

2004 ENGINE

Engine Exhaust - Aztek & Rendezvous

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Catalytic Converter Bolt (All)	45 N.m	33 lb ft
Catalytic Converter Hanger Bolt (All)	45 N.m	33 lb ft
Catalytic Converter Nut (All)	34 N.m	25 lb ft
Exhaust Crossover Pipe Bolt (LY7)	34 N.m	25 lb ft
Exhaust Crossover Pipe Heat Shield Bolt (LA1)	10 N.m	89 lb in
Exhaust Crossover Pipe Nut (LY7)	34 N.m	25 lb ft
Exhaust Crossover Pipe Stud/Nut (LA1)	25 N.m	18 lb ft
Exhaust Manifold Bolt (LY7)	20 N.m	15 lb ft
Exhaust Manifold Heat Shield Bolt (All)	10 N.m	89 lb in
Exhaust Manifold Nut (LA1)	16 N.m	12 lb ft
Exhaust Manifold Stud (LY7)	6 N.m	53 lb in

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE EXHAUST

Begin the system diagnosis by reviewing the system Description and Operation. Reviewing the information will help you determine the correct symptom diagnostic procedure when a malfunction exists. It will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Engine Exhaust** in order to identify the correct procedure for diagnosing the system.

SYMPTOMS - ENGINE EXHAUST

- Review the Exhaust System Description and Operation in order to familiarize yourself with the system functions. 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** in General Information.

Visual/Physical Inspection

- Inspect for aftermarket or non-OEM devices such as, but not including; tailpipe extensions, headers, and exhaust cutouts. This 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 hissing noise

Refer to **Exhaust Leakage**.

- Exhaust popping noise

Refer to **Exhaust Leakage**.

- 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

Tools Required

J 35314-A Exhaust Back Pressure Gauge. See **Special Tools and Equipment**.

Diagnostic Aids

CAUTION: While engine is operating, the exhaust system will become extremely hot. To prevent burns avoid contacting a hot exhaust system.

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**. See **Special Tools and Equipment**. Removing the AIR check valve or 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.

Restricted Exhaust

Step	Action	Value(s)	Yes	No
1	Did you verify the customers complaint?	-	Go to Step 2	-

Step	Action	Value(s)	Yes	No
1	Did you review the customer symptoms and perform the necessary inspections?	-	Go to Step 2	Go to Step 2
2	Did you verify the customer complaint?	-	Go to Step 3	<u>Engine Exhaust</u>
3	Is the system equipped with dual exhaust?	-	Go to Diagnostic Aids	Go to Step 4
4	1. Remove the AIR check valve or the HO2S that is in front of and closest to the catalytic converter. Refer to <u>Heated Oxygen Sensor Replacement - Position 1</u> in Engine Controls - 3.4 L. 2. Install the J 35314-A Exhaust Back Pressure Gauge in place of the AIR check valve or HO2S sensor. See <u>Special Tools and Equipment</u>. 3. Start the engine. 4. Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value?	14 kPa (2 psi)	Go to Step 5	Go to Step 8
5	1. Turn OFF the engine and place the ignition in the lock position. 2. Remove the J 35314-A still installed increase and monitor engine speed to 2,000 RPM. See <u>Special Tools and Equipment</u>. 3. Re-install the AIR check valve/HO2S sensor. Refer to <u>Heated Oxygen Sensor Replacement - Position 1</u> in Engine Controls - 3.4 L. 4. Remove the post-catalyst HO2S sensor. Refer to <u>Heated Oxygen Sensor Replacement - Position 2</u> in Engine Controls - 3.4 L. 5. Install the J 35314-A in place of	14 kPa (2 psi)		

	the post HO2S sensor. See <u>Special Tools and Equipment</u>. 6. Start the engine. 7. Increase and monitor the engine speed at 2,000 RPM. 8. Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value?			
			Go to Step 6	Go to Step 7
6	Inspect the exhaust system for the following conditions: • 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</u>. Did you find and correct the condition?	-		-
			Go to Step 8	
8	1. Remove the J 35314-A and reinstall the AIR check valve or the HO2S sensor. See <u>Special Tools and Equipment</u>. Refer to <u>Heated Oxygen Sensor Replacement - Position 2</u> in Engine Controls - 3.4 L. 2. Clear any codes. 3. Road test the vehicle in order to verify the repair. Did you correct the condition?	-		
			System OK	Go to Step 2

EXHAUST LEAKAGE

Exhaust Leakage

Problem	Action
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CAUTION:Problem	Action
While engine is operating, the exhaust system will become extremely hot. To prevent burns avoid contacting a hot exhaust system.	
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 components to the specifications. Refer to <u>Fastener Tightening Specifications</u>.
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 ● EGR connections ● AIR connections to the exhaust manifold or cylinder head	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.
Exhaust manifold cracked or broken	Replace the exhaust manifold Refer to <u>Exhaust Manifold Replacement - Left (LA1)</u> or <u>Exhaust Manifold Replacement - Left (LY7)</u> or <u>Exhaust Manifold Replacement - Right (LA1)</u> or <u>Exhaust Manifold Replacement - Right (LY7)</u>.
Exhaust system component connection welds leaking Muffler or resonator	Replace the leaking component. Refer to the affected component's procedure for service. Replace the muffler/resonator assembly. Refer to <u>Muffler</u>

damaged or leaking at the seams	<u>Replacement.</u>
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EXHAUST NOISE

Exhaust Noise

Condition	Action
CAUTION: While engine is operating, the exhaust system will become extremely hot. To prevent burns avoid contacting a hot exhaust system.	
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 (buzz, groan, hum). Refer to Symptoms - Engine Exhaust prior to beginning this table.	
Popping or hissing noise	Exhaust leak. Refer to Exhaust Leakage.
Loud exhaust	1. Compare to a known good vehicle. 2. Inspect for a damaged muffler or resonator. 3. Replace the muffler/resonator assembly. Refer to Muffler Replacement.
External rattle or vibration noise	1. Inspect for a bent or loose hanger, loose heat shield, or loose clamp. 2. Inspect for an 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 catalytic converter or the muffler/resonator assembly. Refer to one of the following procedures: • Catalytic Converter Replacement • Muffler Replacement

REPAIR INSTRUCTIONS

EXHAUST MANIFOLD REPLACEMENT - LEFT (LA1)

Removal Procedure

1. Remove the throttle body air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.4L.
2. Drain the engine coolant from the cooling system. Refer to **Draining and Filling Cooling System** in Engine Cooling.
3. Remove the right engine mount strut bracket. Refer to **Engine Mount Strut Bracket Replacement - Right** in Engine Mechanical - 3.4 L.
4. Disconnect the inlet radiator hose from the engine. Refer to **Radiator Hose Replacement - Inlet (LA1)** or **Radiator Hose Replacement - Inlet (LY7)** in Engine Cooling.
5. Remove the thermostat bypass pipe. Refer to **Thermostat Bypass Pipes Replacement** in Engine Cooling.
6. Remove the exhaust crossover pipe. Refer to **Exhaust Crossover Pipe Replacement (LA1)** or **Exhaust Crossover Pipe Replacement (LY7)**.

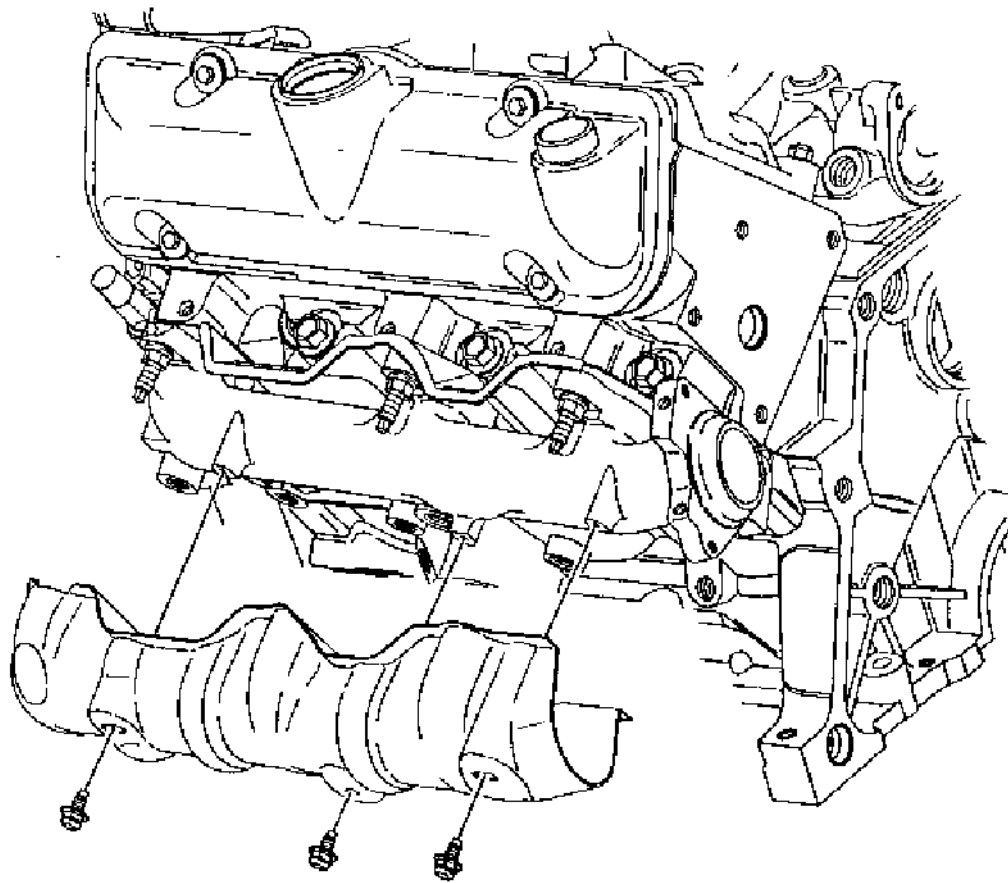


Fig. 1: View Of Exhaust Manifold Heat Shield & Bolts - Left
Courtesy of GENERAL MOTORS CORP.

7. Remove the exhaust manifold heat shield bolts.
8. Remove the exhaust manifold heat shield.

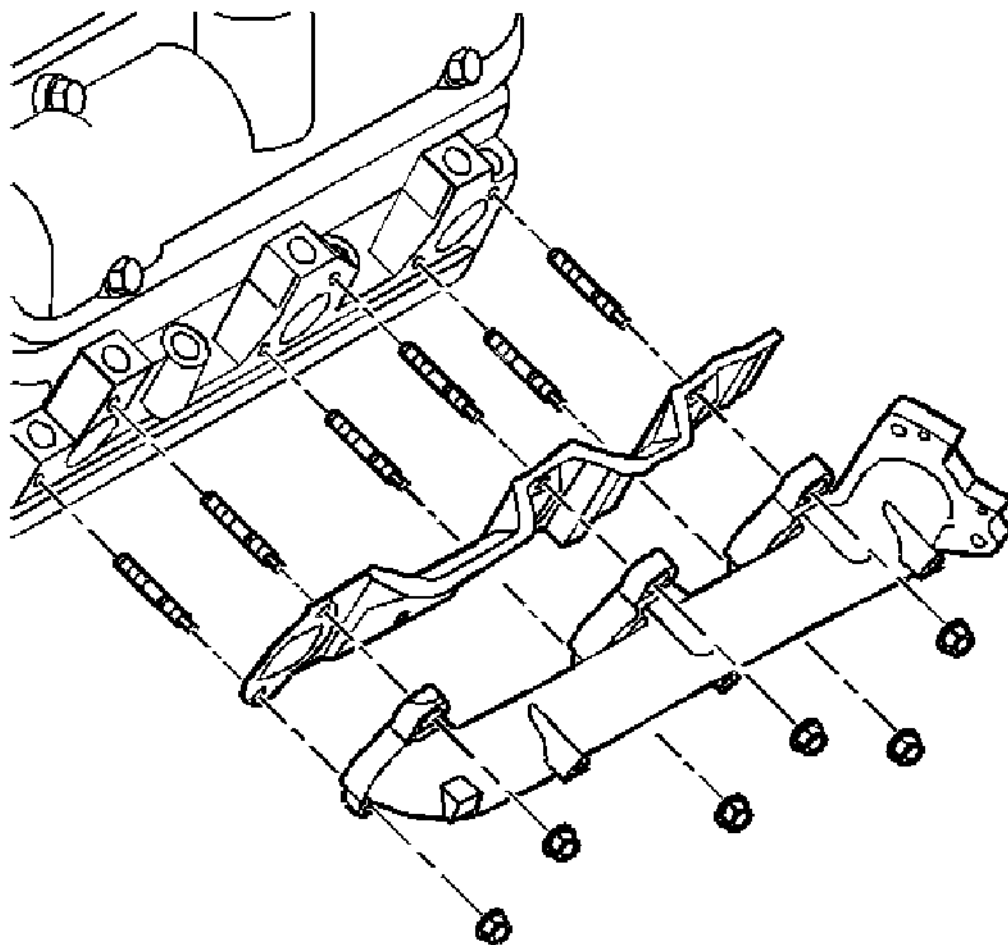


Fig. 2: View Of Exhaust Manifold & Exhaust Manifold Gasket - Left
Courtesy of GENERAL MOTORS CORP.

9. Remove the exhaust manifold nuts.
10. Remove the exhaust manifold.
11. Remove the exhaust manifold gasket.
12. Clean the engine left side exhaust manifold to the engine left side cylinder head sealing surfaces. Refer to **Exhaust Manifold Cleaning and Inspection** in Engine Mechanical 3.4L Unit Repair.

Installation Procedure

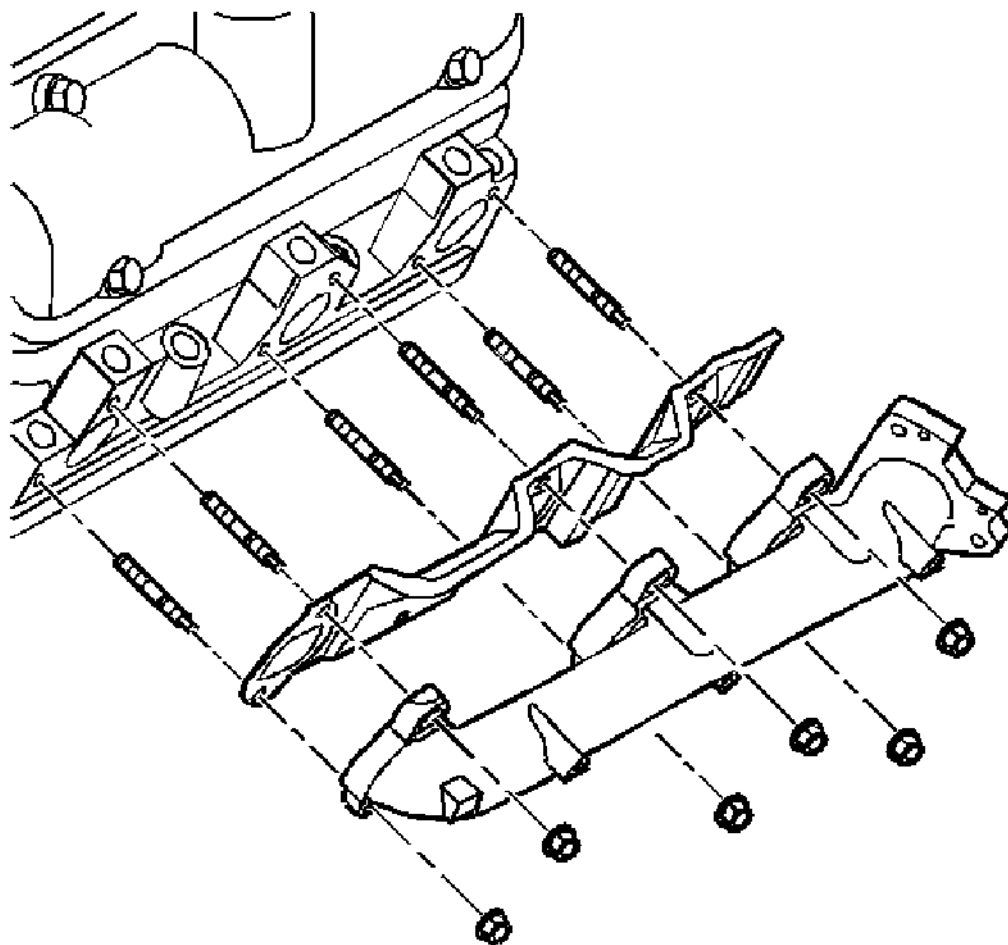


Fig. 3: View Of Exhaust Manifold & Exhaust Manifold Gasket - Left
Courtesy of GENERAL MOTORS CORP.

1. Install the exhaust manifold gasket.
2. Install the exhaust manifold.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the exhaust manifold nuts.

Tighten: Tighten the exhaust manifold nuts to 16 N.m (12 lb ft).

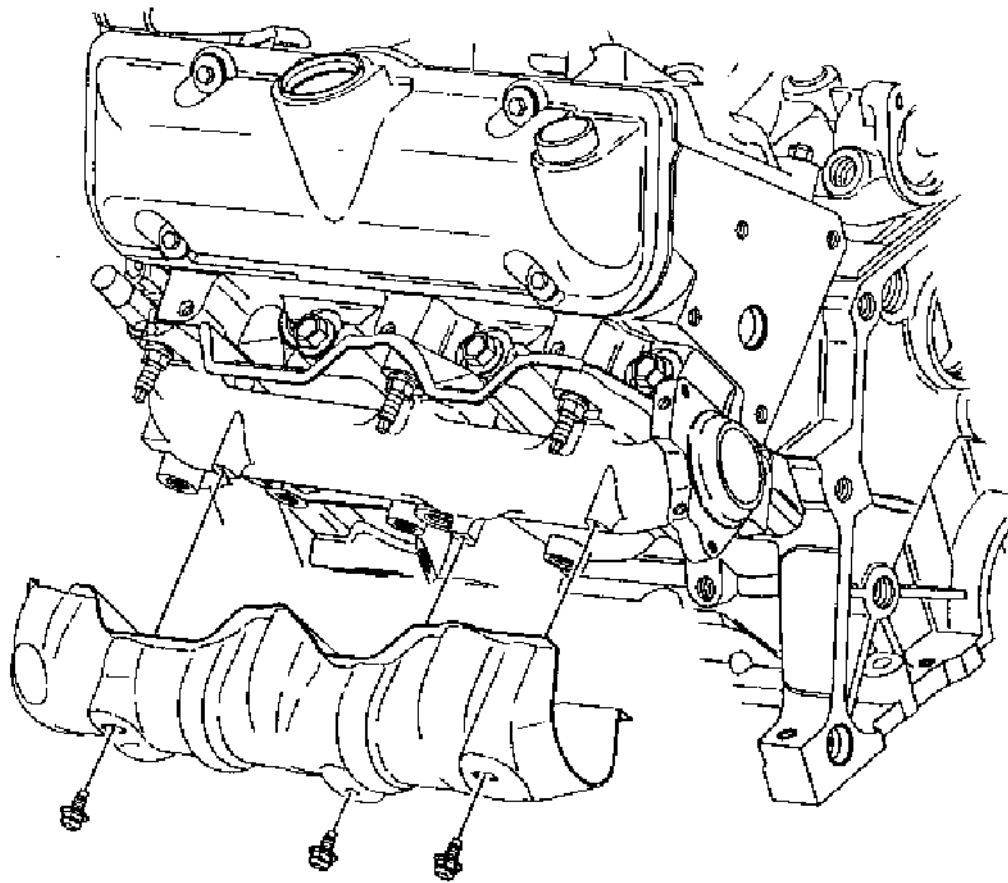


Fig. 4: View Of Exhaust Manifold Heat Shield & Bolts - Left
Courtesy of GENERAL MOTORS CORP.

4. Install the exhaust manifold heat shield.
5. Install the exhaust manifold heat shield bolts.

Tighten: Tighten the exhaust manifold heat shield bolts to 10 N.m (89 lb in).

6. Install the exhaust crossover pipe. Refer to **Exhaust Crossover Pipe Replacement (LA1)** or **Exhaust Crossover Pipe Replacement (LY7)**.
7. Install the thermostat bypass pipe. Refer to **Thermostat Bypass Pipes Replacement** in Engine Cooling.
8. Connect the inlet radiator hose to the engine. Refer to **Radiator Hose Replacement - Inlet (LA1)** or **Radiator Hose Replacement - Inlet (LY7)** in Engine Cooling.
9. Install the right engine mount strut bracket. Refer to **Engine Mount Strut Bracket**

Replacement - Right in Engine Mechanical - 3.4 L.

10. Fill the cooling system with engine coolant. Refer to **Draining and Filling Cooling System** in Engine Cooling.
11. Install the throttle body air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.4L.

EXHAUST MANIFOLD REPLACEMENT - LEFT (LY7)

Removal Procedure

1. Turn the ignition OFF.
2. Remove the left and the right torque strut bolts at the engine strut bracket.

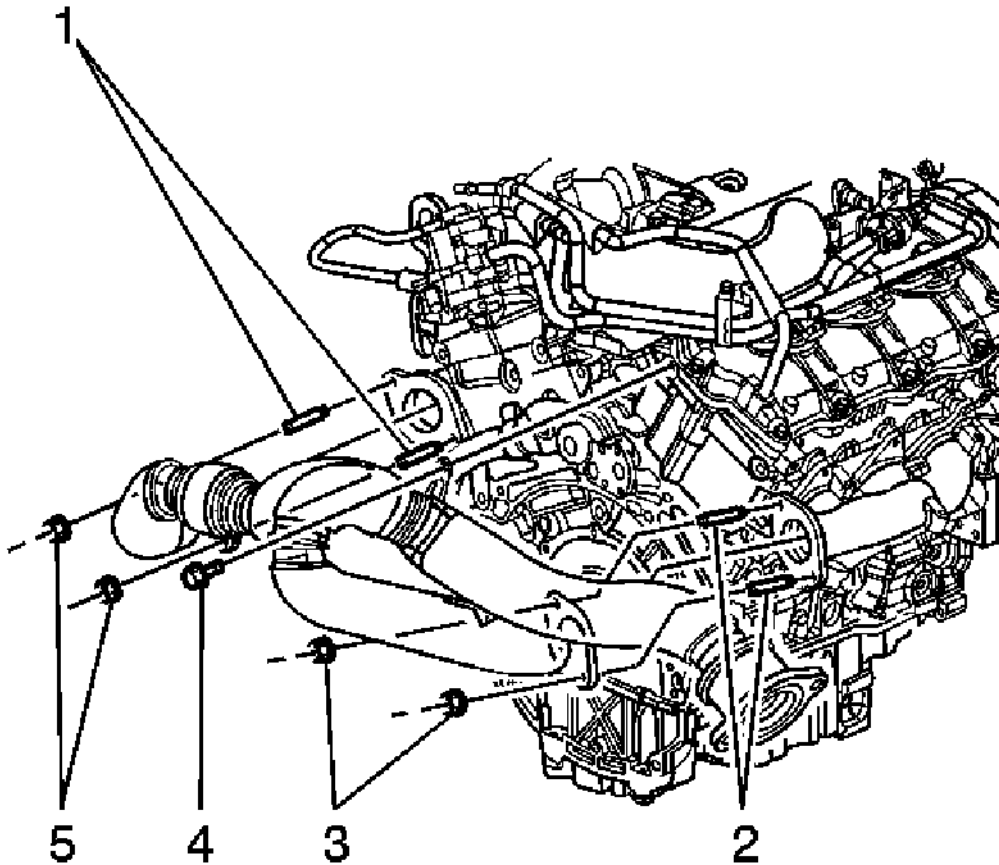


Fig. 5: Locating Exhaust Crossover Pipe To Left Bank Exhaust Manifold Nuts
Courtesy of GENERAL MOTORS CORP.

3. Remove the exhaust crossover pipe to left bank exhaust manifold nuts (5).

4. Remove the oil level indicator and tube. Refer to **Oil Level Indicator and Tube Replacement** .

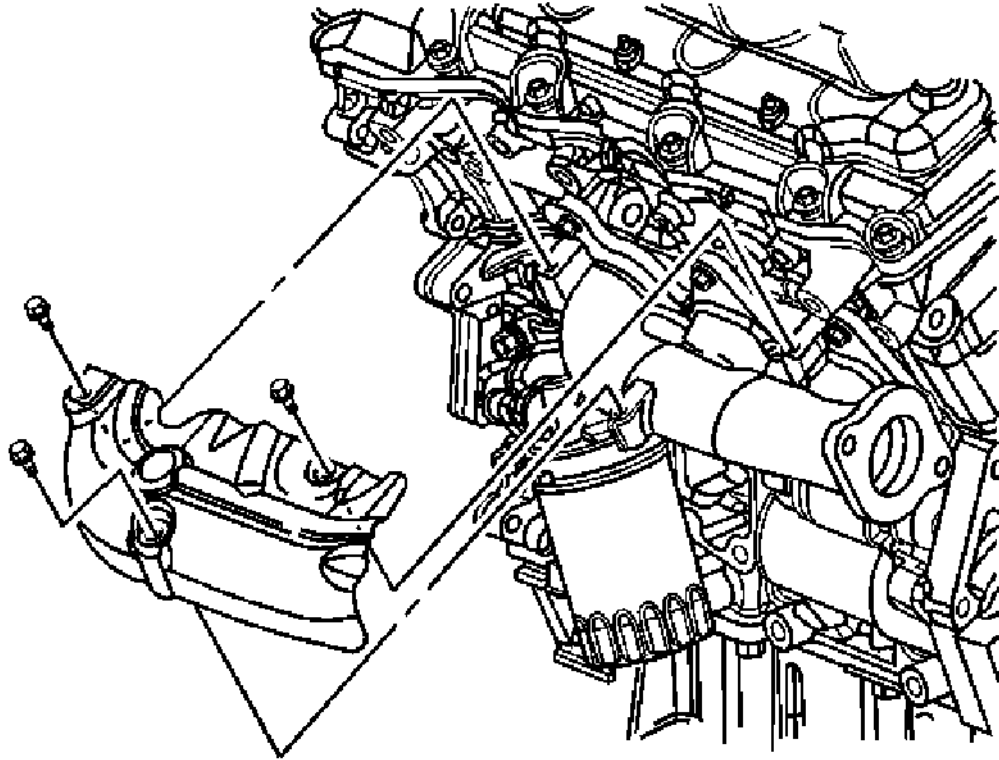


Fig. 6: Identifying Exhaust Manifold Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove The Exhaust Manifold Heat Shield Bolts.
6. Remove the exhaust manifold heat shield.

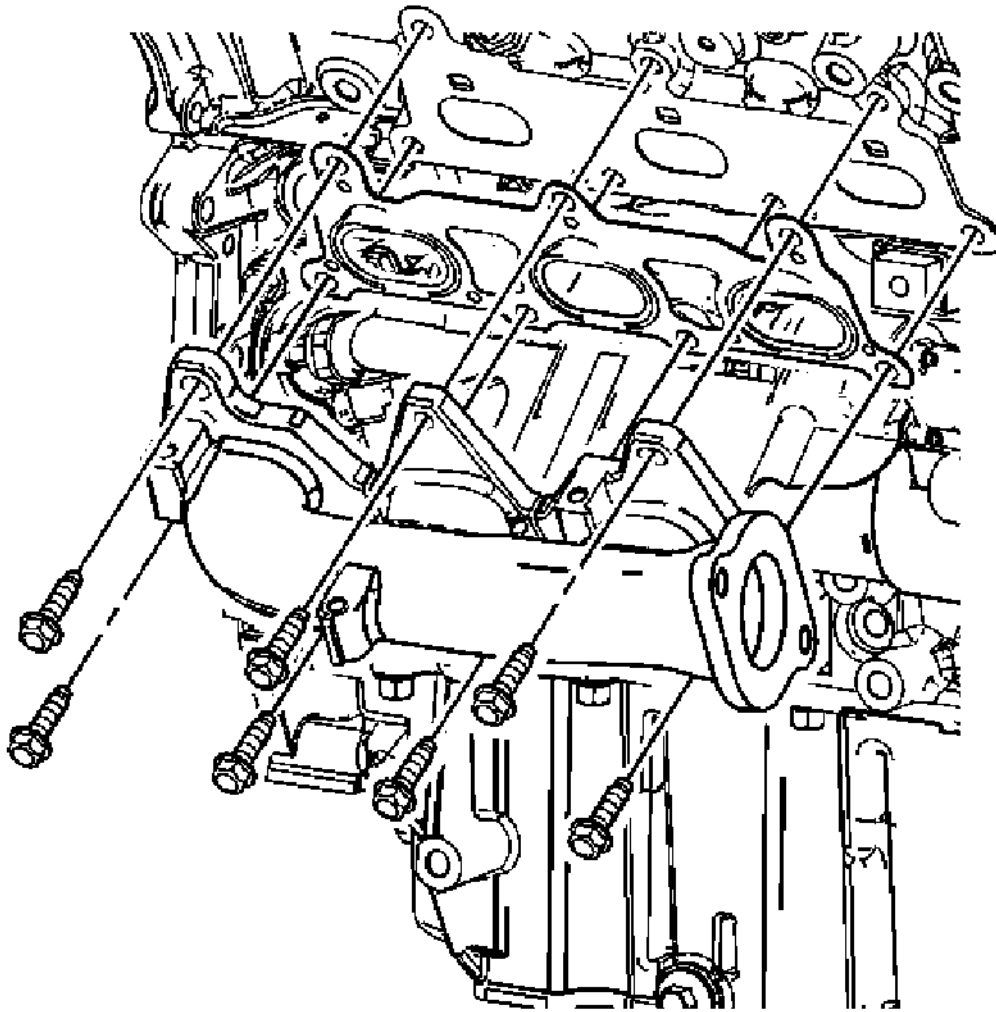


Fig. 7: View Of Exhaust Manifold Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the exhaust manifold bolts.
8. Remove the exhaust manifold.
9. Remove and discard the exhaust manifold gasket.
10. Clean and inspect the exhaust manifold and the sealing surfaces. Refer to **Exhaust Manifold Cleaning and Inspection - Left** in Engine Mechanical - 3.6L (LY7).

Installation Procedure

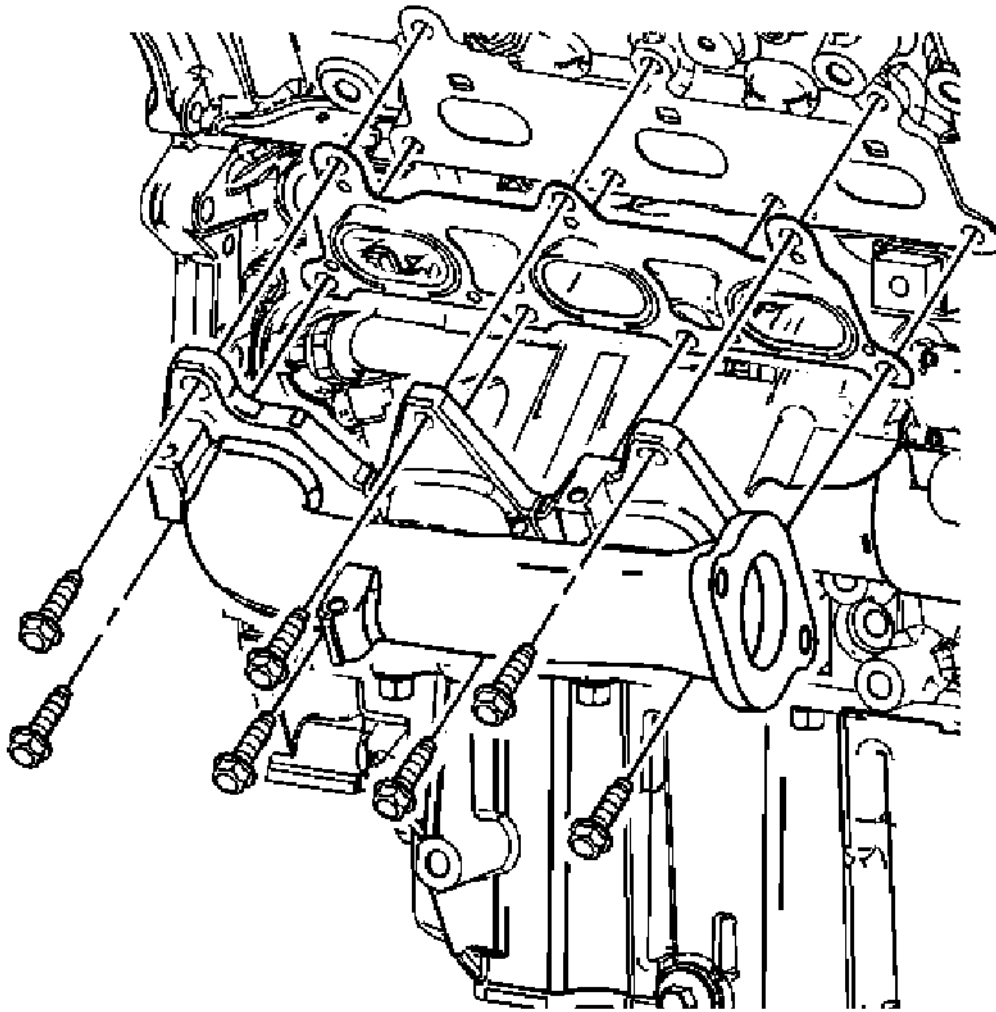


Fig. 8: View Of Exhaust Manifold Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the NEW exhaust manifold gasket.
2. Install the exhaust manifold.

NOTE: Refer to **Fastener Notice** in Cautions and Notices.

3. Install the exhaust manifold bolts.

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

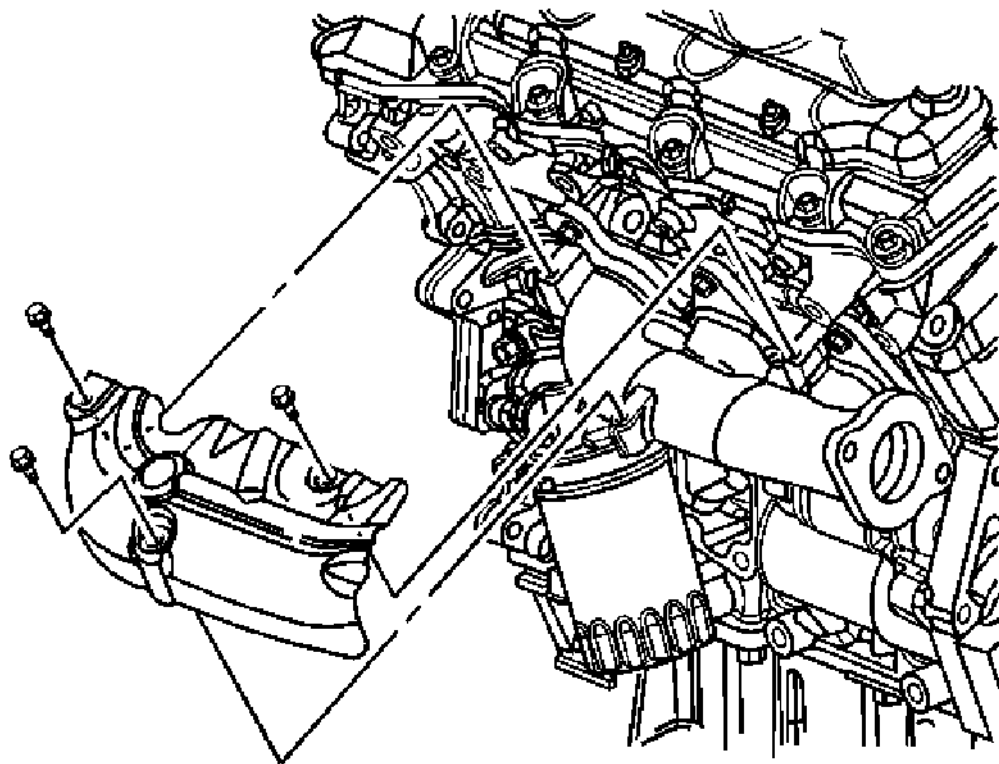


Fig. 9: Identifying Exhaust Manifold Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the exhaust manifold heat shield.
5. Install the exhaust manifold heat shield bolts.

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

6. Install the oil level indicator and tube. Refer to **Oil Level Indicator and Tube Replacement** .

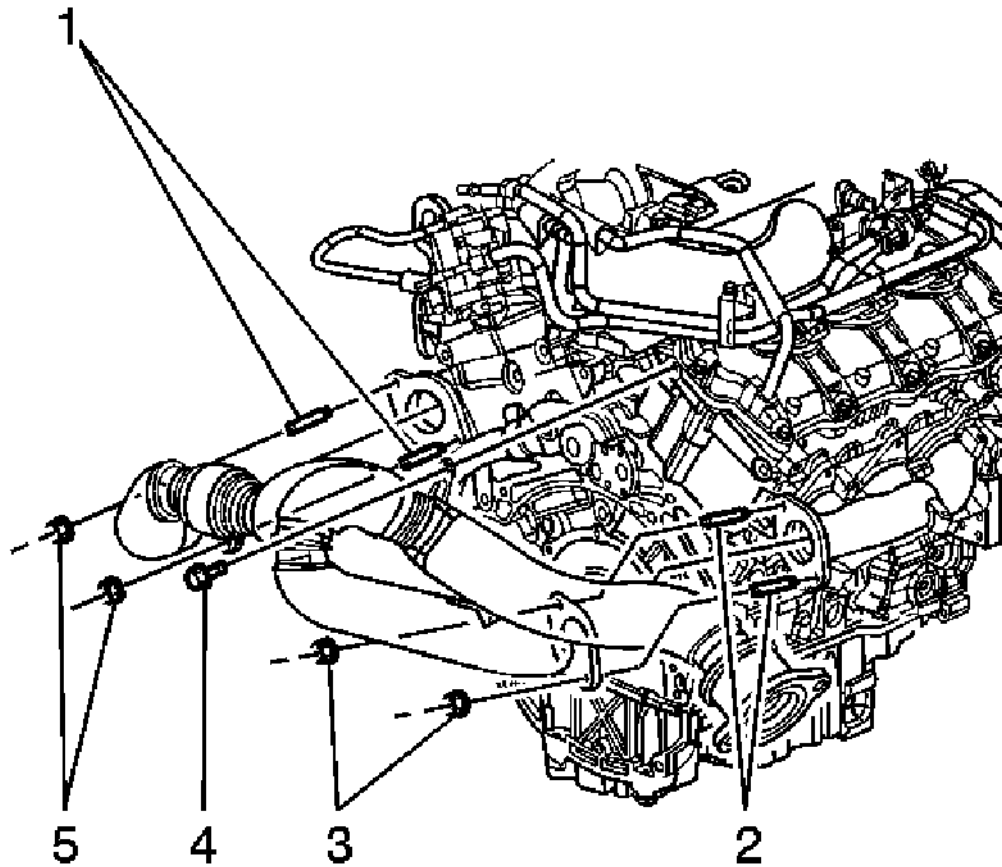


Fig. 10: Locating Exhaust Crossover Pipe To Left Bank Exhaust Manifold Nuts
Courtesy of GENERAL MOTORS CORP.

7. Install the exhaust crossover pipe to left bank exhaust manifold nuts (5). Refer to **Exhaust Crossover Pipe Replacement (LA1)** or **Exhaust Crossover Pipe Replacement (LY7)**.
8. Install the left and the right torque strut at the engine. Secure with the strut bolts.

Tighten: Tighten the bolts to 48 N.m (35 lb ft).

EXHAUST MANIFOLD REPLACEMENT - RIGHT (LA1)

Removal Procedure

1. Disconnect negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)** in Engine Electrical.

2. Remove the throttle body air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.4L.
3. Remove the accelerator cable bracket from the throttle body. Refer to **Accelerator Controls Cable Replacement** in Engine Controls - 3.4L.
4. Remove the manifold air pressure (MAP) sensor. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** in Engine Controls - 3.4L.
5. Remove the exhaust gas recirculation (EGR) valve. Refer to **Exhaust Gas Recirculation (EGR) Valve Replacement** in Engine Controls - 3.4L.
6. Rotate the engine for service access. Refer to **Rotating the Engine for Service Access**.
7. Remove the ignition module and the ignition coils with the bracket.
8. Remove the spark plug wires from the engine right bank spark plugs.
9. Disconnect the oxygen sensor electrical connector.
10. Remove the evaporative emissions (EVAP) solenoid bracket.
11. Remove the exhaust crossover pipe. Refer to **Exhaust Crossover Pipe Replacement (LA1)** or **Exhaust Crossover Pipe Replacement (LY7)**.
12. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
13. Remove the catalytic converter. Refer to **Catalytic Converter Replacement**.

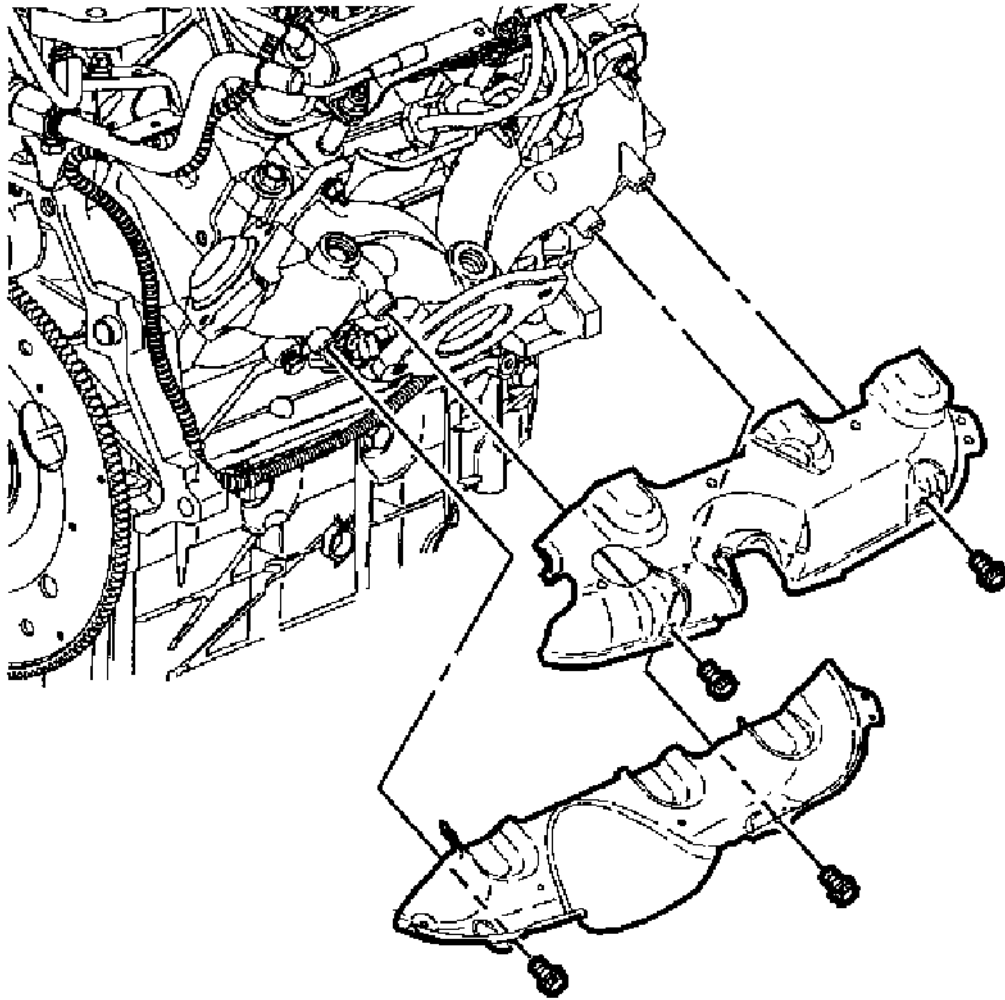


Fig. 11: View Of Right Exhaust Manifold Heat Shields & Bolts
Courtesy of GENERAL MOTORS CORP.

14. Remove the exhaust manifold heat shield bolts.
15. Remove the exhaust manifold heat shields.

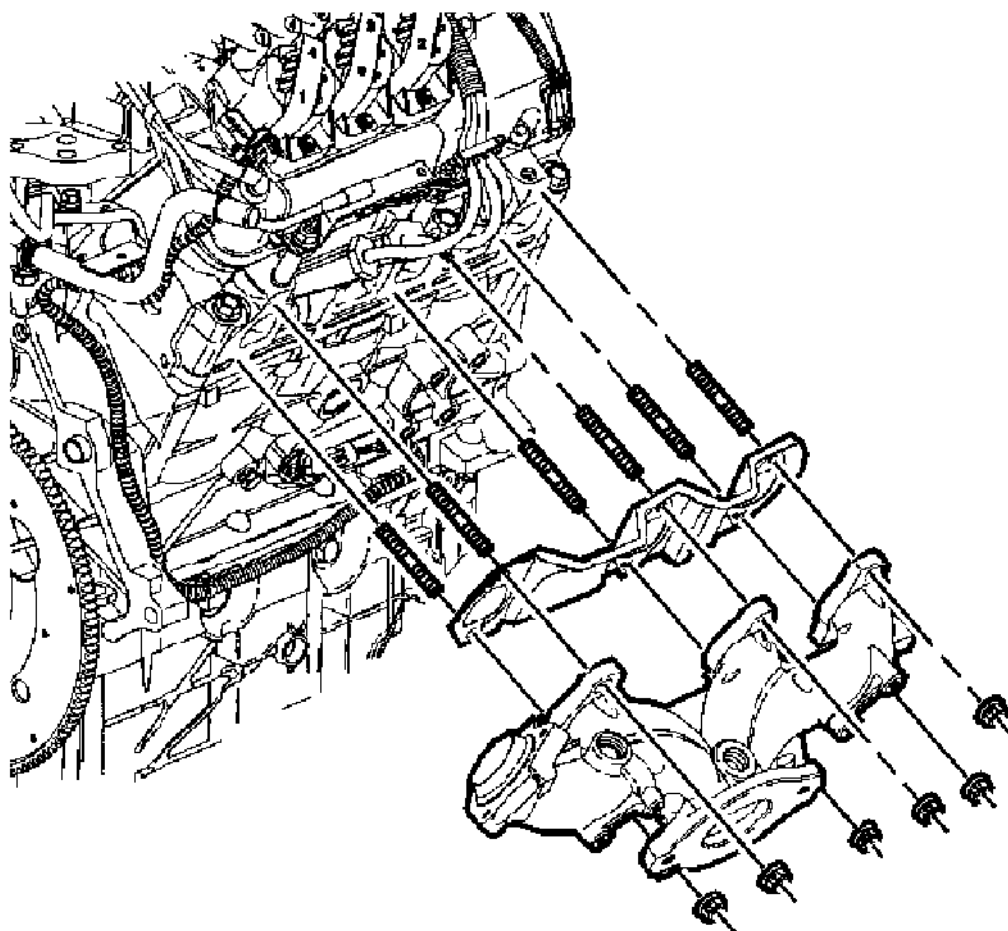


Fig. 12: Right Exhaust Manifold (3.4L)
Courtesy of GENERAL MOTORS CORP.

16. Remove the exhaust manifold nuts.
17. Remove the exhaust manifold.
18. Remove the exhaust manifold gasket.
19. Lower the vehicle.
20. Clean the engine right side exhaust manifold sealing surfaces and the cylinder head sealing surfaces. Refer to **Exhaust Manifold Cleaning and Inspection** in Engine Mechanical 3.4L Unit Repair.
21. If you are REPLACING the engine right side exhaust manifold, remove the exhaust gas recirculation (EGR) valve pipe.
22. If you are REPLACING the engine right side exhaust manifold, remove the Heated Oxygen Sensor (HO2S). Refer to **Heated Oxygen Sensor Replacement - Position 1** in

Engine Controls - 3.4L

Installation Procedure

1. If removed, install the Heated Oxygen Sensor (HO2S). Refer to **Heated Oxygen Sensor Replacement - Position 1** in Engine Controls - 3.4L.
2. If removed, install the exhaust gas recirculation (EGR) valve pipe.
3. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

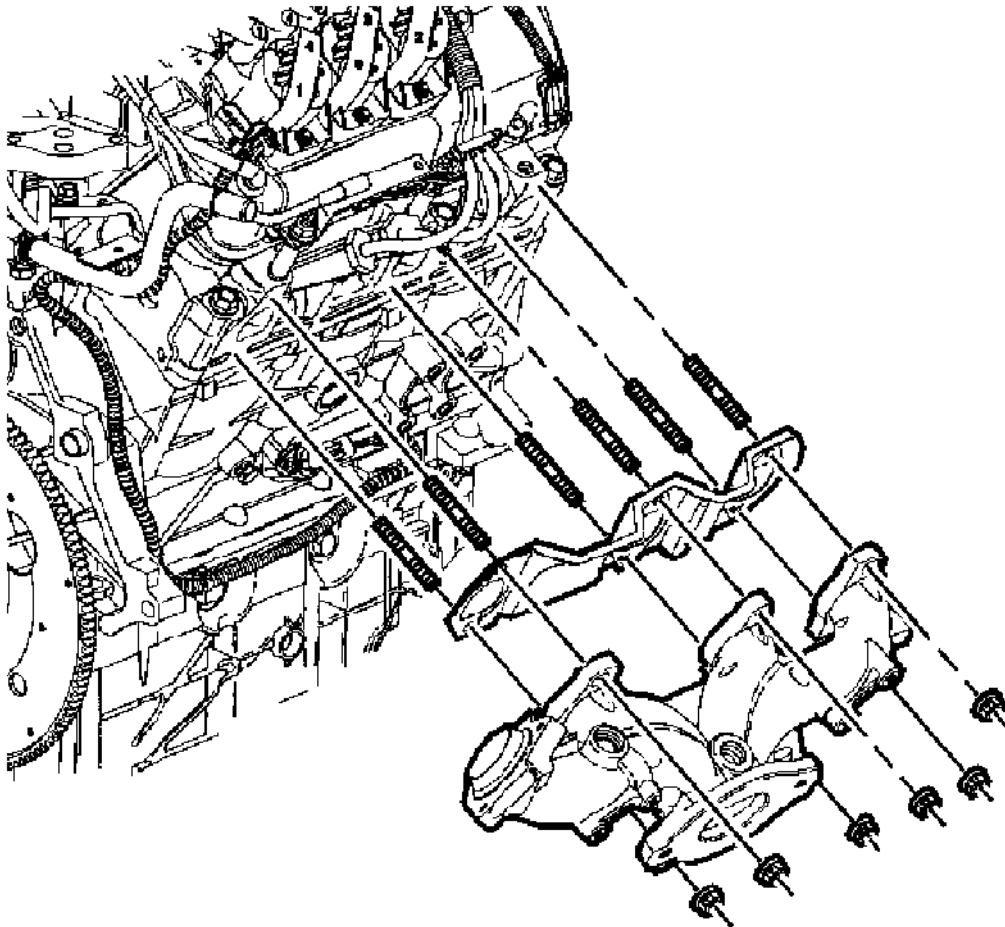


Fig. 13: Right Exhaust Manifold (3.4L)
Courtesy of GENERAL MOTORS CORP.

4. Install the exhaust manifold gasket.
5. Install the exhaust manifold.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the exhaust manifold nuts.

Tighten: Tighten the exhaust manifold nuts to 16 N.m (12 lb ft).

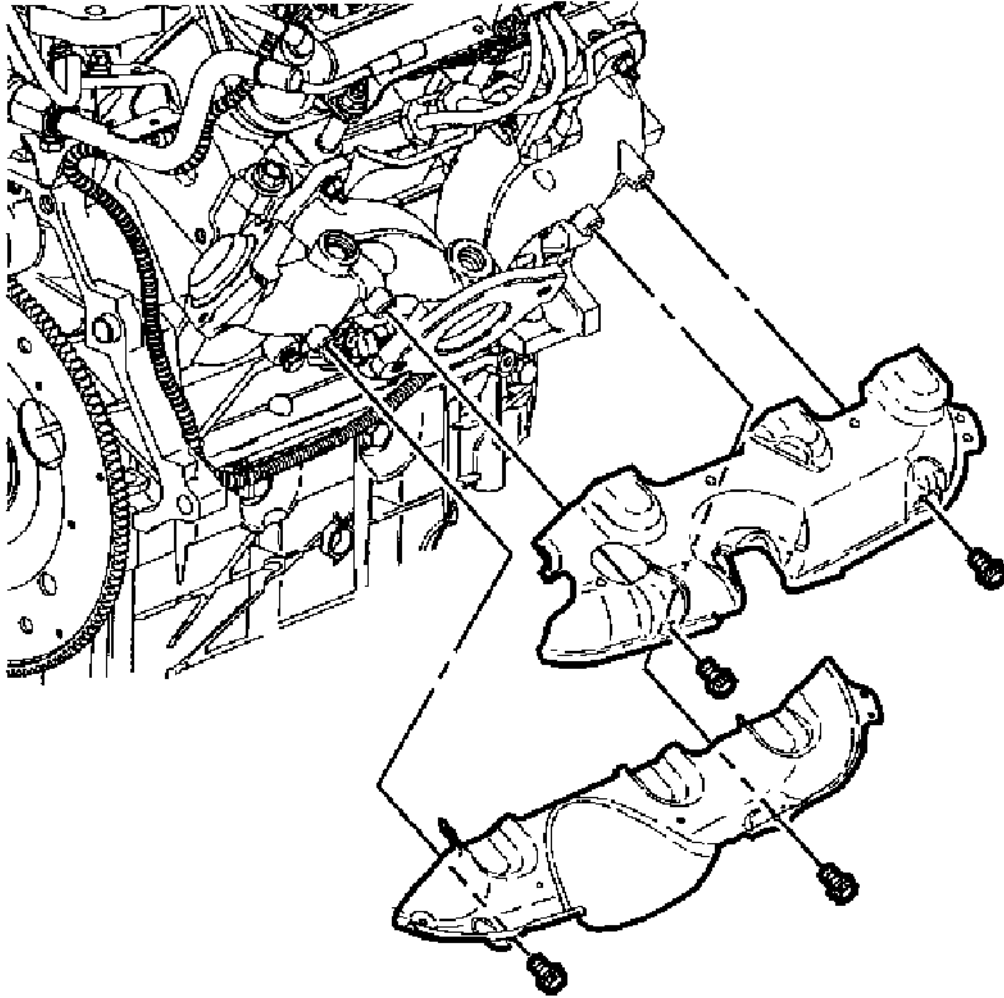


Fig. 14: View Of Right Exhaust Manifold Heat Shields & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Install the exhaust manifold lower heat shield.
8. Install the exhaust manifold upper heat shield.
9. Install the exhaust manifold heat shield bolts.

Tighten: Tighten the exhaust manifold heat shield bolts to 10 N.m (89 lb in).

10. Install the catalytic converter. Refer to **Catalytic Converter Replacement**.
11. Lower the vehicle.
12. Install the exhaust crossover pipe. Refer to **Exhaust Crossover Pipe Replacement (LA1)** or **Exhaust Crossover Pipe Replacement (LY7)**.
13. Install the exhaust crossover pipe heat shield. Refer to **Exhaust Crossover Pipe Replacement (LA1)** or **Exhaust Crossover Pipe Replacement (LY7)**.
14. Connect the Heated Oxygen Sensor (HO2S) electrical connector.
15. Install the EVAP solenoid bracket.
16. Install the spark plug wires to the engine right bank spark plugs.
17. Install the ignition module and the ignition coils with the bracket.
18. Rotate the engine back to the original position. Refer to **Rotating the Engine for Service Access**.
19. Install the EGR valve to the intake manifold. Refer to **Exhaust Gas Recirculation (EGR) Valve Replacement** in Engine Controls - 3.4L.
20. Install the MAP sensor. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** in Engine Controls - 3.4L.
21. Install the accelerator cable bracket to the throttle body. Refer to **Accelerator Controls Cable Replacement** in Engine Controls - 3.4L.
22. Install the throttle body air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.4L.
23. Connect negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)** in Engine Electrical.

EXHAUST MANIFOLD REPLACEMENT - RIGHT (LY7)

Removal Procedure

1. Turn the ignition OFF.
2. Remove the air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.6L (LY7).
3. Remove the master cylinder fluid level sensor to provide clearance for lowering the powertrain. Refer to **Master Cylinder Fluid Level Sensor Replacement** in Hydraulic Brakes.
4. Disconnect the torque struts from the engine. Refer to and in Engine Mechanical - 3.6L (LY7).
5. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General

Information.

6. Disconnect the intermediate steering shaft from the steering gear. Refer to **Intermediate Steering Shaft Replacement** in Steering Wheel and Column.
7. Remove the catalytic converter. Refer to **Catalytic Converter Replacement**.

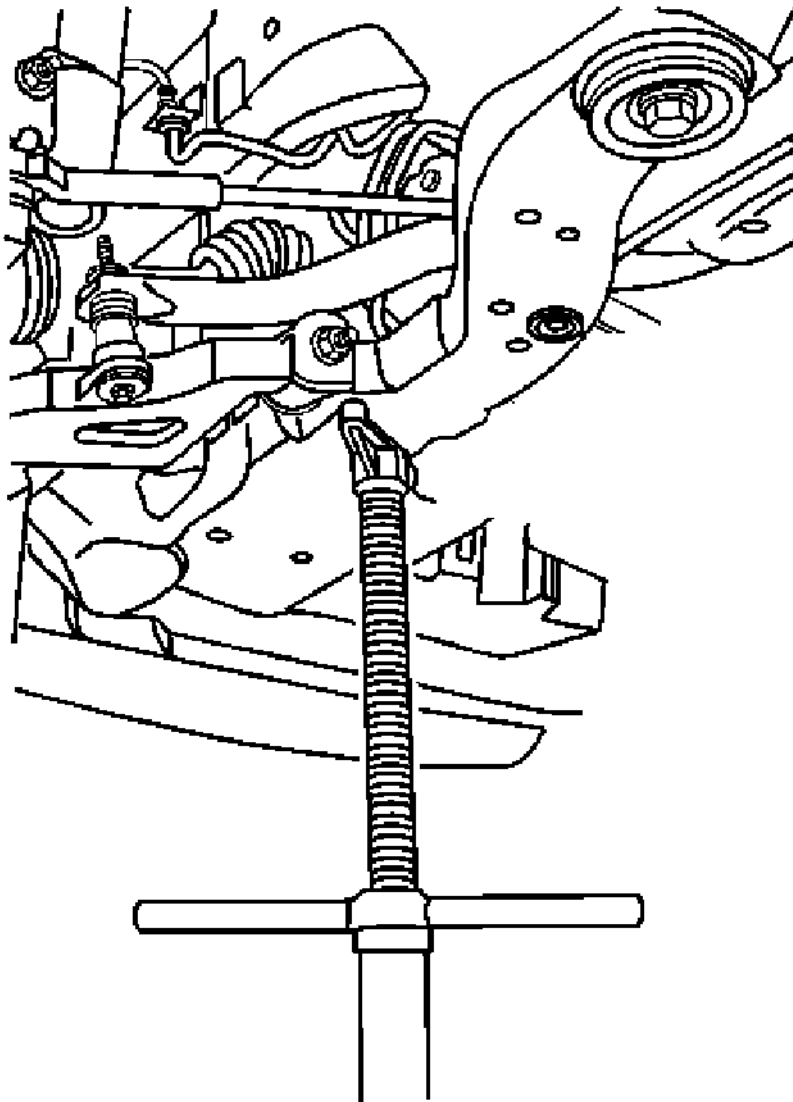


Fig. 15: Supporting Powertrain With Utility Stand At Center Of Left Frame
Courtesy of GENERAL MOTORS CORP.

8. Use a utility stand at the center of the left frame in order to support the powertrain.

9. Remove the front portion of the left front wheel liner in order to provide access to the frame bolt. Refer to **Front Fender Liner Replacement** in Body Front End.
10. Remove the two frame left side bolts only.
11. Raise the vehicle and/or lower the powertrain enough to access to the exhaust crossover pipe to right bank exhaust manifold nuts.

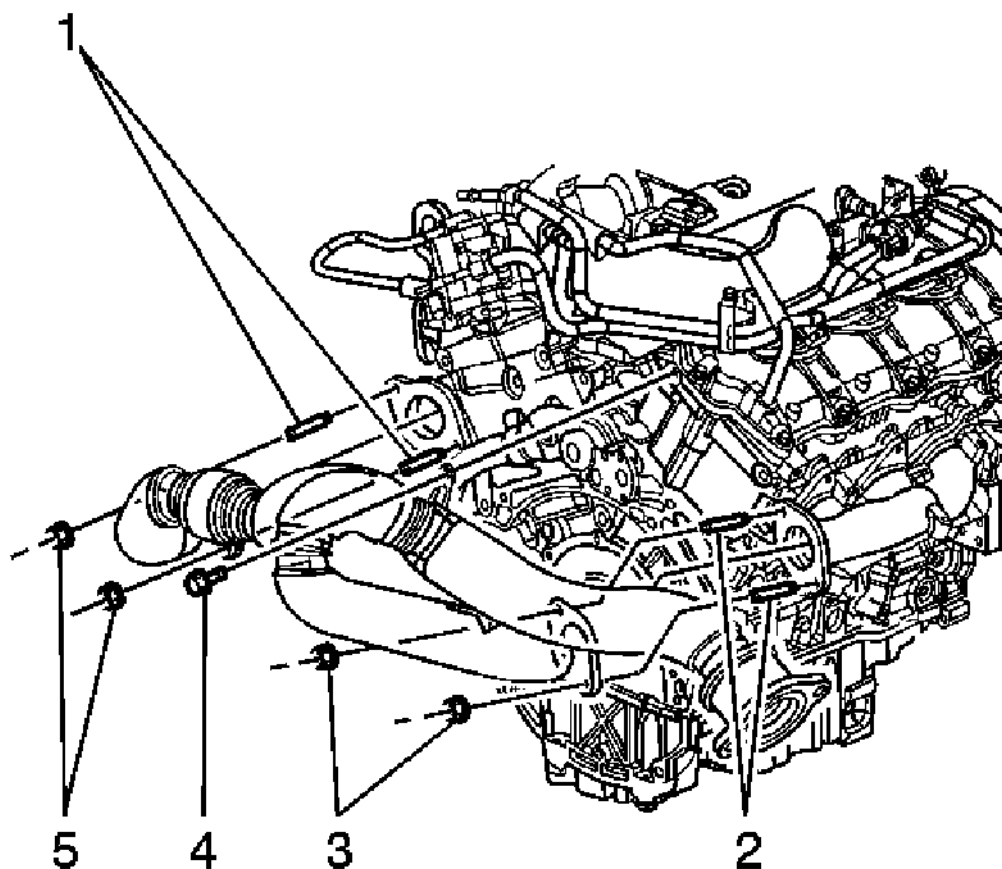


Fig. 16: Locating Exhaust Crossover Pipe To Left Bank Exhaust Manifold Nuts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use a long extension in order to remove the exhaust crossover pipe nuts.

12. Remove the exhaust crossover pipe to right bank exhaust manifold nuts (3).

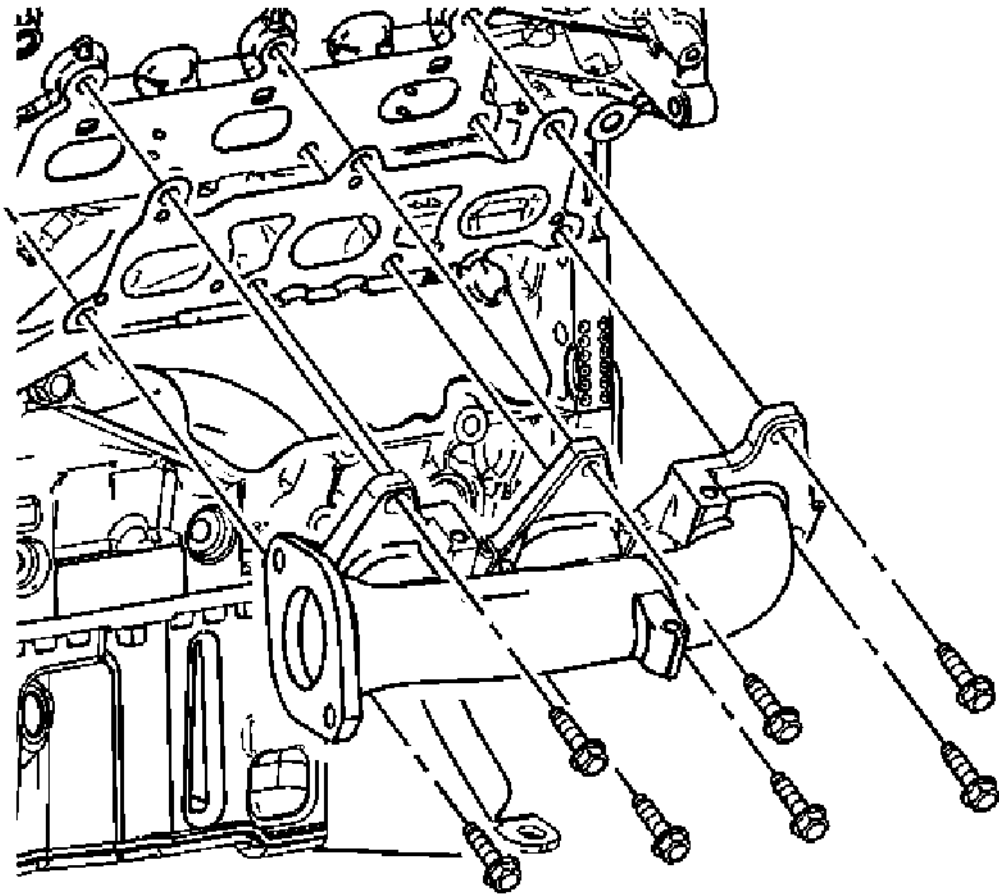


Fig. 17: Identifying Exhaust Manifold Bolts
Courtesy of GENERAL MOTORS CORP.

13. Remove the exhaust manifold bolts.
14. Remove the exhaust manifold with the exhaust manifold heat shield.
15. Remove and discard the exhaust manifold gasket.

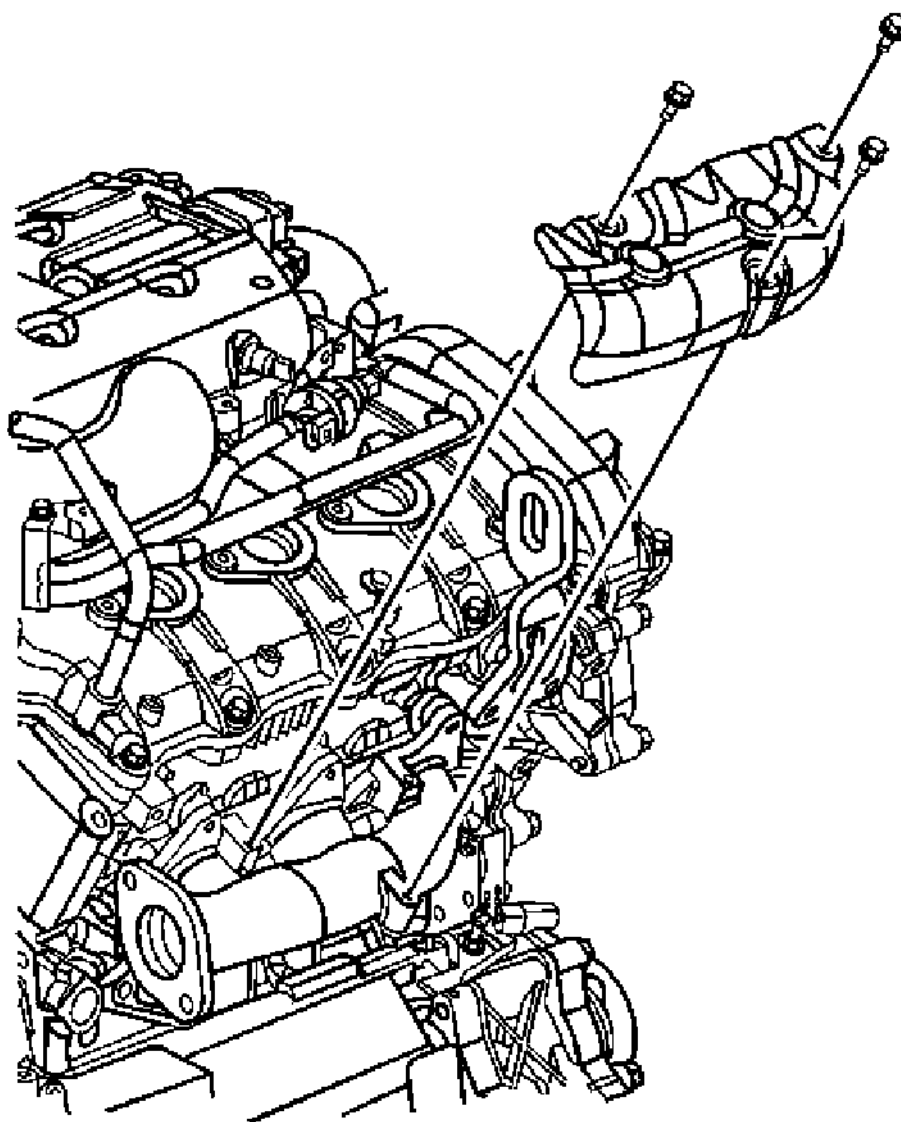


Fig. 18: View Of Exhaust Manifold Heat Shield Bolts And The Heat Shield
Courtesy of GENERAL MOTORS CORP.

16. If the exhaust manifold is being replaced, remove the exhaust manifold heat shield bolts and the heat shield.
17. Clean and inspect the exhaust manifold and the sealing surfaces. Refer to **Exhaust Manifold Cleaning and Inspection - Right** in Engine Mechanical - 3.6L (LY7).

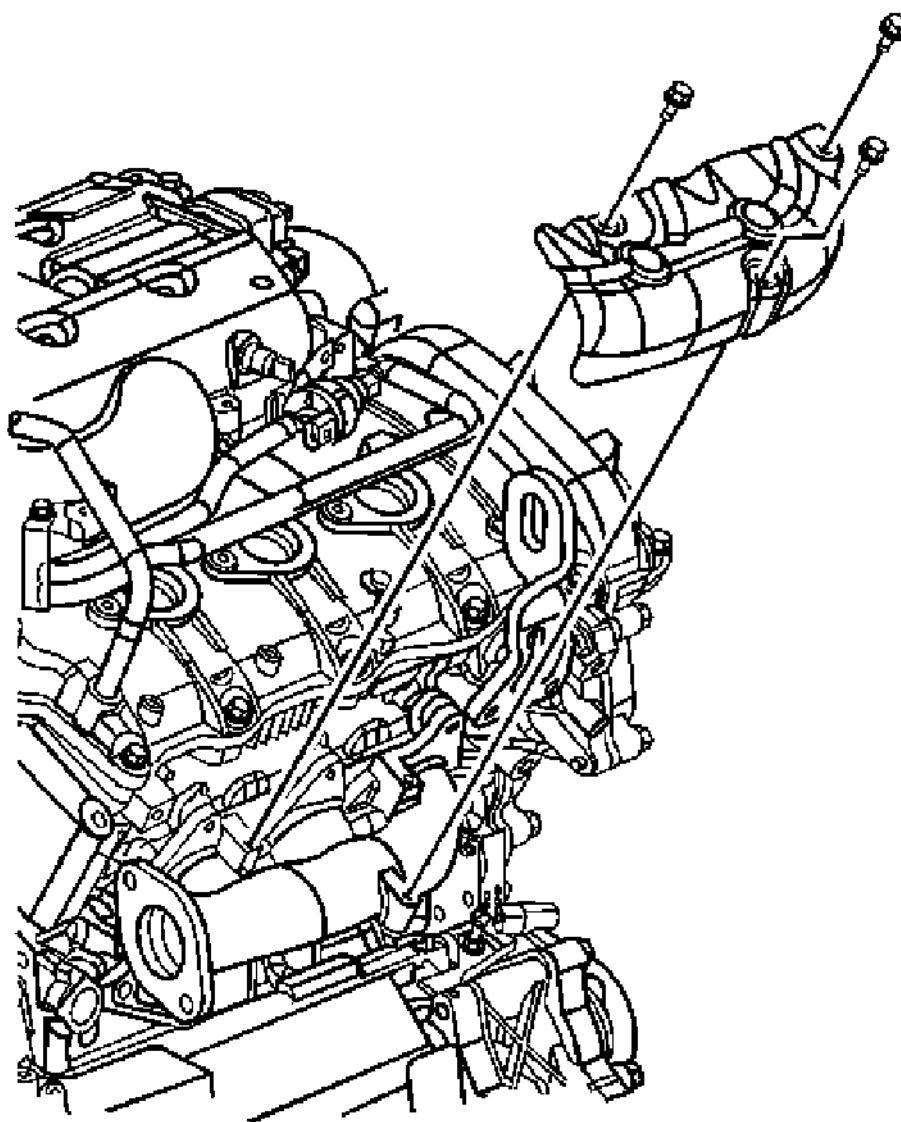


Fig. 19: View Of Exhaust Manifold Heat Shield Bolts And The Heat Shield
Courtesy of GENERAL MOTORS CORP.

1. Install the exhaust manifold heat shield to the exhaust manifold as necessary.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the exhaust manifold heat shield bolts.

Tighten: Tighten the exhaust manifold heat shield bolts to 10 N.m (89 lb in).

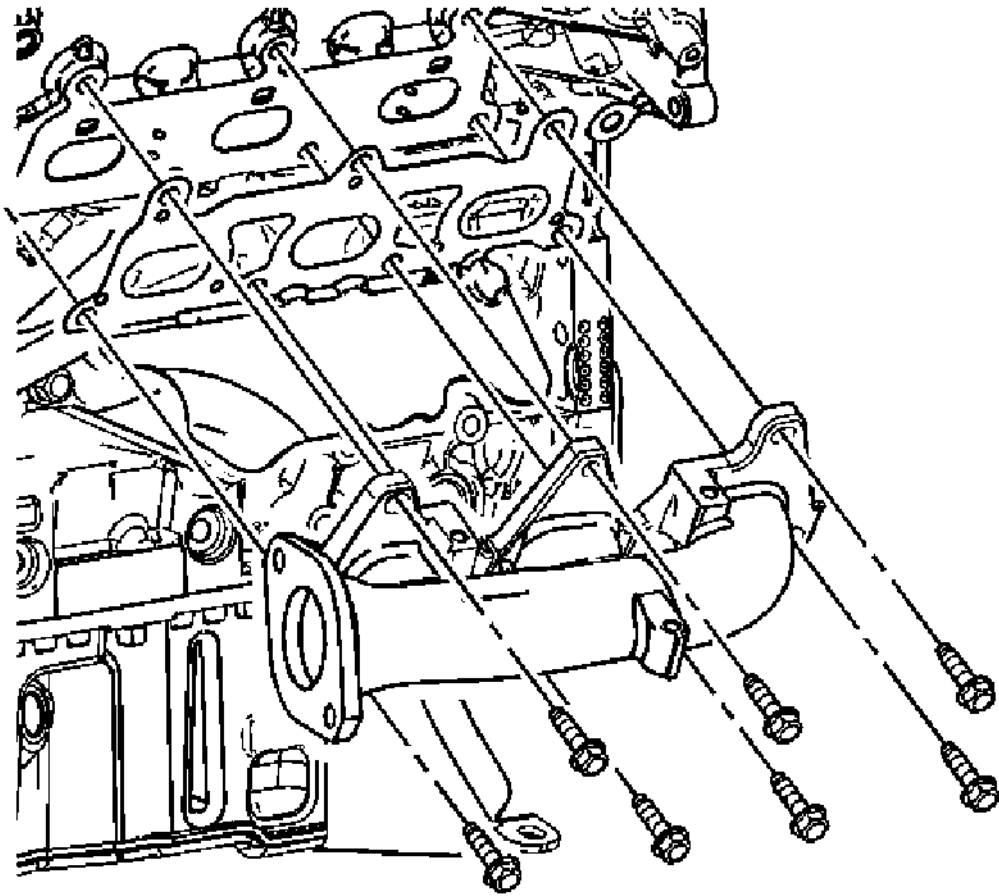


Fig. 20: Identifying Exhaust Manifold Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the NEW exhaust manifold gasket.
4. Install the exhaust manifold.
5. Install the exhaust manifold bolts.

Tighten: Tighten the exhaust manifold bolts to 20 N.m (15 lb ft).

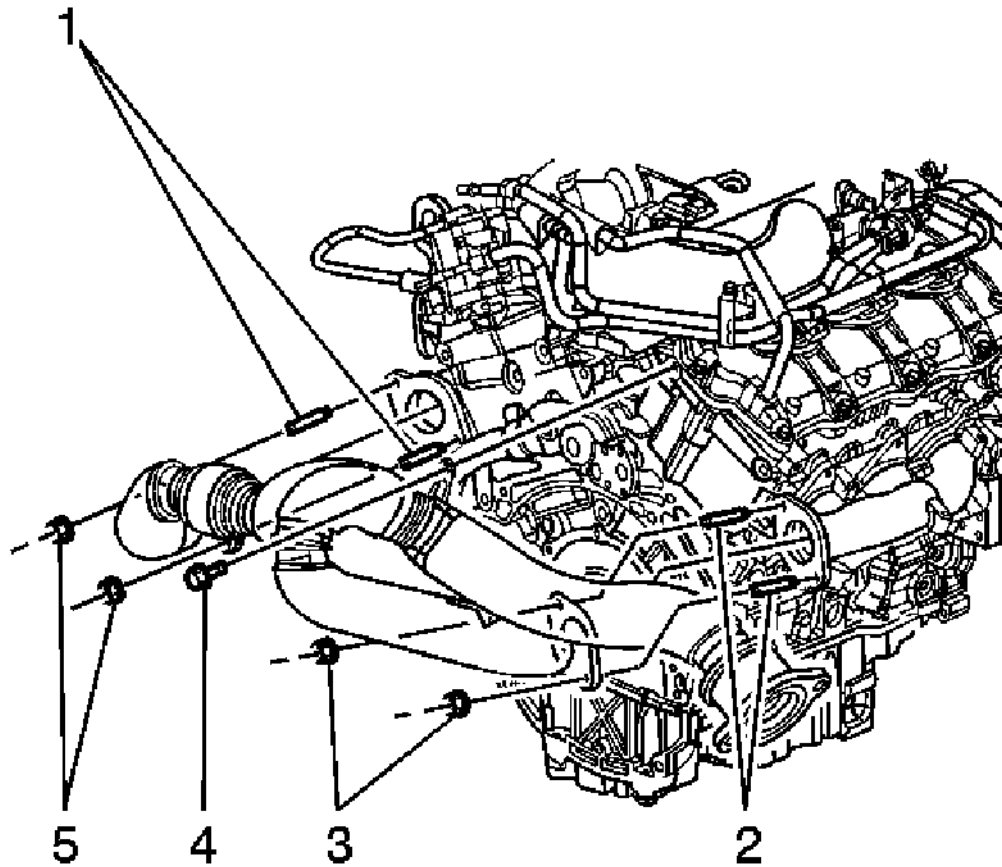


Fig. 21: Locating Exhaust Crossover Pipe To Left Bank Exhaust Manifold Nuts
Courtesy of GENERAL MOTORS CORP.

6. Install the exhaust crossover pipe to right bank exhaust manifold nuts (3). Refer to **Exhaust Crossover Pipe Replacement (LA1)** or **Exhaust Crossover Pipe Replacement (LY7)**.
7. Raise the powertrain and/or lower the vehicle until the frame insulators contact the chassis.
8. Install the two frame left side bolts. Refer to **Frame Replacement - Front (W/AWD)** or **Frame Replacement - Front (W/FWD)** in Frame and Underbody.
9. Install the left front wheel liner. Refer to **Front Fender Liner Replacement** in Body Front End.
10. Remove the utility stand.
11. Install the catalytic converter. Refer to **Catalytic Converter Replacement**.
12. Connect the intermediate steering shaft to the steering gear. Refer to **Intermediate**

Steering Shaft Replacement in Steering Wheel and Column.

13. Lower the vehicle.
14. Connect the torque struts to the engine. Refer to and in Engine Mechanical - 3.6L (LY7).
15. Install the master cylinder fluid level sensor. Refer to **Master Cylinder Fluid Level Sensor Replacement** in Hydraulic Brakes.
16. Install the air inlet duct. Refer to **Air Cleaner Intake Duct Replacement** in Engine Controls - 3.6L (LY7).

EXHAUST CROSSOVER PIPE REPLACEMENT (LA1)

Removal Procedure

1. Disconnect the battery ground (negative) cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable Disconnect/Connect Procedure (LY7)** in Engine Electrical.
2. Remove the throttle body air inlet duct.
3. Drain the coolant from the cooling system. Refer to **Draining and Filling Cooling System** in Engine Cooling.
4. Remove the inlet radiator hose from the engine. Refer to **Radiator Hose Replacement - Inlet (LA1)** or **Radiator Hose Replacement - Inlet (LY7)** in Engine Cooling.
5. Remove the thermostat bypass pipe. Refer to **Thermostat Bypass Pipes Replacement** in Engine Cooling.

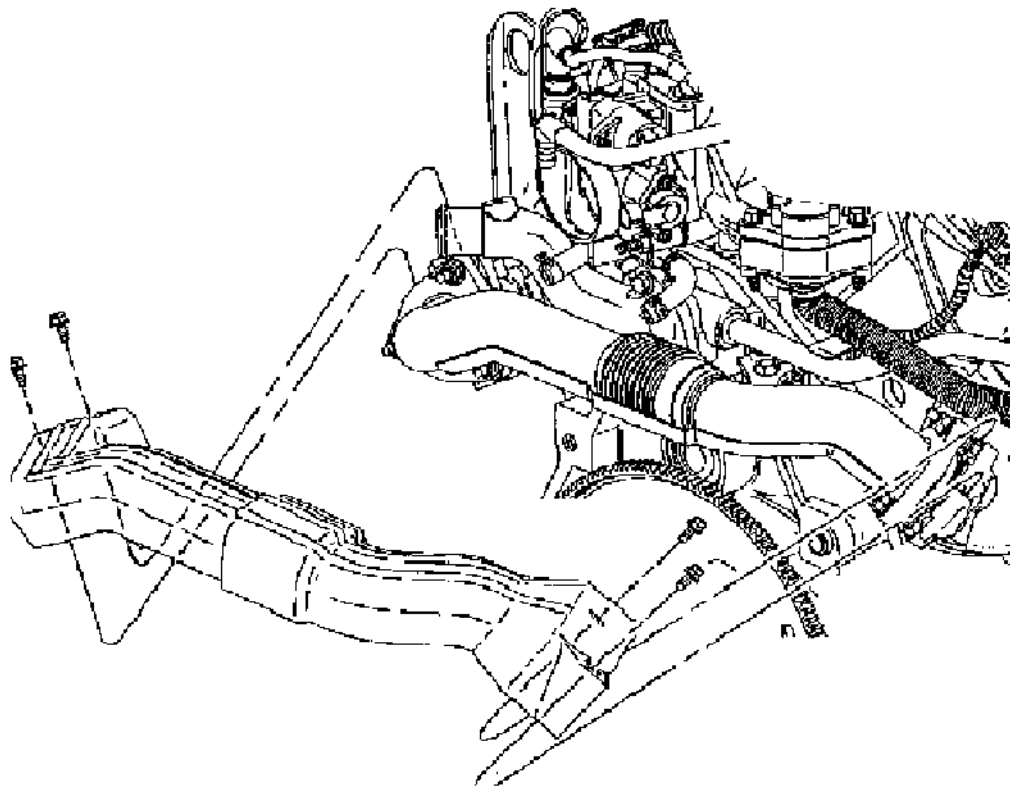


Fig. 22: Locating Exhaust Crossover Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

6. Remove the exhaust crossover heat shield bolts.
7. Remove the exhaust crossover heat shield.

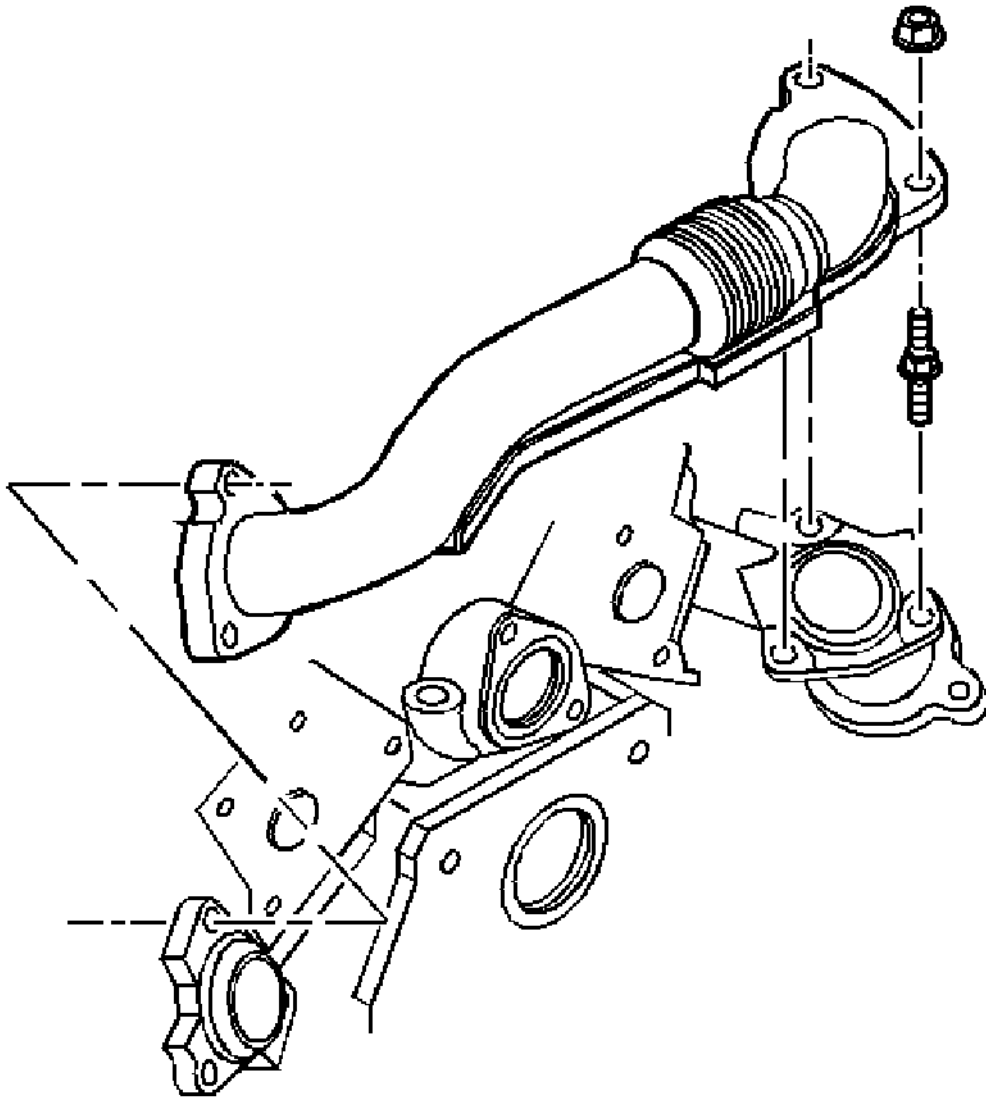


Fig. 23: Identifying Exhaust Crossover Pipe Studs/Nuts
Courtesy of GENERAL MOTORS CORP.

8. Remove the exhaust crossover pipe studs/nuts.
9. Remove the exhaust crossover pipe.

Installation Procedure

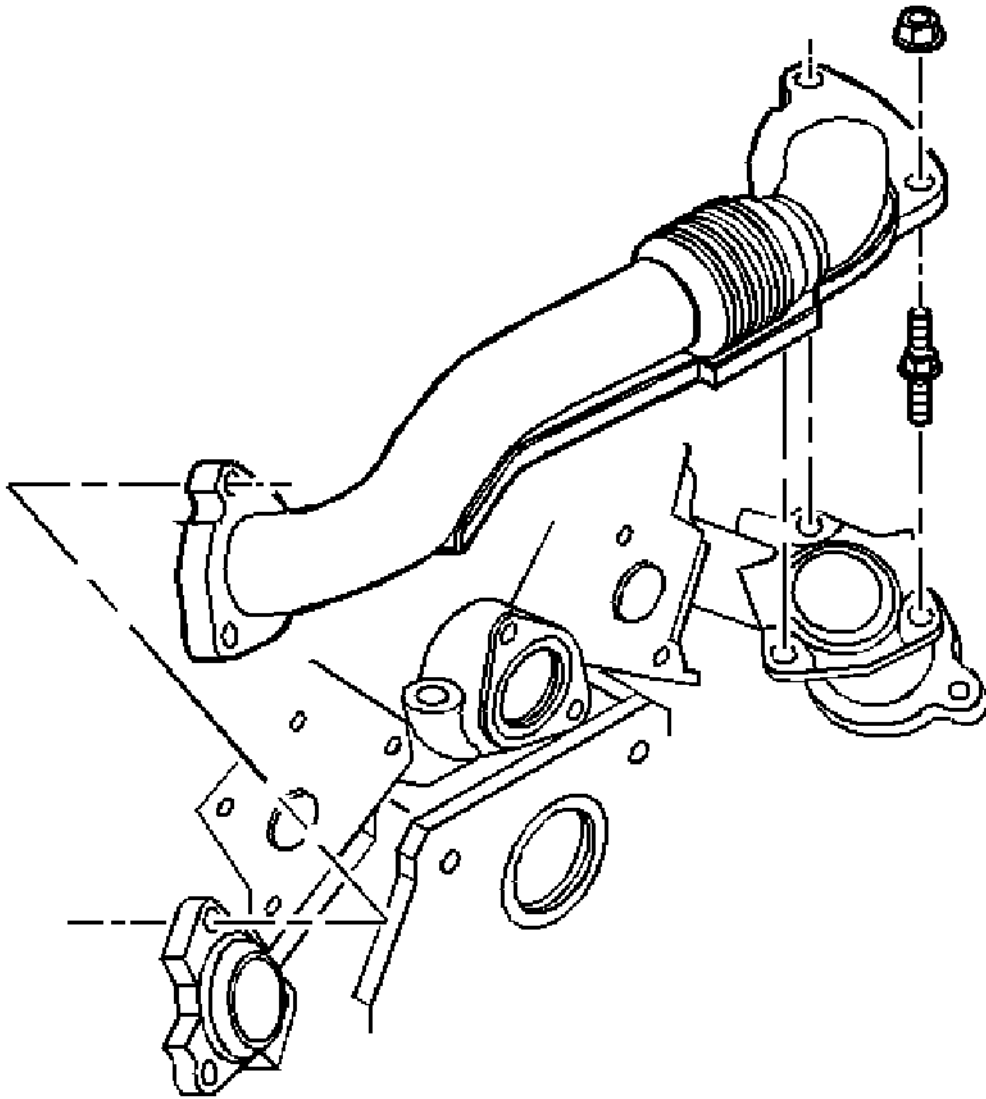


Fig. 24: Identifying Exhaust Crossover Pipe Studs/Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the exhaust crossover pipe.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the exhaust crossover pipe studs/nuts.

Tighten: Tighten the exhaust crossover pipe studs/nuts to 25 N.m (18 lb ft).

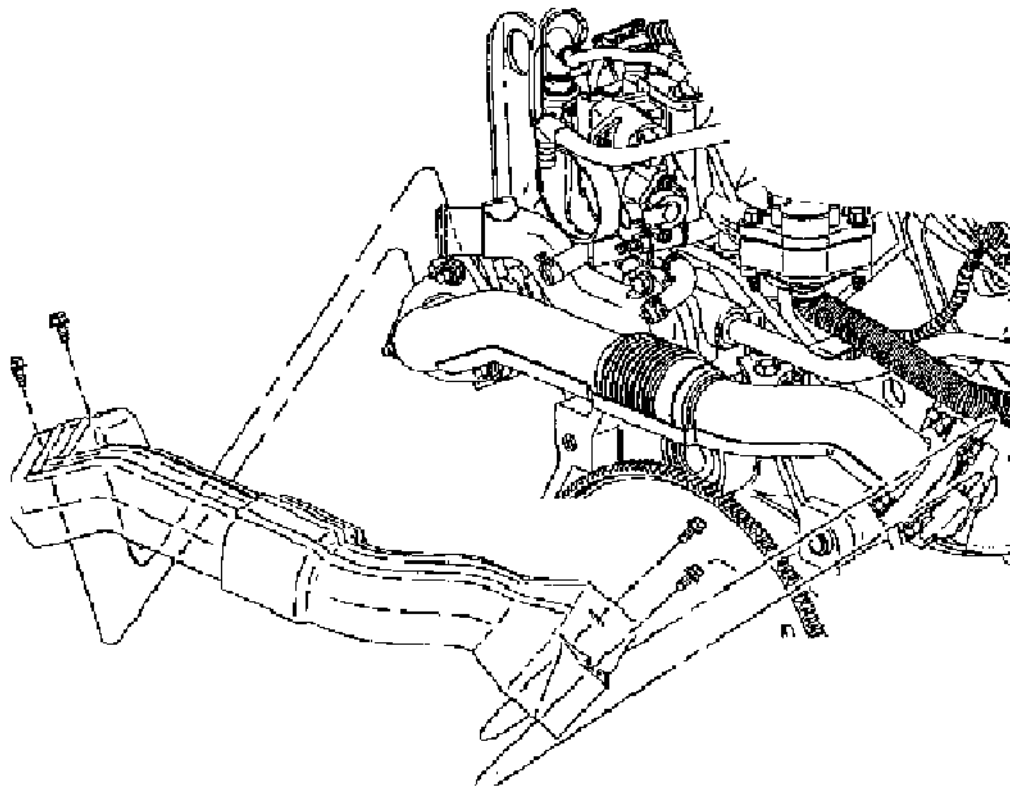


Fig. 25: Locating Exhaust Crossover Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the exhaust crossover heat shield.
4. Install the exhaust crossover heat shield bolts.

Tighten: Tighten the exhaust crossover heat shield bolts to 10 N.m (89 lb in).

5. Install the thermostat bypass pipe. Refer to **Thermostat Bypass Pipes Replacement** in Engine Cooling.
6. Install the inlet radiator hose to the engine. Refer to **Radiator Hose Replacement - Inlet (LA1)** or **Radiator Hose Replacement - Inlet (LY7)** in Engine Cooling.
7. Fill the cooling system with engine coolant. Refer to **Draining and Filling Cooling System** in Engine Cooling.
8. Install the throttle body air inlet duct.
9. Connect the battery ground (negative) cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (LA1)** or **Battery Negative Cable**

Disconnect/Connect Procedure (LY7) in Engine Electrical.

EXHAUST CROSSOVER PIPE REPLACEMENT (LY7)

Removal Procedure

1. Remove the powertrain engine, transmission, and frame assembly from the vehicle. Refer to **Engine Replacement** in Engine Mechanical - 3.6L (LY7).

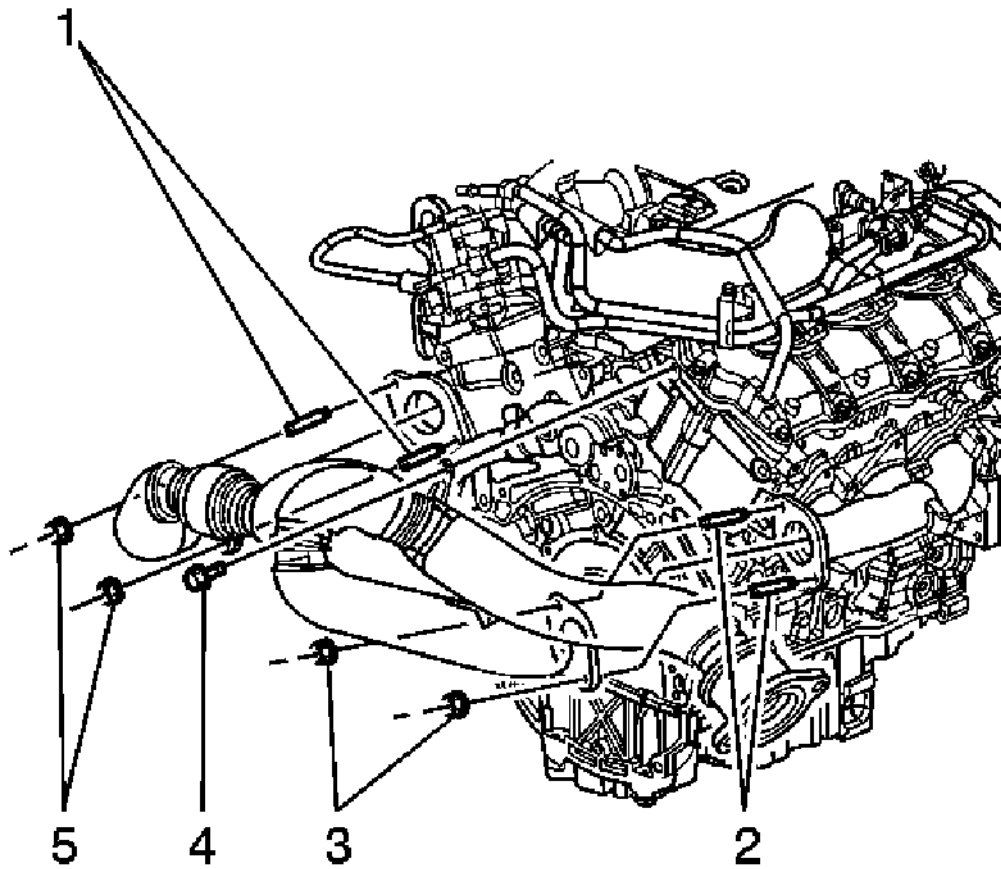


Fig. 26: Locating Exhaust Crossover Pipe To Left Bank Exhaust Manifold Nuts
Courtesy of GENERAL MOTORS CORP.

2. Remove the exhaust crossover pipe nuts (3, 5) and bolt (4).
3. Remove the exhaust crossover pipe.
4. Inspect the exhaust crossover pipe seal. Replace the exhaust crossover pipe seal only if it is excessively worn or damaged.

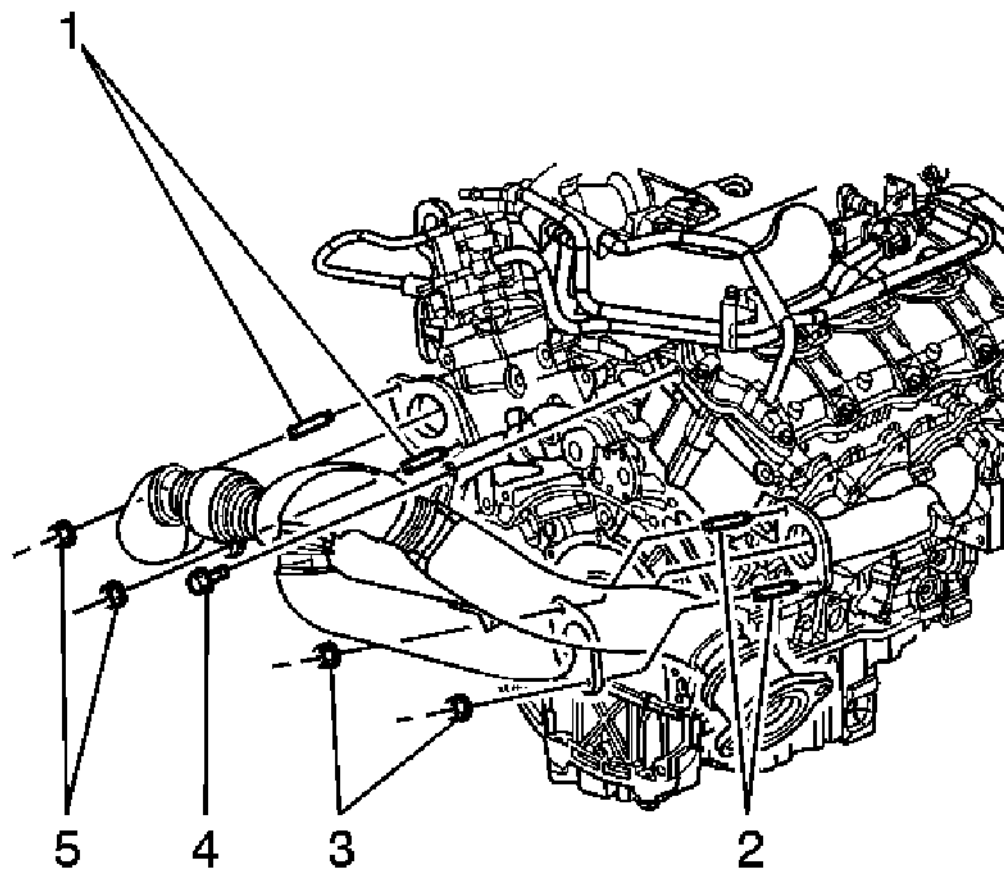


Fig. 27: Locating Exhaust Crossover Pipe To Left Bank Exhaust Manifold Nuts
Courtesy of GENERAL MOTORS CORP.

1. Install the exhaust crossover pipe.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Loosely install the exhaust crossover pipe nuts (3, 5) and bolt (4).

Tighten: Tighten the exhaust crossover pipe nuts (3, 5) to 34 N.m (25 lb ft).

3. Install the exhaust crossover pipe bolt (4).

Tighten: Tighten the exhaust crossover pipe bolt (4) to 34 N.m (25 lb ft).

4. Install the powertrain engine, transmission, and frame assembly to the vehicle. Refer to **Engine Replacement** in Engine Mechanical - 3.6L (LY7).

EXHAUST SEAL REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Use a utility stand to support the catalytic converter.
3. Disconnect the oxygen sensor electrical connector.

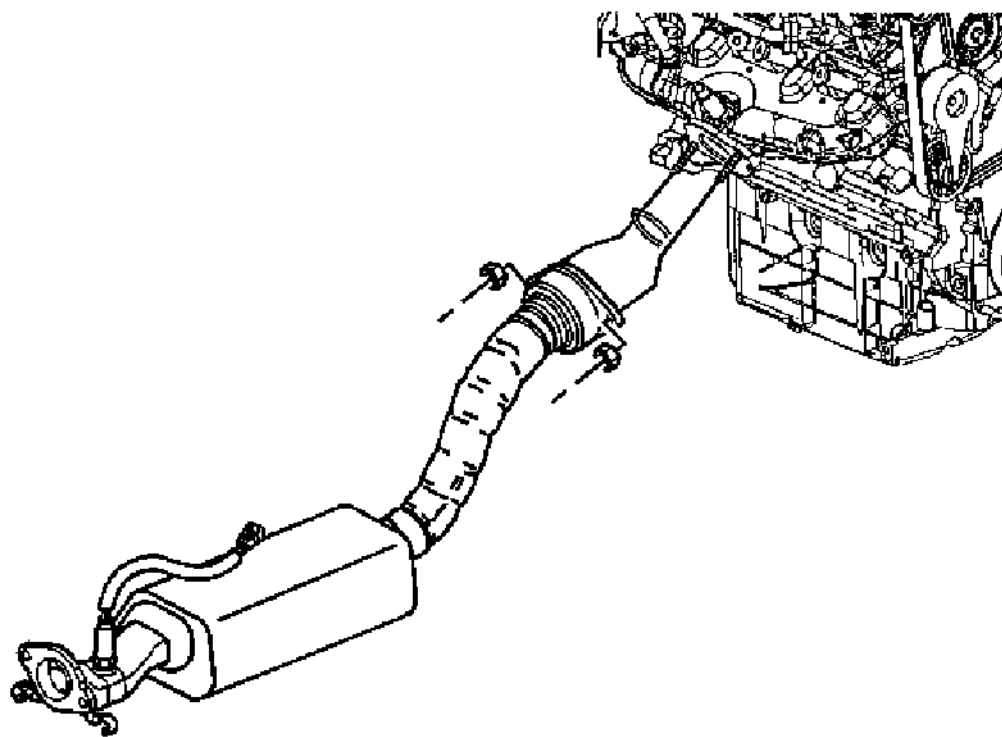


Fig. 28: Identifying Catalytic Converter Nuts
Courtesy of GENERAL MOTORS CORP.

NOTE: To prevent internal damage to the flexible coupling of the catalytic converter assembly, the converter must be supported. The vertical movement at the rear of the catalytic converter assembly must not exceed 6 degrees up or down.

4. Remove the catalytic converter nuts from the exhaust manifold.
5. Disconnect the catalytic converter from the catalytic converter hangers.
6. Reposition the exhaust system in order to access the exhaust seal.

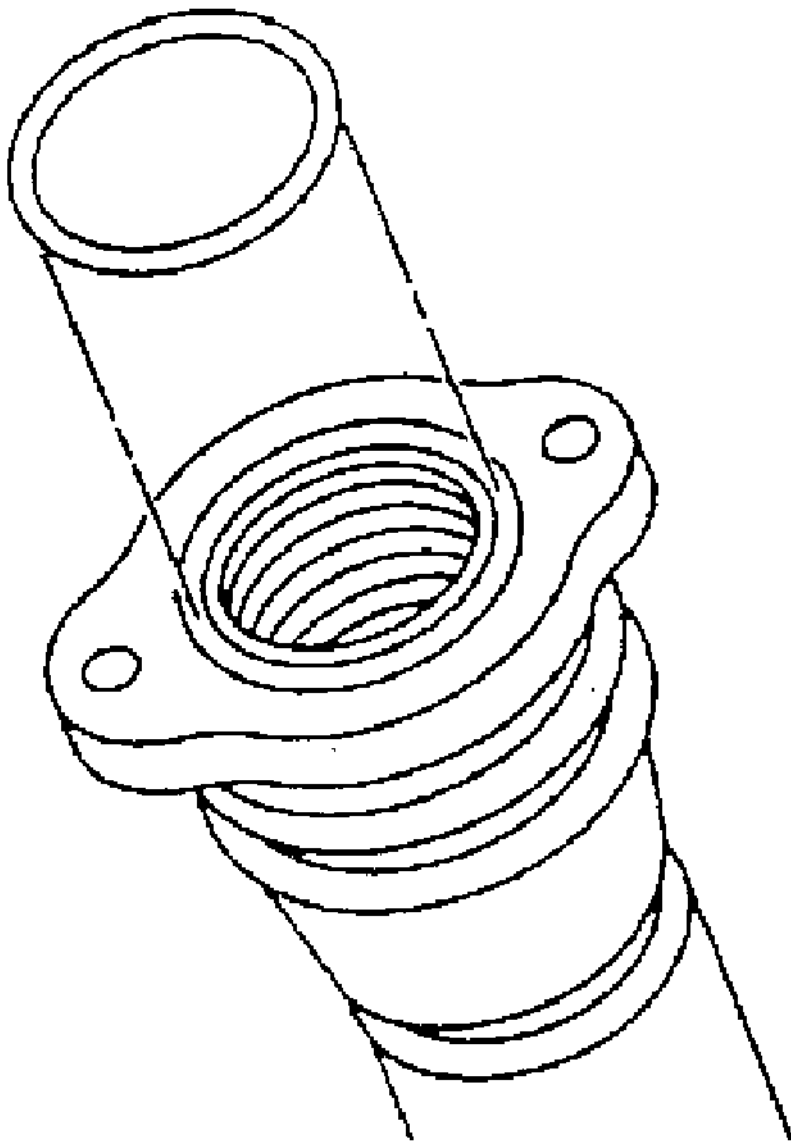


Fig. 29: Exhaust Manifold Pipe Gasket
Courtesy of GENERAL MOTORS CORP.

7. Remove the catalytic converter seal.

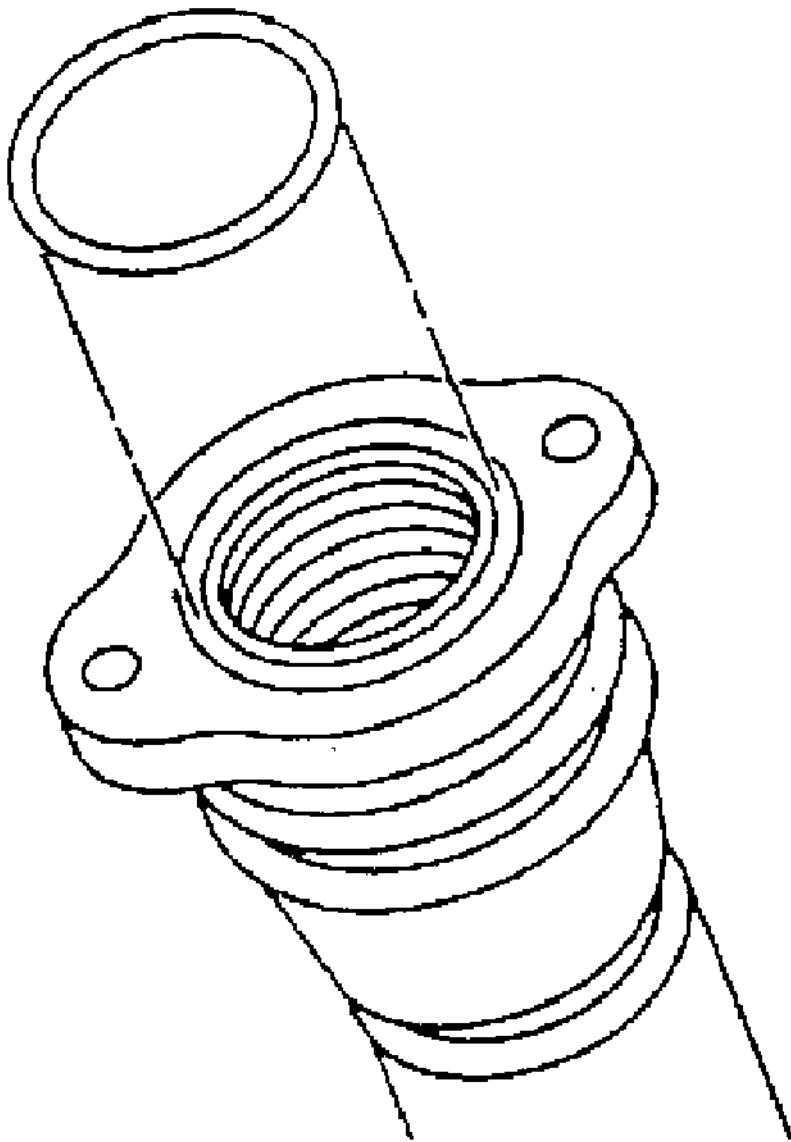


Fig. 30: Exhaust Manifold Pipe Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install the catalytic converter seal.

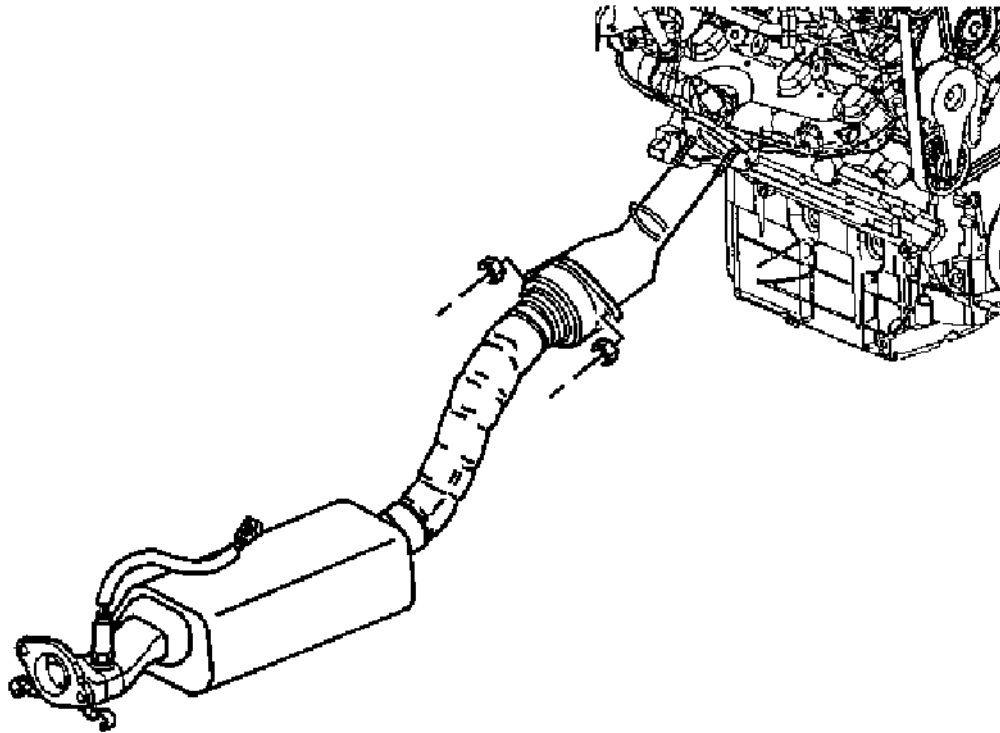


Fig. 31: Identifying Catalytic Converter Nuts
Courtesy of GENERAL MOTORS CORP.

2. Install the catalytic converter to the exhaust manifold.
3. Connect the catalytic converter to the catalytic converter hangers.
4. Remove the utility stand.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Install the catalytic converter nuts.

Tighten: Tighten the catalytic converter nuts to 34 N.m (25 lb ft).

6. Install the oxygen sensor electrical connector.
7. Lower the vehicle.

CATALYTIC CONVERTER REPLACEMENT

Removal Procedure

NOTE: To prevent internal damage to the flexible coupling of the catalytic converter assembly, the converter must be supported. The vertical movement at the rear of the catalytic converter assembly must not exceed 6 degrees up or down.

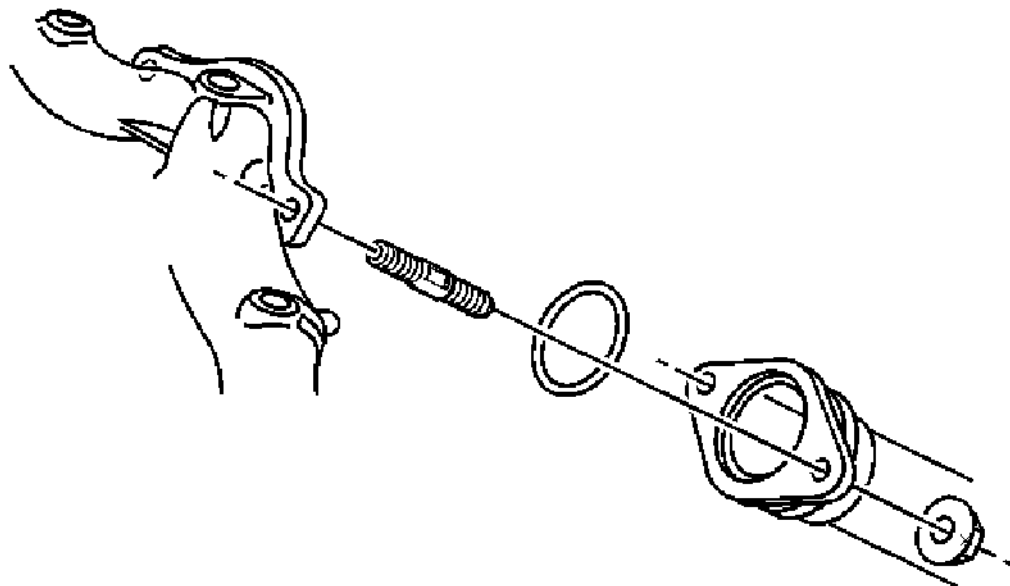


Fig. 32: Exhaust Manifold Pipe Stud
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. If the vehicle is equipped with All-Wheel-Drive, remove the propeller shaft. Refer to **Propeller Shaft Replacement** in Propeller Shaft.
3. Remove the catalytic converter nuts from the exhaust manifold studs.
4. Remove the oxygen sensor. Refer to **Heated Oxygen Sensor Replacement - Position 2** in Engine Controls - 3.4L.

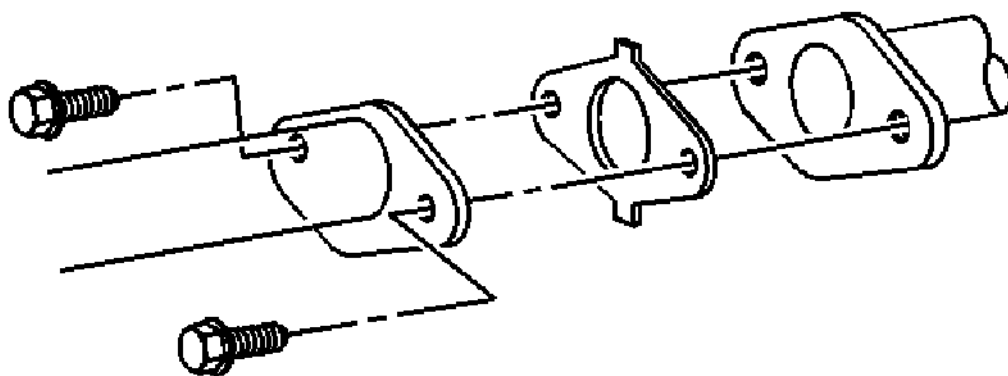


Fig. 33: View Of Catalytic Converter Bolts
Courtesy of GENERAL MOTORS CORP.

5. Remove the catalytic converter bolts.
6. Remove the catalytic converter.

Installation Procedure

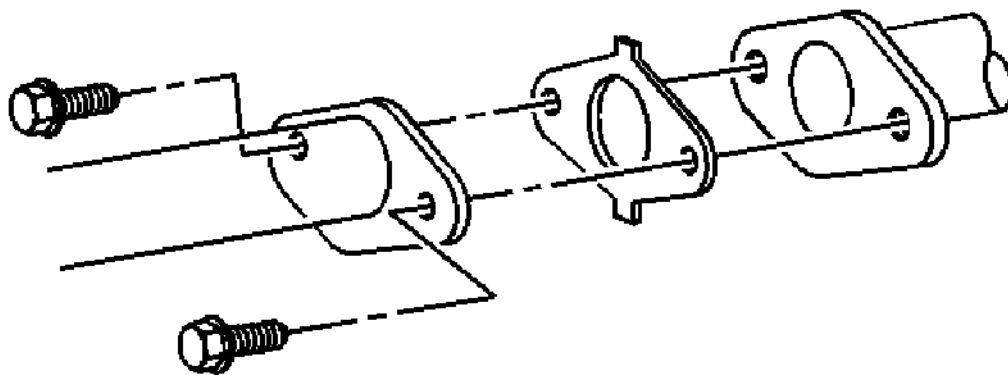


Fig. 34: View Of Catalytic Converter Bolts
Courtesy of GENERAL MOTORS CORP.

1. Position and support the catalytic converter under the vehicle.
2. Install a new catalytic converter gasket.

3. Install the catalytic converter bolts. Do not tighten the bolts.

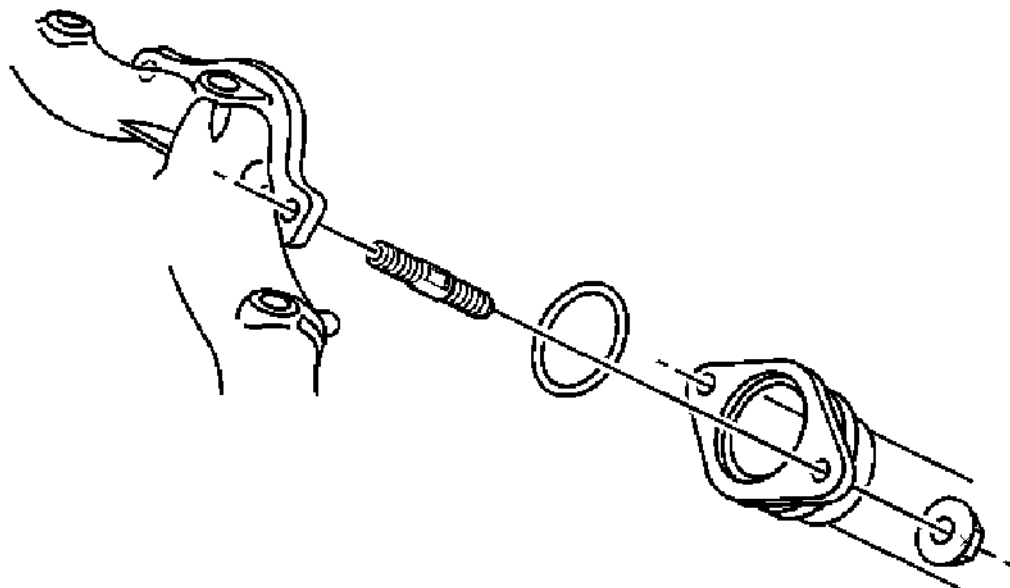


Fig. 35: Exhaust Manifold Pipe Stud
Courtesy of GENERAL MOTORS CORP.

4. Install a new catalytic converter seal.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Install the catalytic converter nuts.

Tighten:

1. Tighten the catalytic converter nuts to 34 N.m (25 lb ft).
 2. Tighten the catalytic converter bolts to 45 N.m (33 lb ft).
6. Install the oxygen sensor. Refer to **Heated Oxygen Sensor Replacement - Position 2** in Engine Controls - 3.4L.
 7. Lower the vehicle.

MUFFLER REPLACEMENT

Removal Procedure

NOTE: To prevent internal damage to the flexible coupling of the catalytic converter assembly, the converter must be supported. The vertical movement at the rear of the catalytic converter assembly must not exceed 6 degrees up or down.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Use a utility stand in order to support the catalytic converter.

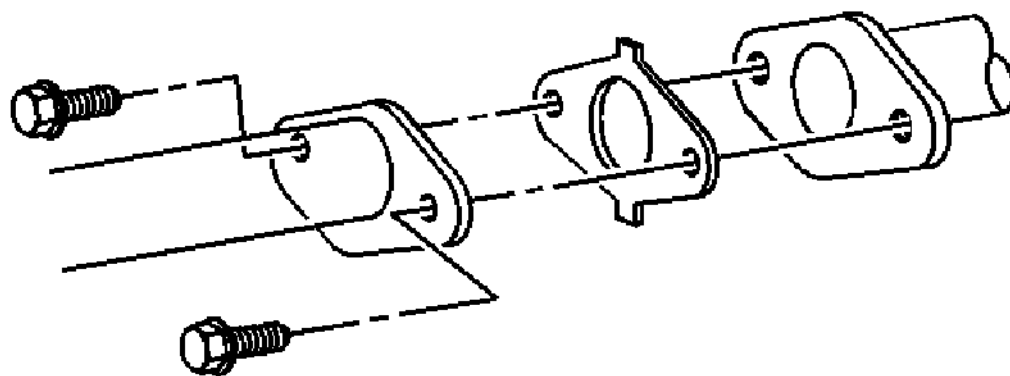


Fig. 36: View Of Catalytic Converter Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the catalytic converter bolts.
4. Remove the catalytic converter gasket.

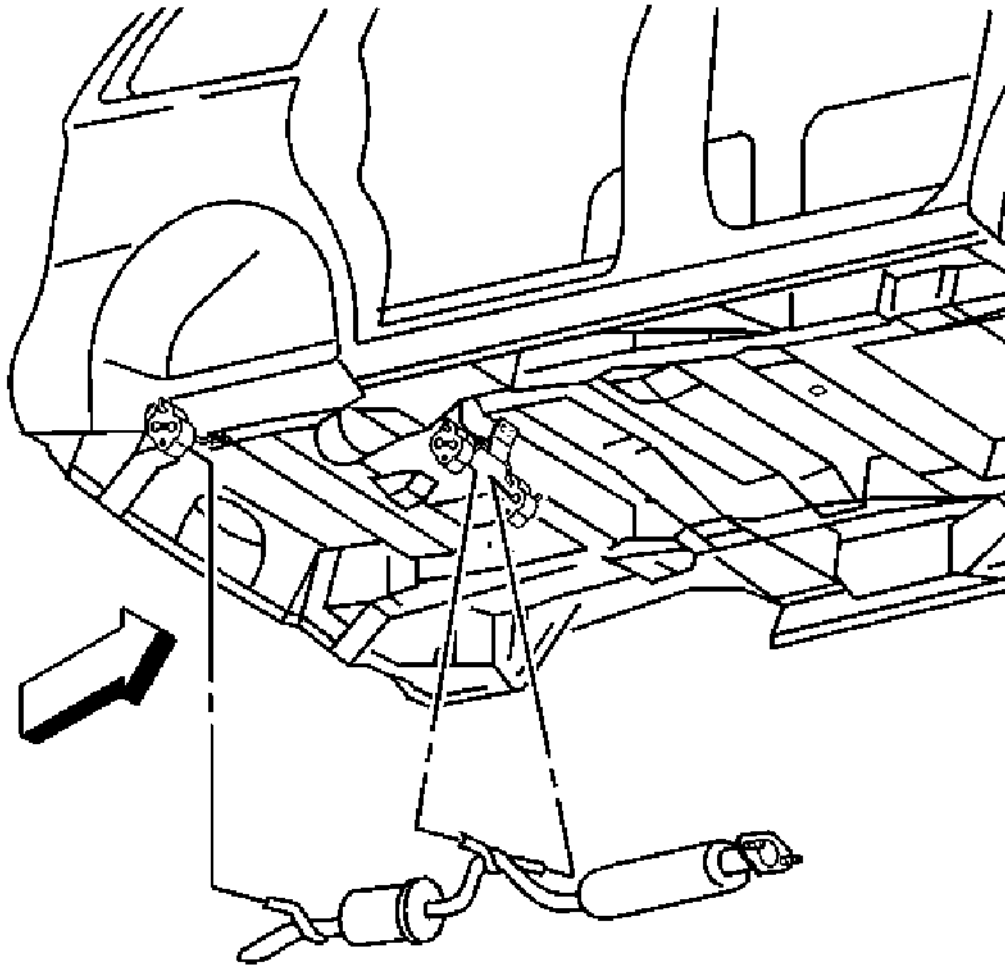


Fig. 37: Locating Exhaust Hanger Insulators
Courtesy of GENERAL MOTORS CORP.

5. Remove the exhaust hanger insulators from the muffler.
6. If the vehicle is equipped with All-Wheel-Drive (AWD), use a utility stand in order to support and lower the crossmember. Refer to **Crossmember Replacement** in Frame and Underbody.
7. Remove the muffler towards the front of the vehicle.
8. Clean the catalytic converter flange and the muffler flange.

Installation Procedure

1. Install the muffler over the rear axle and towards the rear of the vehicle.

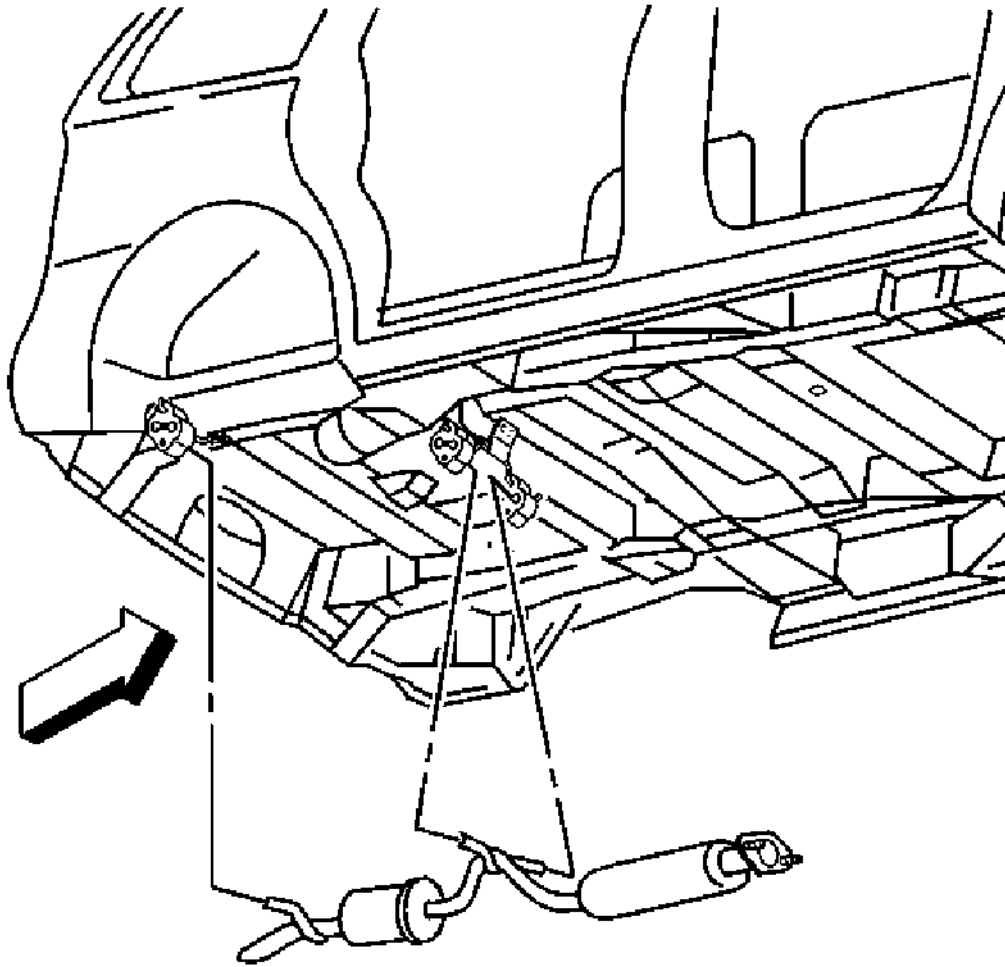


Fig. 38: Locating Exhaust Hanger Insulators
Courtesy of GENERAL MOTORS CORP.

2. Install the exhaust hanger insulators to the muffler.
3. If the vehicle is equipped with AWD, use the utility stand to raise and install the crossmember. Refer to **Crossmember Replacement** in Frame and Underbody.

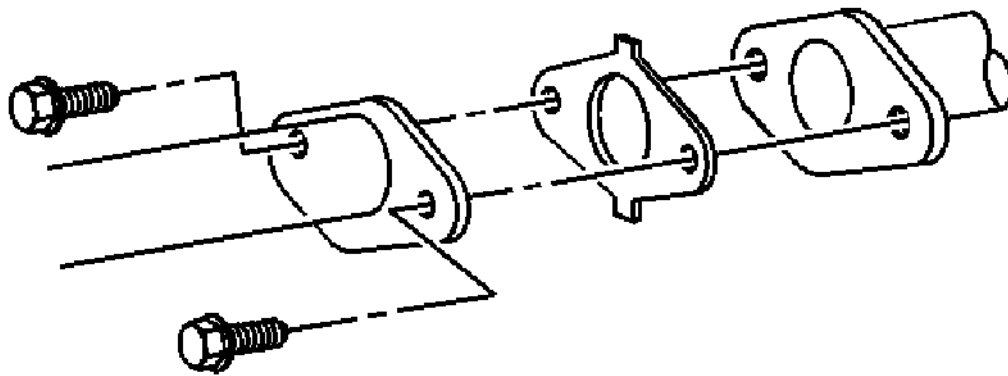


Fig. 39: View Of Catalytic Converter Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install a new catalytic converter gasket.

NOTE: Refer to Fastener Notice in Cautions and Notices.

5. Install the catalytic converter bolts.

Tighten: Tighten the catalytic converter bolts to 45 N.m (33 lb ft).

6. Lower the vehicle.

CONVERTER HANGER ASSEMBLY REPLACEMENT

Removal Procedure

1. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Remove the catalytic converter hanger insulators from the catalytic converter.

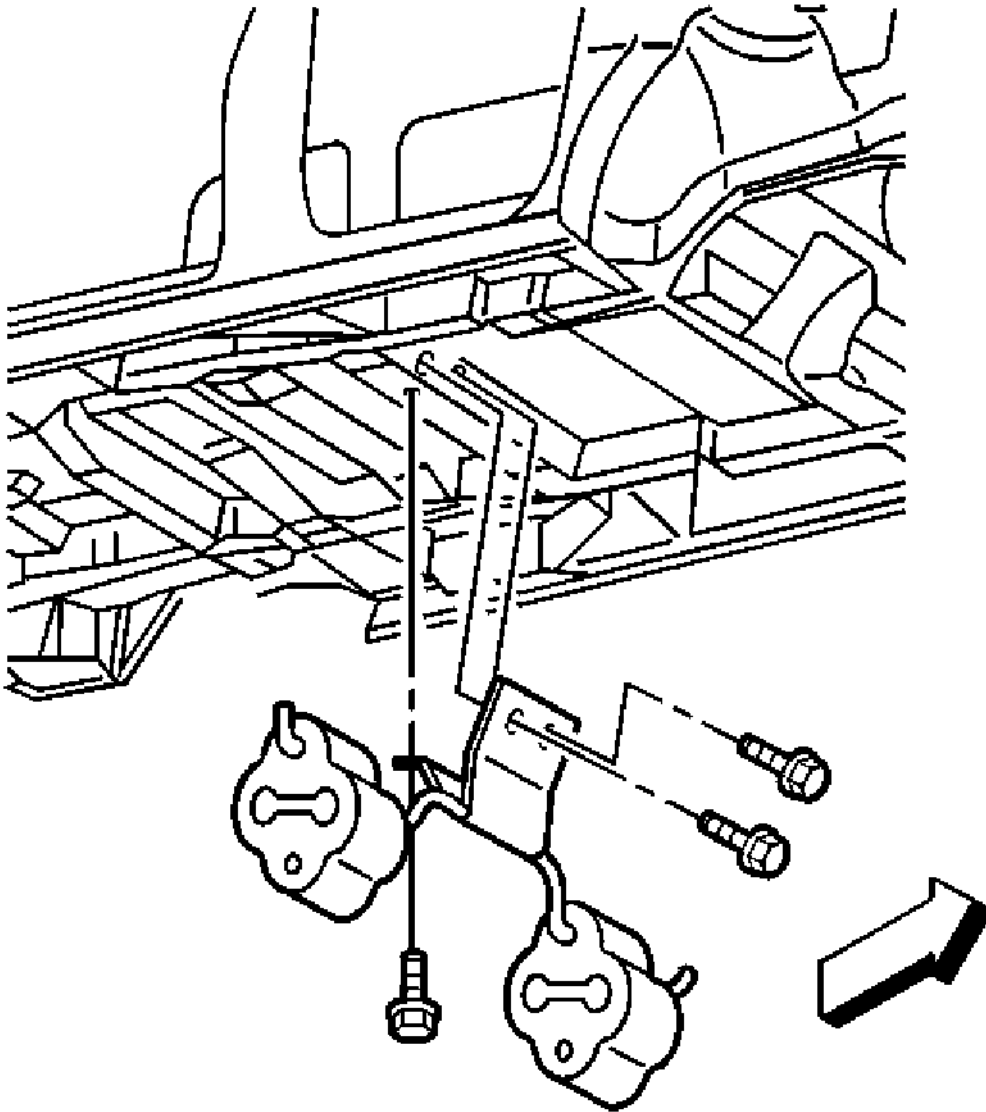


Fig. 40: Identifying Catalytic Converter Hanger Bolts
Courtesy of GENERAL MOTORS CORP.

3. Remove the catalytic converter hanger bolts.
4. Remove the catalytic converter hanger.

Installation Procedure

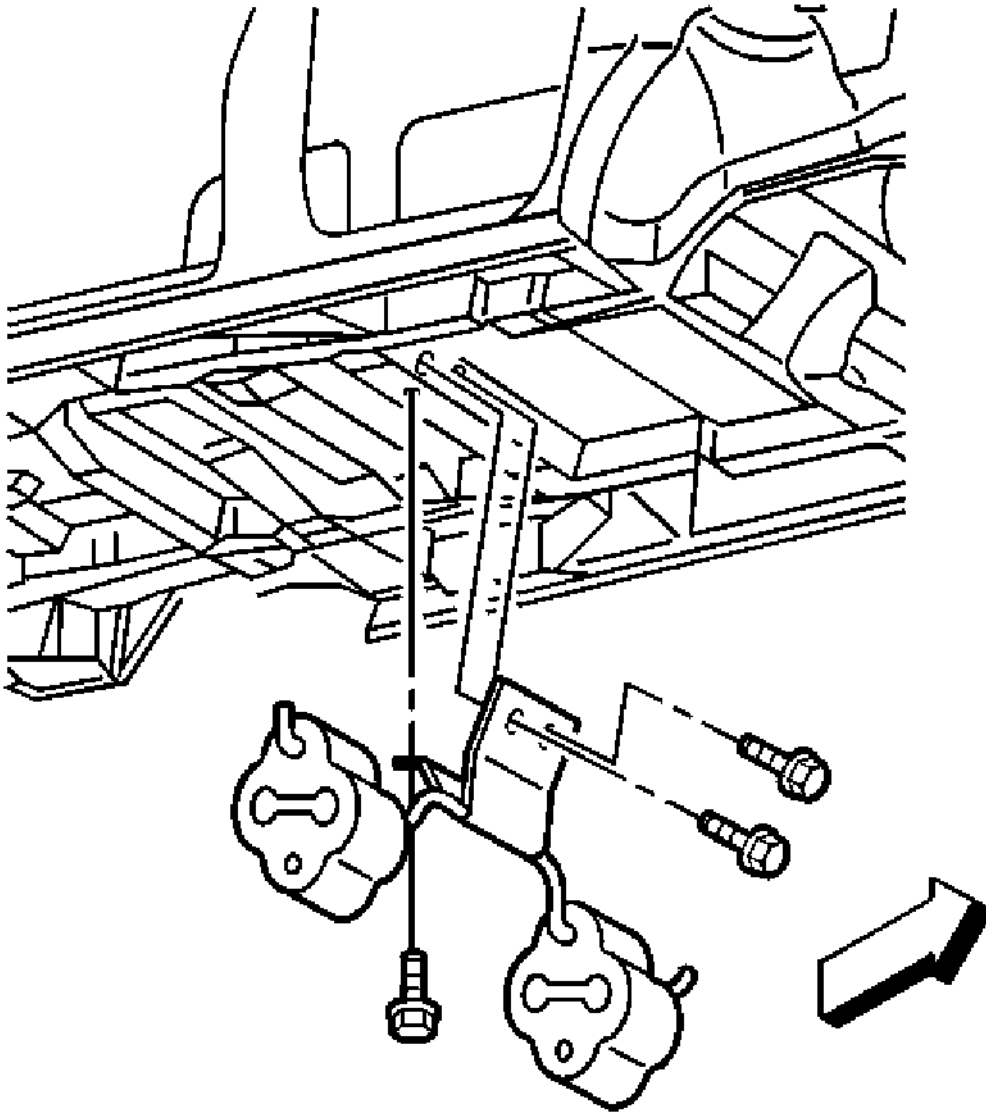


Fig. 41: Identifying Catalytic Converter Hanger Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the catalytic converter hanger.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the catalytic converter hanger bolts.

Tighten: Tighten the catalytic converter hanger bolts to 45 N.m (33 lb ft).

3. Install the catalytic converter hanger insulators to the catalytic converter.
4. Lower the vehicle.

CATALYTIC CONVERTER HEAT SHIELD REPLACEMENT

Removal Procedure

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the catalytic converter. Refer to **Catalytic Converter Replacement**.
3. Use a drill to remove the catalytic converter heat shield rivets.
4. Remove the catalytic converter heat shield.

Installation Procedure

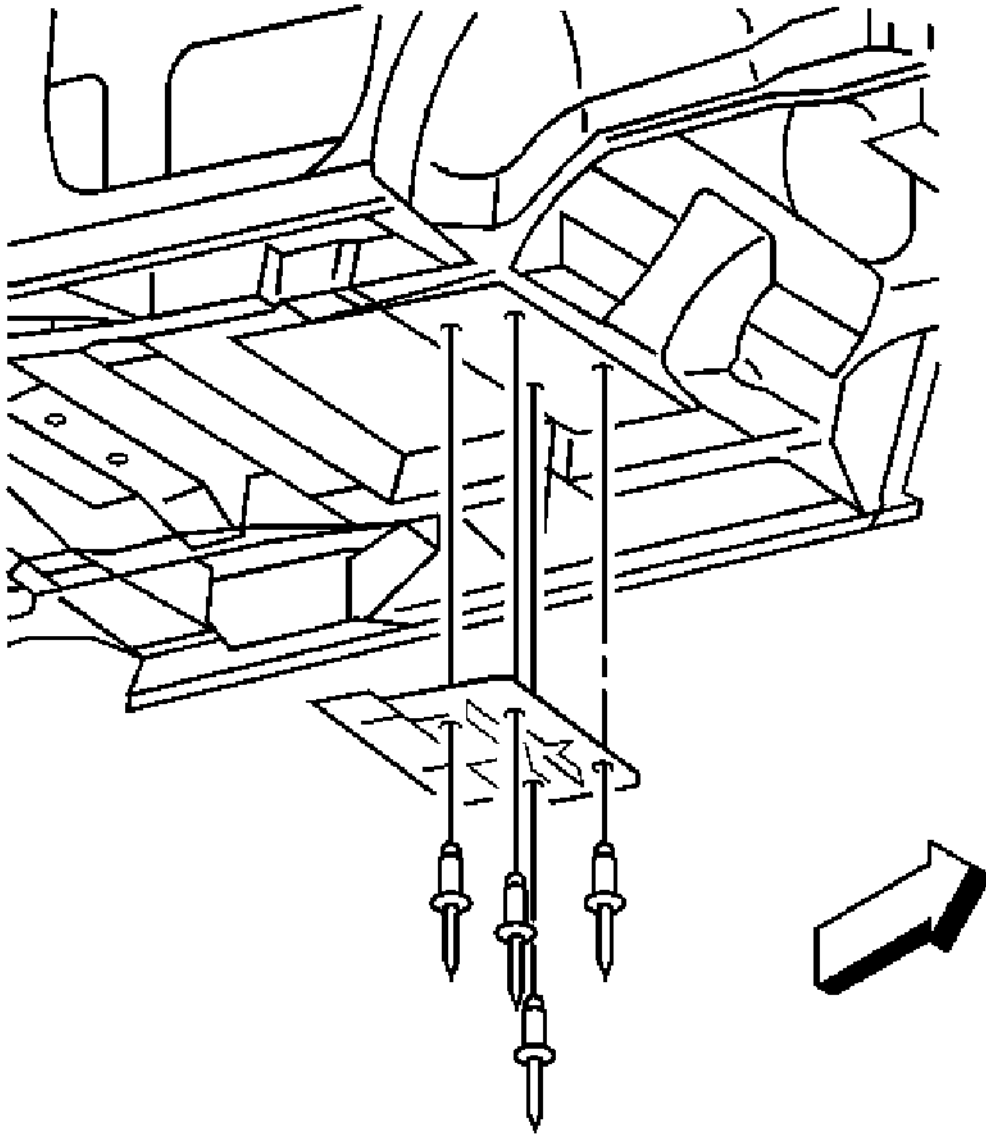


Fig. 42: View Of Catalytic Converter Heat Shield Rivets
Courtesy of GENERAL MOTORS CORP.

1. Install the catalytic converter heat shield.
2. Install the catalytic converter heat shield to the vehicle with new rivets.
3. Install the catalytic converter. Refer to **Catalytic Converter Replacement**.
4. Lower the vehicle.

Removal Procedure

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.

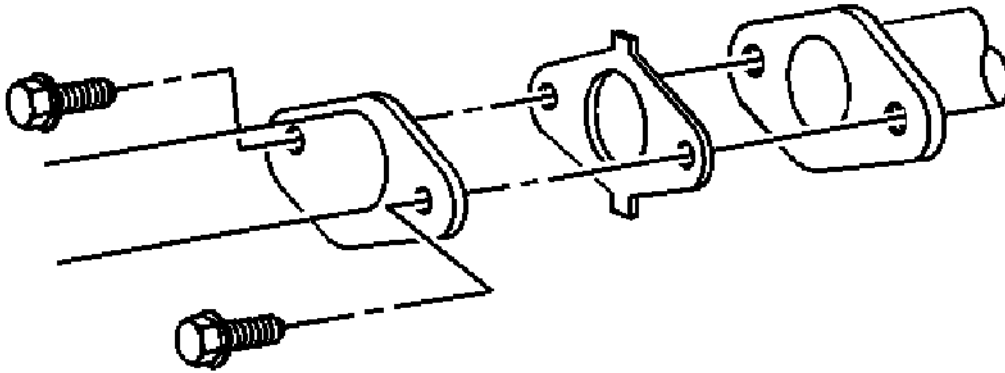


Fig. 43: View Of Catalytic Converter Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not remove the muffler.

2. Remove the fasteners that attach the muffler to the catalytic converter.
3. Reposition the muffler in order to access the heat shield rivets.
4. Use a drill in order to remove the heat shield rivets.
5. Remove the exhaust muffler heat shield from the vehicle.

Installation Procedure

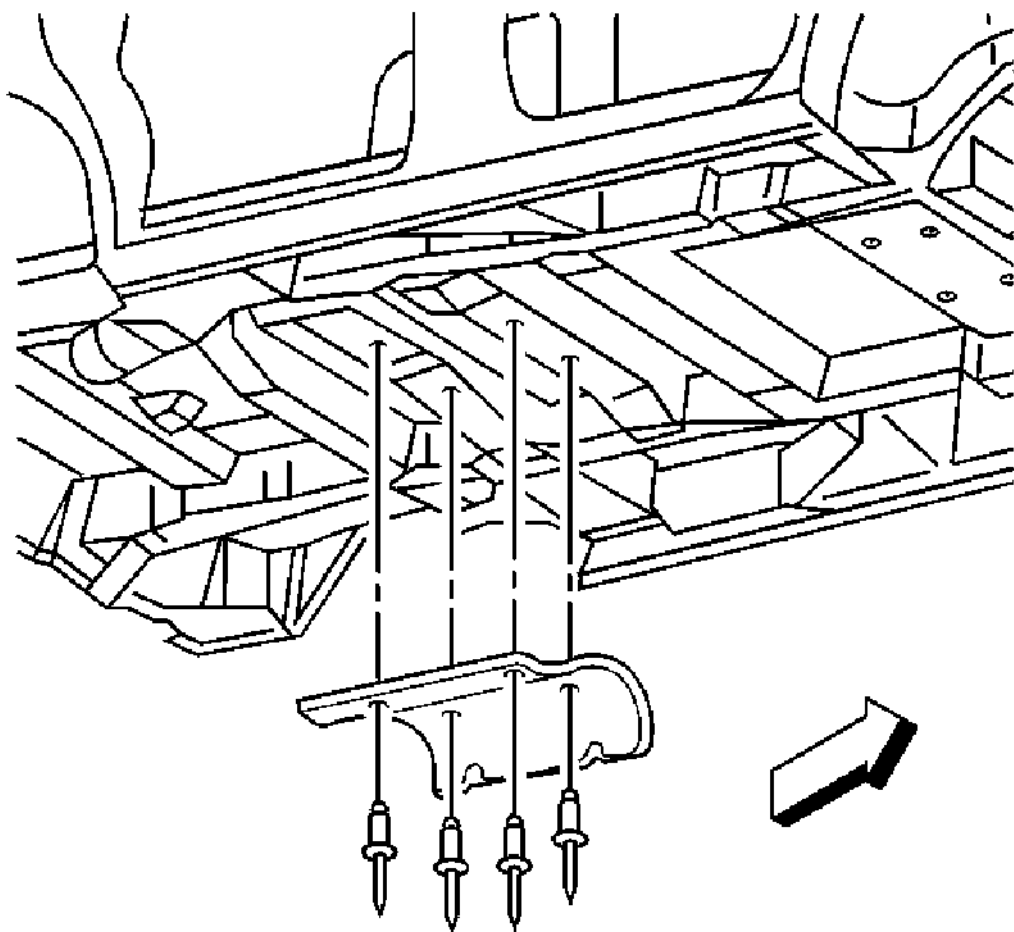


Fig. 44: Locating Exhaust Heat Shield Rivets
Courtesy of GENERAL MOTORS CORP.

1. Install the heat shield to the vehicle with new rivets.

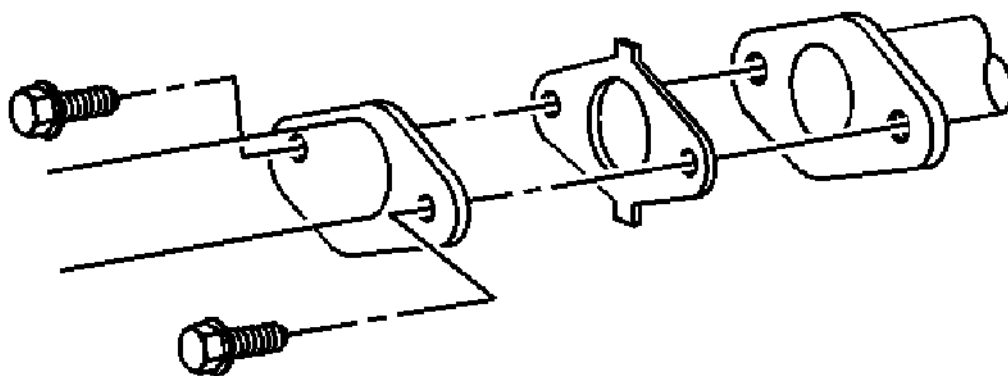


Fig. 45: View Of Catalytic Converter Bolts
Courtesy of GENERAL MOTORS CORP.

2. Connect the muffler to the catalytic converter. Refer to **Muffler Replacement**.
3. Lower the vehicle.

DESCRIPTION AND OPERATION

EXHAUST SYSTEM DESCRIPTION

IMPORTANT: 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 added to the engine exhaust system in order 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 converter is not serviceable.

Muffler

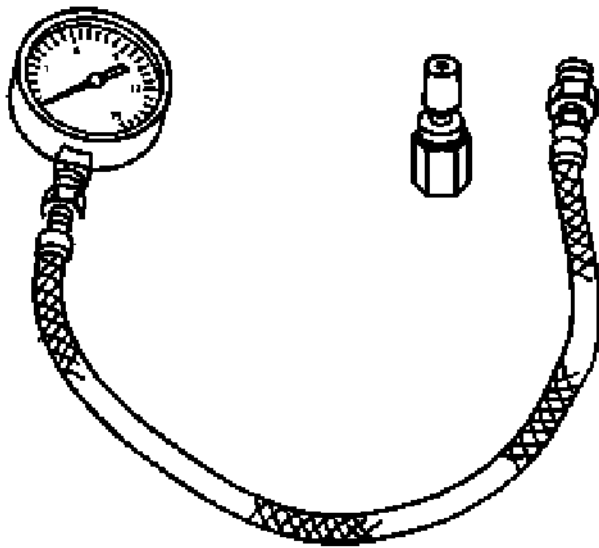
The exhaust muffler reduces the noise levels of the engine exhaust by the use of tuning tubes. The tuning tubes create channels inside the exhaust muffler that lower the sound levels created by the combustion of the engine.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description



J 35314-A
Exhaust Back Pressure Gage

