DTC | P043E | Evaporative Emission System Reference Orifice Clog Up

DTC | P043F | Evaporative Emission System Reference Orifice High Flow

DTC | P2401 | Evaporative Emission Leak Detection Pump Stuck OFF

DTC | P2402 | Evaporative Emission Leak Detection Pump Stuck ON

DTC | P2419 | Evaporative Emission System Switching Valve Control Circuit Low

**DTC SUMMARY**

<table>
<thead>
<tr>
<th>DTC</th>
<th>Monitoring Item</th>
<th>Malfunction Detection Condition</th>
<th>Trouble Area</th>
<th>Detection Timing</th>
<th>Detection Logic</th>
</tr>
</thead>
<tbody>
<tr>
<td>P043E</td>
<td>Reference orifice clogged</td>
<td>P043E, P043F, P2401, P2402 and P2419 present when one of following conditions met during key-off EVAP monitor:</td>
<td>• Canister pump module (Reference orifice, leak detection pump, vent valve) • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM</td>
<td>While ignition switch OFF</td>
<td>2 trip</td>
</tr>
<tr>
<td>P043F</td>
<td>Reference orifice high-flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2401</td>
<td>Leak detection pump stuck OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2402</td>
<td>Leak detection pump stuck ON</td>
<td>• Reference orifice clogged • Reference orifice high-flow • Leak detection pump OFF malfunction • Leak detection pump ON malfunction • Vent valve ON (close) malfunction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2419</td>
<td>Vent valve stuck closed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HINT:**
The reference orifice is located inside the canister pump module.

**DESCRIPTION**
The description can be found in the EVAP (Evaporative Emission) System (see page ES-371).

**INSPECTION PROCEDURE**
Refer to the EVAP System (see page ES-376).

**MONITOR DESCRIPTION**
5 hours* after the ignition switch is turned OFF, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

**HINT:**
*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.
If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

The leak detection pump creates negative pressure through the reference orifice. When the system is normal, the EVAP pressure is between 724 to 752 mmHg* and saturated within a minute. If not, the ECM interprets this as a malfunction. The ECM will illuminate the MIL and set DTC if this malfunction is detected in consecutive drive cycles.

*: Typical value.

---

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Operation</th>
<th>Description</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Atmospheric pressure measurement</td>
<td>Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 76 kPa-a and 110 kPa-a (570 mmHg-a and 825 mmHg-a), ECM cancels EVAP system monitor.</td>
<td>10 seconds</td>
</tr>
<tr>
<td>B</td>
<td>First reference pressure measurement</td>
<td>In order to determine reference pressure, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.</td>
<td>60 seconds</td>
</tr>
<tr>
<td>C</td>
<td>EVAP system pressure measurement</td>
<td>Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.</td>
<td>15 minutes*</td>
</tr>
<tr>
<td>D</td>
<td>Purge VSV monitor</td>
<td>Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normality.</td>
<td>10 seconds</td>
</tr>
<tr>
<td>E</td>
<td>Second reference pressure measurement</td>
<td>After second reference pressure measurement, leak check performed by comparing first and second reference pressure. If stabilized system pressure higher than second reference pressure, ECM determines that EVAP system leaking.</td>
<td>60 seconds</td>
</tr>
</tbody>
</table>

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### Operation A: Atmospheric Pressure Measurement

- Purge VSV: OFF
- Canister Pressure Sensor
- Canister
- Fuel Tank
- Vent Valve: OFF (vent)
- Canister Pump Module
- Canister Filter
- Leak Detection Pump: OFF
- Atmospheric Pressure
- Negative Pressure

### Operation B, E: Reference Pressure Measurement

- Reference Orifice (0.02 Inch)

### Operation C: EVAP System Pressure Measurement

- Vent Valve turned OFF (vent)
- Atmospheric pressure
- Negative pressure

### Operation D: Purge VSV Monitor

- Purge VSV: OFF
- Canister Pressure Sensor
- Canister
- Fuel Tank
- Vent Valve: OFF (vent)
- Canister Pump Module
- Canister Filter
- Leak Detection Pump: OFF
- Atmospheric Pressure
- Negative Pressure

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MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Required Sensors/Components</th>
<th>Canister pump module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of Operation</td>
<td>Once per driving cycle</td>
</tr>
<tr>
<td>Duration</td>
<td>Within 2 minutes</td>
</tr>
<tr>
<td>MIL Operation</td>
<td>2 driving cycles</td>
</tr>
<tr>
<td>Sequence of Operation</td>
<td>None</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

- Monitor runs whenever following DTCs not present: None
- EVAP key-off monitor runs when all of following conditions met: -
  - Atmospheric pressure: 70 to 110 kPa-a (525 to 825 mmHg-a)
  - Battery voltage: 10.5 V or more
  - Vehicle speed: Below 4 km/h (2.5 mph)
  - Ignition switch: OFF
  - Time after key off: 5 or 7 or 9.5 hours
  - Canister pressure sensor malfunction (P0450, P0451, P0452 and P0453): Not detected
  - Purge VSV: Not operated by scan tool
  - Vent valve: Not operated by scan tool
  - Leak detection pump: Not operated by scan tool
  - Both of following conditions met before key off: Conditions 1 and 2
  1. Duration that vehicle driven: 5 minutes or more
  2. EVAP purge operation: Performed
1. Key-off monitor sequence 1 to 8

1. Atmospheric pressure measurement

Next sequence run if following condition set
Atmospheric pressure change
Less than 0.3 kPa-g (2.25 mmHg-g) in 1 second

2. First reference pressure measurement

Next sequence run if all of following conditions set
Condition 1, 2 and 3
1. EVAP pressure just after reference pressure measurement started
-1 kPa-g (-7.5 mmHg-g) or less
2. Reference pressure
-4.85 to -1.057 kPa-g (-36.4 to -7.93 mmHg-g)
3. Reference pressure
Saturated within 60 seconds

3. Vent valve stuck closed check

Next sequence run if following condition set
EVAP pressure change after vent valve ON (closed)
0.3 kPa-g (2.25 mmHg-g) or more

4. Vacuum introduction

Next sequence run if following condition set
EVAP pressure
Saturated within 15 minutes

5. Purge VSV stuck closed check

Next sequence run if following condition set
EVAP pressure change after purge VSV ON (open)
0.3 kPa-g (2.25 mmHg-g) or more

6. Second reference pressure measurement

Next sequence run if all of following conditions set
Condition 1, 2, 3 and 4
1. EVAP pressure just after reference pressure
-1 kPa-g (-7.5 mmHg-g) or less
2. Reference pressure
-4.85 to -1.057 kPa-g (-36.4 to -7.93 mmHg-g)
3. Reference pressure
Saturated within 60 seconds
4. Reference pressure difference between first and second
Less than 0.7 kPa-g (5.25 mmHg-g)

7. Leak check

Next sequence run if following condition set
EVAP pressure when vacuum introduction complete
Second reference pressure or less

8. Atmospheric pressure measurement

EVAP monitor complete if following condition set
Atmospheric pressure difference between sequence 1 and 8
Within 0.3 kPa-g (2.25 mmHg-g)

TYPICAL MALFUNCTION THRESHOLDS
"Saturated" indicates that the EVAP pressure change is less than 0.286 kPa-g (2.14 mmHg-g) in 60 seconds.

One of following conditions met

EVAP pressure just after reference pressure measurement started
More than -1 kPa-g (-7.5 mmHg-g)
Reference pressure
Less than -4.85 kPa-g (-36.4 mmHg-g)
Reference pressure
-1.057 kPa-g (-7.93 mmHg-g) or more
Reference pressure
Not saturated within 60 seconds
Reference pressure difference between first and second
0.7 kPa-g (5.25 mmHg-g) or more

MONITOR RESULT
Refer to CHECKING MONITOR STATUS (see page ES-19).
**DESCRIPTION**

The description can be found in the EVAP (Evaporative Emission) System (see page ES-371).

**INSPECTION PROCEDURE**

Refer to the EVAP System (see page ES-376).

**MONITOR DESCRIPTION**

The two monitors, Key-Off and Purge Flow, are used to detect malfunctions relating to DTC P0441. The Key-Off monitor is initiated by the ECM internal timer, known as the soak timer, 5 hours* after the ignition switch is turned OFF. The purge flow monitor runs while the engine is running.

1. **KEY-OFF MONITOR**
   - 5 hours* after the ignition switch is turned OFF, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.
   
   **HINT:**
   - If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Operation</th>
<th>Description</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECM activation</td>
<td>Activated by soak timer 5, 7 or 9.5 hours after ignition switch turned OFF.</td>
<td></td>
</tr>
<tr>
<td>Sequence</td>
<td>Operation</td>
<td>Description</td>
<td>Duration</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>A</td>
<td>Atmospheric pressure measurement</td>
<td>Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 76 kPa-a and 110 kPa-a (570 mmHg-a and 825 mmHg-a), ECM cancels EVAP system monitor.</td>
<td>10 seconds</td>
</tr>
<tr>
<td>B</td>
<td>First reference pressure measurement</td>
<td>In order to determine reference pressure, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.</td>
<td>60 seconds</td>
</tr>
<tr>
<td>C</td>
<td>EVAP system pressure measurement</td>
<td>Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.</td>
<td>15 minutes*</td>
</tr>
<tr>
<td>D</td>
<td>Purge VSV monitor</td>
<td>Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normality.</td>
<td>10 seconds</td>
</tr>
<tr>
<td>E</td>
<td>Second reference pressure measurement</td>
<td>After second reference pressure measurement, leak check performed by comparing first and second reference pressure. If stabilized system pressure higher than second reference pressure, ECM determines that EVAP system leaking.</td>
<td>60 seconds</td>
</tr>
<tr>
<td>-</td>
<td>Final check</td>
<td>Atmospheric pressure measured and then monitoring result recorded by ECM.</td>
<td>-</td>
</tr>
</tbody>
</table>

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

**Operation A: Atmospheric Pressure Measurement**

- Purge VSV: OFF
- Canister Pressure Sensor: OFF
- Fuel Tank: OFF
- Vent Valve: OFF (vent)
- Canister Pump Module: OFF
- Canister Filter: OFF
- Leak Detection Pump: OFF

**Operation B, E: Reference Pressure Measurement**

- Reference Orifice (0.02 Inch)
- OFF (vent)

**Operation C: EVAP System Pressure Measurement**

- OFF (closed)

**Operation D: Purge VSV Monitor**

- ON (closed)
(a) Purge VSV stuck open

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The EVAP system pressure is then measured by the ECM using the canister pressure sensor. If the stabilized system pressure is higher than [second reference pressure x 0.2], the ECM interprets this as the purge VSV (Vacuum Switching Valve) being stuck open. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).
(b) Purge VSV stuck closed

In operation D, the canister pressure sensor measures the EVAP system pressure. The pressure measurement for the purge VSV monitor is begun when the purge VSV is turned ON (open) after the EVAP leak check. When the measured pressure indicates an increase of 0.3 kPa-g (2.25 mmHg-g) or more, the purge VSV is functioning normally. If the pressure does not increase, the ECM interprets this as the purge VSV being stuck closed. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

2. PURGE FLOW MONITOR

The purge flow monitor consists of the two step monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.
• The 1st monitor
While the engine is running and the purge VSV is ON (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.
• The 2nd monitor
The vent valve is turned ON (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.5 kPa-g (3.75 mmHg-g), the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and sets DTC P0441 (2 trip detection logic).

Atmospheric pressure check:
In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after conduction of the purge flow monitor, is measured by the ECM.

### OBD II MONITOR SPECIFICATIONS

#### 1. Key-off Monitor

<table>
<thead>
<tr>
<th>Monitor Strategy</th>
<th>Purge VSV and canister pump module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Sensors/Components</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Frequency of Operation</td>
<td>Once per driving cycle</td>
</tr>
<tr>
<td>Duration</td>
<td>Within 15 minutes (varies with fuel in tank)</td>
</tr>
<tr>
<td>MIL Operation</td>
<td>2 driving cycles</td>
</tr>
<tr>
<td>Sequence of Operation</td>
<td>None</td>
</tr>
</tbody>
</table>

**Typical Enabling Conditions**

| EVAP key-off monitor runs when all of following conditions met | - |
| Atmospheric pressure | 70 to 110 kPa-a (525 to 825 mmHg-a) |
| Battery voltage | 10.5 V or more |
| Vehicle speed | Below 4 km/h (2.5 mph) |
| Ignition switch | OFF |
| Time after key off | 5 or 7 or 9.5 hours |
| Canister pressure sensor malfunction (P0450, P0451, P0452 and P0453) | Not detected |
| Purge VSV | Not operated by scan tool |
| Vent valve | Not operated by scan tool |
| Leak detection pump | Not operated by scan tool |
| Both of following conditions met before key off | Conditions 1 and 2 |
1. Duration that vehicle driven | 5 minutes or more |
2. EVAP purge operation | Performed |
ECT | 4.4 to 35°C (40° to 95°F) |
IAT | 4.4 to 35°C (40° to 95°F) |

#### 2. Key-off monitor sequence 1 to 8

##### 1. Atmospheric pressure measurement

| Next sequence run if following condition set | - |
| Atmospheric pressure change | Less than 0.3 kPa-g (2.25 mmHg-g) in 1 second |

##### 2. First reference pressure measurement

| Next sequence run if all of following conditions set | Condition 1, 2 and 3 |
| 1. EVAP pressure just after reference pressure measurement started | -1 kPa-g (-7.5 mmHg-g) or less |
| 2. Reference pressure | -4.85 to -1.057 kPa-g (-36.4 to -7.93 mmHg-g) |
| 3. Reference pressure | Saturated within 60 seconds |

##### 3. Vent valve stuck closed check

| Next sequence run if following condition set | - |
| EVAP pressure change after vent valve ON (closed) | 0.3 kPa-g (2.25 mmHg-g) or more |
4. Vacuum introduction
Next sequence run if following condition set
EVAP pressure
Saturated within 15 minutes

5. Purge VSV stuck closed check
Next sequence run if following condition set
EVAP pressure change after purge VSV ON (open)
0.3 kPa-g (2.25 mmHg-g) or more

6. Second reference pressure measurement
Next sequence run if all of following conditions set
EVAP pressure just after reference pressure
-1 kPa-g (-7.5 mmHg-g) or less
Reference pressure
-4.85 to -1.057 kPa-g (-36.4 to -7.93 mmHg-g)
Reference pressure
Saturated within 60 seconds
Reference pressure difference between first and second
Less than 0.7 kPa-g (5.25 mmHg-g)

7. Leak check
Next sequence run if following condition set
EVAP pressure when vacuum introduction complete
Second reference pressure or less

8. Atmospheric pressure measurement
EVAP monitor complete if following condition set
Atmospheric pressure difference between sequence 1 and 8
Within 0.3 kPa-g (2.25 mmHg-g)

Typical Malfunction Thresholds
Purge VSV stuck open:
EVAP pressure when vacuum introduction complete
Higher than reference pressure x 0.2

Purge VSV stuck closed:
EVAP pressure change after purge VSV ON (open)
Less than 0.3 kPa-g (2.25 mmHg-g)

OBD II MONITOR SPECIFICATIONS
1. Purge Flow Monitor
Monitor Strategy
Required Sensors/Components
Purge VSV and canister pump module
Frequency of Operation
Once per driving cycle
Duration
Within 10 minutes
MIL Operation
2 driving cycles
Sequence of Operation
None

Typical Enabling Conditions
Monitor runs whenever following DTCs not present
P0011 (VVT System 1 - Advance)
P0012 (VVT System 1 - Retard)
P0021 (VVT System 2 - Advance)
P0022 (VVT System 2 - Retard)
P0100 - P0103 (MAF meter)
P0110 - P0113 (IAT sensor)
P0115 - P0118 (ECT sensor)
P0120 - P0223, P2135 (TP sensor)
P0125 (Insufficient ECT for Closed Loop)
P0171, P0172 (Fuel system)
P0300 - P0306 (Misfire)
P0335 (CKP sensor)
P0340 (CMP sensor)
P0351 - P0354 (Igniter)
P0450 - P0453 (EVAP press sensor)
P0500 (VSS)

Engine
Running
<table>
<thead>
<tr>
<th>Typical Malfunction Thresholds</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECT</td>
</tr>
<tr>
<td>IAT</td>
</tr>
<tr>
<td>Canister pressure sensor malfunction</td>
</tr>
<tr>
<td>Purge VSV</td>
</tr>
<tr>
<td>EVAP system check</td>
</tr>
<tr>
<td>Battery voltage</td>
</tr>
<tr>
<td>Purge duty cycle</td>
</tr>
</tbody>
</table>

**MONITOR RESULT**

Refer to CHECKING MONITOR STATUS (see page ES-19).