2.4 Auxiliary Emission Control JL4G18-D

2.4.1 Specifications

2.4.1.1 Fastener Tightening Specifications

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Canister Ventilation Filter Mounting Bracket Retaining Bolt	M6 × 1.25 × 20	7-9	5.2-6.7
Canister Solenoid Valve Bracket Retaining Bolts	M6 × 1.25 × 20	7-9	5.2-6.7
Canister Assembly Retaining Bolts	M6 × 1.25 × 20	8-10	6.0-7.4

2.4.2 Description and Operation

2.4.2.1 Heated Oxygen Sensor (HO_2S)

Heated Oxygen Sensors (HO_2S) are installed before and after the three-way catalytic converter. Heated oxygen sensor sends signals to the engine control module (ECM) indicating oxygen content in the exhaust. the engine control module controls the fuel injectors to change the engine Air-Fuel ratio. The ideal Air-Fuel ratio is 14.7:1, at this time the catalytic converters is most efficient. As the fuel injection system continuously measures and adjusts Air-Fuel ratio, it is called "closed loop" control.

1. Open-loop

When the engine has just started and the speed is higher than 400 rpm, the system enter "open loop" operation. In the open-loop mode, the engine control module (ECM) ignores the signal from the heated oxygen (HO_2S) signal and according to signals from the engine coolant temperature sensor (ECT) and intake pressure temperature sensor to calculate the Air-Fuel ratio. Sensors will remain in the "open loop" mode, until the following conditions are met:

- Heated oxygen sensor voltage output changes, showing that the temperature is high enough and the system can enter the normal operation.
- Engine coolant temperature sensor in higher than the specified temperature.
- The engine has been started for the specified period of time.

2. Closed-loop

In the above mentioned situation, the specific values depend on different engines and are stored in electrically erasable programmable read-only memory (EEPROM). When these conditions are met, the system enters into "closed loop" operation. In the "closed loop", the engine control module calculates Air-Fuel ratio according to oxygen sensor signals (ie, fuel injector connected timing), so that the Air-Fuel ratio is always very close to 14.7:1.

Note

Once the engine control module confirms oxygen sensor faulty, the system will be immediately in "open loop" control, that is the Air-Fuel ratio is no longer adjusted according to the oxygen sensor signals.

2.4.2.2 Evaporative Emission Control System

Evaporative emission control system uses the basic principle of Canister storage method. This method transfers fuel vapor from fuel tank to the carbon storage devices in order to save the steam when the vehicle is not running. When the engine is running, the fuel vapor is sucked out from the Canister and burnt in the normal combustion process. Gasoline vapor from the fuel tank flows into the fuel vapor recovery pipe. The vapor is absorbed by the Canister. After the engine runs the required time, the engine control module provides a ground circuit, so that evaporative Canister clean-up solenoid valve is turned on and the air is drawn into the Canister and mixed with vapor. The mixture is then sucked into the intake manifold. The evaporative canister clean-up is controlled by the pulse-width modulated solenoid valve (PWM) signal to open or close. According to the operating conditions determined by air flow, fuel adjustment and intake air temperature, evaporative Canister PWM duty cycle changes.

The following conditions can cause poor idling, stalling and poor performance:

- Canister Solenoid Valve Inoperative
- Canister Damage
- Hose Disconnected, Cracking, Improperly Connected To The Pipeline

Evaporative canister is an emission control device containing active carbon particles. Evaporative Canister is used to store fuel vapor from fuel tank. When certain conditions are met, the engine control module will provide the Canister solenoid valve power, so that the fuel will be sucked into the engine cylinder and burnt off.

2.4.2.3 Purged Crankcase Ventilation (PCV) System

Compressed combustion gases fleeing into the crankcase through the piston rings is known as channeling gas. Channeling gas contains nitrogen oxides, carbon monoxide and hydrocarbons. Crankcase ventilation system prevents the channeling gas entering into the atmosphere. Crankcase ventilation system will force the channeling gas crankshaft back into the intake system and the combustion chamber. Crankcase ventilation system consists of the following components:

- Purged Crankcase Ventilation Valve
- Crankcase Ventilation Tube
- Hose and Connectors

1. Operation

The main control device is the crankcase ventilation (PCV) valve. purged crankcase ventilation valve calculate the channeling air flow according to manifold vacuum signal. Lower crankcase ventilation valve parts below the O-ring are exposed to a vacuum in the intake manifold, parts located between the lower and upper O-ring are exposed to the crankcase gases. Purged crankcase ventilation valve allows some internal vacuum pressure through the valve orifice, and form the low-pressure condition inside the crankcase. The channeling crankcase gas is then sucked into intake system and burnt in the normal combustion process. the channeling gas entering into the intake manifold must be accurately controlled in order to maintain idle quality. Must use the correct and proper calibration of the crankcase ventilation valve. Relationship between the Channeling air flow and engine manifold vacuum is shown in the table below:

Manifold Vacuum	Purged Crankcase Ventilation Valve Opening	Channeling Air Flow
Low	Large	High
High	Small	Low

2. The Consequences Of Abnormal Operation

Valve or hose blockage may lead to the following conditions:

- Poor engine idling.
- Engine stalls or engine idle speed is too low.
- Engine crankcase pressure is too high.
- Engine oil leaks.
- Engine oil enters into the air filter.
- Engine has sludge.
- Engine oil consumption is high.
- Excessive exhaust emissions.

2.4.3 System Working Principle

2.4.3.1 Heated Type Oxygen Sensor Working Principle

- Oxygen sensor's sensing element is a porous ceramic tube, the outer wall surrounded by the engine exhaust and inside exposed to atmosphere. Sensing ceramic wall is a solid electrolyte containing an electric heating tube. When the sensor ceramic tube temperature reaches 350°C (662 ºF), it will have a solid electrolyte properties.
- Oxygen sensor's senses ceramic oxygen ion concentration inside and outside difference and sends it out as a voltage signal.
- The output voltage level is due to internal electronic ceramic tubes movement.
- Meet EOBD vehicles self inspect whether the sensor information is accurate.
- Heated resistor resistance at room temperature is 2.5-4.9 Ω.

Note

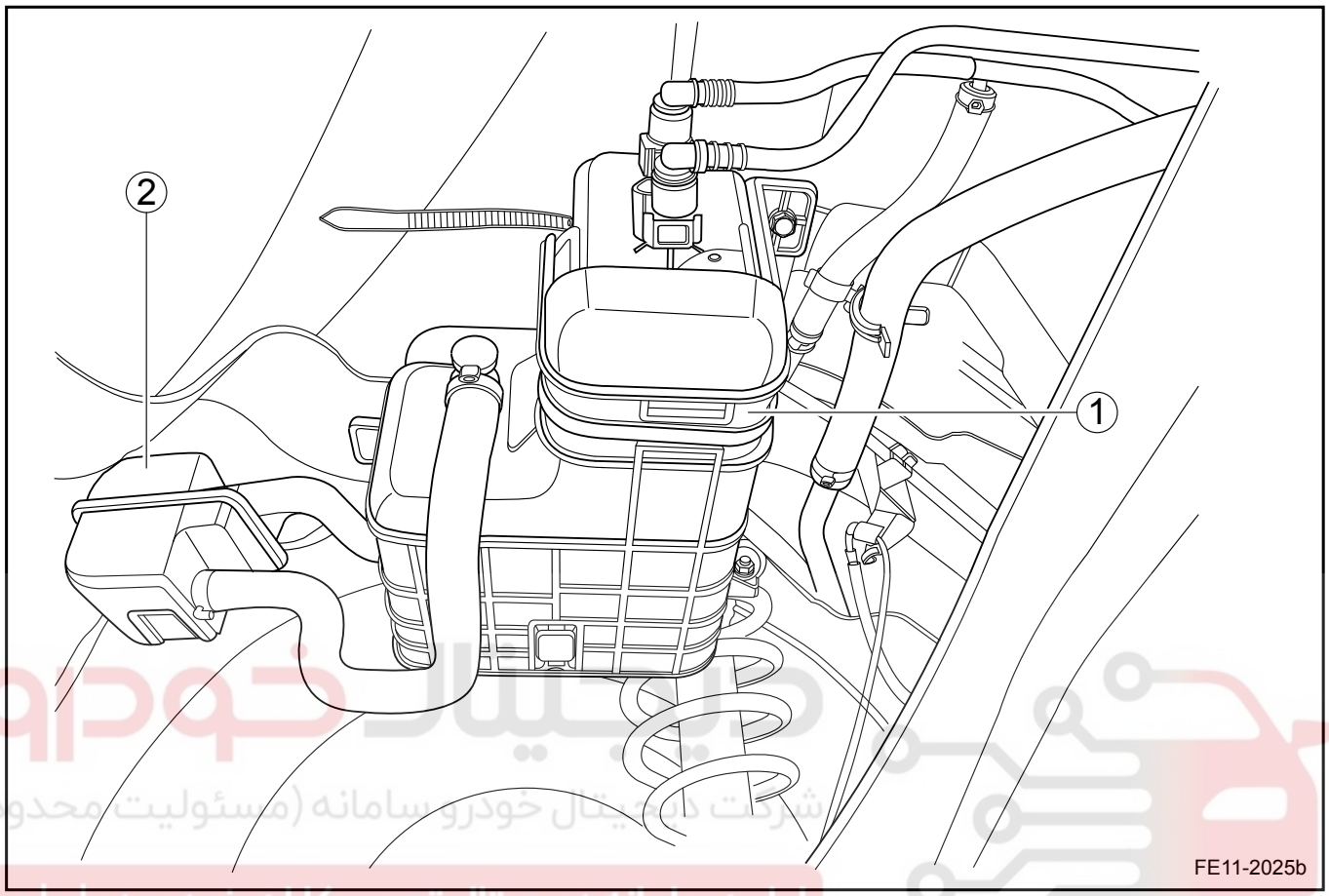
- During the oxygen sensor repair procedure, it is prohibited to use cleaning agent, oily liquids or volatile solids.
- After the replacement of oxygen sensor, apply a layer of anti-rust oil to oxygen sensor threads to prevent rust. Oxygen sensors have electrical cables. The other end of electrical cable is a connector. The external packaging is anti-fire sleeve. A new oxygen sensor will be coated with anti-rust oil on the threads, during installation do not remove these anti-rust oil.

2.4.3.2 Canister Solenoid Valve Working Principle

1. Canister solenoid valve consists of the electromagnetic coil, armature and valves so on. Inlet port has a filter.
2. On one hand, air flow through the Canister solenoid valve is related to ECM output to the Canister solenoid valve electrical pulse duty cycle; on the other hand, it is related to the pressure difference between the Canister solenoid valve inlet port and outlet port. When there is no electrical pulses, the Canister solenoid valve will be turned off.
3. ECM provides signals to control the Canister solenoid valve power according to various engine sensor signals, and indirectly controls the flow of the clean air.
4. When the engine coolant temperature, engine running time and engine load etc. meet the preset requirements, ECM will instruct Canister solenoid valve to start working. In the following situations canister solenoid valve will not work:
   - Engine cold start.
   - Engine coolant temperature is relatively low.
   - Engine idle.
   - Engine load is high.
   - Important sensor system faults.

2.4.4 Component Locator

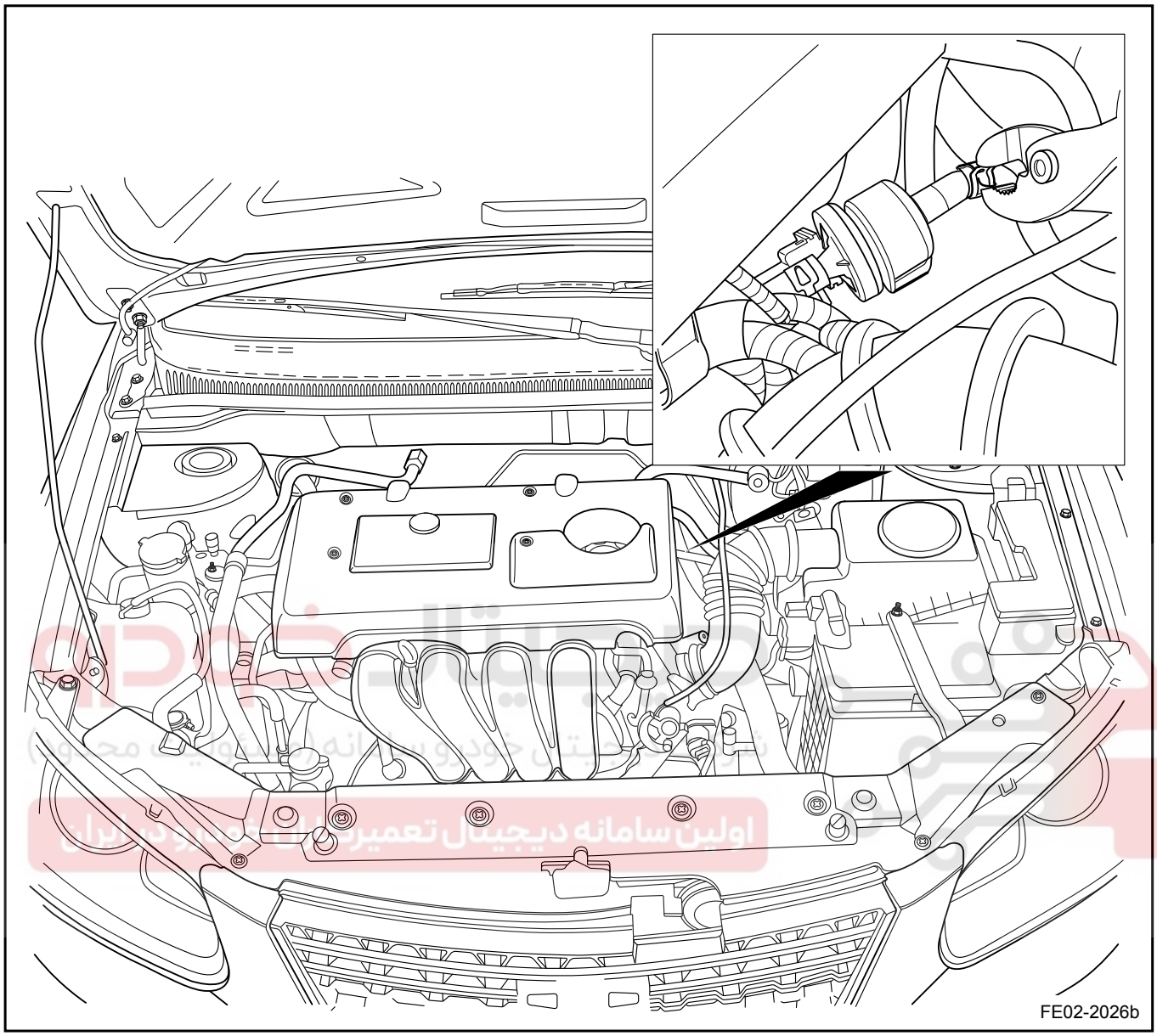
2.4.4.1 Canister Location



Legend

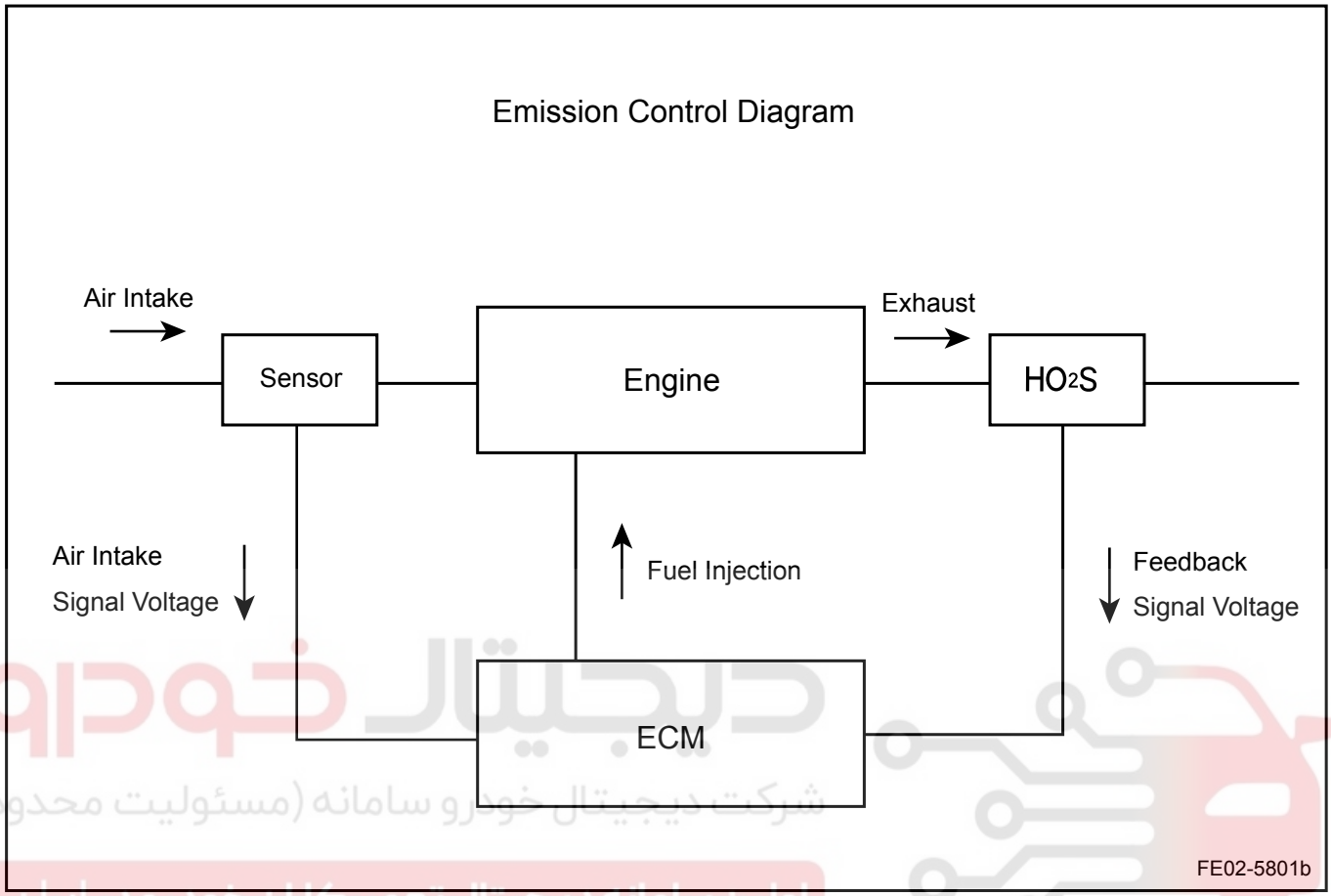
1. Canister Assembly
2. Canister Ventilation Filter

2.4.4.2 Canister Solenoid Valve Location



2.4.5 Schematic

2.4.5.1 Schematic



2.4.6 Diagnostic Information and Procedures

2.4.6.1 Diagnostic Description

Refer to2.4.2 Description and Operationget familiar with the system functions and operations then start system diagnostics, so that it will help with the correct diagnostic steps, more importantly, it will also help to determine whether the customer described the situation is normal.

Canister solenoid valve repair notes:

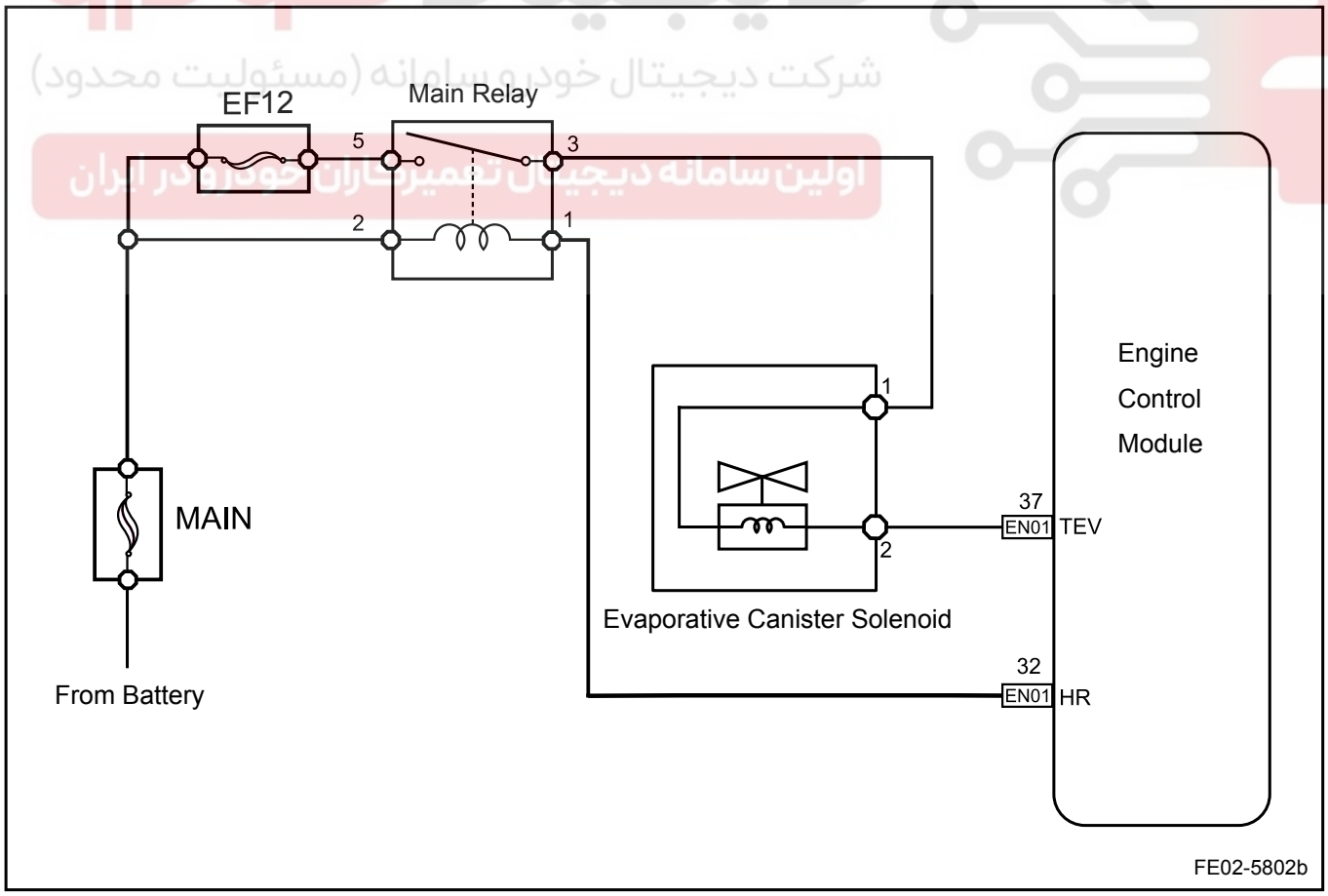
1. Make sure airflow direction comply with specifications.
2. When particles inside the valve body causing the control valve failure, replace canister solenoid valve and check the canister status.
3. During maintenance procedure, avoid water, oil and liquid entering into the valve.

2.4.6.2 Visual Inspection

- Check installed after market equipment that may affect auxiliary emission control devices operation.
- Check the easy to access system components to identify whether there is significant damage or the existence of an external leakage.
- Check whether the fuel is the recommended type and fill up the fuel tank.

2.4.6.3 Canister Solenoid Valve Inoperative

Schematic:



Diagnostic Steps:

Step 1	Check engine emission malfunction warning lamp.

(a) Start the engine.

Check whether the engine emission malfunction warning lamp is lit.

No → Go to step 3

Yes

Step 2	Repair the engine control system fault.

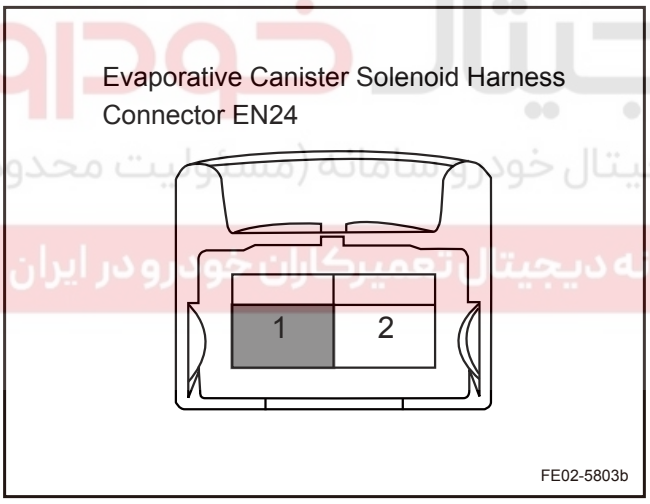
(a) Repair the engine control system fault. Refer to 2.2.7.33 DTC P0444 P0458 P0459.

Is canister solenoid valve working properly?

Yes → System normal

No

Step 3	Check canister solenoid valve power supply circuit.



(a) Turn on the ignition switch.

(b) Measure the canister solenoid valve EN24 terminal No.1 voltage with a multimeter.

Standard Voltage: 11-14 V

Yes → Go to step 5

No

Step 4	Repair the main relay.

(a) Turn off the ignition switch.

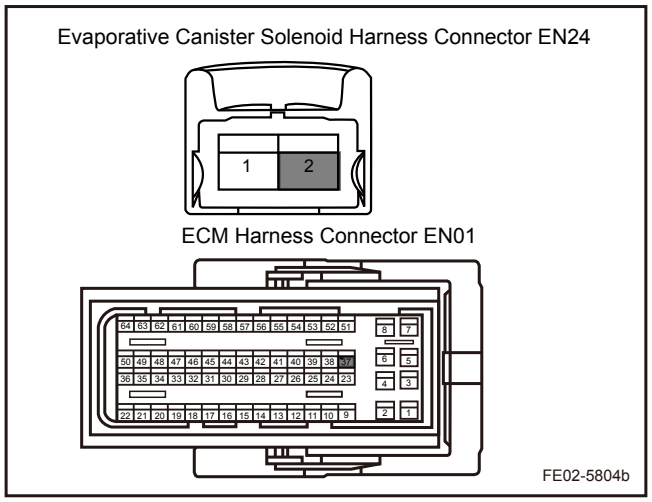
(b) Repair the main relay circuit. Refer to 2.2.7.37 DTC P0560 P0562 P0563.

Is canister solenoid valve working properly?

Yes → System normal

No

Step 5	Check canister solenoid valve wiring harness connector and ECM harness connector circuit.



(a) Turn off the ignition switch.
(b) Check resistance between solenoid valve wiring harness connector EN24 terminal 2 and ECM harness connector EN01 terminal No.37 with the multimeter and confirm the circuit continuity.

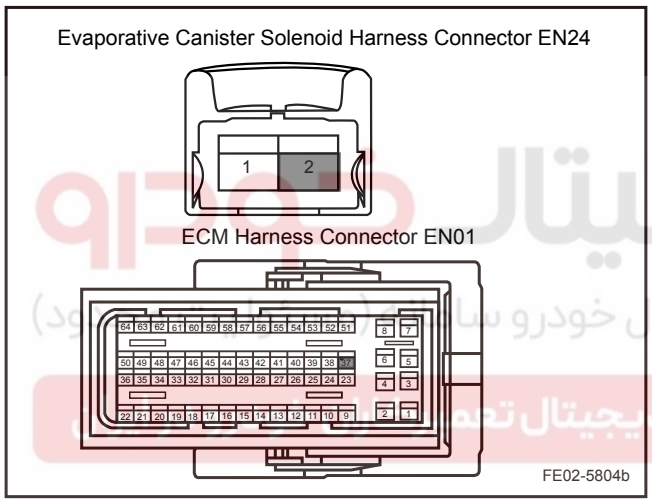
Standard Resistance Value: Less than 1 Ω

Is the resistance standard?

Yes → Go to step 7

No

Step 6	Repair Canister solenoid valve wiring harness connector and ECM harness connector.



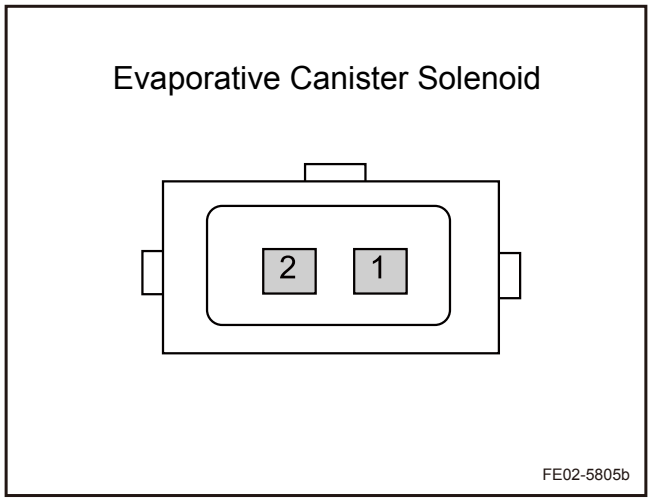
(a) Turn off the ignition switch.
(b) Repair open circuit fault between Canister solenoid valve wiring harness connector EN24 terminal No.2 and ECM harness connector EN01 terminal No.37.

Is canister solenoid valve working properly?

Yes → System normal

No

Step 7	Check canister solenoid valve.



(a) Turn off the ignition switch.
(b) Check canister solenoid valve resistance.

Standard Resistance Value: 26 Ω/20°C(68 ºF)

Is the canister solenoid valve resistance standard?

Yes → System normal

No

Step 8	Replace the canister solenoid valve.

(a) Turn off the ignition switch.
(b) Replace the canister solenoid valve. Refer to 2.4.7.3 Canister Solenoid Valve Replacement.

Confirm the repairs completed.

Next

Step 9	System normal.

2.4.6.4 Crankcase Ventilation (PCV) System Check / Diagnostic

Step 1	Check crankcase ventilation hose whether there is a vacuum. vacuum should be present in the Hose. If not, check whether the hose is blocked, leaking or ventilation tube connector blocked.

Next

Step 2	With the engine running, plug the vacuum hose end. When the hose end plugged, check whether there is collapse in all parts of the hose. If hose collapses, the hose should be replaced.

Next

Step 3	If the engine oil gathered in the intake manifold, check whether there are following situations.

(a) Crankcase vacuum hole blocked.
(b) Crankcase ventilation hood blocked .
(c) Crankcase pressure or channeling gas beyond the acceptable tolerance range. Refer to 2.9.7.3 Abnormal Engine Oil Consumption Diagnostic.

Next

Step 4	Check other parts.

(a) Fresh air ventilation or vent hose assembly connector blocked or leaking.
(b) Throttle body channel blocked.
(c) O-ring missing or damaged.
(d) Check cylinder head covers, oil pan gasket and other sealing parts for leaking.

Next

Step 5	End.

The consequences of not working correctly

1. If the crankcase ventilation hose is blocked, it will cause the following faults:
   - idle instable.

- Engine stalls or idle speed is too low.
- Engine oil leakd.
- Engine oil enters the intake.
- Engine sludges.

2. Ventilation hood or hose leak may lead to the following faults:
   - Poor idle.
   - Engine stall.

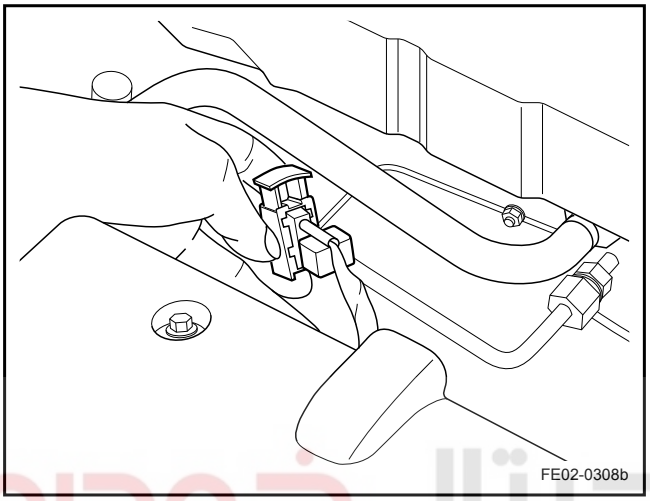
2.4.7 Removal and Installation

2.4.7.1 Post-Catalytic Oxygen Sensor Replacement

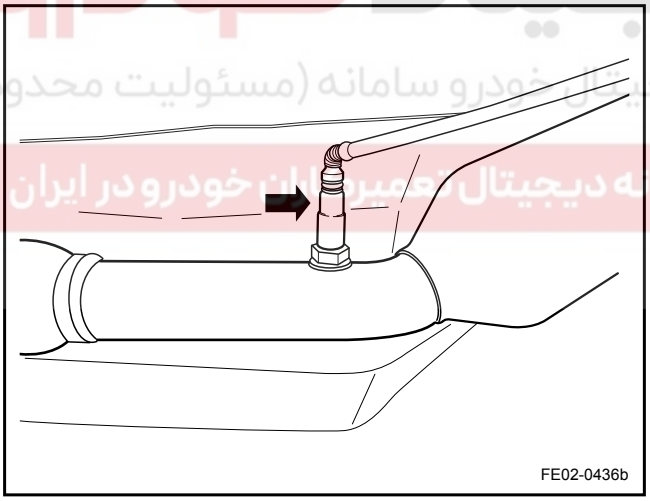
Removal Procedure:

Warning!

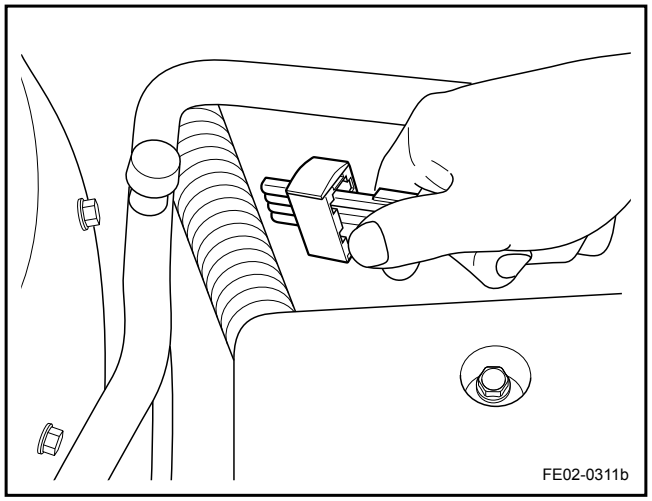
Refer to "Exhaust Service Warning", and "Vehicle Lifting Warning" in "Warnings and Notices".



1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect the post-catalytic oxygen sensor wiring harness connector.



3. Lift the vehicle.
4. Remove the heated post-catalytic oxygen sensor.



Installation Procedure:

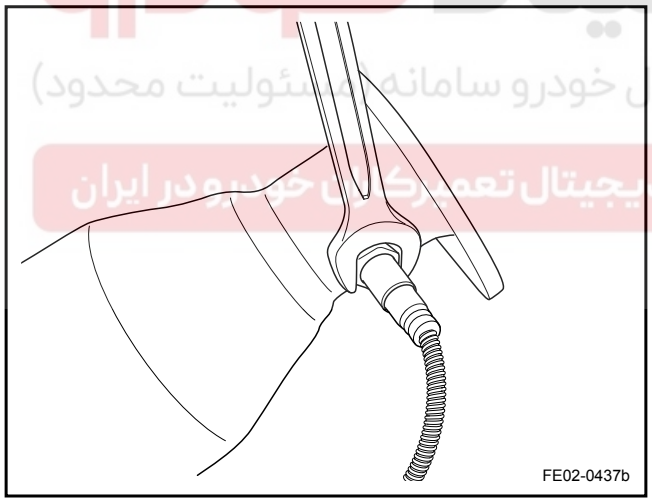
1. Install the heated post-catalytic oxygen sensor.
2. Lower the vehicle.
3. Connect the post-catalytic oxygen sensor wiring harness connector.
4. Connect the battery negative cable.

2.4.7.2 Pre-Catalytic Oxygen Sensor Replacement

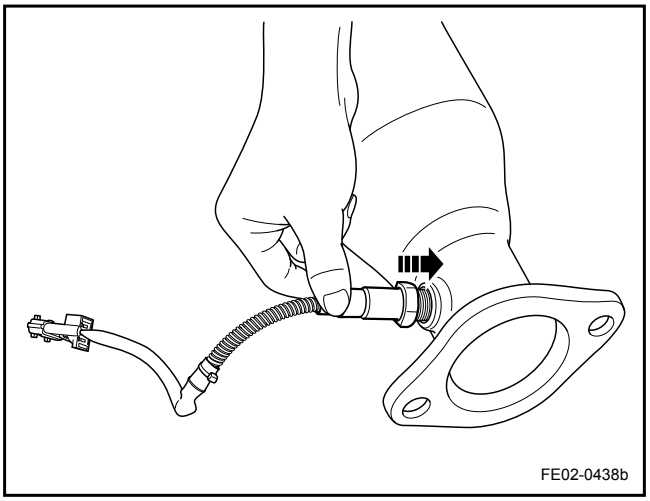
Removal Procedure:

Warning!

Refer to "Exhaust Service Warning" in "Warnings and Notices".

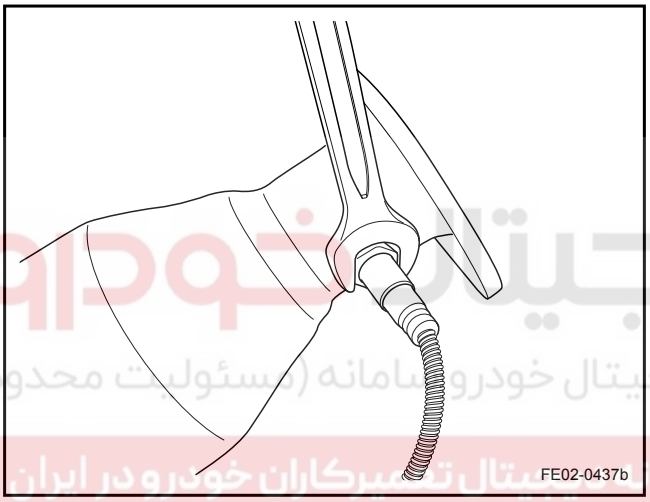


1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove the three-way catalytic converter. Refer to 2.7.6.2 Three-way Catalytic Converter Replacement.
3. Remove the heated Pre-Catalytic oxygen sensor.



Installation Procedure:

1. Install the heated pre-catalytic oxygen sensor.



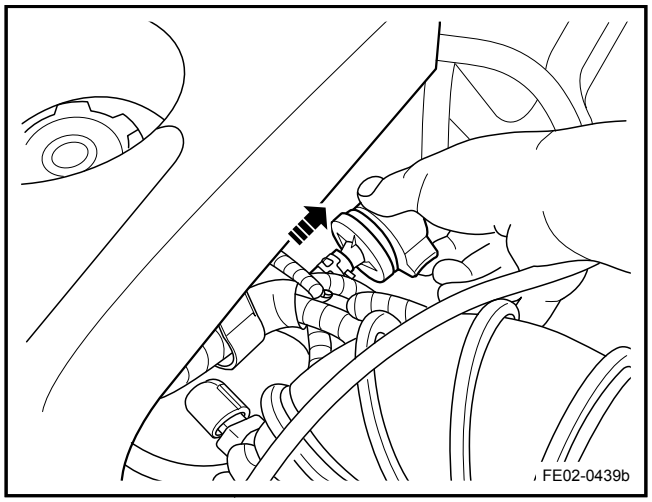
2. Tighten the heated pre-catalytic oxygen sensor.
3. Install the three-way catalytic converter.
4. Connect the battery negative cable.

2.4.7.3 Canister Solenoid Valve Replacement

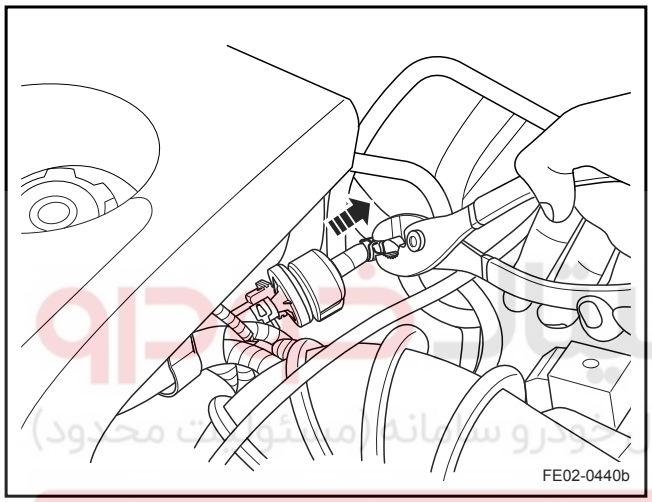
Removal Procedure:

Warning!

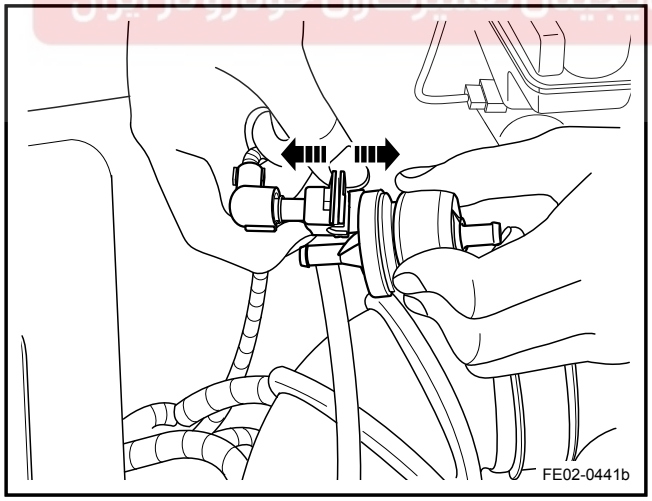
Refer to "Battery Disconnection Warning" in "Warnings and Notices".



1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove the canister solenoid valve from the mounting bracket.

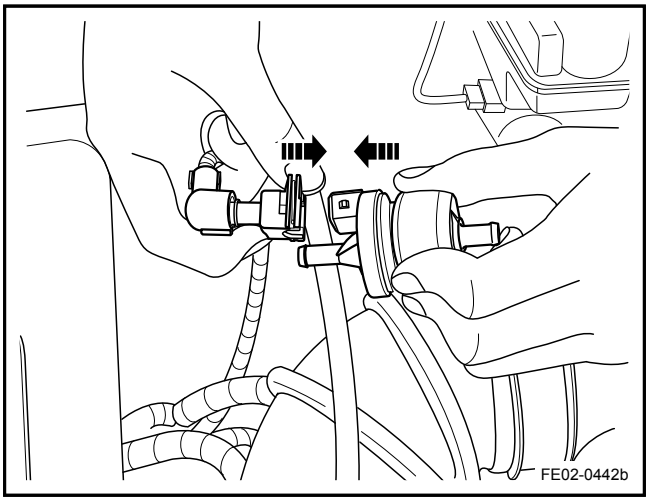


3. Disconnect the canister solenoid valve vacuum tube.

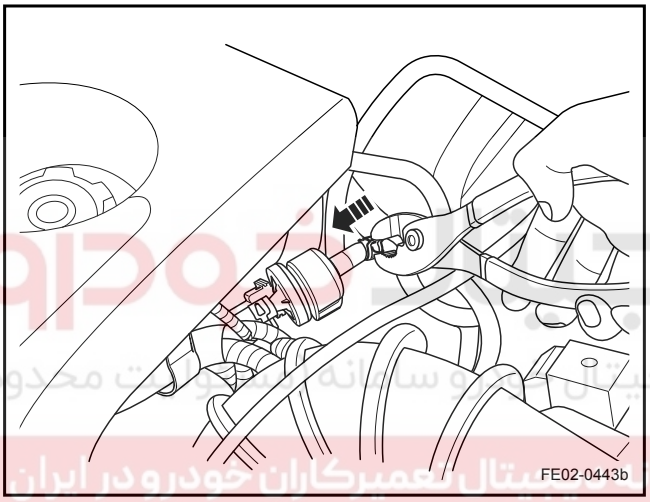


4. Disconnect canister solenoid valve wiring harness connector.

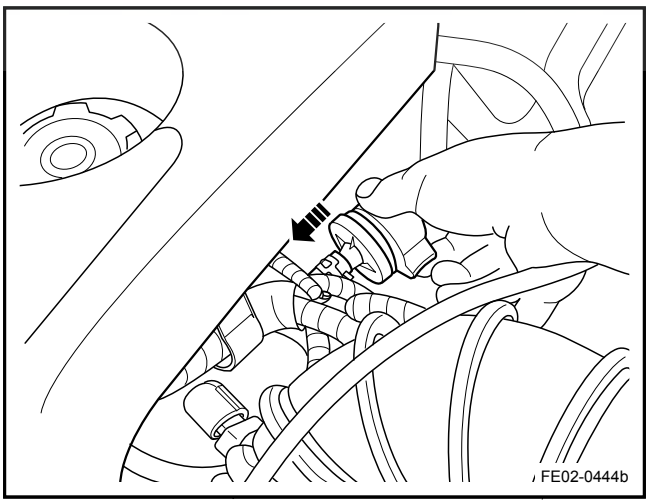
Installation Procedure:



1. Connect canister solenoid valve wiring harness connector.



2. Connect canister solenoid valve vacuum tube.



3. Install the canister solenoid valve to the mounting bracket.
4. Connect the battery negative cable.