Emissions Control System (G4GC – GSL2.0/G6BA – GSL2.7)

GENERAL

SPECIFICATIONS EF5EA784

Item	Specification	
Purge Control Solenoid Valve (PCSV)	Type	Duty Control type
	Resistance (Ω)	24.5 ~ 27.5 at 20 °C (68 °F)
Canister Close Vavle (CCV)	Type	ON/OFF Control type
	Resistance (Ω)	23.9 ~ 26.9 Ω at 20℃ (68℉)

TIGHTENING TORQUES EC5B0C5C

Item	N·m	kgf·cm	lbf·ft
Positive Crankcase Ventilation Valve	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7

TROUBLESHOOTING ECAEB4CF

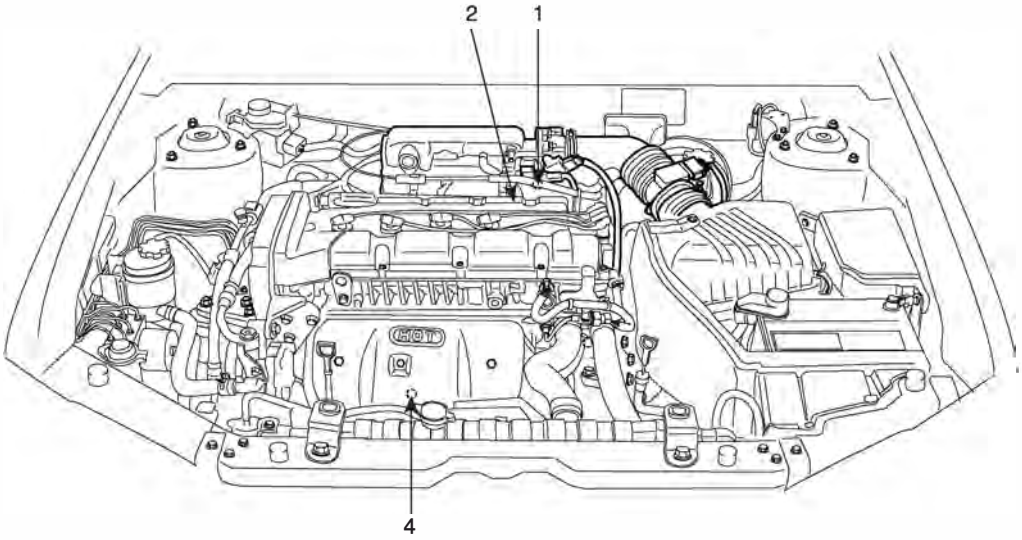
Symptom	Suspect area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the EVAP. Canister Purge Solenoid Valve	Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the PCV valve	Replace
	Malfunction of the evaporative emission canister purge system	Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

COMPONENTS EB4A620D

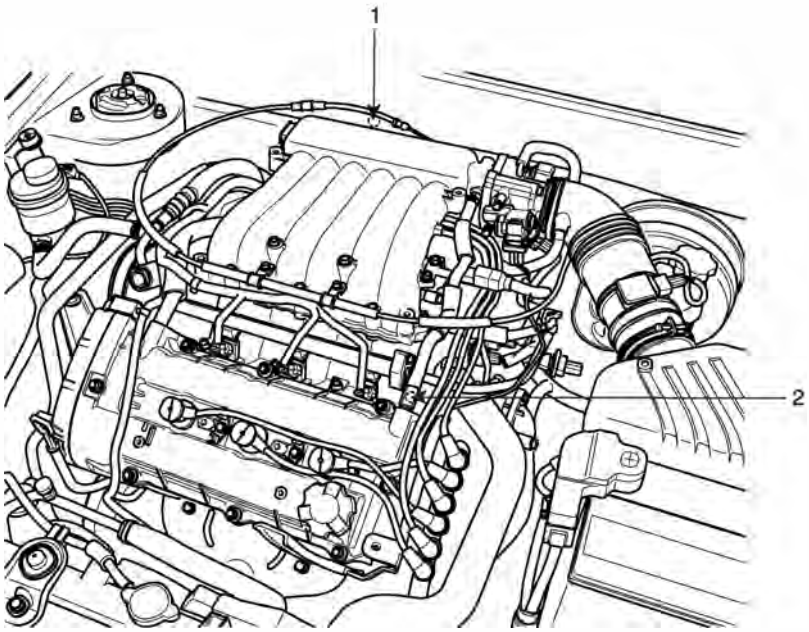
Components	Function	Remarks
Crankcase Emission System - Positive Crankcase Ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System - Evaporative emission canister - Purge Control Solenoid Valve (PCSV)	 HC reduction HC reduction	 Duty control solenoid valve
Exhaust Emission System - MFI system (air-fuel mixtrue control device) - Three-way catalytic converter	 CO, HC, NOx reduction CO, HC, NOx reduction	 Heated oxygen sensor feedback type Monolithic type

COMPONENTS LOCATION E71D00FF

[2.0 DOHC]



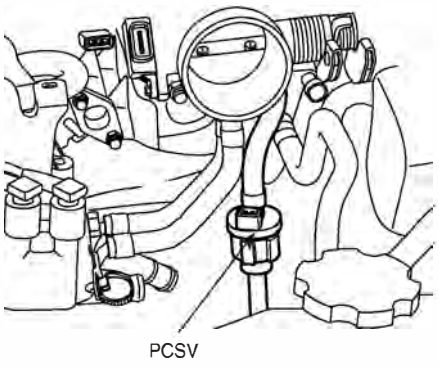
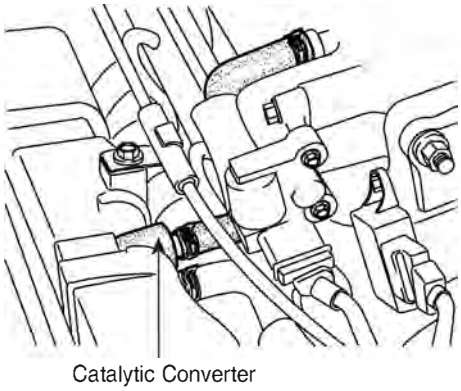
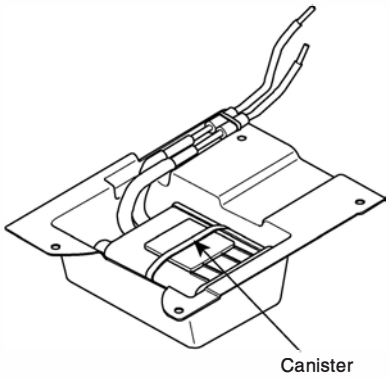
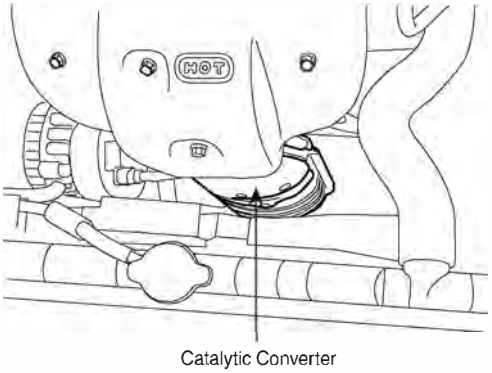
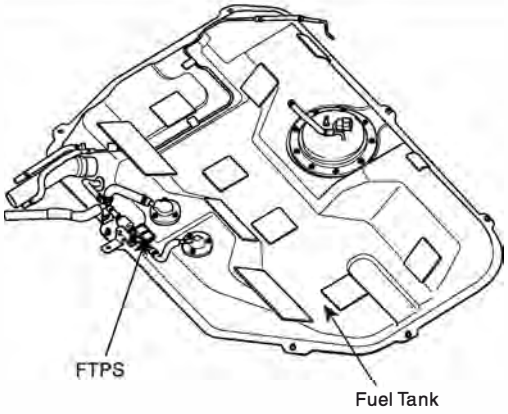
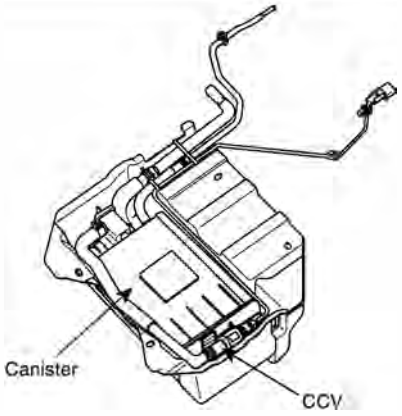
[2.7 V6]



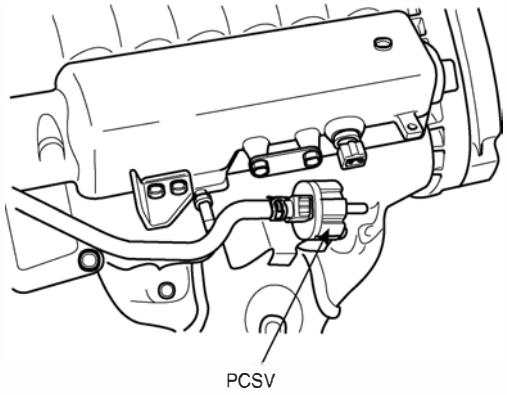
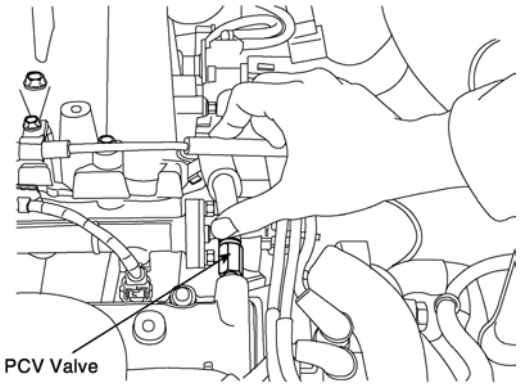
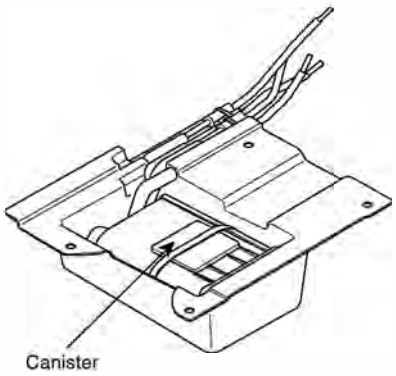
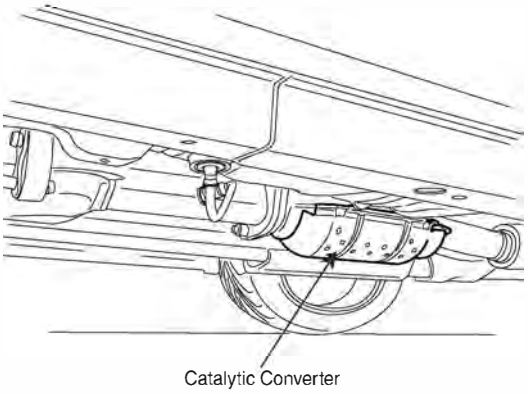
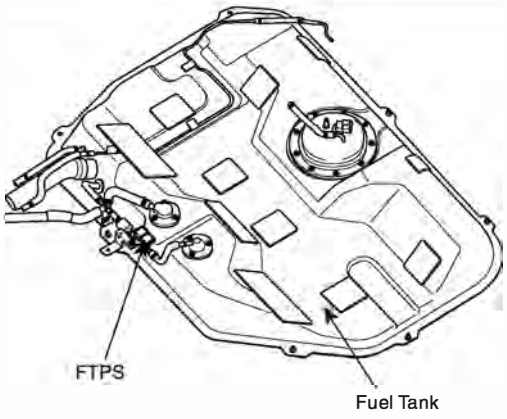
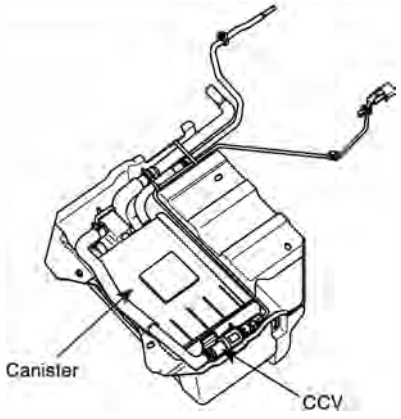
1. Purge Control Solenoid Valve (PCSV)
2. PCV Valve
3. Canister
4. Catalytic Converter
5. Fuel Tank Pressure Sensor (FTPS)
6. Canister Close Valve (CCV)

EEOF801Z

[2.0 DOHC]

1	Purge Control Solenoid Valve (PCSV)	2	PCV Valve
 KEOF302B		 EEOF901D	
3	Canister	4	Catalytic Converter
 EEOF444A		 EEOF301J	
5	Fuel Tank Pressure Sensor (FTPS)	6	Canister Close Valve (CCV)
 EEOF801T		 EEOF801U	

[2.7 V6]

1	Purge Control Solenoid Valve (PCSV)	2	PCV Valve
 KEOF222A		 EEOF010C	
3	Canister	4	Catalytic Converter
 EEOF555A		 EEOF333A	
5	Fuel Tank Pressure Sensor (FTPS)	6	Canister Close Valve (CCV)
 EEOF801T		 EEOF801U	

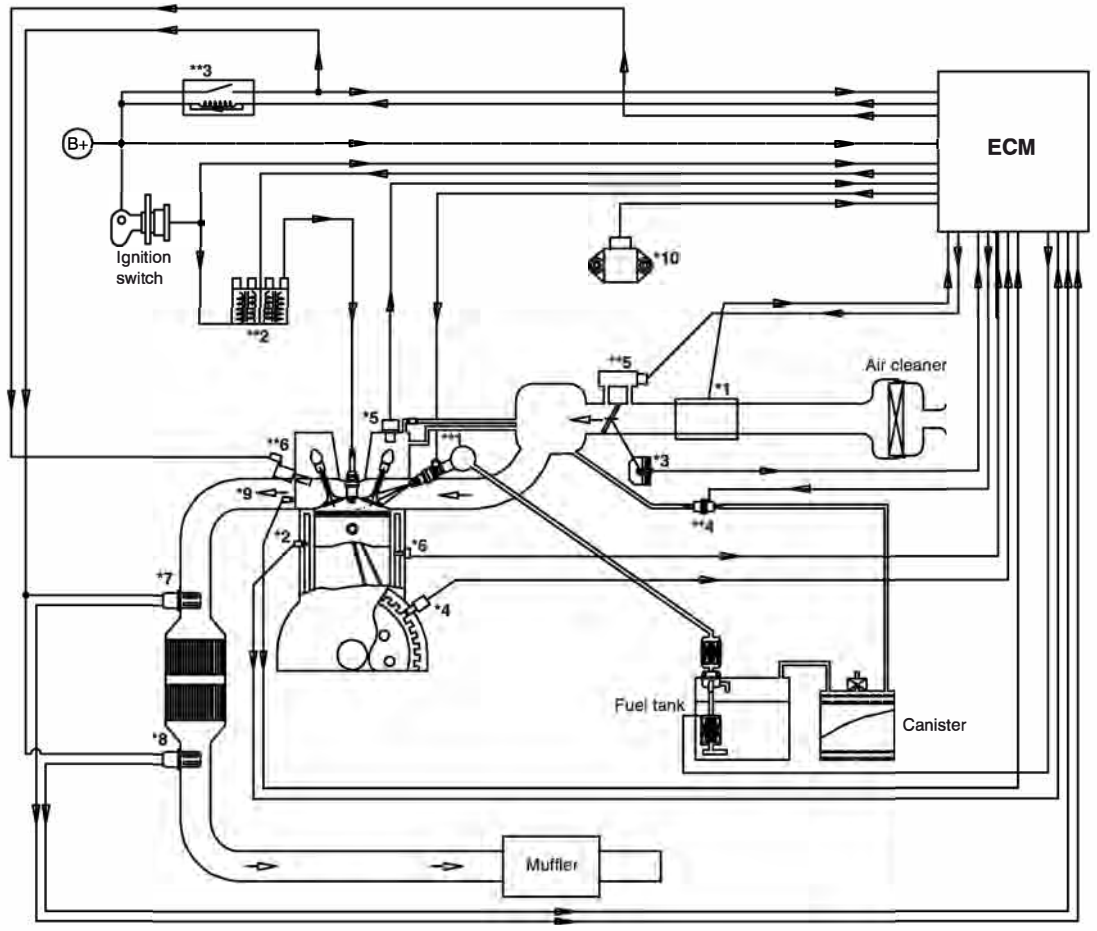
SCHEMATIC DIAGRAM EE182BDC

[2.0 DOHC]

INPUT
*1. Mass Air Flow Sensor (MAFS) & Intake Air Temp. Sensor (IATS)
*2. Engine Coolant Temp. Sensor (ECTS)
*3. Throttle Position Sensor (TPS)
*4. Crankshaft Position Sensor (CKPS)
*5. Camshaft Position Sensor (CMPS)
*6. Knock Sensor (KS)
*7. Heated Oxygen Sensor (H02S)-FR
*8. Heated Oxygen Sensor (H02S)-RR
*9. Oil Temp. Sensor (OTS)
*10. Wheel speed Sensor

ECM

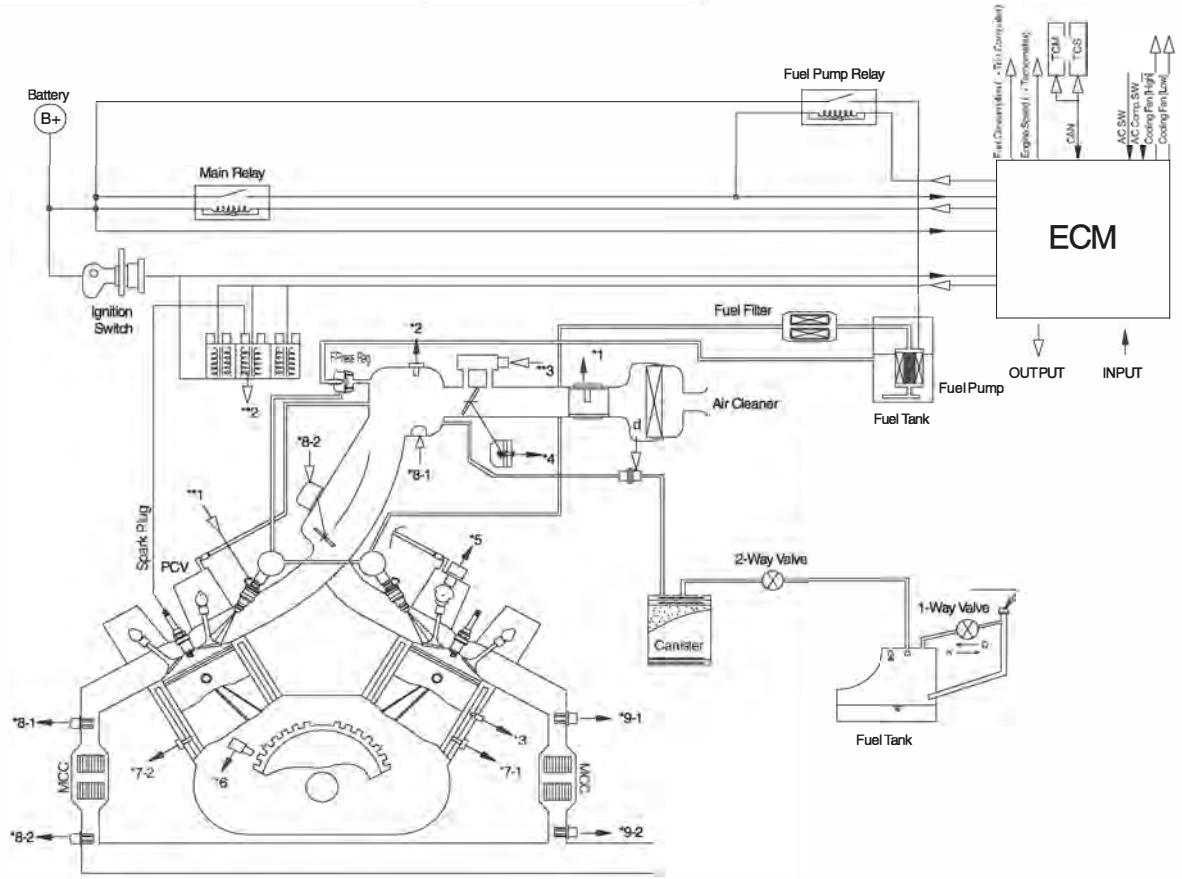
OUTPUT
**1. Fuel Injector
**2. Ignition Coil
**3. Main Relay
**4. Purge Control Solenoid Valve (PCSV)
**5. Idle Speed Actuator (ISCA)
**6. Oil Control Valve (OCV)
**7. Canister Close Valve (CCV)



EEOF801Y

[2.7 V6]

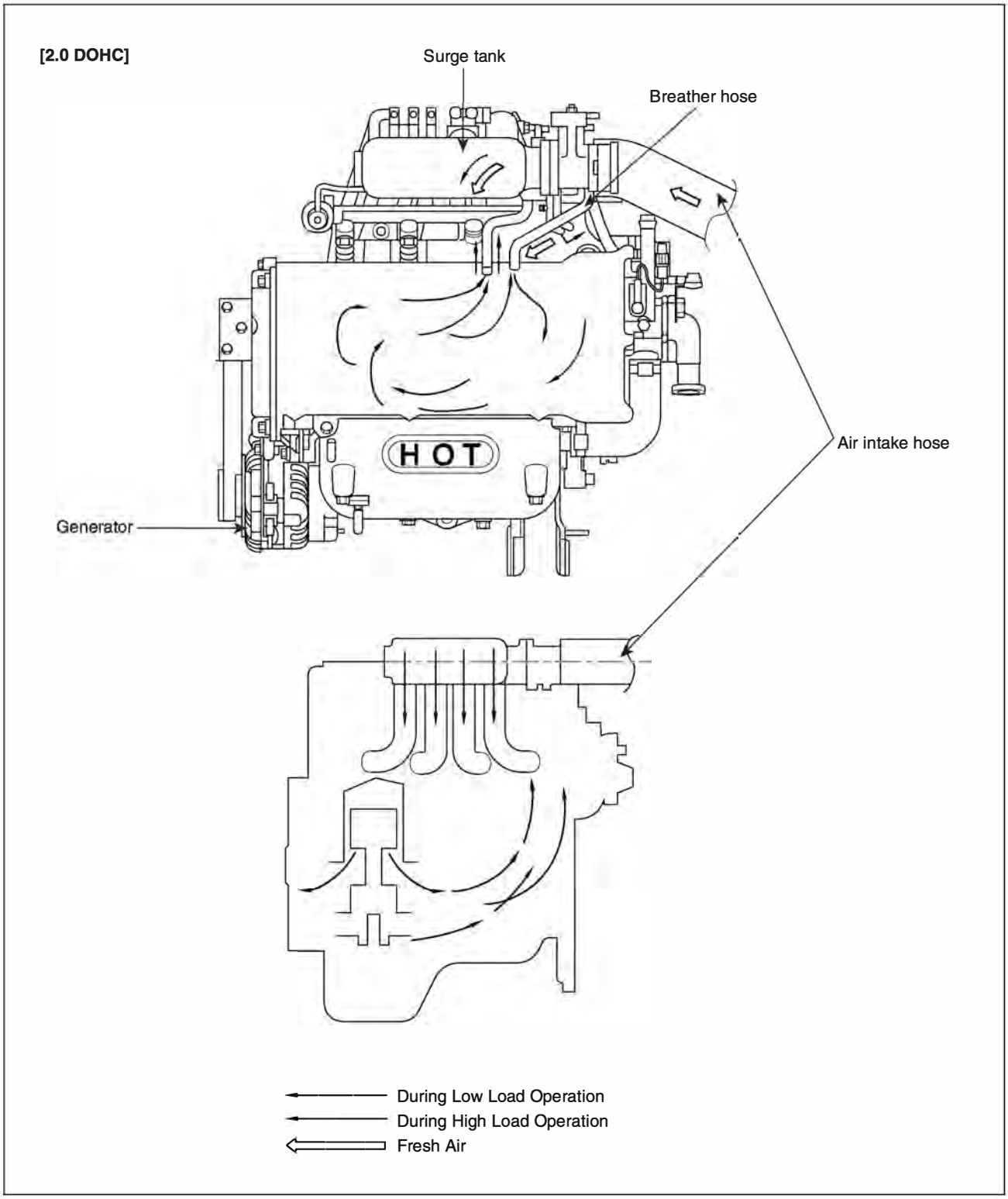
*1. Mass Air Flow Sensor (MAFS) *2. Intake Air Temperature Sensor (IATS) *3. Engine Coolant Temperature Sensor (ECTS) *4. Throttle Position Sensor (TPS) *5. Camshaft Position Sensor (CMPS) *6. Crankshaft Position Sensor (CKPS) *7-1. Knock Sensor (KS) #1 *7-2. Knock Sensor (KS) #2 *8-1. Heated Oxygen Sensor (HO2S) [B1/S1] *8-2. Heated Oxygen Sensor (HO2S) [B2/S2] *9-1. Heated Oxygen Sensor (HO2S) [B2/S1] *9-2. Heated Oxygen Sensor (HO2S) [B2/S2]	• Ignition Switch • Battery Voltage • Wheel Speed Sensor • Coolant Load Signal • "PNP" Switch (A/T only) • Fuel Pump Relay Signal	ECM	**1. Fuel Injector **2. Ignition Coil **3. Idle Speed Control Actuator (ISCA) **4. Purge Control Solenoid Valve (PCSV) **5. Canister Close Valve (CCV) . Fuel Pump Control . Main Relay . Cooler Relay . Ignition Timing Control . Diagnosis



EEOF801X

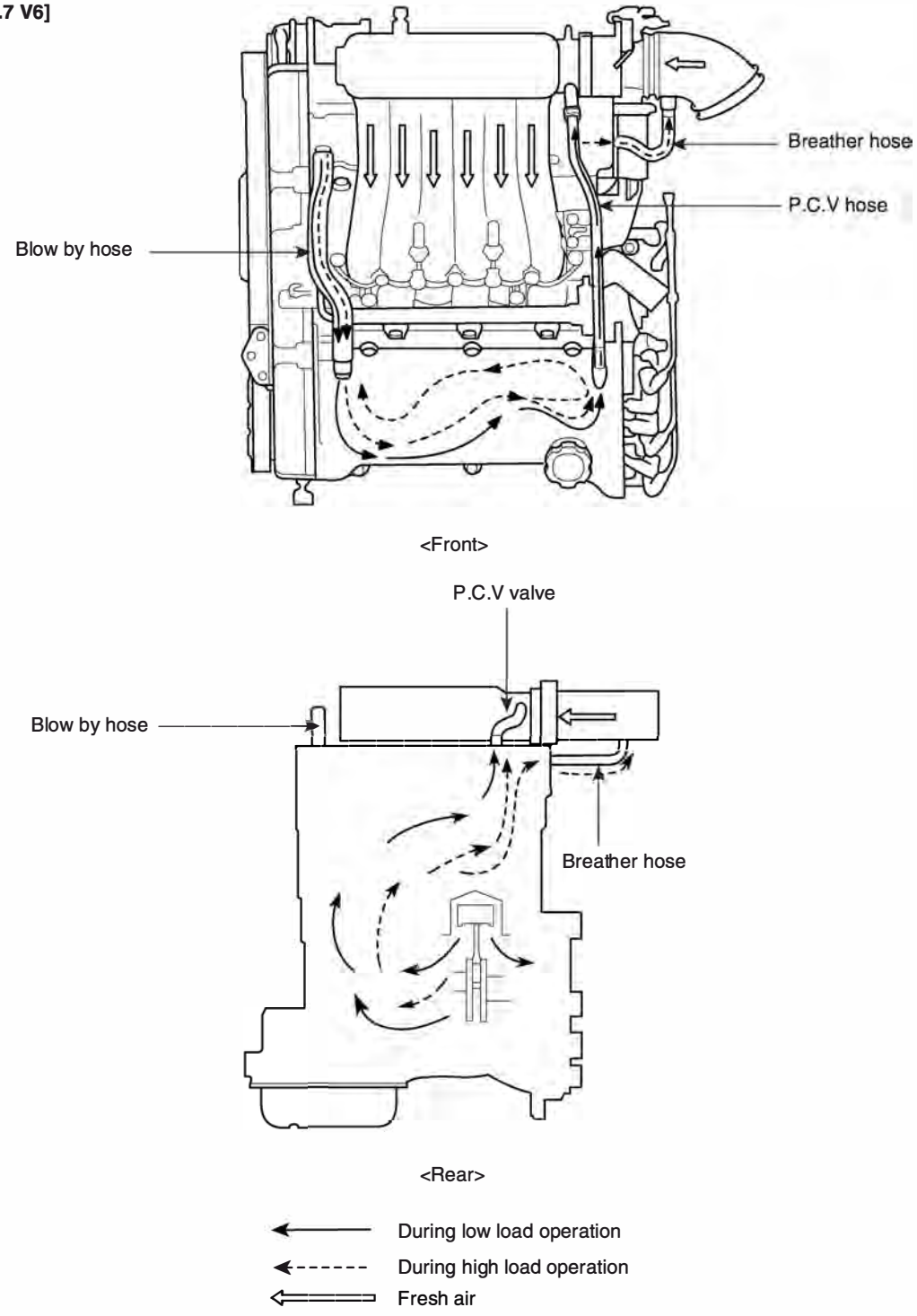
CRANKCASE EMISSION CONTROL SYSTEM

COMPONENTS LOCATION E3D4D1CA



EEOF801V

[2.7 V6]

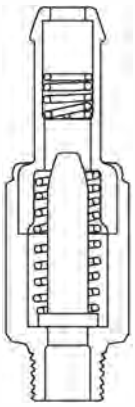


EEOF801M

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

OPERATION E06DEDFF

Intake manifold side (No vacuum)

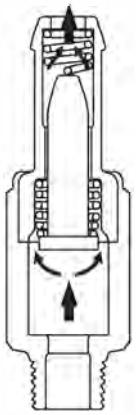


Rocker cover side

BEGE001S

Engine condition	Not running
PCV valve	Not operating
Vacuum passage	Restricted

Intake manifold side (High vacuum)

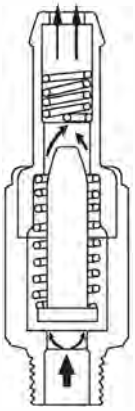


Rocker cover side

BEGE001T

Engine condition	Idling or decelerating
PCV valve	Fully operating
Vacuum passage	Small

Intake manifold side (Moderate vacuum)

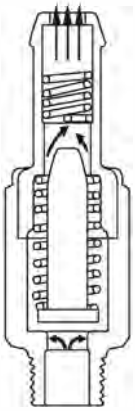


Rocker cover side

BEGE001U

Engine condition	Normal operation
PCV valve	Properly operating
Vacuum passage	Large

Intake manifold side (Low vacuum)



Rocker cover side

BEGE001V

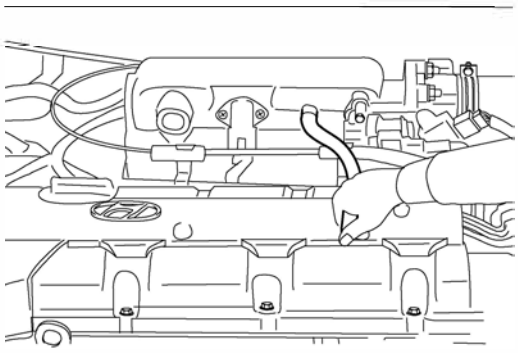
Engine condition	Accelerating and high load
PCV valve	Slightly operating
Vacuum passage	Very large

REMOVAL ECF0958A

1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.
2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

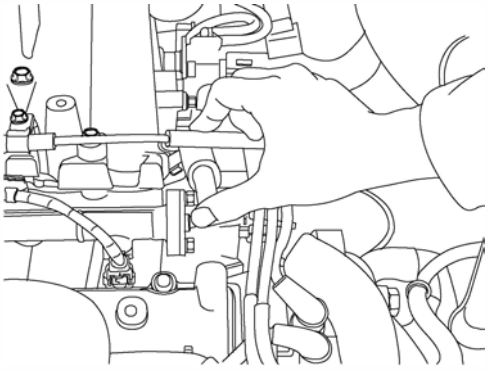
   NOTE

   The plunger inside the PCV valve will move back and forth.



[2.0 DOHC]

EEOF801N



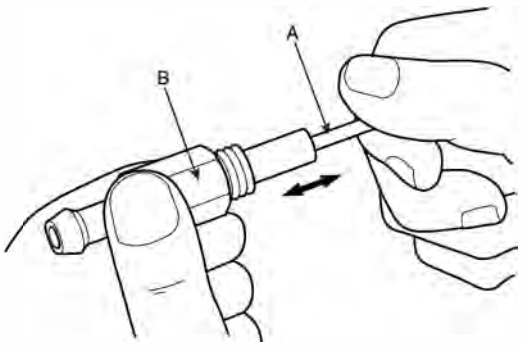
[2.7 V6]

EEOF801G

3. If vacuum is not felt, clean the PCV valve and ventilation hose in cleaning solvent, or replace it if necessary.

INSPECTION EBA26BDA

1. Remove the PCV valve.
2. Insert a thin stick(A) into the PCV valve(B) from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



LEIF603J

INSTALLATION E9CAE065

Install the PCV valve and tighten to the specified torque.

PCV valve tightening toraue:
7.8 ~ 11.8N·m (0.8 ~ 1.2kgf·m, 5.8 ~ 8.7lbf·ft)

EVAPORATIVE AND ORVR EMISSION CONTROL SYSTEM

DESCRIPTION E0DFB92D

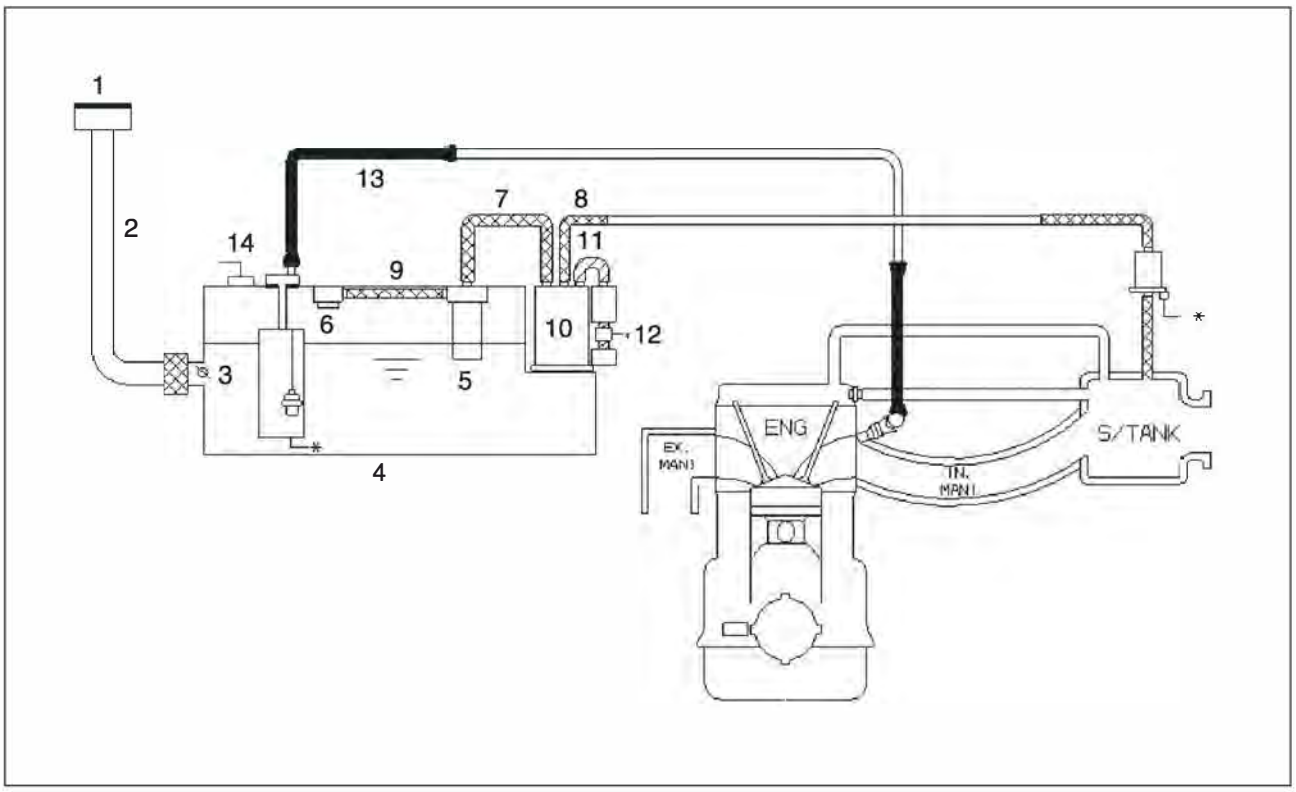
On-Board Refueling Vapor Recovery (ORVR) system is designed to prevent fuel tank vapor (HC) emissions during refueling at the gas station.

This system consists of a fill vent valve, fuel shut-off valve, fuel cut valve (for roll over), two way valve (pressure/vacuum relief), fuel liquid/vapor separator which is installed beside the filler pipe, charcoal canister which is mounted under the rear floor LH side member and protector, tubes and miscellaneous connections.

While refueling, ambient air is drawn into the filler pipe so as not to emit fuel vapors in the air. The fuel vapor in the tank is then forced to flow into the canister via the fill vent valve. The fuel liquid/vapor separator isolates liquid fuel and passes the pure vapor to the charcoal canister.

While the engine is operating, the trapped vapor in the canister is drawn into the intake manifold and then into the engine combustion chamber. According to this purge process, the charcoal canister is purged and recovers its absorbing capability.

COMPONENTS



1. Filler cap
2. Fuel filler pipe
3. Check valve
4. Fuel tank
5. ORVR control valve
6. Vapor valve
7. EVAP. Hose
8. EVAP. Hose
9. EVAP. Hose
10. Canister
11. Drain hose
12. Canister Close Valve (CCV)
13. Fuel feed line
14. Fuel Tank Pressure Sensor (FTPS)

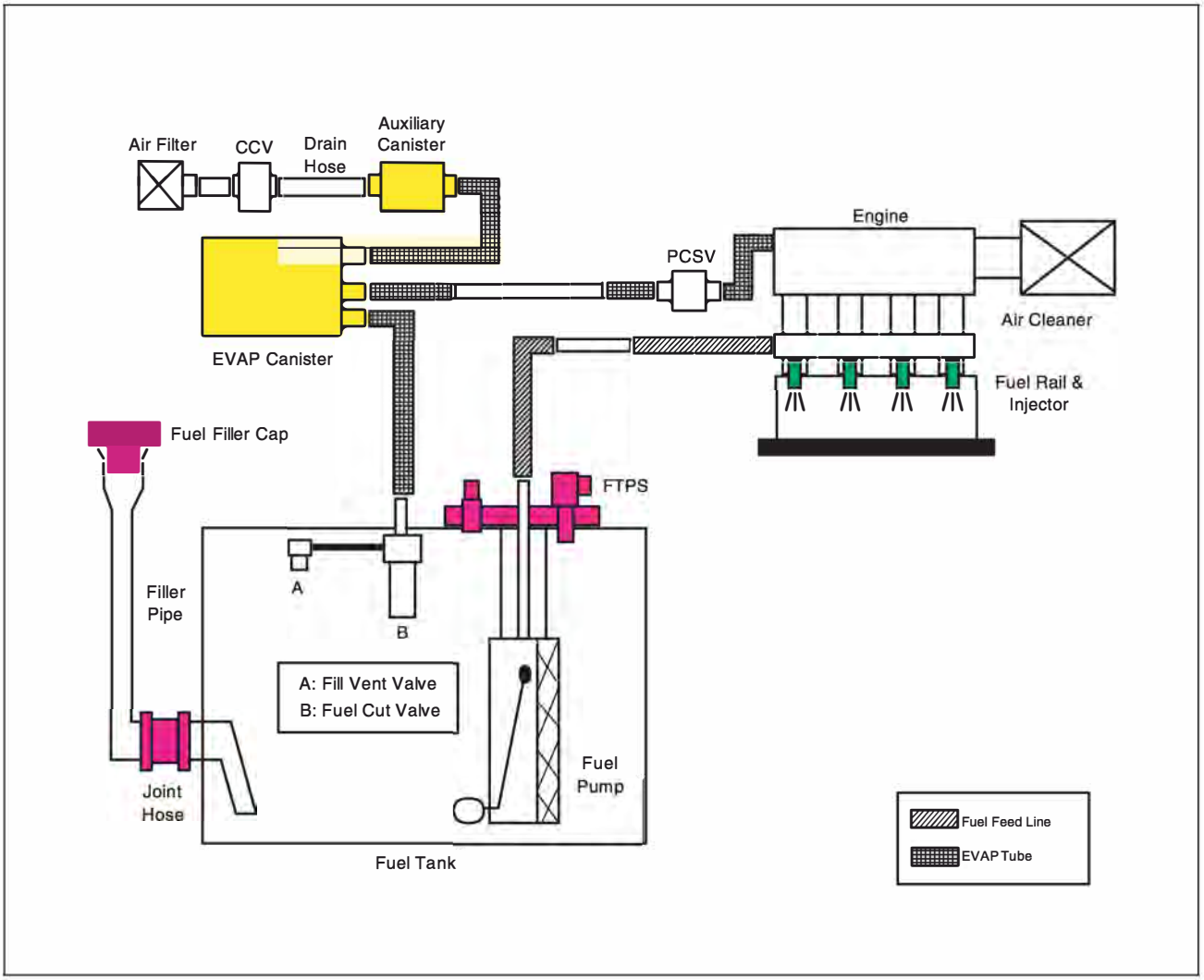
BEGE001O

EVAPORATIVE EMISSION CONTROL SYSTEM

DESCRIPTION E6CE8655

Evaporative Emission Control System prevents fuel vapor stored in fuel tank from draining into the atmosphere.

When the fuel evaporates in the fuel tank, the vapor passes through vent hoses or tubes to EVAP. canister filled with charcoal and the EVAP. canister temporarily holds it with charcoal. If ECM wants to draw the gathered vapor into the combustion chambers during certain operating conditions, it will make vacuum in intake manifold to move it.



BEGE001I

EVAP. CANISTER

EVAP. canister is filled with charcoal and absorbs evaporated vapor in fuel tank. The gathered fuel vapor in EVAP. canister is drawn into a intake manifold by ECM when appropriate condition is set.

PURGE CONTROL SOLENOID VALVE (PCSV)

Purge Control Solenoid Valve (PCSV) is installed in the passage connecting EVAP. canister and intake manifold. It is duty type solenoid valve and is operated by ECM signal. To draw the absorbed vapor into the intake manifold, ECM should open PCSV, otherwise the passage remains closed.

CANISTER CLOSE VALVE (CCV)

The Canister Close Valve (CCV) is located between EVAP. canister air filter and auxiliary canister. It closes off the air inlet to the EVAP. canister for the Evaporative Emissions System leak detection inspection function and also prevents fuel vapors from escaping from the EVAP. Canister when the vehicle is not operating.

FUEL TANK PRESSURE SENSOR (FTPS)

The Fuel Tank Pressure Sensor (FTPS) is an integral part of the monitoring system. The FTPS. checks Purge Control Solenoid Valve (PCSV) operation and leak in the Evaporative Emission Contorl System by monitoring pressure and vacuum level in the fuel tank during PCSV operating cycles.

FUEL FILLER CAP

A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would seal the fuel filler. After the gasket on the fuel filler cap and the fill neck flange contact each other, the ratchet produces a loud clicking noise indicating the seal has been set.

EVAP. SYSTEM MONITORING

Evaporative Emission Control Monitoring System consists of fuel vapor generation, evacuation, and leakage check step. At first, the OBD-II system checks if vapor generation due to fuel temperature is small enough to start monitoring, and then it evacuates the evaporative system by means of PCSV with ramp in order to maintain a certain vacuum level. The final step is to check if there is vacuum loss by any leakage of the system.

VAPOR GENERATION CHECKING

During stabilization period, the PCSV and the CCV are closed, and the system pressure is measured as starting pressure (DP_A). After a certain defined period (T1), the system pressure (DP_B) is measured again and the difference from the starting pressure is calculated. If this difference(DP_B - DP_A) is bigger than a threshold, there should be excessive vapor and the monitor is aborted for next checking. On the contrary, if the difference is lower than another negative threshold, PCSV is regarded as malfunction such as clogged at open position.

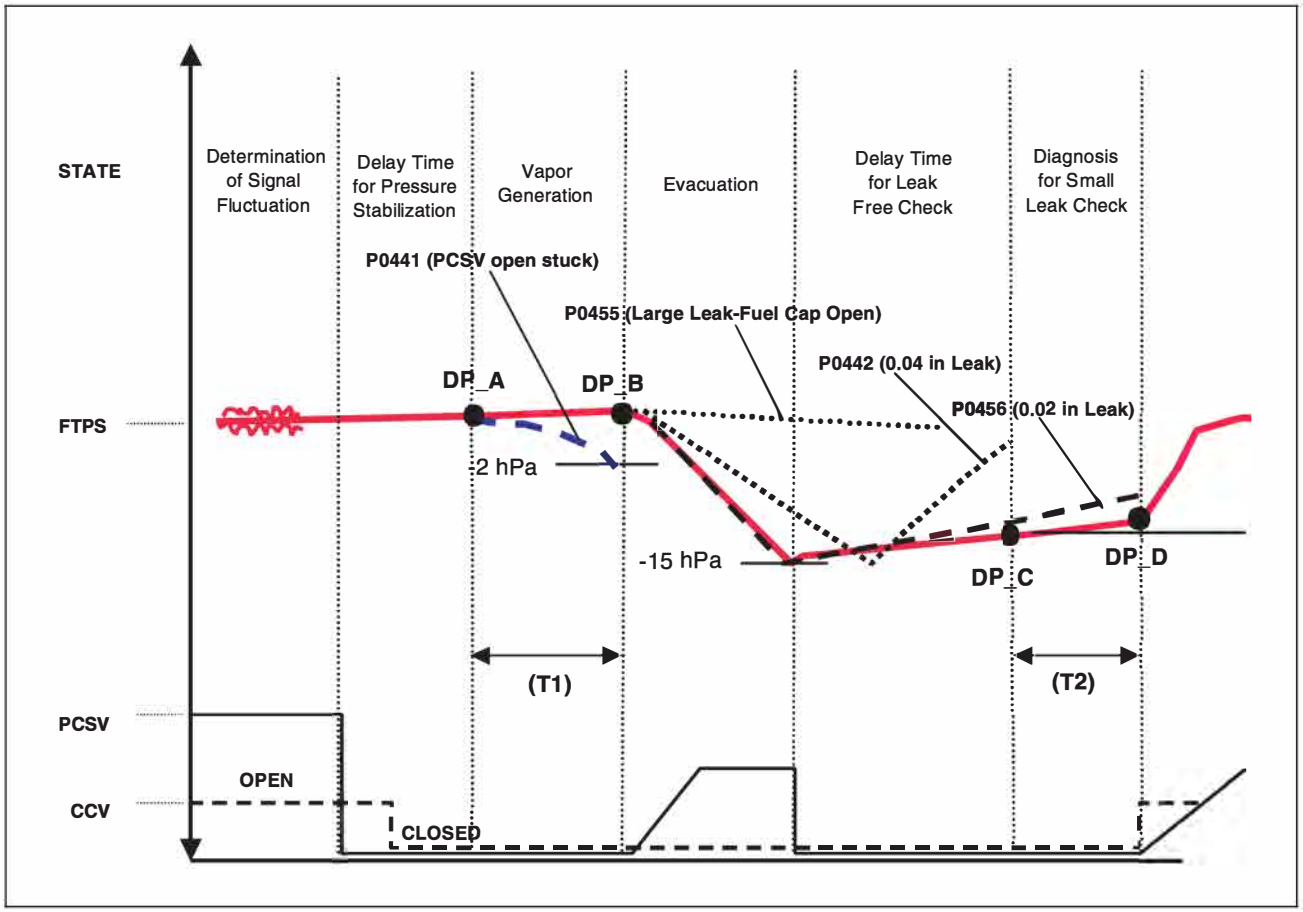
EVACUATION

PCSV is opened with a certain ramp for the pressure to reach down to a certain level. If pressure can't be lowered below a threshold, the system is regarded as fuel-cap-opened or having a large leakage.

LEAKAGE CHECKING

PCSV is closed and the system wait for a period to get stabilized pressure. During Checking period (T2), the system measures the beginning and the end of the system pressure(DP_C, DP_D). The diagnosis value is the pressure difference corrected by natural vapor generation(DP_B - DP_A) rate from the vapor generation checking step.

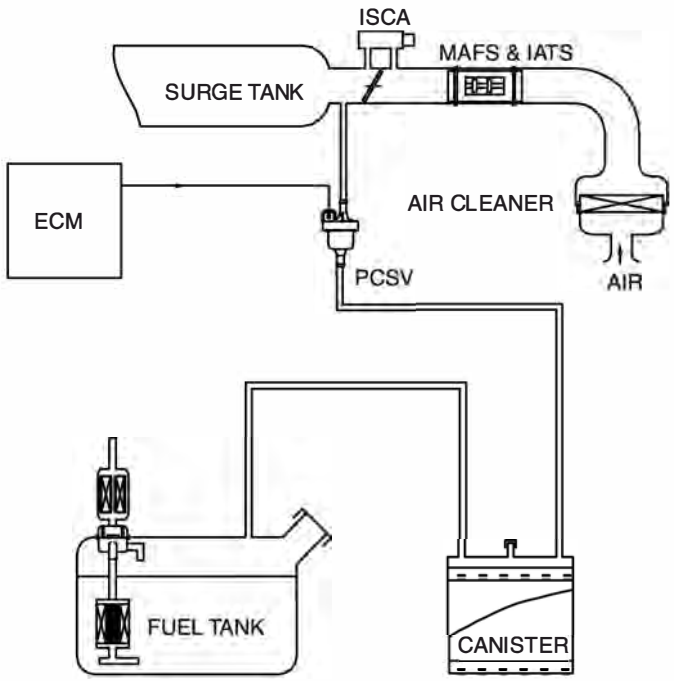
EVAP. SYSTEM MONITORING



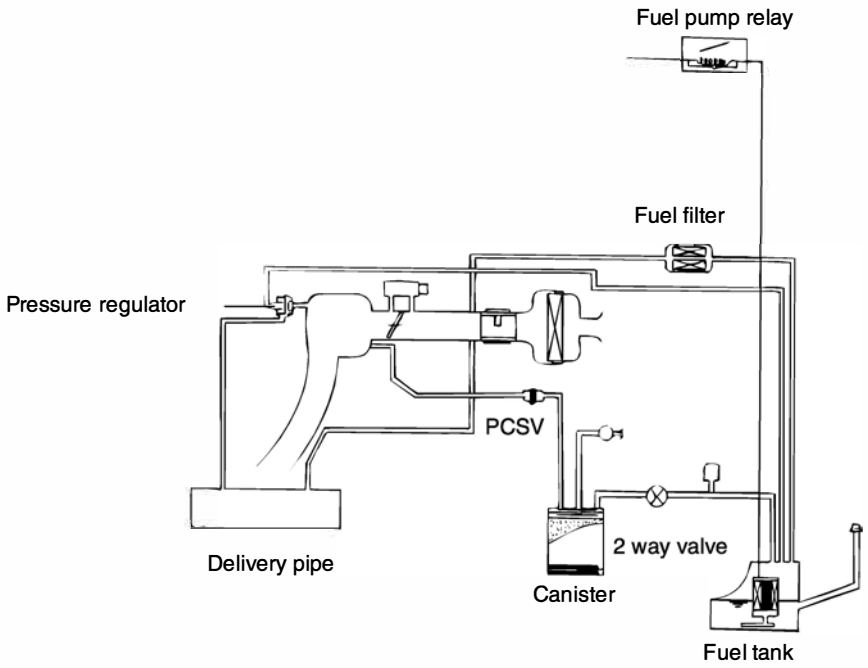
BEGE001J

SCHEMATIC DIAGRAM EF9EDB73

[2.0 DOHC]



[2.7 V6]



EEOF801F

INSPECTION EC45E204

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60°C(140°F) or below] and when it is warm [engine coolant temperature 80°C(176°F) or higher].

WHEN ENGINE IS COLD

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

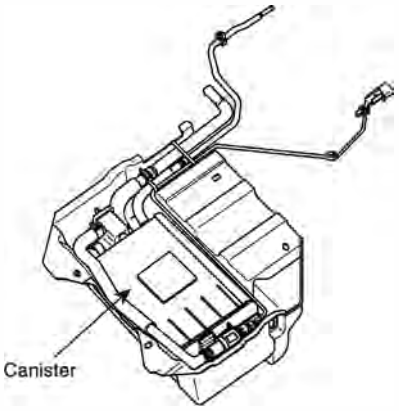
WHEN ENGINE IS WARM

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily, after which, it will be released

EVAPORATIVE (EVAP) CANISTER

INSPECTION E1EFDA5A

1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel leakage.
3. After removing the EVAP. canister, inspect for cracks or damage.



EEOF801W

EVAPORATIVE (EVAP) CANISTER PURGE SOLENOID VALVE

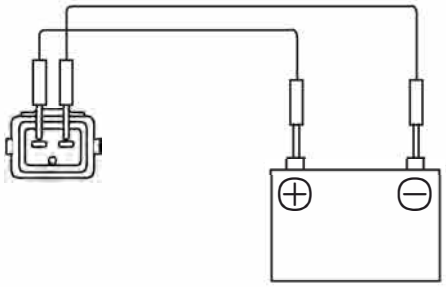
INSPECTION EF9B3FB1

NOTE

When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

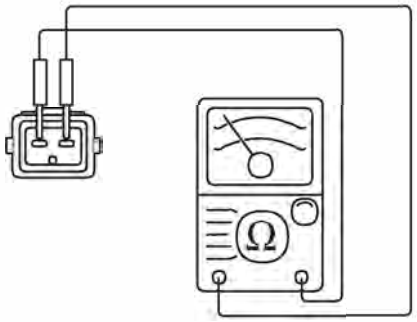
Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained



LEIF603G

5. Measure the resistance between the terminals of the solenoid valve.

PCSV coil resistance (Ω):
24.5 ~ 27.5 Ω at 20℃ (68°F)

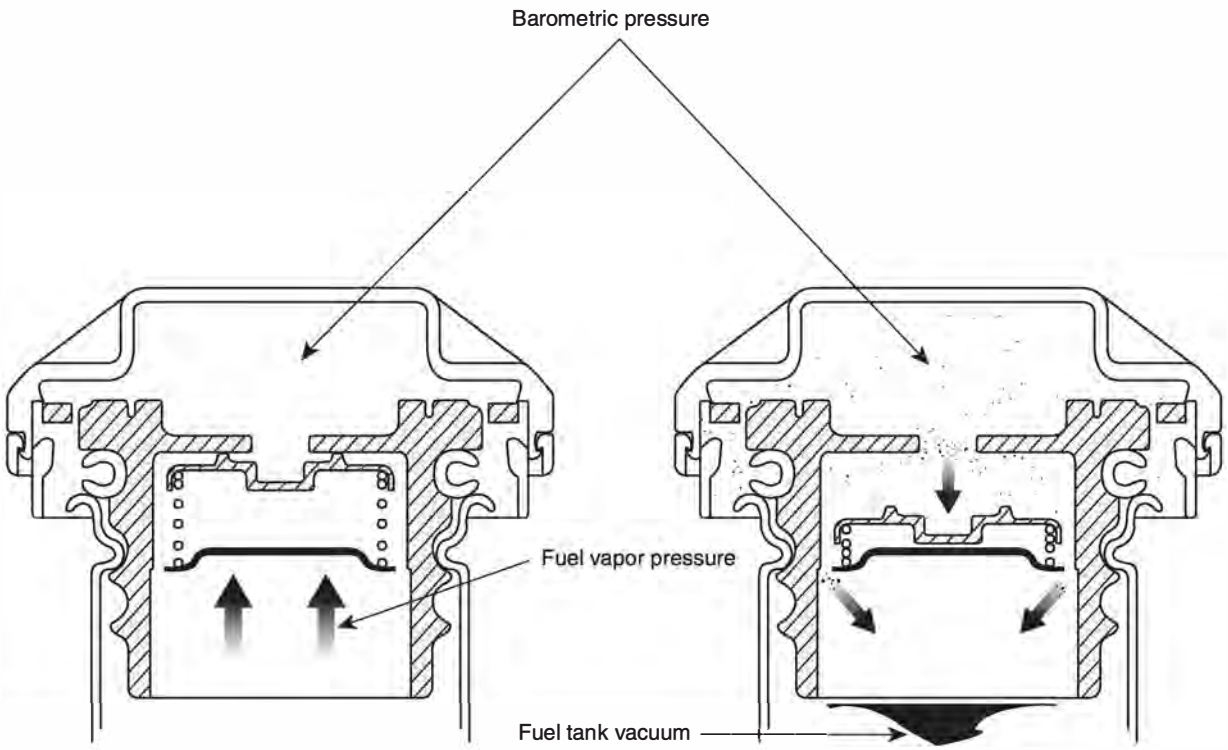


LEIF603H

FUEL FILLER CAP

DESCRIPTION EC7DDC19

A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would seal the fuel filler. After the gasket on the fuel filler cap and the filler neck flange contact each other, the retchet produces a loud clicking noise indicating the seal has been set.



When fuel tank is under pressure. **When fuel tank is under vacuum.**

LEGE015A

EXHAUST EMISSION CONTROL SYSTEM

DESCRIPTION EFD7BA65

Exhaust emissions (CO, HC, NOx) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system.

These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

AIR/FUEL MIXTURE CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM]

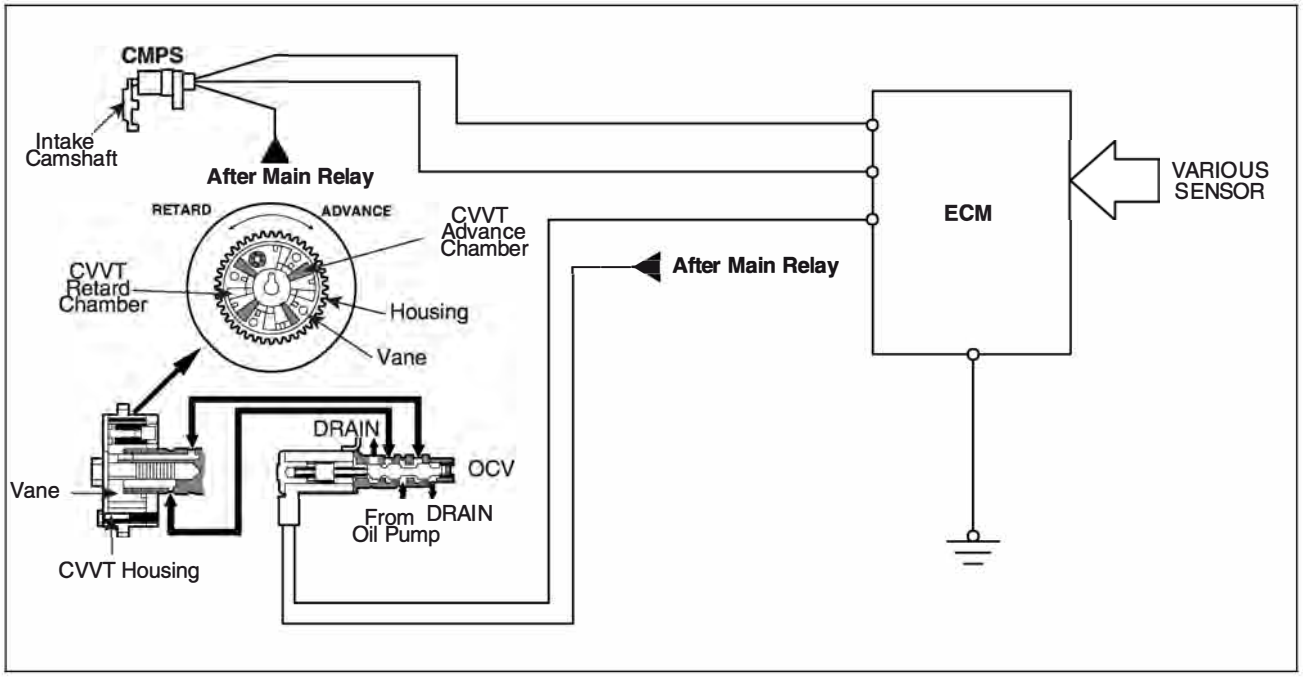
The MFI system is a system which uses the signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, thus precisely regulating the air/fuel mixture ratio and reducing emissions.

This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

CONTINUOUS VARIABLE VALVE TIMING

COMPONENTS LOCATION [2.0 DOHC WITH CVVT] EE5CD3C6

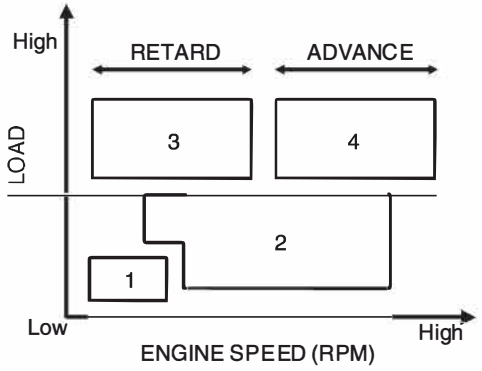


LEIF001P

DESCRIPTION [2.0 DOHC WITH CVVT] E61369ED

The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.
The intake valve timing is optimized by CVVT system depending on engine rpm.

This CVVT system improves fuel efficiency and reduces NOx emissions at all levels of engine speed, vehicle speed, and engine load by EGR effect because of valve over-lap optimization.
The CVVT changes the phase of the intake camshaft via oil pressure.
It changes the intake valve timing continuously.

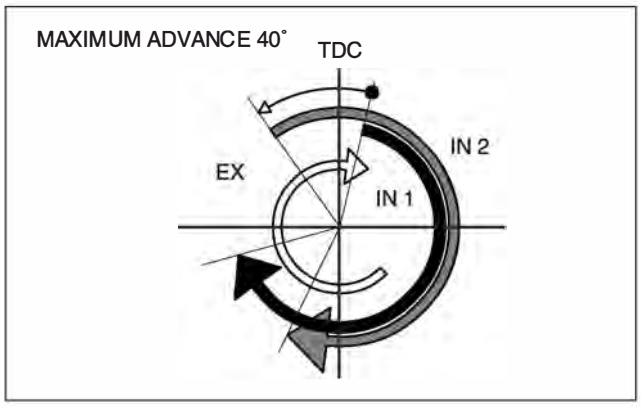


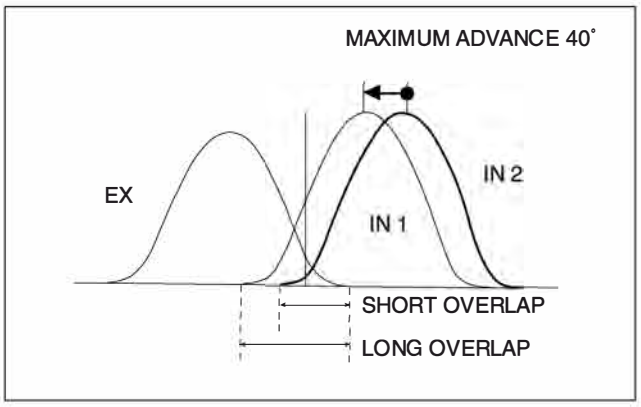
Driving Condition	Intake Valve Timing	Effect
Light load (1)	Retard	Stable combustion
Part load (2)	Advance	Enhanced fuel economy and exhaust emissions
High load& Low rpm (3)	Advance	Enhanced torque
High load& High rpm (4)	Retard	Enhanced Power

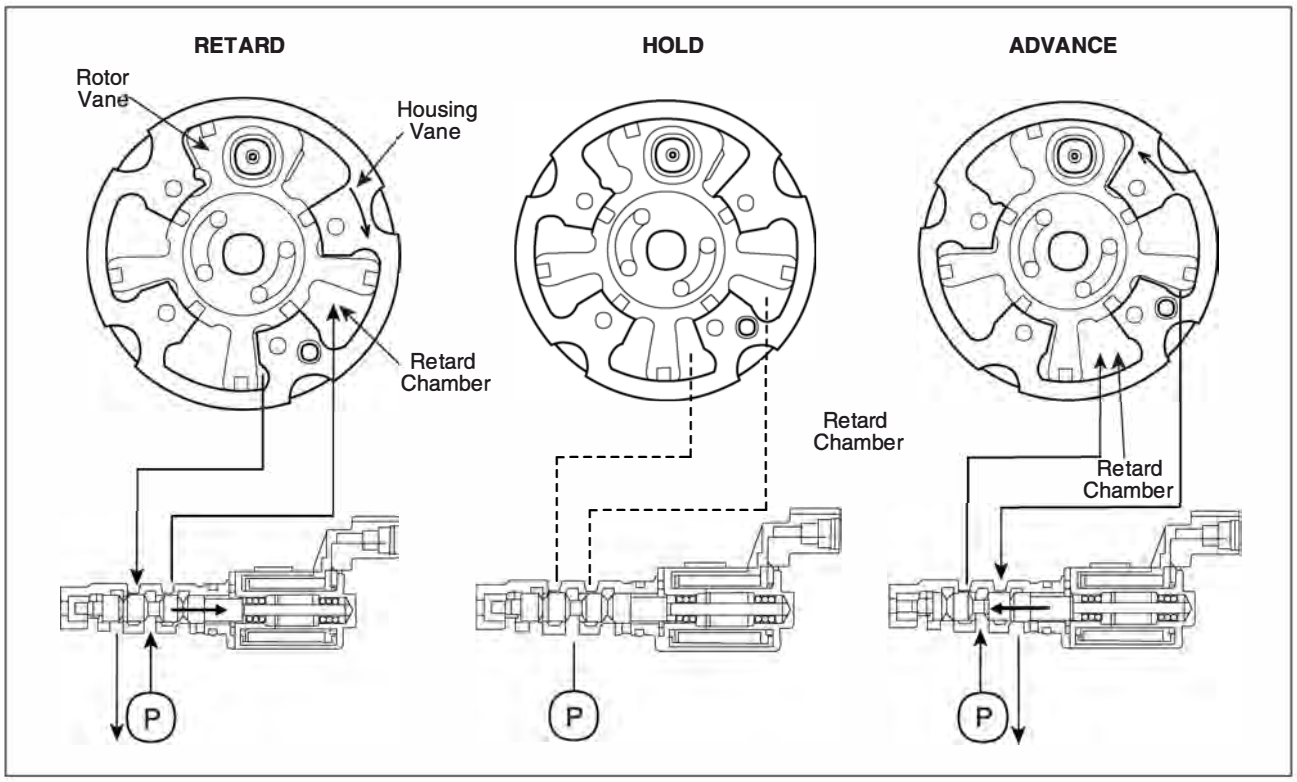
LEIF001Q

OPERATION [2.0 DOHC WITH CVVT] EBF4D4ED

The CVVT system makes continuous intake valve timing changes based on operating conditions.
Intake valve timing is optimized to allow the engine to produce maximum power.
Cam angle is advanced to obtain the EGR effect and reduce pumping loss. The intake valve is closed quickly to reduce the entry of the air/fuel mixture into the intake port and improve the changing effect.
Reduces the cam advance at idle, stabilizes combustion, and reduces engine speed.
If a malfunction occurs, the CVVT system control is disabled and the valve timing is fixed at the fully retarded position.







LEIF001R

1. The above figure shows the relative operation structures of the housing vane to the rotor vane.

2. If the CVVT is held a certain control angle, to hold this state, oil is replenished as much as oil leaks from the oil pump.

The OCV (Oil-flow Control Valve) spool location at this time is as follows.
Oil pump → Advance oil chamber (Little by little open the inflow side to the advance oil chamber) → Almost close the drain side

Be sure there might be a difference in the position according to the engine running state (rpm, oil temperature, and oil pressure).