

## TTCL language:

(e)(10.2.2) (B) Time to Reach Closed-Loop Enable Temperature.

(i) The OBD II system shall detect a malfunction if the ECT sensor does not achieve the stabilized minimum temperature which is needed for the fuel control system to begin closed-loop operation (closed-loop enable temperature) within an EO approved time interval after starting the engine. Closed loop operation shall include the start of stoichiometric or non-stoichiometric operation, whichever occurs first.

This is a big question. If you can use non-stoich closed loop operation, you can shoot for very short times. If you have to wait for stoich operations ( about 50 deg F for us), then this test starts to look like a thermostat test with a lower threshold and it is difficult to meet the times below.

(ii) The time interval shall be a function of starting ECT and/or a function of intake air temperature and, except as provided below in section (e)(10.2.2)(B)(iii), may not exceed:

b. two minutes for engine start temperatures up to 15 degrees Fahrenheit (or 8.3 degrees Celsius) below the closed-loop enable temperature for idle conditions and five minutes for engine start temperatures between 15 and 35 degrees Fahrenheit (or between 8.3 and 19.4 degrees Celsius) below the closed-loop enable temperature for idle conditions for all 2006 through 2008 model year Low Emission Vehicle II applications and all 2009 and subsequent model year vehicles.

This is another big question. The ECT used to determine closed loop/stoich closed loop is not a single value. It is a function of rpm and load. A cold engine at light load can tolerate running at stoich but it needs to be warmer as the load goes up. So what temperature do you pick? You idle values in the calibration will have the coldest ECT values and would therefore give you the worst case time bogey.

(iii) Executive Officer approval of the time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times. The Executive Officer shall allow longer time intervals upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that the vehicle requires a longer time to warm up under normal conditions.

(iv) The Executive Officer shall exempt manufacturers from the requirement of section (e)(10.2.2)(B) if the manufacturer does not utilize ECT to enable closed loop fuel control or the manufacturer has demonstrated that a component monitoring strategy meeting the requirements of (e) (15) or (f) (15) would be equally as effective and timely in detecting faults that would prevent closed loop operation.

This monitor forces manufacturers to set a DTC that is not helpful in allowing a service technician to fix a vehicle. The "likely cause of a malfunction" should be attributed to a faulty component. This allows a manufacturer to use component diagnostics to meet this requirement.

(10.3.2) (B) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(10.2.2)(B) in accordance with section (d)(3.1). Additionally, except as provided for in section (e)(10.3.2)(D), monitoring for malfunctions identified in section (e)(10.2.2)(B) shall be conducted once per driving cycle on every driving cycle in which the ECT sensor indicates a temperature lower than the

closed loop enable temperature at engine start (i.e., all engine start temperatures greater than the ECT sensor out of range low temperature and less than the closed loop enable temperature).

(10.3.2) (D) Manufacturers may suspend or delay the time to reach closed loop enable temperature diagnostic if the vehicle is subjected to conditions which could lead to false diagnosis (e.g., vehicle operation at idle for more than 50 to 75 percent of the warm-up time). Monitoring of the time to reach closed loop enable temperature is not required at engine start temperatures below 20 degrees Fahrenheit.

Unlimited low temperature enablement makes the times in the reg unattainable. Data collection to calibrate the monitor at very cold temps is very difficult to obtain (e.g. - 40 deg F). A reasonable low temp limit needs to be specified. The reg generally allows for 20 deg F. Note, the advantage of a component monitor is that CCM works even at very cold temps.

(e)(6.2.4) The OBD II system shall detect a malfunction whenever the fuel control system fails to enter closed-loop operation (if employed) within an Executive Officer approved time interval or the manufacturer has demonstrated that a component monitoring strategy meeting the requirements of (e) (15) or (f) (15) would be equally as effective and timely in detecting faults that would prevent closed loop operation.

(e)(6.2.6) For engines that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid vehicle or a vehicle with a start-stop system with engine shutoff at idle) on 2019 and subsequent model year vehicles, the OBD II system shall detect whenever the fuel control system fails to enter closed-loop operation (stoichiometric or non-stoichiometric operation, whichever occurs first) within an Executive Officer-approved time interval after an engine restart or the manufacturer has demonstrated that a component monitoring strategy meeting the requirements of (e) (15) or (f) (15) would be equally as effective and timely in detecting faults that would prevent closed loop operation. Executive Officer approval of the time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(e)(7.2.2)(E) For 2019 and subsequent model year vehicles, the OBD II system shall detect a malfunction of the oxygen sensor when a sensor failure or deterioration causes the fuel system (e.g., fuel control) to stop using that sensor as a feedback input (e.g., causes default or open-loop operation).