

<b>DTC</b>	<b>P043E</b>	<b>Evaporative Emission System Leak Detection Reference Orifice Low Flow</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**

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timing	Detection Logic
P043E	Reference orifice clogged	P043E, P043F, P2401, P2402 and P2419 are present when one of the following conditions is 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 (755 mmHg-a)</li> <li>• Reference pressure less than -4.85 kPa-g (726 mmHg-a)</li> <li>• Reference pressure greater than -1 kPa-g (755 mmHg-a)</li> <li>• Reference pressure is not saturated</li> <li>• Reference pressure difference between first and second is 0.7 kPa-g (5 mmHg-g) or more</li> </ul> HINT: These values are typical	<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>	Ignition switch OFF	2 trip

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DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timing	Detection Logic
P043F	Reference orifice high-flow	P043E, P043F, P2401, P2402 and P2419 are present when one of the following conditions is 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 (755 mmHg-a)</li> <li>Reference pressure less than -4.85 kPa-g (726 mmHg-a)</li> <li>Reference pressure greater than -1 kPa-g (755 mmHg-a)</li> <li>Reference pressure is not saturated</li> <li>Reference pressure difference between first and second is 0.7 kPa-g (5 mmHg-g) or more</li> </ul> HINT: These values are typical	<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>	Ignition switch OFF	2 trip

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## DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page [ES-272](#)).

Refer to the EVAP system (see page [ES-272](#)).

## 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:

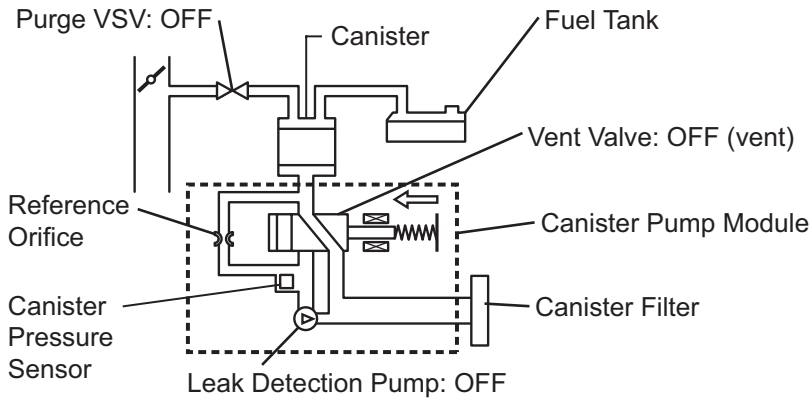
\*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

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

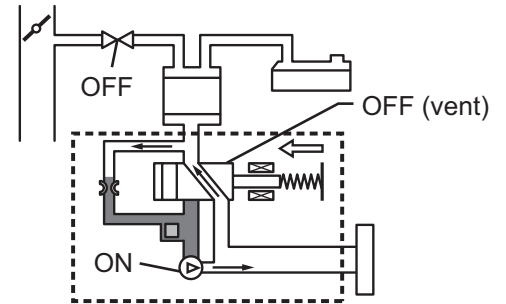
Sequence	Operations	Descriptions	Duration
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak criterion measurement	In order to determine 0.02 inch leak criterion, 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 900 seconds, ECM cancels EVAP system monitor.	900 seconds*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak criterion measurement	After second 0.02 inch leak criterion measurement, leak check performed by comparing first and second 0.02 inch leak criterion. If stabilized system pressure higher than second 0.02 inch leak criterion, 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.

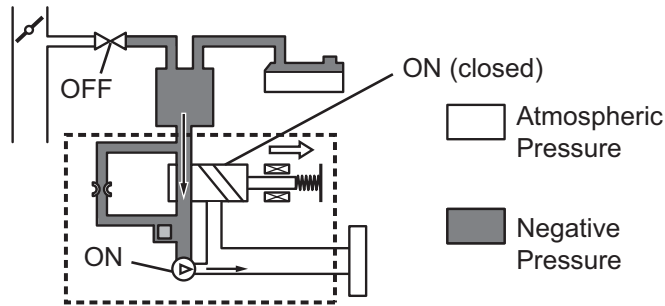
Operation A: Atmospheric Pressure Measurement



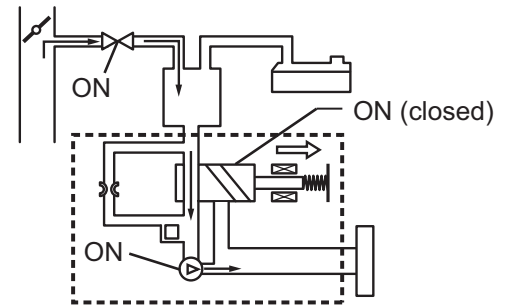
Operation B, E: 0.02 Inch Leak Criterion Measurement



Operation C: EVAP System Pressure Measurement



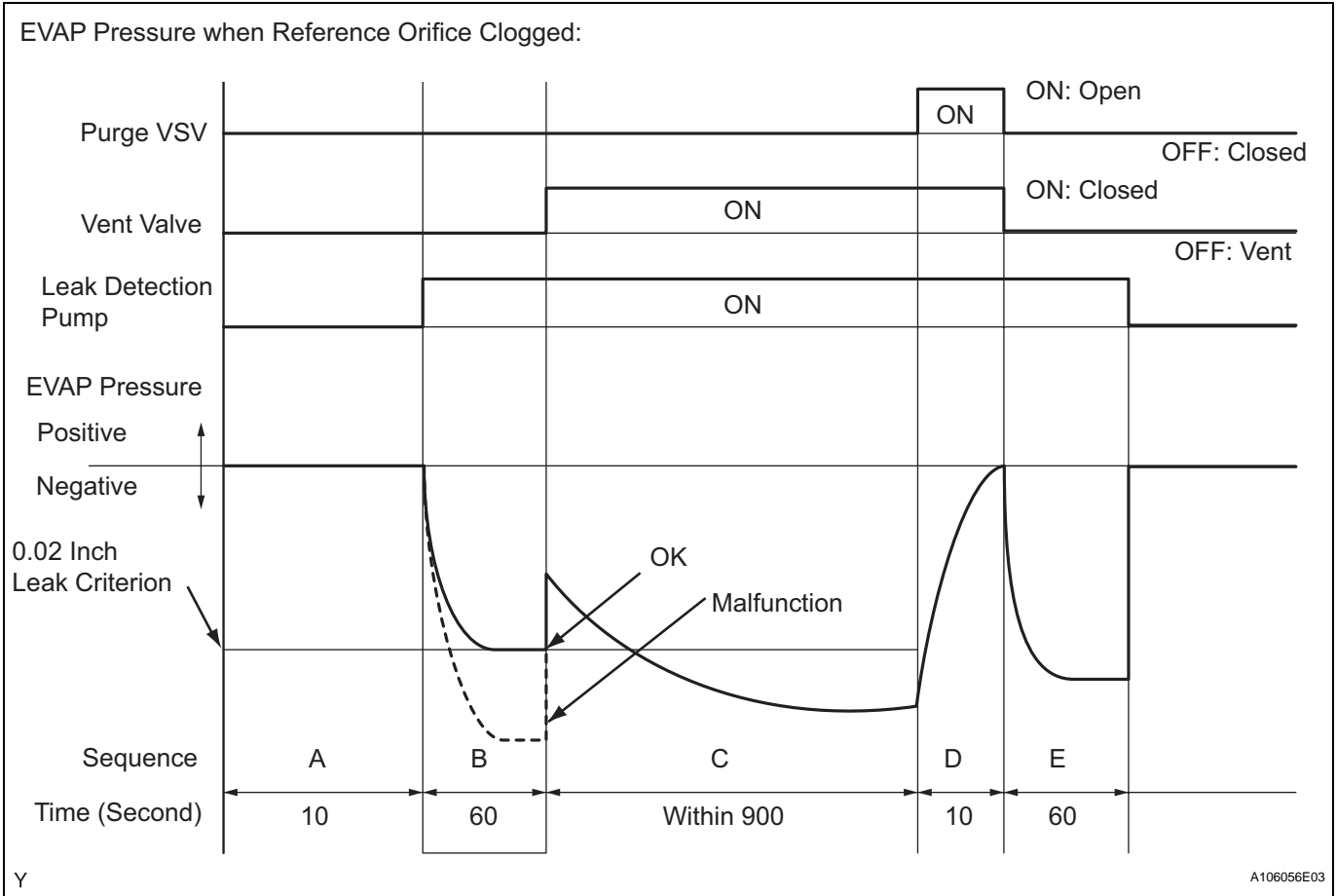
Operation D: Purge VSV Monitor



1. 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 0.02 inch leak criterion. If the pressure is lower than -4.85 kPa (-36.38 mmHg)\*, 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).

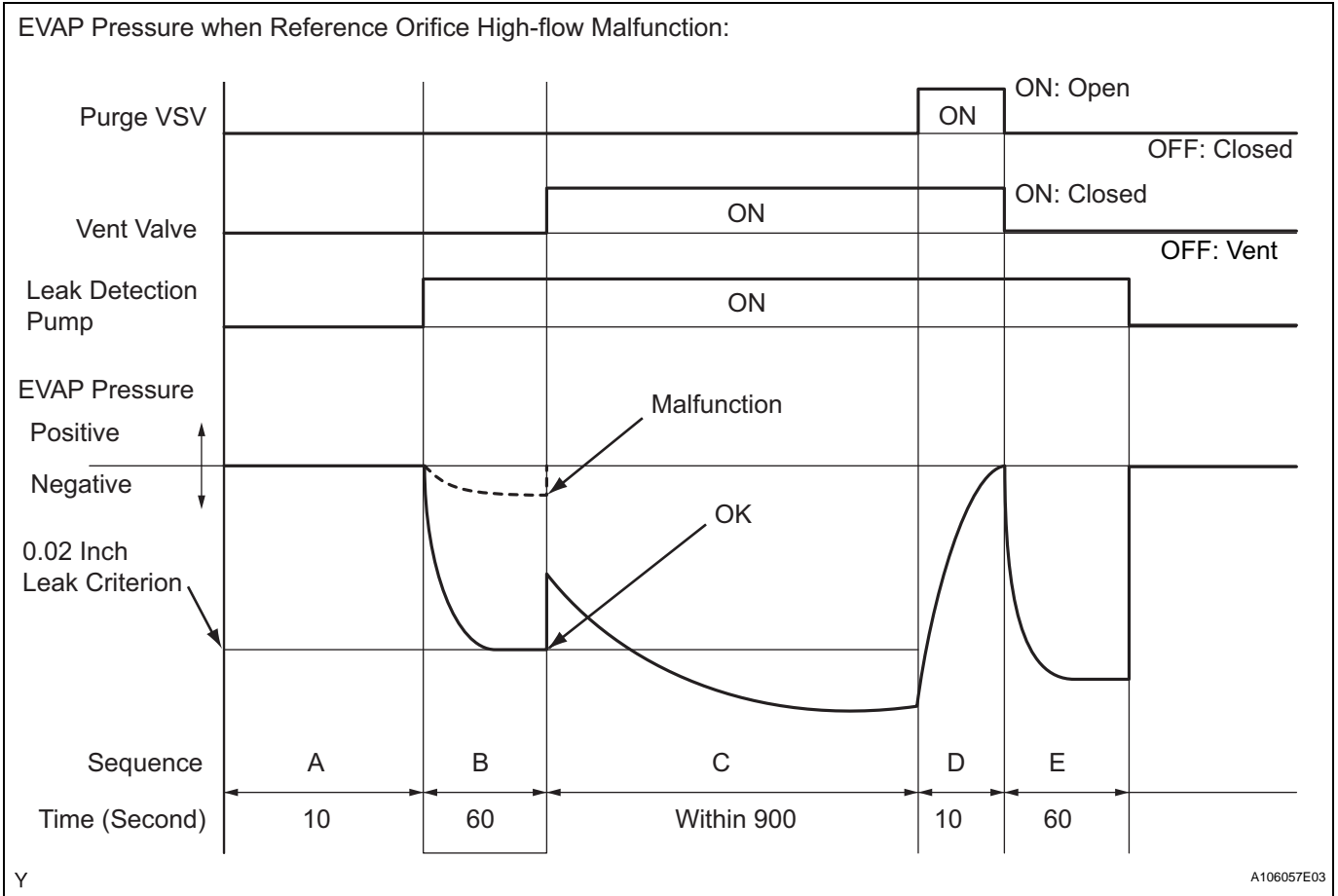
\*: The threshold varies according to the atmospheric pressure measured in operation A. The value described above is based on an atmospheric pressure of 100 kPa (750.1 mmHg): absolute pressure.



2. 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 0.02 inch leak criterion. If the pressure is lower than -1.06 kPa (-7.95 mmHg)\*, 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).

\*: The threshold varies according to the atmospheric pressure measured in operation A. The value described above is based on an atmospheric pressure of 100 kPa (750.1 mmHg): absolute pressure.



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**MONITOR STRATEGY**

Required Sensors/Components	Canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 900 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

**TYPICAL ENABLING CONDITIONS**

Enabling conditions of EVAP key-OFF monitor
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P043E (Reference orifice - low flow)	
P043F (Reference orifice - high flow)	
P0441 (Purge VSV - stuck open)	
P0441 (Purge VSV - stuck closed)	
P0451 (Canister pressure sensor - noise)	
P0455 (EVAP gross leak)	
P0456 (EVAP 0.02 inch leak)	
P2401 (Leak detection pump - stuck OFF)	
P2402 (Leak detection pump - stuck ON)	
P2419 (Vent valve - stuck ON)	
P2420 (Vent valve - stuck OFF)	
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or higher
Vehicle speed	4 km/h (2.5 mph) or less
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours
Canister pressure sensor malfunction (P0450, P0452, 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 the following conditions 1 and 2 are met before key off	-
1. Duration that vehicle has been 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 is run if the following condition is met	-
Atmospheric pressure change	Within 0.3 kPa (2.25 mmHg) in 1 second

### 2. First reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement start	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds

### 3. Vent valve stuck closed 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 900 seconds

### 5. Purge VSV stuck closed 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	-
EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds
Reference pressure difference between first and second	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 is 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**

"Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

One of following conditions met	-
FTP when just after reference pressure measurement started	-1 kPa (755 mmHg) or higher
Reference pressure	-4.85 kPa (726 mmHg) or lower
Reference pressure	-1.05 kPa (754 mmHg) or higher
Reference pressure	Not saturated within 60 seconds
Difference between first reference pressure and second reference pressure	0.7 kPa (5.25 mmHg)

**ES****MONITOR RESULT**

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



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

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timing	Detection Logic
P0441	Purge Vacuum Switching Valve (VSV) stuck open	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. 0.02 inch leak criterion measured at start and at end of leak check. If stabilized pressure higher than [second 0.02 inch leak criterion 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
P0441	Purge VSV stuck closed	After EVAP leak check performed, purge VSV turned ON (open), and atmospheric air introduced into EVAP system. 0.02 inch leak criterion measured at start and at end of leak 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
P0441	Purge flow	While engine running, following conditions are 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 (3.75 mmHg) when vent valve turned ON (closed)</li> <li>Atmospheric pressure change before and after purge flow monitor less than 0.1 kPa (0.75 mmHg)</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

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## DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page [ES-272](#)).

Refer to the EVAP system (see page [ES-272](#)).

## MONITOR DESCRIPTION

The 2 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.

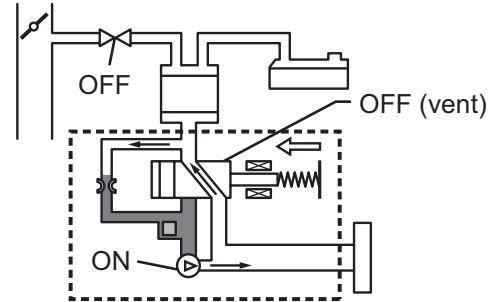
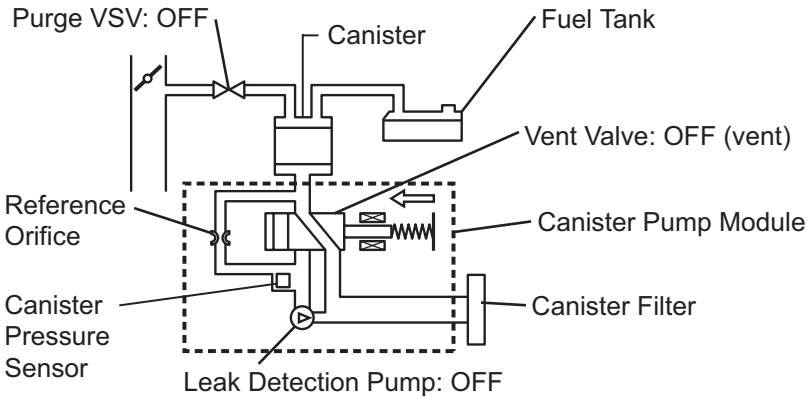
Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch OFF.	-
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak criterion measurement	In order to determine 0.02 inch leak criterion, 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 900 seconds, ECM cancels EVAP system monitor.	900 seconds*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak criterion measurement	After second 0.02 inch leak criterion measurement, leak check performed by comparing first and second 0.02 inch leak criterion. If stabilized system pressure higher than second 0.02 inch leak criterion, ECM determines that EVAP system leaking.	60 seconds

Sequence	Operations	Descriptions	Duration
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.

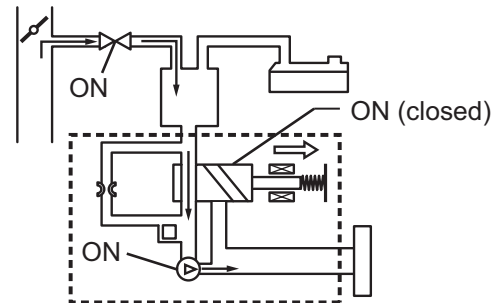
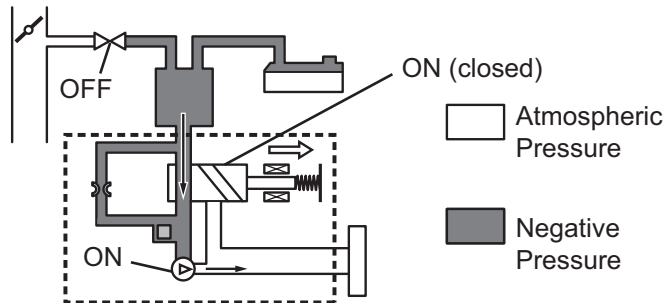
Operation A: Atmospheric Pressure Measurement

Operation B, E: 0.02 Inch Leak Criterion Measurement



Operation C: EVAP System Pressure Measurement

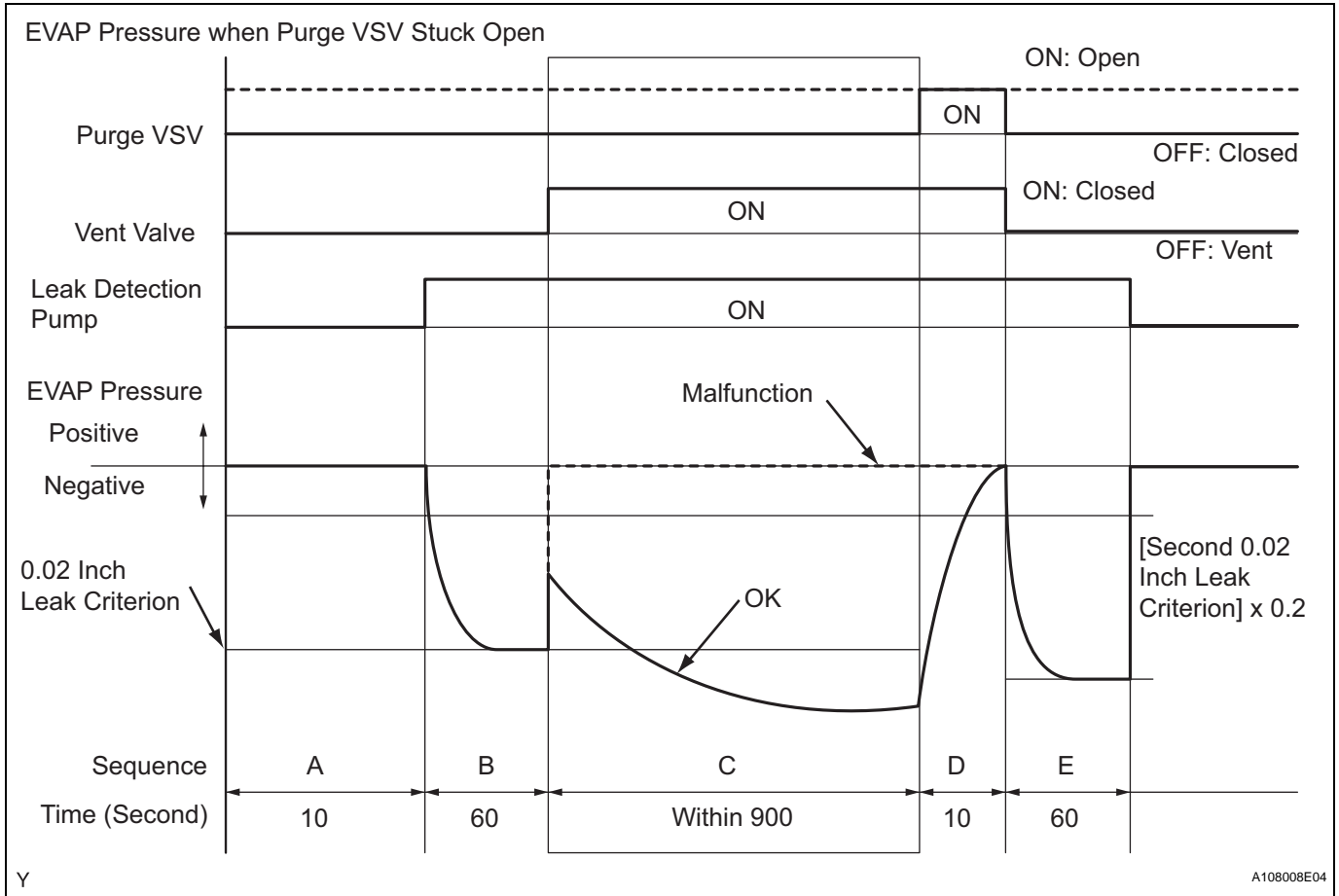
Operation D: Purge VSV Monitor



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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 0.02 inch leak criterion x 0.2], the ECM interprets this as the purge Vacuum Switching Valve (VSV) being stuck open. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

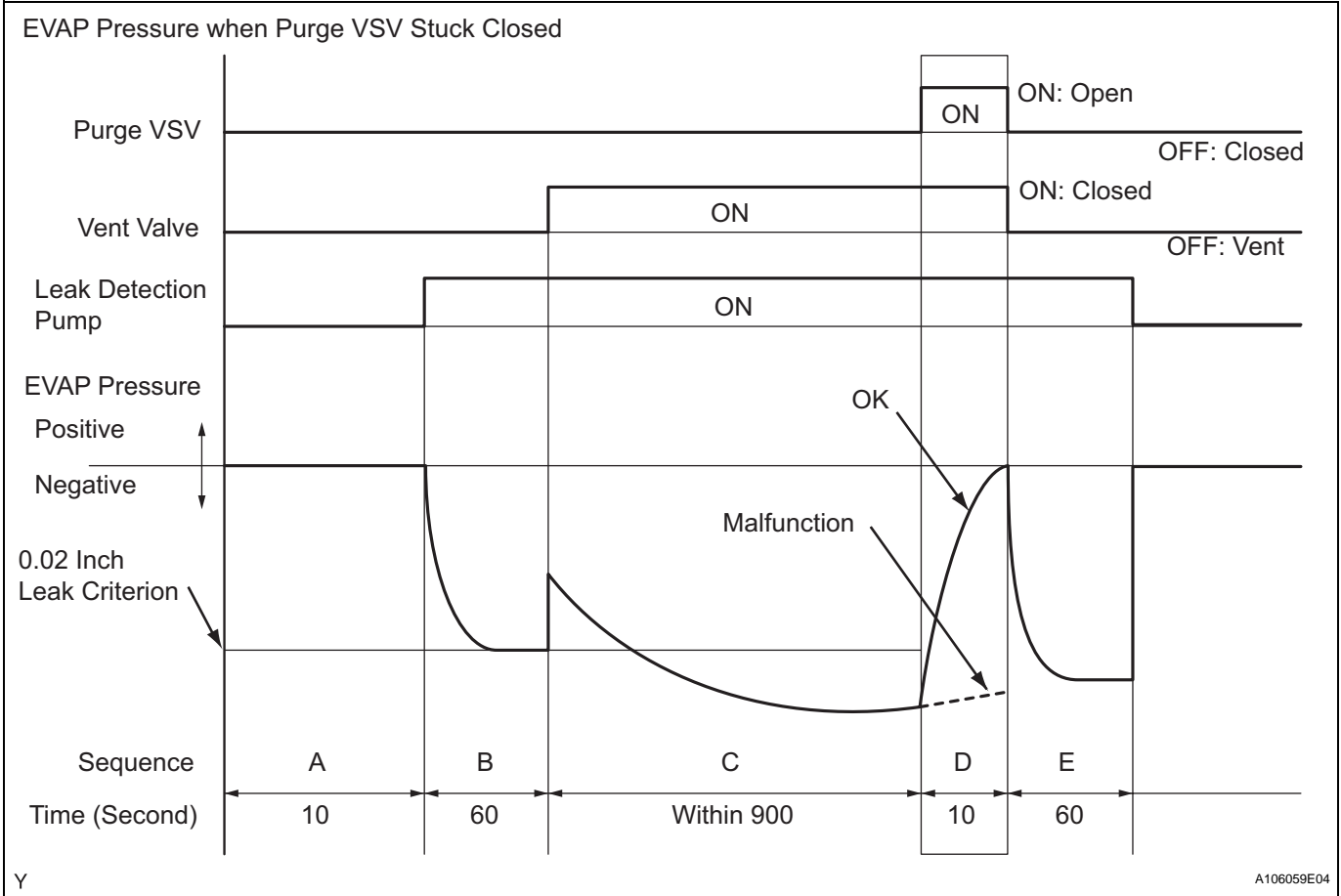


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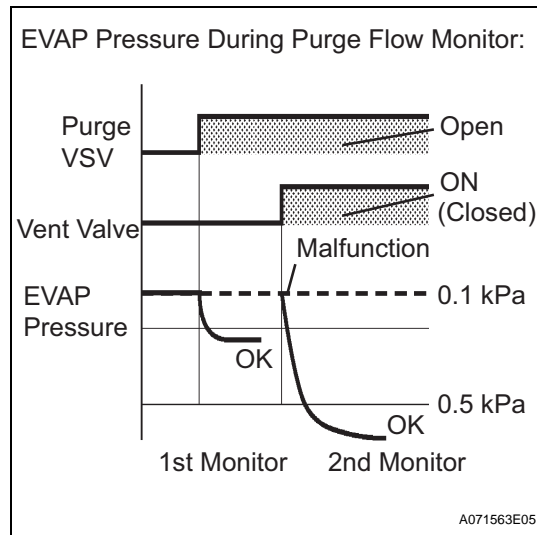
(b) Purge VSV stuck closed

In operation D, the canister pressure sensor measures the EVAP system pressure. The pressure measurement for the purge VSV monitor begins 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).

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2. Purge flow monitor



The purge flow monitor consists of the 2 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 (3.75 mmHg), the ECM interprets this as the purge VSV being stuck closed, 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 pressure before and after conduction of the purge flow monitor is measured by the ECM.

## MONITOR STRATEGY

Related DTCs	P0441: Purge VSV stuck open P0441: Purge VSV stuck closed P0441: Purge flow
Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 900 seconds (varies with amount of fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

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## TYPICAL ENABLING CONDITIONS

### Purge Flow Monitor:

Monitor runs whenever following DTC not present	-
Engine	Running
ECT	4.4°C (40°F) or more
IAT	4.4°C (40°F) or more
FTP sensor malfunction	Not detected
Purge VSV	Not detected by scan tool
EVAP system check	Not detected by scan tool
Battery voltage	10 V or higher
Purge duty cycle	8% or more

### Purge VSV Stuck:

Enabling conditions of EVAP key-OFF monitor	
P043E (Reference orifice - low flow) P043F (Reference orifice - high flow) P0441 (Purge VSV - stuck open) P0441 (Purge VSV - stuck closed) P0451 (Canister pressure sensor - noise) P0455 (EVAP gross leak) P0456 (EVAP 0.02 inch leak) P2401 (Leak detection pump - stuck OFF) P2402 (Leak detection pump - stuck ON) P2419 (Vent valve - stuck ON) P2420 (Vent valve - stuck OFF)	
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or higher
Vehicle speed	4 km/h (2.5 mph) or less
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours
Canister pressure sensor malfunction (P0450, P0452, 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 the following conditions 1 and 2 are met before key off	-
1. Duration that vehicle has been 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 is run if the following condition is met	-
Atmospheric pressure change	Within 0.3 kPa (2.25 mmHg) in 1 second

#### 2. First reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement start	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds

#### 3. Vent valve stuck closed 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 900 seconds

#### 5. Purge VSV stuck closed 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	-
EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds
Reference pressure difference between first and second	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 is 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

"Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

#### Purge Flow Monitor:

Both of the following conditions are met	-
EVAP pressure change when purge flow is started	Lower than 0.1 kPa (0.75 mmHg)
EVAP pressure change during purge flow when EVAP pressure switching valve is ON (closed)	0.5 kPa (3.75 mmHg) or more

**Key-off Monitor: Purge VSV stuck open**

FTP when vacuum introduction complete	Higher than reference pressure x 0.2
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**Key-off Monitor: Purge VSV stuck closed**

FTP change after purge VSV ON (open)	Less than 0.3 kPa (2.25 mmHg)
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**MONITOR RESULT**

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