

<b>DTC</b>	<b>P043E</b>	<b>Evaporative Emission System Reference Orifice Clog Up</b>
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<b>DTC</b>	<b>P043F</b>	<b>Evaporative Emission System Reference Orifice High Flow</b>
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## DTC SUMMARY

DTCs	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timings	Detection Logic
P043E	Reference orifice clogged	P043E, P043F, P2401, P2402 and P2419 present when one of following conditions met during key-off EVAP monitor: <ul style="list-style-type: none"> <li>EVAP pressure just after reference pressure measurement greater than -1 kPa-g (-7.5 mmHg-g)</li> <li>Reference pressure less than -4.85 kPa-g (-36.4 mmHg-g)</li> </ul>	<ul style="list-style-type: none"> <li>Canister pump module (Reference orifice, leak detection pump, vent valve)</li> <li>Connector/wire harness (Canister pump module - ECM)</li> <li>EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose)</li> <li>ECM</li> </ul>	While ignition switch OFF	2 trip
P043F	Reference orifice high-flow	<ul style="list-style-type: none"> <li>Reference pressure greater than -1.057 kPa-g (-7.93 mmHg-g)</li> <li>Reference pressure not saturated</li> <li>Reference pressure difference between first and second 0.7 kPa-g (5.25 mmHg-g) or more</li> </ul> HINT: Typical example values	<ul style="list-style-type: none"> <li>Canister pump module (Reference orifice, leak detection pump, vent valve)</li> <li>Connector/wire harness (Canister pump module - ECM)</li> <li>EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose)</li> <li>ECM</li> </ul>	While ignition switch OFF	2 trip

### 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-335](#)).

## INSPECTION PROCEDURE

Refer to the EVAP System (see page [ES-340](#)).

## 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.

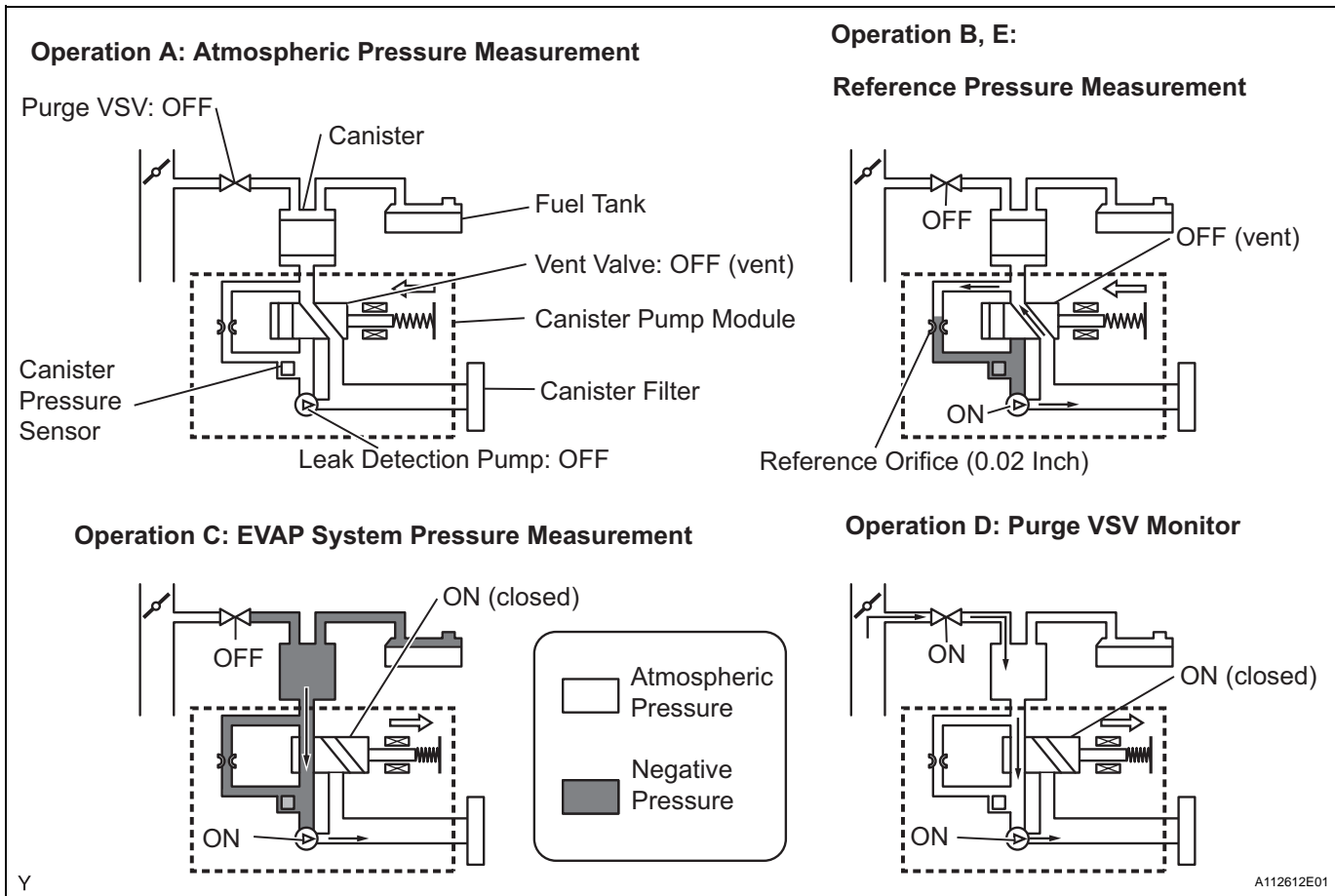
### HINT:

\*: 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.

Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch turned OFF.	-

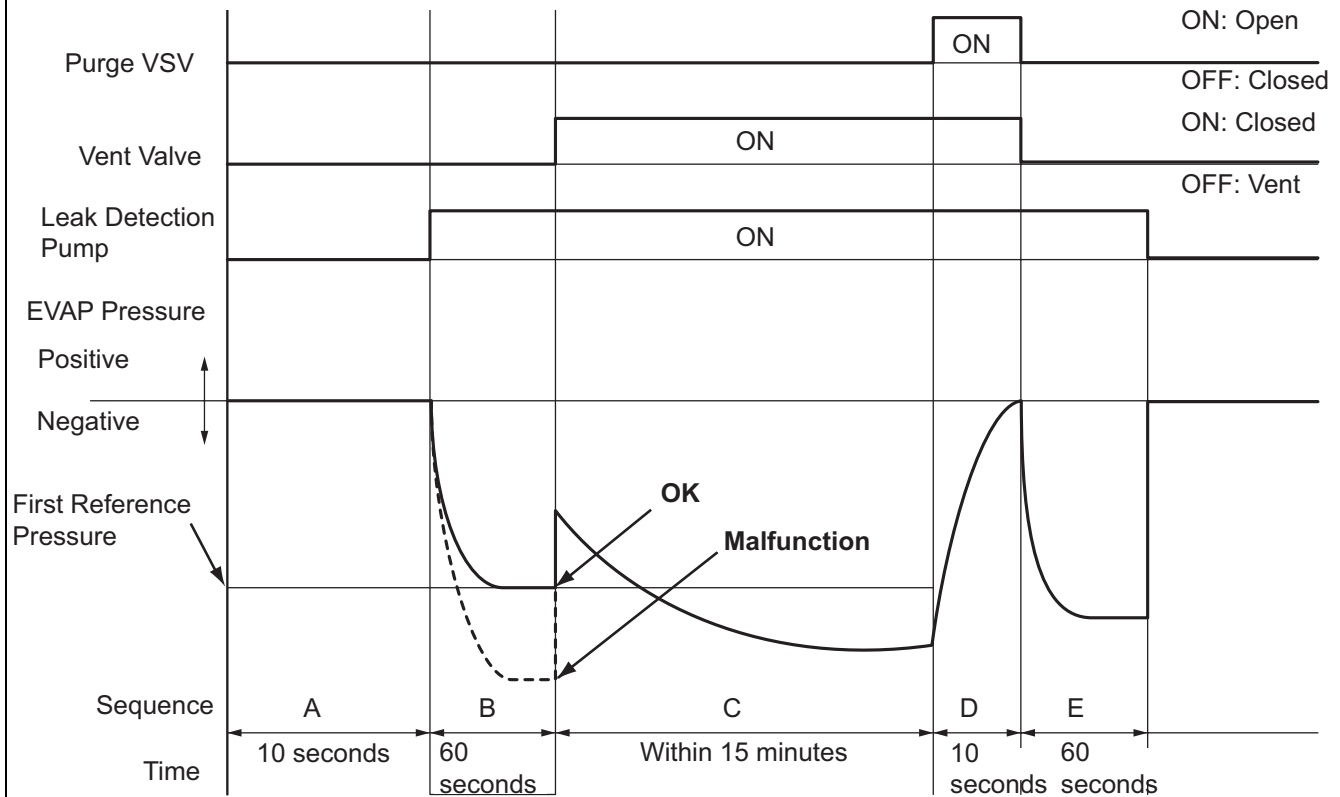
Sequence	Operations	Descriptions	Duration
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 76 kPa-a and 110 kPa-a (570 mmHg-a and 825 mmHg-a), ECM cancels EVAP system monitor.	10 seconds
B	First reference pressure measurement	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.	60 seconds
C	EVAP system pressure measurement	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.	15 minutes*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normality.	10 seconds
E	Second reference pressure measurement	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.	60 seconds
F	Final check	Atmospheric pressure measured and then monitoring result recorded by ECM.	-

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



(a) P043E: Reference orifice clogged

In operation B, the leak detection pump creates negative pressure (vacuum) through the reference orifice. The EVAP system pressure is then measured by the ECM, using the canister pressure sensor, to determine the reference pressure. If the pressure is lower than -4.85 kPa-g (-36.4 mmHg-g), the ECM interprets this as a clog malfunction in the reference orifice, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (2 trip detection logic).

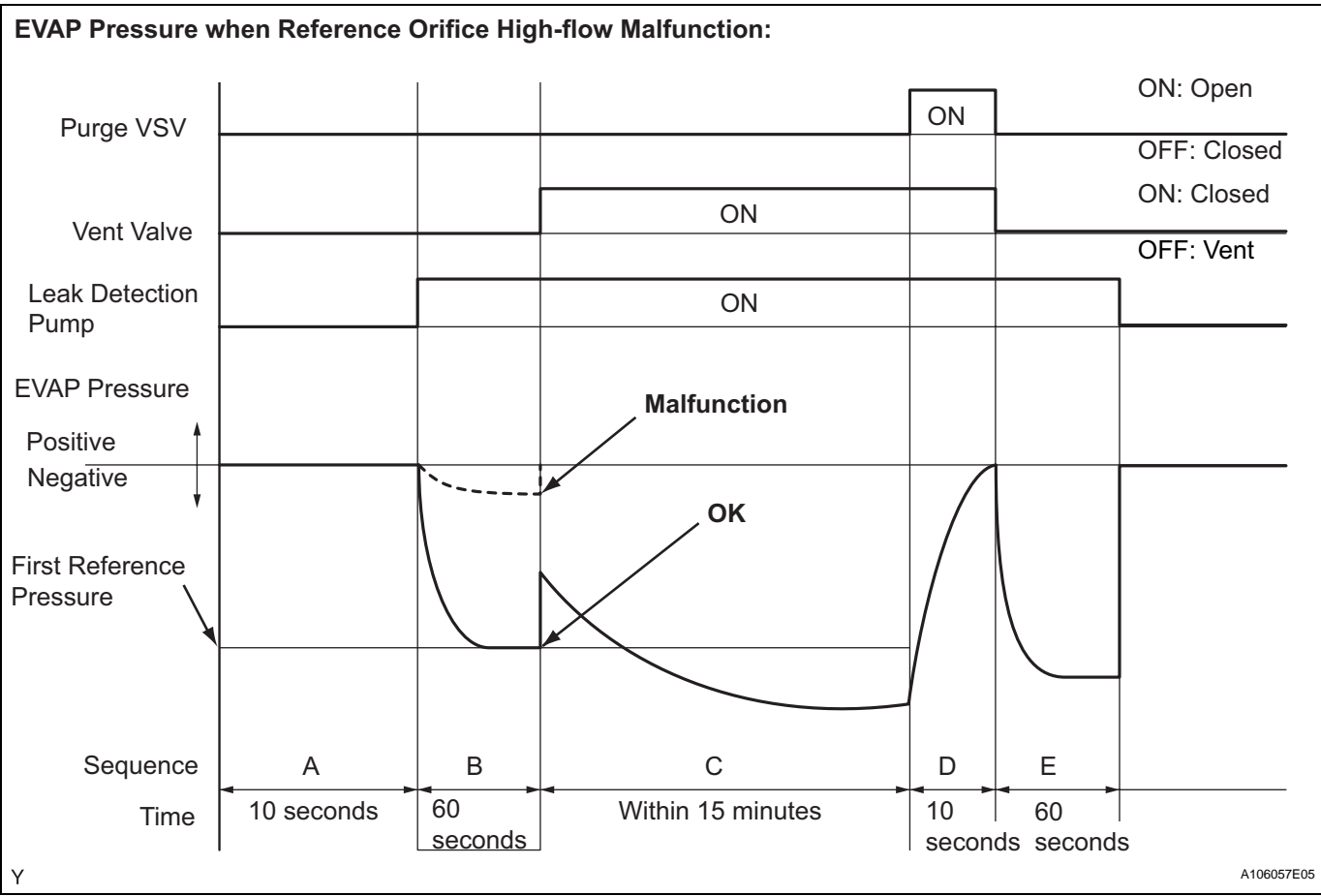
**EVAP Pressure when Reference Orifice Clogged:**

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**(b) P043F: Reference orifice high-flow**

In operation B, the leak detection pump creates negative pressure (vacuum) through the reference orifice. The EVAP system pressure is then measured by the ECM using the canister pressure sensor to determine the reference pressure. If the pressure is higher than  $-1.057 \text{ kPa-g}$  ( $-7.93 \text{ mmHg-g}$ ), the ECM interprets this as a high-flow malfunction in the reference orifice, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (2 trip detection logic).



MONITOR STRATEGY

Required Sensors/Components	Canister 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

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

ECT	4.4° to 35°C (40° to 95°F)
IAT	4.4° to 35°C (40° to 95°F)

**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 start	-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 start	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-17](#)).

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<b>DTC</b>	<b>P0441</b>	<b>Evaporative Emission Control System Incorrect Purge Flow</b>
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**DTC SUMMARY**

DTC	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timings	Detection Logic
P0441	Purge VSV (Vacuum Switching Valve) stuck open	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. Reference pressure measured at start and at end of leak check. If stabilized pressure higher than [second reference pressure x 0.2], ECM determines that purge VSV stuck open.	<ul style="list-style-type: none"> <li>Purge VSV</li> <li>Connector/wire harness (Purge VSV - ECM)</li> <li>ECM</li> <li>Canister pump module</li> <li>Leakage from EVAP system</li> </ul>	While ignition switch OFF	2 trip
	Purge VSV stuck closed	After EVAP leak check performed, purge VSV turned ON (open), and atmospheric air introduced into EVAP system. Reference pressure measured at start and at end of check. If pressure does not return to near atmospheric pressure, ECM determines that purge VSV stuck closed.	<ul style="list-style-type: none"> <li>Purge VSV</li> <li>Connector/wire harness (Purge VSV - ECM)</li> <li>ECM</li> <li>Canister pump module</li> <li>Leakage from EVAP system</li> </ul>	While ignition switch OFF	2 trip
	Purge flow	While engine running, following conditions successively met: <ul style="list-style-type: none"> <li>Negative pressure not created in EVAP system when purge VSV turned ON (open)</li> <li>EVAP system pressure change less than 0.5 kPa-g (3.75 mmHg-g) when vent valve turned ON (closed)</li> <li>Atmospheric pressure change before and after purge flow monitor less than 0.1 kPa-g (0.75 mmHg-g)</li> </ul>	<ul style="list-style-type: none"> <li>Purge VSV</li> <li>Connector/wire harness (Purge VSV - ECM)</li> <li>Leakage from EVAP line (Purge VSV - Intake manifold)</li> <li>ECM</li> </ul>	While engine running	2 trip

**DESCRIPTION**

The description can be found in the EVAP (Evaporative Emission) System (see page [ES-335](#)).

**INSPECTION PROCEDURE**

Refer to the EVAP System (see page [ES-340](#)).

**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:

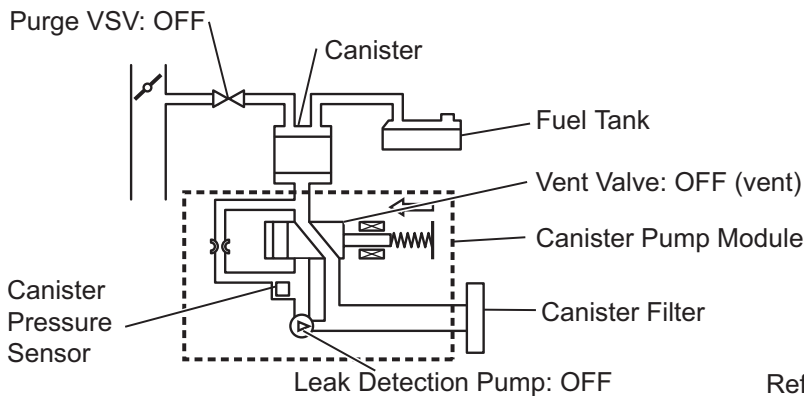
\*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch turned OFF.	-

Sequence	Operations	Descriptions	Duration
A	Atmospheric pressure measurement	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.	10 seconds
B	First reference pressure measurement	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.	60 seconds
C	EVAP system pressure measurement	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.	15 minutes*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normality.	10 seconds
E	Second reference pressure measurement	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.	60 seconds
F	Final check	Atmospheric pressure measured and then monitoring result recorded by ECM.	-

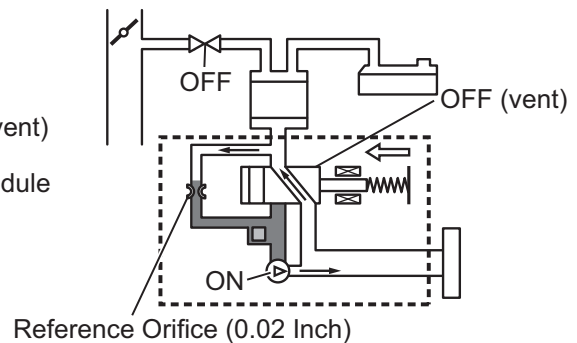
\*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

#### Operation A: Atmospheric Pressure Measurement

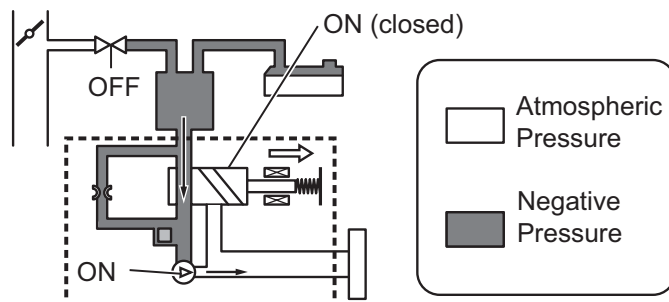


#### Operation B, E:

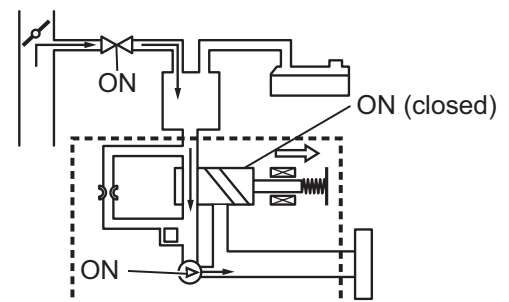
#### Reference Pressure Measurement



#### Operation C: EVAP System Pressure Measurement



#### Operation D: Purge VSV Monitor



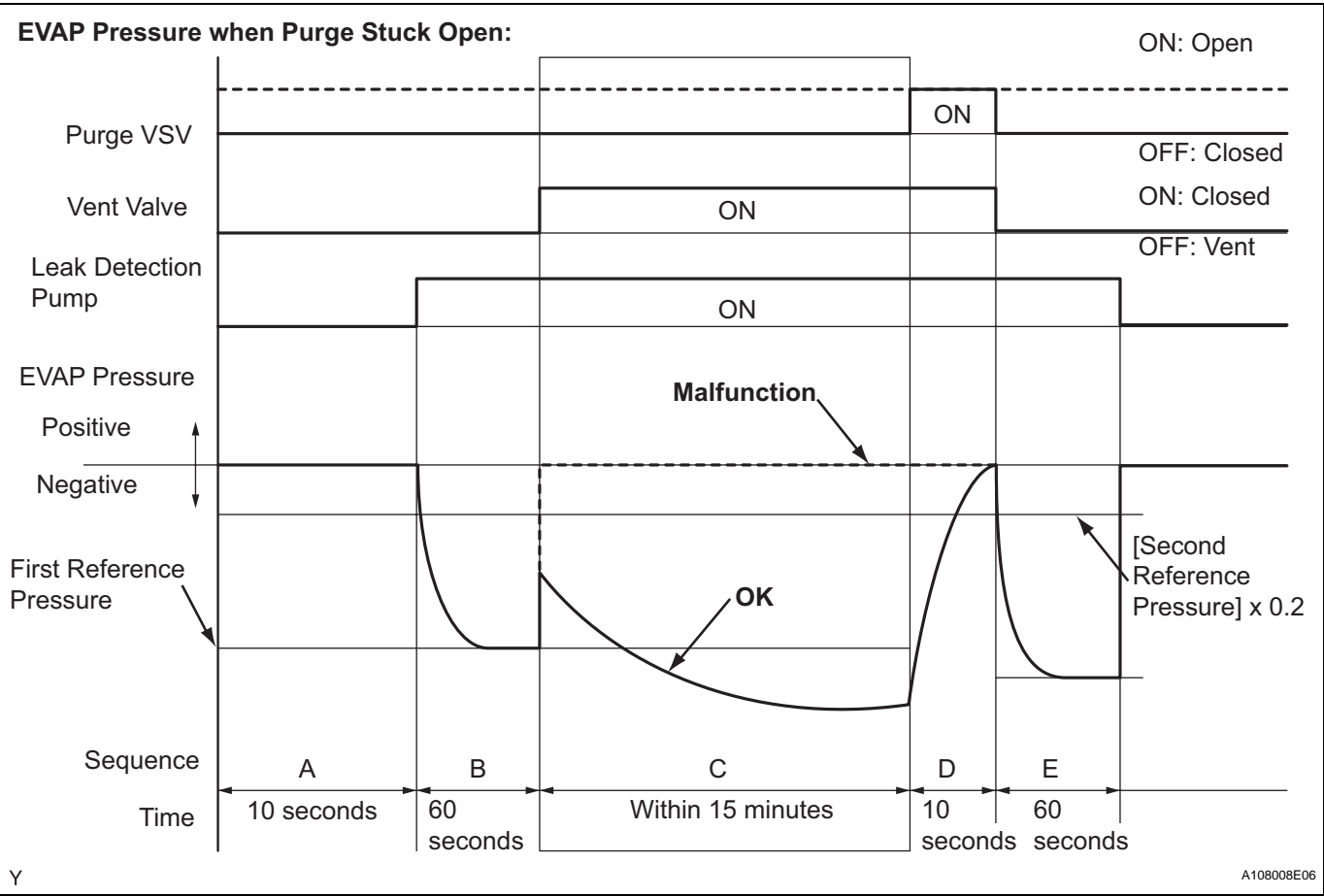
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(a)Purge VSV stuck open

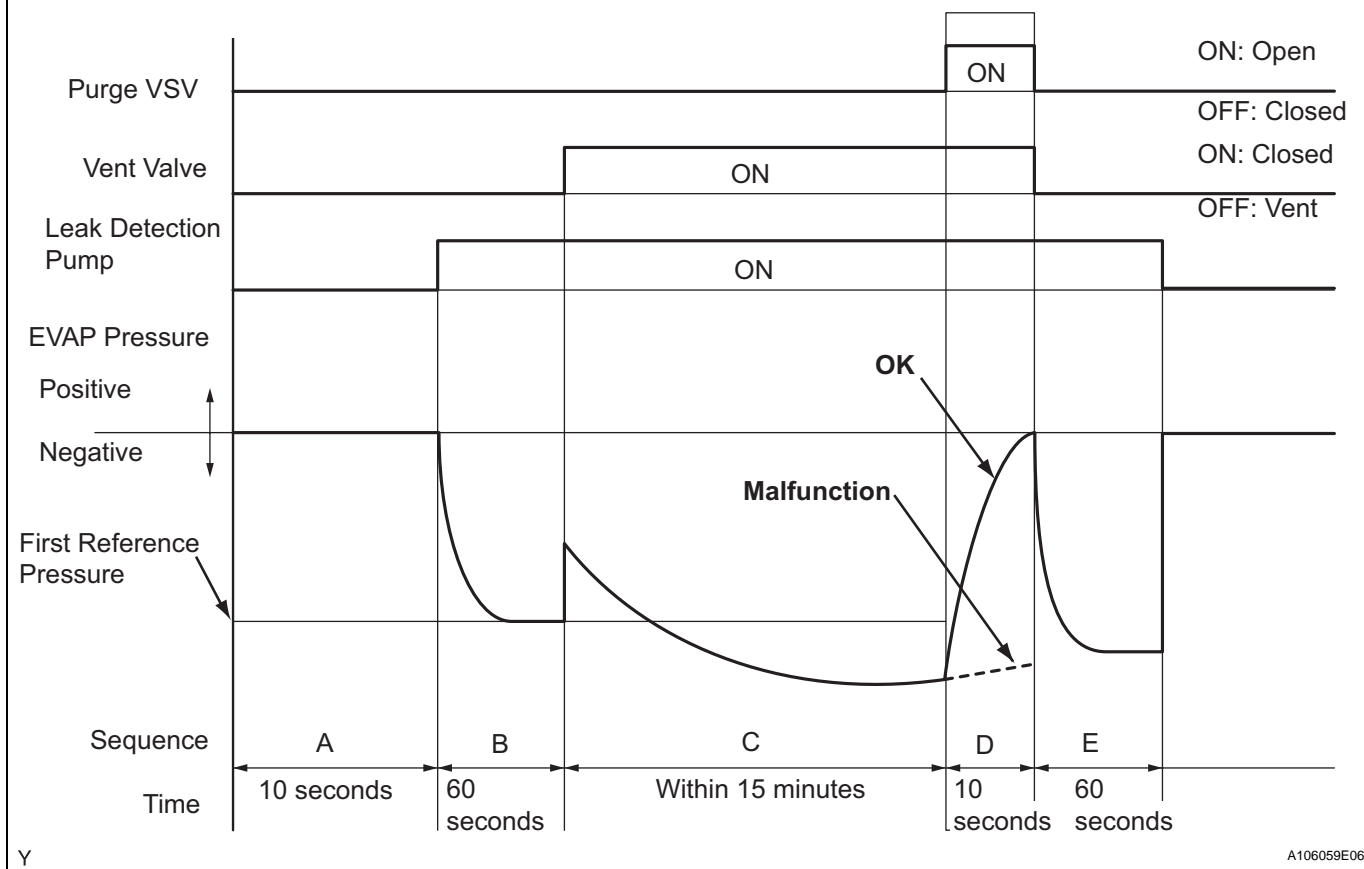
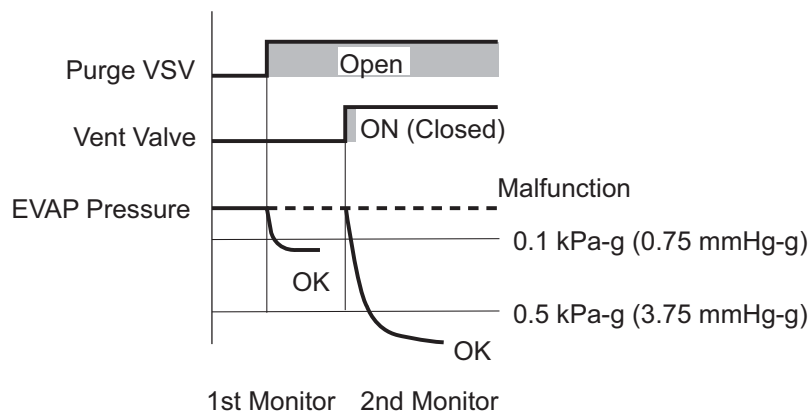
In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The EVAP system pressure is then measured by the ECM using the canister pressure sensor. If the stabilized system pressure is higher than [second reference pressure x 0.2], the ECM interprets this as the purge 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 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).

**EVAP Pressure when Purge VSV Stuck Closed:****2. PURGE FLOW MONITOR****EVAP Pressure During 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.

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## OBD II MONITOR SPECIFICATIONS

### 1. Key-off Monitor

#### Monitor Strategy

Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 15 minutes (varies with fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

#### 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 start	-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**

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) 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 - P0304 (Misfire) P0335 (CKP sensor) P0340 (CMP sensor) P0351 - P0354 (Igniter) P0450 - P0453 (EVAP press sensor) P0500 (VSS)
Engine	Running
ECT	4.4°C (40°F) or more
IAT	4.4°C (40°F) or more

Canister pressure sensor malfunction	Not detected
Purge VSV	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

**Typical Malfunction Thresholds**

Both of following conditions met	Conditions 1 and 2
1. EVAP pressure change when purge operation started	Less than 0.1 kPa-g (0.75 mmHg-g)
2. EVAP pressure change during purge operation when vent valve closed	Less than 0.5 kPa-g (3.75 mmHg-g)



**MONITOR RESULT**

Refer to CHECKING MONITOR STATUS (see page [ES-17](#)).