1UR-FE, 3UR-FE AND 3UR-FBE ENGINES

■ ENGINE CONTROL SYSTEM

Evaporative Emission Control System

General

The evaporative emission control system prevents the fuel vapors created in the fuel tank from being released directly into the atmosphere.
The charcoal canister assembly stores the fuel vapors that have been created in the fuel tank.

- The ECM controls the purge VSV in accordance with the driving conditions in order to direct the fuel vapors into the engine, where they are burned.
- In this system, the ECM checks for evaporative emission leaks and outputs a Diagnostic Trouble Code (DTC) in the event of a malfunction. An evaporative emission leak check consists of an application of vacuum to the evaporative emission system and monitoring the system for changes in pressure in order to detect a leak.
- This system consists of the purge VSV, charcoal canister assembly, canister pump module and ECM.
- A refueling vapor recovery function is provided.
- A canister pressure sensor has been included with the canister pump module.
- A canister filter has been provided on the fresh air line. This canister filter is maintenance-free.
- The following are the typical conditions necessary to enable an evaporative emission (EVAP) leak check:

Typical Enabling Conditions	● 5 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°C to 35°C (40°F to 95°F) ● Intake Air Temperature: 4.4°C to 35°C (40°F to 95°F)

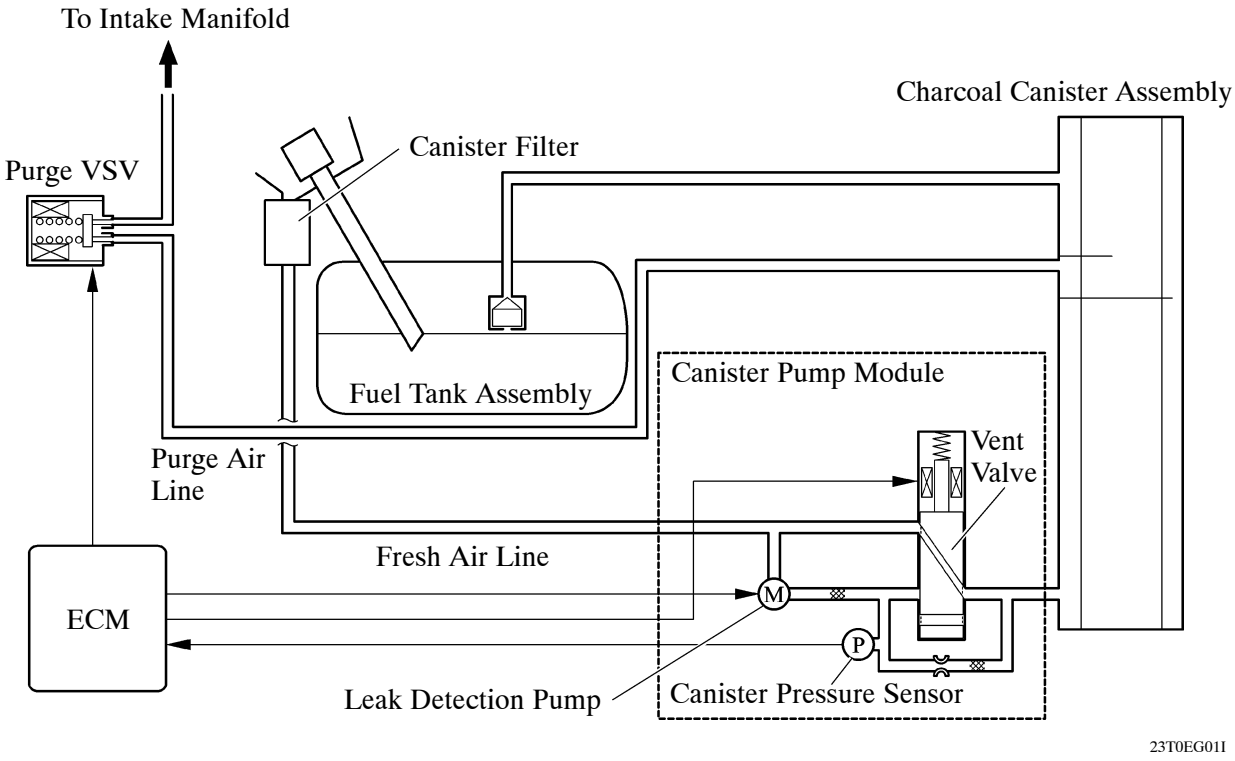
*: If engine coolant temperature does not drop below 35°C (95°F), this time is extended to 7 hours. After that, if the temperature is still not less than 35°C (95°F), the time is extended to 9.5 hours.

Service Tip

The canister pump module performs a fuel evaporative emission leak check. This check is conducted approximately 5 hours after the engine is turned off. Sound may be heard coming from underneath the luggage compartment for several minutes. This does not indicate a malfunction.

- A pinpoint pressure test procedure is used by pressurizing the fresh air line that runs from the canister pump module to the air filler neck. For details, refer to the Repair Manual.

System Diagram



Function of Main Components

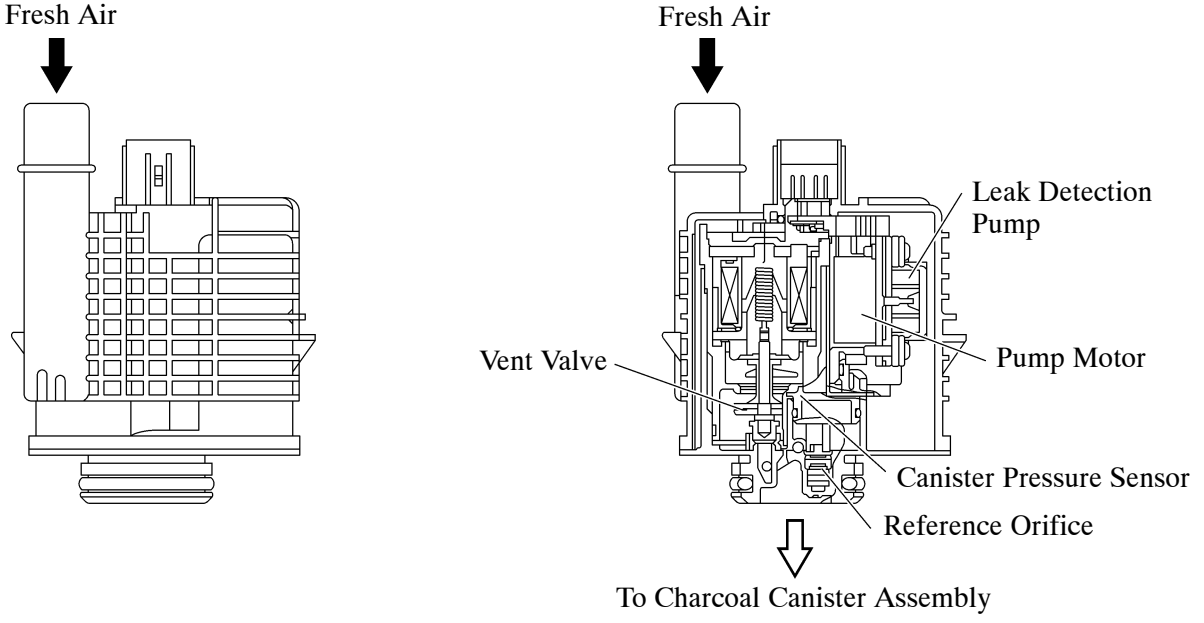
Component		Function
ECM		Controls the canister pump module and the purge VSV in accordance with the signals from various sensors, in order to achieve a purge volume that suits the driving conditions. In addition, the ECM monitors the system for any leak and stores a DTC if a malfunction is found.
Charcoal Canister Assembly		Contains activated charcoal to absorb the fuel vapor that is created in the fuel tank assembly.
Fresh Air Line		Fresh air goes into the charcoal canister assembly 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 signals from the ECM.
	Leak Detection Pump	Applies vacuum to the evaporative emission system in accordance with signals from the ECM.
	Canister Pressure Sensor	Detects the pressure in the evaporative emission system and sends the signals to the ECM.

Component	Function
Purge VSV	Opens in accordance with the signals from the ECM when the system is purging, in order to send the fuel vapor that was absorbed by the charcoal canister assembly into the intake manifold. In system monitoring mode, this valve controls the introduction of vacuum into the fuel tank assembly.
Canister Filter	Prevents dust and debris in the fresh air from entering the system.

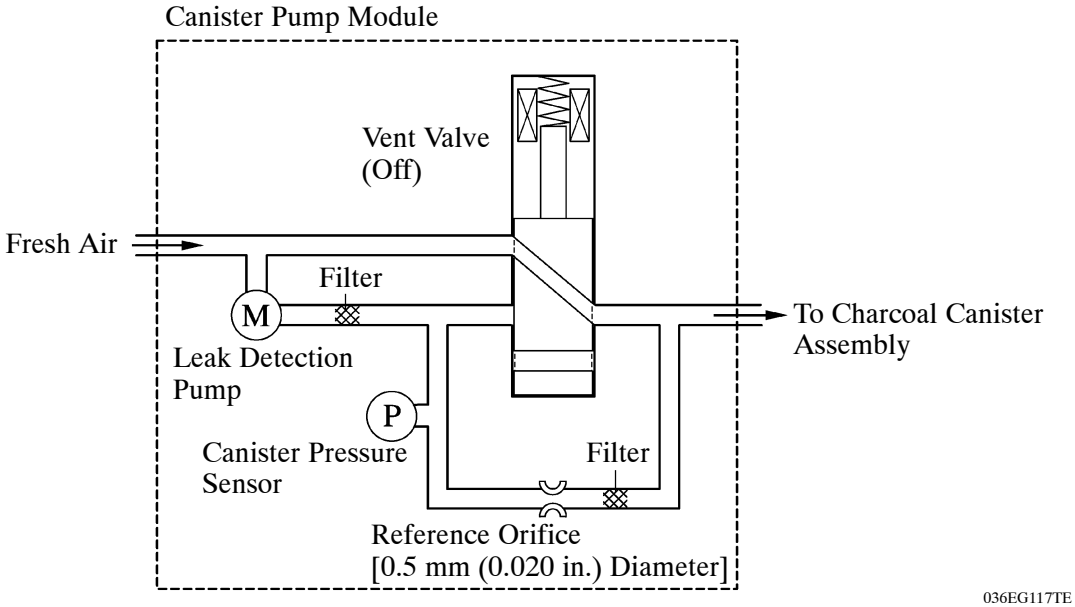
Construction and Operation

Canister Pump Module

- The canister pump module consists of a vent valve, reference orifice, canister pressure sensor, leak detection pump, and pump motor.
- The vent valve switches the passages in accordance with the signals received from the ECM.
- A DC type brushless motor is used for the pump motor.



▶ Simple Diagram ◀

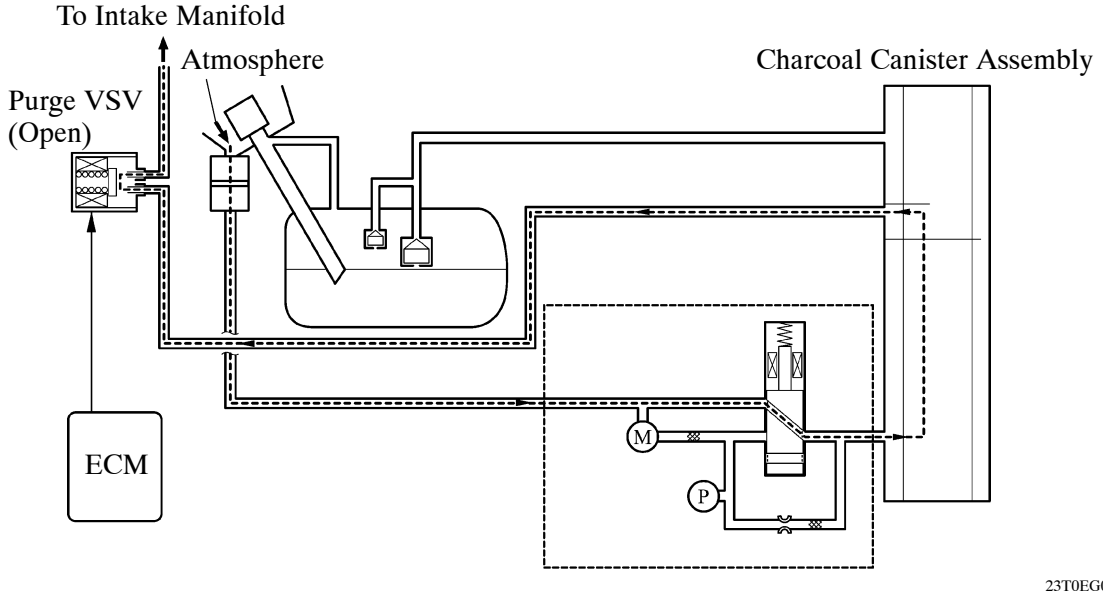


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System Operation

1) Purge Flow Control

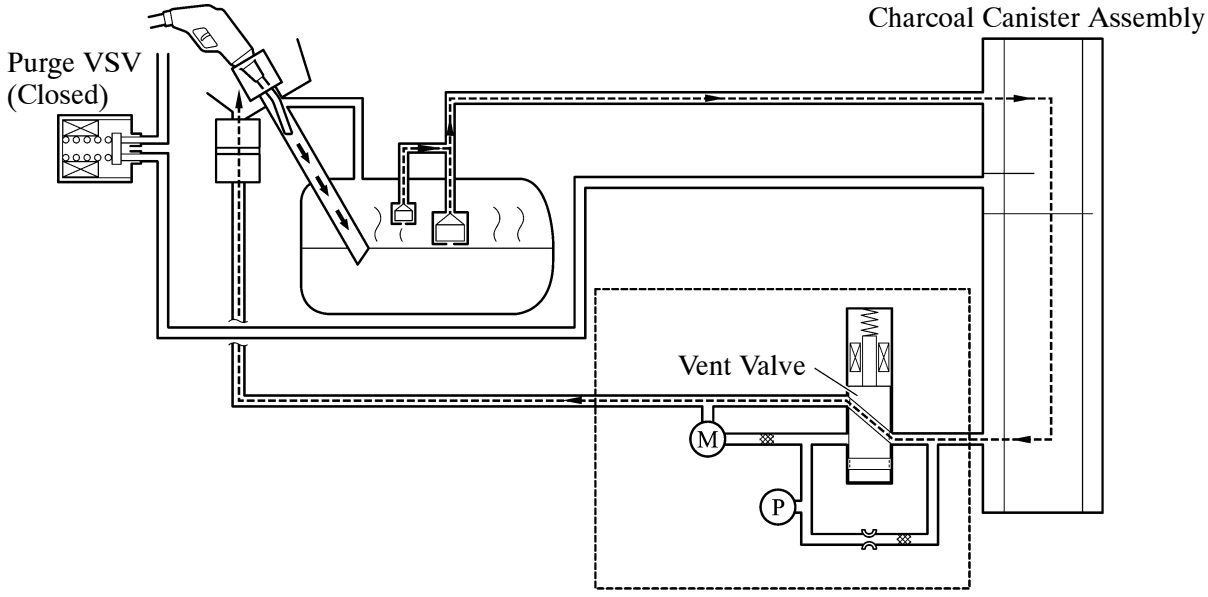
When the engine has reached a predetermined state (closed loop, engine coolant temperature above 80°C (176°F), etc.), stored fuel vapor is purged from the charcoal canister assembly whenever the purge VSV is opened by the ECM.
The ECM will change the duty ratio cycle of the purge VSV, thus controlling 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 charcoal canister assembly to ensure that purge flow is constantly maintained whenever purge vacuum is applied to the charcoal canister assembly.



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2) Refueling Vapor Recovery

When the internal pressure of the fuel tank increases during refueling, the fuel vapors enter the charcoal canister assembly. The air that has had the fuel vapors removed from it will be discharged through the fresh air line. The vent valve is used to open and close the fresh air line, and it is always open (even when the engine is stopped) except when the vehicle is in monitoring mode (the valve will be open as long as the vehicle is not in monitoring mode). If the vehicle is refueled in system 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 the ECM will open the vent valve.



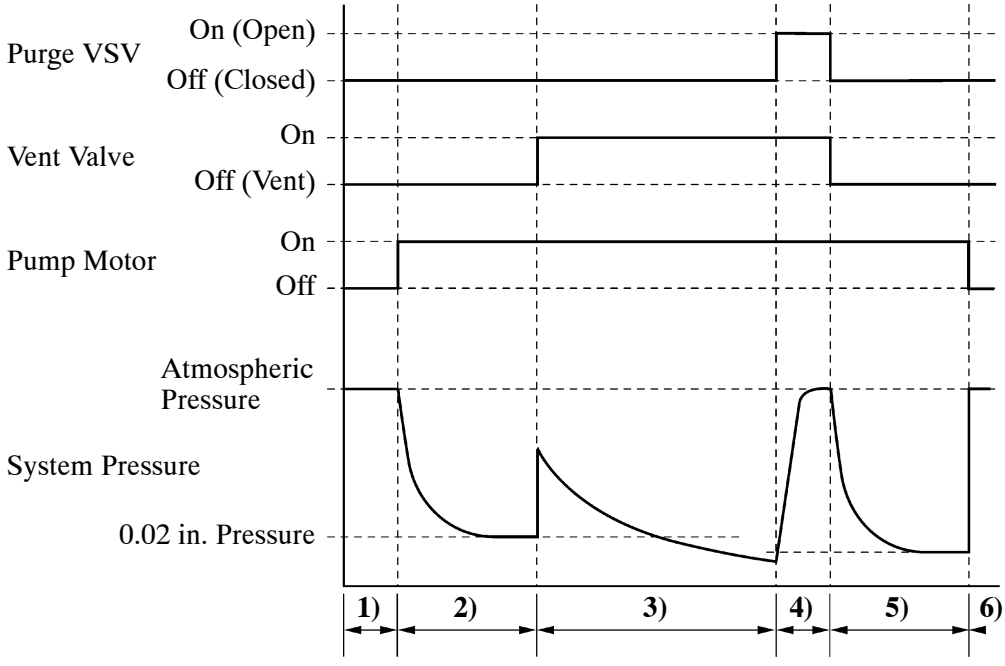
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3) EVAP Leak Check

a. General

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

▶ Timing Chart ◀



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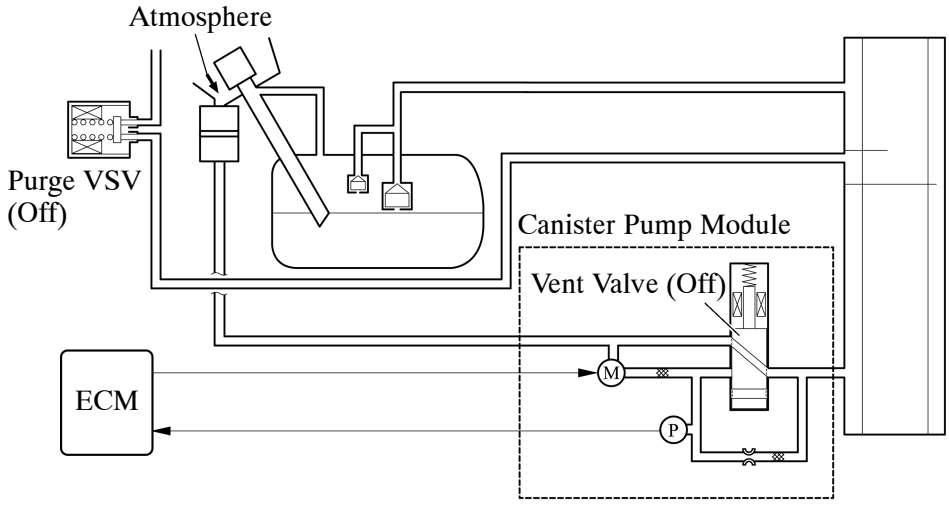
Order	Operation	Description	Time
1)	Atmospheric Pressure Measurement	The ECM turns the vent valve off (vent) and measures EVAP system pressure to memorize the atmospheric pressure.	60 sec.
2)	0.02 in. Leak Pressure Measurement	The leak detection pump creates negative pressure (vacuum) through a 0.02 in. orifice and the pressure is measured. The ECM determines this as the 0.02 in. leak pressure.	360 sec.
3)	EVAP Leak Check	The leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized pressure is larger than the 0.02 in. leak pressure, the ECM determines that the EVAP system has a leak. If the EVAP pressure does not stabilize within 15 minutes, the ECM cancels EVAP monitor.	Within 15 min.
4)	Purge VSV Monitor	The ECM opens the purge VSV and measures the EVAP pressure increase. If the increase is large, the ECM interprets this as normal.	10 sec.
5)	Repeat 0.02 in. Leak Pressure Measurement	The leak detection pump creates negative pressure (vacuum) through the 0.02 in. orifice and the pressure is measured. The ECM determines this as the 0.02 in. leak pressure.	20 sec.
6)	Final Check	The ECM measures the atmospheric pressure and records the monitor result.	—

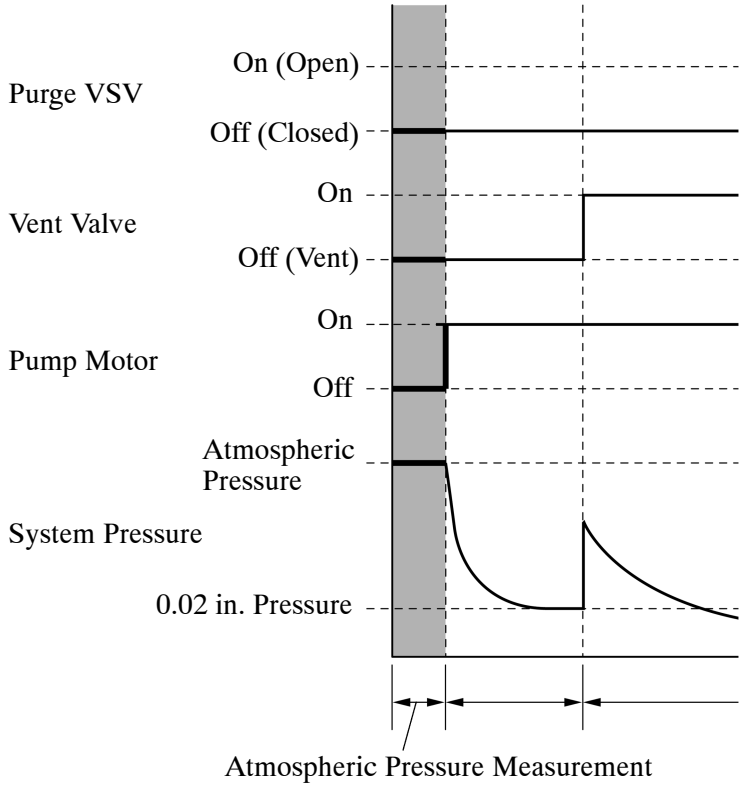
b. Atmospheric Pressure Measurement

1) When the ignition switch is turned off, the purge VSV and the vent valve are turned off. As a result, atmospheric pressure is introduced into the charcoal canister assembly.

2) The ECM measures the atmospheric pressure using the canister pressure sensor.

3) If the measured atmospheric pressure is out of range, the ECM actuates the leak detection pump in order to monitor the changes in the pressure.

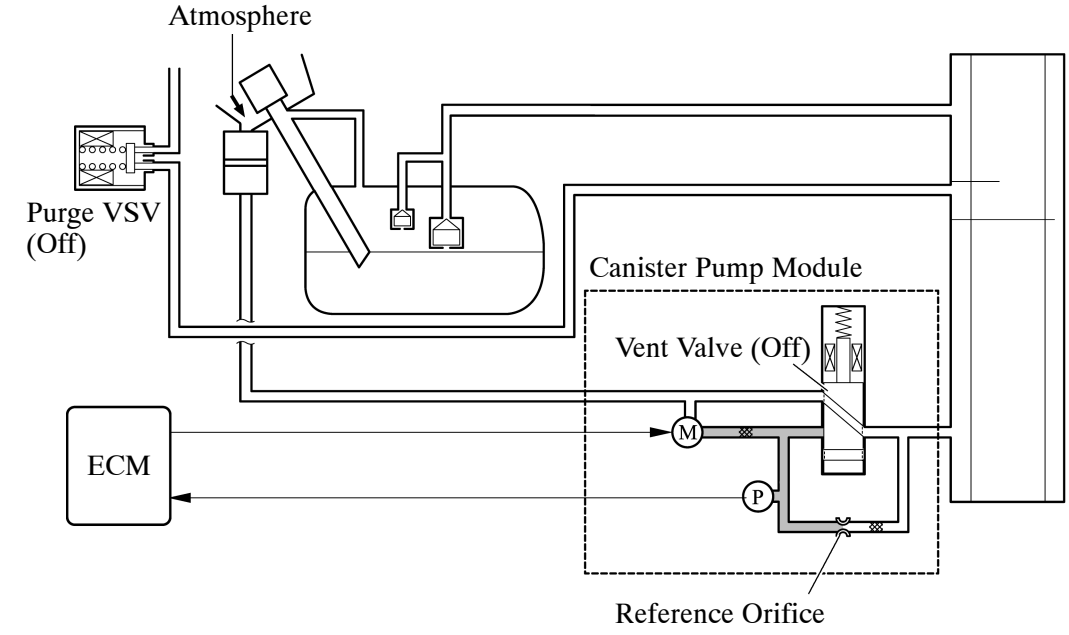


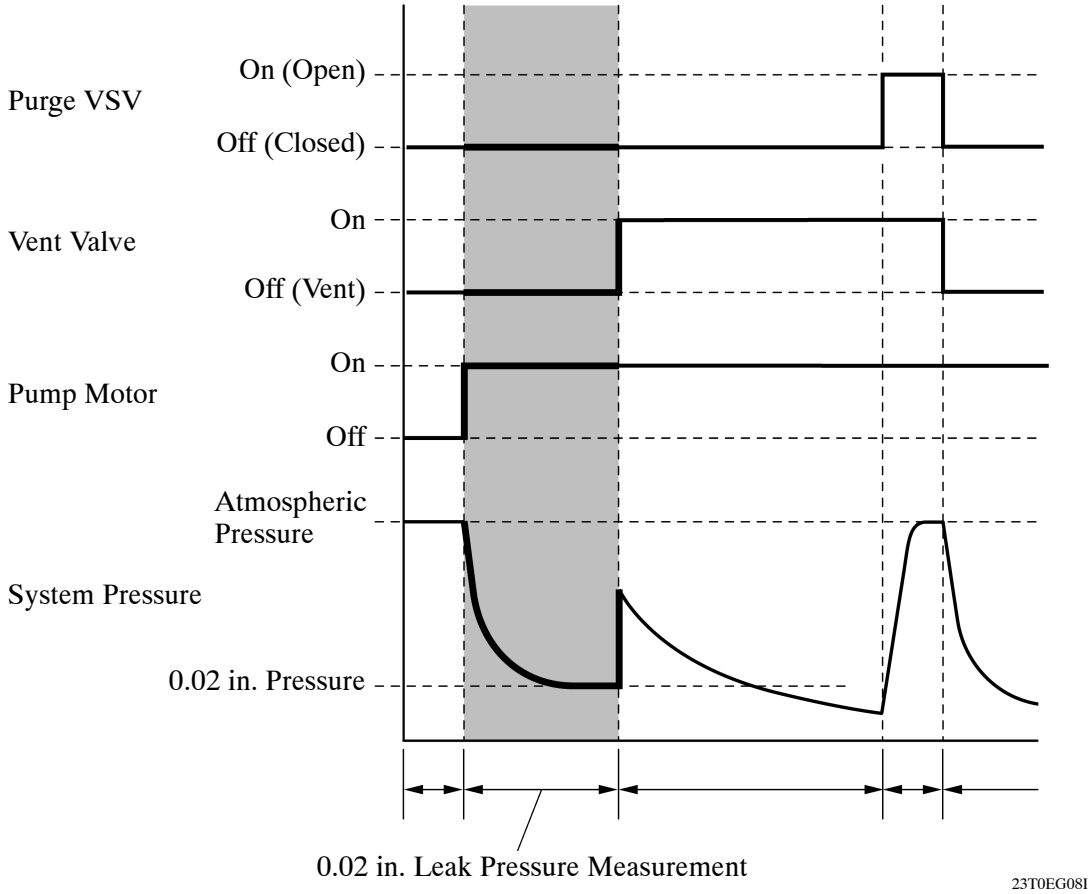


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c. 0.02 in. Leak Pressure Measurement

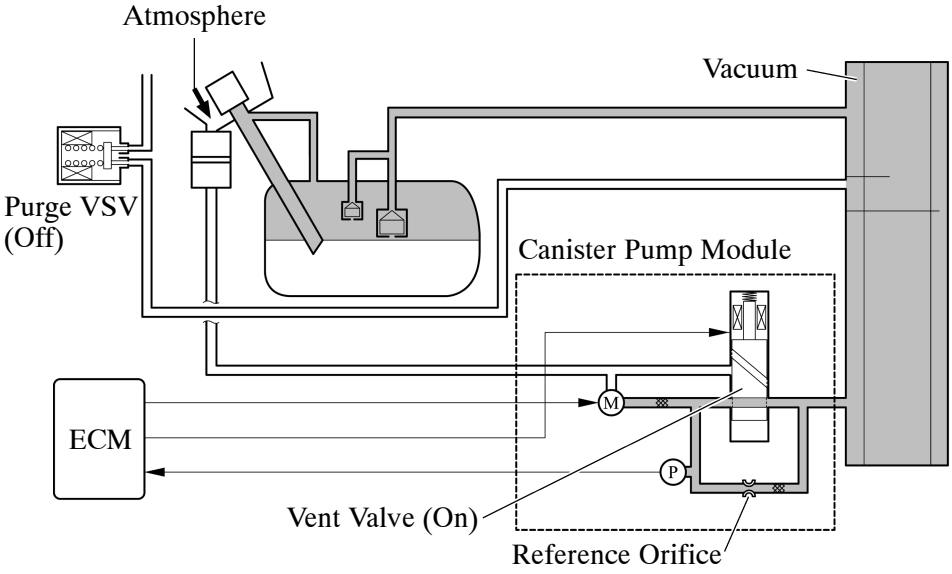
1) The purpose of this measurement is to confirm leak detection pump operation, and to provide a baseline measurement value that will be used for comparison in subsequent leak test steps.
2) The vent valve remains off, atmospheric pressure is introduced into the charcoal canister assembly and the ECM actuates the leak detection pump, creating a vacuum in the piping close to the canister pressure sensor.
3) At this time, the pressure will not decrease below what is referred to as the 0.02 in. pressure due to the atmospheric pressure that enters the piping close to the pump and sensor through the 0.02 in. diameter reference orifice.
4) The ECM compares this pressure against the standard. If the pressure is within the acceptable range, the ECM stores this pressure as the 0.02 in. leak pressure.
5) If the pressure is below the standard, the ECM will determine that the reference orifice is clogged and store DTC P043E in its memory.
6) If the pressure is above the standard, the ECM will determine that a high flow rate pressure is passing through the reference orifice and store DTCs P043F, P2401 and P2402 in its memory.

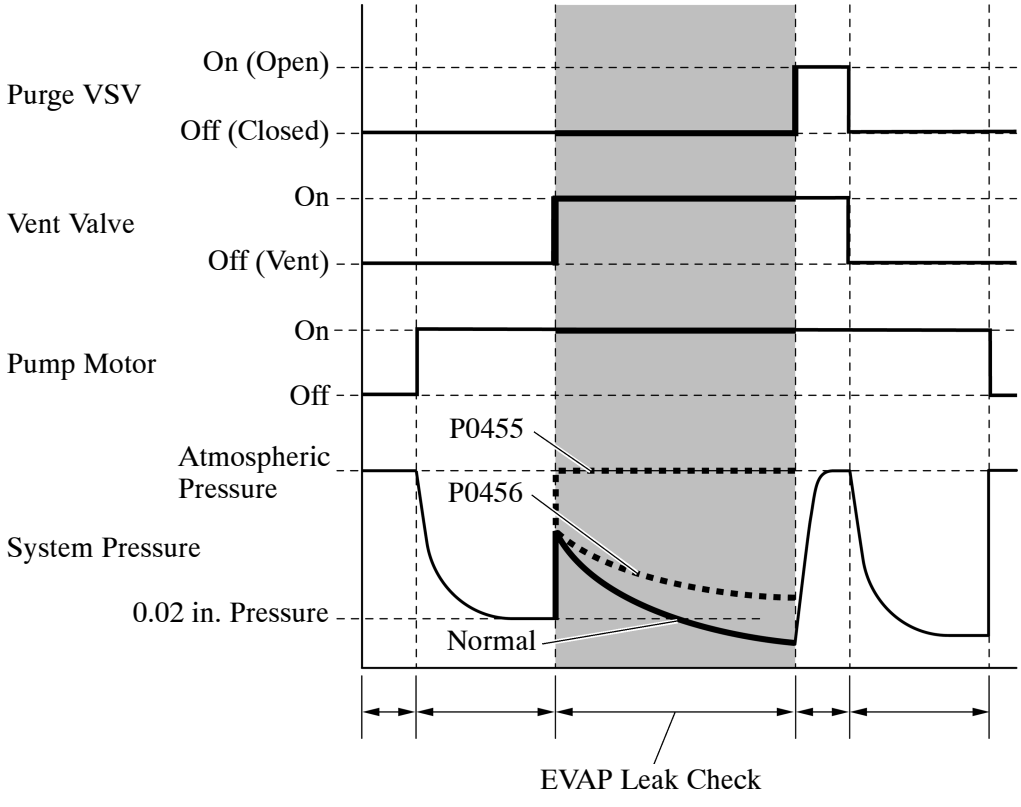

Atmosphere
Purge VSV
(Off)
Canister Pump Module
Vent Valve (Off)
M
ECM
P
Reference Orifice


Purge VSV
On (Open)
Off (Closed)
Vent Valve
On
Off (Vent)
Pump Motor
On
Off
Atmospheric
Pressure
System Pressure
0.02 in. Pressure
0.02 in. Leak Pressure Measurement
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d. EVAP Leak Check

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



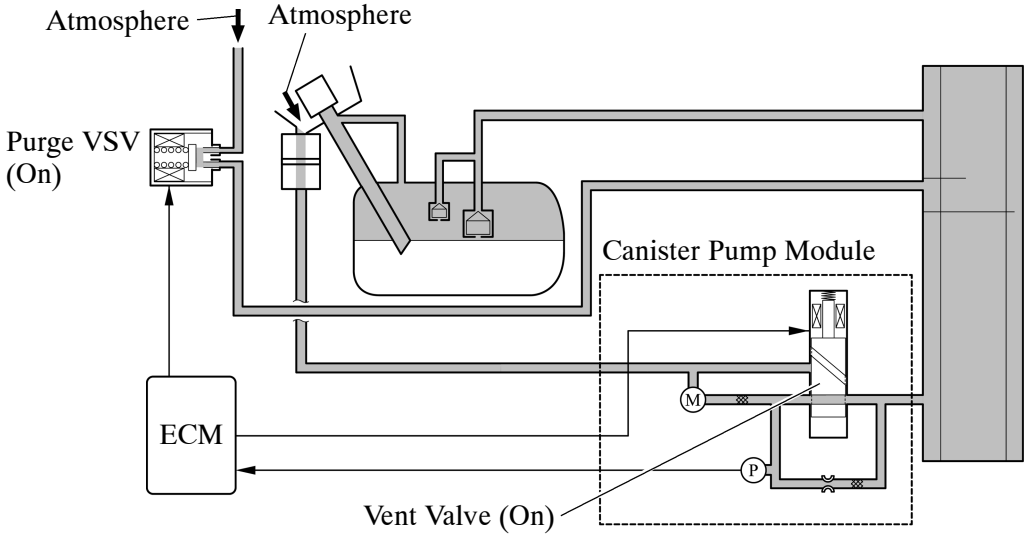


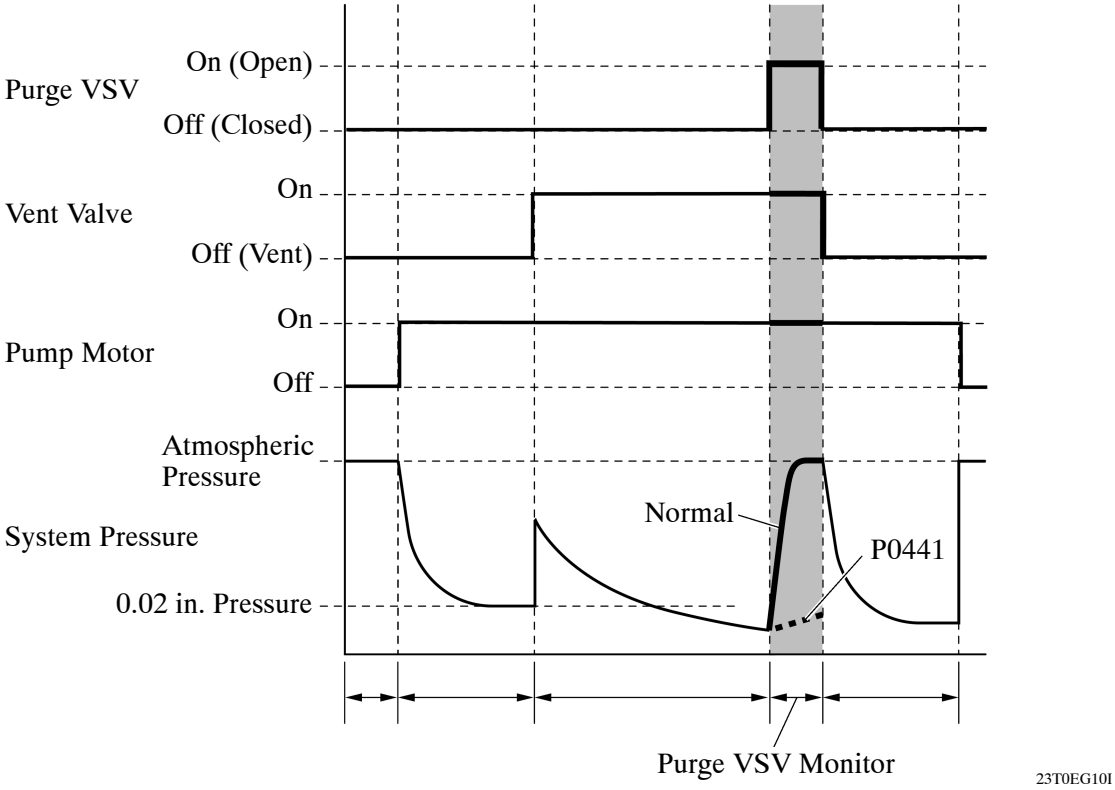
e. Purge VSV Monitor

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

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

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





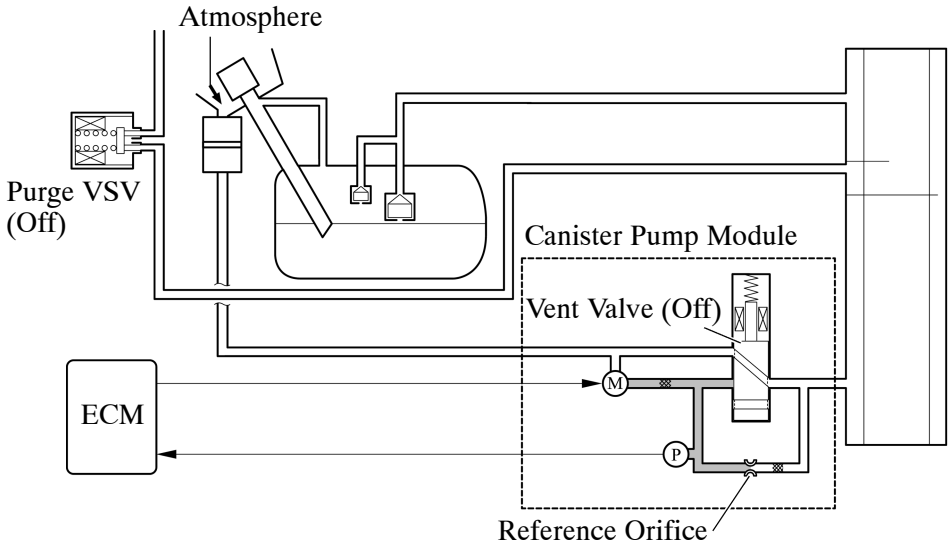
f. Repeat 0.02 in. Leak Pressure Measurement

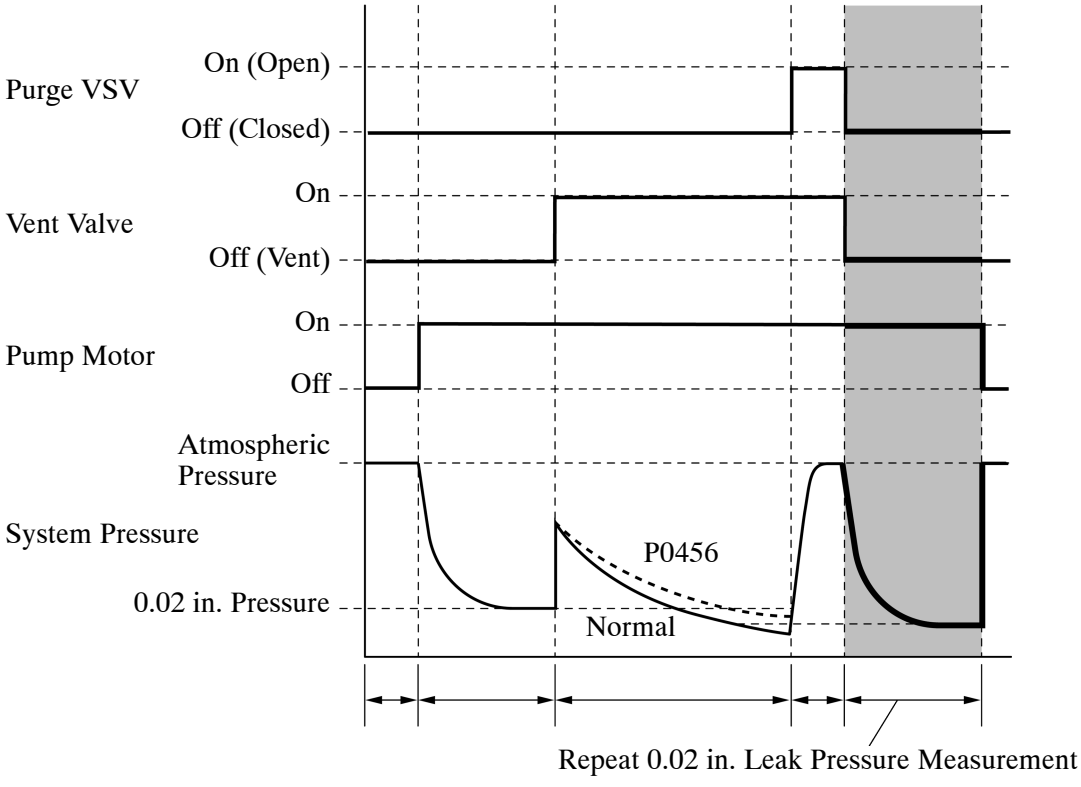
1) While the ECM operates the leak detection pump, the purge VSV and vent valve are turned off and a repeat 0.02 in. leak pressure measurement is performed.

2) The ECM compares the measured pressure with the pressure during the EVAP leak check.

3) If the pressure during the EVAP leak check is less than the repeat 0.02 in. leak pressure measurement, the ECM determines that there is no leak.

4) If the pressure during the EVAP leak check is above the repeat 0.02 in. leak pressure measurement, the ECM determines that there is a small leak and stores DTC P0456 in its memory.





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