

2021 ENGINE

Exhaust System - Canyon, Colorado

SPECIFICATIONS

FASTENER SPECIFICATIONS

Single Use Non-Threaded Fasteners/Components

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>
Application
Catalytic Converter Flange Gasket
Catalytic Converter Gasket
Exhaust Gasket
Exhaust Manifold Gasket
Exhaust Pipe Gasket
Warm Up Three-Way Catalytic Converter Gasket

Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Catalytic Converter Brace Bracket Bolt (LWN)	22 N.m (16 lb ft)
Catalytic Converter Brace Bracket Nut (LWN)	22 N.m (16 lb ft)
Catalytic Converter Bracket @ Engine Fastener (LCV)	58 N.m (43 lb ft)
Catalytic Converter Bracket Fastener (LCV, LWN)	22 N.m (16 lb ft)
Catalytic Converter @ Exhaust Manifold Nut (LCV)	58 N.m (43 lb ft)
Catalytic Converter Heat Shield Bolt (LWN)	10 N.m (89 lb in)
Catalytic Converter @ Nitrogen Oxide Catalytic Converter Nut (LWN)	50 N.m (37 lb ft)
Catalytic Converter Nut (LGZ)	50 N.m (37 lb ft)
Catalytic Converter @ Turbocharger Nut (LWN)	28 N.m (21 lb ft)
Exhaust Front Bracket Bolt (LGZ)	58 N.m (43 lb ft)
Exhaust Front Pipe Nut (LCV)	45 N.m (33 lb ft)
Exhaust Hanger Nut (LCV)	22 N.m (16 lb ft)
Exhaust Manifold Fastener (LCV)	20 N.m (15 lb ft)
Exhaust Manifold Heat Shield Fastener (LCV)	14 N.m (124 lb in)
Exhaust Manifold Heat Shield Bolt (LWN)	10 N.m (89 lb in)
Exhaust Manifold Nut (LWN) Refer to procedure for tightening sequence and torque	Exhaust Manifold Replacement (LCV), or Exhaust Manifold Replacement (LWN).

NOTE:

All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
values.	
Exhaust Muffler Heat Shield Retainer	1.5 N.m (13 lb in)
Exhaust Muffler Nut (LGZ)	45 N.m (33 lb ft)
Exhaust Pipe Fastener @ Catalytic Converter (LWN)	50 N.m (37 lb ft)
Exhaust Pipe Fastener @ Exhaust Muffler (LWN)	45 N.m (33 lb ft)
Exhaust System Rear Bolt	45 N.m (33 lb ft)
Nitrogen Oxide Catalytic Converter Nut (LWN)	50 N.m (37 lb ft)
Turbocharger Brace Bolt (LWN)	32 N.m (24 lb ft)
Turbocharger Coolant Feed Pipe Hollow Screw (LWN)	35 N.m (26 lb ft)
Warm Up Three-Way Catalytic Converter Nut (LGZ)	50 N.m (37 lb ft)

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOMS - ENGINE EXHAUST

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

Visual/Physical Inspection

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

Intermittent

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

Symptom List

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

- Loss of power

Refer to [Restricted Exhaust](#)

- Poor acceleration

Refer to [Restricted Exhaust](#)

- Poor fuel economy

Refer to [Restricted Exhaust](#)

- Excessive smoke diesel

Refer to [Restricted Exhaust](#)

- Exhaust 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

Diagnostic Aids

WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

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.

NOTE: This will not apply if the dual exhaust is equipped with an "H" pipe or similar configuration in which the exhaust flow would be equalized.

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** Exhaust Back Pressure Gauge.

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.

Step	Action	Value(s)	Yes	No
1	Did you verify the customers complaint?	-	Go to Step 2	-
2	Did you review the exhaust symptoms diagnostic information and perform the necessary inspections?	-	Go to Step 3	Go to Symptoms - Engine Exhaust
3	Is the system equipped with dual exhaust?	-	Go to Diagnostic Aids	Go to Step 4
4	1. Remove the secondary air injection (AIR) check valve or the heated oxygen sensor (HO2S) that is in front of and closest to the catalytic converter. Refer to the affected component's service procedure. 2. Install the J-35314-A Exhaust Back Pressure Gauge in place of the AIR check valve or HO2S sensor. 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.	14 kPa (2 psi)		
	Does the reading exceed the specified value?		Go to Step 5	Go to Step 8
5	1. Turn the engine off and place the ignition in the lock position. 2. Remove the J-35314-A Exhaust Back Pressure Gauge. 3. Re-install the AIR check valve/HO2S sensor. Refer to the affected component's service procedure. 4. Remove the post-catalyst HO2S sensor. Refer to the affected component's service procedure. 5. Install the J-35314-A Exhaust Back Pressure Gauge in place of the post HO2S sensor. 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.	14 kPa (2 psi)		
	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	-	Go to Step 8	-

Step	Action	Value(s)	Yes	No
	Two-layer exhaust pipe separation Did you find and correct the condition?			
7	Replace the catalytic converter. Refer to the affected component's service procedure. Did you find and correct the condition?	-	Go to Step 8	-
8	1. Remove the J-35314-A Exhaust Back Pressure Gauge. 2. Reinstall the AIR check valve or the post-catalyst HO2S sensor. Refer to the affected component's service procedure 3. Clear any codes. 4. Road test the vehicle in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

EXHAUST LEAKAGE

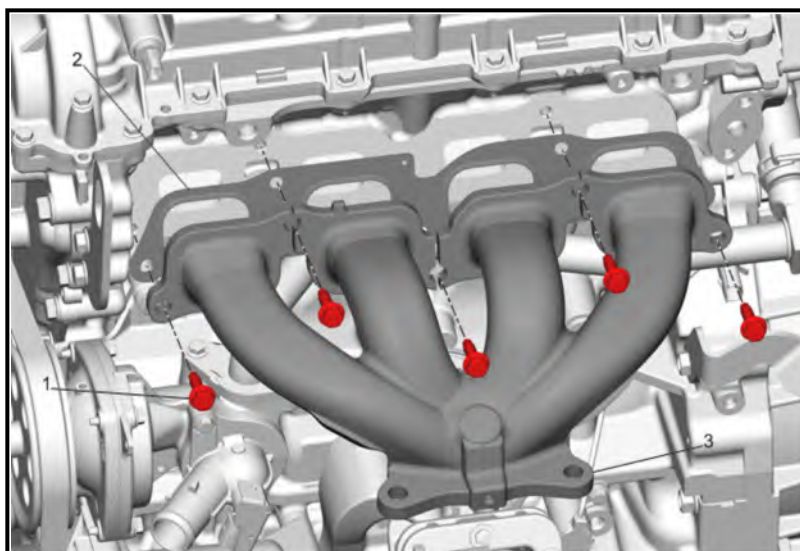
Problem	Action
WARNING: While engine is operating, the exhaust system will become extremely hot. To prevent burns avoid contacting a hot exhaust system.	
DEFINITION: An exhaust leak may show stains at the area of the leak. The leak may be felt by holding a hand near to the suspected areas or using a smoke pencil. The leak may make a popping or hissing noise. DIAGNOSTIC AID: Use the GE-41413-A Smoke Machine or equivalent to apply smoke to the exhaust system at the tailpipe sealed with a shop towel. Inspect for leaks using the GE-41413-151 Combination Light or suitable White/LV Light. If a leak is detected, repair or replace the affected component as necessary. Refer to Symptoms - Engine Exhaust prior to beginning this table.	
Misaligned or improperly installed exhaust system components	- Align and tighten the exhaust system components to the specifications. Fastener Specifications - Ensure the exhaust hangers are in the proper locations and not loose.
Exhaust leaks at the following connections: - Exhaust manifold to pipe - Flanges - Pipe clamps	Tighten the components to the specifications. Fastener Specifications
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 the affected component's procedure for service.
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 the affected component's procedure for service.

EXHAUST NOISE

Condition	Action
WARNING: 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, i.e. 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 or failed muffler. 3. Repair or replace the affected component. Refer to the affected component's service procedure.
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. Repair or replace the affected component. Refer to the affected component's service procedure.

REPAIR INSTRUCTIONS

EXHAUST MANIFOLD REPLACEMENT (LCV)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Exhaust Service Warning . Preliminary Procedure 1. Exhaust Manifold Heat Shield Replacement (LCV) 2. Catalytic Converter Replacement (LCV) - Disconnect	
1	Fastener [5X] CAUTION: Refer to Fastener Caution . Tighten 20 N.m (15 lb ft)
2	Exhaust Manifold Gasket Procedure Install a NEW gasket.
3	Exhaust Manifold

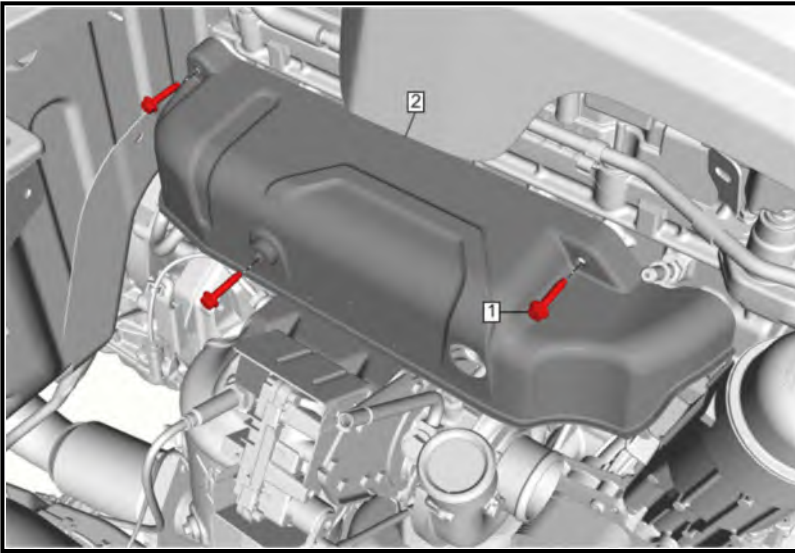
EXHAUST MANIFOLD REPLACEMENT (LWN)

Removal Procedure

WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

1. Exhaust Manifold Heat Shield (2) - Remove - [Exhaust Manifold Heat Shield Replacement \(LWN\)](#)

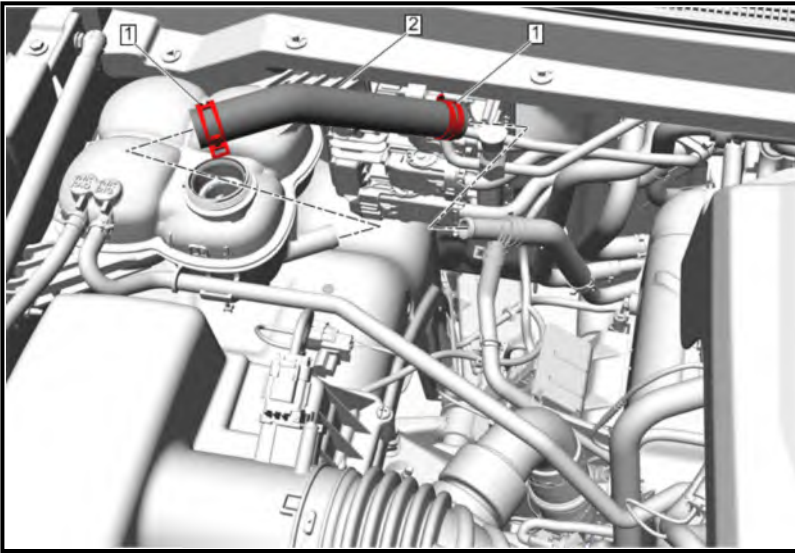


2. Radiator Surge Tank Outlet Hose Clamp (1) - Reposition

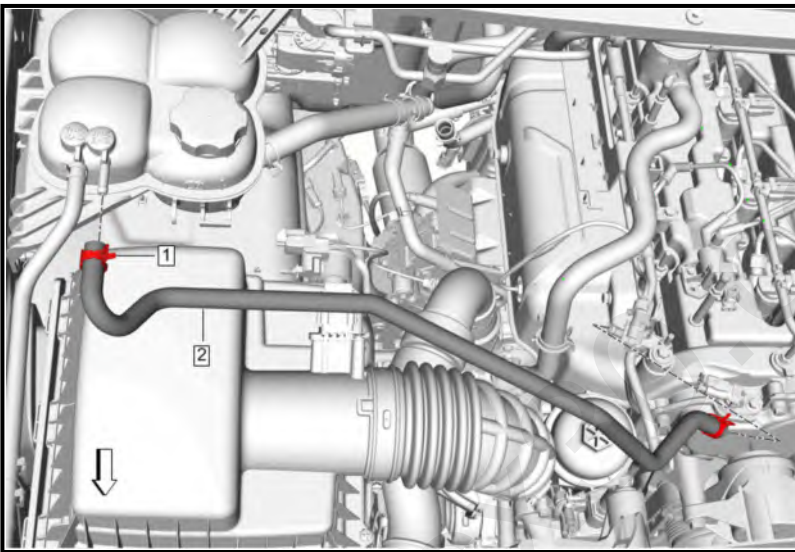


3. Radiator Surge Tank Outlet Hose (2) @ Turbocharger Coolant Return Pipe - Disconnect

4. Radiator Surge Tank Outlet Hose (2) @ Radiator Surge Tank - Reposition - [Radiator Surge Tank Outlet Hose Replacement \(LWN T Connection to Surge Tank\)](#)

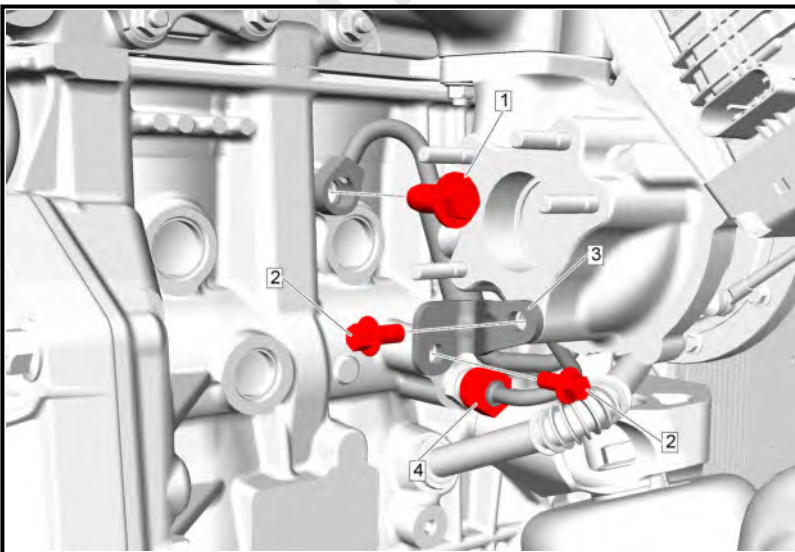


5. Radiator Surge Tank Inlet Hose (2) @ Radiator Surge Tank - Reposition - [Radiator Surge Tank Inlet Hose Replacement \(LWN\)](#)



6. Catalytic Converter - Remove - [Catalytic Converter Replacement \(LWN\)](#)

7. Turbocharger Coolant Feed Pipe Hollow Screw (1) - Remove

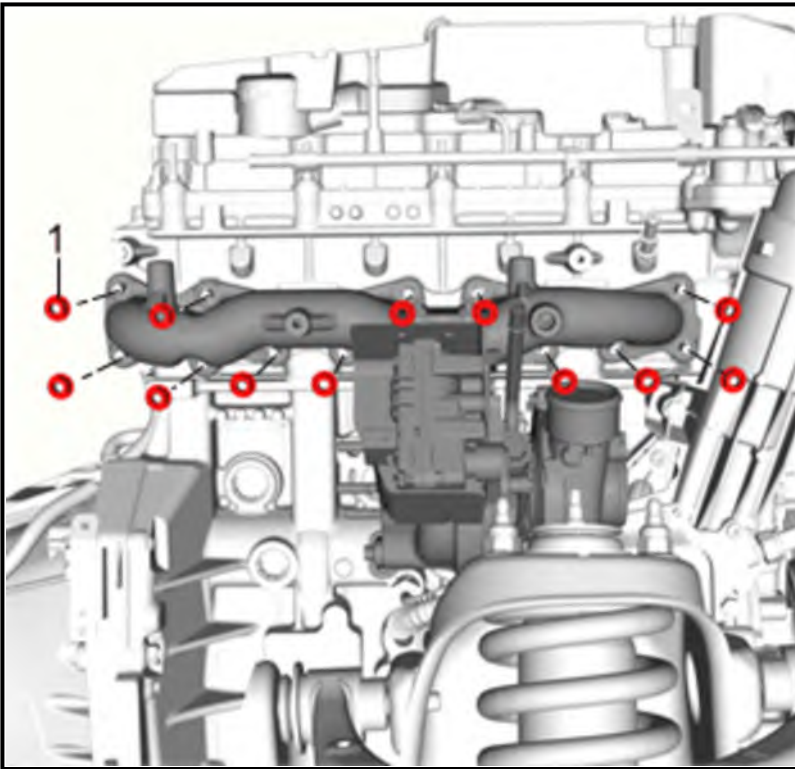


8. Turbocharger Brace Bolt (2) - Remove [2x]

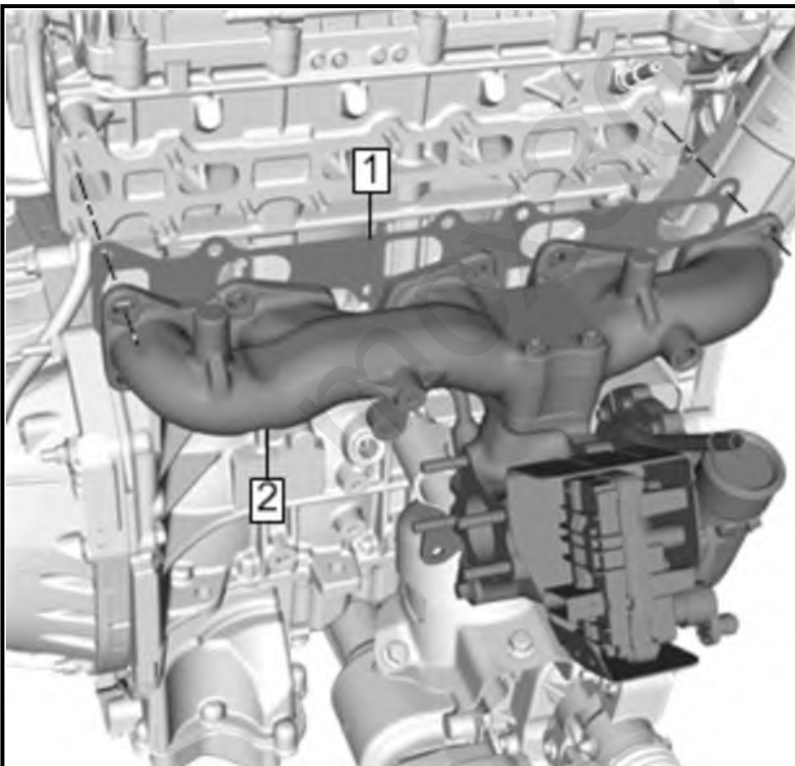
9. Turbocharger Brace (3) - Remove

10. Turbocharger Oil Feed Pipe Nut (4) - Loosen

11. Exhaust Manifold Nut (1) - Remove [12x]



12. Exhaust Manifold and Turbocharger Assembly (2) - Remove

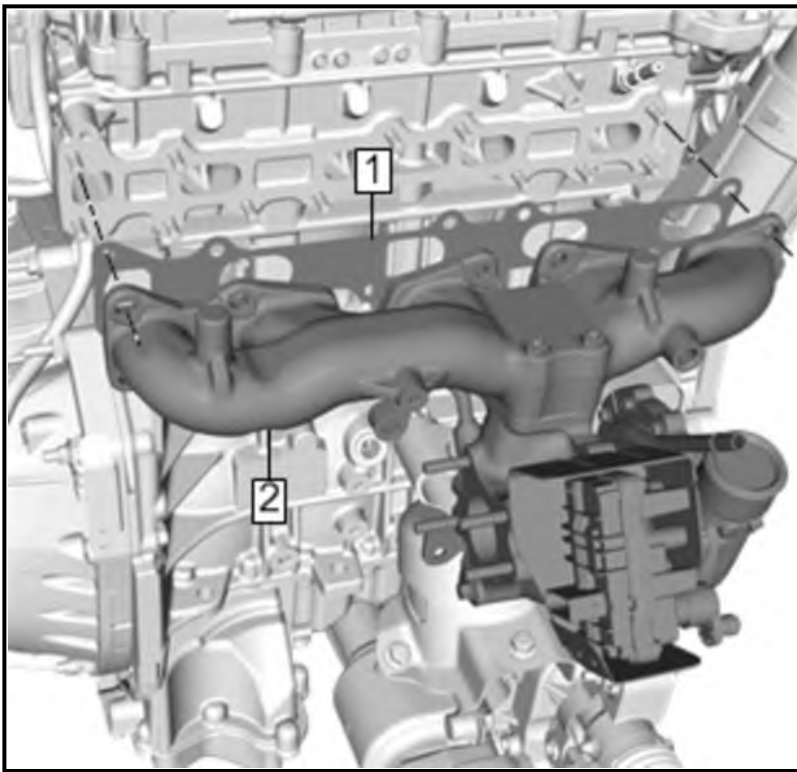


13. Exhaust Manifold Gasket (1) - Remove and DISCARD

14. Compressor Air Intake Turbocharger - Remove - [Compressor Air Intake Turbocharger Replacement](#)

Installation Procedure

1. Compressor Air Intake Turbocharger - Install - [Compressor Air Intake Turbocharger Replacement](#)
2. Exhaust Manifold Gasket (1) - Install

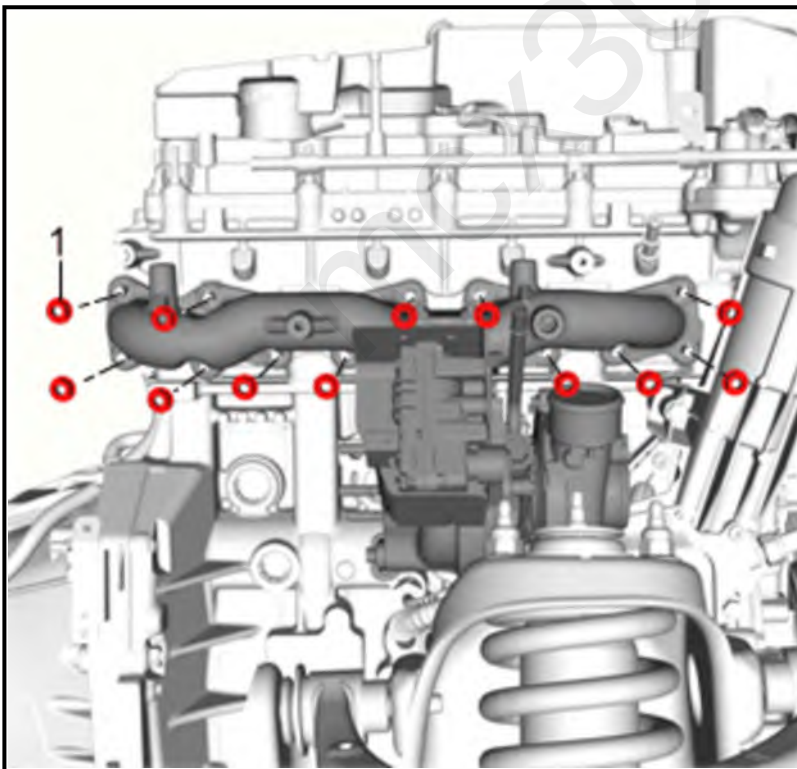


NOTE: Clean exhaust manifold gasket sealing surfaces.

NOTE: Install a **NEW** exhaust manifold gasket.

3. Exhaust Manifold and Turbocharger Assembly (2) - Install

4. Exhaust Manifold Nut (1) - Install and hand tighten [12x]



5. Exhaust Manifold Nut - Tighten in sequence [12x]

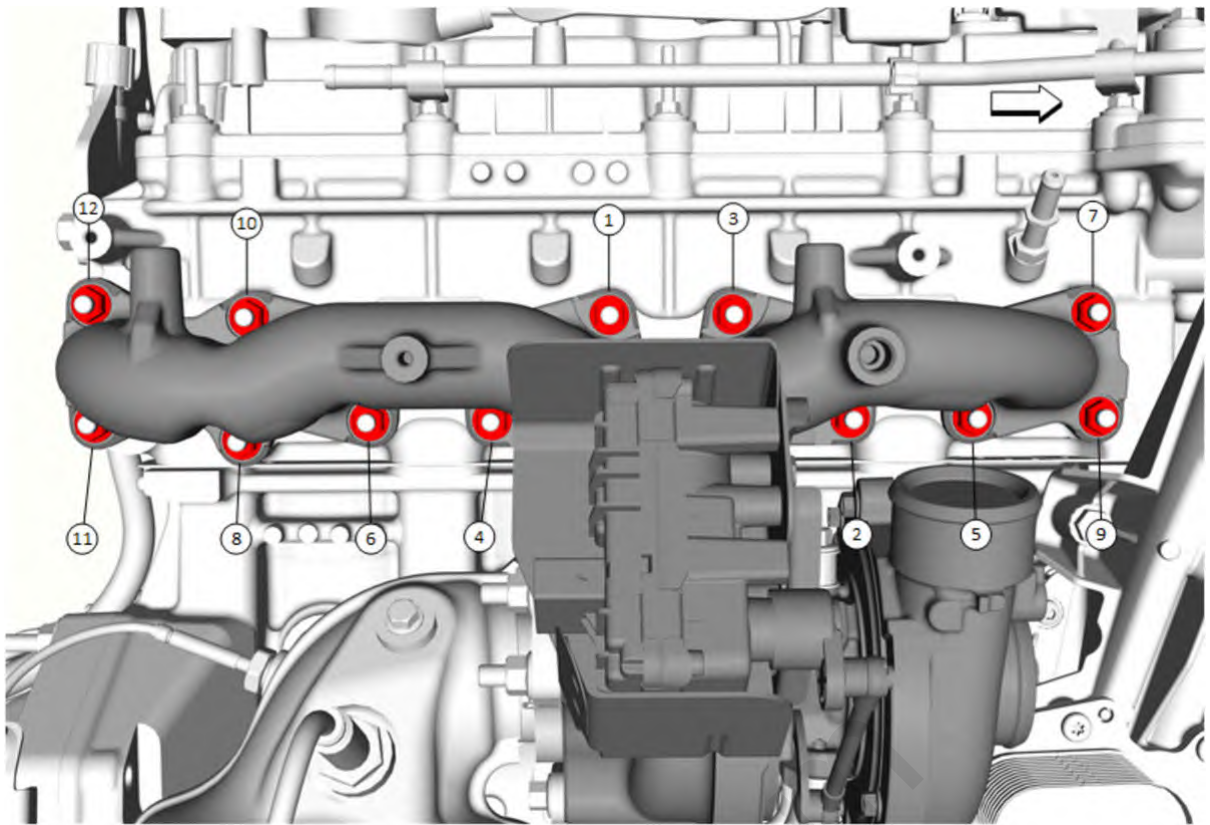
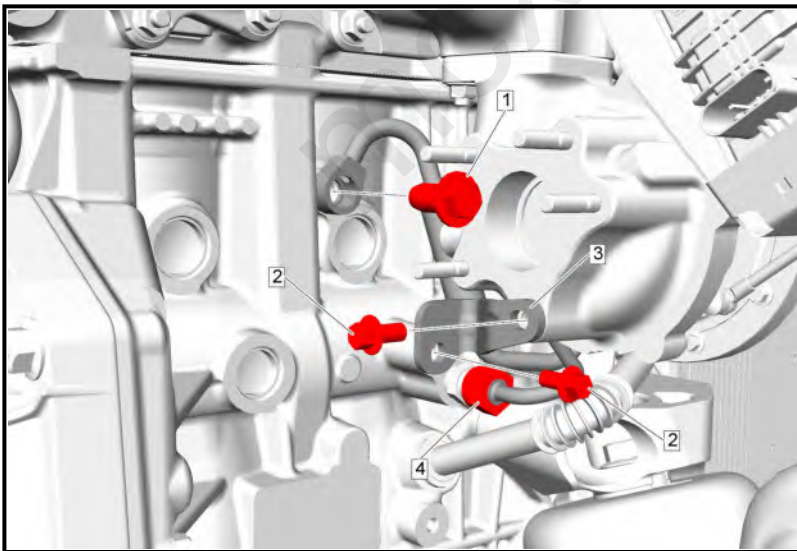


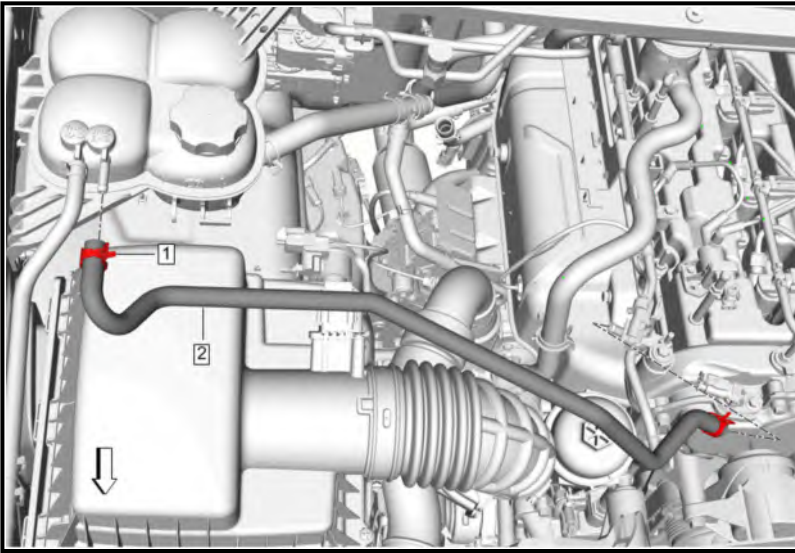
Fig. 1: Exhaust Manifold Nuts Tightening Sequence
 Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

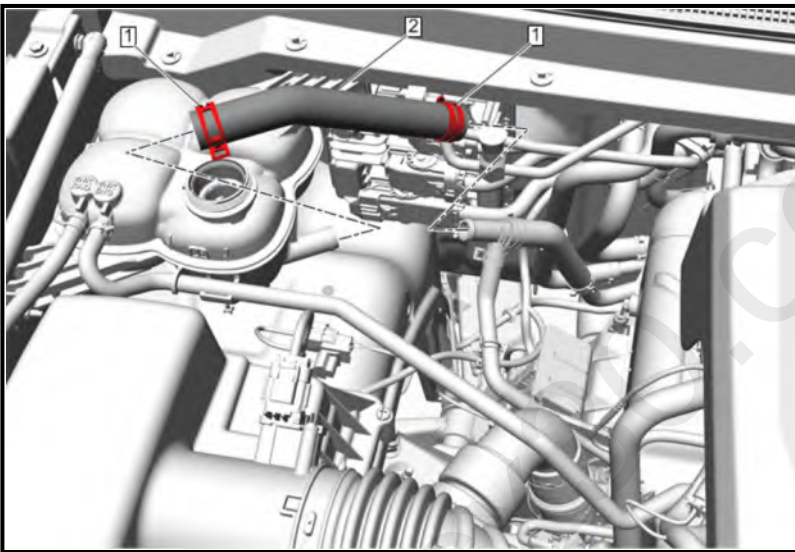
1. First Pass: 12 N.m (106 lb in)
2. First Pass: 32 N.m (283 lb in)
6. Turbocharger Oil Feed Pipe Nut (4) - Tighten 32 N.m (24 lb ft)



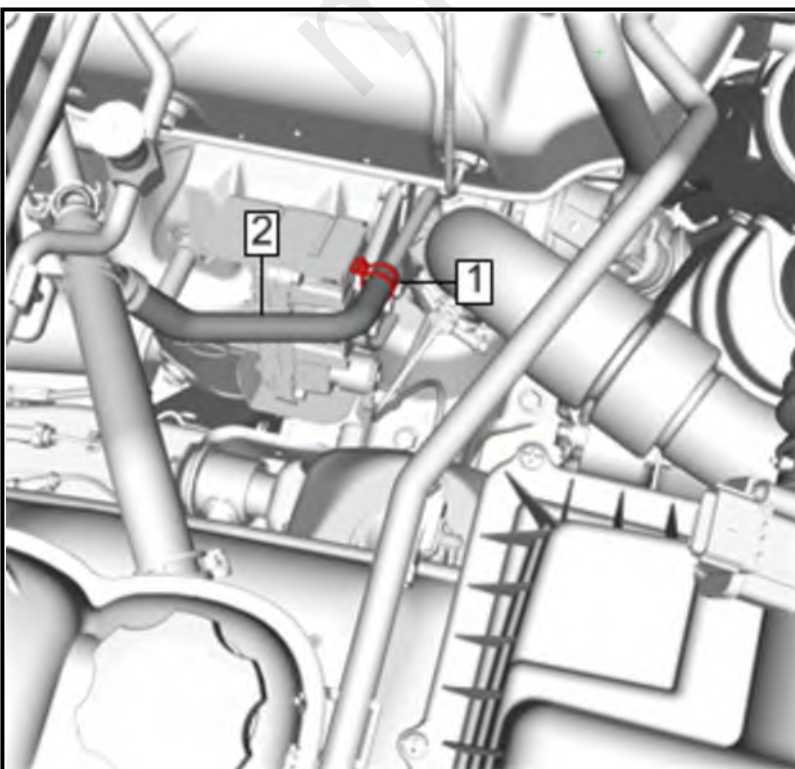
7. Turbocharger Brace (3) - Install
8. Turbocharger Brace Bolt (2) - Install and tighten [2x] 32 N.m (24 lb ft)
9. Turbocharger Coolant Feed Pipe Hollow Screw (1) - Install and tighten 35 N.m (26 lb ft)
10. Catalytic Converter - Install - [Catalytic Converter Replacement \(LWN\)](#)
11. Radiator Surge Tank Inlet Hose (2) @ Radiator Surge Tank - Install - [Radiator Surge Tank Inlet Hose Replacement \(LWN\)](#)



12. Radiator Surge Tank Outlet Hose (2) @ Radiator Surge Tank - Install - [Radiator Surge Tank Outlet Hose Replacement \(LWN T Connection to Surge Tank\)](#)

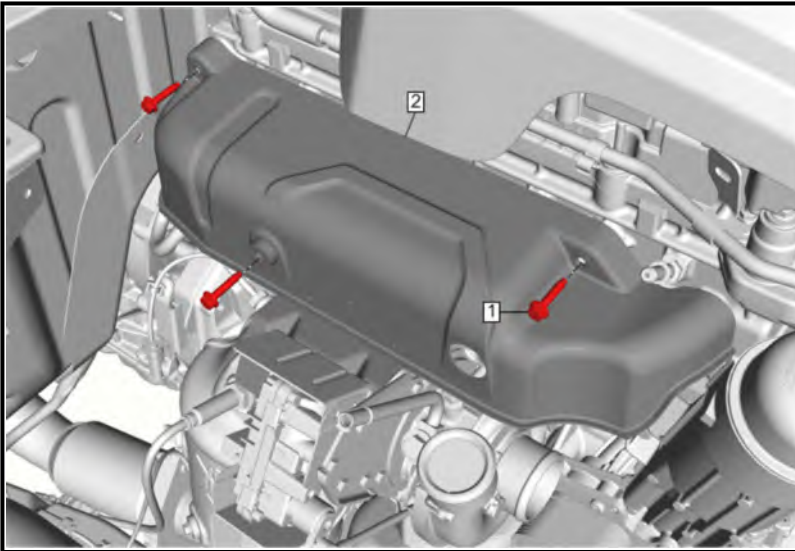


13. Radiator Surge Tank Outlet Hose (2) @ Turbocharger Coolant Return Pipe - Connect



14. Radiator Surge Tank Outlet Hose Clamp (1) - Install

15. Exhaust Manifold Heat Shield - Install - [Exhaust Manifold Heat Shield Replacement \(LWN\)](#).

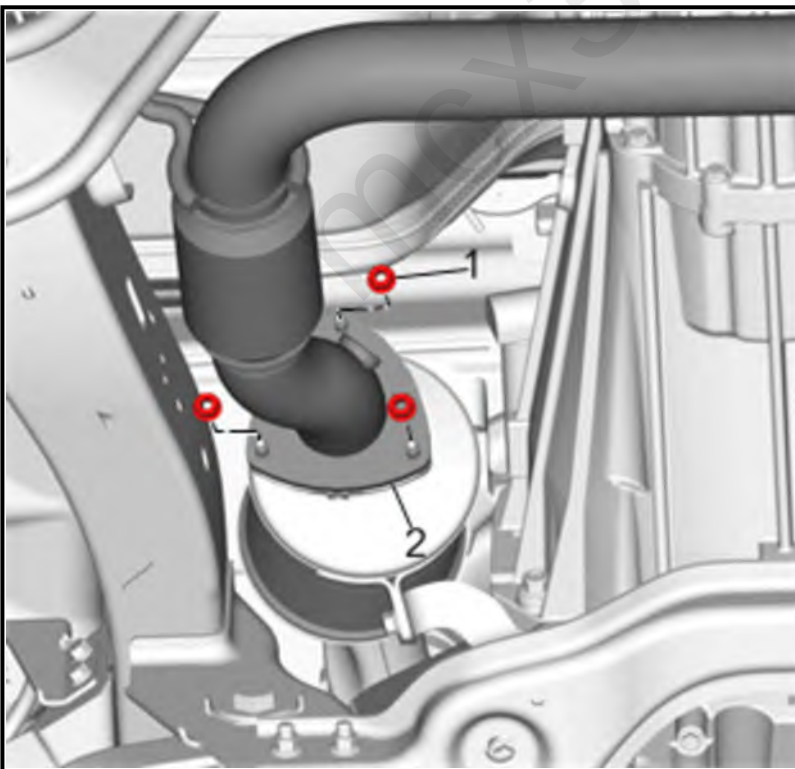


EXHAUST PIPE REPLACEMENT (LCV)

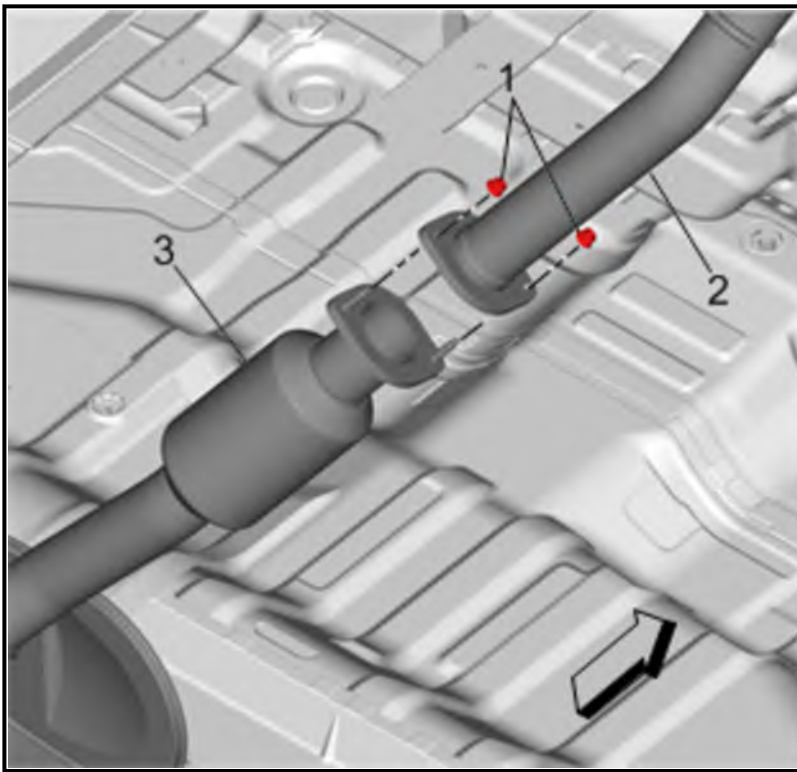
Removal Procedure

WARNING: Refer to [Exhaust Service Warning](#) .

1. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)
2. [Heated Oxygen Sensor Replacement - Sensor 2](#) - Disconnect
3. [Exhaust System Insulator, Hanger, Bracket Replacement \(LCV\)](#) - Disconnect
4. Exhaust Pipe Fasteners (1) - Remove [3X]



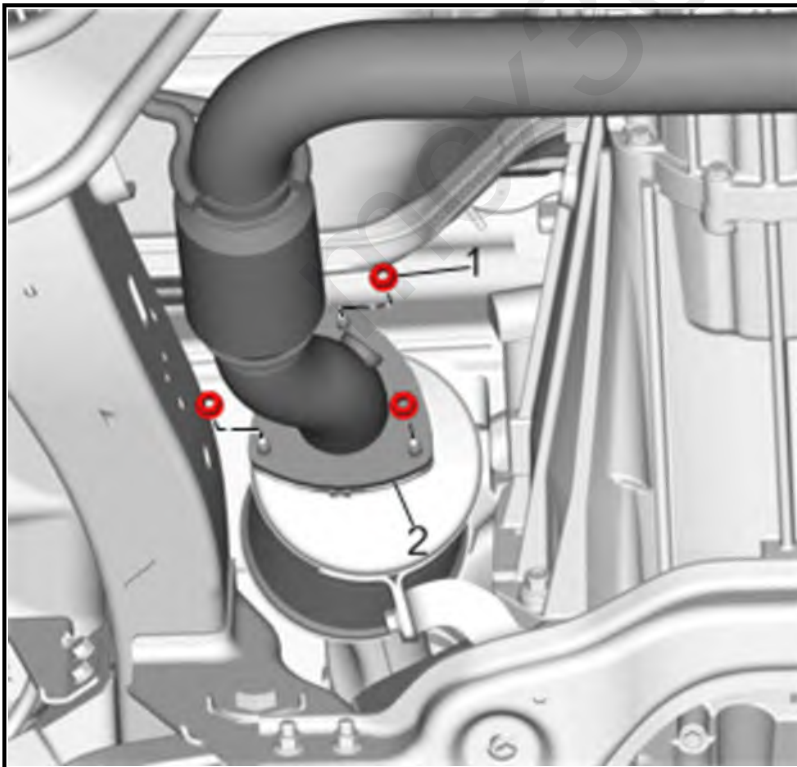
5. Exhaust Pipe (2) - Remove
6. Exhaust Pipe Fasteners (1) - Remove



7. Exhaust Front Pipe (2) @ Exhaust Muffler (3) - Disconnect
8. Exhaust Pipe - Remove

Installation Procedure

1. Install a NEW gasket.
2. Exhaust Pipe (2) - Install

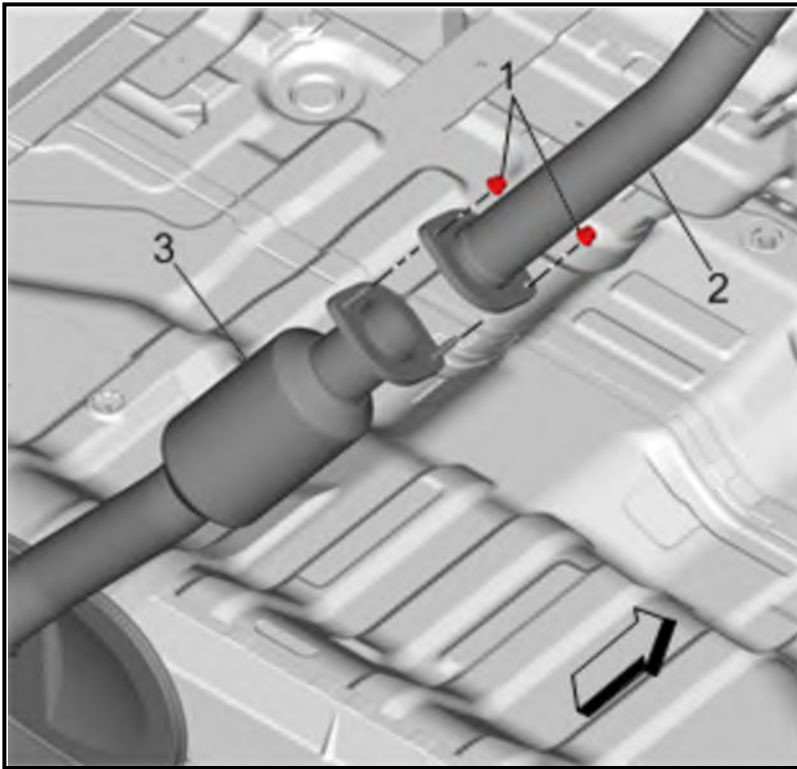


NOTE: Clean and lubricate the exhaust isolators for ease of installation.

CAUTION: Refer to [Fastener Caution](#) .

3. Exhaust Pipe Fasteners (1) - Tighten [3X] 50 N.m (37 lb ft)

4. Install a NEW gasket.



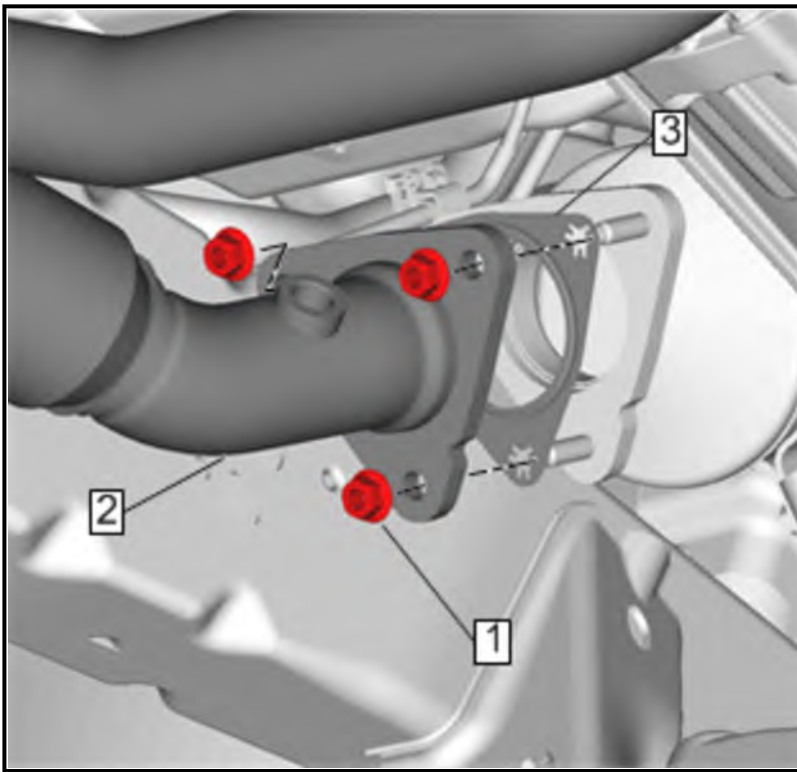
5. Exhaust Front Pipe (2) @ Exhaust Muffler - Connect (3)
6. Exhaust Pipe Fastener (1) - Tighten [2X] 45 N.m (33 lb ft)
7. Exhaust System Insulator, Hanger, Bracket Replacement (LCV) - Connect
8. Heated Oxygen Sensor Replacement - Sensor 2 - Connect
9. Lower the vehicle.

EXHAUST PIPE REPLACEMENT (LWN)

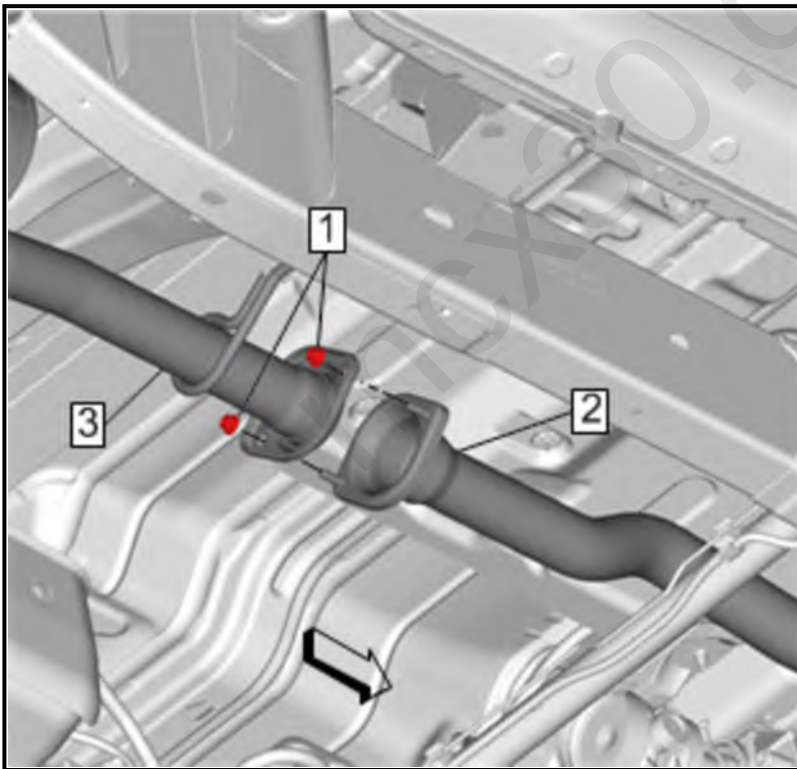
Removal Procedure

WARNING: Refer to Exhaust Service Warning .

1. Raise and support the vehicle. Lifting and Jacking the Vehicle
2. Heated Oxygen Sensor Replacement - Sensor 2 - Disconnect
3. Exhaust System Insulator, Hanger, Bracket Replacement (LWN Intermediate), or Exhaust System Insulator, Hanger, Bracket Replacement (LWN Rear) - Disconnect
4. Exhaust Pipe Fasteners (1) - Remove [3X]



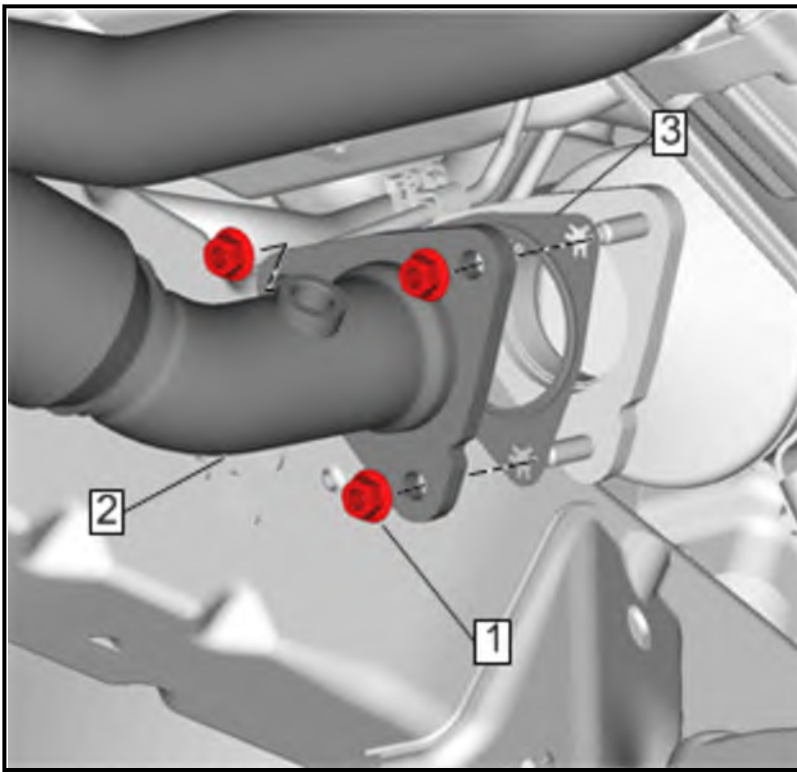
5. Exhaust Pipe (2) - Remove
6. Exhaust Gasket (3) - Remove and DISCARD
7. Exhaust Pipe Fasteners (1) - Remove



8. Exhaust Front Pipe (2) @ Exhaust Muffler (3) - Disconnect
9. Exhaust Front Pipe (2) - Remove

Installation Procedure

1. Install a NEW gasket. (3)



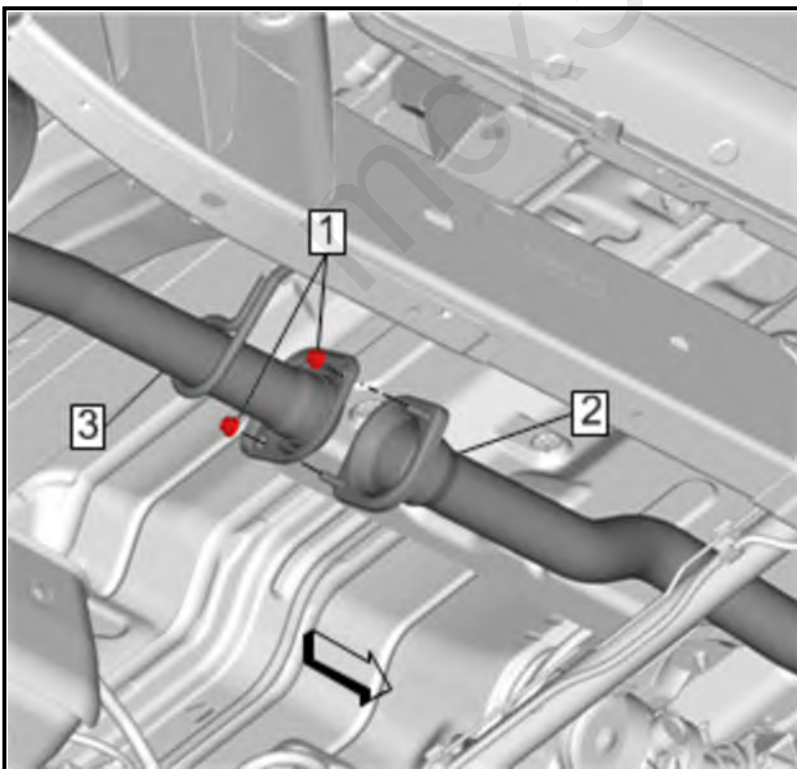
NOTE: Clean and lubricate the exhaust isolators for ease of installation.

2. Exhaust Pipe (2) - Install

CAUTION: Refer to [Fastener Caution](#) .

3. Exhaust Pipe Fasteners (1) - Tighten [3X] 50 N.m (37 lb ft)

4. Exhaust Front Pipe (2) @ Exhaust Muffler - Connect (3)



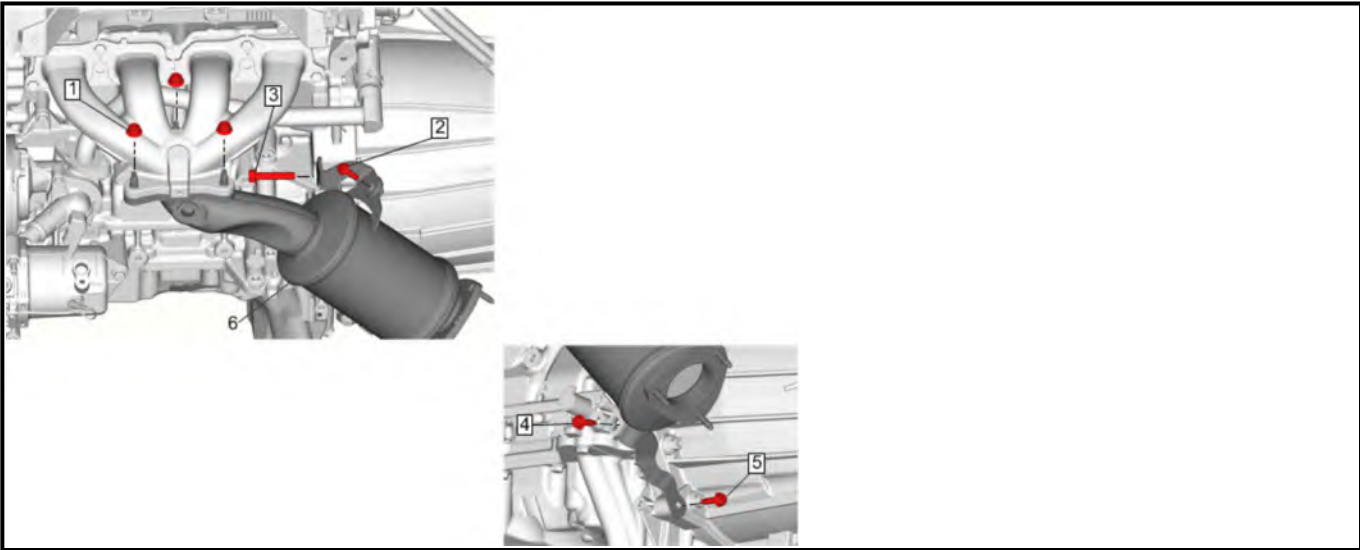
5. Exhaust Pipe Fastener (1) - Tighten [2X] 45 N.m (33 lb ft)

6. [Exhaust System Insulator, Hanger, Bracket Replacement \(LWN Intermediate\)](#), or [Exhaust System Insulator, Hanger, Bracket Replacement \(LWN Rear\)](#) - Connect

7. [Heated Oxygen Sensor Replacement - Sensor 2](#) - Connect

8. Lower the vehicle.

CATALYTIC CONVERTER REPLACEMENT (LCV)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Exhaust Service Warning . IMPORTANT: Torque all fasteners in the order listed. Preliminary Procedure 1. Heated Oxygen Sensor Replacement - Sensor 1 2. Exhaust Manifold Replacement (LCV) 3. Exhaust Pipe @ Catalytic Converter - Disconnect - Exhaust Pipe Replacement (LCV)	
1	Fastener [3x] CAUTION: Refer to Fastener Caution . Tighten 58 N.m (43 lb ft)
2	Fastener [3x] Tighten 22 N.m (16 lb ft)
3	Fastener [3x] Tighten 58 N.m (43 lb ft)

Callout	Component Name
4	Fastener [3X] Tighten 22 N.m (16 lb ft)
5	Fastener [3X] Tighten 22 N.m (16 lb ft)
6	Catalytic Converter Procedure Install a NEW gasket.

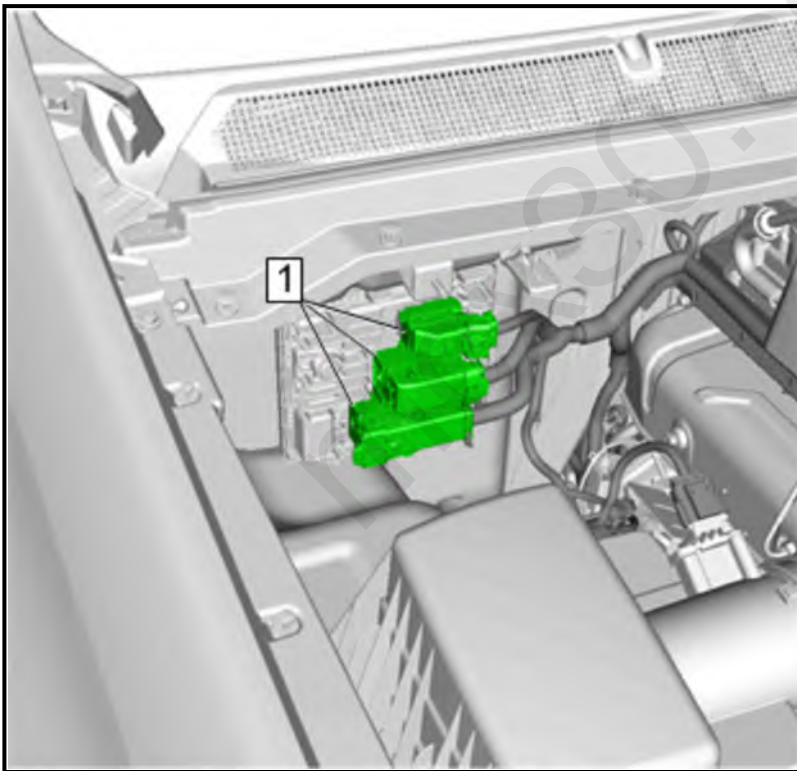
CATALYTIC CONVERTER REPLACEMENT (LWN)

Removal Procedure

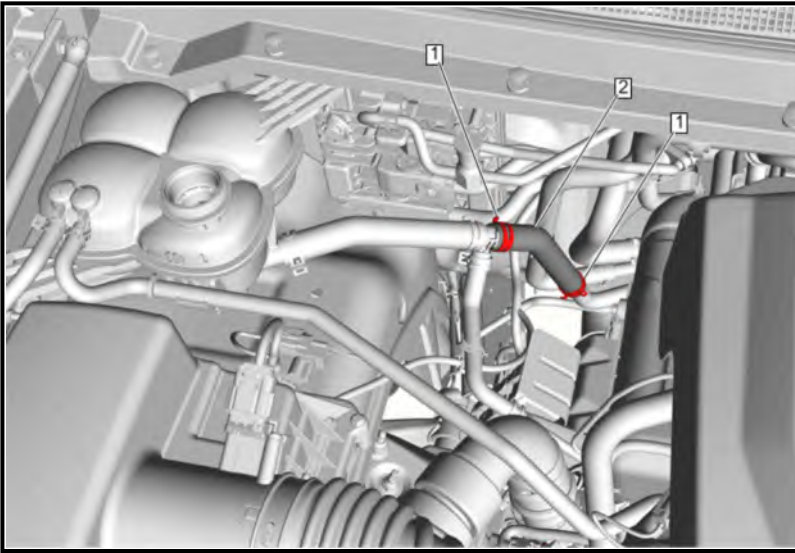
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

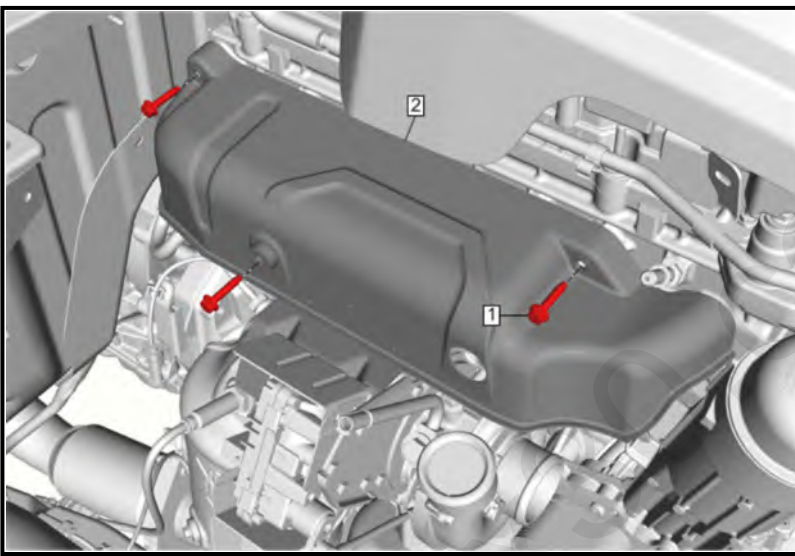
1. Disconnect the engine wiring harness electrical connectors (1) from the powertrain control module and position aside. [Engine Control Module Replacement](#)



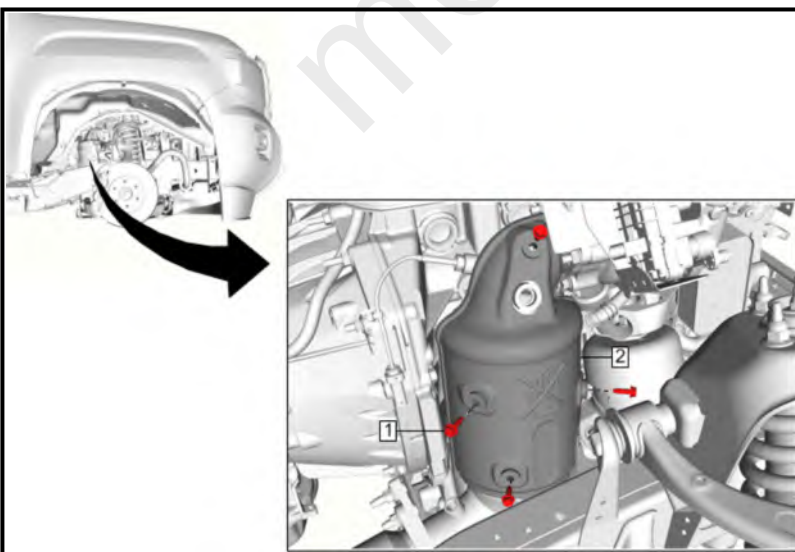
2. Disconnect the mass airflow sensor and the turbocharger actuator electrical connectors, disconnect the harness retainer, and position the harness aside.
3. Disconnect the radiator surge tank outlet hose (2) at the radiator surge tank outlet pipe and position the hose aside. [Radiator Surge Tank Outlet Hose Replacement \(LWN T Connection to Surge Tank\)](#)



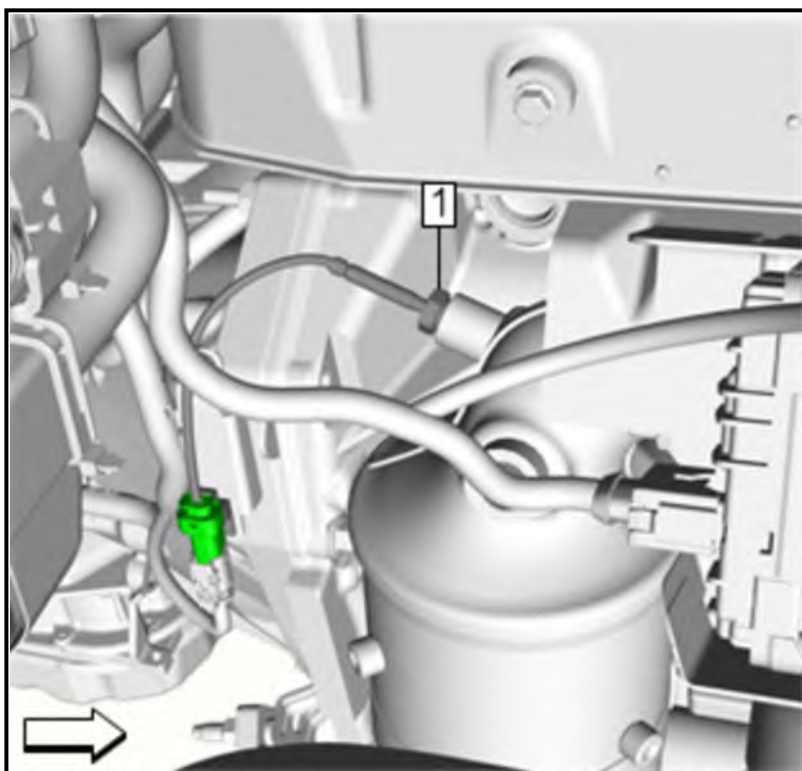
4. Exhaust Manifold Heat Shield (2) - Remove - [Exhaust Manifold Heat Shield Replacement \(LWN\)](#)



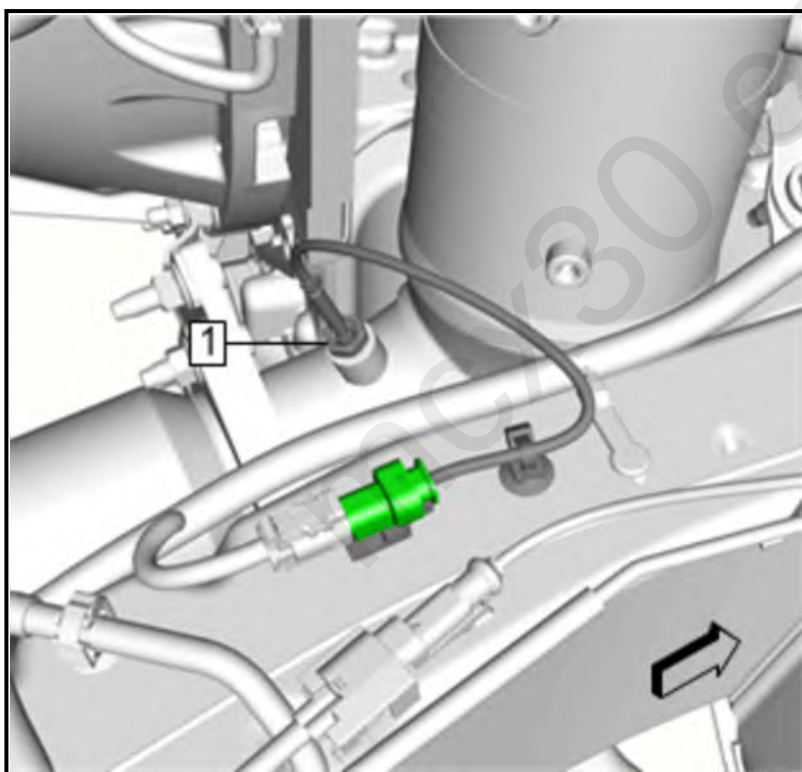
5. Catalytic Converter Heat Shield (2) - Remove - [Catalytic Converter Heat Shield Replacement \(LWN\)](#)



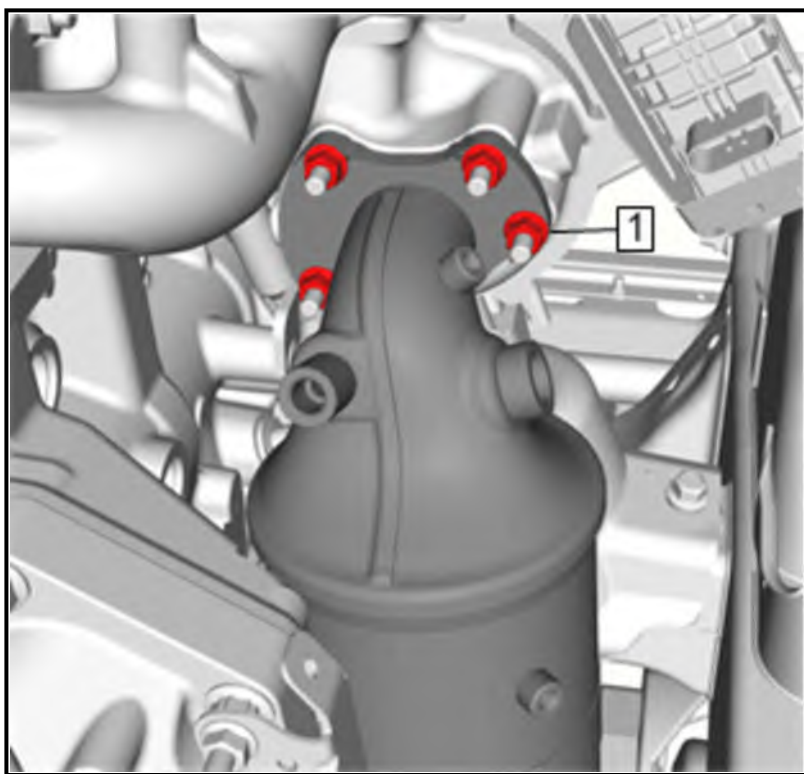
6. Exhaust Temperature Sensor (1) - Disconnect - [Exhaust Temperature Sensor Replacement - Position 1](#)



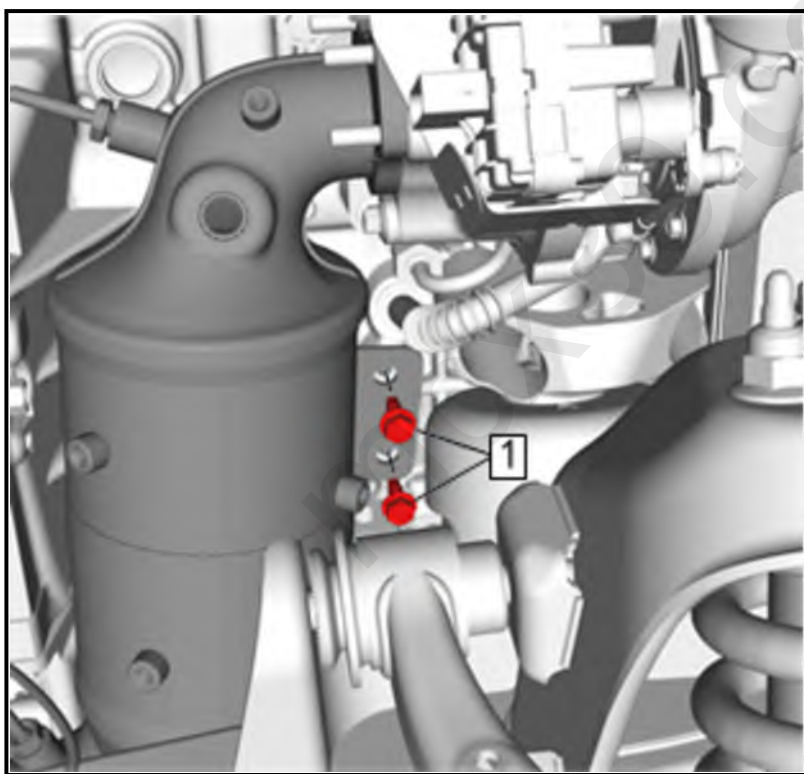
7. Exhaust Temperature Sensor (1) - Disconnect - [Exhaust Temperature Sensor Replacement - Position 2](#)



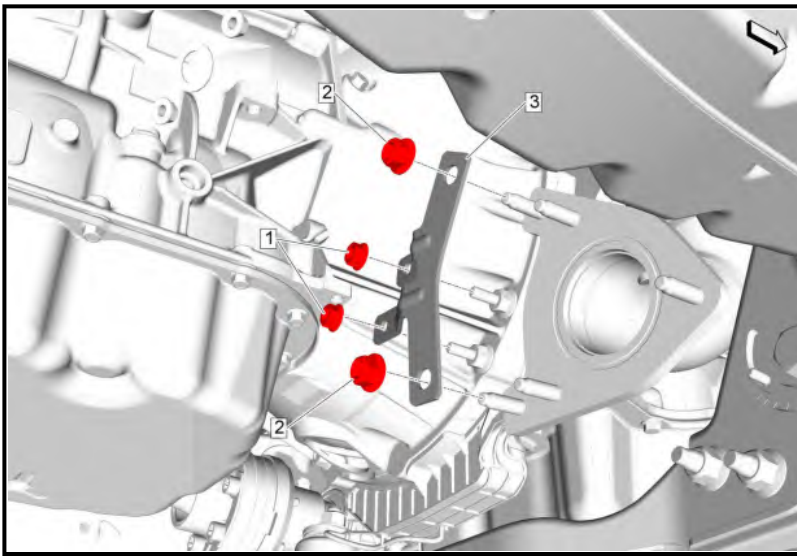
8. Catalytic Converter Nut (1) - Remove [4x]



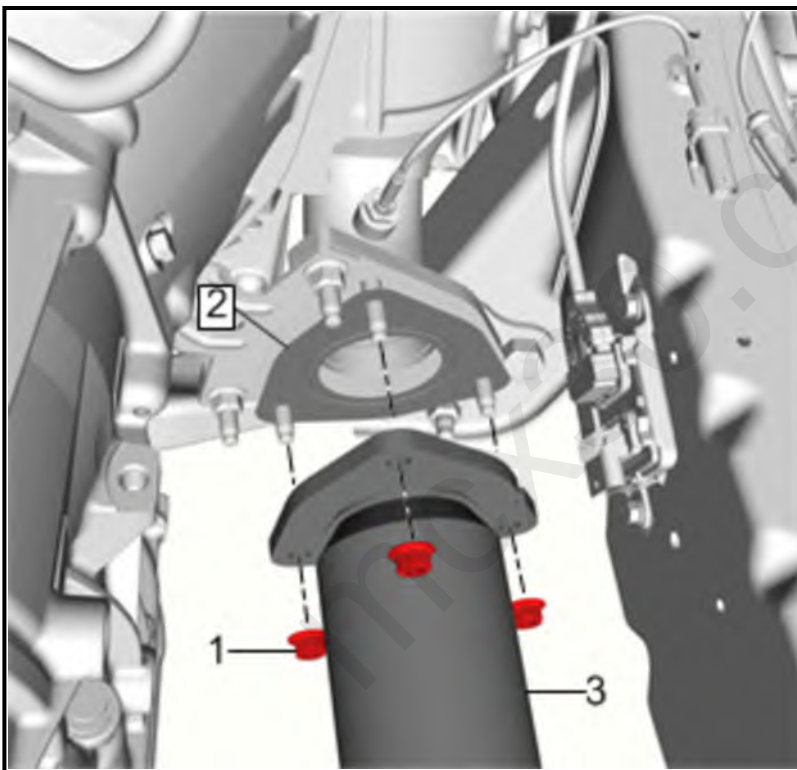
9. Catalytic Converter Brace Bracket Bolt (1) - Remove [2x]



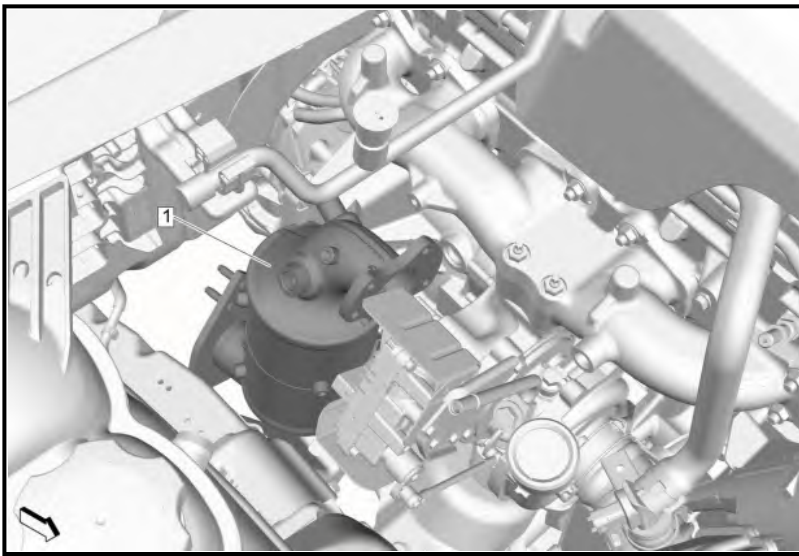
10. Catalytic Converter Brace Bracket Nut (1) - Remove [2x]



- 11. Catalytic Converter Nut (2) - Remove [2x]
- 12. Catalytic Converter Brace Bracket (3) - Remove
- 13. Catalytic Converter Nut (1) - Remove [3x]



- 14. Catalytic Converter Gasket (2) Remove and DISCARD
- 15. Nitrogen Oxides Catalytic Converter (3) - Reposition
- 16. Catalytic Converter (1) - Remove

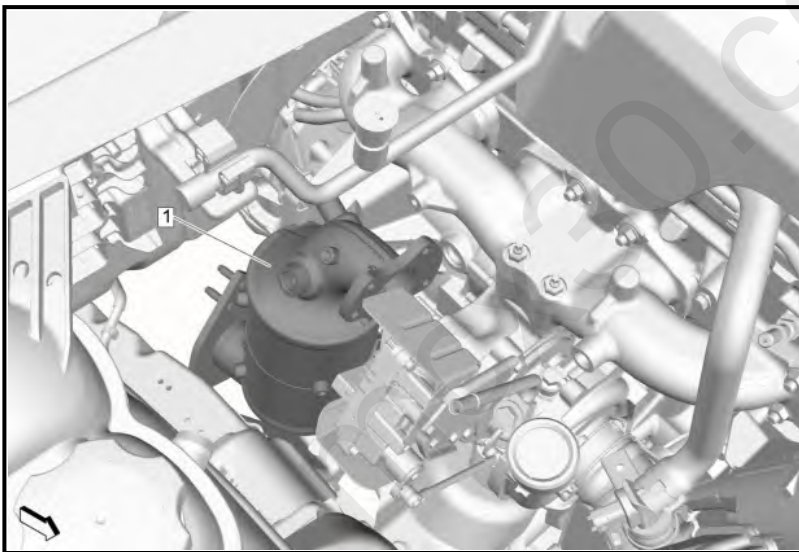


NOTE: Lower the vehicle to remove the catalytic converter through the top of the engine compartment.

17. If replacing the catalytic converter, transfer parts as necessary.

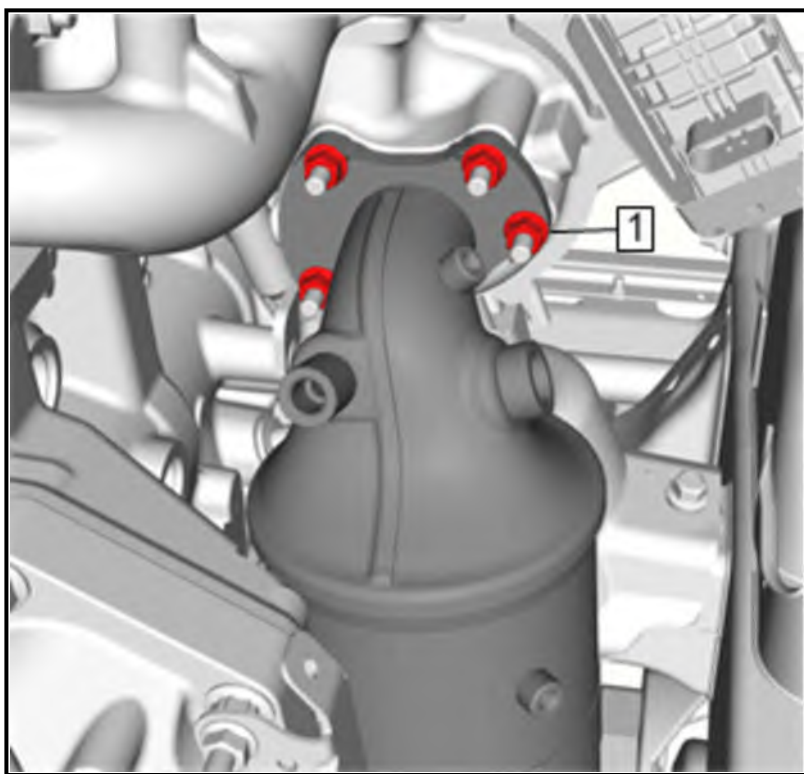
Installation Procedure

1. Catalytic Converter (1) - Install



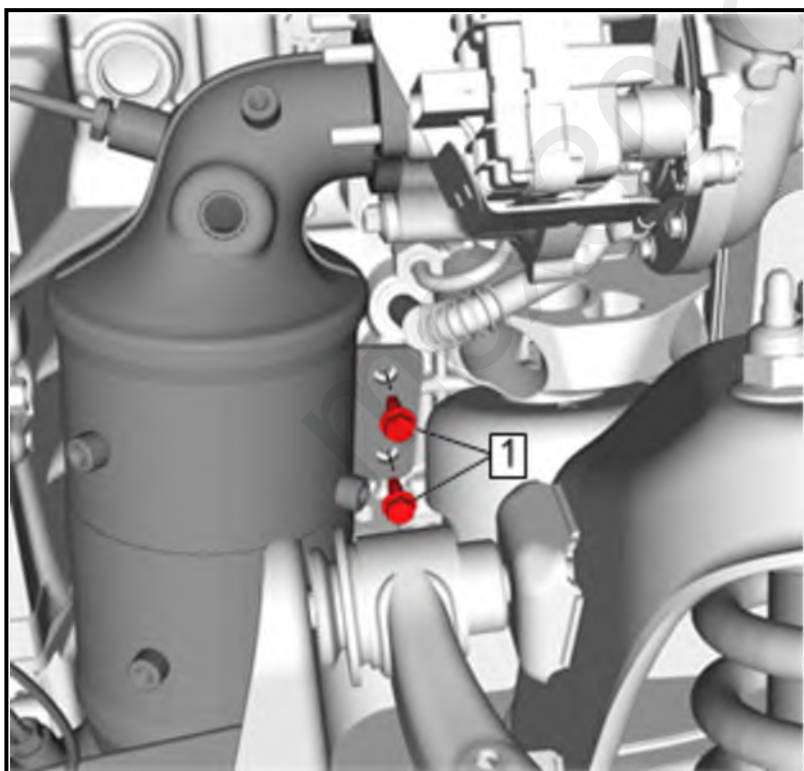
NOTE: Replace the exhaust gaskets with NEW gaskets.

2. Catalytic Converter Nut (1) - Hand tighten [4x]

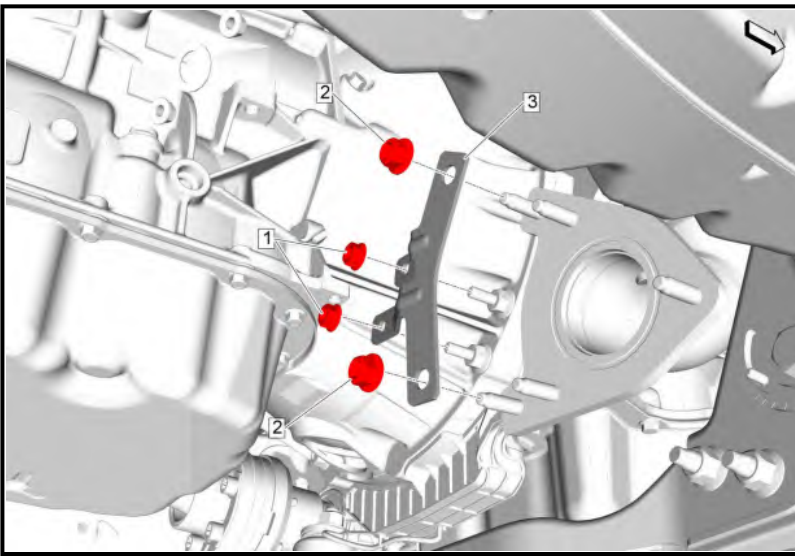


CAUTION: Refer to [Fastener Caution](#) .

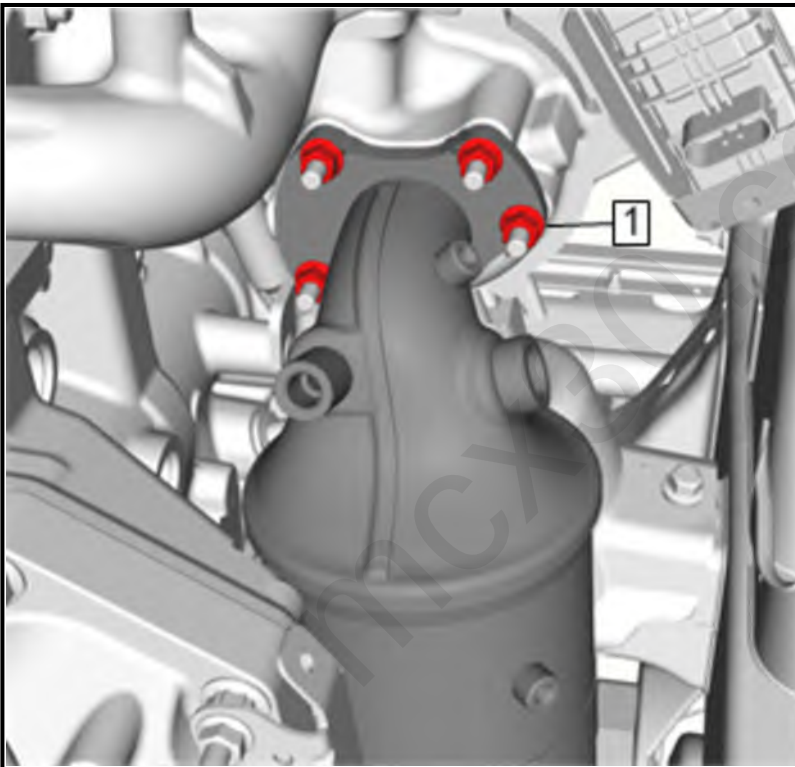
3. Catalytic Converter Brace Bracket Bolt (1) - Hand tighten [2x]



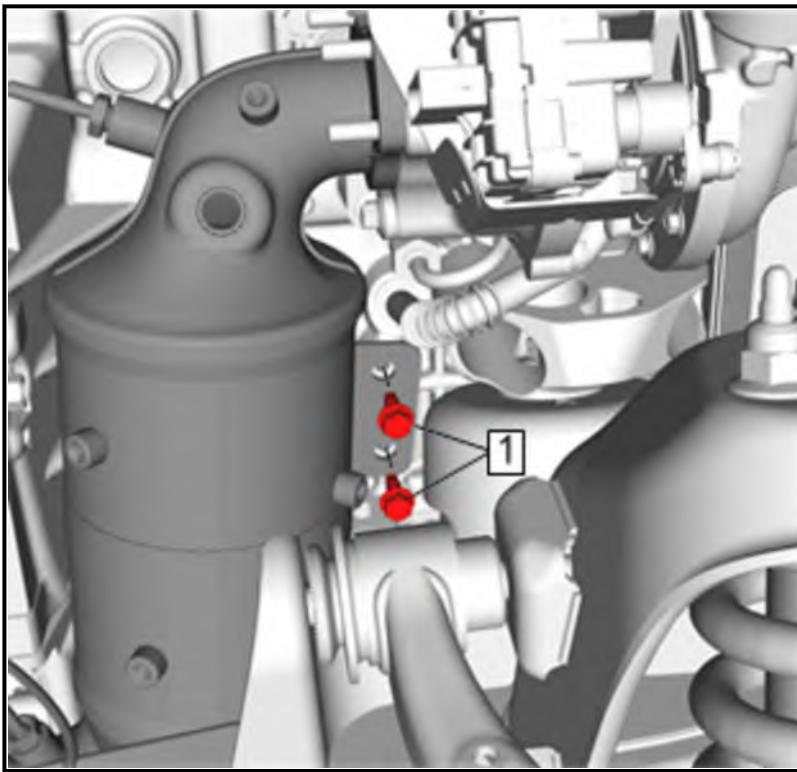
4. Catalytic Converter Brace Bracket (3) - Install



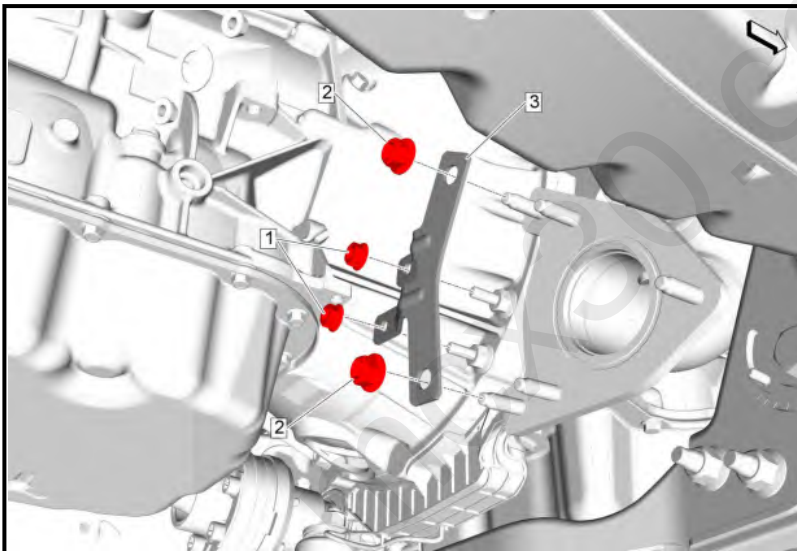
5. Catalytic Converter Nut (2) - Hand tighten [2x]
6. Catalytic Converter Brace Bracket Nut (1) - Hand tighten [2x]
7. Catalytic Converter Nut (1) - Tighten [4x] 28 N.m (21 lb ft)



8. Catalytic Converter Brace Bracket Bolt (1) - Tighten [2x] 22 N.m (16 lb ft)

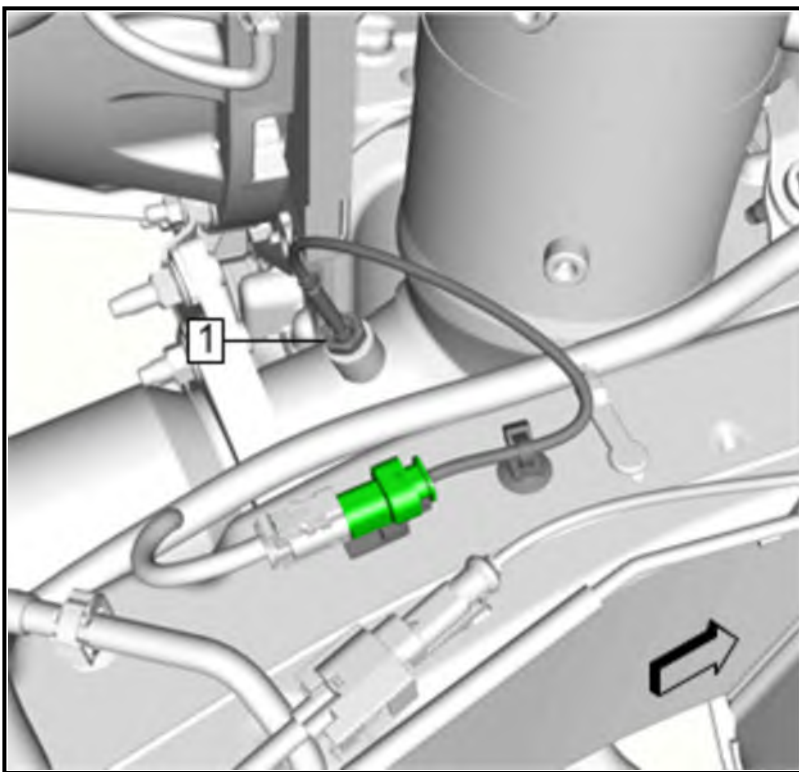


9. Catalytic Converter Nut (2) - Tighten [2x] 50 N.m (37 lb ft)

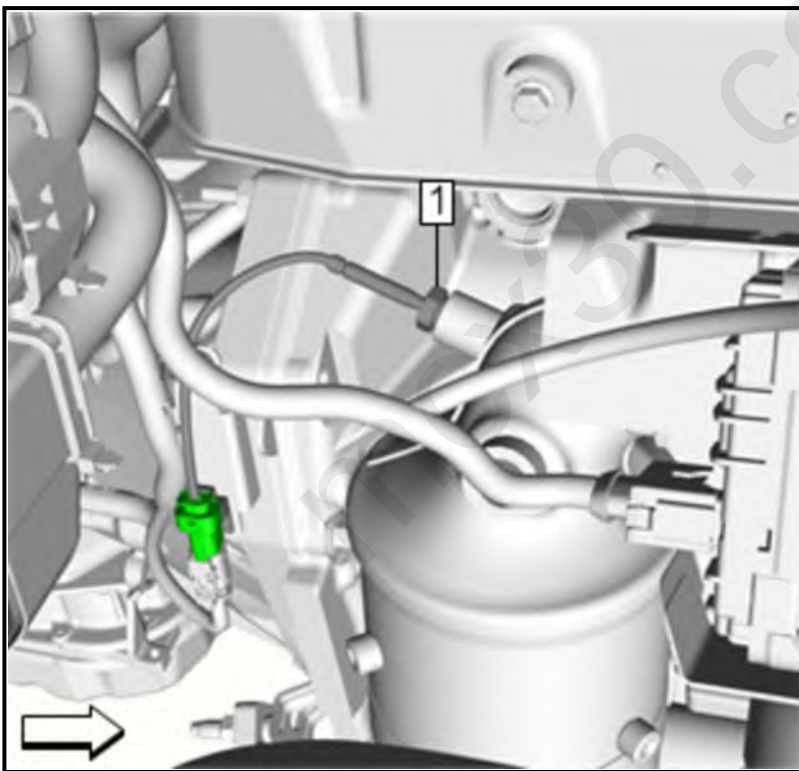


10. Catalytic Converter Brace Bracket Nut (1) - Tighten [2x] 22 N.m (16 lb ft)

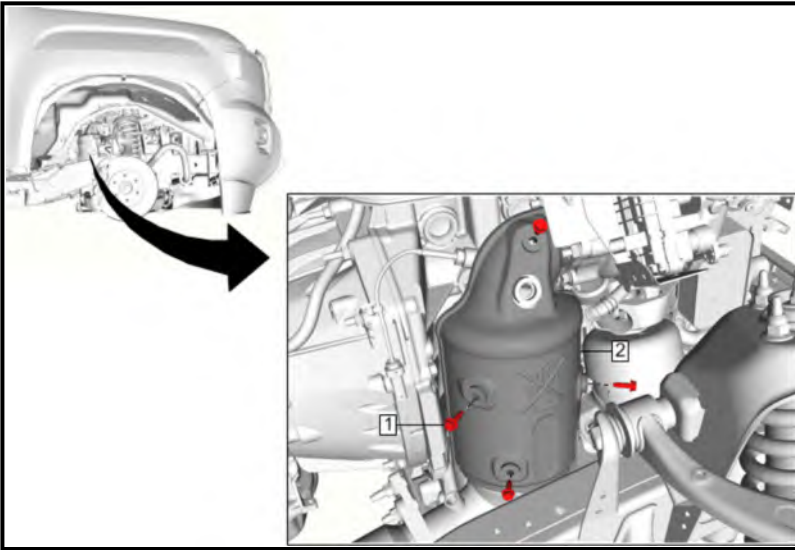
11. Exhaust Temperature Sensor (1) - Connect - [Exhaust Temperature Sensor Replacement - Position 2](#)



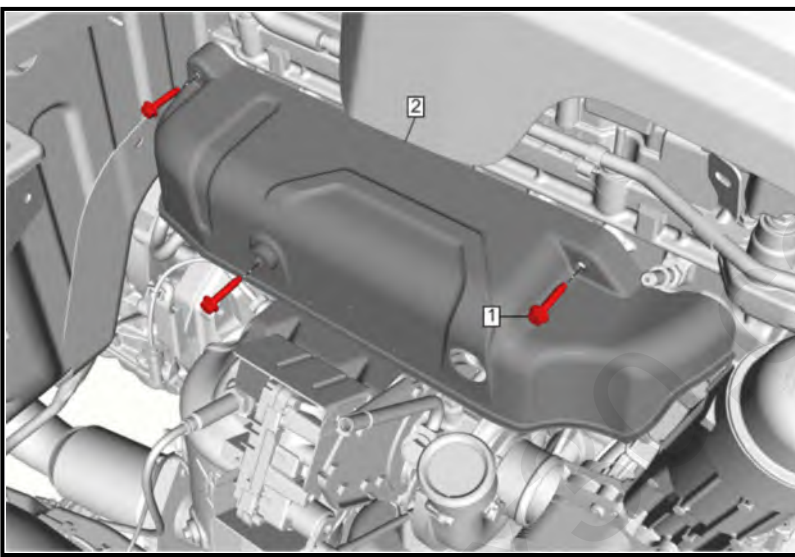
12. Exhaust Temperature Sensor (1) - Connect - [Exhaust Temperature Sensor Replacement - Position 1](#)



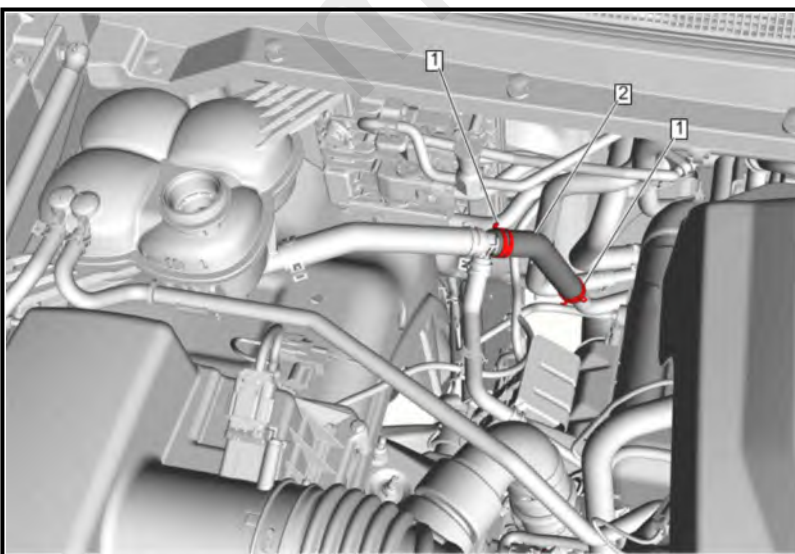
13. Catalytic Converter Heat Shield (2) - Install - [Catalytic Converter Heat Shield Replacement \(LWN\)](#)



14. Exhaust Manifold Heat Shield (2) - Install - [Exhaust Manifold Heat Shield Replacement \(LWN\)](#).

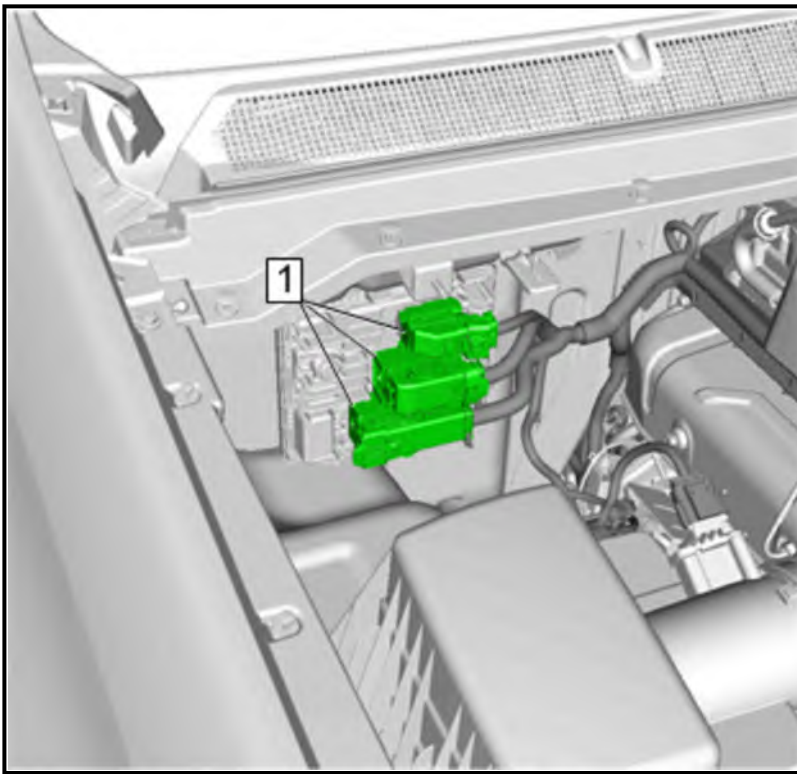


15. Connect the radiator surge tank outlet hose (2) to the radiator surge tank outlet pipe. [Radiator Surge Tank Outlet Hose Replacement \(LWN T Connection to Surge Tank\)](#).



16. Connect the mass airflow sensor and the turbocharger actuator electrical connectors, connect the harness retainer, and position the harness in place.

17. Connect the engine wiring harness electrical connectors (1) to the powertrain control module. [Engine Control Module Replacement](#)



NOTE: If replacing the Catalytic Converter with new, a Catalyst Reset will need to be performed.

18. Perform a Catalyst Reset. [Catalyst Reset](#)

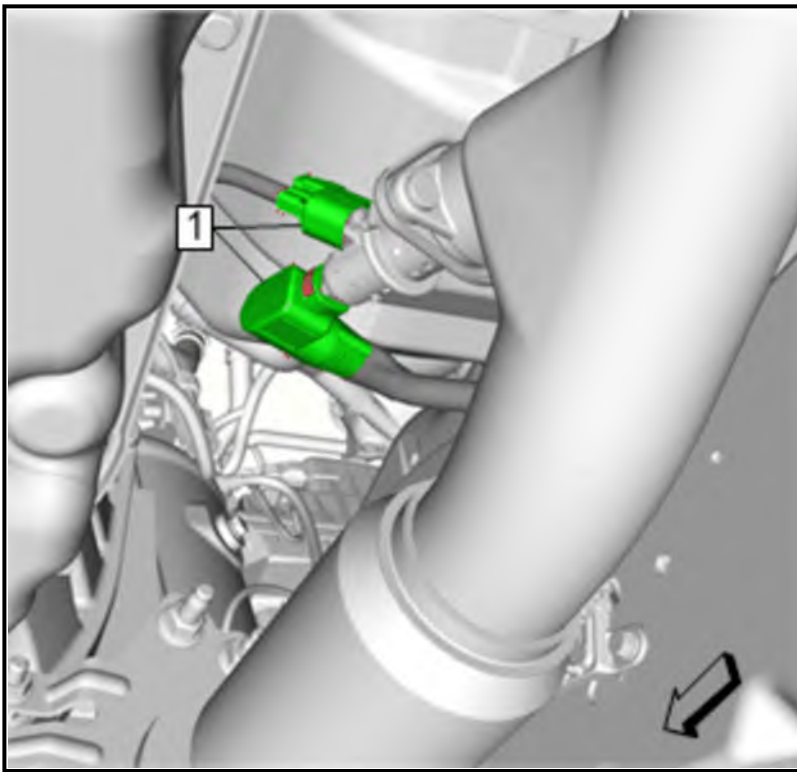
NITROGEN OXIDES CATALYTIC CONVERTER REPLACEMENT (LWN)

Removal Procedure

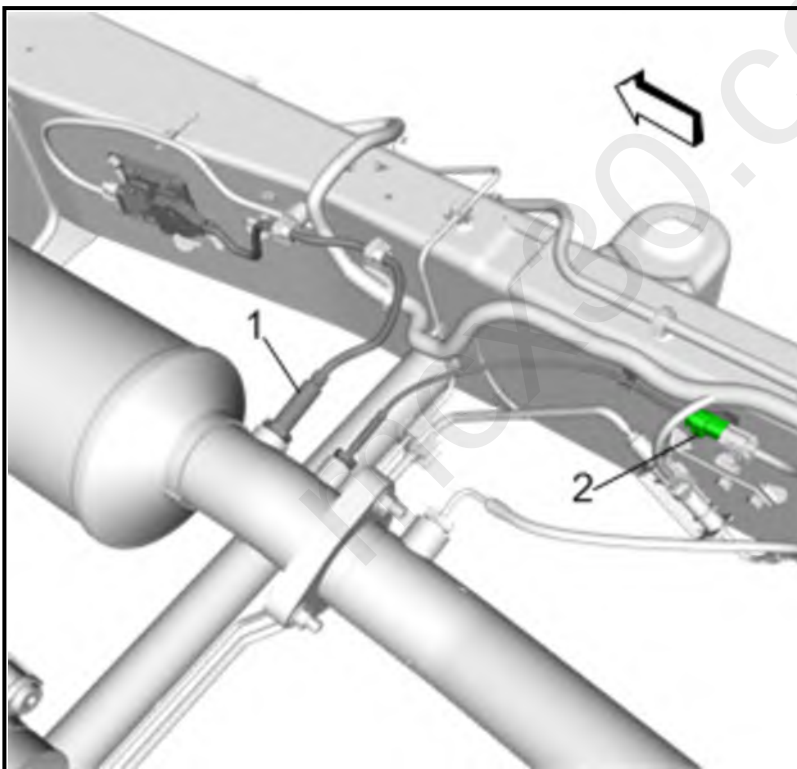
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

1. [Transmission Support Crossmember Replacement \(4 Wheel Drive\)](#) , or [Transmission Support Crossmember Replacement \(2 Wheel Drive\)](#) - Remove
2. Emission Reduction Fluid Injector (1) - Disconnect - [Reductant Fluid Injector Replacement](#)

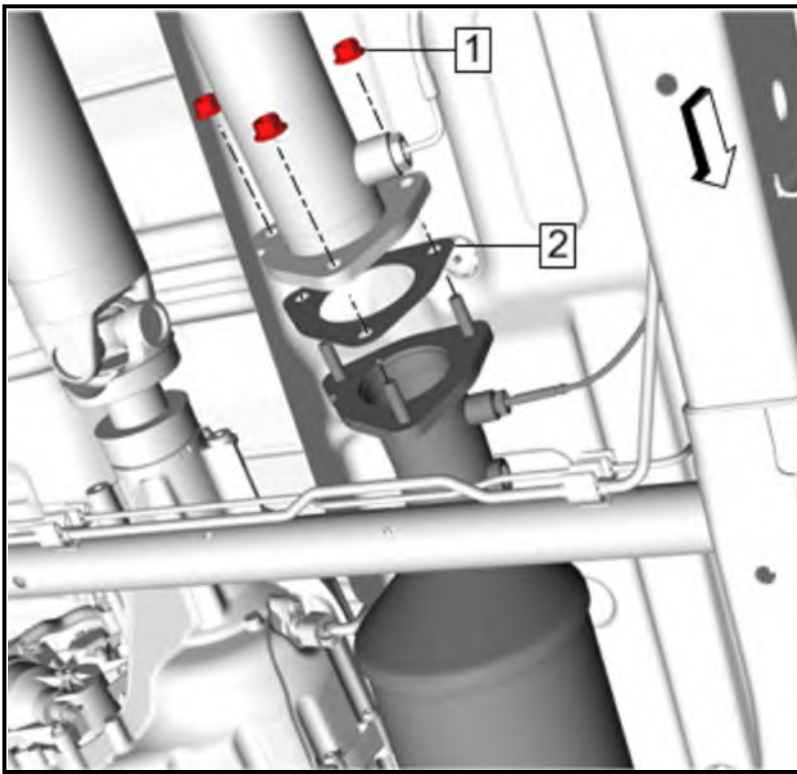


3. Nitrogen Oxides Sensor (1) - Remove - [Nitrogen Oxides Sensor Replacement - Position 2](#)

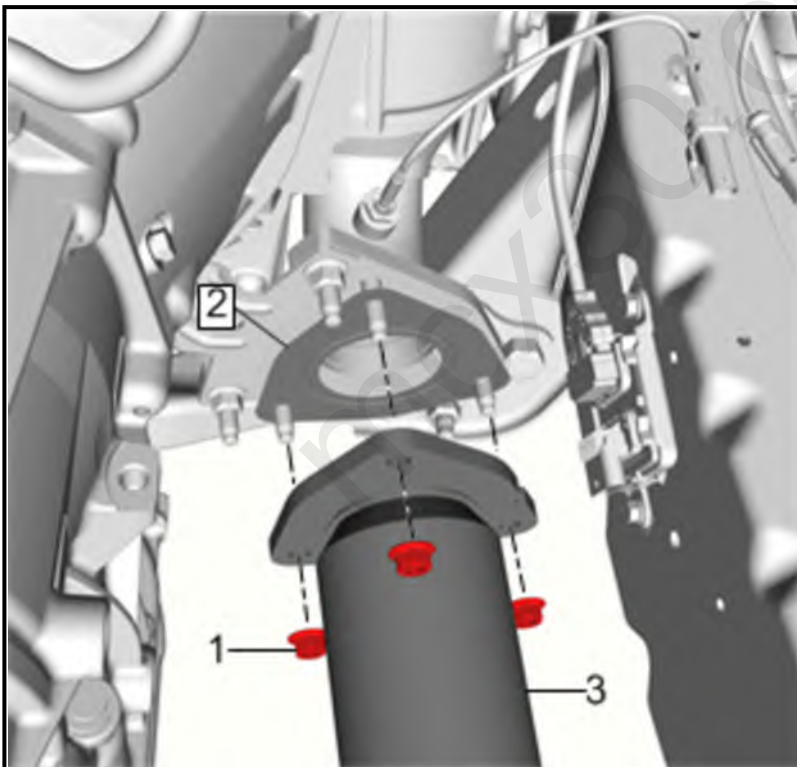


4. Exhaust Temperature Sensor (2) - Disconnect - [Exhaust Temperature Sensor Replacement - Position 3](#)

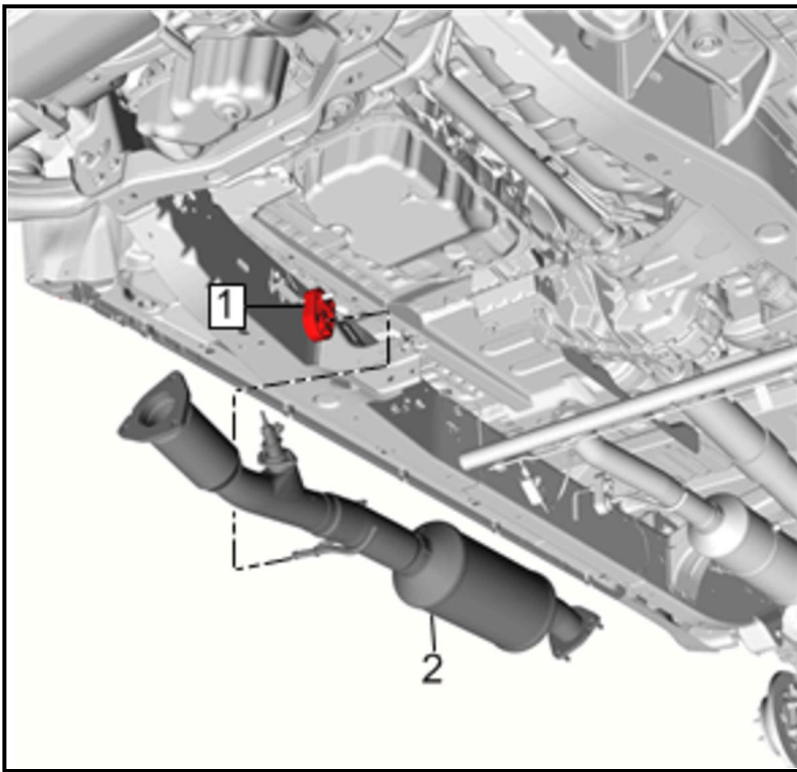
5. Nitrogen Oxides Catalytic Converter Nut (1) - Remove [3x]



6. Remove and DISCARD the gasket. (2)
7. Catalytic Converter Nut (1) - Remove [3x]



8. Remove and DISCARD the gasket. (2)
9. Exhaust Isolator (1) - Remove

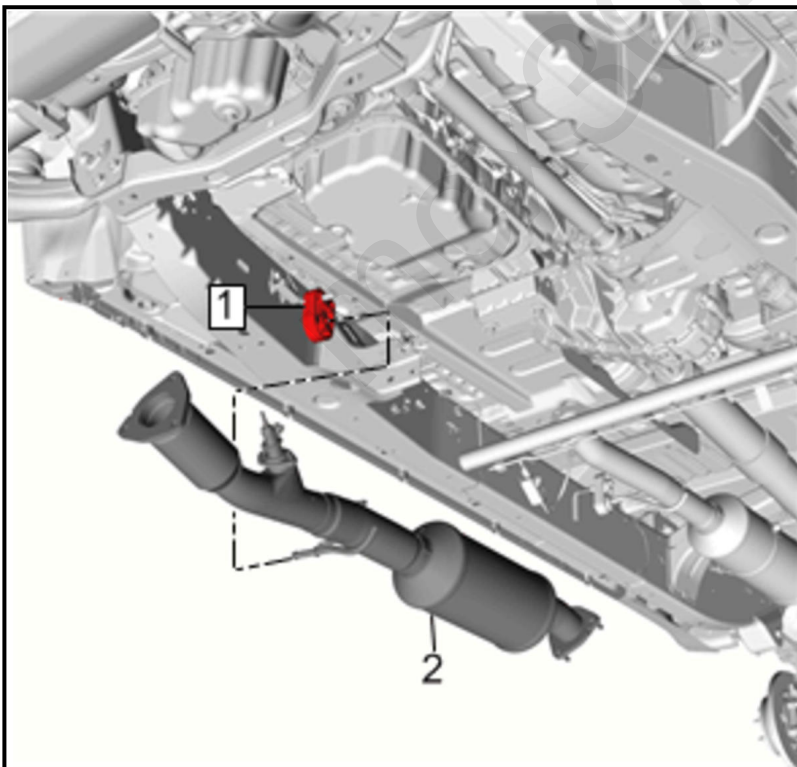


10. Nitrogen Oxides Catalytic Converter (2) - Remove

11. If replacing the catalytic converter, transfer parts as necessary.

Installation Procedure

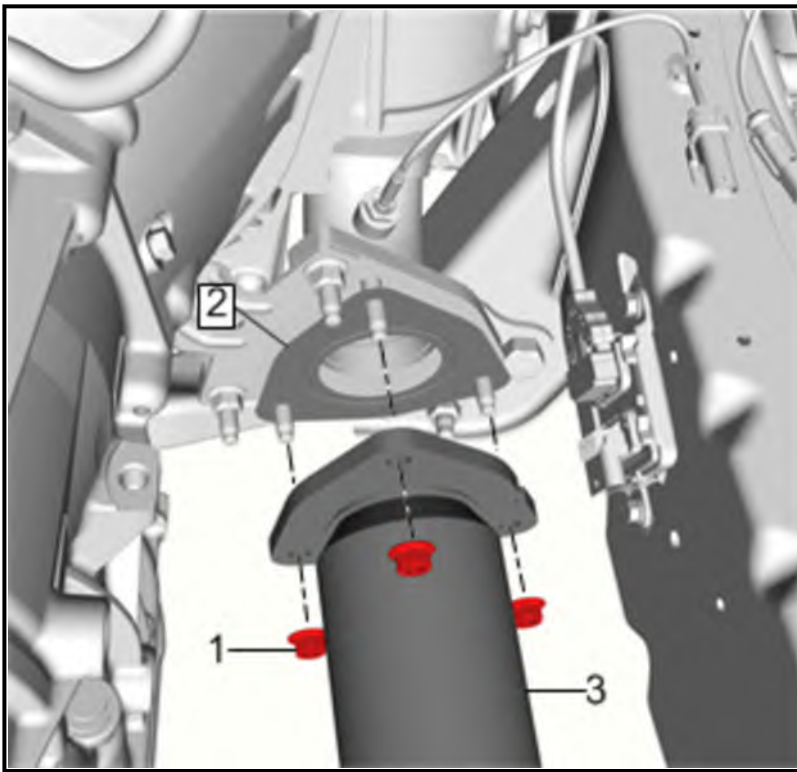
1. Exhaust Isolator (1) - Install



NOTE: Clean and lubricate the exhaust isolators for ease of installation.

2. Nitrogen Oxides Catalytic Converter (2) - Install

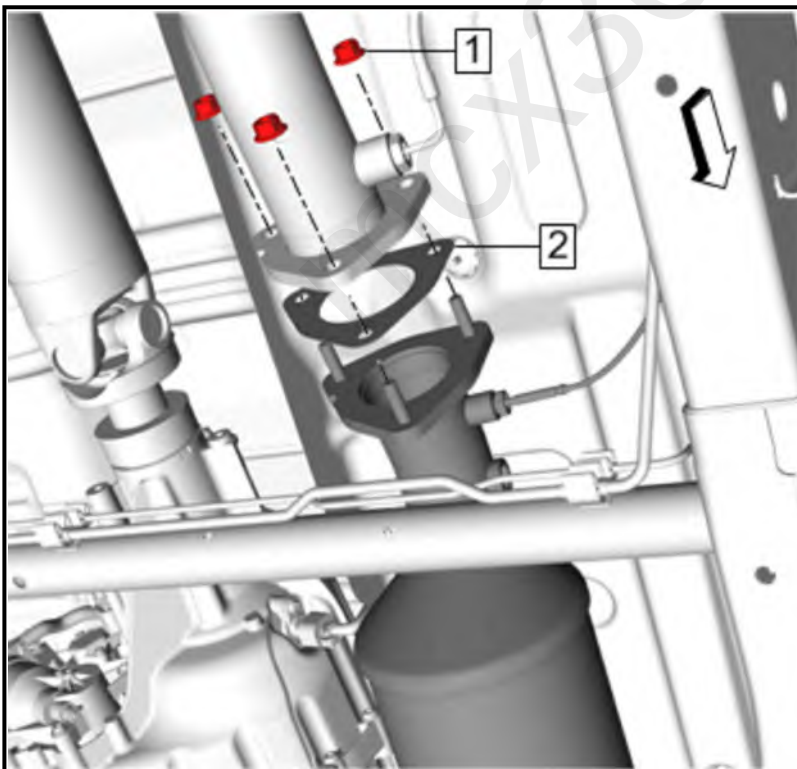
3. Catalytic Converter Gasket (2) - Install



NOTE: Replace the exhaust gaskets with NEW gaskets.

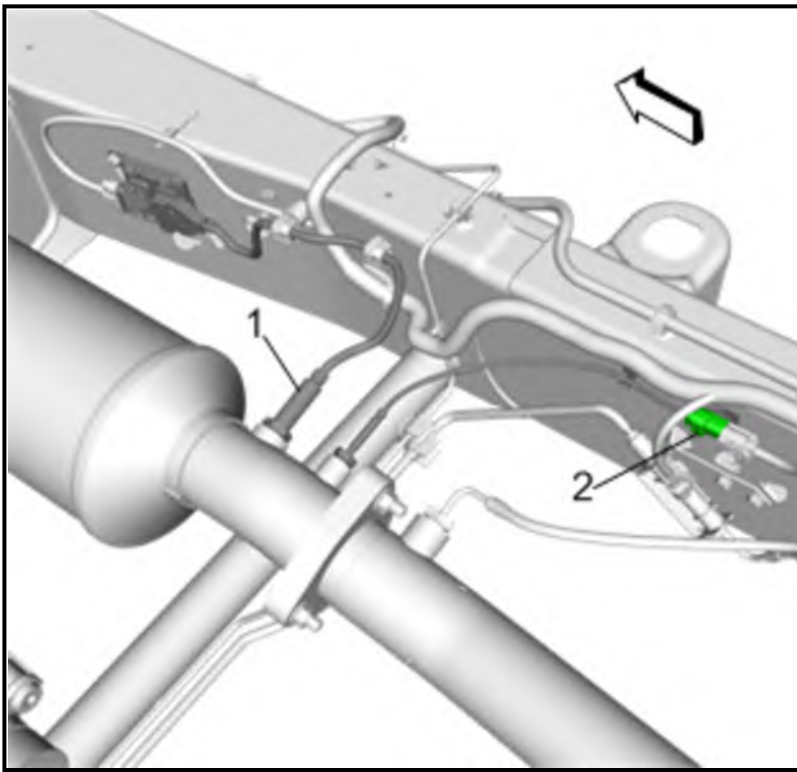
CAUTION: Refer to [Fastener Caution](#) .

4. Catalytic Converter Nut (1) - Install and tighten [3x] 50 N.m (37 lb ft)
5. Catalytic Converter Gasket (2) - Install

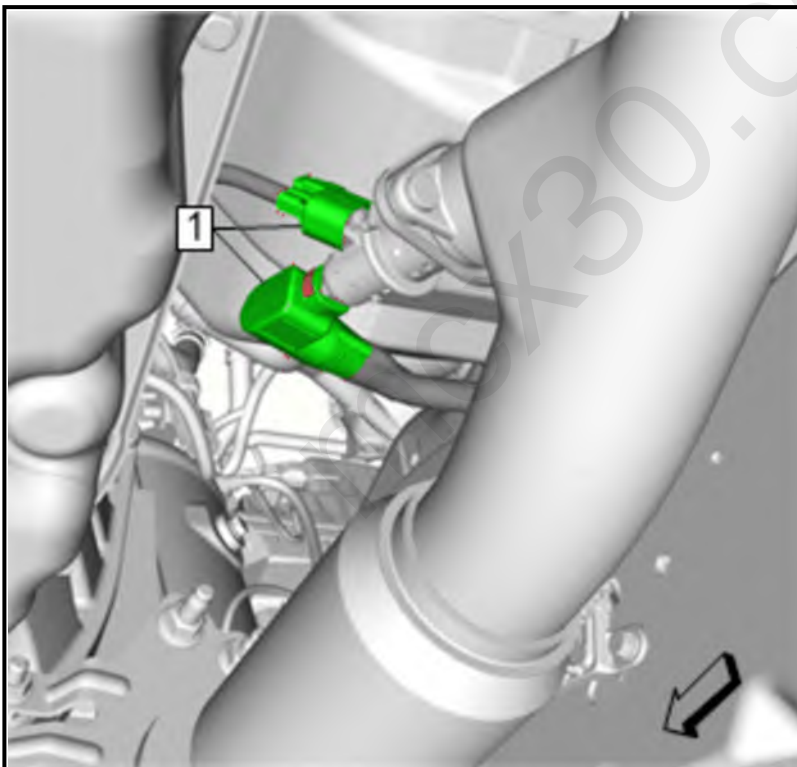


NOTE: Replace the exhaust gaskets with NEW gaskets.

6. Nitrogen Oxides Catalytic Converter Nut (1) - Install and tighten [3x] 50 N.m (37 lb ft)
7. Nitrogen Oxides Sensor (1) - Install - [Nitrogen Oxides Sensor Replacement - Position 2](#)



8. Exhaust Temperature Sensor (2) - Connect - [Exhaust Temperature Sensor Replacement - Position 3](#)
9. Emission Reduction Fluid Injector (1) - Connect - [Reductant Fluid Injector Replacement](#)



10. [Transmission Support Crossmember Replacement \(4 Wheel Drive\)](#) , or [Transmission Support Crossmember Replacement \(2 Wheel Drive\)](#) - Install

NOTE: If replacing the Nitrous Oxides Catalytic Converter with new, a Nox Catalyst Reset will need to be performed.

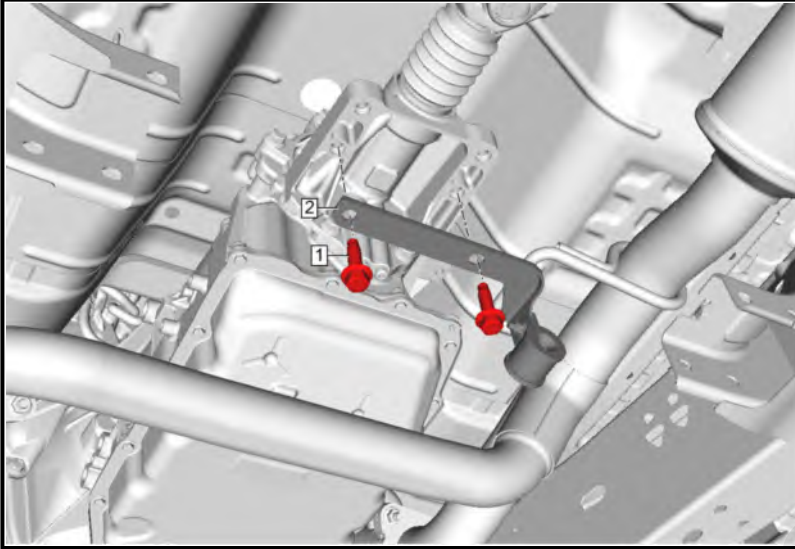
11. Perform a Nox Catalyst Reset. [NOx Catalyst Reset](#)
12. If replacing the Warm Up Nitrogen Oxides Catalytic Converter with new, perform the Diesel Particulate Filter (DPF) Regeneration Enable. [Diesel Particulate Filter \(DPF\) Regeneration Enable](#)

THREE-WAY CATALYTIC CONVERTER REPLACEMENT (LGZ)

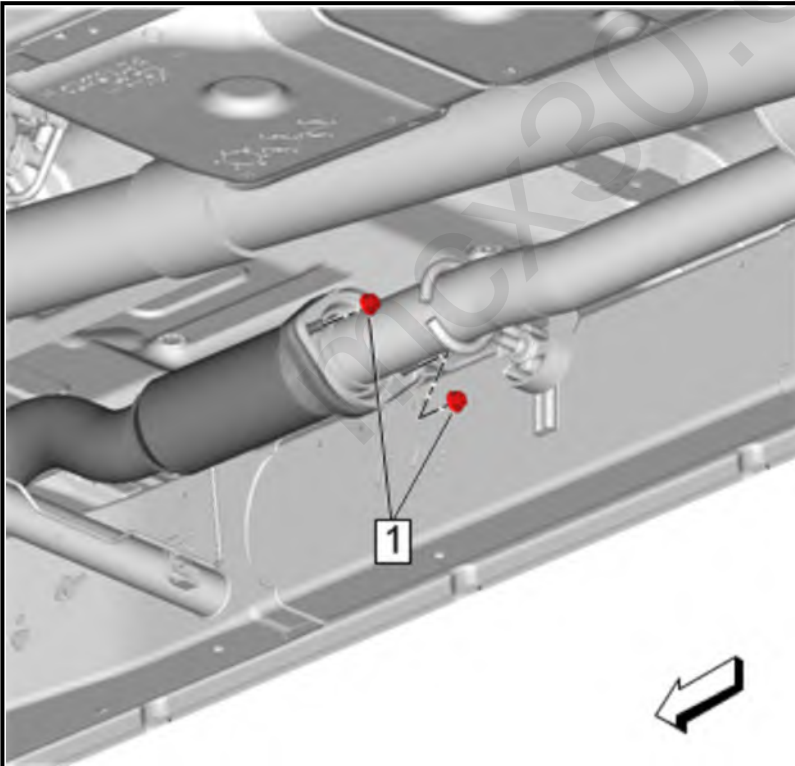
Removal Procedure

WARNING: Refer to [Exhaust Service Warning](#) .

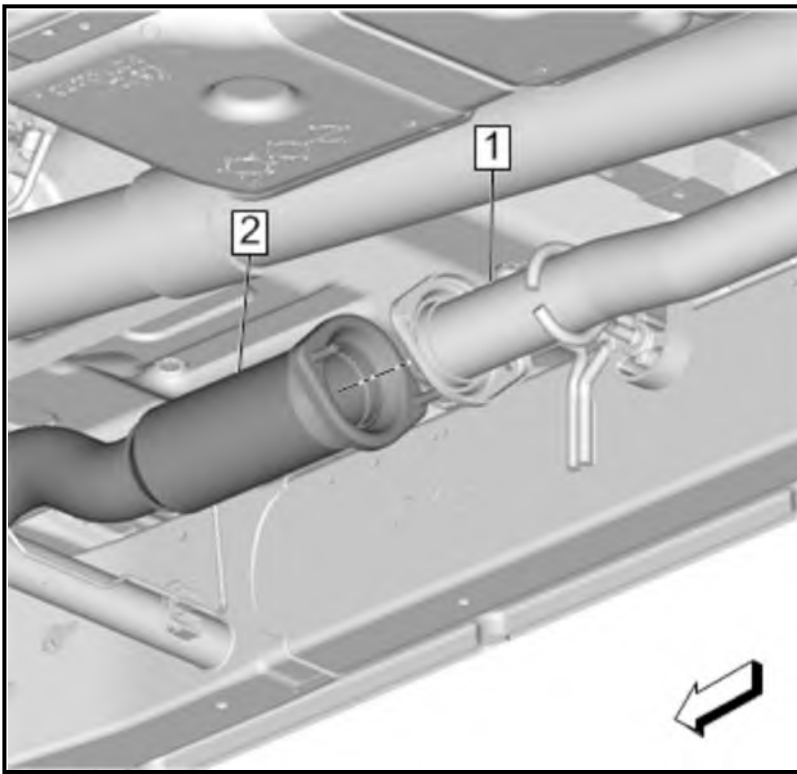
1. Exhaust Front Bracket (2) - Remove - [Exhaust Front Bracket Replacement \(LGZ with 4WD\)](#), or [Exhaust Front Bracket Replacement \(LGZ with 2WD\)](#).



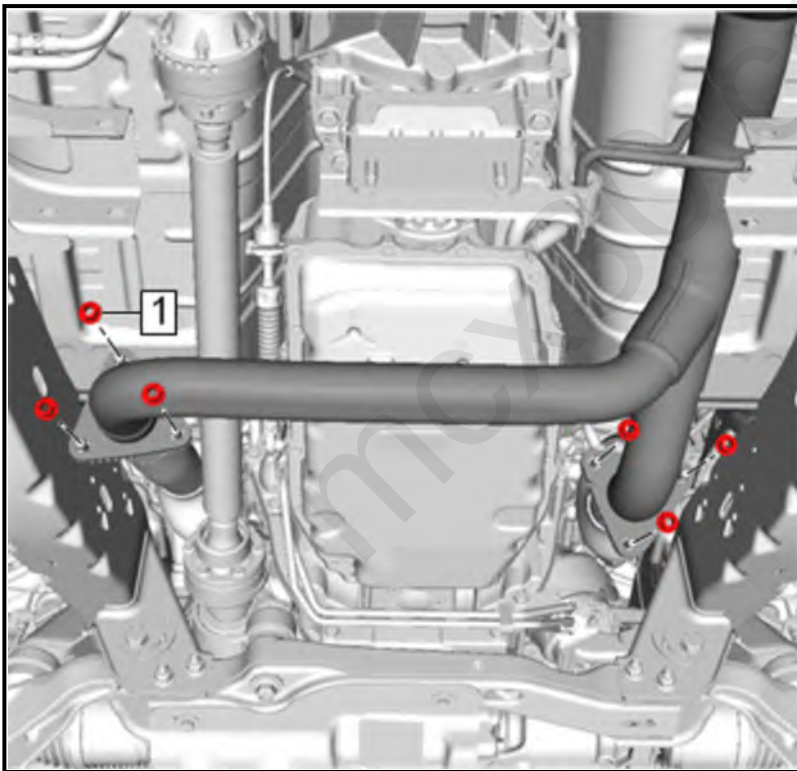
2. Exhaust Muffler Nut (1) - Remove [2x]



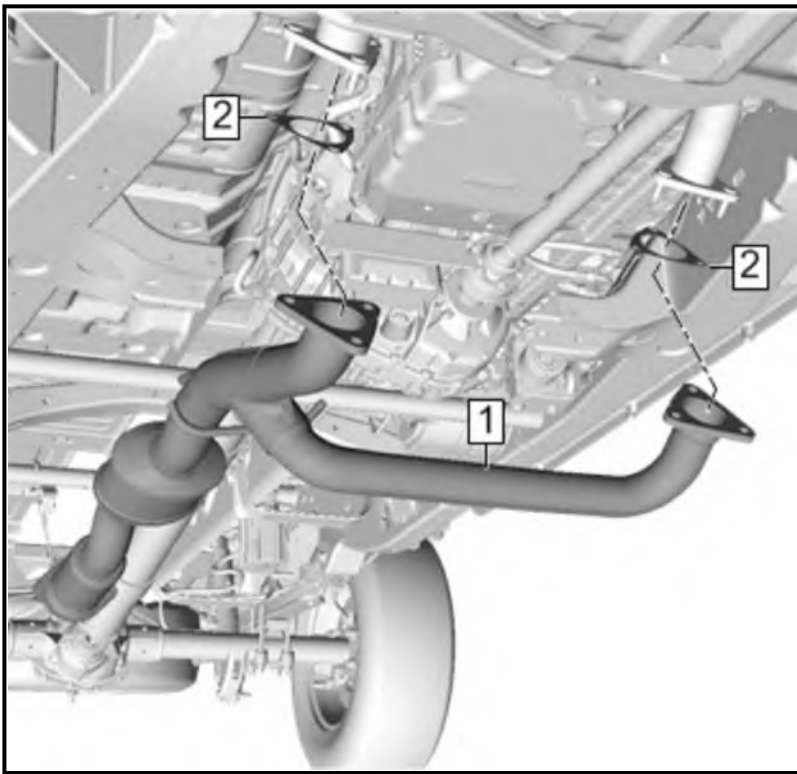
3. Exhaust Muffler (1) @ Three-Way Catalytic Converter (2) - Separate



4. Catalytic Converter Nut (1) - Remove [6x]



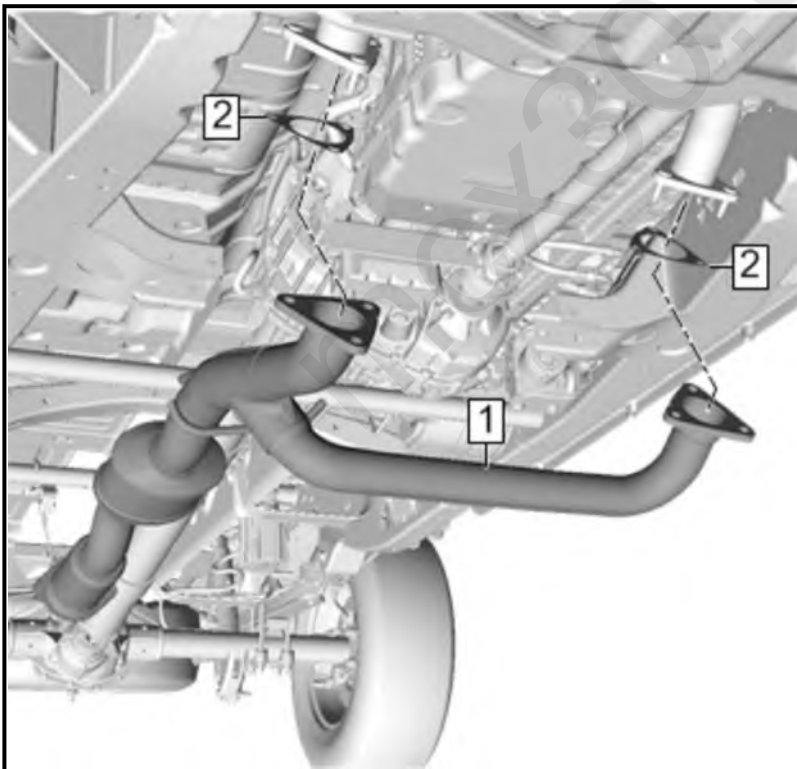
5. Three-Way Catalytic Converter (1) - Remove



6. Catalytic Converter Flange Gasket (2) - Remove and DISCARD [2x]

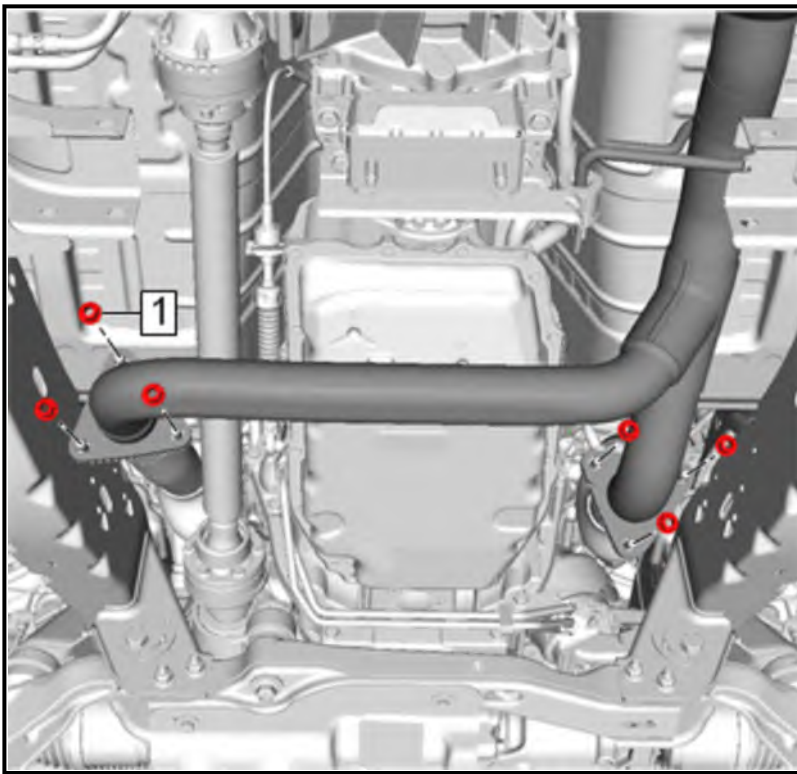
Installation Procedure

1. Catalytic Converter Flange Gasket (2) - Install NEW gaskets. [2x]



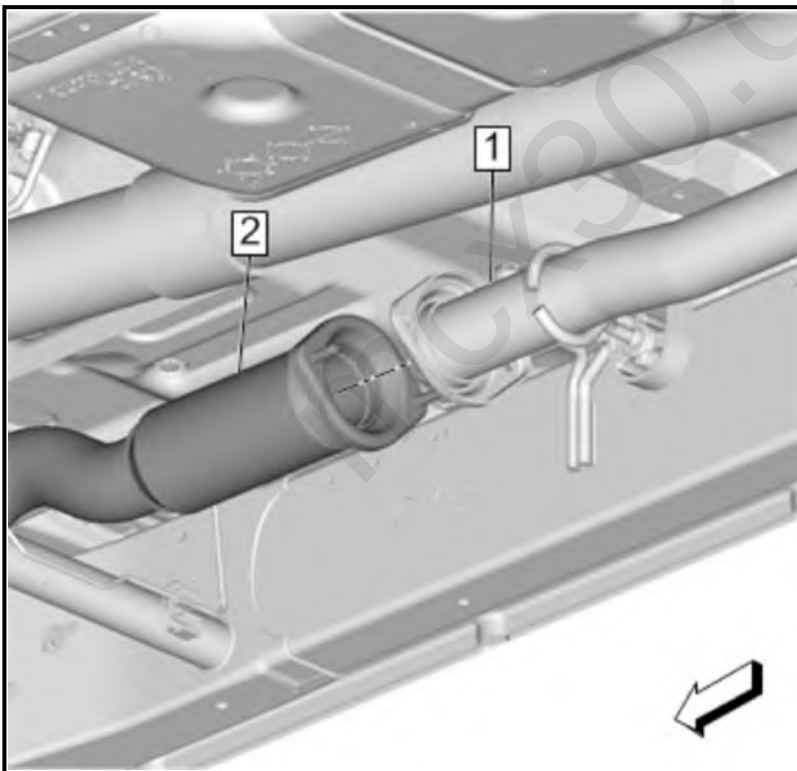
2. Three-Way Catalytic Converter (1) - Install

3. Catalytic Converter Nut (1) - Install and tighten [6x] 50 N.m (37 lb ft)

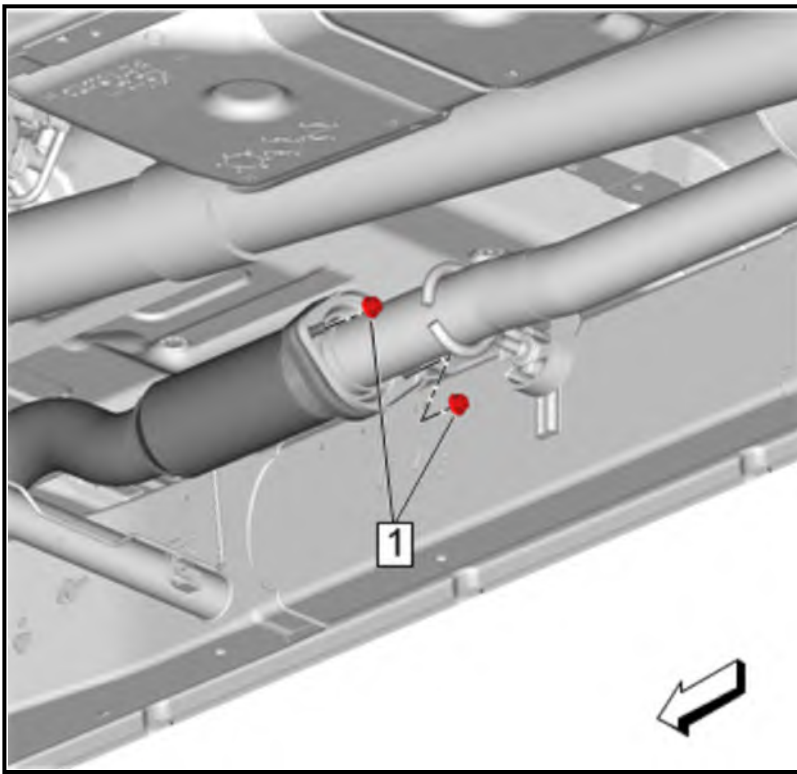


CAUTION: Refer to [Fastener Caution](#) .

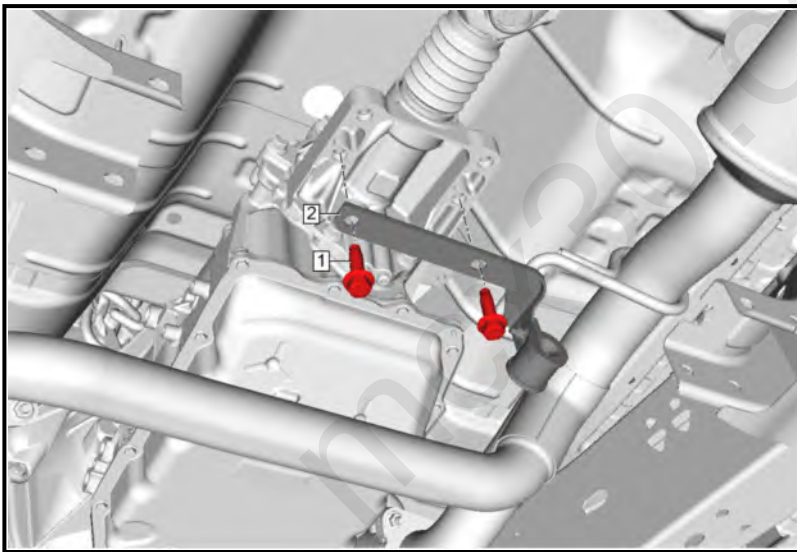
4. Exhaust Muffler (1) @ Three-Way Catalytic Converter (2) - Install



5. Exhaust Muffler Nut (1) - Install and tighten [2x] - [Exhaust Muffler Replacement \(LGZ\)](#)



6. Exhaust Front Bracket (2) - Install - [Exhaust Front Bracket Replacement \(LGZ with 4WD\)](#), or [Exhaust Front Bracket Replacement \(LGZ with 2WD\)](#).



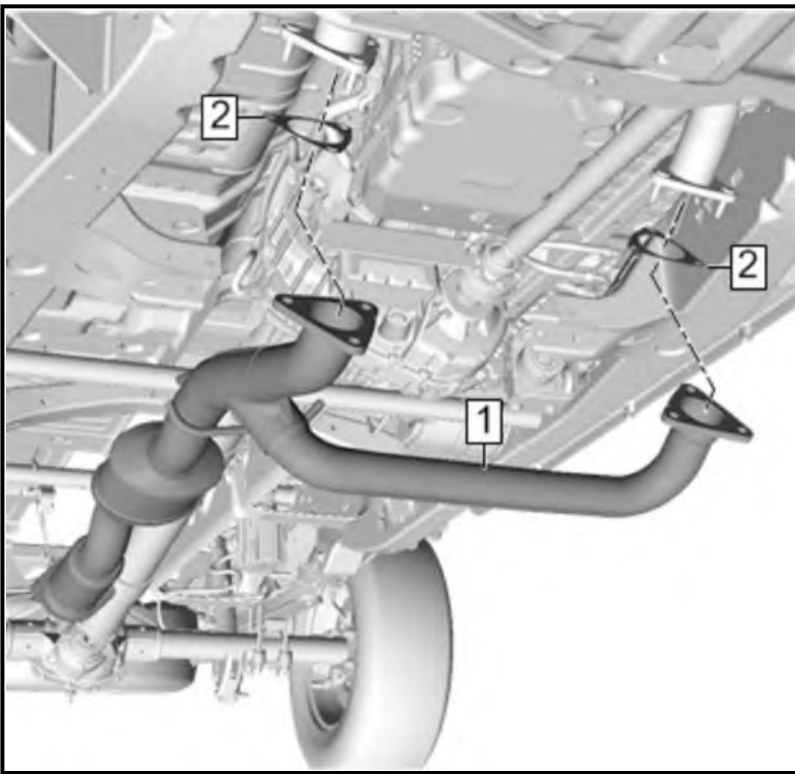
WARM UP THREE-WAY CATALYTIC CONVERTER REPLACEMENT (RIGHT SIDE, LGZ)

Removal Procedure

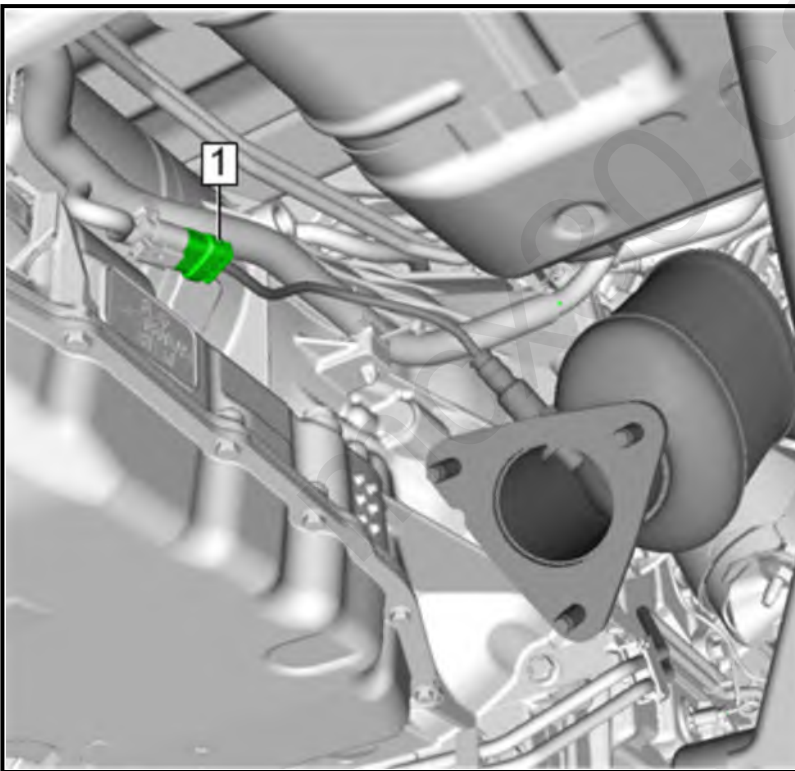
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

1. Three-Way Catalytic Converter (1) @ Warm Up Three-Way Catalytic Converter - Separate and lower - [Three-Way Catalytic Converter Replacement \(LGZ\)](#).

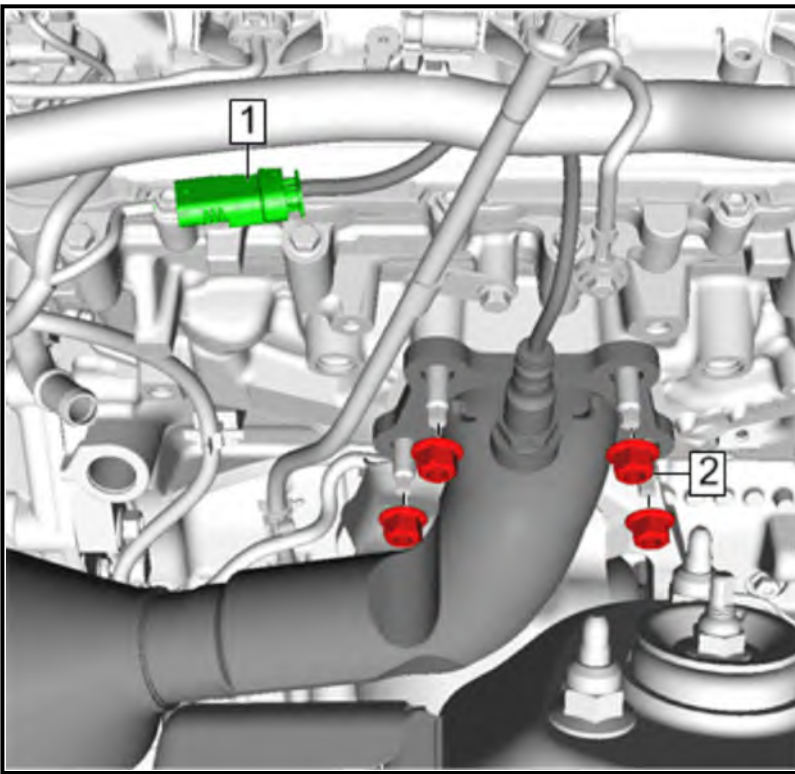


2. Disconnect the heated oxygen sensor electrical connector. (1)

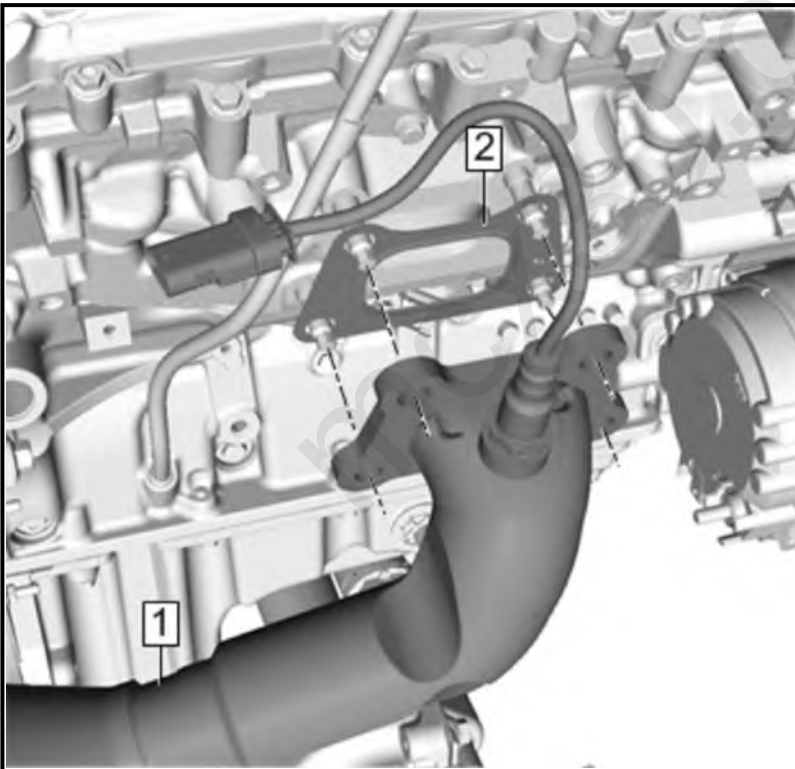


3. Front Wheelhouse Liner @ Right Side - Remove - [Front Wheelhouse Liner Replacement \(Without ZR2\)](#) , or [Front Wheelhouse Liner Replacement \(With ZR2\)](#) , or [Front Wheelhouse Liner Replacement \(Bison\)](#)

4. Disconnect the heated oxygen sensor electrical connector. (1)



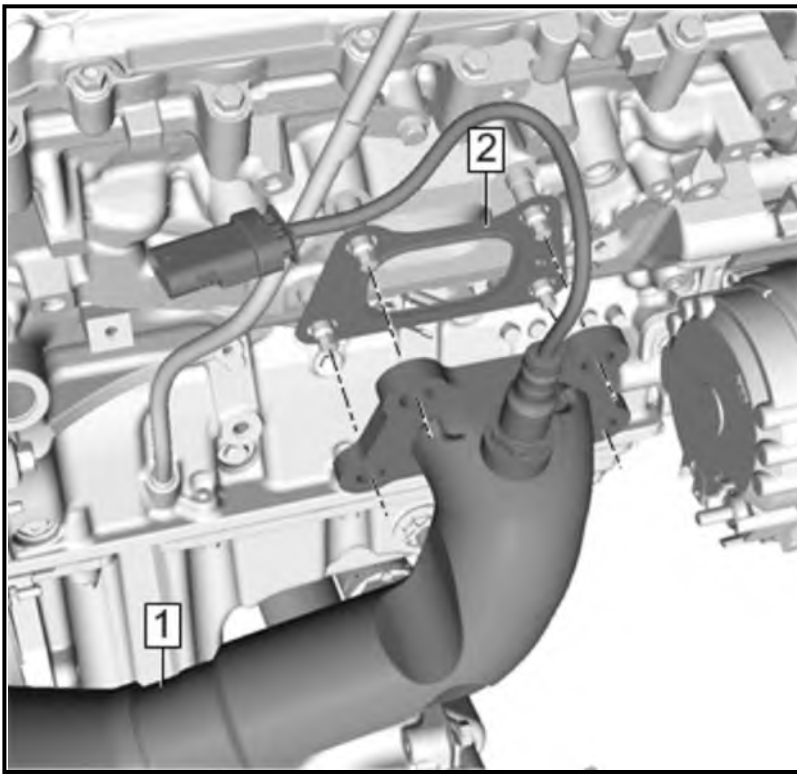
5. Warm Up Three-Way Catalytic Converter Nut (2) - Remove [4x]
6. Warm Up Three-Way Catalytic Converter (1) - Remove



7. Warm Up Three-Way Catalytic Converter Gasket (2) - Remove and DISCARD
8. If replacing the catalytic converter, transfer parts as necessary.

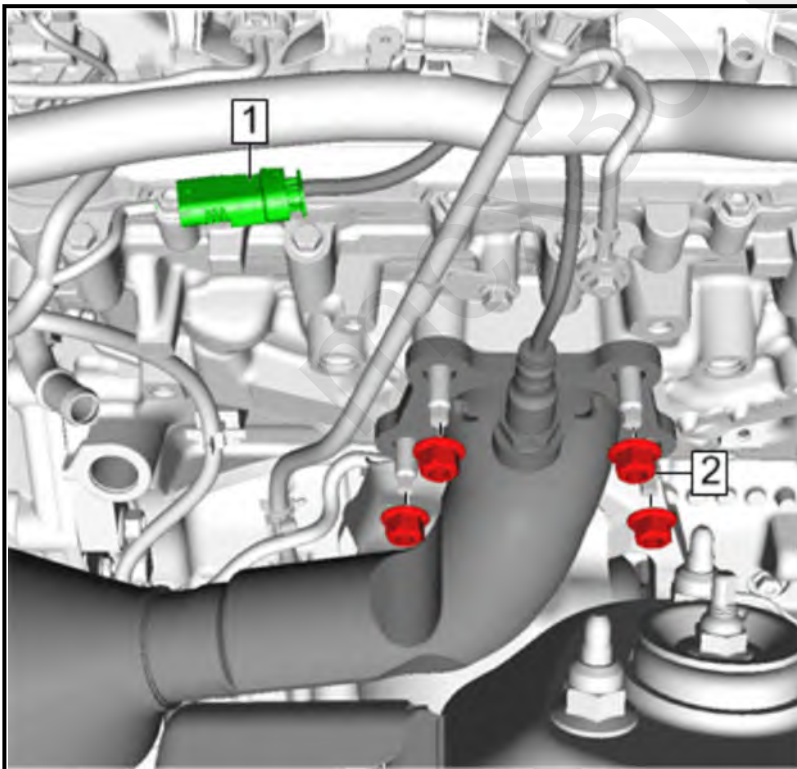
Installation Procedure

1. Warm Up Three-Way Catalytic Converter Gasket (2) - Install



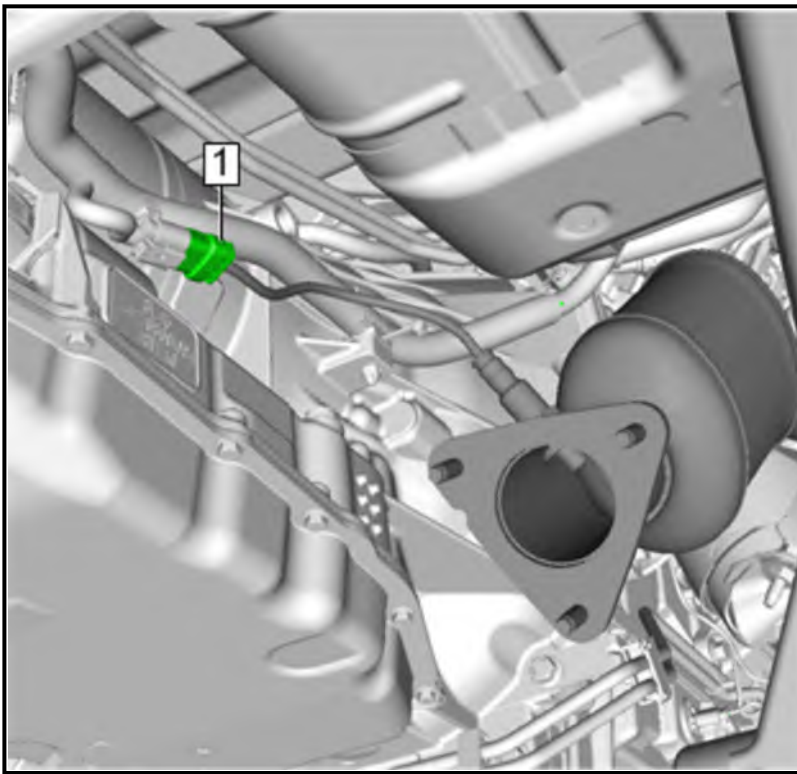
NOTE: Install a **NEW** gasket.

2. Warm Up Three-Way Catalytic Converter (1) - Install
3. Warm Up Three-Way Catalytic Converter Nut (2) - Install and tighten [4x] 50 N.m (37 lb ft)

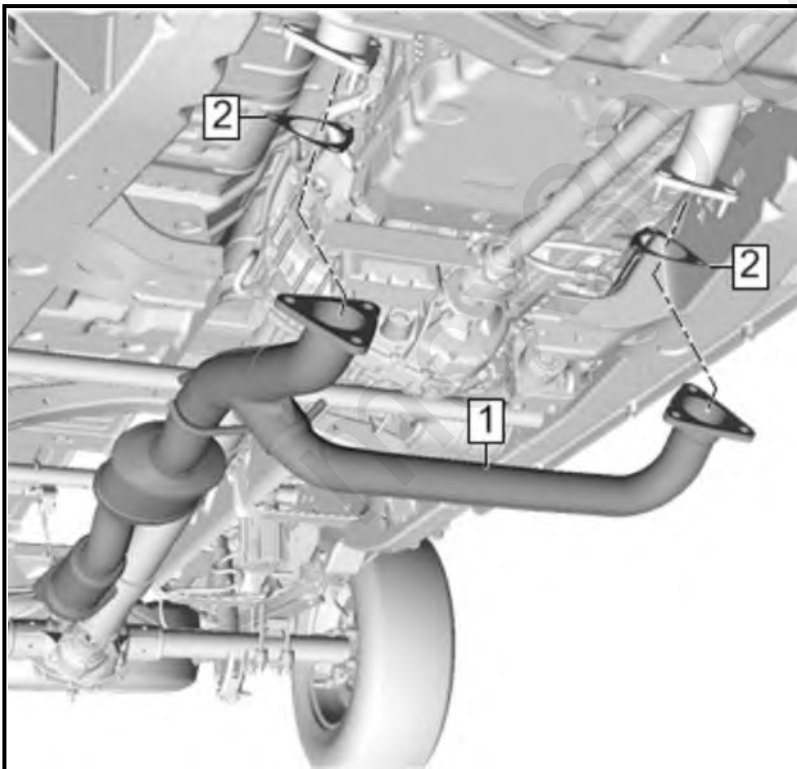


CAUTION: Refer to **Fastener Caution** .

4. Front Wheelhouse Liner @ Right Side - Install - Front Wheelhouse Liner Replacement (Without ZR2) , or Front Wheelhouse Liner Replacement (With ZR2) , or Front Wheelhouse Liner Replacement (Bison)
5. Connect the heated oxygen sensor electrical connector. (1)
6. Connect the heated oxygen sensor electrical connector. (1)



7. Three-Way Catalytic Converter (1) @ Warm Up Three-Way Catalytic Converter - Install - **Three-Way Catalytic Converter Replacement (LGZ)**



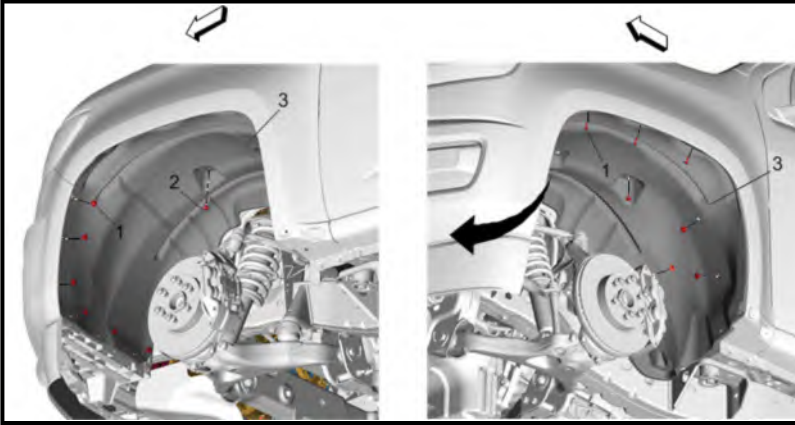
WARM UP THREE-WAY CATALYTIC CONVERTER REPLACEMENT (LEFT SIDE, LGZ 2WD)

Removal Procedure

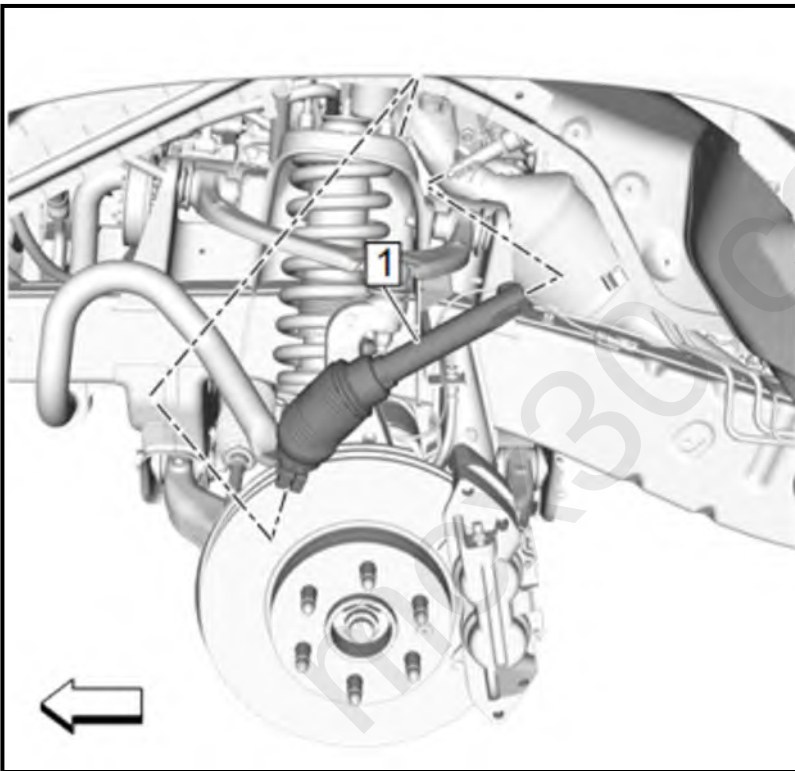
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

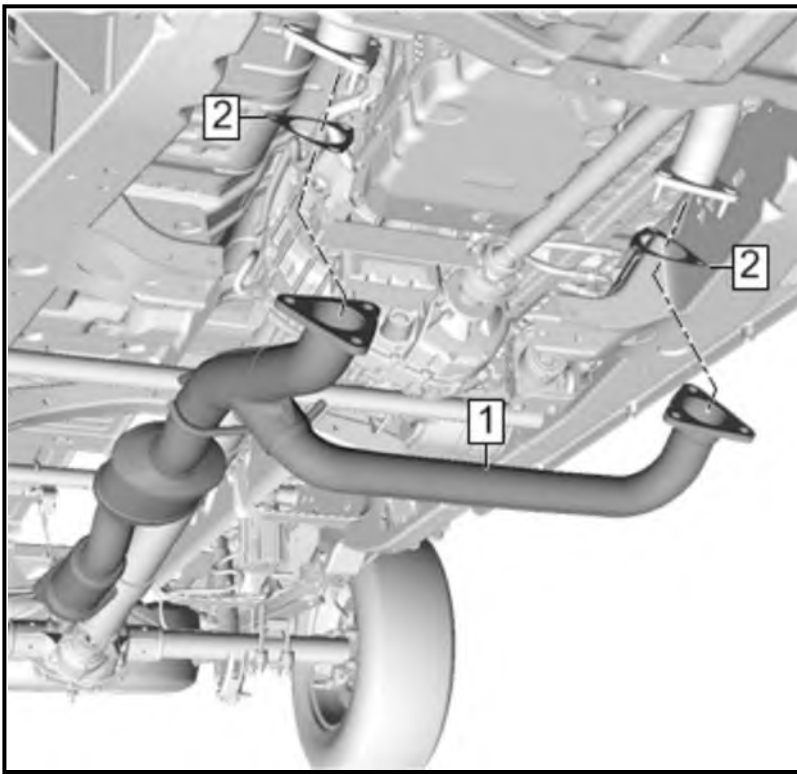
1. Front Wheelhouse Liner-Left Side (3) - Remove - [Front Wheelhouse Liner Replacement \(Without ZR2\)](#) , or [Front Wheelhouse Liner Replacement \(With ZR2\)](#) , or [Front Wheelhouse Liner Replacement \(Bison\)](#).



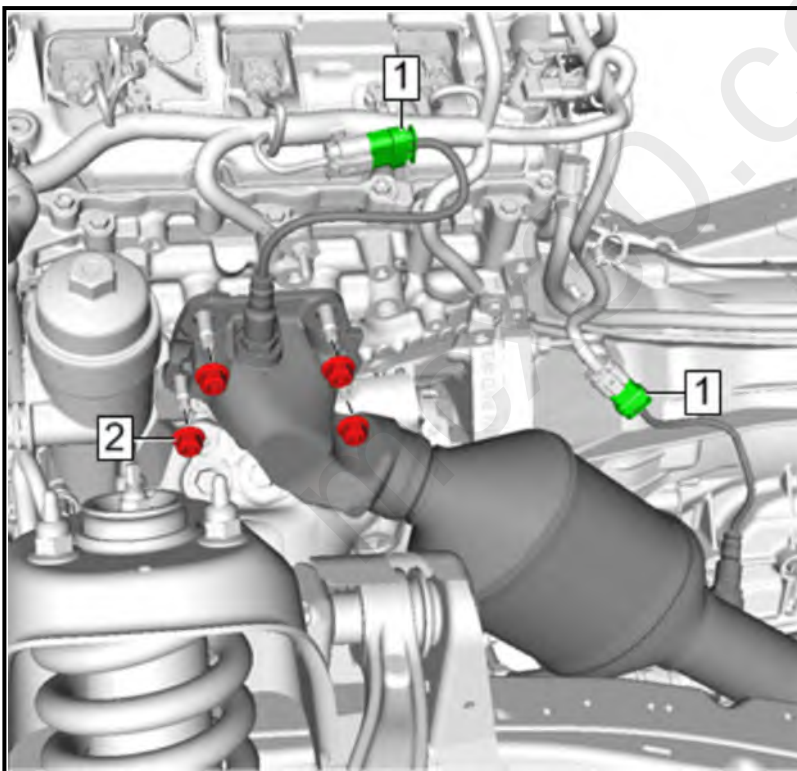
2. Lower Steering Shaft (1) - Remove - [Lower Steering Shaft Assembly Replacement](#)



3. Three-Way Catalytic Converter (1) @ Warm Up Three-Way Catalytic Converter - Separate and lower - [Three-Way Catalytic Converter Replacement \(LGZ\)](#).

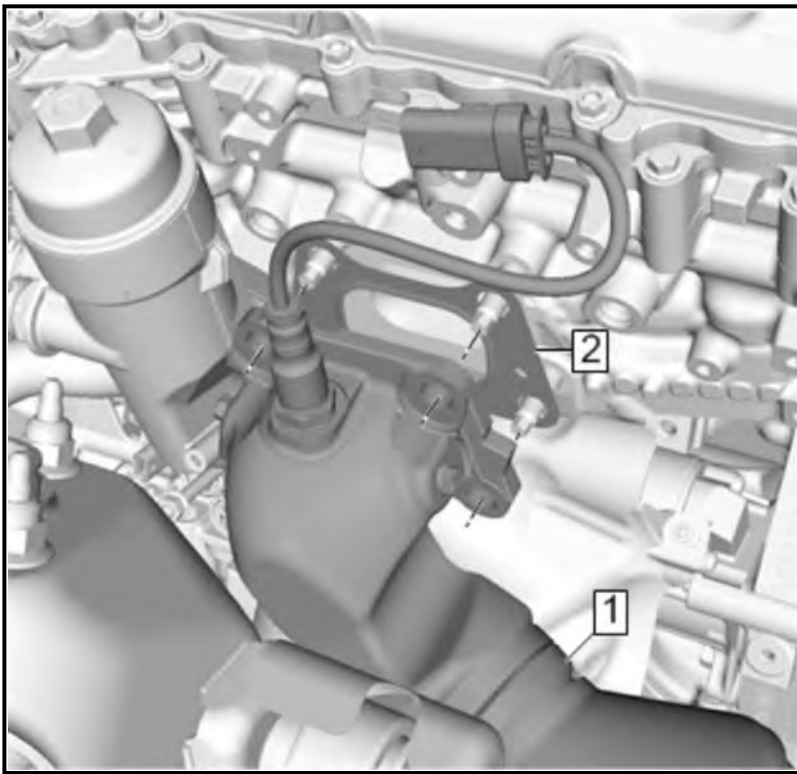


4. Disconnect the heated oxygen sensor electrical connector. (1) [2x]



5. Warm Up Three-Way Catalytic Converter Nut (2) - Remove [4x]

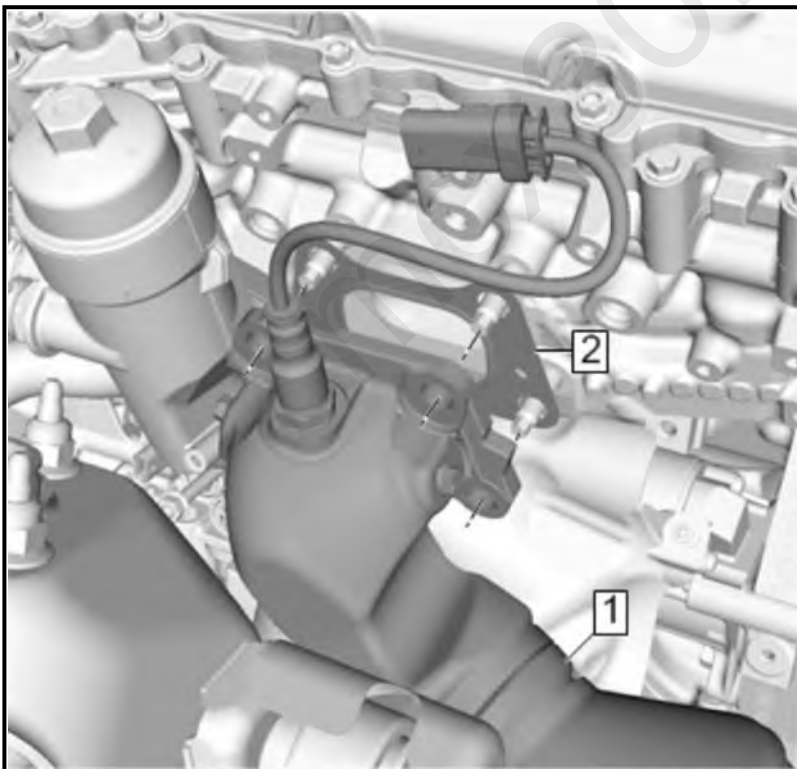
6. Warm Up Three-Way Catalytic Converter (1) - Remove



7. Warm Up Three-Way Catalytic Converter Gasket (2) - Remove and DISCARD
8. If replacing the catalytic converter, transfer parts as necessary.

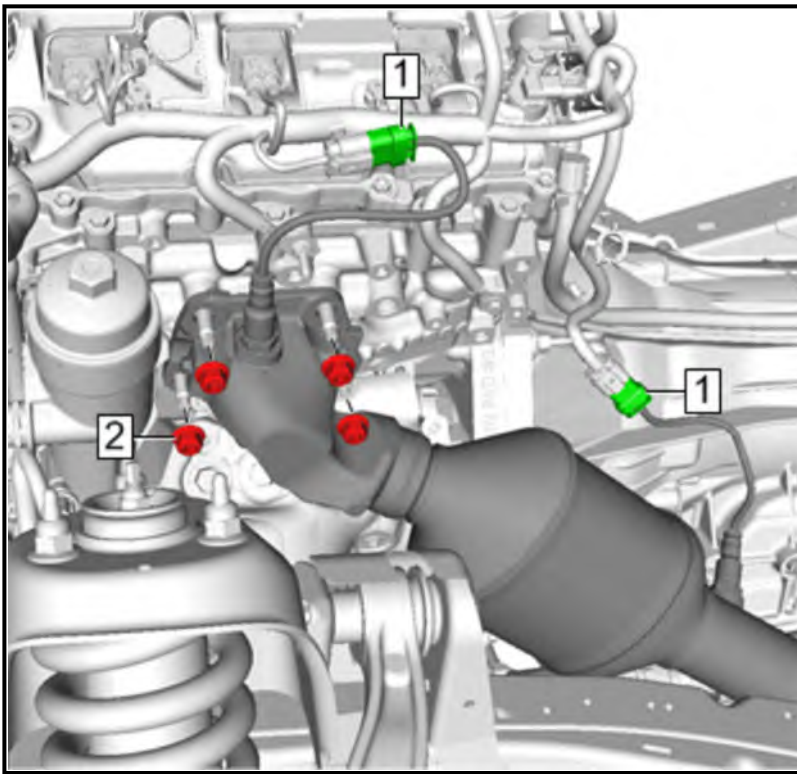
Installation Procedure

1. Warm Up Three-Way Catalytic Converter Gasket (2) - Install



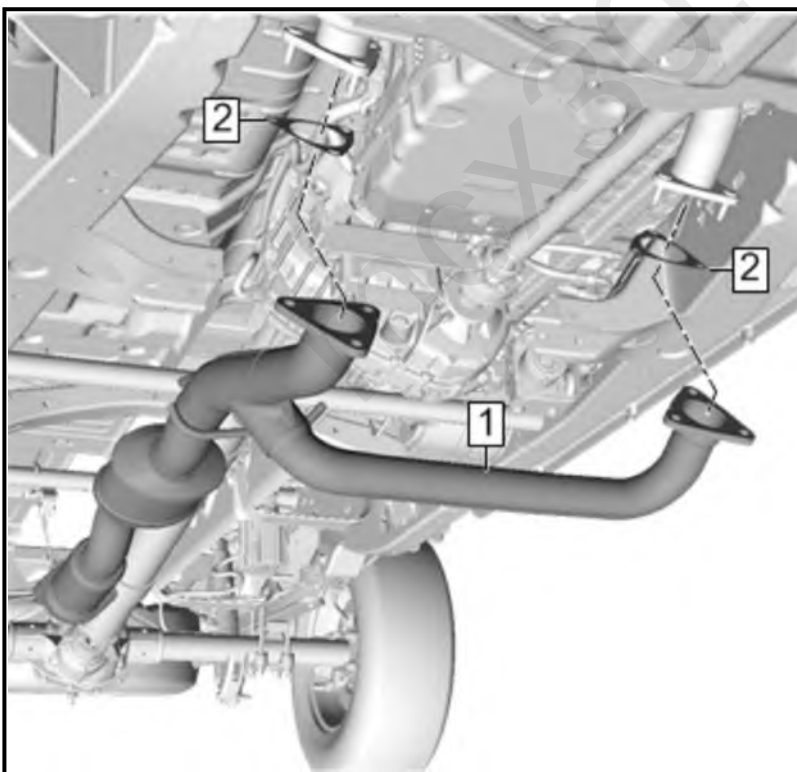
NOTE: Install a NEW gasket.

2. Warm Up Three-Way Catalytic Converter (1) - Install
3. Warm Up Three-Way Catalytic Converter Nut (2) - Install and tighten [4x] 50 N.m (37 lb ft)

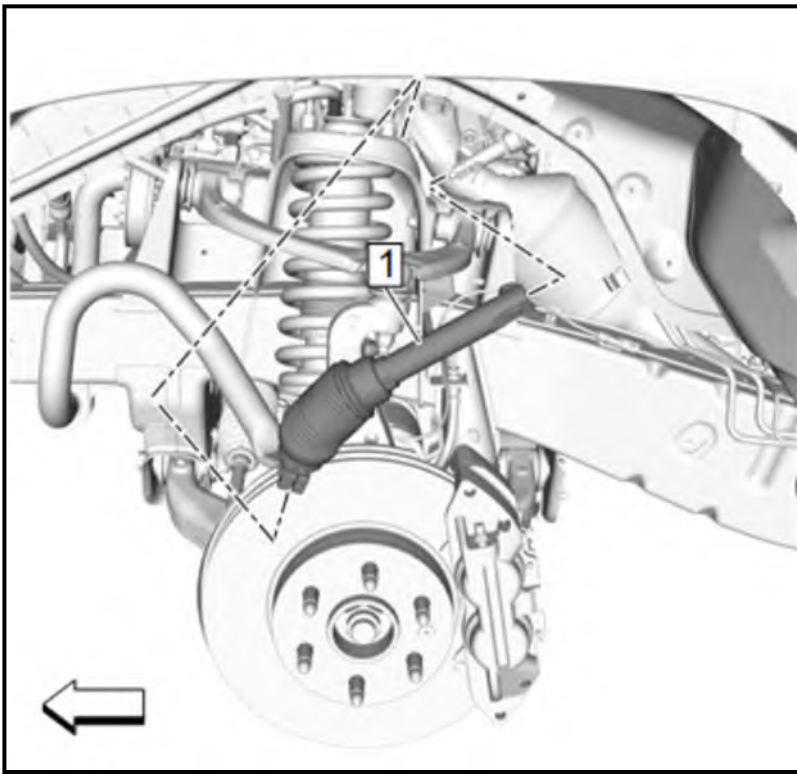


CAUTION: Refer to [Fastener Caution](#) .

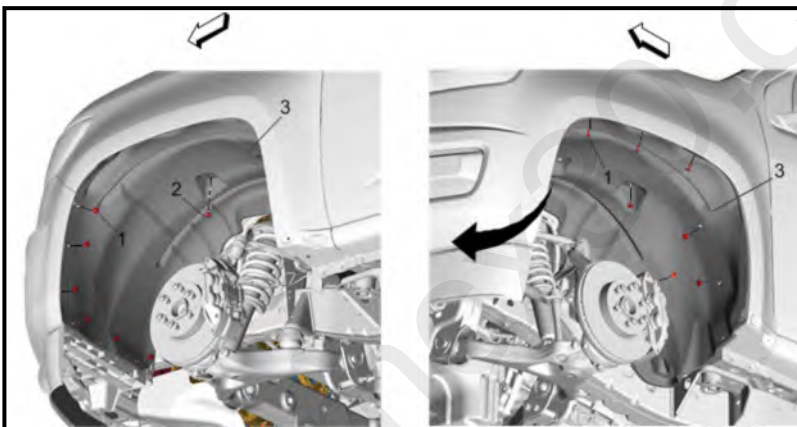
4. Connect the heated oxygen sensor electrical connector. (1) [2x]
5. Three-Way Catalytic Converter (1) @ Warm Up Three-Way Catalytic Converter - Install - [Three-Way Catalytic Converter Replacement \(LGZ\)](#).



6. Lower Steering Shaft (1) - Install - [Lower Steering Shaft Assembly Replacement](#)



7. Front Wheelhouse Liner-Left Side (3) - Install - [Front Wheelhouse Liner Replacement \(Without ZR2\)](#), or [Front Wheelhouse Liner Replacement \(With ZR2\)](#), or [Front Wheelhouse Liner Replacement \(Bison\)](#)



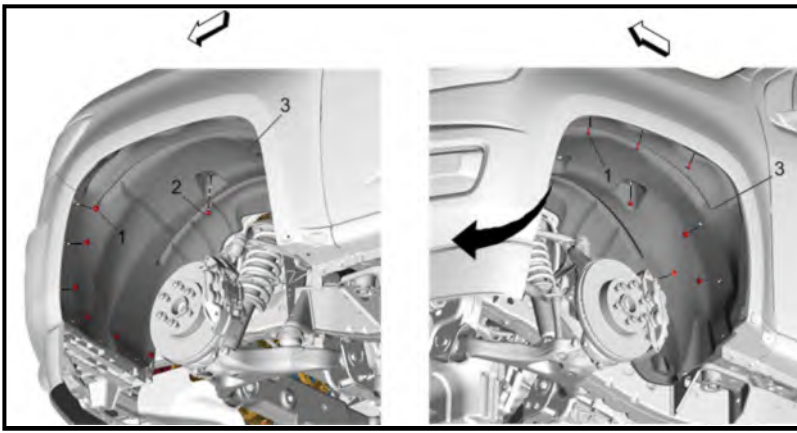
WARM UP THREE-WAY CATALYTIC CONVERTER REPLACEMENT (LEFT SIDE, LGZ 4WD)

Removal Procedure

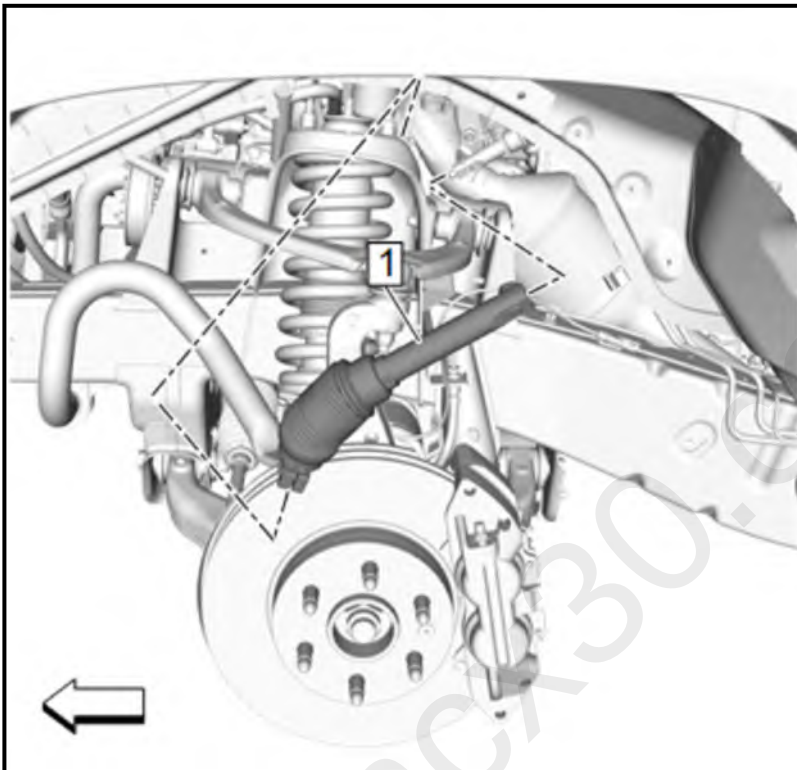
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

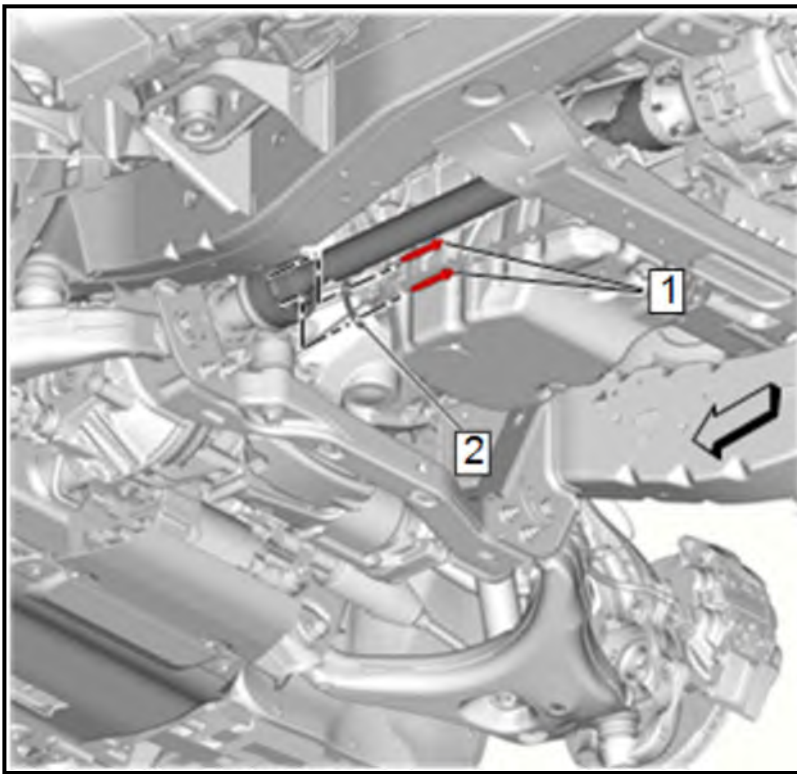
1. Front Wheelhouse Liner-Left Side (3) - Remove - [Front Wheelhouse Liner Replacement \(Without ZR2\)](#), or [Front Wheelhouse Liner Replacement \(With ZR2\)](#), or [Front Wheelhouse Liner Replacement \(Bison\)](#)



2. Lower Steering Shaft (1) - Remove - [Lower Steering Shaft Assembly Replacement](#)

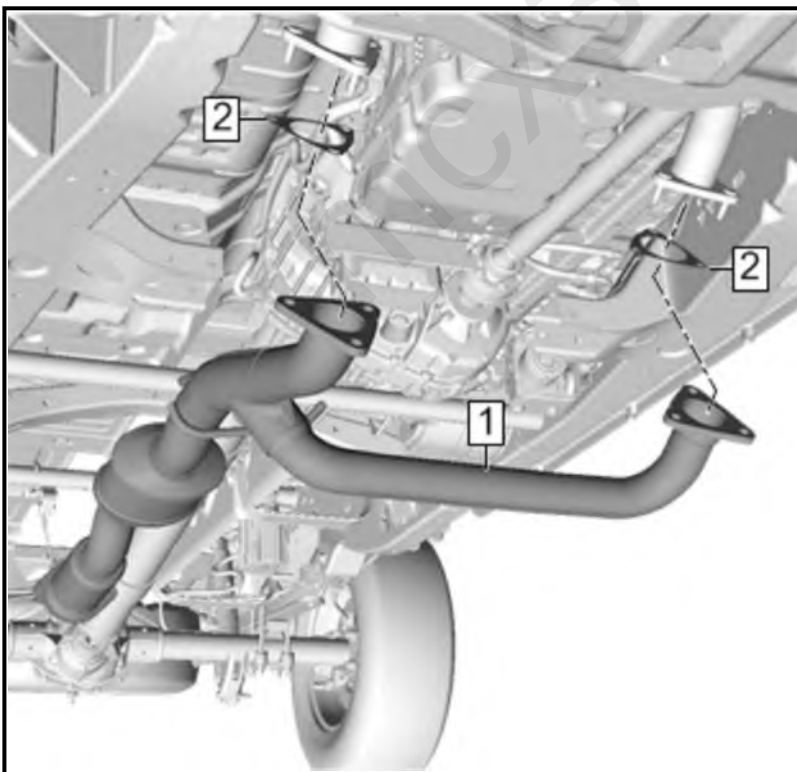


3. Front Propeller Shaft Front Flange Bolt (1) - Remove [6x] - [Front Axle Propeller Shaft Replacement \(Without Bison\)](#), or [Front Axle Propeller Shaft Replacement \(With Bison\)](#)

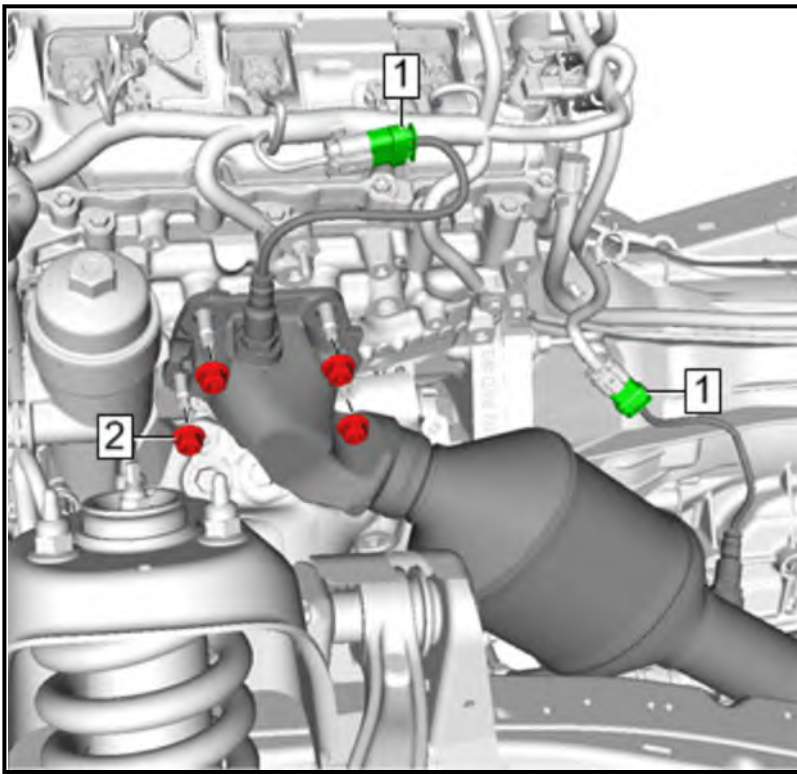


NOTE: With the front propeller shaft front flange bolts removed, reposition the propeller shaft to gain clearance for removal of the three-way catalytic converter.

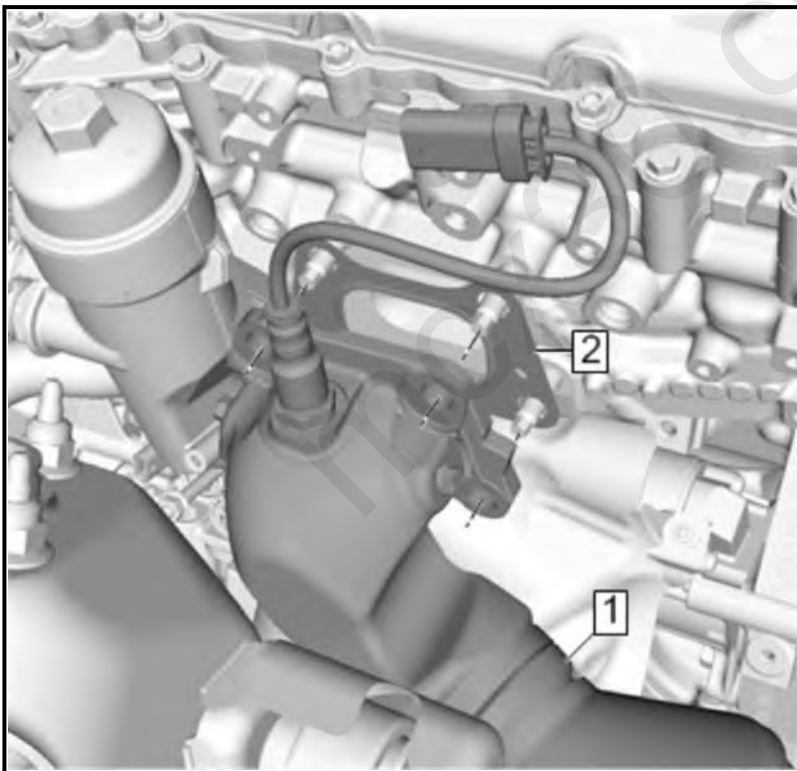
4. Front Propeller Shaft - Position aside
5. Three-Way Catalytic Converter (1) @ Warm Up Three-Way Catalytic Converter - Separate and lower - [Three-Way Catalytic Converter Replacement \(LGZ\)](#)



6. Disconnect the heated oxygen sensor electrical connector. (1) [2x]



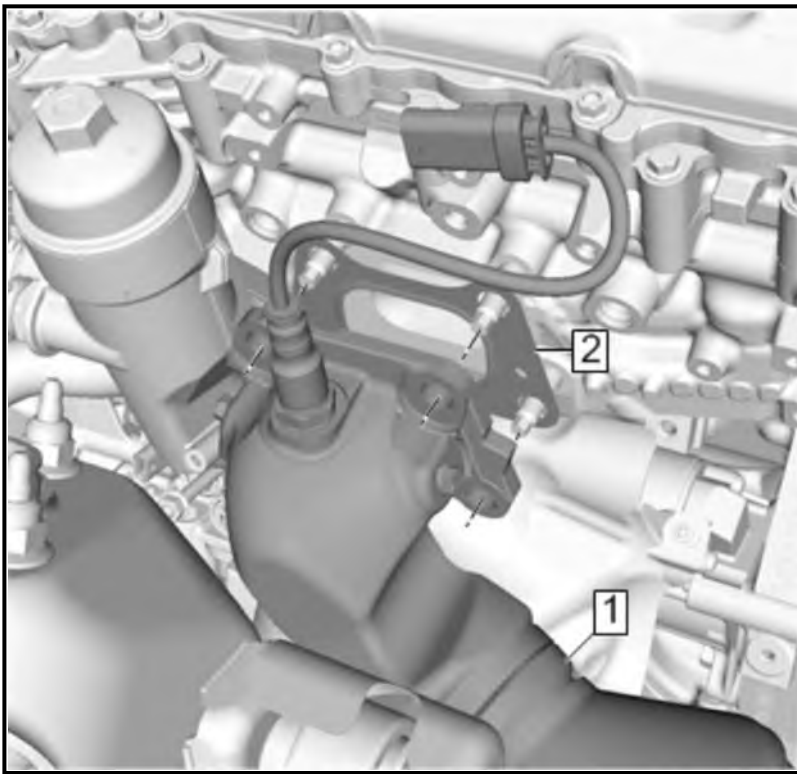
7. Warm Up Three-Way Catalytic Converter Nut (2) - Remove [4x]
8. Warm Up Three-Way Catalytic Converter (1) - Remove



9. Warm Up Three-Way Catalytic Converter Gasket (2) - Remove and DISCARD
10. If replacing the catalytic converter, transfer parts as necessary.

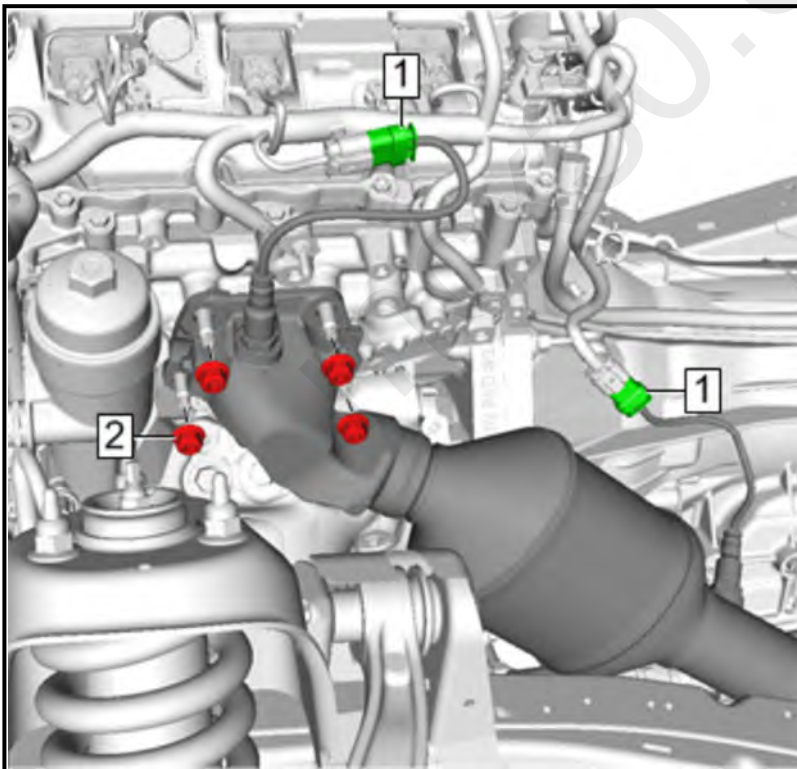
Installation Procedure

1. Warm Up Three-Way Catalytic Converter Gasket (2) - Install



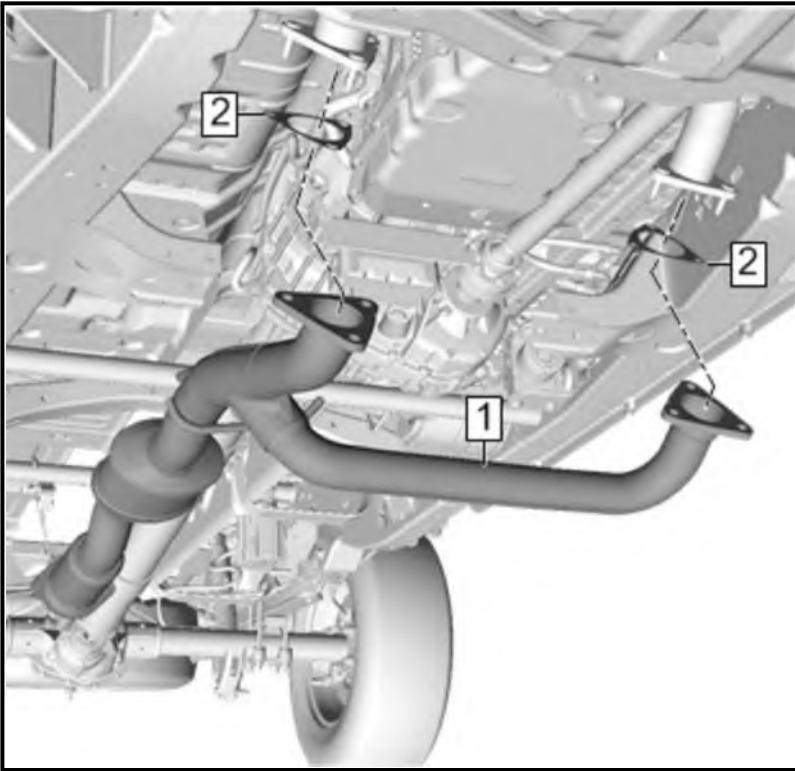
NOTE: Install a **NEW** gasket.

2. Warm Up Three-Way Catalytic Converter (1) - Install
3. Warm Up Three-Way Catalytic Converter Nut (2) - Install and tighten [4x] 50 N.m (37 lb ft)

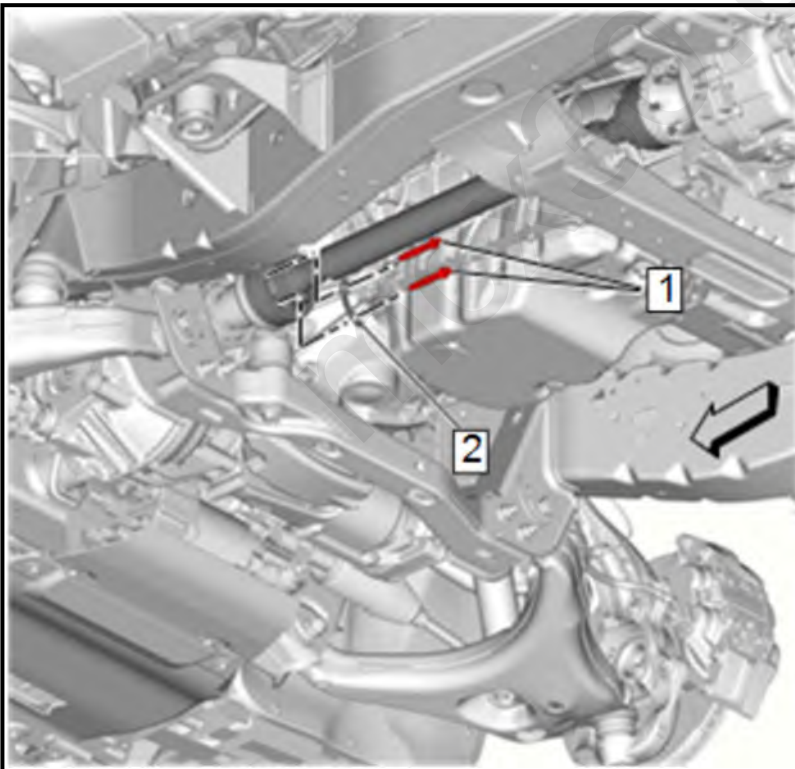


CAUTION: Refer to **Fastener Caution** .

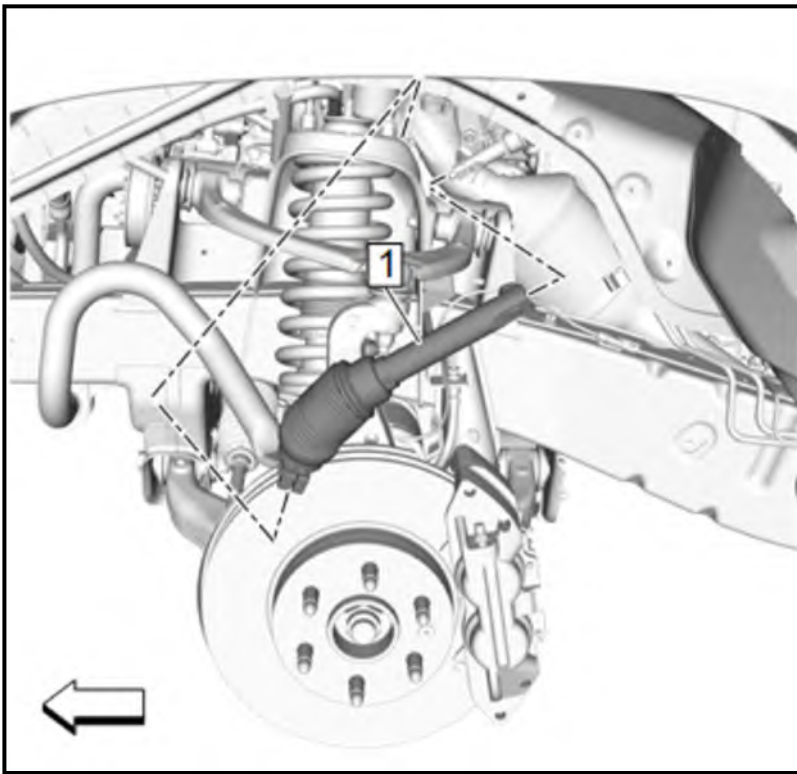
4. Connect the heated oxygen sensor electrical connector. (1) [2x]
5. Three-Way Catalytic Converter (1) @ Warm Up Three-Way Catalytic Converter - Install - **Three-Way Catalytic Converter Replacement (LGZ)**.



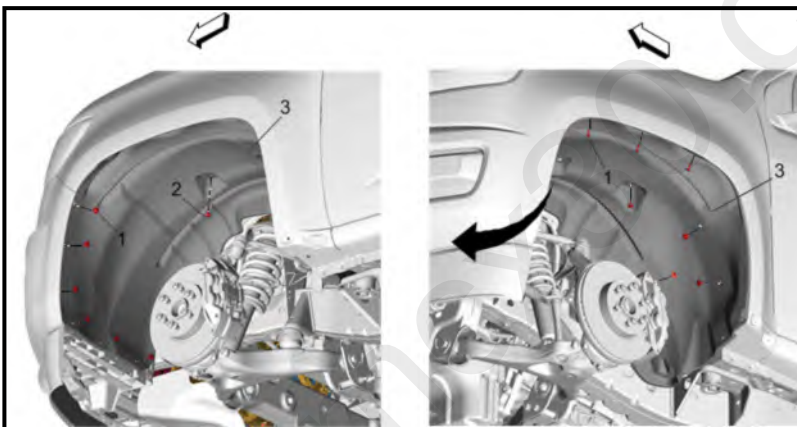
6. Front Propeller Shaft - Install - [Front Axle Propeller Shaft Replacement \(Without Bison\)](#) , or [Front Axle Propeller Shaft Replacement \(With Bison\)](#).
7. Front Propeller Shaft Front Flange Bolt (1) - Install [6x] - [Front Axle Propeller Shaft Replacement \(Without Bison\)](#) , or [Front Axle Propeller Shaft Replacement \(With Bison\)](#).



8. Lower Steering Shaft (1) - Install - [Lower Steering Shaft Assembly Replacement](#)



9. Front Wheelhouse Liner-Left Side (3) - Install - [Front Wheelhouse Liner Replacement \(Without ZR2\)](#), or [Front Wheelhouse Liner Replacement \(With ZR2\)](#), or [Front Wheelhouse Liner Replacement \(Bison\)](#)



EXHAUST PARTICULATE FILTER REPLACEMENT (LWN)

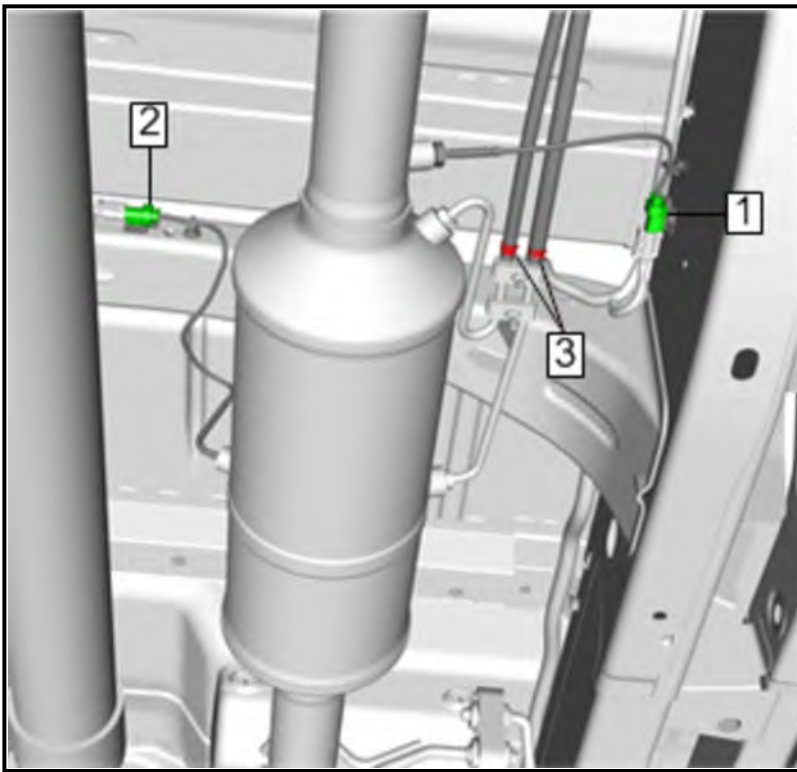
Removal Procedure

WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

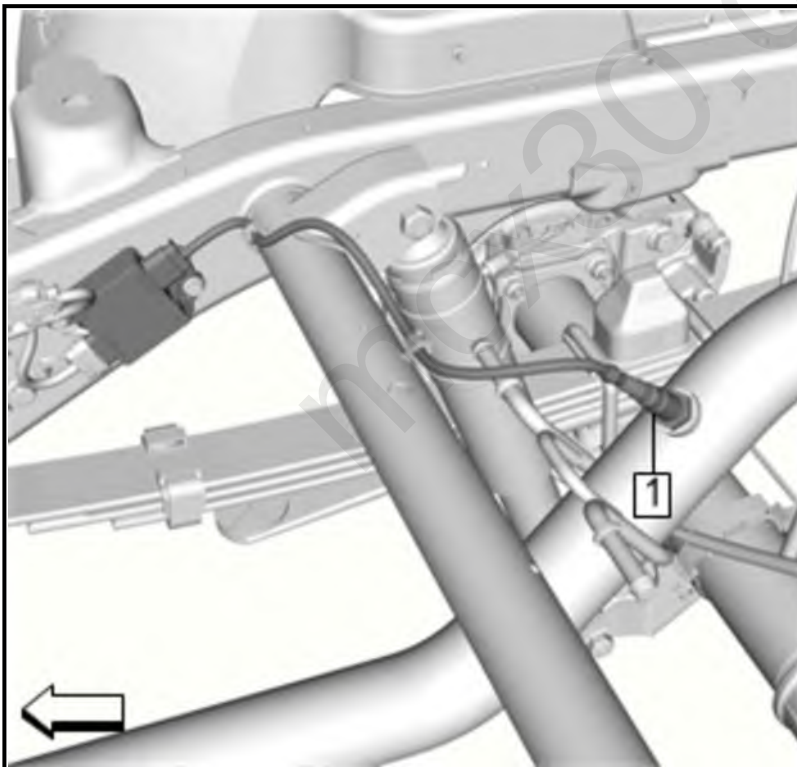
WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

NOTE: Physical cleaning of the exhaust particulate filter and resetting the existing filter calibration with GDS2 to try to enable a forced service regeneration is NOT allowed. Refer to [Diesel Particulate Filter \(DPF\) Service Regeneration](#).

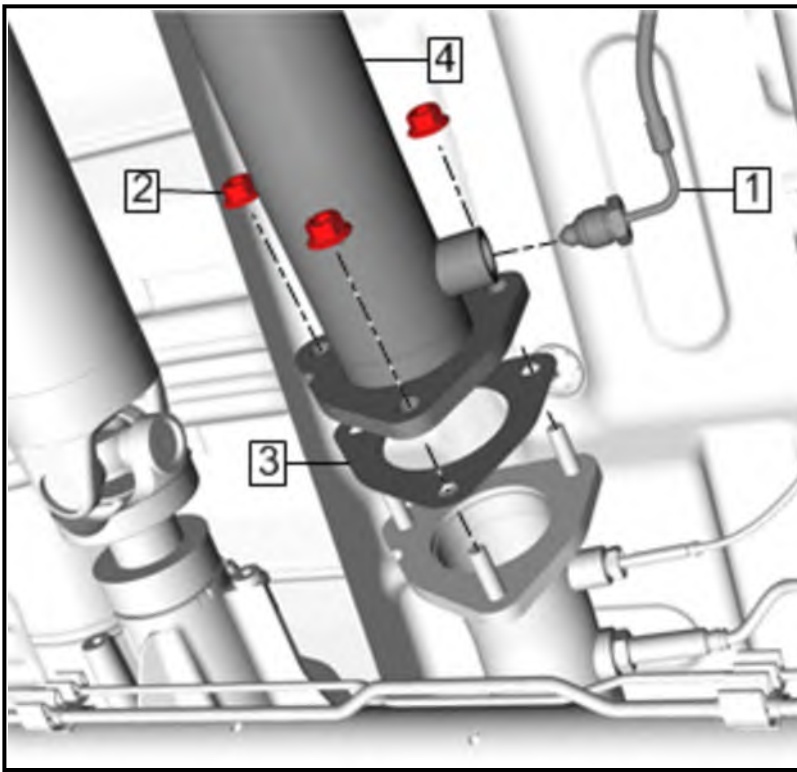
1. Raise and support the vehicle. [Lifting and Jacking the Vehicle](#)
2. Exhaust Temperature Sensor (1) - Disconnect - [Exhaust Temperature Sensor Replacement - Position 5](#)



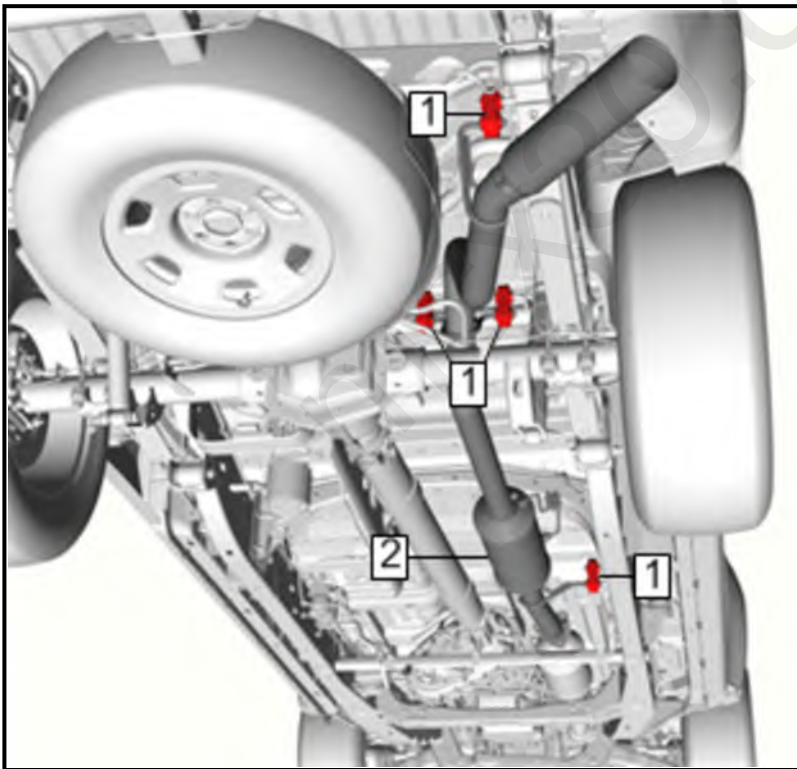
- 3. Exhaust Temperature Sensor (2) - Disconnect - [Exhaust Temperature Sensor Replacement - Position 4](#)
- 4. Exhaust Pressure Sensor Hose (3) - Disconnect [2x]
- 5. Exhaust Particulate Sensor (1) - Remove - [Exhaust Particulate Matter Sensor Replacement](#)



- 6. Low Pressure Diesel Hydrocarbon Injector (1) - Remove - [Low Pressure Diesel Hydrocarbon Injector Replacement](#)



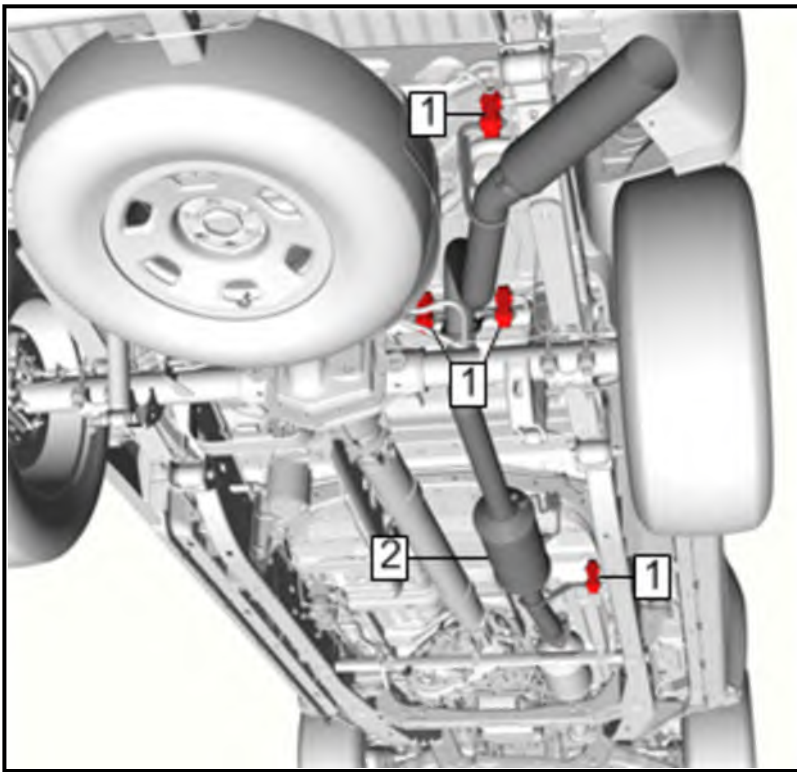
7. Nitrogen Oxides Catalytic Converter Nut (2) - Remove [3x]
8. Remove and DISCARD the gasket. (3)
9. Exhaust Isolator (1) - Remove [4x]



10. Exhaust Particulate Filter (2) - Remove
11. Transfer components as necessary.

Installation Procedure

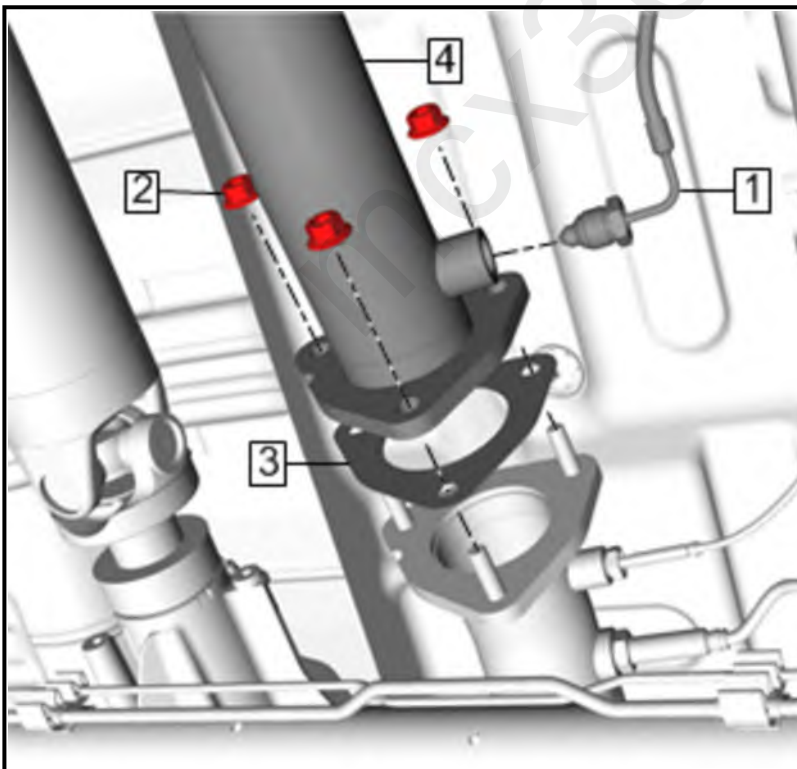
1. Exhaust Isolator (1) - Install [4x]



NOTE:

- If the exhaust particulate filter is replaced, the filter calibration must be reset using GDS2.
- Clean and lubricate the exhaust isolators for ease of installation.

2. Exhaust Particulate Filter (2) - Install
3. Catalytic Converter Gasket (3) - Install



NOTE:

Replace the exhaust gaskets with NEW gaskets.

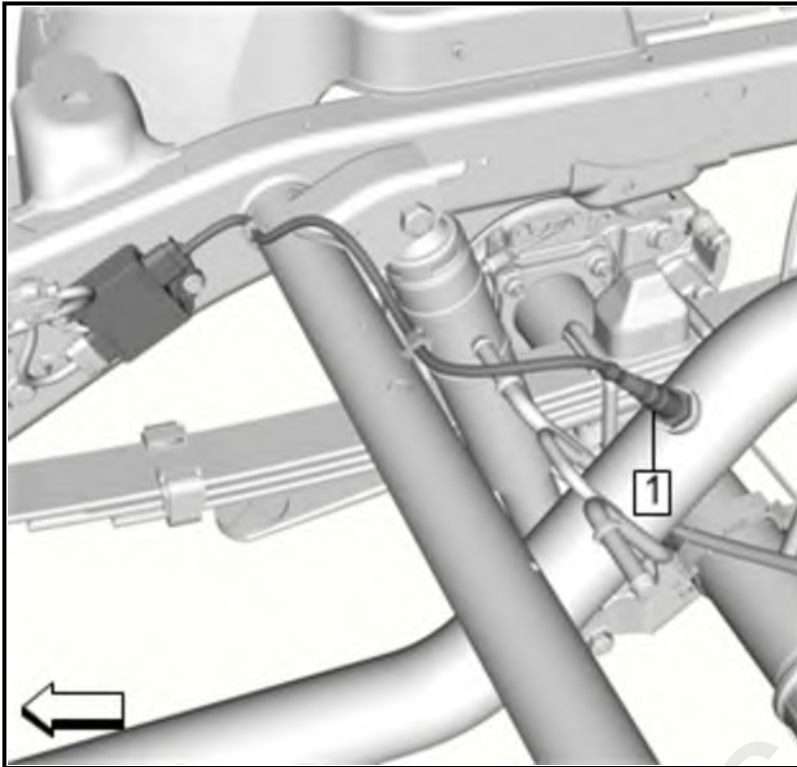
CAUTION:

Refer to [Fastener Caution](#) .

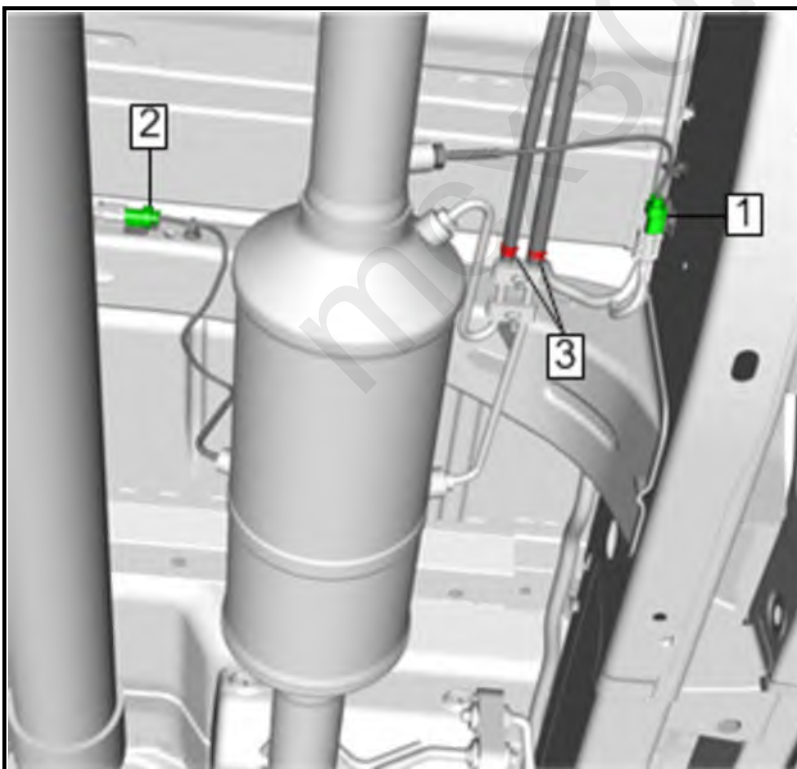
4. Nitrogen Oxides Catalytic Converter Nut (2) - Install and tighten [3x] 50 N.m (37 lb ft)

5. Low Pressure Diesel Hydrocarbon Injector (1) - Install - [Low Pressure Diesel Hydrocarbon Injector Replacement](#)

6. Exhaust Particulate Sensor (1) - Install - [Exhaust Particulate Matter Sensor Replacement](#)



7. Exhaust Temperature Sensor (1) - Connect - [Exhaust Temperature Sensor Replacement - Position 5](#)



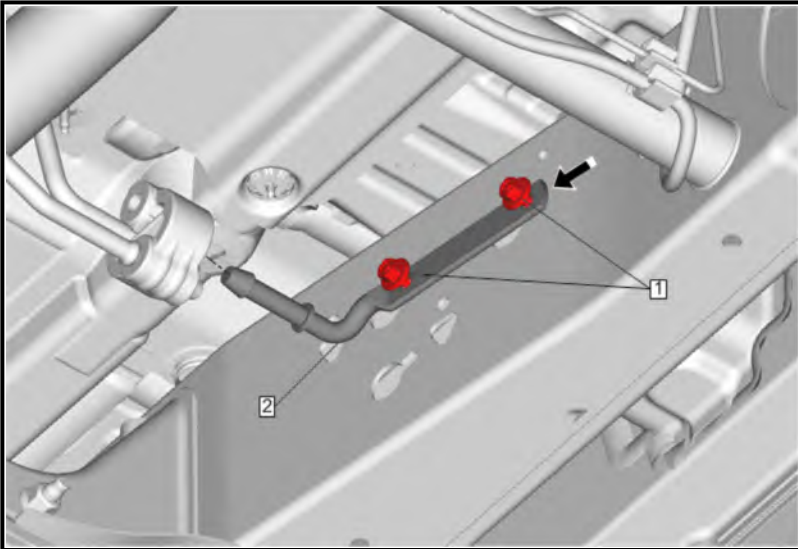
8. Exhaust Temperature Sensor (2) - Connect - [Exhaust Temperature Sensor Replacement - Position 4](#)

9. Exhaust Pressure Sensor Hose (3) - Connect [2x]

NOTE: If the Exhaust Particulate Filter is replaced with NEW, a DPF Reset will need to be performed.

10. Perform a DPF Reset. [DPF Reset](#)

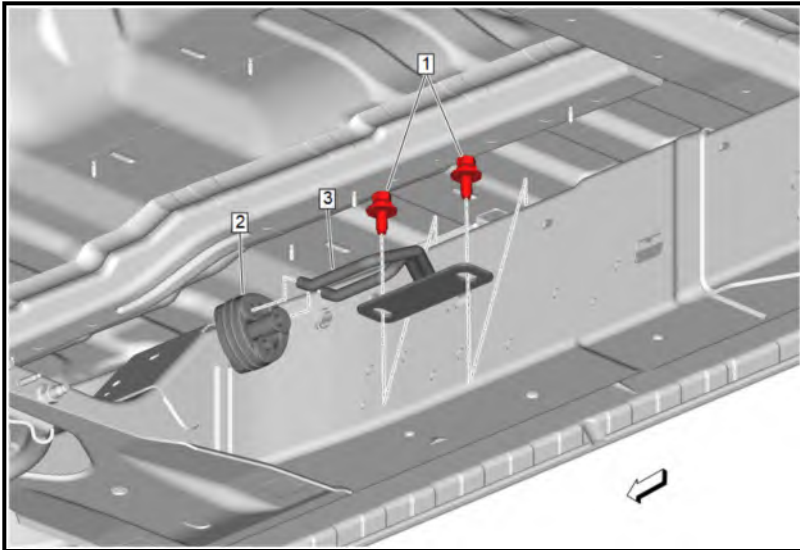
EXHAUST SYSTEM INSULATOR, HANGER, BRACKET REPLACEMENT (LCV)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Lifting and Jacking the Vehicle</u>	
1	Exhaust Hanger Nuts (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Procedure Counter hold the exhaust hanger bolts then loosen the exhaust hanger nuts (1). Tighten 22 N.m (16 lb ft)
2	Exhaust Hanger Procedure NOTE: Clean and lubricate the exhaust isolators for ease of installation. With nuts loose, move the exhaust hanger in the direction of the arrow to disengage and remove if from the frame.

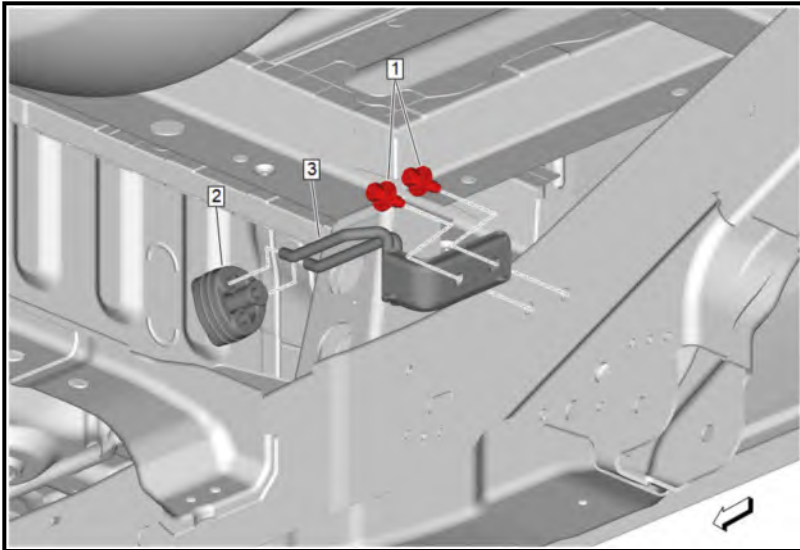
EXHAUST SYSTEM INSULATOR, HANGER, BRACKET REPLACEMENT (LWN INTERMEDIATE)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Lifting and Jacking the Vehicle</u> NOTE: The exhaust pipe is removed for illustration purposes only.	
1	Exhaust System Rear Bolt [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 45 N.m (33 lb ft)
2	Exhaust Rear Muffler Insulator
3	Exhaust Pipe Brace

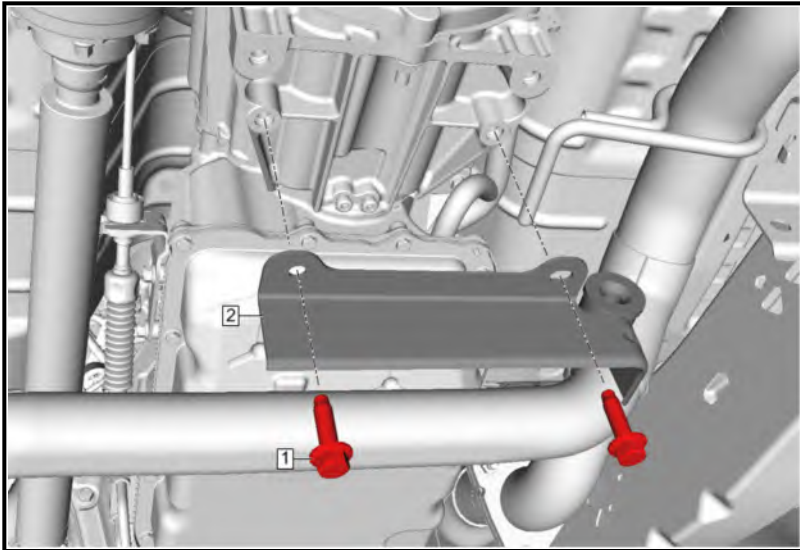
EXHAUST SYSTEM INSULATOR, HANGER, BRACKET REPLACEMENT (LWN REAR)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Lifting and Jacking the Vehicle</u> NOTE: The exhaust pipe is removed for illustration purposes only.	
1	Exhaust System Rear Bolt [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 45 N.m (33 lb ft)
2	Exhaust Rear Muffler Insulator
3	Exhaust Pipe Brace

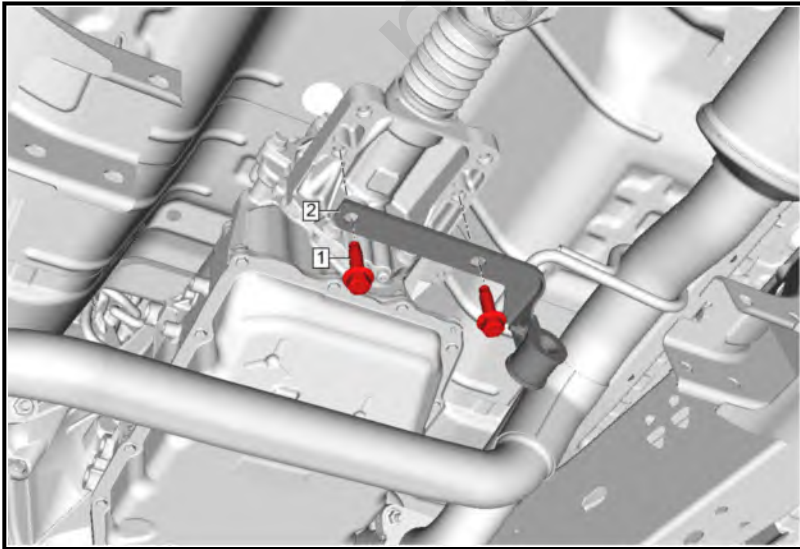
EXHAUST FRONT BRACKET REPLACEMENT (LGZ WITH 4WD)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. <u>Lifting and Jacking the Vehicle</u>	
1	Exhaust Front Bracket Bolt [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 58 N.m (43 lb ft)
2	Exhaust Front Bracket

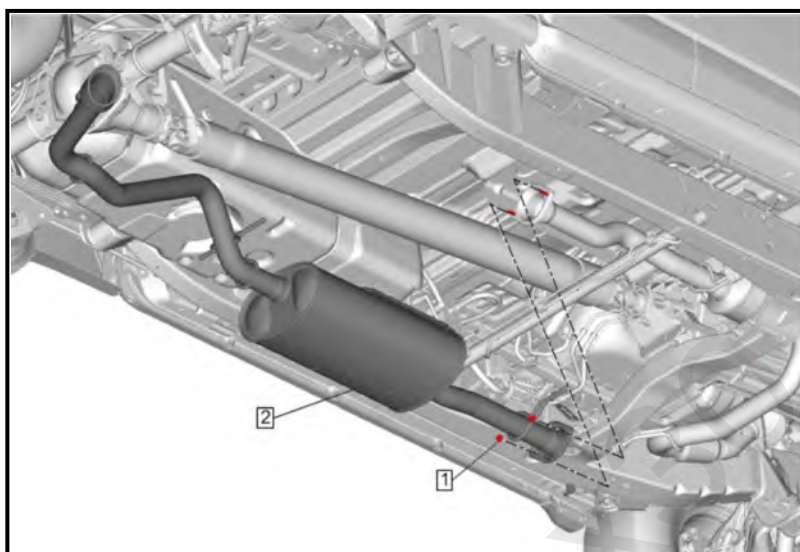
EXHAUST FRONT BRACKET REPLACEMENT (LGZ WITH 2WD)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Raise and support the vehicle. <u>Lifting and Jacking the Vehicle</u>	
1	Exhaust Front Bracket Bolt [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 58 N.m (43 lb ft)
2	Exhaust Front Bracket

EXHAUST MUFFLER REPLACEMENT (LCV)

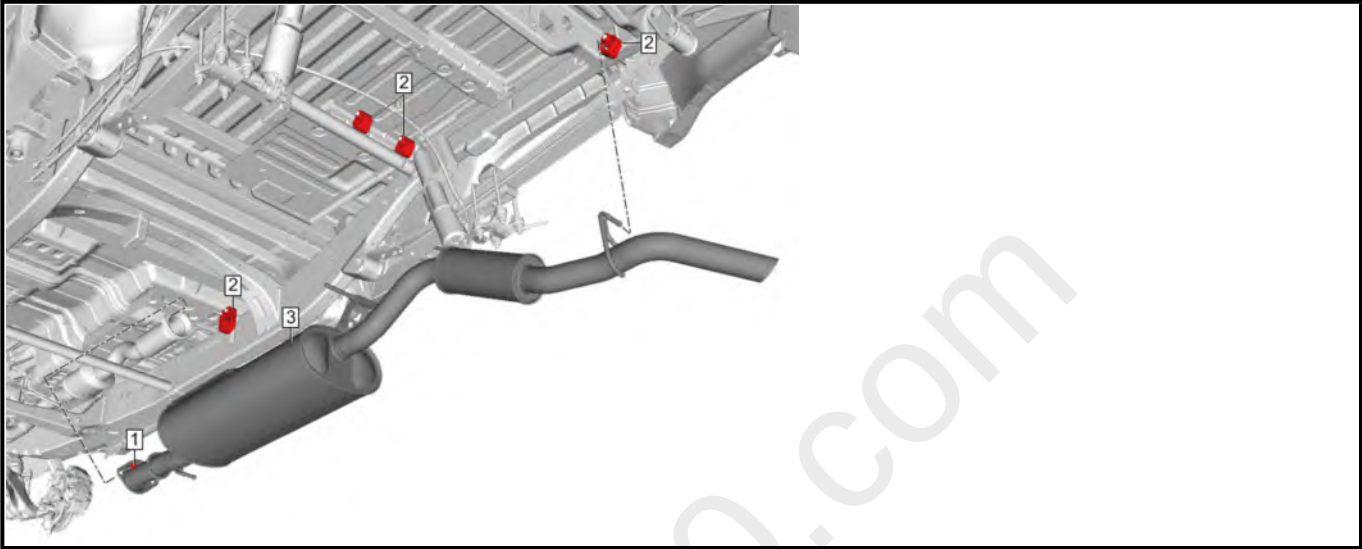


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Lifting and Jacking the Vehicle</u>	
1	Exhaust Front Pipe Nut [x2] WARNING: Refer to <u>Exhaust Service Warning</u> . CAUTION: Refer to <u>Fastener Caution</u> . Tighten 45 N.m (33 lb ft)
2	Exhaust Muffler

Callout	Component Name
	NOTE: Clean and lubricate the exhaust muffler isolator rods for ease of installation.

EXHAUST MUFFLER REPLACEMENT (LGZ)

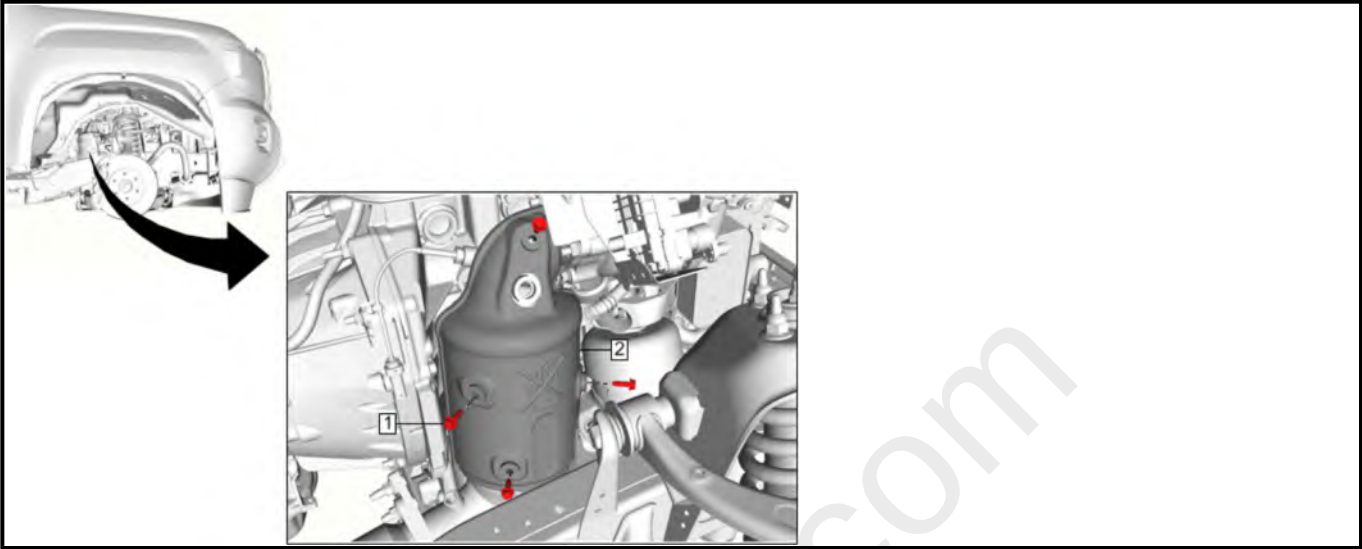


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure Lifting and Jacking the Vehicle	
1	Exhaust Muffler Nut [2x] CAUTION: Refer to Fastener Caution . Tighten 45 N.m (33 lb ft)
2	Exhaust Muffler Isolator [4x] NOTE: Clean and lubricate the exhaust muffler isolator rods for ease of installation.
3	Exhaust Muffler

Callout	Component Name
	NOTE: With the aid of assistant, remove the exhaust muffler.

CATALYTIC CONVERTER HEAT SHIELD REPLACEMENT (LWN)

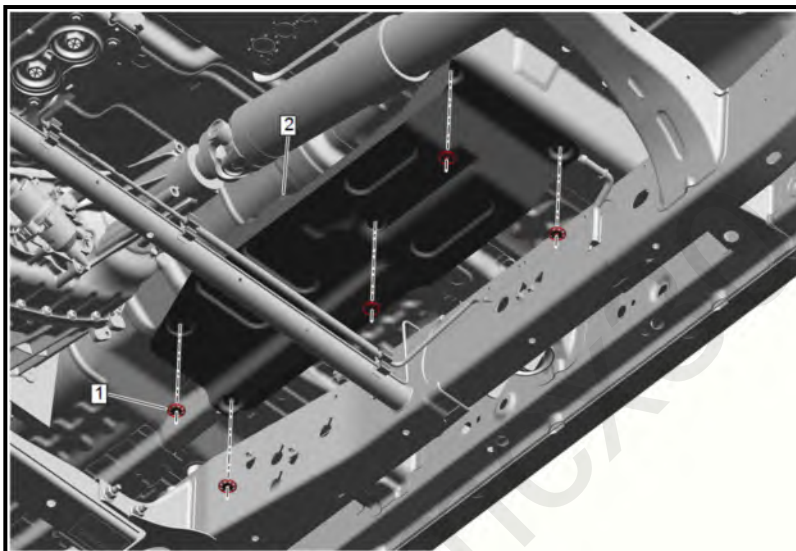


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.	
WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	

Callout	Component Name
Preliminary Procedures <u>Front Wheelhouse Liner Replacement (Without ZR2)</u> , or <u>Front Wheelhouse Liner Replacement (With ZR2)</u> , or <u>Front Wheelhouse Liner Replacement (Bison)</u>. <u>Nitrogen Oxides Sensor Replacement - Position 1</u>	
1	Catalytic Converter Heat Shield Bolt [4x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 10 N.m (89 lb in)
2	Catalytic Converter Heat Shield

EXHAUST INTERMEDIATE UNDERBODY HEAT SHIELD REPLACEMENT (LWN)

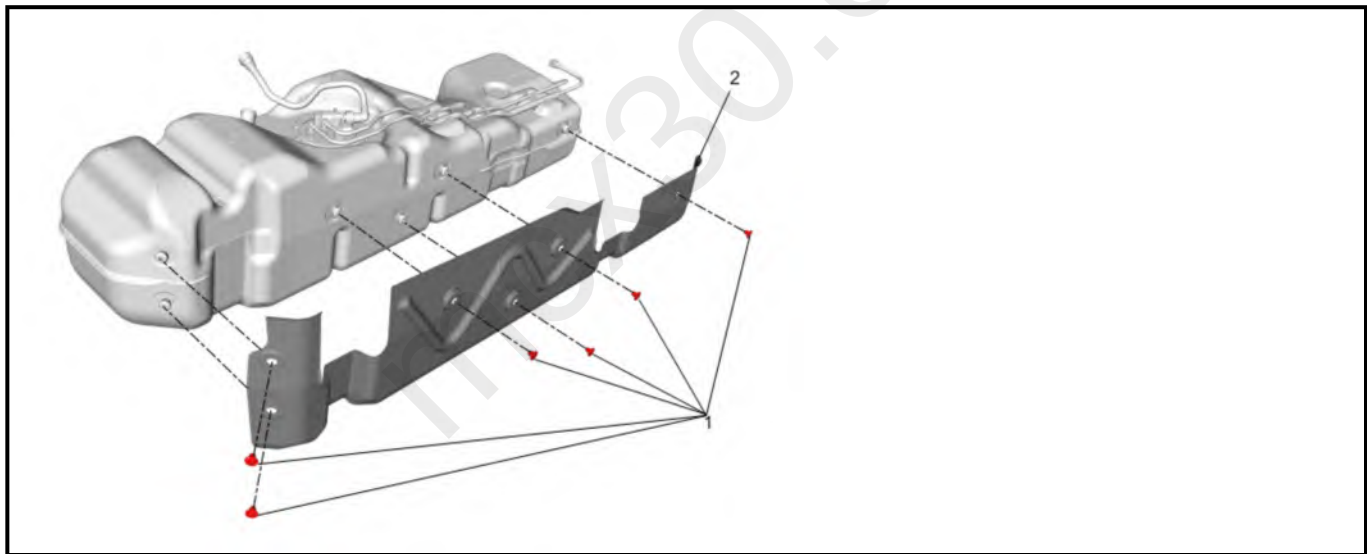


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING:	

Callout	Component Name
Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	
1	Exhaust Heat Shield Retainer [5x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.5 N.m (13 lb in)
2	Exhaust Intermediate Underbody Heat Shield

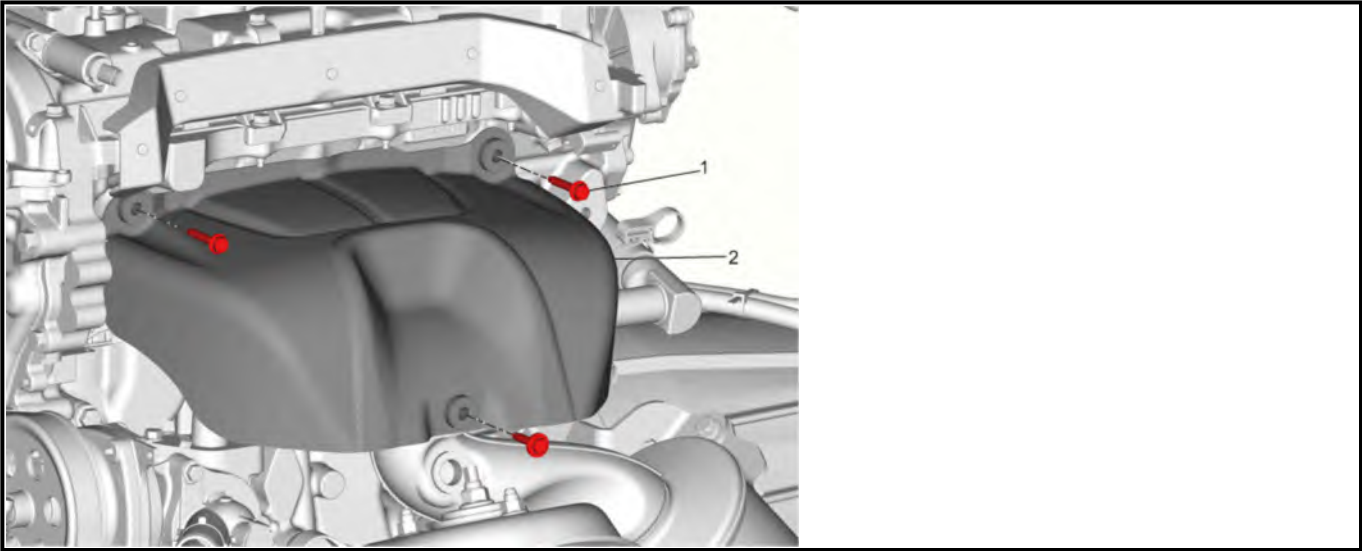
FUEL TANK HEAT SHIELD REPLACEMENT (LWN)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
Preliminary Procedure <u>Fuel Tank Replacement</u>	
1	Fuel Tank Heat Shield Retainer [6x] CAUTION: Refer to <u>Fastener Caution</u>
2	Fuel Tank Heat Shield

EXHAUST MANIFOLD HEAT SHIELD REPLACEMENT (LCV)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: Refer to Exhaust Service Warning .	
1	Fastener [3X] CAUTION: Refer to Fastener Caution . Tighten 14 N.m (10 lb ft)
2	Exhaust Manifold Heat Shield

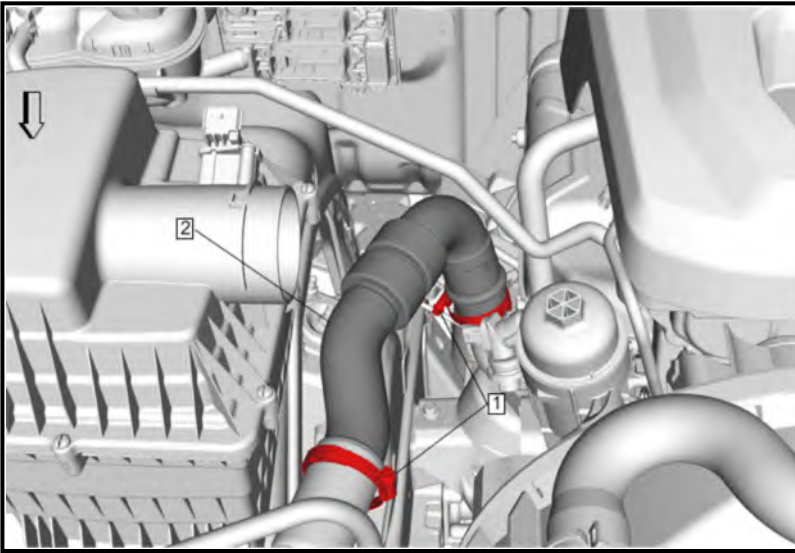
EXHAUST MANIFOLD HEAT SHIELD REPLACEMENT (LWN)

Removal Procedure

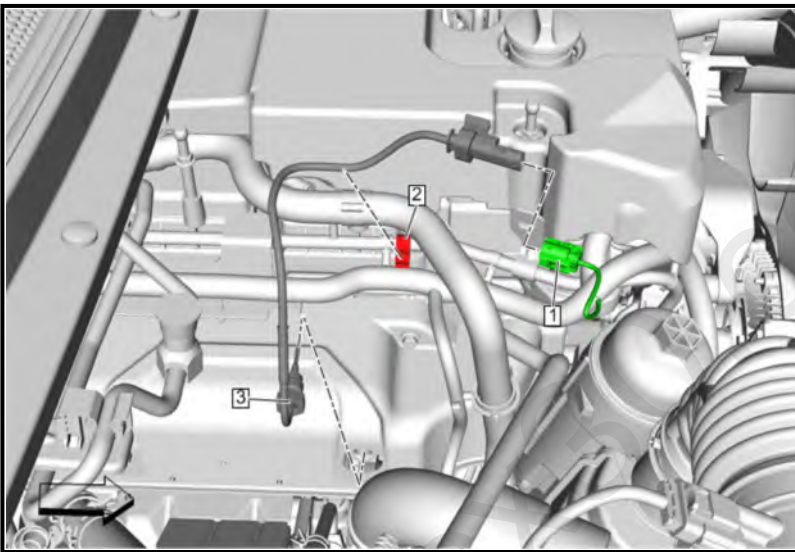
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.

WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.

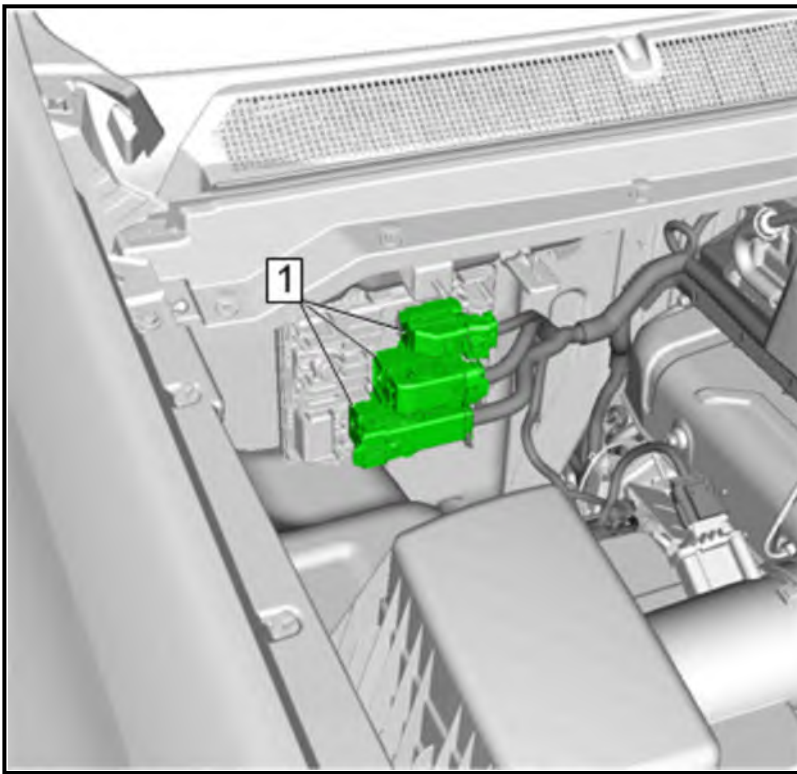
- 1. Charge Air Cooler Inlet Duct (2) - Remove - [Charge Air Cooler Inlet Duct Replacement](#)



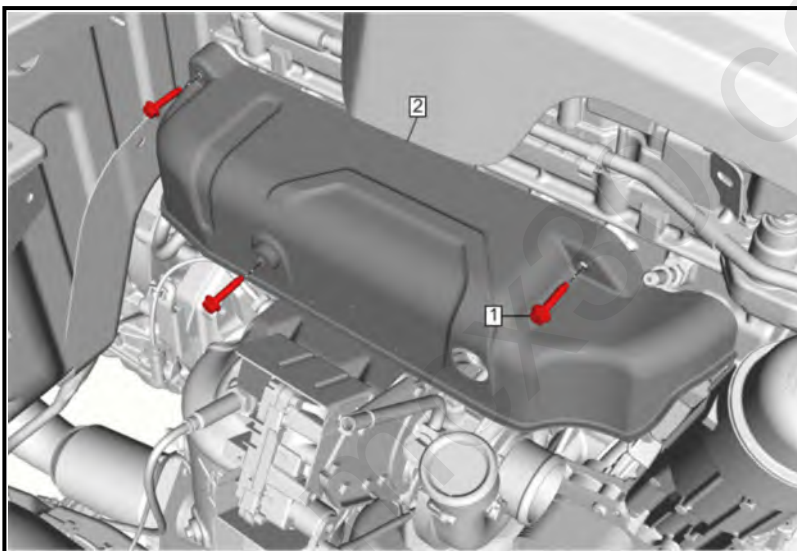
2. Exhaust Gas Recirculation Cooler Temperature Sensor-Position 1 (3) - Remove - [Exhaust Gas Recirculation Cooler Temperature Sensor Replacement - Position 1](#)



3. Disconnect the engine wiring harness electrical connectors (1) from the powertrain control module and position aside. [Engine Control Module Replacement](#)



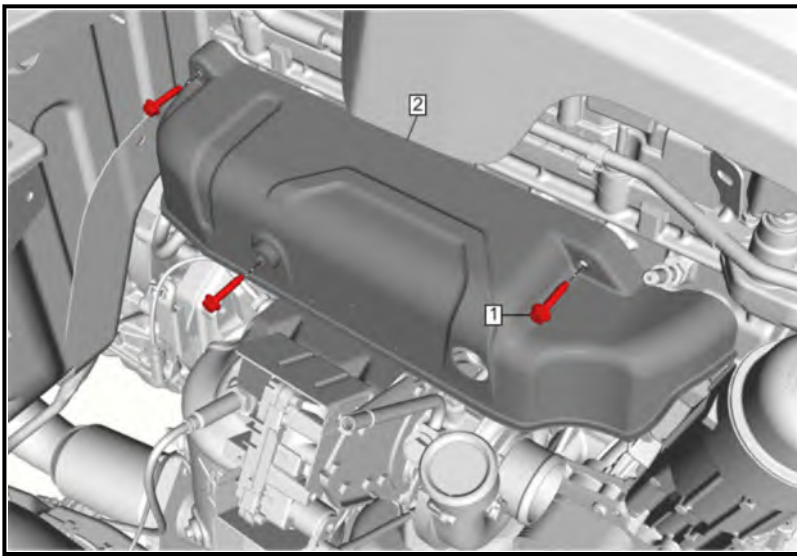
4. Exhaust Manifold Heat Shield Bolt (1) - Remove [3x]



5. Exhaust Manifold Heat Shield (2) - Remove

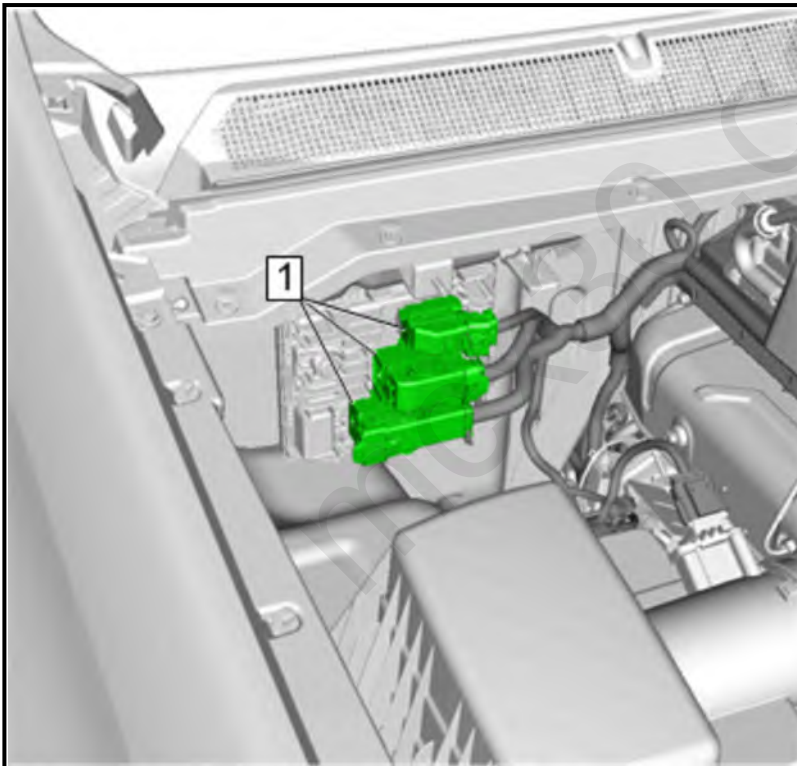
Installation Procedure

1. Exhaust Manifold Heat Shield (2) - Install

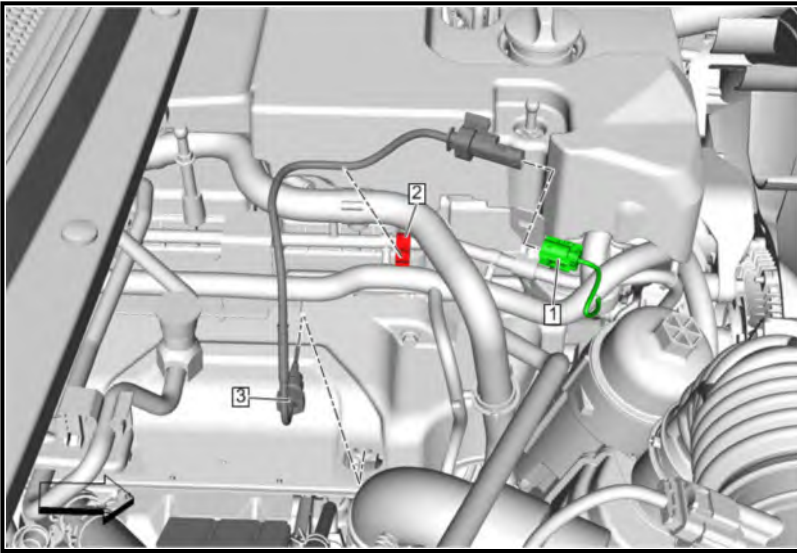


CAUTION: Refer to [Fastener Caution](#) .

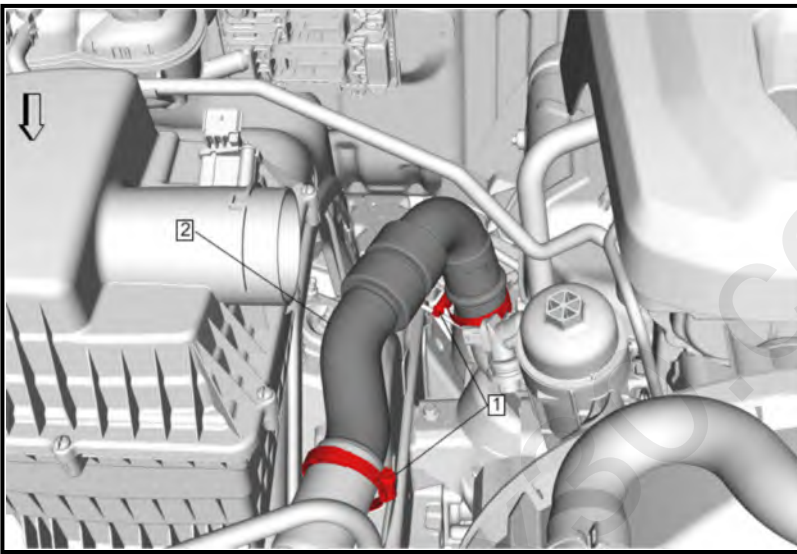
2. Exhaust Manifold Heat Shield Bolt (1) - Install and tighten [3x] 10 N.m (7 lb ft)
3. Connect the engine wiring harness electrical connectors (1) to the powertrain control module. [Engine Control Module Replacement](#)



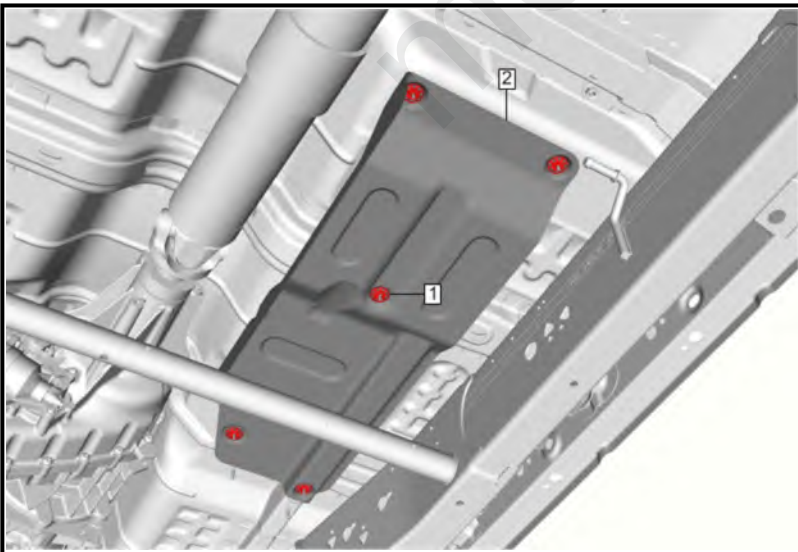
4. Exhaust Gas Recirculation Cooler Temperature Sensor-Position 1 (3) - Install - [Exhaust Gas Recirculation Cooler Temperature Sensor Replacement - Position 1](#)



5. Charge Air Cooler Inlet Duct (2) - Install - [Charge Air Cooler Inlet Duct Replacement](#)



EXHAUST MUFFLER HEAT SHIELD REPLACEMENT (FRONT)

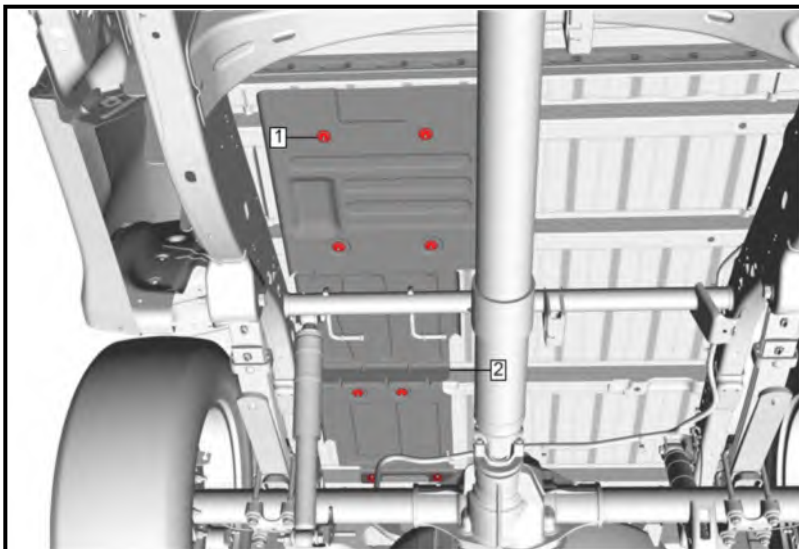


NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING:	

Callout	Component Name
In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury. Preliminary Procedure Lifting and Jacking the Vehicle	
1	Exhaust Heat Shield Retainer [5x] CAUTION: Refer to Fastener Caution . Tighten 1.5 N.m (13 lb in)
2	Exhaust Heat Shield

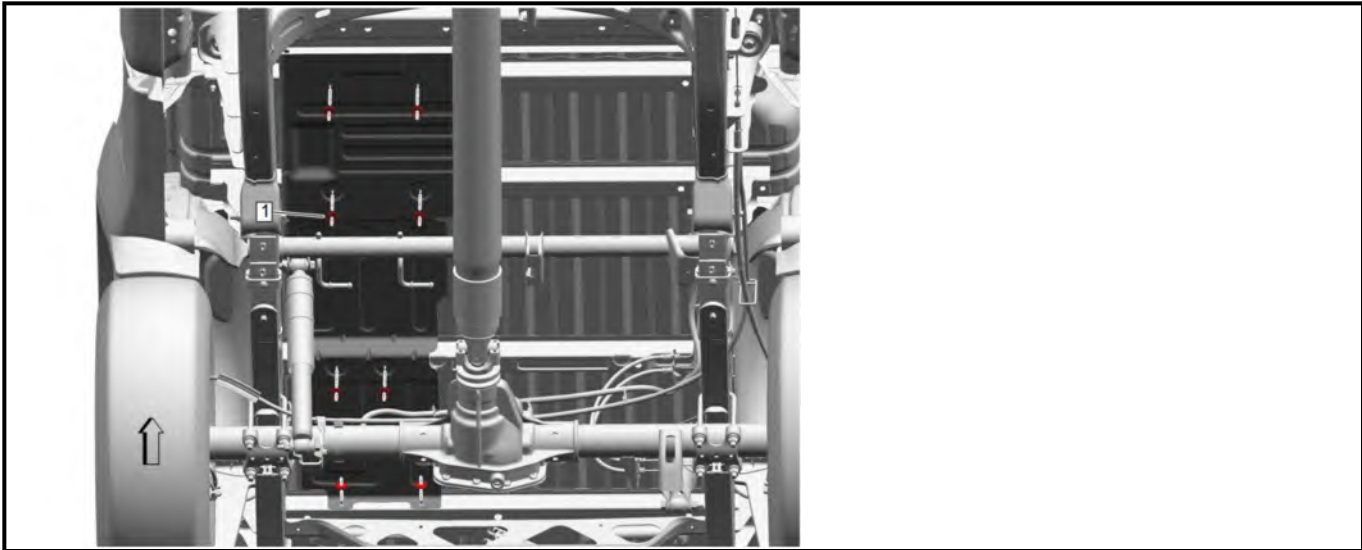
EXHAUST MUFFLER HEAT SHIELD REPLACEMENT (REAR)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool.	
WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury.	
Preliminary Procedure <u>Lifting and Jacking the Vehicle</u>	
1	Exhaust Heat Shield Retainer [8x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.5 N.m (13 lb in)
2	Exhaust Heat Shield

EXHAUST REAR UNDERBODY HEAT SHIELD REPLACEMENT (LWN)



NOTE: Callouts in the following chart represent components shown in graphic above.

Callout	Component Name
WARNING: In order to avoid being burned, do not service the exhaust system while it is still hot. Service the system when it is cool. WARNING: Avoid contact with HOT components. Wear safety glasses and protective gloves to avoid personal injury. NOTE: The exhaust pipe is removed for illustration purposes only.	
Preliminary Procedure <u>Emission Reduction Fluid Tank Support Bracket Replacement</u>	
1	Exhaust Heat Shield Retainer [8x]

Callout	Component Name
	CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.5 N.m (13 lb in)
2	Exhaust Rear Underbody Heat Shield

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.

Diesel Particulate Filter (DPF)

Exhaust Particulate Filter

The exhaust particulate filter (EPF) captures diesel exhaust gas particulates, preventing their release into the atmosphere. This is accomplished by forcing particulate-laden exhaust (1) through a filter substrate of porous cells, which removes the particulates from the exhaust gas. The exhaust gas enters the filter, but because every other cell of the filter is capped at the opposite end, the exhaust particulates cannot exit the cell. Instead, the exhaust gas passes through the porous walls of the cell leaving the particulates trapped on the cell wall. The cleaned exhaust gas exits the filter through the adjacent cell. The EPF is capable of reducing more than 90 percent of particulate matter (PM).

Diesel Oxidation Catalyst

The diesel oxidation catalyst (DOC) (7) has two functions. One function is to reduce emissions of non methane hydro-carbons (NMHC) and carbon monoxide (CO), from the exhaust gases. The other function is to help start a regeneration event by converting the fuel-rich exhaust gases to heat. The engine control module (ECM) monitors the functionality of the DOC by determining if the exhaust gas temperature (EGT) sensor 1 (1) reaches a predetermined temperature during a regeneration event. The Diesel Particulate Filter (DPF) System Description DOC and the exhaust particulate filter (EPF) (6) are downstream of the turbocharger, and are two separate components under the vehicle.

Differential Pressure Sensor (DPS) and Pressure Lines

The difference between the inlet and outlet of the exhaust particulate filter (EPF). When pressure difference has increased above a calibrated threshold, a high particulate loading condition is indicated. The ECM will command a regeneration event in order to restore the filter. If the pressure differential continues to increase across the exhaust filter without a regeneration event, the ECM will illuminate an EPF lamp or send a message to the driver information center (DIC) referring the customer to clean the exhaust filter. To clean the exhaust filter the vehicle must be driven under the conditions necessary for a regeneration to take place. If these lamps and messages are ignored, the ECM will eventually illuminate the malfunction indicator lamp (MIL) and revert to Reduced Engine Power which will require the vehicle to be serviced. The DPS sensor provides a voltage signal to the ECM on a signal circuit relative to the pressure differential changes in the EPF. The ECM converts the signal voltage input to a pressure value. The DPS pressure lines (2) are connected before and after the EPF. To provide the pressure sensor with accurate back pressure measurements, the DPS pressure lines should have a continuous downward gradient without any sharp bends.

Exhaust Gas Temperature Sensors

The ECM uses two exhaust gas temperature (EGT) sensors to measure the temperature of the exhaust gases at the inlet and outlet of the exhaust particulate filter (EPF). The EGT sensors are variable resistors, when the EGT sensors are cold, the sensor resistance is low, and as the temperature increases, the sensor resistance increases. When sensor resistance is high, the ECM detects a high voltage on the signal circuit. When sensor resistance is low, the ECM detects a lower voltage on the signal circuit. Proper EGTs at the inlet and outlet of the EPF are crucial for proper operation and for initiating the regeneration process. A temperature that is too high in the EPF will cause the EPF substrate to melt or crack. The ECM monitors the temperatures at the EPF inlet and outlet to regulate EPF temperatures.

Normal Regeneration

Regeneration is the process of removing the captured particulates through incineration within the exhaust particulate filter (EPF). Elevated temperatures are created in the diesel oxidation catalyst (DOC) through a calibrated strategy in the engine control system. Regeneration occurs when the ECM calculates that the particulate level in the filter has reached a calibrated threshold using a number of different factors, including engine run time, distance traveled, fuel used since the last regeneration, and the exhaust differential pressure. In general, the vehicle will need to be operating continuously at speeds above 48 km/h (30 mph) for approximately 20-30 minutes for a full and effective regeneration to complete. During regeneration the exhaust gases reach temperatures above 550°C (1,022°F). The ECM monitors the EGT sensors during regeneration. If the sensors indicate that regeneration temperatures are exceeding a calibrated threshold, regeneration will be temporarily suspended until the sensors return to a normal temperature. If EGT temperatures fall below a normal calibrated threshold, regeneration will be terminated and a corresponding DTC should set. If a regeneration event is interrupted for any reason, it will continue, including the next key cycle, when the conditions are met for regeneration enablement. Normal regeneration is transparent to the customer.

Service Regeneration

A scan tool is an essential tool that is required for service regeneration. Commanding a service regeneration is accomplished using the output control function. The vehicle will need to be parked outside the facility and away from nearby objects, such as other vehicles and buildings, due to the elevated exhaust gas temperature at the tail pipe during regeneration. The service regeneration can be terminated by applying the brake pedal, commanding service regeneration OFF using the scan tool, or disconnecting the scan tool from the vehicle.

Regeneration Process

A number of engine components are required to function together for the regeneration process to be performed. These components are the fuel injectors, turbocharger, IA valve, fuel pressure control, and the intake air heater (IAH). The regeneration process consists of several stages: Warming up the diesel oxidation catalyst (DOC) to 350°C (662°F) by performing the following:

- Reducing air flow with the intake air valve
- Increasing or decreasing boost pressure with the turbocharger, depending on engine load
- Elevating the engine speed
- Reduce fuel rail pressure
- Retard fuel injection timing
- Add late fuel injection pulses. The added fuel is not combusted but is oxidized by the DOC and exhaust particulate filter (EPF) to create heat.

Ash Loading

Ash is a non-combustible by product from normal oil consumption. Low Ash content engine oil (CJ-4 API) is required for vehicles with the exhaust particulate filter (EPF) system. Ash accumulation in the EPF will eventually cause a restriction in particulate filter. Regeneration will not burn off the ash, only particulate matter is burned off. An ash loaded EPF will need to be removed from the vehicle and cleaned or replaced.

Muffler

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.
