General Information

Description

Emissions control system consists of the three major systems.

- Crankcase Emission Control System prevents blow-by gas from going into the atmosphere. This system burns these gases after moving them to the intake manifold (Closed Crankcase Ventilation Type).
- Evaporative Emission Control System prevents evaporative gas going into the atmosphere. This system burns the gases at appropriate engine operating condition after gathering it in the canister.
- Exhaust Emission Control System converts the three pollutants hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) into harmless substances by using the 3-way catalytic converter.

Specifications

Purge Control Solenoid Valve (PCSV)

▷ Specification

Item		Specification
Coil Resistance (Ω)	1.6 DOHC	16 [20℃(68˚F)]
	2.0 DOHC	19.0 ~ 22.0 [20℃(68˚F)]

Tightening Torques

Item	kgf.m	N.m	lb-ft
Positive Crankcase Ventilation (PCV) Valve installation	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7

Troubleshooting

Symptom	Suspect area
Engine will not start or hard to start	Vapor hose damaged or disconnected
Engine hard to start	Malfunction of the purge control solenoid valve
Rough idle or engine stalls	Vapor hose damaged or disconnected
	Malfunction of the PCV valve
Rough idle	Malfunction of the evaporative emission control system
Excessive oil consumption	Positive crankcase ventilation line clogged

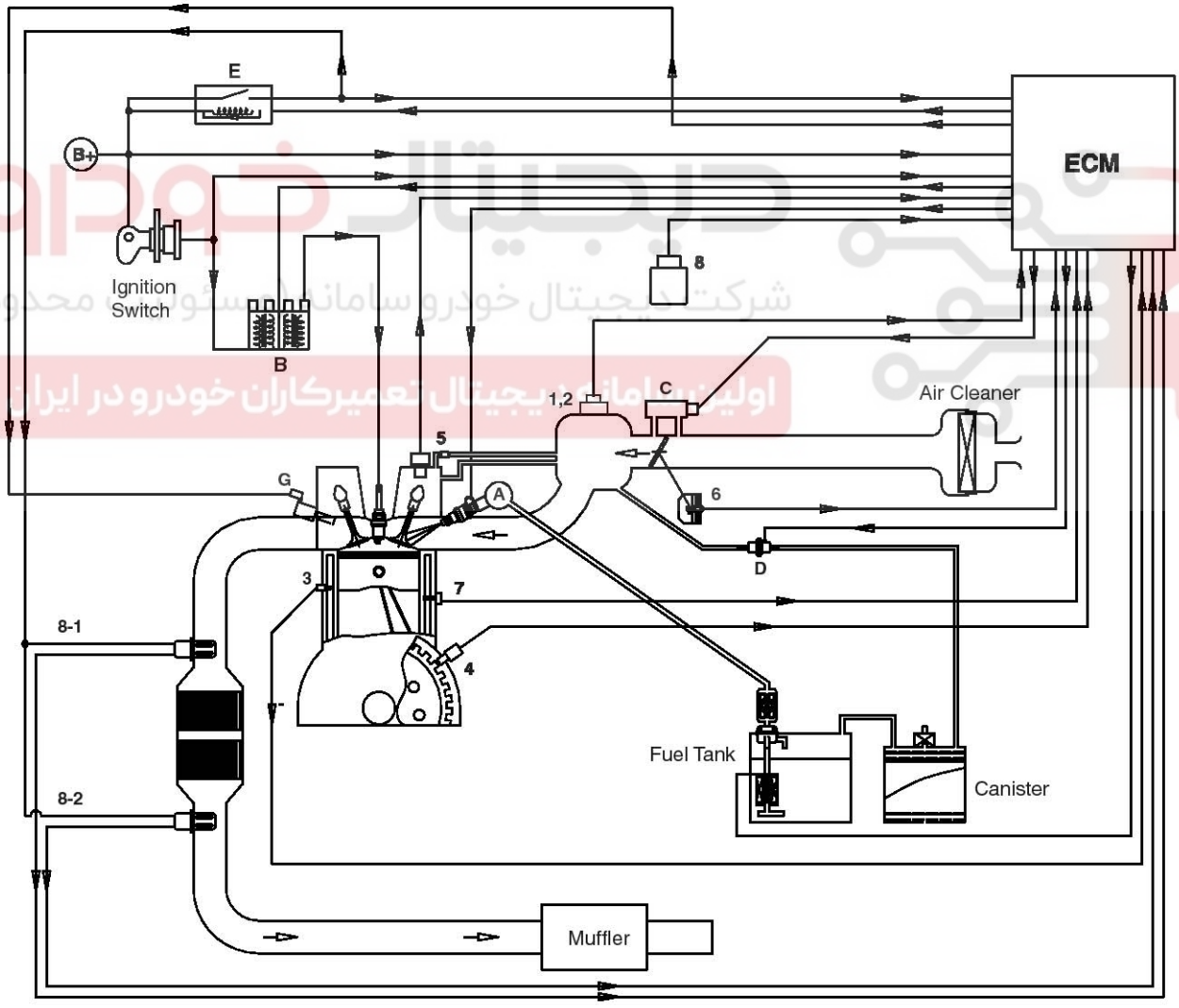
Schematic Diagram

[1.6 DOHC]

1. Manifold Absolute Pressure Sensor (MAPS)
2. Intake Air Temperature Sensor (IATS)
3. Engine Coolant Temperature Sensor (ECTS)
4. Crankshaft Position Sensor (CKPS)
5. Camshaft Position Sensor (CMPS)
6. Throttle Position Sensor (TPS)
7. Knock Sensor (KS)
8-1. Heated Oxygen Sensor (Bank 1, Sensor 1)
8-2. Heated Oxygen Sensor (Bank 1, Sensor 2)
- Switch Input Signals
- Vehicle Speed Signal

INPUT → ECM → OUTPUT

A. Injector
B. Ignition Coil
C. Idle Speed Control Actuator (ISCA)
D. Purge Control Solenoid Valve (PCSV)
E. Main Relay
F. Fuel Pump Relay
G. CVVT Oil Control Valve (OCV)



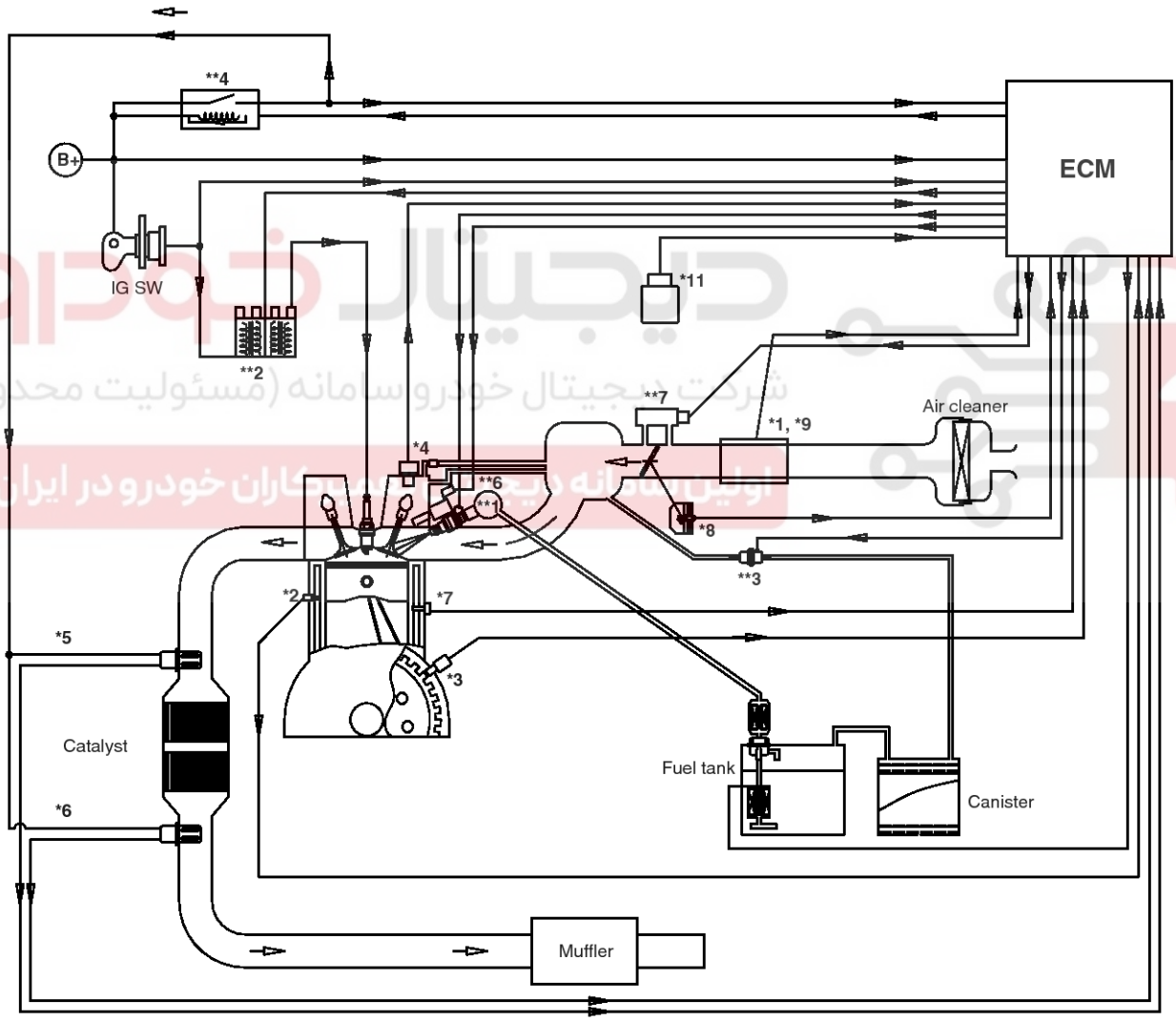
STDEC9100L

[2.0 DOHC]

*1. Manifold Absolute Pressure Sensor (MAPS)
*2. Engine Coolant Temperatuer Sensor (ECTS)
*3. Crankshaft Position Sensor (CKPS)
*4. Camshaft Position Sensor (CMPS)
*5. Heated Oxygen Sensor (Bank 1, Sensor 1)
*6. Heated Oxygen Sensor (Bank 2, Sensor 2)
*7. Knock Sensor
*8. Throttle Position Sensor (TPS) (in ETC Module)
*9. Intake Air Temperature Sensor (IATS)
*10. Accelerator Position Sensor (APS)
*11. Vehicle Speed Signal

ECM

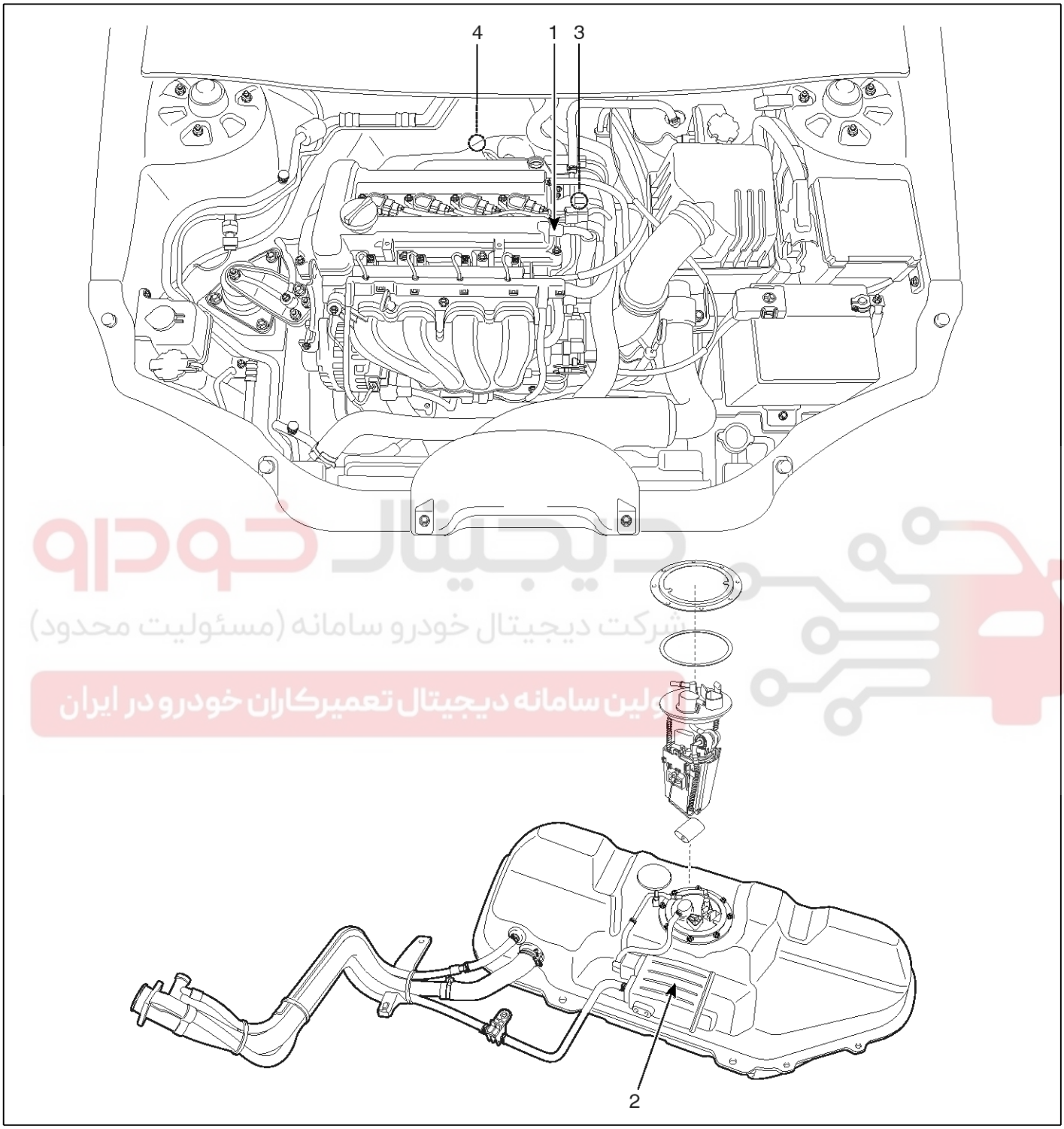
**1. Injector
**2. Ignition Coil
**3. Purge Control Solenoid Valve (PCSV)
**4. Main Relay
**5. Fuel Pump Relay
**6. CVVT Oil Control Valve (OCV)
**7. ETC Motor (in ETC Module)



STDEC9108L

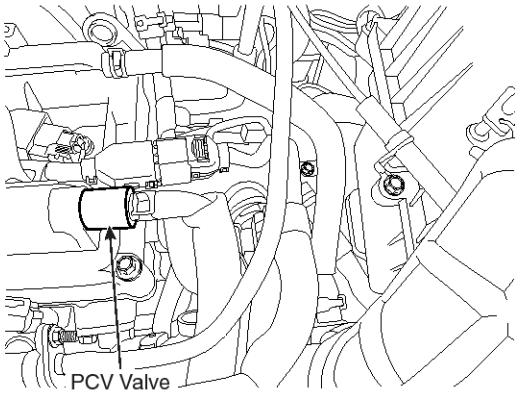
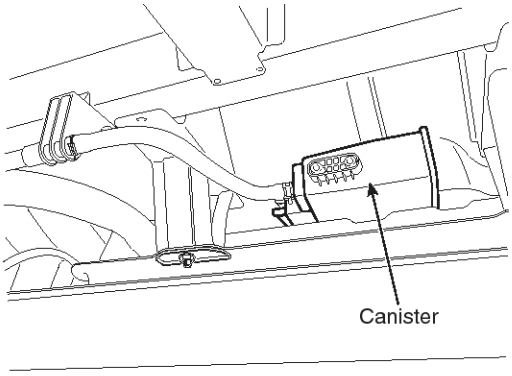
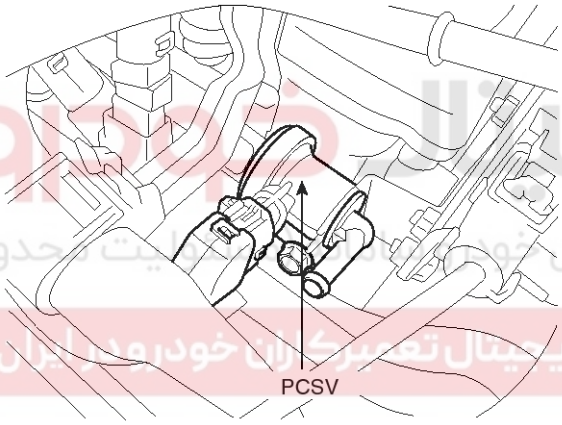
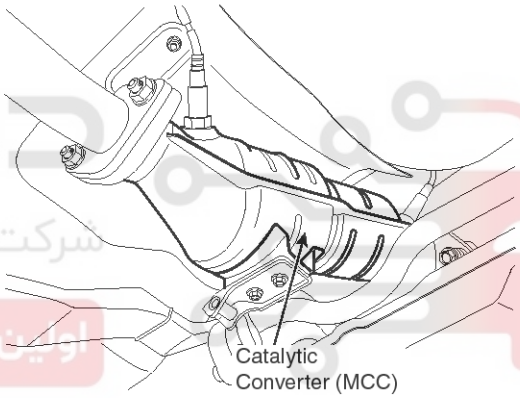
Components Location

[1.6 DOHC]

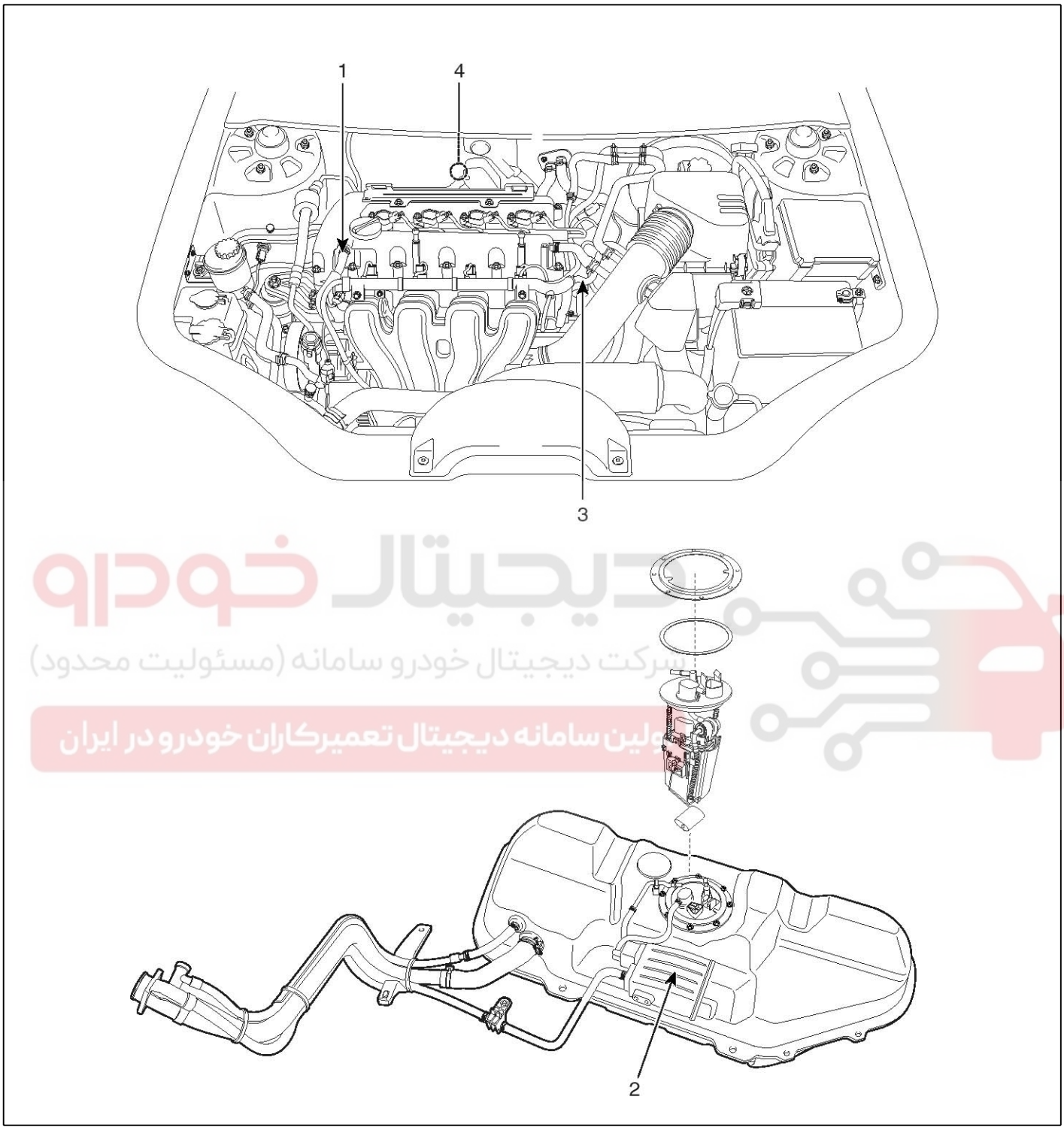


STDEC9101L

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

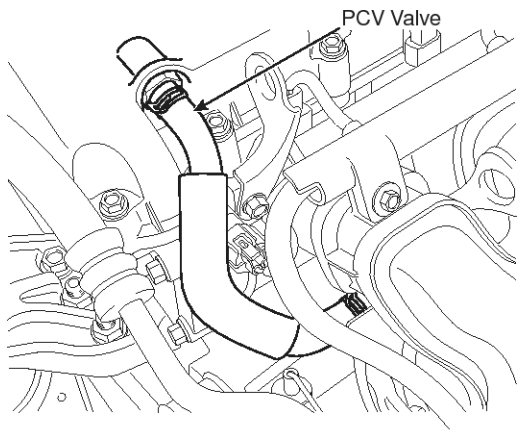
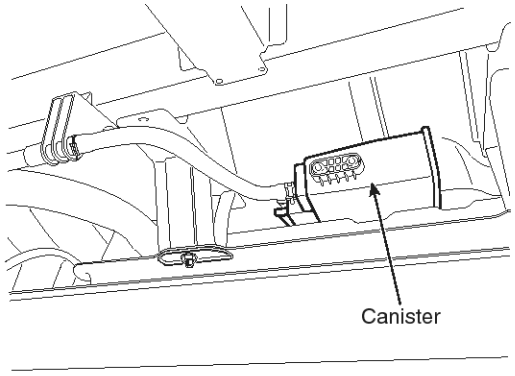
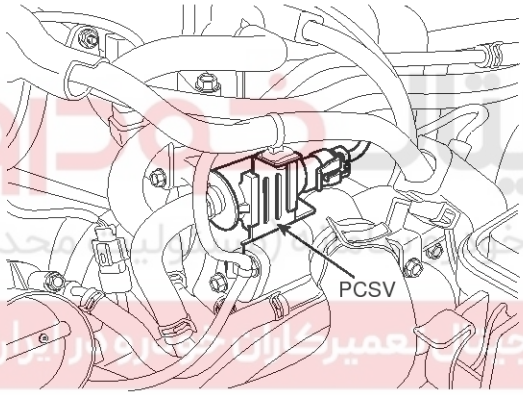
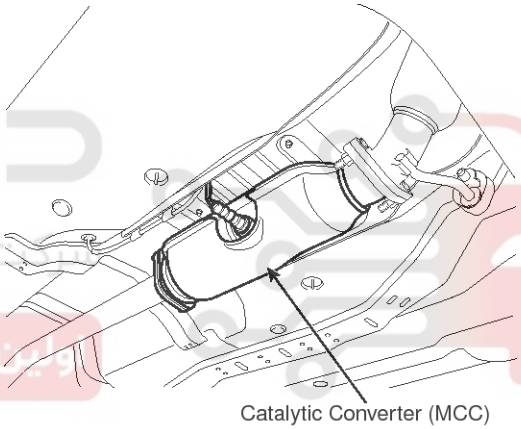
1. PCV Valve	2. Canister
 SPBEC9108L	 STDEC9102L
3. Purge Control Solenoid Valve (PCSV)	4. Catalytic Converter (MCC)
 SHDFL6114L	 STDEC9103L

[2.0 DOHC]



STDEC9104L

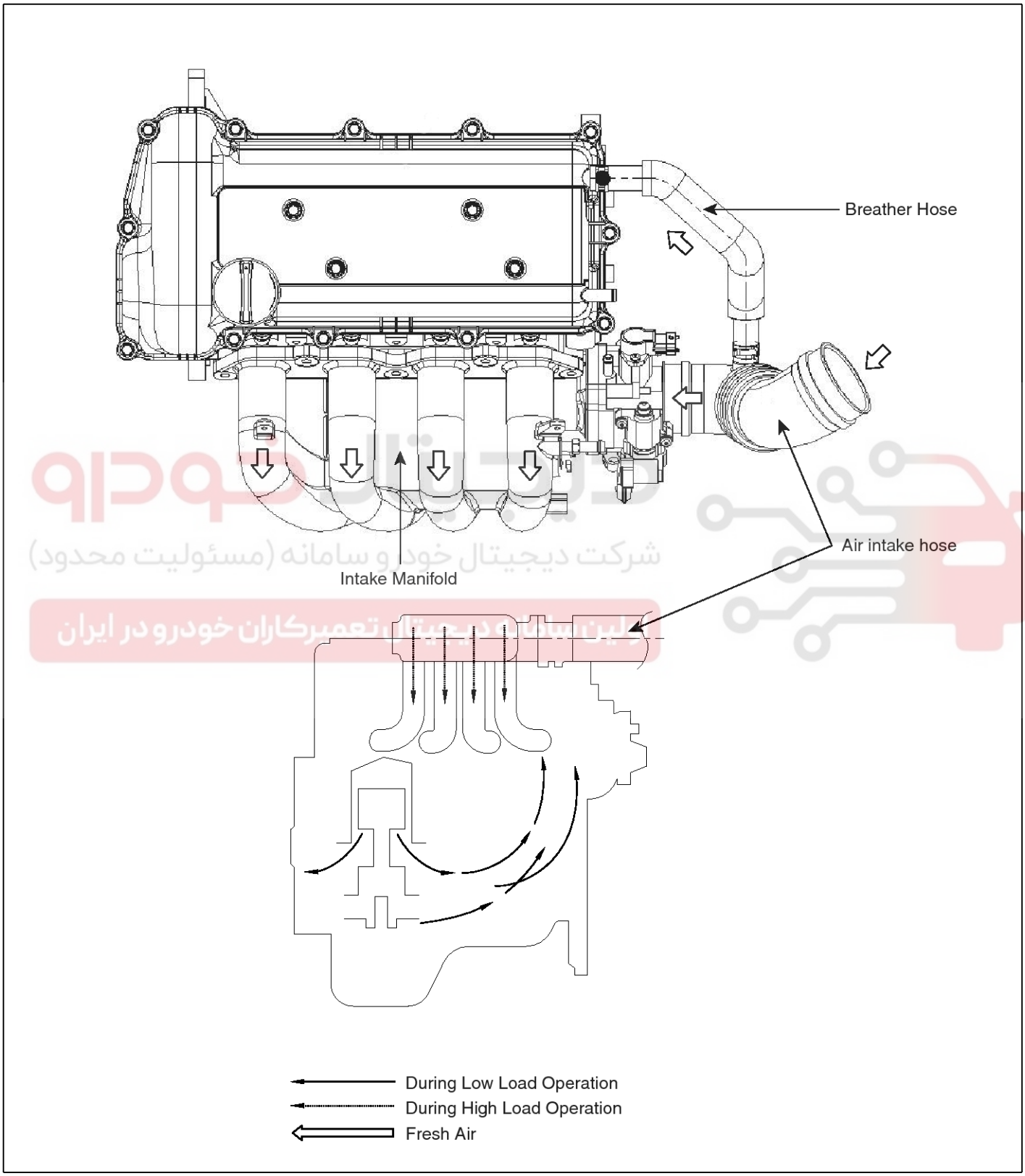
1. PCV Valve
2. Canister
3. Purge Control Solenoid Valve (PCSV)
4. Catalytic Converter (MCC)

1. PCV Valve	2. Canister
 STDEC9105L	 STDEC9102L
3. Purge Control Solenoid Valve (PCSV)	4. Catalytic Converter (MCC)
 STDEC9106L	 STDEC9107L

Crankcase Emission Control System

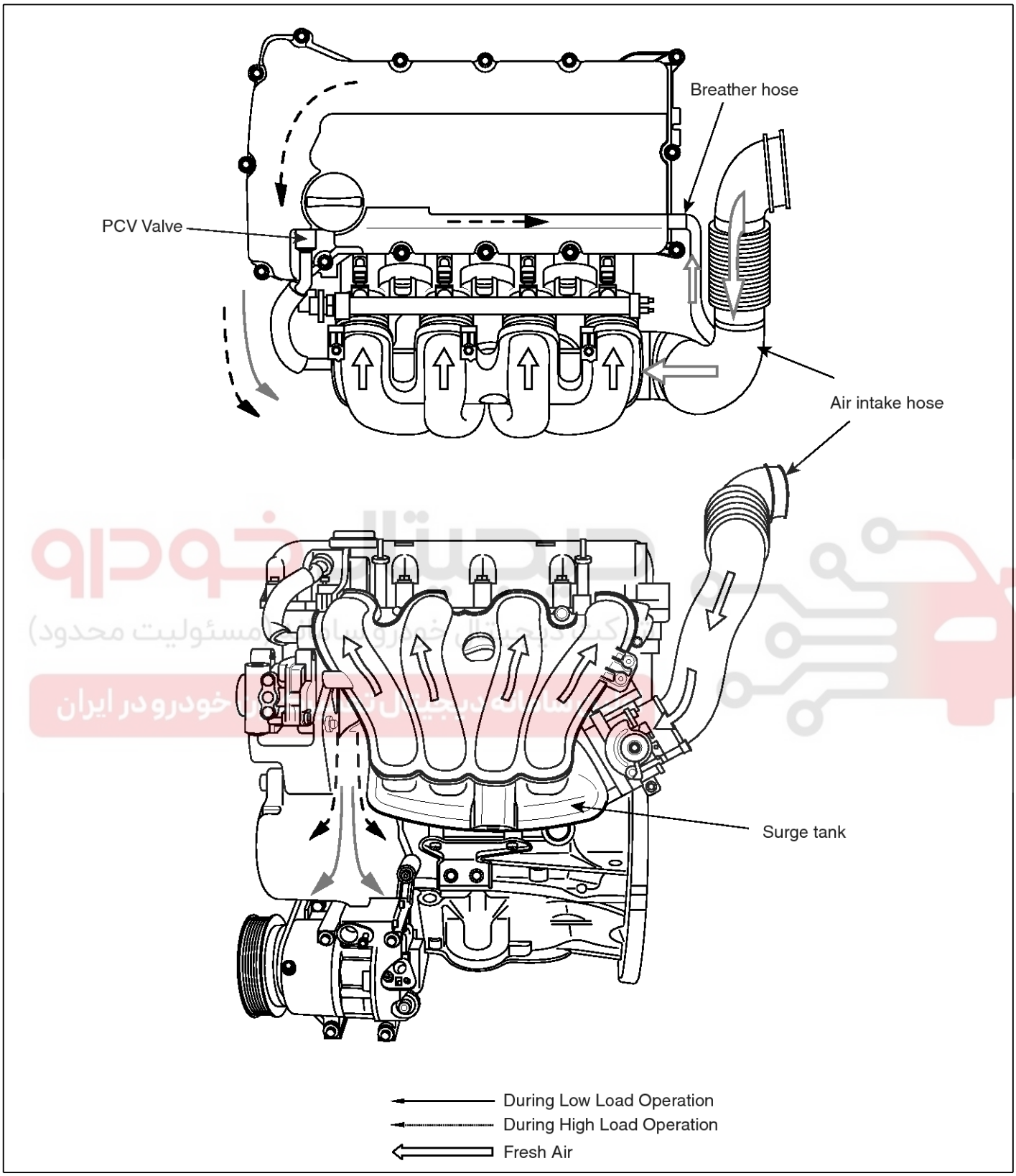
Schematic Diagram

[1.6 DOHC]



SHDEC6110L

[2.0 DOHC]



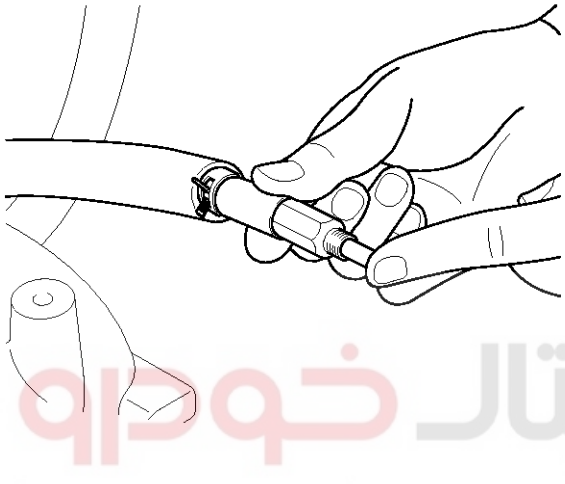
EERF086Z

Inspection

1. After disconnecting the vapor hose from the PCV valve, remove the PCV valve.
2. Reconnect the PCV valve to the vapor hose.
3. 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 at vacuum.

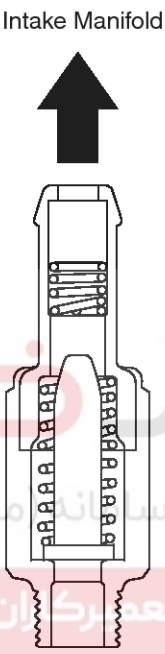
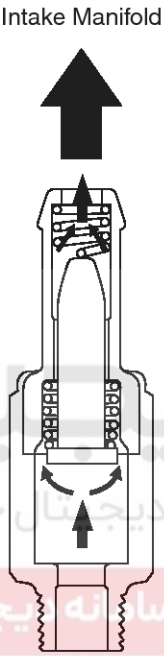
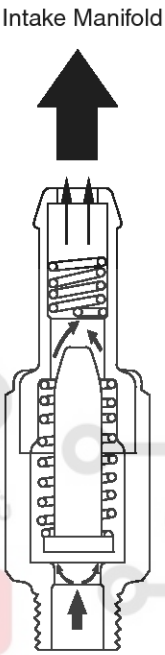
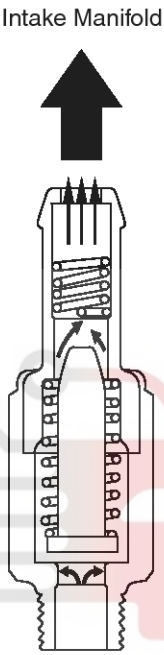


SCMEC6004L

4. If the vacuum is not felt, clean or replace the vapor hose.

Positive Crankcase Ventilation (PCV) Valve

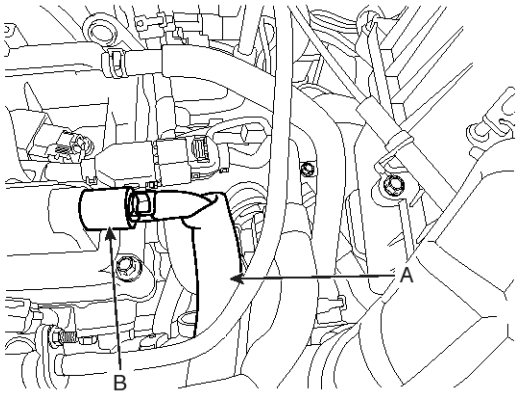
Operation Principle

Engine Condition	Not Running	Idling or Decelerating	Normal Operation	Accelerating and High Load
Vacuum in Intake Manifold	0	High	Moderate	Low
PCV Valve	Close	Slightly Open	Properly Open	Fully Open
Blow-by Gas Flow	0	Small	Medium	Large
Schematic Diagram				

SHDEC8109C

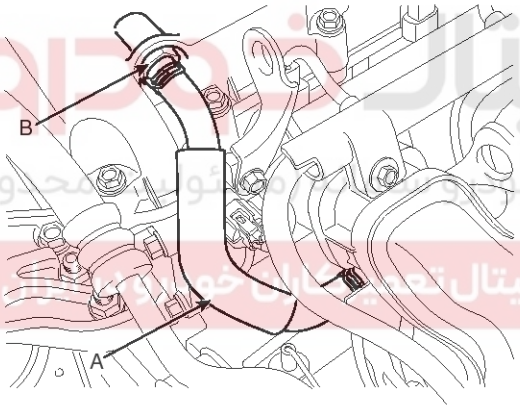
Removal

1. Disconnect the vapor hose (A) and then remove the PCV valve (B).



STDEC9105D

[1.6 DOHC]

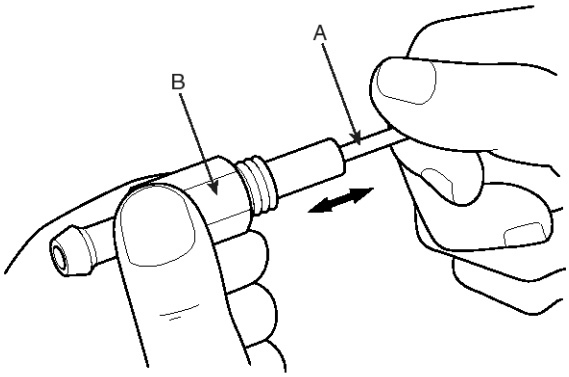


STDEC9109L

[2.0 DOHC]

Inspection

1. Insert a thin stick (A) into the PCV valve (B) from the threaded side to check that the plunger moves.



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NOTICE

If the plunger does not move (PCV valve is clogged), clean or replace the valve.

Installation

1. Installation is reverse of removal.

PCV Valve installation:

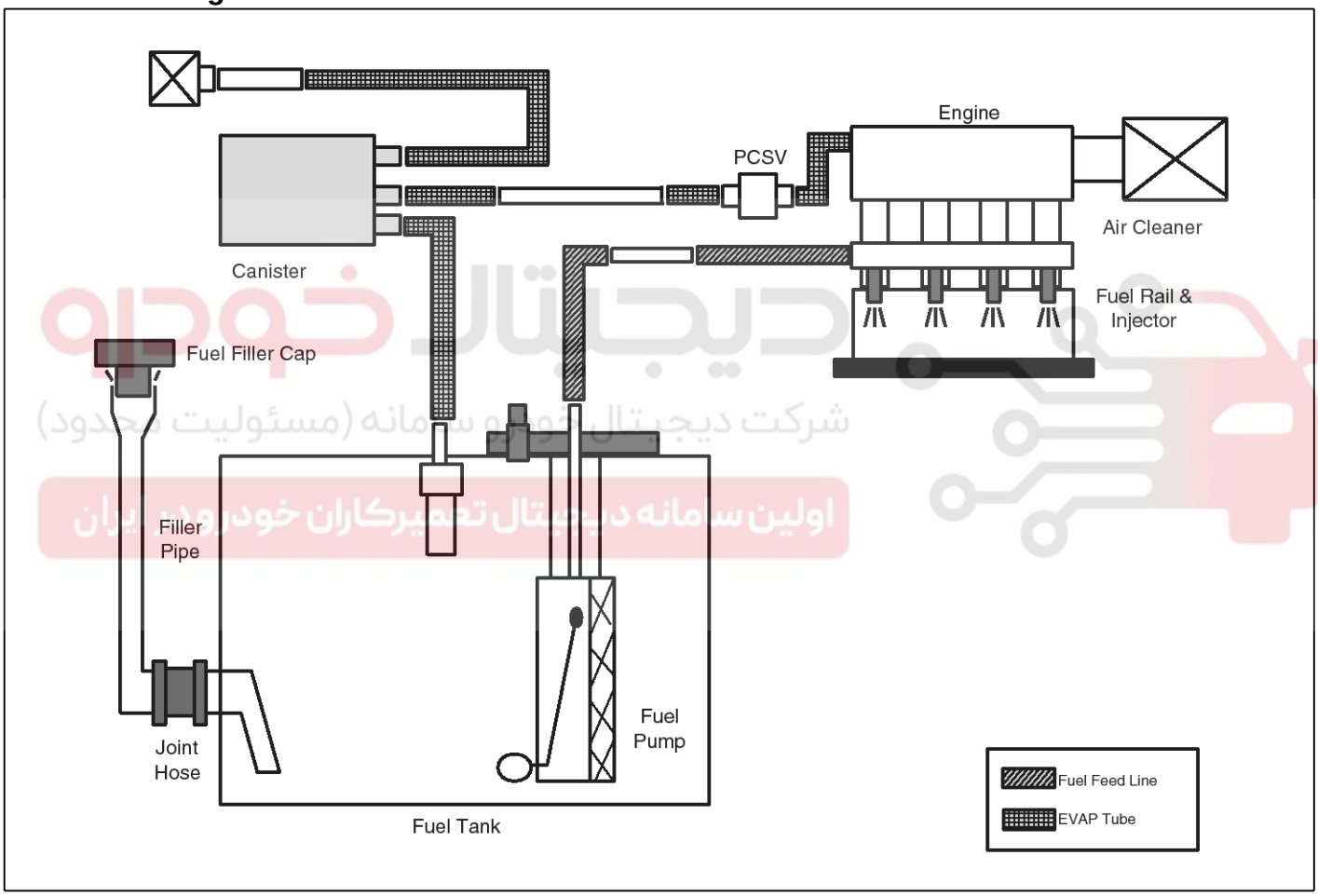
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Evaporative Emission Control System

Description

Evaporative Emission Control System prevents fuel vapor stored in fuel tank from vaporizing into the atmosphere. When the fuel evaporates in the fuel tank, the vapor passes through vent hoses or tubes to the canister filled with charcoal and the canister temporarily holds the vapor in the charcoal. If ECM determines to draw the gathered vapor into the combustion chambers during certain operating conditions, it will use vacuum in intake manifold to move it.

Schematic Diagram



SPBEC9110L

Canister

Canister is filled with charcoal and absorbs evaporated vapor in fuel tank. The gathered fuel vapor in canister is drawn into the intake manifold by the ECM/PCM when appropriate conditions are set.

Purge Control Solenoid Valve (PCSV)

Purge Control Solenoid Valve (PCSV) is installed in the passage connecting canister and intake manifold. It is a duty type solenoid valve and is operated by ECM/PCM signal.

To draw the absorbed vapor into the intake manifold, the ECM/PCM will open the PCSV, otherwise the passage remains closed.

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.

Inspection

[System Inspection]

1. Disconnect the vapor hose from the throttle body and connect a vacuum pump to the nipple on the throttle body.
2. Check the following points with applying vacuum using the vacuum pump.

· At Cold Engine [Engine Coolant Temperature < 60℃(140˚F)]

Engine Operating Condition	Applied Vacuum	Result
Idle	0.5kgf/cm² (50kPa,7.3psi)	Vacuum is held
3,000rpm		

· At Warmed Engine [Engine Coolant Temperature > 80℃(176˚F)]

Engine Operating Condition	Applied Vacuum	Result
Idle	0.5kgf/cm² (50kPa,7.3psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to applyvacuum	Vacuum is released
In 3 minutes after engine start at 3,000 rpm	0.5kgf/cm² (50kPa,7.3psi)	Vacuum will be held momentarily, after which, it will be released

[PCSV Inspection]

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the PCSV connector.
3. Disconnect the vapor hose which is connected with the intake manifold from the PCSV.
4. After connecting a vacuum pump to the nipple, apply vacuum.
5. With the PCSV control line grounded, check valve operation when applying battery voltage to the PCSV or not.

Battery Voltage	Valve	Vacuum
Connected	Open	Released
Disconnected	Close	Maintained

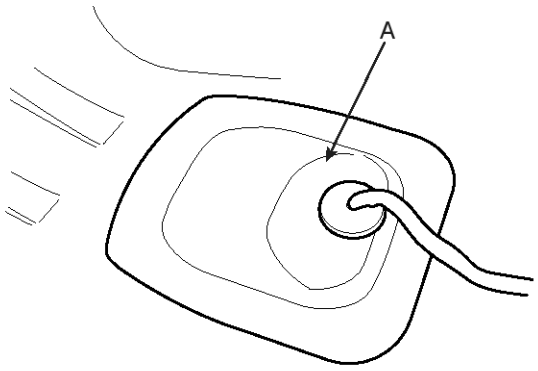
6. Measure the coil resistance of the PCSV.

Specification: 16 Ω [20℃(68˚F)] [1.6 DOHC]
19.0 ~ 22.0 Ω [20℃(68˚F)][2.0 DOHC]

Canister

Removal

1. Remove the rear seat cushion (Refer to "Seat" in BD group).
2. Open the service cover (A).

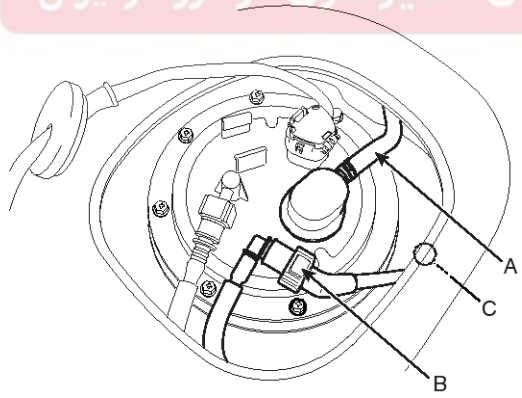


STDFL9159D

3. Disconnect the vapor hose (A) and the vapor tube quick-connector (B).

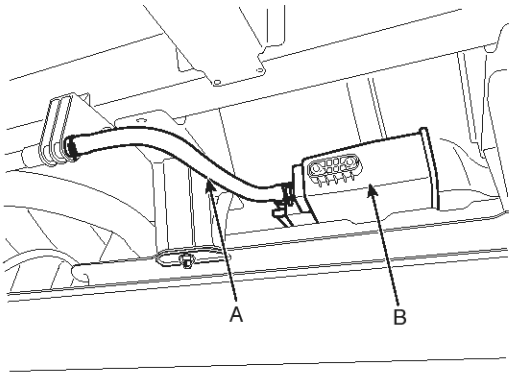
NOTICE

After disconnecting the vapor tube quick-connector (B), release the holder (C) because it is fixed with the holder.



STDEC9110L

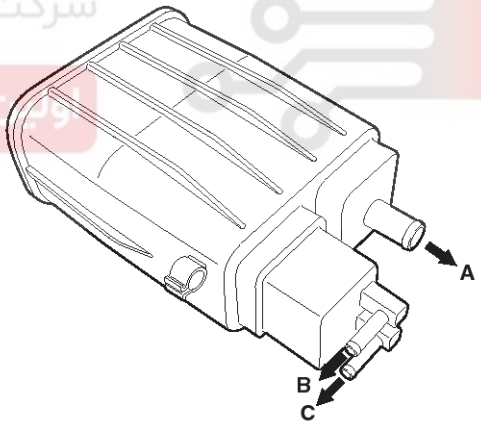
4. After disconnecting the vapor hose (A), pull the canister (B) in the direction of the end of the vehicle.



STDEC9111L

Inspection

1. Check for the following items visually.
   - Cracks or leakage of the canister
   - Loose connection, distortion, or damage of the vapor hose/tube



SHDEC8117C

A: Canister ↔ Atmosphere (via Fuel Tank Air Filter)

B: Canister ↔ Fuel Tank

C: Canister ↔ Intake Manifold

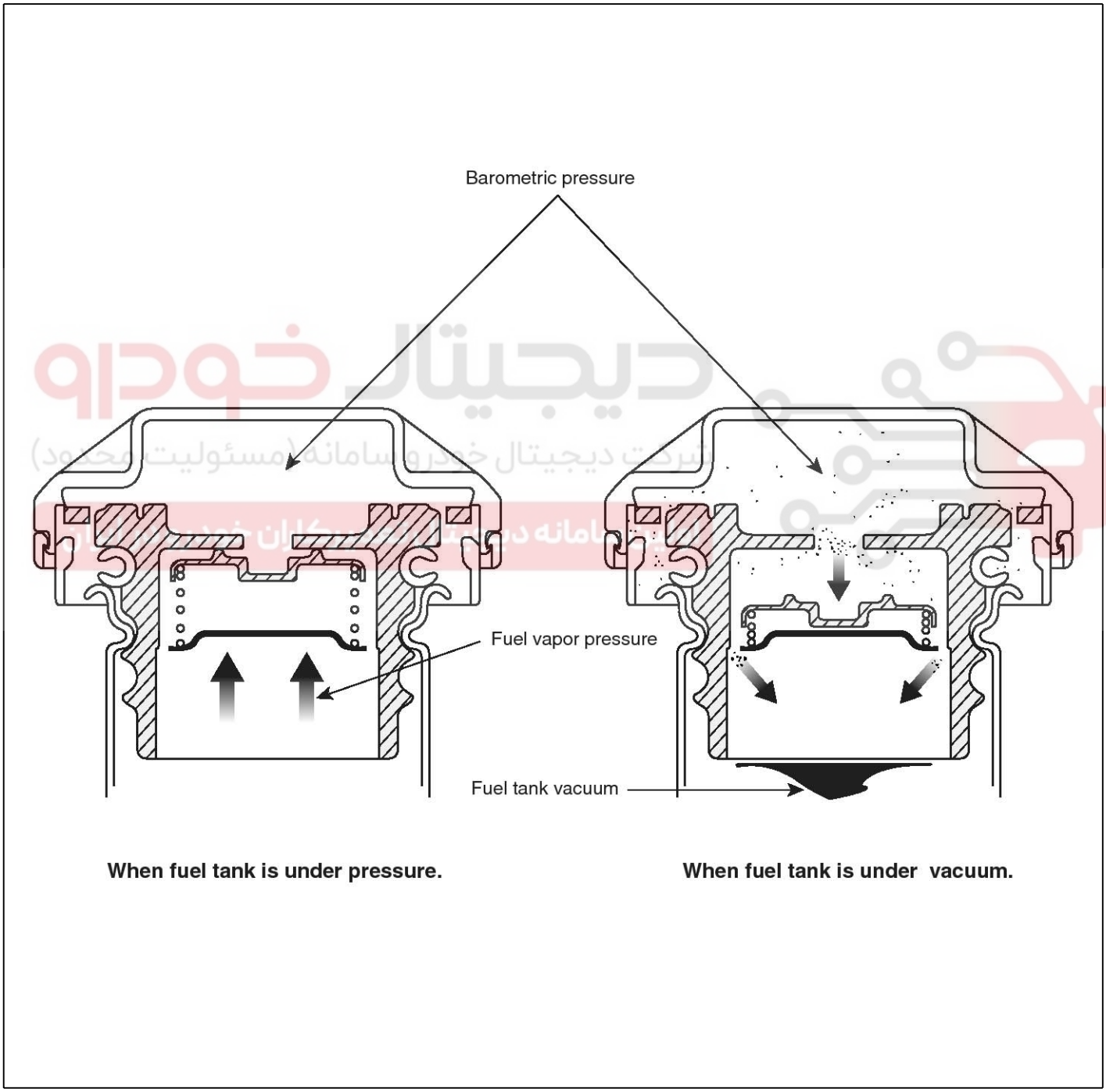
Installation

Installation is reverse of removal.

Fuel Filler Cap

Description

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 ratchet produces a loud clicking noise indicating the seal has been set.



LEGE015A

Exhaust Emission Control System

Description

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 drivability 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.

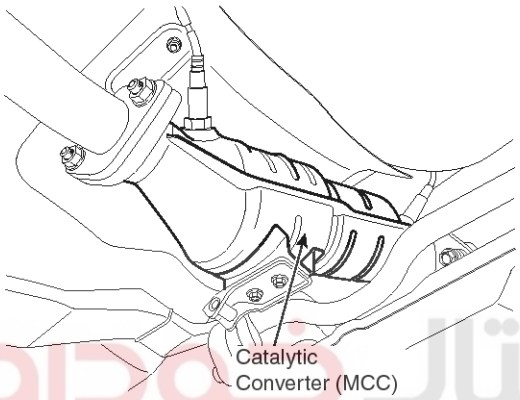
1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

Catalytic Converter

Description

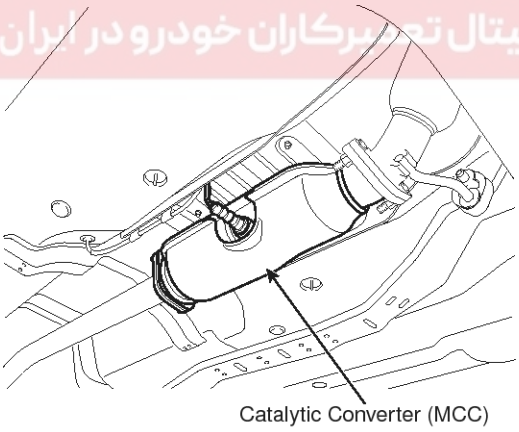
The catalytic converter of the gasoline engine is a three way catalyst. It oxidizes carbon monoxide and hydrocarbons (HC), and separates oxygen from the oxides of nitrogen (NOx).

There are two types of three-way catalyst; Palette type and Monolith type.



STDEC9103L

[1.6 DOHC]

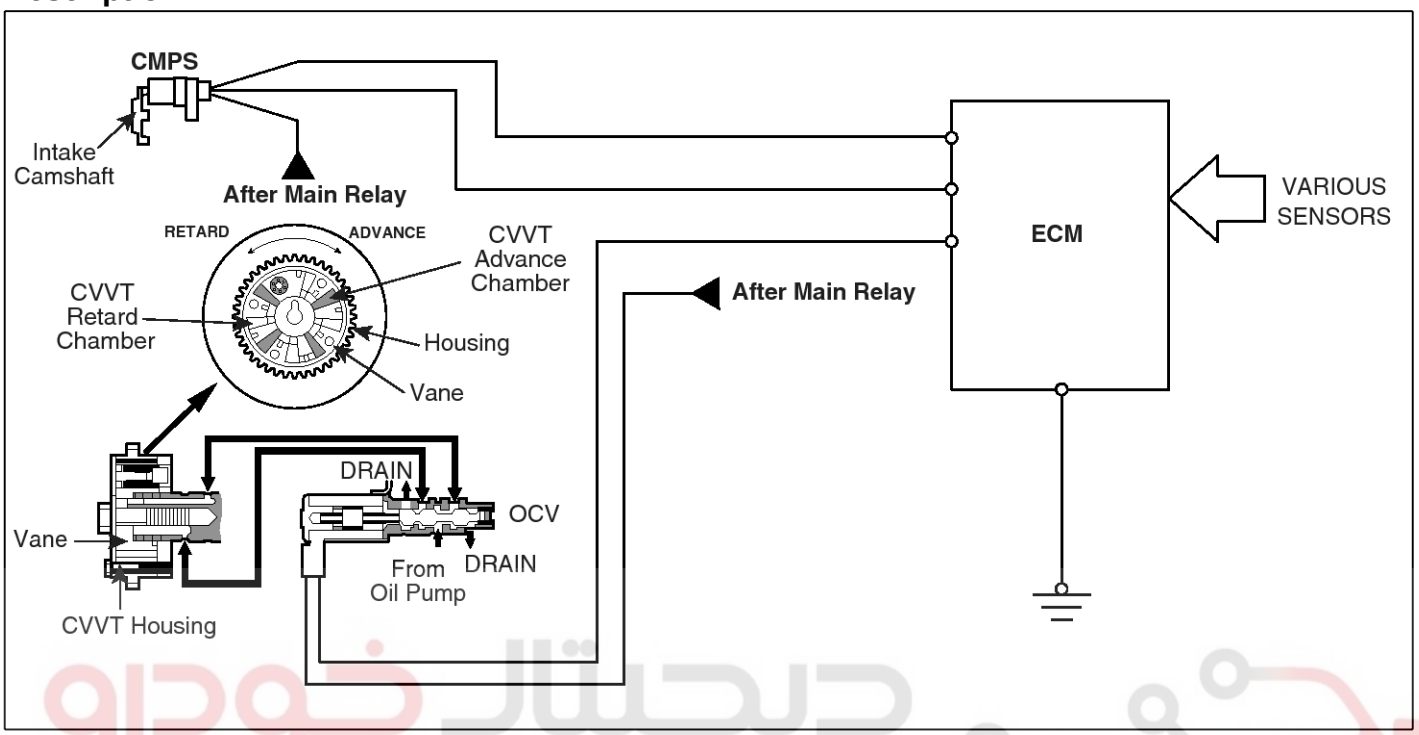


STDEC9107L

[2.0 DOHC]

CVVT (Continuously Variable Valve Timing) System

Description



STDEC9112L

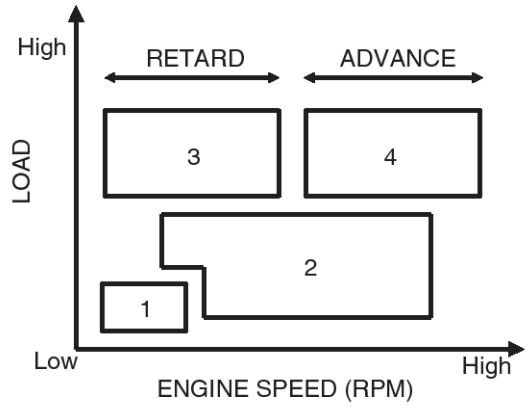
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.

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 Principle

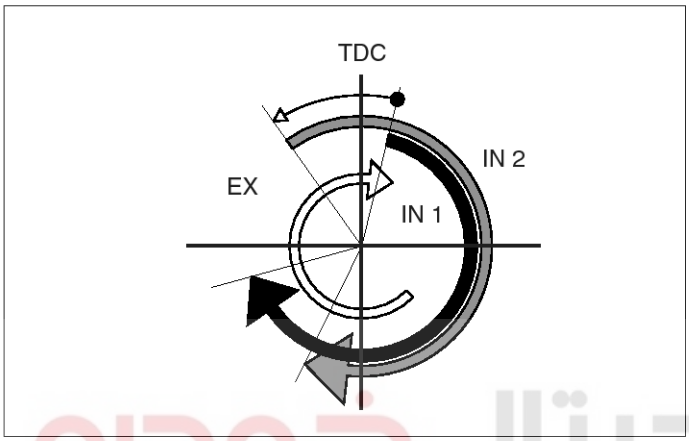
The CVVT system makes continuous intake valve timing changes based on operating conditions.

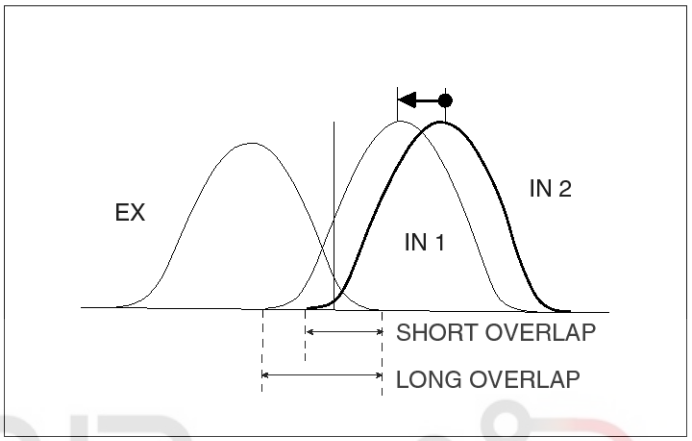
Intake valve timing is optimized to allow the engine to produce maximum power.

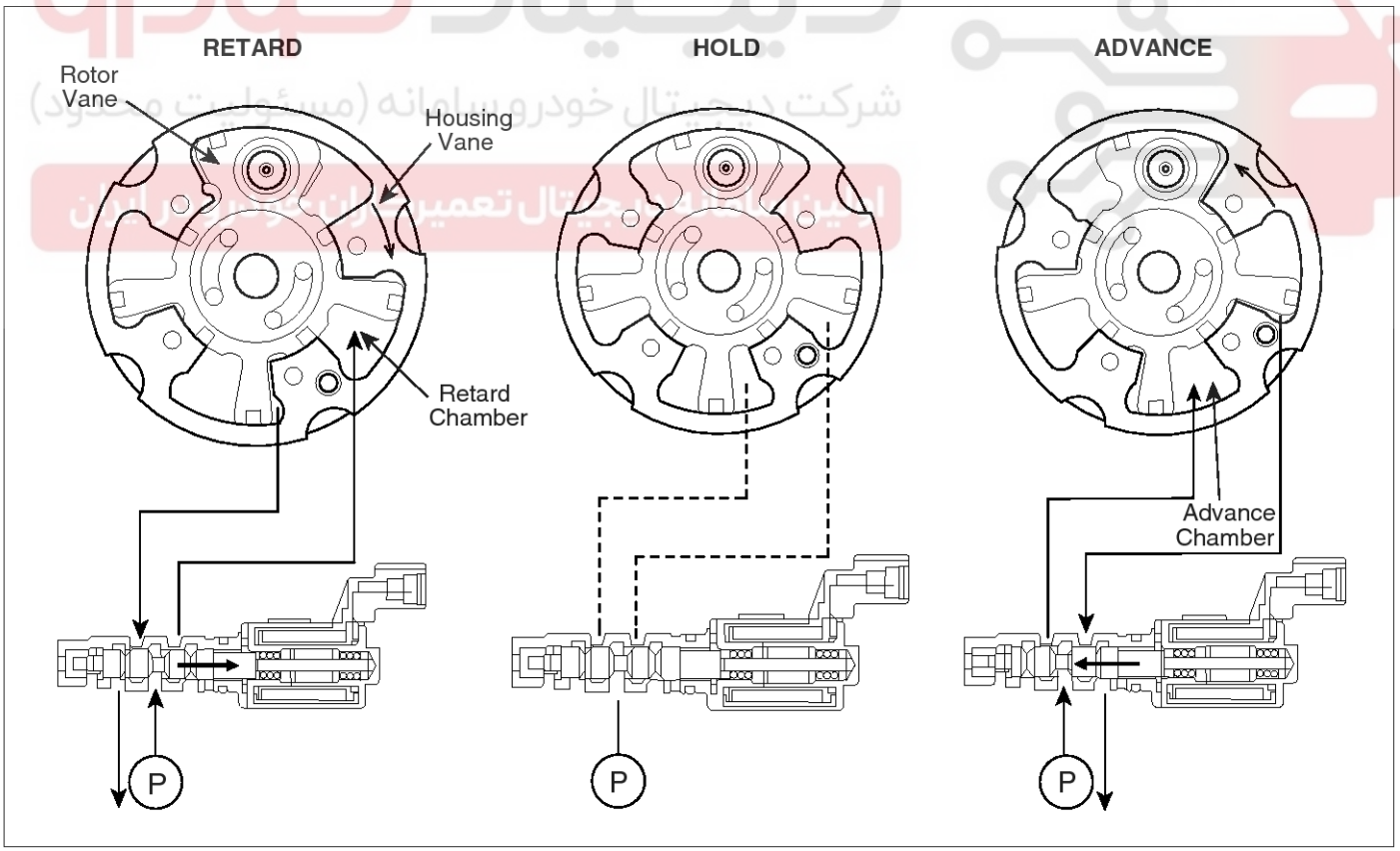
Cam angle is advanced to obtain the EGR effect and reduce pumping loss. The intake valve is closed quickly to reduce the entry of the air/fuel mixture into the intake port and improve the changing effect.

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.







UEBG014A

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 (CVVT Oil 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).