9. Engine Exhaust

9.1. Description and Operation

9.1.1. Exhaust System Description

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

The exhaust system carries exhaust gases, treated by the catalytic converter, then if installed 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 chassis of the vehicle and allows the exhaust system to expand as the exhaust system warms up.

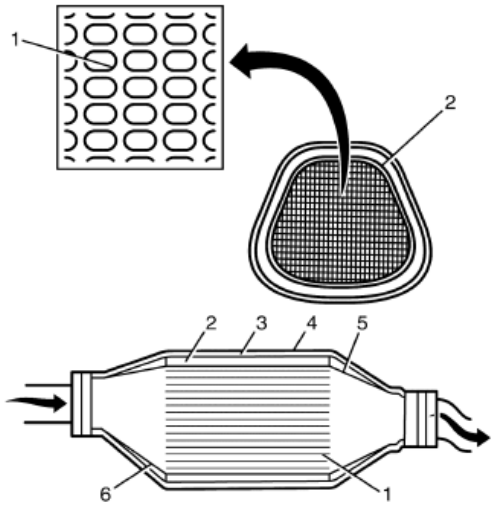
Exhaust heat shields are used to protect the body and other components from damage due to the heat from the exhaust system.

The exhaust system may be comprised of the following components:

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

9.1.1.1. 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.



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 infective, 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).

9.1.1.2. Muffler

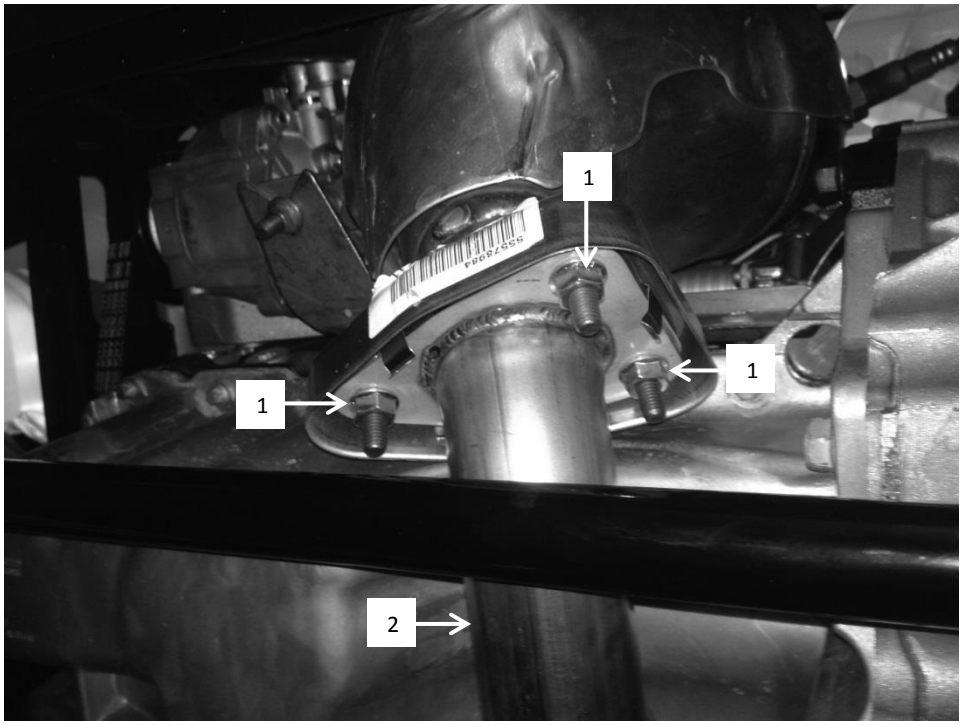
The exhaust muffler reduces the noise levels of the engine exhaust by the use of sound wave deflection and cancelation through channels and baffels inside the exhaust muffler that lower the sound levels created by the combustion of the engine.

9.2. Repair instructions

9.2.1.1. Exhaust Down Pipe Replacement

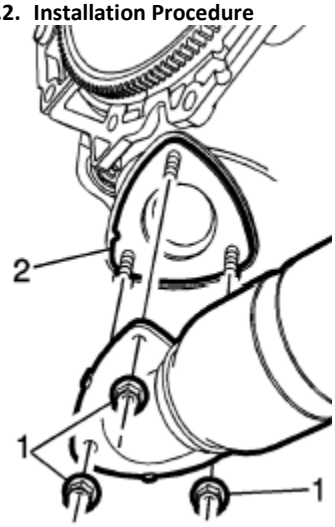
9.2.1.1.1. Removal Procedure

1. Lift and support the vehicle
2. Remove the Anti-sway bar bushings and allow the anti-sway bar to hang
3. Remove the exhaust Y-pipe
4. Disconnect the heated oxygen sensor 2. Refer to Heated Oxygen Sensor Replacement Sensor 2.



5. Remove the catalytic converter fasteners (1) and disconnect the catalytic converter from the down pipe (2).
6. Discard the exhaust gasket.
7. Remove the Down Pipe

9.2.1.1.2. Installation Procedure

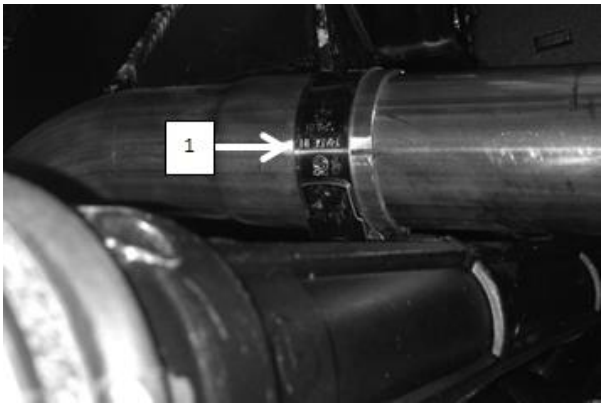


1. Position the exhaust down pipe to the catalytic converter with a NEW gasket (2).
2. Install the exhaust down pipe fasteners (1) to the catalytic converter and tighten to 20 Nm (15 lb ft).
3. Connect the heated oxygen sensor 2. Refer to Heated Oxygen Sensor Replacement Sensor 2.
4. Install the Exhaust Y-Pipe Refer to Exhaust Y-Pipe
5. Install the Anti-sway bar Bushings Refer to Anti-sway bar Bushing
6. Start the engine and check for exhaust leaks.

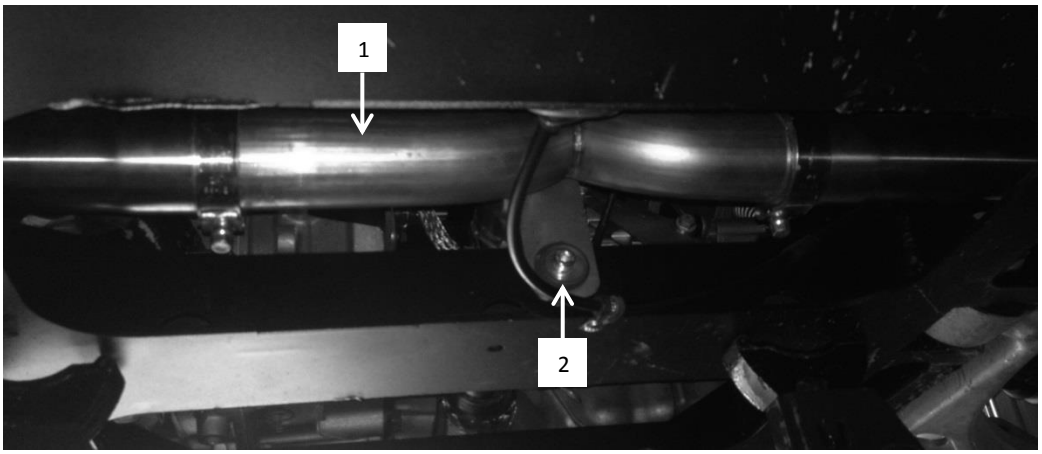
9.2.1.2. Exhaust Y-Pipe Replacement

9.2.1.2.1. Removal Procedures

1. Lift and support the vehicle, Refer to Lifting the Vehicle
2. Remove the Exhaust Tips, Refer to Exhaust Tip Replacement

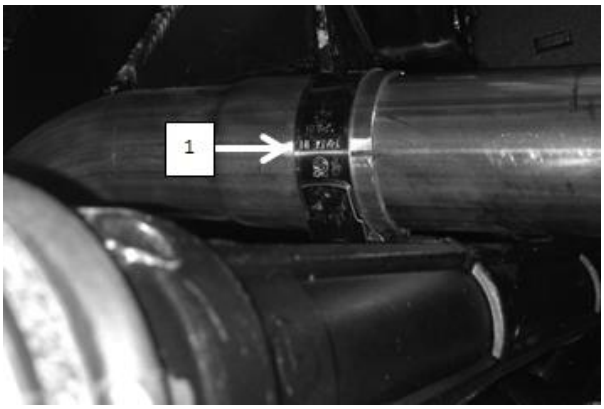


3. Loosen the down pipe exhaust clamp (1)

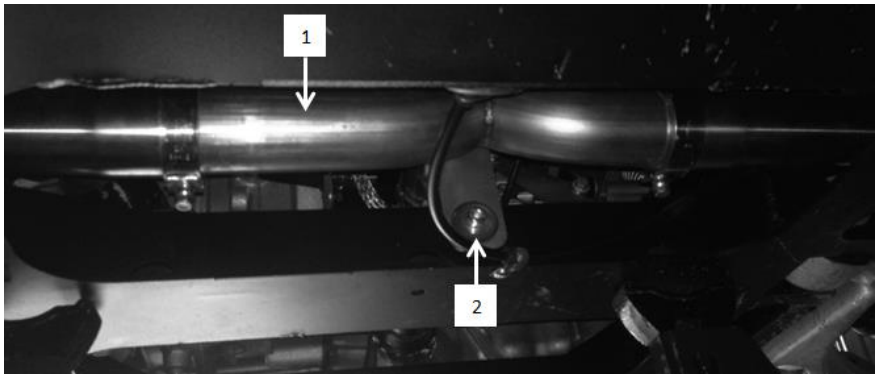


4. Remove the Y-pipe bushing bolt (2)
5. Remove the Y-Pipe

9.2.1.2.2. Installation Procedures

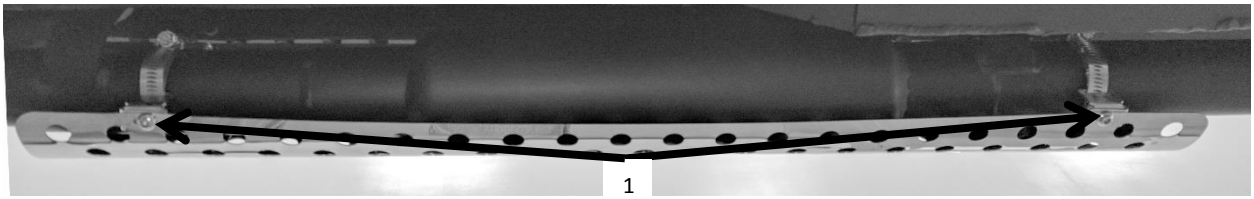


1. Insert the Y-pipe in to the Down pipe
2. Install the Exhaust Tips, Refer to Exhaust Tip Replacement



3. Install the Y-Pipe Bushing bolt and tighten to 7 Nm (60 in lb)
4. Tighten the 3 exhaust clamps to 30 Nm (22 lb ft)
5. Lower the vehicle
6. Start the engine and check for exhaust leaks.

9.2.1.3. Exhaust Heatshield Replacement

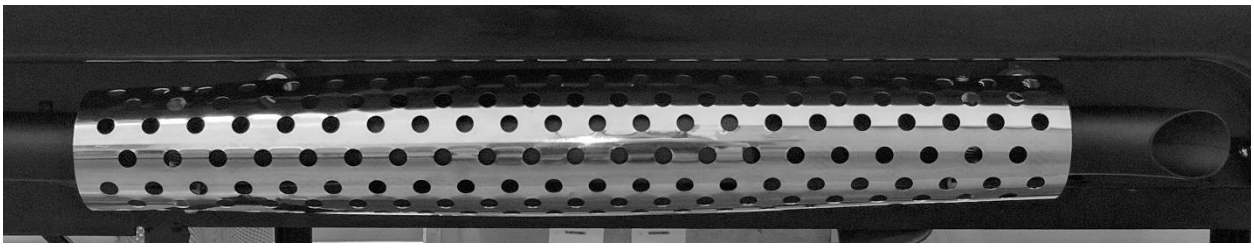


Removal

1. Lift and support the vehicle, Refer to Lifting the Vehicle
2. Remove the two Worm Gear Clamps from around the Exhaust Pipe (1)
    a. Fully remove the Clamp from the Worm Gear Mechanism
3. Remove the Heat Shield

Installation.

1. Wrap the clamp around the exhaust pipe
2. Tighten the Worm Gear Clamp snug

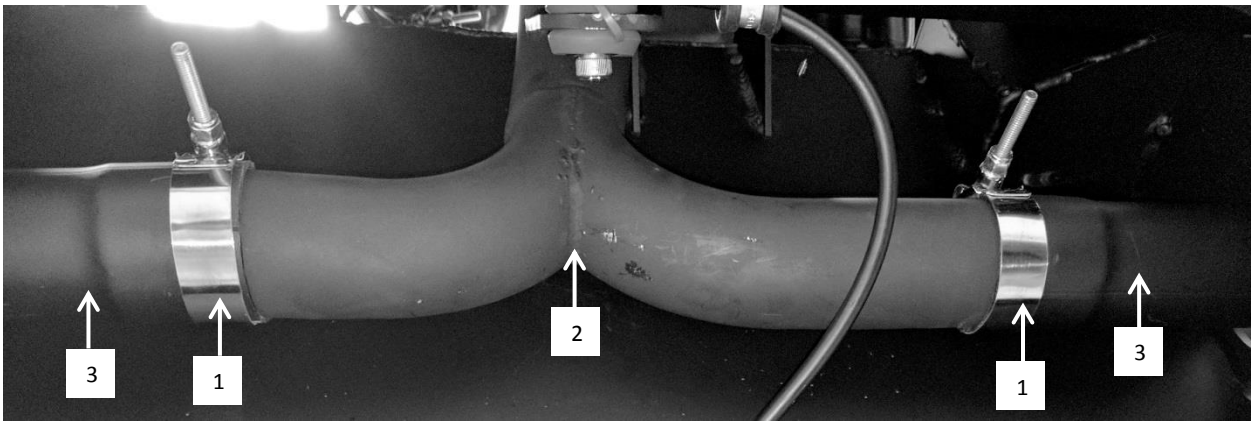


3. Ensure the heatshield is properly aligned
4. Tighten the Worm Gear Clamp to 30 Nm (22 lb ft)
5. Lower the vehicle

9.2.1.4. Exhaust Tip Replacement

9.2.1.4.1. Removal Procedures

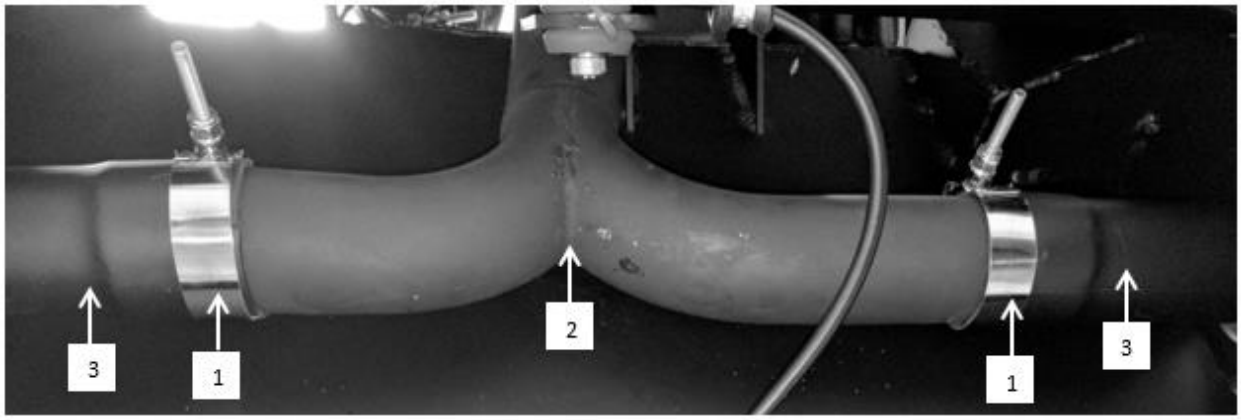
6. Lift and support the vehicle, Refer to Lifting the Vehicle
7. Remove Exhaust Heat Shield, see Heat shield in this section



8. Loosen the Exhaust tip pipe clamp (1) at the Y-Pipe (3)

9. Remove the two Exhaust Tip Mounting bolts (1)
10. Pull the Exhaust tip straight out to remove

9.2.1.4.2. Installation Procedures



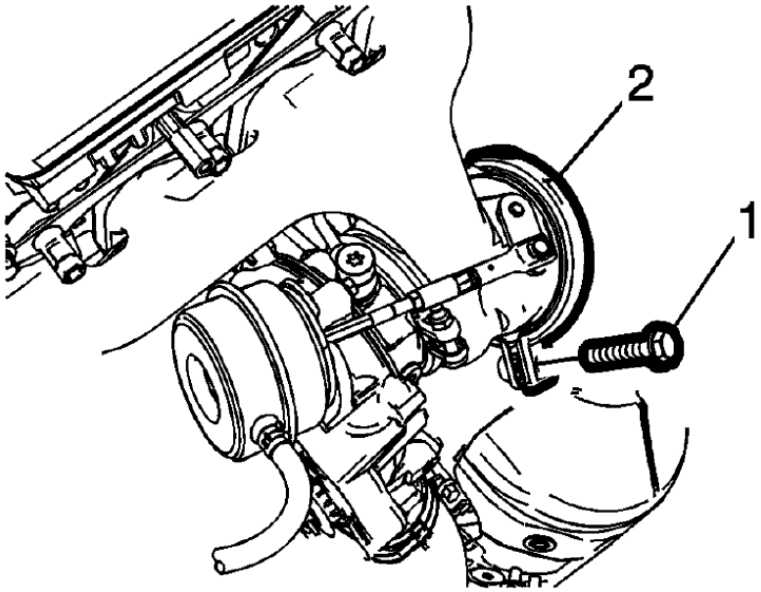
1. Slide the exhaust tip (3) in to the Y-pipe (2)
   1.1. Do not tighten the exhaust clamp

2. Install the Exhaust Tip mounting bolt, tighten to 7 Nm (60 in lb.)
3. Tighten the Exhaust tip pipe clamp at the Y-Pipe to 30 Nm (22 lb ft)
4. Install the Exhaust Heat Shield, Refer to Heat Shield in this section
5. Lower the vehicle
6. Start the engine and check for exhaust leaks.

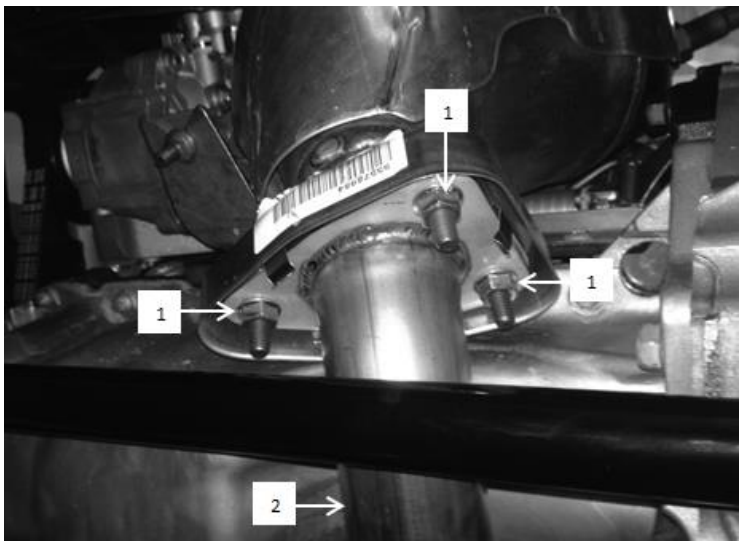
9.2.1.5. Catalytic Converter Replacement

9.2.1.5.1. Removal Procedure

1. Remove the Hood, Refer to Hood in Body Repair
2. Remove the exhaust manifold heat shield. Refer to Exhaust Manifold Heat Shield Replacement.
3. Remove the catalytic converter heated oxygen sensor 1. Refer to Heated Oxygen Sensor Replacement Sensor 1.



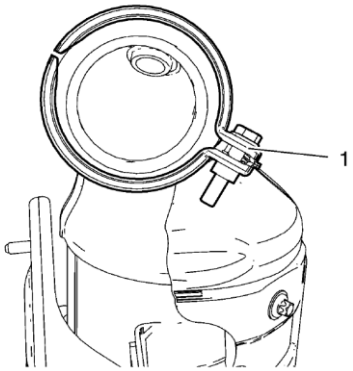
4. Remove the catalytic converter to the turbocharger clamp fastener (1) and discard the clamp (2).
5. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
6. Remove the Anti-sway bar bushings and allow the anti-sway bar to hang



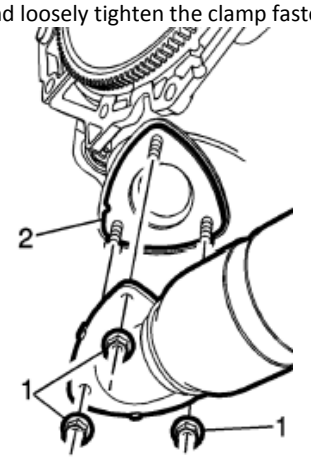
7. Remove the exhaust down pipe fasteners (1) and discard the exhaust gasket (2).
8. Separate the Down pipe from the Catalytic Converter and remove down pipe
9. Remove the catalytic converter brace fasteners from the catalytic converter brace.
10. Remove the catalytic converter.

9.2.1.5.2. Installation Procedure

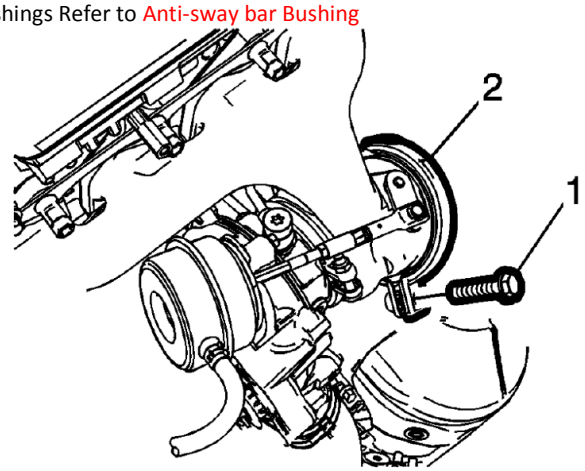
1. Install the catalytic converter into the catalytic converter brace and loosely tighten the fasteners.



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

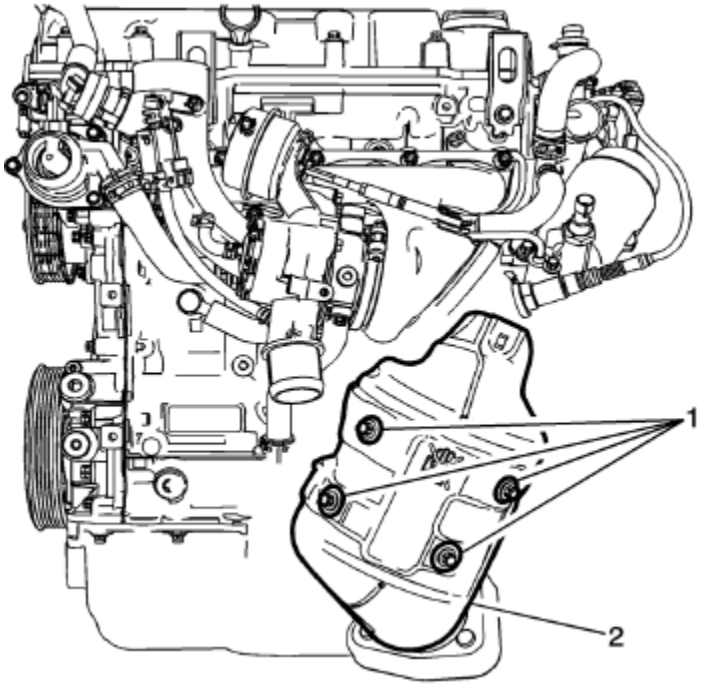


3. Install the exhaust down pipe to the catalytic converter with a NEW gasket (2) and tighten the fasteners (1) to 22 Nm (16 lb ft).
4. **Tighten** the catalytic converter brace fasteners (1) to 22 Nm (16 lb ft).
5. Install the Anti-sway bar Bushings Refer to Anti-sway bar Bushing



6. **Tighten** the turbocharge clamp fastener (1) to 13 Nm (115 lb in).
7. Install the exhaust manifold heat shield. Refer to Exhaust Manifold Heat Shield Replacement.
8. Install the catalytic converter heated oxygen sensor 1. Refer to Heated Oxygen Sensor Replacement Sensor 1.
9. Install the Hood, Refer to Hood in Body Repair
10. Lower the Vehicle
11. Start the engine and check for exhaust leaks.

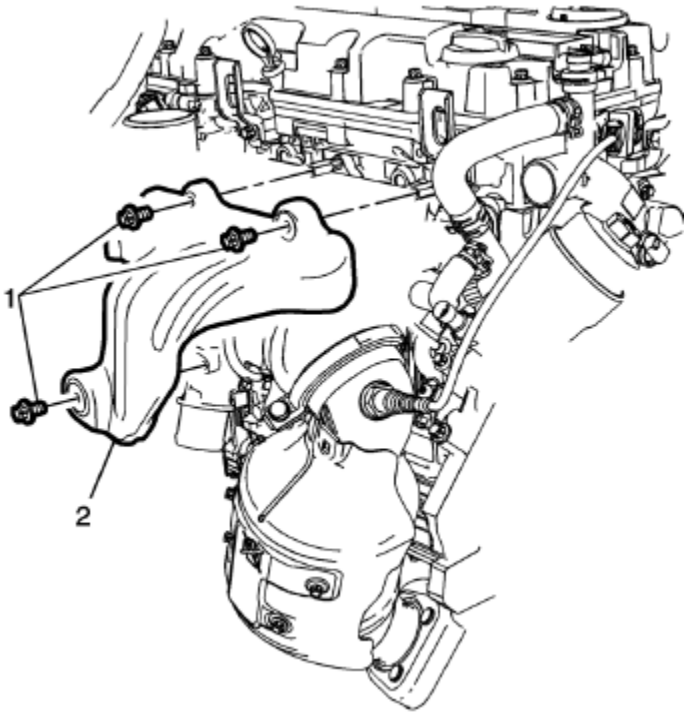
9.2.1.6. Catalytic Converter Heat Shield Replacement



Catalytic Converter Heat Shield Replacement

Callout	Component Name
1	Catalytic Converter Heat Shield Fasteners (Qty: 4) **Tighten** 9 Nm (80 lb in).
2	Catalytic Converter Heat Shield

9.2.1.7. Exhaust Manifold Heat Shield Replacement



Exhaust Manifold Heat Shield Replacement

Callout	Component Name
1	Exhaust Manifold Heat Shield Fasteners (Qty: 3) **Tighten** 9 Nm (80 lb in).
2	Exhaust Manifold Heat Shield

9.3. Specifications

9.3.1. Fastener Specifications

Fastener Specifications

Application	Specification	
	Metric	English
Catalytic Converter-to-Down Pipe	20 Nm	15 lb ft
Catalytic Converter Brace Fastener	22 Nm	16 lb ft
Exhaust Clamps	30 Nm	22 lb ft
Turbocharger Clamp Fastener	13 Nm	115 lb in
Exhaust Tip to Chassis	7 Nm	60 in lb.
Y-Pipe Bushing	7 Nm	60 in lb.