| DTC | P0442 | Evaporative Emission Control System Leak Detected (Small Leak) |
|---|---|---|

| DTC | P0455 | Evaporative Emission Control System Leak Detected (Gross Leak) |
|---|---|---|

| DTC | P0456 | Evaporative Emission Control System Leak Detected (Very Small Leak) |
|---|---|---|

## DESCRIPTION

The circuit description can be found in the EVAP System (See page ES-309).

Refer to the EVAP System (See page ES-313).

## MONITOR DESCRIPTION

The ECM tests the Evaporative Emissions (EVAP) system using the fuel tank pressure sensor, Canister Close Valve (CCV), and EVAP VSV. The ECM closes the EVAP system and creates negative pressure (vacuum) into it. The ECM then monitors the internal pressure using the fuel tank pressure sensor (refer to the Leak Check graphic).

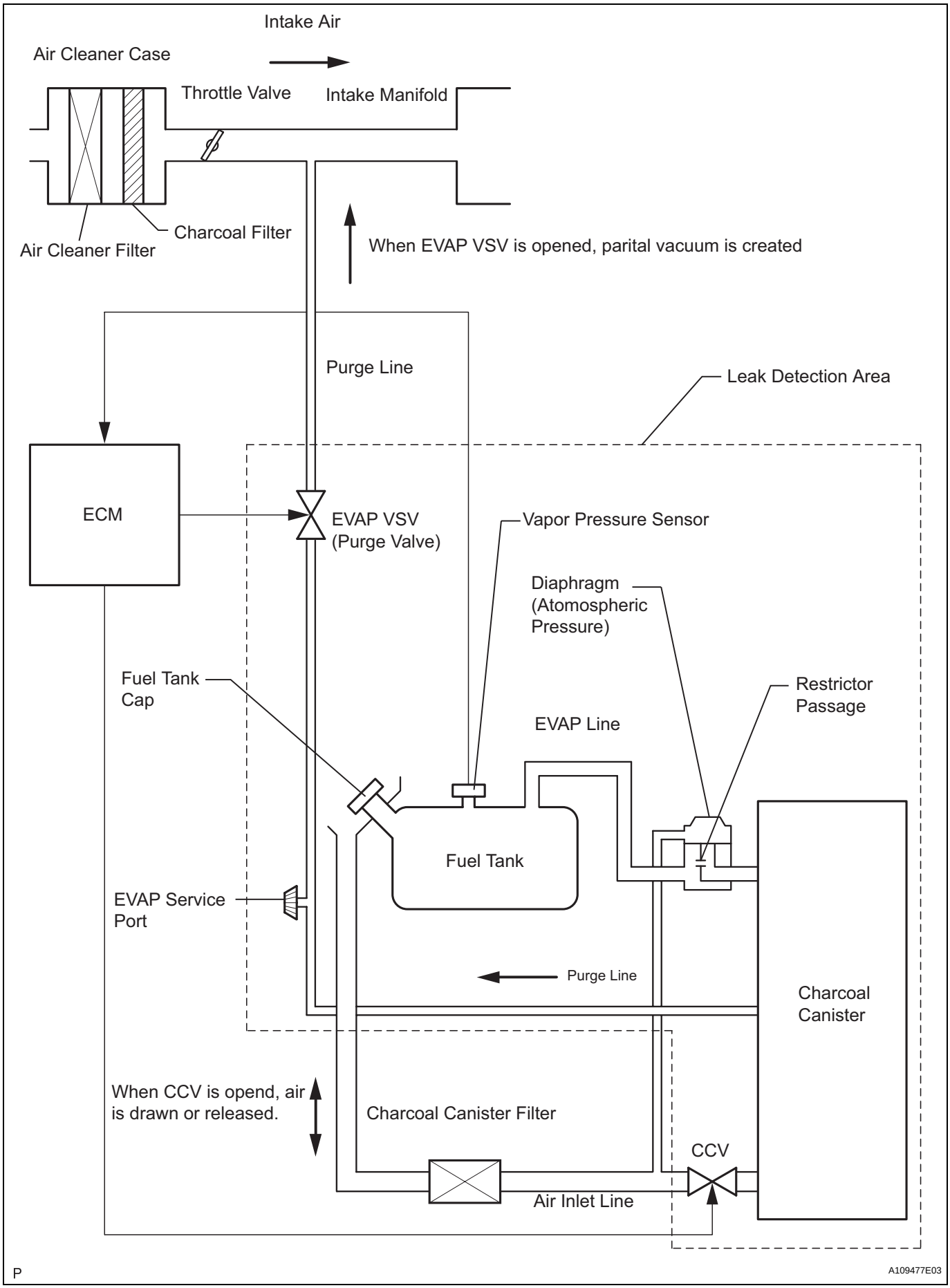
**P0442, P0455 and P0456**

When there is a leak in the evaporative emission system, the ECM sets DTC P0442, P0445 or P0456. The ECM checks if the EVAP has leaks. First, the ECM opens the EVAP VSV while the CCV is closed. After a sufficient amount of time has passed, a high negative pressure (vacuum) will develop in the fuel tank as air is drawn into the intake manifold. The EVAP VSV is then closed. The ECM then monitors the pressure increase (loss of vacuum) in the fuel tank. If the pressure rises beyond a specified amount, the ECM determines that the system has a leak, turns on the MIL and sets a DTC.

The ECM has DTCs for small and large leaks:

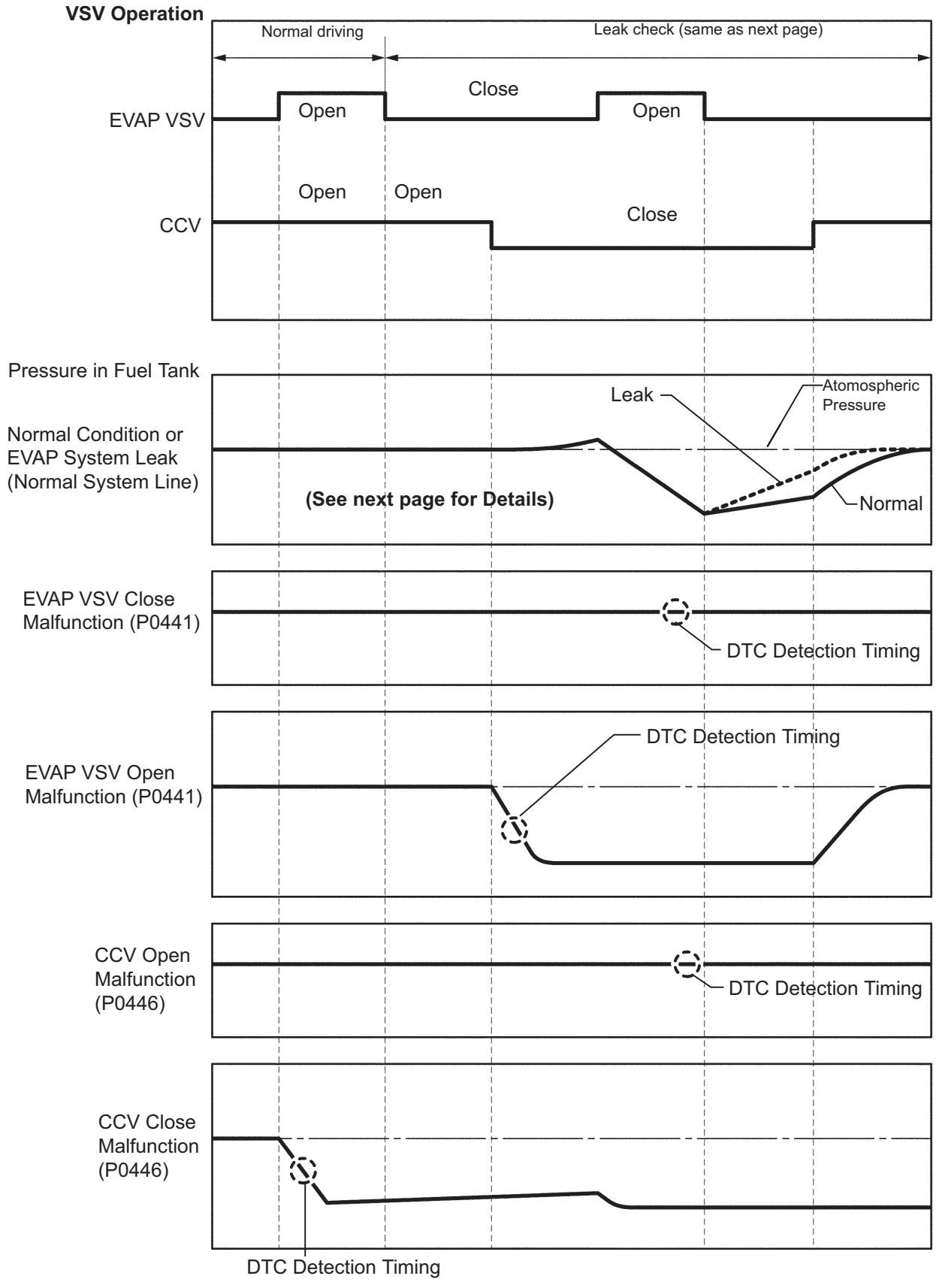
1. DTC P0442 is set when the internal fuel tank pressure has a large increase and the EVAP system has a small leak.
2. DTC P0455 is set when the EVAP system has a very large leak. The ECM tries to create negative pressure (vacuum) in the fuel tank by opening the EVAP VSV while the CCV is closed. However, the fuel tank pressure does not decrease beyond a specified threshold.
3. DTC P0456 is set when the internal fuel tank pressure increases slightly and the EVAP system has a very small leak.

| DTC No. | DTC Detection Condition | Trouble Area |
|---|---|---|
| P0442<br>P0455<br>P0456 | • Cold engine start.<br>• EVAP VSV has been operated and turned OFF, sealing negative pressure (vacuum) in system.<br>• ECM begins to monitor fuel tank pressure increase and one of the following occurs (2 trip detection logic):<br>(a) Rapid, sharp increase in pressure occurs, indicating small leak in EVAP system. DTC P0442 is set.<br>(b) Negative pressure (vacuum) is not strong enough, indicating large hole in EVAP system. DTC P0455 is set.<br>(c) Increase in pressure above expected amount occurs, indicating small leak in EVAP system. DTC P0456 is set. | • Vacuum hose has cracks, holes, or is blocked, damaged or disconnected<br>• Fuel tank cap is incorrectly installed<br>• Fuel tank cap has cracks or is damaged<br>• Open or short in vapor pressure sensor circuit<br>• Vapor pressure sensor<br>• Open or short in EVAP VSV circuit<br>• EVAP VSV<br>• Open or short in CCV circuit<br>• CCV<br>• Fuel tank has cracks, holes, or is damaged<br>• Charcoal canister has cracks, holes, or is damaged<br>• Fuel tank over fill check valve has cracks, or is damaged<br>• ECM |


Intake Air
Air Cleaner Case
Throttle Valve
Intake Manifold
Charcoal Filter
Air Cleaner Filter
When EVAP VSV is opened, parital vacuum is created
Purge Line
Leak Detection Area
ECM
EVAP VSV
(Purge Valve)
Vapor Pressure Sensor
Diaphragm
(Atomospheric
Pressure)
Fuel Tank
Cap
Restrictor
Passage
EVAP Line
Fuel Tank
EVAP Service
Port
Purge Line
Charcoal
Canister
When CCV is opend, air
is drawn or released.
Charcoal Canister Filter
CCV
Air Inlet Line
P
A109477E03

**VSV Malfunction Condition and Leak Check**

EVAP VSV is Open: ON
CCV is Open: OFF




P

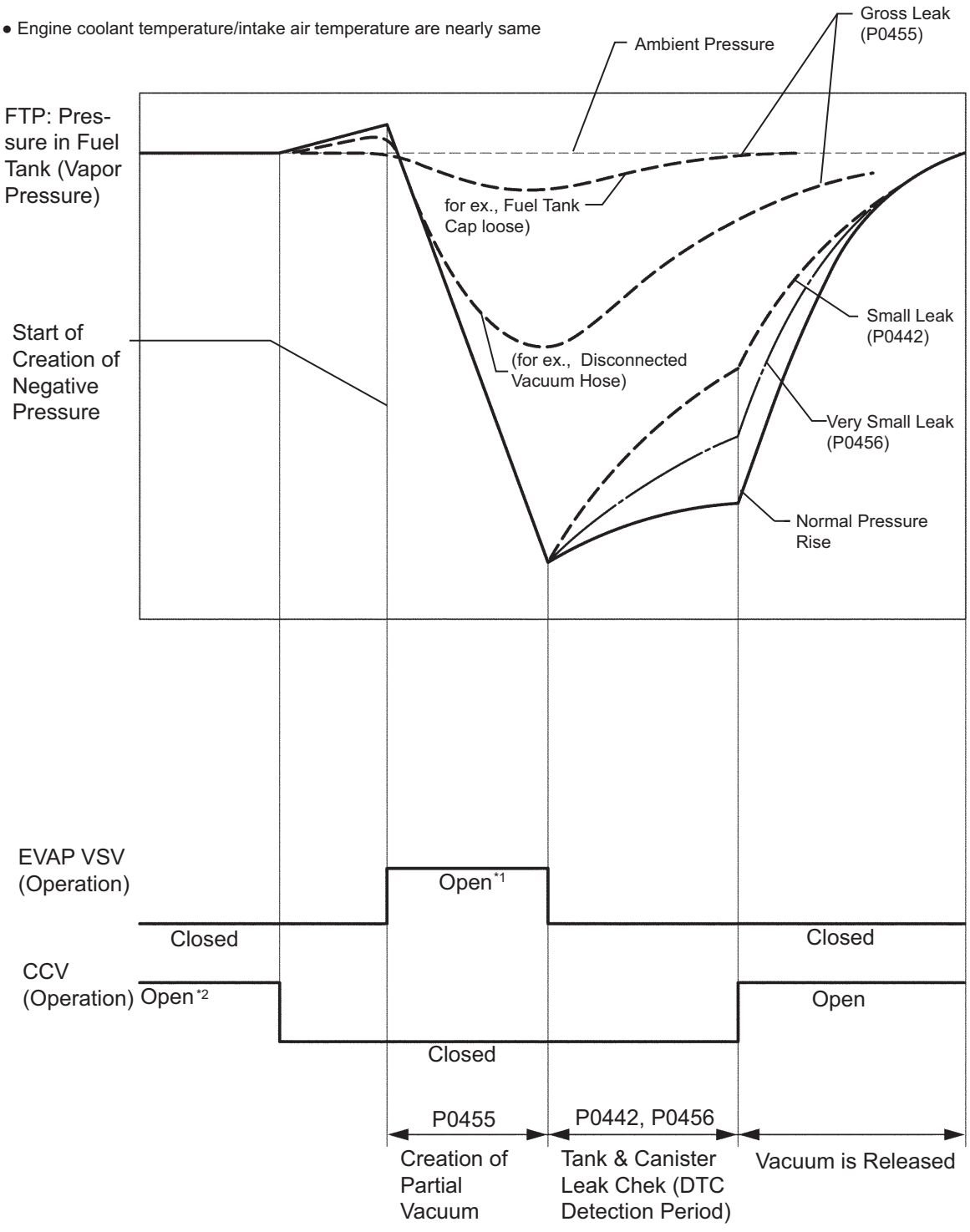
A085438E03

ES

**Leak check**

Initial Condition:

- Cold Start
- Engine coolant temperature/intake air temperature are nearly same




*1 : EVAP VSV is Open: ON
*2 : CCV is Open : OFF

P

A085439E03

## MONITOR STRATEGY

| | |
|---|---|
| Related DTCs | P0442: EVAP 0.04 inch leak<br>P0455: EVAP gross leak<br>P0456: EVAP 0.02 inch leak |
| Required sensors / components (Main) | CCV, EVAP canister, EVAP hose, Fuel cap, Fuel tank and Purge VSV |
| Required sensors / components (Related) | ECT sensor, FTP sensor, IAT sensor, MAF meter, Vehicle speed sensor |
| Frequency of operation | Once per driving cycle |
| Duration | Within 90 seconds |
| MIL operation | 2 driving cycles |
| Sequence operation | None |



## TYPICAL ENABLING CONDITIONS

### All:

| | |
|---|---|
| The monitor will run whenever these DTCs are not present | P0011, P0012, P0021, P0022 (VVT system-Advance, Retard), P0100, P0101, P0102, P0103 (MAF sensor), P0110, P0112, P0113 (IAT sensor), P0115, P0116, P0117, P0118 (ECT sensor), P0120, P0122, P0123, P0220, P0222, P0223, P2135 (TP sensor), P0125 (Insufficient ECT for closed loop), P0171, P0172, P0174, P0175 (Fuel system), P0300, P0301, P0302, P0303, P0304, P0305, P0306 (Misfire), P0335 (CKP sensor), P0340, P0341 (CMP sensor), P0351, P0352, P0353, P0354, P0355, P0356, (Igniter), P0500 (VSS), P0510 (Idle switch) |
| Battery voltage | 11 V or more |
| Altitude | Less than 7,870 ft. (2,400 m) |
| EVAP pressure sensor malfunction | Not detected |
| IAT at engine start - ECT at engine start | -7 to 11.1°C (-12.6 to 20°F) |
| EVAP VSV and CCV | Not operated by scan tool |
| EVAP purge duty cycle | 6 % or more (vary with MAF) |
| Refuel | No refuel during EVAP monitor |
| EVAP pressure | -12.75 mmHg (-1.7 kPa) or more |

### EVAP 0.02 inch leak P0456:

| | |
|---|---|
| ECT at engine start | 4.4 to 32°C (39.9 to 89.6°F) |
| IAT at engine start | 4.4 to 32°C (39.9 to 89.6°F) |
| IAT | 4.4°C (39.9°F) or more |
| Vehicle speed change | Steady speed |
| Time after engine start | Within 50 minutes |
| EVAP pressure change | Minimum change (driving on fairly smooth road) |
| Fuel level | Less than 90 % |
| EVAP 0.04 inch leak | Not detected |
| EVAP CCV malfunction | Not detected |
| Vehicle speed | Less than 81.25 mph (130 km/h) |
| EVAP purge VSV malfunction | Not detected |

### Others:

| | |
|---|---|
| ECT at engine start | 4.4 to 35°C (39.9 to 95°F) |
| IAT at engine start | 4.4 to 35°C (39.9 to 95°F) |
| IAT | 4.4°C (39.9°F) or more |
| Vehicle speed change | Steady speed |
| Time after engine start | Within 50 minutes |
| EVAP pressure change | Minimum change (driving on fairly smooth road) |
| Fuel level | Less than 90 % |

## TYPICAL MALFUNCTION THRESHOLDS

### EVAP 0.04 inch leak P0442:

| | |
|---|---|
| Both of the following conditions are met: | Condition 1 and 2 |
| 1. FTP change for 5 seconds from -20 mmHg (-2.67 kPa) | 1.2 mmHg (0.16 kPa) or more |
| 2. FTP change for 5 seconds from -17 mmHg (-2.27 kPa) | 1.2 mmHg (0.16 kPa) or more |

### EVAP 0.02 inch leak P0456:

| | |
|---|---|
| Both of the following conditions are met: | Condition 1 and 2 |
| 1. FTP change for 5 seconds when FTP is -17 mmHg (-2.27 kPa) | 0.5 mmHg (0.07 kPa) or more |
| 2. FTP change for 5 seconds when FTP is -20 mmHg (-2.67 kPa) | 0.5 mmHg (0.07 kPa) or more |

ES

### EVAP gross leak P0455:

| | |
|---|---|
| FTP when vacuum introduction completed | -7 mmHg (-0.933 kPa) or more |

## MONITOR RESULT

Refer to "CHECKING MONITOR STATUS" for detailed information (See page ES-14 ).
The test value and test limit information are described as shown in the following table. Check the monitor result and test values after performing the monitor drive pattern (See page ES-16).

- TID (Test Identification Data) is assigned to each emissions-related component.
- TLT (Test Limit Type):
  If TLT is 0, the component is malfunctioning when the test value is higher than the test limit.
  If TLT is 1, the component is malfunctioning when the test value is lower than the test limit.
- CID (Component Identification Data) is assigned to each test value.
- Unit Conversion is used to calculate the test value indicated on generic OBD ll scan tools.

**TID $02: EVAP system - LEV ll Vacuum monitor**

| TLT | CID | Unit Conversion | Description of Test Data | Description of Test Limit |
|---|---|---|---|---|
| 1 | $01 | Multiply by 0.183 (mmHg) | Test value of EVAP VSV stuck close: Determined by fuel tank pressure change during vacuum introduction | Malfunction criteria for EVAP VSV stuck closed |
| 0 | $02 | Multiply by 0.0655 (seconds) | Test value of EVAP VSV stuck open: Determined by duration that fuel tank pressure is higher than criteria | Malfunction criteria for EVAP VSV stuck open |
| 0 | $03 | Multiply by 0.0655 (seconds) | Test value of canister closed valve (CCV): Determined by duration that fuel tank pressure is lower than criteria | Malfunction criteria for Canister Closed Valve (CCV) |
| 0 | $04 | Multiply by 0.0458 (mmHg) | Test value 0.04 inch leak: Determined by fuel tank pressure change | Malfunction criteria for 0.04 inch leak |
| 0 | $05 | Multiply by 0.0458 (mmHg) | Test value 0.02 inch leak: Determined by fuel tank pressure change | Malfunction criteria for 0.02 inch leak |

| DTC | P0446 | Evaporative Emission Control System Vent Control Circuit |
|---|---|---|

## DESCRIPTION

The circuit description can be found in the EVAP System (See page ES-309).

Refer to the EVAP System (See page ES-313).

## MONITOR DESCRIPTION

The ECM tests the Evaporative Emissions (EVAP) system using the fuel tank pressure sensor, Canister Close Valve (CCV), and EVAP VSV. The ECM closes the EVAP system and creates negative pressure (vacuum) into it. The ECM then monitors the internal pressure using the fuel tank pressure sensor (See page ES-212).

P0446 (FOR SYSTEM DIAGRAM AND DTC DETECTION TIMING CHART, REFER TO DTC P0441)(See page ES-197).

The CCV is open under normal conditions. The CCV has the following features:

1. Draws fumes from the fuel tank into the charcoal canister after the EVAP VSV purges the EVAP from the fuel tank into the intake manifold,.
2. Relieves pressure inside the fuel tank when the pressure has suddenly risen.
3. Works with the EVAP VSV to create negative pressure (vacuum) inside the fuel tank and performs leak tests.

The ECM checks if the CCV is "stuck closed". The ECM commands the CCV to open while the EVAP VSV is open. If high negative pressure (vacuum) develops in the fuel tank and stays for more than 4 seconds, the ECM determines that the CCV remains closed despite the open command. The ECM will turn on the MIL and set a DTC. The engine coolant temperature is not related to the output of this DTC.

The ECM also has a method for checking if the CCV is "stuck open". The ECM commands the CCV to close while the EVAP VSV is open. If a sufficient amount of negative pressure dose not develop in the fuel tank, the ECM determines that the CCV remains open despite the close command. The ECM will turn on the MIL and set a DTC.

| DTC No. | DTC Detection Condition | Trouble Area |
|---|---|---|
| P0446 | Open or close malfunction in CCV (2 trip detection logic) | • Vacuum hose has cracks, holes, or is blocked, damaged or disconnected<br>• Fuel tank cap is incorrectly installed<br>• Fuel tank cap has cracks or is damaged<br>• Open or short in vapor pressure sensor circuit<br>• Vapor pressure sensor<br>• Open or short in EVAP VSV circuit<br>• EVAP VSV<br>• Open or short in CCV circuit<br>• CCV<br>• Fuel tank has cracks, holes, or is damaged<br>• Charcoal canister has cracks, holes, or is damaged<br>• Fuel tank over fill check valve has cracks, or is damaged<br>• ECM |

## MONITOR STRATEGY

| | |
|---|---|
| Related DTCs | P0446: CCV stuck open<br>P0446: CCV stuck closed |
| Required sensors / components (Main) | CCV, EVAP canister, EVAP hose, Fuel cap, Fuel tank and Purge VSV |
| Required sensors / components (Related) | ECT sensor, FTP sensor, IAT sensor, MAF meter, Vehicle speed sensor |
| Frequency of operation | Once per driving cycle |
| Duration | Within 60 seconds |

| | |
|---|---|
| MIL operation | 2 driving cycles |
| Sequence operation | None |

## TYPICAL ENABLING CONDITIONS

| | |
|---|---|
| The monitor will run whenever these DTCs are not present | P0011, P0012, P0021, P0022 (VVT system-Advance, Retard), P0100, P0101, P0102, P0103 (MAF sensor), P0110, P0112, P0113 (IAT sensor), P0115, P0116, P0117, P0118 (ECT sensor), P0120, P0122, P0123, P0220, P0222, P0223, P2135,(TP sensor), P0125 (Insufficient ECT for closed loop), P0171, P0172, P0174, P0175 (Fuel system), P0300, P0301, P0302, P0303, P0304, P0305, P0306 (Misfire), P0335 (CKP sensor), P0340, P0341 (CMP sensor), P0351, P0352, P0353, P0354, P0355, P0356, (Igniter), P0500 (VSS), P0510 (Idle switch) |
| Battery voltage | 11 V or more |
| Altitude | Less than 7,870 ft. (2,400 m) |
| EVAP pressure sensor malfunction | Not detected |
| IAT at engine start - ECT at engine start | -7 to 11.1°C (-12.6 to 20°F) |
| EVAP VSV and CCV | Not operated by scan tool |
| EVAP purge duty cycle | 6 % or more (vary with MAF) |
| Refuel | No refuel during EVAP monitor |
| EVAP pressure | -12.75 mmHg (-1.7 kPa) or more |
| ECT at engine start | 4.4 to 35°C (39.9 to 95°F) |
| IAT at engine start | 4.4 to 35°C (39.9 to 95°F) |
| IAT | 4.4°C (39.9°F) or more |
| Vehicle speed change | Steady speed |
| Time after engine start | Within 50 minutes |
| EVAP pressure change | Minimum change (driving on fairly smooth road) |
| Fuel level | Less than 90 % |

## TYPICAL MALFUNCTION THRESHOLDS

### CCV stuck close P0446:

| | |
|---|---|
| Duration that the following conditions are met: | 4 seconds or more |
| 1. Accumulated purge volume | 0.5 g or more |
| 2. FTP | Less than -12.75 mmHg (-1.7 kPa) |

### CCV stuck open P0446:

| | |
|---|---|
| Purge VSV stuck closed | Detected |

## MONITOR RESULT

Refer to "checking monitor status" for detailed information (See page ES-14).
The test value and test limit information are described as shown in the following table. Check the monitor result and test values after performing the monitor drive pattern (See page ES-16).

- TID (Test Identification Data) is assigned to each emissions-related component.
- TLT (Test Limit Type):
  If TLT is 0, the component is malfunctioning when the test value is higher than the test limit.
  If TLT is 1, the component is malfunctioning when the test value is lower than the test limit.
- CID (Component Identification Data) is assigned to each test value.
- Unit Conversion is used to calculate the test value indicated on generic OBD ll scan tools.

**TID $02: EVAP system - LEV ll Vacuum monitor**

| TLT | CID | Unit Conversion | Description of Test Data | Description of Test Limit |
|---|---|---|---|---|
| 1 | $01 | Multiply by 0.183 (mmHg) | Test value of EVAP VSV stuck close: Determined by fuel tank pressure change during vacuum introduction | Malfunction criteria for EVAP VSV stuck closed |

| TLT | CID | Unit Conversion | Description of Test Data | Description of Test Limit |
|---|---|---|---|---|
| 0 | $02 | Multiply by 0.0655 (seconds) | Test value of EVAP VSV stuck open: Determined by duration that fuel tank pressure is higher than criteria | Malfunction criteria for EVAP VSV stuck open |
| 0 | $03 | Multiply by 0.0655 (seconds) | Test value of canister closed valve (CCV): Determined by duration that fuel tank pressure is lower than criteria | Malfunction criteria for Canister Closed Valve (CCV) |
| 0 | $04 | Multiply by 0.0458 (mmHg) | Test value 0.04 inch leak: Determined by fuel tank pressure change | Malfunction criteria for 0.04 inch leak |
| 0 | $05 | Multiply by 0.0458 (mmHg) | Test value 0.02 inch leak: Determined by fuel tank pressure change | Malfunction criteria for 0.02 inch leak |