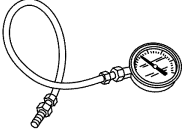
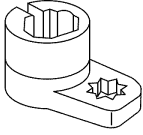


## DIAGNOSIS AND TESTING

### Exhaust System

#### Special Tool(s)

 ST1493-A	Exhaust Back Pressure Gauge 309-D002 (D95L-6000-A) or equivalent
 ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)

#### Inspection and Verification

1. Verify the concern by running the engine (with the vehicle on the ground) or road testing the vehicle to duplicate the condition.
2. Visually inspect the components of the exhaust system and related controls that may affect exhaust gas quality or loss of power.
3. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

#### Visual Inspection Chart

Mechanical
<ul style="list-style-type: none"> <li>• Exhaust pipe pinched or crushed</li> <li>• Damaged muffler</li> <li>• Broken or damaged exhaust hanger brackets</li> <li>• Damaged catalytic converter</li> <li>• Cracked exhaust manifold</li> <li>• Dirty engine air cleaner</li> <li>• Loose or damaged heat shields</li> </ul>

4. Verify that the exhaust system is installed correctly, with clamps correctly located and tightened to specification.
5. If the fault is not visually evident, determine the symptom. GO to [Symptom Chart](#).

**DIAGNOSIS AND TESTING (Continued)****Symptom Chart****Symptom Chart**

<b>Condition</b>	<b>Possible Sources</b>	<b>Action</b>
<ul style="list-style-type: none"> <li>• Rattle, squeaks or buzz type noise — from the bottom of vehicle</li> </ul>	<ul style="list-style-type: none"> <li>• Loose or damaged heat shield.</li> <li>• Loose or damaged exhaust isolators.</li> <li>• Damaged exhaust isolator hanger bracket.</li> <li>• Loose or damaged catalytic converter or muffler.</li> <li>• Exhaust grounded to chassis.</li> </ul>	<ul style="list-style-type: none"> <li>• GO to Exhaust Heat Shields Component Test in this section.</li> <li>• CHECK exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.</li> <li>• INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN bolts to specification or INSTALL new components as necessary.</li> <li>• MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly tap on the muffler, then the catalytic converter. Determine if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.</li> <li>• INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the Exhaust System Alignment in this section.</li> </ul>
<ul style="list-style-type: none"> <li>• Drone or clunk type noise — from bottom of vehicle</li> </ul>	<ul style="list-style-type: none"> <li>• Loose or damaged exhaust isolators.</li> <li>• Exhaust grounded to chassis.</li> </ul>	<ul style="list-style-type: none"> <li>• INSPECT exhaust isolators for wear or damage. INSTALL new isolators as necessary.</li> <li>• INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the Exhaust System Alignment in this section.</li> </ul>

**DIAGNOSIS AND TESTING (Continued)****Symptom Chart (Continued)**

Condition	Possible Sources	Action
<ul style="list-style-type: none"> <li>Whistles, boom, hum or ticking type noise — noise tends to change as engine warms. Noises are often accompanied by exhaust fumes</li> </ul>	<ul style="list-style-type: none"> <li>Punctures in the muffler.</li> <li>Broken, loose or missing exhaust manifold fasteners or gaskets.</li> <li>Loose heated oxygen or catalyst monitor sensor.</li> <li>Exhaust system leak.</li>   <li>Catalytic converter.</li>   <li>Exhaust muffler/resonator drain hole enlarged due to corrosion.</li> </ul>	<ul style="list-style-type: none"> <li>REPAIR as necessary.</li>   <li>INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which would indicate exhaust leakage at that point. To magnify a small leak, have an assistant hold a rag over the tailpipe outlet, while listening for a leak. REPAIR or INSTALL new components as necessary.</li> <li>MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly tap on the muffler, then the catalytic converter. Determine if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.</li> <li><b>NOTE:</b> Check with vehicle on the ground, not on a hoist. CONFIRM drain holes are noise source. INSTALL new components as necessary.</li> </ul>
<ul style="list-style-type: none"> <li>Hissing or rushing noise — high frequency sound. Vehicle performance is unaffected</li> </ul>	<ul style="list-style-type: none"> <li>Exhaust system. Exhaust flow through pipes.</li> </ul>	<ul style="list-style-type: none"> <li>CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly tap on the muffler, then the catalytic converter. Determine if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.</li> </ul>

**DIAGNOSIS AND TESTING (Continued)****Symptom Chart (Continued)**

Condition	Possible Sources	Action
<ul style="list-style-type: none"> <li>Pinging noise — occurs when exhaust system is hot, engine turned off</li> </ul>	<ul style="list-style-type: none"> <li>Catalytic converter/exhaust system.</li> </ul>	<ul style="list-style-type: none"> <li>Cool down pinging is the exhaust system expanding and contracting during heating and cooling. Condition is normal.</li> </ul>
<ul style="list-style-type: none"> <li>Vibration — occurs at idle and at low speeds. Also accompanied by clunk or buzz type noise</li> </ul>	<ul style="list-style-type: none"> <li>Loose or damage exhaust isolator.</li> <li>Loose or damaged exhaust isolator hanger brackets.</li> <li>Damper broken or out of position if equipped.</li> <li>Exhaust system grounded to chassis.</li> </ul>	<ul style="list-style-type: none"> <li>INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.</li> <li>INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary.</li> <li>CHECK for the correct damper orientation in this section. RELOCATE to correct position and tighten nuts to specification. INSPECT for missing or damaged damper. INSTALL new components as necessary.</li> <li>CARRY OUT the Exhaust System Alignment in this section.</li> </ul>
<ul style="list-style-type: none"> <li>Vehicle has low or no power — vehicle performance complaint</li> </ul>	<ul style="list-style-type: none"> <li>Exhaust pipe pinched or crushed.</li> <li>Damaged catalytic converter.</li> <li>Loose obstruction in exhaust.</li> <li>Restricted exhaust (possible frozen condensate in muffler).</li> </ul>	<ul style="list-style-type: none"> <li>GO to Pinpoint Test A to test for restricted exhaust.</li> <li>CHECK drain holes for foreign material. PARK the vehicle inside to thaw. TEST vehicle for normal operation. If concern is still present, GO to Pinpoint Test A.</li> </ul>
<ul style="list-style-type: none"> <li>Burning smell — usually occurs at idle, with possible traces of smoke</li> </ul>	<ul style="list-style-type: none"> <li>Foreign material caught in exhaust system.</li> <li>Missing heat shields.</li> </ul>	<ul style="list-style-type: none"> <li>INSPECT the exhaust system for foreign material or missing heat shields. REPAIR or INSTALL new components as necessary.</li> </ul>
<ul style="list-style-type: none"> <li>Odor — described as a sulfur or rotten egg smell</li> </ul>	<ul style="list-style-type: none"> <li>Catalytic converter.</li> <li>Rich fuel conditions.</li> <li>Miss-fire conditions.</li> <li>Excessive sulfur content in fuel.</li> </ul>	<ul style="list-style-type: none"> <li>At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE customer, no repair required.</li> <li>REFER to the <a href="#">Powertrain Control/Emissions Diagnosis (PC/ED) manual</a>.</li> </ul>
<ul style="list-style-type: none"> <li>Visible rust on surface of exhaust pipes</li> </ul>	<ul style="list-style-type: none"> <li>Catalytic converter/exhaust system.</li> </ul>	<ul style="list-style-type: none"> <li>Surface rust is a characteristic of materials used on exhaust system. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, condition is normal.</li> </ul>

## DIAGNOSIS AND TESTING (Continued)

### Pinpoint Test

**NOTE:** The vehicle can have a lack/loss of power, odor, a noise or a “no start” concern. These concerns may be related to the exhaust system. Carry out the following test, if no trouble codes were stored. This test is for diagnosing the source for these conditions.

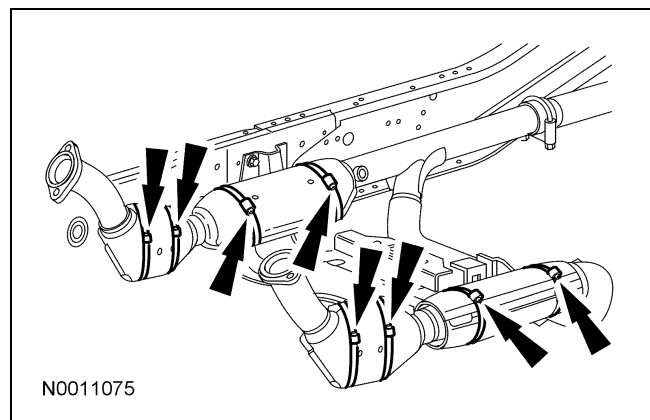
#### PINPOINT TEST A: RESTRICTED EXHAUST SYSTEM TEST

Test Step		Result / Action to Take
<b>A1</b>	<b>EXHAUST SYSTEM INSPECTION</b> <ul style="list-style-type: none"> <li>Inspect the exhaust system for damage or deterioration. Look for cracks, punctures, leaks, loose connections, dents or unusual bending.</li> <li><b>Is the exhaust system OK?</b></li> </ul>	<p><b>Yes</b> GO to <b>A2</b>.</p> <p><b>No</b> REPAIR or INSTALL any damaged or deteriorated exhaust components. Test the system for normal operation.</p>
<b>A2</b>	<b>BACK PRESSURE TEST</b> <ul style="list-style-type: none"> <li>Position vehicle on a hoist. Refer to Section 100-02.</li> <li>Connect a tachometer.</li> <li>Using the special tool, remove the upstream heated oxygen sensor (HO2S).</li> <li>Install the back pressure gauge.</li> <li>Start the engine and gradually increase the engine speed to 2,000 rpm with the transmission in NEUTRAL.</li> <li><b>Is the back pressure greater than 27.6 kPa (4 psi)?</b></li> </ul>	<p><b>Yes</b> GO to <b>A3</b>.</p> <p><b>No</b> No indications of a restriction have been detected. CONDUCT a diagnosis on other suspect systems. CLEAR the DTCs.</p>
<b>A3</b>	<b>BACK PRESSURE TEST — CATALYTIC CONVERTER(S) ON, MUFFLER(S) OFF</b> <ul style="list-style-type: none"> <li>Turn the engine OFF.</li> <li>Disconnect the muffler assembly from the catalytic converter.</li> <li>Repeat the back pressure test.</li> <li><b>Is the back pressure greater than 27 kPa (4 psi)?</b></li> </ul>	<p><b>Yes</b> The restriction is in the catalytic converter. INSTALL a new catalytic converter. INSPECT the muffler to be sure the catalytic converter foreign material has not entered the muffler. CLEAR the DTCs. TEST the system for normal operation.</p> <p><b>No</b> The restriction is in the muffler assembly. INSTALL a new muffler. CLEAR the DTCs. TEST the system for normal operation.</p>

### Component Tests

#### Exhaust Heat Shields

- With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
- Inspect the exhaust system for loose or missing heat shields or foreign material trapped between the heat shields and the exhaust system components.



- If any heat shields are loose, install worm gear clamps.
  - Use one of the following clamps:  
FOTZ-5A231-A or W705949-S300.
  - Trim off the excess ear of the worm clamp.

**DIAGNOSIS AND TESTING (Continued)**

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- Tighten to 7 Nm (62 lb-in).
4. If the heat shields are missing, install new heat shields or exhaust system components as necessary.
  5. If a rattle, noise or buzz condition persists, install a new heat shield.
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