| DTC | P043E | Evaporative Emission System Reference Orifice Clog Up |
|---|---|---|

| DTC | P043F | Evaporative Emission System Reference Orifice High Flow |
|---|---|---|

| DTC | P2401 | Evaporative Emission System Leak Detection Pump Control Circuit Low |
|---|---|---|

| DTC | P2402 | Evaporative Emission System Leak Detection Pump Control Circuit High |
|---|---|---|

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



## DTC SUMMARY

| DTCs | Monitoring Item | Malfunction Detection Condition | Trouble Area | Detection Timing | Detection Logic |
|---|---|---|---|---|---|
| P043E | 0.02 inch orifice clogged | P043E, P043F, P2401, P2402, P2419 are present when one of the following conditions is met during key-off EVAP monitor<br>• Reference orifice clogged<br>• Reference orifice high-flow<br>• Leak detection pump OFF malfunction<br>• Leak detection pump ON malfunction<br>• Vent valve ON (close) malfunction | • Pump module<br>• Connector/wire harness (Pump module - ECM)<br>• ECM | While ignition switch OFF | 2 trip |
| P043F | 0.02 inch orifice high-flow | | | | |
| P2401 | Vacuum pump stuck OFF | | | | |
| P2402 | Vacuum pump stuck ON | | | | |
| P2419 | Vent valve stuck open (vent) | | | | |

HINT:
The 0.02 inch orifice is located inside the pump module.

## DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) System (See page ES-409).

## INSPECTION PROCEDURE

Refer to the EVAP System (See page ES-412).

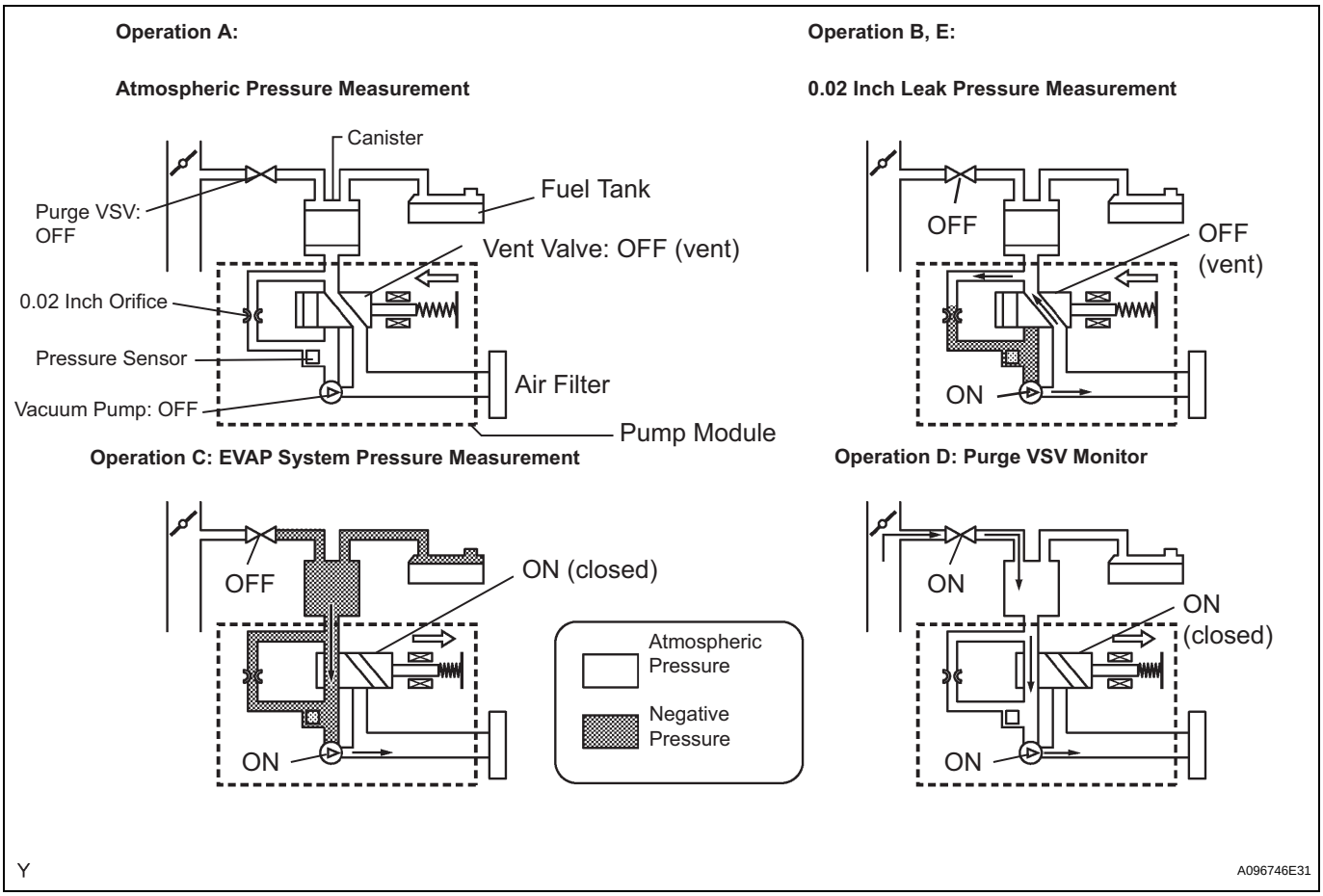
## MONITOR DESCRIPTION

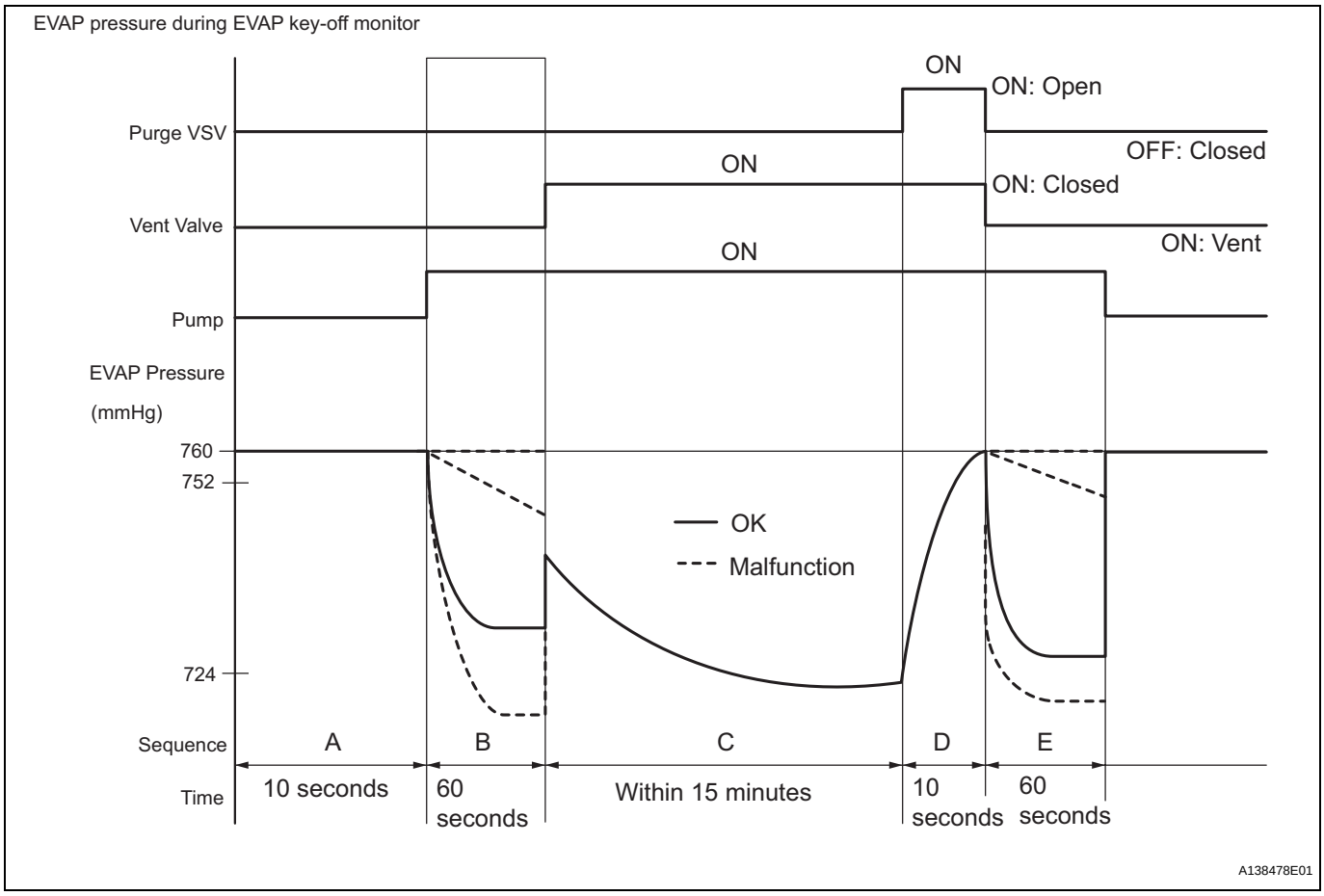
5 hours*1 after the ignition switch is turned off, the electric vacuum pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.
HINT:
*1: If the engine coolant temperature is not below 35°C (95°F) 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.

| Sequence | Operation | Description | Duration |
|---|---|---|---|
| - | ECM activation | Activated by soak timer, 5 hours (7 or 9.5 hours) after ignition switch turned off. | - |

| Sequence | Operation | Description | Duration |
|---|---|---|---|
| A | Atmospheric pressure measurement | Vent valve is turned OFF (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure.<br>If pressure in EVAP system is not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor. | 10 seconds |
| B | First 0.02 inch leak pressure measurement | In order to determine 0.02 inch leak pressure standard, vacuum pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if vacuum pump and vent valve operate normally. | 60 seconds |
| C | EVAP system pressure measurement | Vent valve is turned ON (closed) to shut EVAP system.<br>Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as it will be used in leak check.<br>If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor. | 15 minutes*2 |
| D | Purge VSV monitor | Purge VSV is opened and then EVAP system pressure is measured by ECM.<br>Large increase indicates normal. | 10 seconds |
| E | Second 0.02 inch leak pressure measurement | After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards.<br>If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system is leaking. | 60 seconds |
| F | Final check | Atmospheric pressure is measured and then monitoring result is recorded by ECM. | - |

*2: If there is only a small amount of fuel in the fuel tank, stabilizing the EVAP pressure takes longer than usual.






The leak detection pump creates negative pressure through the reference orifice. When the system is normal, the EVAP pressure is in 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 cycle.

*: Typical valve

## MONITOR STRATEGY

| | |
|---|---|
| Related DTCs | P043E: 0.02 inch orifice clog (built-in pump module)<br>P043F: 0.02 inch orifice high-flow (built-in pump module)<br>P2401: Vacuum pump stuck OFF<br>P2402: Vacuum pump stuck ON<br>P2419: Vent valve stuck open (vent) |
| Required Sensors / Components | Pump module |
| Frequency of Operation | Once per driving cycle |
| Duration | Within 2 minutes |
| MIL Operation | 2 driving cycles |
| Sequence of Operation | None |

## TYPICAL ENABLING CONDITIONS

| | |
|---|---|
| The monitor will run whenever these DTCs are not present | None |
| Atmospheric pressure | 70 to 110 kPa (525 to 825 mmHg) |
| Battery voltage | 10.5 V or more |
| Vehicle speed | Less than 2.5 mph (4 km/h) |
| Ignition switch | OFF |

| | |
|---|---|
| Time after key-off | 5 or 7 or 9.5 hours |
| EVAP pressure sensor malfunction (P0450, P0451, P0452, P0453) | Not detected |
| EVAP canister purge valve | Not operated by scan tool |
| EVAP canister vent valve | Not operated by scan tool |
| EVAP leak detection pump | Not operated by scan tool |
| Both of the following conditions 1 and 2 are met before key-off | - |
| 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) |

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## Key-off monitor sequence 1 to 8

### 1. Atmospheric pressure measurement

| | |
|---|---|
| Next sequence is run if the following condition is met: | - |
| Atmospheric pressure change | Less than 0.3 kPa (2.25 mmHg) in 1 second |

### 2. First reference pressure measurement

| | |
|---|---|
| Next sequence is run if all of the following conditions are met: | Conditions 1, 2 and 3 |
| 1. EVAP pressure just after reference pressure measurement | -1 kPa (-7.5 mmHg) or less |
| 2. Reference pressure | -4.85 to -1.057 kPa (-36.384 to -7.929 mmHg) |
| 3. Reference pressure | Saturated within 1 minute |

### 3. EVAP canister vent valve close stuck check

| | |
|---|---|
| Next sequence is run if the following condition is met: | - |
| EVAP pressure change after vent valve is ON | 0.3 kPa (2.25 mmHg) or more |

### 4. Vacuum introduction

| | |
|---|---|
| Next sequence is run if the following condition is met: | - |
| EVAP pressure | Saturated within 15 minutes |

### 5. EVAP canister purge valve close stuck check

| | |
|---|---|
| Next sequence is run if the following condition is met: | - |
| EVAP pressure change after purge valve is open | 0.3 kPa (2.25 mmHg) or more |

### 6. Second reference pressure measurement

| | |
|---|---|
| Next sequence is run if all of the following conditions are met: | Conditions 1, 2, 3 and 4 |
| 1. EVAP pressure just after reference pressure measurement | -1 kPa (-7.5 mmHg) or less |
| 2. Reference pressure | -4.85 to -1.057 kPa (-36.384 to -7.929 mmHg) |
| 3. Reference pressure | Saturated |
| 4. Difference between first reference pressure and second reference pressure | Less than 0.7 kPa (5.25 mmHg) |

### 7. Leak check

| | |
|---|---|
| Next sequence is run if the following condition is met | - |
| EVAP pressure when vacuum introduction was complete | Lower than second reference pressure |

### 8. Atmospheric pressure measurement

| | |
|---|---|
| EVAP monitor is complete if the following condition is met: | - |

| | |
|---|---|
| Atmospheric pressure difference between sequence 1 and 8 | Within 0.3 kPa (2.25 mmHg) |

## TYPICAL MALFUNCTION THRESHOLDS

| | |
|---|---|
| 1. One of following conditions is met | - |
| 2. EVAP pressure just after reference pressure measurement start | More than -1 kPa (-7.5 mmHg) |
| 3. Reference pressure | Less than -4.85 kPa (-36.384 mmHg) |
| 4. Reference pressure | -1.057 kPa (-7.929 mmHg) or more |
| 5. Reference pressure | Not saturated |
| 6. Difference between first reference pressure and second reference pressure | 0.7 kPa (5.25 mmHg) or more |



## MONITOR RESULT

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

| DTC | P0441 | Evaporative Emission Control System Incorrect Purge Flow |
|---|---|---|

## DTC SUMMARY

| DTCs | Monitoring Item | Malfunction Detection Condition | Trouble Area | Detection Timing | Detection Logic |
|---|---|---|---|---|---|
| P0441 | Purge VSV (Vacuum Switching Valve) stuck open | Vacuum pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. 0.02 inch leak pressure standard is measured at start and end of leak check.<br>If stabilized pressure is higher than [second 0.02 inch leak pressure standard x 0.2], ECM determines that purge VSV is stuck open | • Purge VSV<br>• Purge VSV circuit (between purge VSV and ECM)<br>• Leakage from EVAP line (between purge VSV and intake manifold)<br>• EVAP line clogged (between purge VSV and canister)<br>• ECM | While ignition switch OFF | 2 trip |
| P0441 | Purge VSV stuck closed | After EVAP leak check is performed, purge VSV is turned ON (open), and atmospheric air is introduced into EVAP system. 0.02 inch leak pressure standard is measured at the start and end of leak check.<br>If pressure does not return to near atmospheric pressure, ECM determines that purge valve is stuck closed | | While ignition switch OFF | 2 trip |
| P0441 | Purge flow | While engine running, the following conditions are successively met:<br>• Negative pressure is not created in EVAP system when purge VSV is turned ON (open)<br>• EVAP system pressure change is less than 0.5 kPa (3.75 mmHg) when vent valve is turned ON (closed)<br>• Atmospheric pressure change before and after purge flow monitor is less than 0.1 kPa (0.75 mmHg) | | While ignition switch OFF | 2 trip |

## DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) System (See page ES-409).

## INSPECTION PROCEDURE

Refer to the EVAP System (See page ES-412).

## 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[*1] after the ignition switch is turned off. The purge flow monitor runs while the engine is running.

## 1. KEY-OFF MONITOR

5 hours[*1] after the ignition switch is turned off, the electric vacuum pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

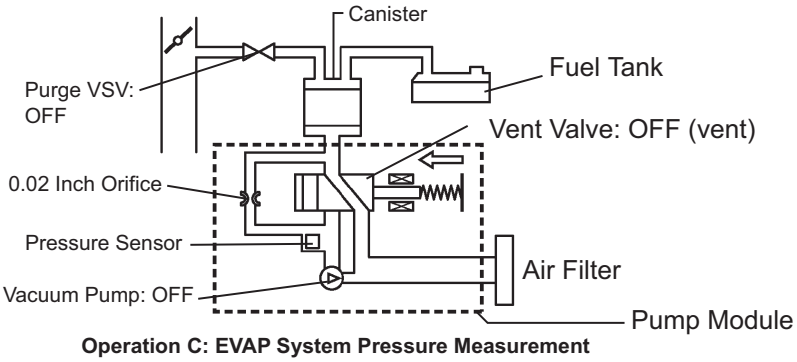
[*1]: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned off, the monitor check starts 2.5 hours later.

| Sequence | Operation | Description | Duration |
|---|---|---|---|
| - | ECM activation | Activated by soak timer, 5 hours (7 or 9.5 hours) after ignition switch turned off. | - |
| A | Atmospheric pressure measurement | Vent valve is turned OFF (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure.<br>If pressure in EVAP system is not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor. | 10 seconds |
| B | First 0.02 inch leak pressure measurement | In order to determine 0.02 inch leak pressure standard, vacuum pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if vacuum pump and vent valve operate normally. | 60 seconds |
| C | EVAP system pressure measurement | Vent valve is turned ON (closed) to shut EVAP system.<br>Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured.<br>Write down measured value as it will be used in leak check.<br>If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor. | 15 minutes[*2] |
| D | Purge VSV monitor | Purge VSV is opened and then EVAP system pressure is measured by ECM.<br>Large increase indicates normal. | 10 seconds |
| E | Second 0.02 inch leak pressure measurement | After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards.<br>If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system leaking. | 60 seconds |
| F | Final check | Atmospheric pressure is measured and then monitoring result is recorded by ECM. | - |

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

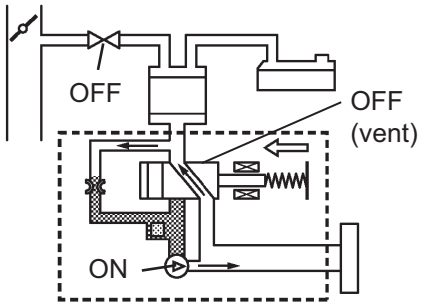
**Operation A:**

**Atmospheric Pressure Measurement**

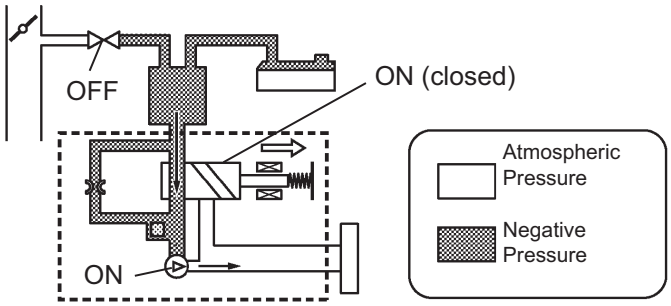



**Operation B, E:**

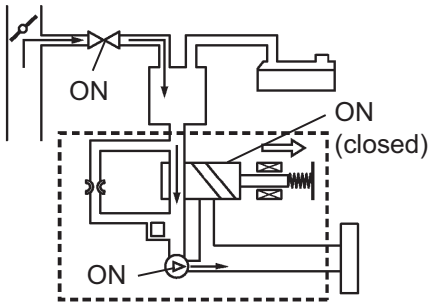
**0.02 Inch Leak Pressure Measurement**




**Operation C: EVAP System Pressure Measurement**




**Operation D: Purge VSV Monitor**

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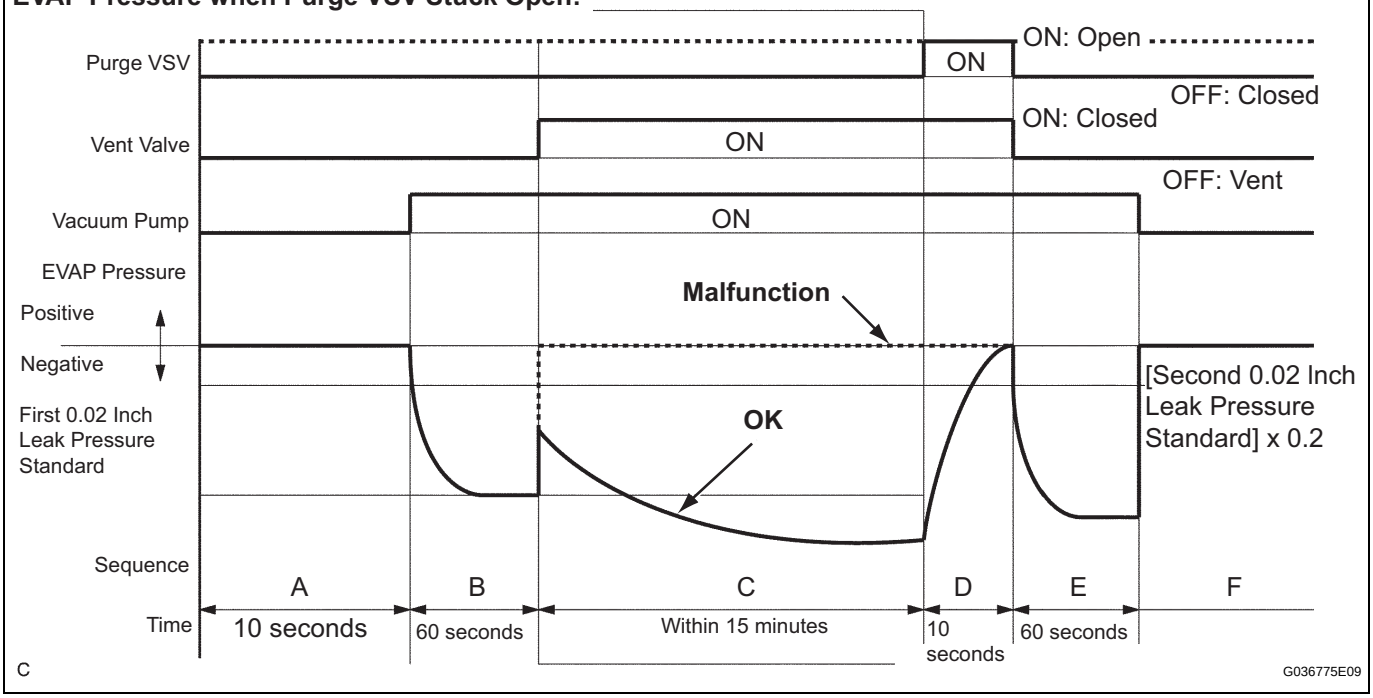
(a) Purge VSV stuck open
In operation C, the vacuum pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The EVAP system pressure is then measured by the ECM using the pressure sensor. If the stabilized system pressure is higher than [second 0.02 inch leak pressure standard 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).

**EVAP Pressure when Purge VSV Stuck Open:**

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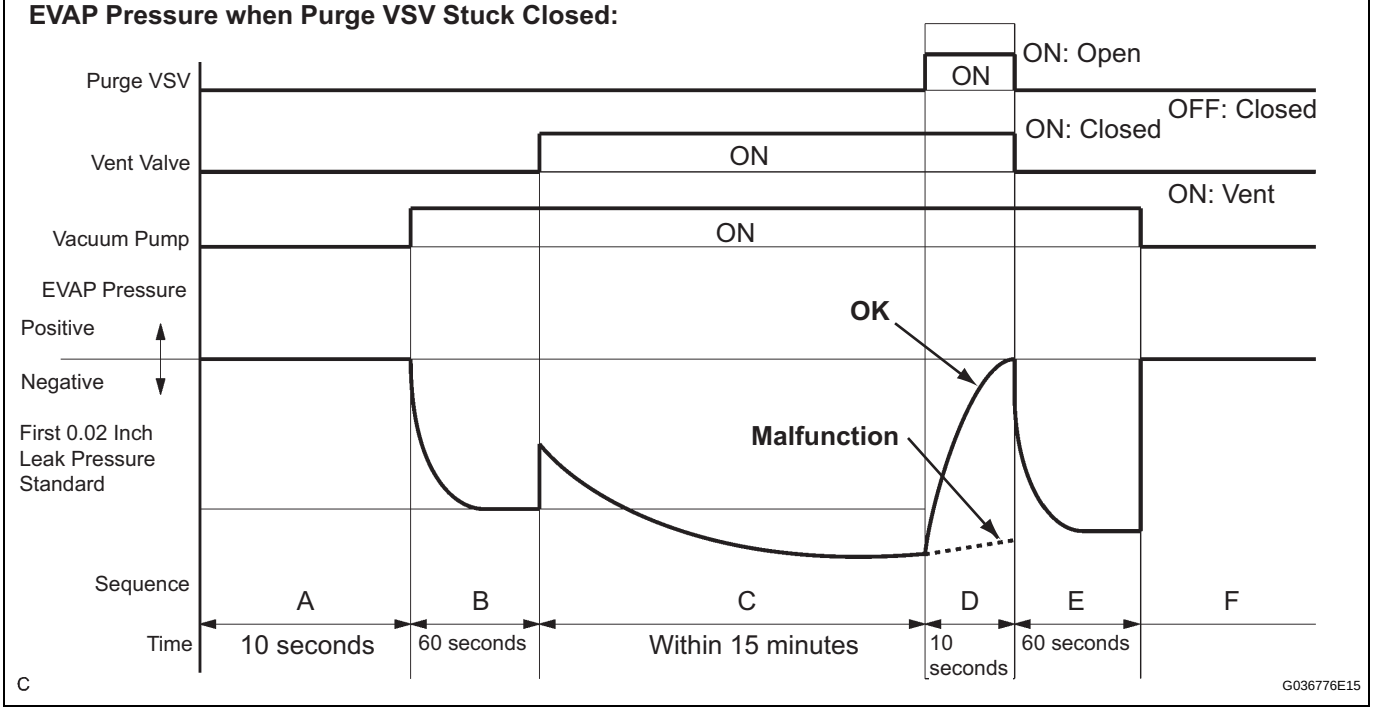
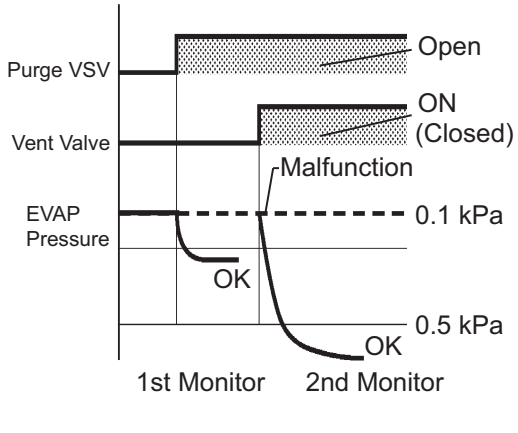
(b) Purge VSV stuck closed
In operation D, the pressure sensor measures the EVAP (Evaporative Emission) system pressure. The pressure measurement for purge VSV monitor is begun when the purge VSV is turned on (open) after the EVAP leak check. When the measured pressure indicates an increase of 0.3 kPa (2.25 mmHg) 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).

**EVAP Pressure when Purge VSV Stuck Closed:**




**EVAP Pressure During Purge Flow Monitor:**




**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 (Vacuum Switching Valve) 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 (3.75 mmHg), 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.

## MONITOR STRATEGY

| | |
|---|---|
| Related DTCs | P0441: Purge VSV stuck open<br>P0441: Purge VSV stuck closed<br>P0441: Purge flow |
| Required Sensors / Components | Purge VSV and pump module |
| Frequency of Operation | Once per driving cycle |
| Duration | Within 15 minutes |
| MIL Operation | 2 driving cycles |
| Sequence of Operation | None |

## TYPICAL ENABLING CONDITIONS

### All:

| | |
|---|---|
| The monitor is run whenever this DTC is not present | P0011, P0012 (VVT System 1-Advance, Retard), P0021, P0022 (VVT System 2-Adavance, Retard), P0100, P0101, P0102, P0103 (MAF Sensor), P0110, P0112, P0113 (IAT Sensor), P0115, P0116, P0117, P0118 (ECT Sensor), P0120, P0121, P0122, P0123, P0220, P0222, P0223 , P2135 (TP Sensor), P0125 (Insufficient ECT for Closed Loop), P0171,P0172 (Fuel System), P0300, P0301, P0302, P0303, P0304, P0305, P0306 (Misfire), P0335 (CKP Sensor), P0340 (CMP Sensor), P0351, P0352, P0353, P0354, P0355, P0356 (Ignitor), P0450, P0451, P0452, P0453 (EVAP pressure Sensor), P0500 (VSS) |

### Purge flow:

| | |
|---|---|
| Engine | Running |
| ECT | 4.4°C (40°F) or more |
| IAT | 4.4°C (40°F) or more |
| EVAP pressure sensor | Not detected |
| EVAP canister purge valve | Not operated by scan tool |
| EVAP system check | Not operated by scan tool |
| Battery voltage | 10 V or more |
| Purge duty cycle | 8% or more |

### Purge VSV stuck open and closed:

| | |
|---|---|
| Atmospheric pressure | 70 to 110 kPa (525 to 825 mmHg) |
| Battery voltage | 10.5 V or more |
| Vehicle speed | Less than 2.5 mph (4 km/h) |
| Ignition switch | OFF |
| Time after key-off | 5 or 7 or 9.5 hours |
| EVAP pressure sensor malfunction (P0450, P0452, P0453) | Not detected |
| EVAP canister purge valve | Not operated by scan tool |
| EVAP canister vent valve | Not operated by scan tool |
| EVAP leak detection pump | Not operated by scan tool |
| Both of the following conditions 1 and 2 are met before key-off | - |
| 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) |

### Key-off monitor sequence 1 to 8

### 1. Atmospheric pressure measurement

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

### 2. First reference pressure measurement

| | |
|---|---|
| Next sequence is run if the following conditions are met | Conditions 1, 2 and 3 |
| 1. EVAP pressure just after reference pressure measurement | -1 kPa (-7.5 mmHg) or less |
| 2. Reference pressure | -4.85 to -1.057 kPa (-36.384 to -7.929 mmHg) |
| 3. Reference pressure | Saturated within 1 minute |

### 3. EVAP canister vent valve close stuck check

| | |
|---|---|
| Next sequence is run if the following condition is met | - |
| EVAP pressure change after vent valve is ON | 0.3 kPa (2.25 mmHg) or more |

### 4. Vacuum introduction

| | |
|---|---|
| Next sequence is run if the following condition is met | - |
| EVAP pressure | Saturated within 15 minutes |



### 5. EVAP canister purge valve close stuck check

| | |
|---|---|
| Next sequence is run if the following condition is met | - |
| EVAP pressure change after purge valve is open | 0.3 kPa (2.25 mmHg) or more |

### 6. Second reference pressure measurement

| | |
|---|---|
| Next sequence is run if the following conditions are met | Conditions 1, 2, 3 and 4 |
| 1. EVAP pressure just after reference pressure measurement | -1 kPa (-7.5 mmHg) or less |
| 2. Reference pressure | -4.85 to -1.057 kPa (-36.384 to -7.929 mmHg) |
| 3. Reference pressure | Saturated |
| 4. Difference between first reference pressure and second reference pressure | Less than 0.7 kPa (5.25 mmHg) |

### 7. Leak check

| | |
|---|---|
| Next sequence is run if the following condition is met | - |
| EVAP pressure when vacuum introduction was complete | Lower than second reference pressure |

### 8. Atmospheric pressure measurement

| | |
|---|---|
| EVAP monitor is complete if the following condition is met | - |
| Atmospheric pressure difference between sequence 1 and 8 | Within 0.3 kPa (2.25 mmHg) |

## TYPICAL MALFUNCTION THRESHOLDS

### Purge flow:

| | |
|---|---|
| Both of the following conditions are met | Conditions (a) and (b) |
| (a) EVAP pressure change when purge flow is started | Less than 0.1 kPa (0.75 mmHg) |
| (b) EVAP pressure change during purge flow when EVAP pressure switching valve ON (closed) | Less than 0.5 kPa (3.75 mmHg) |

### EVAP VSV stuck open:

| | |
|---|---|
| EVAP pressure when vacuum introduction is complete | Higher than reference pressure x 0.2 |

### EVAP VSV stuck closed:

| | |
|---|---|
| EVAP pressure change after EVAP canister purge valve is open | Less than 0.3 kPa (2.25 mmHg) |

## MONITOR RESULT

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