

Cold Start Emission Reduction Monitor

Overview

The cold start emission reduction monitor is an on board strategy designed for vehicles that meet the low emissions vehicle-II (LEV-II) emissions standards. The monitor works by detecting the lack of catalyst warm up resulting from a failure to apply sufficient cold start emission reduction during a cold start. There are 2 types of monitors:

- cold start emission reduction component monitor
- cold start emission reduction system monitor

Cold Start Emission Reduction Component Monitor

The engine speed monitor and the spark timing monitor are carried out during the cold start emission reduction component monitor. The engine speed monitor checks the average difference between the actual and desired engine speeds. The spark timing monitor compares the average difference between desired and commanded spark to a calibrated threshold.

Engine Speed And Spark Timing Monitor

The system monitor and component monitor share the same entry conditions and monitor flow. During the first 15 seconds of a cold start, the monitor checks the entry conditions, counts time in idle, observes catalyst temperature, calculates the average difference between desired and actual engine speed, and calculates the average difference between desired and commanded spark.

If the expected change in catalyst temperature is large enough, the monitor then begins a waiting period of 300 seconds after engine start. This waiting period allows time to diagnose other components and systems that affect the validity of the test. During this waiting period, there are no constraints on drive cycle and the monitor cannot be disabled without turning OFF the ignition.

If the system monitor result falls below its threshold and all of the component monitor results are below their respective thresholds, the monitor determines if the idle time was sufficient. If the idle time was sufficient the test is considered to be a pass and the monitor is complete. If idle time was not sufficient, the monitor will not make a pass call and does not complete. This prevents tip-ins from resulting in false passes.

Cold Start Engine Speed Monitor Operation:

Once the waiting period is complete, the monitor compares the average difference between desired and commanded spark to a calibrated threshold that is a function of the engine coolant temperature at start. If the difference exceeds the calibrated threshold, a DTC sets.

- DTC: P050A Cold start idle air control system performance
- Monitor execution: Once per driving cycle, during the first 15 seconds of a cold start
- Monitor sequence: None
- Monitoring duration: Data gathering occurs during the first 15 seconds of a cold start. The decision to set P050A is made 300 seconds after start. This delay gives time for other diagnostics (for example, misfire monitor) to determine if another DTC should set instead of P050A.

Engine Speed Monitor Entry Conditions:

- Barometric pressure of 76.2 kPa (22.5 in-Hg) or greater
- Engine coolant temperature at start is between 1.67 C (35 F) and 37.8°C (100°F)
- Catalyst temperature at start is between 1.67 C (35 F) and 51.7°C (125°F)
- Fuel level is above 15%
- Injector cutout torque reduction is inactive
- Power take off (PTO) operation is disabled

Cold Start Spark Timing Monitor Operation:

Once the waiting period is complete, the monitor compares the average difference between desired and commanded spark to a calibrated threshold that is a function of the engine coolant temperature at start. If the difference exceeds the calibrated threshold, a DTC is set.

- DTC: P050B Cold start ignition timing performance
- Monitor execution: Once per driving cycle, during the first 15 seconds of a cold start
- Monitor sequence: None
- Monitoring duration: Data gathering occurs during the first 15 seconds of a cold start. The decision to set P050B is made 300 seconds after start. This delay gives time for other diagnostics (for example, misfire monitor) to determine if another DTC should set instead of P050B.

Spark Timing Monitor Entry Conditions:

- Barometric pressure of 76.2 kPa (22.5 in-Hg) or greater
- Engine coolant temperature at start is between 1.67°C (35°F) and 37.8°C (100°F)
- Catalyst temperature at start is between 1.67°C (35°F) and 51.7°C (125°F)
- Fuel level is above 15%
- Injector cutout torque reduction is inactive
- PTO operation is disabled

Cold Start Variable Cam Timing (VCT) Monitor

If the VCT cam phasing is used during a cold start to improve catalyst heating, the VCT system checks the functionality by monitoring the closed loop cam position error correction. If the correct cam position cannot be maintained and the system has an advance or retard error greater than the malfunction threshold, a cold start emission reduction VCT control malfunction is indicated.

- DTC: P052A Cold start camshaft position timing over-advanced (Bank 1)
- DTC: P052B Cold start camshaft timing over-retarded (Bank 1)
- DTC: P052C Cold start camshaft timing over-advanced (Bank 2)
- DTC: P052D Cold start camshaft timing over-retarded (Bank 2)
- Monitor execution: Continuous
- Monitor sequence: None
- Monitoring duration: 5 seconds

Cold Start Emission Reduction System Monitor

The PCM uses the cold start emission reduction system monitor to calculate the actual catalyst warm up temperature during a cold start. The actual catalyst warm up temperature calculation uses measured engine speed, measured air mass and commanded spark timing inputs to the PCM. The PCM then compares the actual temperature to the expected catalyst temperature. The expected catalyst temperature calculation uses desired engine speed, desired air mass and desired spark timing inputs to the PCM. The difference between the actual and expected temperatures is reflected in a ratio. This ratio is a measure of how much loss of catalyst heating occurred over the period of time and when compared with a calibrated threshold it helps the PCM to determine if the cold start emission reduction system is working correctly. This ratio correlates to tailpipe emissions, and a malfunction indicator lamp (MIL) illuminates and a DTC sets when the calibrated threshold is exceeded. The monitor is disabled if a concern is present in any of the sensors or systems used for expected catalyst temperature model calculation.

Cold Start Emission Reduction System Monitor Operation:

- DTC: P050E Cold start engine exhaust temperature too low
- Monitor execution: Once per driving cycle, during the first 15 seconds of a cold start
- Monitor sequence: None
- Monitoring duration: Data gathering occurs during the first 15 seconds of a cold start. The decision to set P050E is made 300 seconds after start. This delay gives time for other diagnostics (for example, misfire monitor) to determine if another DTC should set instead of P050E.

Cold Start Emission Reduction System Monitor Entry Conditions:

- Barometric pressure is above 74.5 kPa (22 in-Hg)
- Engine coolant temperature at the start of the monitor is between 1.67°C (35°F) and 37.78°C (100°F)
- Catalyst temperature at the start of the monitor is between 1.67°C (35°F) and 51.67°C (125°F)
- Fuel level is above 15%
- Injector cutout torque reduction is inactive
- PTO operation is disabled

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