

Engine Exhaust

Specifications

Fastener Tightening Specifications

Application	Specification	
	Metric	English
3-Way Catalytic Converter-to-Front Exhaust Pipe	20 N•m	15 lb ft
3-Way Catalytic Converter-to-Exhaust Muffler	17 N•m	13 lb ft
Catalytic Converter Brace Fastener (LUV)	22 N•m	16 lb ft
Catalytic Converter Brace Fastener (LUW)	20 N•m	15 lb ft
Exhaust Manifold with Catalytic Converter-to-Cylinder Head Fastener (LUW)	15 N•m	11 lb ft
Exhaust Manifold Brace Fastener (LUW)	20 N•m	15 lb ft
Exhaust Manifold Heat Shield (LUV)	9 N•m	80 lb in
Exhaust Muffler Clamp (Service)	50 N•m	37 lb ft
Exhaust Muffler Heat Shield	4 N•m	35 lb in
Front Exhaust Pipe-to-Catalytic Converter (LUW)	20 N•m	15 lb ft
Turbocharger Clamp Fastener (LUV)	13 N•m	115 lb in

Diagnostic Information and Procedures

Symptoms - Engine Exhaust

- Review the Exhaust System Description and Operation in order to familiarize yourself with the system functions. Refer to *Exhaust System Description* on page 9-753.
- 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* on page 6-58.

Visual/Physical Inspection

- Inspect for aftermarket or non-OEM devices such as, but not including, tailpipe extensions, mufflers, and exhaust hangers. 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* on page 9-734.
- Poor acceleration—Refer to *Restricted Exhaust* on page 9-734.
- Poor fuel economy—Refer to *Restricted Exhaust* on page 9-734.
- Exhaust hissing noise—Refer to *Exhaust Leakage* on page 9-736.
- Exhaust popping noise—Refer to *Exhaust Leakage* on page 9-736.
- Exhaust rattle noise—Refer to *Exhaust Noise* on page 9-736.
- Loud exhaust noise—Refer to *Exhaust Noise* on page 9-736.
- Exhaust buzz, groan, hum noise—Refer to *Exhaust Noise* on page 9-736.

Restricted Exhaust

Special Tools

EN-35314-A Exhaust Back Pressure Gauge

For equivalent regional tools. Refer to *Special Tools* on page 9-754.

Diagnostic Aids

A quick check of exhaust flow will help determine for gasoline engines.

Test Description

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

3. 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 *EN-35314-A* gauge.

Removing the heated oxygen sensor may set a DTC. When finishing this diagnostic table, be sure to clear all codes.

4. This step will isolate the catalytic converter from the remainder of the exhaust system.
7. 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	—
2	Did you review the exhaust symptoms diagnostic information and perform the necessary inspections?	—	Go to Step 3	Go to Symptoms - Engine Exhaust on page 9-734
3	1. Remove the heated oxygen sensor 1. Refer to <i>Heated Oxygen Sensor Replacement - Sensor 1</i> on page 9-249 for the 1.4L or <i>Heated Oxygen Sensor Replacement - Sensor 1</i> on page 9-538 for the 1.6L. 2. Install the <i>EN-35314-A</i> gauge in place of the heated oxygen sensor 1. 3. Start the engine. 4. Increase and monitor the engine speed at 2,000 RPM. 5. Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value?	14 kPa (2 psi)	Go to Step 4	Go to Step 7
4	1. Turn the engine off and place the Ignition in the lock position. 2. Remove the <i>EN-35314-A</i> gauge. 3. Install the heated oxygen sensor 1. Refer to <i>Heated Oxygen Sensor Replacement - Sensor 1</i> on page 9-249 for the 1.4L or <i>Heated Oxygen Sensor Replacement - Sensor 1</i> on page 9-538 for the 1.6L. 4. Remove the heated oxygen sensor 2. Refer to <i>Heated Oxygen Sensor Replacement - Sensor 2</i> on page 9-250 for the 1.4L or <i>Heated Oxygen Sensor Replacement - Sensor 2</i> on page 9-539 for the 1.6L. 5. Install the <i>EN-35314-A</i> gauge in place of the heated oxygen sensor 2. 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 5	Go to Step 6
5	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 7	—
6	Replace the catalytic converter. Refer to <i>Warm Up Three-Way Catalytic Converter Replacement (LUV,LUW)</i> on page 9-745. Did you find and correct the condition?	—	Go to Step 7	—

Restricted Exhaust (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Remove the EN-35314-A gauge. 2. Install the heated oxygen sensor 2. Refer to <i>Heated Oxygen Sensor Replacement - Sensor 2</i> on page 9-250 for the 1.4L or <i>Heated Oxygen Sensor Replacement - Sensor 2</i> on page 9-539 for the 1.6L. 3. Clear any DTCs. 4. Road test the vehicle in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 2

Exhaust Leakage

Problem	Action
Warning: 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 <i>Symptoms - Engine Exhaust</i> on page 9-734 prior to beginning this table.	
Misaligned or improperly installed exhaust system components	Align and tighten the components to the specifications. Refer to <i>Fastener Tightening Specifications</i> on page 9-734.
Exhaust leaks at the following connections: • Exhaust manifold to pipe • Flanges • Pipe clamps	Tighten the components to the specifications. Refer to <i>Fastener Tightening Specifications</i> on page 9-734.
Seals or gaskets leaking. • Exhaust manifold to cylinder head • Exhaust pipes to exhaust manifold • Catalytic converter connection • 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 with catalytic converter. Refer to <i>Exhaust Manifold with Catalytic Converter Replacement (LUW)</i> on page 9-737.
Exhaust system component connection welds leaking	Replace the leaking component. Refer to the affected component's procedure for service.
Duct damaged or leaking at the seams	Replace the affected duct. Refer to <i>Air Cleaner Inlet Duct Replacement</i> on page 9-579 for the 1.6L or <i>Air Cleaner Inlet Duct Replacement</i> on page 9-287 for the 1.4L.

Exhaust Noise

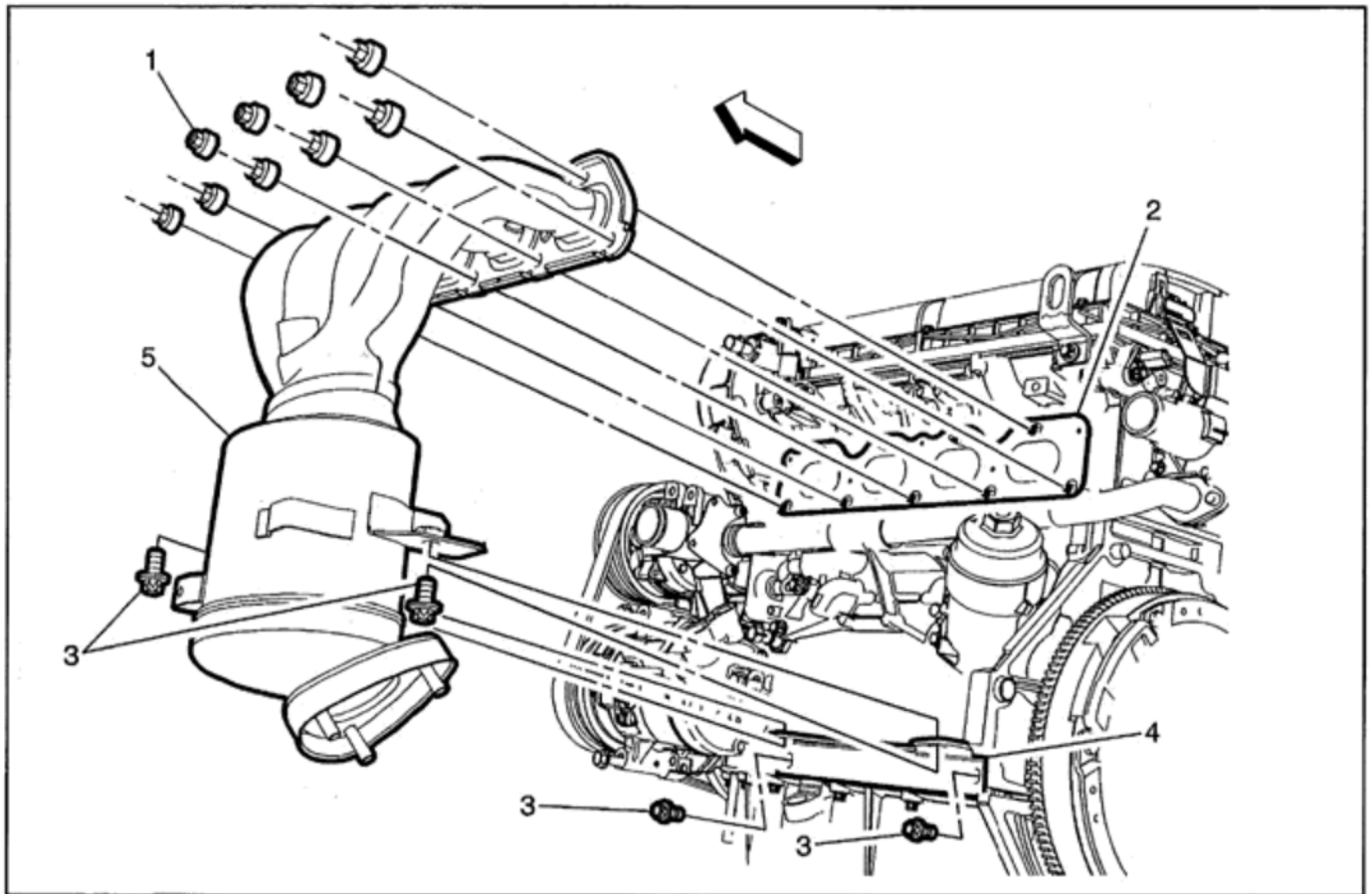
Conditions	Action
DEFINITION: An audible or physical noise due to a faulty component or damaged components causing a loose or misaligned exhaust system resulting in a rattle or vibration noise, i.e. buzz, groan, hum. Refer to <i>Symptoms - Engine Exhaust</i> on page 9-734 prior to beginning this table.	
Popping or hissing noise	Exhaust leak. Refer to <i>Exhaust Leakage</i> on page 9-736.
Loud exhaust	1. Compare to a known good vehicle. 2. Inspect for a damaged or failed muffler. 3. Replace the faulty muffler. Refer to <i>Exhaust System Replacement</i> on page 9-739.
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.

Exhaust Noise (cont'd)

Conditions	Action
Internal rattle	1. Test the components by tapping with a rubber mallet to confirm a rattle. 2. Replace the faulty catalytic converter, or muffler. Refer to one of the following procedures: • <i>Catalytic Converter Replacement (LUV)</i> on page 9-742 • <i>Exhaust System Replacement</i> on page 9-739

Repair Instructions**Exhaust Manifold Replacement (LUV)**

Refer to *Turbocharger Replacement* on page 9-843.

Exhaust Manifold with Catalytic Converter Replacement (LUW)

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Exhaust Manifold with Catalytic Converter Replacement (LUW)

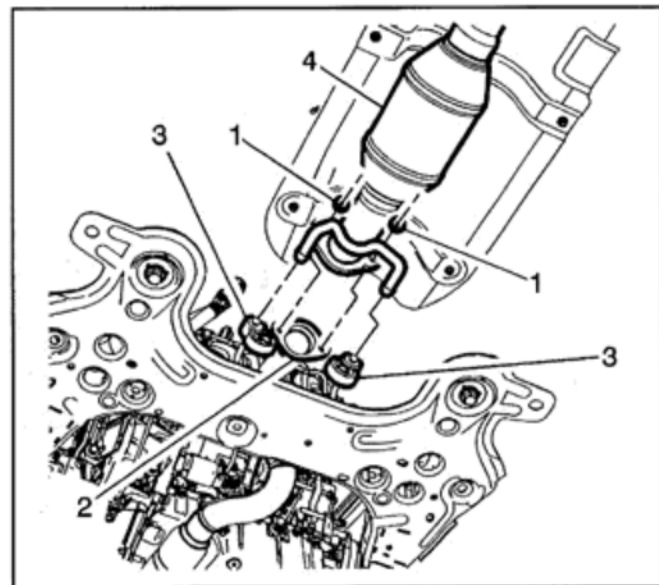
Callout	Component Name
Warning: Refer to <i>Protective Goggles and Glove Warning</i> on page 0-5.	
Warning: Refer to <i>Exhaust Service Warning</i> on page 0-4.	
Preliminary Procedure	
1. Remove the catalytic converter heat shield. Refer to <i>Catalytic Converter Heat Shield Replacement (LUV)</i> on page 9-746.	
2. Remove the exhaust front pipe. Refer to <i>Exhaust Front Pipe Replacement (LUV,LUW)</i> on page 9-738.	
1	Exhaust Manifold to Cylinder Head Nut (Qty: 9) Caution: Refer to <i>Fastener Caution</i> on page 0-8. Tighten 15 N·m (11 lb ft)
2	Exhaust Manifold Gasket
3	Exhaust Manifold Brace Bolt (Qty: 4) Tighten 20 N·m (15 lb ft)
4	Exhaust Manifold Brace
5	Exhaust Manifold with Catalytic Converter Procedure 1. Disconnect the temperature sensor and transfer parts if replacing the exhaust manifold with catalytic converter. 2. Clean the sealing surfaces. 3. Replace the exhaust gasket with a NEW gasket. 4. Replace the exhaust manifold nuts with NEW nuts.

Exhaust Front Pipe Replacement (LUV,LUW)

Removal Procedure

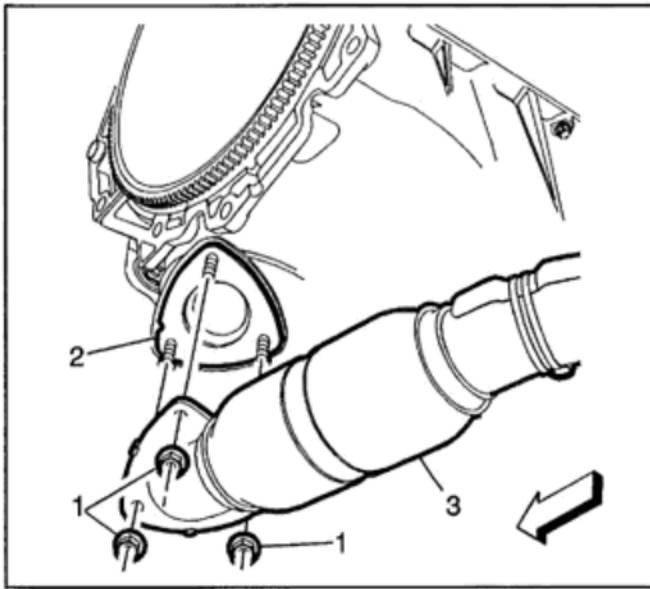
Warning: Refer to *Exhaust Service Warning* on page 0-4.

1. Remove the drivetrain and front suspension frame skid plate. Refer to *Drivetrain and Front Suspension Frame Skid Plate Replacement* on page 3-143.
2. Disconnect the heated oxygen sensor-2. Refer to *Heated Oxygen Sensor Replacement - Sensor 2* on page 9-539.



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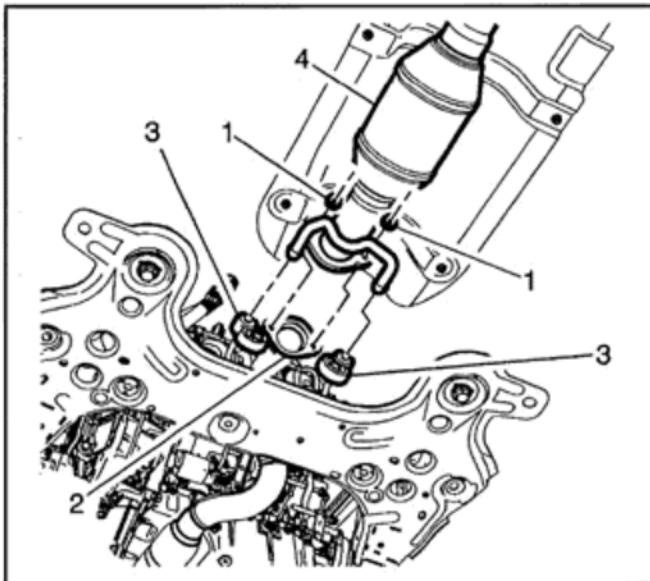
3. Remove the 3-way catalytic converter fasteners (1) and disconnect the 3-way catalytic converter (4) from the front pipe.
4. Discard the exhaust gasket (2).



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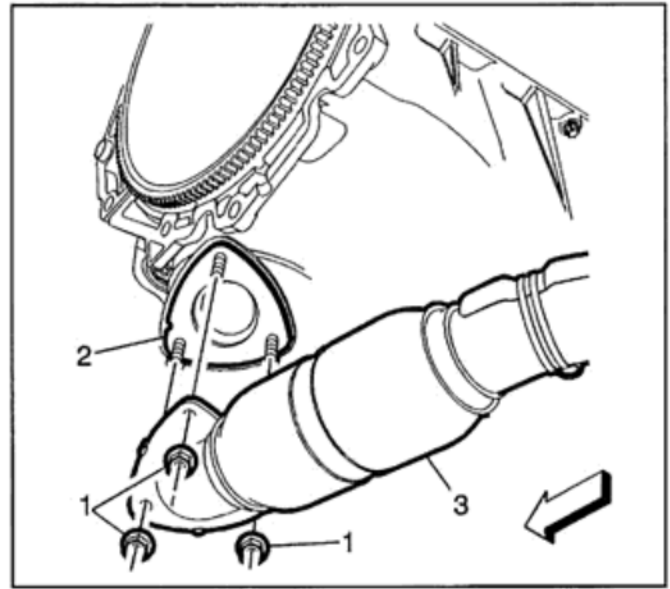
5. Remove the exhaust front pipe (3) to the catalytic converter fasteners (1).
6. Remove the front pipe (3) from the catalytic converter and discard the exhaust gasket (2).

Installation Procedure



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1. Install a NEW gasket (2) to the exhaust front pipe.
- Caution:** Refer to *Fastener Caution* on page 0-8.
2. Install the 3-way catalytic converter (4) to the exhaust isolators (3) and tighten the fasteners (1) to 17 N•m (13 lb ft).



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3. Position the exhaust front pipe (3) to the catalytic converter with a NEW gasket (2).
4. Install the exhaust front pipe fasteners (1) to the catalytic converter and tighten to 20 N•m (15 lb ft).
5. Connect the heated oxygen sensor-2. Refer to *Heated Oxygen Sensor Replacement - Sensor 2* on page 9-539.
6. Install the drivetrain and front suspension frame skid plate. Refer to *Drivetrain and Front Suspension Frame Skid Plate Replacement* on page 3-143.
7. Start the engine and check for exhaust leaks.

Exhaust System Replacement

Removal Procedure

Special Tools

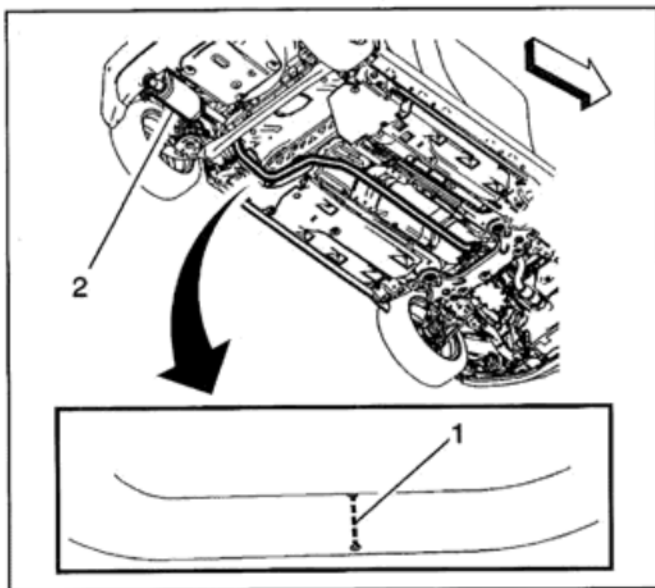
CH-6614 Chain Pipe Cutter

For equivalent regional tools, refer to *Special Tools* on page 9-754.

Warning: Refer to *Protective Goggles and Glove Warning* on page 0-5

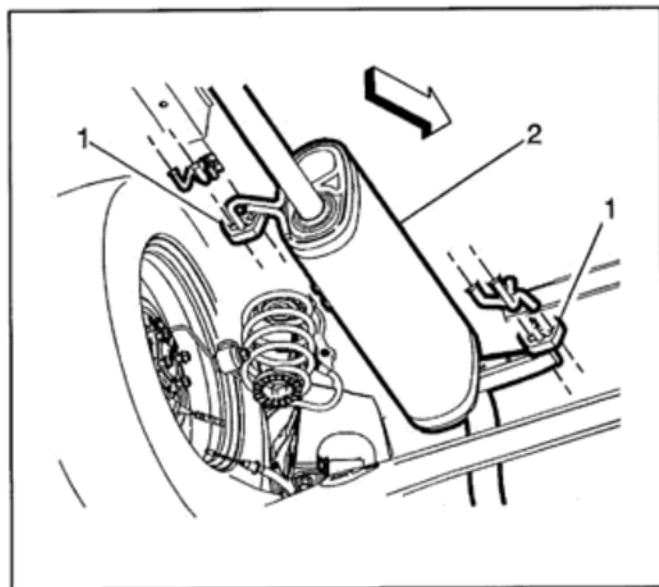
Warning: Refer to *Exhaust Service Warning* on page 0-4.

1. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle* on page 1-31



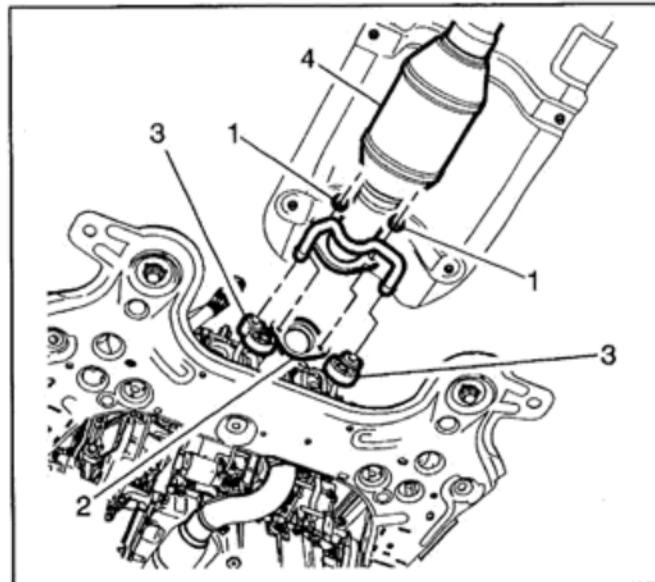
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2. Cut the exhaust rear muffler (2) with the CH-6614 pipe cutter at position (1).



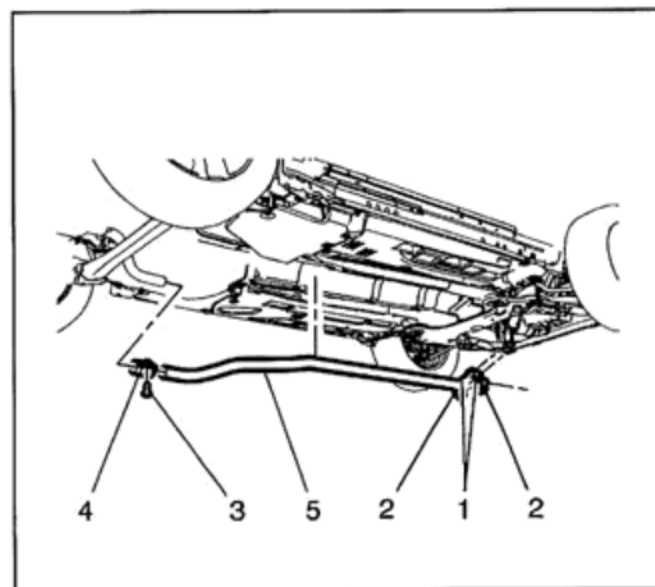
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3. Remove the rear exhaust muffler (2) from the exhaust isolators (1).
4. Sand smooth the front exhaust pipe for ease of installation.
5. Remove the exhaust rear muffler.



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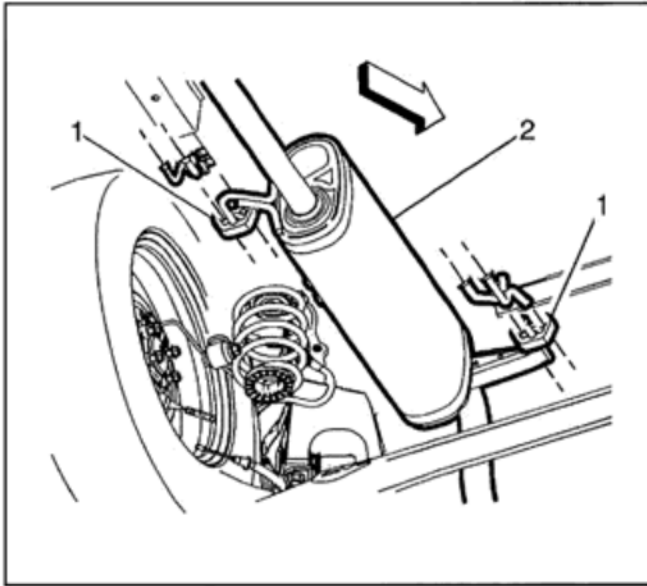
6. Remove the exhaust front pipe fasteners (1) and discard the gasket (2).
7. Remove the 3-way catalytic converter (4) from the exhaust isolators (3).



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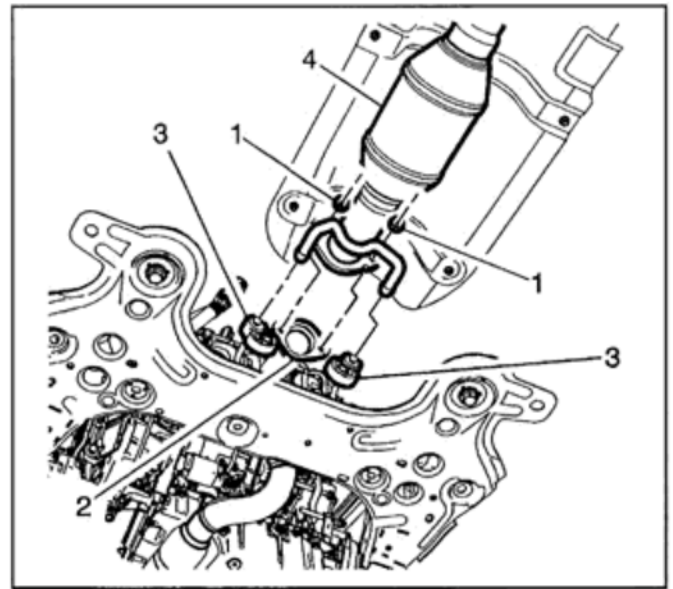
8. Lower the intermediate exhaust front muffler pipe (5).
9. Remove and transfer the catalytic converter, if necessary.

Installation Procedure



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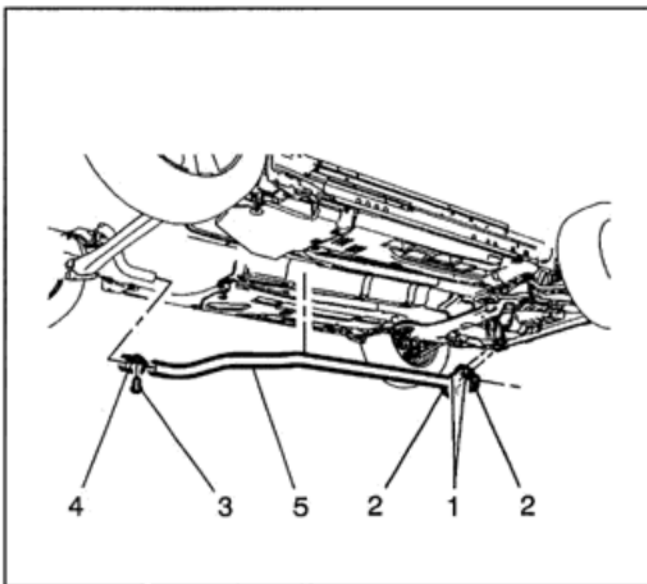
1. Install the exhaust rear muffler (2) into the exhaust isolators (1).



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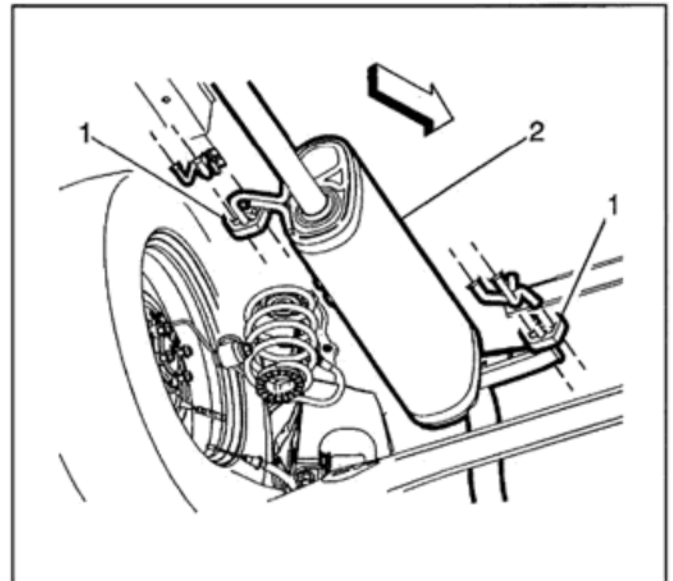
Caution: Refer to *Fastener Caution* on page 0-8.

3. Install the 3-way catalytic converter (4) into the exhaust Isolators (3) with a NEW gasket (2) and tighten the fasteners (1) to 17 N·m (13 lb ft).



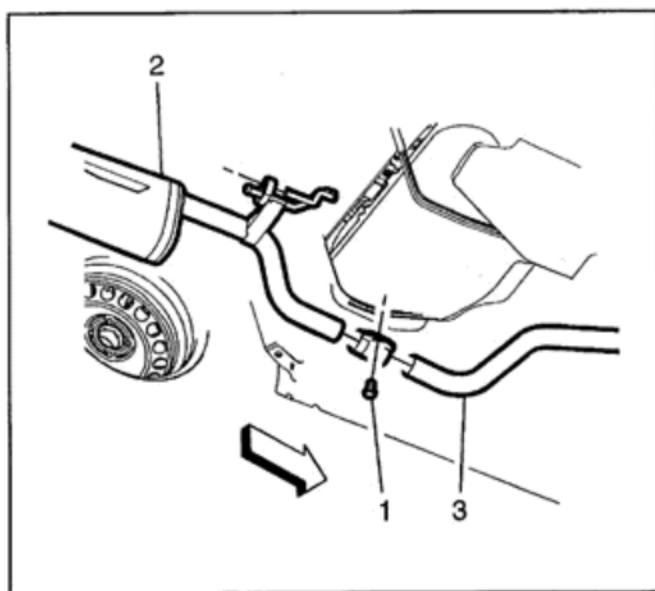
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2. Install the intermediate exhaust front muffler (5) to the front exhaust hanger isolators (2).



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4. Install the new rear exhaust muffler (2) into the exhaust isolators.
5. Lower the vehicle.
6. Start the engine and check for exhaust leaks.



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7. Position the exhaust front pipe (3) into the exhaust muffler clamp.

Note: There are 3 different exhaust muffler clamps depending on the diameter of the exhaust pipe.

8. Install the rear exhaust muffler (2) into the exhaust muffler clamp and tighten the bolt (1) to **50 N·m (37 lb ft)**.
9. Lower the vehicle.
10. Start the engine and check for exhaust leaks.

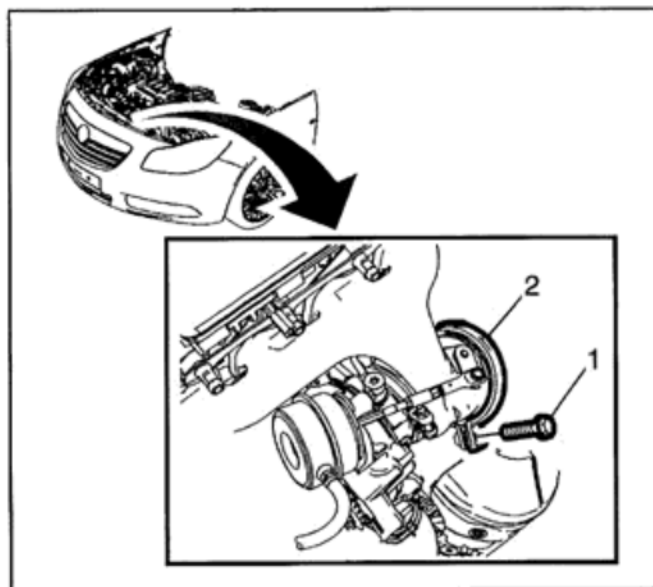
Catalytic Converter Replacement (LUV)

Removal Procedure

Warning: Refer to Exhaust Service Warning on page 0-4.

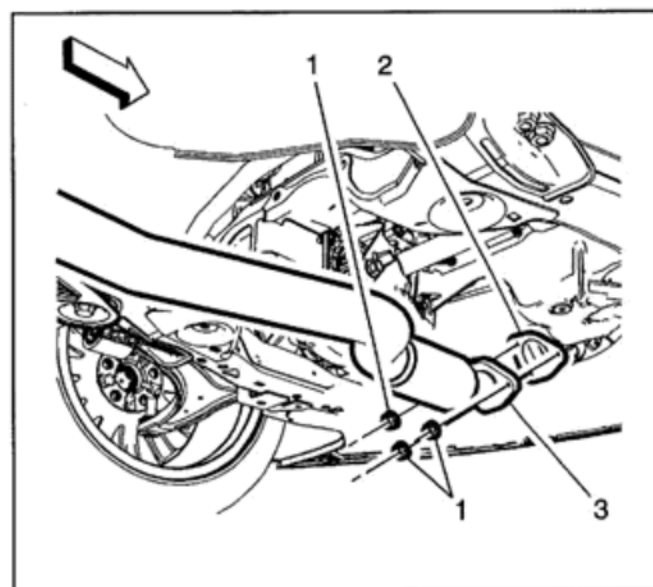
Warning: Refer to Protective Goggles and Glove Warning on page 0-5.

1. Remove the exhaust manifold heat shield. Refer to Exhaust Manifold Heat Shield Replacement (LUV) on page 9-749 or Exhaust Manifold Heat Shield Replacement (LUW) on page 9-750.
2. Remove the catalytic converter heated oxygen sensor - 1. Refer to Heated Oxygen Sensor Replacement - Sensor 1 on page 9-249.



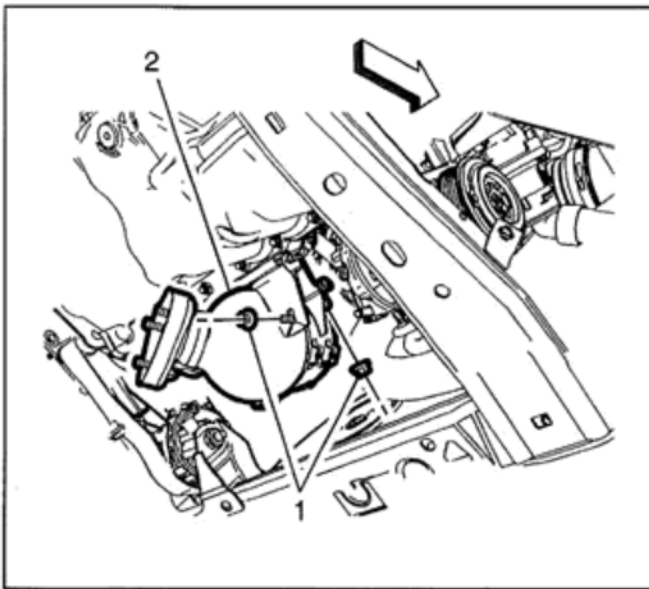
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3. Remove the catalytic converter to the turbocharger clamp fastener (1) and discard the clamp (2).
4. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle on page 1-31.
5. Remove the drivetrain and front suspension frame skid plate. Refer to Drivetrain and Front Suspension Frame Skid Plate Replacement on page 3-143.



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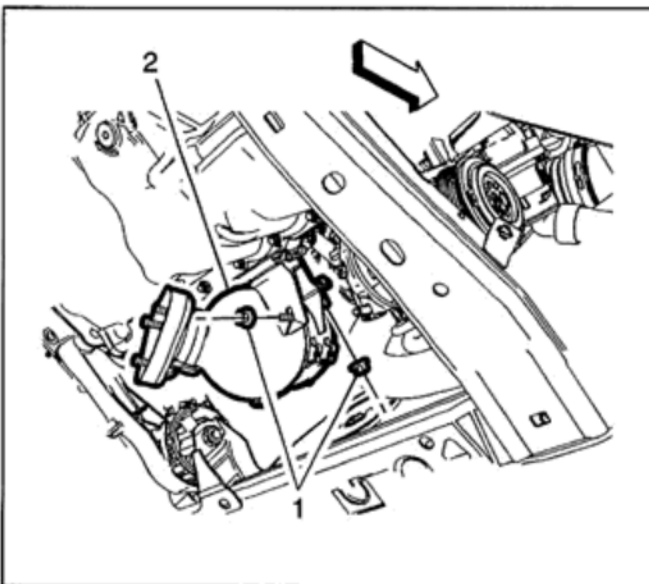
6. Remove the exhaust front pipe fasteners (1) and discard the exhaust gasket (2).



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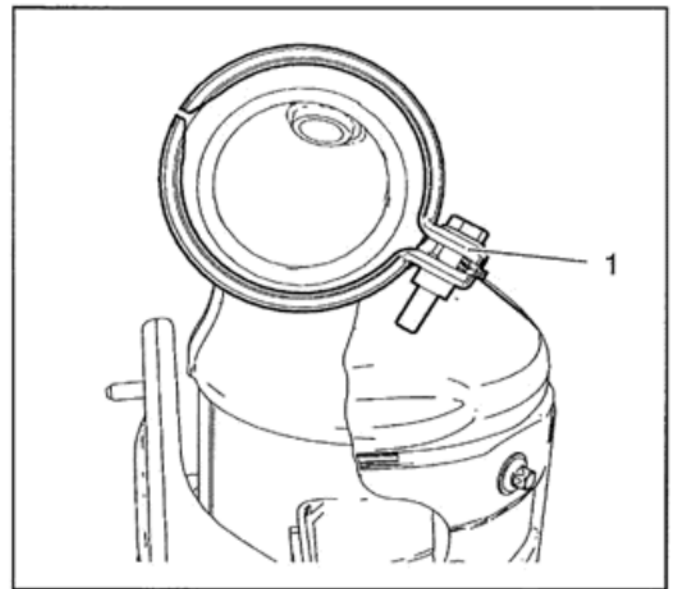
7. Remove the catalytic converter brace fasteners (1) from the catalytic converter brace (2).
8. Remove the catalytic converter.

Installation Procedure



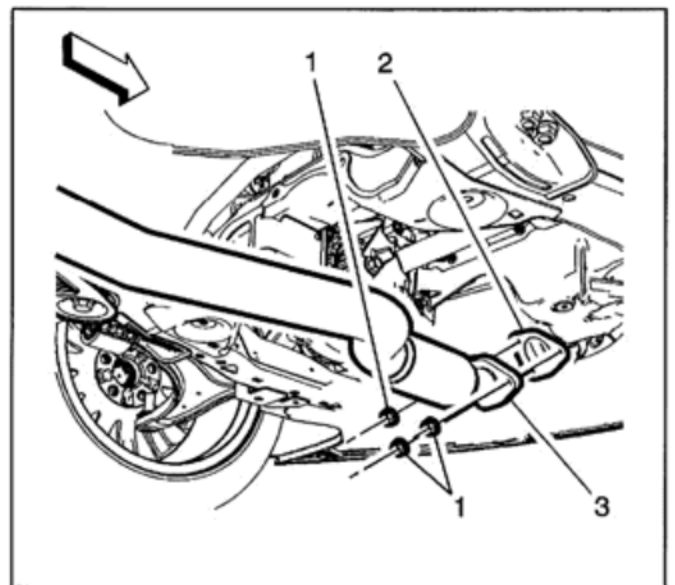
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1. Install the catalytic converter into the catalytic converter brace (2) and loosely tighten the fasteners (1).



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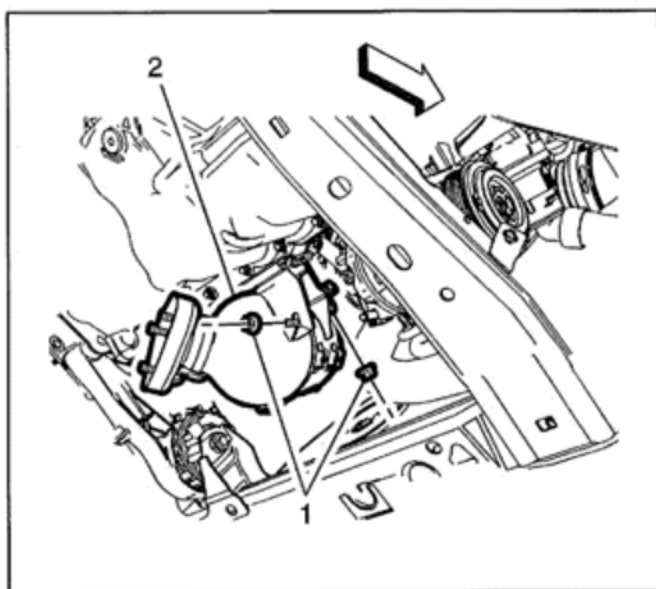
2. Install a NEW clamp into the position shown and loosely tighten the clamp fastener (1).



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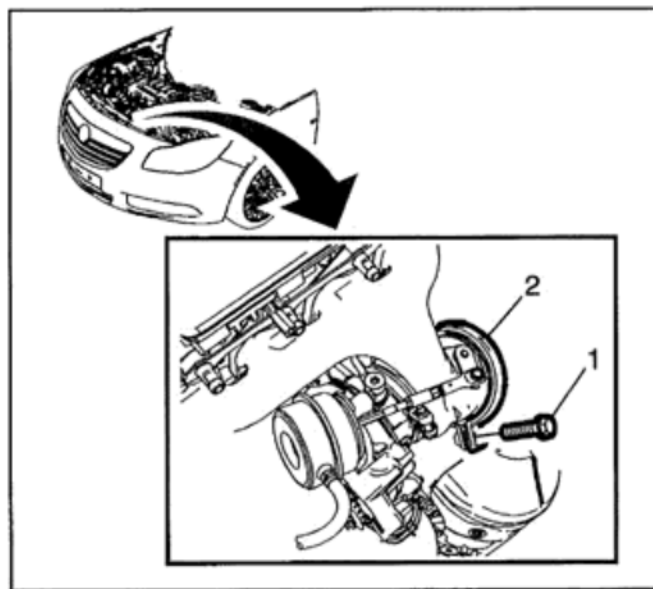
Caution: Refer to *Fastener Caution* on page 0-8.

3. Install the exhaust front pipe (3) to the catalytic converter with a NEW gasket (2) and tighten the fasteners (1) to **22 N·m (16 lb ft)**.



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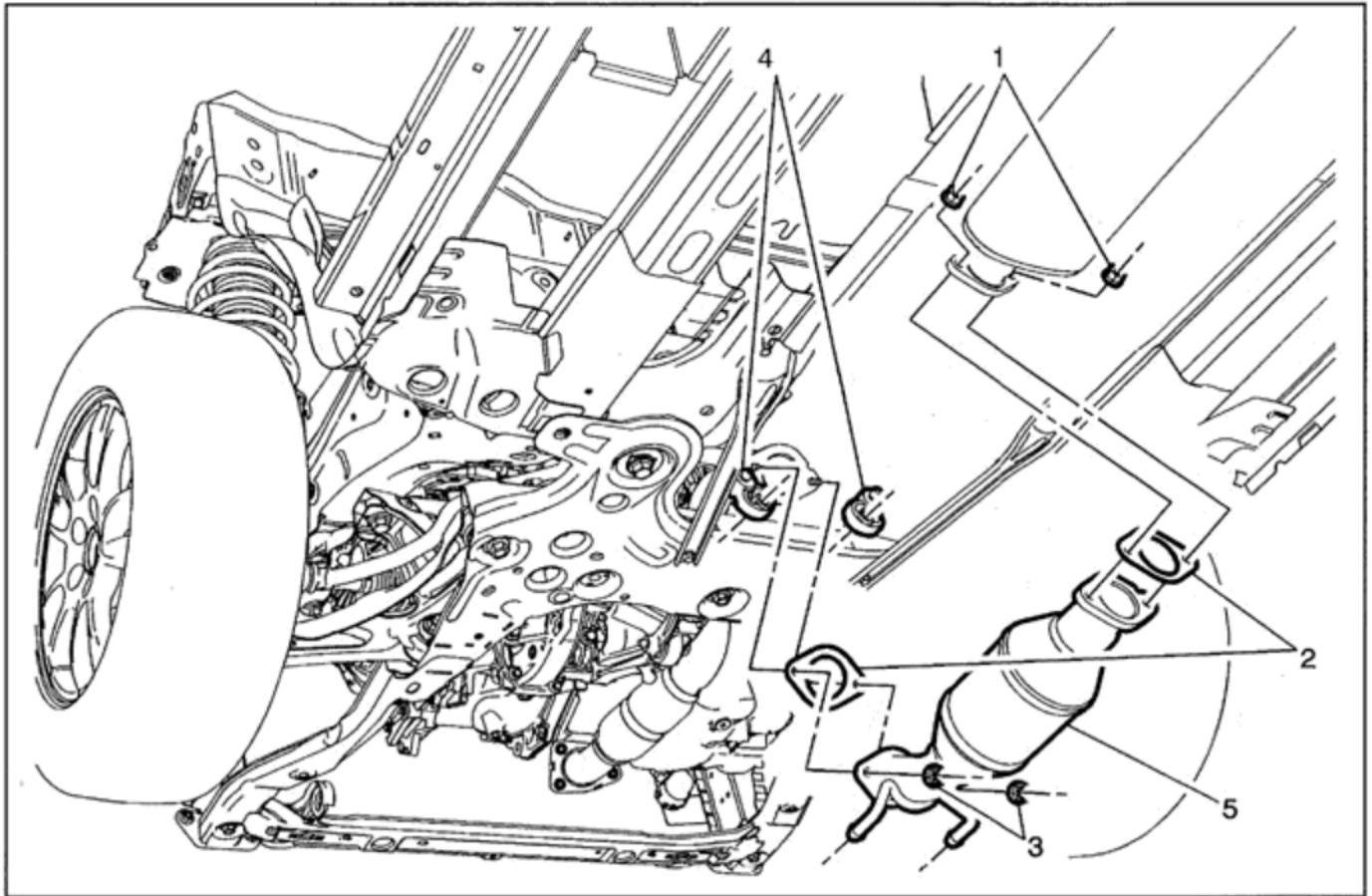
4. Tighten the catalytic converter brace fasteners (1) to **22 N·m (16 lb ft)**.
5. Install the drivetrain and front suspension frame skid plate. Refer to *Drivetrain and Front Suspension Frame Skid Plate Replacement* on page 3-143.
6. Lower the vehicle.



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7. Tighten the turbocharge clamp fastener (1) to **13 N·m (115 lb in)**.
8. Install the exhaust manifold heat shield. Refer to *Exhaust Manifold Heat Shield Replacement (LUV)* on page 9-749 or *Exhaust Manifold Heat Shield Replacement (LUW)* on page 9-750.
9. Install the catalytic converter heated oxygen sensor - 1. Refer to *Heated Oxygen Sensor Replacement - Sensor 1* on page 9-249.
10. Start the engine and check for exhaust leaks.

Warm Up Three-Way Catalytic Converter Replacement (LUV,LUW)

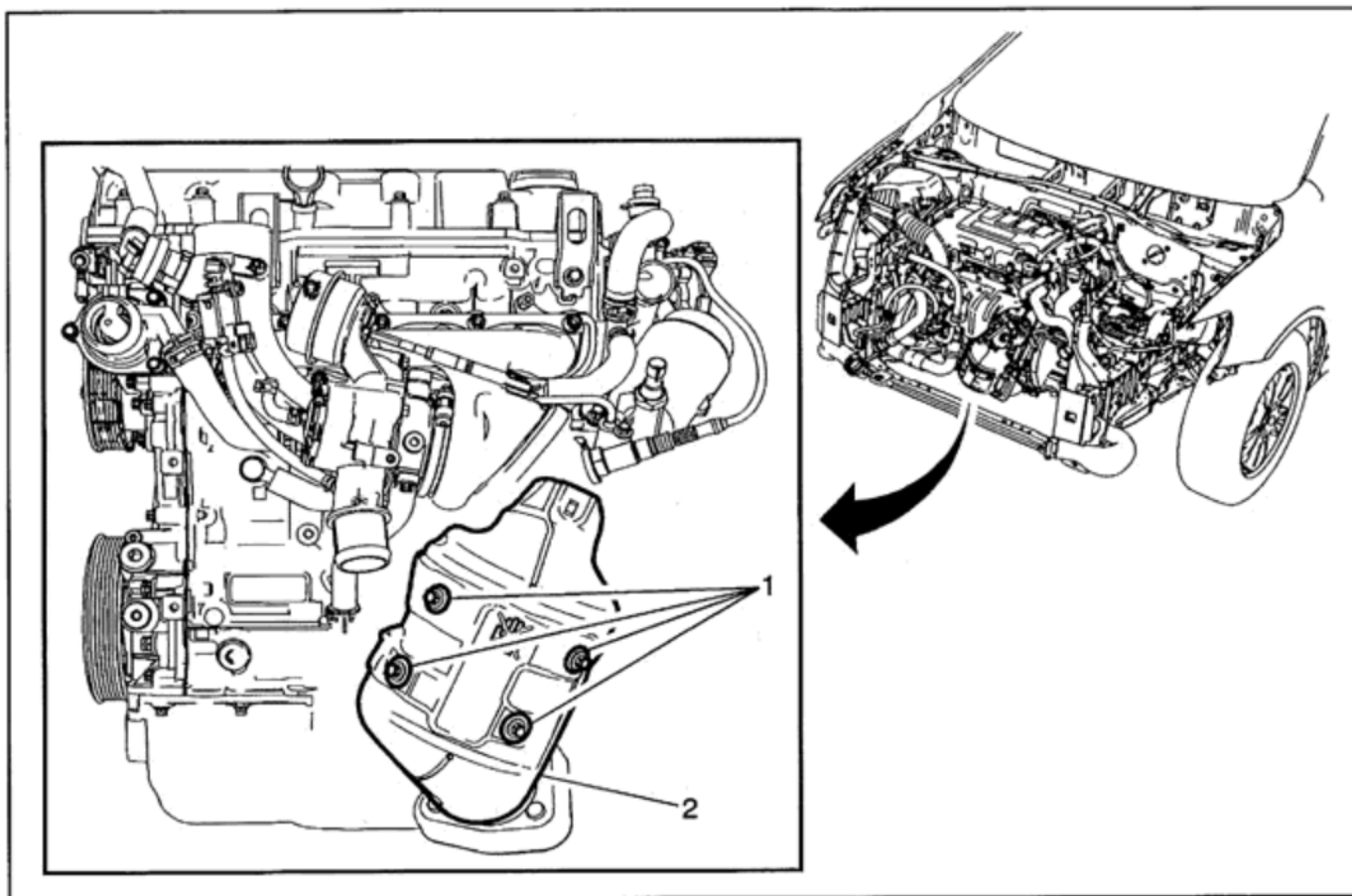


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Warm Up Three-Way Catalytic Converter Replacement (LUV,LUW)

Callout	Component Name
Warning: Refer to Exhaust Service Warning on page 0-4. Warning: Refer to Safety Glasses Warning on page 0-5. Preliminary Procedure Raise and support the vehicle. Refer to <i>Lifting and Jacking the Vehicle</i> on page 1-31.	
1	Exhaust Muffler Fasteners (Qty: 2) Caution: Refer to <i>Fastener Caution</i> on page 0-8. Tighten 17 N•m (13 lb ft).
2	Exhaust Gasket Note: Replace with NEW gaskets
3	Exhaust Front Pipe Fasteners (Qty: 2) Tighten 17 N•m (13 lb ft).
4	Exhaust Isolators
5	Catalytic Converter

Catalytic Converter Heat Shield Replacement (LUV)

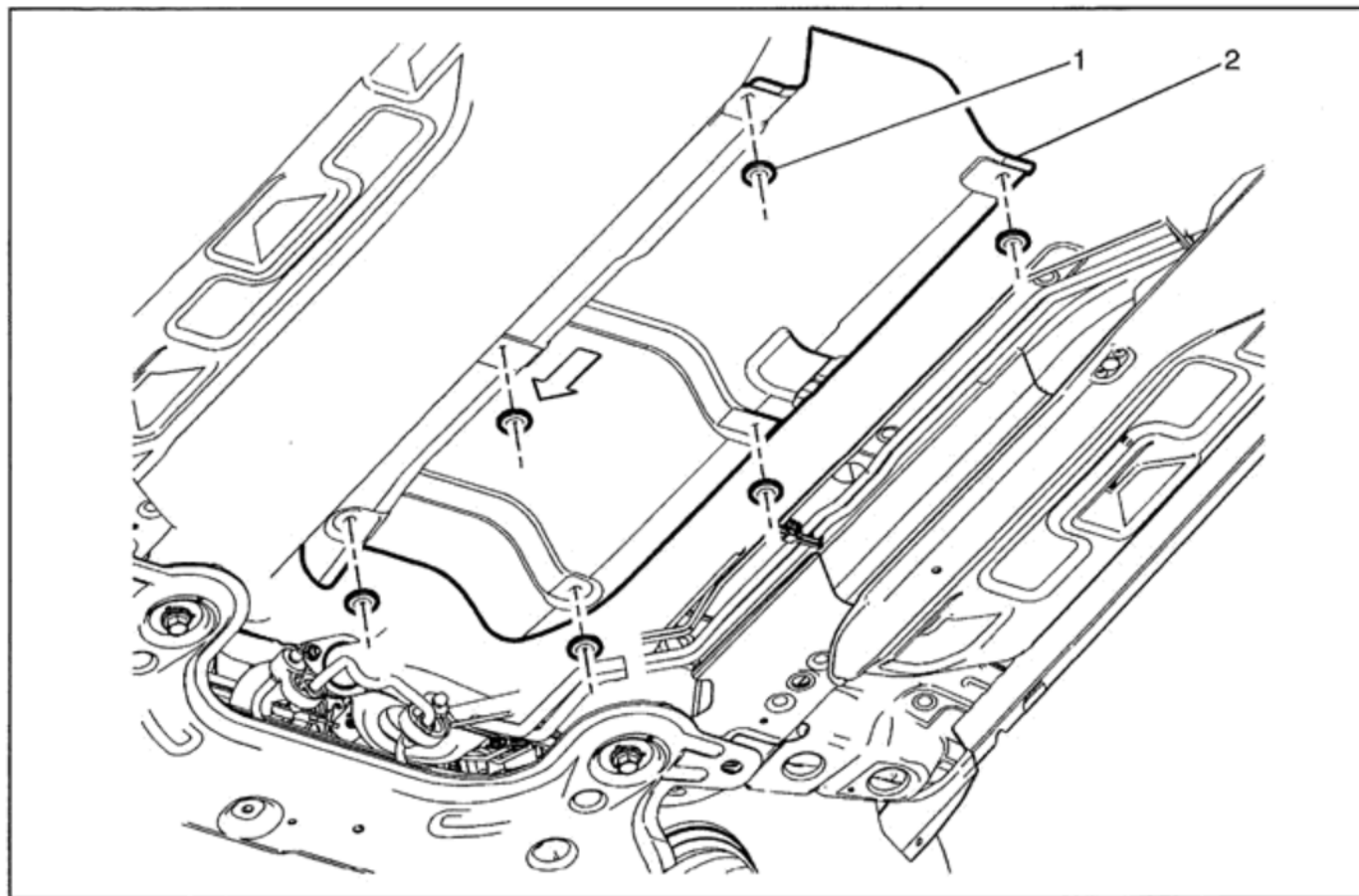


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Catalytic Converter Heat Shield Replacement (LUV)

Callout	Component Name
Warning: Refer to Exhaust Service Warning on page 0-4.	
1	Catalytic Converter Heat Shield Fasteners (Qty: 4) Caution: Refer to Fastener Caution on page 0-8. Tighten 9 N·m (80 lb in).
2	Catalytic Converter Heat Shield

Exhaust Heat Shield Replacement



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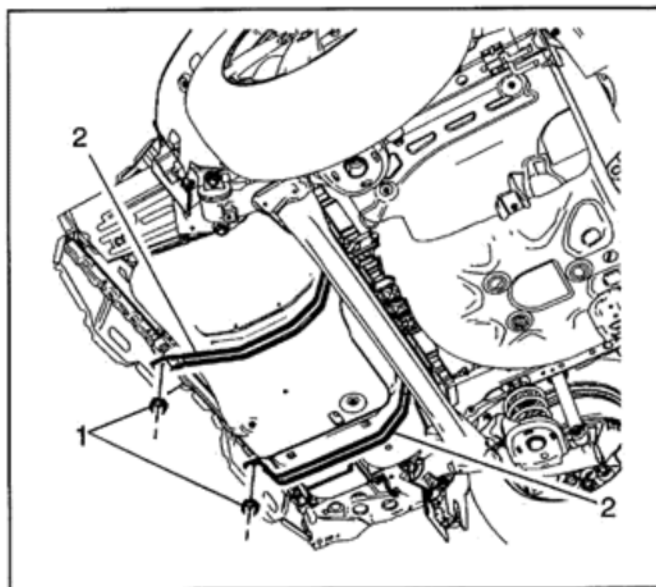
Exhaust Heat Shield Replacement

Callout	Component Name
Preliminary Procedure	
Disconnect the exhaust system hangers and allow the exhaust system to rest on the rear axle.	
1	Exhaust Heat Shield Fastener (Qty: 6)
2	Exhaust Heat Shield

Fuel Tank Heat Shield Replacement

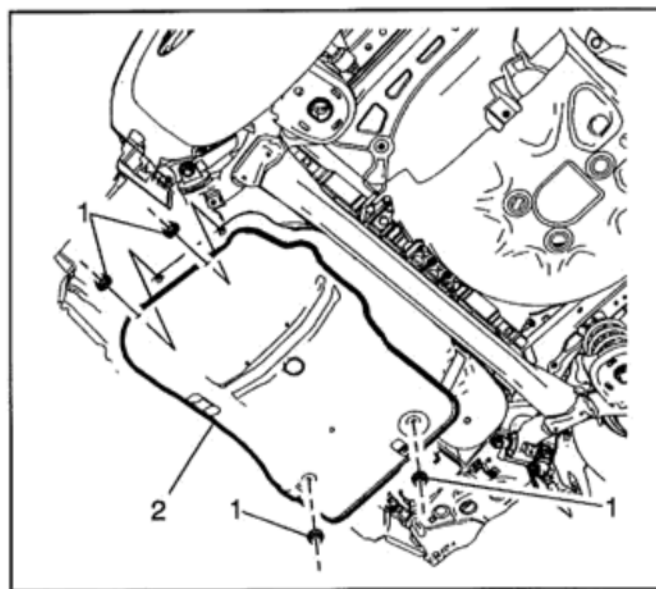
Removal Procedure

1. Support the fuel tank with a suitable jack.



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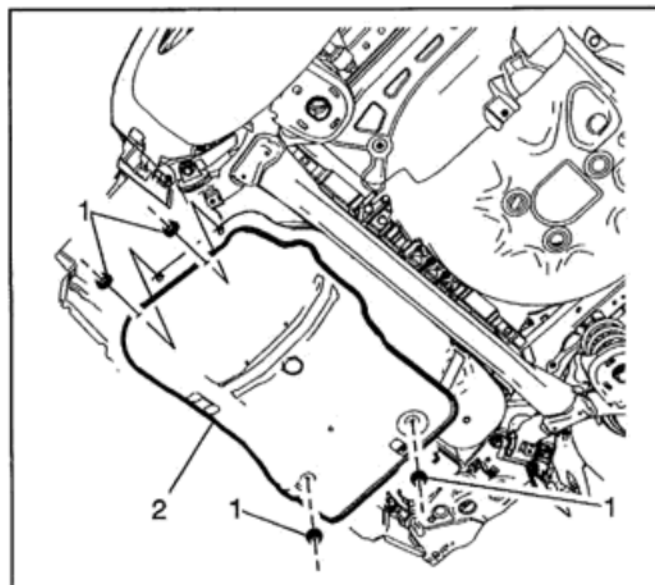
2. Remove the fuel tank strap fasteners (1) and lower the fuel tank straps (2).



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3. Remove the fuel tank heat shield fasteners (1) and remove the fuel tank heat shield (2).

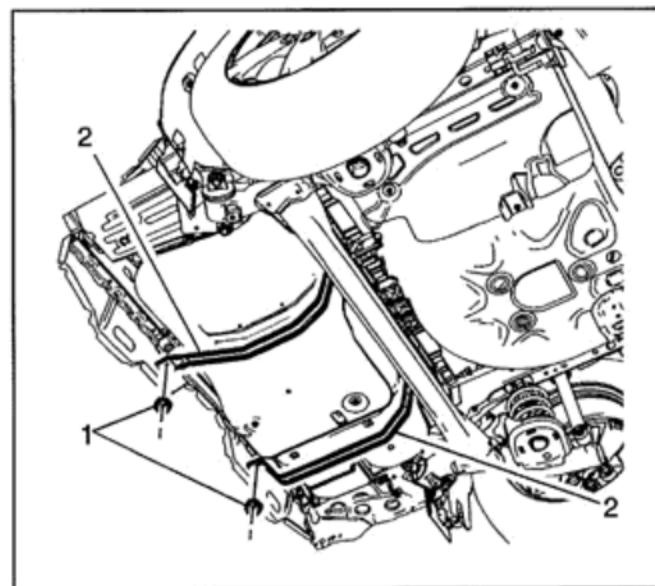
Installation Procedure



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Caution: Refer to *Fastener Caution* on page 0-8.

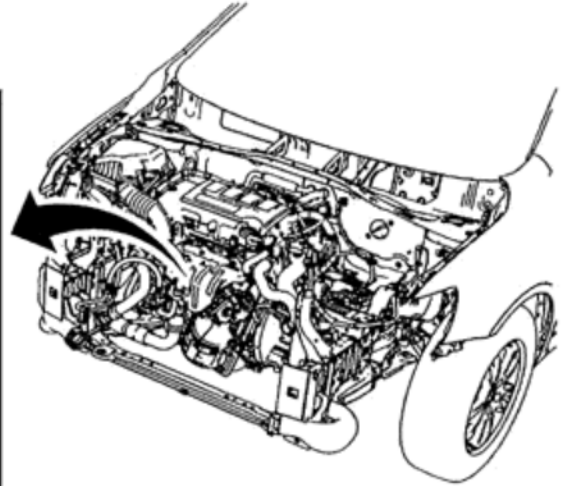
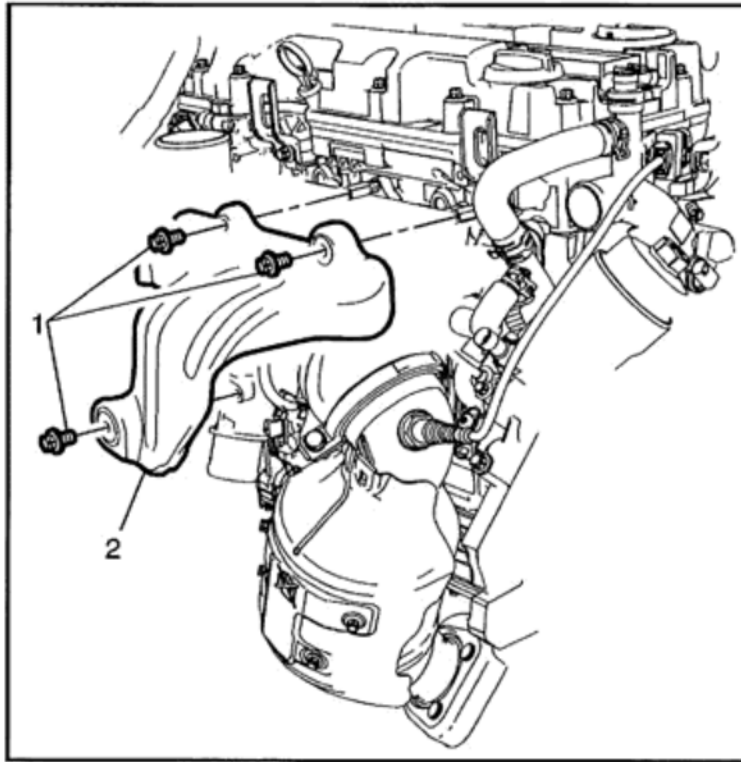
1. Install the fuel tank heat shield (2) and tighten the fasteners (1) to 10 N·m (89 lb in).



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2. Install the fuel tank straps (2) and tighten the fasteners (1) to 22 N·m (16 lb ft).

Exhaust Manifold Heat Shield Replacement (LUV)

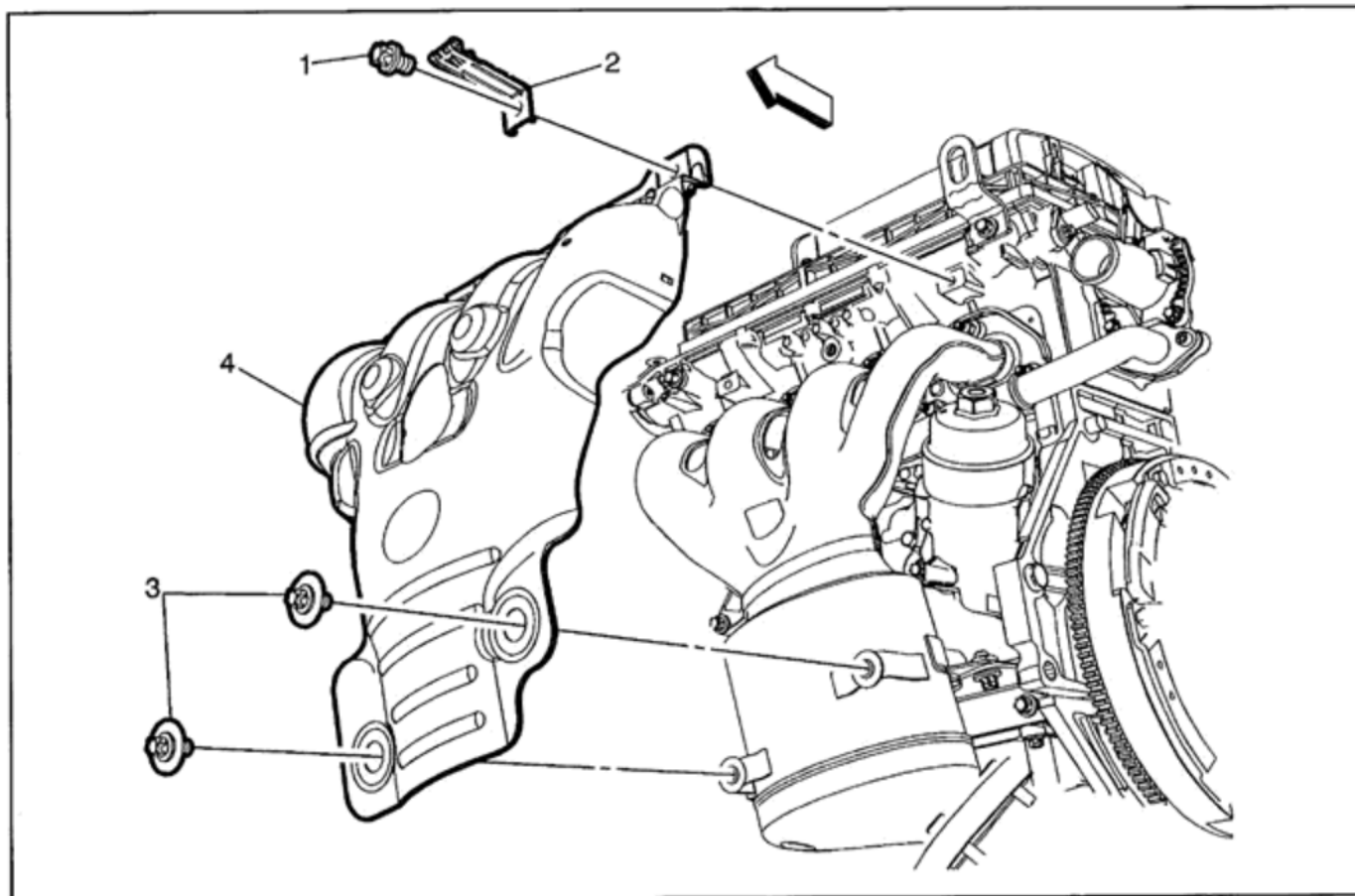


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Exhaust Manifold Heat Shield Replacement (LUV)

Callout	Component Name
Warning: Refer to Exhaust Service Warning on page 0-4.	
1	Exhaust Manifold Heat Shield Fasteners (Qty: 3) Caution: Refer to Fastener Caution on page 0-8. Tighten 9 N•m (80 lb in).
2	Exhaust Manifold Heat Shield

Exhaust Manifold Heat Shield Replacement (LUW)

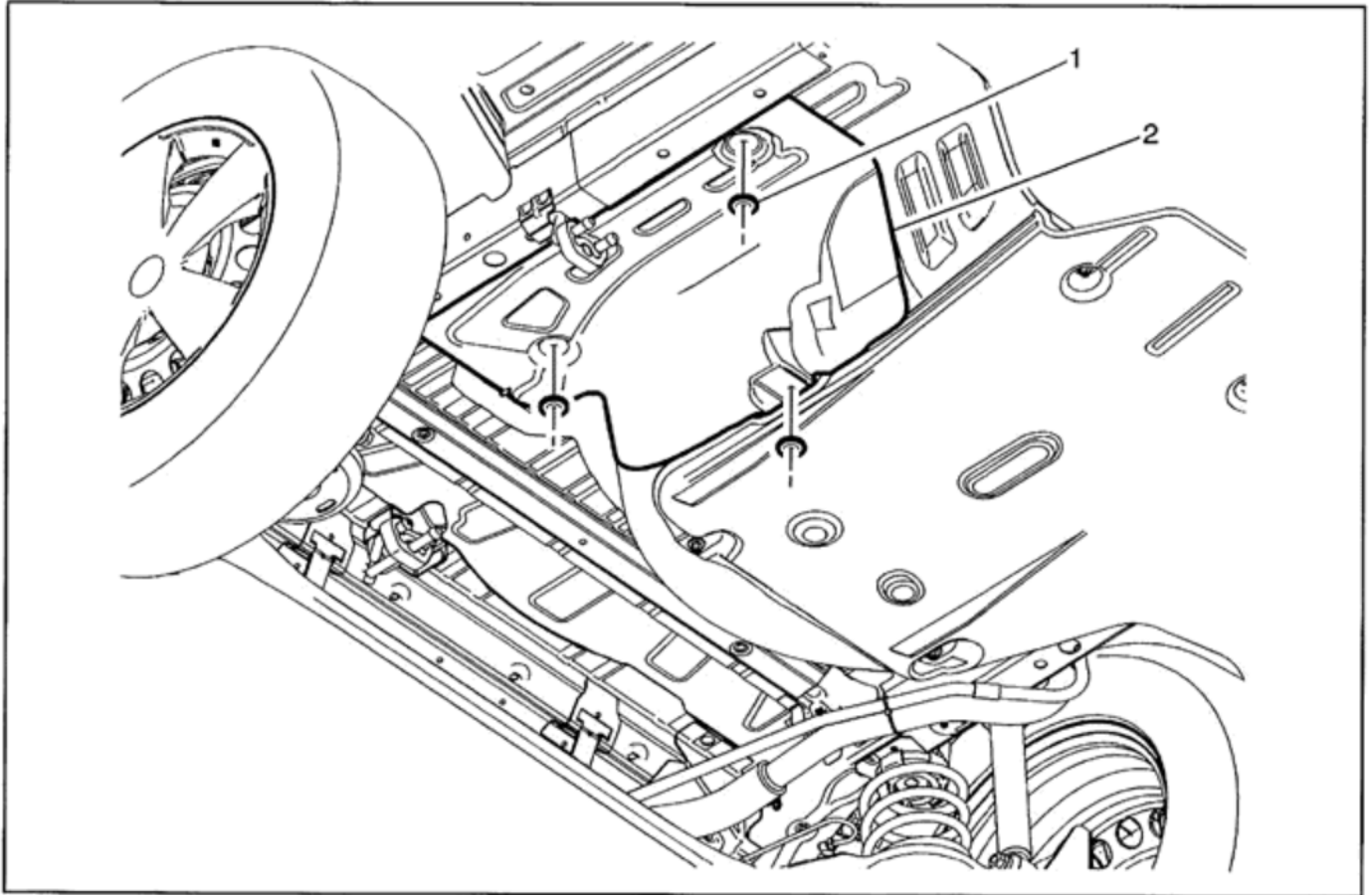


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Exhaust Manifold Heat Shield Replacement (LUW)

Callout	Component Name
Warning: Refer to Exhaust Service Warning on page 0-4.	
Preliminary Procedures	
1. Disconnect the negative battery cable. Refer to <i>Battery Negative Cable Disconnection and Connection</i> on page 9-713.	
2. Remove the oil level indicator tube. Refer to <i>Oil Level Indicator Tube Replacement</i> on page 9-1026.	
3. Disconnect the heated oxygen sensor connector.	
1	Catalytic Converter Heat Shield Bolt Caution: Refer to <i>Fastener Caution</i> on page 0-8. Tighten 15 N·m (11 lb ft)
2	Heated Oxygen Sensor Harness Bracket
3	Catalytic Converter Heat Shield Bolt (Qty: 2) Tighten 8 N·m (71 lb in)
4	Catalytic Converter Heat Shield

Exhaust Rear Muffler Heat Shield Replacement



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Exhaust Rear Muffler Heat Shield Replacement

Callout	Component Name
Preliminary Procedure	
Disconnect the exhaust system hangers in the rear and allow the exhaust system to rest on the rear axle.	
1	Exhaust Heat Shield Rear Muffler Fastener (Qty: 3)
2	Exhaust Heat Shield Rear Muffler

Exhaust Rear Muffler Replacement (LUV,LUW)

Special Tools

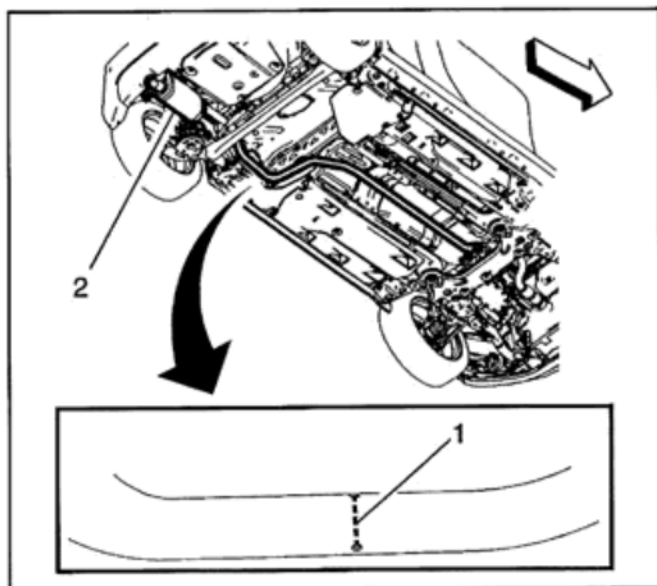
CH-6614 Chain Pipe Cutter

For equivalent regional tools, refer to *Special Tools* on page 9-754.

Removal Procedure

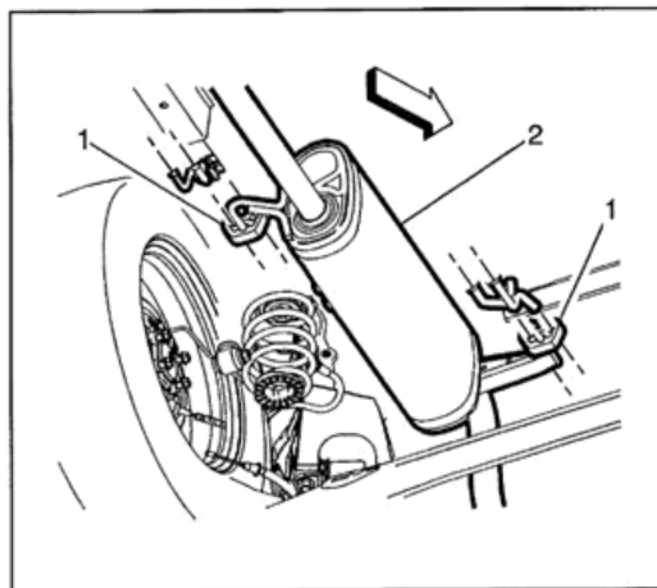
Warning: Refer to *Exhaust Service Warning* on page 0-4.

1. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle* on page 1-31.



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2. Cut the exhaust rear muffler (2) with the CH-6614 pipe cutter at position (1).

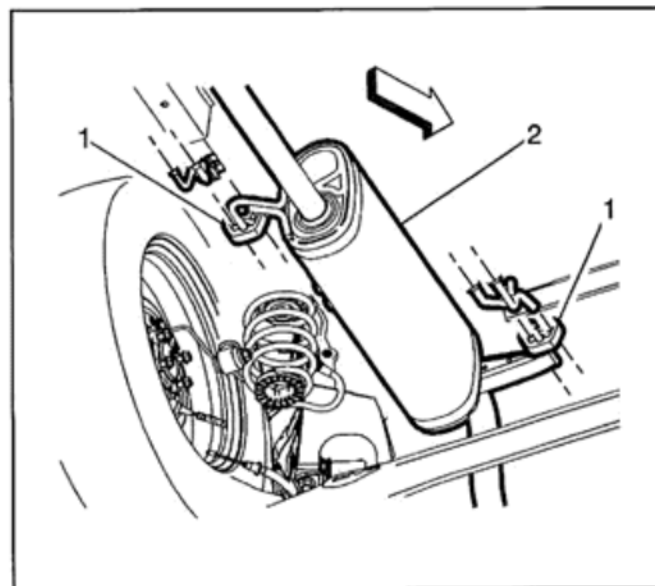


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3. Remove the rear exhaust muffler (2) from the exhaust isolators (1).

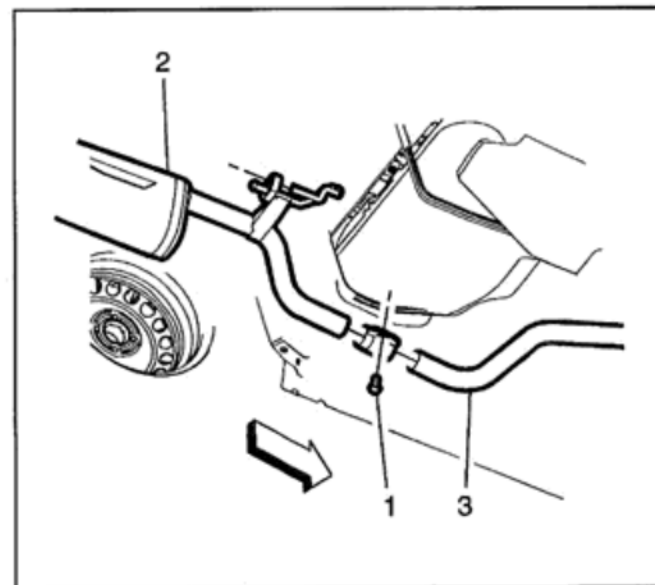
4. Sand smooth the front exhaust pipe for ease of installation.

Installation Procedure



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1. Install the new rear exhaust muffler (2) into the exhaust isolators.



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Caution: Refer to *Fastener Caution* on page 0-8.

Note: There are 3 different exhaust muffler clamps depending on the diameter of the exhaust pipe.

2. Position the exhaust front pipe (3) into the exhaust muffler clamp.
3. Install the rear exhaust muffler (2) into the exhaust muffler clamp and tighten the bolt (1) to 50 N·m (37 lb ft).
4. Lower the vehicle.
5. Start the engine and check for exhaust leaks.

Description and Operation

Exhaust System Description

Note: Use of Non-OEM parts may cause driveability concerns.

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

In order to secure the exhaust pipe to the exhaust manifold, a flange and seal-joint coupling is utilized.

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.

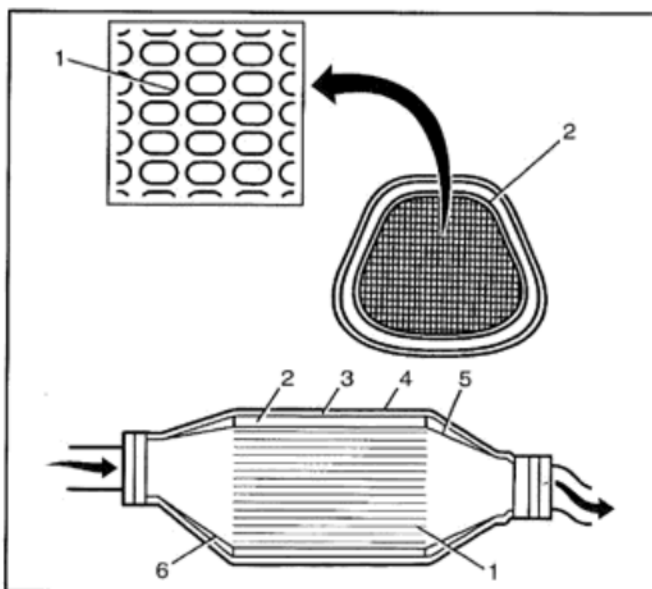
Exhaust heat shields are used to protect the body and other components from damage due to the heat from the exhaust system.

The exhaust system may be comprised of the following components:

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

Catalytic Converter

Through developments in various emissions reduction system, significant reductions in emissions have been achieved. The developments have been primarily concerned with refinements in engine calibration and the optimization of exhaust system catalytic converter configurations.



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The catalytic converter is similar to a muffler in appearance however, within the outer stainless steel shell (4), there is a ceramic monolith (1) which is honeycombed in the direction of the exhaust, as shown. The ceramic monolith is surrounded by a mat (2), which has the primary function of holding the monolith firmly in place to prevent any contact with the inner shell (3). A mesh (5 and 6) at each end of the converter prevents exhaust gases from fouling and eroding the mat.

Surfaces of the ceramic monolith that are exposed to exhaust gases are coated with a catalytic material. This material contains rhodium and platinum, which act to facilitate the chemical reactions necessary to oxidize carbon monoxide and hydrocarbons into harmless carbon dioxide.

The catalytic converter is a substance that accelerates a chemical reaction without itself being changed. Engine exhaust gases contain carbon monoxide (CO), hydrocarbons (HC) and oxides of nitrogen (NOx). When the exhaust gases flow through the monolith, reactions with the catalytic converter occur. CO and HC are converted by oxidation with oxygen (O₂) in the exhaust gases to produce carbon dioxide (CO₂) and water vapour (H₂O). NOx is converted by reduction with CO to produce nitrogen (N₂). The catalytic converter is called a three-way type because it simultaneously converts three components of exhaust gas (CO, HC and NOx) to harmless natural gases.

Service Notes

- Vehicles fitted with a catalytic converter should not be operated with leaded petrol. Lead will contaminate the catalytic converter.
- Do not drop the catalytic converter as it will damage the ceramic monolith.
- Do not allow water, oil or fuel to enter the converter as the ceramic monolith will be contaminated.
- Do not drive the vehicle with the engine misfiring or with any of the spark plug leads disconnected.

Note: Catalytic converter can be damaged or rendered ineffective, if:

- Operated outside the limits of the closed loop mixture control system.
- The engine burns excessive amount of oil.
- The exhaust temperature at the converter is too high (exceeds 840°C).

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.

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.

The center mufflers on vehicles fitted with the LFW engine option contains a variable exhaust valve. The purpose of the valve is to reduce exhaust noise for minimal impact on performance and back pressure. The valve consists of a spring loaded flap which is closed at lower gas flow (lower engine speed/load) forcing the exhaust gasses through a more restrictive path therefore providing improved noise performance. As gas flow increases with higher engine load/speed, the valve opens providing a less restrictive path for the exhaust gases and therefore providing good wide open throttle performance.

Special Tools and Equipment

Illustration	Tool Number/Description
 13544	EN 35314-A J 35314-A Exhaust Back Pressure Gauge
 2028026	CH-6614 MKM-6614