

2021 ENGINE PERFORMANCE

Engine Controls And Fuel - 2.5L (LCV) - 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 RAIL PRESSURE RELIEF VALVE 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: G18 High Pressure Fuel Pump

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: G18 High Pressure Fuel Pump - 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 Rail Pressure Relief Valve Learned Values Reset
7. Follow the instructions on the scan tool.

Repair Instructions

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

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](#)

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
- K20 Engine Control Module - Replaced

Conditions for Running the Procedure

- DTC P0068, P0101, P0102, P0103, 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: Reset Functions
6. Select: Throttle Body Idle Air Flow Compensation Reset
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**

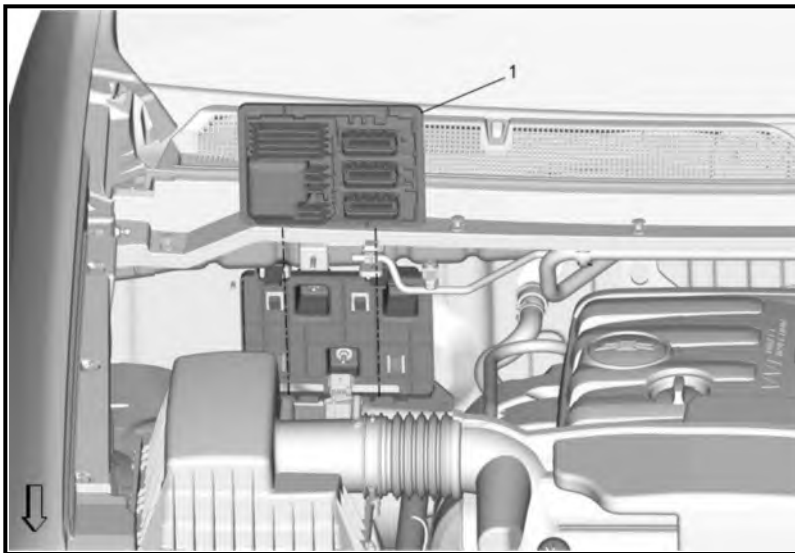
Repeat step 1
 - **Go to next step: If 0**
9. Engine - Idling - At normal operating temperature
10. Verify the scan tool parameter: Engine Speed = -100 to +200 RPM of the Desired Idle Speed
 - **{Test failed 1 time(s)} If not in the specified range**
 1. Engine idling. - For greater than 3 min
 2. Ignition/Vehicle - 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



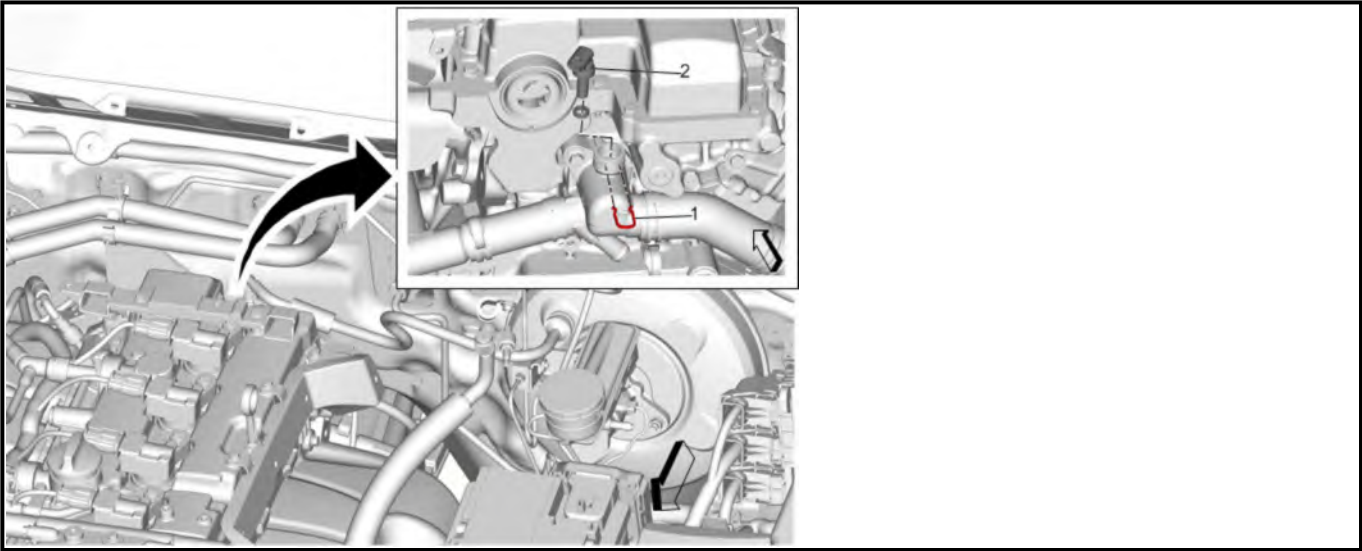
NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection . 2. Remove the radiator surge tank. Refer to Radiator Surge Tank Replacement (LCV, LGZ) .	
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

Callout	Component Name
	or reconnecting 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

Callout	Component Name
	servicing the 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. 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. Refer to 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.

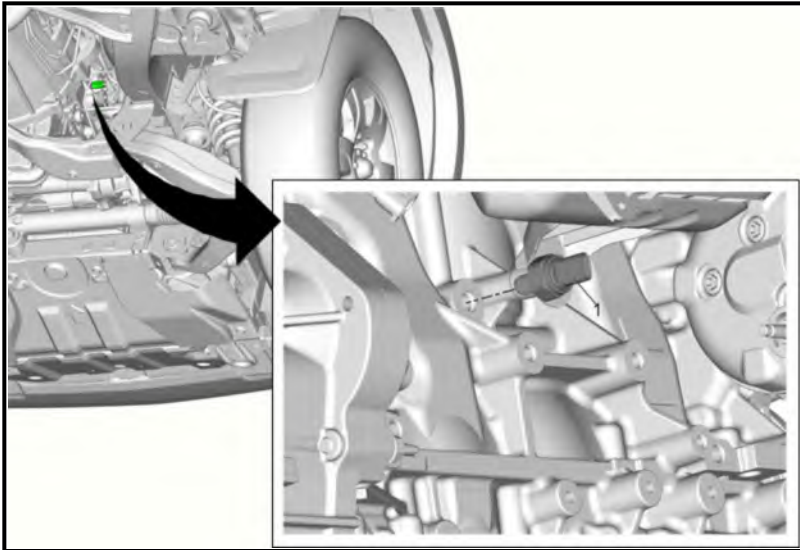
ENGINE COOLANT TEMPERATURE SENSOR REPLACEMENT



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

Callout	Component Name
Preliminary Procedure 1. Drain the cooling system. Refer to Cooling System Draining and Filling (Static Fill) , or Cooling System Draining and Filling (Vac n Fill) . 2. Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement . 3. Remove the plenum front panel. Refer to Plenum Front Panel Replacement . 4. Remove the vacuum pump. Refer to Vacuum Pump Replacement .	
1	Engine Coolant Temperature Sensor Retaining Clip
2	Engine Coolant Temperature Sensor Procedure 1. Disconnect the engine wiring harness electrical connector from the engine coolant temperature sensor. 2. Remove the engine coolant temperature sensor from the thermostat housing. 3. Inspect the seal and replace if necessary.

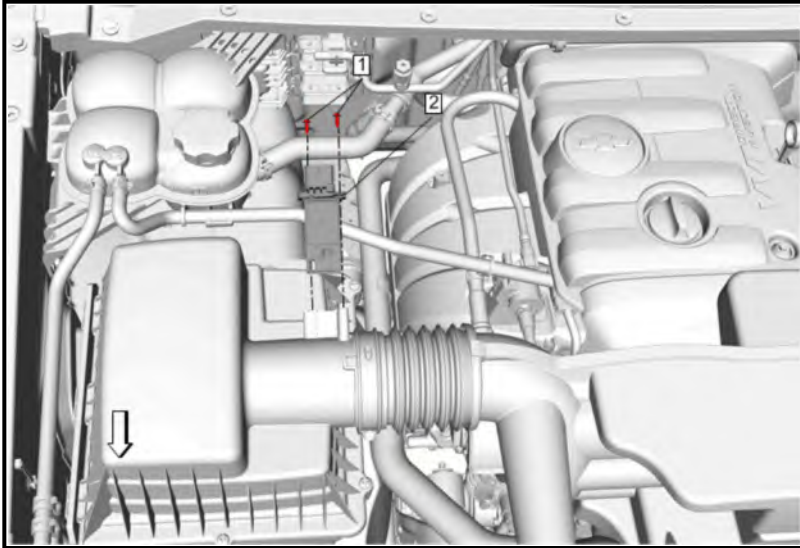
ENGINE OIL PRESSURE SENSOR REPLACEMENT



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

Callout	Component Name
Preliminary Procedure 1. Raise and properly support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Remove the starter. Refer to Starter Replacement (LCV) .	
1	Engine Oil Pressure Sensor CAUTION: Refer to Component Fastener Tightening Caution . Procedure Disconnect the engine oil pressure sensor electrical connector. Tighten 35 N.m (26 lb ft)

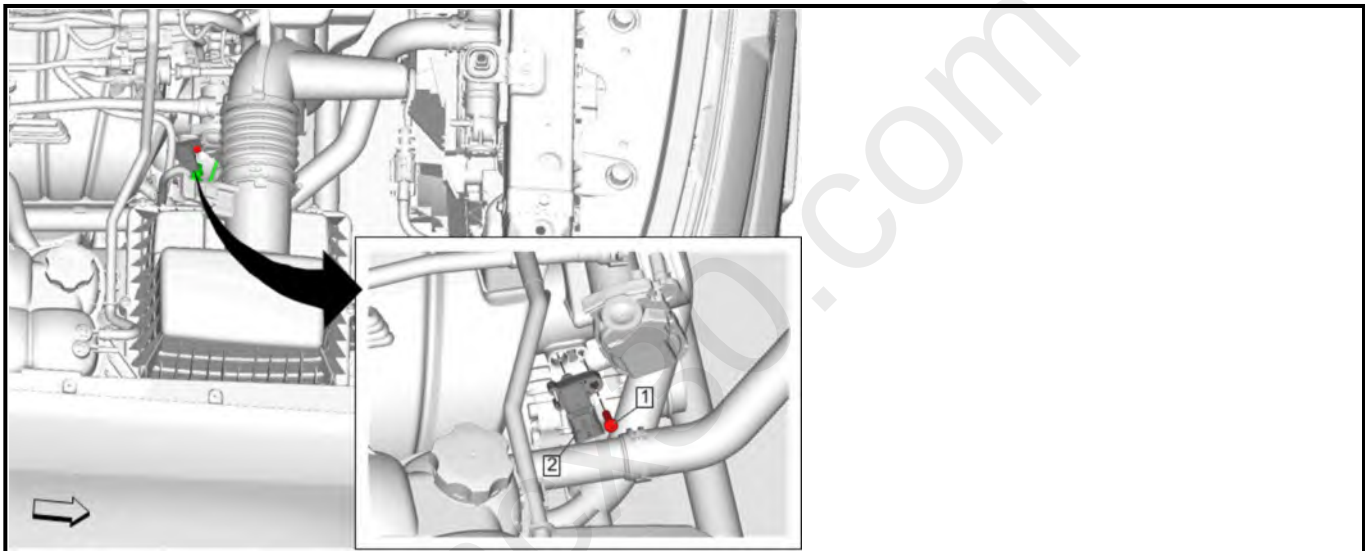
MASS AIRFLOW SENSOR WITH INTAKE AIR TEMPERATURE SENSOR REPLACEMENT



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

Callout	Component Name
1	Mass Air Flow Sensor Fasteners (Qty: 2) CAUTION: Refer to Fastener Caution . Tighten 1.5 N.m (13 lb in)
2	Mass Air Flow Sensor Procedure Disconnect the electrical connector.

MANIFOLD ABSOLUTE PRESSURE SENSOR REPLACEMENT

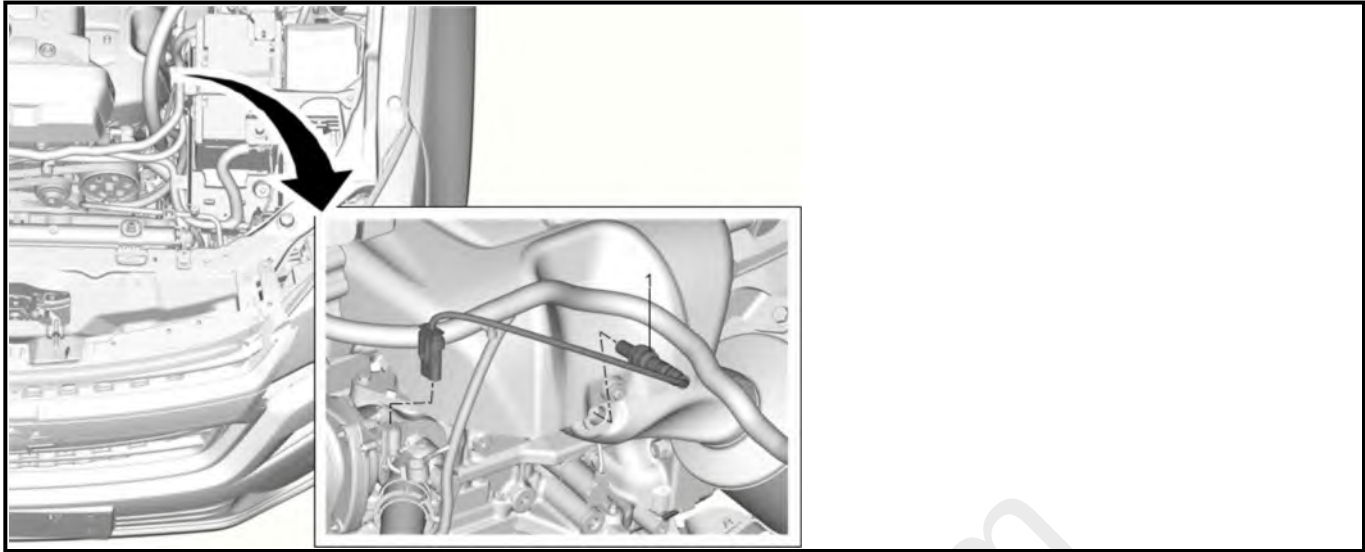


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
1	Manifold Absolute Pressure Sensor Retaining Fastener CAUTION: Refer to Fastener Caution . Tighten 5 N.m (44 lb in)
2	Manifold Absolute Pressure Sensor Procedure 1. Disconnect the engine wiring harness electrical connector from the manifold absolute pressure sensor. 2. Remove the manifold absolute pressure sensor from the intake manifold.

Callout	Component Name
	3. Install a NEW seal if reusing the manifold absolute pressure sensor.

HEATED OXYGEN SENSOR REPLACEMENT - SENSOR 1



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

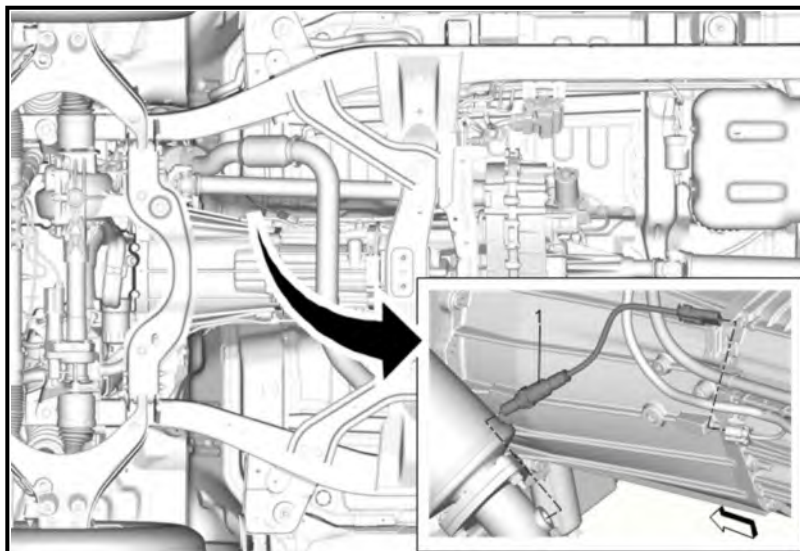
Callout	Component Name
1	Heated Oxygen Sensor WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury. CAUTION: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

Callout	Component Name
	<u>Fastener</u> <u>Tightening</u> <u>Caution</u> . CAUTION: Refer to <u>Heated</u> <u>Oxygen and</u> <u>Oxygen</u> <u>Sensor</u> <u>Caution</u> . CAUTION: Refer to <u>Heated</u> <u>Oxygen</u> <u>Sensor</u> <u>Resistance</u> <u>Learn Reset</u> <u>Caution</u> . 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. <u>HO2S Heater Resistance Learned Values Reset</u> 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

Callout	Component Name
	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> <u>Lubricants,</u> <u>and Sealers</u>

Callout	Component Name
	Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools (Mechanical Tools) , or Special Tools (Diagnostic Tools) .

HEATED OXYGEN SENSOR REPLACEMENT - SENSOR 2



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

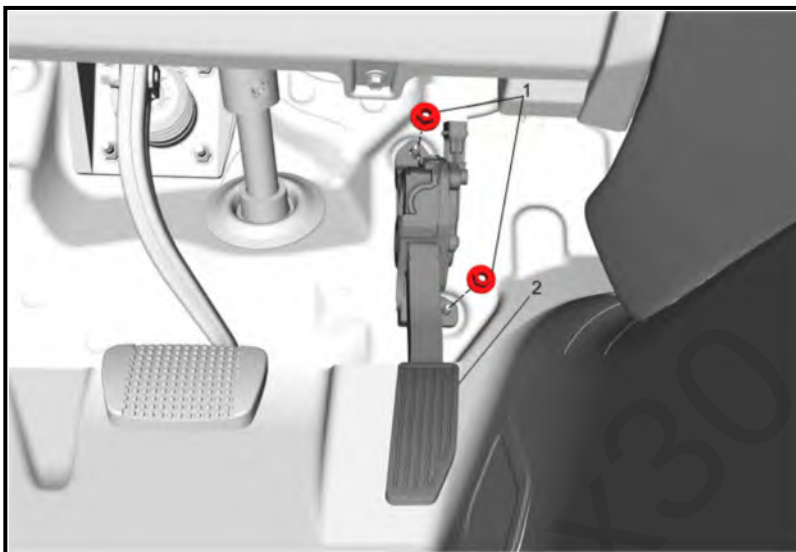
Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.	
WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	

Callout	Component Name
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 connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use

Callout	Component Name
	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 applied before

Callout	Component Name
	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 (Mechanical Tools)</u> , or <u>Special Tools (Diagnostic Tools)</u>.

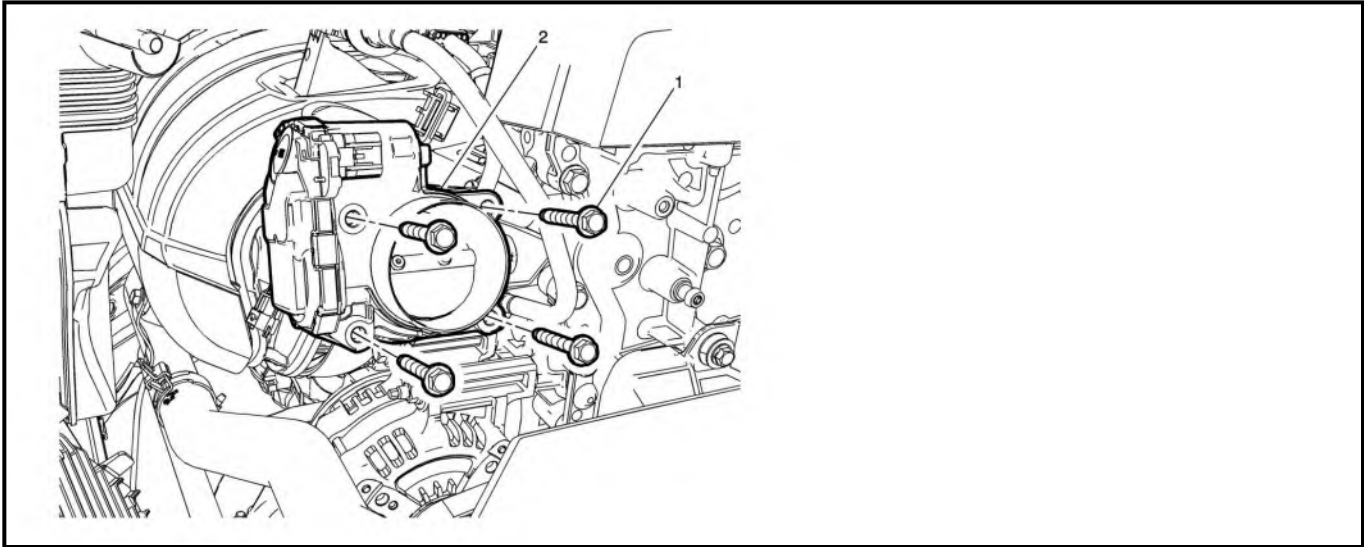
ACCELERATOR PEDAL WITH POSITION SENSOR ASSEMBLY REPLACEMENT



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 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



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

Callout	Component Name
CAUTION: Do not use solvent of any type when cleaning the gasket surfaces on the intake manifold and the throttle body assembly, as damage to the gasket surfaces and throttle body assembly may result. Use care in cleaning the gasket surfaces on the intake manifold and the throttle body assembly, as sharp tools may damage the gasket surfaces.	
CAUTION:	

Callout	Component Name
Do not use any solvent that contains Methyl Ethyl Ketone (MEK). This solvent may damage fuel system components. NOTE: Do NOT prop open the throttle blade with the ignition key in the ON position as it MAY set a diagnostic trouble code (DTC).	
Preliminary Procedure Air Cleaner Outlet Duct Replacement	
1	Throttle Body Bolt [4x] CAUTION: Refer to Fastener Caution. Tighten 10 N.m (89 lb in)
2	Throttle Body Procedure 1. Disconnect the electrical connector. 2. The seal is reusable, inspect the seal and replace if damaged. 3. Perform the throttle body idle air flow compensation reset. Throttle Body Idle Air Flow Compensation Reset

THROTTLE BODY CLEANING

1. Air Cleaner Outlet Duct - Remove - [Air Cleaner Outlet Duct Replacement](#)
2. Disconnect the electrical connector.

WARNING: Turn OFF the ignition before inserting fingers into the throttle bore. Unexpected movement of the throttle blade could cause personal injury.

CAUTION: Do not insert any tools into the throttle body bore in order to avoid

damage to the throttle valve plate.

NOTE: DO NOT prop open the throttle blade with the ignition key in the ON position as it may set a diagnostic trouble code (DTC).

3. Inspect the throttle body bore and the throttle valve plate for deposits. You must open the throttle valve in order to inspect all of the surfaces.

CAUTION: Do not use any solvent that contains Methyl Ethyl Ketone (MEK). This solvent may damage fuel system components.

4. Clean the throttle body bore and the throttle valve plate using a clean shop towel and approved cleaner.
5. Connect the electrical connector.
6. Air Cleaner Outlet Duct - Install - [Air Cleaner Outlet Duct Replacement](#).
7. Perform the following procedure/test: [Diagnostic Repair Verification](#)
8. Perform the configuration/reset function: [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 driver 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 \(Mechanical Tools\)](#) , or [Special Tools \(Diagnostic Tools\)](#)

Installation Procedure

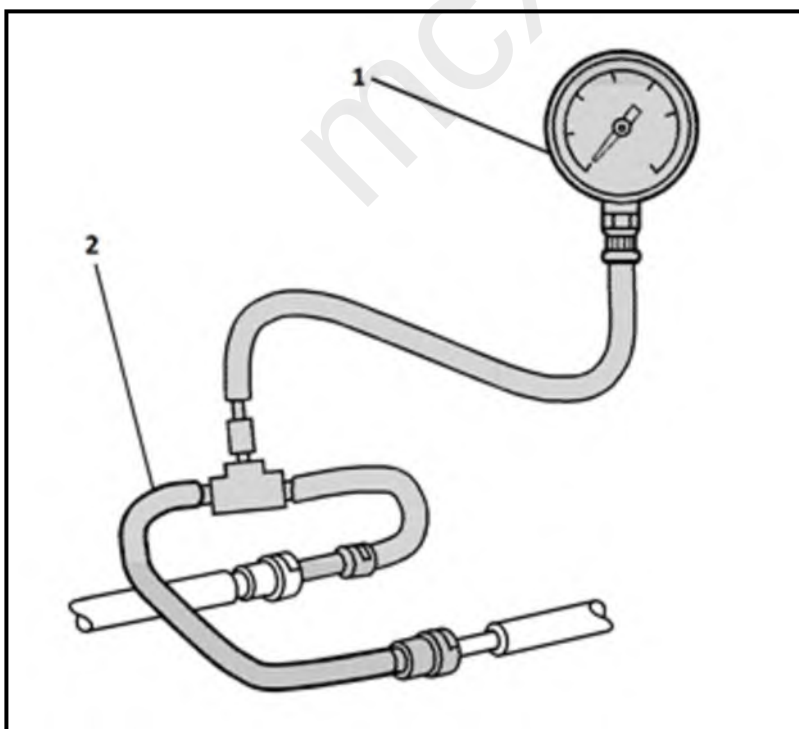
WARNING: Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

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.



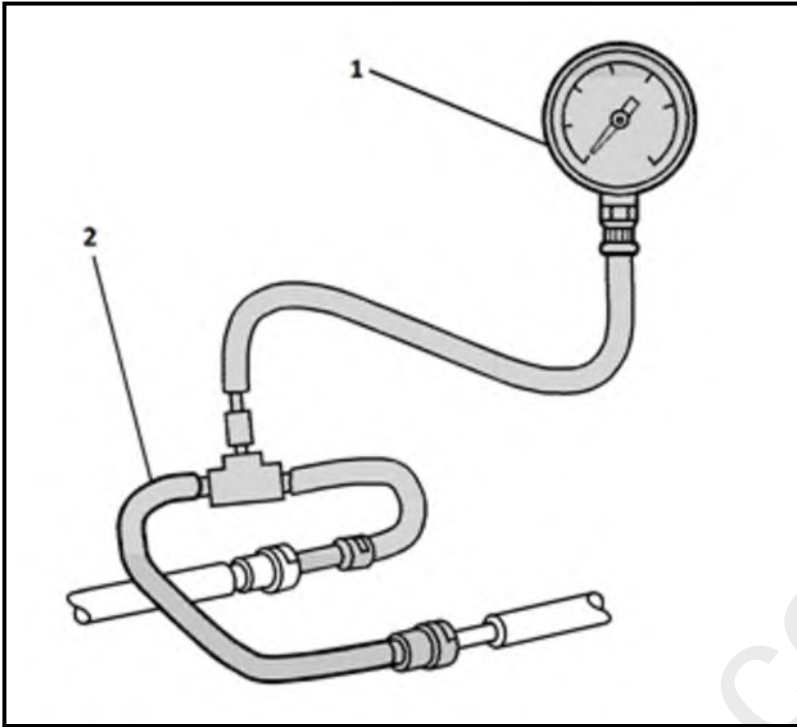
CAUTION: Refer to [Component Fastener Tightening Caution](#) .

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

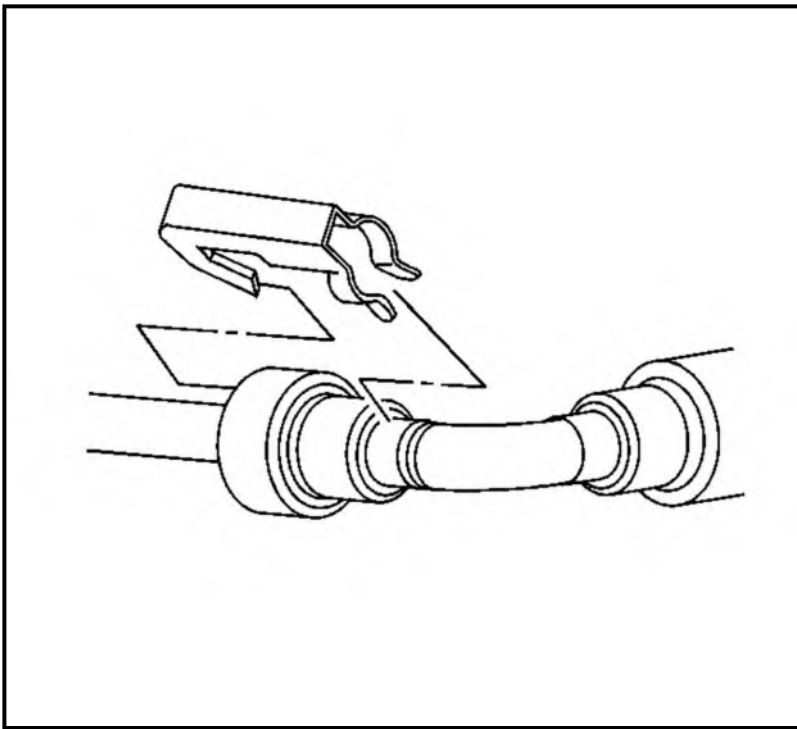
Special Tools

J-41769-1 Fuel Line Disconnect Tool Set

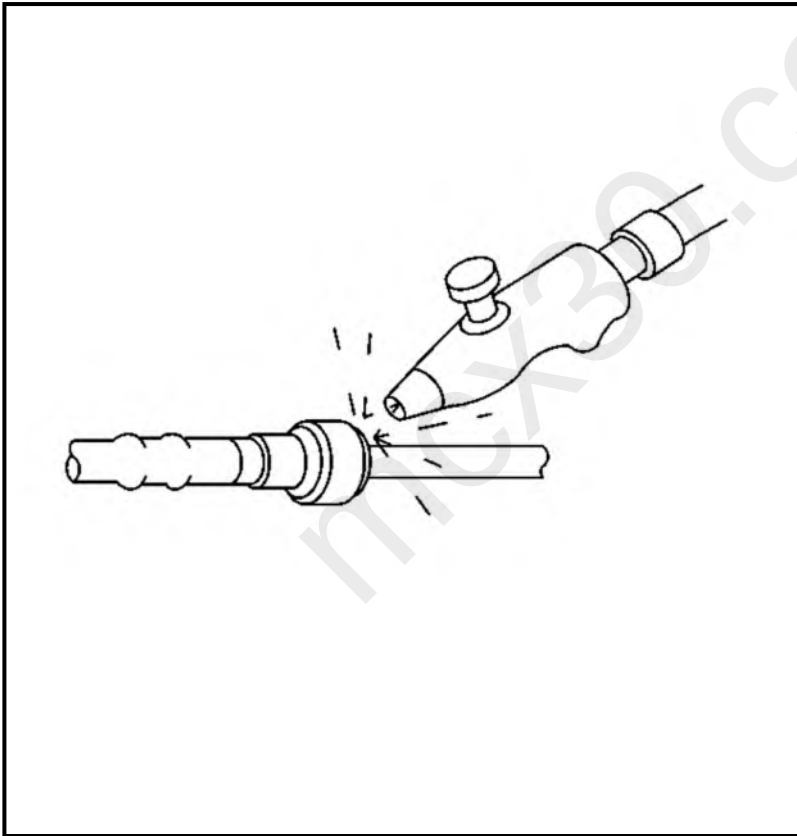
Removal Procedure

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.

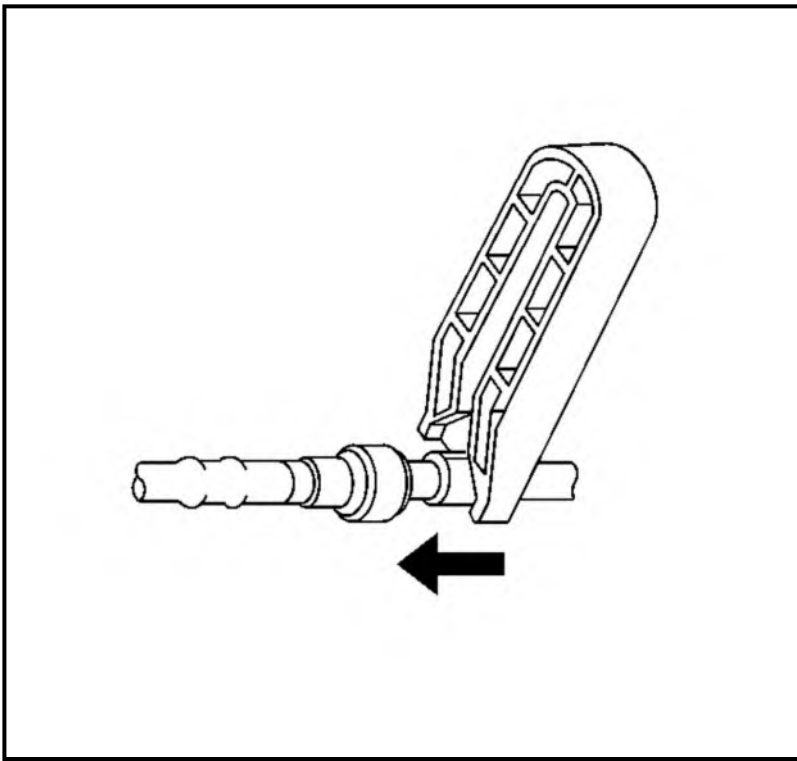


3. Blow dirt out of the fitting using compressed air.

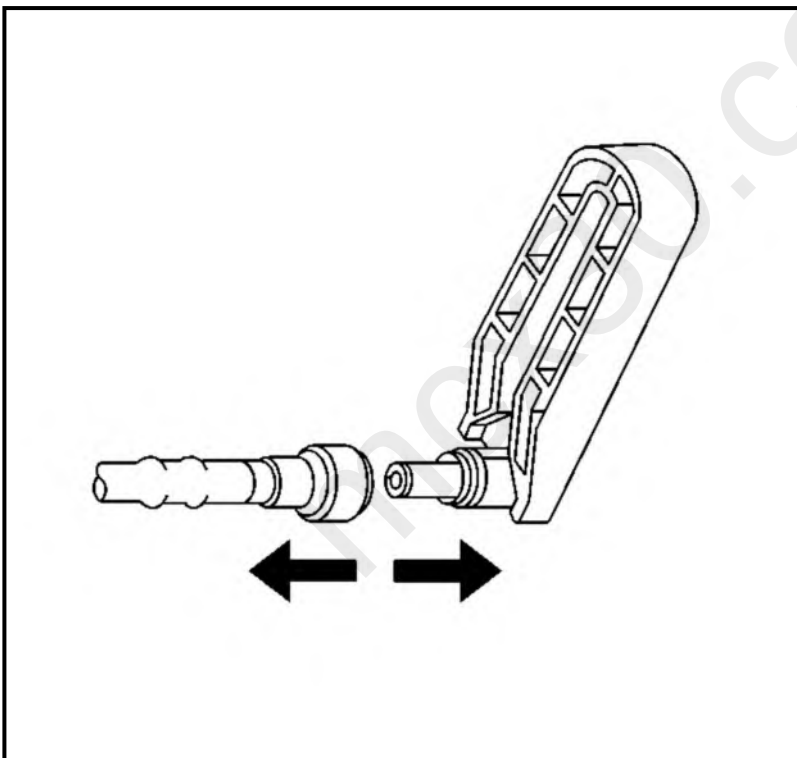


WARNING: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

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.

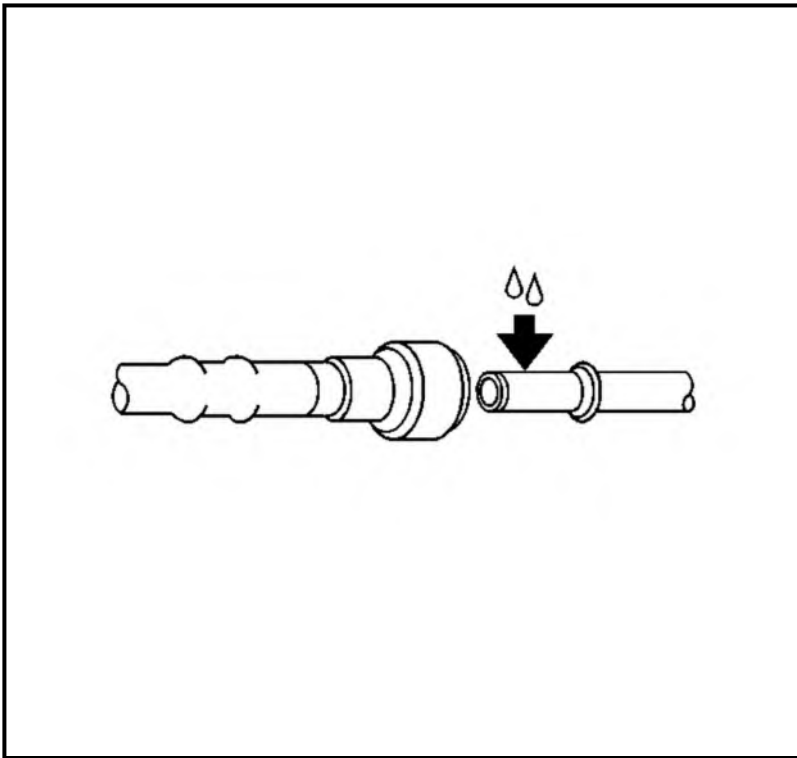
6. Using a clean shop towel, wipe off the male pipe end.

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

Clean or replace the components as required.

Installation Procedure

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

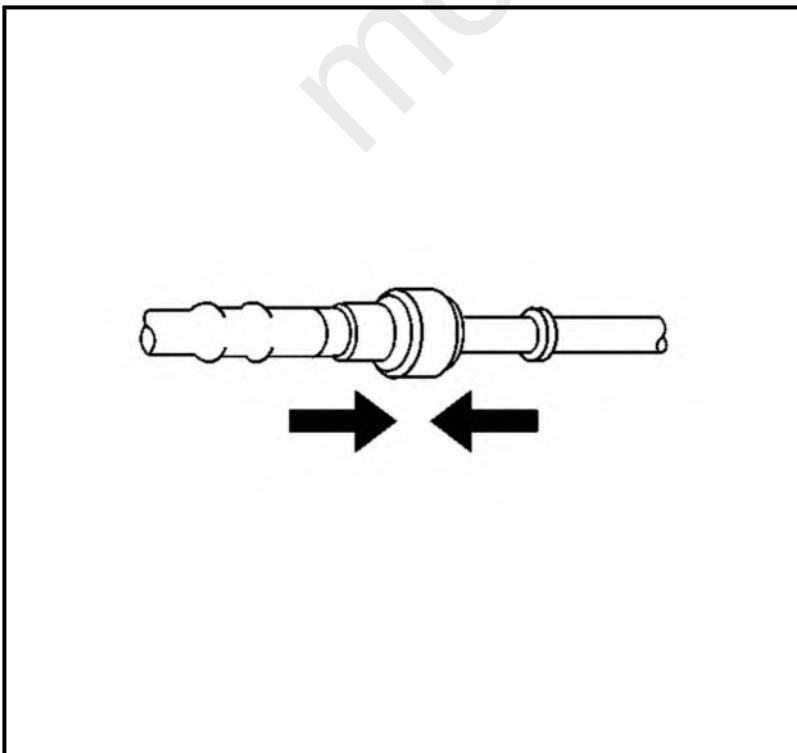


WARNING: In order to reduce the risk of fire and personal injury, before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends.

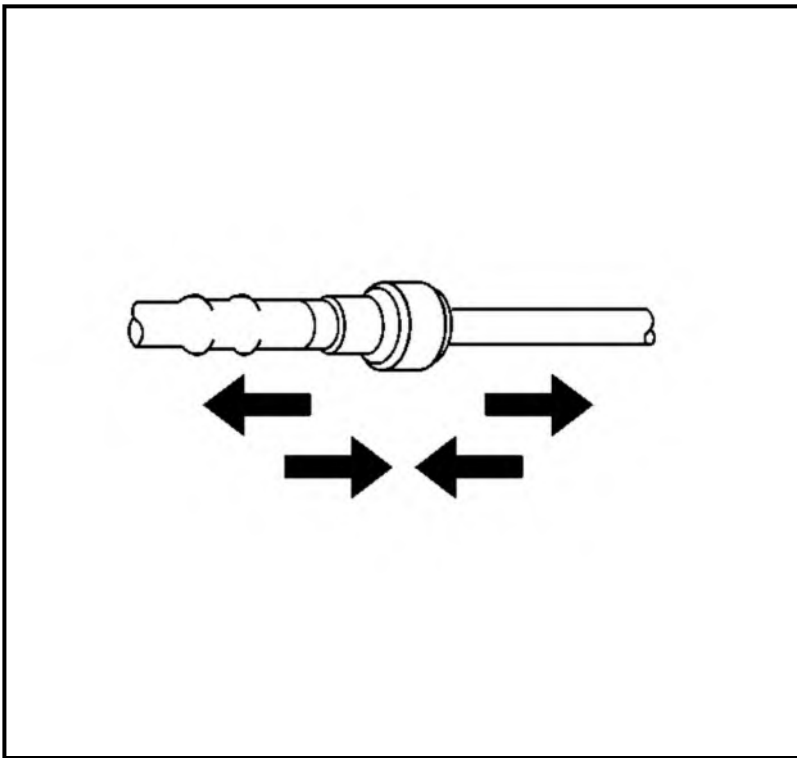
During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

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

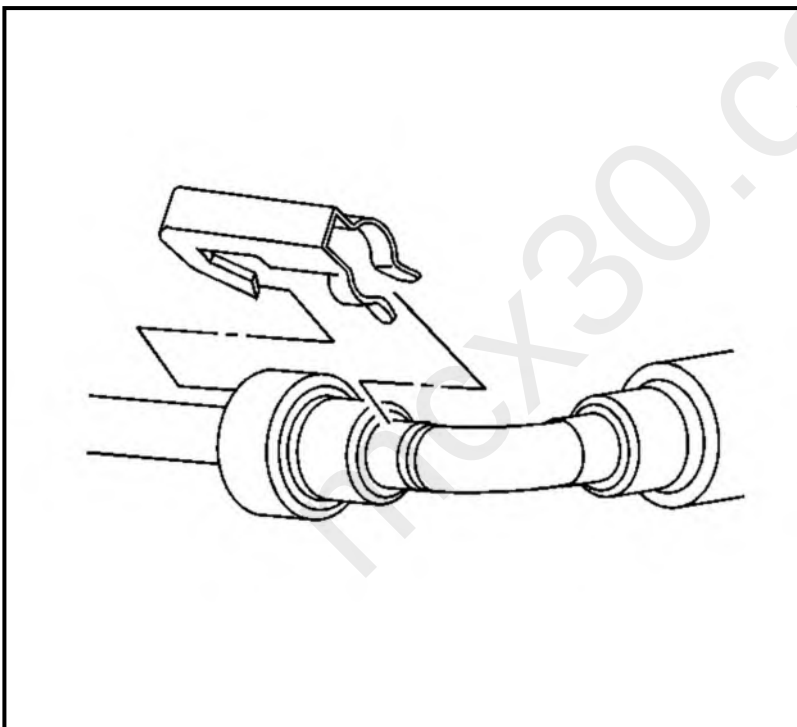
2. Push both sides of the quick-connect fitting together in order to snap the retaining tabs into place.



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.



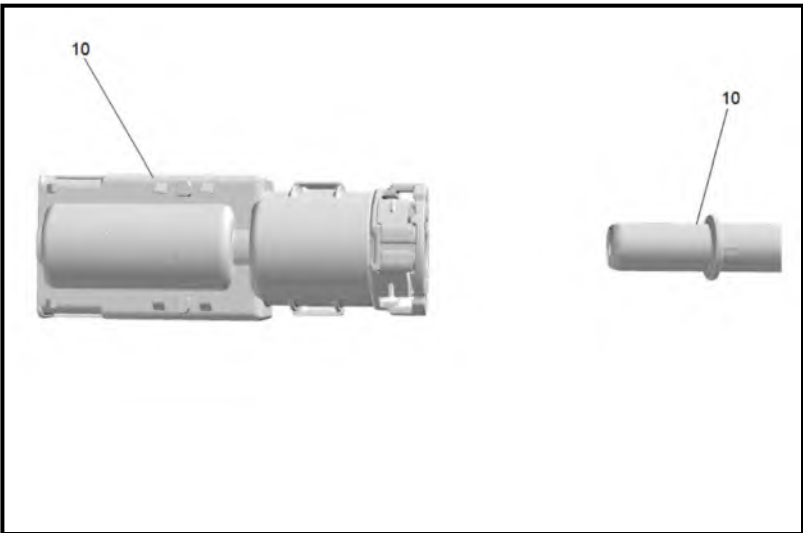
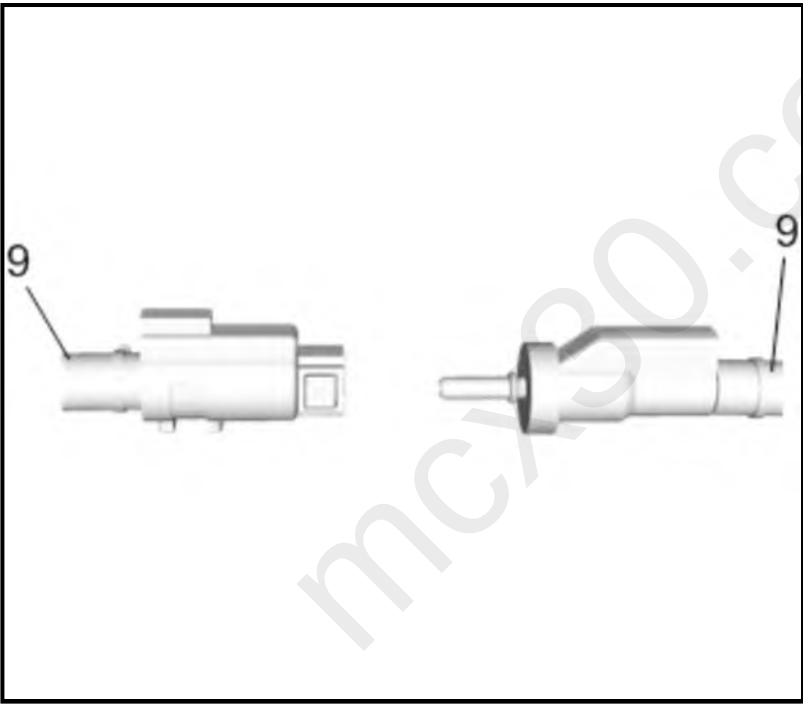
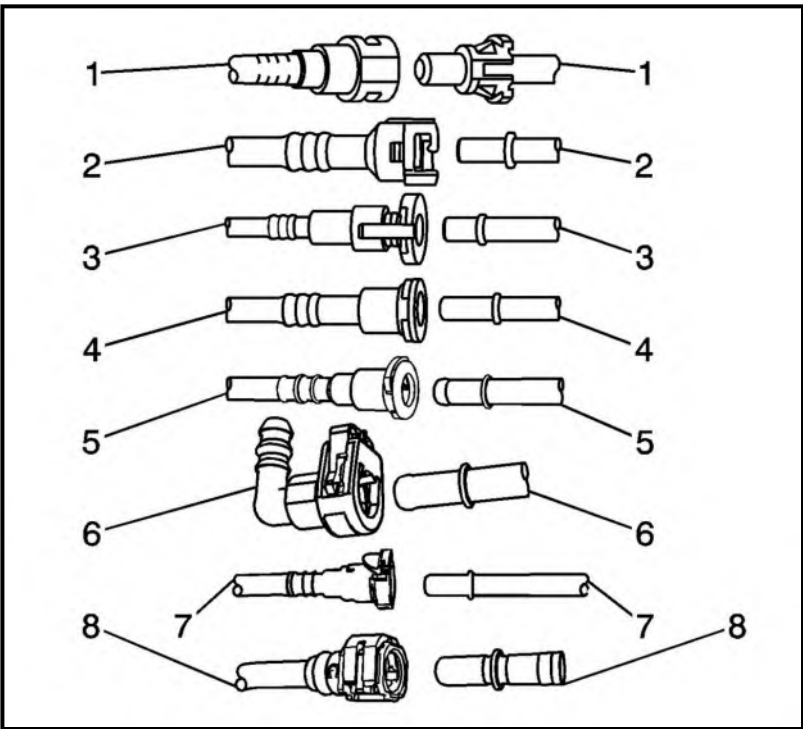
5. Inspect for leaks using the following procedure:

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



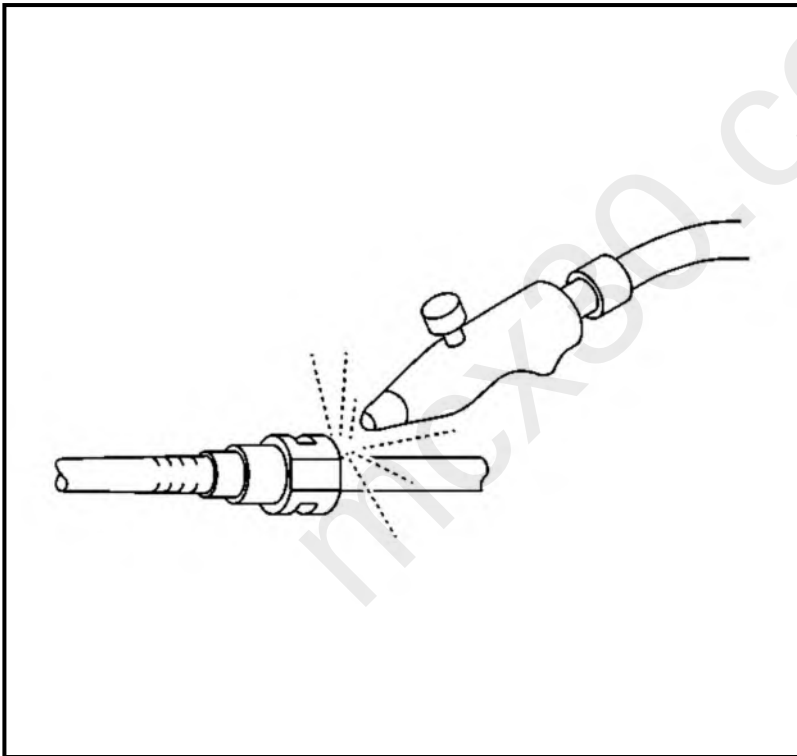
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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)

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

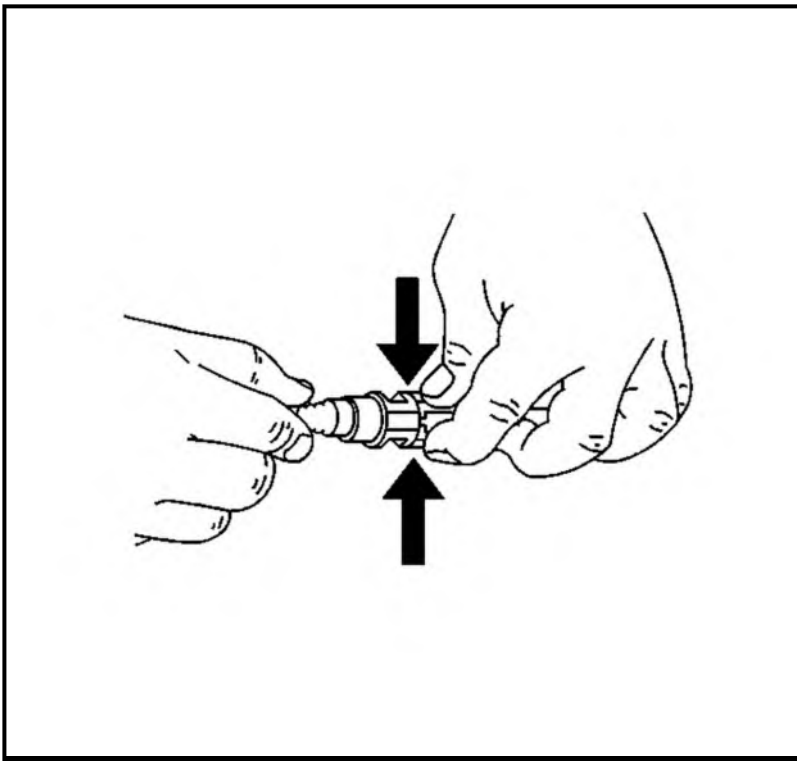
2. Using compressed air, blow any dirt out of the quick-connect fitting.



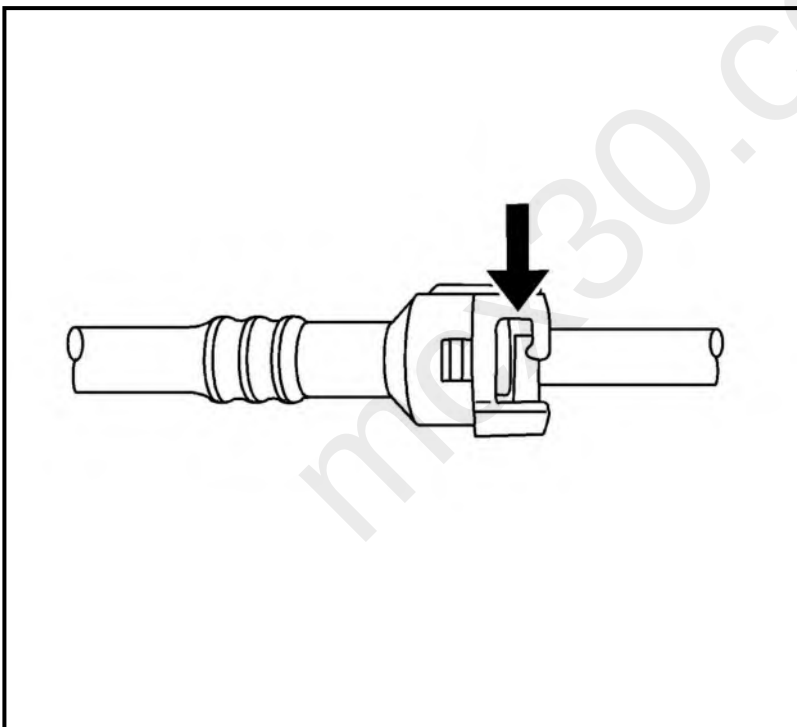
WARNING: Refer to [Safety Glasses and Compressed Air Warning](#) .

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

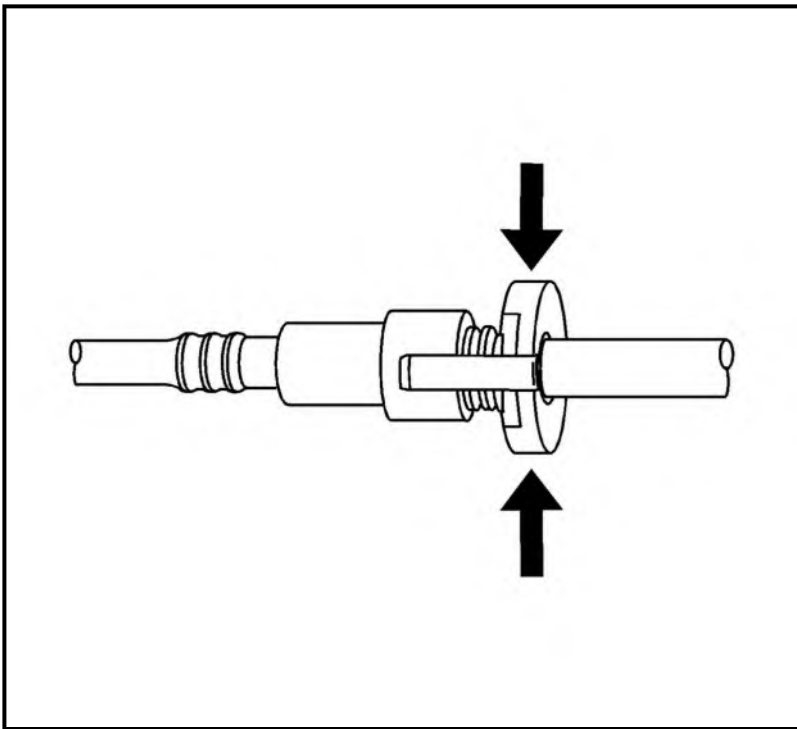
3. This step applies to Bartholomew style connectors ONLY. Squeeze the plastic quick-connect fitting release tabs.



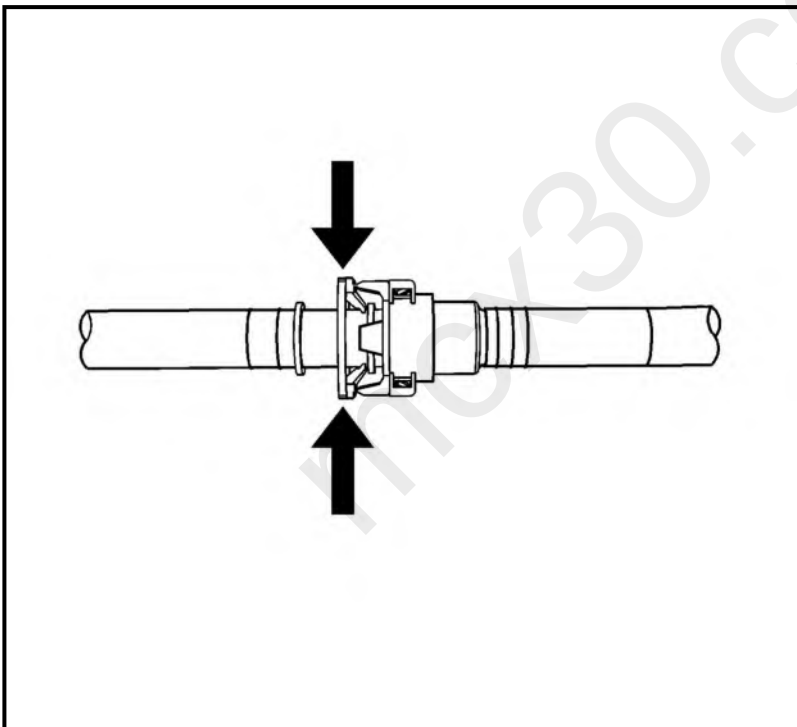
4. This step applies to Q Release style connectors ONLY. Release the fitting by Pushing the tab toward the other side of the slot in the fitting.



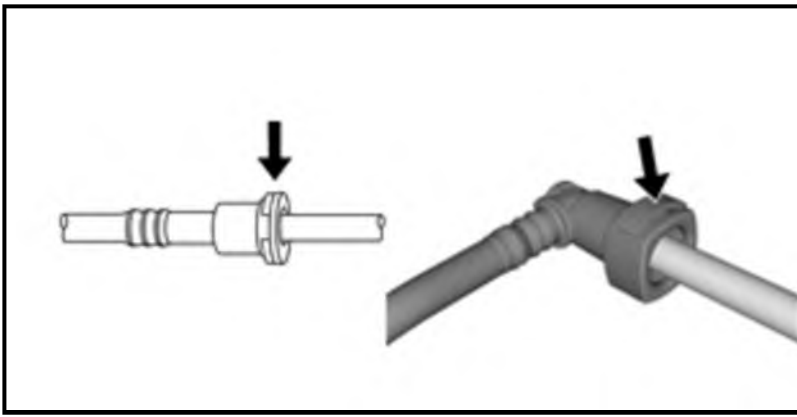
5. This step applies to Squeeze to Release style connectors ONLY. Squeeze where indicated by arrows on both sides of the plastic ring surrounding the quick-connect fitting.



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.

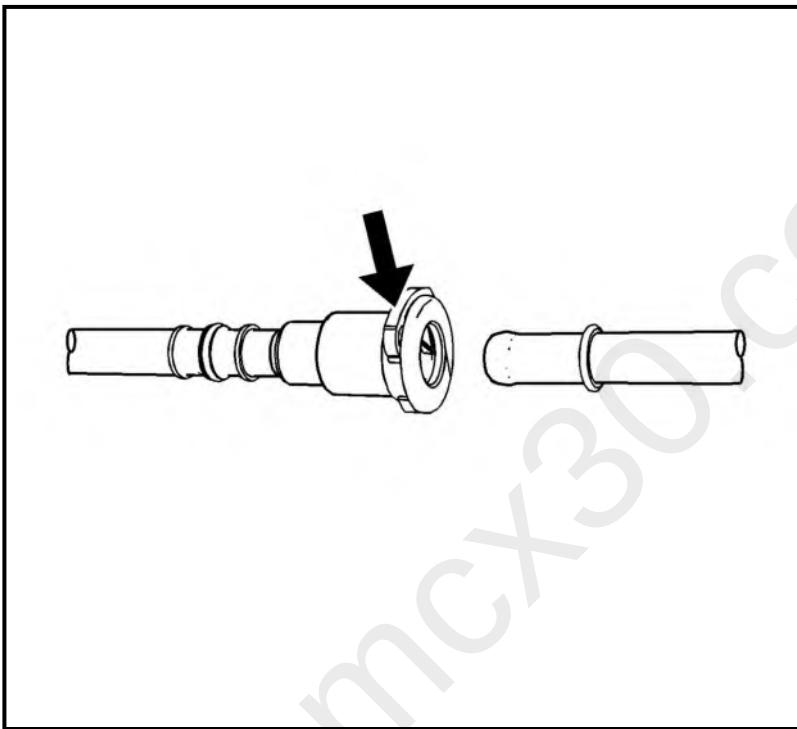


7. This step applies to Sliding Retainer style connectors ONLY. Release the fitting by pressing on one side of the release tab causing it to push in slightly. If the tab doesn't move try pressing the tab in from the opposite side. The tab will only move in one direction.

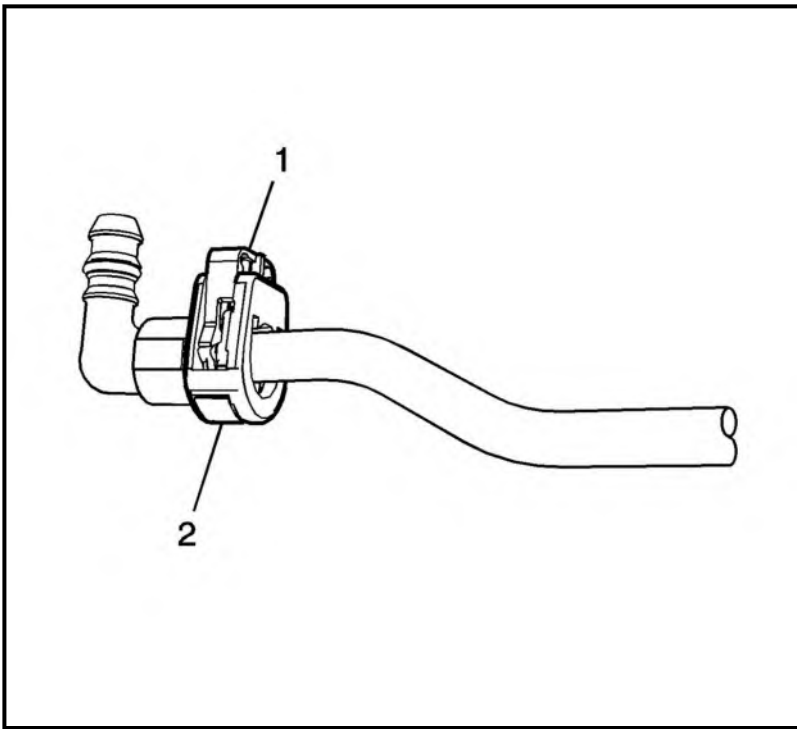


NOTE: There are two variants of sliding retainer style connectors shown above, both have the same release and installation procedure.

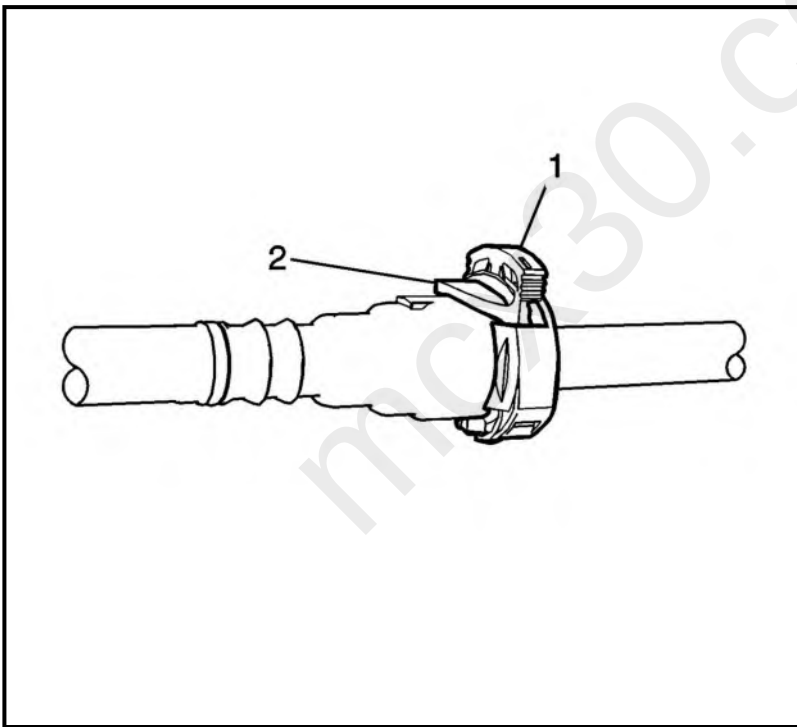
8. This step applies to the Global Connector style only. Push the connector toward the tube in order to release the pressure. Press and hold down the release mechanism, and pull the connector straight out.



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.

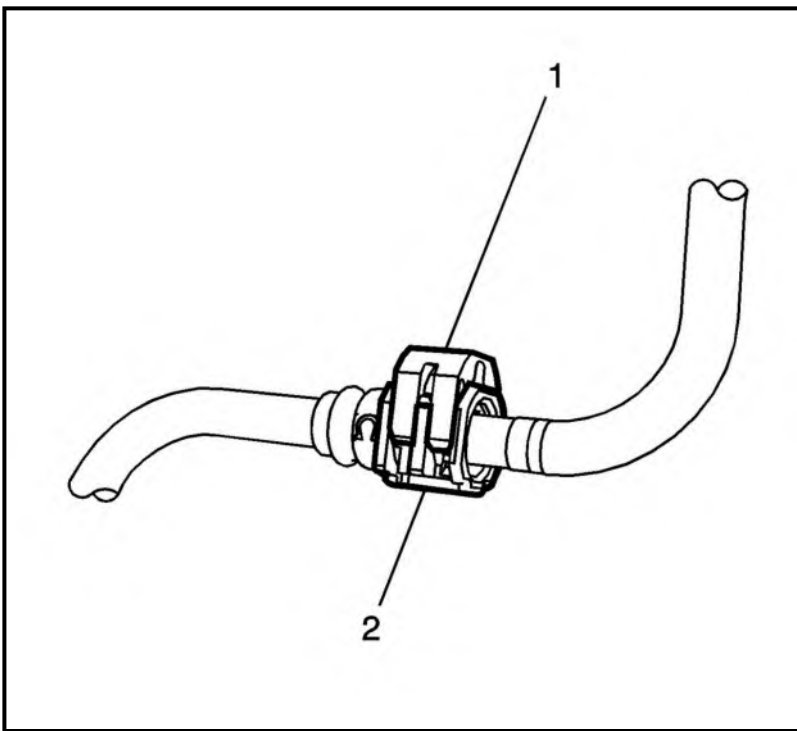


10. This step applies to the Safe Lock style only. Push the connector toward the tube in order to release the pressure. Release the second latch (1) with two fingers. Then press and hold down the bottom release mechanism (2) and pull the connector straight out.

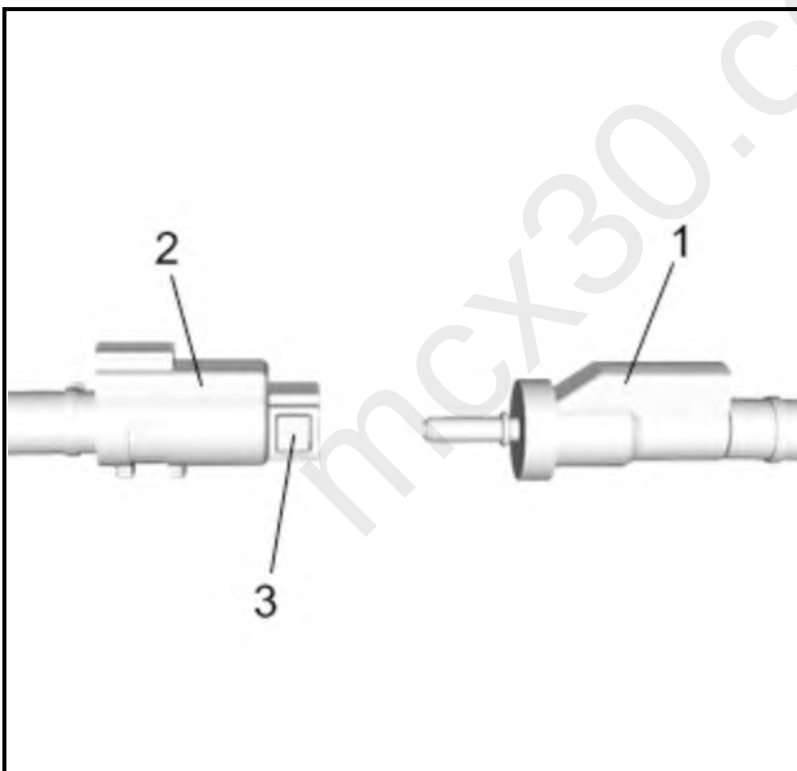


WARNING: Refer to [Relieving Fuel Pressure Warning](#) .

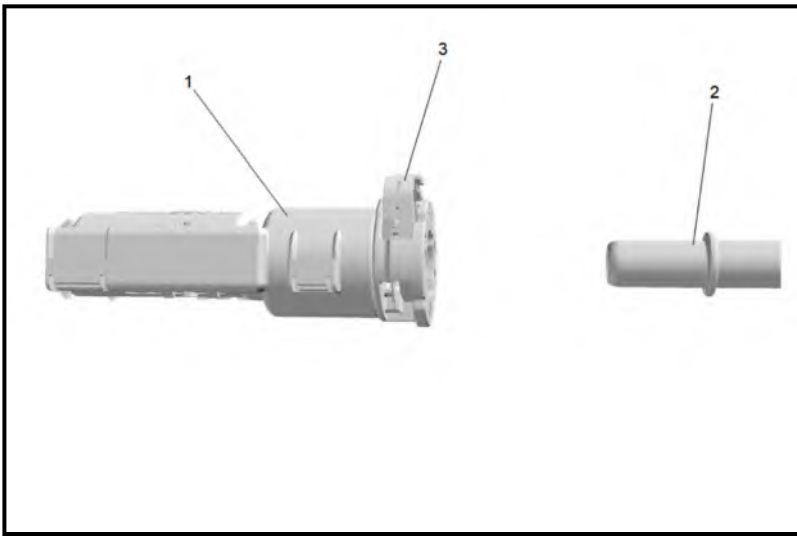
11. This step applies to the Plastic Connector style 8, push the connector toward the tube in order to release the pressure. Press the latch (1) inward in order to release the pipe, while pulling the connector (2) straight out.



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.



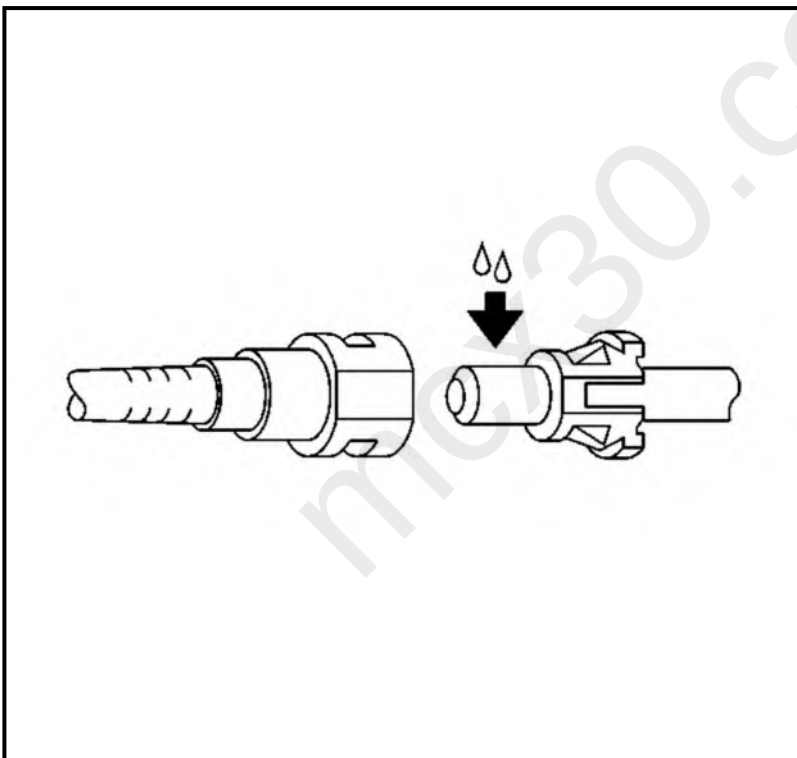
13. Using a clean shop towel, wipe off the male pipe end.
14. Inspect both ends of the fitting for dirt and burrs.
15. Clean or replace components as necessary.
16. For the DEF Connector style only. Push the female side (1) towards connector (2) in order to release the pressure on the connector. Squeeze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

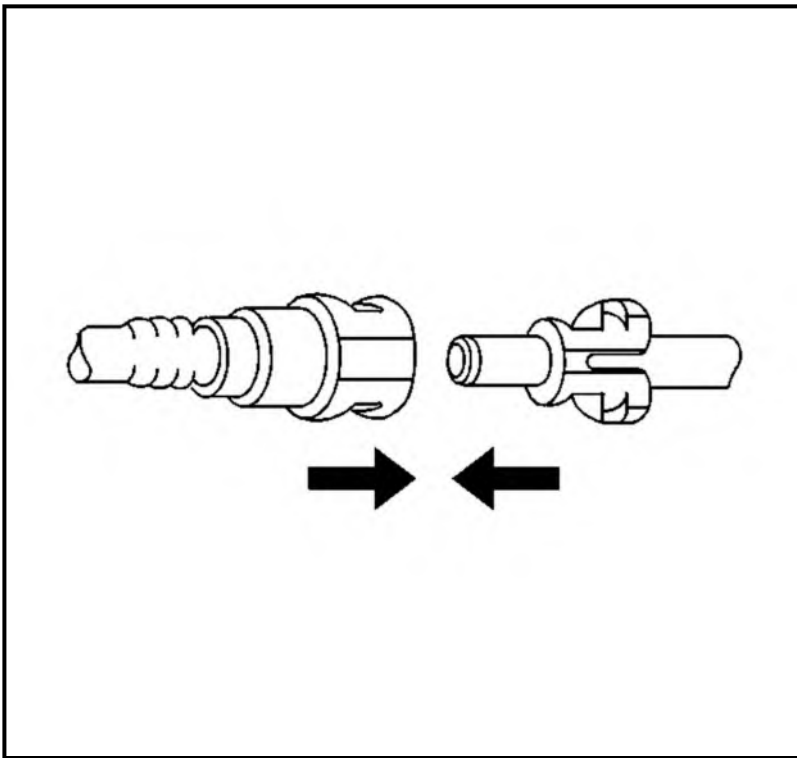
Installation Procedure

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

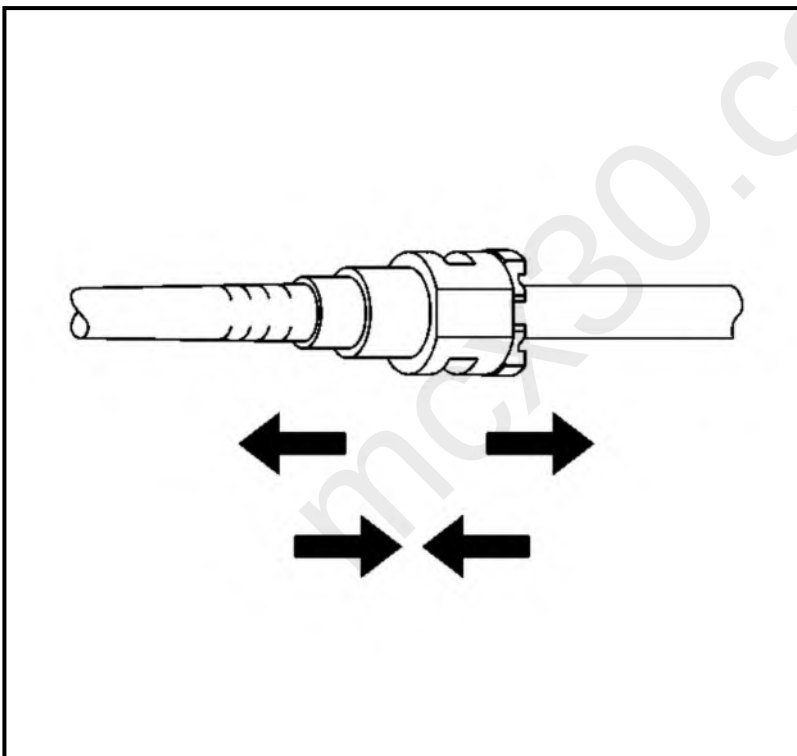


WARNING: Refer to [Fuel Pipe Fitting Warning](#) .

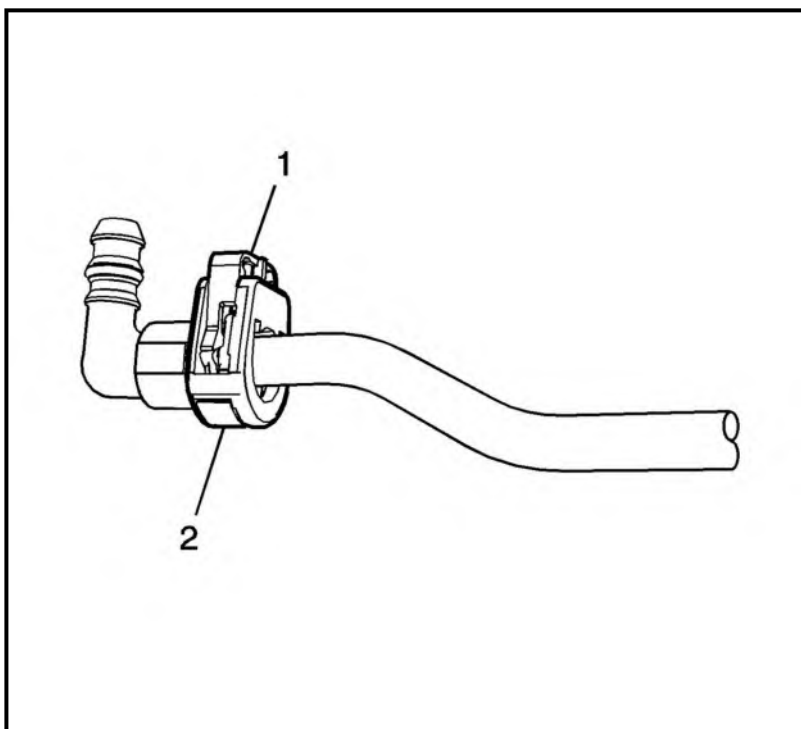
2. Push both sides of the quick-connect fitting together in order to cause the retaining feature to snap into place.



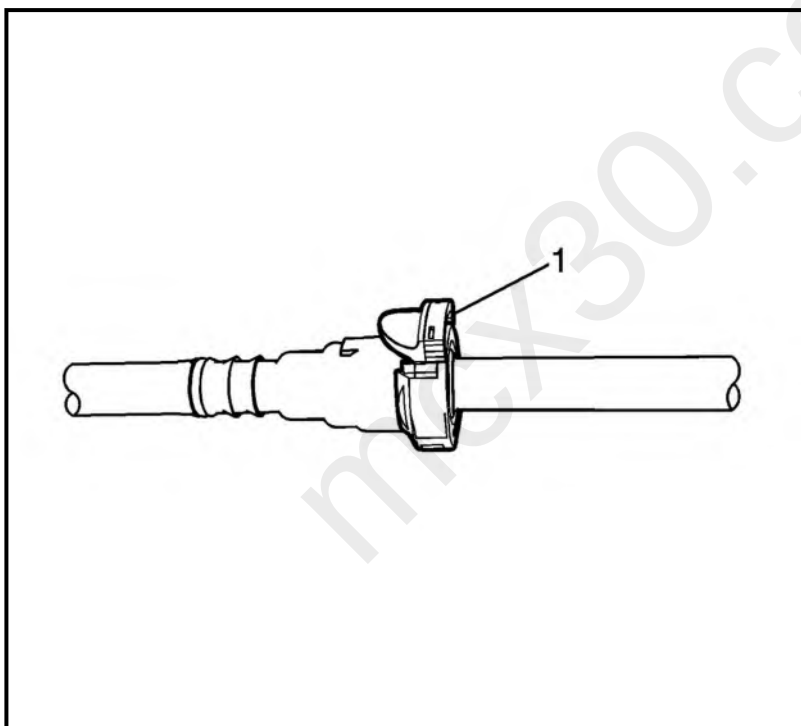
3. Pull on both sides of the quick-connect fitting to make sure the connection is secure.



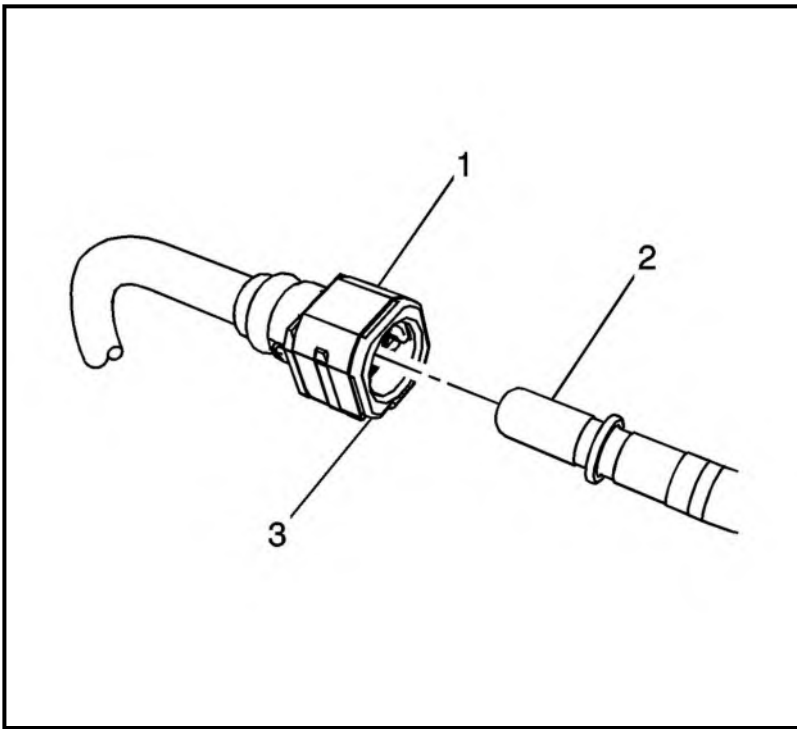
4. Insert the tube in the connector until the retainer snaps in place.



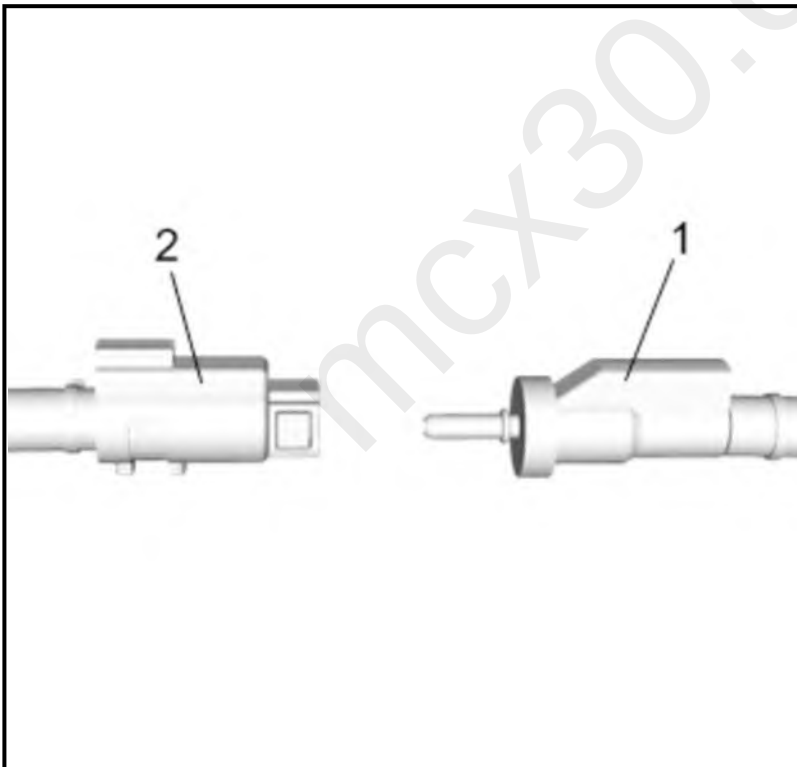
5. Push down on the redundant latch (1) until it is fully engaged and snapped into position.
6. Insert the tube in the connector until the retainer snaps in place.



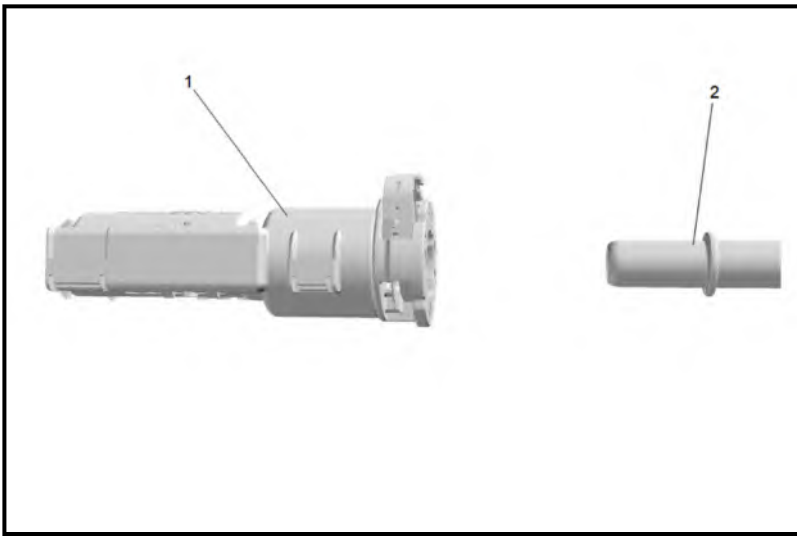
7. Push down on the second latch (1) in order to secure the connection.
8. For the plastic connector type 8, depress the latch (1) while inserting the connector (3) on to the pipe (2).



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

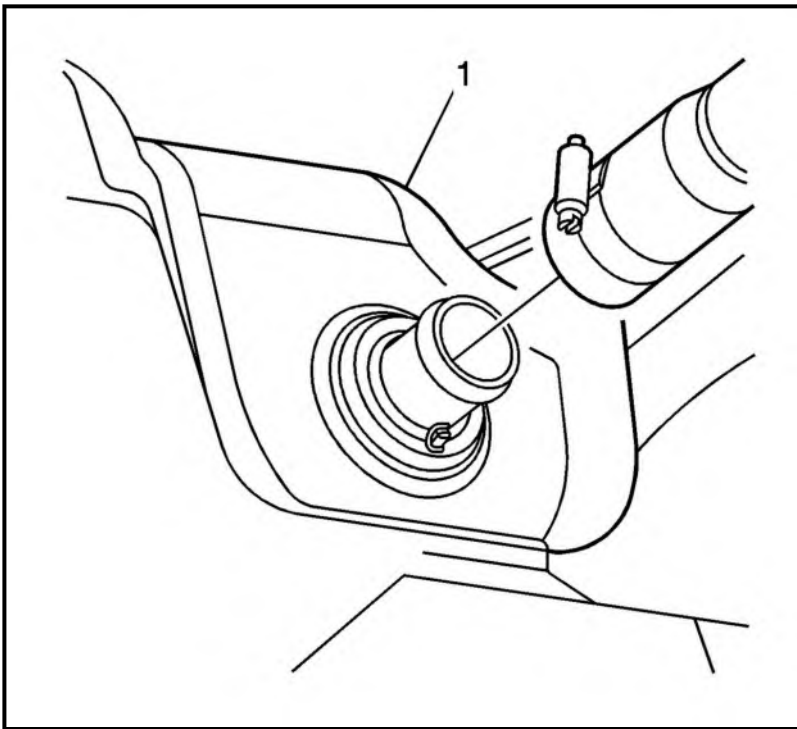
Special Tools

- 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.

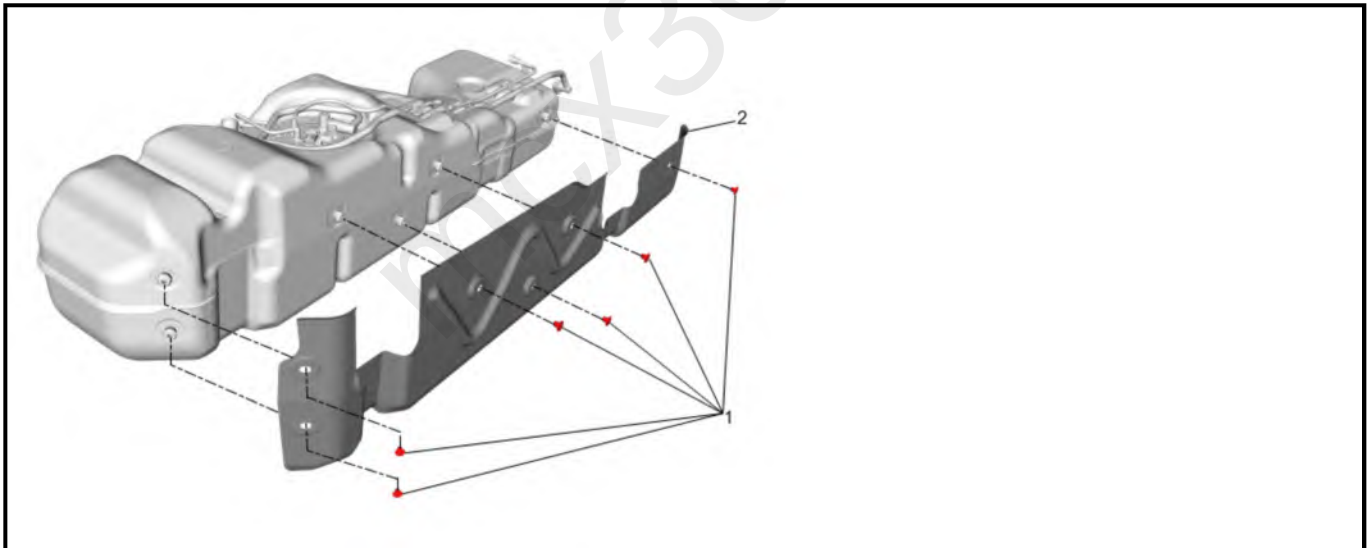
1. Raise and Support the Vehicle. Refer to [Lifting and Jacking the Vehicle](#)
2. Loosen the lower fill hose clamp in order to separate the fill hose from the fuel tank (1).



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 SHIELD 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 Shield Retainers (Qty: 6)

Callout	Component Name
	CAUTION: Refer to Fastener Caution .
2	Fuel Tank Shield

FUEL TANK REPLACEMENT

Removal Procedure

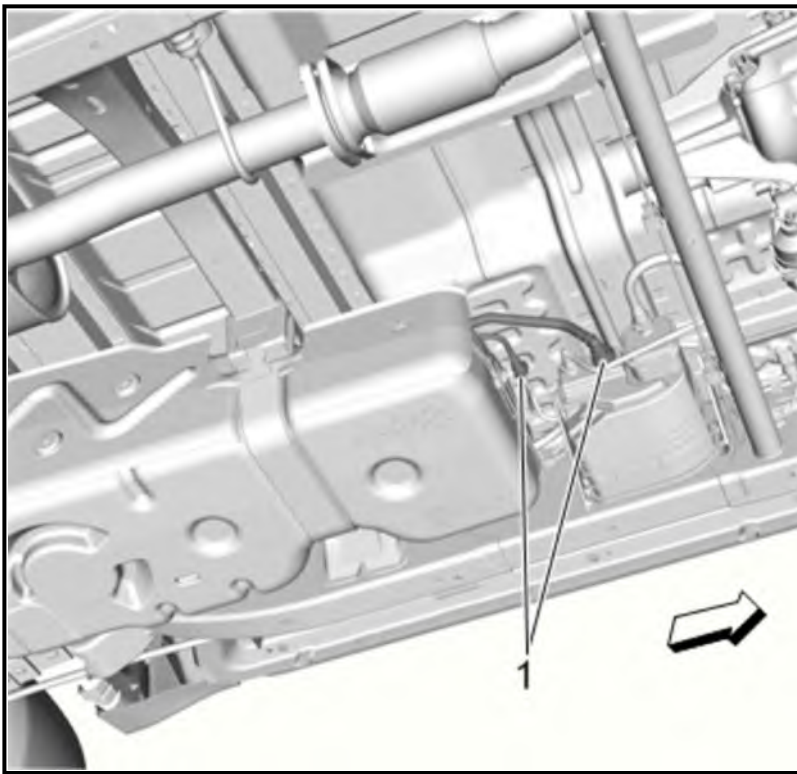
WARNING: To avoid any vehicle damage, serious personal injury or death:

- 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.

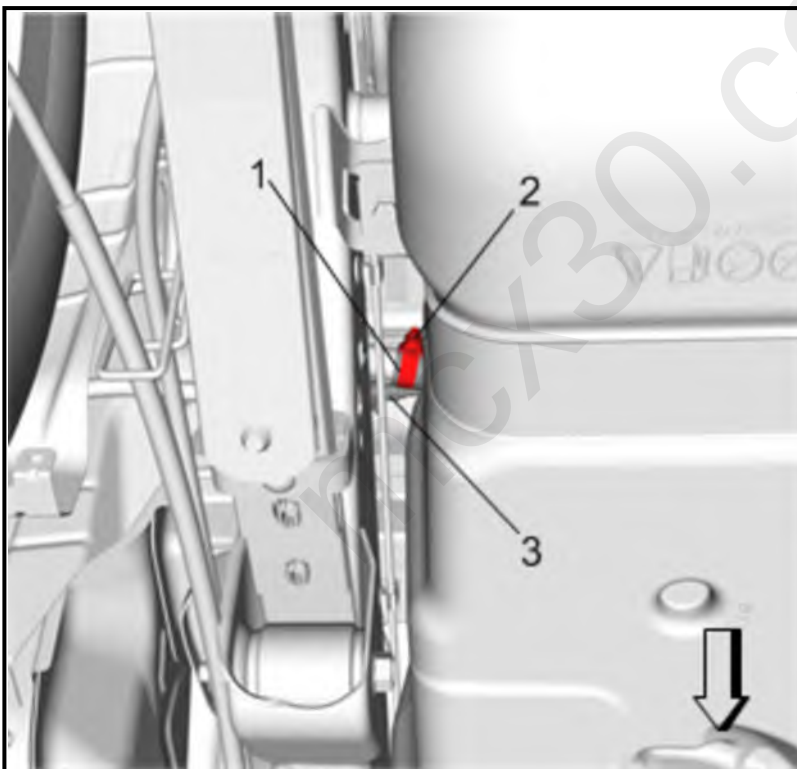
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

1. Relieve the system fuel pressure. Refer to [Fuel Pressure Relief](#)
2. Drain the fuel tank. Refer to [Fuel Tank Draining](#).
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
4. Disconnect the evaporative emission and fuel pipes (1). Refer to [Plastic Collar Quick Connect Fitting Service](#).

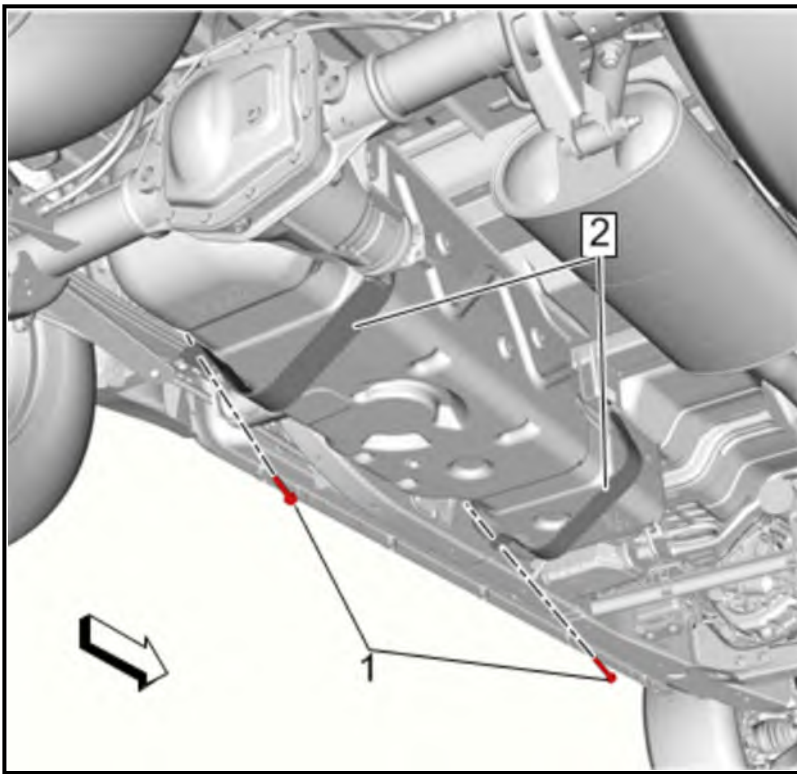


5. Loosen the hose clamps (2) and remove the filler hose (1).

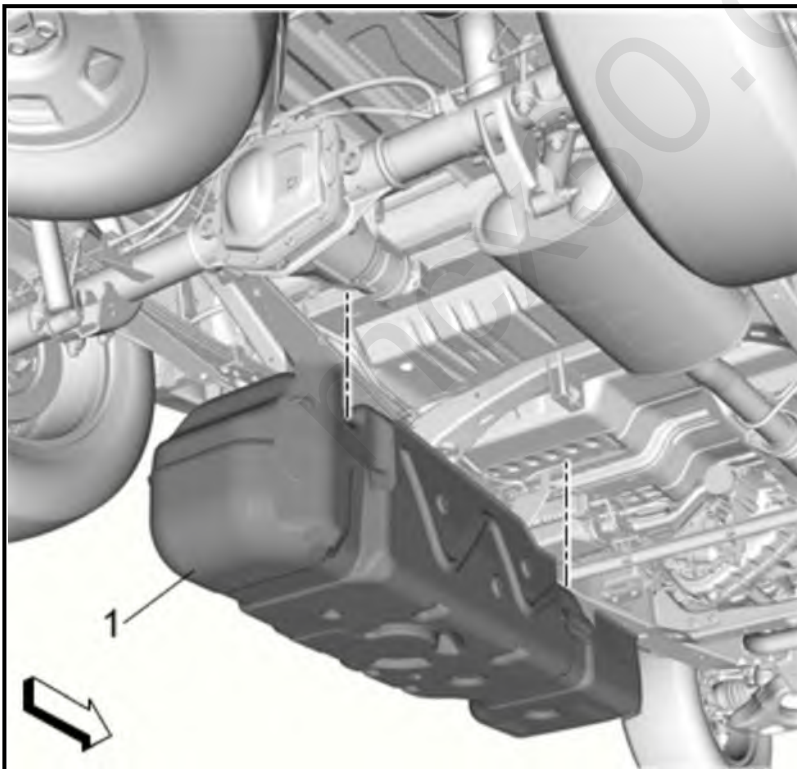


6. Disconnect the evaporative emission line (3) from the filler pipe assembly. Refer to [Plastic Collar Quick Connect Fitting Service](#).

7. Support the fuel tank with a suitable jack.



8. Remove the fuel tank strap bolts (1).
9. Remove the fuel tank straps (2).
10. Disconnect the fuel tank harness electrical connector.

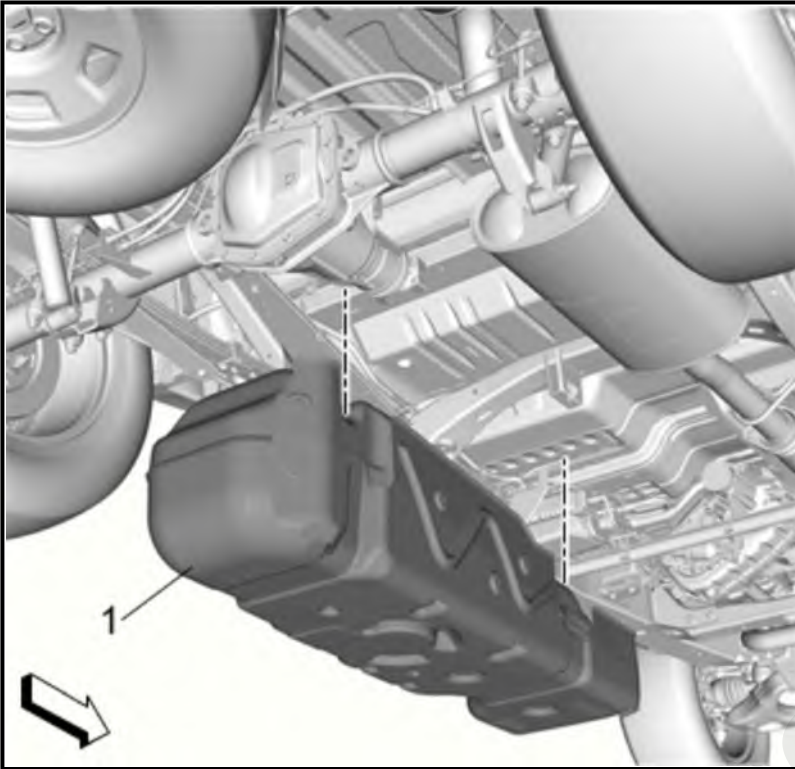


11. Remove the fuel tank (1).
12. Remove the following components if replacing just the fuel tank.
 1. Fuel tank fuel pump module. Refer to [Fuel Tank Fuel Pump Module Replacement](#).
 2. Transfer components as necessary.

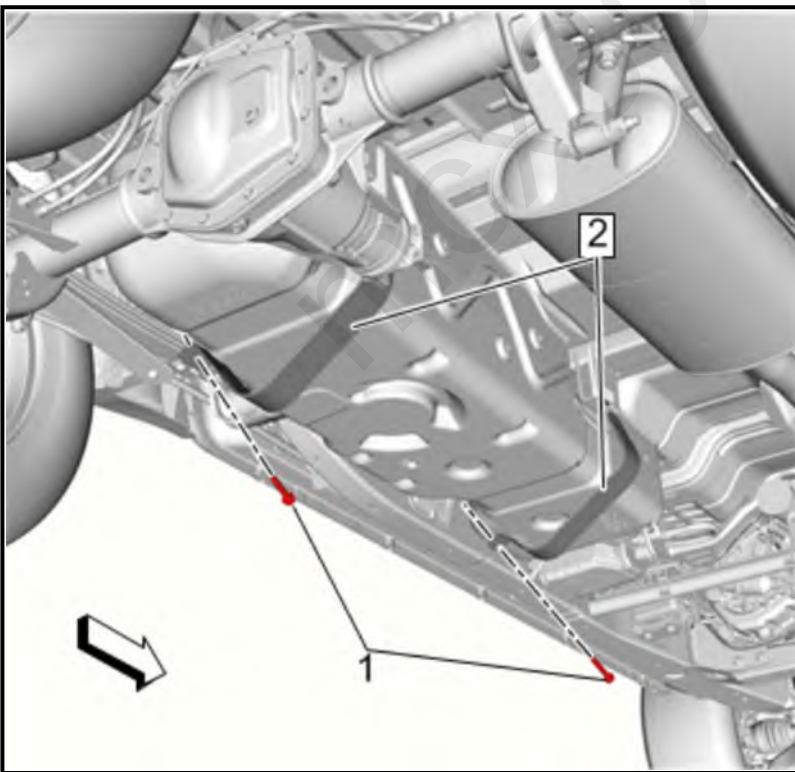
Installation Procedure

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

1. Fuel tank fuel pump module. Refer to [Fuel Tank Fuel Pump Module Replacement](#).
2. Use a suitable jack and install the fuel tank (1).

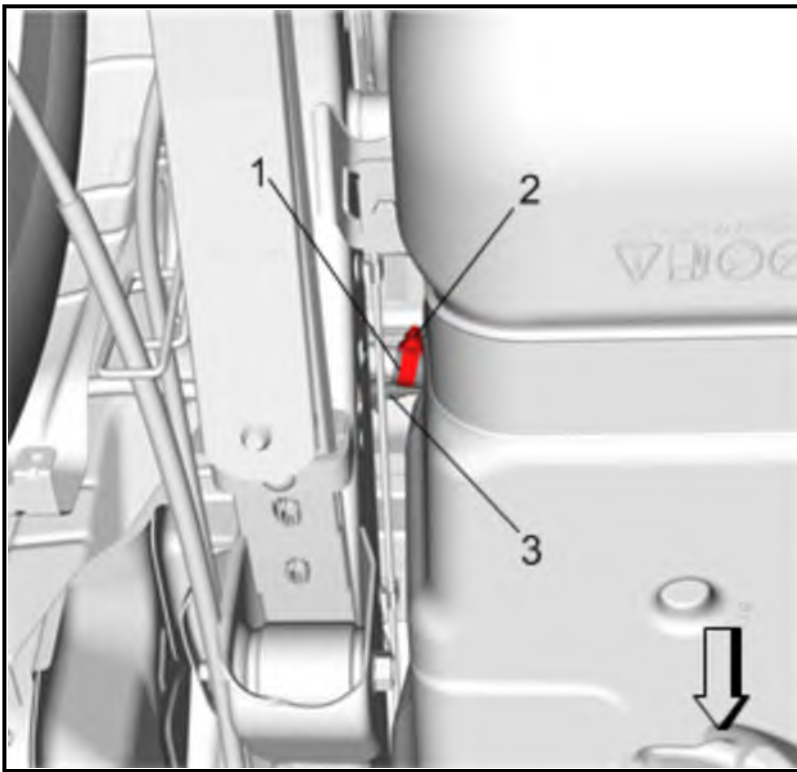


3. Connect the fuel tank harness electrical connector.
4. Install the fuel tank straps (2).

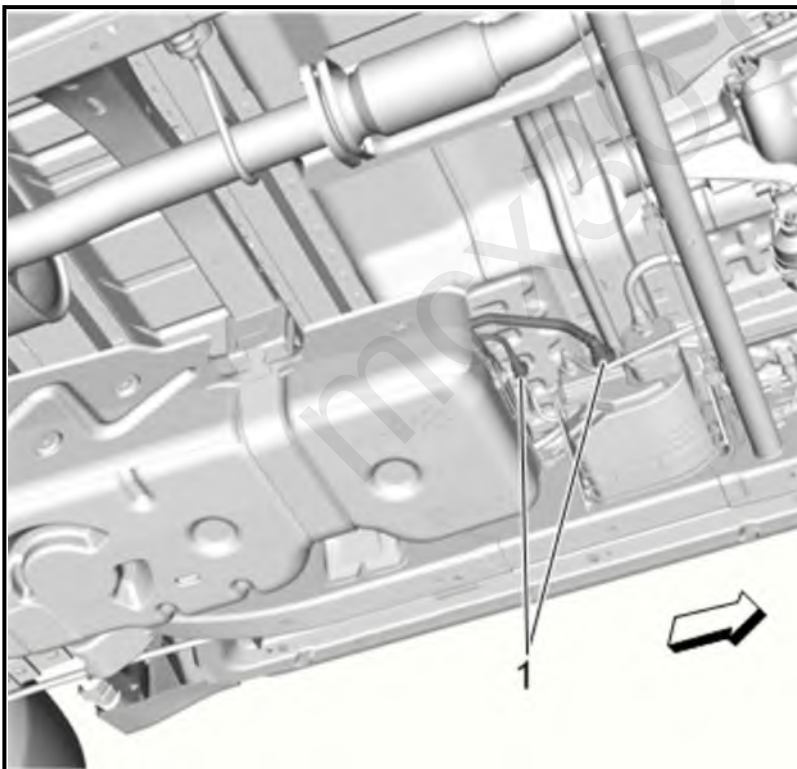


CAUTION: Refer to [Fastener Caution](#) .

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).

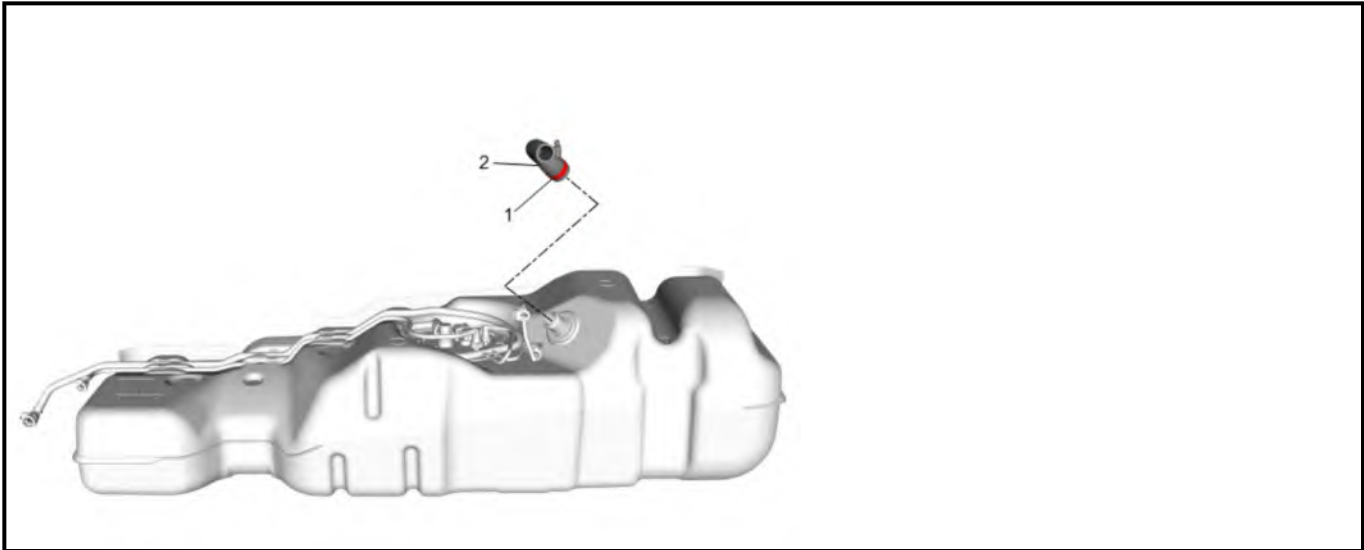


7. Connect the evaporative emission line (3). Refer to [Plastic Collar Quick Connect Fitting Service](#).
8. Connect the evaporative emission and fuel pipes (1). Refer to [Plastic Collar Quick Connect Fitting Service](#).



9. Lower the vehicle.
10. Refill the fuel tank.
11. Inspect for fuel leaks.

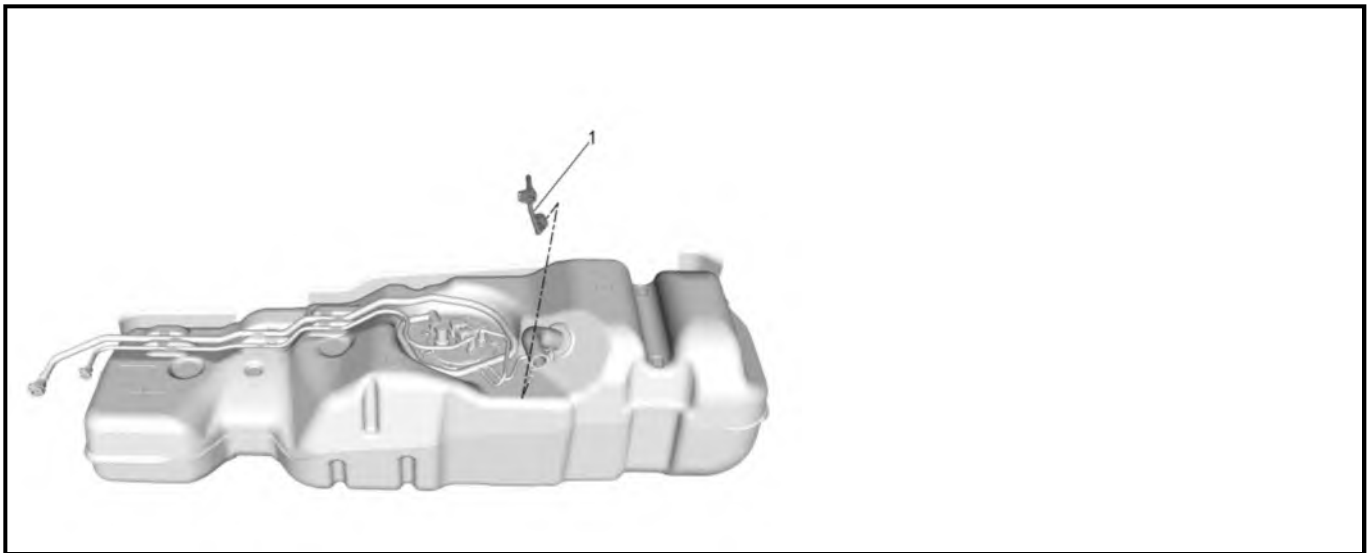
FUEL TANK FILLER HOSE REPLACEMENT



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 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 .	
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 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.

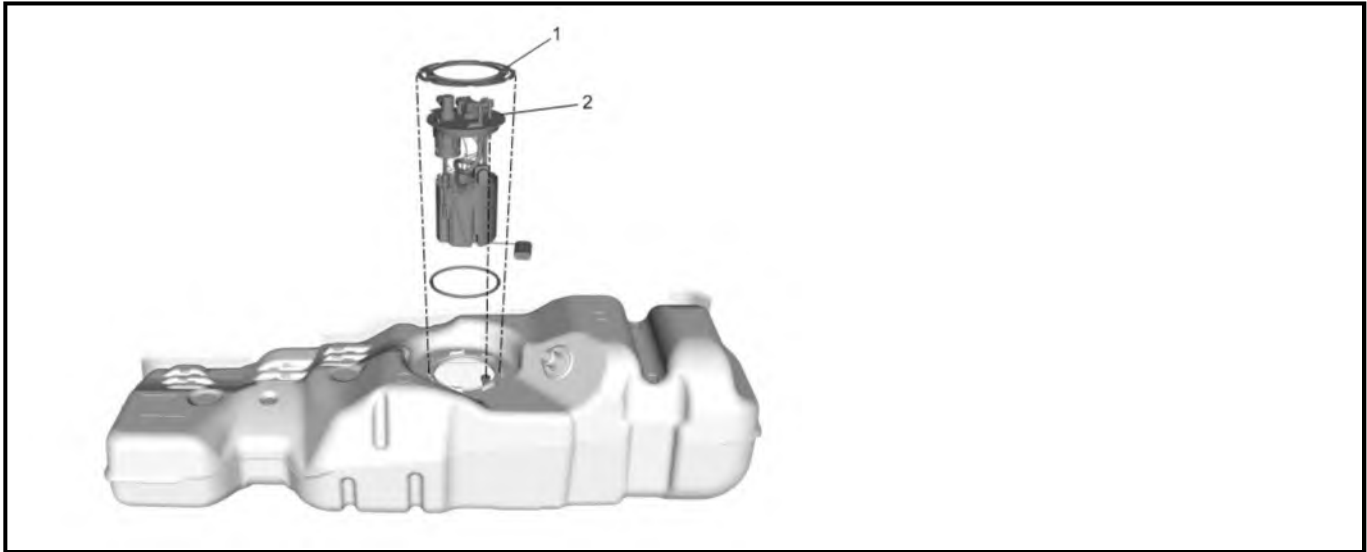
NOTE: Whenever the fuel tank is cleaned, inspect the fuel pump fuel strainer. If the fuel pump fuel strainer is contaminated, replace the fuel pump fuel strainer and inspect the fuel pump.

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](#).

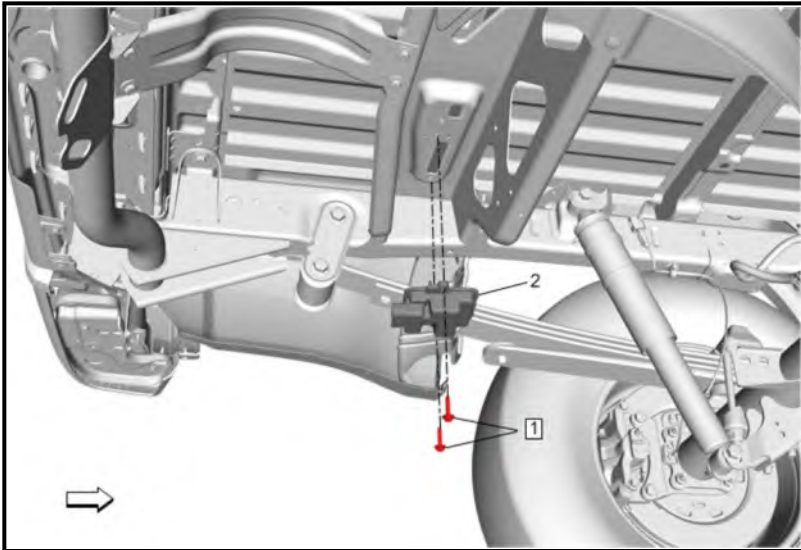
FUEL TANK FUEL PUMP MODULE REPLACEMENT



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) , or Special Tools (Diagnostic 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.

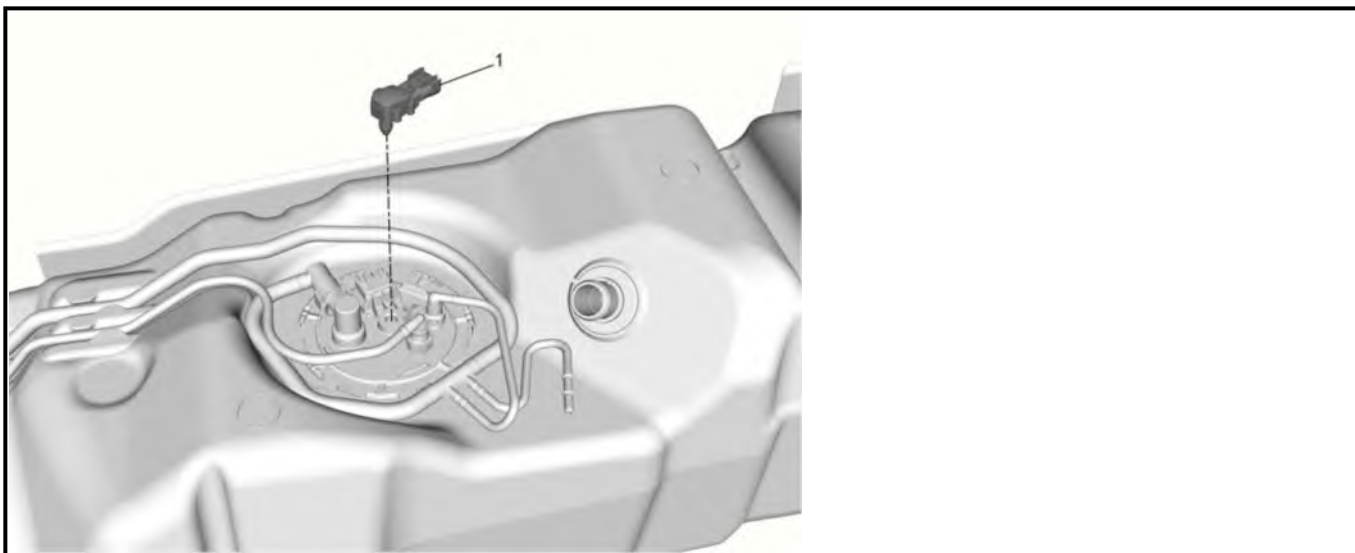
FUEL PUMP POWER CONTROL MODULE REPLACEMENT



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 .

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.

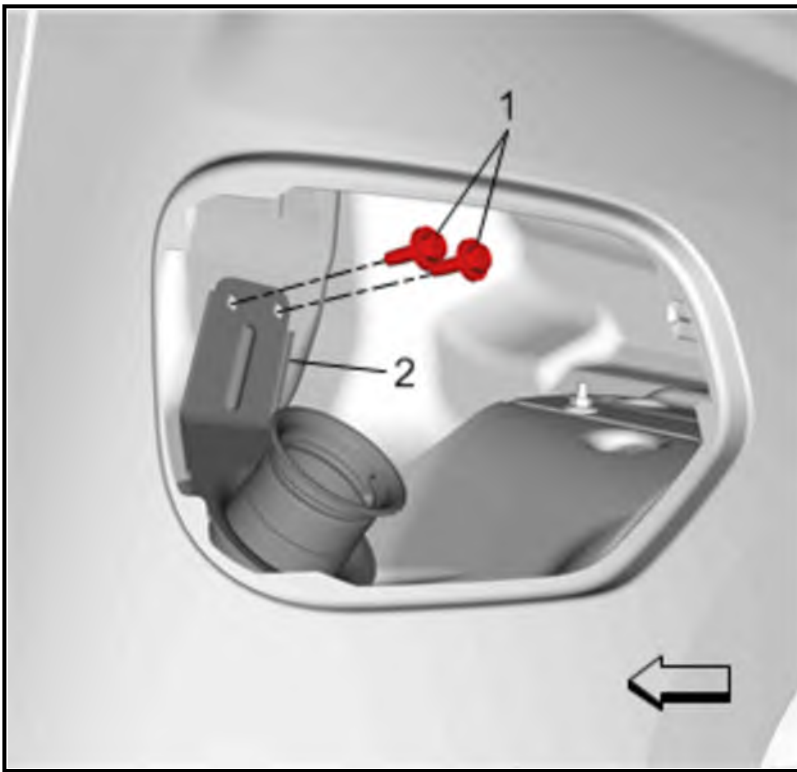
FUEL TANK FILLER PIPE REPLACEMENT

Removal Procedure

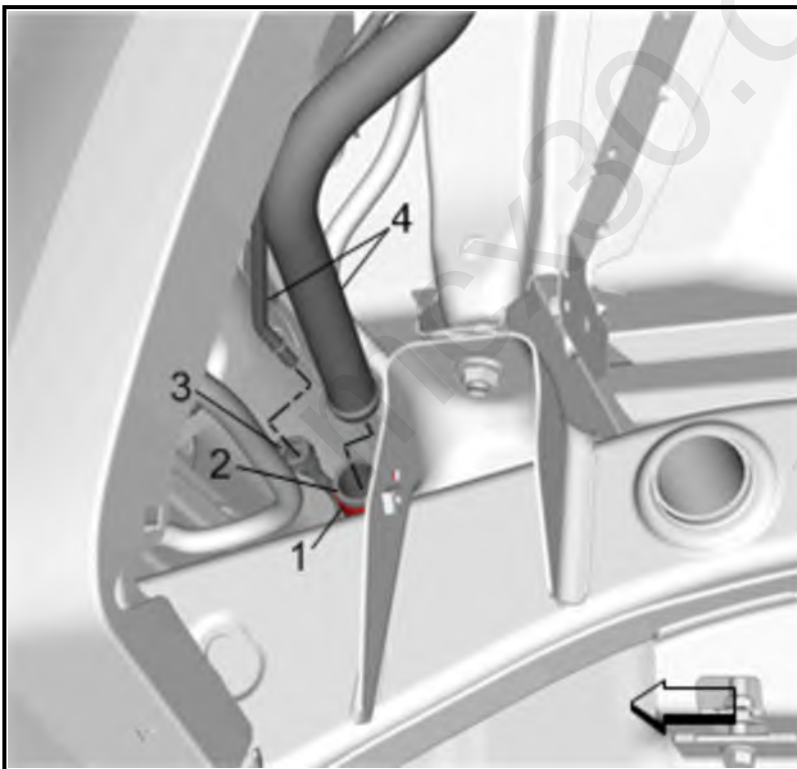
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

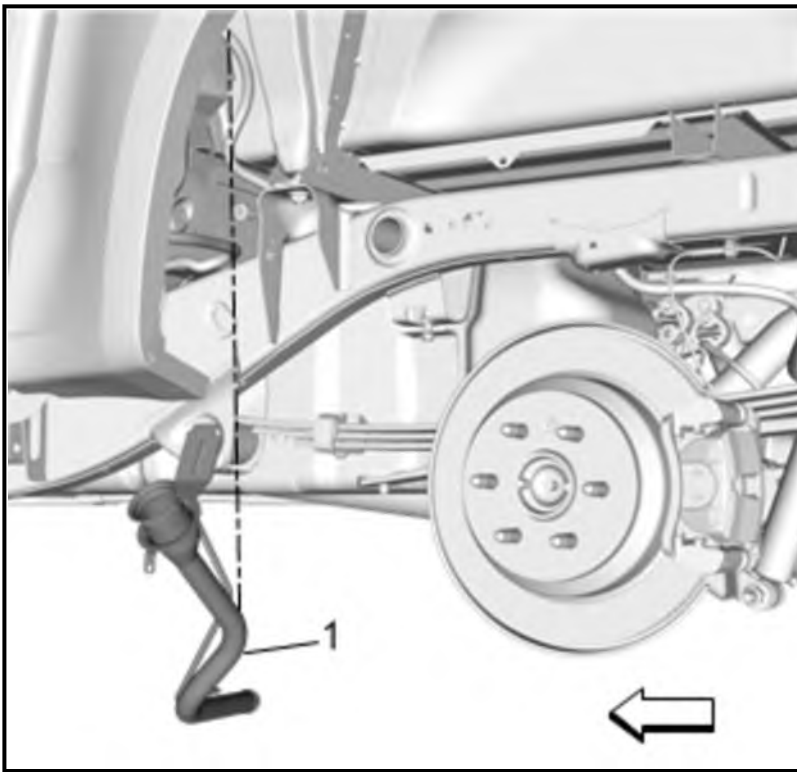
- 1. Remove the fuel tank filler pipe housing. Refer to [Fuel Tank Filler Pipe Housing Replacement](#) .
- 2. Remove the fuel tank filler pipe bolts (1) from the fuel tank filler pipe (2).



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).

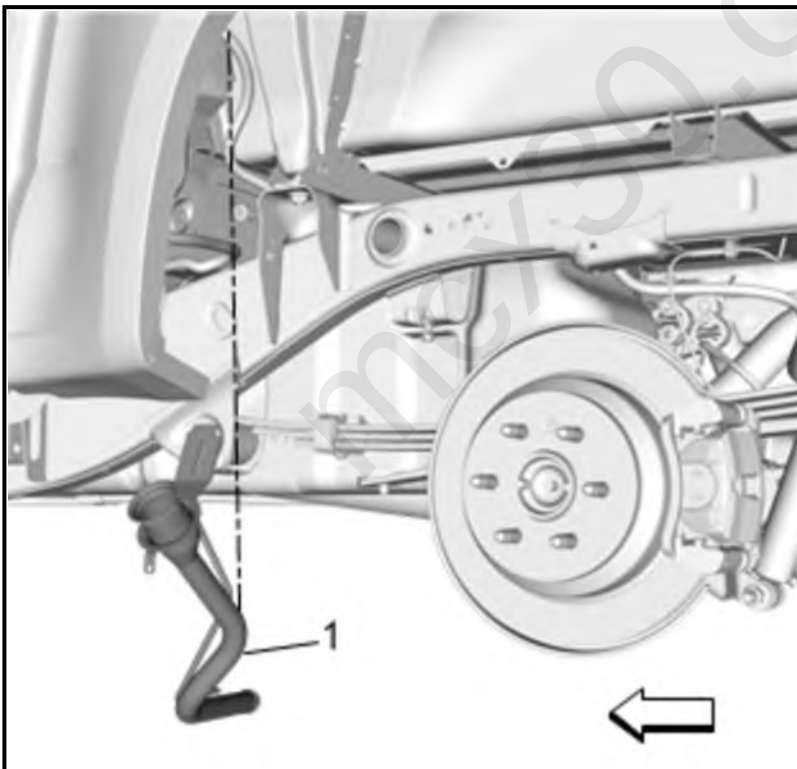


5. Remove the fuel tank filler hose (2) from the fuel tank filler pipe (4).
6. Disconnect the fuel tank vent hose (3) from the fuel tank filler pipe (4). Refer to [Plastic Collar Quick Connect Fitting Service](#).
7. Remove the fuel tank filler pipe (1) from the vehicle.

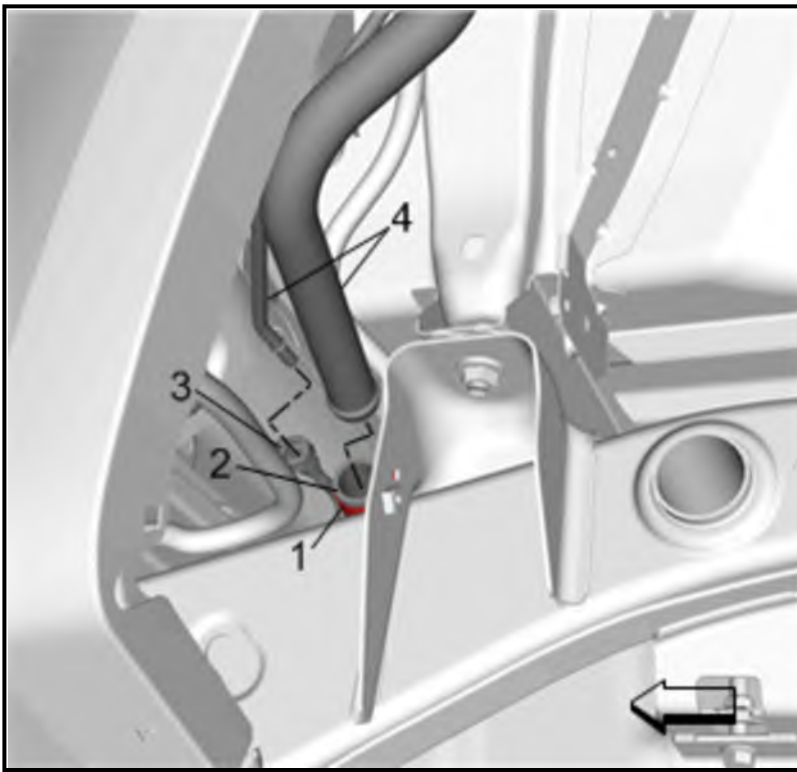


Installation Procedure

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



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



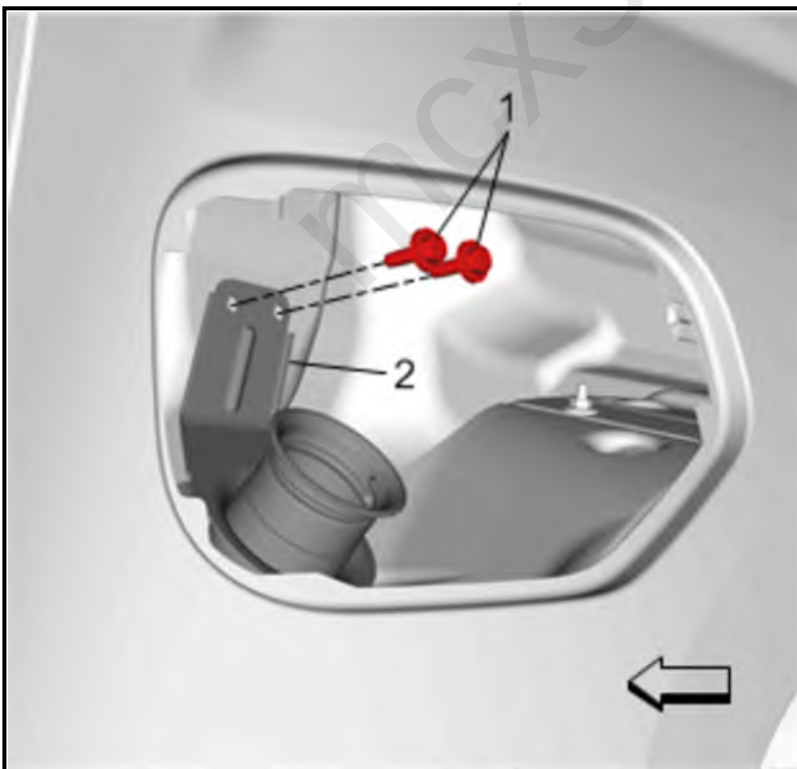
3. Install the fuel tank filler hose (2) to the fuel tank filler pipe (4).

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

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

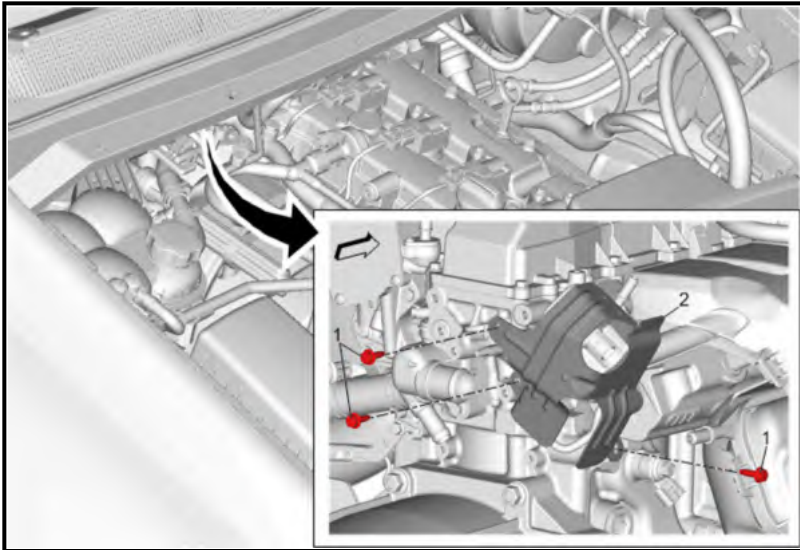
5. Install the evaporative emission system vacuum leak pump filter assembly. Refer to [Evaporative Emission System Vacuum Leak Pump Filter Replacement](#).

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



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

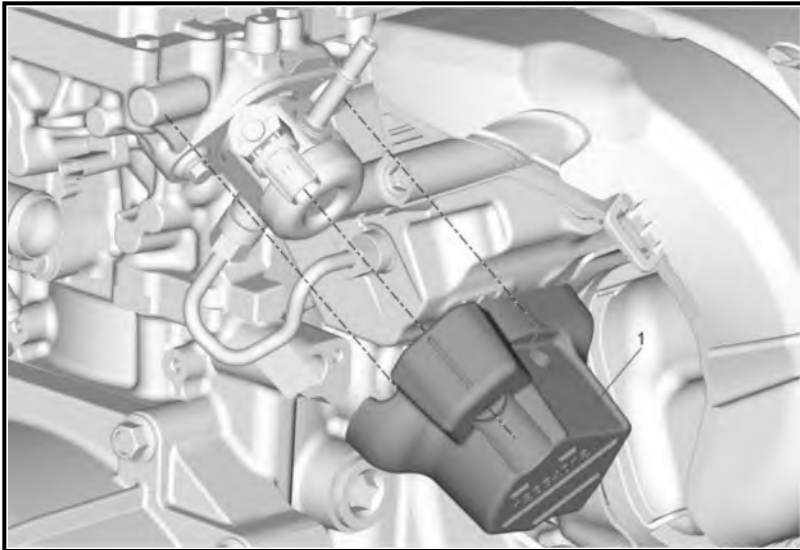
FUEL PUMP COVER REPLACEMENT



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

Callout	Component Name
Preliminary Procedure 1. Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement . 2. Remove the plenum front panel. Refer to Plenum Front Panel Replacement . 3. Disconnect the radiator inlet pipe from the water outlet. Refer to Radiator Inlet Pipe Replacement (LCV) .	
1	Fuel Pump Cover Fasteners (Qty: 3) CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Fuel Pump Cover Procedure Disconnect the electrical wiring harness connector from the fuel pump.

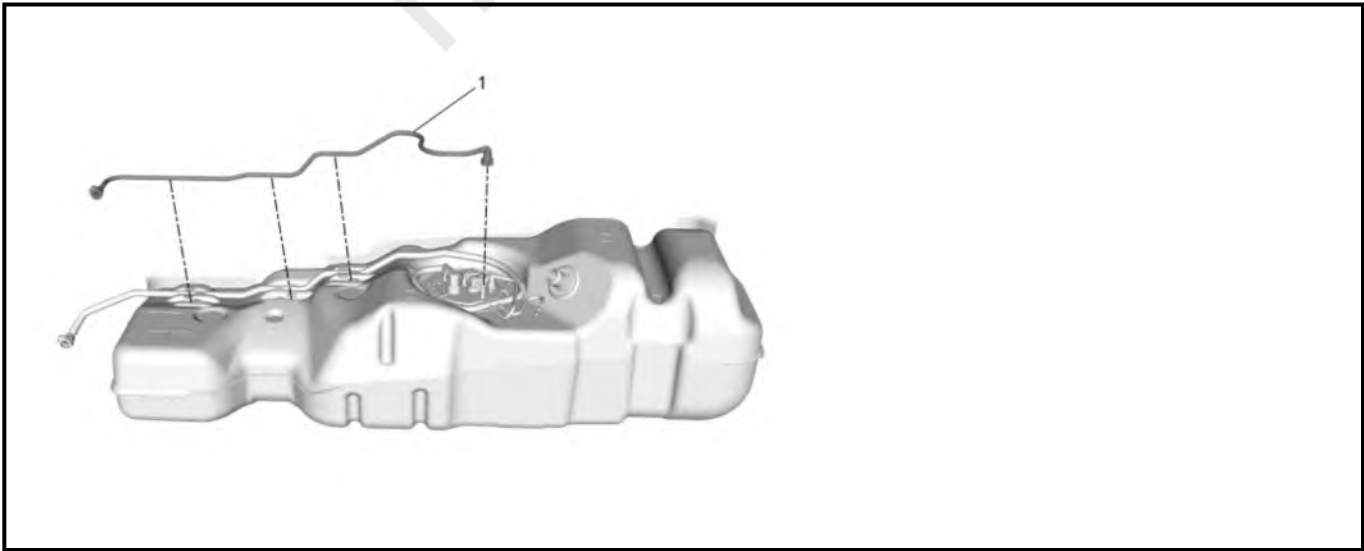
FUEL PUMP INSULATOR REPLACEMENT



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

Callout	Component Name
Preliminary Procedure 1. Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement . 2. Remove the plenum front panel. Refer to Plenum Front Panel Replacement . 3. Remove the fuel pump cover. Refer to Fuel Pump Cover Replacement.	
1	Fuel Pump Insulator NOTE: The fuel pump insulator snaps into place.

FUEL FEED PIPE 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	Fuel Feed Pipe Procedure Disconnect the quick disconnect. Refer to Plastic Collar Quick Connect Fitting Service .

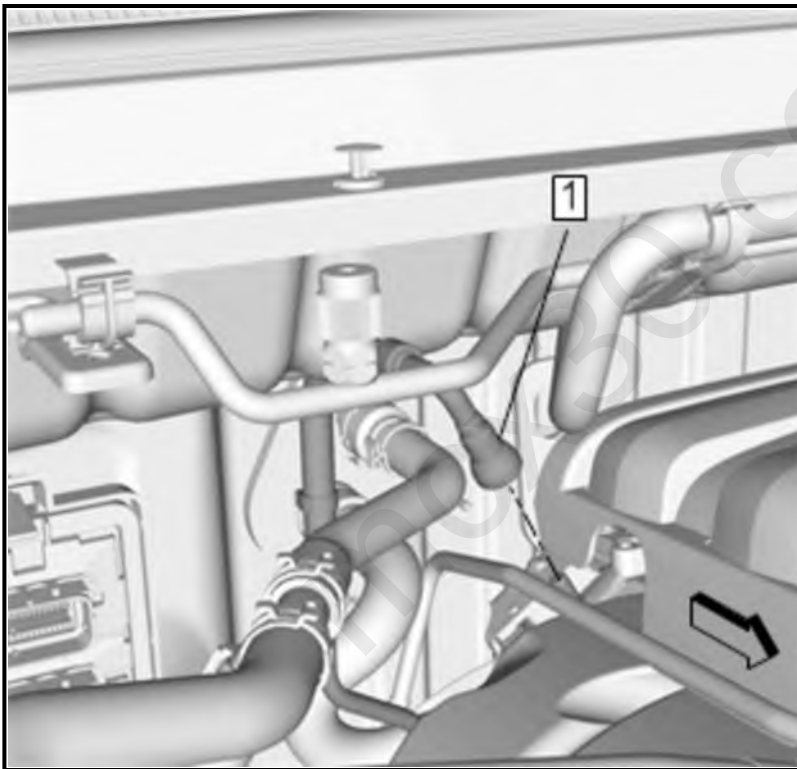
FUEL FEED PIPE REPLACEMENT (AT ENGINE)

Removal Procedure

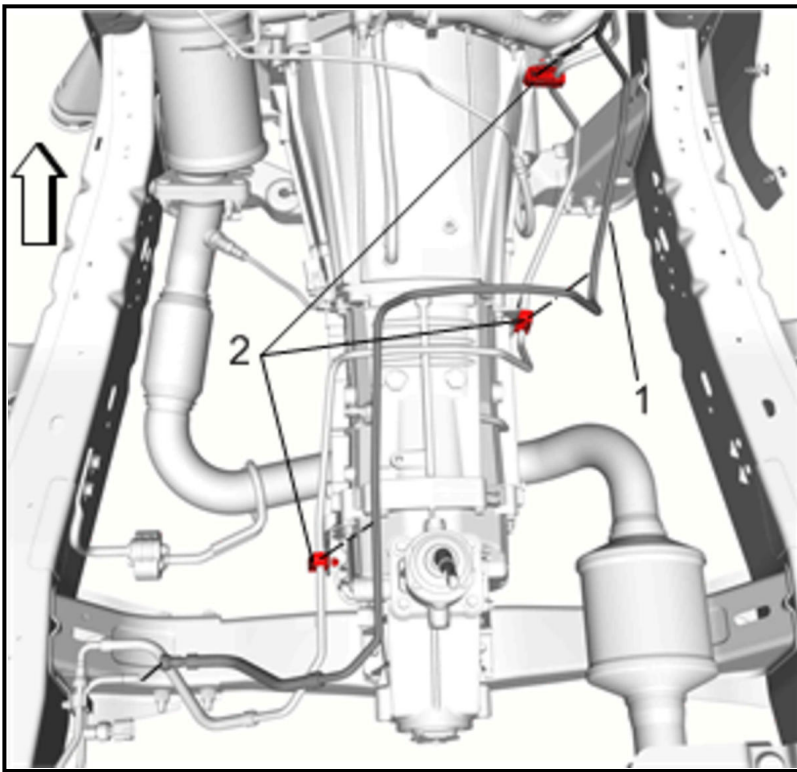
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

1. Relieve the system fuel pressure. Refer to [Fuel Pressure Relief](#).
2. Remove the fuel pump cover. Refer to [Fuel Pump Cover Replacement](#).
3. Disconnect the fuel feed pipe (1) from the fuel feed pipe at engine. Refer to [Metal Collar Quick Connect Fitting Service](#).



4. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
5. graphic element goes here

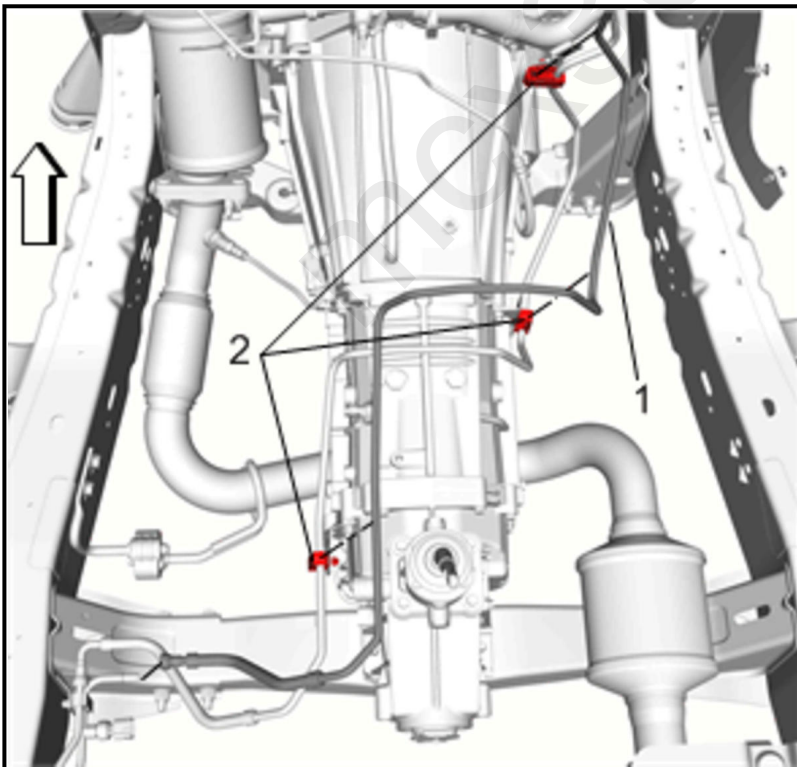


Disconnect the fuel feed pipe (1) and remove from retainers (2). Refer to [Metal Collar Quick Connect Fitting Service](#).

6. Remove the fuel feed pipe (1) from the vehicle.

Installation Procedure

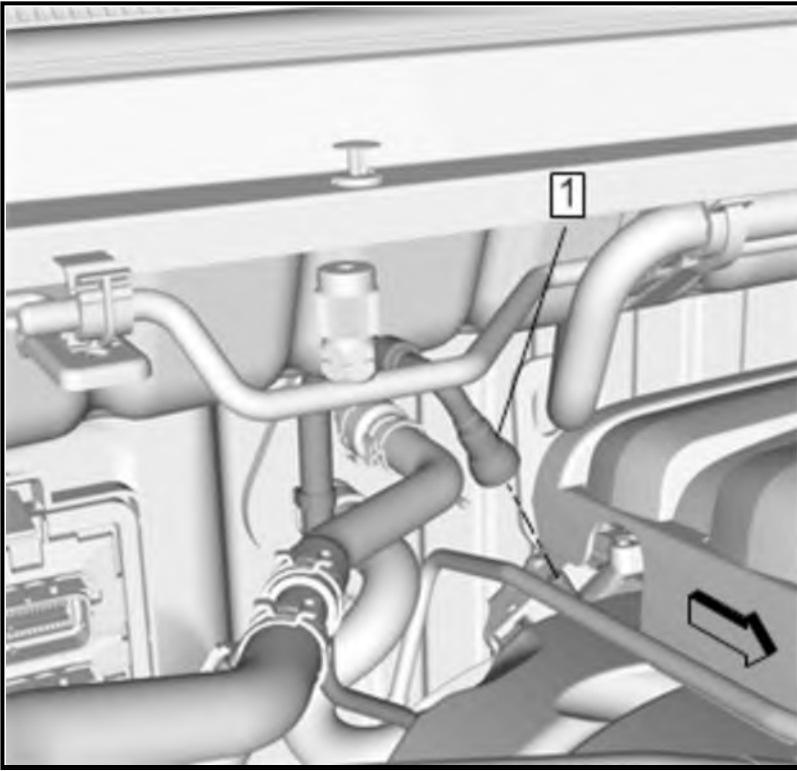
1. Install the fuel feed pipe (1) to the vehicle.



2. Connect the fuel feed pipe (1) and install to retainers (2). Refer to [Metal Collar Quick Connect Fitting Service](#).

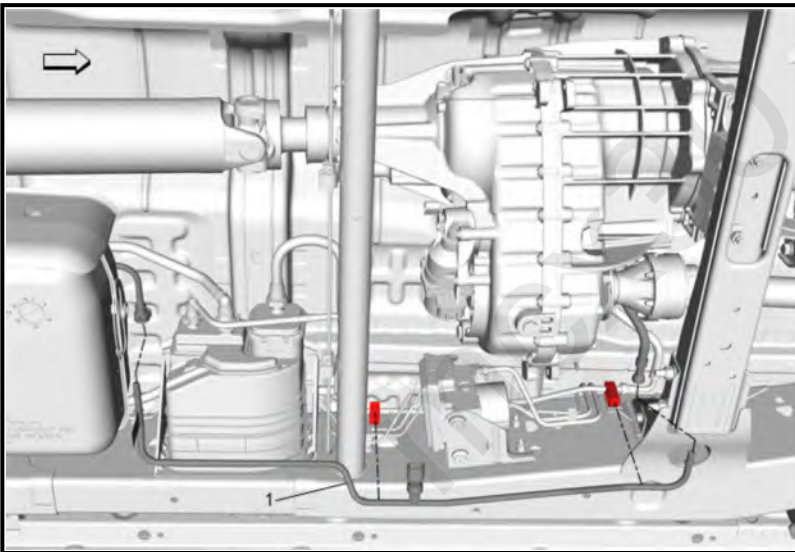
3. Lower the vehicle.

4. Connect the fuel feed pipe (1) to the fuel feed pipe at engine (2). Refer to [Metal Collar Quick Connect Fitting Service](#).



5. Install the fuel pump cover. Refer to [Fuel Pump Cover Replacement](#).

FUEL FEED REAR PIPE REPLACEMENT

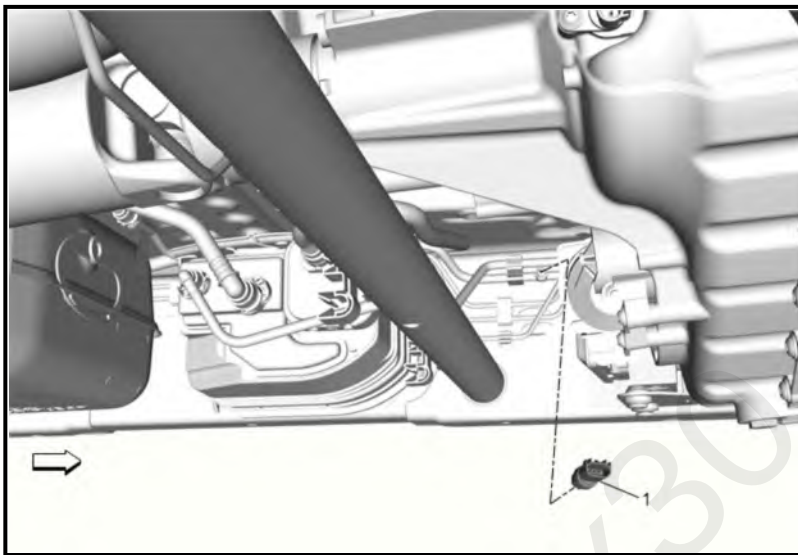


NOTE: Callouts in the following chart represent components shown in graphic above.

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

Callout	Component Name
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. 4. Rear Evaporative Emission Pipe @ Evaporative Emission Canister - Disconnect - Evaporative Emission Rear Pipe Replacement	
1	Fuel Feed Rear Pipe Procedure Disconnect the quick disconnects and remove from the 2 retainers. Plastic Collar Quick Connect Fitting Service , or Metal Collar Quick Connect Fitting Service

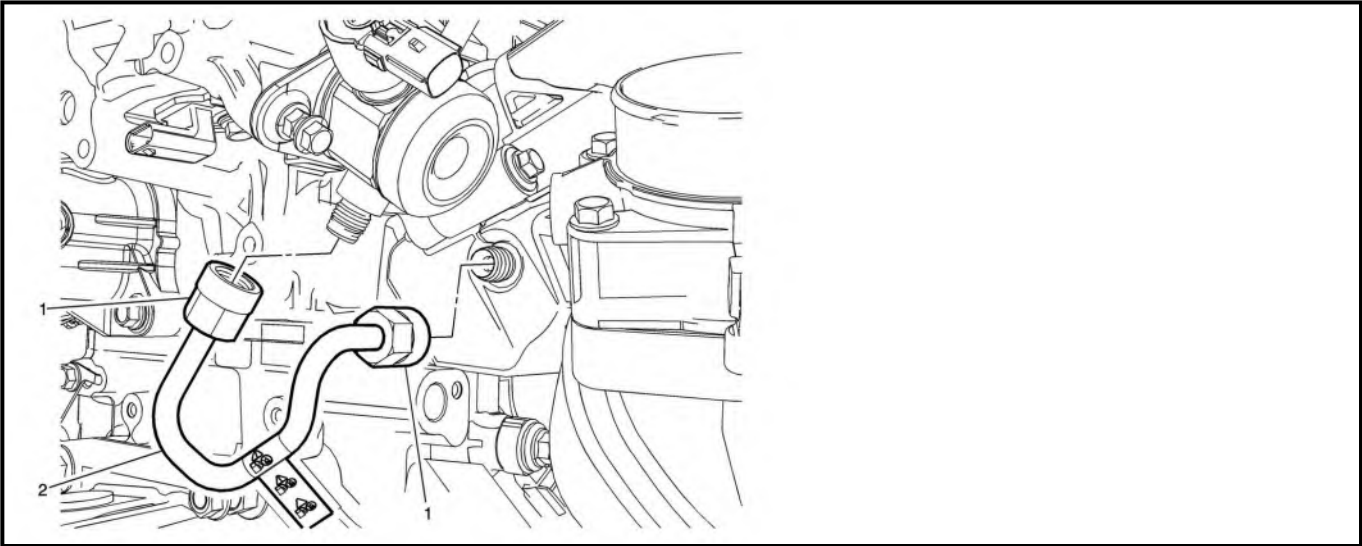
FUEL PRESSURE SENSOR REPLACEMENT - FUEL FEED PIPE



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

Callout	Component Name
Preliminary Procedure 1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief. 2. Raise and support the vehicle. Refer to 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 INTERMEDIATE PIPE REPLACEMENT



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

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . 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 1. Relieve the fuel system pressure. Fuel Pressure Relief 2. Fuel Pump Insulator Replacement	
1	Fuel Feed Intermediate Pipe Fitting [2x] CAUTION: Refer to Component

Callout	Component Name
	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. 3. Start both ends of the NEW fuel feed intermediate pipe by hand. Tighten First Pass: Tighten the fitting at the fuel injection fuel rail to 15 N.m (11 lb ft). Second Pass: Tighten the fitting at the fuel pump to 15 N.m (11 lb ft). Third Pass: Tighten the fitting at the fuel injection fuel rail to 30 N.m (22 lb ft). Final Pass: Tighten the fitting at the fuel pump to 30 N.m (22 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 fitting, the corresponding component will need to be replaced.

FUEL PUMP REPLACEMENT

Special Tools

EN-50790 High Pressure Fuel Pump Installation Alignment Gauge

Equivalent regional tools: Special Tools (Mechanical Tools) , or Special Tools (Diagnostic Tools)

Removal Procedure

WARNING:

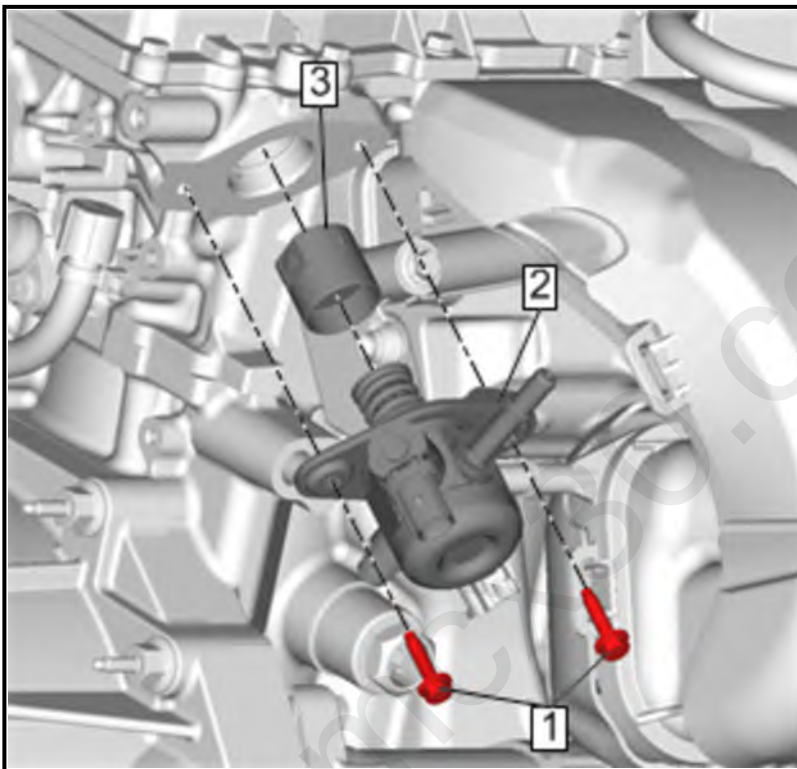
Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

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

1. Relieve the low and high side fuel system pressure. [Fuel Pressure Relief](#)
2. Remove the fuel pump insulator. [Fuel Pump Insulator Replacement](#)
3. Disconnect the engine wiring harness electrical connector from the high pressure fuel pump.
4. Remove the fuel feed pipe. [Fuel Feed Pipe Replacement \(At Tank\)](#), or [Fuel Feed Pipe Replacement \(At Engine\)](#)

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.

5. Remove and DISCARD the fuel feed intermediate pipe. [Fuel Feed Intermediate Pipe Replacement](#)
6. 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

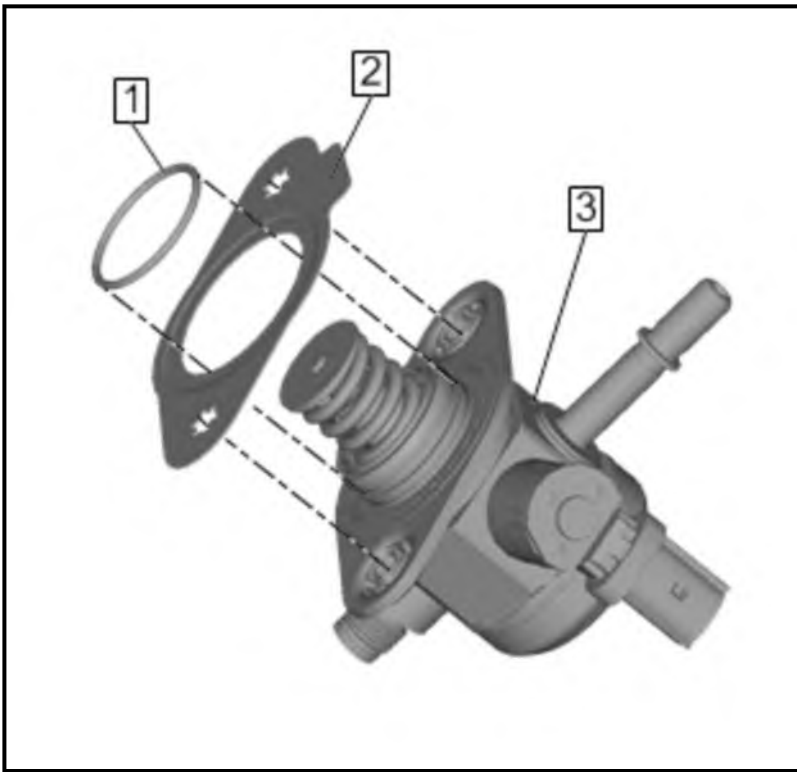
NOTE: Ensure that during removal of the fuel pump that the valve lifter follower does NOT fall apart.

7. Fuel Pump (2) - Remove

NOTE:

- The valve lifter follower MAY remain in the cylinder head bore after removing the fuel pump.
- If the valve lifter follower does NOT pull out of the cylinder head bore with the fuel pump, then remove it afterwards.

8. Valve Lifter Follower (3) - Remove
9. Remove and DISCARD the fuel pump O-ring (1).



10. Remove and DISCARD the fuel pump gasket (2).

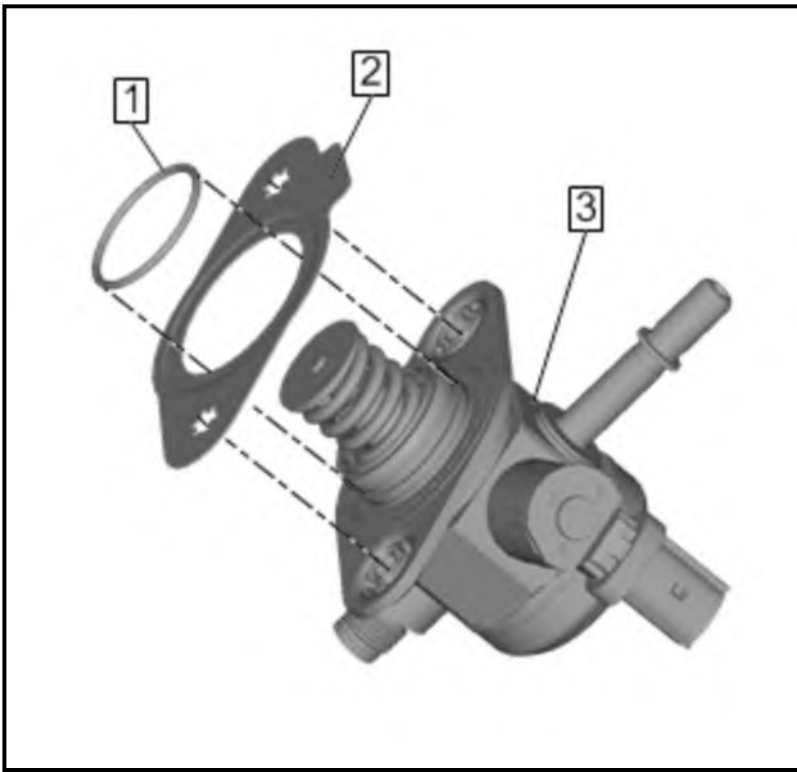
Installation Procedure

1. Before continuing, lubricate the cylinder head bore with clean engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)

NOTE:

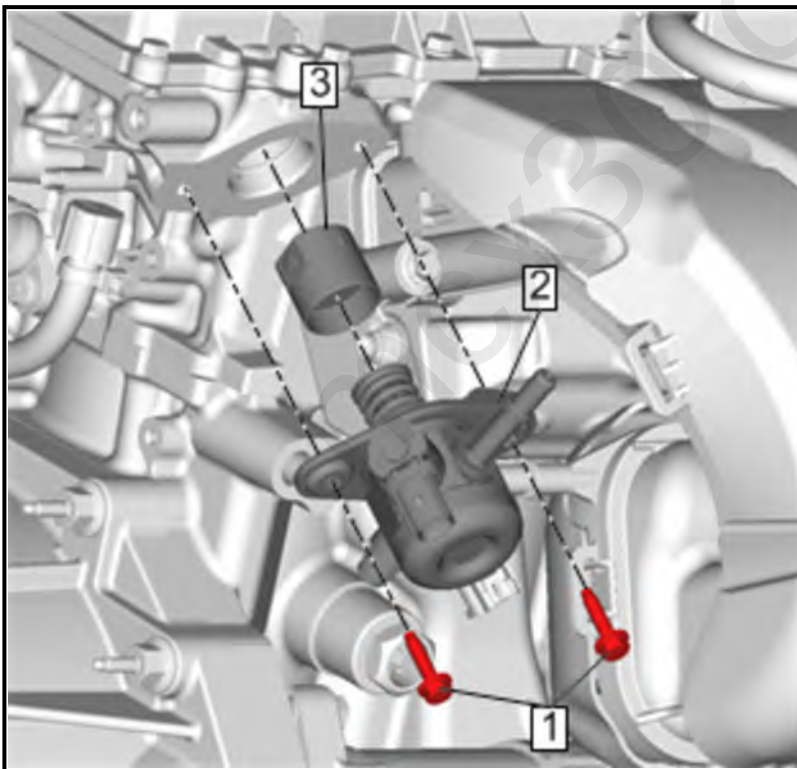
- The camshaft **MUST** be at the base circle position before the fuel pump is installed.
- At the base circle position, the EN-50790 alignment gauge will sit flush with the cylinder head.

2. Install the **EN-50790** alignment gauge and turn the crankshaft until the camshaft lobe is at the base circle position.
3. Lubricate the NEW fuel pump O-ring (1) with clean engine oil and install it on the fuel pump. [Adhesives, Fluids, Lubricants, and Sealers](#)



4. Position the NEW fuel pump gasket (2) to the fuel pump (3).
5. Lubricate the valve lifter follower (3) with clean engine oil and install it into the cylinder head bore.

[Adhesives, Fluids, Lubricants, and Sealers](#)



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.

6. Apply threadlocker to the threads of the NEW fuel pump bolts (1). [Adhesives, Fluids, Lubricants, and Sealers](#)
7. Install the fuel pump (2) into the cylinder head and start the NEW fuel pump bolts (1) by hand.

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.

8. Tighten the NEW fuel pump bolts (1) to:

1. First Pass: 8 N.m (71 lb in)
2. Final Pass: 50 degrees

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.

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

10. Install the fuel feed pipe. [Fuel Feed Pipe Replacement \(At Tank\)](#), or [Fuel Feed Pipe Replacement \(At Engine\)](#)

11. Connect the engine wiring harness electrical connector to the high pressure fuel pump.

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

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.

13. Install the fuel pump insulator. [Fuel Pump Insulator Replacement](#)

14. Perform the fuel rail pressure relief valve learned values reset. [Fuel Rail Pressure Relief Valve Learned Values Reset](#)

FUEL INJECTION FUEL RAIL ASSEMBLY REPLACEMENT

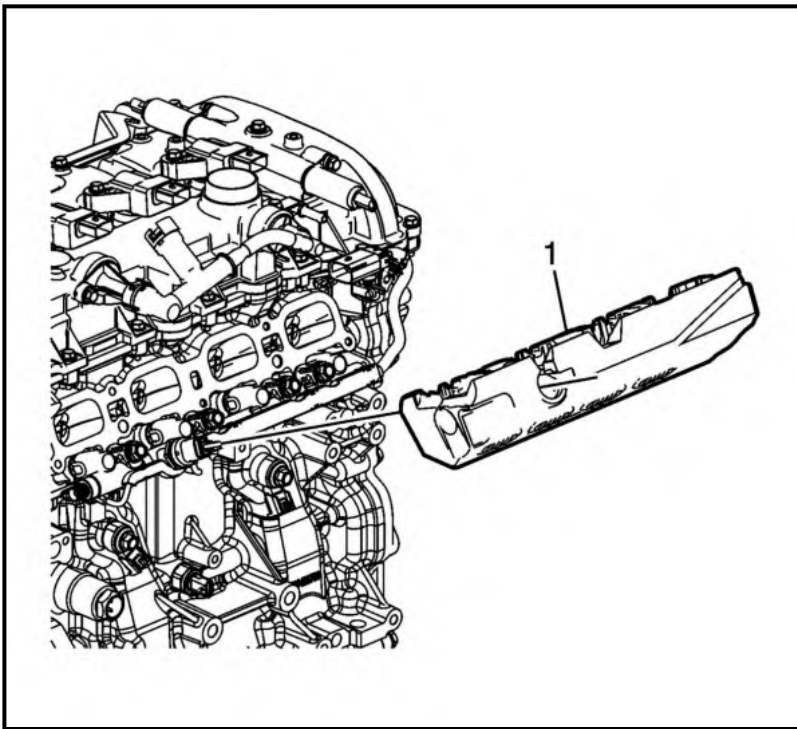
Special Tools

- EN-49248 Fuel Rail Assembly Remover
- EN-47909 Injector Bore and Sleeve Cleaning Kit

For equivalent regional tools, refer to [Special Tools \(Mechanical Tools\)](#) , or [Special Tools \(Diagnostic Tools\)](#) .

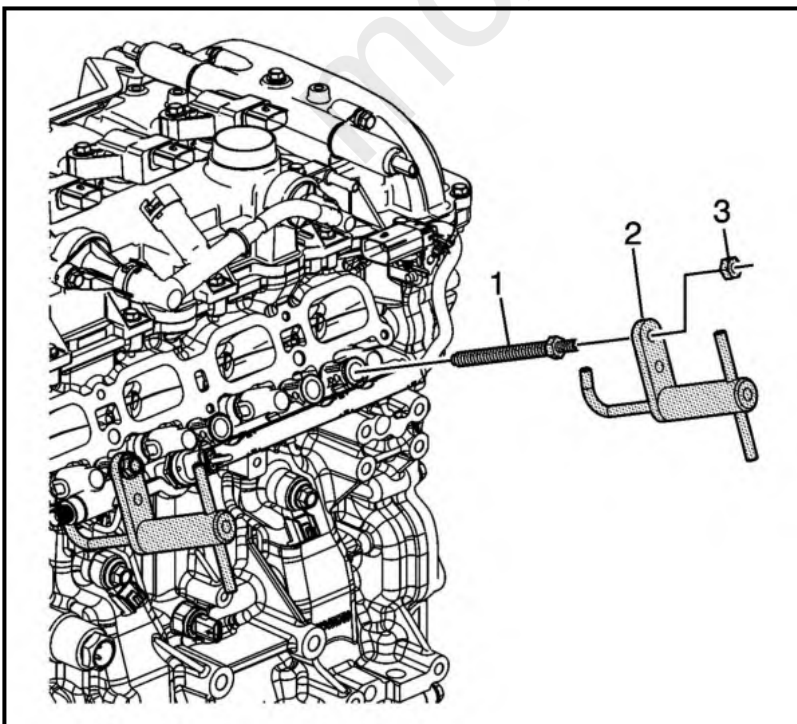
Removal Procedure

1. Remove the fuel injection fuel rail noise shield (1). Refer to [Fuel Injection Fuel Rail Noise Shield Replacement](#).



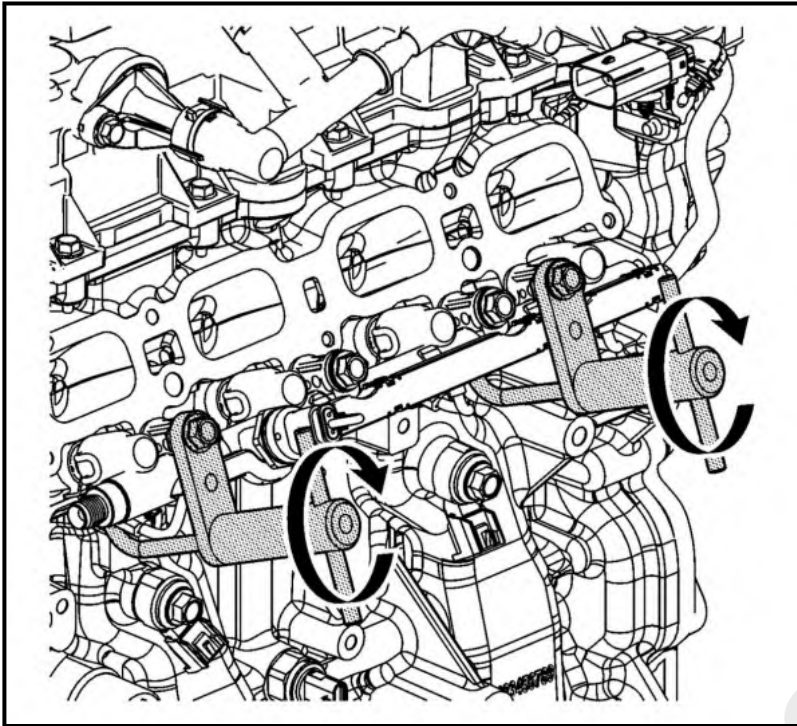
WARNING: The noise cancelling foam component **MUST** be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death.

2. Remove the fuel feed intermediate pipe. Refer to [Fuel Feed Intermediate Pipe Replacement](#).
3. Remove the fuel injection fuel rail pressure sensor. Refer to [Fuel Rail Pressure Sensor Replacement](#).
4. Disconnect the electrical harness from the fuel rail harness connection.
5. Remove the fuel rail assembly retaining bolts and upper rubber grommets, if necessary.
6. Install **EN-49248** studs (1) into the 2 outermost fuel rail assembly retaining bolt locations. Tighten the studs to 22 N.m (16 lb ft).



NOTE: Use care to avoid contact with the fuel rail harness during special tool installation and fuel rail removal.

7. Install **EN-49248** remover (2) onto each stud, and engage the hooks to the fuel rail. Install the nuts (3) retaining the remover onto the studs and tighten until snug.
8. Using **EN-49248** remover, remove the fuel rail assembly.

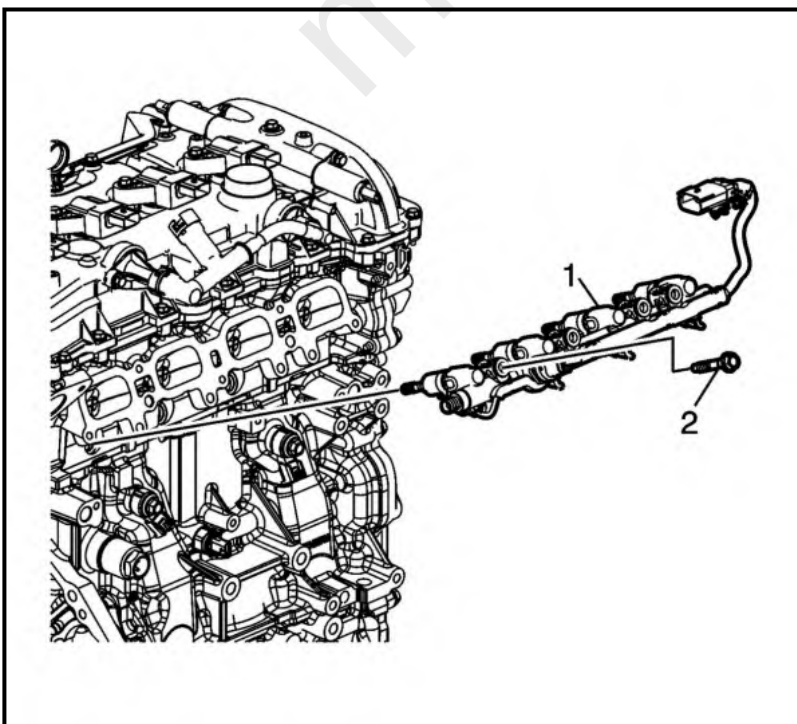


NOTE: EN-49248 will assist in the proper removal of the fuel rail assembly. Ensure that the following conditions are met:

- Turn the handles simultaneously in order to pull the fuel rail straight out along the fuel injector axis.
- DO NOT twist when pulling out on the fuel rail and injector assembly.

Installation Procedure

1. Clean the fuel injector bore in the cylinder head using the **EN-47909** kit.



2. Install NEW fuel injector spacers and O-rings. [Fuel Rail and Injectors Cleaning and Inspection](#)
3. Replace the fuel rail insulators, if necessary. [Fuel Rail and Injectors Cleaning and Inspection](#)
4. Install the fuel rail (1) with injectors into the cylinder head evenly.

NOTE: Mount the bolts evenly to avoid cocking of the fuel injectors during installation.

5. Hand start the 2 outer fuel rail bolts (2) to seat the injectors into the injector bores.
6. Hand start the remaining fuel rail bolts.
7. Tighten the fuel rail bolts in sequence to 25 N.m (18 lb ft).

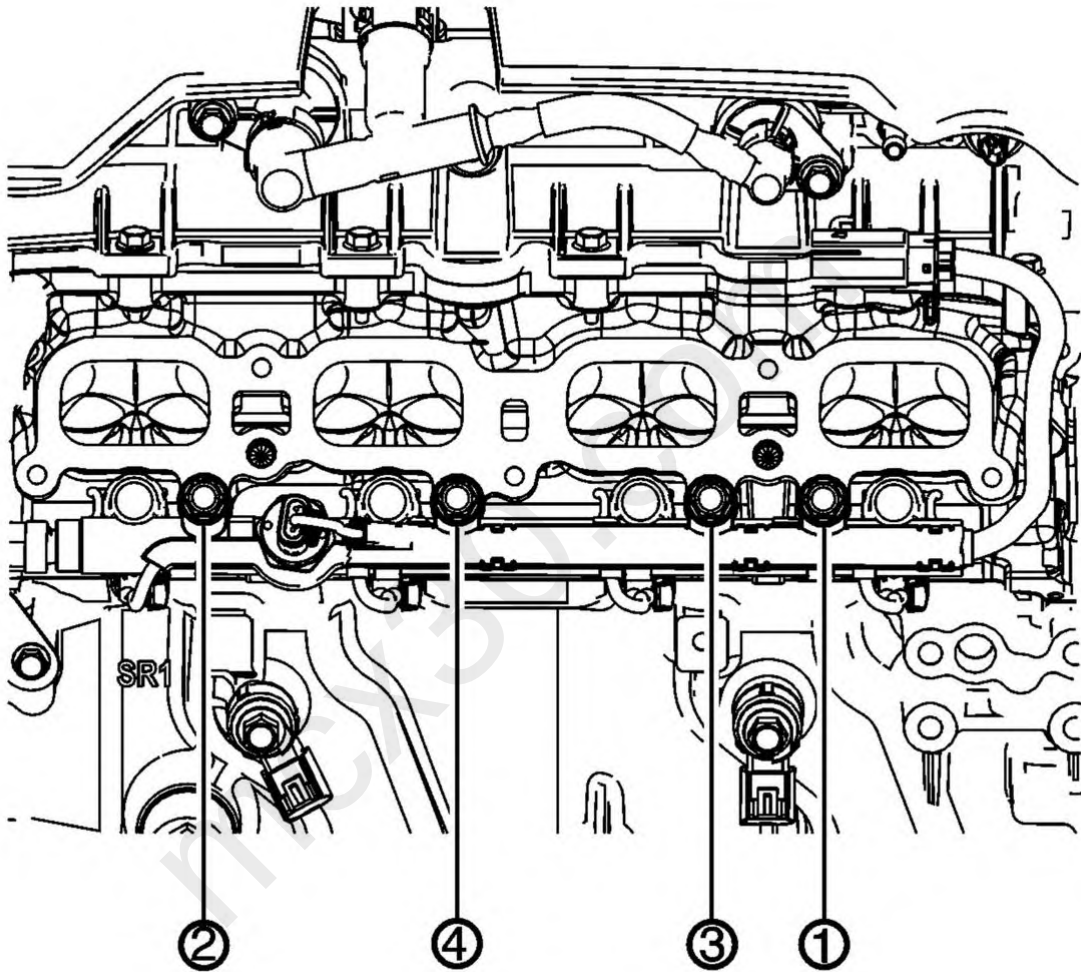
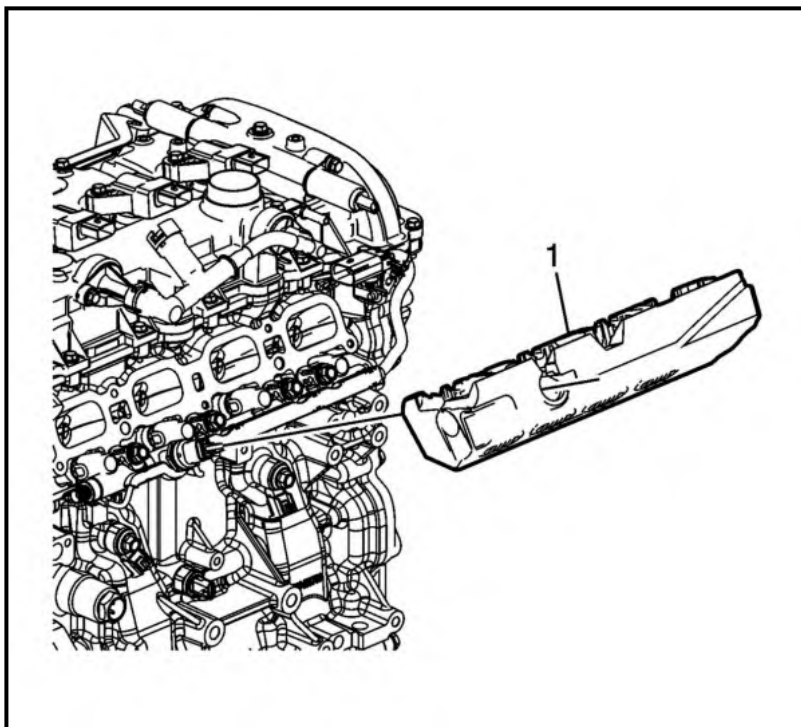


Fig. 1: Fuel Rail Bolt Tightening Sequence

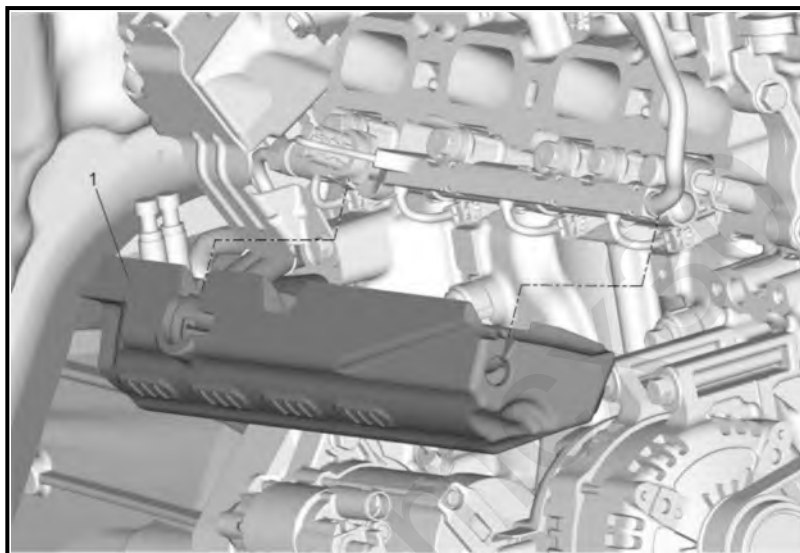
Courtesy of GENERAL MOTORS COMPANY

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

8. Connect the electrical harness to the fuel rail harness connections.
9. Install the fuel injection fuel rail pressure sensor. Refer to [Fuel Rail Pressure Sensor Replacement](#).
10. Install the fuel feed intermediate pipe. Refer to [Fuel Feed Intermediate Pipe Replacement](#).
11. Install the fuel injection fuel rail noise shield (1). Refer to [Fuel Injection Fuel Rail Noise Shield Replacement](#).



FUEL INJECTION FUEL RAIL NOISE SHIELD REPLACEMENT



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

Callout	Component Name
Preliminary Procedure	
Remove the intake manifold. Refer to Intake Manifold Replacement .	
1	Fuel Injection Fuel Rail Noise Shield NOTE: The fuel injection fuel rail noise shield snaps into place.

FUEL RAIL PRESSURE SENSOR REPLACEMENT

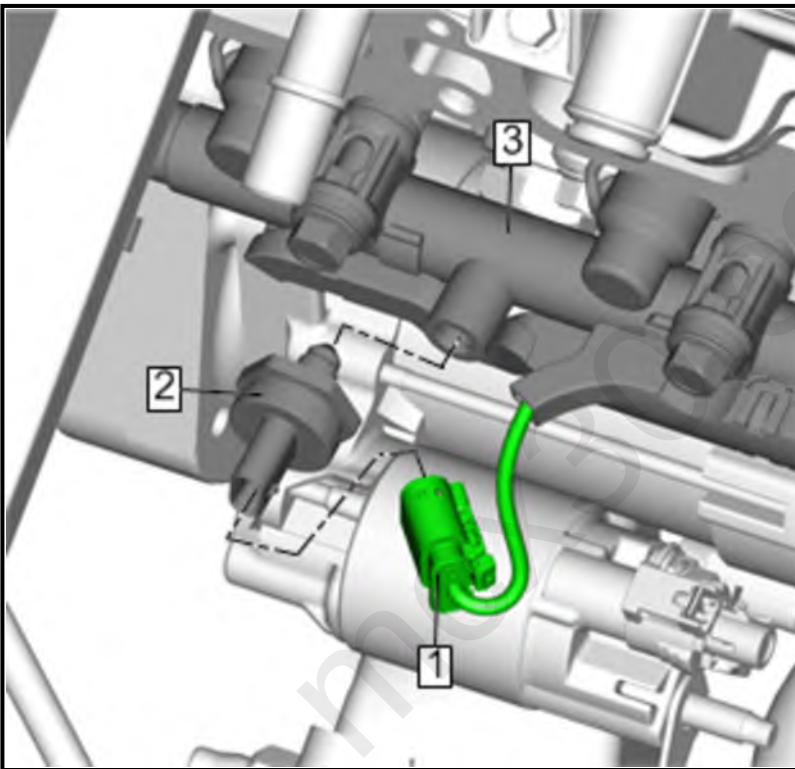
Removal Procedure

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.

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Fuel Injection Fuel Rail Noise Shield - Reposition - [Fuel Injection Fuel Rail Noise Shield Replacement](#)
3. Disconnect the electrical connector (1).



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

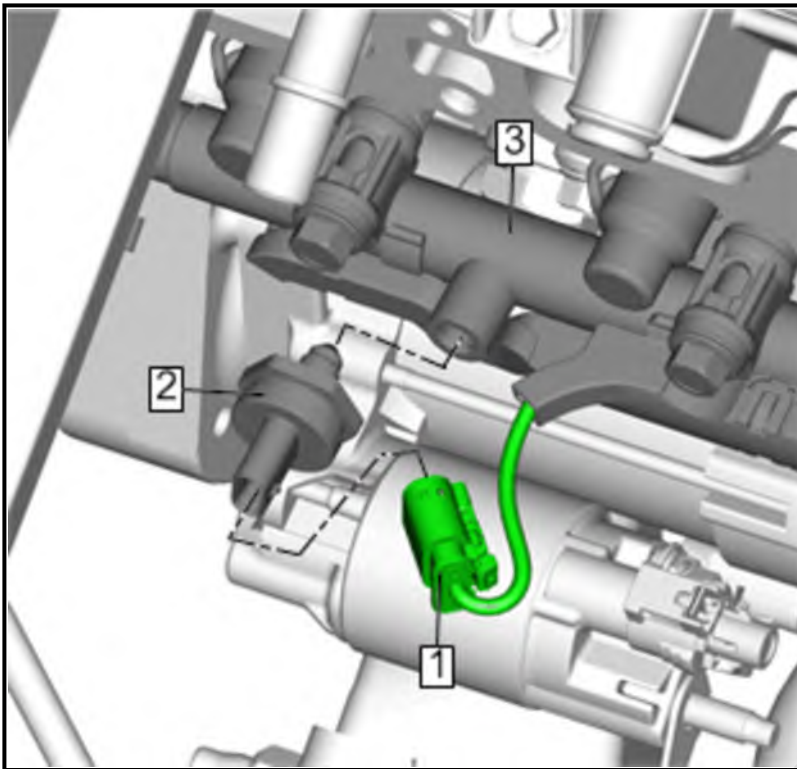
NOTE:

- Do NOT apply force to the plastic housing of the fuel injection fuel rail fuel pressure sensor. **ONLY** apply force to the attached hexagon.
- Some fuel may leak from the fuel injection fuel rail orifice after the sensor is removed. Dry the area around the orifice using a lint free cloth.
- After removal, the area around the fuel injection fuel rail sealing surface should be inspected. The surface should be free of fuel, dirt, debris, and burrs.

4. Remove the fuel injection fuel rail fuel pressure sensor (2).

Installation Procedure

1. To install the fuel injection fuel rail fuel pressure sensor (2) properly, perform the following steps:



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

NOTE:

- Do NOT apply force to the plastic housing of the fuel injection fuel rail fuel pressure sensor. ONLY apply force to the attached hexagon.
- BEFORE installation of the fuel injection fuel rail fuel pressure sensor, the fuel injection fuel rail threads MUST be clean and free of any fuel or the sensor will NOT seal properly.

1. Lubricate the sensor threads and sealing surface with one drop of clean engine oil.
 2. Install the sensor and hand tighten.
 3. Remove the sensor.
 4. Re-lubricate the sensor threads and sealing surface with one drop of clean engine oil.
 5. Install the sensor and tighten to 33 N.m (24 lb ft).
2. Connect the electrical connector (1).

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

3. Pressurize the fuel system and inspect for leaks.
4. Fuel Injection Fuel Rail Noise Shield - Install - [Fuel Injection Fuel Rail Noise Shield Replacement](#)

FUEL INJECTOR REPLACEMENT

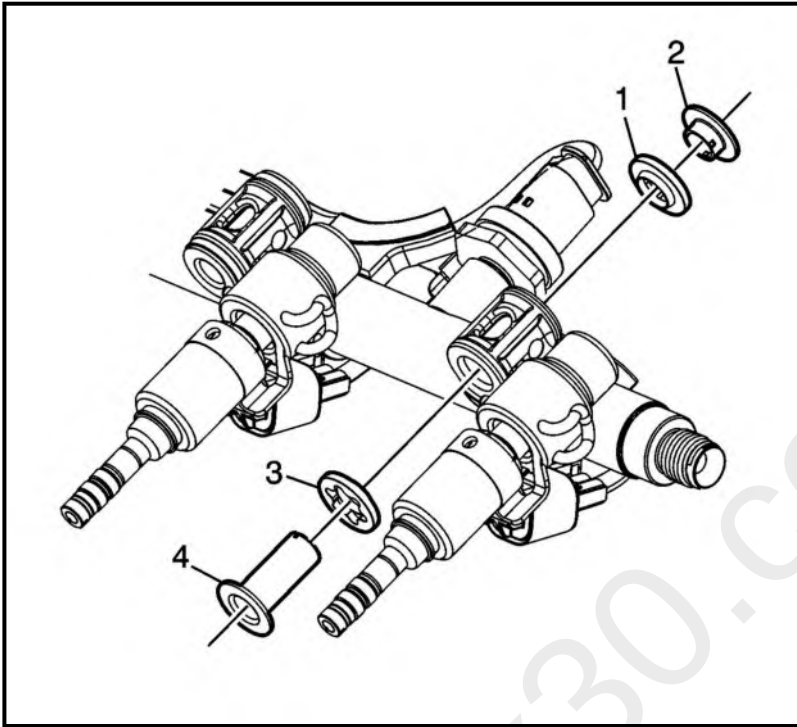
Special Tools

- EN-47909 Injector Bore and Sleeve Cleaning Kit
- EN-49245 Fuel Injector Seal Installer and Sizer
- EN-50791 Fuel Injector Nozzle Installer
- EN-51105 Fuel Injector Seal Installer

Equivalent regional tools: [Special Tools](#)

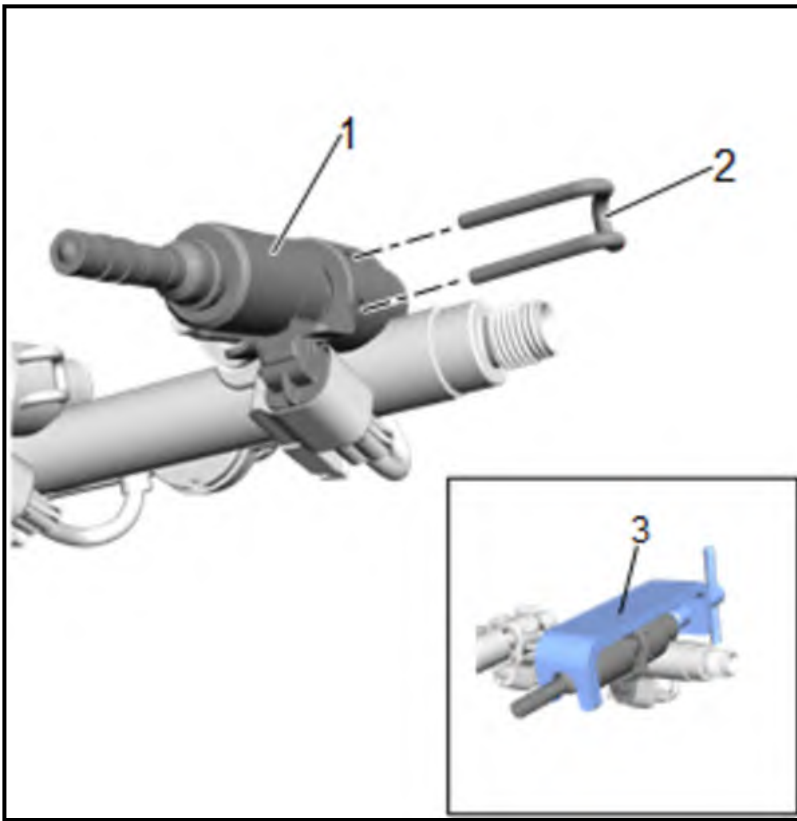
CAUTION: Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. Do not immerse the fuel injector in any type of cleaner. The fuel injector is an electrical component and may be damaged by this cleaning method.

1. Fuel Injection Fuel Rail - Remove - [Fuel Injection Fuel Rail Assembly Replacement](#)
2. Remove and inspect the fuel rail insulator assemblies (1 - 4). Replace the entire assembly if any components show signs of wear or the insulators (4) show the following conditions:

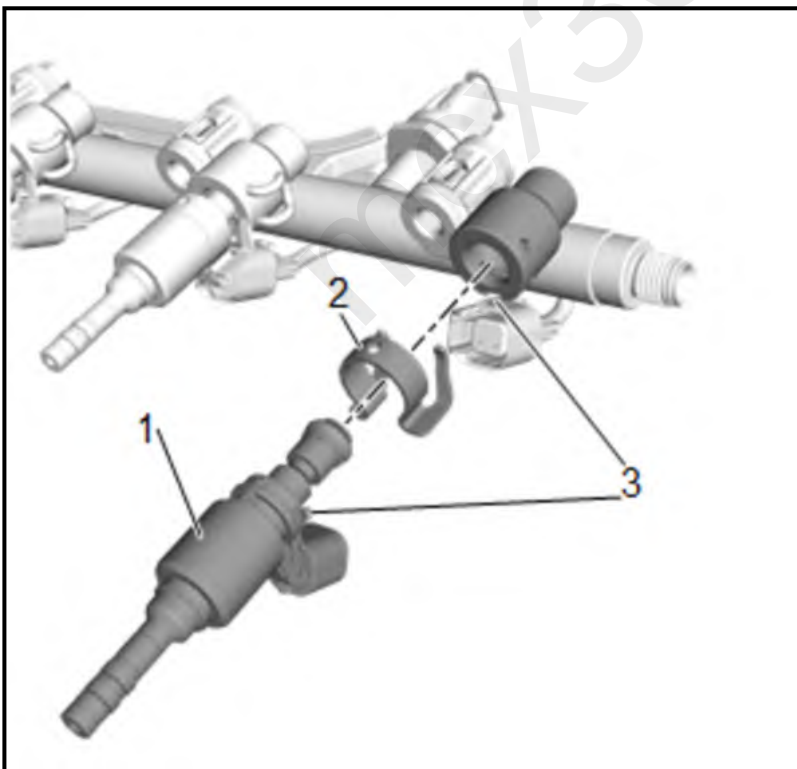


- Dry or cracked appearance
- Flattened or misshapen appearance

3. Disconnect the electrical connectors from the fuel injectors.



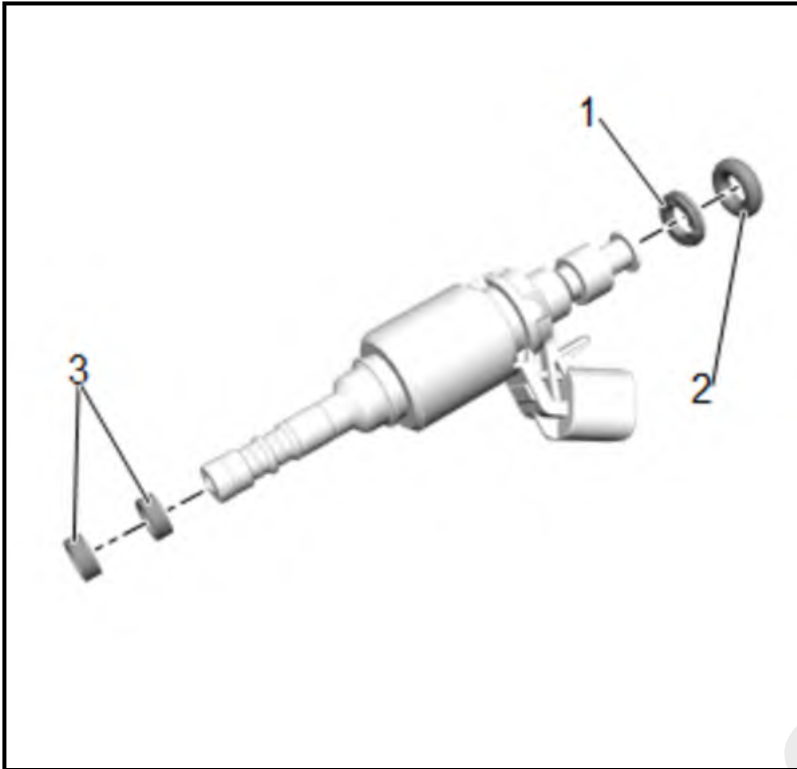
4. Use the **EN-50791** installer (3) to compress the fuel injector (1) and relieve pressure on the retaining pin (2). Remove the fuel injector retaining pin (2). Remove the **EN-50791** installer once the retaining pin is removed.
5. Remove the fuel injector (1) from the fuel injection fuel rail by pulling it straight out along the fuel injector axis. Slight rotation of the fuel injector is acceptable as long as excessive force is not applied to the fuel injector tab while engaged in the fuel rail slot (3).



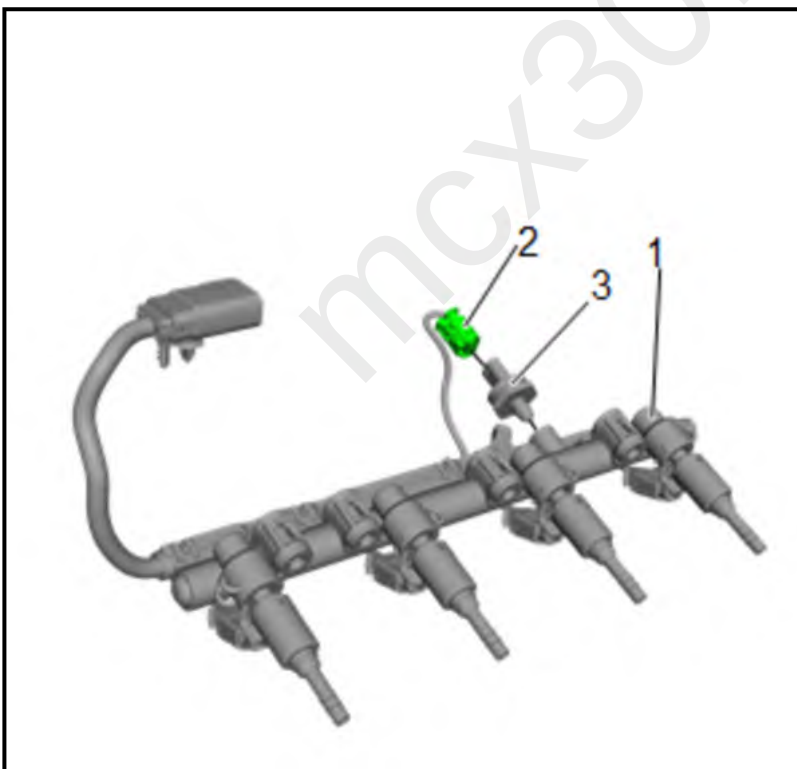
NOTE:

- Support the fuel injector at the widest point.
- Support the fuel injection fuel rail along the bottom.
- Do NOT support or hold the fuel injector by the tip or connector.
- Do NOT tilt or excessively twist the fuel injector during removal.

6. Remove the fuel injector holding clamp (2) from the rear of the fuel injector.
7. Remove and DISCARD the fuel injector O-ring (2) and spacer (1).



8. Remove and DISCARD the fuel injector seals (3).
9. Clean the exterior of the fuel injection fuel rail (1) and the fuel injectors in solvent.



NOTE: Do NOT soak or submerge the fuel injection fuel rail or the fuel injectors in solvent. Do NOT use solvent on the fuel rail label.

10. Use the **EN-47909** cleaning kit to clean the fuel injector bores and sleeves.
11. Inspect the fuel injection fuel rail 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
- Damage to the threads on the fuel rail fuel feed fitting

12. Replace the fuel injection fuel rail if ANY damage is found. Do NOT attempt to repair a fuel rail.

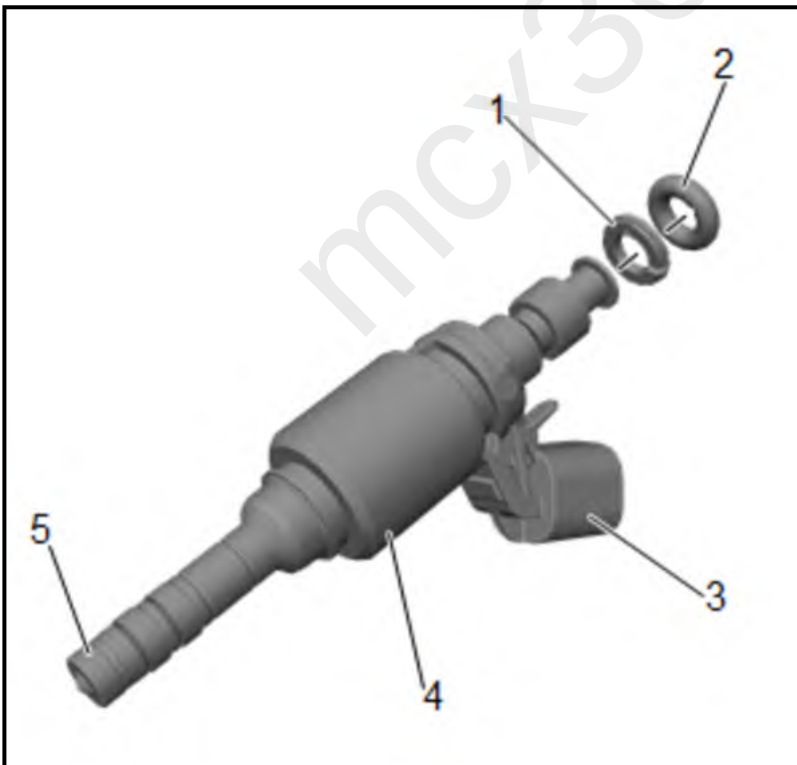
CAUTION: Refer to [Fastener Caution](#) .

NOTE: Remove and inspect the fuel injection fuel rail fuel pressure sensor ONLY if the sensor is suspect.

13. Remove and inspect the fuel injection fuel rail fuel pressure sensor (3) for damage using the following procedure:

1. Disconnect the wiring harness connector from the fuel injection fuel rail fuel pressure sensor.
2. Remove the fuel injection fuel rail fuel pressure sensor. Dry the pressure sensor bore in the fuel rail with a lint free cloth. The bore should be free of fuel, debris, and burrs.
3. Lubricate the fuel injection fuel rail fuel pressure sensor bore with clean engine oil.
4. Lubricate the threads and sealing area on the fuel injection fuel rail fuel pressure sensor with clean engine oil.
5. Install the fuel injection fuel rail fuel pressure sensor hand tight.
6. Remove the fuel injection fuel rail fuel pressure sensor and re-lubricate the bore, threads, and sealing area.
7. Install the fuel injection fuel rail fuel pressure sensor and tighten to 33 N.m (24 lb ft).
8. Connect the wiring harness connector to the fuel injection fuel rail fuel pressure sensor.

14. Inspect the fuel injectors for the following conditions:



- Damage to the fuel injector connector (3)
- Damage to the fuel injector harness connector
- Damage to the fuel injector tip (5)
- Damage to the fuel injector (4)

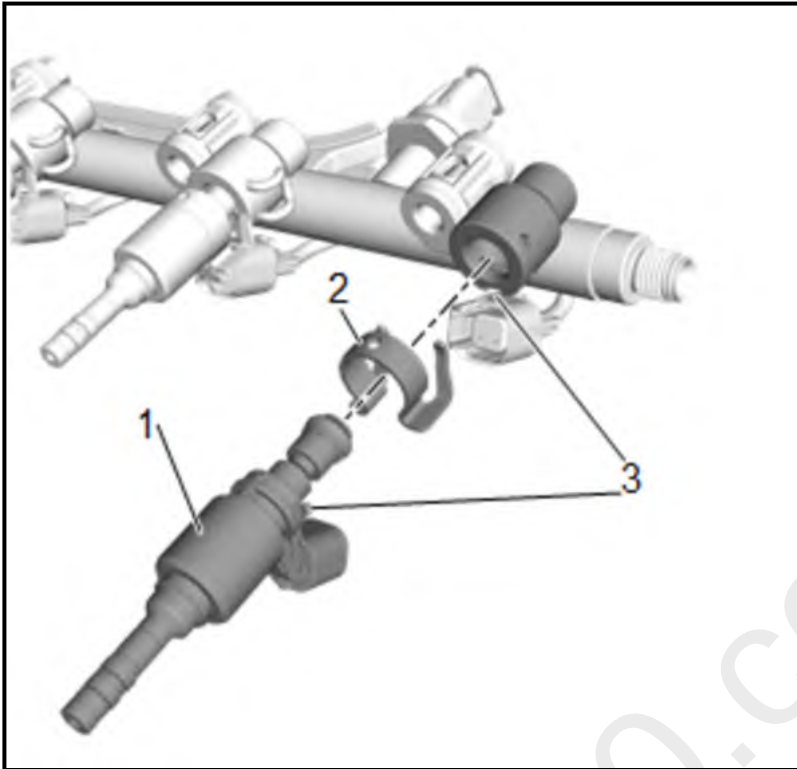
15. Replace the fuel injector if ANY damage is found. Do NOT attempt to repair a fuel injector.

16. Install the NEW fuel injector spacer (1).

NOTE: Lubricate the NEW fuel injector O-ring with clean engine oil.

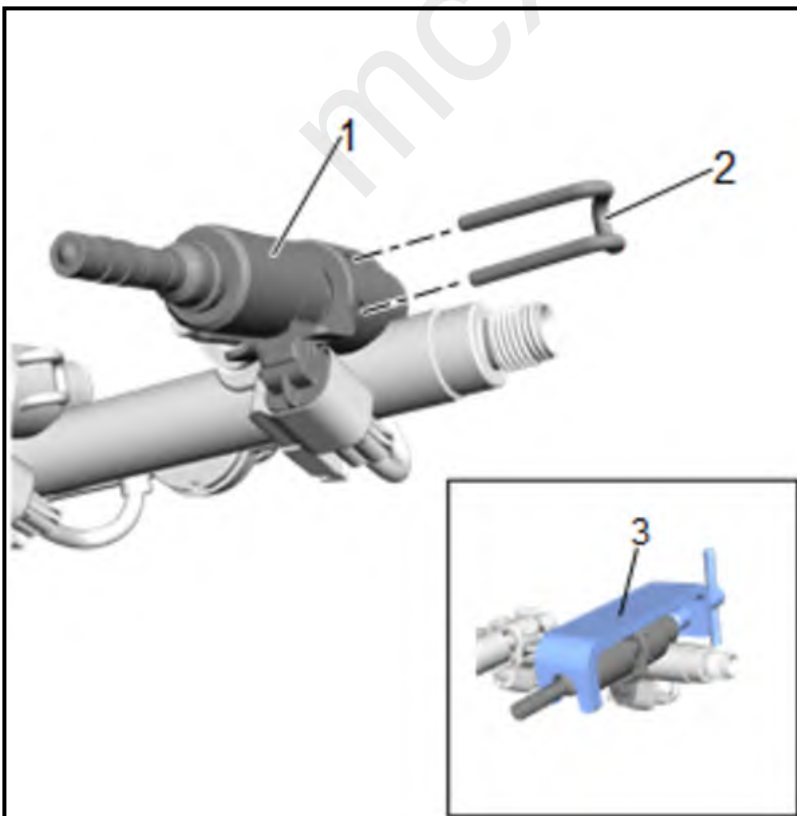
17. Install the NEW fuel injector O-ring.

18. Install the fuel injector holding clamp (2) onto the rear of the fuel injector.



19. Hand install the fuel injector (1) to the fuel injection fuel rail, carefully aligning the fuel injector tab to the slot in the fuel rail (3).

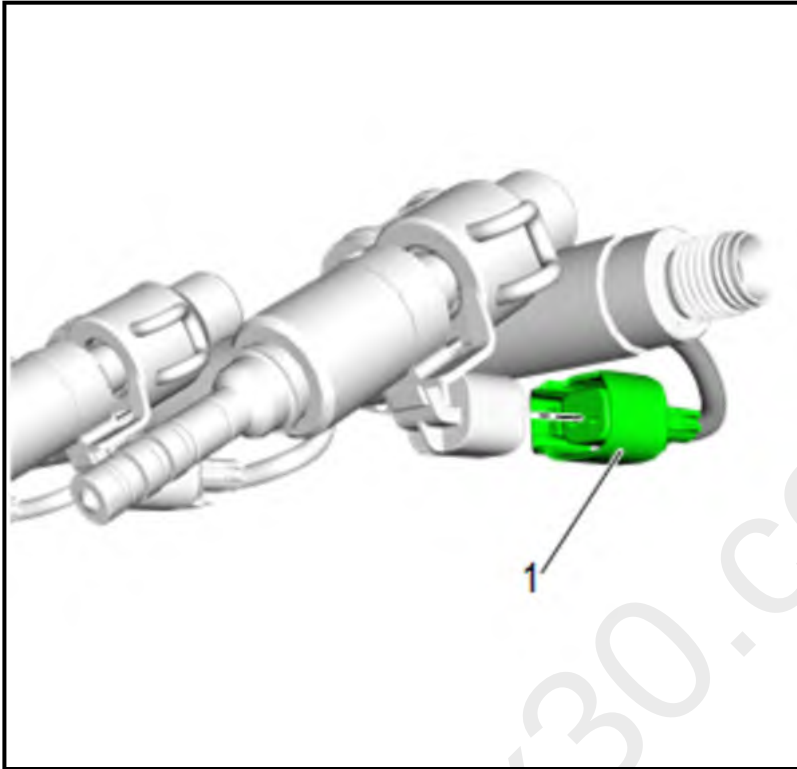
20. Use the **EN-50791** installer (3) to compress the fuel injector (1) into the fuel injection fuel rail.



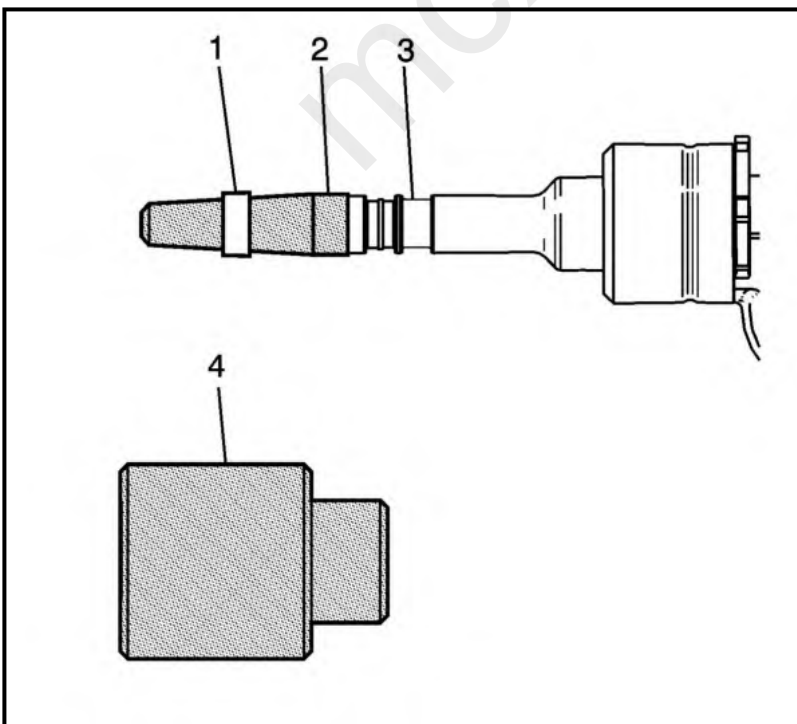
NOTE:

The fuel injector MUST be fully installed and properly aligned with the fuel injection fuel rail before installing the retaining pin.

21. Ensure the fuel injector is fully seated in the fuel injection fuel rail and install the fuel injector retaining pin (4).
22. Ensure the fuel injector retaining pin is fully seated in the fuel injector fuel rail and remove **EN-50791** installer.
23. Repeat the process until all fuel injectors are properly installed to the fuel rail.
24. Connect the electrical connectors (1) to the fuel injectors.



25. Install the **EN-51105 - 1** long protector (2) onto the fuel injector tip.

**NOTE:**

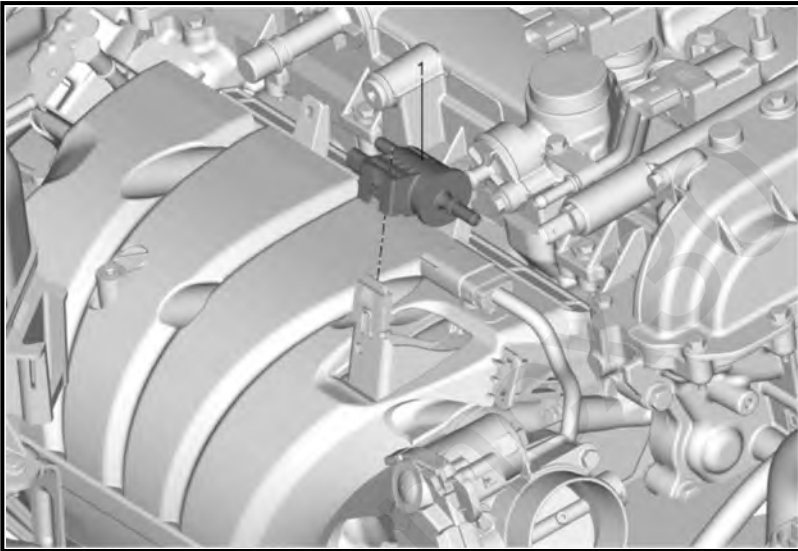
Do NOT use any type of lubricant when installing the NEW fuel injector seals on the fuel injector tip.

26. Place a NEW fuel injector seal (1) onto the **EN-51105 - 1** long protector.
27. Use the **EN-49245** pusher to install the NEW fuel injector seal into the second recessed area (3) of the fuel injector.
28. Remove the **EN-51105 - 1** long protector.
29. Compress the NEW fuel injector seal with your fingers, then resize the seal using the **EN-49245** pusher (4).

NOTE: Do NOT use any type of lubricant when installing the NEW fuel injector seals on the fuel injector tip.

30. Install the **EN-51105 - 2** short protector (2) onto the fuel injector tip.
31. Place a NEW fuel injector seal (1) onto the **EN-51105 - 2** short protector.
32. Use the **EN-49245** pusher to install the NEW fuel injector seal into the remaining recessed area of the fuel injector.
33. Remove the **EN-51105 - 2** short protector.
34. Compress the NEW fuel injector seal with your fingers, then resize the seal using the **EN-49245** pusher (4).
35. Fuel Injection Fuel Rail - Install - [Fuel Injection Fuel Rail Assembly Replacement](#)

EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE REPLACEMENT

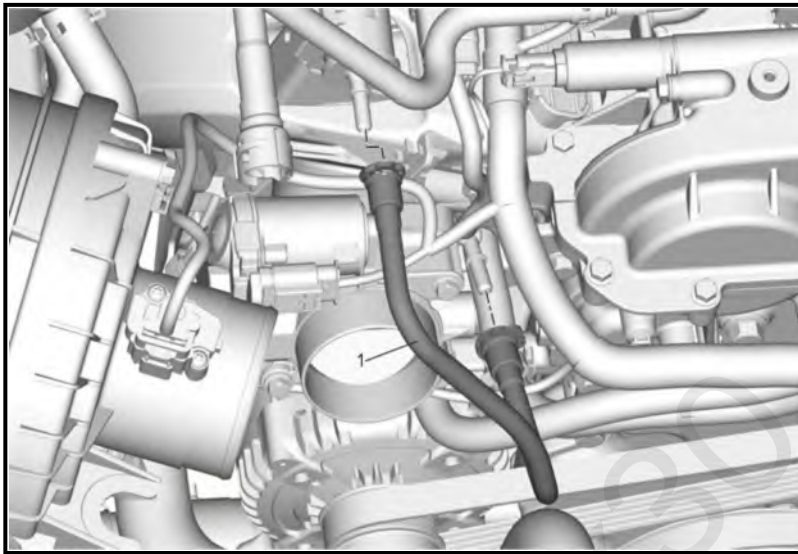


NOTE: Callouts in the following chart represent components shown in graphic above.

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

Callout	Component Name
1. Disconnect the evaporative emission lines. Refer to Plastic Collar Quick Connect Fitting Service. 2. Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement.	
1	Evaporative Emission Canister Purge Solenoid Valve Procedure 1. Disconnect the evaporative emission canister purge solenoid valve electrical connector. 2. Release the retaining tab.

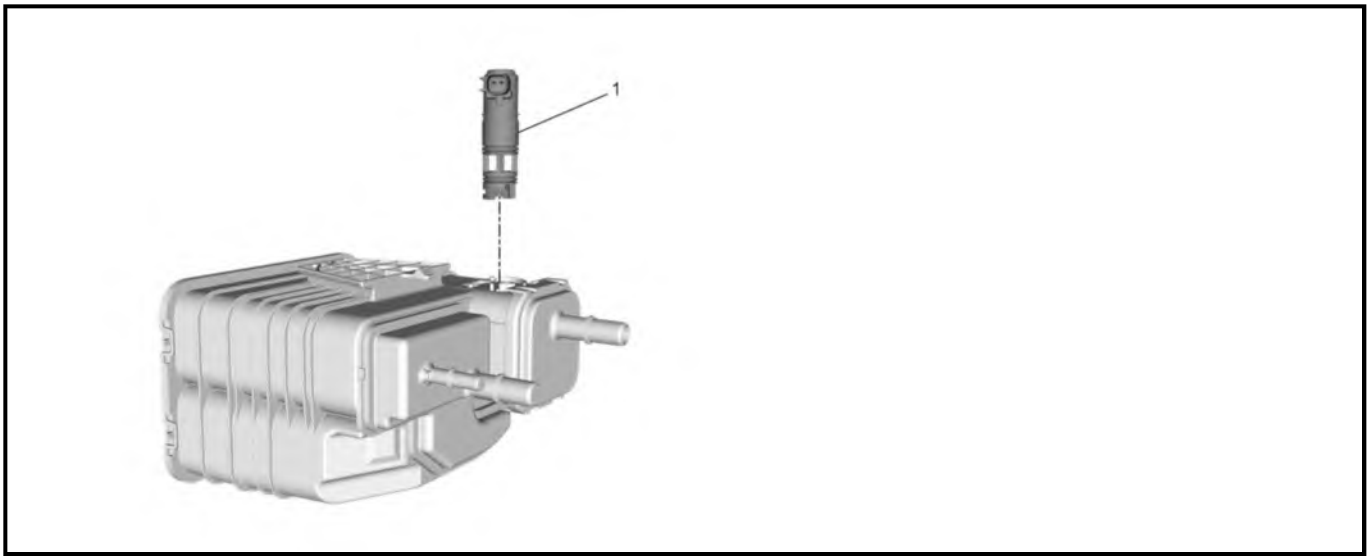
EVAPORATIVE EMISSION CANISTER PURGE TUBE REPLACEMENT



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

Callout	Component Name
Preliminary Procedure 1. Remove the air cleaner outlet duct. Refer to Air Cleaner Outlet Duct Replacement. 2. Disconnect the evaporative emission canister purge tube from the intake manifold and the evaporative emission canister purge valve. Refer to Plastic Collar Quick Connect Fitting Service.	
1	Evaporative Emission Canister Purge Tube

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.

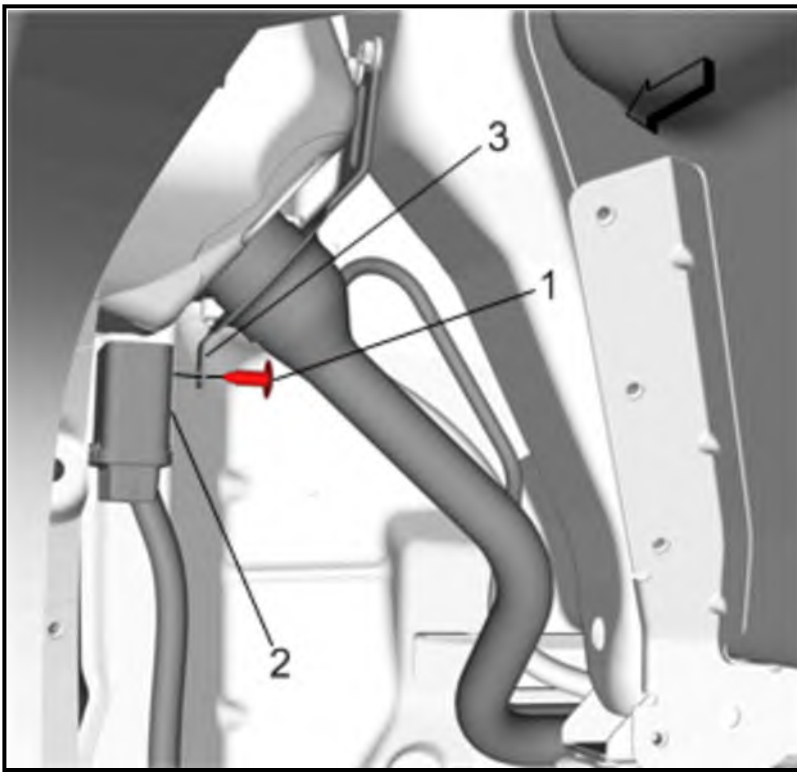
EVAPORATIVE EMISSION SYSTEM VACUUM LEAK PUMP FILTER REPLACEMENT

Removal Procedure

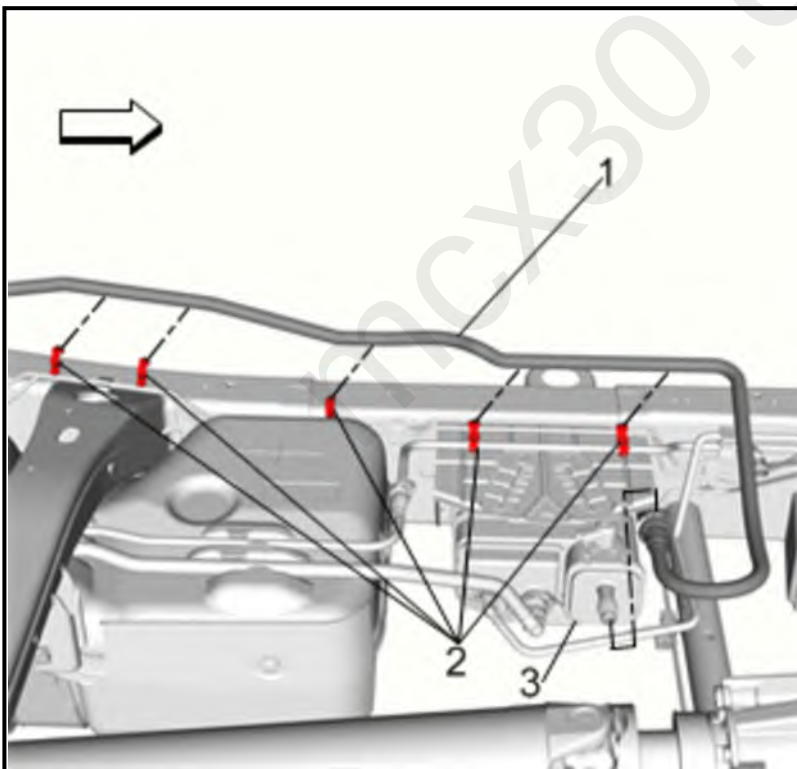
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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).



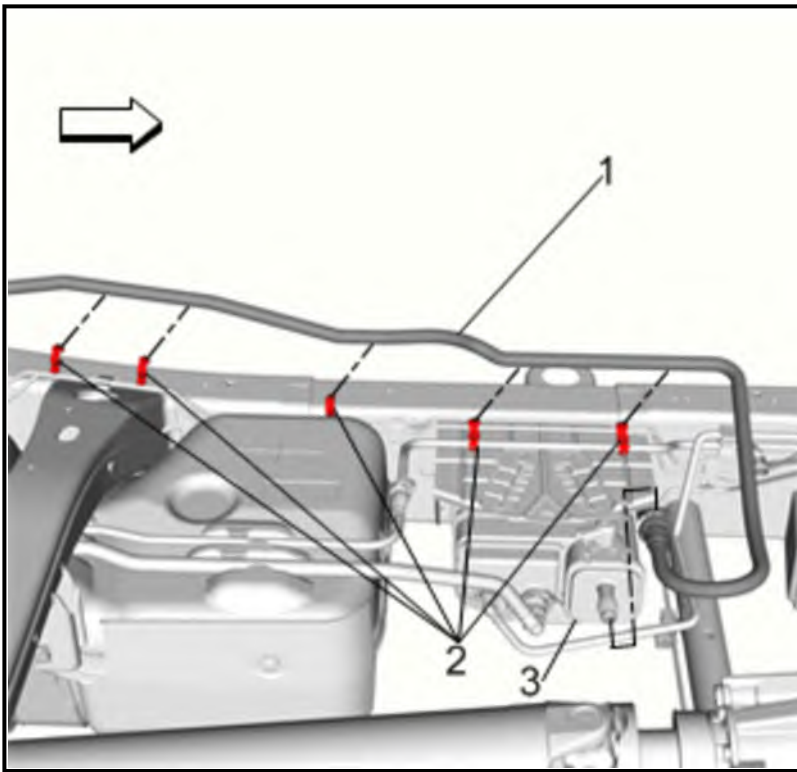
4. Remove the evaporative emission system vacuum leak pump filter assembly (2) from the fuel tank filler pipe (3).
5. Disconnect the evaporative emission system vacuum leak pump filter assembly (1) from the evaporative emission canister (3).



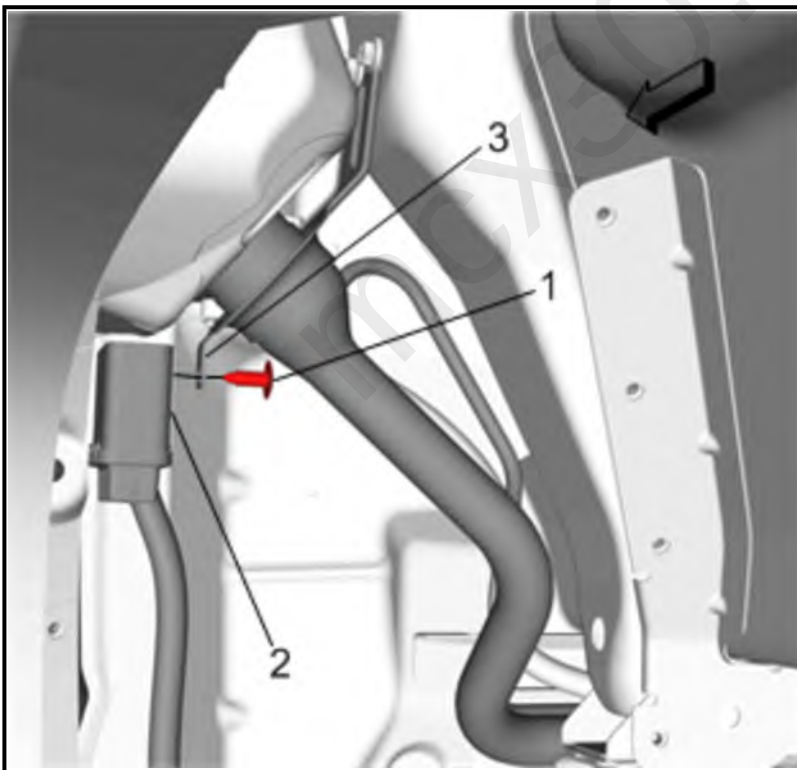
6. Remove the evaporative emission system vacuum leak pump filter assembly (1) from the retainers (2).
7. Remove the evaporative emission system vacuum leak pump filter assembly (1) from the vehicle.

Installation Procedure

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

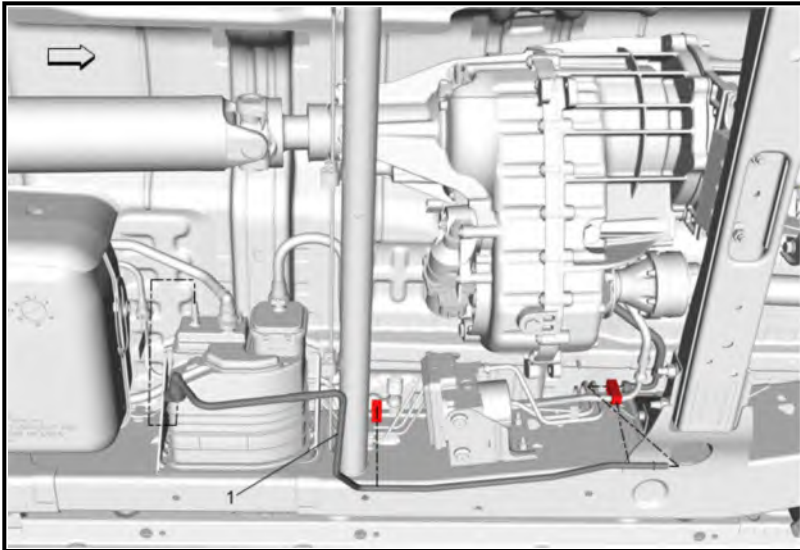


2. Install the evaporative emission system vacuum leak pump filter assembly (1) to the retainers (2).
3. Connect the evaporative emission system vacuum leak pump filter assembly (1) to the evaporative emission canister (3).
4. Install the evaporative emission system vacuum leak pump filter assembly (2) 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 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 Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Evaporative Emission Rear Pipe Procedure Disconnect the quick disconnects and remove from the 2 retainers. Plastic Collar Quick Connect Fitting Service , or Metal Collar Quick Connect Fitting Service

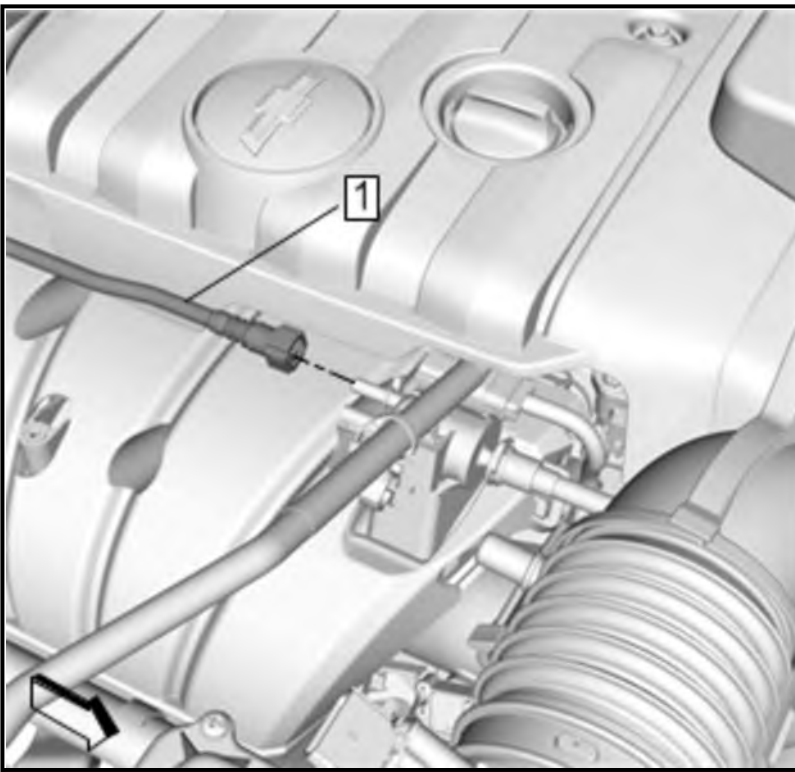
EVAPORATIVE EMISSION LINE REPLACEMENT - ENGINE TO CHASSIS

Removal Procedure

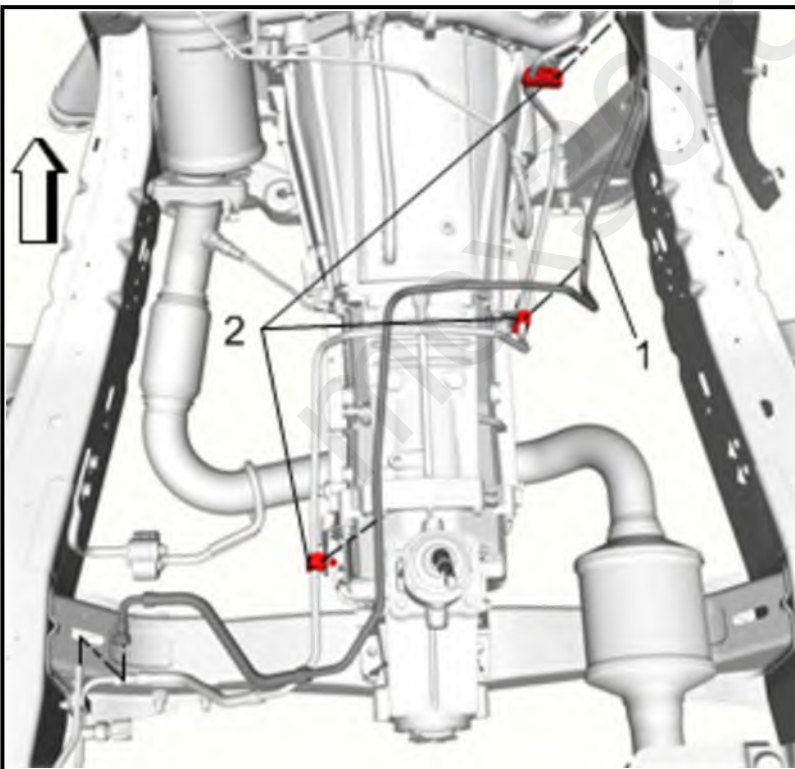
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

- 1. Disconnect the evaporative emission pipe (1) from the evaporative emission canister purge solenoid valve. Refer to [Plastic Collar Quick Connect Fitting Service](#).



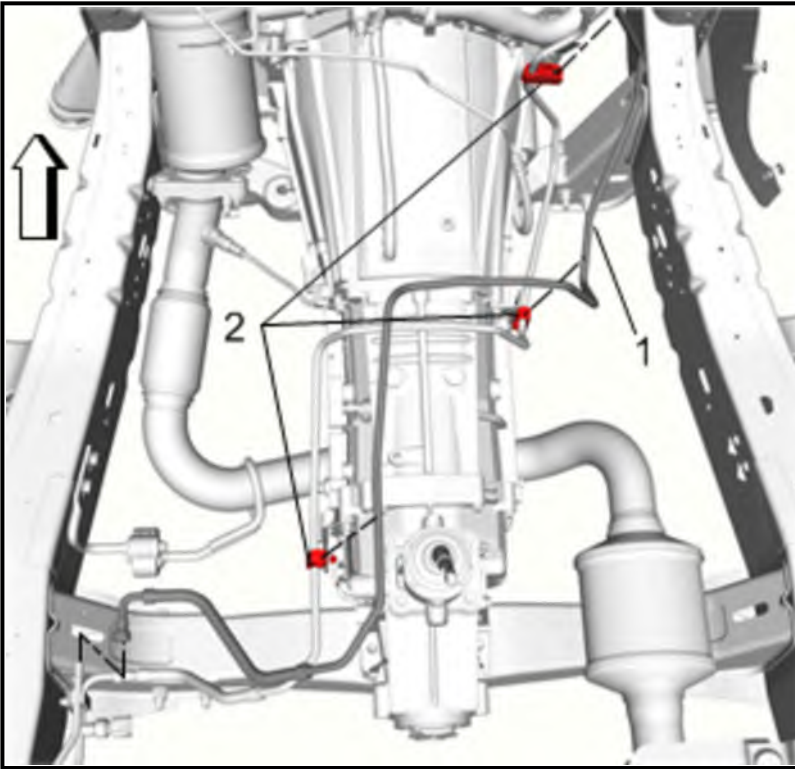
2. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
3. Disconnect the evaporative emission pipe (1) and remove from retainers (2). Refer to [Metal Collar Quick Connect Fitting Service](#).



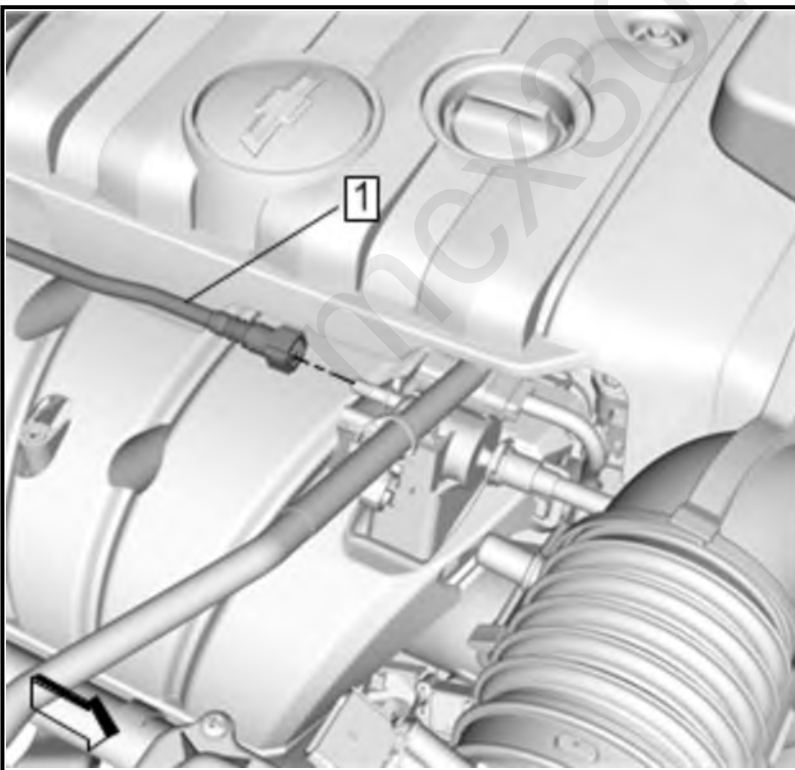
4. Remove the evaporative emission pipe (1) from the vehicle.

Installation Procedure

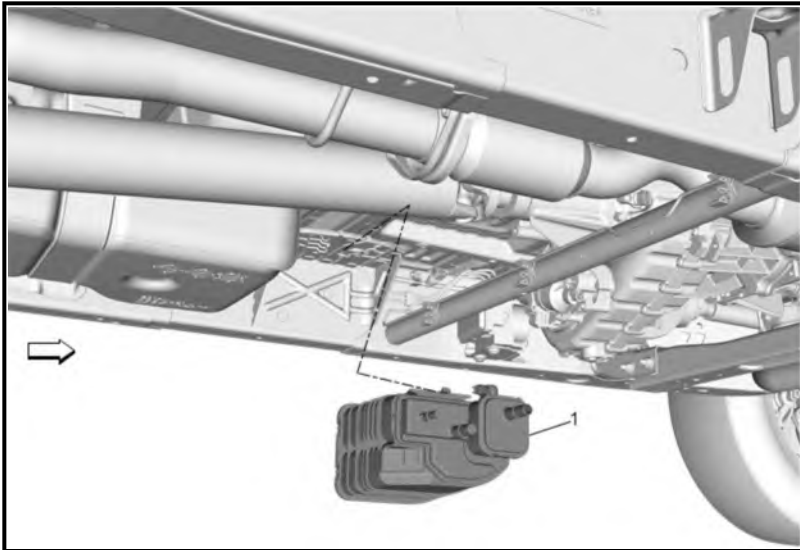
1. Install the evaporative emission pipe (1) to the vehicle.



2. Connect the evaporative emission pipe (1) and install to retainers (2). Refer to [Metal Collar Quick Connect Fitting Service](#).
3. Lower the vehicle.
4. Connect the evaporative emission pipe (1) to the evaporative emission canister purge solenoid valve. Refer to [Plastic 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.

EVAPORATIVE EMISSION SYSTEM CLEANING

Special Tools

GE 41413 - 200 Evaporative Pressure and Purge Station

For equivalent regional tools, refer to [Special Tools \(Mechanical Tools\)](#) , or [Special Tools \(Diagnostic Tools\)](#) .

Inspection Procedure

CAUTION:

Use the Evaporative Emission (EVAP) System Tester GE 41413-A in order to provide a clean, dry, low pressure nitrogen gas source. Do not substitute any other pressurized source, gas or otherwise. Damage may result to the EVAP system, test equipment or cause a safety risk.

NOTE:

Proceed with the following procedure only if referenced by an evaporative emission (EVAP) diagnostic or repair procedure.

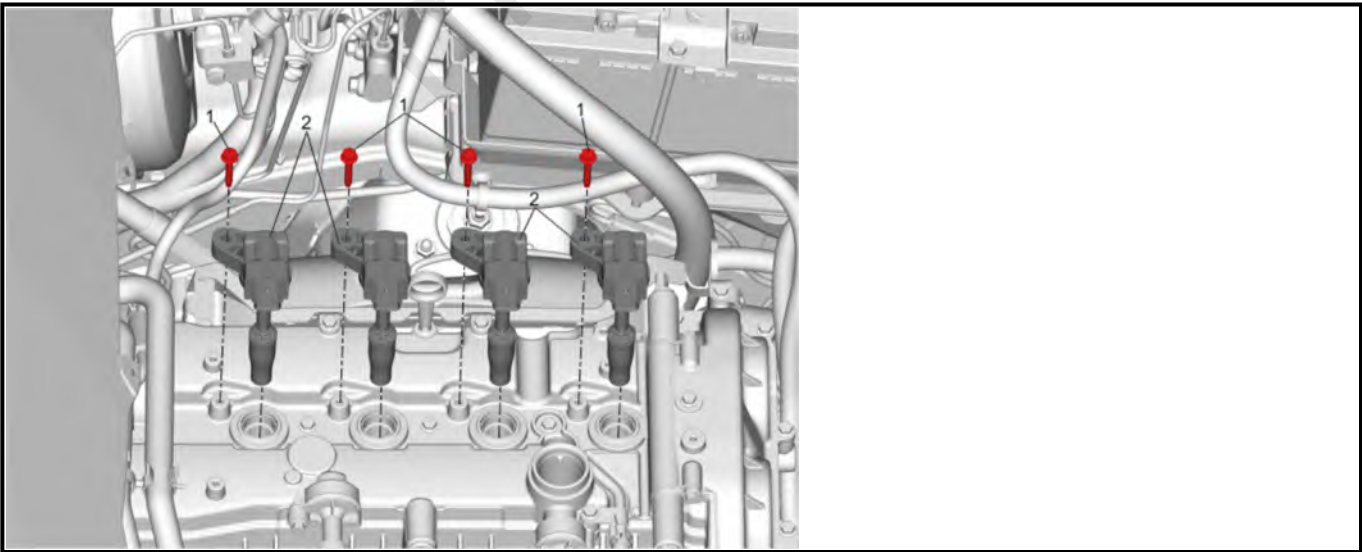
- 1. Turn OFF the ignition.

2. Remove the EVAP canister purge valve. Refer to [Evaporative Emission Canister Purge Solenoid Valve Replacement](#).
3. Lightly tap the EVAP canister purge valve on a hard surface.
4. Inspect for carbon particles exiting either of the vacuum ports.
 - If no carbon particles were detected, but a blockage was detected during a diagnostic procedure, install the original EVAP canister purge valve. Continue with the cleaning procedure.
 - If carbon particles are found during the inspection procedure, continue with the cleaning procedure.
 - If a diagnostic procedure directed you to replace the EVAP canister purge valve and no carbon particles were detected, replace the EVAP canister purge valve. Return to the published service procedure.

Cleaning Procedure

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the EVAP canister. Refer to [Evaporative Emission Canister Replacement](#).
3. Turn OFF the main valve on the **GE 41413 - 200** station.
4. Disconnect the hose from the diagnostic station pressure regulator.
5. Using a section of vacuum hose, connect one end onto the EVAP pressure/purge diagnostic station pressure regulator.
6. Connect the other end of the vacuum hose to the canister side of the purge pipe.
7. Turn ON the main nitrogen cylinder valve and continue to discharge nitrogen for 15 seconds.
8. If the nitrogen does not clear the blockage, replace the purge pipe.
9. Return the EVAP pressure/purge diagnostic station to the stations original condition.
10. Install a new EVAP canister. Refer to [Evaporative Emission Canister Replacement](#).
11. Lower the vehicle.
12. Install a new EVAP canister purge valve. Refer to [Evaporative Emission Canister Purge Solenoid Valve Replacement](#).
13. Return to the diagnostic table that sent you here.

IGNITION COIL REPLACEMENT

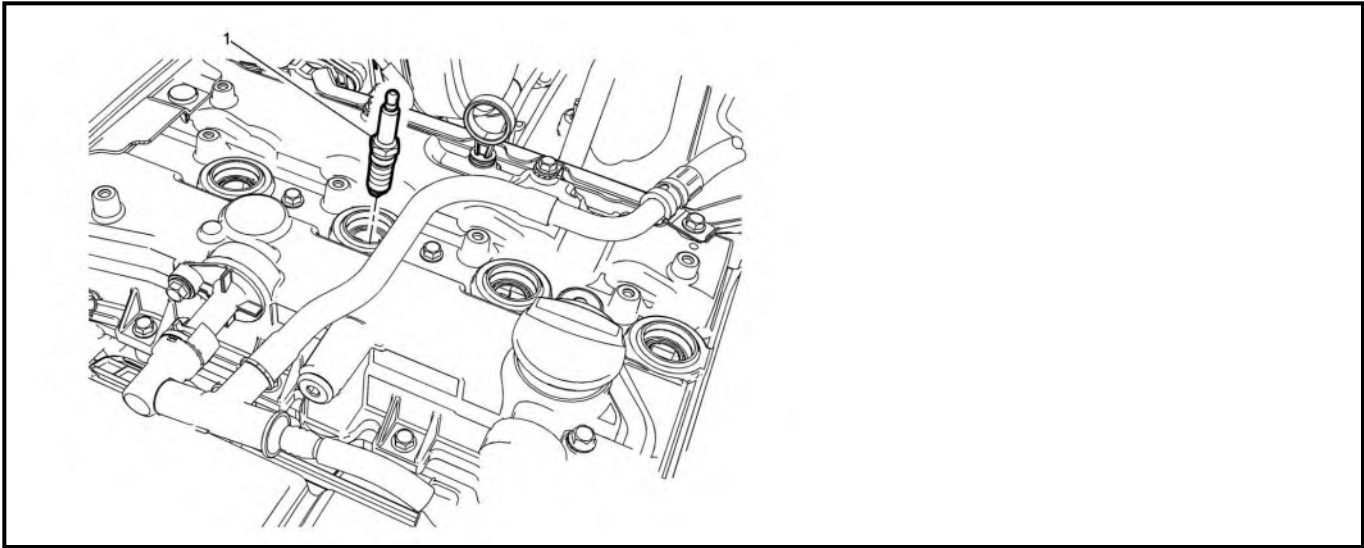


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure	

Callout	Component Name
	1. Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement . 2. If replacing the number 4 ignition coil, remove the plenum front panel. Refer to Plenum Front Panel Replacement . 3. If replacing the number 4 ignition coil, remove the upper intake manifold bracket. Refer to Upper Intake Manifold Bracket Replacement .
1	Ignition Coil Fasteners (Qty: 4) CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Ignition Coils NOTE: Inspect the inside of the ignition coil rubber boot for a thin, even coat of grease. If there is no grease present or additional grease is necessary, complete the following procedure. Procedure 1. Disconnect the electrical wiring harness connectors from the ignition coils and remove coils as necessary. 2. Apply a thin coating of dielectric grease to the inside of the ignition coil rubber boot, up to a depth of 15 mm from the end of the boot. Refer to Adhesives, Fluids, Lubricants, and Sealers . 3. Remove any excess grease from around the end of the boot, and ensure there is not an excessive amount within the boot.

GAS ENGINE IGNITION SPARK PLUG REPLACEMENT

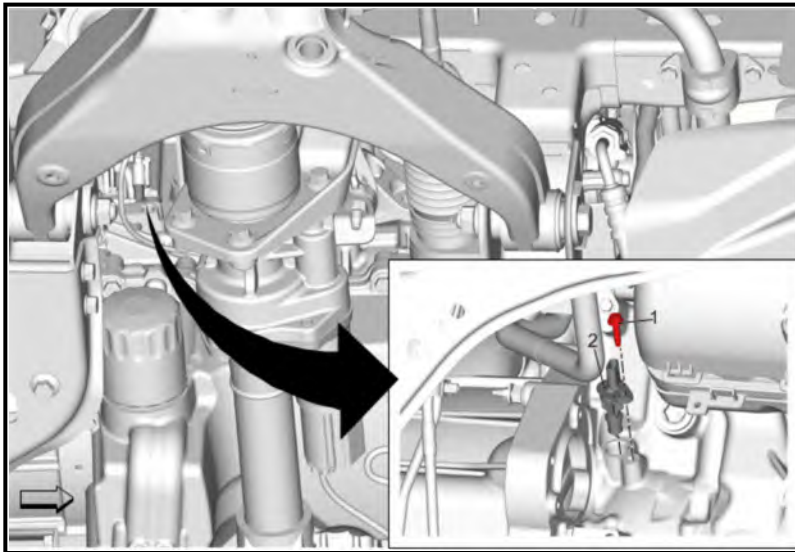


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
CAUTION: This engine has aluminum cylinder heads. Do not remove the spark plugs from a hot engine, allow it to cool first. Removing the spark plugs from a hot engine may cause spark plug thread damage or cylinder head damage. Preliminary Procedure Remove the ignition coil or coils, as required. Ignition Coil Replacement	
1	Spark Plugs (Qty: 4) CAUTION: Refer to Component Fastener Tightening Caution . Procedure Inspect the spark plug and verify the gap. Refer to Refer to Engine Mechanical

Callout	Component Name
	Specifications . Tighten 20 N.m (15 lb ft)

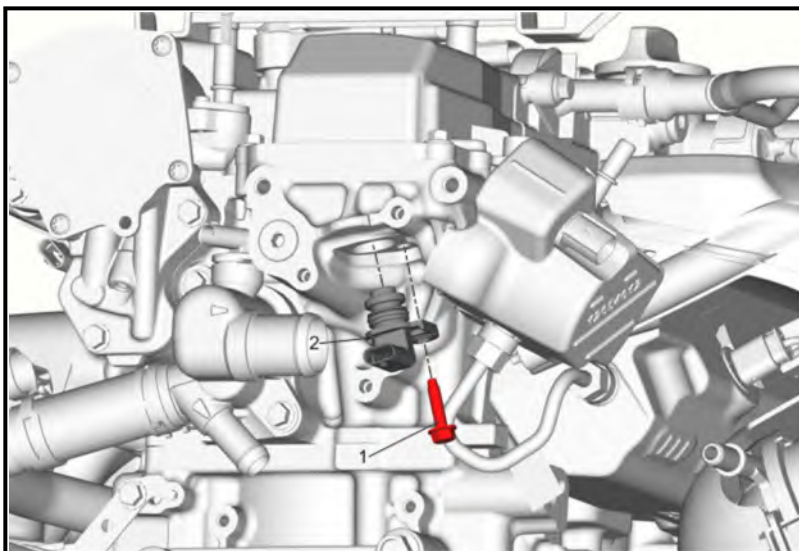
CRANKSHAFT POSITION SENSOR REPLACEMENT



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

Callout	Component Name
Preliminary Procedure 1. Raise and properly support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Remove the starter. Refer to Starter Replacement (LCV) .	
1	Crankshaft Position Sensor Fastener CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Crankshaft Position Sensor Procedure 1. Disconnect the electrical wiring harness connector from the crankshaft position sensor. 2. If installing a new sensor, perform the crankshaft position system variation learn procedure. Refer to Crankshaft Position Variation Learn .

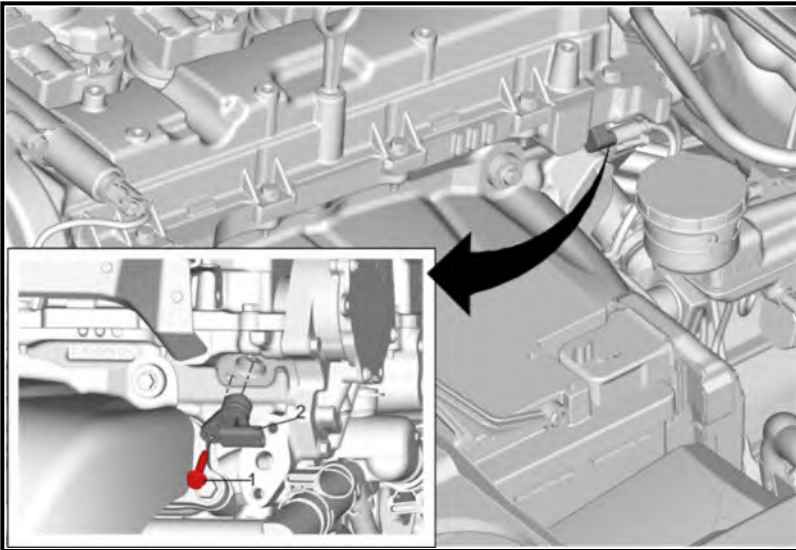
CAMSHAFT POSITION SENSOR REPLACEMENT - INTAKE



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

Callout	Component Name
Preliminary Procedure 1. Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement . 2. Remove the plenum front panel. Refer to Plenum Front Panel Replacement . 3. Remove the fuel pump cover. Refer to Fuel Pump Cover Replacement.	
1	Camshaft Position Sensor Fastener CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Camshaft Position Sensor Procedure 1. Disconnect the electrical wiring harness connector from the camshaft position sensor. 2. Install a NEW seal if reusing the camshaft position sensor.

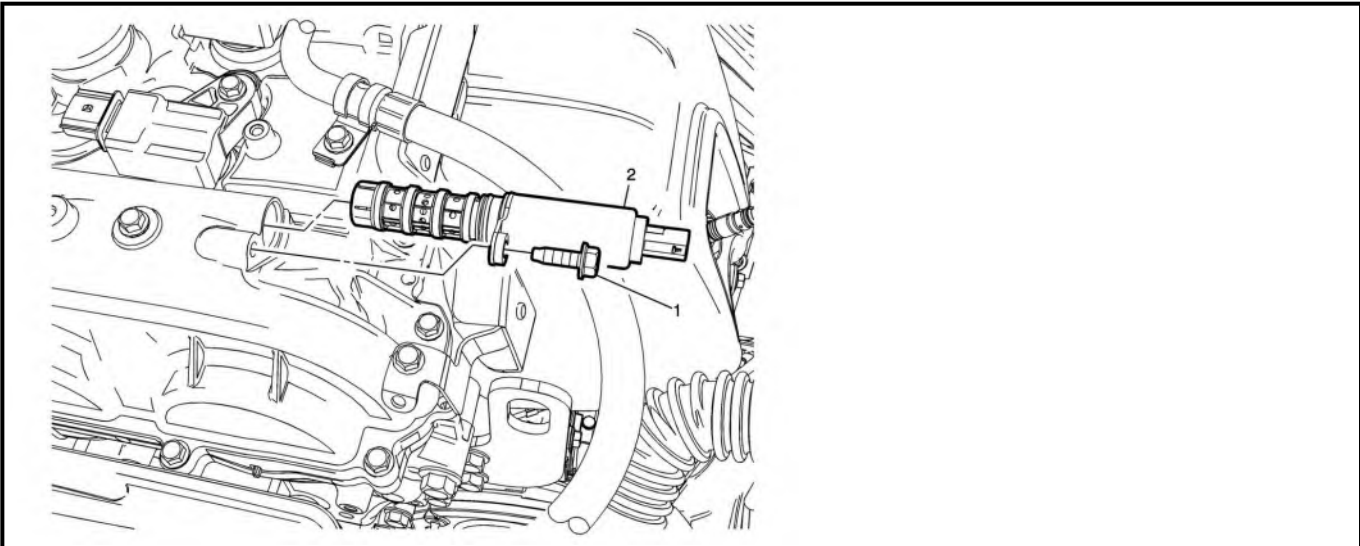
CAMSHAFT POSITION SENSOR REPLACEMENT - EXHAUST



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

Callout	Component Name
Preliminary Procedure Remove the camshaft cover heat shield. Refer to Camshaft Cover Heat Shield Replacement .	
1	Camshaft Position Sensor Fastener CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Camshaft Position Sensor Procedure 1. Disconnect the electrical wiring harness connector from the camshaft position sensor. 2. Install a NEW seal if reusing the camshaft position sensor.

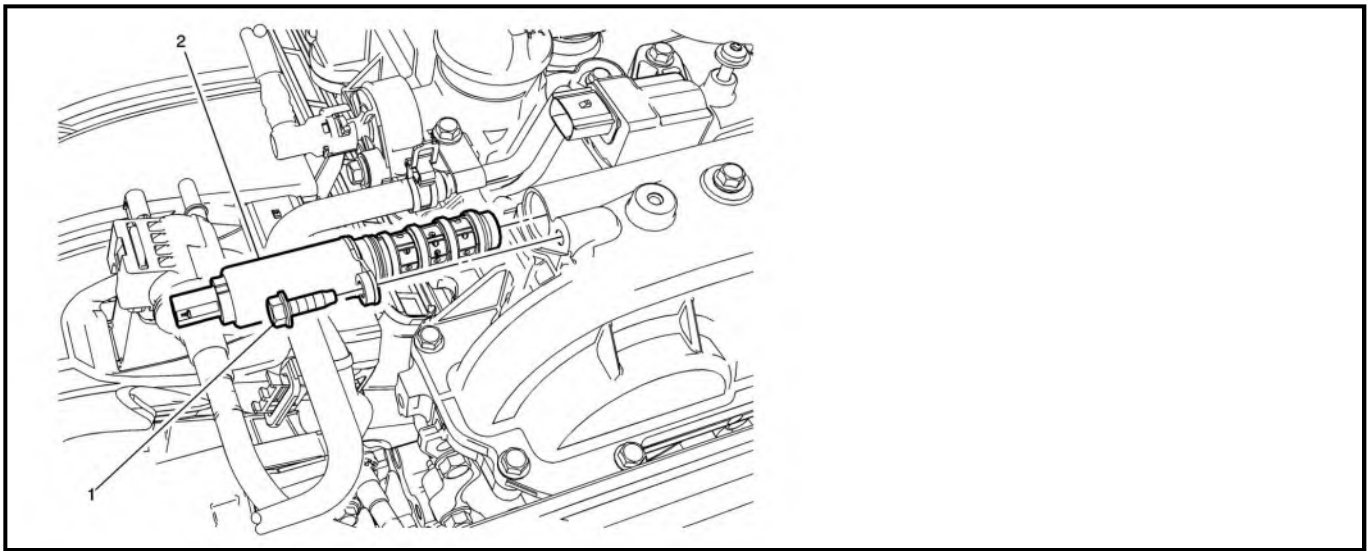
CAMSHAFT POSITION ACTUATOR EXHAUST SOLENOID VALVE REPLACEMENT



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

Callout	Component Name
Preliminary Procedure Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement .	
1	Camshaft Position Actuator Exhaust Solenoid Valve Fastener CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Camshaft Position Actuator Exhaust Solenoid Valve NOTE: Inspect the Camshaft Position Actuator Exhaust Solenoid Valve O-ring seals. If damaged, replace the Camshaft Position Actuator Exhaust Solenoid Valve assembly. Procedure Disconnect the electrical wiring harness connector from the camshaft position actuator exhaust solenoid valve.

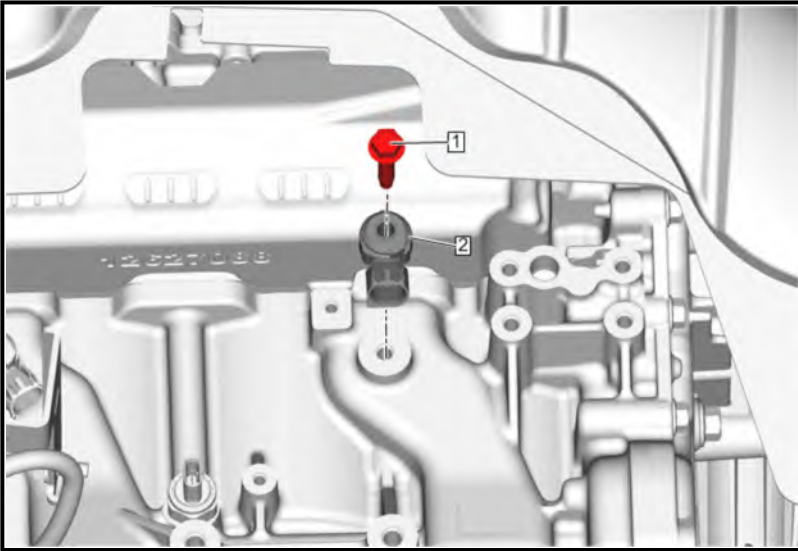
CAMSHAFT POSITION ACTUATOR INTAKE SOLENOID VALVE REPLACEMENT



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

Callout	Component Name
Preliminary Procedure Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement .	
1	Camshaft Position Actuator Intake Solenoid Valve Fastener CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Camshaft Position Actuator Intake Solenoid Valve NOTE: Inspect the Camshaft Position Actuator Intake Solenoid Valve O-ring seals . If damaged, replace the Camshaft Position Actuator Intake Solenoid Valve assembly . Procedure Disconnect the electrical wiring harness connector from the camshaft position actuator intake solenoid valve.

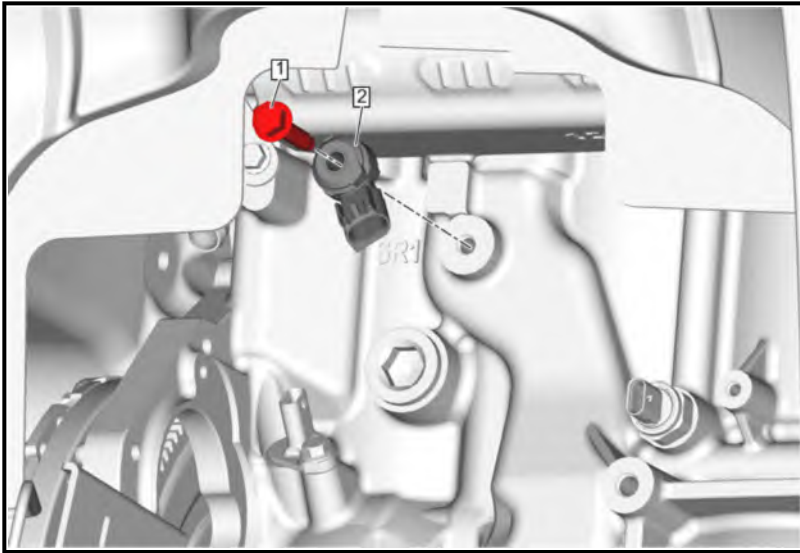
KNOCK SENSOR REPLACEMENT (FRONT)



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

Callout	Component Name
Preliminary Procedure 1. Raise and support the vehicle. <u>Lifting and Jacking the Vehicle</u> 2. Remove the right side front wheelhouse liner. <u>Front Wheelhouse Liner Replacement (Without ZR2)</u> , or <u>Front Wheelhouse Liner Replacement (Bison)</u> 3. <u>Generator Replacement (LCV)</u>	
1	Knock Sensor Fastener CAUTION: Refer to <u>Fastener</u> <u>Caution</u> . Tighten 25 N.m (18 lb ft)
2	Knock Sensor Procedure Disconnect the electrical connector.

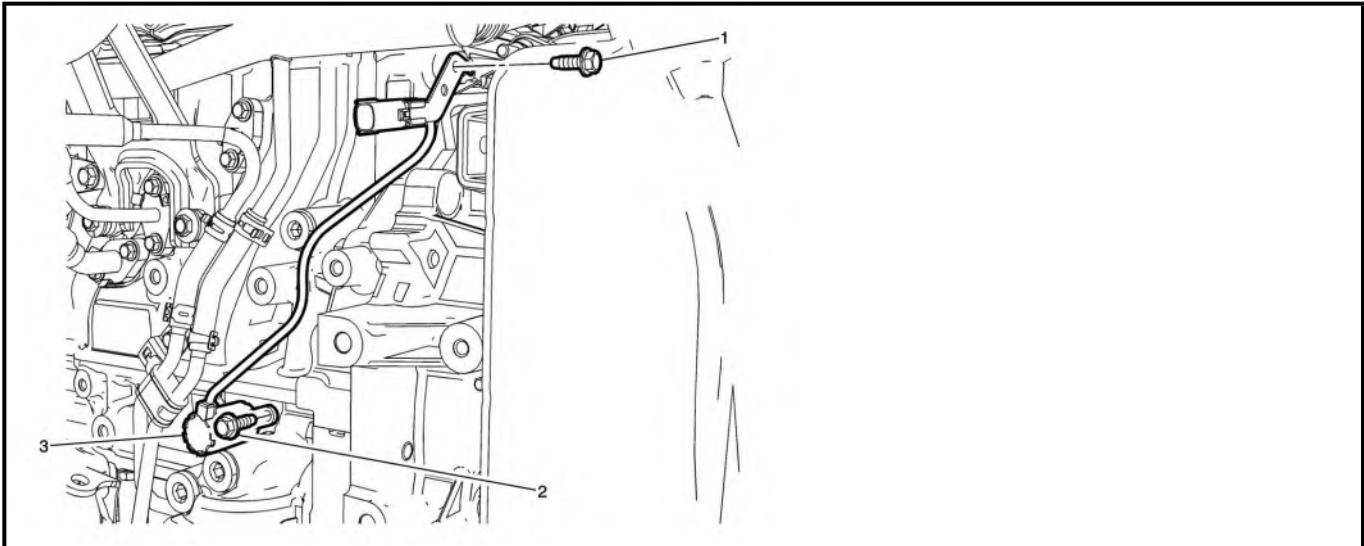
KNOCK SENSOR REPLACEMENT (REAR)



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

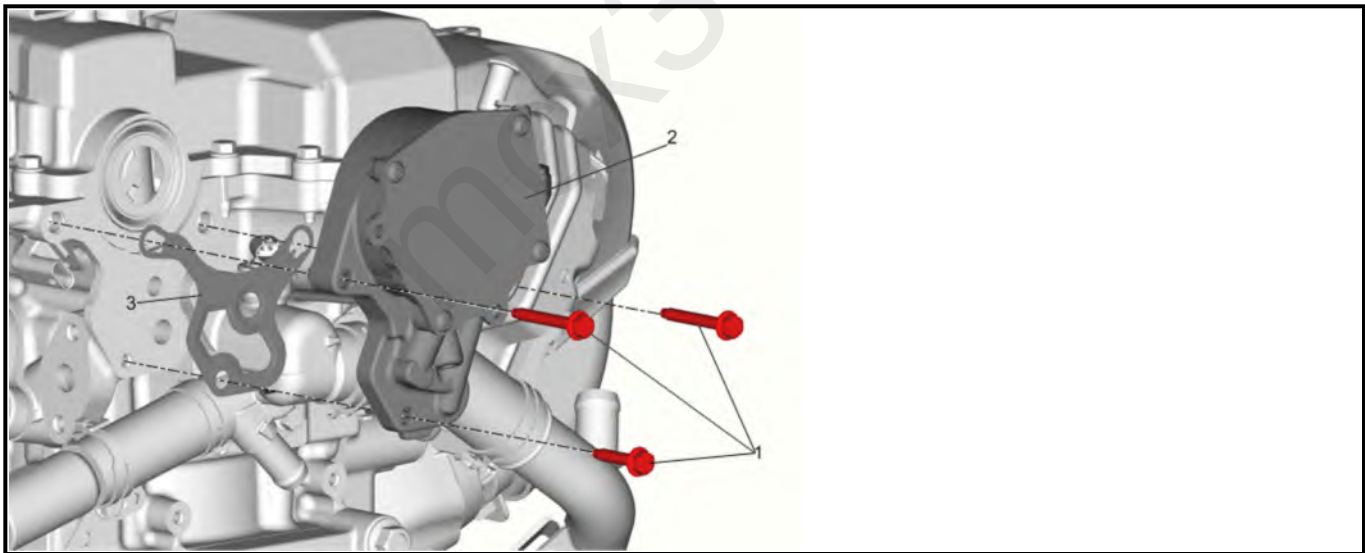
Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Lifting and Jacking the Vehicle 2. Remove the right side front wheelhouse liner. Front Wheelhouse Liner Replacement (Without ZR2) , or Front Wheelhouse Liner Replacement (Bison).	
1	Knock Sensor Fastener CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
2	Knock Sensor Procedure Disconnect the electrical connector.

OIL PUMP FLOW CONTROL VALVE REPLACEMENT



Callout	Component Name
Preliminary Procedure Engine Mount Replacement - Left Side - Remove	
1	Oil Pump Flow Control Valve Electrical Wiring Harness Connector Bracket Fastener CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Oil Pump Flow Control Valve Fastener CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
3	Oil Pump Flow Control Valve Procedure Disconnect the electrical wiring harness connector from the oil pump flow control valve.

VACUUM PUMP REPLACEMENT

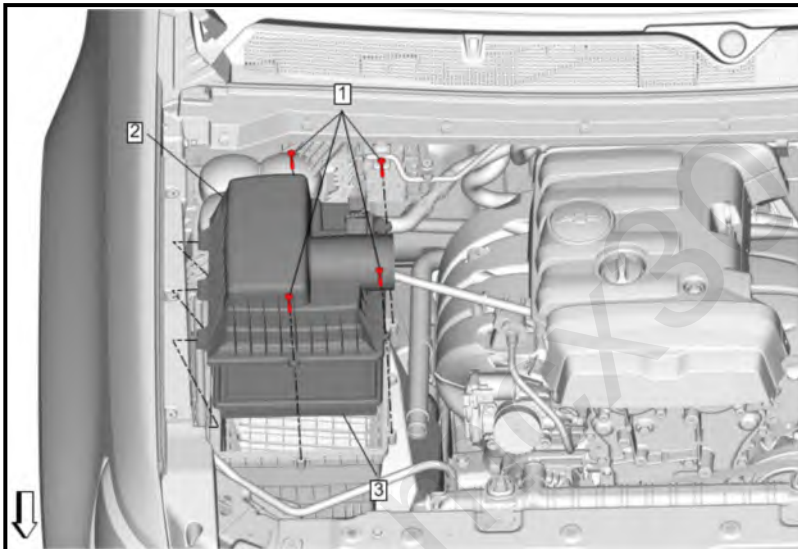


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure	
1. Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement . 2. Remove the plenum front panel. Refer to Plenum Front Panel Replacement . 3. Disconnect the vacuum hose from the vacuum pump. Refer to Power Brake Booster Vacuum Hose Replacement (LCV) .	

Callout	Component Name
1	Vacuum Pump Fasteners (Qty: 3) CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Vacuum Pump
3	Vacuum Pump Gasket NOTE: Inspect the gasket and replace if necessary.

AIR CLEANER ELEMENT REPLACEMENT

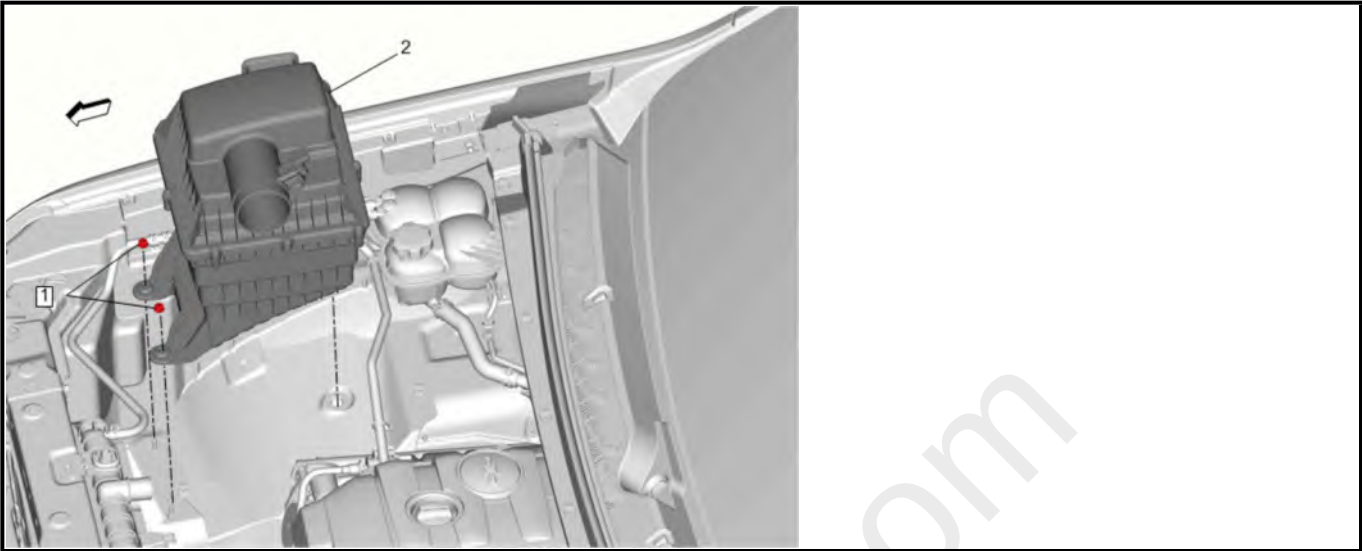


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure 1. Disconnect the air cleaner outlet duct from the air cleaner assembly. Refer to Air Cleaner Outlet Duct Replacement . 2. Disconnect the mass airflow sensor connector.	
1	Air Cleaner Assembly Fastener (Qty: 4) CAUTION: Refer to Fastener Caution .

Callout	Component Name
	Tighten 3.1 N.m (27 lb in)
2	Air Cleaner Upper Cover
3	Air Cleaner Element

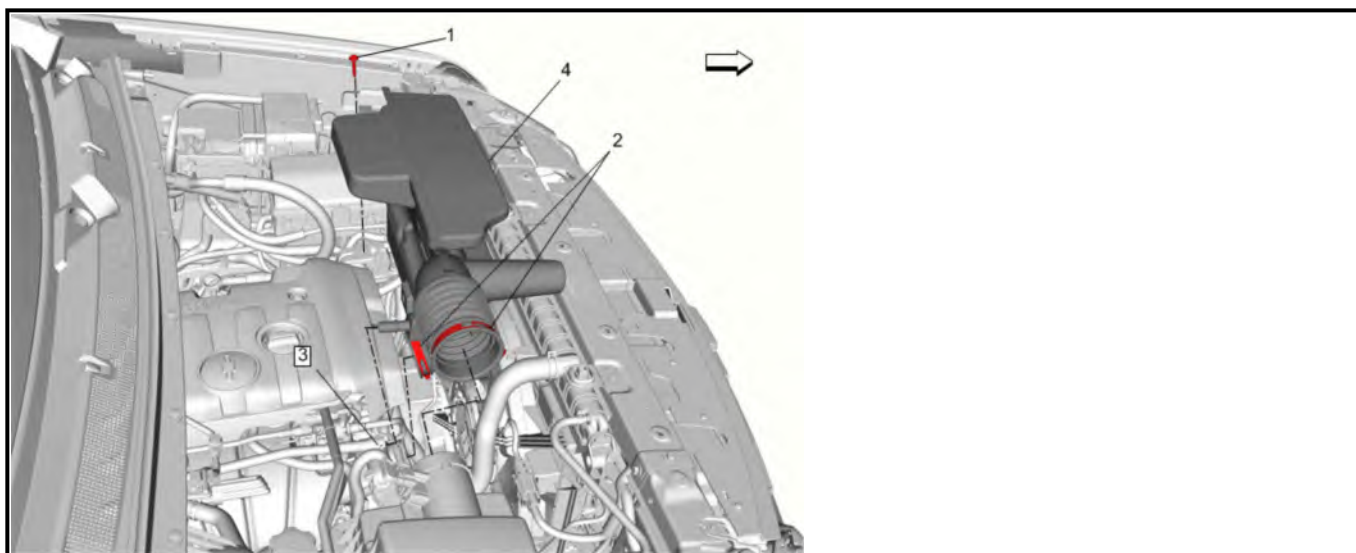
AIR CLEANER ASSEMBLY REPLACEMENT



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

Callout	Component Name
Preliminary Procedure 1. Disconnect the air cleaner outlet duct from the air cleaner assembly. Refer to Air Cleaner Outlet Duct Replacement. 2. Disconnect the mass airflow sensor connector.	
1	Air Cleaner Assembly Fastener (Qty: 2) 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.

AIR CLEANER OUTLET DUCT REPLACEMENT



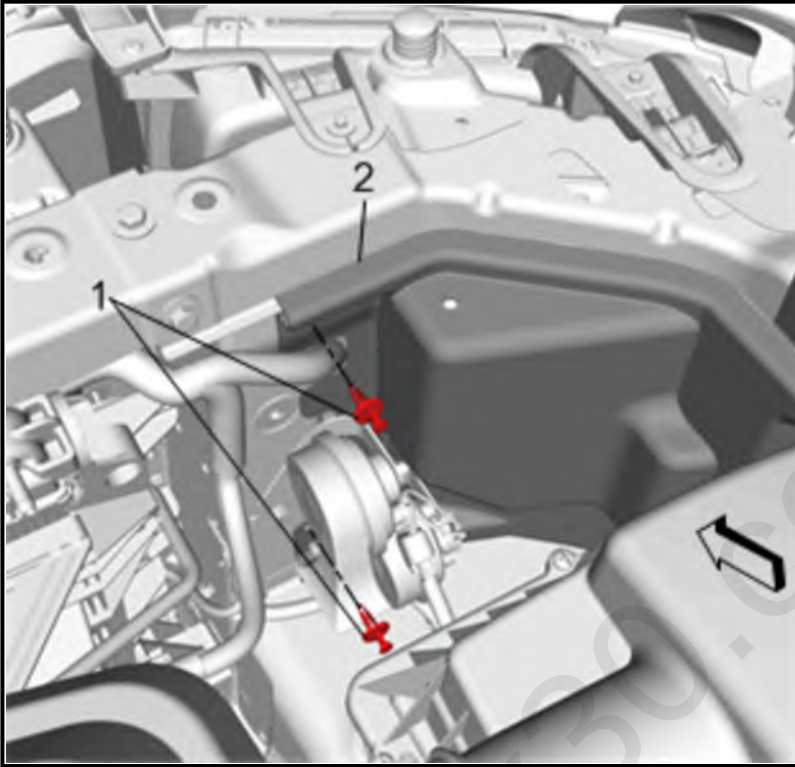
NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
1	Air Cleaner Outlet Duct Fastener CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)
2	Air Cleaner Outlet Duct Clamps (Qty: 2) NOTE: Ensure the outlet duct is fully seated to the mating surfaces before clamping. Verify that the cuff is not rolled under. Tighten 3.5 N.m (31 lb in)
3	PCV Tube Procedure Disconnect the PCV tube from the air cleaner outlet duct. Refer to Plastic Collar Quick Connect Fitting Service.
4	Air Cleaner Outlet Duct Procedure Pull forward and up on the air cleaner outlet duct to release lower retainer.

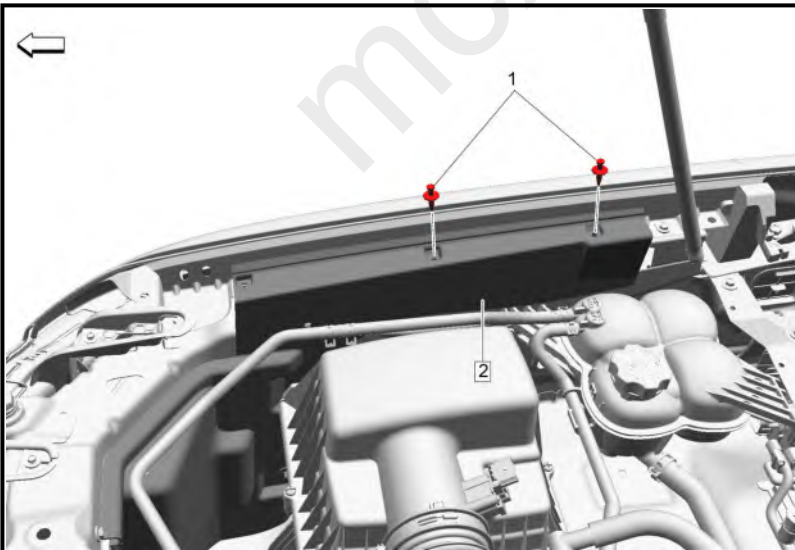
INTAKE AIR SPLASH SHIELD REPLACEMENT

Removal Procedure

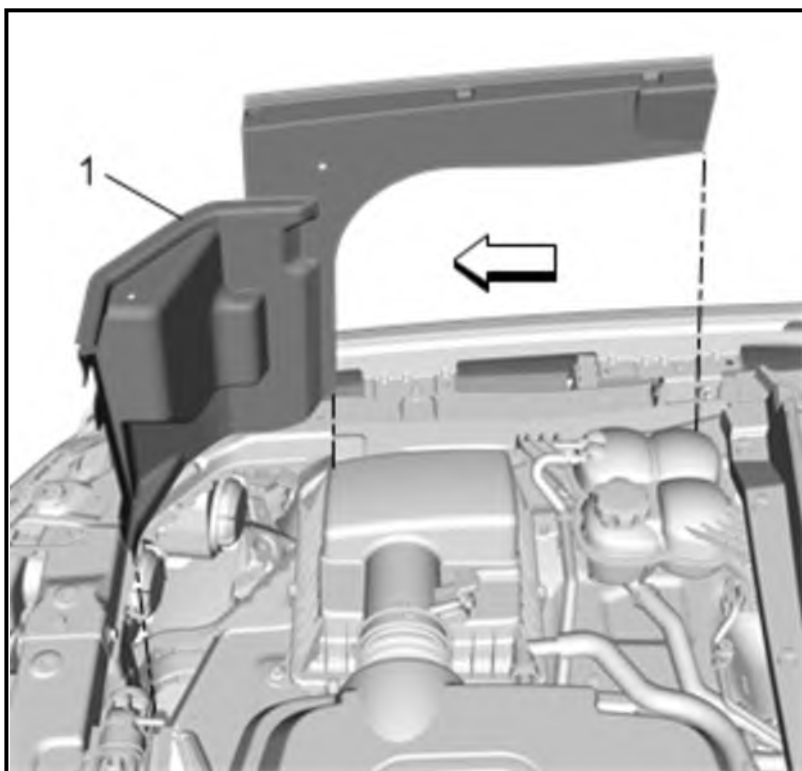
1. Remove the radiator vent outlet hose clips from the intake air splash shield. [Radiator Vent Outlet Hose Replacement \(LCV, LGZ\)](#)
2. Without disconnecting the radiator vent outlet hose reposition the radiator vent outlet hose.
3. Remove the intake air baffle. [Intake Air Baffle Replacement](#)
4. Remove the intake air splash shield retainers (1) from the intake air splash shield (2).



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

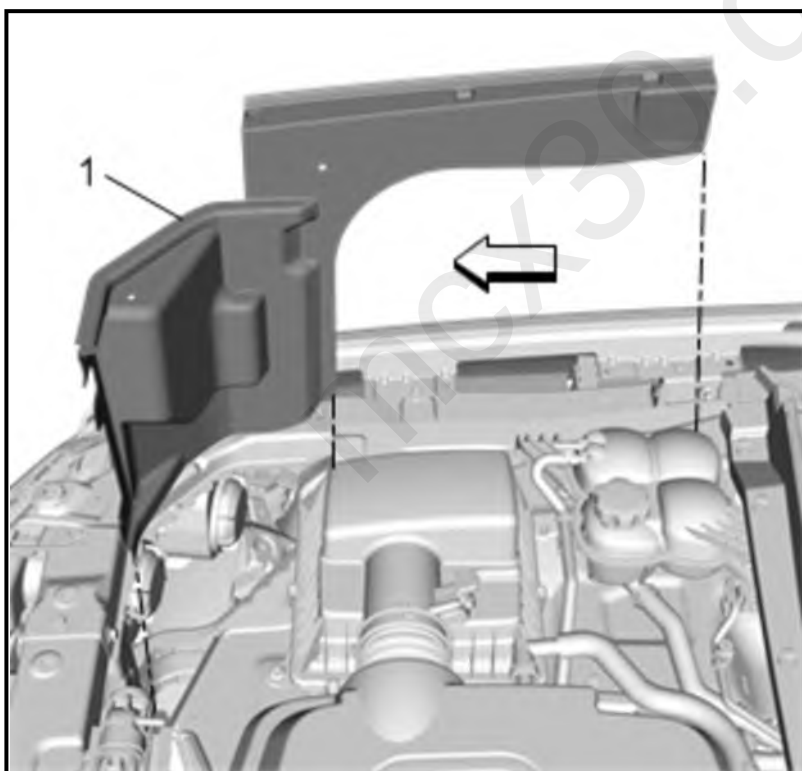


6. Remove the intake air splash shield (1) from the vehicle.

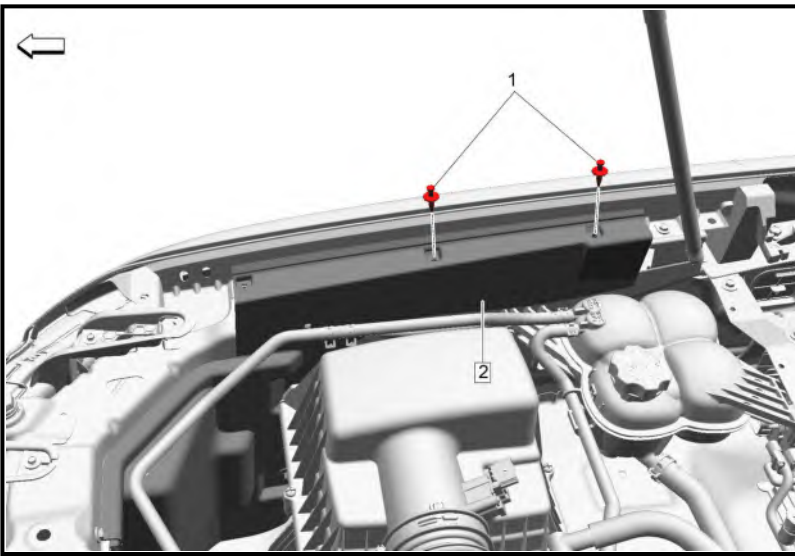


Installation Procedure

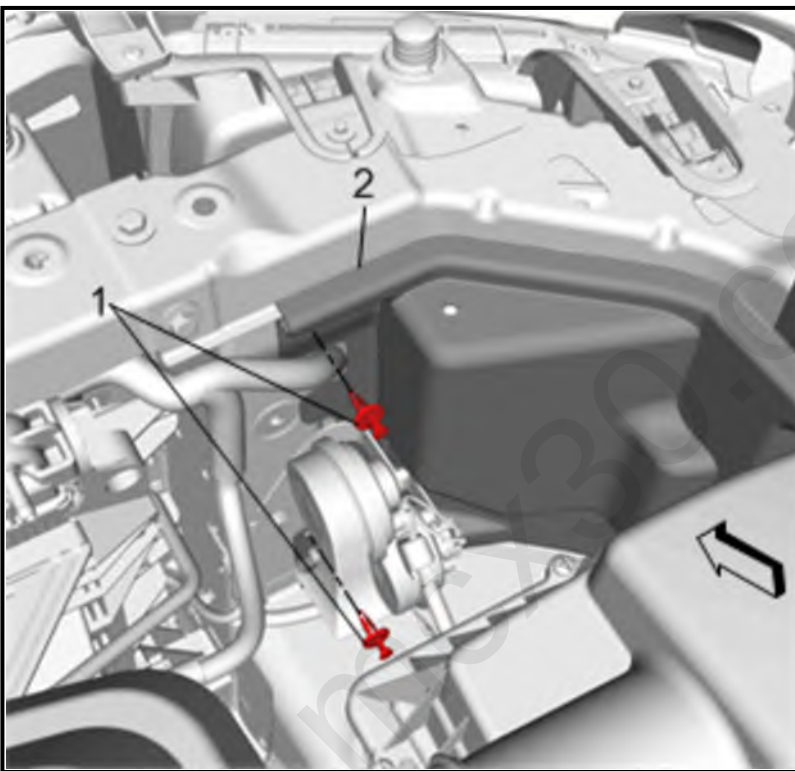
1. Install the intake air splash shield (1) to the vehicle.



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



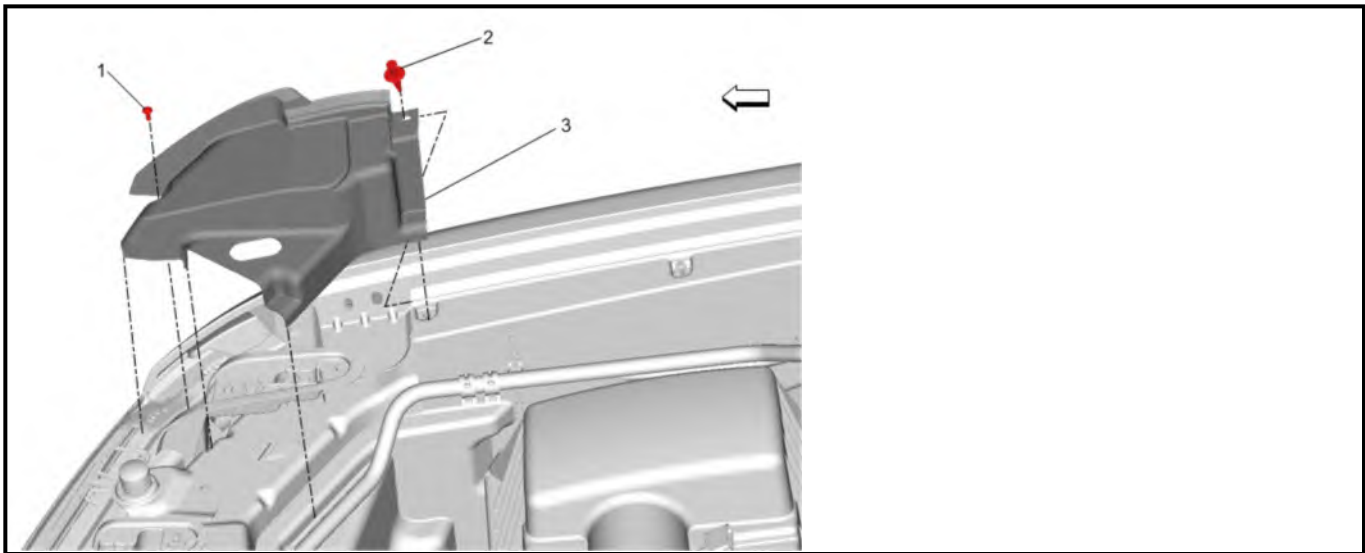
3. Install the intake air splash shield retainers (1) to the intake air splash shield (2).



4. Install the intake air baffle. [Intake Air Baffle Replacement](#)

5. Install the radiator vent outlet hose clips to the intake air splash shield. [Radiator Vent Outlet Hose Replacement \(LCV, LGZ\)](#)

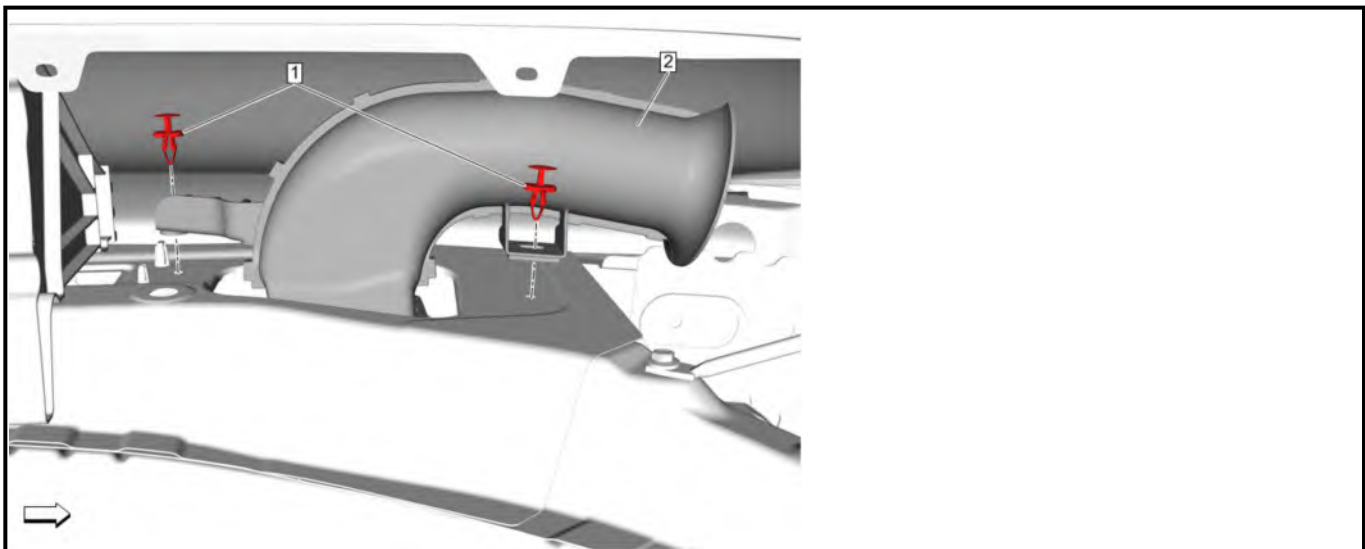
INTAKE AIR BAFFLE REPLACEMENT



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: 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.

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 - <u>Front Wheelhouse Liner Replacement (Without ZR2)</u> , or <u>Front Wheelhouse Liner Replacement (Bison)</u> .	
1	Retainer [2x] CAUTION: Refer to <u>Fastener</u> <u>Caution</u> .
2	Front Intake Air Duct Procedure Pull out on front intake air duct to remove from air cleaner assembly.