

2018 ENGINE PERFORMANCE

Engine Controls And Fuel - 3.6L (LFY) - Repair Instructions - Traverse

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 60°C (140°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: Engine Control Module
5. Select: Configuration/Reset Functions
6. Select: Learn Functions
7. Select: Crankshaft Position Variation Learn
8. 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 1

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

Repeat step 6

- **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**

9. 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](#)

HO2S HEATER RESISTANCE LEARNED VALUES RESET

Diagnostic Instructions

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

Description

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

When to Perform the Procedure

NOTE:

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

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

Conditions for Running the Procedure

Ignition Switch = Run/Crank

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

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

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

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

Repair Instructions

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

THROTTLE BODY IDLE AIR FLOW COMPENSATION RESET

Diagnostic Instructions

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

Description

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

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

When to Perform the Procedure

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

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

Conditions for Running the Procedure

- DTC P0068, P0101, P0102, P010B, P0103, P010C, P010D, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0122, P0123, P0128, P0171, P0172, P0174, P0175, P0201 - P0208, P0220, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P0300 - P0308, P0351 - P0358, P0496, P0601, P0604, P0606, P060D, P0641, P0651, P0697, P06A3, P06D2, P1248, P1249, P124A, P124B, P1516, P16A0 - P16A2, P2101, P2119, P2120, P2122, P2123, P2125, P2127, P2128, P2135, P2138,

P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P216B, P216C, P216E, P216F, P217B, P217C, P217E, P217F, P2176, P2300, P2301, P2303, P2304, P2306, P2307, P2309, P2310, P2312, P2313, P2315, P2316, P2318, P2319, P2321, P2322 = Not set

- Ignition = On
- Vehicle Speed Sensor = 0 km/h (0 MPH)

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition - On / Vehicle - In Service Mode
2. Select: Module Diagnostics
3. Select: Engine Control Module
4. Select: Configuration/Reset Functions
5. Select: Learn Functions
6. Select: Idle Learn
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 (44 mi)
 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](#)

WIRE TO WIRE REPAIR - ENGINE CONTROLS AND FUEL

Special Tools

- **EL-38125-10** Splice Sleeve Crimping Tool (non GMNA)

- **J-38125-5A** Ultra Torch Special Tool
- **J-38125-8** Splice Sleeve Crimping Tool (GMNA)

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

WARNING: In order to reduce the risk of personal injury, loss of high voltage isolation to ground and higher system impedance, do not attempt to repair any HV wiring, connector, or terminal that is damaged. High voltage coaxial type cables are not repairable. Never attempt to repair a coaxial type cable. The entire cable/harness or component must be replaced. In order to maintain system integrity and personal safety, never attempt to repair any high voltage wiring, cables, or terminals. Performing this procedure on high voltage circuits may result in serious injury or death.

NOTE: If the wiring harness internal to the transmission is damaged, the wiring harness must be replaced. The use of splice sleeves in an attempt to repair the internal transmission wires, connectors, or terminals could result in performance issues.

NOTE: Do not splice wires in Door Harness Grommets.

NOTE: The DuraSeal splice sleeves have the following 2 critical features:

- A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.
- A cross hatched (knurled) core crimp provides the necessary low resistance contact integrity for these sensitive, low energy circuits.

Use only DuraSeal splice sleeves to form a one-to-one splice on all types of insulation except high voltage and specialty cables. Use DuraSeal splice sleeves where there are special requirements such as moisture sealing. Follow the instructions below in order to splice copper wire using DuraSeal splice sleeves.

Splice Sleeve Selection

Splice Sleeve Color	Crimp Tool Nest Color		Wire Gauge mm ² / (AWG)
	3 Crimp Nests	4 Crimp Nests	
Salmon (Yellow-Pink) 19300089	Red (1) or Red/Green (1)	Red (2)	0.22 - 0.8/ (18 - 26)
Blue 19168447	Blue (2)	Blue (3)	1.0 - 2.0/ (14 - 16)
Yellow 19168448	Yellow (3)	Yellow (4)	3.0 - 5.0/ (10 - 12)

NOTE: You must perform the following procedures in the listed order. Repeat the procedure if any wire strands are damaged. You must obtain a clean strip with all of the wire strands intact.

1. Open the harness by removing any tape:
 - Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
 - Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.
 - Do not use the crimp and DuraSeal splice sleeve to form a splice with more than 2 wires coming together.
2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.

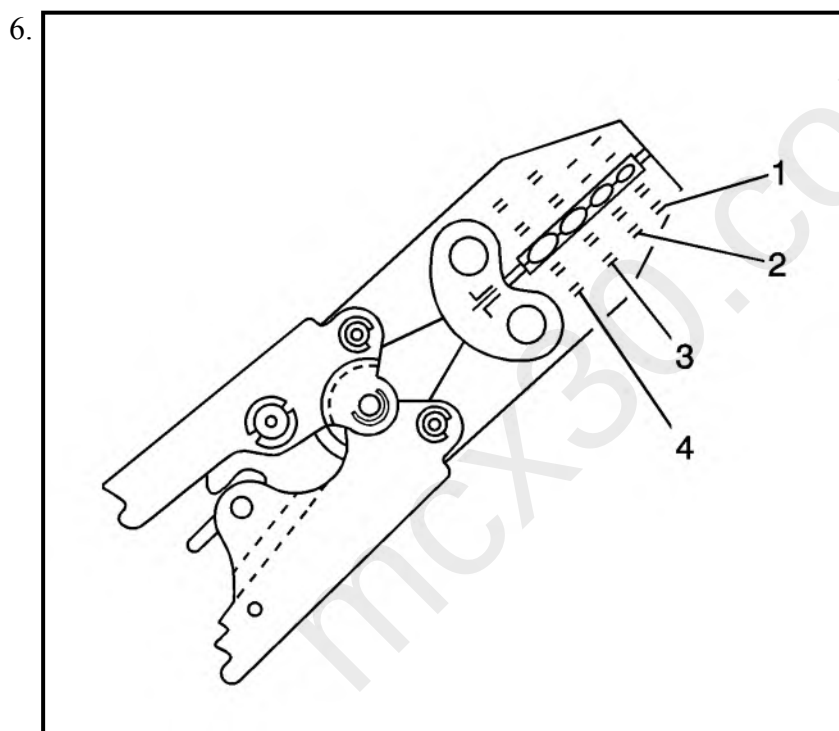
Adjust splice locations so that each splice is at least 40 mm (1.5 in) away from the other splices, harness branches, or connectors.

3. Strip the insulation:

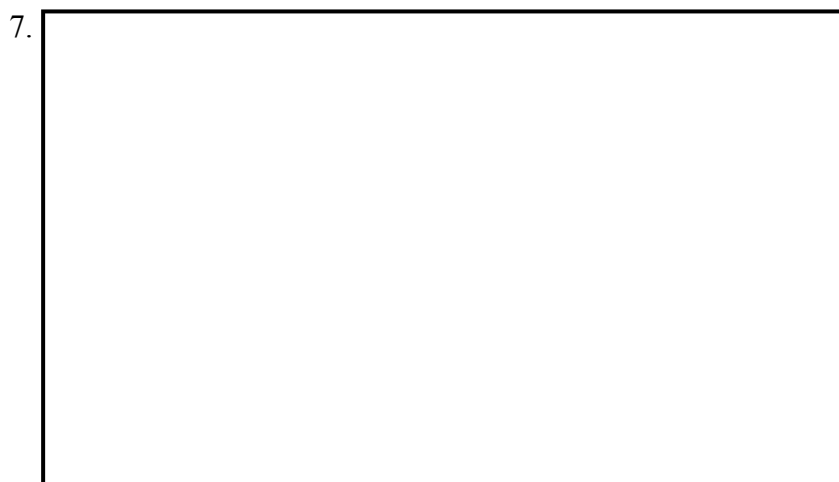
- When adding a length of wire to the existing harness, use the same size wire as the original wire.
- Perform one of the following items in order to find the correct wire size:
 - Find the wire on the schematic and convert to regional wiring gauge size.
 - If you are unsure of the wire size, begin with the largest opening in the wire stripper and work down until achieving a clean strip of the insulation.
- Strip approximately 5.0 mm (0.20 in) of insulation from each wire to be spliced.
- Do not nick or cut any of the strands. Inspect the stripped wire for nicks or cut strands.
- If the wire is damaged, repeat this procedure after removing the damaged section.

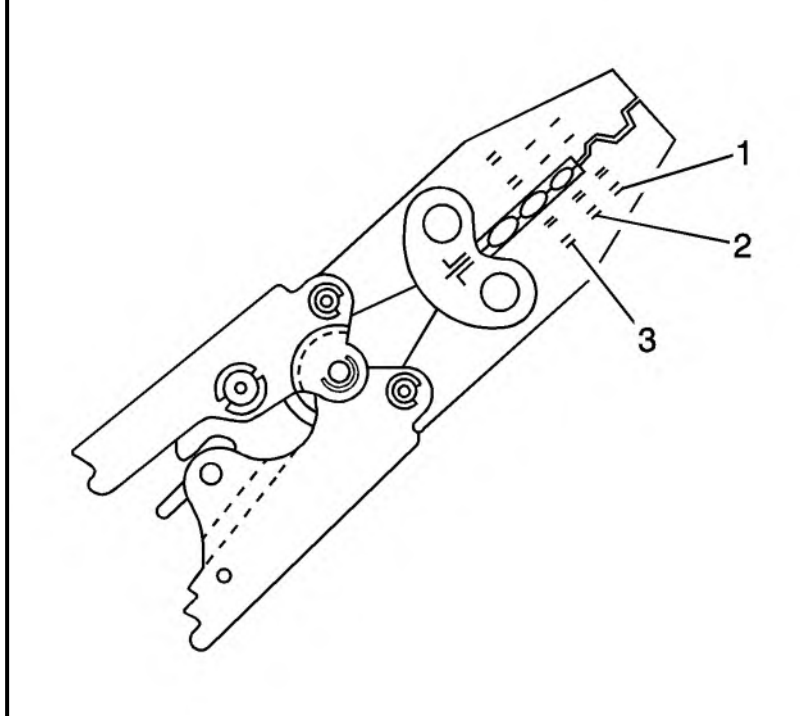
4. For high temperature wiring, slide a section of high temperature SCT1 shrink tubing down the length of wire to be spliced. Ensure that the shrink tubing will not interfere with the splice procedure.

5. Select the proper DuraSeal splice sleeve according to the wire size. Refer to the above table at the beginning of the repair procedure for the color coding of the DuraSeal splice sleeves and the crimp tool nests.



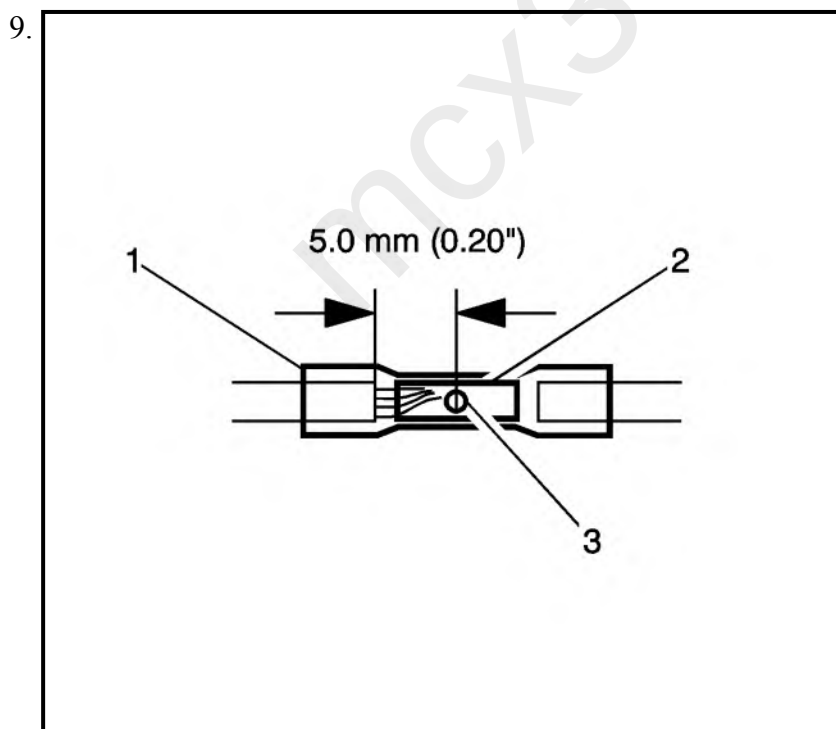
The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest crimp nest (1) is used for crimping 22 to 26 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.



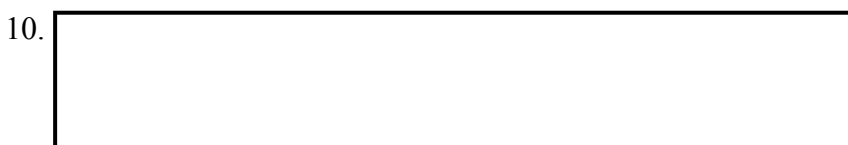


The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

8. Use the splice sleeve crimp tool in order to position the DuraSeal splice sleeve in the proper color nest of the splice sleeve crimp tool. For the four crimp nest tool, use the three largest crimp nests to crimp the splice sleeves. For the three crimp nest tool, use all three crimp nests to crimp the splice sleeves. Use the four and three crimp tool diagrams (above) and the table (farther above) to match the splice sleeve with the correct crimp nest. The crimp tool diagram callout numbers match the numbers in the table (under crimp tool nest color).



Place the DuraSeal splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the DuraSeal splice sleeve in the proper nest.



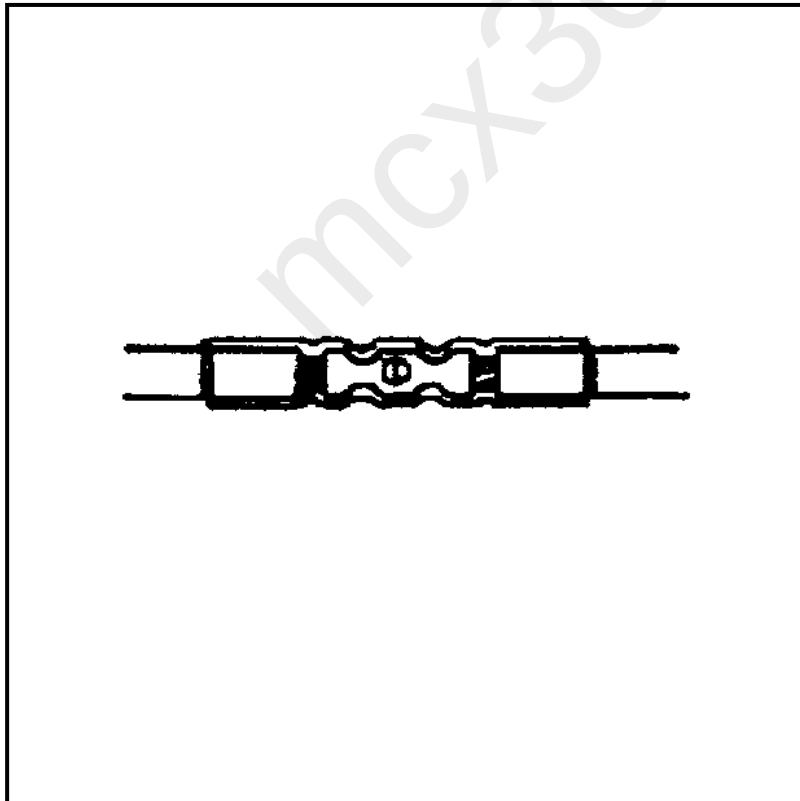


Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

11. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Repeat steps 4 and 6 for the opposite end of the splice.

- 12.

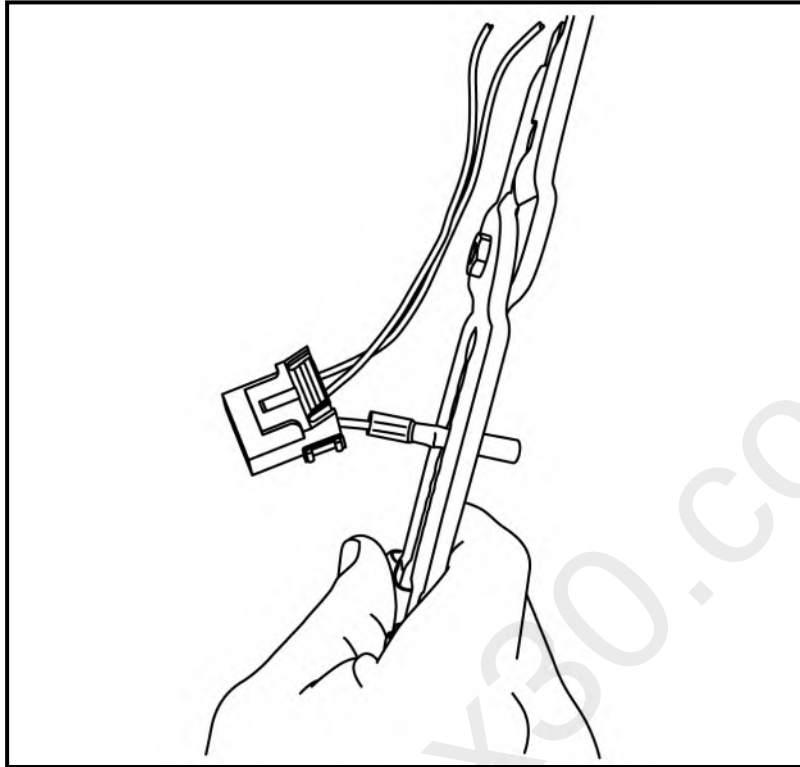


Using the heat torch, apply heat to the crimped area of the barrel.

13. Start in the middle and gradually move the heat barrel to the open ends of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

NOTE: Some replacement pigtail connectors may be delivered without the terminated leads installed into the connector. For Weatherpack™ connectors, all terminated leads included in the package should to be installed into the connector. If the connector end view shows that a terminal is not occupied, the extra terminated lead (s) need to be installed and the end (s) sealed using a DuraSeal splice sleeve and taped back into the harness.

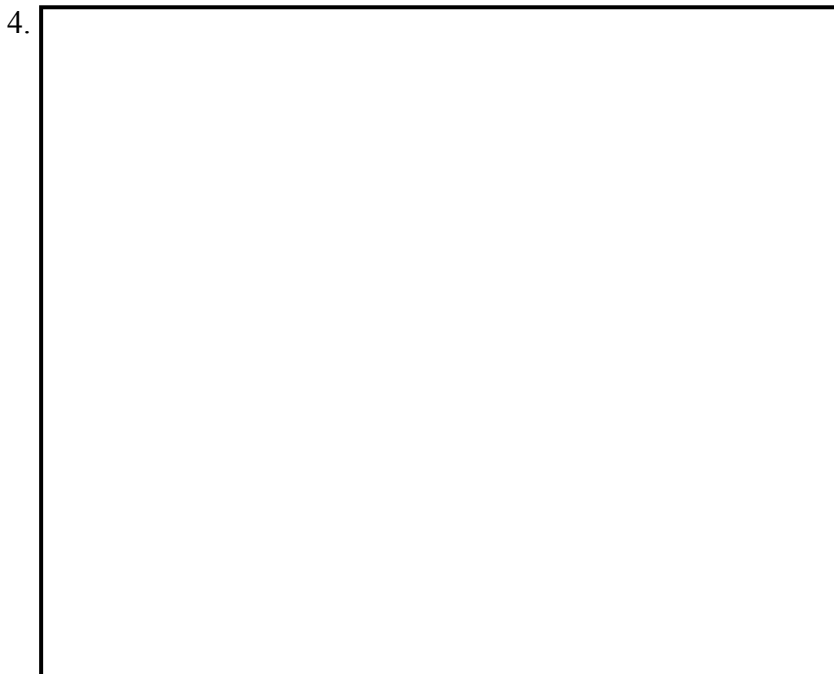
1. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to [Folded-Over Wire Repair](#) for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

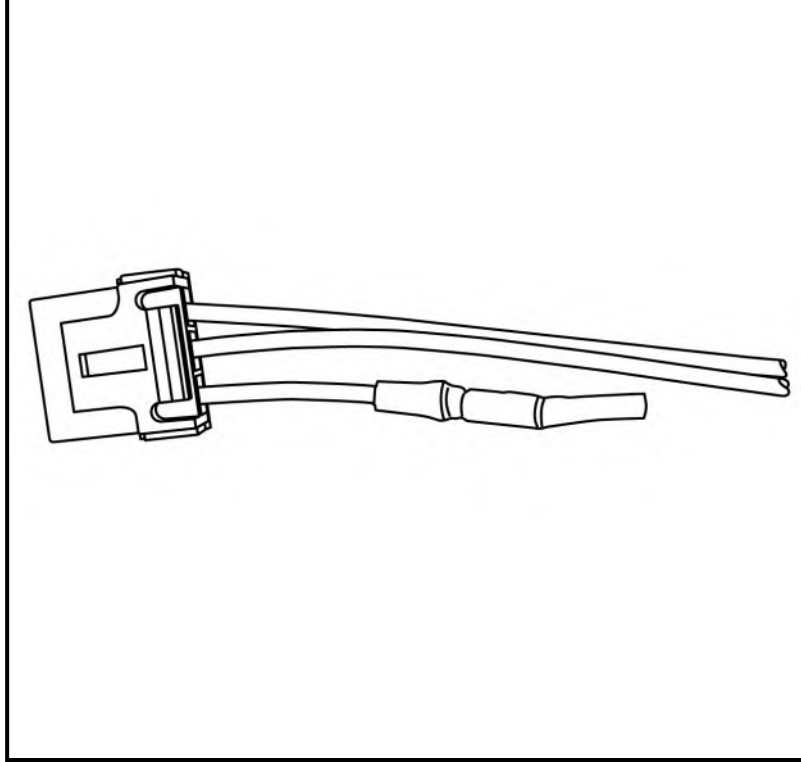


2. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Holding the DuraSEAL with one hand gently tug on the wire to ensure it is crimped in the DuraSeal.

3. Using the heat torch, apply heat to the crimped area of the barrel.

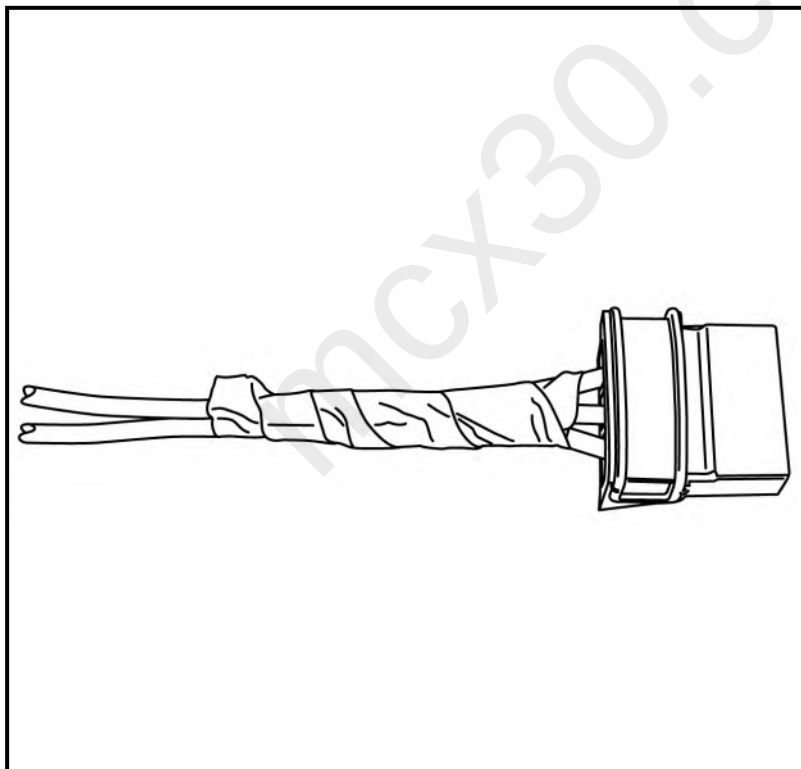




Start in the middle and gradually move the heat barrel to the open ends of the tubing:

- The tubing will shrink completely as the heat is moved along the insulation.
- A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

5.



Tape the extra terminated lead (s) back into the harness.

High Temperature Wiring Repairs

Use the following procedures to perform high temperature wiring repairs:

1. Center the high temperature SCT1 shrink tube over the DuraSeal splice sleeve.
2. Using the heat torch, apply heat to the high temperature heat shrink tubing.
3. Gradually move the heat from the center to the open end of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.

- A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

4. Replace any reflective tape and clips that may have been removed during the repair.

CONNECTOR RECONNECTION - ENGINE CONTROLS AND FUEL

Special Tools

EL-35616 Terminal Test Probe Kit

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

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Loose, corroded, or painted terminal stud/fastener
- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- A terminal not seated all the way into the connector body
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself, and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.
- Wiring which has been pinched, cut, or its insulation rubbed through may cause an intermittent open or short as the bare area touches other wiring or parts of the vehicle.
- Wiring that comes in contact with hot or exhaust components
- Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to [Testing for Electrical Intermittents](#) for test procedures to detect intermittent open, high resistance, short to ground, and short to voltage conditions.
- Refer to [Scan Tool Snapshot Procedure](#) for advanced intermittent diagnosis and Vehicle Data Recorder operation.

Testing for Terminal Fretting

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel, and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease / lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself, or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves, or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact, or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals, and connector body.
3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks, or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses, and any intermediate connections between the voltage source and the module/component. A test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) , and [Power Distribution Wiring Schematics](#) .
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to

be tested. Inspect grounds for clean and tight connections at the grounding point (screw or stud). Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) , and [Ground Distribution Wiring Schematics](#) .

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold, or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot, or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection, or high electrical load
 - Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay, or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to [Checking Aftermarket Accessories](#) .
- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

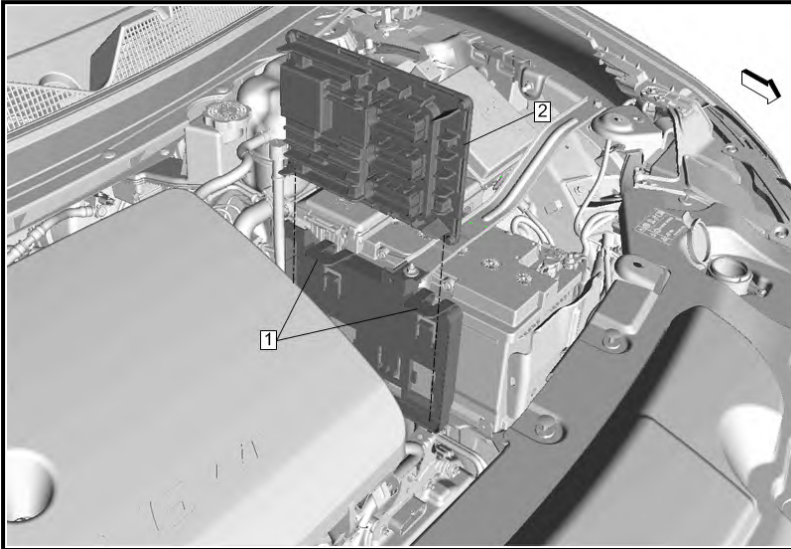
Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:
 - A new service control module is installed.
 - A control module from another vehicle is installed.
 - Revised software/calibration files have been released for this vehicle.

NOTE: **DO NOT re-program the control module with the SAME software/calibration files that are already present in the control module. This is not an effective repair for any type of concern.**

- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to [Control Module References](#) for replacement, setup, and programming.

ENGINE CONTROL MODULE REPLACEMENT

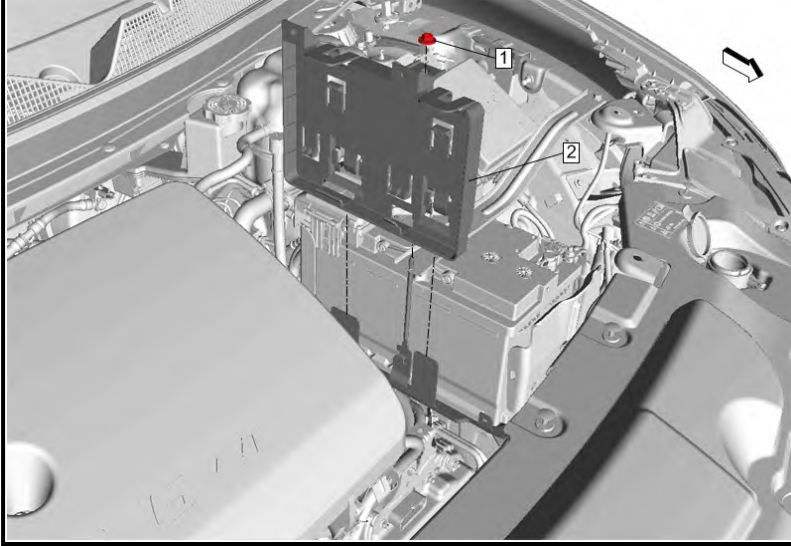


Callout	Component Name
Preliminary Procedure	
Disconnect the negative battery cable. Battery Negative Cable Disconnection and Connection (KL9)	
1	Engine Control Module Bracket Retaining Tab [2x]

Callout	Component Name
2	Engine Control Module WARNING: Refer to Safety Glasses Warning . CAUTION: Always turn the ignition off when installing or removing the ECM connectors in order to prevent damage to the components. CAUTION: • Turn the ignition OFF when installing or removing the control module connectors and disconnecting or reconnecting 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 no touch the connector pins or the soldered components on the circuit board. • Remove any debris from around the control module connector surfaces before servicing the 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. 2. If replacing, program the ECM. Control Module References 3. If replacing, perform the Crankshaft Position Variation Learn. Crankshaft Position Variation Learn NOTE: Before removing the engine control module (ECM), record the oil life percentage remaining. Use the scan tool to reset the Engine Oil Life remaining back to the original percentage recorded.

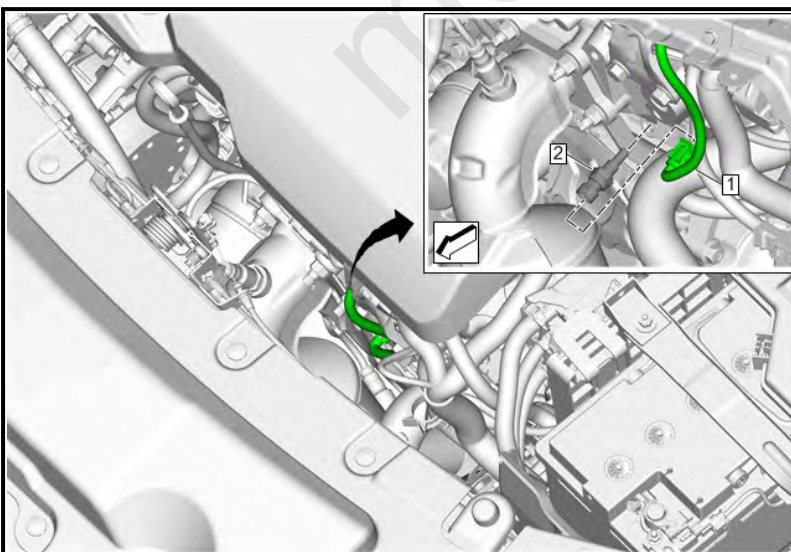
ENGINE CONTROL MODULE BRACKET REPLACEMENT





Callout	Component Name
Preliminary Procedures 1. <u>Engine Control Module Replacement</u> 2. Radiator Surge Tank Overflow Hose @ Engine Control Module Bracket - Reposition away - <u>Radiator Surge Tank Overflow Hose Replacement (LFY Radiator Surge Tank to Engine Coolant Air Bleed Pipe)</u> <u>Radiator Surge Tank Overflow Hose Replacement (LFY Engine Coolant Air Bleed Pipe to Radiator)</u>	
1	Engine Control Module Bracket Nut CAUTION: Refer to <u>Fastener Caution</u> . Tighten 9 N.m (80 lb in)
2	Engine Control Module Bracket

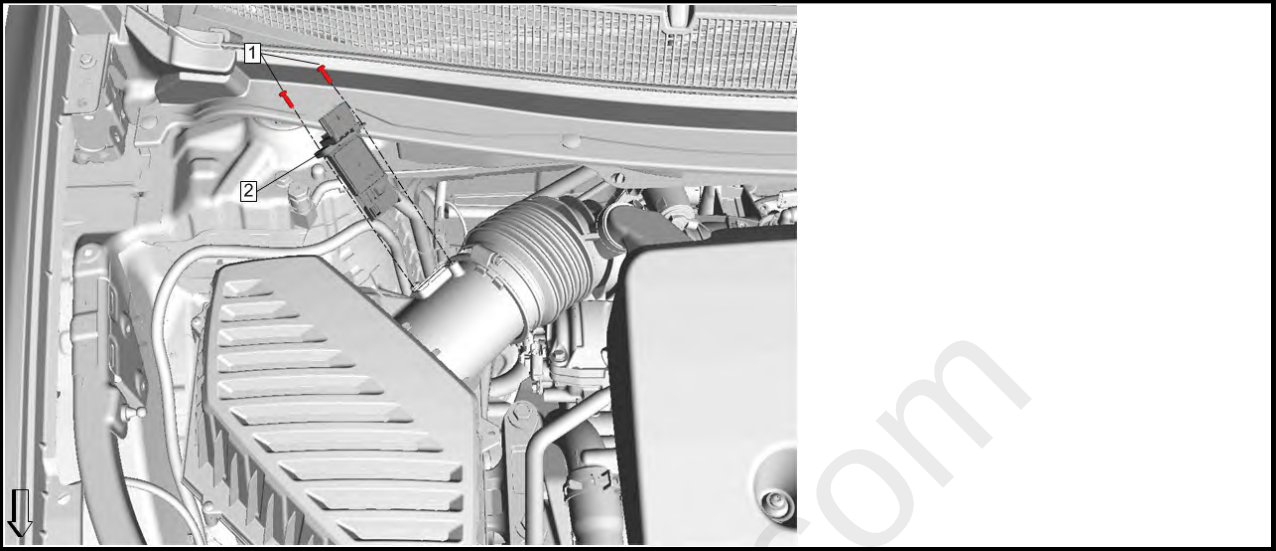
ENGINE COOLANT TEMPERATURE SENSOR REPLACEMENT



Callout	Component Name
Preliminary Procedure <u>Cooling System Draining and Filling.(GE 47716)</u> <u>Cooling System Draining and Filling (Static Fill)</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.

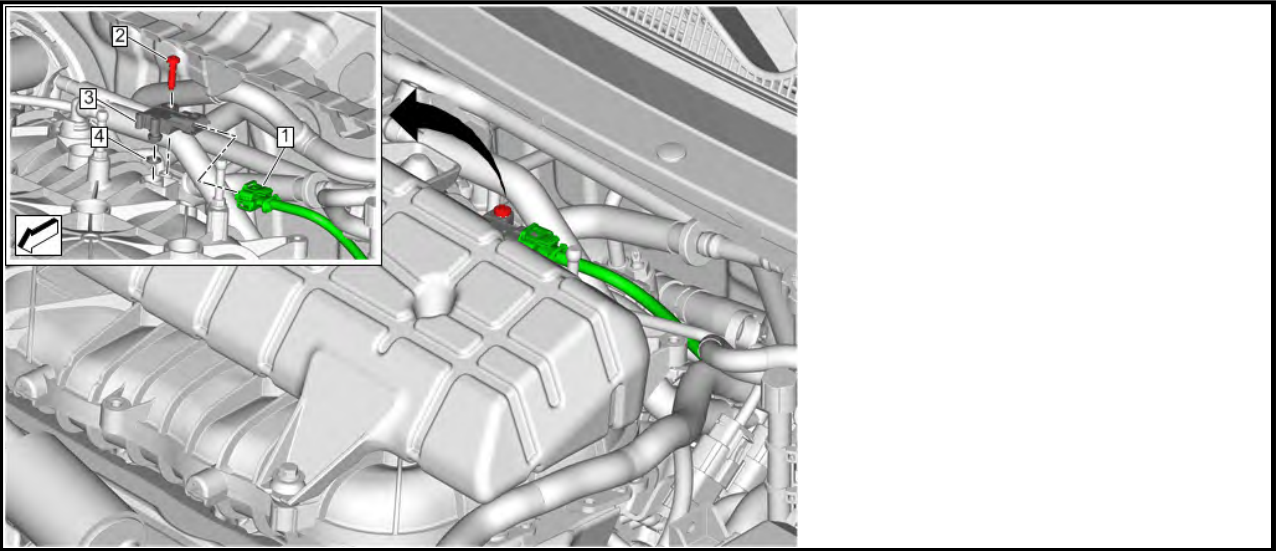
Callout	Component Name
2	Engine Coolant Temperature Sensor CAUTION: Refer to Component Fastener Tightening Caution . Tighten 22 N.m (16 lb ft)

MASS AIRFLOW SENSOR WITH INTAKE AIR TEMPERATURE SENSOR REPLACEMENT



Callout	Component Name
1	Mass Airflow Sensor Bolt [2x] CAUTION: Refer to Fastener Caution . Tighten 4 N.m (35 lb in)
2	Mass Airflow Sensor Procedure Disconnect the electrical connector.

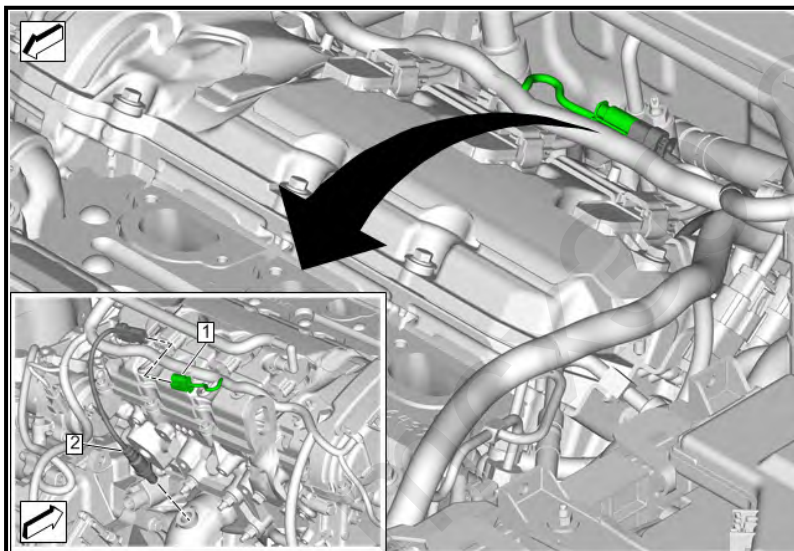
MANIFOLD ABSOLUTE PRESSURE SENSOR REPLACEMENT



Callout	Component Name
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Callout	Component Name
Preliminary Procedure <u>Intake Manifold Cover Replacement</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Manifold Absolute Pressure Sensor Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 4 N.m (35 lb in)
3	Manifold Absolute Pressure Sensor
4	Manifold Absolute Pressure Sensor Seal NOTE: ALWAYS install the seal supplied with the manifold absolute pressure sensor.

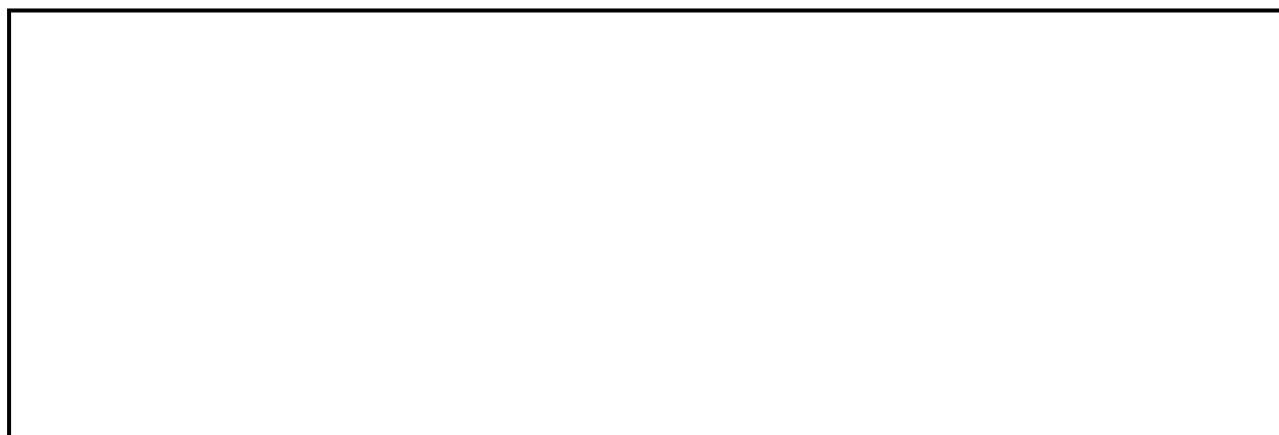
HEATED OXYGEN SENSOR REPLACEMENT - BANK 1 SENSOR 1

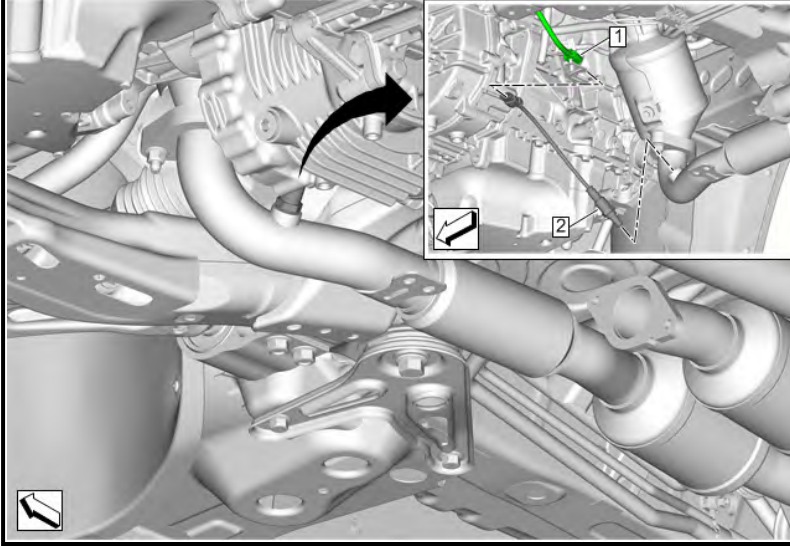


Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	
Preliminary Procedure <u>Upper Intake Manifold Replacement</u>	
1	Electrical Connector

Callout	Component Name
2	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 If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48Â°C (120Â°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. Adhesives, Fluids, Lubricants, and Sealers Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools

HEATED OXYGEN SENSOR REPLACEMENT - BANK 1 SENSOR 2 (AWD)

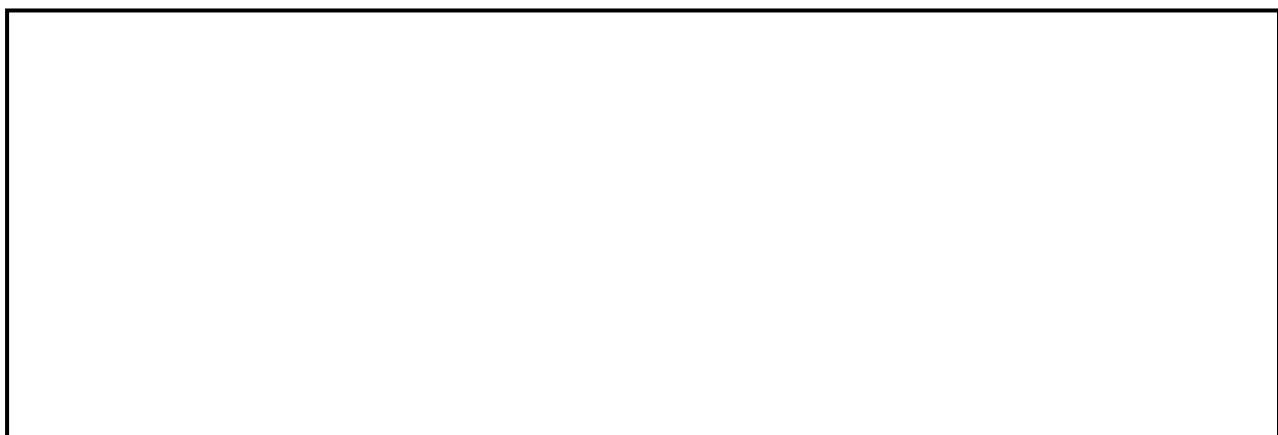


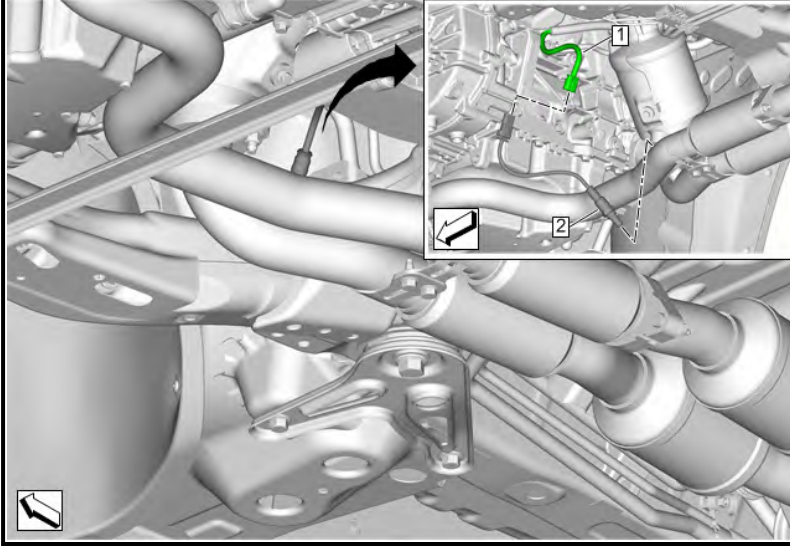


Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.	
WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	
Preliminary Procedure <u>Exhaust Front Pipe Replacement (LFY)</u>	
1	Electrical Connector

Callout	Component Name
2	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 If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48Â°C (120Â°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. Adhesives, Fluids, Lubricants, and Sealers Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools

HEATED OXYGEN SENSOR REPLACEMENT - BANK 1 SENSOR 2 (FWD)

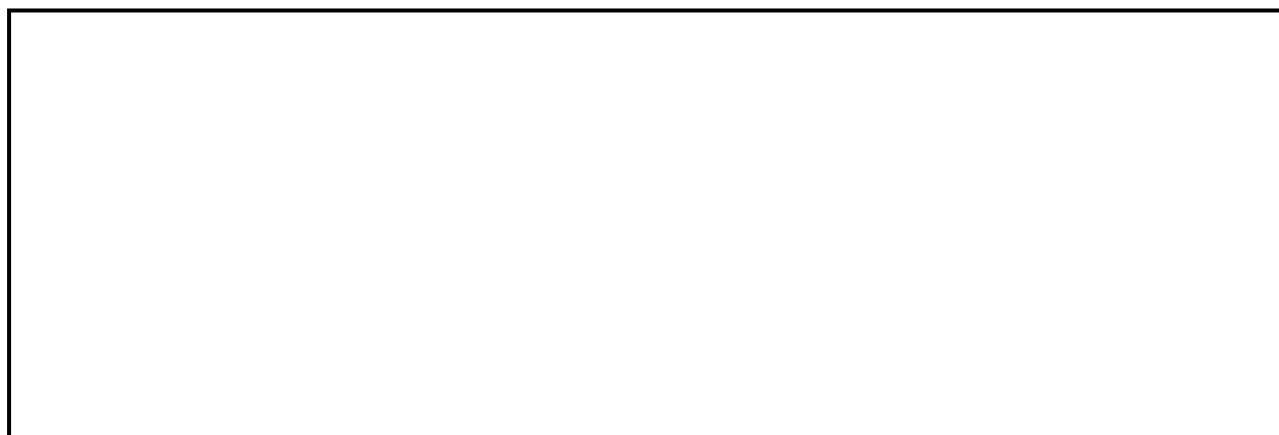


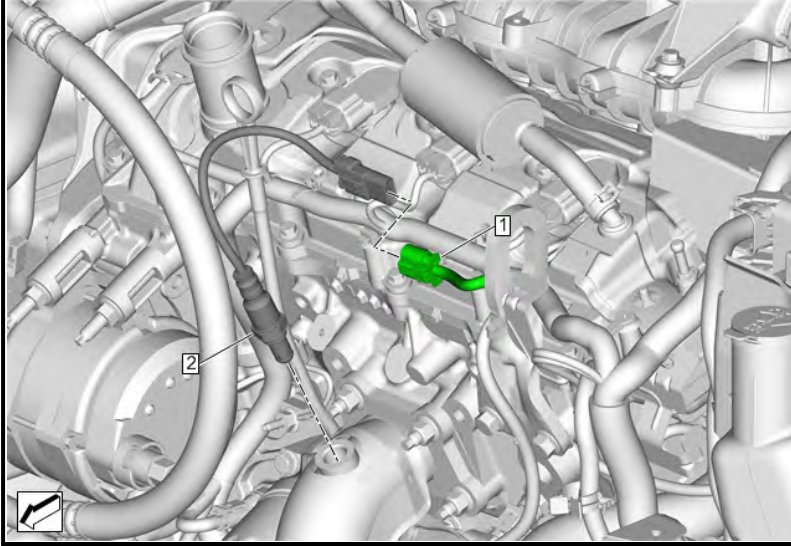


Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.	
WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	
Preliminary Procedure Raise and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

Callout	Component Name
2	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 If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48Â°C (120Â°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. Adhesives, Fluids, Lubricants, and Sealers Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools

HEATED OXYGEN SENSOR REPLACEMENT - BANK 2 SENSOR 1

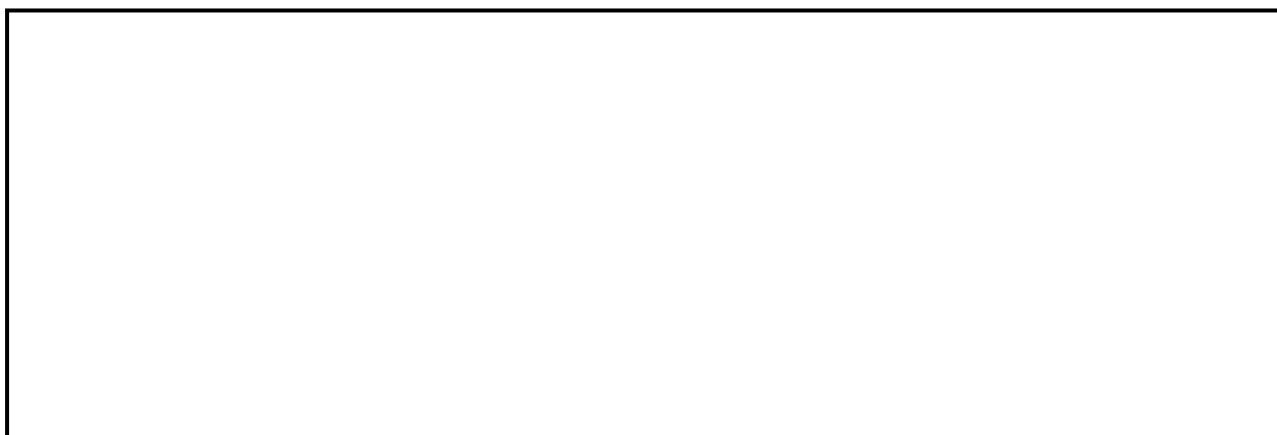


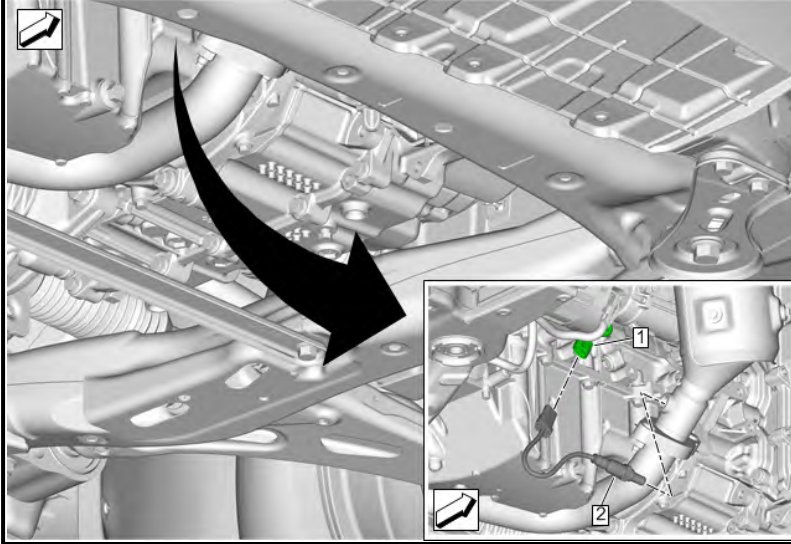


Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.	
WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	
Preliminary Procedure <u>Intake Manifold Cover Replacement</u>	
1	Electrical Connector

Callout	Component Name
2	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 If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48Â°C (120Â°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. Adhesives, Fluids, Lubricants, and Sealers Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools

HEATED OXYGEN SENSOR REPLACEMENT - BANK 2 SENSOR 2 (AWD)

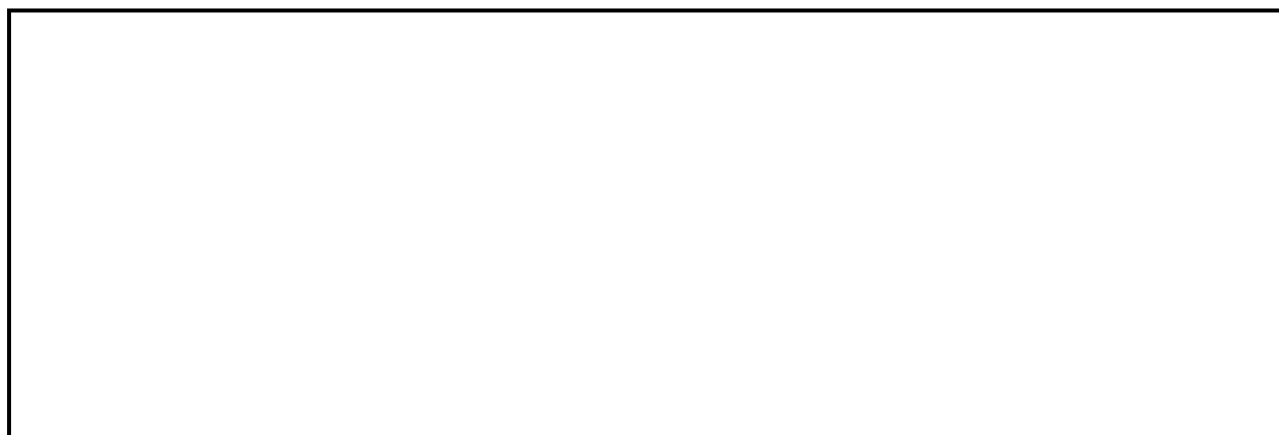


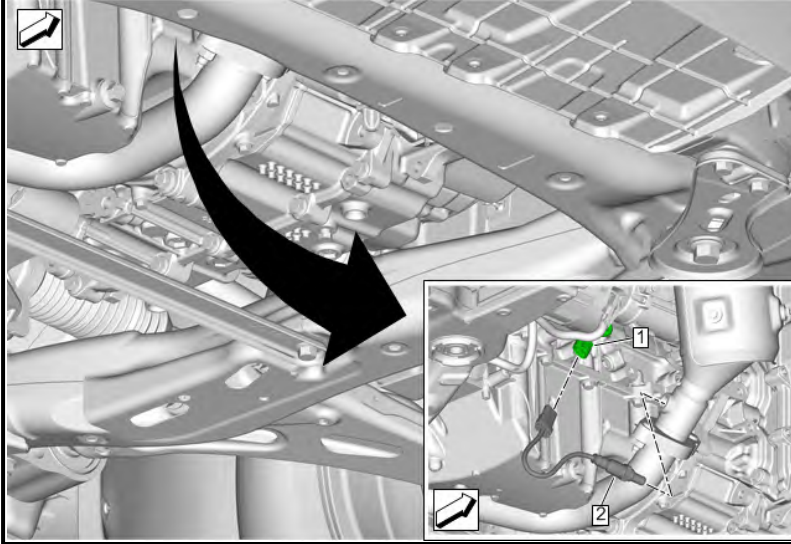


Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury. Preliminary Procedure Raise and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

Callout	Component Name
2	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 If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48Â°C (120Â°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. Adhesives, Fluids, Lubricants, and Sealers Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools

HEATED OXYGEN SENSOR REPLACEMENT - BANK 2 SENSOR 2 (FWD)



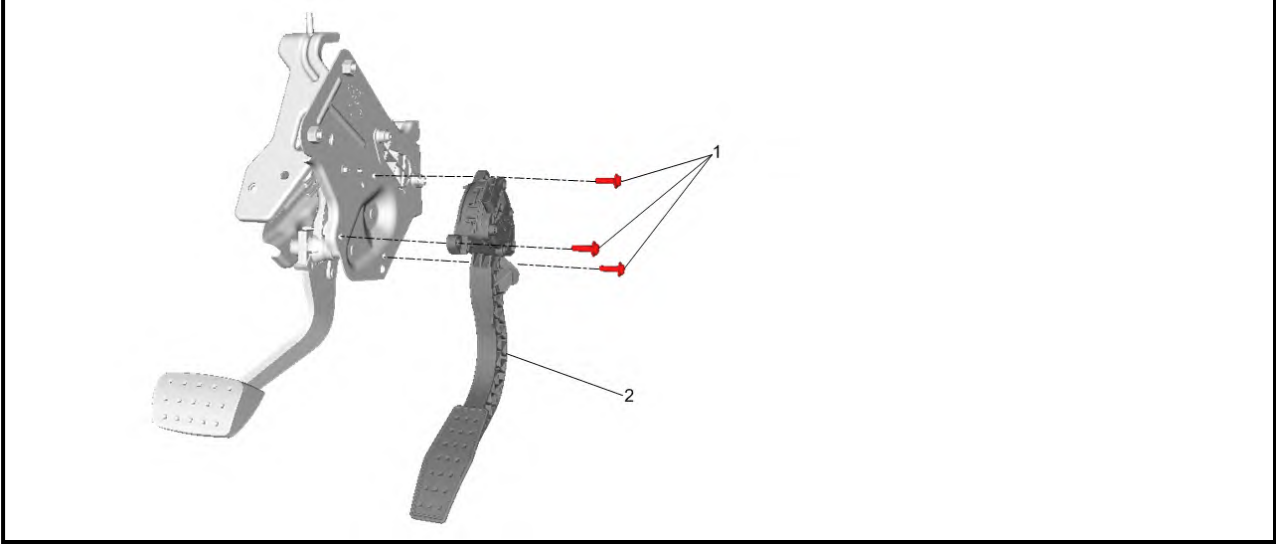


Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury. Preliminary Procedure Raise and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

Callout	Component Name
2	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 If replacing, perform the HO2S heater resistance learned values reset. HO2S Heater Resistance Learned Values Reset NOTE: • The heated oxygen sensor in-line connector and louvered end MUST be kept clear of all grease, dirt, and other contaminants. Do NOT use cleaning solvents of any type. Do NOT drop or roughly handle the sensor. • The heated oxygen sensor MAY be difficult to remove when the engine temperature is less than 48Â°C (120Â°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. Adhesives, Fluids, Lubricants, and Sealers Tighten 42 N.m (31 lb ft) Special Tools J-39194 Oxygen Sensor Wrench Equivalent regional tools: Special Tools

ACCELERATOR PEDAL WITH POSITION SENSOR ASSEMBLY REPLACEMENT



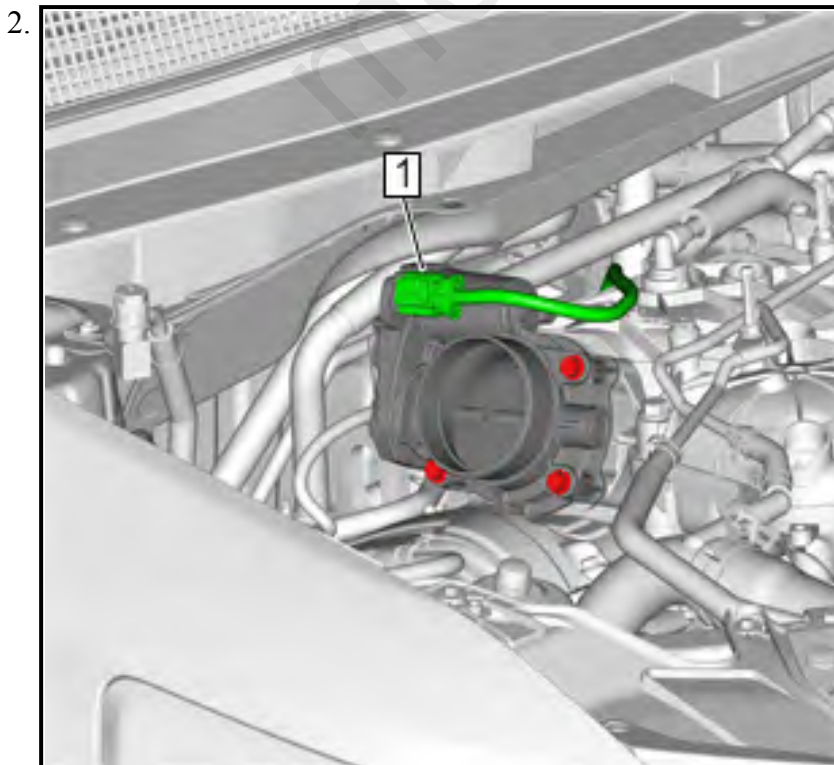


Callout	Component Name
Preliminary Procedure Front Floor Console Extension Panel Replacement - Left Side	
1	Accelerator Pedal Position Sensor Fastener [3x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 2.5 N.m (22 lb in)
2	Accelerator Pedal Position Sensor Procedure Disconnect the electrical connector.

THROTTLE BODY ASSEMBLY REPLACEMENT

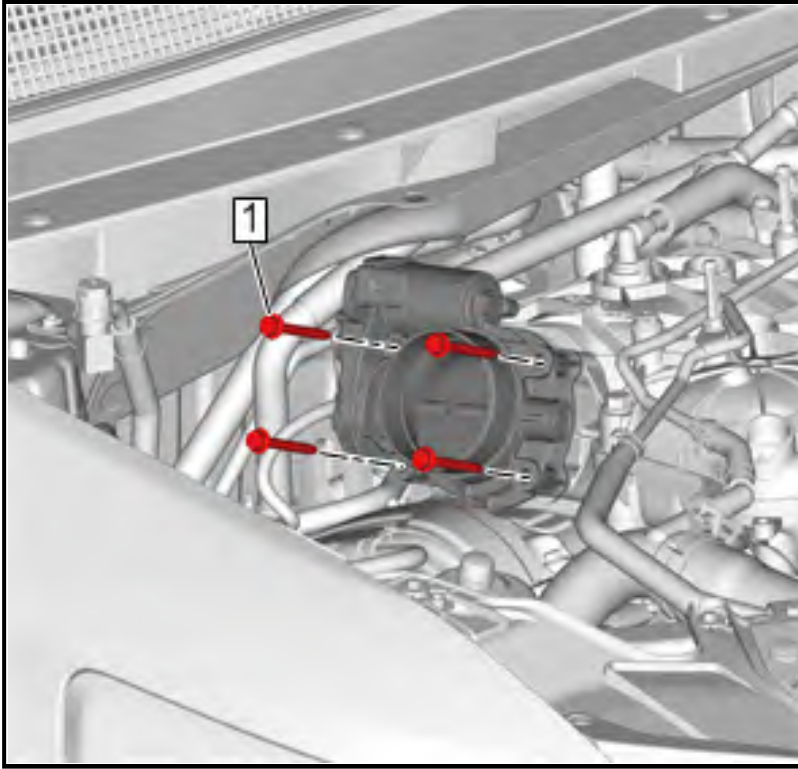
Removal Procedure

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



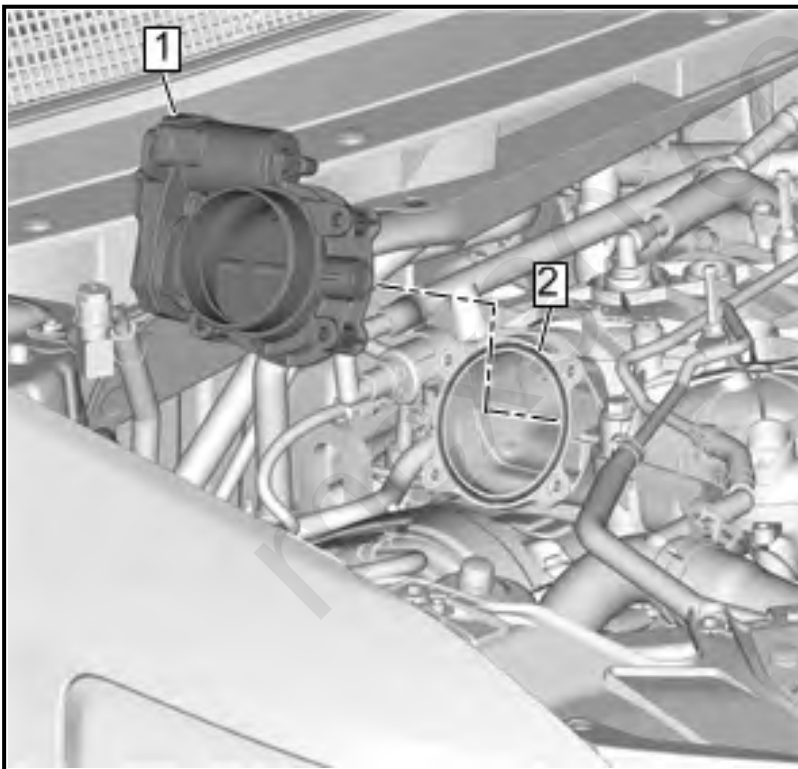
Disconnect the electrical connector (1).

3.



Remove the throttle body bolts (1).

4.



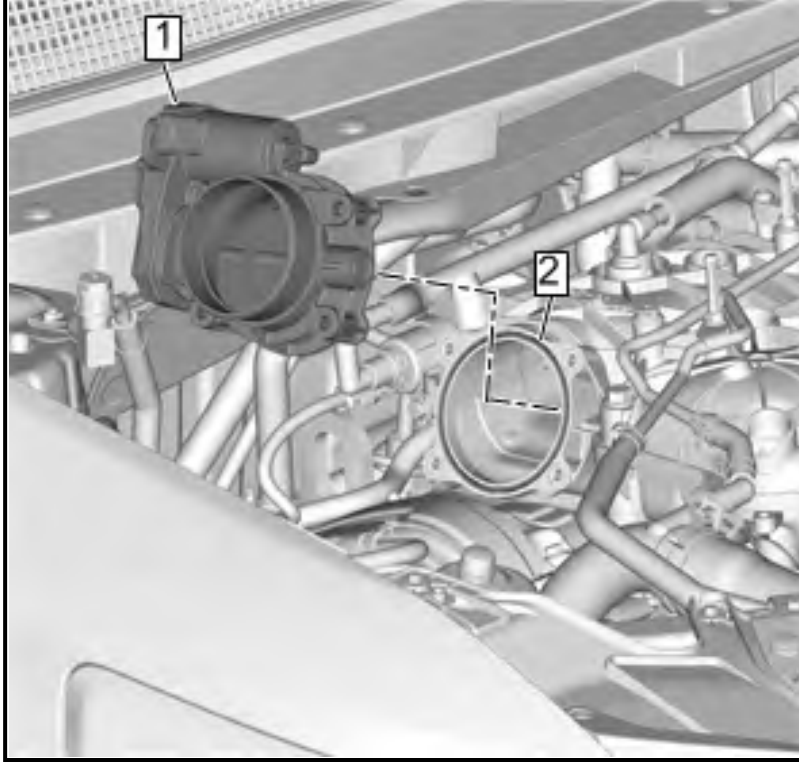
Remove the throttle body (1).

5. Remove and DISCARD the throttle body gasket (2).

Installation Procedure

1.

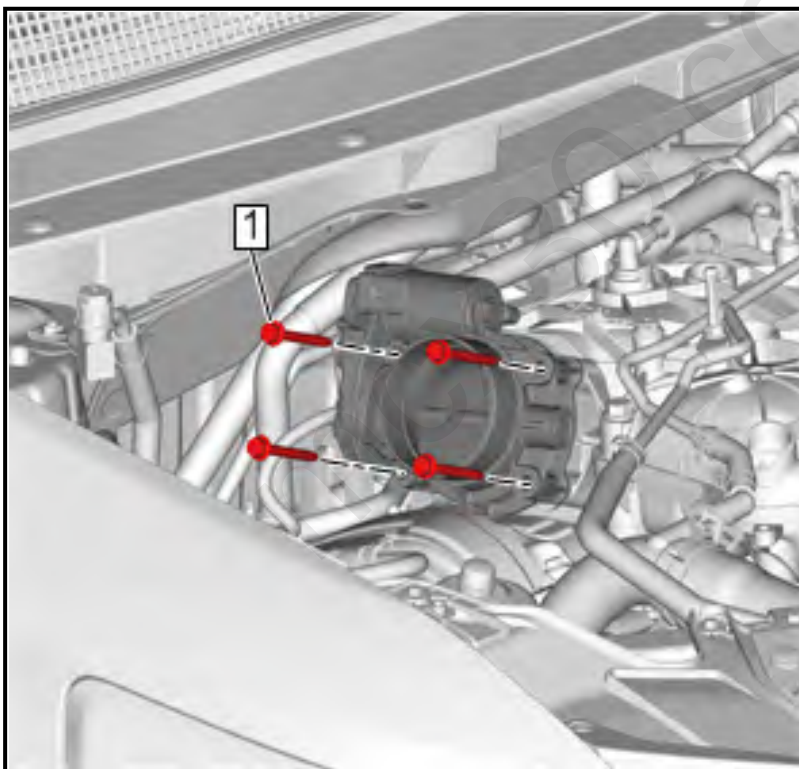




Install a NEW throttle body gasket (2) in the upper intake manifold.

2. Position the throttle body (1) to the upper intake manifold.

3.

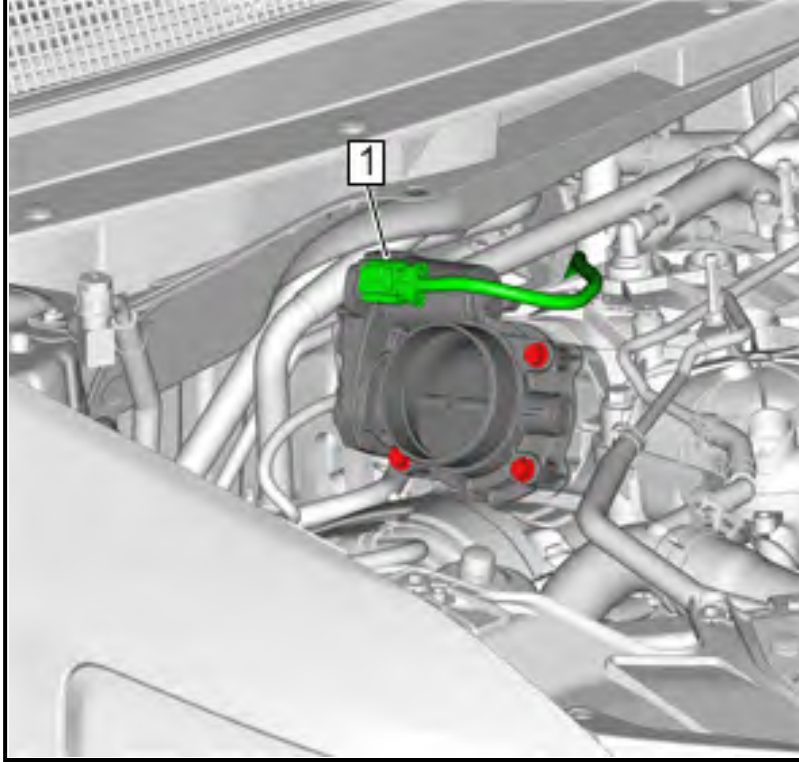


CAUTION: Refer to [Fastener Caution](#) .

Install the throttle body bolts (1) and tighten to 10 N.m (89 lb in).

4.





Connect the electrical connector (1).

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

THROTTLE BODY INSPECTION AND CLEANING

1. Remove the air cleaner outlet duct. [Air Cleaner Outlet Duct Replacement](#)
2. Fully open the throttle valve to inspect the throttle body bore and the throttle valve plate for any deposits.

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

- Throttle position (TP) sensor
- Idle air control (IAC) valve
- Sealed throttle shaft bearings

The cleaners will damage the electric components or sensors.

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

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

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

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

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

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

4. Install the air cleaner outlet duct. [Air Cleaner Outlet Duct Replacement](#)

FUEL PRESSURE RELIEF

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

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

Scan Tool Method - Preferred

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

Alternate Method - If a scan tool is not available

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

FUEL PRESSURE GAUGE INSTALLATION AND REMOVAL

Special Tools

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

Equivalent regional tools: [Special Tools](#)

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.

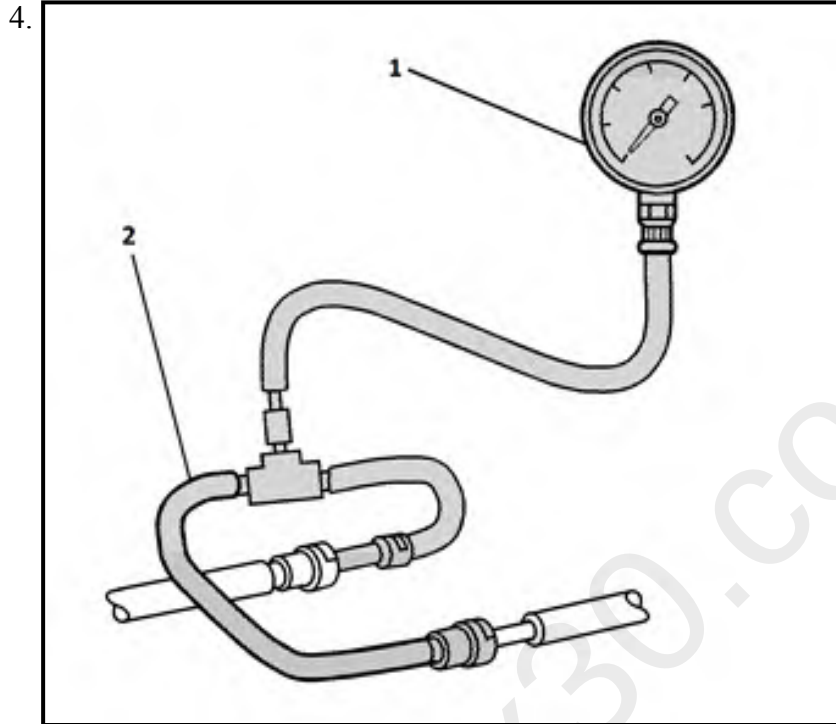
WARNING: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure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

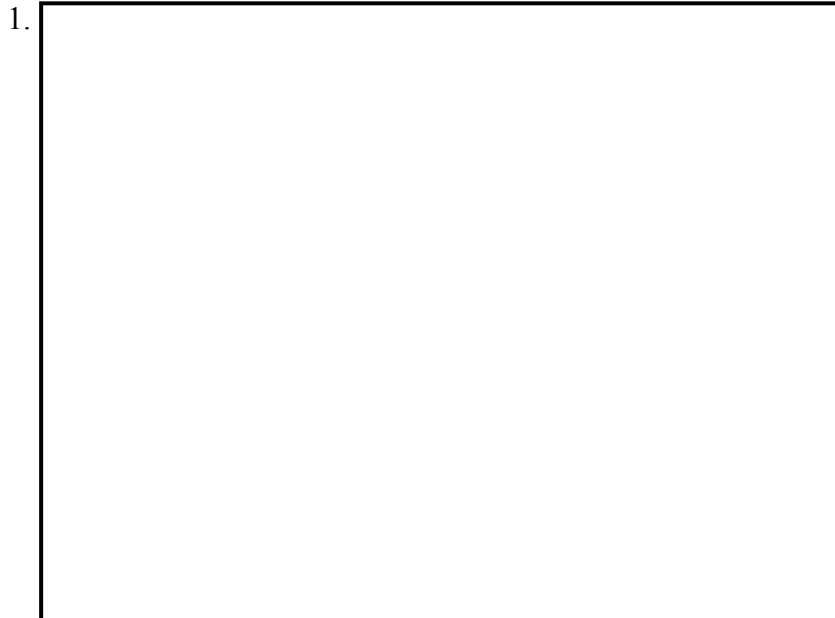


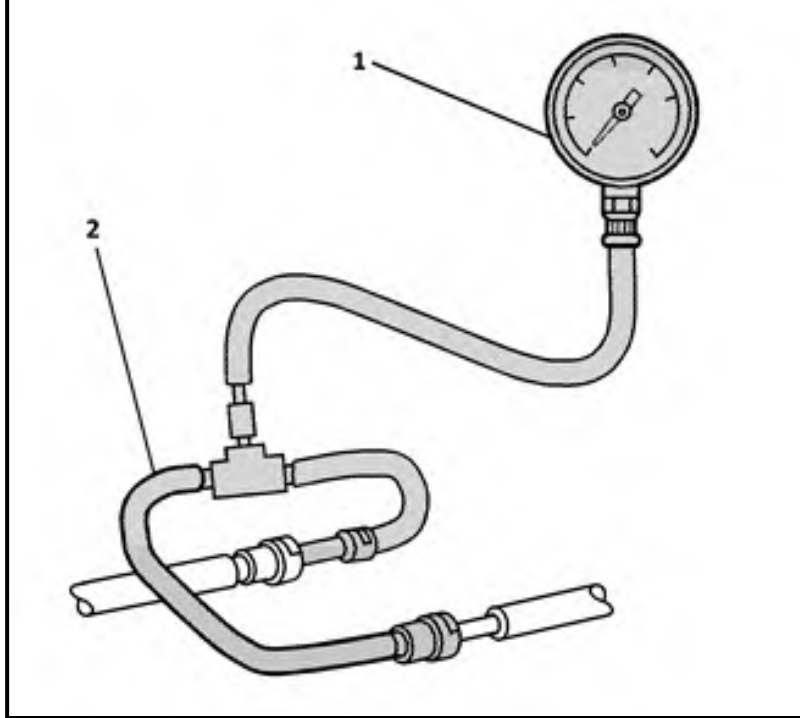
CAUTION: Refer to [Component Fastener Tightening Caution](#) .

Install the **CH-37287-1A** gauge (1) to the **CH-42982** adapter (2), and tighten securely.

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





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

- **CH-41769** Fuel Line Disconnect Tool Set
- **CH-44581** Fuel Line Disconnect Tool

Equivalent regional tools: [Special Tools](#)

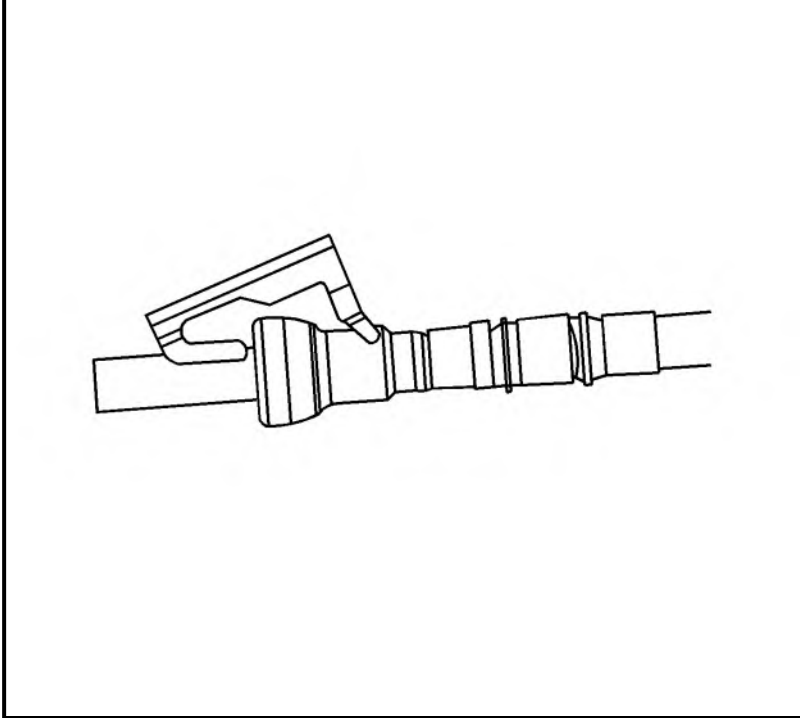
Removal Procedure

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

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

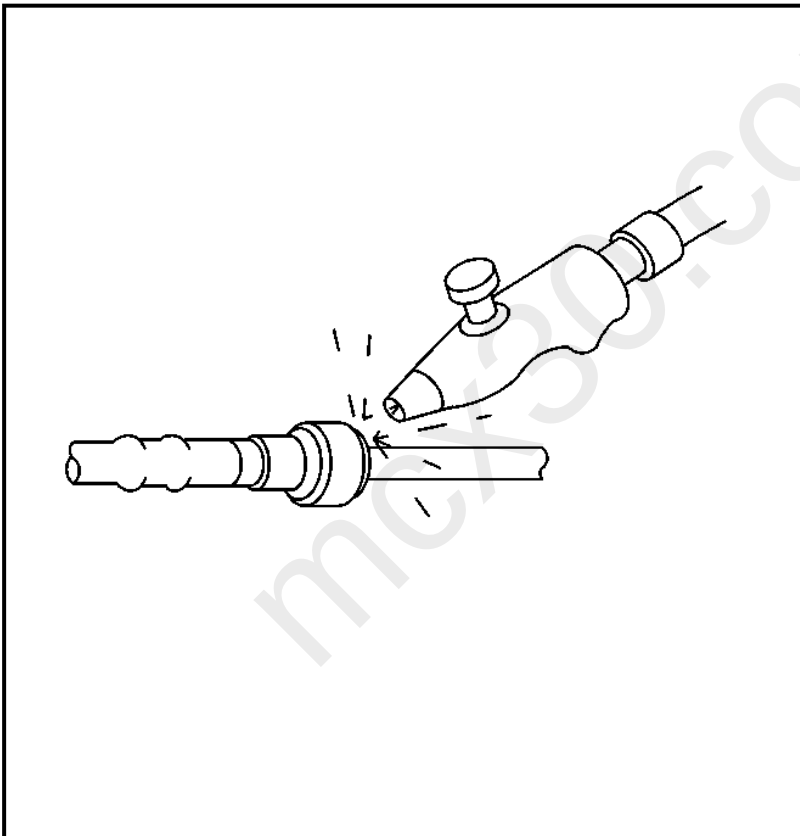
2.





Remove the retainer from the quick connect fitting.

3.

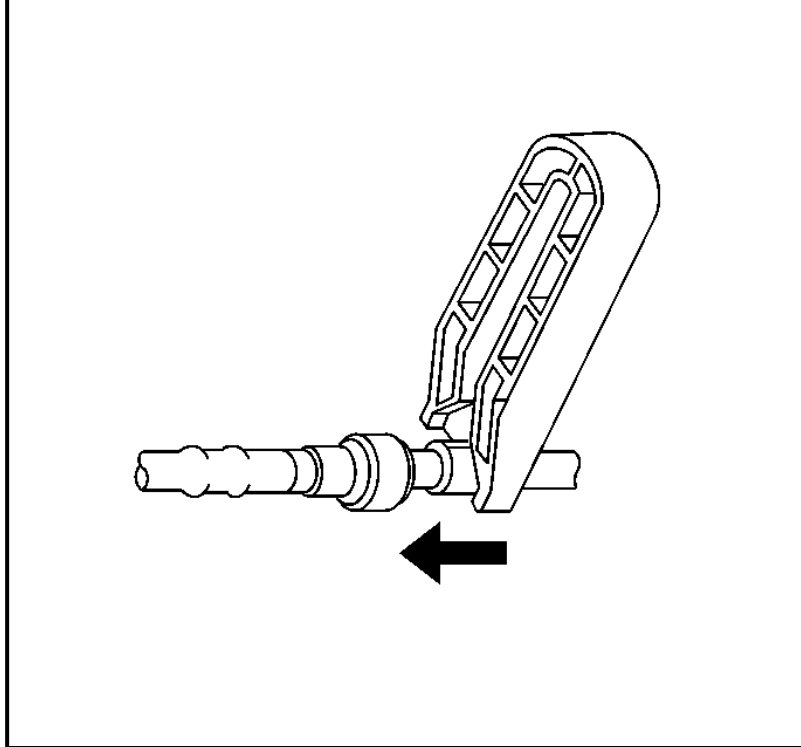


WARNING: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

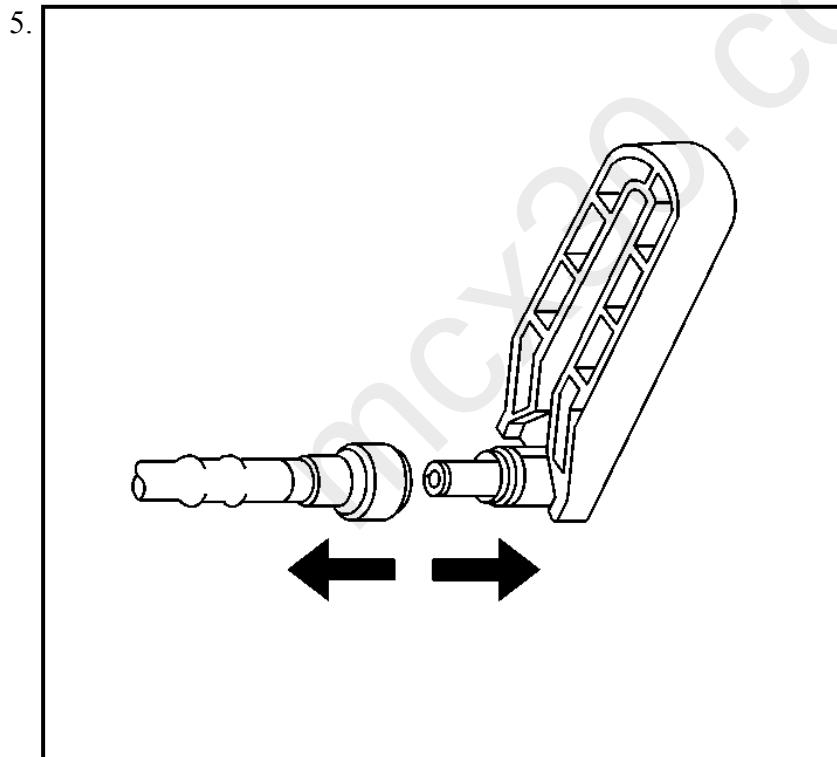
Blow dirt out of the fitting using compressed air.

4.





Depending on the fuel line size and ability to access the fitting, choose the appropriate tool: **CH-41769** fuel line disconnect tool set or **CH-44581** fuel line disconnect tool. Insert the **CH-41769** fuel line disconnect tool set or **CH-44581** fuel line disconnect tool into the female connector, then push inward to release the locking tabs.

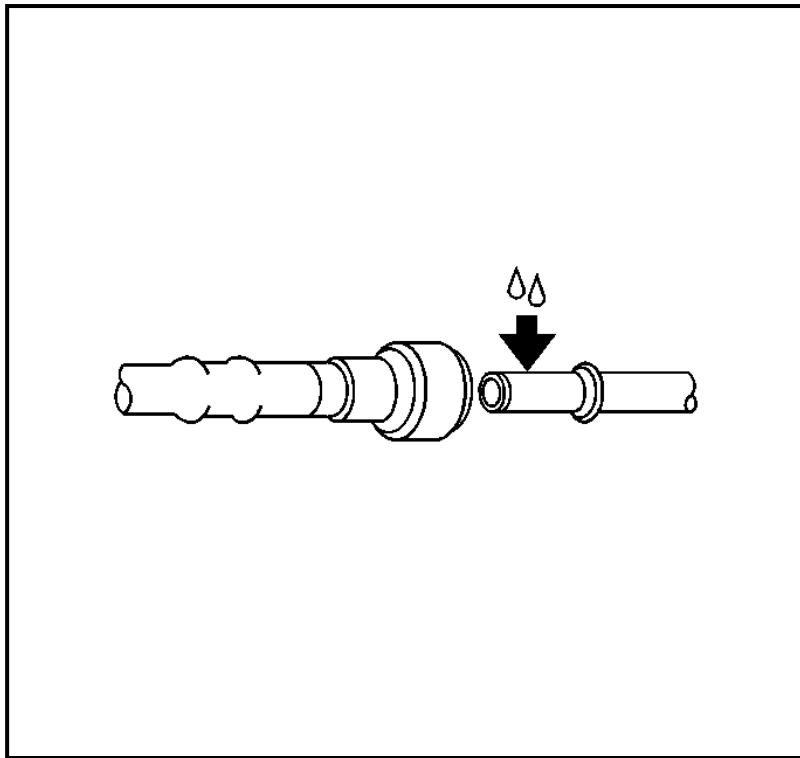


Pull the connection apart.

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.
8. Clean or replace the components as required.

1.



WARNING:

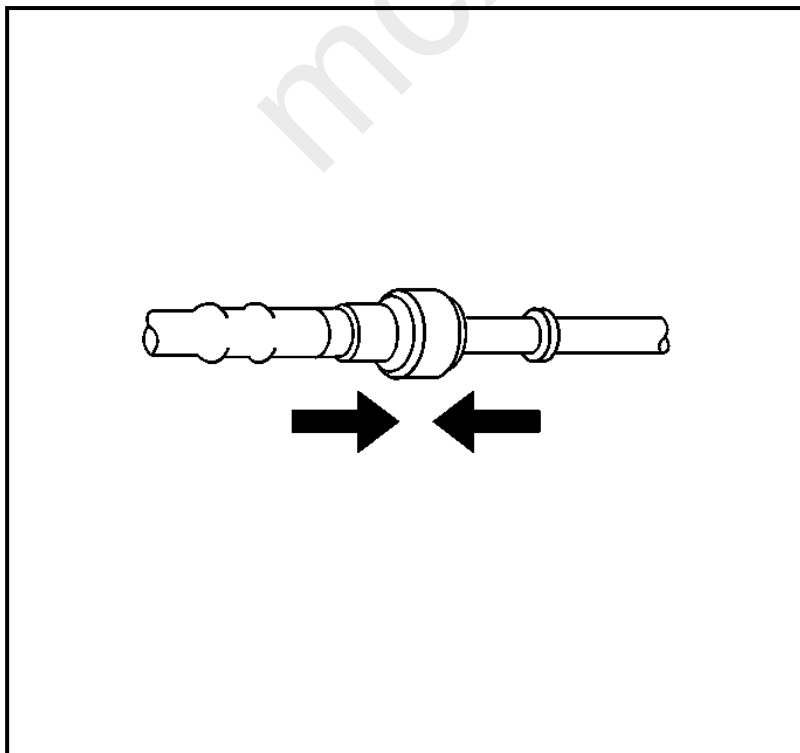
In order to reduce the risk of fire and personal injury, before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends.

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

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

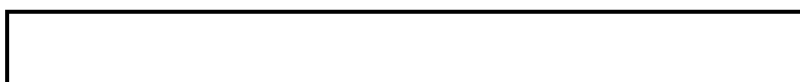
Apply a few drops of clean engine oil to the male pipe end.

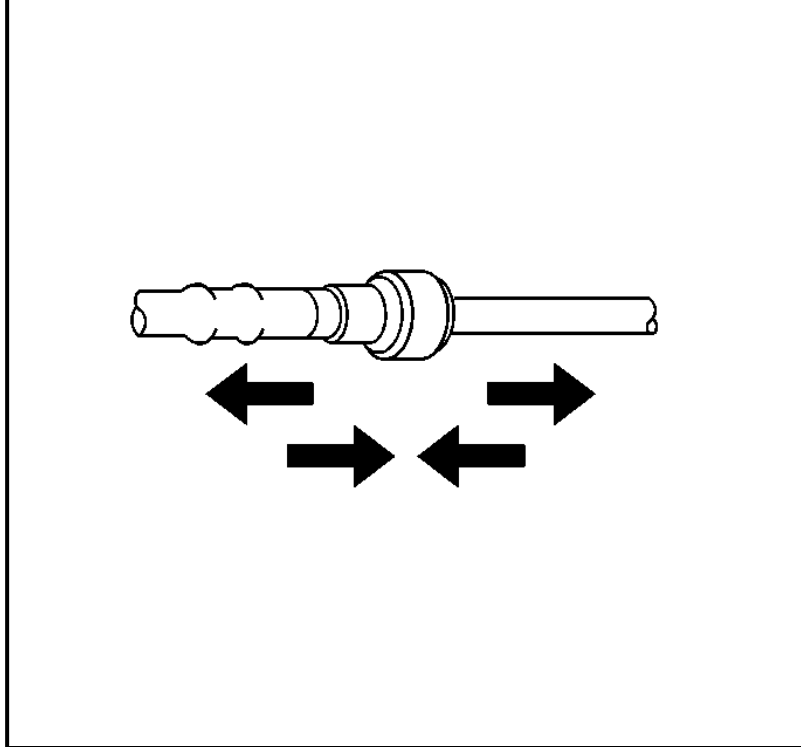
2.



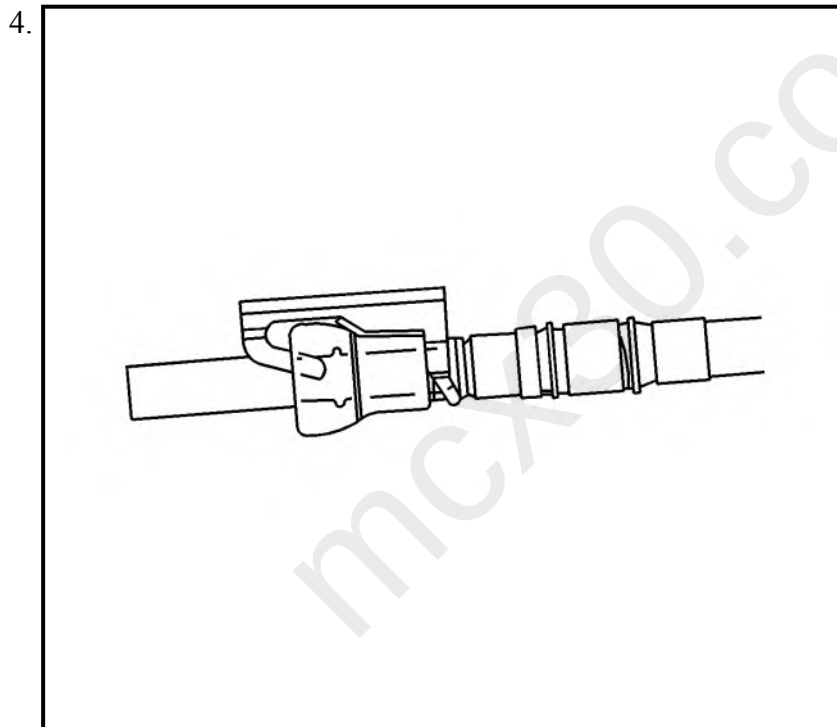
Push both sides of the quick-connect fitting together to cause the retaining tabs to snap into place.

3.





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



Install the retainer to the quick-connect fitting.

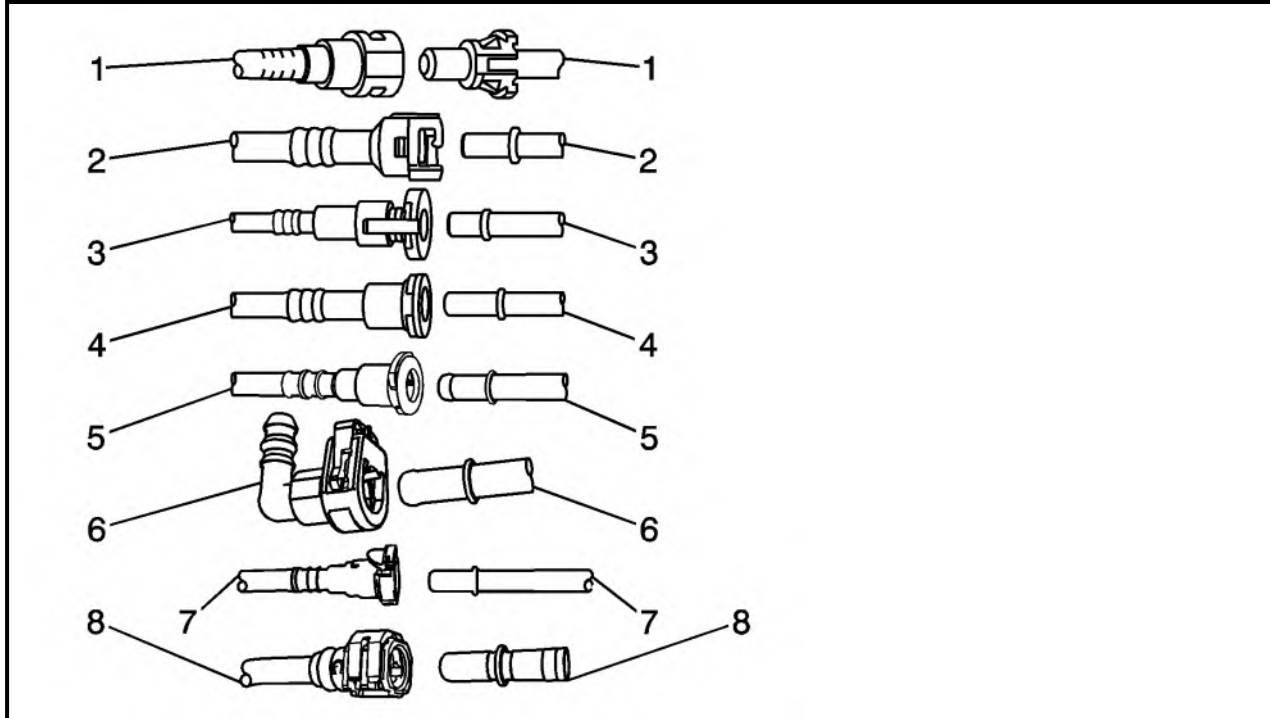
5. Inspect for leaks using the following procedure:
1. Turn the ignition ON, with the engine OFF for 2 seconds.
 2. Turn the ignition OFF, for 10 seconds.
 3. Turn the ignition ON, with the engine OFF for 2 seconds.
 4. Turn the ignition OFF.
 5. Inspect for leaks.

PLASTIC COLLAR QUICK CONNECT FITTING SERVICE

Removal Procedure

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

NOTE: If servicing a fuel system, insure the fuel pressure has been relieved.

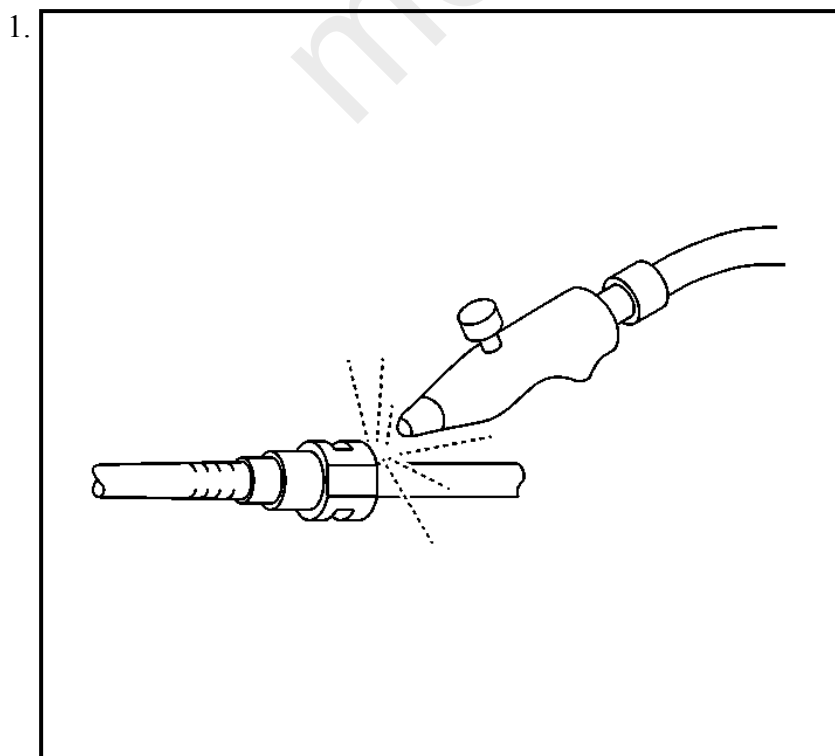


NOTE:

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)

The following instructions apply to all of these types of plastic collar quick connect fittings except where indicated.



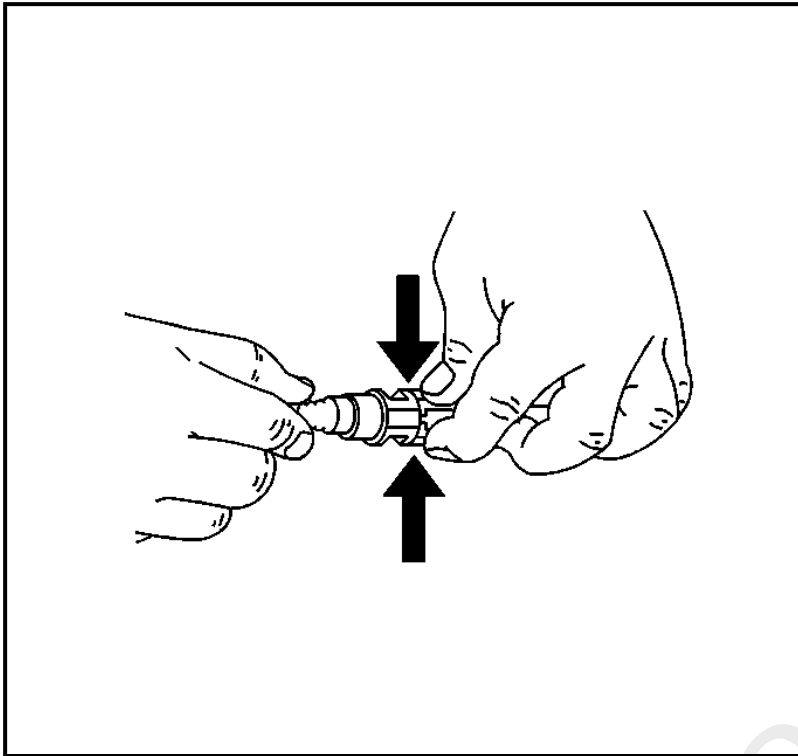
WARNING:

Always apply a few drops of clean engine oil to the male pipe ends before connecting the fuel pipe fittings. This will ensure proper

reconnection and prevent a possible fuel leak. Always replace O-rings.

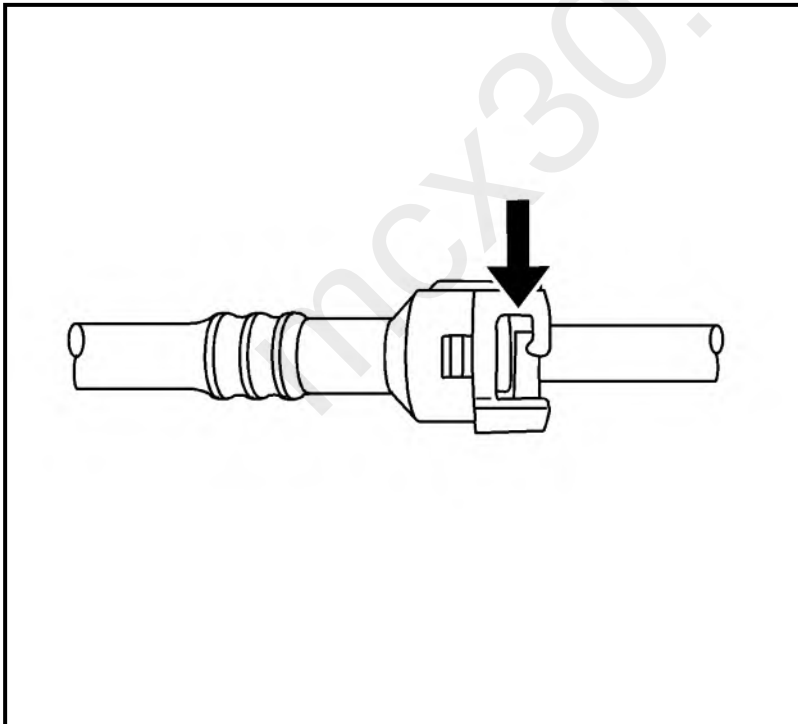
Using compressed air, blow any dirt out of the quick-connect fitting.

2.



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

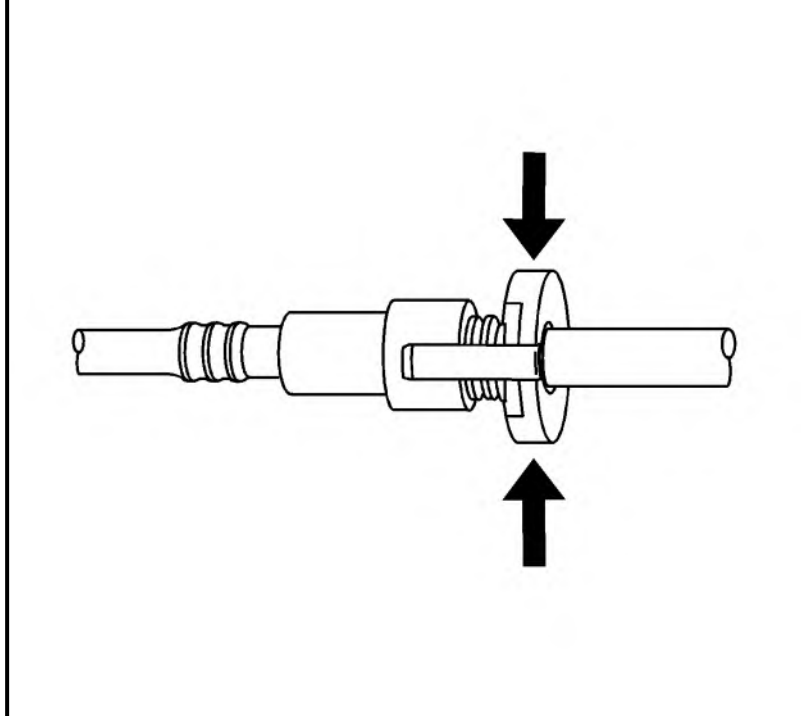
3.



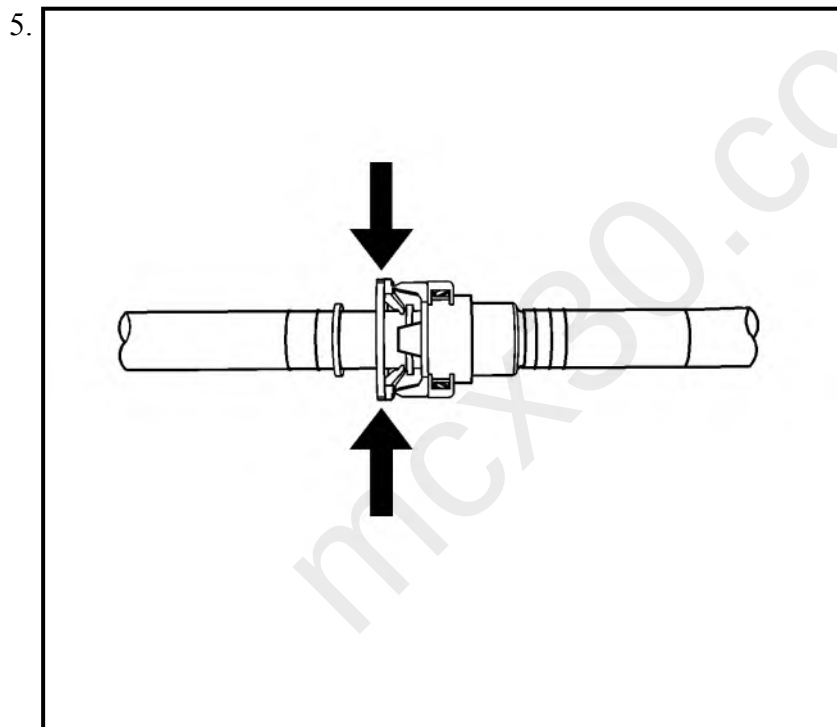
This step applies to Q Release style connectors ONLY. Release the fitting by Pushing the tab toward the other side of the slot in the fitting.

4.

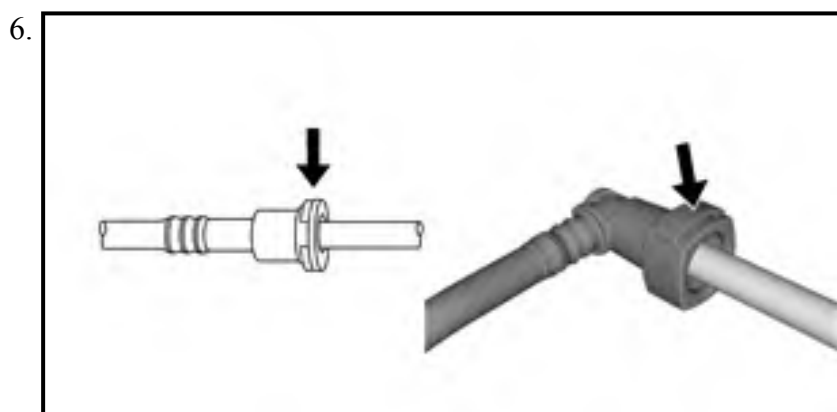




This step applies to Squeeze to Release style connectors ONLY. Squeeze where indicated by arrows on both sides of the plastic ring surrounding the quick-connect fitting.



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.

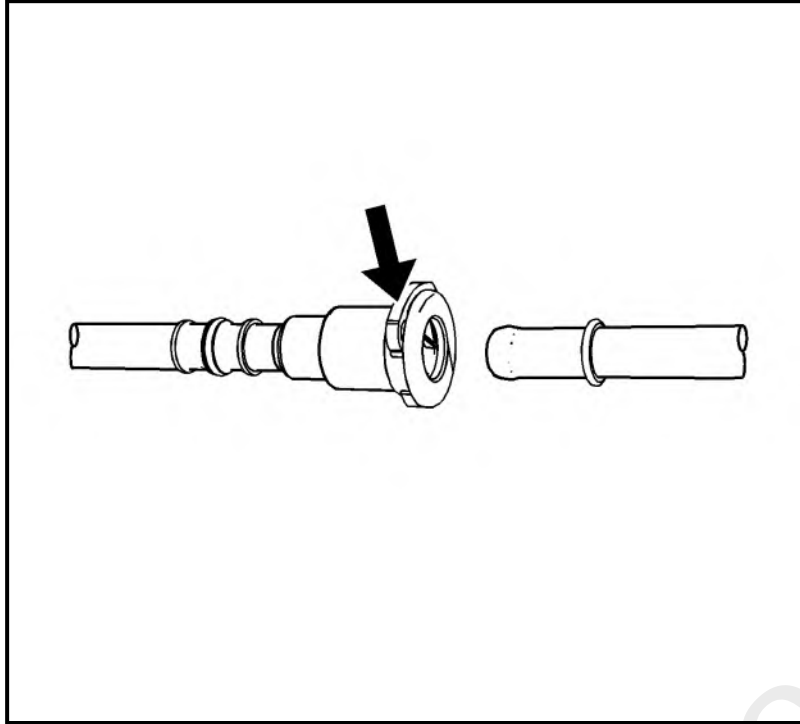


NOTE: There are two variants of sliding retainer style connectors shown

above, both have the same release and installation procedure.

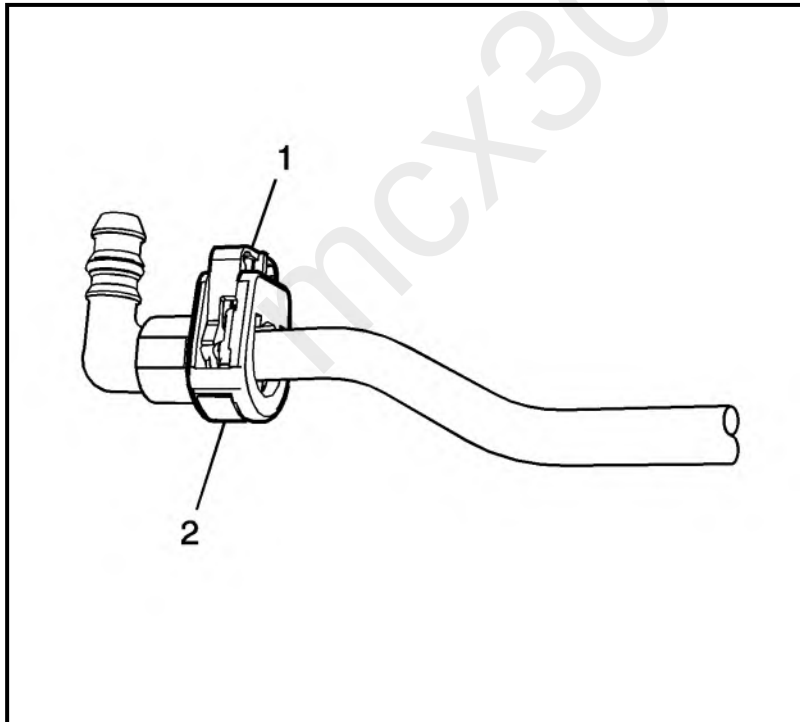
This step applies to Sliding Retainer style connectors ONLY. Release the fitting by pressing on one side of the release tab causing it to push in slightly. If the tab doesn't move try pressing the tab in from the opposite side. The tab will only move in one direction.

7.



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.

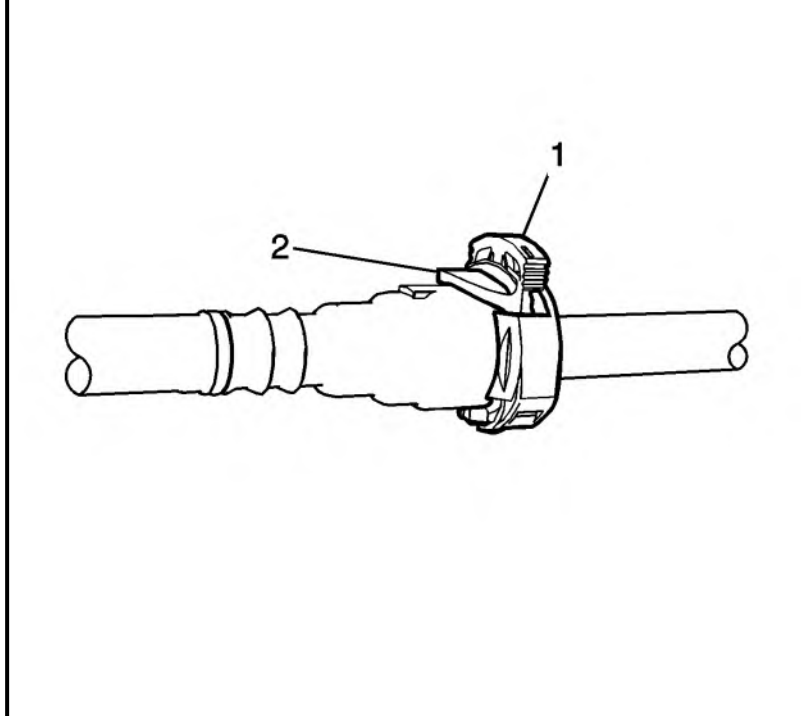
8.



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.

9.

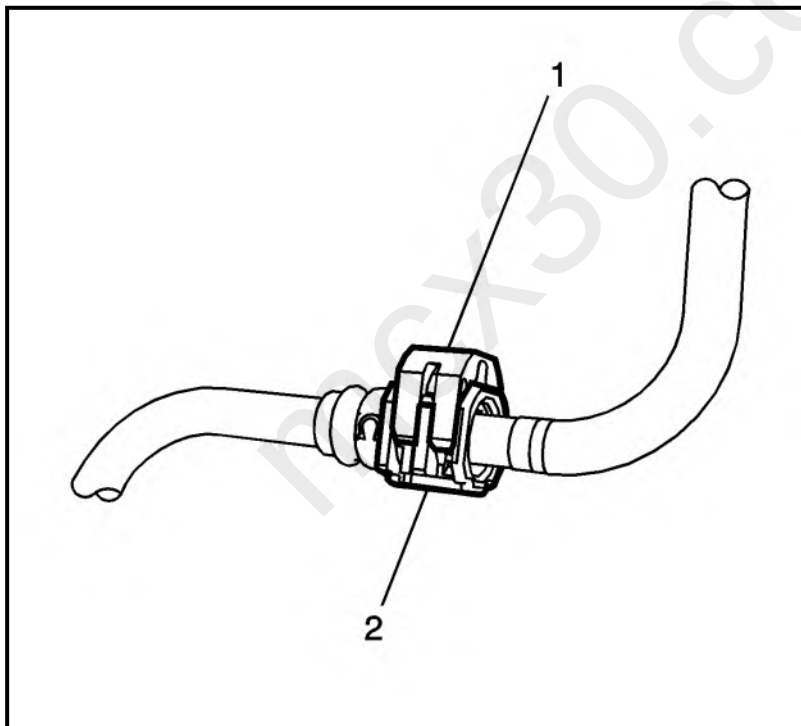




WARNING: Refer to [Relieving Fuel Pressure Warning](#) .

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.

10.

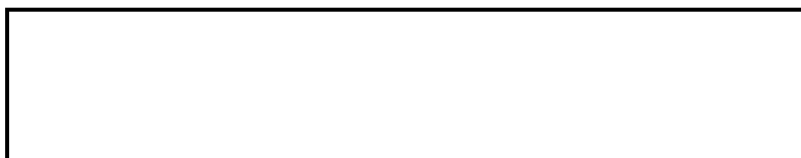


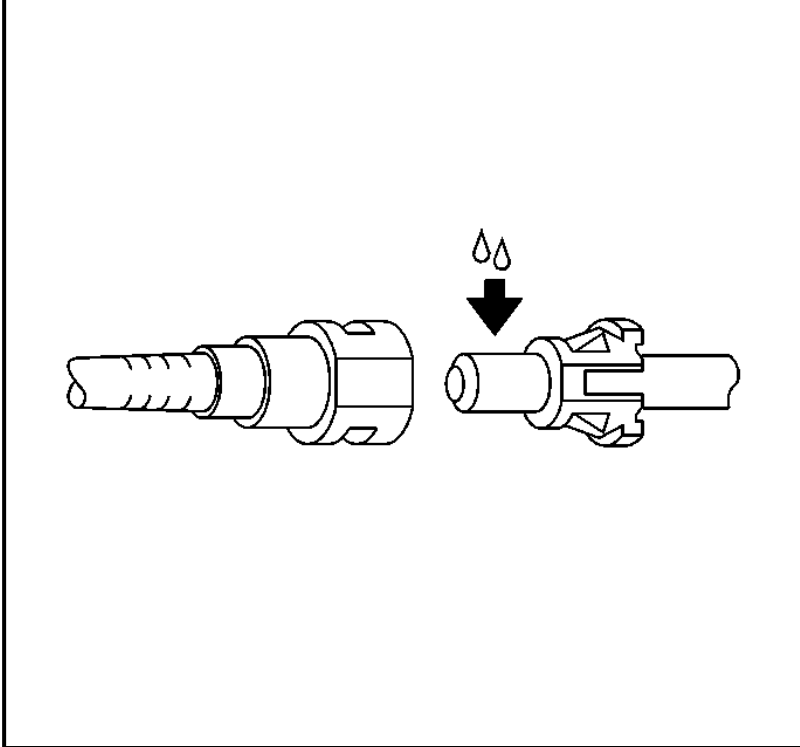
This step applies to the Plastic Connector style 8, push the connector toward the tube in order to release the pressure. Press the latch (1) inward in order to release the pipe, while pulling the connector (2) straight out.

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

Installation Procedure

1.

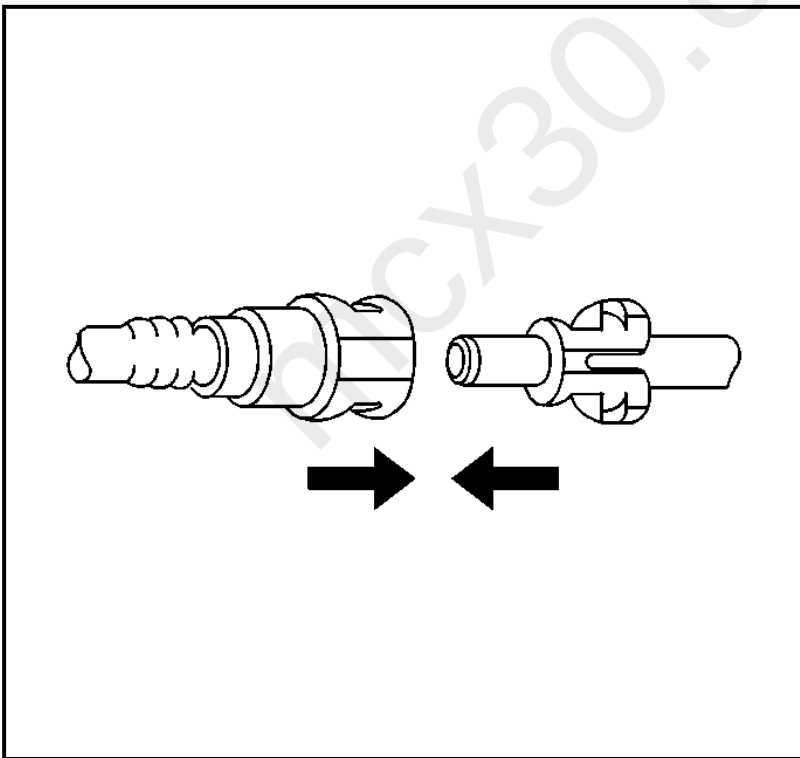




WARNING: Always apply a few drops of clean engine oil to the male pipe ends before connecting the fuel pipe fittings. This will ensure proper reconnection and prevent a possible fuel leak. Always replace O-rings.

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

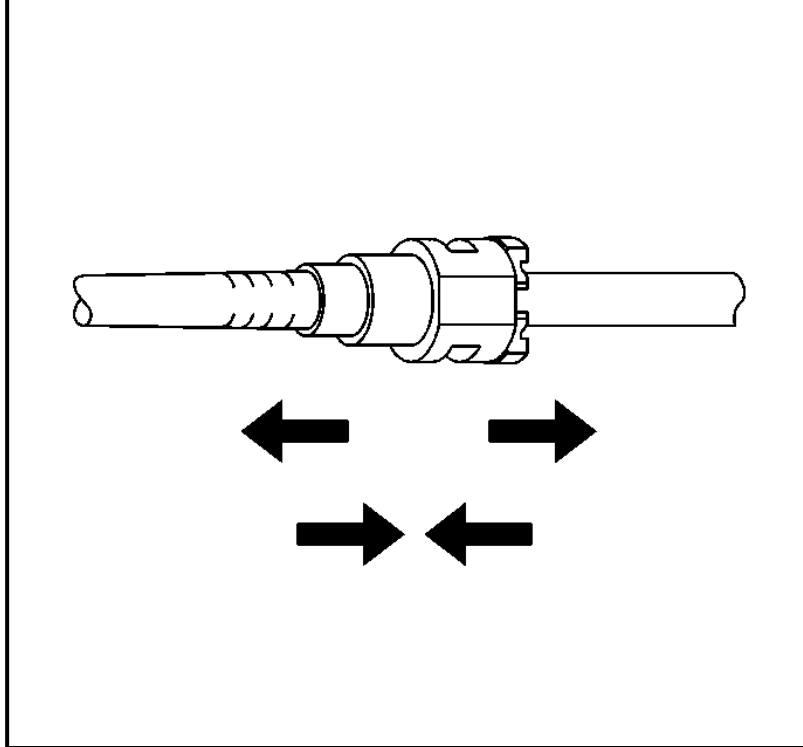
2.



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

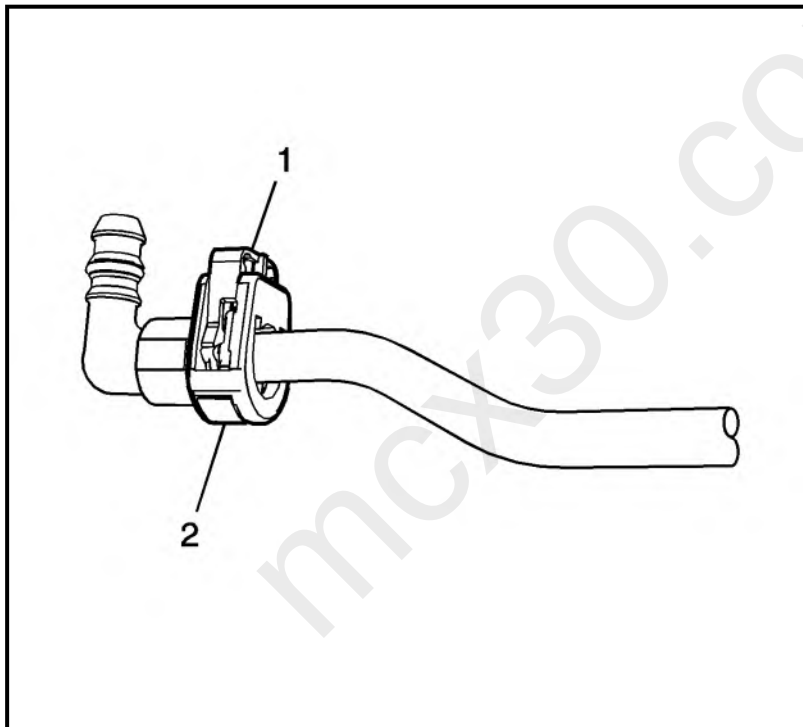
3.





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

4.

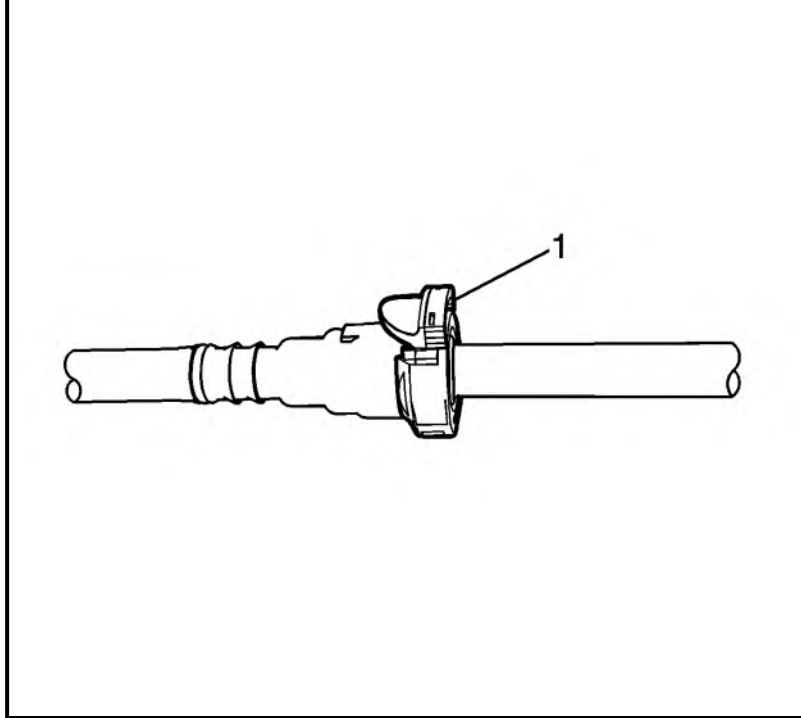


Insert the tube in the connector until the retainer snaps in place.

5. Push down on the redundant latch (1) until it is fully engaged and snapped into position.

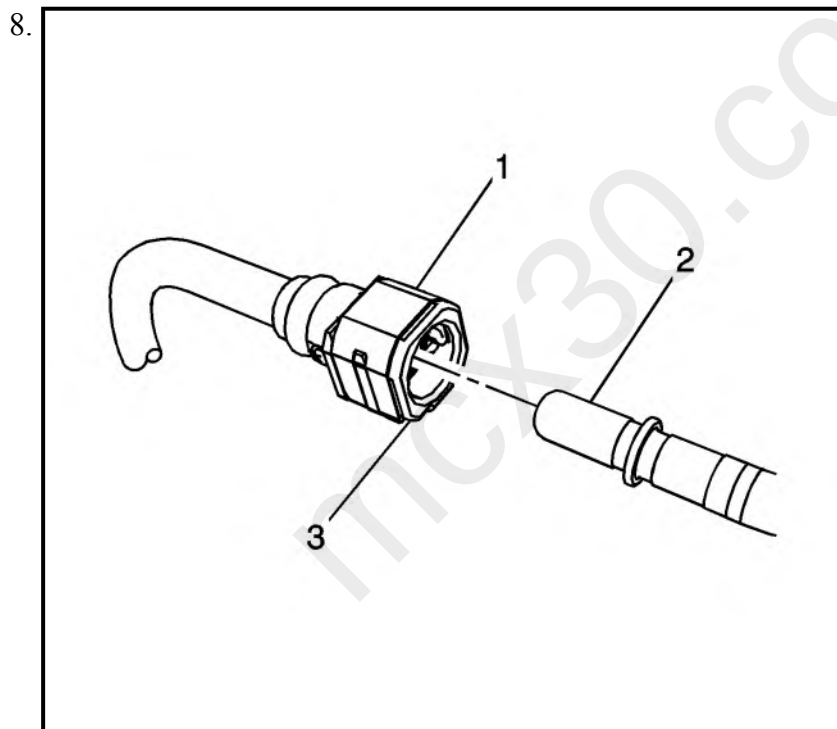
6.





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.



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. 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

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:

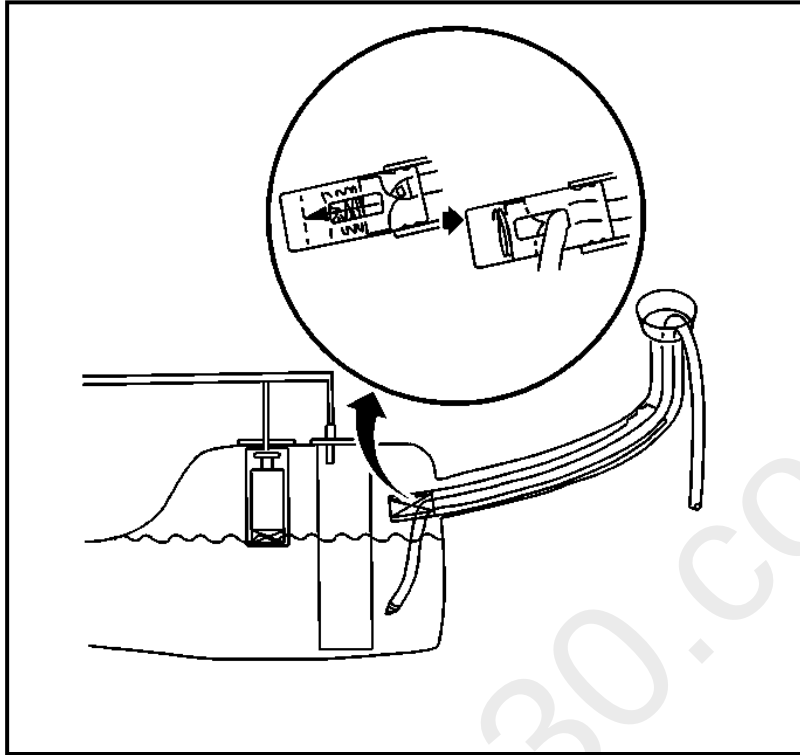
Place a dry chemical (Class B) fire extinguisher nearby before performing any on-vehicle service procedures. Failure to follow these precautions may result in personal injury.

CAUTION:

When performing a fuel tank draining procedure on a capless fuel system, only use the capless adapter funnel or equivalent. Using something other than the capless adapter funnel or equivalent may cause damage to the capless fuel system.

1. Insert the capless adapter funnel or equivalent into the capless fill pipe.

2.

**NOTE:**

Lubricate the fuel drain hose with Transjel Lubricant or equivalent to aid in hose insertion.

Insert the a suitable suction hose into the fuel tank until the bottom is reached.

3. Attach a suitable suction hose to the hose used with the hand or air operated pump device.
4. Use a hand or air operated pump device in order to drain as much fuel through the fuel fill pipe as possible.

FUEL TANK REPLACEMENT (AWD)**Removal Procedure****WARNING:**

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

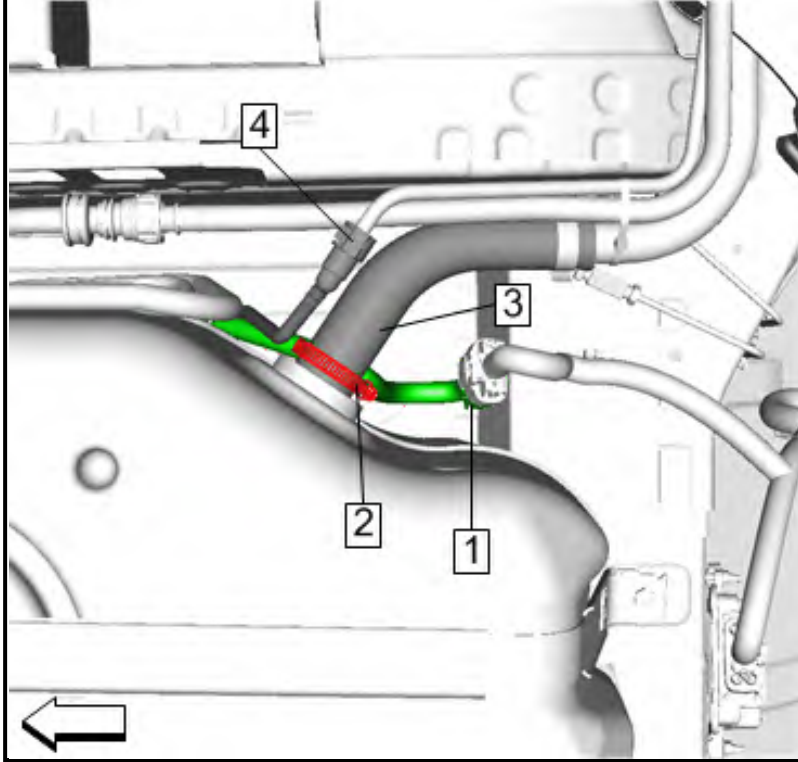
WARNING:

Refer to [Safety Glasses Warning](#) .

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Drain the fuel tank. [Fuel Tank Draining](#)
3. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)
4. Driveline Torque Tube - Remove - [Driveline Torque Tube Replacement](#)

5.



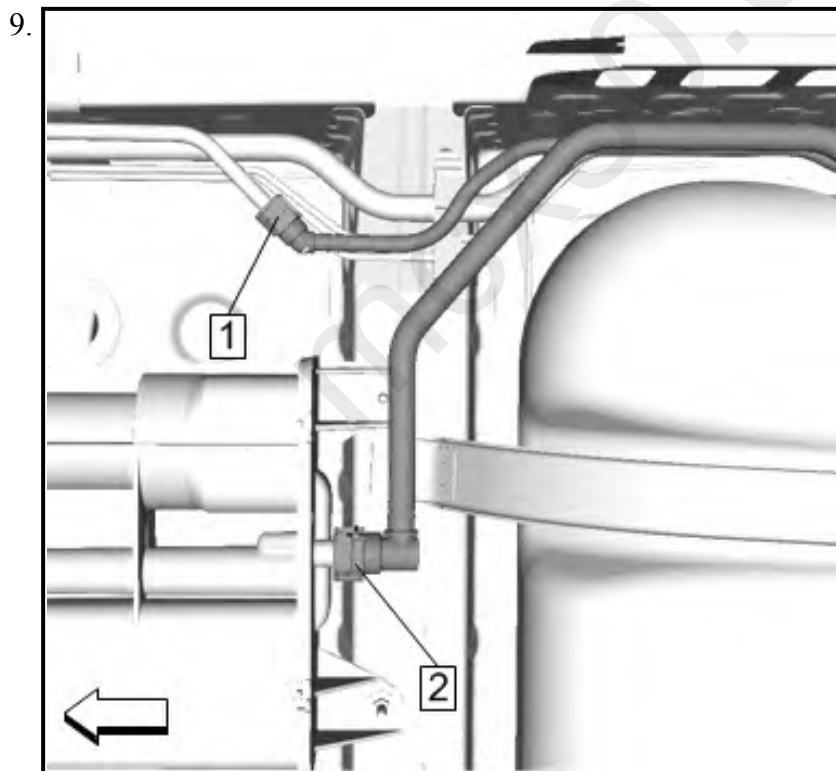


Wiring Harness (1) - Disconnect

6. Fuel Tank Filler Hose Clamp (2) - Remove

7. Fuel Tank Filler Hose (3) - Remove

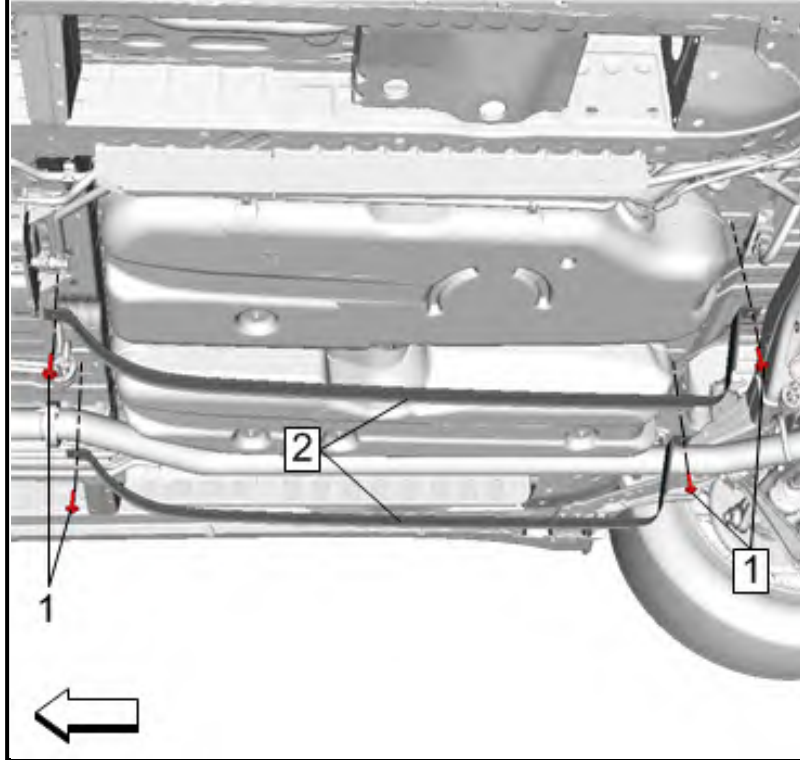
8. Evaporative Emission Canister Vent Hose (4) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)



Fuel Pump Fuel Feed Hose (1) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

10. Evaporative Emission Canister Vent Hose (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)



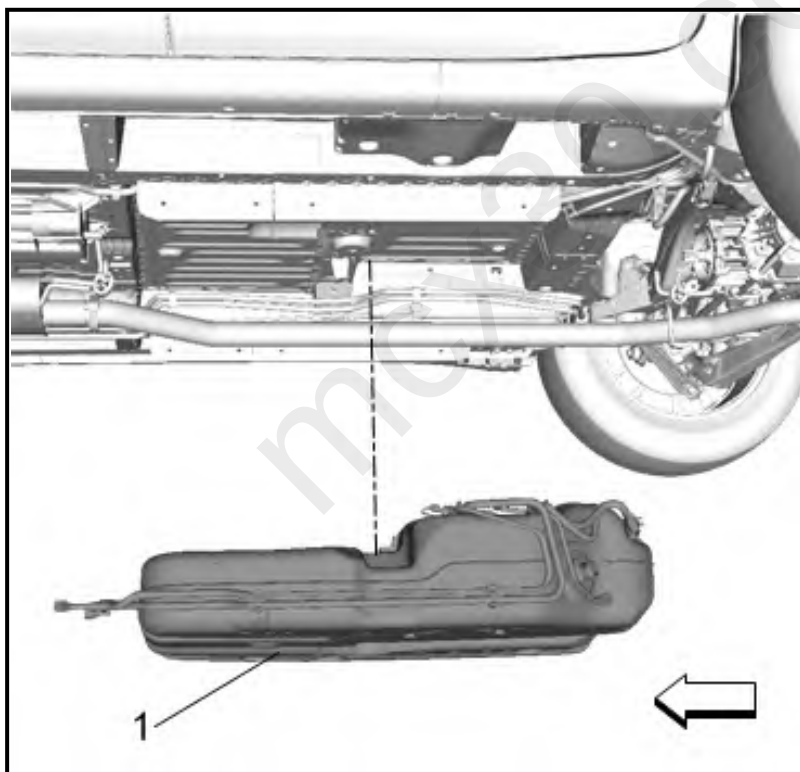


Place a suitable adjustable jack under the fuel tank.

12. Fuel Tank Strap Bolt (1) - Remove [4x]

13. Fuel Tank Strap (2) - Remove [2x]

14.



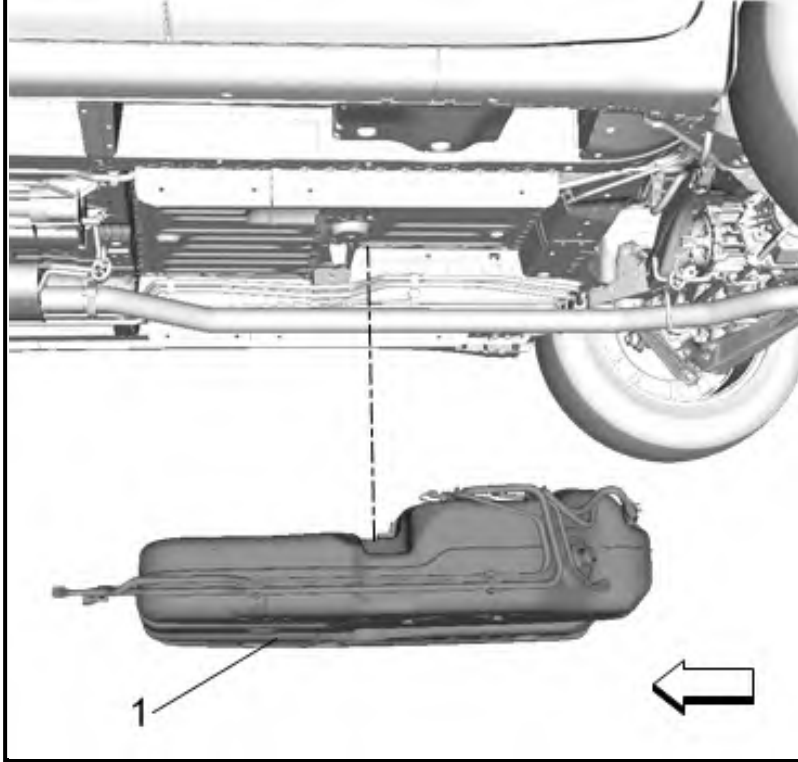
Fuel Tank (1) - Remove

15. If replacing fuel tank transfer parts as necessary.

Installation Procedure

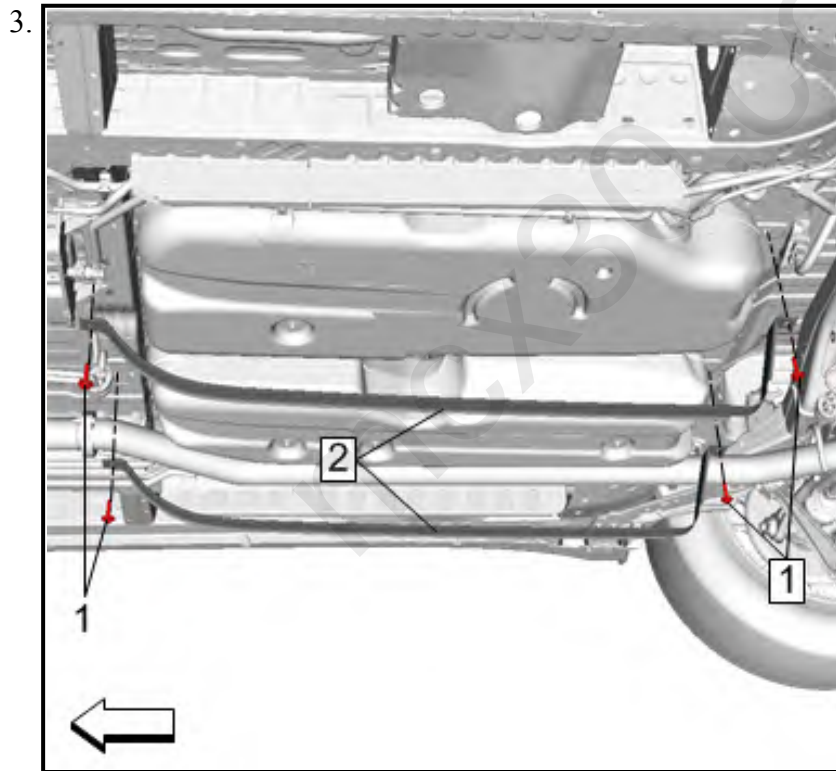
1.





Place a suitable adjustable jack under the fuel tank.

2. Fuel Tank (1) - Install

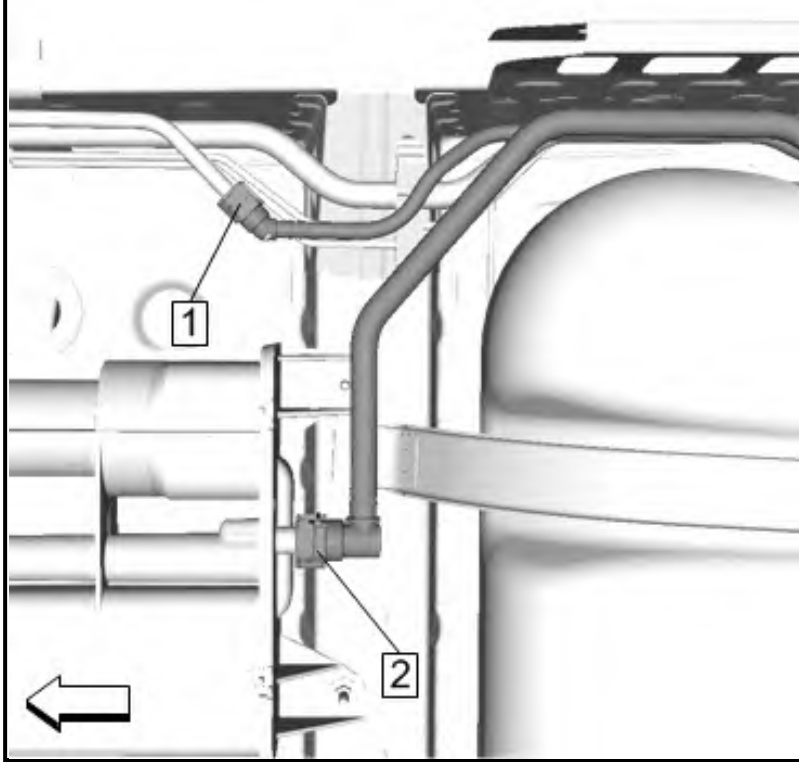


Fuel Tank Strap (2) - Install [2x]

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

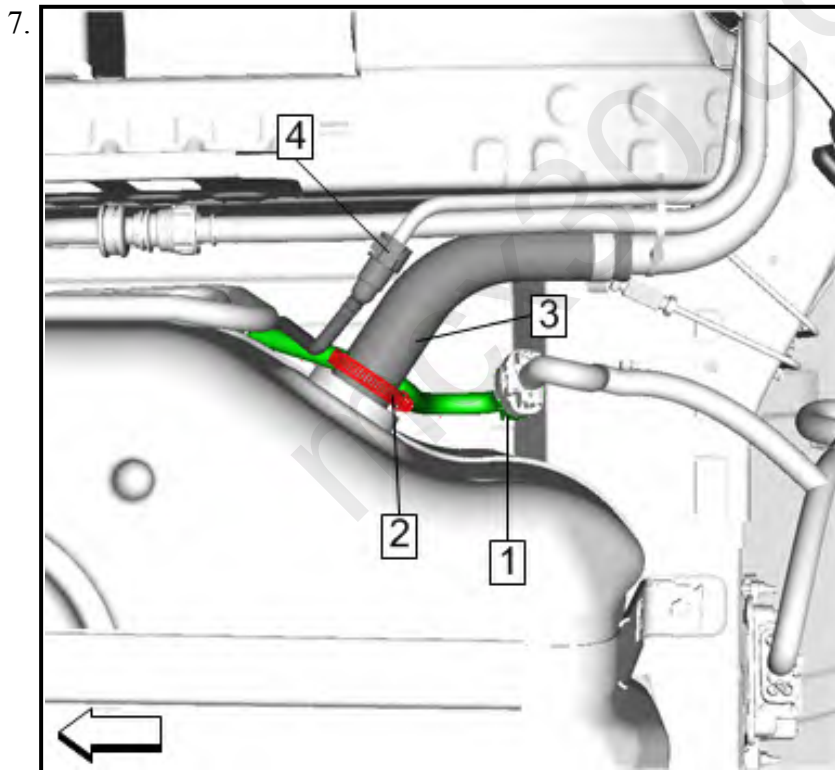
4. Fuel Tank Strap Bolt (1) - Install and tighten [4x] 22 N.m (16 lb ft)





Evaporative Emission Canister Vent Hose (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

6. Fuel Pump Fuel Feed Hose (1) - Connect - [Plastic Collar Quick Connect Fitting Service](#)



Evaporative Emission Canister Vent Hose (4) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

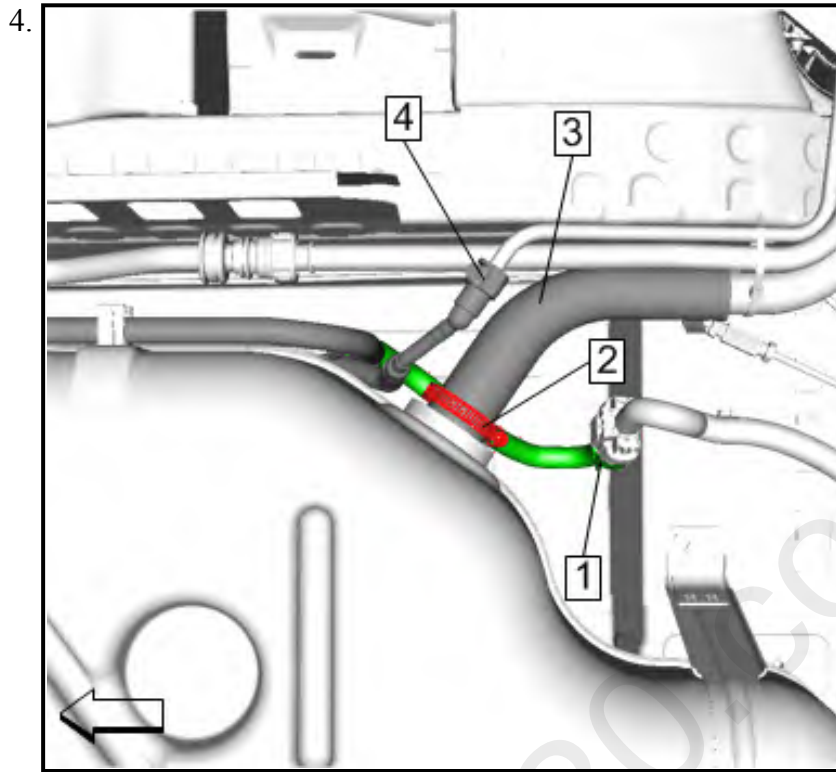
8. Fuel Tank Filler Hose (3) - Install
9. Fuel Tank Filler Hose Clamp (2) - Install and tighten 4 N.m (35 lb in)
10. Wiring Harness (1) - Connect
11. Driveline Torque Tube - Install - [Driveline Torque Tube Replacement](#)
12. Refill the fuel tank.
13. Inspect for fuel leaks.

FUEL TANK REPLACEMENT (FWD)

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

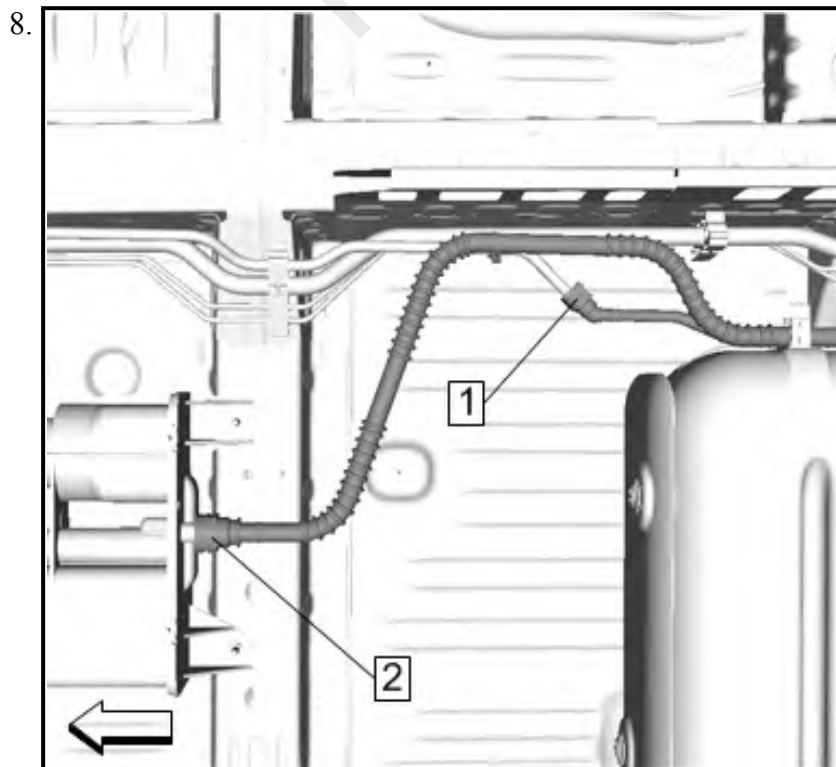
WARNING: Refer to [Safety Glasses Warning](#) .

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Drain the fuel tank. [Fuel Tank Draining](#)
3. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#) .



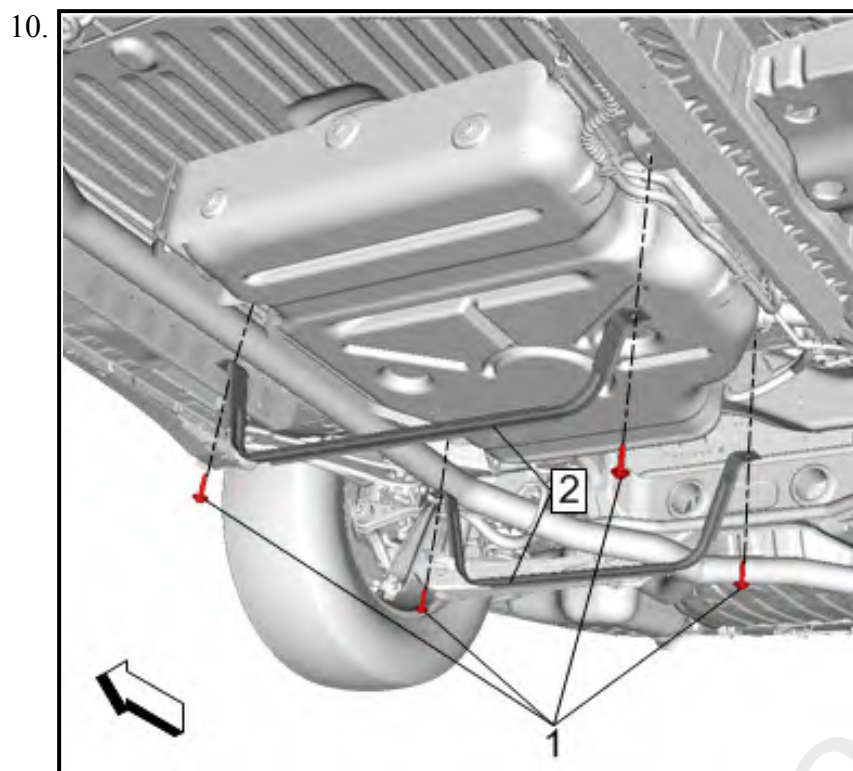
Wiring Harness (1) - Disconnect

5. Fuel Tank Filler Hose Clamp (2) - Remove
6. Fuel Tank Filler Hose (3) - Remove
7. Evaporative Emission Canister Vent Hose (4) - Disconnect [Plastic Collar Quick Connect Fitting Service](#)



Fuel Pump Fuel Feed Hose (1) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

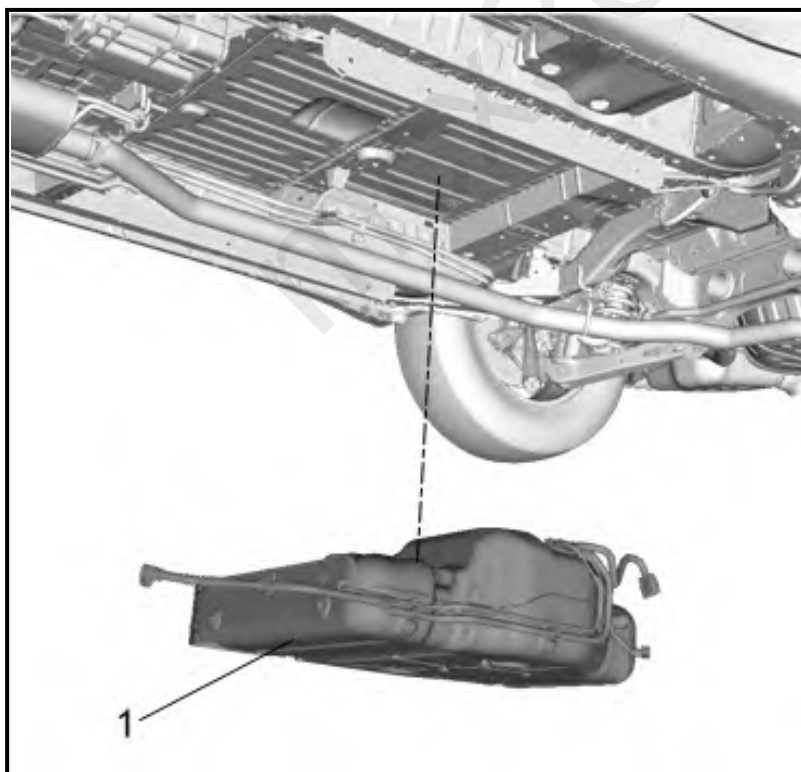
9. Evaporative Emission Canister Vent Hose (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)



Place a suitable adjustable jack under the fuel tank.

11. Fuel Tank Strap Bolt (1) - Remove [4x]

12. Fuel Tank Strap (2) - Remove [2x]

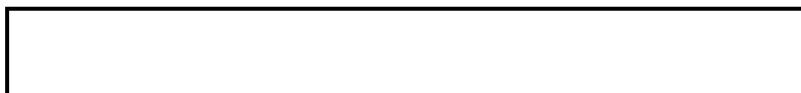


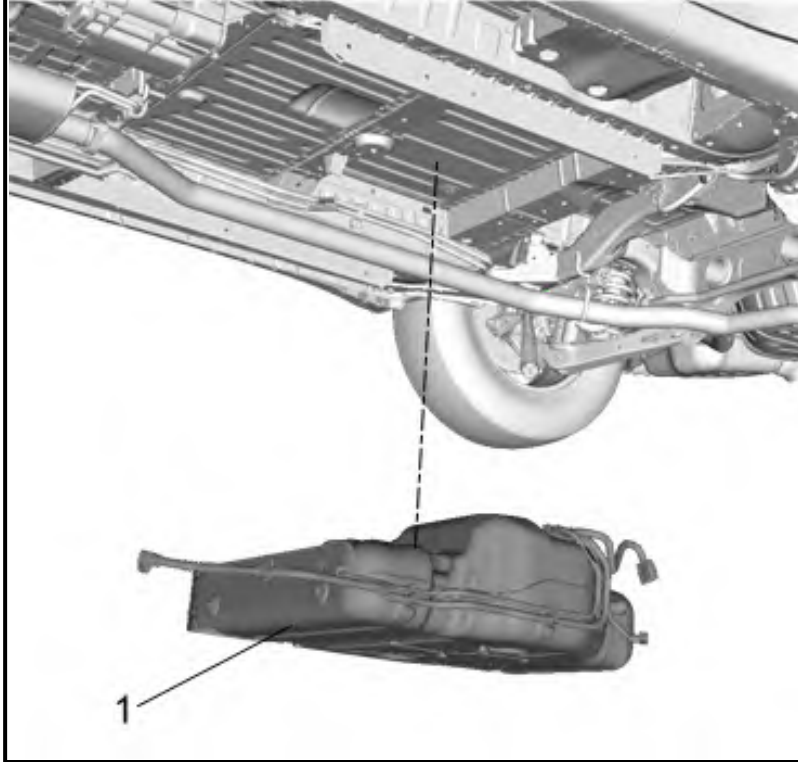
Fuel Tank (1) - Remove

13. If replacing fuel tank transfer parts as necessary.

Installation Procedure

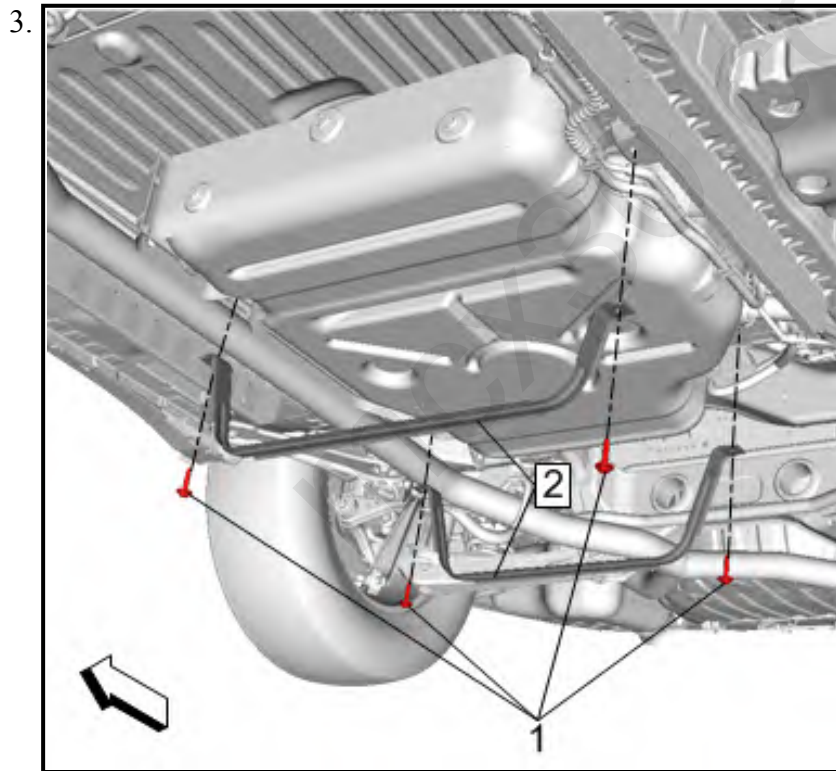
1.





Place a suitable adjustable jack under the fuel tank.

2. Fuel Tank (1) - Install

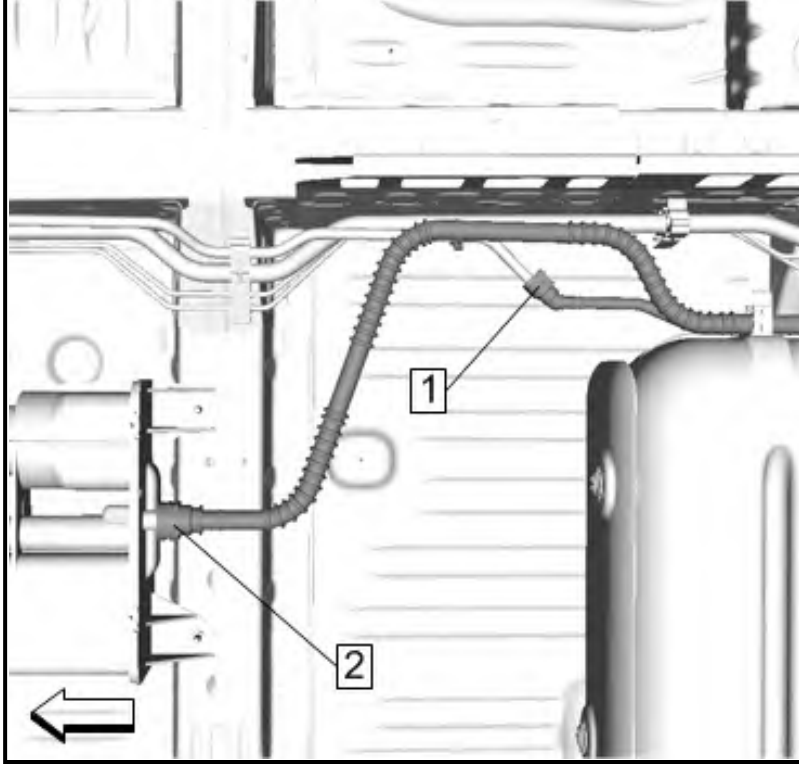


Fuel Tank Strap (2) - Install [2x]

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

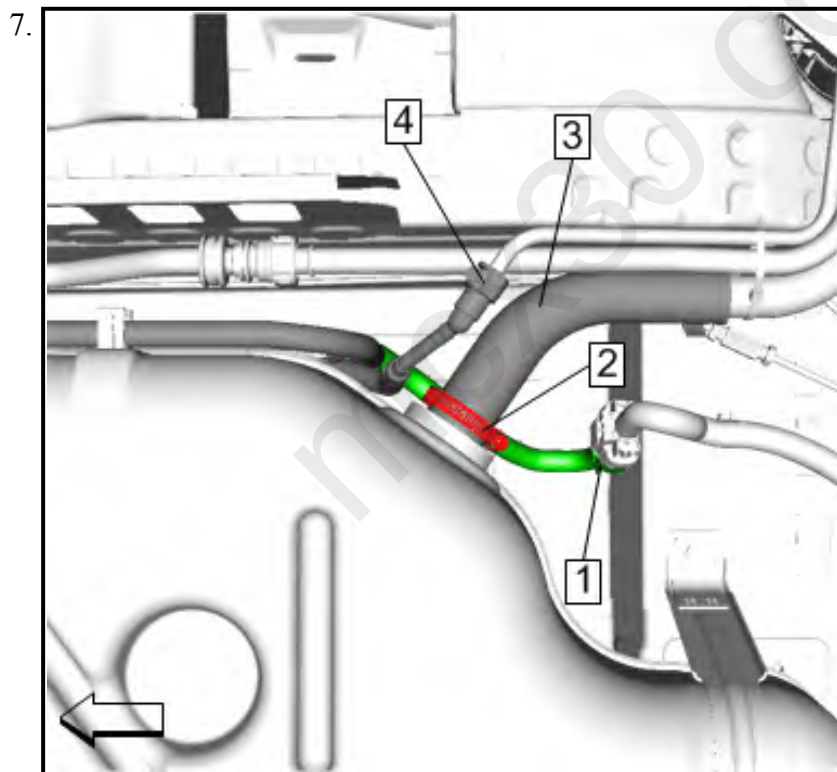
4. Fuel Tank Strap Bolt (1) - Install and tighten [4x] 22 N.m (16 lb ft)





Evaporative Emission Canister Vent Hose (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

6. Fuel Pump Fuel Feed Hose (1) - Connect - [Plastic Collar Quick Connect Fitting Service](#)



Evaporative Emission Canister Vent Hose (4) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

8. Fuel Tank Filler Hose (3) - Install

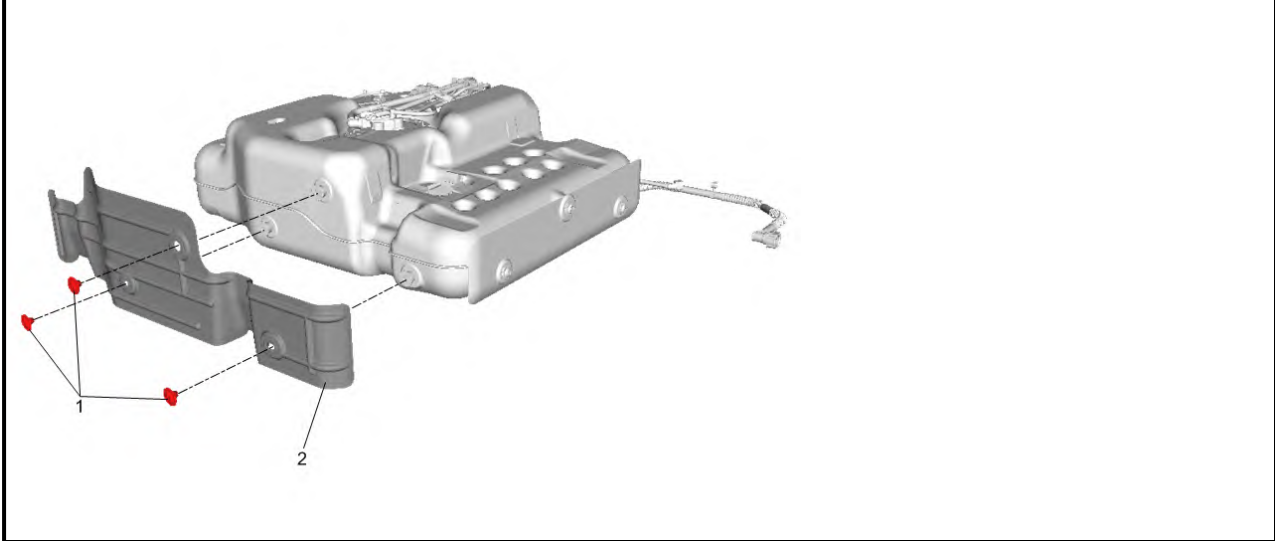
9. Fuel Tank Filler Hose Clamp (2) - Install and tighten 4 N.m (35 lb in)

10. Wiring Harness (1) - Connect

11. Refill the fuel tank.

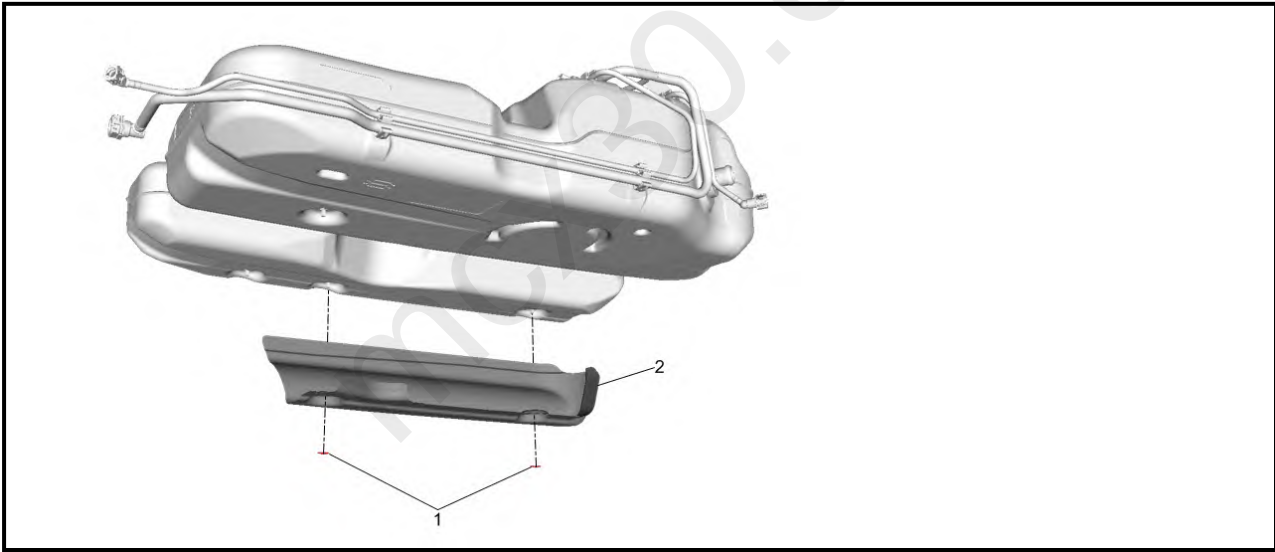
12. Inspect for fuel leaks.

FUEL TANK SHIELD REPLACEMENT (FWD)



Callout	Component Name
Preliminary Procedure <u>Fuel Tank Replacement (FWD)</u>	
1	Fuel Tank Heat Shield Retainer [3x] CAUTION: Refer to <u>Fastener Caution</u> .
2	Fuel Tank Shield

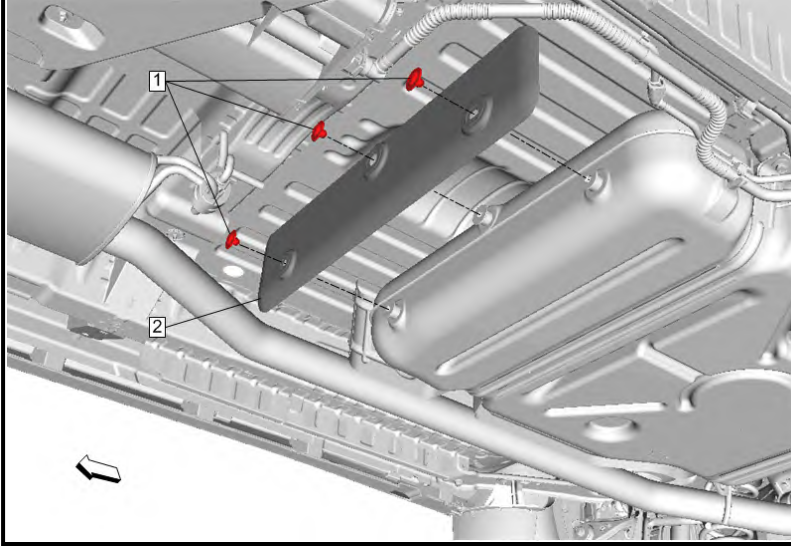
FUEL TANK SHIELD REPLACEMENT (AWD)



Callout	Component Name
Preliminary Procedure <u>Fuel Tank Front Shield Replacement (AWD)</u>	
1	Fuel Tank Heat Shield Retainer [2x] CAUTION: Refer to <u>Fastener Caution</u> .
2	Fuel Tank Shield

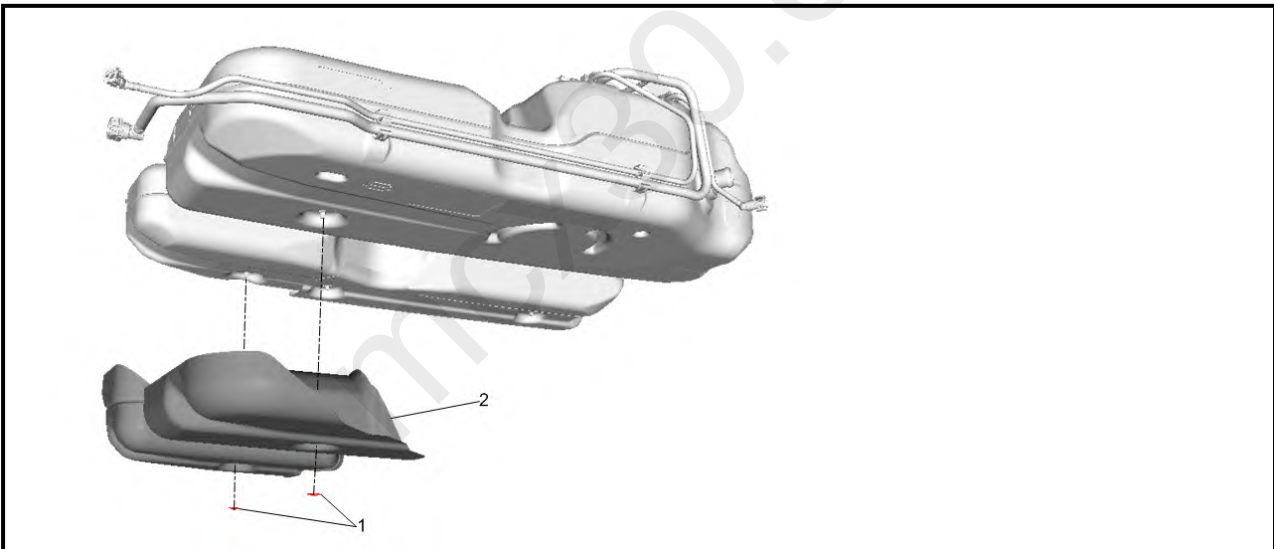
FUEL TANK FRONT SHIELD REPLACEMENT (FWD)





Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Fuel Tank Heat Shield Retainer [3x] CAUTION: Refer to Fastener Caution .
2	Fuel Tank Front Shield

FUEL TANK FRONT SHIELD REPLACEMENT (AWD)



Callout	Component Name
Preliminary Procedure Fuel Tank Replacement (AWD)	
1	Fuel Tank Heat Shield Retainer [2x] CAUTION: Refer to Fastener Caution .
2	Fuel Tank Front Shield

FUEL TANK FUEL PUMP MODULE REPLACEMENT (FWD)

Special Tools

CH 45722 Fuel Sender Lock Ring Wrench

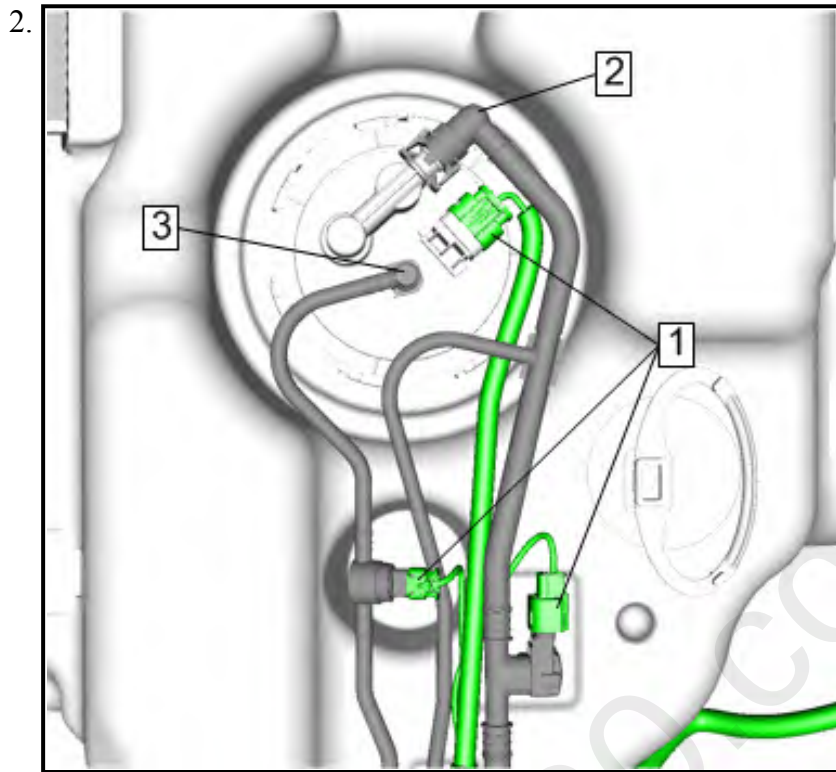
Equivalent regional tools: [Special Tools](#)

Removal Procedure

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

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

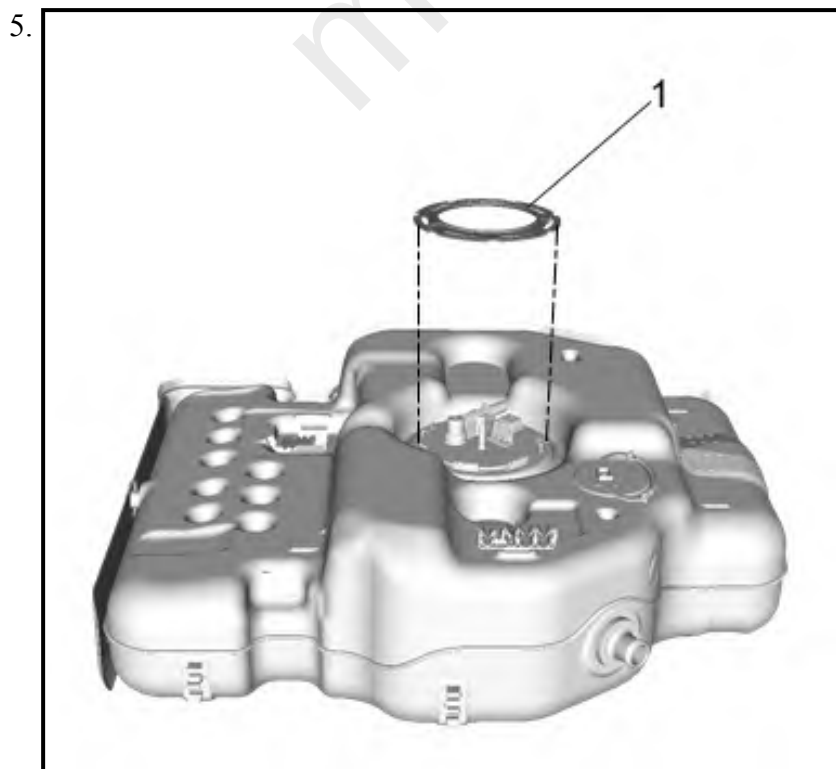
1. [Fuel Tank Replacement \(FWD\)](#) - Remove



Electrical Connector (1) - Disconnect [3x]

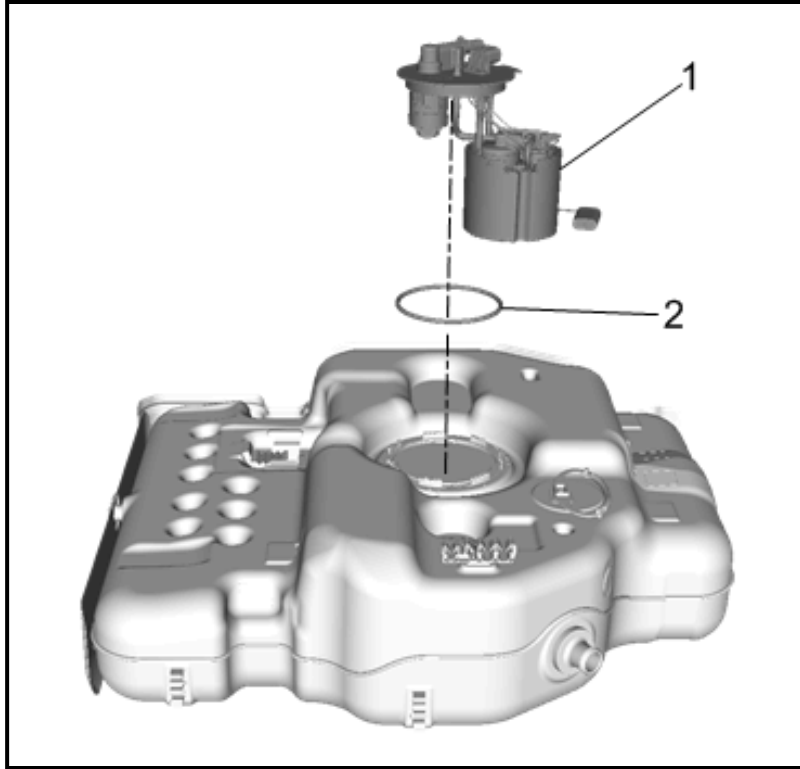
3. Evaporative Emission Canister Vent Hose (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

4. Fuel Pump Fuel Feed Hose (3) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)



Fuel Pump Lock Ring (1) - Remove - **CH 45722** Fuel Sender Lock Ring Wrench

6.

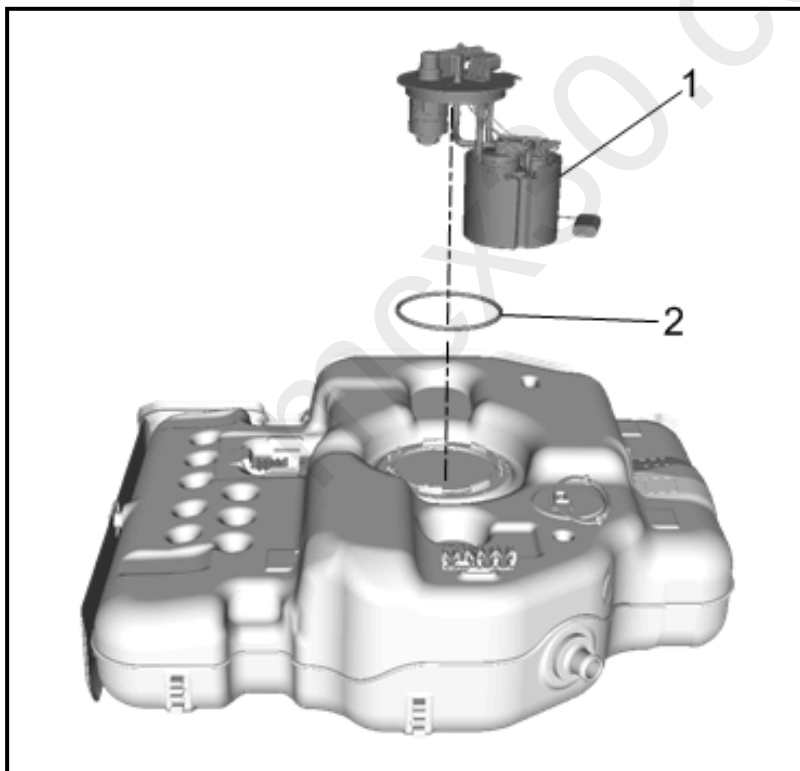


Fuel Tank Fuel Pump Module (1) - Remove

7. O-Ring (2) - Remove and DISCARD

Installation Procedure

1.

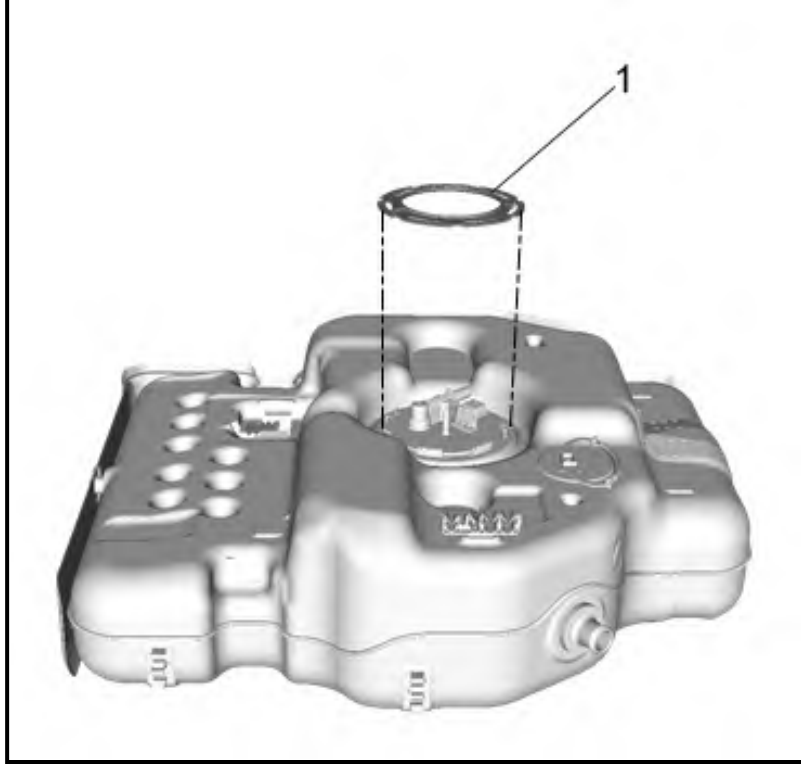


O-Ring (2) - Install New

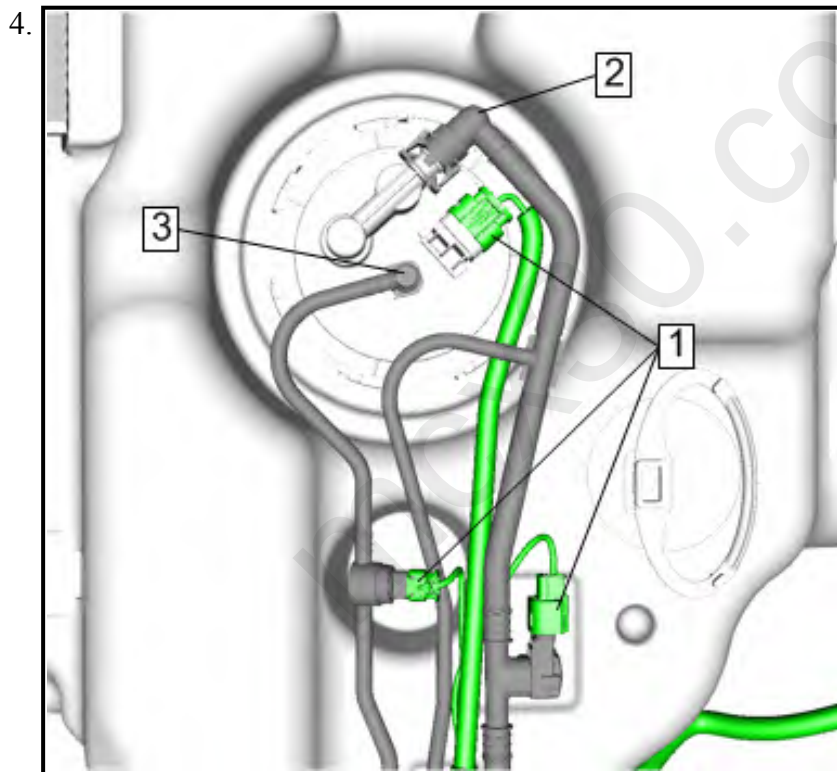
2. Fuel Tank Fuel Pump Module (1) - Install

3.





Fuel Pump Lock Ring (1) - Install - **CH 45722** Fuel Sender Lock Ring Wrench



Fuel Pump Fuel Feed Hose (3) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

5. Evaporative Emission Canister Vent Hose (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)
6. Electrical Connector (1) - Connect [3x]
7. [Fuel Tank Replacement \(FWD\)](#) - Install

FUEL TANK FUEL PUMP MODULE REPLACEMENT (AWD)

Special Tools

CH 45722 Fuel Sender Lock Ring Wrench

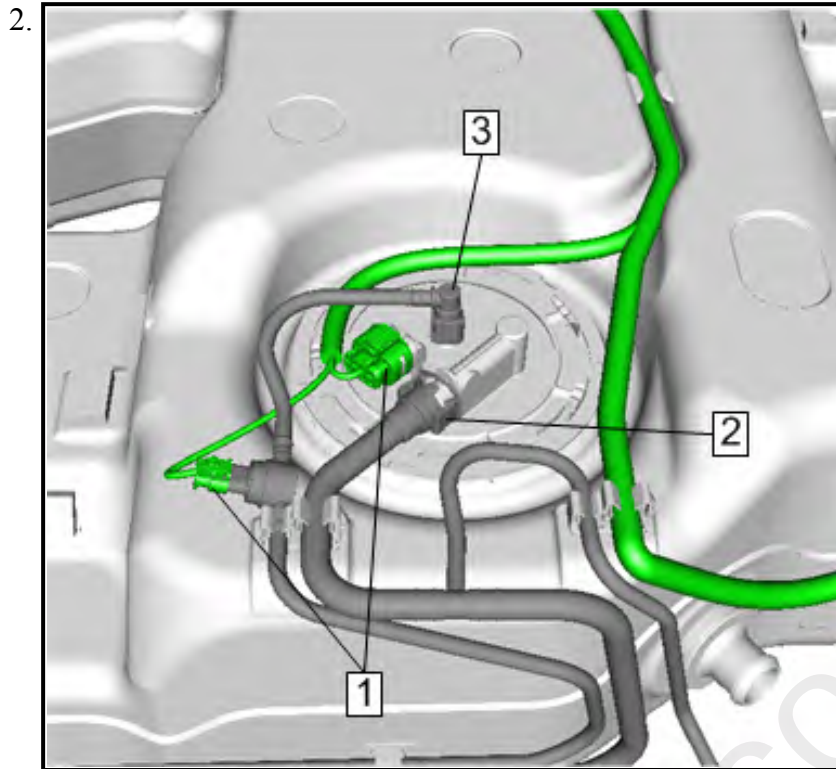
Equivalent regional tools: [Special Tools](#)

Removal Procedure

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

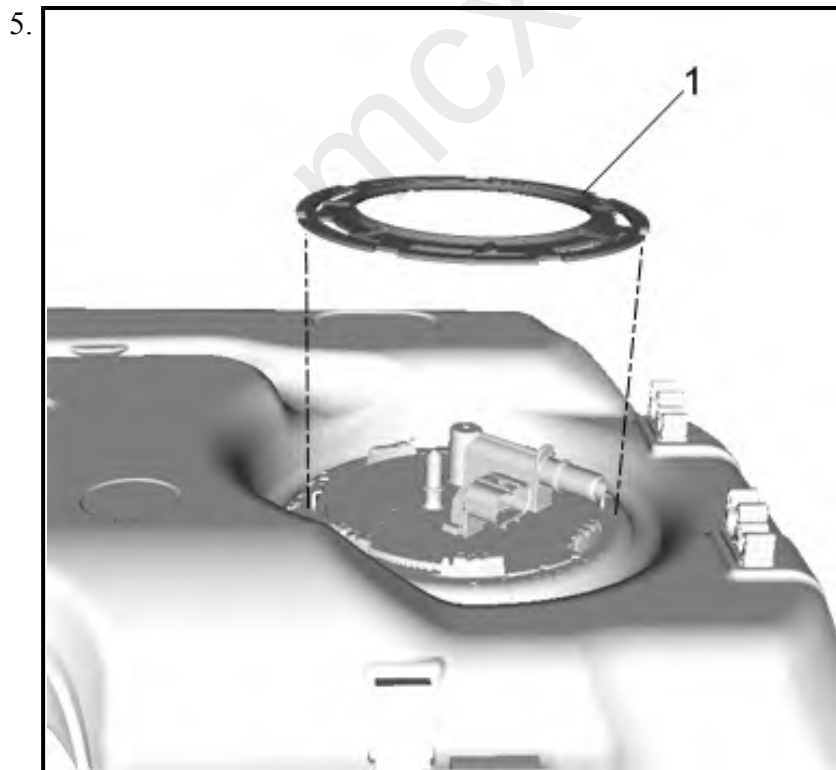
WARNING: Refer to [Safety Glasses Warning](#) .

1. [Fuel Tank Replacement \(AWD\)](#) - Remove

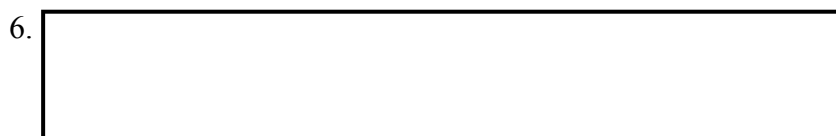


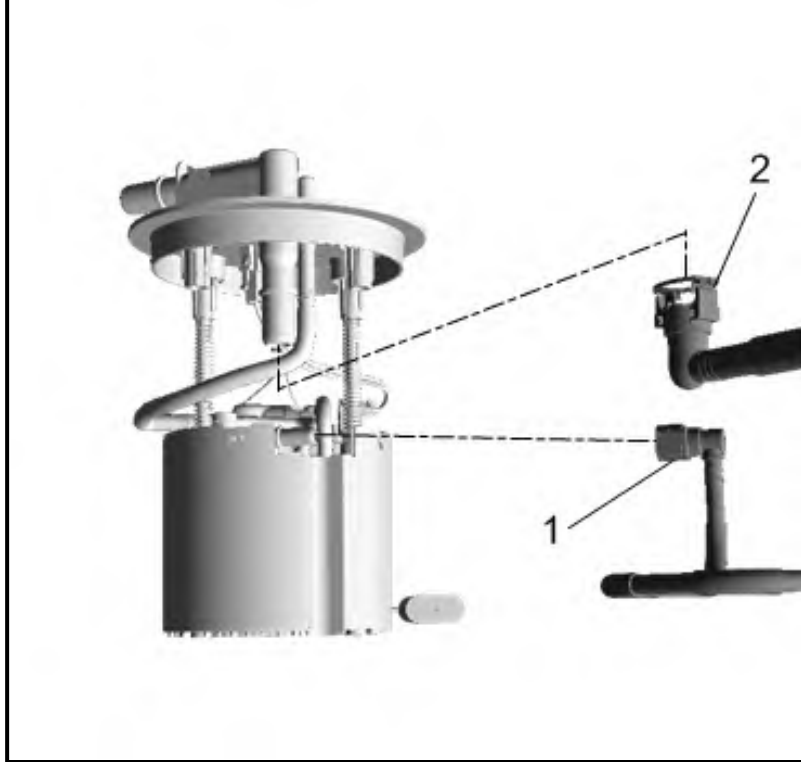
Electrical Connector (1) - Disconnect [2x]

3. Evaporative Emission Canister Vent Hose (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)
4. Fuel Pump Fuel Feed Hose (3) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)



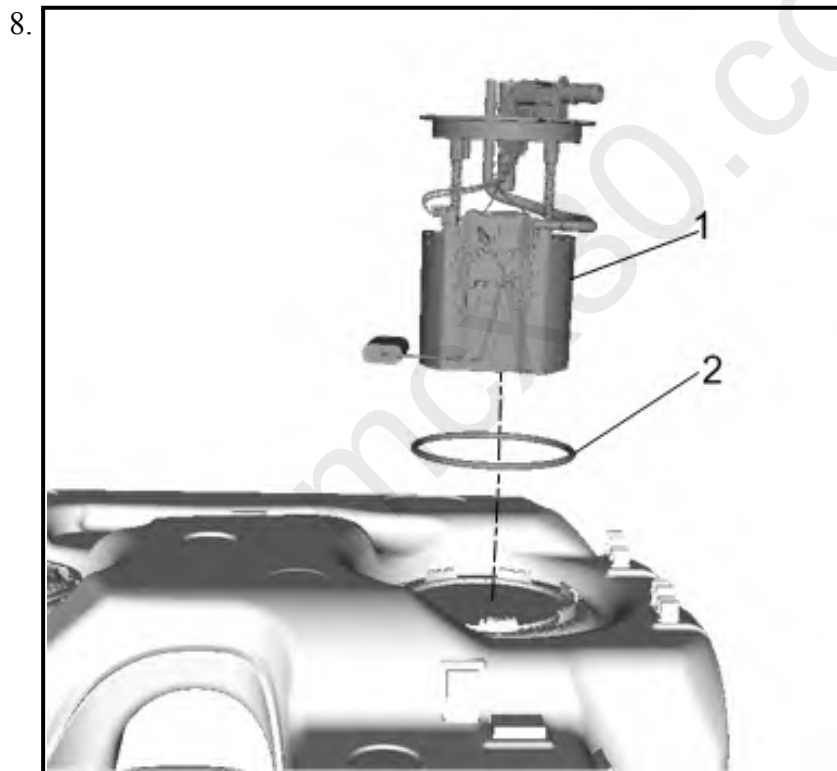
Fuel Pump Lock Ring (1) - Remove - **CH 45722** Fuel Sender Lock Ring Wrench





Transfer Pipe (1) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

7. Fuel Pump Vent Pipe (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

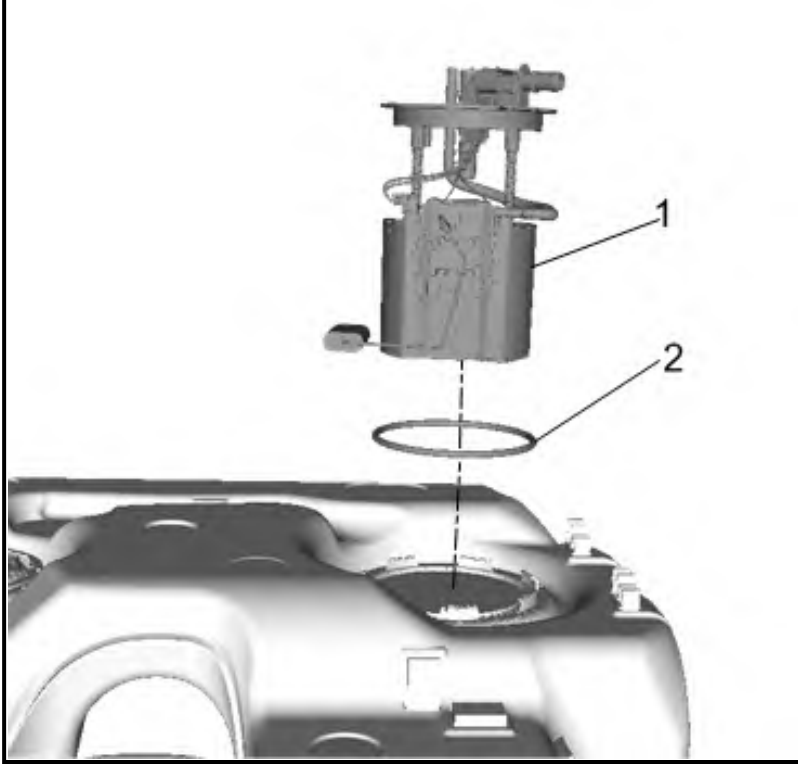


Fuel Tank Fuel Pump Module (1) - Remove

9. O-Ring (2) - Remove and DISCARD

Installation Procedure

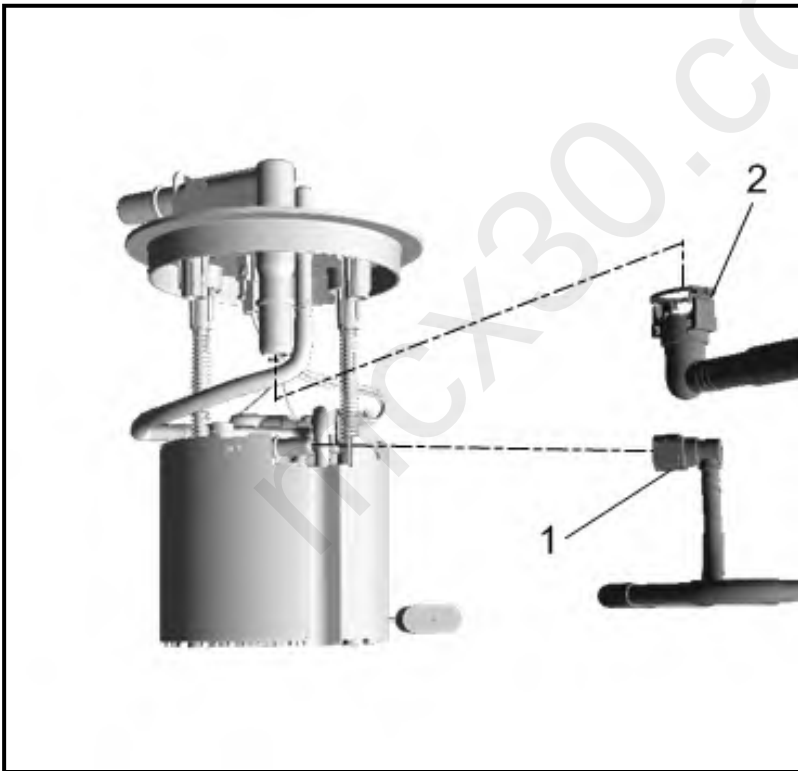




O-Ring (2) - Install NEW

2. Fuel Tank Fuel Pump Module (1) - Install

3.

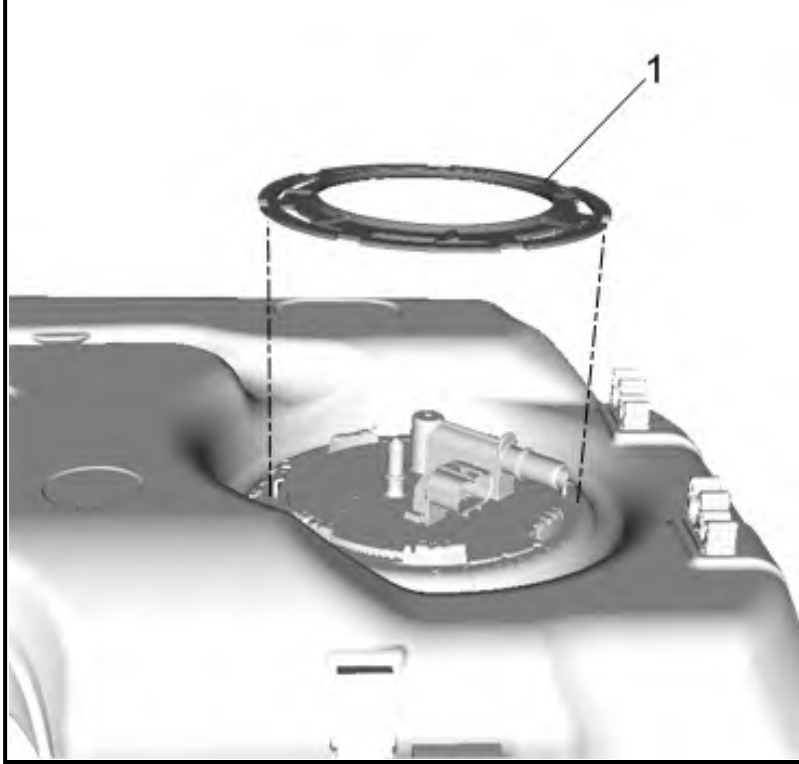


Fuel Pump Vent Pipe (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

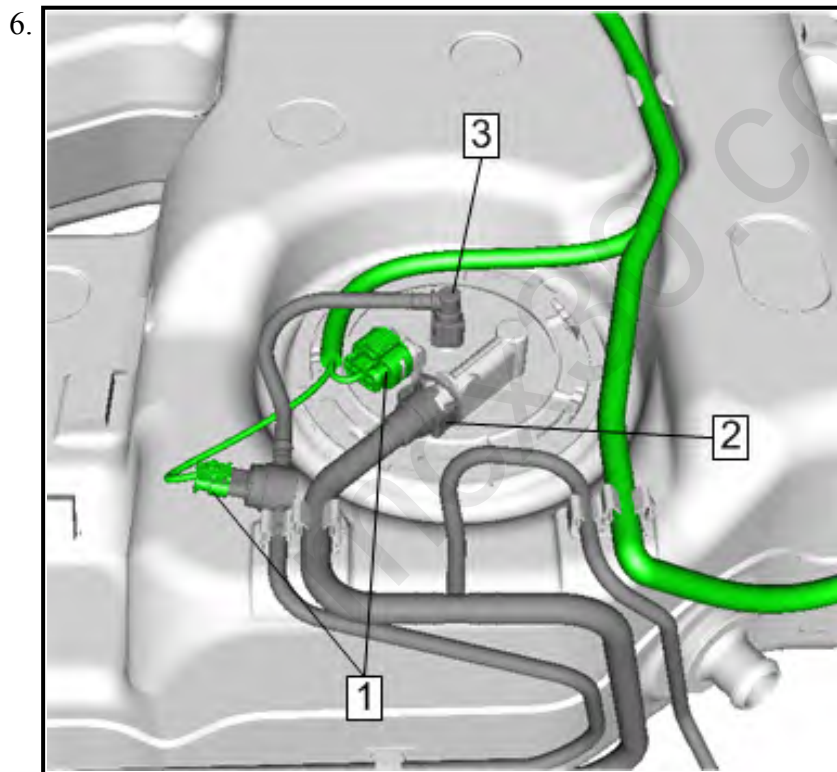
4. Transfer Pipe (1) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

5.





Fuel Pump Lock Ring (1) - Install - **CH 45722 Fuel Sender Lock Ring Wrench**

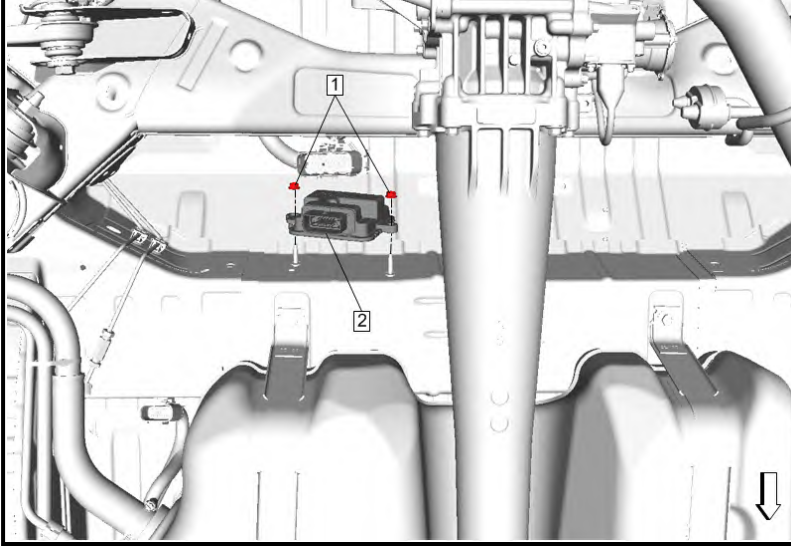


Fuel Pump Fuel Feed Hose (3) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

7. Evaporative Emission Canister Vent Hose (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)
8. Electrical Connector (1) - Connect [2x]
9. [Fuel Tank Replacement \(AWD\)](#) - Install

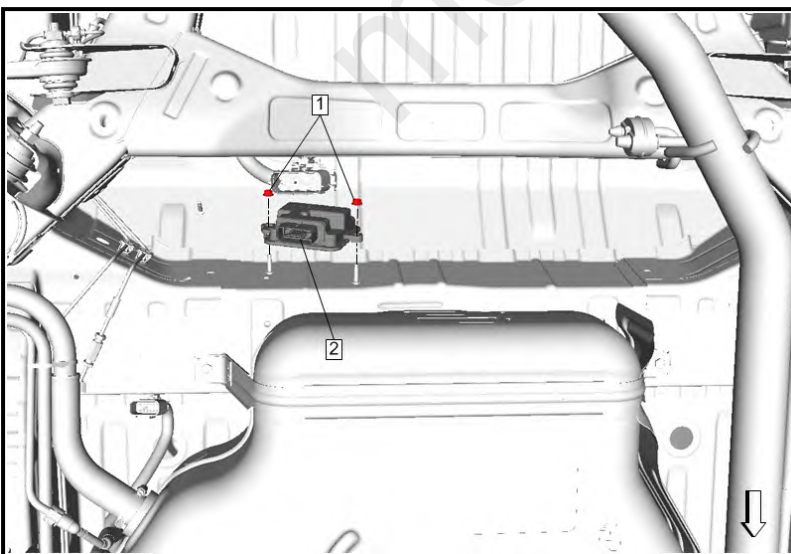
FUEL PUMP POWER CONTROL MODULE REPLACEMENT (AWD)





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

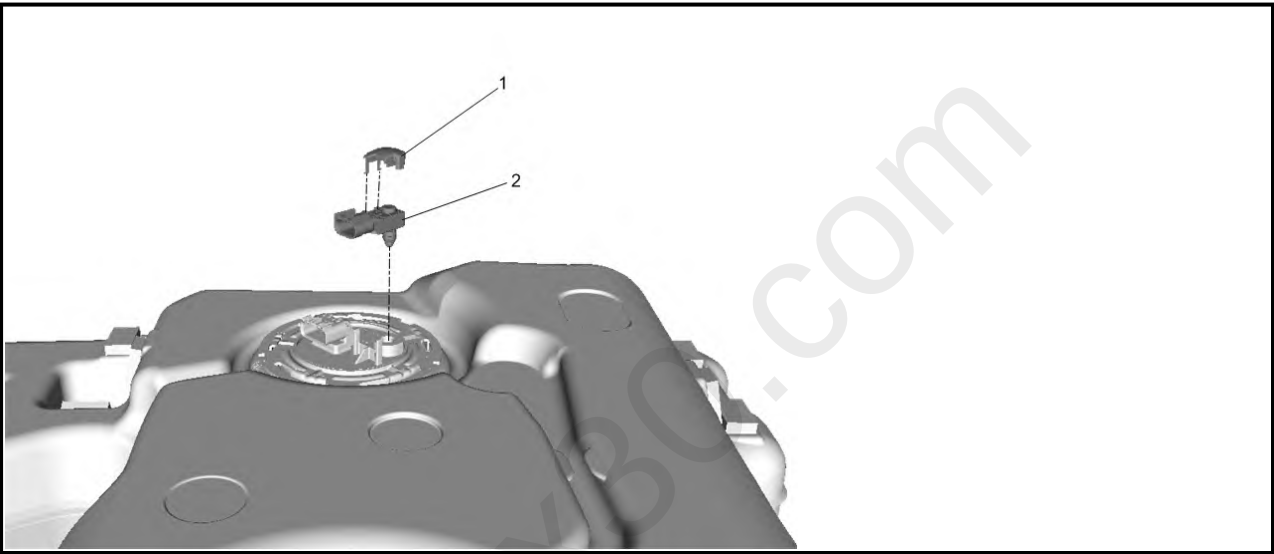
FUEL PUMP POWER CONTROL MODULE REPLACEMENT (FWD)



Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
Empty space for additional procedure steps	

Callout	Component Name
1	Fuel Pump Power Control Module Fastener [2x] CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)
Â	Fuel Pump Power Control Module Procedure 1. Disconnect the electrical connector. 2. If replacing, reprogram the module. Control Module References

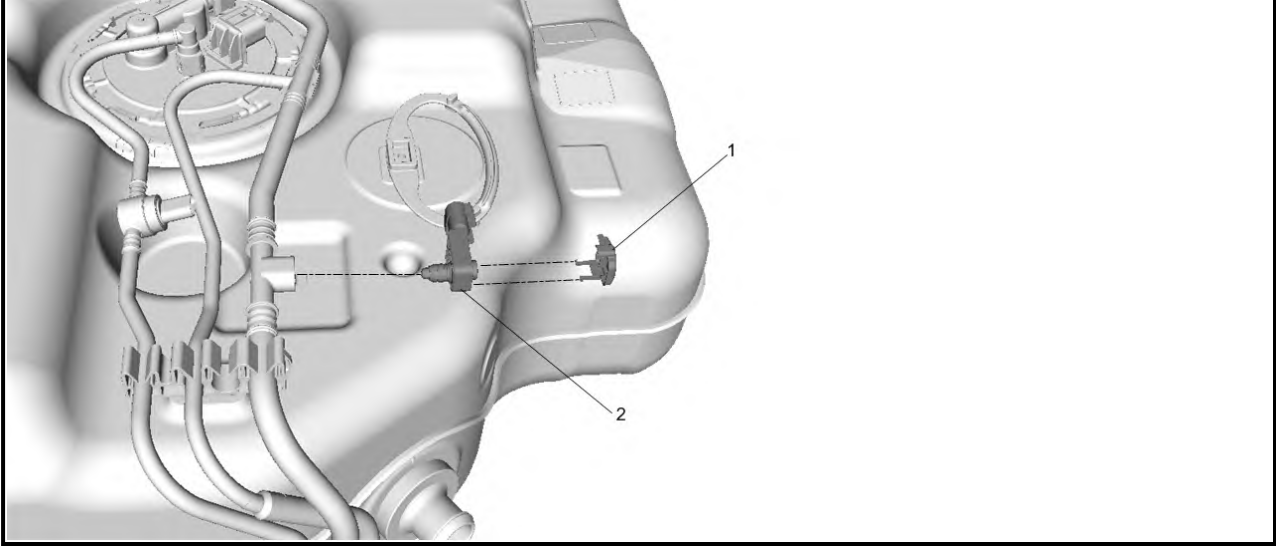
FUEL TANK PRESSURE SENSOR REPLACEMENT (AWD)



Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning . Preliminary Procedure Fuel Tank Replacement (AWD)	
1	Fuel Tank Pressure Sensor Cover
2	Fuel Tank Pressure Sensor Procedure Disconnect the electrical connector.

FUEL TANK PRESSURE SENSOR REPLACEMENT (FWD)





Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Fuel Tank Replacement (FWD)	
1	Fuel Tank Pressure Sensor Cover
2	Fuel Tank Pressure Sensor Procedure Disconnect the electrical connector.

FUEL TANK FILLER PIPE REPLACEMENT (AWD)

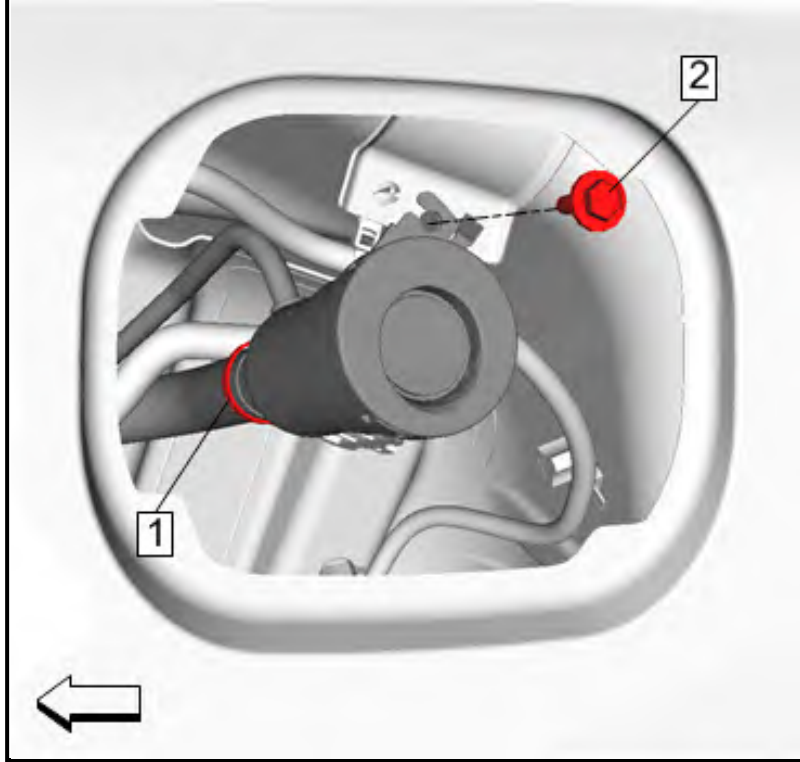
Removal Procedure

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

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

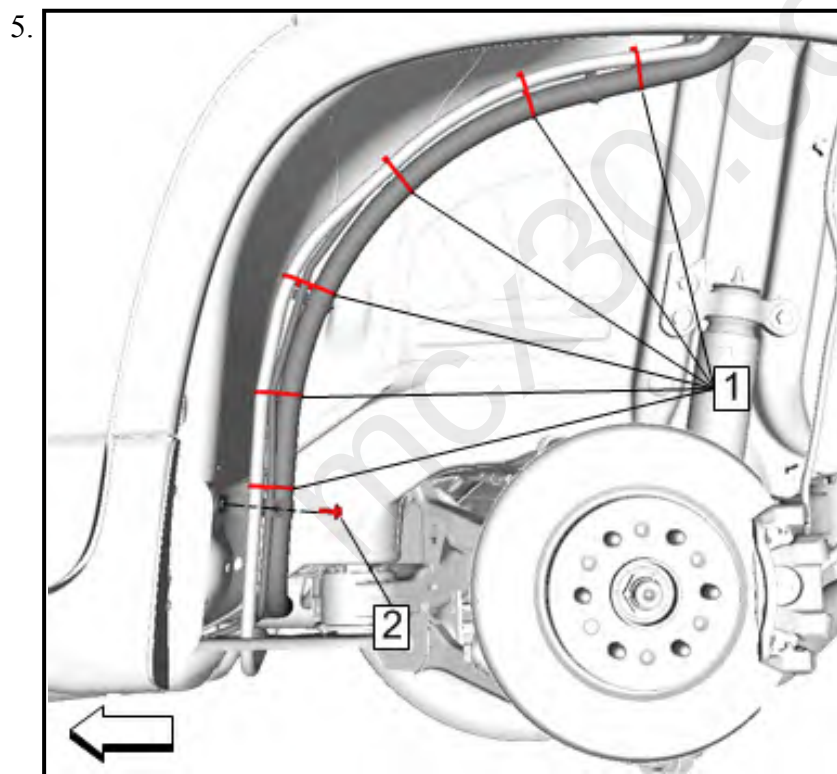
1. Fuel Tank Filler Pipe Housing - Remove - [Fuel Tank Filler Pipe Housing Replacement](#)
2. Rear Wheelhouse Liner - Remove - [Rear Wheelhouse Liner Replacement](#)

3.



Tie Strap (1) - Remove and DISCARD

4. Fuel Tank Filler Pipe Bolt (2) - Remove

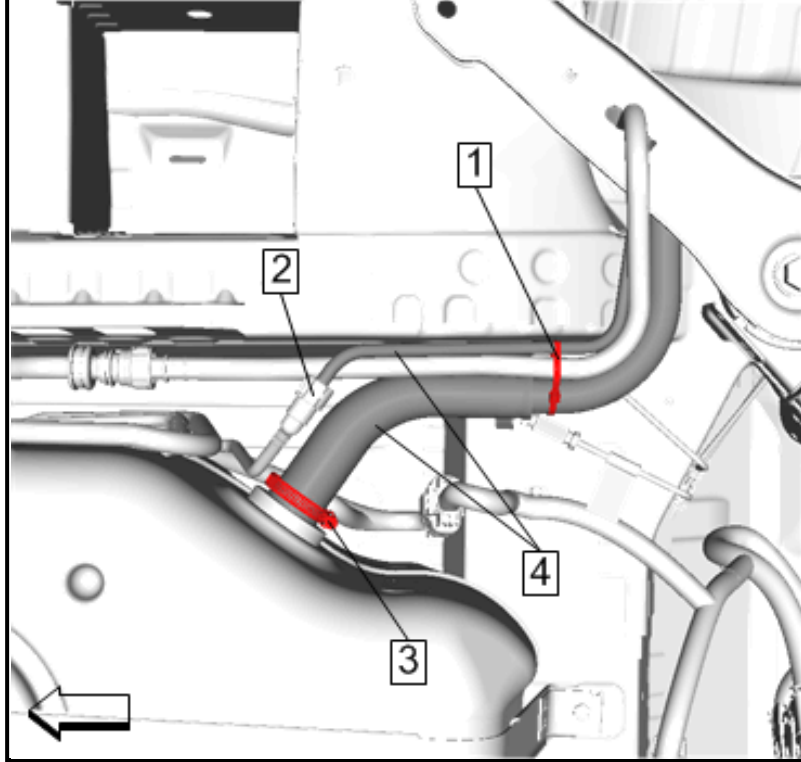


Tie Strap (1) - Remove and DISCARD [6x]

6. Fuel Tank Filler Pipe Bolt (2) - Remove

7. Rear Cradle Mount Bolt Bracket - Remove - [Rear Cradle Mount Bolt Bracket Replacement](#)

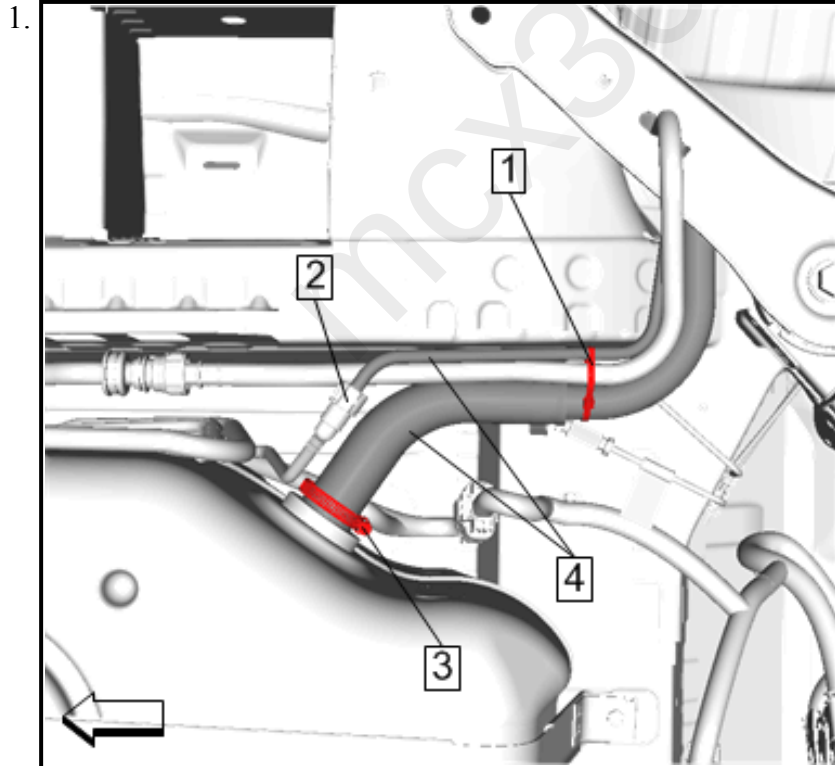




Tie Strap (1) - Remove

9. Evaporative Emission Canister Vent Hose (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)
10. Fuel Tank Filler Hose Clamp (3) - Remove
11. Fuel Tank Filler Hose (4) - Remove

Installation Procedure

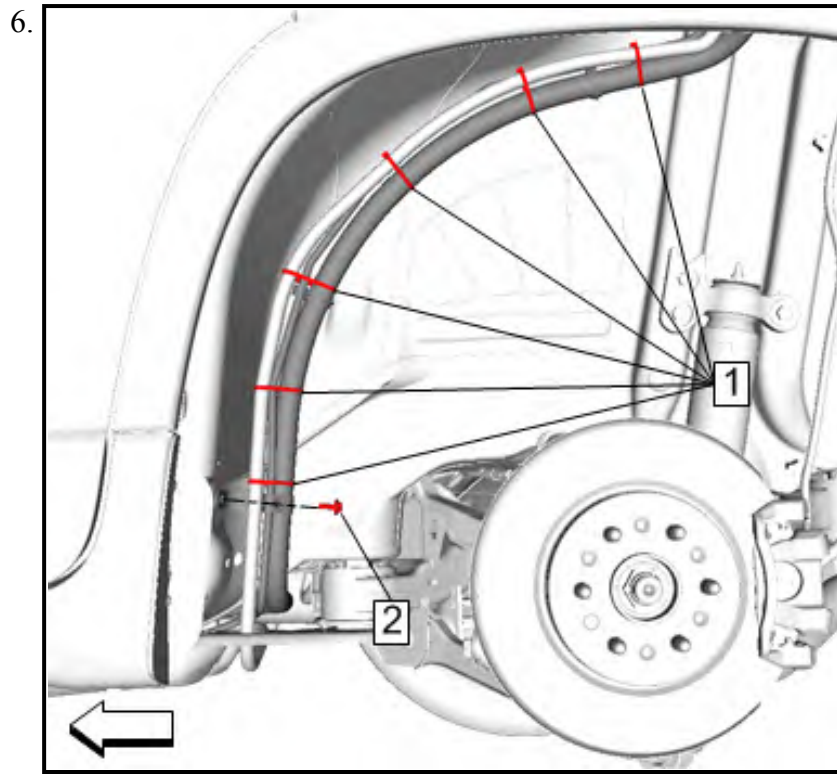


Fuel Tank Filler Hose (4) - Install

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

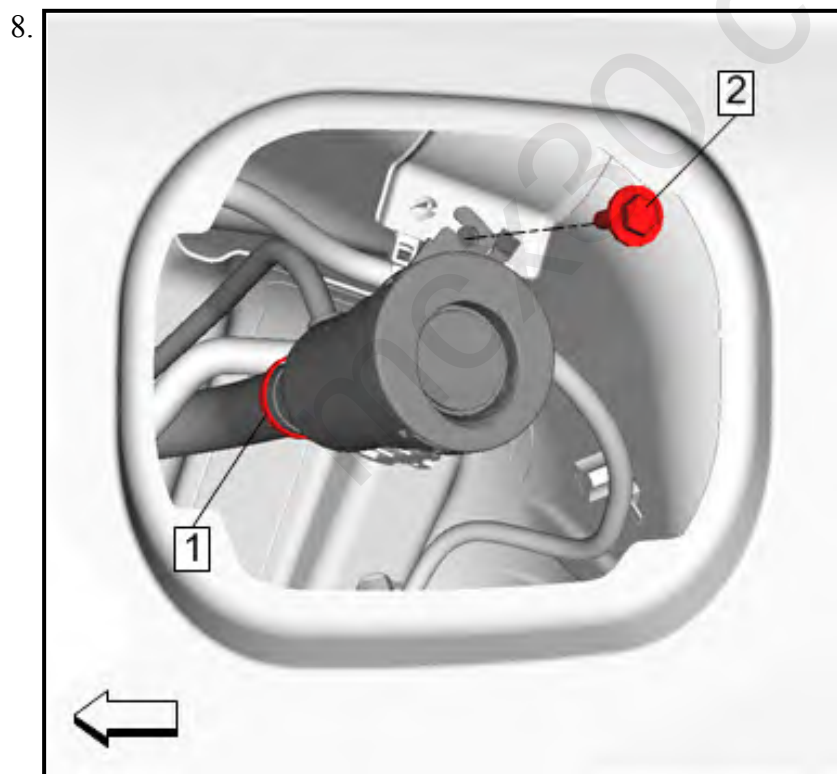
2. Fuel Tank Filler Hose Clamp (3) - Install and tighten 4 N.m (35 lb in)
3. Evaporative Emission Canister Vent Hose (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)
4. Tie Strap (1) - Install NEW

5. Rear Cradle Mount Bolt Bracket - Install - [Rear Cradle Mount Bolt Bracket Replacement](#)



Fuel Tank Filler Pipe Bolt (2) - Install and tighten 9 N.m (80 lb in)

7. Tie Strap (1) - Install NEW [6x]



Fuel Tank Filler Pipe Bolt (2) - Install and tighten 2.5 N.m (22 lb in)

9. Tie Strap (1) - Install NEW

10. Rear Wheelhouse Liner - Install - [Rear Wheelhouse Liner Replacement](#)

11. Fuel Tank Filler Pipe Housing - Install - [Fuel Tank Filler Pipe Housing Replacement](#)

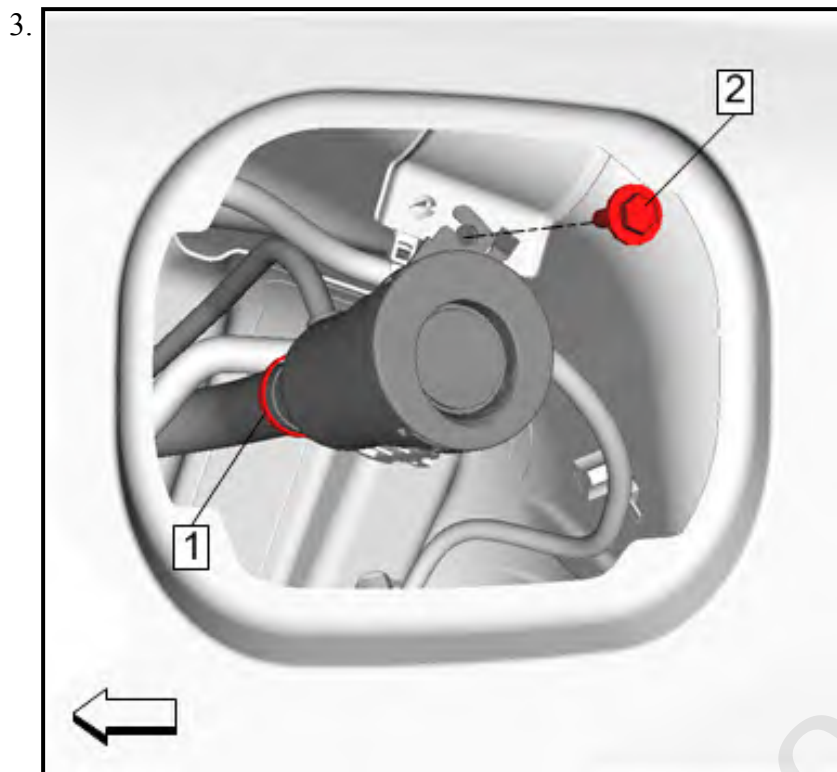
FUEL TANK FILLER PIPE REPLACEMENT (FWD)

Removal Procedure

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

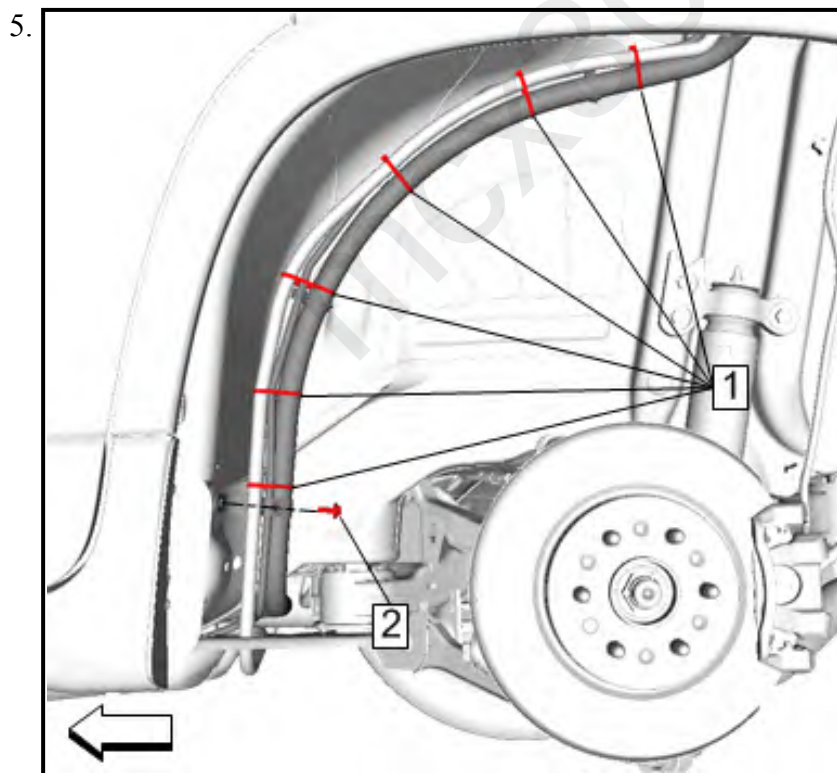
WARNING: Refer to [Safety Glasses Warning](#) .

1. Fuel Tank Filler Pipe Housing - Remove - [Fuel Tank Filler Pipe Housing Replacement](#)
2. Rear Wheelhouse Liner - Remove - [Rear Wheelhouse Liner Replacement](#)



Tie Strap (1) - Remove and DISCARD

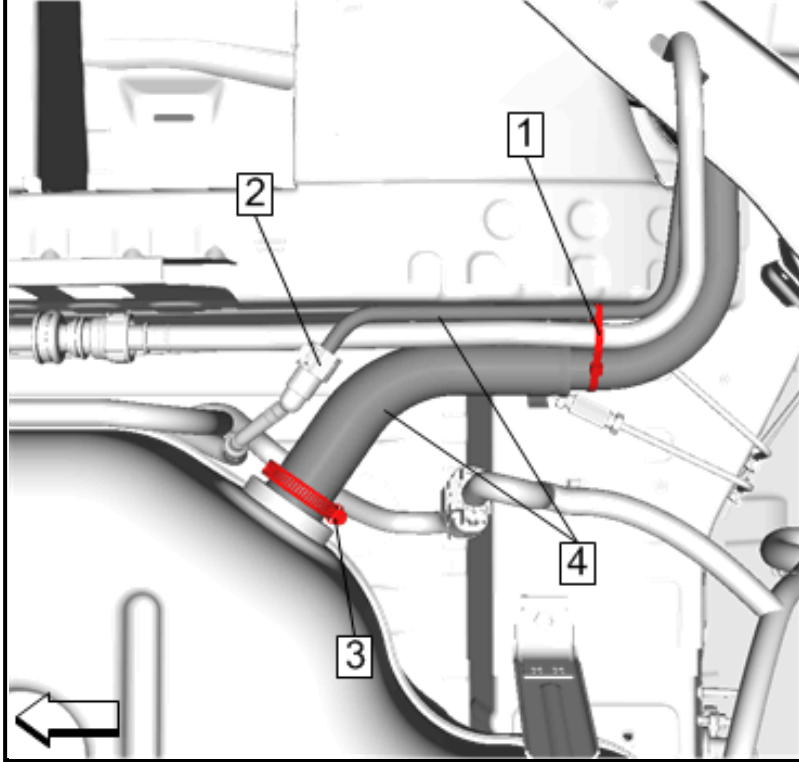
4. Fuel Tank Filler Pipe Bolt (2) - Remove



Tie Strap (1) - Remove and DISCARD [6x]

6. Fuel Tank Filler Pipe Bolt (2) - Remove
7. Rear Cradle Mount Bolt Bracket - Remove - [Rear Cradle Mount Bolt Bracket Replacement](#)

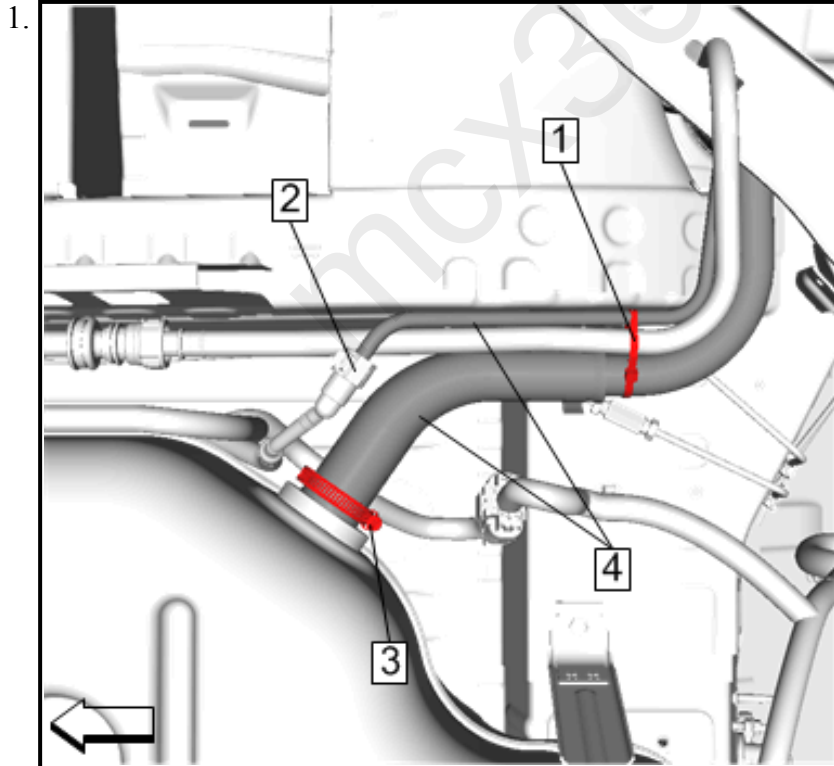




Tie Strap (1) - Remove

9. Evaporative Emission Canister Vent Hose (2) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)
10. Fuel Tank Filler Hose Clamp (3) - Remove
11. Fuel Tank Filler Hose (4) - Remove

Installation Procedure

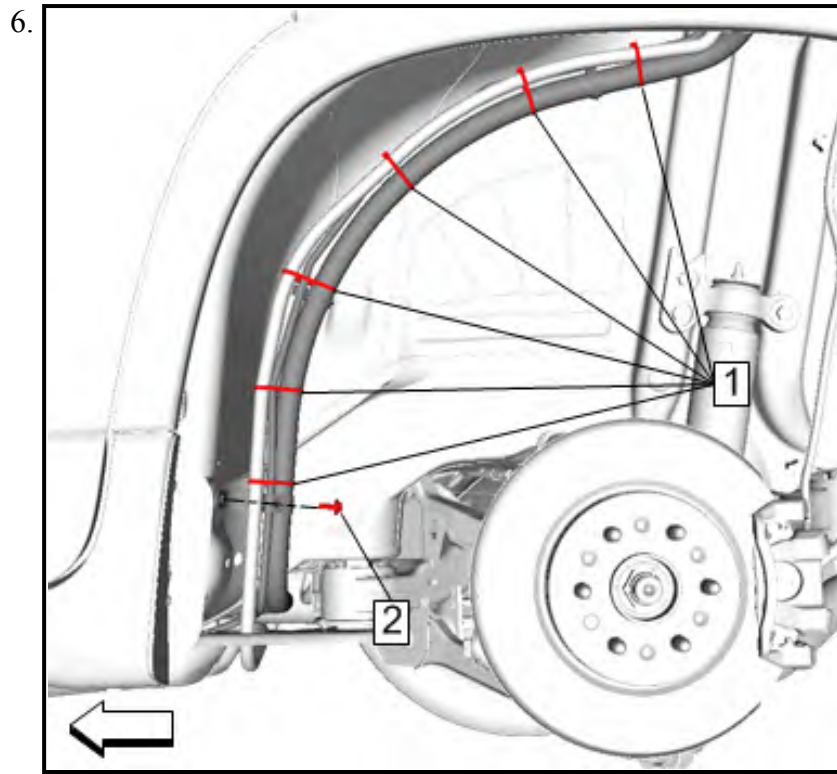


Fuel Tank Filler Hose (4) - Install

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

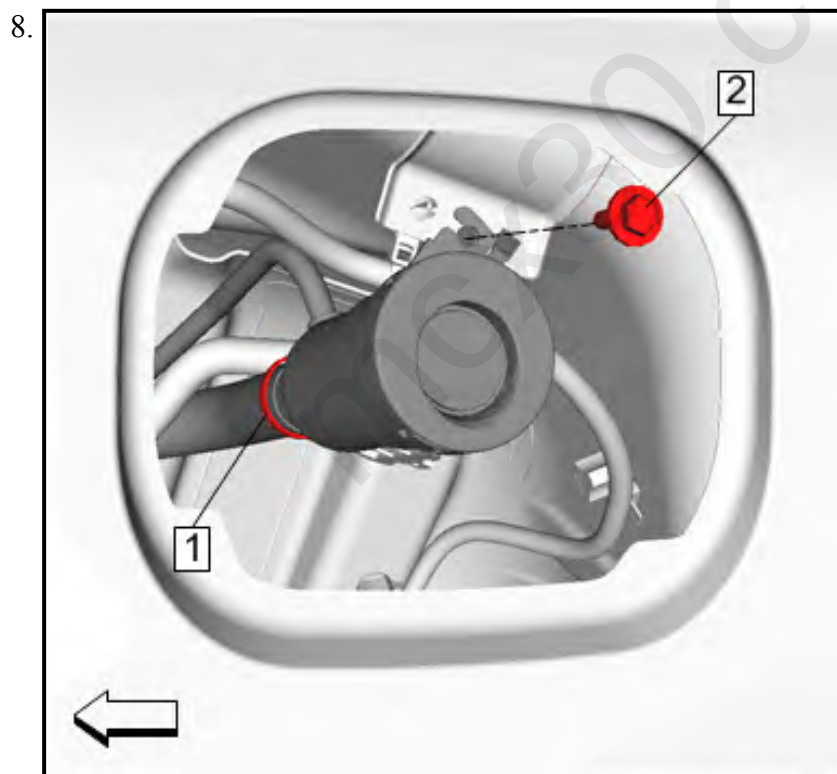
2. Fuel Tank Filler Hose Clamp (3) - Install and tighten 4 N.m (35 lb in)
3. Evaporative Emission Canister Vent Hose (2) - Connect - [Plastic Collar Quick Connect Fitting Service](#)
4. Tie Strap (1) - Install NEW

5. Rear Cradle Mount Bolt Bracket - Install - [Rear Cradle Mount Bolt Bracket Replacement](#)



Fuel Tank Filler Pipe Bolt (2) - Install and tighten 9 N.m (80 lb in)

7. Tie Strap (1) - Install NEW [6x]



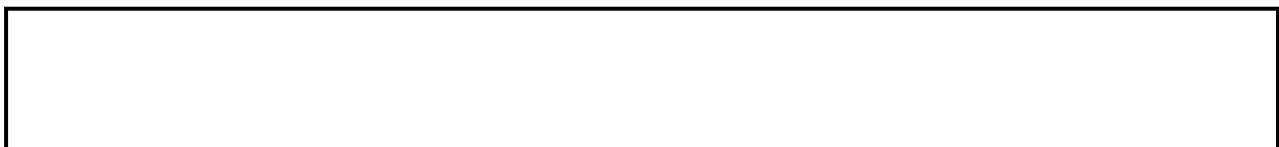
Fuel Tank Filler Pipe Bolt (2) - Install and tighten 2.5 N.m (22 lb in)

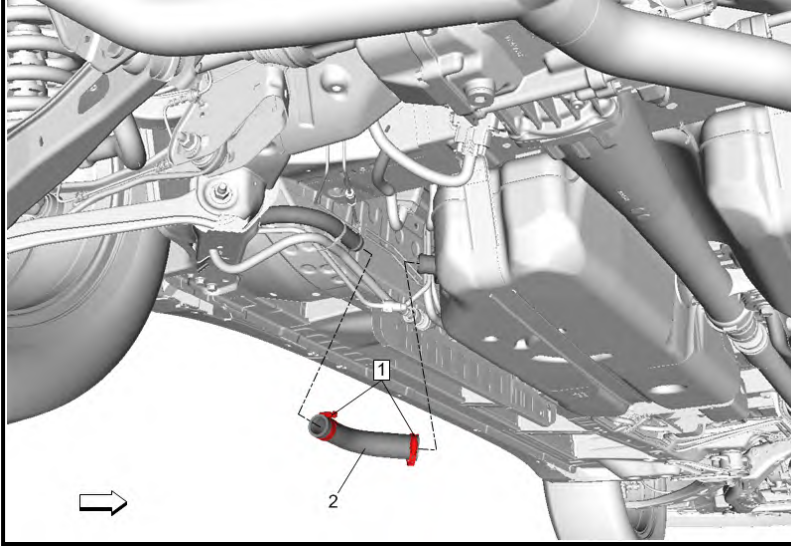
9. Tie Strap (1) - Install NEW

10. Rear Wheelhouse Liner - Install - [Rear Wheelhouse Liner Replacement](#)

11. Fuel Tank Filler Pipe Housing - Install - [Fuel Tank Filler Pipe Housing Replacement](#)

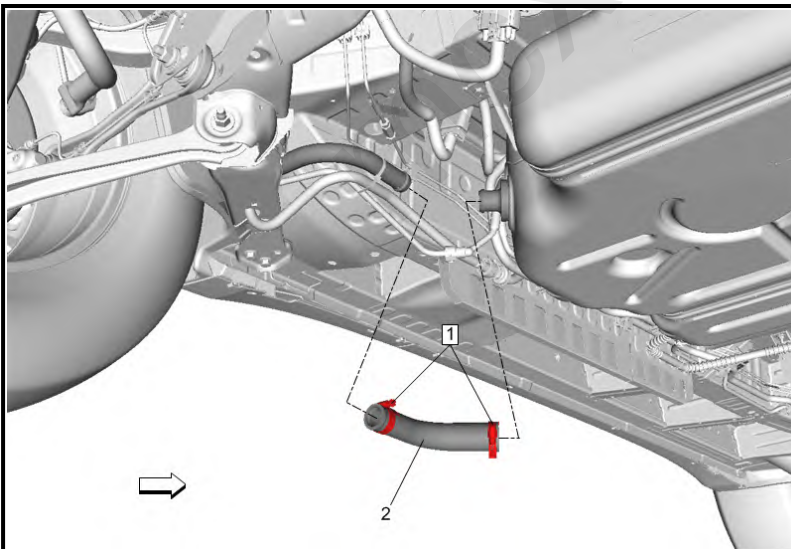
FUEL TANK FILLER HOSE REPLACEMENT (AWD)





Callout	Component Name
Preliminary Procedures Fuel Tank Draining Lifting and Jacking the Vehicle	
1	Fuel Tank Filler Hose Clamp [2x] CAUTION: Refer to Fastener Caution . Tighten 4 N.m (35 lb in)
2	Fuel Tank Filler Hose

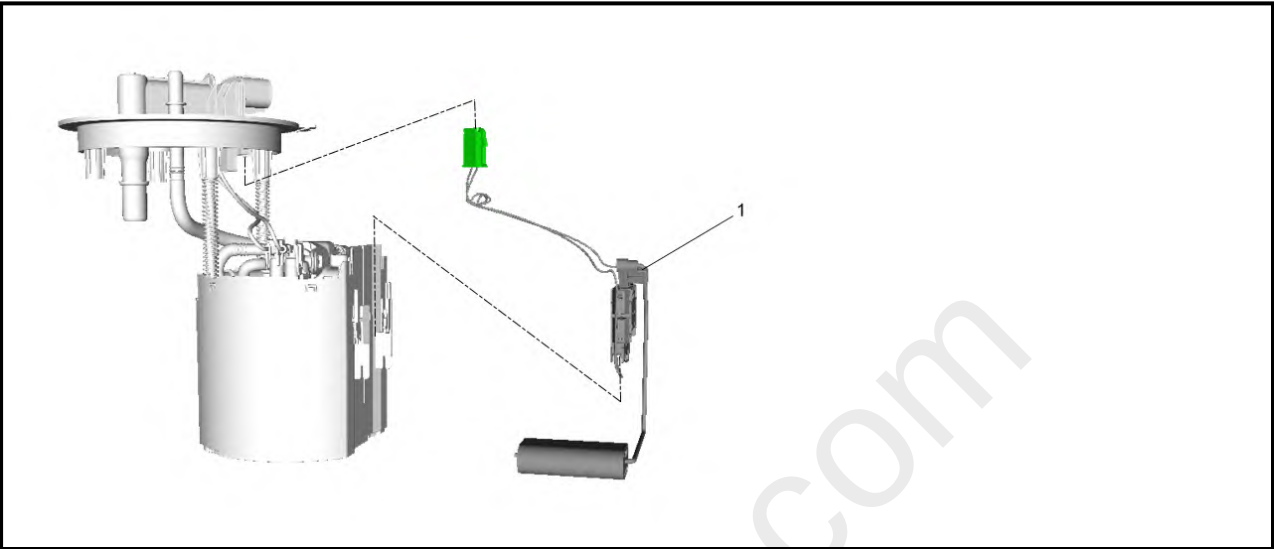
FUEL TANK FILLER HOSE REPLACEMENT (FWD)



Callout	Component Name
Preliminary Procedures Fuel Tank Draining Lifting and Jacking the Vehicle	

Callout	Component Name
1	Fuel Tank Filler Hose Clamp [2x] CAUTION: Refer to Fastener Caution . Tighten 4 N.m (35 lb in)
2	Fuel Tank Filler Hose

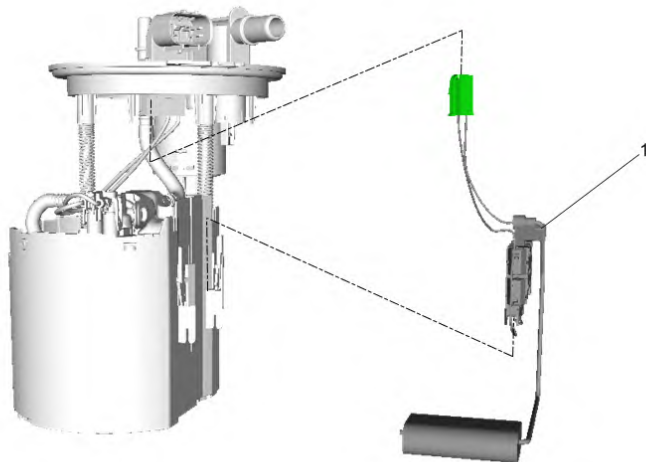
FUEL LEVEL SENSOR REPLACEMENT (AWD)



Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning . Preliminary Procedure Fuel Tank Fuel Pump Module Replacement (AWD)	
1	Fuel Level Sensor Procedure 1. Disconnect the electrical connector. 2. Release the retaining tabs.

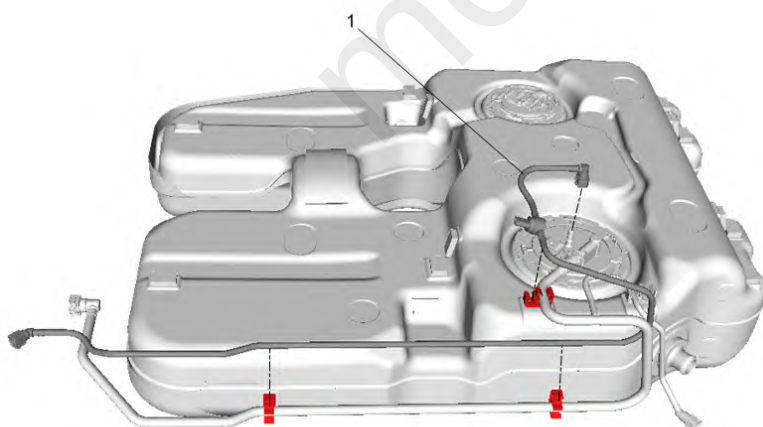
FUEL LEVEL SENSOR REPLACEMENT (FWD)





Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Fuel Tank Fuel Pump Module Replacement (FWD)	
1	Fuel Level Sensor Procedure 1. Disconnect the electrical connector. 2. Release the retaining tabs.

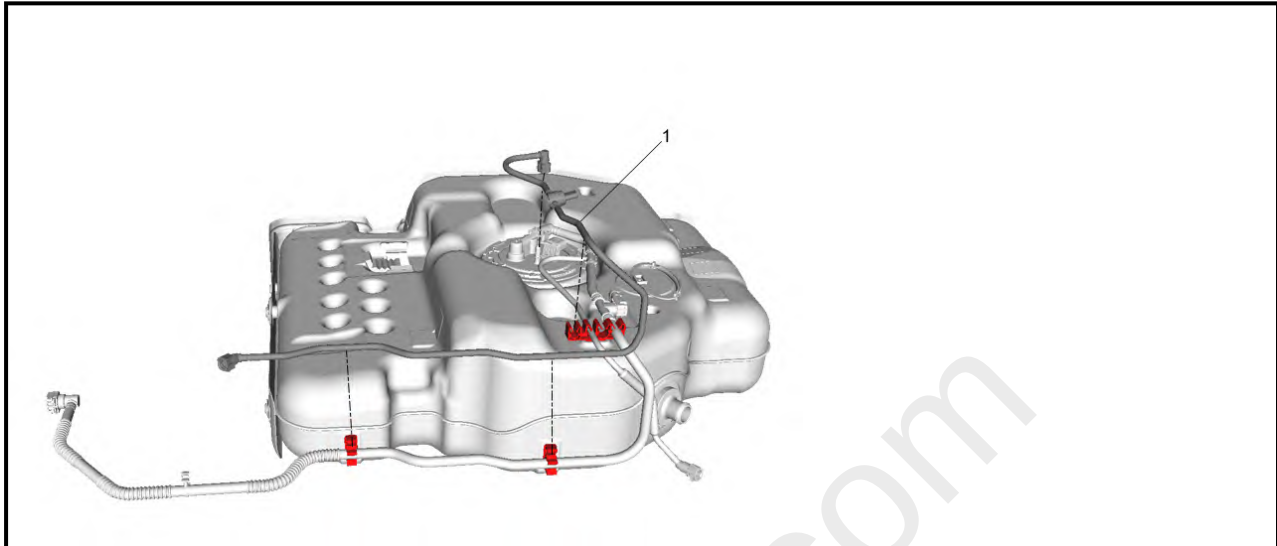
FUEL PUMP FUEL FEED HOSE REPLACEMENT (AWD)



Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Fuel Tank Replacement (AWD)	

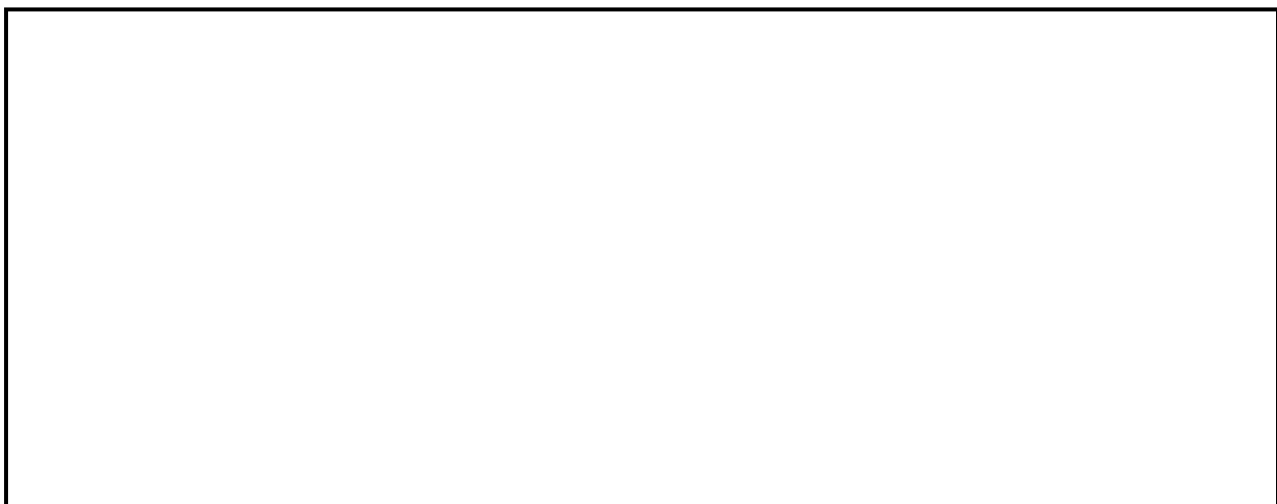
Callout	Component Name
1	Fuel Pump Fuel Feed Hose Procedure 1. Disconnect the electrical connector. 2. Disconnect the quick connect fitting and remove from retainers. Plastic Collar Quick Connect Fitting Service

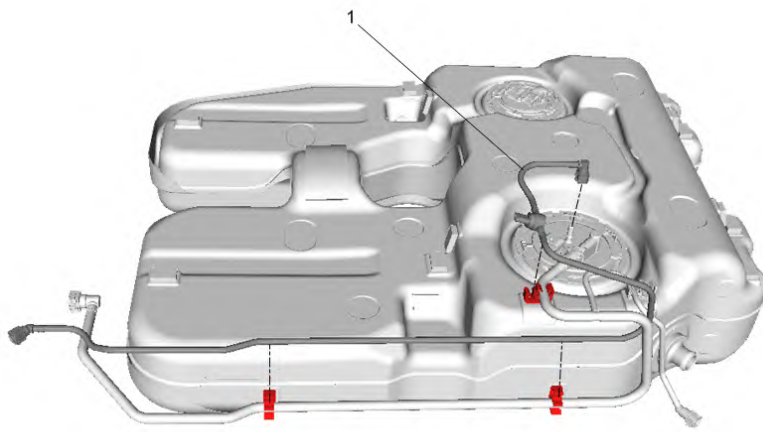
FUEL PUMP FUEL FEED HOSE REPLACEMENT (FWD)



Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning . Preliminary Procedure Fuel Tank Replacement (FWD) .	
1	Fuel Pump Fuel Feed Hose Procedure 1. Disconnect the electrical connector. 2. Disconnect the quick connect fitting and remove from retainers. Plastic Collar Quick Connect Fitting Service

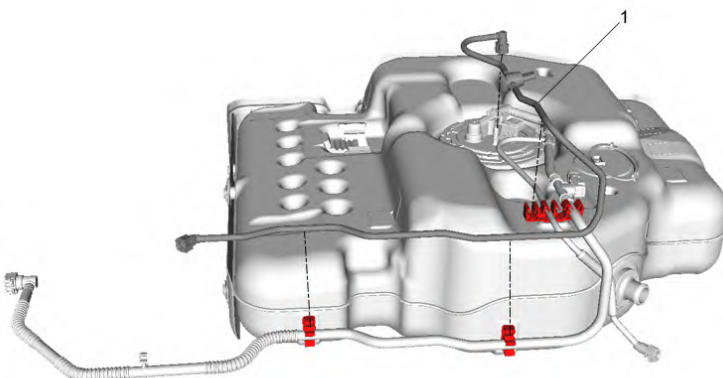
FUEL PRESSURE SENSOR REPLACEMENT - FUEL FEED PIPE (AWD)





Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning . Preliminary Procedure Fuel Tank Replacement (AWD) .	
1	Fuel Pressure Sensor NOTE: Fuel pressure sensor is serviced as part of fuel feed pipe assembly. Procedure 1. Disconnect the electrical connector. 2. Disconnect the fuel feed pipe from the fuel tank fuel pump module and remove from retainers. Plastic Collar Quick Connect Fitting Service

FUEL PRESSURE SENSOR REPLACEMENT - FUEL FEED PIPE (FWD)



Callout	Component Name

Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Fuel Tank Replacement (FWD) .	
1	Fuel Pressure Sensor NOTE: Fuel pressure sensor is serviced as part of fuel feed pipe assembly. Procedure 1. Disconnect the electrical connector. 2. Disconnect the fuel feed pipe from the fuel tank fuel pump module and remove from retainers. Plastic Collar Quick Connect Fitting Service

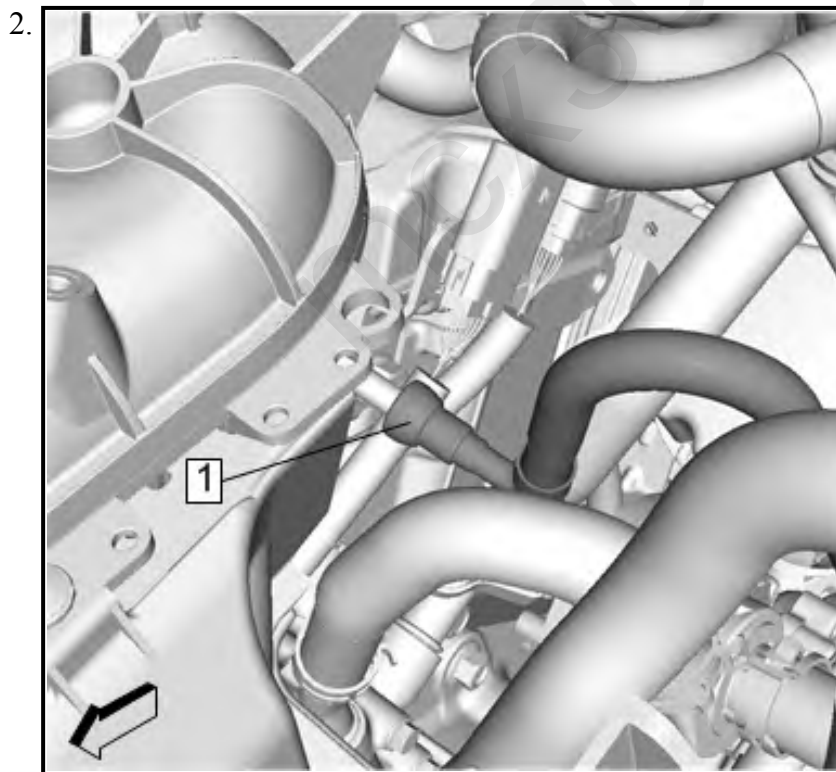
FUEL FEED PIPE REPLACEMENT (AWD)

Removal Procedure

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

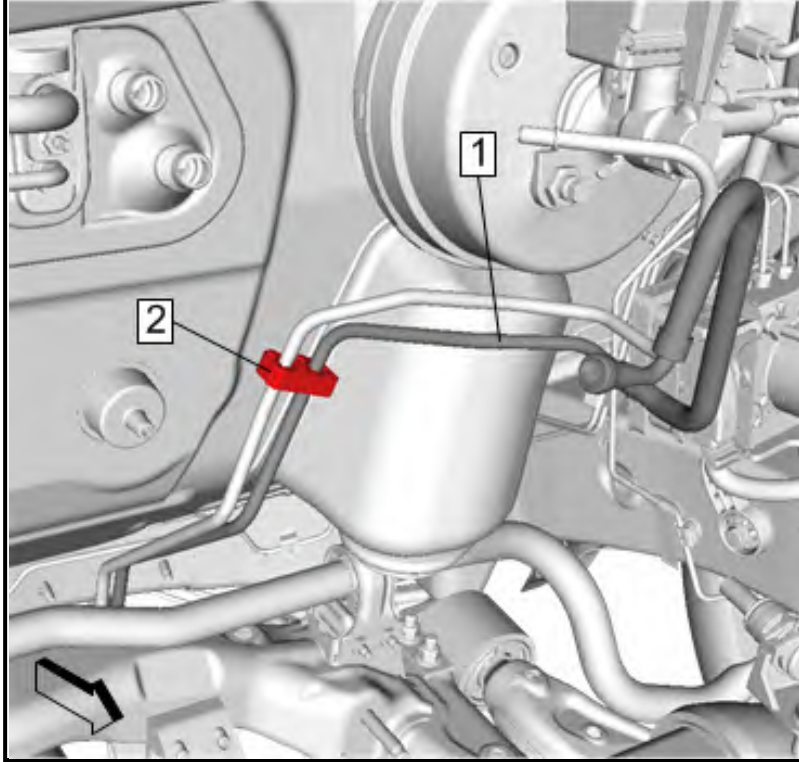
WARNING: Refer to [Safety Glasses Warning](#) .

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



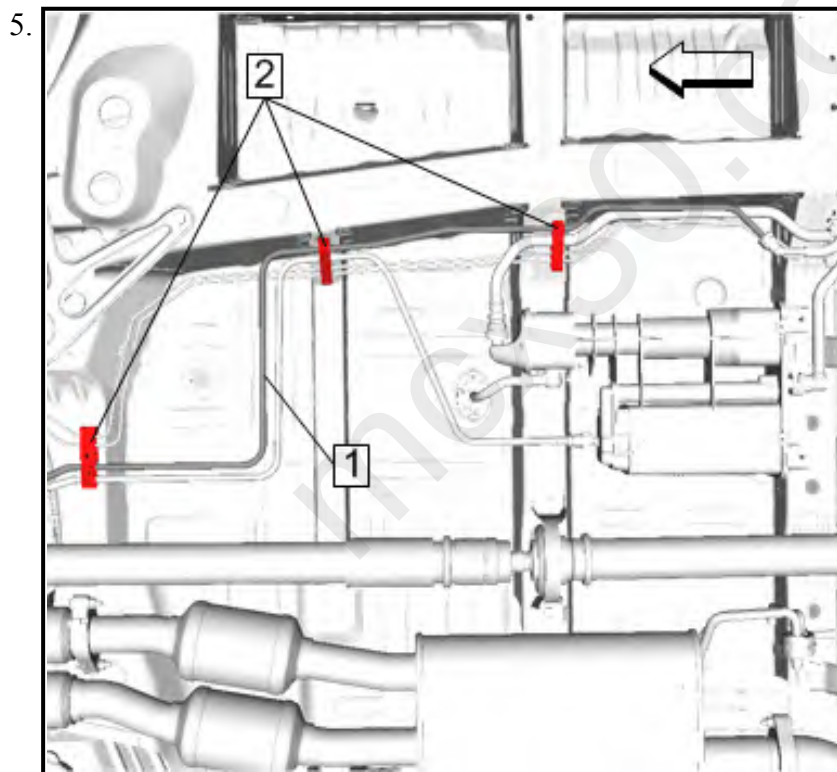
Fuel Feed Pipe (1) - Disconnect - [Metal Collar Quick Connect Fitting Service](#)





Fuel Feed Pipe (1) @ Retainer (2) - Remove

4. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)

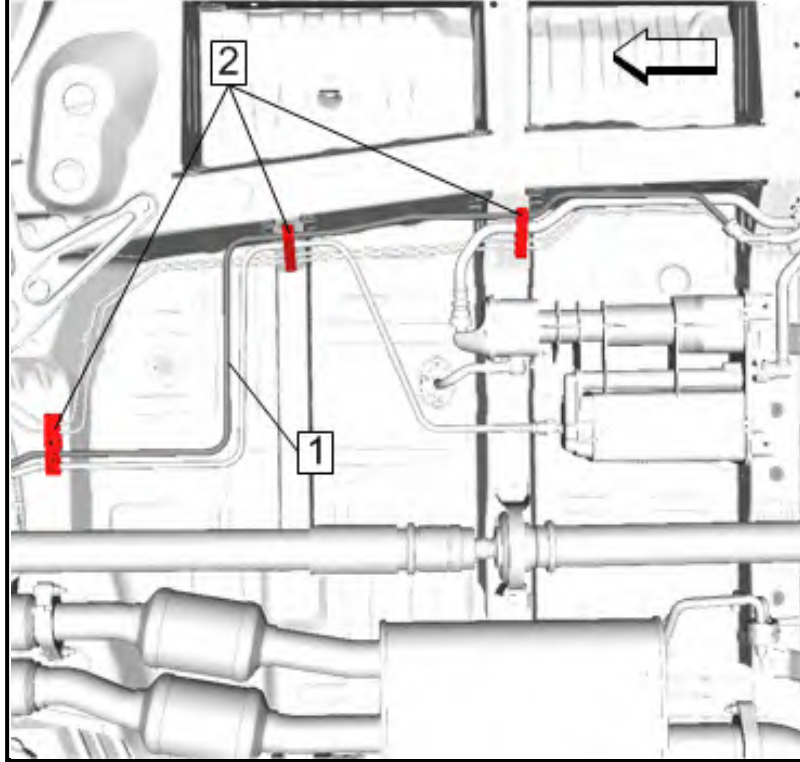


Fuel Feed Pipe (1) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

6. Fuel Feed Pipe (1) @ Retainer (2) - Remove [3x]

Installation Procedure

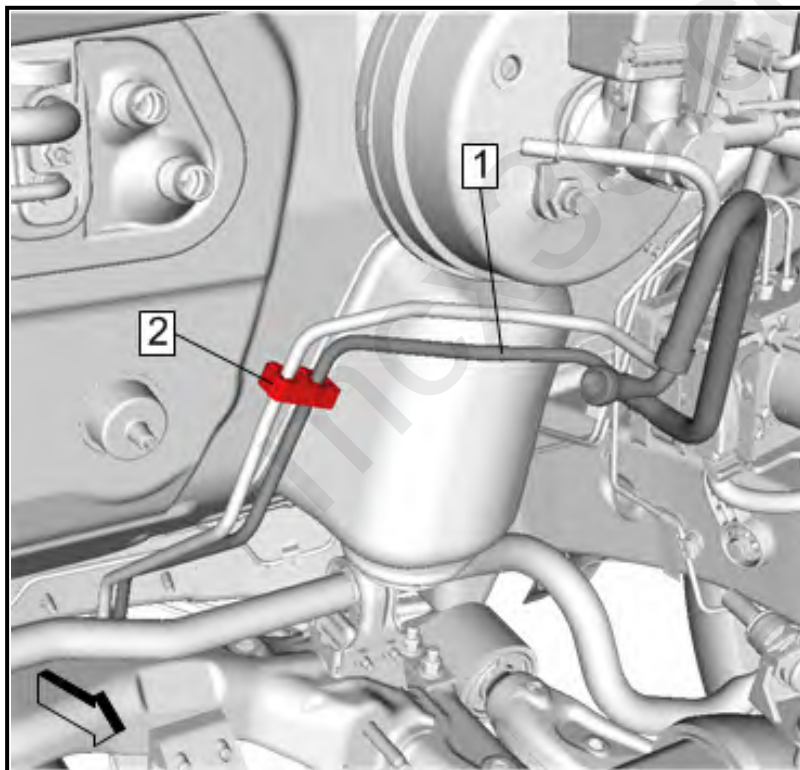




Fuel Feed Pipe (1) @ Retainer (2) - Install [3x]

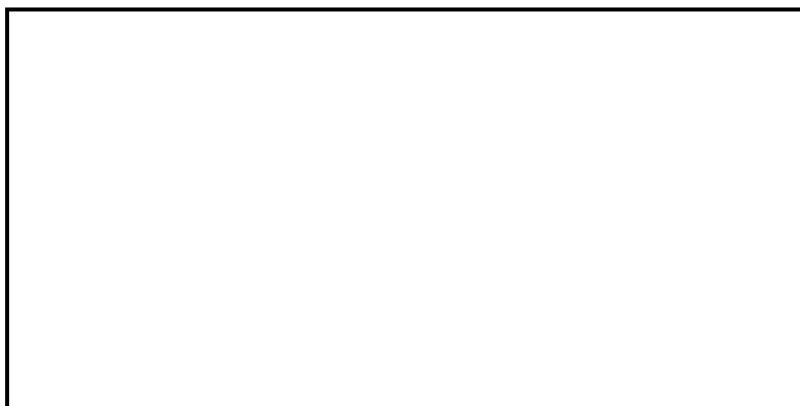
2. Fuel Feed Pipe (1) - Connect - [Plastic Collar Quick Connect Fitting Service](#)
3. Lower the vehicle.

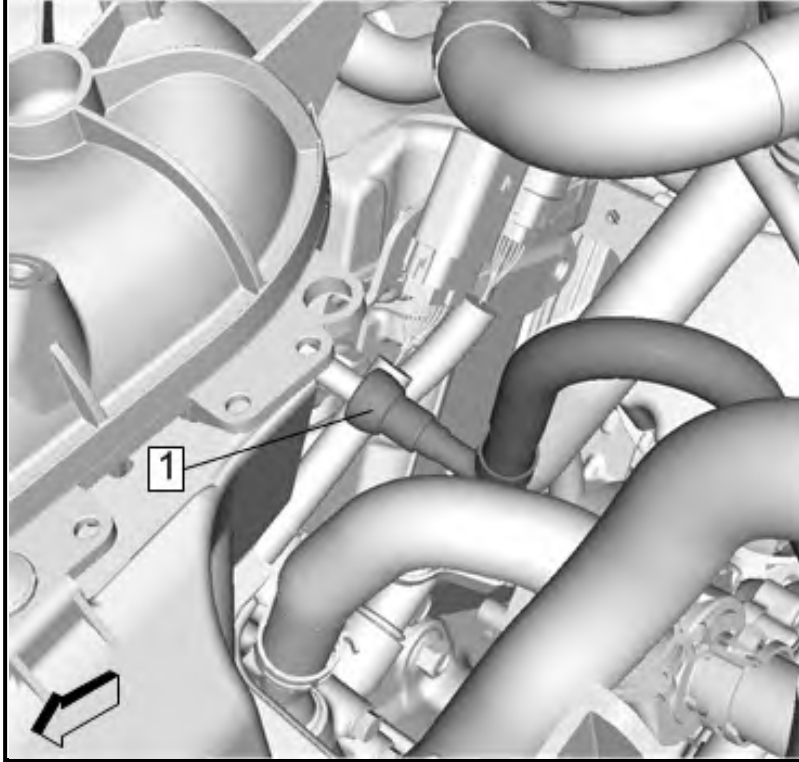
4.



Fuel Feed Pipe (1) @ Retainer (2) - Install

5.





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

FUEL FEED PIPE REPLACEMENT (FWD)

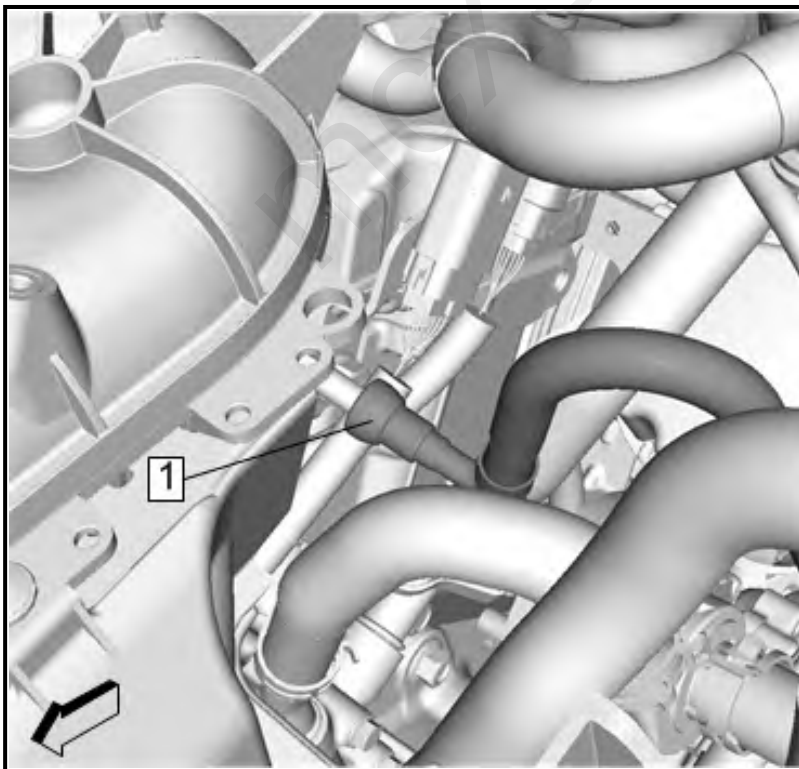
Removal Procedure

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

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

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

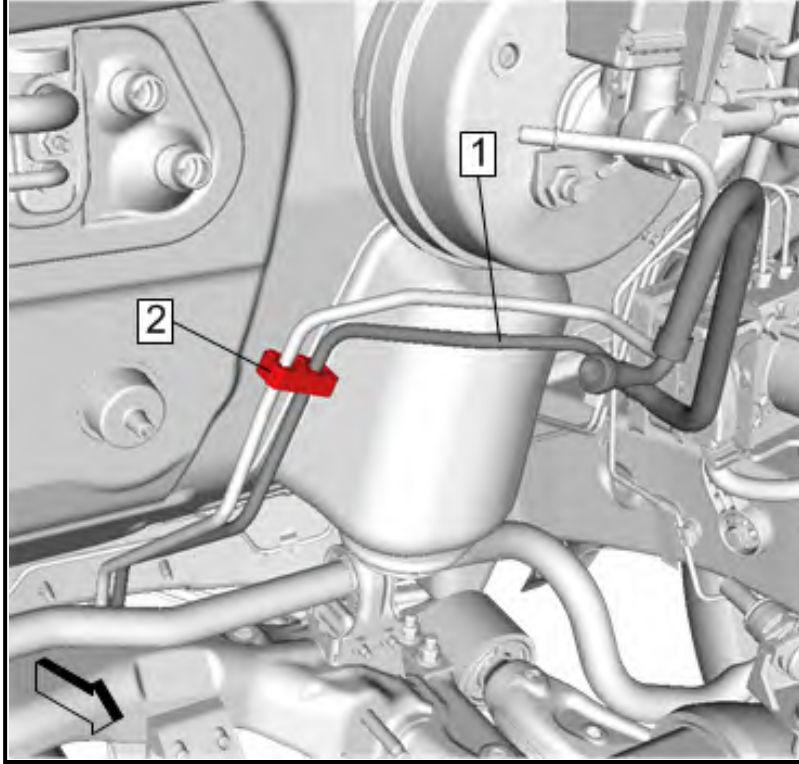
2.



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

3.

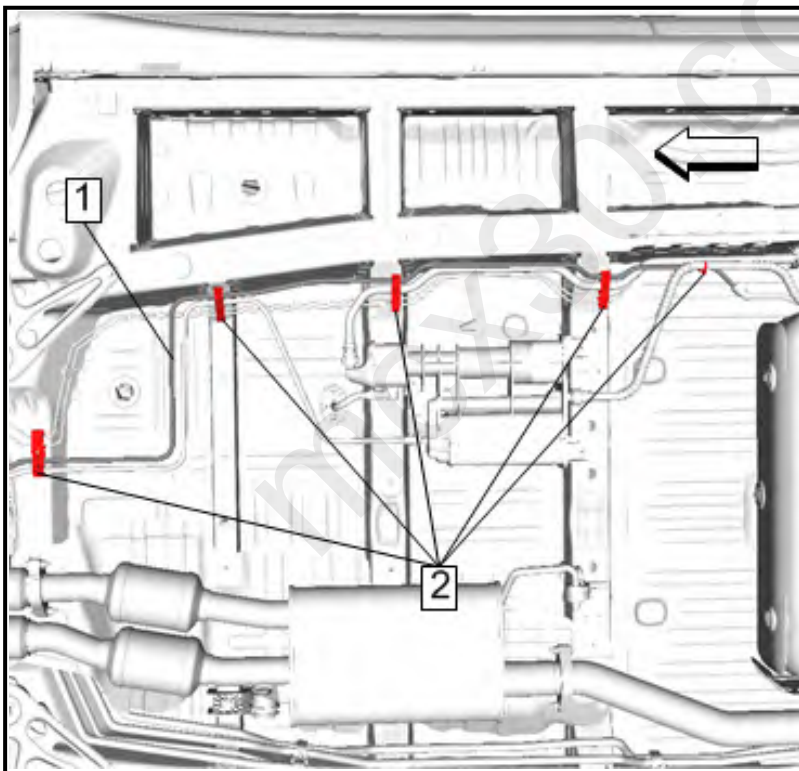




Fuel Feed Pipe (1) @ Retainer (2) - Remove

4. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)

5.



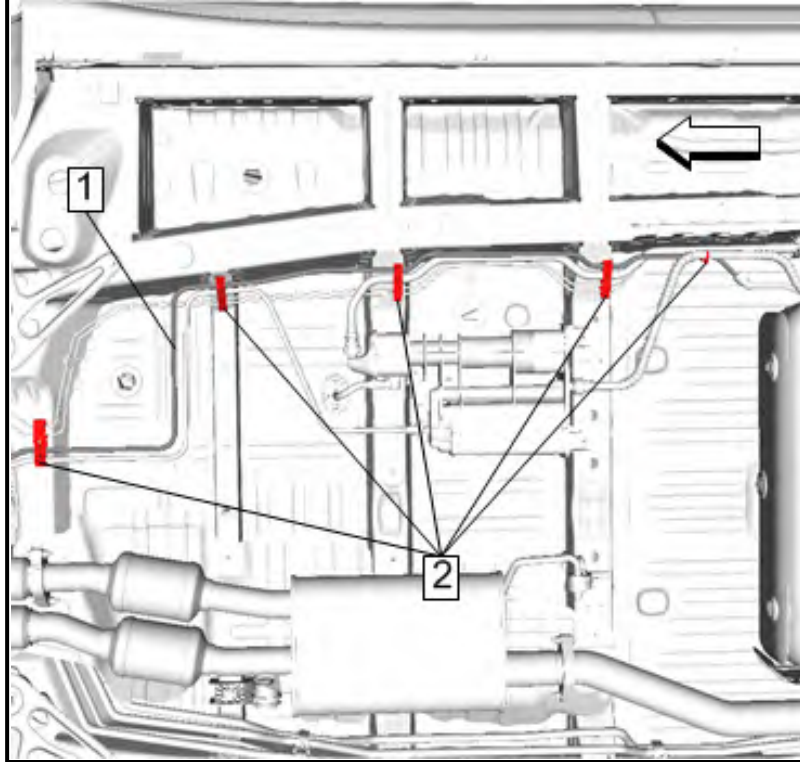
Fuel Feed Pipe (1) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

6. Fuel Feed Pipe (1) @ Retainer (2) - Remove [5x]

Installation Procedure

1.

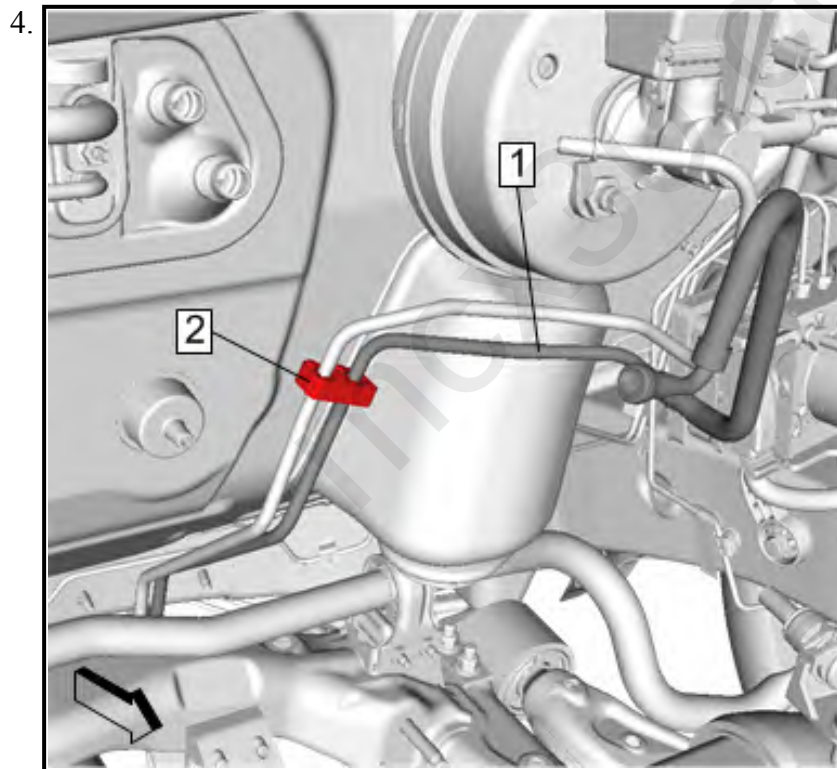




Fuel Feed Pipe (1) @ Retainer (2) - Install [5x]

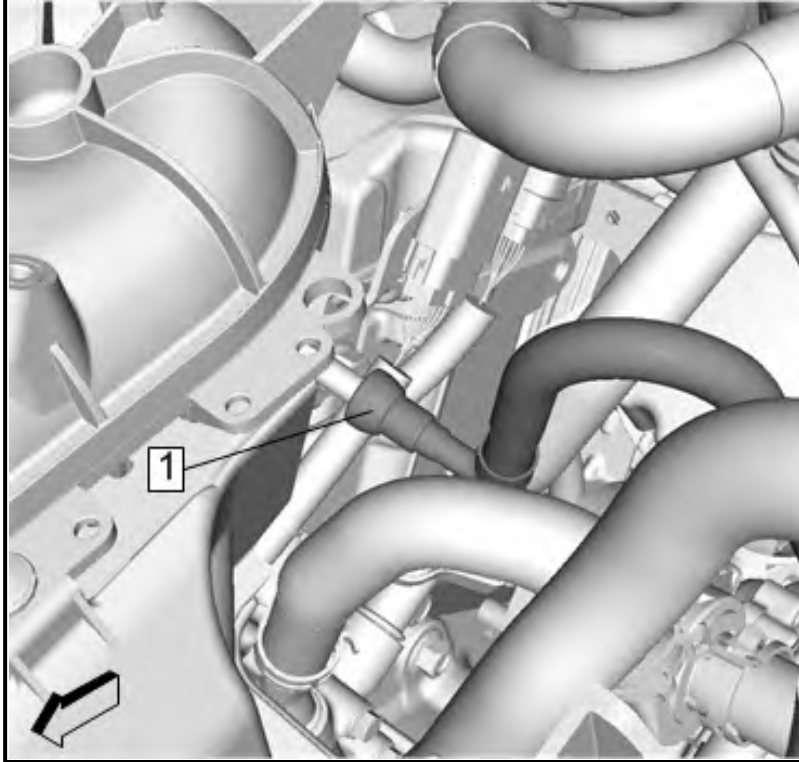
2. Fuel Feed Pipe (1) - Connect - [Plastic Collar Quick Connect Fitting Service](#)

3. Lower the vehicle.



Fuel Feed Pipe (1) @ Retainer (2) - Install





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

FUEL FEED PIPE REPLACEMENT (AWD/FWD, AT ENGINE)

Removal Procedure

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

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

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

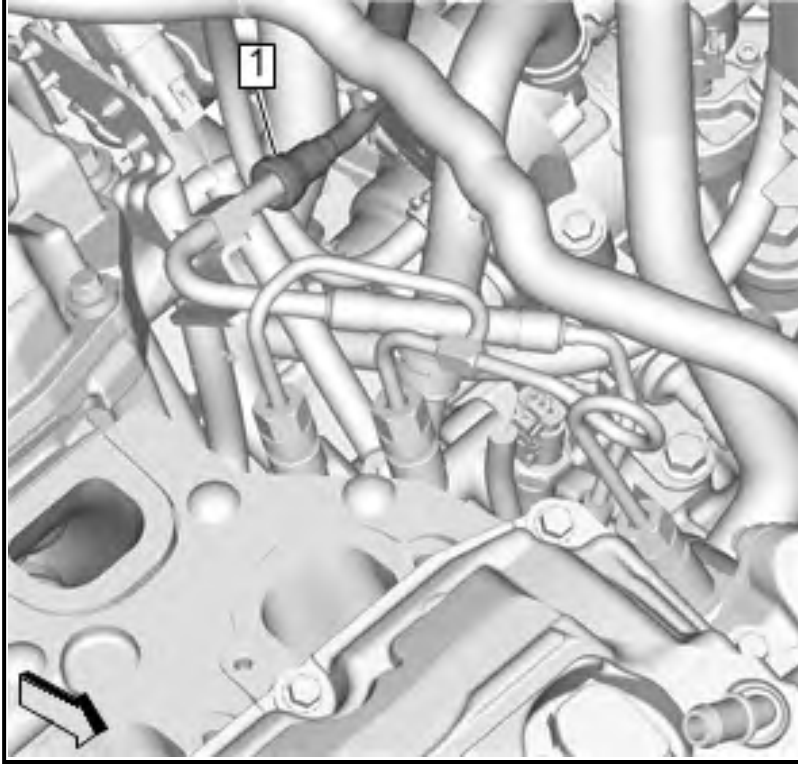
CAUTION: Refer to [Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Caution](#) .

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

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Engine Rear Noise Shield - Remove - [Engine Rear Noise Shield Replacement](#)

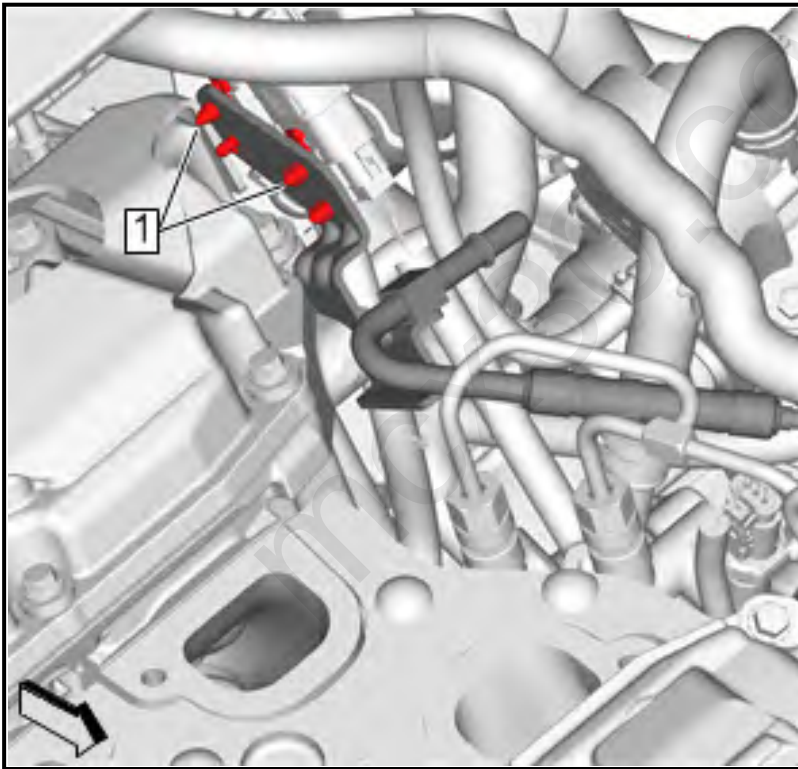
3.





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

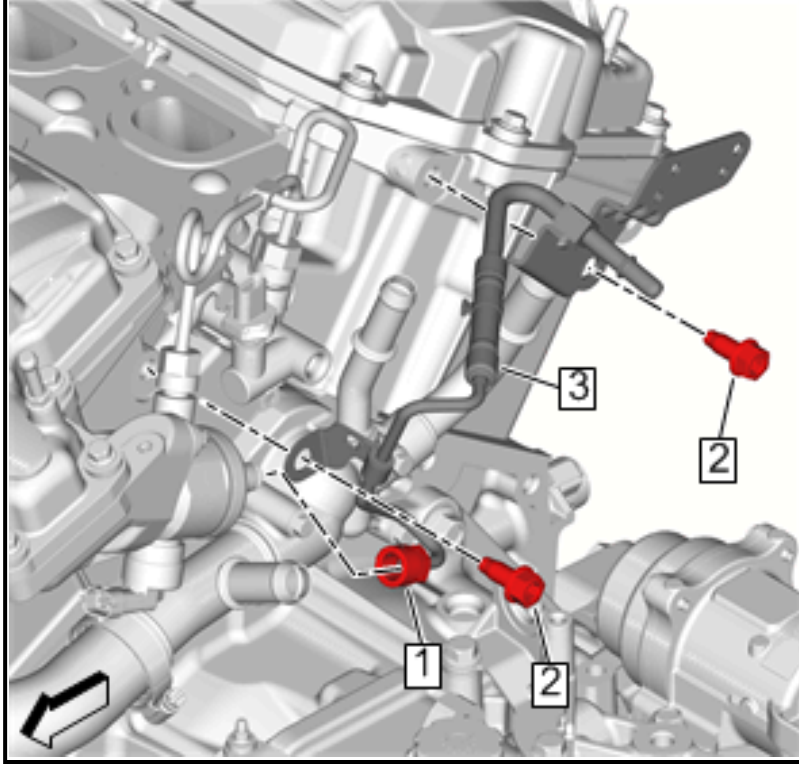
4.



Wiring Harness Retainer (1) @ Bracket - Remove [2x]

5.



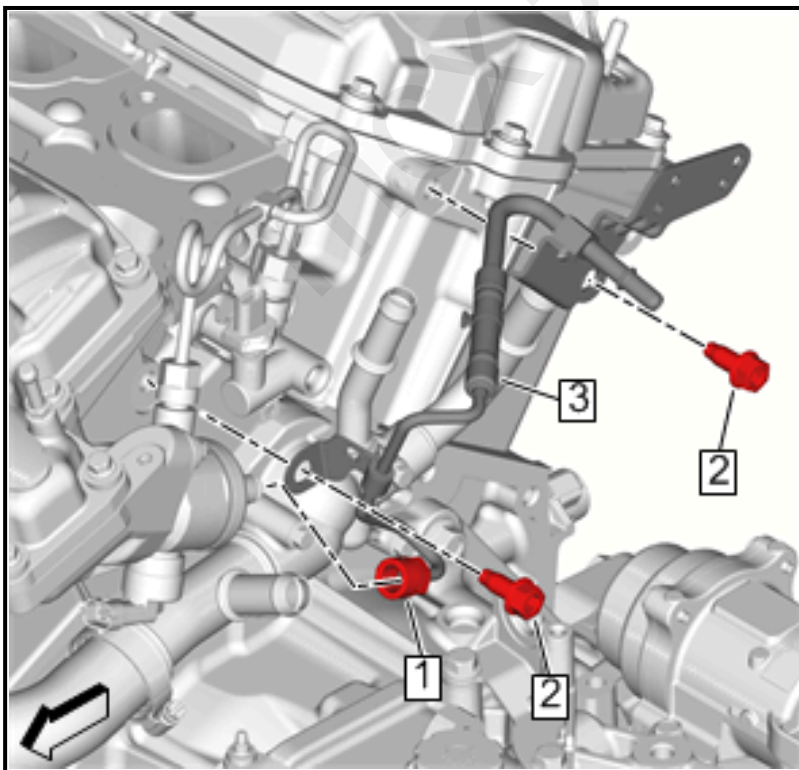


Fuel Feed Pipe Fitting (1) @ Fuel Pump - Remove

6. Fuel Injection Fuel Feed and Return Pipe Retainer Bolt (2) - Remove [2x]
7. Remove and DISCARD the fuel feed pipe (3).

Installation Procedure

1. Ensure ALL fittings are clean and dry prior to assembly.
2. Lubricate the fuel feed pipe fitting with silicon free engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)
- 3.



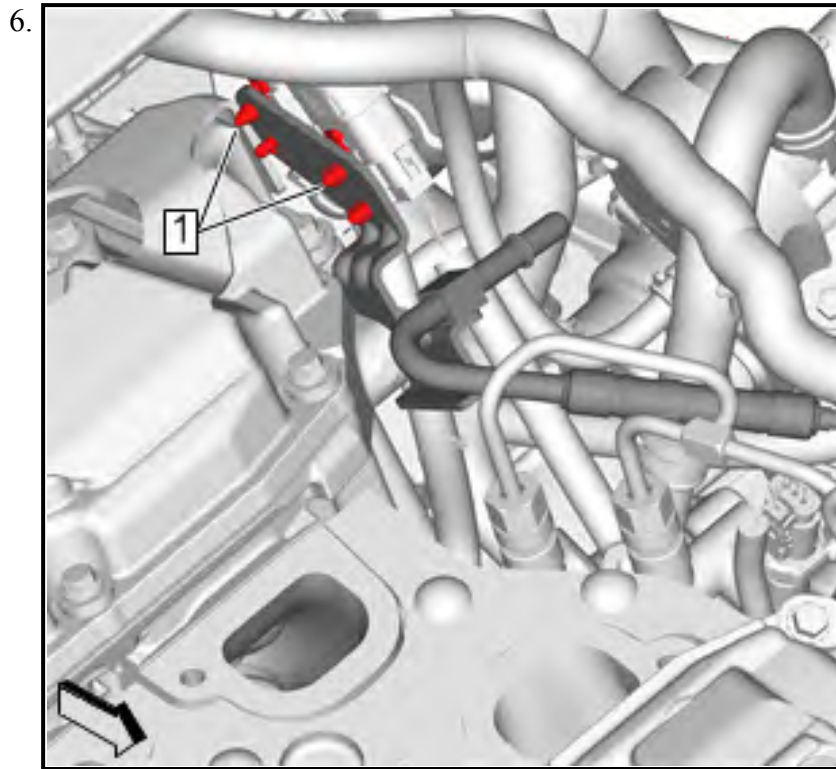
Position the NEW fuel feed pipe (3).

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

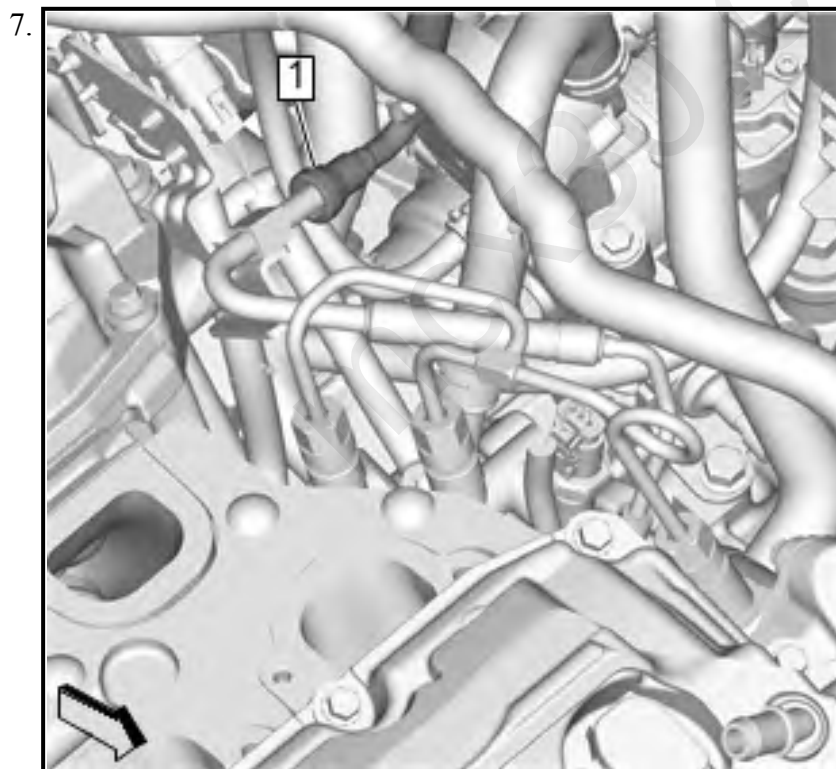
4. Fuel Injection Fuel Feed and Return Pipe Retainer Bolt (2) - Install and tighten [2x] 50 N.m (37 lb ft)

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

5. Fuel Feed Pipe Fitting (1) @ Fuel Pump - Install and tighten 28 N.m (21 lb ft)



Wiring Harness Retainer (1) @ Bracket - Install [2x]



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

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

8. Inspect for leaks using the following procedure:

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

FUEL 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.

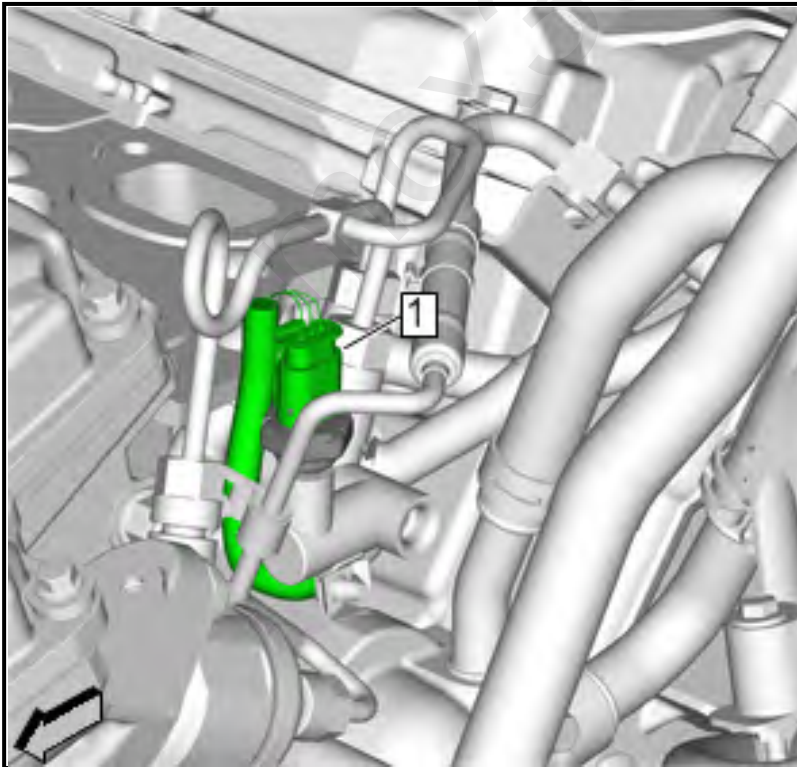
NOTE: Always maintain cleanliness when servicing fuel system components.

1. Remove the fuel tank fuel pump module. [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#)[Fuel Tank Fuel Pump Module Replacement \(AWD\)](#).
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. [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#)[Fuel Tank Fuel Pump Module Replacement \(AWD\)](#).

FUEL INJECTION FUEL RAIL FUEL PRESSURE SENSOR REPLACEMENT

Removal Procedure

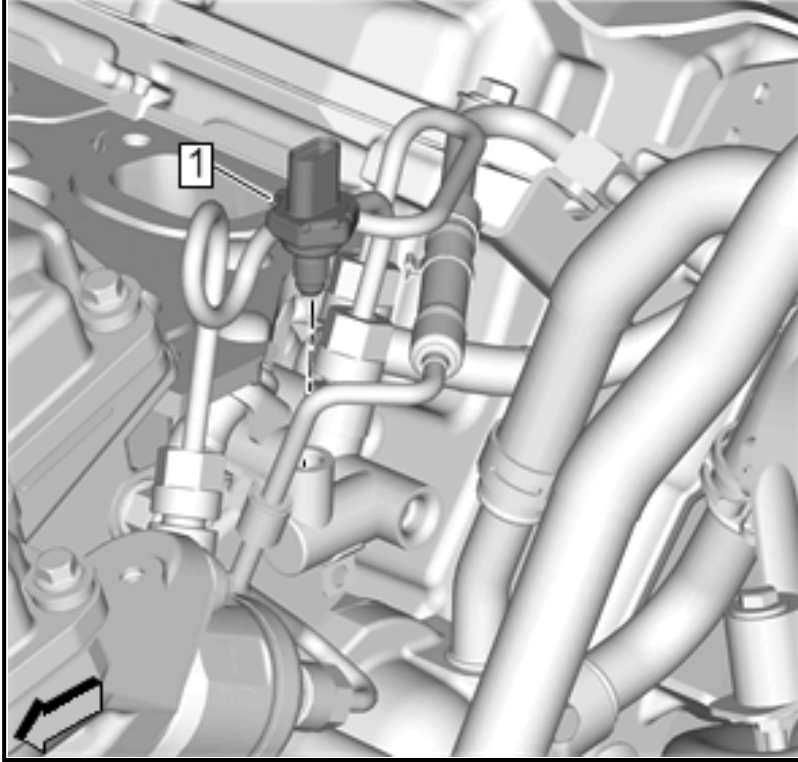
1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Engine Rear Noise Shield - Remove - [Engine Rear Noise Shield Replacement](#)
- 3.



Disconnect the electrical connector (1).

4.





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

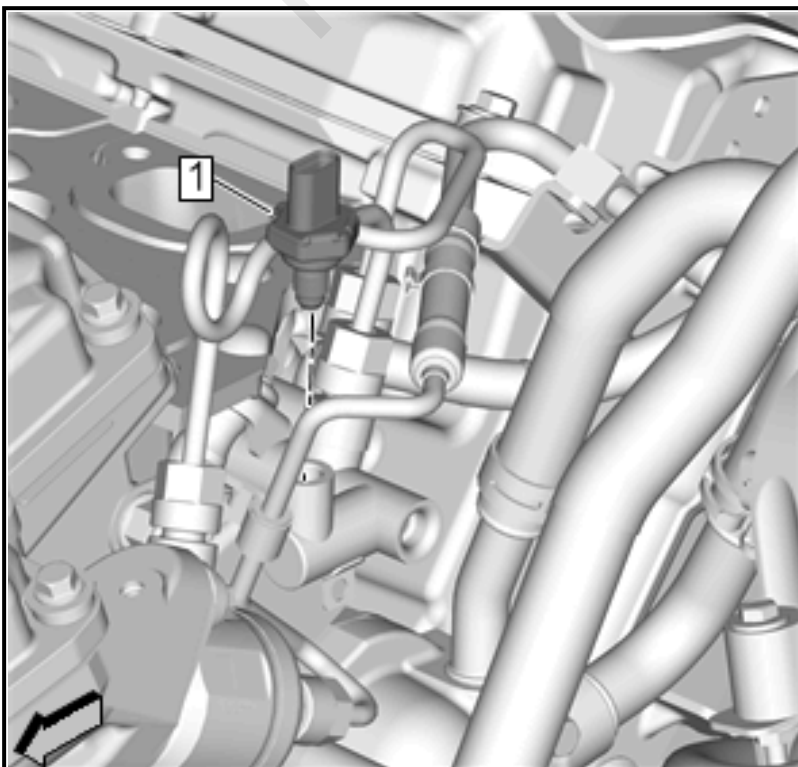
NOTE:

- 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.

Remove and DISCARD the fuel injection fuel rail fuel pressure sensor (1).

Installation Procedure

1.



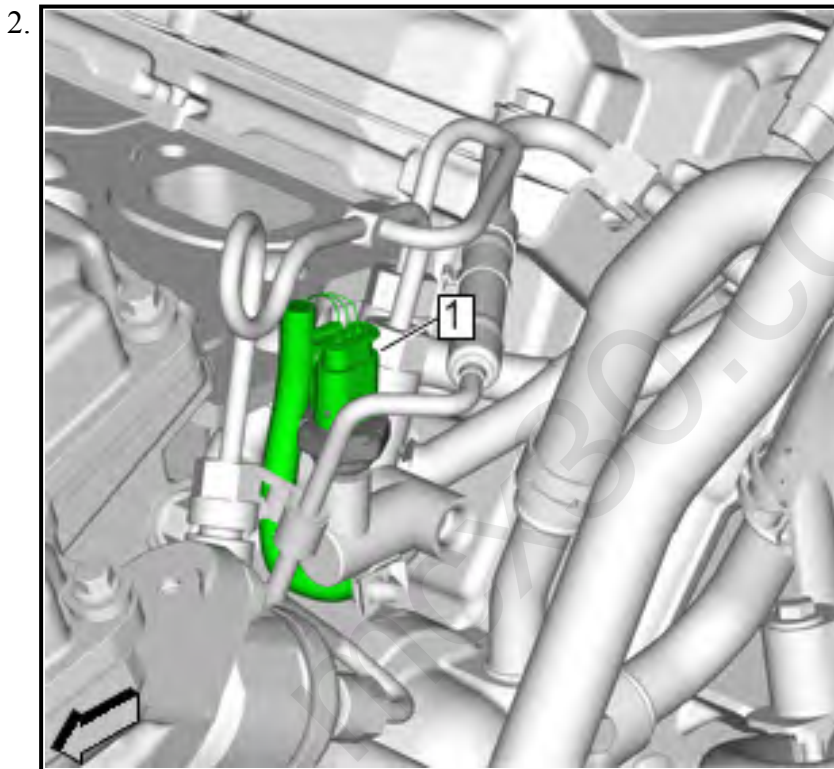
CAUTION: Refer to [Component Fastener Tightening Caution](#) .

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.

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

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).



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

FUEL INJECTION FUEL RAIL ASSEMBLY REPLACEMENT - BANK 1

Special Tools

EN-49248 Injector Rail Assembly Remover

Equivalent regional tools: [Special Tools](#)

Removal Procedure

WARNING: The noise cancelling foam component MUST be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam

component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death.

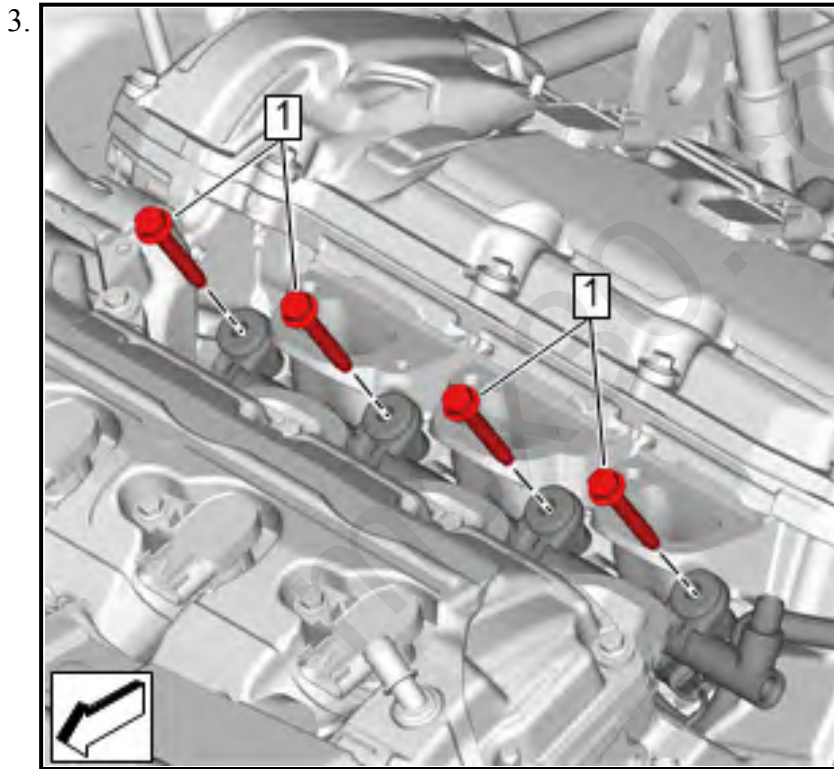
WARNING: Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

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

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

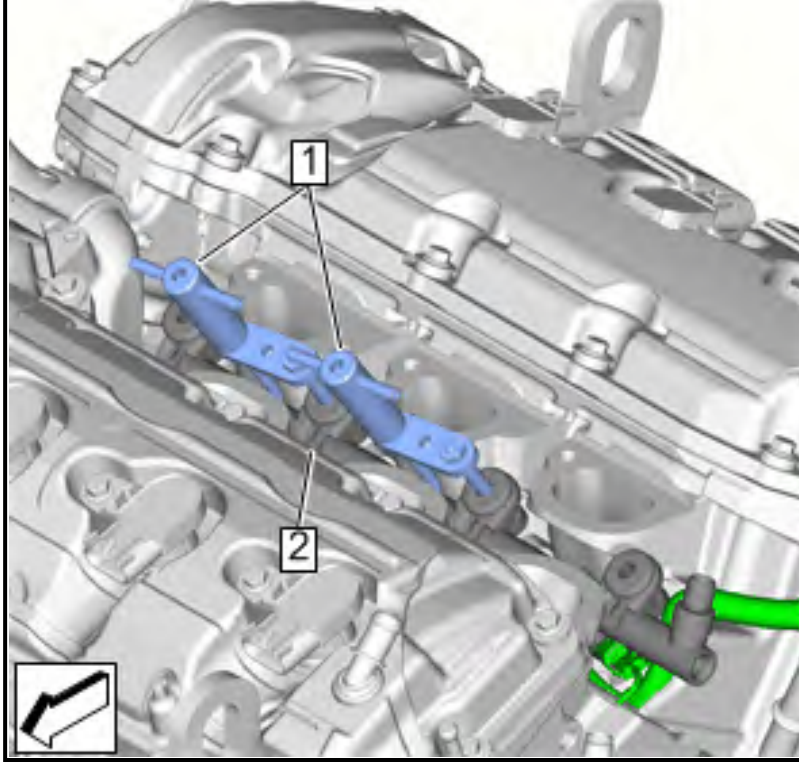
NOTE: High pressure fuel feed pipes are one time use only. ALWAYS install a NEW high pressure fuel feed pipe if the pipe is removed OR the fittings are loosened.

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Fuel Injection Fuel Rail-Bank 2 - Remove - [Fuel Injection Fuel Rail Assembly Replacement - Bank 2](#)



Remove the fuel injection fuel rail bolts (1).

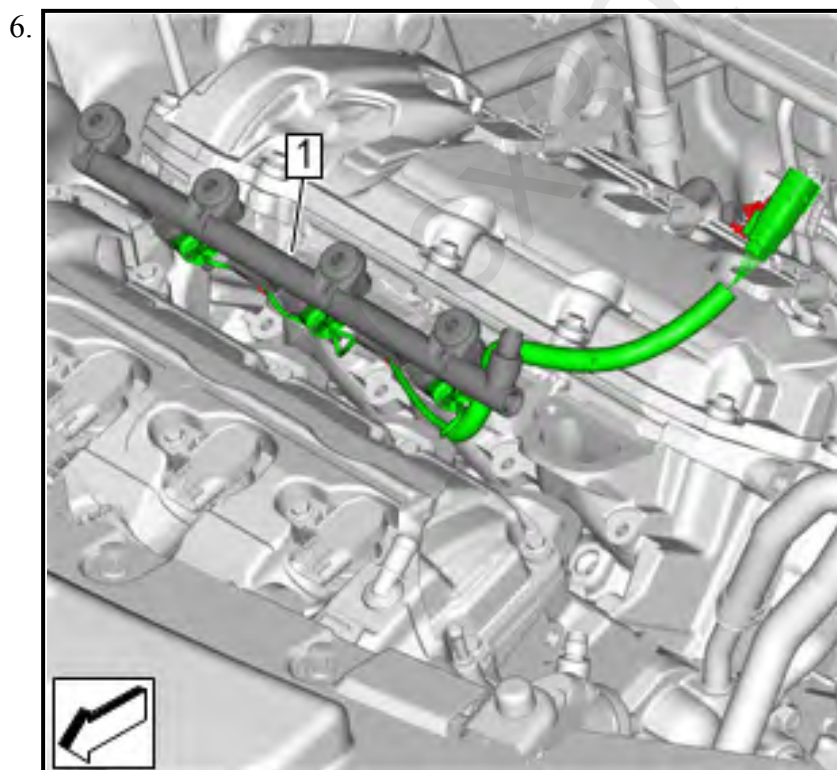




NOTE: The EN-49248 remover hooks **MUST** be properly seated on the underside of the fuel injection fuel rail.

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

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

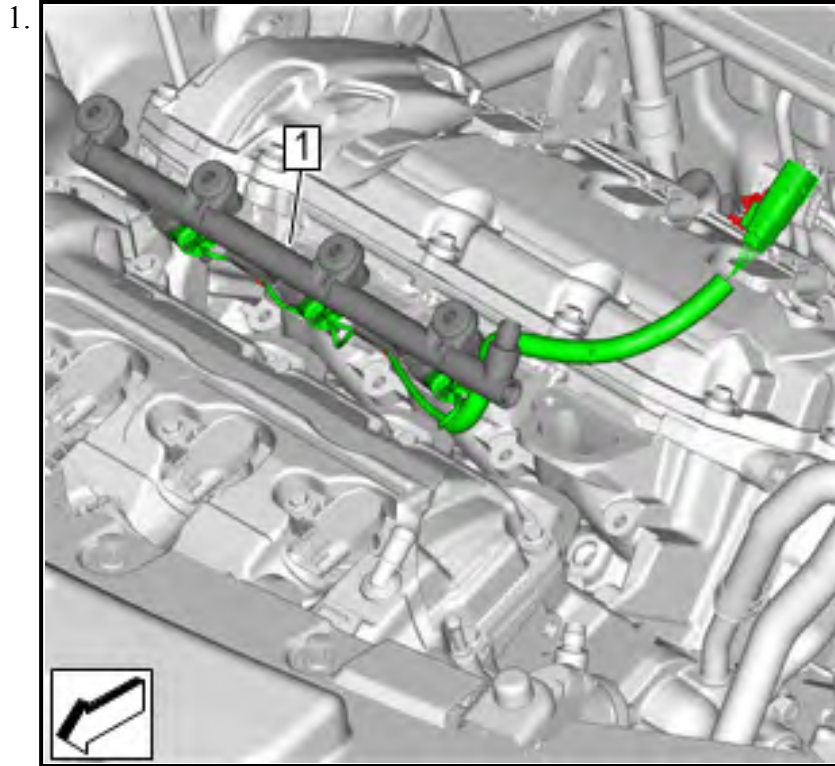


Remove the fuel injection fuel rail (1).

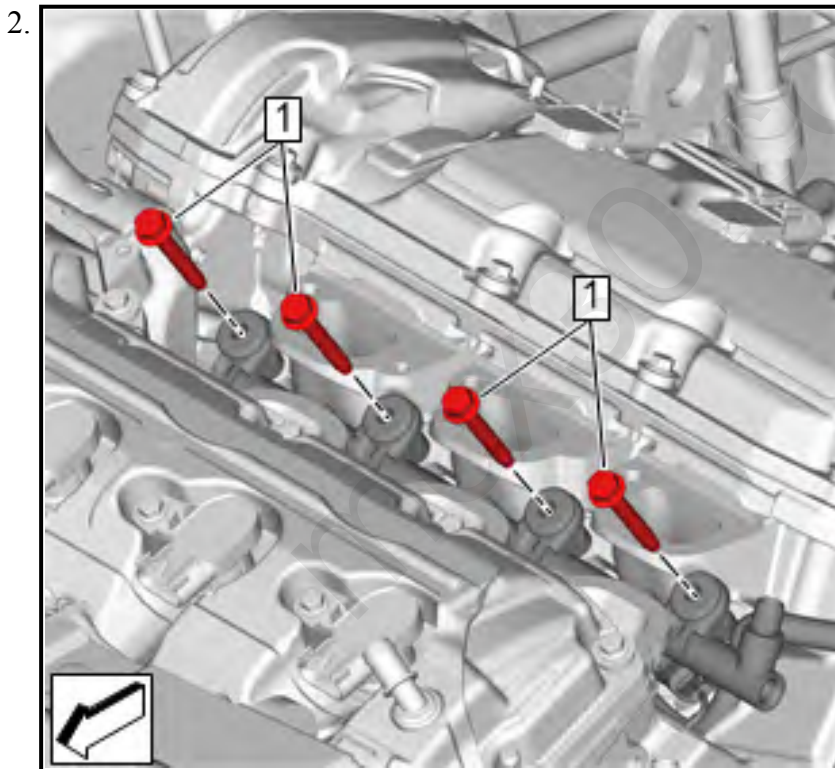
NOTE: Whenever **ANY** fuel injector is removed from the cylinder head or the fuel injection fuel rail, the fuel injector **MUST** be rebuilt.

7. Rebuild ALL of the fuel injectors. [Fuel Rail and Injectors Cleaning and Inspection](#)

8. Transfer components as necessary.



Position the fuel injection fuel rail assembly (1) into the cylinder head as evenly as possible.



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

To install the fuel injection fuel rail bolts (1), perform the following steps:

1. First Pass: Start ALL bolts by hand, but do NOT tighten.
 2. Second Pass: Tighten the outer two bolts by hand.
 3. Third Pass: Tighten the inner two bolts by hand.
 4. Final Pass: 25 N.m (18 lb ft)
3. Fuel Injection Fuel Rail-Bank 2 - Install - [Fuel Injection Fuel Rail Assembly Replacement - Bank 2](#)
4. Inspect for leaks using the following procedure:
1. Turn ON the ignition with the engine OFF for 2 seconds.
 2. Turn OFF the ignition for 10 seconds.

3. Turn ON the ignition with the engine OFF.
4. Inspect for fuel leaks.

FUEL INJECTION FUEL RAIL ASSEMBLY REPLACEMENT - BANK 2

Special Tools

EN-49248 Injector Rail Assembly Remover

Equivalent regional tools: [Special Tools](#)

Removal Procedure

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

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

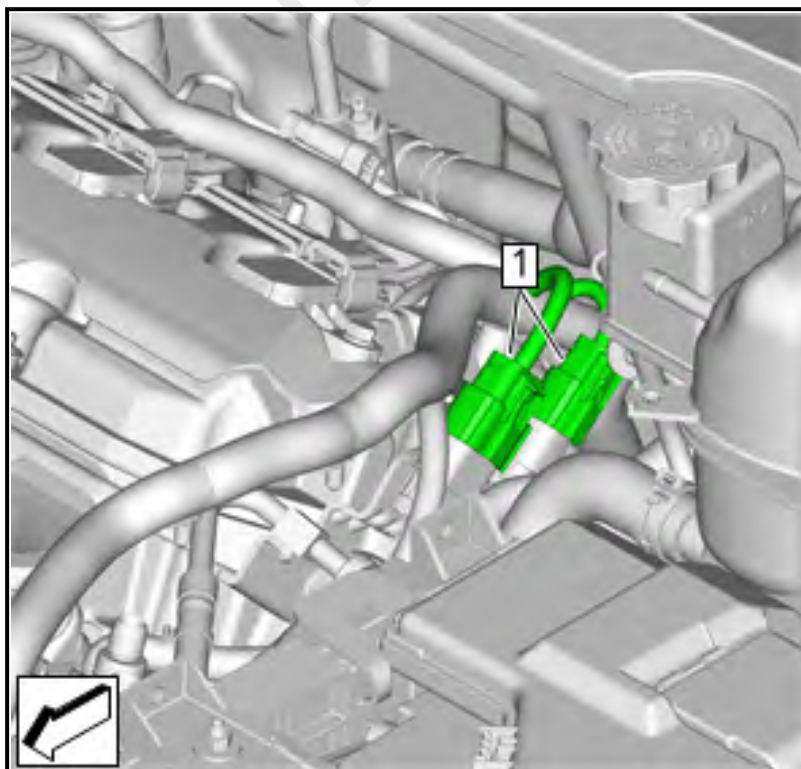
WARNING: Wear safety glasses in order to avoid eye damage.

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

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

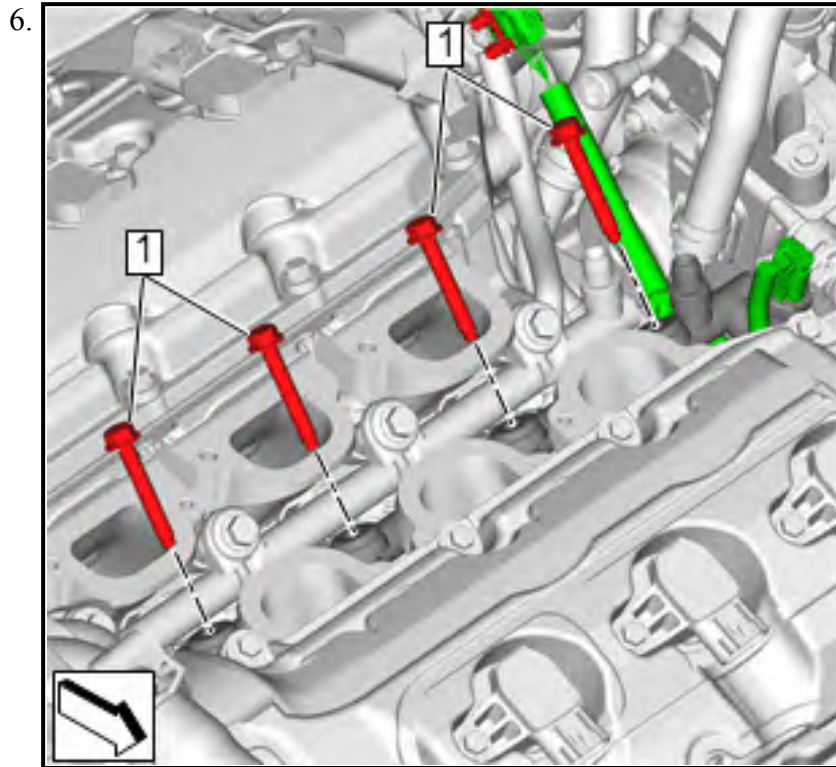
1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Fuel Injection Fuel Rail Noise Shield- Upper - Remove - [Fuel Injection Fuel Rail Noise Shield Replacement \(Upper\)](#)[Fuel Injection Fuel Rail Noise Shield Replacement \(Lower\)](#)
3. Fuel Feed Intermediate Pipe - Remove and DISCARD - [Fuel Feed Intermediate Pipe Replacement](#)

4.

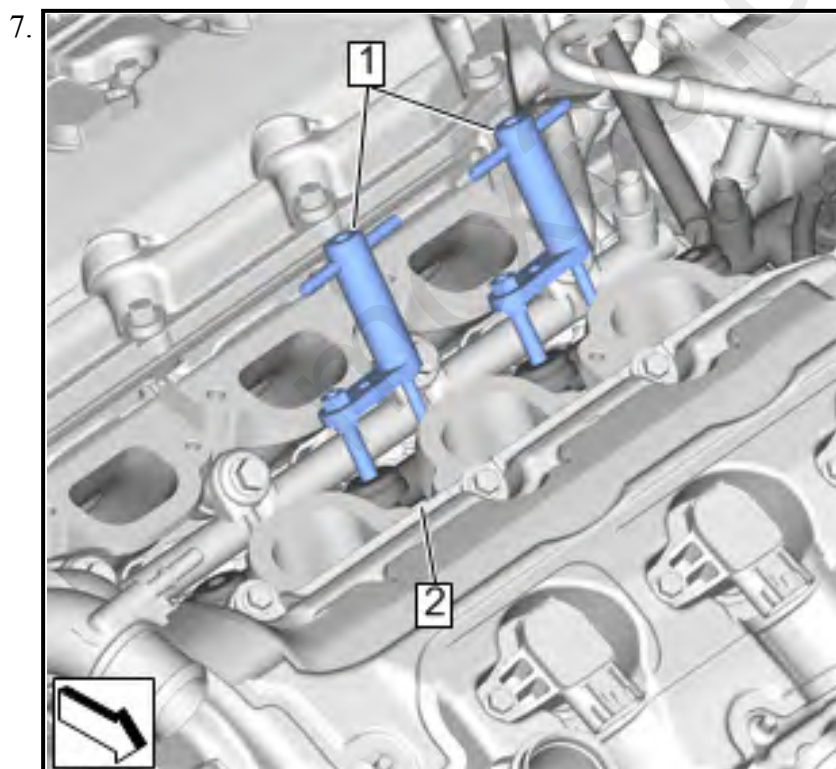


Disconnect the engine wiring harness electrical connectors (1).

5. Fuel Feed Pipe @ Engine - Remove and DISCARD - Fuel Feed Pipe Replacement (AWD)Fuel Feed Pipe Replacement (FWD)Fuel Feed Pipe Replacement (AWD/FWD, At Engine).



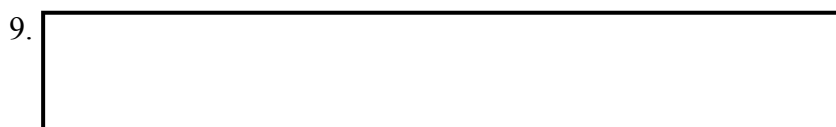
Remove the fuel injection fuel rail bolts (1).

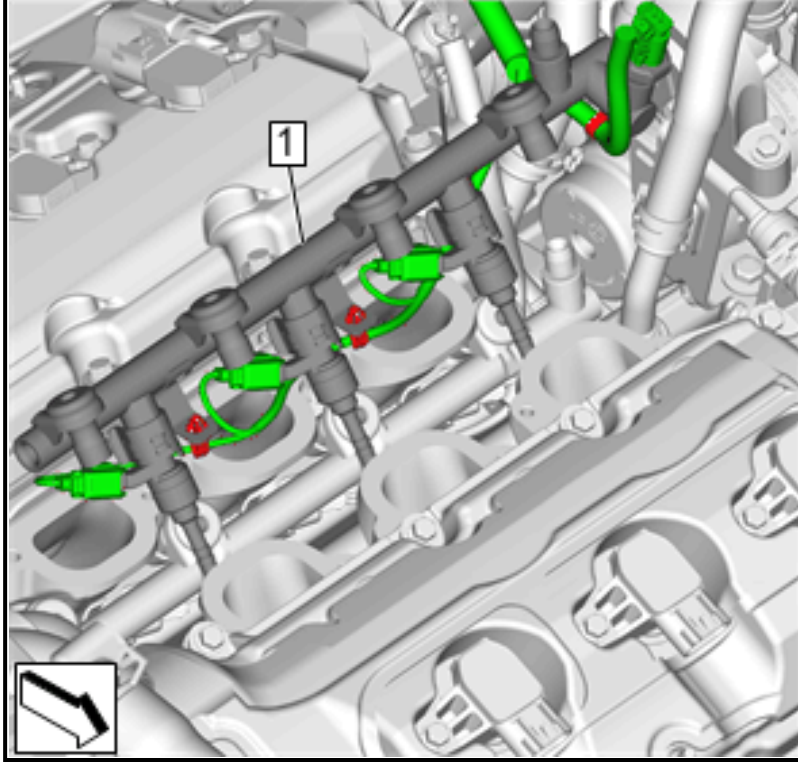


NOTE: The EN-49248 remover hooks **MUST** be properly seated on the underside of the fuel injection fuel rail.

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

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





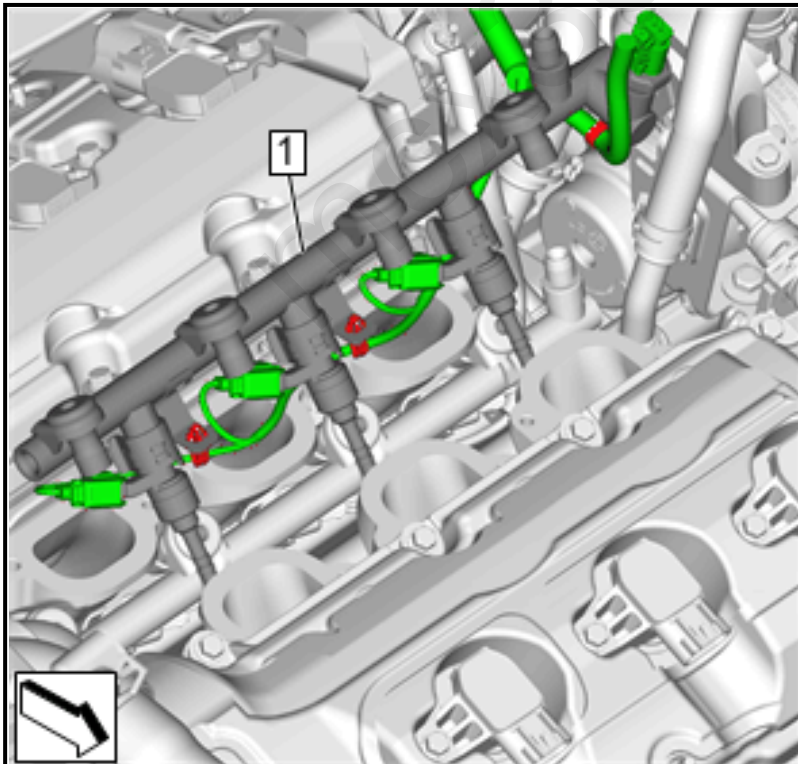
Remove the fuel injection fuel rail (1).

NOTE: Whenever ANY fuel injector is removed from the cylinder head or the fuel injection fuel rail, the fuel injector MUST be rebuilt.

10. Rebuild ALL of the fuel injectors. [Fuel Rail and Injectors Cleaning and Inspection](#)
11. Transfer components as necessary.

Installation Procedure

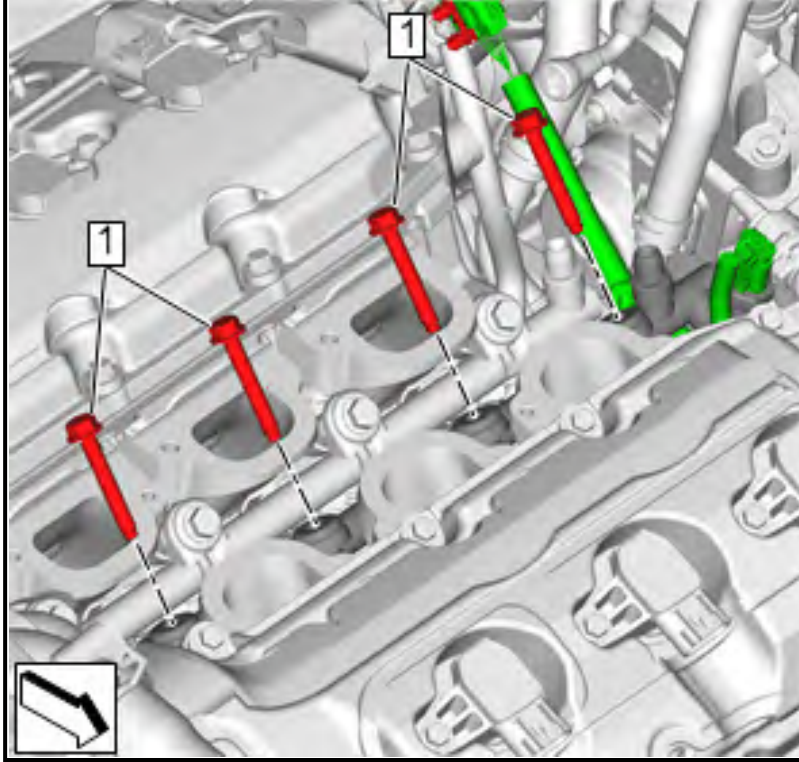
1.



Position the fuel injection fuel rail assembly (1) into the cylinder head as evenly as possible.

2.

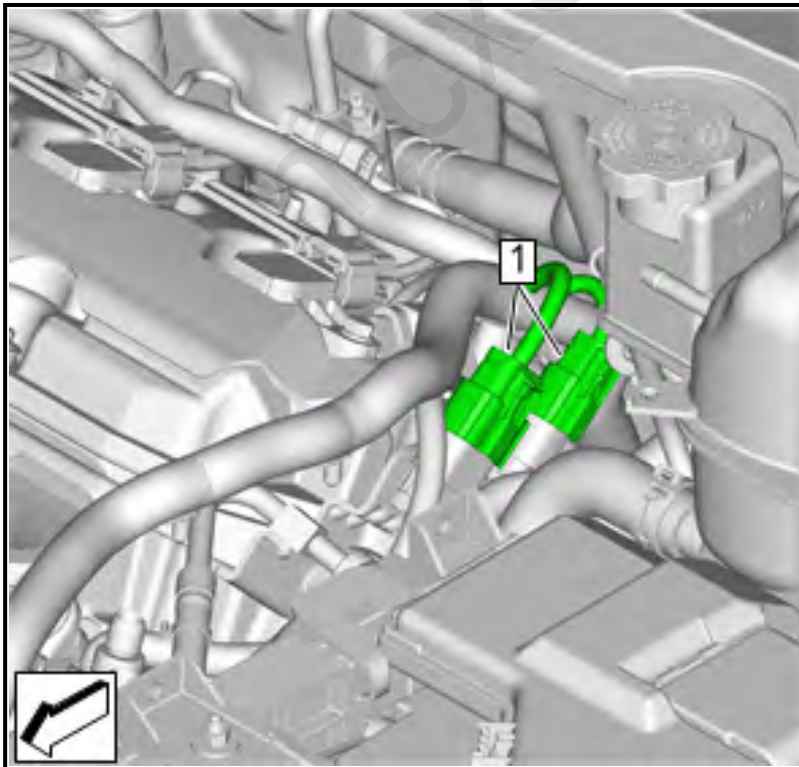




CAUTION: Refer to [Fastener Caution](#) .

To install the fuel injection fuel rail bolts (1), perform the following steps:

1. First Pass: Start ALL bolts by hand, but do NOT tighten.
 2. Second Pass: Tighten the outer two bolts by hand.
 3. Third Pass: Tighten the inner two bolts by hand.
 4. Final Pass: 25 N.m (18 lb ft)
3. Fuel Feed Pipe @ Engine - Install NEW - [Fuel Feed Pipe Replacement \(AWD\)](#)[Fuel Feed Pipe Replacement \(FWD\)](#)[Fuel Feed Pipe Replacement \(AWD/FWD, At Engine\)](#).
- 4.

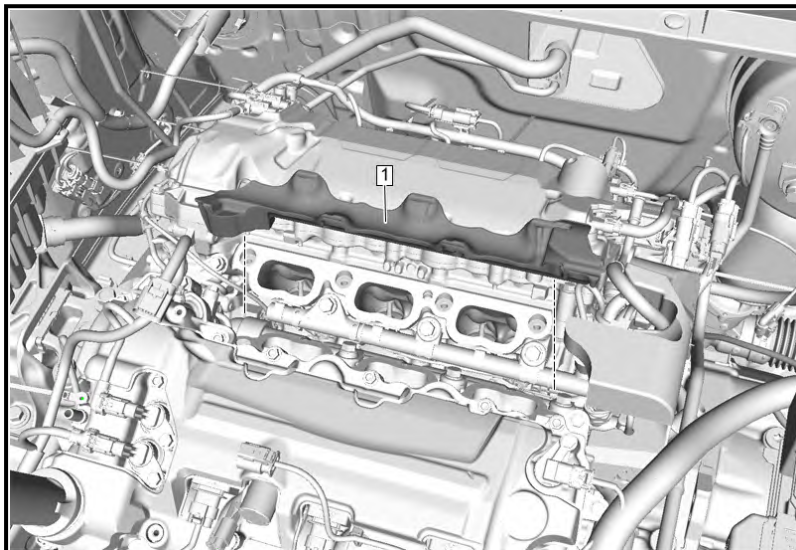


Connect the engine wiring harness electrical connectors (1).

5. Fuel Feed Intermediate Pipe - Install NEW - [Fuel Feed Intermediate Pipe Replacement](#)
6. Inspect for leaks using the following procedure:
 1. Turn ON the ignition with the engine OFF for 2 seconds.

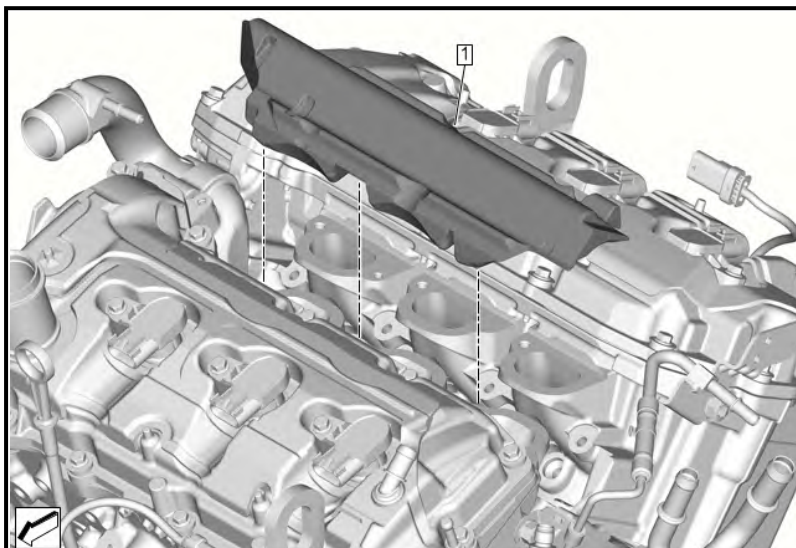
2. Turn OFF the ignition for 10 seconds.
3. Turn ON the ignition with the engine OFF.
4. Inspect for fuel leaks.
7. Fuel Injection Fuel Rail Noise Shield- Upper - Install - **Fuel Injection Fuel Rail Noise Shield Replacement (Upper)****Fuel Injection Fuel Rail Noise Shield Replacement (Lower)**

FUEL INJECTION FUEL RAIL NOISE SHIELD REPLACEMENT (UPPER)



Callout	Component Name
WARNING: The noise cancelling foam component MUST be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death.	
Preliminary Procedure <u>Upper Intake Manifold Replacement</u>	
1	Fuel Injection Fuel Rail Noise Shield- Upper NOTE: The upper fuel injection rail noise shield snaps into place.

FUEL INJECTION FUEL RAIL NOISE SHIELD REPLACEMENT (LOWER)



Callout	Component Name

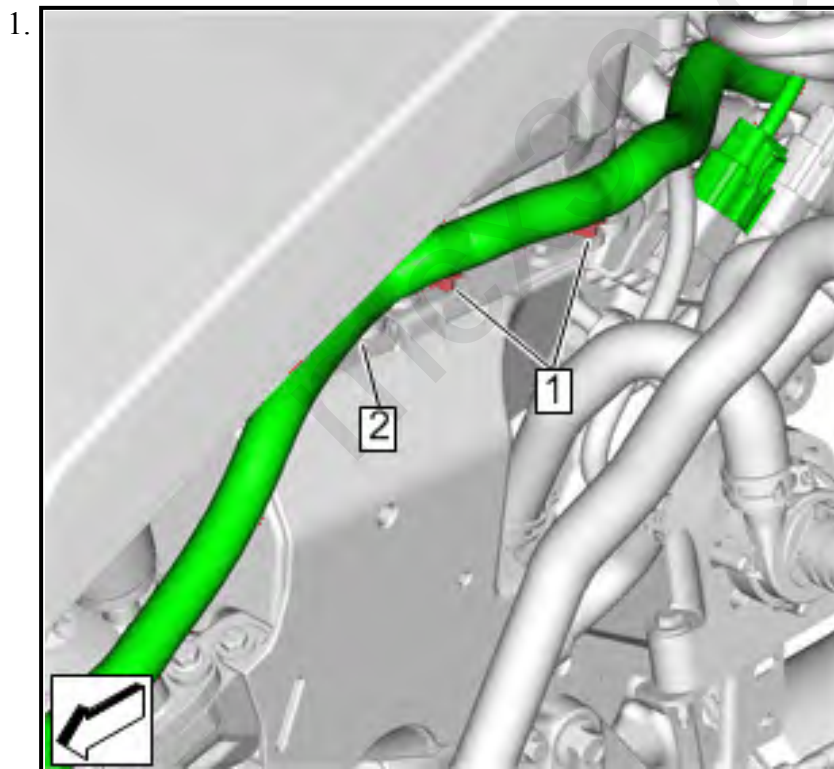
Callout	Component Name
	WARNING: The noise cancelling foam component MUST be replaced if it has been exposed to engine fluids. Failure to replace the noise cancelling foam component that has been exposed to engine fluids may result in an engine fire resulting in catastrophic engine damage, and possible injury or death. WARNING: Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby. WARNING: Wear safety glasses in order to avoid eye damage. CAUTION: Refer to Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Caution . NOTE: High pressure fuel feed pipes are one time use only. ALWAYS install a NEW high pressure fuel feed pipe if the pipe is removed OR the fittings are loosened. Preliminary Procedures 1. Relieve the fuel system pressure. Fuel Pressure Relief 2. Engine Rear Noise Shield Replacement
	Fuel Feed Intermediate Pipe Fitting [3x] CAUTION: Refer to Component Fastener Tightening Caution . Procedure 1. Ensure ALL fittings are clean and dry prior to assembly. 2. Lubricate the fuel feed intermediate pipe fittings with silicon free engine oil. Adhesives, Fluids, Lubricants, and Sealers 3. Tighten the fuel feed intermediate pipe fittings in the sequence shown in the graphic. Tighten 28 N.m (21 lb ft)

Callout	Component Name
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 fuel injection fuel rail fittings, the corresponding component will need to be replaced.

ENGINE REAR NOISE SHIELD 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.



Separate the engine wiring harness retainers (1) from the intake manifold.

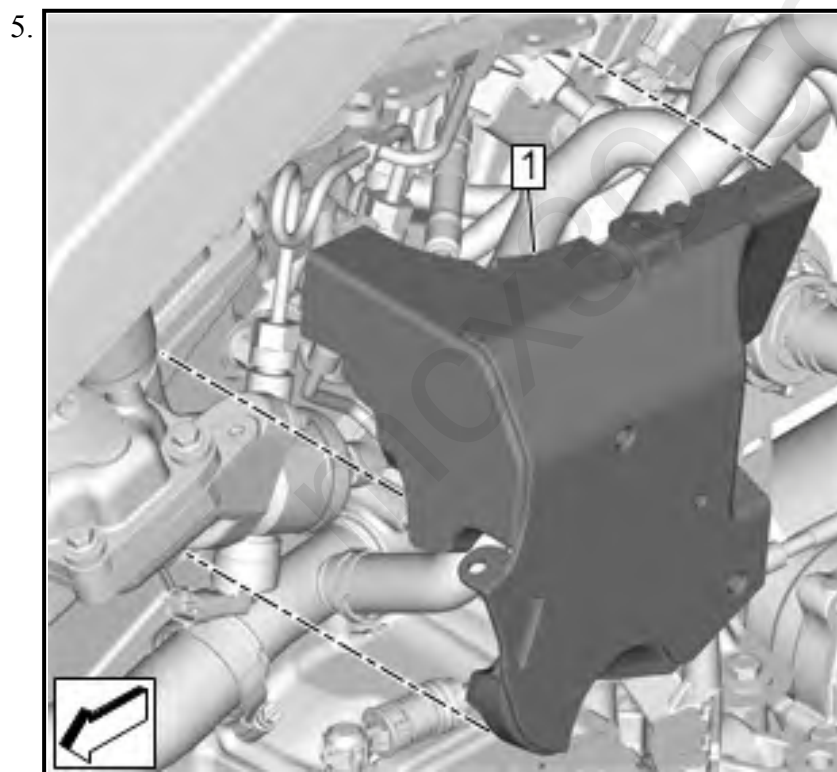
2. Reposition the engine wiring harness (2).





Remove the engine rear noise shield bolt (1).

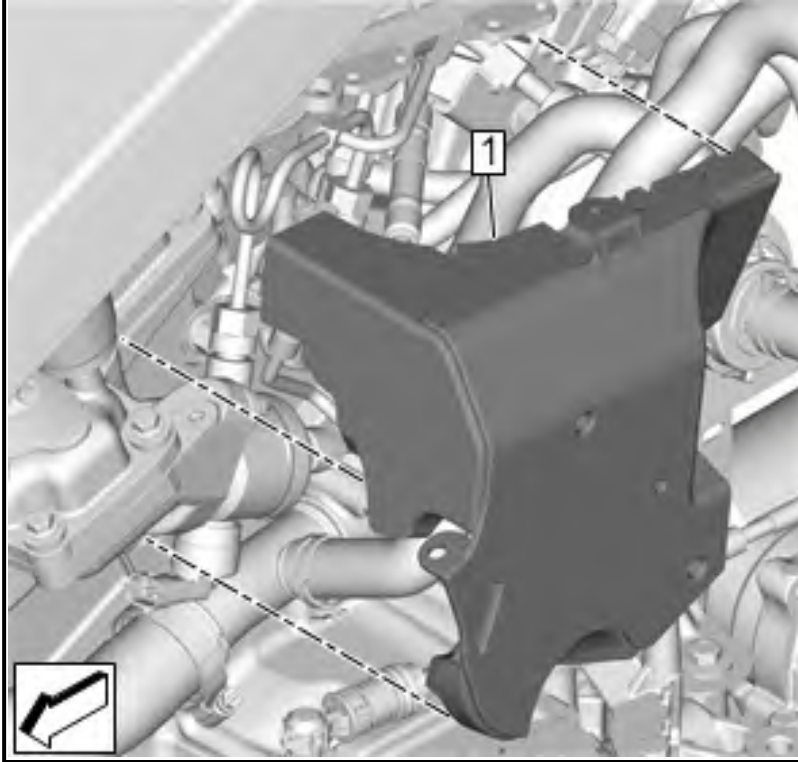
4. Remove the engine rear noise shield retainer (2).



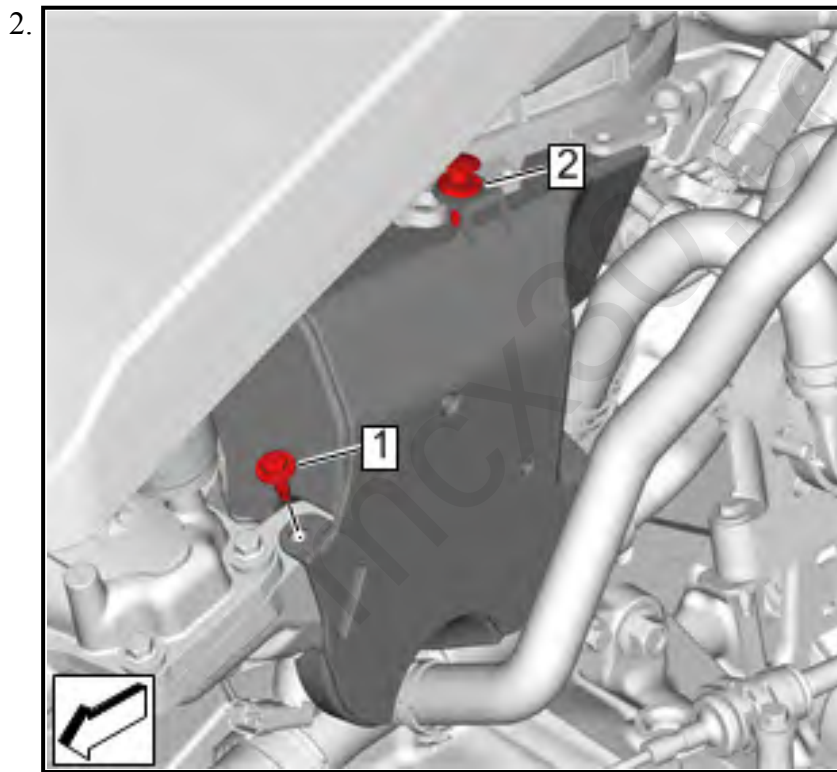
Remove the engine rear noise shield (1).

Installation Procedure





Install the engine rear noise shield (1).

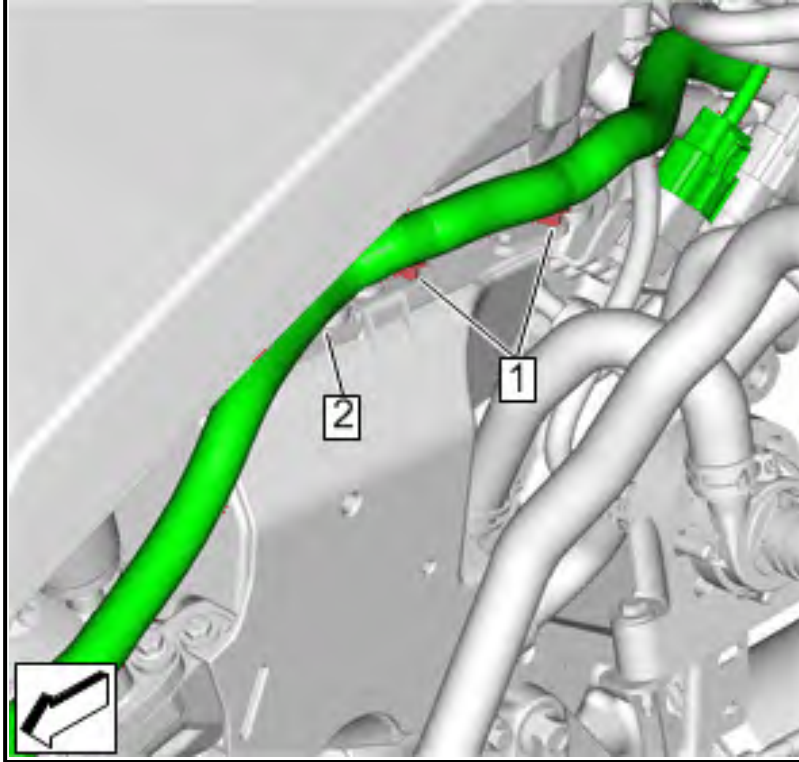


Install the engine rear noise shield retainer (2).

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

3. Install the engine rear noise shield bolt (1) and tighten to 9 N.m (80 lb in).





Position the engine wiring harness (2).

5. Install the engine wiring harness retainers (1) to the intake manifold.

FUEL PUMP REPLACEMENT

Special Tools

EN-48895 High Pressure Fuel Pump Installation Alignment Gauge

Equivalent regional tools: [Special Tools](#)

Removal Procedure

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

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

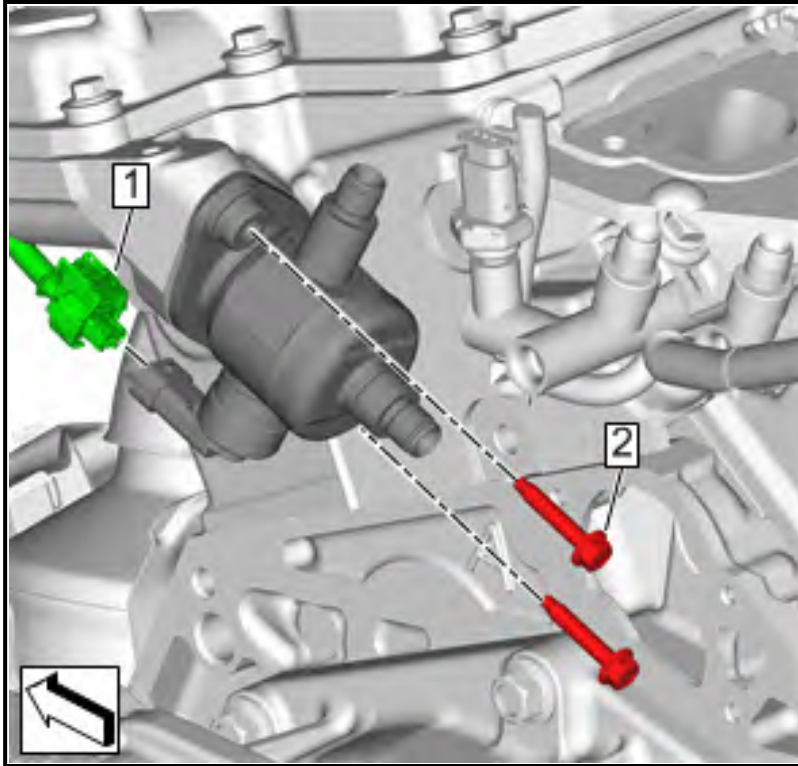
WARNING: Wear safety glasses in order to avoid eye damage.

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

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

1. Relieve the fuel system pressure. [Fuel Pressure Relief](#)
2. Fuel Feed Pipe @ Engine - Remove and DISCARD - [Fuel Feed Pipe Replacement \(AWD\)](#)[Fuel Feed Pipe Replacement \(FWD\)](#)[Fuel Feed Pipe Replacement \(AWD/FWD, At Engine\)](#).
3. Fuel Feed Intermediate Pipe - Remove and DISCARD - [Fuel Feed Intermediate Pipe Replacement](#)

4.



Electrical Connector (1) - Disconnect

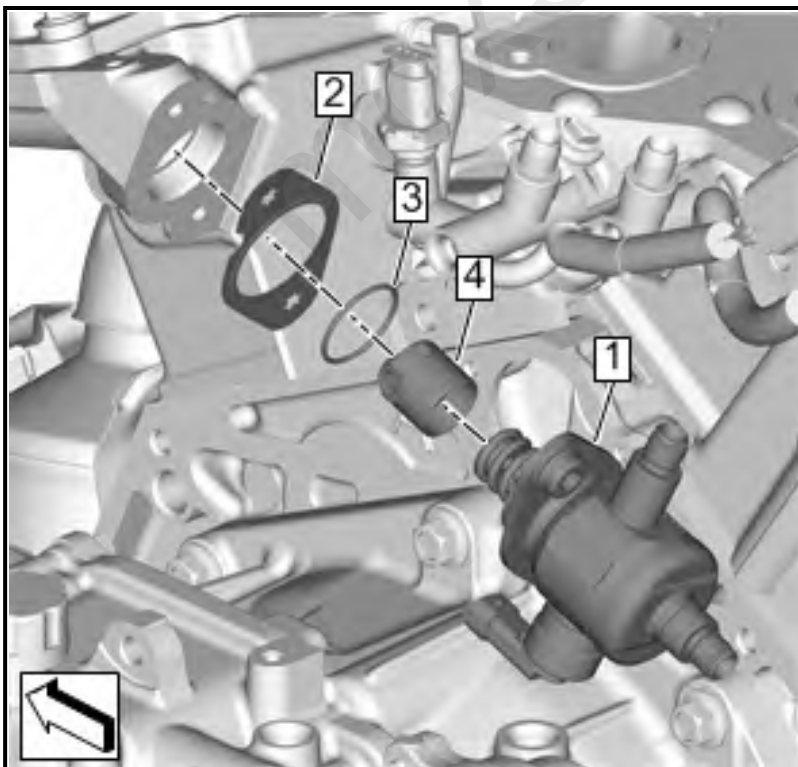
5. Engine Coolant Thermostat Housing - Remove - [Engine Coolant Thermostat Housing Replacement \(LFY\)](#)

CAUTION:

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

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

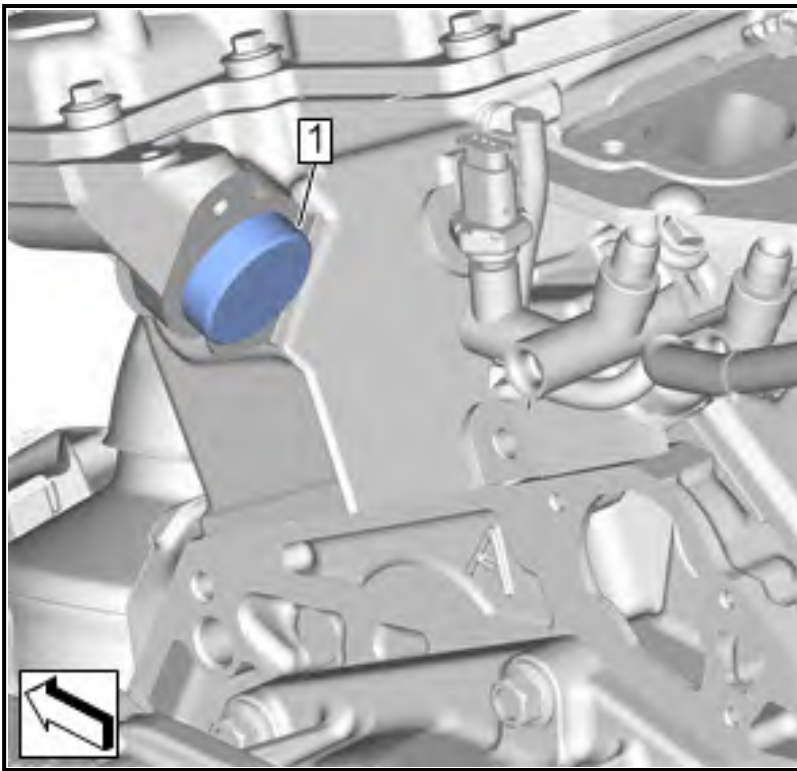
7.



Fuel Pump (1) - Remove

8. Fuel Pump Bracket Gasket (2) - Remove and DISCARD
9. Fuel Pump Housing Seal (3) - Remove and DISCARD
10. Valve Lifter Follower (4) - Remove

1.

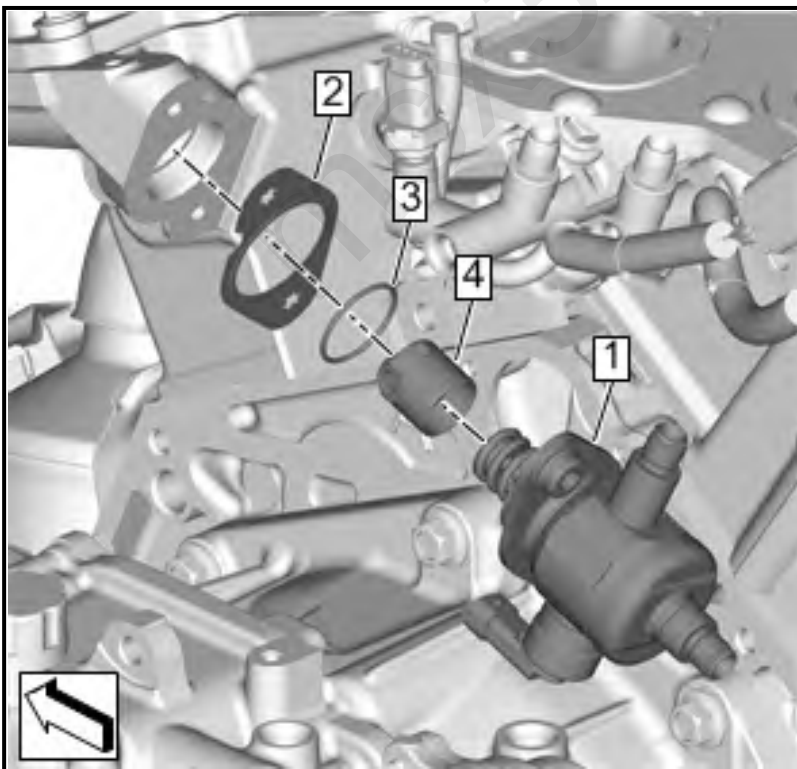


NOTE: The camshaft **MUST** be in the base circle position before the fuel pump is installed.

Use the **EN-48896** alignment gauge (1) to ensure the camshaft lobe is in the base circle position. At the base circle position, the alignment gauge will sit flush with the cylinder head.

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

3.

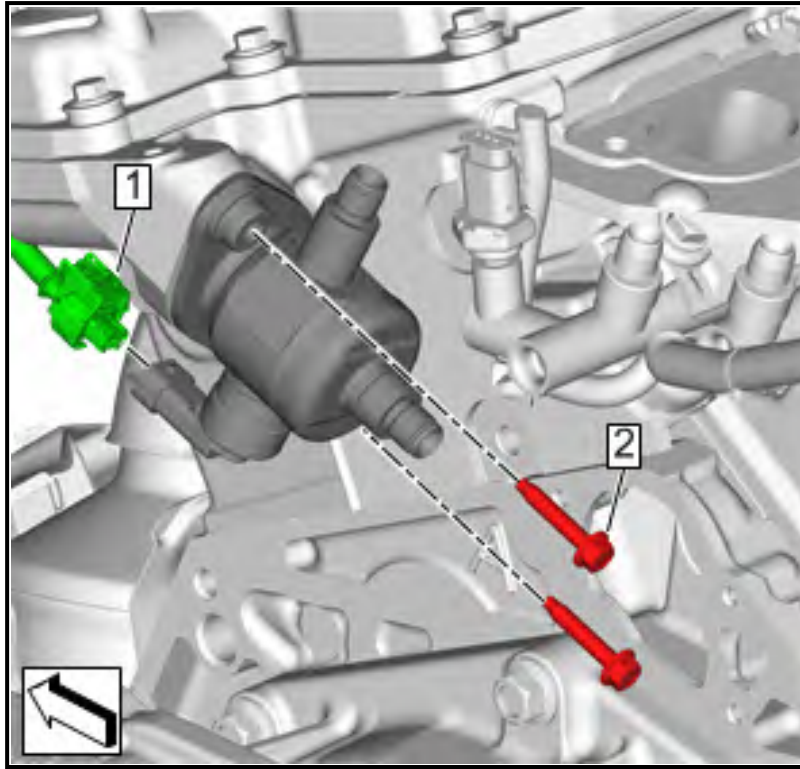


Lubricate the valve lifter follower (4) with clean engine oil and install it into the cylinder head bore.

4. Lubricate the NEW fuel pump housing seal (3) with clean engine oil and install it on the fuel pump.

5. Position the NEW fuel pump bracket gasket (2) and install the fuel pump (1) into the cylinder head.

6.



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

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

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.

Fuel Pump Bolt (2) - Install and tighten [2x] 15 N.m (11 lb ft)

Install NEW bolts.

7. Engine Coolant Thermostat Housing - Install - [Engine Coolant Thermostat Housing Replacement \(LFY\)](#).
8. Electrical Connector (1) - Connect
9. Fuel Feed Intermediate Pipe - Install NEW - [Fuel Feed Intermediate Pipe Replacement](#)
10. Fuel Feed Pipe @ Engine - Install NEW - [Fuel Feed Pipe Replacement \(AWD\)](#)[Fuel Feed Pipe Replacement \(FWD\)](#)[Fuel Feed Pipe Replacement \(AWD/FWD, At Engine\)](#).
11. Inspect for leaks using the following procedure:
 1. Turn ON the ignition with the engine OFF for 2 seconds.
 2. Turn OFF the ignition for 10 seconds.
 3. Turn ON the ignition with the engine OFF.
 4. Inspect for fuel leaks.

FUEL INJECTOR REPLACEMENT

Removal Procedure

1. Relieve the high side fuel system pressure. Refer to [Fuel Pressure Relief](#).

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

2. Remove the fuel injection fuel rail assembly. Refer to [Fuel Injection Fuel Rail Assembly Replacement - Bank 1](#), or [Fuel Injection Fuel Rail Assembly Replacement - Bank 2](#).

NOTE: If there is no damage or defect to the injector bushing retainer or plastic spacer, these parts can be reused.

3. For removal of the fuel injectors, refer to [Fuel Rail and Injectors Cleaning and Inspection](#).

Installation Procedure

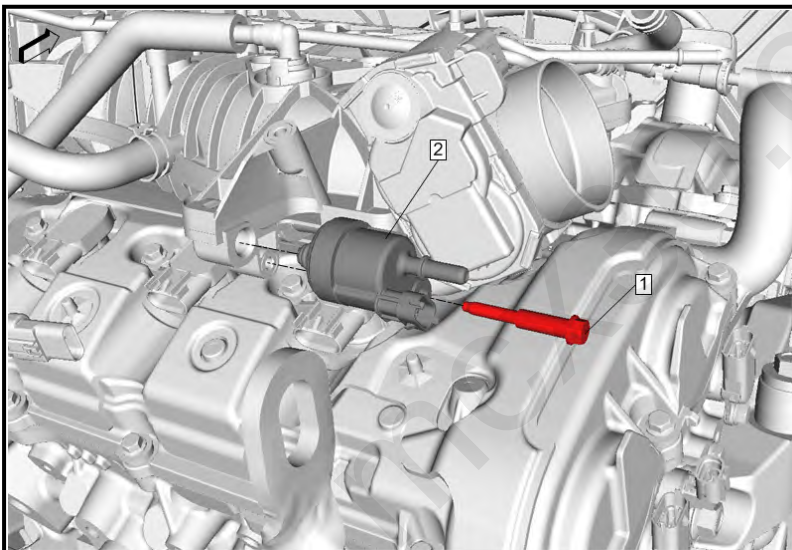
NOTE: If an injector is reused, the injector tips seals must be replaced with NEW.

1. Prepare the fuel injectors for assembly, refer to [Fuel Rail and Injectors Cleaning and Inspection](#).

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

2. Install the fuel injection fuel rail assembly. Refer to [Fuel Injection Fuel Rail Assembly Replacement - Bank 1](#), or [Fuel Injection Fuel Rail Assembly Replacement - Bank 2](#).
3. Pressure up the fuel system and check for leaks.

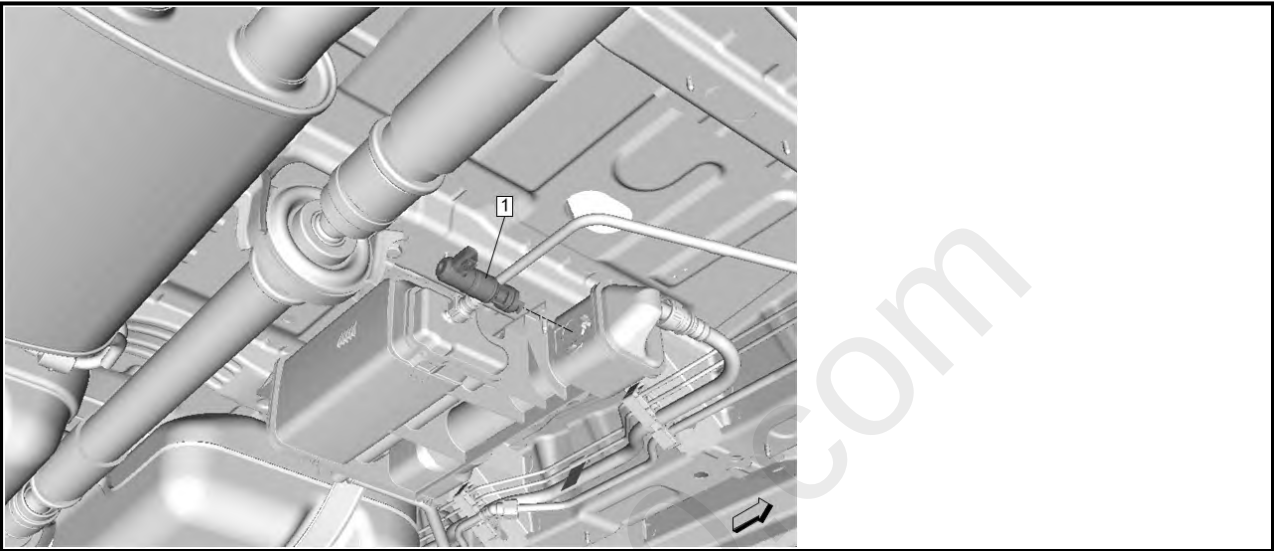
EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE REPLACEMENT



Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedures 1. Air Cleaner Outlet Duct Replacement 2. Disconnect the evaporative emission line. Plastic Collar Quick Connect Fitting Service	

Callout	Component Name
1	Evaporative Emission Canister Purge Solenoid Valve Bolt CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
2	Evaporative Emission Canister Purge Solenoid Valve Procedure Disconnect the electrical connector.

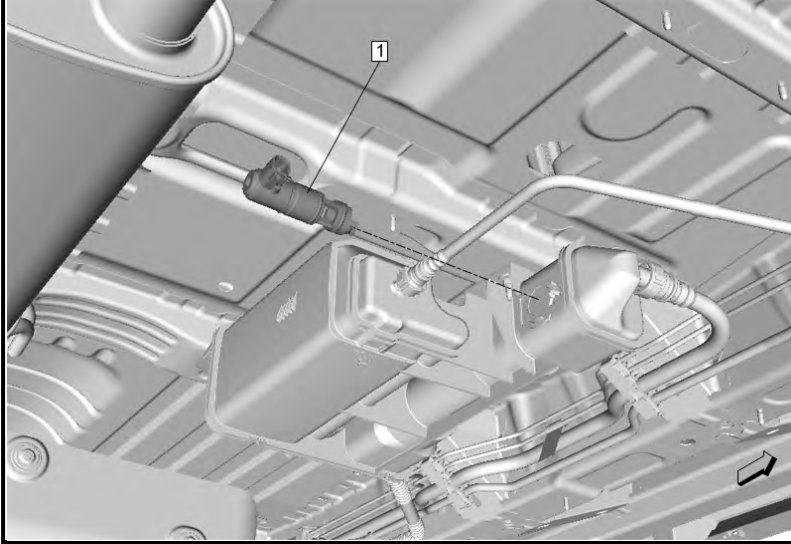
EVAPORATIVE EMISSION CANISTER VENT SOLENOID VALVE REPLACEMENT (AWD)



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 Canister Vent Solenoid Valve Procedure 1. Disconnect the electrical connector. 2. Turn solenoid valve in a clockwise direction and remove.

EVAPORATIVE EMISSION CANISTER VENT SOLENOID VALVE REPLACEMENT (FWD)





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 Canister Vent Solenoid Valve Procedure 1. Disconnect the electrical connector. 2. Turn solenoid valve in a clockwise direction and remove.

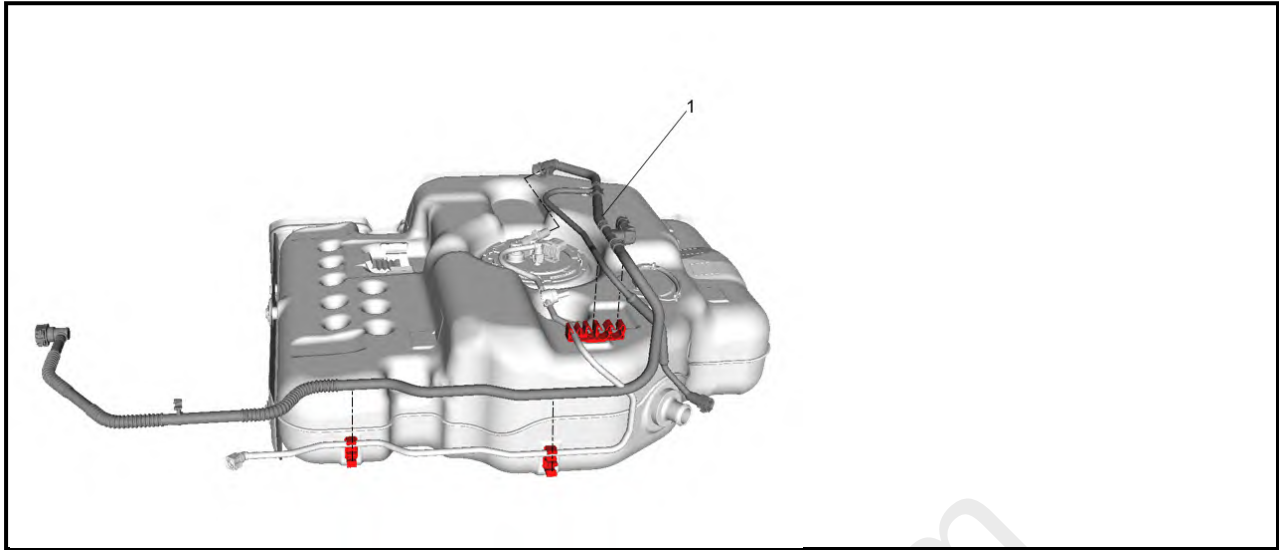
EVAPORATIVE EMISSION CANISTER VENT HOSE REPLACEMENT (AWD)



Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Fuel Tank Replacement (AWD)	

Callout	Component Name
1	Evaporative Emission Canister Vent Hose Procedure Disconnect the quick connect fitting and remove from retainers. Plastic Collar Quick Connect Fitting Service

EVAPORATIVE EMISSION CANISTER VENT HOSE REPLACEMENT (FWD)



Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning . WARNING: Refer to Safety Glasses Warning . Preliminary Procedure Fuel Tank Replacement (FWD) .	
1	Evaporative Emission Canister Vent Hose Procedure 1. Disconnect the electrical connector. 2. Disconnect the quick connect fitting and remove from retainers. Plastic Collar Quick Connect Fitting Service

EVAPORATIVE EMISSION CANISTER FILTER HOSE REPLACEMENT (AWD)

Removal Procedure

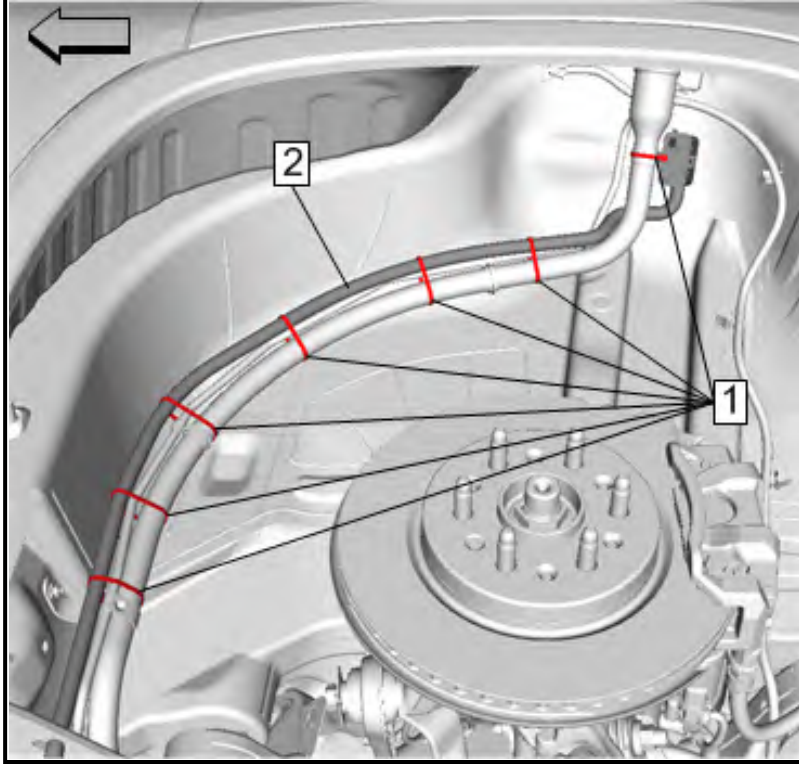
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

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

1. Rear Wheelhouse Liner - Remove - [Rear Wheelhouse Liner Replacement](#)

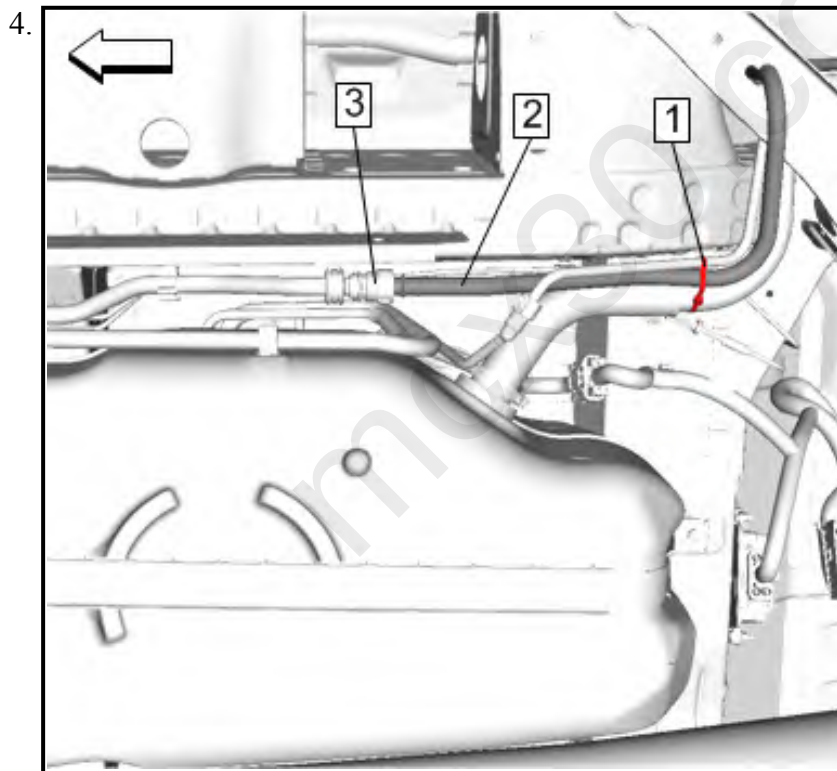
2.





Tie Strap (1) - Remove and DISCARD [7x]

3. Evaporative Emission Canister Filter Hose (2) - Remove

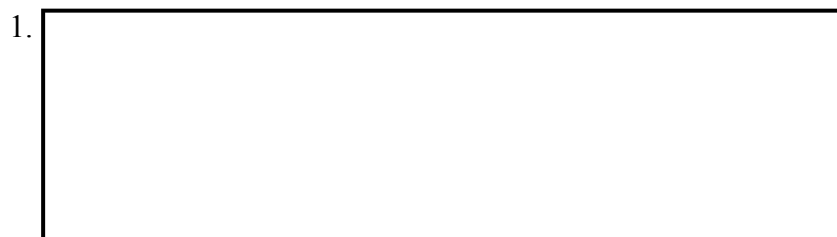


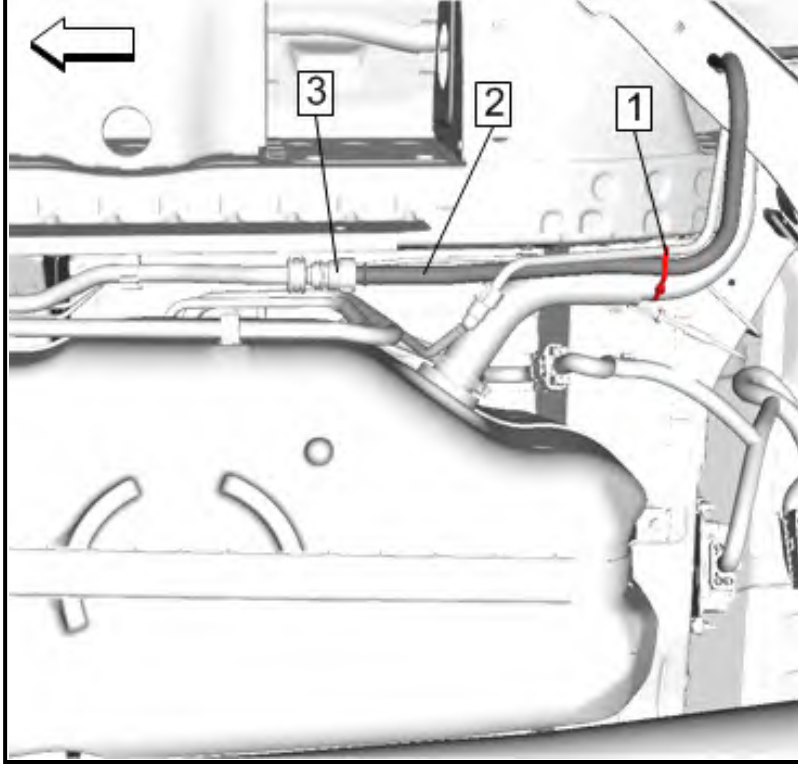
Tie Strap (1) - Remove and DISCARD

5. Evaporative Emission Canister Filter Hose (2) @ Evaporative Emission Canister Air Inlet Hose - Disconnect - **Plastic Collar Quick Connect Fitting Service**

6. Evaporative Emission Canister Filter Hose (2) - Remove

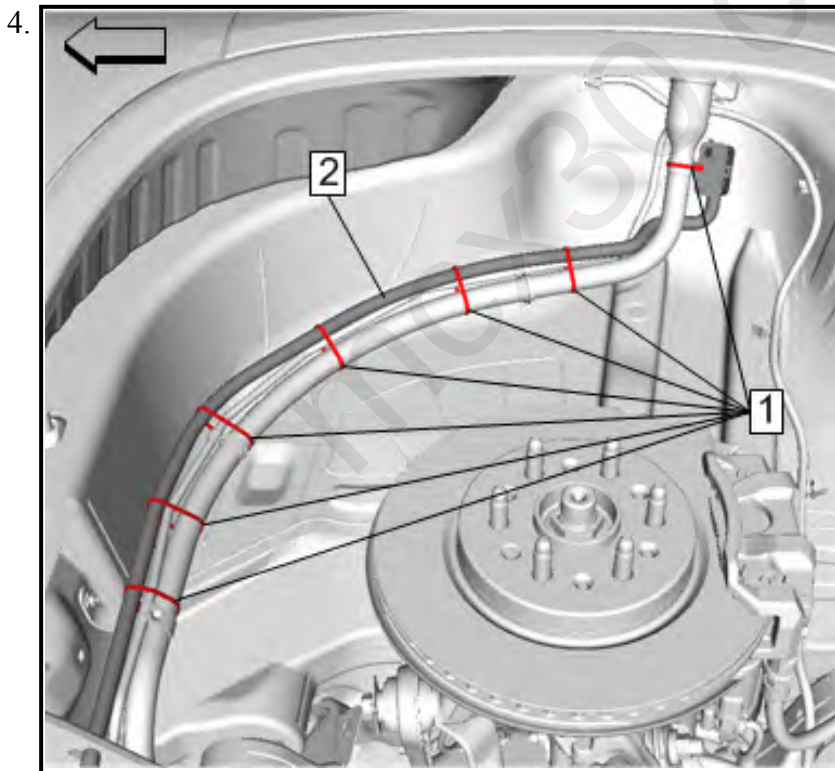
Installation Procedure





Evaporative Emission Canister Filter Hose (2) - Install

2. Evaporative Emission Canister Filter Hose (2) @ Evaporative Emission Canister Air Inlet Hose - Connect - [Plastic Collar Quick Connect Fitting Service](#)
3. Tie Strap (1) - Install NEW



Evaporative Emission Canister Filter Hose (2) - Install

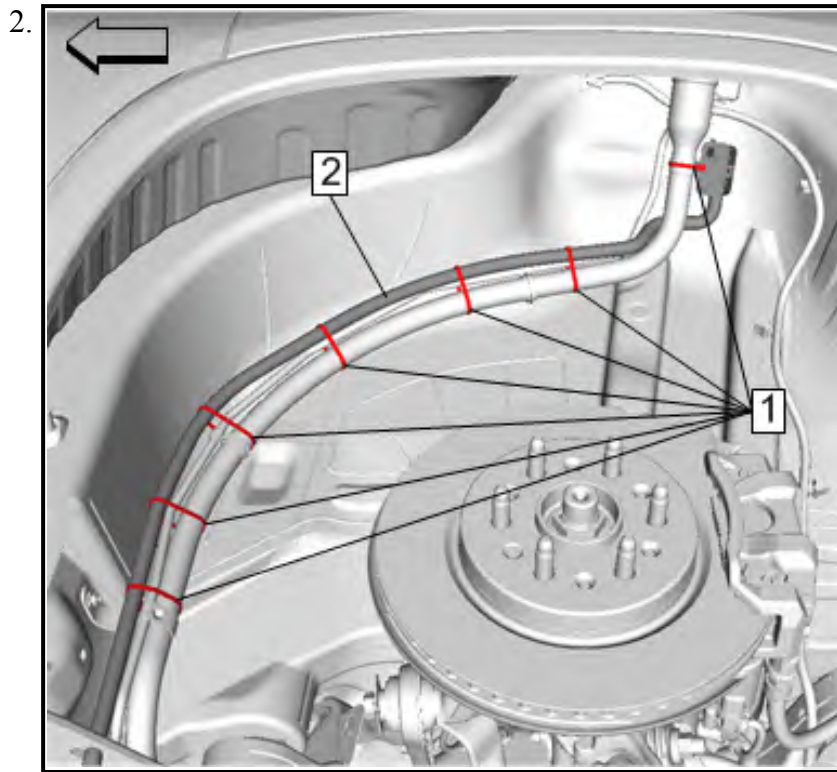
5. Tie Strap (1) - Install NEW [7x]
6. Rear Wheelhouse Liner - Install - [Rear Wheelhouse Liner Replacement](#)

EVAPORATIVE EMISSION CANISTER FILTER HOSE REPLACEMENT (FWD)

Removal Procedure

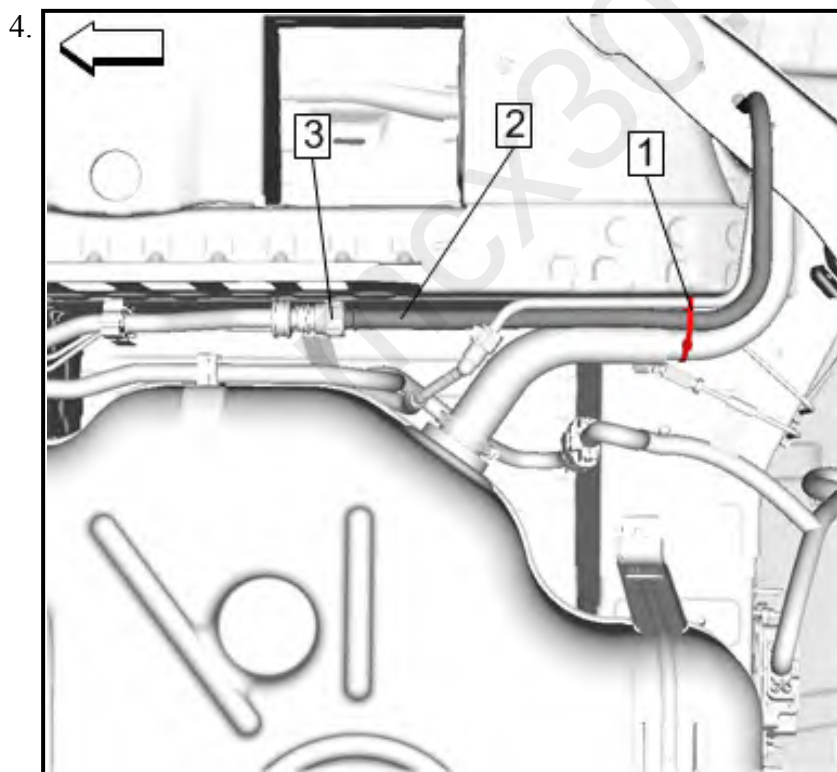
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

1. Rear Wheelhouse Liner - Remove - [Rear Wheelhouse Liner Replacement](#)



Tie Strap (1) - Remove and DISCARD [7x]

3. Evaporative Emission Canister Filter Hose (2) - Remove

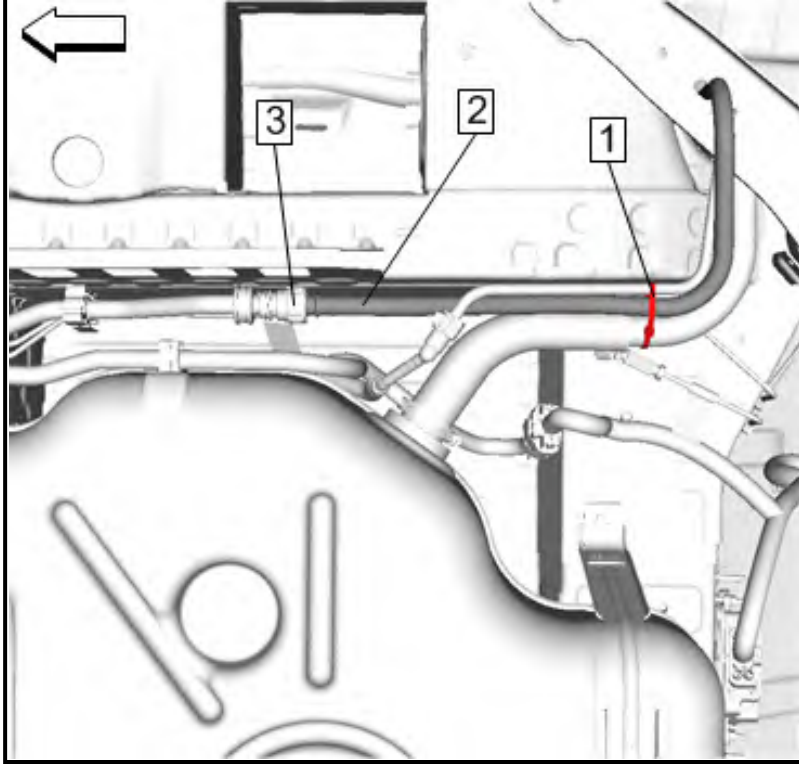


Tie Strap (1) - Remove and DISCARD

5. Evaporative Emission Canister Filter Hose (2) @ Evaporative Emission Canister Air Inlet Hose - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)
6. Evaporative Emission Canister Filter Hose (2) - Remove

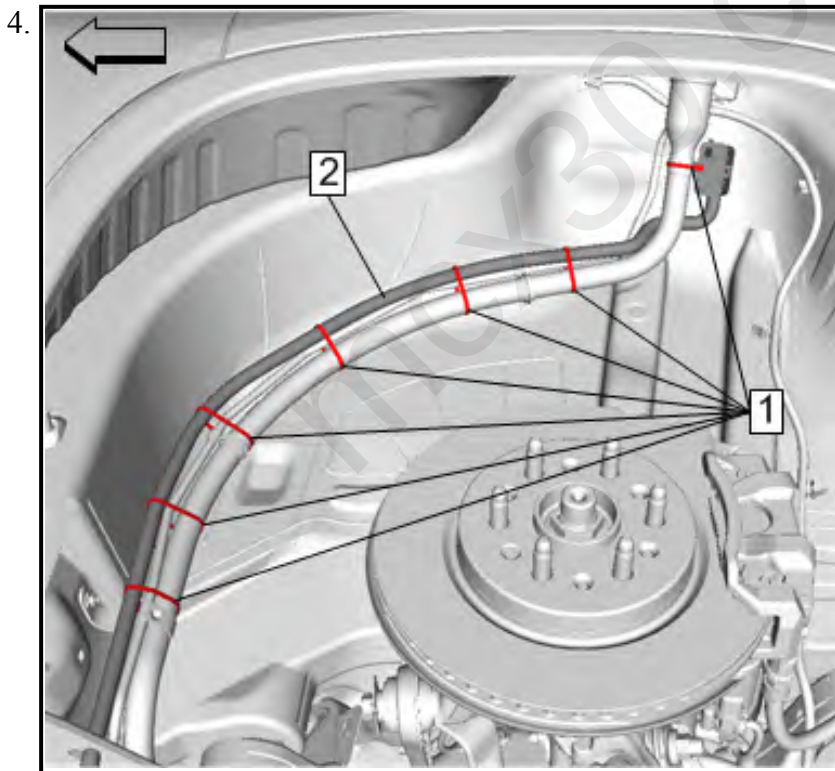
Installation Procedure





Evaporative Emission Canister Filter Hose (2) - Install

2. Evaporative Emission Canister Filter Hose (2) @ Evaporative Emission Canister Air Inlet Hose - Connect - [Plastic Collar Quick Connect Fitting Service](#)
3. Tie Strap (1) - Install NEW



Evaporative Emission Canister Filter Hose (2) - Install

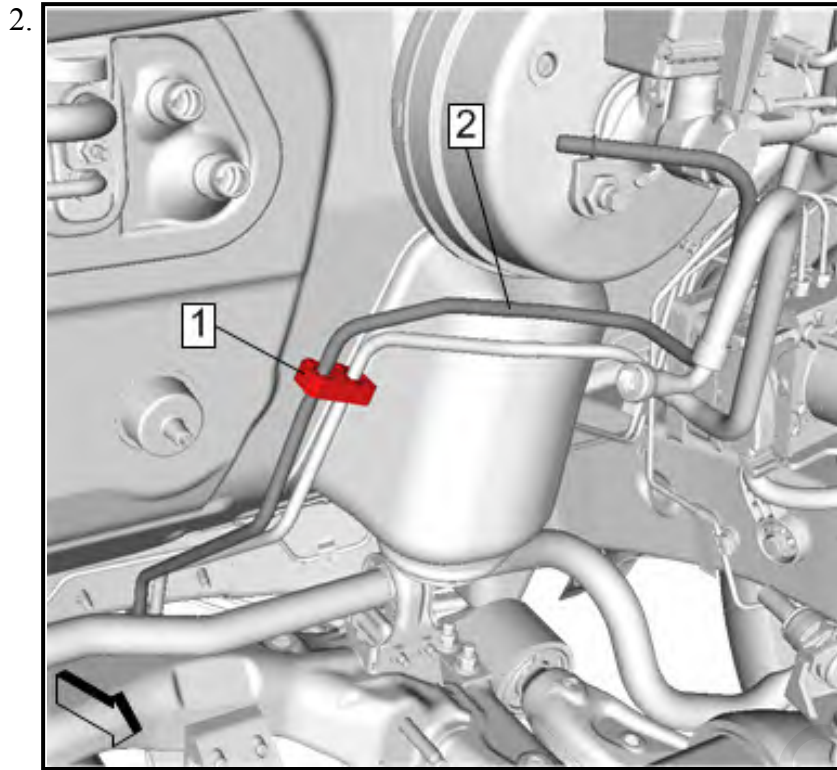
5. Tie Strap (1) - Install NEW [7x]
6. Rear Wheelhouse Liner - Install - [Rear Wheelhouse Liner Replacement](#)

EVAPORATIVE EMISSION FRONT PIPE REPLACEMENT (AWD)

Removal Procedure

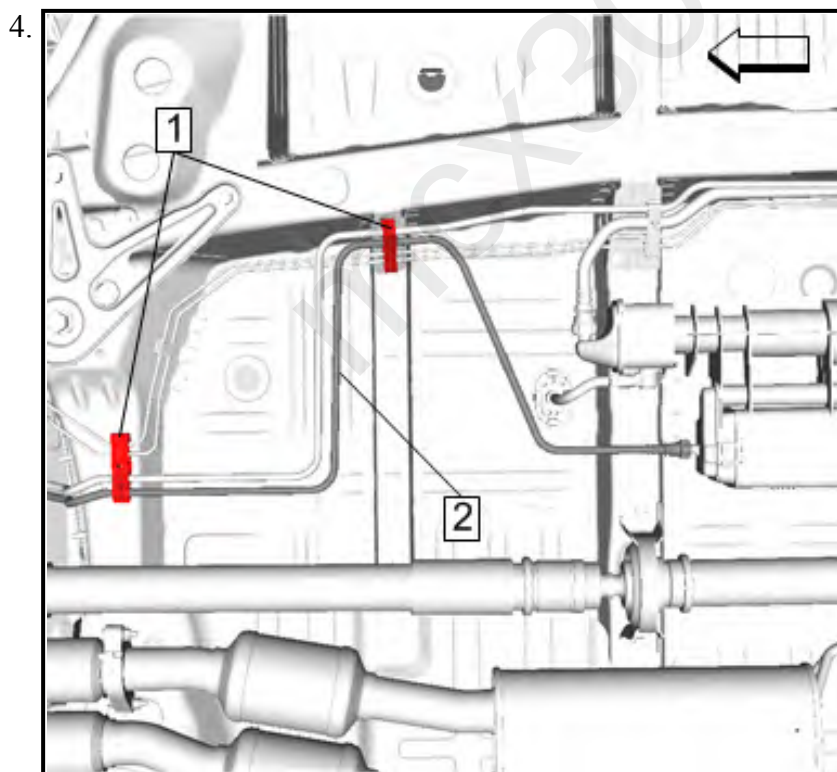
WARNING: Refer to [Diesel/Gasoline Vapors Warning](#) .

1. Evaporative Emission Canister Purge Tube - Remove - [Evaporative Emission Canister Purge Tube Replacement](#)



Evaporative Emission Front Pipe (2) @ Retainer (1) - Remove

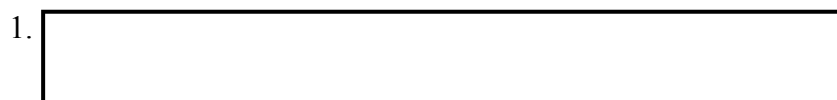
3. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)

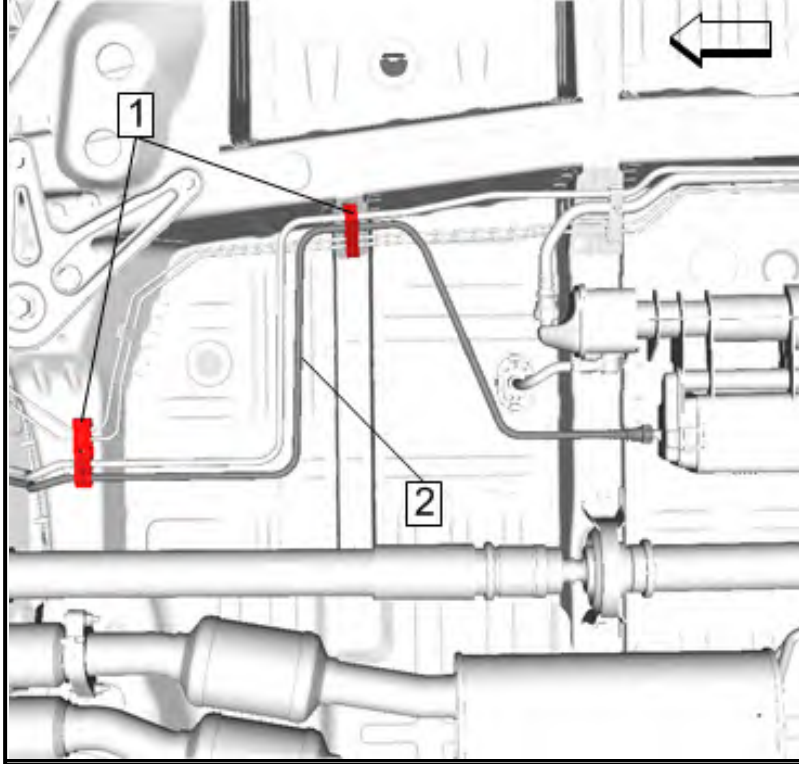


Evaporative Emission Front Pipe (2) @ Evaporative Emission Canister - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

5. Evaporative Emission Front Pipe (2) @ Retainer (1) - Remove [2x]

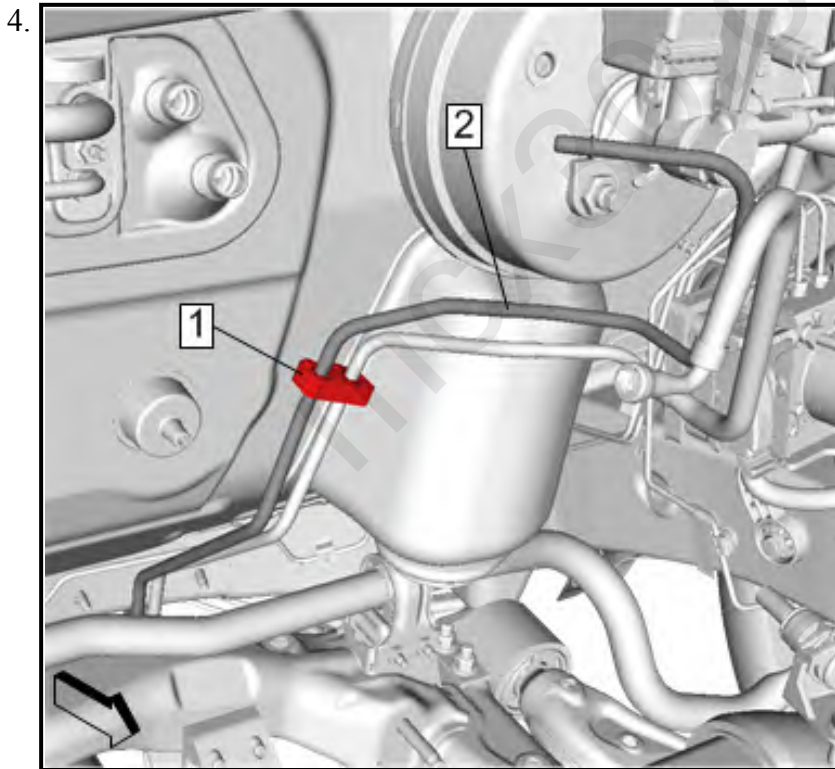
Installation Procedure





Evaporative Emission Front Pipe (2) @ Retainer (1) - Install [2x]

2. Evaporative Emission Front Pipe (2) @ Evaporative Emission Canister - Connect - [Plastic Collar Quick Connect Fitting Service](#)
3. Lower the vehicle.



Evaporative Emission Front Pipe (2) @ Retainer (1) - Install

5. Evaporative Emission Canister Purge Tube - Install - [Evaporative Emission Canister Purge Tube Replacement](#)

EVAPORATIVE EMISSION FRONT PIPE REPLACEMENT (FWD)

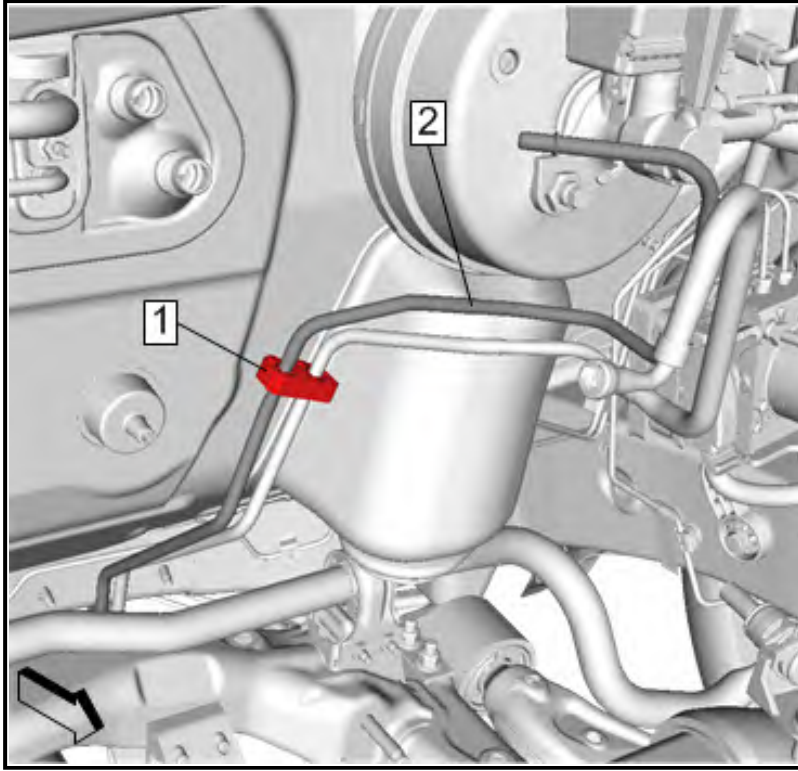
Removal Procedure

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

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

1. Evaporative Emission Canister Purge Tube - Remove - [Evaporative Emission Canister Purge Tube Replacement](#)

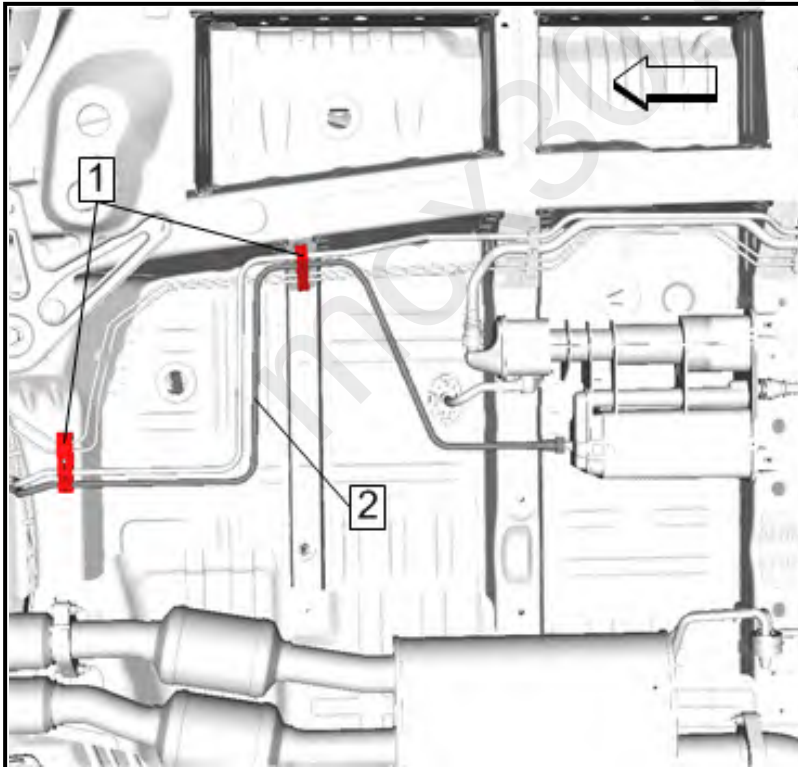
2.



Evaporative Emission Front Pipe (2) @ Retainer (1) - Remove

3. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)

4.



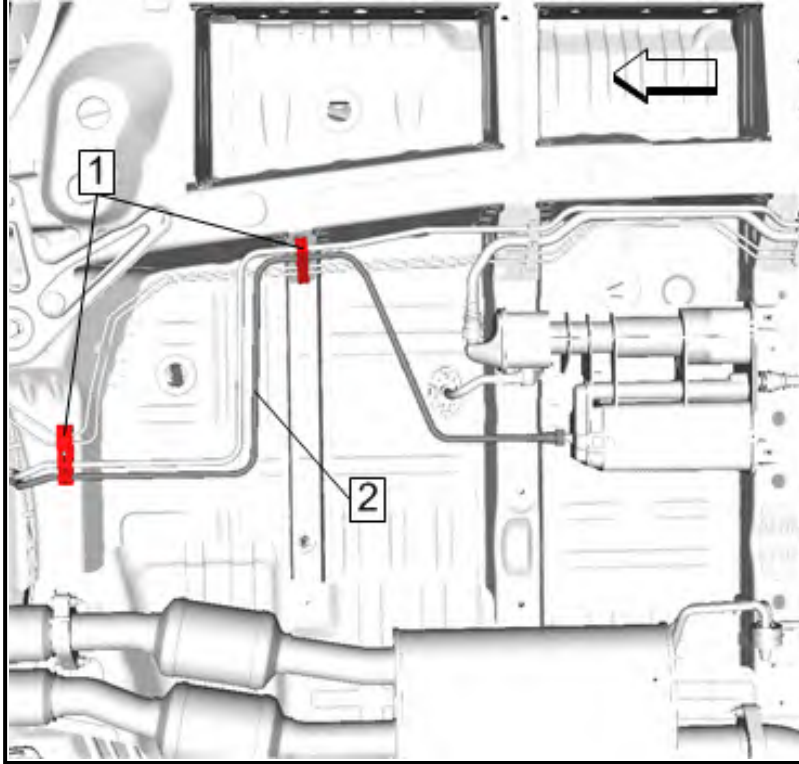
Evaporative Emission Front Pipe (2) @ Evaporative Emission Canister - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

5. Evaporative Emission Front Pipe (2) @ Retainer (1) - Remove [2x]

Installation Procedure

1.

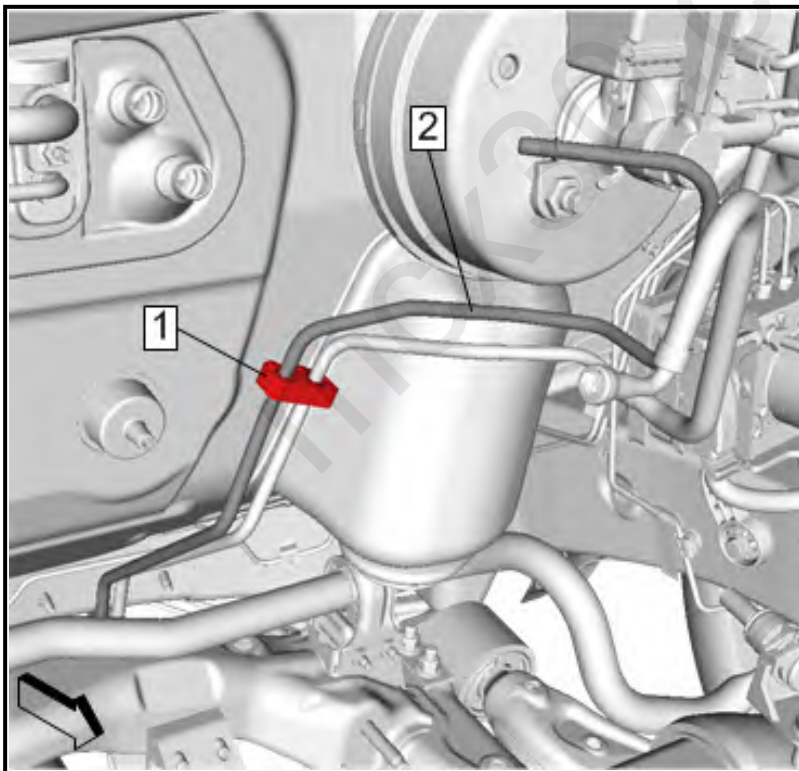




Evaporative Emission Front Pipe (2) @ Retainer (1) - Install [2x]

2. Evaporative Emission Front Pipe (2) @ Evaporative Emission Canister - Connect - [Plastic Collar Quick Connect Fitting Service](#)
3. Lower the vehicle.

4.

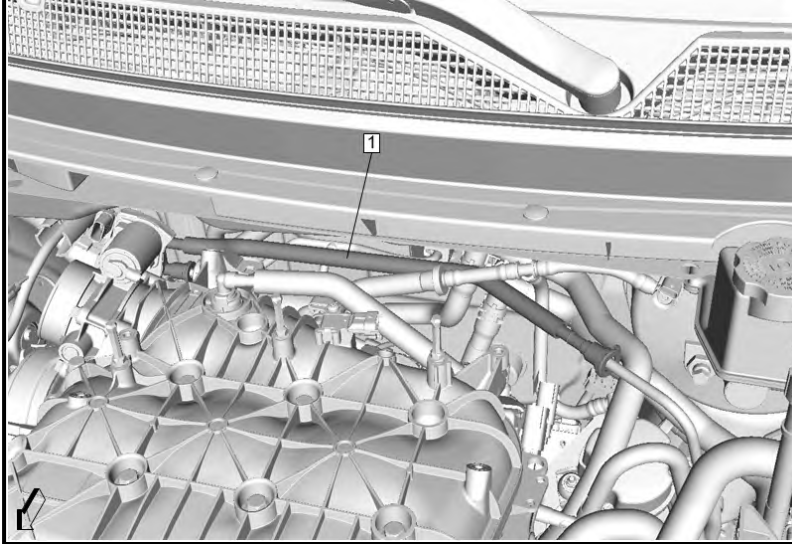


Evaporative Emission Front Pipe (2) @ Retainer (1) - Install

5. Evaporative Emission Canister Purge Tube - Install - [Evaporative Emission Canister Purge Tube Replacement](#)

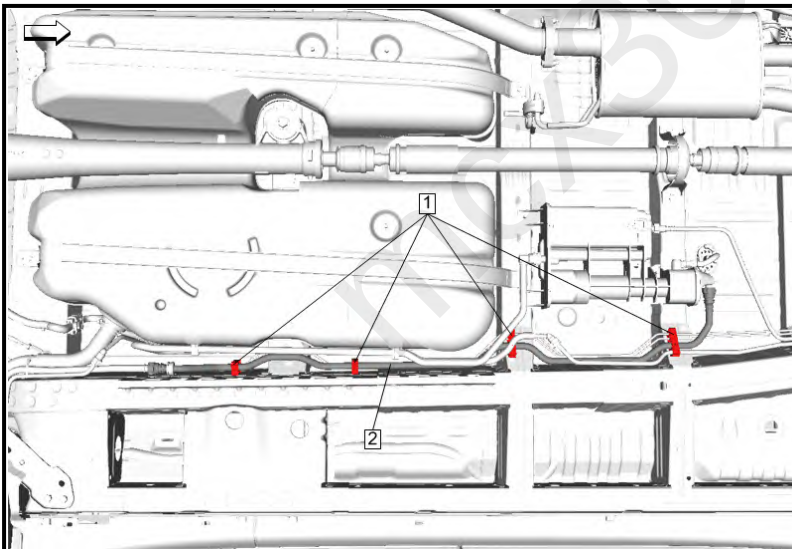
EVAPORATIVE EMISSION CANISTER PURGE TUBE REPLACEMENT





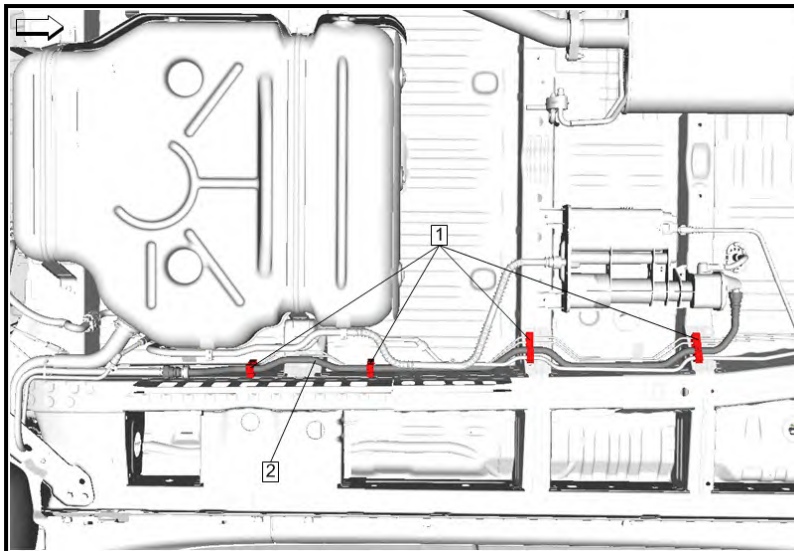
Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Air Cleaner Outlet Duct Replacement	
1	Evaporative Emission Canister Purge Tube Procedure Disconnect the quick connect fittings. Plastic Collar Quick Connect Fitting Service

EVAPORATIVE EMISSION CANISTER AIR INLET HOSE REPLACEMENT (AWD)



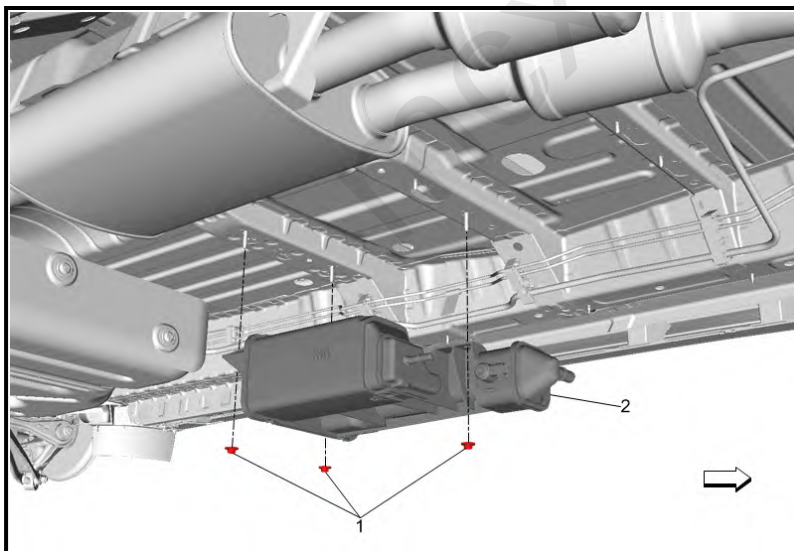
Callout	Component Name
WARNING: Refer to Diesel/Gasoline Vapors Warning .	
WARNING: Refer to Safety Glasses Warning .	
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Retainer [4x]
2	Evaporative Emission Canister Air Inlet Hose Procedure Disconnect the quick connect fitting. Plastic Collar Quick Connect Fitting Service

EVAPORATIVE EMISSION CANISTER AIR INLET HOSE REPLACEMENT (FWD)



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	Retainer [4x]
2	Evaporative Emission Canister Air Inlet Hose
Procedure Disconnect the quick connect fitting. Plastic Collar Quick Connect Fitting Service	

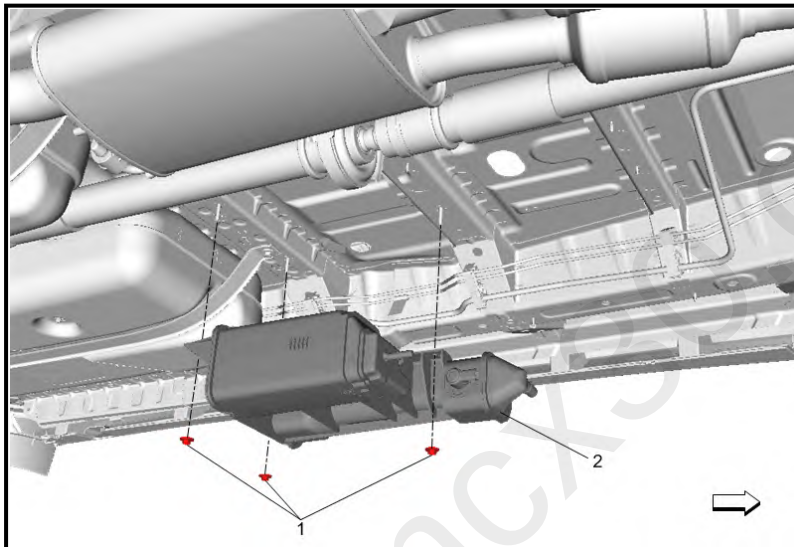
EVAPORATIVE EMISSION CANISTER REPLACEMENT (FWD)



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	

Callout	Component Name
1	Evaporative Emission Canister Fastener [3x] CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)
2	Evaporative Emission Canister Procedure 1. Disconnect the electrical connector. 2. Disconnect the evaporative emission front pipe, evaporative emission canister vent hose, and the evaporative emission canister air inlet hose. Plastic Collar Quick Connect Fitting Service 3. Transfer parts as necessary.

EVAPORATIVE EMISSION CANISTER REPLACEMENT (AWD)



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 Canister Fastener [3x] CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)

Callout	Component Name
2	Evaporative Emission Canister Procedure 1. Disconnect the electrical connector. 2. Disconnect the evaporative emission front pipe, evaporative emission canister vent hose, and the evaporative emission canister air inlet hose. Plastic Collar Quick Connect Fitting Service 3. Transfer parts as necessary.

EVAPORATIVE EMISSION SYSTEM CLEANING

Special Tools

GE 41413 - 200 Evaporative Pressure and Purge Station

Equivalent regional tools: [Special 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.

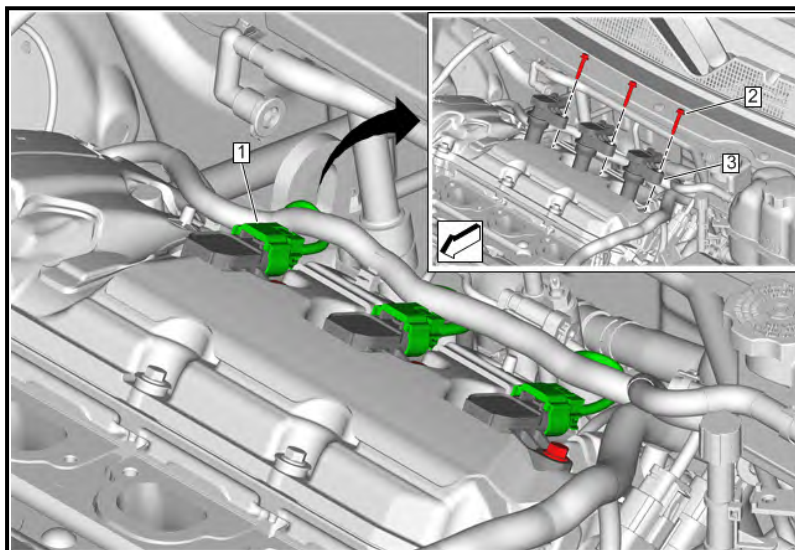
1. Turn OFF the ignition.
2. Remove the EVAP canister purge valve. [Evaporative Emission Canister Purge Solenoid Valve Replacement](#)
3. Lightly tap the EVAP canister purge valve on a hard surface.
4. Inspect for carbon particles exiting either of the vacuum ports.
 - If no carbon particles were detected, 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. [Lifting and Jacking the Vehicle](#)
2. Remove the EVAP canister. [Evaporative Emission Canister Replacement \(FWD\)Evaporative Emission Canister Replacement \(AWD\)](#)
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.

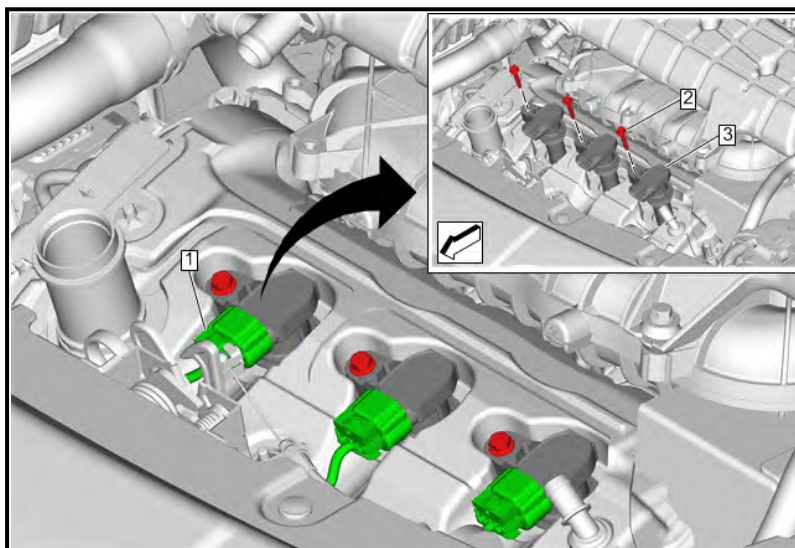
10. Install a new EVAP canister. [Evaporative Emission Canister Replacement \(FWD\)](#)[Evaporative Emission Canister Replacement \(AWD\)](#)
11. Lower the vehicle.
12. Install a new EVAP canister purge valve. [Evaporative Emission Canister Purge Solenoid Valve Replacement](#)
13. Return to the diagnostic table that sent you here.

IGNITION COIL REPLACEMENT - BANK 1



Callout	Component Name
Preliminary Procedure Upper Intake Manifold Replacement	
1	Electrical Connector [3x] Procedure Disconnect the electrical connectors.
2	Ignition Coil Bolt [3x] CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
3	Ignition Coil [3x]

IGNITION COIL REPLACEMENT - BANK 2



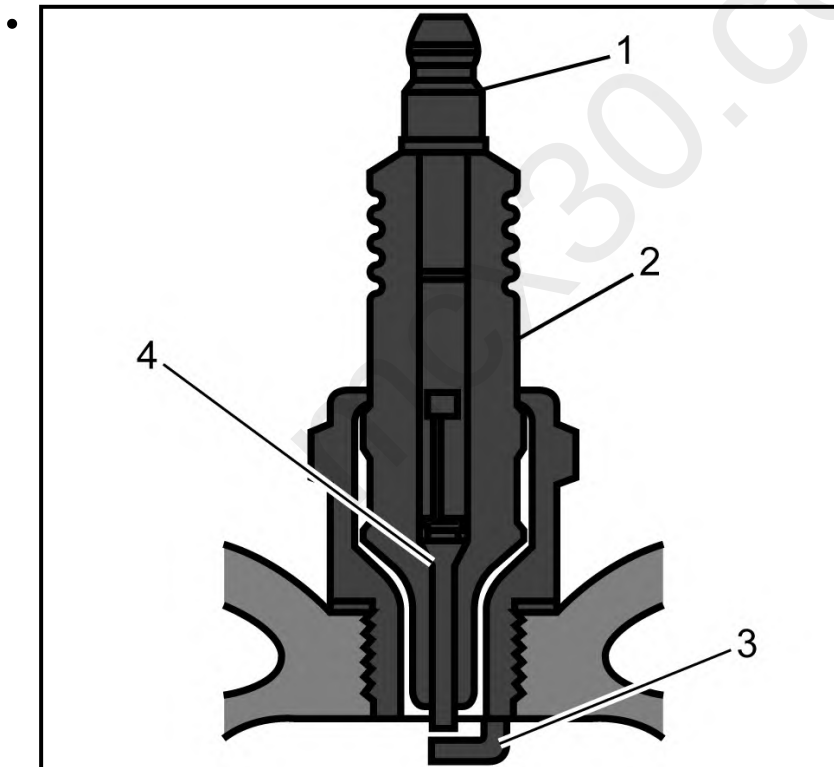
Callout	Component Name
Preliminary Procedure Remove the front positive crankshaft ventilation tube. Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Air Cleaner Outlet Duct to Camshaft Cover). Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Intake Manifold to Camshaft Cover).	
1	Electrical Connector [3x] Procedure Disconnect the electrical connectors.
2	Ignition Coil Bolt [3x] CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
3	Ignition Coil [3x]

SPARK PLUG INSPECTION

Spark Plug Usage

Ensure that the correct spark plug is installed. An incorrect spark plug causes driveability conditions. Refer to the Electronic Parts Catalog.

Spark Plug Inspection



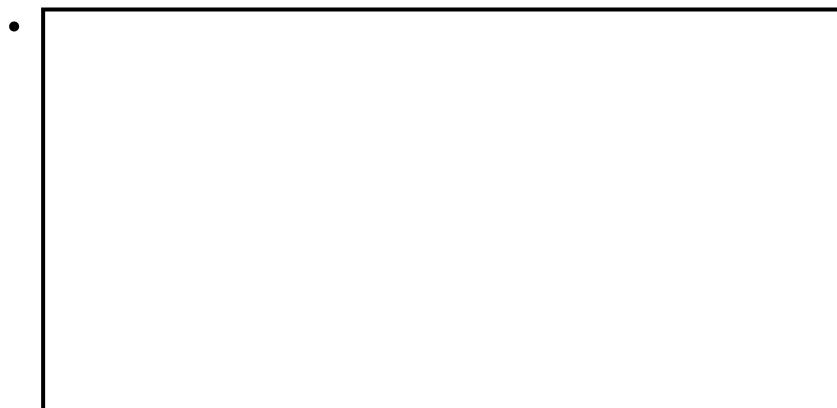
Inspect the terminal post (1) for damage.

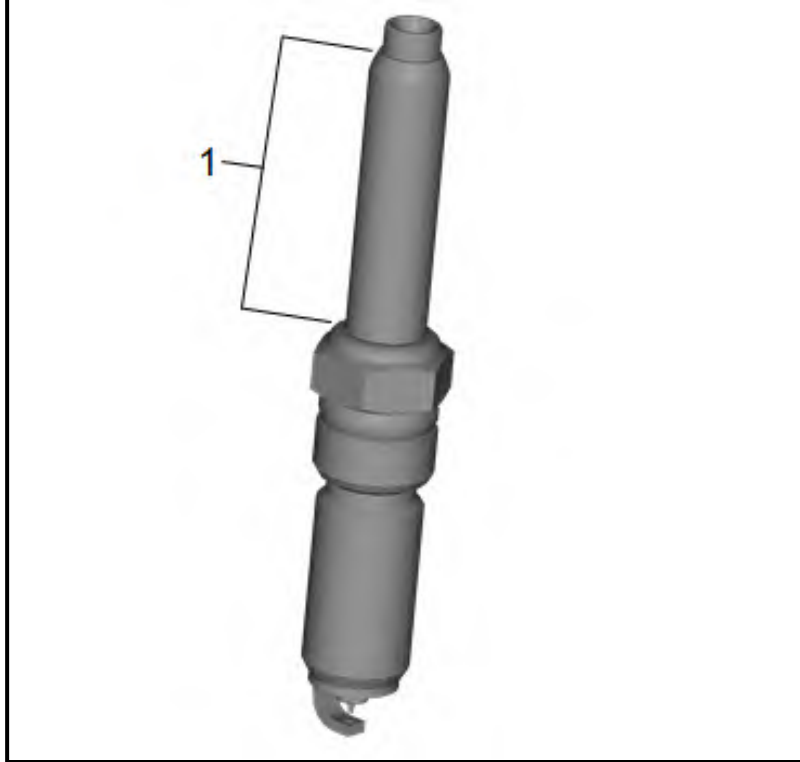
- Inspect for a bent or broken terminal post (1).
- Test for a loose terminal post (1) by twisting and pulling the post. The terminal post (1) should NOT move.
- Inspect the insulator (2) for flashover or carbon tracking, soot. This condition is often mistakenly identified as a cracked insulator. This is caused by the electrical charge traveling across the insulator (2) between the terminal post (1) and ground. Inspect for the following conditions:
 - Inspect the spark plug boot for damage.
 - Inspect the spark plug recess area of the cylinder head for moisture, such as oil, coolant, or water. A spark plug boot that is saturated causes arcing to ground.

- Inspect the insulator (2) for cracks. All or part of the electrical charge may arc through the crack instead of the electrodes (3, 4).
- Inspect for evidence of improper arcing.
 - Measure the gap between the center electrode (4) and the side electrode (3) terminals. This must be done carefully in order to avoid damaging the small diameter Iridium center electrode. An excessively wide electrode gap can prevent correct spark plug operation.
- **Ignition System Specifications**
- Inspect for the correct spark plug torque. Insufficient torque can prevent correct spark plug operation. An over torqued spark plug, causes the insulator (2) to crack. **Ignition System Specifications**
- Inspect for signs of tracking that occurred near the insulator tip instead of the center electrode (4).
- Inspect for a broken or worn side electrode (3).
- Inspect for a broken, worn, or loose center electrode (4) by shaking the spark plug.
 - A rattling sound indicates internal damage.
 - A loose center electrode (4) reduces the spark intensity.
- Inspect for bridged electrodes (3, 4). Deposits on the electrodes (3, 4) reduce or eliminates the gap.
- Inspect for worn or missing platinum pads on the electrodes (3, 4) If equipped.
- Inspect for excessive fouling.
- Inspect the spark plug recess area of the cylinder head for debris. Dirty or damaged threads can cause the spark plug not to seat correctly during installation.

Spark Plug Visual Inspection

- Normal operation - Brown to grayish-tan with small amounts of white powdery deposits are normal combustion by-products from fuels with additives. Reddish orange deposits can indicate MMT fuel additive which is still used in some markets around the world (will cause misfire and cannot be burned off). MMT fuel additive use should be avoided.
- Carbon Fouled - Dry, fluffy black carbon, or soot caused by the following conditions:
 - Rich fuel mixtures
 - Leaking fuel injectors
 - Excessive fuel pressure
 - Restricted air filter element
 - Incorrect combustion
 - Reduced ignition system voltage output
 - Weak coils
 - Worn ignition wires
 - Incorrect spark plug gap
 - Excessive idling or slow speeds under light loads can keep spark plug temperatures so low that normal combustion deposits may not burn off.
- Deposit Fouling - Oil, coolant, or additives that include substances such as silicone, very white coating, reduces the spark intensity. Most powdery deposits will not effect spark intensity unless they form into a glazing over the electrode.

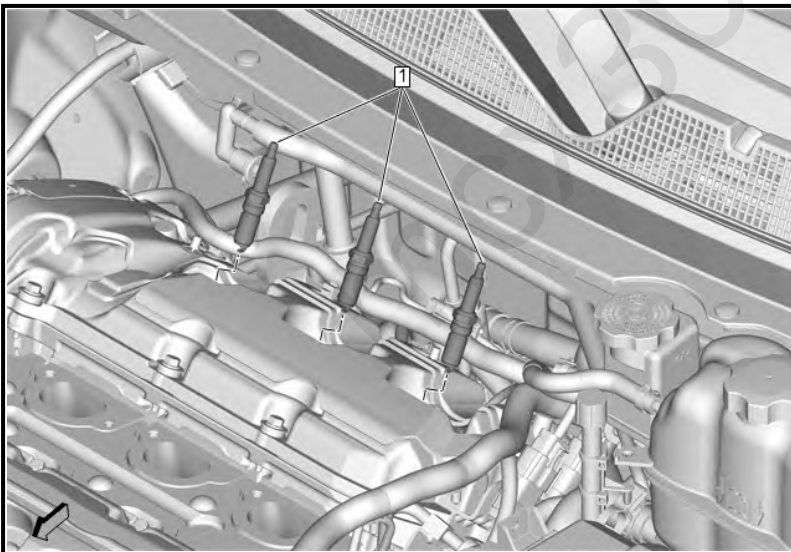




NOTE: Carbon on spark plug tower means carbon will also be on inside of spark plug wire boot or coil boot and will cause both new spark plug and spark plug wire or coil boot to fail again.

- If carbon tracking occurs on spark plug tower (1), replace spark plug and spark plug wire or coil boot.

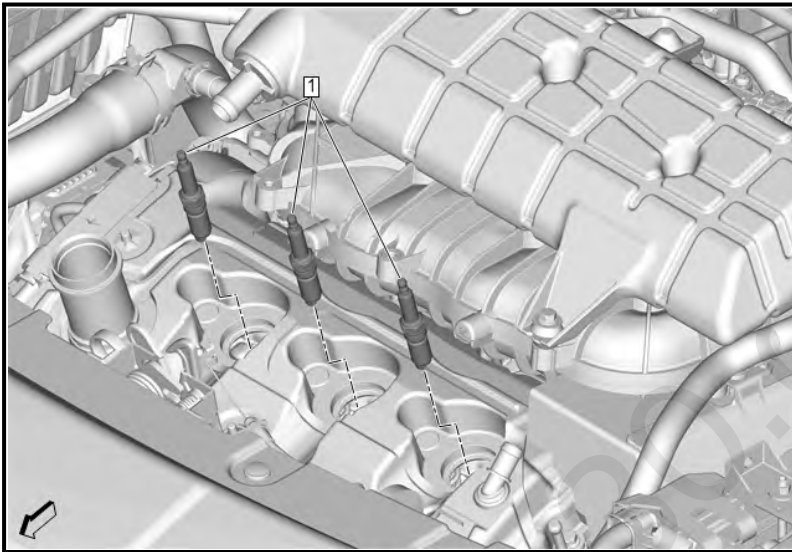
SPARK PLUG REPLACEMENT (BANK 1)



Callout	Component Name
Preliminary Procedure	
<u>Ignition Coil Replacement - Bank 1</u>	

Callout	Component Name
1	Spark Plug [3x] CAUTION: Refer to Component Fastener Tightening Caution . Procedure 1. If reusing the spark plugs, inspect for wear or damage. Spark Plug Inspection 2. If using NEW spark plugs, do NOT attempt to check the spark plug gap. The plugs come pre-gapped. Tighten 18 N.m (13 lb ft)

SPARK PLUG REPLACEMENT (BANK 2)



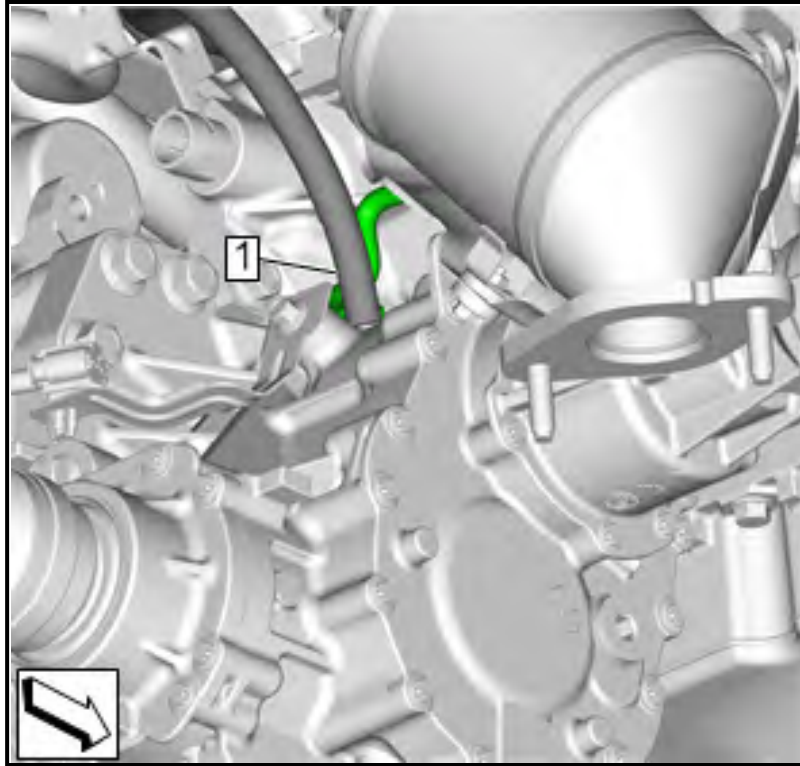
Callout	Component Name
Preliminary Procedure Ignition Coil Replacement - Bank 2	
1	Spark Plug [3x] CAUTION: Refer to Component Fastener Tightening Caution . Procedure 1. If reusing the spark plugs, inspect for wear or damage. Spark Plug Inspection 2. If using NEW spark plugs, do NOT attempt to check the spark plug gap. The plugs come pre-gapped. Tighten 18 N.m (13 lb ft)

CRANKSHAFT POSITION SENSOR REPLACEMENT (AWD)

Removal Procedure

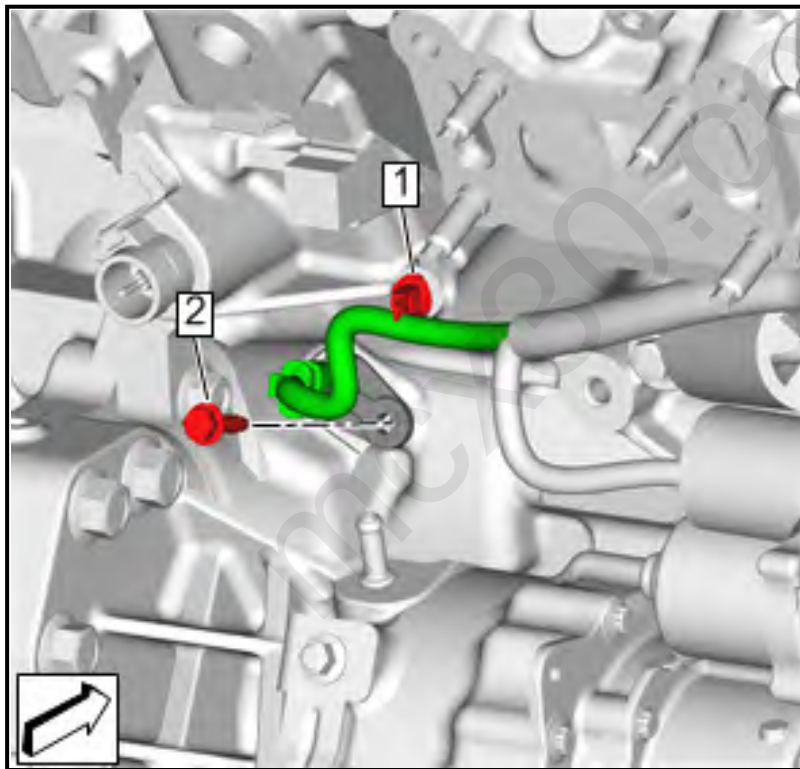
1. Disconnect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)
2. Exhaust Front Muffler - Remove - [Exhaust Front Muffler Replacement \(LFY\)](#)

3.



Disconnect the power transfer unit vent hose (1) from the power transfer unit and set aside.

4.

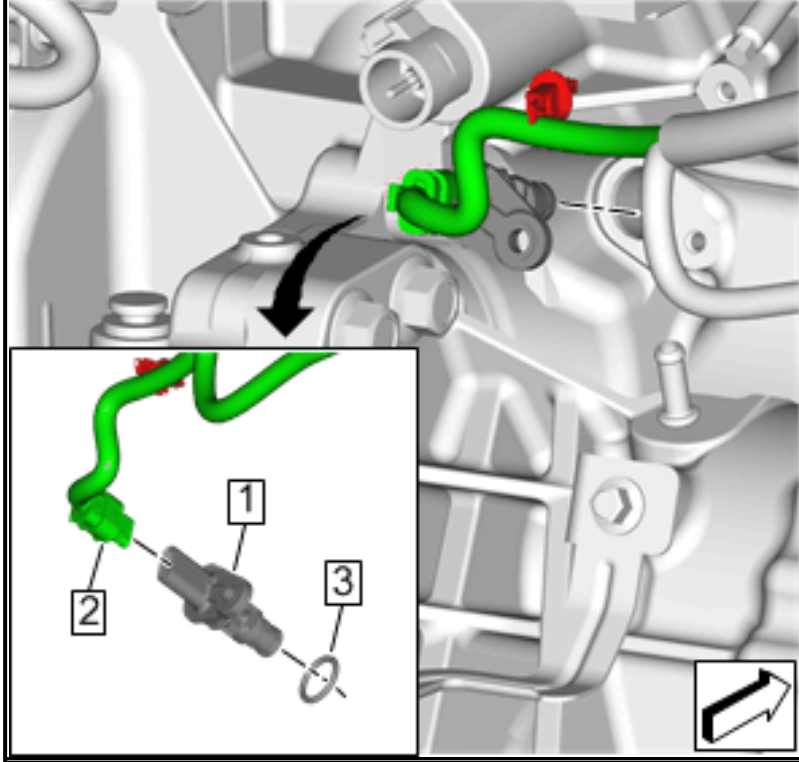


Remove the engine wiring harness clip (1) from the engine block.

5. Remove the crankshaft position sensor bolt (2).

6.

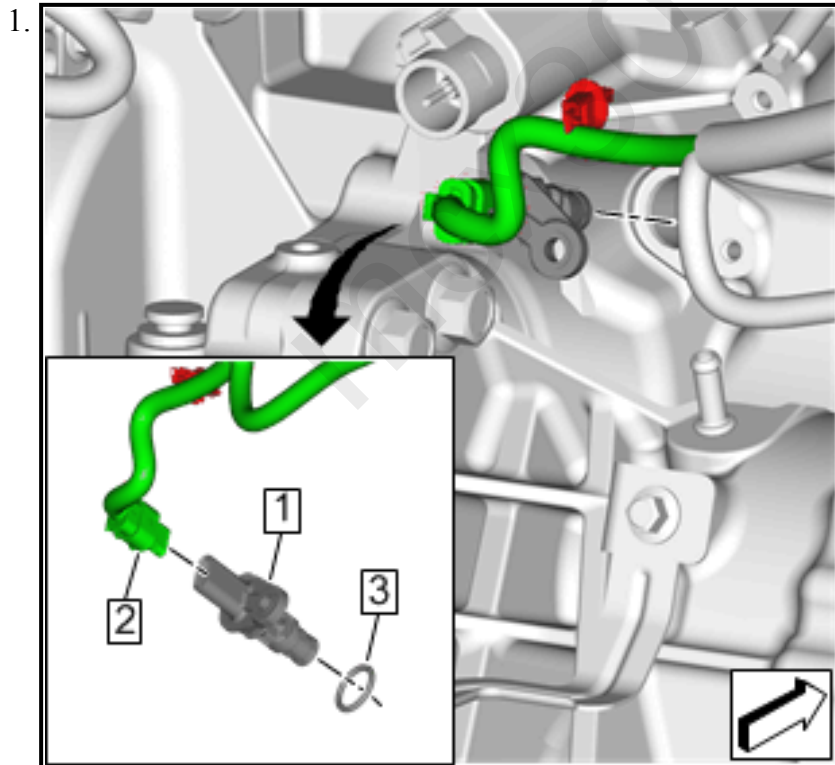




With the electrical connector connected, remove the crankshaft position sensor (1) from the engine.

7. Disconnect the electrical connector (2) from the crankshaft position sensor.
8. DISCARD the crankshaft position sensor seal (3).

Installation Procedure

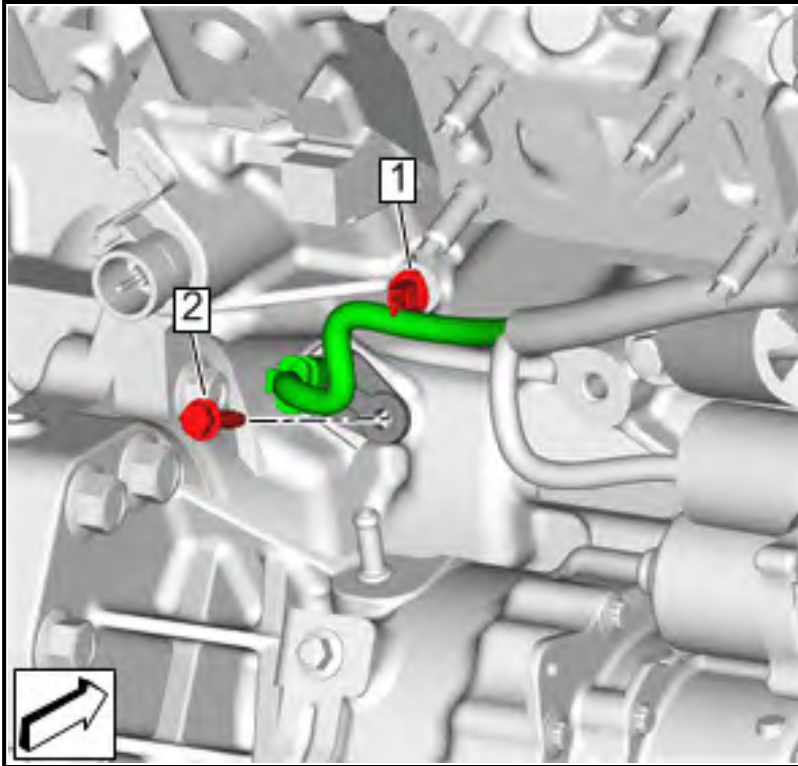


NOTE: A NEW sensor will come with a NEW seal.

Install the NEW crankshaft position sensor seal (3).

2. Lubricate the NEW crankshaft position sensor seal (3) with clean engine oil. [Adhesives, Fluids, Lubricants, and Sealers](#)
3. Connect the electrical connector (2) to the crankshaft position sensor.
4. With the electrical connector connected, install the crankshaft position sensor (1) into the engine.

5.

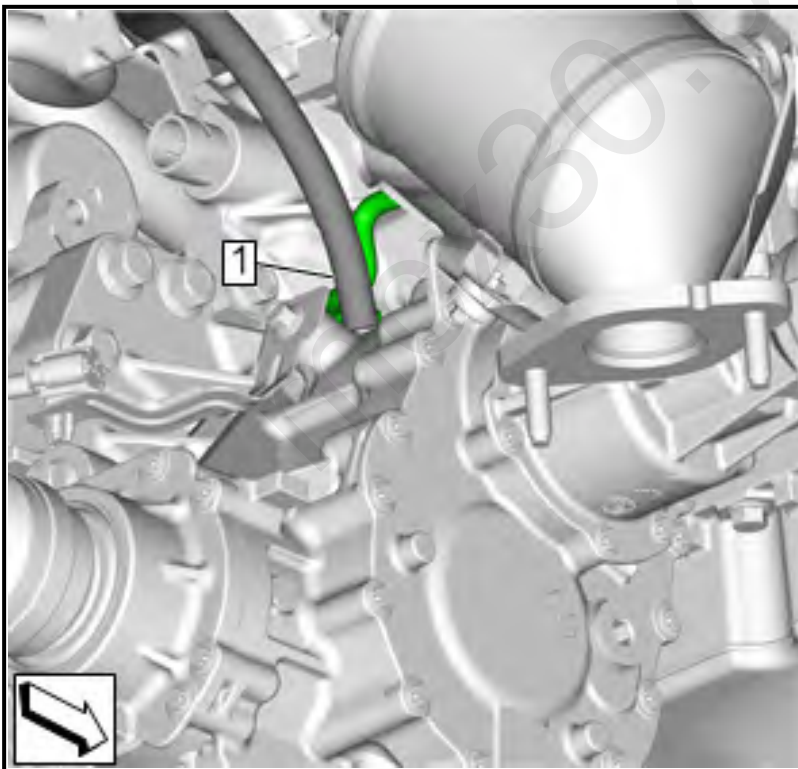


CAUTION: Refer to [Fastener Caution](#) .

Install the crankshaft position sensor bolt (2) and tighten to 10 N.m (89 lb in).

6. Install the engine wiring harness clip (1) to the engine block.

7.



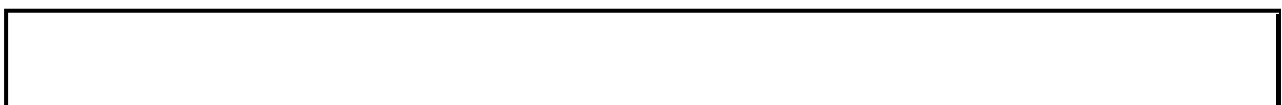
Connect the power transfer unit vent hose (1) to the power transfer unit.

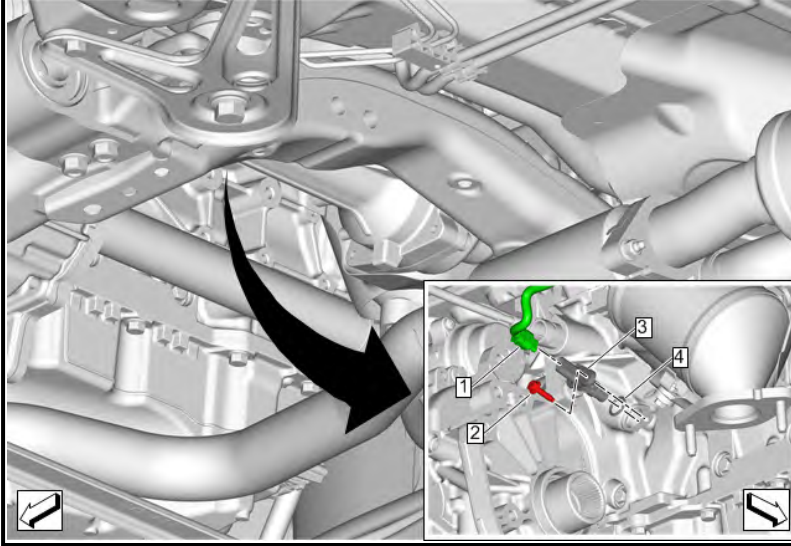
8. Exhaust Front Muffler - Install - [Exhaust Front Muffler Replacement \(LFY\)](#)

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

10. Perform the crankshaft position variation learn. [Crankshaft Position Variation Learn](#)

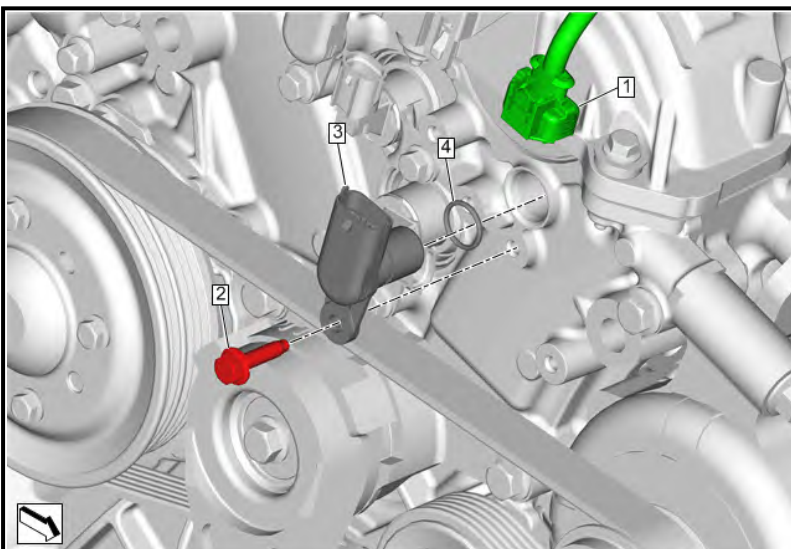
CRANKSHAFT POSITION SENSOR REPLACEMENT (FWD)





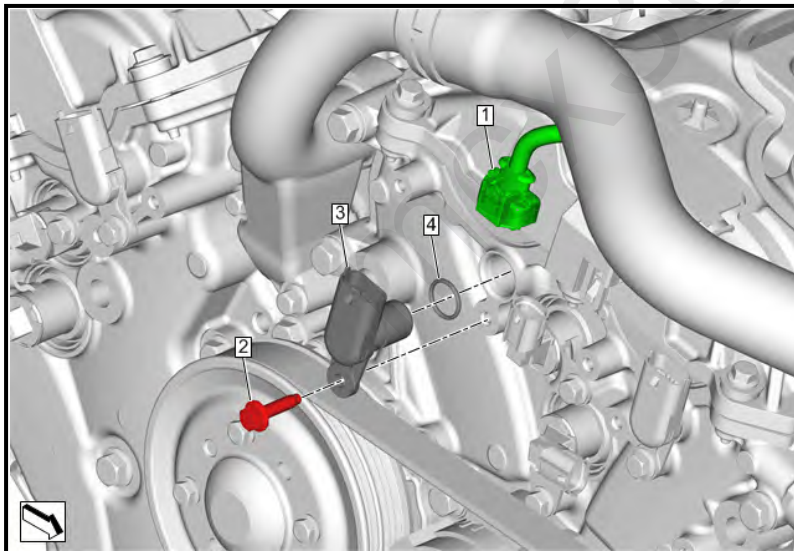
Callout	Component Name
Preliminary Procedure <u>Transmission Mount Strut Bracket Replacement (Front Wheel Drive)</u>	
1	Electrical Connector
2	Crankshaft Position Sensor Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
3	Crankshaft Position Sensor Procedure Perform the crankshaft position variation learn. <u>Crankshaft Position Variation Learn</u>
4	Crankshaft Position Sensor Seal Procedure 1. Install a NEW seal. A NEW sensor will come with a NEW seal. 2. Lubricate the NEW seal with clean engine oil. <u>Adhesives, Fluids, Lubricants, and Sealers</u>

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



Callout	Component Name
Preliminary Procedure <u>Engine Mount Bracket Replacement - Right Side</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Camshaft Position Sensor Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
3	Camshaft Position Sensor
4	Camshaft Position Sensor Seal NOTE: • ALWAYS install the camshaft position sensor seal supplied with the NEW camshaft position sensor. • If reinstalling the camshaft position sensor, inspect the camshaft position sensor seal and replace as necessary. • Lubricate the camshaft position sensor seal with clean engine oil prior to installing the camshaft position sensor.

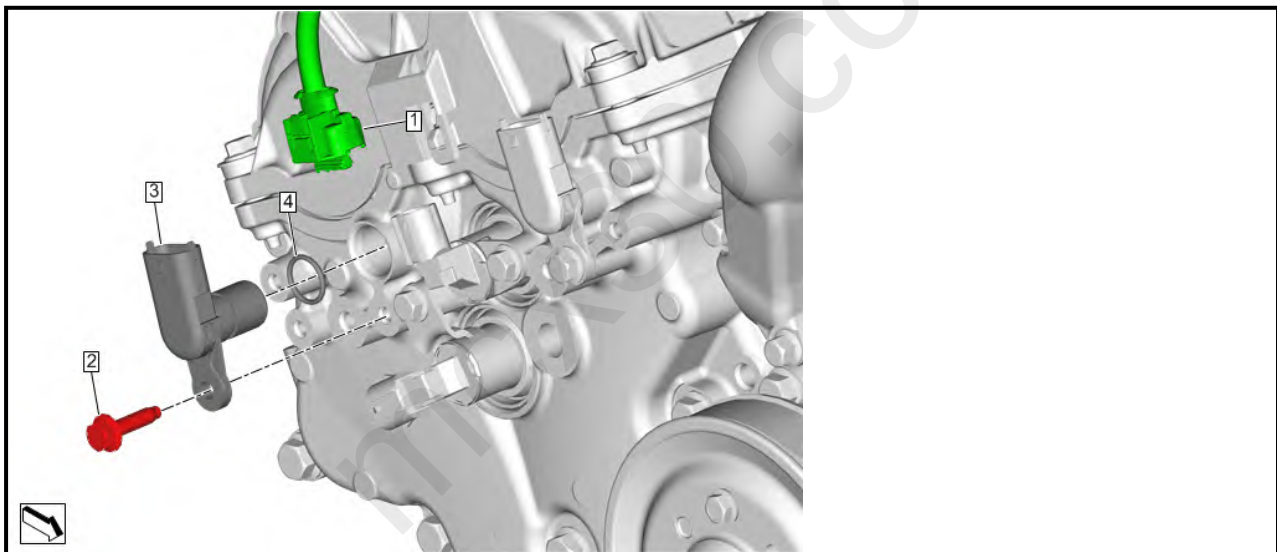
CAMSHAFT POSITION SENSOR REPLACEMENT - BANK 2 (LEFT SIDE) INTAKE



Callout	Component Name
Preliminary Procedure <u>Engine Mount Bracket Replacement - Right Side</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.

Callout	Component Name
2	Camshaft Position Sensor Bolt CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
3	Camshaft Position Sensor
4	Camshaft Position Sensor Seal NOTE: • ALWAYS install the camshaft position sensor seal supplied with the NEW camshaft position sensor. • If reinstalling the camshaft position sensor, inspect the camshaft position sensor seal and replace as necessary. • Lubricate the camshaft position sensor seal with clean engine oil prior to installing the camshaft position sensor.

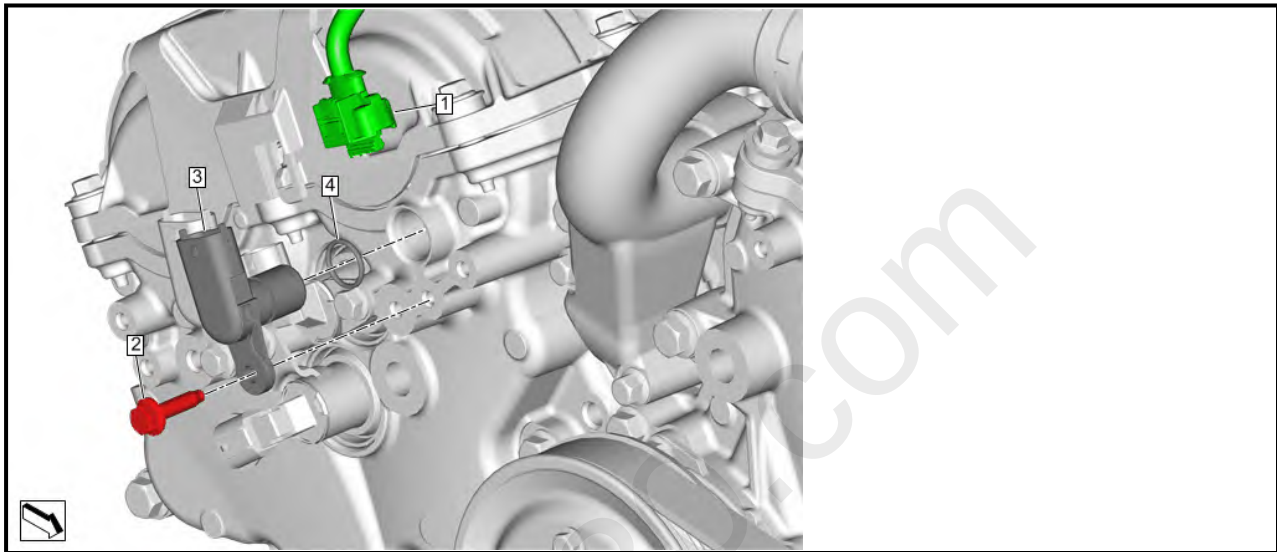
CAMSHAFT POSITION SENSOR REPLACEMENT - BANK 1 (RIGHT SIDE) EXHAUST



Callout	Component Name
Preliminary Procedure Air Cleaner Outlet Duct Replacement	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Camshaft Position Sensor Bolt CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
3	Camshaft Position Sensor

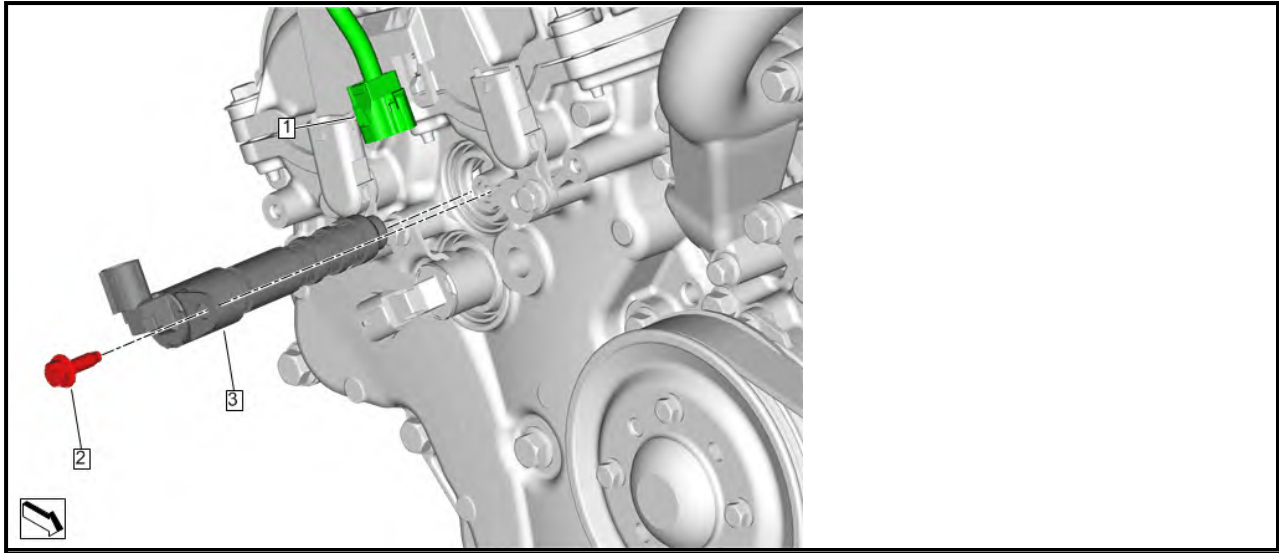
Callout	Component Name
4	Camshaft Position Sensor Seal NOTE: • ALWAYS install the camshaft position sensor seal supplied with the NEW camshaft position sensor. • If reinstalling the camshaft position sensor, inspect the camshaft position sensor seal and replace as necessary. • Lubricate the camshaft position sensor seal with clean engine oil prior to installing the camshaft position sensor.

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



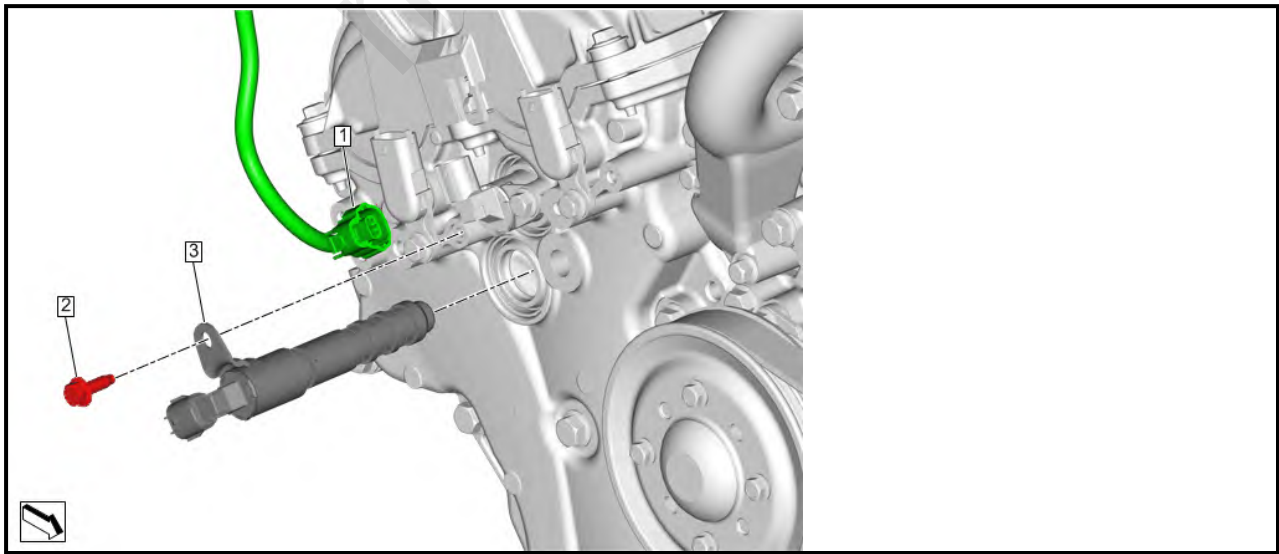
Callout	Component Name
Preliminary Procedure <u>Air Cleaner Outlet Duct Replacement</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Camshaft Position Sensor Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
3	Camshaft Position Sensor
4	Camshaft Position Sensor Seal NOTE: • ALWAYS install the camshaft position sensor seal supplied with the NEW camshaft position sensor. • If reinstalling the camshaft position sensor, inspect the camshaft position sensor seal and replace as necessary. • Lubricate the camshaft position sensor seal with clean engine oil prior to installing the camshaft position sensor.

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



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

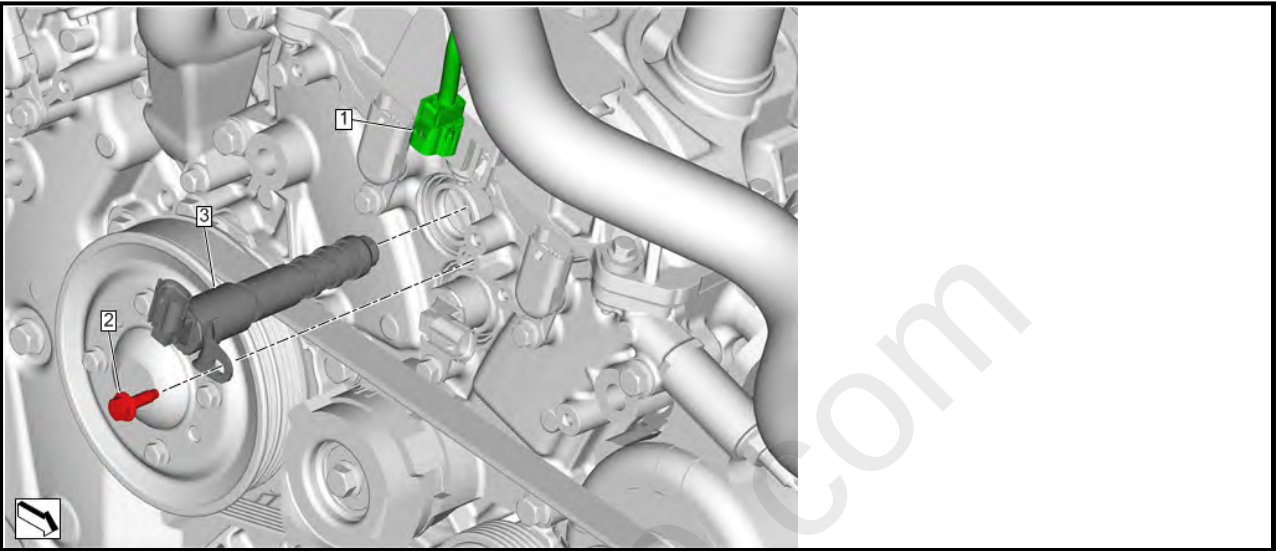
**CAMSHAFT POSITION ACTUATOR SOLENOID VALVE SOLENOID REPLACEMENT -
BANK 1 (RIGHT SIDE) EXHAUST**



Callout	Component Name
Preliminary Procedure <u>Air Cleaner Outlet Duct Replacement</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.

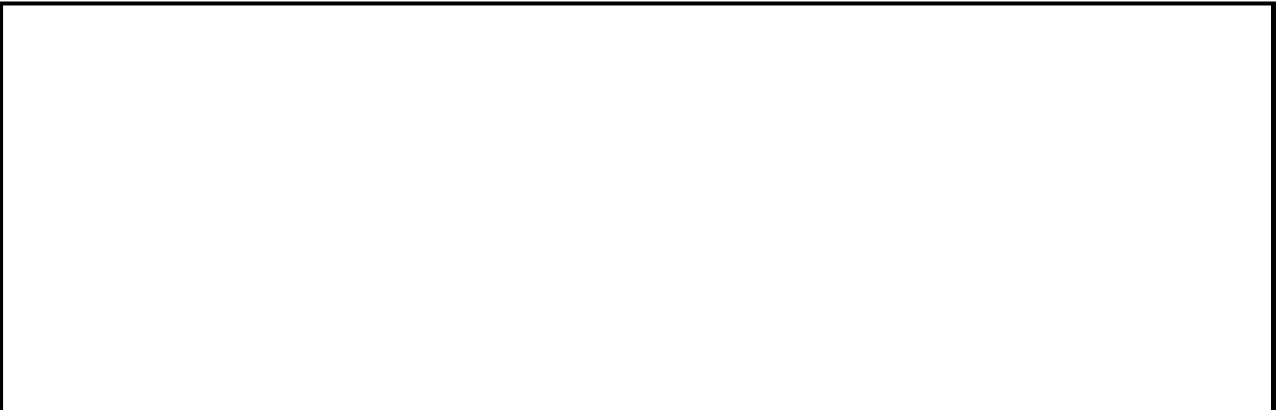
Callout	Component Name
2	Camshaft Position Actuator Solenoid Valve Solenoid Bolt CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
3	Camshaft Position Actuator Solenoid Valve Solenoid

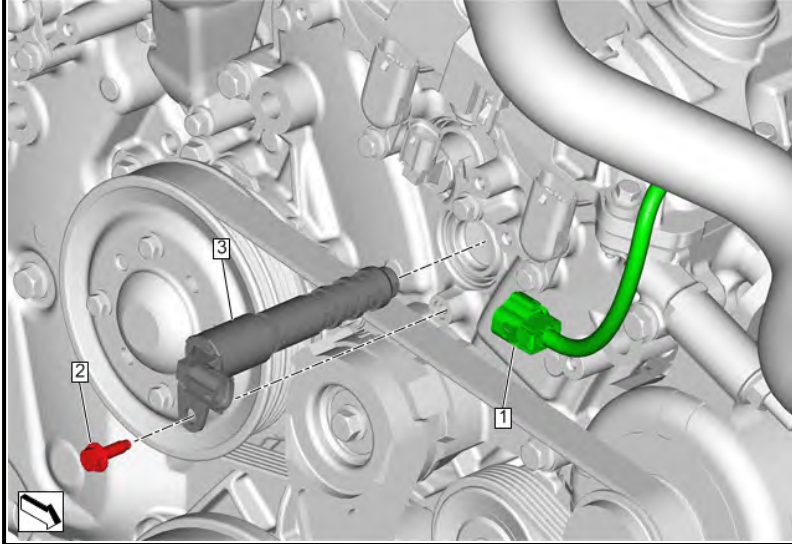
CAMSHAFT POSITION ACTUATOR SOLENOID VALVE SOLENOID REPLACEMENT - BANK 2 (LEFT SIDE) INTAKE



Callout	Component Name
Preliminary Procedure Engine Mount Bracket Replacement - Right Side	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Camshaft Position Actuator Solenoid Valve Solenoid Bolt CAUTION: Refer to Fastener Caution . Tighten 10 N.m (89 lb in)
3	Camshaft Position Actuator Solenoid Valve Solenoid

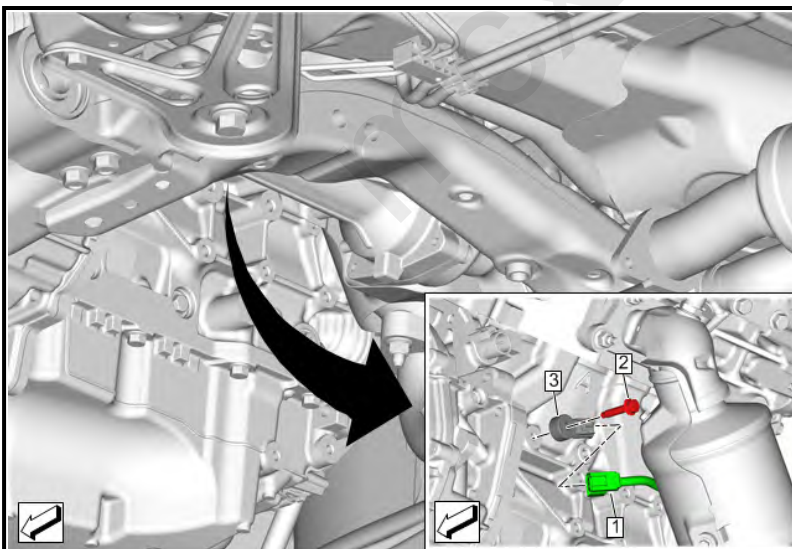
CAMSHAFT POSITION ACTUATOR SOLENOID VALVE SOLENOID REPLACEMENT - BANK 2 (LEFT SIDE) EXHAUST





Callout	Component Name
Preliminary Procedure <u>Engine Mount Bracket Replacement - Right Side</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Camshaft Position Actuator Solenoid Valve Solenoid Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
3	Camshaft Position Actuator Solenoid Valve Solenoid

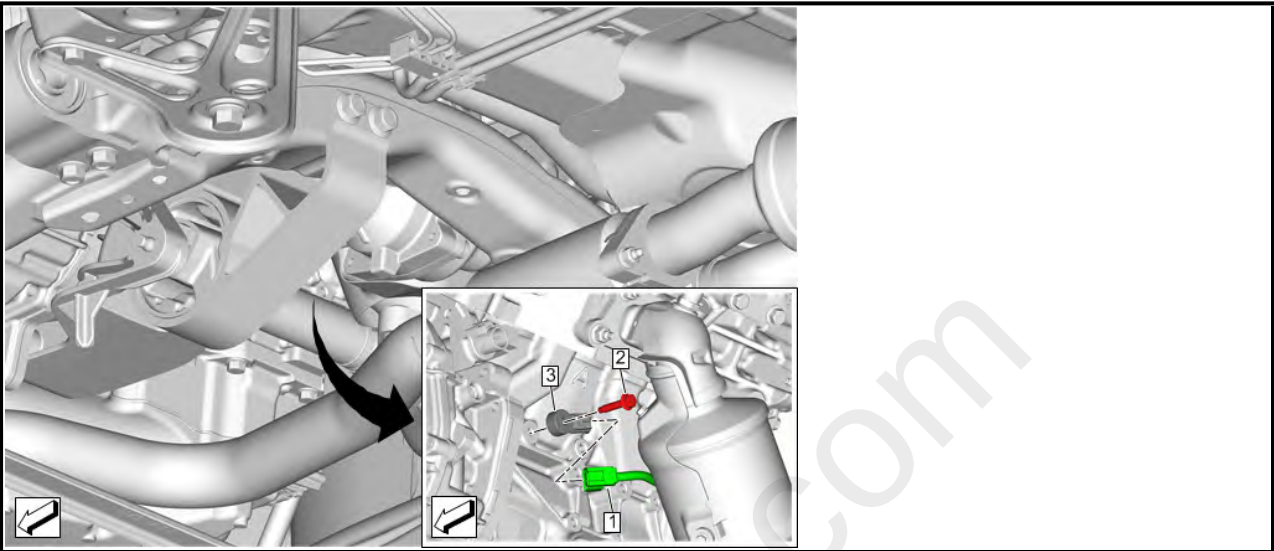
KNOCK SENSOR REPLACEMENT - BANK 1 (AWD)



Callout	Component Name
Preliminary Procedure <u>Power Transfer Unit Case Replacement</u>	
1	Electrical Connector Procedure Disconnect the electrical connector.

Callout	Component Name
2	Knock Sensor Bolt CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
3	Knock Sensor

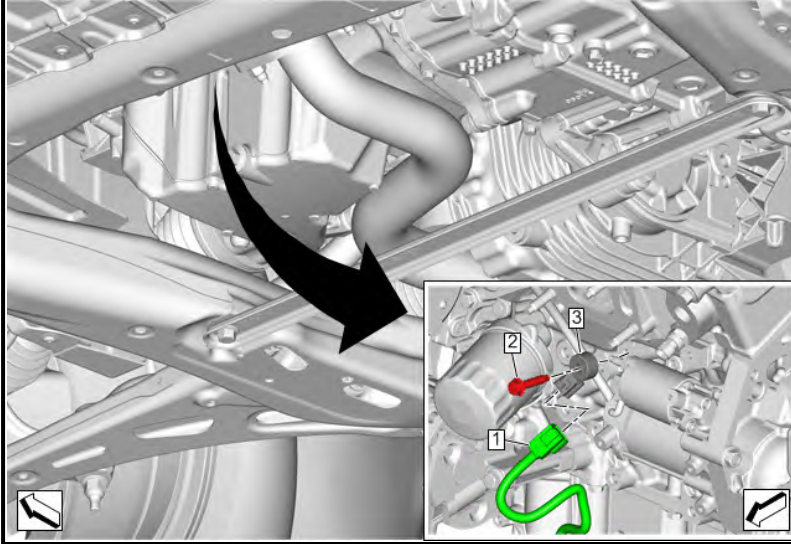
KNOCK SENSOR REPLACEMENT - BANK 1 (FWD)



Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Knock Sensor Bolt CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
3	Knock Sensor

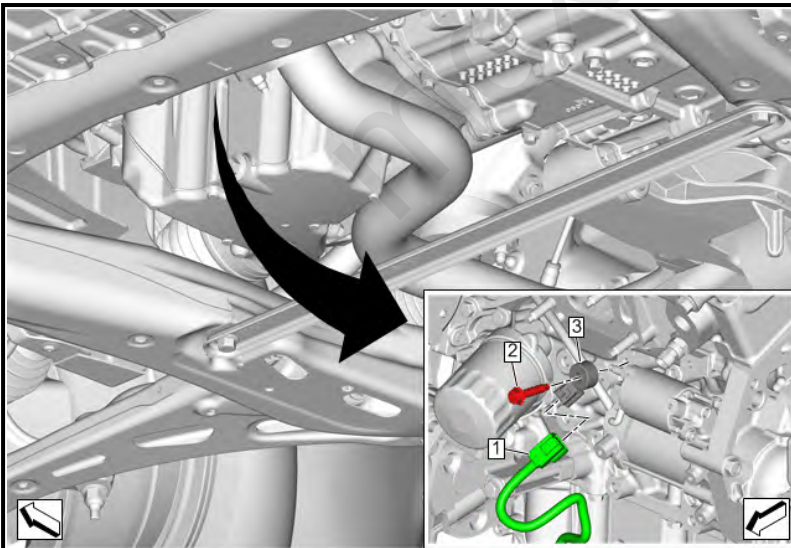
KNOCK SENSOR REPLACEMENT - BANK 2 (AWD)





Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Electrical Connector Procedure Disconnect the electrical connector.
2	Knock Sensor Bolt CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
3	Knock Sensor

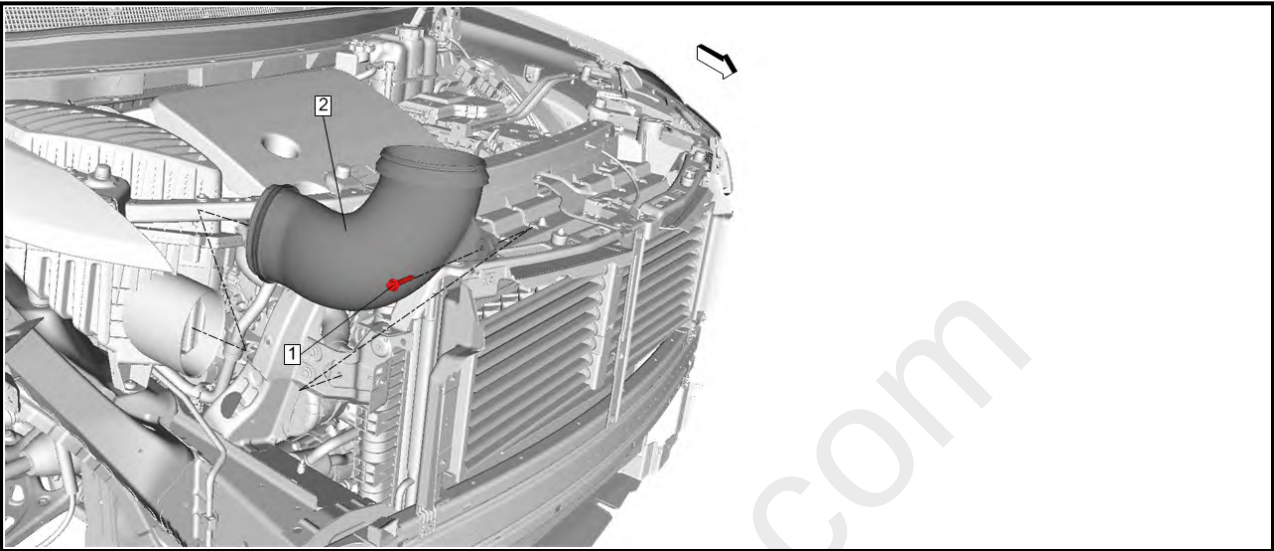
KNOCK SENSOR REPLACEMENT - BANK 2 (FWD)



Callout	Component Name
Preliminary Procedure Raise and support the vehicle. Lifting and Jacking the Vehicle	
1	Electrical Connector Procedure Disconnect the electrical connector.

Callout	Component Name
2	Knock Sensor Bolt CAUTION: Refer to Fastener Caution . Tighten 25 N.m (18 lb ft)
3	Knock Sensor

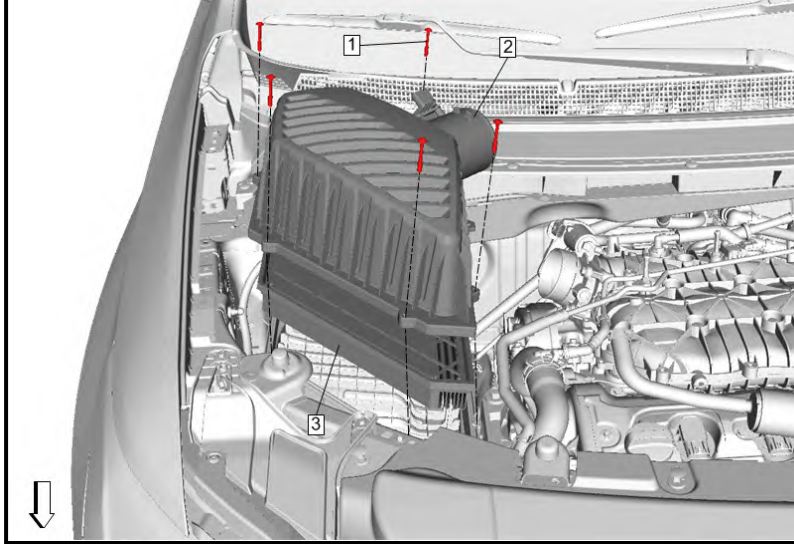
INTAKE AIR DUCT REPLACEMENT



Callout	Component Name
Preliminary Procedures 1. Intake Air Splash Shield Replacement 2. Headlamp - Right Side - Remove - Headlamp Replacement	
1	Intake Air Duct Bolt CAUTION: Refer to Fastener Caution . Tighten 9 N.m (80 lb in)
2	Intake Air Duct Procedure Pull intake air duct froward to release from air cleaner assembly.

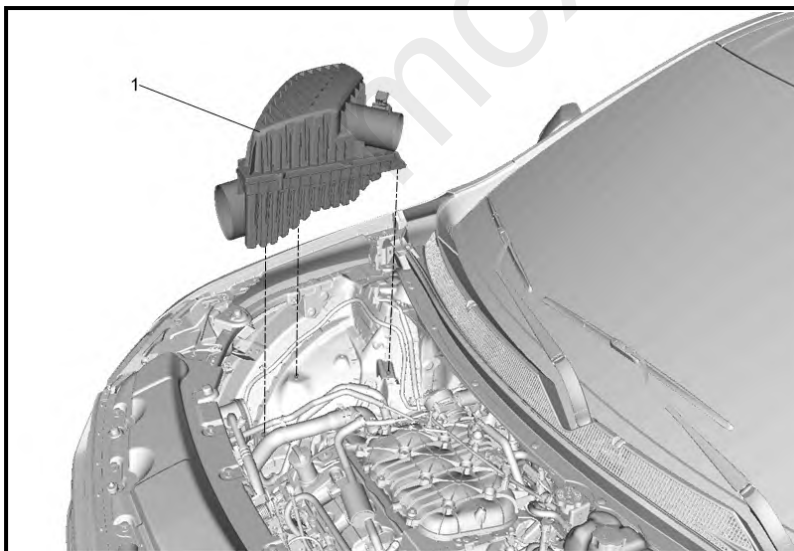
AIR CLEANER ELEMENT REPLACEMENT





Callout	Component Name
Preliminary Procedure Air Cleaner Outlet Duct Replacement - Disconnect the electrical connector.	
1	Air Cleaner Upper Housing Bolt [5x] CAUTION: Refer to Fastener Caution . Tighten 4 N.m (35 lb in)
2	Air Cleaner Upper Housing
3	Air Cleaner Element

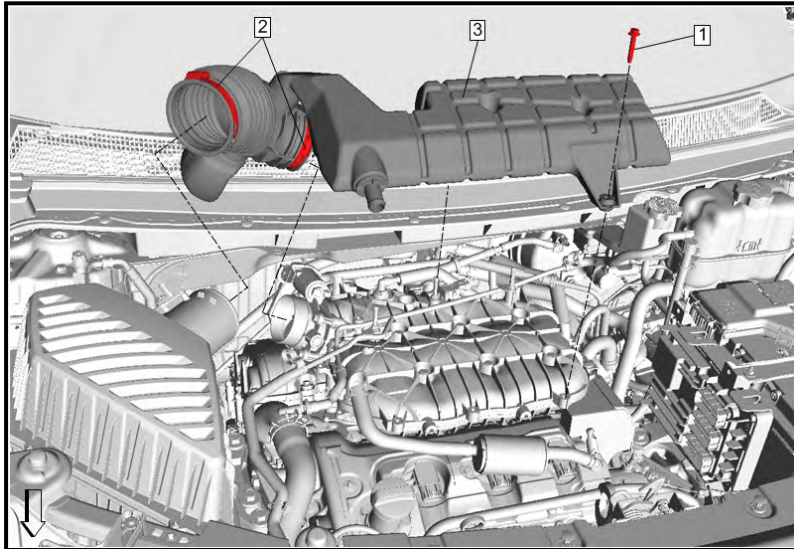
AIR CLEANER ASSEMBLY REPLACEMENT



Callout	Component Name
Preliminary Procedure Air Cleaner Outlet Duct Replacement - Disconnect the electrical connector.	

Callout	Component Name
1	Air Cleaner Assembly Procedure 1. Remove the air cleaner housing from the retainers. 2. Transfer parts as necessary.

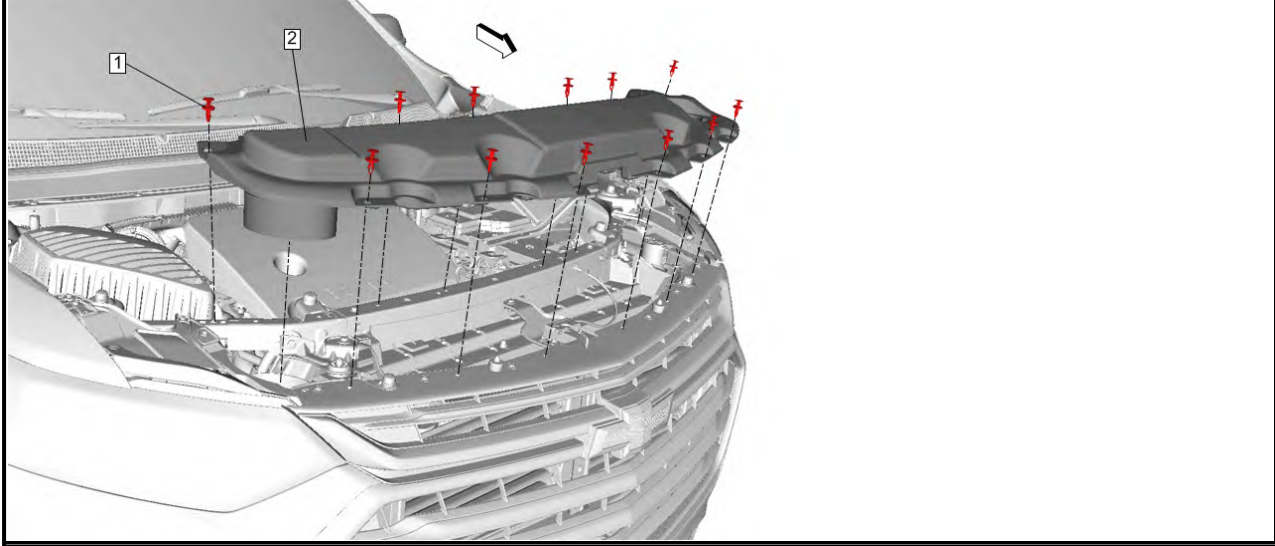
AIR CLEANER OUTLET DUCT REPLACEMENT



Callout	Component Name
Preliminary Procedures 1. <u>Intake Manifold Cover Replacement</u> 2. Positive Crankcase Ventilation Tube @ Air Cleaner Outlet Duct - Remove - <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Air Cleaner Outlet Duct to Camshaft Cover)</u> , <u>Positive Crankcase Ventilation Hose/Pipe/Tube Replacement (Intake Manifold to Camshaft Cover)</u>	
1	Air Cleaner Outlet Duct Fastener CAUTION: Refer to <u>Fastener Caution</u> . Tighten 9 N.m (80 lb in)
2	Air Cleaner Outlet Duct Clamp [2x] Tighten 4 N.m (35 lb in)
3	Air Cleaner Outlet Duct Procedure Lift up to remove from retainers.

INTAKE AIR SPLASH SHIELD REPLACEMENT





Callout	Component Name
1	Intake Air Splash Shield Retainer [12x] CAUTION: Refer to Fastener Caution .
2	Intake Air Splash Shield

FUEL SENDER ASSEMBLY REPLACEMENT (AWD)

Special Tools

CH 48482 Fuel Sender Lock Ring Wrench

Equivalent regional tools: [Special Tools](#)

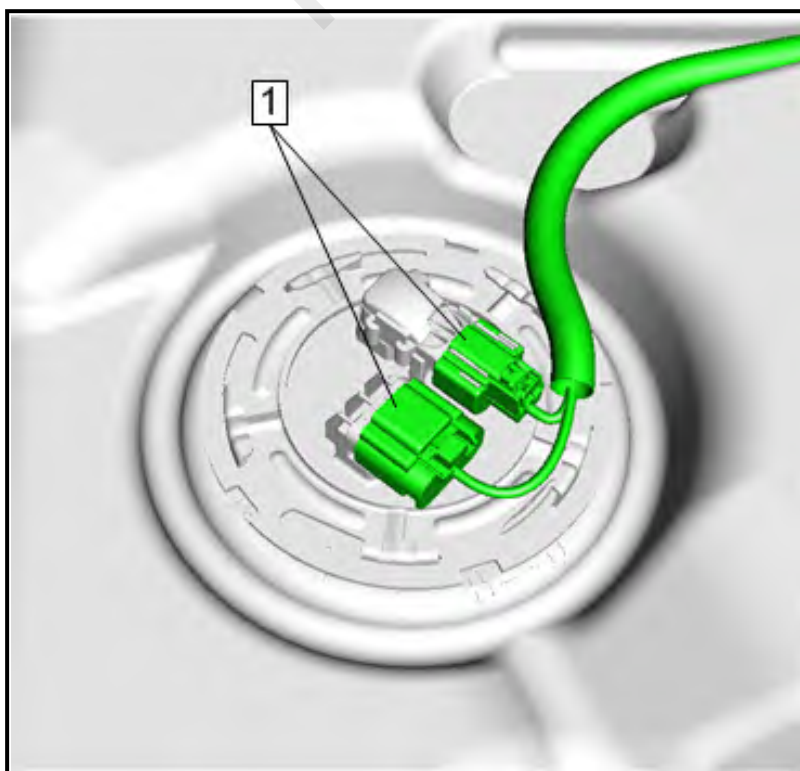
Removal Procedure

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

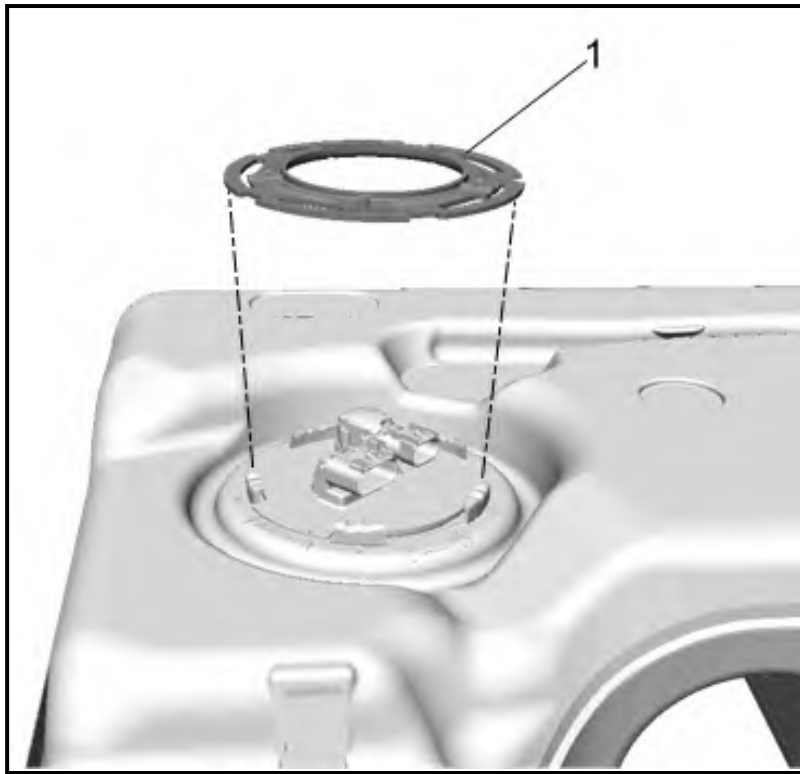
WARNING: Refer to [Safety Glasses Warning](#) .

1. Fuel Tank - Remove - [Fuel Tank Replacement \(AWD\)](#)

2.

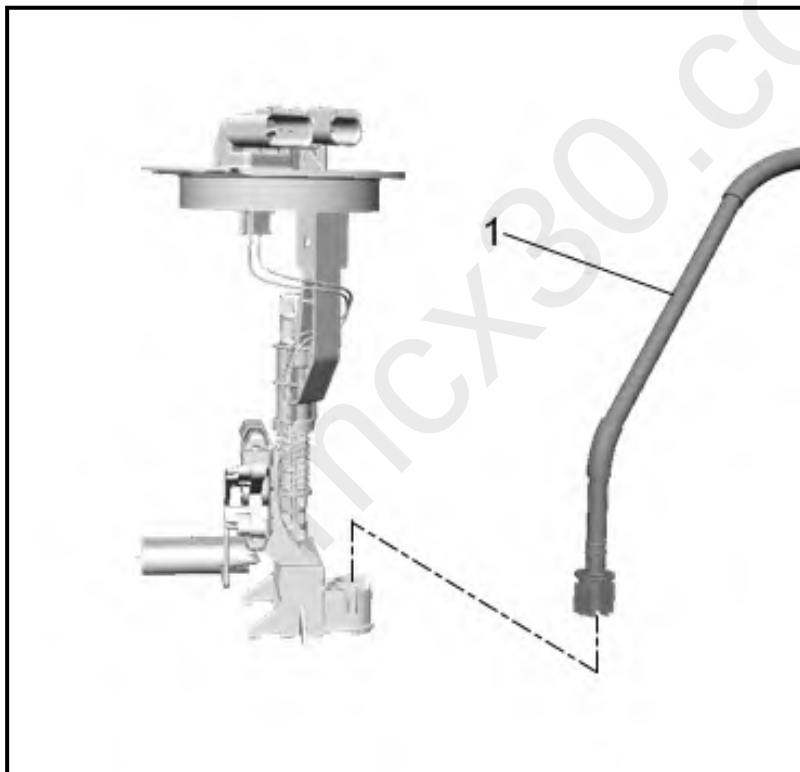


3.



Use the **CH 48482** wrench by turning counter clockwise and remove the lock ring (1).

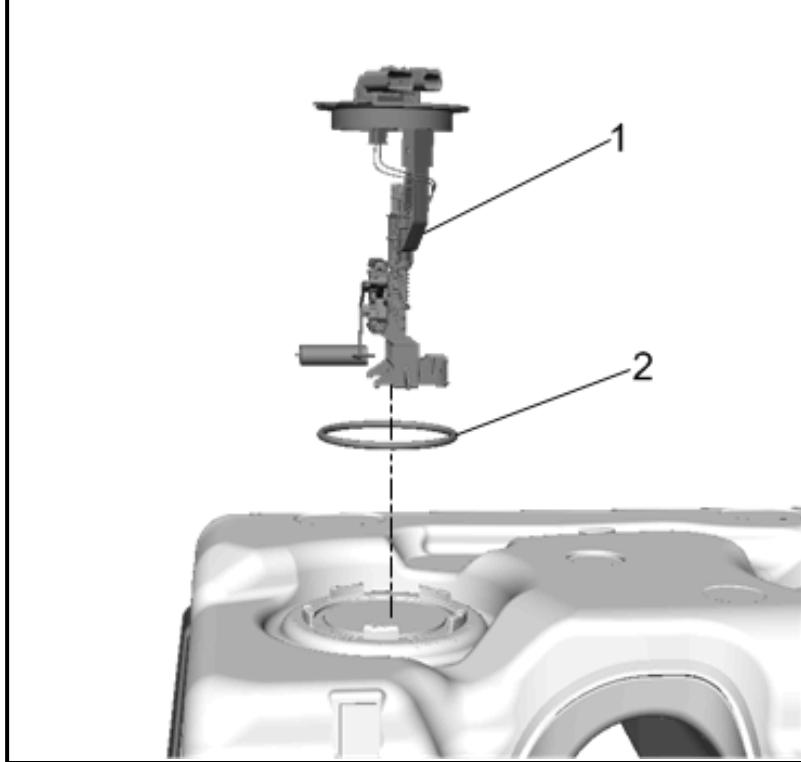
4.



Transfer Hose (1) - Disconnect - [Plastic Collar Quick Connect Fitting Service](#)

5.

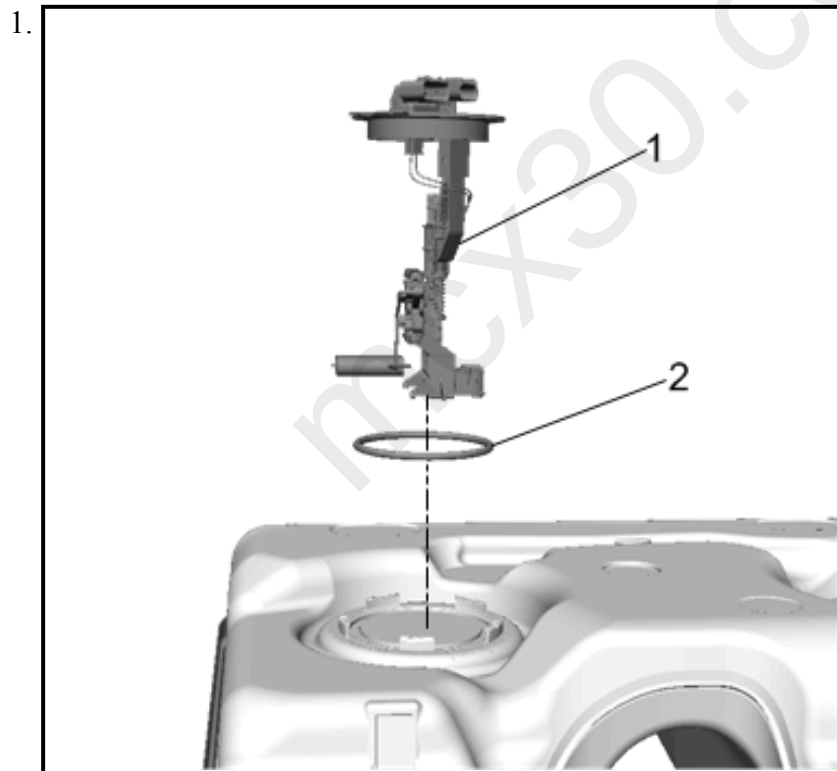




Fuel Sender (1) - Remove

6. Fuel Pump Seal (2) - Remove and DISCARD

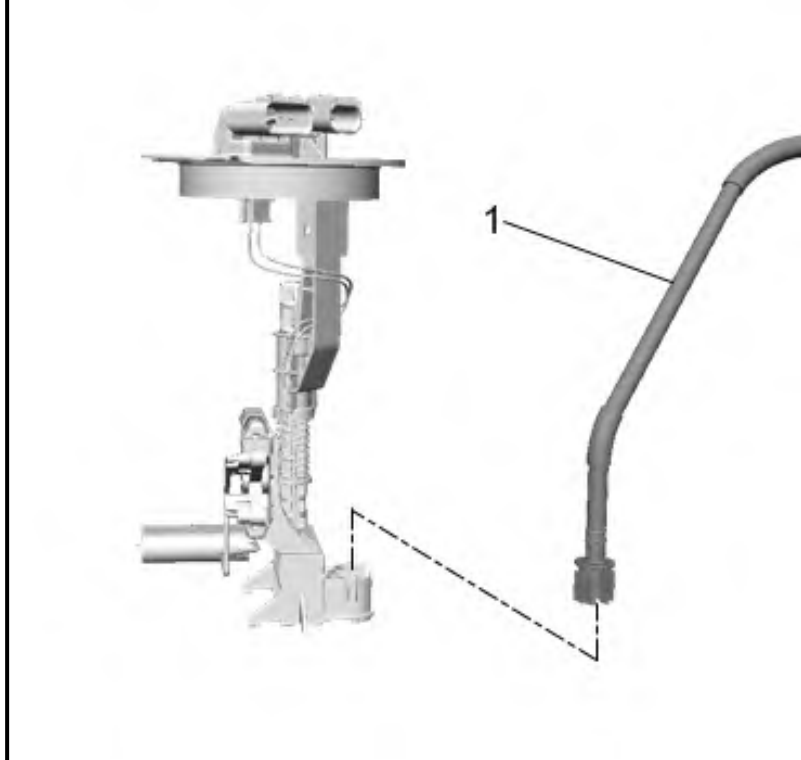
Installation Procedure



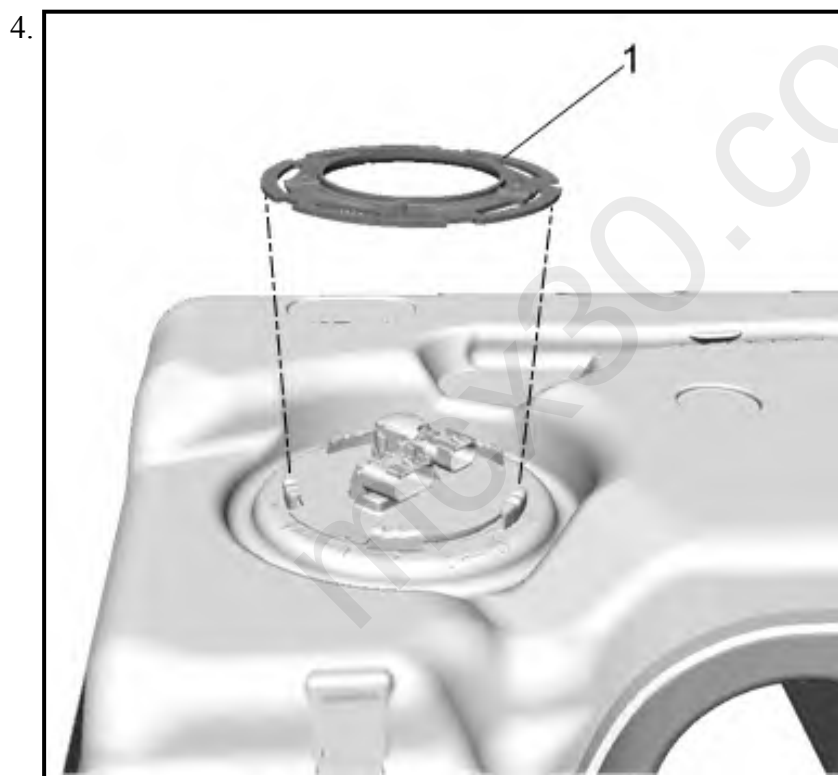
Fuel Pump Seal (2) - Install a NEW seal.

2. Fuel Sender (1) - Install



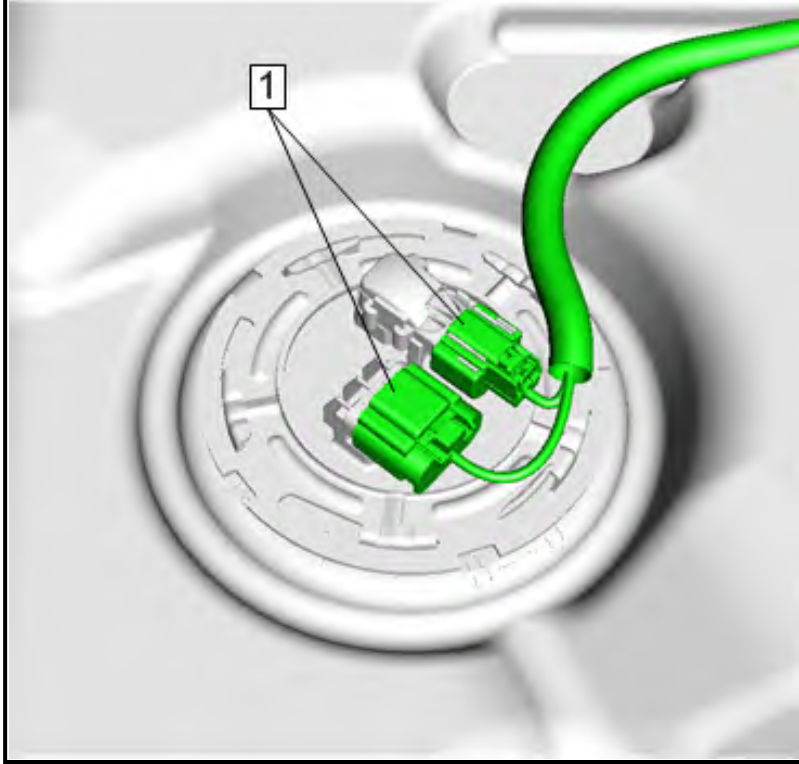


Transfer Hose (1) - Connect - [Plastic Collar Quick Connect Fitting Service](#)



Use the **CH 48482** wrench by turning clockwise and install the lock ring (1).





Electrical Connector (1) - Connect [2x]

6. Fuel Tank - Install - **Fuel Tank Replacement (AWD)**
