



Emission Control System

General Information

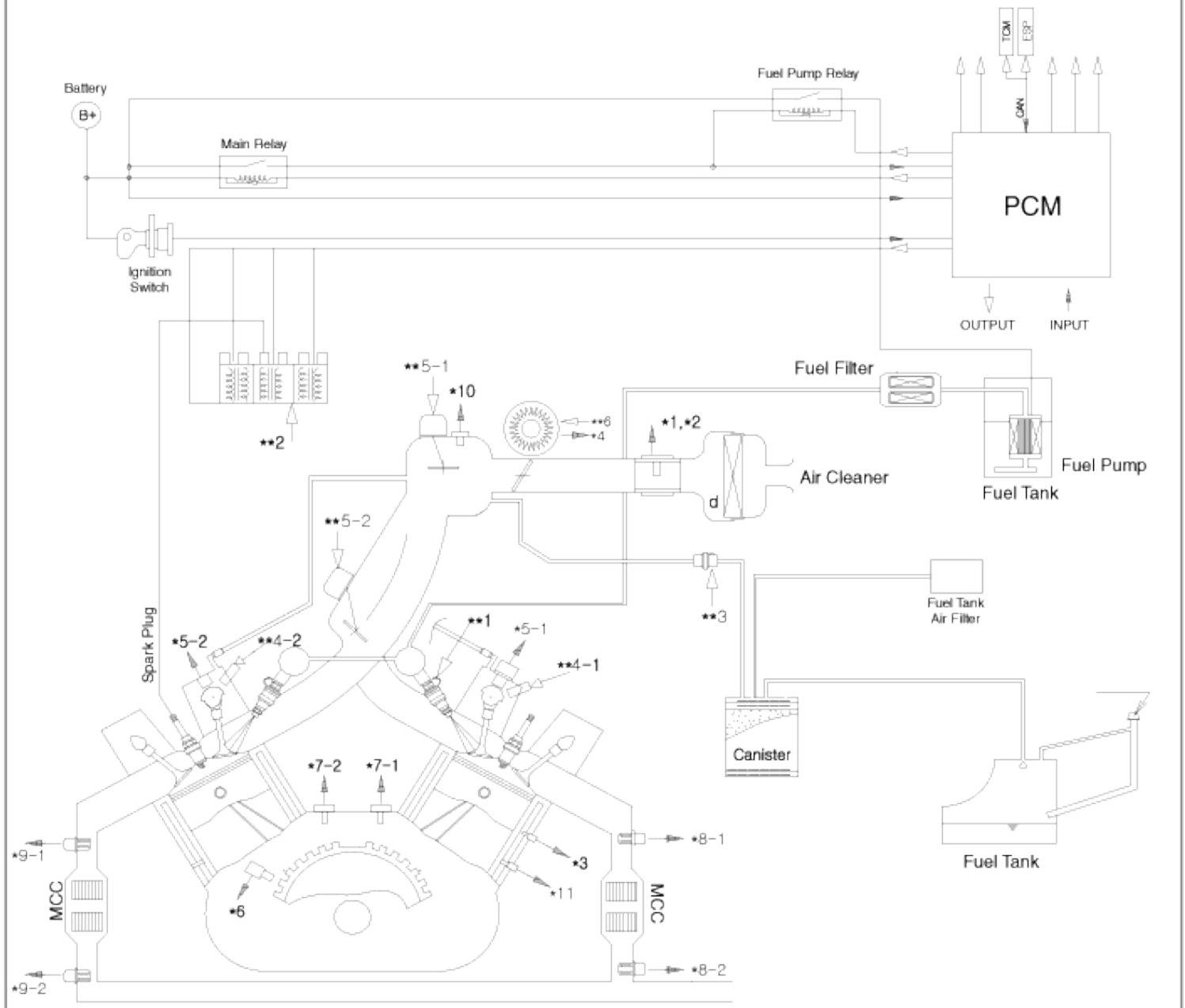
SCHEMATIC DIAGRAM

- *1. Mass Air Flow Sensor (MAFS)
- *2. Intake Air Temperature Sensor (IATS)
- *3. Engine Coolant Temperature Sensor (ECTS)
- *4. Throttle Position Sensor (TPS)
- *5-1. Camshaft Position Sensor (CMPS) [BANK1]
- *5-2. Camshaft Position Sensor (CMPS) [BANK2]
- *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) [B1/S2]
- *9-1. Heated Oxygen Sensor (HO2S) [B2/S1]
- *9-2. Heated Oxygen Sensor (HO2S) [B2/S2]
- *10. Manifold Absolute Pressure Sensor (MAPS)
- *11. CVVT Oil Temperature Sensor (OTS)

- Ignition Switch
- Battery Voltage
- Vehicle Speed Signal
- Coolant Load Signal
- "PNP" Switch (AT only)
- Fuel Pump Relay Signal



- **1. Fuel Injector
- **2. Ignition Coil
- **3. Purge Control Solenoid Valve (PCSV)
- **4-1. CVVT Oil control valve (OCV) [BANK1]
- **4-2. CVVT Oil control valve (OCV) [BANK2]
- **5-1. Variable Intake Manifold Solenoid (VIS) Valve [Surge Tank]
- **5-2. Variable Intake Manifold Solenoid (VIS) Valve [Intake Manifold]
- **6. ETC Motor
- Fuel Pump Control
- Main Relay
- Cooler Relay
- Ignition Timing Control
- Diagnosis

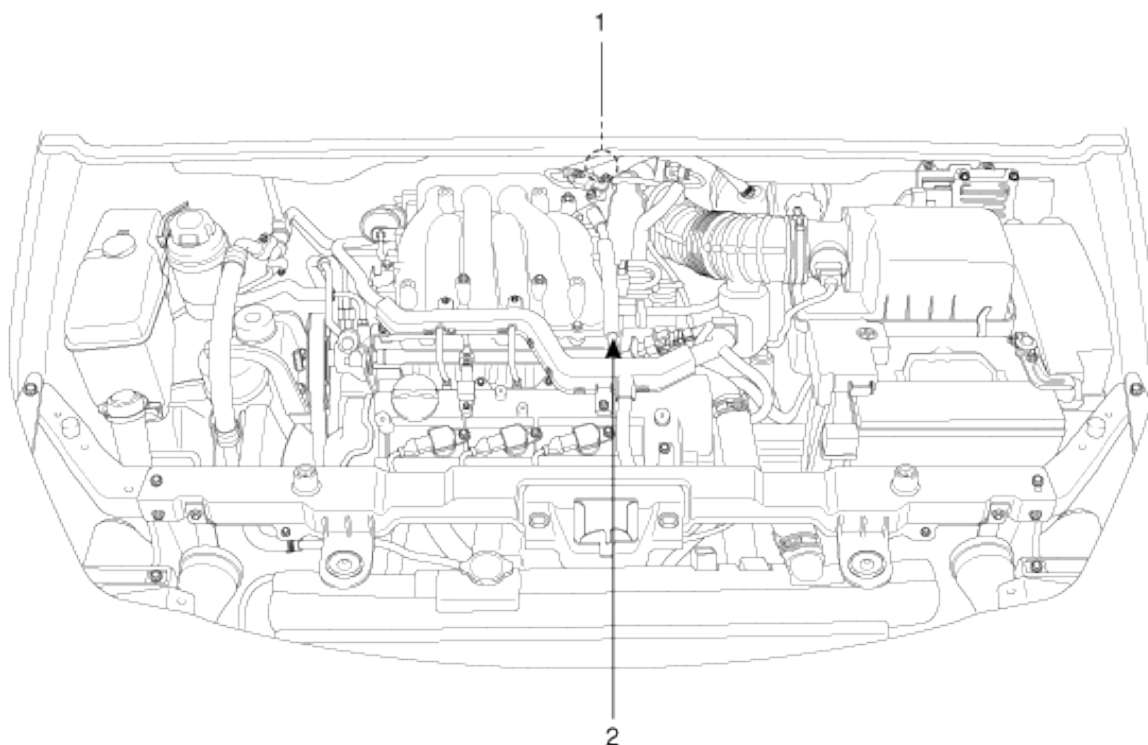


**DESCRIPTION**

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 mixture control device) - Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

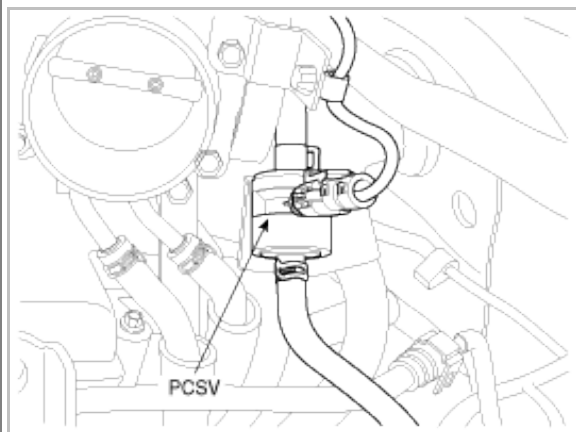


COMPONENT LOCATION



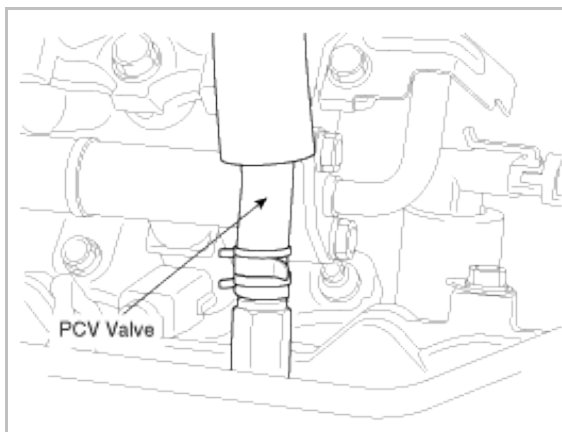
1. Purge Control Solenoid Valve (PCSV)
2. PCV Valve
3. Canister
4. Catalytic Converter (Bank1)
5. Catalytic Converter (Bank2)

1 Purge Control Solenoid Valve (PCSV)

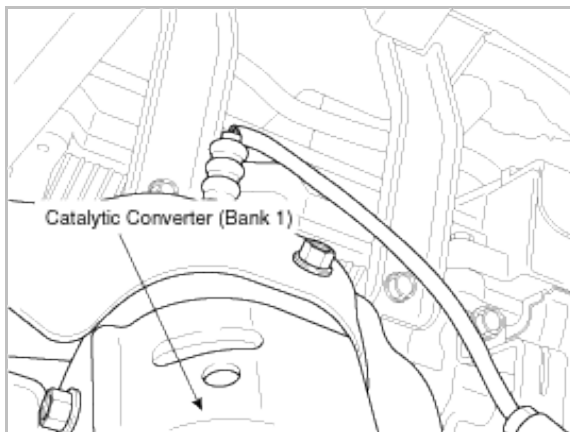
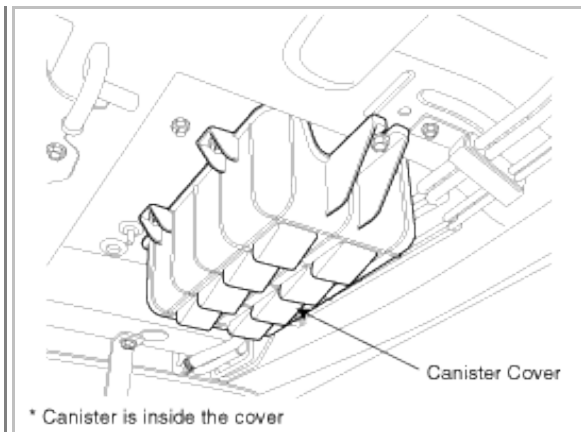


3 Canister

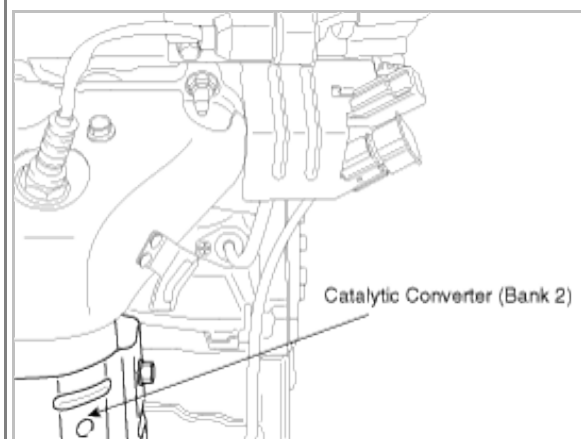
2 Positive Crankcase Ventilation (PCV) Valve



4 Catalytic Converter (Bank 1)



5 Catalytic Converter (Bank 2)



**TROUBLESHOOTING**

Symptom	Suspect area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the Purge Control 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



SPECIFICATIONS

▷ Specification

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0 Ω [20°C (68°F)]

TIGHTENING TORQUES

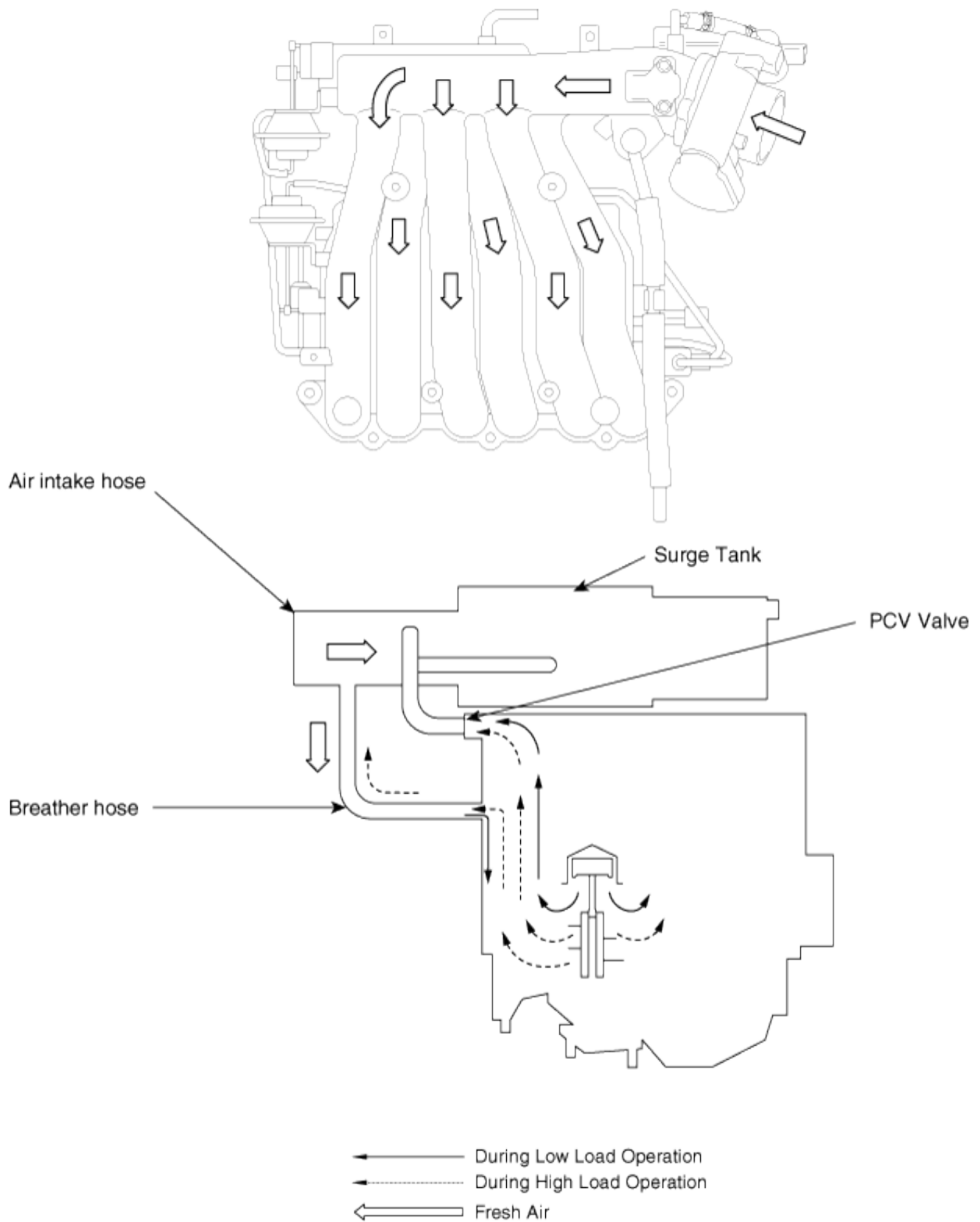
Item	N·m	kgf·m	lbf·m
Positive Crankcase Ventilation Valve	8.0 ~ 12.0	0.8 ~ 1.2	6.0 ~ 8.0



Emission Control System

Crankcase Emission Control System

COMPONENTS



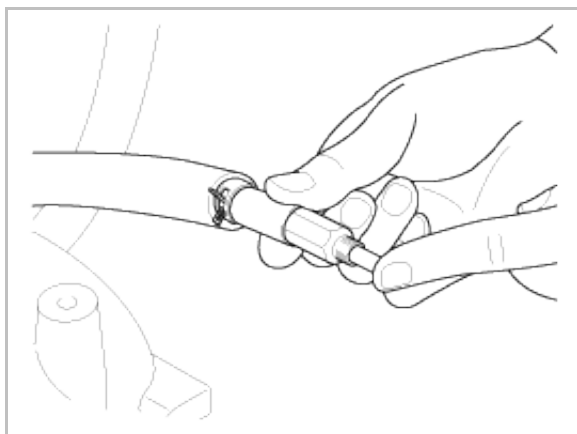


INSPECTION

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.

NOTICE

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



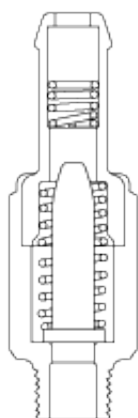
Emission Control System

Crankcase Emission Control System -
Positive Crankcase Ventilation (PCV) Valve



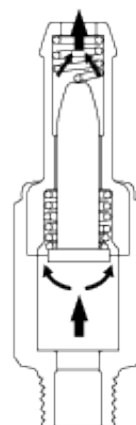
OPERATION

Intake manifold side (No vacuum)



Rocker cover side

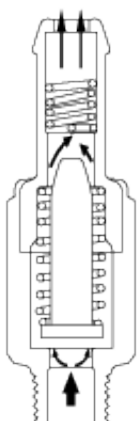
Intake manifold side (High vacuum)



Rocker cover side

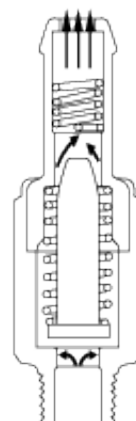
Engine condition	Not running	Engine condition	Idling or decelerating
PCV valve	Not operating	PCV valve	Fully operating
Vacuum passage	Restricted	Vacuum passage	Small

Intake manifold side (Moderate vacuum)



Rocker cover side

Intake manifold side (Low vacuum)



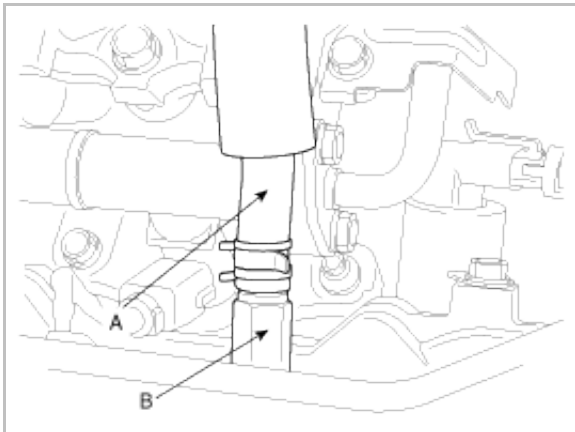
Rocker cover side

Engine condition	Normal operation	Engine condition	Accelerating and high load
PCV valve	Properly operating	PCV valve	Slightly operating
Vacuum passage	Large	Vacuum passage	Very large



REMOVAL

1. Disconnect the vacuum hose (A).



2. Remove the PCV Valve (B).

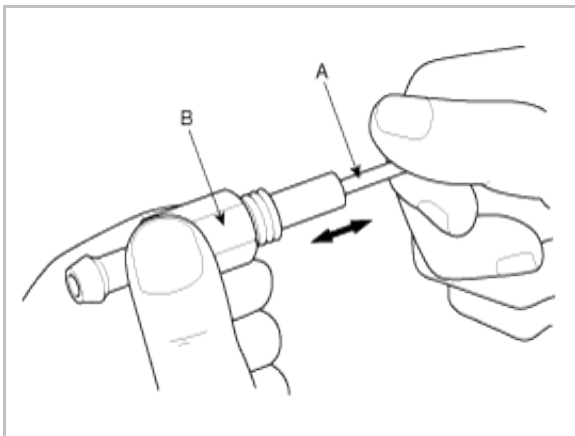
INSTALLATION

Install the PCV valve and tighten to the specified torque.

PCV Valve installation : 7.8 ~ 11.8 N·m (0.8 ~ 1.2 kgf·m, 5.8 ~ 8.7 lbf·ft)

INSPECTION

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.

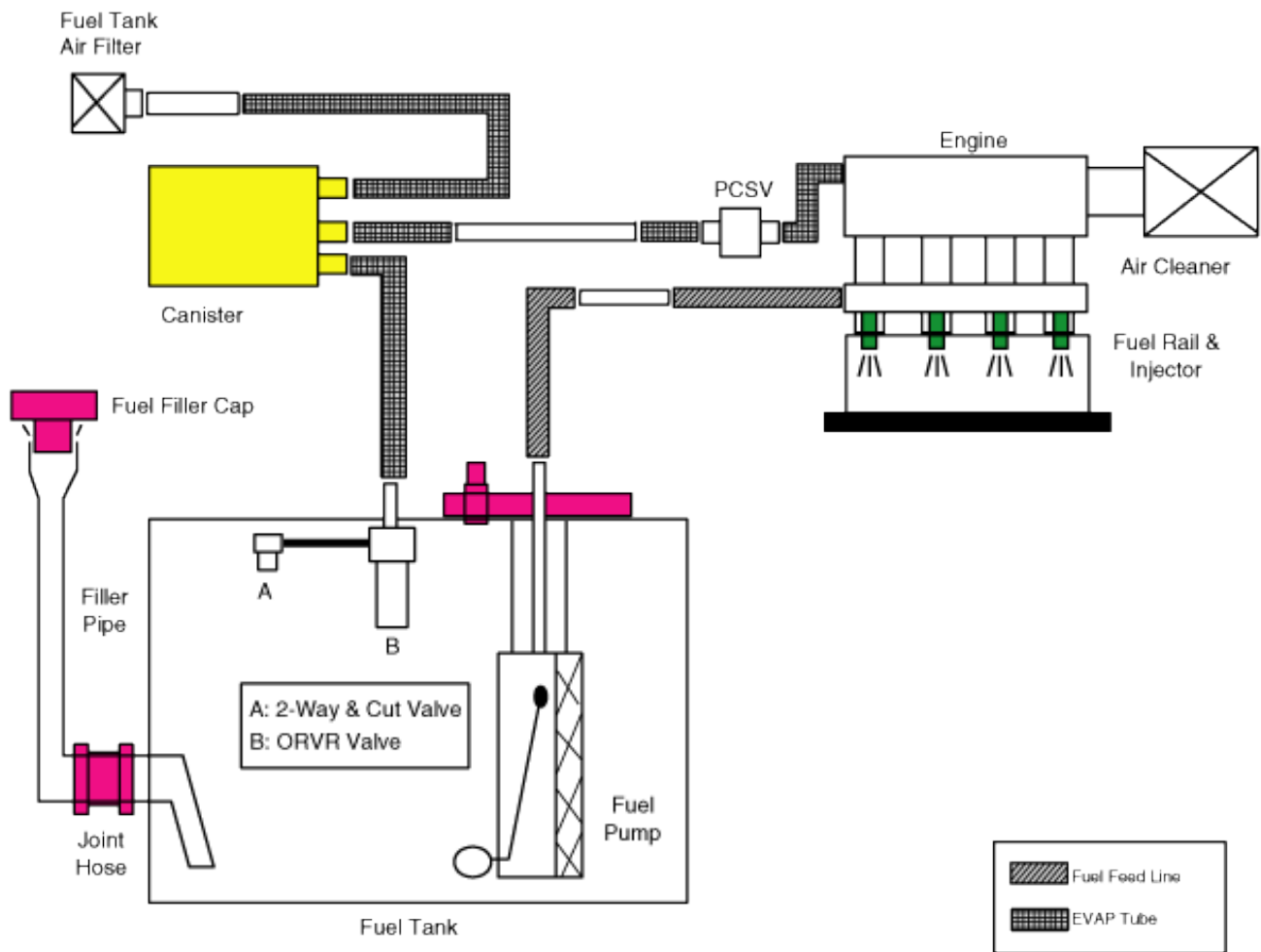




Emission Control System

Evaporative Emission Control System

DESCRIPTION





INSPECTION

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

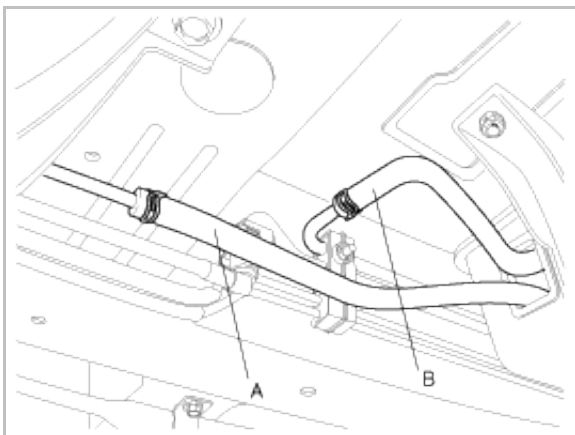


Emission Control System

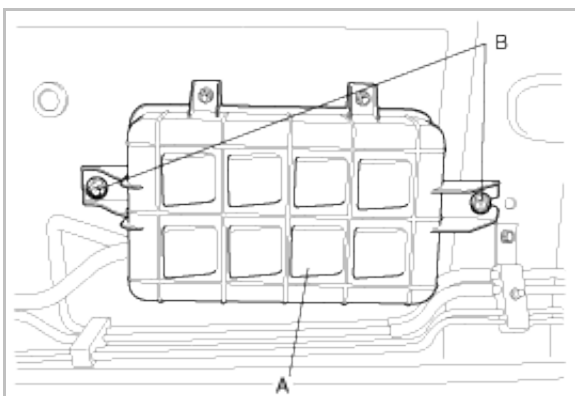
Evaporative Emission Control System -
Canister

REMOVAL

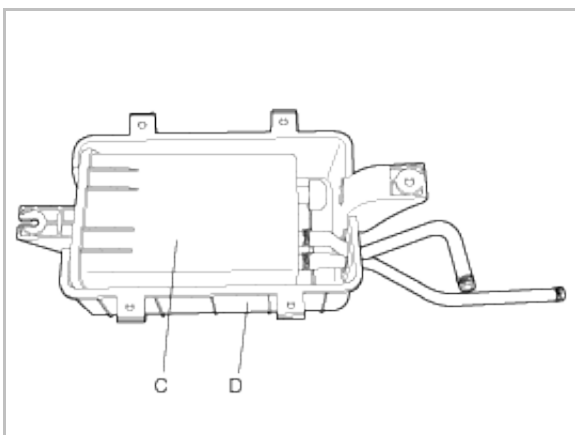
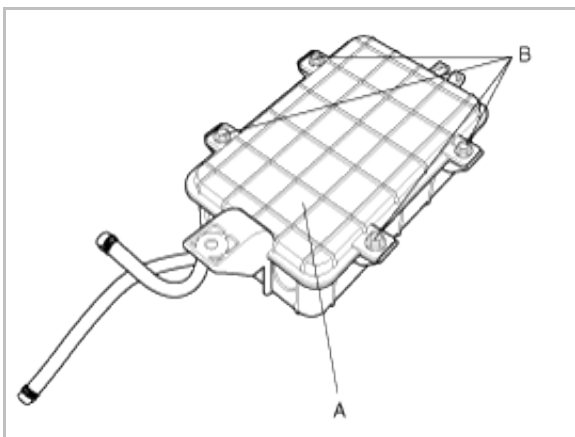
1. Disconnect the vacuum hoses (A,B).



2. Remove the canister assembly (A) with unscrewing the two mounting bolts (B).



3. Open the canister upper cover (A) with unfastening the four bolts (B) and remove the canister (C) from the canister lower cover (D).

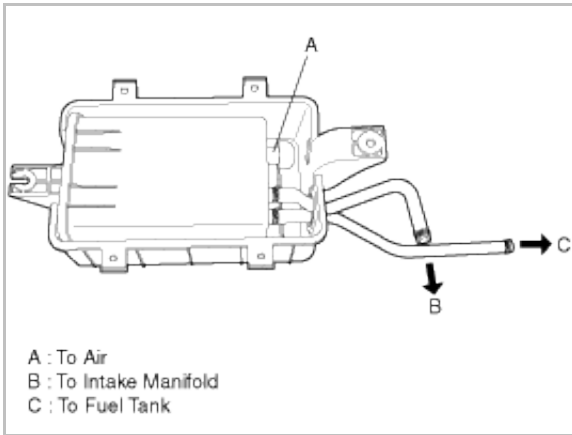


INSTALLATION

Install the canister according to the reverse order of "REMOVAL" procedure.

INSPECTION

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



Emission Control System

Evaporative Emission Control System -
Purge Control Solenoid (PCS) Valve



INSPECTION

NOTICE

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 which is connected to intake manifold.
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

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

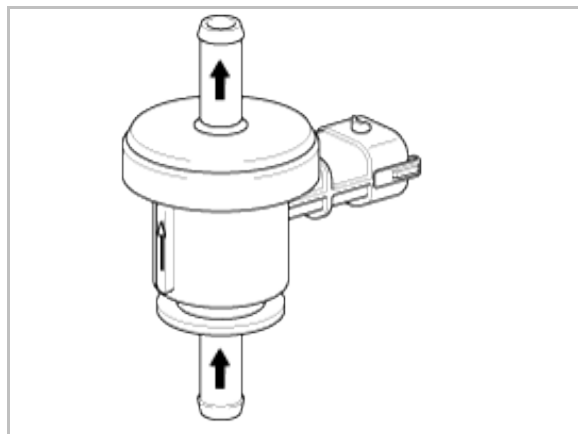
PCSV coil resistance(Ω) :

14.0 ~ 18.0 Ω at 20°C (68°F)

INSPECTION

FUNCTION AND OPERATION PRICIPLE

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the PCM grounds the valve control line. When the passage is open (PCSV ON), fuel vapors stored in the canister is transferred to the intake manifold.



SPECIFICATION

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0 Ω at 20°C (68°F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

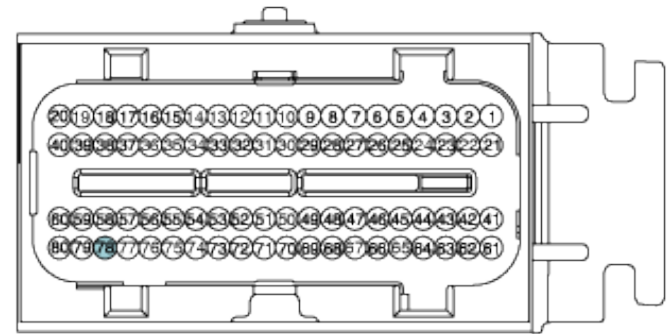
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	PCM C151-1 (78)	PCSV Control

[HARNESS CONNECTORS]



C167

PCSV

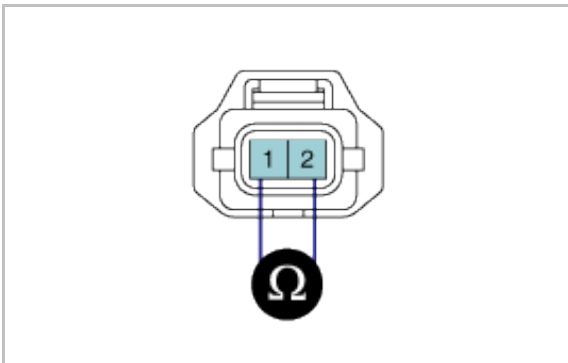


C151-1

PCM

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.



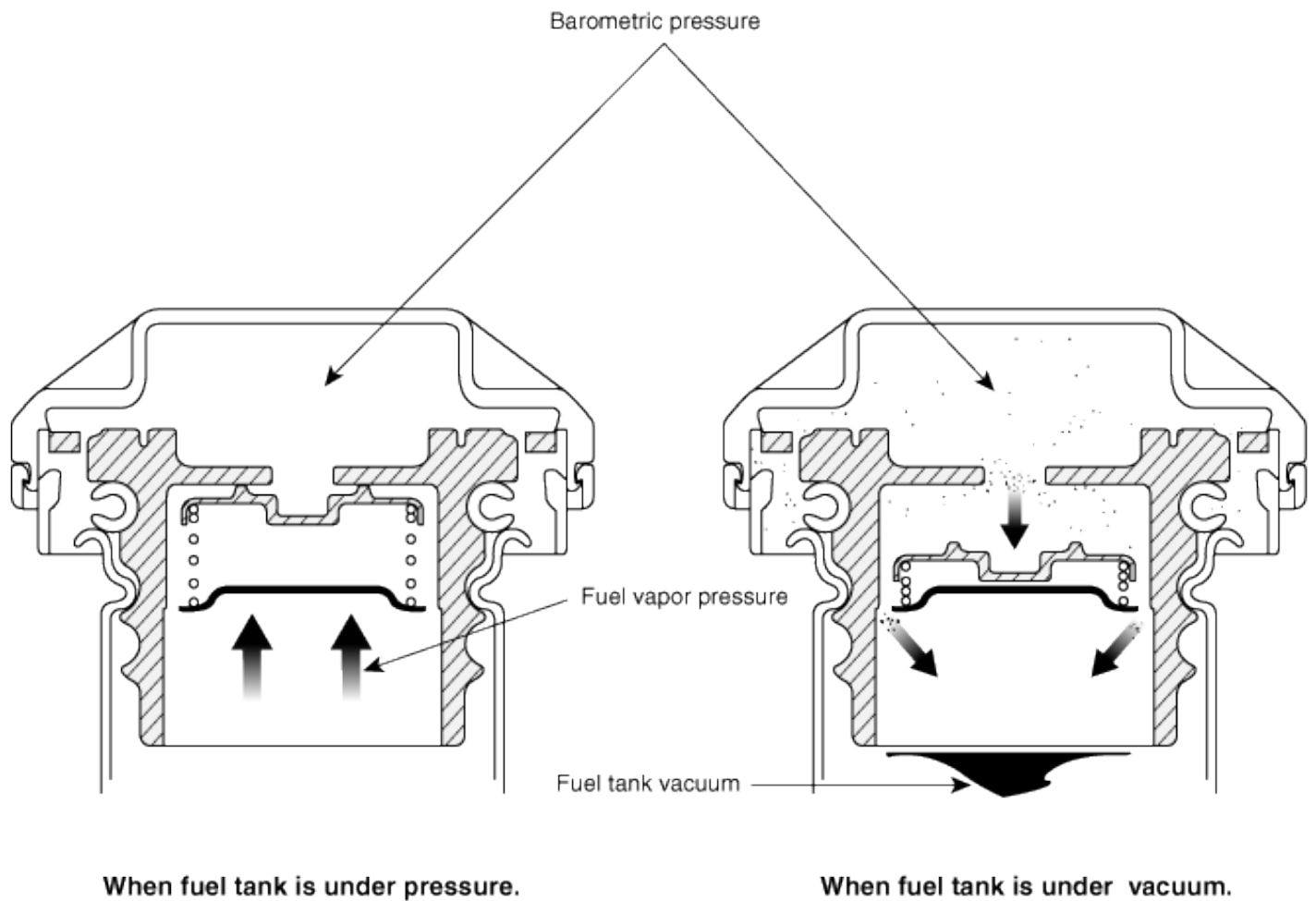
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.



Emission Control System

Crankcase Emission Control System - Fuel
Filler Cap

DESCRIPTION



Emission Control System

Exhaust Emission Control System



DESCRIPTION

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 [MULTIPOINT FUEL INJECTION (MFI) SYSTEM]

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.

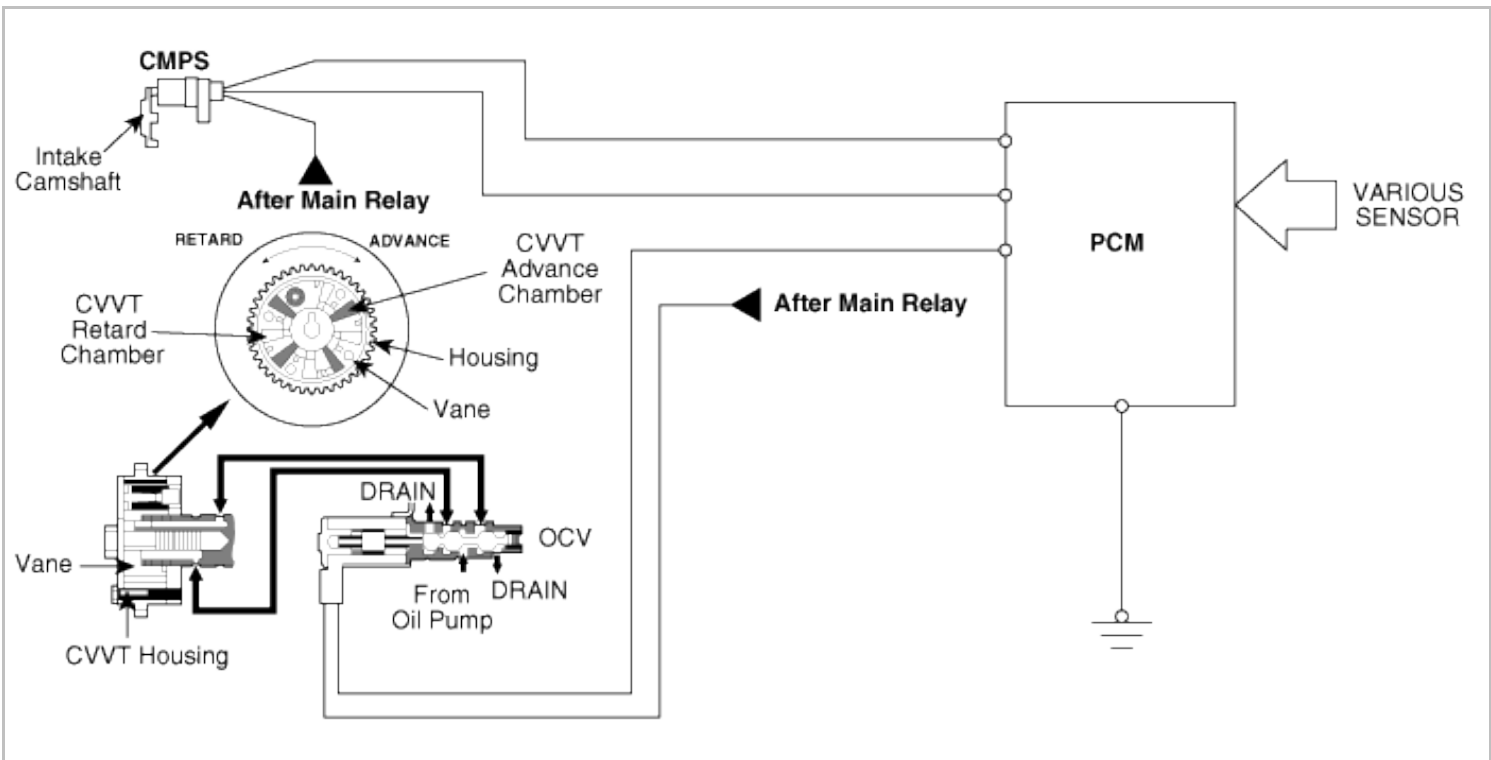
1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.



Emission Control System

Exhaust Emission Control System - CVT
(Continuously Variable Valve Timing) System

DESCRIPTION



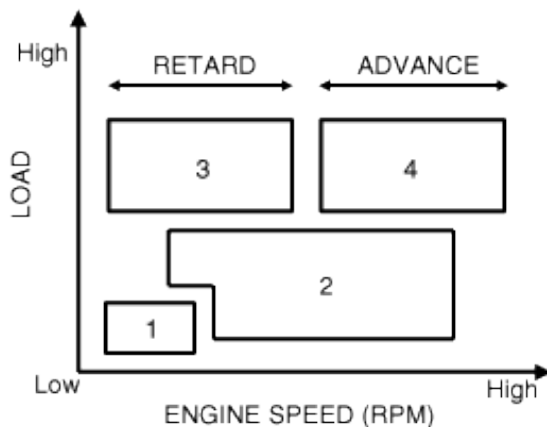
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.

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

OPERATION

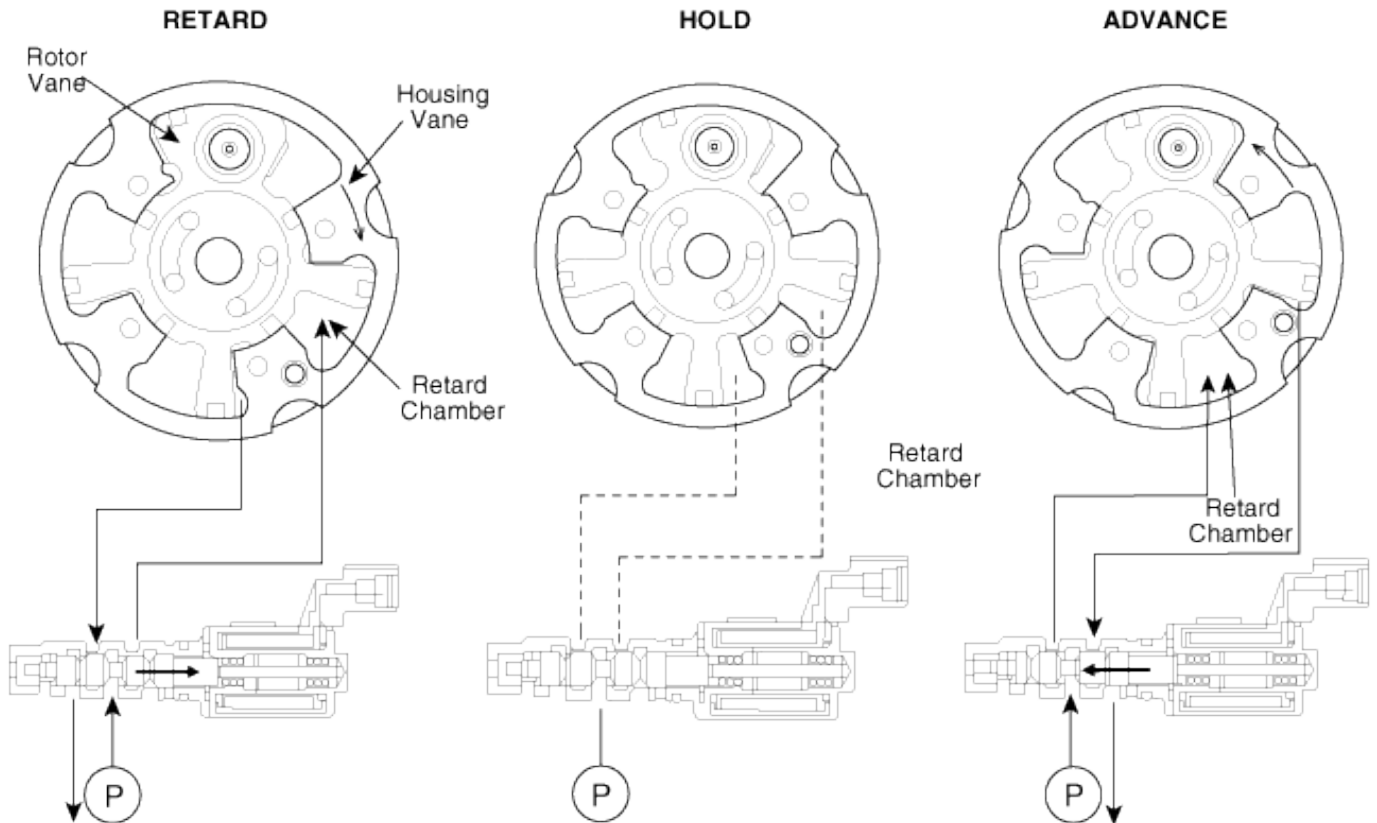
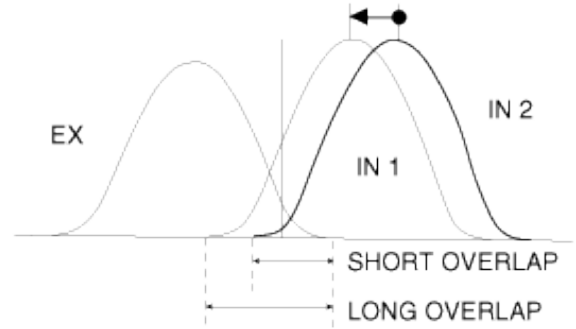
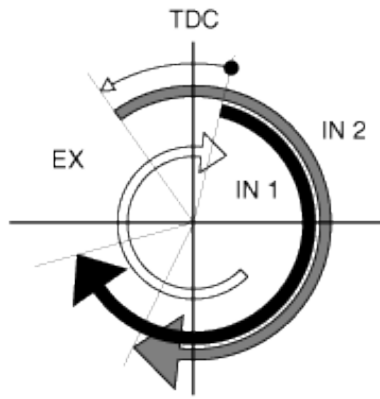
The CVVT system makes continuous intake valve timing changes based on operating conditions.

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.



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).