DTC P2097, P2178, or P2188

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DTC Descriptors

DTC P2097: Post Catalyst Fuel Trim System High Limit Bank 1

DTC P2178: Fuel Trim System Rich at Cruise or Accel

DTC P2188: Fuel Trim System Rich at Idle

Circuit/System Description

The engine control module (ECM) controls the air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. Fuel delivery is controlled differently during Open Loop and Closed Loop. During Open Loop, the ECM determines fuel delivery based on sensor signals without heated oxygen sensor (HO2S) input. During Closed Loop, the ECM adds HO2S inputs to calculate the short and long term fuel trim (FT) adjustments. If the HO2S indicates a lean condition, the fuel trim values will be above 0 percent. If the HO2S indicates a rich condition, the FT values will be below 0 percent. The short term FT values change rapidly in response to the HO2S voltage signals. The long term FT makes coarse adjustments in order to maintain an air/fuel ratio of 14.7:1.

Conditions for Running the DTC

P2097

- DTCs P0030, P0031, P0032, P0053, P0130, P0131, P0132, P0133, P0135, P0137, P0138, P0140, P2231, P2232, P2243, P2251, P2270, P2271, P2297, P2626 are not set.
- The engine speed is between 1,200-2,900 RPM.
- The engine load is between 16-21 percent.
- The engine is in Closed Loop for 3 seconds.
- The DTC runs continuously when the above conditions have been met for 1 second.

P2178

- DTCs P0010, P0011, P0013, P0014, P0030, P0031, P0032, P0053, P0101, P0102, P0103, P0107, P0108, P0117, P0118, P0121, P0122, P0123, P0130, P0131, P0132, P0133, P0135, P0335, P0336, P0338, P0443, P0455, P0458, P0459, P0496, P2088, P2089, P2090, P2091, P2096, P2097, P2176, P2195, P2196, P2243, P2251, P2297, P2626 are not set.
- The engine is running.
- The engine is in Closed Loop for greater than 1 minute.
- The engine coolant temperature is warmer than 60°C (140°F).
- The intake air temperature is equal to or colder than 60°C (140°F).
- The commanded lambda is greater than 0.83.
- The deceleration fuel cut-off (DFCO) is not active.
- The fuel level is greater than 10 percent.
- The mass air flow is equal to or between 6.9-41.7 g/s.

- The engine load is equal to or between 18-80 percent.
- The engine speed is equal to or between 1,200-4,000 RPM.
- The throttle angle is equal to or less than 99.6 percent.
- The DTC runs continuously when the above conditions have been met for 1 second.

P2188

- DTCs P0010, P0011, P0013, P0014, P0030, P0031, P0032, P0053, P0101, P0102, P0103, P0107, P0108, P0117, P0118, P0121, P0122, P0123, P0130, P0131, P0132, P0133, P0135, P0335, P0336, P0338, P0443, P0455, P0458, P0459, P0496, P2088, P2089, P2090, P2091, P2096, P2097, P2176, P2195, P2196, P2243, P2251, P2297, P2626 are not set.
- The engine is running.
- The engine is in Closed Loop.
- The engine coolant temperature is warmer than 60°C (140°F).
- The intake air temperature is equal to or colder than 60°C (140°F).
- The commanded lambda is greater than 0.83.
- The deceleration fuel cut-off (DFCO) is not active.
- The fuel level is greater than 10 percent.
- The mass air flow is equal to or between 1.7-7.8 g/s.
- The engine load is equal to or between 11-45 percent.
- The engine speed is equal to or between 520-1,120 RPM.
- The DTC runs continuously when the above conditions have been met for 1 second.

Conditions for Setting the DTC

P2097

- The post catalyst FT weighted average value is greater than a calibrated value.
- The DTC sets when the above condition is met for 4 seconds continuously, or for 50 seconds cumulatively.

P2178 or P2188

- The long term FT weighted average value is less than a calibrated value at idle, cruise or during acceleration.
- The DTCs set when the above condition is met for 4 seconds continuously, or for 50 seconds cumulatively.

Action Taken When the DTC Sets

DTCs P2097, P2178, and P2188 are Type B DTCs.

Conditions for Clearing the MIL/DTC

DTCs P2097, P2178, and P2188 are Type B DTCs.

Reference Information

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Important: Disregard any transmission symptoms, antilock brake system (ABS) indicators, and traction control system (TCS) indicators until any fuel trim faults are repaired. A fuel trim fault may cause default actions such as harsh shifts and illumination of the ABS/TCS indicators.

1. If any other DTCs are set, perform those diagnostics first.
2. Operate the vehicle within the parameters described in Conditions for Running and Conditions for Setting. The DTC should not set this ignition.
   ⇒ If the DTC sets this ignition, proceed with Circuit/System Testing.

Circuit/System Testing

Important: You must perform the Circuit/System Verification before proceeding with Circuit/System Testing.

Allow the engine to reach operating temperature. With the engine running, observe the Long Term FT parameter with a scan tool. The reading should be between -20 and 0 percent.

⇒ If not within the specified range, inspect for the following:

- With the engine idling and the transmission in the Park or Neutral position, observe the manifold absolute pressure (MAP) sensor parameter. The MAP sensor parameter should be between 19-42 kPa.
  ⇒ If the MAP sensor parameter is not between 19-42 kPa, refer to DTC P0106 or DTC P0107 or P0108.
- With the engine idling, observe the mass air flow (MAF) sensor parameter. The MAF sensor parameter should be between 2-6 g/s at idle.
  ⇒ If the MAF sensor parameter is not between 2-6 g/s at idle, refer to DTC P0100, P0102, or P0103 or DTC P0101.
- Vacuum hoses for splits, kinks, and improper connections
- The air intake duct for being collapsed or restricted
- Leaks in the air induction system between the turbocharger outlet and the throttle body inlet, including the charge air cooler
- The air filter for being dirty or restricted
- Objects blocking the throttle body or MAF Sensor
- Excessive fuel in the crankcase due to leaking fuel injectors
- The evaporative emissions control system for improper operation
- Excessive fuel pressure--Refer to Fuel System Diagnosis.
- Malfunctioning fuel injectors
- Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
- Missing, loose, or leaking exhaust components from the HO2S forward--Refer to Symptoms - Engine Exhaust.
- The HO2S for improper installation and for electrical wires or connectors that may have suffered corrosion, water intrusion, or contacted the exhaust system
- Incorrect terminal tension at electrical connectors
- Loose, corroded, or mislocated electrical ground connections
- A restricted exhaust system--Refer to Symptoms - Engine Exhaust.
- The HO2S signal circuit shorted to voltage
- Malfunctioning engine components--Refer to Symptoms - Engine Mechanical.

Repair Instructions

- Air Cleaner Assembly Replacement

- Air Cleaner Element Replacement
- Air Cleaner Outlet Duct Replacement
- Charge Air Cooler Replacement
- Charge Air Cooler Inlet Pipe Replacement
- Charge Air Cooler Outlet Pipe Replacement
- Direct Fuel Injector Replacement
- Evaporative Emission Canister Replacement
- Evaporative Emission Canister Purge Solenoid Valve Replacement
- Evaporative Emission Canister Vent Solenoid Valve Replacement
- Evaporative Emission Hoses/Pipes Replacement - Canister/Fuel Tank
- Evaporative Emission Hoses/Pipes Replacement - Chassis/Canister
- Evaporative Emission Hoses/Pipes Replacement - Engine/Chassis
- Fuel Feed Pipe Replacement
- Fuel Hose/Pipes Replacement - Chassis
- Fuel Pump Fuel Feed Hose Replacement
- Fuel Pump Module Replacement
- Fuel System Cleaning
- Fuel Tank Draining
- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Manifold Absolute Pressure Sensor Replacement
- Mass Airflow Sensor Replacement
- Throttle Body Assembly Replacement

Repair Verification

Important: After repairs, use the scan tool Fuel Trim Reset function in order to reset the long term fuel trim.

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming, or setup procedures that are required when a component or module is removed or replaced.
3. Turn ON the ignition, with the engine OFF.

   Important: DO NOT clear codes with the engine running. The codes may reset in the same ignition cycle.

4. Clear the DTCs.
5. Turn OFF the ignition for 60 seconds.
6. Start the engine.
7. Duplicate the Conditions for Running the DTC and use the Freeze Frame/Failure Records, if applicable, in order to verify the DTC does not reset. If the DTC resets, or another DTC is present, refer to the Diagnostic Trouble Code (DTC) List - Vehicle and perform the appropriate diagnostic procedure.
8. To verify that the performance of the catalytic converter has not been affected by the condition that set this DTC, perform the Repair Verification for DTC P0420. Refer to DTC P0420.