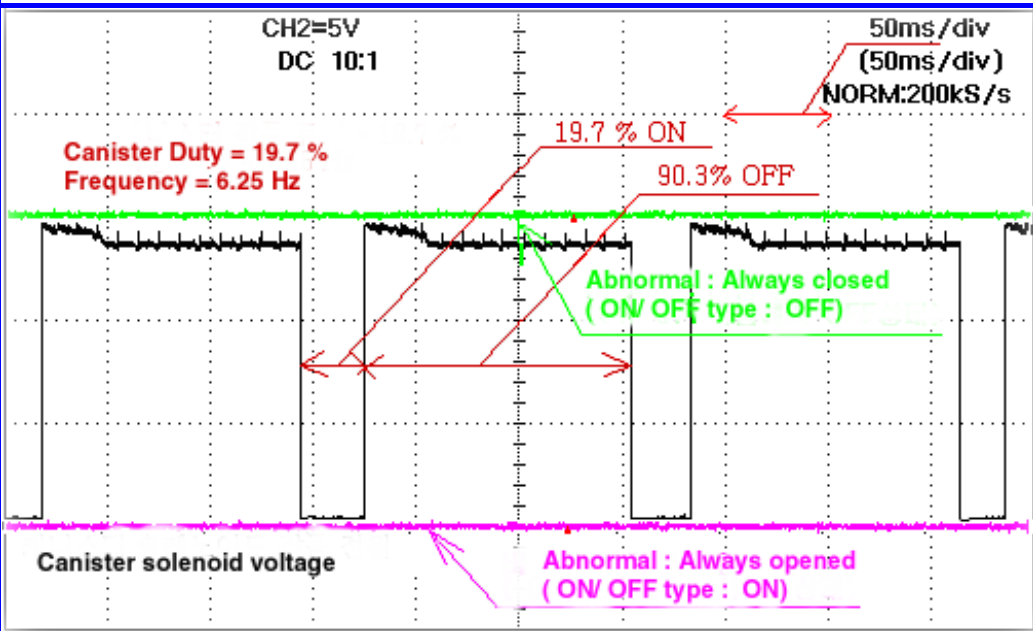


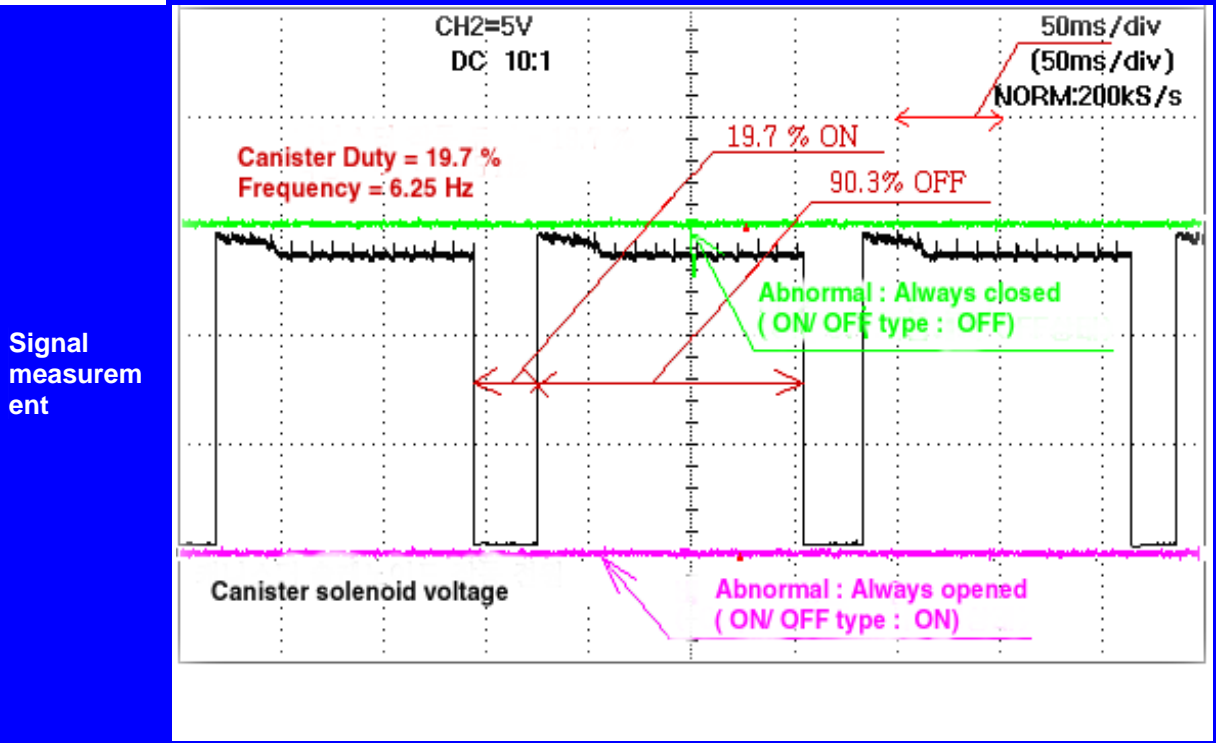
15. The signal check of Purge(Canister) Valve

1. Troubles

1. Power supply line break of canister solenoid valve	
Cause of trouble	1.1 Power supply line break (After main relay : 12[volt]) 1.2 Duty control line break in ECU 1.3 Abnormal canister solenoid valve
Counter action	1.1 Repair power supply line 1.2 Repair duty control line in ECU 1.3 Replace canister solenoid valve
Engine state	There is no problem in engine operation but it may smell fuel from vehicle after warm up.
Signal measurement	 <p>CH2=5V DC 10:1</p> <p>50ms/div (50ms/div) NORM:200kS/s</p> <p>Canister Duty = 19.7 % Frequency = 6.25 Hz</p> <p>19.7 % ON 90.3% OFF</p> <p>Abnormal : Always closed (ON/ OFF type : OFF)</p> <p>Canister solenoid voltage</p> <p>Abnormal : Always opened (ON/ OFF type : ON)</p>

2. Canister solenoid valve is always open

Cause of trouble	2.1 Duty control line in ECU is shorted to ground 2.2 Abnormal canister solenoid
Counter action	2.1 Improvement of duty control line in ECU 2.2 Replace canister solenoid
Engine state	RPM may be unstable due to overflow of fuel gas after start. Surging may be occurred with acceleration.



3. Canister solenoid valve is intermittently opened	
Cause of trouble	3.1 Duty control line in ECU is intermittently shorted to ground 3.2 Intermittent malfunction of canister solenoid valve
Counter action	3.1 Improvement of duty control line in ECU 3.2 Replace canister solenoid : In case of this trouble, canister solenoid valve may be normally operated if engine is cool down. Therefore, it should be checked whether there is leak in canister solenoid valve with engine warm up.
Engine state	RPM is unstable in idle with warmed up engine. And it makes rich fuel control.
Signal measurement	<p>The graph displays three signals over time:</p> <ul style="list-style-type: none"> RPM: Shows fluctuations labeled "RPM instability (too rich)". A/F ratio: Shows a dip labeled "Misfire (too rich)". Oxygen sensor fuel correction: Shows a pulse labeled "Oxygen sensor fuel correction". <p>Annotations include:</p> <ul style="list-style-type: none"> "Time lasting after reaching minimum value 3 ~ 8 sec" (indicated by a double-headed arrow). "Feedback inhibited if time is over after reaching minimum value" (indicated by a dashed oval).

2. Field example

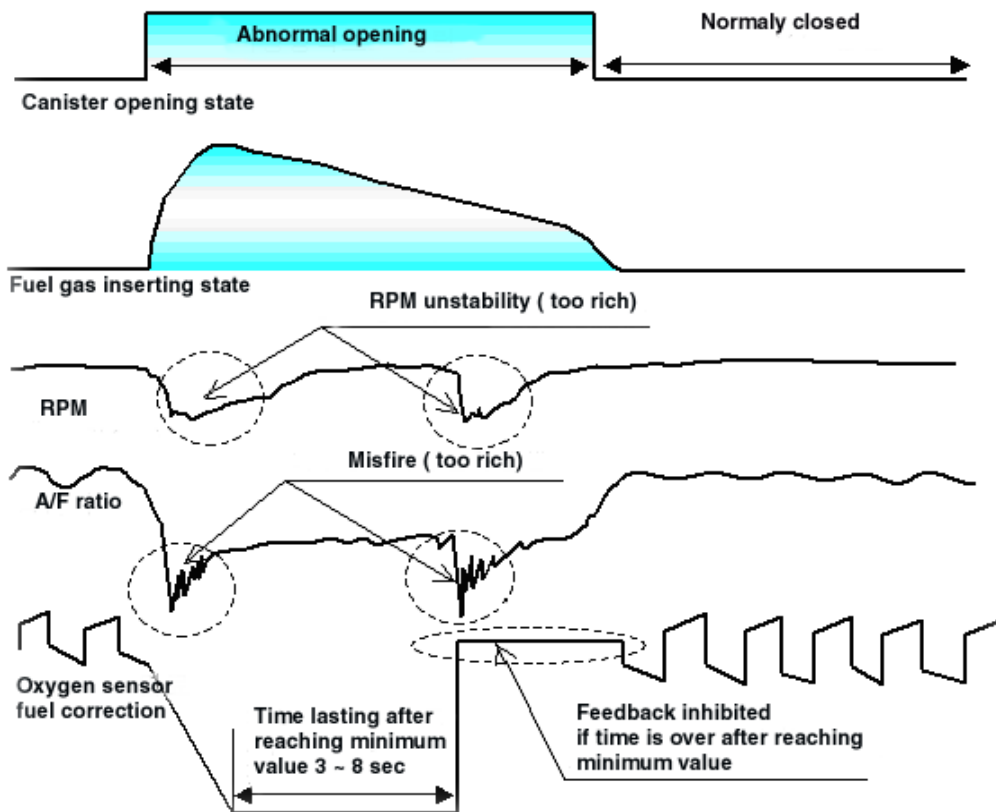
< Example 1 >

Vehicle : New sephia / Avella 1.5L SOHC/DOHC, Odometer : 12,000Km

Problem description : RPM is unstable in idle after start and it smell fuel from exhaust gas.

Cause : The leakage of purge solenoid valve with warmed up engine

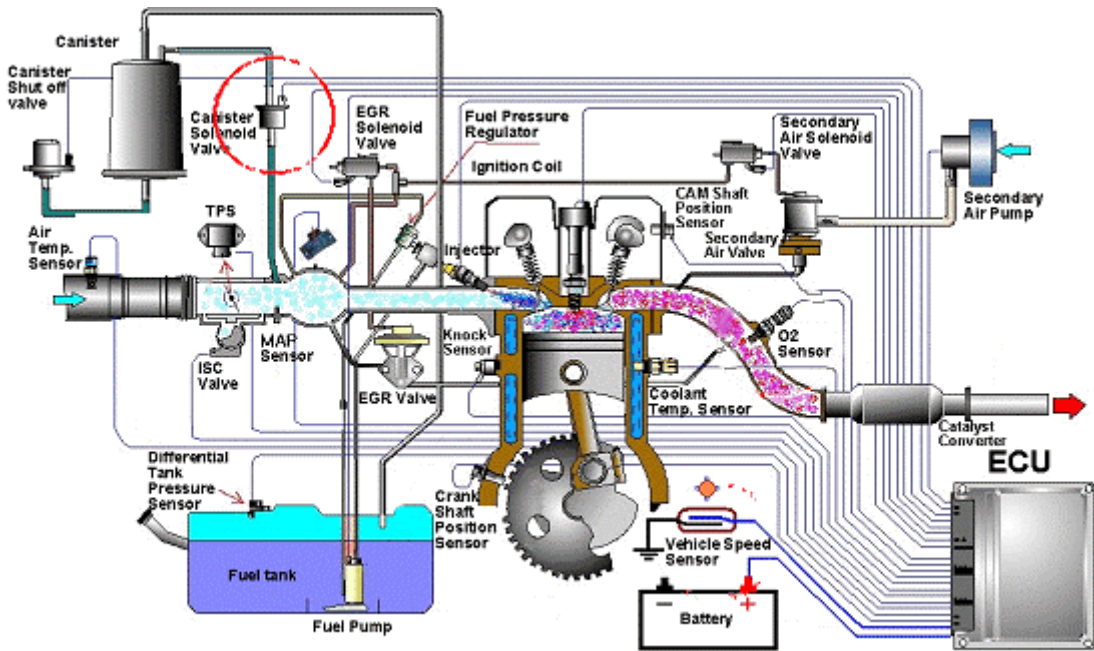
Signal measurement : The power of purge solenoid valve is off but it is abnormally opened.



Explanation : It is so difficult to check problem because purge valve is opened with heated engine and it is normally operated with engine cool down.

Enlargement of application : We can guess overflow of fuel supply by engine vibration and fuel smell. Find conditions that occurring overflow of fuel supply.

3. Location of Canister solenoid valve



4. Check method

Explain the checking Method and Diagnosis of trouble

Preparation

1. Oscilloscope (It prefers not to use Multimeter available)
2. Wiring Diagram for Canister.
3. Scanner

1. Find and connect the sensor power line (Battery voltage), Ground line (grounded by ECU) in referencing the wiring diagram.
2. Look at how the voltage is in connecting the Oscilloscope.
3. It must be measured with stepping on the accelerator pedal in other systems except for BOSCH system because canister valve is opened with small duty in idle state in BOSCH system But closed in the others.

< Reference >

It prefers not to use Multimeter because it is difficult to measure the canister solenoid valve operating state with Multimeter in case of Duty control (continuous ON/OFF type).

< Reference >

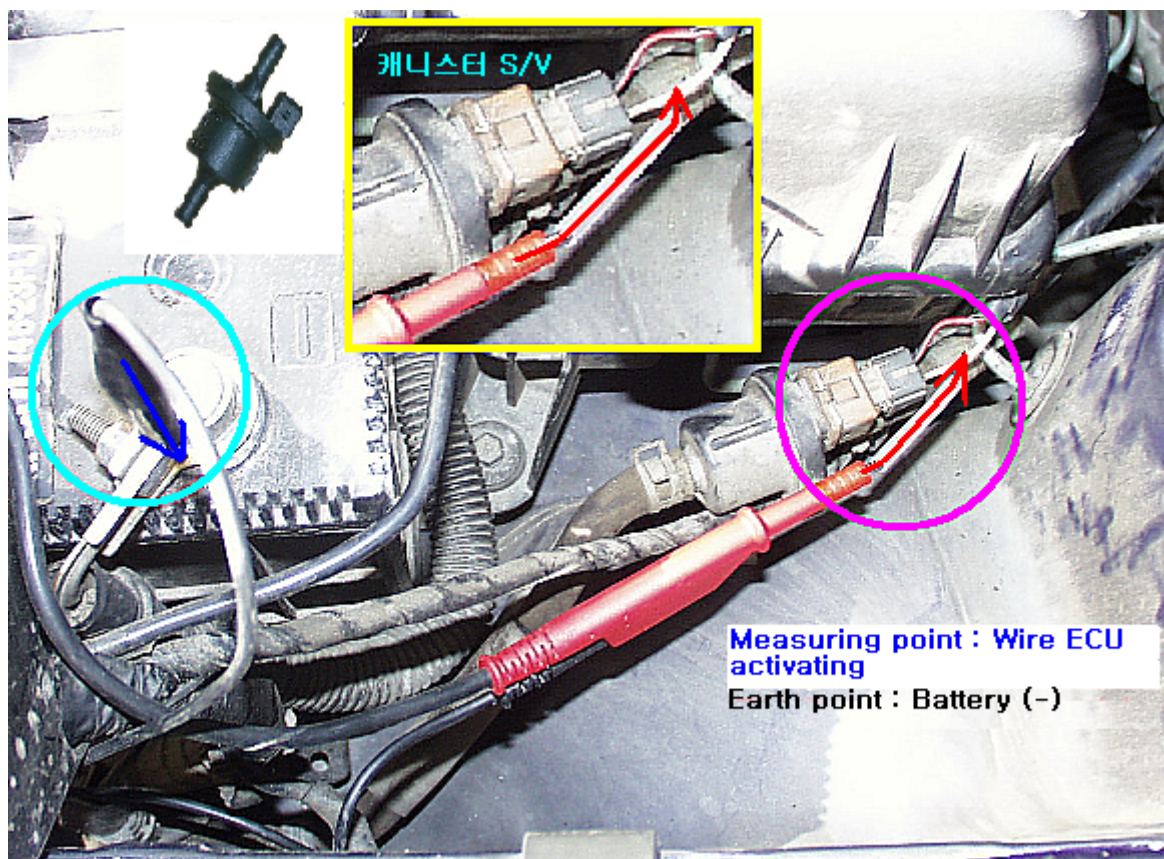
In case of connecting the Auto-Scanner, Let's reference the results because Auto-scanner diagnoses some troubles automatically.

Comparing Method: After measuring the signal, compare the measured signal with **Normal signal**.

- (1) Compare the opening value (Duty when the voltage is '0') with the frequency from normally measured signal.
- (2) It would like to check the Canister operating state with connecting the Scanner.

< Checking items >

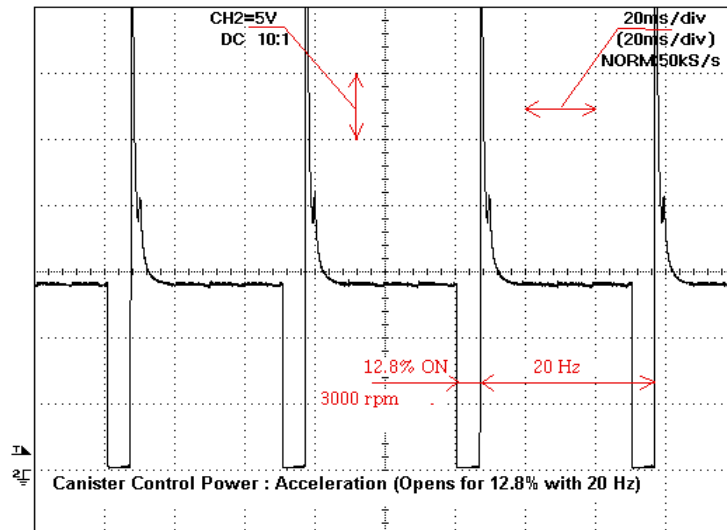
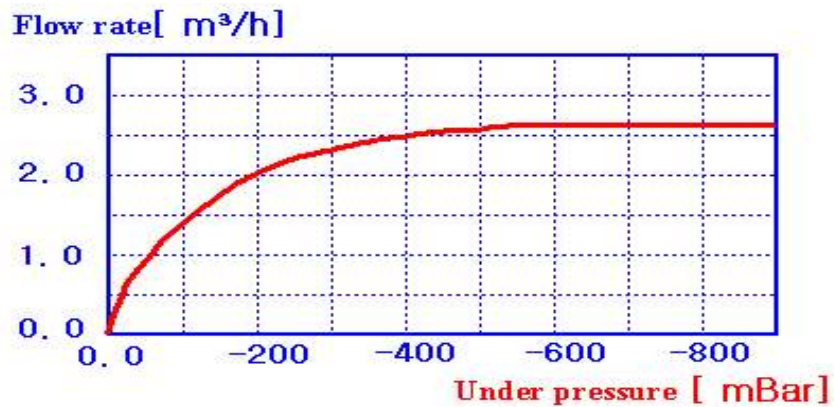
- (1) Is the Frequency right?
- (2) Check whether the canister valve is not opening even though operating or opening even though not operating.
- (3) Is there sensor operating voltage line / Ground line broken?

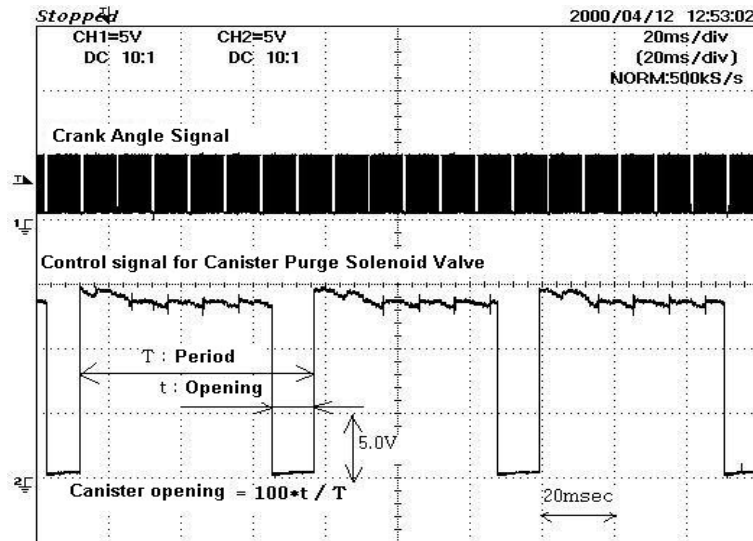


5. Wave analysis

Canister solenoid valve characteristic is as follows:

1. Regular voltage / Ampere: 13.5V / 0.5 A
2. Internal resistance : 15 - 30 Ω
3. Operating voltage : 9 - 16 V
4. Operating frequency / Impulse : 10 - 20 Hz / 6 msec
5. Leakage : 0.002 m³/h
6. Fuel vapor gas flow characteristic :



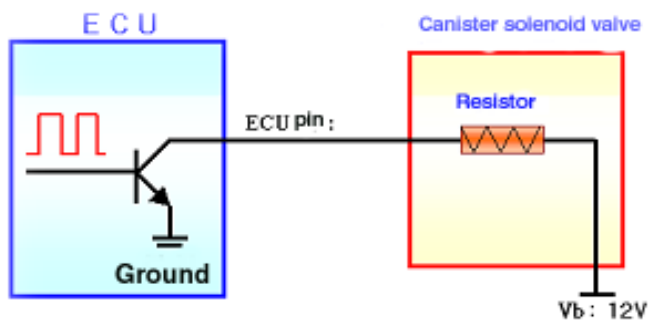


< Reference >

Above example show flow rate of fuel vapor gas by intake manifold vacuum with fully opening of solenoid valve which is controlled by duty cycle. Most of vehicle have same trend but flow rate is different (The bigger and bigger displacement, flow rate is big, ON/OFF type is only controlled from 20 to 40%)

6. General

To suck evaporated gas that is arisen at fuel tank and saved at canister into engine by means of engine vacuum, this part is connected by hose that is in between canister and surge tank, and is duty control valve that is controlled with ON/OFF duty method by ECU. Because it is



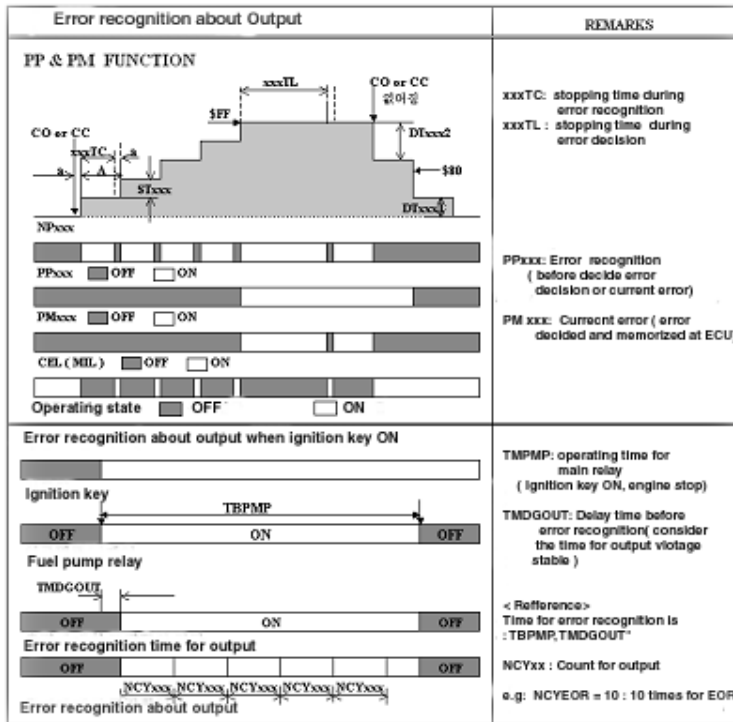
inhibited by regulation that evaporated gas is released into the air, evaporated gas must be controlled. At first this gas is saved at canister, then sucked into engine with sucked air by means of vacuum during engine running and canister solenoid valve is used for passage between canister and surge

tank. As much evaporated gas is entered into engine, air-fuel state within engine come to be rich state. So, to avoid this rich phenomenon, this canister solenoid valve is opened suitably by means of opening duty control (ON/OFF time rate) according to engine rpm/sucked air quantity by ECU

7. Principle (Algorithm) introduction

What can be the problem with the canister in the car? First of all, there is no big problem with that. But, unstable idle speed and acceleration shock can be happened with hot engine. Let's look at it in detail.

For the canister purge error, it is same as other output diagnosis. If the current(or resistance) of



inside of ECU is less or bigger than threshold during operation of output component, error is detected. Diagnosis for output is finished for the first 1sec after ignition key ON. And after engine start, diagnosis is performed under each error check conditions.

For example, canister diagnosis is not performed during idle but part load.

Fuel vapor gas is stored in the canister and supplied to the engine through canister solenoid (purge) valve. Then how much fuel gas

is in the fuel tank? Simply speaking, fuel tank is full of fuel gas as much as fuel tank is expanding like a ball. Therefore, shape of fuel tank is rounded and fuel tank is tied up by steel belt to prevent expansion. Fuel vaporization is a lot like this and if we fully open the solenoid valve to let fuel gas go into the cylinder then engine can be stall due to too much fuel. If we calculate it as fuel quantity, it is approximately 3 or 5 times of idle injection time.

However, there are two reasons for too much fuel gas from canister.

First one is automatic opening of canister (purge) solenoid valve in idle. Purge solenoid valve only can opens when ECU gives power, but if engine is too hot then this solenoid valve is open automatically. Especially, it is very often with "S" company's production and also "B" company's production shows it sometimes.

If purge valve is open in hot engine condition, too much fuel gas is supplied to the engine and this makes unstable engine rpm. Generally, this phenomenon is continued for about 10 – 20sec, but in case of long idle state in the middle of summer, it is continued for more long time.

Duration of this is until the engine consume all fuel gas in the canister and most of case, the duration is about 10min with vehicle driving.

Second one is the case when canister purge is not open in idle with normal operation. In this case, there are much fuel gas generated in idle and if canister is open at take off, suddenly a lot of fuel gas

will be supplied to the engine and too much fuel gas leads unstable combustion and due to this hesitation during acceleration will be happened.

We can see this kind of problem when we slowly take off on the road with heavy traffic jam in the hot summer.

The purpose of canister is not to get good engine operation but to reduce fuel vapor emission and it does not make difficult trouble except above two problems.