Evaporative Emission Control System Description

EVAP System Operation

The evaporative emission (EVAP) control system limits fuel vapors from escaping into the atmosphere. Fuel tank vapors are allowed to move from the fuel tank, due to pressure in the tank, through the vapor pipe, into the EVAP canister. Carbon in the canister absorbs and stores the fuel vapors. Excess pressure is vented through the EVAP vent solenoid to atmosphere. The EVAP canister stores the fuel vapors until the engine is able to use them. At an appropriate time, the control module will command the EVAP purge solenoid ON, open, allowing engine vacuum to be applied to the EVAP canister. With the EVAP vent solenoid OFF, open, fresh air will be drawn through the solenoid to the EVAP canister. Fresh air is drawn through the canister, pulling fuel vapors from the carbon. The air/fuel vapor mixture continues through the EVAP purge pipe and EVAP purge solenoid into the intake manifold to be consumed during normal combustion. The control module uses several tests to determine if the EVAP system is leaking.

Large Leak Test

This tests for large leaks and blockages in the EVAP system. The control module will command the EVAP vent solenoid ON, closed, and command the EVAP purge solenoid ON, open, with the engine running, allowing engine vacuum into the EVAP system. The control module monitors the fuel tank pressure (FTP) sensor voltage to verify that the system is able to reach a predetermined level of vacuum within a set amount of time. The control module then commands the EVAP purge solenoid OFF, closed, sealing the system and monitors the vacuum level for decay. If the control module does not detect that the predetermined vacuum level was achieved, or the vacuum decay rate is more than a calibrated level on 2 consecutive tests, a DTC P0440 will set.

Small Leak Test

If the large leak test passes, the control module will test for small leaks by continuing to monitor the FTP sensor for a change in voltage over a period of time. If the decay rate is more than a calibrated value, the control module will rerun the test. If the test fails again, a DTC P0442 will set.

Canister Vent Restriction Test

If the EVAP vent system is restricted, fuel vapors will not be properly purged from the EVAP canister. The control module tests this by commanding the EVAP purge solenoid ON, open; and commanding the EVAP vent solenoid OFF, open; and monitoring the FTP sensor for an increase in vacuum. If vacuum increases more than a calibrated value, DTC P0446 will set.

Purge Solenoid Leak Test

If the EVAP purge solenoid does not seal properly, fuel vapors could enter the engine at an undesired time, causing driveability concerns. The control module tests for this by commanding the EVAP purge solenoid OFF, closed; and vent solenoid ON, closed; sealing the system, and monitoring the FTP for an increase in vacuum. If the control module detects that EVAP system vacuum increases above a calibrated value, DTC P0496 will set.

Check Gas Cap Message

The control module sends a class 2 message to the Driver Information Center (DIC) illuminating the Check Gas Cap message when any of the following occur:

- A malfunction in the EVAP system and a large leak test fails.
- A malfunction in the EVAP system and a small leak test fails.

EVAP System Components

The EVAP system consists of the following components:

EVAP Canister

The canister is filled with carbon pellets used to absorb and store fuel vapors. Fuel vapor is stored in the canister until the control module determines that the vapor can be consumed in the normal combustion process.

EVAP Purge Solenoid

The EVAP purge solenoid controls the flow of vapors from the EVAP system to the intake manifold. This normally closed solenoid is pulse width modulated (PWM) by the control module to precisely control the flow of fuel vapor to the engine. The solenoid will also be opened during some portions of the EVAP testing, allowing engine vacuum to enter the EVAP system.

EVAP Vent Solenoid

The EVAP vent solenoid controls fresh airflow into the EVAP canister. The solenoid is normally open. The control module will command the solenoid closed during some EVAP tests, allowing the system to be tested for leaks.

Fuel Tank Pressure Sensor

The FTP sensor measures the difference between the pressure or vacuum in the fuel tank and outside air pressure. The control module provides a 5-volt reference and a ground to the FTP sensor. The FTP sensor provides a signal voltage back to the control module that

can vary between 0.1-4.9 volts. As FTP increases, FTP sensor voltage decreases, high pressure = low voltage. As FTP decreases, FTP voltage increases, low pressure or vacuum = high voltage.

EVAP Service Port

The EVAP service port is located in the EVAP purge pipe between the EVAP purge solenoid and the EVAP canister. The service port is identified by a green colored cap.