Heated Oxygen Sensor (HO2S) Monitor

The HO2S monitor is an on-board strategy designed to monitor the HO2S sensors for concerns or deterioration which can affect emissions. The fuel control or stream 1 HO2S are checked for correct output voltage and response rate. Response rate is the time it takes to switch from lean to rich or rich to lean. Stream 2 HO2S sensors are used for catalyst monitoring, and stream 3 HO2S sensors used for fore-aft oxygen sensor (FAOS) control are also monitored for correct output voltage. Input is required from the camshaft position (CMP), crankshaft position (CKP), engine coolant temperature (ECT) or cylinder head temperature (CHT), fuel rail pressure (FRP), fuel tank pressure (FTP), intake air temperature (IAT), mass air flow (MAF), manifold absolute pressure (MAP), and throttle position (TP) sensors and the vehicle speed sensor (VSS) to activate the HO2S monitor. The fuel system monitor and misfire detection monitor must also have completed successfully before the HO2S monitor is enabled.

1. The HO2S senses the oxygen content in the exhaust flow and outputs a voltage between 0 and 1.0 volt. Lean of stoichiometric, air/fuel ratio of approximately 14.7:1, the HO2S generates a voltage between 0 and 0.45 volt. Rich of stoichiometric, the HO2S generates a voltage between 0.45 and 1.0 volt. The HO2S monitor evaluates the stream 1 (fuel control), stream 2 (catalyst monitor), and stream 3 (FAOS control) HO2S for correct function.

2. The time between HO2S switches is monitored after vehicle startup and during closed loop fuel conditions. Excessive time between switches or no switches since startup indicates a concern. Since lack of switching concerns can be caused by HO2S sensor concerns or by shifts in the fuel system, DTCs are stored that provide additional information for the lack of switching concern. Different DTCs indicate whether the sensor always indicates lean/disconnected (P2195 or P2197), or always indicates rich (P2196 or P2198). The HO2S signal is also monitored for high voltage, in excess of 1.1 volts and stores a unique DTC (P0132 or P0152). An over-voltage condition is caused by a HO2S heater or battery power short to the HO2S signal line.

A functional test of the rear HO2S sensors is done during normal vehicle operation. The peak rich and lean voltages are continuously monitored. Voltages that exceed the calibrated rich and lean thresholds indicate a functional sensor. If the voltages have not exceeded the thresholds after a long period of vehicle operation, the air/fuel ratio may be forced rich or lean in an attempt to get the rear sensor to switch. This situation normally occurs only with a green, less than 804.7 km (500 mi), catalyst. If the sensor does not exceed the rich and lean peak thresholds, a concern is indicated. The HO2S signal is also monitored for high voltage, in excess of 1.1 volts and stores a unique DTC (P0138 or P0158). An over-voltage condition is caused by a HO2S heater or battery power short to the HO2S signal line.

3. The MIL is activated after a concern is detected on 2 consecutive drive cycles.

4. Some partial zero emission vehicles (PZEV) use 3 sets of HO2Ss. The front sensors (HO2S11/HO2S21) are the primary fuel control sensors. The next sensors downstream in the exhaust are used to monitor the light-off catalyst (HO2S12/HO2S22). The last sensors downstream in
the exhaust (HO2S13/HO2S23) are used for very long term fuel trim in order to optimize catalyst efficiency (FAOS control). The current PZEV vehicle uses a 4-cylinder engine, so only the Bank 1 DTCs are used.

The HO2S monitor DTCs can be categorized as follows:

- HO2S slow response rate - P0133, P0139, P0153, P0159
- HO2S circuit high voltage - P0132, P0138, P0144, P0152, P0158, P0164
- HO2S heater circuit - P0135, P0141, P0155, P0161, P0147, P0167
- HO2S heater resistance - P0053, P0054, P0055, P0059, P0060
- Downstream HO2S not running in on-demand self-test - P1127
- Swapped HO2S connectors - P0040, P0041
- HO2S lack of switching - P2195, P2196, P2197, P2198
- HO2S lack of switching (sensor indicates lean) - P2270, P2272, P2274, P2276
- HO2S lack of switching (sensor indicates rich) - P2271, P2273, P2275, P2277

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