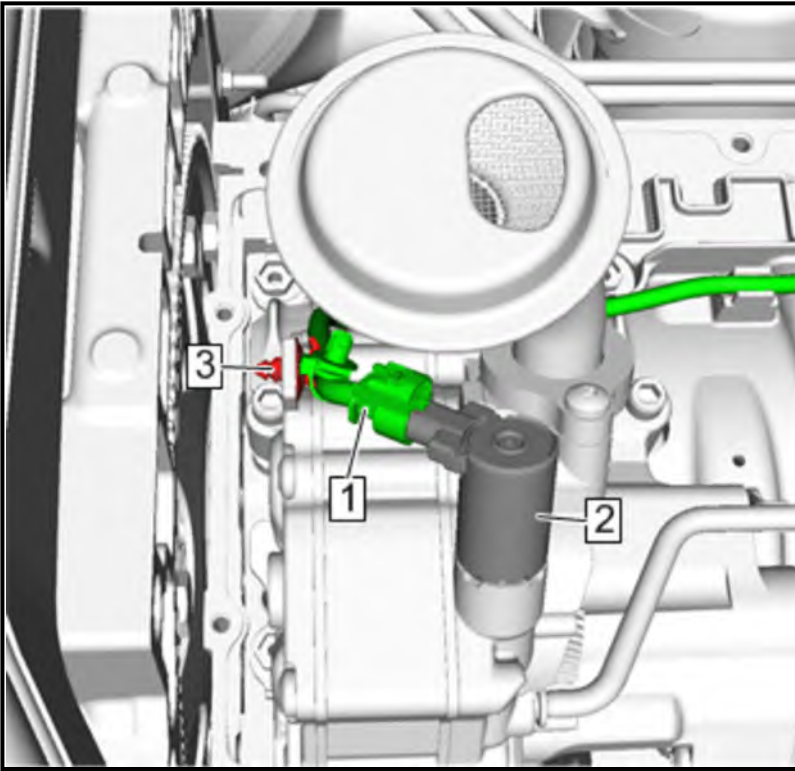
Callout	Component Name
Preliminary Procedure <u>Oil Pump Suction Pipe and Screen Assembly Replacement</u>	
1	Electrical Connector
2	Oil Pump Flow Control Solenoid Valve Wire Clip
3	Oil Pump Flow Control Solenoid Valve Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 5 N.m (44 lb in)
4	Oil Pump Flow Control Solenoid Valve CAUTION: After removing the oil pump flow control valve, ensure the entire valve has been removed and there is no debris left in the oil pump bore. Failure to ensure the oil pump bore is free from debris may result in engine damage.

Callout	Component Name
	Procedure Lubricate the O-ring seals with clean engine oil. NOTE: The engine should be allowed to cool for 2 hours, or until the pump is near ambient temperature or there is a high risk of breaking the oil pump flow control valve off in the bore when attempting removal. NOTE: Inspect the O-ring and replace if necessary.

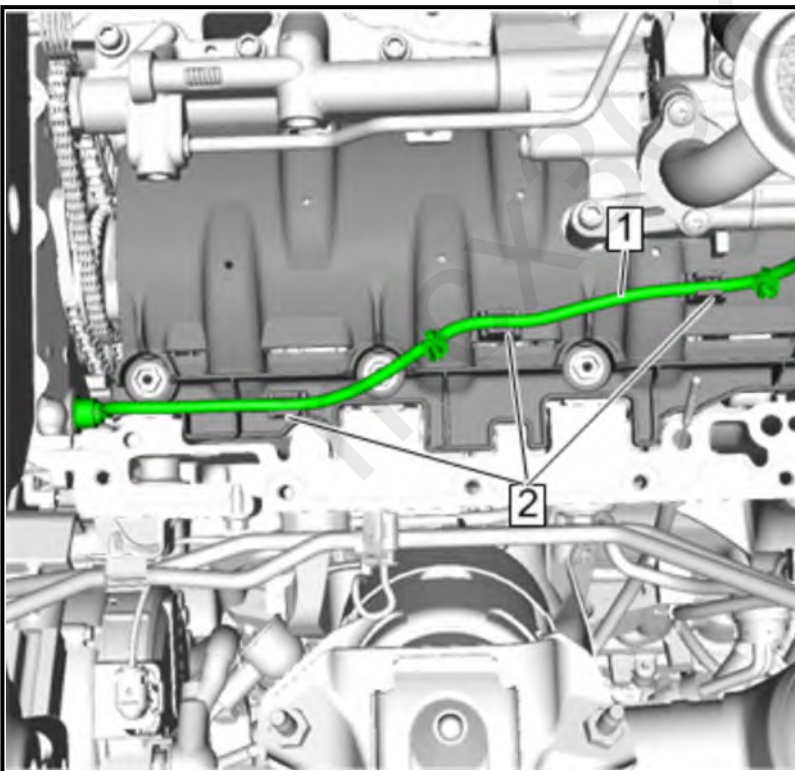
OIL PUMP FLOW CONTROL SOLENOID VALVE HARNESS REPLACEMENT

Removal Procedure

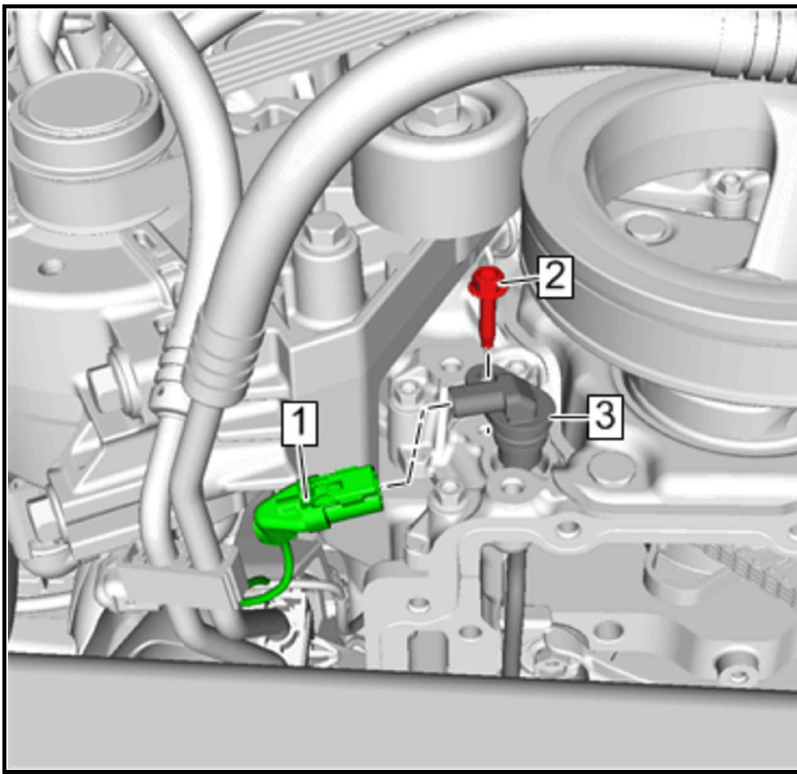
1. Oil Pan - Remove - [Oil Pan Replacement \(4WD\)](#) , or [Oil Pan Replacement \(2WD\)](#)
2. Oil Pump Flow Control Solenoid Valve Harness (1) @ Oil Pump Flow Control Solenoid Valve (2) - Disconnect



3. Oil Pump Flow Control Solenoid Valve Harness (1) @ Oil Pump Flow Control Solenoid Valve Wire Clip (3) - Unclip
4. Oil Pump Flow Control Solenoid Valve Harness (1) @ Crankshaft Oil Deflector (2) - Unclip



5. Engine Wiring Harness (1) @ Oil Pump Flow Control Solenoid Valve Harness (3) - Disconnect



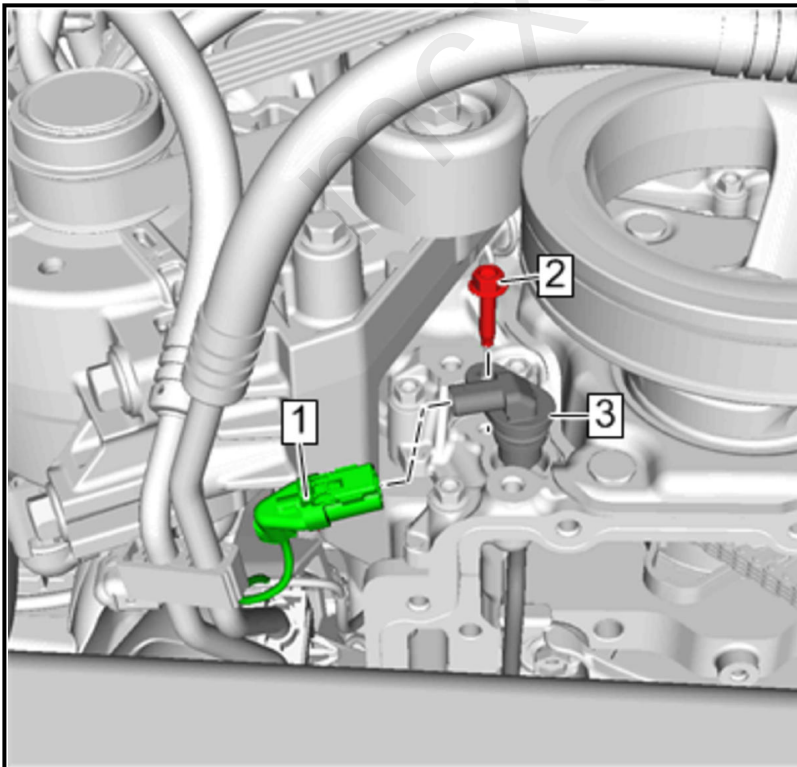
6. Engine Wiring Harness Bracket Bolt (2) - Remove

NOTE: The retaining clips attached to the oil pump flow control solenoid harness are used for initial production only and should be removed and discarded.

7. Remove the oil pump flow control solenoid valve harness (3) through the engine front cover.

Installation Procedure

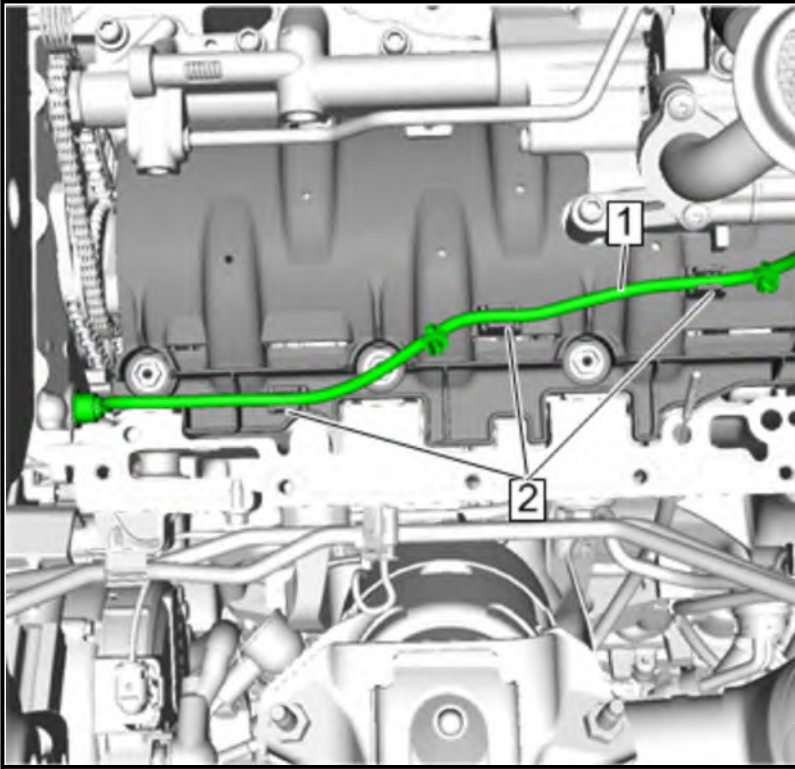
1. Install the oil pump flow control solenoid valve harness (3) through the engine front cover.



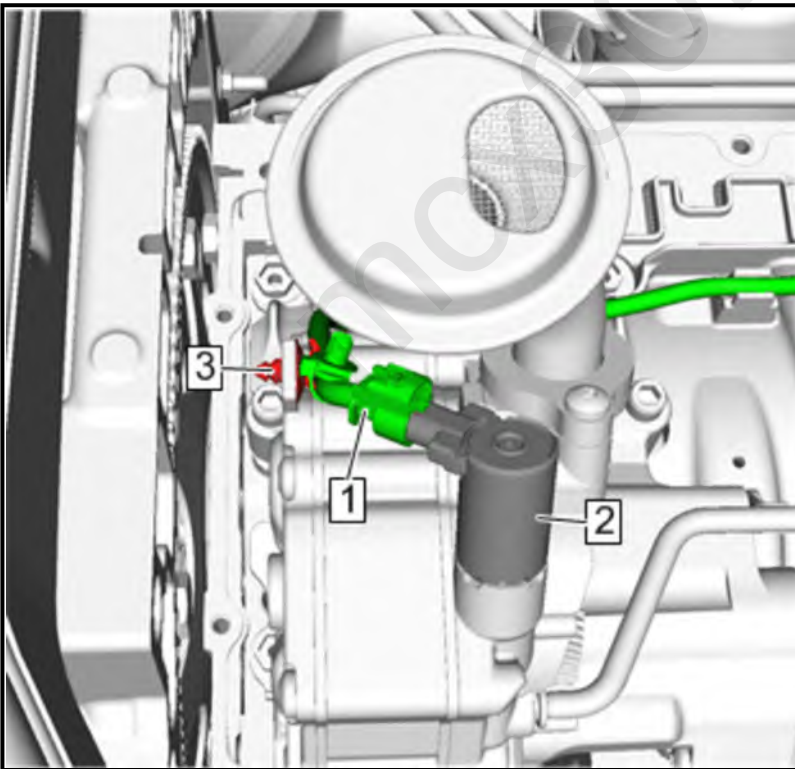
CAUTION: Refer to [Fastener Caution](#) .

2. Oil Pump Flow Control Solenoid Valve Harness Bolt (2) - Install and tighten 15 N.m (11 lb ft)

3. Engine Wiring Harness (1) @ Oil Pump Flow Control Solenoid Valve Harness (3) - Connect
4. Oil Pump Flow Control Solenoid Valve Harness (1) @ Crankshaft Oil Deflector (2) - Install

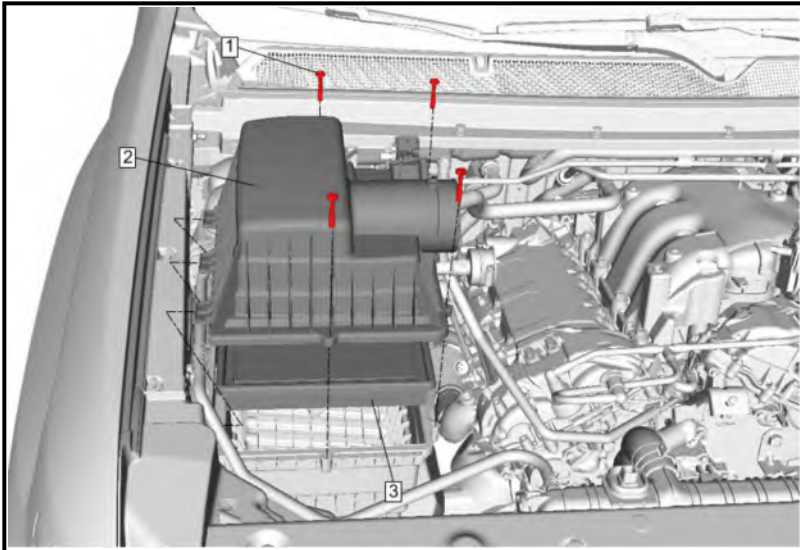


5. Oil Pump Flow Control Solenoid Valve Harness (1) @ Oil Pump Flow Control Solenoid Valve Wire Clip (3) - Install



6. Oil Pump Flow Control Solenoid Valve Harness (1) @ Oil Pump Flow Control Solenoid Valve (2) - Connect
7. Oil Pan - Install - [Oil Pan Replacement \(4WD\)](#) , or [Oil Pan Replacement \(2WD\)](#).

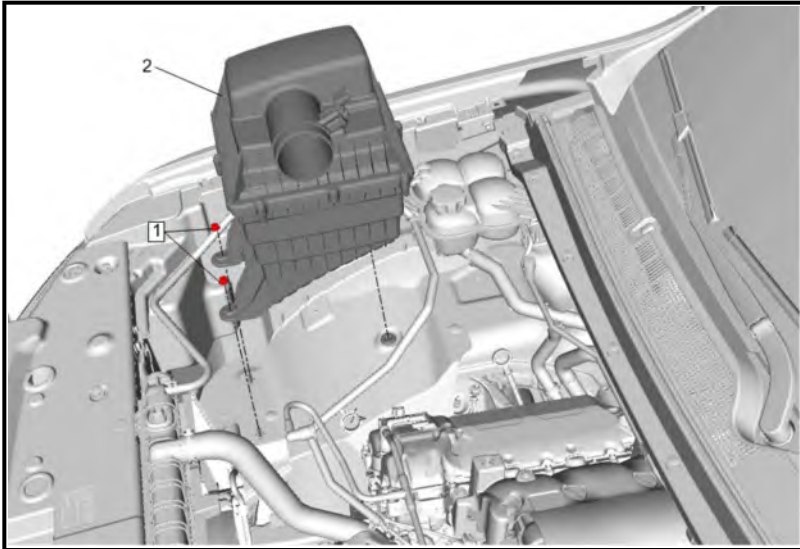
AIR CLEANER ELEMENT REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Air Cleaner Outlet Duct @ Air Cleaner Assembly - Disconnect - Air Cleaner Outlet Duct Replacement 2. Disconnect the electrical connector.	
1	Air Cleaner Housing Cover Bolt [4x] CAUTION: Refer to Fastener Caution . Tighten 3.1 N.m (27 lb in)
2	Air Cleaner Housing Cover
3	Air Cleaner Element

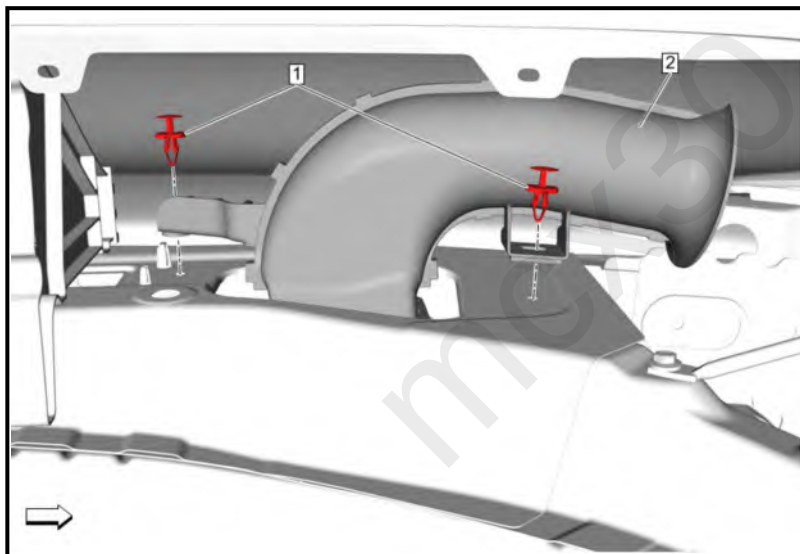
AIR CLEANER ASSEMBLY REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Air Cleaner Outlet Duct @ Air Cleaner Assembly - Disconnect - Air Cleaner Outlet Duct Replacement 2. Disconnect the electrical connector and unclip from air cleaner assembly.	
1	Air Cleaner Assembly Fastener [2x] CAUTION: Refer to Fastener Caution . Tighten 12 N.m (106 lb in)
2	Air Cleaner Assembly Procedure Pull up on the assembly to release lower retainer.

FRONT INTAKE AIR DUCT REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Front Wheelhouse Liner-Right Side - Remove - Front Wheelhouse Liner Replacement (Without ZR2) , or Front Wheelhouse Liner Replacement (With ZR2) , or Front Wheelhouse Liner Replacement (Bison)	
1	Retainer [2x] CAUTION: Refer to Fastener Caution .

Callout	Component Name
2	Front Intake Air Duct Procedure Pull out on front intake air duct to remove from air cleaner assembly.

AIR CLEANER OUTLET DUCT BRACKET REPLACEMENT

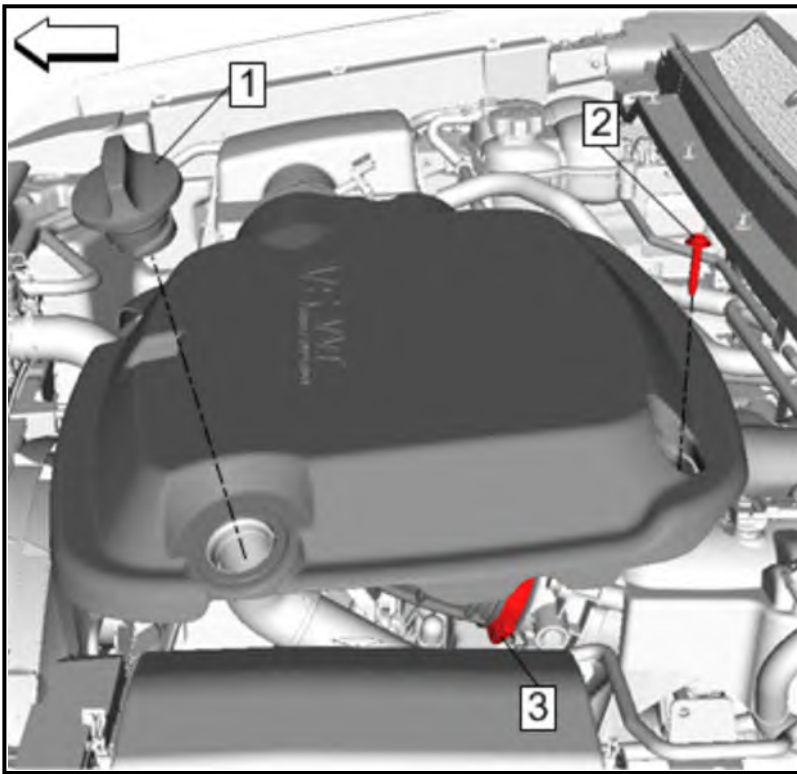
NOTE:
 Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedures 1. Air Cleaner Outlet Duct Replacement 2. Remove wiring harness retainer from air cleaner outlet duct bracket.	
1	Air Cleaner Outlet Duct Bracket Bolt [2x] CAUTION: Refer to Fastener Caution . Tighten 22 N.m (16 lb ft)
2	Air Cleaner Outlet Duct Bracket

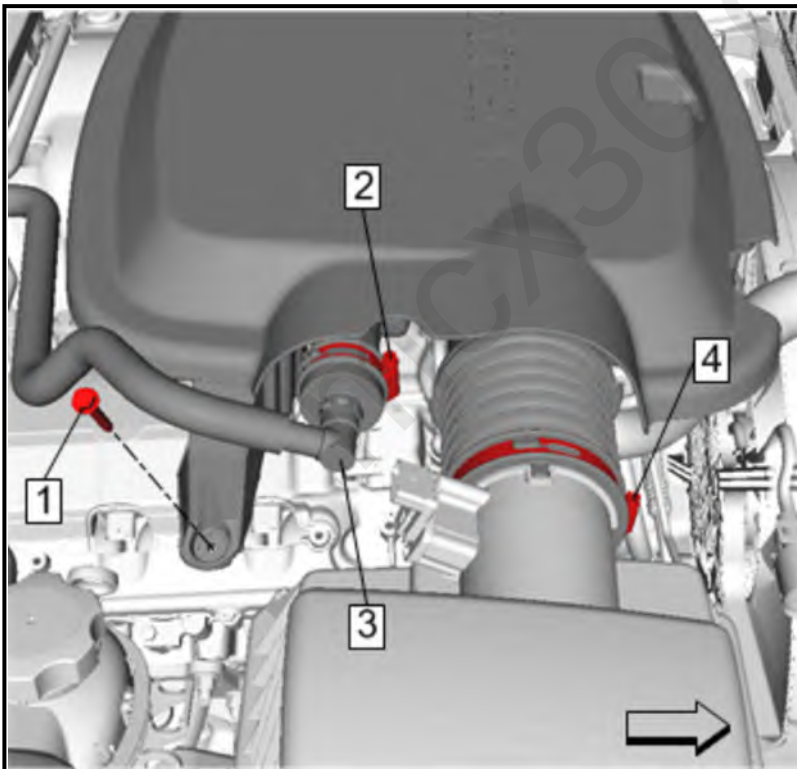
AIR CLEANER OUTLET DUCT REPLACEMENT

Removal Procedure

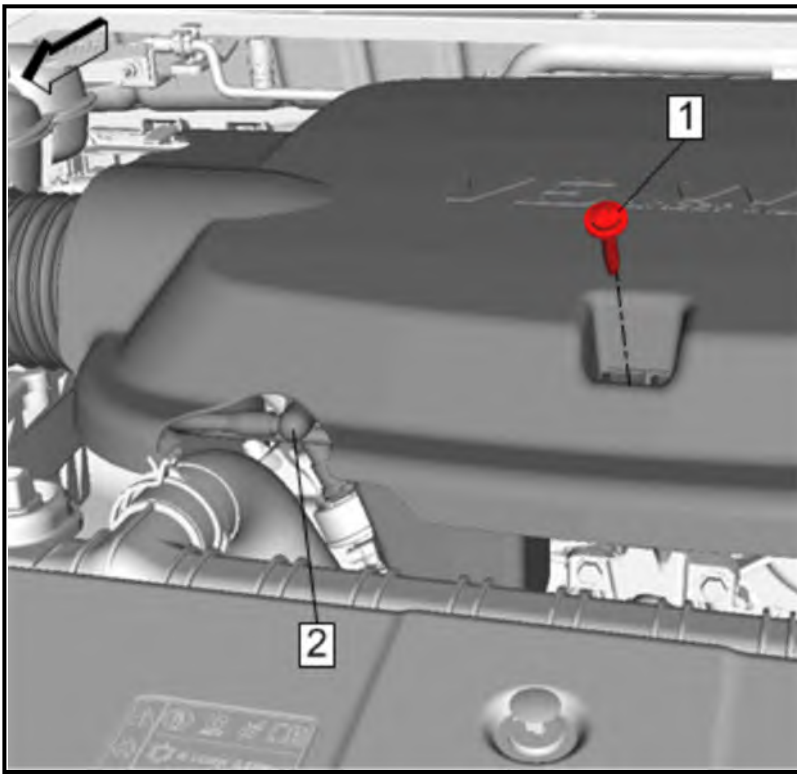
- Oil Filler Cap (1) - Remove



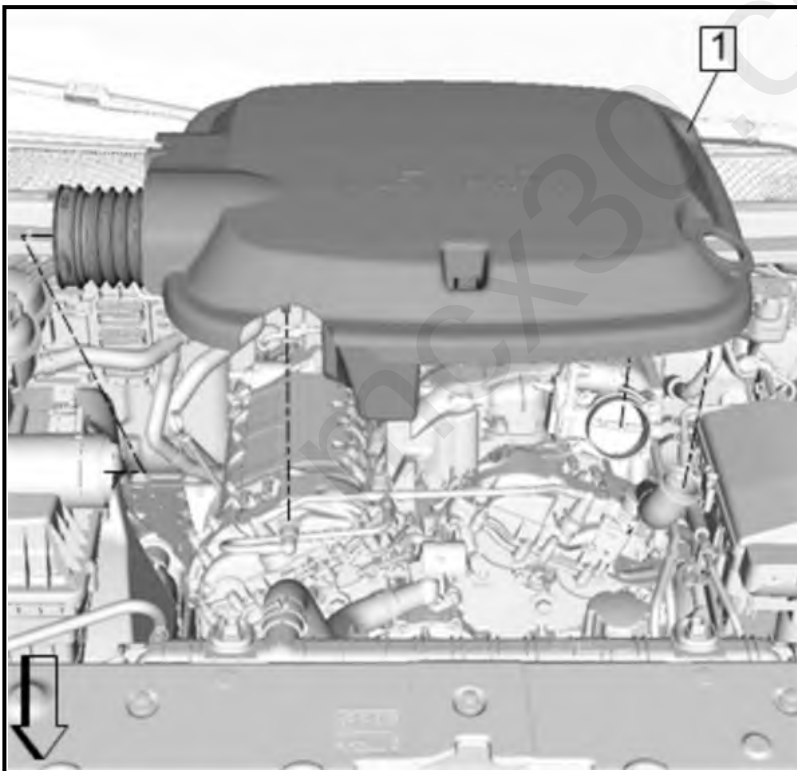
- 2. Air Cleaner Outlet Duct Bracket Bolt (2) - Remove
- 3. Air Cleaner Outlet Duct Clamp (3) - Remove
- 4. Air Cleaner Outlet Duct Bracket Bolt (1) - Remove



- 5. Positive Crankcase Ventilation Hose Clamp (2) - Remove
- 6. Positive Crankcase Ventilation Hose (3) - Remove
- 7. Air Cleaner Outlet Duct Clamp (4) - Remove
- 8. Air Cleaner Outlet Duct Bracket Bolt (1) - Remove

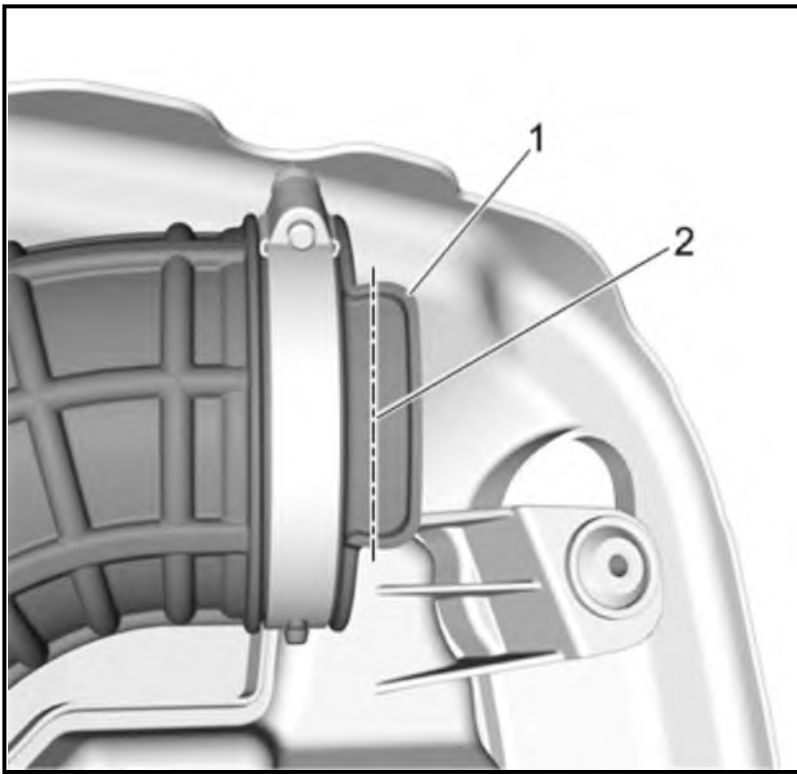


9. Positive Crankcase Ventilation Tube (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)
 10. Air Cleaner Outlet Duct (1) - Remove

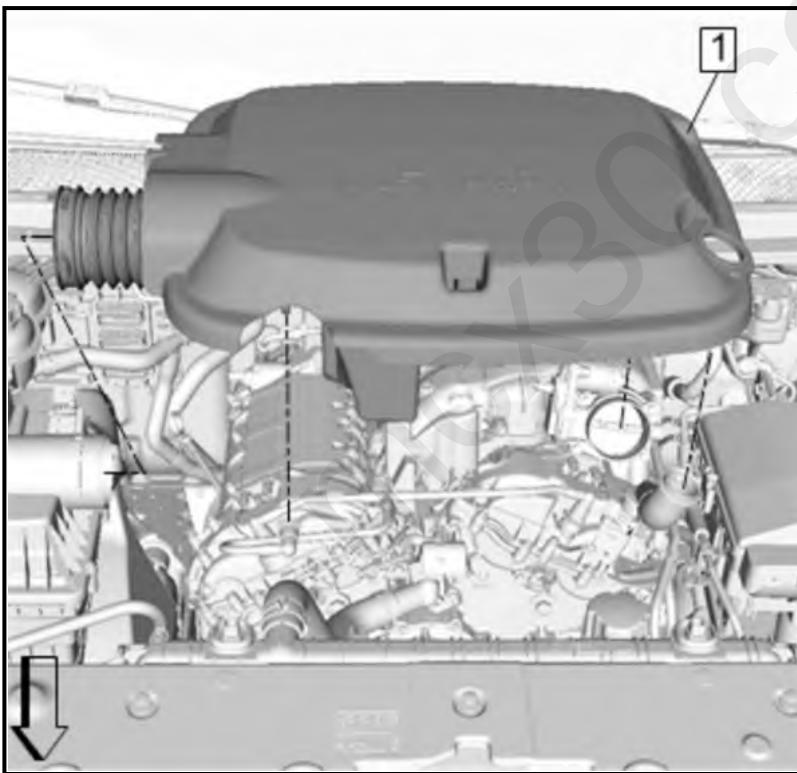


Installation Procedure

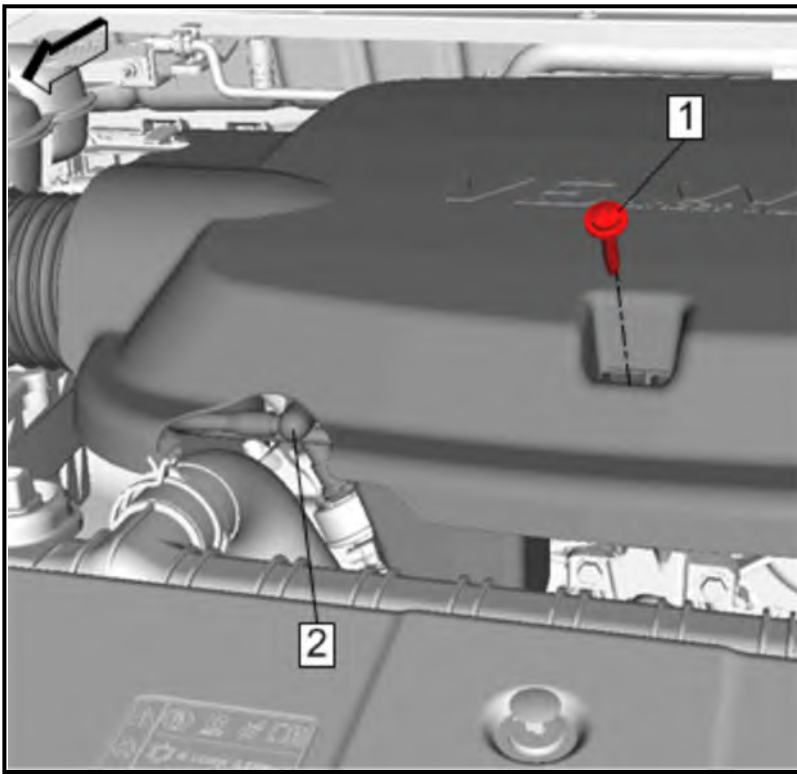
1. {If equipped} Cut off the aide tab (1) at dashed line (2) with scissors or equivalent tool, leave 1-2mm of aide tab (1), as not to disturb the sealing surface.



2. Air Cleaner Outlet Duct (1) - Install

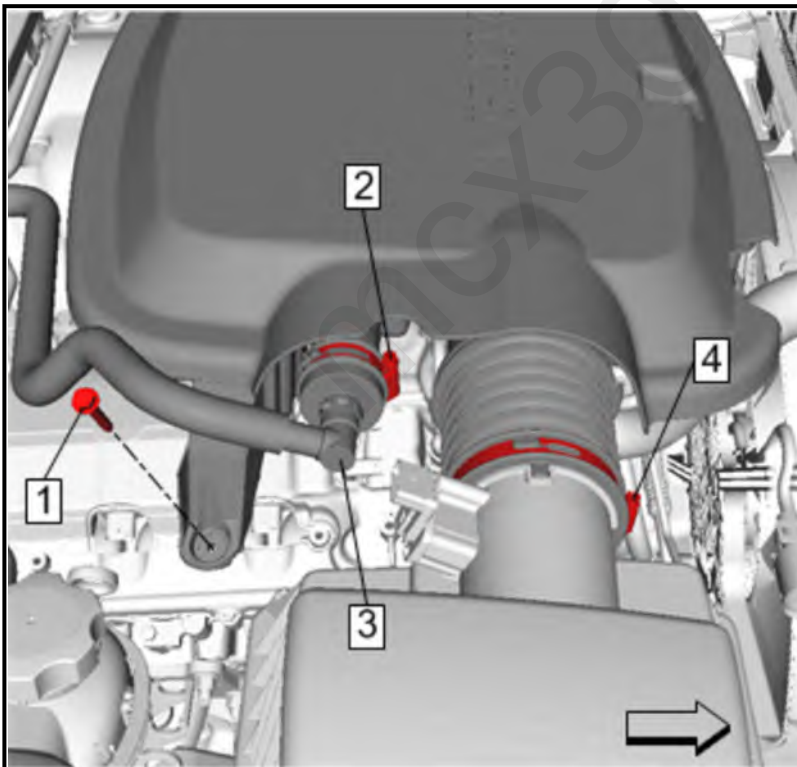


3. Positive Crankcase Ventilation Tube (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)



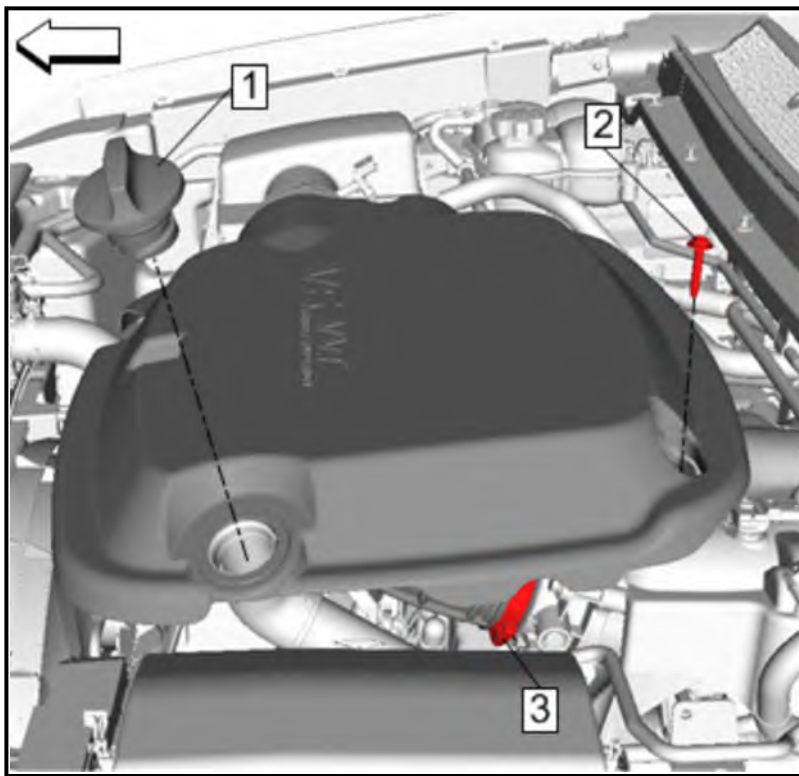
CAUTION: Refer to [Fastener Caution](#) .

- 4. Air Cleaner Outlet Duct Bracket Bolt (1) - Install and tighten 9 N.m (80 lb in)
- 5. Air Cleaner Outlet Duct Clamp (4) - Install and tighten 3.5 N.m (31 lb in)



NOTE: Ensure the outlet duct is fully seated to the mating surfaces before clamping. Verify that the cuff is not rolled under.

- 6. Positive Crankcase Ventilation Hose (3) - Install
- 7. Positive Crankcase Ventilation Hose Clamp (2) - Install and tighten 4 N.m (35 lb in)
- 8. Air Cleaner Outlet Duct Bracket Bolt (1) - Install and tighten 9 N.m (80 lb in)
- 9. Air Cleaner Outlet Duct Clamp (3) - Install and tighten 3.5 N.m (31 lb in)

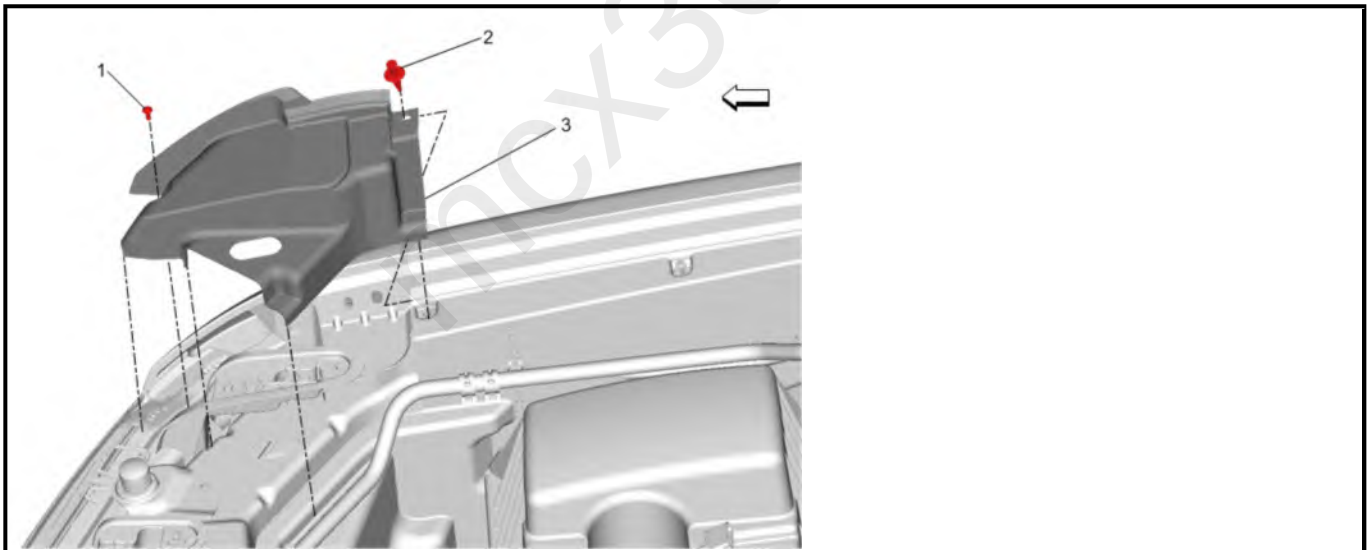


NOTE: Add lube as required and ensure the outlet duct is fully seated to the mating surface before clamping. Verify that the cuff is not rolled under.

10. Air Cleaner Outlet Duct Bracket Bolt (2) - Install and tighten 9 N.m (80 lb in)

11. Oil Filler Cap (1) - Install

INTAKE AIR BAFFLE REPLACEMENT



NOTE: Callouts in the following chart represent components shown in graphic above.

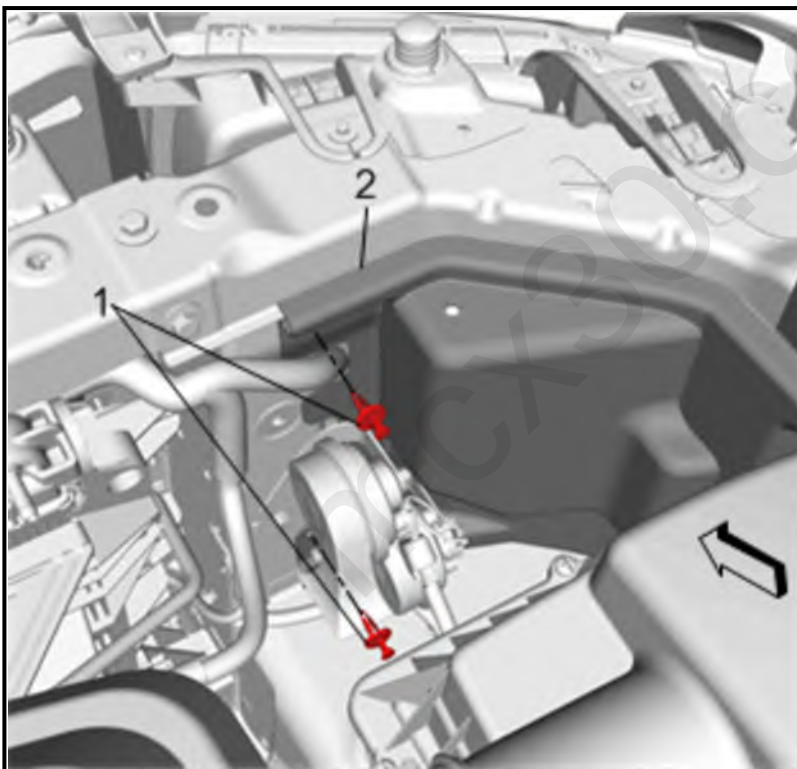
Callout	Component Name
Preliminary Procedure If equipped remove the front compartment front sight shield. Refer to Front Compartment Front Sight Shield Replacement .	
1	Intake Air Baffle Bolt
	CAUTION:

Callout	Component Name
	Refer to Fastener Caution . Tighten 1.5 N.m (13 lb in)
2	Intake Air Baffle Retainer
3	Intake Air Baffle Procedure Lift up and slide forward to remove from underneath intake air splash shield.

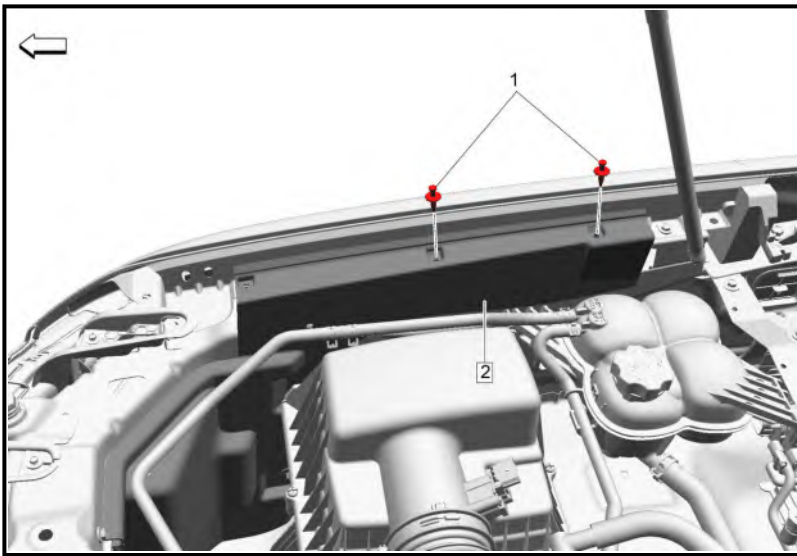
INTAKE AIR SPLASH SHIELD REPLACEMENT

Removal Procedure

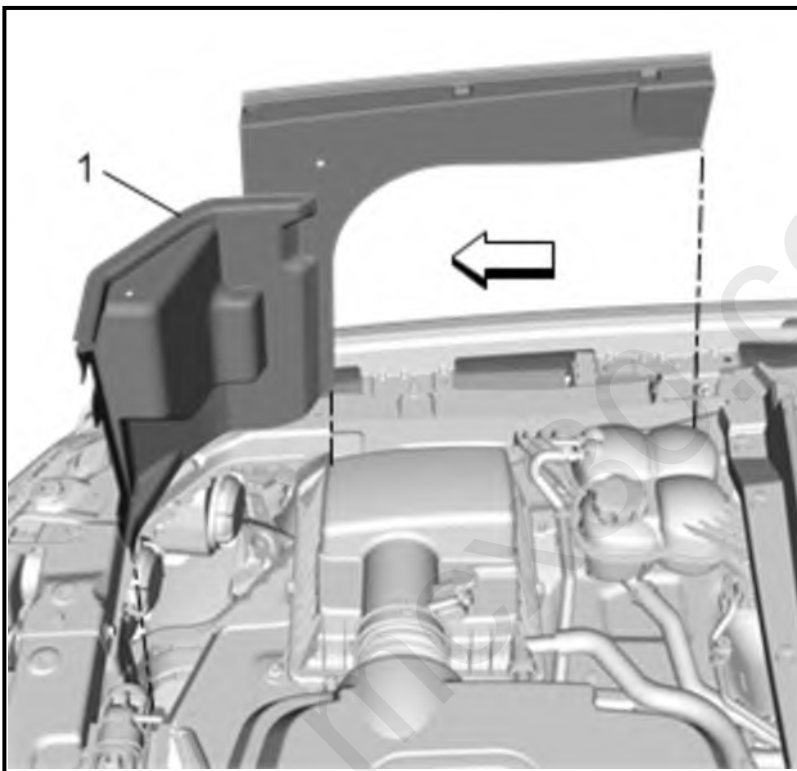
1. Reposition the radiator vent outlet hose. Refer to [Radiator Vent Outlet Hose Replacement \(LCV, LGZ\)](#) .
2. Remove the intake air baffle. Refer to [Intake Air Baffle Replacement](#).
3. Remove the intake air splash shield retainers (1) from the intake air splash shield (2).



4. Remove the intake air splash shield retainers (1) from the intake air splash shield (2).

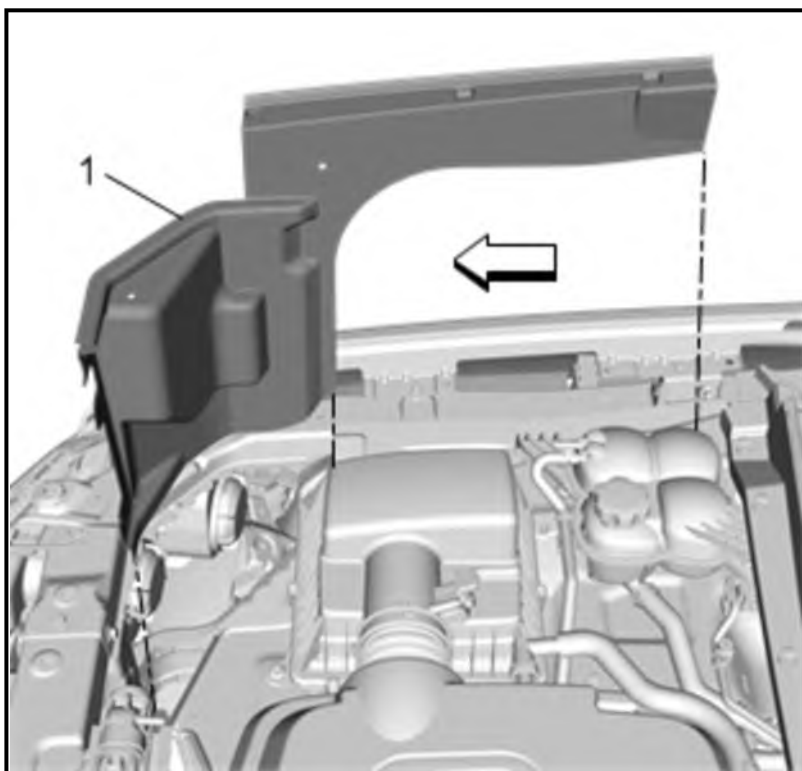


5. Remove the intake air splash shield (1) from the vehicle.

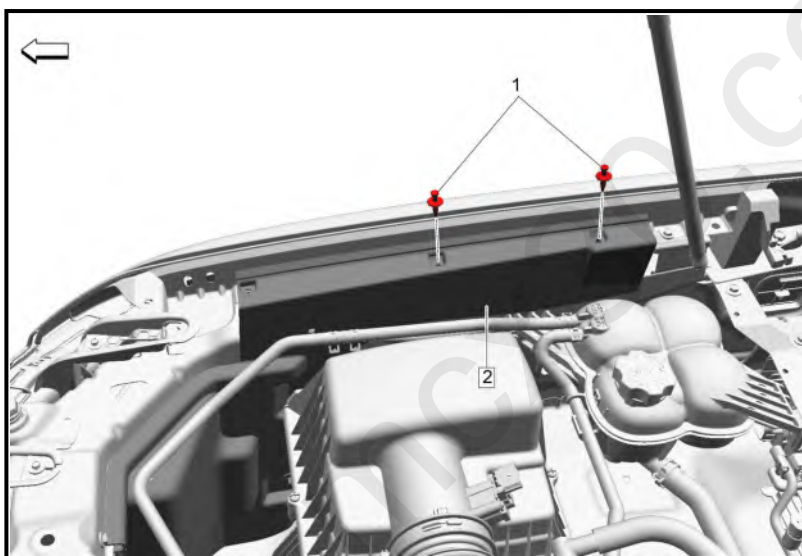


Installation Procedure

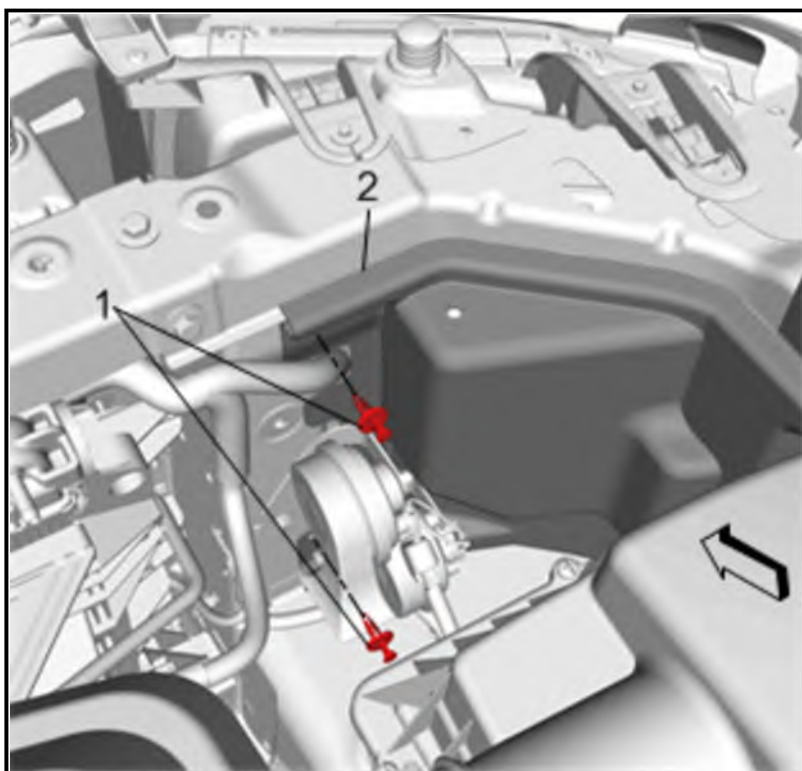
1. Install the intake air splash shield (1) to the vehicle.



2. Install the intake air splash shield retainers (1) to the intake air splash shield (2).



3. Install the intake air splash shield retainers (1) to the intake air splash shield (2).



4. Install the intake air baffle. Refer to [Intake Air Baffle Replacement](#).
 5. Install the radiator vent outlet hose. Refer to [Radiator Vent Outlet Hose Replacement \(LCV, LGZ\)](#).
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