Diversified Environmental Catalysts

OBDII CONVERTER BASICS

Just replacing the converter is like putting a Band-Aid on when you need stitches.

ADDRESSING NOx ISSUES

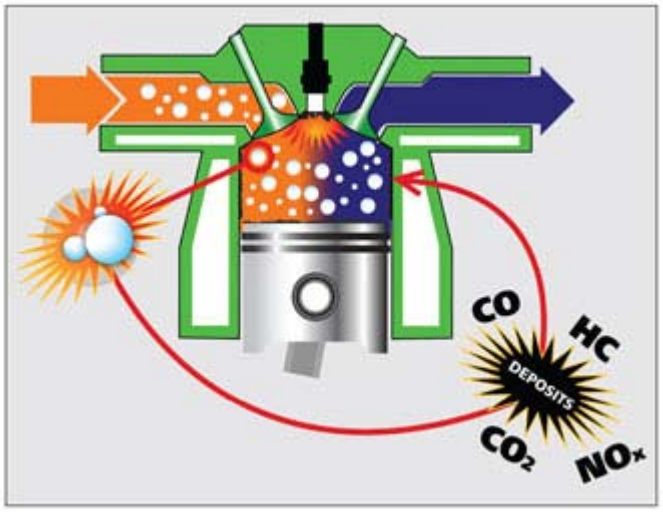
NOx - HighNOx readings are a clear sign of performance issues somewhere in the system. The real questions are:

Where? and Why?

Among the potential causes of high NOx readings are:

- **Misfire condition**
- **Malfunctioning or improperly adjusted EGR valve**
- **Failed O2 sensor**
- **Leak in exhaust tubing upstream of the converter**
- **Excessive carbon deposits in the combustion chamber**
- **Improper spark advance**
- **Blocked coolant passage**
- **Overly lean AFR**
- **Damaged cold air duct**
- **Failed or malfunctioning catalytic converter**
- **Corroded or damaged engine sensor electrical connections**

NOx can be formed by many component failures and system malfunctions – anything that allows the combustion chamber temperatures to exceed 2,300 degrees Fahrenheit. For example, if the cooling system is using pure water, it will absorb combustion heat and boil rapidly, leaving an air pocket around the combustion chamber. The air pocket will become a hot spot, allowing for combustion chamber temperatures to rise. Equally bad is 100% antifreeze, which forms a blanket around the combustion chamber, keeping heat in and allowing the combustion chamber temperature to rise. Rust surrounding the cooling jacket surface will create the same blanket around the combustion chamber. Poor flow through the radiator (as a result of a blockage, poor circulation, a partially closed thermostat, or limited flow from the water pump), will prevent the high temperatures from escaping through the cooling system.



Incomplete combustion illustrating the formation of HC, CO and NOx.

EXHAUST RELATED ERROR CODES

There are 711 possible P0 generic DTC error codes. Only 7 of the 711 codes are exhaust related.

P0401: Insufficient EGR Flow

P0402: Exhaust Gas Recirculation (EGR) Excessive Flow Detected

P0410: Secondary Air Injection System Malfunction

P0420: Catalyst System Efficiency Below Threshold (Bank 1)

P0421: Warm-Up Catalyst Efficiency Below Threshold (Bank 1)

P0430: Catalyst System Efficiency Below Threshold (Bank 2)

P0431: Warm-Up Catalyst Efficiency Below Threshold (Bank 2)

P0420 CODE CATALYTIC CONVERTER FAILURE DIAGNOSTIC

It's important to remember that a P0420 code does not necessarily mean that the catalytic converter is malfunctioning; it means that the unit is not able to function properly. Remember that the catalytic converter is at the very end of the emission diagnostic system, and a number of things can go wrong upstream of the converter that can cause a P0420 (or P0430) MIL light illumination.

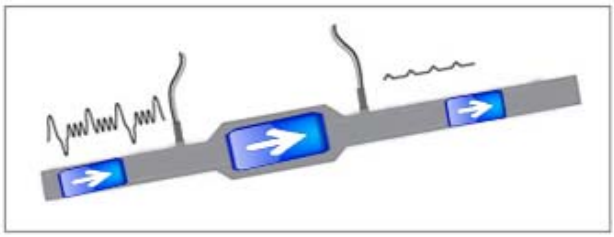
CUSTOMER FEEDBACK

Ask the customer questions about any drivability/performance issues they may have had, any recent repairs or tune-up work performed, if the check engine light was reset and, if so, if the codes were recorded in previous repair orders.

Do not rely on scan tool data alone. In most applications, the customer will have the check engine light reset prior to repair. If the original cause of converter failure is intermittent, only the catalyst failure code may show up (masking the original reason for converter failure).

VEHICLE TEST

- **If possible, test-drive the vehicle and note any drivability issues that may indicate fuel or spark delivery problems such as hesitation, stumbling, spark knock, or signs of misfire.**
- **Idle smoothness. Check for any signs of surging or roughness, indicating misFire. or improper fuel delivery.**
- **Check the tailpipe, particularly immediately following start-up, for any smoke indicating too rich AFR (black smoke), water/antifreeze (white smoke), or oil (blue smoke).**
- **Listen to engine carefully for any signs of vacuum or exhaust manifold leaks.**
- **Inspect intake system for signs of oil indicating excessive blow-by or cracks that may cause leaks.**
- **Inspect spark plugs/wires and air filter.**
- **Scan tool test.**
- **Do not reset MIL light!!**
- **Read the OBDII readiness tests to insure all tests have been completed. If the tests have not been completed, chances are the MIL was recently reset, possibly hiding intermittent problems.**
- **Read trouble codes (if any) and inspect as necessary.**
- **Read pending trouble codes (if any) and inspect as necessary.**



During normal operation, the front O2 sensor shows high activity, while the rear is fairly flat.

• With engine running and at operating temperature, read scan data list. This is typically a table listing all available sensors and outputs.

• Look at Long Term Fuel Trims (LTFT). These show the amount (in %) the computer is modifying fuel delivery, based on the O2 sensor feedback. Positive numbers indicate the computer is adding fuel, negative numbers indicate the computer is removing fuel. Large positive numbers (>10%) should be investigated further as they indicate the computer is adding more fuel than originally designed.

• Look at O2 sensor output signals. Sensor 1 is before the converter, Sensor 2 is behind the converter, Bank 1 and 2 are typically used in V-configurations where Bank 1 is on the side that Cylinder 1 is located. Some inline 6 engines have Bank 1 as Cylinders 1-3 and Bank 2 as Cylinders 4-6. The sensors are usually abbreviated as O2S1B1 (O2 Sensor 1, Bank 1).

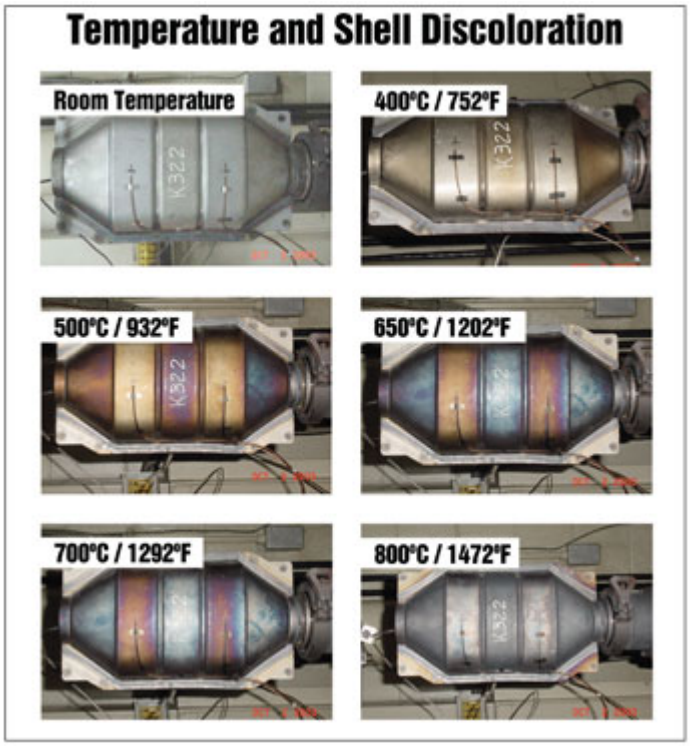
• Sensor 1 output should be very active and oscillate rapidly from approximately 0 to less than 1 volt. If the signal tends to show high voltage with little fluctuation, excessive un-burnt fuel is reaching the sensor. If Sensor 1 shows low or no voltage, the sensor could be defective, or there might be an exhaust leak in front or immediately behind the sensor, or there could be a lack of fuel delivered to the combustion chamber. If the sensor does not respond to a rapid accelerator kick down, chances are the sensor is defective. If it does respond, an exhaust leak or lack of fuel is indicated. (The preceding test must be done after the engine and exhaust system has been allowed to fully heat up.)

• Sensor 2 should show a fairly steady signal. It is not critical what the signal is, only that it does not oscillate as frequently as the front. If the signal is above 250mV, the sensor is fine. If it is below, check for activity by rapid accelerator kick-down or by raising the engine speed to approximately 2000 rpm. Any movement indicates the sensor is fine.

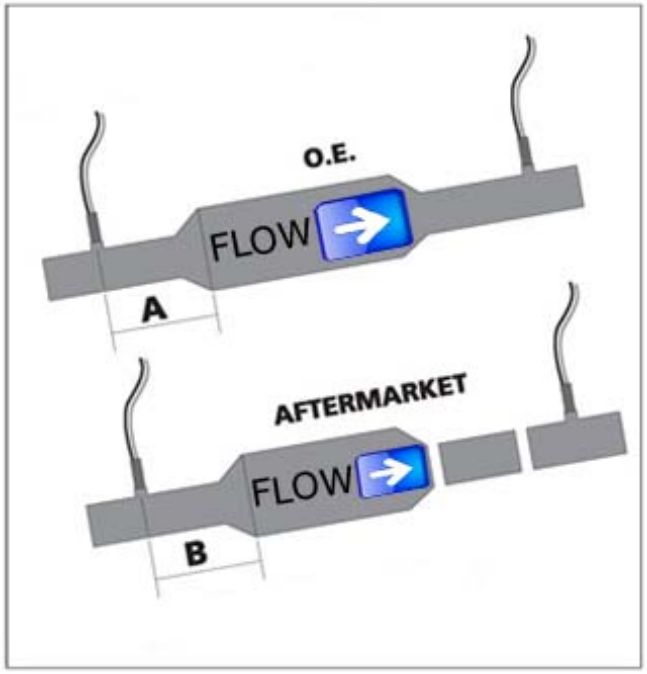
COMPONENT INSPECTION

Inspect the exhaust for any obvious signs of damage including:

- **Physical damage to the converter housing.**
- **O2 sensor wiring to insure good contact at the connectors and that no wires are burnt.**
- **Missing/cracked/loose internal substrate. In addition to above, any of the below indicate the converter has been damaged due to operating conditions outside of the converter "design window". If no other cause of converter failure has been established, any of the below conditions should be noted in the customer's file for future reference.**
- **Severe discoloration indicating excessive temperature.**
- **Excessive build-up of carbon soot or oil on the inside of the converter and/or connecting pipe.**
- **Melted substrate.**



Catalytic Converter shell coloration is a good indicator of Converter Efficiency and Light-Off. Converter Efficiency depends on factors including: exhaust gas composition and temperatures. Converter internal catalytic reactions begin to occur (this start-up phase is known as Light-Off) at exhaust gas temperatures which can vary from about 400°C and reach up to 800°C and higher, depending on various conditions. Note that high operation temperatures should be avoided in order to prevent degradation of the converter. ***It should be further noted that improperly tuned engines can produce exhaust gases and temperatures that will not be able to trigger Converter Light-Off.***



In order to ensure converter light-off, the front of the replacement converter should be installed as close to the OEM position as possible.

CAUSES OF CATALYTIC CONVERTER FAILURE

Excessive heat damage. Typically caused by excessive fuel entering the exhaust, some common causes are:

- **Defective front O2 sensor(s)**
- **Fuel injector leak down**
- **Intake leak**
- **Exhaust leak**
- **Throttle Position Sensor (TPS)**
- **Coolant Temperature Sensor**
- **Ignition misFire. (spark plugs/coil packs/plug wires)**
- **Mass Air Flow Meter (MAF)**
- **Manifold Air Pressure Sensor (MAP)**

Although dif/cult to detect in most instances, the following are the more common types of contaminants that will affect converter and O2 sensor performance:

- **Silicone – Found in most gasket sealants, unless marked "O2 sensor safe", as well as in some brands of antifreeze.**
- **Sulfur – Reduces catalytic activity by coating catalyst and reduces O2 sensor activity. Found in most gasoline, but usually in higher quantity in lower quality/off-brand gasoline.**
- **Oil/Transmission Fluid.**

CONCLUSION

The catalytic converter has been designed to last the life of the vehicle. Catalyst failure indicates engine or engine sensor problems, which must be corrected before catalyst replacement. Failure to properly diagnose converter failure modes and repair of associated components will likely lead to early failure of the new converter. It is like putting a Band-Aid on when you need stitches.