

2004 ENGINE

Engine Exhaust - Vue

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Catalytic Converter Bracket Bolts	22 N.m	16 lb ft
Catalytic Converter Heat Shield Bolts	12 N.m	106 lb in
Catalytic Converter Nuts	18 N.m	13 lb ft
Crossunder Pipe to Converter Nuts	18 N.m	13 lb ft
Exhaust Heat Shield to Underbody Nut	10 N.m	89 lb in
Exhaust Manifold Nuts (L61)	18 N.m	13 lb ft
Exhaust Pipe to Intermediate Pipe Nuts	30 N.m	22 lb ft
Front Pipe to Manifold Nuts	42 N.m	31 lb ft
Front Pipe to Rear Pipe Nuts	30 N.m	22 lb ft
Fuel Tank Strap Bolt	25 N.m	19 lb ft
Manifold to Heat Shield Bolts	23 N.m	17 lb ft
Muffler Pipe Service Clamp	45 N.m	33 lb ft
Outlet Resonator/Duct Assembly to Support Bracket Bolts	10 N.m	89 lb in
Oxygen Sensor	45 N.m	33 lb ft
Resonator Pipe to Flange Nuts	30 N.m	22 lb ft

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

A slight pressure in the exhaust system is normal, but excessive exhaust back pressure seriously affects engine operation. Causes of high exhaust back pressure are dents/obstructions in the exhaust pipe or a plugged three-way catalytic converter/muffler.

Test Method

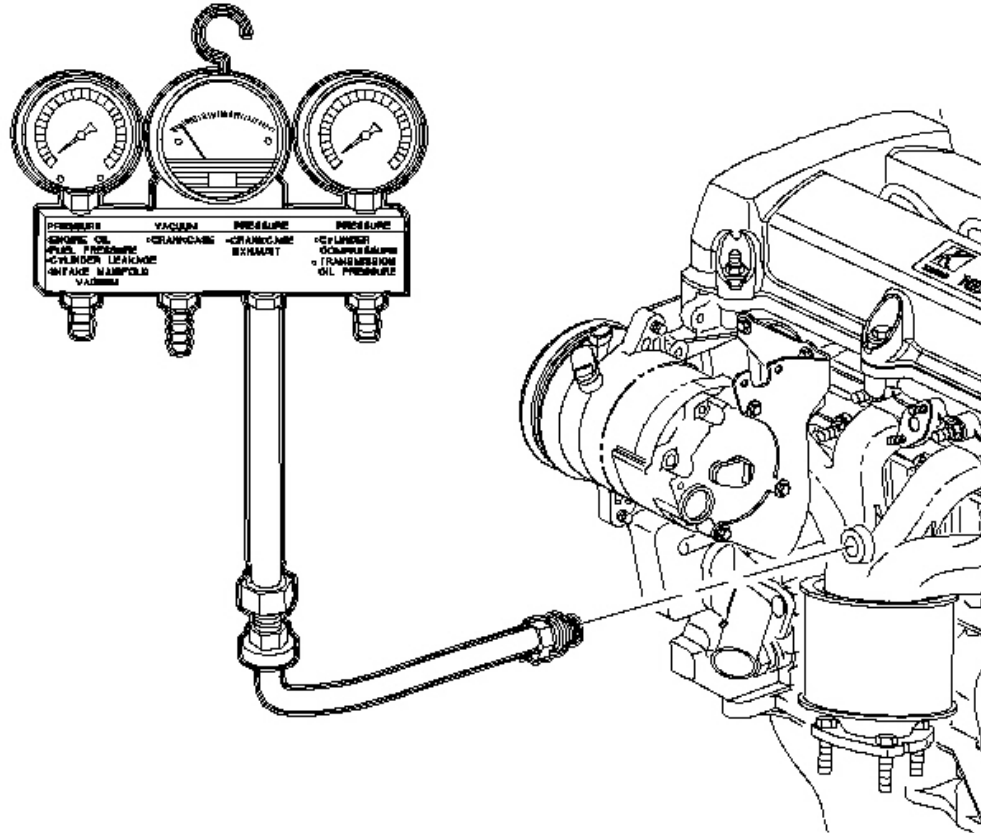


Fig. 1: View Of Exhaust System
 Courtesy of GENERAL MOTORS CORP.

1. Remove the oxygen sensor.
2. Connect the gage bar tool kit SA9127E 0-60 in H₂O.
3. With the engine at normal operation temperature, observe the exhaust back pressure at constant 4,000 RPM for 5 seconds.
4. Back pressure must be less than 20.13 in H₂O (5.0 kPa).

IMPORTANT: If the exhaust pressure exceeds specification, inspect for dents/obstructions. It may be necessary to disconnect the muffler or the pipe before or behind the converter and repeat the test.

5. Replace the damaged or defective parts.
6. Remove the test equipment.

IMPORTANT: Use non-silicon anti-seize compound on the threads. It may be necessary to use a scan tool to delete any codes set while performing the pressure test.

NOTE: Refer to Fastener Notice in Cautions and Notices.

7. Install the oxygen sensor and tighten.

Tighten: Tighten the oxygen sensor to 45 N.m (33 lb ft).

EXHAUST LEAKAGE

Exhaust Leakage

Problem	Action
<p>CAUTION: While engine is operating, the exhaust system will become extremely hot. To prevent burns avoid contacting a hot exhaust system.</p> <p>IMPORTANT: Refer to <u>Symptoms - Engine Exhaust</u> prior to beginning this table.</p> <p>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.</p>	
<p>Misaligned or incorrectly installed exhaust system components</p>	<p>NOTE: Refer to <u>Fastener Notice</u> in Cautions and Notices.</p> <p>Align and tighten the components to the specifications. Refer to <u>Fastener Tightening Specifications</u> .</p>
<p>Exhaust leaks at the following connections:</p> <ul style="list-style-type: none"> • Exhaust manifold to pipe • Flanges • Pipe clamps 	<p>Tighten the components to the specifications. Refer to <u>Fastener Tightening Specifications</u> .</p>
<p>Seals or gaskets leaking:</p> <ul style="list-style-type: none"> • Exhaust manifold to cylinder head • Exhaust pipes to exhaust 	<p>Replace the leaking seal or gasket. Refer to the affected components procedure for service.</p>

manifold <ul style="list-style-type: none"> • Catalytic converter connection • EGR connections • AIR connections to the exhaust manifold or cylinder head 	
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</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 the seams	Replace the affected muffler or resonator. Refer to <u>Muffler Replacement (Production Assembly)</u> <u>Muffler Replacement (Service Part)</u> .

EXHAUST NOISE

Exhaust Noise

Condition	Action
<p>CAUTION: While engine is operating, the exhaust system will become extremely hot. To prevent burns avoid contacting a hot exhaust system.</p> <p>IMPORTANT: Refer to <u>Symptoms - Engine Exhaust</u> prior to beginning this table.</p> <p>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 noises such as: buzz, groan, or hum.</p>	
Popping or hissing noise	Exhaust leak Refer to <u>Exhaust Leakage</u> .
Loud exhaust	<ol style="list-style-type: none"> 1. Compare to a known good vehicle. 2. Inspect for a damaged or failed muffler or resonator. 3. Replace the faulty muffler or resonator. Refer to <u>Muffler Replacement (Production Assembly)</u> or <u>Muffler Replacement (Service Part)</u> .
External rattle or vibration noise	<ol style="list-style-type: none"> 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.
	<ol style="list-style-type: none"> 1. Test the components by tapping with a rubber mallet to confirm a rattle. 2. Replace the faulty catalytic converter, resonator, or muffler. Refer to one of the following procedures:

Internal rattle

- Catalytic Converter Replacement - Left
- Catalytic Converter Replacement - Right
- Muffler Replacement (Production Assembly) or Muffler Replacement (Service Part)
- Mid Muffler Replacement
- Muffler Replacement (Production Assembly) or Muffler Replacement (Service Part)

REPAIR INSTRUCTIONS

EXHAUST MANIFOLD REPLACEMENT

Tools Required

J 39194-C O2 Sensor Remover Tool

Removal Procedure

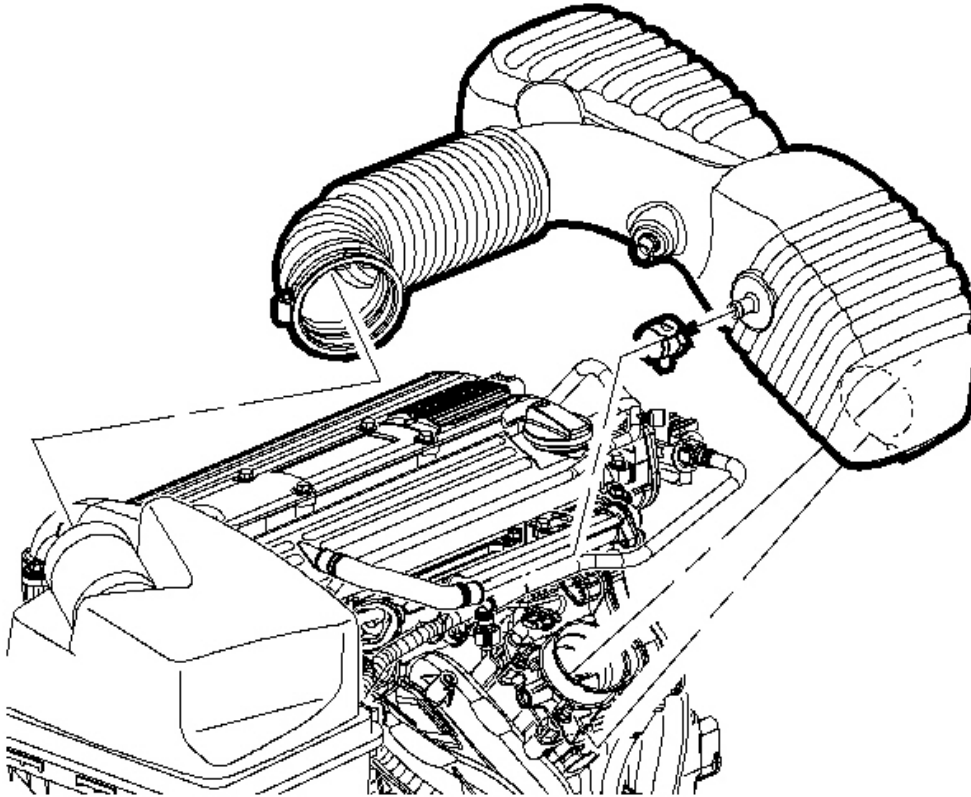


Fig. 2: Locating Air Intake Assembly
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the intake air temperature (IAT) sensor connector.
2. Loosen the clamp at the air cleaner assembly.
3. Remove the push-pin attachment from the outlet resonator/duct assembly to support the bracket.
4. Loosen the clamp at the throttle body assembly.
5. Disconnect the PCV fresh air vent hose at the cam cover.
6. Remove the outlet resonator/duct assembly.

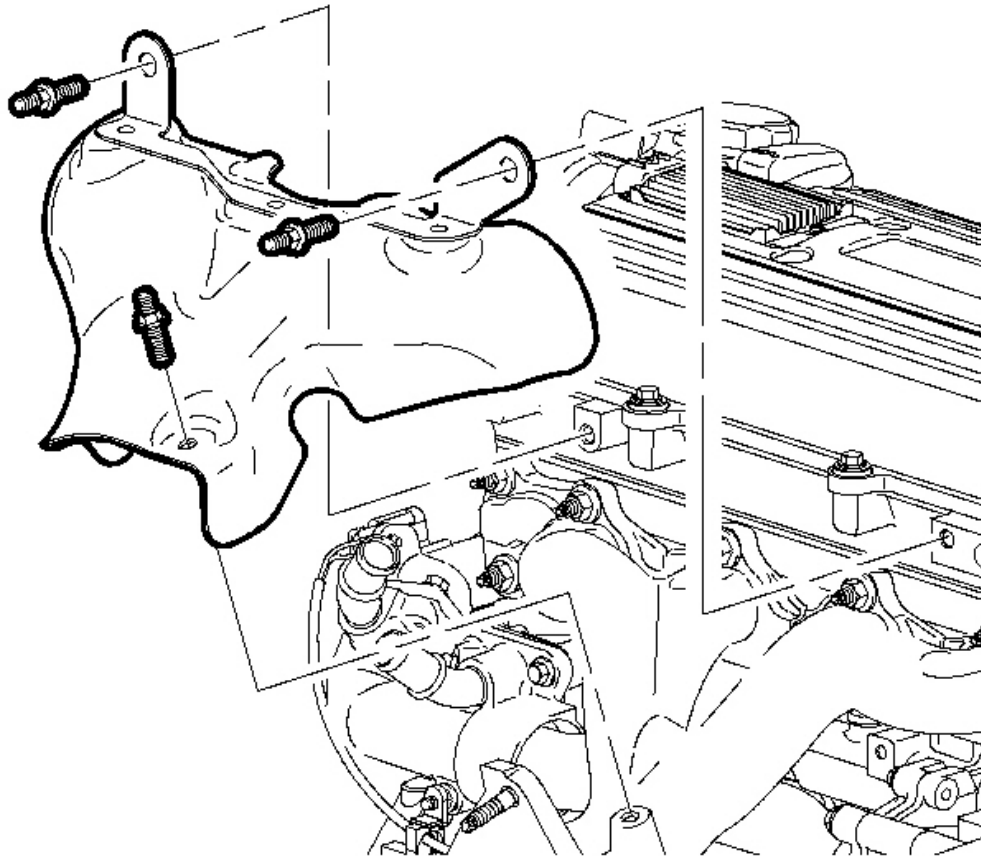


Fig. 3: View Of Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

7. Remove the exhaust manifold heat shield bolts.
8. Remove the exhaust manifold heat shield.
9. Disconnect the front and rear O2 sensor connectors. Remove the sensor if the exhaust manifold is being replaced using **J 39194-C** .
10. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

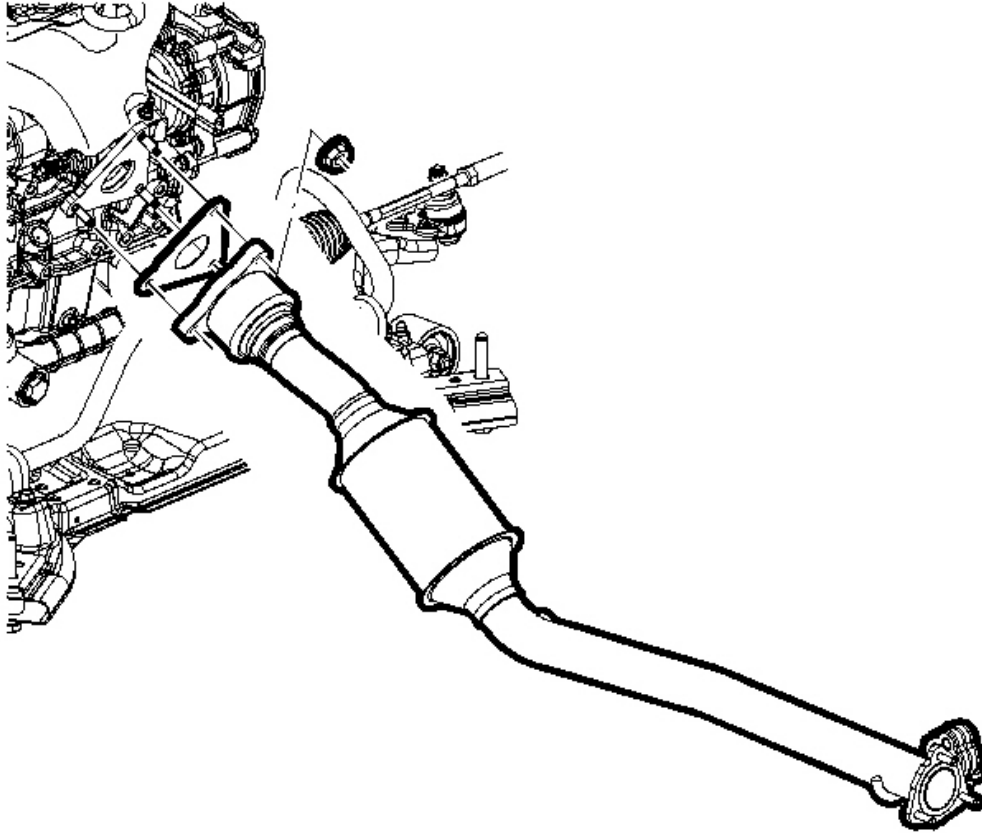


Fig. 4: View Of Exhaust Manifold Pipe
Courtesy of GENERAL MOTORS CORP.

11. Remove the exhaust manifold pipe to manifold nuts.
12. Remove the exhaust manifold pipe to resonator pipe nuts behind the converter.
13. Disconnect the rear O2 sensor wire from the heat shield.
14. Separate the exhaust manifold pipe and resonator pipe. Discard the gaskets.

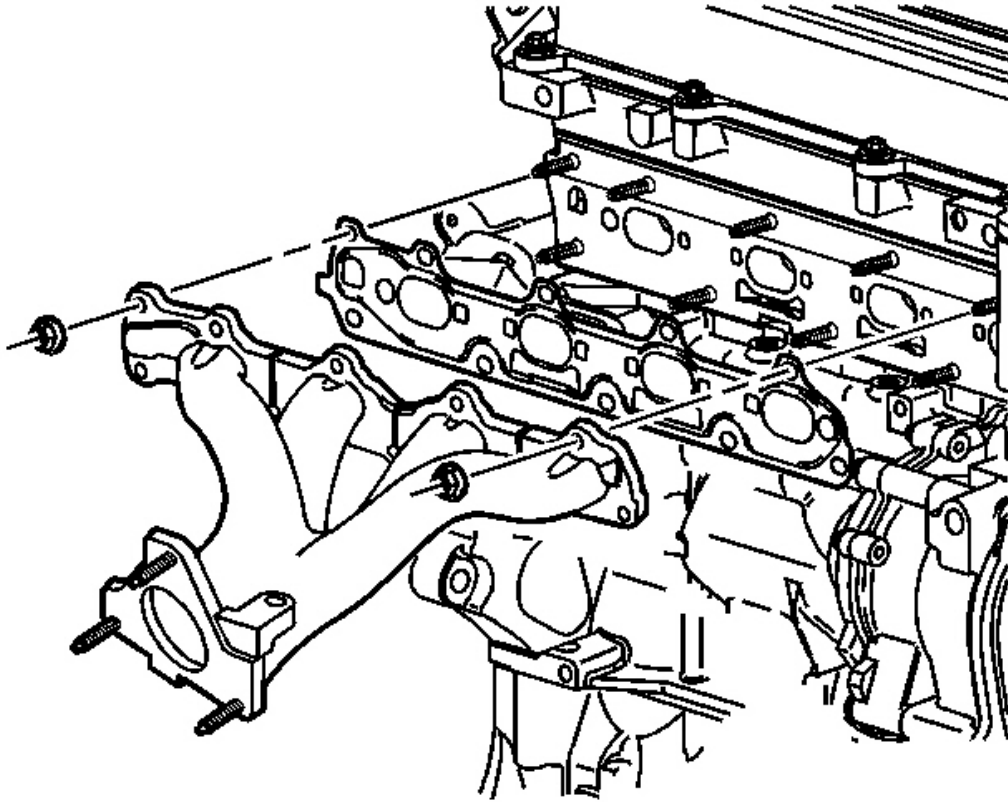


Fig. 5: View Of Exhaust Manifold
Courtesy of GENERAL MOTORS CORP.

15. Remove the exhaust manifold nuts.
16. Remove the exhaust manifold assembly and discard the gasket.

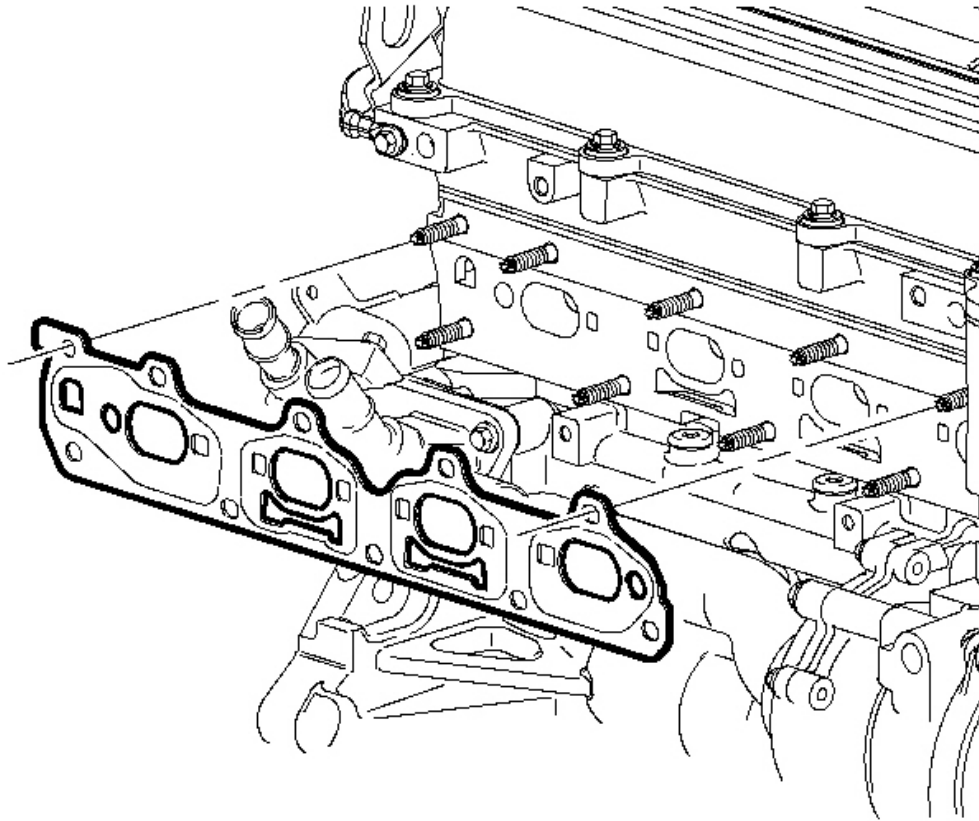


Fig. 6: View Of Manifold Gasket
Courtesy of GENERAL MOTORS CORP.

17. Remove the exhaust manifold gasket and discard.

Installation Procedure

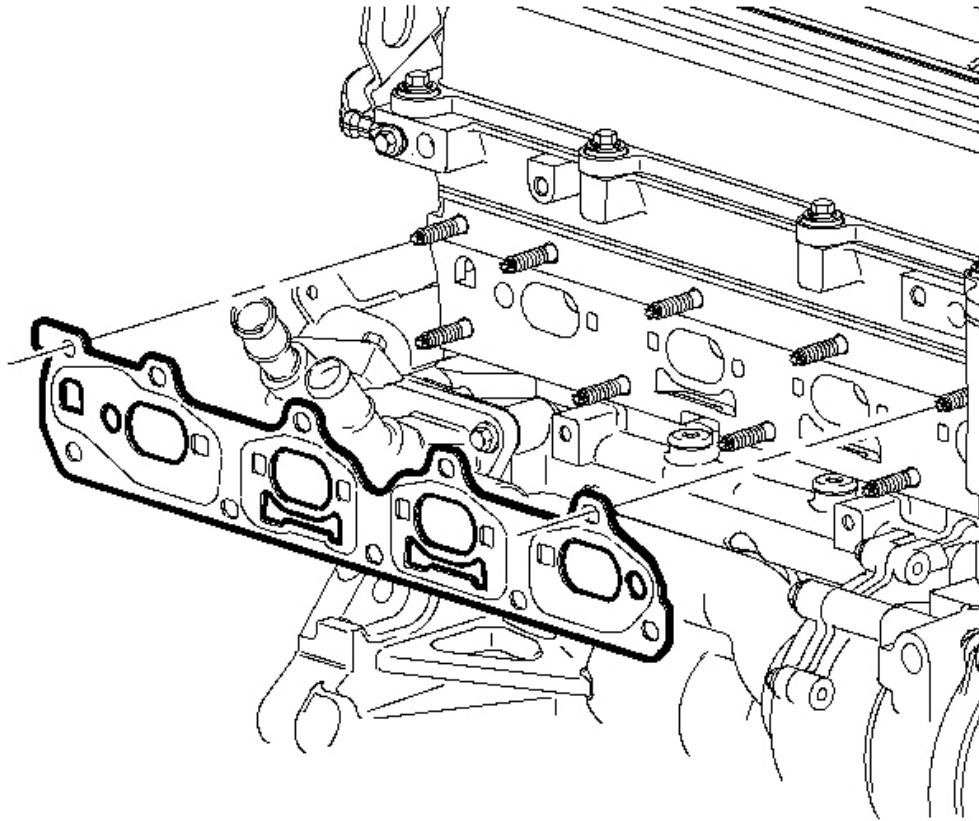


Fig. 7: View Of Manifold Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install a new manifold gasket on the cylinder head.

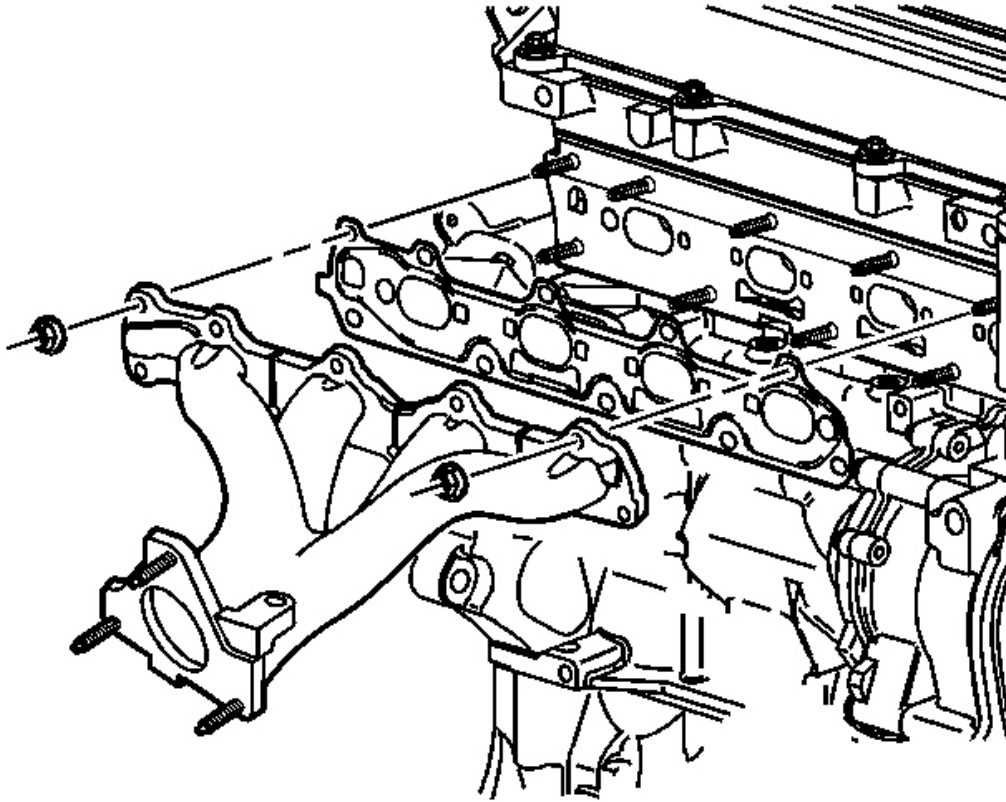


Fig. 8: View Of Exhaust Manifold
Courtesy of GENERAL MOTORS CORP.

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-to-cylinder head nuts L61 to 18 N.m (13 lb ft).

4. If necessary, transfer the O2 sensor from the old manifold.

IMPORTANT: Whenever the oxygen sensor is removed, coat the threads with nickel-based anti-seize compound such as Permatex(R) 77124, SA P/N 21485279 or equivalent.

5. Install the O2 sensor into the exhaust manifold.

Tighten: Tighten the O2 sensor to 45 N.m (33 lb ft).

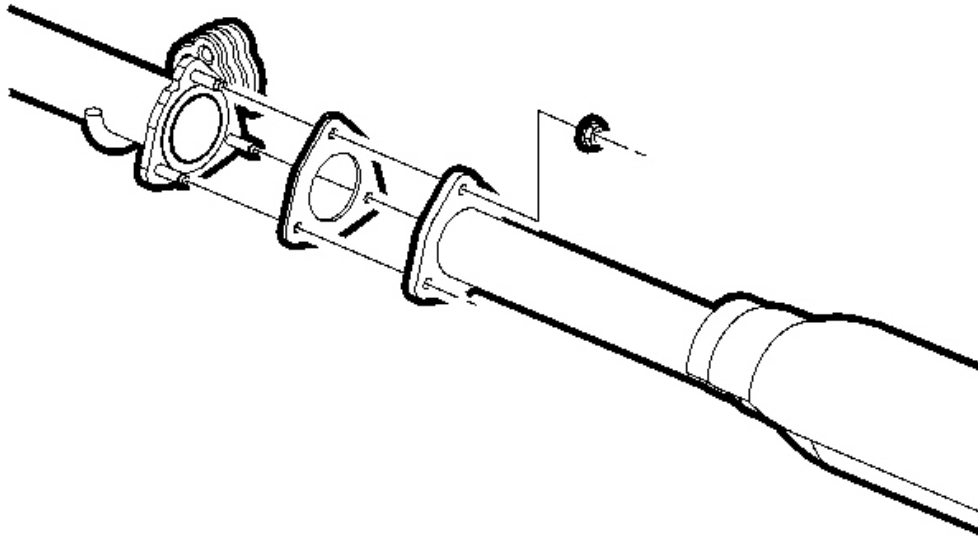


Fig. 9: View Of Gasket & Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

6. Install the gasket and exhaust pipe to the intermediate pipe.
7. Install the exhaust pipe-to-intermediate pipe nuts.

Tighten: Tighten the exhaust pipe-to-intermediate pipe nuts L61 to 30 N.m (22 lb ft).

8. Attach the rear O2 sensor wire to the heat shield.

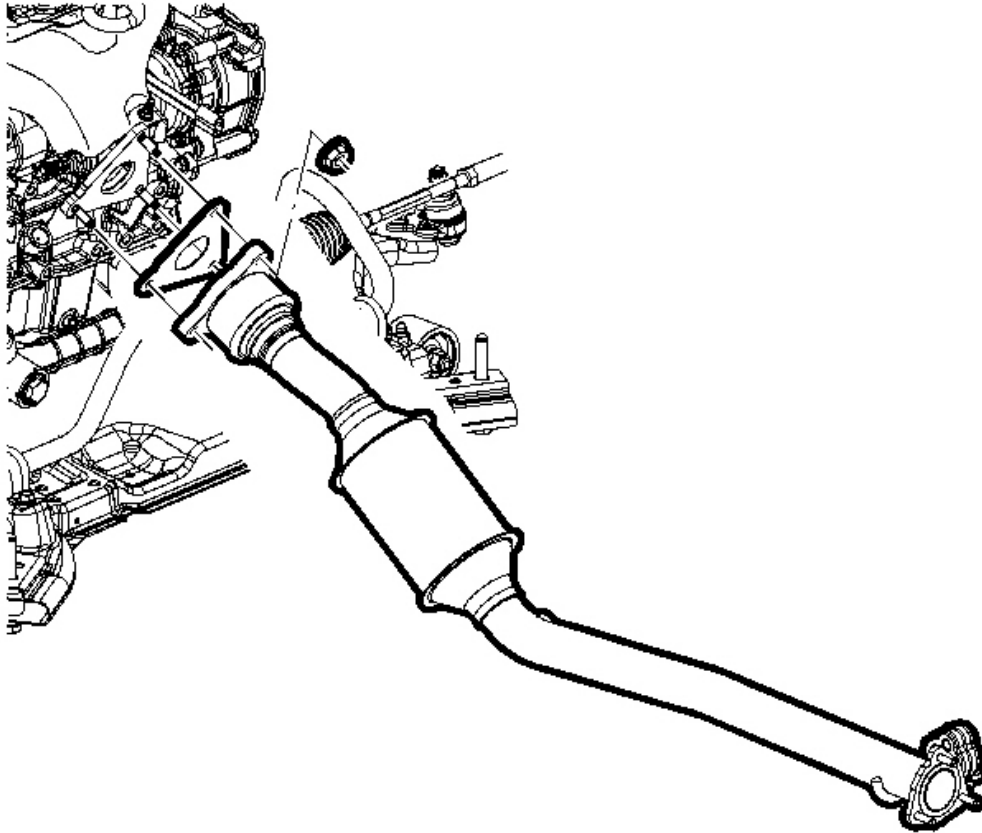


Fig. 10: View Of Exhaust Manifold Gasket
Courtesy of GENERAL MOTORS CORP.

9. Install a new exhaust manifold gasket onto the exhaust manifold flange studs.
10. Position the exhaust manifold pipe onto the exhaust manifold studs and install the exhaust manifold nuts.

Tighten: Tighten the exhaust manifold pipe-to-exhaust manifold nuts L61 to 42 N.m (31 lb ft).

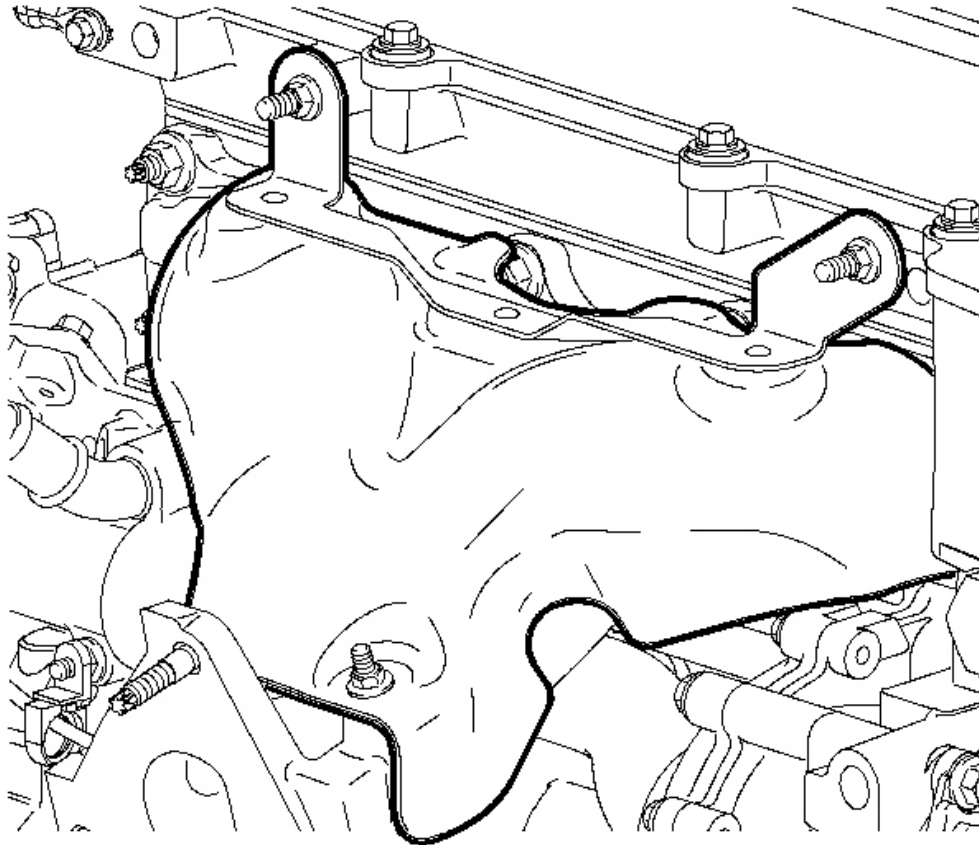


Fig. 11: View Of Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

11. Lower the vehicle.
12. Install the exhaust manifold heat shield.
13. Install the exhaust manifold heat shield bolts.

Tighten: Tighten the exhaust manifold heat shield bolts L61 to 23 N.m (17 lb ft).

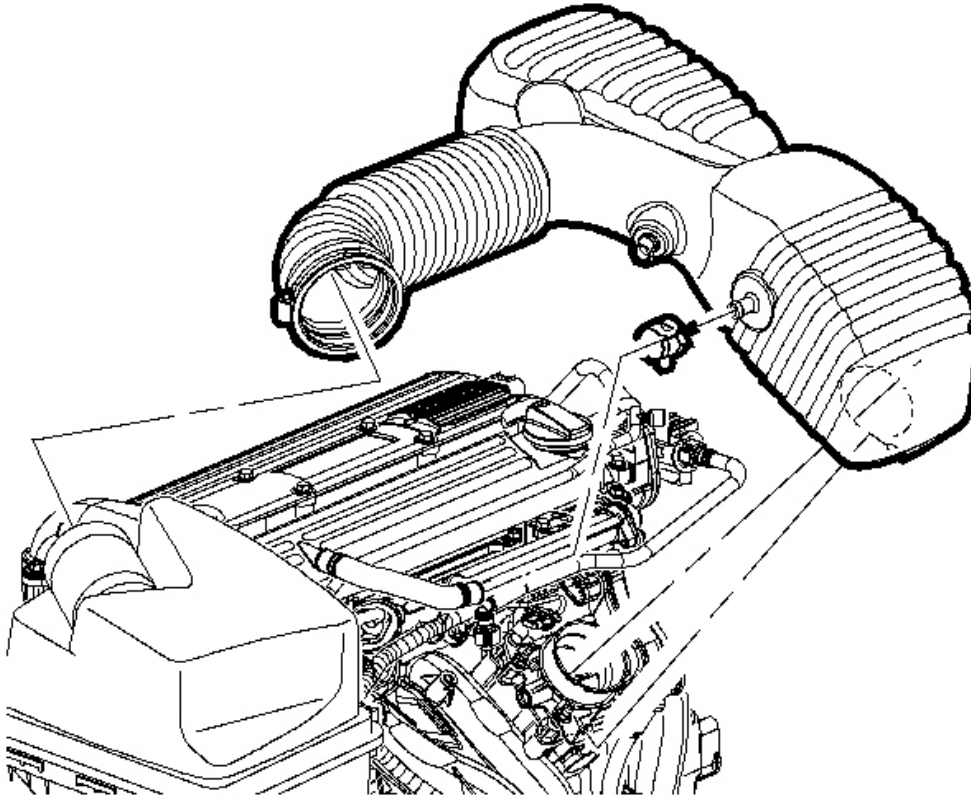


Fig. 12: Locating Air Intake Assembly
Courtesy of GENERAL MOTORS CORP.

14. Install the outlet resonator/duct assembly into position.
15. Connect the PVC fresh air vent hose assembly.
16. Tighten the clamp at the throttle body assembly.
17. Position the outlet resonator/duct assembly up with the support bracket and install the push-pin.
18. Tighten the air cleaner assembly.
19. Connect the intake air temperature (IAT) sensor connector.

EXHAUST MANIFOLD PIPE REPLACEMENT (L66)

Removal Procedure

1. Raise the vehicle on a hoist. Refer to **Lifting and Jacking the Vehicle** in General Information.

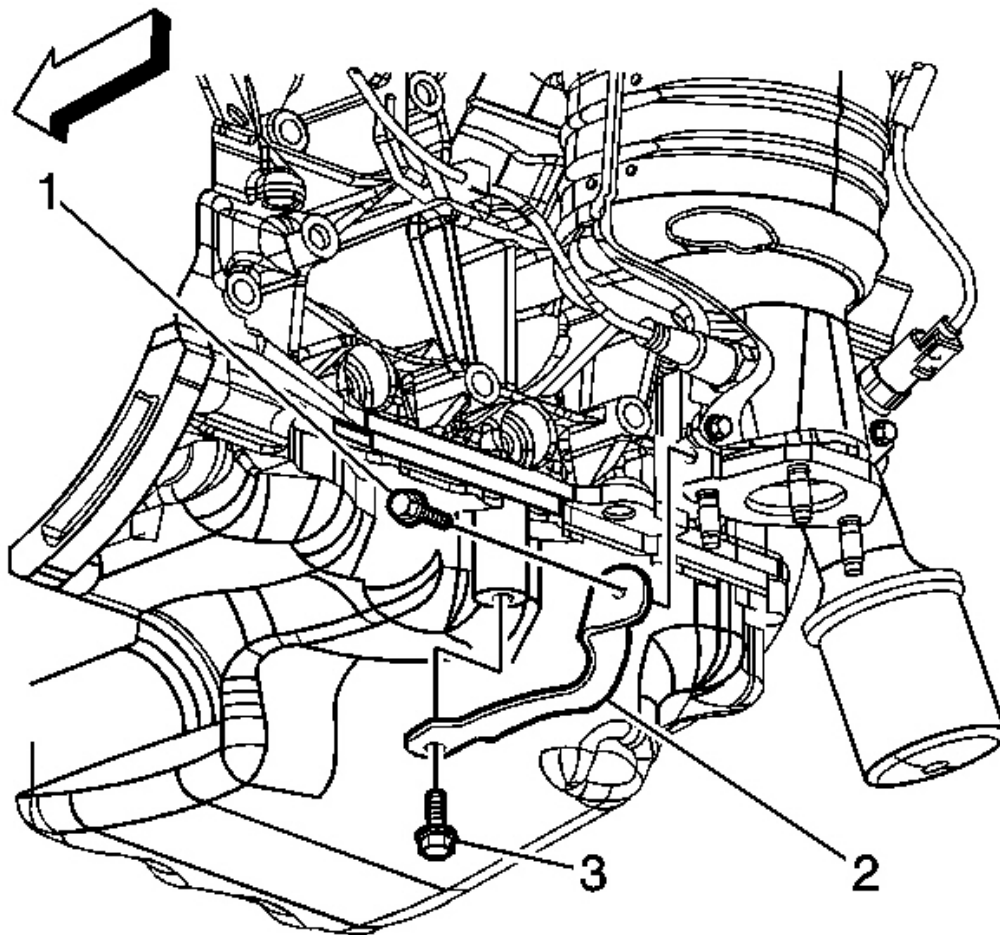


Fig. 13: View Of Exhaust Manifold Pipe (L66)
Courtesy of GENERAL MOTORS CORP.

2. Remove the oil pan bracket (2) and bolts (1, 3).

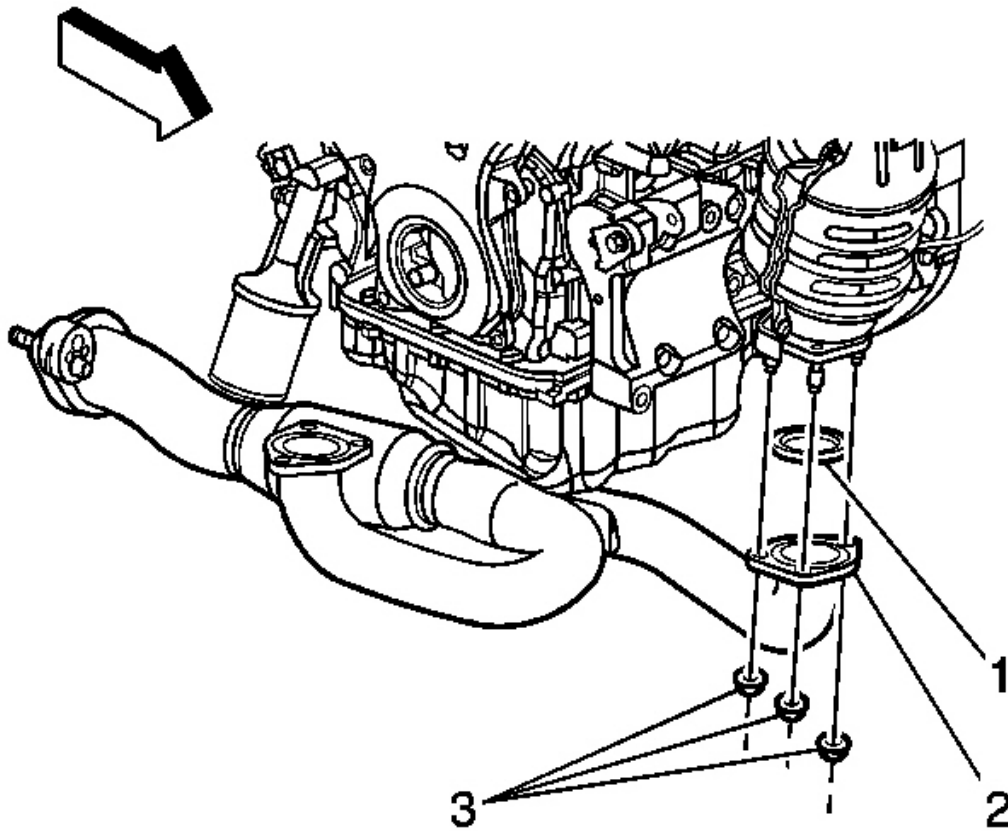


Fig. 14: View Of Gaskets Onto Converter Studs
Courtesy of GENERAL MOTORS CORP.

3. Remove the exhaust pipe flange to the catalytic converter nuts (3).
4. Remove the exhaust pipe to mid muffler pipe nuts.
5. Remove the front exhaust pipe.
6. Fully remove and discard the used gaskets.

Installation Procedure

NOTE: Excessive flexing of the exhaust pipe may damage the flex coupling. Limit flexing to 12 degrees.

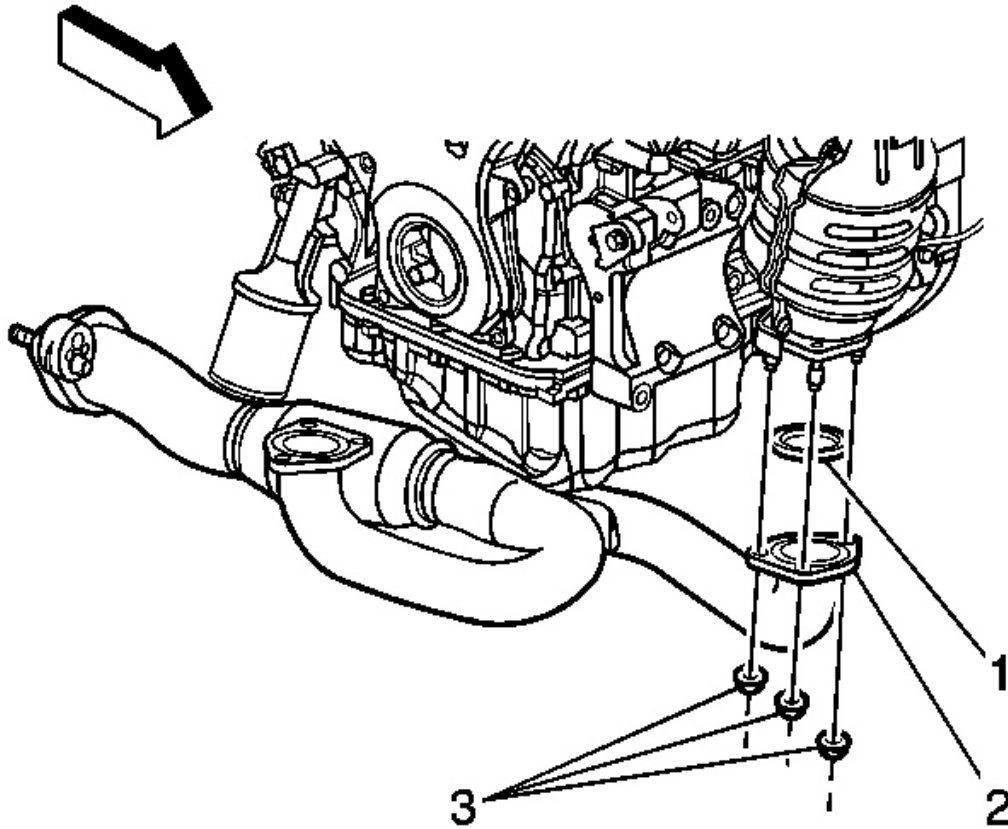


Fig. 15: View Of Gaskets Onto Converter Studs
Courtesy of GENERAL MOTORS CORP.

1. Position pipe into vehicle, and install new gaskets onto converter studs.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Assemble exhaust pipe to converters, install new nuts and tighten.

Tighten: Tighten the nuts to 18 N.m (13 lb ft).

3. Install the new gasket (1) onto the exhaust pipe rear flange.

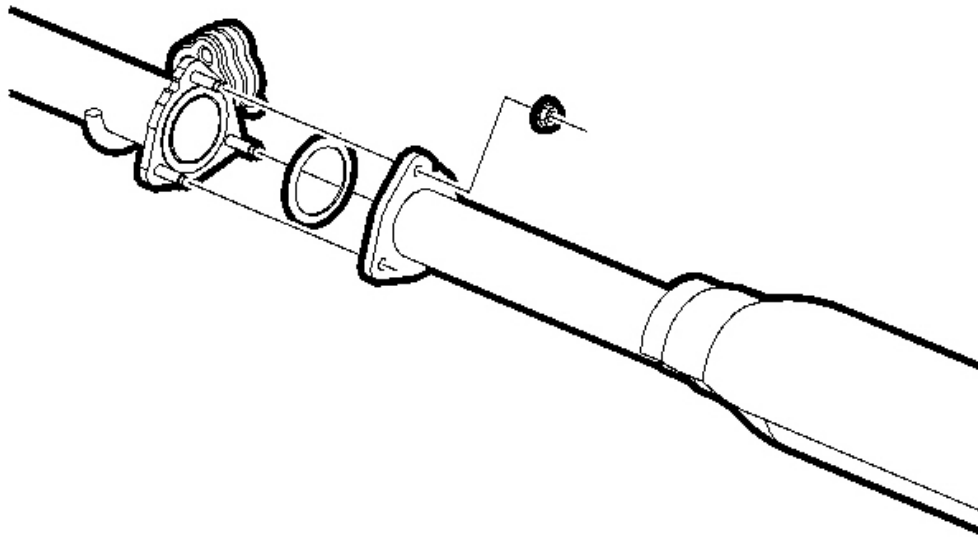


Fig. 16: View Of Front & Rear Pipe
Courtesy of GENERAL MOTORS CORP.

4. Assemble the front pipe to rear pipe, install the nuts and tighten.

Tighten: Tighten the front pipe-to-rear pipe nuts to 30 N.m (22 lb ft).

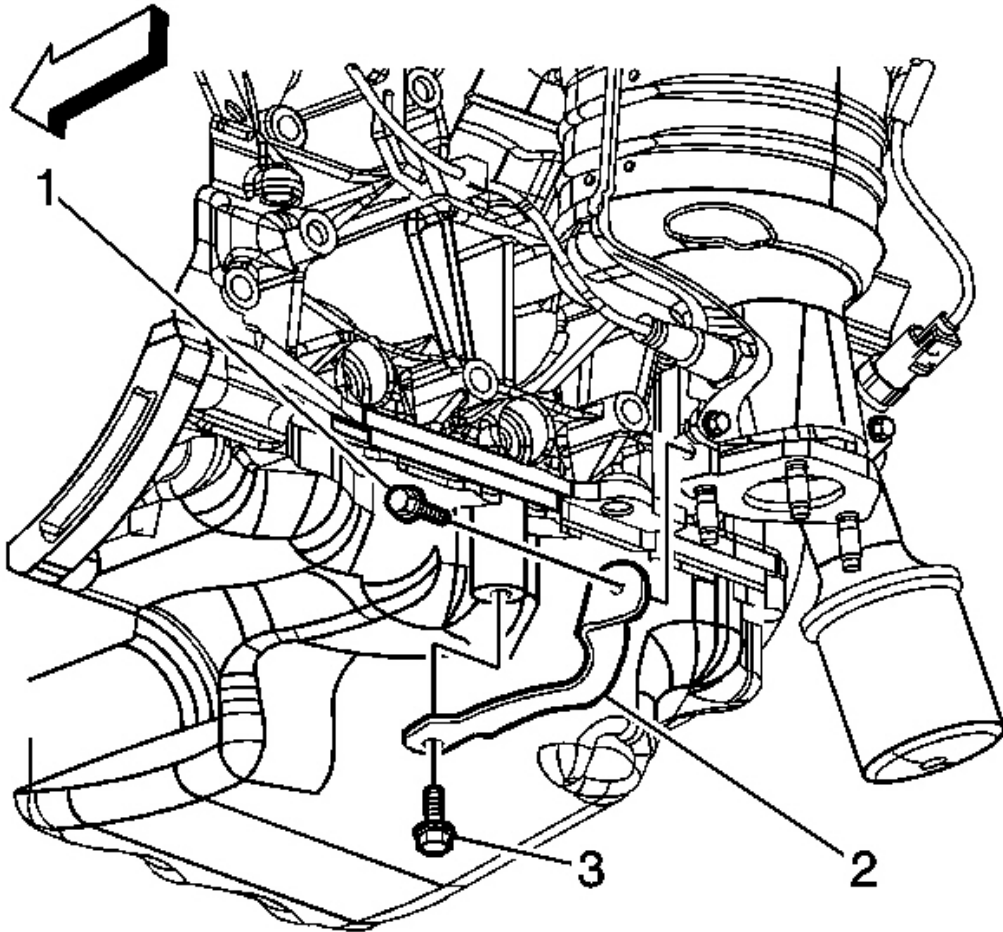


Fig. 17: View Of Oil Pan Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the oil pan bracket (2) and bolts (1, 3) and tighten.

Tighten: Tighten the bolts to 20 N.m (14 lb ft).

6. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
7. Start the engine and check for exhaust leaks.

EXHAUST MANIFOLD PIPE REPLACEMENT (L61)

Removal Procedure

CAUTION: Ensure that the vehicle is properly supported and squarely positioned. To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle on the opposite end from which the components are being removed.

NOTE: Excessive flexing of the exhaust pipe may damage the flex coupling. Limit flexing to 12 degrees.

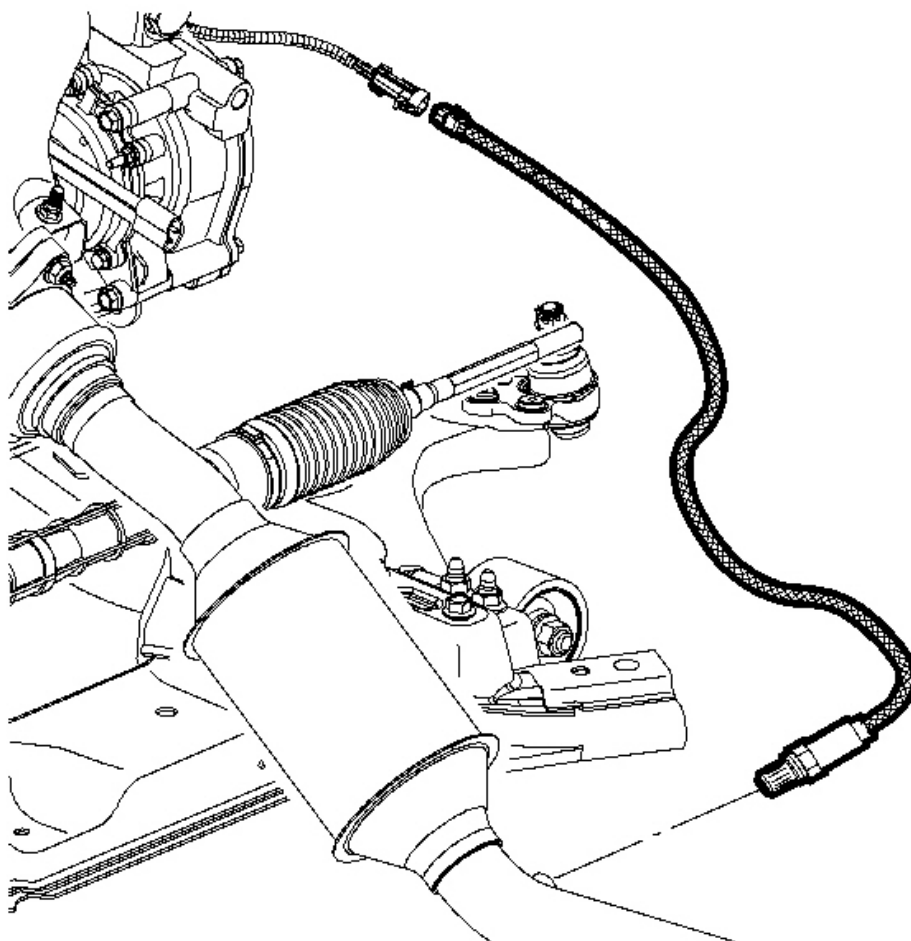


Fig. 18: View Of Exhaust Manifold Pipe (L61)
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle on a hoist. Refer to **Lifting and Jacking the Vehicle** in General Information.

IMPORTANT: Do not apply silicon products to the oxygen sensor.

2. Disconnect the electrical connector from the oxygen sensor (O2S).

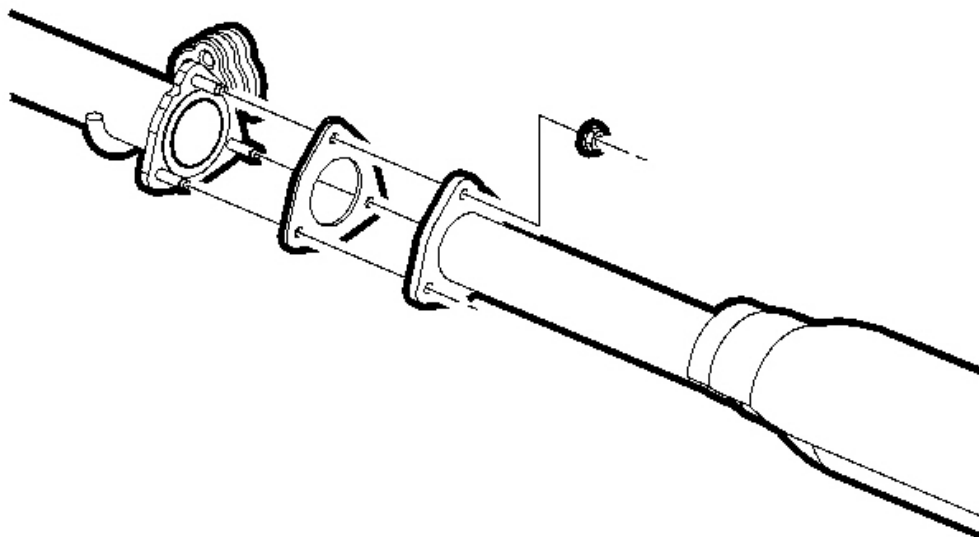


Fig. 19: View Of Gasket & Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

3. Remove the nuts from the exhaust pipe flange to intermediate pipe and separate the flange from the studs.

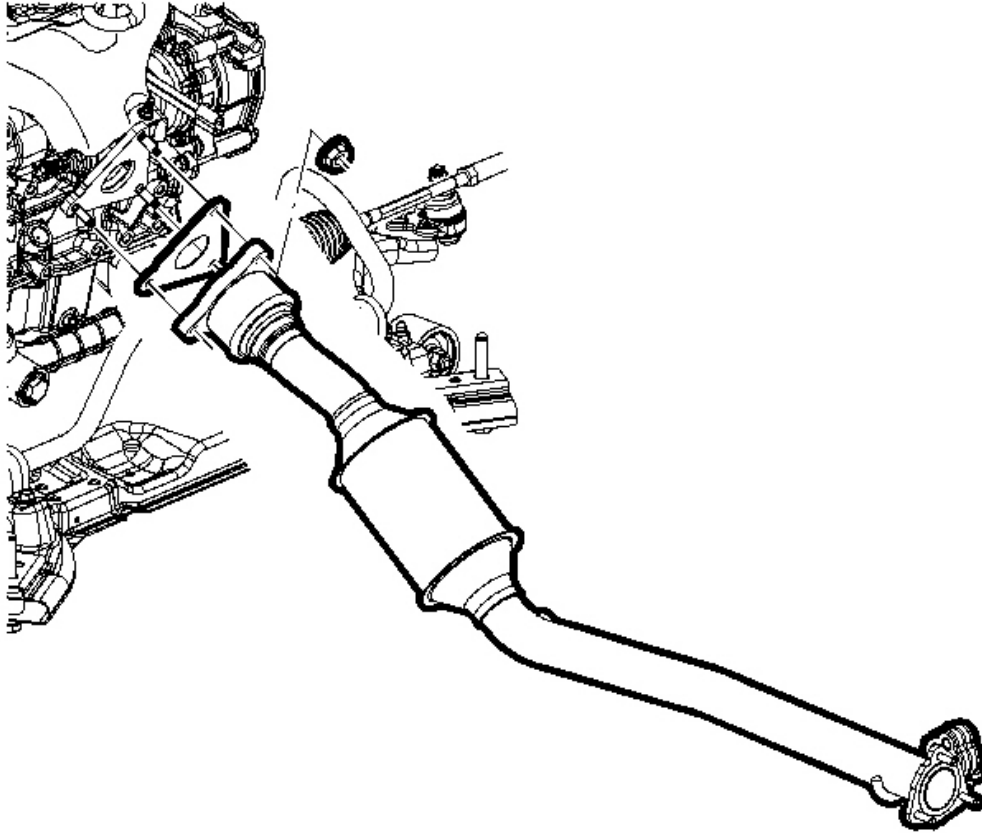


Fig. 20: View Of Exhaust Manifold Pipe
Courtesy of GENERAL MOTORS CORP.

4. Remove the nuts from the exhaust pipe flange to exhaust manifold.

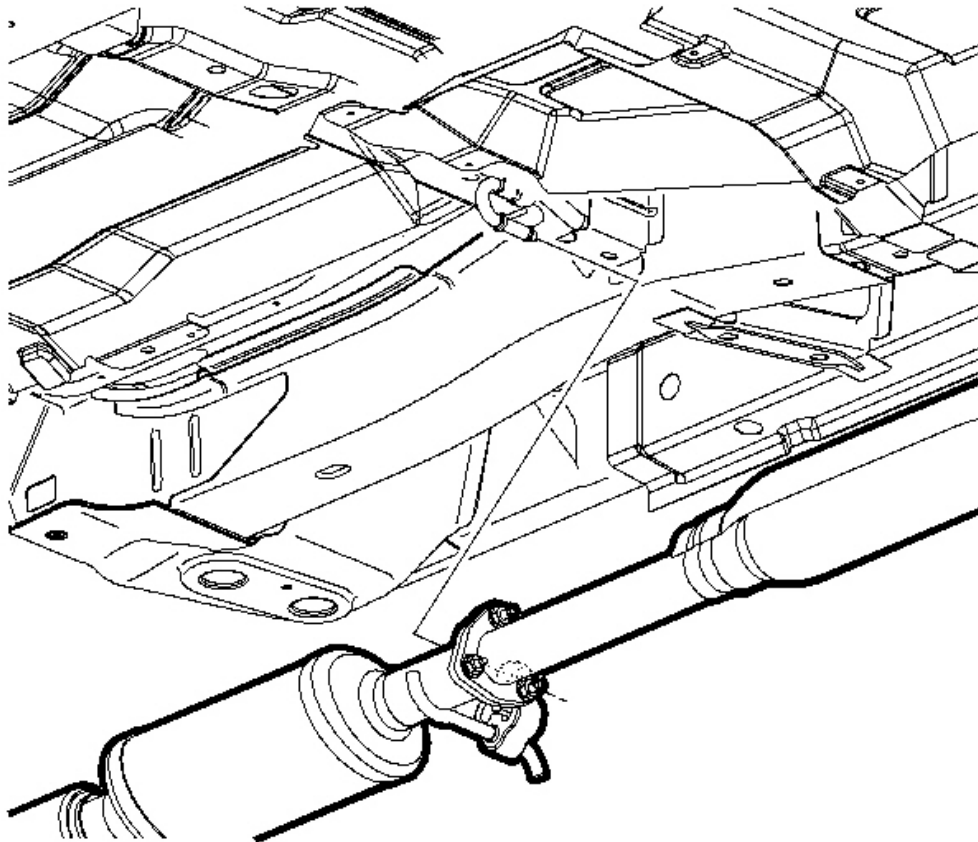


Fig. 21: View Of Hanger From The Rubber Isolators
Courtesy of GENERAL MOTORS CORP.

5. Separate the hanger from the rubber isolator.
6. Separate the pipe flange from the manifold studs and remove the exhaust pipe.
7. Fully remove and discard used gaskets.
8. Remove the oxygen sensor if transferring to a new exhaust pipe.

Installation Procedure

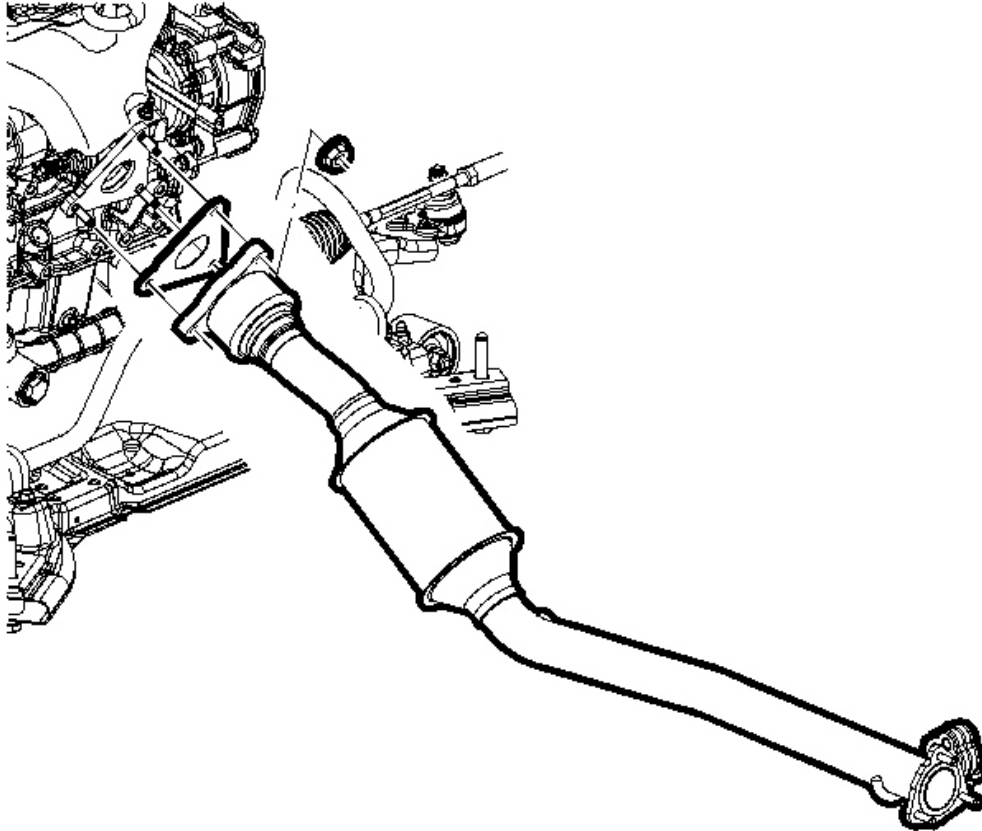


Fig. 22: View Of Exhaust Manifold Gasket
Courtesy of GENERAL MOTORS CORP.

1. Install a new gasket onto the exhaust manifold studs.

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

2. Assemble the exhaust pipe to manifold. Install new nuts and tighten.

Tighten: Tighten the nuts to 42 N.m (31 lb ft).

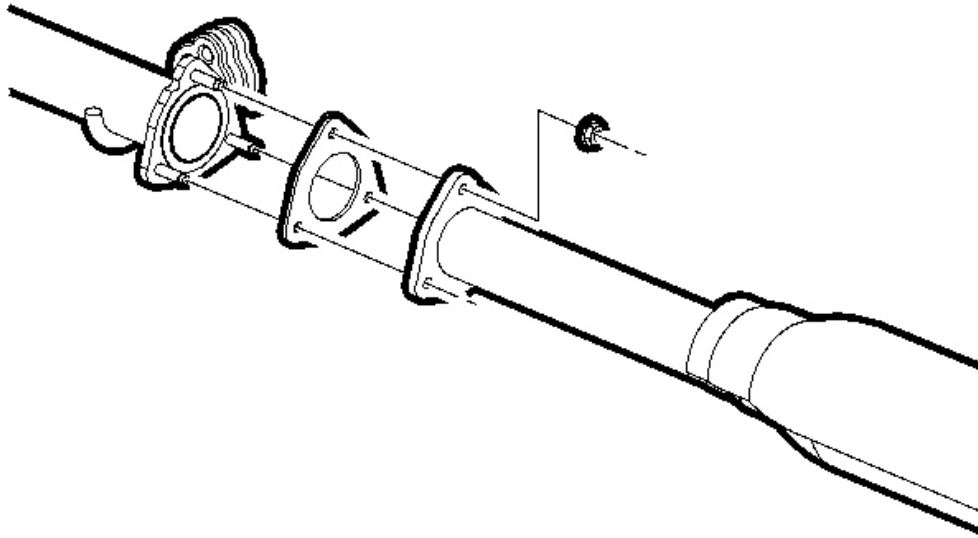


Fig. 23: View Of Gasket & Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

3. Install the new gasket onto the exhaust pipe flange.
4. Assemble the exhaust pipe to intermediate pipe. Install new nuts and tighten.

Tighten: Tighten the nuts to 30 N.m (22 lb ft).

5. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
6. Start the engine and check for exhaust leaks.

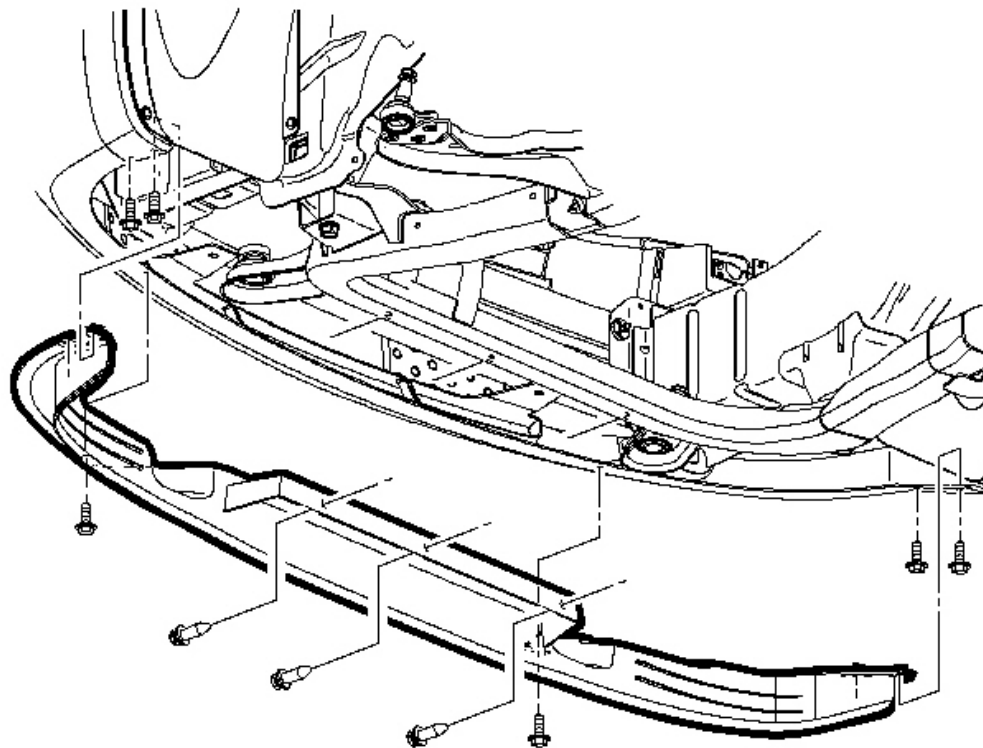


Fig. 24: View Of Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove the front lower air deflector.

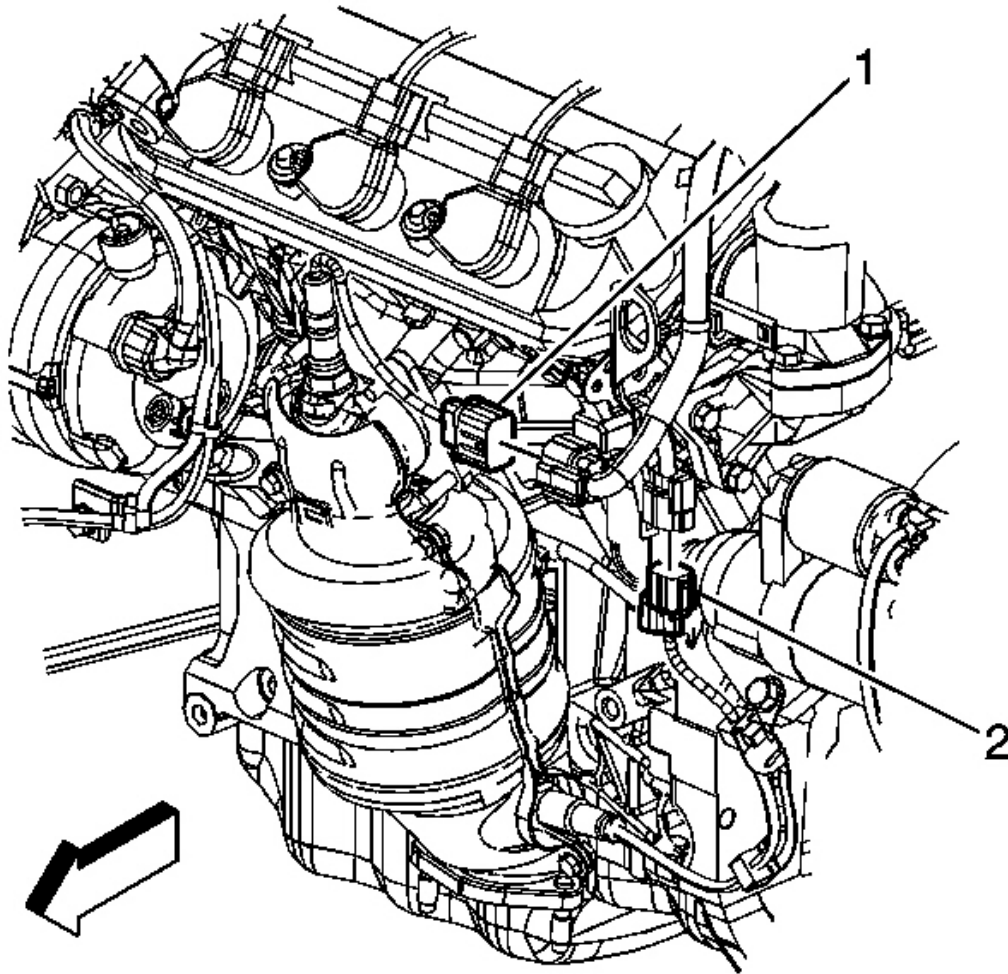


Fig. 25: View Of 2 Sensors
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the O2 sensors (1, 2).
4. Remove the exhaust manifold pipe. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)**.
5. Remove the converter nuts.
6. Position the radiator assembly forward enough for the converter removal clearance.

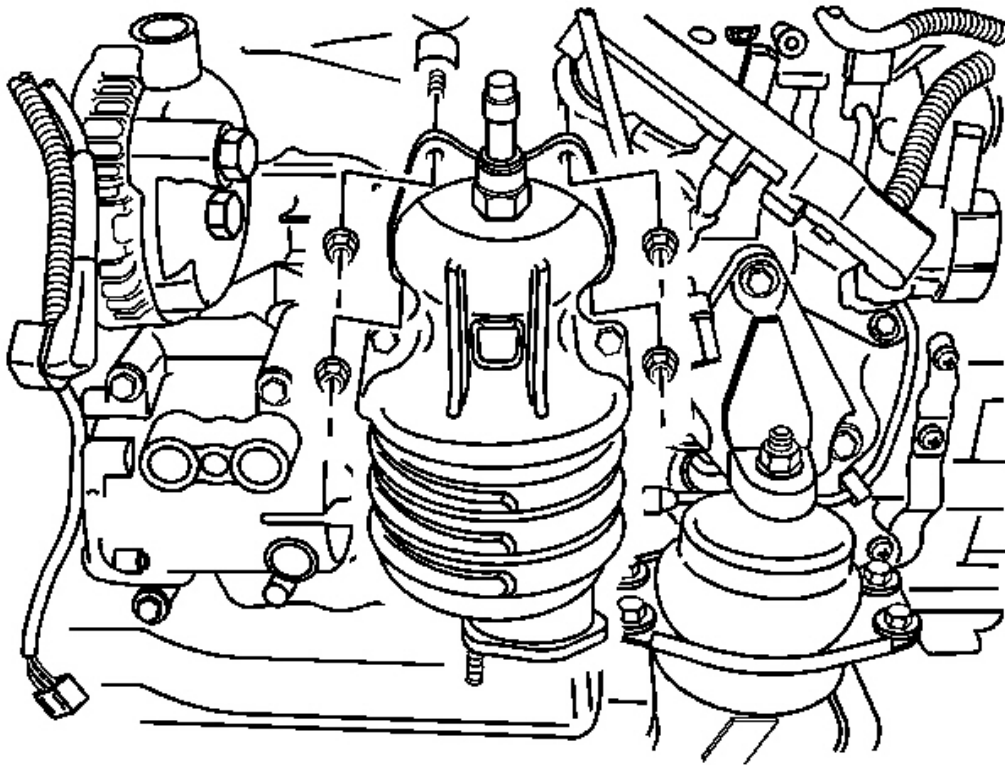


Fig. 26: View Of Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

7. Remove the catalytic converter.

Installation Procedure

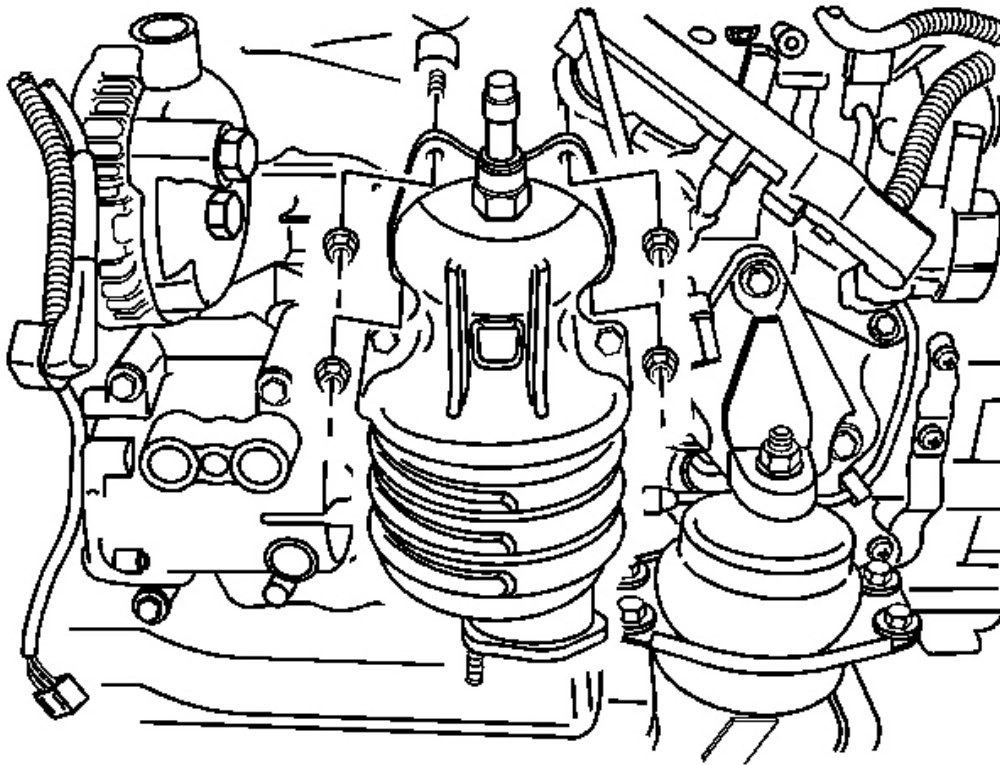


Fig. 27: View Of Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

1. Install the catalytic converter.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the converter nuts.

Tighten: Tighten the nuts to 18 N.m (13 lb ft).

3. Move the radiator assembly to its original position.
4. Install the exhaust manifold pipe. Refer to Exhaust Manifold Pipe Replacement (L66) or Exhaust Manifold Pipe Replacement (L61).

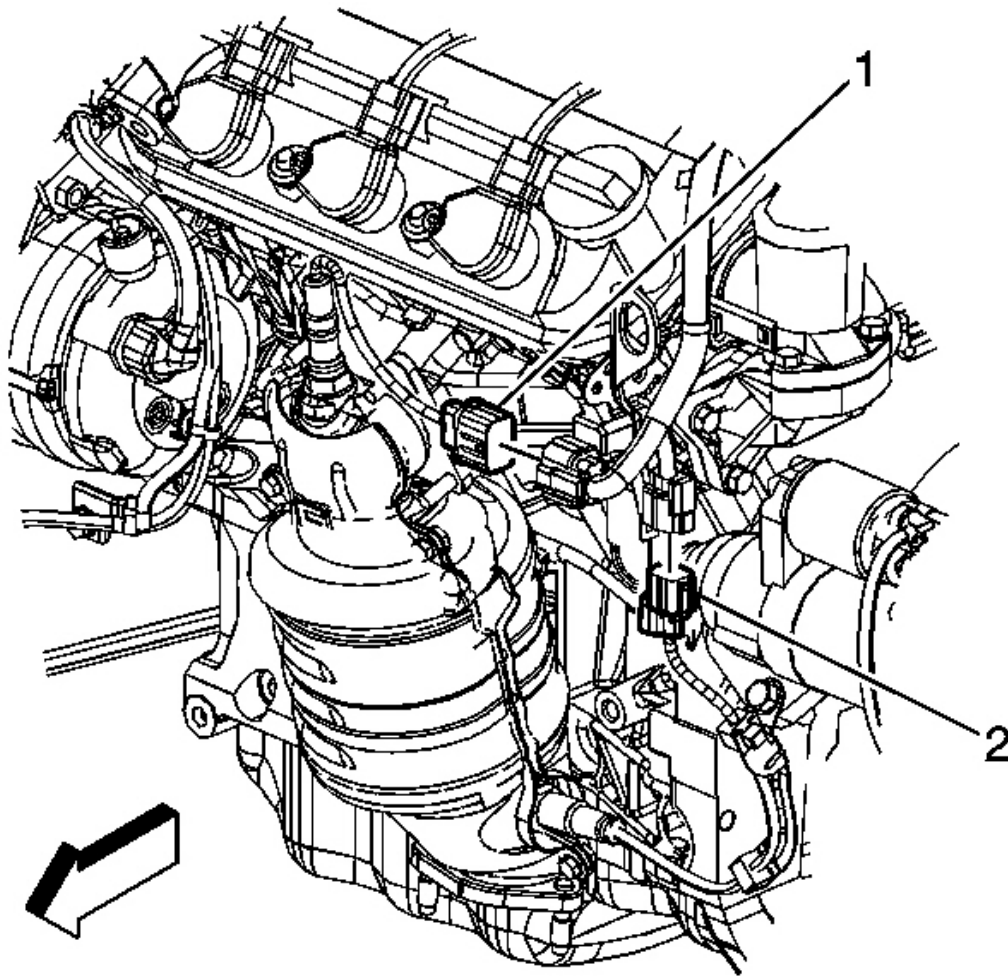


Fig. 28: View Of 2 Sensors
Courtesy of GENERAL MOTORS CORP.

5. Connect the O2 sensors (1, 2).

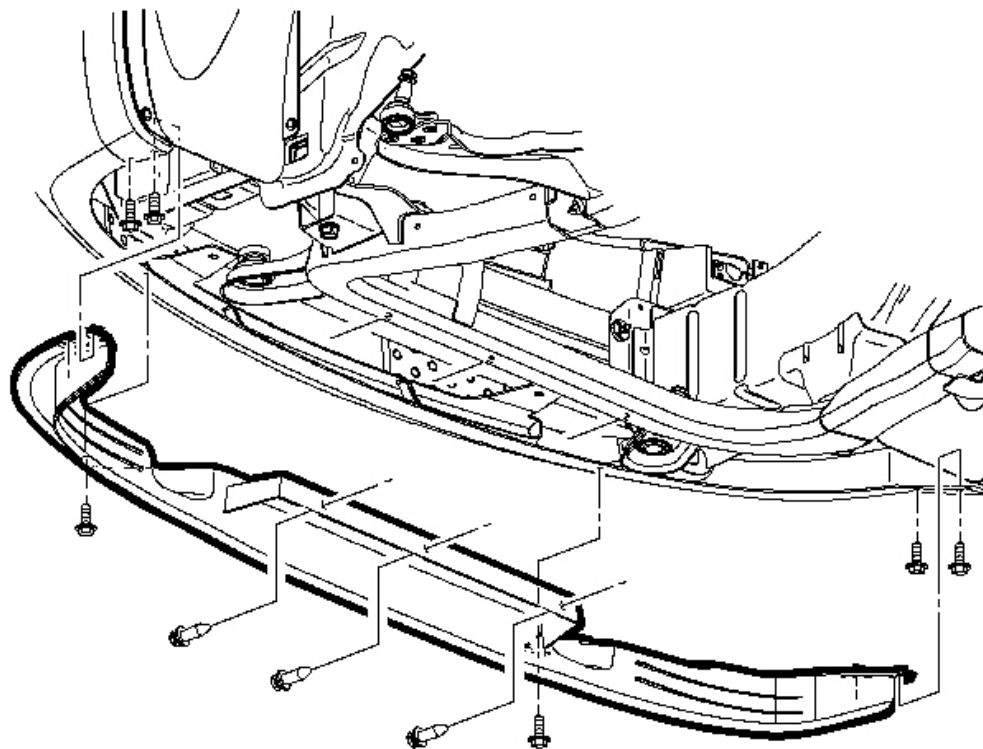


Fig. 29: View Of Front Lower Air Deflector
Courtesy of GENERAL MOTORS CORP.

6. Install the front lower air deflector.
7. Lower the vehicle.

CATALYTIC CONVERTER REPLACEMENT - RIGHT

Removal Procedure

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

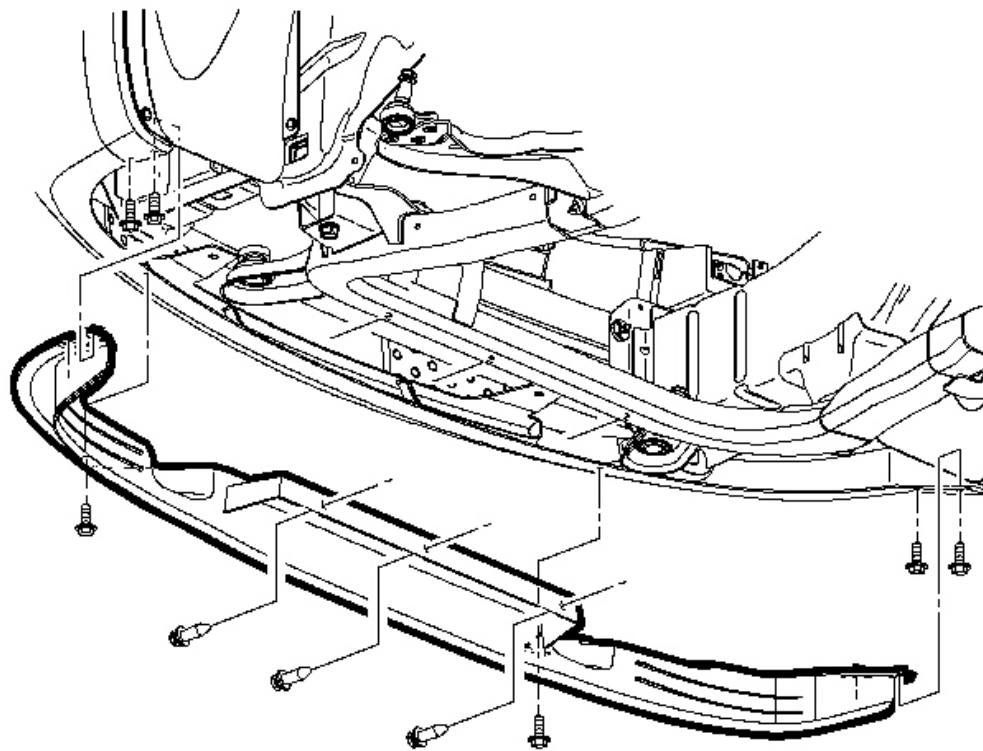


Fig. 30: View Of Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

2. Remove the front lower air deflector.

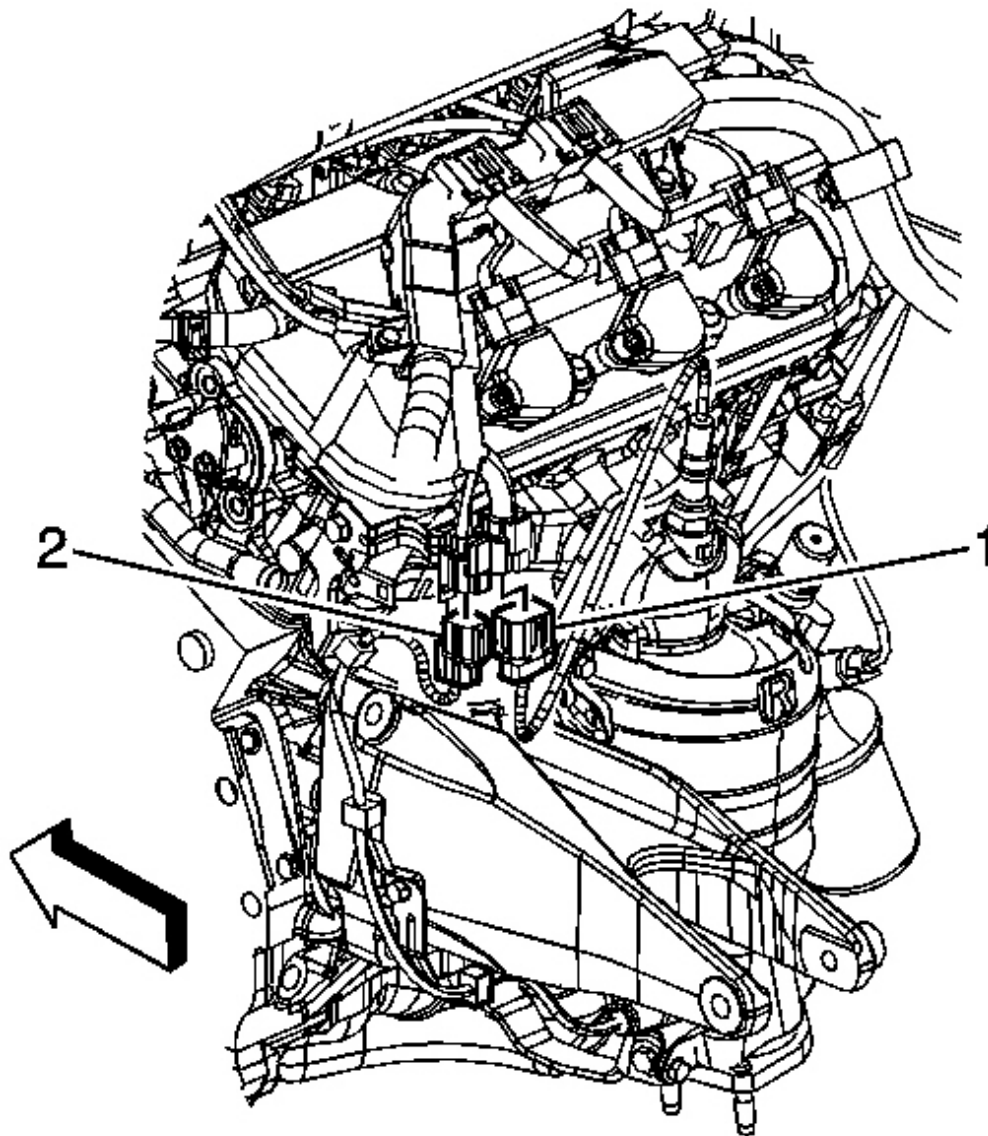


Fig. 31: View Of 2 Sensor Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the O2 sensor electrical connectors (1, 2).
4. Remove the exhaust manifold pipe. Refer to **Exhaust Manifold Pipe Replacement (L66)** or **Exhaust Manifold Pipe Replacement (L61)** .
5. Remove the catalytic converter bracket.

6. Remove the catalytic converter nuts.
7. Remove the catalytic converter.

Installation Procedure

1. Install the catalytic converter.

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

2. Install the catalytic converter nuts.

Tighten: Tighten the nuts to 18 N.m (13 lb ft).

3. Install the catalytic converter bracket and bolts.

Tighten: Tighten the bolts to 22 N.m (16 lb ft).

4. Install the exhaust manifold pipe. Refer to Exhaust Manifold Pipe Replacement (L66) or Exhaust Manifold Pipe Replacement (L61).

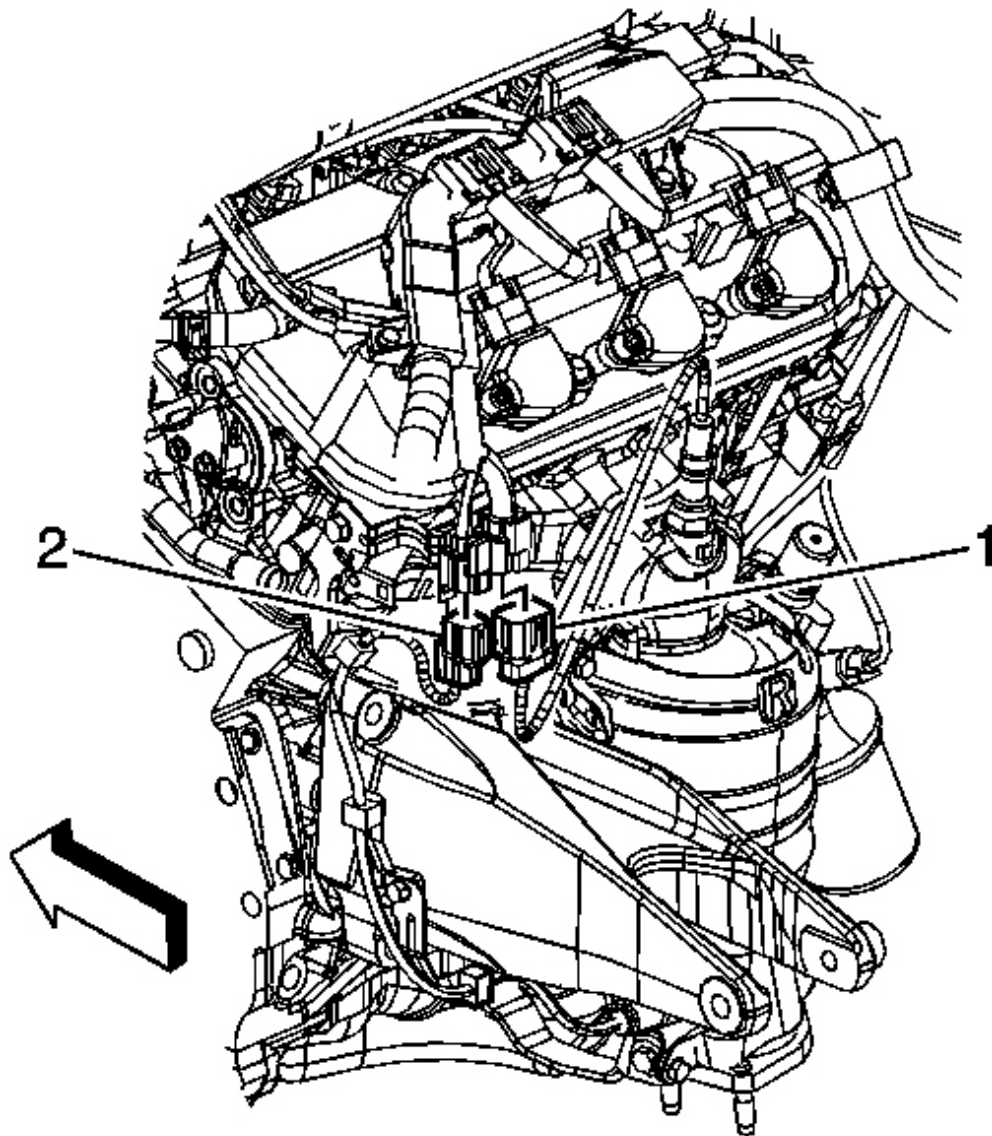


Fig. 32: View Of 2 Sensor Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

5. Connect the O2 sensor electrical connectors (1, 2).
6. Install the front lower air deflector.
7. Lower the vehicle.

MUFFLER REPLACEMENT (PRODUCTION ASSEMBLY)

Removal Procedure

CAUTION: Ensure that the vehicle is properly supported and squarely positioned. To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle on the opposite end from which the components are being removed.

IMPORTANT: The muffler and resonator is not available as a complete assembly. Separate resonator and muffler assemblies are available as service parts.

1. Hoist the vehicle.

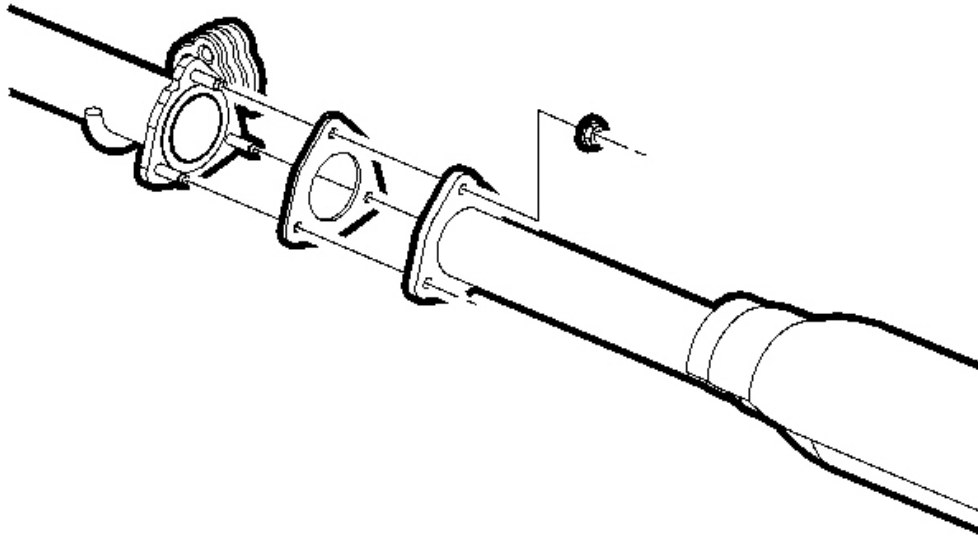


Fig. 33: View Of Muffler
Courtesy of GENERAL MOTORS CORP.

2. Remove the rear exhaust pipe flange to intermediate pipe nuts.

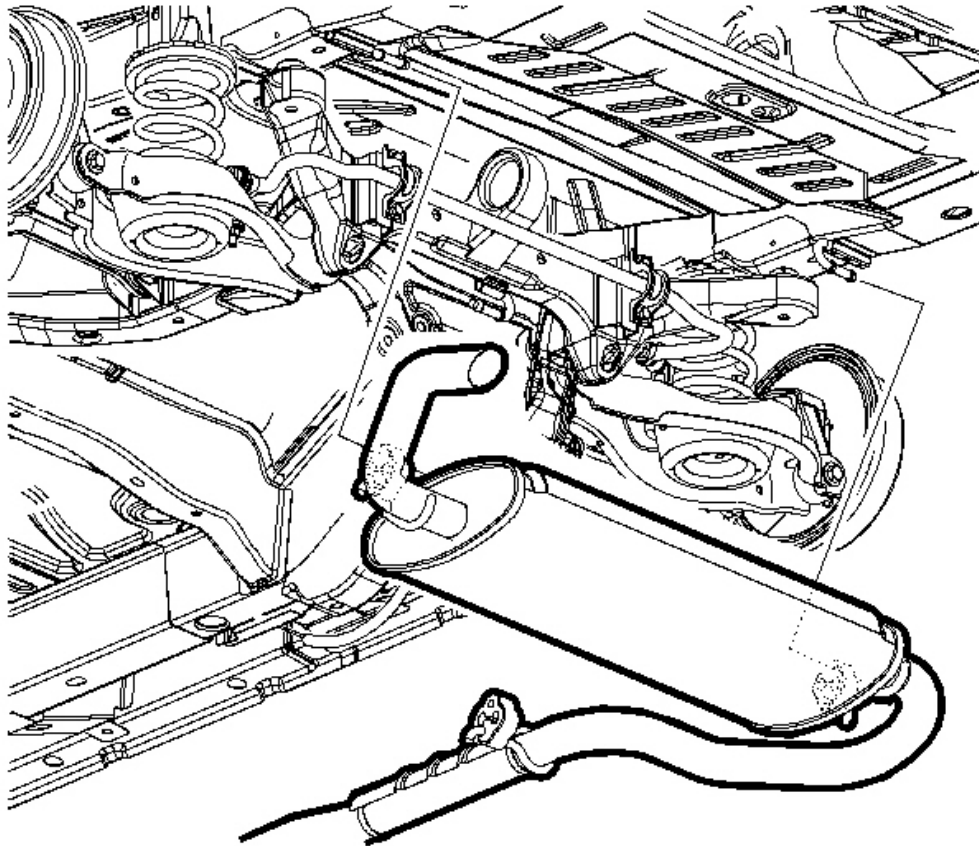


Fig. 34: View Of Hangers From Rubber Isolators
Courtesy of GENERAL MOTORS CORP.

3. Separate the hangers from rubber isolators.
4. Remove the muffler and pipe assembly.

Installation Procedure

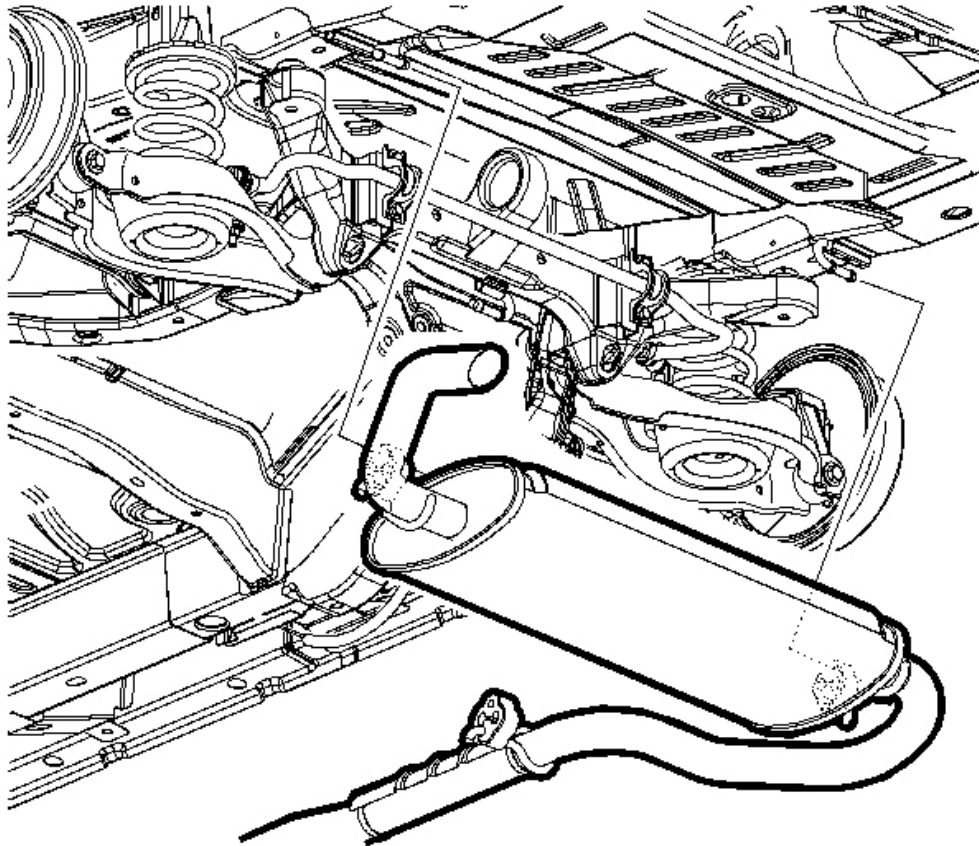


Fig. 35: View Of Hangers From Rubber Isolators
Courtesy of GENERAL MOTORS CORP.

1. Position the muffler and resonator assembly to the vehicle and install into the rubber mounts.

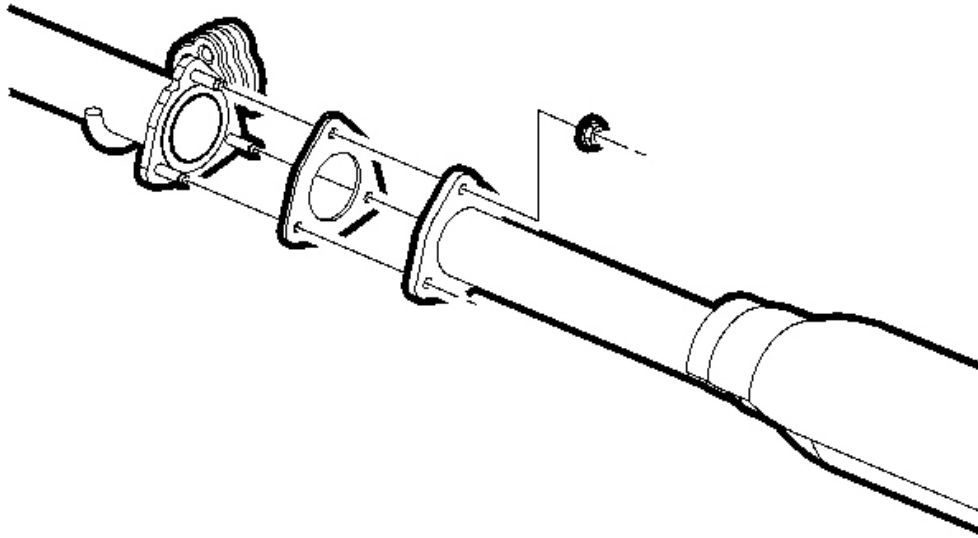


Fig. 36: View Of Gasket & Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

2. Install the new gasket onto the exhaust pipe rear flange.

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

3. Assemble the intermediate pipe to exhaust pipe, install new nuts and tighten.

Tighten: Tighten the exhaust pipe-to-intermediate pipe nuts to 30 N.m (22 lb ft).

4. Check the entire exhaust system for leaks.

MUFFLER REPLACEMENT (SERVICE PART)

Tools Required

SA9168NE Exhaust and Tailpipe Cutter. See Special Tools and Equipment .

Removal Procedure

CAUTION: Ensure that the vehicle is properly supported and squarely positioned. To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle on the opposite end from which the components are being removed.

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

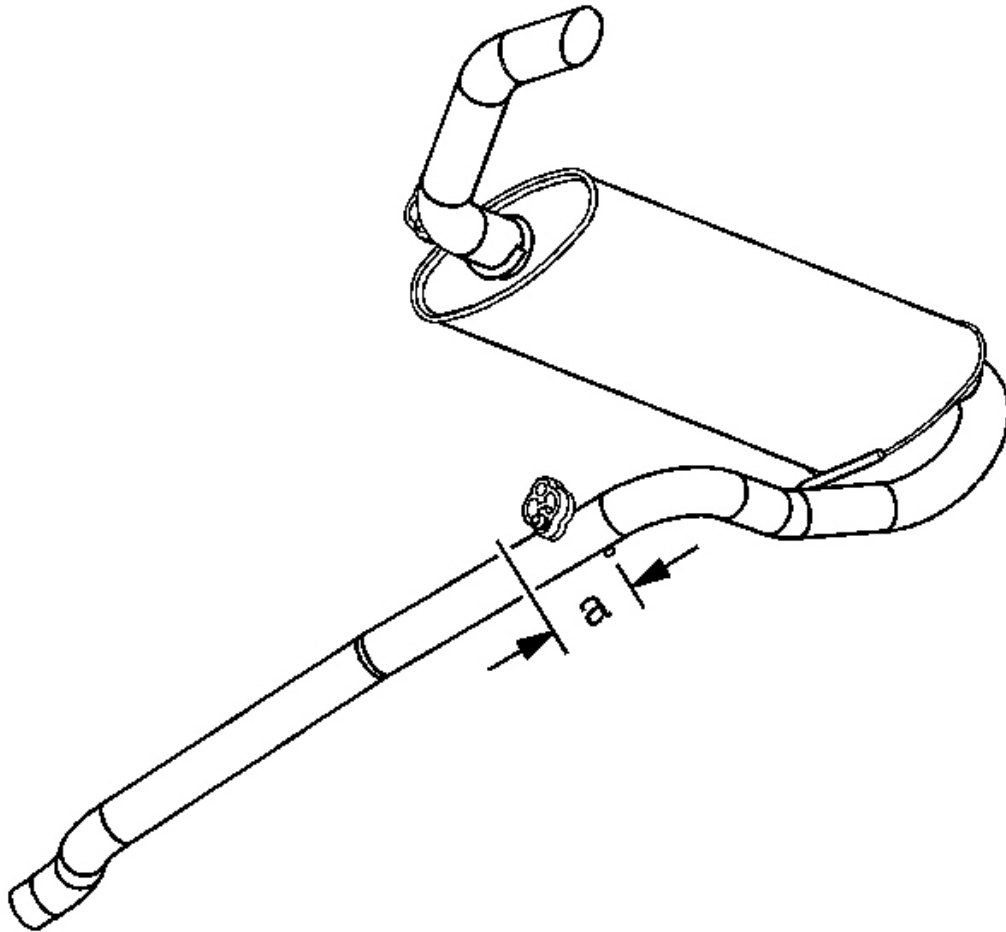


Fig. 37: View Of Muffler & Marking The String On The Pipe
Courtesy of GENERAL MOTORS CORP.

2. Obtain a piece of (non-stretchable) string 135 mm (5.3 in) long. Starting from the muffler, place the string along the pipe. Mark the end of the string on the pipe.

NOTE: Always use a chain cutter to cut the stainless steel pipe. A torch leaves a rough edge and may warp the pipe.

3. Using a SA9168NE (or equivalent) cut the pipe on the mark. See Special Tools and Equipment .

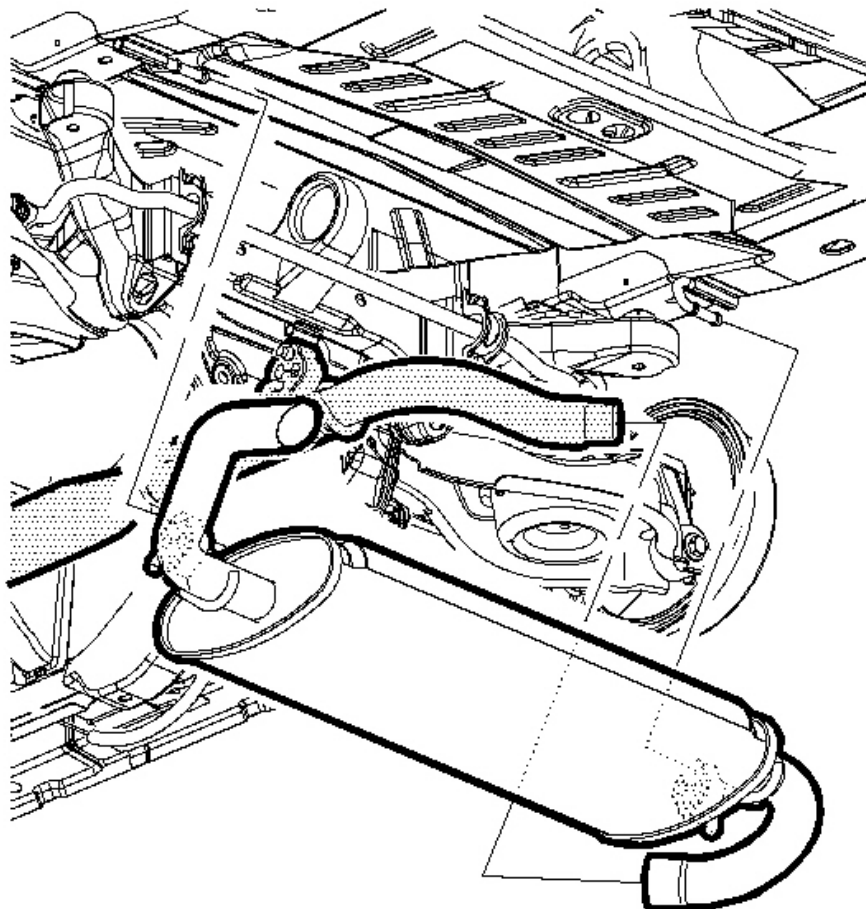


Fig. 38: Positioning Service Muffler & Tailpipe Assembly
Courtesy of GENERAL MOTORS CORP.

4. Separate the muffler and tailpipe.
5. Remove the muffler and tailpipe.

Installation Procedure

IMPORTANT: The service resonator pipe is designed to attach to either the production or service muffler assembly.

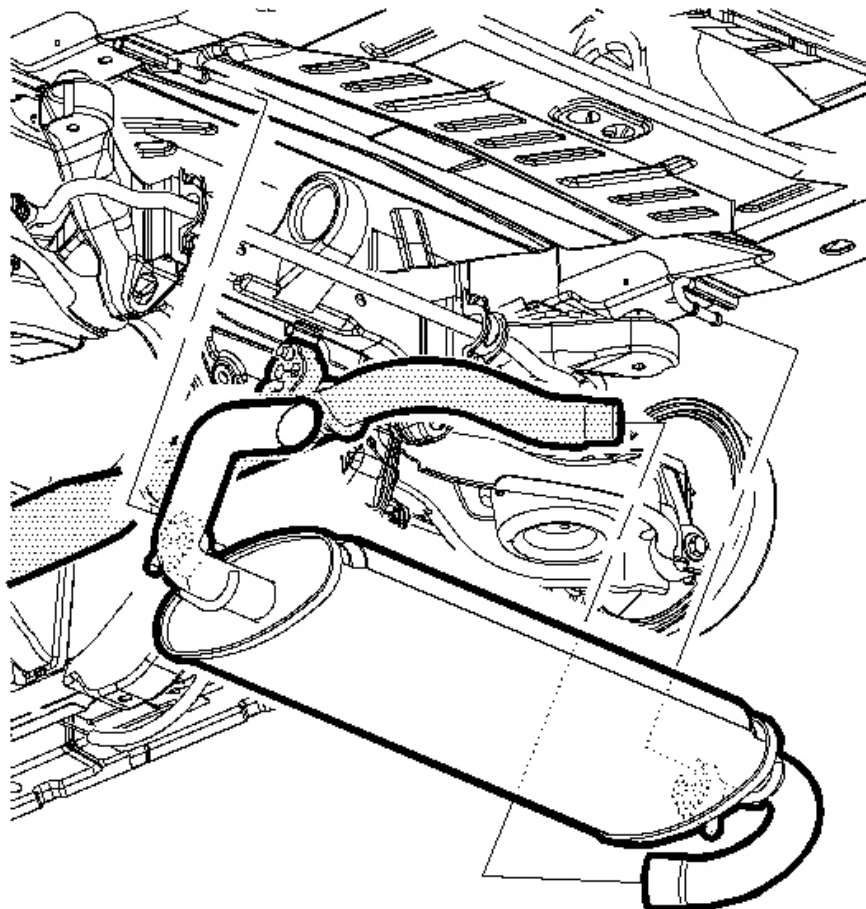


Fig. 39: Positioning Service Muffler & Tailpipe Assembly
Courtesy of GENERAL MOTORS CORP.

1. Deburr the pipe ends as necessary.
2. Position the service muffler and tailpipe assembly onto the intermediate pipe.
3. Install the rubber isolator to mount hanger.

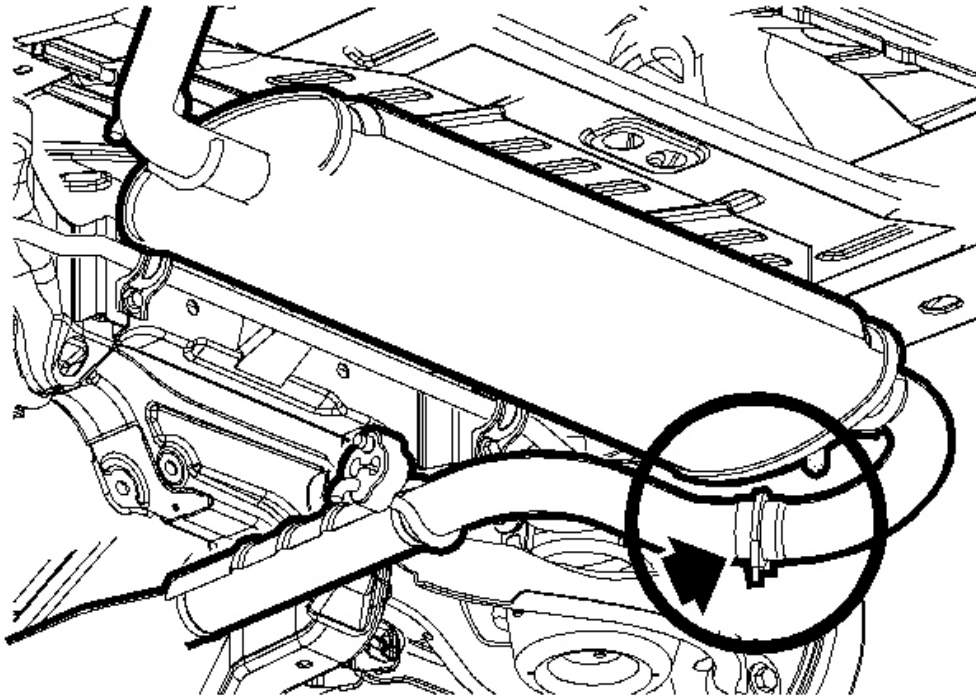


Fig. 40: View Of Rear Muffler Pipe Service Clamp
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the service clamp and tighten

Tighten: Tighten the rear muffler pipe service clamp to 45 N.m (33 lb ft).

MID MUFFLER REPLACEMENT

Tools Required

SA9168NE Exhaust and Tailpipe Cutter. See Special Tools and Equipment .

Removal Procedure

CAUTION: Ensure that the vehicle is properly supported and squarely positioned. To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle on the opposite end from which the components are being removed.

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

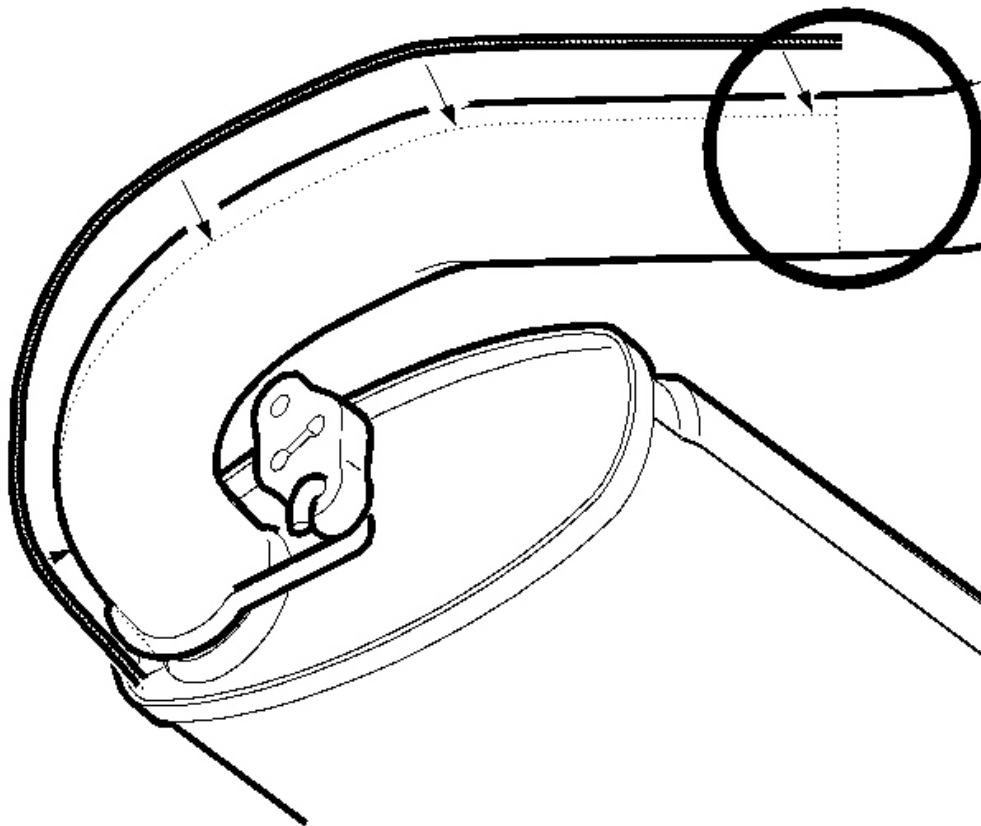


Fig. 41: View Of Mid Muffler
Courtesy of GENERAL MOTORS CORP.

2. Obtain a piece of (non-stretchable) string 135 mm (5.3 in) long. Starting from the muffler, place the string along the pipe. Mark the end of the string on the pipe.

NOTE: Always use a chain cutter to cut the stainless steel pipe. A torch leaves a rough edge and may warp the pipe.

3. Using the SA9168NE (or equivalent), cut the pipe on the mark. See Special Tools and Equipment .

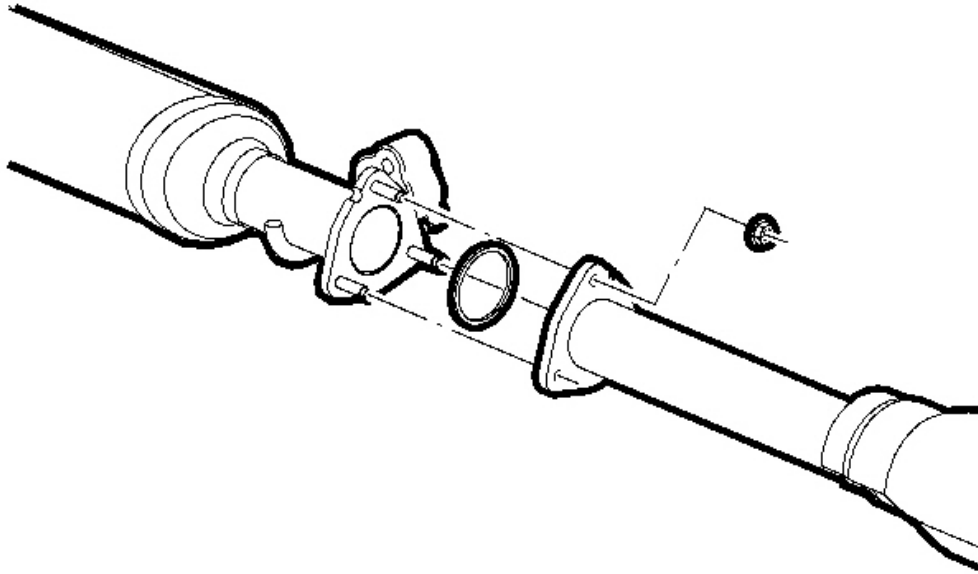


Fig. 42: View Of Gasket Onto The Front Pipe Flange
Courtesy of GENERAL MOTORS CORP.

4. Remove the rear exhaust pipe flange to intermediate pipe nuts.

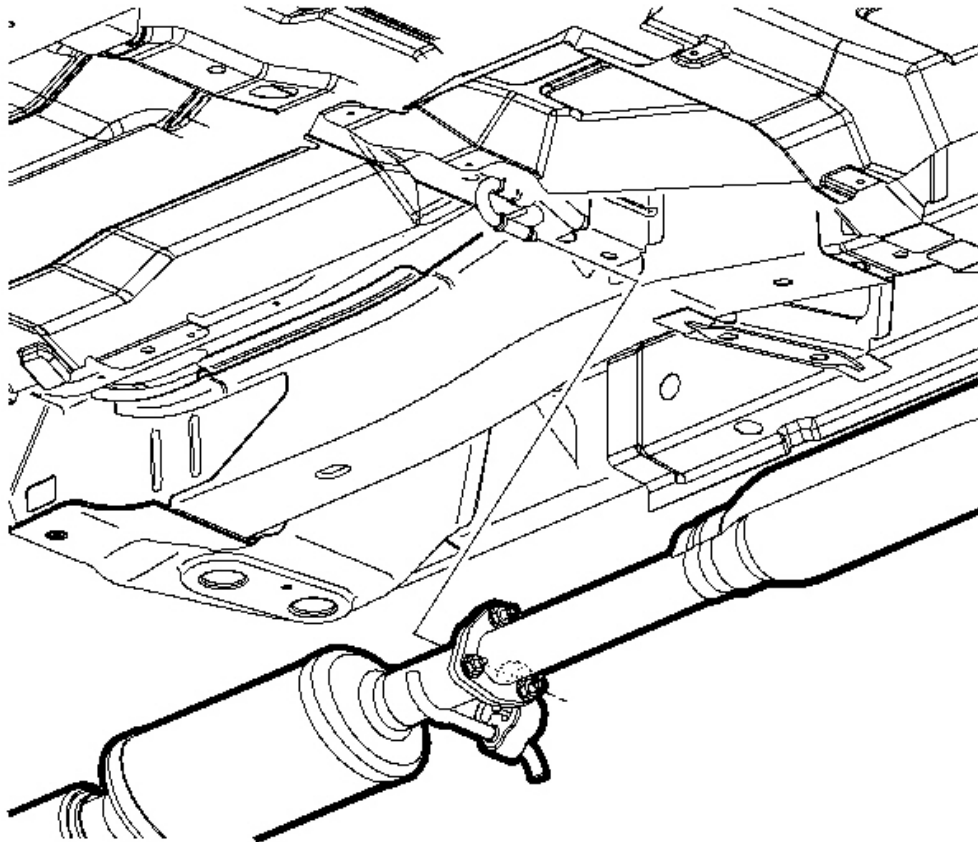


Fig. 43: View Of Hanger From The Rubber Isolators
Courtesy of GENERAL MOTORS CORP.

5. Separate the hanger from the rubber isolators.
6. Remove the resonator and pipe assembly.
7. Fully remove the gasket material and discard.

Installation Procedure

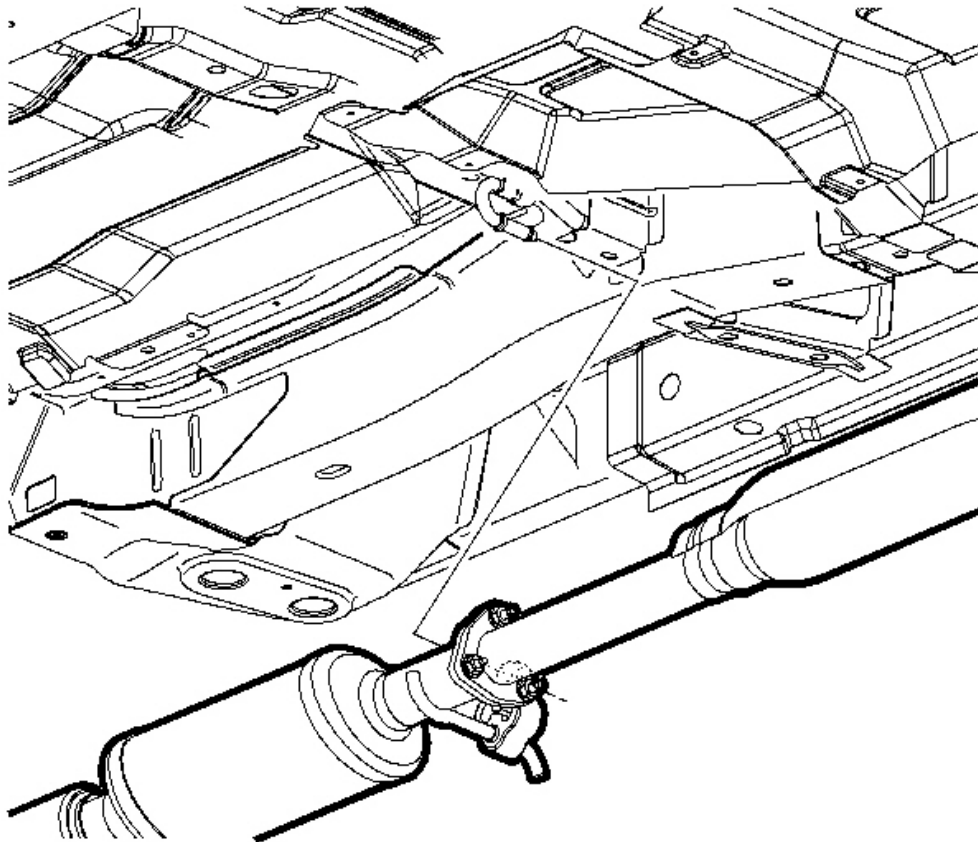


Fig. 44: View Of Manifold Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The service resonator pipe is designed to attach to either the production or service muffler assembly.

1. Deburr the pipe ends as necessary.

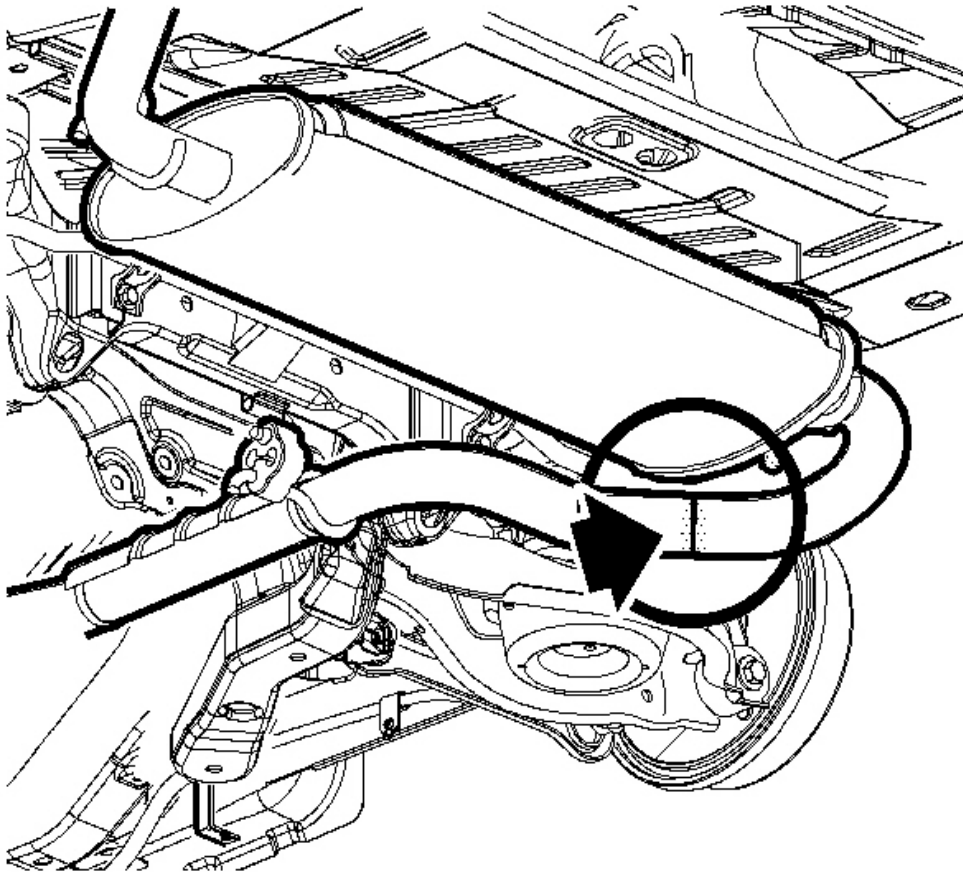


Fig. 45: Positioning Service Intermediate Pipe & Resonator Assembly
Courtesy of GENERAL MOTORS CORP.

2. Position the service intermediate pipe and resonator assembly on the rear muffler pipe.

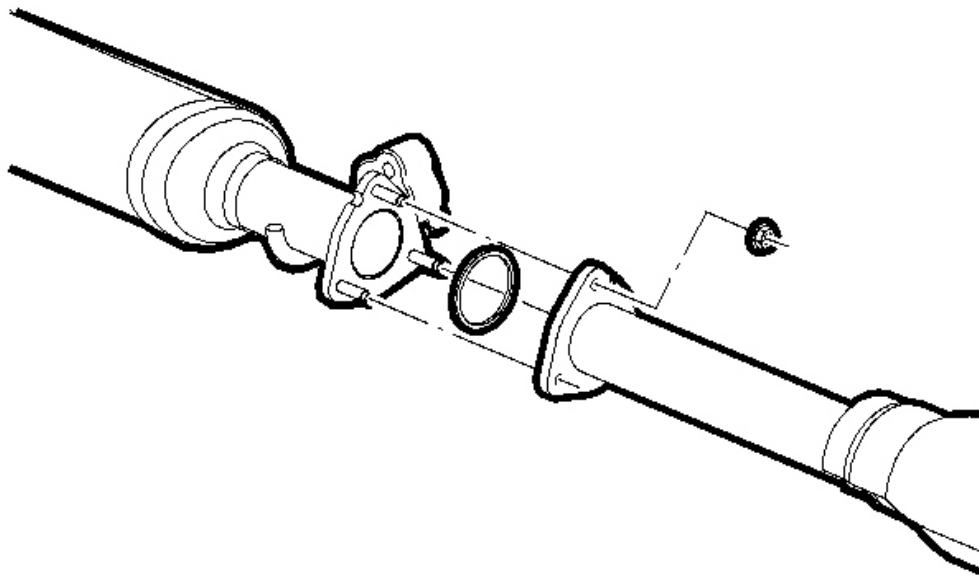


Fig. 46: View Of Gasket Onto The Front Pipe Flange
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the new gasket onto the front pipe flange. Position the resonator pipe to flange. Install the nuts and tighten.

Tighten: Tighten the resonator pipe-to-flange nuts to 30 N.m (22 lb ft).

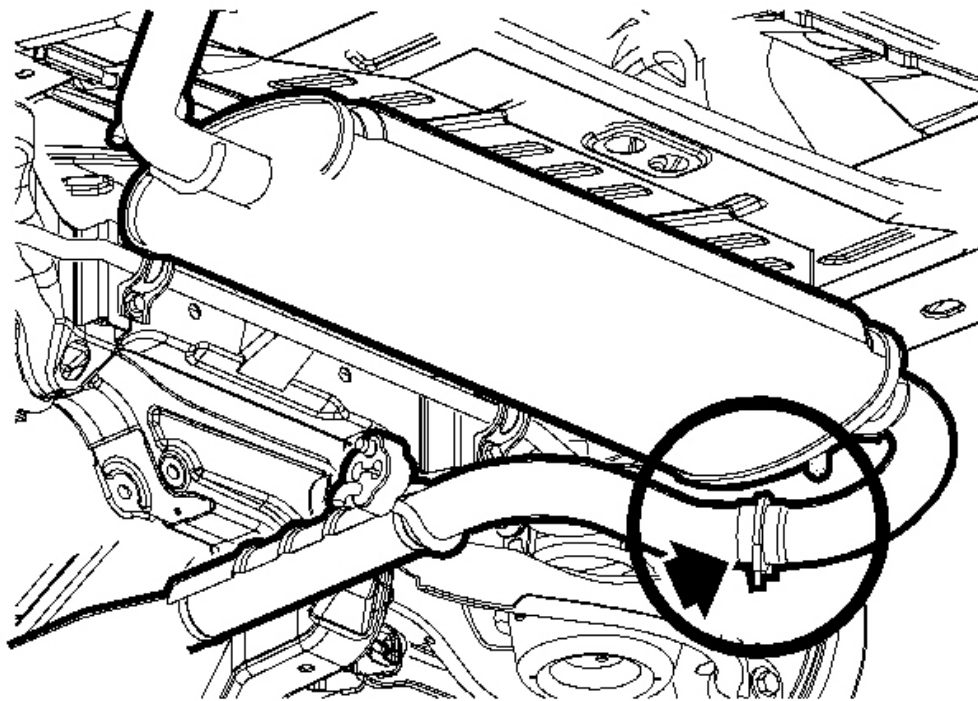


Fig. 47: View Of Rear Muffler Pipe Service Clamp
Courtesy of GENERAL MOTORS CORP.

4. Install the service clamp and tighten.

Tighten: Tighten the rear muffler pipe service clamp to 45 N.m (33 lb ft).

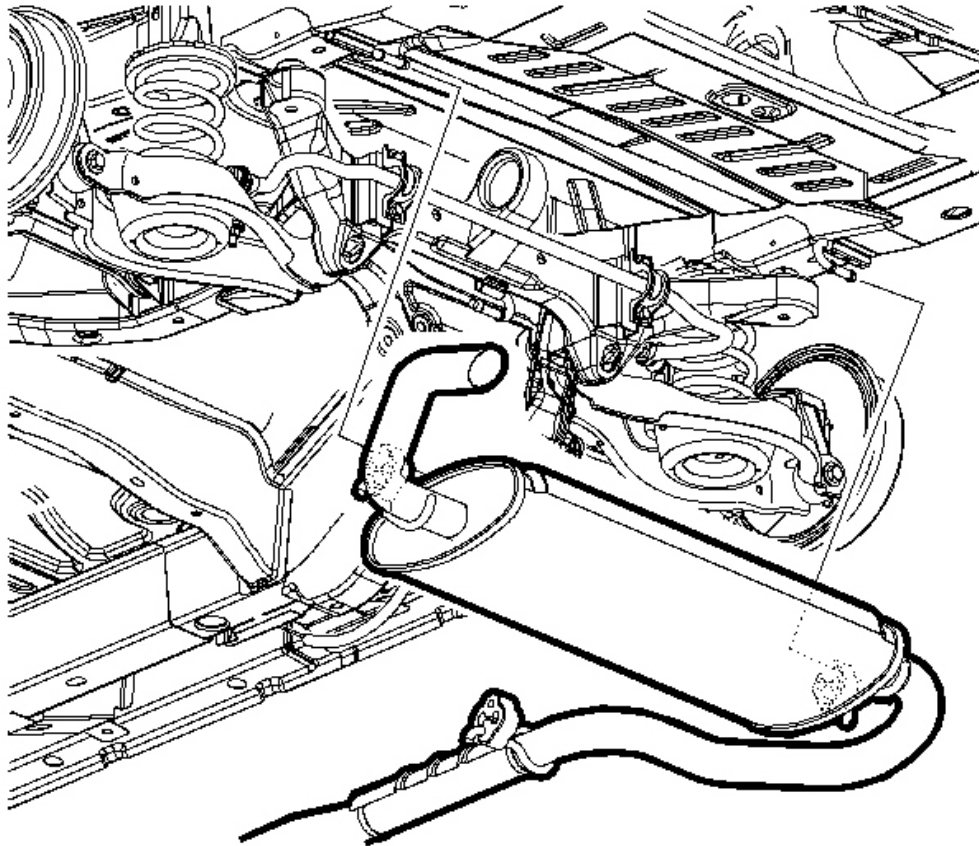


Fig. 48: View Of Hangers From Rubber Isolators
Courtesy of GENERAL MOTORS CORP.

5. Install the rubber isolator to mount hanger.

CATALYTIC CONVERTER HEAT SHIELD REPLACEMENT

Removal Procedure

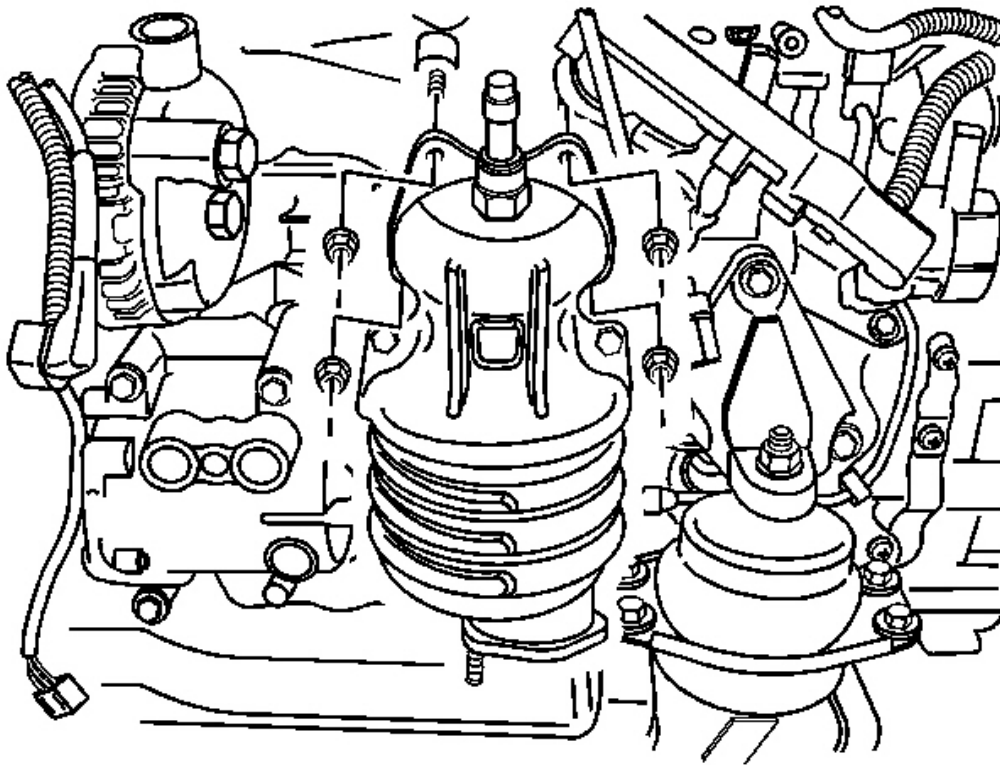


Fig. 49: View Of Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

1. Remove the catalytic converter. Refer to **Catalytic Converter Replacement - Left** and **Catalytic Converter Replacement - Right** .
2. Remove the catalytic converter-to-heat shield bolts.
3. Remove the heat shield.

Installation Procedure

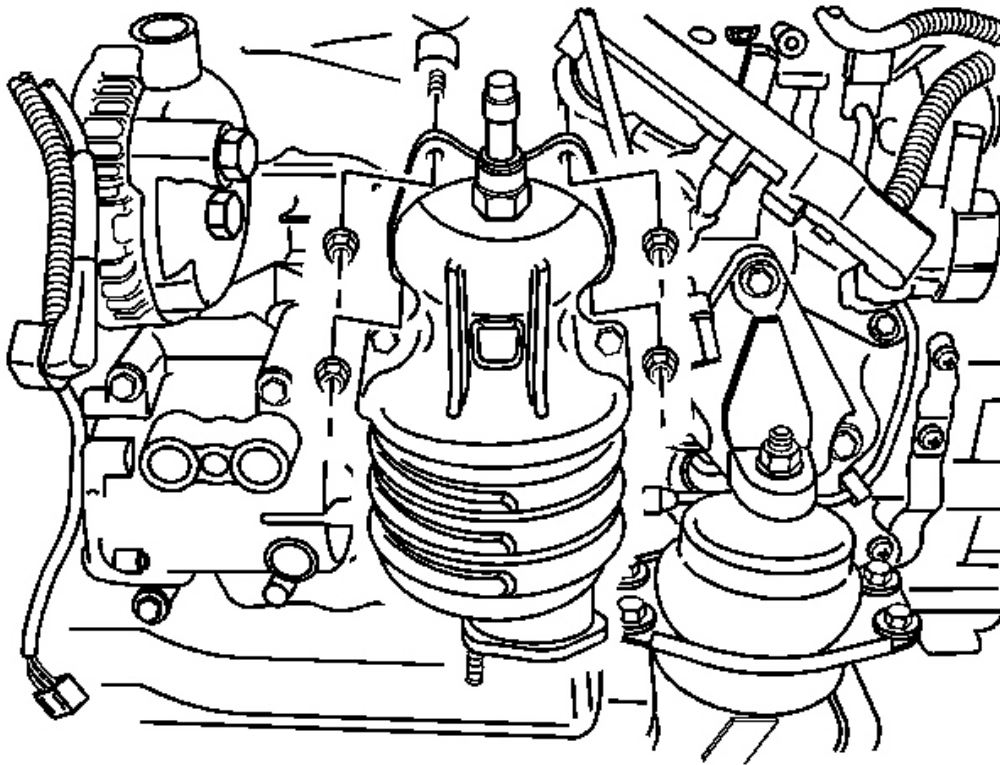


Fig. 50: View Of Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

1. Install the heat shield.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the catalytic converter heat shield bolts.

Tighten: Tighten the bolts to 12 N.m (106 lb in).

3. Install the front catalytic converter. Refer to Catalytic Converter Replacement - Left and Catalytic Converter Replacement - Right.

EXHAUST HEAT SHIELD REPLACEMENT

Removal Procedure

CAUTION: Ensure that the vehicle is properly supported and squarely positioned. To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle on the opposite end from which the components are being removed.

1. Hoist the vehicle.

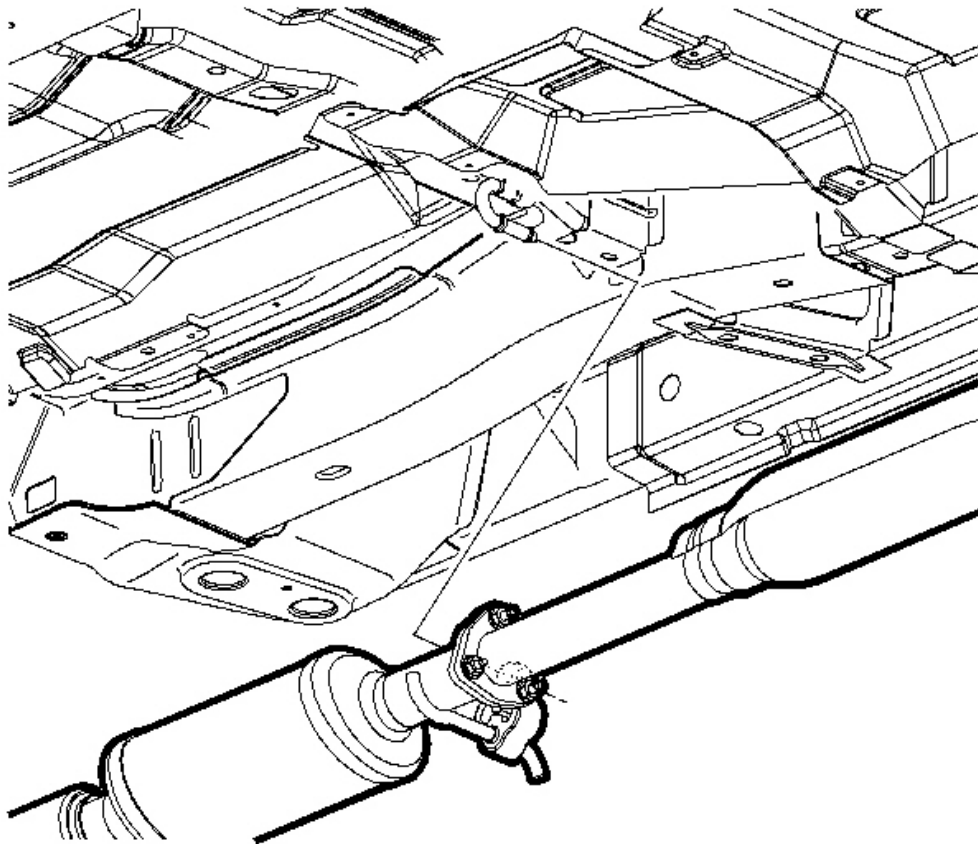


Fig. 51: View Of Manifold Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

2. Remove the manifold exhaust pipe. Refer to Exhaust Manifold Pipe Replacement (L66) or Exhaust Manifold Pipe Replacement (L61) .

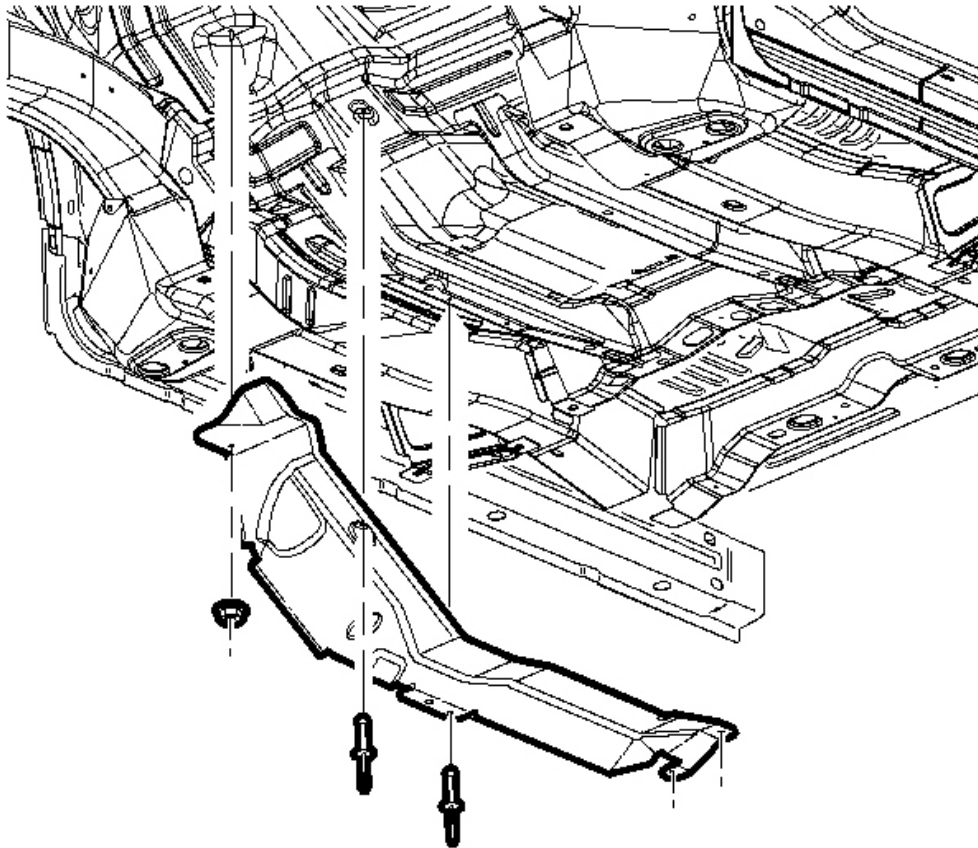


Fig. 52: Positioning Shield Onto The Vehicle
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The front and rear heat shields overlap and utilize common rivet attachment points.

3. Remove the nut and rivets.
4. Remove the heat shield.

Installation Procedure

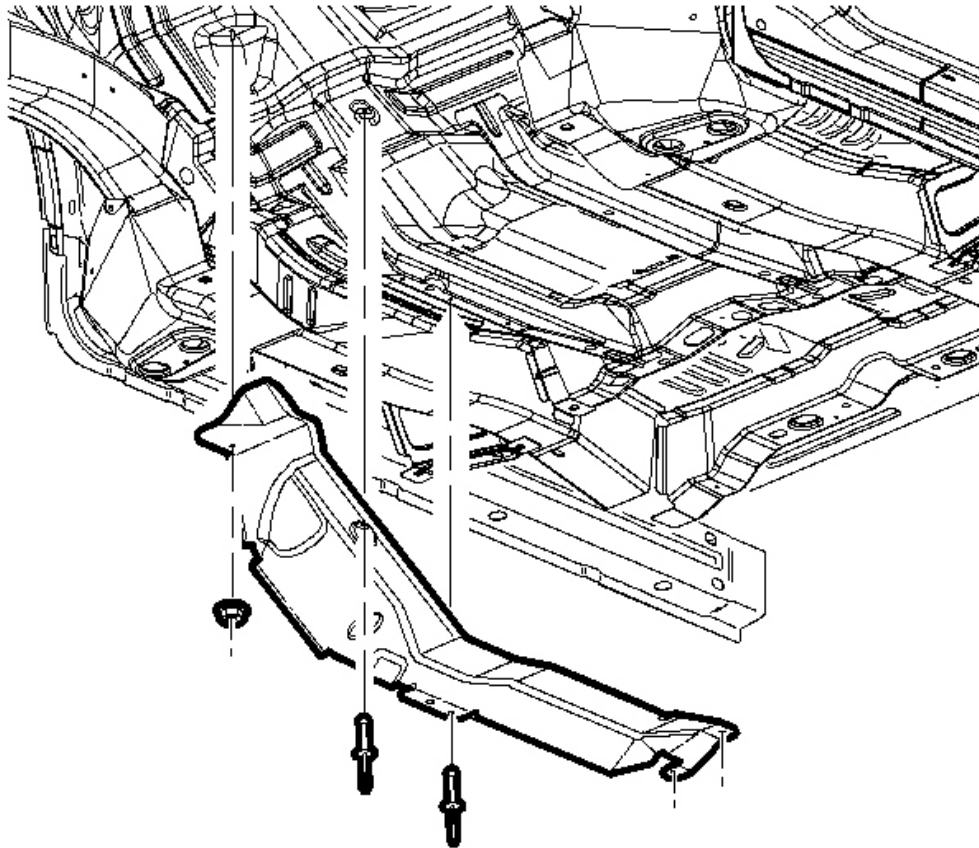


Fig. 53: Positioning Shield Onto The Vehicle
Courtesy of GENERAL MOTORS CORP.

1. Position the shield to the vehicle, aligning the front hole stud. Place the rear of the shield under the rear shield and against the underbody.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the nut and tighten.

Tighten: Tighten the heat shield-to-underbody nut to 10 N.m (89 lb ft).

3. Install the rivets.

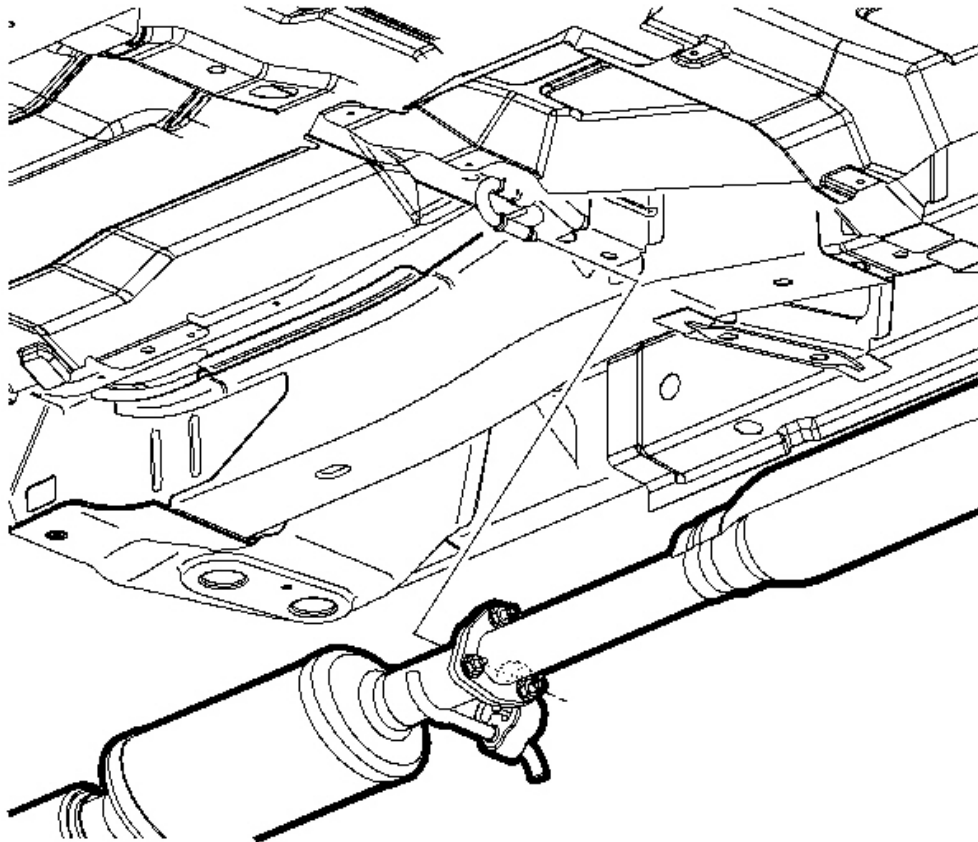


Fig. 54: View Of Manifold Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

4. Install the manifold exhaust pipe. Refer to Exhaust Manifold Pipe Replacement (L66) or Exhaust Manifold Pipe Replacement (L61) .

EXHAUST MANIFOLD HEAT SHIELD REPLACEMENT (L61)

Removal Procedure

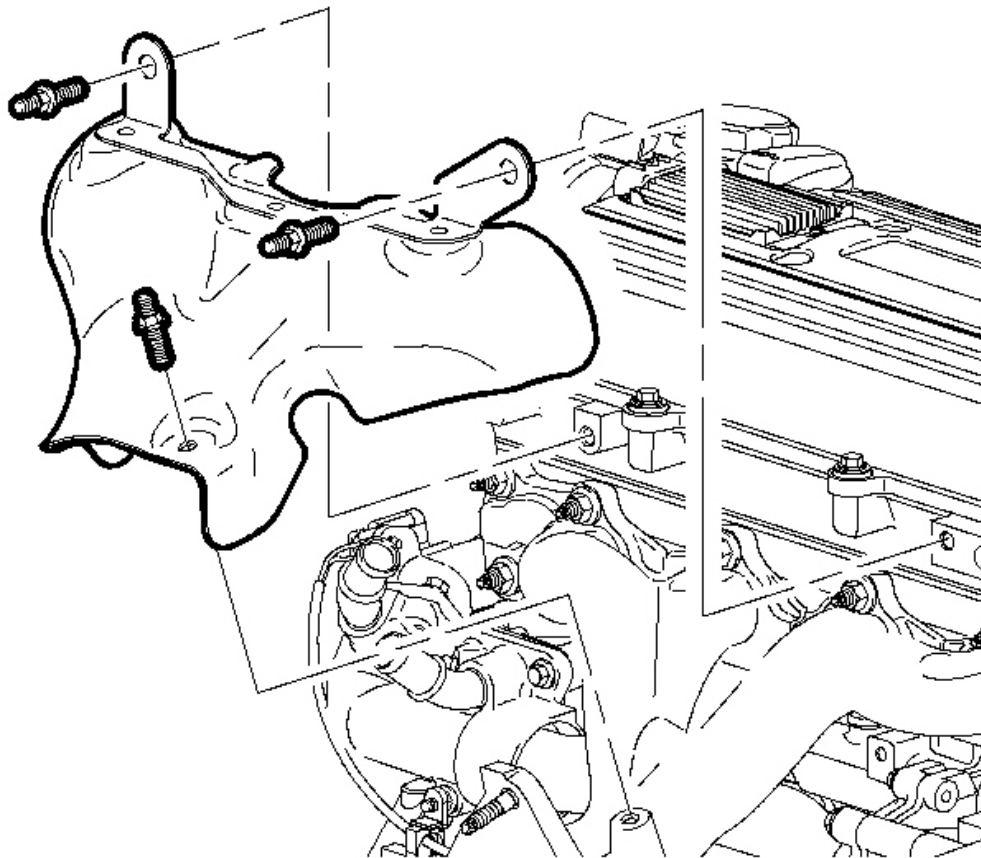


Fig. 55: View Of Exhaust Manifold Heat Shield (L61)
Courtesy of GENERAL MOTORS CORP.

1. Remove exhaust heat shield bolts.
2. Remove exhaust heat shield.

Installation Procedure

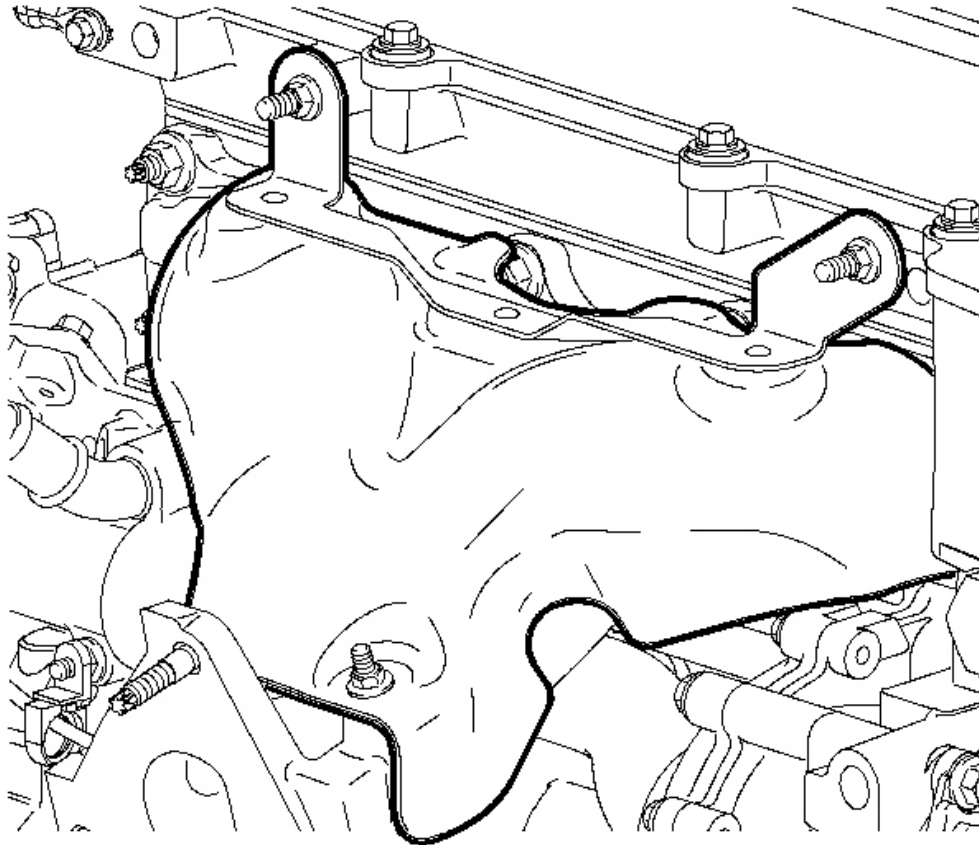


Fig. 56: View Of Exhaust Manifold Heat Shield
Courtesy of GENERAL MOTORS CORP.

1. Install the exhaust manifold heat shield.

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 23 N.m (17 lb ft).

DESCRIPTION AND OPERATION

EXHAUST SYSTEM DESCRIPTION

Three-Way Catalytic Converter

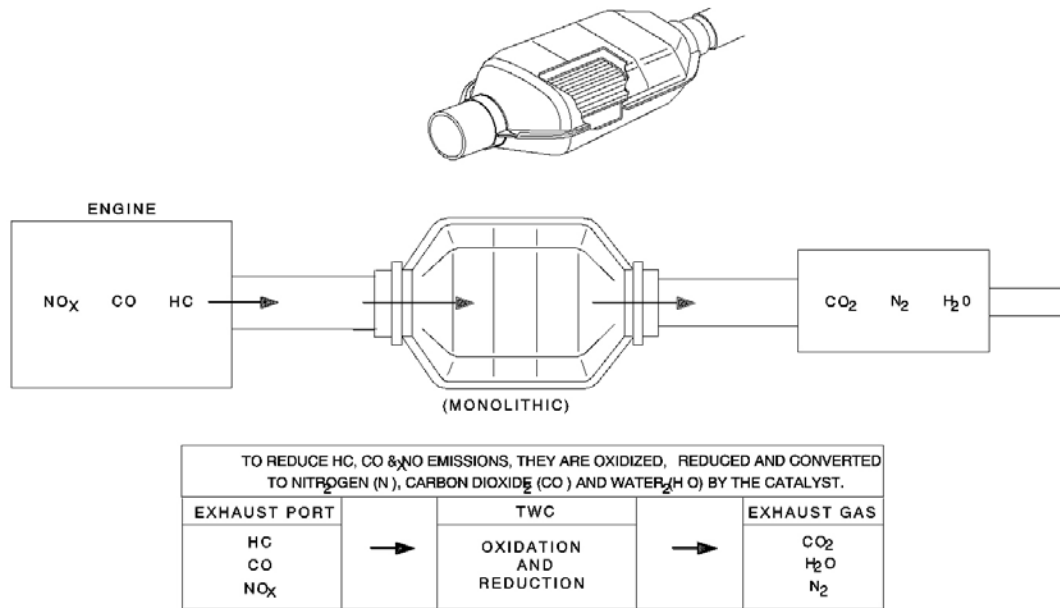


Fig. 57: View Of Three-Way Catalytic Converter
Courtesy of GENERAL MOTORS CORP.

The 3-way catalytic converter is an emission control device added to the exhaust system to reduce pollutants in the exhaust gas stream and requires the use of unleaded fuel only.

The 3-way catalytic converter coating contains platinum and rhodium which lowers the levels of oxides of nitrogen (NO_x) as well as hydrocarbons (HC) and carbon monoxide (CO).

Periodic maintenance of the exhaust system is not required. If the vehicle is raised for other service, it is advisable to check the condition of the complete exhaust system.

Exhaust Manifold/Oxygen (O_2) Sensor

The exhaust manifolds are cast iron. The oxygen sensor is located in the exhaust manifold of all engines.

Exhaust Manifold Pipe

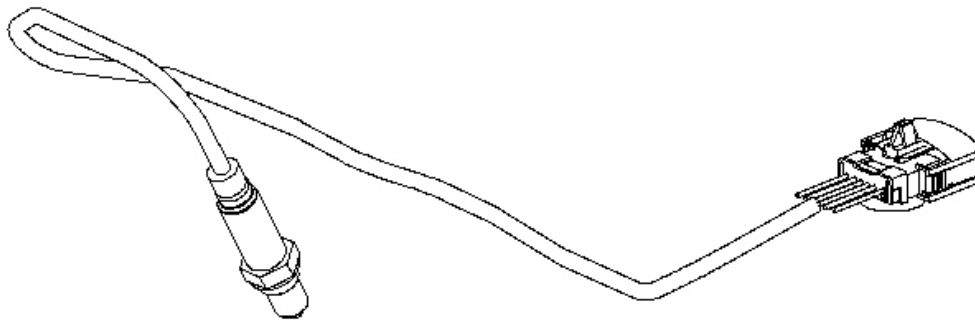


Fig. 58: View Of Exhaust Pipe
Courtesy of GENERAL MOTORS CORP.

The front exhaust pipe incorporates a stainless steel braided sleeve over a flexible bellows sections along with the catalytic converter. The entire pipe assembly is welded joint construction and is only serviced as an assembly.

Rear Heated Oxygen Sensor (HO2S-2)

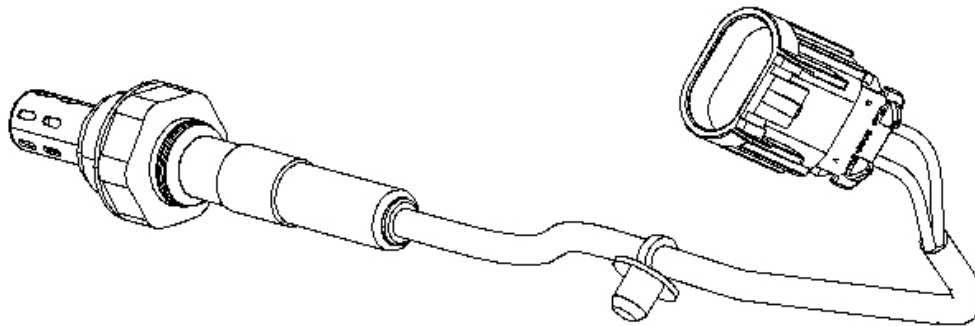


Fig. 59: View Of Heated Rear Oxygen Sensor (HO2S-2)
Courtesy of GENERAL MOTORS CORP.

The heated rear oxygen sensor, mounted behind the catalytic converter, monitors oxygen content in the exhaust to determine the efficiency of the catalytic converter. The HO2S-2 is a four wire sensor; two of the wires heat the sensor (B+ and ground) and the other two wires are the signal reference and ground. The sensor acts as an electro chemical cell, or battery, to produce a voltage in response to the oxygen content in the exhaust. A bias voltage, voltage sent from the PCM, is between 350 mV and 550 mV which is the voltage the PCM will see when the sensor is inactive or cold. As the heater and the converter heat the sensor up to around 275°C (527°F), the sensor will produce its own voltage to counteract this bias voltage. Low voltage from the sensor indicates high oxygen content, lean mixture, whereas high voltage indicates low oxygen content, rich mixture. The wires to the sensor carry air reference which is used to compare differences in oxygen from the atmosphere to the exhaust stream.

The rear HO2S-2 will react slower than the front OS2 due to the oxygen storage in the catalytic converter. The rear oxygen sensor is used only for converter efficiency, not for A/F ratio control.

The rear oxygen sensor operates between 275°C (527°F) to 850°C (1562°F).

Exhaust/Resonator Pipe

The exhaust/resonator pipe is part of the production exhaust system and is serviced by a service only assembly.

Muffler

The muffler is part of the production exhaust system and is serviced by a service only assembly.

Hangers and Isolators

The exhaust system is supported by free hanging rubber mountings which permit some movement of the exhaust system but do not permit the transfer of noise and vibration into the passenger compartment.

The installation of exhaust system supports/isolators is very important as improperly installed supports/isolators can cause annoying vibrations which can be difficult to diagnose.

Clamps

Clamps are used for connecting the Saddle/U-bolt exhaust system slip joints.

Shields

The heat shields are aluminum; they prevent exhaust system heat from penetrating the floor of the vehicle or the fuel tank. Inspect the shields for cracks and tears. Shields must always be re-installed if they are removed for exhaust system or body repairs.

Exhaust Manifold Assembly - L61

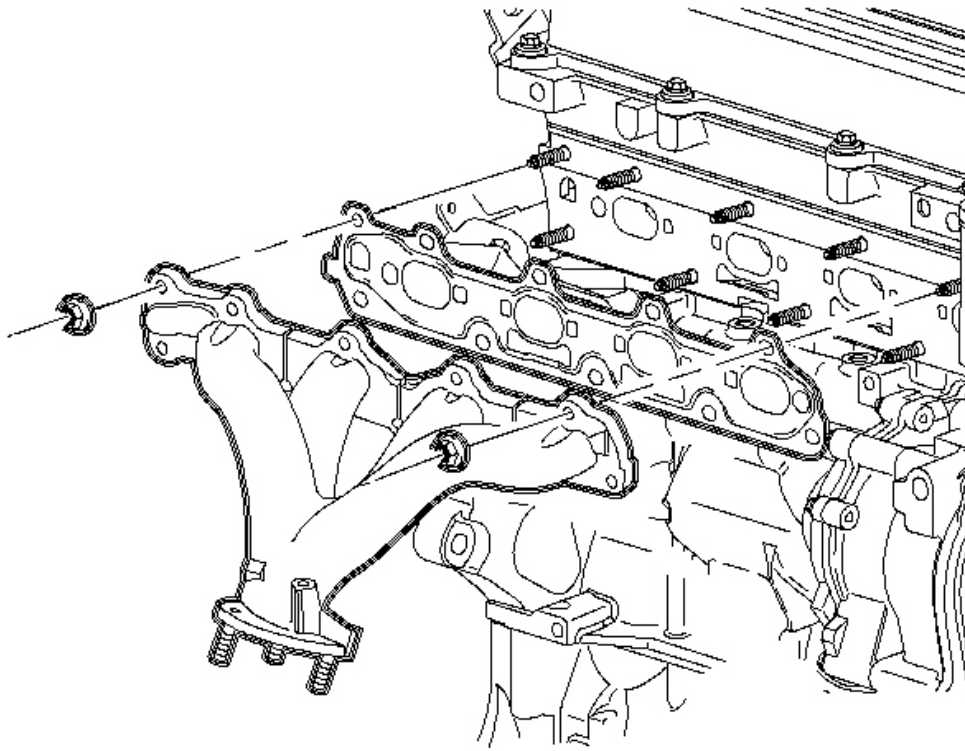


Fig. 60: View Of Exhaust Manifold Assembly (L61)
Courtesy of GENERAL MOTORS CORP.

The exhaust manifold assembly is made from cast iron. The exhaust manifold incorporates a split design which aids in head dissipation and provides attachment points for exhaust pipe and head shield.

Exhaust System Production

Make sure that there is adequate clearance between the components of the exhaust system and all points of the underbody to avoid possible overheating of the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check the complete exhaust system and nearby body areas for broken, damaged, missing or mis-positioned

parts, open seams, holes, loose connections, or other deterioration which could permit exhaust fumes to seep into the passenger compartment. Dust or water in the passenger compartments may be indication of a problem in one of these areas. Any damage should be corrected immediately.

Annoying rattles and noise vibrations in the exhaust system are usually caused by misalignment of parts. When aligning the system, leave all bolts or nuts loose until all parts are properly aligned, then tighten, working from the rear.

Periodic maintenance of the exhaust system is not required. When the vehicle is raised for service, check the general condition of the three way catalytic converter, pipes, mufflers, and heat shields. The steel used in the exhaust system is resistant to corrosion caused by exhaust gases, but rapidly shows surface corrosion on the outside. This surface corrosion is not a cause for replacement.

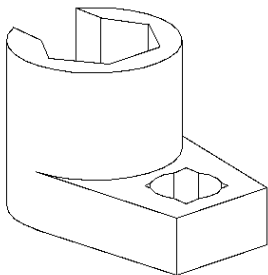
The installation of exhaust system supports is very important, since improperly installed supports can cause annoying vibrations which are difficult to diagnose.

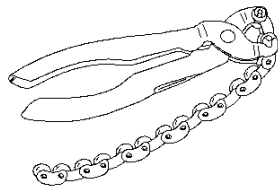
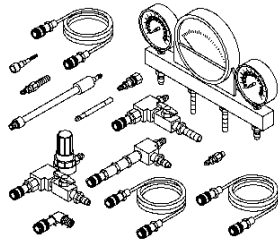
Exhaust system performance complaints, such as excessive back pressure, are noticeable by their effect on engine performance. Other faulty vehicle components, such as emission control devices, have similar effects on engine performance and may be characterized by the same symptoms or complaints.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/ Description
	<p>J 39194-C 02 Sensor Removal Tool</p>
	<p>SA 9127E Gage Bar Set</p>



SA 9168NE
Exhaust and Tailpipe Cutter