

GROUP

3

Powertrain

3.1 Engine - 1.6L

3.1.11 Emission Control System 3.1.11-1

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



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Description and Operation

System Overview

Positive Crankcase Ventilation System

At the end of the engine power combustion process, some unburned mixture leaks from the piston rings into the crankcase with high pressure, this leakage is called "blow-by gas". The blow-by gas contains the nitrogen oxides, carbon monoxide and hydrocarbons. If the mixed gas is not eliminated, the oil in the crankcase will be diluted, so that the engine oil will begin deterioration to cause the premature wear to engine. This blow-by gas will escape into the atmosphere from the crankcase which will cause pollution. In order to prevent blow-by gas emission into the atmosphere, at the same time prevent the oil from deterioration, use the positive crankcase ventilation system to conduct the gas that in the crankcase back into the inlet system, so that the blow-by gas go through the PRV valve from the inlet manifold into the combustion chamber to be burn.

The positive crankcase ventilation system consists of the following components:

- Positive crankshaft ventilation valve
- Crankcase ventilation vacuum tube
- Crankcase air outlet hose

The main control unit of the engine crankcase blow-by gas is the positive crankcase ventilation (PRV) valve. The positive crankcase ventilation valve measures the blow-by gas flow rate based on the manifold vacuum signal. The positive crankcase ventilation valve allows some of the vacuum pressure to go through the valve internal orifice and form low pressure in the crankcase. The blow-by gas in the crankcase then is absorbed into the inlet system and then be burn out during the normal combustion. The blow-by gas that goes into the inlet manifold is precisely controlled to maintain the idle speed quality. Use the correct positive crankshaft ventilation valve that has been properly calibrated. The relationship between the flow rate of the blow-by air flow and the vacuum rate of the engine manifold is showed in the following table:

Manifold Vacuum	Positive Crankshaft Vent Valve Opening	Blow-by Gas Flow Rate
Low	Large	Much
High	Small	Little



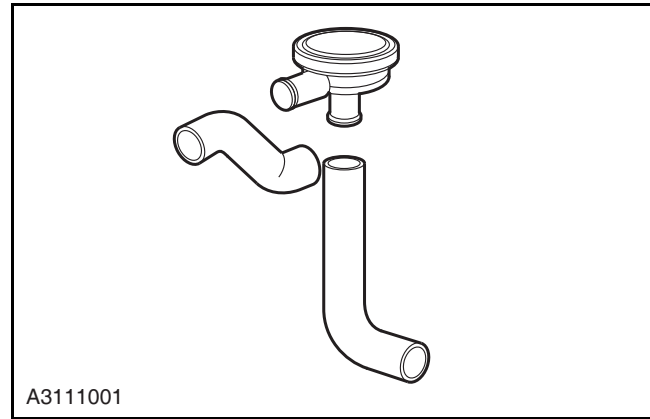
Evaporative Emission (EVAP) Control System

The fuel stored in fuel tank will generate the fuel vapor due to temperature, shaking and other factors. The fuel vapor will escape from the fuel tank into the atmosphere to cause pollution. In order to avoid deterioration of emission, the fuel evaporative emission (EVAP) control system can control emission of fuel vapor. It is activated carbon filter tank storage method. This method transfers the fuel vapor from the fuel tank to carbon canister, or the gasoline vapor from the fuel tank into the fuel vapor recovery pipeline, the carbon can absorb and save the steam when the vehicle is not running. When the engine is running for a required time period, engine control module provides a ground circuit to meet the requirements of the clean working conditions, so that the evaporative emission canister purge valve is energized, air is inhaled into the carbon canister and mixed with steam. Then the mixture of the fuel vapor is sucked out from the carbon then goes into the inlet manifold to enter the cylinder to be consumed in the normal combustion process. The evaporative emission canister purge valve is controlled by the pulse width modulation (PWM) signal. The operating conditions determined by the air flow, fuel regulator and the intake air temperature control the PWM signal duty changes of evaporative emission canister purge valve.

Component Description

Positive Crankcase Ventilation Valve (PRV)

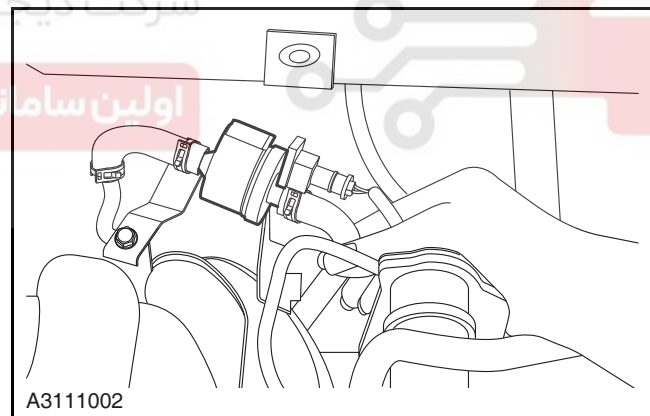
The positive crankcase ventilation valve includes the body, valves, cover and spring. The lower positive crankcase ventilation valve connects to the air inlet manifold by the air inlet vacuum hose, and the upper part connects to the valve chamber cover by the crankcase air outlet hose. The leakage beyond the system capacity (severe wear from the engine, continuous overload, etc.) enters into the air inlet pipe, and been brought into the engine due to the system conditions. The crankcase ventilation system correct operation depends on the engine seals. If the observed oil oxidation or dilution and crankcase ventilation system is normal, inspect the engine to determine the possible causes. Repair the fault.



Evaporative Emission Canister Purge Valve

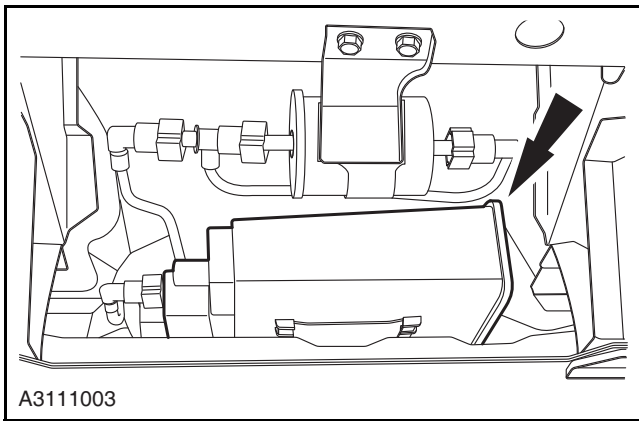
As a NC evaporative emission canister purge valve, it controls the steam flow from the evaporation emission system to the inlet manifold. This valve has its pulse width modulation (PWM) by engine control module to control the fuel steam flow to the engine accurately.

In the evaporative emission system testing process, this solenoid will open to make the engine vacuum enter the evaporative emission system.



Evaporative Emission Carbon Canister

The evaporative emission carbon canister is an activated carbon particles with the emission control device. The evaporative emission carbon canister is used to absorb and store the fuel vapor. The fuel vapor is always been stored in the carbon canister, when meeting certain conditions, the engine control module will power the carbon canister discharge valve so that the fuel vapor is drawn off the engine cylinder and been combusted.



The following conditions can lead to poor idle, stalling and poor maneuverability:

- The carbon canister solenoid does not work.
- The carbon canister is damaged.
- The hose is broken, cracked, or not properly connected to the pipeline.

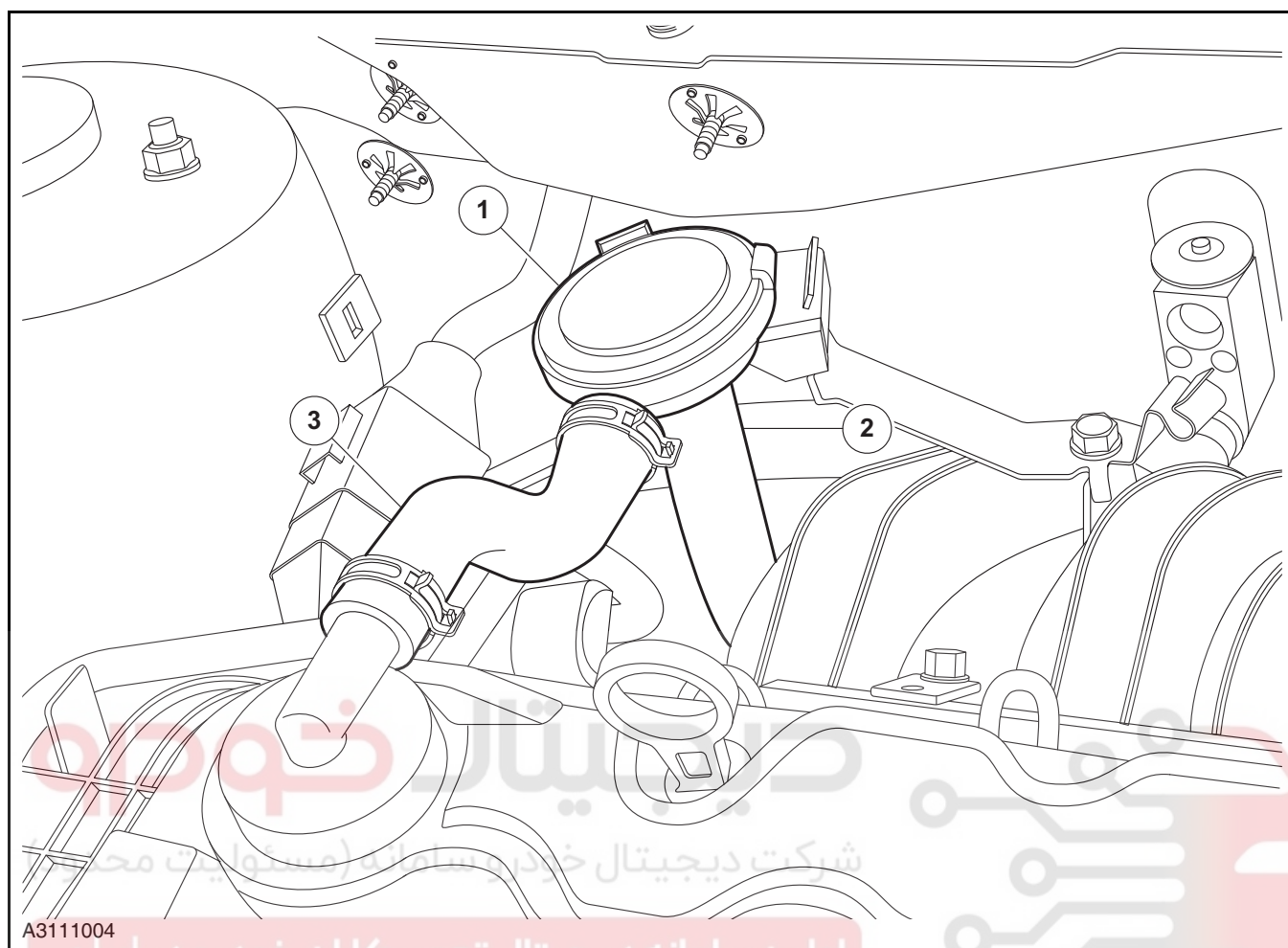
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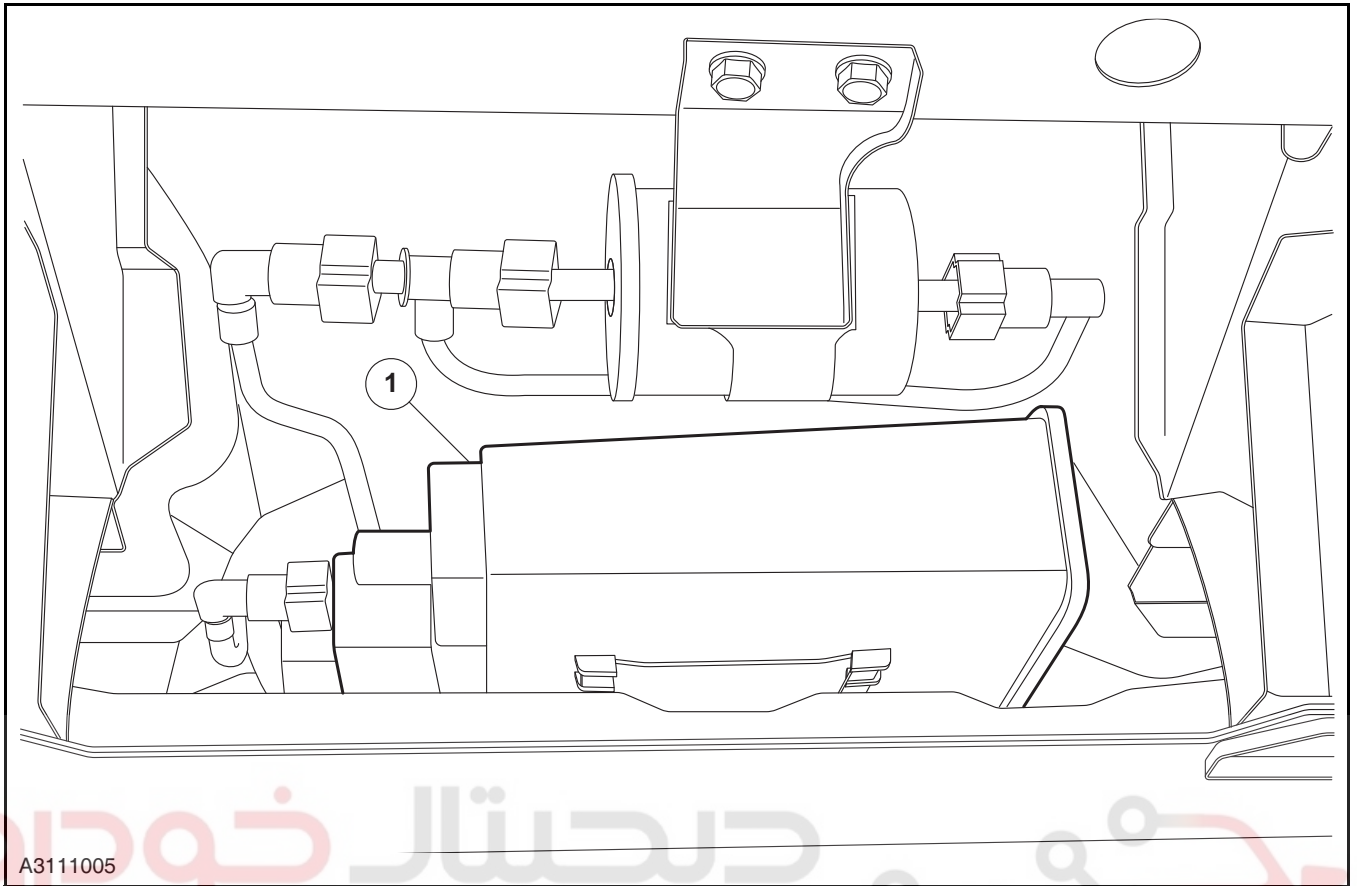
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Location View



Item	Description	Item	Description
1	PRV valve	3	Crankcase air outlet hose
2	Ventilation vacuum tube		



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Item	Description
1	Carbon canister

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General Procedures

General Equipment

Digital Multimeter

PCV Valve Inspection

If the engine idle speed is unstable, inspect the crankcase ventilation valve to see if it is blocked, if the vent filter, air filter is too dirty or the filter or the hose is blocked. Perform the following procedures:

1. Remove the crankcase ventilation valve from the valve chamber cover.
2. Start the engine at idle speed.
3. Put a finger on the valve side to inspect for vacuum. In case the valve is free of vacuum, inspect for the following conditions:
 - The hose is blocked.
 - The manifold port is blocked.
 - The crankcase ventilation valve is blocked.

The PRV valve or hose clogged may cause the following malfunctions:

- The engine idle is unstable.
- The engine stall or idle speed is too low.
- The engine oil leaks.
- The oil enters the air filter.
- The oil is dirty in engine.
- The engine crankcase pressure is too high.

The PRV valve or hose leakage can lead to the following conditions:

- The engine idle is unstable.
- Engine stalling
- Too high engine idle speed
- Engine oil leakage

Evaporative Emission Canister Purge Valve Inspection

Perform the following procedures:

1. Remove the vacuum hose from the sewage solenoid valve.
2. Start the engine at idle speed.
3. Put a finger on the remote vacuum hose, inspect whether the tube is vacuum. In case it is free of vacuum, inspect for the following conditions:
 - The vacuum hose is clogged.
 - The vacuum hose is cracked.
4. Use the appropriate source blow gas from the solenoid imports, the valve channel should be blocked, if there is leakage, replace the solenoid.
5. Use the diagnostic tool to drive the solenoid, then use the appropriate gas supply to blow from the solenoid, the valve channel should be connected, if the channel is berried, repair the fault valve does not work.

Carbon Canister Inspection

1. Inspect the carbon canister ventilation pipe on the filter, if there is any blockage, crack, or deformation, replace the filter.
2. Carbon canister visual inspection: if there is crack or deformation, if so, replace it.
3. Remove and shake the carbon canister, if there is abnormal noise, replace it.
4. Inspect the hose connections on the carbon canister, if blocked, damaged, replace it.
5. Use a suitable gas source, blow from a pipe mouth of the carbon canister, then should flow out from the two other orifices, if there is no gas flow, replace the carbon canister.

Symptom Diagnosis and Testing

General Equipment

Digital Multimeter

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage or electric damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If no obvious problem been found, confirm the failure and refer to the symptoms chart.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> • Hose/Hose joint • Gasket • Positive crankcase ventilation valve • PRV separator • Vacuum tube • Evaporative emission carbon canister • Evaporative emission system pipeline 	<ul style="list-style-type: none"> • Eletronic connector • Wiring harness • Fuse • Relay • Carbon canister sewage valve • Engine control module (ECM)



Symptom Chart

If there is a symptom but no diagnosis trouble code (DTC) is stored in control module and can not confirm the symptom reasons in basic inspect, it is necessary to diagnosis and eliminate the symptoms in the following chart.

Symptom	Possible Sources	Solutions
The crankcase pressure is too high.	<ul style="list-style-type: none"> The PRV valve or hose is clogged or damaged. The crankcase ventilation oil separator is blocked. 	<ul style="list-style-type: none"> Inspect the PRV system for components block, if necessary, clean or install new components.
	<ul style="list-style-type: none"> Engine component is worn or damaged. 	<p>Refer to: Mechanical System (3.1.2 Mechanical System, Assembly and Disassembly).</p>
The evaporative emission system leaks.	<ul style="list-style-type: none"> The purge pipe is cracked. Carbon canister is broken. 	<ul style="list-style-type: none"> Replace the purge pipe. Replace the carbon canister.
The evaporative emission system is blocked.	<ul style="list-style-type: none"> The ventilation pipe is blocked. 	<ul style="list-style-type: none"> Clean the ventilation pipe. Replace the ventilation pipe. Replace the ventilation pipe filter.
	<ul style="list-style-type: none"> Purge pipe is blocked. 	<ul style="list-style-type: none"> Clean the sewage draining port. Replace the purge pipe.
	<ul style="list-style-type: none"> Solenoid pipe is blocked. 	<ul style="list-style-type: none"> Clean the solenoid pipe. Replace the solenoid.
The evaporative Emission Canister Purge Valve does not work.	<ul style="list-style-type: none"> Circuit fault Evaporative Emission Canister Purge Valve fault ECM fault 	<ul style="list-style-type: none"> Diagnose the DTC. Inspect and repair the circuit. Replace the evaporative emission canister purge valve. Replace the ECM.

Evaporative Emission Canister Purge Valve Not Work Diagnosis

Refer to: DTC P0444, P0458, P0459 Diagnosis (3.1.13 Electrical Control System - ME7, DTC Diagnosis and Testing).

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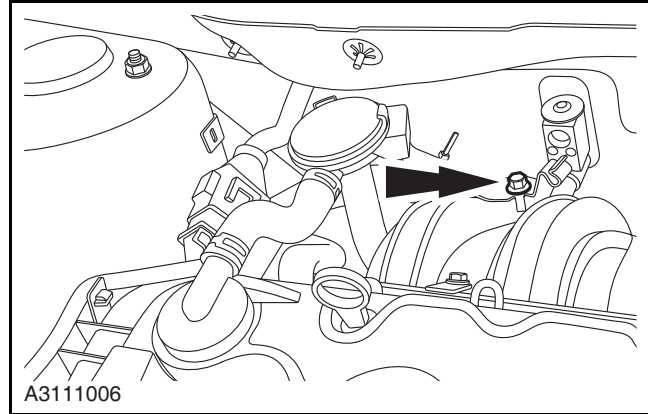
Removal and Installation

PRV Valve

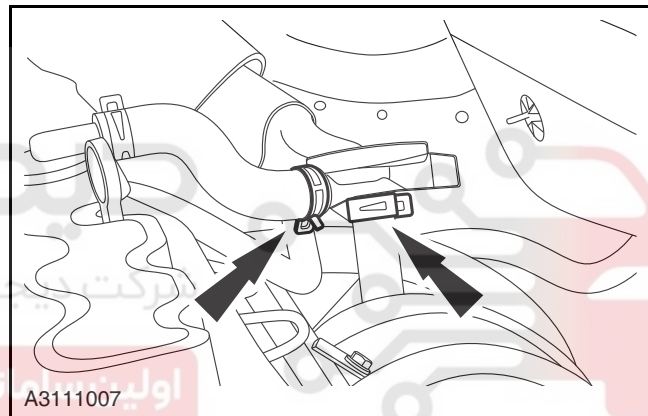
Removal

1. Remove the PRV valve fixed support bolt and take out the fixed support.

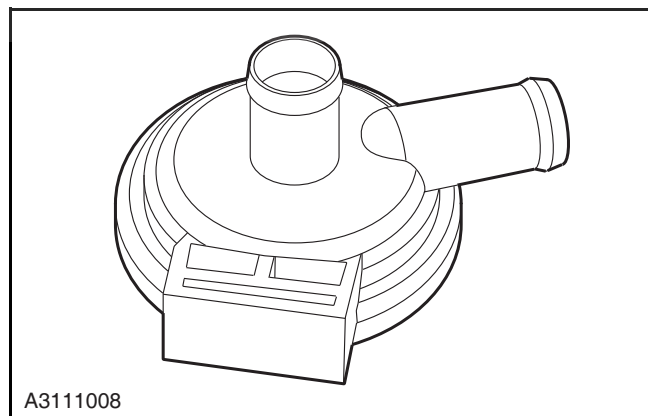
Torque: 10 Nm



2. Release the PCV vacuum tube clamp holder and detach the PCV vacuum tube.




3. Check the PRV valve and replace it if necessary.



Installation

1. To install, reverse the removal procedure.

 **CAUTION:** After installation, inspect whether the intake manifold leaks.

Refer to: Air Intake System Leakage Diagnosis (3.1.5 Intake System, Symptom Diagnosis and Testing).

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EVAP Solenoid Valve

Removal

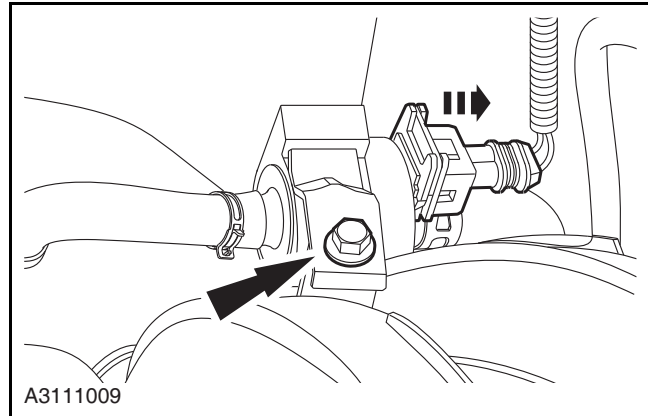
1. Disconnect the battery negative cable.

Refer to: [Battery Inspection \(3.1.10 Charging System, General Procedures\)](#).

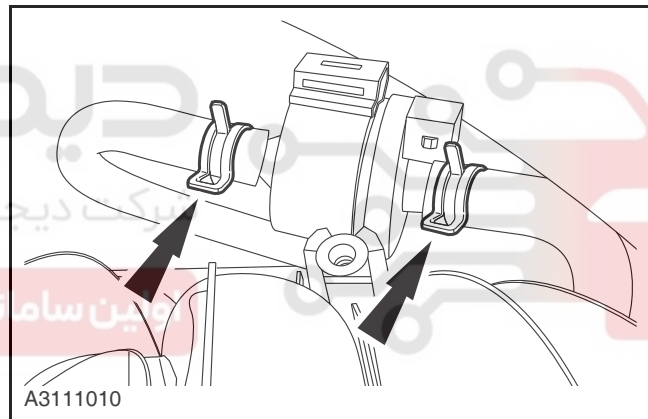
2. Remove the EVAP solenoid valve support bolt and take out the EVAP solenoid valve support.

Torque: 10 Nm

3. Disconnect the EVAP solenoid valve wiring harness connector.



4. Release the EVAP solenoid valve hose clamp holder and disengage the EVAP hose valve.



Installation

1. To install, reverse the removal procedure.

⚠ CAUTION: After installation, inspect whether the intake manifold leaks.

Refer to: [Air Intake System Leakage Diagnosis \(3.1.5 Intake System, Symptom Diagnosis and Testing\)](#).

Active Carbon Canister

Removal

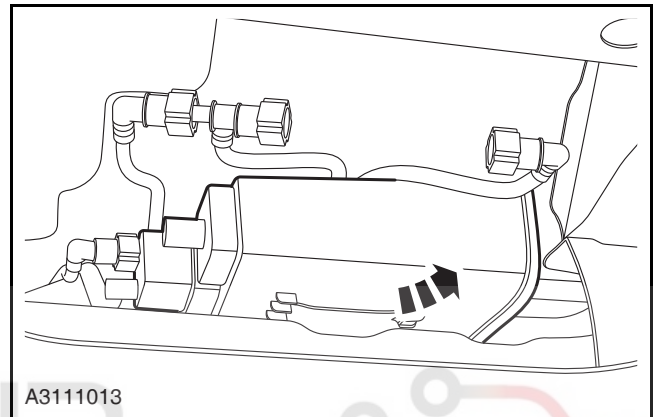
1. Disconnect the battery negative cable.

Refer to: [Battery Inspection \(3.1.10 Charging System, General Procedures\)](#).

2. Remove the fuel filter.

Refer to: [Fuel Filter \(3.1.7 Fuel System, Removal and Installation\)](#).

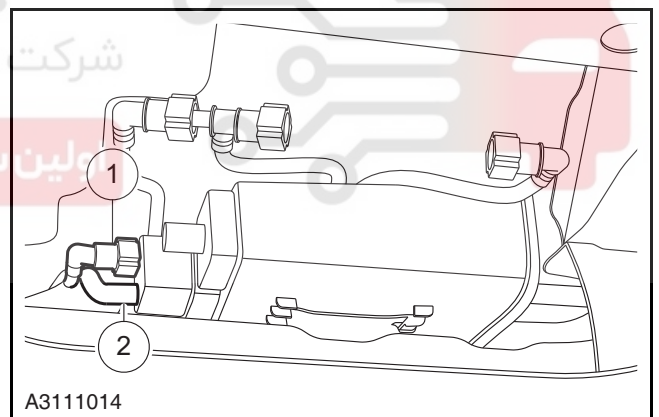
3. Remove the retaining nut of the active carbon canister.



4. Disengage the hose 1 that from the active carbon canister to the fuel tank.

5. Disengage the hose 2 that from the active carbon canister to the solenoid valve.

6. Take out the active carbon canister.



Installation

1. To install, reverse the removal procedure.

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