

2010 ENGINE

Engine Exhaust - Equinox & Terrain

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
3-Way Catalytic Converter to Front Pipe Nut	50 N.m	37 lb ft
3-Way Catalytic Converter to Rear Muffler (Clamp) Nut	40 N.m	29 lb ft
Catalytic Converter to Cylinder Head (LF1) - First Pass	20 N.m	15 lb ft
Catalytic Converter to Cylinder Head (LF1) - Second Pass	46 N.m	34 lb ft
Catalytic Converter Brace Nut/Bolt at Converter (LAF)	50 N.m	37 lb ft
Catalytic Converter Brace Nut/Bolt at Engine Block (LAF)	40 N.m	29 lb ft
Catalytic Converter-to- Exhaust Manifold Nut/Bolt (LAF)	50 N.m	37 lb ft
Catalytic Converter-to- Exhaust Front Flexible Pipe Nut	52 N.m	38 lb ft
Exhaust Front Flexible Pipe to 3-Way Catalytic Converter	50 N.m	37 lb ft
Catalytic Converter Heat Shield Bolt (LF1) - First Pass	20 N.m	15 lb ft
Catalytic Converter Heat Shield Bolt (LF1) - Second Pass	46 N.m	34 lb ft
Exhaust Manifold Nuts (LAF)	14 N.m	10 lb ft

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOMS - ENGINE EXHAUST

- Review the exhaust system description in order to familiarize yourself with the exhaust system components and the intended function of the components. Refer to **Exhaust System Description**.
- All diagnostics on a vehicle should follow a logical process. Strategy Based Diagnostics is a uniform approach for repairing all systems. The diagnostic flow is the place to start when repairs are necessary and may always be used in order to resolve a system problem. For a detailed explanation, refer to **Strategy Based Diagnosis**.

Visual/Physical Inspection

- Inspect for aftermarket or non-OEM devices such as, but not limited to; tailpipe extensions, headers, and exhaust cutouts. Any aftermarket exhaust system devices could affect the operation and proper performance of the exhaust system.
- Verify the exact operating conditions under which the concern exists. Note factors such as engine RPM, engine temperature, engine load, and frequency of concern.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause any symptom.

Intermittent

Test the vehicle under the same conditions that the customer reported in order to verify the system is operating as designed.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Loss of power

Refer to **Restricted Exhaust**

- Poor acceleration

Refer to **Restricted Exhaust**

- Poor fuel economy

Refer to **Restricted Exhaust**

- Excessive smoke diesel

Refer to **Restricted Exhaust**

- Exhaust rattle noise

Refer to **Exhaust Noise**

- Loud exhaust noise

Refer to **Exhaust Noise**

- Exhaust buzz, groan, hum noise

Refer to **Exhaust Noise**

RESTRICTED EXHAUST

Special Tools

J-35314-A: Exhaust Back Pressure Gauge

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

Diagnostic Aids

WARNING: Refer to Hot Exhaust System Warning .

For dual exhaust systems a quick check of exhaust flow will help determine which side of the exhaust system is restricted. The side that has less exhaust flow is the side that will be suspect, and diagnosis should begin there.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: The exhaust system has very low back pressure under normal conditions. If the exhaust system is restricted, a significant increase in the exhaust pressure is noticed on the **J-35314-A:** gauge .Removing the HO2S sensor may set a DTC. When finishing this diagnostic table, be sure to clear all codes.

5: This step will isolate the catalytic converter from the remainder of the exhaust system.

8: Confirming that the condition has been fixed is essential. If the symptom still exists and the vehicle has a dual exhaust system, proceed to step 2 and repeat diagnostic procedure on the opposite exhaust pipe.

Step	Action	Value(s)	Yes	No
1	Did you verify the customers complaint?	-	Go to Step 2	-
2	Did you review the exhaust symptoms diagnostic information and perform the necessary inspections?	-	Go to Step 3	Go to Symptoms - Engine Exhaust
3	Is the system equipped with dual exhaust?	-	Go to Diagnostic Aids	Go to Step 4
4	1. Remove the heated oxygen sensor (HO2S) that is in front of the catalytic converter. Refer to the appropriate procedure. Refer to <u>Heated Oxygen Sensor Replacement - Bank 1 Sensor 1 (LF1)</u> or <u>Heated Oxygen Sensor Replacement - Bank 2 Sensor 1 (LF1)</u> . 2. Install the J-35314-A: Exhaust Back Pressure Gauge in place of the HO2S sensor. 3. Start the engine. 4. Increase and monitor the engine speed at 2,500 RPM. 5. Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value?	9 kPa (1.25 psi)	Go to Step 5	Go to Step 8
	1. Turn the engine OFF and place the ignition in the lock position.			

5	- Remove the J-35314-A: gauge. - Reinstall the HO2S sensor. Refer to <u>Heated Oxygen Sensor Replacement - Bank 1 Sensor 1 (LF1)</u> or <u>Heated Oxygen Sensor Replacement - Bank 2 Sensor 1 (LF1)</u> . - Remove the post-catalyst HO2S sensor. Refer to the appropriate procedure. Refer to <u>Heated Oxygen Sensor Replacement - Bank 1 Sensor 2 (LF1)</u> or <u>Heated Oxygen Sensor Replacement - Bank 2 Sensor 2</u> . - Install the J-35314-A: gauge in place of the post HO2S sensor. - Start the engine. - Increase and monitor the engine speed at 2,500 RPM. - Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value?	9 kPa (1.25 psi)		Go to Step 6	Go to Step 7
6	Inspect the exhaust system for the following conditions: - Secondary catalytic converter restricted - Damage in the exhaust pipe - Debris in the exhaust pipe - Muffler or resonator internal failure - Two-layer exhaust pipe separation Did you find and correct the condition?	-		Go to Step 8	
7	Replace the catalytic converter. Refer to <u>Catalytic Converter Replacement - Left Side (LF1)</u> or <u>Catalytic Converter Replacement - Right Side (LF1)</u>. Did you find and correct the condition?	-		Go to Step 8	
8	- Remove the J-35314-A: gauge. - Reinstall the applicable HO2S sensor. Refer to <u>Heated Oxygen Sensor Replacement - Bank 1 Sensor 2 (LF1)</u> or <u>Heated Oxygen Sensor Replacement - Bank 2 Sensor 2</u> .	-			

3. Clear any codes.			
4. Road test the vehicle in order to verify the repair.			
Did you correct the condition?		System OK	Go to Step 2

EXHAUST LEAKAGE

Condition	Action
WARNING: Refer to <u>Hot Exhaust System Warning</u> .	
DEFINITION: An exhaust leak may show stains at the area of the leak. The leak may be felt by holding a hand close to the suspected areas or using a smoke pencil. The leak may make a popping or hissing noise. Refer to <u>Symptoms - Engine Exhaust</u> prior to beginning this table.	
Misaligned or improperly installed exhaust system components	- Align and tighten the exhaust system components to the specifications. Refer to <u>Fastener Tightening Specifications</u>. - Ensure the exhaust hangers are in the proper locations and not loose.
Exhaust leaks at the following connections: - Exhaust manifold to pipe - Flanges - Pipe clamps	Tighten the components to the specifications. Refer to <u>Fastener Tightening Specifications</u> .
Seals or gaskets leaking; - Exhaust manifold to cylinder head - Exhaust pipes to exhaust manifold - Catalytic converter connection	Replace the leaking seal or gasket. Refer to the affected components procedure for service.
Irregularities at the mating surfaces on the flange connections	Repair as required or replace the affected component. Refer to the affected components procedure for service.
Catalytic Converter cracked or broken	Replace the catalytic converter. Refer to <u>Catalytic Converter Replacement - Left Side (LF1)</u> or <u>Catalytic Converter Replacement - Right Side (LF1)</u> .
Exhaust system component connection welds leaking	Replace the leaking component. Refer to the affected component's procedure for service.
Muffler or resonator, if equipped, damaged or leaking at	Replace the affected muffler or resonator, if equipped. Refer to <u>Exhaust Muffler Replacement</u> .

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EXHAUST NOISE

Condition	Action
WARNING: Refer to <u>Hot Exhaust System Warning</u> .	
DEFINITION: An audible or physical noise due to a faulty component or damaged components causing a loose or misaligned exhaust system resulting in a rattle or vibration noise, i.e. buzz, groan, hum.Refer to <u>Symptoms - Engine Exhaust</u> prior to beginning this table.	
Popping or hissing noise	Exhaust leak-Refer to <u>Exhaust Leakage</u> .
Loud exhaust	1. Compare to a known good vehicle. 2. Inspect for a damaged or failed muffler or resonator, if equipped. 3. Replace the faulty muffler or resonator (if equipped). Refer to <u>Exhaust Muffler Replacement</u>.
External rattle or vibration noise	1. Inspect for a bent or loose hanger, loose heat shield, or loose clamp. 2. Inspect for a exhaust pipe causing interference. 3. Repair or replace the affected component. Refer to the affected component's service procedure.
Internal rattle	1. Test the components by tapping with a rubber mallet to confirm a rattle. 2. Replace the faulty catalytic converter, resonator, if equipped, or muffler. Refer to <u>Exhaust Muffler Replacement</u>.

REPAIR INSTRUCTIONS

EXHAUST MANIFOLD REPLACEMENT (LAF)

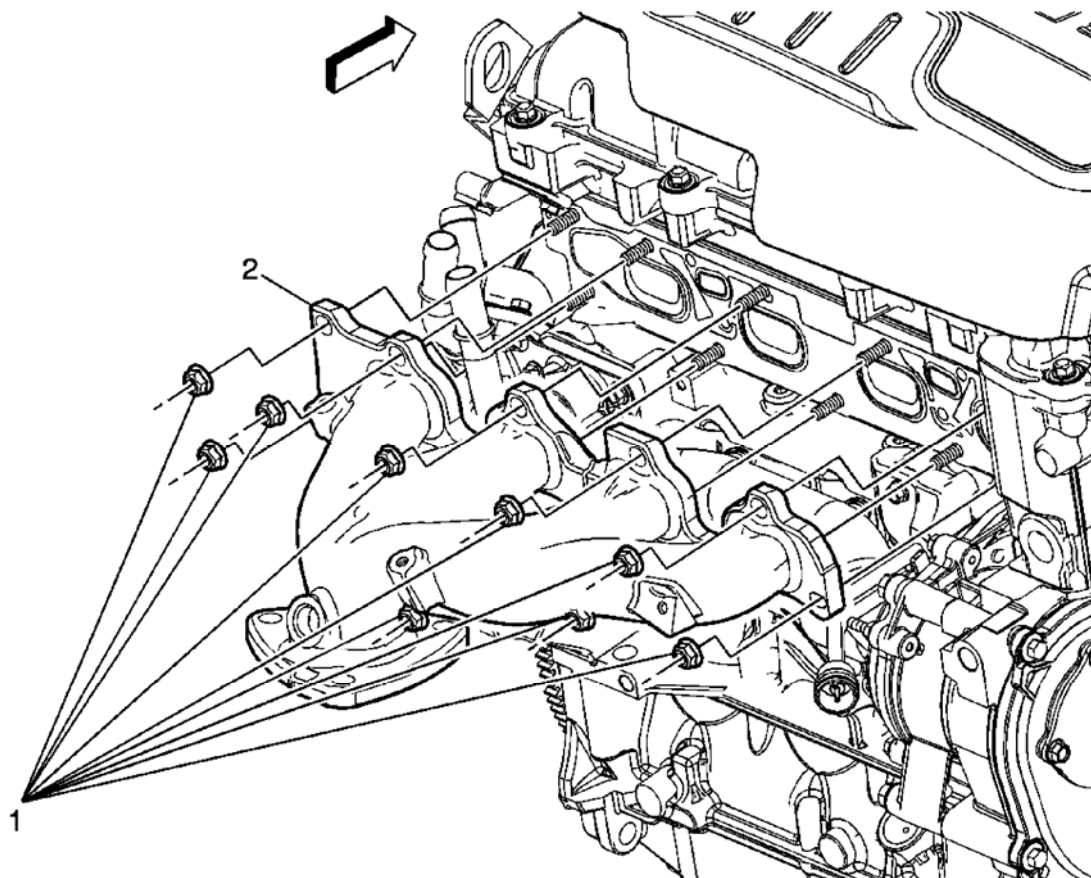


Fig. 1: Exhaust Manifold (LAF)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary procedures	
1. Remove the catalytic converter. Refer to <u>Catalytic Converter Replacement (LAF)</u> 2. Remove the exhaust manifold heated oxygen sensor. Refer to <u>Heated Oxygen Sensor Replacement - Sensor 1 (LE5)</u> . 3. Remove the exhaust manifold heat shield. Refer to <u>Exhaust Manifold Heat Shield Replacement (LAF)</u> .	
1	Exhaust Manifold Nut (Qty: 10) CAUTION: Refer to <u>Hot Exhaust System Warning</u> . CAUTION: Refer to <u>Fastener Caution</u> .

	Tighten: 14 N.m (10 lb ft)
	Exhaust Manifold
2	Procedure 1. Remove and discard the exhaust manifold gasket. 2. Clean any exhaust manifold gasket debris from the cylinder head and exhaust manifold. 3. Install new exhaust manifold gasket. 4. Tighten the exhaust manifold nuts working from the center out.

CATALYTIC CONVERTER REPLACEMENT (LAF)

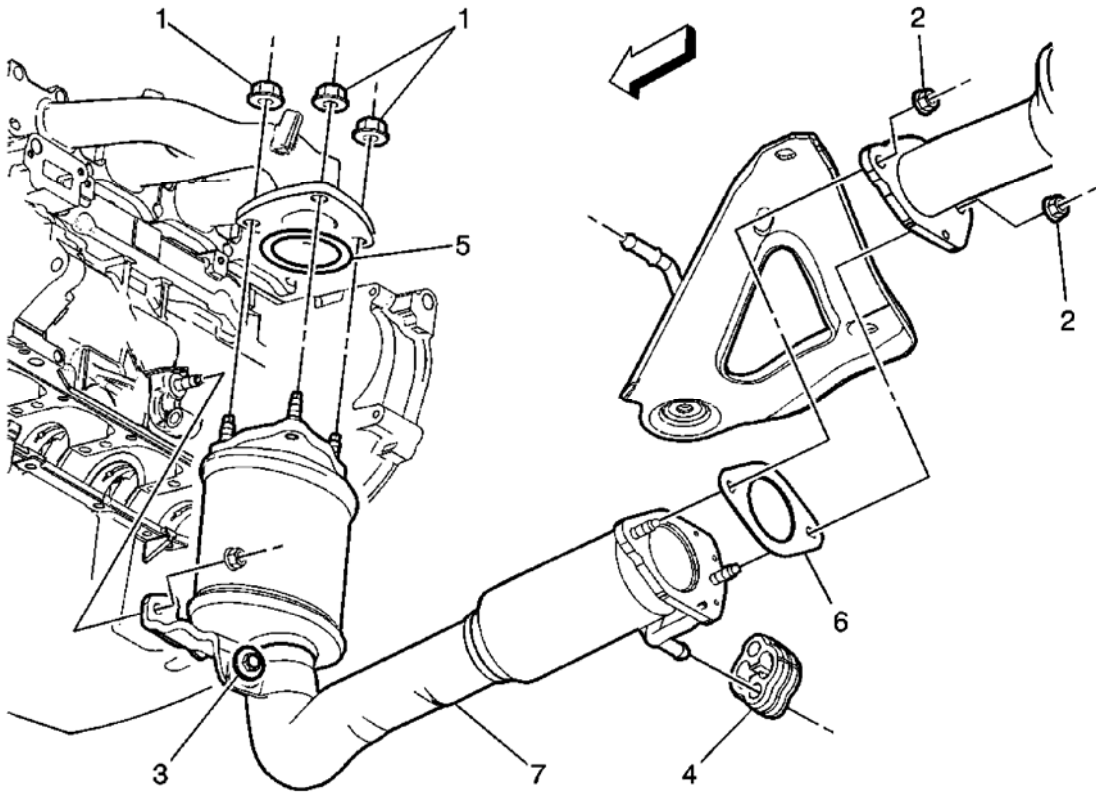


Fig. 2: Catalytic Converter (LAF)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
WARNING: Refer to <u>Hot Exhaust System Warning</u> .	
Preliminary Procedure	

1. Raise and support the vehicle.Refer to **Lifting and Jacking the Vehicle**
2. Remove the exhaust manifold heat hield. Refer to **Exhaust Manifold Heat Shield Replacement (LAF)**
3. Remove the catalytic converter bracket. Refer to **Catalytic Converter Brace Replacement (LAF)**
4. Remove the oxygen sensor after the catalytic converter. Refer to **Heated Oxygen Sensor Replacement - Sensor 2 (LE5)**

1	Exhaust Manifold Nut (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 50 N.m (37 lb ft).
2	Exhaust Muffler Nut (Qty: 2) Tighten: 40 N.m (30 lb ft).
3	Catalytic Converter Bracket Clamp Nut Tighten: 50 N.m (37 lb ft).
4	Exhaust Insulator Hanger
5	Seal
6	Gasket
7	Catalytic Converter Tip: Replace with NEW gasket and seal.

CATALYTIC CONVERTER REPLACEMENT - LEFT SIDE (LF1)

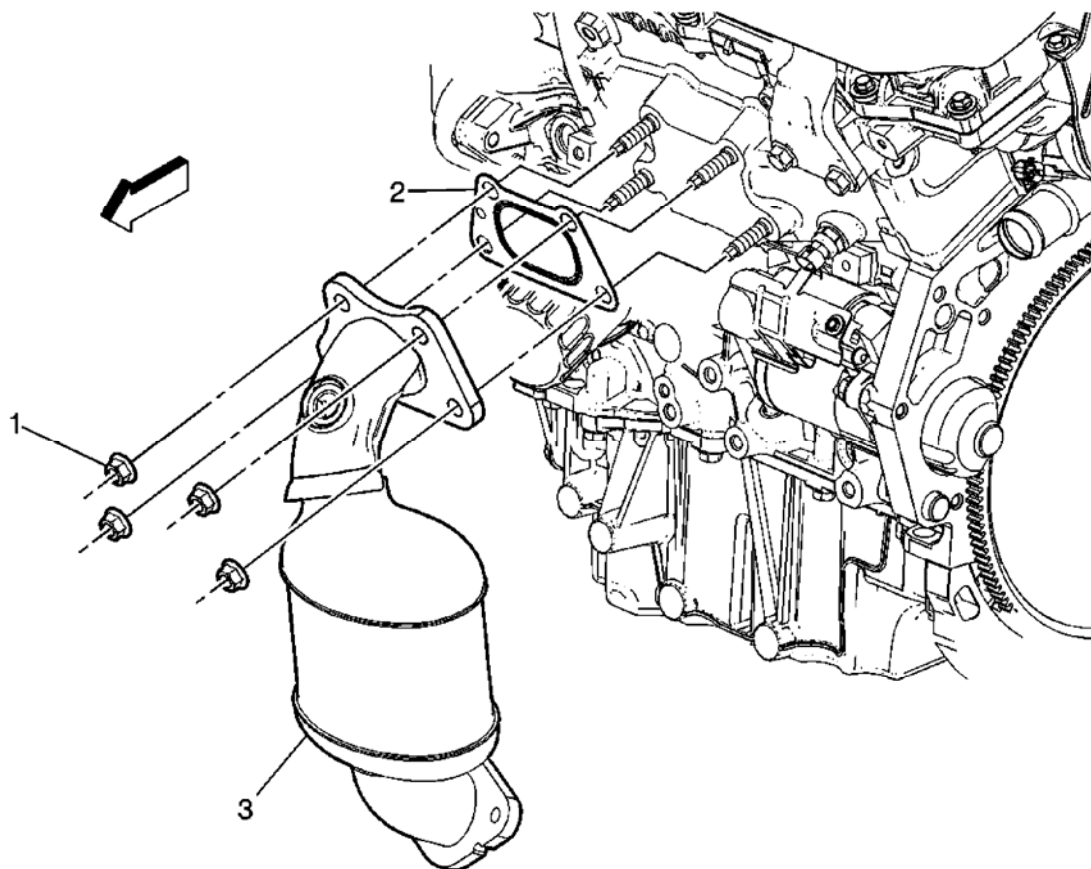


Fig. 3: Catalytic Converter - Left Side (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1. Remove the catalytic converter heat shield. Refer to <u>Catalytic Converter Heat Shield Replacement (LF1)</u> 2. Remove the exhaust flexible pipe. Refer to <u>Exhaust Flexible Pipe Replacement (LF1)</u>.	
	Catalytic Converter Nuts (Qty: 4) WARNING: Refer to <u>Hot Exhaust System Warning</u> . CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Disconnect the oxygen sensor electrical connector.

1	2. Replace the exhaust front pipe nuts and the gasket with new ones. 3. Clean and inspect the studs on the engine cylinder head, replace as necessary. 4. Verify that the studs are fully seated. Stud collar should touch the surface of the engine cylinder head. 5. Tighten nuts in a criss-cross pattern. Tighten: • First Pass: 20 N.m (15 lb ft) • Final Pass: 46 N.m (34 lb ft)
2	Gasket Tip: • If replacing catalytic converter, transfer oxygen sensor. • Improperly installed and/or leaking exhaust manifold gaskets may affect vehicle emissions and/or On-Board Diagnostics (OBD) II system performance.
3	Catalytic Converter

CATALYTIC CONVERTER REPLACEMENT - RIGHT SIDE (LF1)

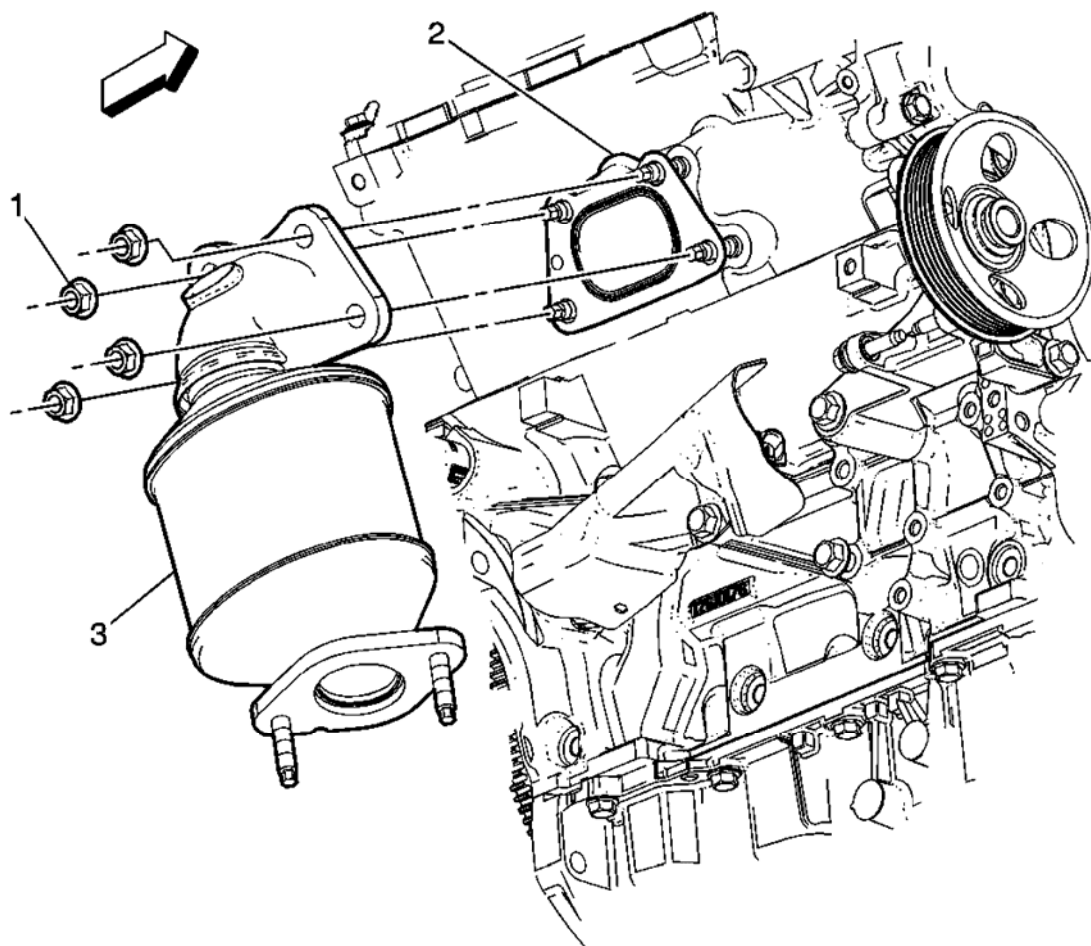


Fig. 4: Catalytic Converter - Right Side (LF1)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Disconnect the oxygen sensor electrical connectors. 2. Remove the catalytic converter heat shield. Refer to <u>Catalytic Converter Heat Shield Replacement (LF1)</u> 3. Remove the exhaust flexible pipe. Refer to <u>Exhaust Flexible Pipe Replacement (LF1)</u>.	
	Catalytic Converter Nut (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Replace nuts and gasket with new ones.

1	2. Clean and inspect the studs on the engine cylinder head, replace as necessary. 3. Verify that the studs are fully seated. Stud collar should touch the surface of the engine cylinder head. 4. Tighten nuts in a criss-cross pattern. Tighten: • First Pass: 20 N.m (15 lb ft) • Final Pass: 46 N.m (34 lb ft)
2	Gasket Tip: Improperly installed and/or leaking exhaust manifold gaskets may affect vehicle emissions and/or On-Board Diagnostics (OBD) II system performance.
3	Catalytic Converter Tip: If replacing catalytic converter, transfer both oxygen sensors.

THREE-WAY CATALYTIC CONVERTER REPLACEMENT (LAF,LF1)

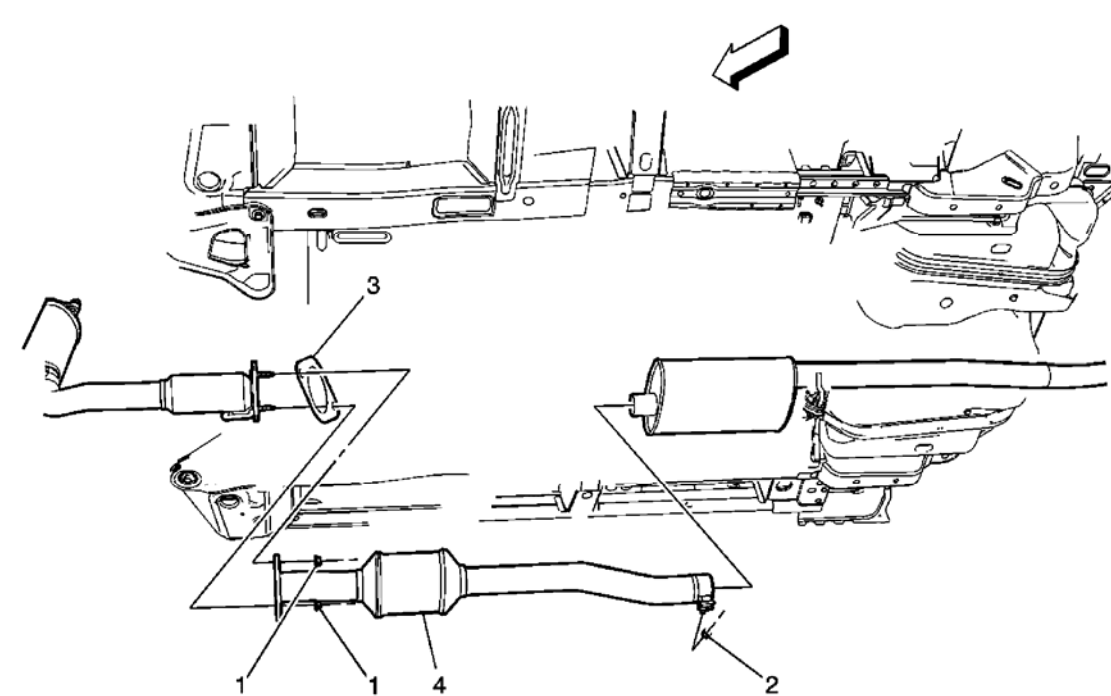


Fig. 5: Three-Way Catalytic Converter (LAF,LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Raise and support the vehicle.Refer to <u>Lifting and Jacking the Vehicle</u>	
	Nut (Qty: 2).

	WARNING: Refer to <u>Hot Exhaust System Warning</u> .
1	CAUTION: Refer to Fastener Caution . Tighten: 50 N.m (37 lb ft).
2	Nut Tighten: 40 N.m (29 lb ft).
3	Gasket Tip: Replace with a NEW gasket.
4	3-Way Catalytic Converter

CATALYTIC CONVERTER BRACE REPLACEMENT (LAF)

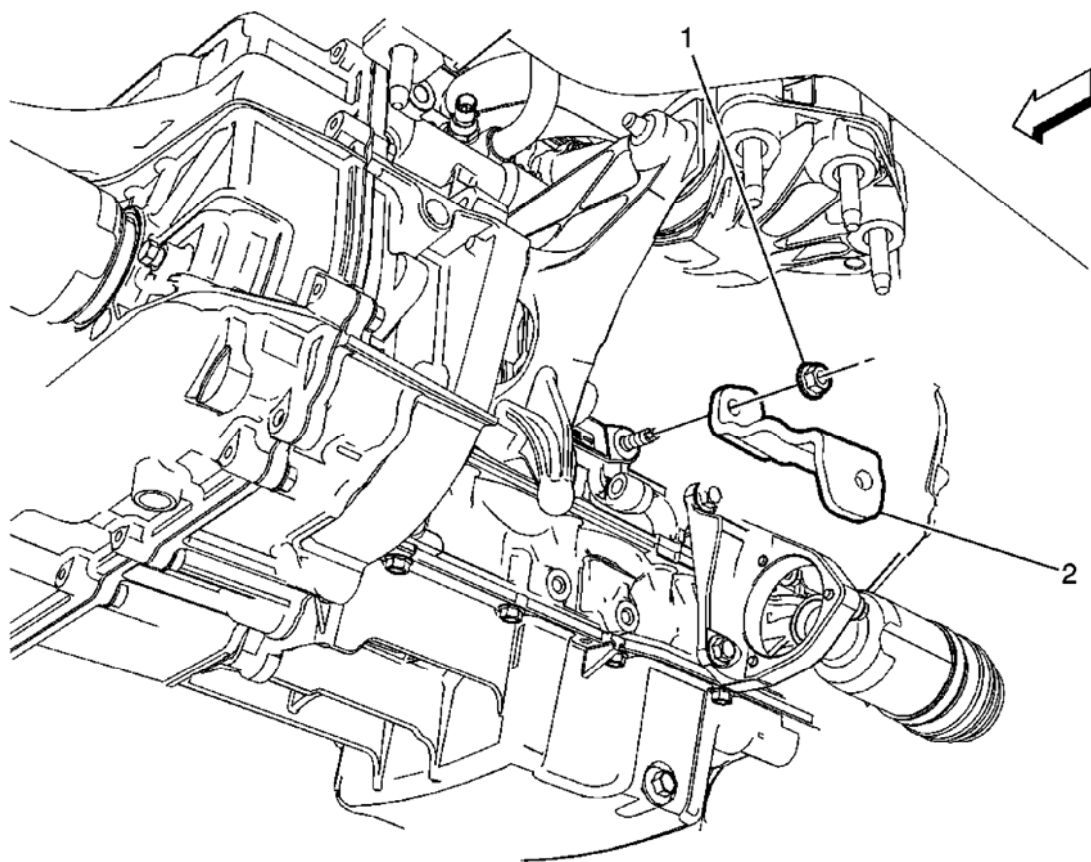


Fig. 6: Catalytic Converter Brace (LAF)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
CAUTION: Refer to <u>Exhaust Service Warning</u> .	
Preliminary Procedure	
1. Raise and support the vehicle.Refer to <u>Lifting and Jacking the Vehicle</u>	
2. Remove the catalytic converter. Refer to <u>Catalytic Converter Replacement (LAF)</u>	
3. If equipped with AWD, remove the transfer case.Refer to <u>Transfer Case Assembly Replacement</u>	
1	Catalytic Converter Bracket Nut CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 50 N.m (37 lb ft).
2	Catalytic Converter Bracket

EXHAUST MUFFLER REPLACEMENT

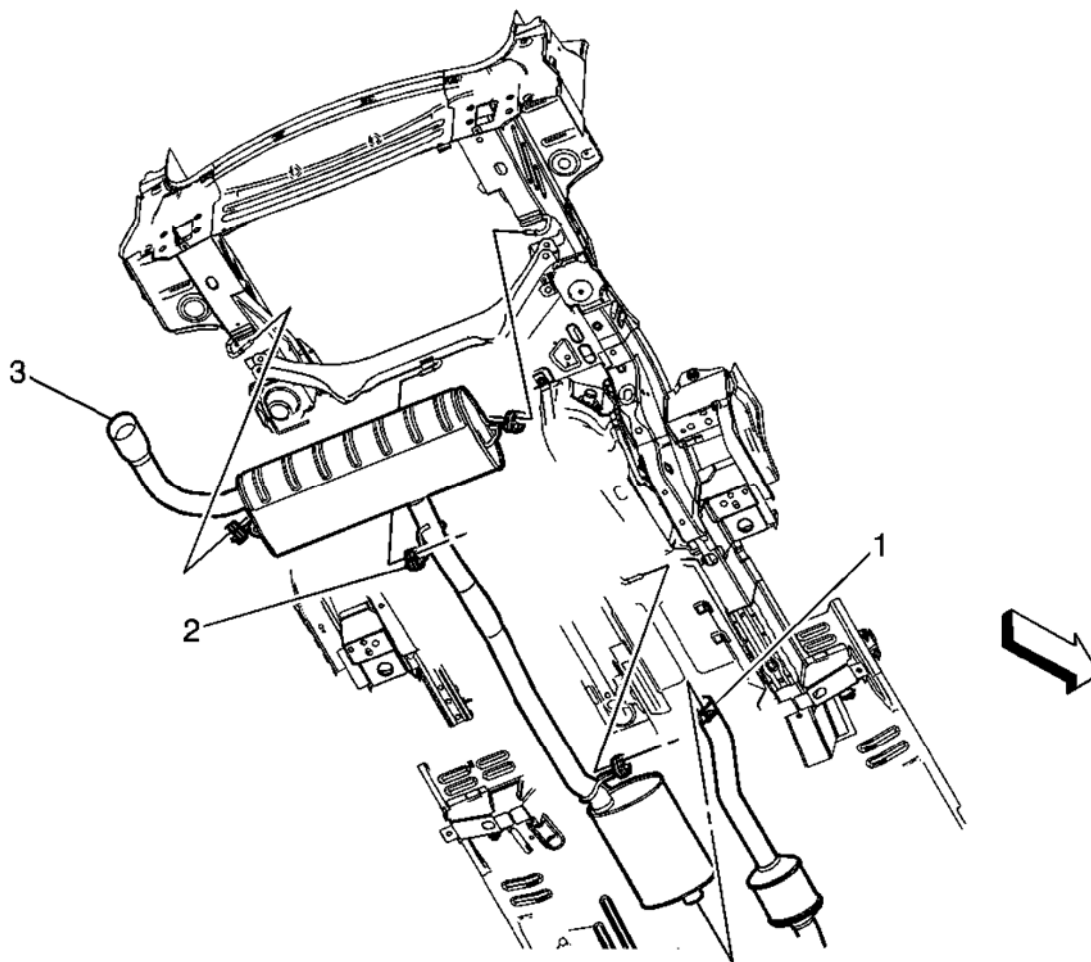


Fig. 7: Exhaust Muffler

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u>	
1	Nut WARNING: Refer to <u>Hot Exhaust System Warning</u> . CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 40 N.m (30 lb ft).
2	Exhaust Insulator Hanger
	Exhaust Muffler

Procedure	
3	1. Disconnect the muffler from the front flexible pipe. 2. Support the front flexible pipe to avoid damaging the flexible pipe. 3. Clean and lubricate the exhaust insulator hangers.

EXHAUST FLEXIBLE PIPE REPLACEMENT (LF1)

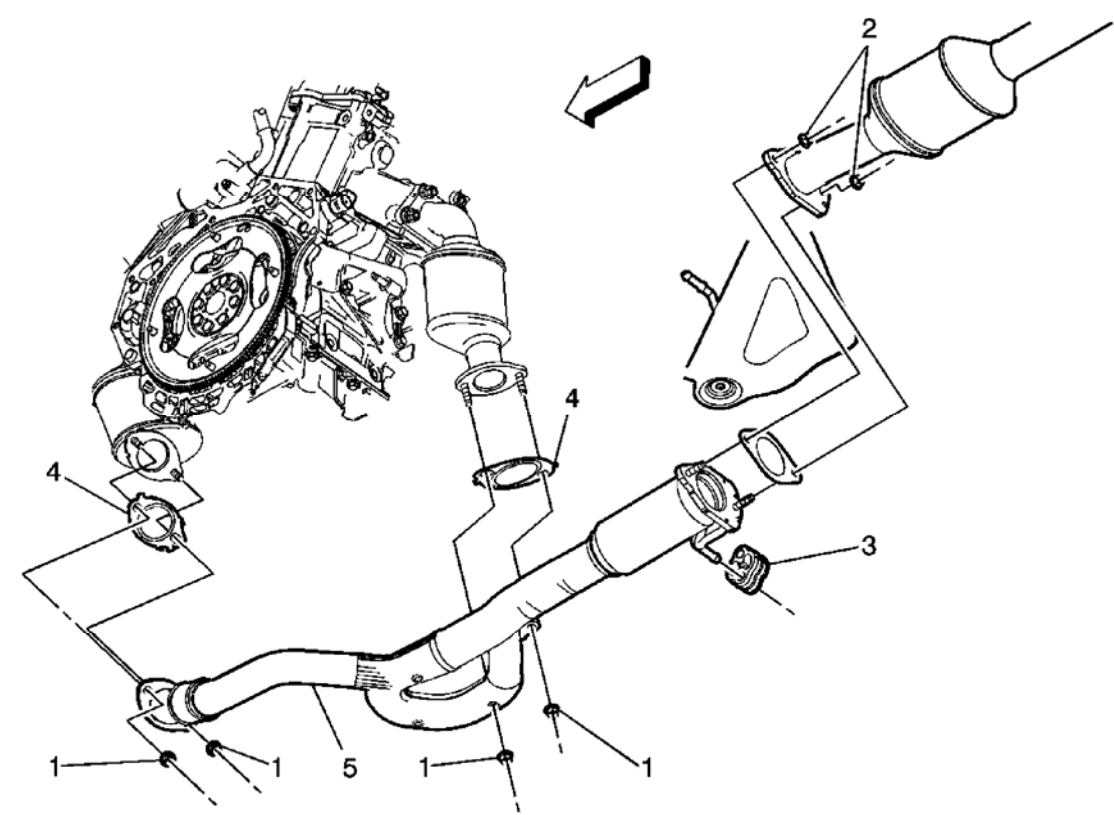


Fig. 8: Exhaust Flexible Pipe (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
WARNING: Refer to <u>Hot Exhaust System Warning</u> . Preliminary Procedure 1. Raise and support the vehicle.Refer to <u>Lifting and Jacking the Vehicle</u> 2. Remove the front lower control arm bracket brace. Refer to <u>Front Lower Control Arm Bracket Brace Replacement</u>	

3. Disconnect the heated oxygen sensor and transfer if necessary.Refer to <u>Heated Oxygen Sensor Replacement - Bank 2 Sensor 2</u>	
1	Nut (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> . Tighten: 52 N.m (38 lb ft).
2	Nut (Qty: 2) Tighten: 50 N.m (37 lb ft).
3	Exhaust Muffler Insulator
4	Gasket Tip: Replace with NEW gaskets.
5	Exhaust Flexible Pipe

CATALYTIC CONVERTER HEAT SHIELD REPLACEMENT (LF1)

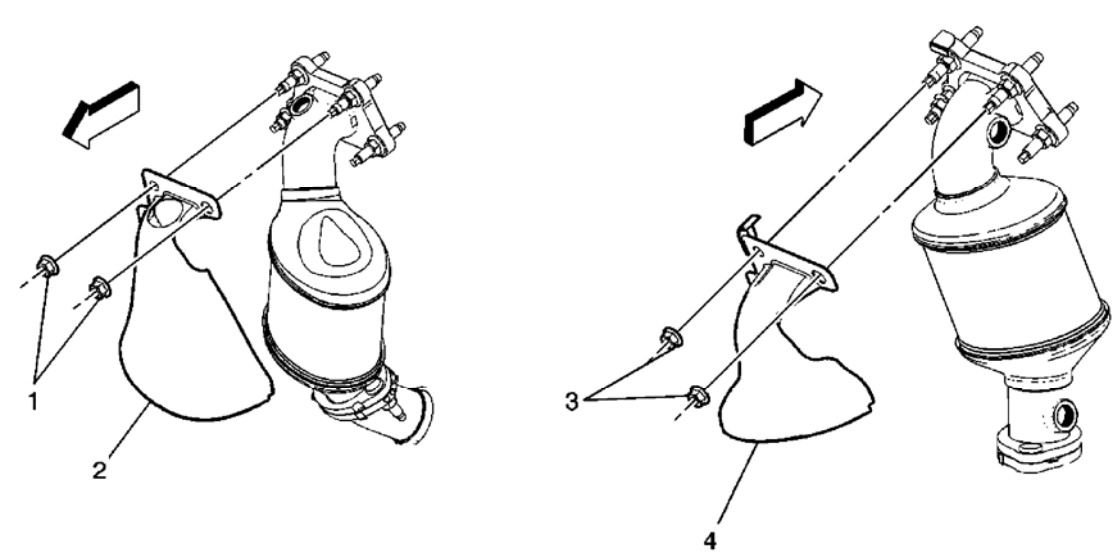


Fig. 9: Catalytic Converter Heat Shield (LF1)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Raise and support the vehicle.Refer to <u>Lifting and Jacking the Vehicle</u>	
	Catalytic Converter Nuts (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .

1	Procedure 1. Clean and inspect the studs on the engine cylinder head, replace as necessary. 2. Verify that the studs are fully seated. Stud collar should touch the surface of the engine cylinder head. 3. Tighten nuts in a criss-cross pattern. Tighten: • First Pass: 20 N.m (15 lb ft) • Final Pass: 46 N.m (34 lb ft)
2	Catalytic Converter Heat Shield-Left
3	Catalytic Converter Nuts (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Procedure 1. Clean and inspect the studs on the engine cylinder head, replace as necessary. 2. Verify that the studs are fully seated. Stud collar should touch the surface of the engine cylinder head. 3. Tighten nuts in a criss-cross pattern. Tighten: • First Pass: 20 N.m (15 lb ft) • Final Pass: 46 N.m (34 lb ft)
4	Catalytic Converter Heat Shield-Right

EXHAUST MANIFOLD HEAT SHIELD REPLACEMENT (LAF)

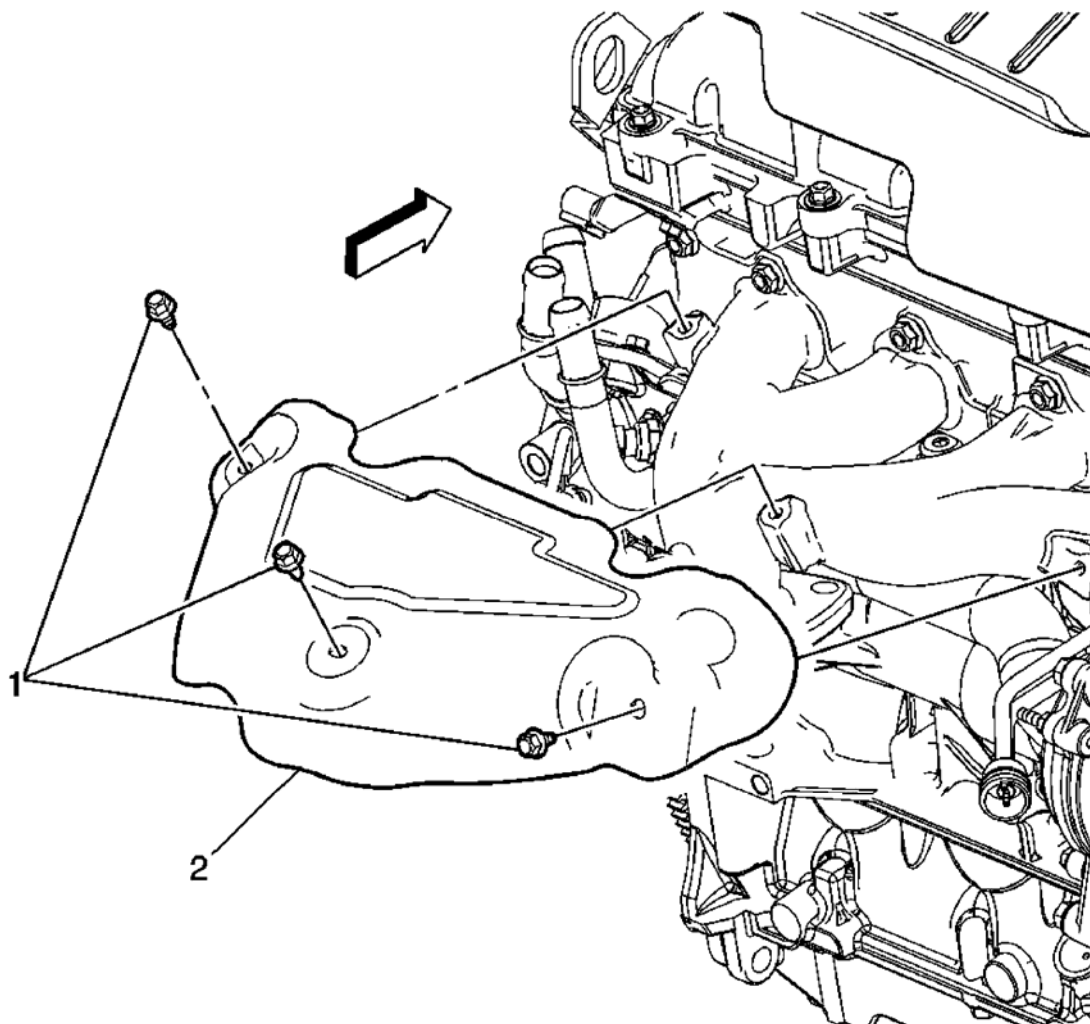


Fig. 10: Exhaust Manifold Heat Shield (LAF)
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	
1. Remove the intake manifold cover and bracket. Refer to <u>Intake Manifold Cover Replacement</u> 2. Disconnect the oxygen sensor.	
1	Exhaust Manifold Heat Shield Bolt (Qty: 3) WARNING: Refer to <u>Hot Exhaust System Warning</u> . CAUTION: Refer to <u>Fastener Caution</u> .

	Tighten: 10 N.m (89 lb in)
2	Exhaust Manifold Heat Shield

DESCRIPTION AND OPERATION

EXHAUST SYSTEM DESCRIPTION

NOTE: **Use of non-OEM parts may cause driveability concerns.**

The exhaust system carries exhaust gases, treated by the catalytic converter, through a resonator, if applicable and into the exhaust muffler where exhaust noise is lessened.

In order to secure the exhaust pipe to the exhaust manifold, a flange and seal-joint coupling is utilized. The exhaust system may utilize a slip-joint coupling design with a clamp and a U-bolt or a flange connection with a gasket.

Exhaust hangers and rubber insulators help to support the weight of the exhaust pipe along with insulating any exhaust system vibration, rattle, or noise.

Exhaust hangers also space the exhaust system away from the underbody of the vehicle and allows the exhaust system to expand as the exhaust system warms up.

Exhaust heat shields are used to protect the body and other components from damage due to the heat from the exhaust system.

The exhaust system may be comprised of the following components:

- Exhaust manifold
- Exhaust pipes
- Catalytic converters
- Exhaust muffler
- Exhaust resonator, if equipped
- Exhaust tail pipe, if equipped
- Exhaust hangers
- Exhaust heat shields

Resonator

Some exhaust systems are equipped with a resonator. The resonator, located either before or after the muffler, allows the use of mufflers with less back pressure. Resonators are used when vehicle characteristics require specific exhaust tuning.

Catalytic Converter

The catalytic converter is an emission control device used to reduce hydrocarbons (HC), carbon monoxide

(CO), and oxides of nitrogen (NOx) pollutants from the exhaust gas.

The catalytic converter is comprised of a ceramic monolith substrate, supported in insulation and housed within a sheet metal shell. The substrate may be washcoated with 3 noble metals:

- Platinum (Pt)
- Palladium (Pd)
- Rhodium (Rh)

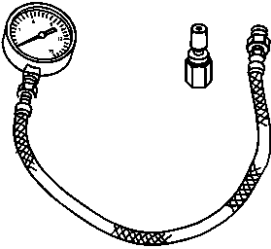
The catalyst in the catalytic converter is not serviceable.

Muffler

The exhaust muffler reduces the noise levels of the engine exhaust by the use of tuning tubes. The tuning tubes create channels inside the exhaust muffler that lower the sound levels created by the combustion of the engine.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J 35314-A Exhaust Back Pressure Gauge