11. Evaporative Emission Control System

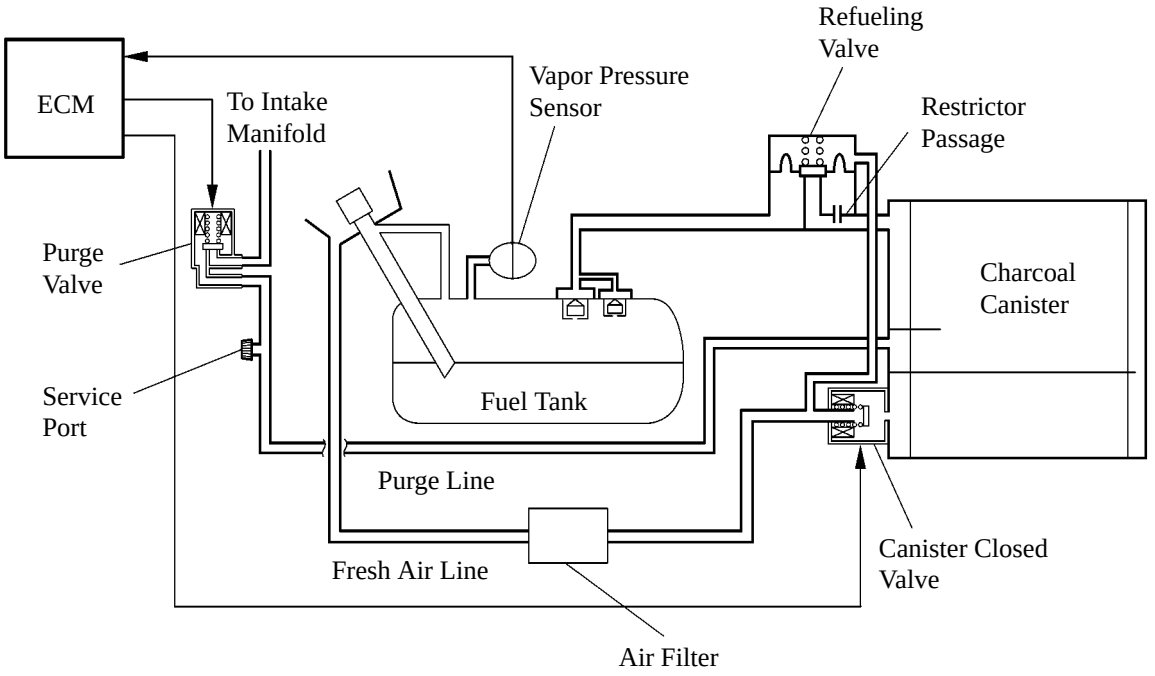
General

- The construction of the evaporative emission control system has been changed to comply with the LEV-II (Low Emission Vehicle-II) evaporative emission regulation which is belong to CARB (California Air Resources Board). Along with this change, the amount of vapor gas that is discharged outside of the vehicle while the vehicle is parked has been reduced considerably. Because of this construction, which is simpler than the previous, the reliability of the system has been improved.
- This system consists primarily of a canister closed valve, purge valve, charcoal canister, vapor pressure sensor, refueling valve, and ECM.
- In this system, the ECM monitors the system for malfunctions and outputs DTCs (Diagnostic Trouble Codes) in the event of a malfunction. The detection method is basically the same as the conventional vacuum type that is used on other models. A vacuum is introduced into the system, and the amount of increase in the internal pressure of the fuel tank is monitored in order to detect any leakage in the system.
- Listed below are the construction differences between this system and the conventional vacuum type:

1) The air drain valve has been discontinued. The air that has been cleaned through the charcoal canister is discharged through the fresh air line. Accordingly, the fresh air inlet has been moved from the air cleaner to a location near the fuel inlet. Furthermore, the pipe diameter of the fresh air line and the flow rate of the canister closed valve have been increased.
2) An ORVR (Onboard Refueling Vapor Recovery) function has been provided in the refueling valve.
3) A restrictor passage has been provided in the refueling valve to prevent the large amount of vacuum during purge operation or system monitoring operation from affecting the pressure in the fuel tank. As a result of this construction, the pressure switching valve has been discontinued.
4) An air filter* has been added to the fresh air line.

*: The air filter is maintenance-free. If the filter becomes clogged, the ECM will illuminate the MIL (Malfunction Indicator Lamp) and record the DTC number P0446 in its memory.

▶ System Diagram ◀



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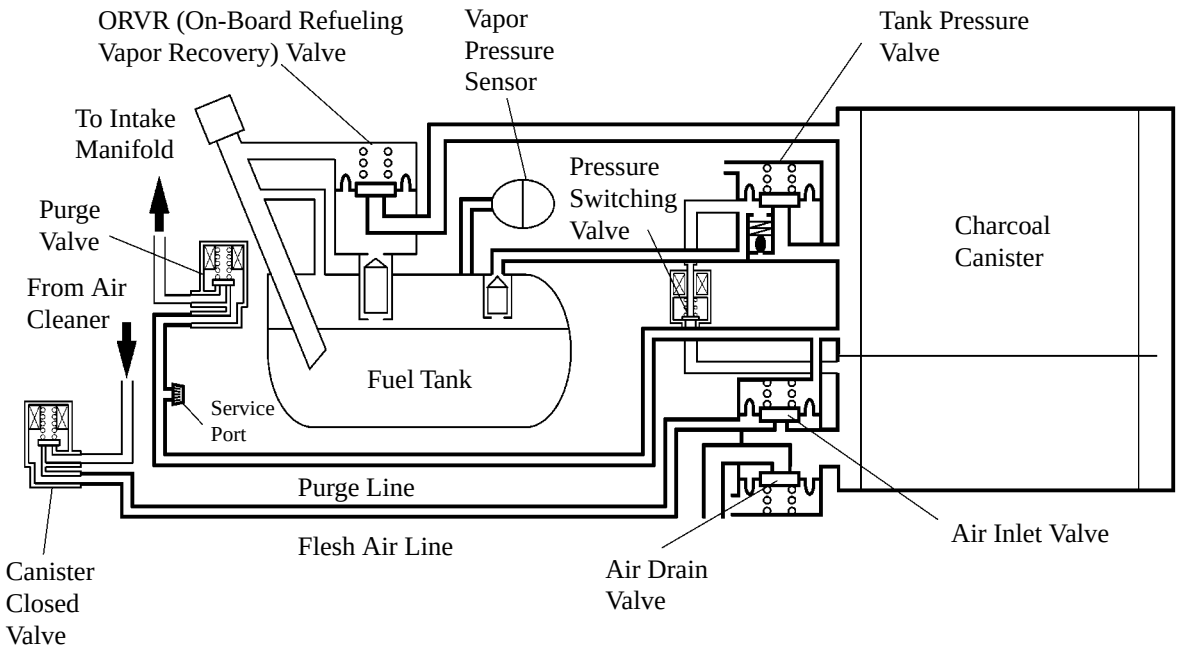
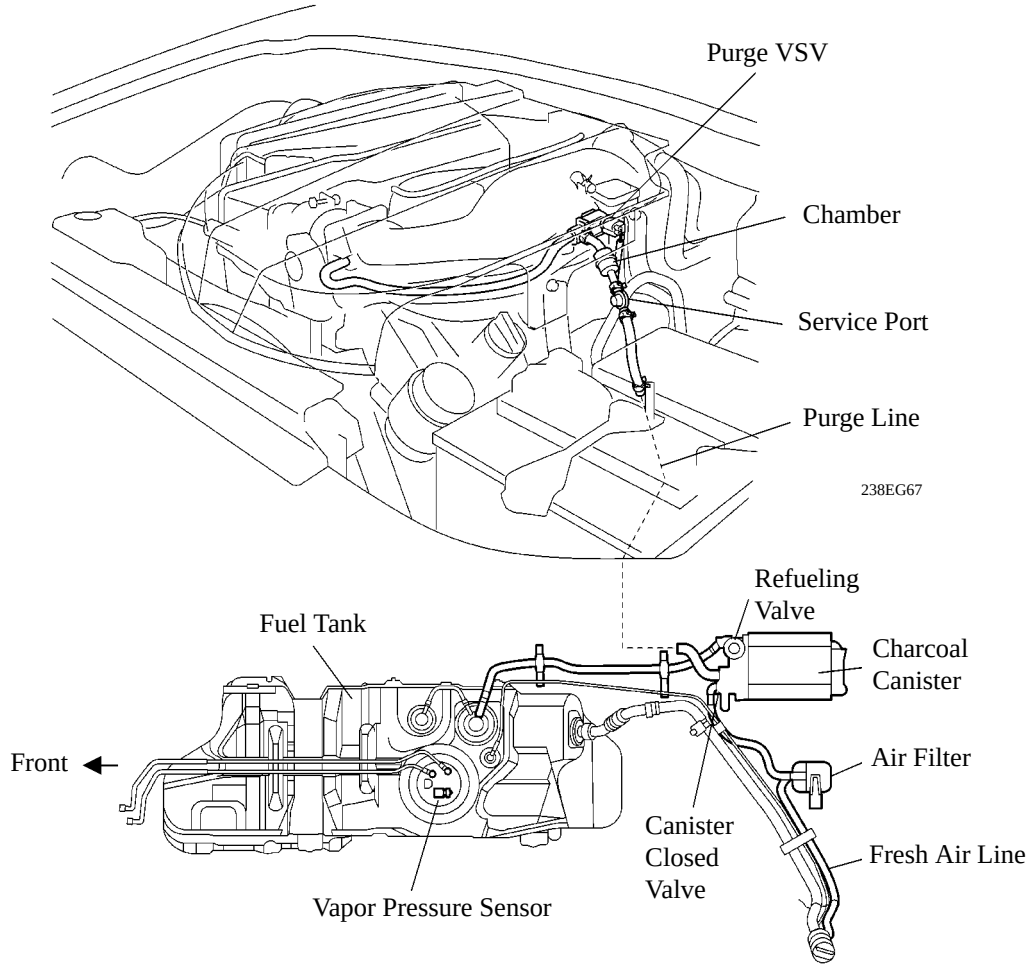


Conventional Vacuum Type 189EG31

Layout of Main Component



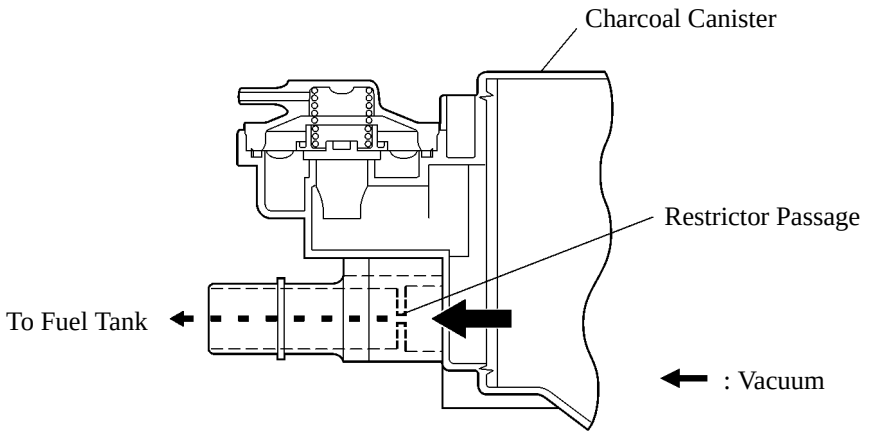
Function of Main Component

Components	Function
Canister Closed Valve	Opens and closes the fresh air line in accordance with the signals from the ECM in order to introduce fresh air and control the pressure relief if the internal pressure in the fuel tank increases.
Purge Valve	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 charcoal canister into the intake manifold. During the system monitoring mode, this valve controls the introduction of the vacuum into the fuel tank.
Charcoal Canister	Contains activated charcoal to absorb the vapor gas that is created in the fuel tank.
Vapor Pressure Sensor	Detects the pressure in the fuel tank and sends the signals to the ECM.
Refueling Valve	Controls the flow rate of the vapor gas from the fuel tank to the charcoal canister when the system is purging or during refueling.
Air Filter	Prevents dust and debris in the fresh air from entering the system.
Service Port	This port is used for connecting a vacuum gauge for inspecting the system.
ECM	Controls the canister closed valve and the purge valve 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

A restrictor passage has been provided in the tank pressure valve. 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 charcoal 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 prevent this from occurring.



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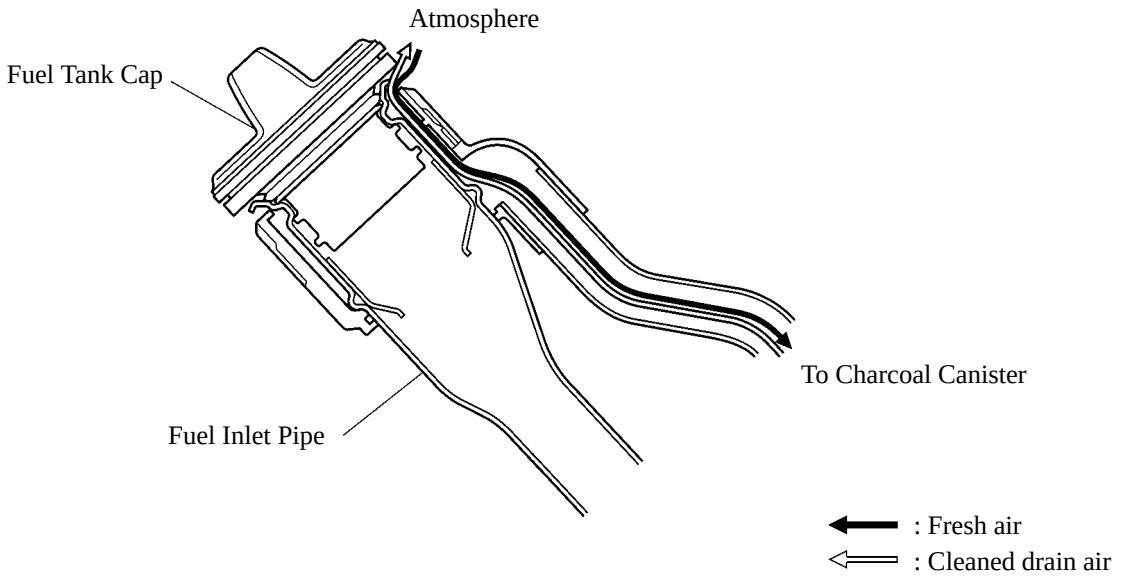
2) Fuel Inlet (Fresh Air Inlet)

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 near fuel inlet. The flesh air from the atmosphere and drain air cleaned by the charcoal canister will go in and out to the system through the passage shown below.



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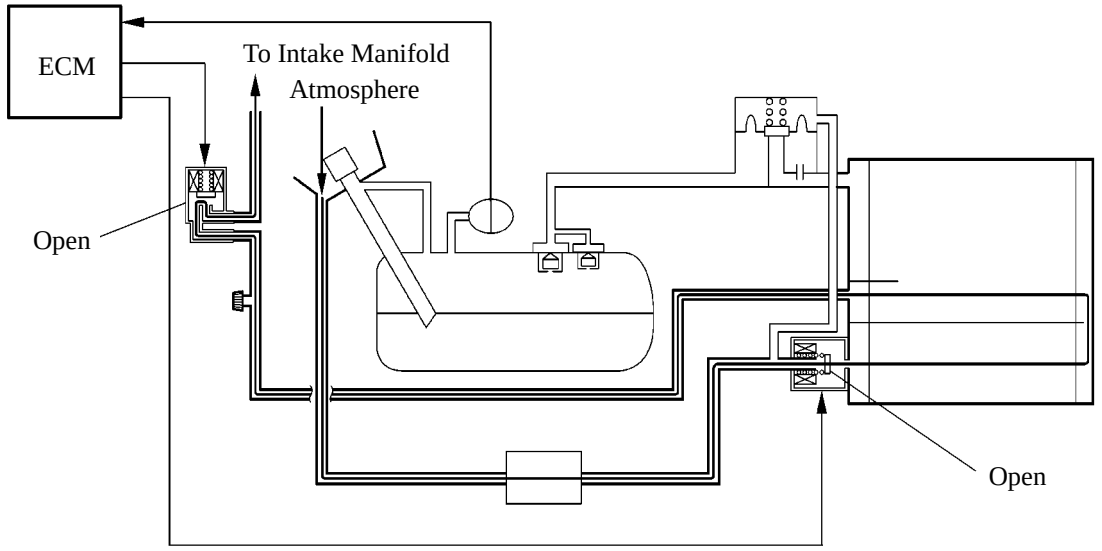
System Operation

1) Purge Flow Control

When the engine has reached predetermined parameters (closed loop, engine coolant temp. above 75°C (167°F), etc), stored fuel vapors are purged from the charcoal canister whenever the purge valve is opened by the ECM.
The ECM will change the duty ratio cycle of the purge valve thus controlling purge flow volume. Purge flow volume is determined by intake manifold pressure and the duty ratio cycle of the purge valve.
Atmospheric pressure is allowed into the charcoal canister to ensure that purge flow is constantly maintained whenever purge vacuum is applied to the charcoal canister.



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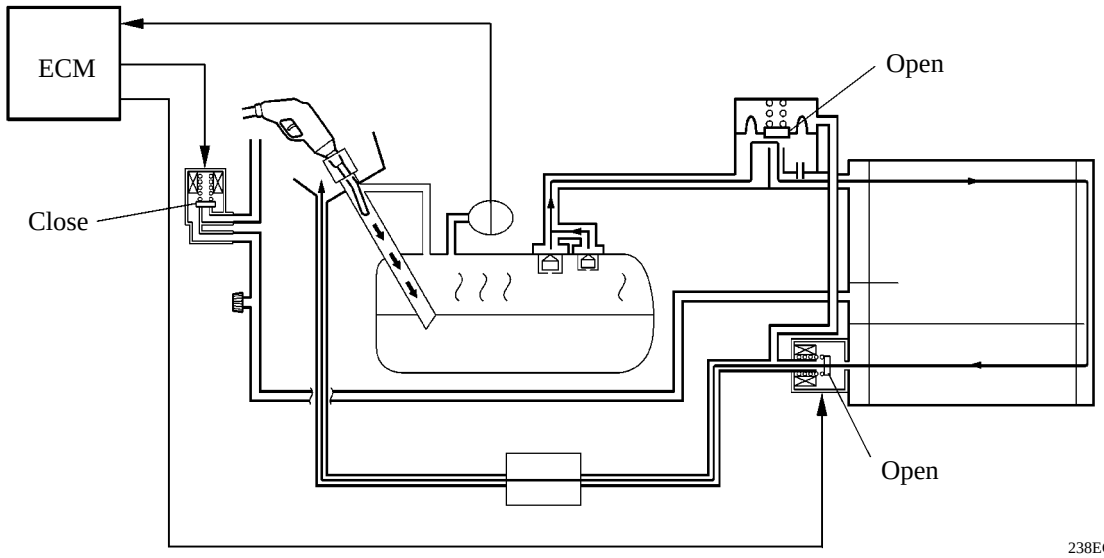
2) ORVR (On-Board Refueling Vapor Recovery)

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 charcoal canister. Because the canister closed 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 charcoal canister is discharged outside of the vehicle via the fresh air line. If the vehicle is refueled during the system monitoring mode, the ECM will recognize the refueling by way of the vapor pressure sensor, which detects the sudden pressure increase in the fuel tank, and will open the canister closed valve.



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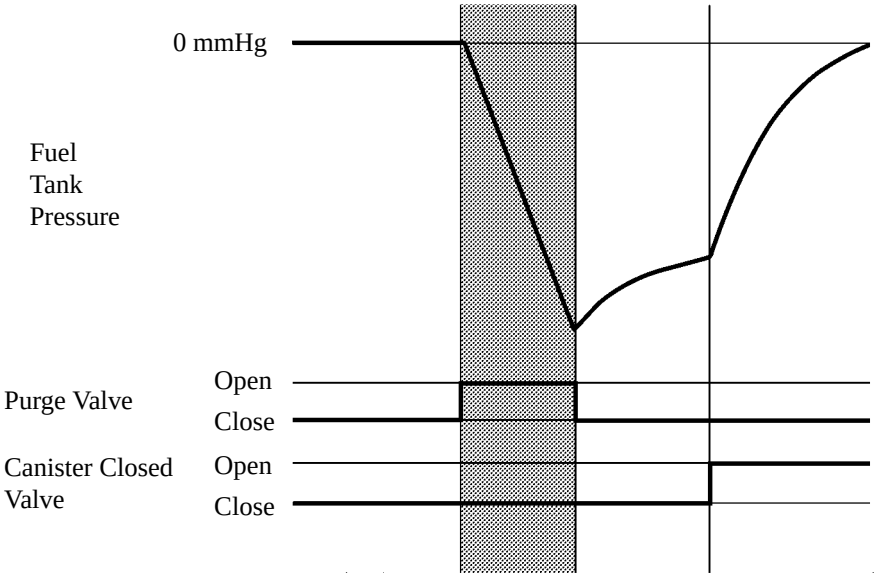
3) System Monitoring

When the initial conditions {low engine temperature (low engine coolant temperature and, engine coolant temperature and intake air temperature being nearly the same) at the engine starting, constant vehicle speed (including idling), and so on.} are met, the ECM introduces a vacuum into the system and monitors the amount of pressure increase in the fuel tank in order to determine if there is any leakage in the system. At the same time, the ECM determines if there is any malfunction in the canister closed valve and the purge valve.

a. Step 1

The ECM opens the purge valve and introduces a vacuum into the fuel tank.



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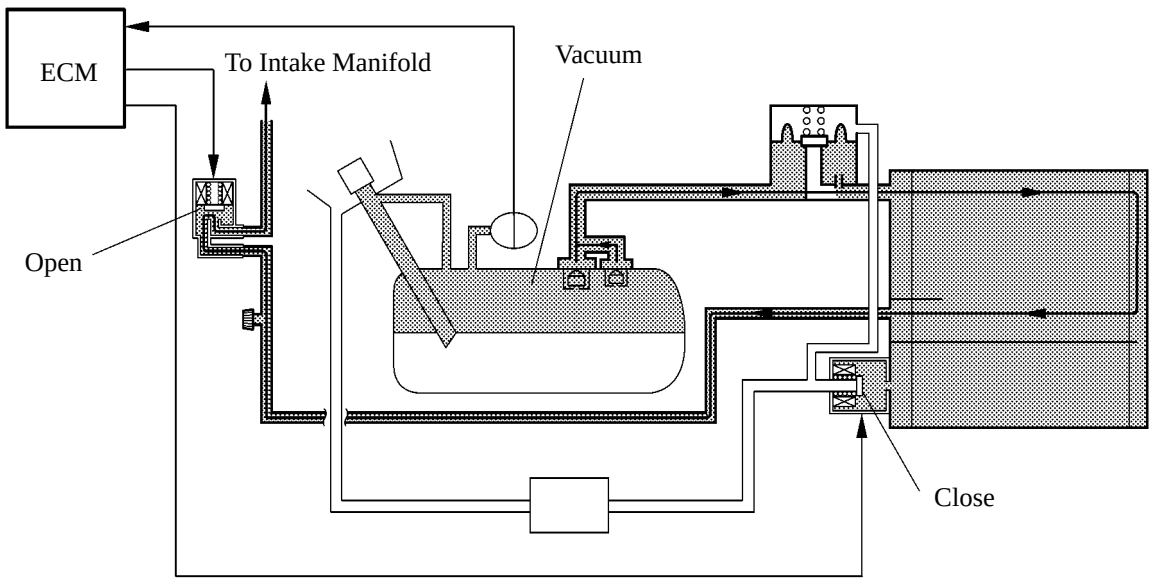

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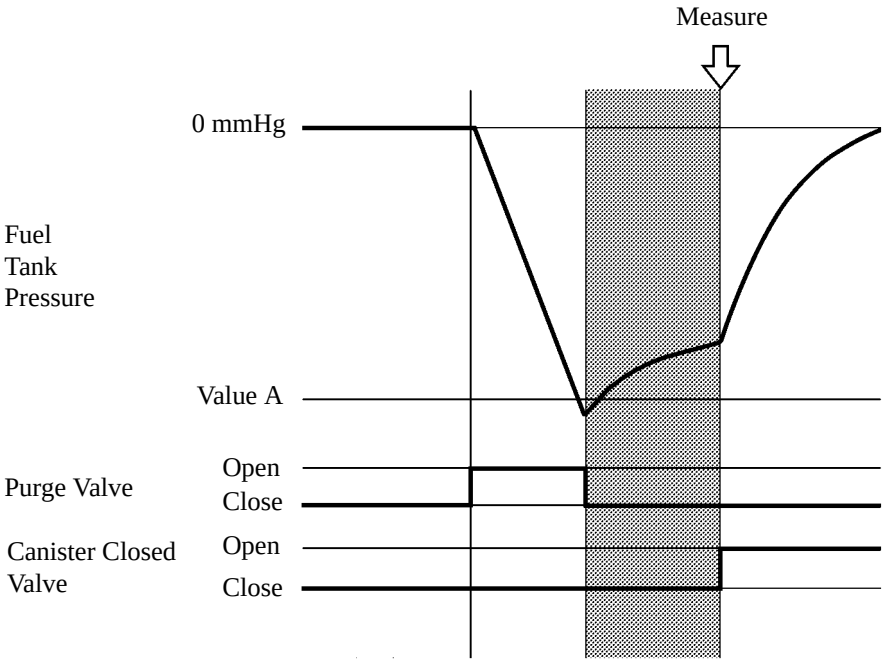
b. Step 2

When the pressure in the fuel tank decreases below value A, the ECM closes the purge valve again. The ECM measures the amount of pressure increase in the tank.



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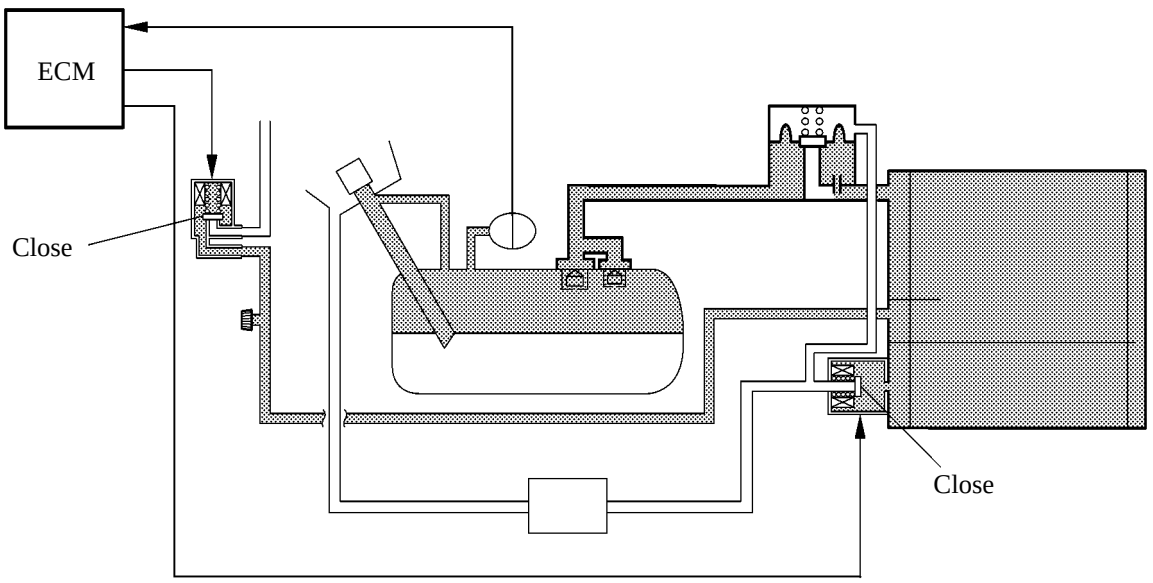

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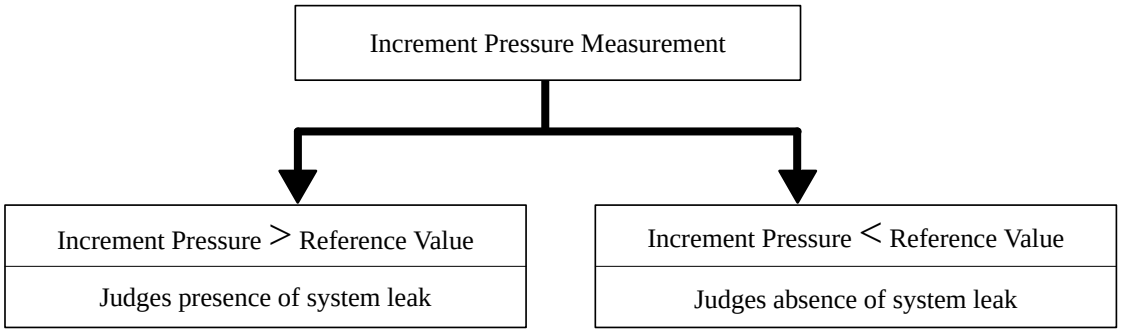
c. System Leak Judgment

The ECM determines whether there is a leakage in the system by the increment amount of fuel tank pressure at Step 2 in the previous page. If the increment amount of the fuel tank pressure is greater than the reference value, the ECM judges that there is a system leak.



- If the ECM judges that there is no system leak, it ends the system monitoring mode and transfers to the normal system control. (Both the purge valve and canister closed valve are opened.)
- If the ECM determines that there is a system leak, it illuminates the MIL and stores the following DTCs in its memory:

Level of Leak	DTC
Small or medium leak	P0442
Large leak	P0441, P0442 and P0446

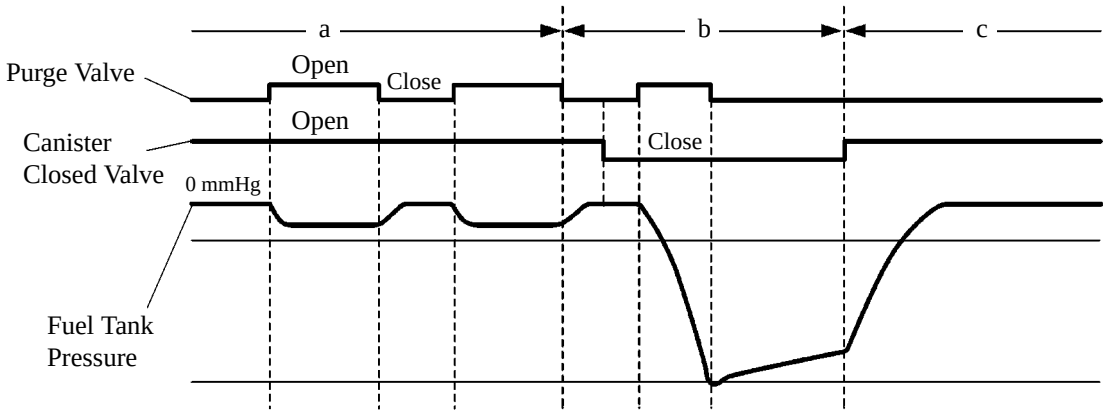
d. VSV (Vacuum Switching Valve) Monitoring

i) Normal Condition

a. During purging, the ECM opens the purge valve, and this creates a slight vacuum in the fuel tank.

b. During the system monitoring mode, the ECM opens the purge valve and closes the canister closed valve to introduce a vacuum into the fuel tank.

c. After the ECM has performed a system leak judgment, it opens the canister closed valve to introduce fresh air into the system. As a result, the atmospheric pressure is reinstated rapidly in the fuel tank.



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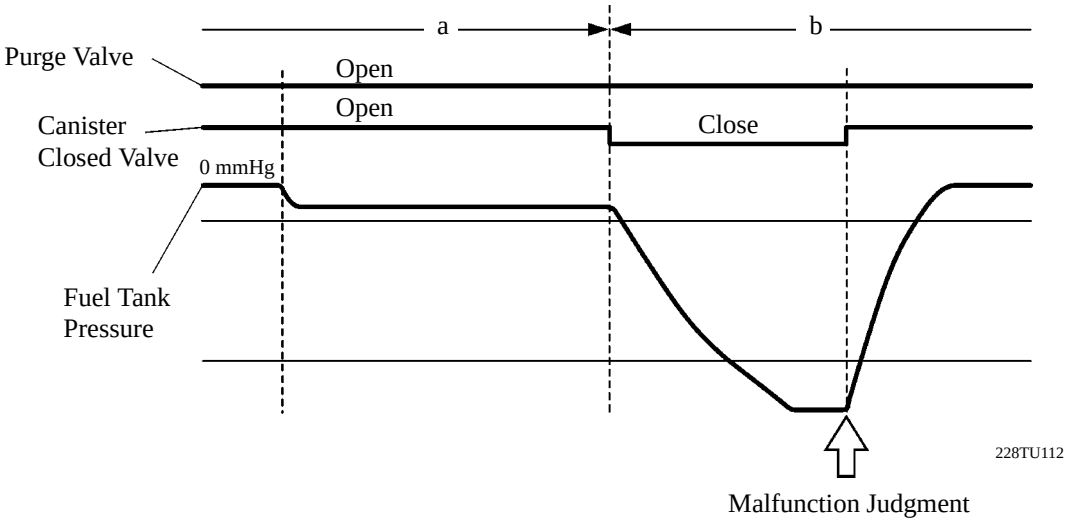
ii) Purge Valve Open Malfunction

a. The fuel tank remains in a constant, slight vacuum state regardless of whether the ECM sends an open or close signal to the purge valve.

b. The pressure in the fuel tank drops rapidly regardless of the close signal that the ECM is sending to the purge valve.

When the ECM detects an open malfunction of the purge valve, it illuminates the MIL and stores the DTC number P0441 in its memory.

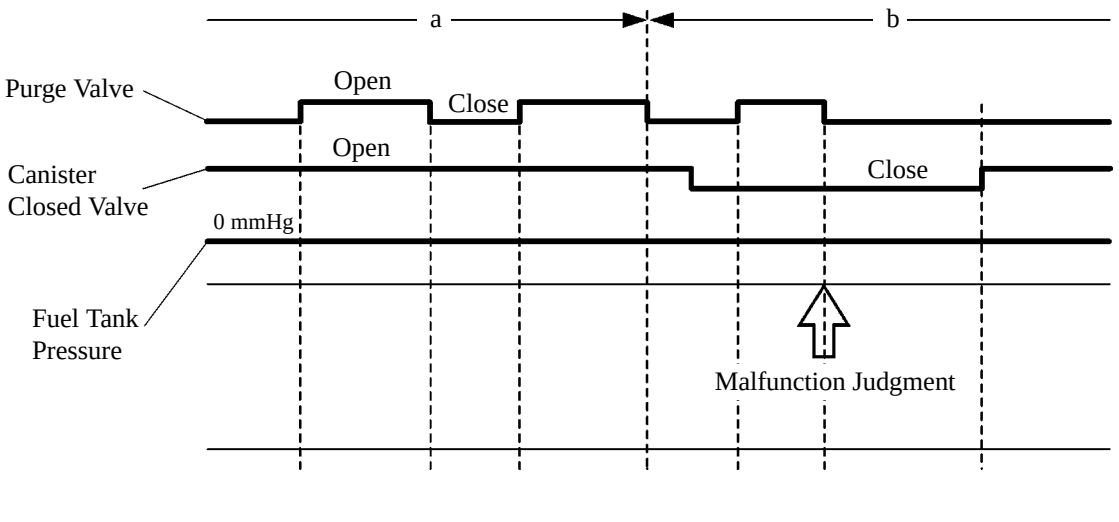


iii) Purge Valve Close Malfunction

a. The pressure in the fuel tank does not change regardless of whether the ECM sends an open or close signal to the purge valve.

b. Even if the ECM closes the canister closed valve in order to transfer to the system monitoring mode, no vacuum is introduced into the fuel tank.

When the ECM detects a close malfunction of the purge valve, it illuminates the MIL and stores the DTC numbers P0441, P0442, and P0446 in its memory.

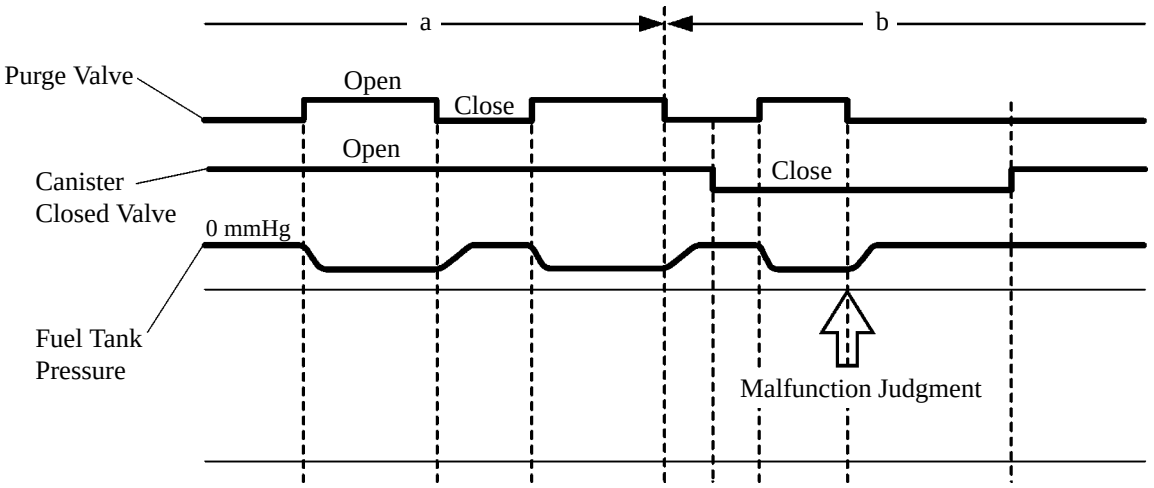


iv) Canister Closed Valve Open Malfunction

a. As the ECM opens the purge valve, a slight vacuum is created in the fuel tank.

b. Even if the ECM sends a close signal to the canister closed valve in order to transfer to the system monitoring mode, it is not possible to completely introduce a vacuum into the fuel tank.

When the ECM detects an open malfunction of the canister close valve, it illuminates the MIL and stores the DTC numbers P0441, P0442, and P0446 in its memory.



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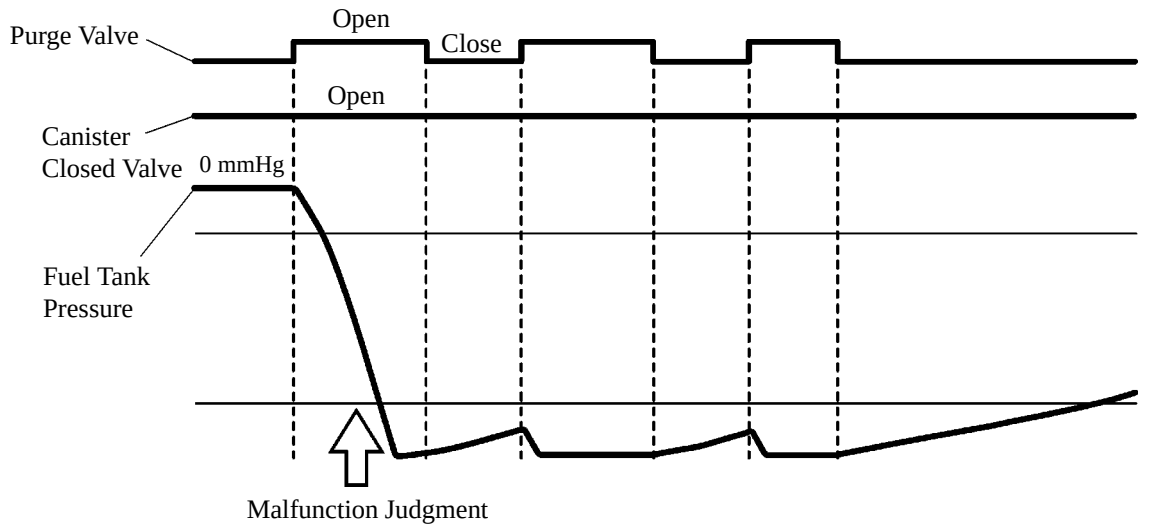
v) Canister Closed Valve Close Malfunction

During purging, a large amount of vacuum is introduced into the fuel tank regardless of the open signal that the ECM sends to the canister closed valve. Even if the purge valve closes, the atmospheric pressure is not reinstated in the fuel tank.

When the ECM detects a close malfunction of the canister close valve, it illuminates the MIL and stores the DTC number P0446 in its memory.



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