# **FUEL SYSTEM**

1890-01/1890-02/2211-00/2211-01/2211-02/2211-03/ 2211-16/

# **FUEL SYSTEM**

GENERAL INFORMATION		REMOVAL AND INSTALLATION	
1. SPECIFICATIONS	3	1890-02 INJECTOR	23 28 31
OVERVIEW AND OPERATING		2211-00 FUEL FILTER2211-16 FUEL FILLER ASSEMBLY	37
PROCESS		2211-01 FUEL TANK ASSEMBLY 2211-03 CANISTER	39 42
1. OVERVIEW	4 4 5		
4. SYSTEM DIAGRAM 5. FUEL EVAP CONTROL SYSTEM	7 ب سا 8 ان		

#### **CONFIGURATION AND FUNCTIONS**

1890-02 INJECTOR	9
1890-01 FUEL RAIL	12
2211-02 FUEL PUMP ASSEMBLY	13
2211-01 FUEL TANK ASSEMBLY	20
2211-03 CANISTER	22





# **FUEL SYSTEM**

# 1890-01

# **GENERAL INFORMATION**

# 1. SPECIFICATIONS

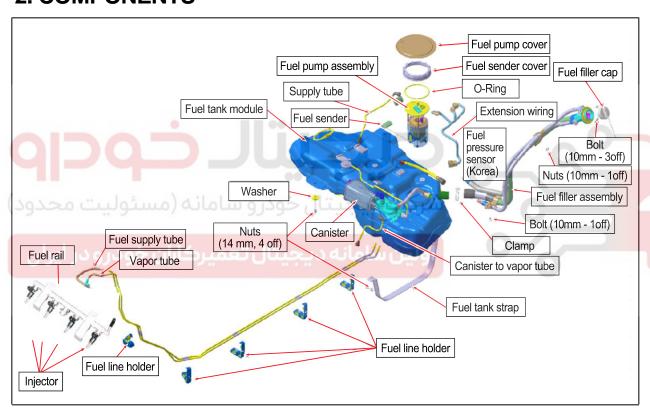
	Category	Specifications		
Fuel		Gasoline		
Fuel tank	Capacity	47 L		
	Material	Plastic		
Fuel filter	Туре	Micro paper type		
	Location	Built in the fuel pump		
	Service interval	Inspect every 30000 km (if using poor quality of fuel, replace every 50000 km)		
Low pressure fuel	Туре	Built in the tank, electric		
pump	Drive	Electric motor		
	Fuel pressure	3.8 bar (110 L/H)		
	Current consumption	6.5 A (12 V, 3.8 bar)		
Fuel pressure	ا دیجیتال خودرو سType	Built in the fuel pump		
regulator	Fuel pressure	3.8 ± 0.05 bar		
ناران خودرو در	Remaining pressure in 30 minutes after key OFF:	2.1 bar or higher		
Injector	Injection holes	4 holes		
	Component resistance	12 Ω ± 5%		
	Rated operating mass flow	2.60 g/sec		
	Injector type	Deka 7		

# **OVERVIEW AND OPERATING PROCESS**

### 1. OVERVIEW

The fuel system consists of fuel tank, fuel pipe line, fuel filter, fuel pump, fuel pressure regulator, injectors, fuel rail. The fuel system is a returnless control type system in which the fuel pressure regulator is built in the fuel pump. This system is controlled by the engine ECU and each injector of the system injects the fuel. The system also has a fuel evaporative control system which forces or blocks the vapor gas stored in the canister to the combustion chamber using the operation of purge control solenoid valve based on the engine load condition.

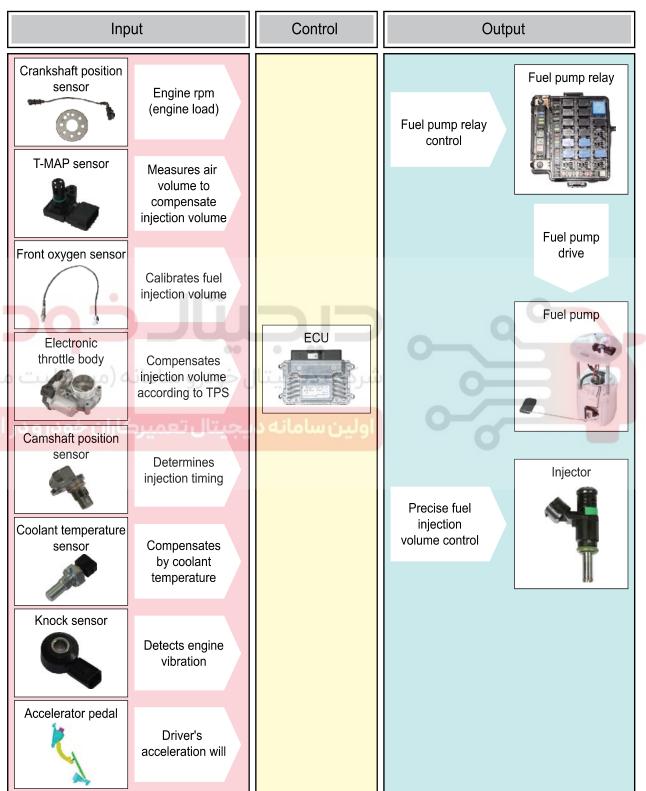
### 2. COMPONENTS



I V O L

### 3. OPERATING PROCESS

The ECU determines fuel injection volume and injection timing based on the engine condition and optimizes the engine operating conditions to reduce the emissions.



#### Basic mapping

#### Stepped control

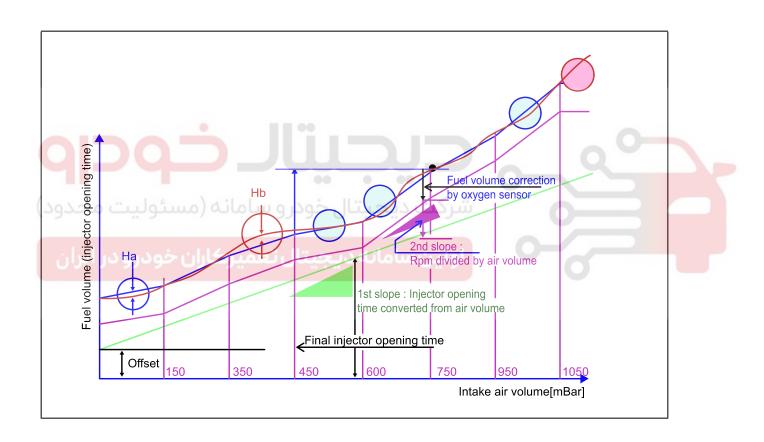
The ECU calculates proper injection volume and timing by considering various parameters to achieve the optimal combustion at each stage of operation.

#### - Starting injection volume control

The fuel injection volume during initial starting is calculated by considering the temperature and engine cranking speed. The starting injection means the injection during the period from when the ignition switch is turned ON until when the engine rpm reaches to the allowable minimum speed.

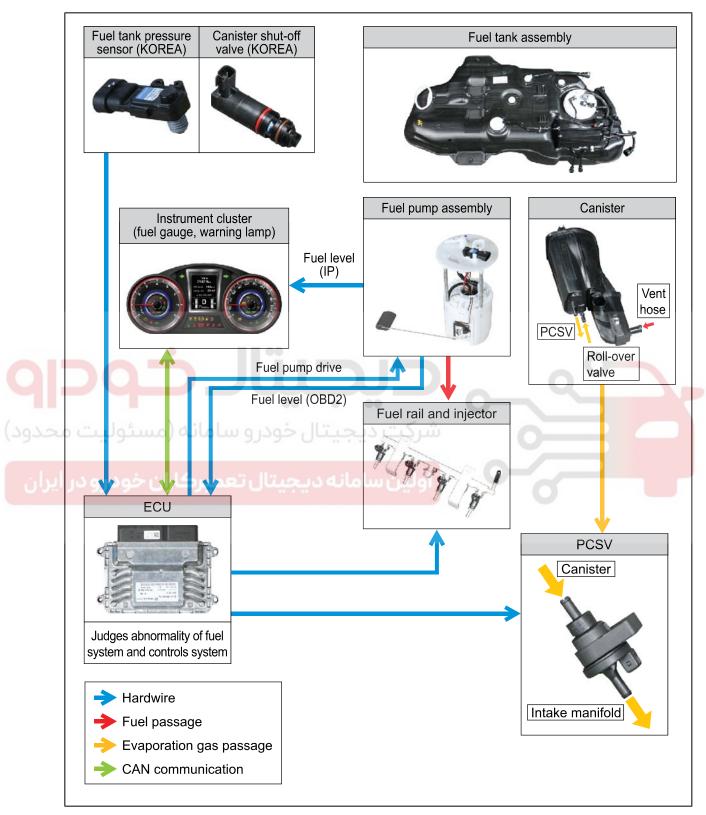
#### **Driving mode control**

- The fuel injection volume during normal driving is calculated based on the accelerator pedal travel and engine rpm and the drive map is used to match the drivers inputs with optimal engine power.



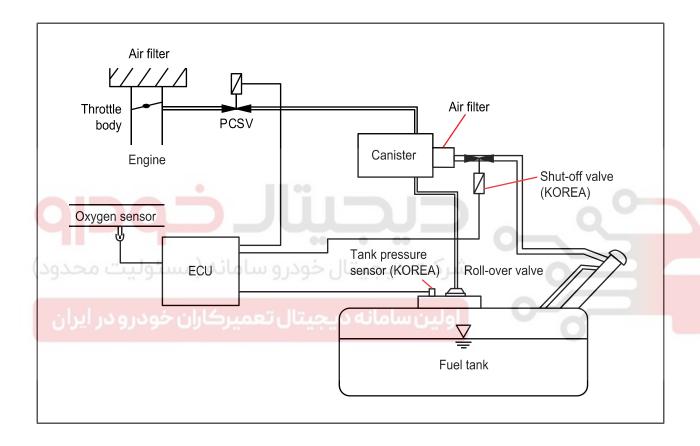
I V O L

# 4. SYSTEM DIAGRAM



### 5. FUEL EVAP CONTROL SYSTEM

The fuel evaporative control system stores the evaporative gas in the canister to prevent the evaporated fuel being released into the atmosphere. This system diagnoses the internal system and checks for abnormalities in the system by using the pressure sensor and canister shut-off valve installed to the fuel tank. The purge control solenoid valve (PCSV) is operated by the engine ECU control according to the engine load condition. The fuel evaporative gas, stored in the canister, is drawn into the engine due to vacuum condition (negative pressure) of the engine when the PCSV is open while the fuel evaporative gas in the fuel system is sucked and stored in the canister when the PCSV is closed.



FUEL SYSTEM

# **CONFIGURATION AND FUNCTIONS**

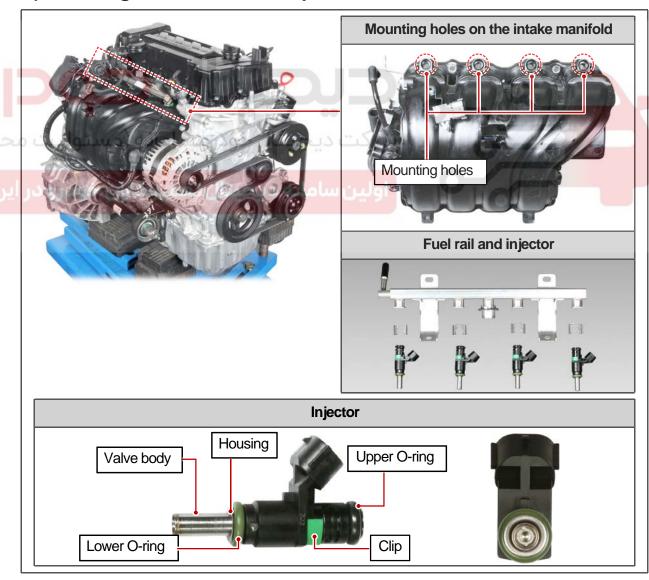
# 1890-02 INJECTOR

## 1) Overview

The injector is controlled by the ECU. The ECU receives the piston position signal and engine speed signal from the crankshaft position sensor and camshaft position sensor, and controls the injector at the ignition timing for each cylinder.

The fuel is injected when the solenoid valve in the injector is powered by the ECU and magnetized. The fuel is converted from the liquid to gaseous state at the time of injection, and this gas goes into the combustion chamber with the air to be burned. The operating time of the injector is controlled by the ECU based on the engine rpm and information from various sensors. The fuel is injected in the sequence of cylinder No. 1, 3, 4, and 2.

# 2) Mounting Location and Components



TIVOLI

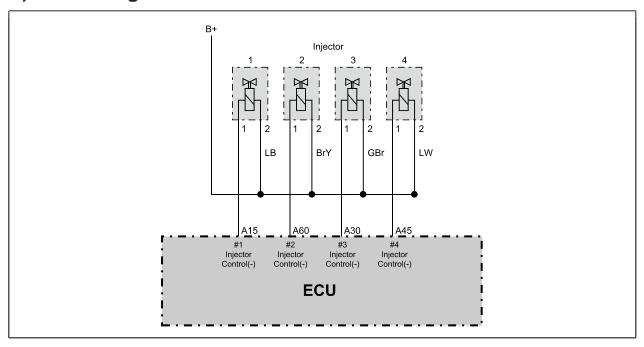
Category	Specifications	
Injection holes	4 holes	
Internal component resistance	12 Ω ± 5%	
Rated operating mass flow	2.60 g/sec	
Injector type	Deka 7	

# 3) Connector



Pin No.	Function
ىئوليت1محدود	Ground (ECU) يتال خودرو سامانه (مس
2	Power supply
فودرو در ایران	اولین سامانه دیجیتال تعمیرکاران -

# 4) Circuit Diagram



**FUEL SYSTEM** 

TIVOLI 2015.03

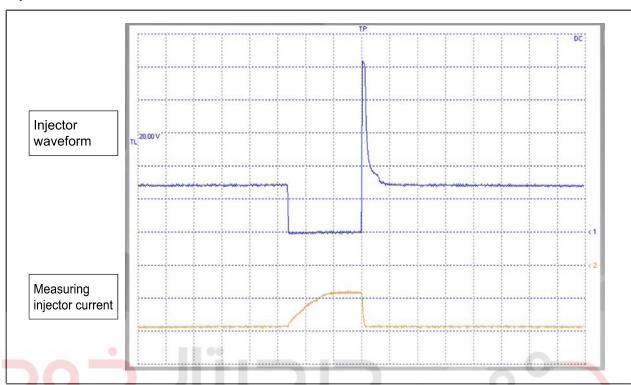
Modification basis

Application basis

Affected VIN

021 62 99 92 92

# 5) Waveform



Measurement condition	At idling مرکت دیجیتال خودرو ساه					
No. 1 injector	No. 1 channel	No. 2 channel				
Measuring method	Measuring probe (+) A15 Measuring probe (-) Body ground	Small current measuring (No. 2 injector wiring)				
Component resistance	12 Ω ± 5%					
Service check	<ul> <li>It is normally supplied with battery power. However, its voltage gets close to 0 V (theoretically) and fuel is sprayed through the injector when the ECU drives (grounds) the injector. When the engine control module does not ground the injector, the injector is closed and peak voltage is generated in a moment.</li> <li>Place the injector into a transparent container (such as a beaker) and operate the injector forcibly to check the injection pattern and droplet in order to find a cause of misfire.</li> </ul>					

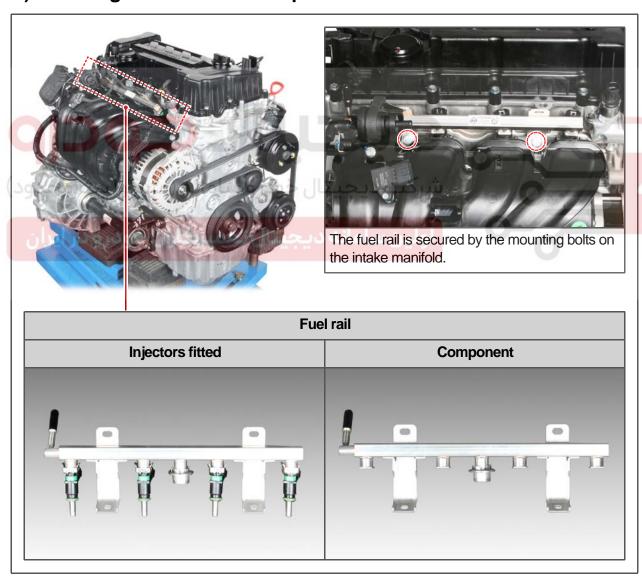
# 1890-01 FUEL RAIL

# 1) Overview

The fuel rail is installed on top of the intake manifold and is equipped with a pulsation damper which reduces fuel pulsation. Four injectors are mounted to the fuel rail holes. The supply pipe connected to the fuel pump is fitted to the No. 4 injector side.

- Specified fuel pressure: 3.8  $\pm$  0.05 bar
- Remaining pressure in 30 minutes after key OFF: 2.1 bar or higher
- Measured value of fuel pump operating performance: 35 sec/1  $\ell$  or more

## 2) Mounting Location and Components

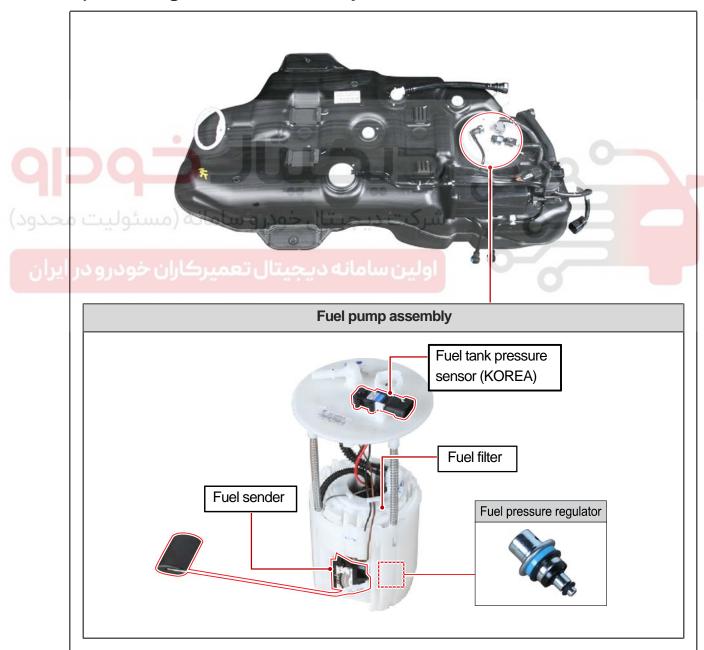


# 2211-02 FUEL PUMP ASSEMBLY

# 1) Overview

The fuel pump assembly is installed in the fuel tank. It draws in the fuel stored in the fuel tank and supplies the fuel to the injectors fitted to the fuel rail through the built-in fuel filter. The fuel pressure regulator integrated to the fuel pump regulates the fuel pressure so that the fuel with constant pressure is supplied to the fuel rail and the remaining fuel is re-circulated. This type of control is called "returnless" control. The fuel pump is operated for 1 to 2 sec. when the ignition is turned ON to raise the low remaining pressure to the correct pressure.

# 2) Mounting Location and Components

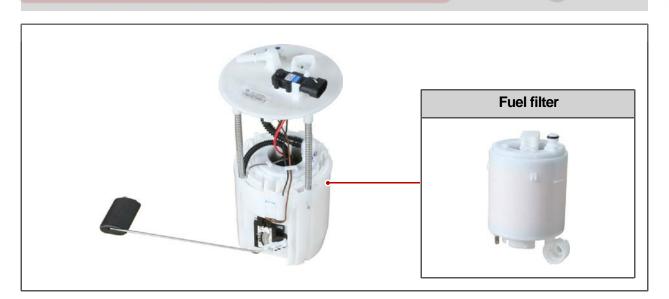


# **Exploded View** 1. Extension wiring 2. Housing bracket 3. Fuel pump motor 4. Retaining pin 5. Plate assembly 6. Mount rubber 7. Assist valve 8. Fuel pressure regulator cover 9. Fuel filter 10.Reservoir cup 11.Pre-filter 12. Fuel pressure regulator 13.Fuel sender

# شرکت دیجیتال خودر و سامانه (مسئولی Fuel filter ▶

The fuel filter is built in the fuel pump. This filer is a micro paper filter type.

Service interval: Inspect every 30,000Km(if using poor guality of fuel, replace every 50,000Km.



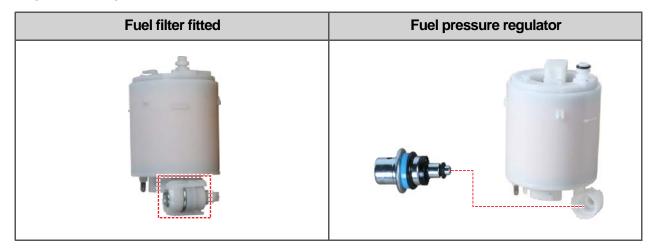
**FUEL SYSTEM** 

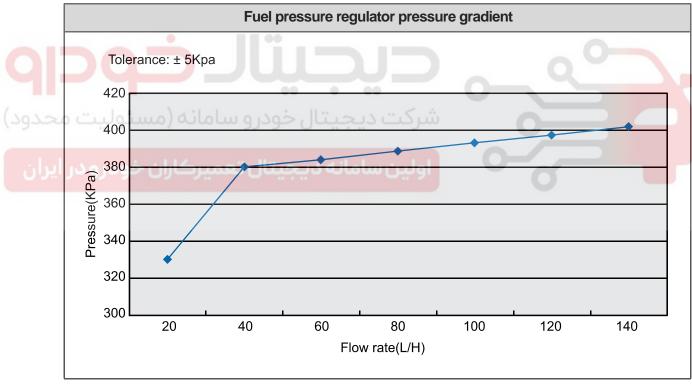
TIVOLI 2015.03		
www.digi	TALKHOI	ORO.COM

V O L

#### ► Fuel pressure regulator

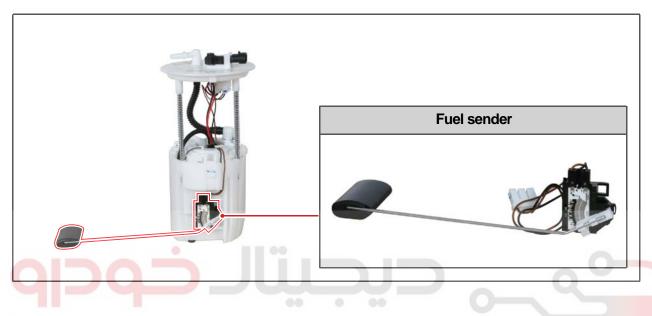
The fuel pressure regulator is installed on the bottom of the fuel filter in the fuel pump assembly. This component keeps the fuel pressure in the fuel system at about  $3.8 \pm 0.05$  bar when the engine is running.





#### ▶ Fuel sender

The fuel sender is installed to the fuel pump assembly in the fuel tank. It measures the fuel level. The float of the fuel sender moves up and down according to the fuel level in the fuel tank when the ignition is turned ON. The fuel sender detects the resistance which changes as the float moves up and down and sends this value to the instrument cluster module. The instrument cluster module calculates using this resistance value and illuminates the fuel level indicator.

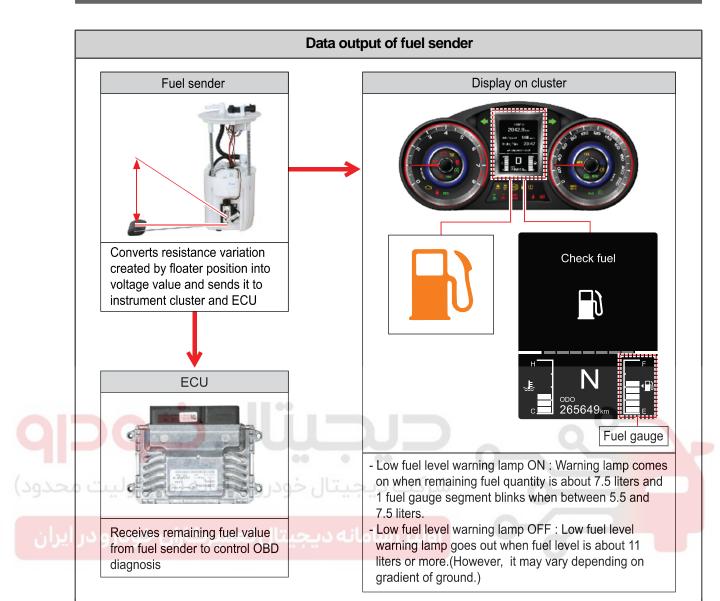


شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

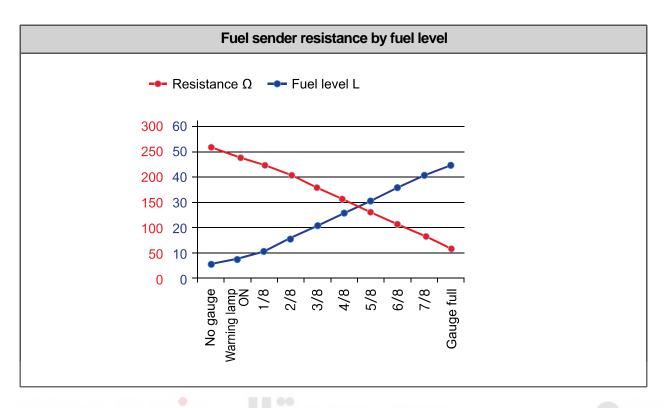
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Affected VIN

I V O L



T I V O L I

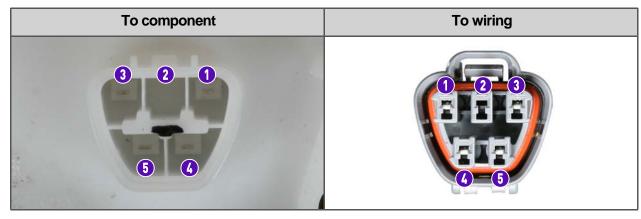


		1/8				0	
	No gauge	Warning lamp ON	OFF	2/8	3/8	4/8	5/8
Sender resistance(Ω)	266.7±3 ~ 283.0±3	250.3±3	225.8±2	201.3±2	176.8±2	152.3±2	127.8±2
Sender height(mm)	24.2±2 ~ 41.0±2	53.8±2	75.4±2	106.1±2	136.8±2	156.4±2	171.4±2
Fuel level(t)	3.0 ~ 5.5	7.5	11.0	16.0	21.0	26.0	31.0

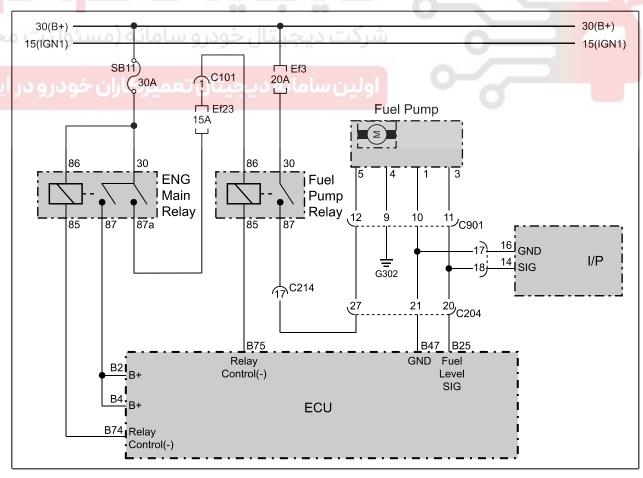
	6/8	7/8	Gauge full
Sender resistance(Ω)	103.3±2	78.8±2	54.3±2 ~ 38.0±2
Sender height(mm)	186.2±2	202.9±2	217.6±2 ~ 221.8±2
Fuel level(ℓ)	36.0	41.0	45.0 ~ 46.0

I V O L

# 3) Connector and Circuit Diagram



Pin No.	Function		
1	Sender ground (ECU)		
2	-		
3	Sender signal (ECU)		
4	Pump power supply		
5	Ground		



# 2211-01 FUEL TANK ASSEMBLY

## 1) Overview

The fuel tank is made of plastic and installed at the bottom of the vehicle. Its capacity is 47 \( \ell \). The fuel tank consists of fuel pump, canister, roll-over valve, and fuel tank pressure sensor, etc.

# 2) Mounting Location and Components



**FUEL SYSTEM** 

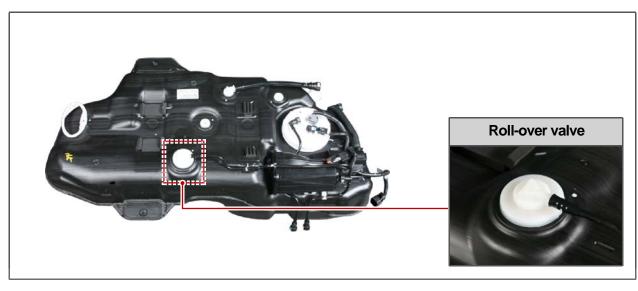
TIVOLI 2015.03

WWW.DIGITALKHODRO.COM

Modification basis		
Application basis		
Affected VIN	021 62 9	9 92 92

#### ▶ Roll-over valve

The roll-over valve is integrated with the two-way check valve. The roll-over valve is mounted on top of the fuel tank and is part of the fuel evaporative control system.





### **₿** NOTE

#### **Functions**

- Prevents the fuel from spilling out when the vehicle is in a roll-over state.
- Is activated when the pressure rises excessively or vacuum is generated in the tank.
- Releases high pressure or vacuum in the fuel tank in normal condition.
- Keeps constant pressure (low pressure) in the fuel tank during fueling.
- Supplies the evaporative gas in the valve to the canister.

V O L

# 2211-03 CANISTER

## 1) Overview

The canister is installed to the side of the fuel tank and stores fuel vapor in the fuel system. fuel vapor is drawn in the canister and absorbed in the activated carbon in the canister. The activated carbon recovers its absorption capacity after the gas is drawn into the intake system while the engine is running. Also, it is equipped with the air filter (air tank) to dilute Hydrocarbon (HC) in the canister and filter any foreign material.





#### NOTE

#### Air filter

Protects the shut-off valve by diluting HC in the canister and filtering foreign materials.

**FUEL SYSTEM** 

TIVOLI 2015.03

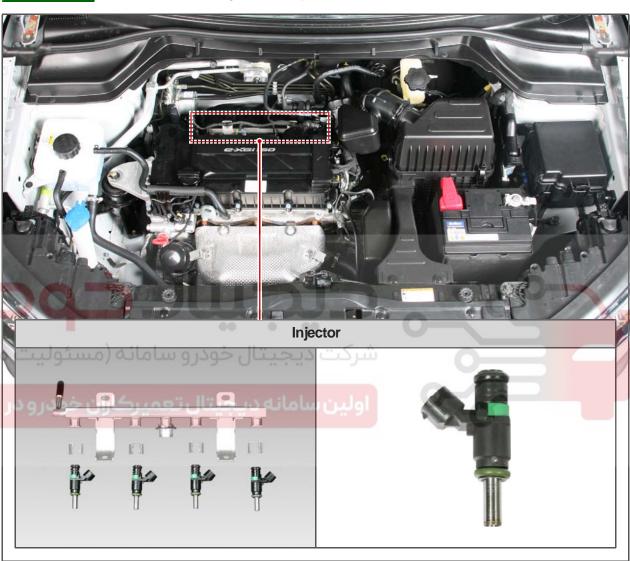
HVOLI 20				
WWW.	DIGIT	<b>'ALK</b> H	IODRO	CON.

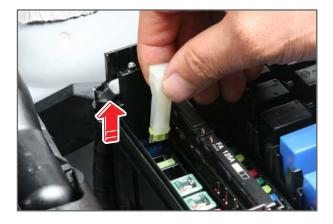
# REMOVAL AND INSTALLATION

# 1890-02 INJECTOR

Preceding work

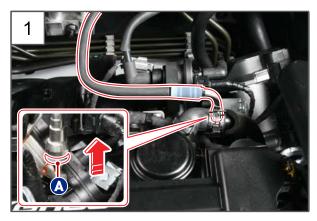
- Disconnect the negative battery cable.



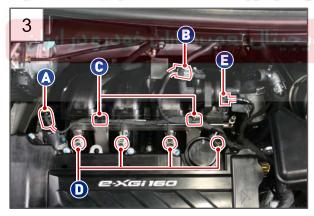


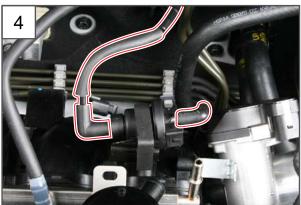
## ♣ NOTE

To remove the injector, the fuel supply tube should be disconnected. Therefore, remove the fuel pump fuse from the engine compartment fuse box and rotate the engine to drain the fuel lines.









1. Disconnect the fuel supply tube from the fuel rail.



### **♣** NOTE

Push up the part (A) of the fuel supply tube in the direction of the arrow to remove the tube.



#### A CAUTION

Be careful not to fold the fuel supply tube to prevent damage to the tube.

2. Disconnect the blowby hose from the cylinder head cover.



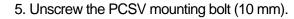
- 3. Disconnect the connectors and disengage the wiring clamps to free the engine main wiring.
  - A. OCV connector to intake side
  - B. T-MAP sensor connector
  - C. Wiring clamp
  - D. Injector connector
  - E. PCSV connector
- 4. Disconnect the 2 hoses to the PCSV.

**FUEL SYSTEM** 

TIVOLI 2015.03
WWW.DIGITALKHODRO.COM







Tightening torque 10 ± 1.0 Nm



6. Remove the PCSV.





7. Unscrew the 2 mounting bolts (13 mm) securing the fuel rail assembly on the top of the intake manifold.

Tightening torque 25 ± 2,5 Nm

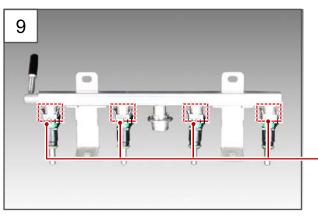


8. Remove the fuel rail assembly from the intake manifold by grasping and pulling it with both hands as shown in the picture.



#### A CAUTION

Make sure to use both hands to pull it out as the fuel rail and injector can break.

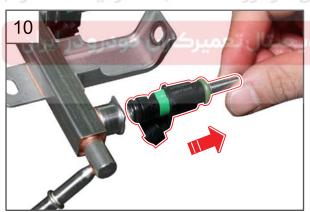


9. Remove the injector retaining key from the removed fuel rail assembly.

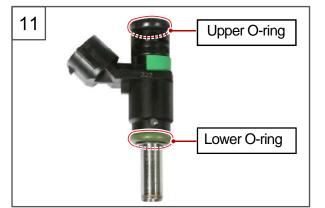








10.Remove the injector from the fuel rail.



11.Install in the reverse order of removal.



## **♦** NOTE

When installing the injector, always replace the upper and lower O-rings of the injector with new ones.

**FUEL SYSTEM** 

TIVOLI 2015.03		
WWW.DIG	ITALKHO	DRO.COM

# Installation of injector

1. Fit the injector retaining key to the injector.

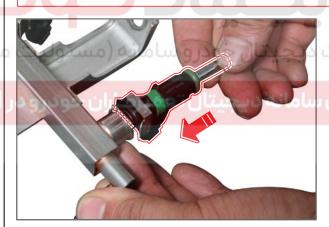






#### A CAUTION

Make sure that the retaining key is aligned and positioned correctly in the groove for the retaining key.



2. Fit the injector to the fuel rail.

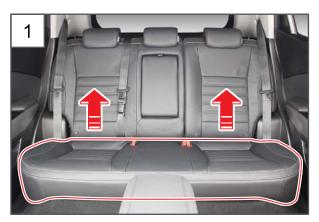
### CAUTION

Make sure that the upper O-ring of the injector is inserted in the fuel rail correctly.

T I V O L I

# 2211-02 FUEL PUMP ASSEMBLY





1. Remove the rear seat cushion.



### **♣** NOTE

Refer to "REAR SEAT" under "REMOVAL AND INSTALLATION" subsection of "SEAT/SEAT BELT" section in "BODY" chapter.

**FUEL SYSTEM** 

TIVOLI 2015.03		
WWW.DIG	ITALKHOD	RO.COM

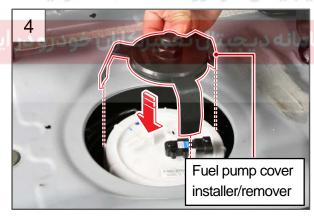




2. Remove the fuel pump dust cover using a hand remover.



 Disconnect the fuel supply tube (A), fuel pump connector (B), and fuel pressure tank sensor connector (C) from the top of the fuel pump assembly.



4. Remove the fuel pump cover using the fuel pump cover installer/remover.

Tightening torque 50 to 120 Nm





T I V O L I

5. Remove the fuel pump assembly from the vehicle.





#### A CAUTION

Remove the fuel pump assembly, being careful not to damage the fuel sender (A).



### 🕹 NOTE

Replace the fuel pump O-Ring (B) with a new one when installing.



6. Install in the reverse order of removal.

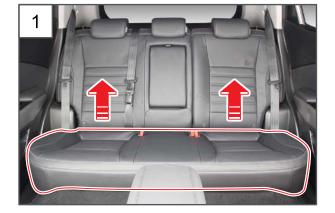
# 2211-00 FUEL FILTER

## **₿** NOTE

#### Fuel filter service Interval

- Inspect every 30000 km (if using poor quality of fuel, replace every 50000 km)





1. Remove the rear seat cushion.

### ♣ NOTE

Refer to "REAR SEAT" under "REMOVAL AND INSTALLATION" subsection of "SEAT/SEAT BELT" section in "BODY" chapter.



2. Remove the fuel pump assembly from the vehicle.

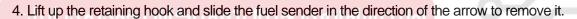


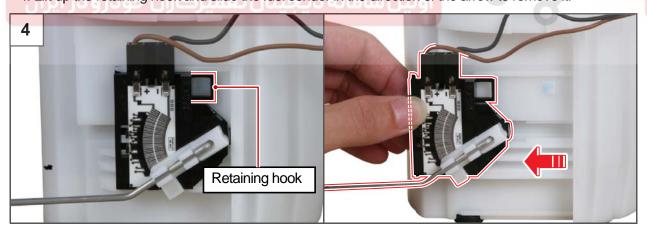
### **♣** NOTE

Refer to "FUEL PUMP ASSEMBLY" under this subsection.



3. Remove the fuel sender connector from the removed fuel pump assembly.





**FUEL SYSTEM** 

5. Remove the fuel pump motor connector (A) and fuel supply tube cap retaining key (B) from the plate assembly.

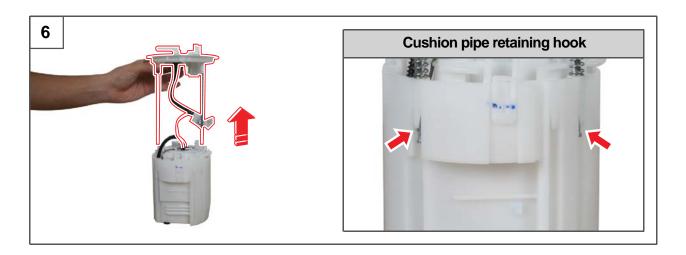




### A CAUTION

Check the O-ring of the fuel supply tube cap.

6. Remove the plate assembly from the reservoir cup by separating the 2 cushion pipe retaining hooks.



7. Remove the fuel filter assembly from the reservoir cup by prying off the 3 reservoir cup retaining hooks.





8. Remove the ground wire (A) and assist valve (B) from the fuel filter assembly.



**FUEL SYSTEM** 

TIVOLI 2015.03		
WWW.DIGI	TALKHO	IDBO COM
	IALIVIIC	



10 A B

Disengage the mounting clip to remove the assist valve.

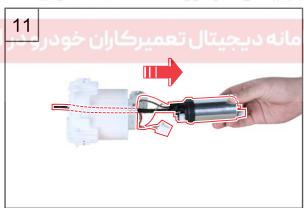
### **A** CAUTION

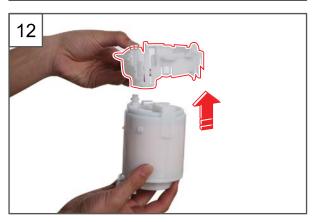
Be careful not to lose the clip.

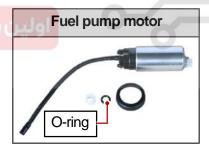


10.Remove the pre-filter (A) and the mount rubber (B).

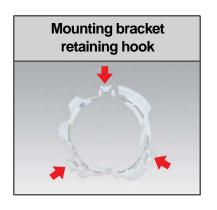
11.Remove the fuel pump motor from the fuel filter assembly.

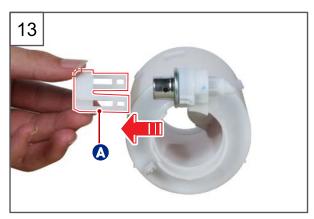






12.Remove the mounting bracket from the fuel filter assembly by prying off the 3 retaining hooks.

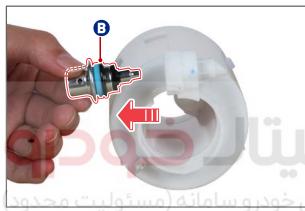


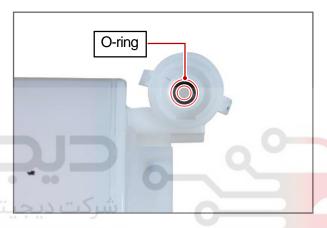


13.Remove the fuel pressure regulator cover (A) and fuel pressure regulator (B).

#### A CAUTION

Check the fuel pressure regulator O-ring on the fuel filter.

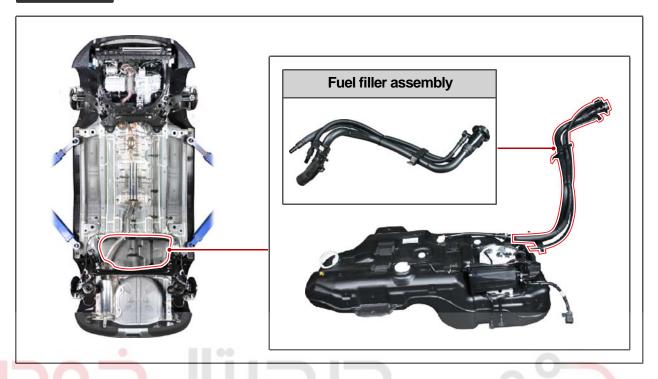




14

14.Install in the reverse order of removal.

# 2211-16 FUEL FILLER ASSEMBLY







1. Remove the rear LH wheel house cover.



2. Disconnect the 3 fuel filler assembly hoses from the fuel tank located under the vehicle.



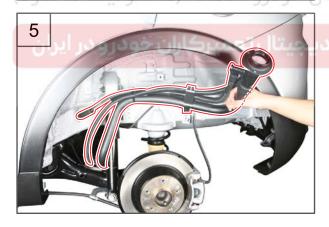
3. Open the fuel filler cap and unscrew the 3 mounting bolts (10 mm) on top of the fuel filler assembly.

Tightening torque 6 to 7 Nm



4. Unscrew the middle mounting nut (A, 10 mm) and lower mounting bolt (B, 10 mm) for the fuel filler assembly.

Tightening torque 4 to 6 Nm



5. Remove the fuel filler assembly.

6. Install in the reverse order of removal.

# 2211-01 FUEL TANK ASSEMBLY





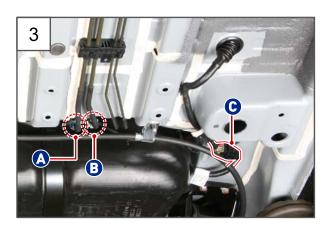
1. Remove the center muffler from the vehicle.



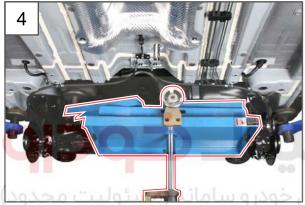
Refer to "CENTER MUFFLER" under
"REMOVAL AND INSTALLATION"
subsection of "EXHAUST SYSTEM" section
in "G16DF ENGINE" chapter.



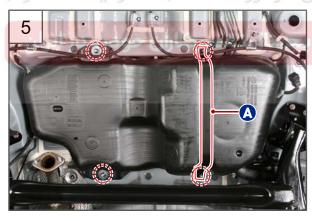
2. Disconnect the 3 fuel filler assembly hoses from the fuel tank located under the vehicle.



3. Disconnect the fuel supply pipe (A), PCSV pipe (B), extension wiring connector (C) from the fuel tank.



4. Securely support the fuel tank by placing a transmission jack or equivalent under the fuel tank.

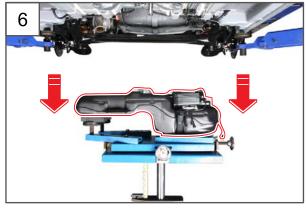


5. Remove the 4 fuel tank assembly mounting nuts (12 mm).



## **♣** NOTE

Remove the fuel tank strap (A) after removing the mounting bolts.



6. Remove the fuel tank assembly. Pay close attention to interferences.

**FUEL SYSTEM** 

TIVOLI 2015.03	
/WW.DIGITALKHODRO.COM	

10.Install in the reverse order of removal.







اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



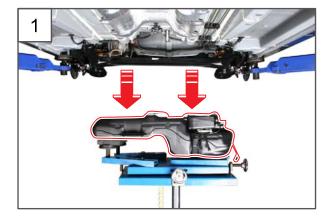
V O L

# 2211-03 CANISTER

Preceding work

- Disconnect the negative cable from the battery.





1. Remove the fuel tank assembly from the vehicle.



Refer to "FUEL TANK ASSEMBLY" under this subsection.

**FUEL SYSTEM** 

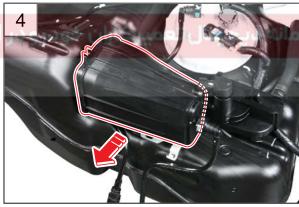
TIVOLI 2015.03		
WWW.DIG	ITALKHOD	RO.COM



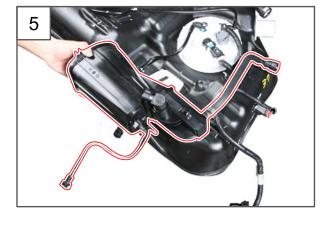
Disconnect the canister shut off valve connector on the top of the air filter of the removed fuel tank assembly. (KOREA)



3. Remove the canister pipe connected to the roll-over valve.

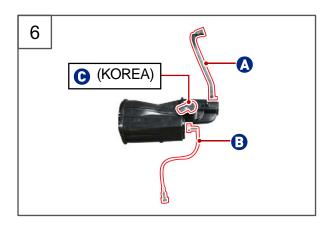


4. Tilt the canister in the direction show in the picture.



5. Remove the canister from the fuel tank assembly.

L



6. Disconnect the hose (A) to the fuel filler and pipe (B) to the PCSV and remove the canister shut off valve (C).



7. Install in the reverse order of removal.





**FUEL SYSTEM**