9. Evaporative Emission Control System

General

The evaporative emission control system prevents the vapor gas that is created in the fuel tank from being released directly into the atmosphere.

- The canister stores the vapor gas that has been created in the fuel tank.
- The ECM controls the purge VSV in accordance with the driving conditions in order to direct the vapor gas into the engine, where it is burned.
- In this system, the ECM checks the evaporative emission leak and outputs DTC (Diagnostic Trouble Codes) in the event of a malfunction. An evaporative emission leak check consists of an application of a vacuum pressure to the system and monitoring the changes in the system pressure in order to detect a leakage.
- This system consists of the purge VSV, canister, refueling valve, canister pump module, and ECM.
- The ORVR (Onboard Refueling Vapor Recovery) function is provided in the refueling valve.
- The canister pressure sensor has been included to the canister pump module.
- The canister filter has been provided on the fresh air line. This canister filter is maintenance-free.
- The followings are the typical conditions for enabling an evaporative emission leak check:

Typical Enabling Condition	● Five hours have elapsed after the engine has been turned OFF*. ● Altitude: Below 2400 m (8000 feet) ● Battery voltage: 10.5 V or more ● Ignition switch: OFF ● Engine coolant temperature: 4.4 to 35°C (40 to 95°F) ● Intake air temperature: 4.4 to 35°C (40 to 95°F)

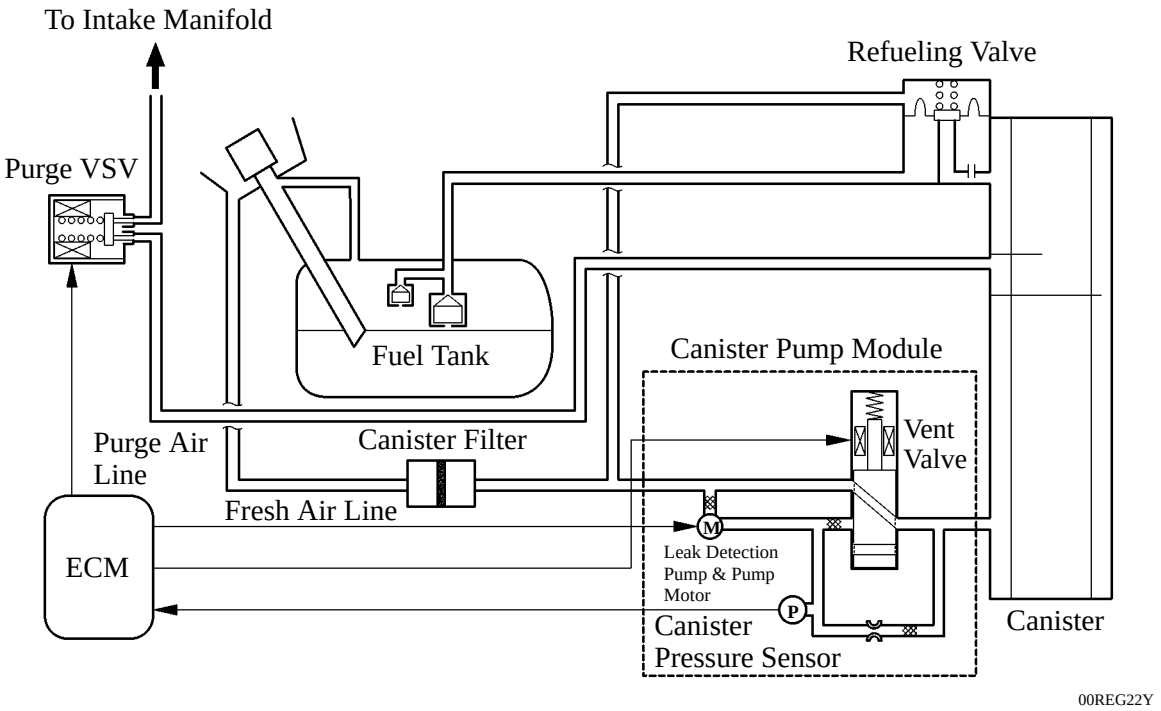
*: If engine coolant temperature does not drop below 35°C (95°F), this time should be extended to 7 hours. Even after that, if the temperature is not less than 35°C (95°F), the time should be extended to 9.5 hours.

Service Tip

The canister pump module performs fuel evaporative emission leakage check. This check is done approximately five hours after the engine is turned off. So you may hear sound coming from underneath the luggage compartment for several minutes. It does not indicate a malfunction.

- The pinpoint pressure test procedure is carried out by pressurizing the fresh air line that runs from the pump module to the air filler neck. For details, see the 2006 Yaris Repair Manual (Pub. No. RM00R0U).

System Diagram



Function of Main Components

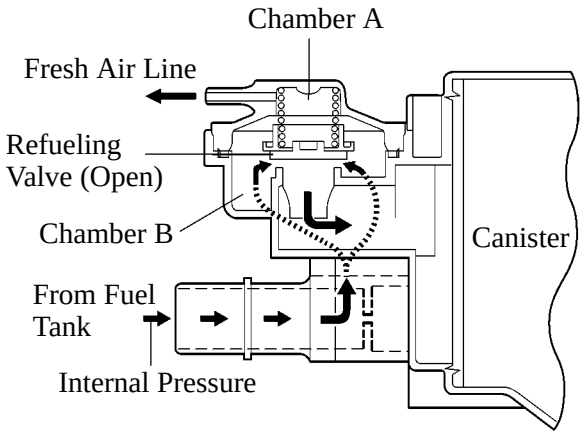
Component		Function
Canister		Contains activated charcoal to absorb the vapor gas that is created in the fuel tank.
Refueling Valve		Controls the flow rate of the vapor gas from the fuel tank to the canister when the system is purging or during refueling.
	Restrictor Passage	Prevents a large amount of vacuum during purge operation or system monitoring operation from affecting the pressure in the fuel tank.
Fresh Air Line		Fresh air goes into the canister and the cleaned drain air goes out into the atmosphere.
Canister Pump Module	Vent Valve	Opens and closes the fresh air line in accordance with the signals from the ECM.
	Leak Detection Pump	Applies vacuum pressure to the evaporative emission system in accordance with the signals from the ECM.
	Canister Pressure Sensor	Detects the pressure in the evaporative emission system and sends the signals to the ECM.
Purge VSV		Opens in accordance with the signals from the ECM when the system is purging, in order to send the vapor gas that was absorbed by the canister into the intake manifold. In system monitoring mode, this valve controls the introduction of the vacuum into the fuel tank.
Canister Filter		Prevents dust and debris in the fresh air from entering the system.
ECM		Controls the canister pump module and purge VSV in accordance with the signals from various sensors, in order to achieve a purge volume that suits the driving conditions. In addition, the ECM monitors the system for any leakage and outputs a DTC if a malfunction is found.

Construction and Operation

1) Refueling Valve

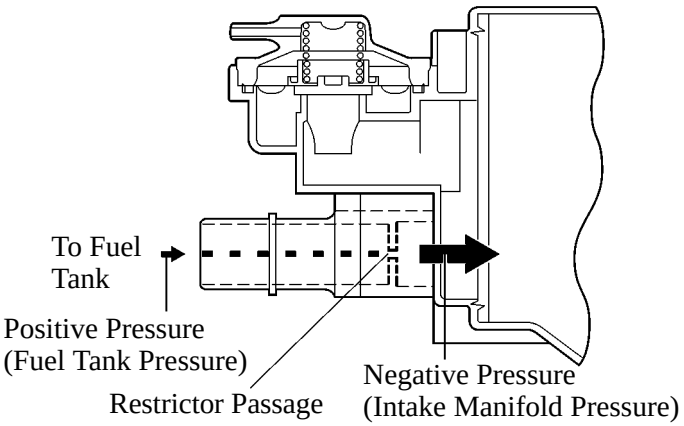
The refueling valve consists of chamber A, chamber B, and the restrictor passage. A constant atmospheric pressure is applied to chamber A.

- During refueling, the internal pressure of the fuel tank increases. This pressure causes the refueling valve to lift up, allowing the fuel vapors to enter the canister.
- The restrictor passage prevents the large amount of vacuum that is created during purge operation or system monitoring operation from entering the fuel tank, and limits the flow of the vapor gas from the fuel tank to the canister. If a large volume of vapor gas recirculates into the intake manifold, it will affect the air-fuel ratio control of the engine. Therefore, the role of the restrictor passage is to help prevent this from occurring.



During Refueling

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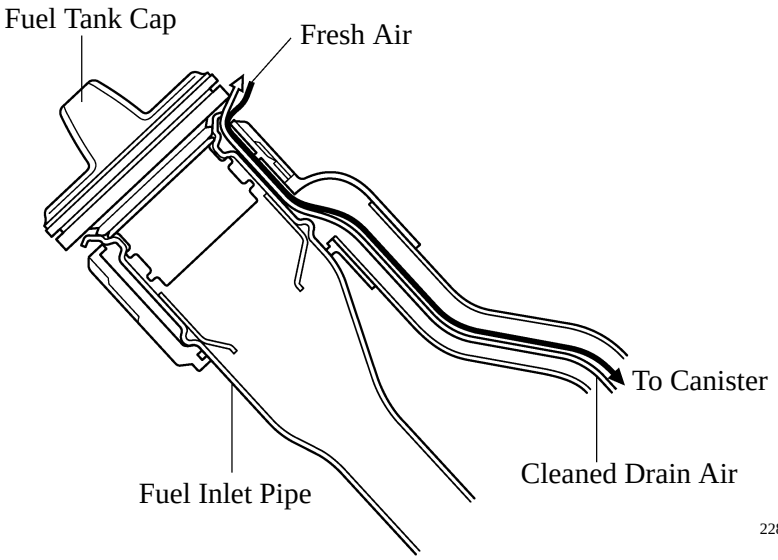


During Purge Operation or System Monitoring Operation

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2) Fuel Inlet (Fresh Air Line)

In accordance with the change of structure of the evaporative emission control system, the location of a fresh air line inlet has been changed from the air cleaner section to the near fuel inlet. The flesh air from the atmosphere and drain air cleaned by the canister will go in and out of the system through the passage shown below.

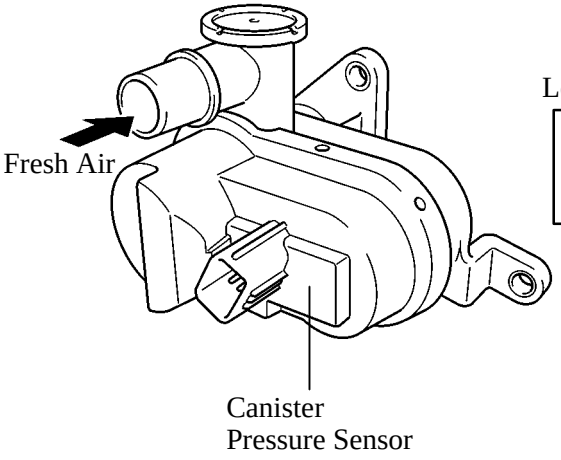


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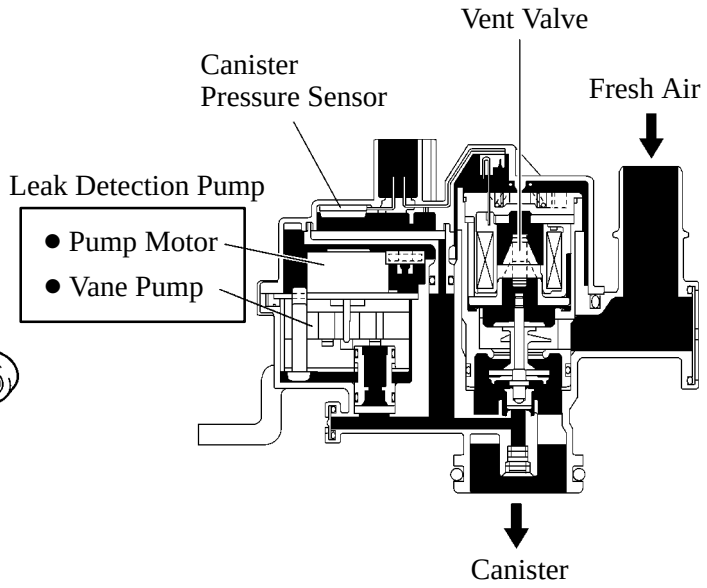
3) Canister Pump Module

Canister Pump module consists of the vent valve, leak detection pump, and canister pressure sensor.

- The vent valve switches the passages in accordance with the signals received from the ECM.
- A DC type brush less motor is used for the pump motor.
- A vane type vacuum pump is used.

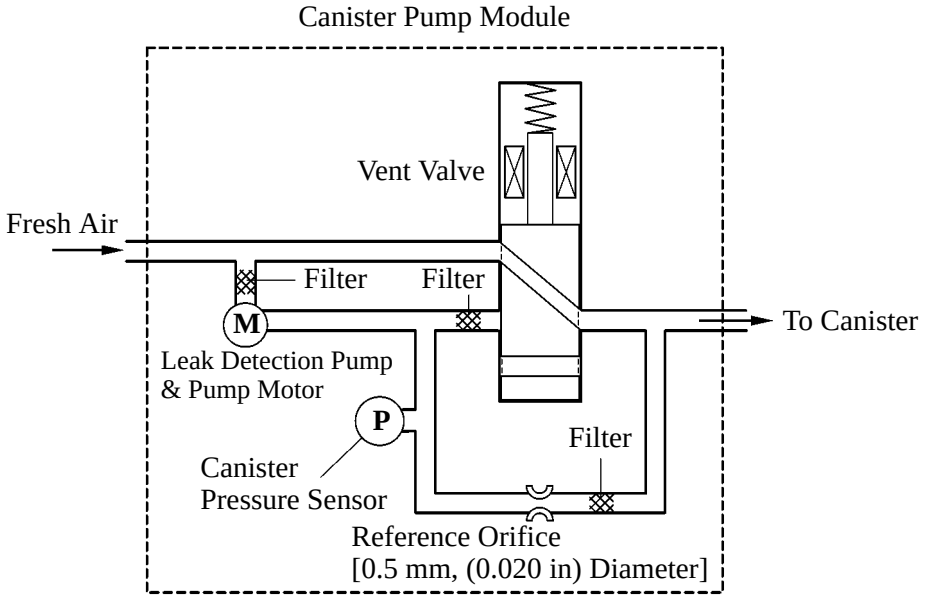


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▶ Simple Diagram ◀



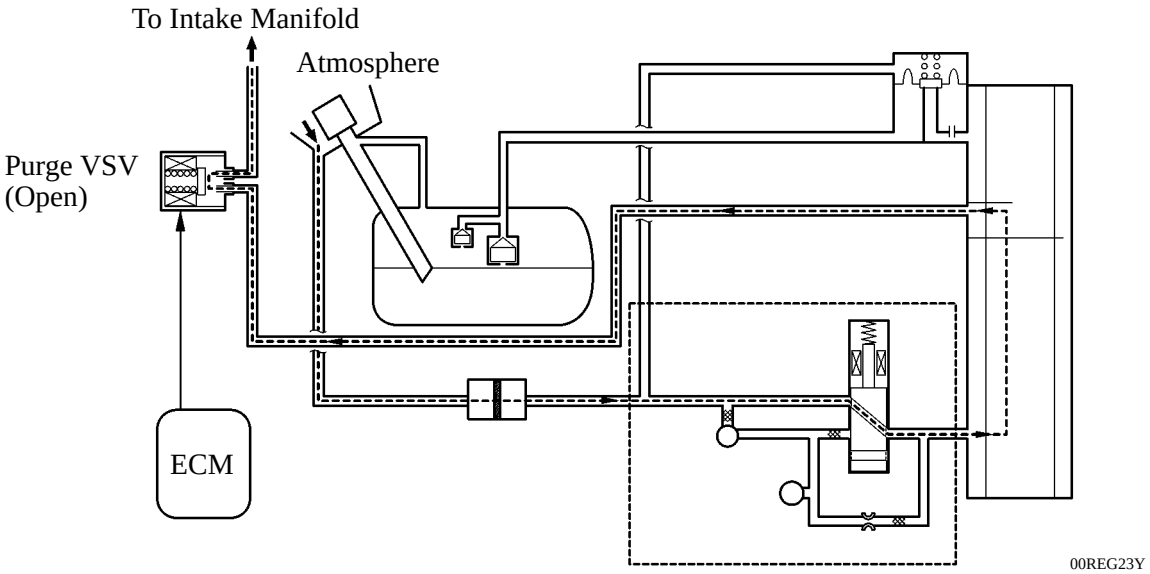
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System Operation

1) Purge Flow Control

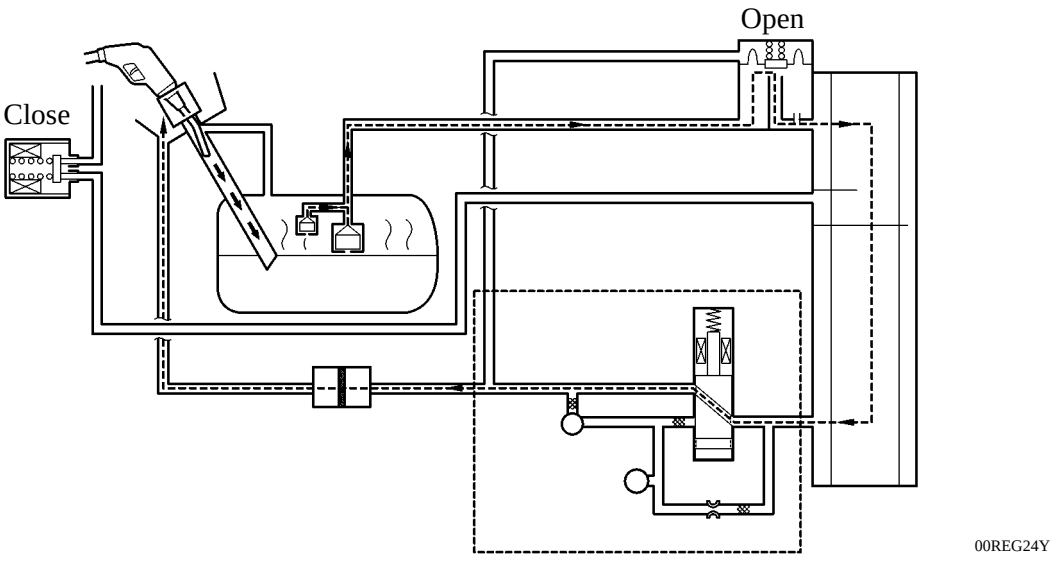
When the engine has reached predetermined parameters (closed loop, engine coolant temperature above 74°C (165°F), etc.), stored fuel vapors are purged from the canister whenever the purge VSV is opened by the ECM.

The ECM will change the duty ratio cycle of the purge VSV, thus controlling purge flow volume. Purge flow volume is determined by intake manifold pressure and the duty ratio cycle of the purge VSV. Atmospheric pressure is allowed into the canister to ensure that purge flow is constantly maintained whenever purge vacuum is applied to the canister.



2) ORVR (On-Board Refueling Vapor Recovery)

When the internal pressure of the fuel tank increases during refueling, this pressure causes the diaphragm in the refueling valve to lift up, allowing the fuel vapors to enter the canister. Because the vent valve is always open (even when the engine is stopped) when the system is in a mode other than the monitoring mode, the air that has been cleaned through the canister is discharged outside the vehicle via the fresh air line. If the vehicle is refueled in the monitoring mode, the ECM will recognize the refueling by way of the canister pressure sensor, which detects the sudden pressure increase in the fuel tank, and will open the vent valve.

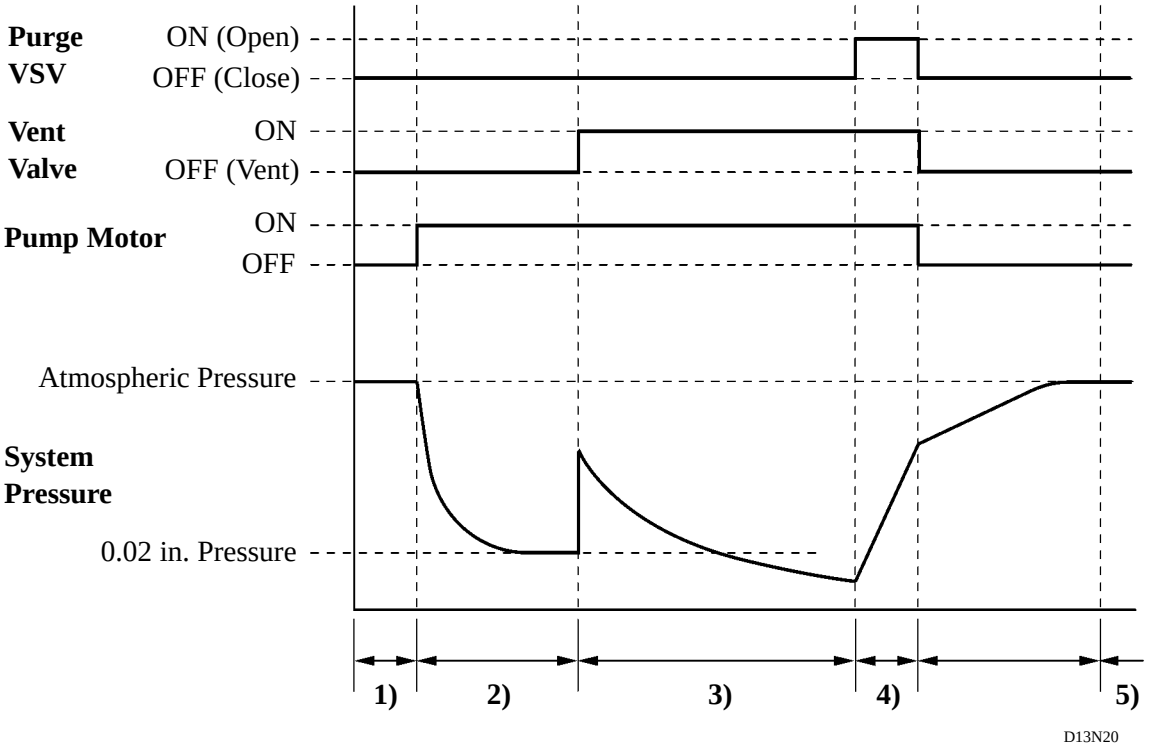


3) EVAP Leak Check

a. General

The EVAP leak check operates in accordance with the following timing chart:

▶ Timing Chart ◀



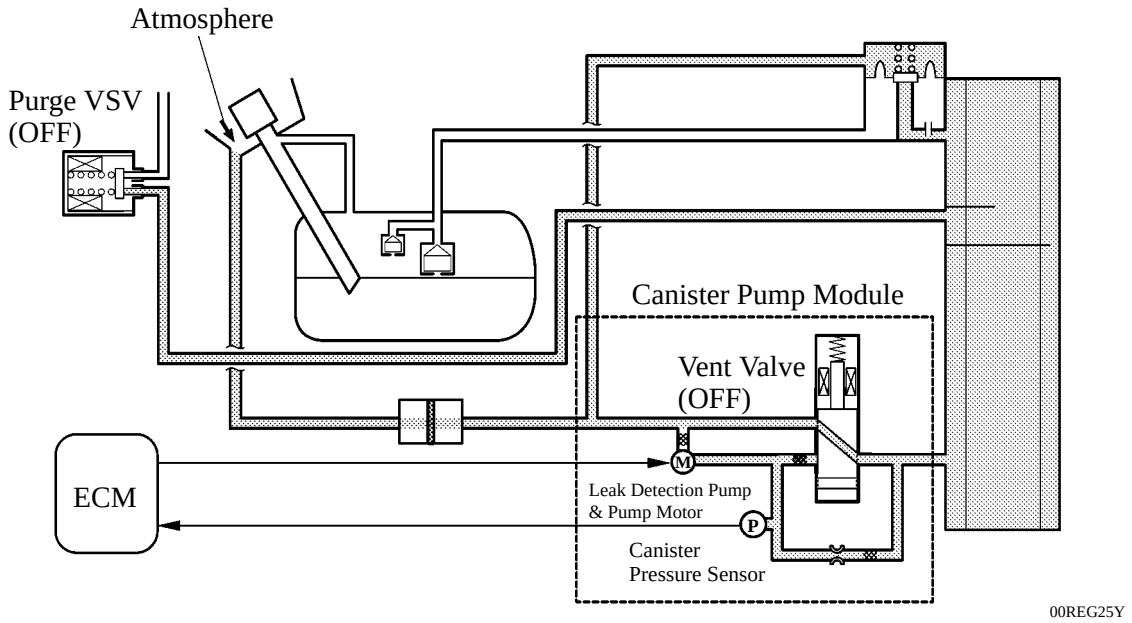
Order	Operation	Description	Time
1)	Atmospheric Pressure Measurement	ECM turns vent valve OFF (vent) and measures EVAP system pressure to memorize atmospheric pressure.	10 sec.
2)	0.02 in. Leak Pressure Measurement	Leak detection pump creates negative pressure (vacuum) through 0.02 in. orifice and the pressure is measured. ECM determines this as 0.02 in. leak pressure.	60 sec.
3)	EVAP Leak Check	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. If stabilized pressure is larger than 0.02 in. leak pressure, ECM determines EVAP system has a leakage. If EVAP pressure does not stabilize within 12 minutes, ECM cancels EVAP monitor.	Within 12 min.
4)	Purge VSV Monitor	ECM opens purge VSV and measure EVAP pressure increase. If increase is large, ECM interprets this as normal.	10 sec.
5)	Final Check	ECM measures atmospheric pressure and records monitor result.	—

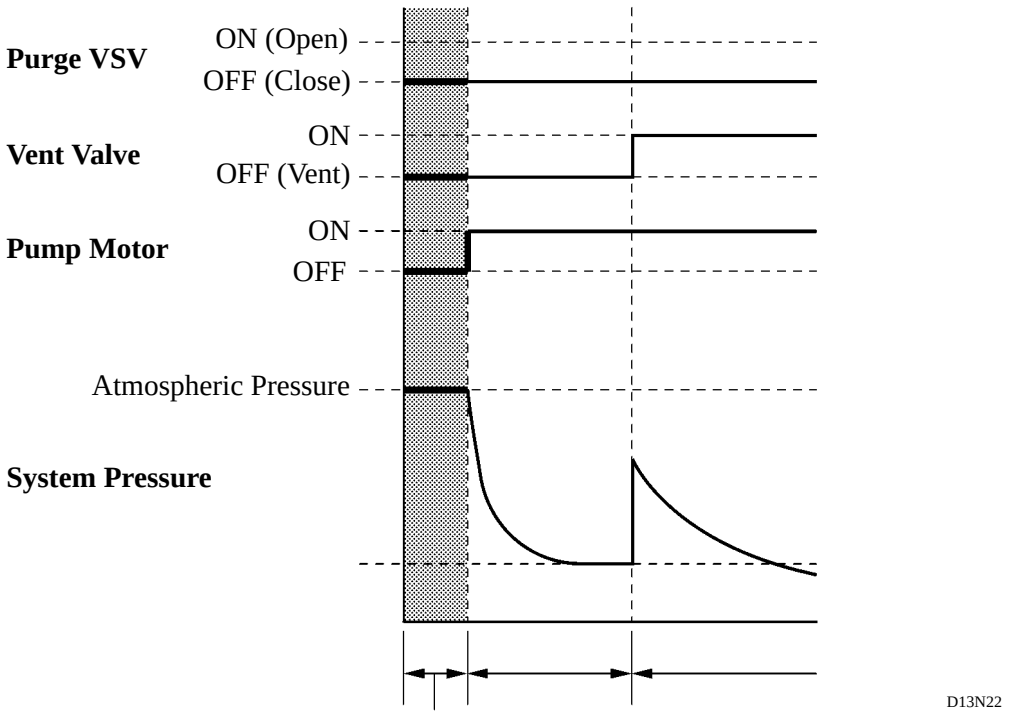
b. Atmospheric Pressure Measurement

1) When the ignition switch is turned OFF, the purge VSV and vent valve are turned OFF. Therefore, the atmospheric pressure is introduced into the canister.

2) The ECM measures the atmospheric pressure through the signals provided by the canister pressure sensor.

3) If the measurement value is out of standards, the ECM actuates the leak detection pump in order to monitor the changes in the pressure.

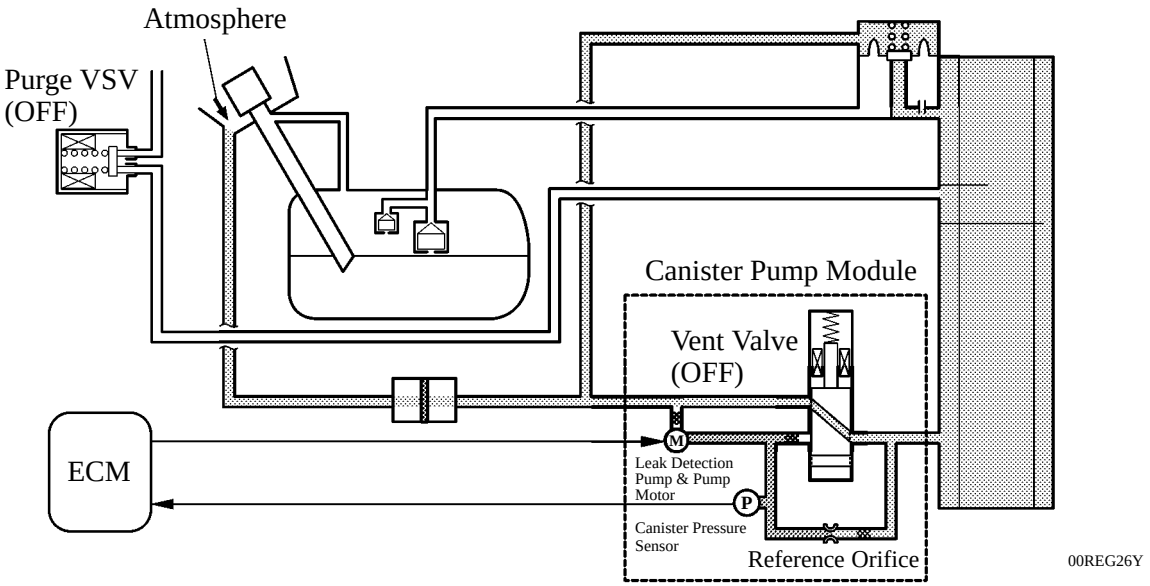


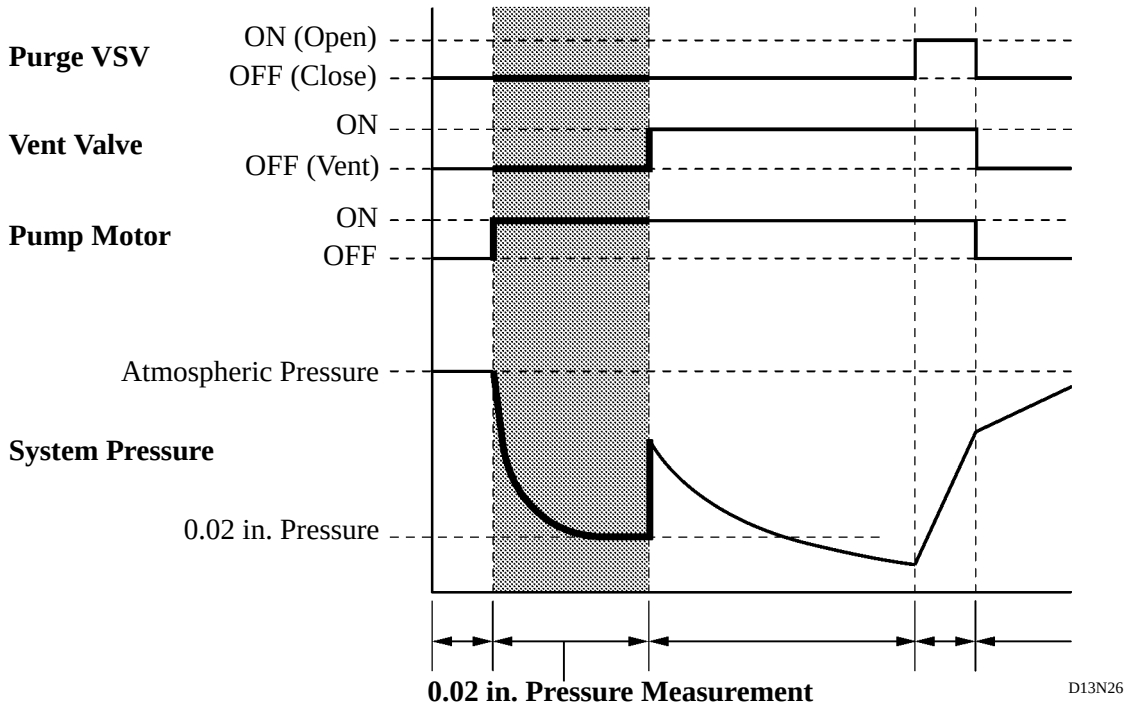


Atmospheric Pressure Measurement

c. 0.02 in. Leak Pressure Measurement

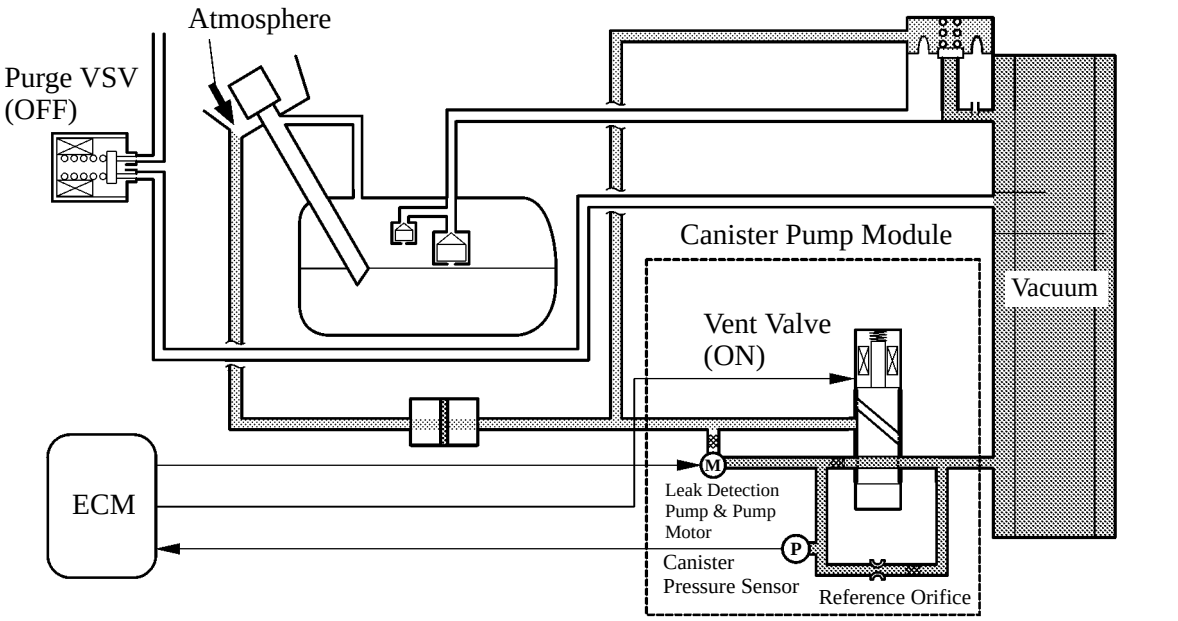
1) The vent valve remains off, and the ECM introduces atmospheric pressure into the canister and actuates the leak detection pump in order to create a negative pressure.
2) At this time, the pressure will not decrease beyond a 0.02 in. pressure due to the atmospheric pressure that enters through a 0.02 in. diameter reference orifice measuring 0.5 mm (0.02 in.).
3) The ECM compares the logic value and this pressure, and stores it as a 0.02 in. leak pressure in its memory.
4) If the measurement value is below the standard, the ECM will determine that the reference orifice is clogged and store DTC (Diagnostic Trouble Code) P043E in its memory.
5) If the measurement value is above the standard, the ECM will determine that a high flow rate pressure is passing through the reference orifice and store DTCs (Diagnostic Trouble Codes) P043F, P2401, P2402, and P2422 in its memory.



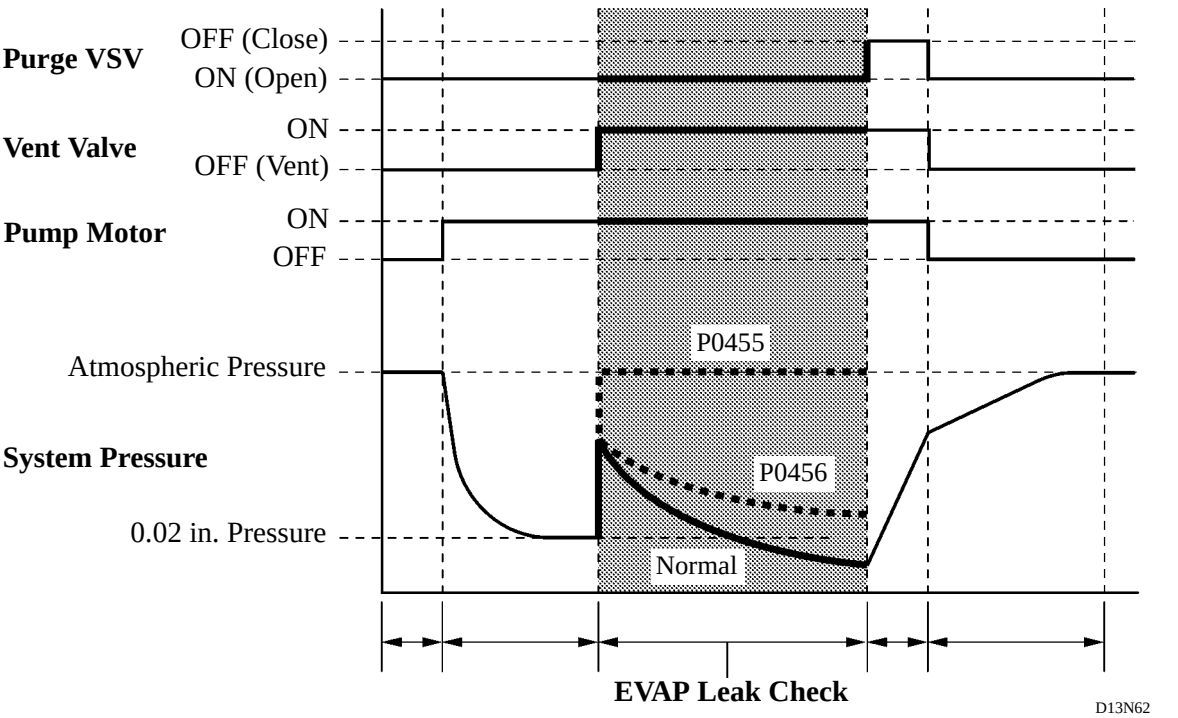


d. EVAP Leak Check

1) While actuating the leak detection pump, the ECM turns ON the vent valve in order to introduce a vacuum into the canister.
2) When the pressure in the system stabilizes, the ECM compares this pressure and the 0.02 in. pressure in order to check for a leakage.
3) If the detection value is below the 0.02 in. pressure, the ECM determines that there is no leakage.
4) If the detection value is above the 0.02 in. pressure and near atmospheric pressure, the ECM determines that there is a gross leakage (large hole) and stores DTC P0455 in its memory.
5) If the detection value is above the 0.02 in. pressure, the ECM determines that there is a small leakage and stores DTC P0456 in its memory.



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e. Purge VSV Monitor

1) After completing an EVAP leak check, the ECM turns ON (open) the purge VSV with the leak detection pump actuated, and introduces the atmospheric pressure from the intake manifold to the canister.

2) If the pressure change at this time is within the normal range, the ECM determines the condition to be normal.

3) If the pressure is out of the normal range, the ECM will stop the purge VSV monitor and store DTC P0441 in its memory.

