

FUEL DELIVERY

04

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FUEL DELIVERY SYSTEM

04

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GENERAL INFORMATION

Description

The fuel system consists of a fuel tank, fuel pump, fuel filter, fuel supply line, fuel rail, fuel pressure regulator and fuel injectors. The fuel system is a returnless fuel supply system.

WARNING!

Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

Operation

The fuel delivery system is enabled when the following conditions are present:

- With the ignition switch ON, the fuel delivery system is enabled for 3-6 seconds.
- When the engine is cranked, the Engine Control Module (ECM) receives a Crankshaft Position (CKP) sensor signal and the fuel delivery system is enabled.

The fuel injectors are a solenoid-operated valve that meter fuel flow to each cylinder. The fuel injectors are opened and closed constantly during engine operation. The amount of fuel is controlled by the length of time the fuel injector is held open. The fuel injectors are powered by a 12-volt source and are controlled through the ground side of the circuit by the ECM.

The fuel pump operation is defined in the fuel system control strategy and is controlled by the ECM.

Specifications

Torque Specifications

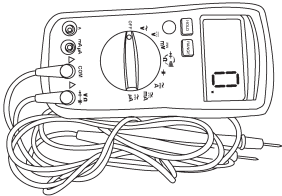
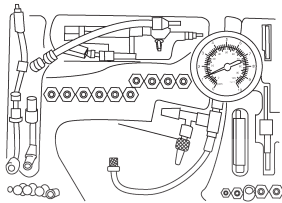
DESCRIPTION	TORQUE (N·m)
Fuel Rail Bracket Bolts	11
Fuel Pump Mounting Nuts	2
Fuel Filter Mounting Bolts	10

Fuel Pressure Specifications

DESCRIPTION	PRESSURE
Fuel Pressure at Fuel Rail - Key On	400 kPa (4 bar)
Fuel Pressure at Fuel Rail - Engine Idle	400 kPa (4 bar) - 420 kPa (4.2 bar)
Fuel Pressure at Fuel Rail - Key Off	380 kPa (3.8 bar) in 10 minutes

GENERAL INFORMATION

Special Tools

Digital Multimeter Fluke 15B & 17B	 besm030002
Fuel Pressure Gauge	 besm030008

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

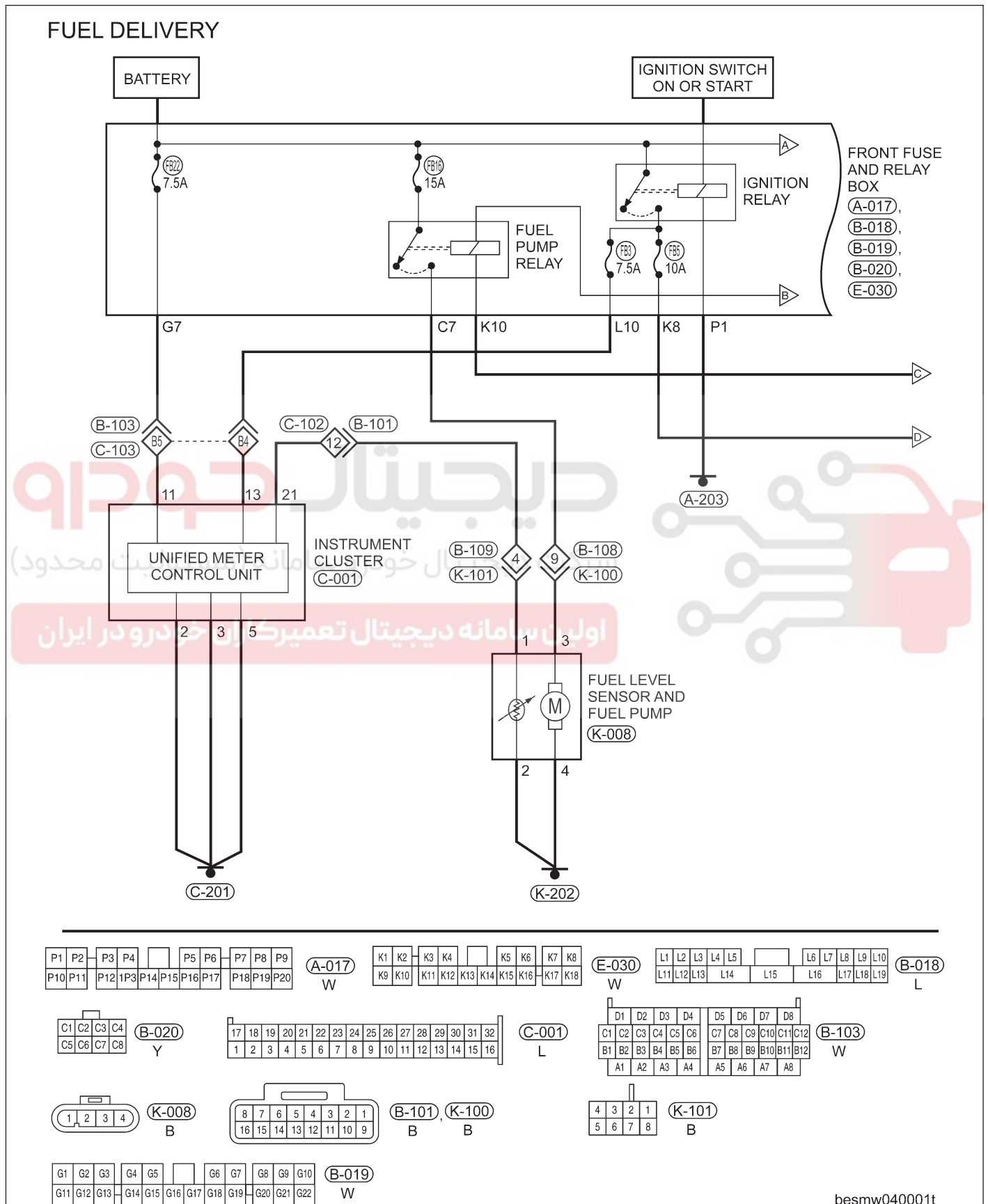
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



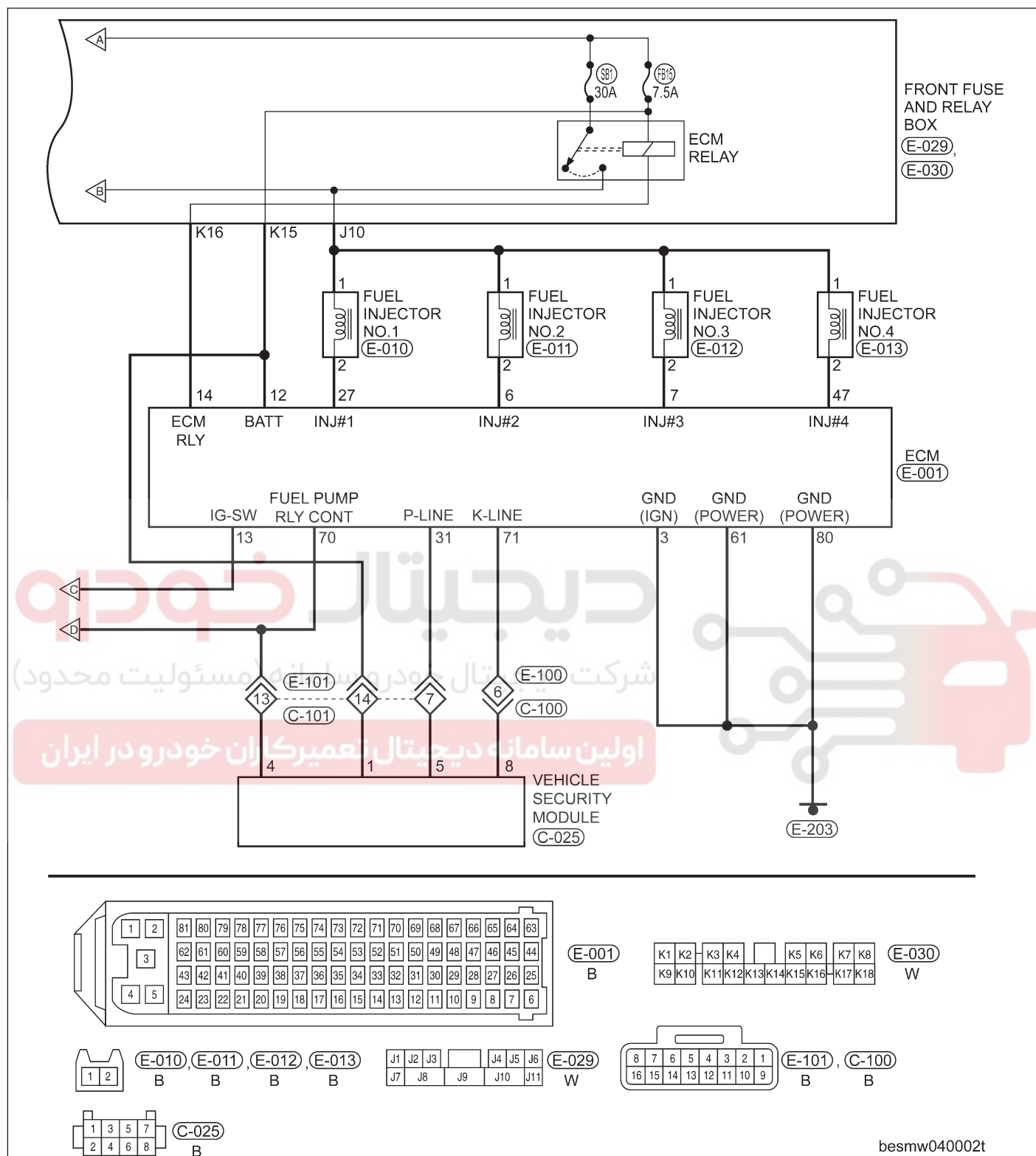
GENERAL INFORMATION

Electrical Schematics

Fuel Delivery System (Page 1 of 2)



04



DIAGNOSIS & TESTING

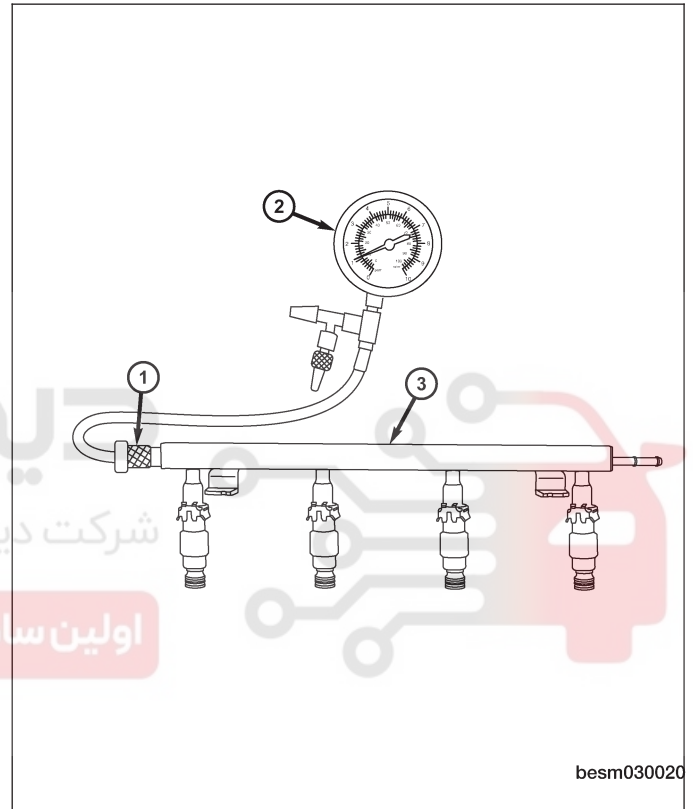
DIAGNOSIS & TESTING

Fuel Pressure Test

WARNING!

Fuel in the fuel system remains under high pressure, even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel (See Fuel Pressure Relief Procedure in section 04 Fuel). Failure to follow these instructions may result in serious personal injury.

Perform the following procedure to test for proper fuel pressure:

**WARNING!**

Wrap towels around hoses to catch any gasoline spillage.

1. Remove the protective cap and connect the fuel pressure gauge (2) to the fuel rail service test port pressure fitting (1) on the fuel rail (3).
2. Start and warm the engine and note pressure gauge reading. Fuel pressure should be 420 kPa (4.2 bar) at idle.
3. If engine runs, but pressure is below 420 kPa (4.2 bar), check for a kinked fuel supply line somewhere between the fuel rail (3) and the fuel pump. If the line is not kinked, replace the fuel pump (See Fuel Pump Removal & Installation in Section 04 Fuel Delivery).
4. If operating pressure is above 420 kPa (4.2 bar), the electric fuel pump is OK, but fuel pressure regulator is defective. Replace the fuel pressure regulator (See Fuel Pump Removal & Installation in Section 04 Fuel Delivery).

NOTE: The fuel pressure regulator is integrated into the fuel pump assembly and is not serviced separately.

5. Install the protective cap to the service test port pressure fitting (1) on the fuel rail.

Observe the following fuel pressures when testing:

DIAGNOSIS & TESTING

FUEL PRESSURE	
Key On	400 kPa (4 bar)
Key Off	380 kPa (3.8 bar) in 10 minutes
Engine Idle	400-420 kPa (4.0-4.2 bar)

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



ON-VEHICLE SERVICE

Fuel Pressure Relief Procedure

Fuel Pressure Relief Procedure

WARNING!

Fuel in the fuel system remains under high pressure, even when the engine is not running. Before servicing or disconnecting any of the fuel lines or fuel system components, the fuel system pressure must be relieved to prevent accidental spraying of fuel. Failure to follow these instructions may result in serious personal injury.

Perform the following procedure to relieve fuel pressure from the fuel system:

1. Remove the cover of the front fuse and relay box.
2. Identify and remove the fuel pump relay from the front fuse and relay box.
3. Start and run engine until it stalls.
4. Attempt to restart engine until it will no longer run.
5. Turn the ignition key to OFF position.

NOTE :

Replace the fuel pump relay when the fuel system service is complete.

Fuel Pump

Description

The fuel pump assembly contains the fuel pump motor, fuel level sensor and fuel pressure regulator.

Operation

The Engine Control Module (ECM) activates the fuel pump relay for several seconds after the ignition switch is turned ON. When the relay is activated, it provides voltage to the fuel pump. When the ECM receives an engine speed signal from the Crankshaft Position (CKP) sensor, the ECM will again energize the fuel pump relay. If the engine speed signal is not received when the ignition switch is ON, the ECM will de-energize the fuel pump relay.

Removal & Installation

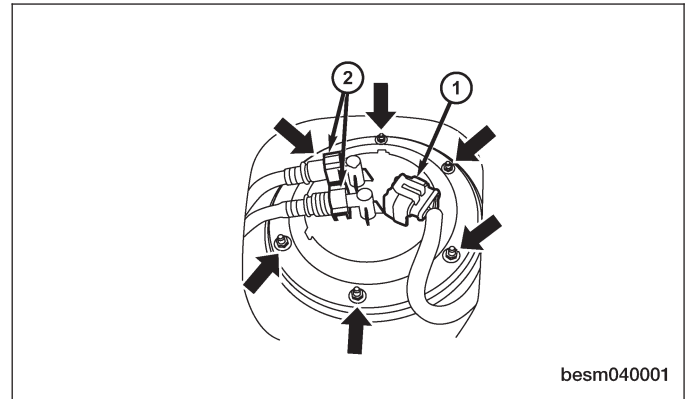
WARNING!

Release fuel system pressure before servicing fuel system components. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle. This may result in personal injury or death.

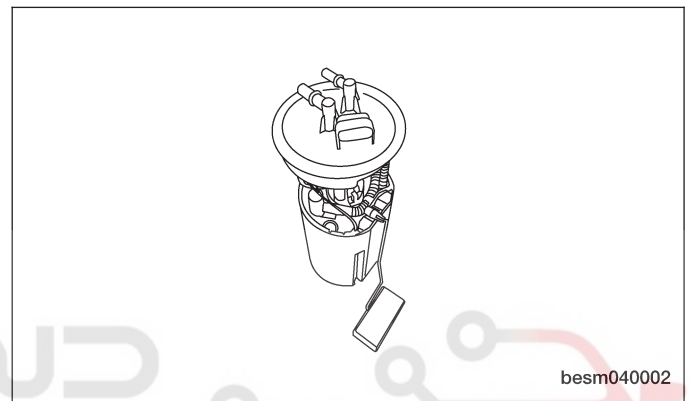
1. Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
2. Remove the negative battery cable.
3. Remove the rear seat cushion.
4. Remove the fuel pump cover.

ON-VEHICLE SERVICE

5. Disconnect the fuel pump connector (1) and the fuel lines (2).
6. Remove the six fuel pump mounting nuts.
(Tighten: Fuel pump mounting nuts to 2 N·m)



7. Pull the fuel pump up and out of the fuel tank.

**WARNING!**

Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

NOTE :

Make sure not to spill fuel inside of vehicle.

8. Tip the fuel pump on its side and drain the fuel from the fuel pump and remove the fuel pump from vehicle.
9. To keep the fuel tank portion clean and to avoid damage and foreign materials, cover them completely with plastic bags or something similar.
10. Remove and discard the seal from the fuel tank.
11. Installation is in the reverse order of removal.

Installation Notes:

- Install a new seal to the fuel pump sealing surface.
- Turn the ignition switch to ON (without starting the engine) to apply fuel pressure to the fuel system, then check the fuel line connections for fuel leaks.
- Start the engine and let it idle and check for fuel leaks at the fuel system connections.

ON-VEHICLE SERVICE

Fuel Filter

Description

The fuel filter consists of a housing with an integrated filter element.

Operation

The fuel flows through the filter from the outside to the inside. As a result, any impurities are trapped inside the filter.

Removal & Installation

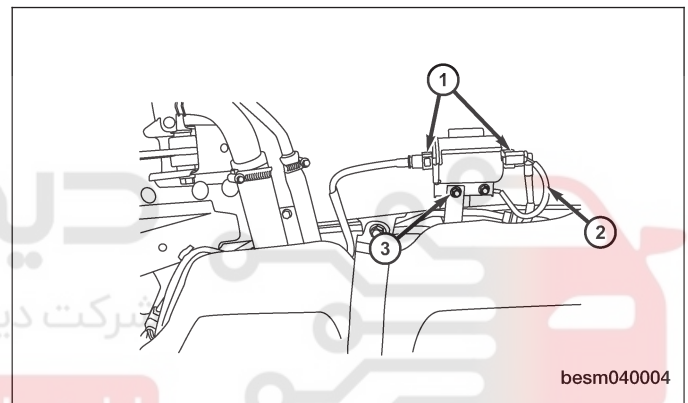
WARNING!

Release fuel system pressure before servicing fuel system components. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle. This may result in personal injury or death.

1. Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
2. Disconnect the negative battery cable.
3. Remove the fuel lines (1) and the ground wire (2).
4. Remove the fuel filter mounting bolts (3).
(Tighten: Fuel filter mounting bolts to 10 N·m)
5. Remove the fuel filter.
6. Installation is in the reverse order of removal.

Installation Notes:

- Verify there are NO leaks at the fuel line connections of the fuel filter.



Fuel Injector Rail

Description

The fuel rail is used to mount the fuel injectors to the engine and is itself mounted to the intake manifold.

Operation

The fuel rail supplies the necessary fuel to each individual fuel injector and is located above the intake manifold and fuel injectors.

Removal & Installation

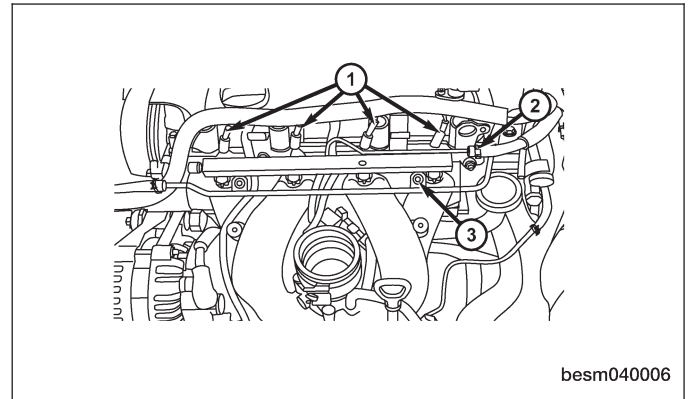
WARNING!

Release fuel system pressure before servicing fuel system components. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle. This may result in personal injury or death.

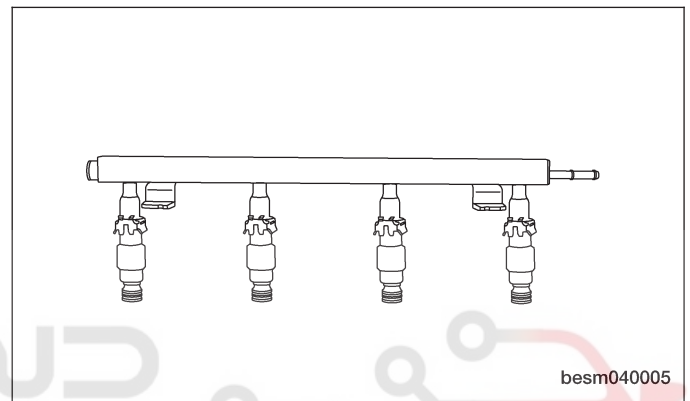
1. Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
2. Turn off the switch. Disconnect and isolate the battery negative cable.
3. Remove the engine cover.

ON-VEHICLE SERVICE

4. Disconnect the electrical connectors (1) from the fuel injectors.
5. Remove the fuel line (2) from the fuel rail.
6. Remove the two fuel rail bracket bolts (3) that mount the fuel rail to the intake manifold.
(Tighten: Fuel rail bracket bolts to 11 N·m)



7. Remove the fuel rail with the four fuel injectors.



8. Installation is in the reverse order of removal.

Installation Notes:

- Install a new seal on the fuel injector sealing surfaces.

Fuel Injector**Description**

The fuel injectors are positioned in the intake manifold with the nozzle ends directly above the intake valve port.

Operation

Injector operation is controlled by a ground path provided for each injector by the Engine Control Module (ECM). Injector on-time (pulse-width) is variable, and is determined by the ECM. Based on the engine operating conditions, the ECM will control injector pulse-width operation to obtain optimum performance.

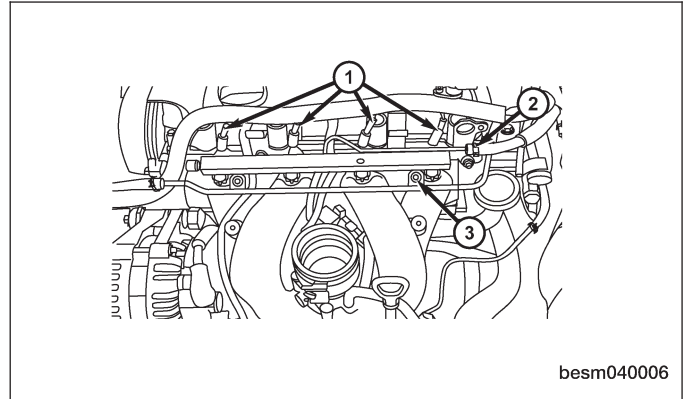
Removal & Installation**WARNING!**

Release fuel system pressure before servicing fuel system components. Service vehicles in well ventilated areas and avoid ignition sources. Never smoke while servicing the vehicle. This may result in personal injury or death.

1. Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
2. Disconnect the negative battery cable.
3. Remove the engine cover.
4. Remove the ground cable on the cylinder head.

ON-VEHICLE SERVICE

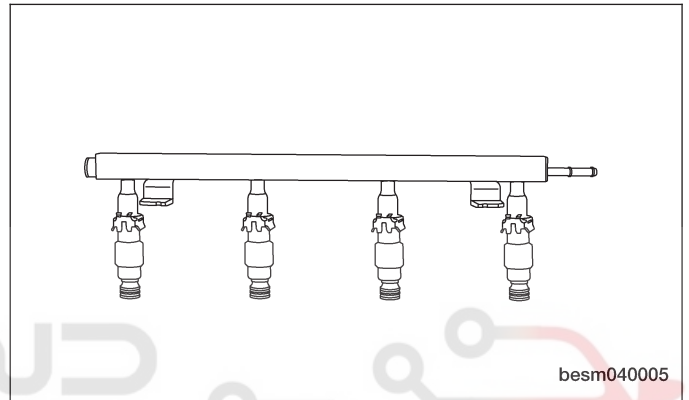
5. Disconnect the electrical connectors (1) from the fuel injectors.
6. Remove the fuel line (2) from the fuel rail.
7. Remove the two fuel rail bracket bolts (3) that mount the fuel rail to the intake manifold.
(Tighten: Fuel rail bracket bolts to 11 N·m)



8. Remove the fuel rail with the four fuel injectors.
9. Remove the clip holding the fuel injector to the fuel rail.
10. Remove the fuel injector from the fuel rail.
11. Installation is in the reverse order of removal.

Installation Notes:

- Install a new seals on the fuel injector sealing surfaces.



دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران