

2010 ENGINE PERFORMANCE**Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX****SYMPTOMS - ENGINE CONTROLS (L 1)****DIAGNOSTIC INSTRUCTIONS**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

SYMPTOMS DESCRIPTION

Symptoms covers conditions that are not covered by DTCs. Certain conditions can cause multiple symptoms. These conditions are listed together under Symptoms Testing. Conditions that may only cause specific symptoms are listed separately under Additional Symptoms Testing. Perform the Symptoms Testing before using the Additional Symptoms Testing.

SYMPTOMS DEFINITION**Backfire**

The fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.

Cuts Out, Misses

A steady pulsation or jerking that follows engine speed, which is usually more pronounced as the engine load increases. This condition is not normally felt above 1,500 RPM or 48 km/h (30 mph). The exhaust has a steady spitting sound at idle or at low speed.

Detonation/Spark Knock

A mild to severe ping which usually occurs worse while under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

Dieseling, Run-On

The engine continues to run after the key is turned OFF, but runs very rough.

Engine Control Module (ECM) Commanded Reduced Engine Power

The ECM illuminates the Reduced Engine Power lamp and will limit engine power under potential engine/vehicle damaging or emissions related conditions. A DTC may not be set.

Fuel Odor

A noticeable smell of unburned fuel.

Hard Start

The engine cranks OK, but does not start for a long time. The vehicle does eventually run, or may start but immediately stall.

Hesitation, Sag, Stumble

A momentary lack of response as the accelerator is pushed down. This condition can occur at any vehicle speed. This condition is usually more pronounced when first trying to make the vehicle move, as from a stop. This condition may cause the engine to stall in severe conditions.

Lack of Power, Sluggishness, or Sponginess

The engine delivers less than expected power. Little or no increase in vehicle speed when the accelerator pedal is pushed down part way.

Poor Fuel Economy

Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, the fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Rough, Unstable, or Incorrect Idle and Stalling

The engine runs unevenly at idle. If severe, the engine or the vehicle may shake. Engine idle speed may vary. Either condition may be severe enough to stall the engine.

Surges/Chuggles

An engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.

SYMPTOMS VERIFICATION

Before using the Symptom tables, perform the following inspections:

- Ensure that the malfunction indicator lamp (MIL) is operating correctly. Use the scan tool to command the lamp ON and OFF.
- Ensure that there are no DTCs that are stored.
- Ensure that the scan tool data is within a normal operating range. Refer to **Control Module References** for scan tool information.
- Verify the customer concern.
- Perform the Visual/Physical Inspection in this section. The visual/physical inspection is extremely important, and can lead to correcting a condition without additional testing. It may also help reveal the cause of an intermittent condition.

Identifying Intermittent Conditions

Many intermittent conditions occur with harness or connector movement due to engine torque, rough pavement, vibration or physical movements of a component. Refer to the following for a list of issues that may cause an intermittent condition:

- Moisture and water intrusion in connectors, terminals, and components
- Incomplete connector mating
- Poor terminal contact
- High circuit or component resistance-High resistance can include any resistance, regardless of the amount, which can interrupt the operation of the component.
- Harness that is too short or tight
- Wire insulation that is chaffed or cut
- High or low ambient temperature
- High or low engine coolant temperatures
- High underhood temperatures
- Heat build up in component or circuit due to circuit resistance, poor terminal contact, or high electrical load
- High or low system voltage
- High vehicle load conditions
- Rough road surfaces
- Electro-magnetic interference (EMI)/circuit interference from relays, solenoids or other electrical surge
- Incorrect installation of aftermarket, add on accessories

Visual/Physical Check

- Ensure that the control module grounds are clean, tight, and correctly located.
- Ensure that the vacuum hoses are not split or kinked, and are properly connected, as shown on the Vehicle Emission Control Information label.
- Ensure that the air filter is clean and free from restrictions.
- Ensure that there is no water intrusion in connectors terminals and components.
- Inspect the air intake ducts for the following conditions:
 - Collapsed
 - Damaged areas
 - Looseness
 - Incorrect installation
 - Leaking
- Inspect for air leaks at the throttle body mounting area, the mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Inspect the wiring harness for the following conditions:
 - Poor connections

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- Pinches
- Cuts
- Inspect for loose, damaged, unseated, or missing sensors/components.
- Inspect the terminals for corrosion and correct contact.

SYMPTOMS TESTING

Backfire, Cuts Out/Misses, Detonation/Spark Knock, Dieseling/Run-On, Hard Start, Hesitation/Sag/Stumble, Lack of Power/Sluggishness/Sponginess, Poor Fuel Economy, Rough, Unstable, or Incorrect Idle and Stalling, or Surges/Chuggles

- Test the fuel system for the following:
 - The fuel system for correct operation volume and pressure - Refer to **Fuel System Diagnosis (LF1 China)** or **Fuel System Diagnosis (LF1 Except China)**.
 - The fuel injectors for proper operation - Refer to **Fuel Injector Solenoid Coil Test (LF1, LFW)**.
 - The fuel quality condition - Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (Without Special Tool)**.
- Test ignition system for the following:
 - Spark plugs for incorrect heat range or an abnormal condition - Refer to **Spark Plug Inspection and Ignition System Specifications (LF1)**.
 - For diagnosis of coolant or oil fouled spark plugs - Refer to **Coolant in Combustion Chamber** or **Oil Consumption Diagnosis**.
 - Wet down the secondary ignition system with water from a spray bottle - Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as the water is applied.
 - Weak spark using the 6 Spark Tester - Refer to **Electronic Ignition System Diagnosis**.
- Inspect for the following conditions:
 - The proper operation of the transmission torque converter clutch (TCC) - The scan tool should indicate an engine speed drop when the TCC is commanded ON. Refer to **Torque Converter Diagnosis**.
 - The proper operation of the A/C compressor.
 - An engine that runs lean or rich. Observe the Fuel Trim parameters with a scan tool.
 - Inspect the heated oxygen sensors (HO2S). The HO2S should respond quickly to different throttle positions.

CAUTION: Refer to Heated Oxygen and Oxygen Sensor Caution.

- Water intrusion in the HO2S connector

NOTE: The embossed arrows on the mass air flow (MAF) sensor indicate the direction of the intake air flow. The arrows must point toward the

engine.

- Inspect the MAF sensor installation. A MAF sensor that is incorrectly installed may cause a hard start. Install the MAF in the proper direction. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)**.
- Inspect the mass air flow (MAF) sensor connections.
- Engine oil contaminated by fuel
- Vacuum hoses for splits or kinks - Verify that the routing and connections are as shown on the Vehicle Emission Control Information label.
- Knock sensor (KS) system for excessive spark retard activity - Observe the Knock Retard parameter on the scan tool for activity more than 0°.
- The exhaust system components for the following:
 - Physical damage or possible internal failure
 - The three-way catalytic converters for a restriction

For more information, refer to **Symptoms - Engine Exhaust**.

- Electromagnetic interference (EMI) on the reference circuit can cause a misfire condition. You can usually detect EMI with a scan tool by monitoring the engine speed parameter. A sudden increase in the engine speed parameter with little change in actual engine speed indicates that EMI is present. Inspect the high voltage components near the ignition control circuit if a condition exists.
- The crankcase ventilation valve for proper operation - Refer to **Crankcase Ventilation System Inspection/Diagnosis**.
- Evaporative emission (EVAP) canister purge solenoid that is stuck open
- The engine cooling system for the following conditions:
 - The thermostat is the correct heat range. Refer to **Thermostat Diagnosis**.
 - Proper engine coolant level - If the level is low, refer to **Loss of Coolant**.
- The crankshaft position sensor for an intermittent condition - Observe the scan tool crankshaft position Resync parameter. The Resync parameter should remain at 0 during all operating conditions, and when moving the related harnesses and connectors between the crankshaft position sensor and the ECM.
- Inspect the engine for the following mechanical failures:

Refer to **Symptoms - Engine Mechanical**.

- Excessive oil in the combustion chamber or leaking valve seals
- Oil Consumption
- Incorrect cylinder compression
- Sticking or leaking valves
- Worn camshaft lobes
- Incorrect valve timing
- Worn rocker arms
- Broken valve springs

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- Excessive carbon buildup in the combustion chambers - Clean the chambers with top engine cleaner. Follow the instructions on the can.
- Incorrect engine parts
- If the above conditions do not address the symptom, refer to the **Additional Symptoms Tests**.

ADDITIONAL SYMPTOMS TESTS

Hard Start

- Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. A value greater than 0 may indicate an excessive accumulation of deposits in the throttle bore. Inspect the throttle body and clean, if necessary. Refer to **Throttle Body Inspection and Cleaning**.
- Test the engine coolant temperature (ECT) sensor. Compare the ECT sensor value to the intake air temperature (IAT) sensor value on a cold engine. The ECT and IAT sensor values should be within $\pm 3^{\circ}\text{C}$ (5°F). If the ECT sensor is out of range with the IAT sensor, test the resistance of the ECT sensor. Refer to **Temperature Versus Resistance - Engine Coolant Temperature Sensor** for resistance specifications. Replace the ECT sensor if the resistance is not within specification. Refer to **Engine Coolant Temperature Sensor Replacement (LF1)**. If the sensor is within the specification, test the ECT sensor circuits for high resistance.
- Verify that the fuel system has adequate pressure for engine start-up. Refer to **Fuel System Diagnosis (LF1 China)** or **Fuel System Diagnosis (LF1 Except China)** for fuel pressure specifications.
- Inspect for excessive crankshaft endplay that will cause the crankshaft position sensor reluctor wheel to move out of alignment with the crankshaft position sensor. Refer to **Crankshaft and Bearing Cleaning and Inspection**.

Hesitation, Sag, Stumble

- Test the fuel pressure. Refer to **Fuel System Diagnosis (LF1 China)** or **Fuel System Diagnosis (LF1 Except China)**.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)**.
- Test the generator. Refer to **Symptoms - Engine Electrical**. Repair the charging system if the generator output voltage is less than 9 volts or more than 16 volts.
- Inspect for excessive crankshaft endplay that will cause the crankshaft position sensor reluctor wheel to move out of alignment with the crankshaft position sensor. Refer to **Crankshaft and Bearing Cleaning and Inspection**.
- Test the manifold absolute pressure (MAP) sensor. Refer to **DTC P0106 (LF1)**.

NOTE: The following actions may need to be repeated in order to verify an intermittent intake or exhaust camshaft actuator condition.

- Engine warm and idling, verify the correct operation of the camshaft position actuator system. Command the intake and exhaust camshaft position actuator for each cylinder bank from 0 degrees to 25 degrees and back to zero while observing the appropriate scan tool Intake Camshaft Position Variance and Exhaust Camshaft Position Variance parameters. Each parameter should be less than 2 degrees in each of the

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commanded states.

- If any of the parameters is greater than 2 degrees, inspect the suspect camshaft actuator and camshaft actuator solenoid valve and valve bore for contamination, obstruction, and damage. Refer to **Camshaft Timing Drive Components Cleaning and Inspection** and **Camshaft Actuator System Description** for additional information.

Poor Fuel Economy

- Heavy loads being carried or towed
- Acceleration rate too much or too often
- Inspect the brake system for brake drag.
- Inspect for incorrect operation of the speedometer.
- Verify that the engine coolant temperature (ECT) has not shifted in value. Allow the engine to run and reach operating temperature. Observe the ECT Sensor parameter with a scan tool and compare the reading to that parameter listed on the **Engine Control Module Scan Tool Information (LF1,LFW)** list. If the reading is not in the range specified in the list, test the resistance of the ECT sensor. Refer to **Temperature Versus Resistance - Engine Coolant Temperature Sensor** for resistance specifications. Replace the ECT sensor if the resistance is not within specification. Refer to **Engine Coolant Temperature Sensor Replacement (LF1)** . If the sensor is within the specification, test the ECT sensor circuits for high resistance.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)** .
- Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. A value greater than 0 may indicate an excessive accumulation of deposits in the throttle bore. Inspect the throttle body and clean, if necessary. Refer to **Throttle Body Inspection and Cleaning** .

Detonation spark Knock

- Inspect for excessive carbon buildup in the combustion chambers. Clean the chambers with Top Engine Cleaner. Follow the instructions on the can.
- Test for an engine overheating condition. Refer to **Engine Overheating** .
- Verify that the engine coolant temperature (ECT) has not shifted in value. Allow the engine to run and reach operating temperature. Observe the ECT Sensor parameter with a scan tool and compare the reading to that parameter listed on the **Engine Control Module Scan Tool Information (LF1,LFW)** list. If the reading is not in the range specified in the list, test the resistance of the ECT sensor. Refer to **Temperature Versus Resistance - Engine Coolant Temperature Sensor** for resistance specifications. Replace the ECT sensor if the resistance is not within specification. Refer to **Engine Coolant Temperature Sensor Replacement (LF1)** . If the sensor is within the specification, test the ECT sensor circuits for high resistance.
- If there are no engine mechanical faults, fill the fuel tank with a known high quality fuel that meets the vehicle minimum octane requirements.

Lack of Power, Hesitation, or Cut Out

- Inspect the engine electrical system for correct operation. Refer to **Symptoms - Engine Electrical** .

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- Verify that each injector harness is connected to the correct injector.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)**.

NOTE: **The following actions may need to be repeated in order to verify an intermittent intake or exhaust camshaft actuator condition.**

- Engine warm and idling, verify the correct operation of the camshaft position actuator system. Command the intake and exhaust camshaft position actuator for each cylinder bank from 0 degrees to 25 degrees and back to zero while observing the appropriate scan tool Intake Camshaft Position Variance and Exhaust Camshaft Position Variance parameters. Each parameter should be less than 2 degrees in each of the commanded states.
 - If any of the parameters is greater than 2 degrees, inspect the suspect camshaft actuator and camshaft actuator solenoid valve and valve bore for contamination, obstruction, and damage. Refer to **Camshaft Timing Drive Components Cleaning and Inspection** and **Camshaft Actuator System Description** for additional information.

Rough, Unstable, or Incorrect Idle and Stalling

- Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. A value greater than 0 may indicate an excessive accumulation of deposits in the throttle bore. Inspect the throttle body and clean, if necessary. Refer to **Throttle Body Inspection and Cleaning**.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)**.
- Inspect the engine mounts.
- Inspect the intake and exhaust manifolds for casting flash.

NOTE: **The ECM uses the cylinder 1 intake camshaft position sensor to determine camshaft to crankshaft relationship in order to control fuel injector and ignition system synchronization. If the cylinder 1 intake camshaft position sensor signal to the ECM is intermittent, a stalling condition will occur and a DTC will not set.**

- Inspect all cylinder 1 intake camshaft position sensor wiring for poor connections. Start the engine and observe for engine stalling while wiggling the cylinder 1 intake camshaft position sensor wiring harness. Refer to **Inducing Intermittent Fault Conditions** for further diagnosis.

Surges/Chuggles

- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)**.
- Test the heated oxygen sensors (HO2S). The HO2S should respond quickly to a change in throttle position. If the HO2S do not respond to different throttle positions, inspect for contamination from fuel, silicon, or the incorrect use of RTV sealant. The sensors may have a white powdery coating and result in a high, but false, signal voltage, which gives a rich exhaust indication. The PCM reduces the amount of

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fuel delivered to the engine, causing a driveability condition.

- Verify that each injector harness is connected to the correct injector.

Fuel Odor

- Saturated EVAP canister - Refer to Evaporative Emission Control System Description .
- A condition with the internal components of the fuel tank assembly - Refer to Fuel System Description (LF1) .
- Inspect for damaged or deteriorated fuel lines.

ECM Commanded Reduced Engine Power

Review the Reduced Engine Power Indication History parameter with a scan tool to determine the reason for the last reduced engine power event.

SYMPTOMS - ENGINE CONTROLS (LAU)

DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.

SYMPTOMS DESCRIPTION

Symptoms covers conditions that are not covered by DTCs. Certain conditions can cause multiple symptoms. These conditions are listed together under Symptoms Testing. Conditions that may only cause specific symptoms are listed separately under Additional Symptoms Testing. Perform the Symptoms Testing before using the Additional Symptoms Testing.

SYMPTOMS DEFINITION

Backfire

The fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.

Cuts Out, Misses

A steady pulsation or jerking that follows engine speed, which is usually more pronounced as the engine load increases. This condition is not normally felt above 1,500 RPM or km/h (30 mph). The exhaust has a steady spitting sound at idle or at low speed.

Detonation/Spark Knock

A mild to severe ping which usually occurs worse while under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

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Dieseling, Run-On

The engine continues to run after the key is turned OFF, but runs very rough.

Engine Control Module (ECM) Commanded Reduced Engine Power

The ECM illuminates the Reduced Engine Power lamp and will limit engine power under potential engine/vehicle damaging or emissions related conditions. A DTC may not be set.

Fuel Odor

A noticeable smell of unburned fuel.

Hard Start

The engine cranks OK, but does not start for a long time. The vehicle does eventually run, or may start but immediately stall.

Hesitation, Sag, Stumble

A momentary lack of response as the accelerator is pushed down. This condition can occur at any vehicle speed. This condition is usually more pronounced when first trying to make the vehicle move, as from a stop. This condition may cause the engine to stall in severe conditions.

Lack of Power, Sluggishness, or Sponginess

The engine delivers less than expected power. Little or no increase in vehicle speed when the accelerator pedal is pushed down part way.

Poor Fuel Economy

Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, the fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Rough, Unstable, or Incorrect Idle and Stalling

The engine runs unevenly at idle. If severe, the engine or the vehicle may shake. Engine idle speed may vary. Either condition may be severe enough to stall the engine.

Surges/Chuggles

An engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.

SYMPTOMS VERIFICATION

Before using the Symptom tables, perform the following inspections:

- Ensure that the malfunction indicator lamp (MIL) is operating correctly. Use the scan tool to command the lamp ON and OFF.
- Ensure that there are no DTCs that are stored.
- Ensure that the scan tool data is within a normal operating range. Refer to **Control Module References** for scan tool information.
- Verify the customer concern.
- Perform the Visual/Physical Inspection in this section. The visual/physical inspection is extremely important, and can lead to correcting a condition without additional testing. It may also help reveal the cause of an intermittent condition.

Identifying Intermittent Conditions

Many intermittent conditions occur with harness or connector movement due to engine torque, rough pavement, vibration or physical movements of a component. Refer to the following for a list of issues that may cause an intermittent condition:

- Moisture and water intrusion in connectors, terminals, and components
- Incomplete connector mating
- Poor terminal contact
- High circuit or component resistance-High resistance can include any resistance, regardless of the amount, which can interrupt the operation of the component.
- Harness that is too short or tight
- Wire insulation that is chaffed or cut
- High or low ambient temperature
- High or low engine coolant temperatures
- High underhood temperatures
- Heat build up in component or circuit due to circuit resistance, poor terminal contact, or high electrical load
- High or low system voltage
- High vehicle load conditions
- Rough road surfaces
- Electro-magnetic interference (EMI)/circuit interference from relays, solenoids or other electrical surge
- Incorrect installation of aftermarket, add on accessories

Visual/Physical Check

- Ensure that the control module grounds are clean, tight, and correctly located.
- Ensure that the vacuum hoses are not split or kinked, and are properly connected, as shown on the Vehicle Emission Control Information label.
- Ensure that the air filter is clean and free from restrictions.

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- Ensure that there is no water intrusion in connectors terminals and components.
- Inspect the air intake ducts for the following conditions:
 - Collapsed
 - Damaged areas
 - Looseness
 - Incorrect installation
 - Leaking
- Inspect for air leaks at the throttle body mounting area, the mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Inspect the wiring harness for the following conditions:
 - Poor connections
 - Pinches
 - Cuts
- Inspect for loose, damaged, unseated, or missing sensors/components.
- Inspect the terminals for corrosion and correct contact.

SYMPTOMS TESTING

Backfire, Cuts Out/Misses, Detonation/Spark Knock, Dieseling/Run-On, Hard Start, Hesitation/Sag/Stumble, Lack of Power/Sluggishness/Sponginess, Poor Fuel Economy, Rough, Unstable, or Incorrect Idle and Stalling, or Surges/Chuggles

- Test the fuel system for the following:
 - The fuel system for correct operation volume and pressure - Refer to **Fuel System Diagnosis (LAU China)** or **Fuel System Diagnosis (LAU Except China)**.
 - The fuel injectors for proper operation - Refer to **Fuel In ector Solenoid Coil Test (LAU)**.
 - The fuel quality condition - Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (Without Special Tool)**.
- Test ignition system for the following:
 - Spark plugs for incorrect heat range or an abnormal condition - Refer to **Spark Plug Inspection and Ignition System Specifications (LAU)** .
 - For diagnosis of coolant or oil fouled spark plugs - Refer to **Coolant in Combustion Chamber** or **Oil Consumption Diagnosis** .
 - Wet down the secondary ignition system with water from a spray bottle - Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as the water is applied.
 - Weak spark using the 6 Spark Tester - Refer to **Electronic Ignition System Diagnosis**.
- Inspect for the following conditions:
 - The proper operation of the transmission torque converter clutch (TCC) - The scan tool should indicate an engine speed drop when the TCC is commanded ON. Refer to **Tor ue Converter Diagnosis** .

- The proper operation of the A/C compressor.
- An engine that runs lean or rich. Observe the Fuel Trim parameters with a scan tool.
- Inspect the heated oxygen sensors (HO2S). The HO2S should respond quickly to different throttle positions.

CAUTION: Refer to Heated Oxygen and Oxygen Sensor Caution .

- Water intrusion in the HO2S connector

NOTE: The embossed arrows on the mass air flow (MAF) sensor indicate the direction of the intake air flow. The arrows must point toward the engine.

- Inspect the MAF sensor installation. A MAF sensor that is incorrectly installed may cause a hard start. Install the MAF in the proper direction. Refer to Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU) .
- Inspect the mass air flow (MAF) sensor connections.
- Engine oil contaminated by fuel
- Vacuum hoses for splits or kinks - Verify that the routing and connections are as shown on the Vehicle Emission Control Information label.
- Knock sensor (KS) system for excessive spark retard activity - Observe the Knock Retard parameter on the scan tool for activity more than 0°.
- The exhaust system components for the following:
 - Physical damage or possible internal failure
 - The three-way catalytic converters for a restriction

For more information, refer to Symptoms - Engine Exhaust .

- Electromagnetic interference (EMI) on the reference circuit can cause a misfire condition. You can usually detect EMI with a scan tool by monitoring the engine speed parameter. A sudden increase in the engine speed parameter with little change in actual engine speed indicates that EMI is present. Inspect the high voltage components near the ignition control circuit if a condition exists.
- The crankcase ventilation valve for proper operation - Refer to Crankcase Ventilation System Inspection/Diagnosis .
- Evaporative emission (EVAP) canister purge solenoid that is stuck open
- The engine cooling system for the following conditions:
 - The thermostat is the correct heat range. Refer to Thermostat Diagnosis .
 - Proper engine coolant level - If the level is low, refer to Loss of Coolant .
- The crankshaft position sensor for an intermittent condition - Observe the scan tool crankshaft position Resync parameter. The Resync parameter should remain at 0 during all operating conditions, and when moving the related harnesses and connectors between the crankshaft position sensor and the ECM.

- Inspect the engine for the following mechanical failures:

Refer to **Symptoms - Engine Mechanical** .

- Excessive oil in the combustion chamber or leaking valve seals
 - Oil Consumption
 - Incorrect cylinder compression
 - Sticking or leaking valves
 - Worn camshaft lobes
 - Incorrect valve timing
 - Worn rocker arms
 - Broken valve springs
 - Excessive carbon buildup in the combustion chambers - Clean the chambers with top engine cleaner. Follow the instructions on the can.
 - Incorrect engine parts
- If the above conditions do not address the symptom, refer to the **Additional Symptoms Tests**.

ADDITIONAL SYMPTOMS TESTS

Hard Start

- Inspect the throttle body and clean, if necessary. Refer to **Throttle Body Inspection and Cleaning** .
- Test the engine coolant temperature (ECT) sensor. Compare the ECT sensor value to the intake air temperature (IAT) sensor value on a cold engine. The ECT and IAT sensor values should be within $\pm 3^{\circ}\text{C}$ (5°F). If the ECT sensor is out of range with the IAT sensor, test the resistance of the ECT sensor. Refer to **Temperature Versus Resistance - Engine Coolant Temperature Sensor** for resistance specifications. Replace the ECT sensor if the resistance is not within specification. Refer to **Engine Coolant Temperature Sensor Replacement (LAU)** . If the sensor is within the specification, test the ECT sensor circuits for high resistance.
- Verify that the fuel system has adequate pressure for engine start-up. Refer to **Fuel System Diagnosis (LAU China)** or **Fuel System Diagnosis (LAU Except China)** for fuel pressure specifications.
- Test the operation of the auxiliary coolant pump. An inoperative auxiliary coolant pump may cause fuel to boil in the fuel rail resulting in a vapor lock condition after a brief hot-soak - Refer to **After Boil Coolant Pump Inoperative** or **After Boil Coolant Pump Malfunction** .
- Inspect for excessive crankshaft endplay that will cause the crankshaft position sensor reluctor wheel to move out of alignment with the crankshaft position sensor. Refer to **Crankshaft and Bearing Cleaning and Inspection** .

Hesitation, Sag, Stumble

- Test the fuel pressure. Refer to **Fuel System Diagnosis (LAU China)** or **Fuel System Diagnosis (LAU Except China)**.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU)** .

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- Test the generator. Refer to **Symptoms - Engine Electrical** . Repair the charging system if the generator output voltage is less than 9 volts or more than 16 volts.
- Inspect for excessive crankshaft endplay that will cause the crankshaft position sensor reluctor wheel to move out of alignment with the crankshaft position sensor. Refer to **Crankshaft and Bearing Cleaning and Inspection** .

NOTE: **The following actions may need to be repeated in order to verify an intermittent intake or exhaust camshaft actuator condition.**

- Engine warm and idling, verify the correct operation of the camshaft position actuator system. Command the intake and exhaust camshaft position actuator for each cylinder bank from 0 degrees to 25 degrees and back to zero while observing the appropriate scan tool Intake Camshaft Position Variance and Exhaust Camshaft Position Variance parameters. Each parameter should be less than 2 degrees in each of the commanded states.
 - If any of the parameters is greater than 2 degrees, inspect the suspect camshaft actuator and camshaft actuator solenoid valve and valve bore for contamination, obstruction, and damage. Refer to **Camshaft Timing Drive Components Cleaning and Inspection** and **Camshaft Actuator System Description** for additional information.

Poor Fuel Economy

- Heavy loads being carried or towed
- Acceleration rate too much or too often
- Inspect the brake system for brake drag.
- Inspect for incorrect operation of the speedometer.
- Verify that the engine coolant temperature (ECT) has not shifted in value. Allow the engine to run and reach operating temperature. Observe the ECT Sensor parameter with a scan tool and compare the reading to that parameter listed on the **Engine Control Module Scan Tool Information (LAU)** list. If the reading is not in the range specified in the list, test the resistance of the ECT sensor. Refer to **Temperature Versus Resistance - Engine Coolant Temperature Sensor** for resistance specifications. Replace the ECT sensor if the resistance is not within specification. Refer to **Engine Coolant Temperature Sensor Replacement (LAU)** . If the sensor is within the specification, test the ECT sensor circuits for high resistance.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)** or **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU)** .
- Inspect the throttle body and clean, if necessary. Refer to **Throttle Body Inspection and Cleaning** .

Detonation/Spark Knock

- Inspect for excessive carbon buildup in the combustion chambers. Clean the chambers with Top Engine Cleaner. Follow the instructions on the can.
- Test for an engine overheating condition. Refer to **Engine Overheating** .
- Verify that the engine coolant temperature (ECT) has not shifted in value. Allow the engine to run and reach operating temperature. Observe the ECT Sensor parameter with a scan tool and compare the

reading to that parameter listed on the **Engine Control Module Scan Tool Information (LAU)** list. If the reading is not in the range specified in the list, test the resistance of the ECT sensor. Refer to **Temperature Versus Resistance - Engine Coolant Temperature Sensor** for resistance specifications. Replace the ECT sensor if the resistance is not within specification. Refer to **Engine Coolant Temperature Sensor Replacement (LAU)**. If the sensor is within the specification, test the ECT sensor circuits for high resistance.

- If there are no engine mechanical faults, fill the fuel tank with a known high quality fuel that meets the vehicle minimum octane requirements.

Lack of Power, Hesitation, or Cut Out

- Ensure that the turbocharger air inlet and outlet ducts are tightly sealed and that the air passages are not obstructed. Inspect the turbocharger moving components for looseness, binding, wear, and damage. Refer to **Turbocharger System Description** and **Turbocharger Cleaning and Inspection**.
- Inspect the engine electrical system for correct operation. Refer to **Symptoms - Engine Electrical**.
- Verify that each injector harness is connected to the correct injector.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU)**.

NOTE: The following actions may need to be repeated in order to verify an intermittent intake or exhaust camshaft actuator condition.

- Engine warm and idling, verify the correct operation of the camshaft position actuator system. Command the intake and exhaust camshaft position actuator for each cylinder bank from 0 degrees to 25 degrees and back to zero while observing the appropriate scan tool Intake Camshaft Position Variance and Exhaust Camshaft Position Variance parameters. Each parameter should be less than 2 degrees in each of the commanded states.
 - If any of the parameters is greater than 2 degrees, inspect the suspect camshaft actuator and camshaft actuator solenoid valve and valve bore for contamination, obstruction, and damage. Refer to **Camshaft Timing Drive Components Cleaning and Inspection** and **Camshaft Actuator System Description** for additional information.

Rough, Unstable, or Incorrect Idle and Stalling

- Inspect the throttle body and clean, if necessary. Refer to **Throttle Body Inspection and Cleaning**.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU)**.
- Inspect the engine mounts.
- Inspect the intake and exhaust manifolds for casting flash.

NOTE: The ECM uses the cylinder 1 intake camshaft position sensor to determine camshaft to crankshaft relationship in order to control fuel in ector and ignition system synchroni ation. If the cylinder 1 intake camshaft position sensor signal to the ECM is intermittent, a stalling condition will occur and a DTC will not set.

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- Inspect all cylinder 1 intake camshaft position sensor wiring for poor connections. Start the engine and observe for engine stalling while wiggling the cylinder 1 intake camshaft position sensor wiring harness. Refer to **Inducing Intermittent Fault Conditions** for further diagnosis.

Surges/Chuggles

- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU)**.
- Test the heated oxygen sensors (O2S). The O2S should respond quickly to a change in throttle position. If the O2S do not respond to different throttle positions, inspect for contamination from fuel, silicon, or the incorrect use of RTV sealant. The sensors may have a white powdery coating and result in a high, but false, signal voltage, which gives a rich exhaust indication. The PCM reduces the amount of fuel delivered to the engine, causing a driveability condition.
- Verify that each injector harness is connected to the correct injector.

Fuel Odor

- Saturated EVAP canister - Refer to **Evaporative Emission Control System Description**.
- A condition with the internal components of the fuel tank assembly - Refer to **Fuel System Description (LAU or LY)**.
- Inspect for damaged or deteriorated fuel lines.

ECM Commanded Reduced Engine Power

Review the Reduced Engine Power Indication history parameter with a scan tool to determine the reason for the last reduced engine power event.

POOR FUEL FILL QUALITY

Problem	Causes
DEFINITION: During the fueling process a continual, occasional or no fuel nozzle shut-off condition has occurred.	
Difficult to fill	• Fuel fill limiter vent valve stuck closed • Evaporative emission (EVAP) canister restricted • EVAP vent valve stuck closed • Hose between canister and canister vent solenoid twisted or kinked if applicable • High fuel temperature • Fuel filler hose is kinked • Faulty dispensing nozzle • Ignition switch ON, vent valve closed
Over fill	• Fill limiter vent valve stuck open or leaking • Fuel inlet check valve stuck open

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Pre-mature shut-off of the fuel dispensing nozzle occurs immediately after engaging dispensing nozzle, tank empty	• Restricted vapor lines or fuel fill pipe • High fuel temperature • Inlet check valve at tank stuck closed, fill pipe full of fuel • Fuel tank full, gauge not accurate
Pre-mature shut-off of the fuel dispensing nozzle, more than 1 8 of tank capacity dispensed	• Kinked, pinched or plugged lines in fuel tank vent system • EVAP vent valve stuck closed or restricted • EVAP canister restricted • Fuel limiting vent valve stuck closed or obstruction at top of fuel tank
Fuel Spitback	• Restricted EVAP canister • High fuel temperature • Ignition switch ON, EVAP vent valve closed

MALFUNCTION INDICATOR LAMP (MIL) DIAGNOSIS

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

Ignition voltage is supplied to the malfunction indicator lamp (MIL). The engine control module (ECM) turns the MIL ON by grounding the MIL control circuit.

DIAGNOSTIC AIDS

If the condition is intermittent, move the related harnesses and connectors with the engine operating. Monitor the scan tool Circuit Test Status parameters for the component. The Circuit Test Status parameter will change from OK or Not run to Fault if there is a condition with the circuit or a connection.

REFERENCE INFORMATION

Schematic Reference

- **Instrument Cluster Schematics**
- **Engine Controls Schematics (LAU)** or **Engine Controls Schematics (LF1)**

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON, observe the scan tool MIL Circuit Test Status parameters. Each of the MIL circuit test status parameters should display OK or Not Run.
2. Ignition ON, command the MIL ON and OFF with a scan tool. The MIL should turn ON and OFF as commanded.
3. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame Failure Records data.

CIRCUIT/SYSTEM TESTING

1. If any other IPC indicators or gauges are inoperative, refer to **Instrument Cluster Gauges Inoperative**.
2. Ignition OFF, disconnect the ECM harness connectors. Ignition ON, the MIL should not illuminate.
 - If the MIL is illuminated, test the MIL control circuit terminal 12- 2 for a short to ground. If the circuit tests normal, replace the IPC.
3. Ignition ON, connect a 3 A fused jumper wire between the MIL control circuit terminal 12- 2 and ground. The MIL should illuminate.
 - If the MIL does not illuminate, test the MIL control circuit for a short to voltage, or an open high resistance. If the circuit test normal, replace the IPC bulb.
4. If all circuits connections test normal, replace the ECM.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References**
- **Instrument Cluster Replacement**

ENGINE CRANKS BUT DOES NOT RUN (LF1)**DIAGNOSTIC INSTRUCTIONS**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

This Engine Cranks but Does Not Run diagnostic procedure is an organized approach to identify a condition which causes the engine to crank but not start. This diagnostic procedure directs the technician to the appropriate system diagnosis.

DIAGNOSTIC AIDS

Inspect for any of the following conditions:

- When attempting to start the engine, the mechanical portion of the vehicle key must be locked in the fully extended position with the fob parallel to the key. Leaving the key partially retracted or folded over when starting may interrupt transponder authentication and result in an intermittent no-start condition. In such instances, DTC B3055 may also be set. If an intermittent no-start complaint is received, it may be necessary to discuss with the customer their starting habits and verify they are locking the key in the fully extended position, fob parallel to the key, before starting.
- The engine control module (ECM) uses the camshaft position (CMP) sensors to determine engine speed and position when there is a crankshaft position (CKP) sensor condition.
- The engine will operate with a CKP sensor condition only if the ECM has stored the learned reference position of the camshafts in memory. With a CKP sensor condition in the signal circuit, the engine will go into a limp home mode after a hard restart. The ECM then calculates engine speed from one of the CMP sensors.
- The fuel pump control module controls and monitor. When attempting to start the engine, the mechanical portion of the vehicle key must be locked in the fully extended position with the fob parallel to the key. Leaving the key partially retracted or folded over when attempting to start the engine may interrupt transponder authentication and result in an intermittent engine cranks but does not run condition. In such instances, DTC B3055 may also be set. If an intermittent engine cranks but does not run complaint is received, it may be necessary to discuss with the customer their starting habits and verify they are locking the key in the fully extended position, fob parallel to the key, before attempting to start the engine, check the operation of the in-tank fuel pump. If the fuel pump control module detects a fault, a DTC sets in the fuel pump control module. The fuel pump control module will then send a serial data message to the engine control module (ECM) requesting the illumination of the malfunction indicator lamp (MIL).
- Insufficient fuel can cause a no start condition. Thoroughly inspect the fuel delivery system for sufficient fuel volume to the fuel injectors. Inspect the fuel supply components for partial blockage or restrictions.
- Fuel injectors with partially blocked and restricted nozzles, or a malfunctioning solenoid, can cause a no start condition. Refer to **Fuel Injector Solenoid Coil Test (LF1, LFW)**.
- There may be fuel spray at the fuel injectors and the indicated fuel pressure may be correct, yet there may not be enough fuel to start the engine. If the fuel injectors and the injector circuit are OK, and fuel spray is detected, the fuel injector ON time may be inadequate. If the engine control module (ECM) receives incorrect inputs from the various information sensors, the fuel delivered by the fuel injectors may be inadequate to start the engine. Check all the engine data parameters with a scan tool and compare the

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values indicated with the expected values or the values from a known good vehicle.

- Inspect the engine for good secure electrical grounds.
- Water or foreign material in the fuel can cause a no start or engine will not stay running condition. During freezing weather water can freeze inside the fuel system. The engine may start after 30 min in a heated repair shop. The malfunction may not recur until parked overnight in freezing temperatures. Extreme weather conditions can cause contaminated fuel to prevent the vehicle from starting.
- A vehicle that starts and runs after being brought to the repair shop for a no start condition, may have an ignition system that is susceptible to moisture. Spray water on the ignition system components and the wiring in order to check for an engine starting or will not stay running concern.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics (LF1)

Connector End View Reference

Component Connector End Views

Description and Operation

- Electronic Ignition System Description
- Fuel System Description (LF1)
- Immobilizer Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

CIRCUIT/SYSTEM VERIFICATION

1. Verify there is adequate fuel in the fuel tank.
2. Ignition ON, test the fuses that are supplied voltage by the powertrain relay. The test lamp should illuminate for each test point of the fuses.
 - If the test lamp does not illuminate for at least one test point of each fuse, refer to **DTC P0 8 or P0 0 (LF1)** for powertrain relay system diagnosis.

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3. Engine cranking, observe the Engine Speed parameter with a scan tool. The reading should show engine speed greater than 175 RPM.
 - If the cranking speed is slow, refer to **Engine Cranks Slowly**.
 - If engine speed reading is 0 RPM, refer to **DTC P033 (LF1)** for crankshaft position sensor diagnosis.
4. Ignition ON, observe the ECM, fuel pump control module, and theft deterrent module DTC information with a scan tool. No DTCs should be set.
 - If there are any DTCs set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** for diagnosis.
5. Disconnect the B75B mass airflow (MAF) sensor. Attempt to start the engine. The ECM will ignore MAF sensor input, default to calculated airflow, and the engine should start and run if the MAF sensor is faulted.
 - If the engine starts and runs, and the MAF sensor circuits test OK, replace the B75B MAF sensor.
6. Ignition OFF, inspect the engine air filter, intake duct, and B75B MAF sensor. The air way should be clear.
 - If the intake duct is blocked or collapsed, or the filter is restricted or water saturated, repair or replace as necessary.
 - If the MAF sensor is damaged or contains water, replace it.
7. Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. The reading should be less than 80%.
 - If the reading is greater than 80%, inspect the Q38 throttle body bore for excessive carbon deposits and clean the throttle body. Refer to **Throttle Body Inspection and Cleaning**.
8. Ignition ON, observe the BARO parameter with a scan tool. Determine your altitude and compare the BARO reading to the **Altitude Versus Barometric Pressure** table. The reading should be within the range specified.
 - If the reading is not within the specified range in the table, and the barometric pressure sensor circuits test OK, replace the B17 barometric pressure sensor.
9. Perform the **Electronic Ignition System Diagnosis** to verify the ignition system provides spark to the cylinders.
10. Ignition OFF, remove and inspect the engine spark plugs. They should be dry.
 - If the spark plugs are coolant fouled, refer to **Coolant in Combustion Chamber**.
 - If the spark plugs are fuel fouled, replace the spark plugs.
11. Collect a fuel sample from the fuel tank. The sample should be bright and clear, free of water, dirt, or other debris. Also, verify the fuel is the correct type for this engine. Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (Without Special Tool)**.
 - If the fuel is contaminated with water, dirt, or other debris, replace the fuel filter and refer to **Fuel System Cleaning**.
 - If the fuel is not the correct type, drain the fuel system and the fuel tank and replace with the correct type.
12. Perform the **Fuel System Diagnosis (LF1 China)** or **Fuel System Diagnosis (LF1 Except China)** to verify proper fuel pump operation and fuel pressure.
13. Ignition ON, observe the ECT Sensor parameter with a scan tool. Compare the parameter reading to the actual engine coolant temperature. The readings should be within $\pm 3^{\circ}\text{C}$ ($\pm 5^{\circ}\text{F}$).

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- If the temperature readings are not within the $\pm 3^{\circ}\text{C}$ ($\pm 5^{\circ}\text{F}$) of each other and the ECT sensor circuits test OK, replace the B34 ECT sensor.
- 14. Test the engine compression. Refer to **Engine Compression Test** . The compression should be within specification.
 - If engine compression is not within specification, repair the engine as necessary.
- 15. Inspect the exhaust system. The exhaust system should be free of restrictions. Refer to **Restricted Exhaust** .
 - If a restriction or blockage is found, repair the exhaust system as necessary.
- 16. Ignition OFF, inspect the timing chain and sprockets. They should be properly aligned, free of damage, with minimal wear. Refer to **Setting Camshaft Timing** and **Camshaft Timing Drive Components Cleaning and Inspection** .
 - If a condition is found, repair the engine as necessary.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Air Cleaner Element Replacement (LF1)**
- **Air Cleaner Outlet Duct Replacement (LF1)** .
- **Spark Plug Replacement**
- **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)**
- **Engine Coolant Temperature Sensor Replacement (LF1)**

ENGINE CRANKS BUT DOES NOT RUN (LAU)

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

This Engine Cranks but Does Not Run diagnostic procedure is an organized approach to identify a condition which causes the engine to crank but not start. This diagnostic procedure directs the technician to the appropriate system diagnosis.

DIAGNOSTIC AIDS

Inspect for any of the following conditions:

- When attempting to start the engine, the mechanical portion of the vehicle key must be locked in the fully extended position with the fob parallel to the key. Leaving the key partially retracted or folded over when starting may interrupt transponder authentication and result in an intermittent no-start condition. In such

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instances, DTC B3055 may also be set. If an intermittent no-start complaint is received, it may be necessary to discuss with the customer their starting habits and verify they are locking the key in the fully extended position, fob parallel to the key, before starting.

- The engine control module (ECM) uses the camshaft position sensors to determine engine speed and position when there is a crankshaft position sensor condition.
- The engine will operate with a crankshaft position sensor condition only if the ECM has stored the learned reference position of the camshafts in memory. With a crankshaft position sensor condition in the signal circuit, the engine will go into a limp home mode after a hard restart. The ECM then calculates engine speed from one of the camshaft position sensors.
- The fuel pump control module controls and monitors the operation of the in-tank fuel pump. If the fuel pump control module detects a fault, a DTC sets in the fuel pump control module. The fuel pump control module will then send a serial data message to the engine control module (ECM) requesting the illumination of the malfunction indicator lamp (MIL).
- Insufficient fuel can cause a no start condition. Thoroughly inspect the fuel delivery system for sufficient fuel volume to the fuel injectors. Inspect the fuel supply components for partial blockage or restrictions.
- Fuel injectors with partially blocked and restricted nozzles, or a malfunctioning solenoid, can cause a no start condition. Refer to **Fuel Injector Solenoid Coil Test (LAU)**.
- There may be fuel spray at the fuel injectors and the indicated fuel pressure may be correct, yet there may not be enough fuel to start the engine. If the fuel injectors and the injector circuit are OK, and fuel spray is detected, the fuel injector ON time may be inadequate. If the engine control module (ECM) receives incorrect inputs from the various information sensors, the fuel delivered by the fuel injectors may be inadequate to start the engine. Check all the engine data parameters with a scan tool and compare the values indicated with the expected values or the values from a known good vehicle.
- Inspect the engine for good secure electrical grounds.
- Water or foreign material in the fuel can cause a no start or engine will not stay running condition. During freezing weather water can freeze inside the fuel system. The engine may start after 30 min in a heated repair shop. The malfunction may not recur until parked overnight in freezing temperatures. Extreme weather conditions can cause contaminated fuel to prevent the vehicle from starting.
- A vehicle that starts and runs after being brought to the repair shop for a no start condition, may have an ignition system that is susceptible to moisture. Spray water on the ignition system components and the wiring in order to check for an engine starting or will not stay running concern.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics (LAU)

Connector End View Reference

Component Connector End Views

Description and Operation

- **Electronic Ignition System Description**

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- Fuel System Description (LAU or LY7)
- Immobilizer Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

CIRCUIT/SYSTEM VERIFICATION

1. Verify there is adequate fuel in the fuel tank.
2. Ignition ON, test the fuses that are supplied voltage by the powertrain relay. The test lamp should illuminate for each test point of the fuses.
 - If the test lamp does not illuminate for at least one test point of each fuse, refer to **DTC P0 8 P0 8 P0 87 P0 8 or P0 0 (LAU)** for powertrain relay system diagnosis.
3. Engine cranking, observe the Engine Speed parameter with a scan tool. The reading should show engine speed greater than 175 RPM.
 - If the cranking speed is slow, refer to **Engine Cranks Slowly**.
 - If engine speed reading is 0 RPM, refer to **DTC P033 (LF1)** for crankshaft position sensor diagnosis.
4. Ignition ON, observe the ECM, fuel pump control module, and theft deterrent module DTC information with a scan tool. No DTCs should be set.
 - If there are any DTCs set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** for diagnosis.
5. Disconnect the B75B mass airflow (MAF) sensor. Attempt to start the engine. The ECM will ignore MAF sensor input, default to calculated airflow, and the engine should start and run if the MAF sensor is faulted.
 - If the engine starts and runs, and the MAF sensor circuits test OK, replace the B75B MAF sensor.
6. Ignition OFF, inspect the engine air filter, intake duct, and B75B MAF sensor. The air way should be clear.
 - If the intake duct is blocked or collapsed, or the filter is restricted or water saturated, repair or replace as necessary.
 - If the MAF sensor is damaged or contains water, replace it.
7. Inspect the Q38 throttle body. The throttle body should be clean and free of carbon deposits. Refer to **Throttle Body Inspection and Cleaning**.
8. Ignition ON, observe the BARO parameter with a scan tool. Determine your altitude and compare the BARO reading to the **Altitude Versus Barometric Pressure** table. The reading should be within the range specified.

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- If the reading is not within the specified range in the table, and the ECM atmospheric vent is free of moisture and debris, replace the ECM.
- 9. Perform the **Electronic Ignition System Diagnosis** to verify the ignition system provides spark to the cylinders.
- 10. Ignition OFF, remove and inspect the engine spark plugs. They should be dry.
 - If the spark plugs are coolant fouled, refer to **Coolant in Combustion Chamber**.
 - If the spark plugs are fuel fouled, replace the spark plugs.
- 11. Collect a fuel sample from the fuel tank. The sample should be bright and clear, free of water, dirt, or other debris. Also, verify the fuel is the correct type for this engine. Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (Without Special Tool)**.
 - If the fuel is contaminated with water, dirt, or other debris, replace the fuel filter and refer to **Fuel System Cleaning**.
 - If the fuel is not the correct type, drain the fuel system and the fuel tank and replace with the correct type.
- 12. Perform the **Fuel System Diagnosis (LAU China)** or **Fuel System Diagnosis (LAU Except China)** to verify proper fuel pump operation and fuel pressure.
- 13. Ignition ON, observe the ECT Sensor parameter with a scan tool. Compare the parameter reading to the actual engine coolant temperature. The readings should be within 3 C (5 F).
 - If the temperature readings are not within the 3 C (5 F) of each other and the ECT sensor circuits test OK, replace the ECT sensor.
- 14. Test the engine compression. Refer to **Engine Compression Test**. The compression should be within specification.
 - If engine compression is not within specification, repair the engine as necessary.
- 15. Inspect the exhaust system. The exhaust system should be free of restrictions. Refer to **Restricted Exhaust**.
 - If a restriction or blockage is found, repair the exhaust system as necessary.
- 16. Ignition OFF, inspect the timing chain and sprockets. They should be properly aligned, free of damage, with minimal wear. Refer to **Setting Camshaft Timing** and **Camshaft Timing Drive Components Cleaning and Inspection**.
 - If a condition is found, repair the engine as necessary.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Air Cleaner Element Replacement (LAU)**
- **Air Cleaner Inlet Duct Replacement**
- **Engine Control Module Replacement**
- **Air Cleaner Outlet Duct Replacement (LAU)**
- **Spark Plug Replacement**
- **Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU)**
- **Engine Coolant Temperature Sensor Replacement (LF1)** or **Engine Coolant Temperature Sensor**

Replacement (LAU)**FUEL PUMP ELECTRICAL CIRCUIT DIAGNOSIS****DIAGNOSTIC INSTRUCTIONS**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provide an overview of each diagnostic category.

DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open or High Resistance	Short to Voltage	Signal Performance
Fuel Pump High Signal	P0231	P023F	P0232	P023F, P2635
Fuel Pump Low Signal	-	P023F	-	P023F, P2635

CIRCUIT/SYSTEM DESCRIPTION

The engine control module (ECM) supplies voltage to the fuel pump control module when the ECM detects that the ignition is on. The voltage from the ECM to the fuel pump control module remains active for two seconds, unless the engine is in crank or run. While this voltage is being received, the fuel pump control module closes the ground switch of the fuel pump and also supplies a varying voltage to the fuel tank pump module in order to maintain the desired fuel rail pressure.

REFERENCE INFORMATION**Schematic Reference**

Engine Controls Schematics (LAU) or **Engine Controls Schematics (LF1)**

Connector End View Reference**Component Connector End Views****Description and Operation**

Fuel System Description (LF1) or **Fuel System Description (LAU or LY7)**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference**Powertrain Diagnostic Trouble Code (DTC) Type Definitions****Scan Tool Reference**

Control Module References for scan tool information

CIRCUIT/SYSTEM VERIFICATION

Ignition ON, command the fuel pump ON and OFF using the scan tool ECM output control. The fuel pump should turn on and off.

CIRCUIT/SYSTEM TESTING

1. Ignition OFF, disconnect the harness connector at the G12 fuel pump.
2. Connect a test lamp between the control circuit terminal A and ground.
3. Ignition ON, command the G12 fuel pump ON and OFF using a scan tool ECM fuel pump output control. The test lamp should turn ON and OFF, as commanded.
 - If the test lamp is always ON, test the control circuit for a short to voltage. If the circuit tests normal, replace the 27 fuel pump control module.
 - If the test lamp is always OFF, test the control circuit for a short to ground or an open high resistance. If the circuit tests normal, replace the 27 fuel pump control module.
4. Ignition OFF, connect a test lamp between the control circuit terminal A and the low reference circuit terminal .
5. Ignition ON, command the G12 fuel pump ON using a scan tool. The test lamp should illuminate.
 - If the test lamp does not illuminate, test the low reference circuit terminal A for a short to voltage or an open high resistance. If the circuit tests normal, replace the 27 fuel pump control module.
6. If all circuits test normal, replace the G12 fuel pump.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for fuel pump control module replacement, setup, and programming

FUEL SYSTEM DIAGNOSIS (LF1 CHINA)**DIAGNOSTIC INSTRUCTIONS**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

The engine control module (ECM) supplies voltage to the fuel pump control module when the ECM detects that the ignition is ON. The voltage from the ECM to the fuel pump control module remains active for two seconds, unless the engine is in Crank or Run. While this voltage is being received, the fuel pump control module closes the ground switch of the fuel pump and also supplies a varying voltage to the fuel tank module in order to maintain the desired fuel rail pressure.

The fuel system is an electronic returnless on-demand design. A returnless fuel system reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank. Reducing the internal temperature of the fuel tank results in lower evaporative emissions.

An electric turbine style fuel pump attaches to the primary fuel pump module inside the fuel tank. The fuel pump supplies fuel through the fuel filter and the fuel feed pipe to the high pressure fuel pump. The high pressure fuel pump supplies fuel to a variable-pressure fuel rail. Fuel enters the combustion chamber through precision multi-hole fuel injectors. The high pressure fuel pump, fuel rail pressure, fuel injection timing, and injection duration are controlled by the engine control module (ECM).

The primary fuel tank module also contains a primary jet pump and a secondary jet pump. Fuel pump flow loss, caused by vapor expulsion in the pump inlet chamber, is diverted to the primary jet pump and the secondary jet pump through a restrictive orifice located on the pump cover. The primary jet pump fills the reservoir of the primary fuel tank module. The secondary jet pump creates a venturi action which causes the fuel to be drawn from the secondary side of the fuel tank, through the fuel transfer pipe, to the primary side of the fuel tank.

REFERENCE INFORMATION

Description and Operation

Fuel System Description (LF1) or Fuel System Description (LAU or LY7)

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **CH 48027:** Digital Pressure Gauge
- **J 37287:** Fuel Line Shut-off Adapter
- For equivalent regional tools, refer to **Special Tools**.

CIRCUIT/SYSTEM VERIFICATION**NOTE:**

- Repair all fuel system related DTCs before performing this diagnostic.
- Inspect the fuel system for damage or external leaks before proceeding.
- Verify that adequate fuel is in the fuel tank before proceeding.
- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- Before proceeding with this test review the User Manual CH 48027-5 for Safety Information and Instructions.

1. Ignition OFF, all accessories OFF, install a **CH 48027: Gauge**. Refer to **Fuel Pressure Gauge Installation and Removal**.

NOTE:

High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

2. Ignition ON, engine OFF, command the fuel pump ON with a scan tool. Verify the fuel pressure is between 276-448 kPa (40-65 psi) and does not decrease more than 34 kPa (5 psi) in 1 min.
3. Engine idling at normal operating temperature, verify the scan tool Fuel Pump Control Module Fuel Pressure Sensor parameter is between 297-400 kPa (43-58 psi).

CIRCUIT/SYSTEM TESTING**NOTE:**

- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- DO NOT start the engine.
- High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

1. Ignition ON, engine OFF, command the Fuel Pump Enable ON with a scan tool and observe the fuel pressure gauge while the fuel pump is operating. Verify the fuel pressure is between 276-448 kPa (40-65 psi).
 - If the fuel pressure is greater than the specified range test for a restriction in the return side of the fuel filter. If the fuel filter tests normal, replace the primary fuel tank module.
 - If the fuel pressure is less than the specified range, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Restricted or plugged fuel filter
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections.
2. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 min.

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- If the fuel pressure decreases more than the specified value, perform the following procedure:
 1. Ignition OFF, relieve the fuel pressure. Refer to **Fuel Pressure Relief**.
 2. Install the **J 37287**: Adapter between the chassis fuel feed hose and the engine compartment fuel feed pipe.
 3. Open the valve on the **J 37287**: Adapter.
 4. Ignition ON, command the Fuel Pump Enable ON with a scan tool and bleed the air from the **CH 48027**: Gauge.
 5. Command the Fuel Pump Enable ON and then OFF with a scan tool.
 6. Close the valve on the **J 37287**: Adapter.
 7. Monitor the fuel pressure for 1 min.
 - If the fuel pressure does not decrease more than 34 kPa (5 psi) within the specified time, replace the primary fuel tank module.
- 3. Relieve the fuel pressure to 69 kPa (10 psi). Verify that the fuel pressure does not decrease more than 14 kPa (2 psi) in 5 min.
 - If the fuel pressure decreases more than the specified value, replace the primary fuel tank module.
- 4. Operate the vehicle within the conditions of the customer's concern while monitoring the fuel pressure with the **CH 48027**: Gauge. The fuel pressure should not drop off during acceleration, cruise or hard cornering.
 - If the fuel pressure drops off, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Restricted or plugged fuel filter
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections
- 5. If the fuel system tests normal, refer to **Symptoms - Engine Controls (LF1)** or **Fuel Injector Solenoid Coil Test (LF1 LFW)** and **Fuel Injector Balance Test (LF1 LFW)**.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Fuel Feed Pipe Replacement**
- **Fuel Filter Replacement (China)**
- **Fuel Line Replacement - Chassis**
- **Primary Fuel Tank Module Replacement (NT7 NU)** or or **Primary Fuel Tank Module Replacement (China)**

FUEL SYSTEM DIAGNOSIS (LF1 EXCEPT CHINA)

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

The engine control module (ECM) supplies voltage to the fuel pump control module when the ECM detects that the ignition is ON. The voltage from the ECM to the fuel pump control module remains active for two seconds, unless the engine is in Crank or Run. While this voltage is being received, the fuel pump control module closes the ground switch of the fuel pump and also supplies a varying voltage to the fuel tank module in order to maintain the desired fuel rail pressure.

The fuel system is an electronic returnless on-demand design. A returnless fuel system reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank. Reducing the internal temperature of the fuel tank results in lower evaporative emissions.

An electric turbine style fuel pump attaches to the primary fuel pump module inside the fuel tank. The fuel pump supplies fuel through the fuel feed pipe to the high pressure fuel pump. The high pressure fuel pump supplies fuel to a variable-pressure fuel rail. Fuel enters the combustion chamber through precision multi-hole fuel injectors. The high pressure fuel pump, fuel rail pressure, fuel injection timing, and injection duration are controlled by the engine control module (ECM).

The primary fuel tank module also contains a primary jet pump and a secondary jet pump. Fuel pump flow loss, caused by vapor expulsion in the pump inlet chamber, is diverted to the primary jet pump and the secondary jet pump through a restrictive orifice located on the pump cover. The primary jet pump fills the reservoir of the primary fuel tank module. The secondary jet pump creates a venturi action which causes the fuel to be drawn from the secondary side of the fuel tank, through the fuel transfer pipe, to the primary side of the fuel tank.

REFERENCE INFORMATION

Description and Operation

Fuel System Description (LF1)

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **CH 48027:** Digital Pressure Gauge

- **J 37287:** Fuel Line Shut-off Adapter

CIRCUIT/SYSTEM VERIFICATION

NOTE:

- Repair all fuel system related DTCs before performing this diagnostic.
- Inspect the fuel system for damage or external leaks before proceeding.
- Verify that adequate fuel is in the fuel tank before proceeding.
- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- Before proceeding with this test review the User Manual CH 48027-5 for Safety Information and Instructions.

1. Ignition OFF, all accessories OFF, install a **CH 48027:** Gauge. Refer to **Fuel Pressure Gauge Installation and Removal**.

NOTE: High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

2. Ignition ON, engine OFF, command the fuel pump ON with a scan tool. Verify the fuel pressure is between 276-448 kPa (40-65 psi) and does not decrease more than 34 kPa (5 psi) in 1 min.
3. Engine idling at normal operating temperature, verify the scan tool Fuel Pump Control Module Fuel Pressure Sensor parameter is between 297-400 kPa (43-58 psi).

CIRCUIT/SYSTEM TESTING

NOTE:

- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- DO NOT start the engine.
- High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

1. Ignition ON, engine OFF, command the Fuel Pump Enable ON with a scan tool and observe the fuel pressure gauge while the fuel pump is operating. Verify the fuel pressure is between 276-448 kPa (40-65 psi).
 - If the fuel pressure is less than the specified range, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections.
2. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 min.
 - If the fuel pressure decreases more than the specified value, perform the following procedure:

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1. Ignition OFF, relieve the fuel pressure. Refer to **Fuel Pressure Relief**.
2. Install the **J 37287**: Adapter between the chassis fuel feed hose and the engine compartment fuel feed pipe.
3. Open the valve on the **J 37287**: Adapter.
4. Ignition ON, command the Fuel Pump Enable ON with a scan tool and bleed the air from the **CH 48027**: Gauge.
5. Command the Fuel Pump Enable ON and then OFF with a scan tool.
6. Close the valve on the **J 37287**: Adapter.
7. Monitor the fuel pressure for 1 min.
 - If the fuel pressure does not decrease more than 34 kPa (5 psi) within the specified time, replace the primary fuel tank module.
3. Relieve the fuel pressure to 69 kPa (10 psi). Verify that the fuel pressure does not decrease more than 14 kPa (2 psi) in 5 min.
 - If the fuel pressure decreases more than the specified value, replace the primary fuel tank module.
4. Operate the vehicle within the conditions of the customer's concern while monitoring the fuel pressure with the **CH 48027**: Gauge. The fuel pressure should not drop off during acceleration, cruise or hard cornering.
 - If the fuel pressure drops off, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections
5. If the fuel system tests normal, refer to **Symptoms - Engine Controls (LF1)** or **Fuel Injector Solenoid Coil Test (LF1 LFW)** and **Fuel Injector Balance Test (LF1 LFW)**.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Fuel Feed Pipe Replacement**
- **Fuel Line Replacement - Chassis**
- **Primary Fuel Tank Module Replacement (NT7 NU)**.

FUEL SYSTEM DIAGNOSIS (LAU CHINA)

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

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The engine control module (ECM) supplies voltage to the fuel pump control module when the ECM detects that the ignition is ON. The voltage from the ECM to the fuel pump control module remains active for two seconds, unless the engine is in Crank or Run. While this voltage is being received, the fuel pump control module closes the ground switch of the fuel pump and also supplies a varying voltage to the fuel tank module in order to maintain the desired fuel rail pressure.

The fuel system is an electronic returnless on-demand design. A returnless fuel system reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank. Reducing the internal temperature of the fuel tank results in lower evaporative emissions.

An electric turbine style fuel pump attaches to the primary fuel tank module inside the fuel tank. The fuel pump supplies fuel through the fuel filter and the fuel feed pipe to the fuel injection system. The primary fuel tank module contains a reverse flow check valve. The check valve maintains fuel pressure in the fuel feed pipe and the fuel rail in order to prevent long cranking times.

The primary fuel tank module also contains a primary jet pump and a secondary jet pump. Fuel pump flow loss, caused by vapor expulsion in the pump inlet chamber, is diverted to the primary jet pump and the secondary jet pump through a restrictive orifice located on the pump cover. The primary jet pump fills the reservoir of the primary fuel tank module. The secondary jet pump creates a venturi action which causes the fuel to be drawn from the secondary side of the fuel tank, through the fuel transfer pipe, to the primary side of the fuel tank.

REFERENCE INFORMATION

Description and Operation

Fuel System Description (LF1)

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **CH 48027:** Digital Pressure Gauge
- **J 37287:** Fuel Line Shut-off Adapter
- For equivalent regional tools, refer to Special Tools.

CIRCUIT/SYSTEM VERIFICATION

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2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

NOTE:

- Repair all fuel system related DTCs before performing this diagnostic.
- Inspect the fuel system for damage or external leaks before proceeding.
- Verify that adequate fuel is in the fuel tank before proceeding.
- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- Before proceeding with this test review the User Manual CH 48027-5 for Safety Information and Instructions.

1. Ignition OFF, all accessories OFF, install a **CH 48027: Gauge**. Refer to **Fuel Pressure Gauge Installation and Removal**.

NOTE:

High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

2. Ignition ON, engine OFF, command the Fuel Pump Enable with a scan tool. Verify the fuel pressure is between 276-448 kPa (40-65 psi) and does not decrease more than 34 kPa (5 psi) in 1 min.
3. Engine idling at normal operating temperature, verify the scan tool Fuel Pump Control Module Fuel Pressure Sensor parameter is between 297-400 kPa (43-58 psi).
4. High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

CIRCUIT/SYSTEM TESTING

NOTE:

- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- DO NOT start the engine.

1. Ignition ON, engine OFF, command the Fuel Pump Enable ON with a scan tool and observe the fuel pressure gauge while the fuel pump is operating. Verify the fuel pressure is between 276-448 kPa (40-65 psi).
 - If the fuel pressure is greater than the specified range test for a restriction in the return side of the fuel filter. If the fuel filter tests normal, replace the primary fuel tank module.
 - If the fuel pressure is less than the specified range, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Restricted or plugged fuel filter
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections.
2. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 min.
 - If the fuel pressure decreases more than the specified value, perform the following procedure:
 1. Ignition OFF, relieve the fuel pressure. Refer to **Fuel Pressure Relief**.
 2. Install the **J 37287: Adapter** between the chassis fuel feed hose and the engine compartment

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fuel feed pipe.

3. Open the valve on the **J 37287**: Adapter.
4. Ignition ON, command the Fuel Pump Enable ON with a scan tool and bleed the air from the **CH 48027**: Gauge.
5. Command the Fuel Pump Enable ON and then OFF with a scan tool.
6. Close the valve on the **J 37287**: Adapter.
7. Monitor the fuel pressure for 1 min.
 - If the fuel pressure decreases more than 34 kPa (5 psi) within the specified time, locate and replace the leaking fuel injector(s).
 - If the fuel pressure does not decrease more than 34 kPa (5 psi) within the specified time, replace the primary fuel tank module.
3. Relieve the fuel pressure to 69 kPa (10 psi). Verify that the fuel pressure does not decrease more than 14 kPa (2 psi) in 5 min.
 - If the fuel pressure decreases more than the specified value, replace the primary fuel tank module.
4. Operate the vehicle within the conditions of the customer's concern while monitoring the fuel pressure with the **CH 48027**: Gauge. The fuel pressure should not drop off during acceleration, cruise or hard cornering.
 - If the fuel pressure drops off, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Restricted or plugged fuel filter
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections
5. If the fuel system tests normal, refer to **Symptoms - Engine Controls (LF1)**.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Fuel Filter Replacement (China)**
- **Fuel Injection Fuel Rail Assembly Replacement - Bank 2 (LF1)**
- **Fuel Line Replacement - Chassis**
- **Primary Fuel Tank Module Replacement (China)**

FUEL SYSTEM DIAGNOSIS (LAU EXCEPT CHINA)

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

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2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

The engine control module (ECM) supplies voltage to the fuel pump control module when the ECM detects that the ignition is ON. The voltage from the ECM to the fuel pump control module remains active for two seconds, unless the engine is in Crank or Run. While this voltage is being received, the fuel pump control module closes the ground switch of the fuel pump and also supplies a varying voltage to the fuel tank module in order to maintain the desired fuel rail pressure.

The fuel system is an electronic returnless on-demand design. A returnless fuel system reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank. Reducing the internal temperature of the fuel tank results in lower evaporative emissions.

An electric turbine style fuel pump attaches to the primary fuel tank module inside the fuel tank. The fuel pump supplies fuel through the fuel filter, contained in the fuel tank module, and the fuel feed pipe to the fuel injection system. The primary fuel tank module contains a reverse flow check valve. The check valve maintains fuel pressure in the fuel feed pipe and the fuel rail in order to prevent long cranking times.

The primary fuel tank module also contains a primary jet pump and a secondary jet pump. Fuel pump flow loss, caused by vapor expulsion in the pump inlet chamber, is diverted to the primary jet pump and the secondary jet pump through a restrictive orifice located on the pump cover. The primary jet pump fills the reservoir of the primary fuel tank module. The secondary jet pump creates a venturi action which causes the fuel to be drawn from the secondary side of the fuel tank, through the fuel transfer pipe, to the primary side of the fuel tank.

REFERENCE INFORMATION

Description and Operation

Fuel System Description (LAU or LY7)

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **CH 48027:** Digital Pressure Gauge
- **J 37287:** Fuel Line Shut-off Adapter

CIRCUIT/SYSTEM VERIFICATION

NOTE:

- Repair all fuel system related DTCs before performing this diagnostic.

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2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

- Inspect the fuel system for damage or external leaks before proceeding.
- Verify that adequate fuel is in the fuel tank before proceeding.
- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- Before proceeding with this test review the User Manual CH 48027-5 for Safety Information and Instructions.

1. Ignition OFF, all accessories OFF, install a **CH 48027: Gauge**. Refer to **Fuel Pressure Gauge Installation and Removal**.

NOTE: High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

2. Ignition ON, engine OFF, command the Fuel Pump Enable ON with a scan tool. Verify the fuel pressure is between 276-448 kPa (40-65 psi) and does not decrease more than 34 kPa (5 psi) in 1 min.
3. Engine idling at normal operating temperature, verify the scan tool Fuel Pump Control Module Fuel Pressure Sensor parameter is between 297-400 kPa (43-58 psi).

CIRCUIT/SYSTEM TESTING

NOTE:

- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- DO NOT start the engine.
- High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase to the setting of the pressure relief regulator valve, approximately 580 kPa (84 psi).

1. Ignition ON, engine OFF, command the Fuel Pump Enable ON with a scan tool and observe the fuel pressure gauge while the fuel pump is operating. Verify the fuel pressure is between 276-448 kPa (40-65 psi).
 - If the fuel pressure is less than the specified range, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections.
2. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 min.
 - If the fuel pressure decreases more than the specified value, perform the following procedure:
 1. Ignition OFF, relieve the fuel pressure. Refer to **Fuel Pressure Relief**.
 2. Install the **J 37287: Adapter** between the chassis fuel feed hose and the engine compartment fuel feed pipe.
 3. Open the valve on the **J 37287: Adapter**.
 4. Ignition ON, command the Fuel Pump Enable ON with a scan tool and bleed the air from the

CH 48027: Gauge.

5. Command the Fuel Pump Enable ON and then OFF with a scan tool.
6. Close the valve on the **J 37287:** Adapter.
7. Monitor the fuel pressure for 1 min.
 - If the fuel pressure decreases more than 34 kPa (5 psi) within the specified time, locate and replace the leaking fuel injector(s).
 - If the fuel pressure does not decrease more than 34 kPa (5 psi) within the specified time, replace the primary fuel tank module.
3. Relieve the fuel pressure to 69 kPa (10 psi). Verify that the fuel pressure does not decrease more than 14 kPa (2 psi) in 5 min.
 - If the fuel pressure decreases more than the specified value, replace the primary fuel tank module.
4. Operate the vehicle within the conditions of the customer's concern while monitoring the fuel pressure with the **CH 48027:** Gauge. The fuel pressure should not drop off during acceleration, cruise or hard cornering.
 - If the fuel pressure drops off, test, inspect, and repair the items listed below. If all items test normal, replace the primary fuel tank module.
 - Restricted fuel feed pipe
 - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections
5. If the fuel system tests normal, refer to **Symptoms - Engine Controls (LAU)**.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Fuel Injection Fuel Rail Assembly Replacement - Bank 2 (LF1)**
- **Fuel Line Replacement - Chassis**
- **Primary Fuel Tank Module Replacement (China)**

FUEL INJECTOR SOLENOID COIL TEST (LAU)**DIAGNOSTIC INSTRUCTIONS**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

The control module enables the appropriate fuel injector pulse for each cylinder. The ignition voltage is supplied directly to the fuel injectors. The control module controls each fuel injector by grounding the control circuit via a solid state device called a driver. A fuel injector coil winding resistance that is too high or too low will affect the engine driveability. A fuel injector control circuit DTC may not set, but a misfire may be apparent. The fuel injector coil windings are affected by temperature. The resistance of the fuel injector coil

windings will increase as the temperature of the fuel injector increases.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics (LAU) .

Connector End View Reference

- Component Connector End Views
- Inline Harness Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

COMPONENT TESTING

Verify the resistance of each fuel injector with one of the following methods

- If the engine coolant temperature (ECT) sensor is between 10-32 °C (50-90 °F), the resistance of each fuel injector should be 11-14 ohms.
 - If the injectors measure OK, perform the Fuel Injector Balance Test. Refer to **Fuel Injector Balance Test (LAU)**.
 - If not within the specified range, replace the fuel injector.
- If the ECT sensor is not between 10-32 °C (50-90 °F), measure and record the resistance of each fuel injector with a DMM. Subtract the lowest resistance value from the highest resistance value. The difference between the lowest value and the highest value should be equal to or less than 3 ohms.
 - If the difference is equal to or less than 3 ohms, perform the Fuel Injector Balance Test. Refer to **Fuel Injector Balance Test (LAU)**.
 - If the difference is more than 3 ohms, add all of the fuel injector resistance values to obtain a total resistance value. Divide the total resistance value by the number of fuel injectors to obtain an average resistance value. Subtract the lowest individual fuel injector resistance value from the average resistance value. Compute the difference between the highest individual fuel injector resistance value and the average resistance value. Replace the fuel injector that displays the greatest difference above or below the average.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

FUEL INJECTOR SOLENOID COIL TEST LF1, LFW

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

The engine control module (ECM) supplies a separate high voltage supply circuit and a high voltage control circuit for each fuel injector. The injector high voltage supply circuit and the high voltage control circuit are both controlled by the ECM. The ECM energizes each fuel injector by grounding the control circuit. The ECM controls each fuel injector with 65 V. This is controlled by a boost capacitor in the ECM. During the 65 V boost phase, the capacitor is discharged through an injector, allowing for initial injector opening. The injector is then held open with 12 V. A fuel injector coil winding resistance that is too high or too low will affect the engine driveability. The fuel injector coil windings are affected by temperature. The resistance of the fuel injector coil windings will increase as the temperature of the fuel injector increases.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics (LF1)

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

COMPONENT TESTING

NOTE:

- The resistance test must be performed at the fuel injector or mis-diagnosis will occur.
- The DMM and test leads must be calibrated to 0 ohms in order to prevent mis-diagnosis.

1. Test for 1.9-2.3 ohms at 20 °C (68 °F) between the high voltage supply circuit terminal 2 and the high voltage control circuit terminal 1 at the LF1 fuel injector.
 - If not within the specified range, replace the LF1 fuel injector.
2. Measure the resistance between each terminal at the LF1 fuel injector and the LF1 fuel injector housing/case. The DMM should display 0 ohms.

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- If less than the specified value, replace the 17 fuel injector.
- 3. If the injectors measure O₂, perform the Fuel Injector Balance Test. Refer to **Fuel Injector Balance Test (LF1 LF)**.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Fuel Injection Fuel Rail Assembly Replacement - Bank 1 (LF1)**
- **Fuel Injection Fuel Rail Assembly Replacement - Bank 2 (LF1)**

FUEL INJECTOR BALANCE TEST WITH SPECIAL TOOL EXCEPT LF1 AND LLT

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

The **CH-47976** Active Fuel Injector Tester (AFIT) is used to test the fuel pump, fuel system leak down, and the fuel injectors. See **Special Tools**. The on screen prompts or selections will indicate the steps required to perform each of the available tests. The tester will perform all of the tests automatically and display results of the test. The results can also be down loaded for storage and printing. Refer to the User Guide, CH 47976-11 for more information.

DIAGNOSTIC AIDS

- Monitoring the misfire current counters, or misfire graph, may help to isolate the fuel injector that is causing the condition.
- Operating the vehicle over a wide temperature range may help isolate the fuel injector that is causing the condition.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics (LF1)

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **CH-47976** Active Fuel Injector Tester (AFIT). See **Special Tools** .
- **EL-39021-460** Fuel Injector Test Adapter. See **Special Tools** .

COMPONENT TESTING**Fuel Injector Balance Test with Special Tool**

1. Ignition ON, verify that the scan tool engine coolant temperature (ECT) parameter is less than 94 C (201 F).
 - If the ECT is greater than 94 C (201 F) allow the engine to cool before proceeding.
2. Turn OFF all accessories.
3. Turn OFF the ignition.

NOTE: **DO NOT connect the EL-3 021- 0 until prompted by the AFIT. See Special Tools .**

4. Install the AFIT. Refer to the AFIT User Guide.
5. Turn ON the AFIT and select the vehicle.
6. Turn ON the ignition and perform the Injector Test.
 - If the AFIT aborts testing due to fuel pressure or fuel leak down, refer to **Fuel System Diagnosis (LF1 China)** or **Fuel System Diagnosis (LF1 Except China)** .
7. View the test results.
 - If any injector exceeds the recommended tolerance, replace the injector(s).

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

FUEL INJECTOR BALANCE TEST**DIAGNOSTIC INSTRUCTIONS**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provide an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

When performing the fuel injector balance test with the fuel injector tester or the scan tool, the scan tool is first used to energize the fuel pump relay. The fuel injector tester or the scan tool is then used to pulse each injector for a precise amount of time, allowing a measured amount of fuel to be injected. This causes a drop in the system fuel pressure that can be recorded and used to compare each injector.

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The Active Fuel Injector Tester, CH 47976, is used to test the fuel pump, fuel system leak down, and the fuel injectors. Following the User Guide, CH 47976-11, and the on screen prompts or selections, will indicate the steps required to perform each of the available tests. The tester will perform all of the tests automatically and display results of the test. The results can also be down loaded for storage and printing.

DIAGNOSTIC AIDS

- Monitoring the Current Misfire Counters, or misfire graph, may help to isolate the fuel injector that is causing the condition.
- Operating the vehicle over a wide temperature range may help isolate the fuel injector that is causing the condition.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics (LAU) .

Connector End View Reference

- Component Connector End Views
- Inline Harness Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- **CH 47976:** Active Fuel Injector Tester
- **CH 47976-60:** J-Tool Adapter
- **CH 48027:** Digital Pressure Gauge
- **EL 39021-460:** Fuel Injector Test Adapter
- **J 39021:** Fuel Injector Coil and Balance Tester
- **J 39021-210:** Injector Tester Adapter Box

NOTE:

- **DO NOT** perform this test if the engine coolant temperature ECT is above

C 201 F . Irregular fuel pressure readings may result due to hot soak fuel boiling.

- **Verify that adequate fuel is in the fuel tank before proceeding with this diagnostic.**
- **Before proceeding with this test review the Owner Manual CH 02 -5 for Safety Information and Instructions.**

Fuel Injector Balance Test-Fuel Pressure Test

1. Install a fuel pressure gauge. Refer to **Fuel Pressure Gauge Installation and Removal** .
2. Turn ON the ignition, with the engine OFF.

NOTE:

- **The fuel pump relay may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.**
- **DO NOT start the engine.**

3. Command the fuel pump relay ON with a scan tool.
4. Observe the fuel pressure gauge with the fuel pump commanded ON. The fuel pressure should be 345-414 kPa (50-60 psi).
 - If the fuel pressure is not within the specified range, refer to **Fuel System Diagnosis (LAU China)** **Fuel System Diagnosis (LAU Except China)** .
5. Monitor the fuel pressure gauge for one minute. The fuel pressure should not decrease more than 34 kPa (5 psi).
 - If the fuel pressure decreases more than 34 kPa (5 psi), refer to **Fuel System Diagnosis (LAU China)** **Fuel System Diagnosis (LAU Except China)** .
6. Perform the Fuel Injector Balance Test with Special Tool, the Fuel Injector Balance Test with Tech 2, or the Fuel Injector Balance Test with the Active Fuel Injector Tester.

Fuel Injector Balance Test with Special Tool

1. Set the amperage supply selector switch on the fuel injector tester to the Balance Test 0.5-2.5 A position.
2. Disconnect the multi-way harness connector of the fuel injectors.
3. Connect the **J 39021: Fuel Injector Coil and Balance Tester**, the **J 39021-210: Injector Tester Adapter Box**, and the **EL 39021-460: Fuel Injector Test Adapter** to the fuel injector multi-way harness connector.
4. Command the fuel pump relay ON and then OFF three times with a scan tool. On the last command, as the fuel pressure begins to slowly degrade and stabilize, select a fuel pressure within 34 kPa (5 psi) of the maximum pump pressure. Record this fuel pressure. This is the starting pressure at which you will pulse each injector.
5. Command the fuel pump relay ON one more time and energize the fuel injector by depressing the Push to Start Test button on the **J 39021: Fuel Injector Coil and Balance Tester** at the previously selected pressure.
6. After the injector stops pulsing, select Min from the Display Mode on the **CH 48027: Gauge** and record the Min pressure.

NOTE: New test results will not be recorded if the Min/Max results are not cleared after each injector is tested.

7. Clear the Min/Max results on the **CH 48027:** Gauge.
8. Select Normal from the Display Mode on the **CH 48027:** Gauge.
9. Repeat steps 5 through 8 for each fuel injector.
10. Subtract the minimum pressure from the starting pressure for one fuel injector. The result is the pressure drop value.
11. Obtain a pressure drop value for each fuel injector.
12. Add all of the individual pressure drop values except for the injector suspected of being faulty. This is the total pressure drop.
13. Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop. The difference between any individual pressure drop and the average pressure drop should not be more than 20 kPa (3 psi).
 - o If the difference between any individual pressure drop and the average pressure drop is more than 20 kPa (3 psi), replace the fuel injector.

Fuel Injector Balance Test with Tech 2

1. Command the fuel pump relay ON and then OFF three times with a scan tool. On the last command, as the fuel pressure begins to slowly degrade and stabilize, select a fuel pressure within 34 kPa (5 psi) of the maximum pump pressure. Record this fuel pressure. This is the starting pressure at which you will pulse each injector.
2. With a scan tool, select the Fuel Injector Balance Test function within the Special Functions menu.
3. Select an injector to be tested.
4. Press Enter to prime the fuel system.
5. Energize the fuel injector by depressing the Pulse Injector button on the scan tool at the previously selected pressure.
6. After the injector stops pulsing, select Min from the Display Mode on the **CH 48027:** Gauge and record the Min pressure.

NOTE: New test results will not be recorded if the Min/Max results are not cleared after each injector is tested.

7. Clear the Min/Max results on the **CH 48027:** Gauge.
8. Select Normal from the Display Mode on the **CH 48027:** Gauge.
9. Press Enter on the scan tool to bring you back to the Select Injector screen.
10. Repeat steps 3 through 9 for each fuel injector.
11. Subtract the minimum pressure from the starting pressure for one fuel injector. The result is the pressure drop value.
12. Obtain a pressure drop value for each fuel injector.
13. Add all of the individual pressure drop values except for the injector suspected of being faulty. This is the

total pressure drop.

14. Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop. The difference between any individual pressure drop and the average pressure drop should not be more than 20 kPa (3 psi).
 - If the difference between any individual pressure drop and the average pressure drop is more than 20 kPa (3 psi), replace the fuel injector.

Fuel Injector Balance Test with the Active Fuel Injector Tester

1. Turn OFF all accessories.
2. Turn OFF the ignition.

NOTE: DO NOT connect the EL 3 021- 0: Fuel Injector Test Adapter until prompted by the Active Fuel Injector Tester.

3. Install the Active Fuel Injector Tester. Refer to the Active Fuel Injector Tester User Guide.
4. Turn ON the Active Fuel Injector Tester and select the vehicle.
5. Turn ON the ignition and perform the Injector Test.
 - If the Active Fuel Injector Tester aborts testing due to fuel pressure or fuel leak down, refer to **Fuel System Diagnosis (LAU China)****Fuel System Diagnosis (LAU Except China)**.
6. View the test results.
 - If any injector exceeds the recommended tolerance, replace the injector(s).

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

FUEL INJECTOR BALANCE TEST LF1, LFW

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

CIRCUIT/SYSTEM DESCRIPTION

The fuel injector balance test is performed while the engine is running at idle. The scan tool pressurizes the fuel rail to a predetermined pressure before each injector is pulsed for a precise amount of time allowing a measured amount of the fuel to be injected. This causes a drop in the system fuel pressure that is recorded and used to compare each injector.

DIAGNOSTIC AIDS

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- Monitoring the Current Misfire Counters may help to isolate the fuel injector that is causing the condition.
- Operating the vehicle over a wide temperature range may help isolate the fuel injector that is causing the condition.

COMPONENT TESTING

NOTE:

- **DO NOT perform this test if the engine coolant temperature ECT is above 0 C 1 0 F . Irregular fuel pressure readings may result due to hot soak fuel boiling.**
- **Verify that adequate fuel is in the fuel tank and that the battery is fully charged before proceeding with this diagnostic. It may be necessary to install a battery charger.**

Fuel Injector Balance Test

1. Verify the correct low side fuel pressure. Refer to Fuel System Diagnosis (LF1 China) or Fuel System Diagnosis (LF1 Except China).

NOTE: The engine speed must be between 00-1000 RPM to perform this test.

2. Engine running at normal operating temperature. With a scan tool, select the Fuel Injector Balance function within the Output Controls menu.
3. Select and test an injector. Repeat for each injector in order to obtain a pressure drop value for each injector.
4. After all injectors are tested, record the fuel pressure drops.
5. Add all of the individual pressure drop values except for the injector suspected of being faulty. This is the total pressure drop.
6. Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop.
7. Multiply the average pressure drop by 0.20. This is the acceptable variance from the average pressure drop, 20 percent.
 - If the difference between any individual pressure drop and the average pressure drop is more than the acceptable variance, replace the fuel injector.

REPAIR PROCEDURES

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Fuel Injection Fuel Rail Assembly Replacement - Bank 1 (LF1)
- Fuel Injection Fuel Rail Assembly Replacement - Bank 2 (LF1)

ALCOHOL/CONTAMINANTS-IN-F EL DIAGNOSIS SPECIAL TOOL

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DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DESCRIPTION

Water contamination in the fuel system may cause driveability conditions such as hesitation, stalling, no start, or misfires in one or more cylinders. Water may collect near a single fuel injector at the lowest point in the fuel injection system, and cause a misfire in that cylinder. If the fuel system is contaminated with water, inspect the fuel system components for rust or deterioration.

Ethanol concentrations of greater than 10 percent can cause driveability conditions and fuel system deterioration. Fuel with greater than 10 percent ethanol could result in driveability conditions such as hesitation, lack of power, stalling, or no start. Excessive concentrations of ethanol used in vehicles not designed for it may cause fuel system corrosion, deterioration of rubber components, and fuel filter restriction.

TEST PROCEDURE

1. Test the fuel composition using **J 44175** Fuel Composition Tester and J44175-3 Instruction Manual. See **Special Tools**.
2. If water appears in the fuel sample clean the fuel system, refer to **Fuel System Cleaning**.
3. Subtract 50 from the reading on the DMM in order to obtain the percentage of alcohol in the fuel sample. Refer to the examples in the Fuel Composition Test Examples table.
4. If the fuel sample contains greater than 15 percent ethanol, add fresh, regular gasoline to the vehicle's fuel tank.
5. Test the fuel composition.
6. If testing shows the ethanol percentage is still greater than 15 percent, replace the fuel in the vehicle. Refer to **Fuel Tank Draining**.

Fuel Composition Test Examples

-	Frequency (Hz)	Subtract 50	Ethanol Percent
Example A	50 Hz	-50	0
Example B	65 Hz	-50	15
Example C	129 Hz	-50	79

ALCOHOL/CONTAMINANTS-IN-FUEL DIAGNOSIS WITHO T SPECIAL TOOL

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DESCRIPTI

Water contamination in the fuel system may cause driveability conditions such as hesitation, stalling, no start, or misfires in one or more cylinders. Water may collect near a single fuel injector at the lowest point in the fuel rail, and cause a misfire in that cylinder. If the fuel system is contaminated with water, inspect the fuel system components for rust, or deterioration.

Alcohol concentrations greater than 10 percent in the fuel can be detrimental to fuel system components. Alcohol contamination may cause fuel system corrosion, deterioration of rubber components, and subsequent fuel filter restriction. Fuel contaminated with alcohol may cause driveability conditions such as hesitation, lack of power, stalling, or no start. Some types of alcohol are more detrimental to fuel system components than others.

ALC LI FUEL TESTI PR CEDURE

The fuel sample should be drawn from the bottom of the tank so that any water present in the tank will be detected. The sample should be bright and clear. If alcohol contamination is suspected then use the following procedure to test the fuel quality.

1. Using a 100 ml (3.38 o .) specified cylinder with 1 ml (0.34 o .) graduation marks, fill the cylinder with fuel to the 90 ml (3.04 o .) mark.
2. Add 10 ml (0.34 o .) of water in order to bring the total fluid volume to 100 ml (3.38 o .) and install a stopper.
3. Shake the cylinder vigorously for 10-15 seconds.
4. Carefully loosen the stopper in order to release the pressure.
5. Re-install the stopper and shake the cylinder vigorously again for 10-15 seconds.
6. Put the cylinder on a level surface for approximately 5 minutes in order to allow adequate liquid separation.

If alcohol is present in the fuel, the volume of the lower layer, that now contains both alcohol and water, will be greater than 10 ml (0.37 o .). For example, if the volume of the lower layer is increased to 15 ml (0.51 o .), this indicates at least 5 percent alcohol in the fuel. The actual amount of alcohol may be somewhat more because this procedure does not extract all of the alcohol from the fuel.

PARTICULATE C TAMI A TSI FUEL TESTI PR CEDURE

The fuel sample should be drawn from the bottom of the tank so that any contaminants present in the tank will be detected. The sample should be bright and clear. If the sample appears cloudy or contaminated with water as indicated by a water layer at the bottom of the sample, use the following procedure to diagnose the fuel.

1. Using an approved fuel container, draw approximately 0.5 liter (0.53 qt) of fuel.
2. Place the cylinder on a level surface for approximately 5 minutes in order to allow settling of the particulate contamination.

Particulate contamination will show up in various shapes and colors. Sand will typically be identified by a white or light brown crystals. Rubber will appear as black and irregular particles. If particles are found, clean the entire fuel system thoroughly. Refer to **Fuel System Cleaning**.

EVAPORATIVE EMISSION SYSTEM DIAGNOSIS

PERFORM THE EVAPORATIVE EMISSION SYSTEM TEST (EEST)

Vehicle Setup

NOTE: A large difference between the vehicle temperature and shop temperature will seriously affect the accuracy of the tests. Always allow enough time, at least 15 minutes, for the vehicle temperature to adjust to the shop temperature. Refer to **Temperature Variation Instructions** for more information about vehicle versus shop temperatures.

1. Engine OFF, open the hood. Position a large fan to blow air under the vehicle onto the fuel tank area.
2. Connect the red battery clip from the tester to the positive battery terminal.

NOTE: The vehicle battery must be fully charged for optimum tester performance.

3. Connect the black battery clip from the tester to chassis ground.

FLOWMETER TEST - LEAK DETECTION

1. Open the Nitrogen tank valve and turn the NITROGEN/SMOKE valve on the front control panel to NITROGEN.
2. Connect the hose to the correct test orifice on the bottom front of the tester. For orifice size, refer to the GM Service manual for the vehicle being tested. The vehicle specific information can be found in service procedures for DTCs that relate to evaporative emission (EVAP) system leaks.
3. Press and release the remote switch to activate the tester.
4. Position the sliding red flag on the flowmeter to align with the floating indicator. When the red flag is set, press and release the remote switch to deactivate the tester.
5. Remove the hose from the test orifice and install the hose onto the vehicle. For proper connection location, and the special tool numbers for any adapters that may be required, refer to the service procedures for DTCs that relate to EVAP system leaks.
6. Ignition ON, seal the EVAP system per instructions in the service procedures for DTCs that relate to EVAP system leaks. Most systems can be sealed using a scan tool output control for the EVAP canister vent solenoid valve, other systems require that the vent system be plugged.

NOTE:

- Larger volume fuel tanks, and/or those with lower fuel levels, may require several minutes to fill with nitrogen.
- Static buildup may cause the float indicator to stick. It may be necessary to tap on the flowmeter to free up the float.

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7. Press and release the remote switch to activate the nitrogen flow and fill the system.
8. Compare the stable floating indicator position to the red flag.
 - ABOVE the red flag, the result is UNACCEPTABLE, FAIL - Go to **Smoke Procedure - Locate the Leak**
 - BELOW the red flag, the result is ACCEPTABLE, PASS - Test complete
9. Press and release the remote switch to deactivate the tester.

SM OKE P R C E D U R E - L O C A T E T H E L E A K

NOTE: It is not recommended to use the tester in an outside repair bay area because wind and sunlight may affect temperature and your ability to see the smoke.

1. Turn OFF any fans that may cause air movement around or near the vehicle.

NOTE: Completely unwind the nitrogen/smoke hose from the bracket to optimize the tester's performance.

2. Connect the nitrogen/smoke hose to the vehicle as directed in the service procedures. Some vehicles require that the nitrogen/smoke hose be connected at the front of the EVAP system at the EVAP service port. An adapter may be necessary. Other vehicles require the connection be made at the rear of the system using an adapter at the fuel fill cap. Consult the service procedures for DTCs that relate to evaporative emission (EVAP) system leaks for vehicle specific instructions regarding connection location and adapters.
3. Open the nitrogen tank valve and turn the NITROGEN/SMOKE valve on the control panel to SMOKE.

NOTE: The remote switch operates in a push ON, push OFF fashion.

4. Press and release the remote switch to activate the tester and inject smoke into the EVAP system.
5. Verify smoke has filled the EVAP system by opening the system opposite the end where smoke is injected. When injecting smoke at the service port, remove the fuel fill cap, or temporarily leave the EVAP canister vent valve open, until smoke is observed. Then close the system and continue testing. If using a special tool fuel fill cap adapter at the filler neck, vent the system at the service port until smoke is observed then close the system to continue with the test.

NOTE: Inject smoke in less than 2-minute cycles for optimum tester performance.

6. Press and release the remote switch to deactivate the tester.

NOTE: For optimum visual smoke performance, deactivate the smoke flow and allow the system pressure to drop. Allowing the smoke to exit small holes at a low flow rate greatly enhances visibility.

7. Introduce smoke into the system for an additional 60 seconds. Continue introducing smoke at 15-second

intervals, as necessary.

8. Using the a high-intensity white light, inspect the entire EVAP system path, and look for the source of the leak indicated by the exiting smoke. Introduce smoke at 15-second intervals, as needed, until leak source is identified.

TEMPERATURE VARIATIONS IN EVAP SYSTEM

The Concern

Ideal circumstances for conducting the EVAP Flowmeter Test require equal temperatures between the nitrogen gas and the vehicle EVAP system. Significant differences in temperature between them can result in a flow or pressure change during testing, causing misleading results. Typically, the Evaporative Emissions System Tester is stored indoors, approximately 21°C (70°F). Vehicles brought in for diagnosis may have an EVAP system at significantly different temperatures -40 to +43°C (-40 to +110°F).

For Example

NOTE: With no temperature difference between the nitrogen gas and EVAP system, the resulting vehicle EVAP system pressure will remain stable at 13 inches H₂O once pressurized, providing no leaks are present.

When the EVAP Flowmeter Tests are performed with significant differences in temperature between the nitrogen gas and the vehicle EVAP system, the following results can occur:

- An increase in flow during the flowmeter test can be caused by a vehicle's warm EVAP system cooling down.
- A decrease in flow during the flowmeter test can be caused by a vehicle's cool EVAP system warming up.

The Solution

When working on a vehicle with significant temperature differences between the vehicle EVAP system and the nitrogen gas, allow the vehicle EVAP system temperature to stabilize as close as possible to the temperature of the nitrogen gas before conducting the Flowmeter Test.

ELECTRONIC IGNITION SYSTEM DIAGNOSIS

Diagnostic Strategy

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

Circuit/System Description

The ignition system on this engine uses individual ignition coils and ignition control circuits for each cylinder. Ignition voltage is supplied to each bank of ignition coils. The engine control module (ECM) controls the

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ignition system operation. The ECM controls each coil using the ignition control circuits. The ECM commands the ignition control circuit low when a spark event is requested. The sequencing and timing are controlled by the ECM.

DIA STIC AIDS

- The ignition coils for each bank are fused separately. If a fuse opens or the ignition voltage circuit opens between the fuse and the splice, all the ignition coils for one bank of the engine would be inoperative. If the ground circuit opens at the engine block, the ignition coils would be inoperative for one bank of the engine.
- Inspect the ignition coils for aftermarket devices. An aftermarket device connected to the ignition coil circuits, may cause a condition with the ignition coils.

REFERE CE I F RMATI

Schematic Re erence

Engine Controls Schematics (LAU) or Engine Controls Schematics (LF1)

Connector End Vie Re erence

Component Connector End Vie s

Description and peration

Electronic Ignition System Description

Electrical In ormation Re erence

- Circuit Testing
- Connector Repairs
- Testing or Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Re erence

Control Module Re erences for scan tool information

Special Tools

- EL 26792 Spark Tester
- For equivalent regional tools, refer to Special Tools .

CIRCUIT/SYSTEM TESTI

NOTE: Do not perform this diagnostic procedure if you were not sent here from a

misfire DTC or the Engine Cranks but Does Not Run diagnostic.

1. Ignition OFF, disconnect the harness connector of the affected T8 ignition coil.
2. Ignition ON, test for battery voltage between the ignition voltage circuit terminal D or 2 and ground.
 - If less than B+, test the ignition voltage circuit for a short to ground or an open/high resistance. If the circuit tests normal and the ignition circuit fuse is open, test all the components connected to the ignition voltage circuit and replace as necessary.
3. Crank or start the engine. Test for 200-400 mV between the appropriate ignition control circuit terminal C or 1 and ground.
 - If less than the specified value, test the ignition control circuit for a short to ground or an open/high resistance. If the circuit/connection tests normal, replace the K20 ECM.
 - If greater than the specified value, test the ignition control circuit for a short to voltage. If the circuit/connection tests normal, replace the K20 ECM.
4. Ignition OFF, all vehicle systems OFF, this may take up to 2 min, test for less than 5 ohms between the low reference circuit terminal B or 3 and the K20 ECM housing.
 - If greater than the specified value, test for an open/high resistance in the low reference circuit. If the circuit/connection tests normal, replace the K20 ECM.
5. Test for less than 5 ohms between the ground circuit terminal A or 4 and ground.
 - If greater than the specified value, test for an open, or high resistance in the ground circuit.
6. Remove the T8 ignition coil from the engine. Connect the harness.
7. Remove the fuse for the fuel pump or the fuel pump control module, if equipped.
8. Crank the engine and test for strong spark using the **EL 26792:** Tester.
 - If no spark or weak spark is observed, replace the T8 ignition coil.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Ignition Coil Replacement - Bank 1**
- **Ignition Coil Replacement - Bank 2**
- **Control Module References** for ECM replacement, setup, and programming

INSPECTION/MAINTENANCE SYSTEM C ECK**DIAGNOSTIC INSTRUCTIONS**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DESCRIPTION

Several states require that a vehicle pass on-board diagnostic (OBD) system tests and the inspection/maintenance (I/M) emission inspection in order to renew license plates. This is accomplished by viewing the I/M System Status display on a scan tool. Using a scan tool, the technician can observe the I/M System Status in order to verify that the vehicle meets the criteria that complies with the local area requirements. While testing in the I/M System Status mode, some DTCs may occur that are called I/M Test DTCs. An I/M Test DTC is defined as a fault code that is currently commanding the MIL ON, and is stored in non-volatile memory. The intended use of this data is to prevent vehicles from passing I/M inspection without proper repair to the vehicle. These fault codes are not erasable from any scan tool command or erasable by disconnecting power to the controller. The I/M Test DTCs will be supported by all emissions related ECUs such as ECMs, TCMs, FPCMs, etc. An I/M Test DTC will not be stored or erased from the ECU except at the end of trip processing which occurs 5 s after ignition OFF.

CONDITIONS FOR UPDATING THE I/M SYSTEM STATUS

Each system requires at least one, and sometimes several, diagnostic tests. The results of these tests are reported by a diagnostic trouble code (DTC). A system monitor is complete when either all of the DTCs comprising the monitor have Run and Passed, or any one of the DTCs comprising the monitor have illuminated the malfunction indicator lamp (MIL). Once all of the tests are completed, the I/M System Status display will indicate YES in the Completed column.

For example, when the HO2S Heater Status indicates YES, either all of the oxygen sensor heater tests have passed or one of the tests has illuminated the MIL. If the vehicle has four heated oxygen sensors, either all four heater circuit tests have passed or one of the heater circuit tests has illuminated the MIL. The I/M System Status will indicate NO under the Completed column when any of the required tests for that system have not run. The following is a list of conditions that would set the I/M System Status indicator to NO:

- The vehicle is new from the factory and has not yet been driven through the necessary drive conditions to complete the tests.
- The battery has been disconnected or discharged below operating voltage.
- The control module power or ground has been interrupted.
- The control module has been reprogrammed.
- The control module DTCs have been cleared as part of a service procedure.

CONDITIONS FOR CLEARING I/M TEST DTCs

1. Only the OBD II System can erase the I/M Test DTC. The OBD II system must determine that the malfunction that caused the I/M Test DTC to be stored is no longer present and is not commanding the MIL. Each of the following represents ways to clear an I/M Test DTC:
 - If the MIL goes out due to 3 passing drive cycles, scan tool code clear is not used, the I/M Test DTC is erased at power down of the last drive cycle.
 - If a scan tool code clear is used to turn OFF the MIL, the I/M Test DTC is not erased, the DTC must PASS and not FAIL. The I/M Test DTC is erased at power down of the drive cycle.
 - If the controller is reflashed/reprogrammed, all I/M Test DTCs are erased.
2. For the OBD II System to run a single drive cycle for clearing an I/M Test DTC, all of the following conditions must occur:

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- Cumulative time of engine run time is greater than 600 s.
- Cumulative vehicle operation above 41 kPa (25 mph) for over 300 s.
- Continuous vehicle idle for greater than 30 s.
- Turn ignition OFF for 5 s and allow the code to clear.

MONITORED EMISSION CONTROL SYSTEMS

The OBD II system monitors all emission control systems that are on-board. Not all vehicles need every possible emission control system. For example, a vehicle may not be equipped with secondary air injection (AIR) or exhaust gas recirculation (EGR). The OBD II regulations require monitoring of the following; if equipped:

- The air conditioning system
- The catalytic converter efficiency
- Comprehensive component monitoring - Emission related inputs and outputs
- The evaporative emission (EVAP) system
- The fuel delivery system
- Heated catalyst monitoring
- Misfire monitoring
- The oxygen sensor system (O2S or HO2S)
- The oxygen sensor heater system (HO2S heater)

For the specific DTCs required for each system, refer to **Inspection/Maintenance (I/M) Test DTC Table**. Systems such as misfire and comprehensive components may not be listed in a system status list. These tests run continuously and do not require an I/M System Status indicator.

DIAGNOSTIC AIDS

The I/M System Status display provides an indication of when the control module has completed the required tests. This does not necessarily mean that the test has passed, only that a decision was made. If the diagnostic fails, a DTC will indicate the failure. If a failure indication is present for a DTC associated with one of the I/M regulated systems, it may prevent other required tests from running. For example, a DTC for the control circuit of the EVAP purge solenoid may not be listed in the Inspection/Maintenance System DTC Table because it is a continuous test. If this DTC is set, the Active Tests for the EVAP system may not run.

The I/M System Status information may be useful for a technician to determine if diagnostics have run when verifying repairs.

CIRCUIT/SYSTEM VERIFICATION

Review the I/M System Status indicators. All I/M System Status indicators should report YES, and no I/M Test DTCs should be present.

CIRCUIT/SYSTEM TESTING

NOTE: Many DTC related repairs will instruct the technician to clear the DTC information. Clearing the DTC will reset the I/M System Status indicators to NO. Performing the I/M Complete System Set Procedure will set each of the I/M System Status indicators to YES.

1. Observe the Engine DTC information with a scan tool. Verify no DTCs are present.
 - If a DTC is set that would prevent the I/M System Status tests from completing, diagnose that DTC before continuing. Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**.
2. Review applicable service bulletins for software updates that would prevent the I/M System Status tests from completing.
 - If a control module re-program or other repair is required, perform the **Inspection/Maintenance Complete System Set Procedure**.
3. Observe the I/M System Status indicators.
 - If any I/M System Status indicators report NO, perform the **Inspection/Maintenance Complete System Set Procedure**.
4. Observe the I/M Test DTC information with a scan tool. Verify there are no I/M Test DTCs present.
 - If an I/M Test DTC is set and all of the I/M System Status indicators are Yes, there is no need to perform the Complete System Set Procedure. Diagnose the DTC using the **Diagnostic Trouble Code (DTC) List - Vehicle** and refer to Conditions for Clearing the I/M Test DTCs.
 - If an I/M Test DTC is set and the I/M System Status indicators are NO, diagnosis the DTC and perform the **Inspection/Maintenance Complete System Set Procedure**.

INSPECTION/MAINTENANCE COMPLETE SYSTEM SET PROCEDURE

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DESCRIPTION

The purpose of the Inspection/Maintenance (I/M) complete system set procedure is to satisfy the enable criteria necessary to execute all of the I/M readiness diagnostics and complete the trips for those particular diagnostics. When all I/M monitored diagnostic tests are completed, the I/M System Status indicators are set to YES. Perform the Inspection/Maintenance (I/M) Complete System Set Procedure if any I/M System Status indicators are set to NO.

CONDITIONS FOR MEETING A COLD START

- The ignition voltage between 10 and 15 V.
- The barometric pressure (BARO) is more than 75 kPa (10.9 psi).
- The engine coolant temperature (ECT) at start-up is less than 42°C (108°F).
- The intake air temperature (IAT) is between 2-32°C (36-90°F).

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- The engine is OFF for greater than 6 hours or the following conditions must be met:
 - The start-up IAT minus start-up ECT are within 12°C (22°F).
 - The start-up ECT minus start-up IAT are within 50°C (90°F).
- Fuel level is between 25 and 75 %.

CIRCUIT/SYSTEM VERIFICATION

Review the Inspection/Maintenance (I/M) System Status indicators. All I/M System Status indicators should report YES, and no I/M Test DTCs should be present.

INSPECTION/MAINTENANCE (I/M) SYSTEM SET PROCEDURE

1. Ensure that the vehicle meets the conditions for a cold start listed above.
 - If the EVAP I/M System Status indicator displays NO, perform the EVAP Service bay test if applicable.
2. Turn OFF all accessories; HVAC system, other electrical loads, including aftermarket/add-on equipment, etc., and open the hood.
3. Set the vehicle parking brake and ensure the vehicle is in park for automatic transmission or neutral for manual transmission.
4. Start and idle the engine for 2 min.

WARNING: Refer to Road Test Warning .

5. Close the hood, release the parking brake and Accelerate at part throttle to 72-80 km/h (45-50 mph) with this speed maintained until the engine reaches operating temperature, 8-10 min.
6. Continue operation under these conditions for an additional 6 min.
7. Accelerate at part throttle to 90 km/h (55 mph) with this speed maintained for 2 min.
8. Release the accelerator pedal for at least 10 s. This will allow the vehicle to enter the decel fuel cut off.

NOTE: Do NOT touch the accelerator pedal until told to do so. A change in TP Sensor angle or an increase in engine speed may invalidate this portion of the test.

9. Safely stop the vehicle, with the engine in drive for automatic or neutral with the clutch pedal depressed and parking brake applied for manual. Allow the vehicle to idle for 2 min.
10. Shift the vehicle to park for automatic and neutral for manual. Turn OFF the ignition and exit the vehicle. Do NOT disturb the vehicle for 45 min.
11. Observe the Inspection/Maintenance (I/M) System Status with a scan tool. All of the I/M System Status indicators should display YES.
 - If the EVAP I/M System Status indicator displays NO, turn OFF the ignition, ensure that the vehicle meets the conditions for a cold start, and repeat steps 6-11 three more times, or until the EVAP I/M System Status indicator transitions to YES. If the indicator continues to display NO,

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refer to the **Inspection/Maintenance (I/M) Test DTC Table** to identify the DTCs that did not run.

- If any of the I/M System Status indicators display NO, refer to the **Inspection/Maintenance (I/M) Test DTC Table** for the indicator which did not display YES. The I/M System DTC Table identifies the DTCs associated with each I/M System Status Indicator.

NOTE: An I/M Test DTC will not be stored or erased from the EC except at the end of trip processing, which occurs 5 s after ignition OFF.

12. Observe the I/M Test DTC information with a scan tool. Verify there are no I/M Test DTCs present.
 - If an I/M Test DTC is set, diagnose the DTC using the **Diagnostic Trouble Code (DTC) List - Vehicle** and refer to **Inspection/Maintenance System Check**.
13. Observe the engine DTC information with a scan tool. Verify no DTCs are present.
 - If a DTC is set, diagnose using the **Diagnostic Trouble Code (DTC) List - Vehicle**. After repairs, perform the **Inspection/Maintenance Complete System Set Procedure** to verify no further DTCs are set.

INSPECTION/MAINTENANCE I/M TEST DTC TABLE

System	DTCs Required to Set System Status to YES
If an I/M System Status indicator did NOT update to YES during the <u>Inspection/Maintenance Complete System Set Procedure</u> , review each indicator and reference this table to determine each DTC associated with the I/M System Status Indicator. Each DTC listed below has specific conditions that must be met for the diagnostic to run. Included within the conditions are additional DTCs, which if set, may inhibit the DTCs listed below from running. Reviewing and operating the vehicle within the Conditions for Running for each DTC listed below will allow the I/M System Status Indicators to transition to YES.	
Catalyst	<u>DTC P0420 or P0430</u>
EVAP	• <u>DTC P0442</u> • <u>DTC P0446</u> • <u>DTC P0450 or P0451 (LAU)</u> for LAU • <u>DTC P0451-P0454 (LF1)</u> for LF1 • <u>DTC P0455 or P0497 (LAU)</u> for LAU • <u>DTC P0455 (LF1)</u> for LF1 • <u>DTC P0496</u>
Oxygen Sensor	• <u>DTC P0130 (Without LF1)</u> for LAU • <u>DTC P0131, P0132, or P0134 (Without LF1)</u> for LAU • <u>DTC P0133, P013A, or P013E (Without LF1)</u> for LAU • <u>DTC P0137, P0138, or P0140 (Without LF1)</u> for LAU • <u>DTC P2270 (Without LF1)</u> for LAU • <u>DTC P2271 (Without LF1)</u> for LAU • <u>DTC P0131, P0132, P0137, P0138, P0151, P0152, P0157, P0158, P2A00, P2A01, P2A03, or P2A04 (LF1)</u> for LF1

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	• <u>DTC P0133, P013A-P013F, P014A, P014B, P0153, P1133, or P1153 (LF1)</u> for LF1 • <u>DTC P0134, P0140, P0154, or P0160 (LF1)</u> for LF1 • <u>DTC P2270 or P2272 (LF1)</u> for LF1 • <u>DTC P2271 or P2273 (LF1)</u> for LF1
Oxygen Sensor Heater	• <u>DTC P0030, P0031, P0032, P0036, P0037, or P0038 (Without LF1)</u> for LAU • <u>DTC P0135 or P0141 (Without LF1)</u> for LAU • <u>DTC P0030, P0036, P0050, P0053, P0054, P0056, P0059, P0060, P0135, P0141, P0155, or P0161 (LF1)</u> for LF1
Camshaft System	• <u>DTC P000A-P000D, P0011, P0014, P0021, or P0024 (Without LF1, LFW)</u> for LAU • <u>DTC P0011, P0014, P0021, or P0024 (LF1, LFW)</u> for LF1
AIR	• <u>DTC P2431-P2433</u> for LAU • <u>DTC P0418, P2257, or P2258</u> for LAU • <u>DTC P0411</u> for LAU

2010 ENGINE PERFORMANCE**Engine Controls and Fuel - 2. L, 3.0L, 3.2L, or 3. L - SRX****REPAIR INSTRUCTIONS****CRANKSHAFT POSITION SYSTEM VARIATION LEARN (LF1)**

NOTE: The Crankshaft Position System Variation Learn procedure is also required when the following service procedures have been performed, regardless of whether DTC P0315 is set:

- An engine replacement
- A engine control module ECM replacement
- A crankshaft balancer replacement
- A crankshaft replacement
- A crankshaft position sensor replacement
- Any engine repairs which disturb the crankshaft to crankshaft position sensor relationship.

NOTE: The ECM monitors certain component signals to determine if all the conditions are met to continue with the crankshaft position System Variation Learn Procedure. The scan tool only displays the condition that inhibits the procedure. The scan tool displays the signals of the following components:

- Crankshaft position sensors activity - If there is a crankshaft position sensor condition, refer to the applicable DTC that set.
- Camshaft position sensor signal activity - If there is a camshaft position sensor signal condition, refer to the applicable DTC that set.
- Engine coolant temperature ECT - If the engine coolant temperature is not warm enough, idle the engine until the engine coolant temperature reaches the correct temperature.

1. Install a scan tool.
2. Monitor the ECM for DTCs with a scan tool. If other DTCs are set, except DTC P0315, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** for the applicable DTC that set.
3. With a scan tool, select the Crankshaft Position System Variation Learn Procedure and perform the following
 1. Block drive wheels.
 2. Set parking brake.
 3. DO NOT apply brake pedal.
 4. Cycle ignition from OFF to ON.
 5. Apply and hold brake pedal for the duration of the procedure.

6. Start and idle engine.
7. Turn the air conditioning (A/C) OFF.
8. The vehicle must remain in Park or Neutral.

NOTE: While the learn procedure is in progress, release the throttle immediately when the engine starts to decelerate. The engine control is returned to the operator and the engine responds to throttle position after the learn procedure is complete.

9. Accelerate to wide open throttle (WOT) and release when the fuel cut-off occurs.
4. The scan tool displays **Learn Status** **Learned this Ignition**. If the scan tool indicates that DTC P0315 ran and passed, the crankshaft position variation learn procedure is complete. If the scan tool indicates DTC P0315 failed or did not run, or another DTC is present, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** and perform the appropriate diagnostic procedure.
5. Once the learn procedure has successfully completed, and in order to store the crankshaft position system variation values in the ECM, turn OFF the ignition and verify all vehicle systems are OFF. This may take up to 2 minutes.

ENGINE CONTROL MODULE REPLACEMENT

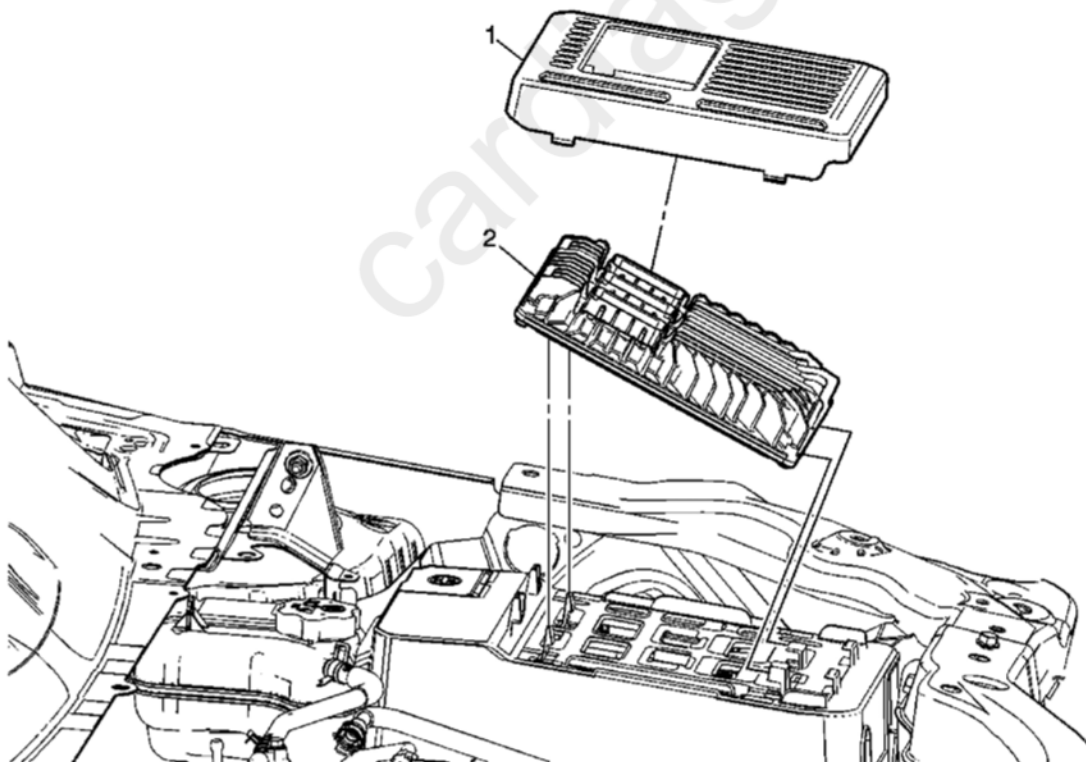


Fig. 1: Identifying Engine Control Module
Courtesy of GENERAL MOTORS CORP.

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Callout	Component Name
1	Engine Control Module Cover Engine Control Module CA TION: • 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 not touch the connector pins or the soldered components on the circuit board. • Remove any debris from around the control module connector surfaces before servicing the 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.
2	CA TION: In order to prevent any possible electrostatic discharge damage to the ECM, do not touch the connector pins. Procedure 1. Use a DVOM in order to measure the main relay circuit voltage at the ECM/TCM/IGN fuse in the underhood fuse block. Refer to <u>Electrical Center Identification Views</u>. 2. Use a DVOM in order to measure the main relay circuit voltage at the TCM/BATT fuse in the underhood fuse block. Refer to <u>Electrical Center Identification Views</u>. 3. Disconnect the negative battery cable. Refer to <u>Battery Negative Cable Disconnection and Connection</u>. 4. Remove the TCM/BATT fuse from the underhood fuse block. Refer to <u>Electrical Center Identification Views</u>. 5. Remove the ECM/TCM/IGN fuse from the underhood fuse block. Refer to <u>Electrical Center Identification Views</u>. 6. Disconnect the electrical connectors. 7. It is necessary to record the remaining engine oil life. If the replacement module is not programmed with the remaining engine oil life, the engine oil life will default to 100 percent. If the replacement module is not programmed with the remaining engine oil life, the engine oil will need to be changed at 5000 km (3,000 mi) from the last

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engine oil change.

8. It is necessary to record the remaining automatic transmission fluid life. If the replacement module is not programed with the remaining automatic transmission fluid life, the automatic transmission fluid life will default to 100 percent. If the replacement module is not programmed with the remaining automatic transmission fluid life, the automatic transmission fluid will need to be changed at 83000 km (50,000 mi) from the last automatic transmission fluid change.
9. Ensure that there is no main relay circuit voltage (ECM/TCM/IGN Fuse).
10. If replacing, reprogram the ECM. Refer to **Engine Control Module Programming and Setup (LAU)** or **Engine Control Module Programming and Setup (LF1)**.

THROTTLE IDLE LEARN (LF1 LFW)

Description

The engine control module (ECM) learns the airflow through the throttle body to ensure the correct idle. The learned airflow values are stored within the ECM. These values are learned to adjust for production variation and will continuously learn during the life of the vehicle to compensate for reduced airflow due to throttle body coking. Anytime the throttle body airflow rate changes, for example due to cleaning or replacing, the values must be relearned.

An engine that had a heavily coked throttle body that has been cleaned or replaced may take several drive cycles to learn out the coking. To accelerate the process, the scan tool has the ability to reset all learned values back to zero. A new ECM will also have values set to zero.

The idle may be unstable or a DTC may set if the learned values do not match the actual airflow.

Conditions for Running the Throttle Learn Procedure

Reset Procedure

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0122, P0123, P0128, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0220, P0222, P0223, P0300, P0351, P0352, P0353, P0496, P0601, P0604, P0606, P060D, P0641, P0651, P1516, P2101, P2119, P2120, P2122, P2123, P2125, P2127, P2128, P2135, P2138, or P2176 are not set.
- Ignition ON, engine OFF.
- The vehicle speed sensor (VSS) is 0 km/h (0 mph).

Learn Procedure

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0122, P0123, P0128, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0220, P0222, P0223, P0300, P0351, P0352, P0353, P0496, P0601, P0604, P0606, P060D, P0641, P0651, P1516, P2101, P2119, P2120, P2122, P2123, P2125, P2127, P2128, P2135, P2138, or P2176 are not set.
- The engine speed is between 450-4,000 RPM.
- The manifold absolute pressure (MAP) is greater than 5 kPa.

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- The mass air flow (MAF) is greater than 2 g/s.
- The ignition voltage is greater than 10 volts.

Throttle Learn

Reset Procedure (Performed after the throttle body is cleaned or replaced)

1. Ignition ON, engine OFF, perform the Idle Learn Reset in Module Setup with a scan tool.
2. Start the engine and monitor the TB Idle Airflow Compensation parameter. The TB Idle Airflow Compensation value should equal 0 percent and the engine should be idling at a normal idle speed.
3. Clear the DTCs and return to the diagnostic that referred you here.

Learn Procedure (Performed after the ECM is flashed or replaced)

NOTE: Do NOT perform this procedure if DTCs are set. Refer to Diagnostic Trouble Code DTC List - Vehicle.

1. Start and idle the engine for 3 minutes.
2. With a scan tool, monitor the Desired Idle Speed and the actual Engine Speed.
3. The ECM will start to learn the new idle cells and Desired Idle Speed should start to decrease.
4. Ignition OFF for 60 seconds.
5. Start and idle the engine for 3 minutes.
6. After the 3 minute run time the engine should be idling normal.

NOTE: During the drive cycle the check engine light may come on with idle speed DTCs. If idle speed codes are set, clear codes so the ECM can continue to learn.

- If the engine idle speed has not been learned the vehicle will need to be driven at speeds above 70 km/h (44 mph) with several decelerations and extended idles.
7. After the drive cycle, the engine should be idling normally.
 - If the engine idle speed has not been learned, turn OFF the ignition for 60 seconds and repeat step 6.
8. Once the engine speed has returned to normal, clear DTCs and return to the diagnostic that referred you here.

THROTTLE IDLE LEARN (WITHOUT LF1 LFW)

Description

The engine control module (ECM) learns the idle position of the throttle body to ensure the correct idle operation. Anytime the ECM or the throttle body is replaced, the ECM must learn the idle position. The engine idle may be unstable or a DTC may set if the idle position is not learned.

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Conditions for Running the Idle Learn Procedure

- DTCs P0121, P0122, P0123, P0221, P0222, P0223, P0638, P2100, P2101, P2105, and P2119 are not set.
- The engine speed is less than 40 RPM.
- The vehicle speed is 0 km/h (0 mph).
- The accelerator pedal position is less than 14.9 percent.
- The ignition 1 voltage is more than 10 volts.
- The engine coolant temperature is between 5-85 °C (41-185 °F).
- The intake air temperature is between 5-60 °C (41-140 °F).

Idle Learn Procedure

NOTE:

- Ensure the above conditions are met before performing with this procedure.
- Do not perform this procedure if a throttle position sensor or other throttle actuator control TAC system DTCs are set other than P2100. The ECM will not perform the idle learn procedure with a DTC set.

1. Turn OFF the ignition for 30 seconds.
2. Turn ON the ignition, with the engine OFF for 60 seconds.
3. Turn OFF the ignition.
4. Turn ON the ignition, with the engine OFF.
5. Clear the DTCs with a scan tool.

ENGINE COOLANT TEMPERATURE SENSOR REPLACEMENT (LF1)

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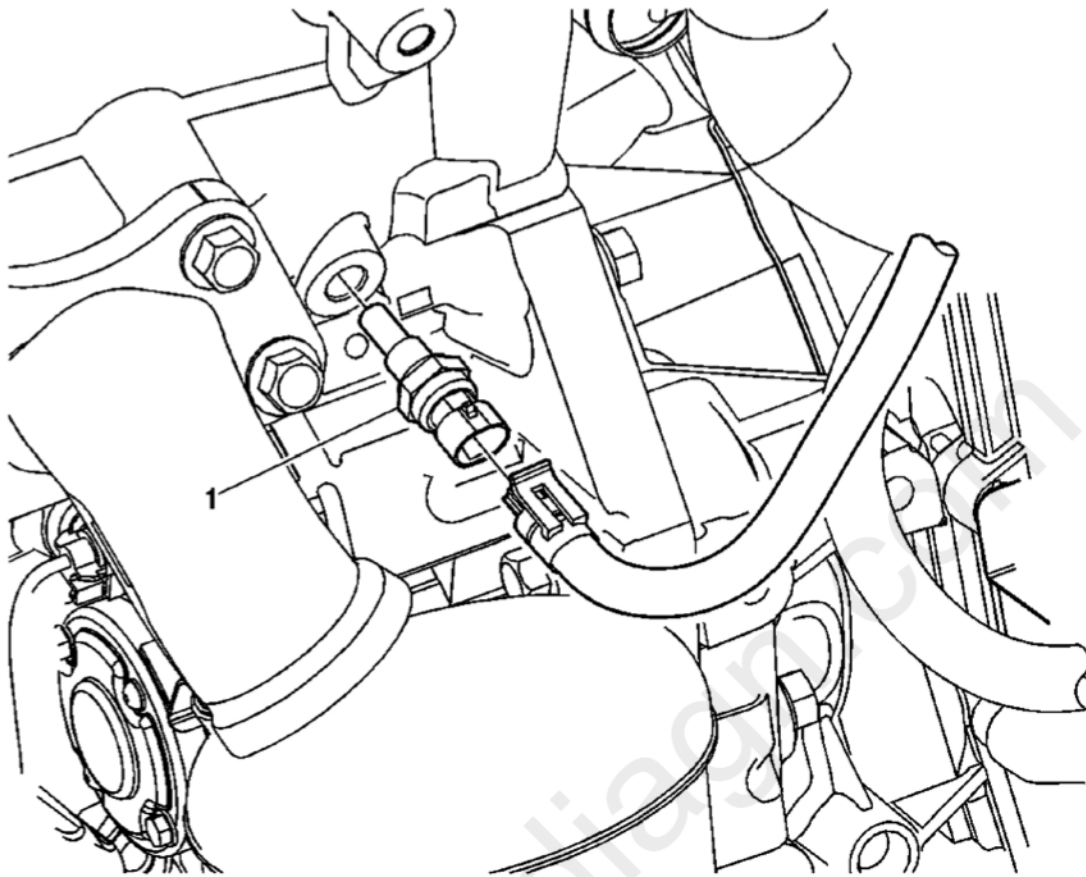
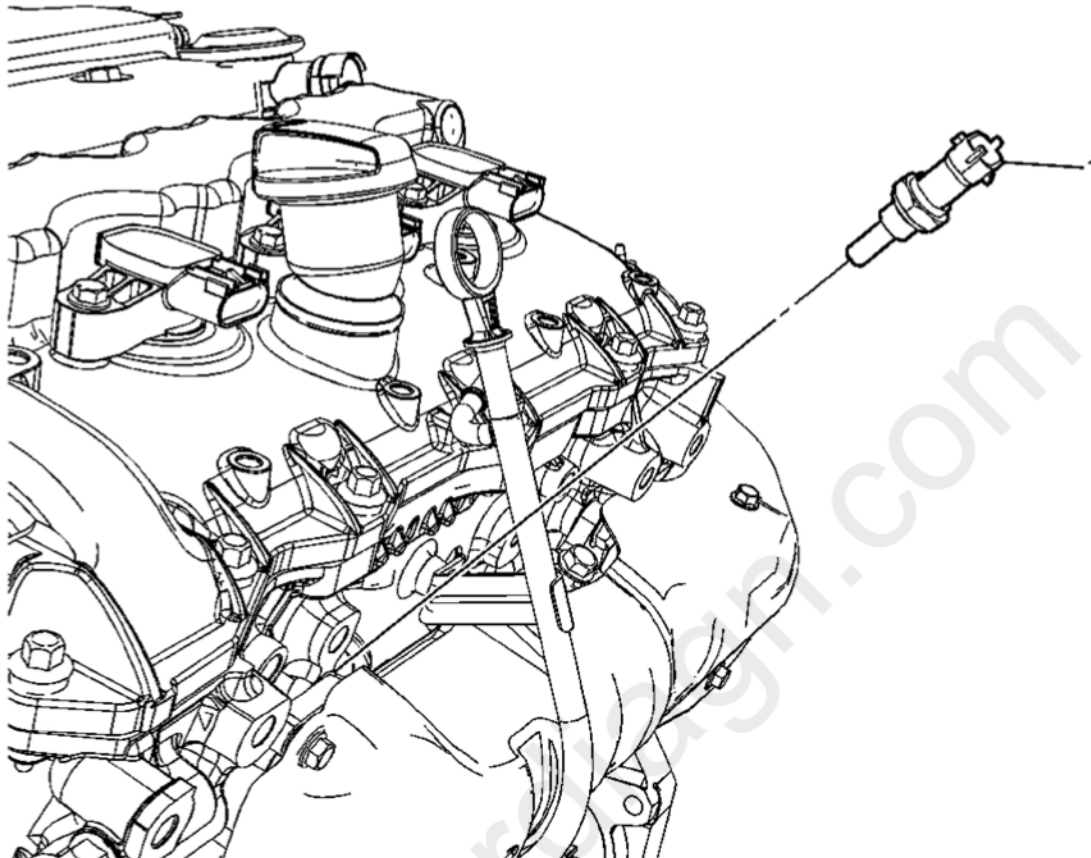


Fig. 2: Identifying Engine Coolant Temperature Sensor (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Partially drain the cooling system. Refer to <u>Cooling System Draining and Filling (Static Fill LF1)</u> or <u>Cooling System Draining and Filling - Vac-N-Fill (GE 47716)</u> or <u>Cooling System Draining and Filling (Static Fill LAU)</u> .	
1	Engine Coolant Temperature Sensor CA TION: Refer to <u>Fastener Caution</u> . Procedure 1. Reposition the sensor heat shield. 2. Disconnect the ECT sensor harness connector. Tighten: 20 N.m (35 lb in)

ENGINE COOLANT TEMPERATURE SENSOR REPLACEMENT (LAU)**Fig. 3: Identifying Engine Coolant Temperature Sensor (LAU)**

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> . 2. Remove the oil level indicator tube. Refer to <u>Oil Level Indicator Tube Replacement (LAU)</u> . 3. Partially drain the cooling system. Refer to <u>Cooling System Draining and Filling (Static Fill LF1)</u> or <u>Cooling System Draining and Filling - Vac-N-Fill (GE 47716)</u> or <u>Cooling System Draining and Filling (Static Fill LAU)</u> .	
1	Engine Coolant Temperature Sensor CA TION: Refer to <u>Fastener Caution</u> . Procedure:

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Disconnect the electrical connector.

Tighten: 22 N.m (16 lb ft)

MASS AIRFLOW SENSOR WITH INTAKE AIR TEMPERATURE SENSOR REPLACEMENT (LF1)

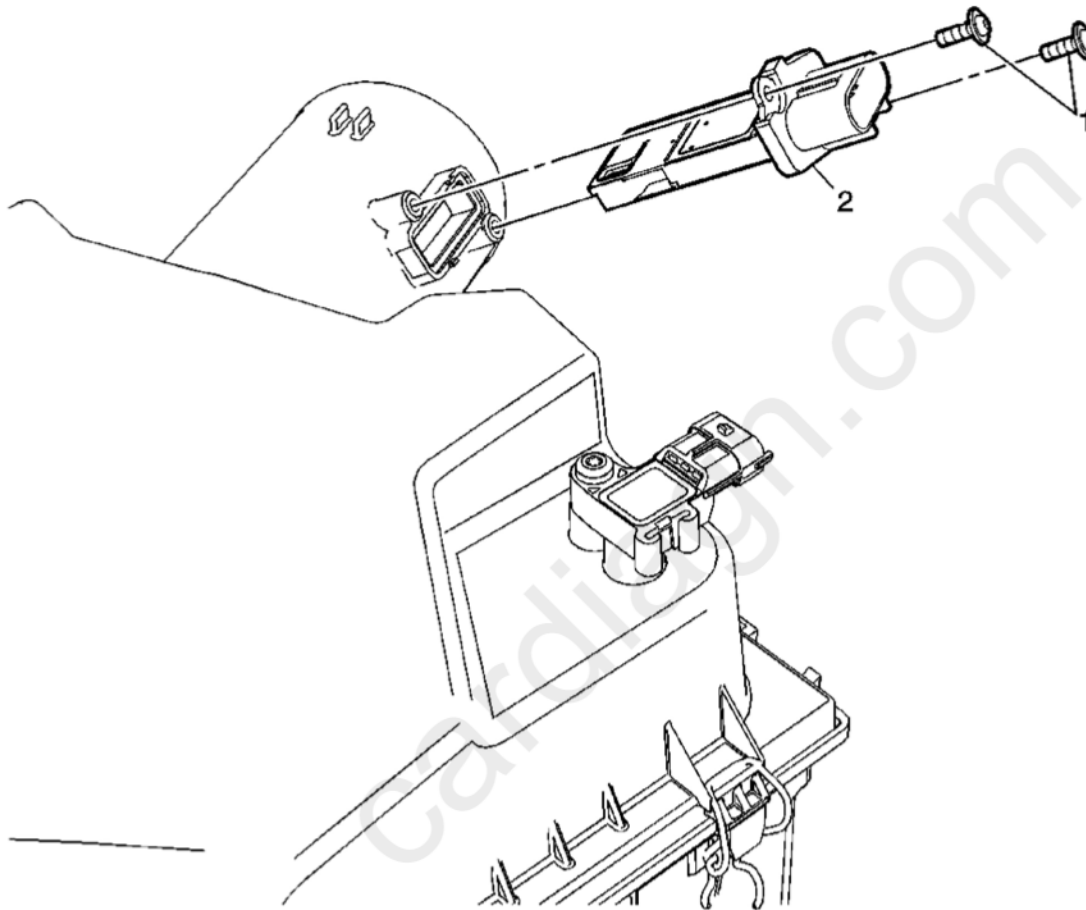


Fig. 4: Identifying Mass Airflow Sensor with Intake Air Temperature Sensor (LF1)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Mass Airflow Sensor Fastener (ty 2) CA TION: Refer to <u>Fastener Caution</u> . Tighten: 3 N.m (27 lb in)
2	Mass Airflow Sensor with Intake Air Temperature Sensor Procedure: Disconnect the electrical connector.

MASS AIRFLOW SENSOR WITH INTAKE AIR TEMPERATURE SENSOR REPLACEMENT (LAU)

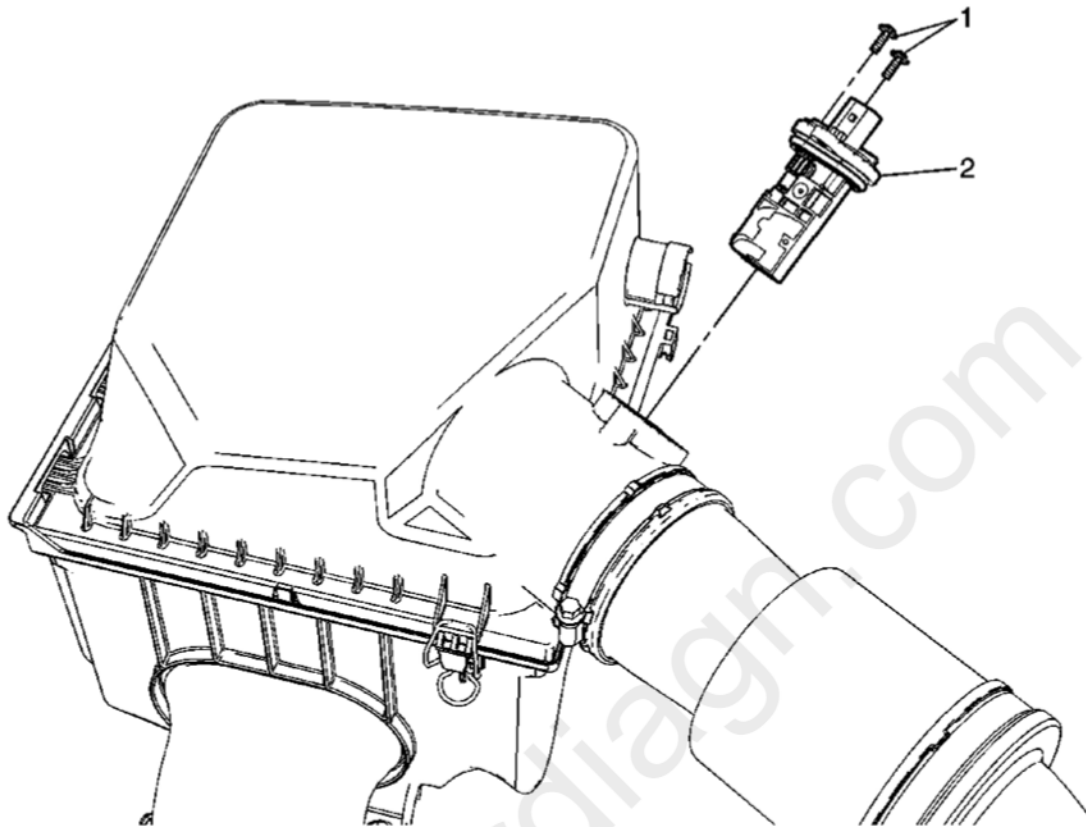


Fig. 5: View Of Mass Airflow Sensor with Intake Air Temperature Sensor (LAU)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Mass Airflow Sensor Fastener (ty 2) CA TION: Refer to <u>Fastener Caution</u> . Tighten: 4 N.m (35 lb in)
2	Mass Airflow Sensor with Intake Air Temperature Sensor Procedure: Disconnect the electrical connector.

MANIFOLD ABSOLUTE PRESSURE SENSOR REPLACEMENT (LF1)

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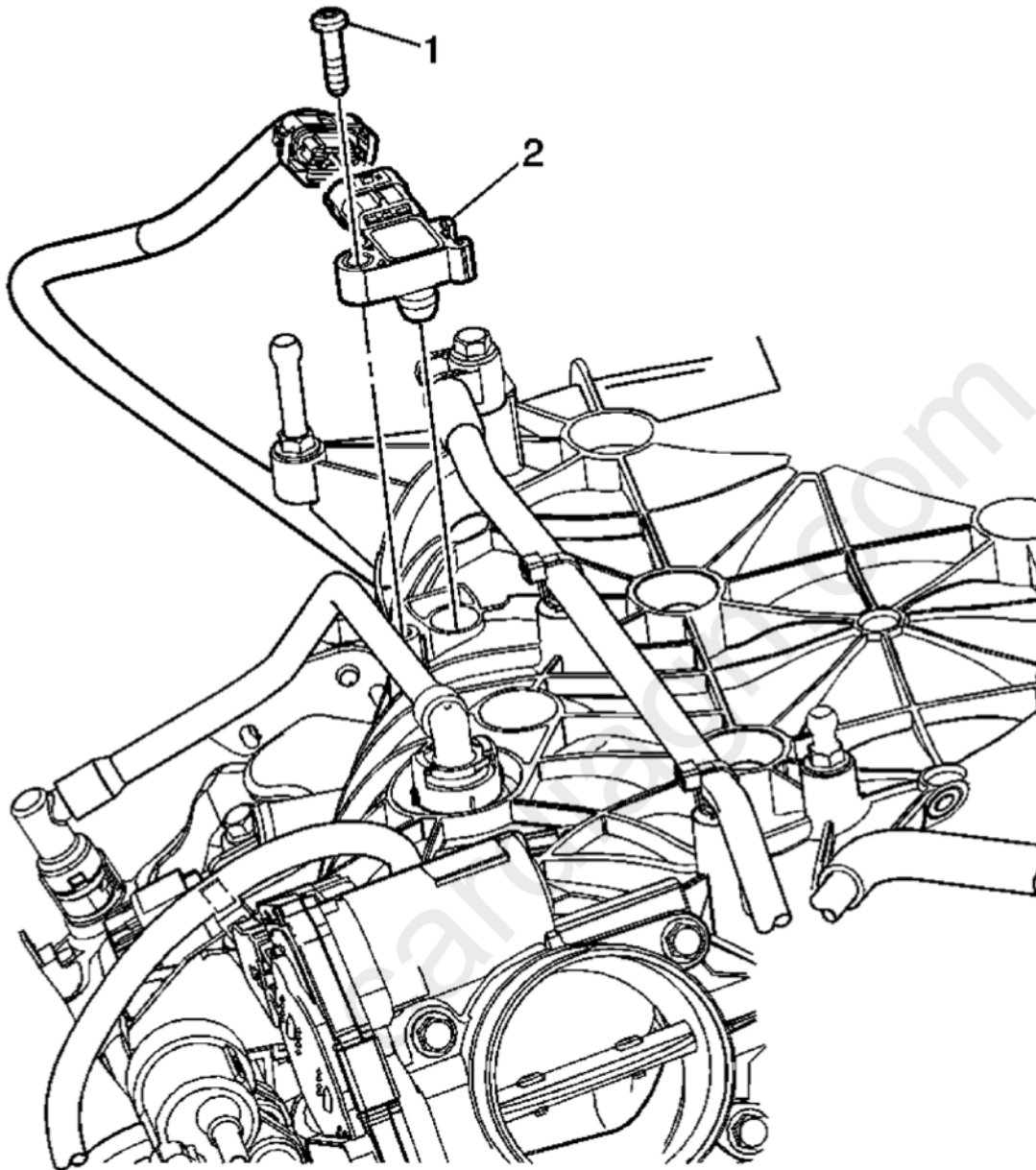


Fig. : Identifying Manifold Absolute Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
1	Bolt CAUTION: Refer to <u>Fastener Caution</u> .

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	Tighten: 5 N.m (44 lb in)
2	Manifold Absolute Pressure Sensor Procedure: Disconnect the electrical connector.

THROTTLE INLET ABSOLUTE PRESSURE SENSOR REPLACEMENT (LF1)

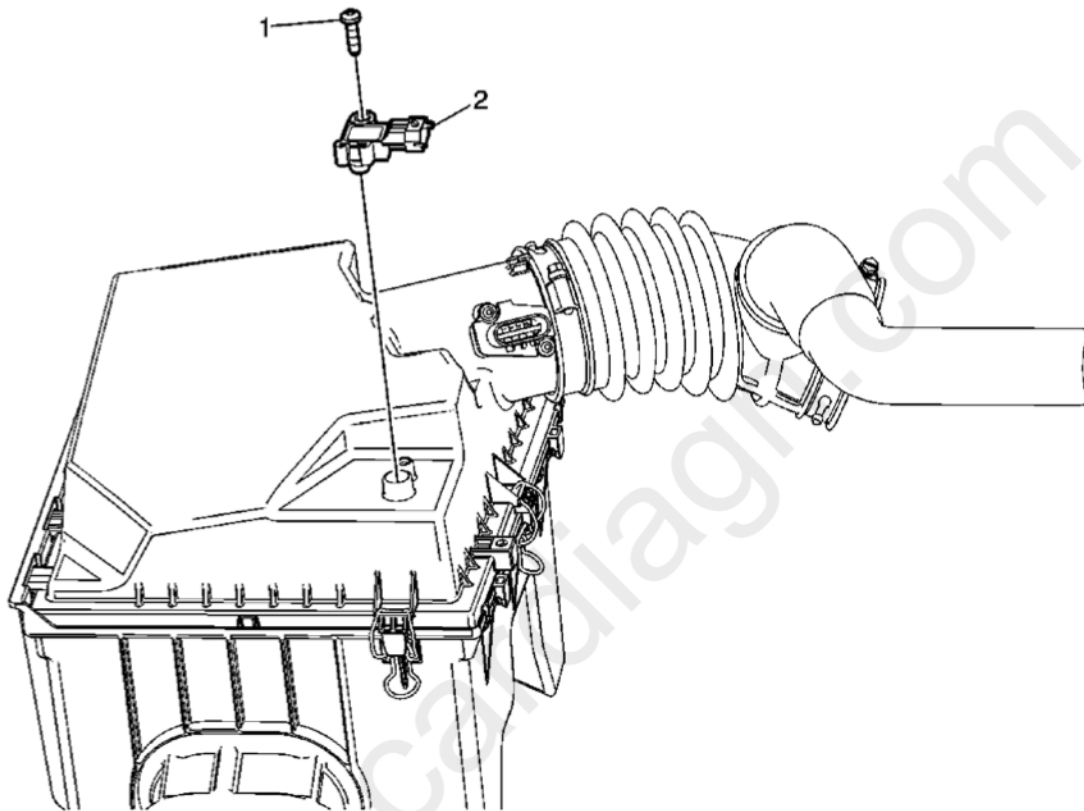


Fig. : Locating Throttle Inlet Absolute Pressure Sensor (LF1)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Throttle Inlet Absolute Pressure Sensor Fastener CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 4 N.m (35 lb in)
2	Throttle Inlet Absolute Pressure Sensor Procedure: Disconnect the electrical connector.

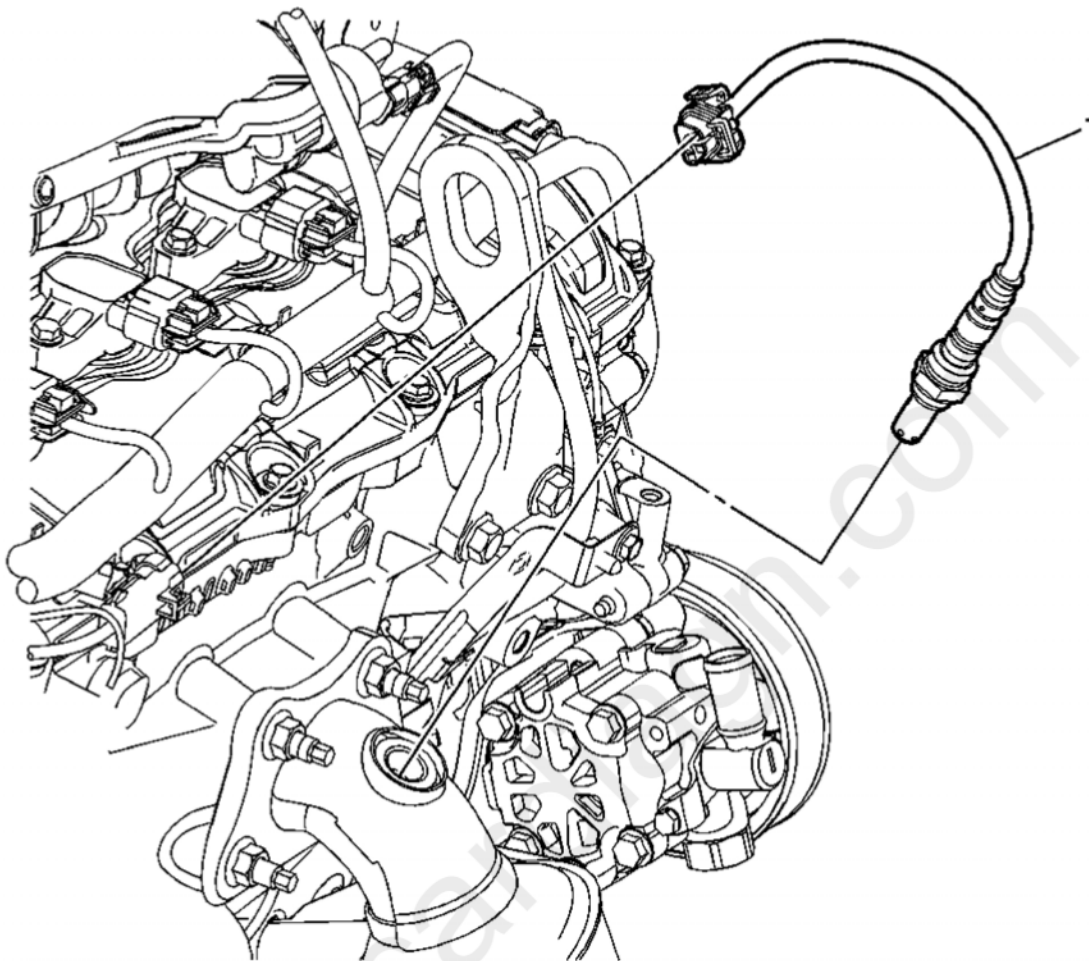
HEATED OXYGEN SENSOR REPLACEMENT - BANK 1 SENSOR 1 (LF1)

Fig. : Identifying Heated Oxygen Sensor - Bank 1 Sensor 1 (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. If equipped with FWD, raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. If equipped with AWD, lower the front suspension frame. Refer to <u>Drivetrain and Front Suspension Frame Replacement</u> .	
	Heated Oxygen Sensor
	CAUTION: Refer to <u>Heated Oxygen and Oxygen Sensor Caution</u> .
	CAUTION:

Refer to Fastener Caution .

Procedure

1. Disconnect the heated oxygen sensor harness connector.
2. If reinstalling the old sensor, coat the threads with anti-sieze compound. Refer to Adhesives, Fluids, Lubricants, and Sealers .

1

Tip: A special anti-sieze compound is used in the O₂S threads. The compound consists of liquid graphic and glass beads. The graphic tends to burn away, but the glass beads remain, making the sensor easier to remove. New, or service replacement sensors already have the compound applied to the threads. If the sensor is removed from an exhaust component and if for any reason the sensor is to be reinstalled, the threads must have anti-sieze compound applied before reinstallation.

Tighten: 42 N.m (31 lb in)

HEATED OXYGEN SENSOR REPLACEMENT - BANK 1 SENSOR 2 (LF1)

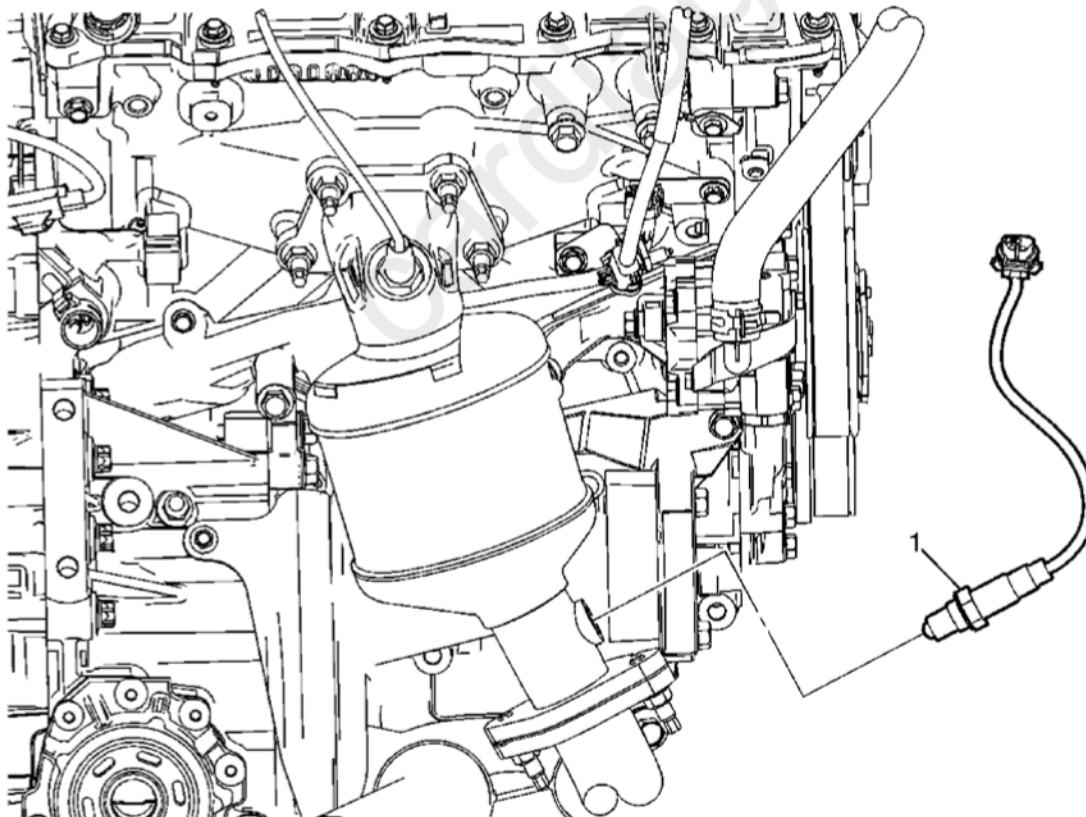


Fig. : Identifying Heated Oxygen Sensor - Bank 1 Sensor 2 (LF1)
Courtesy of GENERAL MOTORS CORP.

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Callout	Component Name
Preliminary Procedure: Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
1	Heated Oxygen Sensor CAUTION: Refer to <u>Heated Oxygen and Oxygen Sensor Caution</u> . CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Disconnect the heated oxygen sensor harness connector. 2. If reinstalling the old sensor, coat the threads with anti-seize compound. Refer to <u>Adhesives, Fluids, Lubricants, and Sealers</u> . Tip: A special anti-seize compound is used in the O₂S threads. The compound consists of liquid graphic and glass beads. The graphic tends to burn away, but the glass beads remain, making the sensor easier to remove. New, or service replacement sensors already have the compound applied to the threads. If the sensor is removed from an exhaust component and if for any reason the sensor is to be reinstalled, the threads must have anti-seize compound applied before reinstallation. Tighten: 42 N.m (31 lb in)

HEATED OXYGEN SENSOR REPLACEMENT - BANK 2 SENSOR 1 (LF1)

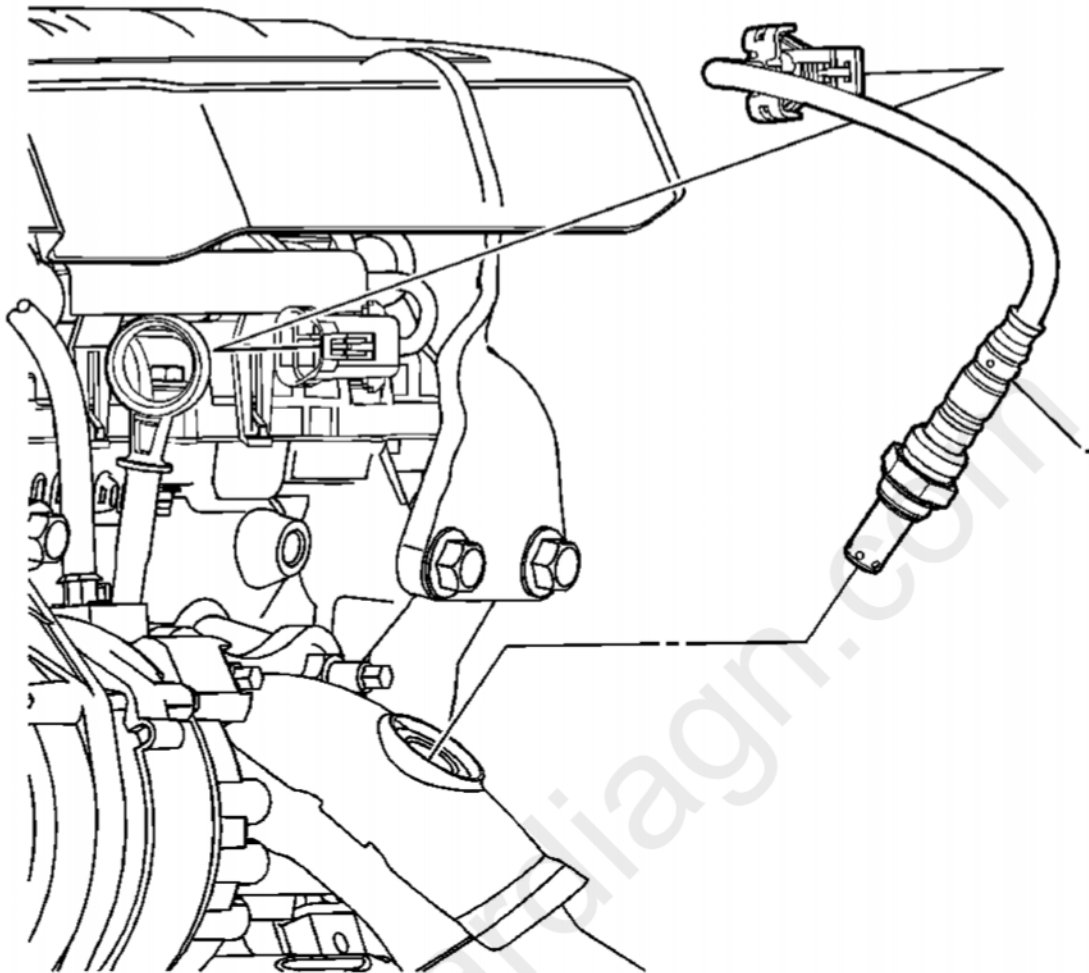


Fig. 10: Identifying Heated Oxygen Sensor - Bank 2 Sensor 1 (LF1)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Heated Oxygen Sensor CAUTION: Refer to <u>Heated Oxygen and Oxygen Sensor Caution</u> . CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Disconnect the heated oxygen sensor harness connector. 2. If reinstalling the old sensor, coat the threads with anti-sieze compound. Refer to <u>Adhesives, Fluids, Lubricants, and Sealers</u> .

Tip: A special anti-seize compound is used in the HO2S threads. The compound consists of lithium graphic and glass beads. The graphic tends to burn away, but the glass beads remain, making the sensor easier to remove. New, or service replacement sensors already have the compound applied to the threads. If the sensor is removed from an exhaust component and if for any reason the sensor is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

Tighten: 42 N.m (31 lb in)

HEATED OXYGEN SENSOR REPLACEMENT - BANK 2 SENSOR 2 (LF1)

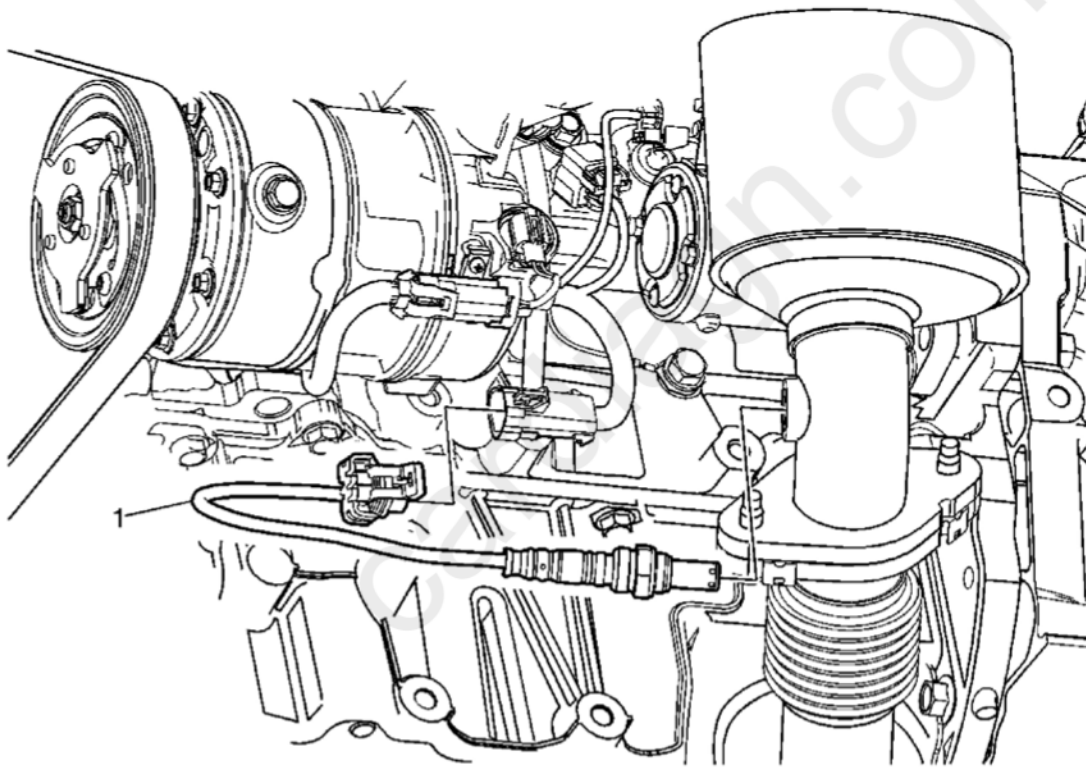


Fig. 11: Locating Heated Oxygen Sensor - Bank 2 Sensor 2 (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
	Heated Oxygen Sensor
	CAUTION: Refer to <u>Heated Oxygen and Oxygen Sensor Caution</u> .

CAUTION:

Refer to astener Caution .

Procedure

1. Disconnect the heated oxygen sensor harness connector.
2. If reinstalling the old sensor, coat the threads with anti-sieze compound. Refer to Adhesives, Fluids, Lubricants, and Sealers .

1

Tip: A special anti-sieze compound is used in the HO2S threads. The compound consists of li uid graphic and glass beads. The graphic tends to burn away, but the glass beads remain, making the sensor easier to remove. New, or service replacement sensors already have the compound applied to the threads. If the sensor is removed from an exhaust component and if for any reason the sensor is to be reinstalled, the threads must have anti-sieze compound applied before reinstallation.

Tighten: 42 N.m (31 lb in)

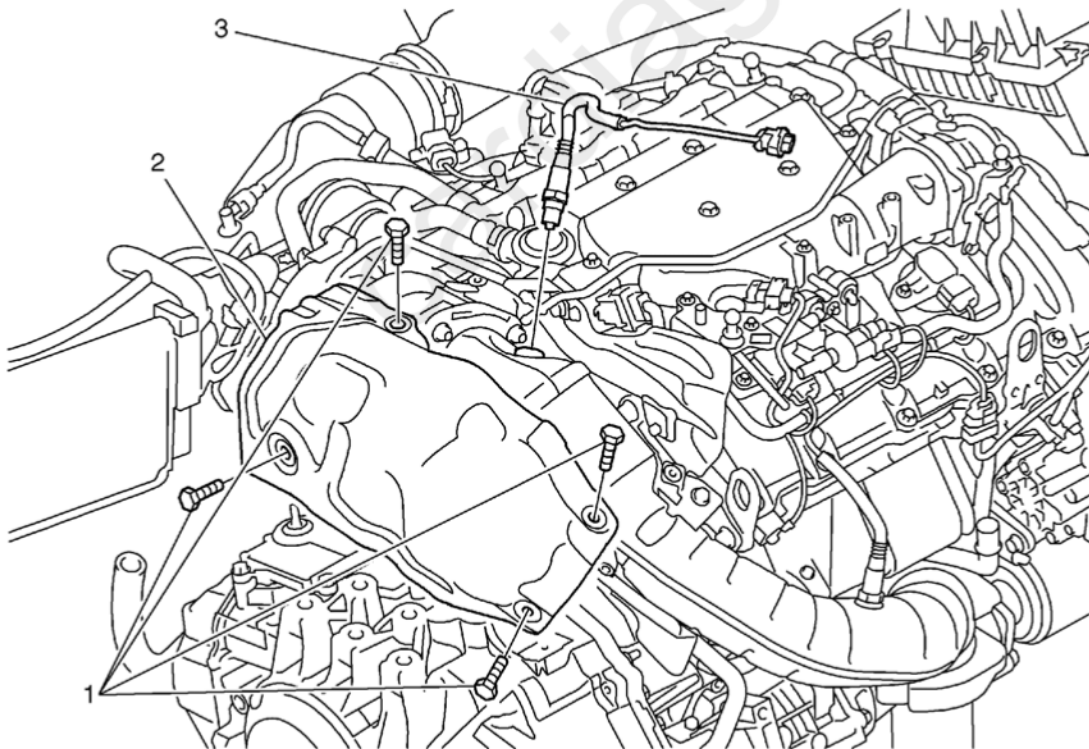
HEATED OXYGEN SENSOR REPLACEMENT - SENSOR 1 (LAU)

Fig. 12: Identifying Heated Oxygen Sensor - Sensor 1 (LAU)
Courtesy of GENERAL MOTORS CORP.

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2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Preliminary Procedure:

Remove the intake manifold cover. Refer to Intake Manifold Cover Replacement .

1	Catalytic Converter Front Heat Shield Fastener (ty 4) CAUTION: Refer to <u>astener Caution</u> . Tighten: 8 N.m (71 lb in)
2	Catalytic Converter Front Heat Shield
3	Heated Oxygen Sensor Procedure: Disconnect the electrical connector. Tighten: 42 N.m (31 lb ft)

HEATED OXYGEN SENSOR REPLACEMENT - SENSOR 2 (LAU)

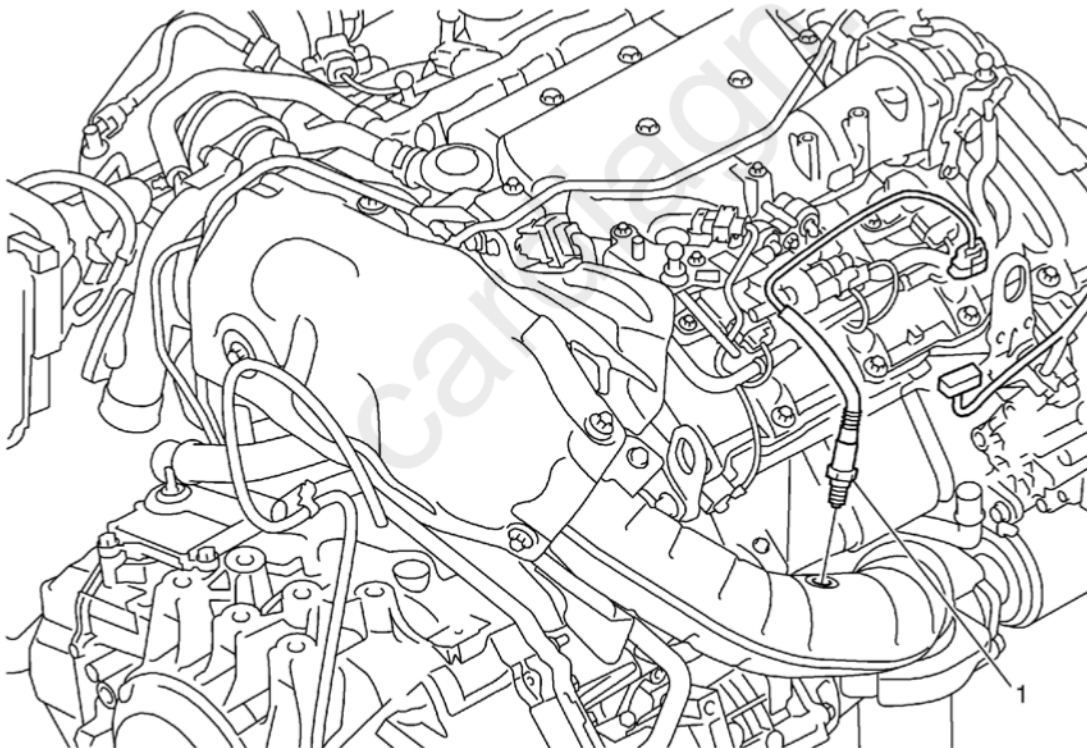


Fig. 13: Identifying Heated Oxygen Sensor - Sensor 2 (LAU)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
	Heated Oxygen Sensor

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1

CAUTION:

Refer to astener Caution .

Procedure:

Disconnect the electrical connector.

Tighten: 42 N.m (31 lb ft)

ACCELERATOR PEDAL WITH POSITION SENSOR ASSEMBLY REPLACEMENT

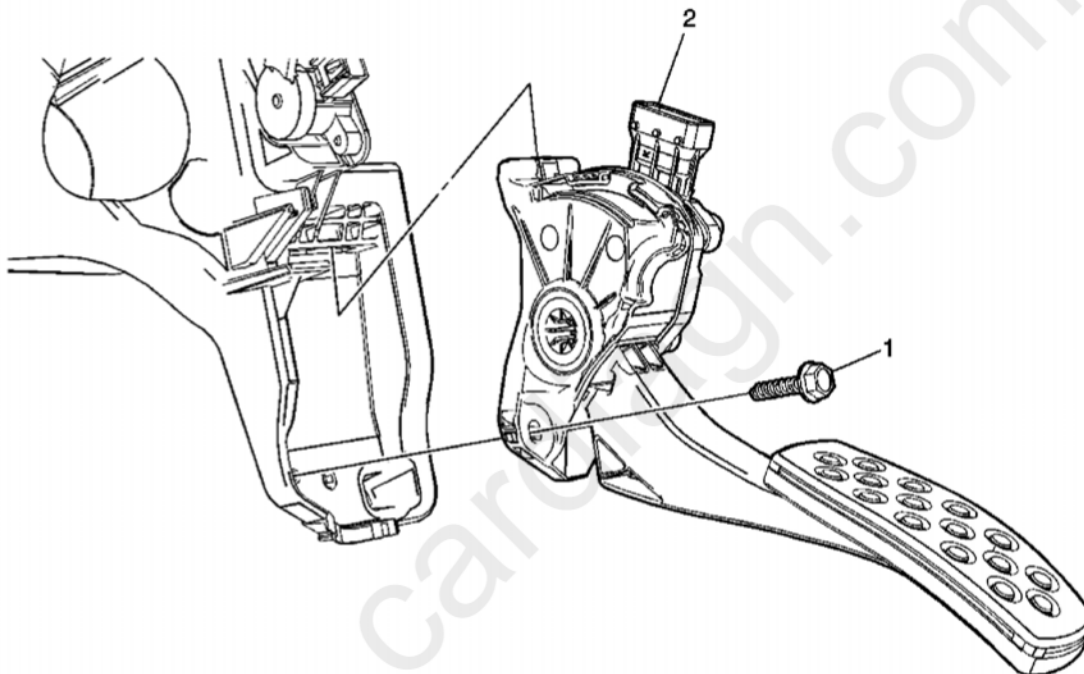


Fig. 14: Identifying Accelerator Pedal With Position Sensor Assembly
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Accelerator Pedal Position Sensor Assembly Bolt CAUTION: Refer to <u>astener Caution</u> Tighten: 9 N.m (80 lb in)
2	Accelerator Pedal Position Sensor Assembly

THROTTLE BODY ASSEMBLY REPLACEMENT (LF1)

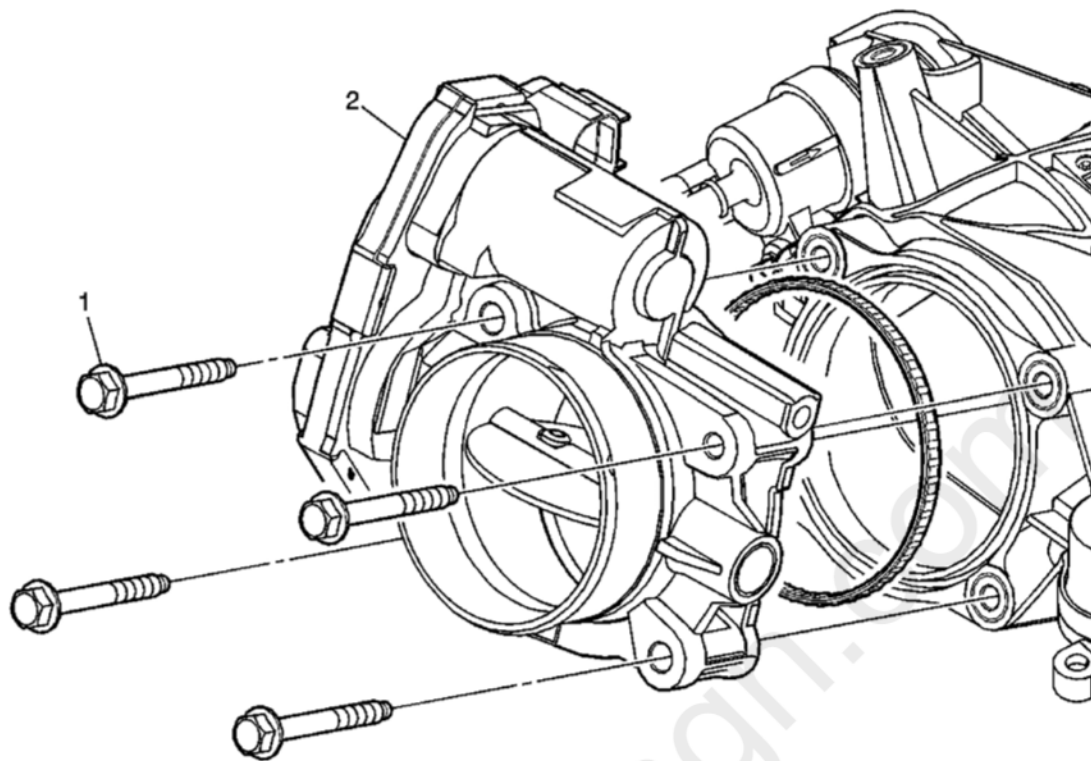


Fig. 15: View Of Throttle Body Assembly Bolts (LF1)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the air cleaner outlet duct. Refer to <u>Air Cleaner Outlet Duct Replacement (LF1)</u> .	
1	Throttle Body Fastener Qty: 4 CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 10 N.m 7 lb in
2	Throttle Body Procedure 1. Disconnect the throttle body harness electrical connector. 2. Install a new throttle body seal. 3. Perform the throttle learn procedure. Refer to <u>Throttle Idle Learn (LF1 LF2)</u>.

THROTTLE BODY ASSEMBLY REPLACEMENT (LAU)

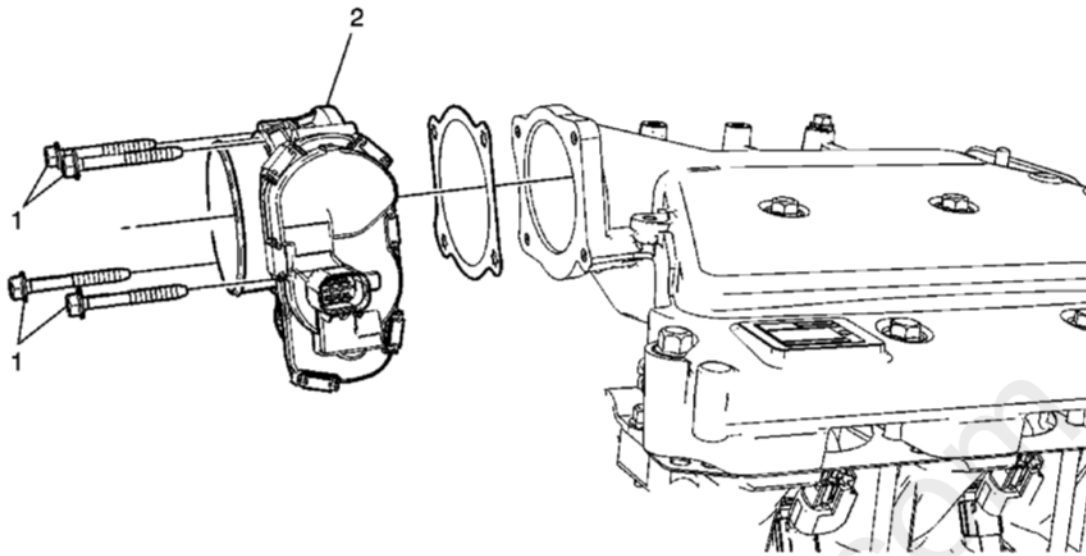


Fig. 16: View Of Throttle Body Assembly Bolts (LAU)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the charge air cooler outlet duct and support bracket. Refer to <u>Charge Air Cooler Outlet Duct Replacement</u> .	
1	Throttle Body Fastener Qty: 4 CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 10 N.m 11 lb in
2	Throttle Body Procedure 1. Disconnect the electrical connector. 2. Install a New throttle body seal. 3. Perform the throttle learn procedure. Refer to <u>Throttle Idle Learn (Callout LF1 LF2)</u>.

THROTTLE BODY INSPECTION AND CLEANING

NOTE: Over extended time and mileage, deposits may accumulate on the back of the throttle valve plate. The source of the deposit is exhaust gas recirculation (EGR) gas. Typically these deposits pose no problem. Occasionally the deposit may accumulate to a point where perceived pedal effort or throttle valve movement

is effected. This procedure should not be performed on vehicles with mileage under 80 450 km (50,000 mi).

1. Remove the air cleaner outlet duct. Refer to Air Cleaner Outlet Duct Replacement (LF1) or Air Cleaner Outlet Duct Replacement (LAU).

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

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

2. Inspect the throttle body bore and the throttle valve plate for deposits. You will need to open the throttle valve in order to inspect all surfaces.

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

3. Clean the throttle body bore and the throttle valve plate using a clean shop towel with top engine cleaner. Refer to Additives Fluids Lubricants and Sealers.
4. Install the air cleaner outlet duct. Refer to Air Cleaner Outlet Duct Replacement (LF1) or Air Cleaner Outlet Duct Replacement (LAU).
5. Perform the throttle idle learn procedure. Refer to Throttle Idle Learn (LF1 LF) or Throttle Idle Learn (LF1 LF).

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.

NOTE: If a scan tool is not available, WAIT at LEAST 2 hours after the engine has been run, before removing the high pressure fuel line.

1. Install a scan tool to the vehicle and command the fuel pump relay OFF, allowing the low pressure fuel pump to shut off.
2. Start the vehicle and allow the engine to idle until the engine stops. The engine will stop in approximately 20-30 seconds.
3. Turn the ignition OFF.
4. Using the scan tool, verify that there is little to no fuel pressure, if there still is fuel pressure repeat step 2.

FUEL PRESSURE GAUGE INSTALLATION AND REMOVAL

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Special Tools

CH 48027: Digital Pressure Gauge

For equivalent regional tools, refer to **Special Tools**

Installation Procedure

WARNING: Refer to **Gasoline/Gasoline Vapors Warning** .

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.

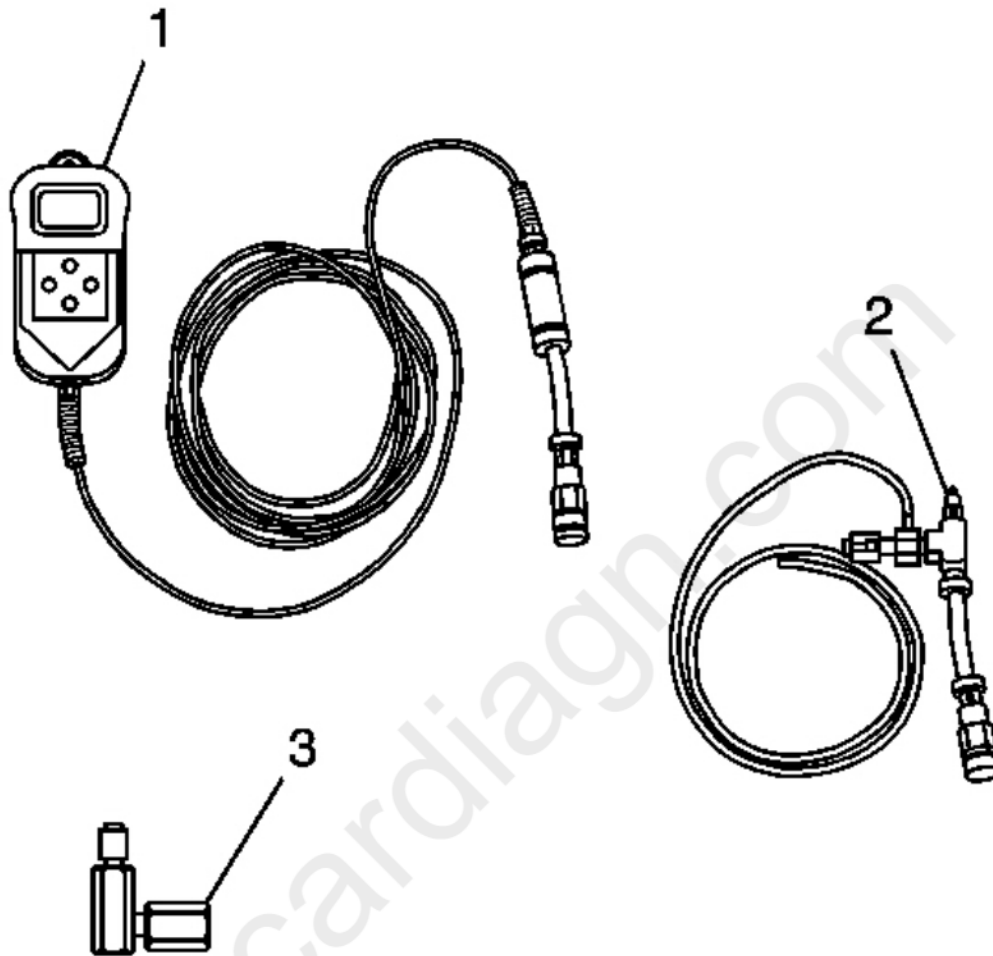


Fig. 17: Identifying CH-48027-100 Components
 Courtesy of GENERAL MOTORS CORP.

1. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief**.
2. Connect the **CH 48027**: gauge 1 to the **CH 48027**: adapter 2 .
3. Remove the shop towel from around the fuel rail service port, and place in an approved gasoline container.
4. Perform any tests and or diagnostics as needed. For the proper usage of the **CH 48027**: gauge 1 , refer to the manufacture s directions.

Removal Procedure

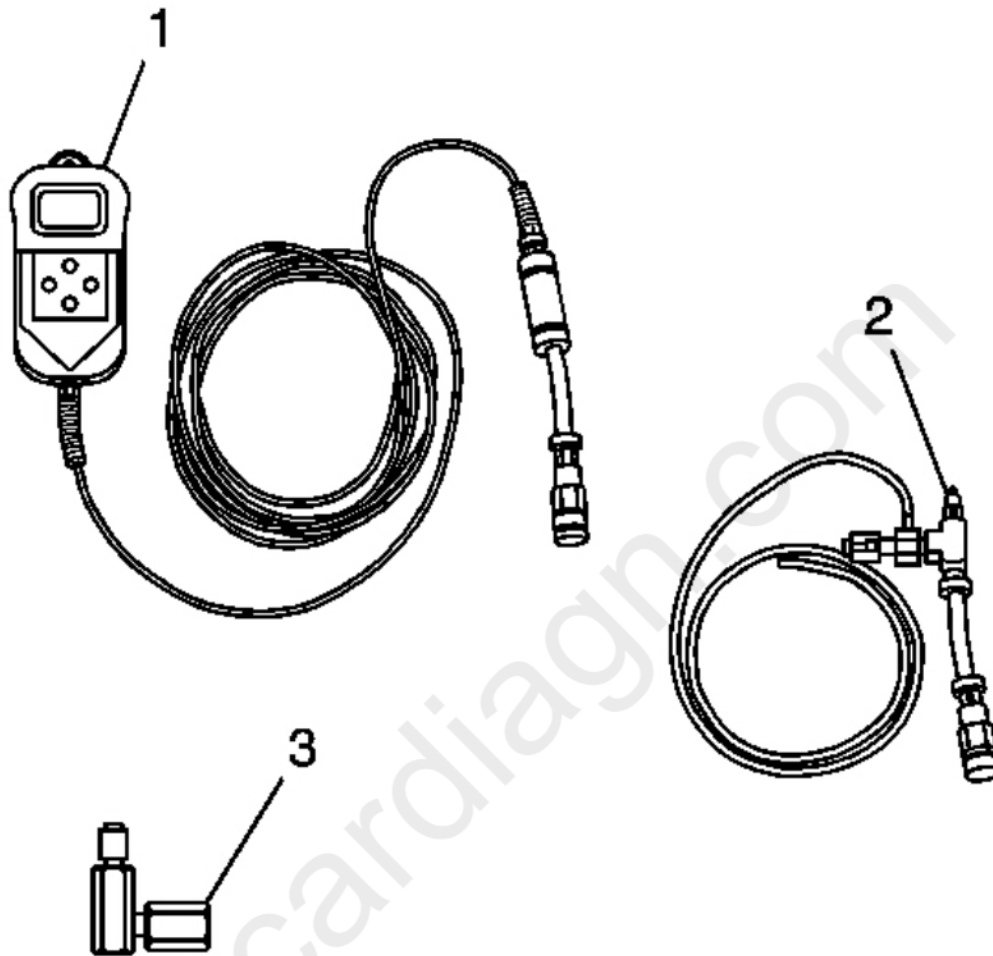


Fig. 18: Identifying CH-48027-100 Components
Courtesy of GENERAL MOTORS CORP.

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.

1. Relieve the fuel system pressure, if required. Perform the following steps
 1. Wrap a shop towel around the fuel rail service port.
 2. Place the hose on the **CH 48027**: adapter (2) into an approved gasoline container.

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3. Open the valve on the **CH 48027:** adapter (2) in order to bleed any fuel from the fuel rail.
4. Close the valve on the **CH 48027:** adapter (2).
5. Remove the hose on the **CH 48027:** adapter (2) from the approved gasoline container.
6. Remove the shop towel from around the fuel rail service port, and place in an approved gasoline container.

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

2. Disconnect the **CH 48027:** gauge (1) from the **CH 48027:** gauge (2).
3. Disconnect the **CH 48027:** adapter (2) from the **CH 48027:** adapter (3).
4. Disconnect the **CH 48027:** adapter (3) from the fuel rail service port.
5. Install the fuel rail service port cap.
6. Install the engine cover, if required.
7. Tighten the fuel fill cap.

METAL COLLAR QUICK CONNECT FITTING SERVICE

Special Tools

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

For equivalent regional tools, refer to **Special Tools**.

Removal Procedure

WARNING: Refer to **Gasoline/Gasoline Vapors Warning**.

1. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief**.

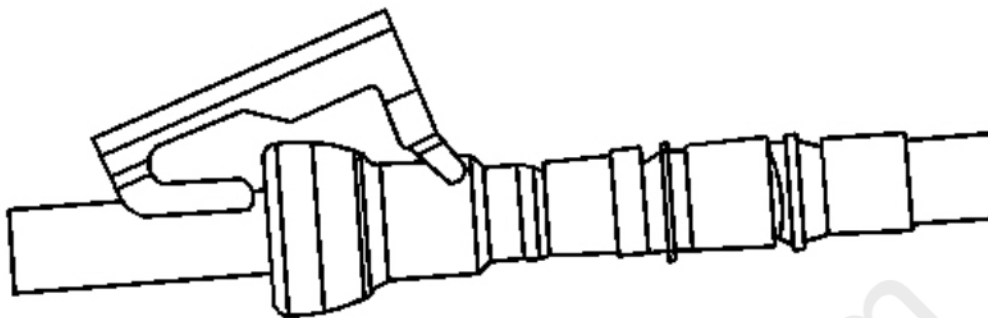


Fig. 19: View Of Quick-Connect Fitting Retainer
Courtesy of GENERAL MOTORS CORP.

2. Remove the retainer from the quick-connect fitting.

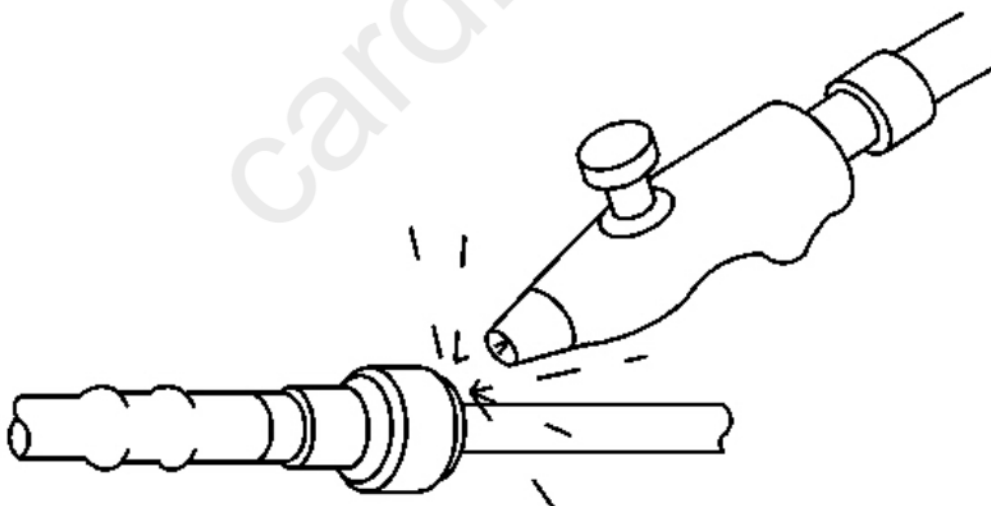


Fig. 20: View Of Blowing Dirt Out Of Fitting (Metal Collar)
Courtesy of GENERAL MOTORS CORP.

WARNING: Wear safety glasses when using compressed air, as flying dirt

particles may cause eye injury.

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

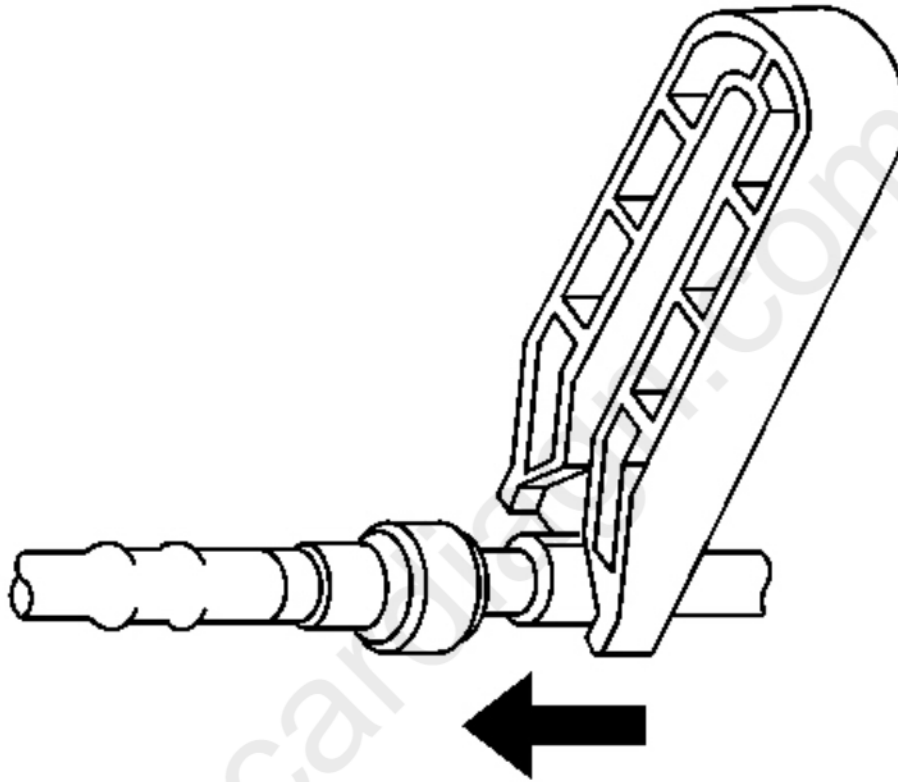


Fig. 21: View Of Quick Connect Locking Tabs (Metal Collar)
Courtesy of GENERAL MOTORS CORP.

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.

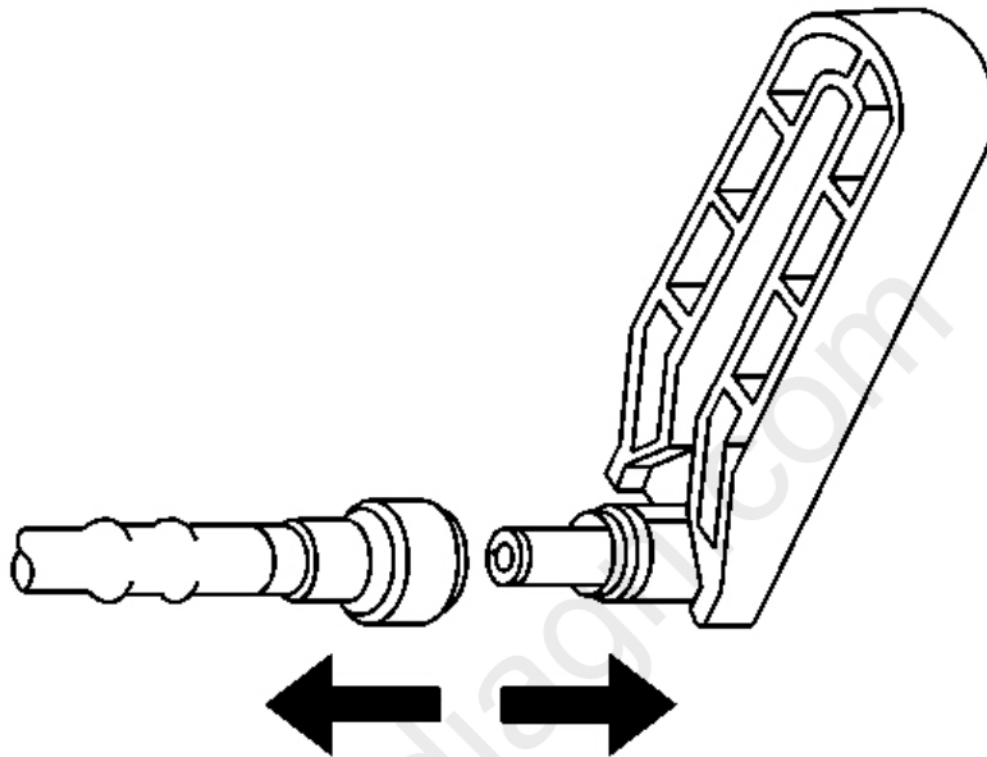


Fig. 22: View Of Quick Connect Locking Tabs (Metal Collar)
Courtesy of GENERAL MOTORS CORP.

5. Pull the connection apart.

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

6. Using a clean shop towel, wipe off the male pipe end.
7. Inspect both ends of the fitting for dirt and burrs.
8. Clean or replace the components as required.

Installation Procedure

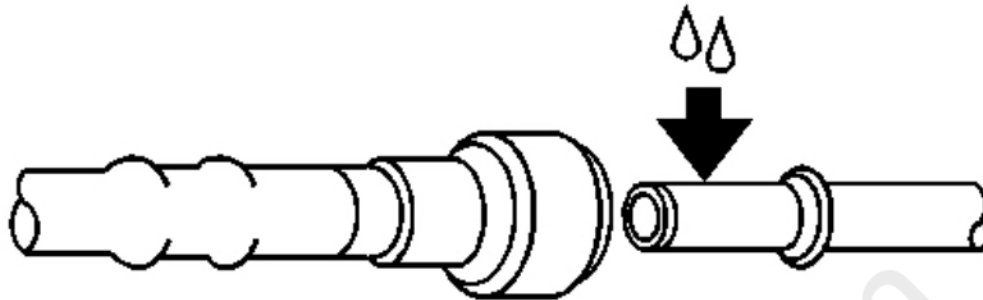


Fig. 23: View Of Oiling Male Pipe Ends (Metal Collar)
Courtesy of GENERAL MOTORS CORP.

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.

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

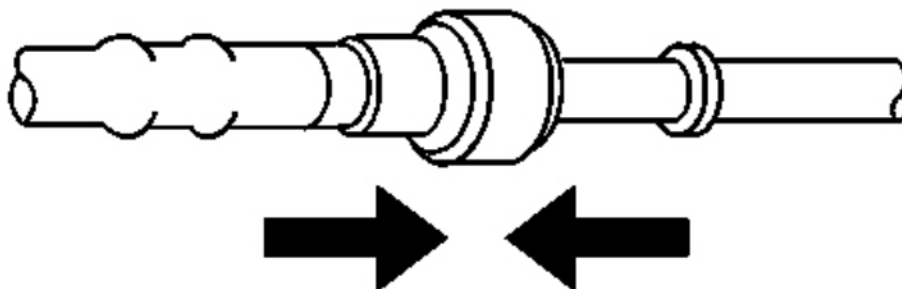


Fig. 24: View Of Connectors (Metal Collar)
Courtesy of GENERAL MOTORS CORP.

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

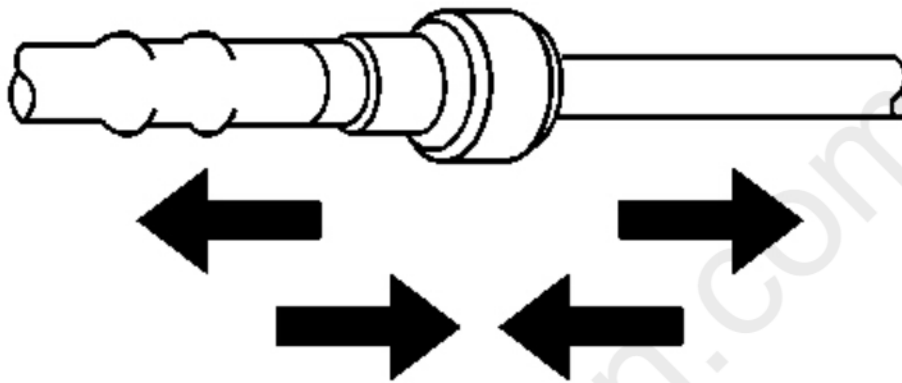


Fig. 25: Ensuring Connection (Metal Collar) Is Secure
Courtesy of GENERAL MOTORS CORP.

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

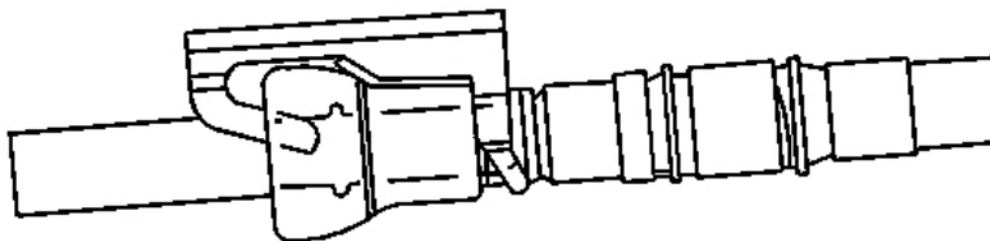


Fig. 2 : View Of Fuel Pipe Retainer
Courtesy of GENERAL MOTORS CORP.

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

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

PLASTIC COLLAR Q IC CONNECT FITTING SERVICE

Re o al Procedure

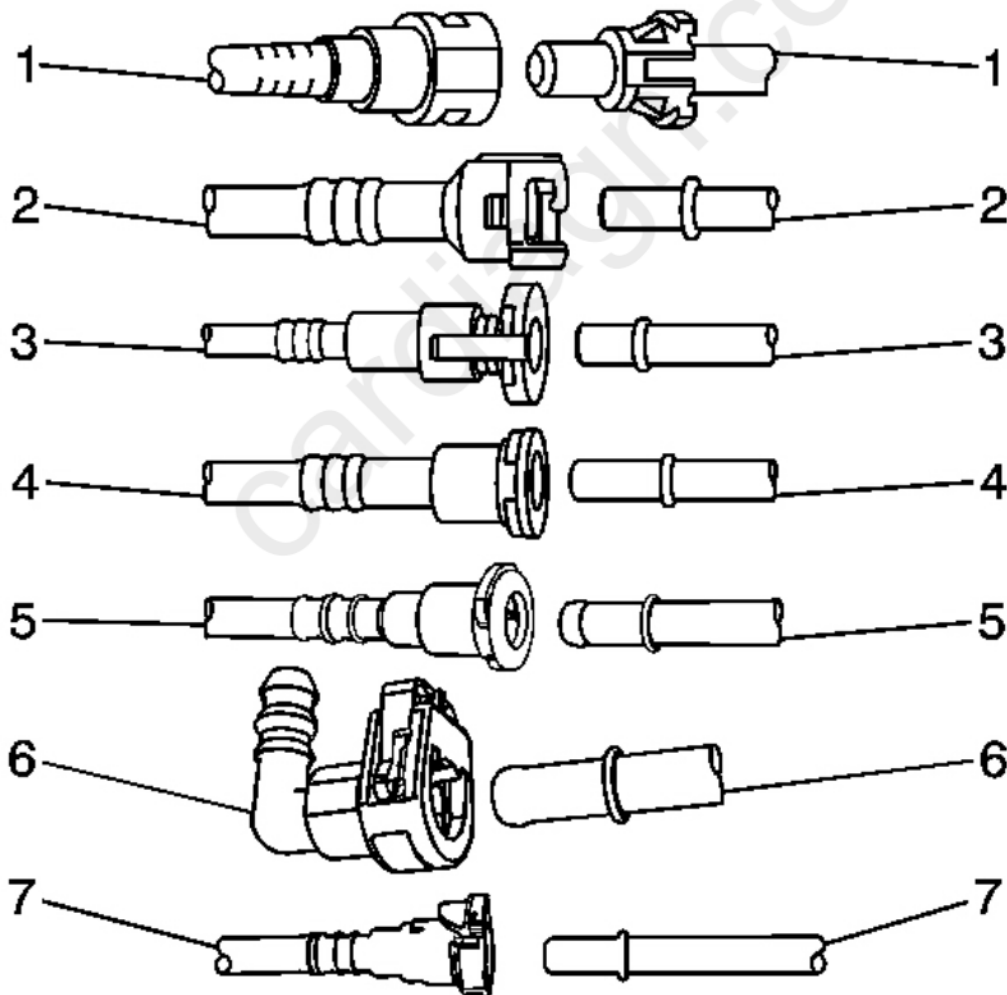


Fig. 2 : Plastic Collar Quick Connect Fitting Service
Courtesy of GENERAL MOTORS CORP.

WARNING: Refer to Gasoline/Gasoline Vapors Warning .

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

- Push to Lock
- Release
- Squeeze to Release
- Sliding Retainer
- Global Connect
- Tip Lock
- Safety Lock

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

1. Relieve the fuel system pressure before servicing any fuel system connection. Refer to the Fuel Pressure Relief.

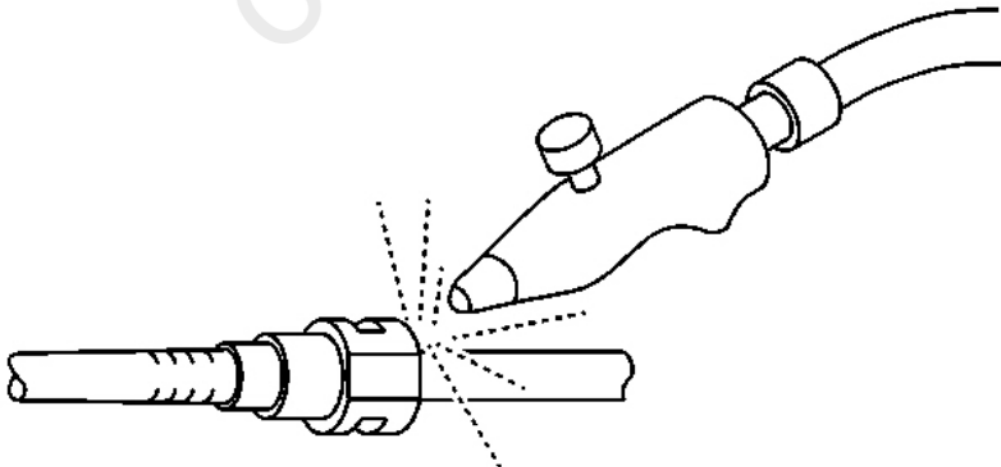


Fig. 2 : View Of Removing Dirt Out Of Fitting (Plastic Collar)

Courtesy of GENERAL MOTORS CORP.

WARNING: Always apply a few drops of clean engine oil to the male pipe ends before connecting the fuel pipe fittings in order to reduce the risk of fire and personal injury. This will ensure proper reconnection and prevent a possible fuel leak. During normal operation, the O rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

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

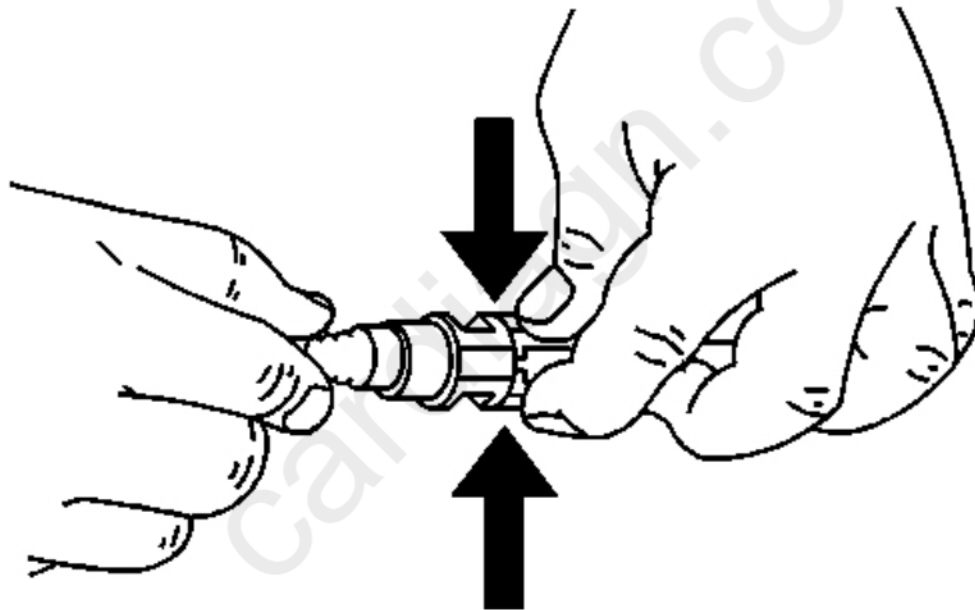


Fig. 2 : View Of Quick Connect Fitting Release Tabs (Plastic Collar)
Courtesy of GENERAL MOTORS CORP.

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

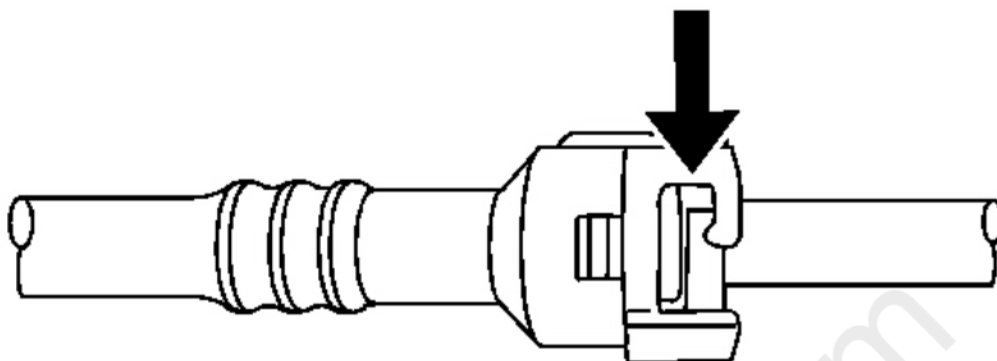


Fig. 30: View Of Quick Release Style Connectors (Plastic Collar)
Courtesy of GENERAL MOTORS CORP.

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

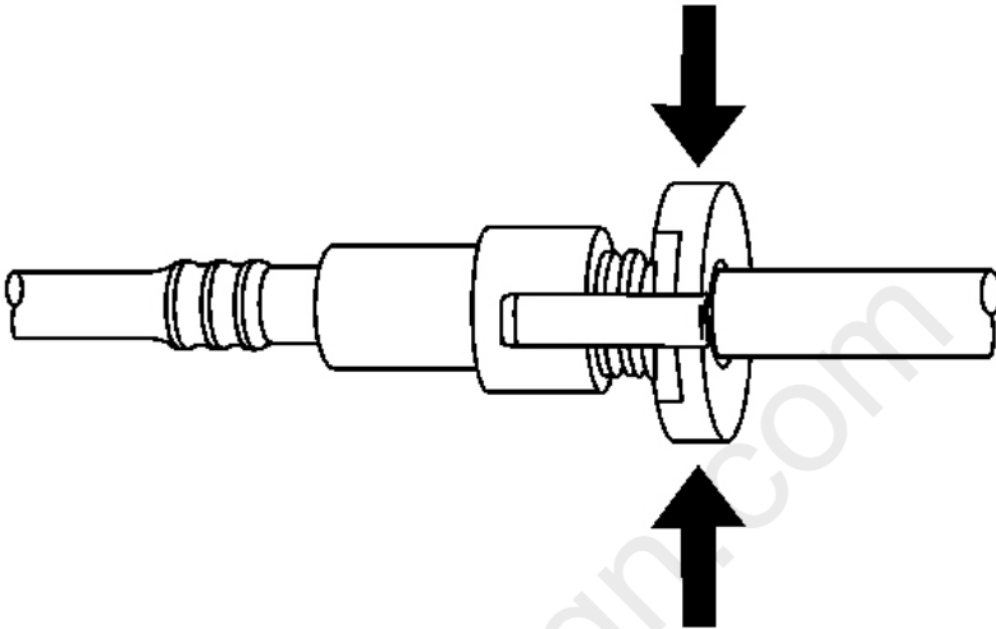


Fig. 31: Disengaging Quick Connect Fitting (Plastic Collar)
Courtesy of GENERAL MOTORS CORP.

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

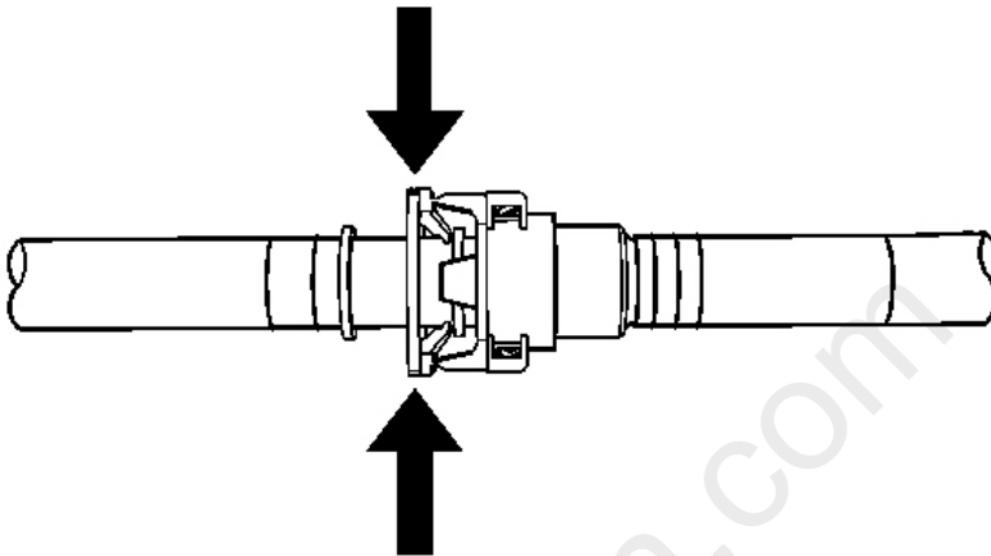


Fig. 32: Pushing In Male Side Of Connector

Courtesy of GENERAL MOTORS CORP.

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

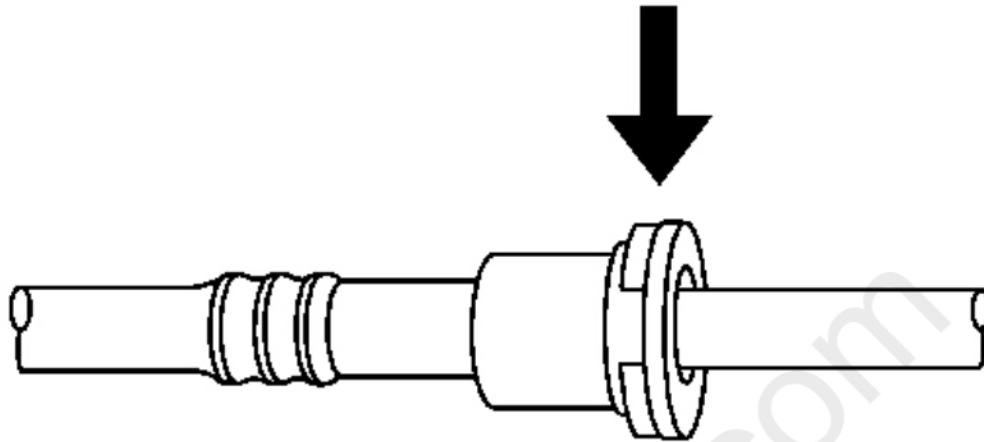


Fig. 33: View Of Sliding Retainer Style Connector
Courtesy of GENERAL MOTORS CORP.

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

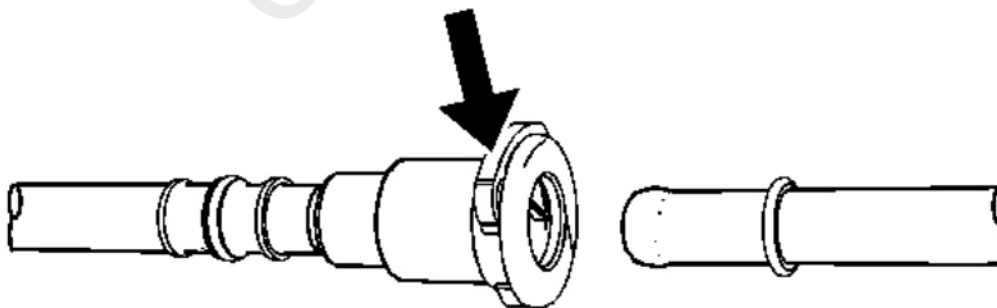


Fig. 34: View Of Global Connector Style
Courtesy of GENERAL MOTORS CORP.

8. This step applies to the Global Connector style only. Push the connector toward the tube in order to

release the pressure. Press and hold down the release mechanism, and pull the connector straight out.

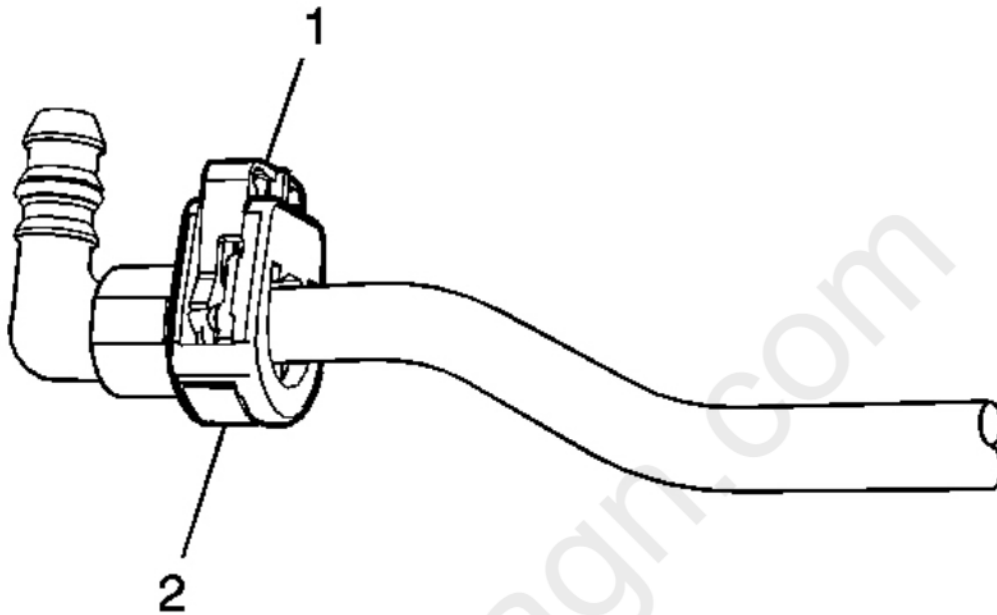


Fig. 35: View Of TI Loc style

Courtesy of GENERAL MOTORS CORP.

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

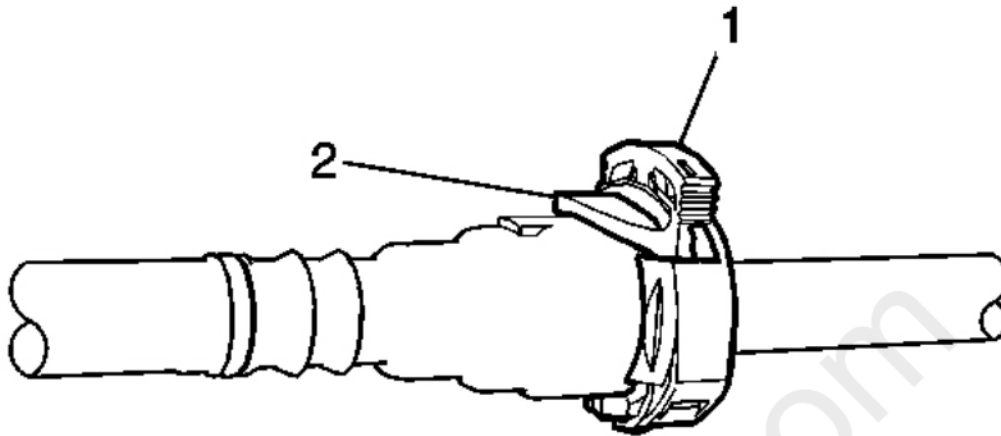


Fig. 36: View Of Safe Lock Style Components
Courtesy of GENERAL MOTORS CORP.

WARNING: Refer to Relieving Fuel Pressure Warning .

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

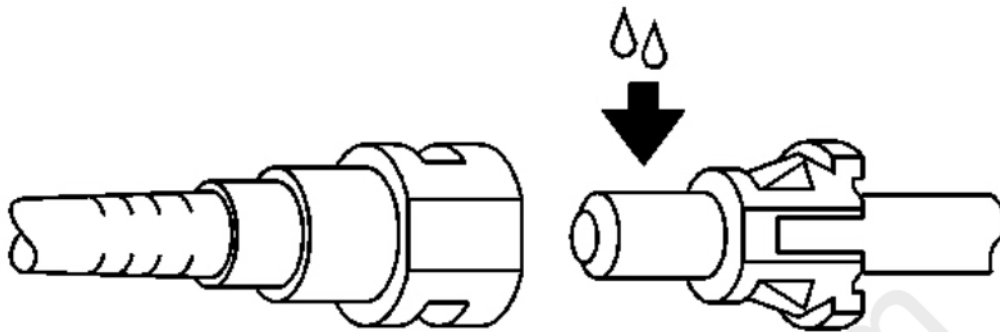


Fig. 37: Lu ricating Male Pipe End
Courtesy of GENERAL MOTORS CORP.

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

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

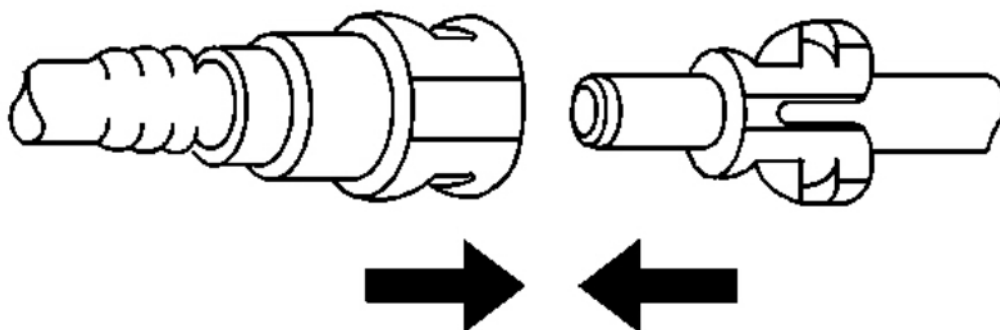


Fig. 3 : Connecting Quick-Connect Fittings
Courtesy of GENERAL MOTORS CORP.

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

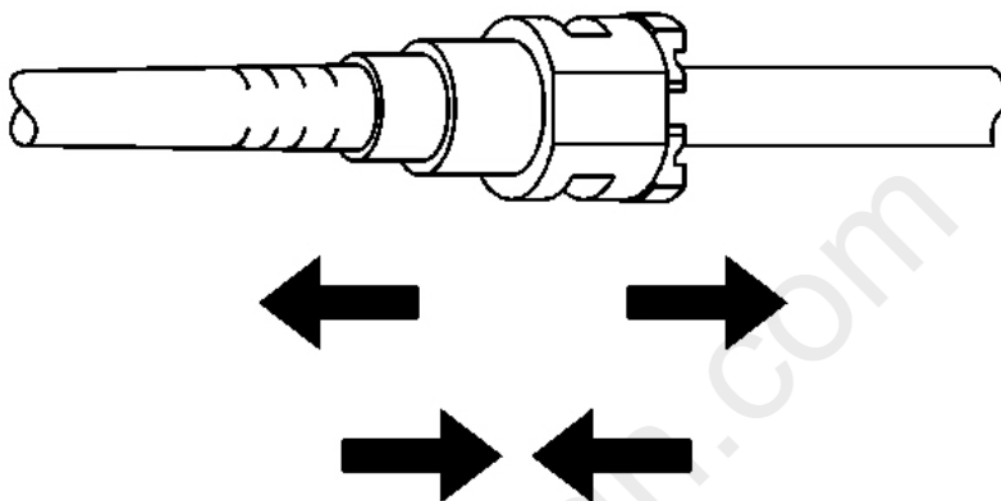


Fig. 39: Ensuring Secure Connection (Plastic Collar)
Courtesy of GENERAL MOTORS CORP.

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

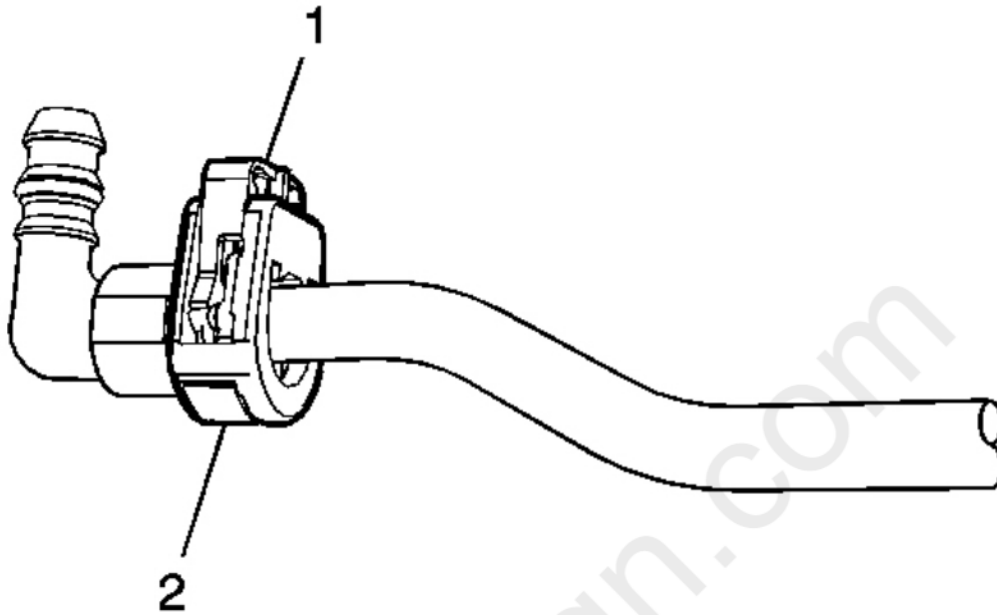


Fig. 40: View Of TI Loc style
Courtesy of GENERAL MOTORS CORP.

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.

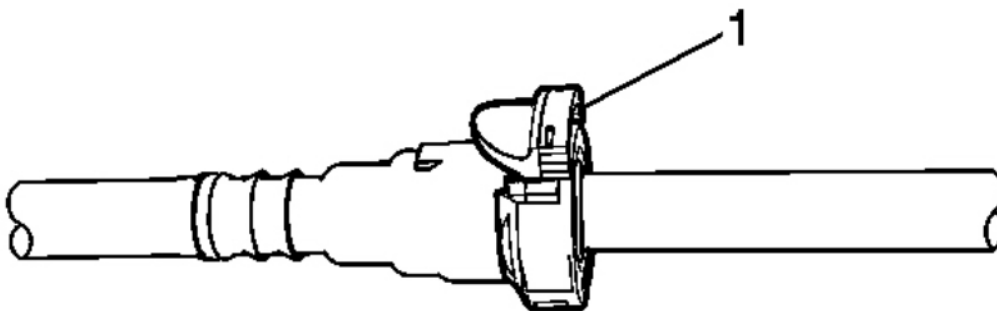


Fig. 41: Identifying Redundant Latch

Courtesy of GENERAL MOTORS CORP.

6. Insert the tube in the connector until the retainer snaps in place.
7. Push down on the second latch (1) in order to secure the connection.
8. 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 FILTER REPLACEMENT (CHINA)

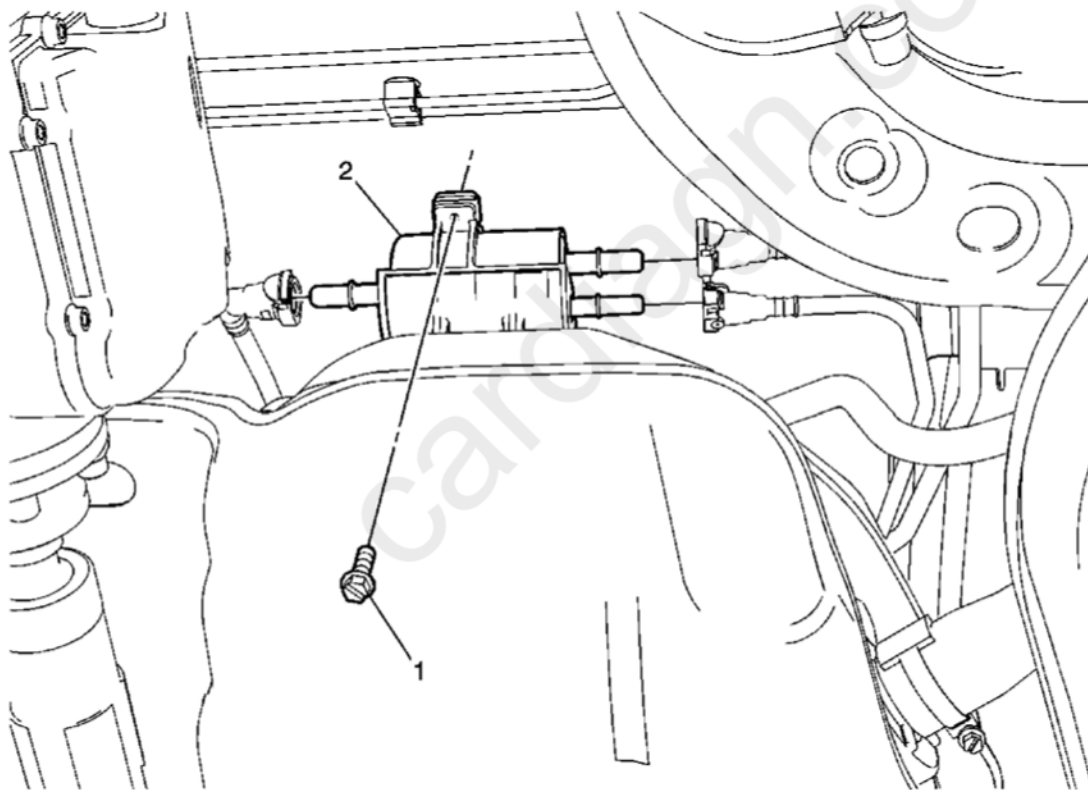


Fig. 4 : Identifying Fuel Filter (China)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1.	Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .
2.	Disconnect the fuel lines. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

1	Fuel Filter Fastener
	CAUTION: Refer to <u>Fastener Caution</u> .
	Tighten: 9 N.m (80 lb in)
2	Fuel Filter

FUEL TANK DRAINING

Special Tools

CH-45004: Fuel Tank Drain Hose

For equivalent regional tools, refer to **Special Tools** .

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 fire extinguisher nearby before performing any on-vehicle service procedures. Failure to follow these precautions may result in personal injury.

Fuel Tank Draining Procedure

1. Remove the fuel fill cap.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Loosen the fuel fill pipe hose clamps and slide the fill pipe hose up the filler pipe.
4. Insert the **CH-45004:** fuel tank drain hose into the fuel tank until the hose reaches the bottom of the fuel tank.
5. Use an hand or air operated pump device in order to drain as much fuel as possible.

FUEL TANK REPLACEMENT

Removal Procedure

WARNING: Refer to **Gasoline/Gasoline Vapors Warning** .

1. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief**.
2. Drain the fuel tank. Refer to **Fuel Tank Draining**.
3. Remove the exhaust system. Refer to **Exhaust Muffler Replacement (LF1)** or **Exhaust Muffler Replacement (LAU)** .

4. If required, remove the propeller shaft. Refer to **Propeller Shaft Replacement**.

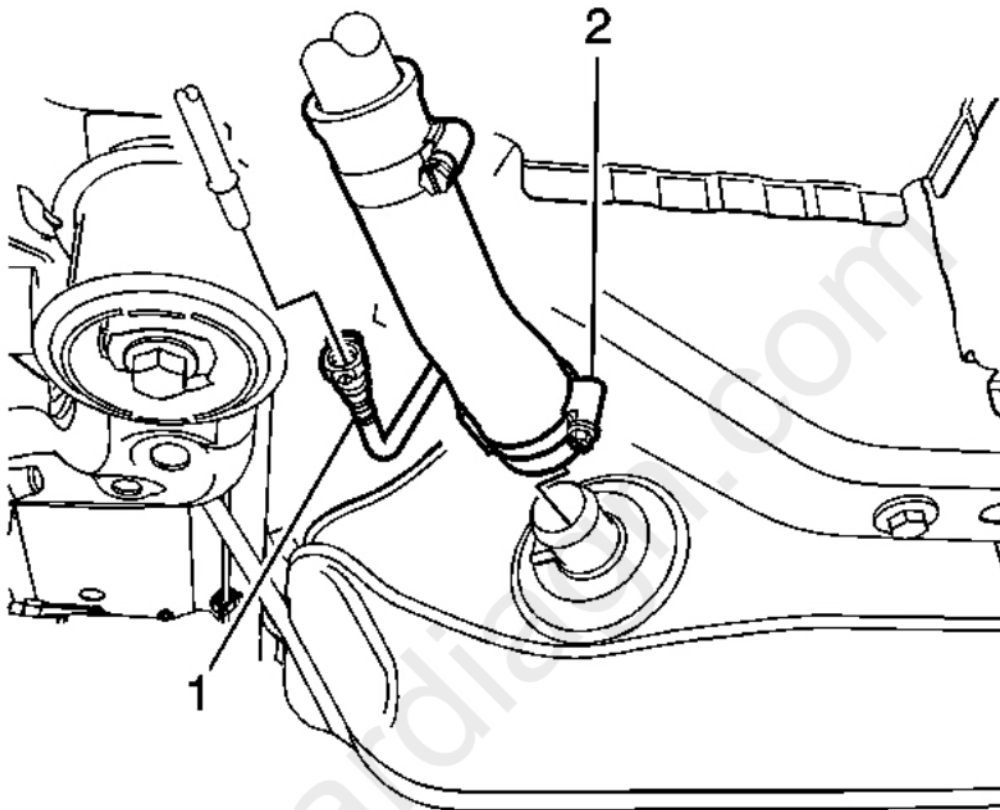


Fig. 43: View Of Evaporative Emission Line
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.
6. Loosen the upper fill pipe clamp and hose clamp (2) and slide the hose up the filler pipe.

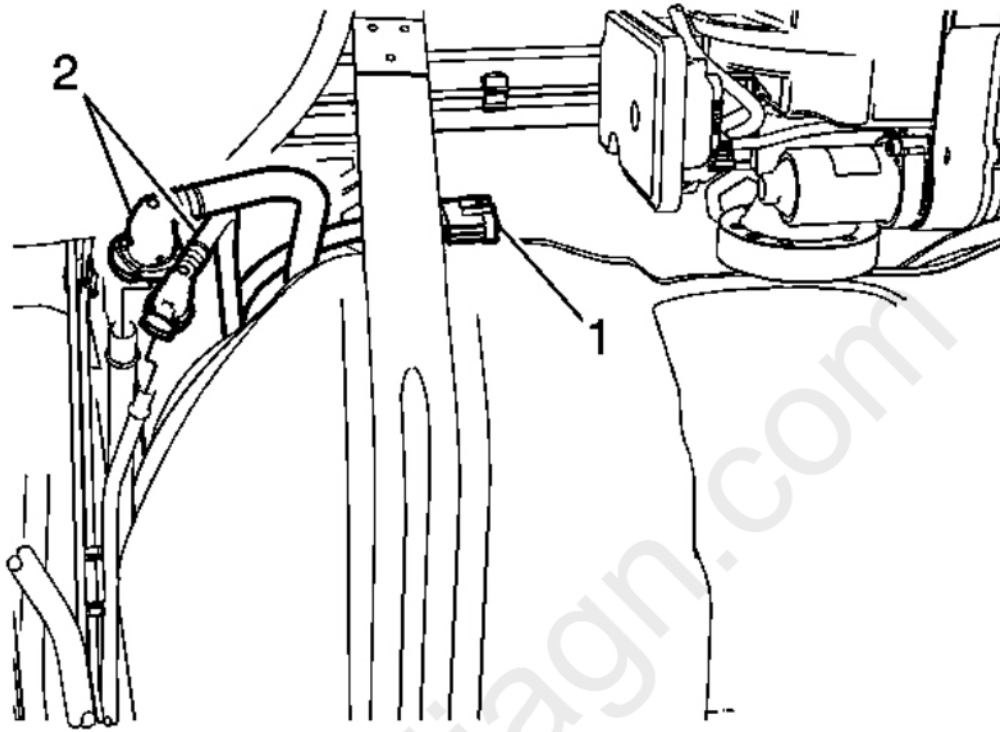


Fig. 44: Identifying Fuel Tank Electrical Connector
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the fuel tank electrical connector (1).
8. Disconnect the fuel line and evaporative emission line connectors (2). Refer to **Plastic Collar Quick Connect Fitting Service**.

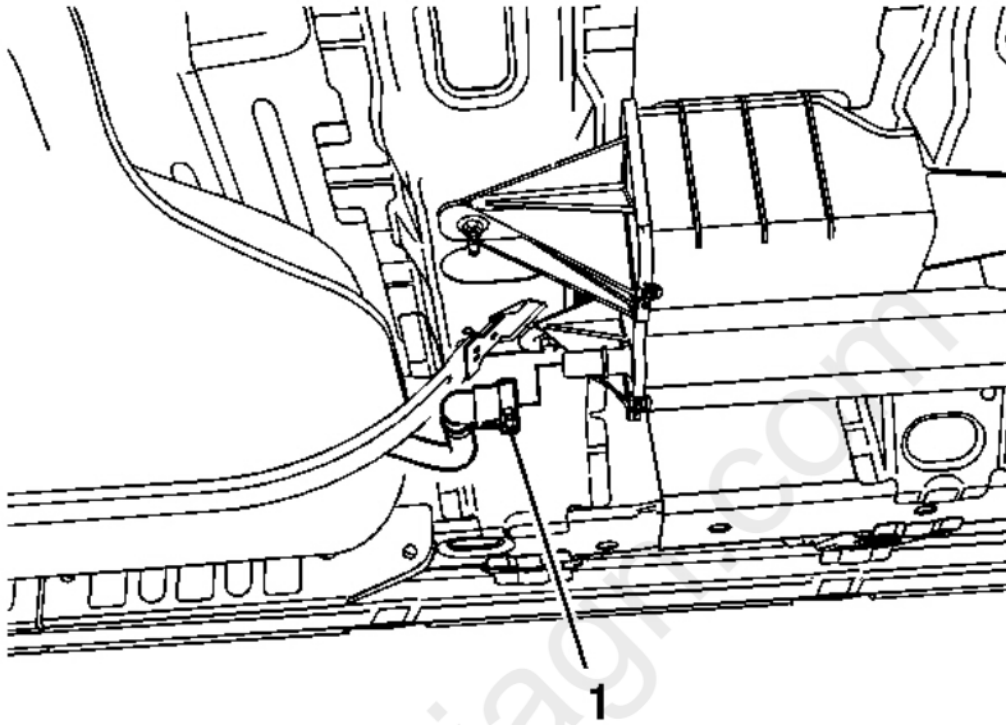


Fig. 45: Identifying Evaporative Emission Line & Canister
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the evaporative emission line (1) from the canister.

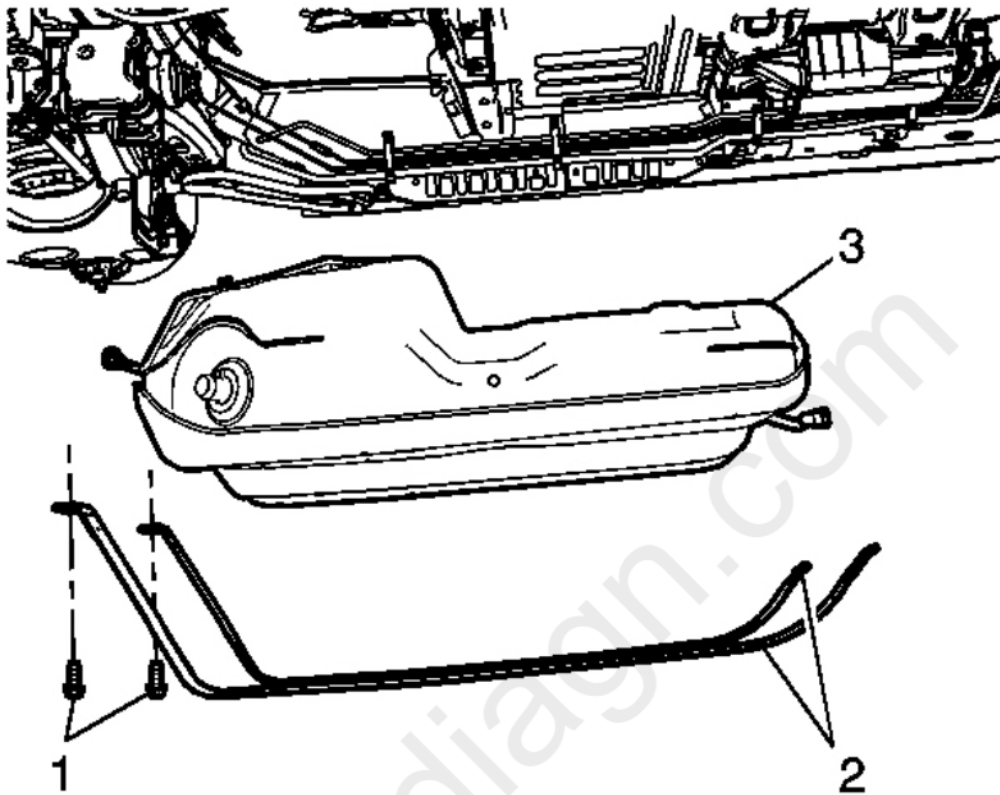


Fig. 46: View Of Fuel Tank, Strap & Bolts
Courtesy of GENERAL MOTORS CORP.

10. Support the fuel tank with a suitable jack.
11. Remove the fuel tank strap bolts (1) and reposition the straps (2) downward toward the front of the vehicle.
12. Using a suitable jack, lower the fuel tank (3).
13. Remove the following components if replacing just the fuel tank
 - The primary fuel tank module-Refer to **Primary Fuel Tank Module Replacement (NT7, NU5)** or **Primary Fuel Tank Module Replacement (NA3, NE9, NF9)**.
 - The secondary fuel tank module-Refer to **Secondary Fuel Tank Module Replacement**.

Installation Procedure

1. Install the following components if fuel tank replacement was necessary
 - The primary fuel tank module-Refer to **Primary Fuel Tank Module Replacement (NT7, NU5)** or **Primary Fuel Tank Module Replacement (NA3, NE9, NF9)** or **Primary Fuel Tank Module**

Replacement (China).

- The secondary fuel tank module-Refer to **Secondary Fuel Tank Module Replacement.**

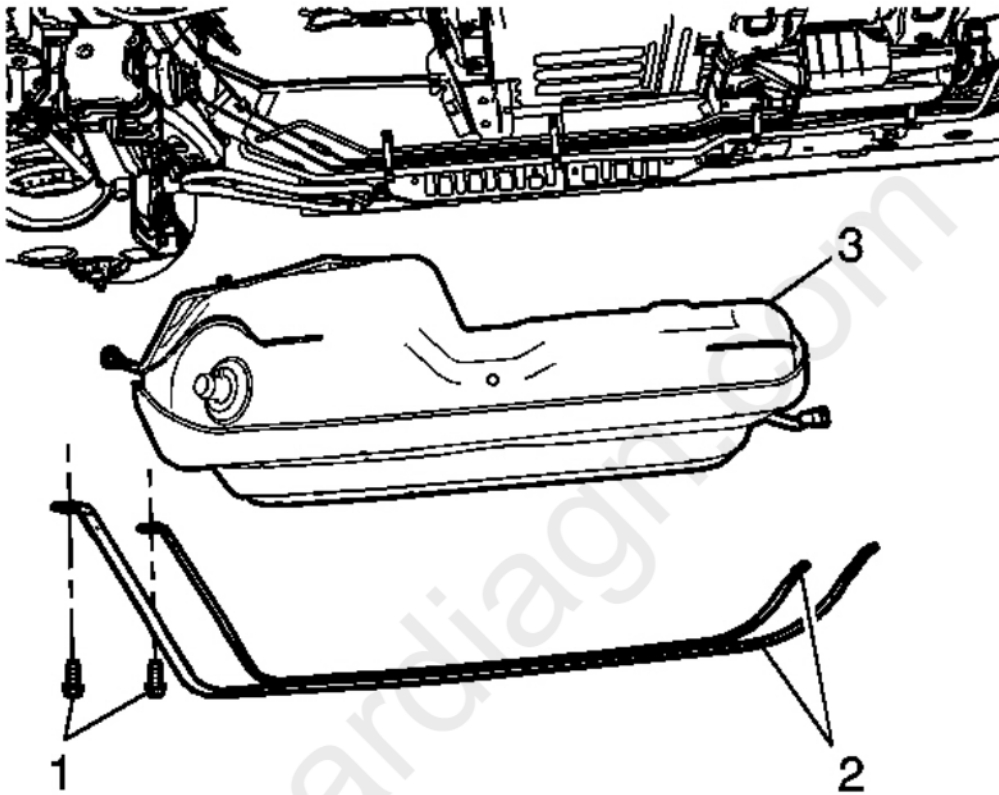


Fig. 47: View Of Fuel Tank, Strap & Bolts
 Courtesy of GENERAL MOTORS CORP.

2. Raise the fuel tank (3) to the vehicle.

CAUTION: Refer to **astener Caution** .

3. Ensure the fuel tank straps are seated properly. Install the fuel tank straps (2) and bolts (1) then tighten to 45 N.m (33 lb ft).

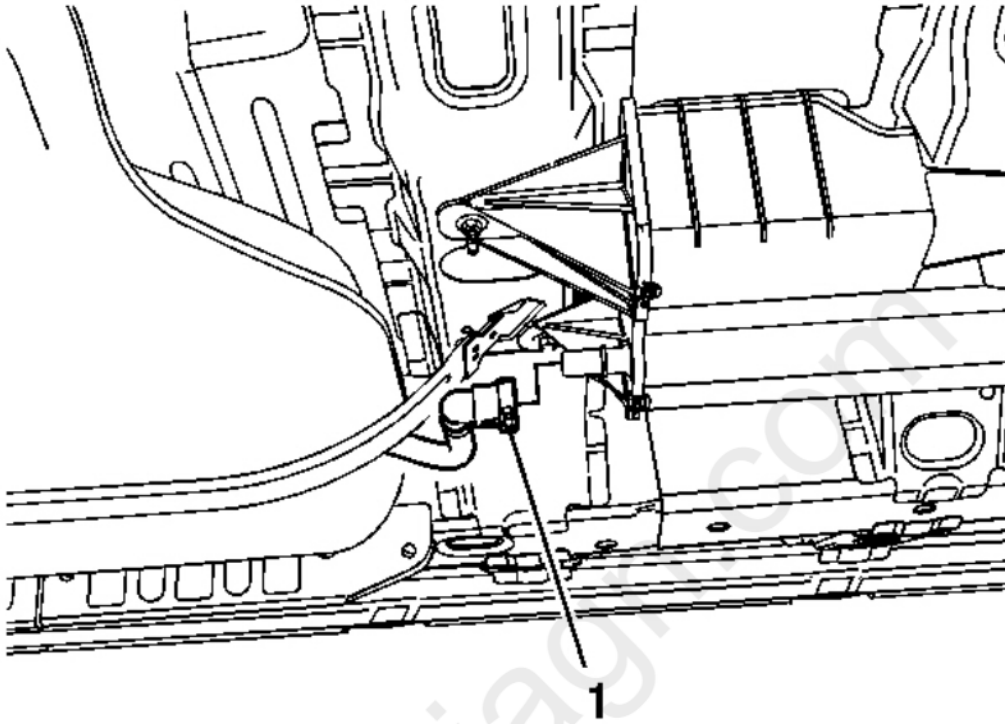


Fig. 4 : Identifying Evaporative Emission Line & Canister
Courtesy of GENERAL MOTORS CORP.

4. Connect the evaporative emission line (1) to the canister.

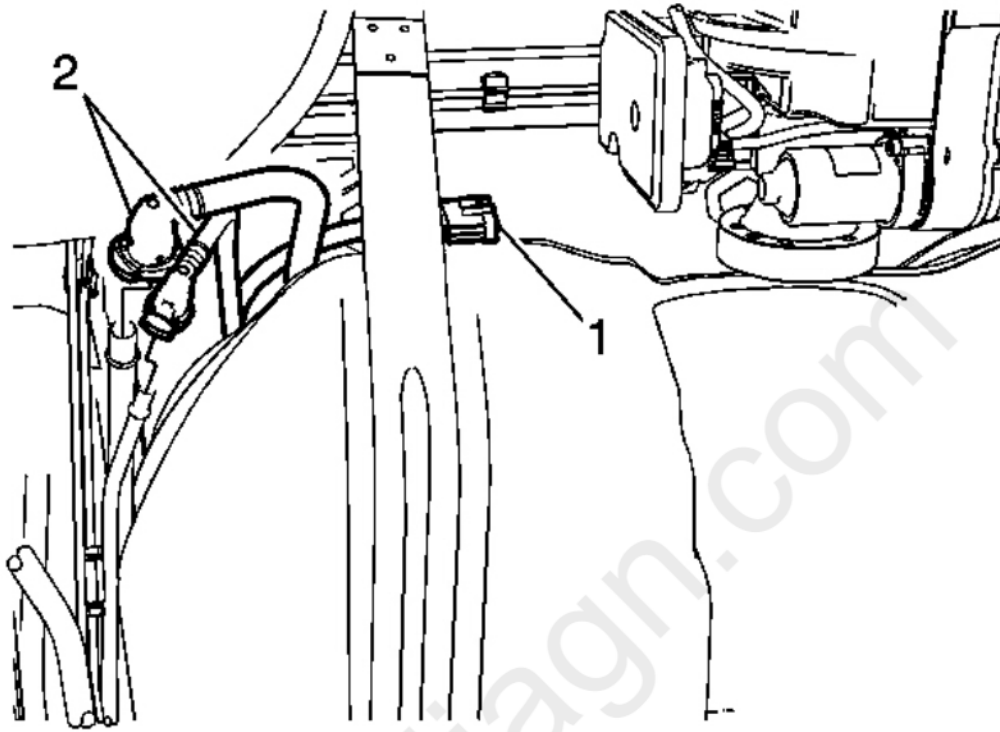


Fig. 4 : Identifying Fuel Tank Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the fuel tank electrical connector (1).
6. Connect the fuel line and evaporative emission line connectors (2). Refer to **Plastic Collar Quick Connect Fitting Service**.

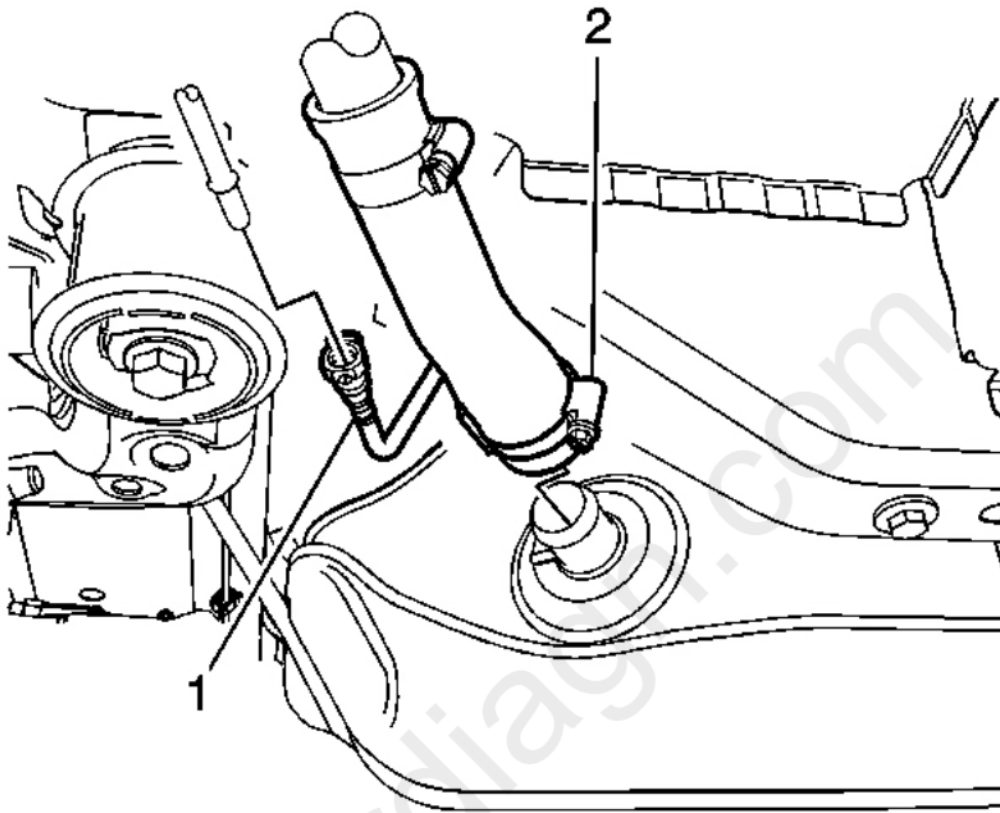


Fig. 5 : View Of Evaporative Emission Line
 Courtesy of GENERAL MOTORS CORP.

7. Connect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.
8. Install the filler tube and tighten the hose both clamp (2) to 5 N.m (44 lb in).
9. Perform a leak down test. Refer to **Evaporative Emission System Diagnosis** .
10. If required, install the propeller shaft. Refer to **Propeller Shaft Replacement** .
11. Install the exhaust system. Refer to **E haust Muffler Replacement (LF)** or **E haust Muffler Replacement (LAU)** .
12. Refill the fuel tank.
13. Inspect for fuel leaks.

FUEL PUMP FLOW CONTROL MODULE REPLACEMENT

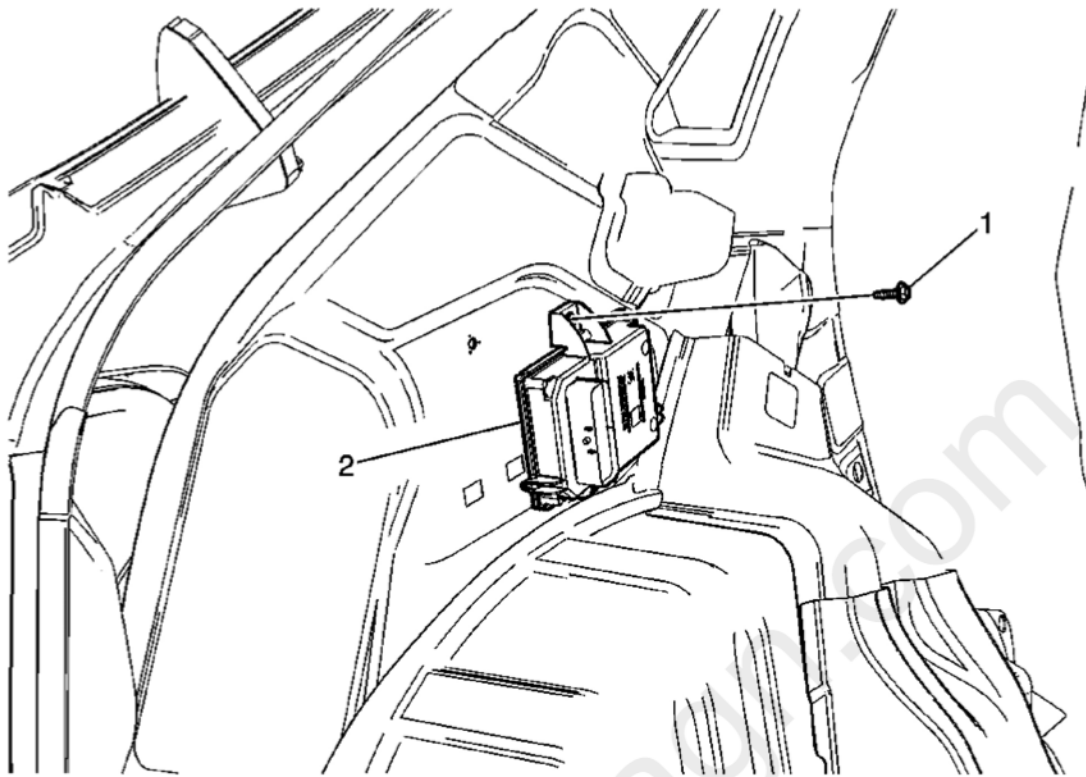


Fig. 5 : Identifying Fuel Pump Flow Control Module
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Fuel Pump Flow Control Module Fastener CAUTION: Refer to <u>Fastener Caution</u> Tighten: 8 N.m (71 lb in)
2	Fuel Pump Flow Control Module Procedure 1. Remove the left body side trim panel. Refer to <u>Body Side Trim Panel Replacement</u> . 2. Disconnect the electrical connector. 3. If replacing, reprogram the module. Refer to <u>Control Module References</u>

FUEL TANK PRESSURE SENSOR REPLACEMENT

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

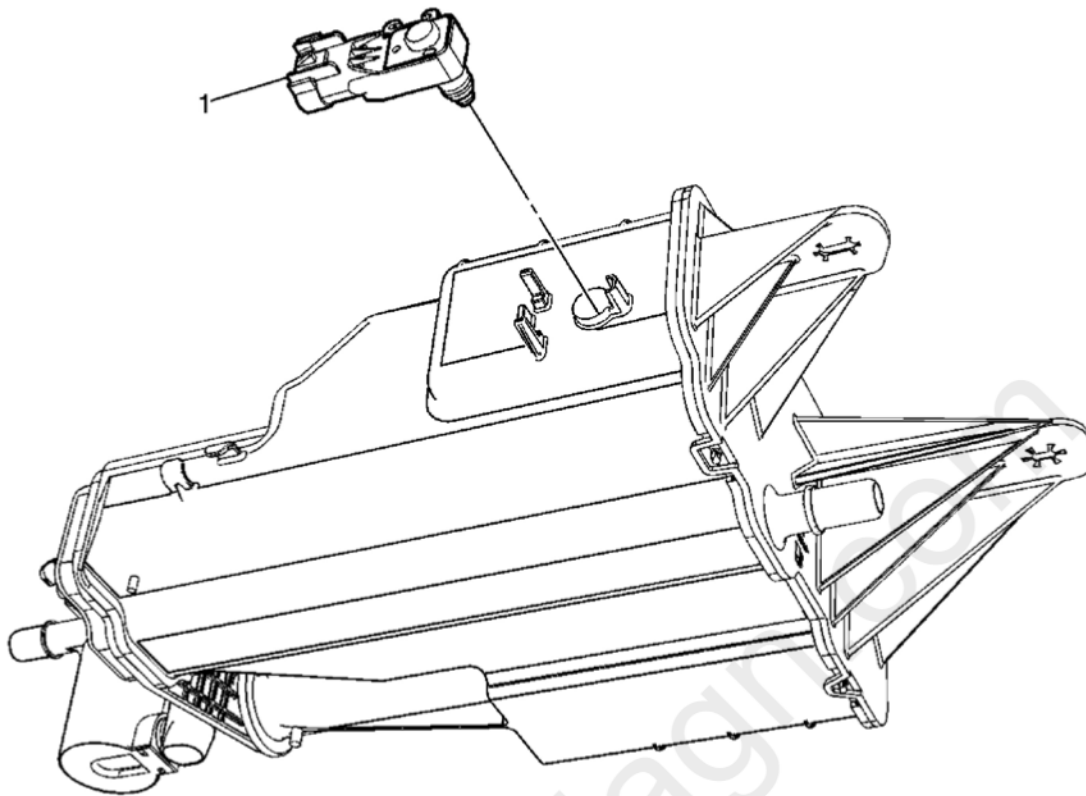


Fig. 52: Identifying Fuel Tank Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .	
1	Fuel Tank Pressure Sensor Procedure: Disconnect the electrical connector.

FUEL TANK FILLER PIPE REPLACEMENT

Removal Procedure

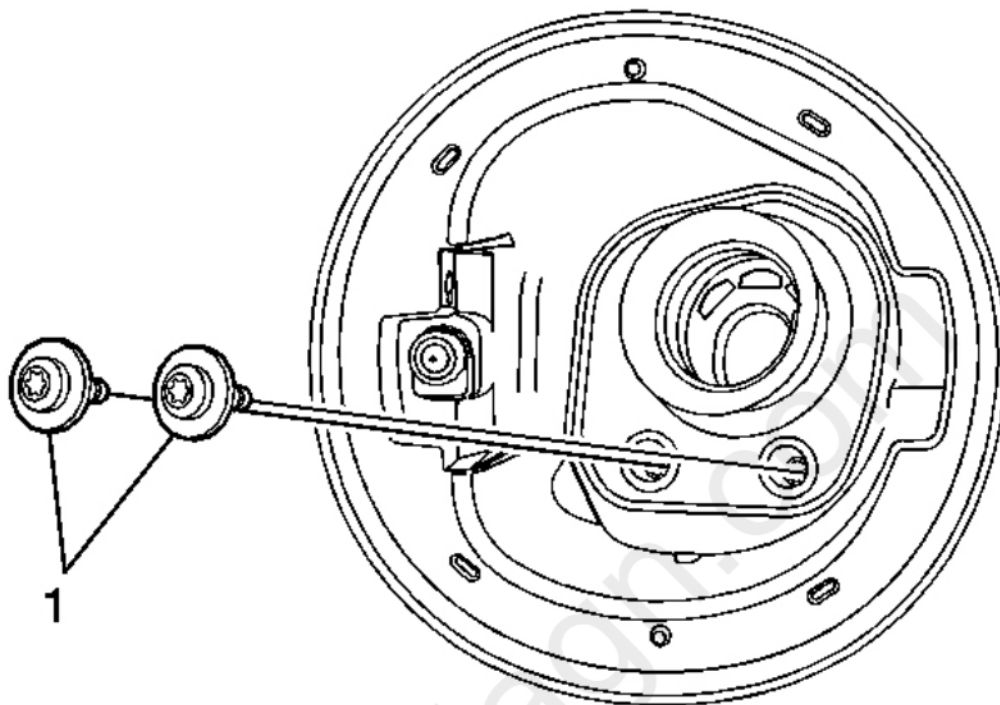


Fig. 53: Identifying Fuel Tank Filler Pipe, Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Drain the fuel tank if necessary. Refer to **Fuel Tank Draining**
2. Remove the housing fasteners (1).
3. Remove the right rear wheelhouse panel liner. Refer to **Rear Wheelhouse Panel Liner Replacement**.

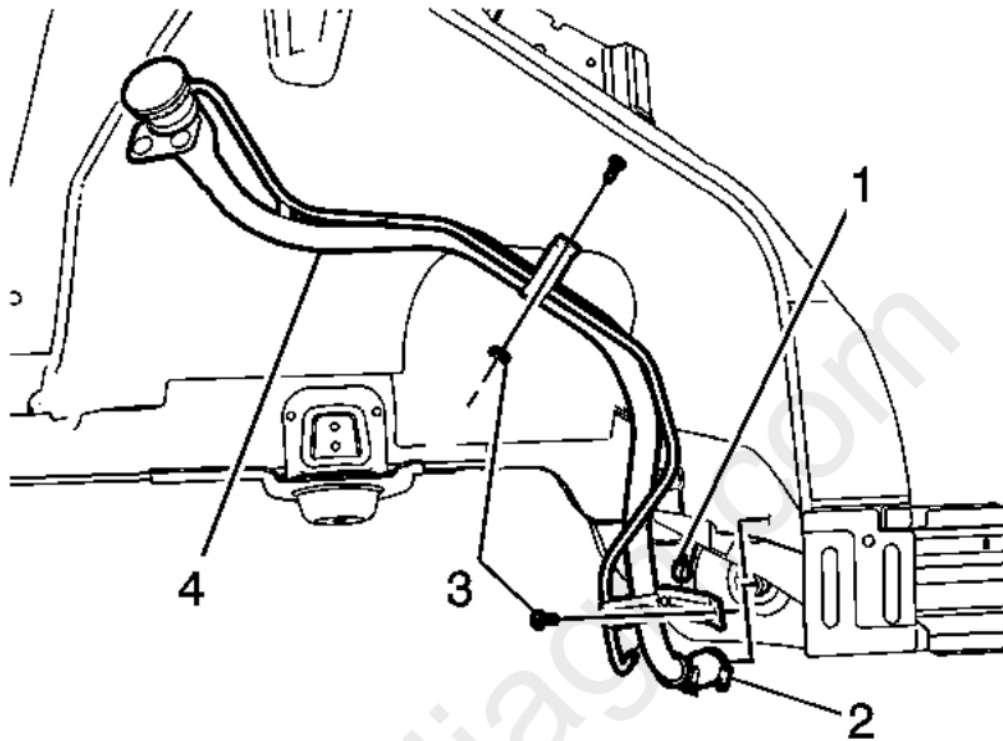


Fig. 54: View Of Filler Pipe, Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.
5. Remove the lower filler tube fastener (3).
6. Loosen the filler pipe hose clamp (2) and disconnect the hose.
7. Remove the upper filler tube fastener (3).
8. Remove the filler pipe (4).

Installation Procedure

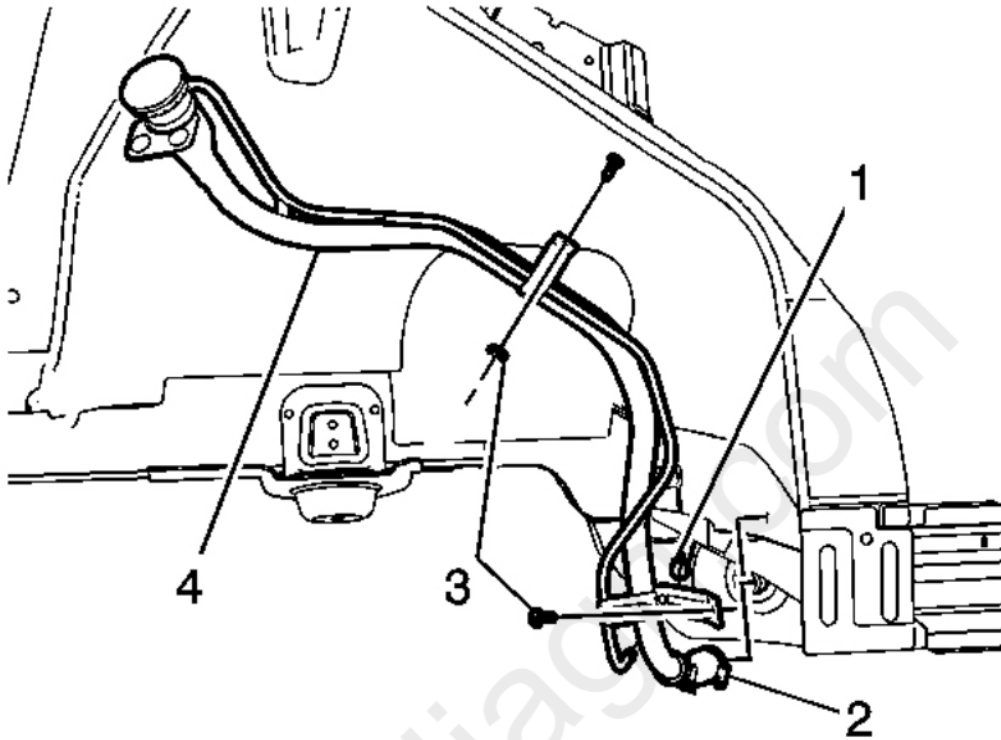


Fig. 55: View Of Filler Pipe, Hose & Clamp
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

1. Position the filler pipe (4) in place and hand tighten the center nut (3).
2. Install the filler pipe hose and tighten the clamp (2) to 5 N.m (44 lb in).
3. Start and hand tighten the lower filler pipe fastener (3).
4. Connect the evaporative emission line (1). Refer to Plastic Collar Quick Connect Fitting Service.
5. Tighten the fasteners (3) to 10 N.m (89 lb in).

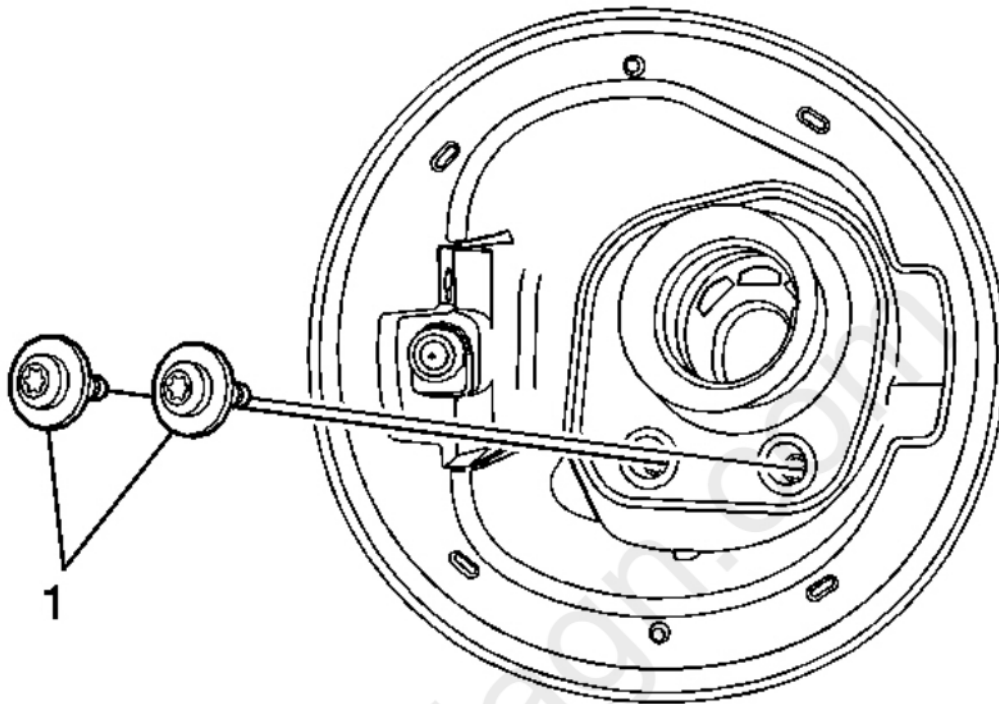


Fig. 56: Identifying Fuel Tank Filler Pipe, Housing & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the housing fasteners (1) and tighten to 10 N.m (89 lb in).
7. Install the right rear wheelhouse panel liner. Refer to **Rear Wheelhouse Panel Liner Replacement** .

PRIMARY FUEL TANK MODULE REPLACEMENT (NT7, NU5)

Special Tools

CH 45722: Fuel Tank Sender Wrench

For equivalent regional tools, refer to **Special Tools**

Removal Procedure

WARNING: Refer to **Gasoline/Gasoline Vapors Warning** .

1. Remove the fuel tank. Refer to **Fuel Tank Replacement**.

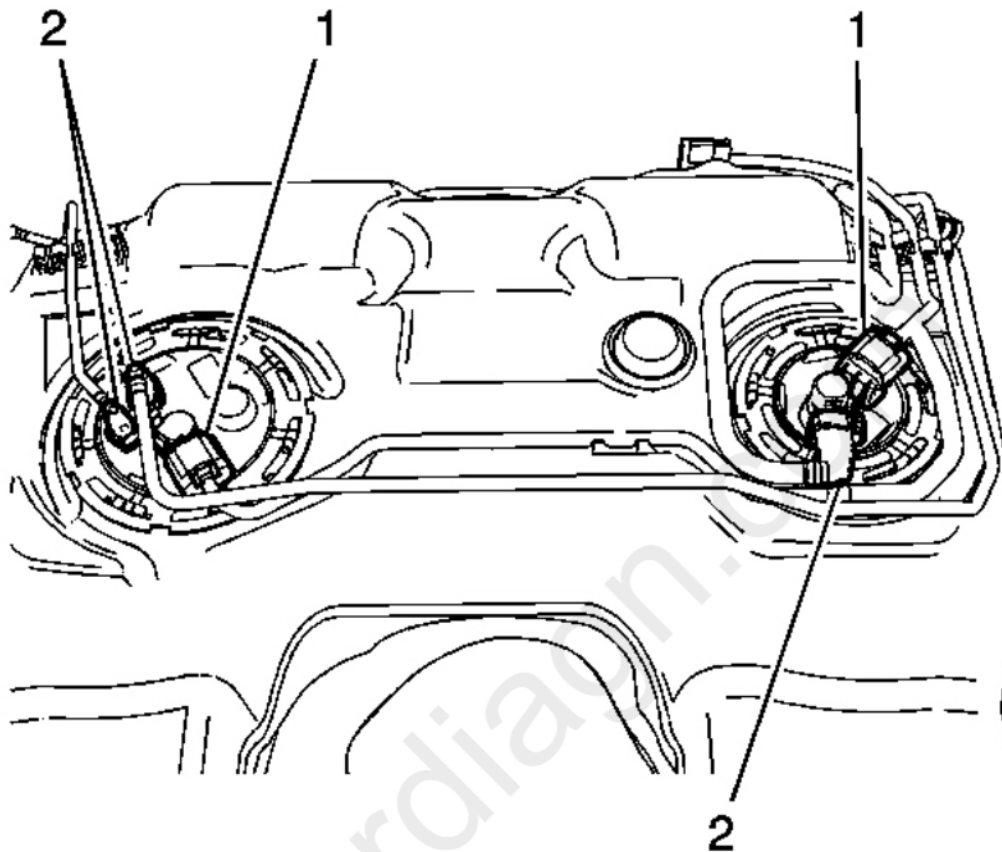


Fig. 57: Identifying Electrical Connectors At Primary & Secondary Fuel Tank Modules
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the electrical connectors (1) from the primary and secondary fuel tank modules.
3. Disconnect the fuel and evaporative emission lines (2). Refer to **Plastic Collar Quick Connect Fitting Service**.
4. Remove the secondary fuel pump module. Refer to **Secondary Fuel Tank Module Replacement**.

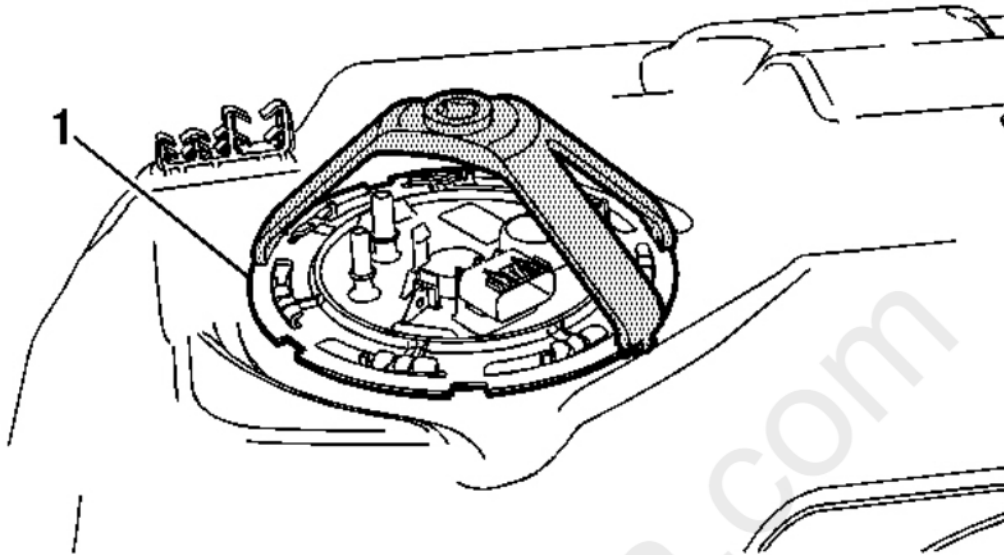


Fig. 58: Identifying Special Tool CH 45722
Courtesy of GENERAL MOTORS CORP.

5. Using the **CH 45722:** wrench, remove the cam lock ring (1) by turning counterclockwise.

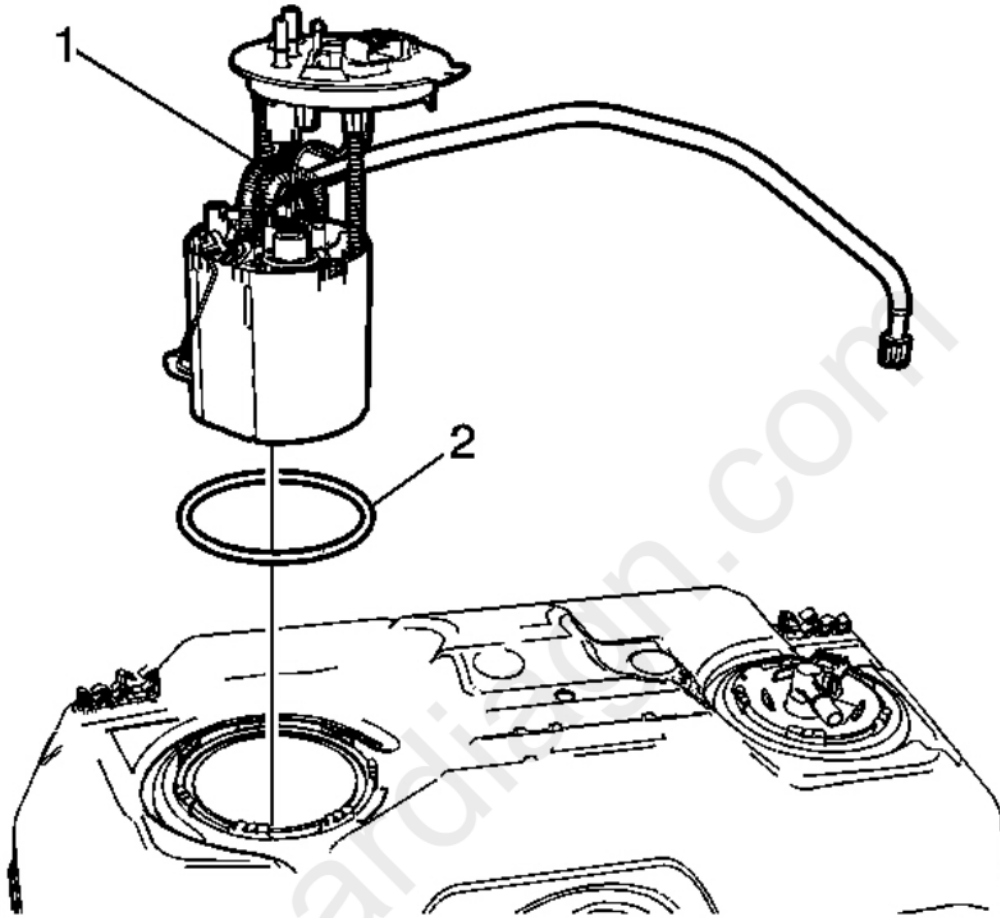


Fig. 59: View Of Primary Fuel Tank Module
Courtesy of GENERAL MOTORS CORP.

6. Remove the primary fuel tank module (1) and the O-ring (2).
7. If replacing the fuel pump module only, remove the primary fuel level sensor. Refer to **Primary Fuel Level Sensor Replacement**.

Installation Procedure

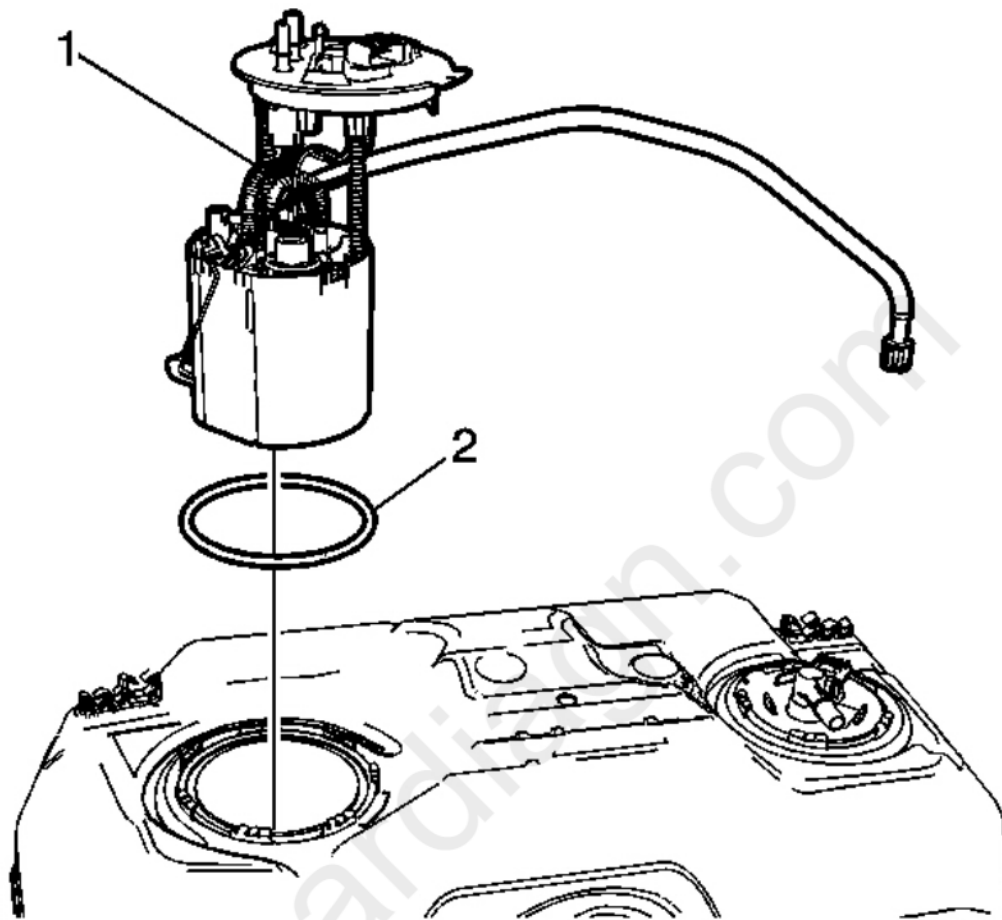


Fig. 60: View Of Primary Fuel Tank Module
Courtesy of GENERAL MOTORS CORP.

1. If replacing the fuel pump module only, install the primary fuel level sensor. Refer to **Primary Fuel Level Sensor Replacement**.
2. Install a NEW O-ring (2) and the primary fuel tank module (1).

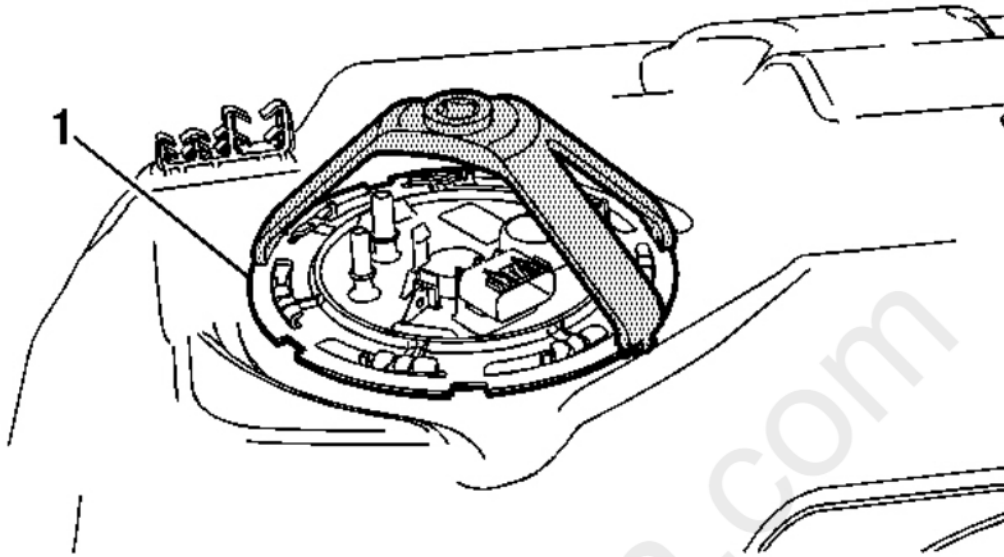


Fig. 61: Identifying Special Tool CH 45722
Courtesy of GENERAL MOTORS CORP.

3. Using the **CH 45722:** wrench, install the cam lock ring (1) by turning clockwise.
4. Install the secondary fuel pump module. Refer to **Secondary Fuel Tank Module Replacement**.

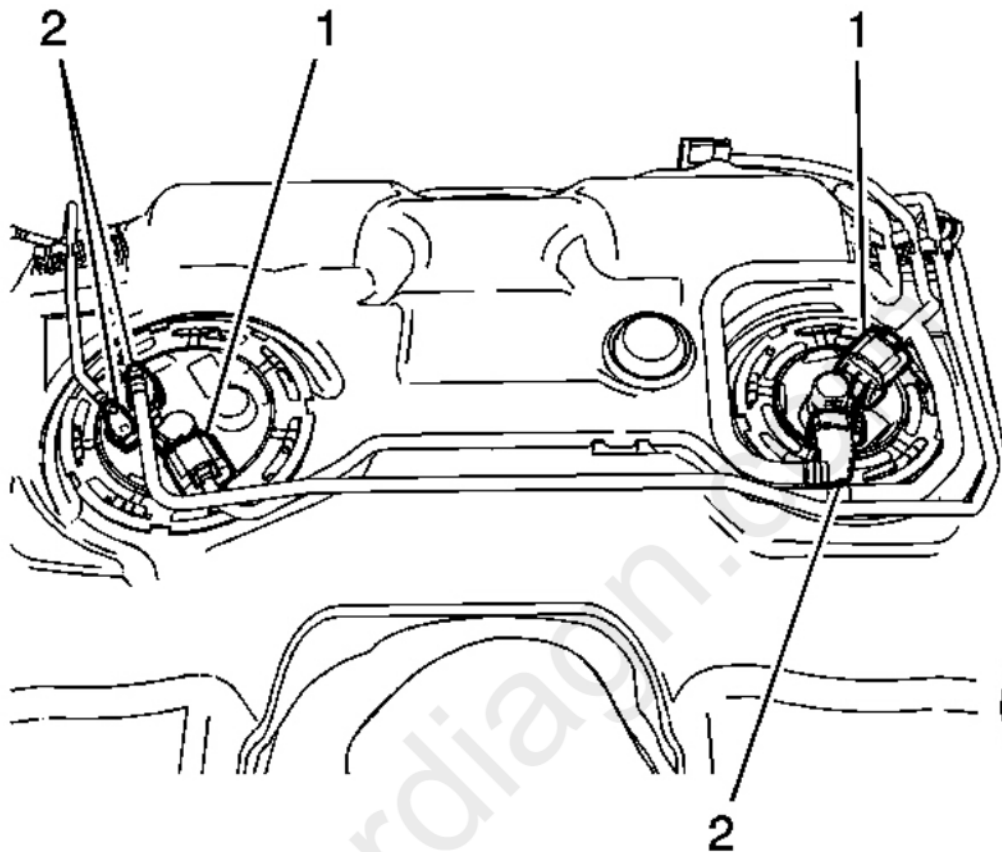


Fig. 62: Identifying Electrical Connectors At Primary & Secondary Fuel Tank Modules
Courtesy of GENERAL MOTORS CORP.

5. Connect the electrical connectors (1) to the primary and secondary fuel tank modules.
6. Connect the fuel and evaporative emission lines (2). Refer to **Plastic Collar Quick Connect Fitting Service**.
7. Install the fuel tank. Refer to **Fuel Tank Replacement**.

PRIMARY FUEL TANK MODULE REPLACEMENT (NA NE9 NF9)

Special Tools

CH 45722: Fuel Tank Sender Wrench

For equivalent regional tools, refer to **Special Tools**

Removal Procedure

WARNING: Refer to Gasoline/Gasoline Vapors Warning .

1. Remove the fuel tank. Refer to Fuel Tank Replacement.

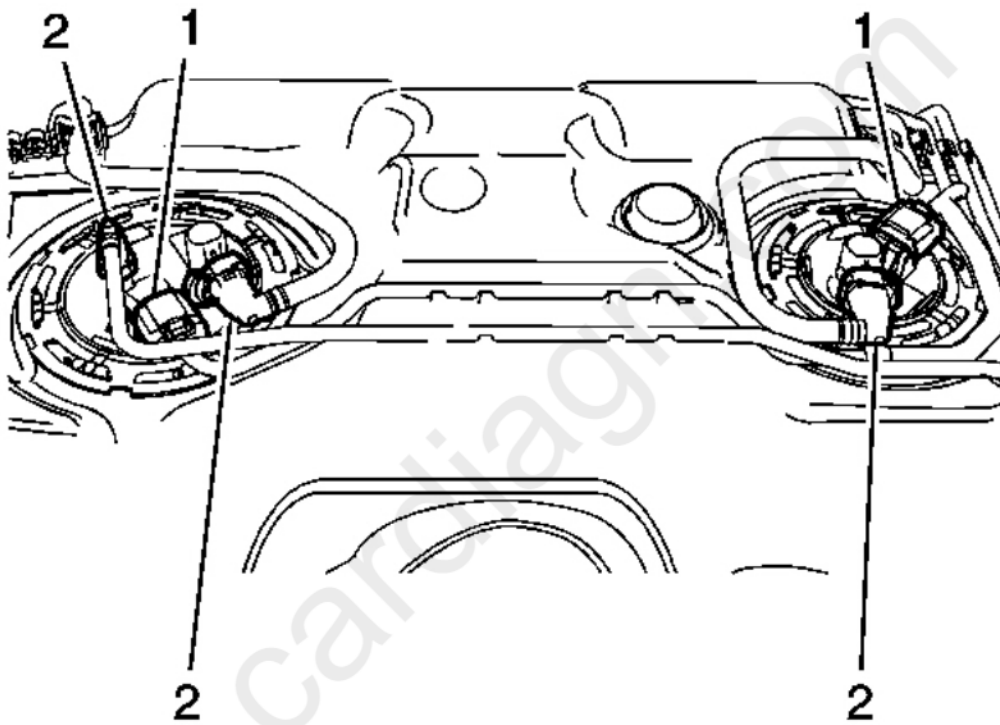


Fig. 6 : View Of Electrical Connectors At Primary & Secondary Fuel Tank Modules
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the electrical connectors (1) from the primary and secondary fuel tank modules.
3. Disconnect the fuel and evaporative emission lines (2). Refer to Plastic Collar Quick Connect Fitting Service.
4. Remove the secondary fuel pump module. Refer to Secondary Fuel Tank Module Replacement.

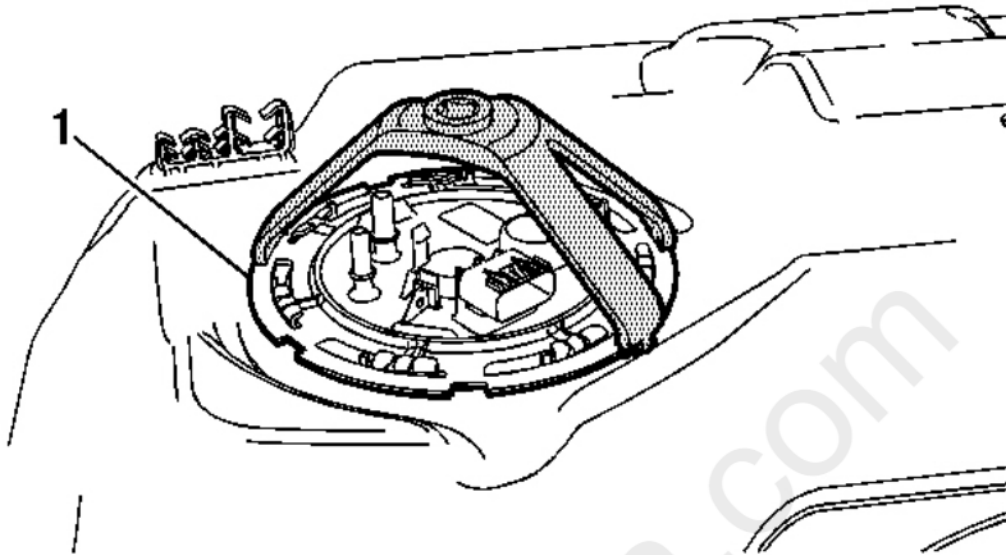


Fig. 64: Identifying Special Tool CH 45722
Courtesy of GENERAL MOTORS CORP.

5. Using the **CH 45722:** wrench, remove the cam lock ring (1) by turning counterclockwise.

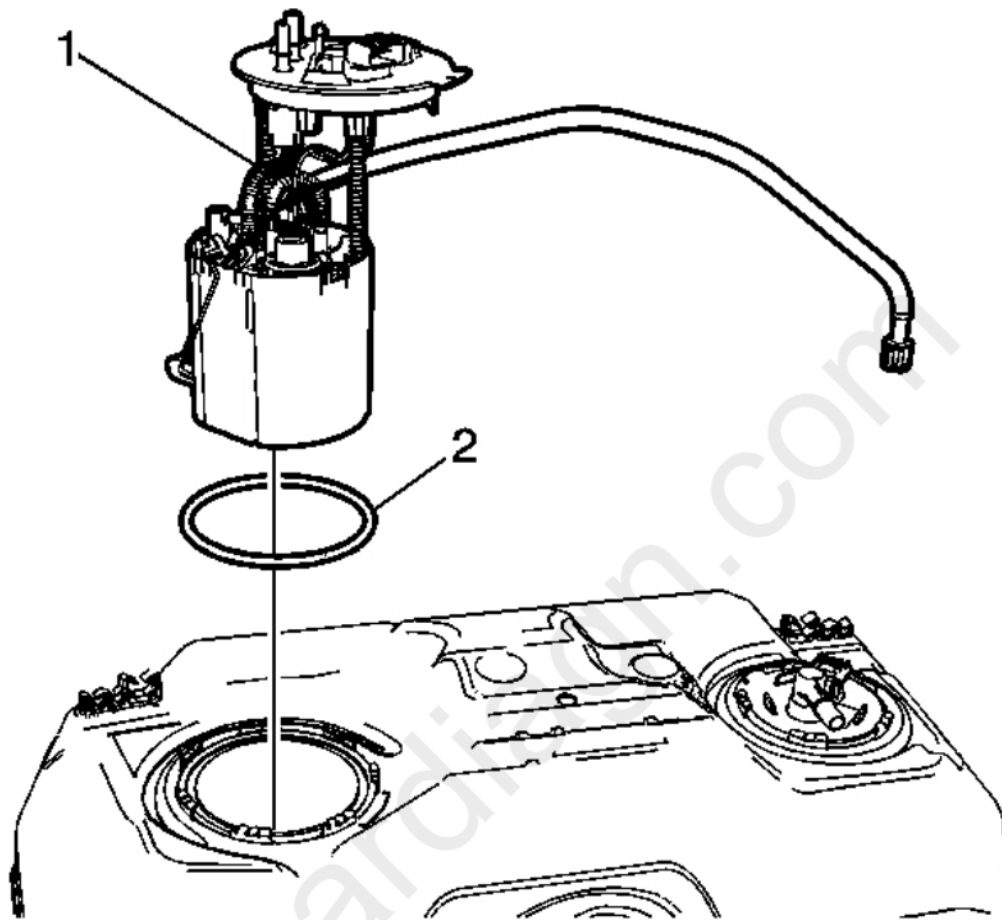


Fig. 65: View Of Primary Fuel Tank Module
Courtesy of GENERAL MOTORS CORP.

6. Remove the primary fuel tank module (1) and the O-ring (2).
7. If replacing the fuel pump module only, remove the primary fuel level sensor. Refer to **Primary Fuel Level Sensor Replacement**.

Installation Procedure

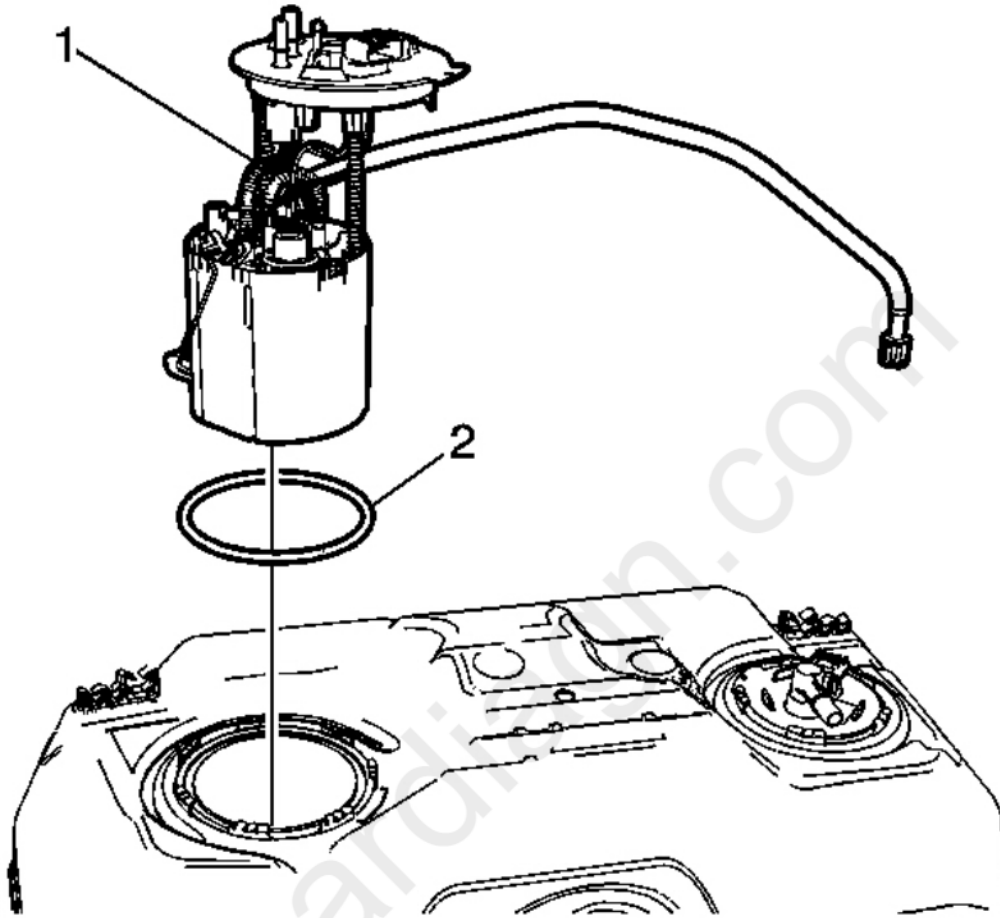


Fig. 66: View Of Primary Fuel Tank Module
Courtesy of GENERAL MOTORS CORP.

1. If replacing the fuel pump module only, install the primary fuel level sensor. Refer to **Primary Fuel Level Sensor Replacement**.
2. Install a NEW O-ring (2) and the primary fuel tank module (1).

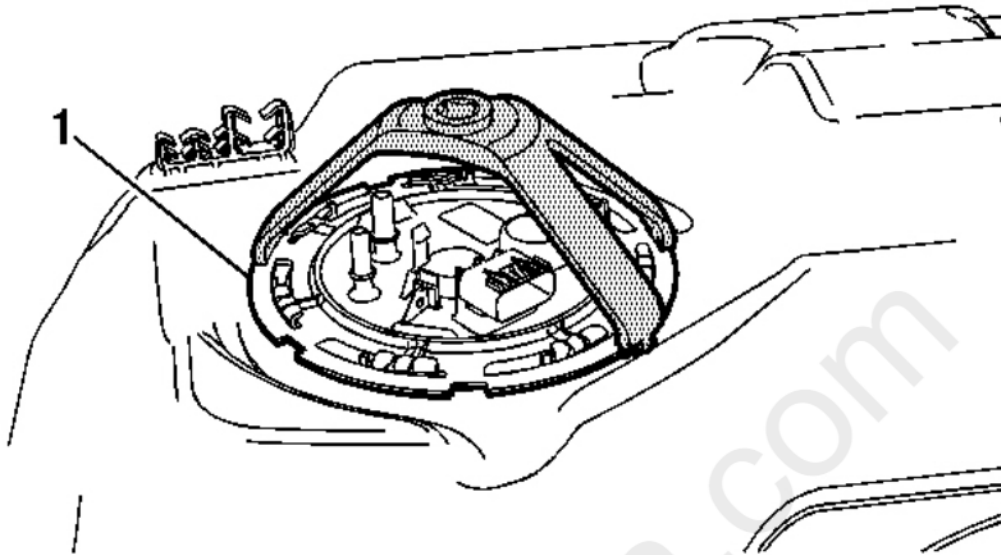


Fig. 67: Identifying Special Tool CH 45722
Courtesy of GENERAL MOTORS CORP.

3. Using the **CH 45722** wrench, install the cam lock ring (1) by turning clockwise.
4. Install the secondary fuel pump module. Refer to **Secondary Fuel Tank Module Replacement**.

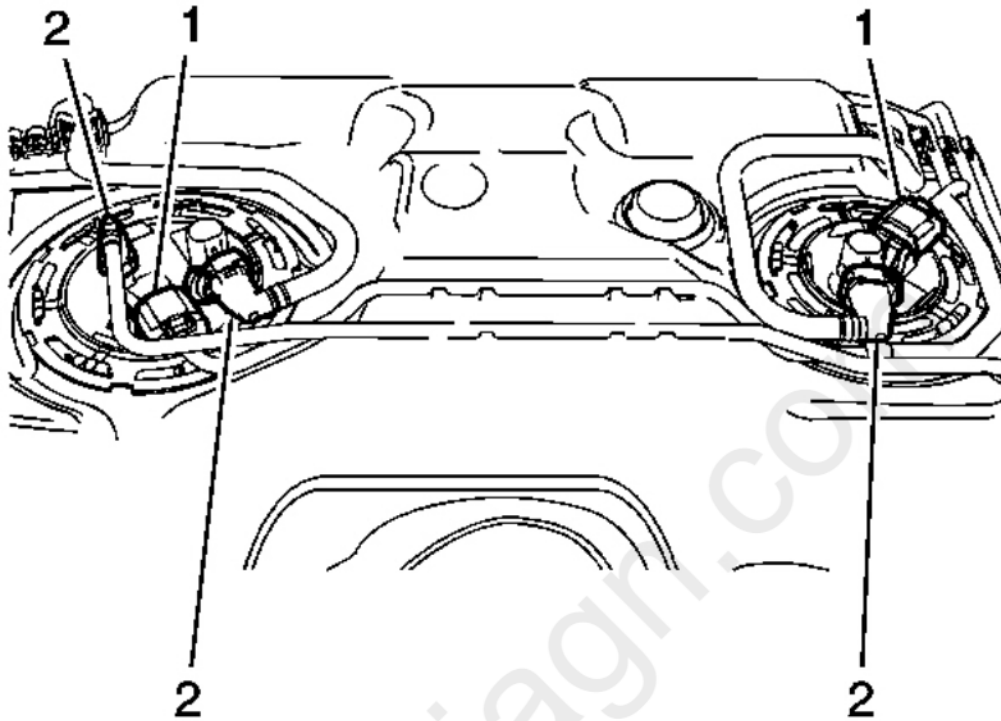


Fig. 68: View Of Electrical Connectors At Primary & Secondary Fuel Tank Modules
Courtesy of GENERAL MOTORS CORP.

5. Connect the electrical connectors (1) to the primary and secondary fuel tank modules.
6. Connect the fuel and evaporative emission lines (2). Refer to **Plastic Collar Quick Connect Fitting Service**.
7. Install the fuel tank. Refer to **Fuel Tank Replacement**.

PRIMARY FUEL TANK MODULE REPLACEMENT (CHINA)

Special Tools

CH 45722: Fuel Tank Sender Wrench

For equivalent regional tools, refer to **Special Tools**

Removal Procedure

WARNING: Refer to **Gasoline/Gasoline Vapors Warning** .

1. Remove the fuel tank. Refer to **Fuel Tank Replacement**.

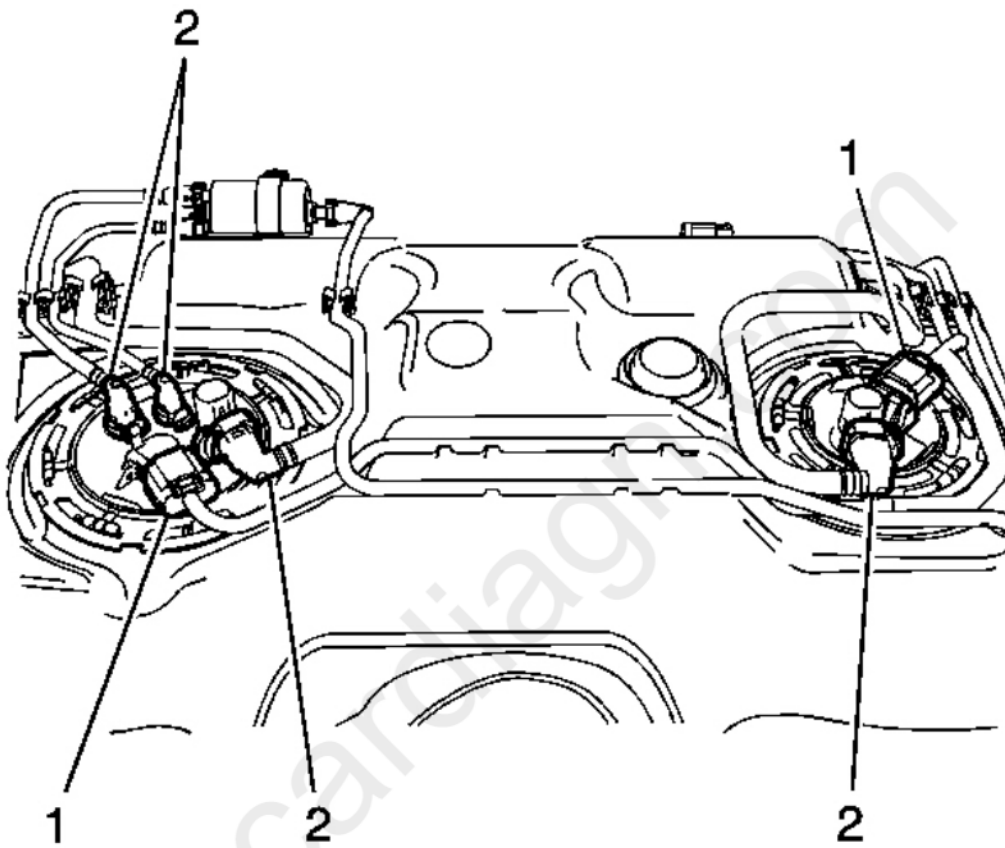


Fig. 69: Identifying Primary & Secondary Fuel Tank Module Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the electrical connectors (1) from the primary and secondary fuel tank modules.
3. Disconnect the fuel and evaporative emission lines (2). Refer to **Plastic Collar Quick Connect Fitting Service**.
4. Remove the secondary fuel pump module. Refer to **Secondary Fuel Tank Module Replacement**.

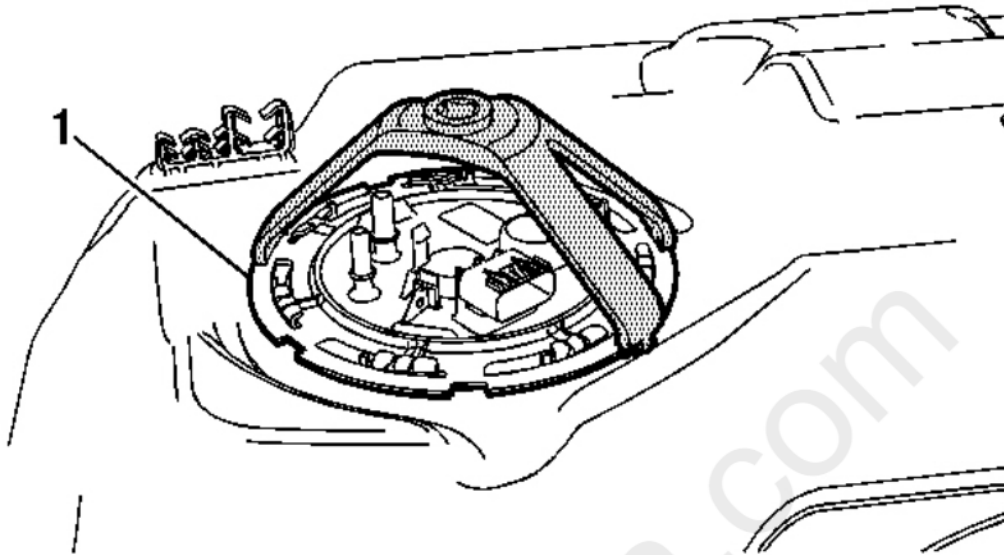


Fig. 70: Identifying Special Tool CH 45722
Courtesy of GENERAL MOTORS CORP.

5. Using the **CH 45722:** wrench, remove the cam lock ring (1) by turning counterclockwise.

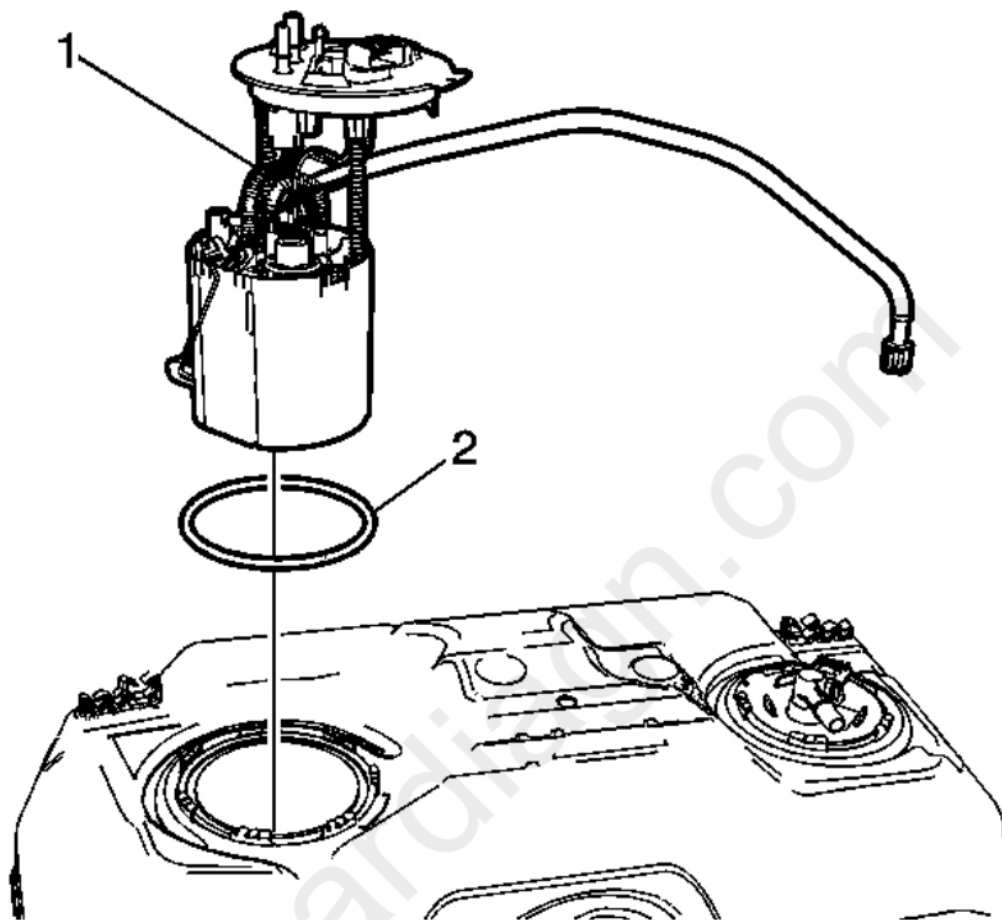


Fig. 71: View Of Primary Fuel Tank Module
Courtesy of GENERAL MOTORS CORP.

6. Remove the primary fuel tank module (1) and the O-ring (2).
7. If replacing the fuel pump module only, remove the primary fuel level sensor. Refer to **Primary Fuel Level Sensor Replacement**.

Installation Procedure

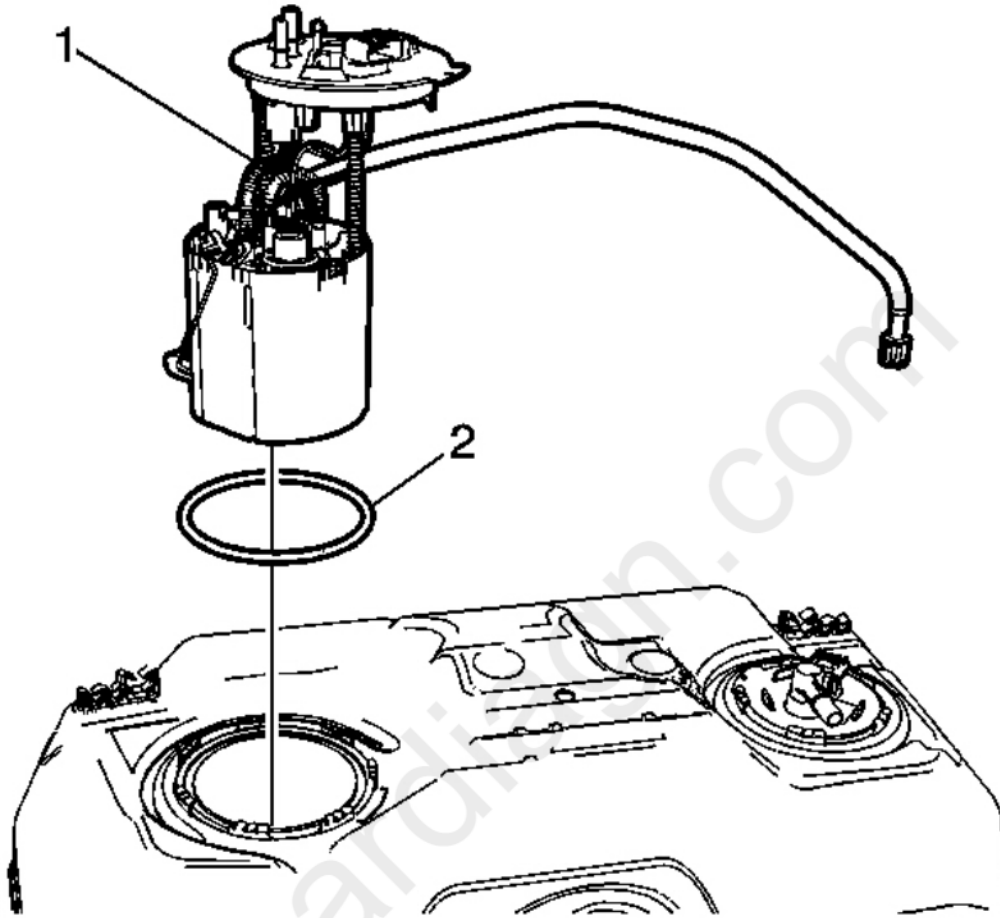


Fig. 7 : View Of Primary Fuel Tank Module
Courtesy of GENERAL MOTORS CORP.

1. If replacing the fuel pump module only, install the primary fuel level sensor. Refer to **Primary Fuel Level Sensor Replacement**.
2. Install a NEW O-ring (2) and the primary fuel tank module (1).

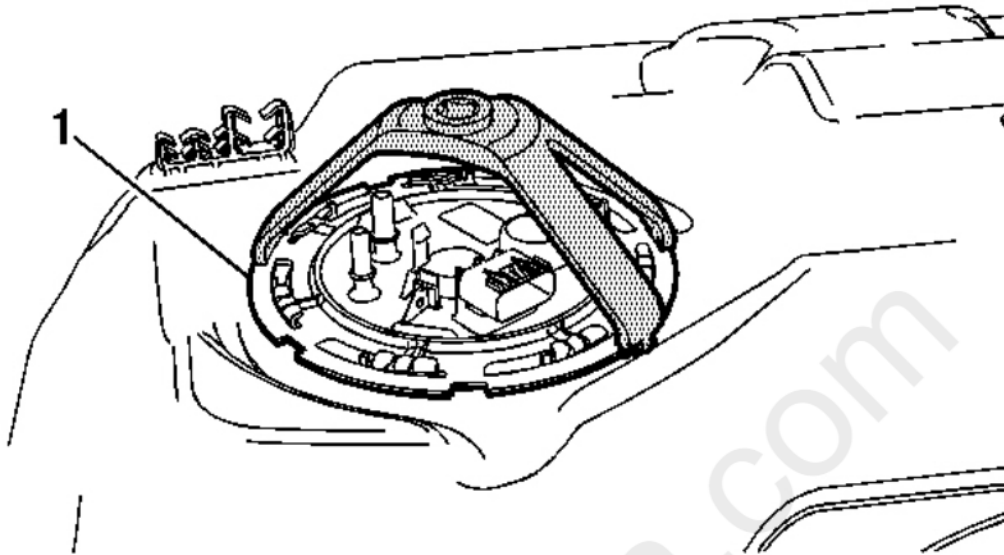


Fig. 7 : Identifying Special Tool C 7
Courtesy of GENERAL MOTORS CORP.

3. Using the C 7 : wrench, install the cam lock ring (1) by turning clockwise.
4. Install the secondary fuel pump module. Refer to **Secondary Fuel Tank Module Replacement**.

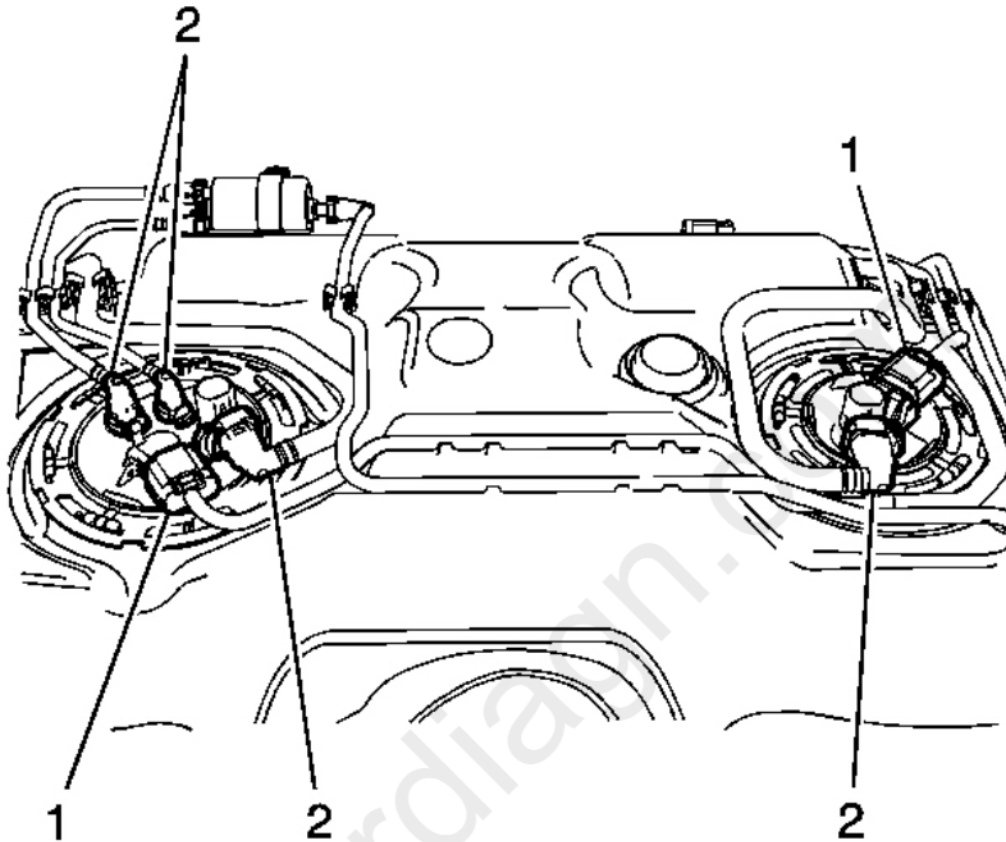


Fig. 7 : Identifying Primary & Secondary Fuel Tank Module Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

5. Connect the electrical connectors (1) to the primary and secondary fuel tank modules.
6. Connect the fuel and evaporative emission lines (2). Refer to **Plastic Collar Quick Connect Fitting Service**.
7. Install the fuel tank. Refer to **Fuel Tank Replacement**.

SECONDARY FUEL TANK MODULE REPLACEMENT

Special Tools

C 8 8 : Fuel Tank Sender Wrench

For equivalent regional tools, refer to **Special Tools**.

Removal Procedure

WARNING: Refer to Gasoline/Gasoline Vapors Warning .

1. Remove the fuel tank. Refer to Fuel Tank Replacement.

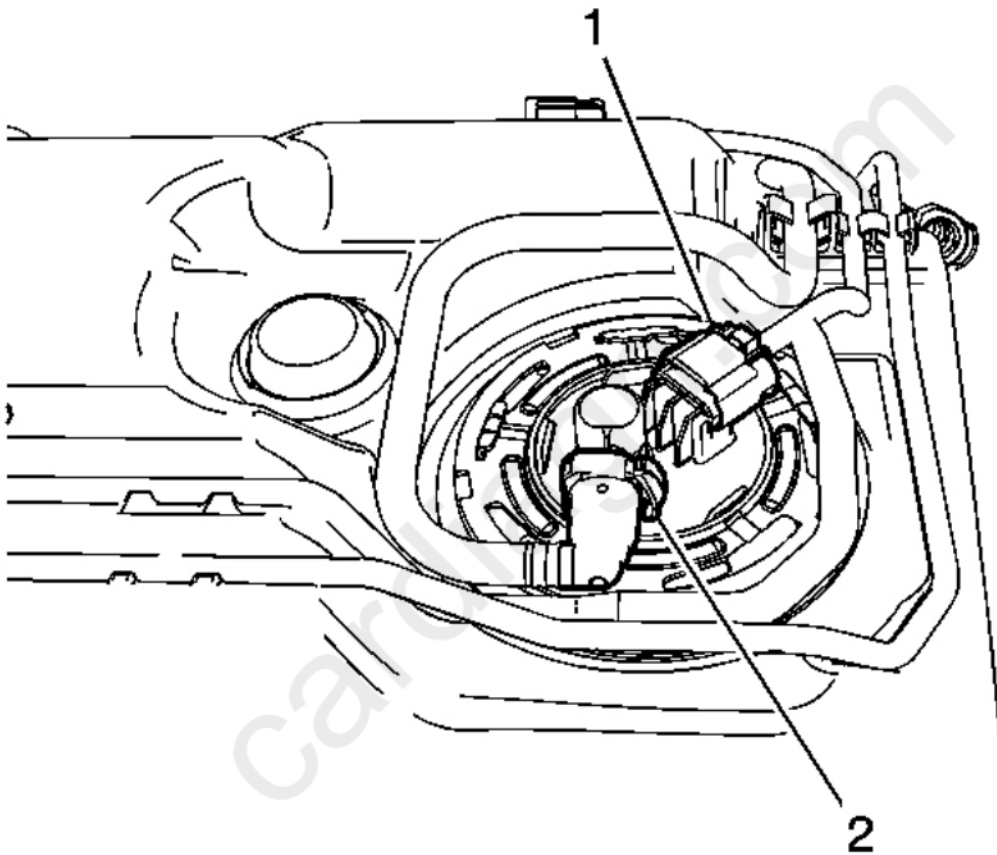


Fig. 7 : Locating Fuel Tank Module Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the electrical connector (1).
3. Disconnect the evaporative emission line (2). Refer to Plastic Collar Quick Connect Fitting Service.

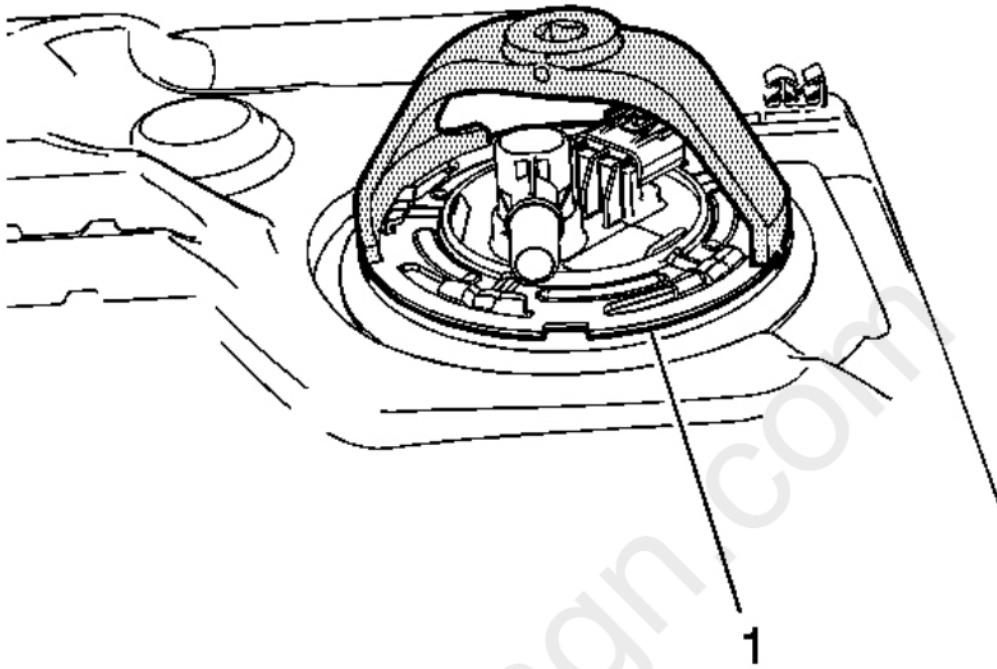


Fig. 7 : Identifying Special Tool C 8 8
Courtesy of GENERAL MOTORS CORP.

4. Using the C 8 8 : wrench, remove the cam lock ring (1) by turning counterclockwise.

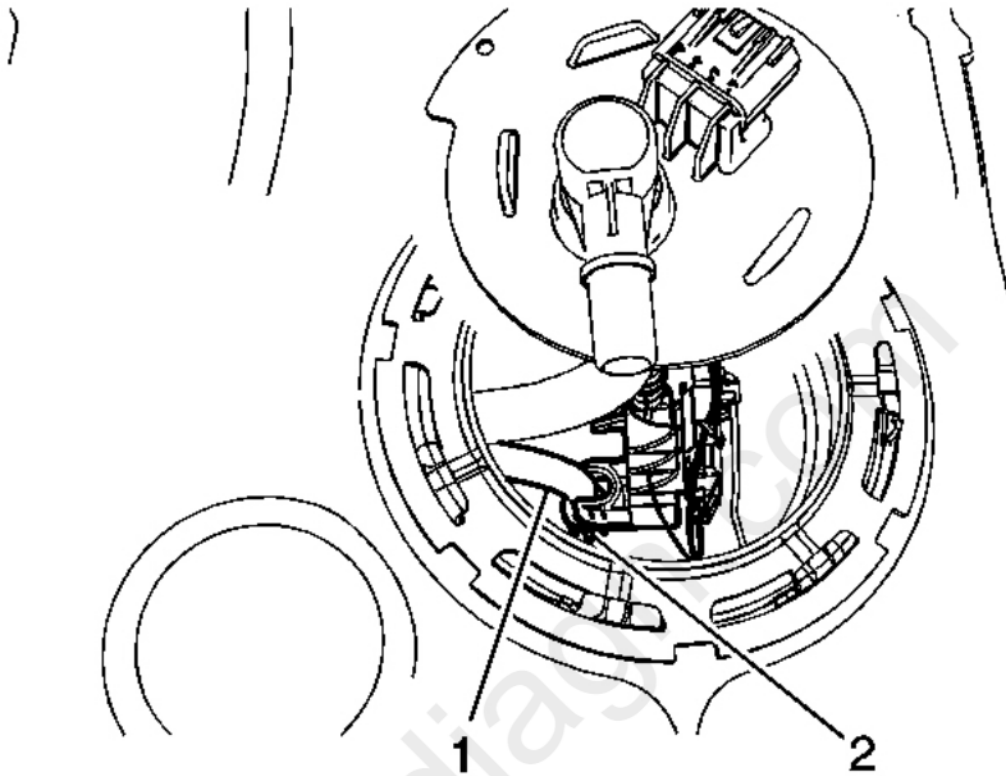


Fig. 77: Identifying Secondary Fuel Pump Module & Crossover Tube
Courtesy of GENERAL MOTORS CORP.

5. Partially raise the secondary fuel pump module and disconnect the crossover tube (1) by pulling back the plastic retaining tab (2).

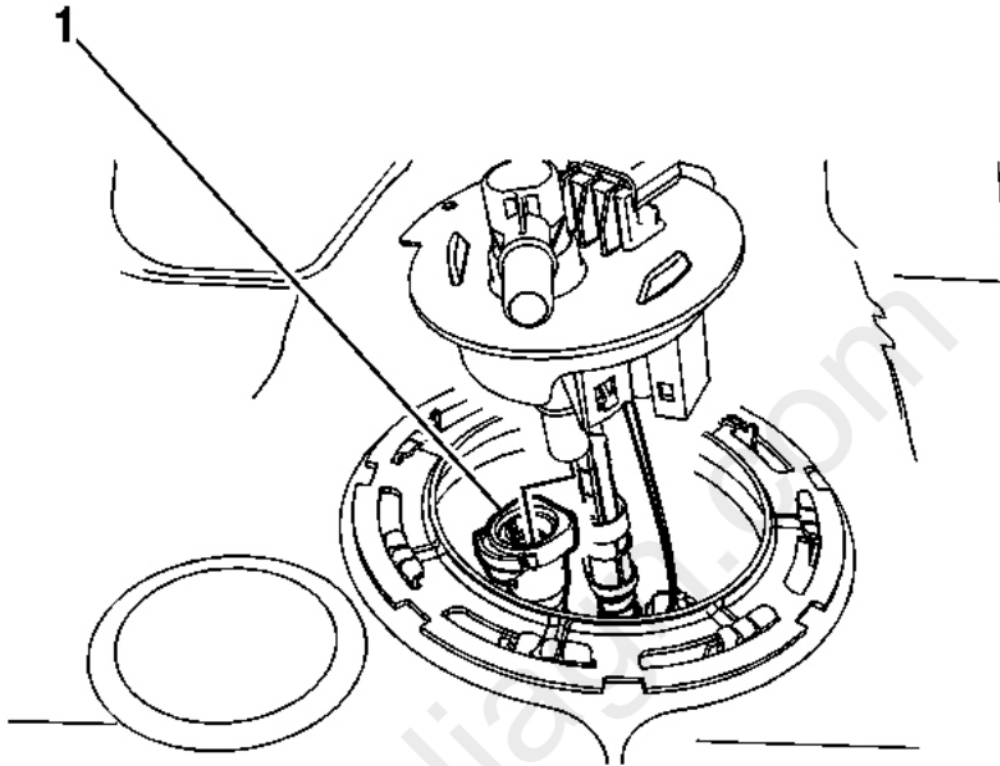


Fig. 78: View Of Evaporative Emission Line
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.

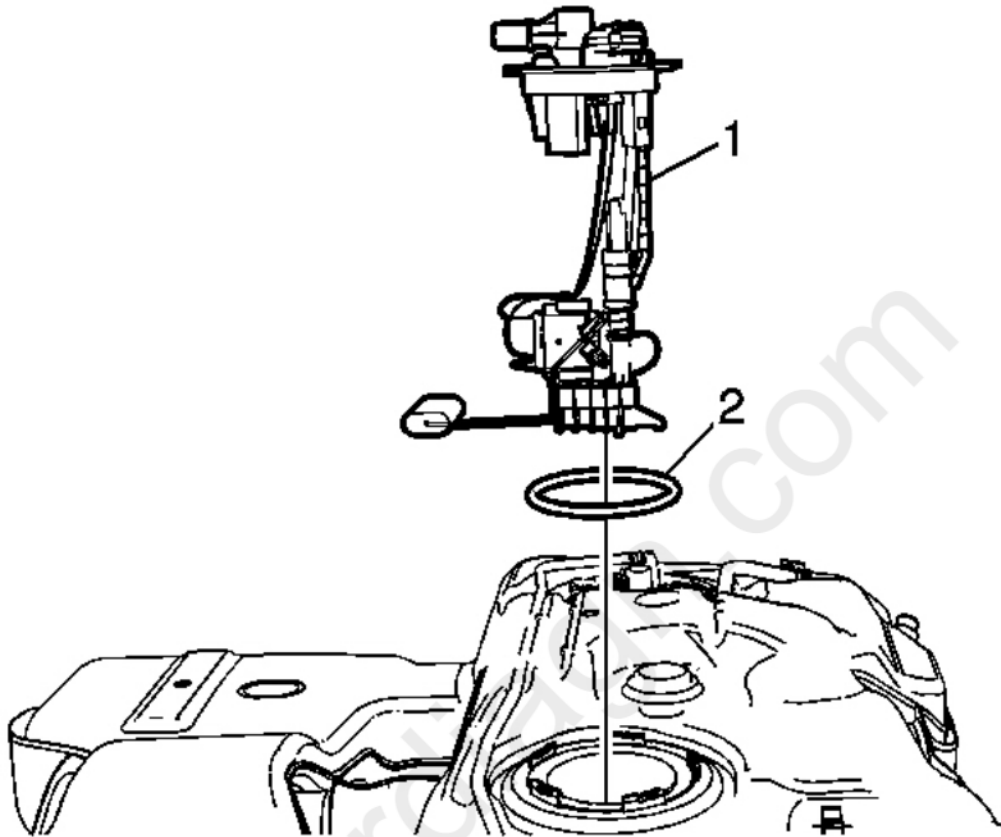


Fig. 79: Identifying Secondary Fuel Tank Module & O-Ring
Courtesy of GENERAL MOTORS CORP.

7. Remove the secondary fuel tank module (1) and the O-ring (2).

Installation Procedure

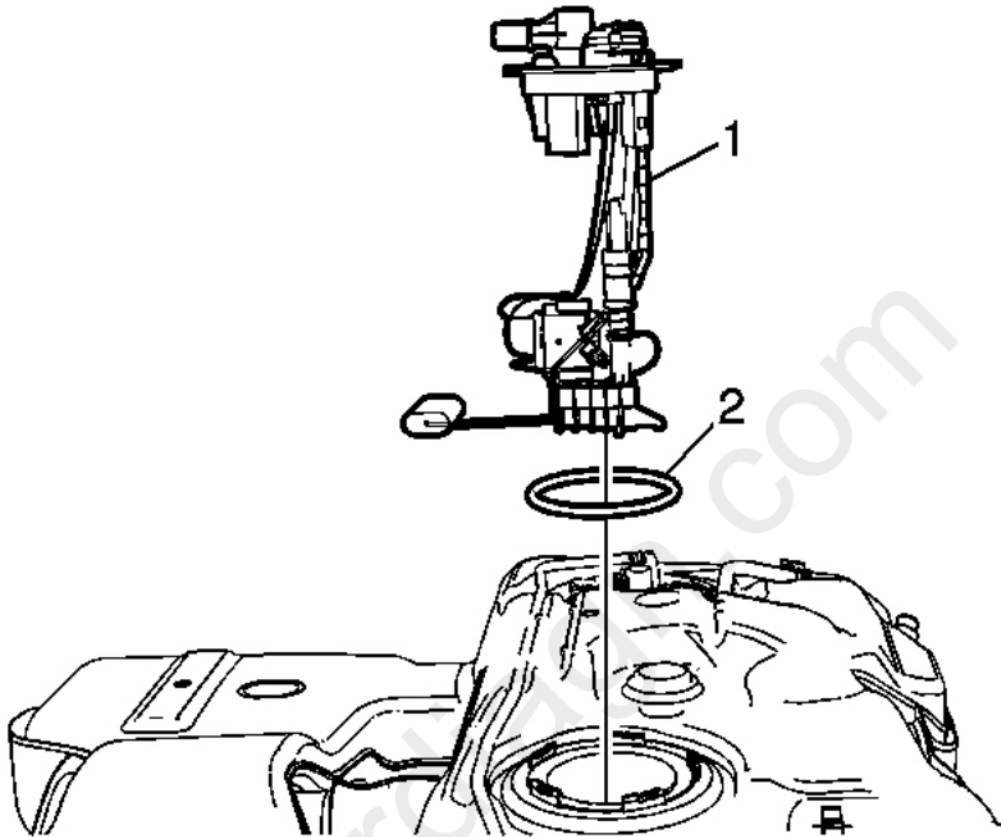


Fig. 80: Identifying Secondary Fuel Tank Module & O-Ring
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW O-ring (2) and the primary fuel tank module (1).

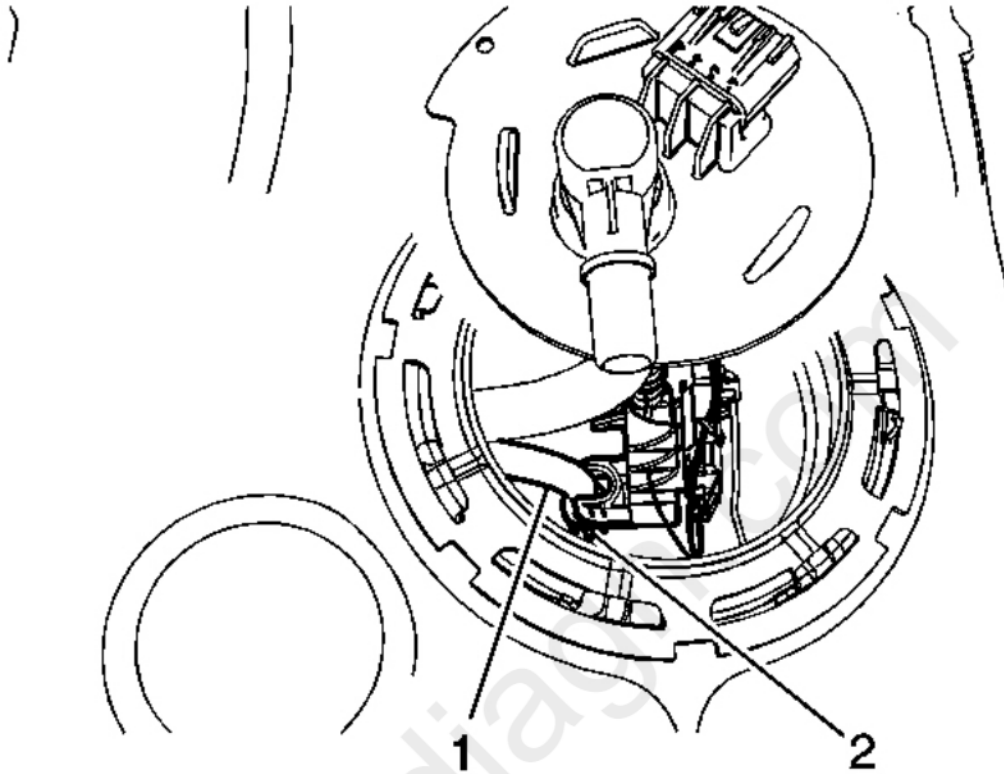


Fig. 81: Identifying Secondary Fuel Pump Module & Crossover Tube
Courtesy of GENERAL MOTORS CORP.

2. Partially install the secondary fuel pump module and connect the crossover tube (1).

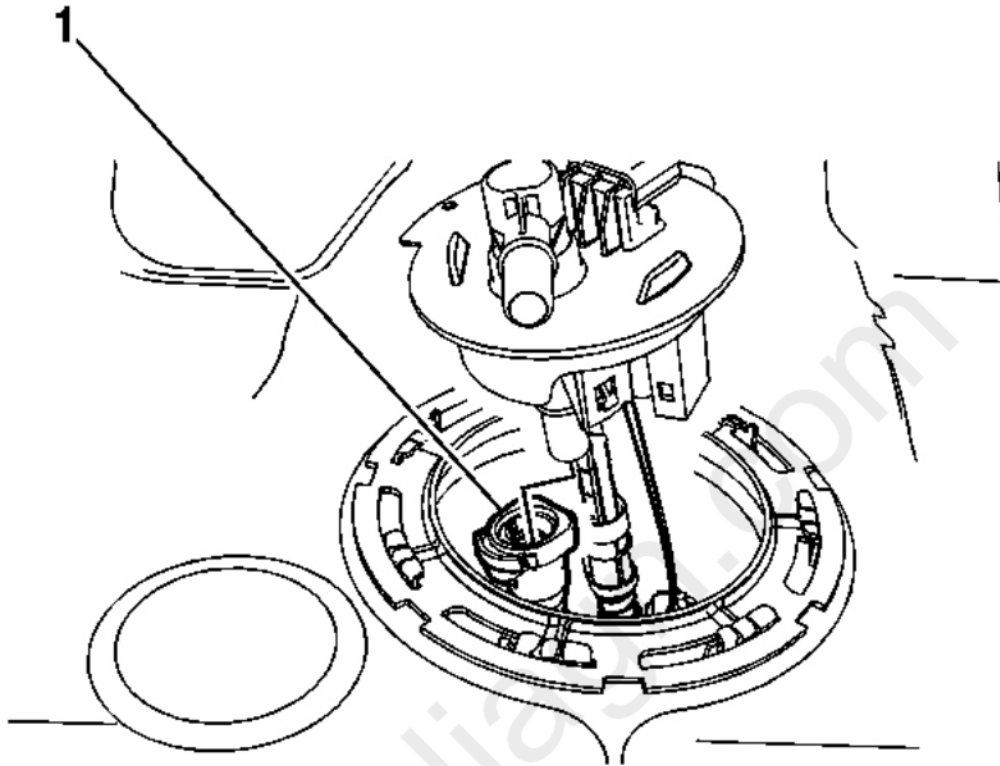


Fig. 8 : ie Of Evaporative Emission Line
Courtesy of GENERAL MOTORS CORP.

3. Connect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.

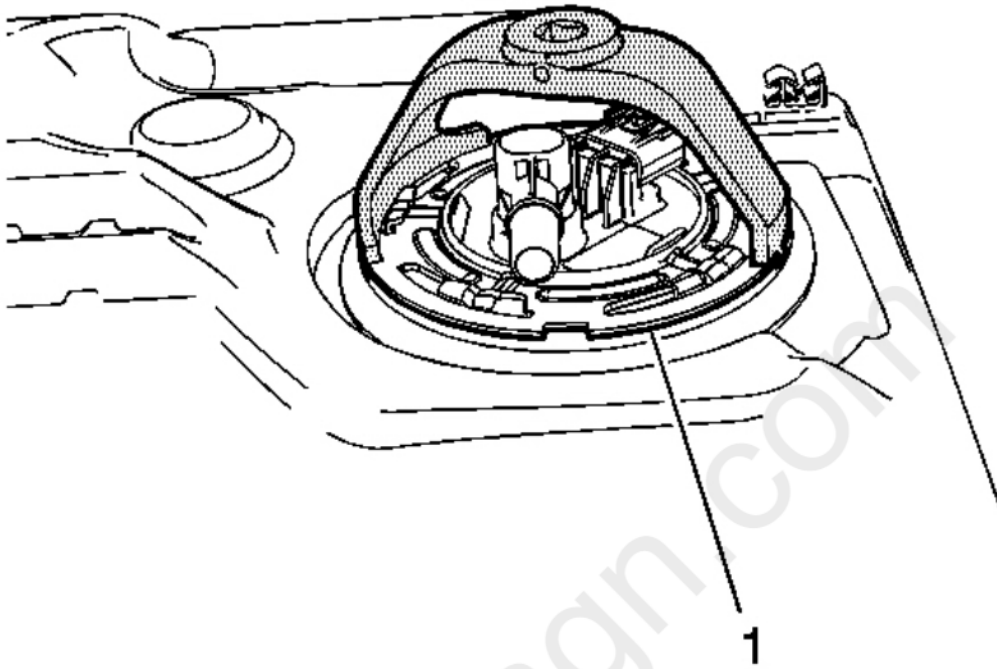


Fig. 83: Identifying Special Tool CH 8 8
Courtesy of GENERAL MOTORS CORP.

4. Using the **CH 8 8** : wrench, install the cam lock ring (1) by turning clockwise.

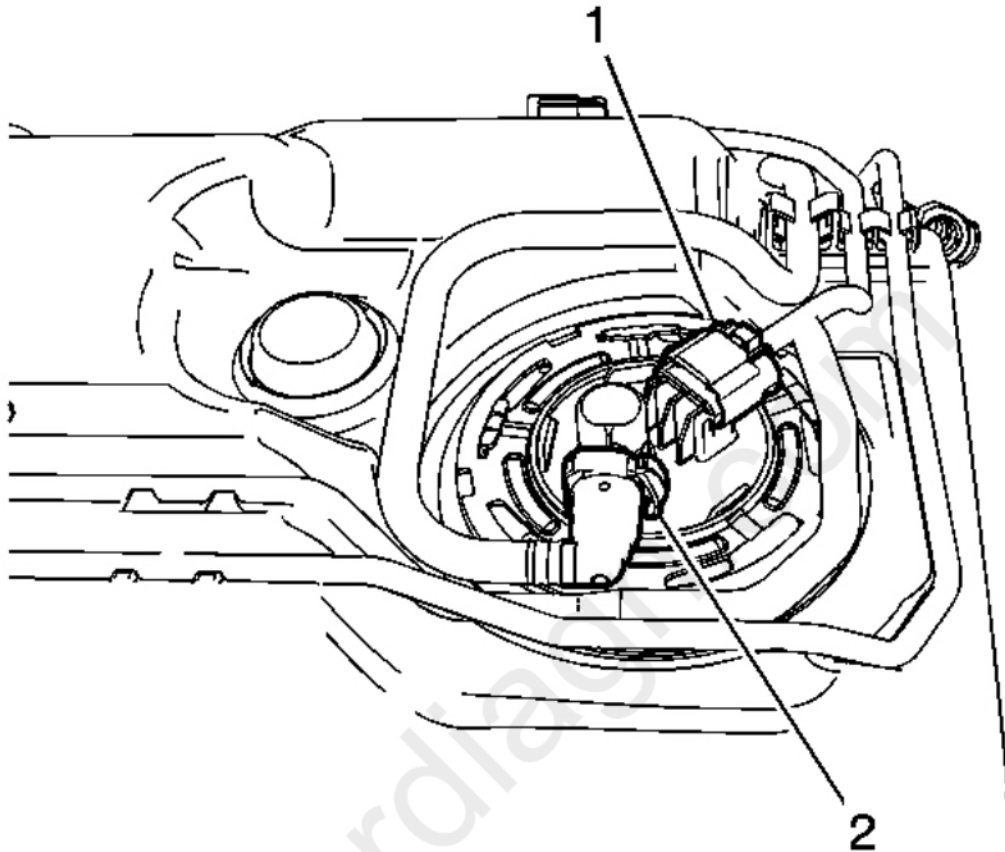


Fig. 8 : Locating Fuel Tank Module Electrical Connector
Courtesy of GENERAL MOTORS CORP.

5. Connect the electrical connector (1).
6. Connect the evaporative emission line (2). Refer to **Plastic Collar Quick Connect Fitting Service**.
7. Install the fuel tank. Refer to **Fuel Tank Replacement**.

PRIMAR FUEL LE EL SENSOR REPLACEMENT

Removal Procedure

WARNING: Fuel Vapors can collect while servicing fuel system parts in enclosed areas such as a trunk. To reduce the risk of fire and increased exposure to vapors:

- Use forced air ventilation such as a fan set outside of the trunk.

- Plug or cap any fuel system openings in order to reduce fuel vapor formation.
- Clean up any spilled fuel immediately.
- Avoid sparks and any source of ignition.
- Use signs to alert others in the work area that fuel system work is in process.

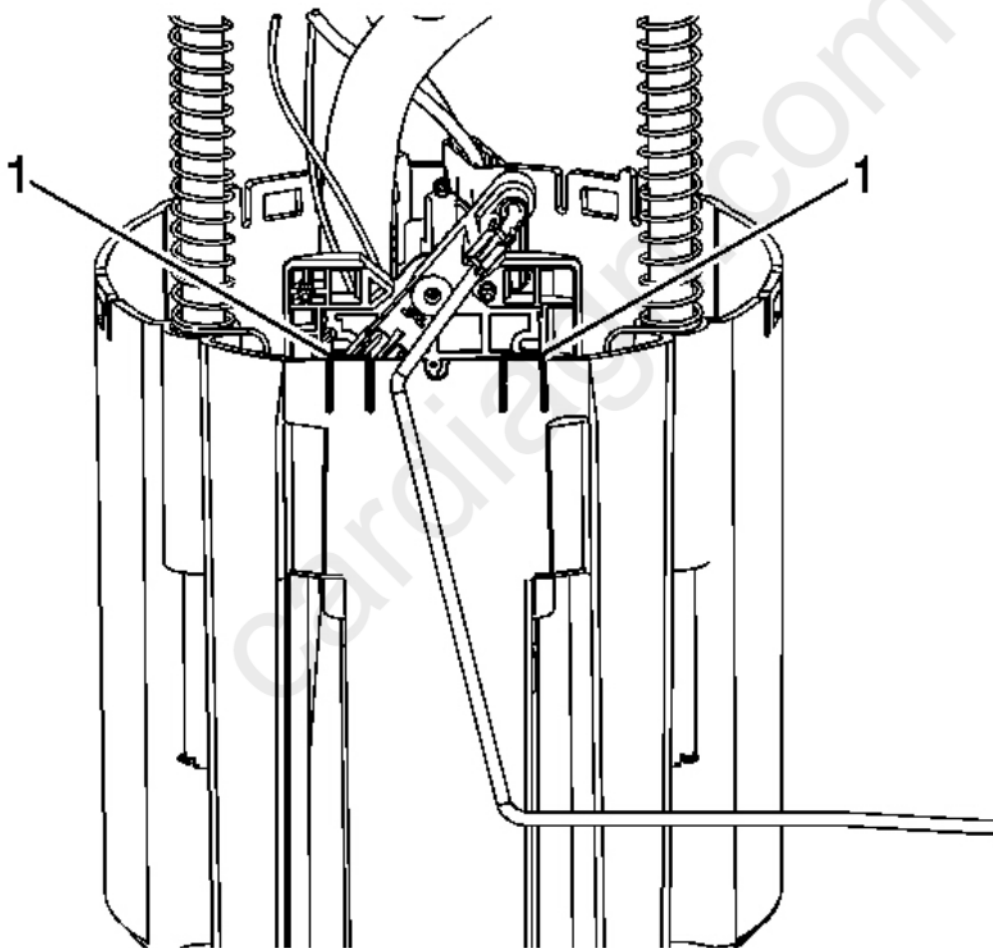


Fig. 85: Identifying Locking Tabs
Courtesy of GENERAL MOTORS CORP.

1. Remove the primary fuel tank module. Refer to **Primary Fuel Tank Module Replacement (NT7, NU5)** or **Primary Fuel Tank Module Replacement (NA3, NE9, NF9)** or **Primary Fuel Tank Module**

Replacement (China).

2. Using two flat-bladed tools, carefully pull both locking tabs (1) outward while simultaneously lifting the level sensor.

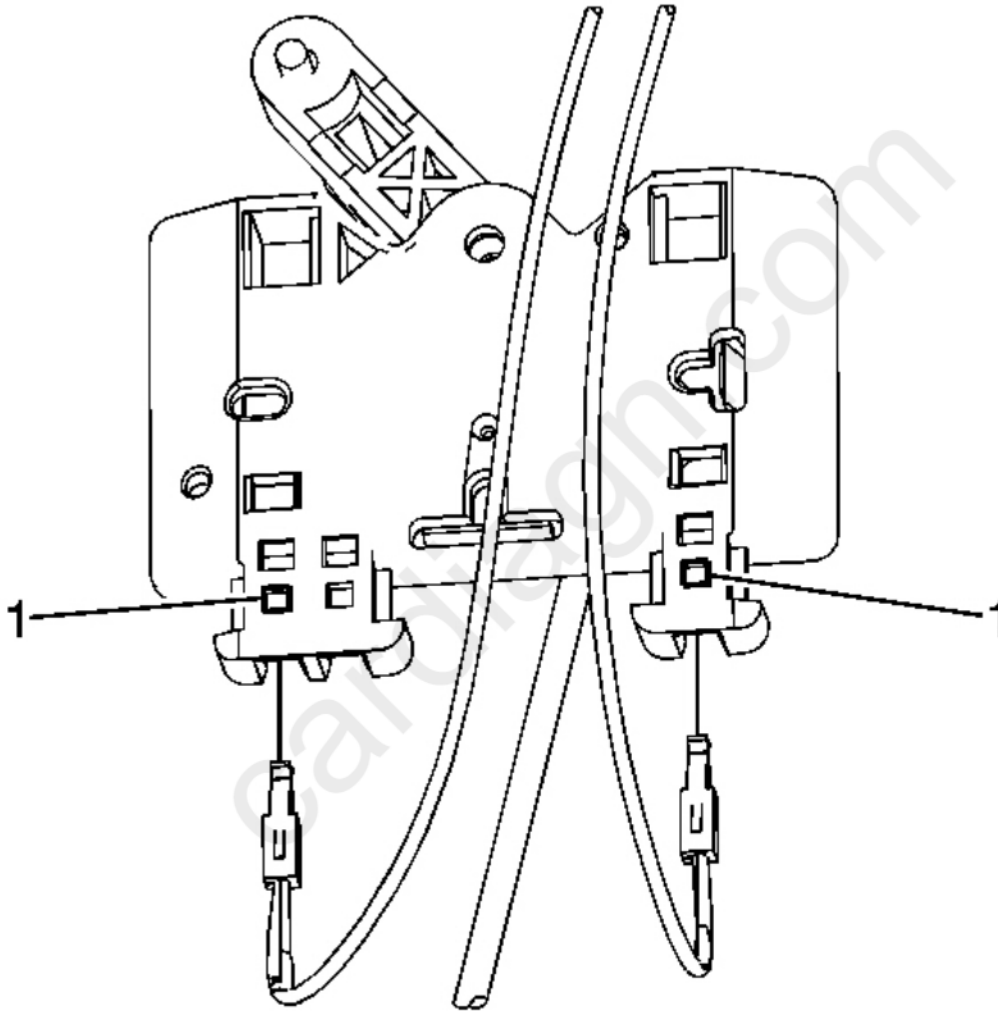


Fig. 8 : Identifying Electrical Terminals
Courtesy of GENERAL MOTORS CORP.

3. Using a small bladed tool, push in the electrical terminals (1) while simultaneously pulling out.

Installation Procedure

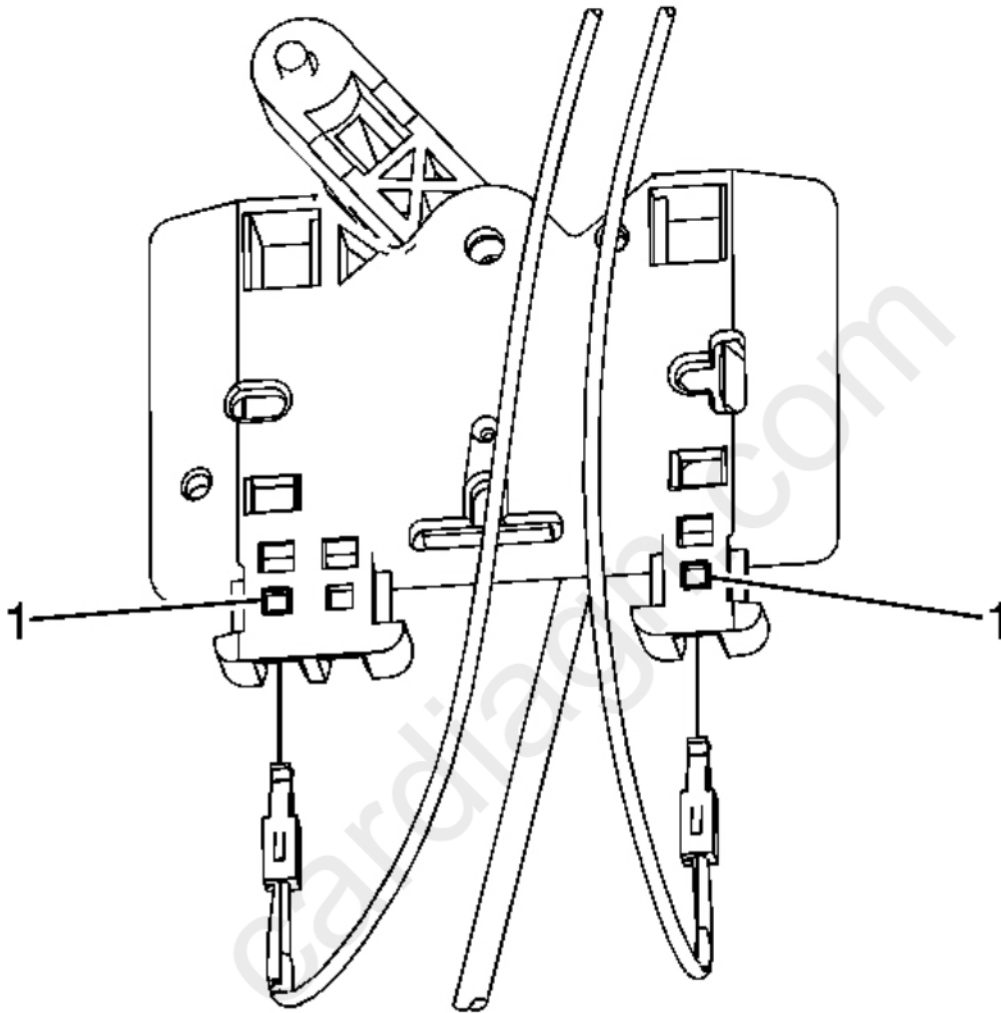


Fig. 87: Identifying Electrical Terminals
Courtesy of GENERAL MOTORS CORP.

1. Push in the electrical terminals (1) and ensure the terminals are secure.

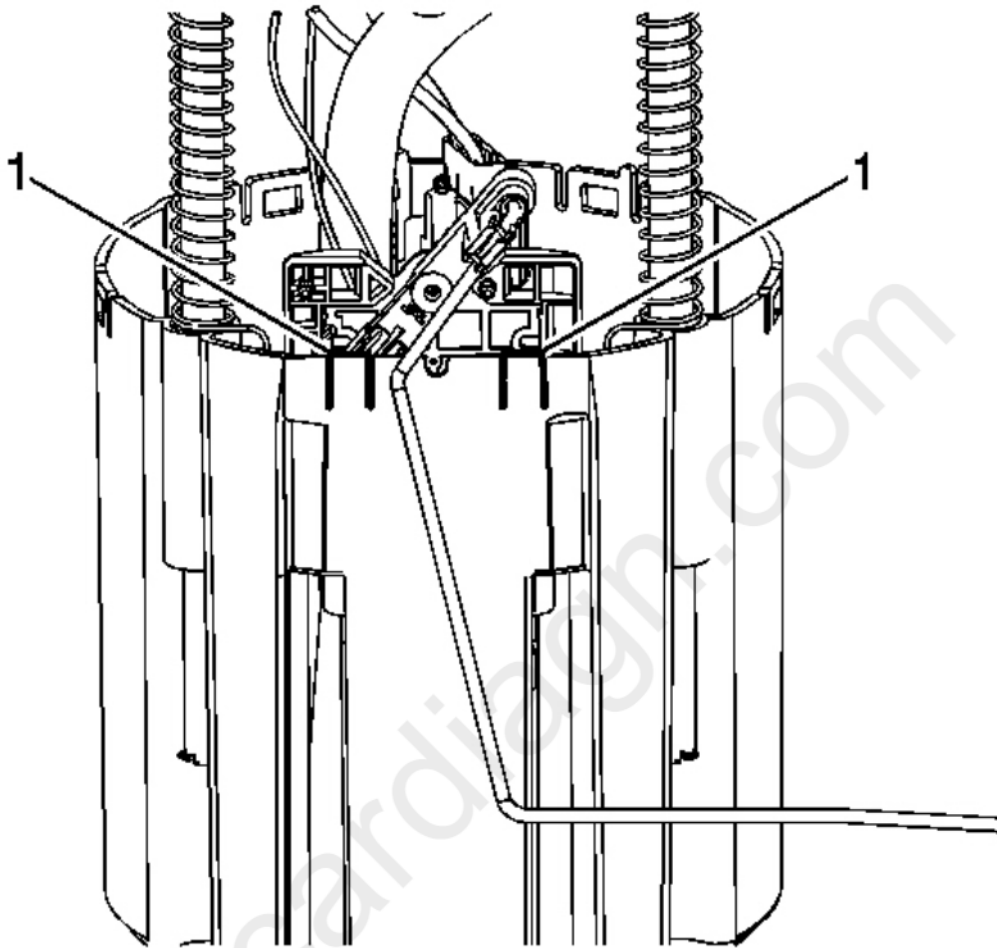


Fig. 88: Identifying Locking Tabs
Courtesy of GENERAL MOTORS CORP.

2. Carefully insert the level sensor until the locking tabs (1) snap into the locking position.
3. Install the primary fuel tank module. Refer to **Primary Fuel Tank Module Replacement (NT7, NU5)** or **Primary Fuel Tank Module Replacement (NA3, NE9, NF9)** or **Primary Fuel Tank Module Replacement (China)**.

FUEL LINE REPLACEMENT - CHASSIS

Removal Procedure

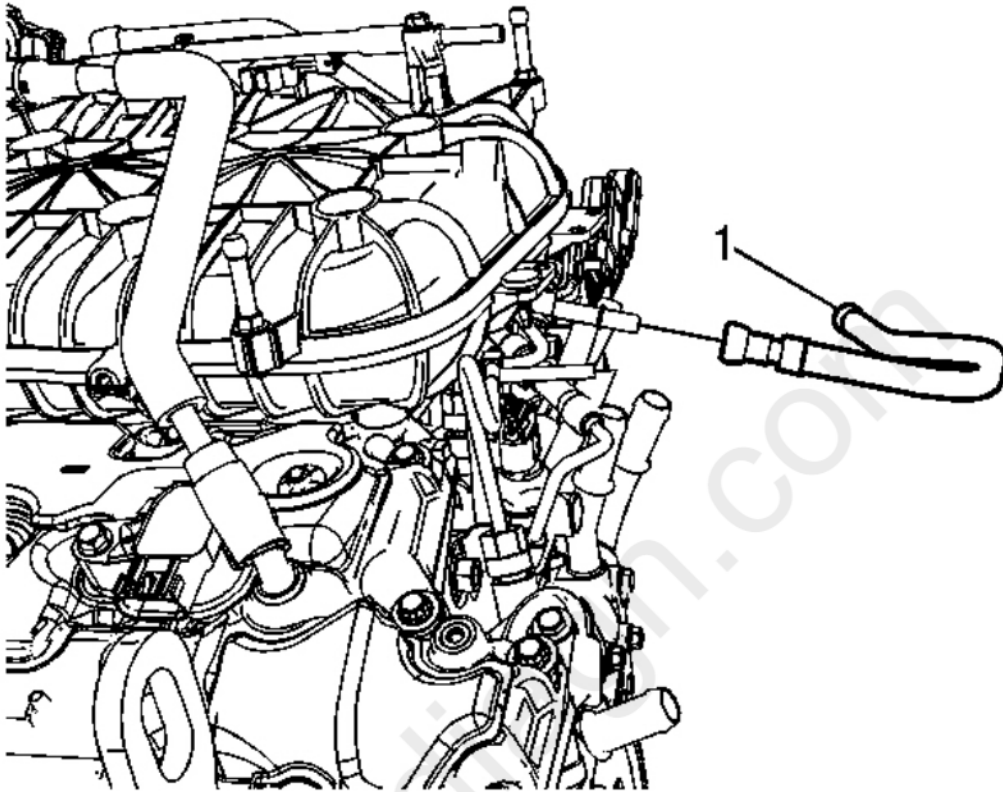


Fig. 89: Identifying Fuel Feed Line

Courtesy of GENERAL MOTORS CORP.

1. Disconnect the fuel feed line (1). Refer to Metal Collar Quick Connect Fitting Service.

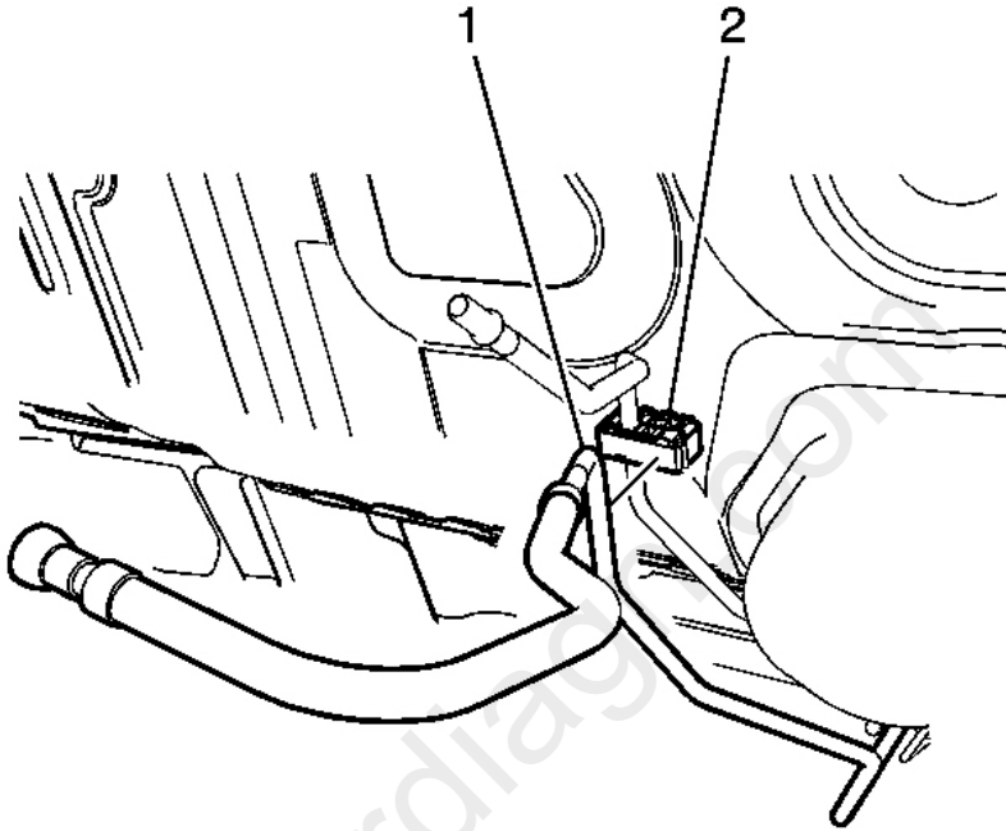


Fig. 90: Identifying Fuel Feed Line & Plastic Retainer
Courtesy of GENERAL MOTORS CORP.

2. Disengage the fuel feed line (1) from the plastic retainer (2).
3. Remove the fuel pressure sensor. Refer to **Fuel Pressure Sensor Replacement - Fuel Feed Pipe**.

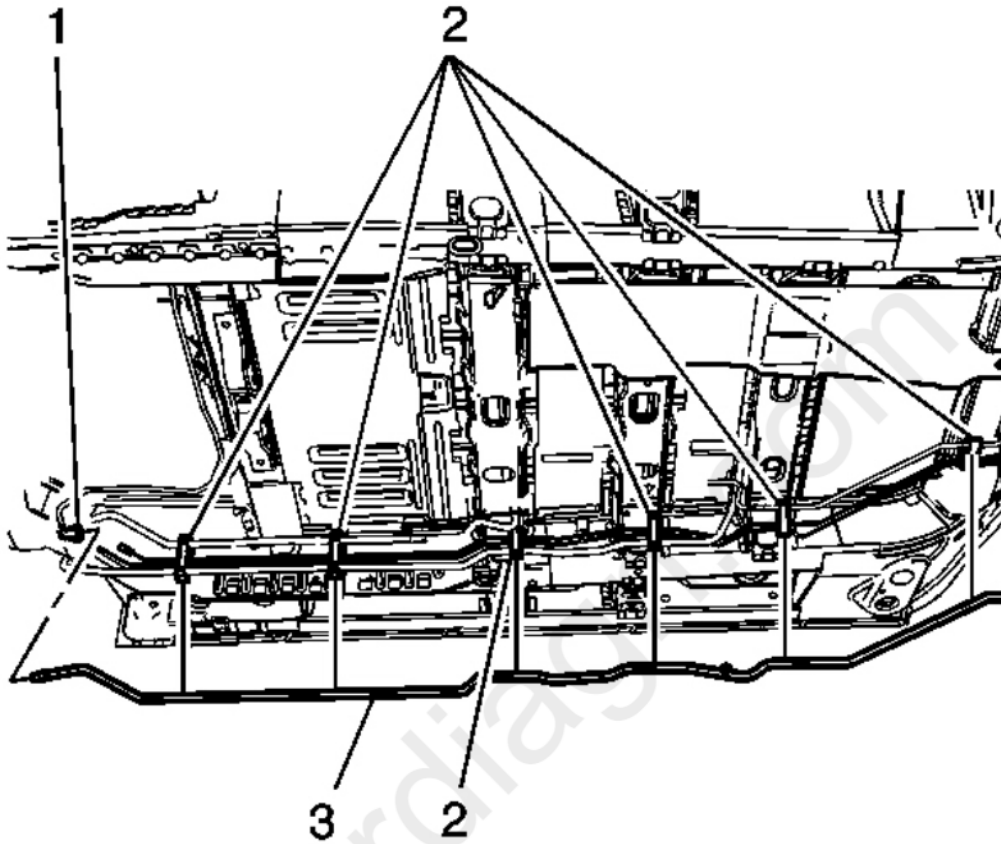


Fig. 91: Identifying Fuel Feed Line & Plastic Retainers
Courtesy of GENERAL MOTORS CORP.

- . Disconnect the fuel feed line quick connect (1). Refer to **Plastic Collar Quick Connect Fitting Service**.
- 5. Disengage the fuel feed line (3) from the plastic retainers (2) and remove the fuel feed line.

Installation Procedure

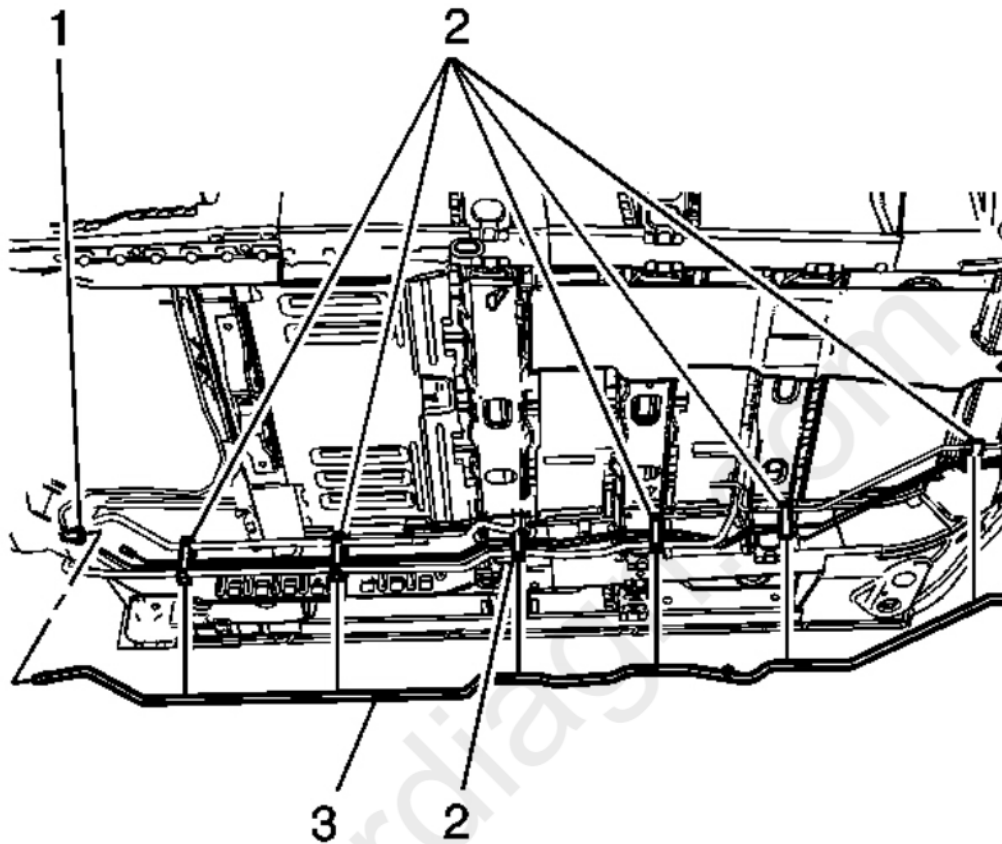


Fig. 92: Identifying Fuel Feed Line Plastic Retainers
Courtesy of GENERAL MOTORS CORP.

1. Install the fuel feed line (3) into the plastic retainers (2).
2. Connect the fuel feed line quick connect (1). Refer to **Plastic Collar Quick Connect Fitting Service**.
3. Install the fuel pressure sensor. Refer to **Fuel Pressure Sensor Replacement - Fuel Feed Pipe**.

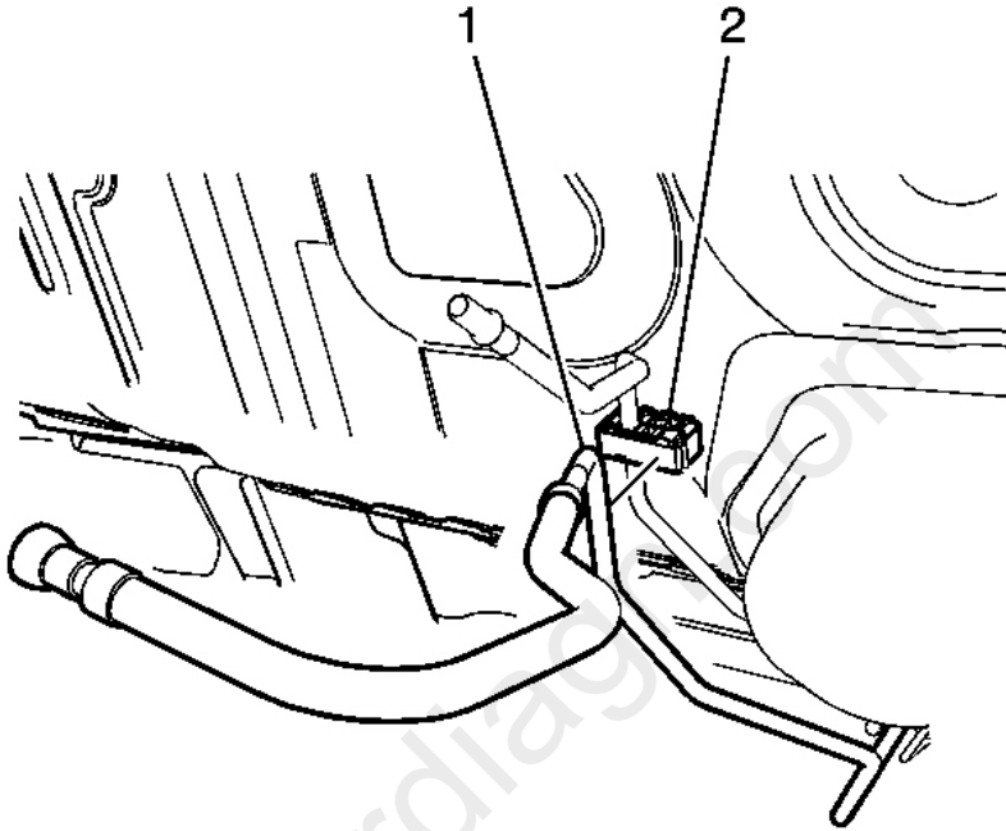


Fig. 93: Identifying Fuel Feed Line Plastic Retainer
Courtesy of GENERAL MOTORS CORP.

4. Engage the fuel feed line (1) to the plastic retainer (2).

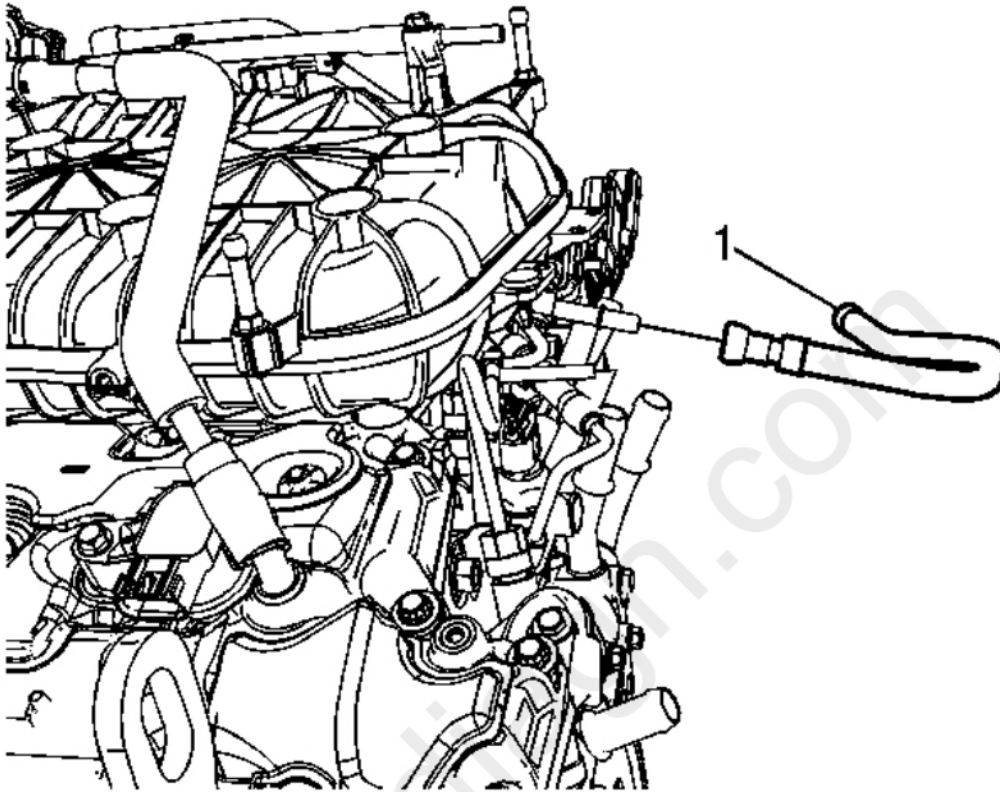


Fig. 94: Identifying Fuel Feed Line

Courtesy of GENERAL MOTORS CORP.

5. Connect the fuel feed line (1). Refer to **Metal Collar Quick Connect Fitting Service**.

FUEL PRESSURE SENSOR REPLACEMENT - FUEL FEE PIPE

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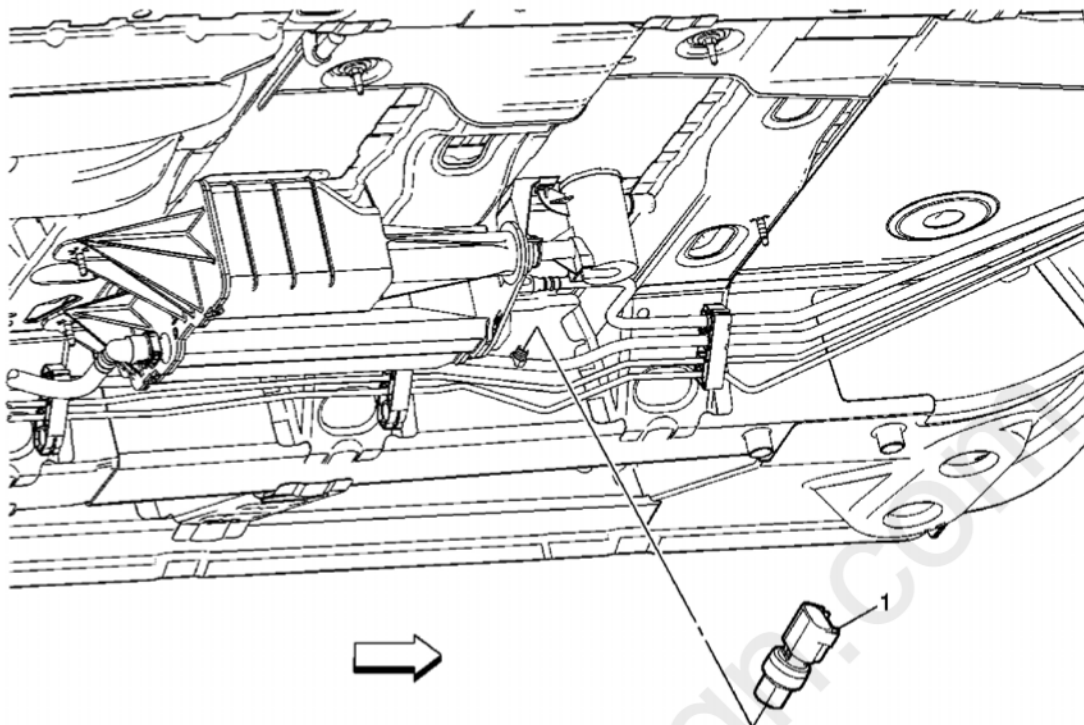


Fig. 95: Identifying Fuel Pressure Sensor - Fuel Feed Pipe
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief. 2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.	
1	Fuel Pressure Sensor CAUTION: Refer to Fastener Caution. Procedure 1. Use a NEW O-ring. 2. Disconnect the electrical connector. Tighten: 9 N.m (80 lb in)

FUEL FEE PIPE REPLACEMENT

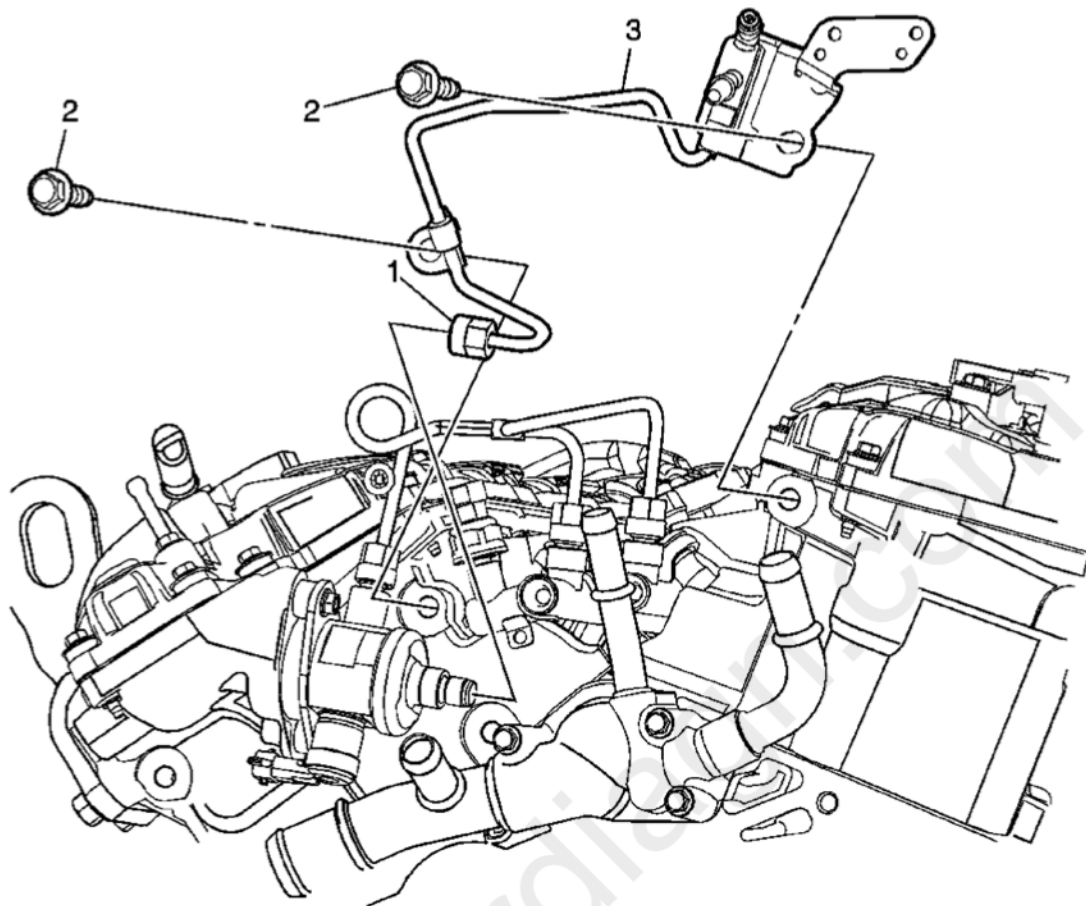


Fig. 9 : View Of Fuel Feed Pipe Components
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1. Relieve the fuel system pressure. Refer to <u>Fuel Pressure Relief</u> 2. Remove the Intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> 3. Remove the fuel pipe shield. Refer to <u>Fuel Pipe Shield Replacement</u> .	
1	Fitting (ty 1) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 28 N.m (20 lb ft)
2	Bolt (ty 2) Tighten: 50 N.m (28 lb ft)

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Fuel Feed Pipe

Procedure

3

1. Discard the pipe when removed and install a new pipe.
2. Ensure that the high pressure fuel pipe, and fuel pump fittings are clean and dry prior to assembly.
3. Pressure up the fuel system and check for leaks.

FUEL SYSTEM CLEANING

WARNING: Refer to Gasoline/Gasoline Vapors Warning.

The following procedure covers the disassembly and the inspection of the complete fuel supply system. If the fuel system is contaminated, the fuel system can be cleaned. You can usually determine the extent of the fuel system contamination during the disassembly.

System Cleaning Procedure

1. If required, remove the fuel filter. Refer to Fuel Filter Replacement (China).
2. Inspect the fuel system for contamination of the in-line fuel filter. Replace the filter after cleaning the fuel lines if the filter is plugged or contaminated.
3. Remove the fuel module assemblies. Refer to Primary Fuel Tank Module Replacement (NT7, NU5) or Primary Fuel Tank Module Replacement (NA3, NE9, NF9) and Secondary Fuel Tank Module Replacement.
4. Locate the tank in a suitable work area away from any heat, any flame, or any other source of ignition.
5. Perform the following procedures:
 - Inspect the fuel sender strainer. Replace the primary fuel tank module if the strainer is contaminated.
 - Inspect the secondary fuel tank module for debris. Clean the secondary fuel tank module if debris is found.

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

- Use compressed air in order to apply air pressure to the transfer tube.

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

6. Flush the fuel tank with running hot water for at least five minutes. Pour the water out of the fuel sender

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assembly opening. Rock the tank in order to ensure that the removal of the water from the tank is complete.

7. Refer to **Metal Collar Quick Connect Fitting Service** in order to disconnect the following quick connect fittings from the fuel rail:
 - The feed hose/pipe
 - The return hose/pipe
8. Use compressed air in order to apply air pressure to the fuel lines in the opposite direction from the normal fuel flow.
9. Remove the fuel injectors and fuel rail. Refer to **Fuel Injection Fuel Rail Assembly Replacement - Bank 1 (LF1)** and **Fuel Injection Fuel Rail Assembly Replacement - Bank 2 (LF1)**.
10. Clean and inspect the fuel injectors and fuel rail.

Installation Procedure

Assemble the fuel system as follows:

1. Install the fuel injectors and fuel rail. Refer to **Fuel Injection Fuel Rail Assembly Replacement - Bank 1 (LF1)** and **Fuel Injection Fuel Rail Assembly Replacement - Bank 2 (LF1)**.
2. Install the fuel module assemblies. Refer to **Primary Fuel Tank Module Replacement (NT7, NU5)** or **Primary Fuel Tank Module Replacement (NA3, NE9, NF9)** and **Secondary Fuel Tank Module Replacement**.
3. If required, install the fuel filter. Refer to **Fuel Filter Replacement (China)**.
4. Refer to **Metal Collar Quick Connect Fitting Service** in order to connect the following quick connect fittings to the fuel rail:
 - The feed hose/pipe
 - The return hose/pipe

FUEL PRESSURE SENSOR REPLACEMENT - FUEL INJECTION FUEL RAIL

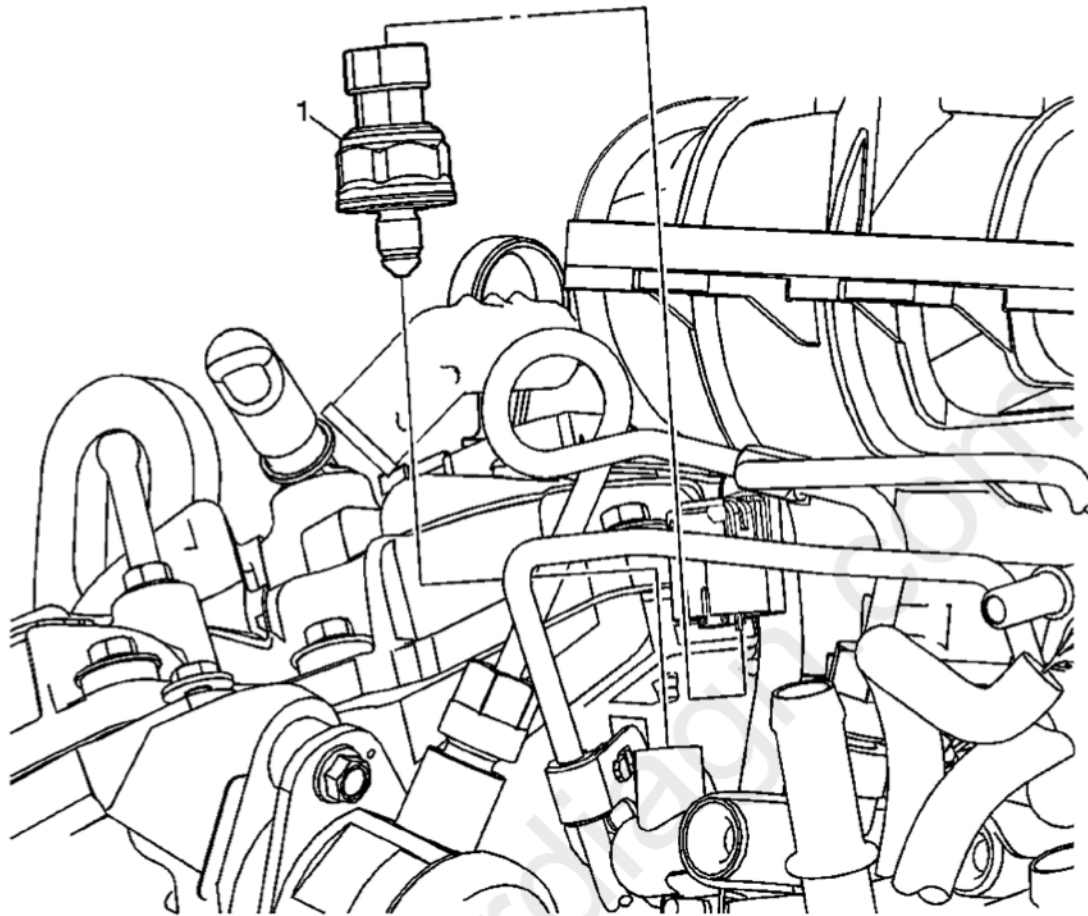


Fig. 97: Identifying Fuel Pressure Sensor - Fuel Injection Fuel Rail (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the fuel pipe shield. Refer to <u>Fuel Pipe Shield Replacement</u> .	
1	Fuel Injection Fuel Rail Fuel Pressure Sensor CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 33 N.m (25 lb ft)

FUEL PRESSURE SENSOR REPLACEMENT (NT7, NU5)

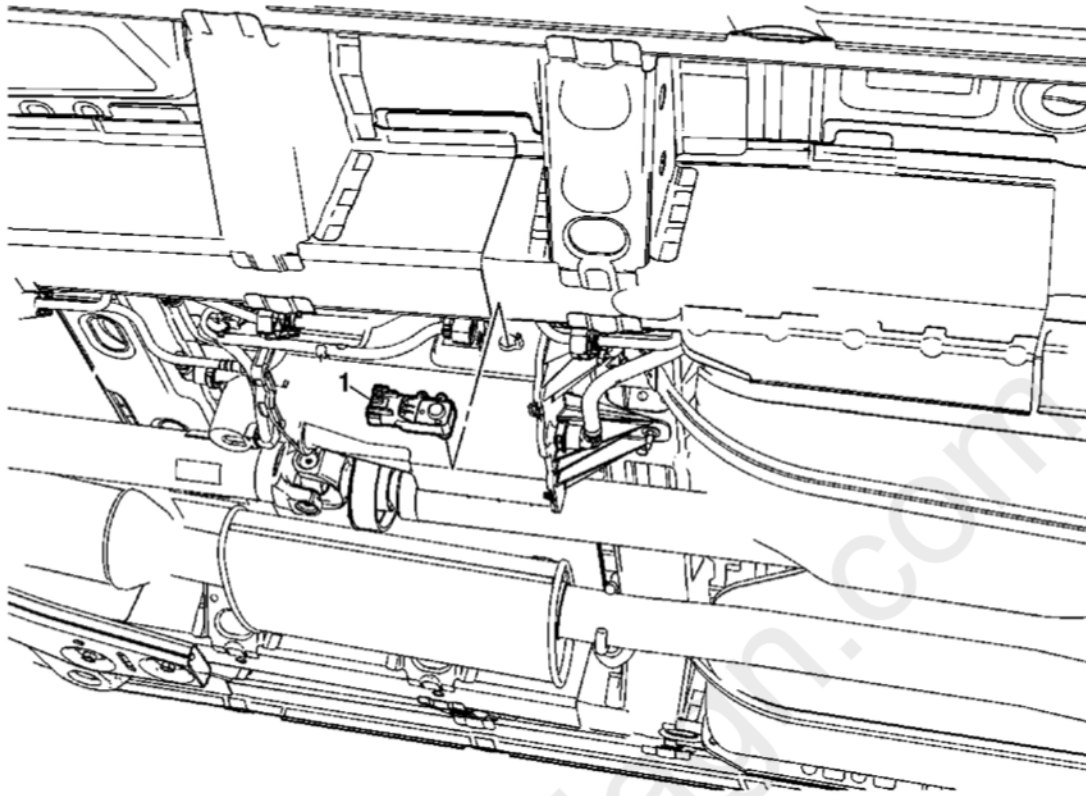


Fig. 98: Identifying Fuel Pressure Sensor (NT7, NU5)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .	
1	Fuel Pressure Sensor Procedure: Disconnect the electrical connector.

FUEL INJECTION FUEL RAIL ASSEMBLY REPLACEMENT - BANK 1 (LF1)

Special Tools

EN-49248: Injector Rail Assembly Remover

For equivalent regional tools, refer to **Special Tools** .

Removal Procedure

1. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief**.
2. Remove the fuel pipe shield. Refer to **Fuel Pipe Shield Replacement**.

3. Remove the intake manifold. Refer to **Intake Manifold Replacement** .
4. Remove the fuel feed intermediate pipe. Refer to **Fuel Feed Intermediate Pipe Replacement (LF1)**.
5. Remove the cylinder head. Refer to **Cylinder Head Replacement - Left Side (LF1)** or **Cylinder Head Replacement - Left Side (LAU)** .
6. Remove the foam insulator from the fuel rails.

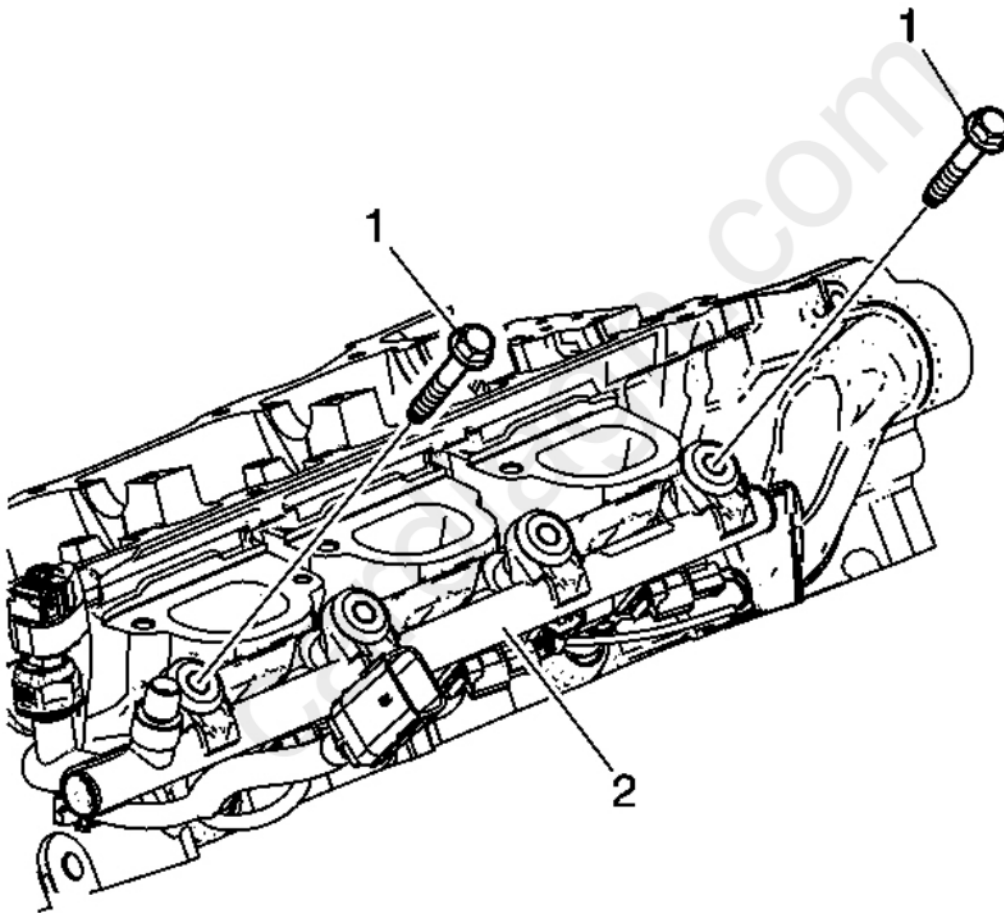


Fig. 99: Identifying Fuel Rail Bolts

Courtesy of GENERAL MOTORS CORP.

7. Disconnect the fuel pressure sensor electrical connector and cut the wire harness tie straps.
8. Remove the fuel rail bolts (1).

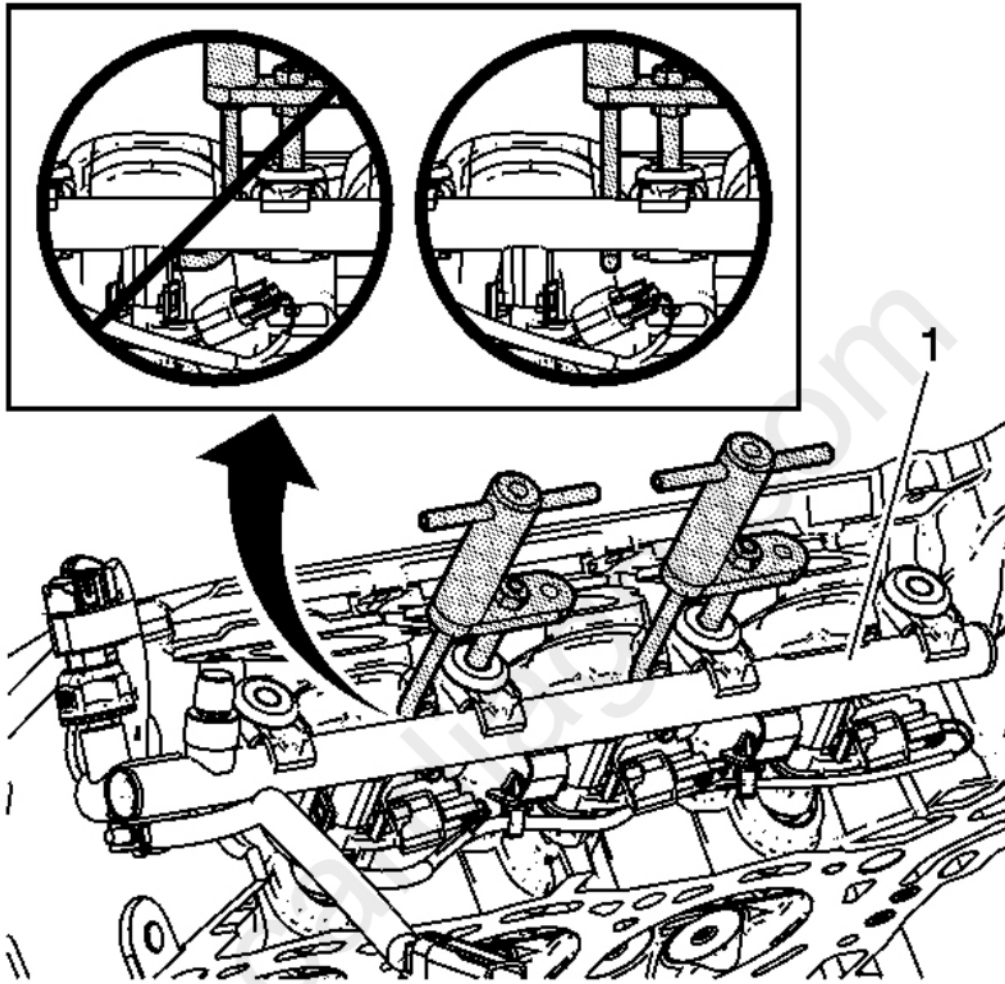


Fig. 100: Identifying Fuel Rail & Injectors
Courtesy of GENERAL MOTORS CORP.

9. Remove the fuel rail and injectors (1) as an assembly using the **EN-49248: remover**.
10. Remove the fuel pressure sensor. Refer to **Fuel Pressure Sensor Replacement - Fuel Injection Fuel Rail**.
11. Remove and discard the direct fuel injector hold down clamps.

NOTE: The direct fuel injectors must be rebuilt whenever the injector has been released from the fuel rail or cylinder head.

12. Once the fuel rail is removed, remove the fuel injectors and rebuild them. Refer to **Fuel Rail and**

Injectors Cleaning and Inspection (LF1 or LFW) or Fuel Rail and Injectors Cleaning and Inspection (LAU or LBW) .

Installation Procedure

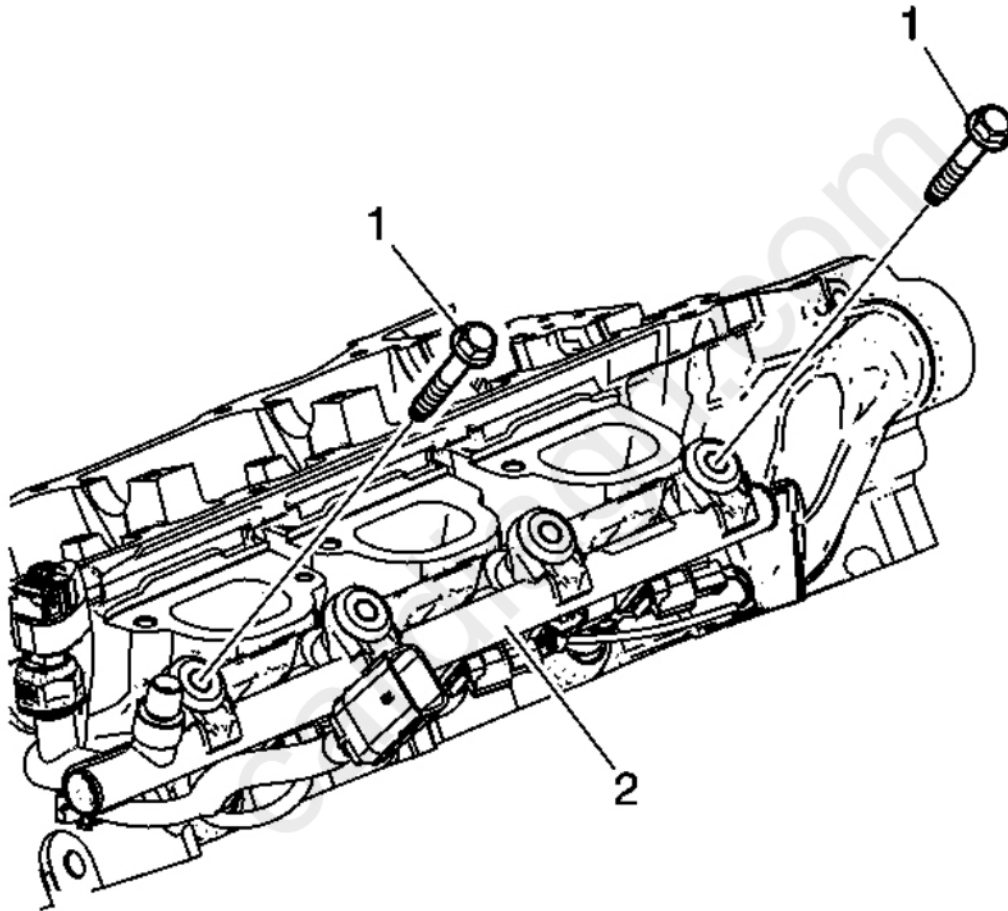


Fig. 101: Identifying Fuel Rail Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the fuel rail with injectors (2) into the cylinder head evenly.
2. Install NEW direct injector hold down clamps to the injector.
3. Hand tighten the two outer fuel rail bolts to seat the injector in the injector bores.
4. Start and hand tighten the remaining fuel rail bolts and tighten the fuel rail bolts (1).

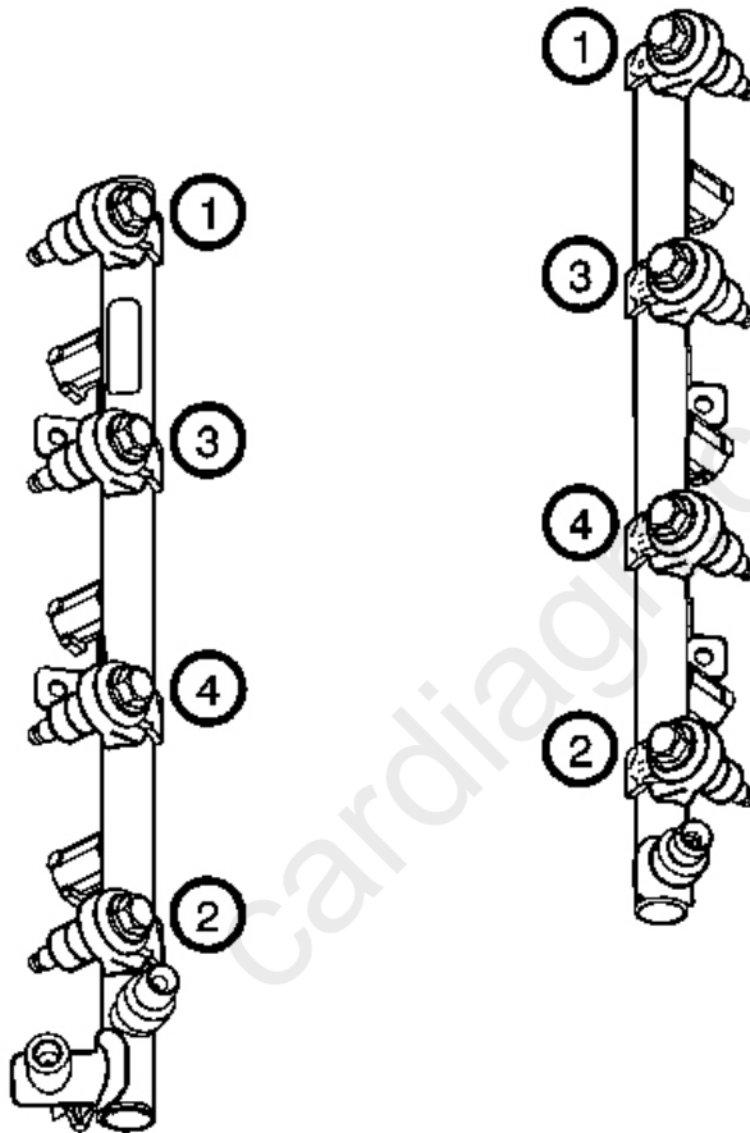


Fig. 102: Identifying Fuel Rail Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

5. Tighten the fuel rail bolts in the sequence shown

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1. Tighten the Bank 1 fuel rail bolts first pass to 12 N.m (106 lb in).
2. Tighten the Bank 1 fuel rail bolts final pass to 23 N.m (17 lb ft).
6. Install the fuel feed intermediate pipe. Refer to **Fuel Feed Intermediate Pipe Replacement (LF1)**.
7. Install the high pressure fuel sensor. Refer to **Fuel Pressure Sensor Replacement - Fuel Injection Fuel Rail**.
8. Connect the fuel injector wiring harness electrical connector to the fuel injectors, fuel rail and fuel pressure sensor.
9. Inspect for fuel 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: Before installing the foam insulator, remove any remaining fuel from the injector well.

10. Install the foam insulator to the fuel rails.
11. Install the intake manifold. Refer to **Intake Manifold Replacement**.
12. Install the fuel pipe shield. Refer to **Fuel Pipe Shield Replacement**.
13. Install the cylinder head. Refer to **Cylinder Head Replacement - Left Side (LF1)** or **Cylinder Head Replacement - Left Side (LAU)**.
14. Install the low side fuel pressure service port cap.
15. Install the fuel tank cap.

FUEL INJECTION FUEL RAIL ASSEMBLY REPLACEMENT - BANK 2 (LF1)

Special Tools

EN-49248: Injector Rail Assembly Remover

For equivalent regional tools, refer to **Special Tools**

Removal Procedure

1. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief**.
2. Remove the fuel pipe shield. Refer to **Fuel Pipe Shield Replacement**.
3. Remove the intake manifold. Refer to **Intake Manifold Replacement**.
4. Remove the fuel feed intermediate pipe. Refer to **Fuel Feed Intermediate Pipe Replacement (LF1)**.
5. Remove the cylinder head. Refer to **Cylinder Head Replacement - Left Side (LF1)** or **Cylinder Head Replacement - Left Side (LAU)**.

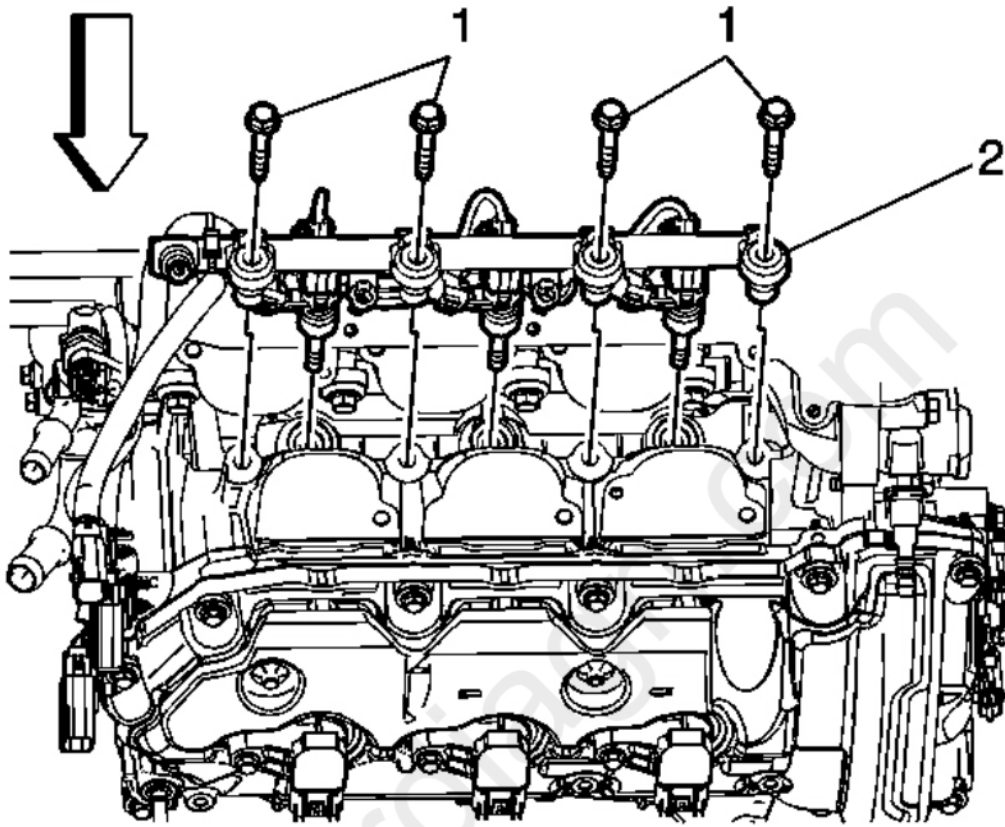


Fig. 10 : Identifying Fuel Rail & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the fuel rail bolts (1).

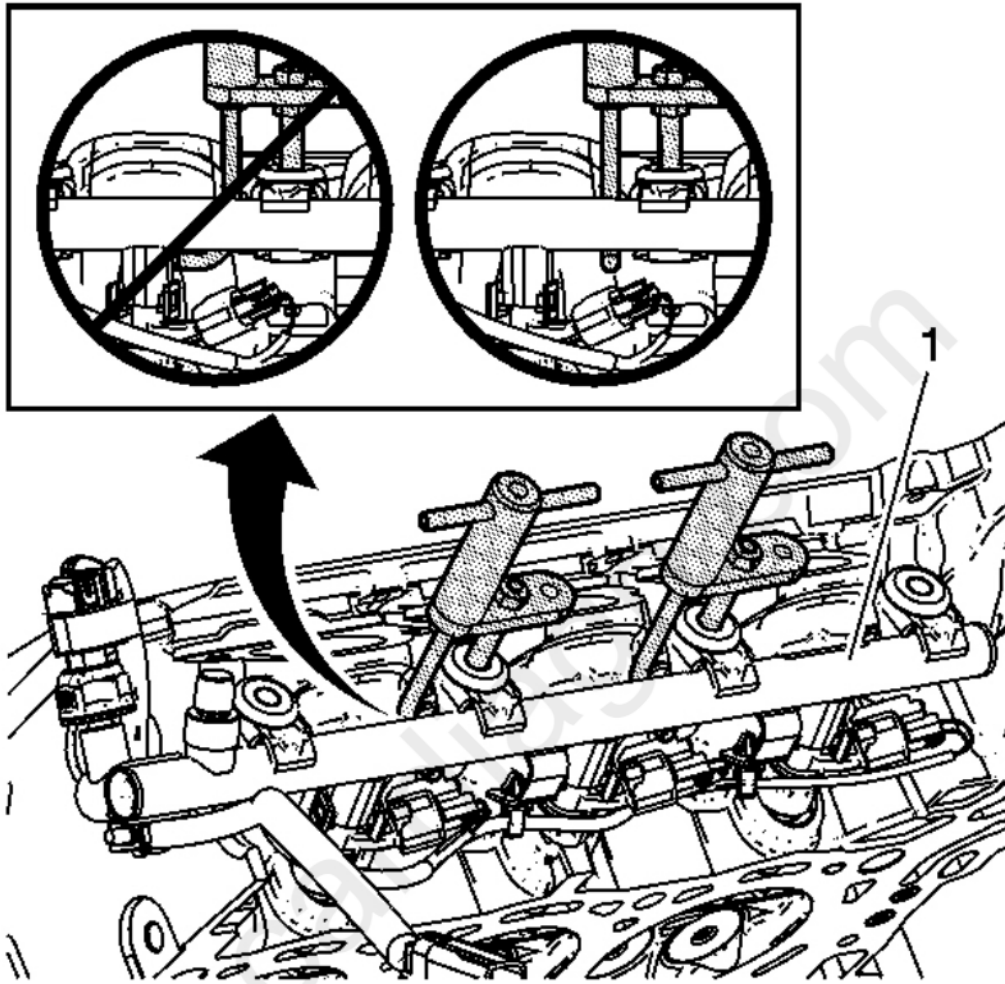


Fig. 104: Identifying Fuel Rail & Injectors
Courtesy of GENERAL MOTORS CORP.

7. Remove the fuel rail and injectors (1) as an assembly using the **EN-49248: remover**.
8. Remove and discard the direct fuel injector hold down clamps.

NOTE: The direct fuel injectors must be rebuilt whenever the injector has been released from the fuel rail or cylinder head.

9. Once the fuel rail is removed, remove the fuel injectors and rebuild them. Refer to **Fuel Rail and Injectors Cleaning and Inspection (LF1 or LFW)** or **Fuel Rail and Injectors Cleaning and Inspection (LAU or LBW)**.

Installation Procedure

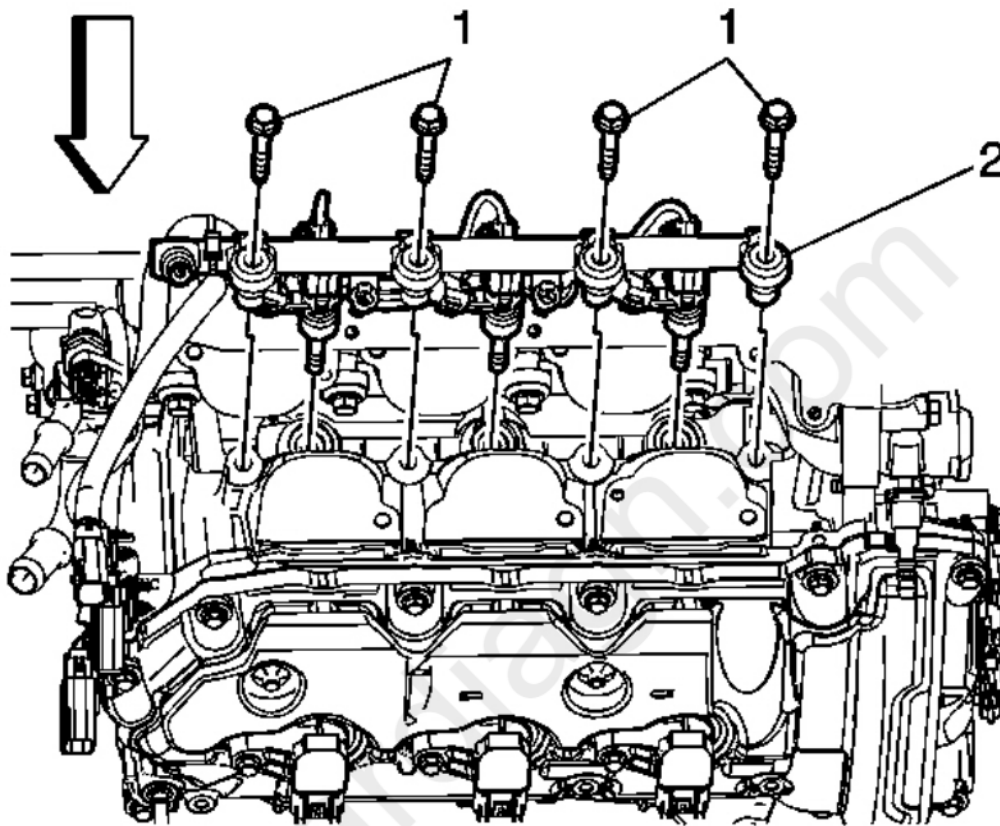


Fig. 105: Identifying Fuel Rail & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the fuel rail with injectors (2) into the cylinder head evenly.
2. Hand tighten the two outer fuel rail bolts to seat the injector in the injector bores.
3. Start and hand tighten the remaining fuel rail bolts (1).

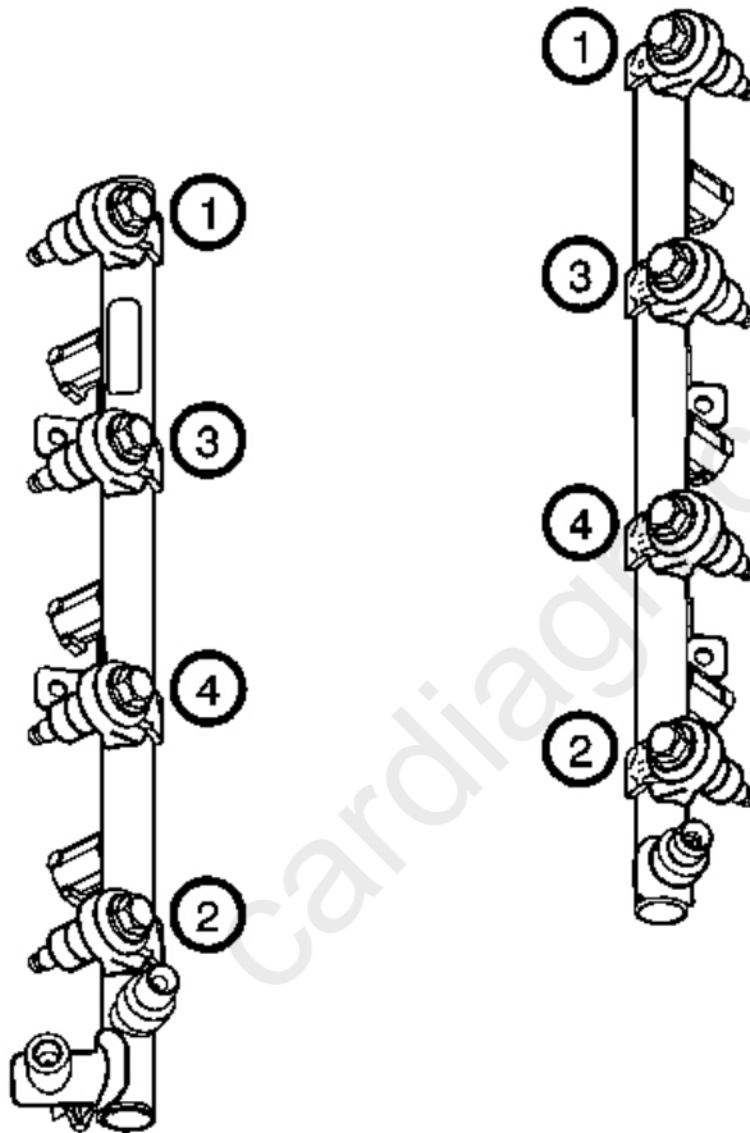


Fig. 106: Identifying Fuel Rail Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

4. Tighten the fuel rail bolts in the sequence shown

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1. Tighten the Bank 1 fuel rail bolts first pass to 12 N.m (106 lb in).
2. Tighten the Bank 1 fuel rail bolts a final pass to 23 N.m (17 lb ft).
5. Install the fuel feed intermediate pipe. Refer to **Fuel Feed Intermediate Pipe Replacement (LF1)**.
6. Connect the fuel injector wiring harness electrical connector from the fuel injectors, fuel rail and fuel pressure sensor.
7. Inspect for fuel 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: Before installing the foam insulator, remove any remaining fuel from the injector well.

8. Install the foam insulator to the fuel rails.
9. Install the intake manifold. Refer to **Intake Manifold Replacement**.
10. Install the fuel pipe shield. Refer to **Fuel Pipe Shield Replacement**.
11. Install the cylinder head. Refer to **Cylinder Head Replacement - Left Side (LF1)** or **Cylinder Head Replacement - Left Side (LAU)**.
12. Install the low side fuel pressure service port cap.
13. Install the fuel tank cap.

FUEL FEED INTERMEDIATE PIPE REPLACEMENT (LF1)

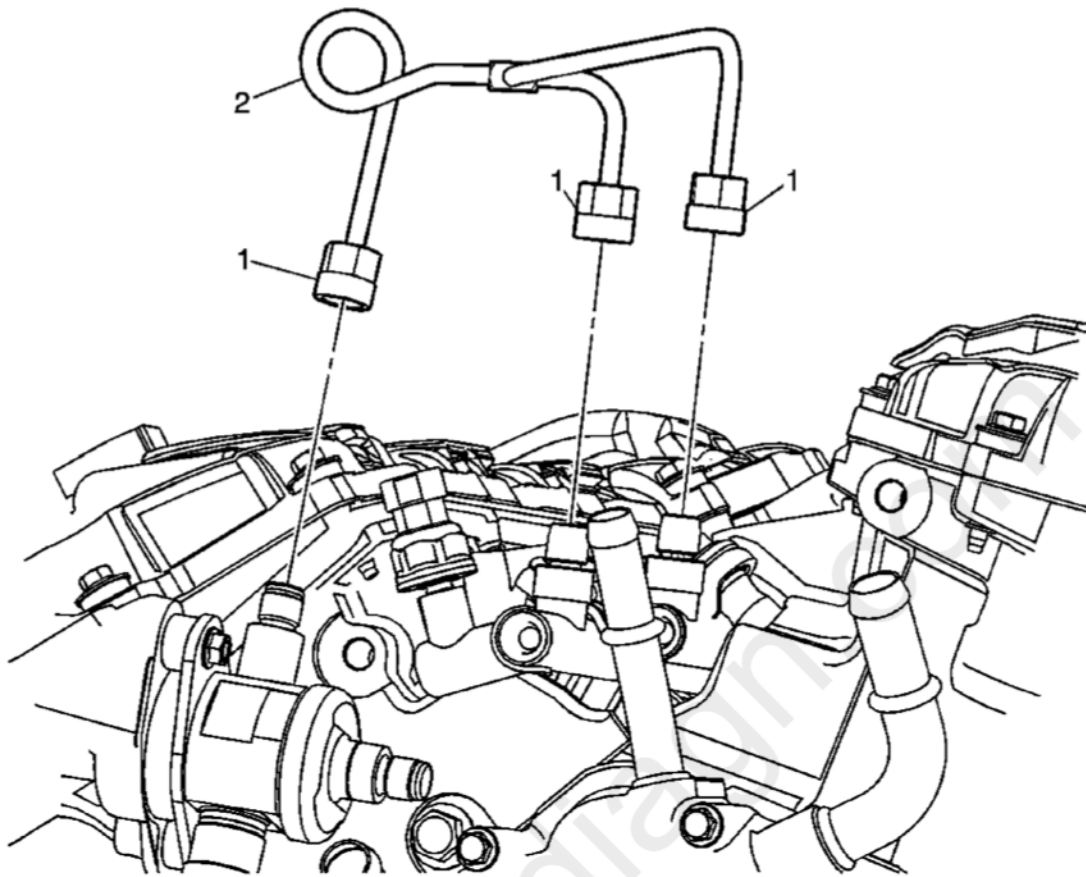


Fig. 107: View Of Fuel Feed Intermediate Pipe (LF1)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Relieve the fuel system pressure. Refer to <u>Fuel Pressure Relief</u>. 2. Remove the Intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u>. 3. Remove the fuel pipe shield. Refer to <u>Fuel Pipe Shield Replacement</u>.	
1	Fitting (ty 3) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: • Tighten the fittings in se uence as numbered 1, 2, 3 • First Pass 15 N.m (11 lb ft) • Second Pass 30 N.m (22 lb ft)

Fuel Feed Intermediate Pipe

Procedure

2

1. Discard the pipe when removed and install a NEW pipe.
2. Lubricate the pipes with silicon free engine oil. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.
3. Pressure up the fuel system and check for leaks.

FUEL PIPE SHIELD REPLACEMENT

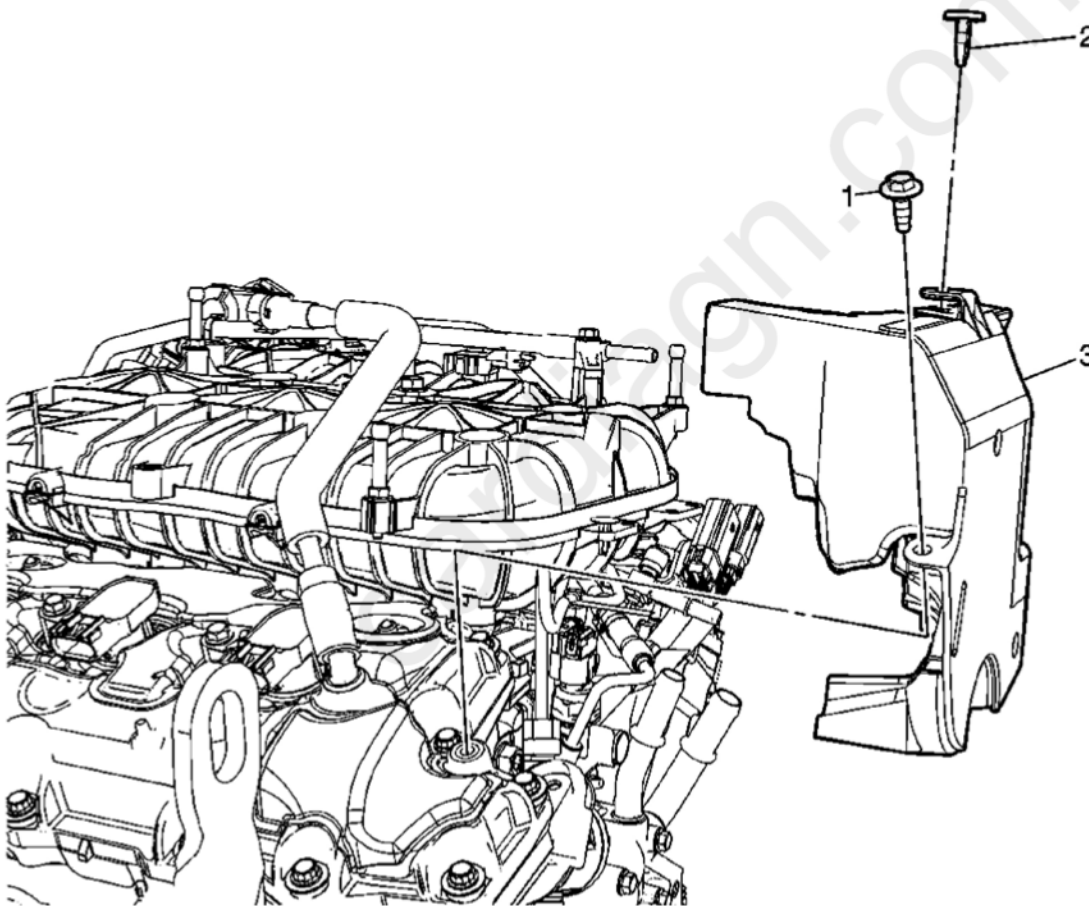


Fig. 1 : Identifying Fuel Pipe Shield

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
	Fuel Pipe Shield Fastener

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1	CAUTION: Refer to Fastener Caution . Tighten: 9 N.m (80 lb in)
2	Fuel Pipe Shield Push-Pin
3	Fuel Pipe Shield

FUEL PUMP REPLACEMENT

Special Tools

EN 4 6: High Pressure Fuel Pump Installation Alignment Gauge

For equivalent regional tools, refer to **Special Tools**

Removal Procedure

1. Relieve the low and high side fuel system pressure. Refer to **Fuel Pressure Relief**.
2. Remove the high pressure fuel pump shield. Refer to **Fuel Pipe Shield Replacement**.

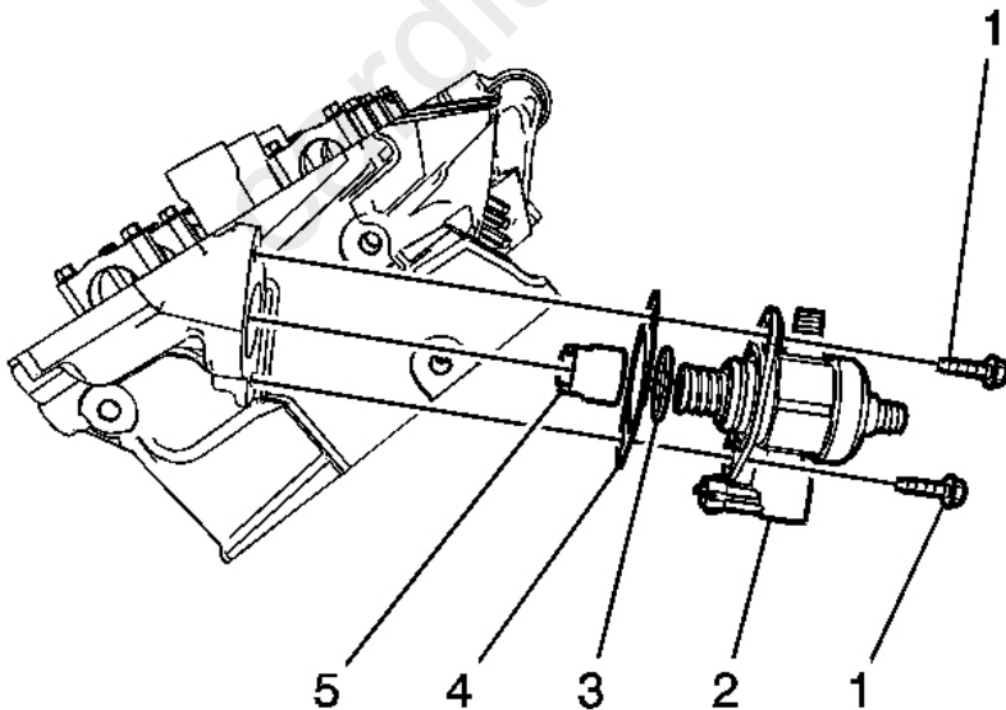


Fig. 1 : Identifying High Pressure Fuel Pump Components
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the engine wiring harness electrical connector from the high pressure fuel pump.
4. Remove the low pressure feed pipe. Refer to **Fuel Feed Pipe Replacement**.
5. Remove the high pressure pipe. Discard the pipe. Refer to **Fuel Feed Intermediate Pipe Replacement (LF1)**.
6. Remove and discard the high pressure fuel pump bolts (1).
7. Remove the high pressure fuel pump (2).
8. Remove and discard the high pressure fuel pump O-ring (3).
9. Remove and discard the high pressure fuel pump gasket (4).
10. Remove the high pressure fuel pump roller lifter (5).

Installation Procedure

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

1. Use the **EN 4 6**: alignment gauge to ensure that the camshaft lobe is in the base circle position. At base circle the tool will be flush with the head.
2. Lubricate the high pressure fuel pump cylinder head bore and roller lifter with camshaft prelube. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.

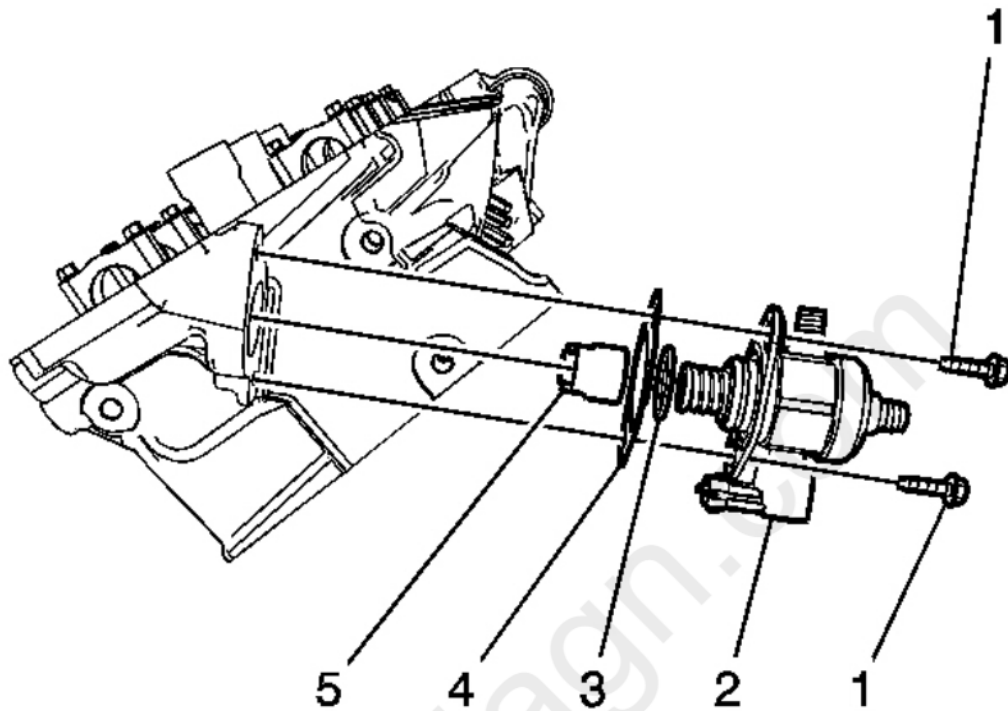


Fig. 11 : Identifying High Pressure Fuel Pump Components
Courtesy of GENERAL MOTORS CORP.

NOTE: The high pressure fuel pump gasket has a retaining feature to hold the pump retaining bolts in place.

- 3.
4. Install the high pressure fuel pump roller lifter (5).
5. Install a NEW high pressure fuel pump O-ring (3).
6. Position the NEW high pressure fuel pump gasket (4) and bolts (1) to the fuel pump.
7. Install the high pressure fuel pump (2). Force will be required while hand tightening the bolts.

CAUTION: Refer to Fastener Caution.

8. Tighten the high pressure fuel pump retaining bolts to 15 N.m (11 lb ft).
9. Ensure the high pressure fuel pump and fuel rail fittings are clean prior to assembly.
10. Install a NEW high pressure fuel pipe. Refer to Fuel Feed Intermediate Pipe Replacement (LF1).

11. Install the fuel feed pipe to the high pressure fuel pump. Refer to **Fuel Feed Pipe Replacement**.
12. Connect the high pressure fuel pump wiring harness.
13. Install the fuel tank cap.

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

14. 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.
15. Install the pressure relief cap to the fuel feed pipe.
16. Install the intake manifold. Refer to **Intake Manifold Replacement**.
17. Install the high pressure fuel pump shield. Refer to **Fuel Pipe Shield Replacement**.

FUEL INJECTOR REPLACEMENT

Removal Procedure

WARNING: Refer to **Gasoline/Gasoline Vapors Warning**.

1. Relieve the fuel system pressure. Refer to **Fuel Pressure Relief**.
2. Remove the upper intake manifold with the lower intake manifold. Refer to **Upper Intake Manifold Replacement**.

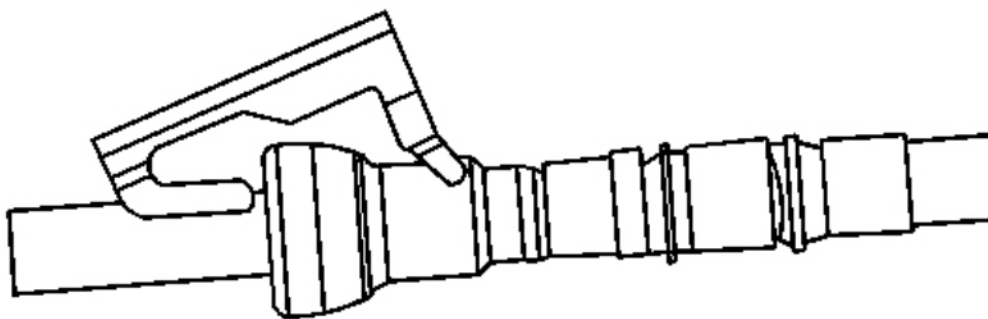


Fig. 111: View Of Quick Connect Fitting Retainer

Courtesy of GENERAL MOTORS CORP.

3. Remove the fuel pipe retaining clip.

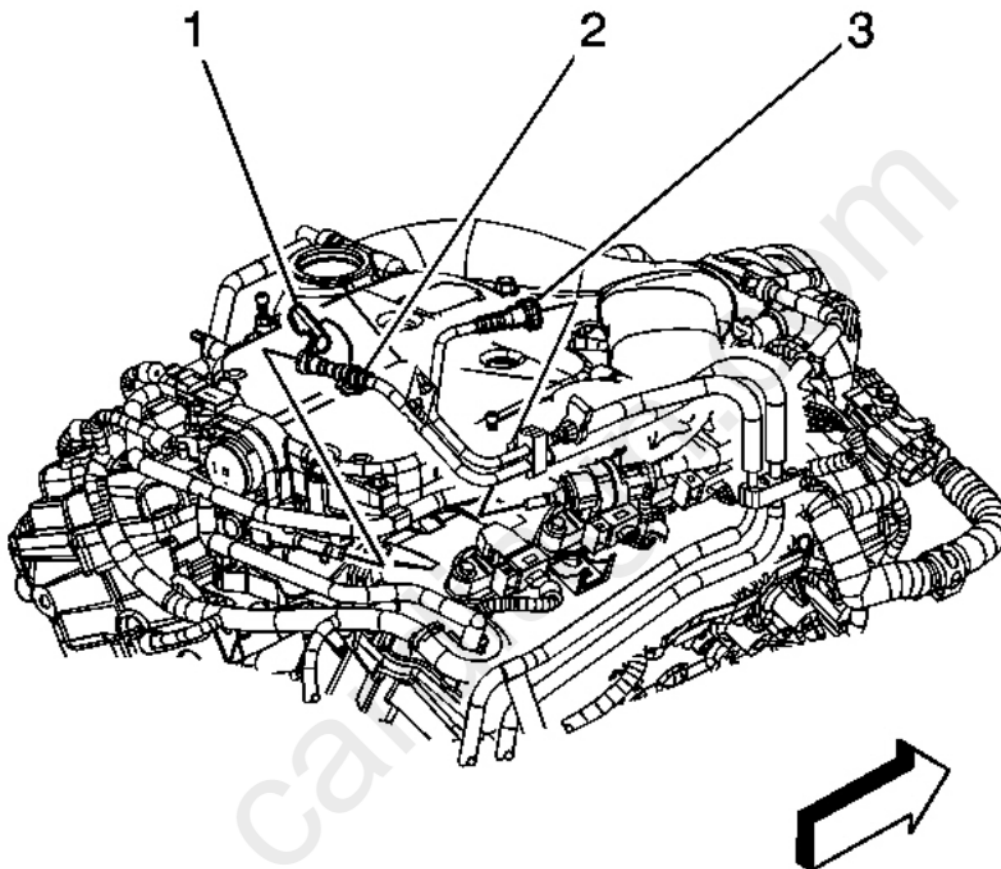


Fig. 112: Top Of Engine View

Courtesy of GENERAL MOTORS CORP.

4. Disconnect the fuel feed pipe (2) from the fuel injector rail. Refer to **Metal Collar Quick Connect Fitting Service**.

WARNING: Refer to **Safety Glasses and Compressed Air Warning** .

5. Use compressed air in order to remove debris from the area where the fuel injectors enter the intake manifold.

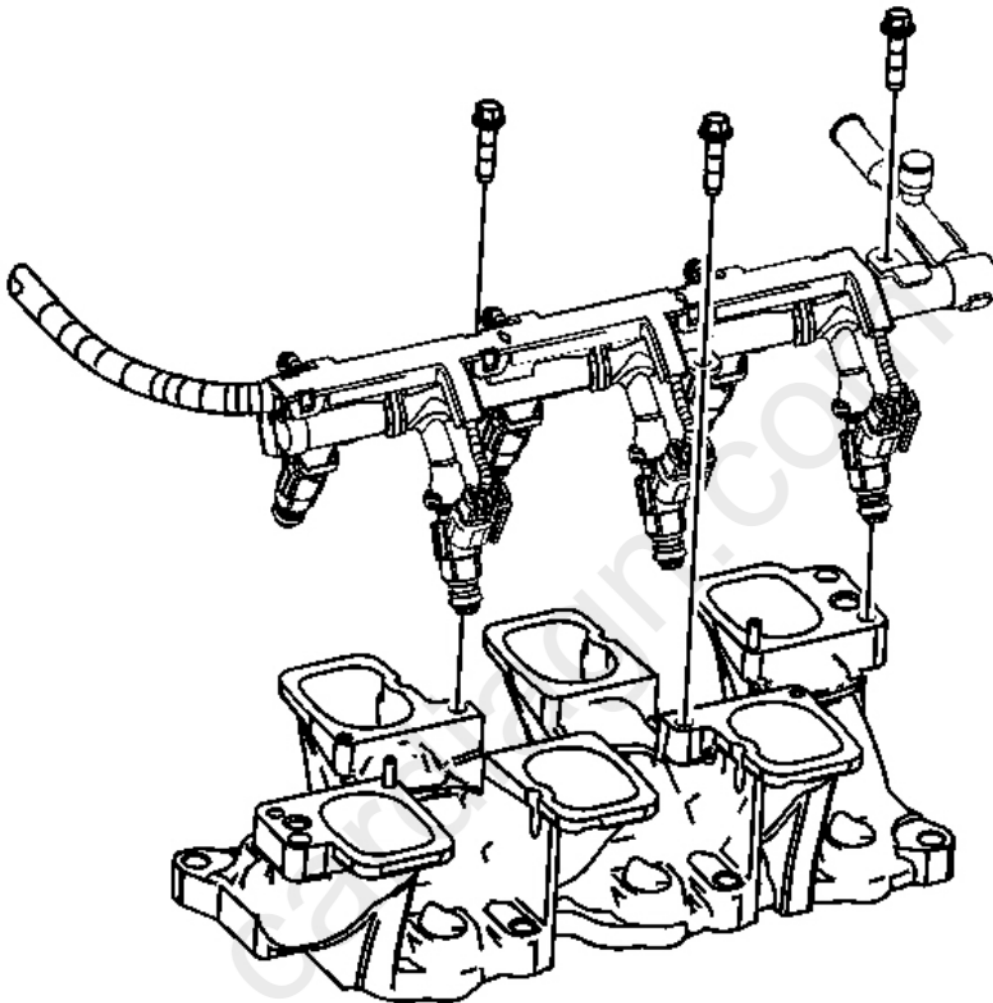


Fig. 113: Identifying Fuel Rail Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the fuel rail bolts.

CAUTION:

- Remove the fuel rail assembly carefully in order to prevent damage to the injector electrical connector terminals and the injector spray tips. Support the fuel rail after the fuel rail is removed in order to avoid damaging the fuel rail components.
- Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from

entering open pipes and passages.

7. Remove the fuel rail with the fuel injectors.

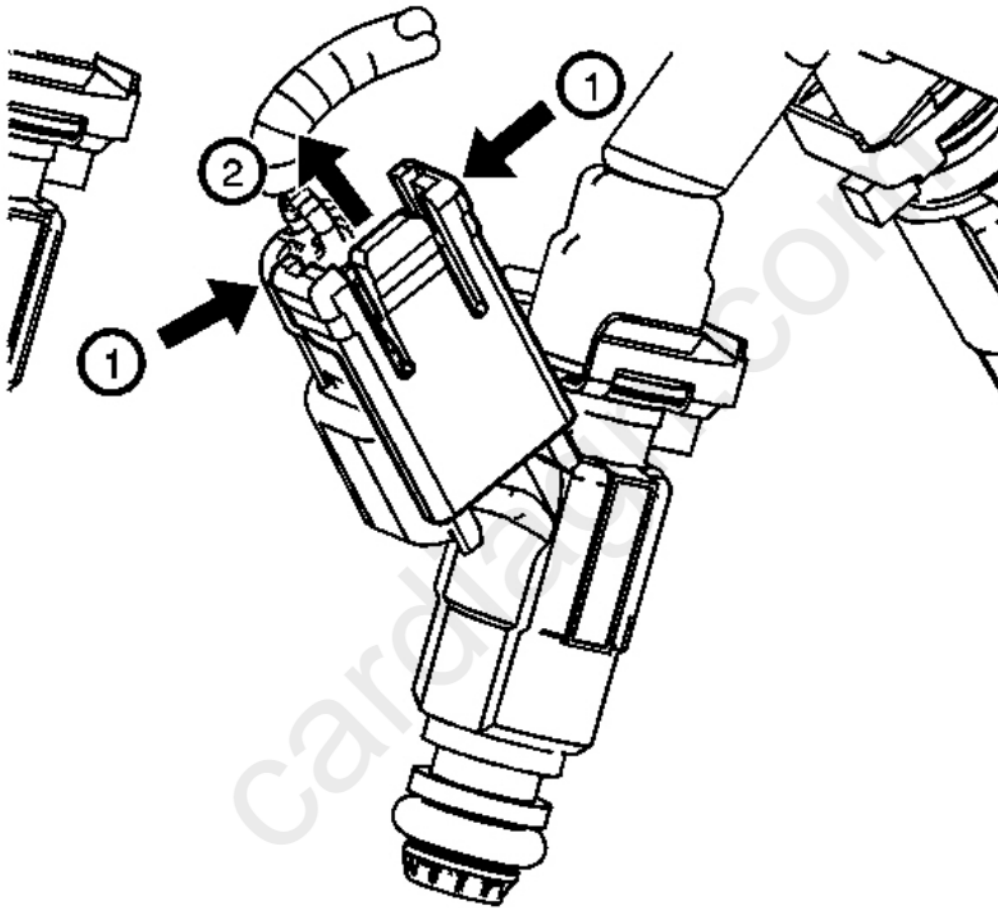


Fig. 114: Locating Fuel Injector Electrical Connector Lock
Courtesy of GENERAL MOTORS CORP.

8. Disengage the fuel injector electrical connector lock.

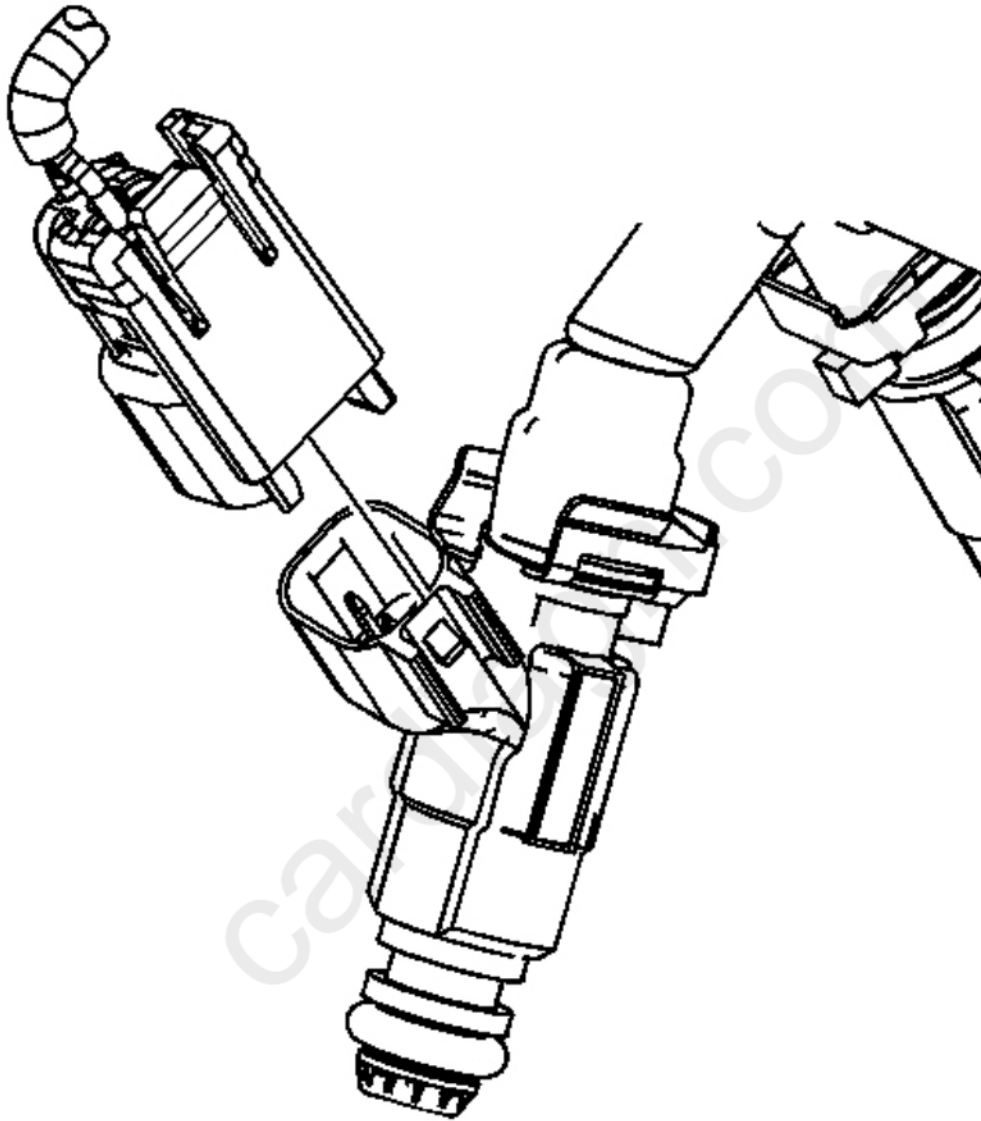


Fig. 115: View Of Fuel Injector Electrical Connector
Courtesy of GENERAL MOTORS CORP.

9. Disconnect the fuel injector electrical connector.

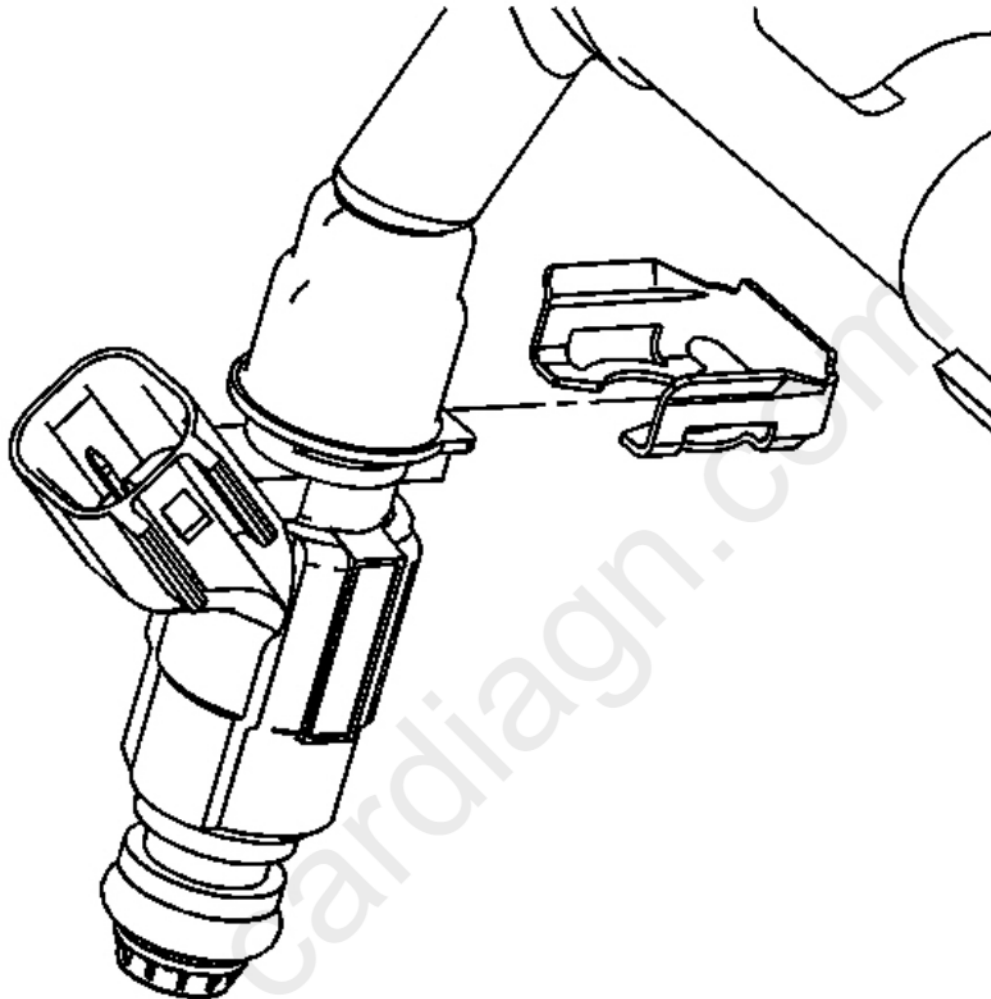


Fig. 116: Identifying Fuel Injector Retainer Clip
Courtesy of GENERAL MOTORS CORP.

10. Remove the fuel injector retainer clip.

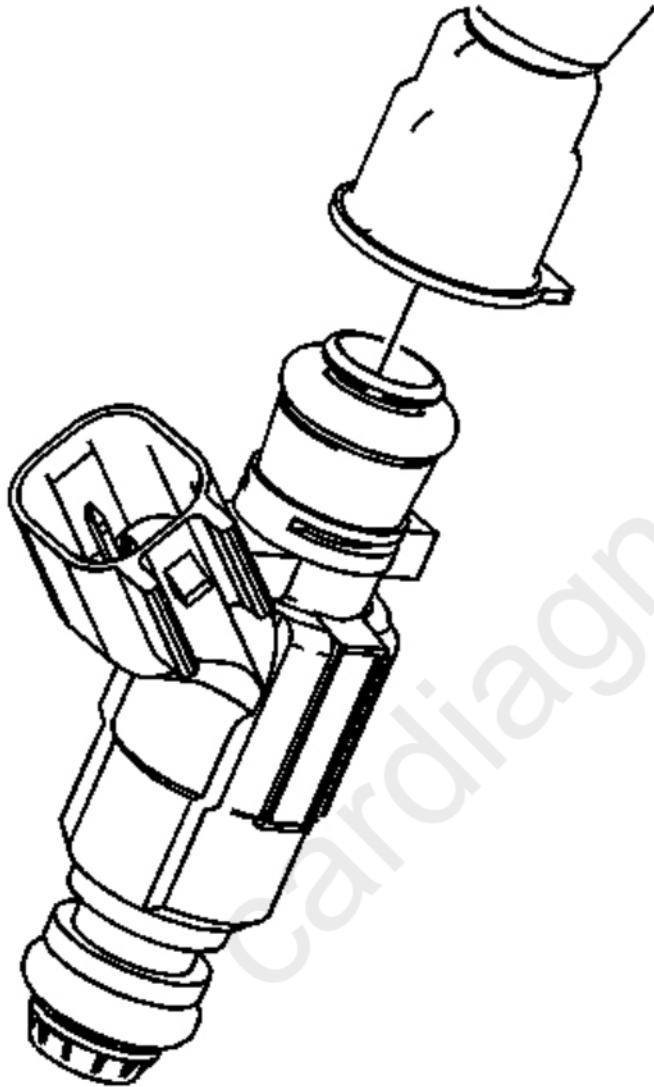


Fig. 117: Locating Fuel Injector
Courtesy of GENERAL MOTORS CORP.

11. Remove the fuel injector.
12. Remove and discard the fuel injector seals.

Installation Procedure

1. Install NEW fuel injector seals.

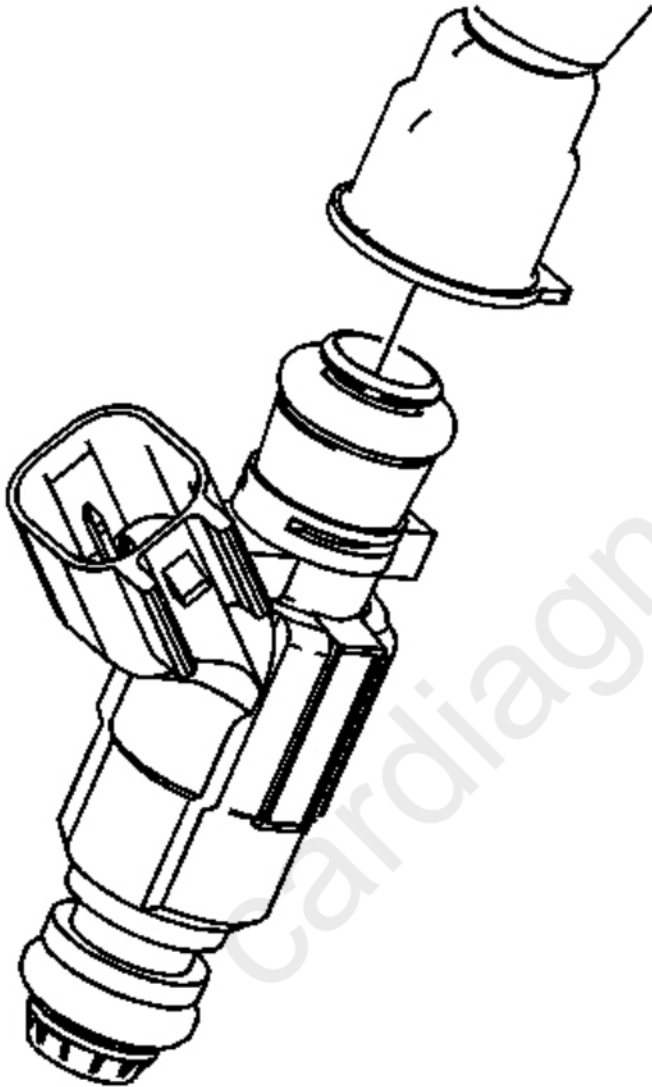


Fig. 118: Locating Fuel Injector
Courtesy of GENERAL MOTORS CORP.

2. Install the fuel injector.

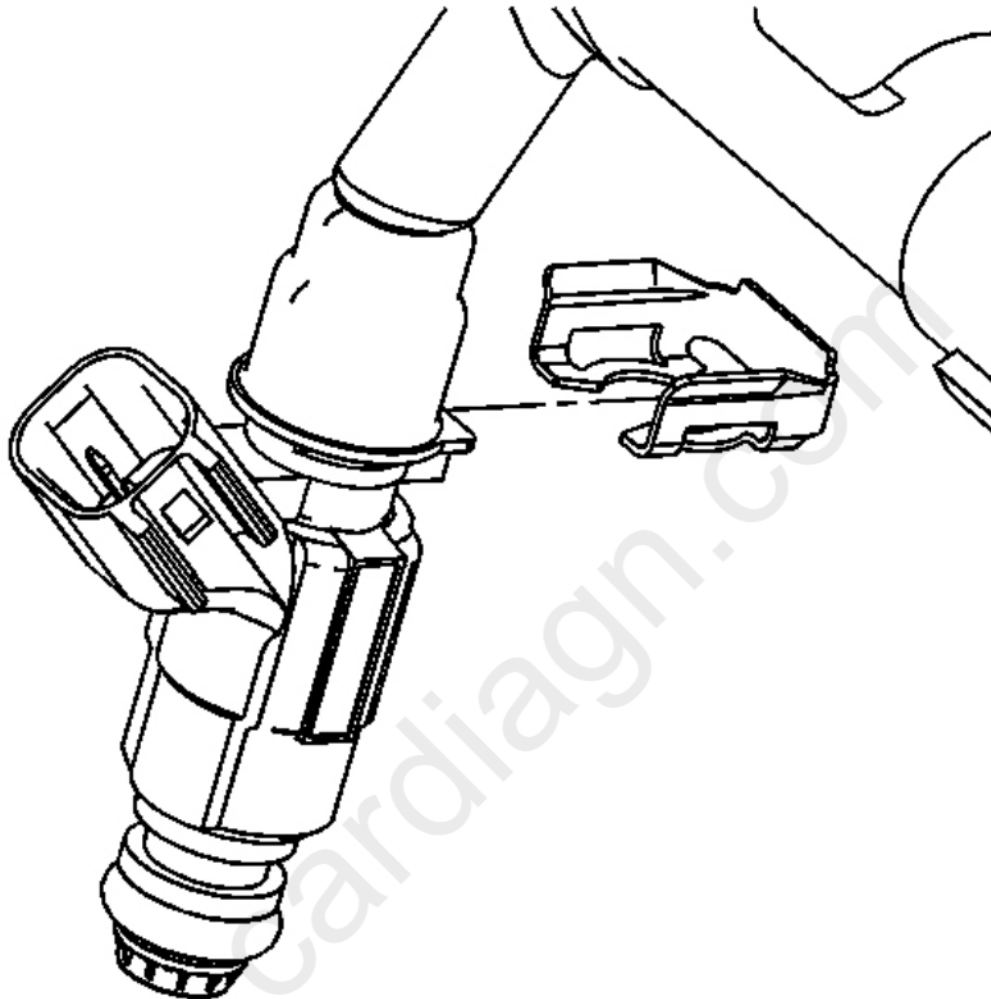


Fig. 119: Identifying Fuel Injector Retainer Clip
Courtesy of GENERAL MOTORS CORP.

3. Install the fuel injector retainer clip.

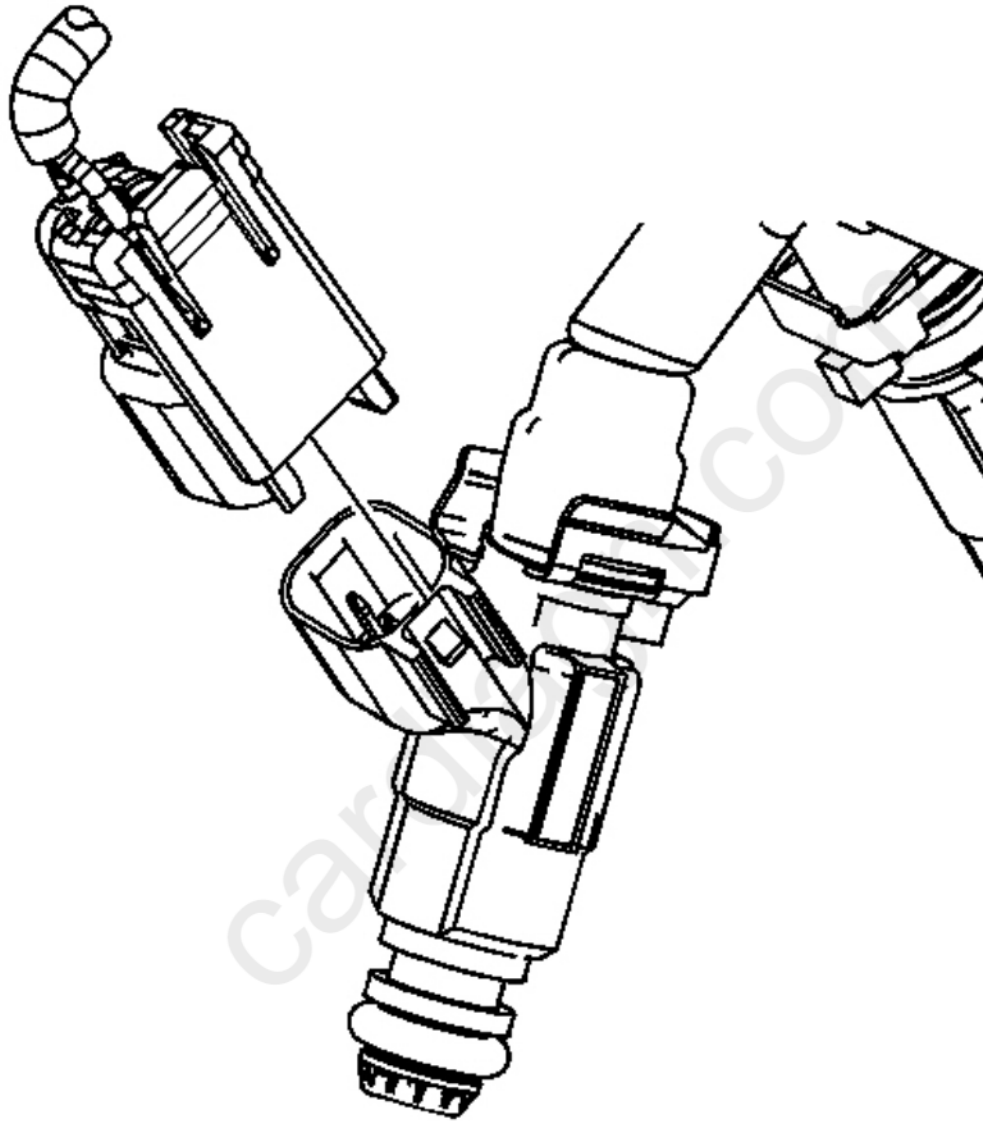


Fig. 120: View Of Fuel Injector Electrical Connector
Courtesy of GENERAL MOTORS CORP.

4. Install the fuel injector electrical connector.
5. Engage the fuel injector electrical connector lock.

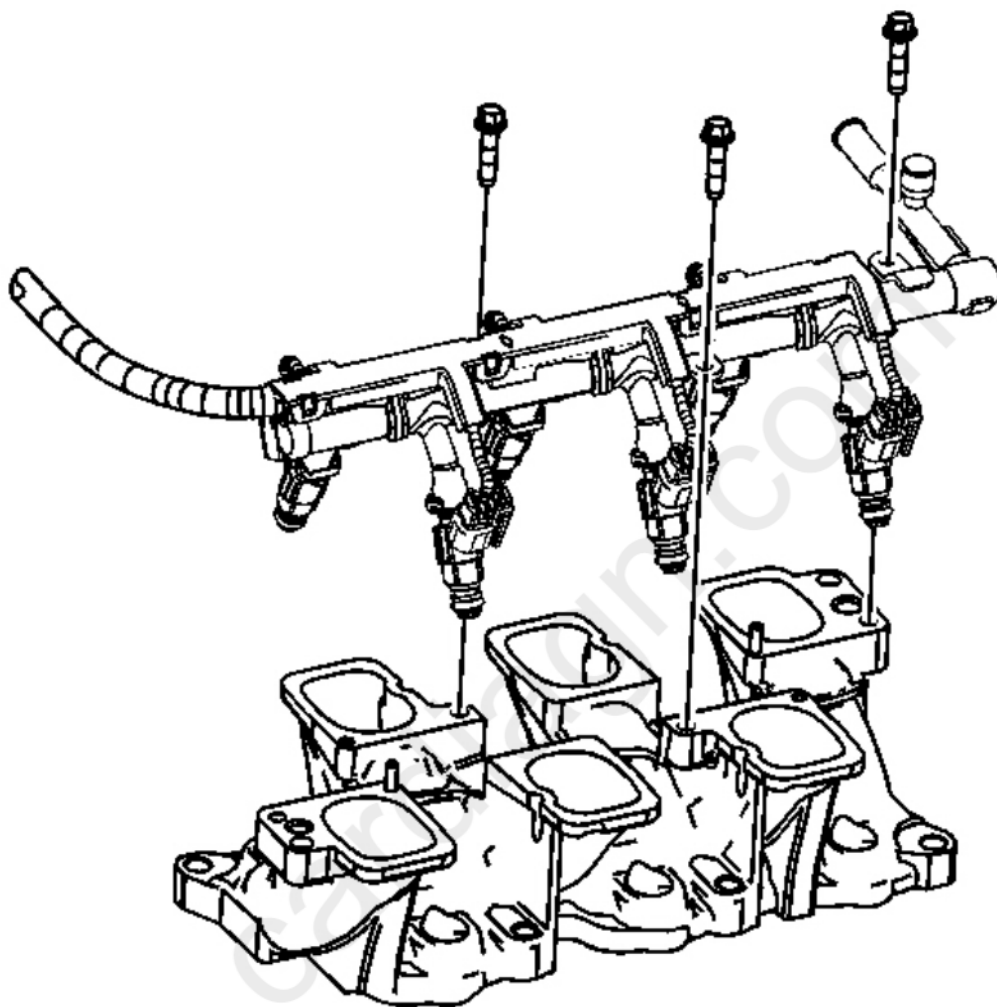


Fig. 121: Identifying Fuel Rail Bolts
Courtesy of GENERAL MOTORS CORP.

6. Install the fuel rail with the fuel injectors.

CAUTION: Refer to astener Caution .

7. Install the fuel rail bolts.

Tighten: Tighten the fuel rail bolts to 10 N.m (89 lb in).

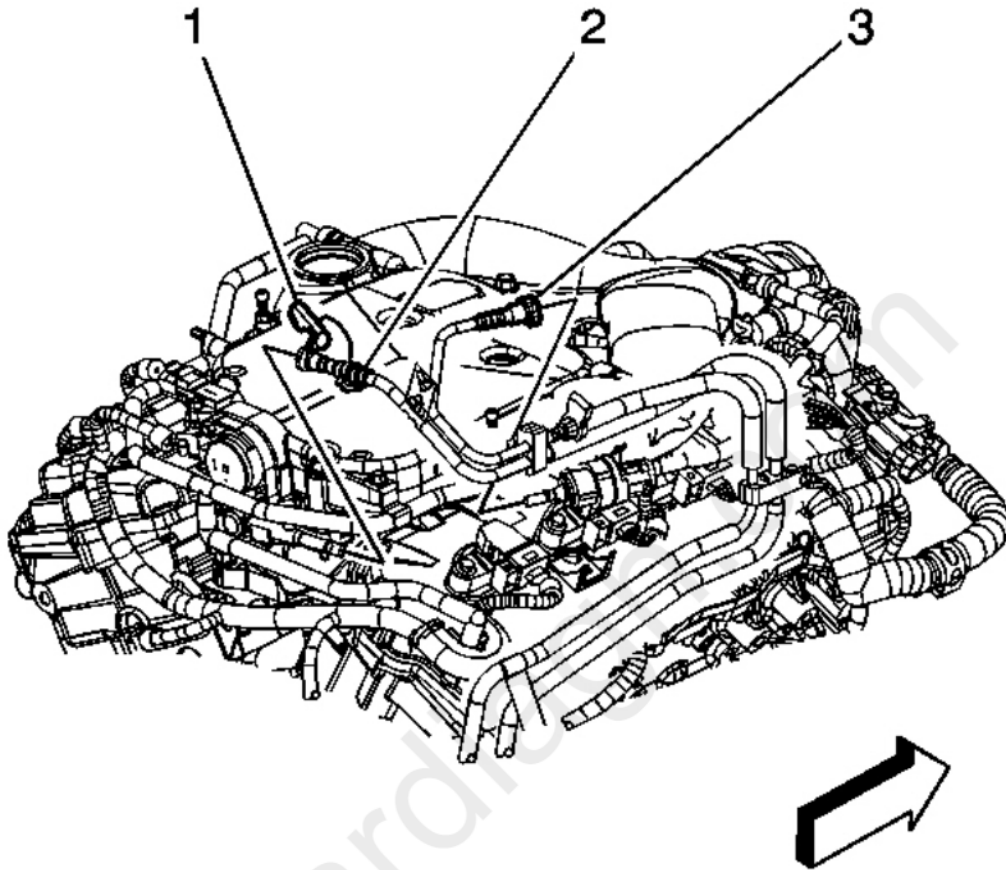


Fig. 122: Top Of Engine View

Courtesy of GENERAL MOTORS CORP.

8. Connect the fuel feed pipe (2) to the fuel rail. Refer to **Metal Collar Quick Connect Fitting Service**.

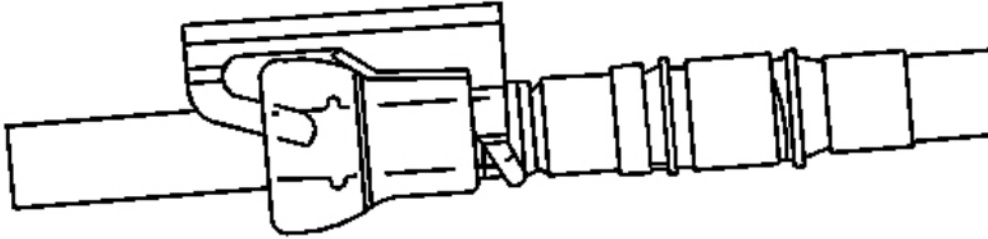


Fig. 123: View Of Fuel Pipe Retainer
Courtesy of GENERAL MOTORS CORP.

9. Install the fuel pipe retaining clip.
10. Install the upper intake manifold. Refer to Upper Intake Manifold Replacement .

EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE REPLACEMENT (LF1)

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

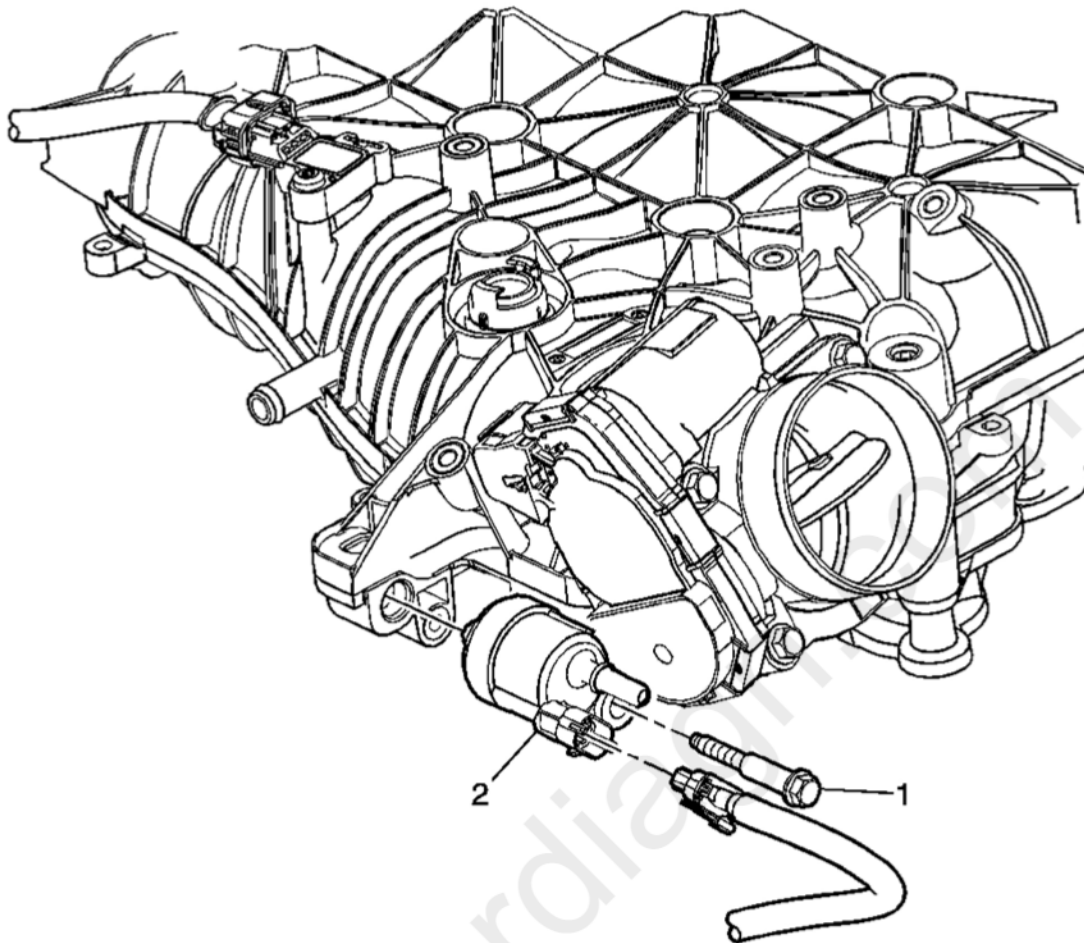


Fig. 124: View Of Evaporative Emission Canister Purge Solenoid Valve (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
1	Bolt CAUTION: Refer to <u>Canister Caution</u> . Tighten: 10 N.m (89 lb in)
2	Evaporative Emission Canister Purge Solenoid Valve Procedure 1. Disconnect the EVAP canister purge solenoid harness connector. 2. Install a NEW O-ring.

EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE REPLACEMENT (LAU)

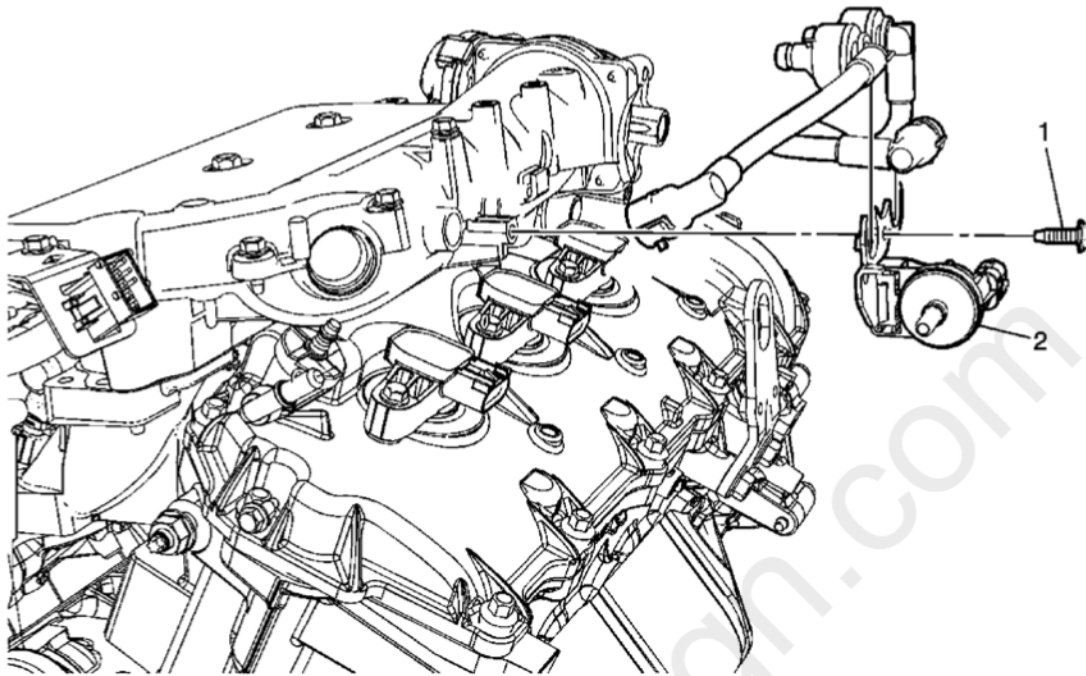


Fig. 125: Identifying Evaporative Emission Canister Purge Solenoid Valve (LAU)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1. Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
2. Disconnect the quick connects. Refer to <u>Plastic Collar Quick Connect Fitting Service</u>	
1	Evaporative Emission Canister Purge Solenoid Fastener CAUTION: Refer to <u>Fastener Caution</u> . 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 (NT7, NU5)

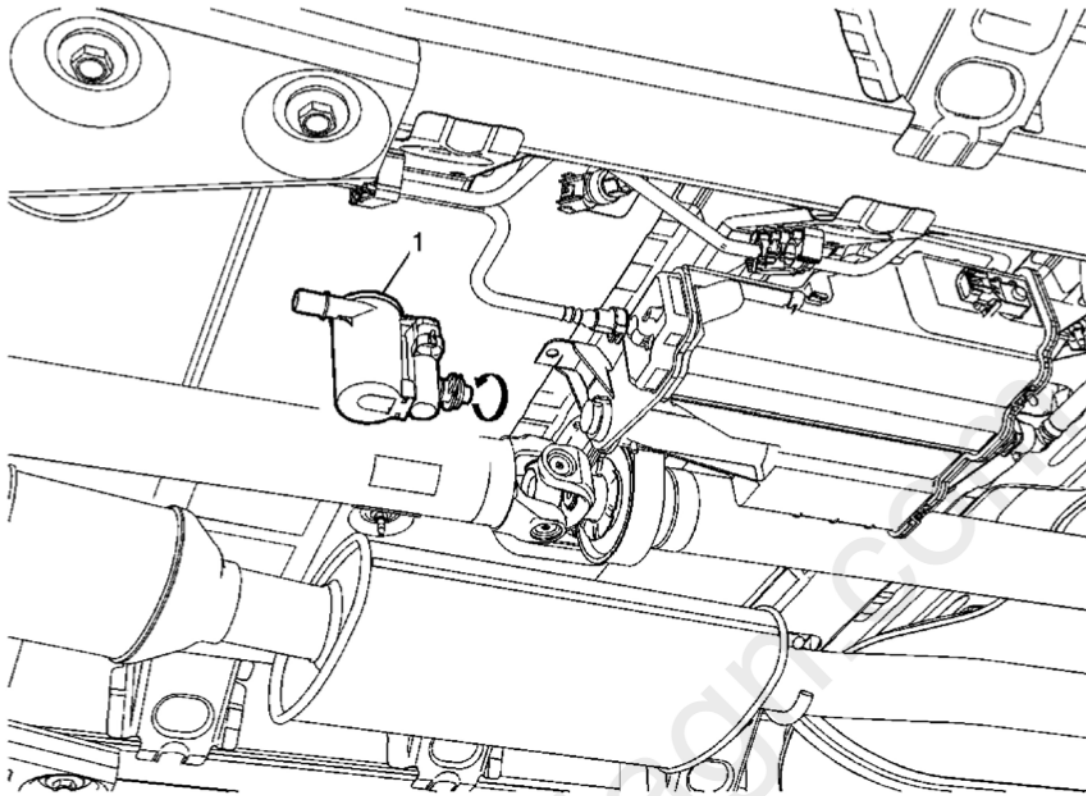


Fig. 126: Identifying Evaporative Emission Canister Vent Solenoid Valve (NT7, NU5)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
2. Disconnect the evaporative emission line. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .	
1	Evaporative Emission Vent Solenoid Valve
	Procedure
	1. Pull back the plastic locking tab and rotate the entire valve counterclockwise.
	2. Disconnect the electrical connector.

EVAPORATIVE EMISSION FRONT PIPE REPLACEMENT

Removal Procedure

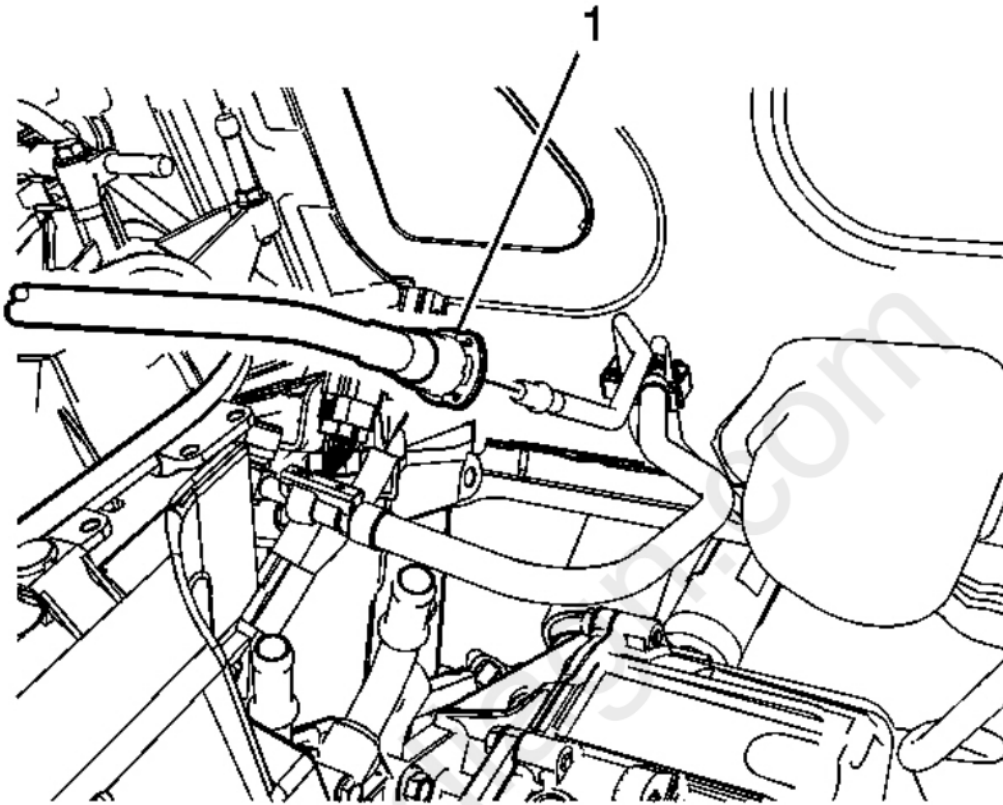


Fig. 127: Identifying Evaporative Emission Line
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.

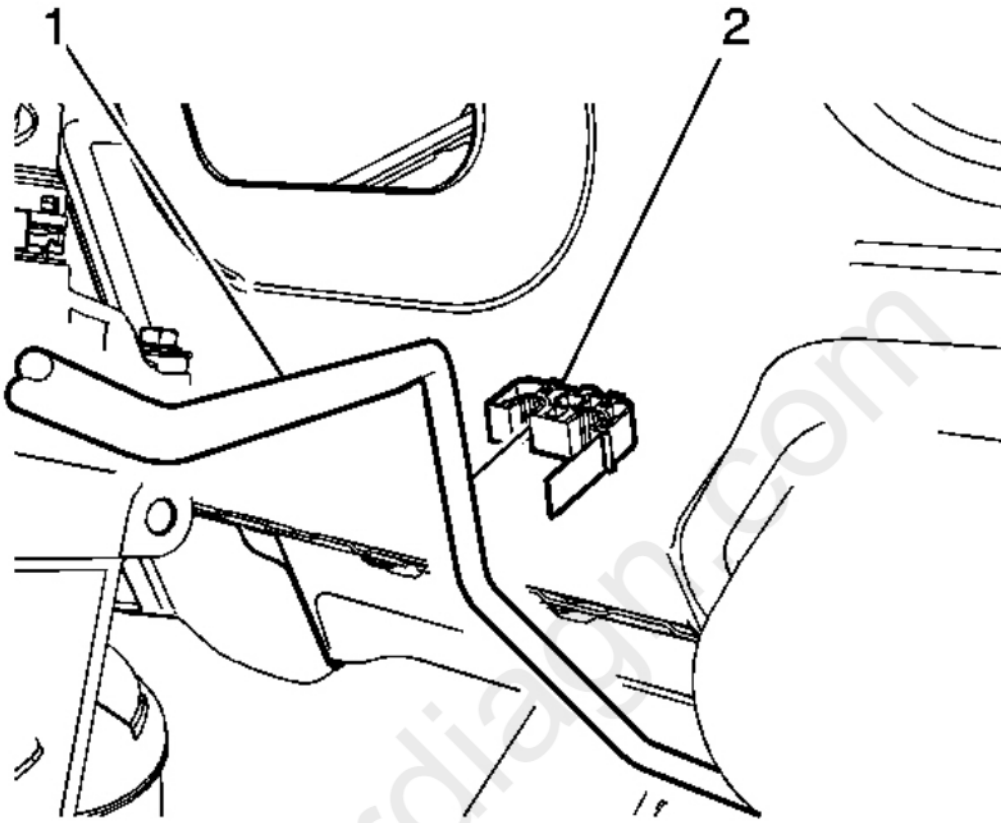


Fig. 12 : Identifying Evaporative Emission Line & Plastic Retainer
Courtesy of GENERAL MOTORS CORP.

2. Disengage the evaporative emission line (1) from the plastic retainer (2).

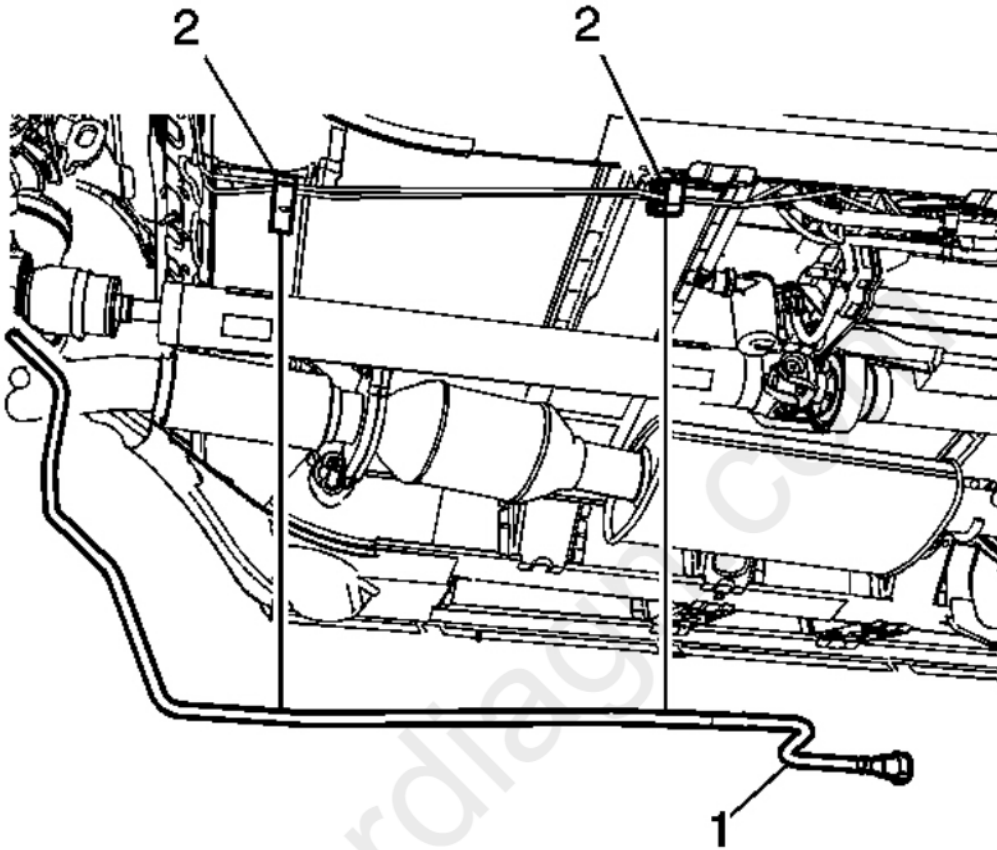


Fig. 12 : View Of Evaporative Emission Line
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.
 - . Disengage the evaporative emission line (1) from the plastic retainers (2) and remove the evaporative emission line.

Installation Procedure

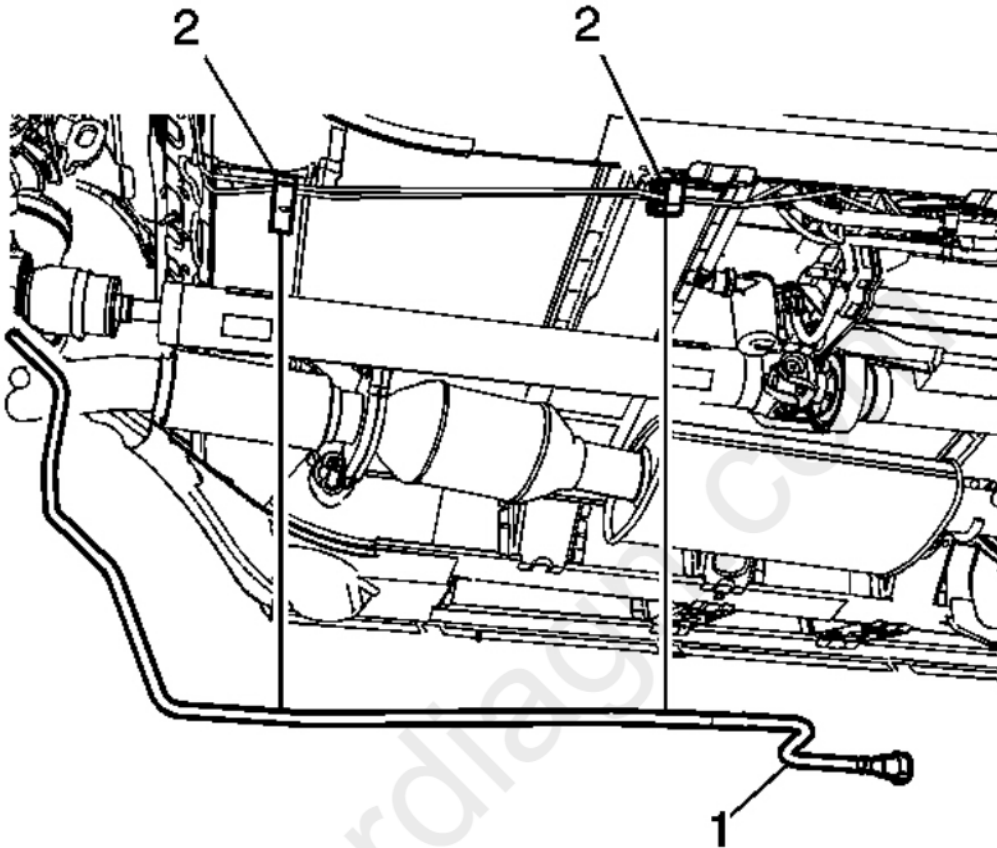


Fig. 13 : View Of Evaporative Emission Line
Courtesy of GENERAL MOTORS CORP.

1. Install the evaporative emission line (1) into the plastic retainers (2).
2. Connect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.

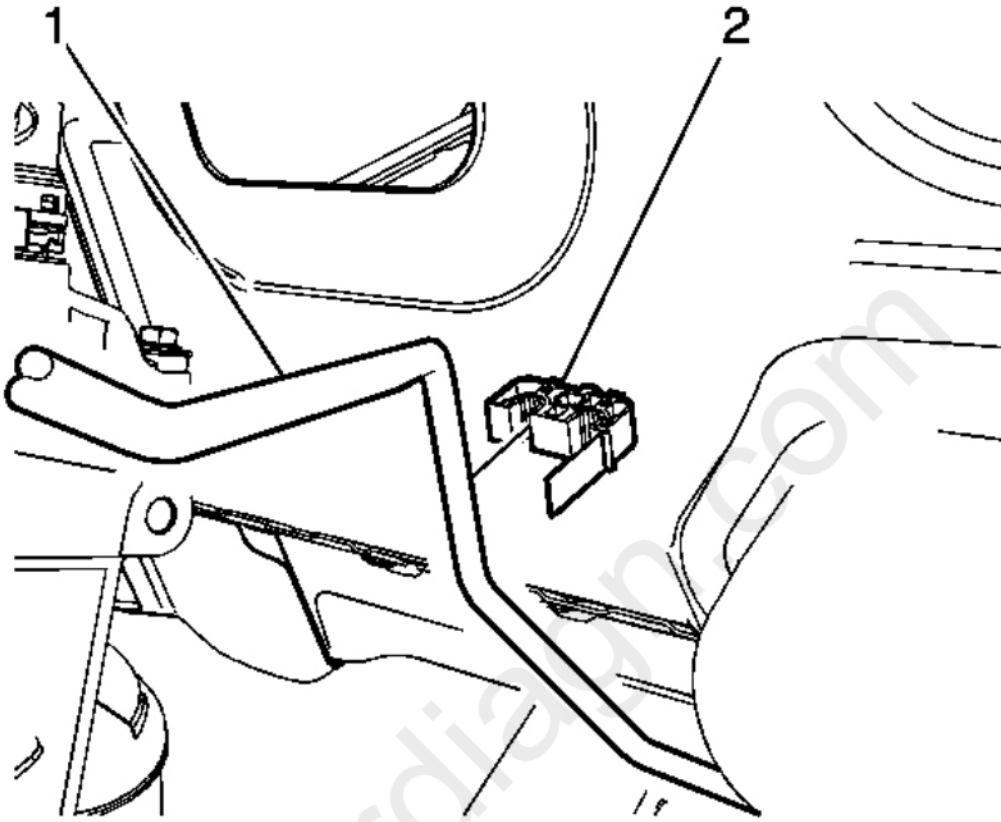


Fig. 131: Identifying Evaporative Emission Line & Plastic Retainer
Courtesy of GENERAL MOTORS CORP.

3. Engage the evaporative emission line (1) to the plastic retainer (2).

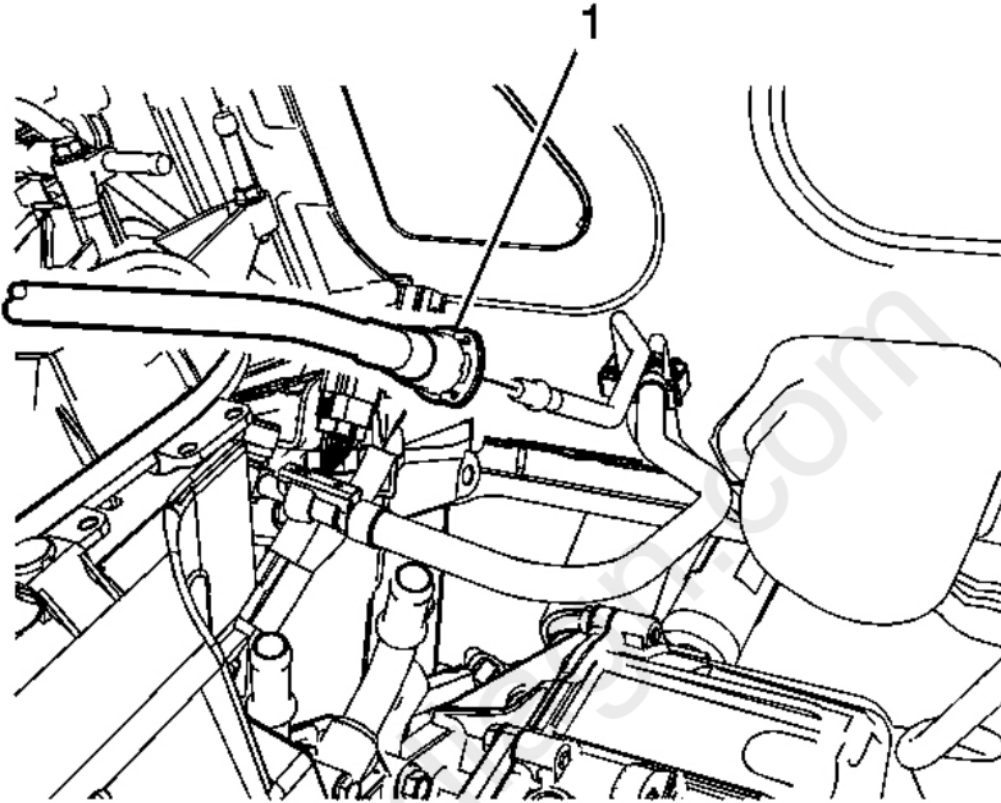


Fig. 132: Identifying Evaporative Emission Line
Courtesy of GENERAL MOTORS CORP.

4. Connect the evaporative emission line (1). Refer to **Plastic Collar Quick Connect Fitting Service**.

EVAPORATIVE EMISSION REAR PIPE REPLACEMENT

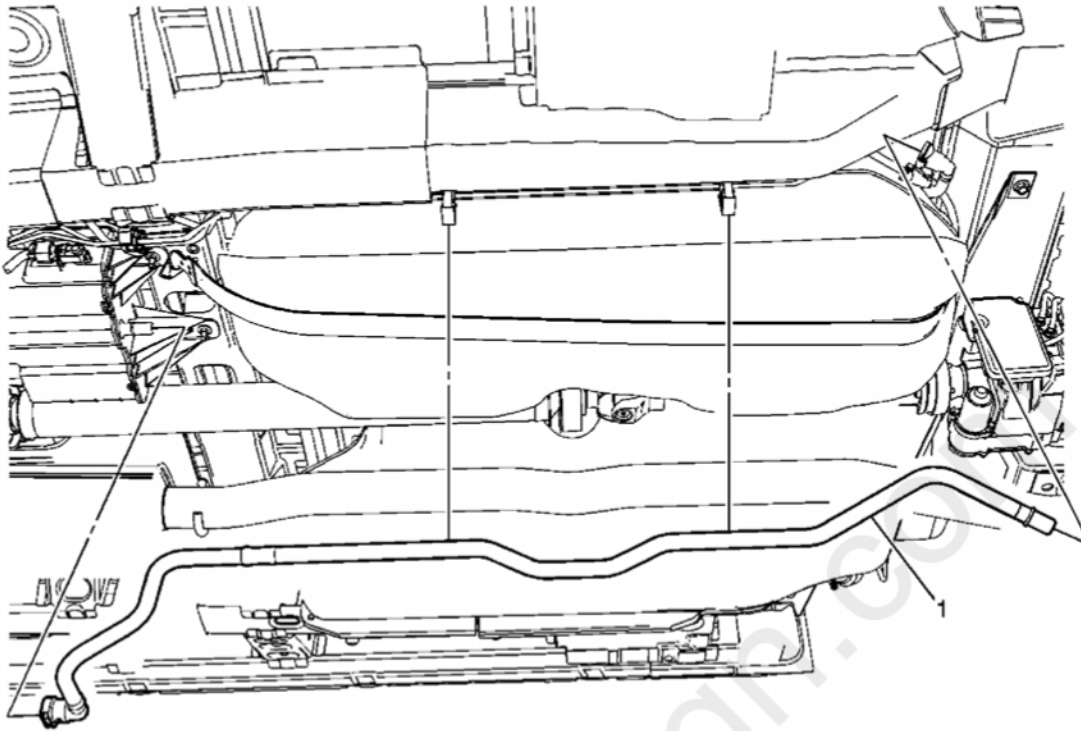


Fig. 133: Identifying Evaporative Emission Rear Pipe
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Disconnect the evaporative emission lines. Refer to <u>Plastic Collar Quick Connect Fitting Service</u>.	
1	Evaporative Emission Rear Pipe Procedure: Disengage the evaporative emission line from the plastic retaining clips.

EVAPORATIVE EMISSION CANISTER PURGE TUBE REPLACEMENT (LF1)

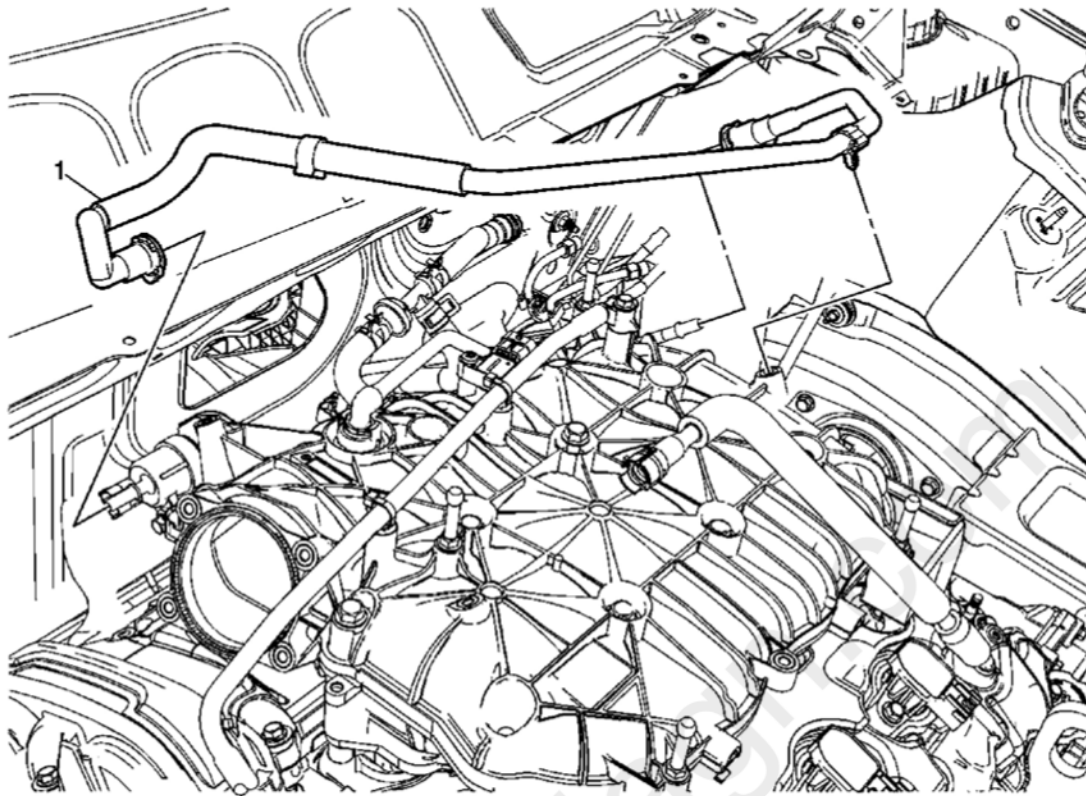


Fig. 134: View Of Evaporative Emission Canister Purge Tube (LF1)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1. Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
2. Disconnect the evaporative emission lines. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .	
1	Evaporative Emission Front Pipe

EVAPORATIVE EMISSION CANISTER PURGE TUBE REPLACEMENT (LAU)

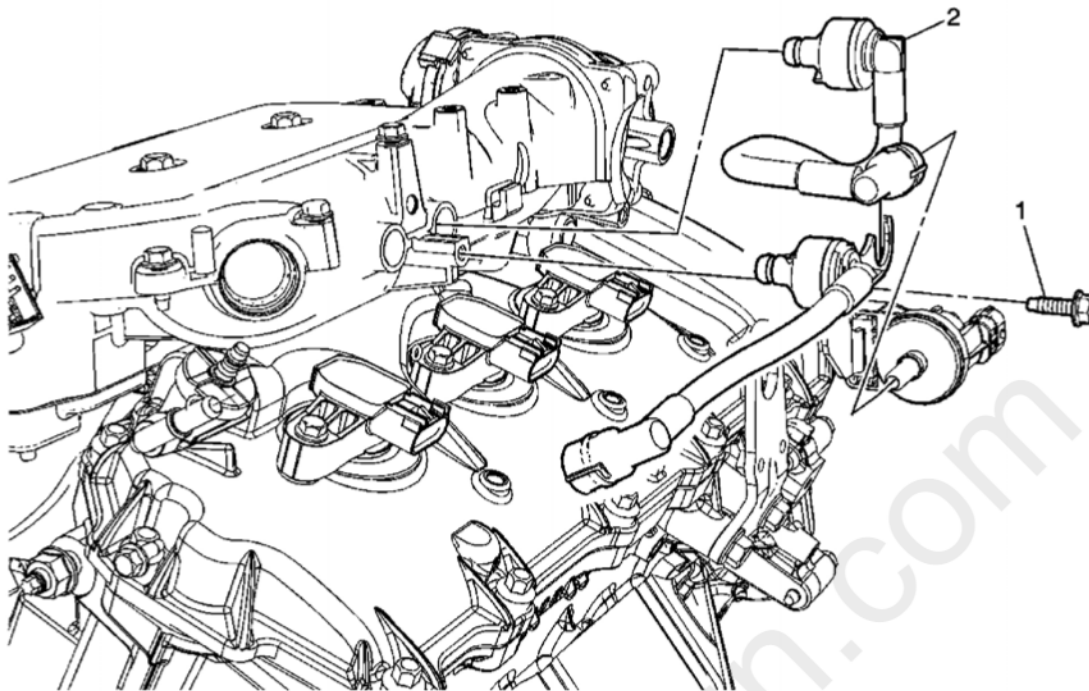


Fig. 135: Identifying Evaporative Emission Canister Purge Tube & Bolt (LAU)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> . 2. Disconnect the quick connects. Refer to <u>Plastic Collar Quick Connect Fitting Service</u>	
1	Evaporative Emission Canister Purge Solenoid Fastener CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 10 N.m (89 lb in)
2	Evaporative Emission Purge Tube

EVAPORATIVE EMISSION CANISTER AIR INLET HOSE REPLACEMENT

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

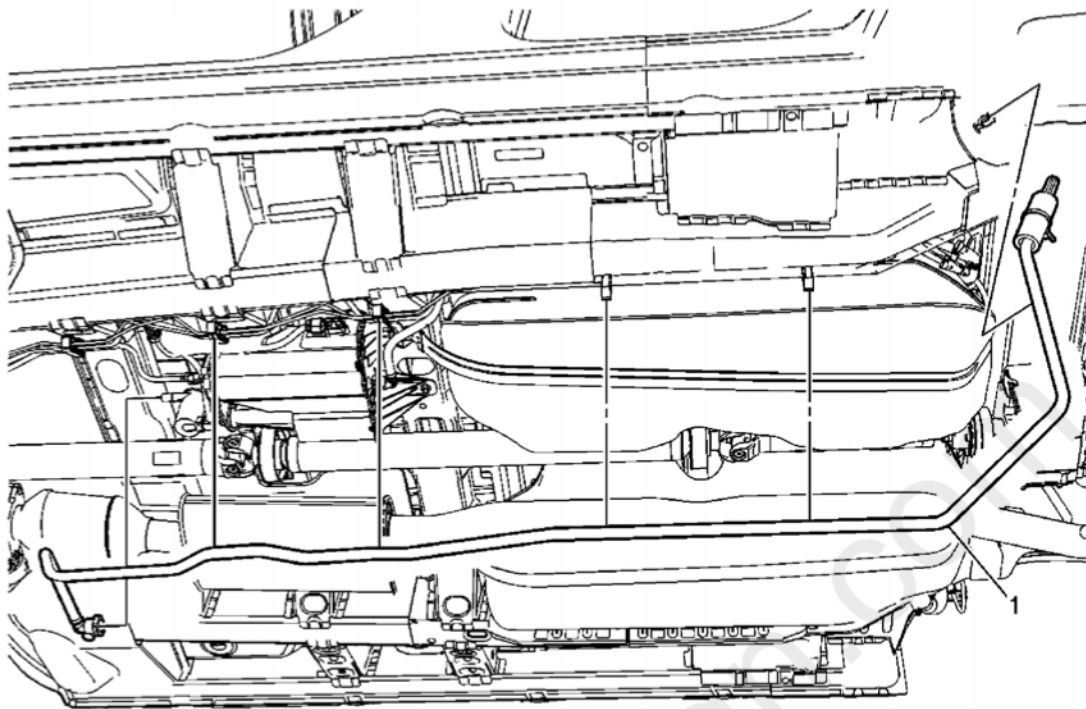


Fig. 136: Identifying Evaporative Emission Canister Air Inlet Hose
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Remove the left rear wheelhouse liner. Refer to Rear Wheelhouse Panel Liner Replacement .	
2. Disconnect the evaporative emission line. Refer to Plastic Collar Quick Connect Fitting Service .	
1	Evaporative Emission Canister Air Inlet Hose Procedure: Disengage the line from the plastic retainers.

EVAPORATIVE EMISSION CANISTER REPLACEMENT (NT7, NU5)

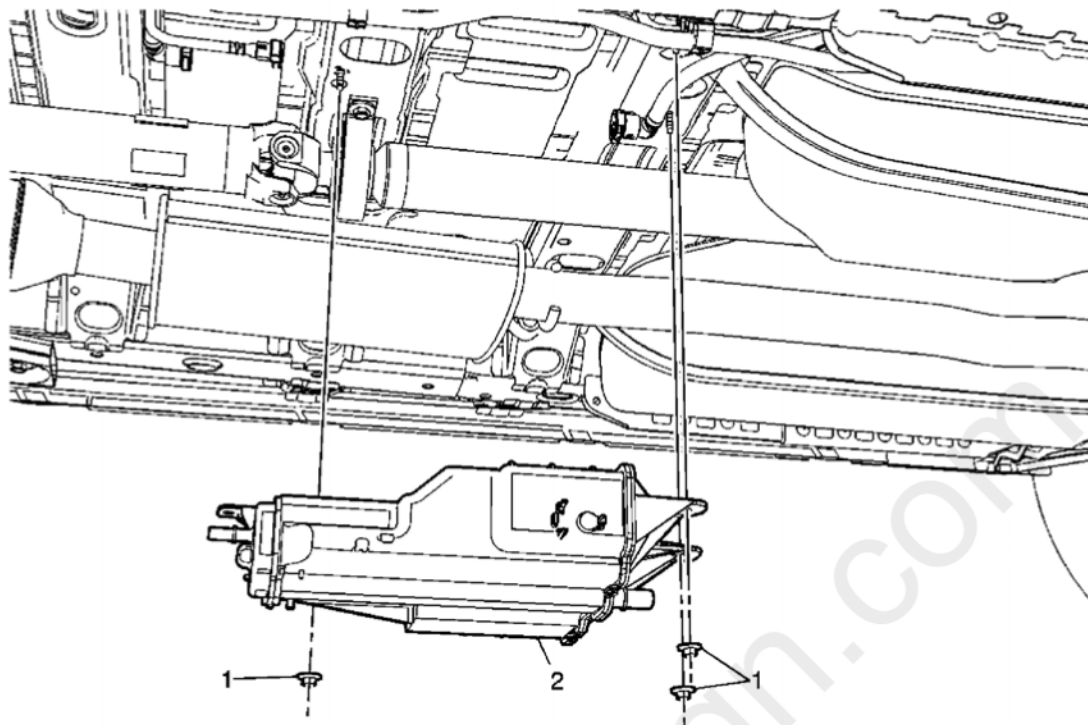


Fig. 1 7: View Of Evaporative Emission Canister (NT7 NU)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Disconnect the evaporative emission lines. Refer to Plastic Collar Quick Connect Fitting Service .	
1	Evaporative Emission Canister Fasteners (Qty 3) CAUTION: Refer to Fastener Caution . Tighten: 9 N.m (80 lb in)
2	Evaporative Emission Canister Procedure: Disconnect the electrical connector.

EVAPORATIVE EMISSIONS SYSTEM CLEANING

Special Tools

GE 4141 : Evaporative Pressure and Purge Station

For equivalent regional tools, refer to **Special Tools**.

Inspection Procedure

CAUTION: Use the **A** pressure purge Diagnostic Station 1 1 in order to provide a clean, dry, low pressure gas source. Do not substitute any other pressurized gas source. Damage may result to the **A** system.

NOT : proceed with the following procedure only if referenced by an evaporative emission **A** diagnostic or repair procedure.

1. Turn OFF the ignition.
2. Remove the EVAP canister purge valve. Refer to **Evaporative Emission Canister Purge Solenoid Valve Replacement (LF1)** or **Evaporative Emission Canister Purge Solenoid Valve Replacement (LAU)**.
3. Lightly tap the EVAP canister purge valve on a hard surface.
4. Inspect for carbon particles exiting either of the vacuum ports.
 - If no carbon particles were detected, but a blockage was detected during a diagnostic procedure, install the original EVAP canister purge valve. Continue with the cleaning procedure.
 - If carbon particles are found during the inspection procedure, continue with the cleaning procedure.
 - If a diagnostic procedure directed you to replace the EVAP canister purge valve and no carbon particles were detected, replace the EVAP canister purge valve. Return to the published service procedure.

Cleaning Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle**.
2. Remove the EVAP canister. Refer to **Evaporative Emission Canister Replacement (NT7 NU)**.
3. Turn OFF the main valve on the **GE 4141** : station.
4. Disconnect the hose from the diagnostic station pressure regulator.
5. Using a section of vacuum hose, connect one end onto the EVAP pressure/purge diagnostic station pressure regulator.
6. Connect the other end of the vacuum hose to the canister side of the purge pipe.
7. Turn ON the main nitrogen cylinder valve and continue to discharge nitrogen for 15 seconds.
8. If the nitrogen does not clear the blockage, replace the purge pipe.
9. Return the EVAP pressure/purge diagnostic station to the stations original condition.
10. Install a new EVAP canister. Refer to **Evaporative Emission Canister Replacement (NT7 NU)**.
11. Lower the vehicle.
12. Install a new EVAP canister purge valve. Refer to **Evaporative Emission Canister Purge Solenoid Valve Replacement (LF1)** or **Evaporative Emission Canister Purge Solenoid Valve Replacement (LAU)**.
13. Return to the diagnostic table that sent you here.

IGNITION COIL REPLACEMENT AN 1**Removal Procedure**

1. Remove the intake manifold. Refer to Upper Intake Manifold Replacement .

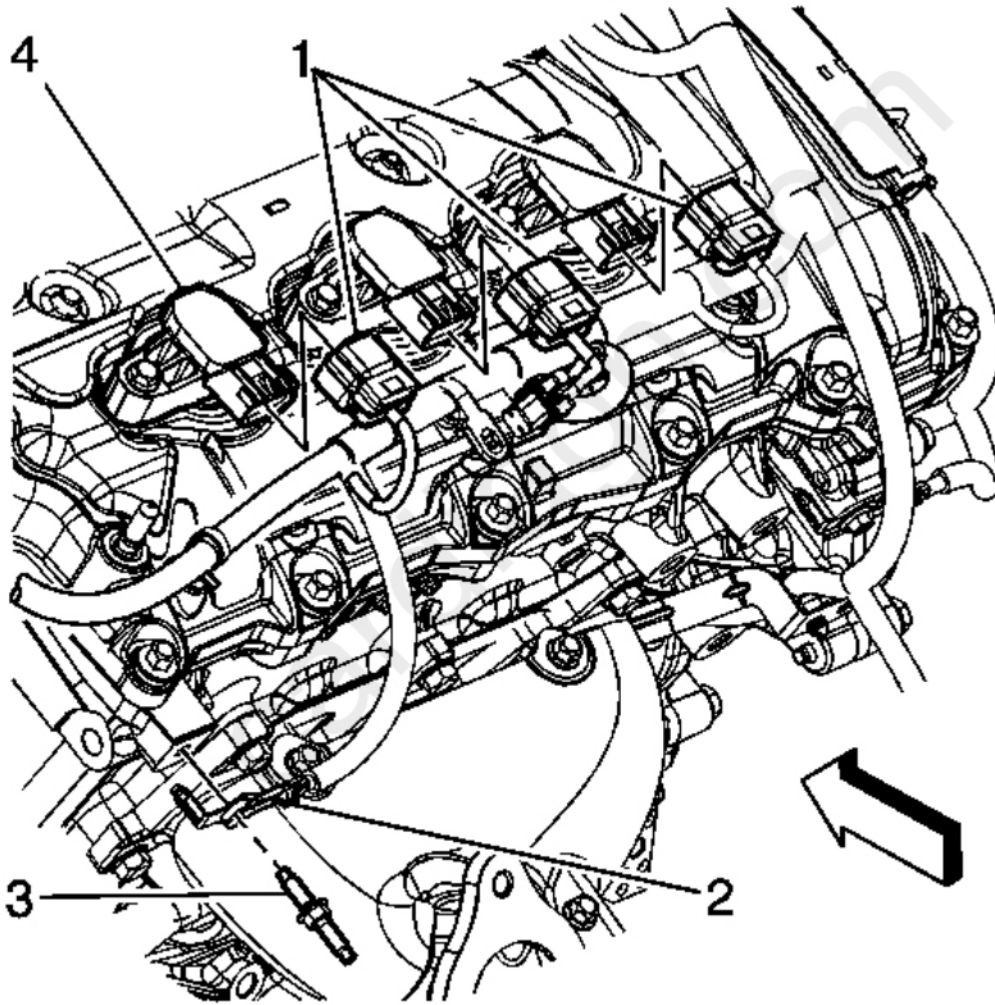


Fig. 1 8: View Of Ignition Coil Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the engine wiring harness electrical connector(s) (1) from the ignition coil(s) (4).

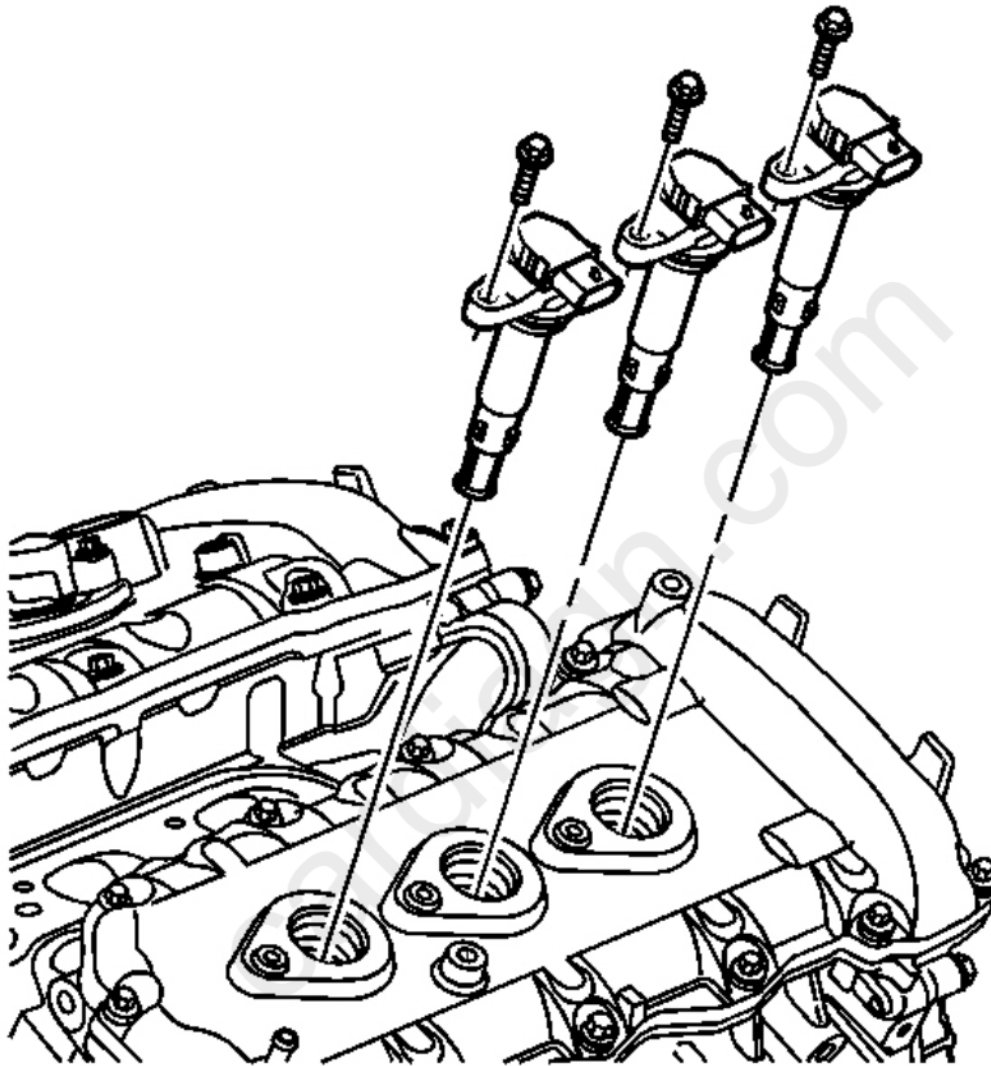


Fig. 1 9: Ignition Coil View

Courtesy of GENERAL MOTORS CORP.

3. Remove the ignition coil bolt(s).
4. Remove the ignition coil(s).

Installation Procedure

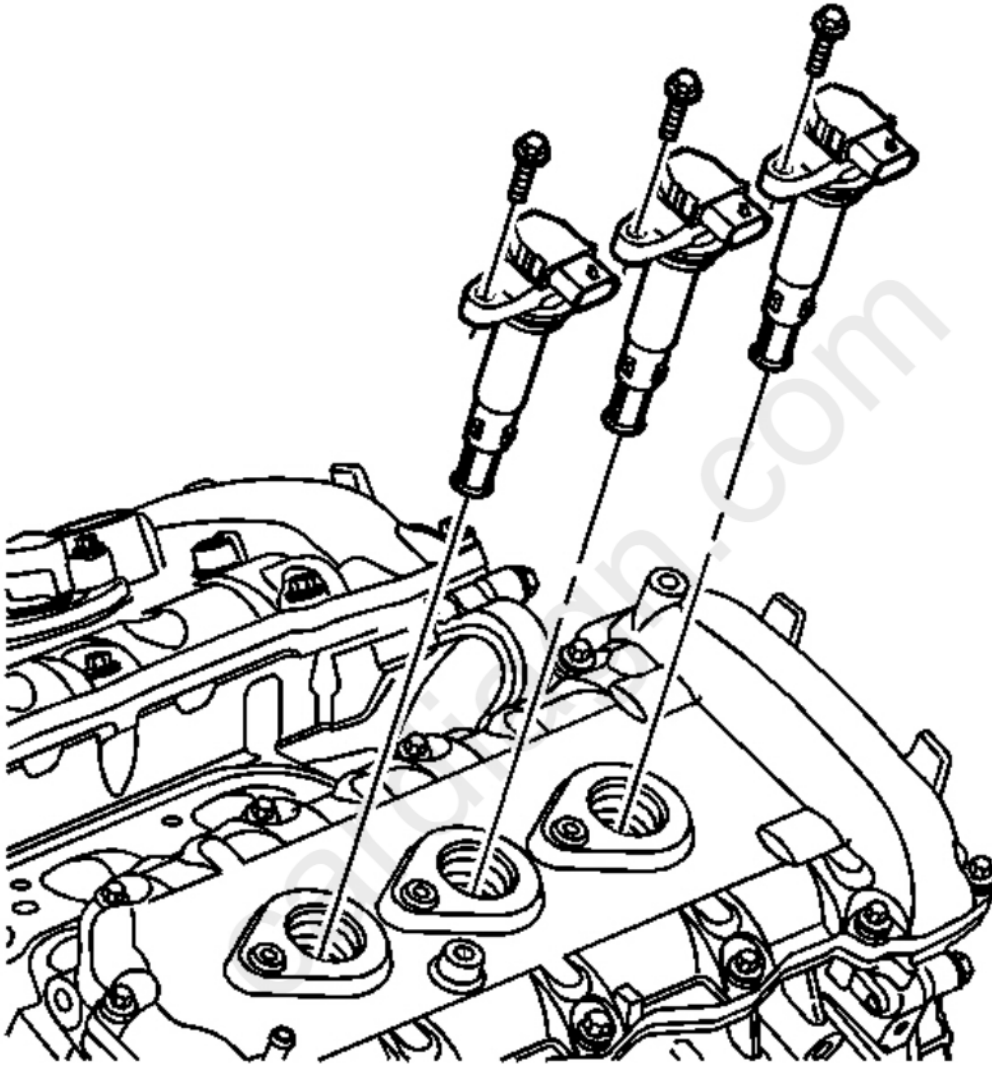


Fig. 14 : Ignition Coil View

Courtesy of GENERAL MOTORS CORP.

1. Install the ignition coil(s).

CAUTION: Refer to Fastener Caution .

2. Install the ignition coil bolt(s).

Tighten: Tighten the bolt(s) to 10 N.m (89 lb in).

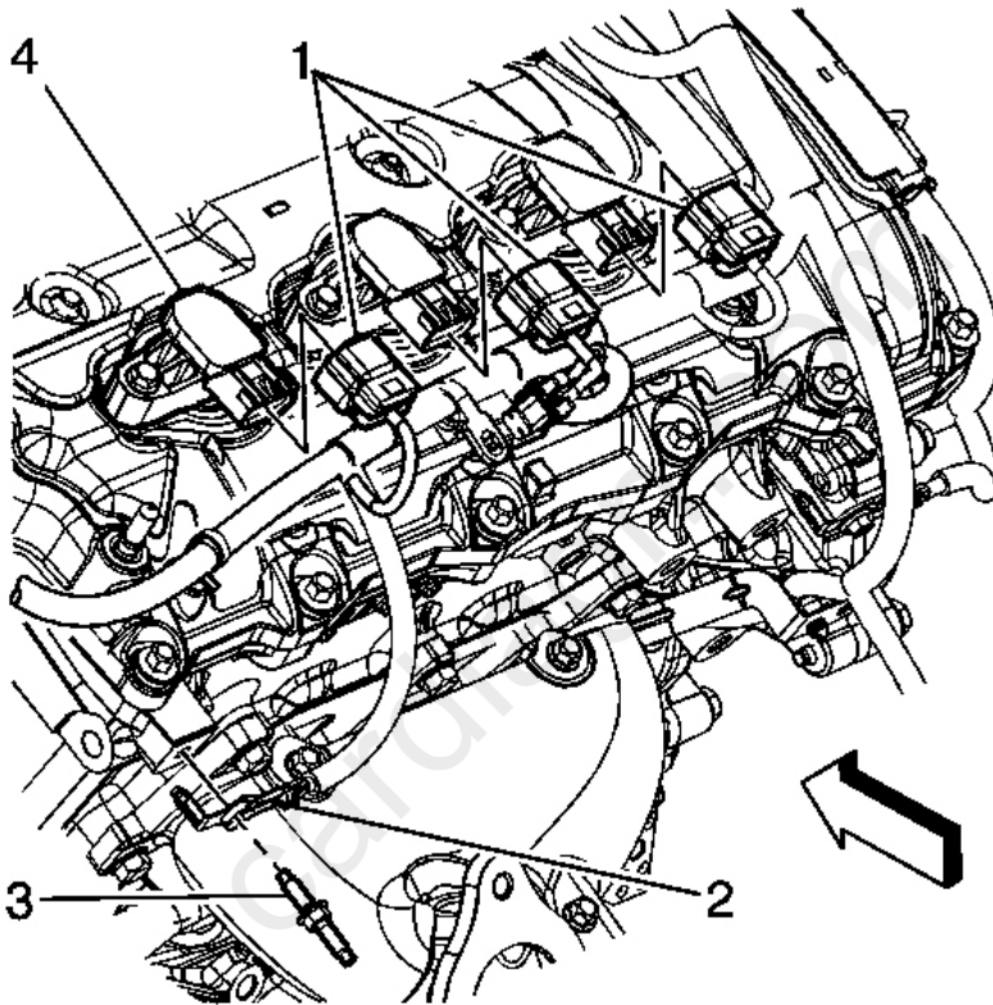


Fig. 141: View Of Ignition Coil Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the engine wiring harness electrical connector(s) (1) to the ignition coil(s) (4).
4. Install the intake manifold. Refer to **Upper Intake Manifold Replacement** .

IGNITION COIL REPLACEMENT - BANK 2

Removal Procedure

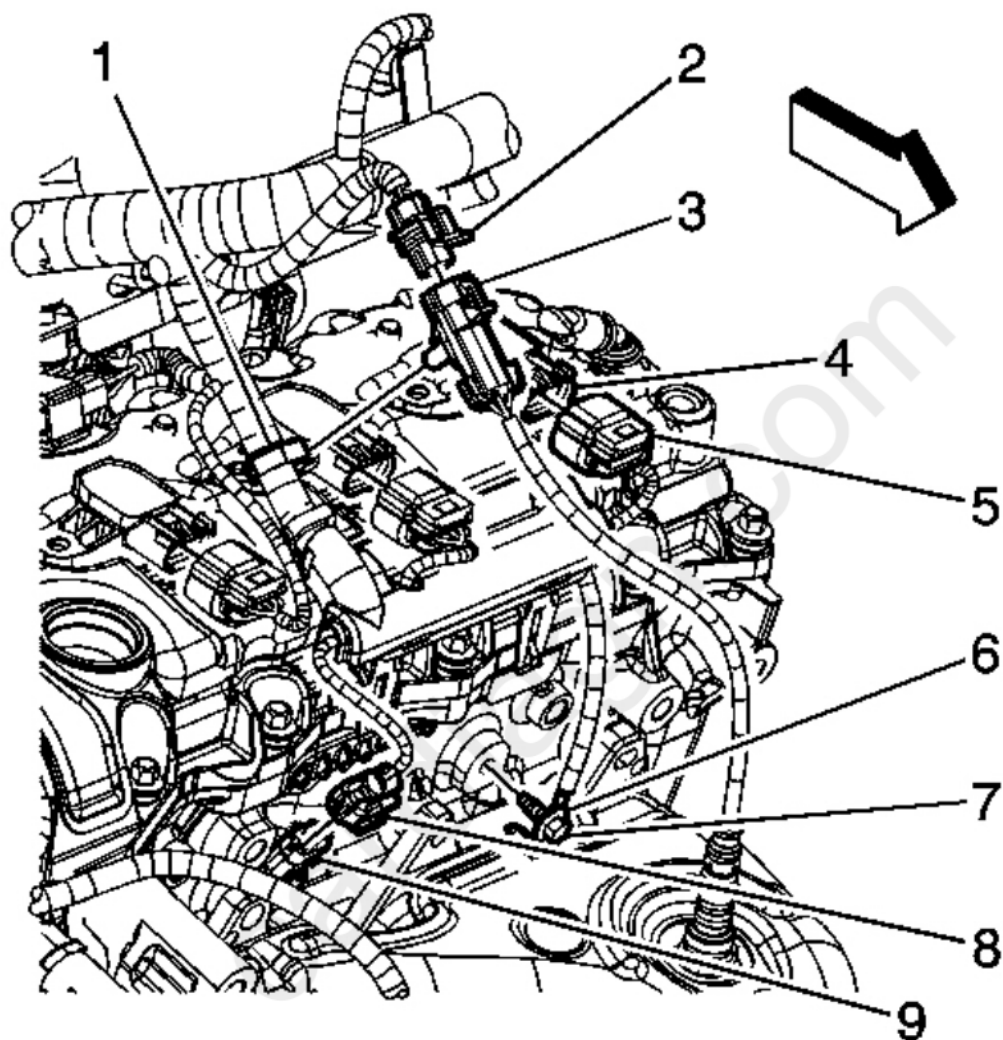


Fig. 142: Identifying Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Remove the intake manifold cover. Refer to **Upper Intake Manifold Replacement** .
2. Disconnect the engine wiring harness electrical connector(s) (5) from the ignition coil(s) (4).

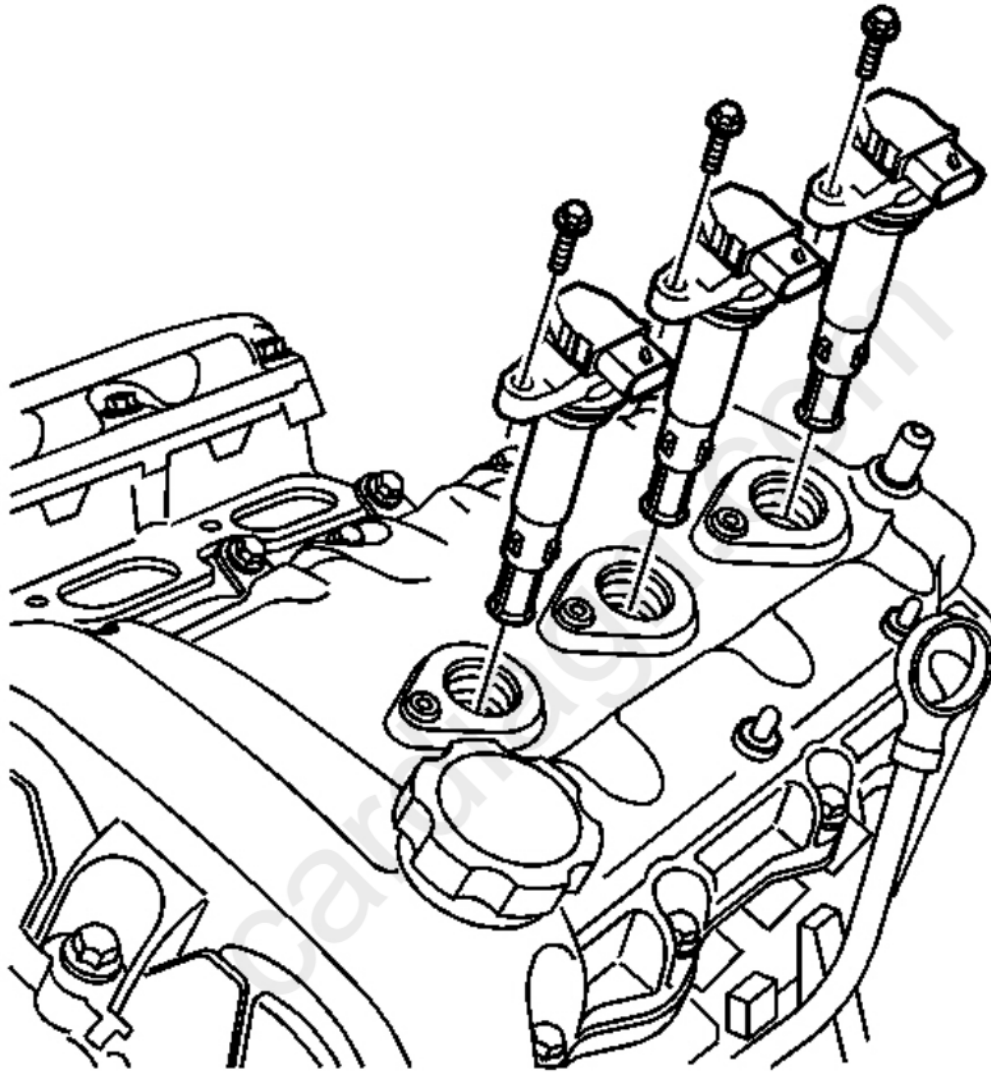


Fig. 143: Identifying Left Cylinder Head Ignition Coils
Courtesy of GENERAL MOTORS CORP.

3. Remove the ignition coil bolt(s).
4. Remove the ignition coil(s).

Installation Procedure

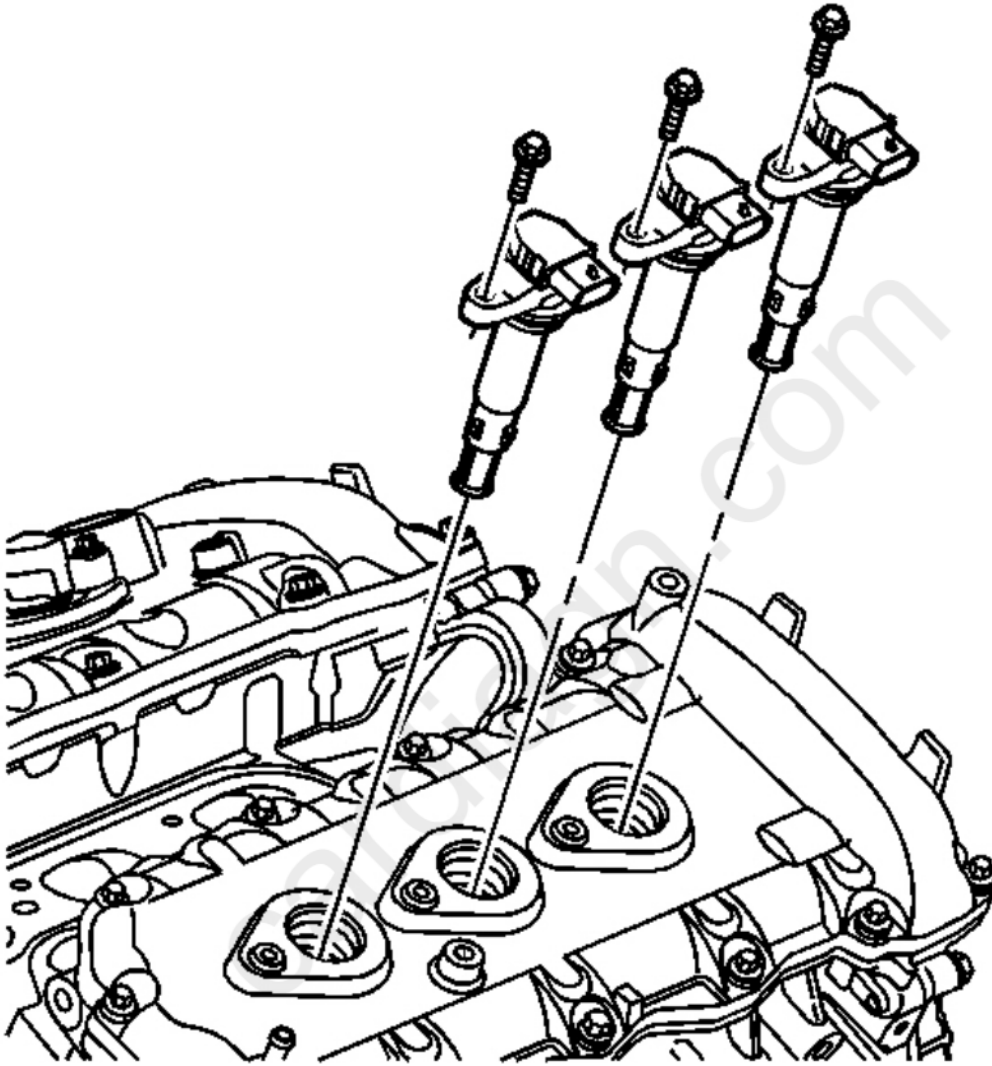


Fig. 144: Ignition Coil View

Courtesy of GENERAL MOTORS CORP.

1. Install the ignition coil(s).

CAUTION: Refer to Fastener Caution .

2. Install the ignition coil bolt(s).

Tighten: Tighten the bolt(s) to 10 N.m (89 lb in).

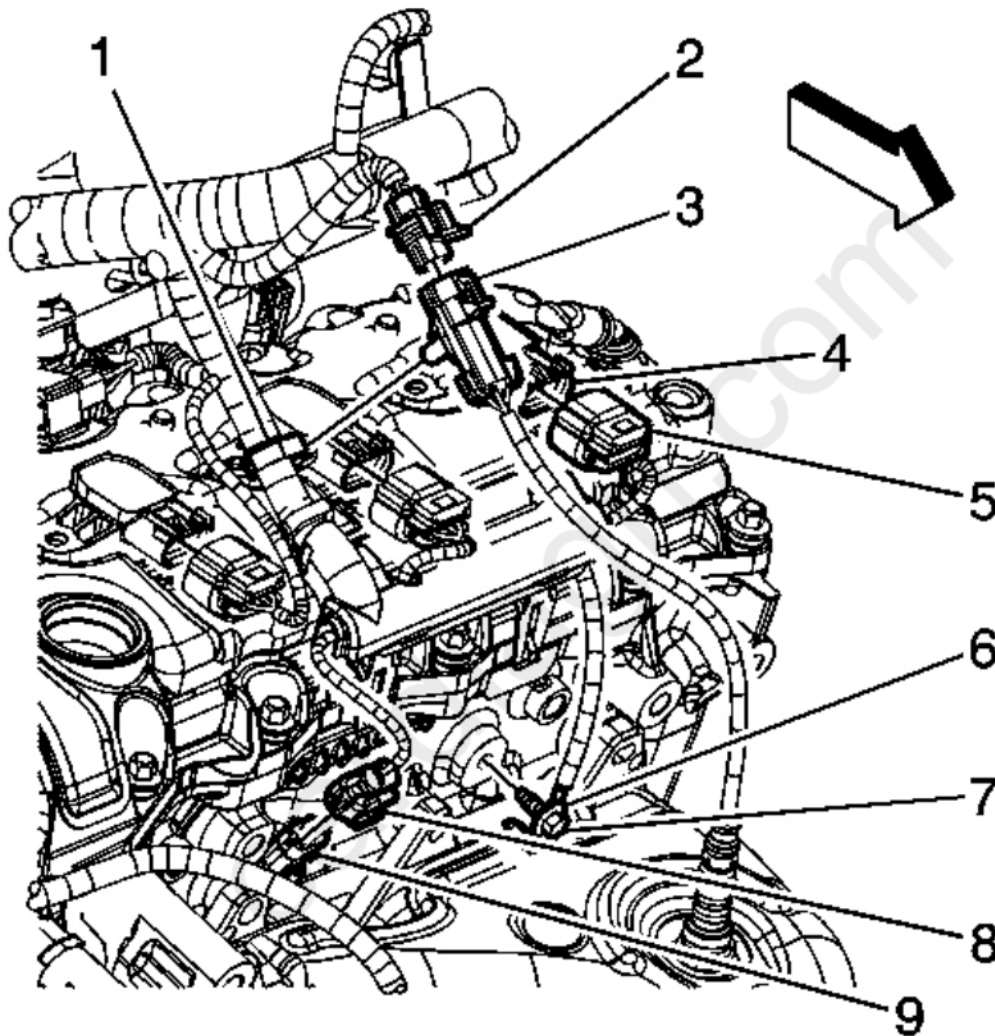


Fig. 145: Identifying Engine Wiring Harness Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Connect the engine wiring harness electrical connector(s) (5) to the ignition coil(s) (4).
4. Install the intake manifold cover. Refer to **Upper Intake Manifold Replacement**.

SPARK PLUG INSPECTION

Spark Plug Usage

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

- Ensure that the correct spark plug is installed. An incorrect spark plug causes driveability conditions. Refer to **Ignition System Specifications (LAU)** or **Ignition System Specifications (LF1)** for the correct spark plug.
- Ensure that the spark plug has the correct heat range. An incorrect heat range causes the following conditions:
 - Spark plug fouling - Colder plug
 - Pre-ignition causing spark plug and or engine damage - hotter plug

Spark Plug Inspection

cardiagn.com

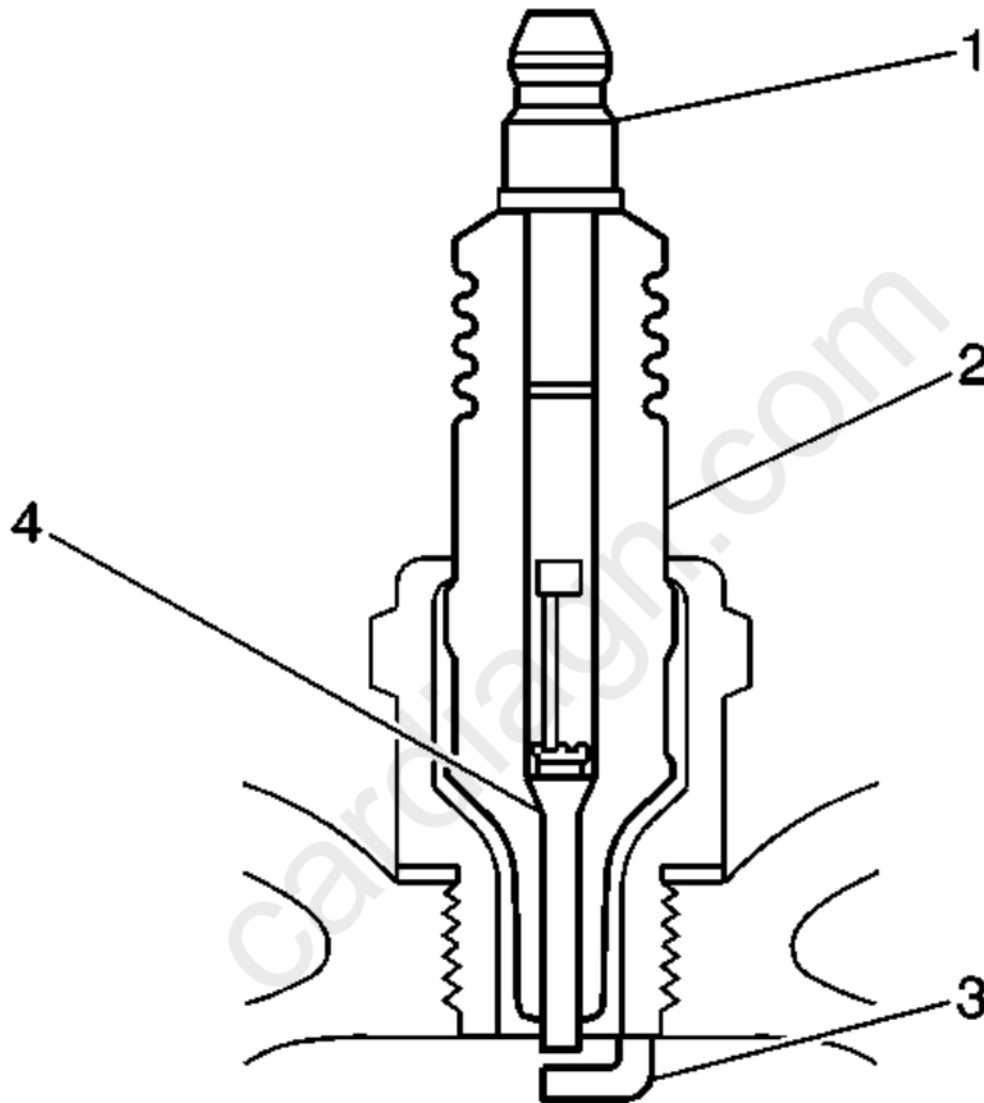


Fig. 146: Cross Sectional View Of Spark Plug
Courtesy of GENERAL MOTORS CORP.

- 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.

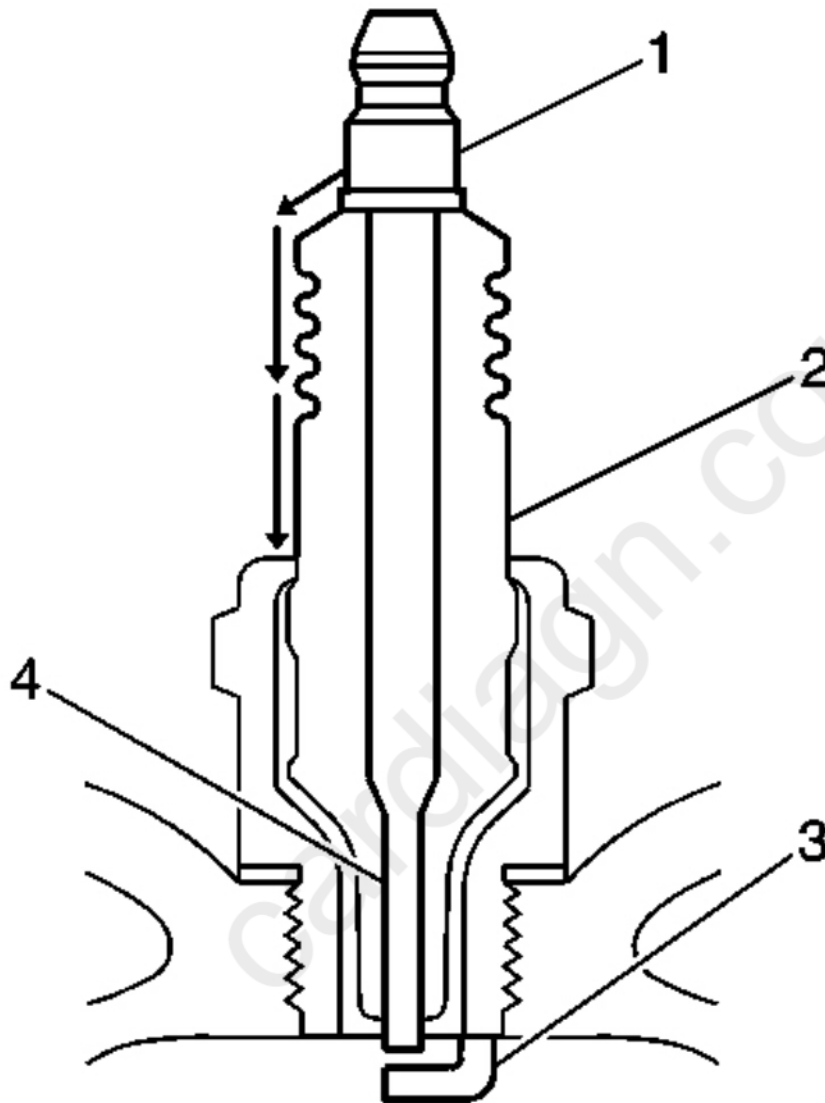


Fig. 147: Identifying Points For Inspecting Spark Plug For Flashover Or Carbon Tracking Soot
Courtesy of GENERAL MOTORS CORP.

- Inspect the insulator (2) for flashover or carbon tracking, soot. 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.

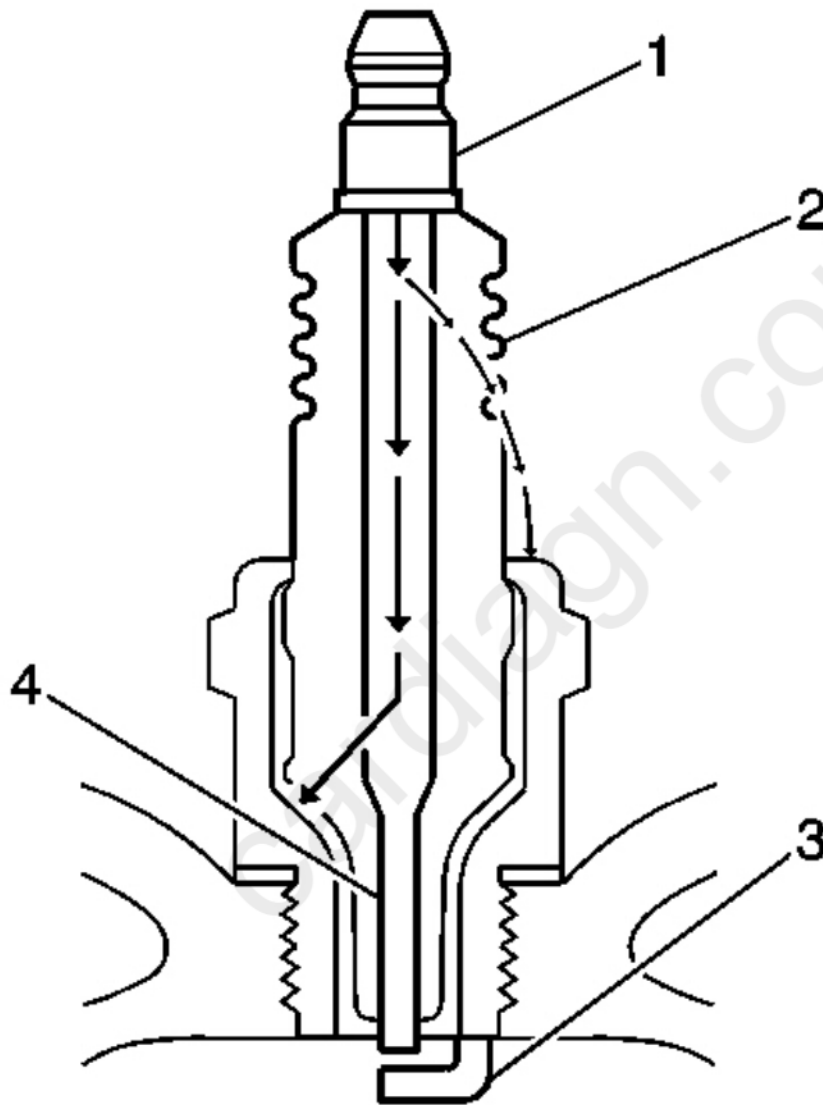


Fig. 148: Inspecting Spark Plug Insulator
Courtesy of GENERAL MOTORS CORP.

- Inspect the insulator (2) for cracks. All or part of the electrical charge may arc through the crack instead of the electrodes (3, 4).

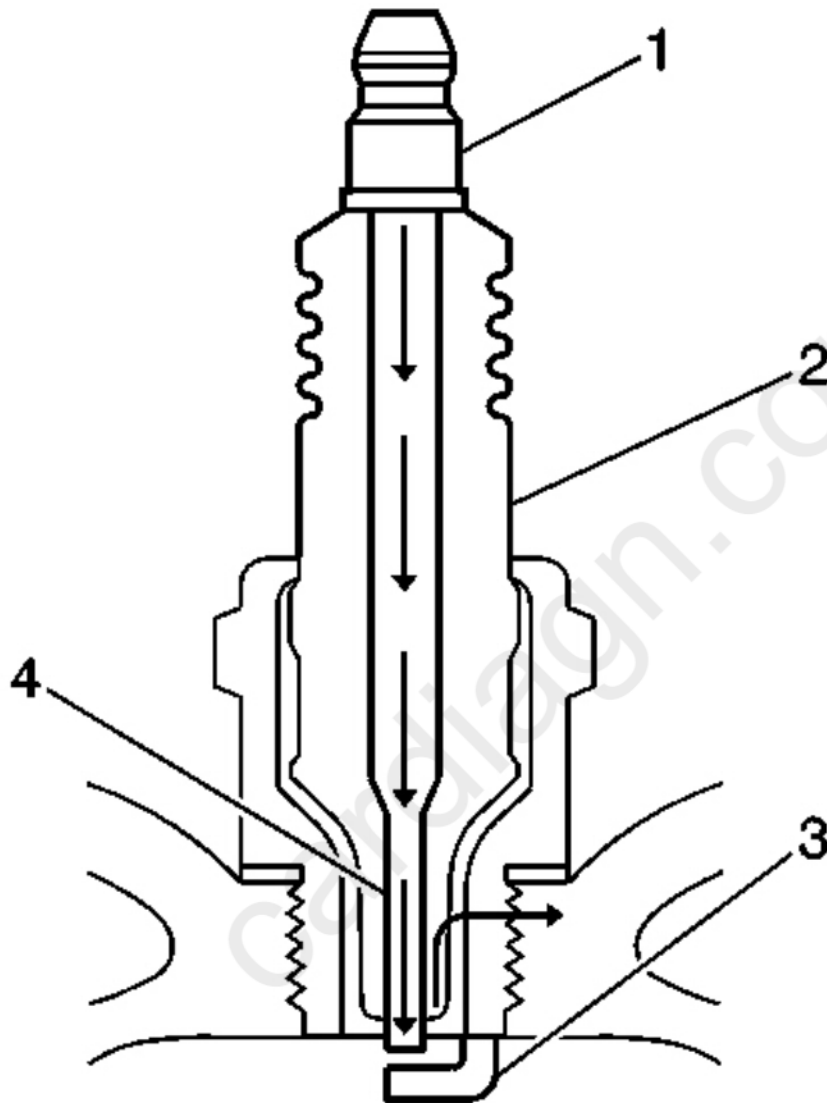


Fig. 149: Cutaway/Description View Of Spark Plug
Courtesy of GENERAL MOTORS CORP.

- Inspect for evidence of improper arcing.
 - Measure the gap between the center electrode (4) and the side electrode (3) terminals. Refer to **Ignition System Specifications (LAU)** or **Ignition System Specifications (LF1)** . An excessively wide electrode gap can prevent correct spark plug operation.
 - Inspect for the correct spark plug torque. Refer to **Ignition System Specifications (LAU)** or

Ignition System Specifications (LF1) . Insufficient torque can prevent correct spark plug operation. An over torqued spark plug, causes the insulator (2) to crack.

- 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.
- 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.

SPARK PLUG REPLACEMENT

Removal Procedure

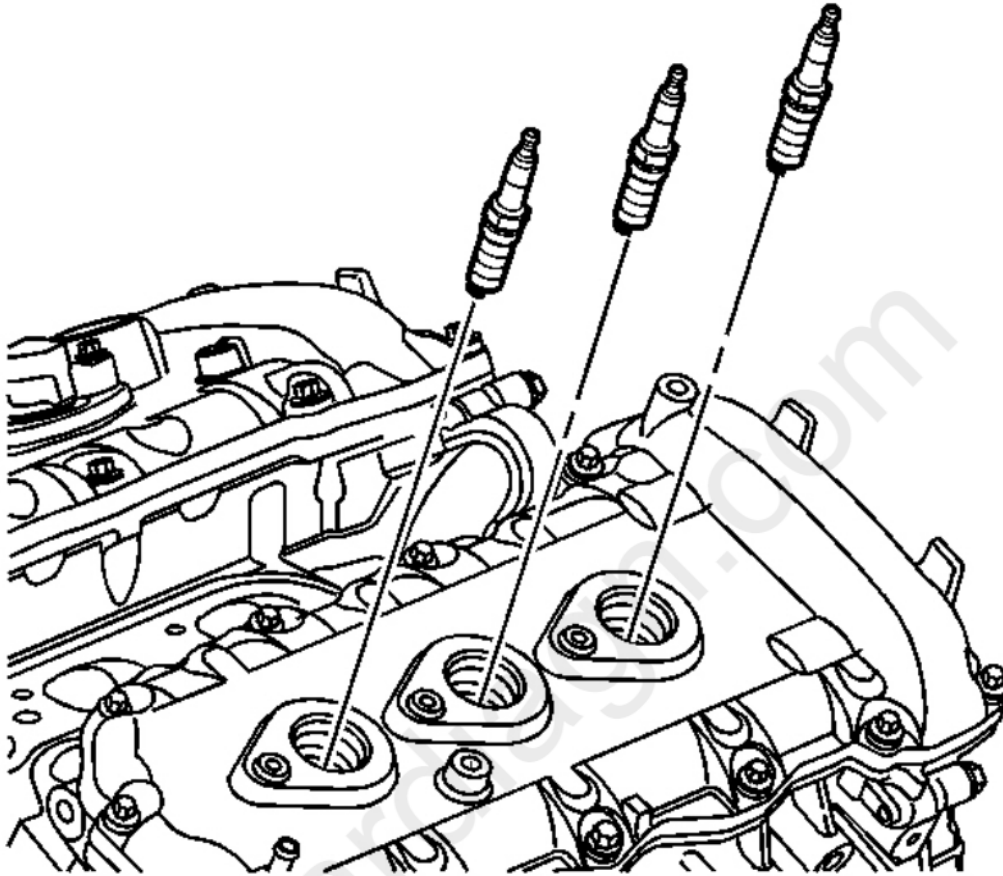


Fig. 15 : Vie Of Spark Plugs

Courtesy of GENERAL MOTORS CORP.

1. Remove the ignition coil(s). Refer to **Ignition Coil Replacement - Bank 1** and/or **Ignition Coil Replacement - Bank 2**.

WARNING: Refer to **Safety Glasses and Compressed Air Warning** .

CAUTION: Clean the spark plug recess area before removing the spark plug. Failure to do so could result in engine damage because of dirt or foreign material entering the cylinder head, or by the contamination of the cylinder head threads. The contaminated threads may prevent the proper seating of the new plug. Use a thread chaser to clean the threads of any contamination.

2. Use compressed air in order to remove debris from the spark plug cavity.

CAUTION: Allow the engine to cool before removing the spark plugs. Attempting to remove the spark plugs from a hot engine may cause the plug threads to seize, causing damage to cylinder head threads.

3. Remove the spark plug.

Installation Procedure

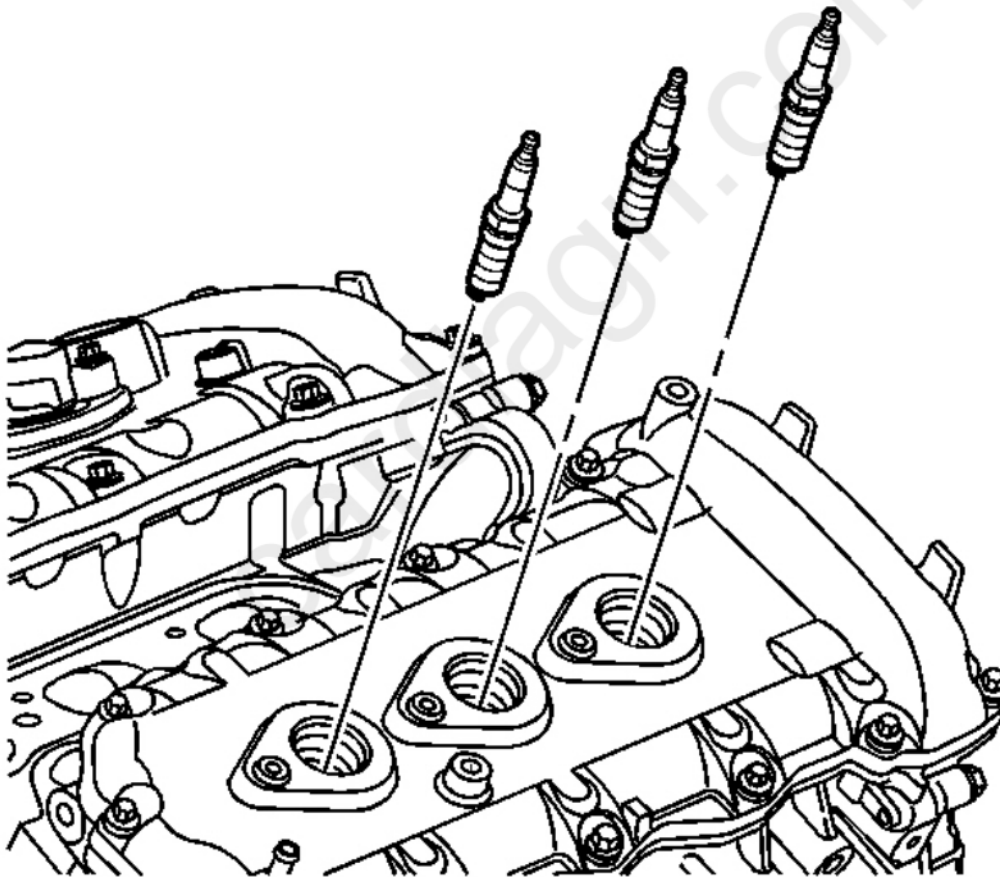


Fig. 151: View Of Spark Plugs

Courtesy of GENERAL MOTORS CORP.

CAUTION: Use only the spark plugs specified for use in the vehicle. Do not install spark plugs that are either hotter or colder than those

specified for the vehicle. Installing spark plugs of another type can severely damage the engine.

CAUTION: Check the gap of all new and reconditioned spark plugs before installation. The pre-set gaps may have changed during handling. Use a round feeler gauge to ensure an accurate check. Installing the spark plugs with the wrong gap can cause poor engine performance and may even damage the engine.

1. Ensure that the spark plug gap is equivalent to the spark plug gap specification. Refer to **Ignition System Specifications (LAU)** or **Ignition System Specifications (LF1)**.

CAUTION: Be sure that the spark plug threads smoothly into the cylinder head and the spark plug is fully seated. Use a thread chaser, if necessary, to clean threads in the cylinder head. Cross-threading or failing to fully seat the spark plug can cause overheating of the plug, exhaust blow-by, or thread damage.

CAUTION: Refer to **Fastener Caution**.

2. Install the spark plug.

Tighten: Tighten the spark plug to 20 N.m (15 lb ft).

3. Install the ignition coil(s). Refer to **Ignition Coil Replacement - Bank 1** and/or **Ignition Coil Replacement - Bank 2**.

CRANKSHAFT POSITION SENSOR REPLACEMENT

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

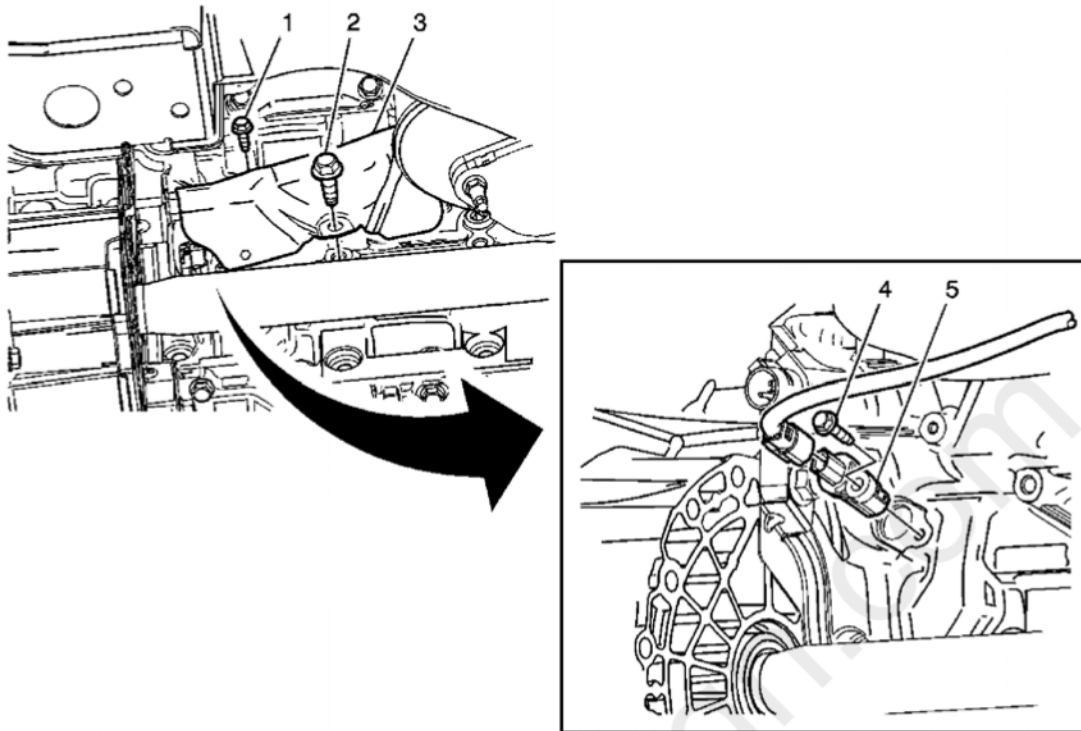


Fig. 152: Identifying Crankshaft Position Sensor
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
- If equipped with AWD, remove the right side catalytic converter. Refer to Catalytic Converter Replacement - Right Side (LF1). - Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.	
1	Bolt CAUTION: Refer to Fastener Caution . Tighten: 9 N.m (80 lb in)
2	Bolt Tighten: 58 N.m (42 lb ft)
3	Exhaust Manifold Lower Heat Shield
4	Bolt Tighten: 10 N.m (89 lb in)
	Crankshaft Position Sensor

Procedure

5

1. Disconnect the crankshaft position sensor harness connector.
2. If LF1, perform the crankshaft position system variation learn procedure. Refer to **Crankshaft Position System Variation Learn (LF1)**

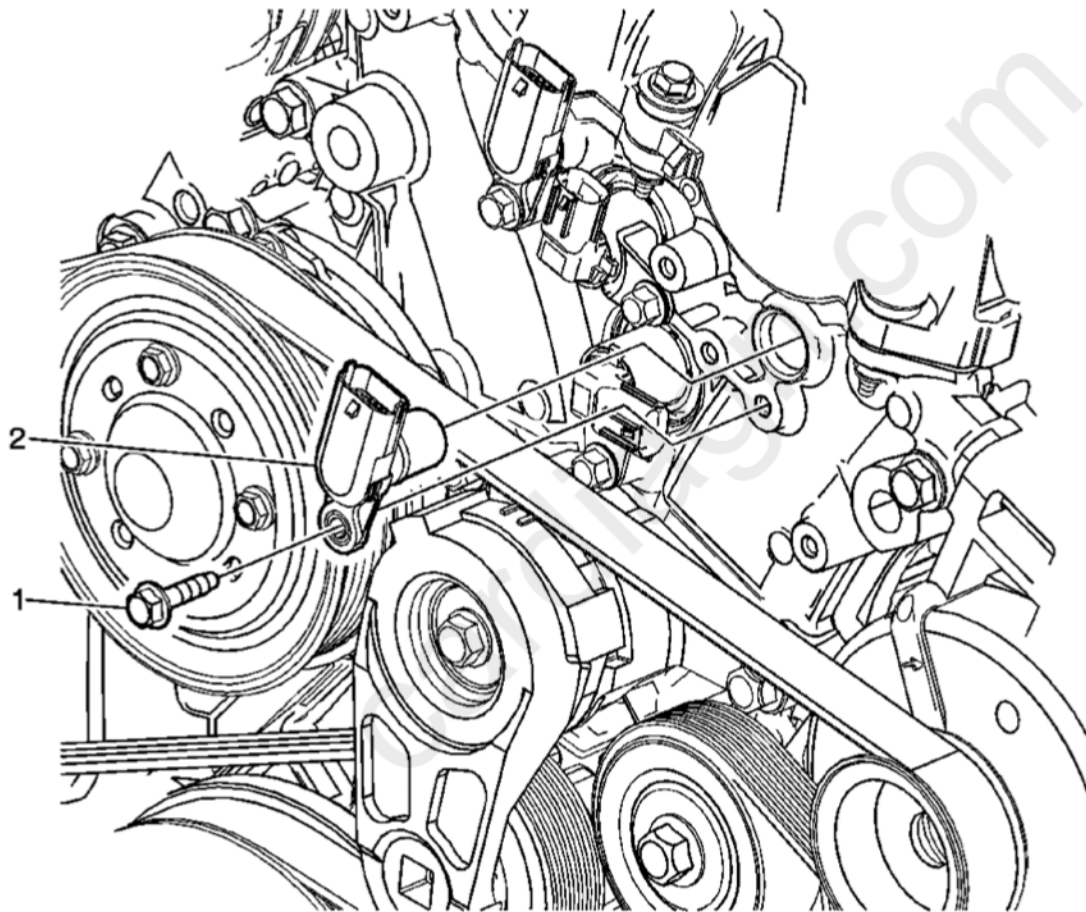
CAMSHAFT POSITION SENSOR REPLACEMENT - BANK 2 (LEFT SIDE) EXHAUST

Fig. 153: Identifying Camshaft Position Sensor - Bank 2 (Left Side) Exhaust
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the engine mount bracket. Refer to <u>Engine Mount Bracket Replacement - Right Side</u> .	
1	Camshaft Position Sensor Fastener CAUTION: Refer to <u>astener Caution</u> .

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

	Tighten: 10 N.m (89 lb in)
2	Camshaft Position Sensor Procedure: Disconnect the electrical connector.

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

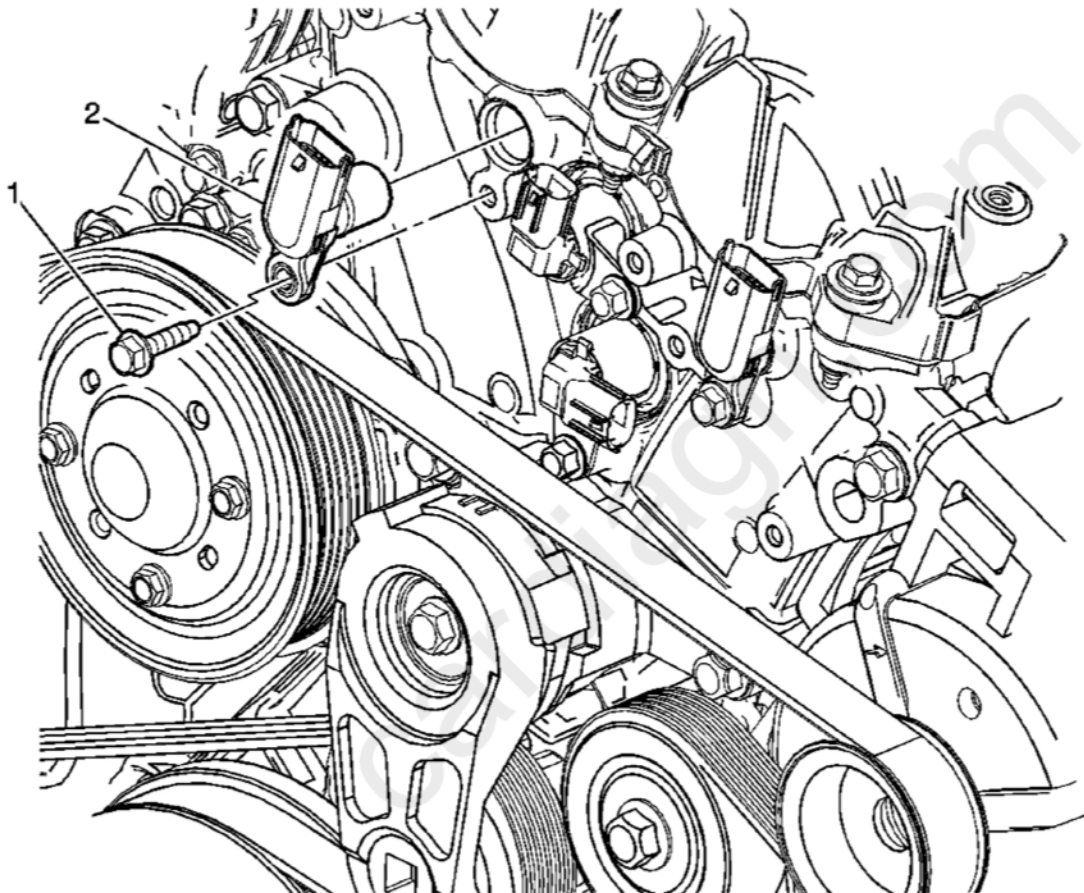


Fig. 154: Identifying Camshaft Position Sensor - Bank 2 (Left Side) Intake
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the engine mount bracket. Refer to Engine Mount Bracket Replacement - Right Side .	
1	Camshaft Position Sensor Fastener CAUTION: Refer to Fastener Caution .

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Tighten: 10 N.m (89 lb in)

2

Camshaft Position Sensor

Procedure:

Disconnect the electrical connector.

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

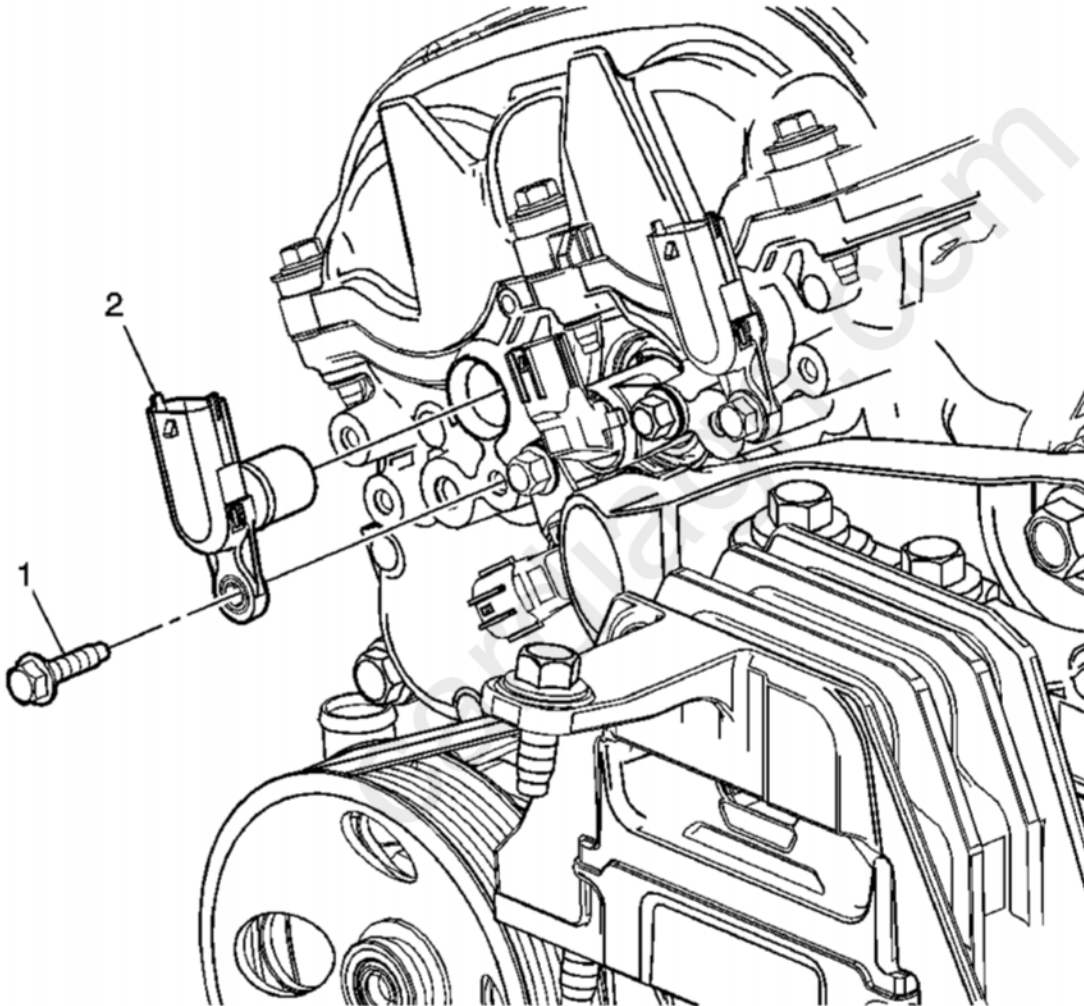


Fig. 155: Identifying Camshaft Position Sensor - Bank 1 (Right Side) Exhaust
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the air cleaner assembly. Refer to <u>Air Cleaner Assembly Replacement (LF1)</u> or <u>Air Cleaner Assembly Replacement (LAU)</u> .	
	Camshaft Position Sensor Fastener

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

1	CAUTION: Refer to <u>astener Caution</u> . Tighten: 10 N.m (89 lb in)
2	Camshaft Position Sensor Procedure: Disconnect the electrical connector.

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

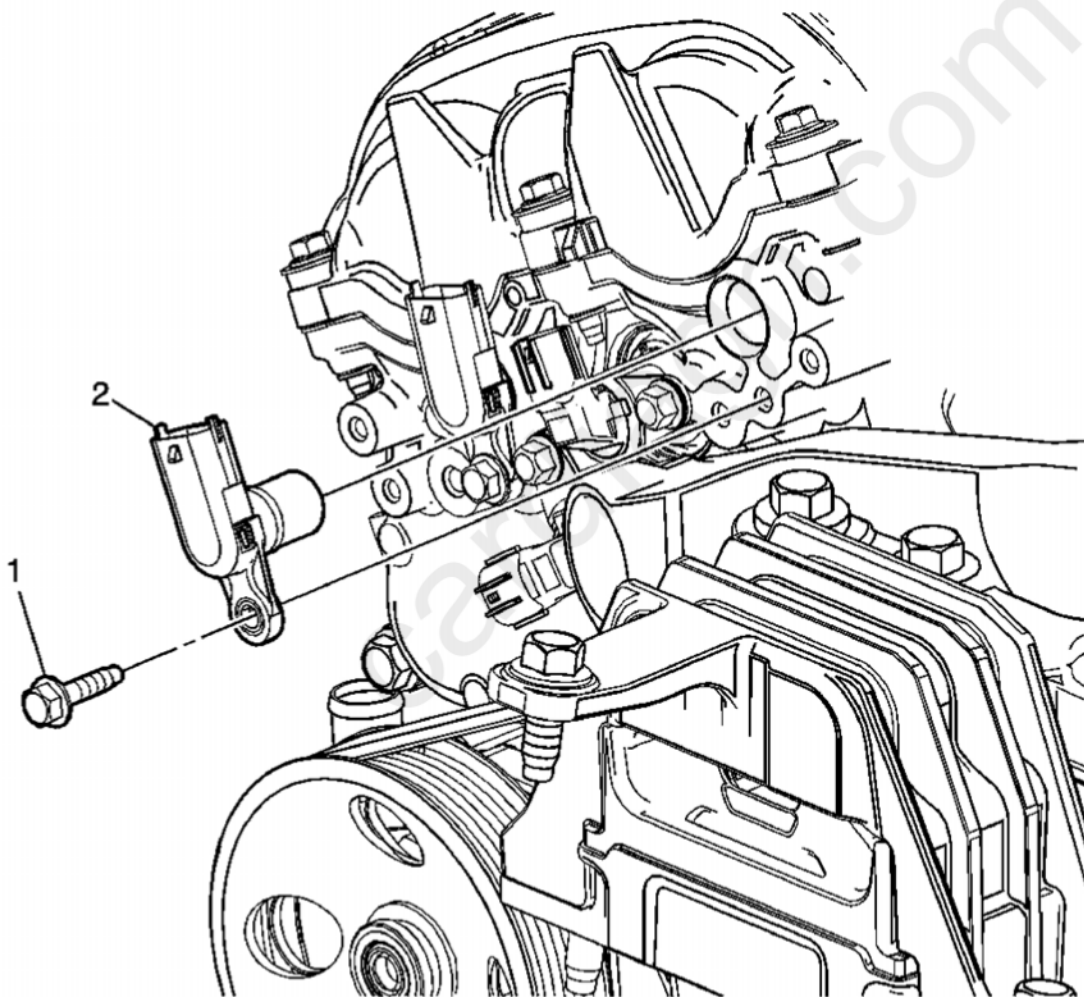


Fig. 156: Identifying Camshaft Position Sensor - Bank 1 (Right Side) Intake
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the air cleaner assembly. Refer to <u>Air Cleaner Assembly Replacement (LF1)</u> or <u>Air Cleaner</u>	

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Assembly Replacement (LAU).

1	Camshaft Position Sensor Fastener CAUTION: Refer to <u>astener Caution</u> . Tighten: 10 N.m (89 lb in)
2	Camshaft Position Sensor Procedure: Disconnect the electrical connector.

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

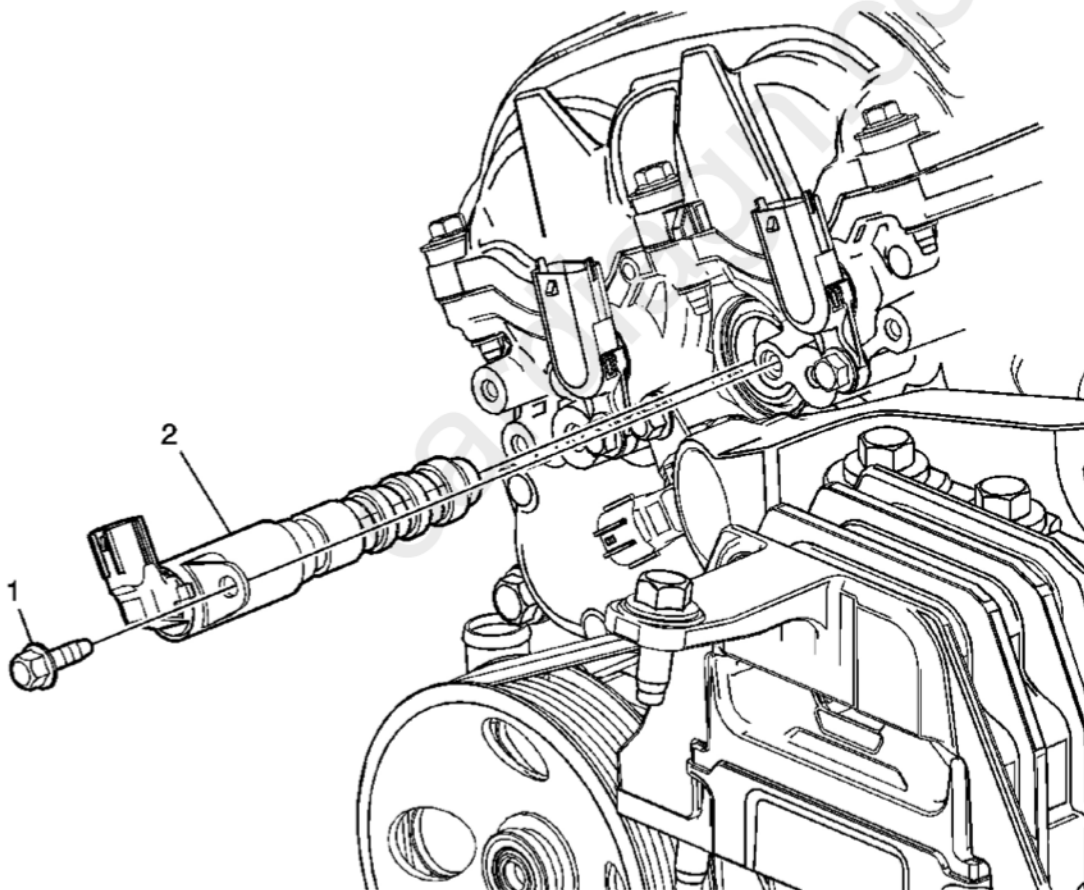


Fig. 157: Locating Camshaft Position Actuator Solenoid Valve Solenoid - Bank 1 (Right Side) Intake
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures:	

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Remove the air cleaner assembly. Refer to [Air Cleaner Assembly Replacement \(LF1\)](#) or [Air Cleaner Assembly Replacement \(LAU\)](#).

1	Camshaft Position Actuator Solenoid Valve Fastener CAUTION: Refer to <u>Fastener Caution</u> . Procedure: Disconnect the electrical connector. Tighten: 10 N.m (89 lb in)
2	Camshaft Position Actuator Solenoid Valve

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

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

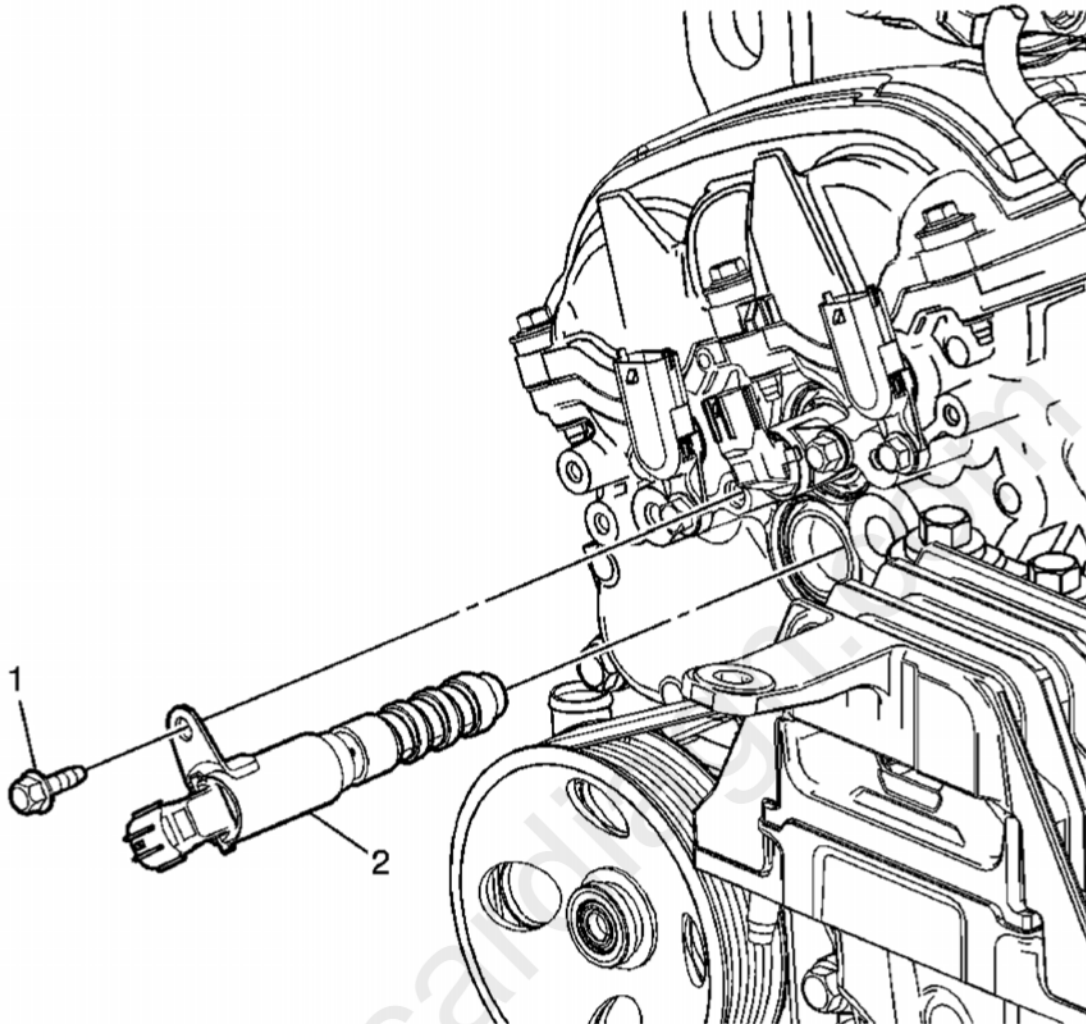


Fig. 15 : Locating Camshaft Position Actuator Solenoid Valve Solenoid - Bank 1 (Right Side) E haust
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures: Remove the air cleaner assembly. Refer to <u>Air Cleaner Assembly Replacement (LF1)</u> or <u>Air Cleaner Assembly Replacement (LAU)</u> .	
1	Camshaft Position Actuator Solenoid Valve Fastener CAUTION: Refer to <u>astener Caution</u> . Procedure: Disconnect the electrical connector.

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Tighten: 10 N.m (89 lb in)

2 Camshaft Position Actuator Solenoid Valve

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

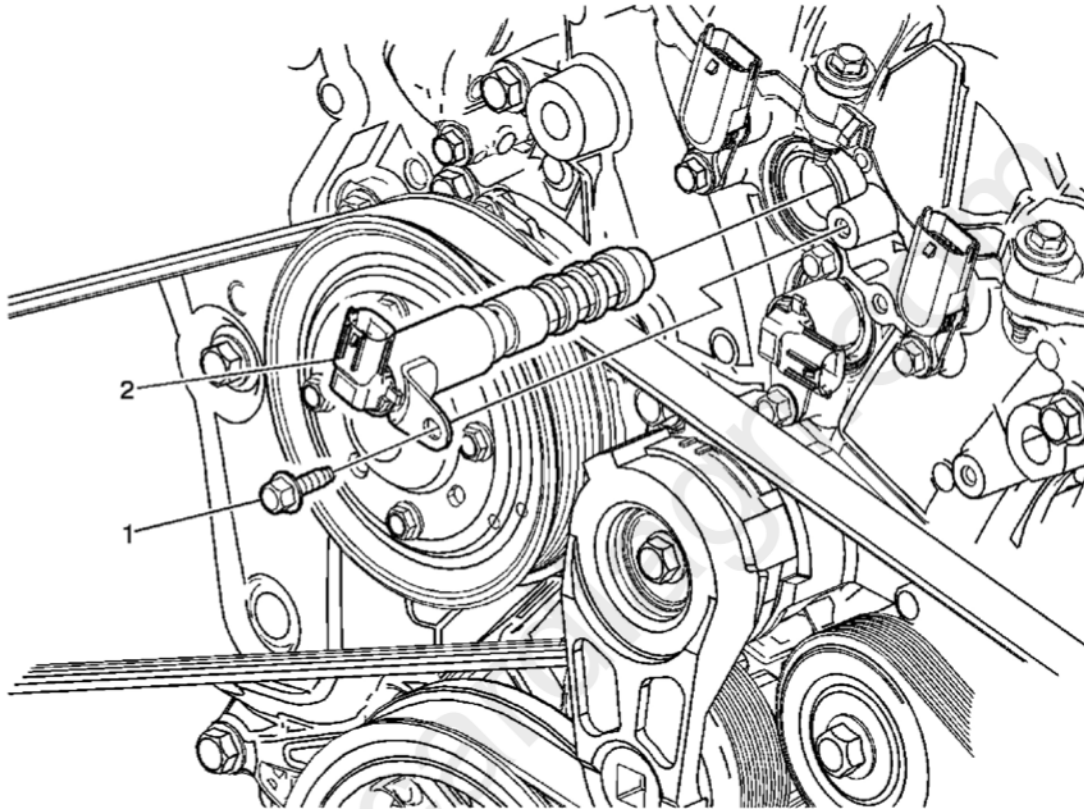


Fig. 15 : Identifying Camshaft Position Actuator Solenoid Valve Solenoid - Bank 2 (Left Side) Intake
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the engine mount bracket. Refer to <u>Engine Mount Bracket Replacement - Right Side</u> .	
1	Camshaft Position Actuator Solenoid Valve Fastener CAUTION: Refer to <u>Fastener Caution</u> . Procedure: Disconnect the electrical connector.

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Tighten: 10 N.m (89 lb in)

2 Camshaft Position Actuator Solenoid Valve

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

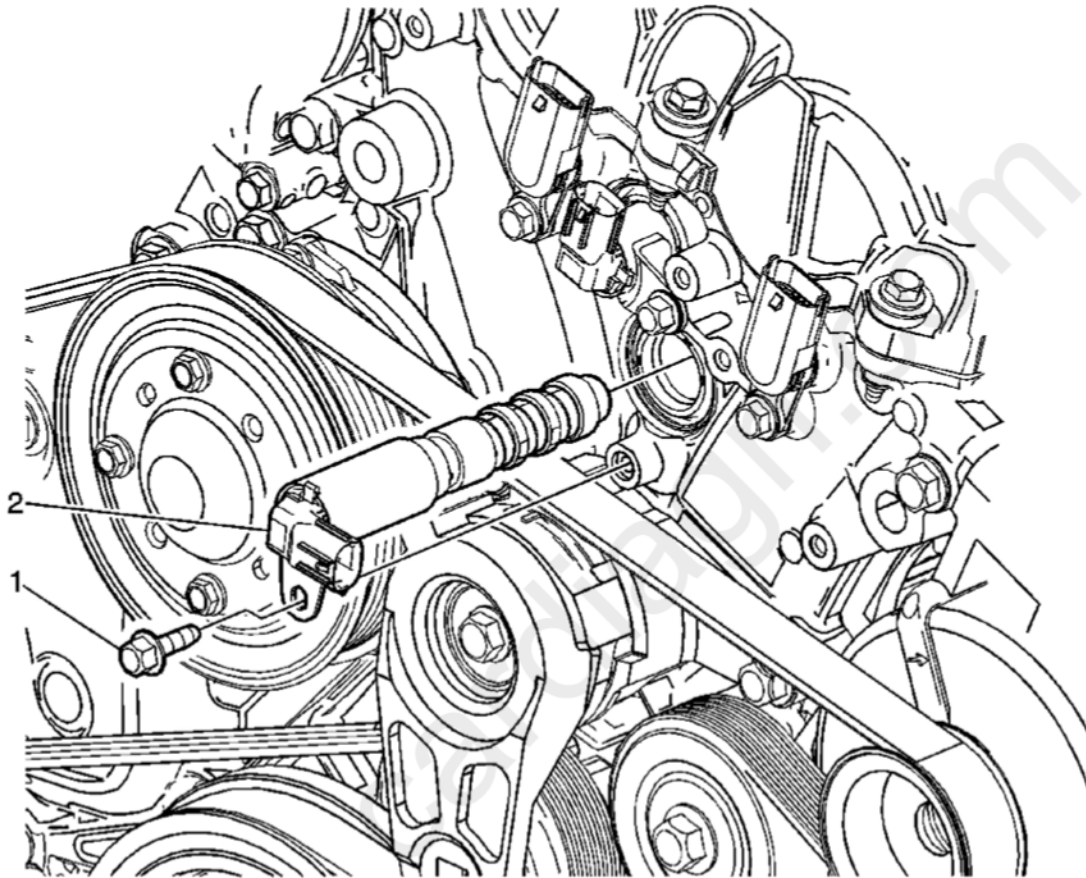


Fig. 16 : Camshaft Position Actuator Solenoid Valve Solenoid - Bank 2 (Left Side) E haust
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the engine mount bracket. Refer to <u>Engine Mount Bracket Replacement - Right Side</u> .	
1	Camshaft Position Actuator Solenoid Valve Fastener CAUTION: Refer to <u>astener Caution</u> . Tighten: 10 N.m (89 lb in)
	Camshaft Position Actuator Solenoid Valve

2

Procedure:

Disconnect the electrical connector.

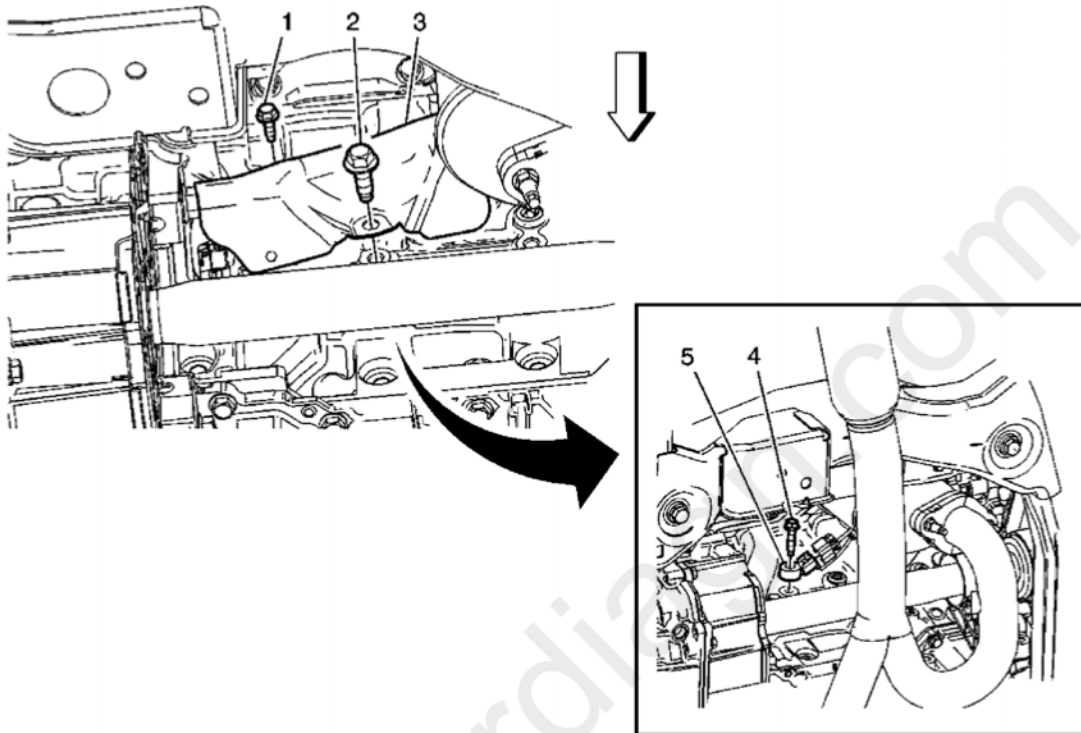
KNOCK SENSOR REPLACEMENT - BANK 1

Fig. 161: Identifying Knock Sensor - Bank 1
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. If equipped with AWD, remove the right side catalytic converter. Refer to <u>Catalytic Converter Replacement - Right Side (LF1)</u> .	
2. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
1	Bolt CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 25 N.m (18 lb ft)
2	Bolt Tighten: 58 N.m (42 lb ft)

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

3	Exhaust Manifold ower Heat Shield
4	Bolt Tighten: 25 N.m (18 lb ft)
5	Knock Sensor Procedure: Disconnect the electrical connector.

KNOCK SENSOR REPLACEMENT - BANK 2

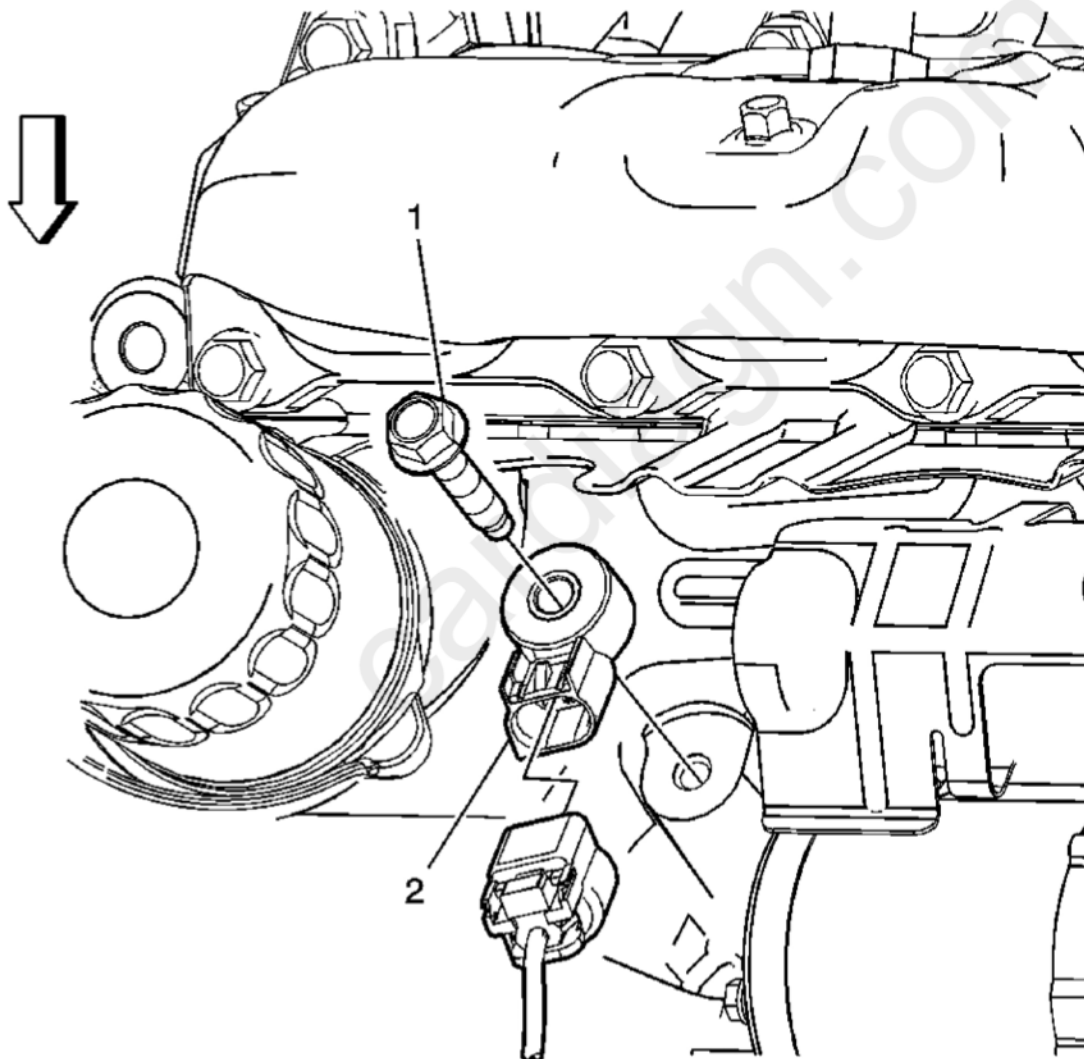


Fig. 162: Identifying Knock Sensor - Bank 2
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure:	

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

1	nock Sensor Fastener CAUTION: Refer to <u>astener Caution</u> . Tighten: 9 N.m (80 lb in)
2	nock Sensor Procedure: Disconnect the electrical connector.

TURBOCHARGER PRESSURE SENSOR REPLACEMENT

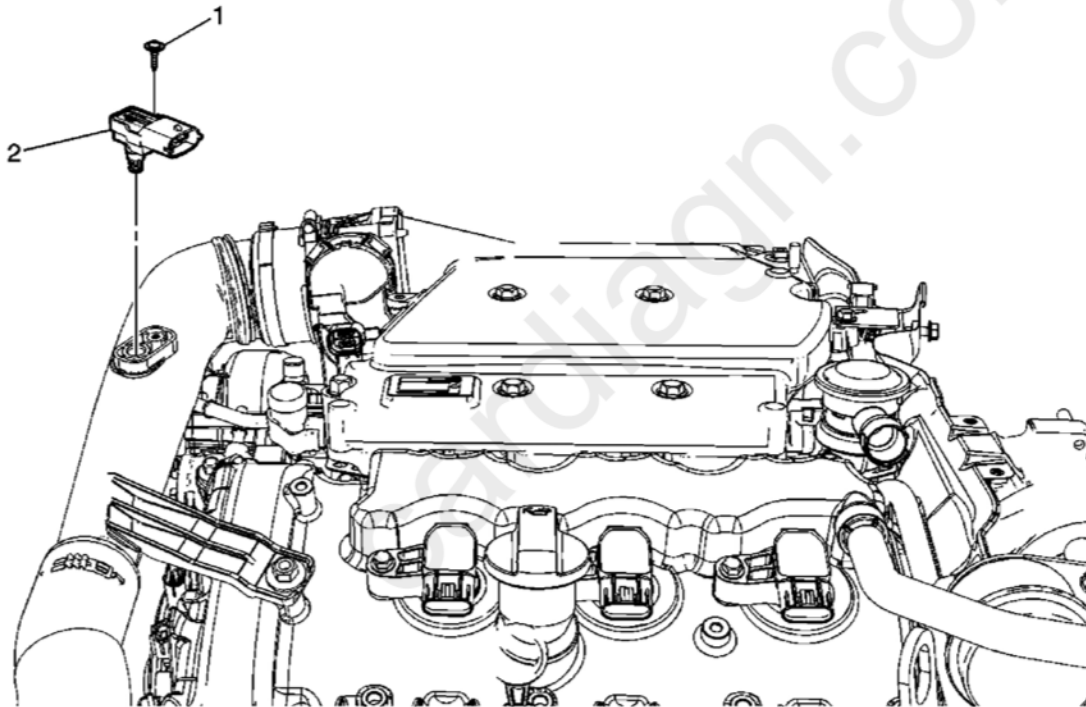


Fig. 163: Identifying Turbocharger Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
1	Turbo Pressure Sensor Fastener CAUTION: Refer to <u>astener Caution</u> .

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

	Tighten: 4 N.m (35 lb in)
2	Turbo Pressure Sensor Procedure: Disconnect the electrical connector.

CHARGE AIR COOLER OUTLET DUCT REPLACEMENT

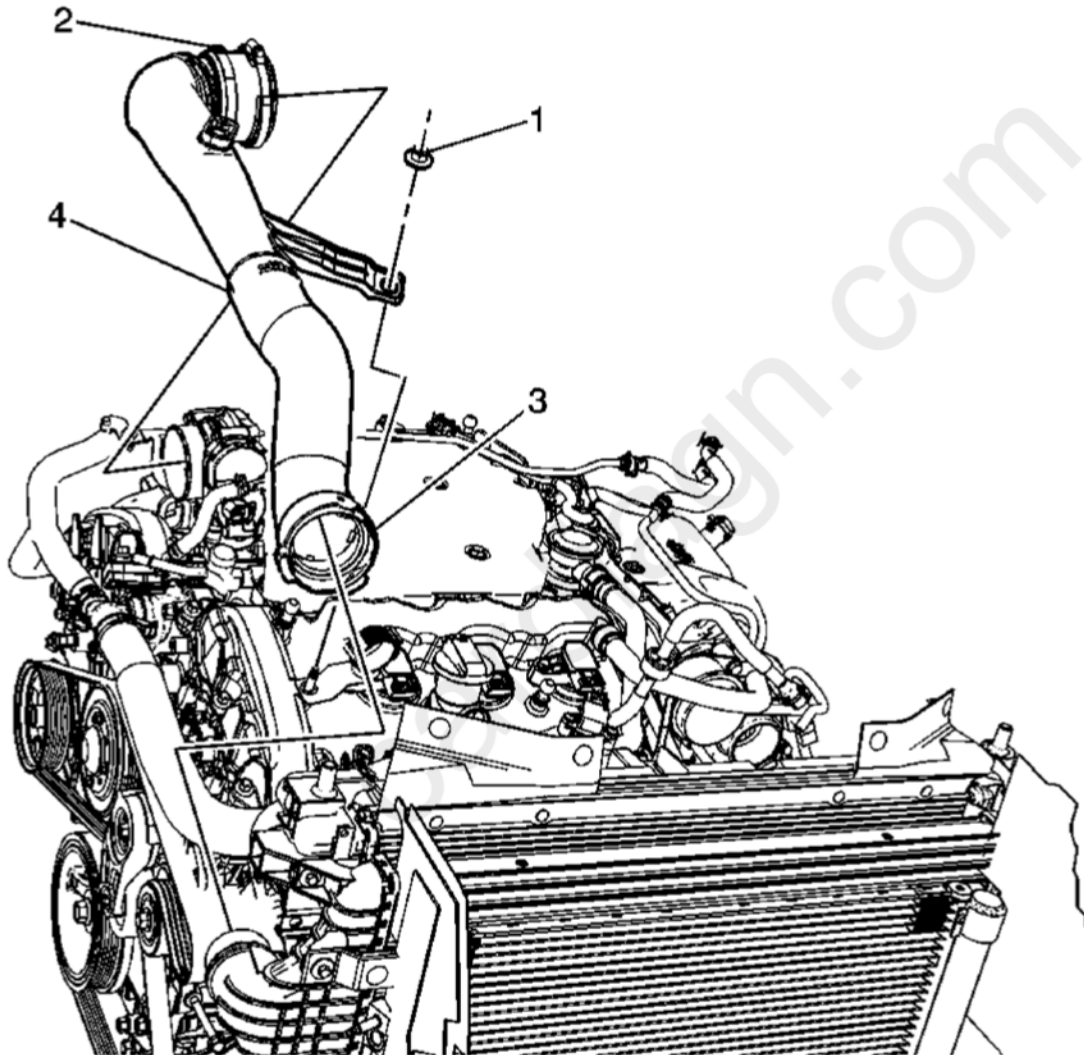


Fig. 164: Identifying Charge Air Cooler Outlet Duct
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1.	Remove the air cleaner outlet duct. Refer to <u>Air Cleaner Outlet Duct Replacement (LF1)</u> or <u>Air Cleaner Outlet Duct Replacement (LAU)</u> .

2. Remove the turbo charger pressure sensor. Refer to **Turbocharger Pressure Sensor Replacement**.

1	Charge Air Cooler Outlet Duct Fastener (Qty 2) CAUTION: Refer to <u>Fastener Caution</u> Tighten: 10 N.m (89 lb in)
2	Charge Air Cooler Outlet Duct Clamp Tighten: 4 N.m (35 lb in)
3	Charge Air Cooler Outlet Duct Spring Clamp
4	Charge Air Cooler Outlet Duct

CHARGE AIR COOLER INLET DUCT REPLACEMENT

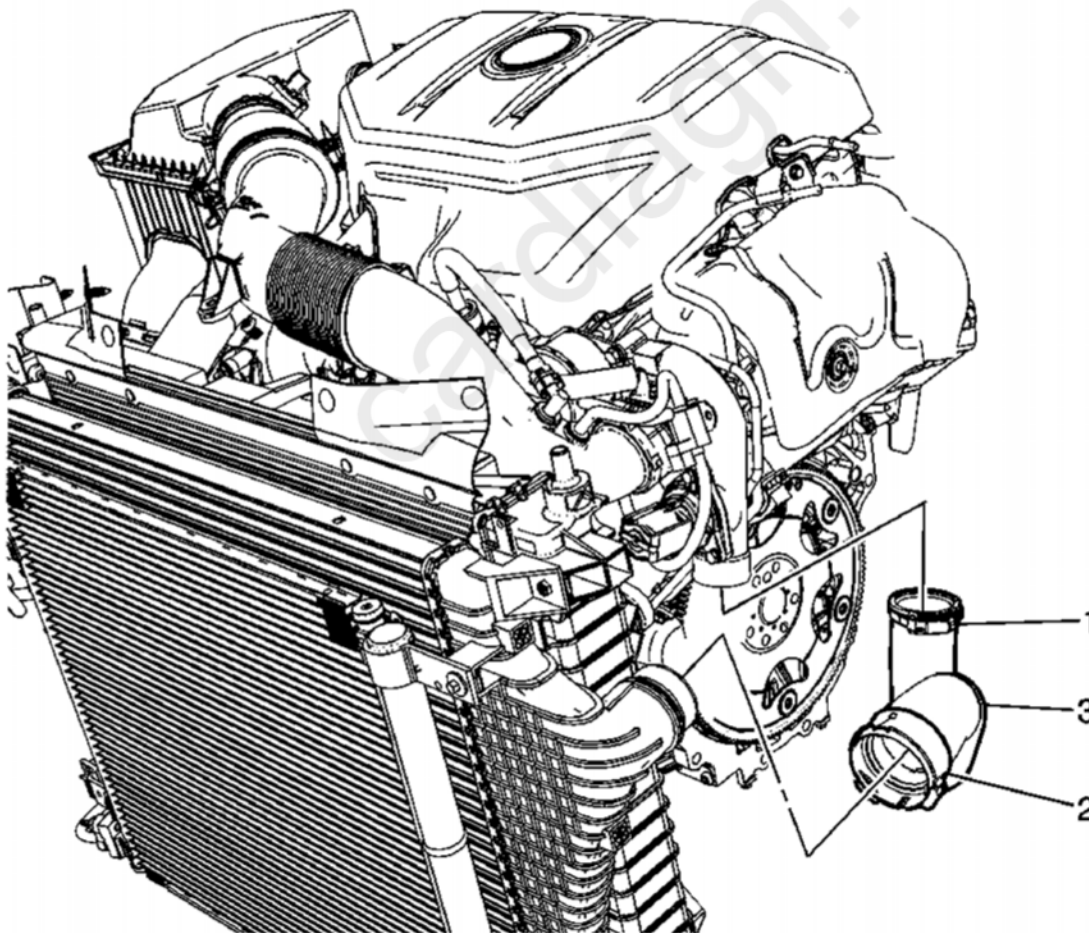


Fig. 165: Identifying Charge Air Cooler Inlet Duct
Courtesy of GENERAL MOTORS CORP.

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

Callout	Component Name
Preliminary Procedure: Remove the left front wheelhouse liner. Refer to Front Wheelhouse Liner Replacement .	
1	Charge Air Cooler Inlet Duct Clamp CAUTION: Refer to <u>Fastener Caution</u> Tighten: 4 N.m (35 lb in)
2	Charge Air Cooler Inlet Duct Spring Clamp
3	Charge Air Cooler Inlet Duct

SECONDARY AIR INJECTION PIPE REPLACEMENT

Removal Procedure

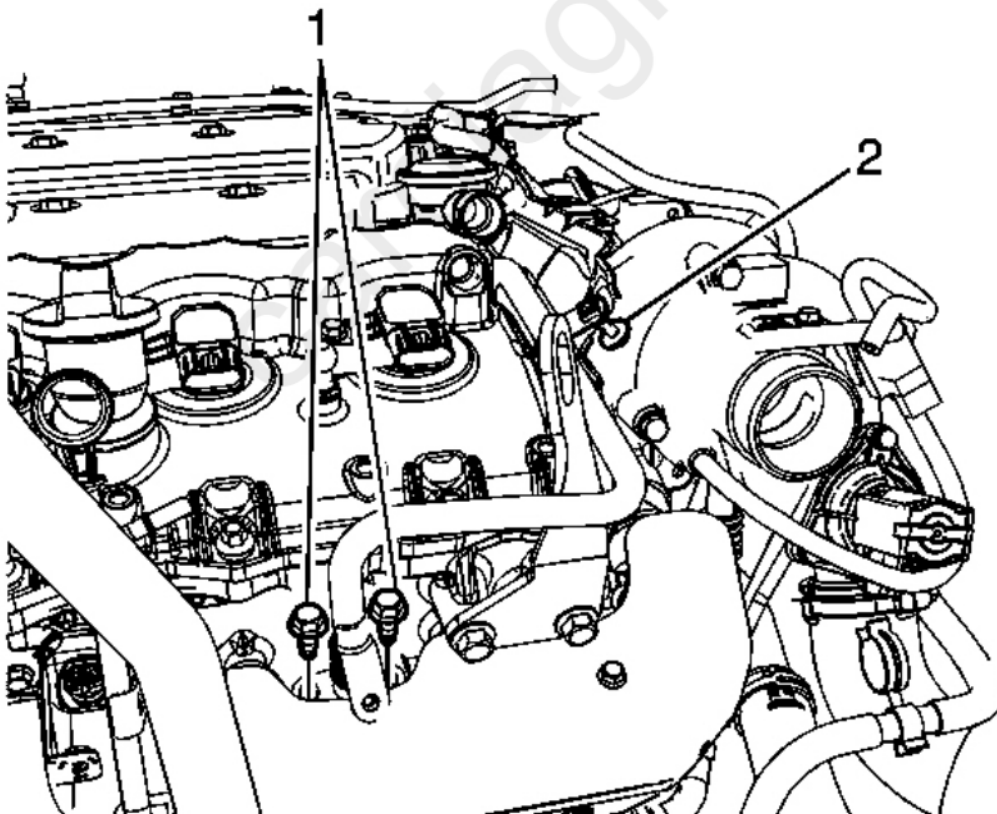


Fig. 166: Identifying Check Valve Pipe & Fasteners
Courtesy of GENERAL MOTORS CORP.

1. Remove the three-way catalytic converter. Refer to **Three Way Catalytic Converter Replacement (Service)**.
2. Remove the secondary air injection pump pipe. Refer to **Secondary Air Injection Pump Pipe Replacement**.
3. Remove the check valve pipe fasteners (1) and (2).

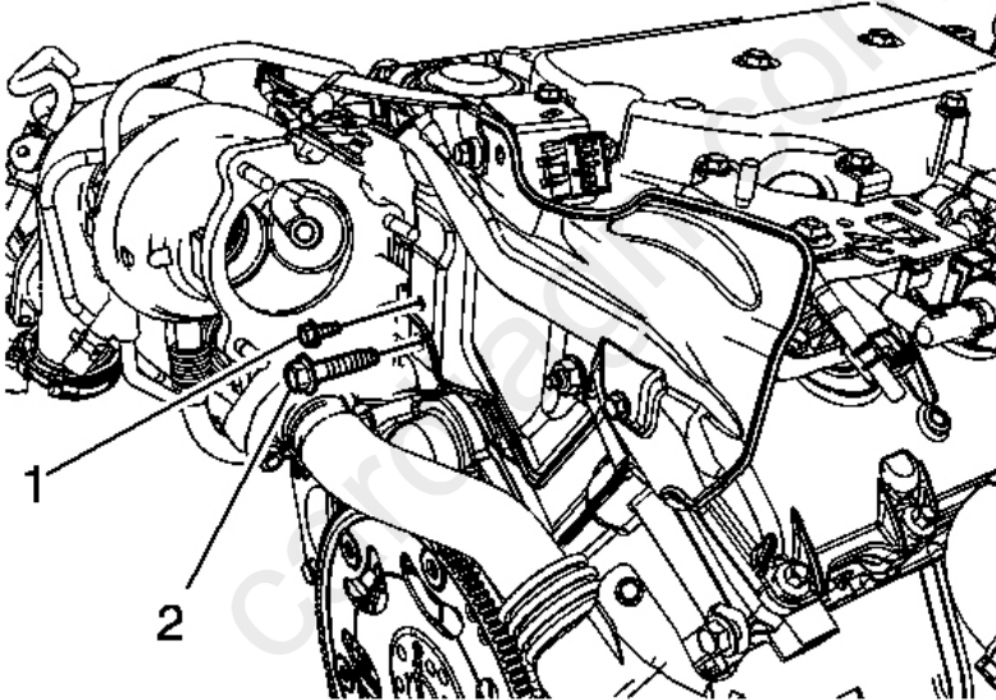


Fig. 167: Locating Check Valve Bracket Fasteners
Courtesy of GENERAL MOTORS CORP.

4. Remove the check valve bracket fasteners (1) and (2).

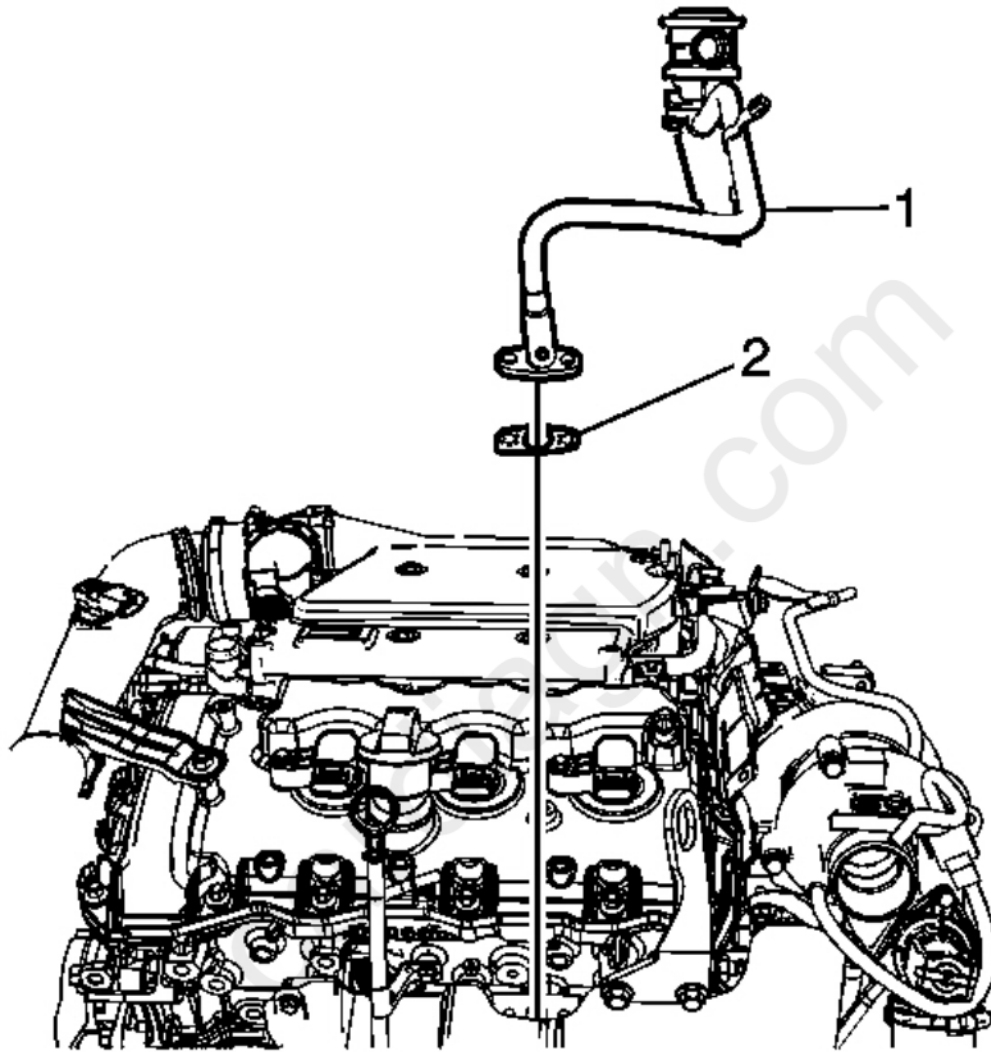


Fig. 16 : View Of Check Valve & Gasket
Courtesy of GENERAL MOTORS CORP.

5. Remove the check valve (1) and gasket (2).

Installation Procedure

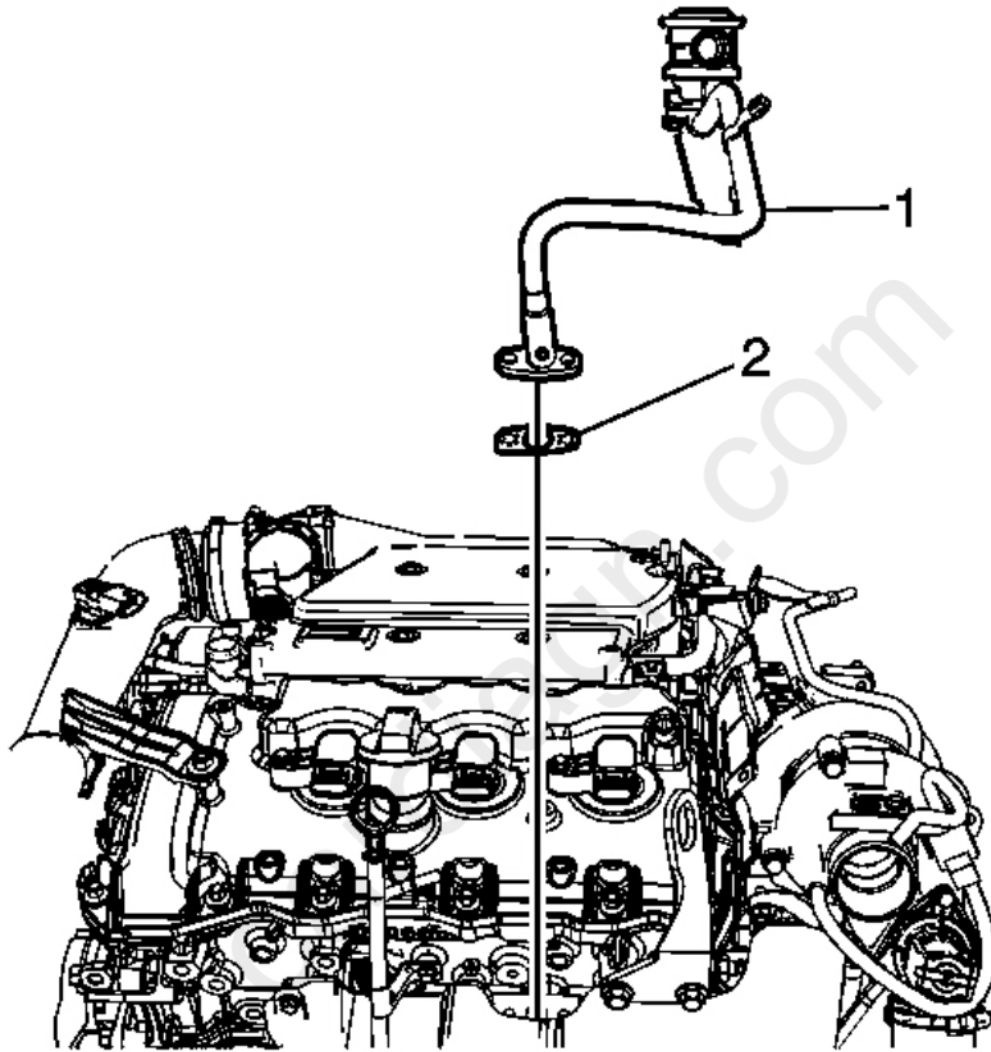


Fig. 16 : View Of Check Valve & Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install the check valve (1) and gasket (2).

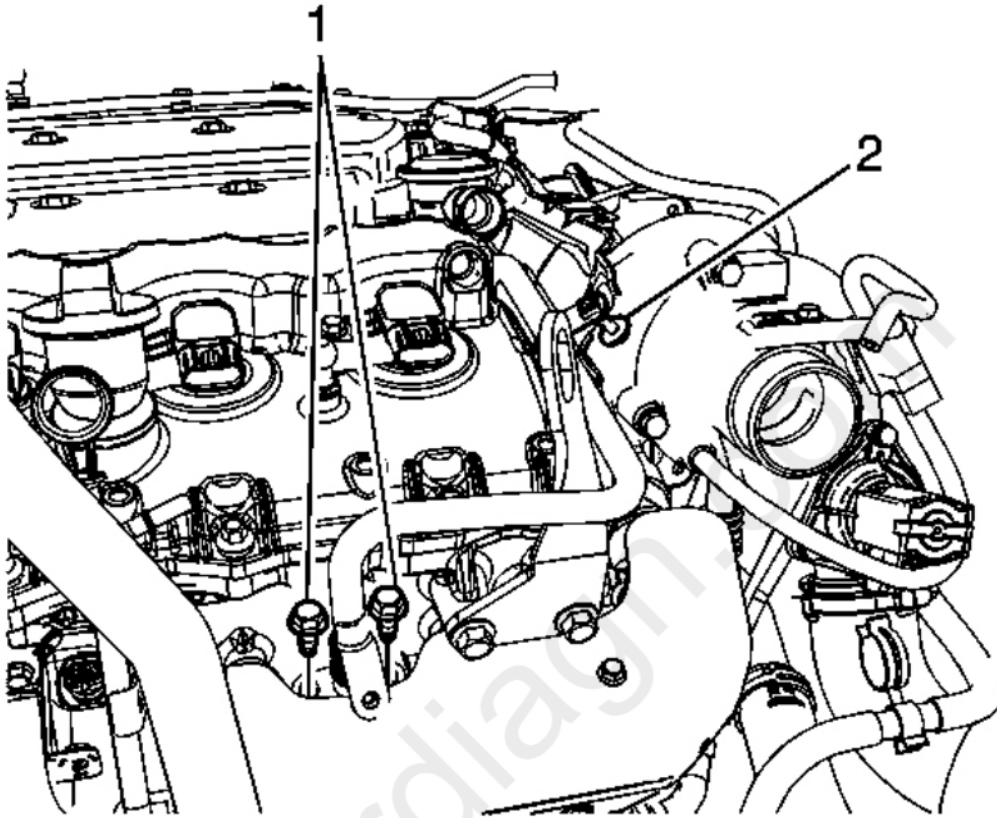


Fig. 17 : Identifying Check Valve Pipe & Fasteners
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Fastener Caution .

2. Install the check valve bracket fastener (1) and tighten to 9 N.m (80 lb in).
3. Install the check valve bracket fastener (2) and tighten to 58 N.m (43 lb ft).

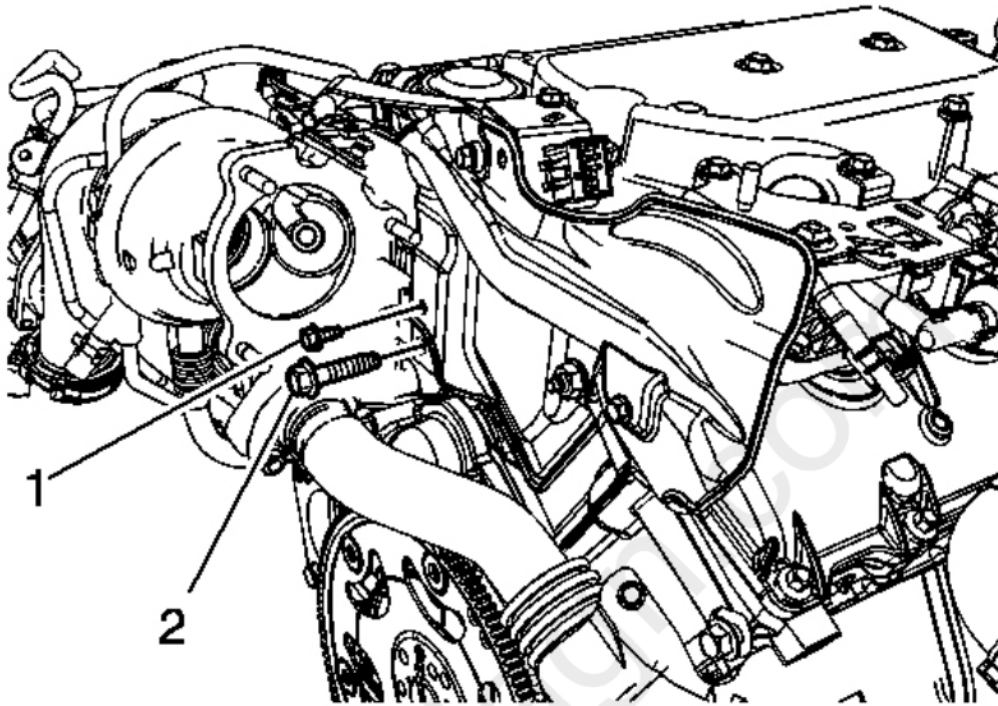


Fig. 171: Locating Check Valve Bracket Fasteners
Courtesy of GENERAL MOTORS CORP.

4. Install the check valve pipe fasteners (1) and (2).
5. Tighten the check valve pipe fastener (1) to 23 N.m (17 lb ft).
6. Tighten the check valve pipe fastener (2) to 9 N.m (80 lb in).
7. Install the three-way catalytic converter. Refer to **Three Way Catalytic Converter Replacement (Service)**.
8. Install the secondary air injection pump pipe. Refer to **Secondary Air Injection Pump Pipe Replacement**.

SECONDARY AIR INJECTION PUMP PIPE REPLACEMENT

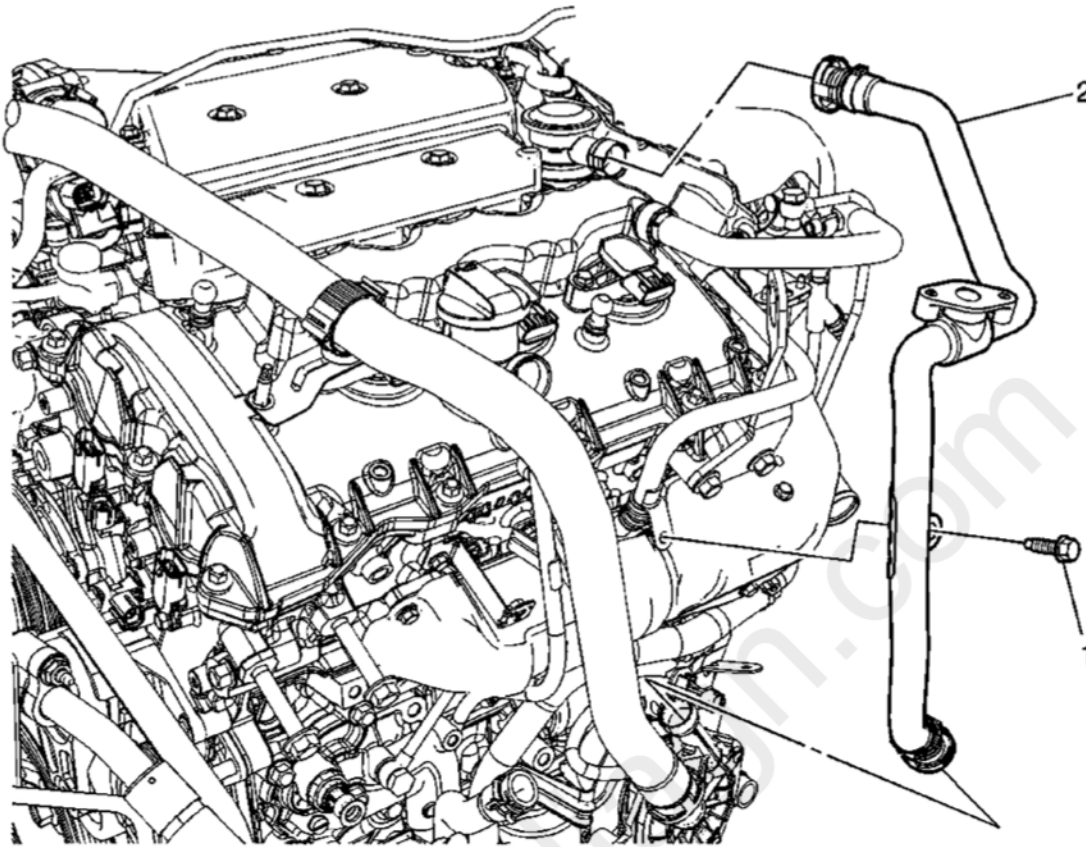


Fig. 172: Identifying Secondary Air Injection Pump Pipe
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u>. 2. Remove the secondary injection shutoff valve pressure sensor. Refer to <u>Secondary Injection Shutoff Valve Pressure Sensor Replacement</u>. 3. Disconnect the air pump connectors. Refer to <u>Plastic Collar Quick Connect Fitting Service</u>.	
1	Secondary Air Injection Pump Pipe Fastener CAUTION: Refer to <u>Fastener Caution</u> Tighten: 10 N.m (89 lb in)
2	Secondary Air Injection Pump Pipe

SECONDARY INJECTION SHUTOFF VALVE PRESSURE SENSOR REPLACEMENT

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

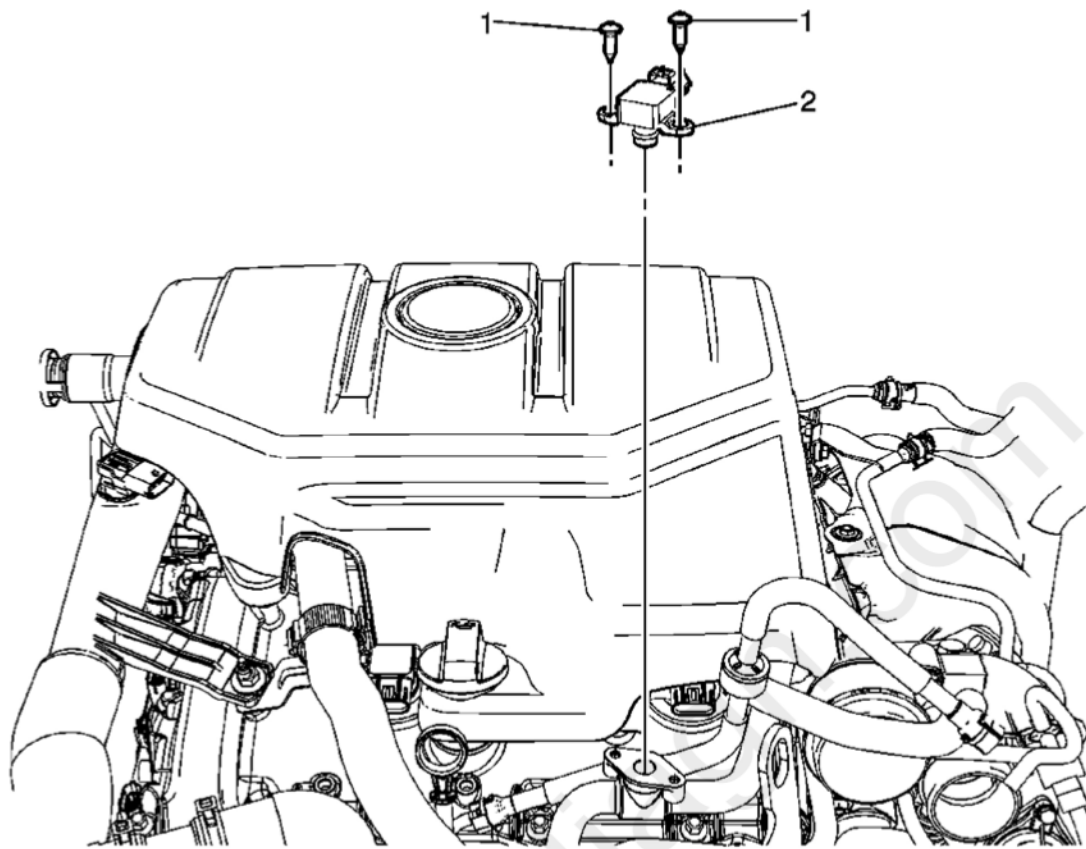


Fig. 173: Identifying Secondary Injection Shutoff Valve Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Secondary Injection Shutoff Valve Pressure Sensor Fastener (Qty 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 4 N.m (35 lb in)
2	Secondary Injection Shutoff Valve Pressure Sensor

SECONDARY AIR INJECTION PUMP REPLACEMENT

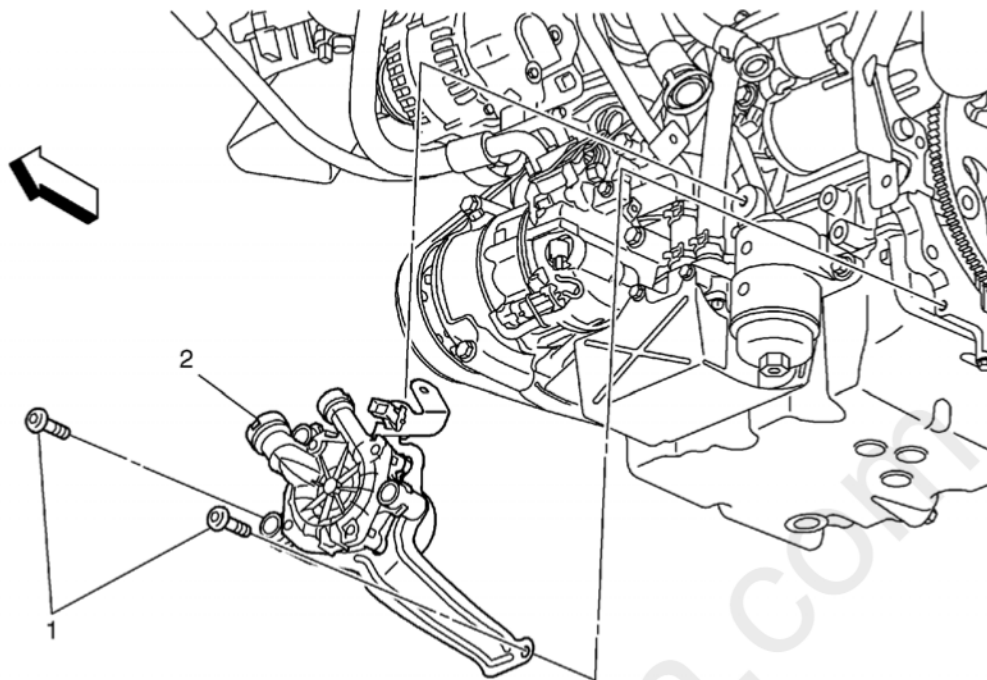


Fig. 174: Identifying Secondary Air Injection Pump

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Turn the ignition OFF. 2. Disconnect the negative battery cable. Refer to <u>Battery Negative Cable Disconnection and Connection</u> . 3. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> .	
1	Secondary Air Injection Pump Fastener (ty 2) CAUTION: Refer to <u>astener Caution</u> . Procedure 1. Disconnect both uick connectors. 2. Disconnect the electrical connector. Tighten: 17 N.m (13 lb ft)
2	Secondary Air Injection Pump

SECONDARY AIR INJECTION PUMP HOSE REPLACEMENT

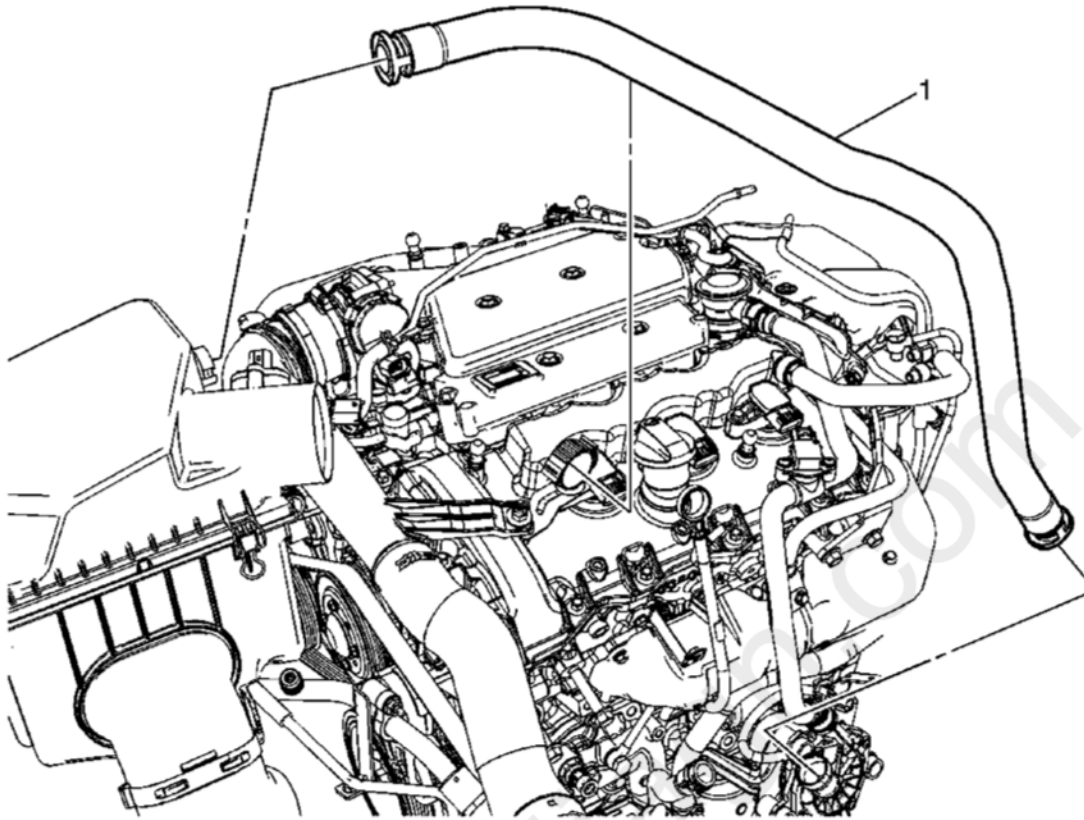


Fig. 175: Identifying Secondary Air Injection Pump Hose
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Remove the intake manifold cover. Refer to <u>Intake Manifold Cover Replacement</u> .	
2. Disconnect the air pump connectors. Refer to <u>Plastic Collar Quick Connect Fitting Service</u> .	
1	Secondary Air Injection Pump Hose Fastener Procedure: Disconnect the plastic retainer. CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 10 N.m (89 lb in)

AIR CLEANER ELEMENT REPLACEMENT (LF1)

2010 Cadillac SRX

2010 ENGINE PERFORMANCE Engine Controls and Fuel - 2.8L, 3.0L, 3.2L, or 3.6L - SRX

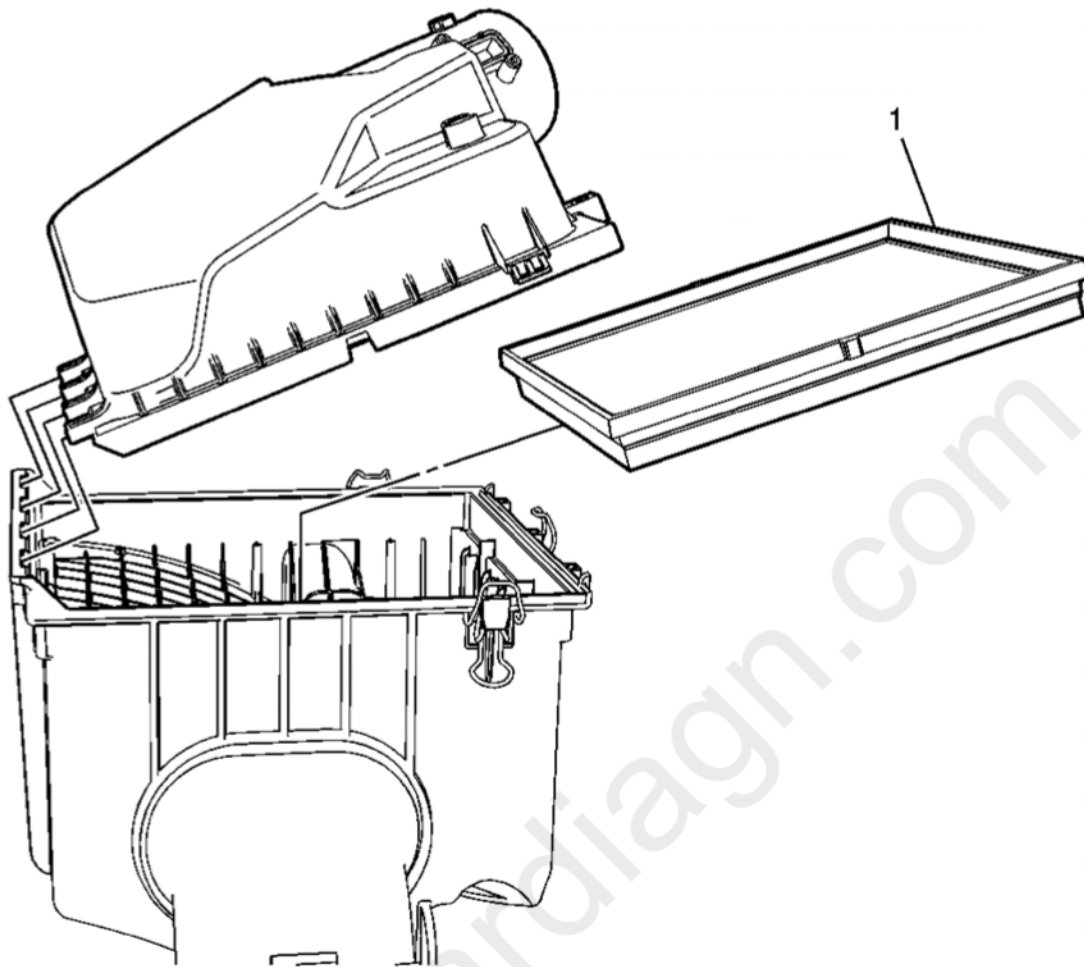


Fig. 176: View Of Air Cleaner Case & Element (LF1)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Disconnect the air cleaner outlet duct from the air cleaner. Refer to <u>Air Cleaner Outlet Duct Replacement (LF1)</u> or <u>Air Cleaner Outlet Duct Replacement (LAU)</u> .	
1	Air Cleaner Element Procedure 1. Disconnect the mass airflow with intake air temperature sensor electrical connector. 2. Disconnect the throttle inlet absolute pressure sensor electrical connector. 3. Release the air cleaner retaining clips.

AIR CLEANER ELEMENT REPLACEMENT (LAU)

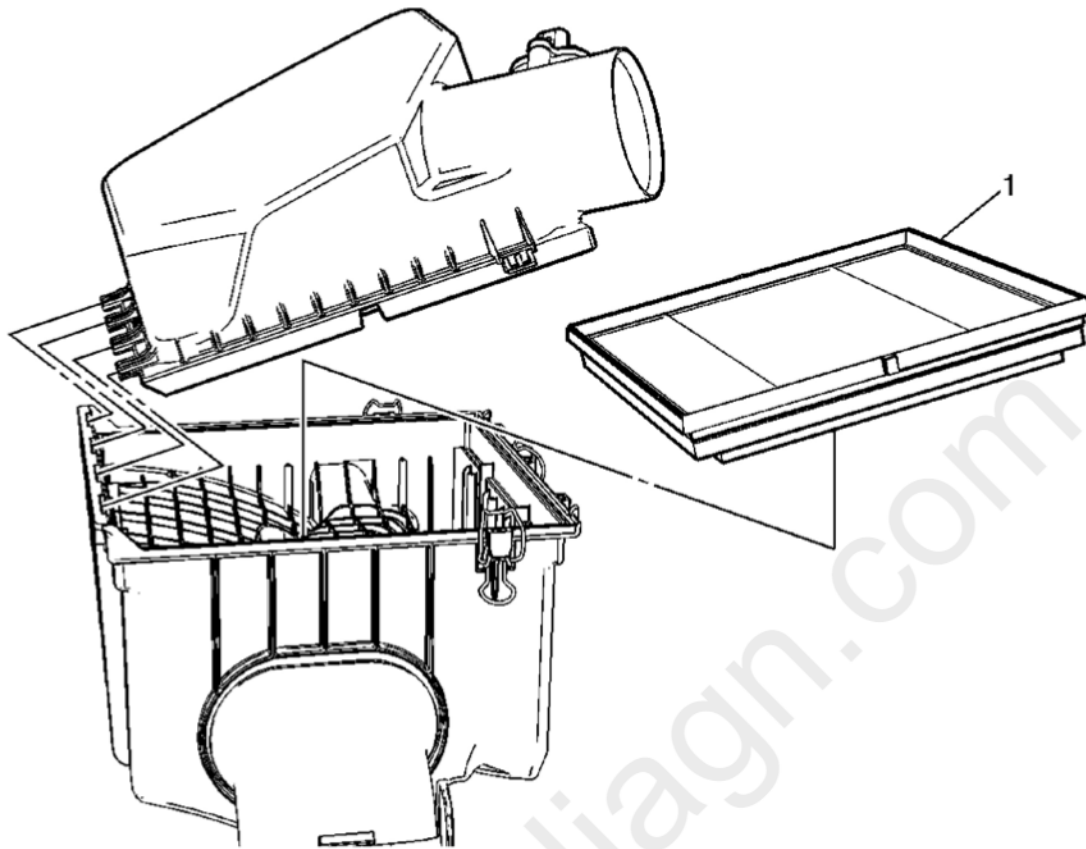


Fig. 1 : View Of Air Cleaner Case Element (LAU)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1. Disconnect the air cleaner outlet duct from the air cleaner. Refer to <u>Air Cleaner Outlet Duct Replacement (LF1)</u> or <u>Air Cleaner Outlet Duct Replacement (LAU)</u>. 2. Disconnect the secondary air injection hose from the air cleaner assembly. Refer to <u>Secondary Air Injection Pump Hose Replacement</u>.	
1	Procedure 1. Disconnect the mass airflow with intake air temperature sensor. 2. Release the air cleaner retaining clips.

AIR CLEANER ASSEMBLY REPLACEMENT (LF1)

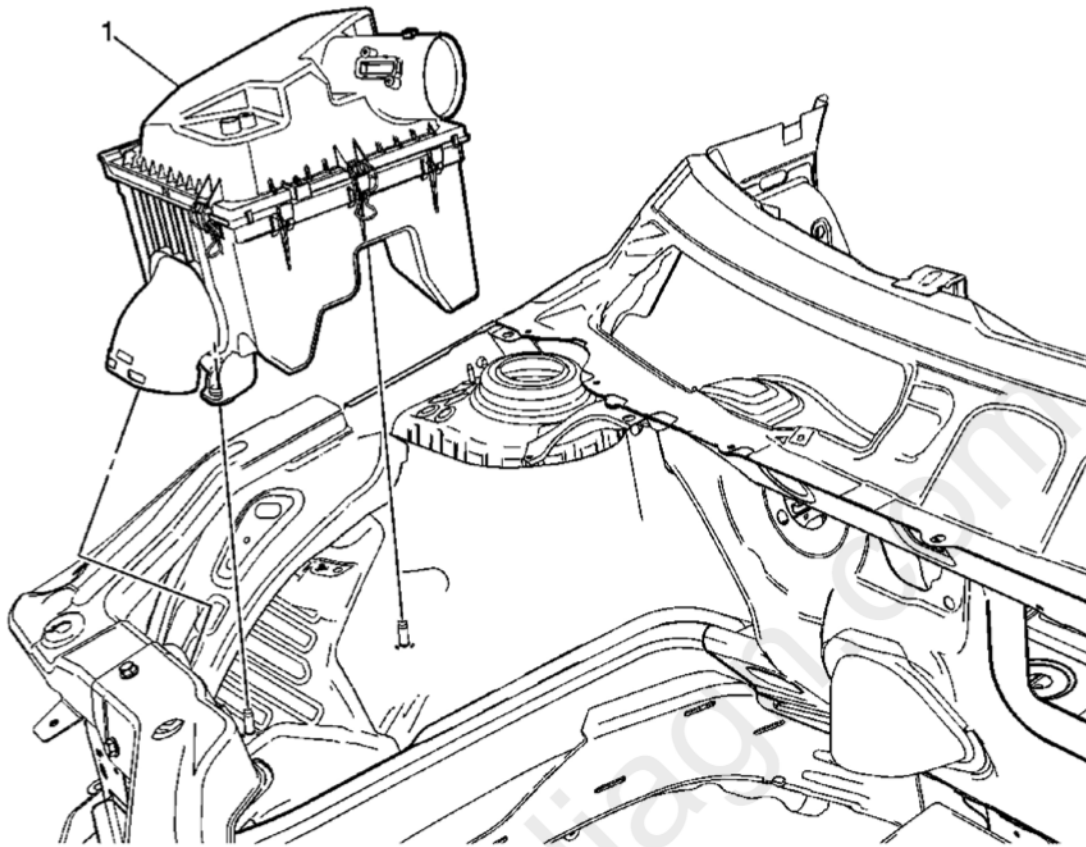


Fig. 1 8: View Of Air Cleaner Assembly (LF1)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Disconnect the air cleaner outlet duct from the air cleaner assembly. Refer to <u>Air Cleaner Outlet Duct Replacement (LF1)</u> or <u>Air Cleaner Outlet Duct Replacement (LAU)</u> .	
1	Air Cleaner Assembly Procedure 1. Disengage the air cleaner housing grommets from the studs, while guiding the housing out of the inlet duct. 2. If replacing the air cleaner assembly, transfer parts as necessary.

A R CLEANER ASSEM L REPLACEMENT (LAU)

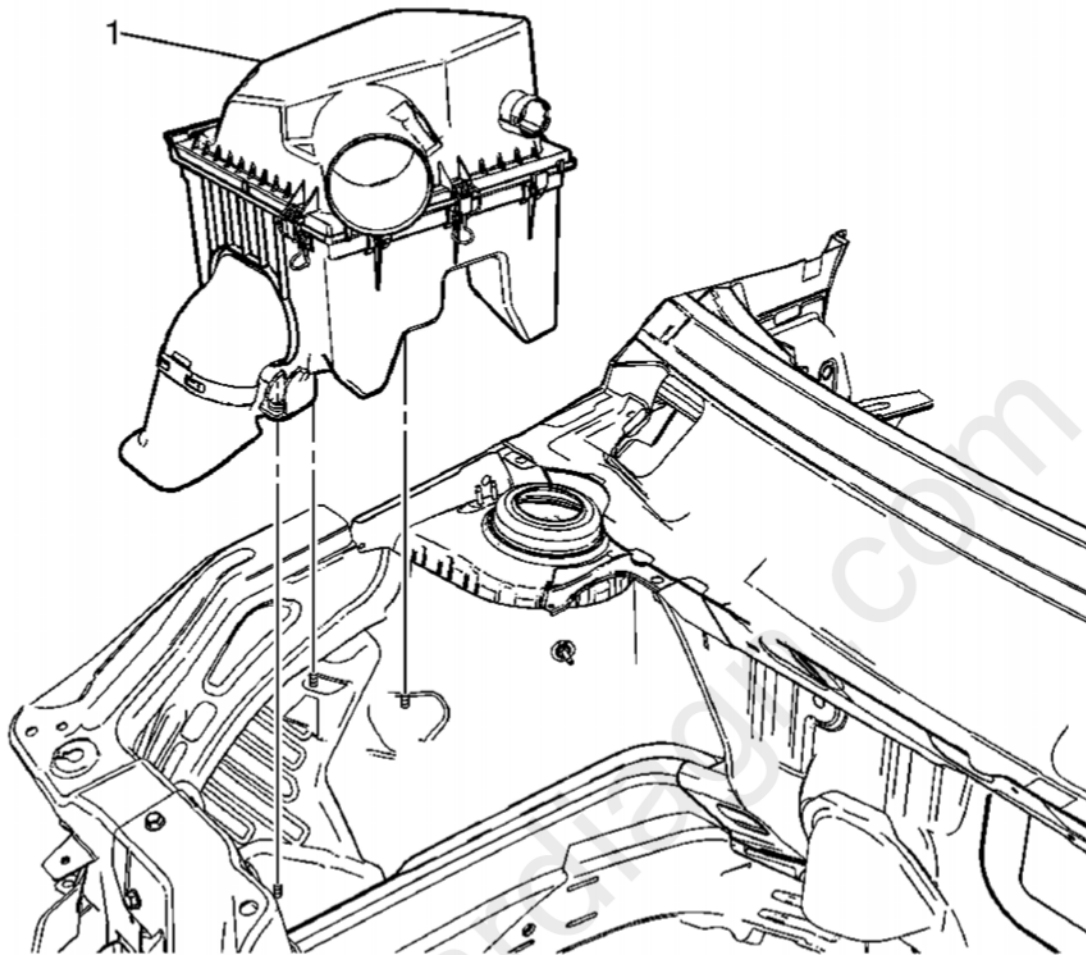


Fig. 1 : View Of Air Cleaner Assembly (LAU)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1. Disconnect the air cleaner outlet duct from the air cleaner assembly. Refer to <u>Air Cleaner Outlet Duct Replacement (LF1)</u> or <u>Air Cleaner Outlet Duct Replacement (LAU)</u>. 2. Remove the mass airflow sensor. Refer to <u>Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LF1)</u> or <u>Mass Airflow Sensor with Intake Air Temperature Sensor Replacement (LAU)</u>. 3. Disconnect the secondary air injection hose from the air cleaner. Refer to <u>Secondary Air Injection Pump Hose Replacement</u>	
1	Air Cleaner Assembly Procedure 1. Disengage the air cleaner housing grommets from the studs, while guiding the

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housing out of the inlet duct.

2. Transfer parts as necessary.

AIR CLEANER INLET DUCT REPLACEMENT

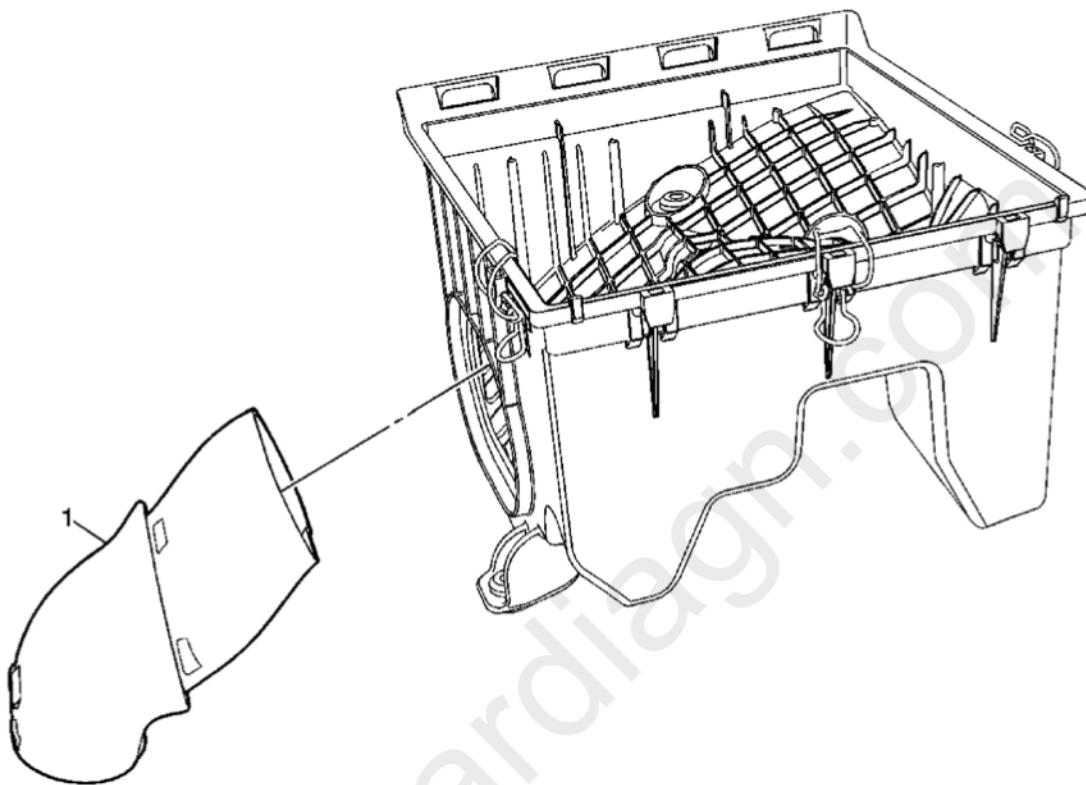


Fig. 18 : View Of Air Cleaner Inlet Duct
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the air cleaner assembly. Refer to <u>Air Cleaner Assembly Replacement (LF1)</u> or <u>Air Cleaner Assembly Replacement (LAU)</u> .	
1	Air Cleaner Inlet Duct

AIR CLEANER OUTLET DUCT REPLACEMENT (LF1)

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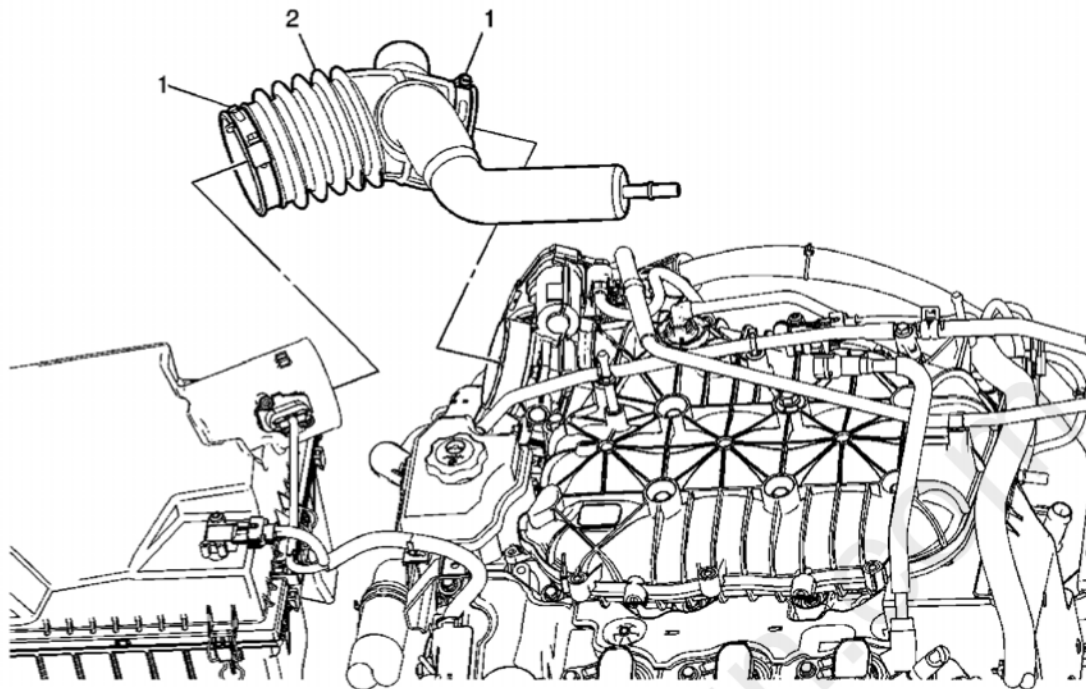


Fig. 181: View Of Air Cleaner Outlet Duct (LF1)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Disconnect the positive crankcase ventilation tube. Refer to <u>Positive Crankcase Ventilation Tube Replacement - Front</u> .	
1	Air Cleaner Outlet Duct Clamp (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 4 N.m (35 lb in)
2	Air Cleaner Outlet Duct

AIR CLEANER OUTLET DUCT REPLACEMENT (LAU)

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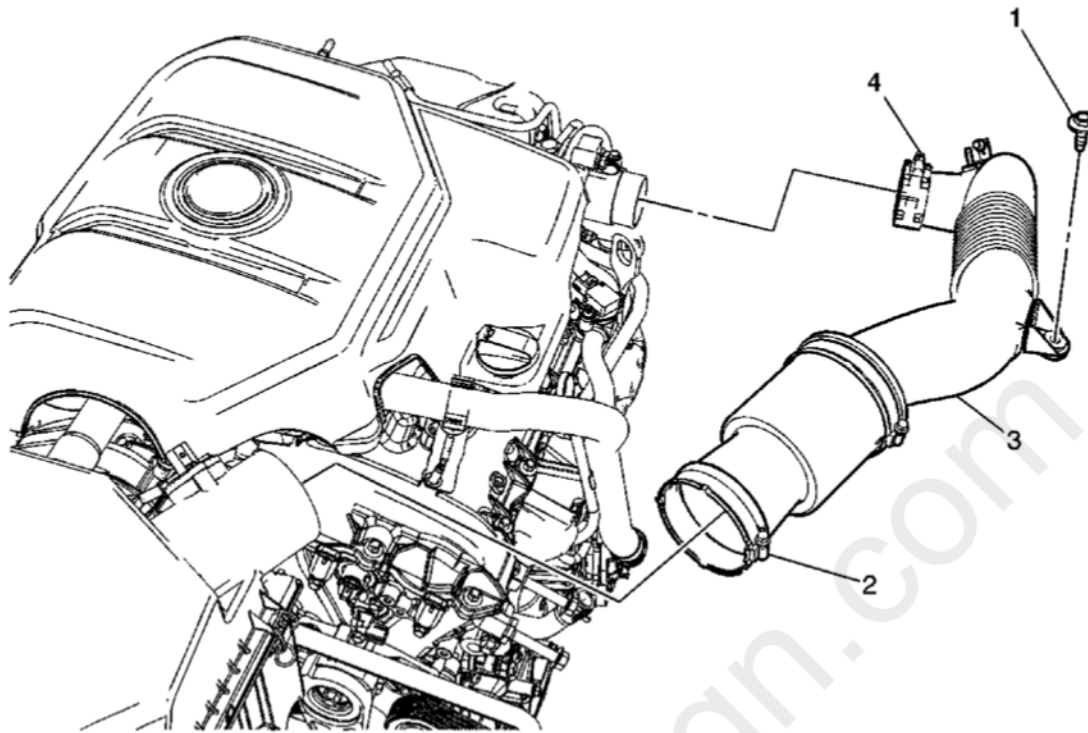


Fig. 182: View Of Air Cleaner Outlet Duct (LAU)

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the PCV pipe at the outlet duct. Refer to <u>Positive Crankcase Ventilation Tube Replacement - Dipstick to Air Outlet Duct</u> .	
1	Air Cleaner Outlet Duct Fastener CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 10 N.m (89 lb in)
2	Air Cleaner Outlet Duct Clamp Tighten: 4 N.m (35 lb in)
3	Air Cleaner Outlet Duct Procedure: Disconnect the vacuum hose.
4	Air Cleaner Outlet Duct Clamp to Turbo Tighten: 5 N.m (44 lb in)

