P2097: POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

OVERVIEW

Severity	:	High
DIY Difficulty Level	:	Intermediate
Repair Cost	:	**$80-$380**
Can I Still Drive?	:	**Yes**

What Does The P2097 Code Mean?

Anytime that I come across a trouble code P2097, I know means that the powertrain control module (PCM) has detected a signal voltage input from the downstream (post catalyst) oxygen (O2) sensor for engine bank one that indicates the oxygen particle content is too low. Bank 1 is the engine bank that contains the number one cylinder.

The O2 sensor consists of a zirconium dioxide sensing element enclosed within a vented steel housing. Platinum electrodes are used to connect the sensing element to wire leads in the O2 sensor wiring harness. The O2 sensor wiring harness is connected to the PCM via the controller area network. The O2 sensor provides the PCM with real-time data pertaining to the percentage of oxygen particles in the engine exhaust as compared to the oxygen content of ambient air.

Spent engine exhaust gases are pushed through the exhaust manifold, into the exhaust pipe, and through the catalytic converter. Afterward, they pass over the downstream O2 sensor. Exhaust gases flow through vent holes in the steel housing and across the sensing element. Outside air is drawn into a chamber in the middle of the sensor, through the wire lead cavities. In the chamber, ambient air is heated, forcing the oxygen ions to produce (energy) voltage.

Variations between the concentration of oxygen molecules in ambient air (drawn into the O2 sensor) and the concentration of oxygen ions in the exhaust cause the voltage to fluctuate. These fluctuations cause the oxygen ions inside the O2 sensor to bounce from one platinum layer to the

other, very rapidly and repeatedly.

Changes in voltage occur as the surging oxygen ions move between platinum layers. The PCM recognizes these changes in voltage as variations in exhaust oxygen concentration. These variations reflect whether the engine is running lean (too little fuel) or rich (too much fuel). The voltage signal output from the O2 sensor is lower when more oxygen is present in the exhaust (lean condition). The voltage signal output is higher when less oxygen is present in the exhaust (rich condition). This data is used by the PCM to calculate fuel delivery strategy and ignition timing, among other things.

Once the PCM enters closed loop operation, if the downstream O2 sensor circuit input readings reflect too few oxygen molecules in the exhaust, a P2097 code will be stored and a malfunction indicator lamp may be illuminated.

What Are The Symptoms Of The P2097 Code?

Symptoms of a P2097 code may include:

- Decreased fuel efficiency
- A lack of general engine performance
- Other related diagnostic trouble codes may be stored
- Service engine soon lamp illumination

What Are The Potential Causes Of The P2097 Code?

Possible causes for this engine code include:

- Faulty catalytic converter
- A faulty mass air flow or manifold air pressure sensor
- Defective O2 sensor/s
- Burnt, chafed, broken, or disconnected wiring and/or connectors
- Engine exhaust leaks

How Can You Fix The P2097 Code?

Check The Technical Service Bulletins (TSB)

A good starting point is always to check for technical service bulletins (TSB) for your particular vehicle. Your issue may be a known issue with a known fix put out by the manufacturer and can save you time and money during diagnosis.

A diagnostic scanner, digital volt ohmmeter (DVOM), and a vehicle service manual will be helpful in diagnosing a code P2097. All Data (DIY) is also an excellent source for system wiring diagrams and other application specific information.

The engine must be running efficiently before attempting to diagnosis this code. Misfire codes, throttle position sensor codes, manifold air pressure code, and mass air flow sensor codes should be addressed before attempting to diagnose a code P2097.

Visually Inspect The System Wiring Harnesses And Connectors

Start with a visual inspection of system wiring harnesses and connectors. With a P2097, I would pay particular attention to harnesses that are routed near hot exhaust pipes and manifolds, as well as those that are routed near sharp (cylinder head) edges.

Connect the scanner to the diagnostic port and retrieve all stored trouble codes and freeze frame data. Write this information down. It may be helpful if this proves to be an intermittent code. Intermittent codes can be harder to diagnose.

If the P2097 is immediately reset, start the engine and allow it to reach normal operating temperature. Let it idle (with the transmission in neutral or park). Use the scanner to observe O2 sensor input data. Narrowing the scope of the data stream to include only pertinent data will get you faster data response. Observe the downstream O2 sensor signal. If the engine is running efficiently, downstream O2 sensor data should reach a mid-line and settle there.

Check Resistance Of The O2 Sensor

The DVOM can be used to check resistance of the O2 sensor in question, as well as voltage and ground signals for the O2 sensor circuit. Disconnect related controllers before attempting to test system circuit resistance with the DVOM.

Additional diagnostic notes:

- The downstream O2 sensor should not cycle as frequently as upstream sensors (once the PCM has entered closed loop operation). If the downstream sensor continues to cycle as frequently as the upstream sensor, after the engine is warmed up and the PCM has entered closed loop operation, suspect a defective catalytic converter
- When catalytic converter replacement is necessary, consider an OEM quality component. Remanufactured or substandard replacement converters usually fail quickly and repeatedly

Severity Description

A P2097 code means that the post catalytic converter O2 sensor has detected a rich exhaust condition. Fuel efficiency may be compromised and the code should be addressed as severe.

Reference Sources

ENGINE CONTROL SYSTEM [GASOLINE ENGINE (V-6)] SERVICE MANUAL for P2097 - Pages 809-813.