Evaporative Emission (EVAP) Leak Check Monitor

The EVAP leak check monitor is an on-board strategy designed to detect a leak from a hole (opening) equal to or greater than 0.508 mm (0.020 inch) in the enhanced EVAP system. The correct function of the individual components of the enhanced EVAP system, as well as its ability to flow fuel vapor to the engine, is also examined. The EVAP leak check monitor relies on the individual components of the enhanced EVAP system to either allow a natural vacuum to occur in the fuel tank or apply engine vacuum to the fuel tank and then seal the entire enhanced EVAP system from the atmosphere. The fuel tank pressure is then monitored to determine the total vacuum lost (bleed-up) for a calibrated period of time. Inputs from the engine coolant temperature (ECT) sensor or cylinder head temperature (CHT) sensor, intake air temperature (IAT) sensor, mass air flow (MAF) sensor, vehicle speed, fuel level input (FLI) and fuel tank pressure (FTP) sensor are required to enable the EVAP leak check monitor.

During the EVAP leak check monitor repair verification drive cycle, clearing the continuous diagnostic trouble codes (DTCs) and resetting the emission monitors information in the powertrain control module (PCM) bypasses the minimum soak time required to complete the monitor. The EVAP leak check monitor does not run if the ignition is turned off after clearing the continuous DTCs and resetting the emission monitors information in the PCM. The EVAP leak check monitor does not run if a MAF sensor concern is present. The EVAP leak check monitor does not initiate until the heated oxygen sensor (HO2S) monitor is complete.

If the vapor generation is high on some vehicle enhanced EVAP systems, where the monitor does not pass, the result is treated as a no test. Therefore, the test is complete for the day.

Some vehicle applications have an engine off natural vacuum (EONV) check as part of the EVAP leak check monitor.

Engine On EVAP Leak Check Monitor

The engine on EVAP leak check monitor is executed by the individual components of the enhanced EVAP system as follows:

1. The EVAP canister purge valve is used to control the flow of vacuum from the engine and create a target vacuum on the fuel tank.

2. The canister vent (CV) solenoid is used to seal the EVAP system from the atmosphere. It is closed by the PCM (100% duty cycle) to allow the EVAP canister purge valve to obtain the target vacuum on the fuel tank.

3. The FTP sensor is used by the engine on EVAP leak check monitor to determine if the target vacuum necessary to carry out the leak check on the fuel tank is reached. Some vehicle applications with the engine on EVAP leak check monitor use a remote in-line FTP sensor. Once the target vacuum on the fuel tank is achieved, the change in fuel tank vacuum over a calibrated period of time determines if a leak exists.

4. If the initial target vacuum cannot be reached, DTC P0455 (gross leak detected) is set. The engine on EVAP leak check monitor aborts and does not continue with the leak check portion of the test.

   For some vehicle applications, if the initial target vacuum cannot be reached after a refueling event and the purge vapor flow is excessive, DTC P0457 (fuel cap off) is set.

   If the initial target vacuum is exceeded, a system flow concern exists and DTC P1450 (unable to bleed-up fuel tank vacuum) is set. The engine on EVAP leak check monitor aborts and does not continue with the leak check portion of the test.

   If the vacuum increase is quicker than expected, a blocked fuel vapor tube is suspected and if confirmed after an intrusive test, DTC P144A is set.

   If the target vacuum is obtained on the fuel tank, the change in the fuel tank vacuum (bleed-up) is calculated for a calibrated period of time. The calculated change in fuel tank vacuum is compared to a calibrated threshold for a leak from a hole (opening) of 1.016 mm (0.040 inch) in the enhanced EVAP

system. If the calculated bleed-up is less than the calibrated threshold, the enhanced EVAP system passes. If the calibrated bleed-up exceeds the calibrated threshold, the test aborts. The test can be repeated up to three times.

If the bleed-up threshold is still being exceeded after three tests, a vapor generation test must be carried out before DTC P0442 (small leak detected) is set. This is accomplished by returning the enhanced EVAP system to atmospheric pressure by closing the EVAP canister purge valve and opening the CV solenoid. Once the FTP sensor observes the fuel tank is at atmospheric pressure, the CV solenoid closes and seals the enhanced EVAP system.

The fuel tank pressure build-up over a calibrated period of time is compared to a calibrated threshold for pressure build-up due to vapor generation.

If the fuel tank pressure build-up exceeds the threshold, the leak test results are invalid due to vapor generation. The engine on EVAP leak check monitor attempts to repeat the test again.

If the fuel tank pressure build-up does not exceed the threshold, the leak test results are valid and DTC P0442 is set.

5. If the 1.016 mm (0.40 inch) test passes, the test time is extended to allow the 0.508 mm (0.020 inch) test to run.

   The calculated change in fuel vacuum over the extended time is compared to a calibrated threshold for a leak from a 0.508 mm (0.020 inch) hole (opening).

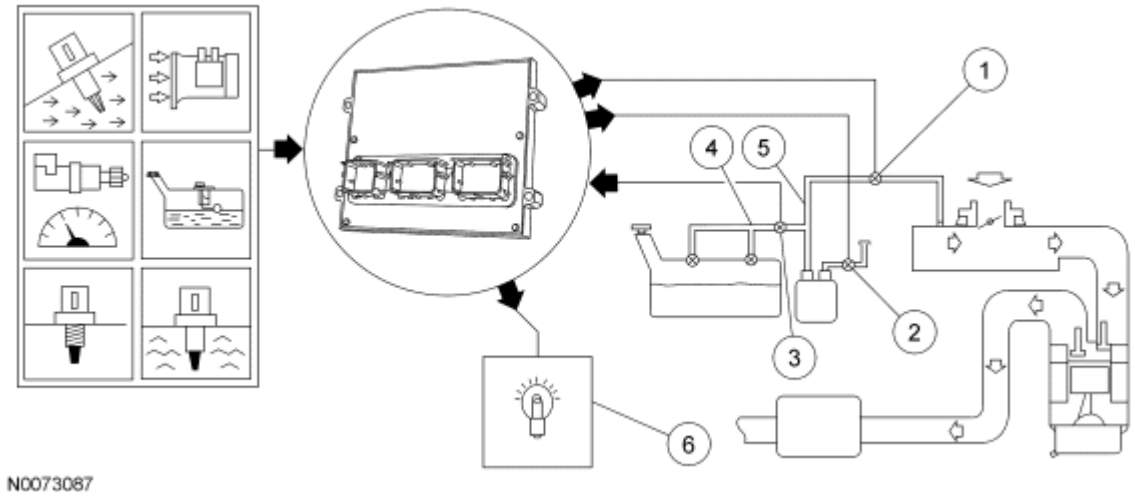
   If the calculated bleed-up exceeds the calibrated threshold, the vapor generation test is run. If the vapor generation test passes (no vapor generation), an internal flag is set in the PCM to run a 0.508 mm (0.020 inch) test at idle (vehicle stopped).

   On the next start following a long engine off period, the enhanced EVAP system is sealed and evacuated for the first 10 minutes of operation.

   If the appropriate conditions are met, a 0.508 mm (0.020 inch) leak check is conducted at idle.

   If the test at idle fails, a DTC P0456 is set. There is no vapor generation test with the idle test.

6. The malfunction indicator lamp (MIL) is activated for DTCs P0442, P0455, P0456, P0457, and P1450 (or P0446) after 2 occurrences of the same concern and for DTC P144A after a sufficient number of completions. The MIL can also be activated for any enhanced EVAP system component DTCs in the same manner. The enhanced EVAP system component DTCs P0443, P0452, P0453, and P1451 are tested as part of the CCM.



Evaporative Emission (EVAP) Leak Check Monitor

Engine Off Natural Vacuum (EONV) EVAP Leak Check Monitor

The EONV EVAP leak check monitor is executed during ignition off, after the engine on EVAP leak check monitor is completed. The EONV EVAP leak check monitor determines a leak is present when the naturally occurring change in fuel tank pressure or vacuum does not exceed a calibrated limit during a calibrated amount

of time. A separate, low power consuming, microprocessor in the PCM manages the EONV leak check. The engine off EVAP leak check monitor is executed by the individual components of the enhanced EVAP system as follows:

1. The EVAP canister purge valve is normally closed at ignition off.

2. The normally open canister vent (CV) remains open for a calibrated amount of time to allow the fuel tank pressure to stabilize with the atmosphere. During this time period the FTP sensor is monitored for an increase in pressure. If pressure remains below a calibrated limit the CV is closed by the PCM (100% duty cycle) and seals the EVAP system from the atmosphere.

3. The FTP sensor is used by the EONV EVAP leak check monitor to determine if the target pressure or vacuum necessary to complete the EONV EVAP leak check monitor on the fuel tank is reached. Some vehicle applications with the EONV EVAP leak check monitor use a remote in-line FTP sensor. If the target pressure or vacuum on the fuel tank is achieved within the calibrated amount of time, the test is complete.

4. The EONV EVAP leak check monitor uses the naturally occurring change in fuel tank pressure as a means to detect a leak in the EVAP system. At ignition off, a target pressure and vacuum is determined by the PCM. These target values are based on the fuel level and the ambient temperature at ignition off. As the fuel tank temperature increases, the pressure in the tank increases and as the temperature decreases a vacuum develops. If a leak is present in the EVAP system the fuel tank pressure or vacuum does not exceed the target value during the testing time period. The EONV EVAP leak check monitor begins at ignition off.

   After ignition off the normally open canister vent (CV) remains open for a calibrated amount of time to allow the fuel tank pressure to stabilize with the atmosphere. During this time period the FTP sensor is monitored for an increase in pressure. If pressure remains below a calibrated limit the CV is closed by the PCM (100% duty cycle) and seals the EVAP system from the atmosphere.

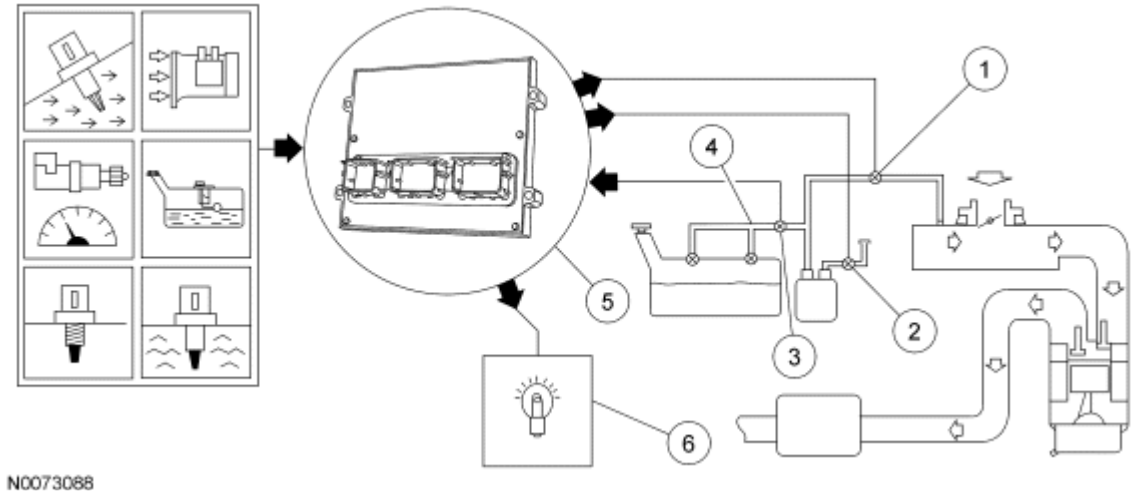
   If the pressure on the fuel tank decreases after the EVAP system is sealed, the EONV EVAP leak check monitor begins to monitor the fuel tank pressure. When the target vacuum is exceeded within the calibrated amount of time the test completes and the fuel tank pressure and time since ignition off information is stored. If the target vacuum is not reached in the calibrated amount of time, a leak is suspected and the fuel tank pressure and time since ignition off information is stored.

   If the pressure on the fuel tank increases after the EVAP system is sealed, but does not exceed the target pressure within a calibrated amount of time the CV is opened to allow the fuel tank pressure to again stabilize with the atmosphere. After a calibrated amount of time the CV is closed by the PCM and seals the EVAP system. When the fuel tank pressure exceeds either the target pressure or vacuum within the calibrated amount of time the test completes and the fuel tank pressure and time since ignition off information is stored. If the target pressure or vacuum is not reached in the calibrated amount of time, a leak is suspected and the fuel tank pressure and time since ignition off information is stored.

   When a leak is suspected, the PCM uses the stored fuel tank pressure and time since ignition off information from an average run of four tests to suspect a leak. Some vehicles use an alternative method of a single run of five tests to determine the presence of a leak. If a leak is still suspected after two consecutive runs of four tests, (eight total tests) or one run of five tests, DTC P0456 is set and the MIL is illuminated.

5. The EONV EVAP leak check monitor is controlled by a separate low power consuming microprocessor inside the PCM. The fuel level indicator, fuel tank pressure, and battery voltage are inputs to the microprocessor. The microprocessor outputs are the CV solenoid and the stored test information. If the separate microprocessor is unable to control the CV solenoid or communicate with other processors DTC P260F is set.

6. The MIL is activated for DTCs P0456 and P260F. The MIL can also be activated for any enhanced EVAP system component DTCs in the same manner. The enhanced EVAP system component DTCs P0443, P0446, P0452, P0453, and P1451 are tested as part of the CCM.



EONV EVAP Leak Check Monitor