2.10 Ignition System JL4G18-D

2.10.1 Specifications

2.10.1.1 Fastener Tightening Specifications

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Crankshaft Position Sensor Mounting Bolt	M6 × 12	8-10	6-7.4
Camshaft Position Sensor Mounting Bolt	M6 × 14	8-10	6-7.4
Ignition Coil Retaining Bolts	M6 × 35	8-10	6-7.4
Spark Plug	M14 × 1.25 × 22	20-30	14.8-22.2
Knock Sensor	M8 × 30	15-21	11-15.5

2.10.1.2 Ignition System Specification

Applications	Specifications
Ignition Sequence	1-3-4-2
Ignition Timing	8 °-14 ° Before The TDC
Ignition Type	Spark Discharge
Spark Plug Gap	1.0-1.1 mm (0.04-0.043 in)
Spark Plug Manufacturer	Zhuzhou Torch Spark Plug Co., Ltd.
Spark Plug Type	K6RTC

2.10.2 Description and Operation

2.10.2.1 Description and Operation

This vehicle uses DLI ignition system igniting two cylinders at the same time. The ignition voltage is sent directly from the ignition coil to the Spark Plug. Main system components are ECM, two ignition coils, high voltage damping line, Spark Plug, crankshaft position sensor, camshaft position sensor, knock sensor etc.. This Ignition system is known as the direct ignition type. Cylinder No.1 is paired with Cylinder No.4 and Cylinder No.2 is paired with Cylinder No.3. When ECM triggers the ignition coil to ignite, spark occurs in both cylinders at the same time. At this time one cylinder is in compression stroke and the other is in exhaust stroke. For the cylinder in the exhaust stroke, because the cylinder pressure is low, the temperature is high, the spark plug only requires minimal energy to break ignition voltage gap. It is an invalid ignition, the remaining energy is used by the spark plug in the compression stroke cylinder.

As a result of using DLI Ignition System, ECM controls the best ignition timing based on a variety of load conditions, so that the engine output power, acceleration, economy and emission performance have reached the ideal situations. The ignition system voltage does not decrease as the speed increases. In the absence of mechanical components, there is mechanical error.

The ignition coil can not be repaired and it must be replaced as an assembly.

2.10.3 System Working Principle

2.10.3.1 System Working Principle

When the ignition switch is at "ON" or "ST" position, the ignition switch wiring harness connector IP23 terminal No.1 and terminal No.2 are connected, so that IG1 relay coil forms a complete circuit.Battery voltage passes through the fuses EF01, EF22, IG1 Relay, fuse IF30 to reach the ignition coil, supplies power to the ignition coil.

Crankshaft position sensor is a magnetic inductive speed sensor. Crankshaft position sensor signal plate and the flywheel is an integrated part. When the engine rotates, so does the crankshaft position sensor signal drive plate. So the sensor produces an alternating signal. This signal is transmitted to ECM. ECM calculates the current crank angle based on this signal in order to determine the piston reaches the TDC, directly affecting the accuracy of the ignition advance angle control. This sensor signal is a crucial input signal in the ignition system. When ECM can not receive the signal, the ignition system can not work. ECM harness connector EN01 terminals No.46 and No.47 receive crankshaft position sensor input. After calculation, ECM obtains the ignition advance angle. ECM harness connector EN01 terminal No.3 controls cylinders No.1 and No.4 ignition, terminal No.7 cylinders No.2 and No.3 ignition.

For crankshaft position sensor technical specifications. Refer to 2.2.1.2 Temperature Sensor Temperature and Resistance Correlation.

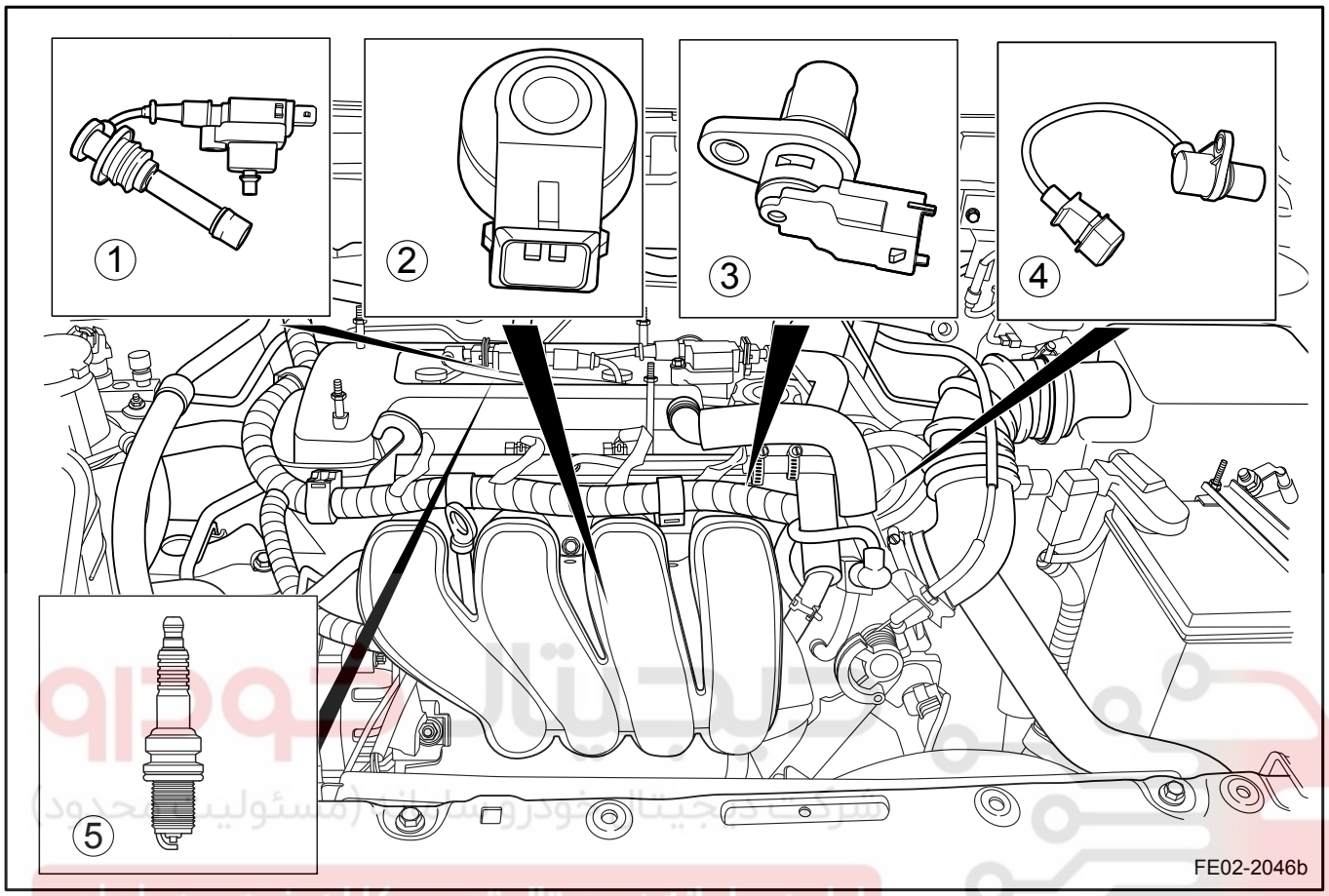
For knock Sensor technical specifications. Refer to 2.2.1.2 Temperature Sensor Temperature and Resistance Correlation.

Note

When the vehicle Anti-theft alarm system and engine anti-theft locking system are activated, ECM does not allow ignition coil to be ignited. The ignition system is inoperative at this time.

2.10.4 Component Locator

2.10.4.1 Component Locator

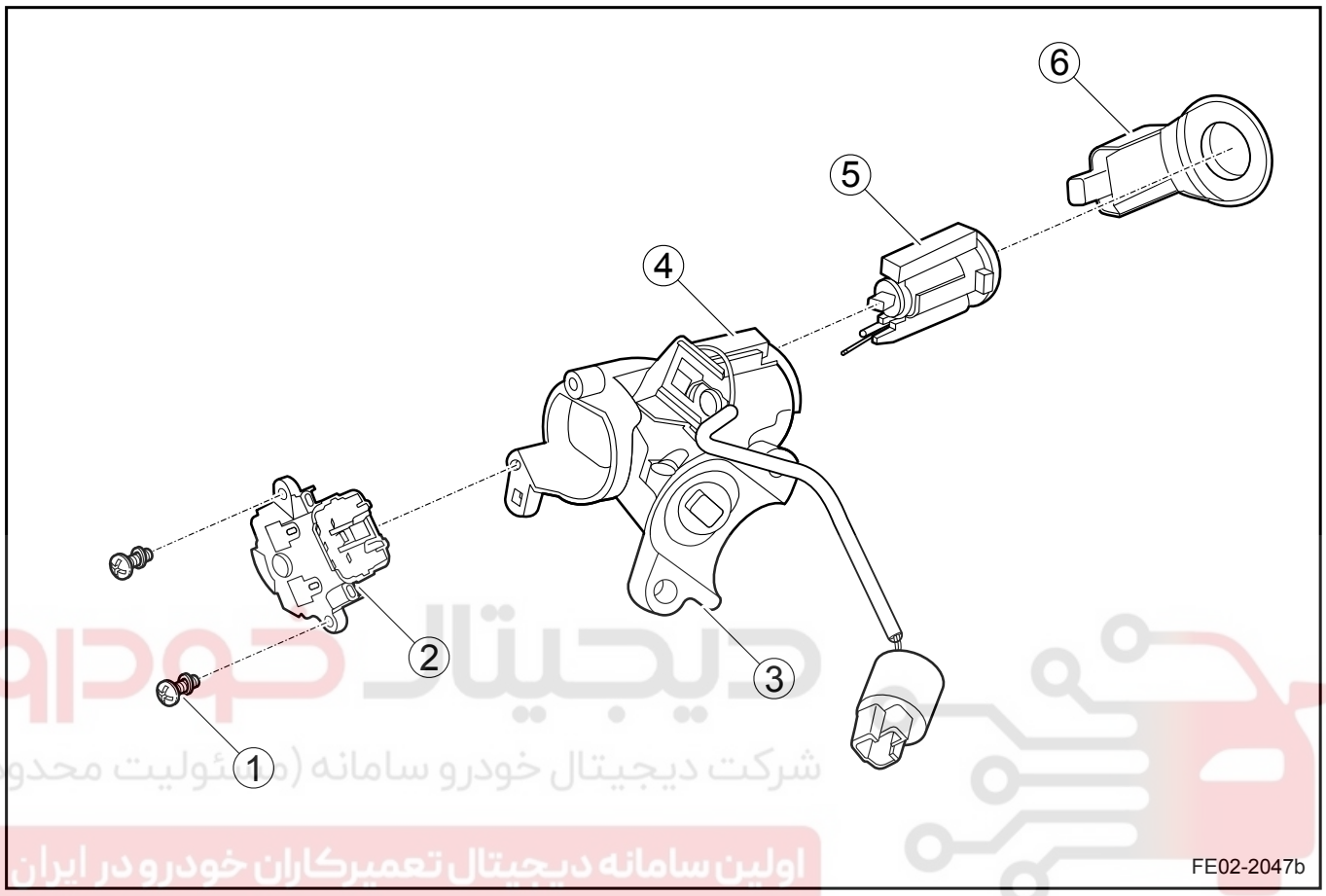


Legend

1. Ignition Coil and High-Voltage Damping Line
2. Knock Sensor
3. Camshaft Position Sensor
4. Crankshaft Position Sensor
5. Spark Plug

2.10.5 Disassemble View

2.10.5.1 Ignition Cylinder Assembly Disassemble View

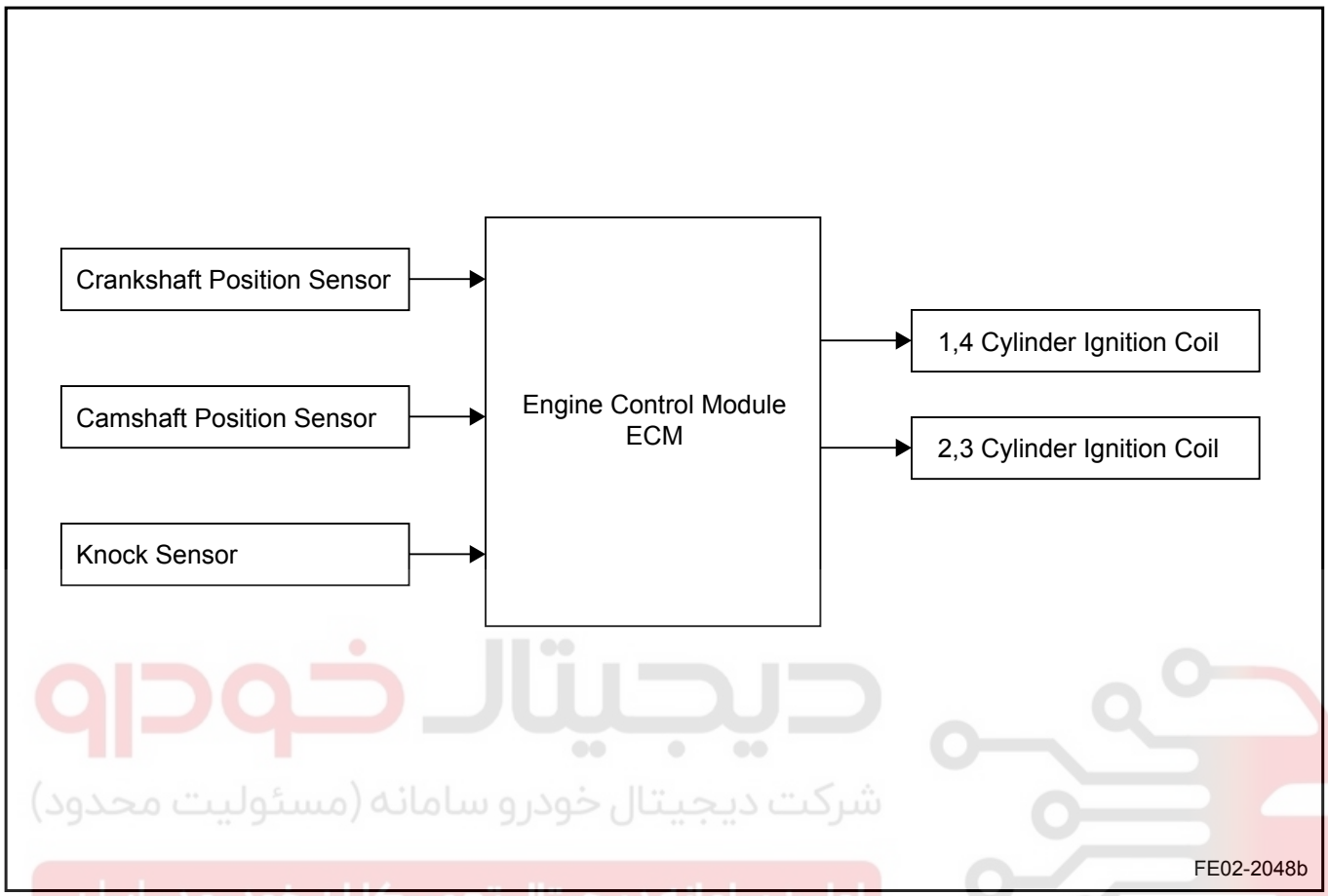


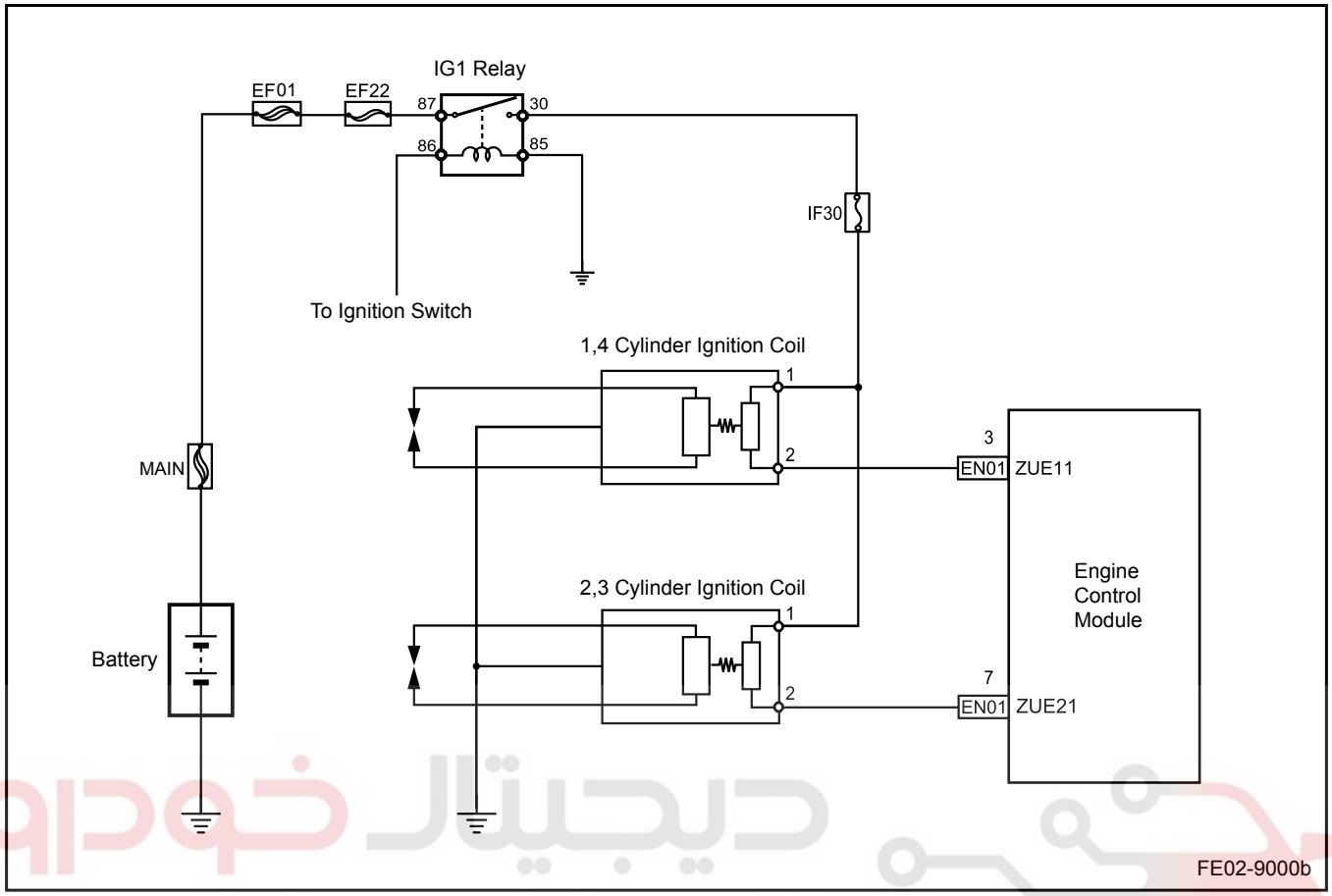
Legend

1. Ignition Switch Retaining Bolts
2. Ignition Switch Assembly
3. Ignition Cylinder Bracket
4. Ignition Key Reminder Switch
5. Ignition Cylinder
6. EAS Coil

2.10.6 Schematic

2.10.6.1 Schematic





2.10.7 Diagnostic Information and Procedures

2.10.7.1 Diagnosis Description

Refer to 2.10.2.1 Description and OperationGet familiar with the system functions and operation before start system diagnostics, so that it will help to determine the correct troubleshooting steps, more importantly, it will also help to determine whether the customer described situation is normal.

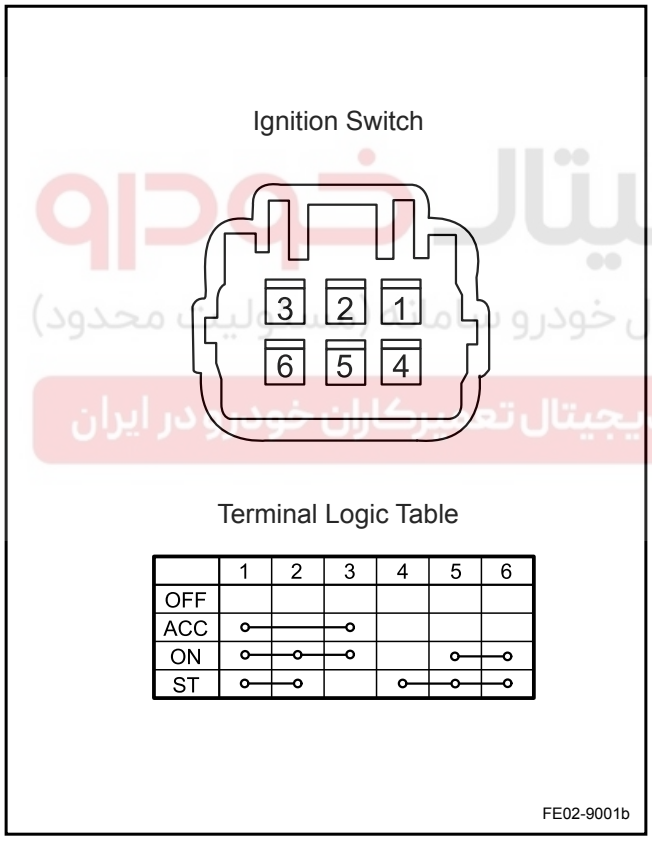
For the ignition system DTC code. Refer to the "control system diagnostic information and the steps" in the "2.2.7.1 Diagnostic Description."

2.10.7.2 Visual Inspection

- Check installed aftermarket equipment that may affect the ignition system performance.
- Check the easy to access system components to identify whether there is significant damage or potential faults.

2.10.7.3 Check Ignition Switch

Check the ignition switch terminals continuity according to the following diagram



1. Turn the ignition switch to "OFF" position.
2. Disconnect the ignition switch wiring harness connector IP23.
3. Remove the ignition switch assembly.
4. Test ignition switch terminals continuity

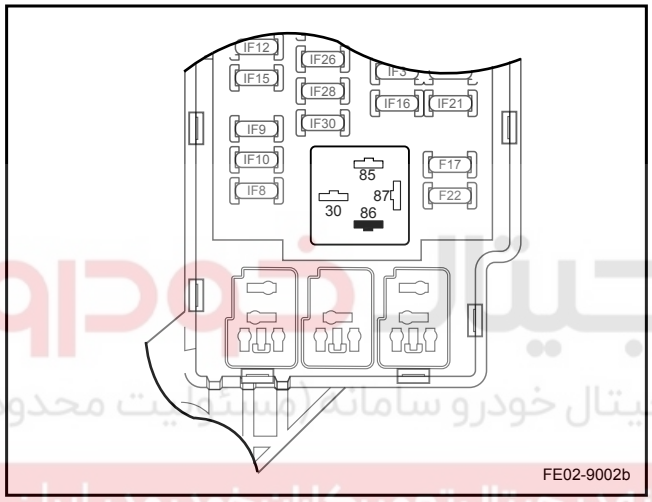
Location	Related Terminal	Standard
OFF	All Terminals	Infinity

Location	Related Terminal	Standard
ACC	1-3	Conducted
ON	1-2-3	Conducted
	5-6	
ST	1-2	Conducted
	4-5-6	

If you detect there is one item that is not complying with standards, replace the ignition switch.

2.10.7.4 Ignition Relay IG1 No Power Output

Step 1	Check IG1 relay coil control power supply.

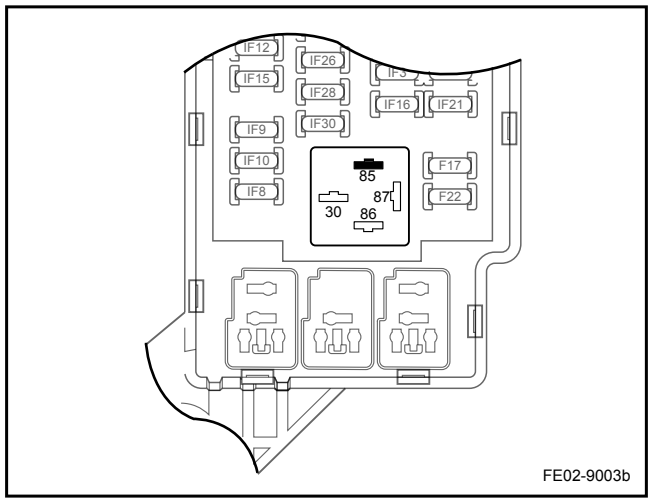


(a) Turn the ignition switch to "OFF" position.
(b) Remove the ignition relay.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between ignition relay IG1 terminal No.86 and a reliable ground.
Standard Voltage: 11-14 V
Is the voltage specified value?

No → Go to step 5

Yes

Step 2	Check IG1 relay coil ground circuit.

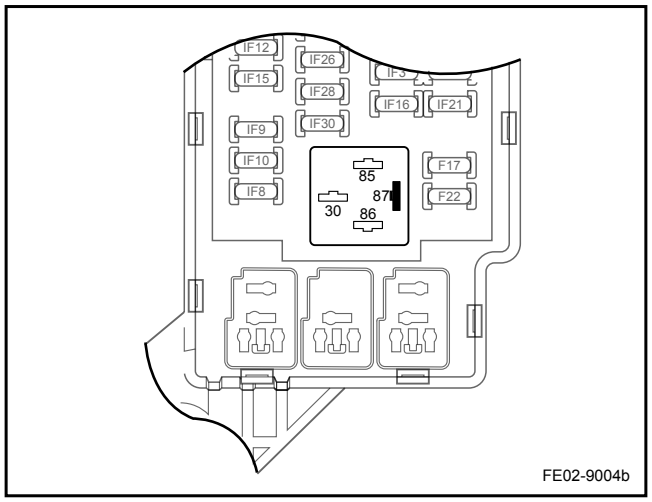


(a) Turn the ignition switch to "OFF" position.
(b) Remove the ignition relay.
(c) Measure resistance between ignition relay IG1 terminal No. 85 and a reliable ground.
Standard Resistance: Less than 1 Ω
Is the resistance specified value?

No → The circuit between the relay terminal No.85 and the ground is open.

Yes

Step 3	Check the relay power input.

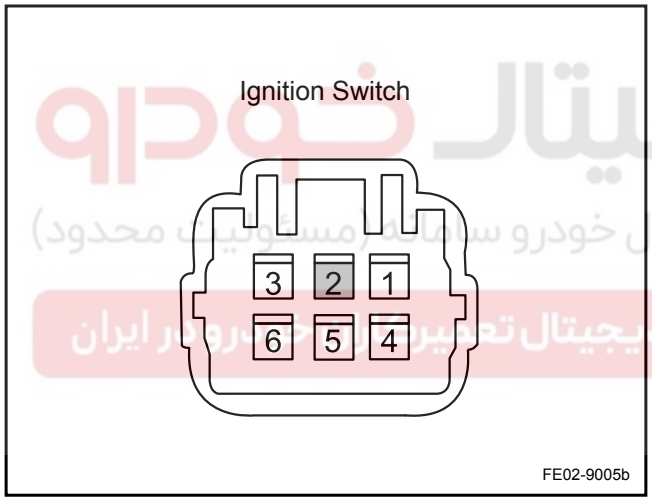


(a) Turn the ignition switch to "OFF" position.
(b) Remove ignition relay.
(c) Measure voltage between ignition relay IG1 terminal No.87 and a reliable ground.
Standard Voltage: 11-14 V
Is the voltage specified value?

No → The circuit between the relay terminal No.87 and fuse EF22 is open.

Yes

Step 4	Replace the ignition relay IG1.
Step 5	Check ignition switch IG1 power output.



(a) Turn the ignition switch to "ON" position.
(b) Measure voltage between ignition switch harness connector IP23 terminal No.2 and a reliable ground. (Note: During this test, the ignition switch wiring harness connector can not be disconnected).
Standard Voltage: 11-14 V
Is the voltage specified value?

No → Check the ignition switch, refer to the2.10.7.3 Check Ignition Switch

Yes

Step 6	The circuit between ignition switch wiring harness connector IP23 terminal No.2 and the ignition relay IG1 terminal No.86 is open.

Next

Step 7	Diagnostic completed.

2.10.7.5 Spark Plug Does Not Arcing

Note

Before carry out the Spark Plug do not arcing diagnostic, make sure that the engine anti-theft locking system is not activated and working properly.

It is prohibited directly contact the ignition wire with the ground, as this may damage the ignition coil or the engine control module. the correct approach is to use a good spark plug with one end to connect the ignition wire, the other to a reliable ground.

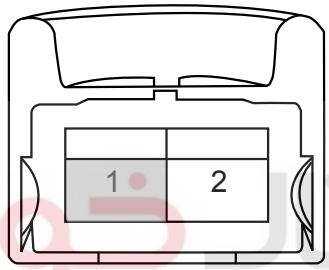
Step 1	Are instruments, wiper and other electrical accessories working properly?

No → Ignition relay IG1 is not working properly. Refer to 2.10.7.4 Ignition Relay IG1 No Power Output

Yes

Step 2	Check the ignition coil power supply.

Ignition Coil Harness Connector EN19 (EN20)



FE02-9006b

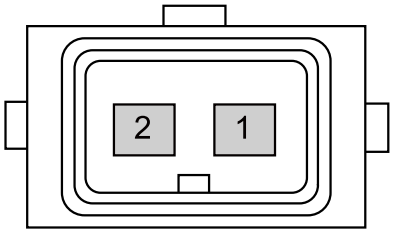
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition coil harness connector EN19 (EN20).
(c) Turn the ignition switch to "ON" position.
(d) Measure the voltage between ignition coil harness connector EN19 (EN20) terminal No.1 and a reliable ground.
Standard Voltage: 11-14 V
Is the voltage specified value?

No → The ignition relay IG1 terminal No.30 circuit is open.

Yes

Step 3	Measure the ignition coil primary resistance.

Ignition Coil



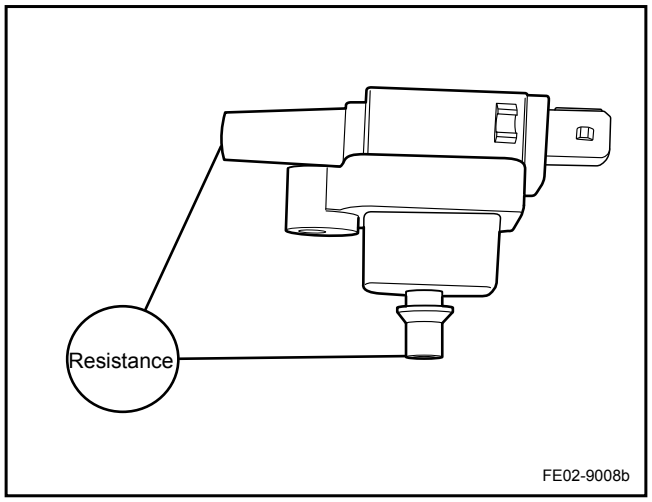
FE02-9007b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition coil harness connector EN19 (EN20).
(c) Measure resistance between the ignition coil terminal No.1 and No.2.
Standard Resistance Value: 0.7-0.9 Ω
Is the resistance specified value?

No → Replace the ignition coil. Refer to 2.10.8.3 Ignition Coil Replacement

Yes

Step 4	Measure the ignition coil secondary resistance.



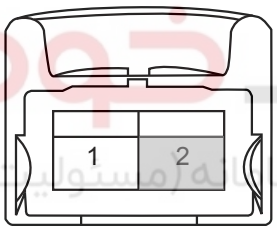
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition coil harness connector EN19 (EN20).
(c) Measure resistance between the ignition coil secondary terminals.
Standard Resistance Value: 9.68-12.32 kΩ
Is the resistance specified value?

No → Replace the ignition coil. Refer to 2.10.8.3 Ignition Coil Replacement

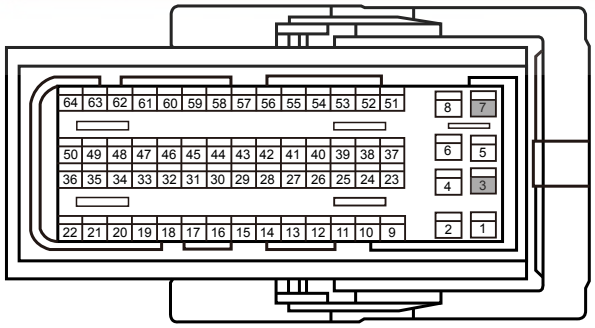
Yes

Step 5	Check the ignition coil control circuit.

Ignition Coil Harness Connector EN19 (EN20)



ECM Harness Connector EN01



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Disconnect the ignition coil harness connector EN19 (EN20).
(d) Measure resistance between ECM harness connector EN01 terminal No.3(7) and the ignition coil harness connector EN19 (EN20) terminal No.2 with a multimeter.
(e) Measure resistance between the ignition coil harness connector EN19 (EN20) terminal No.2 and a reliable ground with a multimeter. Check whether there is short to ground circuit.
(f) Measure voltage between the ignition coil harness connector EN19 (EN20) terminal No.2 and a reliable ground with a multimeter. Check whether there is short to power supply circuit.
Standard Value:

Measurements	Standard Value
EN01 (3) / (7) -EN19/EN20 (2) Resistance	0 Ω
Resistance Between EN19/EN20 (2) and A Reliable Ground	10 kΩ or higher
Voltage Between EN19/EN20 (2) and A Reliable Ground	0 V

Are the measured values specified values?

No → Repair the circuit fault.

Yes

Step 6	Turn the ignition switch to the "ST" position to observe whether the instrument displays engine speed?

Note: Each time the ignition switch can not stay at the "ST" location more than 5s, otherwise it will damage the starter motor.

Note: The scan tool can also be to diagnose. Turn the ignition switch to the "ST" position to observe the scan tool data: Engine / data list / "engine speed."

Speed not shown?

No → Go to step 10

Yes

Step 7	Check the crankshaft position sensor.

For inspection steps, refer to 2.2.7.29 DTC P0321 P0322

Confirm the resistance is the specified value.

No → Replace the crankshaft position sensor. Refer to 2.10.8.2 Crankshaft Position Sensor Replacement

Yes

Step 8	Check the crankshaft position sensor signal circuit.

For inspection steps, refer to 2.2.7.29 DTC P0321 P0322

Normal?

No → Repair the circuit fault.

Yes

Step 9	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.

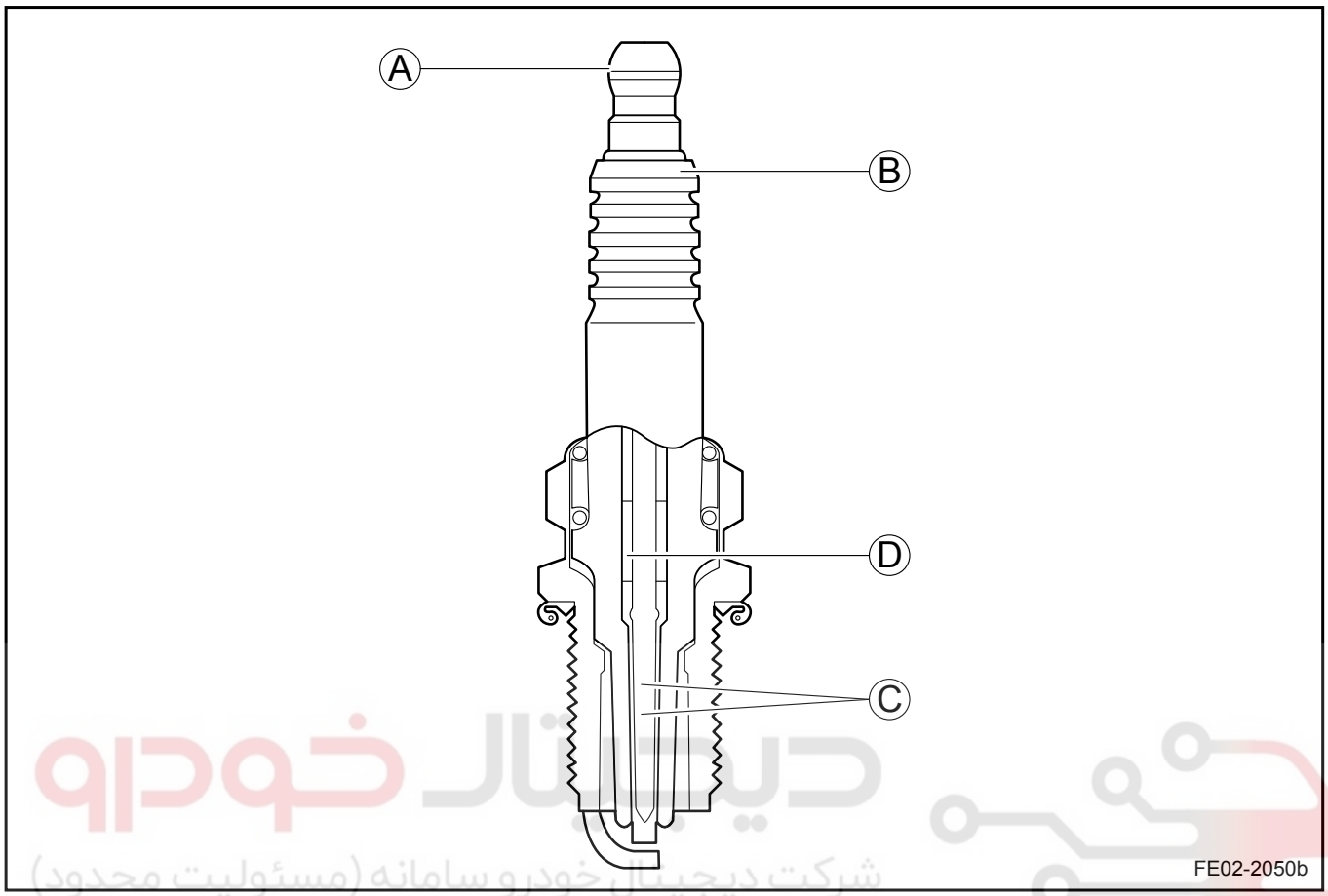
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 10	Replace ECM.

2.10.7.6 Spark Plug Diagnostic



Step 1	Remove the spark plug. Refer to 2.10.8.4 Spark Plug Replacement.

Next

Step 2	Check whether the terminal terminal A is bent or broken, pull the terminal to test whether the terminal A is loose.

Next

Step 3	Check whether the B-insulator has arcing or signs of leakage, which is due to discharge between terminal A and terminal B two ends.

Check whether there are following conditions:

(a) Check the high-voltage damping line for damage.

(b) Check whether the cylinder head spark plug groove is wet. Whether there is engine oil, engine coolant or water. Damped spark plug will cause arc discharge.

Next

Step 4	Check whether there is crack on the insulator B, otherwise it will cause discharge.

Next

Step 5	Check center electrode C for signs of abnormal discharge, measure the gap between the center electrodes.

(a) Check whether the spark plug torque is correct, the spark plug tightening torqueis the 20-30Nm (14.8-22.2lb-ft). If the torque is not adequate, the spark plug will not work correctly. It the torque is too large, it may lead to insulator B cracking.
(b) Check for signs of leakage around the insulator tip rather than near the center electrode D.
(c) Check for the electrode C-side fracture and worn.
(d) Check whether the spark plug is broken, worn or loose by shaking center electrode D. If a popping sound is heard, it indicates the internal parts have been damaged. If the center electrode spark D is loose, the spark plug intensity will be reduced .
(e) Check whether electrodes C and D are shorted. If it is the case, the residue on the electrode C will reduce or even the gap will disappear.
(f) Check whether the electrode is too dirty.

Next

Step 6	Check the cylinder head slot for debris, otherwise it may damage the spark plug during the installation.

2.10.7.7 Common Spark Plug Malfunction

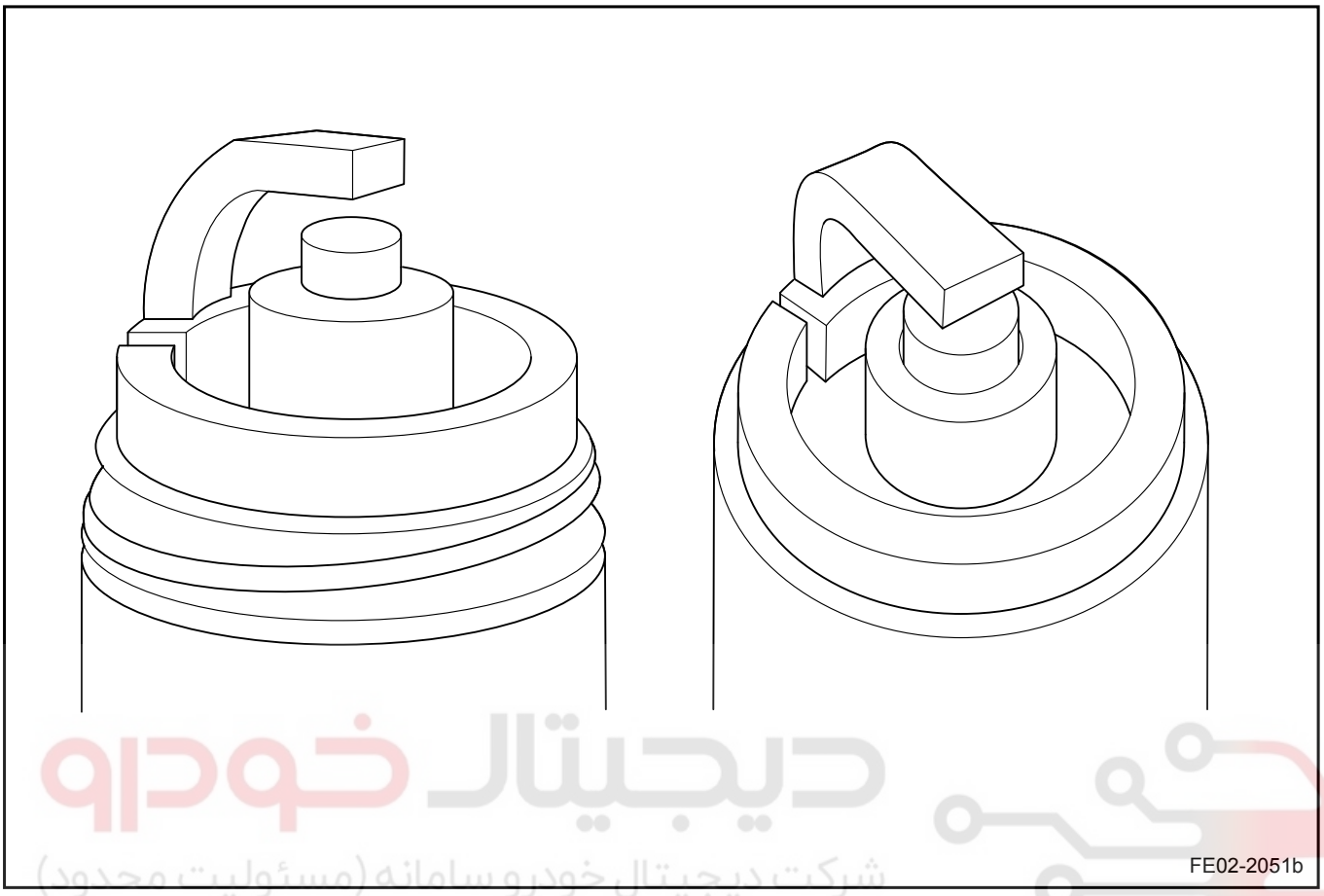
Serious Spark Plug Burn: Spark plug top scars, damage or electrode melting, brunt all indicate that the spark plug has been damaged and should be replaced. Check the symptoms as well as color changes when replacing the spark plug, in order to analyze the reasons for malfunction. Refer to 2.10.8.4 Spark Plug Replacement.

1. Electrode melting and the insulator turning white indicate that combustion chamber temperature is too high. This may be because there is too much carbon residue in the combustion chamber, so that valve clearance is too small caused by overheating or cooling malfunction. Another possible reason it that the spark plug tightening torque does not match the specified value.
2. Electrode becomes rounded and the insulator has a scar, indicating that an early engine combustion. It may be because premature ignition timing, low-octane gasoline or spark plug too hot.
3. Insulator top is broken. Knock combustion is the main reason for the insulator rupture. Premature ignition timing, low-octane gasoline or spark plug too hot may lead to engine knocking.
4. Insulator top has gray black strips, which indicate that the spark plug may have been leaking and should be replaced.

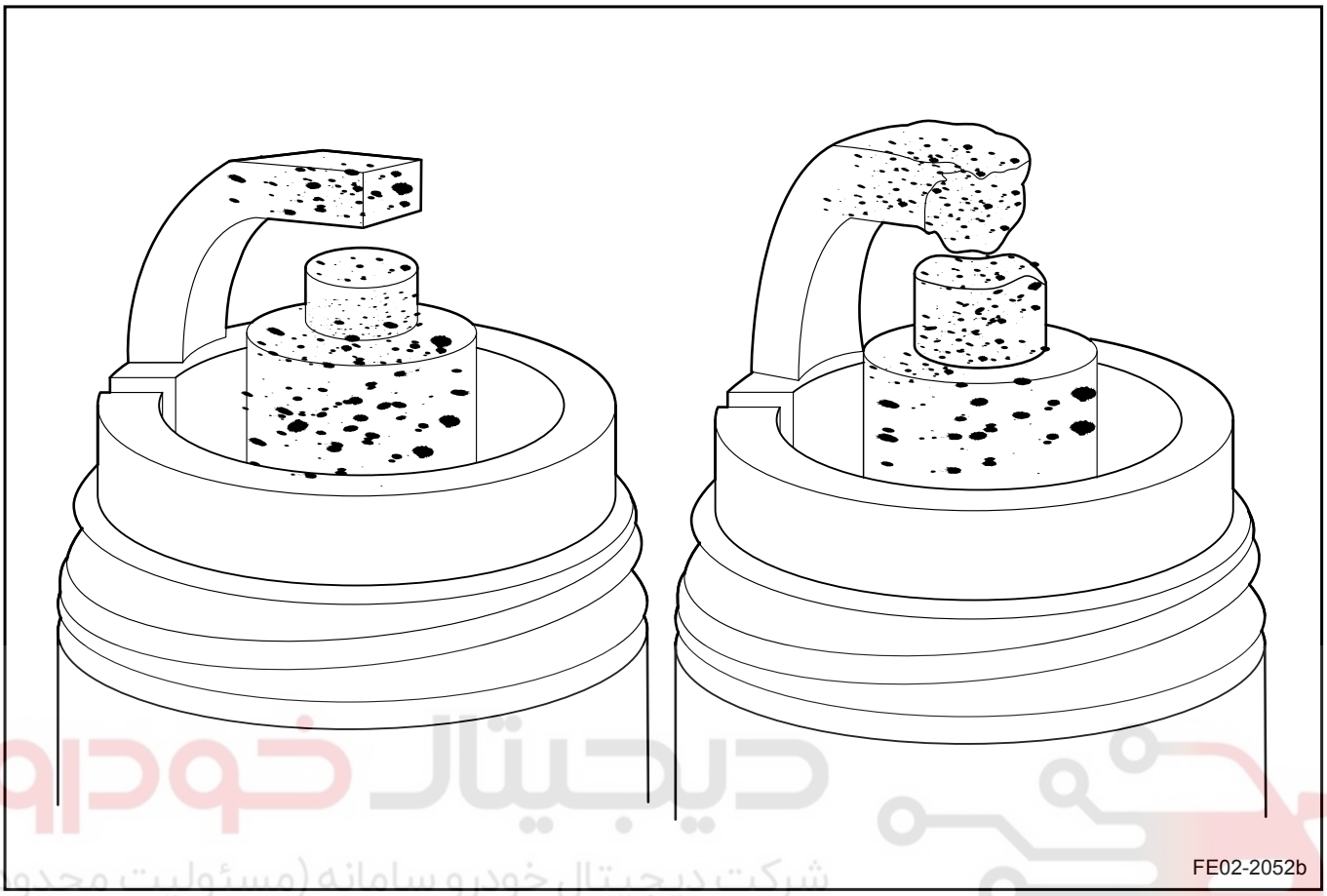
Spark Plug Residue: There is residue between the spark plug insulator top and the electrodes. In severe cases, it can cause the engine inoperative. Cleaning the spark plug can be a temporary solution. In order to maintain good performance, identify the root cause for the malfunction.

1. Oily Residue. Spark plug has oily residues, indicating that lubricating oil entering into the combustion chamber. If it only happens to an individual spark plug, the valve rod seals may be damaged. If every cylinder spark plug has oily residue, it indicates that there is cylinder channeling oil. Check whether the air filter and ventilation device is blocked.
2. Black Residue. There is black residue on the spark plug electrodes and inside the spark plug, indicating that the mixture is too rich. Increase the engine running speed and continue for a few minutes to burn the layer of black soot on the electrode.

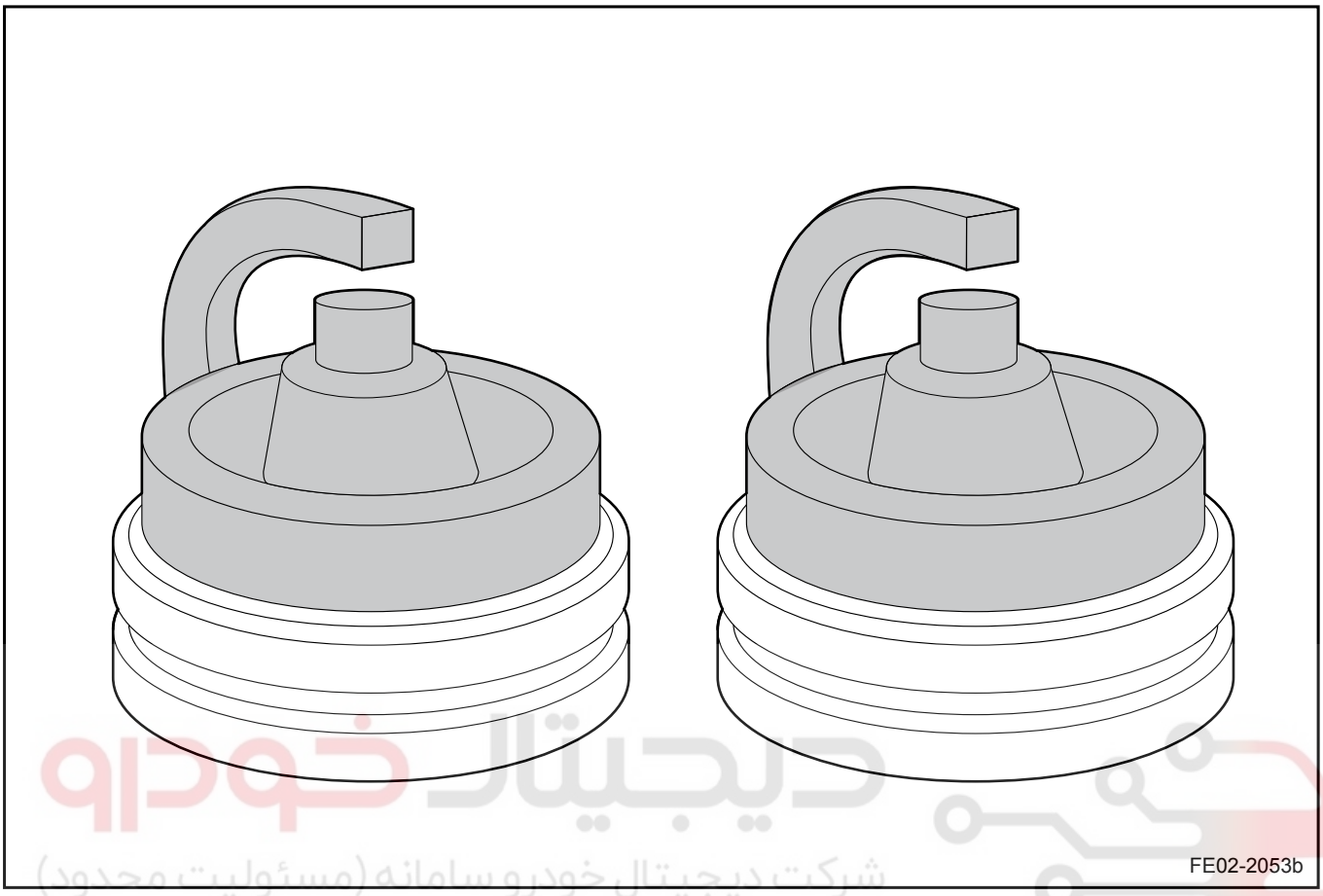
1. With normal spark plug, center electrode is gray or yellow.



2. With excessive fuel combustion, spark plug center electrode has serious corrosion.



3. With incorrect spark plug heat value or fuel system malfunction, the spark plug center electrode has excessive carbon residue.



2.10.8 Removal and Installation

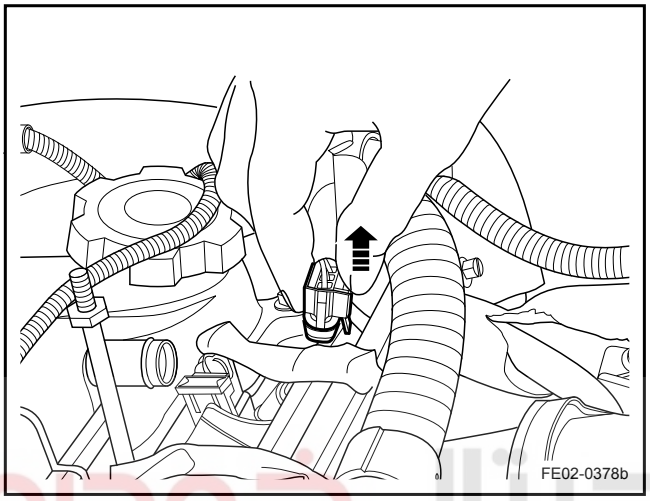
2.10.8.1 Camshaft Position Sensor Replacement

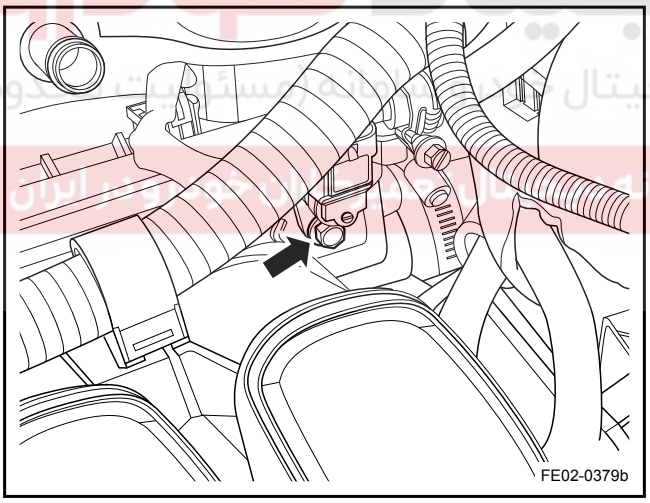
Removal Procedure:

Warning!

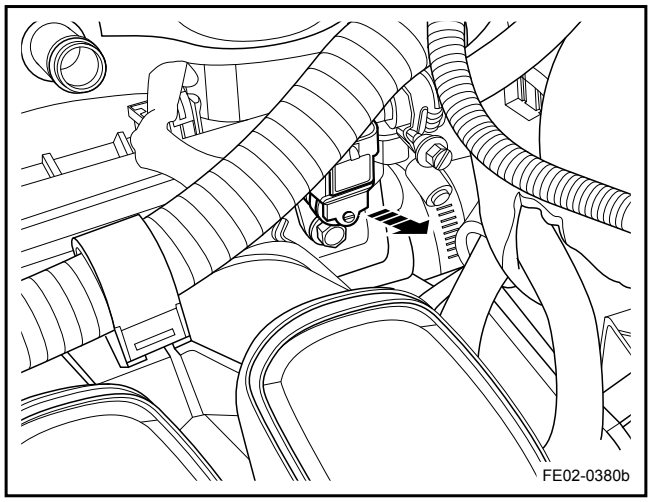
Refer to "Battery Disconnection Warning" in "Warnings and Notices".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect the camshaft position sensor wiring harness connector.



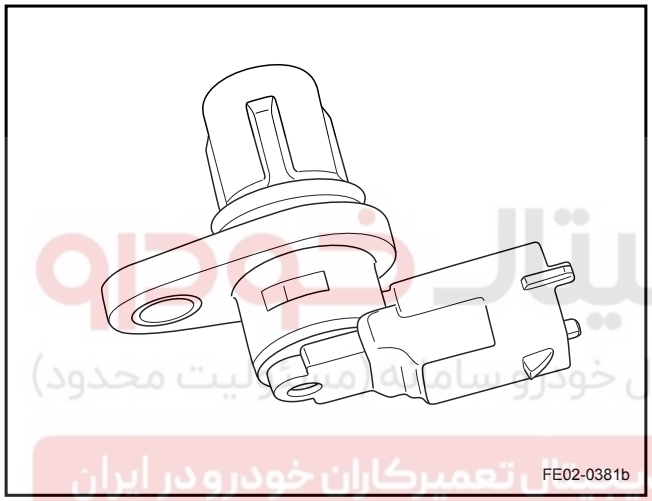


3. Remove the sensor retaining bolts.

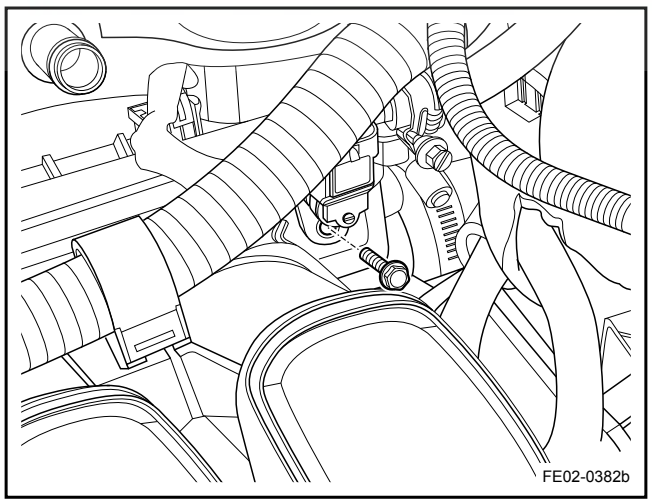


4. Remove the camshaft position sensor.

Installation Procedure:

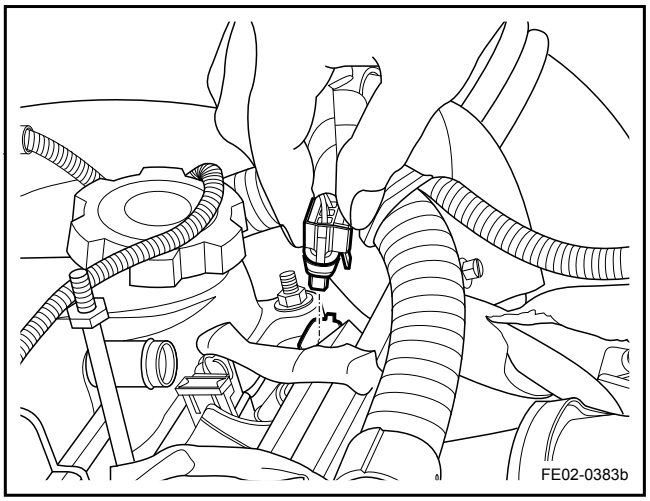


1. Check to confirm whether the camshaft position sensor seals are intact.



2. Install camshaft position sensor and tighten the retaining bolt.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)



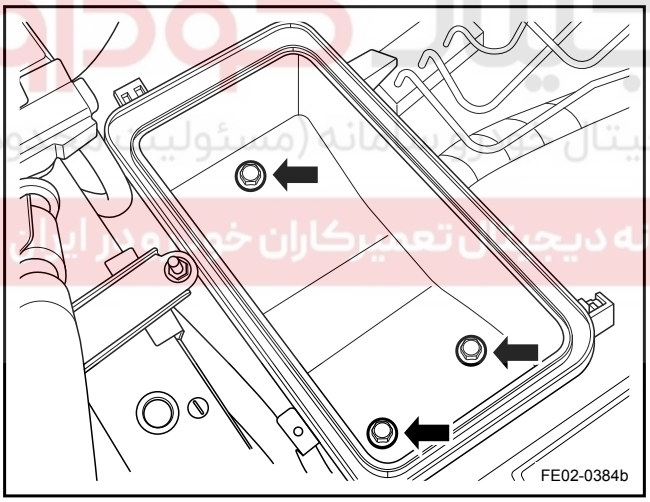
3. Connect the camshaft position sensor wiring harness connector.
4. Connect the battery negative cable.

2.10.8.2 Crankshaft Position Sensor Replacement

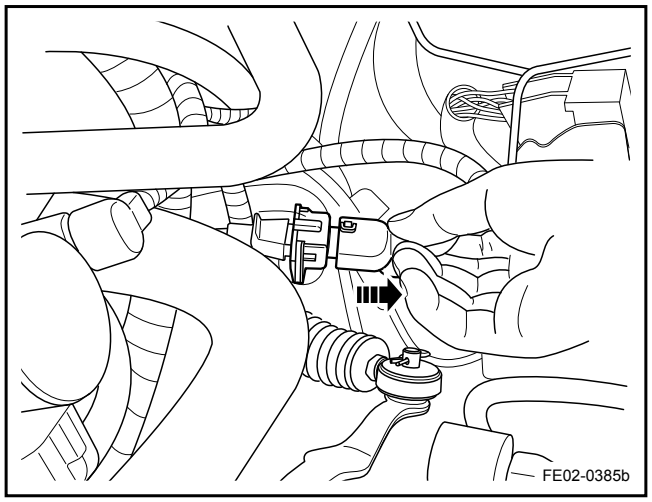
Removal Procedure:

Warning!

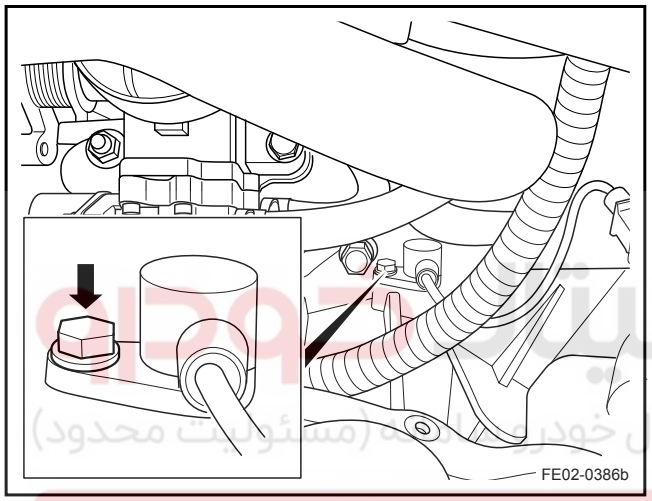
Refer to "Battery Disconnection Warning" in "Warnings and Notices".



1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove the air filter.



3. Disconnect the crankshaft position sensor wiring harness connector.

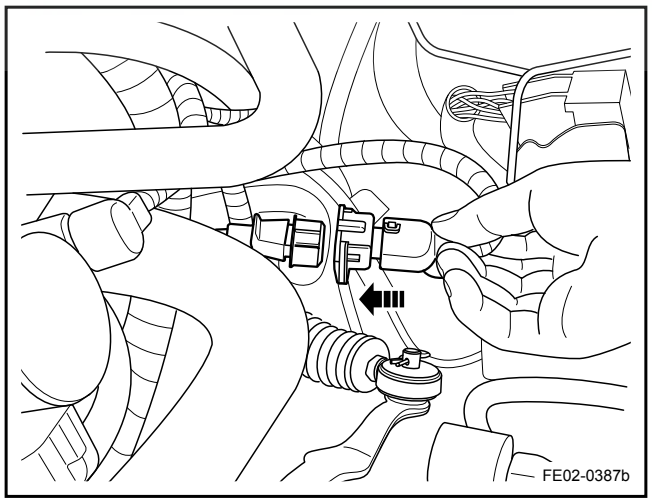


4. Remove the sensor retaining bolts.

Note

After removing the sensor, plug the sensor mounting hole to prevent debris falling into it.

Installation Procedure:



1. Install the sensor and tighten the retaining bolts.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)

2. Connect the crankshaft position sensor wiring harness connector.

3. Install the air filter assembly.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)

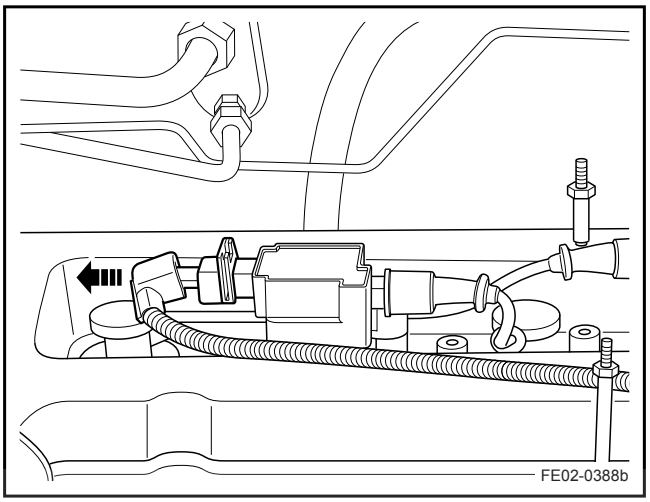
4. Connect the battery negative cable.

2.10.8.3 Ignition Coil Replacement

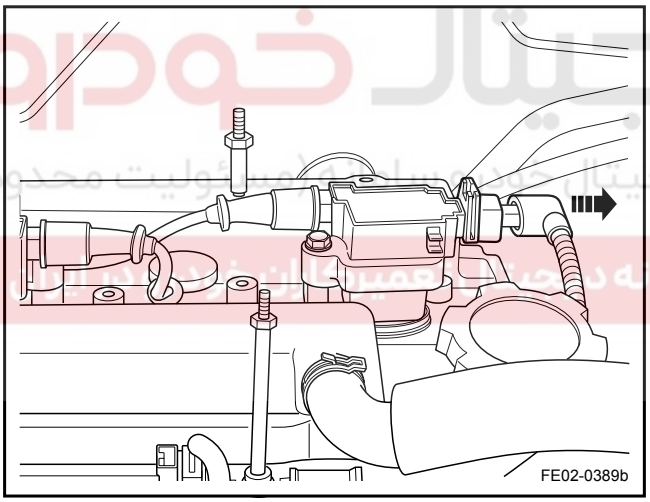
Removal Procedure:

Warning!

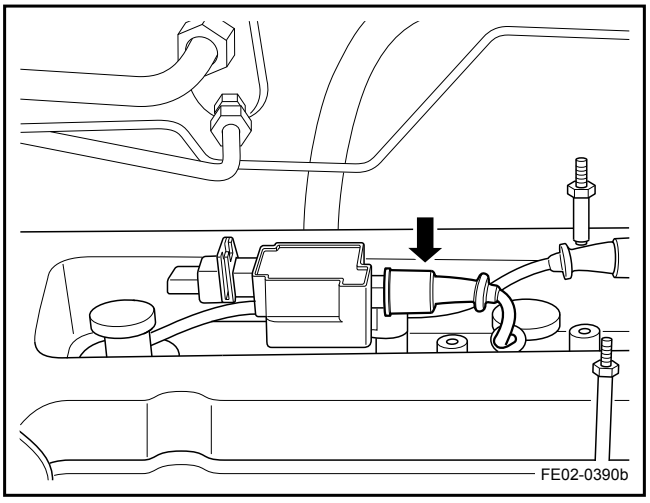
Refer to "Battery Disconnection Warning" in "Warnings and Notices".



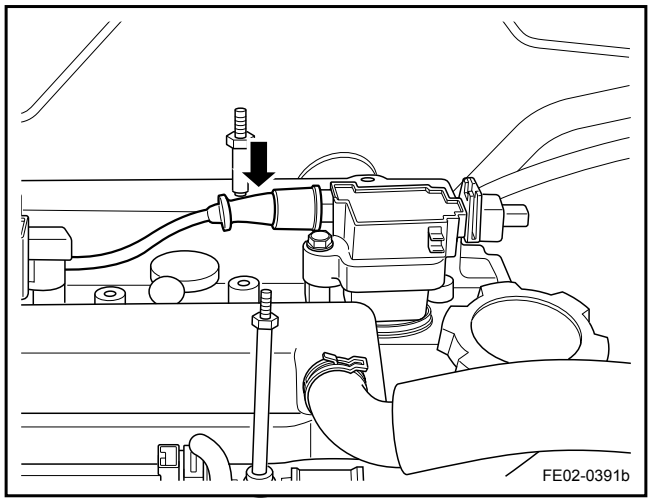
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove the hood. Refer to 2.6.8.1 Plastic Engine Shield Replacement.
3. Disconnect cylinder No.2 and No.3 ignition coil harness connectors.



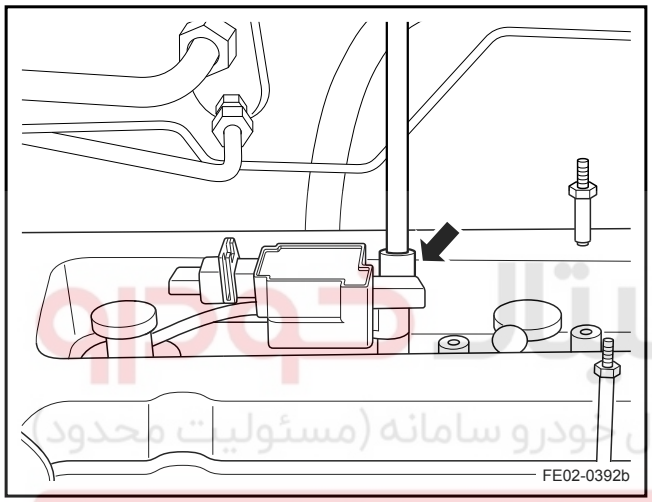
4. Disconnect cylinder No.1 and No.4 ignition coil harness connectors.



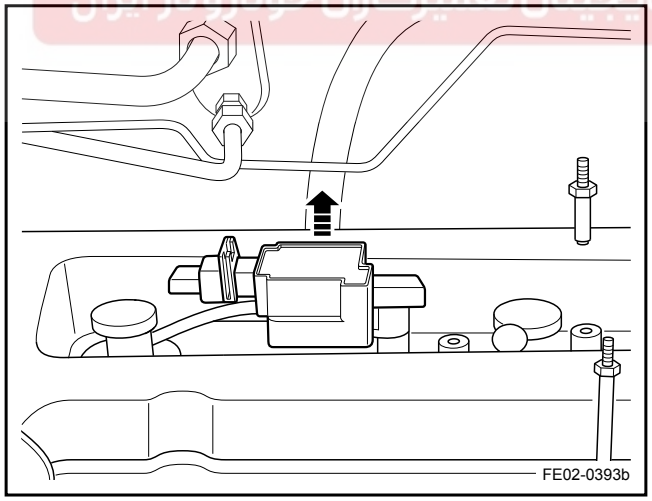
5. Disconnect the cylinder No.3 high pressure damping line.



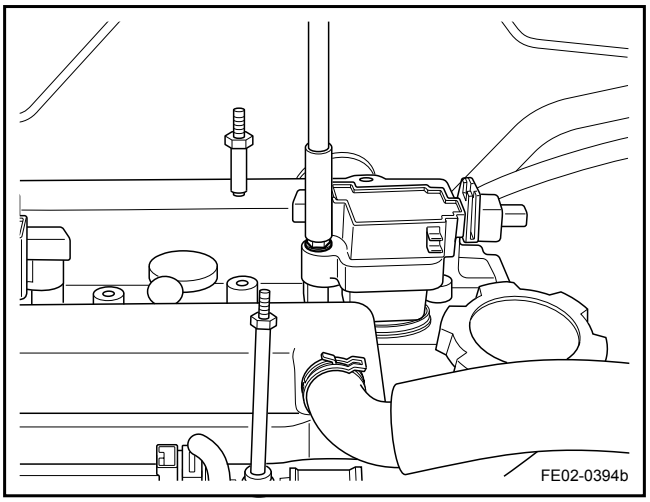
6. Disconnect the cylinder No.1 high pressure damping line.



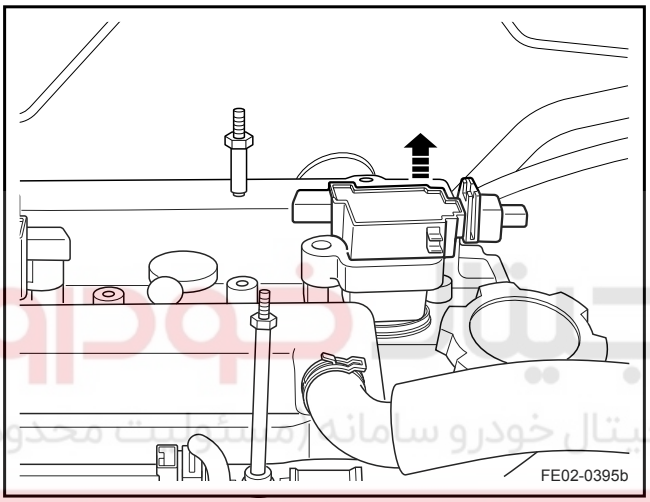
7. Remove cylinder No.2 and No.3 ignition coil retaining bolts.



8. Remove cylinder No.2 and No.3 ignition coils.

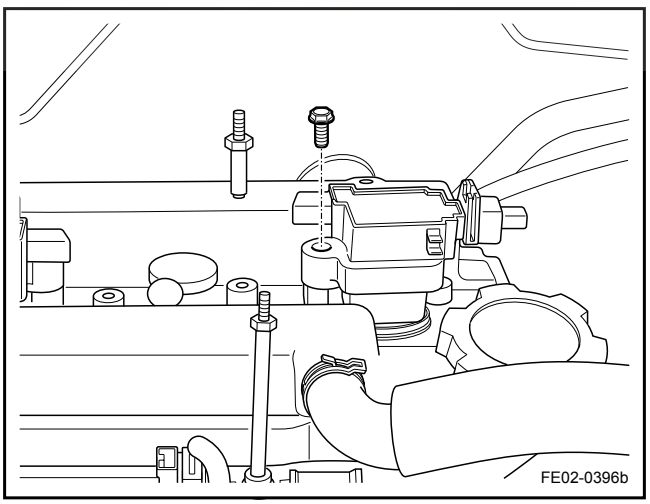


9. Remove cylinder No.1 and No.4 ignition coil retaining bolts.



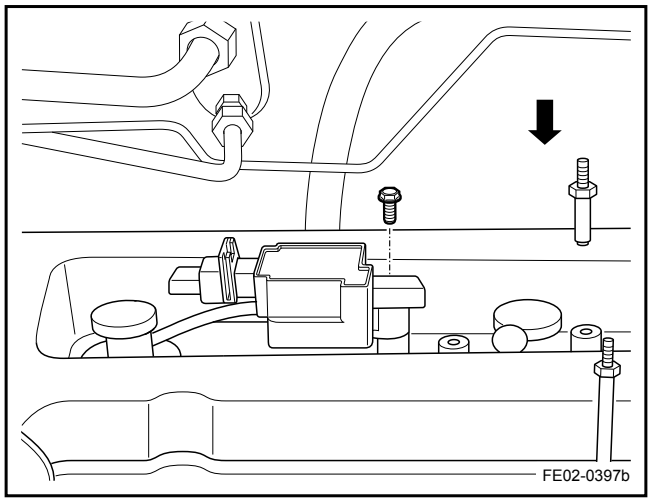
10. Remove cylinder No.1 and No.4 ignition coils.

Installation Procedure:



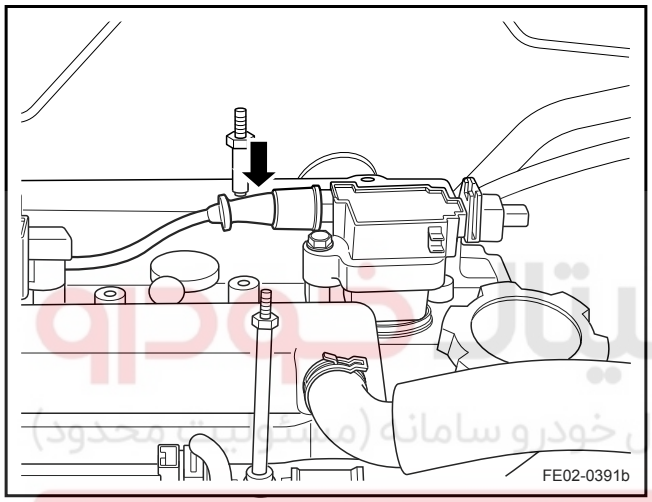
1. Install cylinder No.1 and No.4 ignition coils, and tighten the retaining bolts.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)



2. Install cylinder No.2 and No.3 ignition coils, and tighten the retaining bolts.

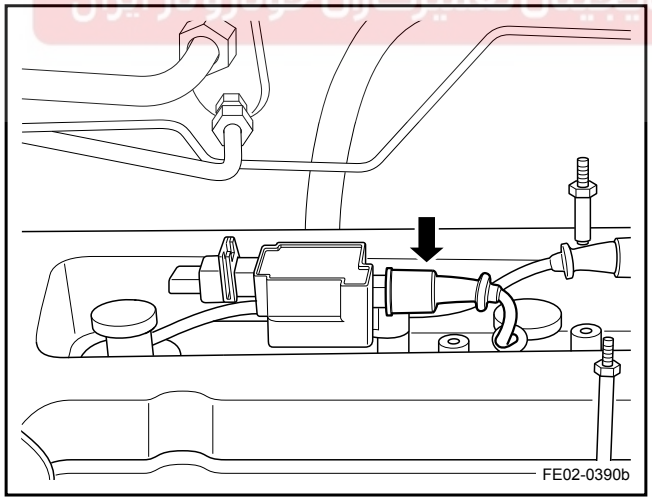
   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)



3. Connect the cylinder No.1 high pressure damping line.

   Note

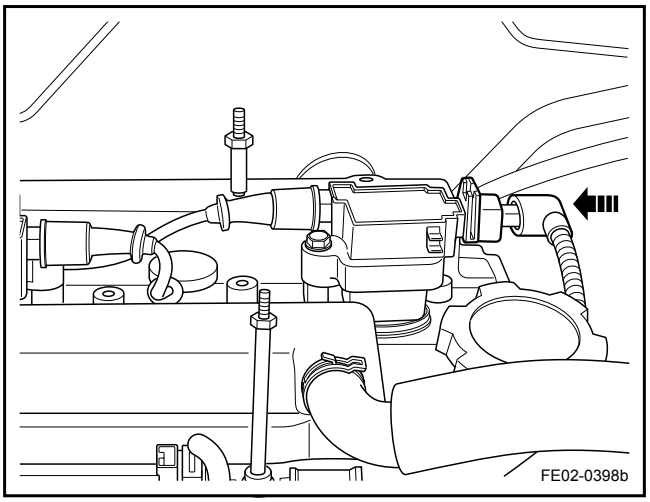
   Confirm the high-pressure damping line is installed in place, otherwise it will cause a secondary arch and engine malfunction.



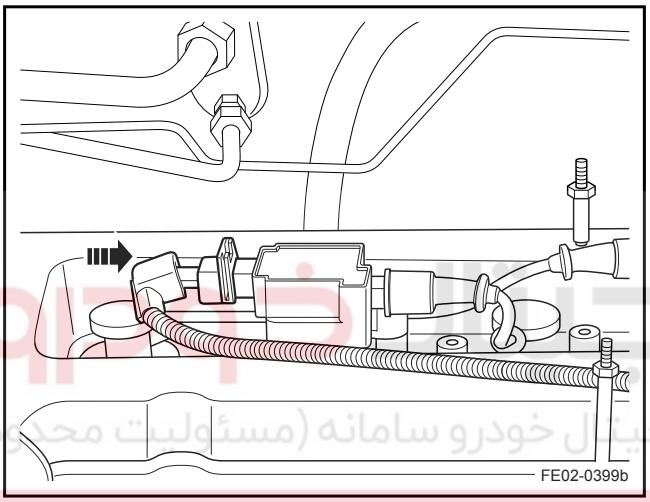
4. Connect the cylinder No.3 high pressure damping line.

   Note

   Confirm the high-pressure damping line is installed in place, otherwise it will cause a secondary arch and engine malfunction.



5. Connect cylinder No.1 and No.4 ignition coil harness connectors.



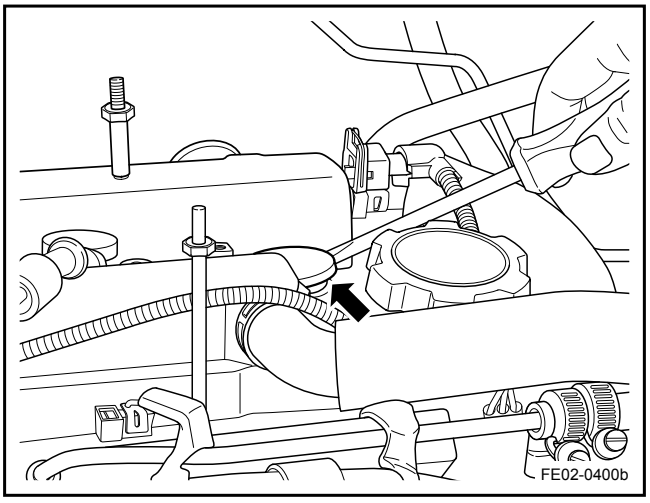
6. Connect cylinder No.2 and No.3 ignition coil harness connectors.
7. Install the engine hood.
8. Connect the battery negative cable.

2.10.8.4 Spark Plug Replacement

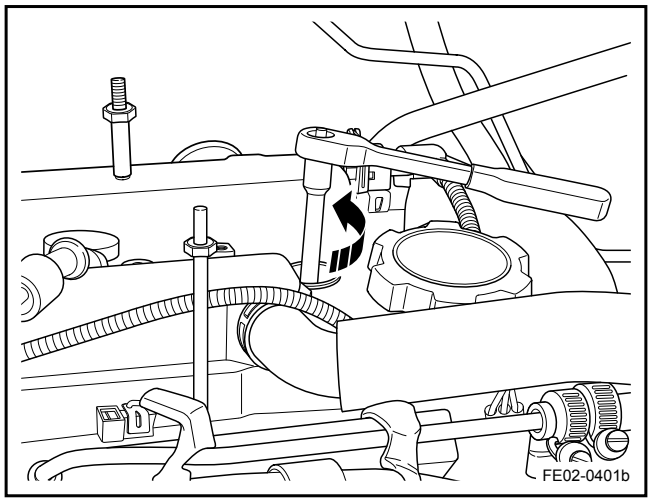
Removal Procedure:

Warning!

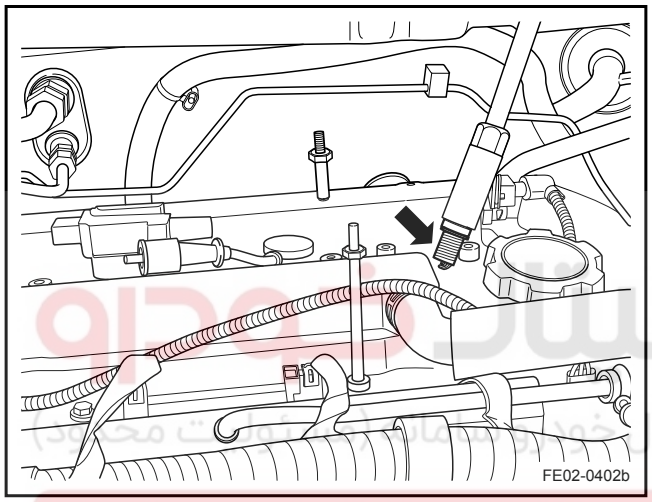
Refer to "Battery Disconnection Warning" in "Warnings and Notices".



1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove the hood. Refer to 2.6.8.1 Plastic Engine Shield Replacement.
3. Remove the ignition coil. Refer to 2.10.8.3 Ignition Coil Replacement.
4. Remove the high-voltage damping line.

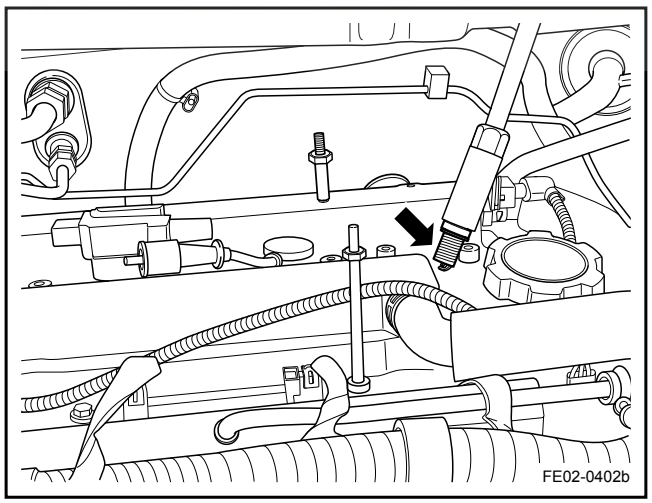


5. Use spark plug socket to rotate the spark plug counterclockwise to remove the spark plug.



6. Remove the Spark Plug from the cylinder head .

Installation Procedure:

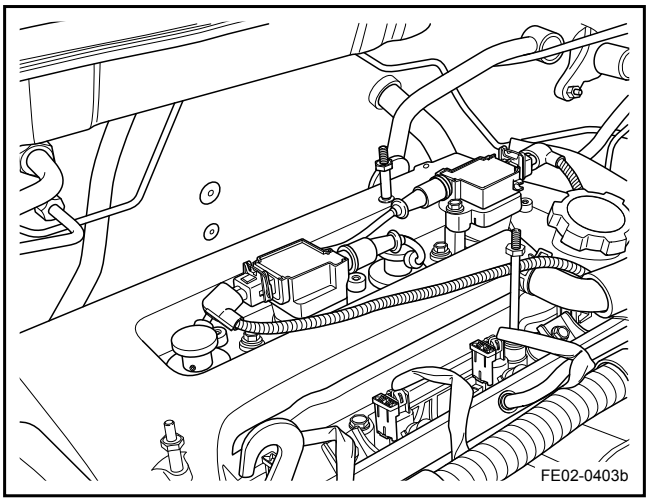


1. Clean the Spark Plug and check the spark plug electrode gap.

   Spark plug gap: 1.0-1.1 mm (Metric) 0.04-0.043 in (US English)

2. Use spark plug socket to install the spark plug into the engine.

   Torque: 25 Nm (Metric) 18.5 lb-ft (US English)



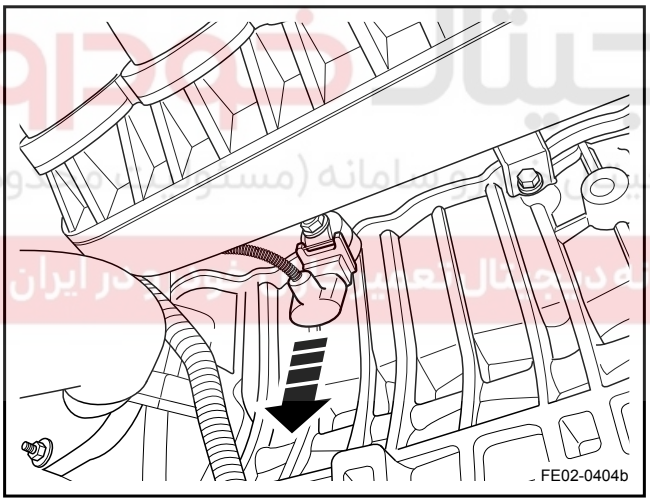
3. Install the high-voltage damping line and the spark plug.
4. Install the engine hood.
5. Connect the battery negative cable.

2.10.8.5 Knock Sensor Replacement

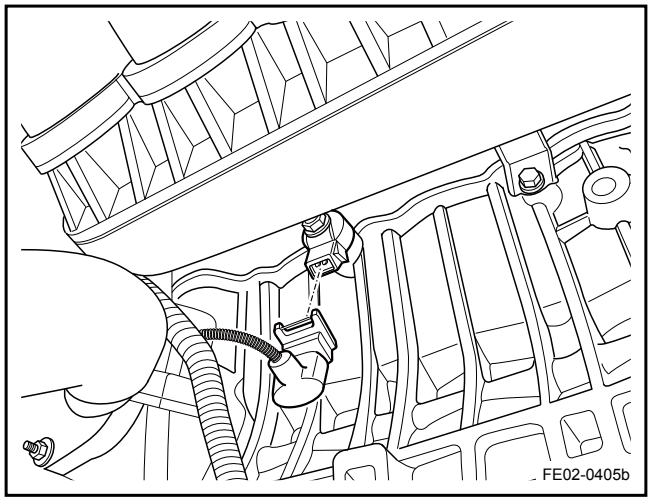
Removal Procedure:

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 starter. Refer to 2.11.8.4 Starter Replacement.
3. Disconnect the knock sensor harness connector.
4. Remove the retaining bolts and the knock sensor.



Installation Procedure:

1. Install the knock sensor retaining bolts.

   Torque: 18 Nm (Metric) 13.3 lb-ft (US English)

2. Connect the knock sensor wiring harness connector.
3. Install the starter.
4. Connect the battery negative cable.

2.11 Starting / Charging System JL4G18-D

2.11.1 Specifications

2.11.1.1 Fastener Tightening Specifications

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Battery Cable Nut	M6	8.5-12	6.3-8.9
Battery Bracket To Battery Stud Nut	M6	7.5-10.5	5.6-7.8
Battery Terminal Bolt	M6 × 34	8.5-12	6.3-8.9
Battery Upper Bracket Bolt	M10 × 1.5 × 20	13	9.6
Generator Drive Shaft Nut	M24	100	74
Generator Upper Mounting Bolt	M8 × 30	20-30	14.8-22.2
Generator Screw	M10 × 1.25 × 72	44-64	32.6-47.4
Starter Electromagnetic Switch Assembly Screws	M6 × 28	8	5.9
Starter Solenoid Switch Terminal To Battery Cable Terminal Nut	M13	10	7.4
Starter To Engine Block Mounting Bolt	M10 × 1.25 × 60	37	27.4
Starter To Transmission Mounting Bolt	M10 × 1.25 × X80	37	27.4

2.11.1.2 General Specifications

Battery Specifications

Applications	Specifications
Cold Start Current	400 A
Rated Capacity	60 A/h
Rated Voltage	12 V

Start Motor Specifications

Applications	Specifications
Starter	
No-Load Test (12.2 V)	40-90 A
No-Load Test Power Consumption	0.5 kW

Applications	Specifications
Drive Gear Speed	2,600-4,800 rpm
Solenoid	
Coil (12.2V)	35 A
Suction Coil (12.2V)	35 A

Generator Specifications

Applications	Specifications
Current	90 A
Model	JFZ1906

2.11.2 Description and Operation

2.11.2.1 Battery Description and Operation

Warning!

Refer to "Battery Acid Fluid" in "Warnings and Notices".

This vehicle uses uses a maintenance-free battery, which is different from a conventional battery. There is no vent plug in this battery. Apart from a small vent on both sides of batteries, the battery is completely sealed. Vent holes can discharge a small amount of gas generated by the battery. The electrolyte inside the battery generates a small amount of gas after chemical reactions. If there is no exhaust vent, battery internal pressure increases as the gas pressure increases. When the pressure is over limit that the battery shell can withstand, the battery shell will break.

Compared with a conventional battery, this battery has the following advantages:

- No need to fill water during the life of the battery.
- Overcharge protection.
- Electricity leakage is less likely to happen as compared with a conventional battery.
- Lighter, smaller and capacity is larger.

In the entire electrical system, battery has main functions:

- Provide energy to the starter for starting the vehicle.
- Play a role as the electrical system voltage regulator.
- When the generator electrical system capacity can not meet the demand, the battery can provide power in a certain period of time.

Battery technical parameters explained:

1. Rated capacity: Witt the minimum output of electrical loads and without generator power, the time the vehicle drives at night.
2. Cold start current: Starting current when the battery temperature is -18°C.

If the battery test is normal, but the battery voltage often appears inadequate, the vehicle can not start at night etc., consider the reasons from the following aspects:

- Electrical equipment in the vehicle remain turned on all night.
- Driving speed is low, stop and start frequently.
- Vehicle electrical load exceeds the generator output, especially if the vehicle is equipped with aftermarket equipments.
- Charging system fault, such as electrical short circuit, generators belt slipping, generator malfunction or voltage regulator malfunction.
- Improper use of the battery, including failed to maintain battery cable terminals clean and tighten, or the battery bracket is loose.
- Mechanical failure in the electrical system, such as short circuit or circuit damage.

2.11.2.2 Starting System Description and Operation

Starting system includes the battery, ignition switch, starter, starter relays and related circuits, all of these parts are connected by circuits. When the ignition switch is turned to "ST" position, the starter relay pull-in and provides power to starter motor magnetic switch, starter motor runs. For specific control principle. Refer to 2.11.3.1 Starting System Working Principle.

2.11.2.3 Charging System Description and Operation

Charging system includes the battery, generator, instrument cluster and relevant circuits. Generator consists of the voltage regulator, rectifier, stator and rotor, which are all installed inside the generator housing. When the engine rotates, the drive belt drives the generator to rotate. The generator rotation generates an alternating current, which is converted to a direct current by the diode rectifier and then transmitted to the charging system. Voltage regulator automatically adjusts the generator field current to control voltage output to keep it within the appropriate charging range. For detailed working principle. Refer to the2.11.3.2 Charging System Working Principle.

Charging Process:

1. Remove the sealed-type battery from the vehicle and install proper adapter components. Make sure that all the charging cables are clean and firm. To achieve best results, charge the battery when the electrolyte and electrode are at room temperature. If the battery temperature is too low, the charger may not start charging after a few hours.
2. Charge the battery until the battery is full or the tested battery voltage is close to full load capacity. Check the battery every half an hour during charging.
3. Test the battery load after charging. Refer to 2.11.7.9 Battery Discharging Current Parasitic Load Test.

Charge a fully discharged battery (off the vehicle):

Strictly abide by the following procedure, otherwise a good battery might be mistakenly replaced .

Follow the following procedures, charge a fully discharged battery:

1. Measure the battery terminal voltage with a precision voltage meter. If the reading is less than 10 V, the charging current will be low. The battery can only be charged with more than a few mA of current after a certain period of time.
2. Set the battery charger at a high value.
3. Continue to charge the battery, with 16V charging voltage for more than 4 hours:
   - If after 4 hours, there is still no charging current. The battery should be replaced.
   - If there is charging current, then the battery intact. Continue to charge the battery until it is fully charged.

2.11.3 System Working Principle

2.11.3.1 Starting System Working Principle

When the ignition switch in at "ST" position:

- Power passes through the underhood fuse EF15 to starter relay terminal No.87.
- Power passes through the underhood fuses EF01, EF18 to the ignition switch wiring harness connector IP23 terminal No.5.
- Power passes through the ignition switch wiring harness connector IP23 terminal No.4 to starter relay terminal No. 85.
- Starter relay terminal No.86 and the BCM harness connector IP29 terminal No.11 is connected. When the engine anti-theft locking system and vehicle Anti-theft alarm system are not activated, BCM grounds the terminal No.11, relay coil is provided with power and the relay pull-in.
- After the relay pull-in, the relay provides power through terminal No.30 to the starter motor wiring harness connector EN18.
- Starter motor electromagnetic switch is closed after power provided between the battery and starter motor closed-loop. Starter motor is grounded through the engine block. When the power supply and ground conditions are meet, the starter motor starts running and the engine starts.

Start motor working principle: The motor is a DC reduction motor. The stator is a permanent magnet and the rotor is coil windings located in the armature. Through the magnetic field the coil excites the windings. Solenoid core is located inside the drive cover to avoid dust, ice and splash of water. When the switch is closed, the electromagnetic switch coil power resulting a magnetic field, causing the core and fork move and driving gear and the engine flywheel ring gear meshing. When the electromagnetic switch main contacts are closed, the battery to starter motor circuit is connected. The armature rotates and through a reduction mechanism increases the torque to drive the engine to rotate. With the starter motor rotating, due to the driving gear and the engine flywheel ring gear mesh, so the engine rotates. When the engine starts, the driver gear overdrive in order to prevent the armature speed is too high to damage the starter, at this moment the return spring separates the drive gear. In order to prevent the speed is too high to damage the starter, the ignition switch should be immediately released after the engine starts.

2.11.3.2 Charging System Working Principle

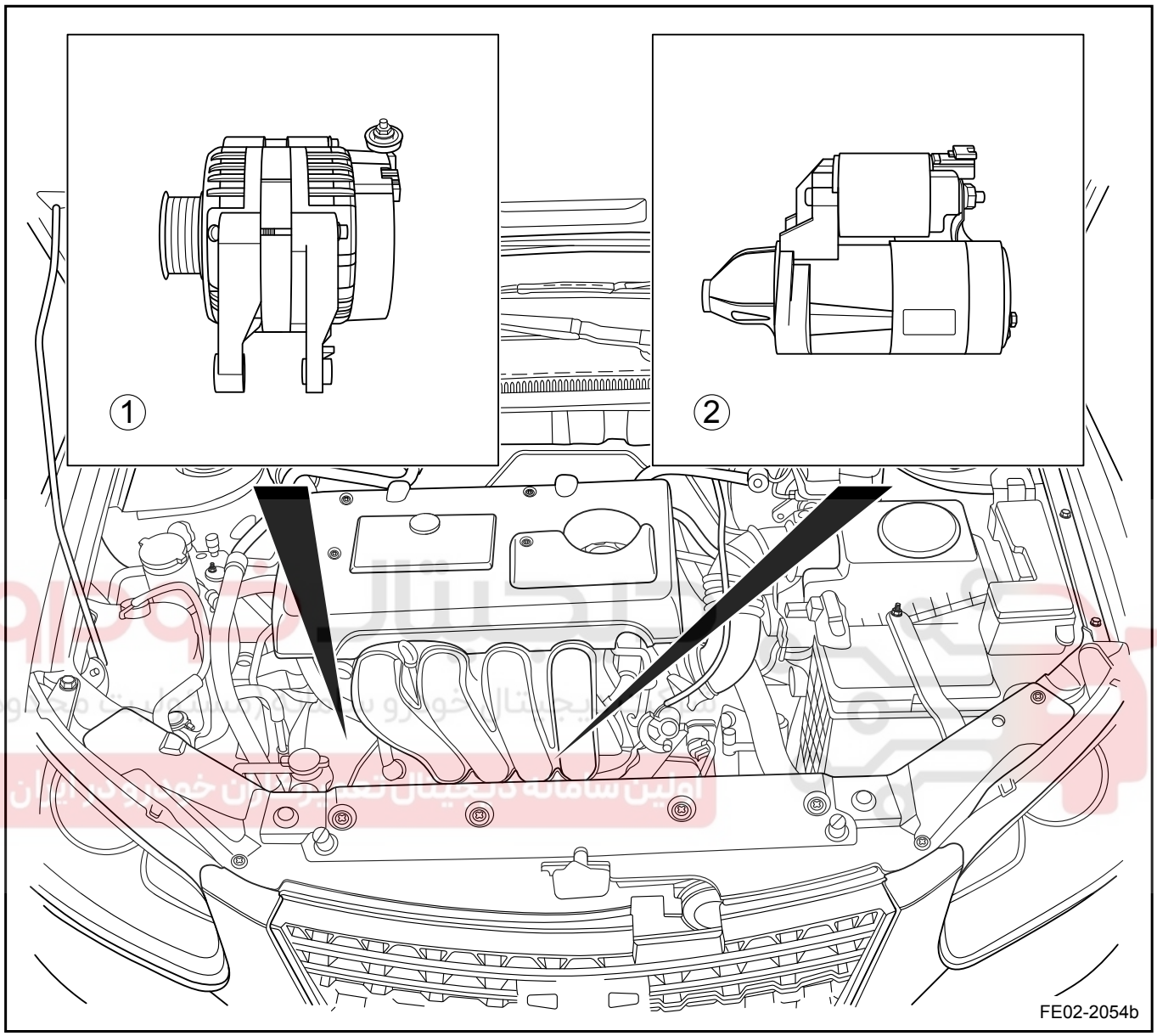
Generator provides DC voltage to the vehicle electrical system and maintains the battery charged. The voltage output is controlled by the regulator integrated inside the generator:

- When the ignition switch is at "OFF" position: battery voltage passes through the I/P fuse EF03 to the generator harness connector EN07 terminal No.3. This voltage is the regulator working power supply.
- When the ignition switch is at "ON" position and the engine is not running:
  1. Generator harness connector EN07 terminal No.3 still has voltage. When the ignition switch is at "ON" position, it provides IG1 relay terminal No.85 voltage. The relay pull-in.
  2. Battery voltage passes through the I/P fuse EF01, EF22 to IG1 relay terminal No.87, due to relay pull-in, relay output passes the battery voltage through relay terminal No.30, to the I/P fuse IF25, and then to the generator harness connector EN07 terminal No.2. After the magnetizing coil is provided with power, this voltage produces a good magnetic field around the coil.
  3. Generator harness connector EN07 terminal No.1 is connected with the instrument cluster connector IP03 terminal No.13, so the EN07 terminal controls the generator charging indicator. When the engine is not running, the terminal provides a good ground, so the charging indicator lights.
- When the engine is running: Because the excitation coil produces a magnetic field, so the stator coil produces alternating voltage. Voltage regulator senses the voltage and controls the field current. The AC voltage is generated by the three stator coils. This AC voltage is converted to DC voltage through the built-in rectifier. Adjusted by the voltage regulator, the generator output voltage is applied to the vehicle battery and the battery terminals power circuit. With the generator working, generator harness connector EN07 terminal No.1 voltage and the charging indicators on both sides is the same, thus the charging indicator loses ground and off.

– Because the generator wiring harness connector EN07 terminal No.3 and the battery is connected, when the battery is fully charged, the regulator will reduce the magnetic field excitation current, thereby reducing the generator output voltage to prevent overcharging. When the battery discharging or load is big, the voltage regulator increases the magnetic field excitation current to increase the generator output voltage.

2.11.4 Component Locator

2.11.4.1 Generator and Starter

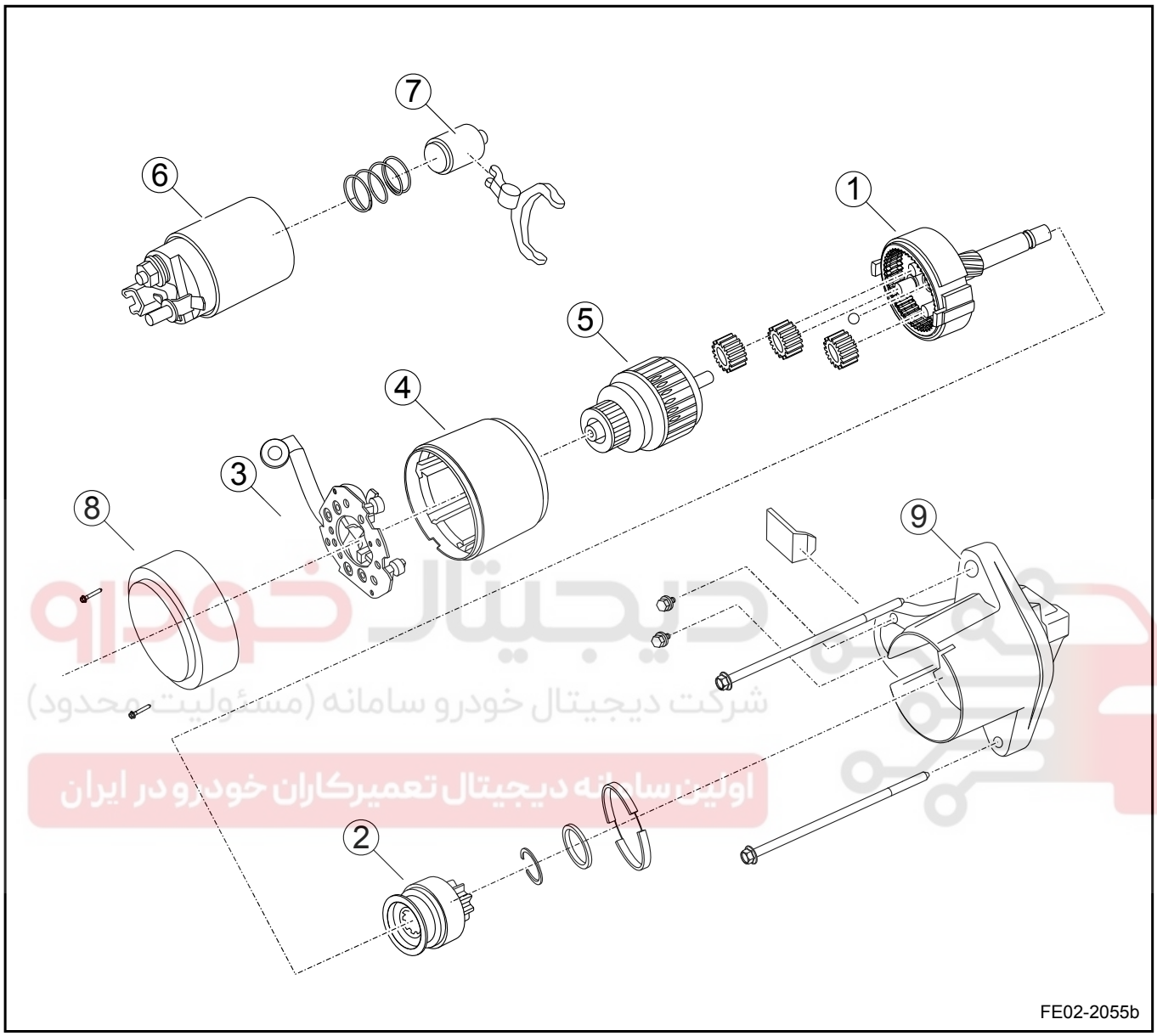


Legend

1. Generator
2. Starter

2.11.5 Disassemble View

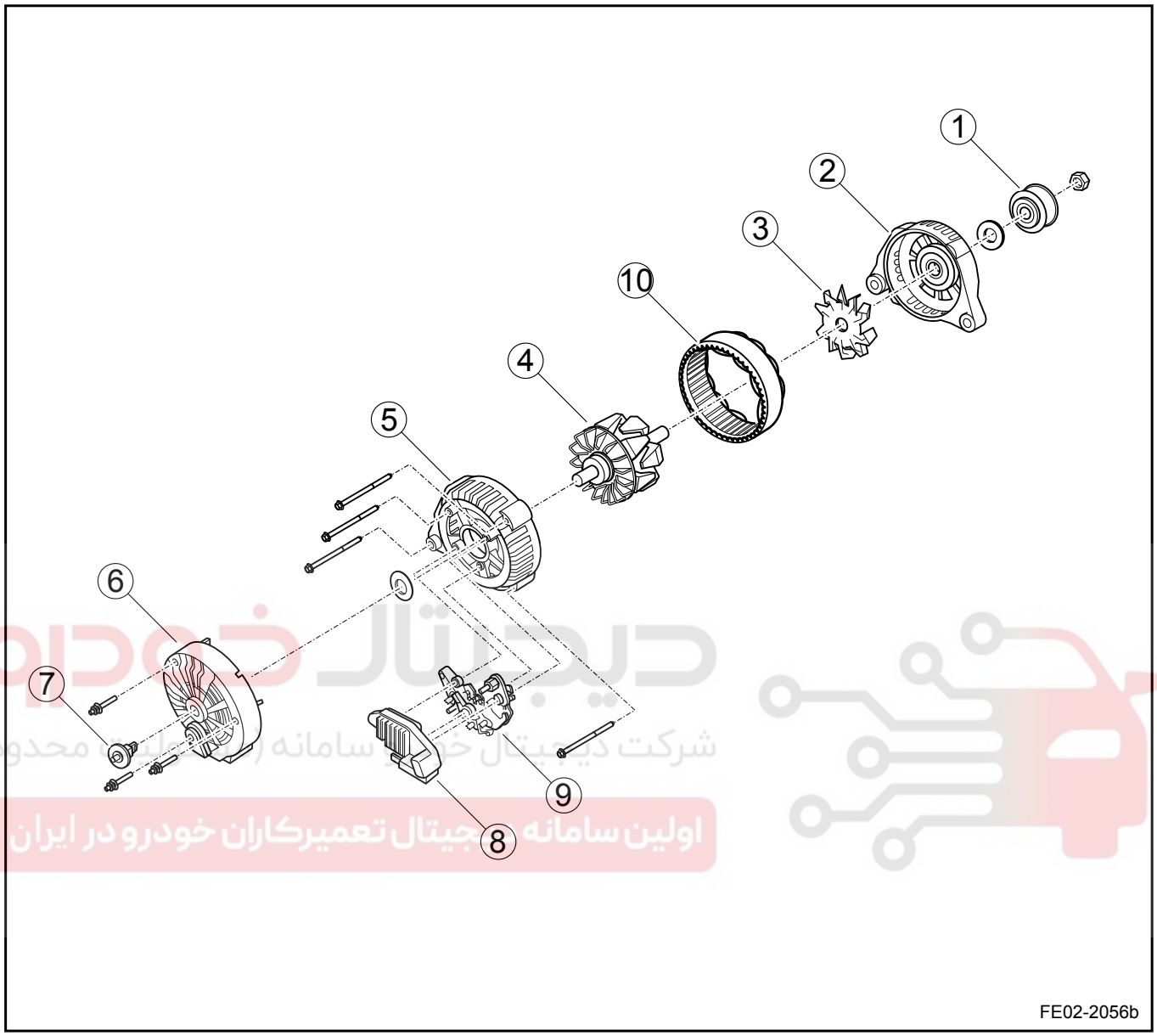
2.11.5.1 Starter Disassemble View



Legend

1. Planetary Gear Reducer Assembly
2. Drive Gear Assembly
3. Brush Holder Assembly
4. Magnetic Frame Assembly
5. Armature Assembly
6. Electromagnetic Switch Assembly
7. Fork
8. Motor Rear Cover
9. Motor Shell

2.11.5.2 Generator Disassemble View

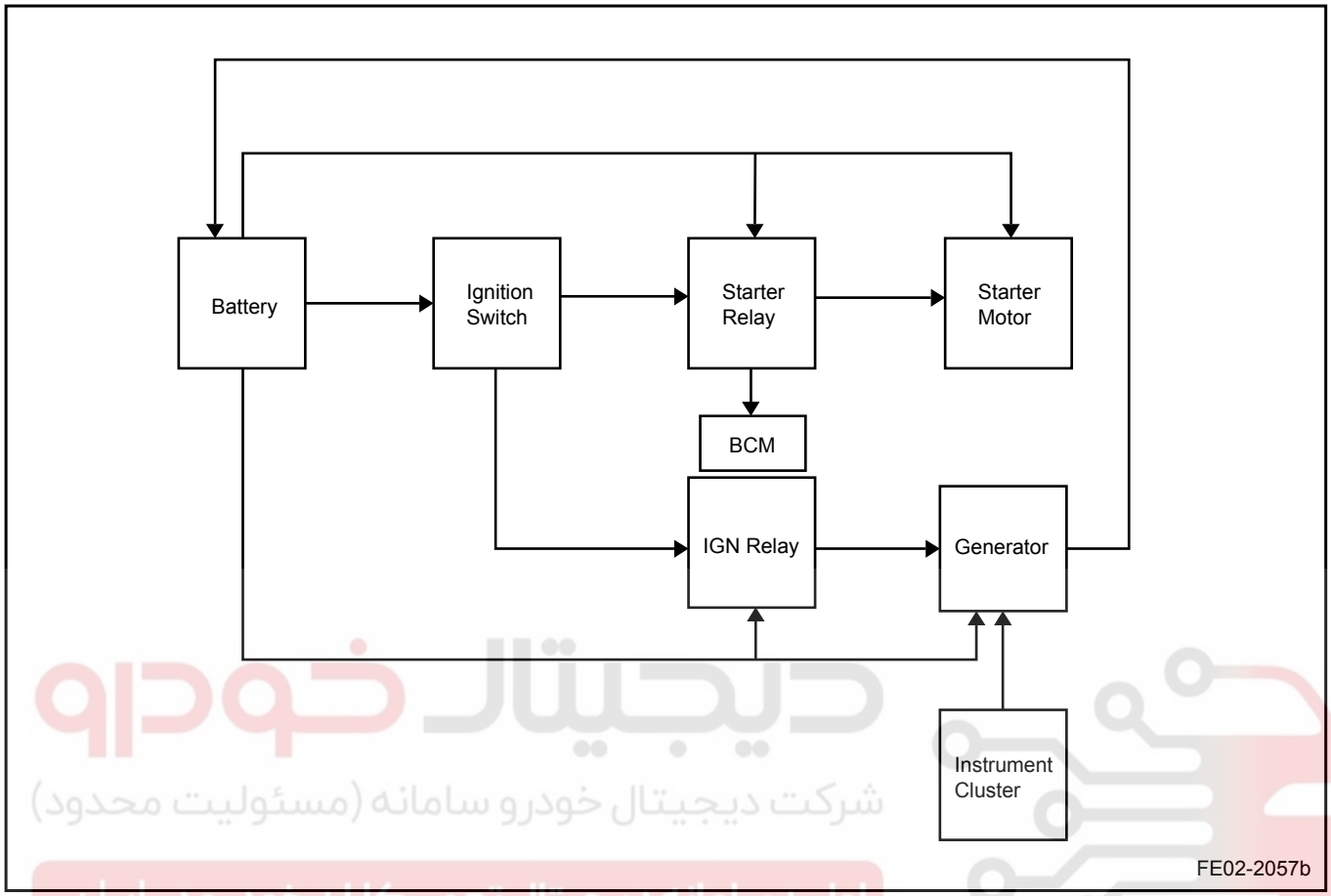


Legend

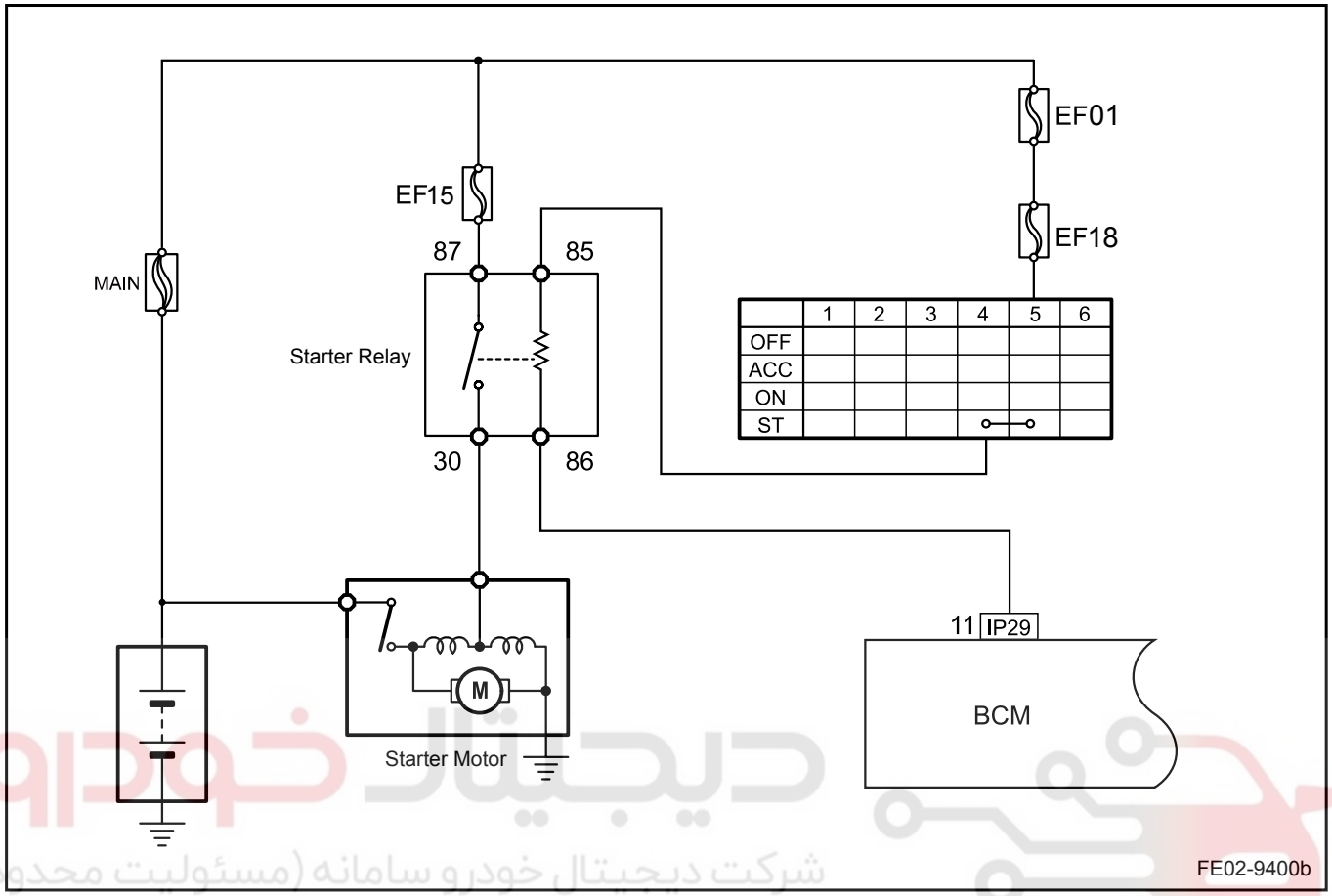
1. Drive Belt
2. Generator Front Cover
3. Cooling Fan
4. Rotor
5. Generator Rear Cover
6. Generator Rear Shield
7. Generator Output Terminal
8. Voltage Regulator
9. Rectifier
10. Stator

2.11.6 Schematic

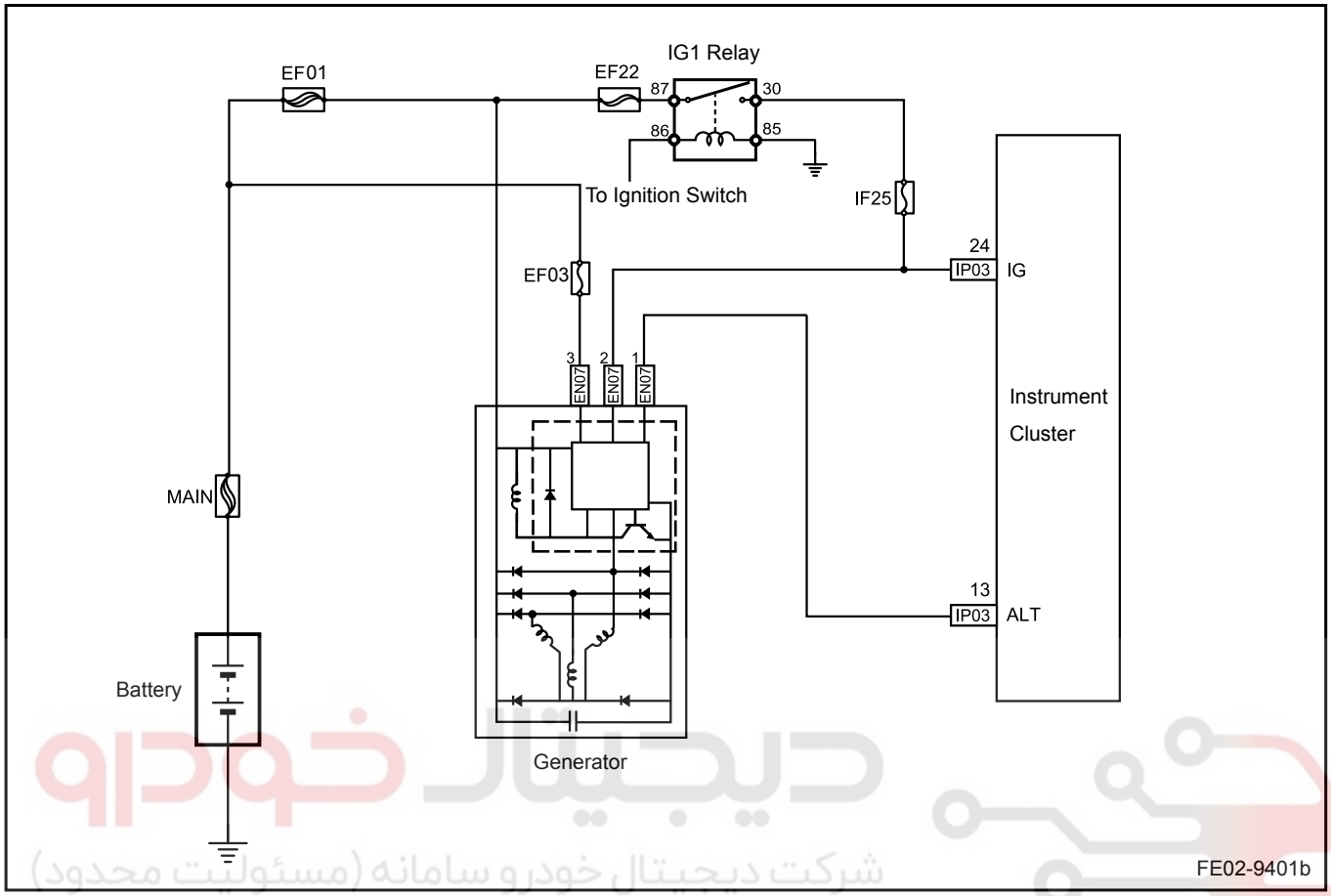
2.11.6.1 Schematic



Starting System Diagram



Charging System Diagram



2.11.7 Diagnostic Information and Procedures

2.11.7.1 Diagnosis Description

Refer to 2.11.2.2 Starting System Description and Operationget familiar with the system functions and operation before start system diagnostics, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the customer described situation is normal.

2.11.7.2 Visual Inspection

1. Check whether there are after market equipment that may affect the starting, charging or ignition system operations.
2. Check the easy to access system components to identify whether there is obviously damage or potential fault.
3. Check whether the battery is installed correctly.
4. Test battery status. Battery voltage is not less than 11 V.
5. Check whether there is wire damage. check starter motor, starter solenoid switches, ignition switches and the battery. Check whether all ground connections are reliable.
6. If the battery, wires and switches are normal, and motor functions are normal, remove and test the starter motor.
7. When the charging system works properly, turn the ignition switch to "ON" position, the charge indicator lamp will be on. The lamp will be off after the engine starts running.
8. Check whether the generator is loose or improperly installed, as well as the drive belt tension is normal, whether there is the possibility of slipping.

2.11.7.3 Starter Can Not Stop

Step 1	Make sure the ignition switch is at "OFF" position.

Next

Step 2	After removal of the start motor relay, does the starter motor run?

No → Go to step 5

Yes

Step 3	Disconnect starter motor wiring harness connector.

(a) Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
(b) Disconnect starter motor wiring harness connector EN18.
(c) Connect the battery negative cable.
Does the starter motor run?

No → The circuit between starter relay terminal No. 30 and starter harness connector is short to power supply. Check and repair the faulty part.

Yes

Step 4	Replace the starter motor. Confirm that the fault has been fixed.

Step 5	Ignition switch is at "ON" position, does relay 85 terminal have 12V voltage?

No → Replace the starter. Confirm whether the fault has been fixed.

Yes

Step 6	Check starter relay terminal No.85 voltage

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition switch wiring harness connector IP23.
(c) Measure starter relay terminal No.85 voltage, whether there is 12V voltage?

No → Replace the ignition switch.

Yes

Step 7	Circuit between the ignition switch wiring harness connector IP23 and starter relay terminal No.85 is short to power supply. Repair the faulty part.

Next

Step 8	Diagnostic completed.

2.11.7.4 Engine Can Not Start

Prior to the implementation of this test procedure, it is necessary to check all the starting system fuses, so that it will help with quick Diagnostic.

Step 1	Verify the fault.

Next

Step 2	Does the engine run?

No → Go to step 7

Yes

Step 3	Does the engine run properly?

No → Go to step 5

Yes

Step 4	Check ignition / fuel system. Refer to 2.2.7.45 Crankshaft rotates, but the engine can not start..
Step 5	Check the starter motor power supply.

Check the following:

(a) Whether the battery capacity is normal, whether the starting voltage is lower than 10.5V, otherwise recharge the battery.

(b) Check the battery terminal connections for existence of loose and corrosion.

(c) Check the engine mechanical system for existence of unusual noise. Check whether the cylinder compression pressure is normal.

All normal?

No → Repair the faulty part.

Yes

Step 6	Replace the starter motor.
Step 7	Does the starter rotate?

Yes → Replace the starter motor.

No

Step 8	Does the starter motor electromagnetic switch work?

No → Go to step 14

Yes

Step 9	Check whether the engine and drive belt system catching (engine catching, generator catching)?

Yes → Repair the catching parts.

No

Step 10	Check whether the resistance between the battery and the starter solenoid switch is too high?

Standard Resistance:<0.3 Ω

Is the resistance specified value?

No → Check and repair the cable, if necessary, replace the cable.

Yes

Step 11	Check whether the resistance between the battery and the starter ground circuit is too high.

Standard Resistance:<1 Ω

Is the resistance specified value?

No → Check and repair the cable, if necessary, replace the cable.

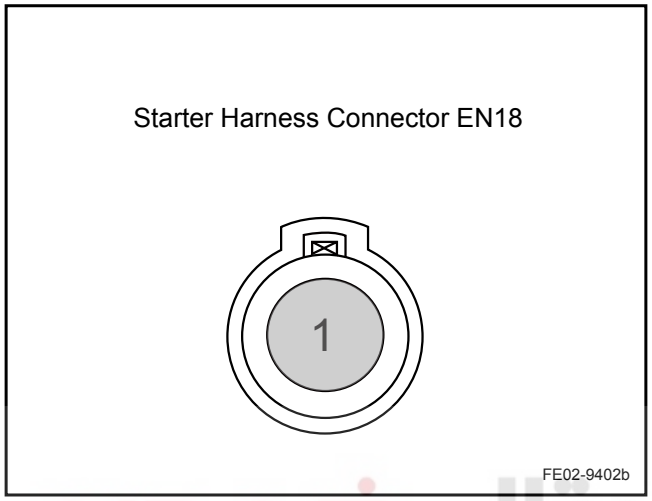
Yes

Step 12	Check whether the starter solenoid switch wiring harness connections is normal.

No → Check and repair the cable, if necessary, replace the cable.

Yes

Step 13	Replace the starter motor.
Step 14	Check the starter motor control power supply.

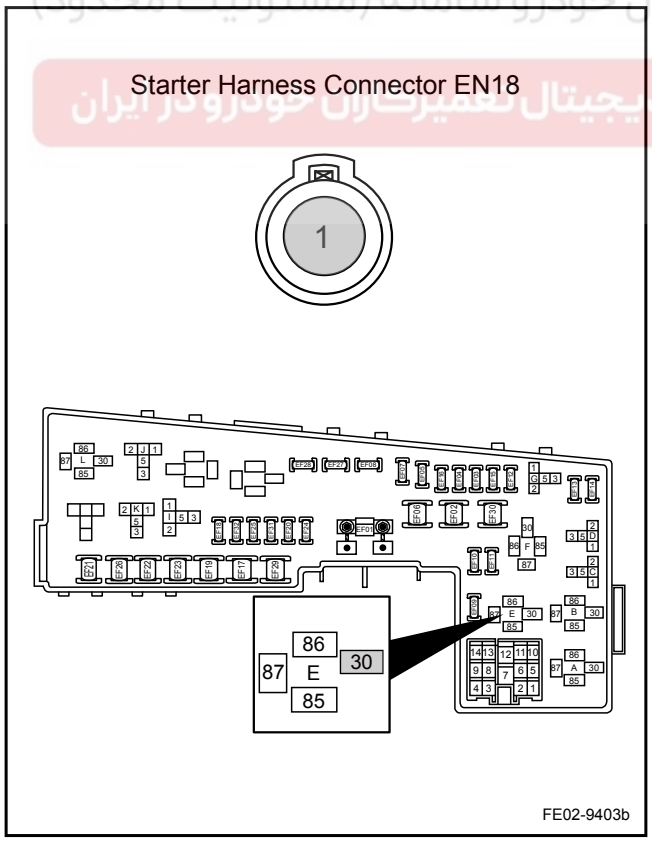


(a) Turn the ignition switch to "OFF" position.
(b) Disconnect starter harness connector EN18.
(c) Turn the ignition switch to "ON" position.
(d) Measure starter harness connector EN18 No.1 terminal voltage.
Standard Voltage: 11-14 V
Is the voltage specified value?

Yes → Replace the starter motor.

No

Step 15	Check the starter motor control harness connector terminal EN18 continuity.



(a) Turn the ignition switch to "OFF" position.
(b) Measure resistance between starter relay terminal No.30 and starter harness connector EN18 terminal No.1 with a multimeter.
Standard Resistance:<1 Ω
Is the resistance specified value?

No → The circuit between starter relay terminal No. 30 and starter harness connector EN18 is open.

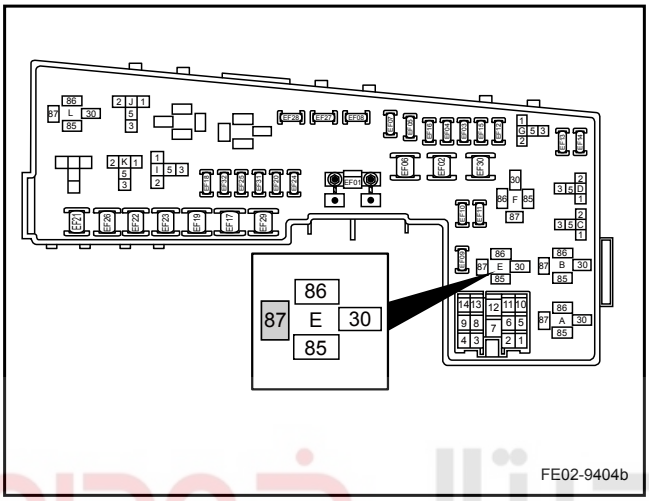
Yes

Step 16	Turn the ignition switch to the "ST" position, Does the starter relay pull-in?

No → Go to step 19

Yes

Step 17	Measure starter relay terminal No.87 power supply.



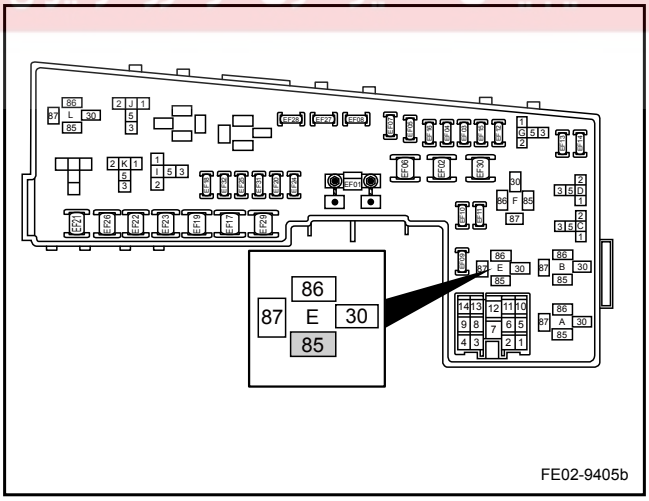
FE02-9404b

(a) Remove the starter relay.
(b) Measure the starter relay terminal No.87 voltage.
Standard Voltage: 11-14 V
Is the voltage specified value?

Yes → Replace the starter relay.

No

Step 18	Check whether the starter relay terminal No.87 power supply circuit is open.
Step 19	Check the starter relay terminal No.85.



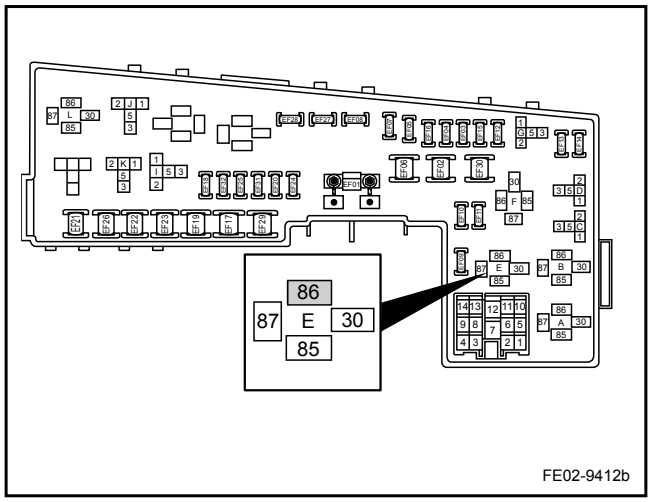
FE02-9405b

(a) Turn the ignition switch to "OFF" position.
(b) Remove the starter relay.
(c) Turn the ignition switch to the "ST" position.
(d) Measure starter relay terminal No.85 voltage.
Standard Voltage: 11-14 V
Is the voltage specified value?

No → Go to step 22

Yes

Step 20	Check starter relay ground resistance.



(a) Turn the ignition switch to "OFF" position.
(b) Remove the starter relay.
(c) Measure resistance between starter relay terminal No.86 and a reliable ground.
Standard Resistance:<1 Ω
Is the voltage specified value?

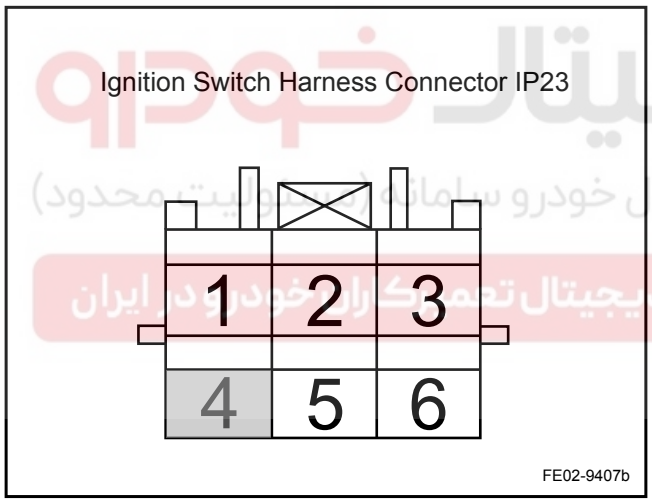
Yes → Replace the starter relay.

No

Step 21	Check the starter relay terminal No.86 and the BCM connector IP29 terminal No.11 wiring harnesses.

(a) Check whether the BCM anti-theft is activated.

Step 22	Check the ignition switch power output.



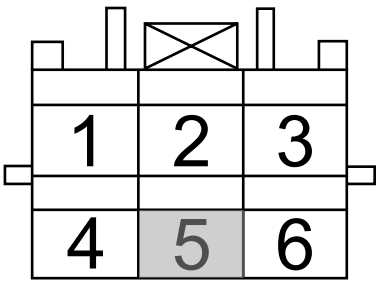
(a) Connect the ignition switch wiring harness connector IP23 terminal No.4 with a multimeter (Note: During this test, do not Disconnect the wiring harness connector IP23.).
(b) Turn the ignition switch to the "ST" position.
(c) Measure voltage between IP23 terminal No.4 and a reliable ground.
Standard Voltage: 11-14 V
Is the voltage specified value?

Yes → The circuit between ignition switch IP23 terminal No.4 and the starter relay terminal No.85.

No

Step 23	Check the ignition switch power input.

Ignition Switch Harness Connector IP23



FE02-9408b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition switch wiring harness connector IP23.
(c) Measure voltage between IP23 terminal No.5 and a reliable ground.
Standard Voltage: 11-14 V
Is the voltage specified value?

Yes → Replace the ignition switch.

No

Step 24	The circuit between ignition switch wiring harness connector IP23 terminal No.5 and power supply is open.

Next

Step 25	Diagnostic completed.

2.11.7.5 Start Motor Noise Diagnostic

Before the diagnostic, please refer to the2.11.2.1 Battery Description and Operation, 2.11.2.2 Starting System Description and Operation and 2.11.2.3 Charging System Description and Operation and perform the necessary checks.

Step 1	Start the engine, while monitoring whether the generator motor starts turning.

When the engine started and the starter remained at the bonding position, whether there is loud "breathing" (If the starter remains in bonding position and further increase the engine speed, the sound may sound as an alarm)?

Yes → Check the flywheel ring gear for existence of the following: tooth cracking, tooth loss, tooth wear, flywheel bent or the tooth damage, if necessary, replace the flywheel.

No

Step 2	When the engine started, and the starter gradually stops, is there any "rumble", "roar" or in some cases "percussion sound "?

Yes → Go to step 4

No

Step 3	The engine crankshaft rotates and the starts as per normal, is there any high-frequency hum sound?

Yes → Replace the starter motor. Refer to 2.11.8.4 Starter Replacement

No

Step 4	Remove the starter motor.

Check starter motor sleeve and clutch gear for clutch gear cracks,worn or sleeve worn?

Yes → Replace the starter motor. Refer to 2.11.8.4 Starter Replacement

No

Step 5	Replace the flywheel.

Next

Step 6	Diagnostic completed.

2.11.7.6 Charging Indicator Always On

Step 1	Start the engine, is the battery charging indicator still on?

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

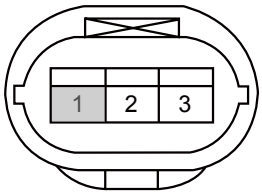
Step 2	Measure the battery terminal voltage with a multimeter, is it between 11 V and 14.9 V?

No → Go to step 5

Yes

Step 3	Check the charging indicator control circuit.

Generator Harness Connector EN07



Instrument Cluster Harness Connector IP03

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

FE02-9409b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect generator harness connector EN07.
(c) Remove the instrument cluster, Disconnect the instrument cluster wiring harness connector IP03.
(d) Check the continuity between instrument cluster wiring harness connector IP03 and generator harness connector EN07 terminal No.1.
(e) Measure resistance between generator harness connector EN07 terminal No.1 and a reliable ground.
Standard Resistance Value:

Test Items	Standard Value Value
Continuity Between IP03 (13) and EN07 (1)	<1 Ω
Resistance Between EN07 (1) and A Reliable Ground	<1 Ω

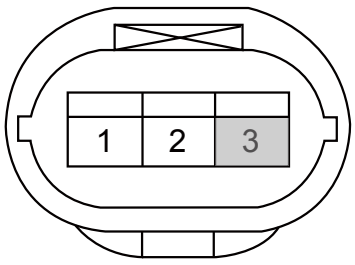
(f) Connect generator harness connector EN07.
(g) Connect instrument cluster harness connector IP03, and install the instrument cluster.
Is the resistance specified value?

No → Repair the faulty part. Confirm the fault has been fixed.

Yes

Step 4	Replace the instrument cluster. Confirm the fault has been fixed.
Step 5	Check the generator regulator power supply circuit.

Generator Harness Connector EN07



FE02-9410b

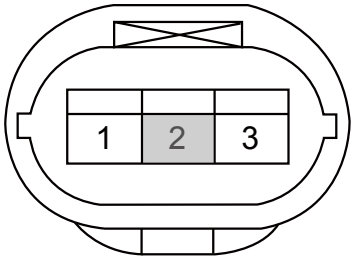
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect generator harness connector EN07.
(c) Measure voltage between generator harness connector EN07 terminal No.3 and a reliable ground.
Standard Voltage: 11-14 V
(d) Connect generator harness connector EN07.
Is the voltage specified value?

No → Generator regulator power circuit is open. Repair the faulty part. Confirm the fault has been fixed.

Yes

Step 6	Check the generator regulator excitation power supply.

Generator Harness Connector EN07



FE02-9411b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect generator harness connector EN07.
(c) Measure voltage between generator harness connector EN07 terminal No.2 and a reliable ground.
Standard Voltage: 11-14 V
(d) Connect generator harness connector EN07.
Is the voltage specified value?

No → Go to step 8

Yes

Step 7	Replace the generator. Refer to 2.11.8.3 Generator Replacement.
Step 8	Are Instrument cluster, electric windows, air-conditioning system working properly?

No → Relay IG1 does not provide IG1 power. Check the IG1 relay.

Yes

Step 9	The circuit between EN07 terminal No.2 and instrument cluster fuse IF25 is open. Check and repair the faulty part.

Next

Step 10	Diagnostic completed.

2.11.7.7 Charging Indicator Always Off

Step 1	Connect the ignition switch, and keep the engine off, is battery charging indicator on?

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 2	Disconnect generator harness connector EN07, is battery charging indicator on?

No → Go to step 6

Yes

Step 3	Check the generator regulator power supply circuit.

Refer to 2.11.7.6 Charging Indicator Always On Step 4.

Is the voltage specified value?

No → The generator regulator power circuit is open. Repair the faulty part. Confirm the fault has been fixed.

Yes

Step 4	Check the generator regulator excitation power supply.

Refer to 2.11.7.6 Charging Indicator Always On Step 5.

Confirm the fault has been fixed.

No → Refer to 2.11.7.6 Charging Indicator Always On Step 6

Yes

Step 5	Replace the generator. Confirm the fault has been fixed.
Step 6	Are other instrument lights and indicators working properly?

No → Go to step 8

Yes

Step 7	Replace the instrument cluster. Refer to 12.8.3.1 Instrument Panel Replacement.
Step 8	Check the instrument power circuit and ground circuit. Refer to 11.7.6.7 DTC U129C U129D.

Next

Step 9	Diagnostic completed.

2.11.7.8 Generator Noise Diagnosis

Diagnostic Tips:Generator noise may be caused by electrical or mechanical noise. Electrical noise (electromagnetic hum sound) is usually added to the generator with the electrical load changes, which is the normal operating characteristics of all generators. During the service, pay attention to distinguish, otherwise it will cause unnecessary customer complaints. When diagnose the generator mechanical noise, firstly check whether there are loose generator components or interference. In some cases even if the sound in engine compartment is light, it can enter into the passenger compartment. If this is the case, replacing the generator does not solve the problem, which leads to misjudgments.

Step 1	Keep the generator not working, and confirm whether the noise disappears.

(a) Start the engine, verify that the noise can be heard.
(b) Shut down the engine.
(c) Disconnect the generator from the generator on the wiring harness connector EN07.
(d) Start the engine.
Confirm whether the noise disappears?

Yes → Go to step 6

No

Step 2	Check the generator shaft.

(a) Shut down the engine.
(b) Remove the drive belt.
(c) Rotate the generator pulley by hand.
Does the generator rotate smoothly without catching and grinding noise?

Yes → Go to step 6

No

Step 3	Reinstall the generator.

Remove and install the generator. Tighten the generator retaining bolts to the specified torque. Refer to 2.11.8.3 Generator Replacement. Start the engine, does the noise disappear?

Yes → System normal

No

Step 4	Is the drive belt loose?

Yes → Go to step 7

No

Step 5	Compare with a known good vehicle, is the noise the same?

Yes → System normal

No

Step 6	Replace the generator.

Important Note

If a clear generator fault has not been found, make sure that all other possible noise sources have been excluded and then replace the generator.

If the noise is part of the normal generator characteristics, after replacing generator the noise will not disappear.

Yes → Troubleshooting

Step 7	Replace the drive belt or the drive belt tensioner.

Refer to 2.6.8.3 Drive Belt Replacement or 2.6.8.4 Drive Belt Tensioner Replacement.

Next

Step 8	Diagnostic completed.

2.11.7.9 Battery Discharging Current Parasitic Load Test

If the battery continues to loss power, perform the following test to check whether there are parasitic battery current.

Note

Before carry out this procedure, please check whether there are installed after market equipments such as DVD, audio power amplifier, subwoofer speaker box back and other non-original accessories. If there are, please Disconnect these systems and then carry out this test procedure.

Warning!

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

Step 1	Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.

Next

Step 2	With a digital multimeter, connect one end to the battery negative cable, the other to the negative battery post.

Next

Step 3	Select digital multimeter's "current test" maximum range.

Next

Step 4	Left open the front door to observe the meter display readings.

Note

Do not carry out any other operations action at this time, otherwise it is likely to damage the multimeter.

Next

Step 5	If the multimeter has no display, check whether the meter is damaged. If there is displayed reading, close the left front door and press down the engine compartment button, press the remote control door lock button.

Next

Step 6	Observe the body Anti-theft system lamp the indicating system is in alert mode.

Next

Step 7	Wait for more than 10 min to observe the meter readings, (if the multimeter shows an abnormal reading, tune the multimeter to minimum range). The reading should be below 30 mA. If the reading is higher than 30 mA, there may be parasitic current.

Note

When the system parasitic current can not be confirmed, compare the vehicle with a known good vehicle to helping with diagnostic.

2.11.7.10 Jump Start Procedure

Warning!

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

Step 1	Park the vehicle that will provide jump starting power properly to make sure the jumper cable can connect two vehicles batteries.

Next

Step 2	Turn both vehicles' ignition switch to "OFF" position and turn off headlights and all the accessories power supplies.

Next

Step 3	Press the hazard warning lamp switch, so that hazard warning lamps are on.

Next

Step 4	Apply two vehicles parking brake.

Next

Step 5	Make sure that the transmission gears are in neutral gear position.

Warning!

The jumper cable must be intact without exposed wires, otherwise it will cause unnecessary personal injury or vehicle damage.

Next

Step 6	Connect one end of the red cable to the positive terminal of the battery with sufficient capacity providing the power, and confirm that there is no contact with other metal parts.

Next

Step 7	Connect the other end of the red cable the positive terminal of the flat battery. Do not connect the red cable to the negative terminal of flat battery.

Warning!

Do not connect the jumper cable directly to a flat battery negative terminal to prevent the spark and possible battery gas explosion.

Next

Step 8	Connect one end of the black cable to the negative terminal of the battery with sufficient capacity providing the power.

Next

Step 9	Finally, connect the other end of the black cable to the flat battery engine ground, and at least 500mm away form the flat battery (19.7 in).

Next

Step 10	Start the vehicle, which has a battery with sufficient power, and run the engine speed at intermediate speed for more than 3min.

Next

Step 11	Start the vehicle with the flat battery.

Next

Step 12	Remove the by jumper cables in reverse order.

Note

During the removal procedure, if the other end of the cable has not been fully disconnected, avoid the cable clamp contact with any metal objects.

Next

Step 13	Operation is completed.

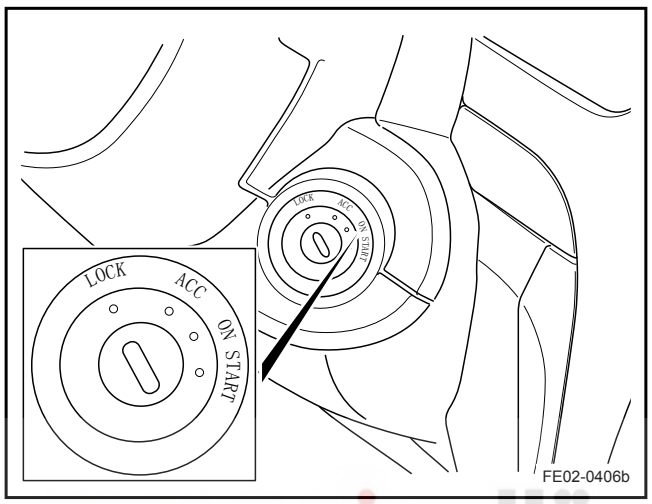
2.11.8 Removal and Installation

2.11.8.1 Battery Disconnection

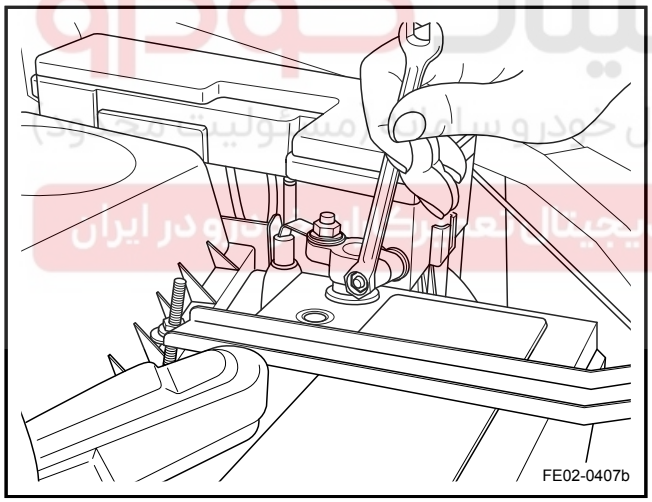
Disconnecting Procedure:

Warning!

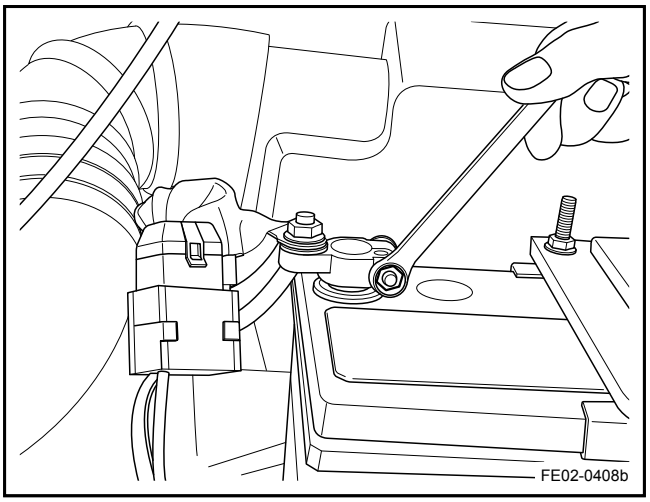
Refer to "Battery Disconnection Warning" in "Warnings and Notices".



1. Turn off all electrical equipments, and turn the ignition switch to "OFF" position.

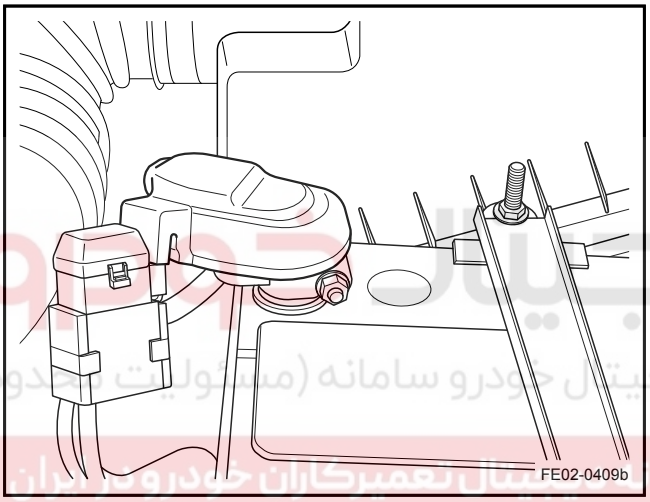


2. Disconnect the battery negative cable.



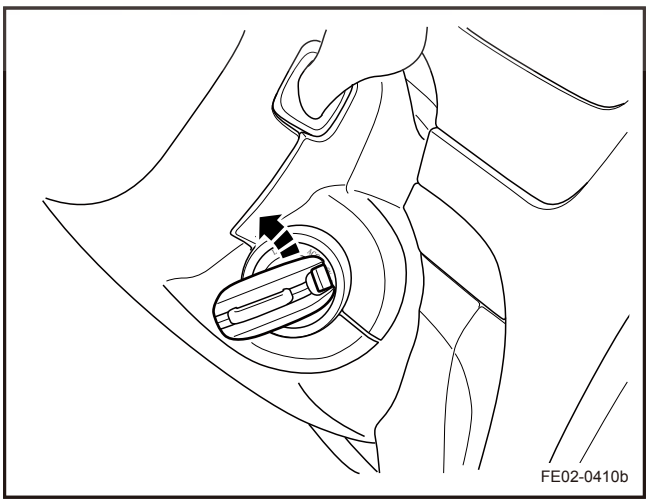
3. Disconnect battery positive cable.

Connecting Procedure:

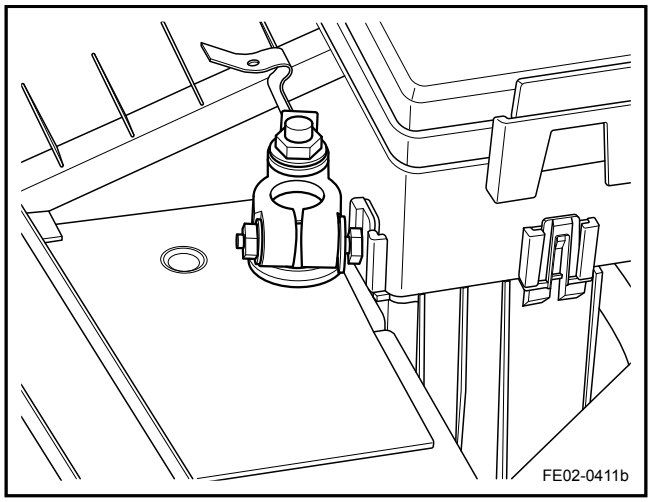


1. Connect battery positive cable, and tighten the retaining nut.

   Torque: 10.3 Nm (Metric) 7.6 lb-ft (US English)



2. Make sure the ignition switch is turned to "OFF" position.



3. Connect the battery negative cable.

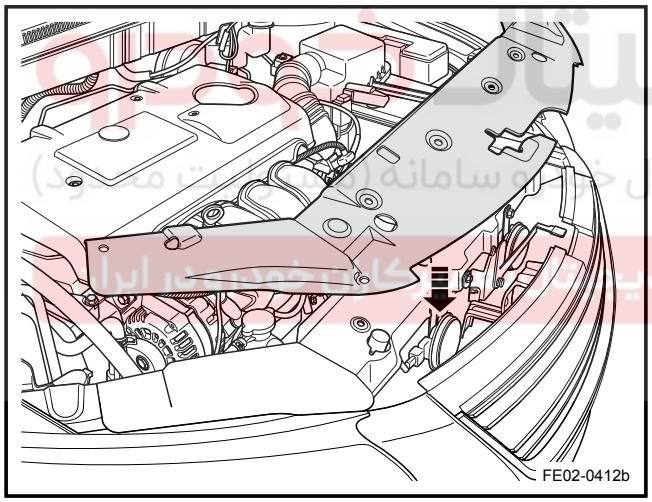
   Torque: 10.3 Nm (Metric) 7.6 lb-ft (US English)

2.11.8.2 Battery Replacement

Removal Procedure:

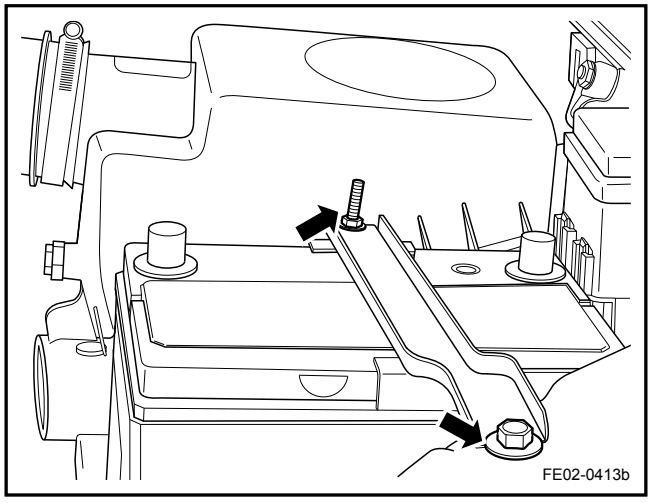
Warning!

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

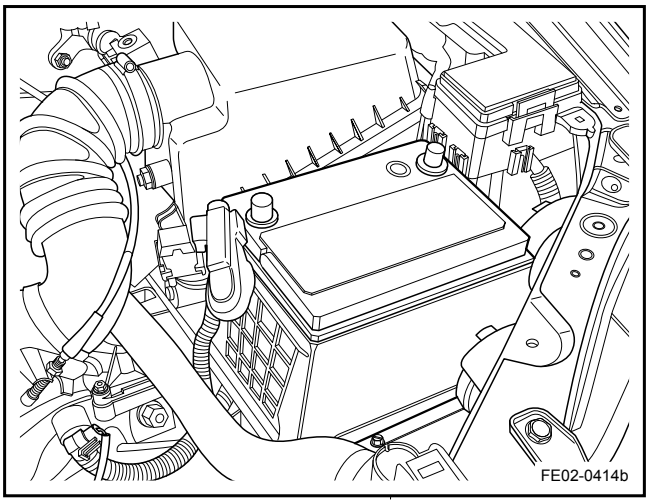


1. Disconnect battery positive and negative cables. Refer to 2.11.8.1 Battery Disconnection.
2. prior to Remove

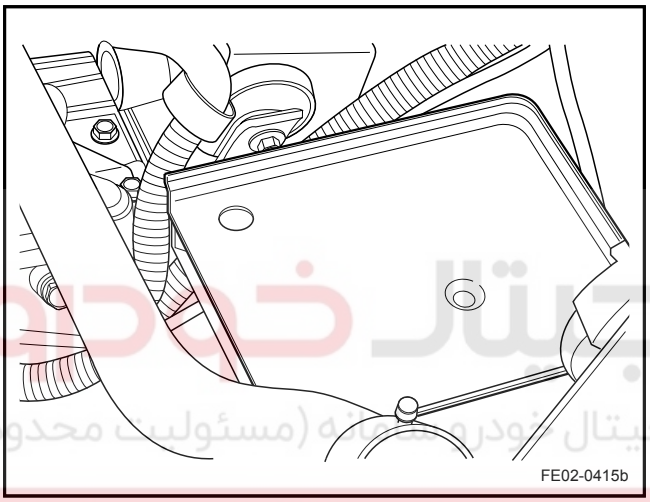
   Remove the radiator upper grille retaining clips, and remove the radiator upper grille from the front bumper.



3. Remove the battery bracket retaining bolts and nuts.

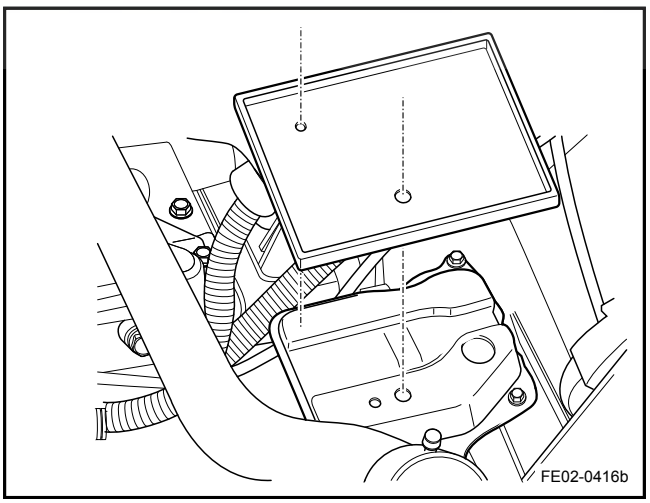


4. Remove the battery.



5. Remove the battery bracket.

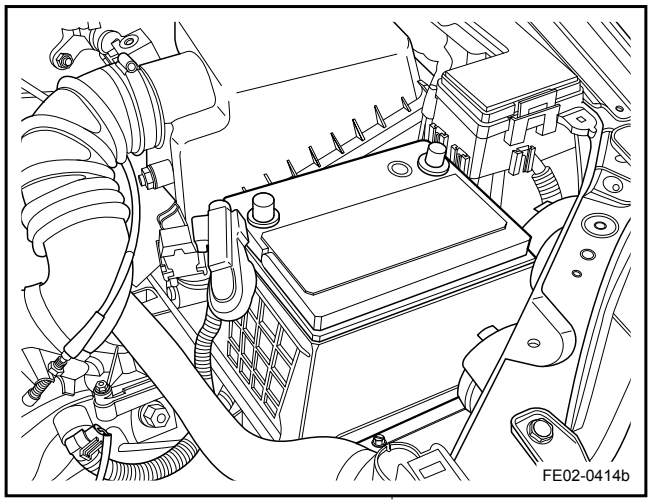
Installation Procedure:



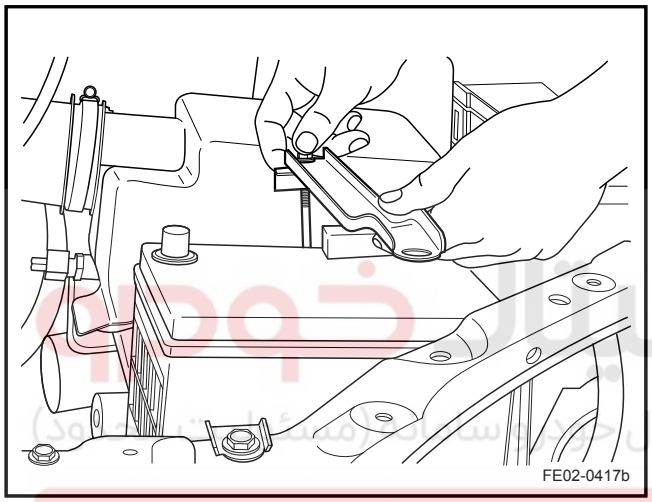
1. Install the battery bracket.

Note

The battery bracket is retained by two convex sets, pay attention during installation align the convex with the bracket holes.

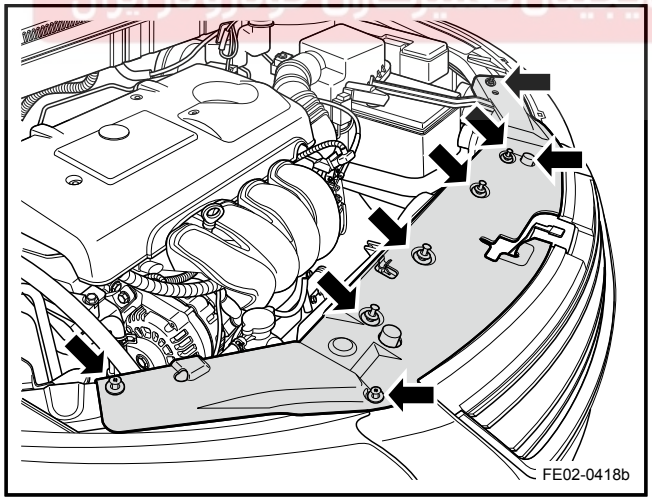


2. Install the battery.



3. Install the battery bracket and tighten the nuts and bolts.

   Torque: 13 Nm (Metric) 9.6 lb-ft (US English)



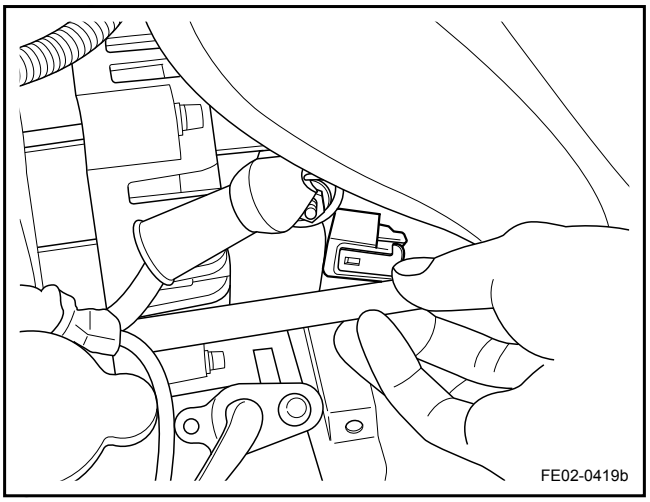
4. Install the radiator upper grille.
5. Connect the battery positive and negative cables.

2.11.8.3 Generator Replacement

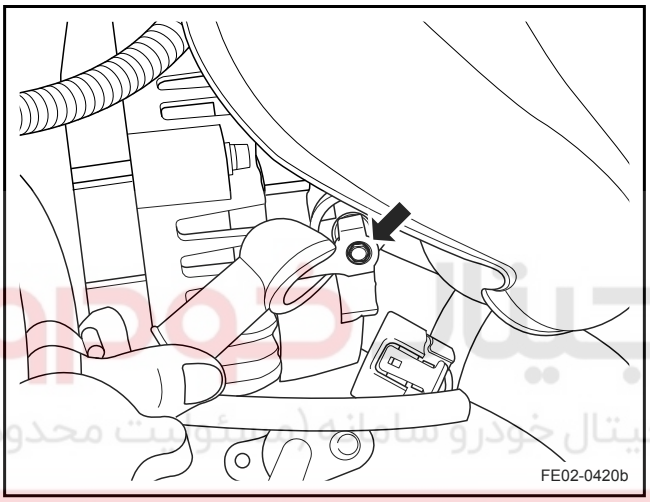
Removal Procedure:

Warning!

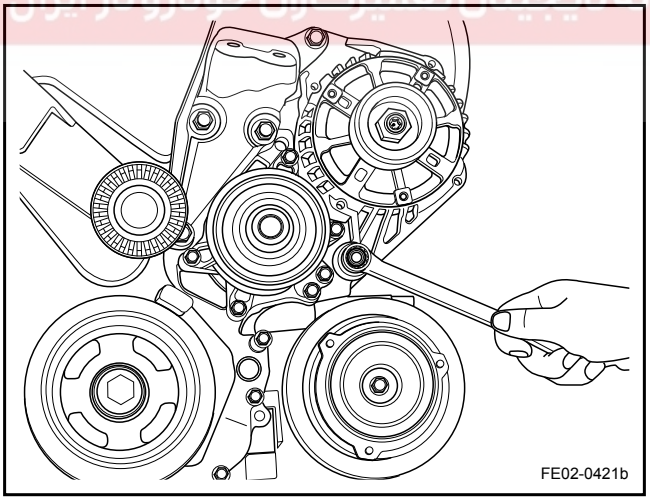
Refer to "Battery Disconnection Warning" in "Warnings and Notices".



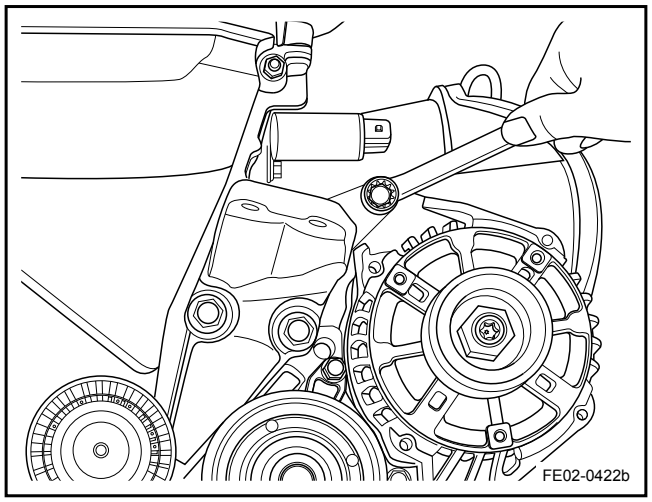
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect the generator harness connector.



3. Remove the generator charging wiring harness retaining nut.

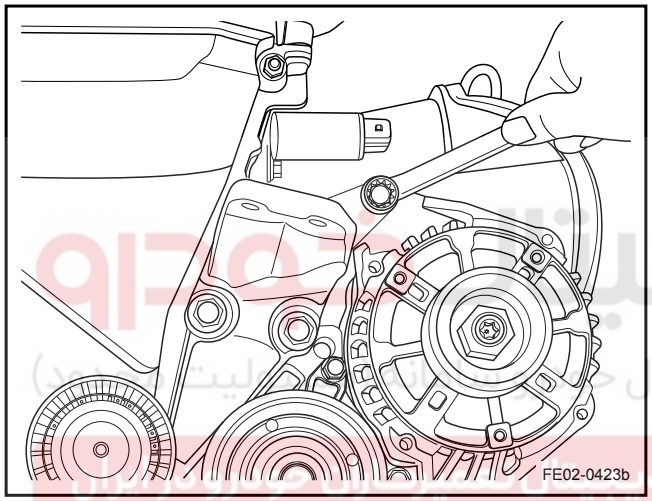


4. Remove the drive belt. Refer to 2.6.8.3 Drive Belt Replacement.
5. Remove the generator lower retaining bolt.



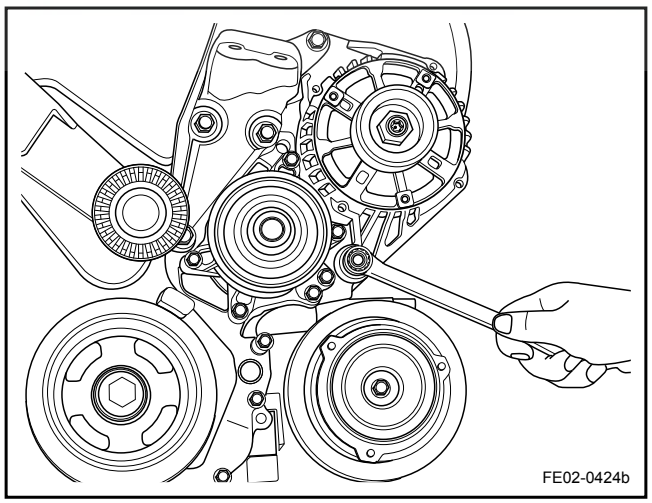
6. Remove the generator upper retaining bolt.
7. Remove the generator from the generator bracket.

Installation Procedure:



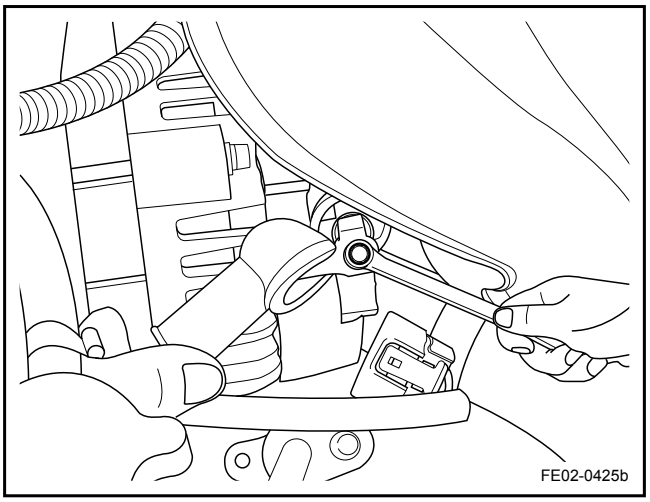
1. Install and tighten the generator upper retaining bolt.

   Torque: 25 Nm (Metric) 18.5 lb-ft (US English)



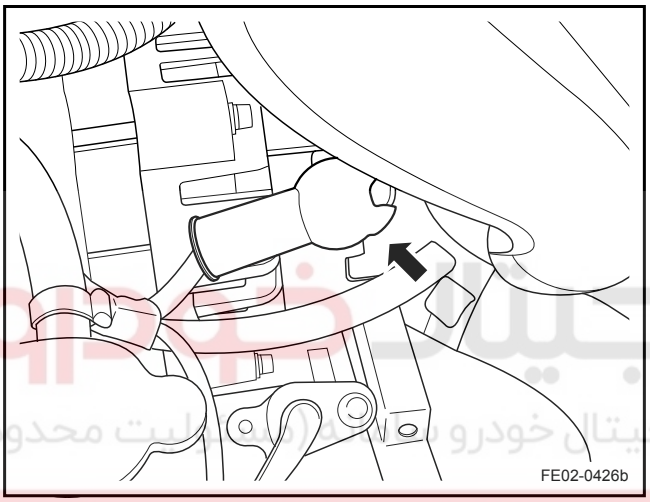
2. Install and tighten the generator lower retaining bolt.

   Torque: 54 Nm (Metric) 40 lb-ft (US English)



3. Install the drive belt.
4. Install the generator charging wiring harness and tighten the harness retaining nut.

   Torque: 10 Nm (Metric) 7.4 lb-ft (US English)



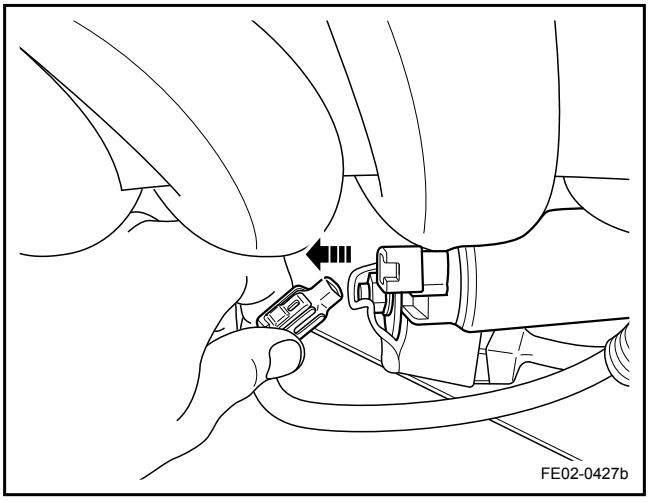
5. Connect the generator harness connector.
6. Connect the battery negative cable.

2.11.8.4 Starter Replacement

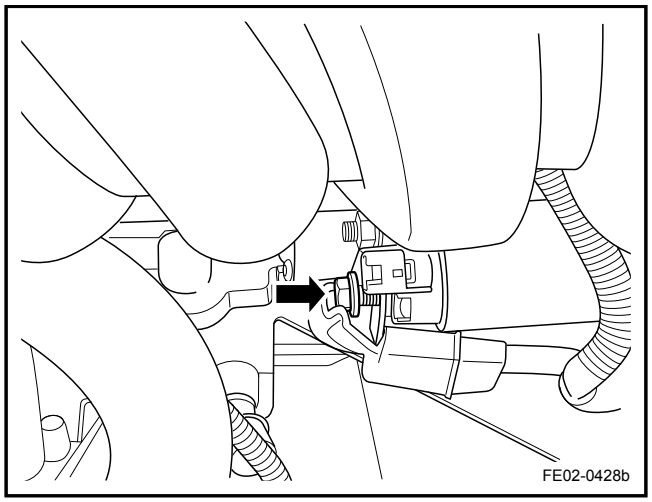
Removal Procedure:

Warning!

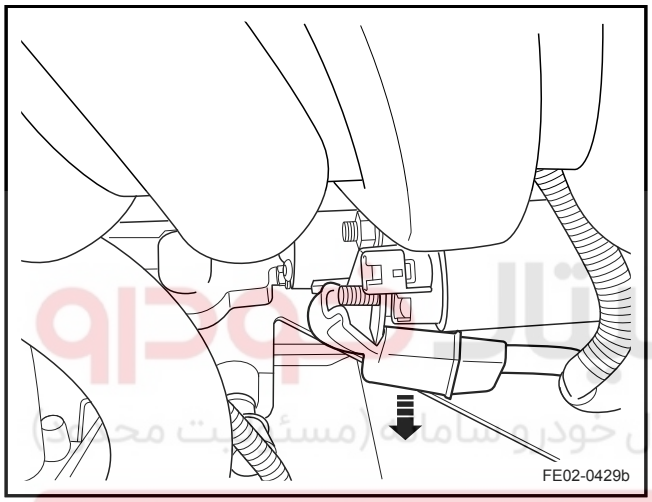
Refer to "Battery Disconnection Warning" in "Warnings and Notices"



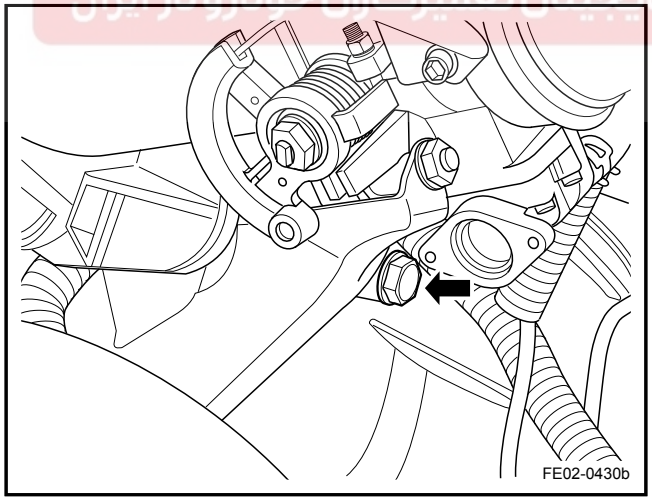
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect starter control wiring harness connector.



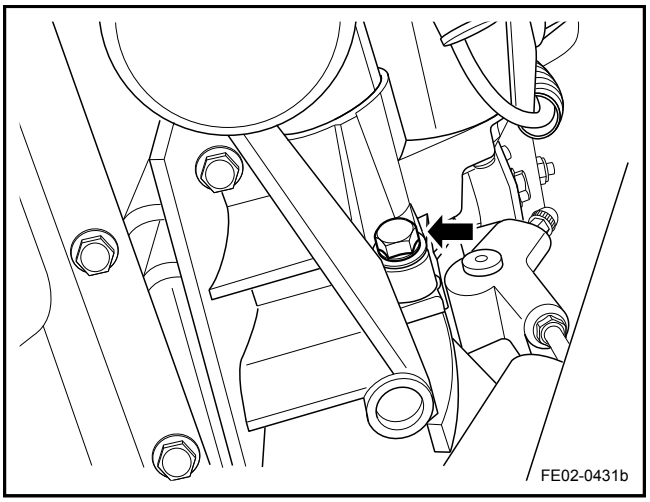
3. Remove the starter power supply wiring harness retaining nut.



4. Remove the starter power supply wiring harness.

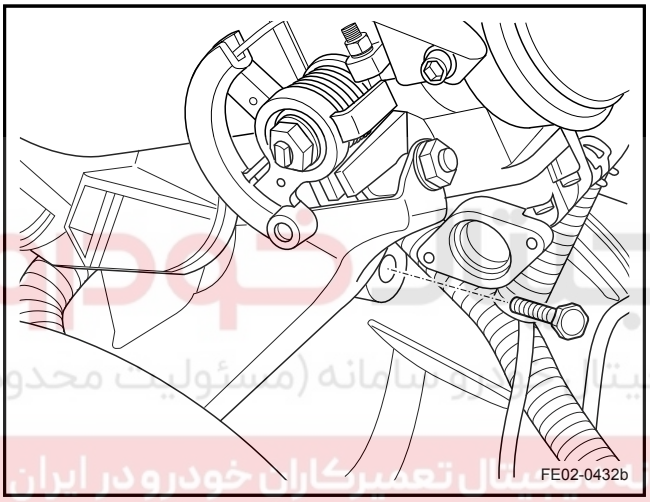


5. Remove the starter upper retaining bolt.



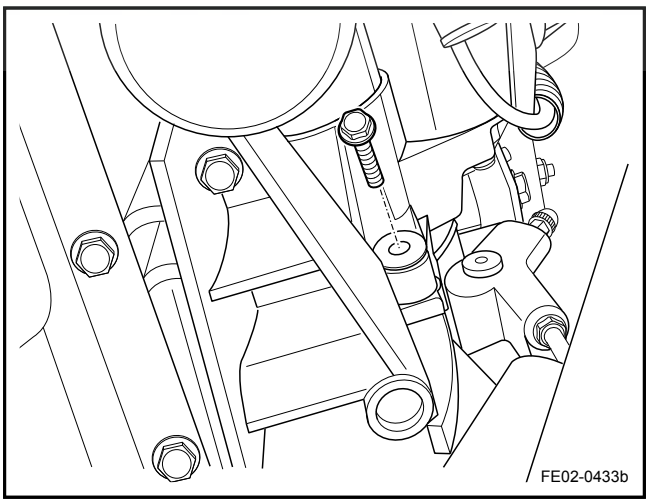
6. Remove the starter lower retaining bolt.

Installation Procedure:



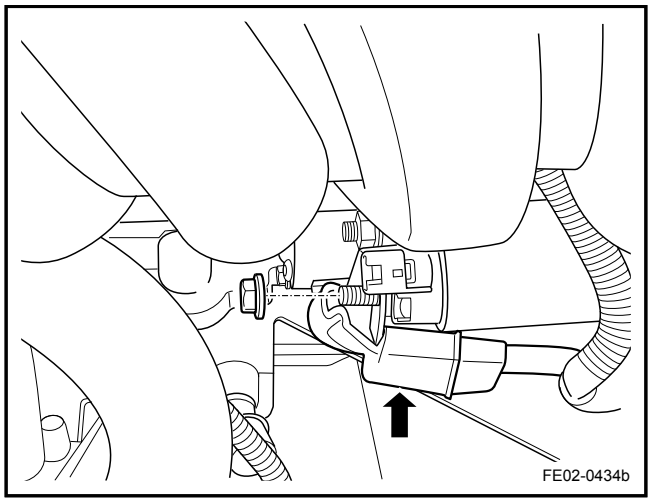
1. Install the starter upper retaining bolt.

   Torque: 37 Nm (Metric) 27.4 lb-ft (US English)

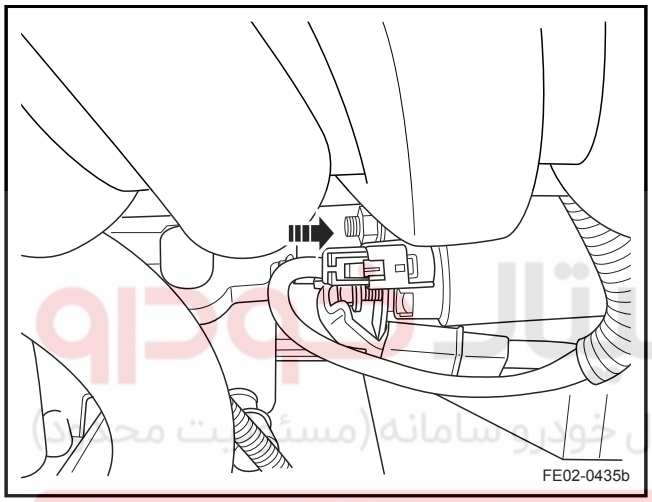


2. Install the starter lower retaining bolt.

   Torque: 37 Nm (Metric) 27.4 lb-ft (US English)



3. Install the starter power supply wiring harness and tighten the retaining nut.



4. Connect the starter motor control wiring harness connector.
5. Connect the battery negative cable.

2.12 Control System JL4G15-D

2.12.1 Specifications

2.12.1.1 Fastener Tightening Specifications

Applications	Models	Specifications	
		Metric (Nm)	US English (lb-ft)
Camshaft Position Sensor Retaining Bolts	M6X14	8-10	6.0-7.4
Crankshaft Position Sensor Retaining Bolts	M6X12	8-10	6.0-7.4
Ignition Coil Retaining Bolts	M6X35	7-11	5.2-7.8
Engine Control Module Retaining Bolts	M6X16	8-10	6.0-7.4
Engine Coolant Temperature Sensor Retaining Bolts	M12 × 1.5 × 6	15	11
Evaporative Emission Canister	M6X20	7-9	5.2-6.7
Evaporative Emission Canister Solenoid Valve Bracket Bolts	M6X20	7-9	5.2-6.7
Fuel Filter Mounting Bracket Assembly Bolts	M6X16	8-10	6.0-7.4
Fuel Filter Mounting Bracket Bolts	M6X16	8-10	6.0-7.4
Fuel Rail Retaining Bolts	M6X20	10	7
Fuel Tank Retaining Bolts	M10X30	38-46	28.1-34.0
Idle Air Control Valve Retaining Bolts	M4X10	2-3	1.5-2.2
Knock Sensor Retaining Bolts	M8X30	15-22	10.7-16.0
Intake Manifold Absolute Pressure and Temperature Sensors Retaining Bolts	M6X12	8-10	6.0-7.4
Oxygen Sensor Bolts	M18X8	44	32.6
Air-Conditioning Compressor Mounting Bolts	M8X80	25	18.2
Spark Plug	M14 × 1.25 × 22	20-30	14.8-22.2
Throttle Body Retaining Nut	M8	20-25	14.8-18.5

2.12.1.2 Intake Air Temperature Sensor Non-Load Resistance Temperature Characteristics Table

Temperatur (˚C / ℉)	Resistance (Ω)	Temperature (˚C / ℉)	Resistance (Ω)
-40/-40	100,865	60/140	671
-30/-22	52,594	70/158	470
-20/-4	28,582	80/176	334
-10/14	16,120	90/194	242

Temperatur (˚C / ℉)	Resistance (Ω)	Temperature (˚C / ℉)	Resistance (Ω)
0 / 32	9,399	100/212	178
10/50	5,658	110/230	133
20/68	3,511	120/248	101
30/86	2,240	130/266	76
40/104	1,465	140/284	60
50/122	980	150/302	48

2.12.1.3 Intake Air Pressure Sensor Output Voltage and Pressure Relationship

Pressure (kPa)	15	40	94	102
Output Voltage (V)	0.12-0.38	1.52-1.68	4.44-4.60	4.86-5.04

2.12.2 Description and Operation

2.12.2.1 Overview

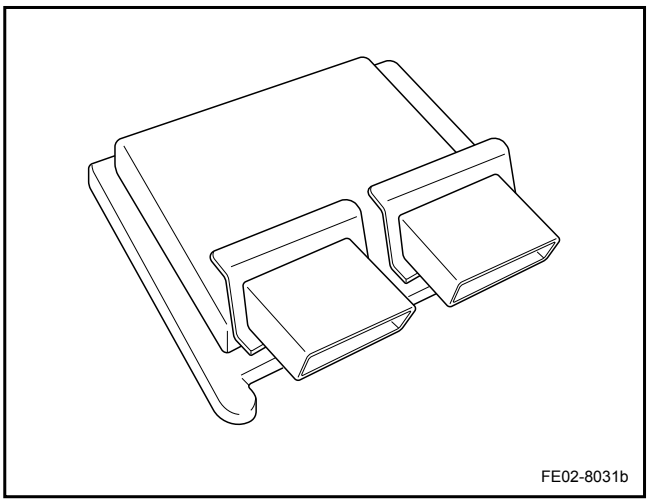
4G15D uses Delphi MT80 Engine Control System. Its main characteristic is that the engine control module (ECM) is the core system. The traditional mechanical throttle pedal and mechanical throttle body are replaced by more advanced electronic throttle acceleration pedal sensor assembly and the electronic throttle body assembly. Due to adopt this system, ECM control over the engine torque is more convenient. In addition, MT80 control system also incorporates multi-point sequential fuel injection, group direct ignition without electricity distributions, variable valve timing control and three-way catalytic converter processing, to meet the increasingly stringent emission regulations.

System main functions includes:

1. Engine torque output control mode: ECM calculated the gas flow through the intake air temperature sensor and intake manifold pressure sensor signals, so that the Air-Fuel ratio is closer to the current engine operating conditions demand.
2. Torque control mode: ECM calculates the output torque required and controls the engine output power, according to the acceleration pedal position sensor signal.
3. Main relay control.
4. Close-loop control multi-point sequential fuel injection: A close-loop fuel control can precisely control the engine Air-Fuel ratio, therefore efficiently controls emissions. Close-loop control can effectively eliminate the system and related mechanical components wear and tear due to manufacturing error and improves vehicle consistency.
5. Variable Valve Timing (VVT) control: Variable valve timing control system uses VVT actuator to change the intake camshaft and the crankshaft relative positions. Engine power management system calculates the best valve timing based on engine operating conditions, and controls VVT solenoid valve movement, allowing oil pressure, flow and direction to change, and ultimately promoting the camshaft movement to the desired position.
6. Fuel control without fuel return.
7. Fuel pump control.
8. ECM has built-in ignition drive module, without electricity distinction group direct ignition.
9. Knock Control: When the knock sensor detects a knock occurring, the system will calculate the ignition advance angle delay based on the current conditions, knock intensity and other necessary information, and defers the ignition advance angle, so as to avoid or reduce knock. Electronic Throttle Control: Since the system uses an electronic throttle idle speed control, highly precise idle control can be achieved. Such as the electrical load compensation, when there are electrical loads or the load is cut off, due to a sudden increase or decrease in engine load, resulting in engine speed fluctuation in a certain range, this increases the electrical load control adjustments. When the load increases or decreases, the air flow rate and (or) the ignition advance angle will be adjusted accordingly, so that the idle speed remains steady.
10. Canister solenoid valve control
11. Cooling fan relay control
12. System self-diagnostic function: After the system enters into working condition, ECM controls all system components working, and tests them in real time. Once the system or component malfunction occurs, the system will light up the engine malfunction lamp to remind the driver to repair or service the vehicle on time. In the mean time ECM will start fault protection mode.
13. System voltage over load protection: When the charging system malfunction causes the voltage too high, the system will enter protection mode to restrict the engine speed to prevent ECM damage.

2.12.2.2 Components Descriptions

1. Engine Control Module (ECM)

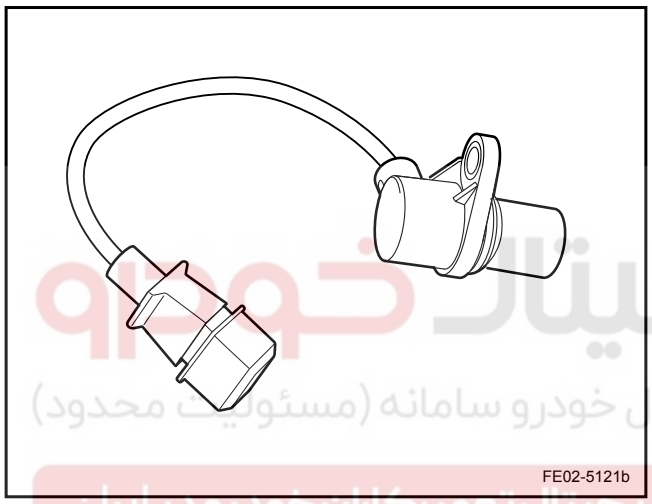


Engine control module is a core microprocessor with a a micro chip controller. Its function is to process data from various vehicle sensors to determine the engine's working condition, and through the various actuators controls engine actuators.
ECM normal working voltage is 9.0 V-16 V

Note

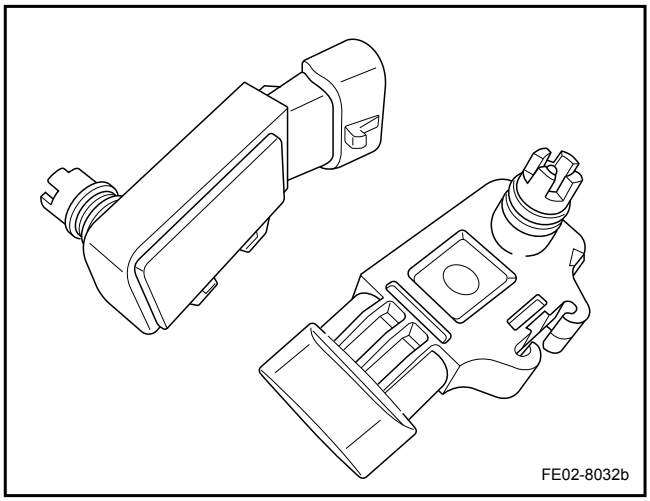
Although ECM has the voltage over load and reverse polarity voltage protection function, during the repair process it is prohibited to connect the battery positive and negative wrong or apply voltage higher than 15V. Otherwise, it will cause damage to ECM and other electrical equipments.

2. Crankshaft Position Sensor (CKP)



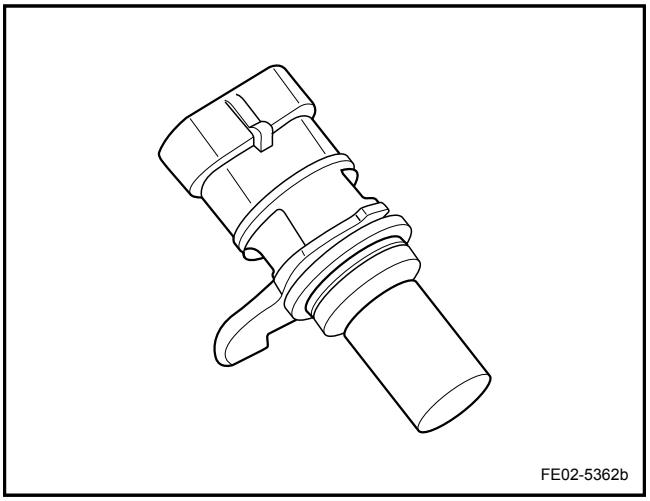
The crankshaft position sensor output can be used to determine crankshaft position and rotation speed. Crankshaft position sensor is a magnetic-electric sensor, which is installed in the front end of the transmission housing, and tightened with bolts, below the coolant temperature sensor. Flywheel signal plate and the crankshaft sensor is an integrated part. The sensor and the signal plate tooth gap in between 0.3 and 1.5 mm (0.01-0.06 in). The signal plate has 58 machined slots. When the crankshaft rotates, 58X tooth tip and the alveolar passes through the sensor from different distances. The sensor senses the reluctance change, the alternating reluctance generates an alternating output signal. The 58X gear plate gap position aligns with engine top dead center. When the cylinder No.1 reaches top dead center, The sensor aligns with the 20th tooth lower edge. ECM uses this signal to determine crankshaft position and rotation speed.
Sensor Resistance: 500 Ω-610 Ω
Output Voltage: 400 mV when 60 rpm. The voltage increases as the speed increases.

3. Intake Manifold Pressure / Temperature Sensor (MAP / IAT)



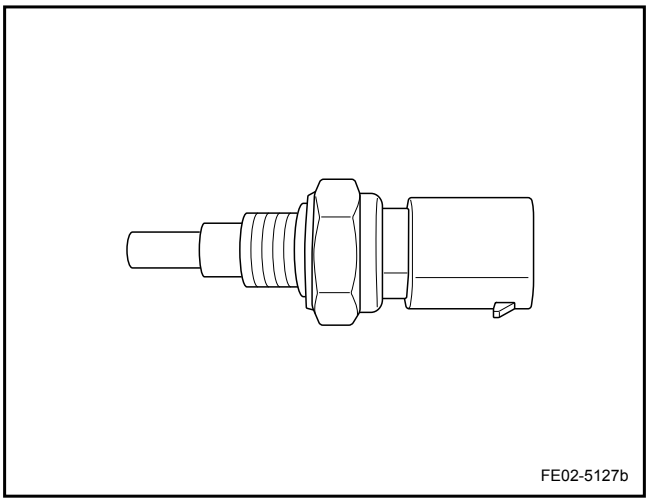
This sensor detects intake manifold pressure change caused by engine load and speed changes. These changes will be converted to the voltage output. When the engine decelerates, the throttle body closes resulting in a relatively low intake manifold absolute pressure output. Intake manifold absolute pressure and vacuum degree is opposite. When the manifold pressure is high, the vacuum is low. MAP sensor is also used to measure atmospheric pressure. This measurement is calculated as part of the MAP calculation. When the ignition switch is turned on and the engine is not running, the engine control module reads atmospheric pressure as the intake manifold pressure, and adjusts the Air-Fuel ratio accordingly. With this kind of altitude compensation, the system can maintain a low emissions while maintaining maneuverability. Sensor signal passes through ECM harness connector EN01 terminal No.19 to ECM. When MAP sensor and its circuit malfunction occurs, DTC P0105, P0106, P0107, P0108 will be recorded.

4. Camshaft Position Sensor (CMP)



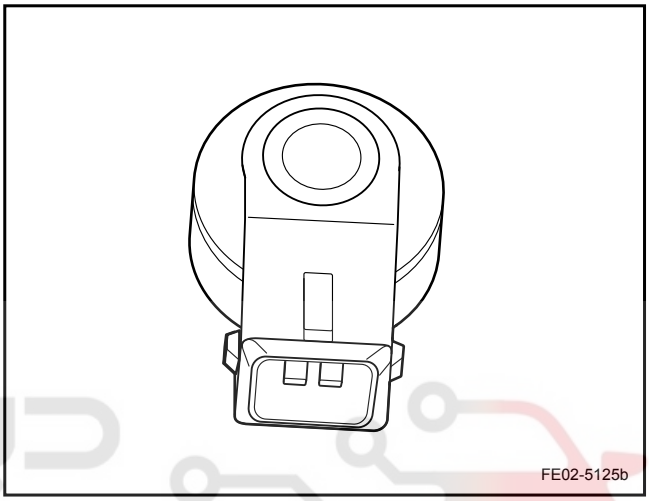
Camshaft position sensor is a Hall-effect sensor, which is installed in the vicinity of the intake camshaft, and works together with camshaft signal wheel. The signal wheel is corresponding to the specific engine location. ECM measures digital voltage signal through the sensor, therefore determining the working cylinder and to implement one to one control. Engine control module then calculates the actual sequence of fuel injection. If the engine is running when the camshaft position sensor signal is lost, the fuel injection system will be converted to fuel injection order based on the final fuel injection pulse, while the engine continues to run. If the engine starts after being shut down, the fuel injection will be converted from sequential injection to group injection. Even if the fault exists, the engine can be restarted.

5. Engine Coolant Temperature Sensor (ECT)



Engine coolant temperature (ECT) sensor is used to detect the engine operating temperature. ECM provides the best control scheme depending on the temperature. The sensor uses a negative temperature coefficient thermistor as the sensing element, when the coolant temperature rises, the resistance decreases. At -30 ° C (-22 ° F) the resistance is 26000 Ω; at 130 ° C (266 ° F), the resistance is 90 Ω. The sensors is installed in the main coolant path. The coolant temperature signal is important to the ignition timing and fuel injection adjustment, while the signal is also transmitted to the instrument panel (IP) through the CAN network, used to display the current engine working temperature.

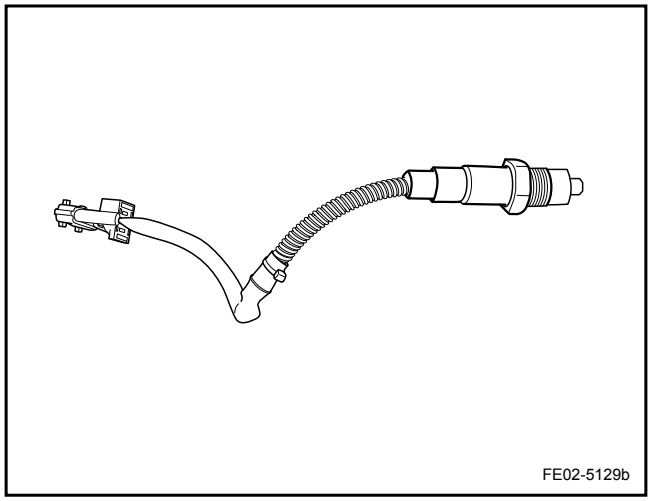
6. Knock Sensor (KS)



Knock sensor is a frequency response sensor, installed in the engine block the most sensitive to knocking part, the lower intake manifold. ECM uses knock sensor to detect knock intensity, and then to adjust the ignition advance angle, to effectively control knocking and optimize the engine power, fuel economy and emission levels. If the engine knocking occurs, ECM will receive the signal, filter out the non-knock signals and determine engine cycle calculated by camshaft and crankshaft position sensor signals. ECM determines the cylinder in which the knock occurs and will delay the ignition advance angle for this cylinder until the knock disappears. Then ECM advances the ignition advance angle until the ignition angle is best suited for the operating conditions at that time.

Due to weak sensor signals, the sensor wire has a shielded cable. Its resistance is 1M Ω, in any case the output signal is greater than 17mV / g

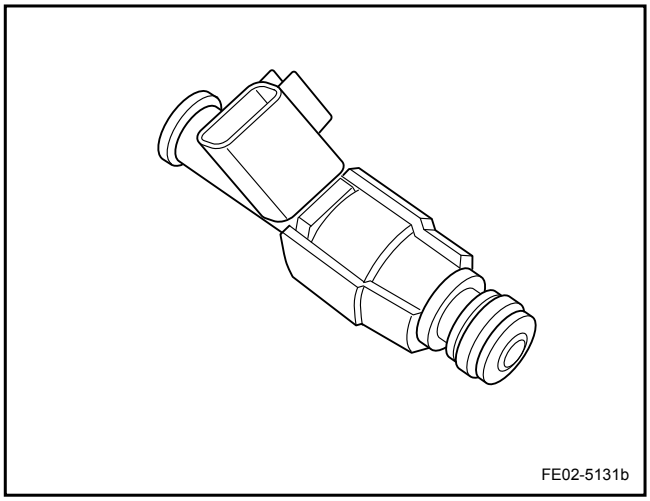
7. Oxygen Sensor (HO2S)



Oxygen sensor is an important sensor in a close-loop fuel control system, which adjusts and maintains the ideal Air-Fuel ratio, so that three-way catalytic converter achieves the best conversion efficiency. When the mixture Air-Fuel ratio becomes lean, the oxygen content in the exhaust increases, and oxygen sensor output voltage is reduced. On the contrary, the output voltage increase feedback to ECM indicates the air-fuel ratio.

Oxygen sensor sensing material is zirconia, hollow with an external sensing part. When Zirconia components are heated, they are activated, reference air enters the hollow parts of zirconium oxide from the wire. Exhaust passes through the outer electrode, oxygen ions move from the center of zirconia to the outer electrode, thus consisting a simple atomic battery with a voltage between two electrodes. According to the oxygen concentration in the exhaust, Zirconium oxide changes the output voltage, and thus determining the oxygen content in the exhaust. Usually the exhaust oxygen sensor design generates a voltage amplitude jump in the vicinity of the Air-Fuel ratio (14.6:1) to help ECM to determine the exact Air-Fuel ratio. Pre-Catalytic oxygen sensor is installed in the exhaust manifold, the three-way catalytic converter front end. Post-Catalytic oxygen sensor is installed in the three-way catalytic converter rear end. When the mixture is rich, the output voltage is 750 mV. When the mixture is lean, the output voltage is less than 200 mV. When the mixture becomes rich from lean, the responding time is less than 75 ms. When the mixture becomes lean from rich, the responding time is less than 150 ms.

8. Fuel Injectors



The injector structure is an electromagnetic switch valve device. The coil form poles leads to the engine wiring harness and ECM and is connected to power supply. When the coil is controlled by ECM to connect to the system ground, the resulting magnetic force overcomes the spring force, fuel pressure and manifold vacuum suction, and draws the valve core. The fuel sprays through the valve seat hole to the guide hole as a mist type spraying into the intake valve. When the power supply is cut off, the magnetic force disappears, with the spring force and fuel pressure, the injector closes.

The top of the fuel injector rubber seal and the fuel rail form a reliable fuel pressure seal; the lower part of the same rubber seal and the engine air intake manifold form an air seal. Fuel injector resistance is 11.6-12.4 Ω.

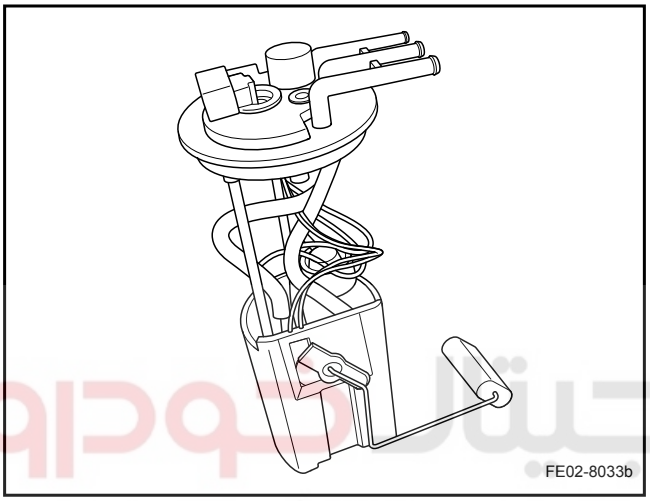
Note

When the fuel injector is blocked or not closed tight, the engine malfunction lamp may be lit, but the detection of DTC code is: oxygen sensor distortion, erratic signal, such as Air-Fuel ratio is not normal fault. At this time component malfunction should be carefully judged. Because when the fuel injector is blocked or leaking, the amount of fuel injected is not controlled by the ECM pulse width control. The oxygen sensor feedback to ECM will be very different from the ECM control target. When ECM detects this signal, it will determine the oxygen sensor is not working properly. But the system can not determine whether the fault is the oxygen sensor itself or other associated parts. Therefore when diagnose such a malfunction, the malfunction component must be carefully identified.

9. Oil Pressure Regulator

With a non fuel return system, fuel pressure regulator is installed in the fuel pump assembly. Hydraulic regulator function is to regulate the fuel pressure in the fuel rail to eliminate the fuel supply rate change, fuel pump supply change and engine vacuum changes interfering the fuel injection. Using the internal springs, the fuel supply system pressure will be constant at 350 kPa. After regulation, the excessive fuel returns back to the fuel tank through the return pipe.

10. Fuel Pump Assembly



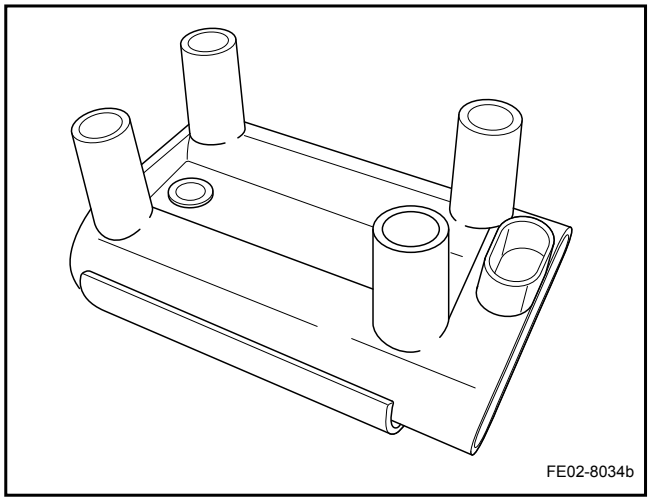
Fuel pump assembly consists of the fuel pump, brackets, fuel level sensor, fuel pressure regulator (non return-style design). Its function is to provide adequate fuel pressure at the same time to provide the driver fuel amount information on instrument panel. The fuel pump assembly is installed inside the fuel tank. The fuel pump is a turbine-type single-stage electric fuel pump, controlled by ECM through the fuel pump relay. It is different from the joint electronic control system. This control system controls fuel pump relay power supply. The fuel pump outlet has a one-way valve. When the engine is not running, the fuel inside the pipeline will not quickly return to the fuel tank to ensure the re-starting performance. Fuel level sensor is a variable resistance type.

Fuel pump output fuel pressure is greater than 350 kPa.

Note

If the fuel pump outlet check valve leaks, the vehicle will be difficult to start in a short period of time. Because there is no fuel inside the pipe. It takes some time to establish a certain degree of fuel pressure. In summer heat, if the check valve leaks, fuel supply system does not have residual pressure. It will produce air resistance, resulting in difficulty in starting, or can not start.

11. Ignition Coil

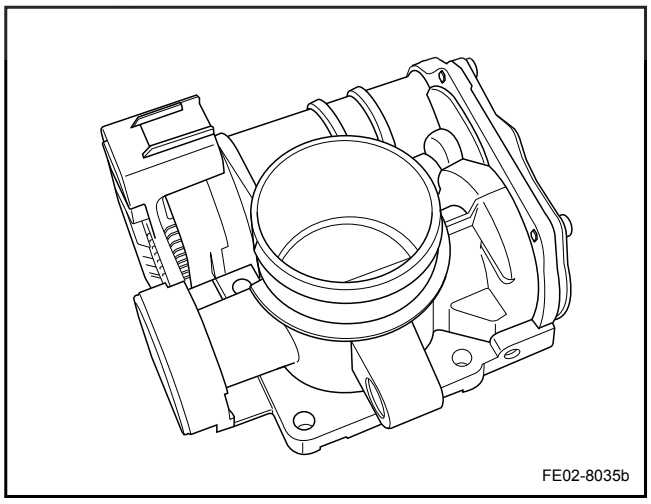


Ignition coil assembly includes two sets of coils.The coils provide ignition spark to two cylinders with 360-degree crankshaft angle difference. Ignition occurs when one piston is at compression TDC, the other is at exhaust TDC. The cylinder at exhaust TDC internal air pressure is low, and the temperature is high. Less energy will enable the ignition, known as redundant ignition. The cylinder at compression TDC mixture density and pressure is high, so more ignition energy sis required for spark plug ignition. The mixture is quickly ignited for power, this is called an effective ignition.

Ignition Coil Primary Resistance: 0.45-0.55 Ω

Ignition Coil Primary Resistance: 0.45-0.55 Ω

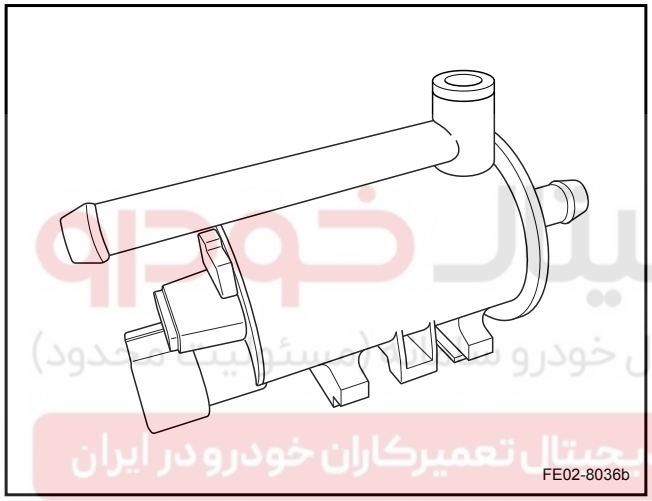
12. Electronic Throttle Body (ETC)



The throttle valve assembly opening is determined by ECM according to the driver-controlled throttle pedal control input signals, and other input signals. ECM calculates the vehicle currently needed power to control the fuel supply (spray) amount, and adjusts based on feedback signals to make sure that the engine works in the best controlled status. Electronic throttle body valve adds the drive motor, gear drive mechanism and other components, as well as a function and reliability enhanced throttle position sensor.

Without power supply, throttle body initial angle is 14.5 degrees. When the ignition switch is turned on, it has a 13 degree angle. At this point, the data stream readings of the throttle body opening is 6.62 %. (Note: the former represents percentage of opening, the latter perspective of value.)

13. Canister Solenoid Valve (EVAP)

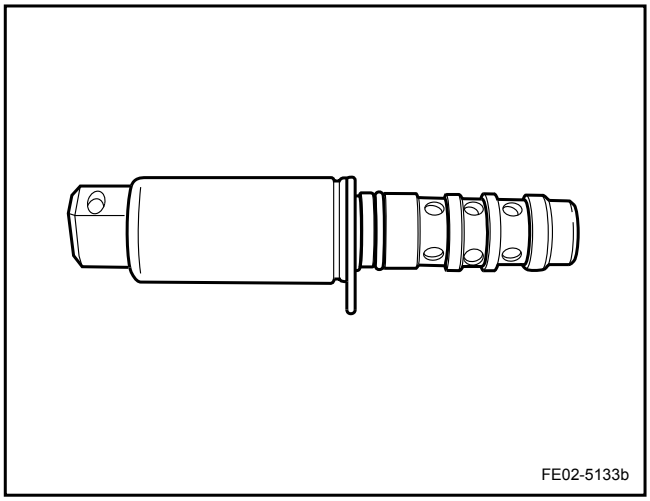


The Canister control valve is located at the engine cylinder head side (transmission side) and is used to control the Canister clean air flow. ECM controls intake manifold gasoline vapor volume through Canister solenoid valve. ECM sends square pulse wave. Air flow volume and control square wave pulse relationship is linear.

ECM changes canister working time and rate according to engine speed and load conditions.

Solenoid valve coil resistance: 19-22 Ω.

14. Variable Valve Timing Solenoid Valve (VVT)

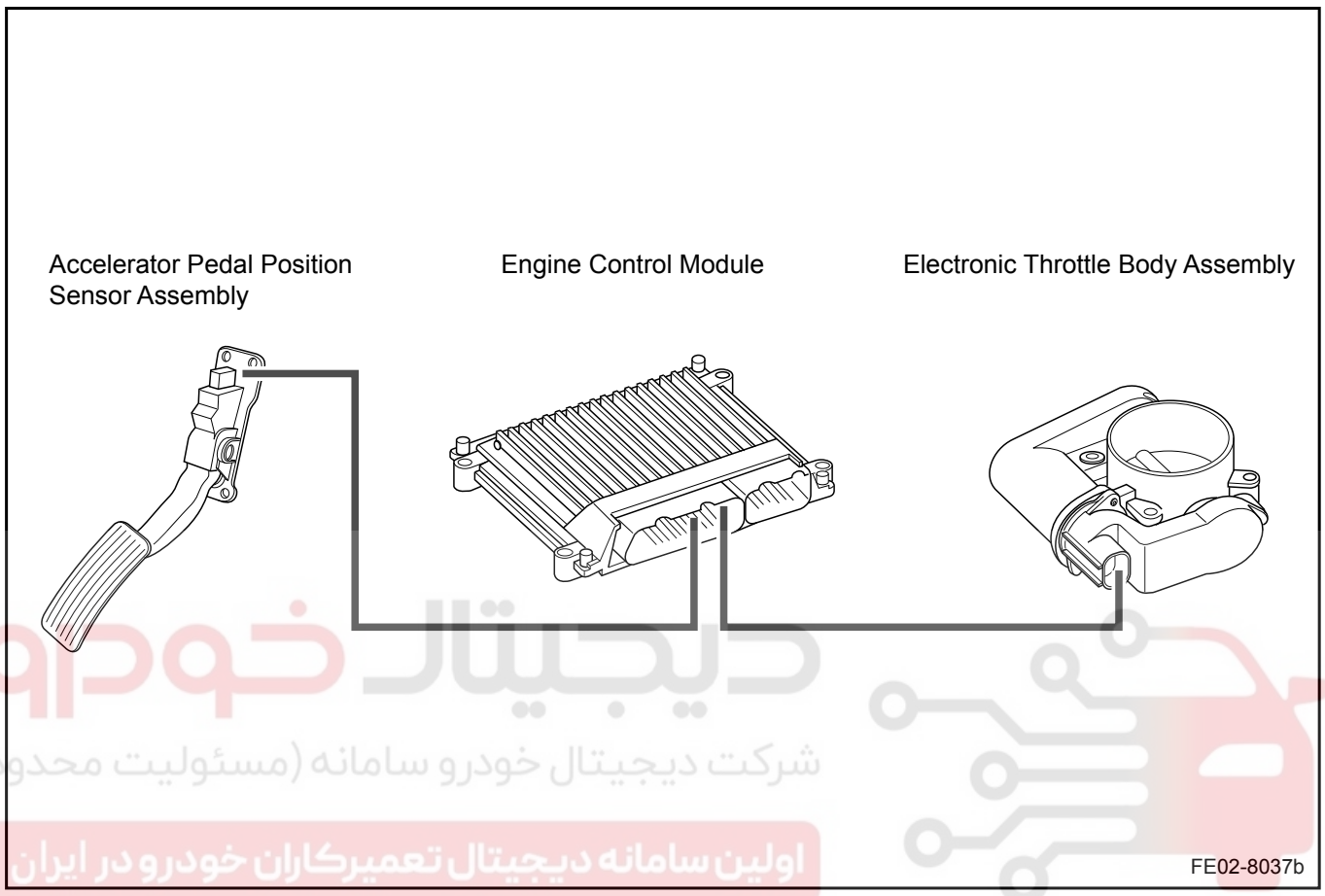


VVT solenoid valve is located at the engine intake manifold side near the front. VVT magnetic valve is a 4-bit 4-pass solenoid valve, the working power supplied from main relay controlled by ECM. ECM controls VVT solenoid valve ground with a pulse width modulation signal. The crankshaft to the camshaft timing relations can be continuously changed. The best valve timing control can be achieved at different engine running conditions. This will help to increase engine efficiency, improve idle stability, and provide more torque and power, while helping to improve fuel economy and lower emissions of hydrocarbons and nitrogen oxides.

Solenoid valve resistance: 7.2 Ω/20°C (68 ℉)

2.12.3 System Working Principle

2.12.3.1 Electronic Throttle Body (ETC) Working Principle



Electronically controlled throttle body assembly must be use dedicated engine electronic control module (ECM) with ETC system-driven feature hardware as the core control element. System control software usually uses the engine torque output control mode as computer algorithms. At the same time, due to the cancellation of the traditional mechanical throttle valve control of mechanical pull cables, ETC is equipped with a pedal position sensor (APP) with a resistive potentiometer device, in order to provide vehicle handling demand information and other information for the driver to control the vehicle to the engine electronic control module (ECM).

Electronic throttle body opening is determined by ECM according to the acceleration pedal control input signals. With other engines and vehicles sensor input signals, ECM analyzes the driver's intention and calculates the needed engine output power and accordingly adjusts the engine throttle opening and fuel supply (injection) amount. At the same time, the electronically controlled throttle position sensor can detect the actual throttle opening and send the feedback to ECM. ECM then based on this feedback signal adjusts the vehicle control parameters. This control process ensures that the engine and vehicle work in the ideally controlled conditions.

Due to the rapid development of modern science and technology, High-Speed ECM can quickly analyze the driver's intention and calculate the basic throttle opening parameter values, based on the throttle pedal signal, the signal variation and signal change rate. At the same time, ECM adjusts and optimizes the throttle opening parameter, based on various sensors input signal status, so that the system further calculates the optimum throttle opening control parameters and implements the actual throttle control. ECM sends the output control signal to the ETC motor drive circuit to open the throttle according to the calculated opening parameter, based on the revised throttle opening and pre-determined control strategy. Because of the high speed calculation, the system enables the engine speed changes are smooth under transition engine operating conditions. The whole control process only requires a few milliseconds, achieving excellent vehicle performance.

The application of automotive electronic technology makes the electronic drive control valve assembly diagnosis difficult to use conventional visual inspection method. In the event of electronic controlled throttle body malfunction, the system needs to provide a "Jolt-limited" function to allows the driver to drive the vehicle to a repair station for repair.
"Jolt-limited" control has the following two kinds of control modes

1. System is unable to control the engine power

   ECM will limit the engine power output, and the system can not control the throttle opening and closing. The throttle opens to the system pre-determined position.
   ECM will shut down the engine ignition output. At this time ECM internal fault occurs, the system can not control the engine torque output. The throttle body adjust the opening to (zero bit) off status. The system will be fully turn off the ignition control functions.

2. System can not monitor the driver's intention

   ECM will limit the engine power output. At this point, the system loses the ability to determine and monitor the driver's intention. In order to prevent damage to the engine, ECM will limit the engine power output and lower engine power increment and velocity increment. When braking, ECM will adjust the engine speed to idle speed and adjust the throttle opening to the system pre-determined position. ECM will force the engine working at idle running status. When the system loses the ability to determine and monitor the driver's intention, ECM will force the engine working at idle running status, and the idle speed will be the default speed.

2.12.3.2 ECM Controlled Fuel Supply System

1. Fuel Pump Control

When the ignition switch is turned on, the fuel pump will run for 2 s. At this moment, if ECM does not detect the engine speed signal, fuel pump stops running. Once the engine rotates, ECM detects the engine speed signal and then controls the fuel pump running.

0.6 s after the engine speed signal is lost, or the anti-theft device requests to shut down the fuel pump, the fuel pump stops running.

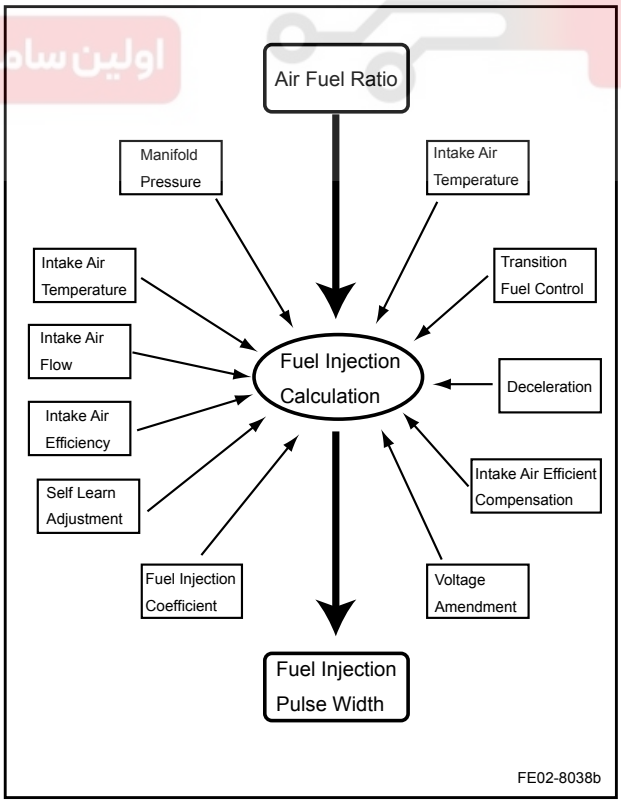
2. Start-up Fuel Injection Control

The pre-injection only occurs once during a normal start-up process, and the following conditions have to be met:

- Engine starts to running (ECM detects a valid engine speed signal).
- Fuel pump relay pull-in
- Fuel pump running longer than the accumulator delay time
- The pre-injection has not yet happened

Once all the above conditions are met, the pre-injection will happen in all cylinders at the same time.

3. Fuel Injection Pulse Width Control



A. Air-Fuel Ratio

Start Air-Fuel ratio, normal start Air-Fuel ratio, clear the flooded cylinder Air-Fuel ratio, engine running Air-Fuel ratio, cooling state Air-Fuel ratio, warm-up state Air-Fuel ratio, theoretical Air-Fuel ratio, power-enriched Air-Fuel ratio, catalytic overheating protection Air-Fuel ratio, engine overheating protection Air-Fuel ratio.

B. Intake Manifold Absolute Pressure

Intake manifold absolute pressure is detected by the MAP sensor installed on the intake manifold.

C. Volumetric Efficiency

Volumetric efficiency is the actual air flow into the cylinder to the ideal air flow ratio.

D. Phase Volumetric Efficiency

The valve timing changes affect the engine's volumetric efficiency. The basic efficiency table is set when the valve timing control system has not started to work, the camshaft and the crankshaft are at initial positions. When the valve timing control system starts to work, the system will compensate the volumetric efficiency to ensure an accurate calculation of air flow.

E. Self Learn

self learn does not amend the changes as the engine running time increases, or the engine and vehicle manufacturing errors.

F. Close-loop Feedback Correction

Close-loop feedback correction controls the actual Air-Fuel ratio close to the theoretical Air-Fuel ratio through the oxygen sensor feedback signals.

G. Transition Condition Fuel Control

System uses more complex algorithms to establish the fuel evaporation model to calculate Air-Fuel mixing conditions, taking into account the engine coolant temperature, intake air temperature and engine working condition and the best fuel injection amount. It greatly improves fuel control under various transitional working conditions, including sudden acceleration/ deceleration and other working conditions.

H. Protective Fuel Supply Control

When any one of the following conditions is met, the system will stop fuel injection:

- When the engine speed is higher than 6,400 rpm, resume fuel supply when the engine speed drops below 6,000 rpm.
- When the system detects a ignition system malfunction, it stops the fuel supply.
- When the system voltage is greater than 18 V, it will enter the electronic throttle body function restriction mode (forced idle mode).

I. Basic Fuel Injection Constant

The basic fuel injection constant provides engine displacement and the fuel injector fuel flow rate relationship.

J. Battery Voltage Amendment

When the battery voltage changes, voltage is amended to ensure the correct amount of fuel injection.

2.12.3.3 ECM Controlled Ignition System

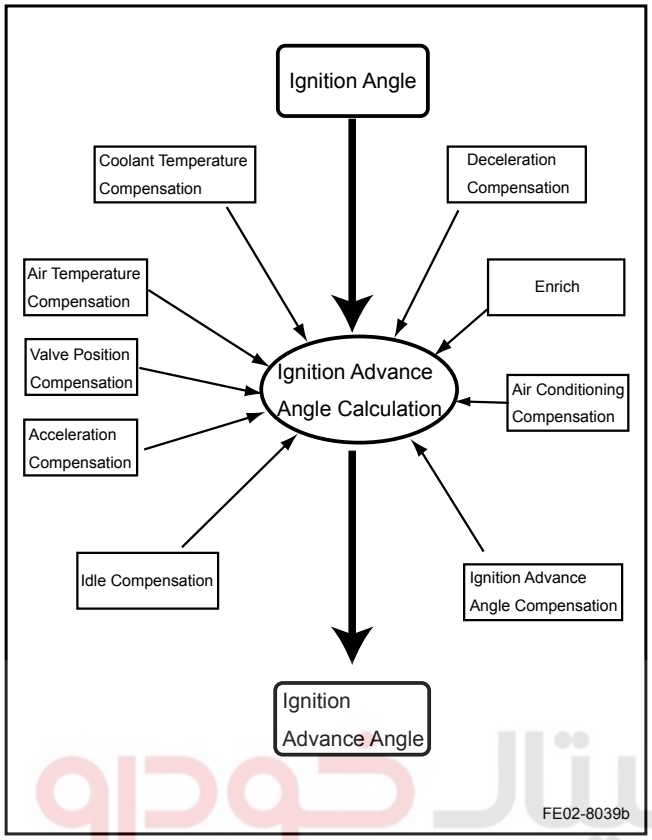
1. Closed Ignition Angle Control

The length the ignition angle closes determines the spark plug ignition energy. Ignition coil magnetizing too long will damage the coil or ECM internal ignition coil driver circuit, while too short will cause ignition failure (misfire).

2. Starting Mode

In the starting mode, the system uses a fixed ignition angle in order to ensure cylinder mixture is ignited, and provide positive torque. When the engine starts to run, the engine speed increases. The ignition angle will no longer be in starting mode.

3. Ignition Advance Angle Calculation and Control



A. Main Ignition Advance Angle

When the engine temperature is normal, with the throttle opening, the main ignition angle is the minimum ignition angle with the optimal torque or the threshold of detonation. When the throttle is closed, the ignition angle should be less than optimal torque point for idle stability.

Without affecting driving with a cold engine, in order to reach the normal operating temperature as quickly as possible, in the catalytic converter heating process, the basic ignition angle can be angle other than the minimum ignition angle with the optimal torque or the threshold of detonation. This angle should also be delayed as much as possible without affecting the driving ability.

B. Ignition Advance Angle Adjustment

temperature adjustment, intake air temperature adjustment, altitude compensation adjustment, idle speed adjustment, power-enriched adjustment, deceleration fuel supply adjustment, Air-Conditioning control adjustment, exhaust gas recirculation adjustment.

C. Acceleration Adjustment

Ignition advance angle acceleration adjustment is used to mitigate the drive system torque shock caused by engine speed fluctuations, and also to eliminate possible detonation during acceleration, so that the acceleration is smooth.

D. Valve Timing-controlled Ignition Angle Compensation

In order to obtain a better power and torque, system will enrich the Air-Fuel ratio to achieve the optimal torque and adjusts the ignition advance to achieve the optimal torque output.

E. Valve Timing-controlled Ignition Angle Compensation

When the valve timing control system works, the engine's intake and exhaust overlap angle change will affect the internal exhaust gas recirculation rate and the cylinder temperature. According to different valve timing, system needs to adjust ignition advance angle to ensure that under current valve timing, the actual ignition advance angle is the best.

F. Deceleration Fuel Supply Adjustment

When the system exits the deceleration fuel supply control mode, the ignition angle will be adjusted to make the throttle closing transition smooth.

G. Air-Conditioning Control Adjustment

When the engine is idling, the Air-Conditioning is turned off. The ignition angle will be adjusted to make the engine run smoothly.

2.12.3.4 Electronic Throttle Body Function Restrictions

1. Forced Shut Down

When ECM reports a malfunction, intake or throttle air flow control has a malfunction. The control strategy is to stop the fuel supply, stop the ignition and close the throttle and shut down the engine.

2. Forced Idle Power Management Mode

When the engine is idling, ETC system can not reliably use the throttle to control engine power. At this point ETC cancels the throttle control. The throttle opening is at the default position. The engine power control is achieved by stopping one cylinder fuel injection and delaying the ignition angle.

3. Forced Idle Mode

When the driver's intention can not be reliably detected, such as when the pedal signal is lost. The vehicle only maintains cooling, heating, electricity supply and lighting functions with engine idling. When pressing the acceleration pedal there is no engine response, so in this mode the vehicle can not be driven.

4. Restricted Power Management Mode

ETC system can not use the throttle to control engine power. In this mode, the system determines whether the engine is at idle speed or is accelerating based on the acceleration pedal signal. The system controls engine power output by shutting down the engine, or by stopping a cylinder fuel injection, or by delaying the ignition. The engine output fluctuation is obvious. Working a long time in this mode would be harmful to the engine emission system. The model ensures that the vehicle can be driven, but difficult to control in normal driving or in traffic or on a steep slope.

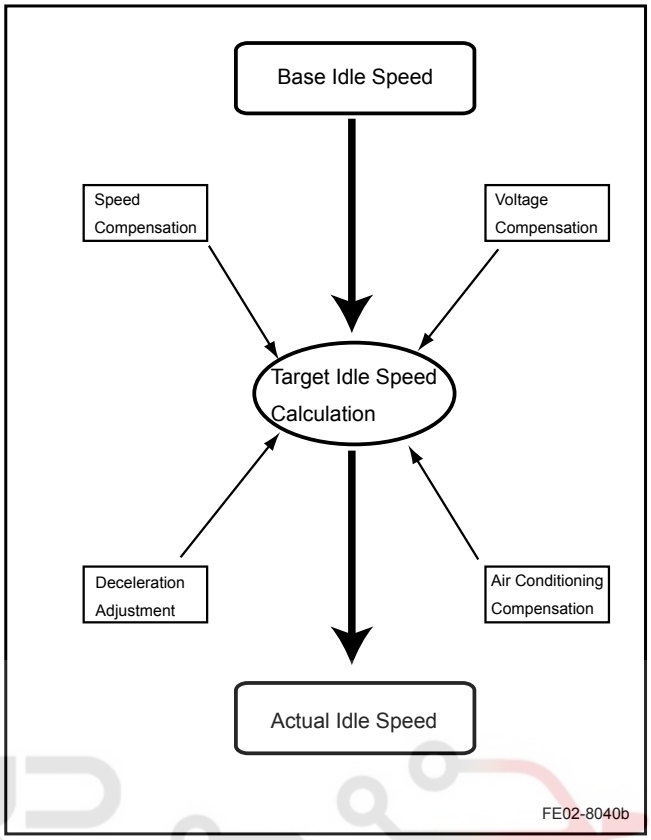
5. When the reliability of determining the drive intention is decreased or when the system can not achieve high power output

When the two acceleration pedal position sensors input signals difference is too great, the engine's output torque is limited. The engine's response to with the pedal position change is much slower. The driver may feel that the engine power output will be significantly weakened , but the vehicle will still be able to drive in normal traffic.

2.12.3.5 Idle Speed Control

idle air flow control is that the engine control system maintains the throttle body fully closed at target idle speed. The system maintains a smooth transition with the throttle body fully closed to prevent the stall. When the engine load changes at idle speed, system maintains a steady engine speed.

1. Target Idle Speed Calculating



2. The Basic Target Idle Speed

At different coolant temperatures, the basic target idle settings are as following:

Coolant Temperature (°C/ ºF)	Target Idle Speed (rpm)
< 20/-4	1,175
-10/14	1,200
0/32	1,200
10/50	1,150
20/68	1,150
30/86	1,150
40/104	1,000
50/122	900
60/140	850
70/158	800
80/176	750
90/194	750

Coolant Temperature (°C/ ºF)	Target Idle Speed (rpm)
100/212	750
110/230	750
>?20/248	800

3. Vehicle Speed Compensation and Deceleration Speed Adjustment

To improve the deceleration and stop driving performance, when the vehicle is driving, the target idle speed increases by 100 rpm higher than stopping idle speed. During the deceleration and stopping, the speed gradually decreases to the parking target idle speed.

4. Air-Conditioning Compensation

When the air-conditioning is turned on with the vehicle parking, in order to compensate for the compressor power consumption, when the coolant temperature is below 0°C / 32F, the target idle speed increases by 50 rpm; when the coolant temperature is above 0°C / 32F, the target idle speed increases by 200 rpm.

5. Voltage Compensation

When the system voltage is lower than 11.5 V, and not restored in 10 s, the system will increase the target idle speed by 250 rpm, in order to increase the amount of electricity generated.

When the external power load impacts the system, the transient voltage will fluctuate. The system will automatically compensate for the air flow rate in order to curb the engine speed fluctuations.

2.12.3.6 Knock Control

Knock control is used to eliminate engine detonations that may occur during the combustion to optimize engine power and fuel economy. System can control different cylinder knocking independently.

1. Knock Control Enable Conditions

- The engine running time is longer than 2 s.
- The engine coolant temperature is higher than 70°C /158 ºF
- The engine speed is greater than 800 rpm .

2. Knock Control Mode

When a knocking occurs or is likely to occur, the system will quickly delay the ignition advance angle. System-based spark advance angle is either normal ignition advance angle or safety ignition advance angle. Knock controlled speed is between thees two.

- Steady-State Control

  When the engine is running as per normal, ECM collects and analyzes engine combustion signals filters knocking signal through the knock sensor. Once the knock intensity is higher than the acceptable limit, the system will rapidly delay the ignition advance angle cylinder in which the detonation happened, to eliminate detonation in the following combustion. The ignition advance angle will be back to normal angle gradually.

- Transient Control

  During a sudden acceleration or a engine sudden speed change, detonation is likely to happen. The system predicts the likelihood of detonation, and automatically delays the ignition advance angle in order to avoid a strong detonation.

- Rapidly Delayed Ignition Advance Angle

  Once the system detects a detonation, according to different engine speeds, the system rapid delays ignition advance angle 3-5 degrees, and resumes to normal controls in 2-3 s afterward.

- Adaptive Ignition Advance Angle

  Due to wear and tear after long-term use, there are differences between the engines. When the system and the engine are in initial use or ECM is supplied with power, the engine detonation may occur. The system will record the detonation, after a period of running, the system will automatically generate an adaptive adjustment value of the ignition (self learn value). When the engine is running in the same conditions, the system will automatically advance the ignition angle, to the detonation occurring.
  System adaptive learn process is constantly updated with the engine running.

2.12.3.7 Air-Conditioning Switch Off Control

In some cases, in order to ensure the engine power or protect the engine or protect the Air-Conditioning system, ECM must stop the Air-Conditioning compressor working or prohibit the Air-Conditioning system to start. At the same time to prevent the compressor clutch and frequently on-off, once the system enters into the Air-Conditioning switch off mode, ECM delays for a specified period of time to control Air-Conditioning clutch pull-in.

- Full-throttle Air-Conditioning Off Mode: Ensure the vehicle dynamic.

  Engine speed is less than 3,600 rpm
  No TPS fault
  TPS is greater than 105%, and since the last time full-throttle air-condition-off the TPS is less than this value

- Engine Speed Too High Air-Conditioning Off Mode: Protect the Air-Conditioning system.

  A/C off, the engine speed is less than 4,900 rpm, the compressor is allowed to start.
  A/C on, the engine speed is greater than 5,100 rpm, the compressor is off.

- Engine Coolant Temperature Too High Air-Conditioning Off Mode: Protect the engine.

  A/C off, when the coolant temperature is less than 106°C (223°F), the compressor is allowed to start.
  A/C on, when the coolant temperature is higher than 108°C (226°F), the compressor is off.

- Air-Conditioning Evaporator Temperature Too Low Air-Conditioning Off Mode: Protect the Air-Conditioning system.

  Air-Conditioning evaporator temperature sensor malfunction
  Air-Conditioning evaporator temperature is less than 3°C (37°F)

2.12.3.8 Canister Solenoid Valve Control

Canister solenoid valve controls the amount and time the fuel vapor enters in cylinders by controlling the passage between the Canister and intake manifold opening and closing timing, therefore maximizing the vehicle emissions, while minimizing the impact on engine performance.

1. Canister solenoid valve working conditions

In order to reduce the amount of fuel vapor entering into the cylinder affecting the combustion, following conditions must be met before the Canister solenoid valve is open:

- System voltage is less than 18 V and more than 8 V
- Engine coolant temperature is higher than 0°C (32 ºF)
- Engine intake air temperature is higher than 0°C (32 ºF)
- No Related System Malfunctions
  - Fuel System Malfunction
  - Fuel Pump Malfunction
  - Idle Speed Too High / Too Low
  - Intake Air Pressure Sensor Malfunction
  - Engine Misfire
  - Pre-Catalytic Oxygen Sensor Heating Malfunction
  - Pre-Catalytic Oxygen Sensor Signal Malfunction
  - System Voltage Too Low / Too High
  - Crankshaft Position Sensor Malfunction
  - Ignition Coil Malfunction
  - Fuel Injector Malfunction
  - Canister Solenoid Valve Output Malfunction

2. Operating Mode

Canister solenoid valve opening is determined by ECM according to the duty cycle (PWM) signal. In the non-idling state, the maximum Canister solenoid valve opening is determined by the close-loop air flow with a maximum 100%.

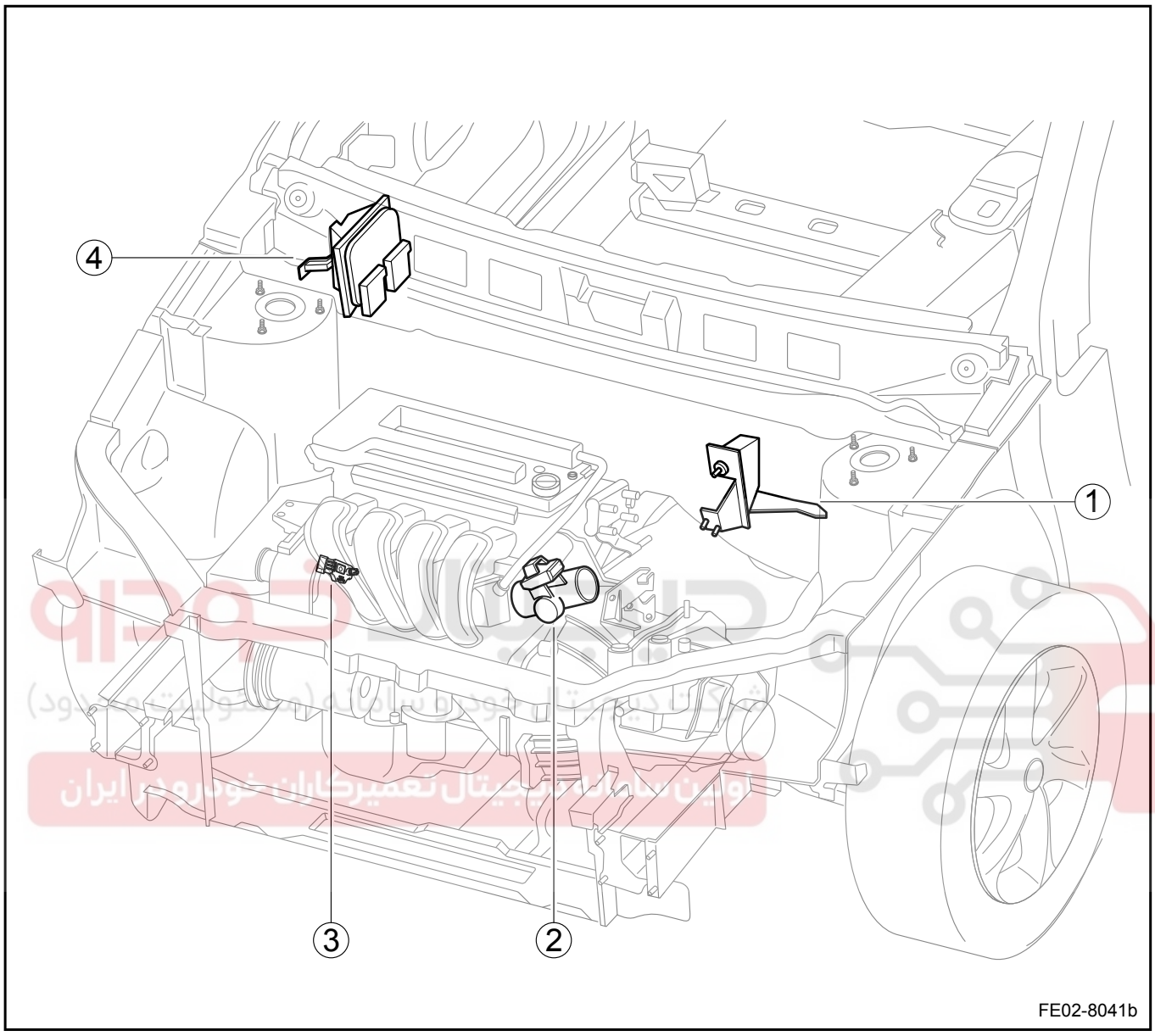
2.12.3.9 Fault Self-diagnosis and Protection Function

When the system is working and the engine is running, ECM controls all system components working, and monitors components directly connected to it. When one or more components are in abnormal working conditions, the system will automatically set an alarm. Each fault condition has a corresponding unique DTC code and once the fault occurs, the system will sends output signal corresponding to this code through the datalink connector. The engine malfunction indicator lamp will be lit to alert the driver to repair. DTC code indicates a possible malfunction component.

When a malfunction occurs, the system controls the engine using temporary emergency program to ensure that the vehicle can be driven to a repair station for repair.

2.12.4 Component Locator

2.12.4.1 Component Locator

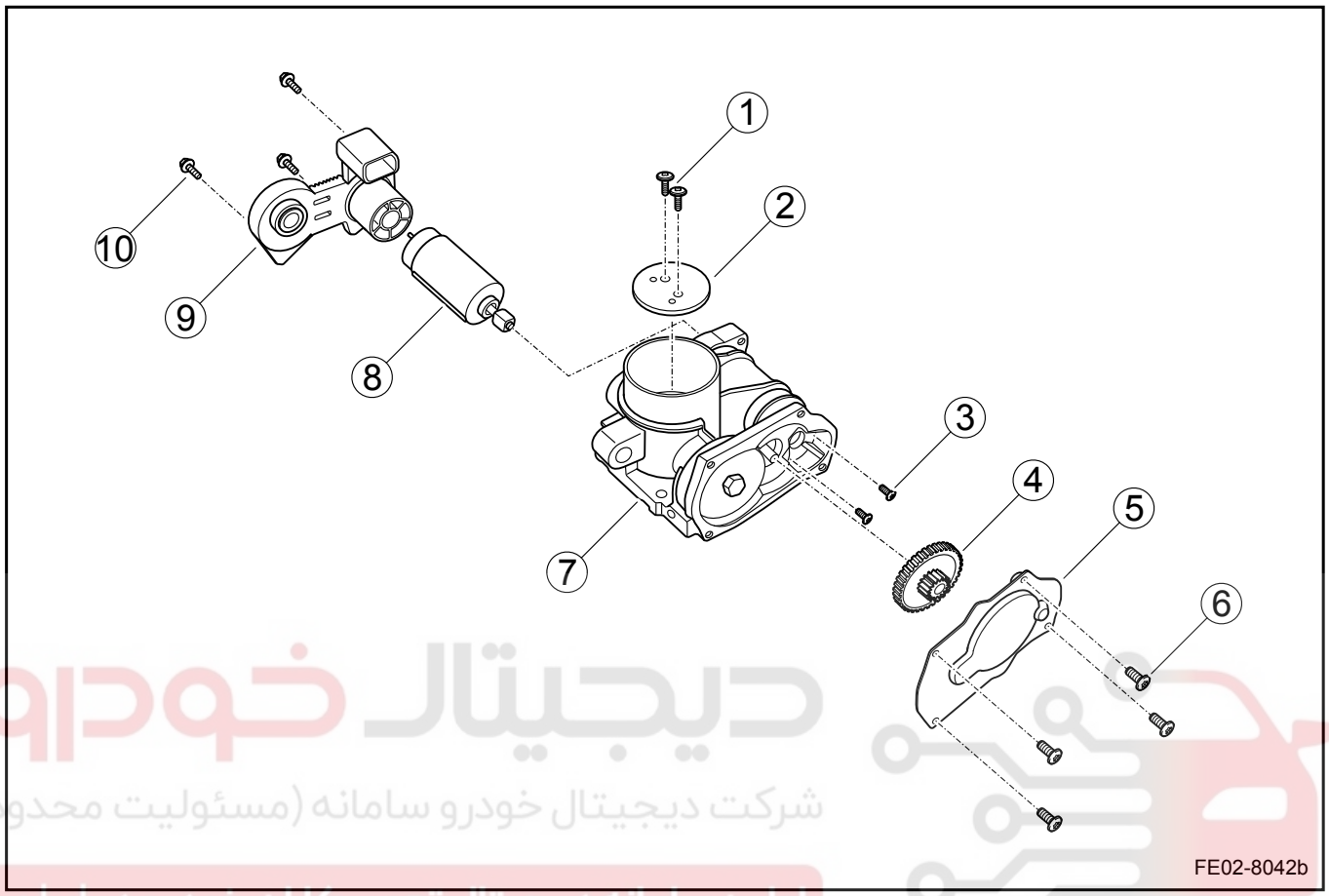


Legend

1. Acceleration Pedal Position Sensor
2. Electronic Throttle Body (ETC) Assembly
3. Intake Air Pressure / Temperature Sensor
4. Electronic Control Module (ECM)

2.12.5 Disassemble View

2.12.5.1 Disassemble View

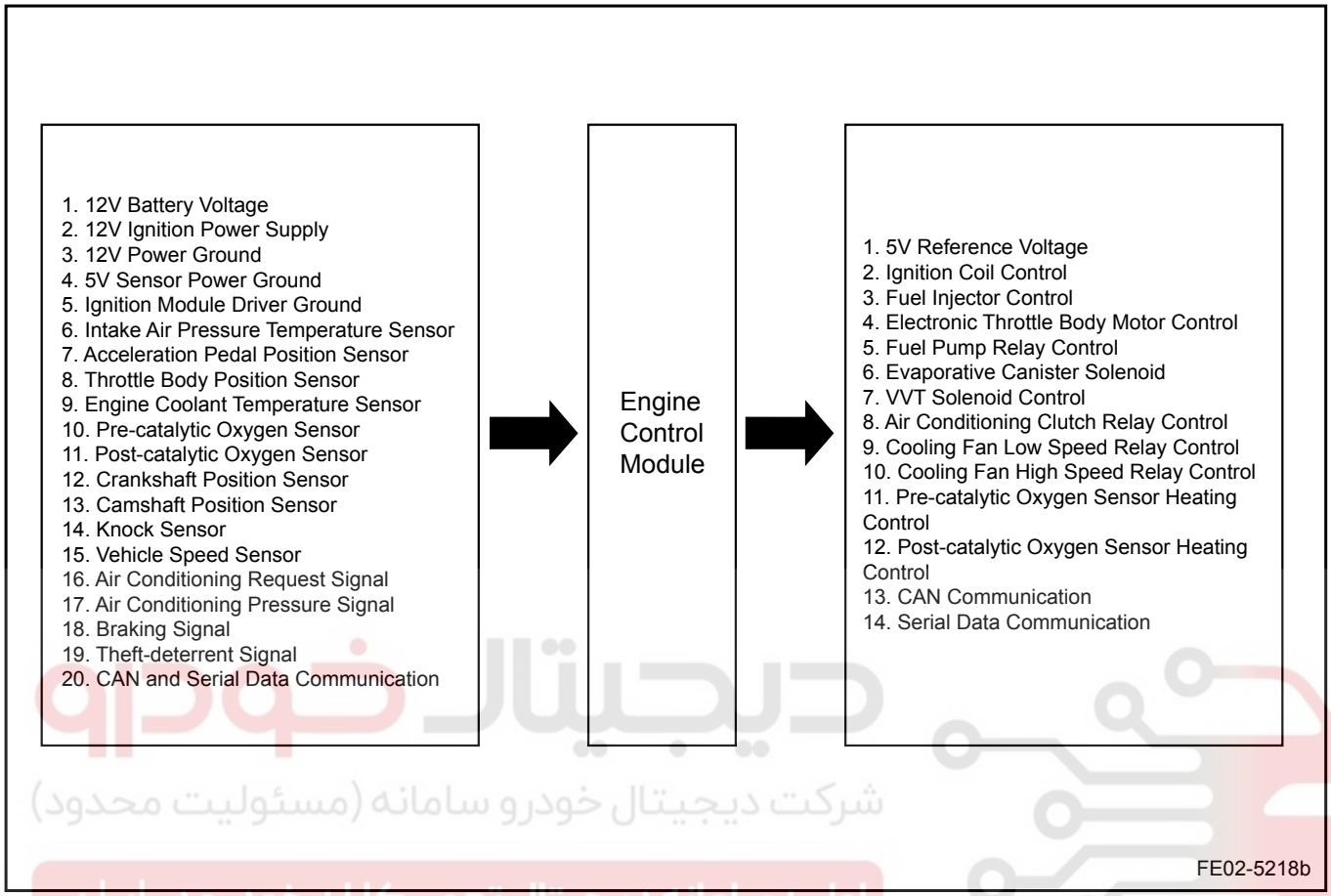


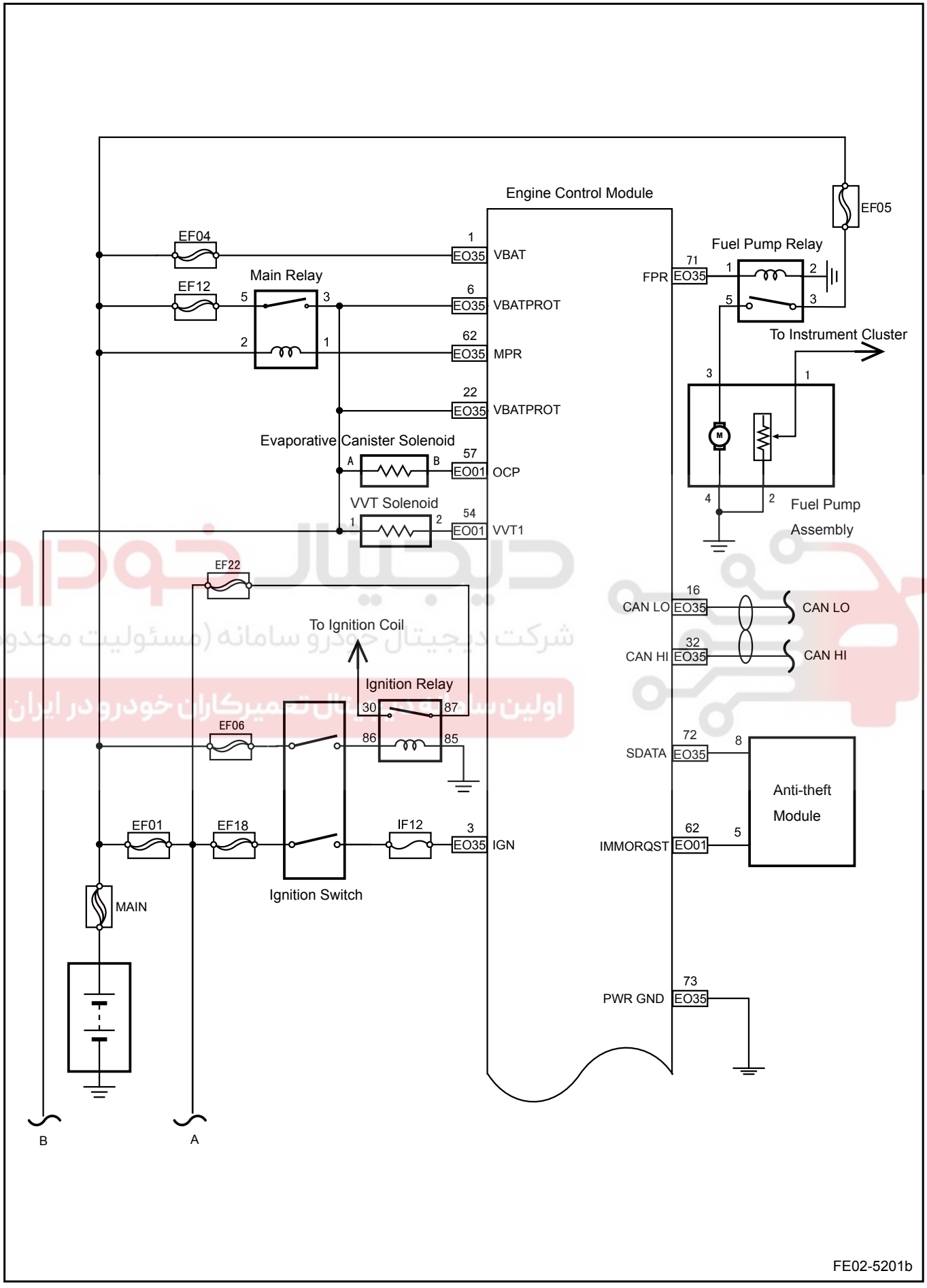
Legend

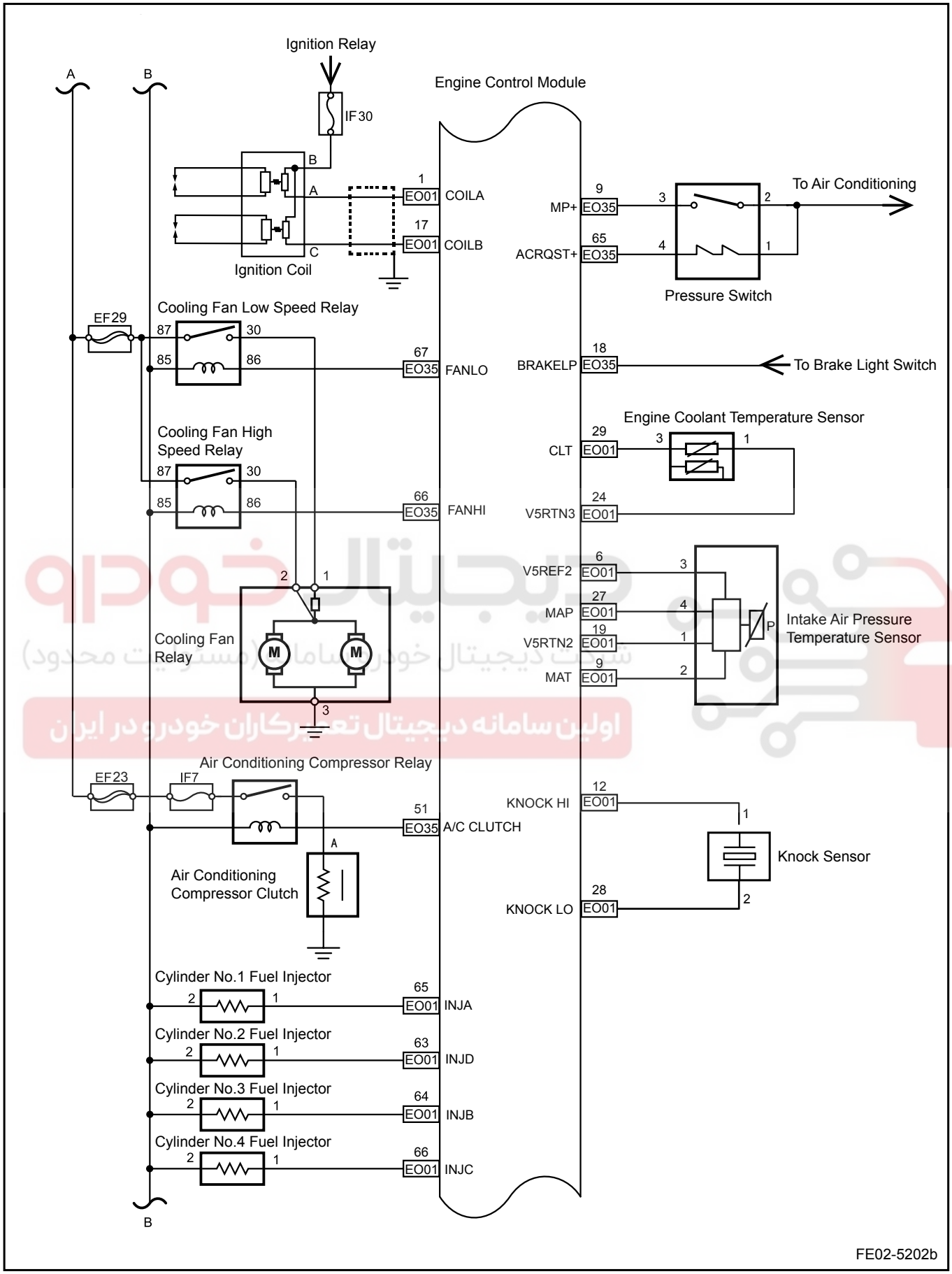
1. Throttle Valve Retaining Bolts
2. Throttle Valve
3. Throttle Drive Motor Retaining Bolts
4. Throttle Drive Gear
5. Seal Plate
6. Seal Plate Retaining Bolts
7. Throttle Body
8. Throttle Drive Motor
9. Throttle Position Sensor
10. Throttle Position Sensor Retaining Bolts

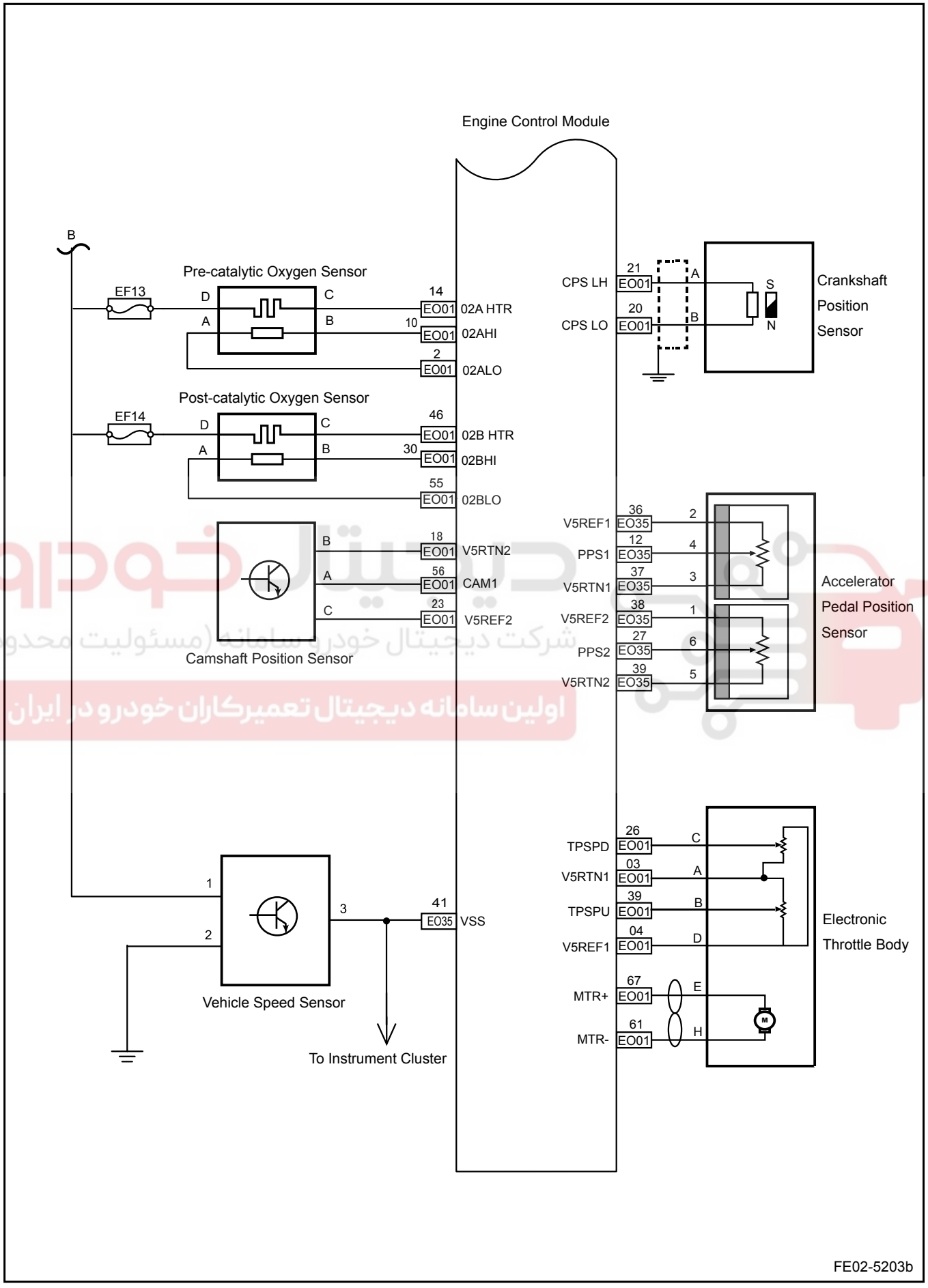
2.12.6 Schematic

2.12.6.1 Schematic









2.12.7 Diagnostic Information and Procedures

2.12.7.1 Diagnosis Description

Before carry out the control system diagnostic. Refer to2.12.2 Description and Operationand2.12.3 System Working Principle. Understand and get familiar with control system working principle, and then start systematic diagnostic, so that it will help to determine the correct diagnostic steps, more importantly, it also help to determine whether the customer described situation is normal.

Before any control system fault diagnostic, using the2.2.7.2 Control System Checkas a starting point to guide the servie personnel to take the next logical step for fault diagnosis. Understand and correctly use the diagnostic flow chart can reduce the diagnostic time and avoid misjudge on components.

2.12.7.2 Control System Check

For 4G15-D engine control system check. Refer to the 4G18-D engine2.2.7.2 Control System Check.

2.12.7.3 Intermittent Fault Check

For 4G15-D engine intermittent fault check, please refer to the 4G18-D engine2.2.7.3 Intermittent Fault Check.

2.12.7.4 Symptoms Table

If a malfunction occurs, but it has been not stored in ECM DTC code (DTC), and its faulty reason can not be identified in the basic diagnostic, carry out the diagnostic based on the following table listed order.

Symptoms	Suspected Faulty Items	Relevant Sections
Retardation, Engine Speed Decreases, Speed Instability Fault Definition: When pressing the acceleration pedal, there is no response. At any speed, this malfunction may occur. Start the vehicle for the first time (for example, start after parking), this malfunction is usually more obvious. In severe cases, this malfunction may lead to engine stalling.	1.ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Intake Manifold Absolute Pressure (MAP) Sensor	Refer to 2.12.7.18 DTC P0107 P0108
	3. Fuel Pressure Abnormal	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	4. Injector Working Abnormal	
	5. Mixture Too Rich	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Mixture Too Lean	
	7. Ignition system: spark plug abnormal, ignition wires abnormal.	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	8. Knock Sensor (KS) system, the ignition delay is too great.	
	9. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	10. Thermostat Abnormal	2.18 Engine Cooling System JL4G15-Din2.18.3 Diagnostic Information and Procedures
	11. Generators Working Abnormal	Refer to2.11 Starting / Charging System JL4G18-Din2.11.7 Diagnostic Information and Procedures
Only when Air-Conditioning is working, the engine stalls.	1. Air-Conditioning Signal Circuit	Refer to8.2 Automatic Air-conditioningin8.2.7 Diagnostic Information and Procedures

Symptoms	Suspected Faulty Items	Relevant Sections
Fault Definition: When Air-Conditioning is working, the engine speed is instable or engine stalls.	2. Electronic Throttle Body	Refer to 2.12.7.54 DTC P2135
	3.ECM	Refer to 2.2.8.8 Engine Control Module Replacement
High Fuel Consumption, Poor Fuel Economy Fault Definition: During the actual road test, fuel consumption is significantly higher than expected. In addition, the fuel consumption is also significantly higher than the actual road test the same vehicle had.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Mixture Too Rich	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	3. Air filter Blocked	-
	4. Poor Fuel Quality, Fuel Contamination	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	5. Fuel Pressure Abnormal	
	6. Injector Working Abnormal	
	7. Electronic Throttle Body	Refer to 2.12.7.54 DTC P2135
	8. The driver has the following driving habits: • Air-Conditioning or Defroster Always On • Tire pressure is incorrect • Vehicle Overload • Accelerate Too Fast, Too Frequent	-
	9. Air Leakage In Intake System and Crankcase System	Refer to2.14 Auxiliary Emission Control JL4G15-Din2.14.2 Diagnostic Information and Procedures
	10. Crankcase Ventilation Valve Catching	
	11. Knock Sensor (KS) System Ignition Delay Too Great	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	12. Spark Plug: Thermal value is incorrect, damp, crack, gap incorrect, excessive erosion, excessive carbon residue, contaminated by fuel	
	13. Spark Plug Wire Damage	
	14. Ignition Coil Damage	
	15. Coolant Level Too Low, Thermostat Malfunction	Refer to2.18 Engine Cooling System JL4G15-Din2.18.3 Diagnostic Information and Procedures
	16. Too Much Oil In Combustion Chamber or Valve Seals Leakage	Refer to2.6 Engine Mechanical System JL4G18-Din2.6.7 Diagnostic Information and Procedures
	17. Cylinder Compression Pressure Incorrect	
	18. Valve Stagnant or Leaking, Broken Valve Spring, Valve Timing Incorrect	
	19. Too Much Carbon Residue In Combustion Chamber	

Symptoms	Suspected Faulty Items	Relevant Sections
	20. Vacuum Hose Cracking or Kink, The Connection Is Unreliable	
	21. Exhaust Blocked: Three-Way Catalytic Converter Blocked, Muffler Internal Damage	Refer to2.7 Exhaust System JL4G18-Din2.7.5 Diagnostic Information and Procedures
	22. Braking System Dragging or Operation Abnormal	Refer to6 Brake Systemin6.2.4 Diagnostic Information and Procedures
	23. Electromagnetic interference (EMI) on voltage circuit may lead to misfire. Use a scan tool to monitor the engine speed to detect electromagnetic interference. Engine speed parameter suddenly increase while the actual engine speed is almost not changed, then there is electromagnetic interference. If there is a malfunction, check whether there is a high voltage component in the vicinity of the ignition control circuit.	-
Fuel Supply Stopped, Misfire Fault Definition: Continuous pulsation or jitter as the engine speed increases, usually with the engine load increases it is even more noticeable. When the engine speed is above 1500 rpm, the malfunction does not occur.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air Filter Blocked	-
	3. Fuel Pressure Abnormal	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	4. Injector Working Abnormal	
	5. Mixture Too Rich	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Mixture Too Lean	
	7. Electronic Throttle Body	Refer to 2.12.7.54 DTC P2135
	8. Knock Sensor (KS) system ignition delay is too great	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	9. Spark Plug: Thermal value is incorrect, damp, crack, gap incorrect, excessive erosion, excessive carbon residue, contaminated by fuel	
	10. Spark Plug Wire Damage	
	11. Ignition Coil Damage	
	12. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	13. Too Much Oil In Combustion Chamber or Valve Oil Seals Leakage	Refer to2.6 Engine Mechanical System JL4G18-Din2.6.7 Diagnostic Information and Procedures
	14. Cylinder compression pressure is incorrect	
	15. Valve Stagnant or Leakage	

Symptoms	Suspected Faulty Items	Relevant Sections
	16. Camshaft Convex Corner Wear	
	17. Valve Timing Incorrect	
	18. Valve Spring Broken	
	19. Too Much Carbon Residue In Combustion Chamber	
	20. Camshaft, Cylinder Head, Piston, Connecting Rod and Bearing Abnormal	
	21. Exhaust Blocked: Three-Way Catalytic Converter Blocked, Muffler Internal Damage	Refer to2.7 Exhaust System JL4G18-Din2.7.5 Diagnostic Information and Procedures
Poor idle, Idle Speed Unstable, Inaccurate or Engine Stall Fault Definition: When idling, the engine running is not smooth. In extreme cases, the engine or the vehicle will tremble. With a certain throttle opening, the engine idle speed may fluctuate. Any of these circumstances is likely to be serious enough to make the engine stall.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air Cleaner Filter Blocked	-
	3. Fuel Pressure Abnormal	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	4. Fuel Contamination	
	5. Injector Working Abnormal	
	6. Electronic Throttle Body	Refer to 2.12.7.54 DTC P2135
	7. Acceleration Pedal Position Sensor	Refer to 2.12.7.55 DTC P2138
	8. Crankcase Ventilation Valve	Refer to2.14 Auxiliary Emission Control JL4G15-Din2.14.2 Diagnostic Information and Procedures
	9. Evaporative emission (EVAP) Canister Solenoid Valve	
	10. Knock Sensor (KS) system ignition delay is too great	
Poor Idle, Idle Speed Unstable, Inaccurate or Stall Fault Definition: When idling, the engine running is not smooth. In extreme cases, the engine or the vehicle will tremble. With a certain throttle opening, the engine idle speed may fluctuate. Any of these circumstances is likely to be serious enough to make the engine stall.	11. Spark Plug: Thermal value is incorrect, damp, crack, gap incorrect, excessive erosion, excessive carbon residue, contaminated by fuel.	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	12. Spark Plug Wire Damage	
	13. Ignition Coil Damage	
	14. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	15. Too Much Oil In Combustion Chamber or Valve Seals Leakage	Refer to2.6 Engine Mechanical System JL4G18-Din2.6.7 Diagnostic Information and Procedures
	16. Cylinder Compression Pressure Incorrect	
	17. Valve Catching or Leak, Broken Valve Spring, Valve Timing Incorrect	
	18. Too Much Carbon Residue In Combustion Chamber	
	19. Check Engine Bearings	

Symptoms	Suspected Faulty Items	Relevant Sections
	20. Electromagnetic interference (EMI) on voltage circuit may lead to misfire. Use a scan tool to monitor the engine speed to detect electromagnetic interference. Engine speed parameter suddenly increase while the actual engine speed is almost not changed, then there is electromagnetic interference. If there is a malfunction, check whether there is a high voltage component in the vicinity of the ignition control circuit.	-
Detonation, Ignition Knock Fault Definition: Knocking sound is worsen during accelerating. With the throttle opening changes, the engine will generate a sharp metal knocking sound.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Incorrect Fuel	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	3. Fuel Pressure Abnormal	
	4. Injector Working Abnormal	
	5. Mixture Too Lean	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Knock Sensor (KS) System Ignition Delay Too Great	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	7. Spark Plug Heat Value Incorrect	
	8. Cooling system: Coolant level is too low, coolant is incorrect, coolant leaks, cooling fan is not running	Refer to2.18 Engine Cooling System JL4G15-Din2.18.3 Diagnostic Information and Procedures
	9. Too Much Oil In Combustion Chamber and The Valve Seal Leaking	Refer to2.6 Engine Mechanical System JL4G18-Din2.6.7 Diagnostic Information and Procedures
	10. Cylinder Compression Pressure Too High	
	11. Too Much Carbon Residue In Combustion Chamber	
	12. Camshaft, Cylinder Head, Piston, Connecting Rod and Bearing Abnormal	
Difficulty In Starting The Engine Fault Definition: The engine crankshaft rotation is normal, but the vehicle can not start for a long time. Eventually the vehicle will be able to start, but it the engine may shut down immediately.	1. Too Much Oil In Combustion Chamber and The Valve Seal Leaking	Refer to2.6 Engine Mechanical System JL4G18-Din2.6.7 Diagnostic Information and Procedures
	2. Too Carbon Residue In Combustion Chamber	
	3. Timing Chain Installation Incorrect	
	4. Cylinder Compression Pressure Incorrect	
	5. Fuel Pump Relay, Fuel Pump, Fuel Injector, Fuel Contamination	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures

Symptoms	Suspected Faulty Items	Relevant Sections
	6. Ignition System: Ignition Wires, Spark Plug, Ignition Coil	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	7. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	8. Engine Coolant Temperature Sensor	Refer to 2.12.7.20 DTC P0117 P0118
	9. Electronic Throttle Body	Refer to 2.12.7.54 DTC P2135
	10. Acceleration Pedal Position Sensor	Refer to 2.12.7.55 DTC P2138
Backfire, Pinging Fault Definition: Unburned gases enter the intake manifold or the exhaust system, ignited, producing a very loud cracking sound.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Fuel Pressure Abnormal	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	3. Fuel Contamination	
	4. Injector Working Abnormal	
	5. Air Leakage In Intake System and Crankcase	Refer to2.14 Auxiliary Emission Control JL4G15-Din2.14.2 Diagnostic Information and Procedures
	6. Crankcase Ventilation Valve	
	7. Knock Sensor (KS) System Ignition Delay Too Great	Refer to 2.12.7.34 DTC P0324 P0325
	8. Spark Plug: Thermal value is incorrect, damp, crack, gap is incorrect, excessive erosion, excessive carbon residue, contaminated by fuel	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	9. Spark Plug Wire Damage	
	10. Ignition Coil Damage	
	11. Coolant Level Too Low, Thermostat Malfunction	2.18 Engine Cooling System JL4G15-Din2.18.3 Diagnostic Information and Procedures
Surge Fault Definition: When the throttle opening is stable, the engine power changes. The vehicle speed changes while the acceleration pedal position does not change.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air-Conditioning Compressor	Refer to8.2 Automatic Air-conditioningin8.2.7 Diagnostic Information and Procedures
	3. Heated Oxygen Sensor Abnormal	Refer to 2.12.7.22 DTC P0131 P0132 P0133 P0134
	4. Poor Fuel Quality, Fuel Contamination	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	5. Fuel Pressure Abnormal	
	6. Injector Working Abnormal	
	7. Mixture Too Rich	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	8. Mixture Too Lean	

Symptoms	Suspected Faulty Items	Relevant Sections
	9. Intelligent Variable Valve Timing System	Refer to2.6 Engine Mechanical System JL4G18-Din2.6.7 Diagnostic Information and Procedures
	10. Vacuum Hose Cracking or Kink, The Connection Unreliable	
	11. Spark Plug: Thermal value is incorrect, damp, crack, gap is incorrect, excessive erosion, excessive carbon residue, contaminated by fuel	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	12. Spark Plug Wire Damage	
	13. Ignition Coil Damage	
Power Shortage Fault Definition: The engine power output is lower than expected. Half-press the acceleration pedal, almost no acceleration or no acceleration at all.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air Filter Blocked	-
	3. Poor Fuel Quality, Fuel Contamination	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	4. Fuel Pressure Abnormal	
	5. Injector Working Abnormal	
	6. Mixture Too Rich	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	7. Mixture Too Lean	
	8. Knock Sensor (KS) system ignition delay is too large	Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	9. Spark Plug: Thermal value is incorrect, damp, crack, gap is incorrect, excessive erosion, excessive carbon residue, contaminated by fuel	
	10. Spark Plug Wire Damage	
	11. Ignition Coil Damage	
	12. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	13. Too Much Oil In Combustion Chamber or Valve Seals Leakage	Refer to2.6 Engine Mechanical System JL4G18-Din2.6.7 Diagnostic Information and Procedures
	14. Cylinder compression pressure is incorrect	
	15. Valve Catching or Leak, Broken Valve Spring, Valve Timing Is Incorrect	
	16. Too Much Carbon Residue In Combustion Chamber	
	17. Intelligent Variable Valve Timing System	
	18. Exhaust Blocked: Three-Way Catalytic Converter Blocked, Muffler Internal Damage	Refer to2.7 Exhaust System JL4G18-Din2.7.5 Diagnostic Information and Procedures
Engine Does Not Turn	1. Battery	Refer to2.11 Starting / Charging System JL4G18-Din2.11.7.4 Engine

Symptoms	Suspected Faulty Items	Relevant Sections
Fault Definition: When the ignition switch is at "ST" position, the engine crankshaft does not rotate.	2. Starter	Can Not Start.
	3. Start Relay	
	4. Ignition Switch	
	5. BCM	
	6. Engine Anti-theft Locking System	Refer to2.5 Engine Anti-theft System JL4G18-Din2.5.7 Diagnostic Information and Procedures.
Engine Does Not Start Fault Definition: When the ignition switch is at "ST" position, the engine crankshaft rotates, but the vehicle does not start.	1. ECM Power Supply Circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	3. Camshaft Position Sensor	Refer to 2.12.7.36 DTC P0340 P0341
	4. Ignition System	2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures
	5. Fuel Pump Control Circuit	Refer to2.13 Fuel System JL4G15-Din2.13.1 Diagnostic Information and Procedures
	6. Fuel Injectors Working Circuit	
	7. ECM	Refer to 2.2.8.8 Engine Control Module Replacement

2.12.7.5 ECM Terminal List

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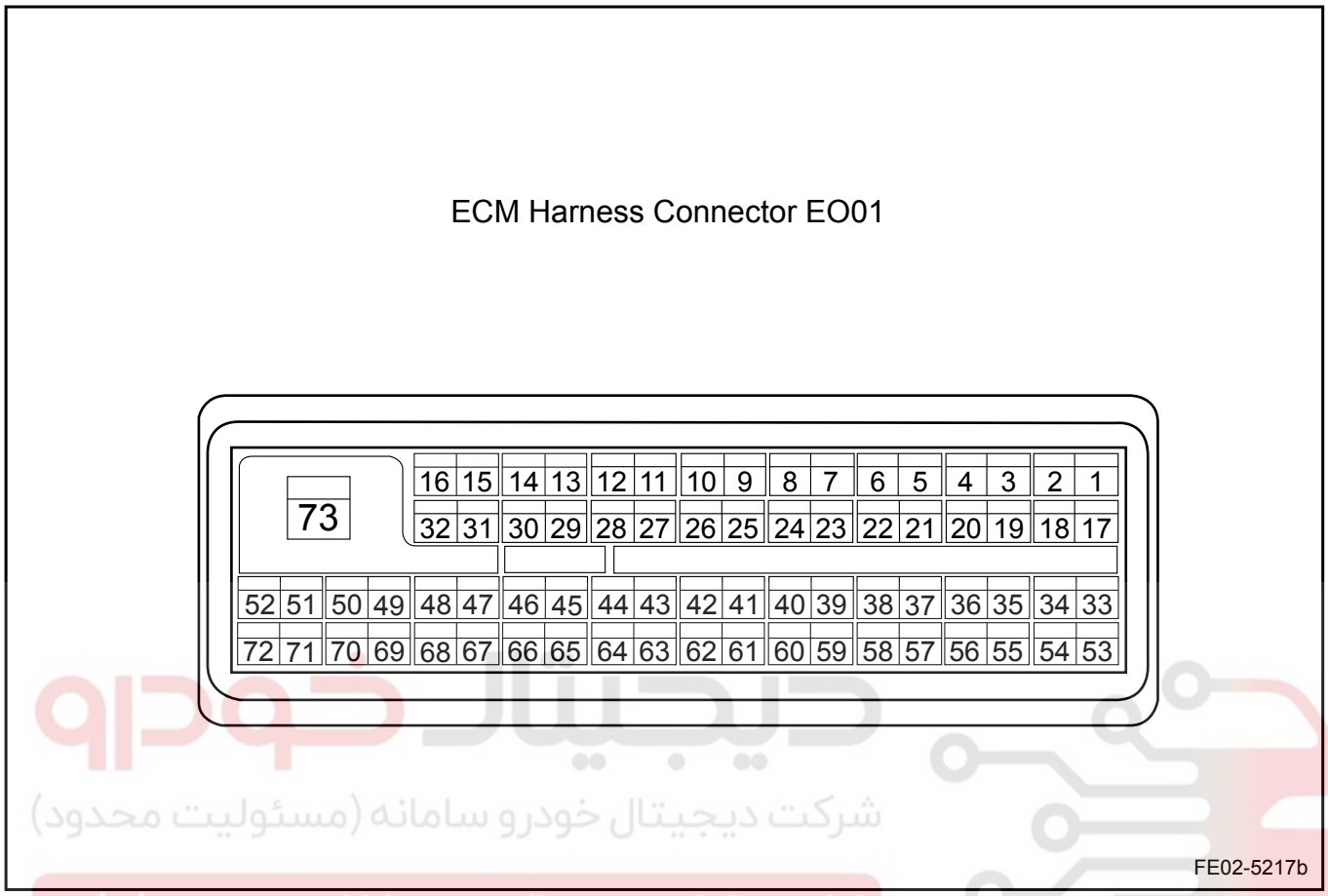


Note:

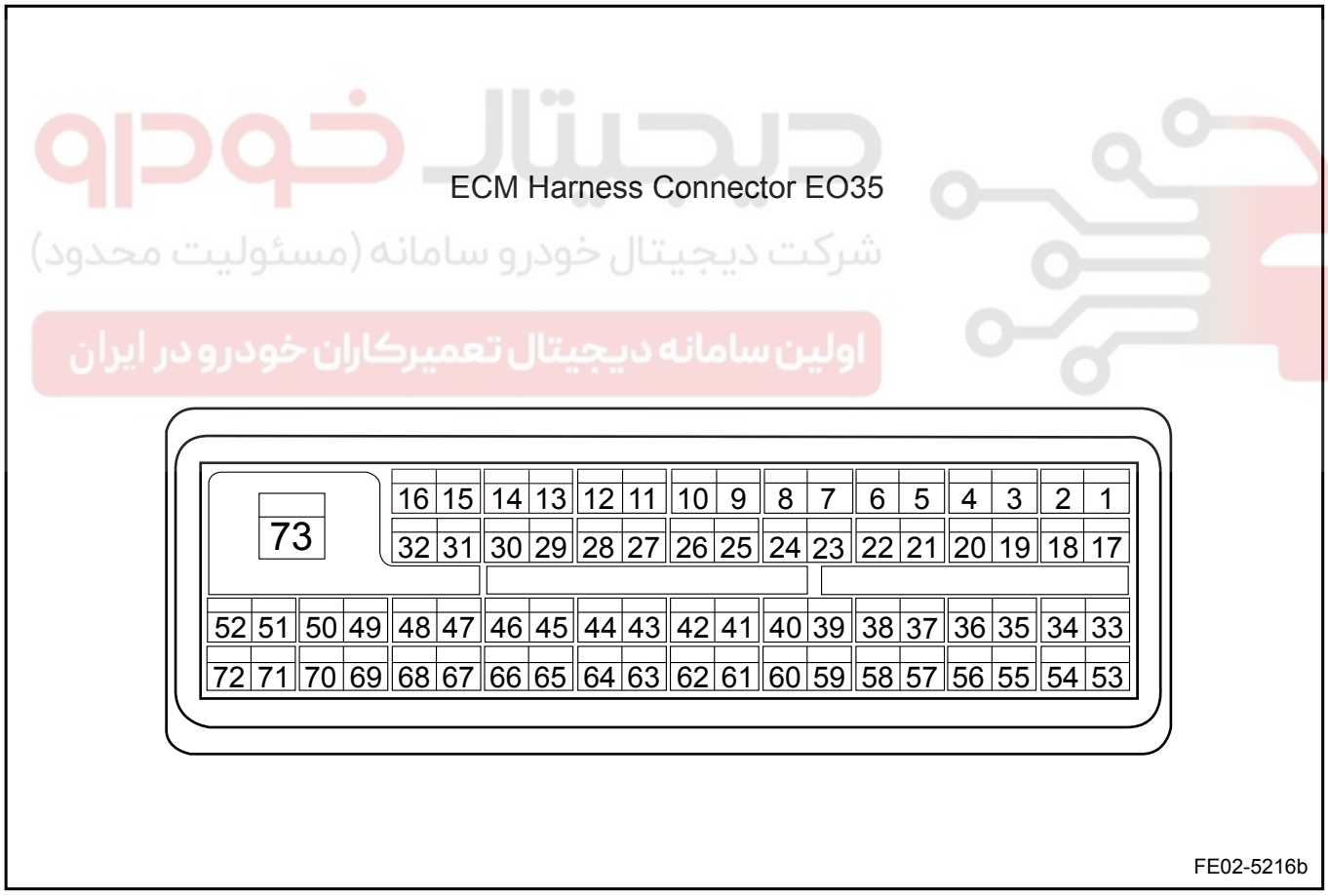
1. UB is the battery voltage.
2. If there is no instruction, GND is 0 V or close to 0 V.

Terminal ID	Name	Wiring	Terminal Instructions	Status	Specified Conditions
1	COILA	0.85 W	Ignition Coil A	Engine Running	GND-UB PWM Wave
2	O2ALO	0.5 L/R	Pre-Catalytic Oxygen Sensor A-Side	Ignition Switch "ON"	0-5 V
3	V5RTN1	0.5 G/W	5V Power Supply Ground	-	GND
4	V5REF1	0.5 G	5V Power Supply	Ignition Switch "ON"	5 V
5	-	-	-	-	-
6	V5REF2	0.5 L/B	5V Power Supply	Ignition Switch "ON"	5 V
7-8	--	--	--	--	--
9	MAT	0.5 G/Y	Intake Air Temperature	Ignition Switch "ON"	0-5 V

Terminal ID	Name	Wiring	Terminal Instructions	Status	Specified Conditions
10	O2AHi	0.5 P	Pre-Catalytic Oxygen Sensor B-Side	Ignition Switch "ON"	0-5 V
11	--	--	--	--	--
12	KNOCK_Hi	0.5 L	Knock Sensor A-Side	Engine Running	PWM Wave
13	--	--	--	--	--
14	O2A_HTR	0.75 B/G	Heated Pre-Catalytic Oxygen Sensor	Heating	PWM Wave
15-16	-	-	-	-	-
17	COILB	0.85 O	Ignition Coil B	Engine Running	GND-UB PWM Wave
18	V5RTN2	0.5 W/R	5V Voltage Ground	-	GND
19	V5RTN2	0.5 Gr	5V Voltage Ground	-	GND
20	CPS_Lo	0.5 L	58-Tooth B-Side	Engine Running	Sin / Cos Wave, AB Conjugate Signal
21	CPS_Hi	0.5 Gr	58-Tooth A-Side	Engine Running	-
22	-	-	-	-	-
23	V5REF2	0.5 B/R	5V Voltage	Ignition Switch "ON"	5 V
24	V5REF3	0.5 Y/L	5V Voltage	Ignition Switch "ON"	5 V
25	--	--	--	--	--
26	TPSPD	0.5 W / P	Electronically Controlled Throttle Body C-Side	Ignition Switch "ON"	0-5 V
27	MAP	0.5 Br/Y	Intake Air Pressure Sensor	Ignition Switch "ON"	0-5 V
28	KNOCK_Lo	0.5 L/W	Knock Sensor B-Side	Engine Running	PWM Wave
29	CLT	0.5 O/G	Coolant Temperature Sensor	Ignition Switch "ON"	0-5 V
30-38	--	--	--	--	--
39	TPSPU	0.5 Gr/W	Electronically Controlled Throttle Body B-Side	Ignition Switch "ON"	0-5 V
40-53	-	-	-	-	-
54	VVT1 (PWM)	0.75 W/L	Intake VVT Valve	Engine Running	0-5 V
55	-	-	-	-	-
56	Camshaft1	0.5 R	Camshaft Position Sensor	Engine Running	GND-UB PWM Wave
57	CCP (PWM)	0.5 B/Y	Canister Solenoid Valve	Engine Running	PWM Wave
58-60	-	-	-	-	-

Terminal ID	Name	Wiring	Terminal Instructions	Status	Specified Conditions
61	MTR-	0.75 O	Electronically Controlled Throttle Body H-Side	Ignition Switch "ON"	GND
62	IMMORQST	0.5 Gr/W	Immobilisier A-Side	Ignition Switch "ON"	-
63	INJD	0.5 Y/B	Cylinder No.2 Injector	Engine Running	GND-UB PWM Wave
64	INJB	0.5 Y/V	Cylinder No.3 Injector	Engine Running	GND-UB PWM Wave
65	INJA	0.5 G/L	Cylinder No.1 Injector	Engine Running	GND-UB PWM Wave
66	INJC	0.5 B/L	Cylinder No.4 Injector	Engine Running	GND-UB PWM Wave
67	MTR +	0.7 V/O	Electronically Controlled Throttle Body E-Side	Ignition Switch "ON"	UB
68-73	--	--	--	--	--

EO35



Note:

1.UB is the battery voltage.

2.If no instructions, GND is 0 V or close to 0 V.

Terminal ID	Name	Wiring	Terminal Instructions	Status	Specified Conditions
1	VBATT	0.75 R	Battery Voltage	All	UB
2	--	--	--	--	--
3	IGN	0.5 W/Y	Ignition Switch	Ignition Switch "ON"	UB
4-5	--	--	--	--	--
6	VBATPROT	0.5 G / Y	Main Relay Controlled Power Supply	Ignition Switch "ON"	UB
7-8	--	--	--	--	--
9	MP+	0.5 B/O	Air-Conditioning Medium Voltage Switch	On or Off	UB or GND
10-11	--	--	--	--	--
12	PPS1	0.5 G/B	Accelerator Acceleration Pedal Sensor 1	Ignition Switch "ON"	0-5 V
13-15	--	--	--	--	--
16	CANLO	0.5 Y/R	CAN Communication	Ignition Switch "ON"	PWM Wave
17	--	--	--	--	--
18	BRKLP	0.5 Gr	Brake Signal	Braking	UB or GND
19-21	--	--	--	--	--
22	VBATPROT	0.5 G/Y	Main Relay Controlled Power Supply	Ignition Switch "ON"	UB
23-26	--	--	--	--	--
27	PPS2	0.5 R/B	Acceleration Pedal Sensor 2	Ignition Switch "ON"	0-5 V
28-29	--	--	--	--	--
30	O2BHI	0.5 V	Post-Catalytic Oxygen Sensor B-Side	Ignition Switch "ON"	UB
31	--	--	--	--	--
32	CANHI	0.5 L/R	CAN Communication	Ignition Switch "ON"	PWM Wave
33-35	--	--	--	--	--
36	V5REF1	0.5 W/B	5V Voltage	Ignition Switch "ON"	5 V
37	V5RTN1	0.5 R	5V Voltage Ground	-	GND
38	V5REF2	0.5 G	5V Voltage	Ignition Switch "ON"	5 V
39	V5RTN2	0.5 W	5V Voltage Ground	--	GND
40	--	--	--	--	--
41	VSS	0.5 Y	Vehicle Speed Sensor	Moving	PWM Wave

Terminal ID	Name	Wiring	Terminal Instructions	Status	Specified Conditions
42-45	--	--	--	--	--
46	O2B_HTR	0.75 B/O	Post-Catalytic Oxygen Sensor Heating	Heating	PWM Wave
47-50	--	--	--	--	--
51	A/C Relay	0.5 B/Y	Air-Conditioning Compressor Relay	Air-Conditioning Switch	UB or GND
52-54	--	--	--	--	--
55	O2BLO	0.5 L/R	Post-Catalytic Oxygen Sensor A-Side	Ignition Switch "ON"	0-5 V
56-61	--	--	--	--	--
62	MPR	0.5 B/L	Main Relay	All	UB
63-64	--	--	--	--	--
65	ACRQST+	0.5 P	Air-Conditioning Request	Ignition Switch "ON"	UB orGND
66	FANHI	0.5 B/O	High-Speed Fan Relay	Coolant Temperature That Activates High-Speed Fan	UB or GND
67	FANLO	0.5 L	Low-Speed Fan Relay	Coolant Temperature That Activates Low-Speed Fan	UB or GND
68-70	--	--	--	--	--
71	FPR(HSD)	0.5 G	Oil Pump Relay	Ignition Switch "ON"	UB or GND
72	SDATA	0.5 Gr/P	Data Link Connector	Using	PWM Wave
73	PWRGND	4 B	Power Ground	All	GND

2.12.7.6 DTC Code Type Definition

In the diagnosis calibration settings, different fault type settings have different fault lamps light timing and methods. Fault type is divided into A, B, C, E, Z, their definitions and fault lamps light principles are as following :

Fault Type	Emission-Related	Definition
A-type	Yes	Occurring once MIL lamp will be lit and a DTC code will be recorded
B-type	Yes	Occurring once in each two consecutive trips, MIL lamp will be lit and a DTC code will be recorded.
E-type	Yes	Occurring once in each three consecutive trips, MIL lamp will be lit and a DTC code will be recorded.
C-type	No	Record the DTC code when the fault occurs, but the MIL lamp will not be lit, SVS lamps may be lit.

Z-type	-	Record the DTC code when the fault occurs, but does not light any lamp

In three consecutive trips, if the system does not detect any faults, and no other faults are detected, the MIL lamp will be off.

If a fault no longer occurs in more than 40 warm-up cycles, vehicle diagnostic system will request to clear the DTC code and the driving distance and the fixed grid data associated with the fault.

2.12.7.7 DTC Code (DTC) List

DTC Code	Description	Fault Type
P0011	Intake VCP Valve Timing Response Lag	B
P0012	Intake VCP Camshaft Valve Timing Error	A
P0016	Intake Camshaft Gear VCP Learning Bias Out Of Range	B
P0026	Intake VCP Hydraulic Control Valve	A
P0068	Electronic Throttle Air Flow Error	A
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	A
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	A
P0106	Intake Pressure / Throttle Position Fault	E
P0107	Intake Air Pressure Sensor Circuit Low Voltage or Open	A
P0108	Intake Air Pressure Sensor Circuit High Voltage	A
P0112	Intake Air Temperature Sensor Circuit Low Voltage	E
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open	E
P0117	Coolant Temperature Sensor Circuit Low Voltage	A
P0118	Coolant Temperature Sensor Circuit High Voltage or Open	A
P0122	Electronic Throttle Position Sensor 1 Circuit Low Voltage	A
P0123	Electronic Throttle Position Sensor 1 Circuit High Voltage	A
P0131	Pre-Catalytic Oxygen Sensor Circuit Short To Low Voltage	E
P0132	Pre-Catalytic Oxygen Sensor Circuit Short To High Voltage	E
P0133	Pre-Catalytic Oxygen Sensor Response Too Slow	E
P0134	Pre-Catalytic Oxygen Sensor Circuit Open	A
P0135	Pre-Catalytic Oxygen Sensor Heater Malfunction	A
P0137	Post-Catalytic Oxygen Sensor Circuit Short To Low Voltage	E
P0138	Post-Catalytic Oxygen Sensor Circuit Short To High Voltage	E
P0140	Post-Catalytic Oxygen Sensor Circuit Open	E
P0141	Post-Catalytic Oxygen Sensor Heater Malfunction	A
P0171	Fuel System Too Lean	E
P0172	Fuel System Too Rich	E

DTC Code	Description	Fault Type
P0222	Electronic Throttle Position Sensor 2 Circuit Low Voltage	A
P0223	Electronic Throttle Position Sensor 2 Circuit High Voltage	A
P0230	Oil Pump Relay Malfunction	A
P0261	Nozzle 1 Circuit Low Voltage Fault	A
P0262	Nozzle 1 Circuit High Voltage Fault	A
P0264	Nozzle 2 Circuit Low Voltage Fault	A
P0265	Nozzle 2 Circuit High Voltage Fault	A
P0267	Nozzle 3 Circuit Low Voltage Fault	A
P0268	Nozzle 3 Circuit High Voltage Fault	A
P0270	Nozzle 4 Circuit Low Voltage Fault	A
P0271	Nozzle 4 Circuit High Voltage Fault	A / B
P0300	One or More Cylinder Misfire	C
P0324	Knock Control System Malfunction	C
P0325	Knock Sensor Malfunction	A
P0335	Crankshaft Position Sensor Circuit No Signal	E
P0336	Crankshaft Position Sensor Circuit Signal Interference	A
P0340	Intake VCP Camshaft Position Sensor Status Diagnostic	A
P0341	Intake VCP Target Diagnostic	A
P0351	Ignition Coil 1 Malfunction	A
P0352	Ignition Coil 2 Malfunction	A
P0420	Catalytic Converter Low Conversion Efficiency	A
P0458	Canister Solenoid Valve Short To Low Voltage or Open Circuit	E
P0459	Canister Solenoid Valve Short To High Voltage	E
P0480	Low-Speed Fan Malfunction	C
P0481	High-Speed Fan Malfunction	C
P0502	Vehicle Speed Sensor No Signal	E
P0506	Idle Speed Too Low	E
P0507	Idle Speed Too High	E
P0562	System Voltage Low	C
P0563	System Voltage High	C
P0571	Brake Lamp Switch Status No Change When Braking	C
P0601	ROM Error	A

DTC Code	Description	Fault Type
P0602	ECM Processor Malfunction	A
P0604	RAM Error	A
P0606	ECM Processor Malfunction	A
P060A	ECM Programming Error	A
P0641	ETC Reference Voltage A Amplitude Malfunction	A
P0646	Air-Conditioning Clutch Relay Short To Low Voltage or Open Circuit	C
P0647	Air-Conditioning Clutch Relay Short To High Voltage	C
P0650	Fault Indicator Malfunction	C
P0651	ETC Reference Voltage B Amplitude Malfunction	A
P0685	Main Relay Fault Malfunction	A
P1167	Post-Catalytic Sensor Indicating Fuel Too Rich During Deceleration	E
P1171	Pre-Catalytic Sensor Indicating Fuel Too Lean During Acceleration	E
P1336	58-Tooth Gear Error Not Learn	A
P1516	ETC-Driver Second-Order Diagnostic Error	A
P2101	ETC-Driver Steady-State Diagnostic Error	A
P2104	Controlled idle	A
P2105	Engine Forced Shutdown	A
P2106	Restrictions on Engine Performance	A
P2110	Engine Power Management	A
P2119	Electronic Throttle Return Malfunction	A
P2122	Electronic Throttle Pedal Position Sensor 1 Circuit Low Voltage	A
P2123	Electronic Throttle Pedal Position Sensor 1 Circuit High Voltage	A
P2127	Electronic Throttle Pedal Position Sensor 2 Circuit Low Voltage	A
P2128	Electronic Throttle Pedal Position Sensor 2 Circuit High Voltage	A
P2135	Electronic Throttle Position Sensor 1 and 2 Circuits Malfunction	A
P2138	Electronic Throttle Pedal Position Sensor 1 and 2 Circuits Malfunction	A
P2187	Mixture Too Lean During idle	E
P2188	Mixture Too Rich During idle	E
P2610	LPC Malfunction	E
P0633	Alarm Does Not Learn Malfunctions	C
U0167	Anti-theft Device No Response	C

DTC Code	Description	Fault Type
U0426	Anti-theft Device Authentication Failure	C

2.12.7.8 DTC Fail-Safe List

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P0068	Electronic Throttle Air Flow Error	Electronic Throttle Position Sensor 1 Circuit Low Voltage	Electronic Throttle Position Sensor 1 Circuit Low Voltage
P0122	Electronic Throttle Position Sensor 1 Circuit Low Voltage	Use TPS signal value that is not expired. If the both TPS1 and TPS2 fail, the system will enter into the "Engine Power Management" mode, while reporting P2106, P2110 fault; VCP inoperative	No malfunction condition detected.
P0123	Electronic Throttle Position Sensor 1 Circuit Low Voltage		
P0222	Electronic Throttle Position Sensor 1 Circuit Low Voltage		
P0223	Electronic Throttle Position Sensor 1 Circuit Low Voltage		
P0571	Brake Lamp Switch Status No Change During Braking	At this time if the system enters "Restrictions on Engine Performance" mode, the system enters the "engine controlled idle" mode.	No malfunction condition detected.
P0606	ECM Processor Malfunction	System enters into "engine forced shutdown" mode, the engine can not start and the system will report P2105 fault.	Next key cycle, no malfunction condition detected.
P060A	ECM Programming Malfunction	Engine can not start.	Next key cycle, no malfunction condition detected.
P0641	ETC Reference Voltage A # Amplitude Fault	System enters "Engine Power Management" mode, while reporting P0122, P0223, P2106, P2110 fault; VCP inoperative	Next key cycle, no malfunction condition detected.
P0651	ETC Reference Voltage B # Amplitude Fault	System enters "restrictions on engine performance" model, while reported P2106 fault; VCP inoperative	No malfunction condition detected.
P1516	ETC-Driver Steady-State Diagnostic Error	System enters "Engine Power Management" mode, while reporting P2106, P2110 fault; VCP inoperative	Next key cycle, no malfunction condition detected.

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P2101	ETC-Driver Second-Order Diagnostic Error	System enters "Engine Power Management" mode, while reporting P2106, P2110 fault; VCP inoperative	Next key cycle, no malfunction condition detected.
P2104	Engine Controlled idle	Refer to ETC TPS and APS diagnostics.	Refer to ETC TPS and APS diagnostics.
P2105	Engine Forced Shutdown		
P2106	Restrictions on engine performance.		
P2110	Engine Power Management		
P2119	Electronic Throttle Return Malfunction	No	No malfunction condition detected.
P2122	Electronic Throttle Pedal Position Sensor 1 Circuit Low Voltage	(1) Single APS malfunction, the system enters "Restrictions on engine performance" mode, while reporting P2106 fault (2) If both APS1 and APS2 fail, the system enters "engine forced idle" mode, while reporting P2104 fault (3) VCP Inoperative	Next key cycle, no malfunction detected.
P2123	Electronic Throttle Pedal Position Sensor 1 Circuit High Voltage		
P2127	Electronic Throttle Pedal Position Sensor Circuit 2 Low Voltage		
P2128	Electronic Throttle Pedal Position Sensor 2 Circuit High Voltage		
P2135	Electronic Throttle Position Sensors 1 and 2 Related Malfunctions	System enters "restrictions on engine performance" model, while reporting P2106 fault; VCP inoperative	No malfunction condition detected.
P2138	Electronic Throttle Pedal Position Sensors 1 and 2 Related Malfunctions	System enters "restrictions on engine performance" model, while reporting P2106 fault; VCP inoperative	No malfunction condition detected.
P0011	Intake VCP Valve Timing Response Lag	No	No malfunction condition detected.
P0012	Intake VCP Camshaft Valve Timing Error	VCP Inoperative	No malfunction condition detected.
P0016	Intake VCP Camshaft Gear Learning Bias Out Of Range	OCV cleaning function turned on; VCP inoperative	No malfunction condition detected.
P0026	Intake VCP Hydraulic Control Valve	OCV cleaning function turned on, if the cleaning is unsuccessful, VCP inoperative	No malfunction condition detected.
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	VCP Inoperative	No malfunction condition detected.

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	VCP Inoperative	Next key cycle, no malfunction condition detected.
P0340	Intake VCP Camshaft Position Sensor Status Diagnostic	VCP Inoperative, Ignition Angle	No malfunction condition detected.
P0341	Intake VCP Target Diagnostic	VCP Inoperative, Ignition Angle	No malfunction condition detected.
P0106	Intake Pressure / Throttle Position Fault	(1) Key On, the system uses the default intake manifold pressure 100 kPa (2) Engine running, the system uses the estimated intake manifold pressure value	No malfunction condition detected.
P0107	Intake Air Pressure Sensor Circuit Low Voltage or Open Circuit	(1) Key On, the system uses the default intake manifold pressure 100 kPa (2) Engine running, the system uses the estimated intake manifold pressure value	No malfunction condition detected.
P0108	Intake Air Pressure Sensor Circuit High Voltage		
P0112	Intake Air Temperature Sensor Circuit Low Voltage	System uses the default intake air temperature 20°C	No malfunction condition detected.
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit		
P0117	Coolant Temperature Sensor Circuit Low Voltage	(1) System calculates the engine coolant temperature, up to 98°C, based on intake air temperature and when Key On and the engine running time (2) There is a malfunction present, high or Low-Speed fan turned on.	No malfunction condition detected.
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit		
P0131	Pre-Catalytic Oxygen Sensor Short To Low Voltage	Open Loop Control	No malfunction condition detected.
P0132	Pre-Catalytic Oxygen Sensor Short To High Voltage	Open Loop Control	No malfunction condition detected.
P0133	Pre-Catalytic Oxygen Sensor Response Too Slow	No	No malfunction condition detected.
P0134	Pre-Catalytic Oxygen Sensor Open Circuit	Open Loop Control	No malfunction condition detected.

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P0135	Pre-Catalytic Oxygen Sensor Heater Malfunction	Open Loop Control; Pre-Catalytic Oxygen Sensor Heater Inoperative	Next key cycle, no malfunction condition detected.
P1167	Pre-Catalytic Oxygen Sensor Indicating Mixture Too Rich During Deceleration	No	No malfunction condition detected.
P1171	Pre-Catalytic Oxygen Sensor Indicating Mixture Too Lean During Acceleration	No	No malfunction condition detected.
P0137	Post-Catalytic Oxygen Sensor Short To Low Voltage	No	No malfunction condition detected.
P0138	Post-Catalytic Oxygen Sensor Short To High Voltage	No	No malfunction condition detected.
P0140	Post-Catalytic Oxygen Sensor Circuit Open	No	No malfunction condition detected.
P0141	Post-Catalytic Oxygen Sensor Heater Malfunction	Post-Catalytic Oxygen Sensor Heater Inoperative	Next key cycle, no malfunction condition detected.
P0171	Mixture Too Lean When Non-idling	No	No malfunction condition detected.
P0172	Mixture Too Rich When Non-idling	No	No malfunction condition detected.
P2187	Mixture Too Lean When idling	No	No malfunction condition detected.
P2188	Mixture Too Rich When idling	No	No malfunction condition detected.
P0230	Fuel Pump Relay Malfunction	Vehicle can not start.	(1) Open circuit or short to ground, no malfunction condition detected. (2) Short to power supply. Next key cycle, no malfunction condition detected.
P0261	Fuel Injector 1 Circuit Low Voltage	Prolonged malfunction, reporting misfire (P0300); system enters open loop fuel control.	No malfunction condition detected.
P0264	Fuel Injector 2 Circuit Low Voltage		
P0267	Fuel Injector 3 Circuit Low Voltage		
P0270	Fuel Injector 4 Circuit Low Voltage		
P0262	Fuel Injector 1 Circuit High Voltage		Next key cycle, no malfunction condition detected.
P0265	Fuel Injector 2 Circuit High Voltage		
P0268	Fuel Injector 3 Circuit High Voltage		
P0271	Fuel Injector 4 Circuit High Voltage		

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P0300	One or More Cylinder Misfire	Catalytic converter damaged, the system enters open loop control. in certain operating conditions, fault lamp flashes.	No malfunction condition detected.
P0324	Knock Control System Malfunction	Ignition Back Angle	Next key cycle, no malfunction condition detected.
P0325	Knock Sensor No Signal	Ignition Back Angle	Next key cycle, no malfunction condition detected.
P0335	Crankshaft Position Sensor Circuit No Signal	Vehicle can not start.	No malfunction condition detected.
P0336	Crankshaft Position Sensor Circuit Signal Interference	Ignition Back Angle; VCP Inoperative	No malfunction condition detected.
P1336	58-Tooth Gear Error Not Learned	No misfire diagnostic	New tooth learn successful
P0351	Ignition Coil 1 Malfunction (Cylinder No.2 and 3)	Prolonged Malfunction, Reporting Misfire (P0300)	(1) Open Circuit or Short To Ground, No Malfunction Condition Detected. (2) Short to power supply. Next key cycle, no malfunction condition detected.
P0352	Ignition Coil 2 Malfunction (Cylinder No.1 and 4)		
P0420	Catalytic Converter Low Conversion Efficiency	No	No malfunction condition detected.
P0458	Canister Solenoid Valve Short Circuit To Low Voltage or Open Circuit	No	No malfunction condition detected.
P0459	Canister solenoid valve circuit short to high voltage	No	Next key cycle, no malfunction condition detected.
P0480	Low-Speed Fan Malfunction	No	No malfunction condition detected.
P0481	High-Speed Fan Malfunction	No	Next key cycle, no malfunction condition detected.
P0502	Vehicle Speed Sensor No Signal	Malfunctions Reported, Engine idle	No malfunction condition detected.
P0506	Idle Speed Low	No	No malfunction condition detected.
P0507	Idle Speed High	No	No malfunction condition detected.
P0562	System Voltage Low	Other Diagnostics Shielded; Idle Speed Increased; VCP Inoperative	No malfunction condition detected.
P0563	System Voltage High	Other Diagnostics Shielded; VCP Inoperative	No malfunction condition detected.

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P0601	ROM Error	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0602	ECM Processor Malfunction	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0604	RAM error	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0646	Air-Conditioning Clutch Relay Short To Low Voltage or Open Circuit	No	No malfunction condition detected.
P0647	Air-Conditioning Clutch Relay Short To High Voltage	No	Next key cycle, no malfunction condition detected.
P0650	Fault Indicator Malfunction	No	No malfunction condition detected.
P0685	Main Relay Malfunction	Vehicle may not start.	(1) Open circuit, no malfunction condition detected. (2) Short to power supply. Next key cycle, no malfunction condition detected.
P2610	LPC Malfunction	No	No malfunction condition detected.
P0633	Alarm does not learn from malfunction.	SVS lamp flashing; vehicle can not start.	Next key cycle, IMMO learn successful, or No malfunction condition detected.
U0167	Anti-theft Device No Response		
U0426	Anti-theft Device Authentication Failure		

2.12.7.9 Data Stream List

By reading the "Data Stream List" on the scan tool, you can check switches, sensors, actuators working state without removing any parts. Before the control system diagnosis, observing and analyzing data is the first step, so that the diagnose time could be shortened.

Note

Data under normal conditions is listed in the following table for reference only. Do not determine whether a part is faulty solely based on these reference values. Under normal circumstances you can compare the vehicle that needs to be repaired with a normal working vehicle in the same state to determine the current vehicle diagnostic data is normal or not.

1. Run the engine to reach normal working temperature.
2. Turn the ignition switch to "OFF" position.
3. Connect the scan tool.
4. Turn the ignition switch to "ON" position.
5. Select "Engine"/"Read data stream."

6. Refer to the table and check all the data.

Data Stream Name	Ignition Switch "ON"	Idle Speed	2,500 rpm When
Engine Speed	0 rpm	795 rpm	2,500 rpm
Vehicle Speed	0	0	0
Current Computing Load	0.0%	100%	100%
Coolant Temperature	93°C (199 ºF)	93°C (199 ºF)	93°C (199 ºF)
Current Short-Term Fuel Adjustment (Bank1)	100%	90.62%	93.75%
Current Long-Term Fuel Adjustment (Bank1)	92.97%	92.97%	99.22%
Absolute Boost Pressure	100 kPa	47 kPa	27 kPa
Intake Air Temperature	54°C (129 ºF)	47°C (117 ºF)	52°C (126 ºF)
Absolute Throttle Position A	80.78%	85.10%	82.75%
Ignition Voltage	12.3 V	13.3 V	13.7 V
Oxygen Sensor 1 Installation Location	Yes	Yes	Yes
Oxygen Sensor 2 Installation Location	Yes	Yes	Yes
Pre-Catalytic Oxygen Sensor Voltage	0.08 V	0.07-0.81 V	0.067-0.81 V
Pre-Catalytic Oxygen Sensor Short-Term Fuel Adjustment	100%	92.19%	94.53%
Post-Catalytic Oxygen Sensor Voltage	0.71 V	1.28 V	0.68 V
Post-Catalytic Oxygen Sensor Short-Term Fuel Adjustment	99.22%	99.22%	99.22%
Current Instruction to Cylinder No.1 Ignition Advance Angle	4 °	2 °	33 °
Vehicle Driving Distance When MIL Lamp Light	0 km	0 km	0 km
Relative Throttle Position	6.27%	1.57%	3.92%
Absolute Throttle Position B	18.82%	14.12%	16.86%
Acceleration Pedal Position D	14.51%	14.51%	18.43%
Acceleration Pedal Position E	7.06%	7.06%	9.02%
Throttle Position	8.63%	1.96%	5.49%
Vehicle Driving Time When MIL Lamp Light	0 min	0 min	0 min
Air-Conditioning Pressure Switch Voltage	0 V	0 V	0 V
Pre-Catalytic Oxygen Sensor Heating	78 mV	143-706 mV	14 mV
Post-Catalytic Oxygen Sensor Heating	703 mV	755 mV	660 mV
Fuel Sensor Voltage	5 V	5 V	5 V
Coolant Temperature (Start)	87°C (189 ºF)	87°C (189 ºF)	87°C (189 ºF)

Data Stream Name	Ignition Switch "ON"	Idle Speed	2,500 rpm When
EVAP Valve Duty Cycle	0%	6.25%	0%
Fuel Adjustment Cell	19 cell	18 cell	2 cell
Target Idle Speed	935 rpm	737 rpm	887 rpm
Injection	8.67 ms	2.56 ms	1.82 ms
Atmospheric Pressure	100.37 kPa	100.37 kPa	100.37 kPa
Air-Fuel Ratio	11.5	14.5	14.5
Engine Running Time	0 s	0 s	0 s
Calculated Catalyst Temperature	600°C (1112 °F)	498°C (928 °F)	591°C (1096 °F)
Detonation Delay	0 °	0 °	0 °
Cylinder No.2 Currently Misfire	0 count	0 count	0 count
Cylinder No.1 Currently Misfire	0 count	0 count	0 count
Cylinder No.3 Currently Misfire	0 count	0 count	0 count
Cylinder No.4 Currently Misfire	0 count	0 count	0 count
Engine Odometer	0 km	0 km	0 km
ETC Acceleration Pedal Position	0%	0%	2.22%
Intake Valve Opening (As Opposed To LWOT)	8.66%	2.02%	5.55%
ETC Pedal Position Sensor 1	0%	0%	4.16%
ETC Pedal Position Sensor 2	0%	0%	4.09%
ETC Throttle Position Sensor 1	6.62%	1.54%	4.21%
ETC Throttle Position Sensor 2	6.55%	1.54%	4.21%
Fuel Level Output	4.71%	4.71%	4.71%
Pre-Catalytic Oxygen Sensor - Rich To Lean Average Time	0.0 ms	0.0 ms	0.0 ms
Intake Air Temperature At Startup	55°C (131 °F)	49°C (120 °F)	49°C (120 °F)
Intake Air Pressure	0.0 kPa	0.0 kPa	0.0 kPa
TEC Attempt To Convert To Lean	0 count	0 count	0 count
TEC ideal Throttle Position	8.82%	2.15%	5.76%
VVT Target Location	0 °	0 °	0 °
ETC Unpowered Throttle Position	8.40%	8.44%	8.44%
Pre-Catalytic Oxygen Sensor Heating	0.70 E	0.80 E	0.50 E
Post-Catalytic Oxygen Sensor Heating	0.42 E	0.44 E	0.34 E

2.12.7.10 Action Test Table

By reading the "Action Test Table" on the scan tool, you can check switches, sensors, actuators working state without removing any parts. Before the control system diagnosis, carrying out action test is a prerequisite, so that the diagnose time could be shortened.

Note

Data under normal conditions is listed in the following table for reference only. Do not determine whether a part is faulty solely based on these reference values. Under normal circumstances you can compare the vehicle that needs to be repaired with a normal working vehicle in the same state to determine the current vehicle diagnostic data is normal or not.

1. Run the engine to reach normal working temperature.
2. Turn the ignition switch to "OFF" position.
3. Connect scan tool.
4. Turn the ignition switch to "ON" position.
5. Select "engine" / "Action Test".
6. Refer to the following table to test.

Scan Tool Display Item	Test Component	Control Range	Diagnosis Description
Fault Indicator	Enable the engine fault indicator.	ON/OFF	When the engine is running (or) the ignition switch is turned on, with the signal accepted, the engine control module will request the fault indicator to light through the CAN bus. The fault indicator will be on or off in 3-5s.
Canister Control Valve	Enable the canister solenoid valve	0%, 50%, 100%	When the command is "ON" the solenoid valve will be on or off within 3-5s.
Fuel Pump	Enable the Fuel Pump	ON/OFF	Note Carry out this test only when the vehicle speed is equal to zero the and vehicle vehicle speed sensor has no fault. This function controls the fuel pump relay. Fuel pump relay will be ON/OFF within 3-5s.
Low-Speed Fan	Enable the Low-Speed cooling fan.	ON/OFF	Note Carry out this test only when the engine coolant temperature is below 100°C (212 ºF) and Air-Conditioning is not switched on. This function controls the Low-Speed cooling fan relay. When the instruction is received, the cooling fan will be on at high speed for 5 s.

Scan Tool Display Item	Test Component	Control Range	Diagnosis Description
High-Speed Fan	Enable the High-Speed cooling fan	ON/OFF	Note Carry out this test only when the engine coolant temperature is below 100°C (212 ºF) and Air-Conditioning is not switched on. This function controls the High-Speed cooling fan relay. When the instruction is received, the cooling fan will be on at high speed for 5 s.
Air-Conditioning Clutch	Enable the Air-Conditioning compressor clutch.	ON/OFF	Note Carry out this test only when the ignition switch is at "ON" position and the engine is not running. This function controls Air-Conditioning compressor relay. When the instruction is "ON", the Air-Conditioning compressor relay will be on or off in 3-5 s.
Ignition Advance Angle	Control the ignition advance angle	0, 45, 246, 255	-
Fuel Injector	Disable the fuel injection (Cylinder No.1, Cylinder No.2, Cylinder No.3, Cylinder No.4).	ON/OFF	-
BLM Learn	Fuel closed-loop learn	-	Fuel closed-loop learn not allowed when the ignition switch is ON. Based on the software logic, decide whether to conduct relevant learn when the ignition switch is OFF.
Fuel Open-Loop Control	ECM Open-Loop Control	ON/OFF	-
BLM Reset	Fuel Closed-Loop Learn	ON/OFF	All fuel closed-loop learn values reset to 1
Idle Catalyst Monitor	Enable catalyst monitor diagnostics	ON/OFF	-
ETC Motor	Electronic throttle body movements	0, 50%, 100%	-
Reset TPS Learn Value	Clear throttle position sensor learn value	-	-
Intake Camshaft Phasing Device	Used to control the VVT's current valve timing, the control parameter is not a percentage, but the target valve timing.	0, 30%, 60%	-
Intake Camshaft Valve Timing Control Device	VVT Control Valve Control Signal Duty Cycle Test	0, 50%, 100%	-

Scan Tool Display Item	Test Component	Control Range	Diagnosis Description
Expected idle	Control the idle speed	0,700 rpm, 800 rpm, 900 rpm, 1,000 rpm	-

2.12.7.11 Crankshaft Position Sensor (CKP) Learn

Note

After crankshaft position sensor replacement, ECM replacement or engine replacement, the crankshaft position sensor adaptive learn must be carried out. Otherwise the fault warning lamp will be always on, while ECM will record "P1336 58-tooth gear tolerance does not learn "DTC code.

Before the gear learn, the following conditions must be met:

1. Make sure the engine coolant temperature is above 60°C (140 ºF)
2. Air-Conditioning switch is not turned on.
3. 10 s after start the engine.

Carry out the following steps when the above conditions are met:

Step 1	Connect scan tool. (a) Connect scan tool to the datalink connector. (b) Turn the ignition switch to "ON" position. (c) Start and run the engine at idle speed to warm up the engine for at least 5 min. (d) Select the "engine" / gear to learn.

Next

Step 2	Carefully read the instructions attached to scan tool and press confirm key.

Next

Step 3	Enter the learning interface,press start button.

Next

Step 4	Press the acceleration pedal to 80% of the full travel and keep the pedal position.

Next

Step 5	Make the engine speed jumping back and forth between 1,300 rpm and 4,500 rpm 3-5 cycles, maintain the engine speed at above 4,000 rpm.

Next

Step 6	Release the acceleration pedal, Turn the ignition switch to "OFF" position.

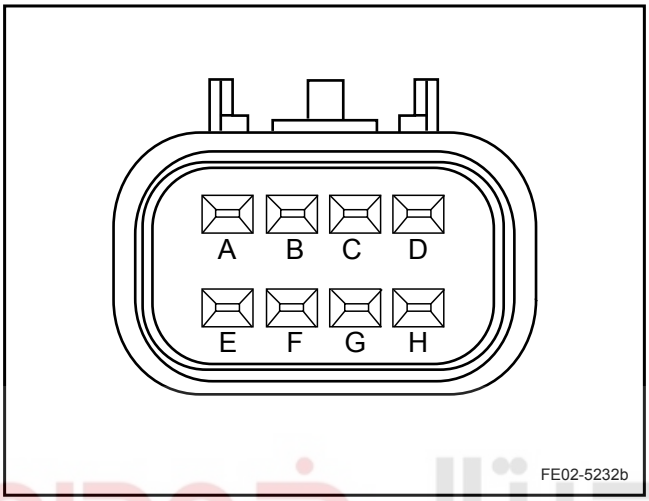
Next

Step 7	Complete the learn, clear the DTC code.

2.12.7.12 Electronic Throttle Body (ETC) Check

Electronic throttle body consists of two throttle position sensors and a throttle body drive motor.

1. Electronic Throttle Body Connector View and Functions:



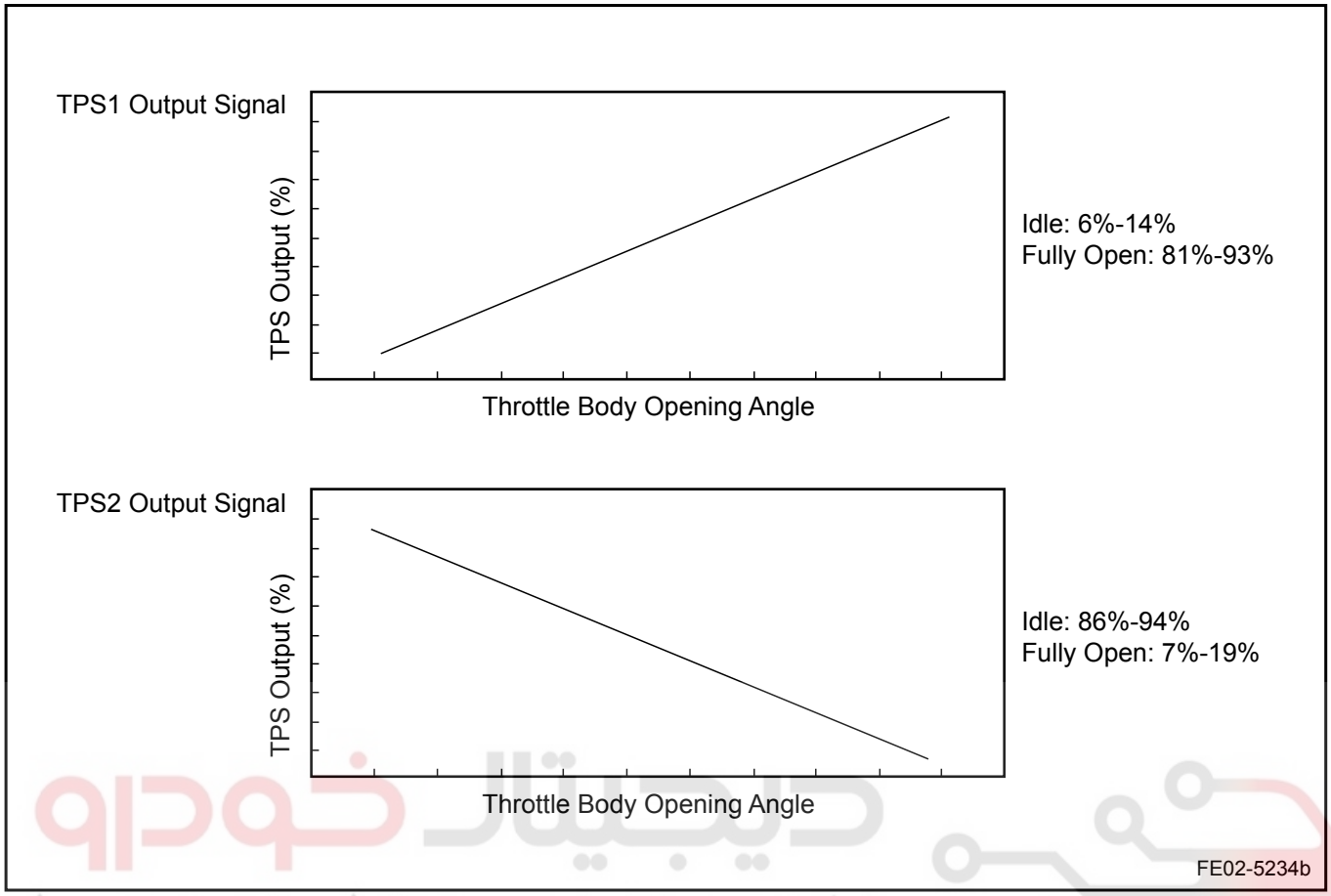
Terminal ID	ECM Related Terminal No.	Function
A	EO01 (3)	Low Reference Voltage
B	EO01 (39)	TPS1 Signal
C	EO01 (26)	TPS1 Signal
D	EO01 (4)	5V Reference Voltage
E	EO01 (67)	Throttle Body Motor Control (Plus)
F	-	Empty
G	-	Empty
H	EO01 (61)	Throttle Body Motor Control (Minus)

2. Throttle Position Sensor Technical Specifications

As one of the system security measures, the system consists of dual output throttle position sensors. One throttle position sensor output voltage signal increases as the throttle body opening increases, while the other throttle position sensor output voltage signal decreases as the throttle body opening increases.

Resistance Between Terminals A and D: 1.9 ± 0.9 kΩ

TPS Sensor Output Signal Diagram:



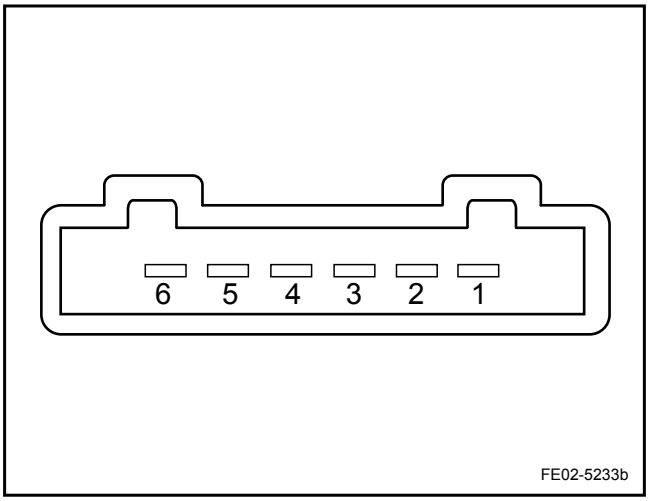
Note

When test the above TPS sensor output signals, use an oscilloscope. the output waveform of the circuit should be smooth and without other waveforms. If the throttle body rotates to an angle and the output signal drops to zero or drops rapidly, replace the ETC. ETC is an assembly. Do not disassemble it to repair.

2.12.7.13 Acceleration Pedal Position Sensor (APP) Check

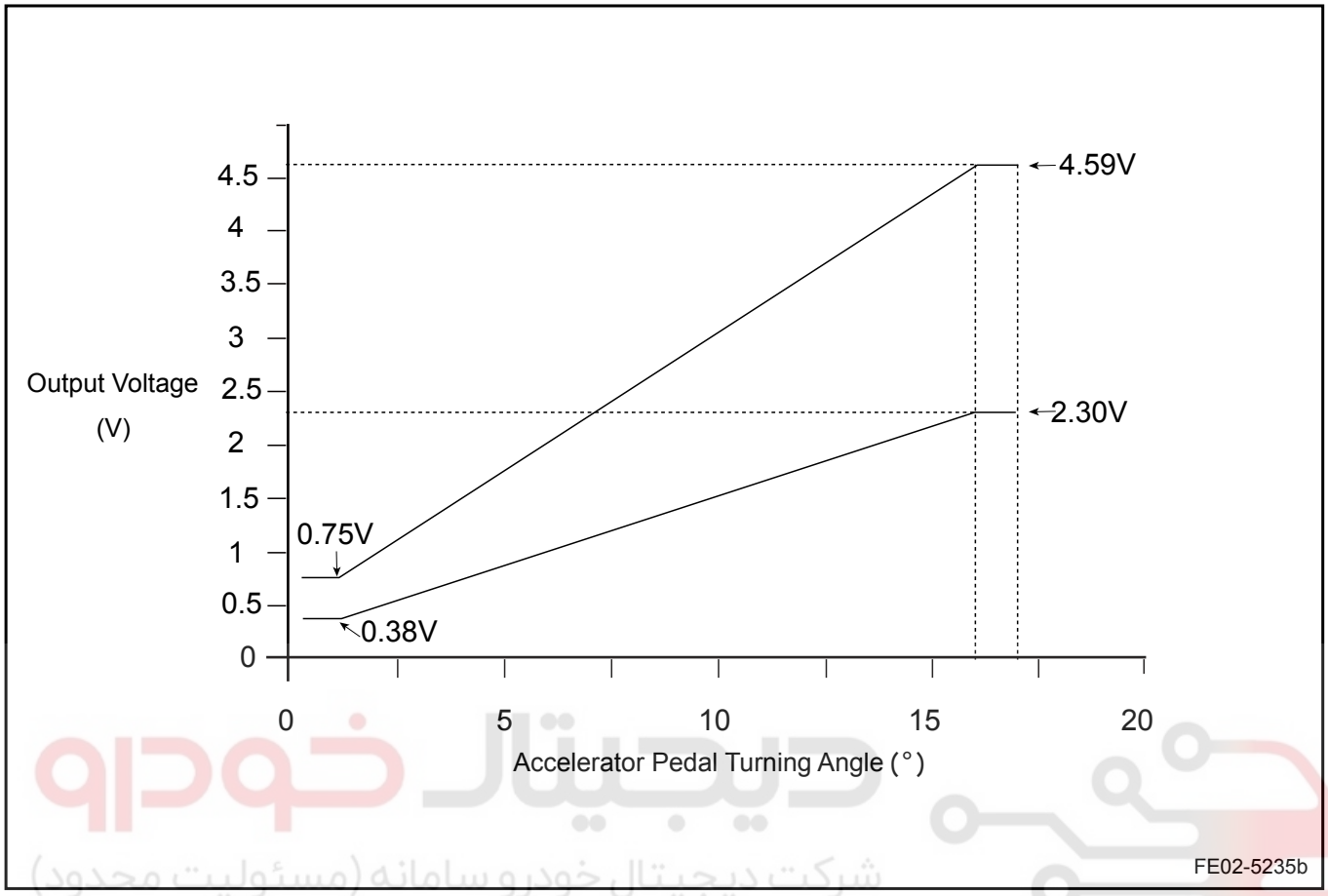
As one of the system security measures, acceleration pedal position sensor is designed to have dual outputs. Two sensors output voltage signals increase as the acceleration pedal position increases.

1. Acceleration Pedal Position Sensor Connector End View and Function



Terminal ID	ECM Related Terminal No.	Function
1	EO36 (38)	Sensor No.2 Reference Voltage
2	EO36 (36)	Sensor No.1 Reference Voltage
3	EO36 (37)	Sensor No.1 Low Reference Voltage
4	EO36 (12)	Sensor No.1 Output Signal
5	EO36 (39)	Sensor No.2 Low Reference Voltage
6	EO36 (27)	Sensor No.2 Output Signal

2. Acceleration Pedal Position Sensor Technical Specifications



Note

When test the above APP sensor output signals, use an oscilloscope. the output waveform of the circuit should be smooth and without other waveforms. If the acceleration pedal rotates to an angle and the output signal drops to zero or drops rapidly, replace the APP. APP is an assembly. Do not disassemble it to repair.

2.12.7.14 DTC Code Index

DTC code	Description	Diagnostic Procedures
P0011	Intake VCP Valve Timing Response Lag	Refer to 2.12.7.15 DTC P0011 P0012 P0016 P0026
P0012	Intake VCP Camshaft Valve Timing Error	
P0016	Intake VCP Camshaft Gear Learn Bias Out Of Range	
P0026	Intake VCP Hydraulic Control Valve	
P0068	Electronic Throttle Air Flow Error	Refer to 2.12.7.16 DTC P0068 P0106
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	Refer to 2.12.7.17 DTC P0076 P0077
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	
P0106	Intake Pressure / Throttle Position Fault	Refer to "2.12.7.16 DTC P0068 P0106

DTC code	Description	Diagnostic Procedures
P0107	Intake Air Pressure Sensor Circuit Low Voltage or Open Circuit	Refer to 2.12.7.18 DTC P0107 P0108
P0108	Intake Air Temperature Sensor Circuit High Voltage	Refer to 2.12.7.18 DTC P0107 P0108
P0112	Intake Air Temperature Sensor Circuit Low Voltage	Refer to 2.12.7.19 DTC P0112 P0113
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit	
P0117	Coolant Temperature Sensor Circuit Low Voltage	Refer to 2.12.7.20 DTC P0117 P0118
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit A	
P0122	Electronic Throttle Position Sensor 1 Circuit Low Voltage	Refer to 2.12.7.21 DTC P0122 P0123
P0123	Electronic Throttle Position Sensor Circuit 1 High Voltage	
P0131	Pre-Catalytic Oxygen Sensor Circuit Short To Low Voltage	Refer to 2.12.7.22 DTC P0131 P0132 P0133 P0134"
P0132	Pre-Catalytic Oxygen Sensor Circuit Short To High Voltage	
P0133	Pre-Catalytic Oxygen Sensor Response Too Slow	
P0134	Pre-Catalytic Oxygen Sensor Circuit Open	
P0135	Pre-Catalytic Oxygen Sensor Heater Malfunction	Refer to 2.12.7.23 DTC P0135
P0137	Post-Catalytic Oxygen Sensor Circuit Short To Low Voltage	Refer to 2.12.7.24 DTC P0137 P0138 P0140"
P0138	Post-Catalytic Oxygen Sensor The Short-Circuit To High Voltage	
P0140	Post-Catalytic Oxygen Sensor Circuit Open	
P0141	Post-Catalytic Oxygen Sensor Heater Malfunction	Refer to 2.12.7.25 DTC P0141
P0171	Mixture Too Lean	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
P0172	Mixture Too Rich	
P0222	Electronic Throttle Position Sensor 2 Circuit Low Voltage	Refer to 2.12.7.27 DTC P0222 P0223
P0223	Electronic Throttle Position Sensor 2 Circuit High Voltage	
P0230	Fuel Pump Relay Malfunction	Refer to 2.12.7.28 DTC P0230
P0261	Fuel Injector 1 Low Voltage Fault	Refer to 2.12.7.29 DTC P0261 P0262
P0262	Fuel Injector 1 High Voltage Fault	
P0264	Fuel Injector 2 Low Voltage Fault	Refer to 2.12.7.30 DTC P0264 P0265
P0265	Fuel Injector 2 High Voltage Fault	
P0267	Fuel Injector 3 Low Voltage Fault	Refer to 2.12.7.31 DTC P0267 P0268

DTC code	Description	Diagnostic Procedures
P0268	Fuel Injector 3 High Voltage Fault	
P0270	Fuel Injector 4 Low Voltage Fault	Refer to 2.12.7.32 DTC P0270 P0271
P0271	Fuel Injector 4 High Voltage Fault	
P0300	One or More Cylinder Misfire	Refer to 2.12.7.33 DTC P0300
P0324	Knock Control System Malfunction	Refer to 2.12.7.34 DTC P0324 P0325
P0325	Knock Sensor Malfunction	
P0335	Crankshaft Position Sensor Circuit No Signal	Refer to 2.12.7.35 DTC P0335 P0336
P0336	Crankshaft Position Sensor Circuit Signal Interference	
P0340	Intake VCP Camshaft Position Sensor Status Diagnostic	Refer to 2.12.7.36 DTC P0340 P0341
P0341	Intake VCP Target Diagnostic	
P0351	Ignition Coil 1 Malfunction	Refer to 2.12.7.37 DTC P0351 P0352
P0352	Ignition Coil 1 Malfunction	
P0420	Catalytic Converter Low Conversion Efficiency	Refer to 2.12.7.38 DTC P0420
P0458	Canister Solenoid Valve Circuit Short To Low Voltage or Open	Refer to 2.12.7.39 DTC P0458 P0459
P0459	Canister Solenoid Valve Circuit Short To High Voltage	
P0480	Low-Speed Fan Malfunction	Refer to 2.12.7.40 DTC P0480 P0481
P0481	High-Speed Fan Malfunction	
P0502	Vehicle Speed Sensor No Signal	Refer to 2.12.7.41 DTC P0502
P0506	Idle Speed Too Low	Refer to 2.12.7.42 DTC P0506 P0507
P0507	Idle Speed Too High	
P0562	System Voltage Low	Refer to 2.12.7.43 DTC P0562 P0563
P0563	System Voltage High	
P0571	Brake Lamp Switch Status No Change During Braking	Refer to 2.12.7.44 DTC P0571
P0601	ROM error	Refer to 2.12.7.45 DTC P0601 P0602 P0604 P0606 P060A P1516 P2101
P0602	ECM Processor Malfunction	
P0604	RAM Error	
P0606	ECM Processor Malfunction	
P060A	ECM Programming Errors	
P0641	ETC Reference Voltage A Amplitude Fault	Refer to 2.12.7.46 DTC P0641 P0651
P0646	Air-Conditioning Clutch Relay Circuit Short To Low Voltage or Open	Refer to 2.12.7.47 DTC P0646 P0647

DTC code	Description	Diagnostic Procedures
P0647	Air-Conditioning Clutch Relay Circuit Short To High Voltage	
P0650	Fault Indicator Malfunction	Refer to 2.12.7.48 DTC P0650
P0651	ETC Reference Voltage B Amplitude Fault	Refer to 2.12.7.46 DTC P0641 P0651
P0685	Main Relay Malfunction	Refer to 2.12.7.49 DTC P0685
P1167	Pre-Catalytic Oxygen Sensor Indicating Mixture Too Rich During Deceleration	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
P1171	Post-Catalytic Oxygen Sensor Indicating Mixture Too Lean During Acceleration	
P1336	58-Tooth Gear Error Not Learn	Refer to "2.12.7.11 Crankshaft Position Sensor (CKP) Learn.
P1516	ETC-Driver Second-Order Diagnostic Error	Refer to 2.12.7.45 DTC P0601 P0602 P0604 P0606 P060A P1516 P2101
P2101	ETC-Driver Steady-Status Diagnostic Error	
P2104	Engine Controlled idle	Refer to 2.12.7.50 DTC P2104 P2105 P2106 P2110
P2105	Engine Shutdown	
P2106	Restrictions On Engine Performance	
P2110	Engine Power Management	
P2119	Electronic Throttle Return Malfunction	Refer to 2.12.7.51 DTC P2119
P2122	Electronic Throttle Pedal Position Sensor 1 Circuit Low Voltage	Refer to 2.12.7.52 DTC P2122 P2123
P2123	Electronic Throttle Pedal Position Sensor 1 Circuit High Voltage	
P2127	Electronic Throttle Pedal Position Sensor 2 Circuit Low Voltage	Refer to 2.12.7.53 DTC P2127 P2128
P2128	Electronic Throttle Pedal Position Sensor 2 Circuit High Voltage	
P2135	Electronic Throttle Position Sensors 1 and 2 Circuits Related Malfunctions	Refer to 2.12.7.54 DTC P2135
P2138	Electronic Acceleration Pedal Position Sensors 1 and 2 Circuits Related Malfunctions	Refer to 2.12.7.55 DTC P2138
P2187	Mixture Too Lean At idle	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
P2188	Mixture Too Rich At idle	
P2610	LPC Malfunction	Refer to 2.12.7.56 DTC P2610
P0633	Anti-theft Device Not Learn From Malfunctions	Refer to 2.12.7.57 DTC P0633 U0167 U0426
U0167	Anti-theft Device No Response	

DTC code	Description	Diagnostic Procedures
U0426	Anti-theft Device Authentication Failure	

2.12.7.15 DTC P0011 P0012 P0016 P0026

1. DTC Descriptor:

DTC	P0011	Intake VCP Valve Timing Response Lag

DTC	P0012	Intake VCP Camshaft Valve Timing Error

DTC	P0016	Intake VCP Camshaft Gear Learn Bias Out Of Range

DTC	P0026	Intake VCP Hydraulic Control Valve

Intake camshaft position (CMP) actuator is connected to the intake camshaft and operated by the hydraulic pressure, which is provided by the oil pump in order to change the intake camshaft to the CKP (CKP) relative angle. Intake VVT solenoid valve power is provided from the main relay. ECM controls ground with a pulse-width modulation signal to control the engine oil flow to the camshaft position actuator. Oil pressure moves a security slide valve within the camshaft position actuator body at the front of the camshaft. When the safety slide valve moves, the oil is imported to the camshaft position actuator to rotate the camshaft. The intake camshaft camshaft actuator change the camshaft working angle up to 50 degrees.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0011	VVT Actual Angle and Target Angle Difference Too Great	1. VVT Actual Angle and Target Angle Difference Too Great 2. Camshaft completed self learn. 3. Oil Temperature Between -40°C (-40 ºF) and 120°C (248 ºF). 4. Coolant Temperature Between 0°C (32 ºF) and 105°C (221 ºF) . 5. Engine Speed Between 600 rpm and 6,000 rpm. 6. No VVT Circuit Fault Set.	1. Valve Timing 2. VVT Solenoid Valve 3. Solenoid Valve Filter 4. VVT Actuator 5. ECM

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0012 P0016 P0026	VVT is not at the default position	1. VVT actual angle and default angle difference greater than or equal to 20 degrees. 2. Camshaft completed self learn. 3. The engine running time is less than or equal to 1.5 s. 4. Oil Temperature Between -40°C (-40 ºF) and 120°C (248 ºF) . 5. Coolant Temperature Between 0°C (32 ºF) and 105°C (221 ºF) . 6. Engine Speed Between 600 rpm and 6,000 rpm. 7. No VVT circuit fault set.	1. Valve Timing 2. VVT Solenoid Valve 3. Solenoid Valve Filter 4. VVT Actuator 5. ECM

3. Schematic:

Refer to 2.12.7.17 DTC P0076 P0077.

4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Check whether there are control system DTC codes other than DTC P0011, P0012, P0016 and P0026.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
DTC P0011, P0012, P0016, P0026	Yes
DTC codes other than DTC P0011, P0012, P0016 and P0026	No

No → Refer to 2.12.7.14 DTC Code Index

Yes

Step 2	Check the following items.

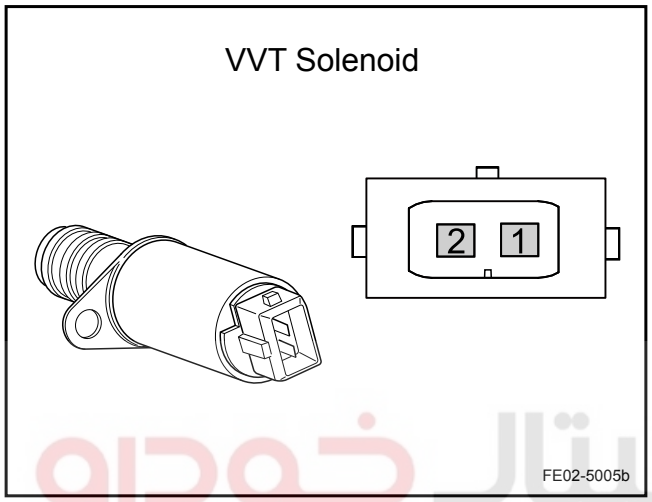
(a) Check whether the oil viscosity is normal and whether the oil is clean.
(b) Observe the Engine oil level. Engine oil level should be within the work range.

(c) Check whether the oil is changed in a timely manner and whether the engine oil contains additives or viscosity is incorrect.

No → Replace engine oil and oil filter. When necessary, clean the engine lubrication system.

Yes

Step 3	Check VVT solenoid valve resistance.



(a) Disconnect VVT solenoid valve wiring harness connector EN10.

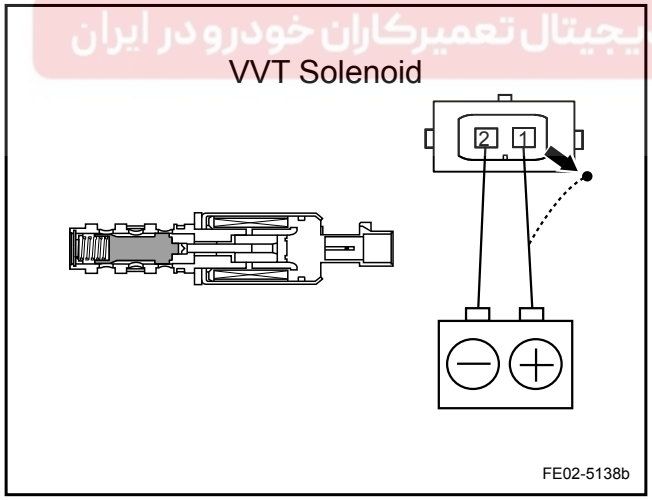
(b) Measure resistance between the two VVT solenoid valve terminals.

Standard Resistance: 10.5 Ω (68 °F) at 20°C

No → Replace the VVT solenoid valve. Refer to 2.2.8.4 VVT Solenoid Valve Replacement and Filter Cleaning.

Yes

Step 4	Check the VVT solenoid valve actuator.



Note: In the testing process, it is strictly prohibited Connect two wires directly together, otherwise it might cause an explosion, fire or other dangers.

(a) Connect the battery positive terminal to VVT solenoid valve terminal No.1 and the negative terminal to the VVT solenoid valve terminal No.2.

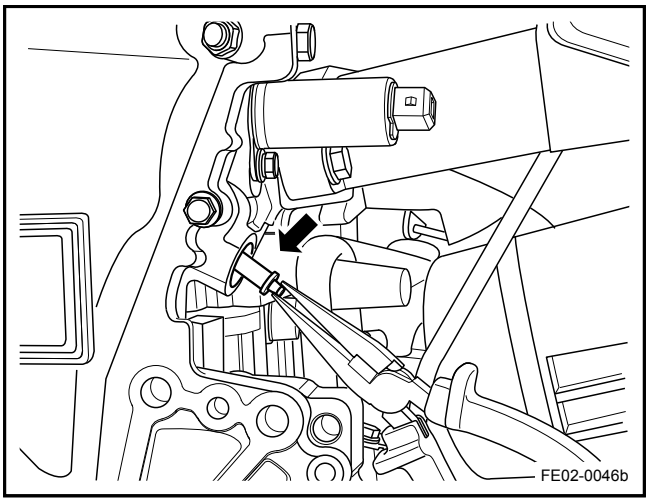
(b) Check the filter movement.

Does the filter move?

No → Replace the VVT solenoid valve. Refer to 2.2.8.4 VVT Solenoid Valve Replacement and Filter Cleaning.

Yes

Step 5	Check VVT solenoid valve filter.

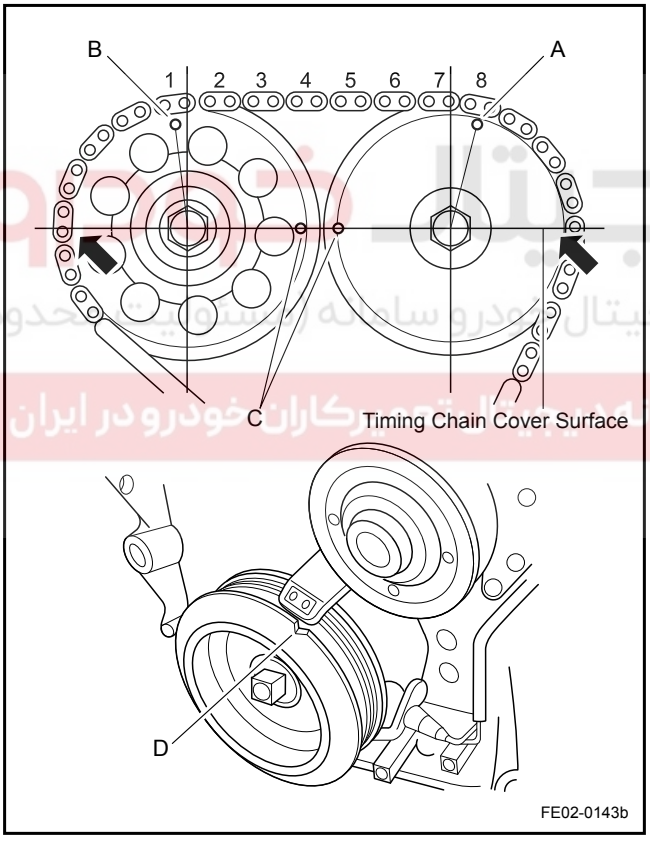


(a) Remove the VVT solenoid valve filter.
(b) Check whether the filter is blocked.
(c) Check whether the filter is damaged.
(d) Reinstall the VVT solenoid valve filter.

No → Clean VVT solenoid valve filter. If necessary, replace it.

Yes

Step 6	Check whether the timing system is normal.



(a) Remove the cylinder head cover.
(b) Align point D shown in the graphic. Rotate the crankshaft pulley, so that the timing mark on the pulley groove aligns with "0" marked on the timing chain cover.
(c) Check points C alignment shown in the graphic. The camshaft timing gear timing marks should be at horizontal positions as shown in the graphic.
(d) Check points A,B alignment shown in the graphic. Make sure intake, exhaust camshaft gear timing marks distance between A and B is 8 timing chain sections.
(e) Reinstall the cylinder head cover.

Are timing marks shown as in the graphic?

No → Adjust the valve timing

Yes

Step 7	Replace the VVT actuator.

Next

Step 8	Check control system DTC codes.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.

(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.
Any DTC code?

No → Intermittent Fault. Refer to 2.12.7.4 Symptoms Table

Yes

Step 9	System normal, diagnostic completed.

5. Repair Instructions:

Intake VVT Actuator can only be replaced as an assembly. Do not disassemble it and repair. VVT actuator replacement2.6.8.12 Camshaft Replacement.

2.12.7.16 DTC P0068 P0106

1. DTC Descriptor:

DTC	P0068	Electronic Throttle Air Flow Error

DTC	P0106	Intake Pressure / Throttle Position Fault

Intake Manifold Absolute Pressure (MAP) Sensor measures intake manifold pressure changes caused by the engine load, intake manifold vacuum and engine speed changes, and convert these changes into voltage output and send to the engine Control Module (ECM). At the same time the engine control module (ECM) compares the actual and expected intake manifold absolute pressure changes based on the throttle position opening change, to determine whether the intake manifold absolute pressure sensor responds to throttle position opening change and whether or not set DTC P0106.

Engine Control Module (ECM) detects air flow based on the intake manifold pressure sensor and intake air temperature sensors measured data and compare the sir flow with expected air flow based on throttle position sensor. If the engine control module (ECM) detects that the intake manifold absolute pressure / temperature sensor detected actual air flow and expected air flow based on throttle position sensor is inconsistent, it will set DTC P0068.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0068	Difference between intake manifold absolute pressure / temperature sensor detected air flow and the expected air flow based on throttle position is 9g/s.	1. Engine Running 2. No Intake Air Pressure / Temperature Sensor Fault 3. Duration Longer Than 4 s	1. Intake Manifold Pressure / Temperature Sensor 2. Intake Manifold and Vacuum Tube 3. Throttle 4. ECM

P0106	Atmospheric Pressure Greater Than The Maximum or Less Than The Minimum	1. Engine Running 2. No intake air pressure sensor, coolant temperature sensor, ETC throttle position sensor, fuel injector, ignition coil and misfire fault,etc. 3. Coolant temperature is higher than 60°C (140 ºF). 4. Duration Longer Than 15 s	

3. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Check the existence of the following conditions:

(a) Damaged Intake Manifold Pressure / Temperature Sensor Housing Is, Broken Vacuum Tubes
(b) Damaged Intake Manifold Pressure / Temperature Sensor Seals
(c) Intake Manifold Pressure / Temperature Sensor Loose or Improperly Installed
(d) Throttle seals is damaged, causing air leaks.

Next

Step 2	Check whether there is control system DTC code other than DTC P0068 P0106.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
DTC P0068 P0106	No
DTC Code Other Than DTC P0068 P0106	Yes

Yes → 2.12.7.14 DTC Code Index

No

Step 3	Check scan tool atmospheric pressure data.

(a) Compare the actual atmospheric pressure with atmospheric pressure parameter. Refer to "4G18-D Engine Control

System2.2.1.3 Altitude and Atmospheric Pressure Correlation".

Similar?

No → Replace the intake manifold pressure / temperature sensor.

Yes

Step 4	Check the intake manifold pressure (MAP) sensor value with the engine running.

(a) Start the engine.
(b) When idling, observe the intake manifold pressure (MAP) sensor values.
(c) During acceleration, observe the intake manifold pressure (MAP) sensor values.
(d) Compare the above intake manifold pressure (MAP) sensor values.

Are above intake manifold pressure (MAP) sensor values changed?

Yes → Go to step 7

No

Step 5	Check the intake manifold pressure sensor.

(a) Shut down the engine.
(b) Turn the ignition switch to "ON".
(c) Without disconnecting the intake manifold pressure sensor wiring harness connector, pull out the intake manifold pressure sensor from the intake manifold and use the vacuum pump. install the vacuum pump tube to the intake manifold pressure sensor.
(d) Apply 50 kPa pressure on the intake manifold pressure sensor.

Observe whether the intake manifold pressure (MAP) sensor value changes?

No → Replace the intake manifold pressure / temperature sensor.

Yes

Step 6	Check the intake manifold pressure sensor installation port and vacuum tubes.

(a) Check the intake manifold pressure sensor installation port and vacuum tubes.

Are the installation port and vacuum tubes blocked?

Yes → Clean and service the intake manifold and vacuum tubes.

No → Go to step 9

Step 7	Check whether the intake manifold pressure sensor parameter respond to changes.

(a) Engine Running
(b) Change the throttle position, hold the throttle position, observe intake manifold pressure sensor parameter value. Whether the value rapidly changes with the throttle position changes.

Does intake manifold pressure (MAP) sensor value rapidly change with the throttle position changes?

Yes → Go to step 9

No

Step 8	Check the intake manifold pressure sensor installation port and vacuum tubes.

(a) Check the intake manifold pressure sensor installation port and vacuum tubes.

Are the installation port and vacuum tubes blocked?

Yes → Clean and service the intake manifold and vacuum tubes.

No → Replace the intake manifold pressure sensor.

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

Yes → Diagnostic

No

Step 10	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 11	Replace ECM.

(a) Replace ECM.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 12	Use scan tool to confirm whether the DTC code is stored again. (a) Connect scan tool to the datalink connector. (b) Turn the ignition switch to "ON" position. (c) Clear DTC code. (d) Start and run the engine at idle speed to warm up the engine for at least 5 min. (e) Read control system DTC code again to confirm that the system has no DTC code. No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 13	Diagnostic completed.

5. Repair Instructions:

Replace intake pressure / temperature sensor. Refer to 2.2.8.7 Intake Air Pressure and Temperature Sensor Replacement.

Refer to 2.2.8.8 Engine Control Module ReplacementReplace ECM.

2.12.7.17 DTC P0076 P0077

1. DTC Descriptor:

DTC	P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit
DTC	P0077	Intake VCP Hydraulic Control Valve Coil High Voltage

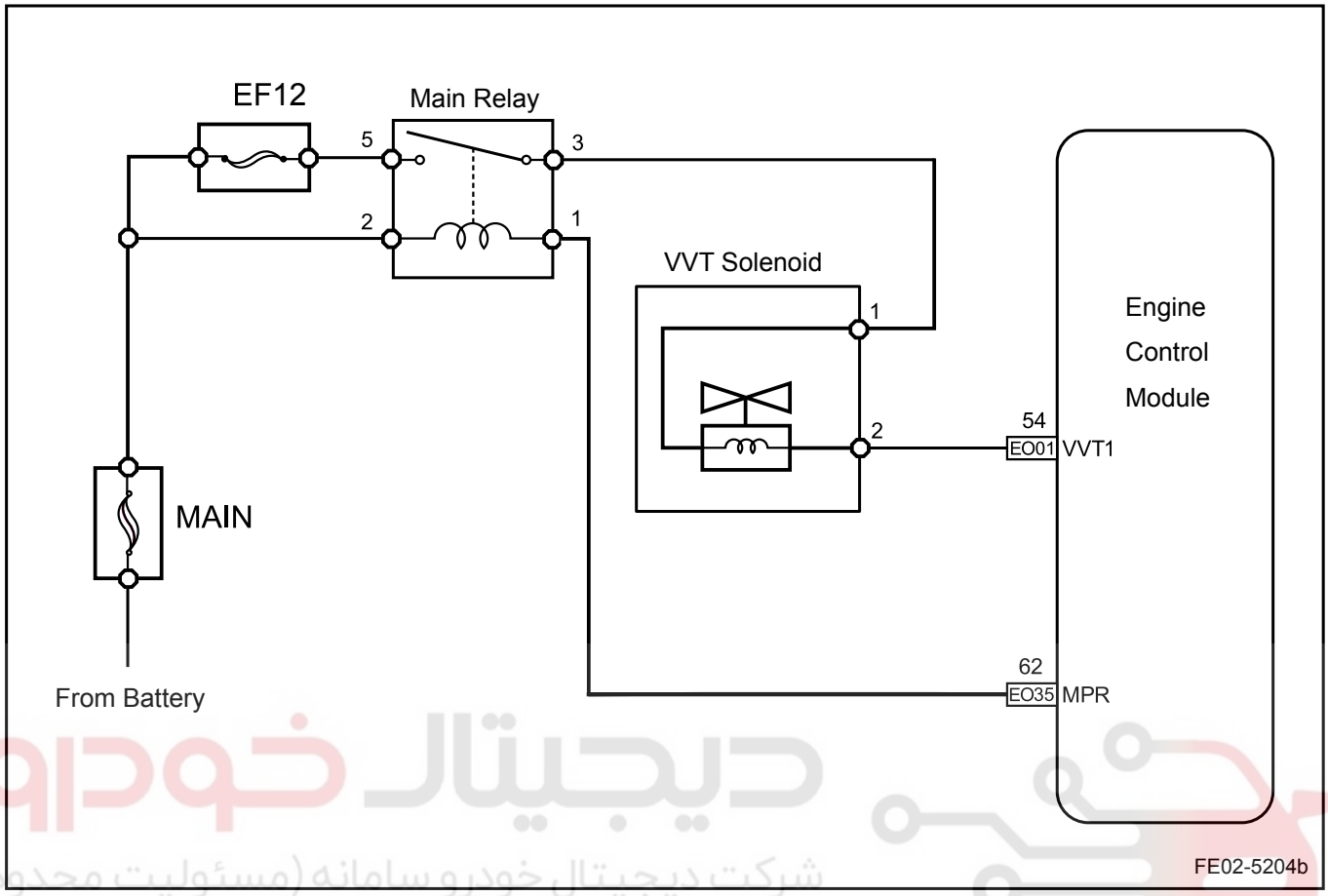
Intake camshaft position (CMP) actuator is connected to the intake camshaft and operated by the hydraulic pressure, which is provided by the oil pump in order to change the intake camshaft to the CKP (CKP) relative angle. Intake VVT solenoid valve power is provided from the main relay. ECM controls ground with a pulse-width modulation signal to control the engine oil flow to the camshaft position actuator. Oil pressure moves a security slide valve within the camshaft position actuator body at the front of the camshaft. When the safety slide valve moves, the oil is imported to the camshaft position actuator to rotate the camshaft. The intake camshaft camshaft actuator change the camshaft working angle up to 50 degrees.

ECM controls the solenoid valve internal ground through ECM harness connector EN01 terminal No.2. There is a feedback circuit within ECM. Engine ECM monitors feedback signals to determine whether the control circuit is open, short to ground or short to voltage. If ECM detects the control circuit voltage is within the specified range when the control circuit is instructed to disconnect, it will set this DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0076 P0077	Hardware Circuit Checks	1. Circuit Open 2. Circuit Short To Power Supply 3. Circuit Short To Ground	1. Solenoid Valve Circuit 2. Solenoid Valve 3. ECM

3. Schematic:

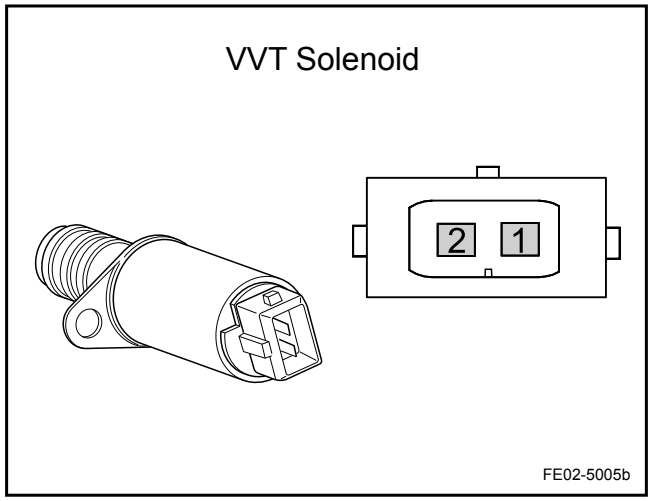


4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Measure VVT solenoid valve resistance.



(a) Disconnect VVT solenoid valve wiring harness connector EN10.

(b) Measure resistance between the two VVT solenoid valve terminals.

Standard Resistance: 9.4-10.6 Ω at 20°C(68 °F)

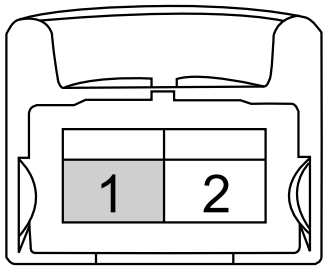
(c) Connect VVT solenoid valve wiring harness connector.

No	Replace VVT solenoid valve. Go to step 7

Yes

Step 2	Measure VVT solenoid valve working power supply.

VVT Solenoid Harness Connector EO10



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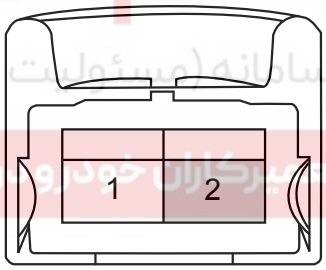
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect VVT solenoid valve wiring harness connector EO10.
(c) Turn the ignition switch to "ON" position.
(d) Test EO10 connector terminal No.1 with a multimeter.
Standard Voltage: 11-14 V
(e) Connect VVT solenoid valve wiring harness connector E010.
Results:

No → Check whether circuit between EN10 solenoid valve wiring harness connector terminal No.1 and main relay terminal No.3 is open or short to ground.

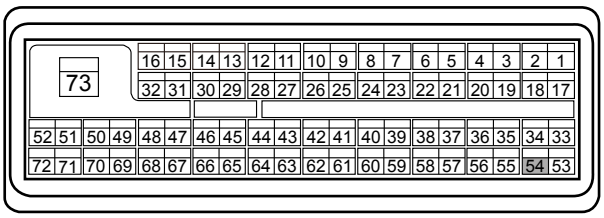
Yes

Step 3	Check VVT solenoid valve control circuit.

VVT Solenoid Harness Connector EO10



ECM Harness Connector EO01



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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect VVT solenoid valve wiring harness connector EO10.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between VVT solenoid valve wiring harness connector EO10 terminal No.2 and ECM harness connector EO01 terminal No.2 with a multimeter. the Standard Value is in the table below.
(e) Measure resistance between VVT solenoid valve wiring harness connector EO10 terminal No.2 and a reliable ground with a multimeter. the Standard Value is in the table below.
(f) Turn the ignition switch to "ON" position, (Note: At this point EO01, EO10 connectors must be disconnected) Measure voltage between VVT solenoid valve wiring harness connector EO10 terminal No.2 and a reliable ground with a multimeter. the Standard Value is in the table below.

Test Connection	Standard Value
Resistance Between EO10 (2) and EO01 (2)	Less than 1 Ω
Resistance Between EO10 (2) and Ground	10 kΩ or higher
Voltage Between EO10 (2) and Ground	Less than 0 V

No → Repair or replace wiring harness connectors.

Yes

Step 4	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 5	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 6	Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 7	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code.

Verify that the system has no DTC code.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 8	Diagnostic completed.

5. Repair Instructions:

VVT solenoid valve replacement, refer to 2.2.8.4 VVT Solenoid Valve Replacement and Filter Cleaning.

2.12.7.18 DTC P0107 P0108

1. DTC Descriptor:

DTC	P0107	Intake Air Pressure Sensor Circuit Low Voltage or Open

DTC	P0108	Intake Air Pressure Sensor Circuit High Voltage

Intake Manifold Absolute Pressure (MAP) Sensor responds to the intake manifold pressure changes. Pressure varies as engine load changes. MAP sensor circuit consists of the following:

- 5 V Reference Voltage Circuit

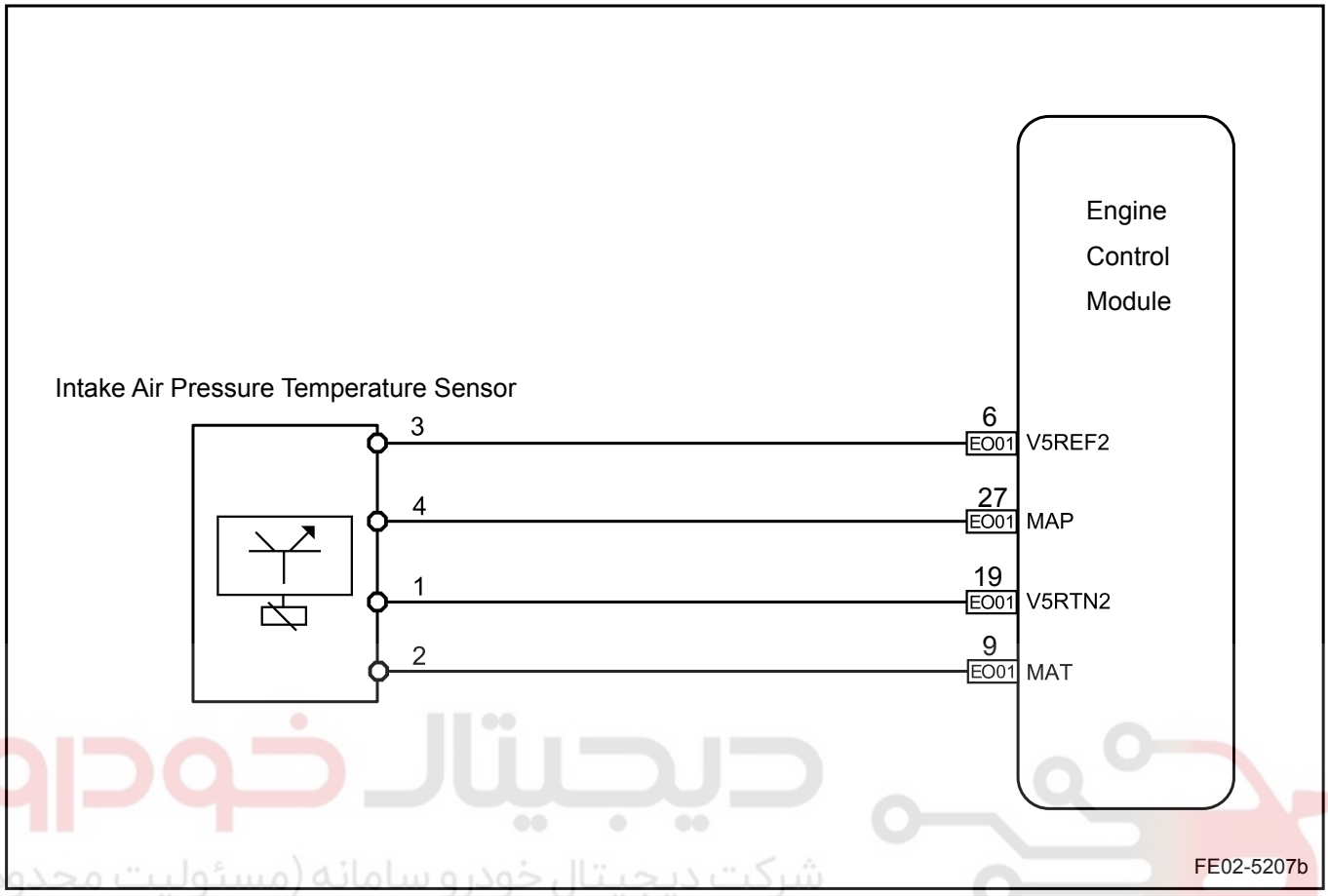
- Low Reference Voltage Circuit
- Sensor Signal Circuit

ECM provides 5 V reference voltage through ECM harness connector EO01 terminal No.6 to the sensor harness connector EO16 terminal No.3 and a low reference voltage through EO01 terminal No.19 to EO16 terminal No.1. The sensor provides a signal through EO16 terminal No.4 to ECM harness connector EO01 terminal No.27. This signal is related to the intake manifold pressure change. When the intake manifold absolute pressure is low, such as at idle or during deceleration, ECM detected signal voltage is low. When the intake manifold absolute pressure is high, such as the ignition switch turned on with the engine is turned off, or when the throttle is fully open, ECM detected signal voltage is high. Sensors are also used to determine the atmospheric pressure. Running the engine with the throttle fully open, atmospheric pressure readings will also be updated. ECM monitors sensor signals in order to determine whether the voltage is beyond the normal range.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0107	Circuit Inspection, Lower Than The Minimum	1. Idle 2. When the sensor circuit short or ground, the sensor signal voltage is 0	1. Sensor Circuit 2. Sensor 3. ECM
P0108	Circuit Inspections, Exceeding The Maximum	1. Idle 2. When the sensor circuit short to power supply or a 5 V reference voltage 3. Sensor A / D initial signal is 99.6%	

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Check the existence of the following conditions:

(a) Sensor housing damage, vacuum tubes broken.
(b) Sensor seal damage.
(c) Sensor loose or improperly installed.
(d) Sensor tube blockage.

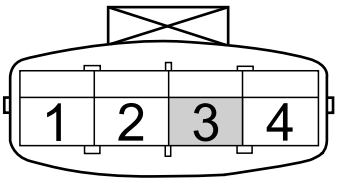
Next

Note

It is prohibited Connect intake manifold absolute pressure sensor 5 V reference voltage circuit to other components, otherwise it will damage the sensor and ECM.

Step 2	Measure intake manifold absolute pressure sensor 5 V reference voltage.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



FE02-5335b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EO16.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between intake manifold absolute pressure sensor wiring harness connector EO16 terminal No.3 and a reliable ground.

Standard voltage: 4.5V-5.5V

(e) Connect intake manifold absolute pressure sensor wiring harness connector EO16.

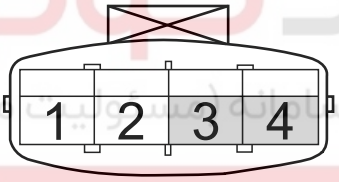
Is the voltage specified value?

No → Go to step 6

Yes

Step 3	Measure sensor signal circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



FE02-5336b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EO16.
(c) Turn the ignition switch to "ON" position.
(d) Connect a 5A fuse cross-wiring between EO16 terminals No. 3 and No.4. With a scan tool, observe "Actual Intake Manifold Absolute Pressure Sensor Voltage" parameter.

standard value: 4.5V-5.5V

(e) Connect intake manifold absolute pressure sensor wiring harness connector EO16.

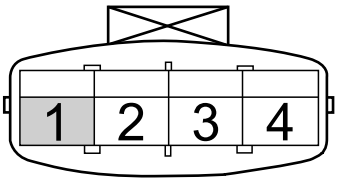
Data normal?

No → Go to step 7

Yes

Step 4	Measure intake manifold absolute pressure sensor ground circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



FE02-5337b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EO16.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EO16 terminal No. 1 and a reliable ground.

Standard Value: Less than 3 Ω

(e) Connect intake manifold absolute pressure sensor wiring harness connector EO16.

Resistance normal?

No → Go to step 8

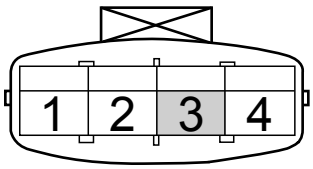
Yes

Step 5	Replace intake manifold absolute pressure sensor.

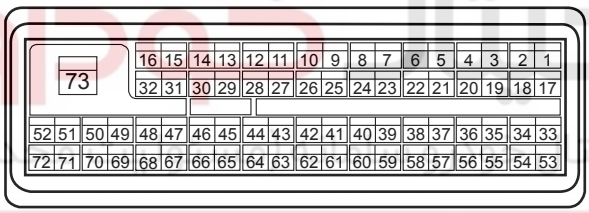
Next → Go to step 10

Step 6	Check sensor 5 V reference voltage circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



ECM Harness Connector EO01



FE02-5338b

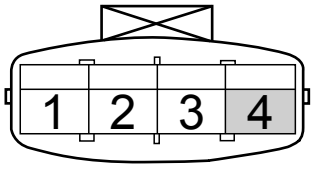
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EO16.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EO16 terminal No. 3 and ECM harness connector terminal No.6. Check whether the circuit is open. Otherwise, repair the fault part.
(e) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EO16 terminal No. 3 and a reliable ground. check whether the circuit is short to ground. Otherwise, repair the fault part.
(f) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EO16 terminal No. 3 and power supply. check whether the circuit is short to power supply. Otherwise, repair the fault part.

Test Items	Standard Value
Resistance Between EO16 (3) and EO01 (6)	Less than 1 Ω
Resistance Between EO16 (3) and A Reliable Ground	10 kΩ or higher
Voltage Between EO16 (3) and A Reliable Ground	0 V

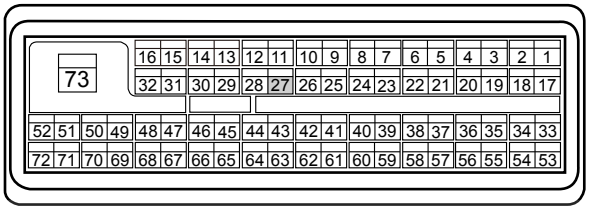
Next → Go to step 9

Step 7	Check sensor signal circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



ECM Harness Connector EO01



FE02-5339b

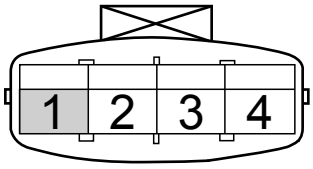
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EO16.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between intake manifold absolute pressure sensor harness connector EO16 terminal No.4 and ECM harness connector terminal No.27. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure resistance between intake manifold absolute pressure sensor harness connector EO16 terminal No.4 and a reliable ground. Check whether the circuit is short to ground. Otherwise, repair the faulty part.
(f) Measure voltage between intake manifold absolute pressure sensor harness connector EO16 terminal No.4 and power supply. Check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO16 (4) and EO01 (27)	Less than 1 Ω
Resistance Between EO16 (4) and A Reliable Ground	10 kΩ or higher
Voltage Between EO16 (4) and A Reliable Ground	0 V

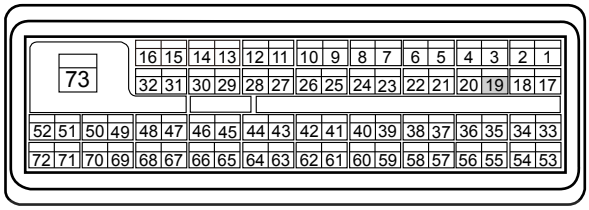
Normal	Go to step 9

Step 8	Check sensor ground circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



ECM Harness Connector EO01



FE02-5340b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EN16.
(c) Disconnect ECM harness connector EN01.
(d) Measure resistance between intake manifold absolute pressure sensor harness connector EO16 terminal No.1 and ECM harness connector terminal No.19. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure voltage between intake manifold absolute pressure sensor harness connector EO16 terminal No.1 and a reliable ground. check whether the circuit is short to ground. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO16 (1) and EO01 (19)	Less than 1 Ω
Voltage Between EO16 (1) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 9	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 10	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 11	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 12	Diagnostic completed.

5. Repair Instructions:

Replace MAP sensor. Refer to 2.2.8.7 Intake Air Pressure and Temperature Sensor Replacement.

Refer to 2.2.8.8 Engine Control Module ReplacementReplace ECM.

2.12.7.19 DTC P0112 P0113

1. DTC Descriptor:

DTC	P0112	Intake Air Temperature Pressure Sensor Circuit Low Voltage

DTC	P0113	Intake Air Temperature Pressure Sensor Circuit High Voltage or Open

Intake air temperature pressure sensor has a signal circuit and an ECM internal ground circuit. Intake air temperature pressure sensor is used to measure the air temperature entering the engine. ECM provides 5 V reference voltage through ECM harness connector EO01 terminal No.9 to the intake air temperature pressure sensor harness connector EO16 terminal No.2 and an internal low reference voltage through EO01 terminal No.19 to the intake air temperature pressure sensor EO16 terminal No.1. When the intake air temperature pressure sensor in cold, the sensor resistance is relatively high. When the air temperature rises, the sensor resistance decreases. When the sensor resistance is high, ECM detected intake air temperature pressure sensor signal circuit voltage is high. With the decrease of sensor resistance, ECM detected intake air temperature pressure sensor signal circuit voltage also decreases.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0112 P0113	1. More Than the Upper Limit 2. Lower Than the Lower Limit	1. Vehicle speed is greater than 50 km/h. 2. MAT circuit is short to ground. 3. MAT signal voltage becomes 0 immediately.	1. Sensor Circuit 2. Sensor 3. ECM
		1. Vehicle speed is less than 25 km/h. 2. MAT circuit is open or short to 5 V reference voltage.	

3. Schematic:

schematic Refer to 2.12.7.18 DTC P0107 P0108in Schematic.

4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Check the existence of the following conditions:

(a) Sensor housing is damaged.
(b) Sensor loose or improperly installed.
(c) Sensor wiring harness connector loose.

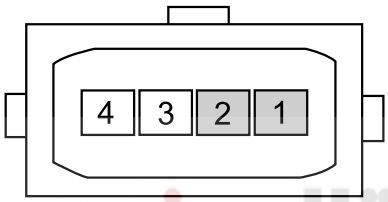
Next

Note

It is prohibited Connect intake manifold absolute pressure sensor 5 V reference voltage circuit and other components, otherwise it will damage the sensor and ECM.

Step 2	Measure intake air pressure and temperature sensor resistance.

Intake Air Temperature/Pressure Sensor



FE02-5024b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake air pressure and temperature sensor wiring harness connector EN16.
(c) Measure intake air temperature sensor resistance.

Standard Resistance: (Refer to the specific parameters2.2.1.2 Temperature Sensor Temperature and Resistance Correlation): 2,400 Ω/20°C(68 ºF)

(d) Connect intake air pressure and temperature sensor wiring harness connector EO16.

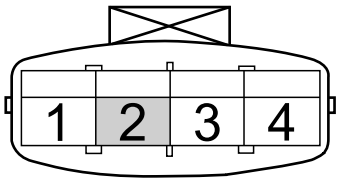
Is the resistance specified value?

No → Replace the intake air pressure and temperature sensor. Go to step 9

Yes

Step 3	Measure intake air temperature pressure sensor signal circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



FE02-5341b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake air pressure and temperature sensor wiring harness connector EO16.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between intake air pressure and temperature sensor wiring harness connector EO16 terminal No.2 and a reliable ground.

Standard Voltage: 4.7-5.5 V

(e) Connect intake air pressure and temperature sensors connector EO16.

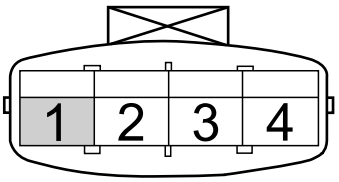
Voltage normal?

No → Go to step 5

Yes

Step 4	Measure intake air temperature pressure sensor ground circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



FE02-5342b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake air pressure and temperature sensor wiring harness connector EO16.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between intake air pressure and temperature sensor wiring harness connector EO16 terminal No.1 and a reliable ground.

Standard Resistance Value: Less than 3 Ω

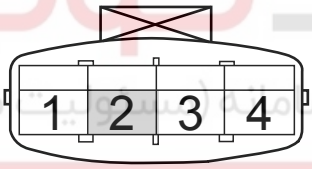
(e) Connect intake air pressure and temperature sensors wiring harness connector EO16.

Resistance normal?

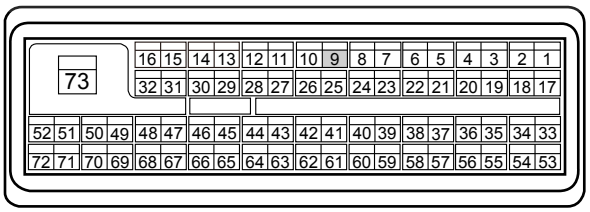
No	Go to step 6
Yes	Go to step 7

Step 5	Check intake air temperature pressure sensor signal circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



ECM Harness Connector EO01



FE02-5343b

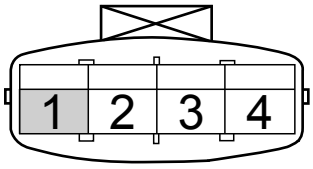
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake air pressure and temperature sensor wiring harness connector EO16.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between intake air pressure and temperature sensor wiring harness connector EO16 terminal No.2 and ECM harness connector terminal No.9. Check whether the circuit is open.
(e) Measure resistance between intake air pressure and temperature sensor wiring harness connector EO16 terminal No.2 and a reliable ground. check whether the circuit is short to ground.
(f) Measure voltage between intake air pressure and temperature sensor wiring harness connector EO16 terminal No.2 and power supply. check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EO16 (2) and EO01 (9)	Less than 1 Ω
Resistance Between EO16 (2) and A Reliable Ground	10 kΩ or higher
Voltage Between EO16 (2) and A Reliable Ground	0 V

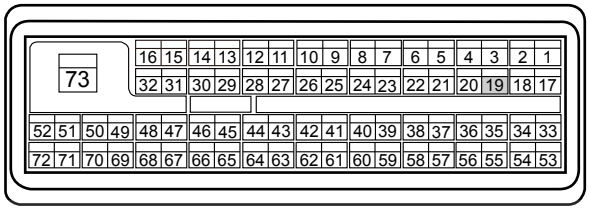
Next	Go to step 7

Step 6	Check intake air temperature pressure sensor ground circuit.

Intake Air Temperature/Pressure Sensor Harness Connector EO16



ECM Harness Connector EO01



FE02-5340b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect intake air pressure and temperature sensor wiring harness connector EO16.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between intake air pressure and temperature sensor wiring harness connector EO16 terminal No.1 and ECM harness connector terminal No.19. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure voltage between intake air pressure and temperature sensor wiring harness connector EO16 terminal No.1 and a reliable ground. check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO16 (1) and EO01 (19)	Less than 1 Ω
Voltage Between EO16 (1) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Replace intake air pressure and temperature sensors. Refer to 2.2.8.7 Intake Air Pressure and Temperature Sensor Replacement.

2.12.7.20 DTC P0117 P0118

1. DTC Descriptor:

DTC	P0117	Engine Coolant Temperature Sensor Circuit Voltage Too Low

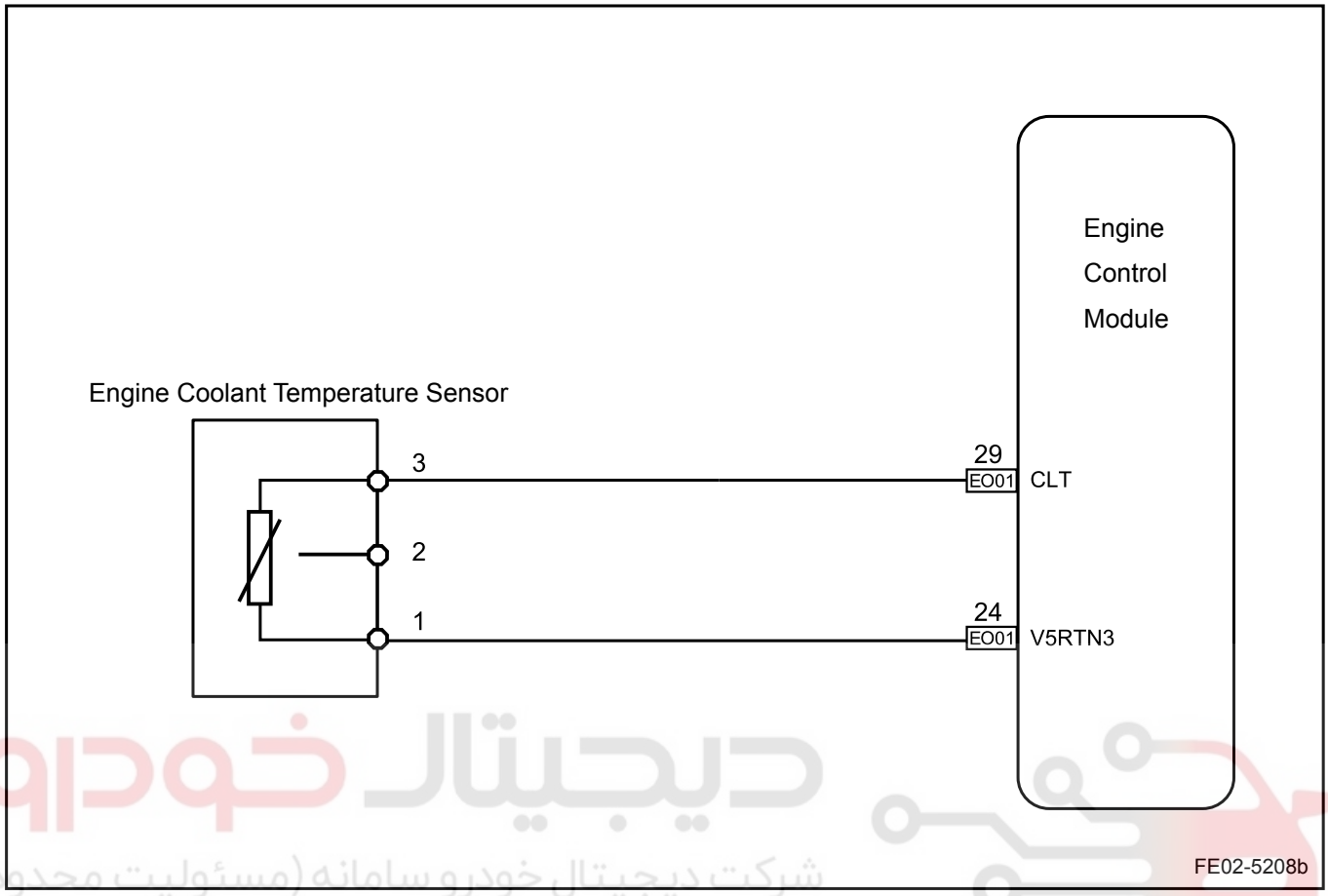
DTC	P0118	Engine Coolant Temperature Sensor Circuit Voltage Too High

ECT sensor is a variable resistor with a negative temperature coefficient and used to measure the temperature of engine coolant. ECM provides a 5V voltage through ECM harness connector EO01 terminal No.24 to ECT sensor harness connector EO23 terminal No.1 and a low internal reference voltage through EO01 terminal No.29 to ECT sensor connector EO23 terminal No.3. ECM will always record the length of time the ignition switched off. When starting, if the ignition switched off time reaches the preset time, the engine control module will compare the engine coolant temperature and intake air temperature in order to determine whether the difference between the two is in normal working range.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0117	1. More Than the Upper Limit 2. Lower Than the Lower Limit	1. Idle 2. Coolant temperature sensor circuit is short to ground. 3. Coolant temperature by default changes as the running time changes.	1. Sensor Circuit 2. Sensor 3. ECM
P0118		1. Idle. 2. Coolant temperature sensor signal circuit is open or short to 5V voltage. 3. Coolant temperature by default changes as the running time changes.	

3. Schematic:



4. Diagnostic Steps:

Warning!

Refer to "Cooling System Service Warning" in "Warnings and Notices".

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Note

At any time do not use flammable antifreeze, such as alcohol. Combustible antifreeze can cause serious fires.

Step 1	Initial Inspection

(a) Check the engine coolant temperature sensor whether there is evidence of corrosion, as well as the engine coolant is leaking through the sensor.

(b) Check whether the engine coolant level is correct.

Next

Step 2	Measure engine coolant temperature sensor resistance.

(a) Turn the ignition switch to "OFF" position.

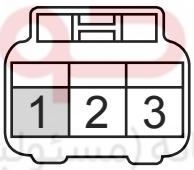
(b) Disconnect the engine coolant temperature sensor wiring harness connector EO23.
(c) Measure engine coolant temperature sensor resistance.
Standard Resistance: (Refer to the specific parameters2.2.1.2 Temperature Sensor Temperature and Resistance Correlation): 2,400 Ω/20°C (68 °F)
(d) Connect the engine coolant temperature sensor wiring harness connector EO23.
Is the resistance specified value?

No → Replace the engine coolant temperature sensor. Go to step 9

Yes

Step 3	Measure engine coolant temperature sensor signal circuit.

Engine Coolant Temperature Sensor Harness Connector EO23



FE02-5344b

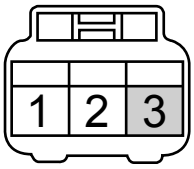
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the engine coolant temperature sensor wiring harness connector EO23.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between engine coolant temperature sensor EO23 terminal No.1 and a reliable ground.
Standard Voltage: 4.7-5 .5 V
(e) Connect the engine coolant temperature sensor wiring harness connector EO23.
Voltage normal?

No → Go to step 5

Yes

Step 4	Measure engine coolant temperature sensor ground circuit.

Engine Coolant Temperature Sensor Harness Connector EO23



FE02-5345b

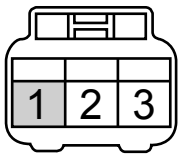
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the engine coolant temperature sensor wiring harness connector EO23.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between engine coolant temperature sensor wiring harness connector EO23 terminal No.3 and A reliable ground.
Standard Resistance: Less than 3 Ω
(e) Connect the engine coolant temperature sensor wiring harness connector EO23.
Resistance normal?

No → Go to step 6

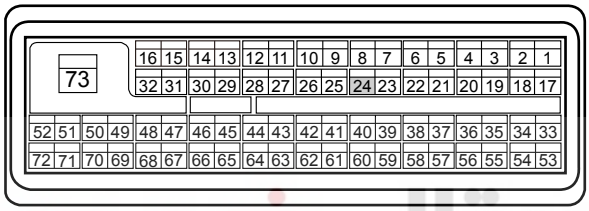
Yes → Go to step 7

Step 5	check the engine coolant temperature sensor signal circuit.

Engine Coolant Temperature Sensor Harness Connector EO23



ECM Harness Connector EO01



FE02-5346b

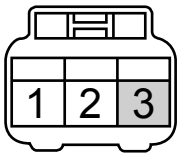
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the engine coolant temperature sensor wiring harness connector EO23.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between engine coolant temperature sensor wiring harness connector EO23 terminal No.1 and ECM harness connector terminal No.24. Check whether the circuit is open.
(e) Measure resistance between engine coolant temperature sensor wiring harness connector EO23 terminal No.1 and a reliable ground. Check whether the circuit is short to ground.
(f) Measure voltage between engine coolant temperature sensor wiring harness connector EO23 terminal No.1 and a reliable ground. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EO23 (1) and EO01 (24)	Less than 1 Ω
Resistance Between EO23 (1) and A Reliable Ground	10 kΩ or higher
Voltage Between EO23 (1) and A Reliable Ground	0 V

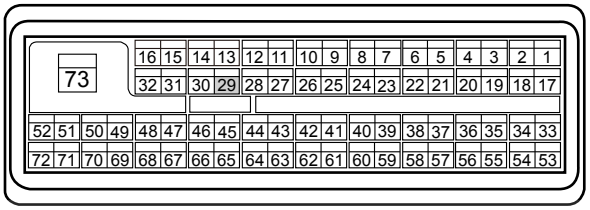
Next → Go to step 7

Step 6	Check the engine coolant temperature sensor ground circuit.

Engine Coolant Temperature Sensor Harness Connector EO23



ECM Harness Connector EO01



FE02-5347b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the engine coolant temperature sensor wiring harness connector EO23.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between engine coolant temperature sensor wiring harness connector EO23 terminal No.3 and ECM harness connector terminal No.29. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure voltage between engine coolant temperature sensor wiring harness connector EO23 terminal No.3 and a reliable ground. Check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO23 (3) and EO01 (29)	Less than 1 Ω
Voltage Between EO23 (3) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Replace the engine coolant temperature sensor. Refer to 2.2.8.6 Engine Coolant Temperature Sensor Replacement.

2.12.7.21 DTC P0122 P0123

1. DTC Descriptor:

DTC	P0122	Electronic Throttle Position Sensor 1 Circuit Low Voltage

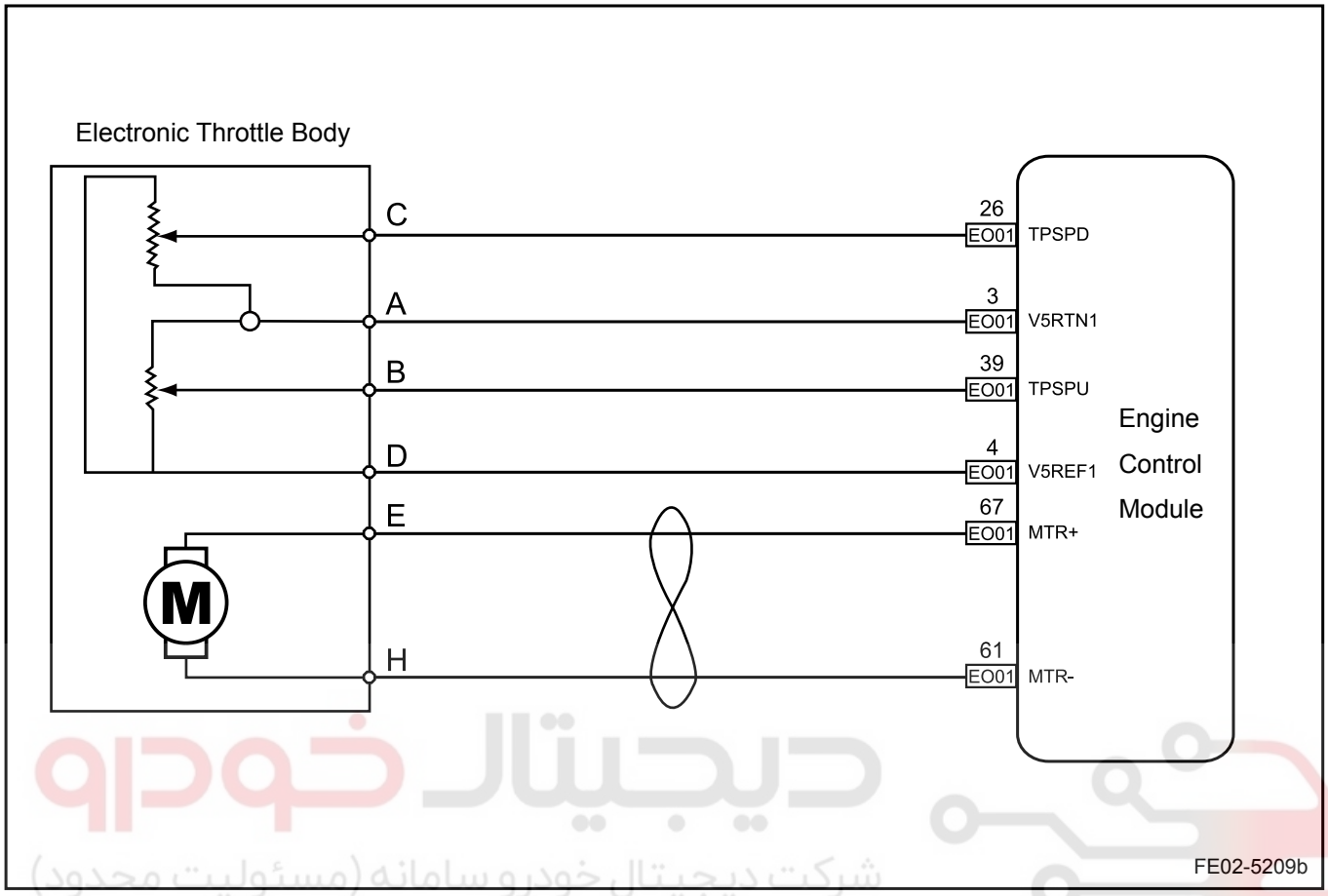
DTC	P0123	Electronic Throttle Position Sensor 1 Circuit High Voltage

TPS1 sensor sends signal through ECT harness connector EO27 terminal B to ECM through ECM harness connector EO01 terminal No.39. If the TPS1 sensor signal is lost, but ECM is able to receive the normal TPS2 sensor signal, then ECM controls the engine enter "reliability of determining the driver's intention decline or no high power output mode". Engine responds to the pedal changes slow and engine power output will be significantly weaker, although the vehicle can still be able to driving in normal traffic.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0122	Hardware Circuit Malfunction	TPS signal is short to ground or open, the input signal is less than 8%, DTC code set.	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0123	Hardware Circuit Malfunction	TPS signal is short to power supply, input signal is greater than 92.7%, DTC code set.	

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	check for DTC code P0641, P0651, P0222, P0223.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

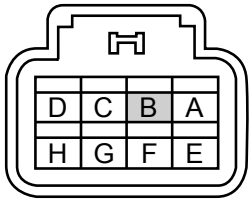
DTC Codes Shown	To Step
P0122, P0123	Yes
P0222, P0223, P0641, P0651	No

No	Refer to 2.12.7.46 DTC P0641 P0651

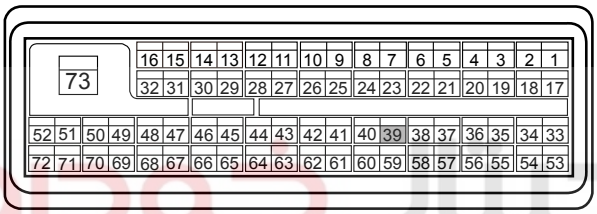
Yes

Step 2	Check EO27 terminal B.

Electronic Throttle Body Harness Connector EO27



ECM Harness Connector EO01



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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ETC harness connector EO27.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between EO27 terminal B and a reliable ground.
(e) Measure voltage between EO27 terminal B and a reliable ground.
(f) Test continuity between EO27 terminal B and EO01 terminal No.39.

Results:

Test Items	Standard Value
Resistance Between EO27 (B) and A Reliable Ground	10 kΩ or higher
Voltage Between EO27 (B) and A Reliable Ground	0 V
EO27 (B) and EO01 (39) Continuity	Less than 1 Ω

Is the value specified value?

No → Circuit malfunction, repair the circuit.

Yes

Step 3	Check terminal B voltage output signal.

(a) Connect ETC harness connector EO27.
(b) Connect ECM harness connector EO01.
(c) Measure ETC harness connector EO27 terminal B output voltage.
Standard Value: Refer to 2.12.7.12 Electronic Throttle Body (ETC) Check.
Is the output voltage value specified value?

No → Replace the electronic throttle body (ETC). Refer to 2.16.3.2 Electronic Throttle Body Replacement.

Yes

Step 4	Check ECM power supply circuit and ground circuit.

(a) Check ECM Power Supply Circuit and ground circuit. Refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Repair power and ground fault circuits.

Yes

Step 5	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 6	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 7	Diagnostic completed.

5. Repair Instructions:

Electronic throttle body (ETC) can only be replaced as an assembly. Do not disassemble it and repair. Refer to 2.16.3.2 Electronic Throttle Body Replacementreplacement.

2.12.7.22 DTC P0131 P0132 P0133 P0134

1. DTC Descriptor:

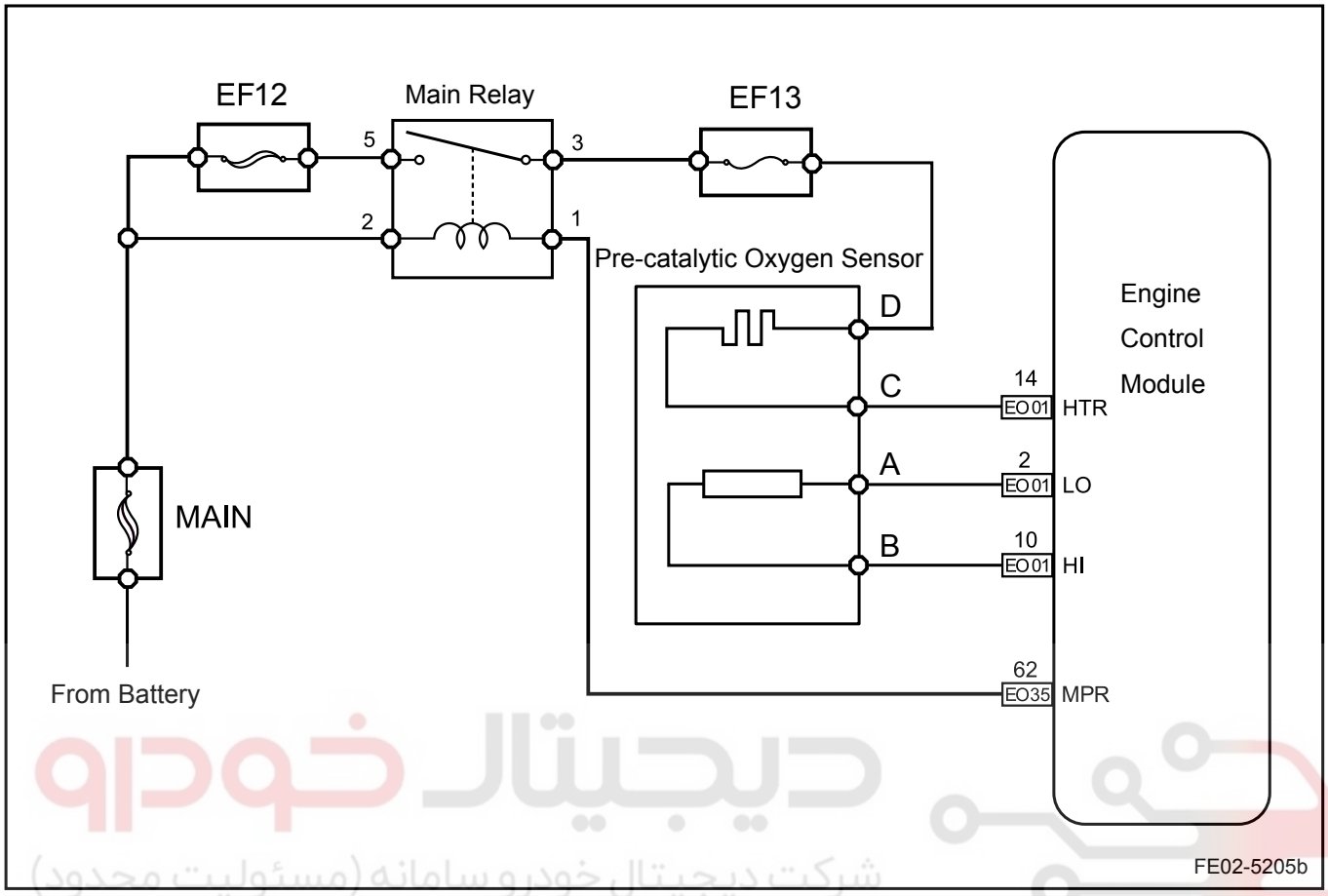
DTC	P0131	Pre-Catalytic Oxygen Sensor Circuit Short To Low Voltage
DTC	P0132	Pre-Catalytic Oxygen Sensor Circuit Short To High Voltage
DTC	P0133	Pre-Catalytic Oxygen Sensor Slow Response
DTC	P0134	Pre-Catalytic Oxygen Sensor Circuit Open

After the vehicle started, ECM works in open-loop mode, in which ECM ignores the Pre-Catalytic oxygen sensor signal voltage when calculating the Air-Fuel ratio. ECM provides an approximate 450mV reference voltage to the Pre-Catalytic oxygen sensor. When the engine is running, Pre-Catalytic oxygen sensors start heating and begin to generate a 0-0.1 V voltage, which fluctuates. Once ECM detects that the Pre-Catalytic oxygen sensor voltage exceeds a preset threshold voltage, ECM immediately enters into the closed-loop mode. ECM uses Pre-Catalytic oxygen sensor signal voltage to determine the Air-Fuel ratio. If the Pre-Catalytic oxygen sensor voltage is increased to above the reference voltage (tend to 1 V), the mixture is too rich. If the Pre-Catalytic oxygen sensor the voltage decreased to below the reference voltage (tend to 0 mV), the mixture is too lean.
ECM provides a signal through ECM harness connector EO01 terminal No.10 to Pre-Catalytic oxygen sensor wiring harness connector EO02 terminal B and an internal low reference voltage through ECM harness connector EO01 terminal No.2 to Pre-Catalytic oxygen sensor wiring harness connector EO02 terminal No. A.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0131	1. Pre-Catalytic Oxygen Sensor Voltage Too High 2. Pre-Catalytic Oxygen Sensor Voltage Too Low	1. Engine Running Longer Than 60 s. 2. Coolant Temperature Less Than 70°C (158 ºF). 3. Oxygen sensor signal is 0. 4. Duration Longer Than 25 s.	1. Sensor Circuit 2. Sensor 3. ECM
P0132		1. Engine Running Longer Than 60 s. 2. Coolant temperature is less than 70°C (158 ºF). 3. Pre-Catalytic oxygen sensor signal is short to power supply, oxygen sensor signal is around 3,200 mV. 4. Duration Longer Than 25 s.	
P0133	1. Post-Catalytic oxygen sensor control integral value is over than upper limit. 2. Post-Catalytic oxygen sensor control integral value is lower than lower limit. 3. Filtered Pre-Catalytic oxygen sensor signal period is greater than the specified value.	1. Engine Running Longer Than 60 s. 2. Coolant temperature is greater than 70°C (158 ºF). 3. Engine speed range is 1,700-2,350 rpm. 4. Oxygen sensors to the exhaust oxygen concentration changes responding time longer than the system preset threshold.	1. Sensor Circuit 2. Sensor 3. ECM 4. Mixture Too Rich 5. Mixture Too Lean
P0134	1. Signal Circuit Open. 2. Oxygen Sensors High-Temperature and High Resistance.	1. Engine Running Longer Than 60 s. 2. Coolant Temperature Less Than 70°C (158 ºF). 3. Duration Longer Than 25 s.	1. Sensor Circuit 2. Sensor 3. ECM

3. Schematic:



4. Diagnostic Steps:

Step 1	Connect scan tool.

Next

Step 2	Start engine and turn on the scan tool.

Next

Step 3	Maintain the engine speed at 2,500 rpm for more than 2 min to warm up the engine, until the engine coolant temperature reaches 0°C (176 ºF).

Next

Step 4	Select on the scan tool: Engine / read data stream / group 1 oxygen sensor voltage 1 (Pre-Catalytic oxygen sensors).

Next

Step 5	Observe oxygen sensor output voltage, which should fluctuate within 0.1-0.8 V.

Yes → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

No

Step 6	Carry out the oxygen sensor signal test.

(a) If the voltage is consistently below 0.45 V (mixture too lean), carry out the following steps:
- Spray proper amount propane gas into intake.
- Observe whether the Pre-Catalytic oxygen sensor voltage has a significant change, so the voltage will rise rapidly.

(b) If the voltage is always higher than 0.45 V (the mixture too rich), carry out the following steps:
- Put the gear into neutral.
- Apply hand brake.
- Press the acceleration pedal so the engine speed suddenly increased to 4,000 rpm and then quickly release the acceleration pedal.
- Repeat the previous step more than 3 times.
- Check whether the Pre-Catalytic oxygen sensor voltage has a significant change, so the voltage will rise rapidly.

During the above test, the oxygen sensor signal voltage should have a significant change.

Does the voltage have a significant change?

Yes → Check the cause for engine Air-Fuel ratio too thin / too rich. Refer to 2.12.7.4 Symptoms Table.

No

Step 7	Check and confirm there is no other control system DTC code.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

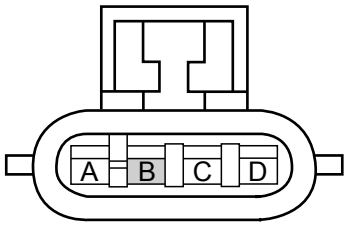
DTC Codes Shown	To Step
DTC other than P0131, P0133, P0134	No
P0131, P0133, P0134	Yes

No → Refer to 2.12.7.14 DTC Code Index

Yes

Step 8	Measure pre-catalytic oxygen sensor signal circuit.

Pre-catalytic Oxygen Sensor Harness Connector EO02



FE02-5348b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect oxygen sensor wiring harness connector EO02.
(c) Turn the ignition switch to "ON" position.
(d) Measure pre-catalytic oxygen sensor wiring harness connector terminal No. EO02 B, the voltage between ground and reliable value.

Standard Voltage Value: 0.35-0.5 V

(e) Connect pre-catalytic oxygen sensor wiring harness connector EO02.

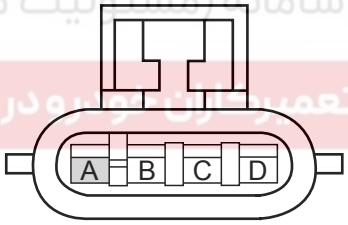
Is the voltage specified value?

No → Go to step 11

Yes

Step 9	Measure pre-catalytic oxygen sensor ground circuit.

Pre-catalytic Oxygen Sensor Harness Connector EO02



FE02-5349b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect oxygen sensor wiring harness connector EN02.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between Pre-Catalytic oxygen sensor EO02 terminal A and a reliable ground.

Standard Resistance: Less than 1 Ω

(e) Connect pre-catalytic oxygen sensor wiring harness connector EO02.

Is the resistance specified value?

No → Go to step 12

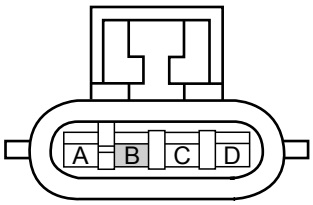
Yes

Step 10	Replace the pre-catalytic oxygen sensor. Refer to 2.4.7.2 Pre-Catalytic Oxygen Sensor Replacement.

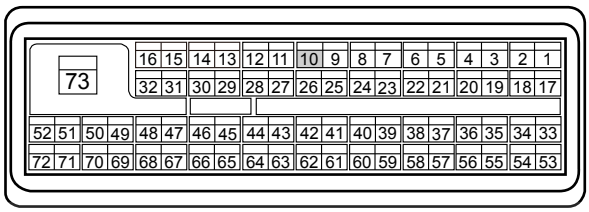
Next → Go to step 15

Step 11	Check pre-catalytic oxygen sensor signal circuit.

Pre-catalytic Oxygen Sensor Harness Connector EO02



ECM Harness Connector EO01



FE02-5350b

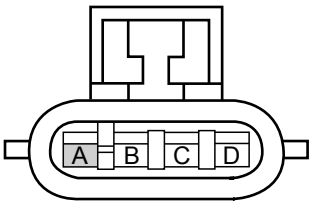
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect oxygen sensor wiring harness connector EO02.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between pre-catalytic oxygen sensor wiring harness connector EO02 terminal B and ECM harness connector terminal No.10. Check whether the circuit is open. otherwise, repair the faulty part.
(e) Measure resistance between pre-catalytic oxygen sensor wiring harness connector EO02 terminal B and a reliable ground. Check whether the circuit is short to ground. otherwise, repair the faulty part.
(f) Measure voltage between pre-catalytic oxygen sensor wiring harness connector EO02 terminal B and a reliable ground. Check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO02 (B) and EO01 (10)	Less than 1 Ω
Resistance Between EO02 (B) and A Reliable Ground	10 kΩ or higher
Voltage Between EO02 (B) and A Reliable Ground	0 V

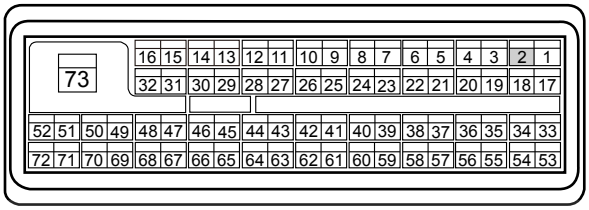
Normal	Go to step 15

Step 12	Check pre-catalytic oxygen sensor ground circuit..

Pre-catalytic Oxygen Sensor Harness Connector EO02



ECM Harness Connector EO01



FE02-5351b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect oxygen sensor wiring harness connector EO02.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between pre-catalytic oxygen sensor wiring harness connector EO02 terminal A and ECM harness connector terminal No.2. Check whether the circuit is open. otherwise, repair the faulty part.
(e) Measure resistance between pre-catalytic oxygen sensor wiring harness connector EO02 terminal A and a reliable ground. Check whether the circuit is short to ground. otherwise, repair the faulty part.
(f) Measure voltage between pre-catalytic oxygen sensor wiring harness connector EO02 terminal A and a reliable ground. Check whether the circuit is short to power supply. otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO02 (A) and EO01 (2)	Less than 1 Ω
Resistance Between EO02 (A) and A Reliable Ground	10 kΩ or higher
Voltage Between EO02 (A) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 13	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 14	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 15	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 16	Diagnostic completed.

5. Repair Instructions:

Replace the pre-catalytic oxygen sensor. Refer to 2.4.7.2 Pre-Catalytic Oxygen Sensor Replacement.

2.12.7.23 DTC P0135

1. DTC Descriptor:

DTC	P0135	Pre-Catalytic Oxygen Sensor Heater Malfunction

Upstream Heated Oxygen Sensor (HO_2S) is used for fuel control. The sensor compares the oxygen content in ambient air and oxygen content in the exhaust flow. Each heated oxygen sensor has an internal heating element. ECM controls the heated oxygen sensor heating control circuit. This makes the system enter the closed-loop system earlier, so that ECM will calculate Air-Fuel ratio earlier. ECM controls the heating control circuit switched on or off, so that heated oxygen sensor working temperature maintains in the specified range. ECM measures the heater current to determine the temperature.

Pre-Catalytic oxygen sensor heating coil voltage is provided by The Main Relay controlled by ECM, when the ignition switch is turned to "ON", EO02 sensor harness connector terminal D will have battery voltage. ECM controls heater working hours through ECM harness connector EO01 terminal No.14.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0135	Hardware Circuit Checks	1. Engine Running Longer Than 60 s. 2. At idle Running Condition. 3. Pre-Catalytic Oxygen Sensor Heating 4. Pre-Catalytic Oxygen Sensor Heating Control Terminal Disconnected. 5. Duration Less Than 20 s.	1. Sensor Circuit 2. Sensor 3. ECM

3. Schematic:

Refer to 2.12.7.22 DTC P0131 P0132 P0133 P0134.

4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Check the existence of following factors that will affect the oxygen sensor working status:

(a) Exhaust system leakage or blockage.
(b) Water entering the heated oxygen sensor connector.
(c) Engine working at high temperatures, exhaust pipes too hot.

Next

Step 2	Check pre-catalytic oxygen sensor heater resistance.

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect oxygen sensor wiring harness connector.
(c) Measure heater resistance between pre-catalytic oxygen sensor terminals C and D.

Standard Resistance: 9 Ω/20°C (68 ºF)

(d) Connect pre-catalytic oxygen sensor wiring harness connector.

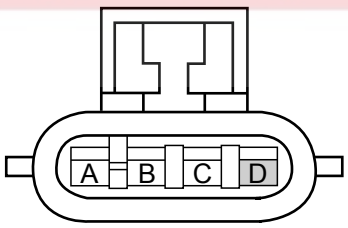
Is the resistance specified value?

No → Replace the pre-catalytic oxygen sensor. Refer to 2.4.7.2 Pre-Catalytic Oxygen Sensor Replacement

Yes

Step 3	Check terminal D to ground voltage.

Pre-catalytic Oxygen Sensor Harness Connector EO02



FE02-5352b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect oxygen sensor wiring harness connector.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between Pre-Catalytic oxygen sensor wiring harness connector EO02 terminal D and a reliable ground.

Standard Voltage Value: 11-14 V

(e) Connect the pre-catalytic oxygen sensor wiring harness connector EO02.

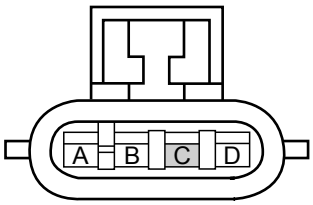
Is the voltage specified value?

No → Pre-Catalytic oxygen sensor heater power supply circuit fault

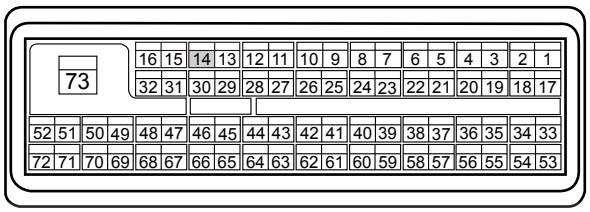
Yes

Step 4	Check pre-catalytic oxygen sensor heater control terminal continuity.

Pre-catalytic Oxygen Sensor Harness Connector EO02



ECM Harness Connector EO01



FE02-5353b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect oxygen sensor wiring harness connector EO02.
(c) Disconnect ECM harness connector EO01.
(d) Test Continuity between pre-catalytic oxygen sensor wiring harness connector EO02 terminal C and ECM harness connector EO01 terminal No.14.

Standard Resistance: Less than 1 Ω

(e) Connect ECM harness connector EO01.
(f) Connect pre-catalytic oxygen sensor wiring harness connector EO02.

Is the resistance specified value?

No → ECM control circuit malfunction

Yes

Step 5	Check ECM working circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

(a) Replace ECM.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 7	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 5 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 8	Diagnostic completed.

5. Repair Instructions:

Replace the pre-catalytic oxygen sensor. Refer to 2.4.7.2 Pre-Catalytic Oxygen Sensor Replacement.

2.12.7.24 DTC P0137 P0138 P0140

1. DTC Descriptor:

DTC	P0137	Post-Catalytic Oxygen Sensor Circuit Short To Low Voltage
DTC	P0138	Post-Catalytic Oxygen Sensor Circuit Short To High Voltage
DTC	P0140	Post-Catalytic Oxygen Sensor Circuit Open

After the vehicle started, ECM works in open-loop mode, in which ECM ignores the Pre-Catalytic oxygen sensor signal voltage when calculating the Air-Fuel ratio. ECM provides an approximate 450 mV reference voltage to the Pre-Catalytic oxygen sensor. When the engine is running, Pre-Catalytic oxygen sensors start heating and begin to generate a 0-0.1 V voltage, which fluctuates. Once ECM detects that the Pre-Catalytic oxygen sensor voltage exceeds a preset threshold voltage, ECM immediately enters into the closed-loop mode. ECM uses Pre-Catalytic oxygen sensor signal voltage to determine the Air-Fuel ratio. If the Pre-Catalytic oxygen sensor voltage is increased to above the reference voltage (tend to 1 V), the mixture is too rich. If the Pre-Catalytic oxygen sensor the voltage decreased to below the reference voltage (tend to 0 mV), the mixture is too lean.

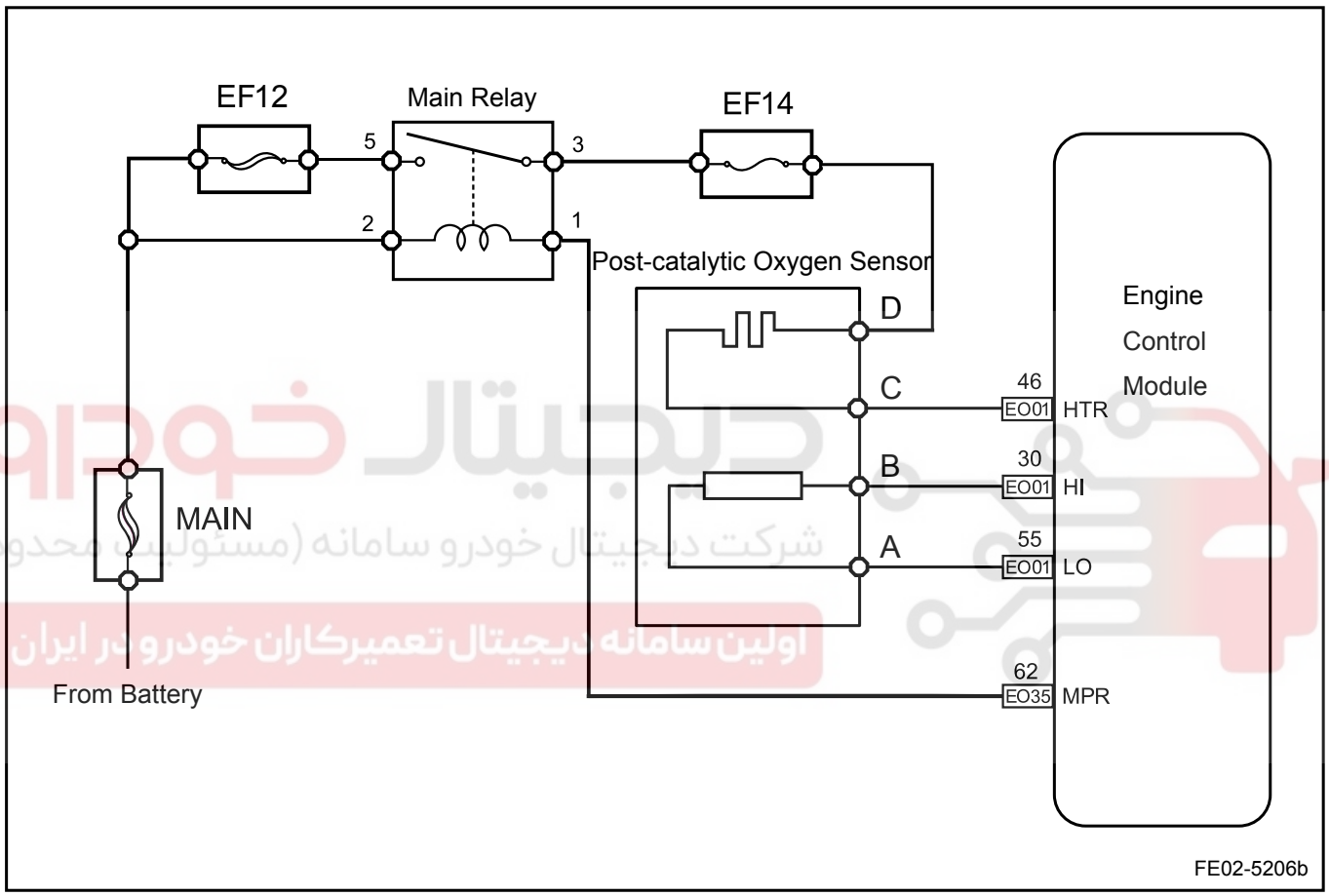
- ECM provides a signal through ECM harness connector EO01 terminal No.30 to Post-Catalytic oxygen sensor wiring harness connector EO03 terminal B.
- ECM provides an internal low reference voltage through ECM harness connector EO01 terminal No.55 to Pre-Catalytic oxygen sensor wiring harness connector EO03 terminal No.A.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0137	Short to Ground When Cold	1. Engine running longer than 60 s. 2. Coolant temperature is less than 70 °C (158 ºF). 3. Post-Catalytic oxygen sensor signal 0. 4. Duration longer than 25 s.	1. Sensor circuit 2. Sensor 3. ECM
P0138	Post-Catalytic oxygen sensor voltage signal too high	1. Engine running longer than 60 s. 2. Coolant temperature is less than 70 °C (158 ºF). 3. Post-Catalytic oxygen sensor signal around 3,200 mV. 4. Duration longer than 25 s.	

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0140	1. Oxygen sensor signal circuit open 2. Oxygen sensor high-temperature and high resistance	1. Engine running longer than 60 s. 2. Coolant temperature is less than 70 °C (158 ºF). 3. Post-Catalytic oxygen sensor signal exceeds a reasonable range. 4. Duration longer than 25 s.	

3. Schematic



4. Diagnostic Steps:

Step 1	Connect scan tool.

Next

Step 2	Start engine and turn on the scan tool.

Next

Step 3	Select on the scan tool: Engine / read data flow / group 1 oxygen sensor voltage 2(Post-Catalytic oxygen sensors).

Next

Step 4	Observe oxygen sensor output voltage, which should be within 0.6-0.7 V.

Yes → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

No

Step 5	Carry out the oxygen sensor signal test.

(a) If the data is consistently below 0.45 V (mixture too lean), carry out the following steps:
- Spray proper amount propane gas into intake.
- Observe whether the Post-Catalytic oxygen sensor voltage has a significant change, as the signal voltage will increase rapidly.

(b) If the data is consistently higher than 0.45 V (mixture too rich), carry out the following steps:
- Put the gear into neutral.
- Apply hand brake.
- Press the acceleration pedal so the engine speed suddenly increases to 4,000 rpm and then quickly release the acceleration pedal.
- Repeat the previous step more than 3 times.
- Observe whether the Post-Catalytic oxygen sensor voltage has a significant change, as the signal voltage will decrease rapidly.

During the above test, the oxygen sensor signal voltage should have a significant change.

Does the voltage have a significant change?

Yes → Check the cause for Air-Fuel ratio too thin / too rich. Refer to 2.12.7.4 Symptoms Table.

No

Step 6	Confirm no other control system DTC code.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
DTC codes other than P0137, P0138, P0140	No
P0137, P0138, P0140	Yes

No → Refer to 2.12.7.14 DTC Code Index

Yes

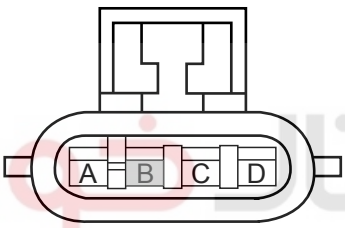
Step 7	Inspect the exhaust system seal.

(a) Check whether the three-way catalytic converter looks good (signs of excessive heat and gasket missing, etc.).
(b) Check whether the exhaust pipe is intact, whether the gasket is intact.

No → replace the damaged parts. Go to step 15

Step 8	measure oxygen sensor signal circuit.

Post-catalytic Oxygen Sensor Harness Connector EO03



FE02-5354b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the oxygen sensor wiring harness connector EO03.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between oxygen sensor wiring harness connector EO03 terminal B and a reliable ground.

Standard Voltage Value: 0.35-0.5 V

(e) Connect the oxygen sensor wiring harness connector EO03.

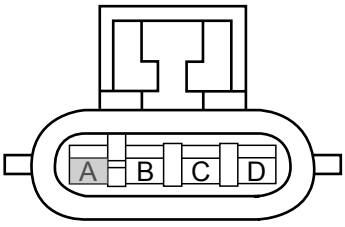
Is the voltage specified value?

No → Go to step 11

Yes

Step 9	Measure Post-Catalytic oxygen sensor ground circuit.

Post-catalytic Oxygen Sensor Harness Connector EO03



FE02-5355b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the oxygen sensor wiring harness connector EO03.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between oxygen sensor EO03 terminal A and a reliable ground.

Standard Resistance: Less than 1 Ω

(e) Connect the oxygen sensor wiring harness connector EO03.

Is the resistance specified value?

No → Go to step 12

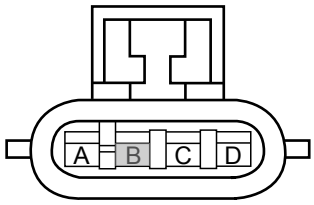
Yes

Step 10	replace the oxygen sensor.

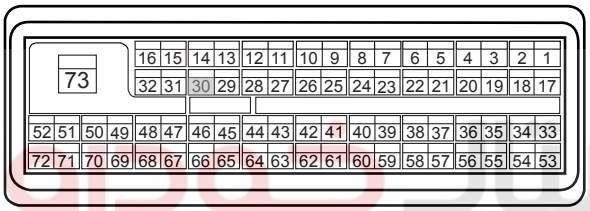
Next → Go to step 15

Step 11	check Post-Catalytic oxygen sensor signal circuit.

Post-catalytic Oxygen Sensor Harness Connector EO03



ECM Harness Connector EO01



FE02-5356b

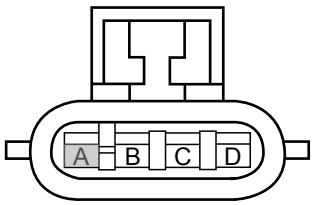
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the oxygen sensor wiring harness connector EO03.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between oxygen sensor wiring harness connector EO03 terminal B and ECM harness connector terminal No.30. Check whether the circuit is open. otherwise, repair the faulty part.
(e) Measure resistance between oxygen sensor wiring harness connector EO03 terminal B and a reliable ground. Check whether the circuit is short to ground. otherwise, repair the faulty part.
(f) Measure voltage between oxygen sensor wiring harness connector EO03 terminal B and a reliable ground. Check whether the circuit is short to power supply. otherwise, repair the faulty part.

Test Items	Standard Value
Resistance between EO03 (B) and EO01 (30)	Less than 1 Ω
Resistance between EO03 (B) and a reliable ground	10 kΩ or higher
Voltage between EO03 (B) and a reliable ground	0 V

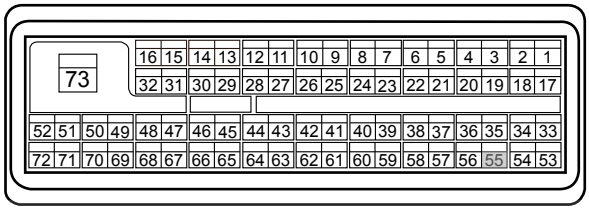
normal → Go to step 13

Step 12	Check Post-Catalytic oxygen sensor ground circuit.

Post-catalytic Oxygen Sensor Harness Connector EO03



ECM Harness Connector EO01



FE02-5357b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the oxygen sensor wiring harness connector EO03.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between oxygen sensor wiring harness connector EO03 terminal A and ECM harness connector terminal No.55. Check whether the circuit is open. otherwise, repair the faulty part.
(e) Measure resistance between oxygen sensor wiring harness connector EO03 terminal A and a reliable ground. Check whether the circuit is short to ground. otherwise, repair the faulty part.
(f) Measure voltage between oxygen sensor wiring harness connector EO03 terminal A and a reliable ground. Check whether the circuit is short to power supply. otherwise, repair the faulty part.

Test Items	Standard Value
Resistance between EO03 (A) and EO01 (55)	Less than 1 Ω
Resistance between EO03 (A) and a reliable ground	10 kΩ or higher
Voltage between EO03 (A) and a reliable ground	0 V

Execute next step as per normal.

Next

Step 13	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 14	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 15	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 16	Diagnostic completed.

5. Repair Instructions:

Replace the Post-Catalytic oxygen sensor. Refer to 2.4.7.1 Post-Catalytic Oxygen Sensor Replacement.

2.12.7.25 DTC P0141

1. DTC Descriptor:

DTC	P0141	Post-Catalytic oxygen sensor heater malfunction

Heated Post-Catalytic Oxygen Sensor (HO_2S) is used to monitor the three-way catalytic converter working status. The sensor compares the oxygen content in ambient air and oxygen content in the exhaust flow. Each heated oxygen sensor has an internal heating element. ECM controls the heated oxygen sensor heating control circuit. This makes the system enter the closed-loop system earlier, so that ECM will calculate Air-Fuel ratio earlier. ECM controls the heating control circuit switched on or off, so that heated oxygen sensor working temperature maintains in the specified range. ECM measures the heater current to determine the temperature.

The Post-Catalytic oxygen sensor heating coil voltage is provided by The Main Relay controlled by ECM. When the ignition switch is turned to "ON", Post-Catalytic oxygen sensor connector EO03 terminal D will have battery voltage. ECM controls the heater working hours by ECM harness connector EO01 terminal No.46.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0141	Hardware Circuit Checks	1. Engine Running Longer Than 60 s. 2. Idle Running Condition. 3. Post-Catalytic Oxygen Sensor Heating. 4. Post-Catalytic Oxygen Sensor Heating Control Terminal Circuit Open. 5. Duration Less Than 20 s.	1. Sensor Circuit 2. Sensor 3. ECM

3. Schematic:

Refer to 2.12.7.24 DTC P0137 P0138 P0140.

4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Check the existence of following factors that will affect the oxygen sensor working status:

(a) Exhaust system leakage or blockage.
(b) Water entering the oxygen sensor connector.
(c) Engine working at high temperatures, exhaust pipes too hot.

Next

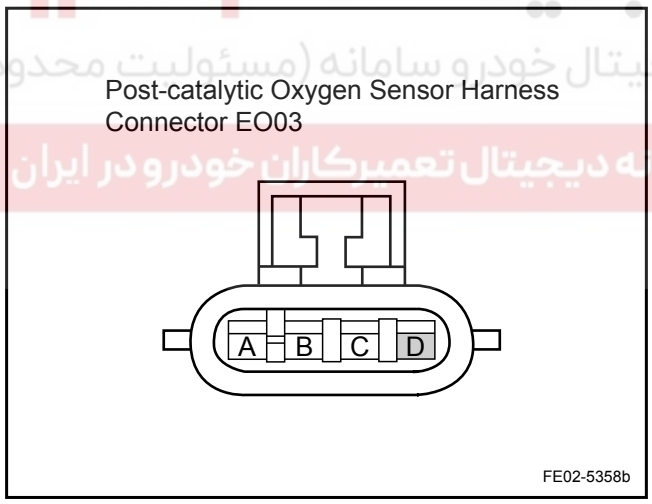
Step 2	check oxygen sensor heater resistance.

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the oxygen sensor wiring harness connector.
(c) Measure the oxygen sensor heater resistance.
Standard Resistance: Connectors C and D, 9 Ω/20°C(68 ºF)
(d) Connect the oxygen sensor wiring harness connector.
Is the resistance specified value?

No → Replace oxygen sensor. Refer to 2.4.7.1 Post-Catalytic Oxygen Sensor Replacement

Yes

Step 3	Measure voltage between terminal D and ground.



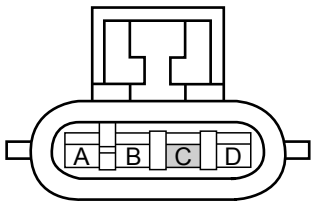
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the oxygen sensor wiring harness connector.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between oxygen sensor harness connector EO03 terminal D and ground.
Standard Voltage: 11-14 V
(e) Connect the oxygen sensor wiring harness connector EO03.
Is the voltage specified value?

No → Post-Catalytic oxygen sensor heater power supply circuit fault.

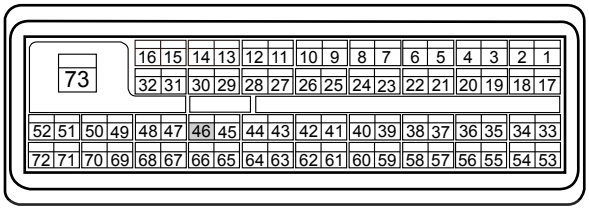
Yes

Step 4	Check oxygen sensor heater control terminal Continuity.

Post-catalytic Oxygen Sensor Harness Connector EO03



ECM Harness Connector EO01



FE02-5359b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the oxygen sensor wiring harness connector EO03.
(c) Disconnect ECM harness connector EO01.
(d) Test Continuity between oxygen sensor wiring harness connector EO03 terminal C and ECM harness connector EO01 terminal No.46.

Standard Resistance: Less than 1 Ω

(e) Connect ECM harness connector EO01.
(f) Connect the oxygen sensor wiring harness connector EO03.

Is the resistance specified value?

No → ECM control circuit malfunction.

Yes

Step 5	Check ECM working circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

(a) Replace ECM.
(b) Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 7	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 5 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 8	Diagnostic completed.

5. Repair Instructions:

Replace post-catalytic oxygen sensor. Refer to 2.4.7.1 Post-Catalytic Oxygen Sensor Replacement.

2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188

1. DTC Descriptor:

DTC	P0171	Mixture Too Lean
DTC	P0172	Mixture Too Rich
DTC	P1167	Pre-Catalytic Oxygen Indicating Mixture Too Rich During Deceleration
DTC	P1171	Pre-Catalytic Oxygen Indicating Mixture Too Lean During Acceleration
DTC	P2187	Mixture Too Lean When idling
DTC	P2188	Mixture Too Rich When idling

Engine Control Module (ECM) controls the close-loop Air-Fuel ratio Measure system that achieves optimal combination of performance, fuel economy and emissions control. In the close-loop mode, the engine control module monitors heated oxygen sensor (HO_2S) signal voltage and adjusts fuel supply according to the signal. Changes in fuel supply will change the value of long-term and short-term fuel supply adjustment. Short-term fuel supply adjustment will respond to heated oxygen sensor signal voltage and rapidly change. These changes will fine tune the fuel supply. Long-term fuel supply adjustment will respond to the trend in short-term fuel supply adjustment. Long-term fuel adjustment adjusts the fuel supply in order to return to the center of the short-term fuel adjustment value and controls the short-term fuel adjustment. The ideal fuel adjustment value is around 0%. A positive value indicates that engine control module is increasing fuel supply to compensate the lean Air-Fuel mixture. A negative value indicates that engine control module is decreasing fuel supply to compensate the rich Air-Fuel mixture.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0170 P0171 P0172 P2177 P2178 P2187 P2188	1. Fuel Adjustment Value Higher Than Maximum Limit 2. Fuel Adjustment Value Lower Than Minimum Limit 3. Fuel Adjustment Value Higher Than Maximum Limit (Low-Load Zone) 4. Fuel Adjustment Value Lower Than Minimum Limit (Low-Load Zone)	1. Engine slows down and enters (DFCO) working condition. 2. ECM detected oxygen sensor signal voltage is higher than 0.55 V. 3. Engine enters power-enriched (PE) working condition. 4. ECM detected oxygen sensor signal voltage is lower than 0.35 V. 5. Duration is longer than 12 s.	1. Fuel Injectors 2. Canister 3. MAP 4. TPS 5. HO_2S (Pre-Catalytic)

3. Schematic:

Refer to 2.12.6.1 Schematic.

4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Check there are no other control system DTC codes.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Are there DTC codes other than P0170, P0171, P0172, P2177, P2178, P2187, P2188?

Yes → Refer to 2.12.7.14 DTC Code Index

No

Step 2	Read the intake manifold absolute pressure sensor data.

(a) Turn ignition switch to "OFF" position, connect scan tool.
(b) Start the vehicle.
(c) Read the intake manifold absolute pressure sensor data.
(d) Read the scan tool for atmospheric pressure value, and compare it with table 2.2.1.3 Altitude and Atmospheric Pressure Correlation.

Is scan tool atmospheric pressure reading normal?

No → Refer to 2.12.7.18 DTC P0107 P0108

Yes

Step 3	Read the throttle position sensor data.

(a) Start the vehicle.
(b) Warm up the engine with normal idle speed and throttle opening is less than 10%.
(c) Use scan tool to read throttle position sensor data.
Is throttle position sensor data normal?

No → Refer to 2.12.7.27 DTC P0222 P0223

Yes

Step 4	Read the Pre-Catalytic oxygen sensor data.

(a) Start the vehicle.
(b) Warm up the engine with normal idle speed.
(c) Read the Pre-Catalytic oxygen sensor data.
Pre-Catalytic oxygen sensor standard value: 0.2-0.8 V

Is Pre-Catalytic oxygen sensor data is normal?

No → Refer to 2.12.7.22 DTC P0131 P0132 P0133 P0134

Yes

Step 5	Observe the long-term fuel adjustment parameter.

(a) Start the vehicle.
(b) Warm up the engine.
(c) Observe the long-term fuel adjustment parameter.
Is the long-term fuel adjustment parameter normal?

Yes → System normal

No

Step 6	Check engine and its components.

(a) Turn the ignition switch to "OFF" position.
(b) Check the vacuum hose crack, kink or connections.
(c) Check the intake manifold, throttle body and fuel injector vacuum leakage.
(d) Check the crankshaft ventilation system leakage.
(e) Check Fuel Contamination.
(f) Check the fuel system working at Air-Fuel ratio too lean.
(g) Check injector nozzle spray fuel too lean.
(h) Check the fuel system working at Air-Fuel ratio too rich.
(i) Check injector spray fuel too rich.
(j) Check intake manifold collapse or obstruction.
(k) Check whether there is excessive fuel in the crankcase.
(l) Check evaporative emission control systems working condition.

(m) Check other fault lights in I/P working condition.

Is engine System normal?

Yes	System normal

No

Step 7	Repair engine and its components.

Next

Step 8	System normal.

5. Repair Instructions:

Replace fuel injectors. Refer to 2.2.8.2 Fuel Injector Replacement.

Replace Canister solenoid valve. Refer to 2.4.7.3 Canister Solenoid Valve Replacement.

2.12.7.27 DTC P0222 P0223

1. DTC Descriptor:

DTC	P0222	Electronic Throttle Position Sensor 2 Circuit Low Voltage

DTC	P0223	Electronic Throttle Position Sensor 2 Circuit High-Voltage

TPS2 sensor sends signal through ECT harness connector EO27 terminal C to ECM through ECM harness connector EO01 terminal No.26. If the TPS2 sensor signal is lost, ECM is still able to receive the normal TPS1 sensor signal, then ECM controls the engine enter "reliability of determining the driver's intention decline or no high power output mode". Engine responds to the pedal changes slow and engine power output will be significantly weaker, although the vehicle can still be able to driving in normal traffic.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0122	Hardware Circuit Malfunction	TPS signal end short to ground or open, the input signal is less than 8%, DTC code set.	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0123	Hardware Circuit Malfunction	TPS signal end short to power supply, input signal is greater than 92.7%, DTC code set.	

3. Schematic:

Refer to 2.12.7.21 DTC P0122 P0123.

4. Diagnostic Steps:

Step 1	Check for DTC codes P0641, P0651, P0222, P0223.

(a) Connect scan tool to the datalink connector.

(b) Turn the ignition switch to "ON" position.

(c) Press the scan tool power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results:

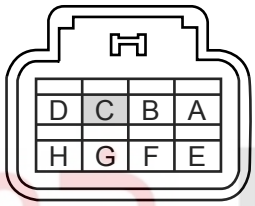
DTC Codes Shown	To Step
only P0222, P0223	Yes
P0122, P0123, P0641, P0651	No

No → Refer to 2.12.7.46 DTC P0641 P0651

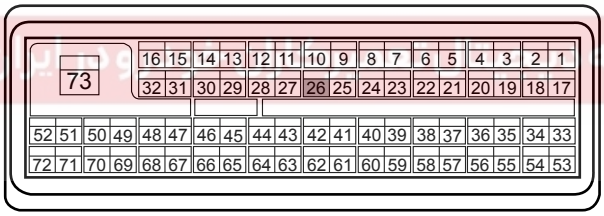
Yes

Step 2	Check EO27 terminal C.

Electronic Throttle Body Harness Connector EO27



ECM Harness Connector EO01



FE02-5237b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ETC harness connector EO27.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between EO27 terminal C and a reliable ground.
(e) Measure voltage between EO27 terminal C and a reliable ground.
(f) Test continuity between EO27 terminal C and EO01 terminal No.26.

Results:

Test Items	Standard Value
Resistance Between EO27 (C) and A Reliable Ground	10 kΩ or higher
Voltage Between EO27 (C) and A Reliable Ground	0 V
EO27 (C) and EO01 (26) Continuity	Less than 1 Ω

Is the value specified value?

No → Circuit malfunction, repair the circuit.

Yes

Step 3	Check terminal C voltage output signal.

(a) Connect ETC harness connector EO27.
(b) Connect ECM harness connector EO01.
(c) Measure ETC harness connector EO27 terminal C output voltage.

Standard Value: Refer to 2.12.7.12 Electronic Throttle Body (ETC) Check.

Is the output voltage value specified value?

No → Replace the electronic throttle body (ETC). Refer to the throttle replacement.

Yes

Step 4	Check ECM power supply circuit and ground circuit.

(a) Check ECM Power Supply Circuit and ground circuit. Refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Repair power and ground fault circuits.

Yes

Step 5	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 6	Carry out crankshaft position sensor self learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 7	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code.

Verify the system output is DTC free.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 8	Diagnostic completed.

5. Repair Instructions:

Electronic throttle body (ETC) can only be replaced as an assembly. Do not disassemble it and repair. Refer to "Electronic Throttle Body Replacement".

2.12.7.28 DTC P0230

1. DTC Descriptor:

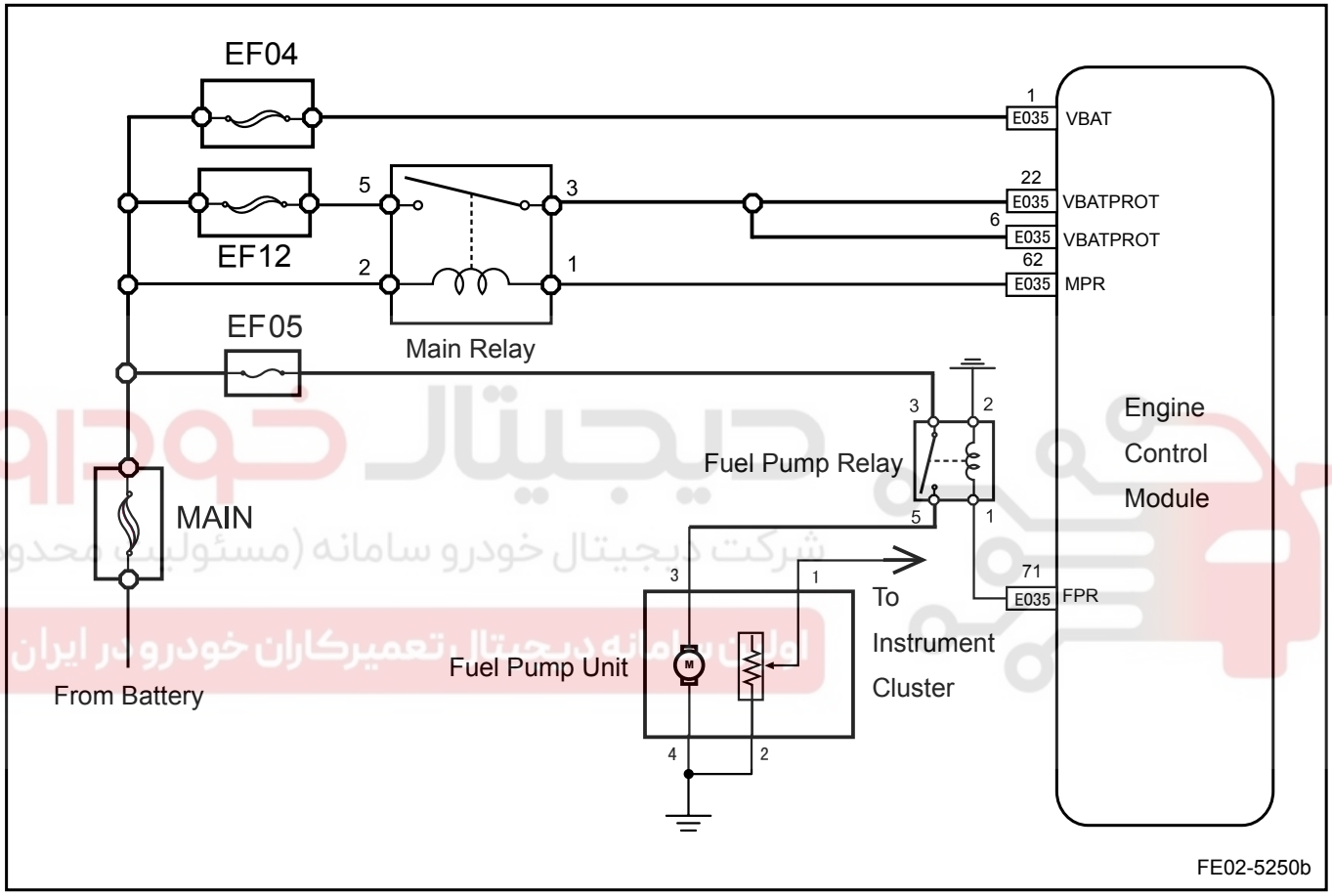
DTC	P0230	Fuel Pump Relay Malfunction

The power pump relay coil working voltage is provided by ECM. ECM provides power through ECM harness connector EO35 terminal No.71 to pump relay terminal No.1. The fuel pump is grounded through the terminal No.2, pump relay pull-in. ECM has an internal detection circuit. By monitoring the feedback voltage ECM determines whether the control circuit is open, short to ground or short to voltage.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0230	Hardware Circuit Checks	The ignition switch is turned on, turning on time longer than the system preset threshold. the fuel pump relay voltage is too high or too low.	1. Relay Circuit 2. Relay 3. ECM

3. Schematic



4. Diagnostic Steps:

For fuel pump relay diagnostic. Refer to 2.13.1.1 Fuel Pump Inoperative.

2.12.7.29 DTC P0261 P0262

1. DTC Descriptor:

DTC	P0261	Cylinder No.1 Fuel Injector Circuit Low Voltage Fault

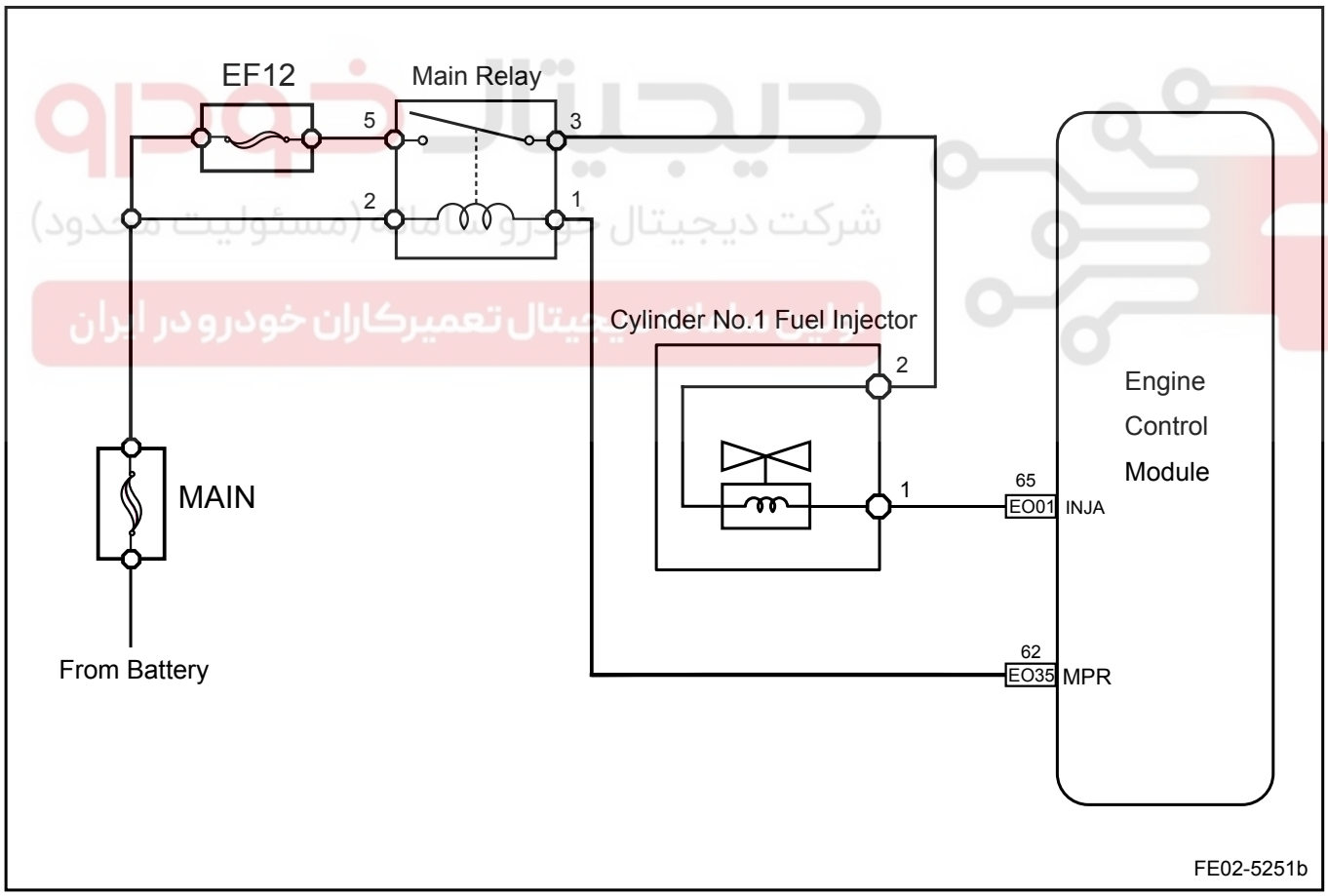
DTC	P0262	Cylinder No.1 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.1. ECM controls Cylinder No.1 fuel injector internal ground circuit through ECM harness connector EO01 terminal No.65. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0261	Hardware Circuit Checks	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM
P0262	Hardware Circuit Checks	Injector Signal Circuit Short To Power Supply	1. Sensor Circuit 2. Sensor 3. ECM

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

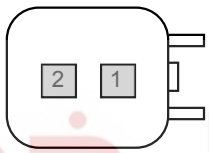
Step 1	Initial Inspection

(a) Check for fuel injector wiring harness connector damage, poor connection, aging and signs of loosening.

Next

Step 2	Measure the fuel injector resistance.

Cylinder No.1 Fuel Injector



FE02-5052b

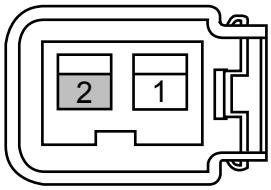
(a) Disconnect the fuel injector wiring harness connector EO11.
(b) Measure resistance between the two fuel injector terminals.
Standard Resistance: 11.6-12.4 Ω at 20°C(68 ºF)
(c) Connect the fuel injector wiring harness connector EO11.

No → Replace fuel injector. Refer to 2.2.8.2 Fuel Injector Replacement.

Yes

Step 3	Measure fuel injector working power supply.

Cylinder No.1 Fuel Injector Harness Connector EO11



FE02-5252b

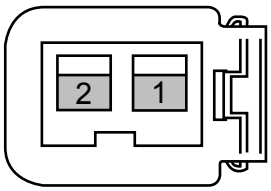
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.1 fuel injector wiring harness connector EO11.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between cylinder No.1 fuel injector wiring harness connector EO11 terminal No.2 and a reliable ground.
Standard Voltage: 11-14 V
(e) Connect cylinder No.1 fuel injector wiring harness connector EO11.
Voltage normal?

No → Go to step 5

Yes

Step 4	Check the fuel injector control circuit.

Cylinder No.1 Fuel Injector Harness Connector EO11



FE02-5253b

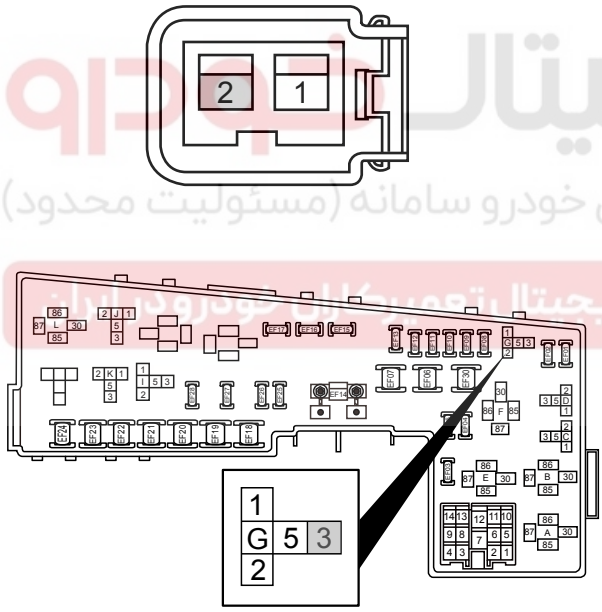
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.1 fuel injector wiring harness connector EO11.
(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EO11 terminal No.1 and 2.
(d) Start the engine.
(e) Observe whether test lamp is flashing.

Is the test lamp flashing?

No	Go to step 6
Yes	Go to step 7

Step 5	Check and repair cylinder No.1 fuel injector power circuit.

Cylinder No.1 Fuel Injector Harness Connector EO11



FE02-5254b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the fuel injector wiring harness connector EO11.
(c) Remove the engine main relay.
(d) Measure resistance between cylinder No.1 fuel injector wiring harness connector EO11 terminal No.2 and engine main relay terminal No.3.
(e) Measure resistance between cylinder No.1 fuel injector wiring harness connector EO11 terminal No.2 and a reliable ground.

Test Items	Standard Value
Resistance Between EO11 (2) and Main Relay Terminal No.3	Less than 1 Ω
Resistance Between EO11 (2) and a reliable ground	10 kΩ or higher

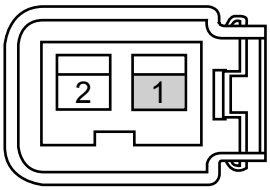
(f) Install the engine main relay.
(g) Connect cylinder No.1 fuel injector wiring harness connector EO11.

Exclude fuel injector power circuit malfunction.

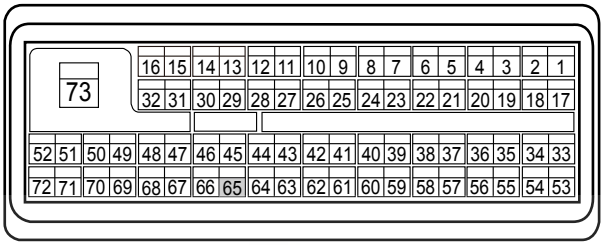
Next	Go to step 9

Step 6	Check cylinder No.1 fuel injector control circuit.

Cylinder No.1 Fuel Injector Harness Connector EO11



ECM Harness Connector EO01



FE02-5255b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.1 fuel injector wiring harness connector EO11.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between cylinder No.1 fuel injector wiring harness connector EO11 terminal No.1 and ECM harness connector terminal No.65. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure resistance between cylinder No.1 fuel injector wiring harness connector EO11 terminal No.1 and a reliable ground. Check whether the circuit is short to ground. Otherwise, repair the faulty part.
(f) Measure voltage between cylinder No.1 fuel injector wiring harness connector EO11 terminal No.1 and a reliable ground. Check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO11 (1) and EO01 (65)	Less than 1 Ω
Resistance Between EO11 (1) and A Reliable Ground	10 kΩ or higher
Voltage Between EO11 (1) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 10	Diagnostic completed.

2.12.7.30 DTC P0264 P0265

1. DTC Descriptor:

DTC	P0264	Cylinder No.2 Fuel Injector Circuit Low Voltage Fault

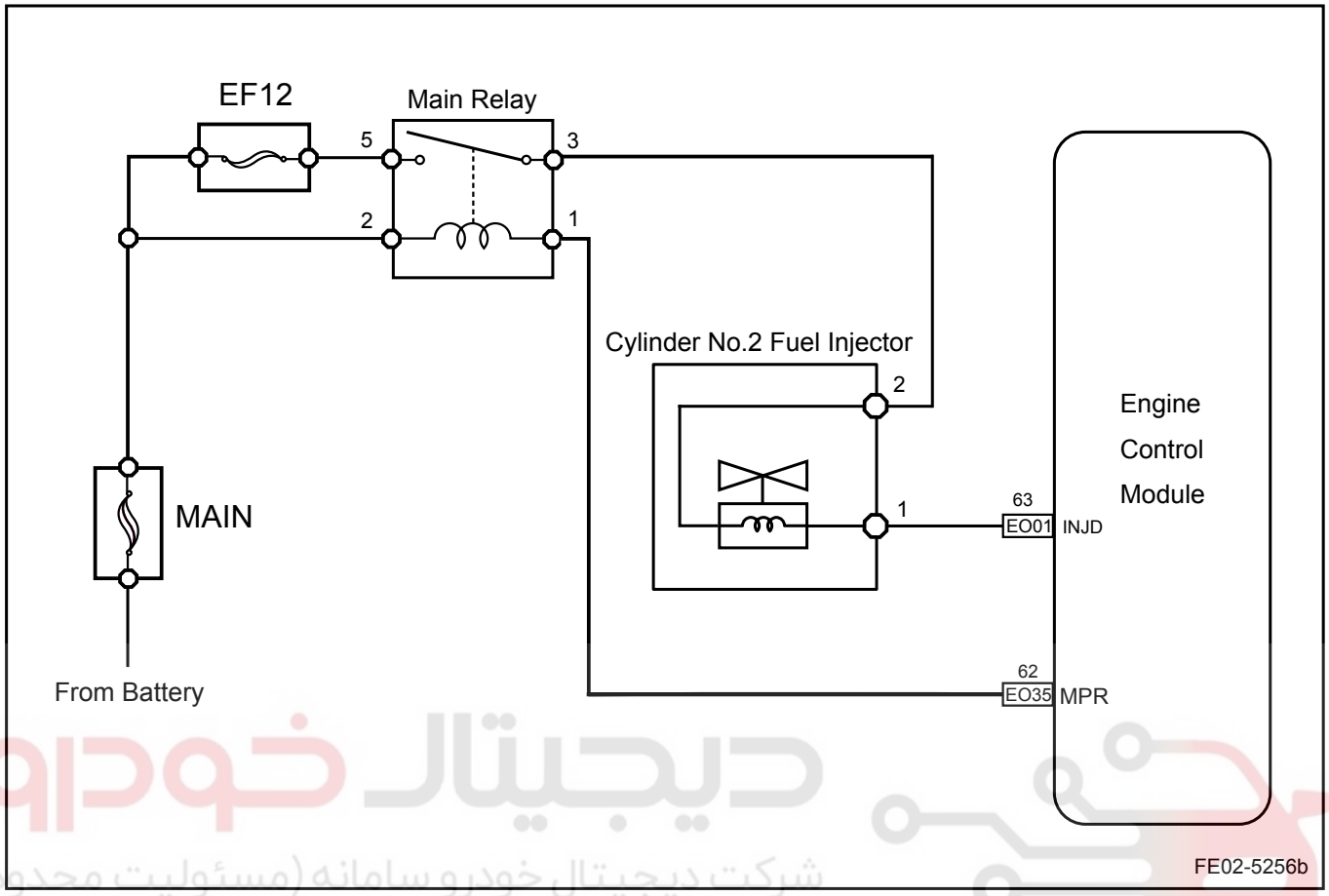
DTC	P0265	Cylinder No.2 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.1. ECM controls Cylinder No.2 fuel injector internal ground circuit through ECM harness connector EO01 terminal No.63. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0264	Hardware Circuit Checks	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM
P0265	Hardware Circuit Checks	Injector Signal Circuit Short To Power Supply	1. Sensor Circuit 2. Sensor 3. ECM

3. Schematic:



4. Diagnostic Steps:

Note

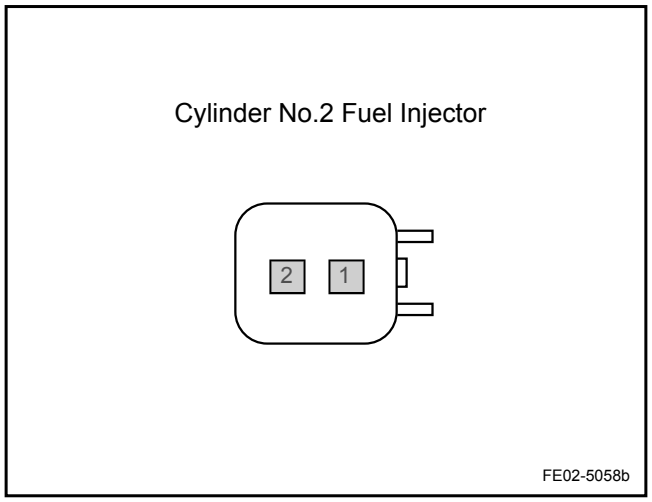
Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Check for fuel injector wiring harness connector damage, poor connection, aging and signs of loosening.

Next

Step 2	Measure the fuel injector resistance.

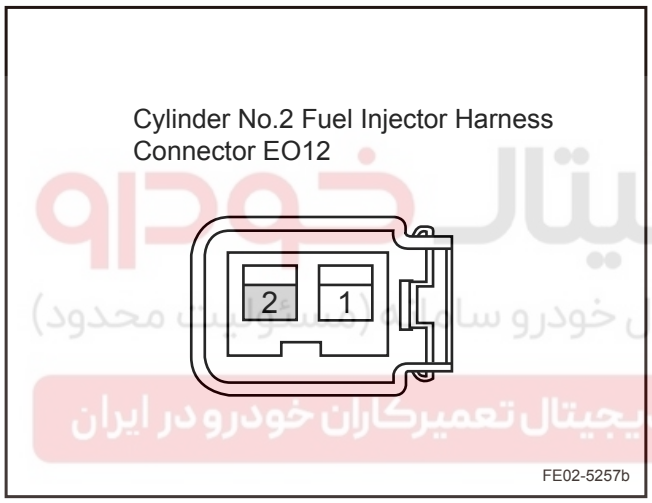


(a) Disconnect the fuel injector wiring harness connector EO12.
(b) Measure resistance between the two fuel injector terminals.
Standard Resistance: 11.6-12.4 Ω at 20°C(68 ºF)
(c) Connect the fuel injector wiring harness connector EO12.

No → Replace fuel injector. Refer to 2.2.8.2 Fuel Injector Replacement.

Yes

Step 3	Measure fuel injector working power supply.

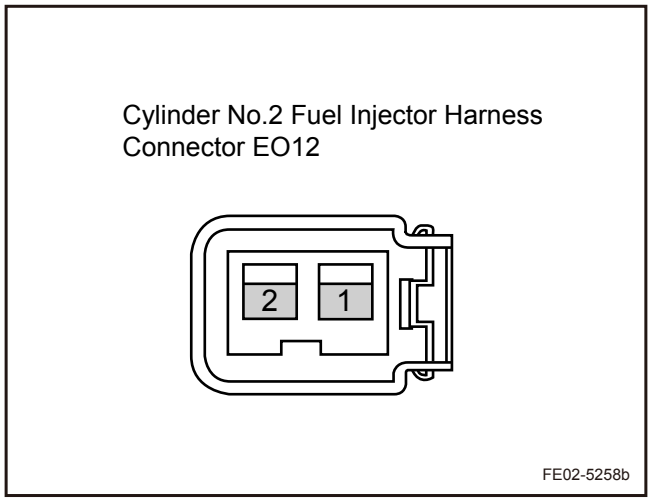


(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.2 fuel injector wiring harness connector EO12.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between cylinder No.2 fuel injector wiring harness connector EO12 terminal No.2 and a reliable ground.
Standard Voltage: 11-14 V
(e) Connect cylinder No.2 fuel injector wiring harness connector EO12.
Voltage normal?

No → Go to step 5

Yes

Step 4	Check the fuel injector control circuit.



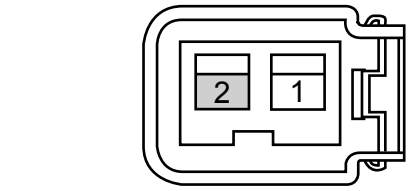
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.2 fuel injector wiring harness connector EO12.
(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EO12 terminal No.1 and 2.
(d) Start the engine.
(e) Observe whether test lamp is flashing.
Is the test lamp flashing?

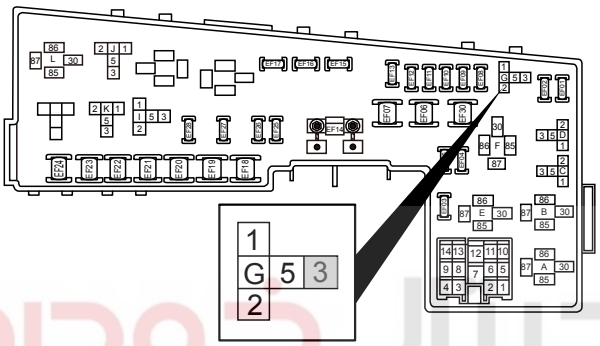
No → Go to step 6

Yes → Go to step 7

Step 5	Check and repair cylinder No.2 fuel injector power circuit.

Cylinder No.2 Fuel Injector Harness Connector EO12





FE02-5259b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the fuel injector wiring harness connector EO12.
(c) Remove the engine main relay.
(d) Measure resistance between cylinder No.1 fuel injector wiring harness connector EO12 terminal No.2 and engine main relay terminal No.3.
(e) Measure resistance between cylinder No.1 fuel injector wiring harness connector EO12 terminal No.2 and a reliable ground.

Test Items	Standard Value
Resistance Between EO12 (2) and Main Relay Terminal No.3	Less than 1 Ω
Resistance Between EO12 (2) and A Reliable Ground	10 kΩ or higher

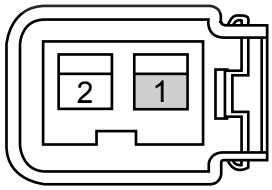
(f) Install the engine main relay.
(g) Connect cylinder No.2 fuel injector wiring harness connector EO12.

Exclude fuel injector power circuit malfunction.

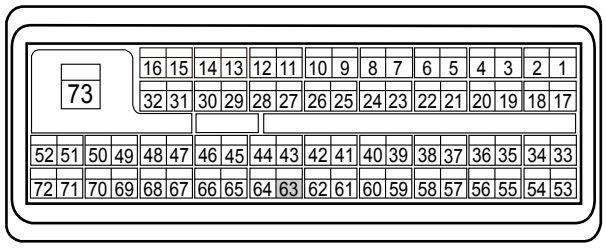
Next → Go to step 9

Step 6	Check cylinder No.2 fuel injector control circuit.

Cylinder No.2 Fuel Injector Harness Connector EO12



ECM Harness Connector EO01



FE02-5260b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.2 fuel injector wiring harness connector EO12.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between cylinder No.2 fuel injector wiring harness connector EO12 terminal No.1 and ECM harness connector terminal No.63. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure resistance between cylinder No.2 fuel injector wiring harness connector EO12 terminal No.1 and a reliable ground. Check whether the circuit is short to ground. Otherwise, repair the faulty part.
(f) Measure voltage between cylinder No.2 fuel injector wiring harness connector EO12 terminal No.1 and a reliable ground. Check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO12 (1) and EO01 (63)	Less than 1 Ω

Resistance Between EO12 (1) and A Reliable Ground	10 kΩ or higher
Voltage Between EO12 (1) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Replace the fuel injector. Refer to 2.2.8.2 Fuel Injector Replacement.

2.12.7.31 DTC P0267 P0268

1. DTC Descriptor:

DTC	P0267	Cylinder No.3 Fuel Injector Circuit Low Voltage Fault

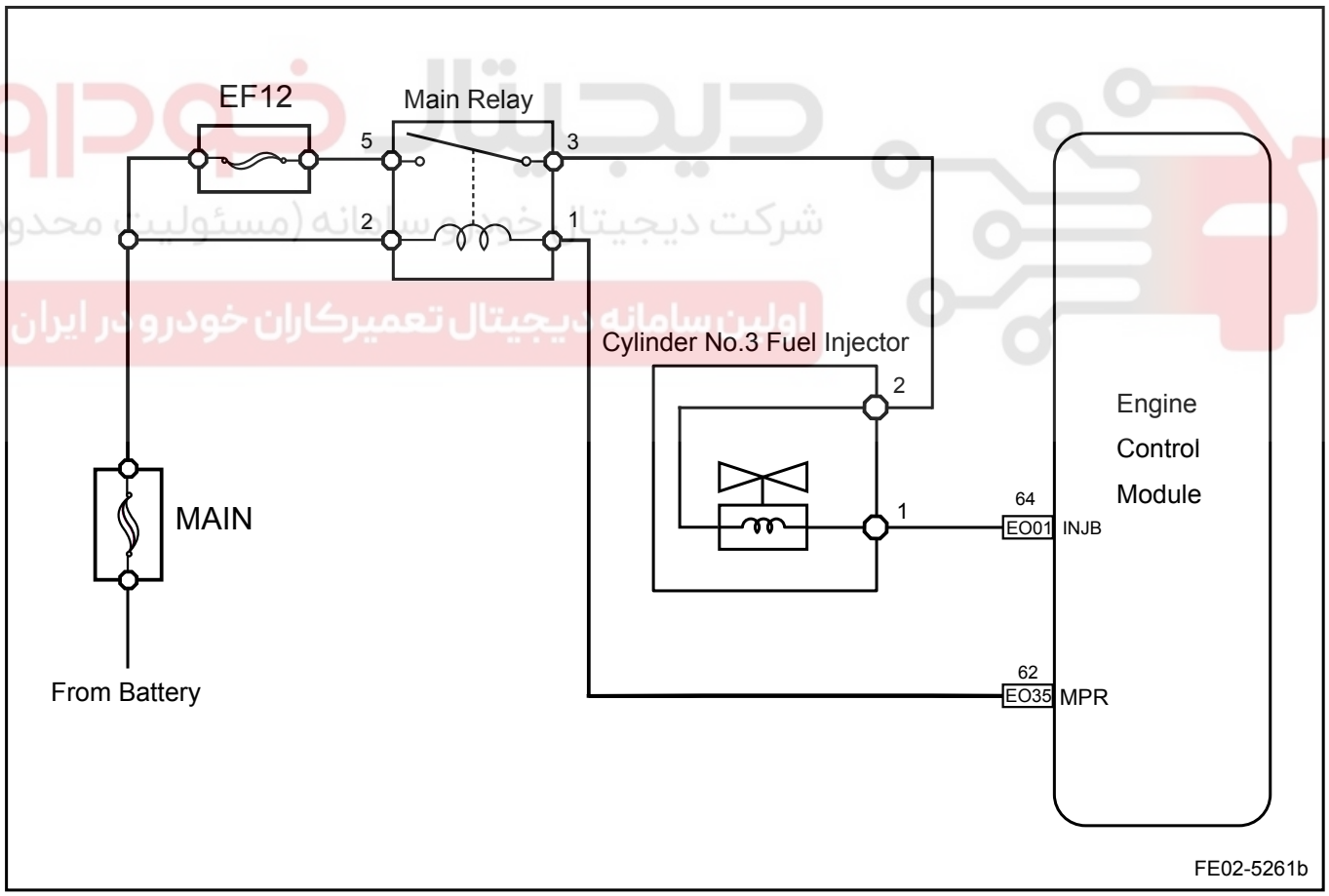
DTC	P0268	Cylinder No.3 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.1. ECM controls Cylinder No.3 fuel injector internal ground circuit through ECM harness connector EO01 terminal No.64. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0267	Hardware Circuit Checks	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM
P0268	Hardware Circuit Checks	Injector Signal Circuit Short To Power Supply	1. Sensor Circuit 2. Sensor 3. ECM

3. Schematic



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

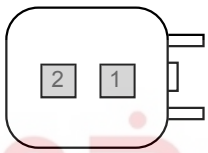
Step 1	Initial Inspection

(a) Check for fuel injector wiring harness connector damage, poor connection, aging and signs of loosening.

Next

Step 2	Measure the fuel injector resistance.

Cylinder No.3 Fuel Injector



FE02-5064b

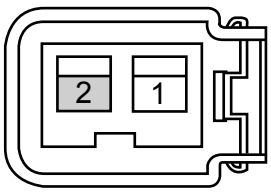
(a) Disconnect the fuel injector wiring harness connector EO13.
(b) Measure resistance between the two fuel injector terminals.
Standard Resistance: 11.6-12.4 Ω at 20°C(68 ºF)
(c) Connect the fuel injector wiring harness connector EO13.

No → Replace fuel injector. Refer to 2.2.8.2 Fuel Injector Replacement.

Yes

Step 3	Measure fuel injector working power supply.

Cylinder No.3 Fuel Injector Harness Connector EO13



FE02-5262b

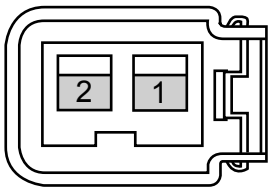
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.3 fuel injector wiring harness connector EO13.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between cylinder No.3 fuel injector wiring harness connector EO13 terminal No.2 and a reliable ground.
Standard Voltage: 11-14 V
(e) Connect cylinder No.3 fuel injector wiring harness connector EO13.
Voltage normal?

No → Go to step 5

Yes

Step 4	Check the fuel injector control circuit.

Cylinder No.3 Fuel Injector Harness Connector EO13



FE02-5263b

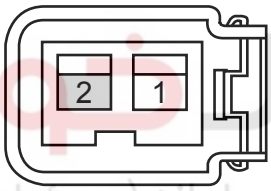
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.3 fuel injector wiring harness connector EO13.
(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EO13 terminal No.1 and 2.
(d) Start the engine.
(e) Observe whether test lamp is flashing.

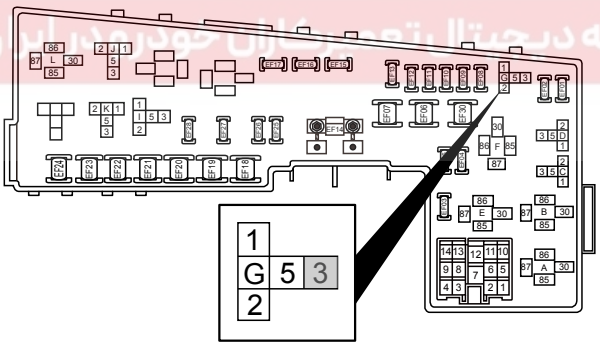
Is the test lamp flashing?

No	Go to step 6
Yes	Go to step 7

Step 5	Check and repair cylinder No.3 fuel injector power circuit.

Cylinder No.3 Fuel Injector Harness Connector EO13





FE02-5264b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the fuel injector wiring harness connector EO13.
(c) Remove the engine main relay.
(d) Measure resistance between cylinder No.3 fuel injector wiring harness connector EO13 terminal No.2 and engine main relay terminal No.3.
(e) Measure resistance between cylinder No.3 fuel injector wiring harness connector EO13 terminal No.2 and a reliable ground.

Test Items	Standard Value
Resistance Between EO13 (2) and Main Relay Terminal No.3	Less than 1 Ω
Resistance Between EO13 (2) and A Reliable Ground	10 kΩ or higher

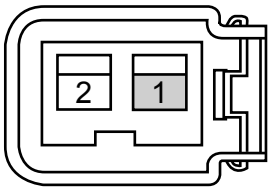
(f) Install the engine main relay.
(g) Connect cylinder No.3 fuel injector wiring harness connector EO13.

Exclude fuel injector power circuit malfunction.

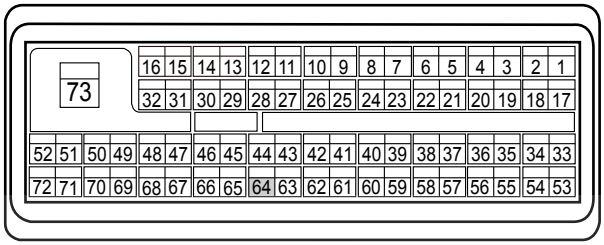
Next	Go to step 9

Step 6	Check cylinder No.3 fuel injector control circuit.

Cylinder No.3 Fuel Injector Harness Connector EO13



ECM Harness Connector EO01



FE02-5265b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.3 fuel injector wiring harness connector EO13.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between cylinder No.3 fuel injector wiring harness connector EO13 terminal No.1 and ECM harness connector terminal No.64. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure resistance between cylinder No.3 fuel injector wiring harness connector EO13 terminal No.1 and a reliable ground. Check whether the circuit is short to ground. Otherwise, repair the faulty part.
(f) Measure voltage between cylinder No.3 fuel injector wiring harness connector EO13 terminal No.1 and a reliable ground. Check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO13 (1) and EO01 (64)	Less than 1 Ω
Resistance Between EO13 (1) and A Reliable Ground	10 kΩ or higher
Voltage Between EO13 (1) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Replace the fuel injector. Refer to 2.2.8.2 Fuel Injector Replacement.

2.12.7.32 DTC P0270 P0271

1. DTC Descriptor:

DTC	P0270	Cylinder No.4 Fuel Injector Circuit Low Voltage Fault

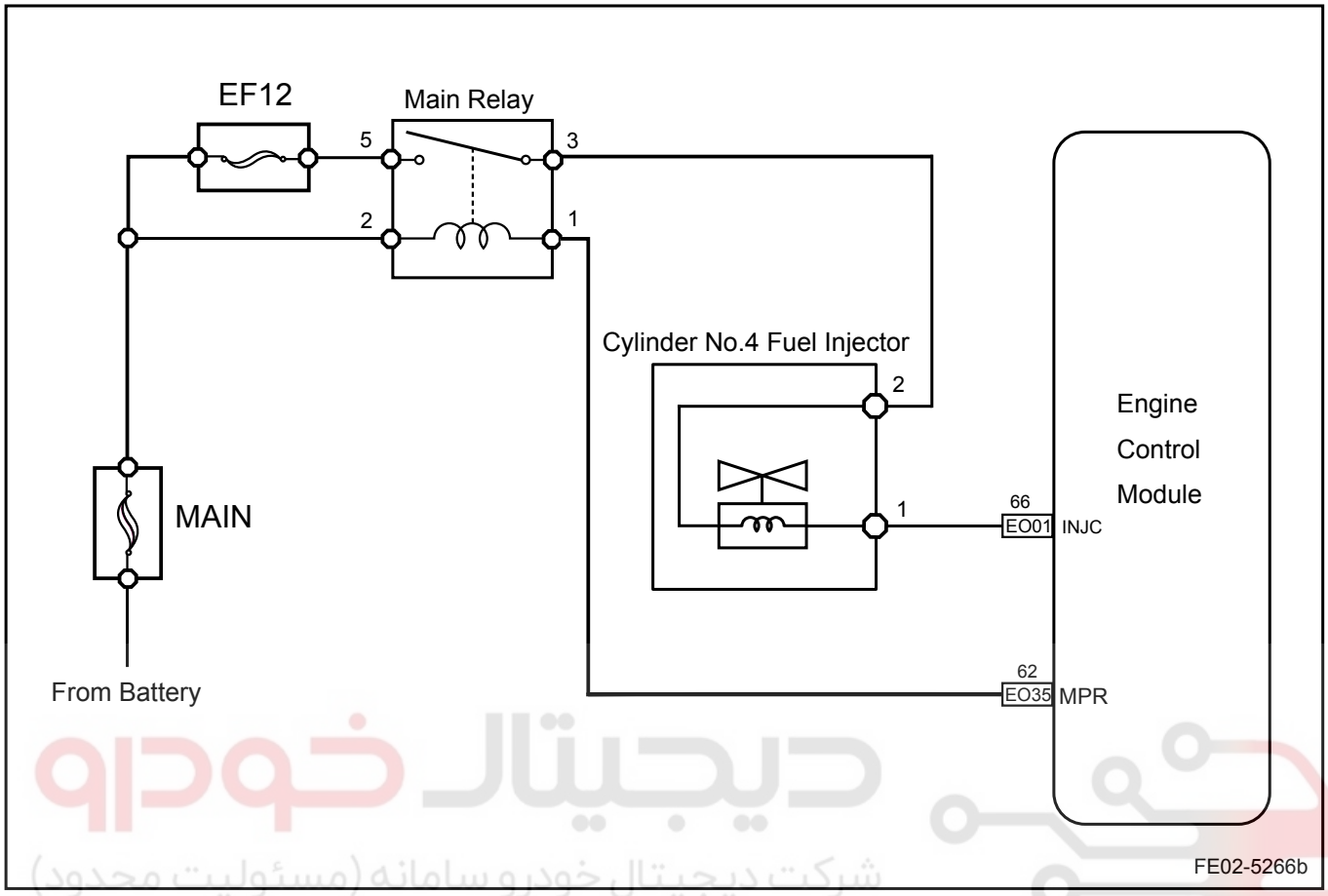
DTC	P0271	Cylinder No.4 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.1. ECM controls Cylinder No.4 fuel injector internal ground circuit through ECM harness connector EO01 terminal No.66. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0270	Hardware Circuit Checks	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM
P0271	Hardware Circuit Checks	Injector Signal Circuit Short To Power Supply	1. Sensor Circuit 2. Sensor 3. ECM

3. Schematic:



4. Diagnostic Steps:

Note

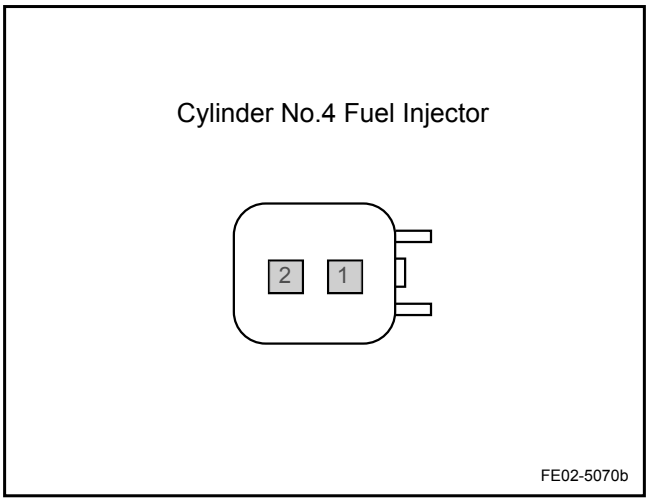
Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Check for fuel injector wiring harness connector damage, poor connection, aging and signs of loosening.

Next

Step 2	Measure the fuel injector resistance.

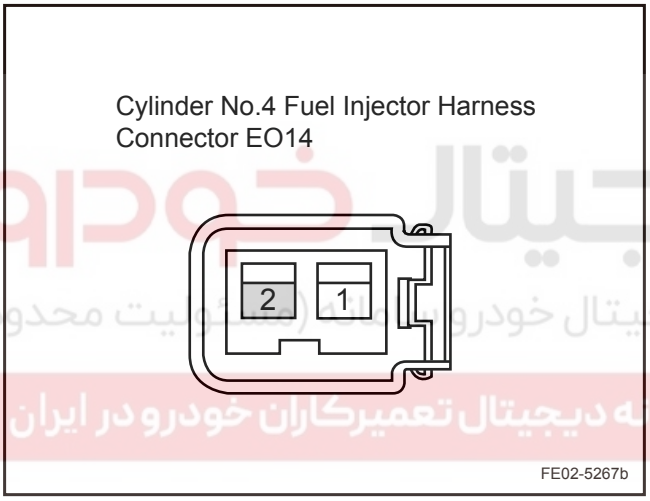


(a) Disconnect the fuel injector wiring harness connector EO14.
(b) Measure resistance between the two fuel injector terminals.
Standard Resistance: 11.6-12.4 Ω at 20°C(68 ºF)
(c) Connect the fuel injector wiring harness connector EO14.

No → replace fuel injector. Refer to 2.2.8.2 Fuel Injector Replacement.

Yes

Step 3	Measure fuel injector working power supply.

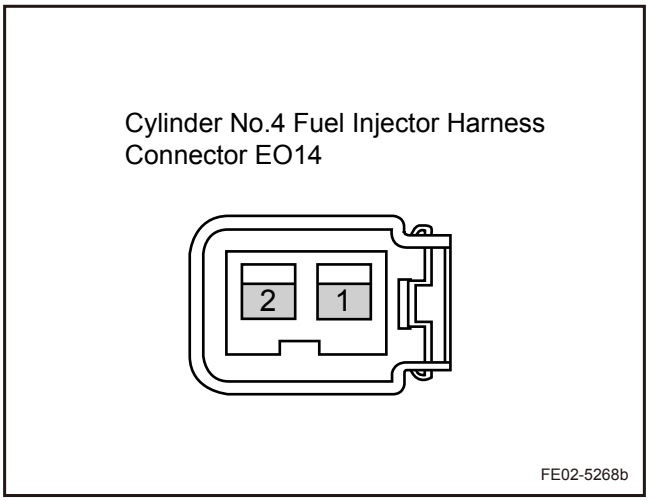


(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.4 fuel injector wiring harness connector EO14.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between cylinder No.4 fuel injector wiring harness connector EO14 terminal No.2 and a reliable ground.
Standard Voltage: 11-14 V
(e) Connect cylinder No.4 fuel injector wiring harness connector EO14.
Voltage normal?

No → Go to step 5

Yes

Step 4	Check the fuel injector control circuit.



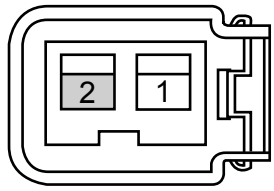
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.4 fuel injector wiring harness connector EO14.
(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EO14 terminal No.1 and 2.
(d) Start the engine.
(e) Observe whether test lamp is flashing.
Is the test lamp flashing?

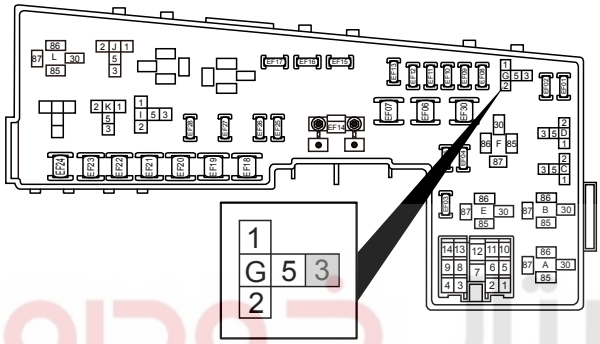
No → Go to step 6

Yes → Go to step 7

Step 5	Check and repair cylinder No.4 fuel injector power circuit.

Cylinder No.4 Fuel Injector Harness Connector EO14





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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the fuel injector wiring harness connector EO14.
(c) Remove the engine main relay.
(d) Measure resistance between cylinder No.4 fuel injector wiring harness connector EO14 terminal No.2 and engine main relay terminal No.3.
(e) Measure resistance between cylinder No.4 fuel injector wiring harness connector EO14 terminal No.2 and a reliable ground.

Test Items	Standard Value
Resistance Between EO14 (2) and Main Relay Terminal No.3	Less than 1 Ω
Resistance Between EO14 (2) and A Reliable Ground	10 kΩ or higher

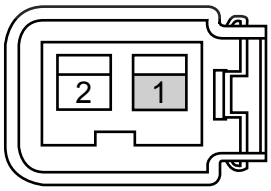
(f) Install the engine main relay.
(g) Connect cylinder No.4 fuel injector wiring harness connector EO14.

Exclude fuel injector power circuit malfunction.

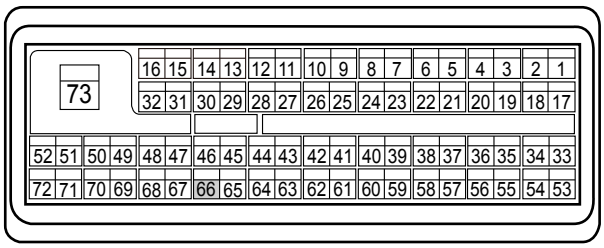
Next → Go to step 9

Step 6	Check cylinder No.4 fuel injector control circuit.

Cylinder No.4 Fuel Injector Harness Connector EO14



ECM Harness Connector EO01



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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cylinder No.4 fuel injector wiring harness connector EO14.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between cylinder No.4 fuel injector wiring harness connector EO14 terminal No.1 and ECM harness connector terminal No.66. Check whether the circuit is open. Otherwise, repair the faulty part.
(e) Measure resistance between cylinder No.4 fuel injector wiring harness connector EO14 terminal No.1 and a reliable ground. Check whether the circuit is short to ground. Otherwise, repair the faulty part.
(f) Measure voltage between cylinder No.4 fuel injector wiring harness connector EO14 terminal No.1 and a reliable ground. Check whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	Standard Value
Resistance Between EO14 (1) and EO01 (66)	Less than 1 Ω

Resistance Between EO14 (1) and a reliable ground	10 kΩ or higher
voltage between EO14 (1) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Replace the fuel injector. Refer to 2.2.8.2 Fuel Injector Replacement.

2.12.7.33 DTC P0300

1. DTC Descriptor:

DTC	P0300	One or More Cylinder Misfire

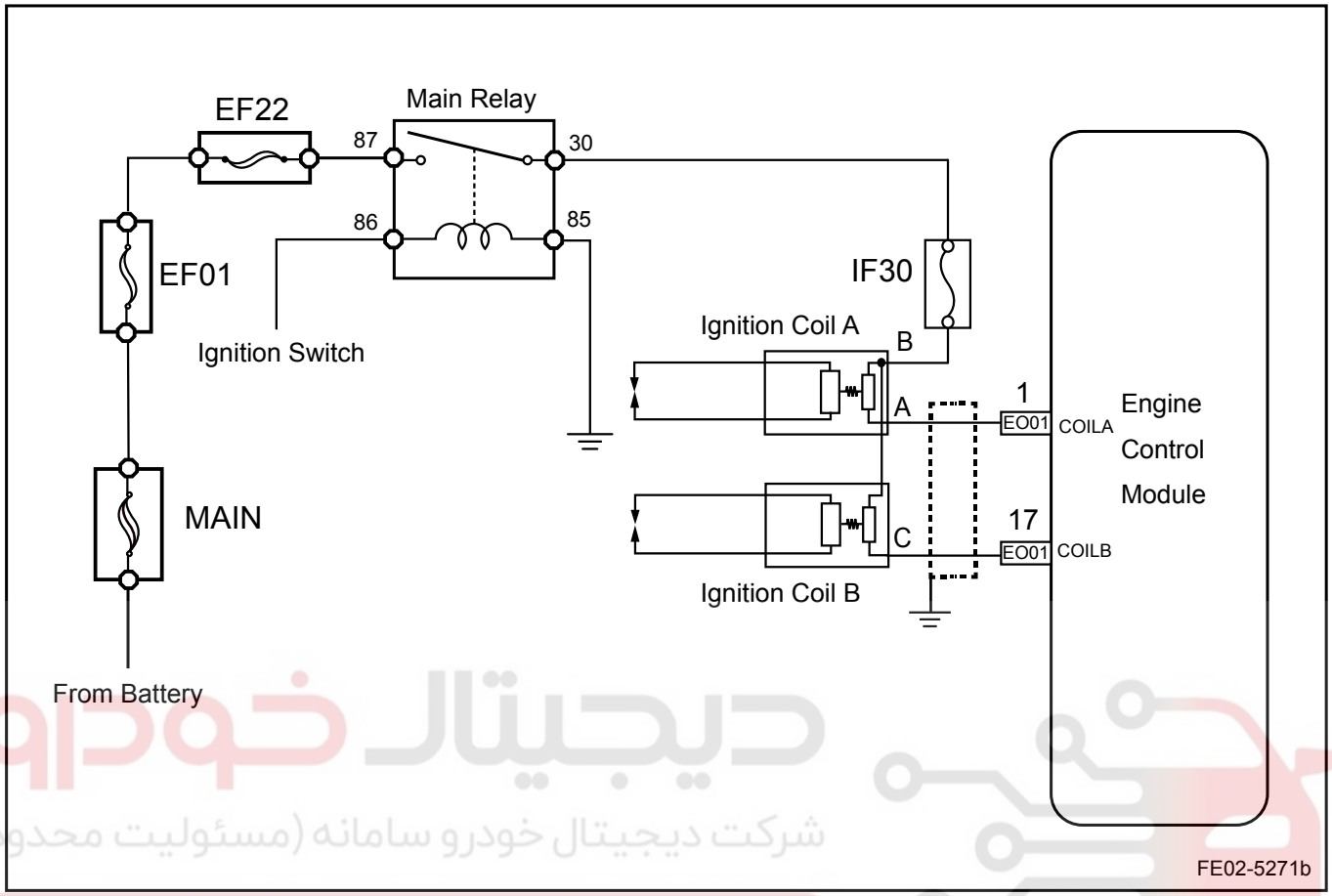
The engine control module (ECM) uses information from the crankshaft position (CKP) sensor and the camshaft position (CMP) sensors to determine when an engine misfire is occurring. By monitoring variations in the crankshaft rotation speed for each cylinder ECM is able to detect individual misfire events. When a misfire happens, unburnt mixture will be discharged into the exhaust system and burnt in the exhaust system. A misfire rate that is high enough can cause 3-way catalytic converter damage. The malfunction indicator lamp (MIL) will flash ON and OFF when the conditions for catalytic converter damage are present. A DTC will be set.

2. DTC Code Set Up and Removal Conditions:

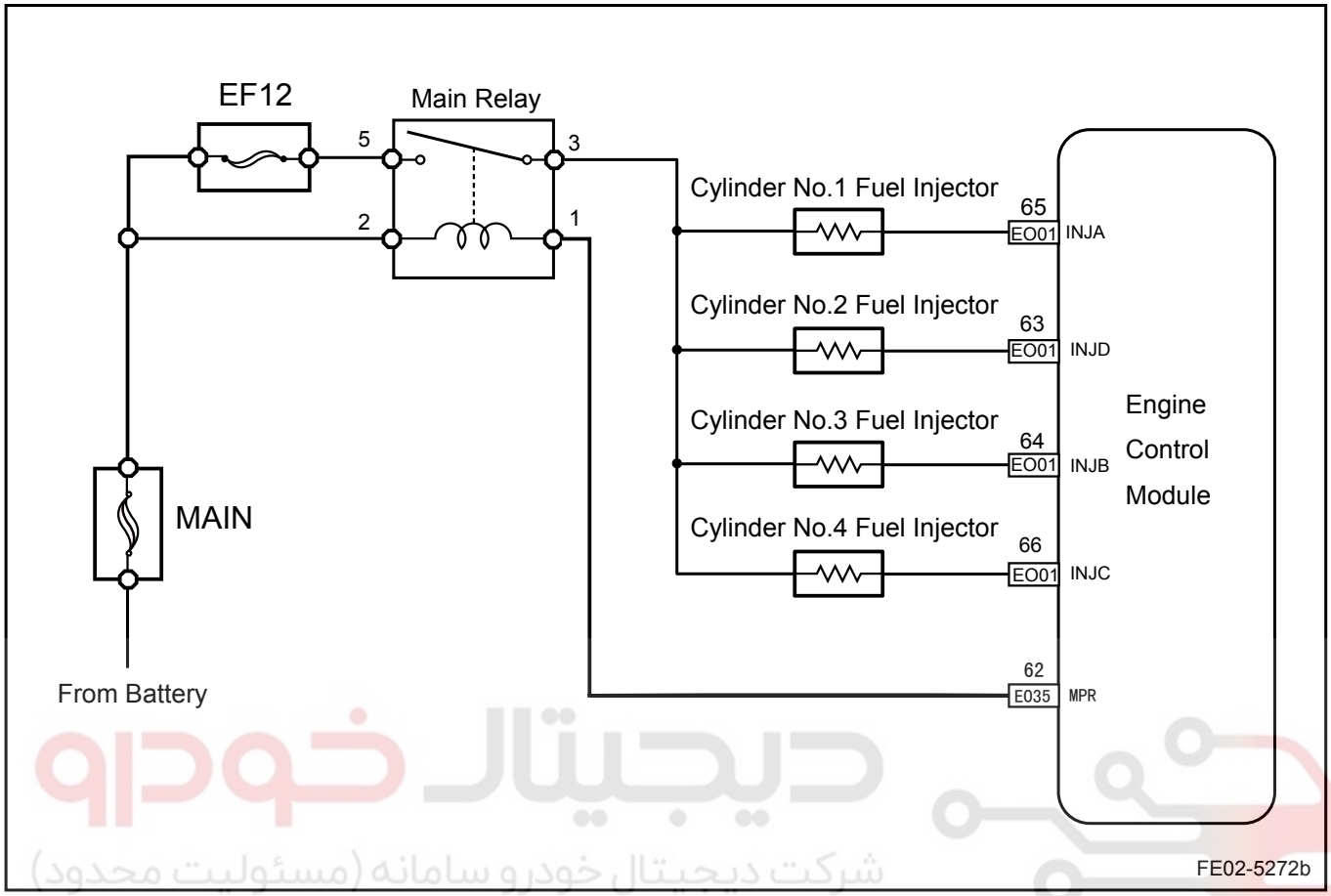
DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0300	Under stable operating conditions, ECM detects the crankshaft rotation speed fluctuations.	Under stable operating conditions, when ECM detect fluctuations in the crankshaft rotation speed exceeds the preset threshold value and when a mild misfire occurs, there is no emergency control programs. System only records the DTC code and data flow, and malfunction lamp light. When there a serious misfire, the system will be forced into the open-loop control mode, and the oxygen sensor learn is not allowed. The malfunction lamp will flash at 1 Hz frequency.	1. Connector Loose or Poor Connection 2. Vacuum Tube Hose Broken or Loose 3. Ignition System 4. Fuel Injectors 5. Fuel Pressure 6. Intake Air Pressure Sensor 7. Engine Coolant Temperature Sensor 8. Cylinder Compression Pressure 9. Valve Clearance and Timing 10. Evaporative Emission Control System 11. Purged Crankcase Ventilation System 12. Intake System 13. Poor Exhaust System Ventilation 14. ECM

3. Schematic:

Ignition System



Fuel Injector



4. Diagnostic Steps:

Note

- If the control system stores DTC other than misfire, diagnose these DTC first and eliminate the faults.
- If the vehicle does not have a misfire when sent to a service station, road test the vehicle, so that the misfire will occur again. Use scan tool to record ECM data when misfire is occurring, in order to facilitate analyzing the cause of the fault.
- If after a long period road test, ECM does not store any misfire associated DTC codes, then the fault may be due to the following reasons:
  - Overfill fuel tank and fuel enters into the evaporative emission control system, so that the mixture is too rich and causes misfire.
  - Use improper fuel caused poor combustion and misfire.
  - Contaminated spark plug causes the ignition failure and misfire.
  - Carry out basic checks at fault locations identified by DTC codes.
- Road test the vehicle after repair to confirm no DTC is stored.

Step 1	Initial Inspection

(a) Check the wiring harness connector for damage, poor connection, aging or signs of loosening.

(b) Check the vacuum tube for damaged, loose, leakage and so on.

Next

Step 2	Check for other DTC codes.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.
Results:

DTC Codes Shown	To Step
DTC Codes Other Than DTC P0300-P0304	No
DTC P0300	Yes

No → Refer to 2.12.7.14 DTC Code Index.

Yes

Step 3	Check valves and air intake system.

(a) Check vacuum solenoid valve Canister connection is correct or not and leakage.
(b) Check the vacuum brake booster vacuum tube connection is correct or not and leakage.
(c) Check the intake tube pressure sensor connection is correct or not and leakage.
(d) Check purged crankcase ventilation valve, ventilation pipe connection is correct or not and leakage.
(e) Check whether there is intake leakage.
Is there above mentioned fault?

Yes → Repair the faulty part. Go to step 17

No

Step 4	Check the spark plug.

(a) Remove the spark plug from the misfire cylinder.
(b) Check whether the spark plug gap is too large or too small.
Standard Gap: 0.8-1.0 mm (0.031-0.039 in)
(c) Check the existence of spark plug electrode erosion, damage.
(d) Check whether the spark plug and the electrode part skirt is wet or not and check the existence of a serious gasoline leakage.
(e) Reinstall the spark plug.
Is there above mentioned fault?

Yes → Replace the spark plug. Refer to 2.10.8.4 Spark Plug Replacement. Go to step 8

No

Note

Prior to the implementation of this program, the following conditions must be met:

1. Disconnect all fuel injector connectors.
2. Engine running time must not be longer than 5 s.

Step 5	Check whether the spark plug arcing is normal.

(a) Test the spark.
(b) Remove misfire cylinder ignition wires.
(c) Disconnect all fuel injector cylinder connectors.
(d) Install the ignition wires to the spark plug.
(e) Run the engine (the engine running time no longer than 5s) and check the arcing.
(f) Reconnect all cylinder fuel injector connectors.
(g) Install the ignition wires.

Is spark plug arcing normal?

No → Go to step 9

Yes

Step 6	Check the misfire cylinder compression pressure.

(a) For detailed steps. Refer to .

Is cylinder compression pressure normal?

Yes → Go to step 10

No

Step 7	Check the cause of cylinder compression pressure too low. Refer to the "Engine Mechanical System" in the2.6.7 Diagnostic Information and Procedures.

Step 8	Check fuel and misfire cylinder fuel injectors.

(a) Check whether there is fuel injectors leakage and stagnate.
(b) Check fuel quality.

Is there above mentioned fault?

Yes → Repair the faulty part. Go to step 17

No

Note

Prior to the implementation of this test, the following conditions must be met:

1. Disconnect all fuel injector connectors.

2. Run the engine for no longer than 5 s.

Step 9	Use a properly working spark plug and check whether there is misfire cylinder arcing.

(a) Replace the installed spark plug with a spark plug that works properly.
(b) Test spark plug.
(c) Remove misfire cylinder ignition wires.
(d) Disconnect all fuel injector cylinder connectors.
(e) Install the ignition wires to the spark plug.
(f) Run the engine (the engine running time no longer than 5 s) and check the arcing.
(g) Reconnect all cylinder fuel injector connectors.
(h) Install the ignition wires.

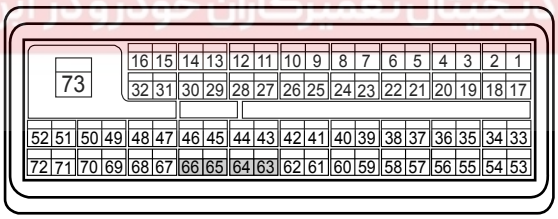
Is spark plug arcing normal?

No → Check the ignition coil and ignition wire. Go to step 17

Yes → Replace the spark plug. Refer to 2.10.8.4 Spark Plug Replacement. Go to step 17

Step 10	Check ECM control connector terminal voltage of the misfire cylinder fuel injector.

ECM Harness Connector EO01



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(a) Turn the ignition switch to the "ON" position.
(b) Remove ECM harness connector EO01.
(c) Measure ECM harness connector EN01 terminal voltage according to the following table.

Connector Terminal	Standard Value
EO01 (65)	9-14 V
EO01 (63)	
EO01 (64)	
EO01 (66)	

Is voltage the specified value?

No → Check the fuel injector circuit. Refer to 2.12.7.29 DTC P0261 P0262.

Yes

Step 11	Check the misfire cylinder valve gap.

(a) Refer to the "Engine Mechanical System" in the2.6.8.20 Valve Clearance Adjustments, Is valve clearance normal?

No → Adjust the valve clearance. Go to step 17

Yes

Step 12	Check valve timing system.

(a) Refer to the "Engine Mechanical System" in the2.6.8.9Timing Chain Cover Replacement, Is valve timing normal?

No → Adjust the valve timing. Go to step 17

Yes

Step 13	Check the fuel pressure.

(a) Refer to "Fuel System" in the2.3.7.7 Fuel Pressure Testing Procedure, Is fuel pressure normal?

No → Check fuel system: fuel pump, fuel filter, fuel pipe circuit and fuel pressure regulator.

Yes

Step 14	Check whether the data in the data stream table is normal.

(a) Check intake air pressure sensor data.
(b) Check engine coolant temperature sensor data.
(c) Check throttle position sensor.
Are these components normal?

No → Replace the damaged components. Go to step 17

Yes

Step 15	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 16	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 17	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 18	Diagnostic completed.

5. Repair Instructions:

Replace the spark plug. Refer to 2.10.8.4 Spark Plug Replacement.

2.12.7.34 DTC P0324 P0325

1. DTC Descriptor:

DTC	P0324	Knock Control System Malfunction

DTC	P0325	Knock Sensor Malfunction

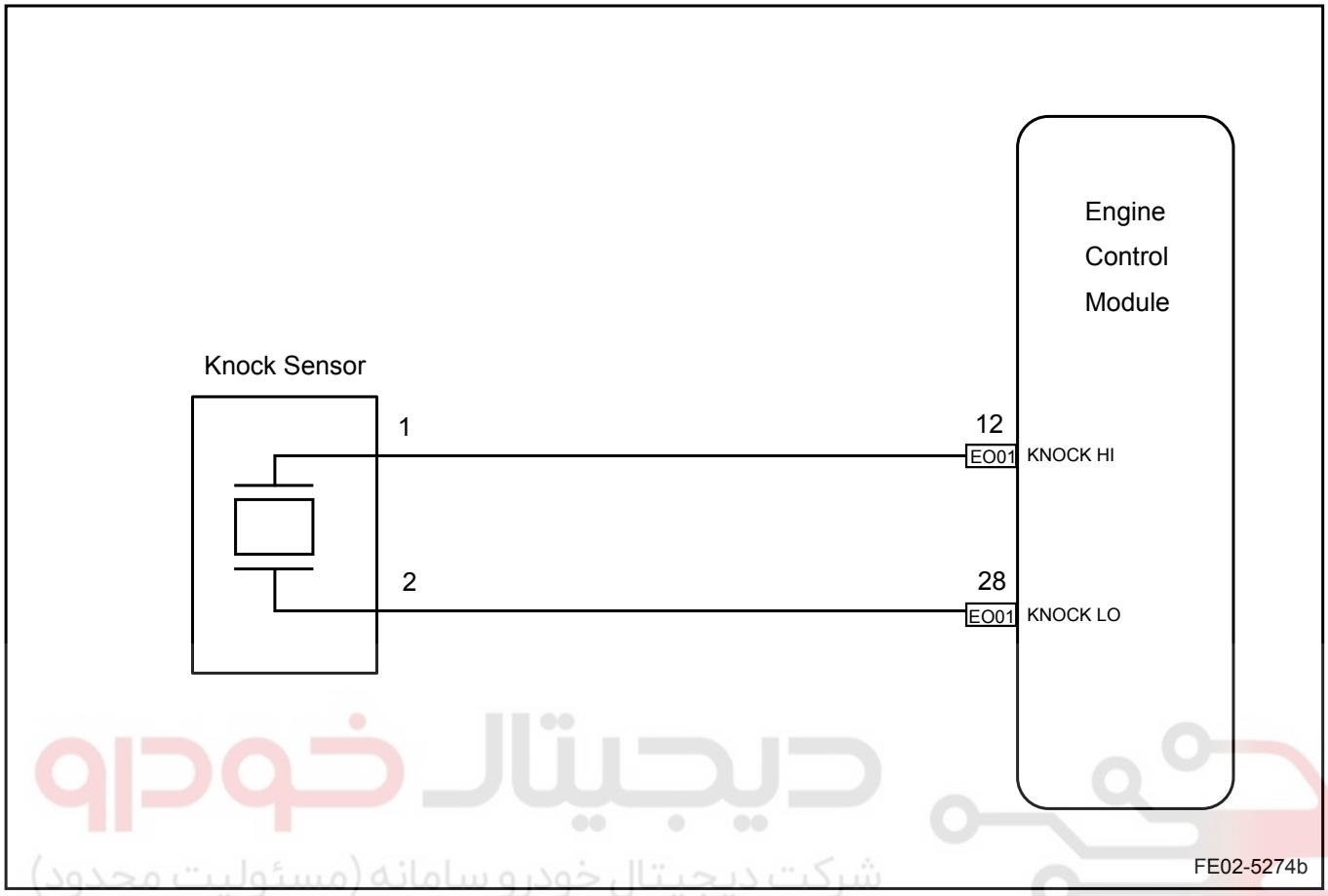
KS sensor to ECM feedback signal helps ECM control the ignition timing to achieve the optimal operation and the ignition system to achieve the best performance, as well as to prevent damage to the engine by a potential knock. KS sensor is located below the intake manifold on the cylinder. KS sensor voltage changes with the AC signal generated by the vibration with running engine. Engine control module adjusts spark timing according to KS sensor signal amplitude and frequency.

ECM receives signals from KS sensor harness connector EN08 terminal No.1 and 2 through ECM harness connector EN01 terminal No.12 and 28.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0324	Shock Control System Malfunction	1. Engine speed is higher than 1,600 rpm. 2. Certain Load Conditions. 3. Sensor signal circuit is short to ground.	1. Sensor Circuit 2. Sensor 3. ECM
P0325	Knock Sensor Malfunction	1. Engine speed is higher than 1,600 rpm. 2. Certain Load Conditions. 3. Sensor Signal Circuit Open.	

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Check whether there is KS sensor physical damage.
(b) Check whether KS sensor is installed correctly. Torque is set too tight or too loose will trigger DTC codes.
(c) Check KS sensor installation surface whether there are glitches, casting flash and foreign matter.
(d) Knock sensor must be kept away from hoses, brackets and engine wires.

Are above mentioned parts normal?

No → Repair the faulty part. Go to step 9

Yes

Step 2	Read the engine data (engine speed) on the scan tool.

(a) Connect scan tool to datalink connector.

(b) Turn the ignition switch to "ON" position.
(c) Select "Engine"/"Read Data"/"Knock Sensor Signal 1".
(d) Start and run the engine at normal working temperature.
(e) Road test the vehicle and read the engine speed data on the scan tool.

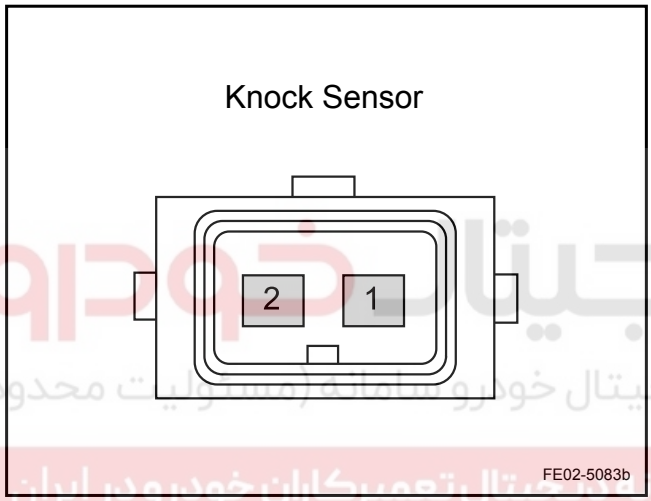
Is data normal?

Standard Value: Normal data. Refer to 2.12.7.9 Data Stream List.

No → Go to step 4

Yes

Step 3	Intermittent Fault. Refer to 2.12.7.4 Symptoms Table.
Step 4	Check the knock sensor.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect Knock Sensor harness connector EN08.
(c) Measure knock sensor resistance.

Standard Resistance: >1M Ω at 25°C(77 °F)

(d) Connect Knock Sensor harness connector EN08.

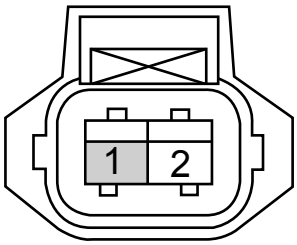
Is resistance normal?

No → Replace the knock sensor. Refer to 2.10.8.5 Knock Sensor Replacement.

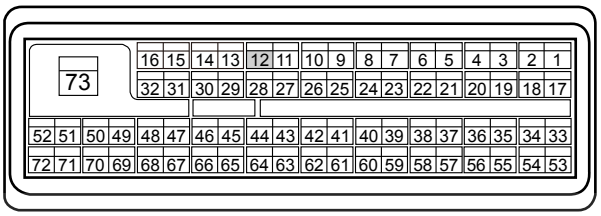
Yes

Step 5	Check sensor terminal No.1 line.

Knock Sensor Harness Connector EO08



ECM Harness Connector EO01



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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect Knock Sensor harness connector EN08.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between knock sensor harness connector EN08 terminal No.1 and ECM harness connector EN01 terminal No.12. Check whether the circuit is open.
(e) Measure resistance between knock sensor harness connector EN08 terminal No.1 and a reliable ground. Check whether the circuit is short to ground.
(f) Measure voltage between knock sensor harness connector EN08 terminal No.1 and a reliable ground. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EN08 (1) and EN01 (12)	Less than 1 Ω
Resistance Between EN08 (1) and A Reliable Ground	10 kΩ or higher
Voltage Between EN08 (1) and A Reliable Ground	0 V

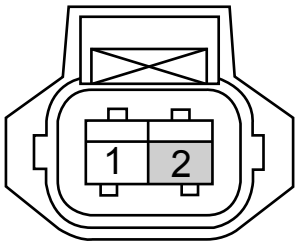
Are the values specified values?

No	Repair the faulty part. Go to step 9

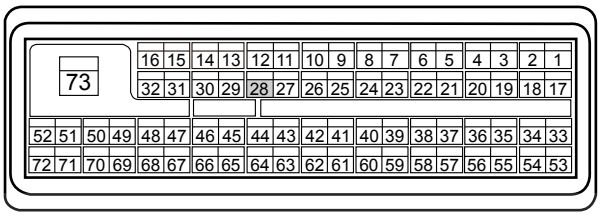
Yes

Step 6	Check sensor terminal No.2 circuit.

Knock Sensor Harness Connector EO08



ECM Harness Connector EO01



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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect Knock Sensor harness connector EO08.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between knock sensor harness connector EN08 terminal No.2 and ECM harness connector EN01 terminal No.28. Check whether the circuit is open.
(e) Measure resistance between knock sensor harness connector EN08 terminal No.2 and a reliable ground. Check whether the circuit is short to ground.
(f) Measure voltage between knock sensor harness connector EN08 terminal No.2 and power supply. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EN08 (2) and EN01 (28)	Less than 1 Ω
Resistance Between EN08 (2) and A Reliable Ground	10 kΩ or higher
Voltage Between EN08 (2) and A Reliable Ground	0 V

Are the values specified values?

No → Repair the faulty part. Go to step 9

Yes

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Replace the knock sensor. Refer to 2.10.8.5 Knock Sensor Replacement.

2.12.7.35 DTC P0335 P0336

1. DTC Descriptor:

DTC	P0335	Crankshaft Position Sensor Circuit No Signal

DTC	P0336	Crankshaft Position Sensor Circuit Signal Interference

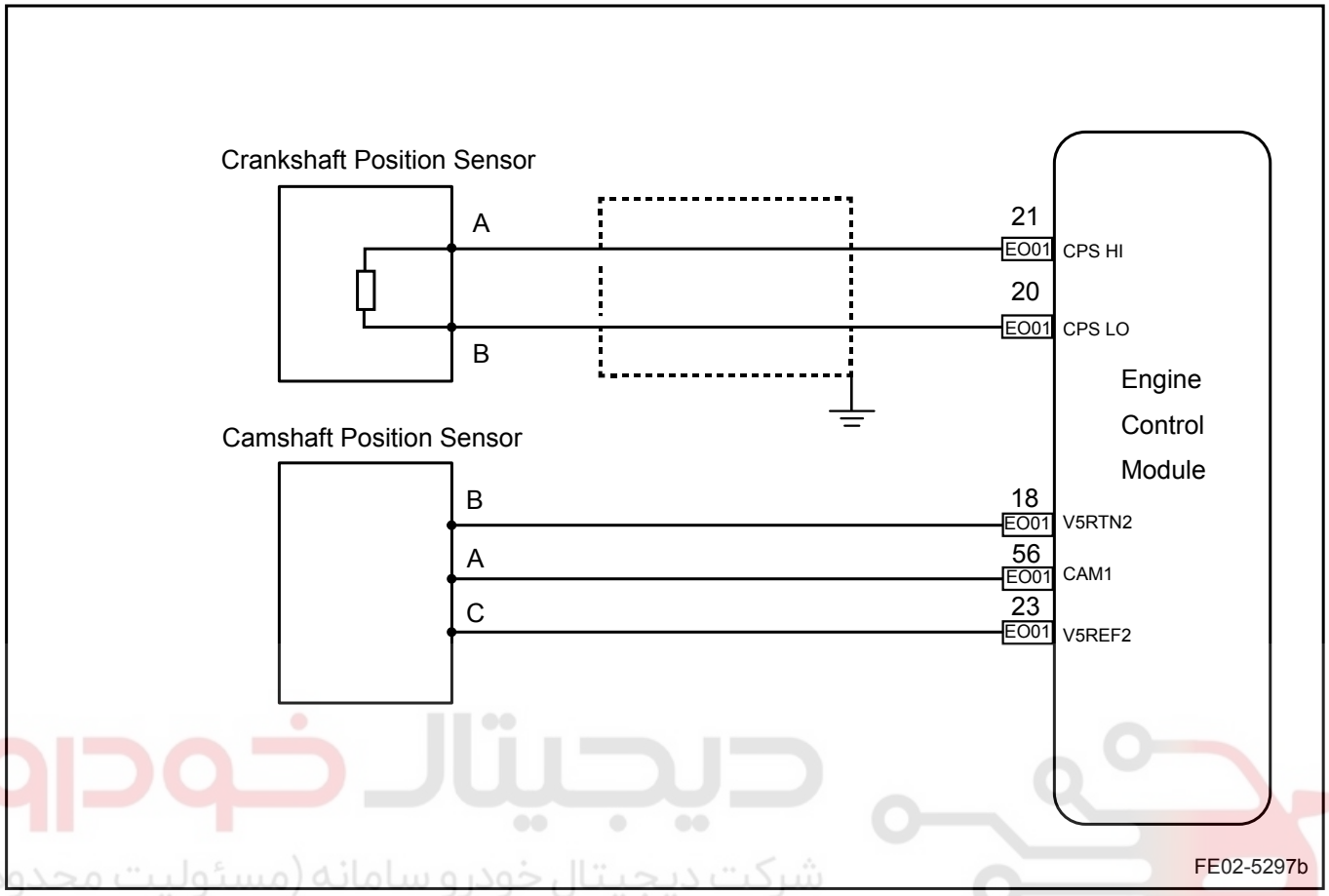
CKP sensor signals ECM current crankshaft speed and position. CKP sensor produces an alternating voltage with different amplitude and frequency. Frequency depends on the crankshaft speed, the output AC voltage depends on the CKP. The CKP sensor works in conjunction with a 58X reluctor wheel that is attached to the crankshaft. ECM calculates the ignition timing, injection timing, and knock ignition timing based on CKP sensor and camshaft position sensor input signals. CKP sensor is also used to detect misfire and tachometer display. ECM uses CAN network to send the engine speed signal to the instrument cluster.

CKP sensor signal is sent through CKP sensor harness connector EO26 terminals A, B to ECM harness connector No.EO01 terminals No.21 and 20.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0335	Hardware Circuit Checks	1. During startup, the crankshaft position sensor is disconnected, short to Ground and short to power supply. 2. Fault timer accumulated time is longer than 2 s.	1. Sensor Circuit 2. Sensor 3. ECM 4. Sensor Signal Plate
P0336	Hardware Circuit Checks	1. Crankshaft position sensor and the signal tooth gap is too large. 2. The difference between actual identified number of teeth and 58 teeth is bigger than a specified value.	1. Sensor Circuit 2. Sensor 3. ECM 4. Sensor Signal Plate

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Check the sensor wiring harness connector EN26 whether there is loose or poor connection and so on.
(b) Check whether the sensor is installed correctly.
(c) Check whether the sensor gap is normal.

No → Repair the faulty part. Go to step 10

Yes

Step 2	Read the engine data (engine speed) on the scan tool.

(a) Connect scan tool to datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Select "Engine"/"Reading Data"/"Engine Speed."
(d) Start the engine.
(e) With the engine running, read the engine data on the scan tool

Standard Value: Normal data. Refer to 2.12.7.9 Data Stream List.

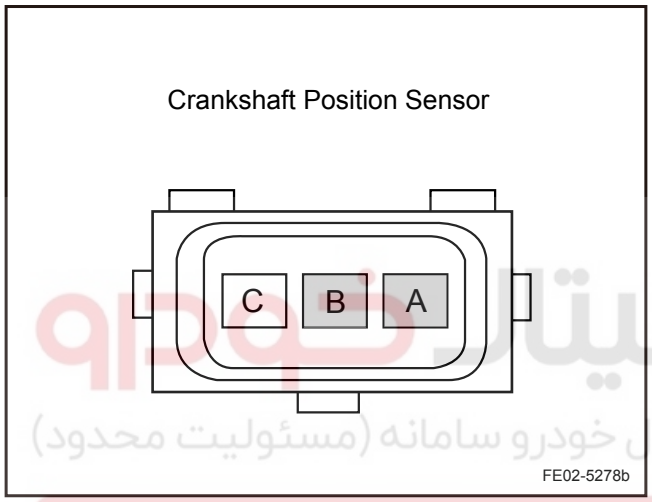
(f) If the engine does not start, check the data with the engine running.

(g) If the engine speed is shown as "0", it indicates the circuit between the crankshaft position sensor and ECM wiring harness open or short.

Yes → Go to step 4

No

Step 3	Intermittent Fault. Refer to 2.12.7.4 Symptoms Table.
Step 4	Check the crankshaft position sensor.



(a) Turn the ignition switch to "OFF" position.

(b) Disconnect the crankshaft position sensor wiring harness connector EO26.

(c) Measure crankshaft position sensor resistance.

Standard Resistance: 504-616 Ω at 25°C(77 ºF)

(d) Connect the crankshaft position sensor wiring harness connector EN26.

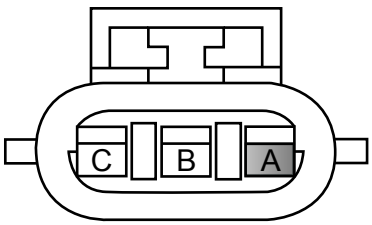
Is resistance normal?

No → Replace the crankshaft position sensor. Refer to 2.10.8.2 Crankshaft Position Sensor Replacement.

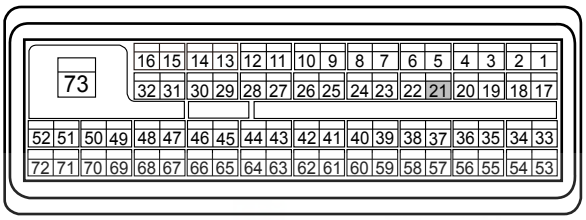
Yes

Step 5	Check sensor terminal No.A circuit.

Crankshaft Position Sensor Harness Connector EO26



ECM Harness Connector EO01



FE02-5279b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the crankshaft position sensor wiring harness connector EO26.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal A and ECM harness connector EN01 terminal No.21. Check whether the circuit is open.
(e) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal A and a reliable ground. Check whether the circuit is short to ground.
(f) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal A and power supply. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EN26 (A) and EN01 (21)	Less than 1 Ω
Resistance Between EN26 (A) and A Reliable Ground	10 kΩ or higher
Voltage Between EN26 (A) and A Reliable Ground	0 V

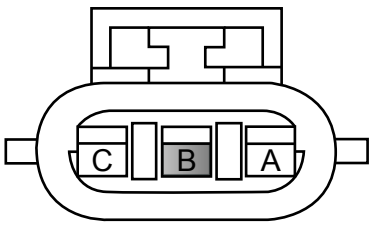
Are the values specified values?

No → Repair the faulty part. Go to step 10

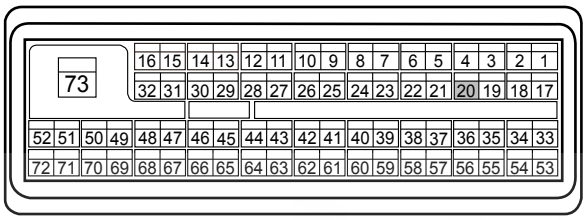
Yes

Step 6	Check sensor terminal B circuit.

Crankshaft Position Sensor Harness Connector EO26



ECM Harness Connector EO01



FE02-5280b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the crankshaft position sensor wiring harness connector EO26.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal B and ECM harness connector EN01 terminal No.20. Check whether the circuit is open.
(e) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal B and a reliable ground. Check whether the circuit is short to ground.
(f) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal B and power supply. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EN26 (B) and EN01 (20)	Less than 1 Ω
Resistance Between EN26 (B) and A Reliable Ground	10 kΩ or higher
Voltage Between EN26 (B) and A Reliable Ground	0 V

Are the values the specified values?

No → Repair the faulty part. Go to step 10

Yes

Step 7	Check sensor signal plate.

(a) Check whether the sensor signal plate is damaged, missing and so on.
(b) Check whether the sensor signal plate is installed correctly.

No → Repair the faulty part. Go to step 10

Yes

Step 8	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 9	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 10	Use scan tool to confirm whether the DTC code is stored again. (a) Connect scan tool to the datalink connector. (b) Turn the ignition switch to "ON" position. (c) Clear DTC code. (d) Start and run the engine at idle speed to warm up the engine for at least 5 min. (e) Road test the vehicle for at least 10 min. (f) Read control system DTC code again to confirm that the system has no DTC code. No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 11	Diagnostic completed.

5. Repair Instructions:

Replace crankshaft position sensor. Refer to 2.10.8.2 Crankshaft Position Sensor Replacement.

2.12.7.36 DTC P0340 P0341

1. DTC Descriptor:

DTC	P0340	Intake VCP Camshaft Position Sensor Status Diagnosis
DTC	P0341	Intake VCP Target Wheel Diagnosis

Camshaft position (CMP) sensor is used to detect camshaft position, and is associated with the crankshaft position. It sends signals to the engine control module (ECM) to determine the upcoming fuel injection.

Engine Control Module (ECM) also uses the camshaft position sensor output to determine the camshaft to the crankshaft relative position to control the valve timing of camshaft adjustment and conduct emergency operations.

Camshaft position sensor circuit includes the following:

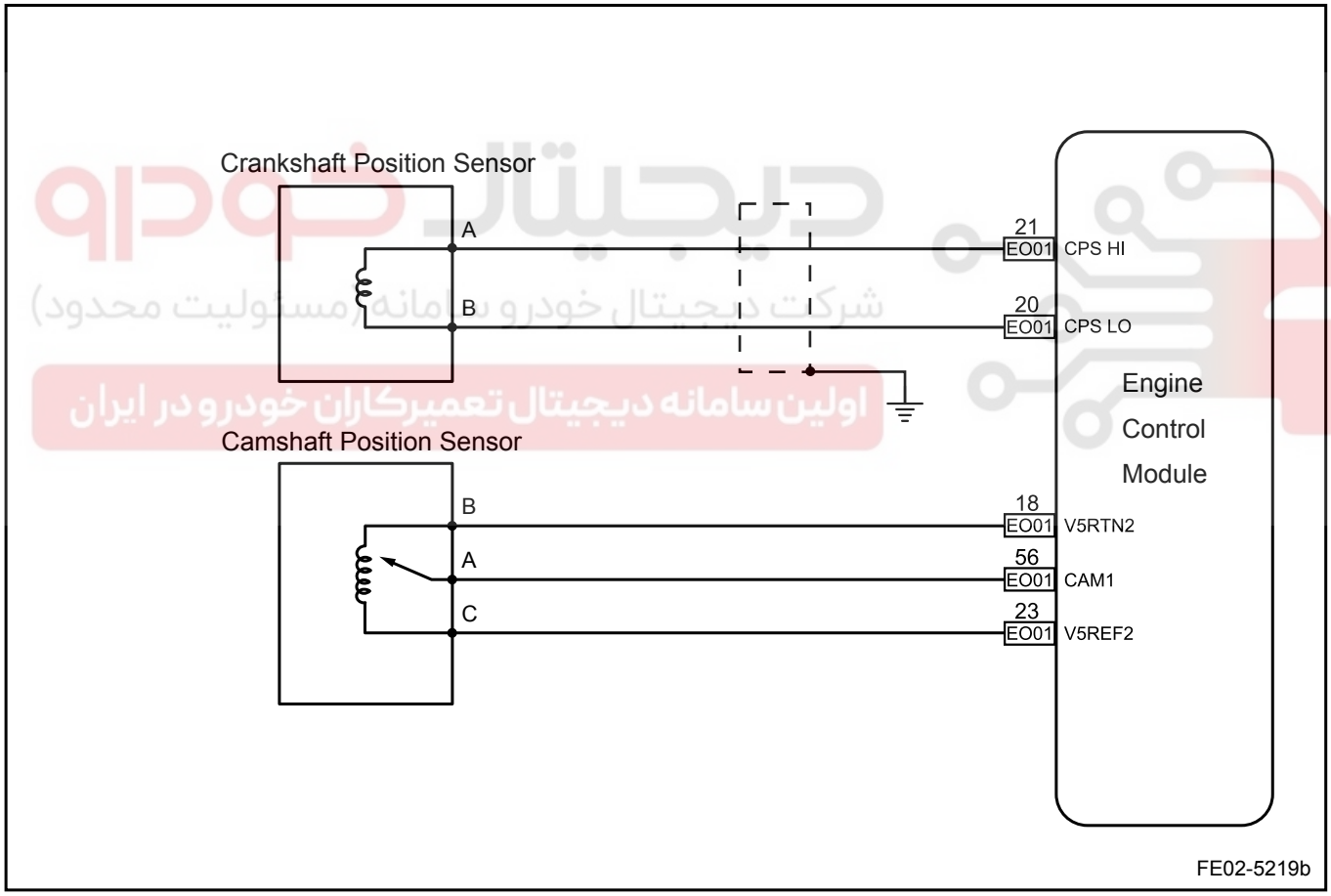
- Reference Voltage: ECM provides a reference voltage to CMP sensor harness connector EN15 terminal C via ECM harness connector EN01 terminal No.23.
- Signal Circuit: ECM receives signal voltage from CMP sensor harness connector EN15 terminal A via ECM harness connector EN01 terminal No.56.
- ECM Low Reference Voltage Circuit: ECM provides a low reference voltage to CMP sensor harness connector EN15 terminal B via ECM harness connector EN01 terminal No.18.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations

P0340	ECM detects the engine running but does not receive the camshaft position sensor signal	1. ECM detects the engine running. 2. ECM detects the crankshaft position sensor signal. 3. Camshaft position sensor signal is lost.	1. Sensor Circuit 2. Sensor 3. Camshaft Signal Wheel 4. ECM
P0341	ECM detects the engine running, but receives a camshaft position sensor signal and that does not match calibration.	1. ECM detects the engine running. 2. ECM detects the crankshaft position sensor signal. 3. ECM detected camshaft position sensor signal does not match the reference crankshaft position sensor signal.	

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Check the sensor wiring harness connector EN15 whether there is loose or poor connection and so on.
(b) Check whether the sensor is installed correctly.
(c) Check whether the sensor gap is normal.

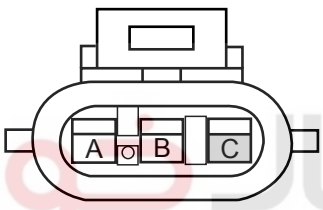
Are above mentioned parts normal?

No → Repair the faulty part. Go to step 9

Yes

Step 2	Measure sensor 5 V reference voltage.

Camshaft Position Sensor Harness Connector EO15



FE02-5311b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect camshaft position sensor wiring harness connector EN15.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between camshaft position sensor wiring harness connector EN15 terminal No.3 and a reliable ground.

Standard Voltage: 4.5-5 .5 V

(e) Connect camshaft position sensor wiring harness connector EN15.

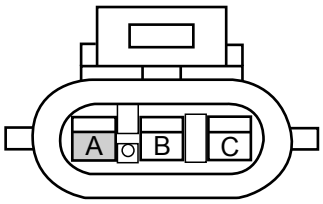
Is the value specified value?

No → Go to step 6

Yes

Step 3	Measure sensor signal circuit.

Camshaft Position Sensor Harness Connector EO15



FE02-5312b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect camshaft position sensor wiring harness connector EO15.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between camshaft position sensor wiring harness connector EN15 terminal A and a reliable ground.

Standard Voltage: 4.5-5 .5 V

(e) Connect camshaft position sensor wiring harness connector EN15.

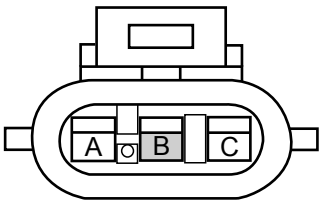
Is the value specified value?

No → Go to step 7

Yes

Step 4	Test ECM internal low reference circuit.

Camshaft Position Sensor Harness Connector EO15



FE02-5313b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect camshaft position sensor wiring harness connector EO15.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between camshaft position sensor wiring harness connector EN15 terminal B and a reliable ground.

Standard Resistance: Less than 3 Ω

(e) Connect camshaft position sensor wiring harness connector EN15.

Is the value specified value?

No → Go to step 8

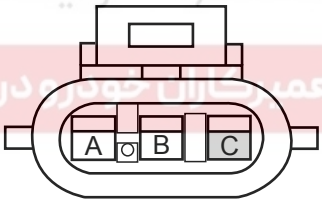
Yes

Step 5	Replace the camshaft position sensor. Refer to 2.10.8.1 Camshaft Position Sensor Replacement.

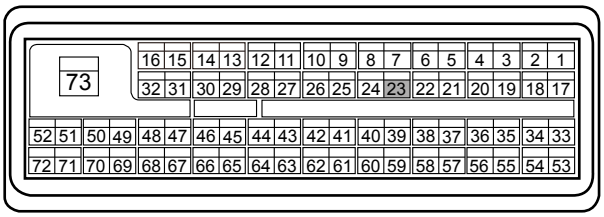
Next → Go to step 12

Step 6	Check the sensor 5 V reference voltage circuit.

Camshaft Position Sensor Harness Connector EO15



ECM Harness Connector EO01



FE02-5314b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect camshaft position sensor wiring harness connector EO15.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between camshaft position sensor harness connector EN015 terminal C and ECM harness connector EN01 terminal No.23. Check whether the circuit is open.
(e) Measure resistance between camshaft position sensor harness connector EN015 terminal C and a reliable ground. Check whether there is short to ground circuit.
(f) Measure voltage between camshaft position sensor harness connector EN015 terminal C and power supply. Check whether there is short to power supply circuit.

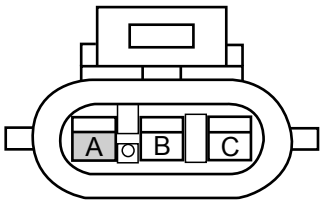
Test Items	Standard Value
Resistance Between EN15 (C) and EN01 (23)	Less than 1 Ω
Resistance Between EN15 (C) and A Reliable Ground	10 kΩ or higher
Voltage Between EN15 (C) and A Reliable Ground	0 V

Execute next step as per normal.

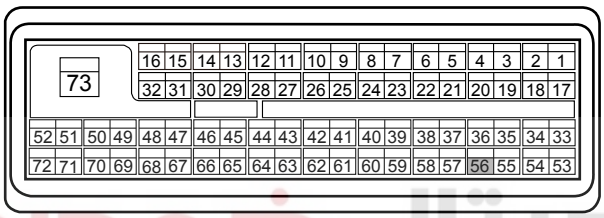
Next → Repair the faulty part. Go to step 12

Step 7	Check sensor signal circuit.

Camshaft Position Sensor Harness Connector EO15



ECM Harness Connector EO01



FE02-5315b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect camshaft position sensor wiring harness connector EO15.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between camshaft position sensor harness connector EN015 terminal A and ECM harness connector EN01 terminal No.56. Check whether the circuit is open.
(e) Measure resistance between camshaft position sensor harness connector EN015 terminal A and a reliable ground. Check whether the circuit is short to ground.
(f) Measure resistance between camshaft position sensor harness connector EN015 terminal A and power supply. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EN15 (A) and EN01 (56)	Less than 1 Ω
Resistance Between EN15 (A) and A Reliable Ground	10 kΩ or higher
Voltage Between EN15 (A) and A Reliable Ground	0 V

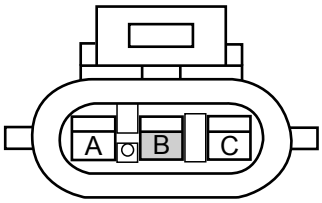
Are the values specified values?

No → Repair the faulty part. Go to step 12

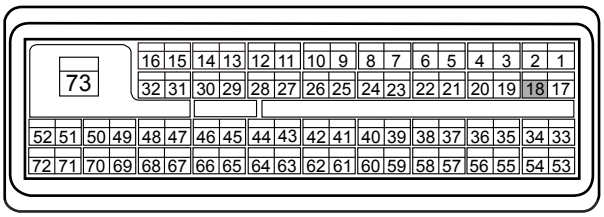
Yes

Step 8	Check ECM internal low reference circuit.

Camshaft Position Sensor Harness Connector EO15



ECM Harness Connector EO01



FE02-5316b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect camshaft position sensor wiring harness connector EO15.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between camshaft position sensor wiring harness connector EN15 terminal B and ECM harness connector EN01 terminal No.18. Check whether the circuit is open.
(e) Measure voltage between camshaft position sensor wiring harness connector EN15 terminal B and a reliable ground. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EN15 (B) and EN01 (18)	Less than 1 Ω
Voltage Between EN15 (B) and A Reliable Ground	0 V

Execute next step as per normal.

Next

Step 9	Check whether camshaft signal plate is normal.

No → Repair the faulty part. Go to step 12

Yes

Step 10	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 11	Replace ECM.

Next

Step 12	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 13	Diagnostic completed.

5. Repair Instructions:

Replace CMP sensor. Refer to 2.10.8.1 Camshaft Position Sensor Replacement.

2.12.7.37 DTC P0351 P0352

1. DTC Descriptor:

DTC	P0351	Ignition Coil 1 Malfunction

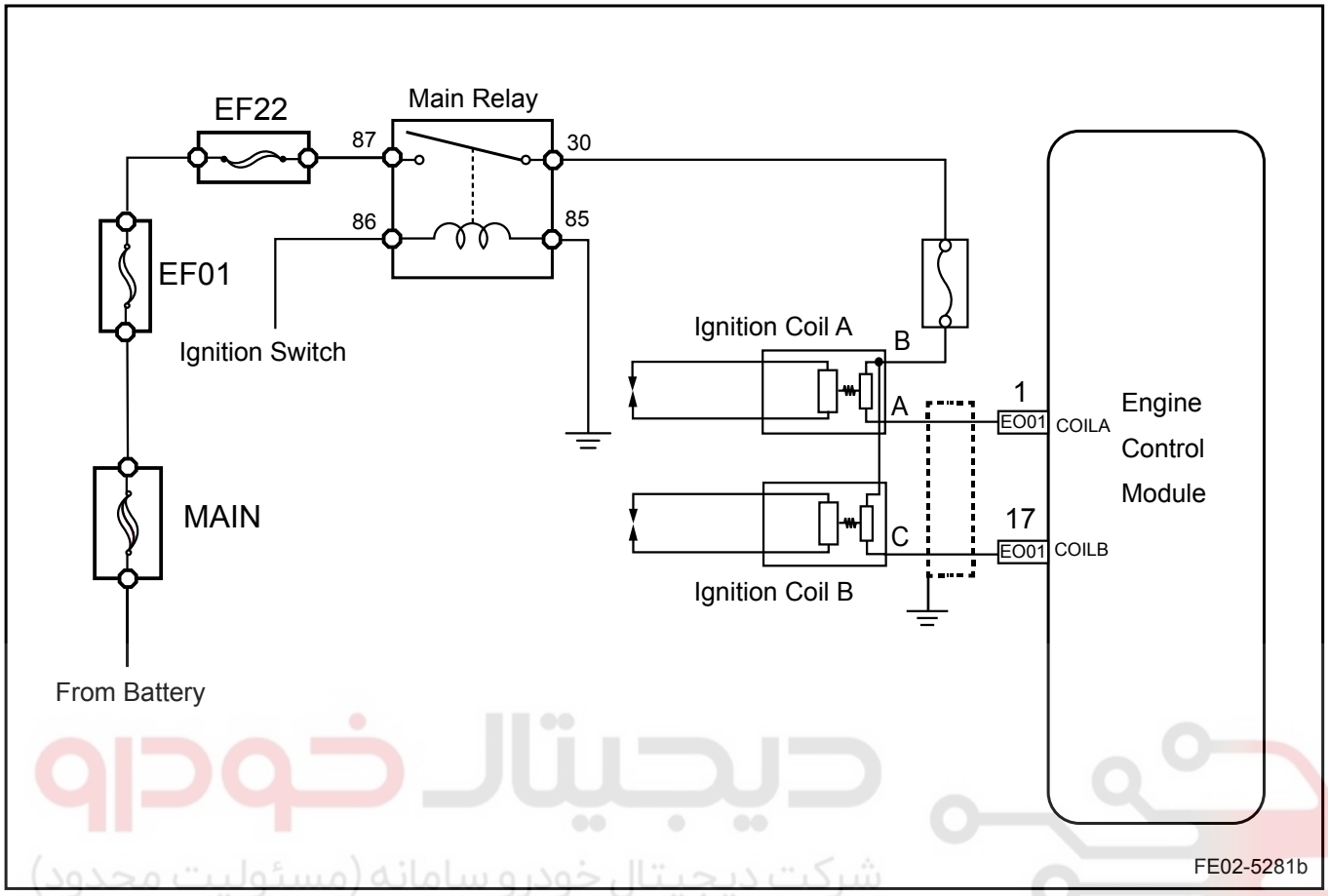
DTC	P0352	Ignition Coil 2 Malfunction

Ignition coil 1 provides ignition for cylinders No.1 and 4. Ignition coil 2 provides ignition for cylinders No.2 and 3. Ignition relay provides power time to the two ignition coils at the same time. ECM controls cylinders No.1 and 4 primary ground circuit through ECM harness connector EO01 terminal No.1. ECM controls cylinders No.2 and 3 primary ground circuit through ECM harness connector EO01 terminal No.17.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0351 P0352	Hardware Circuit Checks	Operating at idle, with the ignition coil control end disconnected, short to ground and short to power supply, this DTC code will be set. The fuel injection to the cylinder with this DTC code stops. Engine speed fluctuates.	1. Ignition Coil Circuit 2. Ignition Coil 3. ECM

3. Schematic:



4. Diagnostic Steps:

Check ignition coil. Refer to2.20 Ignition System JL4G15-Din2.20.4 Diagnostic Information and Procedures.

5. Repair Instructions:

Replace the ignition coil. Refer to 2.10.8.3 Ignition Coil Replacement.

2.12.7.38 DTC P0420

1. DTC Descriptor:

DTC	P0420	Three-Way Catalytic Converter Conversion Efficiency Low

ECM uses two oxygen sensors (Pre-Catalytic oxygen sensor and Post-Catalytic oxygen sensor) installed before and after the three-way catalytic converters to monitor the conversion efficiency of the three-way catalytic converter (TWC). ECM uses Pre-Catalytic oxygen sensor for Air-Fuel ratio close-loop control and monitors oxygen content in the exhaust gas not purified by TWC. The Post-Catalytic oxygen sensor sends voltage signal to ECM indicating the oxygen content in the exhaust gas purified by the TWC. ECM compares signals from the two sensors to determine whether the TWC is currently under normal working condition. If the calculated TWC conversion efficiency is too low, the fault lamp will be lit and the DTC code will be set.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0420	Hardware Circuit Checks	Coolant temperature is higher than 70°C (158 ºF), and the fuel system is in close-loop mode. After driving some distance and stop the vehicle, run the engine at idle, the system compares the Pre-Catalytic and Post-Catalytic oxygen sensor signals to calculate three-way catalyst converter oxygen storing time. When the oxygen storing time is less than the threshold, the system reports a fault.	1. Pre-Catalytic Oxygen Sensor 2. Post-Catalytic Oxygen Sensor 3. Three-Way Catalytic Converter 4. Exhaust Leak

3. Schematic:

Refer to 2.2.6.1 Schematic

4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Check whether there are control system DTC codes other than DTC P0420.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC code

DTC Codes Shown	To Step
DTC P0420	Yes
DTC Code Other Than DTC P0420	No

No → Refer to 2.12.7.14 DTC Code Index.

Yes

Step 2	Start engine and turn on the scan tool.

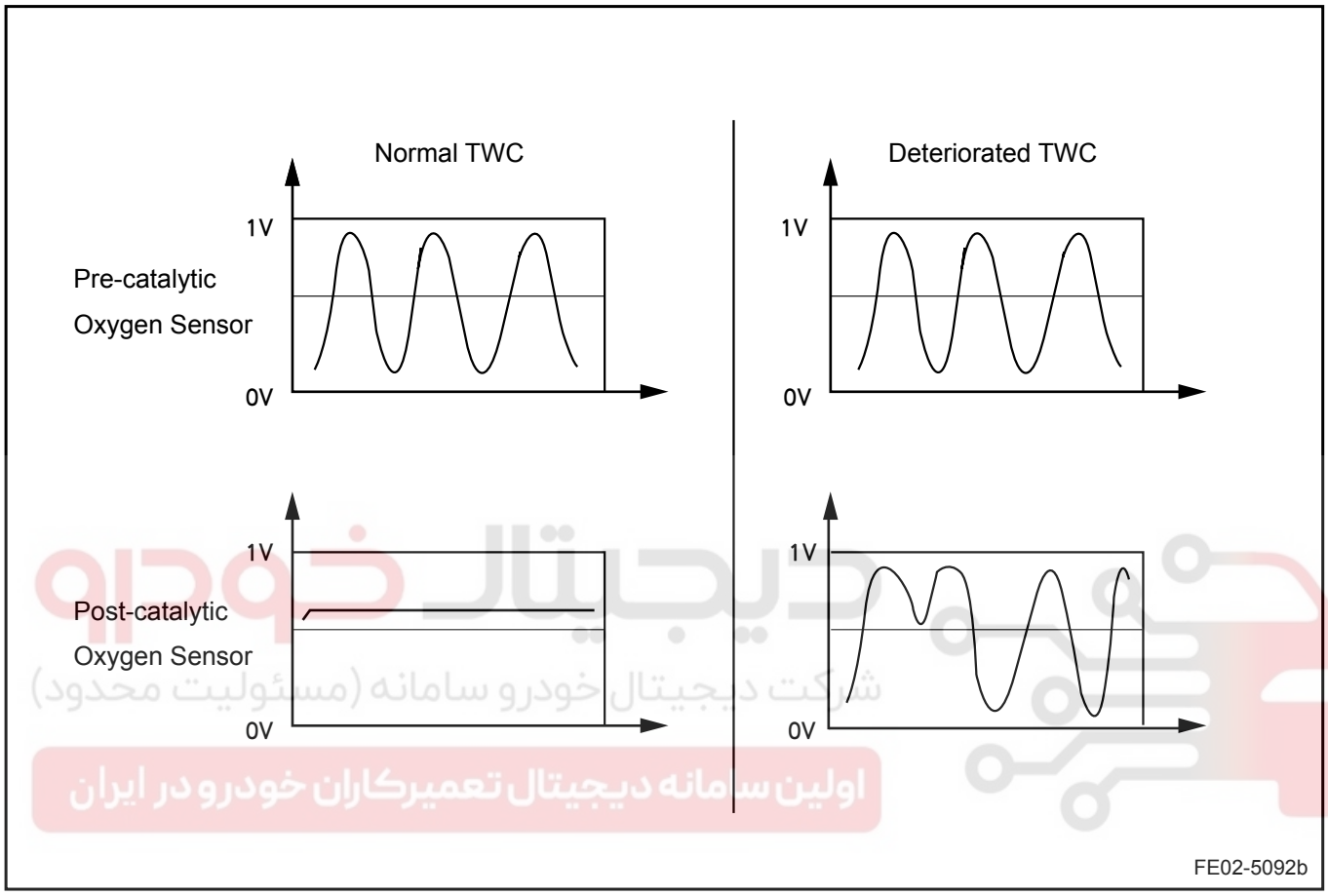
Next

Step 3	Keep the engine speed at 2,500 rpm for more than 2 min to warm up the engine, until the engine coolant temperature reaches 80°C (176 ºF).

Next

Step 4	Select on the scan tool: Engine/Read data/Group 1 oxygen sensor voltage 1 (Pre-Catalytic oxygen sensor), Group 1 oxygen sensor voltage 2 (Post-Catalytic oxygen sensor)

Next



Step 5	Observe Pre-Catalytic oxygen sensor and Post-Catalytic oxygen sensor output voltages.

Whether Pre-Catalytic oxygen sensor and Post-Catalytic oxygen sensor signal voltage is matching "Normal TWC" in the graphic?

Yes → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

No

Warning!

Propane gas as is a flammable gas. It is strictly prohibited to operate propane gas near a fire, otherwise it will cause a fire.

Step 6	Test the oxygen sensor signal.

(a) If the voltage data is consistently below 0.45 V (mixture too lean), carry out the steps as following:

- Spray proper amount of propane gas into the intake.

- Inspect whether the sensor voltage data is changed significantly, as the signal voltage will increase rapidly.

Pre-Catalytic Oxygen Sensor Signal Voltage	Post-Catalytic Oxygen Sensor Signal Voltage	To Step
Obvious Change	No Change	A
No Change	Obvious Change	B
Obvious Change	No Change	C
No Change	No Change	D

B → Replace the pre-catalytic oxygen sensor. Refer to 2.4.7.2 Pre-Catalytic Oxygen Sensor Replacement.

C → Go to step 9

D → Check the cause for engine air-fuel ratio too lean/too rich. Refer to 2.12.7.4 Symptoms Table

A

Step 7	Check whether there is exhaust leakage.

Yes → Repair the faulty part. Go to step 11

No

Step 8	Replace the three-way catalytic converter. Refer to 2.7.6.2 Three-way Catalytic Converter Replacement.

Next → Go to step 11

Step 9	Check whether there is exhaust leakage.

Yes → Repair the faulty part. Go to step 11

No

Step 10	Replace the post-catalytic oxygen sensor. Refer to 2.4.7.1 Post-Catalytic Oxygen Sensor Replacement.

Next

Step 11	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 12	Diagnostic completed.

2.12.7.39 DTC P0458 P0459

1. DTC Descriptor:

DTC	P0458	Canister Control Valve Control Circuit Short To Ground or Open

DTC	P0459	Canister Control Valve Control Circuit Short To Power Supply

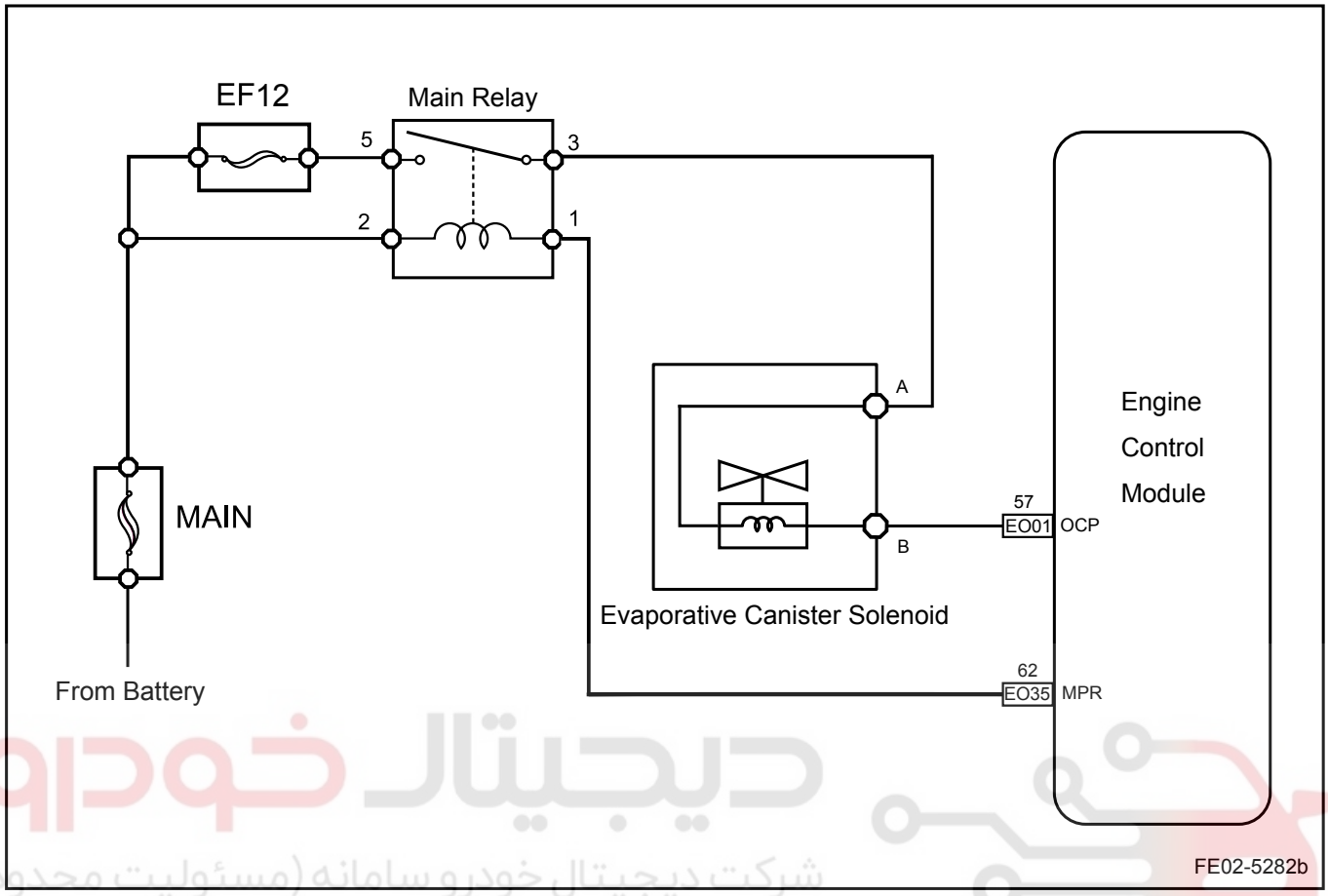
EVAP solenoid valve absorbs fuel vapor from the evaporative emission Canister to the intake manifold. EVAP solenoid valve is controlled by the pulse width modulation (PWM). The circuit consists of:

- Operating Voltage: Battery voltage passes through ECM controlled main relay terminal No.87 to reach EVAP solenoid harness connector EN24 terminal A.
- ECM control circuit: EVAP solenoid valve wiring harness connector EN24 terminal B is connected to ECM harness connector EN01 terminal No.57. ECM has an internal driver circuit to control the solenoid valve ground. Driver circuit is equipped with a ECM feedback circuit. ECM monitors the feedback voltage to determine whether the control circuit is open, short to ground or short to power supply.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0458	Hardware Circuit Checks	At idle conditions, canister solenoid valve inoperative, canister solenoid valve circuit short to ground or open, DTC code set.	1. Canister Solenoid Valve Circuit 2. Solenoid Valve 3. ECM
P0459	Hardware Circuit Checks	At idle conditions, canister solenoid valve inoperative, canister solenoid valve circuit short to power supply, DTC code set.	1. Canister Solenoid Valve Circuit 2. Solenoid Valve 3. ECM

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

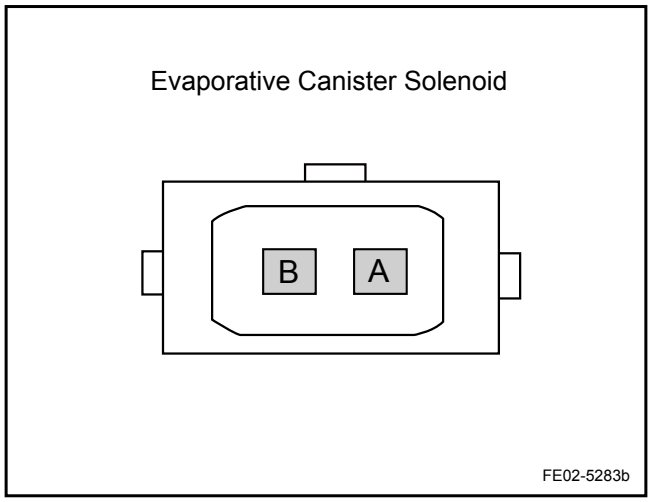
Step 1	Use scan tool for canister solenoid valve active testing.

(a) Connect scan tool to the "Data Link Connector".
(b) Disconnect the Canister solenoid valve to the Canister vacuum tubes.
(c) Start engine and turn on the scan tool.
(d) Select the following menu: "Engine"/"Action Test"/"Canister Solenoid Valve"
(e) Use scan tool to enable the use of "Canister Control Valve". Place a finger over the vacuum port solenoid valve and check whether there is suction.

Yes → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

No

Step 2	Measure canister solenoid valve resistance.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect Canister solenoid valve harness connector EO24.
(c) Measure resistance between the Canister solenoid valve two terminals.

Standard Resistance: 19-22 Ω at 20°C(68 ºF)

(d) Connect canister solenoid valve harness connector EN24.

Is the value specified value?

No → Replace the canister solenoid valve. Refer to 2.4.7.3 Canister Solenoid Valve Replacement.

Yes

Step 3	Measure canister solenoid valve working power supply.

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect Canister solenoid valve harness connector EN24.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between Canister solenoid valve wiring harness connector EN24 terminal A and a reliable ground.

Standard Voltage: 11-14 V

(e) Connect canister solenoid valve harness connector EN24.

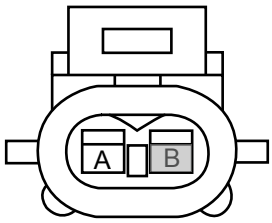
Is the value specified value?

No → Check whether there is an open circuit or a circuit short to ground between solenoid valve wiring harness connector EN24 terminal A and main relay terminal No.3. Repair the faulty part. Go to step 7

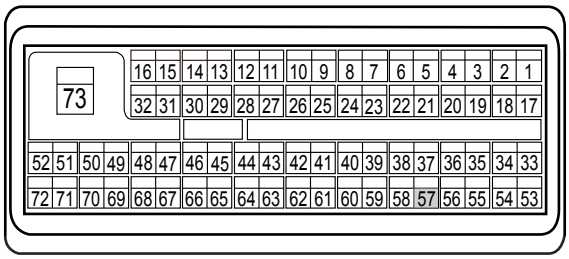
Yes

Step 4	Check canister solenoid valve control circuit.

Evaporative Canister Solenoid Harness Connector EO24



ECM Harness Connector EO01



FE02-5285b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect Canister solenoid valve harness connector EO24.
(c) Disconnect ECM harness connector EO01.
(d) Measure resistance between Canister solenoid valve wiring harness connector EN24 terminal B and ECM harness connector EN01 terminal No.57. Check whether the circuit is open.
(e) Measure resistance between Canister solenoid valve wiring harness connector EN24 terminal B and a reliable ground. Check whether the circuit is short to ground.
(f) Measure voltage between Canister solenoid valve wiring harness connector EN24 terminal B and a reliable ground. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EN24 (B) and EN01 (57)	Less than 1 Ω
Resistance Between EN24 (B) and A Reliable Ground	10 kΩ or higher
Voltage Between EN24 (B) and A Reliable Ground	0 V

Are the values specified values?

No → Repair or replace the wiring harness connectors. Go to step 7

Yes

Step 5	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 7	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 8	Diagnostic completed.

5. Repair Instructions:

Replace EVAP solenoid valve. Refer to 2.4.7.3 Canister Solenoid Valve Replacement.

2.12.7.40 DTC P0480 P0481

1. DTC Descriptor:

DTC	P0480	Low-Speed Fan Malfunction

DTC	P0481	High-Speed Fan Malfunction

High or low speed cooling fan relay coil power is provided by ECM controlled main relay. ECM controls the relay via ECM harness connector EO36 terminal No.66 and 67. ECM has an internal driver circuit that controls the relay coil ground. Drive circuit is equipped with a feedback circuit to ECM. ECM monitors the feedback voltage control circuit to determine whether the control circuit is open, short to ground or short to ground.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0480	Hardware Circuit Checks	Under idle operating condition, when the fan is working. The fan control is short to power supply, DTC code set.	1. Relay Circuit 2. Relay 3. ECM 4. Cooling Fan
P0481	Hardware Circuit Checks	Under idle operating condition, when the fan is working. The fan control is short to power supply, DTC code set.	

3. Schematic:

Refer to 2.12.6.1 Schematic.

4. Diagnostic Steps:

Refer to 2.18.3.1 Cooling Fan Circuit Diagnosis

5. Repair Instructions:

Replace the cooling fan. Refer to 2.8.8.3 Cooling Fan Replacement.

2.12.7.41 DTC P0502

1. DTC Descriptor:

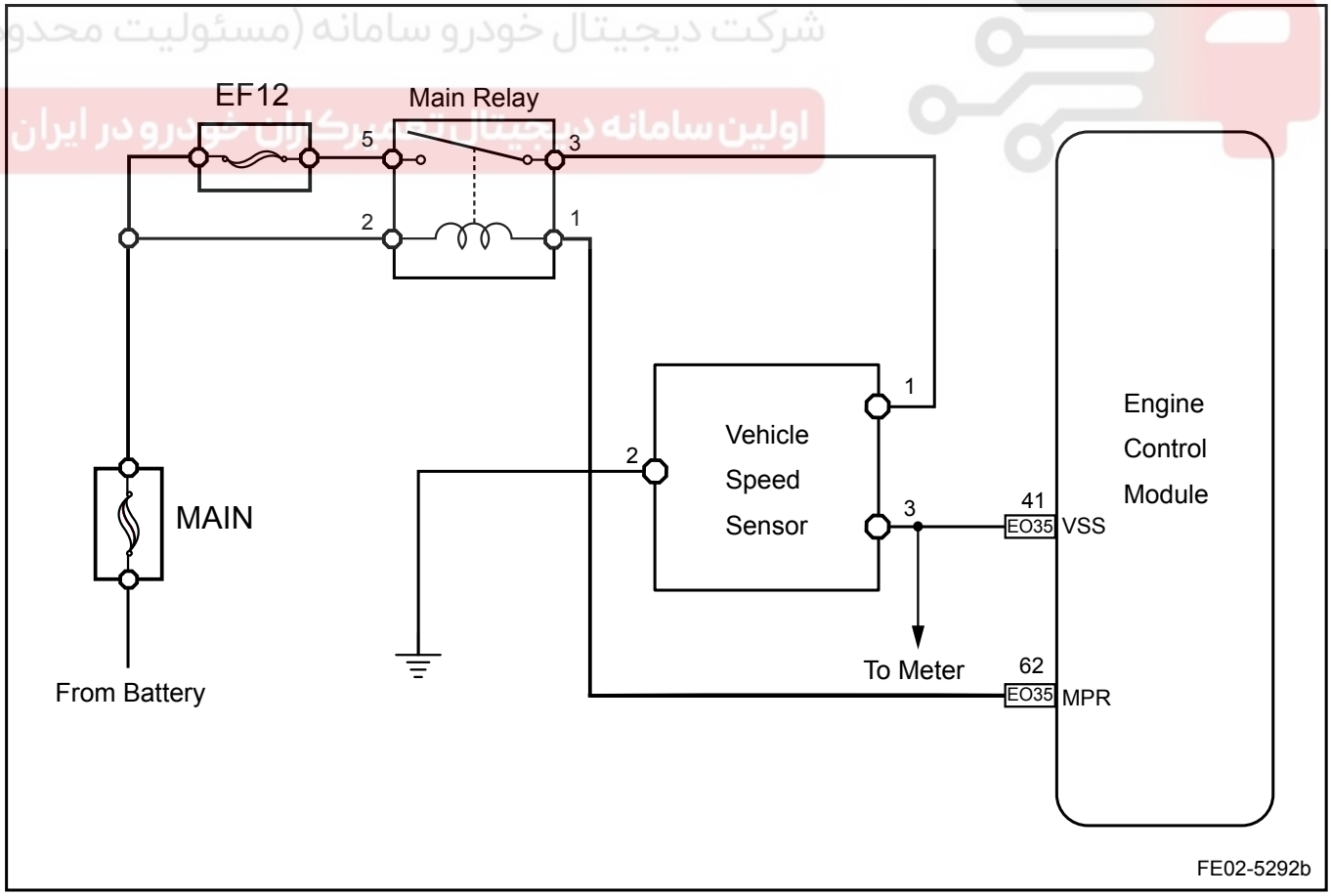
DTC	P0502	Vehicle Speed Sensor No Signal

The vehicle speed signal is used to monitor the vehicle speed. The vehicle speed signal is one of the fuel control reference signals during an urgent deceleration. The vehicle speed sensor working voltage is provided by The Main Relay which is controlled by ECM via ECM harness connector EN01 terminal No.57. The vehicle speed sensor signal is sent to the instrument panel used for the vehicle speed display.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0502	Vehicle Speed Sensor No Signal	1. Under hot operating conditions, driving the vehicle at Low-Speed at 3rd gear, Disconnect the vehicle speed sensor. and then press the acceleration pedal hard to accelerate to higher than 4,000 and immediately release the pedal. Engine speed, vehicle speed and MAP values begin to decline. When entering the fault setting window, DTC code will be set. 2. Under hot operating conditions, driving the vehicle at medium speed at 4th gear, Disconnect the vehicle speed sensor. and then press the acceleration pedal to accelerate the vehicle. Engine speed, vehicle speed and MAP values entering the fault setting window, DTC code will be set.	1. Vehicle Speed Sensor Circuit 2. Vehicle Speed Sensor 3. ECM

3. Schematic:



4. Diagnostic Steps:

Step 1	Road test the vehicle. Is the vehicle speed meter display working properly?

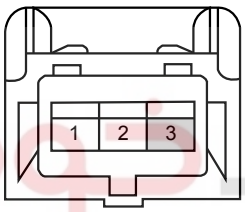
(a) If the instrument panel displays the vehicle speed as per normal, the vehicle speed sensor is working correctly.
(b) If the instrument panel displays the vehicle speed abnormally, the vehicle speed sensor or the circuit may be faulty.

No → Go to step 3

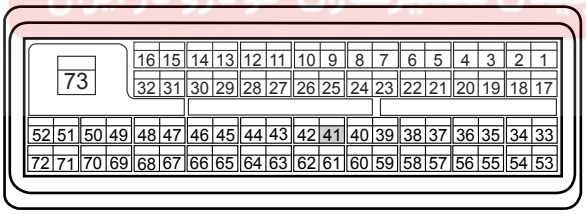
Yes

Step 2	Check the vehicle speed signal circuit.

Vehicle Speed Sensor Harness Connector EO21



ECM Harness Connector EO35



FE02-5293b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect vehicle speed sensor wiring harness connector EO21.
(c) Disconnect ECM harness connector EO35.
(d) Measure resistance between the vehicle speed sensor harness connector EO21 terminal No.3 and ECM harness connector EO35 terminal No.41. Check whether the circuit is open.
(e) Measure resistance between the vehicle speed sensor harness connector EO21 terminal No.3 and a reliable ground. Check whether the circuit is short to ground.
(f) Measure voltage between the vehicle speed sensor harness connector EO21 terminal No.3 and power supply. Check whether the circuit is short to power supply.

Test Items	Standard Value
Resistance Between EO21 (3) and EO35 (41)	Less than 1 Ω
Resistance Between EO21 (3) and A Reliable Ground	10 kΩ or higher
Voltage Between EO21 (2) and A Reliable Ground	0 V

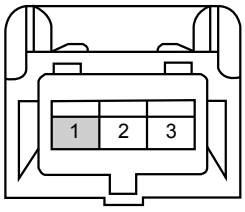
Are the values specified values?

No → Repair or replace wiring harness connectors. Go to step 8

Yes → Go to step 6

Step 3	Check the vehicle speed sensor power supply circuit.

Vehicle Speed Sensor Harness Connector EO21



FE02-5294b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect vehicle speed sensor wiring harness connector EO21.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between vehicle speed sensor harness connector EO21 terminal No.1 and a reliable ground.

Standard Voltage: 11-14 V

(e) Connect vehicle speed sensor harness connector EO21.

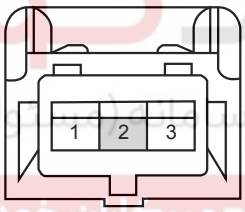
Is the value specified value?

No → Check whether there is a short circuit between the vehicle speed sensor terminal No.1 and the main relay terminal No.87. Repair the faulty part.

Yes

Step 4	Check the vehicle speed sensor ground circuit.

Vehicle Speed Sensor Harness Connector EO21



FE02-5295b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect vehicle speed sensor wiring harness connector EO21.
(c) Measure resistance between vehicle speed sensor harness connector EO21 terminal No.2 and a reliable ground. Check whether the circuit is short to ground.

Standard Resistance: Less than 1 Ω

Is the value specified value

No → Check whether there is an open circuit between the vehicle speed sensor terminal No.2 and a reliable ground. Repair the faulty part.

Yes

Step 5	Replace the vehicle speed sensor.

Next → Go to step 8

Step 6	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 7	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 8	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 9	Diagnostic completed.

2.12.7.42 DTC P0506 P0507

1. DTC Descriptor:

DTC	P0506	Idle Speed Too Low
DTC	P0507	Idle Speed Too High

Throttle actuator control motor is controlled by the engine control module (ECM). Internal DC motor drives throttle body. In order to reduce idle speed and adjust the spark and fuel supply, engine control module commands the throttle to close. By reducing the air flow into the engine, idle speed is lowered. In order to improve idle, the engine control module commands the throttle to open, so that more air flows through the throttle.

Engine Control Module (ECM) calculates and controls engine idle speed based on coolant temperature, speed compensation, reducing speed, Air-Conditioning compensation and voltage compensation.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0506	Idle speed is lower than the target speed by 100 rpm	1. Engine is at idle. 2. Vehicle speed is equal to 0. 3. Engine coolant temperature is higher than 60°C (140 °F) . 4. Duration Longer Than 10 s.	1. ETC throttle body assembly 2. Intake System 3. Exhaust System 4. ECM

P0507	Idle speed is higher than the target speed by 200 rpm	1. Engine is at idle. 2. Vehicle speed is equal to 0. 3. Engine coolant temperature is higher than 60°C (140 ºF) . 4. Duration Longer Than 10 s.	

3. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Check whether there are control system DTC codes other than DTC P0506 P0507.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
DTC P0506 P0507	No
DTC code other than P0506 P0507	Yes

Yes → 2.2.7.11 DTC Code Index

No

Step 2	Check whether generator is working properly.

(a) Use scan tool to observe whether the system voltage parameters are normal.

Generator generating capacity normal?

No → Repair generator fault.

Yes

Step 3	Check intake air pressure sensor parameters.

(a) Use scan tool to observe whether system intake pressure transducer parameters are correct. Refer to "Data Stream List".

Are intake air pressure sensor parameters normal?

No → Go to step 5

Yes

Step 4	Check air-conditioning working condition.

(a) Use scan tool to observe whether the Air-Conditioning working status is consistent with the actual Air-Conditioning working condition. Refer to the "Data Stream List".

When the air-conditioning is switched on and the pressure switch voltage is greater than 0 V, does the idle speed increase by about 150 rpm?

Yes → Go to step 7

No

Step 5	Check air intake system, exhaust system.

(a) Check exhaust system for the existence of congestion, air leakage.

(b) Too much carbon residue in throttle.

Any of these malfunctions?

Yes → Repair the faulty parts.

No

Step 6	Check engine mechanical parts and accessory drive.

(a) Shut down the engine and turn the ignition switch to "OFF".

(b) Check whether engine accessory drive belt is slack.

(c) Remove engine accessory belt, neutral gear. Rotate the engine crankshaft check whether mechanical moving parts catching.

(d) Rotate engine accessory pulley and air-conditioning pump. Check whether engine and other components catching.

Any of these malfunctions?

Yes → Repair the faulty parts.

No

Step 7	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.

(b) Check whether ECM ground circuit is normal.

No → Repair the faulty parts.

Yes

Step 8	Replace ECM.

(a) Replace ECM.

(b) Carry out crankshaft position sensor self learn. Refer to the "crankshaft position sensor to learn."

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Replace throttle valve. Refer to "Throttle Replacement".

Refer to 2.2.8.8 Engine Control Module ReplacementReplace ECM.

2.12.7.43 DTC P0562 P0563

1. DTC Descriptor:

DTC	P0562	System Voltage Too Low
DTC	P0563	System Voltage Too High

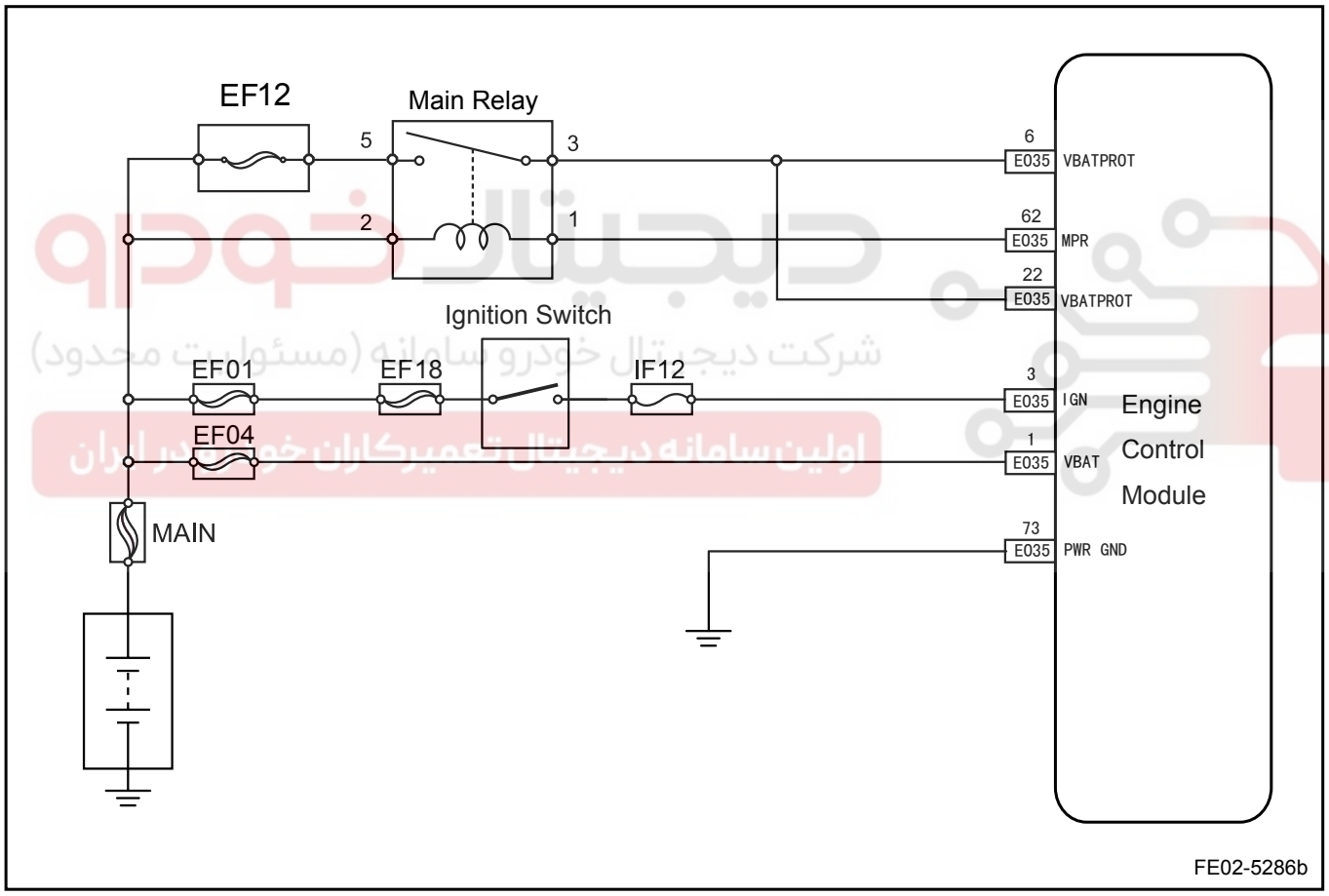
ECM Power Supply Circuit consists of the following circuits:

- Battery power passes through main fuse and EF04 to ECM harness connector EO35 terminal No.1.
- When the ignition switch turned to "ON" position, battery power passes through the ignition switch wiring harness connector IP23 terminal No.6 to the ECU fuse 10, and finally to ECM harness connector EO35 terminal No. 3.
- When ECM detects both ECM harness connector EO35 terminal No.3 and ECM connector EO35 terminal No.62 have battery voltage, ECM grounds EO35 terminal No.62 through an internal circuit. Because EO35 terminal No.62 and main fuse terminal No.1 are connected, the main relay pulls in.
- When main relay pulls in, the battery power passes through main relay terminal No.3 to ECM harness connector EO35 terminals No.6 and 22.

2. Conditions For Setting DTC and The Fault Location:

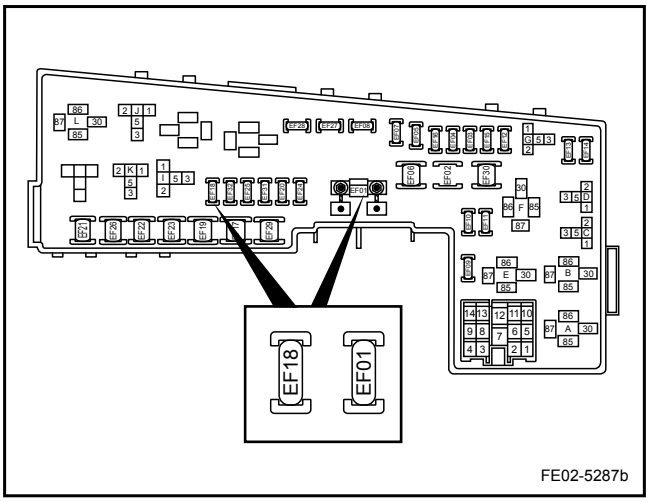
DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0562	Lower Than the Lower Limit	1. Ignition switch is at "ON". 2. Battery voltage is less than 11 V. 3. Duration is longer than 40 s.	1. ECM Power Supply Circuit 2. Generator 3. ECM
P0563	More Than the Upper Limit	1. Ignition switch is at "ON". 2. Battery voltage is greater than 16 V. 3. Duration is longer than 40 s.	

3. Schematic:



4. Diagnostic Steps:

Step 1	Check ECM fuses EF01 and EF18.



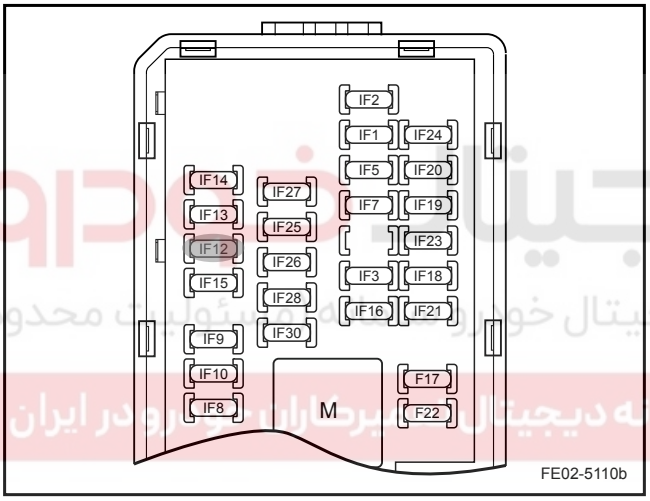
(a) Turn the ignition switch to "OFF" position.
(b) Remove fuses EF01 and EF18.
(c) Test continuity between the two fuses with a multimeter.

Conducted?

No → Check whether there is a short circuit. Replace the fuse.

Yes

Step 2	Check ECM fuse IF12 in I/P fuse block.



(a) Turn the ignition switch to "OFF" position.
(b) Remove IF12 from I/P fuse block.
(c) Test continuity between the two fuses with a multimeter.

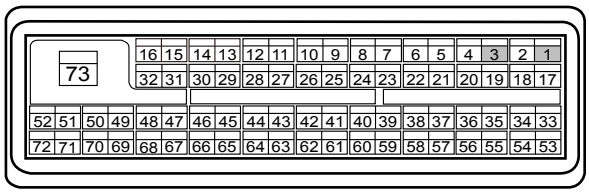
Conducted?

No → Check whether there is a short circuit. Replace the fuse.

Yes

Step 3	Check ECM power supply voltage.

ECM Harness Connector EO35



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between ECM harness connector EO35 terminal No.1 and a reliable ground.
(e) Measure voltage between ECM harness connector EO35 terminal No.3 and a reliable ground.

Standard Voltage: 11-14 V

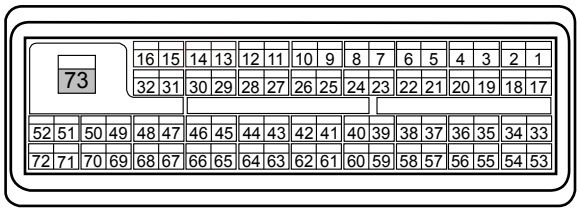
Voltage normal?

No → Go to step 5

Yes

Step 4	Check ECM grounding the circuit.

ECM Harness Connector EO35



FE02-5289b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EO35.
(c) Measure resistance between ECM harness connector EO35 terminal No.73 of and a reliable ground.

Standard Resistance: Less than 1 Ω

Resistance normal?

No → ECM ground circuit malfunction. Repair the faulty part.

Yes

Step 5	Check charging system.

(a) Check the battery voltage.
Standard voltage: 11-14 V

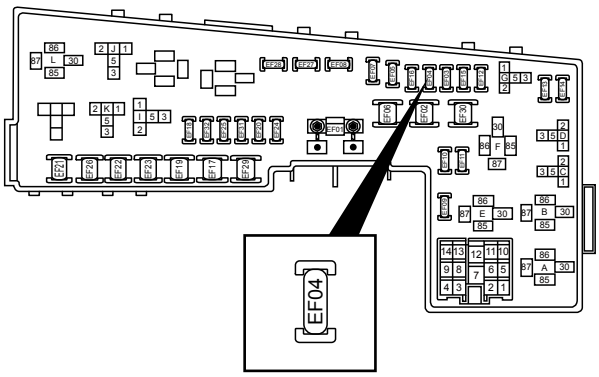
(b) Check voltage generator charging voltage.
Standard voltage: 11.5-14.5V

All normal?

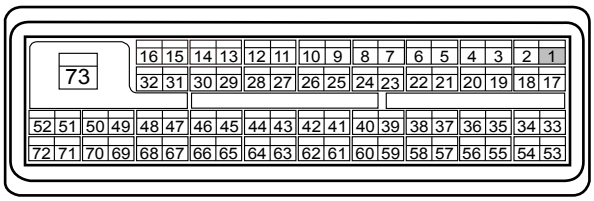
No → Repair the faulty part.

Yes → Go to step 9

Step 6	Check fuse EF04 to ECM circuit.



ECM Harness Connector EO35



FE02-5290b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EO35.
(c) Test continuity between ECM harness connector EO35 terminal No.1 and fuse EF04.
(d) Measure resistance between ECM harness connector EO35 terminal No.1 and a reliable ground.

Standard Value:

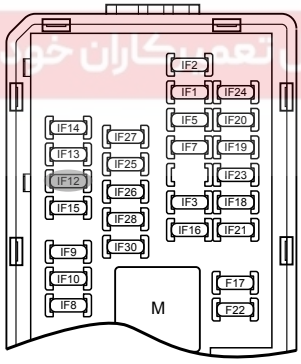
Test Items	Specified Value
Continuity Between EO35 (1) and EF04	Turn
Resistance Between EO35 (1) and A reliable ground	10 kΩ or higher

Normal?

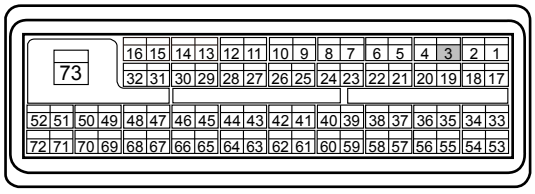
No → Circuit malfunction. repair or replace the wiring harness.

Yes

Step 7	Check fuse IF12 to ECM circuit.



ECM Harness Connector EO35



FE02-5291b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EO35.
(c) Test Continuity between ECM harness connector EO35 No. 3 terminal and fuse IF12.
(d) Measure resistance between ECM harness connector EO35 terminal No.3 and a reliable ground.

Standard Value:

Test Items	Specified Value
Continuity Between EO35 (3) and IF12	Turn
Resistance Between EO35 (3) and A reliable ground	10 kΩ or higher

All normal?

No → Circuit malfunction, repair or replace the wiring harness.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 10	Diagnostic completed.

2.12.7.44 DTC P0571

1. DTC Descriptor:

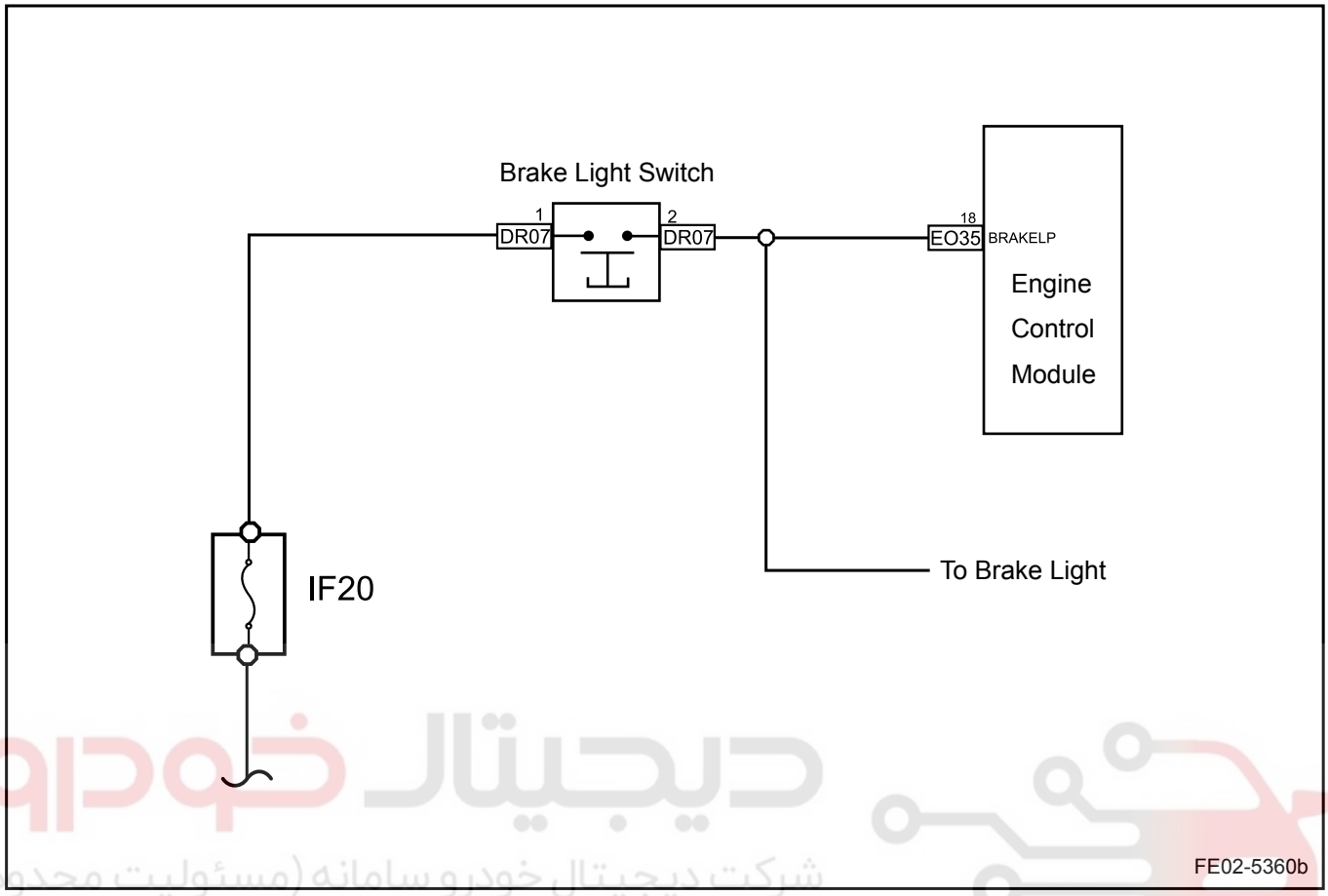
DTC	P0571	Brake Lamp Switch Status No Change During Braking

Disconnect the brake light switch signal. the vehicle braking, system enters the diagnostic window. After multiple braking, DTC code appears. Engine running smooth, the vehicle can be driven.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0571	ECM receives the brake light switch signal.	1. Brake Light Switch Signal Disconnected. 2. Vehicle braking, system enters the diagnostic window. 3. DTC codes appear after repeatedly braking.	1. Brake Light Switch Circuit 2. Brake Lights Switch 3. ECM

3. Schematic:



4. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

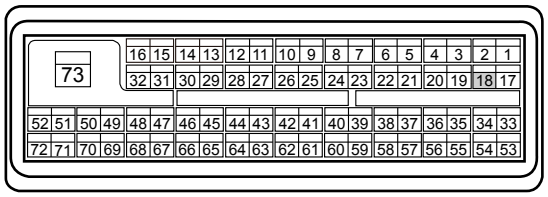
Step 1	Check whether brake lights are working properly.

No → Refer to 11.4.7.8 Brake Lamp Inoperative.

Yes

Step 2	Test continuity between brake light switch wiring harness connector R07 and ECM harness connector EO35.

ECM Harness Connector EO35



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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EO35.
(c) Press the brake pedal.
(d) Measure ECM harness connector EO35 terminal No.18 voltage.

Standard Voltage: 11-14 V

Is voltage normal.

Yes → Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement

No

Step 3	Repair circuit between brake light switch wiring harness connector DR07 and ECM harness connector EO35.

(a) Repair circuit between brake light switch wiring harness connector DR07 and ECM harness connector EO35.
(b) Confirm repair completed.

Next

Step 4	Diagnostic completed.

2.12.7.45 DTC P0601 P0602 P0604 P0606 P060A P1516 P2101

1. DTC Descriptor:

DTC	P0601	ROM Error
DTC	P0602	ECM Processor Malfunction
DTC	P0604	RAM Error
DTC	P0606	ECM Processor Malfunction
DTC	P060A	ECM Programming Errors
DTC	P1516	ETC-Driver Second-Order Diagnostic Error
DTC	P2101	ETC-Driver Steady-State Diagnostic Error

ECM Internal Program Errors.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0601	ECM Internal Monitoring	---	ECM

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0602	ECM Internal Monitoring	---	ECM
P0604	ECM Internal Monitoring	---	ECM
P0606	ECM Internal Monitoring	---	ECM
P060A	ECM Internal Monitoring	---	ECM
P1516	ECM Internal Monitoring	---	ECM
P2101	ECM Internal Monitoring	---	ECM

4. Diagnostic Steps:

Step 1	Check whether there is control system DTC code other than P0601, P0602, P0604, P0606, P060A, P1516, P2101.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
DTC P0601, P0602, P0604, P0606, P060A, P1516, P2101	Yes
DTC code other than DTC P0601, P0602, P0604, P0606, P060A, P1516, P2101	No

No → Refer to 2.12.7.14 DTC Code Index.

Yes

Step 2	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

2.12.7.46 DTC P0641 P0651

1. DTC Descriptor:

DTC	P0641	ETC Reference Voltage A # Amplitude Fault

DTC	P0651	ETC Reference Voltage B # Amplitude Fault

As ETC uses two throttle position sensors, its normal working required 5 V reference voltage and low reference voltage is shared with ETC harness connector terminals A and D. Where A and EO01 terminal No.3 is connected, sharing the low reference voltage. D terminal and EO01 terminal No.4 is connected, sharing 5 V reference voltage. Malfunction in any circuit will report DTC code P0641 or P0651.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0641	Hardware Circuit Malfunction	-	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0651	Hardware Circuit Malfunction	-	

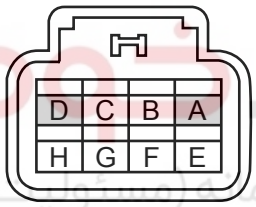
3. Schematic:

Refer to 2.12.7.21 DTC P0122 P0123.

4. Diagnostic Steps:

Step 1	Check ETC harness connector EO27 terminals A and D.

Electronic Throttle Body Harness Connector EO27



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(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ETC harness connector EO27.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between EO27 terminal A and a reliable ground.
(e) Measure voltage between EO27 terminal D and a reliable ground.

Results:

Test Items	Standard Value
Resistance Between EO27 (A) and A Reliable Ground	Less than 3 Ω
Voltage Between EO27 (D) and A Reliable Ground	4.8-5.2 V

Standard values?

No → Circuit malfunction, repair circuit.

Yes

Step 2	Replace the electronic throttle body.

(a) Refer to "Electronic Throttle Body Replacement".

Next

Step 3	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 4	Check ECM power supply circuit and ground circuit.

(a) Check ECM power supply circuit and ground circuit. Refer to "2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

Step 5	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 6	Carry out crankshaft position sensor learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 7	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code.

Verify that the system has no DTC code output.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 8	Diagnostic completed.

2.12.7.47 DTC P0646 P0647

1. DTC Descriptor:

DTC	P0646	Air-Conditioning Clutch Relay Circuit Short To Low Voltage or Open

DTC	P0647	Air-Conditioning Clutch Relay Circuit Short To High Voltage

Air-Conditioning compressor working voltage is provide by main relay which is controlled by ECM. ECM controls Air-Conditioning compressor relay internal ground through ECM harness connector EO35 terminal No.51 of, relay pull-in. ECM has a drive circuit which controls relay coil ground, and drive circuit is equipped with a feedback circuit to ECM. By monitoring the feedback voltage, ECM determines whether the control circuit is open, short to ground or short to power supply.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0646	Hardware Circuit Checks	When air-conditioning is not working, with air-conditioning relay control circuit open or short to ground, the DTC code will be set.	1. Air-Conditioning Relay 2. ECM 3. Air-Conditioning Relay Circuit
P0647	Hardware Circuit Checks	When air-conditioning is not working, with air-conditioning relay control circuit open or short to ground, the DTC code will be set.	1. Air-Conditioning Relay 2. ECM 3. Air-Conditioning Relay Circuit

3. Schematic:

Refer to 8.2.6.2 Air-conditioning System Circuit Schematic.

4. Diagnostic Steps:

Refer to 8.2.7.6 Air-conditioning Clutch Inoperative.

2.12.7.48 DTC P0650

1. DTC Descriptor:

DTC	P0650	Fault Indicator (MIL) Malfunction

CAN network is used in vehicles. Fault lamps are controlled via the instrument panel circuit. When ECM DTC code is set to light fault lamps, ECM sends a "Light the fault lamp" signal through the CAN network the instrument panel. The instrument panel internal circuit light the fault lamp indicating engine fault after receiving the instruction from ECM.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0650	Hardware Circuit Checks	Fault indicator output state and ECM expected status does not match.	1. Instrument Cluster 2. CAN-Bus

Diagnostic Steps:

Step 1	Check other fault lights working.

(a) Turn the ignition switch to "ON" position.

Other fault lights normal?

Yes → Go to step 3

No

Step 2	Repair instrument cluster circuit.

Instrument Repair

(a) Repair instrument cluster power supply circuit. Refer to 11.7.6.7 DTC U129C U129D.

(b) Repair instrument cluster ground circuit. Refer to 11.7.6.7 DTC U129C U129D.

Is fault resolved?

Yes → System normal.

No

Step 3	Check instrument DTC.

(a) Connect scan tool.

(b) Turn the ignition switch to "ON" position.

(c) Scan instrument DTC.

Is there DTC code?

Yes → Go to step 5

No

Step 4	Test fault indicator.

(a) Connect scan tool.

(b) Turn the ignition switch to "ON" position.

(c) Choose scan tool "Function Test" menu and then "Fault Light Test".

Is fault indicator lit?

Yes → Go to step 6

No

Step 5	Replace instrument cluster.

(a) Turn off the ignition switch and remove the ignition key.

(b) Disconnect the battery negative cable.

(c) Replace instrument cluster. Refer to 11.7.7.1 Instrument Cluster Replacement.

Is fault solved?

Yes → System normal.

No

Step 6	Check instrumentation and ECM network communication.

(a) Repair instrumentation and ECM network communication malfunction. Refer to 11.17.7.4 CAN Bus Integrity Diagnosis.

Is fault solved?

Yes → System normal

No

Step 7	Repair ECM power supply circuits.

(a) Repair ECM power supply circuit. Refer to 2.12.7.43 DTC P0562 P0563.

Is fault solved?

Yes → System normal.

No

Step 8	Replace ECM.

(a) Connect scan tool.
(b) Turn the ignition switch to "ON" position.
(c) Scan ECM DTC codes, repair ECM Repair the faulty part. if necessary, replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.
(d) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.
(e) Clear malfunction code.

Next

Step 9	System normal.

2.12.7.49 DTC P0685

1. DTC Descriptor:

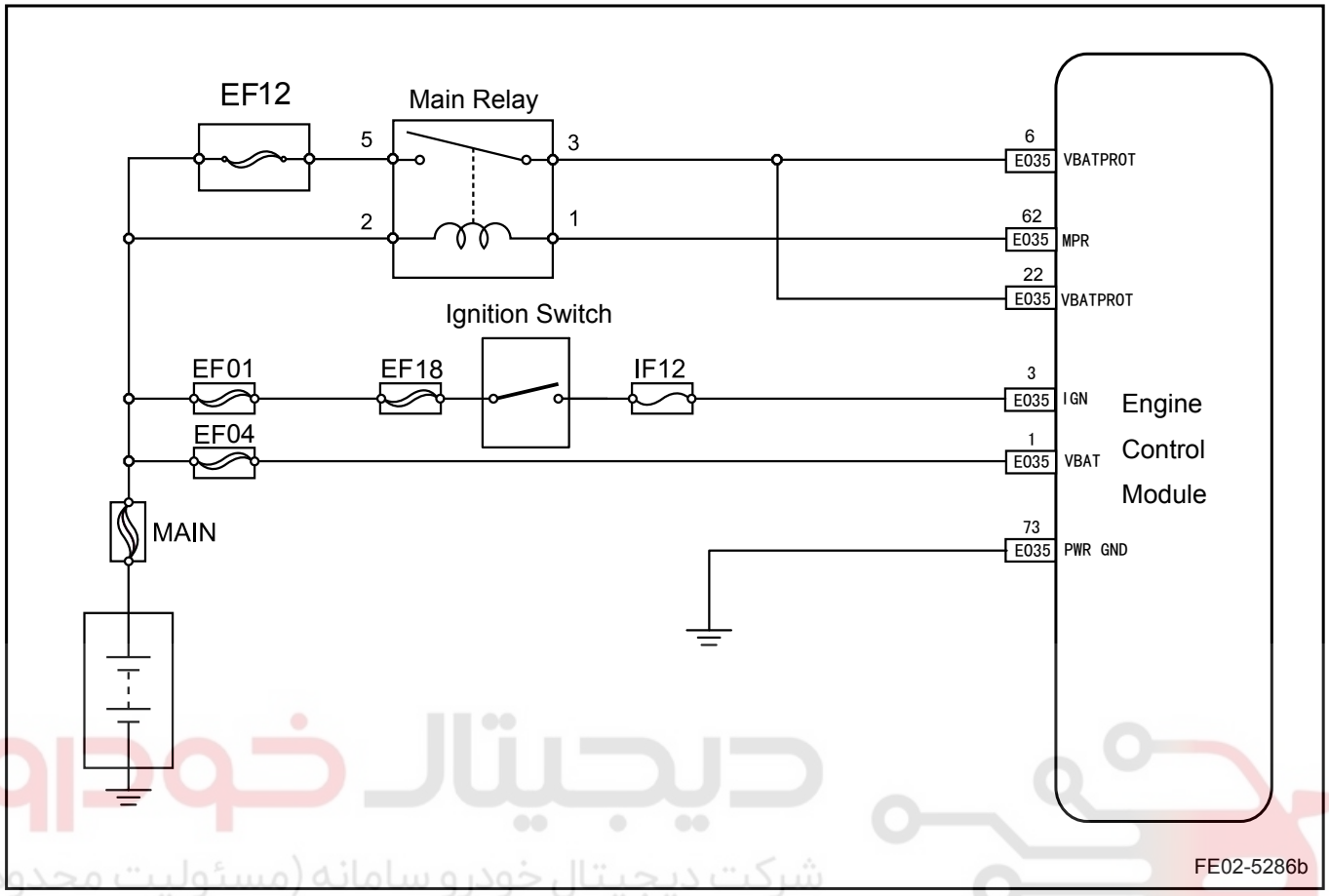
DTC	P0685	Main Relay Malfunction

Main relay is used to provide power to fuel injectors and oxygen sensors and other components. Battery provides power to main relay terminal No.2. ECM controls main relay ground through ECM harness connector EO35 terminal No.62. ECM has a detection circuit. By monitoring the feedback voltage, ECM determines whether the control circuit is open, short to ground or short to power supply.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0685	Main Relay Malfunction	The main relay circuit control state does not match ECM expected status.	1. Main Relay Circuit 2. Main Relay 3. ECM

3. Schematic:



4. Diagnostic Steps:

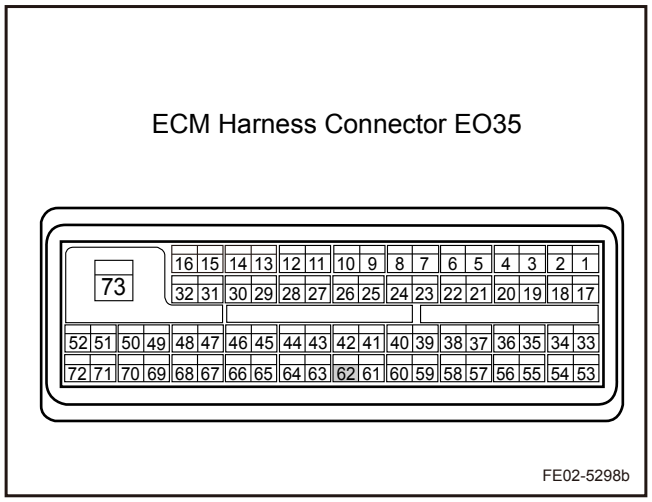
Step 1	Visual Inspection.

(a) Check main relay for signs of damage.

Yes → Replace the main relay. Go to step 10.

No

Step 2	Check ECM harness connector EO35 terminal No.62.



(a) Turn the ignition switch to "OFF" position.
(b) Remove of ECM harness connector EO35.
(c) Measure voltage between ECM harness connector EO35 terminal No.62 and a reliable ground.
(d) Measure resistance between ECM harness connector EO35 terminal No.62 and a reliable ground.

Standard Value:

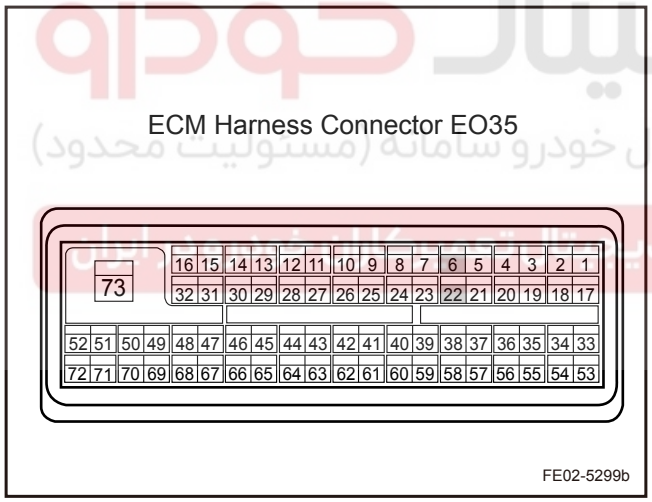
Test Items	Specified Value
Voltage Between EO35 (62) and A Reliable Ground	11-14 V
Resistance Between EO35 (62) and A Reliable Ground	10 kΩ or higher

All normal?

No → Repair circuit between the battery and EO35 terminal No.62. Go to step 10.

Yes

Step 3	Check ECM harness connector EO35 terminals No.6 and 22.



(a) Turn the ignition switch to "OFF" position.
(b) Measure resistance between ECM harness connector EO35 terminals No.6, 22 and a reliable ground.
(c) Connect EO35 terminal NO.62 to ground.
(d) Measure voltage between ECM harness connector EO35 terminals No.6, 22 and a reliable ground.

Standard Value:

Test Items	Specified Value
Resistance Between EO35 (6,22) and A Reliable Ground	10 kΩ or higher
Voltage Between EO35 (6,22) and A Reliable Ground	11-14 V

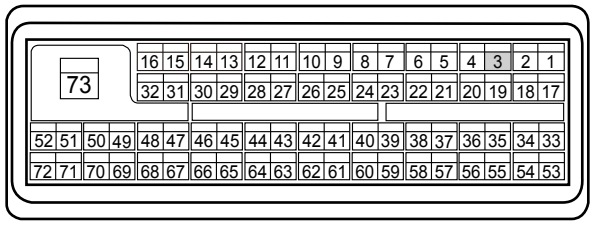
All normal?

No → Go to step 5

Yes

Step 4	Check the ignition switch input signal.

ECM Harness Connector EO35



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(a) Turn the ignition switch to "ON" position.
(b) Measure voltage between ECM harness connector EO35 terminal No.3 and a reliable ground.

Standard Value:

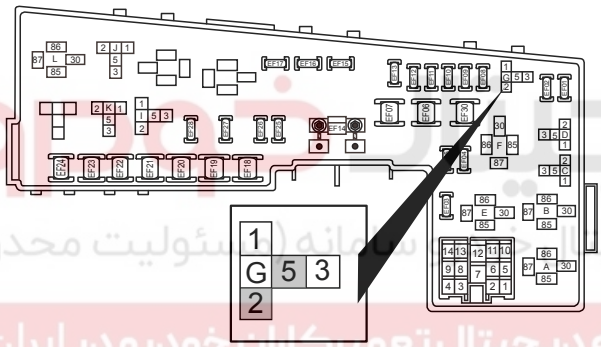
Test Items	Specified Value
Voltage Between EO35 (3) and A Reliable Ground	11-14 V

(c) Turn the ignition switch to "OFF" position.

Voltage normal?

No	Repair circuit between the battery and EO35 terminal No.3.
Yes	Go to step 8

Step 5	Check main relay terminals No.2 and 5 voltage.



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(a) Remove the main relay.
(b) Measure voltage between the main relay terminal No.2,5 and a reliable ground.
(c) Measure resistance between the main relay terminal No.2,5 and a reliable ground.

Standard Value:

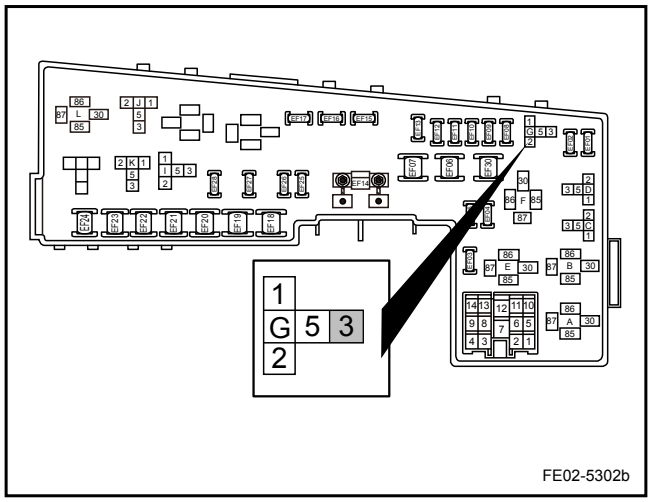
Test Items	Standard Value
Voltage Between The Main Relay Terminal No.2,5 and A Reliable Ground	11-14 V
Resistance Between The Main Relay Terminal No.2,5 and A Reliable Ground	10 kΩ or higher

All normal?

No	Repair battery to the main relay terminal No. 2,5 circuit.

Yes

Step 6	Check main relay terminal No.3.



(a) Install the main relay.
(b) Connect ECM harness connector EO35 terminal No.62 to ground.
(c) Measure voltage between main relay terminal No.3 and a reliable ground.

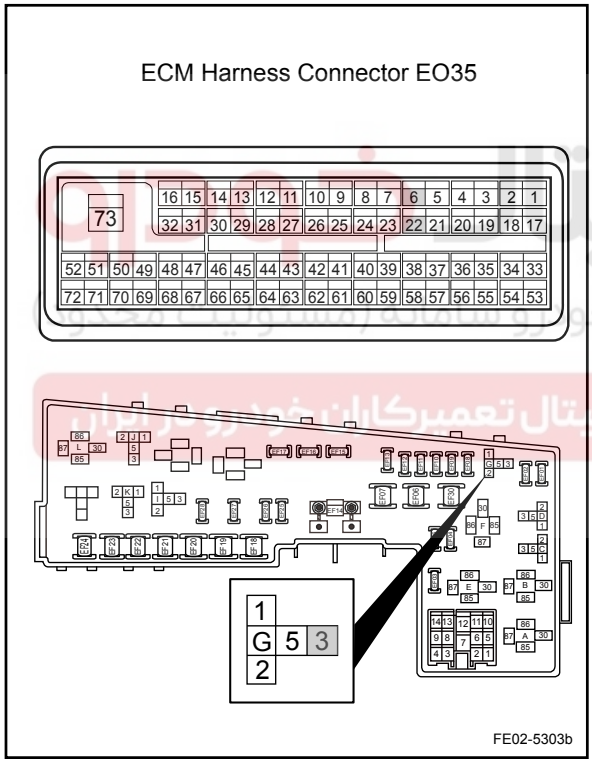
Standard voltage: 11-14 V

Voltage normal?

No → Replace the main relay. Go to step 10

Yes

Step 7	Test continuity between main relay and ECM harness connector.



(a) Remove the main relay.
(b) Measure resistance between main relay terminal No.3 and ECM harness connector EO35 terminals No. 6,22.

Standard Resistance: Less than 1 Ω

Resistance normal?

No → Repair the circuit between main relay terminal No.3 and ECM harness connector EO35 terminals No. 6,22.

Step 8	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair ECM Power Supply Circuits.

Yes

Step 9	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 10	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

Yes

Step 11	Diagnostic completed.

2.12.7.50 DTC P2104 P2105 P2106 P2110

1. DTC Descriptor:

DTC	P2104	Mandatory Engine idling
DTC	P2105	Mandatory Engine Shutdown
DTC	P2106	Restrictions On Engine Performance
DTC	P2110	Engine Power Management

When the intake system or throttle body valve air floe control have faults, ETC system can not reliably use the throttle to control engine power. ECM will report the relevant DTC code, while the engine works in the protected mode.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P2104	Protected mandatory idle	1. Engine At idle. 2. Acceleration pedal position sensor signal 1 and signal 2 circuits all open, or short to GND and short to 5 V.	---
P2105	Fault Protection Mandatory Shutdown	1. Engine At idle. 2. Use scan tool to modify engine running state, shut down the engine.	

P2106	Fault Protection Limits	1. Engine At idle. 2. Acceleration pedal position sensor signal 1 and signal 2 circuits all open, there is a sensor related fault. 3. Sensor DTC codes appears, engine enters into the limited implementation state.	
P2110	Failsafe Power Limit	1. Engine At idle. 2. throttle position sensor signal 1 and signal 2 circuits all open, there is a sensor related fault. 3. Sensor DTC codes appears, default throttle opening.	

3. Diagnostic Steps:

Note

Before carrying out this diagnosis step, observe the data list on scan tool and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Check whether there is control system DTC code other than DTC P2104 P2105 P2106 P2110.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
DTC P2104 P2105 P2106 P2110	No
DTC code other than DTC P2104 P2105 P2106 P2110	Yes

Yes → 2.2.7.11 DTC Code Index

No

Step 2	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

Yes → Diagnostic

No

Step 3	Check ECM power supply circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty parts. Go to step 5

Yes

Step 4	Replace ECM.

(a) Replace ECM.
(b) Carry out crankshaft position sensor self learn. Refer to the "Crankshaft Position Sensor Learn".

Next

Step 5	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

Yes

Step 6	Diagnostic completed.

5. Repair Instructions:

Refer to 2.2.8.8 Engine Control Module Replacement Replace ECM.

2.12.7.51 DTC P2119

1. DTC Descriptor:

DTC	P2119	Electronic Throttle Return Malfunction

After the ignition switch is switched off, electronic throttle stays at the initial angle of 14.5 degrees. If the ignition switch is off, the throttle is always off, the DTC code may be recorded, and it may be accompanied by the engine difficult to start and so on.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P2119	Electronic Throttle Return Malfunction	1. Ignition Switch "OFF". 2. Throttle is always off, so throttle fails to reach proper opening for return test.	1. Electronic Throttle Body Dirty 2. Electronic Throttle Body Mechanical Malfunction

3. Diagnostic Steps:

Step 1	Check whether there is other ETC system related DTC code?

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
Only P2119	Yes
DTC Code Other Than P2119	No

No → Refer to 2.12.7.14 DTC Code Index

Yes

Step 2	Cleaning electronic throttle body.

(a) Remove electronic throttle body. Refer to the "Electronic Throttle Body Replacement".
(b) Clean electronic throttle body.

Next

Step 3	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → Diagnostic

Yes

Step 4	Replace electronic throttle body.

(a) Replace electronic throttle body. Refer to the "Electronic Throttle Body Replacement".

Next

Step 5	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) start the engine and idle speed warm-up run for at least 5 min.
(e) Read control system DTC code again to confirm that the system has no DTC code.

No → diagnostic

Yes

Step 6	Check ECM power supply circuit and ground circuit.

(a) Check ECM power supply circuit and ground circuit. Refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Repair power and ground circuit faults

Yes

Step 7	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 8	Carry out crankshaft position sensor learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 10	Diagnostic completed.

2.12.7.52 DTC P2122 P2123

1. DTC Descriptor:

DTC	P2122	Electronic Throttle Pedal Position Sensor 1 Circuit Low Voltage

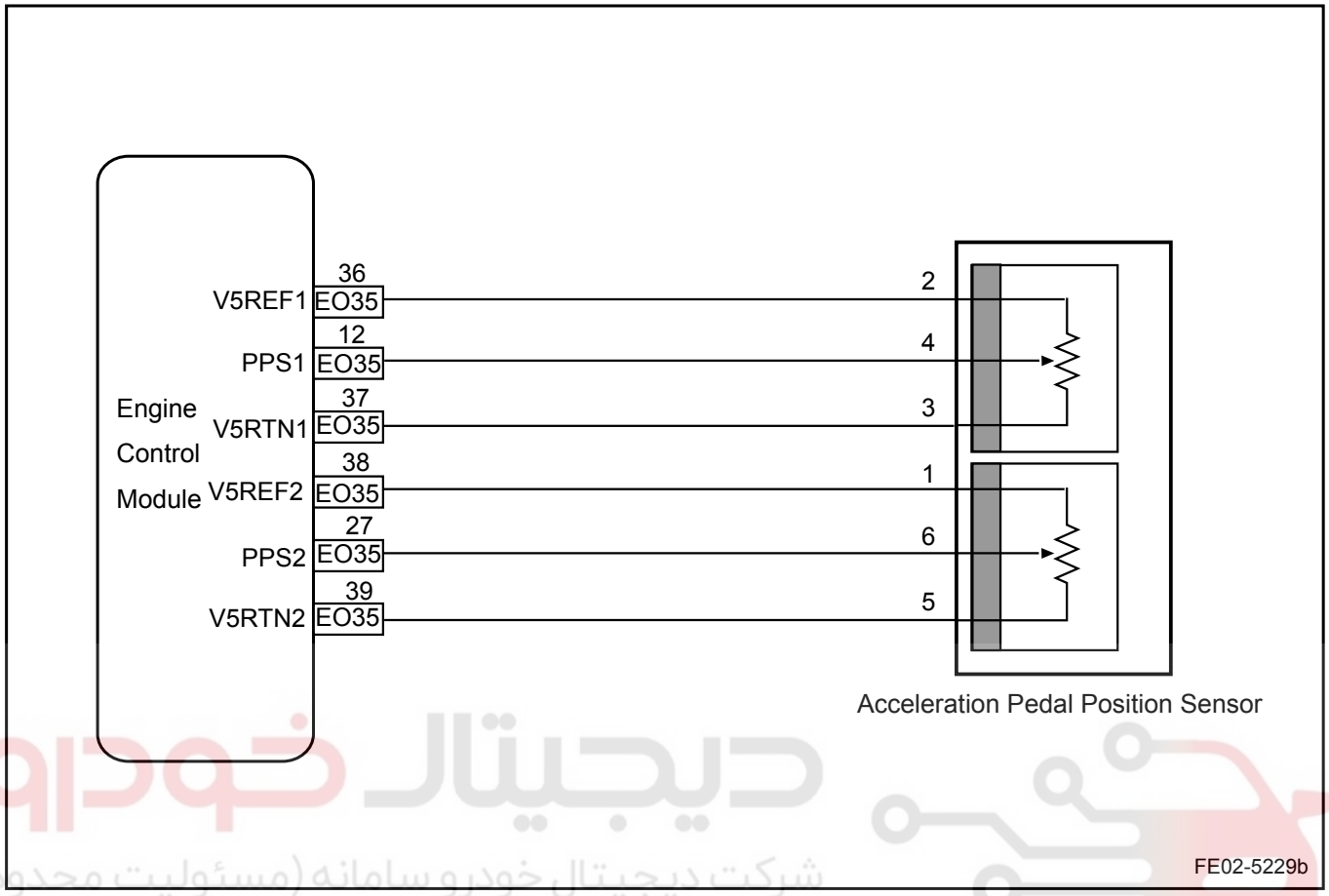
DTC	P2123	Electronic Throttle Pedal Position Sensor 1 Circuit High Voltage

In order to protect the security of the system, acceleration pedal position sensor (APP) uses a dual-sensor setting, sliding resistive. APP sensor 1 output is IP50 terminal No.4, through ECM wiring harness Connect EO35 terminal No.12 to ECM.

2. Conditions For Setting DTC and The Fault Location:

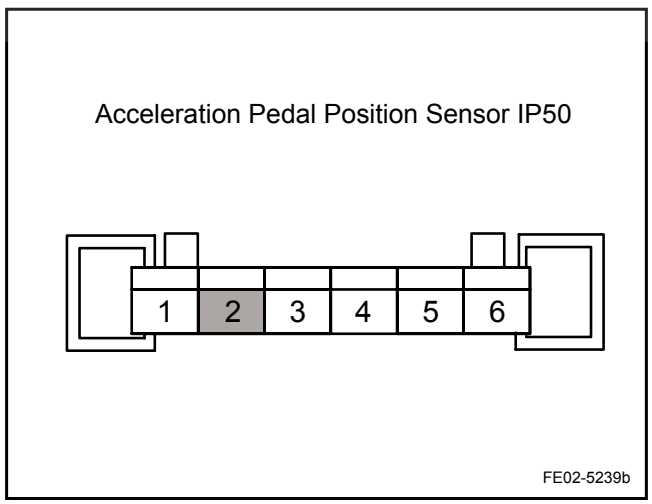
DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P2122	Hardware Circuit Malfunction	Voltage is below the minimum limit, or short to ground	1. Acceleration Pedal Position Sensor 2. Acceleration Pedal Position Sensor Circuit 3. ECM
P2123	Hardware Circuit Malfunction	Voltage is higher than the maximum limit, or short to power supply	

3. Schematic:



4. Diagnostic Steps:

Step 1	Check APP sensor harness connector IP50 terminal No.2 voltage.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between IP50 terminal No.2 and a reliable ground.

Standard Voltage: 4.8-5 .2 V

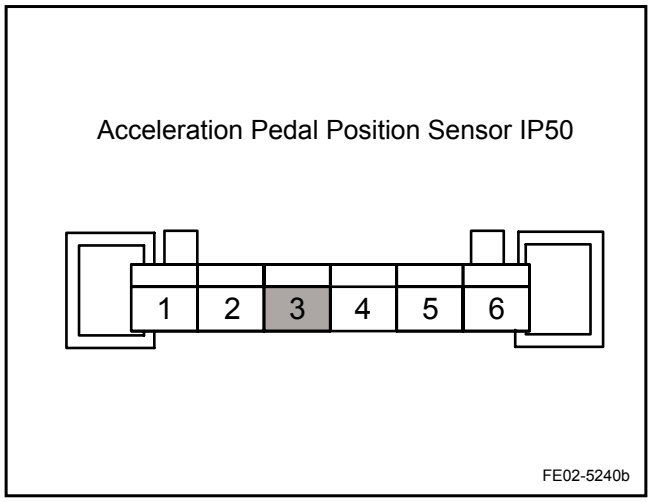
Standard values?

No

If the voltage is higher than the standard value, the circuit is short to power supply, if the voltage is lower than the standard value.

Yes

Step 2	Check resistance between APP sensor harness connector IP50 terminal No.3 and a reliable ground.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between IP50 terminal No.3 and a reliable ground.

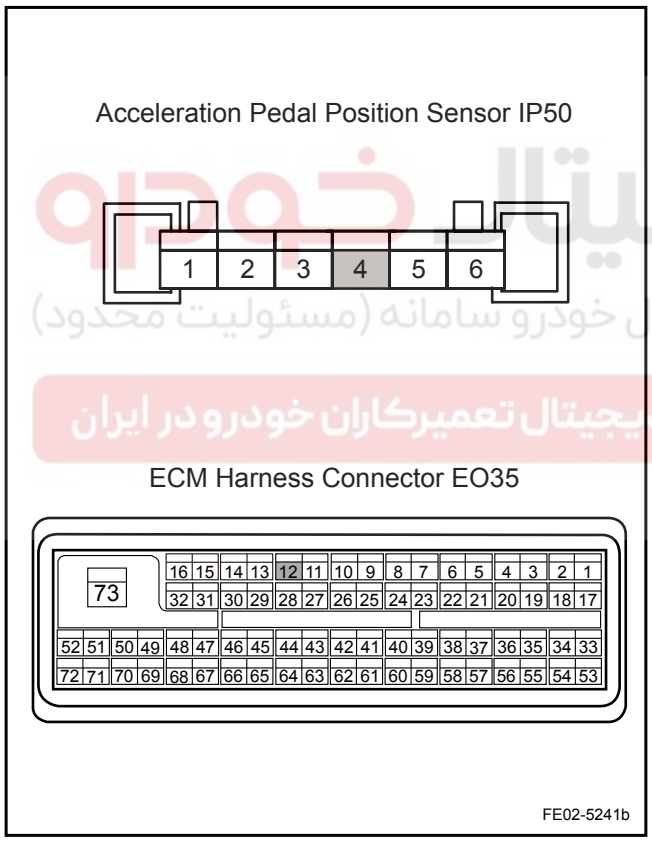
Standard Resistance: Less than 3 Ω

Is the resistance standard value?

No → Go to step 5

Yes

Step 3	Check APP sensor harness connector IP50 terminal No.4.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Disconnect ECM harness connector EO35.
(d) Measure resistance between IP50 terminal No.4 and a reliable ground.
(e) Measure voltage between IP50 terminal No.4 and a reliable ground.
(f) Test continuity between IP50 terminal No.4 and EO35 terminal No.12.

Results:

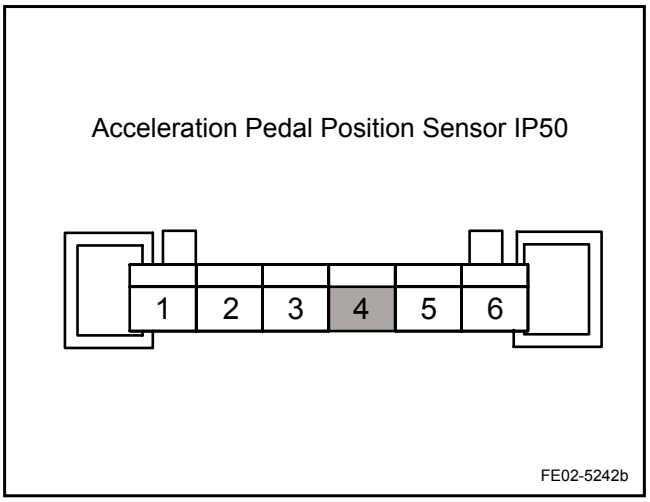
Test Items	Standard Value
Resistance Between IP50 (4) and A Reliable Ground	10 kΩ or higher
Voltage Between IP50 (4) and A Reliable Ground	0 V
Continuity Between IP50 (4) and EO35 (12)	Less than 1 Ω

Standard values?

No → Circuit fault. Repair the faulty part.

Yes

Step 4	Check APP sensor harness connector IP50 terminal No.4 output voltage.



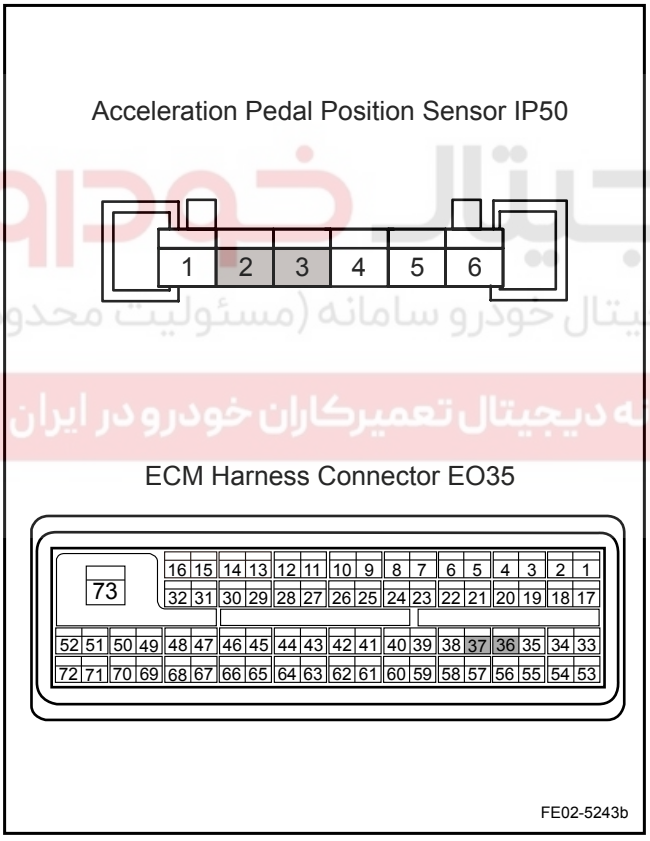
(a) Check APP sensor harness connector IP50 terminal No.4 output voltage. For the Standard Value. Refer to 2.12.7.13 Acceleration Pedal Position Sensor (APP) Check.

Is the output voltage Standard Value?

No	Replace the APP sensor. Refer to the "APP sensor better."
Yes	Go to step 7

Yes

Step 5	Check APP sensor harness connector IP50 terminals No.2 and 3.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Disconnect ECM harness connector EO35.
(d) Turn the ignition switch to "ON" position.
(e) Measure resistance between IP50 terminal No.2 and a reliable ground.
(f) Test continuity between IP50 terminal No.2 and EO35 terminal No.36.
(g) Measure voltage between IP50 terminal No.2 and a reliable ground.
(h) Test continuity between IP50 terminal No.3 and EO35 terminal No.37.

Results:

Test Items	Standard Value
Resistance Between IP50 (2) and A Reliable Ground	10 kΩ or higher
Continuity Between IP50 (2) and EO35 (36)	Less than 1 Ω
Voltage Between IP50 (3) and A Reliable Ground	0 V
Continuity Between IP50 (3) and EO35 (37)	Less than 1 Ω

Standard values?

No	Circuit fault, Repair the faulty part.

Yes

Step 6	Check ECM power supply circuit and ground circuit.

(a) Check ECM power supply circuit and ground circuit. Refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Power and ground circuit fault.

Yes

Step 7	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 8	Carry out crankshaft position sensor learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Acceleration pedal position sensor (APP) can only be replaced as an assembly. Do not disassemble. APP replacement Refer to "Acceleration Pedal Position Sensor Replacement".

2.12.7.53 DTC P2127 P2128

1. DTC Descriptor:

DTC	P2127	Electronic Throttle Pedal Position Sensor 2 Circuit Low Voltage

DTC	P2128	Electronic Throttle Pedal Position Sensor 2 Circuit High Voltage

In order to protect the security of the system, acceleration pedal position sensor (APP) uses a dual-sensor setting, sliding resistive. APP sensor 2 output is IP50 terminal No.6, through ECM wiring harness Connect EO35 terminal No.27 to ECM.

2. Conditions For Setting DTC and The Fault Location:

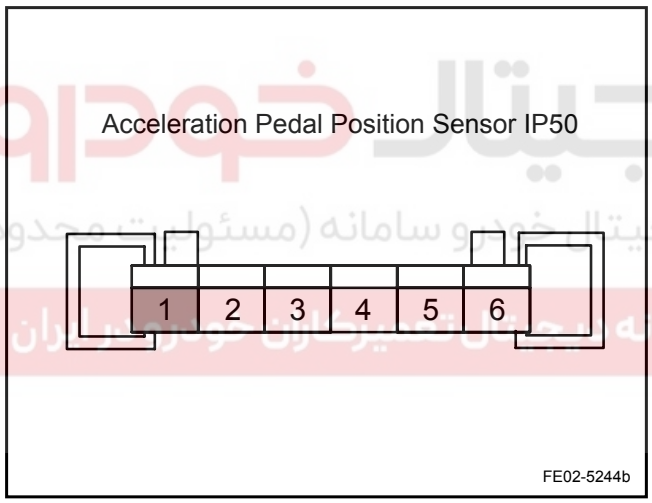
DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P2127	Hardware Circuit Malfunction	Voltage is below the minimum limit, or short to ground	1. Acceleration Pedal Position Sensor 2. Acceleration Pedal Position Sensor Circuit 3. ECM
P2128	Hardware Circuit Malfunction	Voltage is higher than the maximum limit, or short to power supply	

3. Schematic:

Refer to 2.12.7.52 DTC P2122 P2123.

4. Diagnostic Steps:

Step 1	Check APP sensor harness connector IP50 terminal voltage of the No.1.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between IP50 terminal No.1 and a reliable ground.

Standard Voltage: 4.8-5.2 V

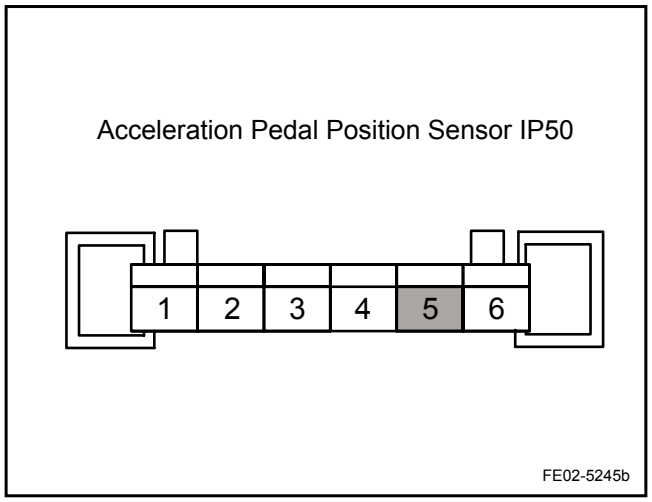
Standard values?

No

If the voltage is higher than the Standard Value, the circuit is short to power supply, if the voltage is lower than the standard value.

Yes

Step 2	Check resistance between APP sensor harness connector IP50 terminal No.5 and a reliable ground.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Turn the ignition switch to "ON" position.
(d) Measure resistance between IP50 terminal No.5 and a reliable ground.

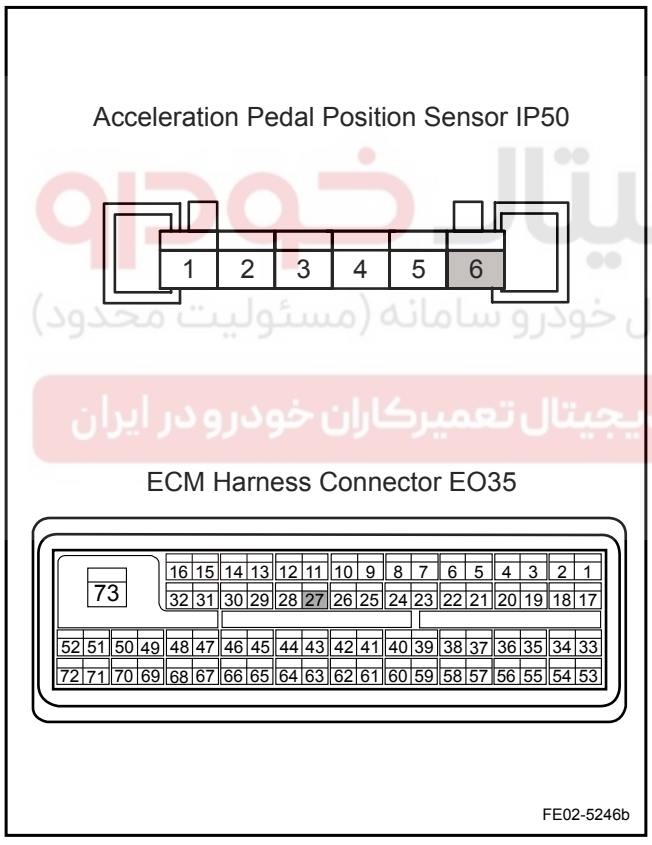
Standard Resistance: Less than 3 Ω

Standard resistance?

No → Go to step 5

Yes

Step 3	Check APP sensor harness connector IP50 terminal No.6.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Disconnect ECM harness connector EO35.
(d) Measure resistance between IP50 terminal No.6 and a reliable ground.
(e) Measure voltage between IP50 terminal No.6 and a reliable ground.
(f) Test continuity between IP50 terminal No.64 and EO35 terminal No.27.

Results:

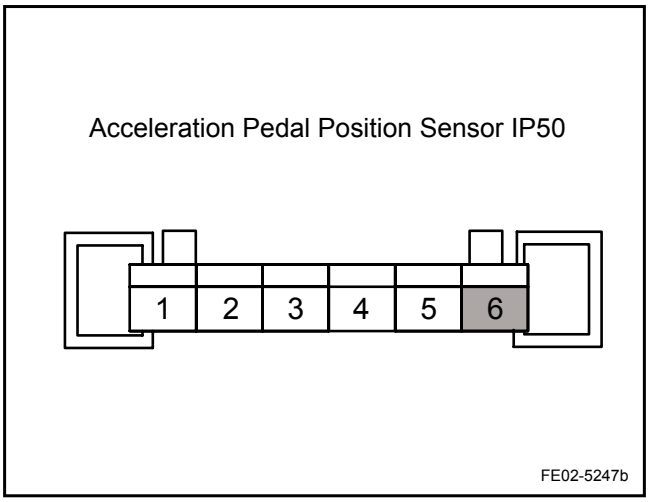
Test Items	Standard Value
Resistance Between IP50 (6) and A Reliable Ground	10 kΩ or higher
Voltage Between IP50 (6) and A Reliable Ground	0 V
Continuity Between IP50 (6) and EO35 (27)	Less than 1 Ω

Standard values?

No → Circuit fault. Repair the faulty part.

Yes

Step 4	Check APP sensor harness connector IP50 terminal No.6 output voltage.



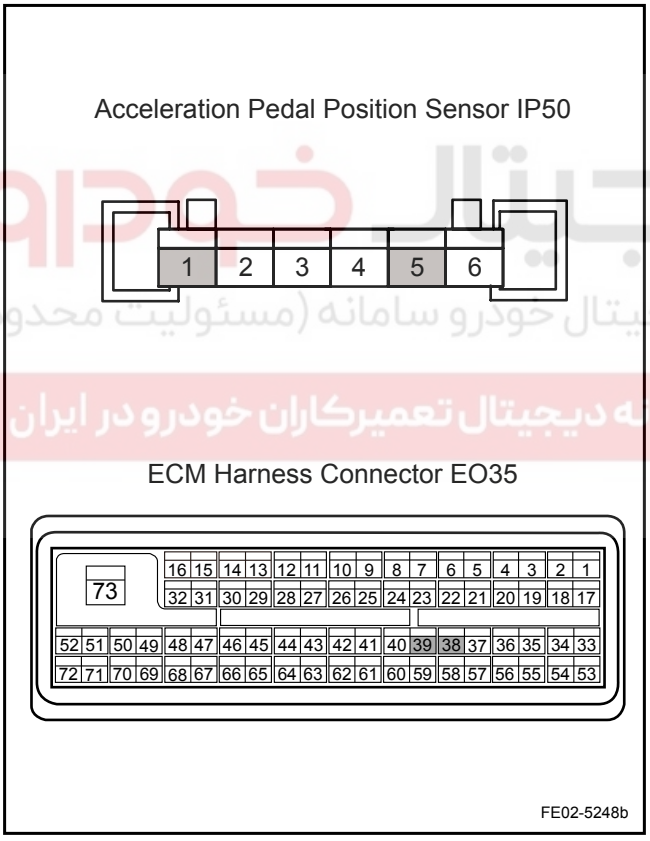
(a) Check APP sensor harness connector IP50 terminal No.6 output voltage. For the Standard Value. Refer to 2.12.7.13 Acceleration Pedal Position Sensor (APP) Check.

Is the output voltage Standard Value?

No	Replace the APP sensor. Refer to the "APP sensor replacement."
Yes	Go to step 7

Yes

Step 5	Check APP sensor harness connector IP50 terminals No.1 and 5.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect APP sensor harness connector IP50.
(c) Disconnect ECM harness connector EO35.
(d) Turn the ignition switch to "ON" position.
(e) Measure resistance between IP50 terminal No.1 and a reliable ground.
(f) Test continuity between IP50 terminal No.1 and EO35 terminal No.38.
(g) Measure voltage between IP50 terminal No.5 and a reliable ground.
(h) Test continuity between IP50 terminal No.5 and EO35 terminal No.39.

Results:

Test Items	Standard Value
Resistance Between IP50 (1) and A Reliable Ground	10 kΩ or higher
Continuity Between IP50 (1) and EO35 (38)	Less than 1 Ω
Voltage Between IP50 (5) and A Reliable Ground	0 V
Continuity Between IP50 (5) and EO35 (39)	Less than 1 Ω

Standard values?

No	Circuit fault, repair the faulty part.

Yes

Step 6	Check ECM power supply circuit and ground circuit.

(a) Check ECM Power Supply Circuit and ground circuit. Refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No	Power and ground circuits fault.

Yes

Step 7	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 8	Carry out crankshaft position sensor learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.
(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No	Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 10	Diagnostic completed.

5. Repair Instructions:

Acceleration pedal position sensor (APP) can only be replaced as an assembly. Do not disassemble. APP replacement Refer to "Acceleration Pedal Position Sensor Replacement".

2.12.7.54 DTC P2135

1. DTC Descriptor:

DTC	P2135	Electronic Throttle Position Sensor 1 and 2 Circuits Relations Malfunctions

ECM compares TPS1 and TPS2 input signals. Two input signals' sum at any time should be close to 5V. If ECM detects difference between the sum of TPS1 and TPS2 signals and the theoretical value is big, ECM will report the DTCs code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P2135	Hardware Circuit Malfunction	Voltage is lower than the minimum limit, or circuit short to ground.	1. ETC 2. TPS Sensor Circuit 3. ECM

3. Schematic

Refer to 2.12.7.21 DTC P0122 P0123.

4. Diagnostic Steps:

Step 1	Check whether there is other TPS system related DTC code?

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
Only P2135	Yes
P0122, P0123, P0222, P0223	No

No → Refer to 2.12.7.14 DTC Code Index

Yes

Step 2	Check TPS1 and TPS2 output voltage signals.

(a) For technical specifications. Refer to 2.12.7.12 Electronic Throttle Body (ETC) Check.

Specified values?

No → Replace electronic throttle body. Refer to "Electronic Throttle Body Assembly Replacement".

Yes

Step 3	Check ECM power supply circuit and ground circuit.

(a) Check ECM power supply circuit and ground circuit. Refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

Step 4	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 5	Carry out crankshaft position sensor learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 6	Use scan tool to confirm whether the DTC code is stored again. (a) Connect scan tool to the datalink connector. (b) Turn the ignition switch to "ON" position. (c) Clear DTC code. (d) Start and run the engine at idle speed to warm up the engine for at least 5 min. (e) Road test the vehicle for at least 10 min. (f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 7	Diagnostic completed.

2.12.7.55 DTC P2138

1. DTC Descriptor:

DTC	P2138	Electronic Acceleration Pedal Position Sensor 1 and 2 Circuits Relations Malfunctions

ECM compares APP1 and APP2 signals. APP2 input signal at any given time should be close to twice the APP1 signal. If ECM detects the APP1 and APP2 signals do not satisfy this condition, ECM will report the DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P2138	Hardware Circuit Malfunction	Voltage is below the minimum limit, or circuit short to ground	1. APP 2. APP Sensor Circuit 3. ECM

3. Schematic

Refer to 2.12.7.52 DTC P2122 P2123.

4. Diagnostic Steps:

Step 1	Check whether there is other APP sensor related DTC code?

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Press the scan tool power button.
(d) Select the following menu items: Engine/Read DTC codes.
(e) Read DTC codes.

Results:

DTC Codes Shown	To Step
Only P2138	Yes
P2122, P2123, P2127, P2128	No

No → Refer to 2.12.7.14 DTC Code Index

Yes

Step 2	Check TPS1 and TPS2 output voltage signals.

(a) For technical specifications. Refer to 2.12.7.13 Acceleration Pedal Position Sensor (APP) Check.

Specified values?

No → Replace the acceleration pedal. Refer to the "acceleration pedal assembly replacement."

Yes

Step 3	Check ECM Power Supply Circuit and ground circuit.

(a) Check ECM Power Supply Circuit and ground circuit. Refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

Step 4	Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Next

Step 5	Carry out crankshaft position sensor learn. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 6	Use scan tool to confirm whether the DTC code is stored again.

(a) Connect scan tool to the datalink connector.
(b) Turn the ignition switch to "ON" position.
(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.
(e) Road test the vehicle for at least 10 min.
(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Intermittent Fault. Refer to 2.12.7.3 Intermittent Fault Check

Yes

Step 7	Diagnostic completed.

2.12.7.56 DTC P2610

Lack of information, to provide in the future.

2.12.7.57 DTC P0633 U0167 U0426

1. DTC Descriptor:

DTC	P0633	Alarm Does Not Learn Malfunction
DTC	U0167	Anti-theft Device No Response
DTC	U0426	Anti-theft Device Authentication Failure

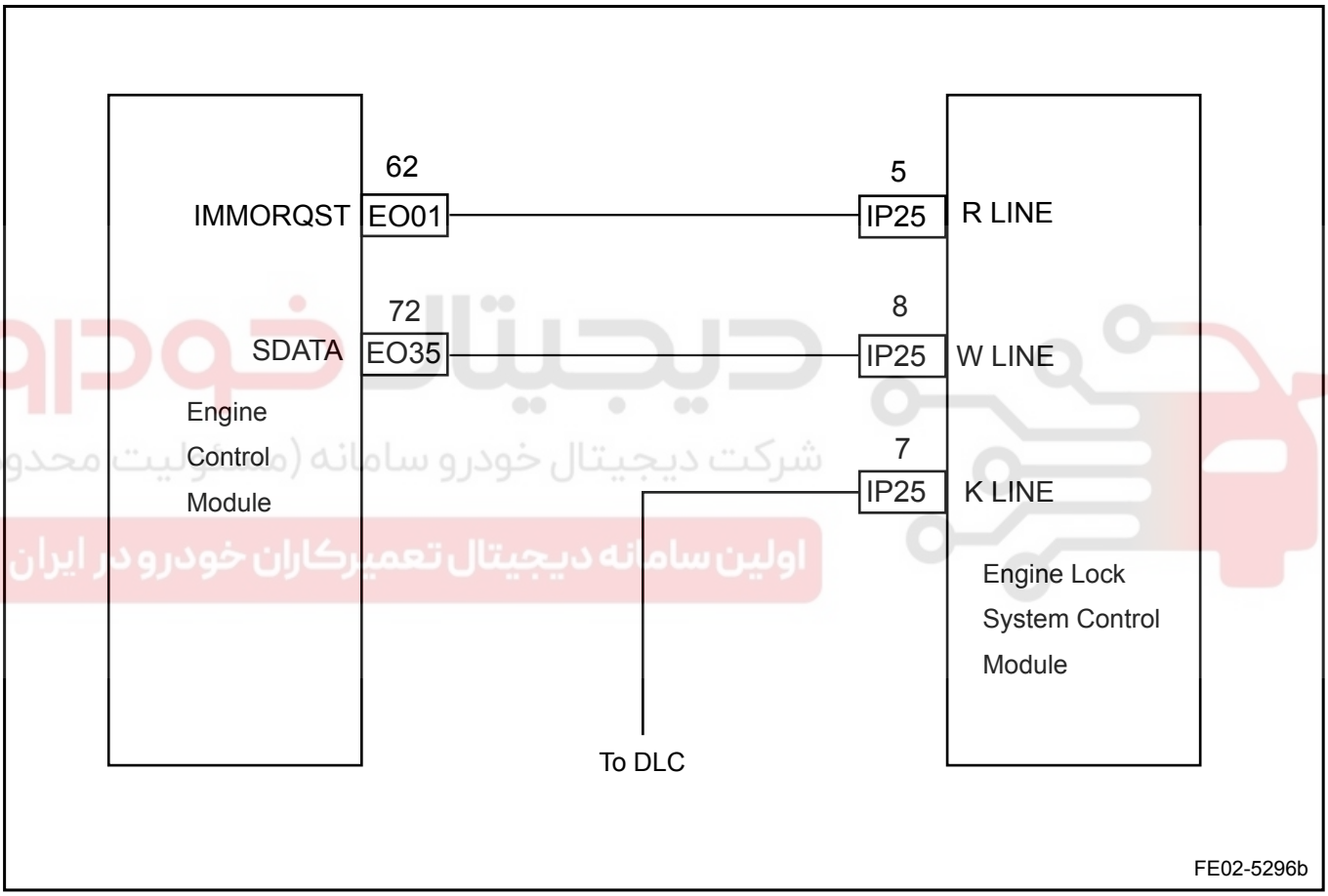
ECM communicates with Anti-theft control module through ECM harness connector EO01 terminal No.62 R-LIN circuit and wiring harness connector EO35 terminal No.72 R-LIN circuit. For details, Refer to 11.17 Data Communication System.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0633	Alarm Does Not Learn Malfunction	Ignition Switch "ON".	1. Ignition Key 2. Ignition Key Incentive Coil 3. ECM 4. Chip Security Module 5. Data Circuit (W-LIN Circuit, R-LIN Circuit)
U0167	Anti-theft Device No Response	Ignition Switch "ON".	1. Ignition Key 2. Ignition Key Incentive Coil 3. ECM 4. Chip Security Module 5. Data Circuit (W-LIN Circuit, R-LIN Circuit)

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
U0426	Anti-theft Device Authentication Malfunction	Ignition Switch "ON".	1. Ignition key 2. Ignition Key Incentive Coil 3. ECM 4. Chip Security Module 5. Data Circuit (W-LIN Circuit, R-LIN Circuit)

3. Schematic:



4. Diagnostic Steps:

Refer to 2.15.1.1 Engine Anti-theft System Warning Lamp Flashing, The Vehicle Can Not Be Started.

5. Repair Instructions:

Anti-theft system repair. Pefer to anti-theft system,2.15.1 Diagnostic Information and Procedures.

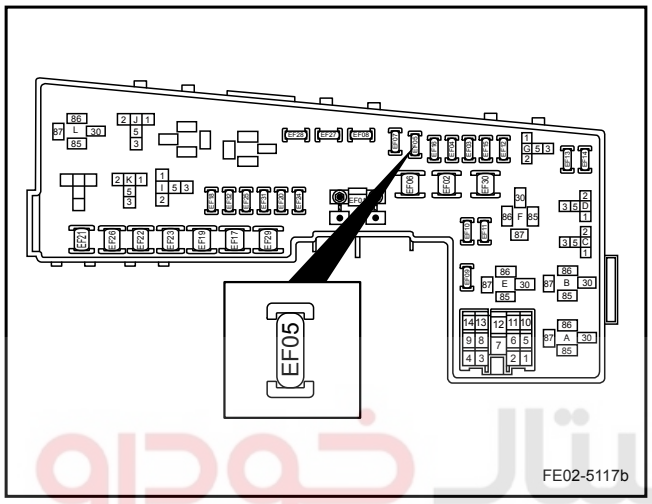
2.12.7.58 Crankshaft Rotation Normal, But The Engine Can Not Start

Note

Before carry out this diagnostic step, make sure the engine oil meets manufacturers requirements and make sure the fuel tank has sufficient fuel, battery capacity meets the requirements for engine starting. Observe the scan tool data list, analyze the accuracy of the data, as it will help with quick Diagnostic.

Diagnostic Steps:

Step 1	Check fuel pump fuse.



(a) Check whether the fuel pump fuse is faulty.
(b) Repair pump fuse power circuit.
(c) When necessary, replace the faulty fuel pump fuse.

Is fault solved?

Yes → System normal.

No

Step 2	Scan ECM DTC codes.

(a) Connect scan tool.
(b) Turn the ignition switch to "ON" position.
(c) Scan ECM DTC codes.
(d) Repair any fuel system related DTC code and Repair the faulty part. Refer to 2.2.7.11 DTC Code Index.
(e) Clear ECM DTC code.

Start the engine, fault solved?

Yes → System normal.

No

Step 3	Check fuel pump relay.

(a) Connect scan tool.
(b) Turn the ignition switch to "ON" position.
(c) Choose scan tool "Action Test" then "fuel pump relay" to drive the fuel pump relay.

Is pump relay working properly?

Yes → Go to step 6

No

Step 4	Repair fuel pump relay.

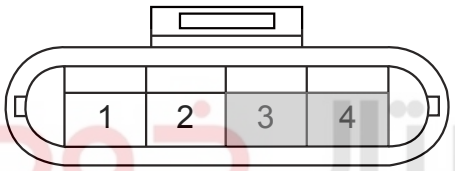
(a) Refer to "Fuel System" in the2.3.7.3 Fuel Pump Inoperative.
(b) Replace the pump relay.
(c) Repair pump relay circuit. Repair circuit faults.
Start the engine, fault solved?

Yes → System normal.

No

Step 5	Check the fuel pump circuit.

Fuel Pump Harness Connector SO29



FE02-5119b

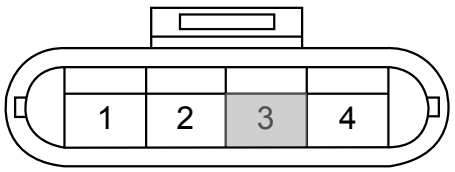
(a) Turn the ignition switch to "OFF" position.
(b) Disconnect fuel pump harness connector SO29.
(c) Connect scan tool.
(d) Turn the ignition switch to "ON" position.
(e) Choose scan tool "Function Test" then "fuel pump relay" to drive the fuel pump relay.
(f) Use a test lamp to connect SO29 terminals No. 3 and 4.
Is test lamp lit properly?

Yes → Go to step 8

No

Step 6	Repair fuel pump circuit.

Fuel Pump Harness Connector SO29



FE02-5120b

(a) Turn the ignition switch to "ON" position.
(b) Check fuel pump working circuit, repair the pump SO29 terminals No.3 and fuel pump relay terminal No.5 open circuit fault.
Start the engine, fault solved?

Yes → System normal.

No

Step 7	Check fuel pressure.

(a) Turn the ignition switch to "OFF" position.
(b) Install fuel pressure gage, connect scan tool.

(c) Turn the ignition switch to "ON" position.
(d) Connect scan tool, select the "Function Test" then "fuel pump relay" to drive the fuel pump relay.

Standard fuel pressure: 400 kPa

Is fuel pressure normal?

Yes → Go to step 9

No

Step 8	Replace the fuel pump.

(a) Turn off the ignition switch and remove the ignition key.
(b) Replace the fuel pump. Refer to 2.3.8.3 Fuel Pump Assembly Replacement.

Start the engine, fault solved?

Yes → System normal

No

Step 9	Inspect (repair) fuel injectors.

(a) Inspect (repair) fuel injectors. Refer to the DTC code2.12.7.32 DTC P0270 P0271repair procedures. If necessary, replace the faulty fuel injectors.

Start the engine, fault solved?

Yes → System normal.

No

Step 10	Check ignition coils.

(a) Turn the ignition switch to "OFF" position.
(b) Remove cylinder No.1 ignition wire, connected the spark plug wire to the ignition wire, so that spark plug connects to a reliable ground.
(c) Remove fuel pump fuse.
(d) Start the engine.

Is spark plug ignition normal?

Yes → Go to step 13

No

Step 11	Replace the ignition coil.

(a) Turn off the ignition switch and remove the ignition key.
(b) Replace the ignition coil. Refer to 2.10.8.3 Ignition Coil Replacement.

Start the engine, fault solved?

Yes → System normal.

No

Step 12	Check crankshaft position sensor and circuit.

(a) Check crankshaft position sensor. Refer to 2.12.7.35 DTC P0335 P0336.
(b) Measure crankshaft position sensor resistance with a multimeter.
Standard Resistance: 504-616 Ω
(c) Inspect sensor circuit, repair the faulty part. If necessary, replace the crankshaft position sensor. Refer to 2.10.8.2 Crankshaft Position Sensor Replacement.
Start the engine, fault solved?

Yes → System normal.

No

Step 13	Test cylinder pressure.

(a) Test cylinder compression pressure. Refer to the "Engine Mechanical System" in the.
Standard Cylinder Pressure: 800 kPa
is cylinders compression pressure the specified value?

Yes → Go to step 16

No

Step 14	Inspect Timing Chain positioning.

(a) Turn off the ignition switch and remove the ignition key.
(b) Inspect Timing Chain positioning. Refer to "Engine Mechanical System" in the2.6.8.11 Timing Chain Inspection.
Is the chain positioned properly?

Yes → Go to step 16

No

Step 15	Install timing chain.

(a) Turn off the ignition switch and remove the ignition key.
(b) Install timing chain. Refer to "Engine Mechanical System" in the2.6.8.10 Timing Chain Replacement.
Start the engine, fault solved?

Yes → System normal.

No

Step 16	Check engine mechanical parts. (a) Remove the engine. (b) Check engine mechanical parts. If necessary, repair the damaged engine parts. (c) identify the engine damaged parts repair has been completed.

Next

Step 17	Diagnostic completed.

2.12.7.59 Electronic Throttle Body (ETC) Adaptive Learn Program

Note

After the throttle body for cleaning and serving, carry out ETC self-adaptive learn. Otherwise there will be idle instable, jitter and so on.

Step 1	Use scan tool "Action Test" function, clear the TPS learn value.

Next

Step 2	Turn the ignition switch to "ON" position, after 3 s to "OFF" position.

Next

Step 3	In 1s turn the ignition switch to "ON" position, after 3 s to "OFF" position.

Next

Step 4	Repeat the above steps 5 times.

Next

Step 5	Initialization completed.

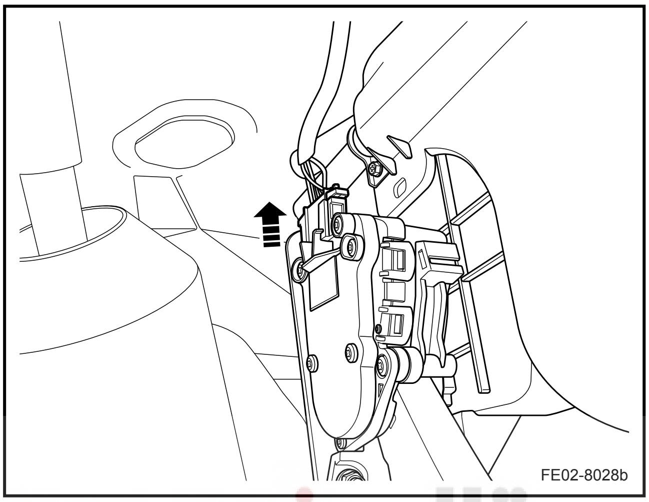
2.12.8 Removal and Installation

2.12.8.1 Acceleration Pedal Replacement

Removal Procedure:

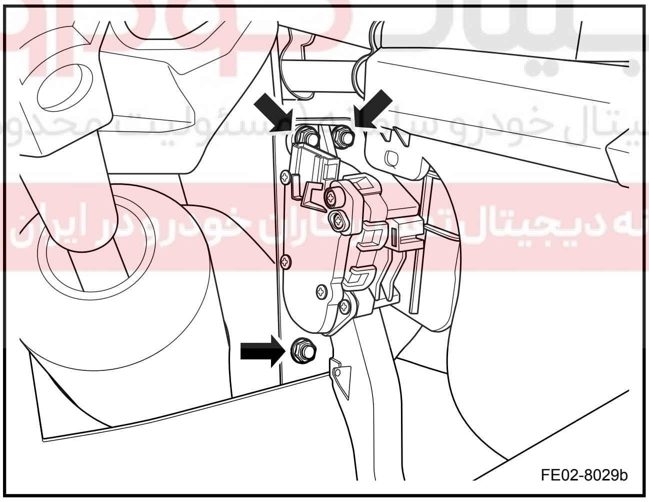
Warning!

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



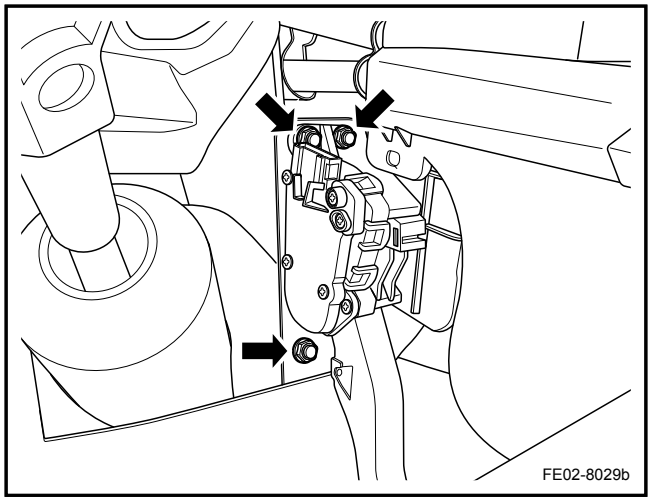
FE02-8028b

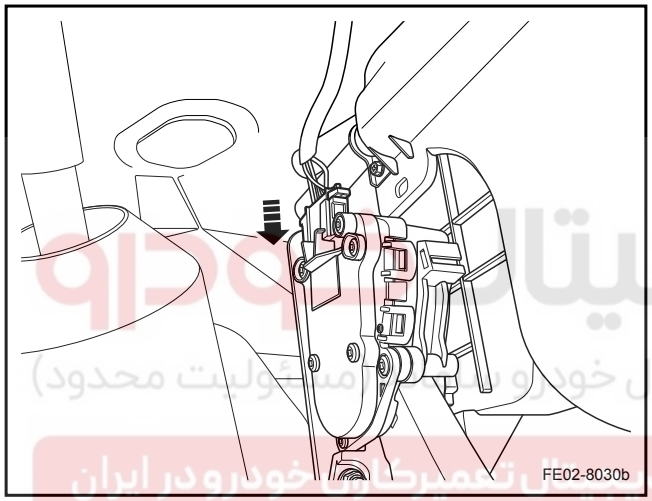
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect the acceleration pedal harness connector.



FE02-8029b

3. Remove the acceleration pedal bolts and remove the acceleration pedal.





Installation Procedure:

1. Install the acceleration pedal and tighten the retaining nuts.

   Torque: 15 Nm (Metric) 11 lb-ft (US English)

2. Connect the acceleration pedal harness connector.
3. Connect the battery negative cable.

2.13 Fuel System JL4G15-D

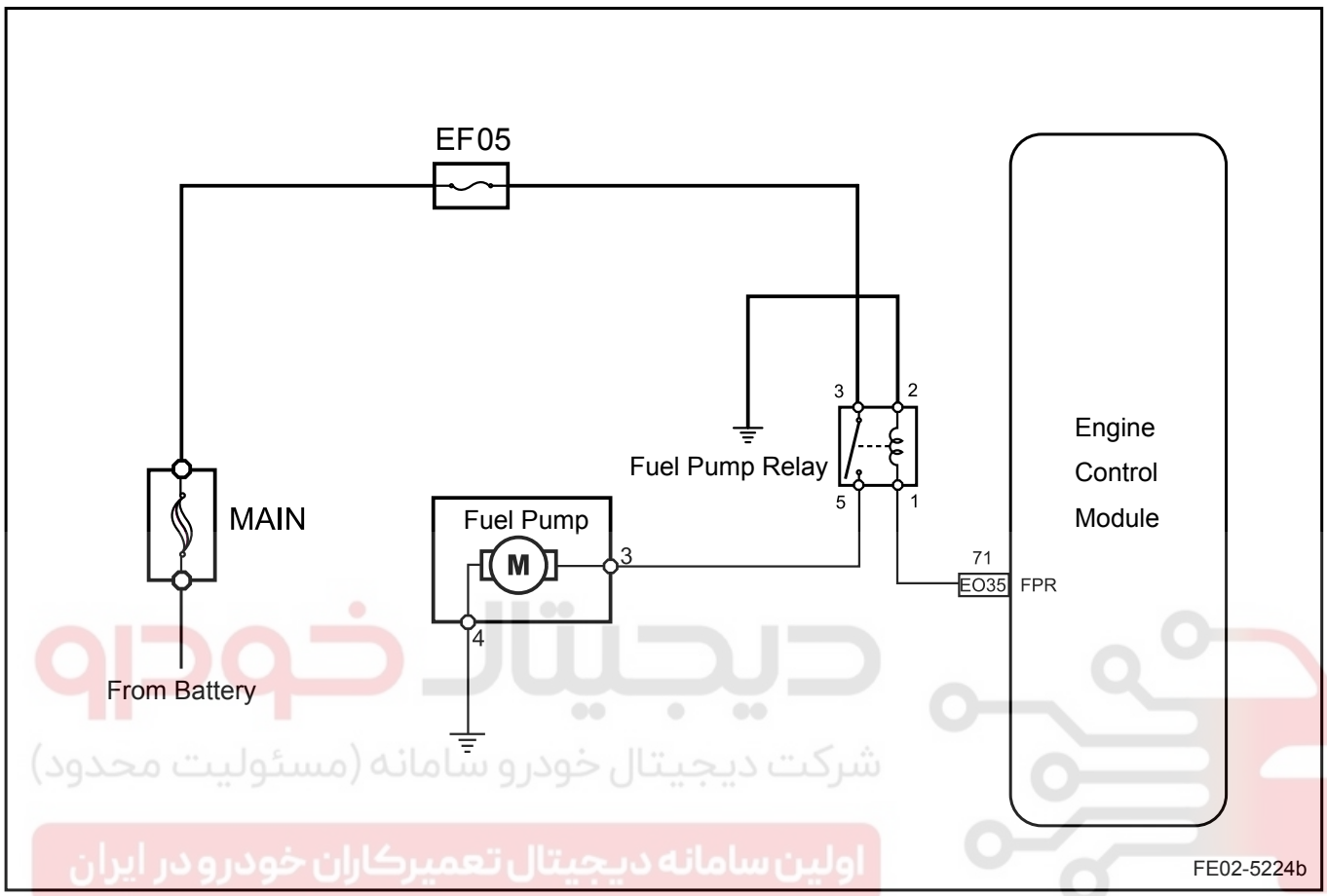
2.13.1 4G15-D Fuel System Overview

Compared with 4G18-D, 4G15-D engine fuel system has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

2.13.1 Diagnostic Information and Procedures

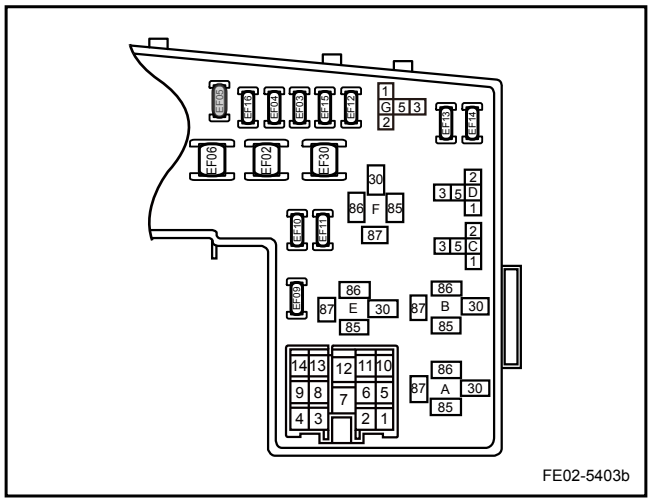
2.13.1.1 Fuel Pump Inoperative

Schematic



Diagnostic Steps:

Step 1	Check fuel pump fuse EF05.



Is the fuel pump fuse EF05 blown?

No → Go to step 3

Yes

Step 2	Repair fuel pump fuse EF05 circuit.

(a) Check fuel pump fuse EF05 circuit.
(b) Repair fuel pump power circuit short to ground.
(c) Replace the fuse EF05.

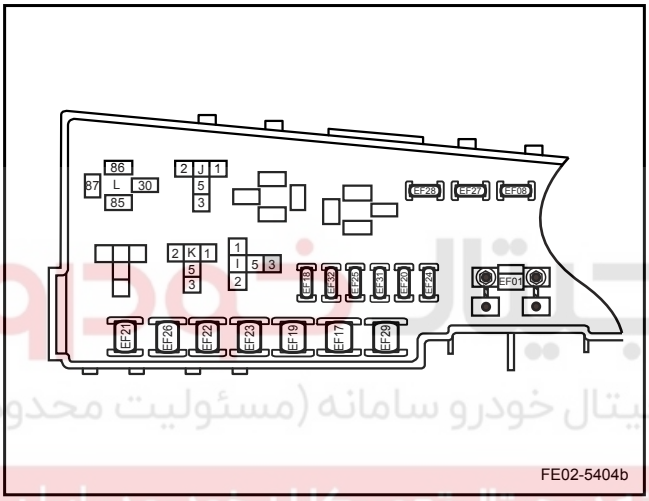
Fuse Rating: 15 A

Is fuel pump working properly?

Yes → System normal

No

Step 3	Check fuel pump relay terminal No.3 voltage.



FE02-5404b

(a) Turn the ignition switch.
(b) At the same time, check the fuel pump relay terminal No.3 voltage with a multimeter.

Note

Pump relay will only work for a short period. use scan tool drive fuel pump relay work to facilitate inspection.

Standard Voltage: 11-14 V

Is the voltage Standard Value?

Yes → Go to step 5

No

Step 4	Repair fuel pump relay terminal No.3 and fuel pump fuse EF05 circuit open fault.

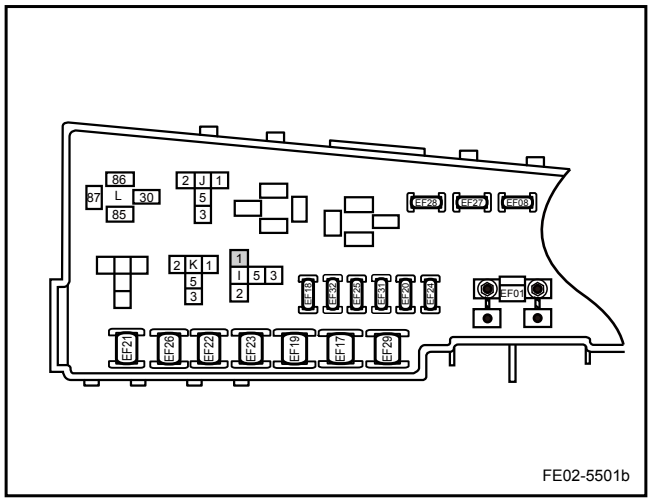
(a) Repair fuel pump relay terminal No.3 and fuel pump fuse EF05 circuit open fault.

Is fuel pump working properly?

Yes → System normal

No

Step 5	Check fuel pump relay terminal No.1 voltage.



(a) Use scan tool to drive pump relay.
(b) Check fuel pump relay terminal No.1 voltage with a multimeter.

Standard Voltage: 11-14 V

Is the voltage Standard Value?

Yes → Go to step 8

No

Step 6	Repair ECM harness connector EO35 terminal No.71 and pump relay connector No.1 circuit open fault.

(a) Repair ECM harness connector EO35 terminal No.71 and pump relay connector No.1 circuit open fault.

Is fuel pump working correctly?

No → System normal

Yes

Step 7	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Note

Replace ECM. Make sure that ECM power supply and ground circuits have no faults.

Is fuel pump working properly?

Yes → System normal

No

Step 8	Test continuity between pump relay terminal No.2 and the ground circuit.

(a) Measure resistance between pump relay terminal No.2 and ground with a multimeter.

Standard Value: Less than 1 Ω

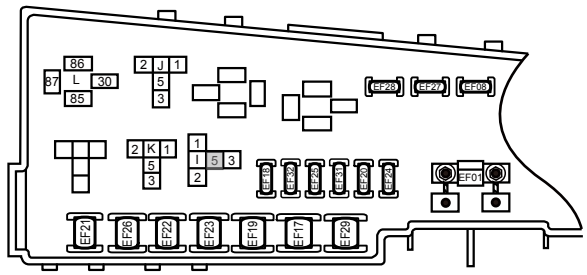
Is the resistance specified value?

Yes → Go to step 10

No

Step 9	Repair pump relay terminal No.2 Ground circuit fault.

Step 10	Check pump relay terminal No.5 voltage.



FE02-5407b

(a) Turn on the ignition switch.
Standard Voltage: 11-14 V

Confirm whether the voltage is standard value.

Yes → Go to step 12

No

Step 11	Replace the fuel pump relay.

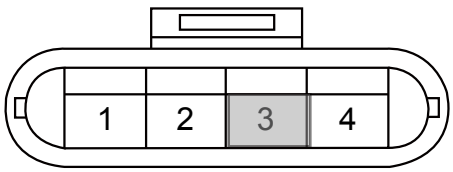
(a) Replace the fuel pump relay.
Make sure fuel pump is working properly.

Yes → System normal

No

Step 12	Check the fuel pump wiring harness connector SO29 terminal No.3 voltage.

Fuel Pump Harness Connector SO29



FE02-5408b

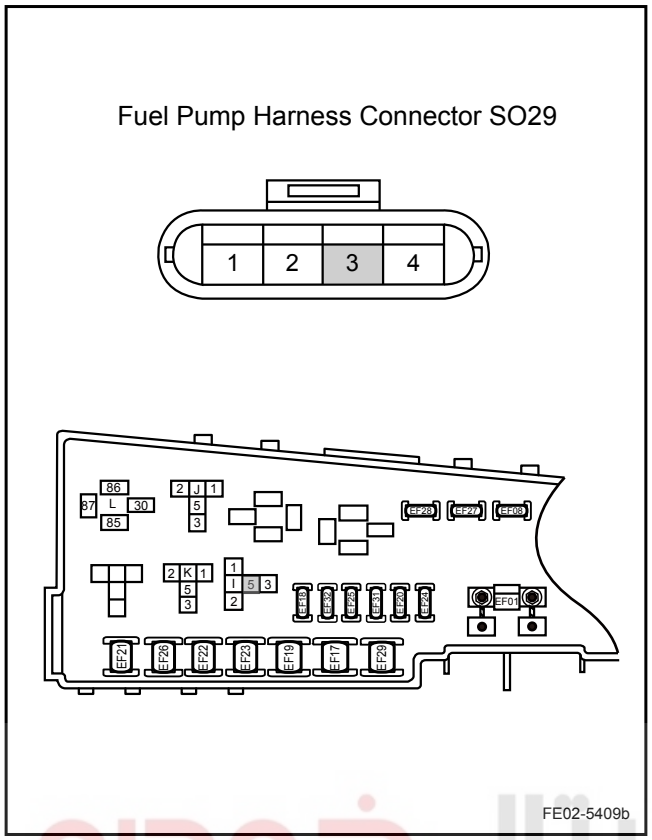
(a) Check fuel pump wiring harness connector SO29 terminal No.3 voltage with a multimeter.
Standard Voltage: 11-14 V

Is the voltage standard value?

Yes → Go to step 14

No

Step 13	Repair the circuit between fuel pump wiring harness connector SO29 terminal No.3 and the fuel pump relay terminals No.5.



(a) Check the circuit between fuel pump wiring harness connector SO29 terminal No.3 and the fuel pump relay terminals No.5.

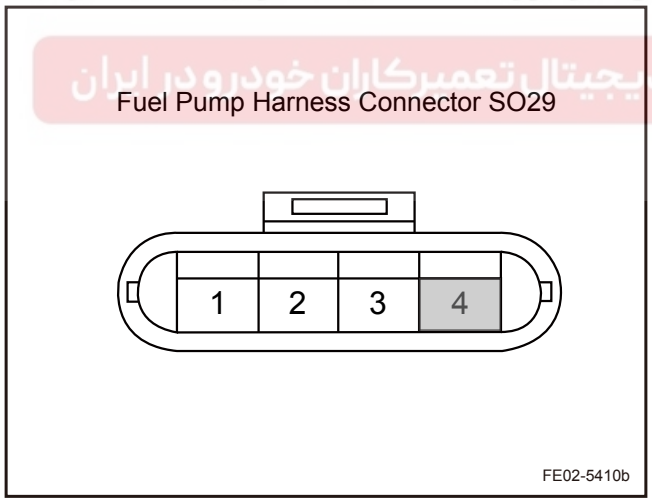
(b) Repair the circuit between fuel pump wiring harness connector SO29 terminal No.3 and the fuel pump relay terminals No.5 open fault.

Is fuel pump working properly?

Yes	System normal

No

Step 14	Check fuel pump wiring harness connector SO29 terminal No.4 and body ground circuit.



(a) Check resistance between fuel pump wiring harness connector SO29 terminal No.4 and body ground circuit with a multimeter.

Standard Resistance Value: Less than 1 Ω

Is fuel pump ground circuit normal?

Yes	Go to step 16

No

Step 15	Repair fuel pump wiring harness connector SO29 terminal No.4 and body ground circuit.

(a) Repair fuel pump wiring harness connector SO29 terminal No.4 and body ground circuit open fault.

Is fuel pump working properly?

Yes	System normal

No

Step 16	Replace the fuel pump.

(a) Replace the fuel pump. Refer to 2.3.8.3 Fuel Pump Assembly Replacement.

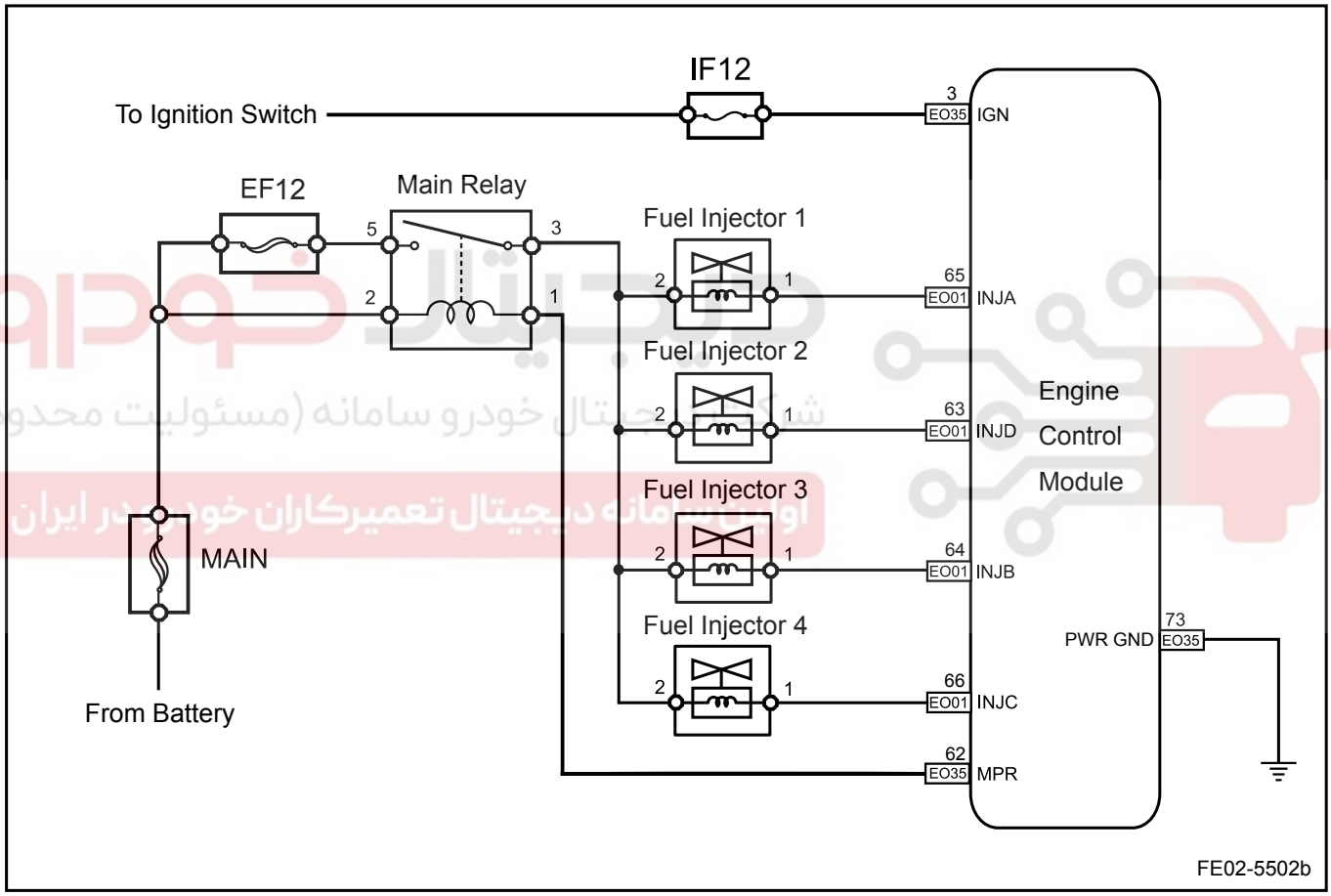
Confirm repair completed.

Next

Step 17	System normal.

2.13.1.2 All Fuel Injectors Inoperative

Schematic:



Diagnostic Steps:

Step 1	Check whether the engine anti-theft system is activated.

Does engine trouble indicator light flashes?

No	Go to step 3

Yes

Step 2	Repair the engine anti-theft system malfunction.

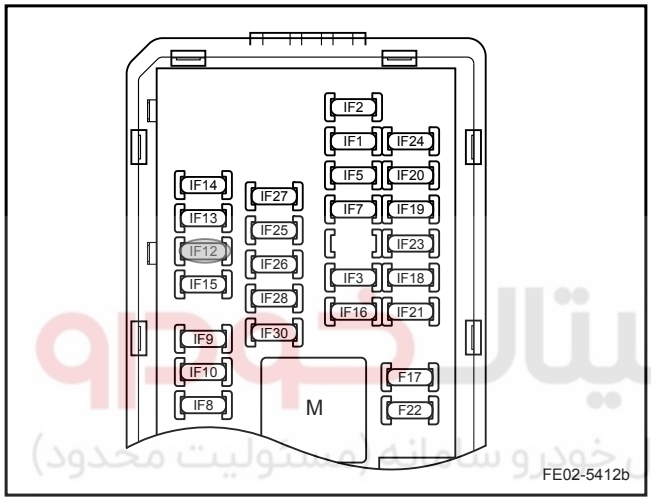
(a) Repair the engine anti-theft system malfunction. Refer to 2.5.7.12 Engine Anti-theft Warning Lamp Flashing, Vehicle Can Not Start.

Is fuel injector working properly?

Yes → System normal

No

Step 3	Check ECM fuse.

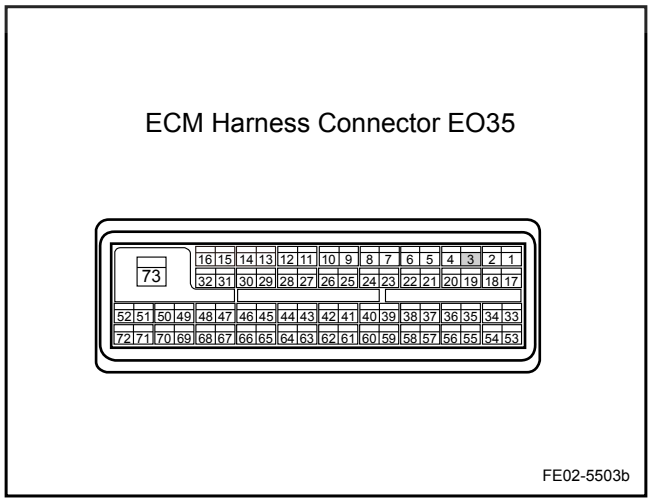


Check whether ECM fuse IF12 is blown?

No → Go to step 6

Yes

Step 4	Check ECM power supply circuit.



(a) Repair ECM power supply short to body ground fault.

(b) Replace the fuse IF12.

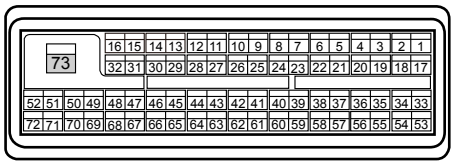
Is fuel injector working properly?

Yes → System normal

No

Step 5	Inspect and repair ECM ground circuit.

ECM Harness Connector EO35



FE02-5504b

(a) Check ECM ground circuit.
(b) Repair open circuit ECM connector EO35 terminal No.73 and the body.

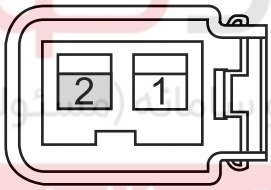
Is fuel injector working properly?

Yes → System normal

No

Step 6	Check fuel injector wiring harness connector terminal No.2 voltage.

Fuel Injector 1 Harness Connector EO11



FE02-5505b

(a) Turn on the switch.
(b) Measure fuel injector wiring harness connector terminal No. 3 voltage with a multimeter.

Standard voltage:11-14 V

Is the voltage Standard Value?

Yes → Go to step 8

No

Step 7	Repair main relay circuit malfunction.

(a) Repair main relay circuit malfunction. Refer to 2.12.7.49 DTC P0685.

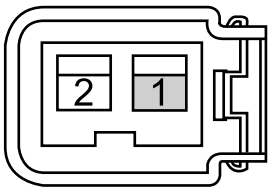
Is fuel injector working properly?

Yes → System normal

No

Step 8	Check the fuel injector wiring harness connector terminal No.1 periodical low voltage waveform.

Fuel Injector 1 Harness Connector EO11



FE02-5506b

(a) Turn on the ignition switch and try to Start the engine.
(b) At the same time, check the fuel injector wiring harness connector terminal No.1 periodical low voltage waveform.

Is there a periodical low voltage waveform?

Yes → Go to step 10

No

Step 9	Replace ECM.

(a) Replace ECM. Refer to 2.2.8.8 Engine Control Module Replacement.

Is fuel injector working properly?

Yes → System normal

No

Step 10	Replace fuel injectors.

(a) Replace fuel injectors. Refer to 2.2.8.2 Fuel Injector Replacement.

Confirm repair completed.

Next

Step 11	System normal.

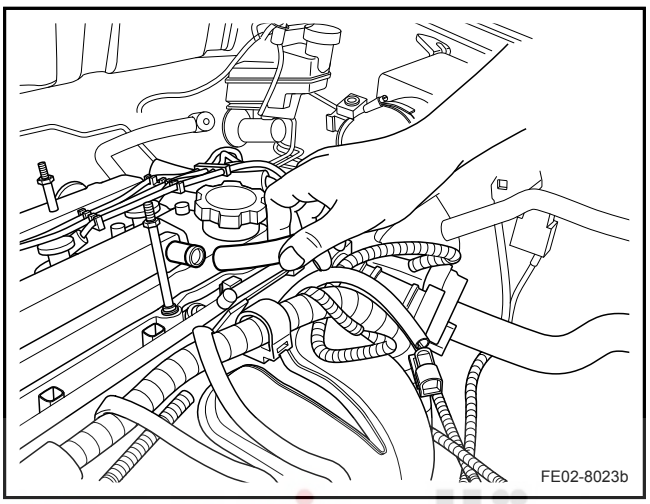
2.13.2 Removal and Installation

2.13.2.1 Fuel Injector Replacement

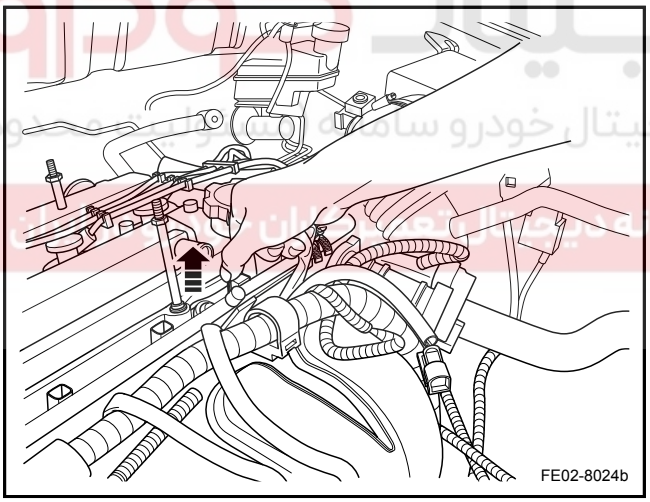
Removal Procedure:

Warning!

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



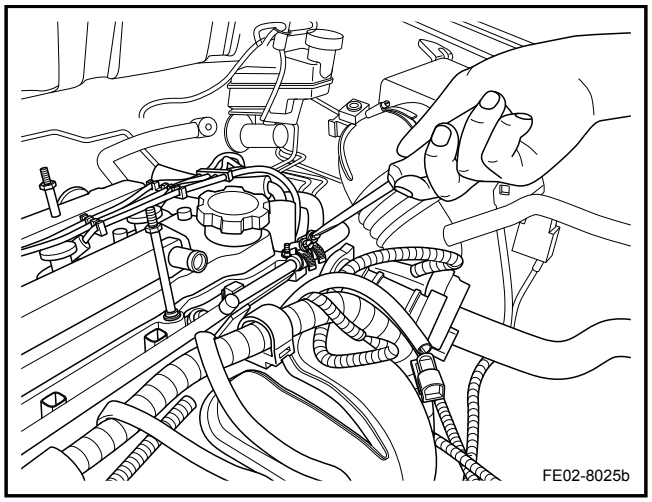
1. Release fuel system pressure. Refer to 2.3.8.1 Fuel Pressure Release Procedure.
2. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
3. Remove the hood. Refer to 2.6.8.1 Plastic Engine Shield Replacement.
4. Disconnect the crankcase ventilation tube from the cylinder head cover.



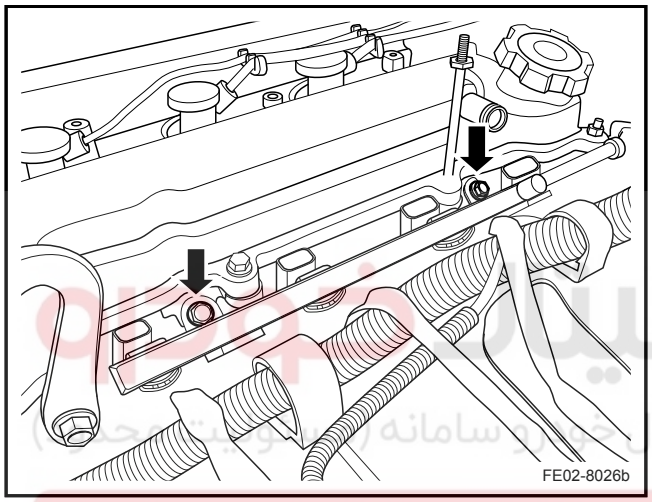
5. Disconnect the engine fuel injector harness connector.

Note

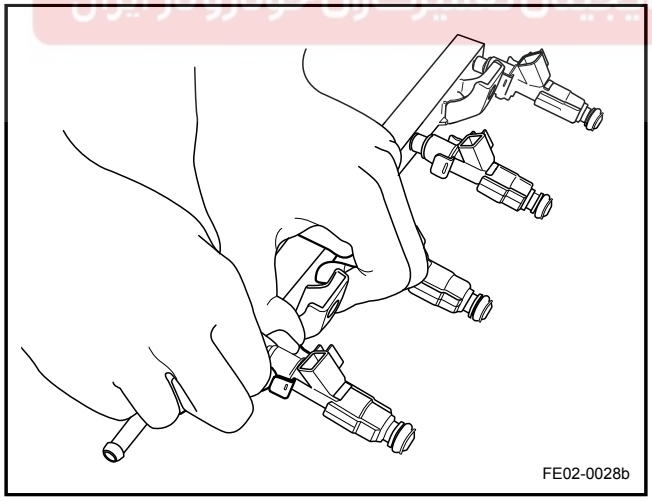
Pull up the gray self-locking device, and then press to Disconnect the connector.



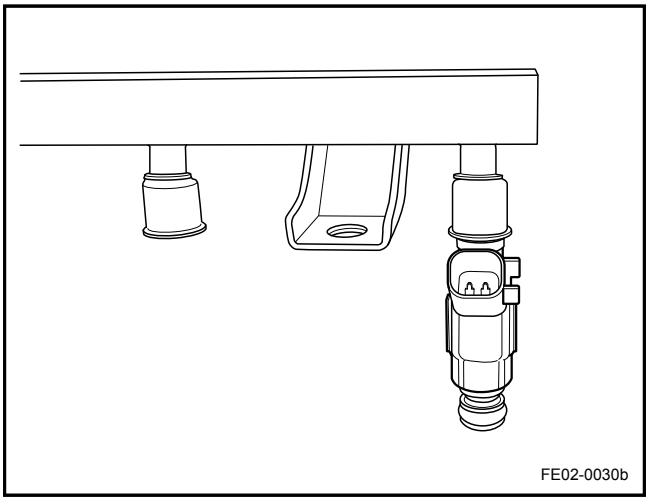
6. Remove the fuel pipe form fuel rail.



7. Remove the fuel rail retaining bolts and remove the fuel rail.



8. Remove fuel injectors spring and unplug the fuel injectors.

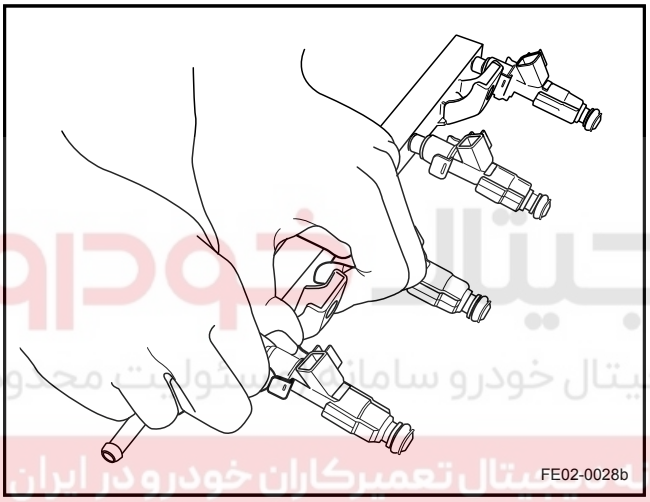

FE02-0030b

Installation Procedure:

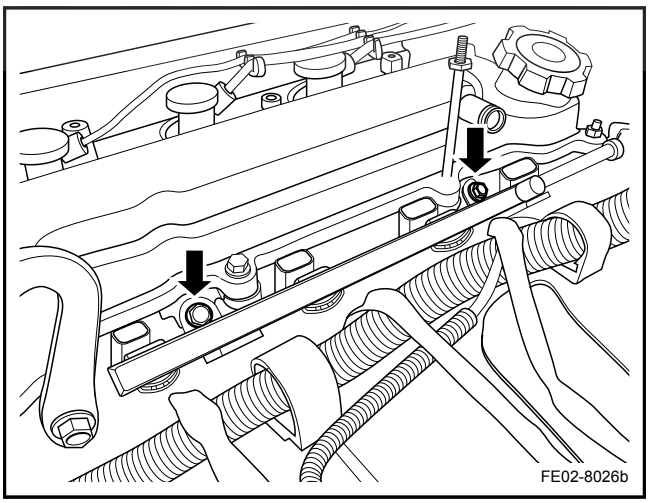
1. Apply a small amount of engine oil to lubricate the fuel injector O-ring.
2. Install the fuel injectors to the fuel rail.

   Note

   Fuel injectors terminal should face outward.

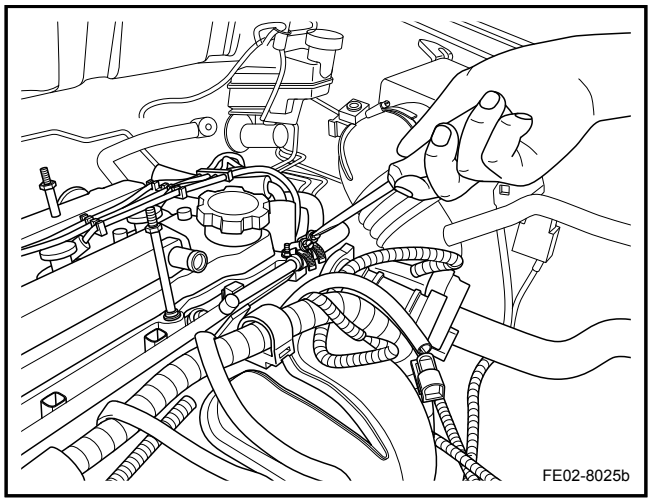

FE02-0028b

3. Install fuel injectors springs, make sure that the fuel injector wiring harness connector port and the fuel rail mounting hole are in the same direction.


FE02-8026b

4. Install the fuel rail and tighten the retaining bolts.

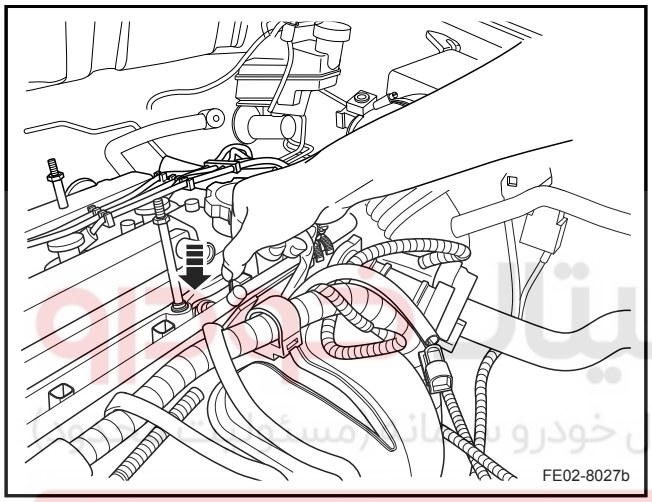
   Torque: 10 Nm (Metric) 7.4 lb-ft (US English)



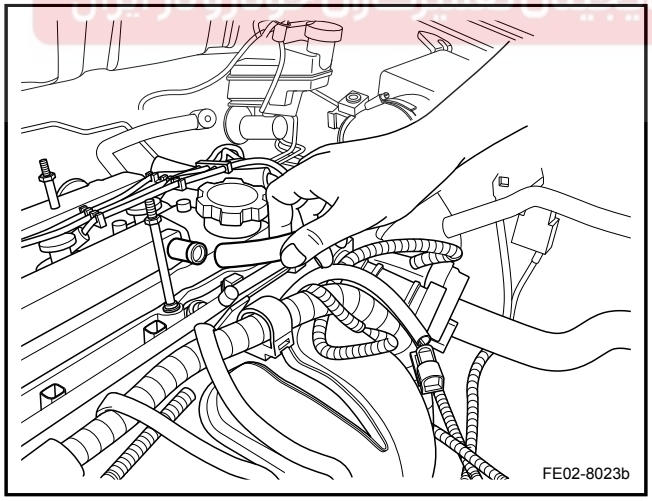
5. Connect the fuel pipe into fuel rail.

   Note

   Fuel pipe must be inserted into the fuel rail after the second boss and then tighten.



6. Connect engine fuel injector wiring harness connector.



7. Connect crankcase ventilation tube.
8. Connect the battery negative cable.

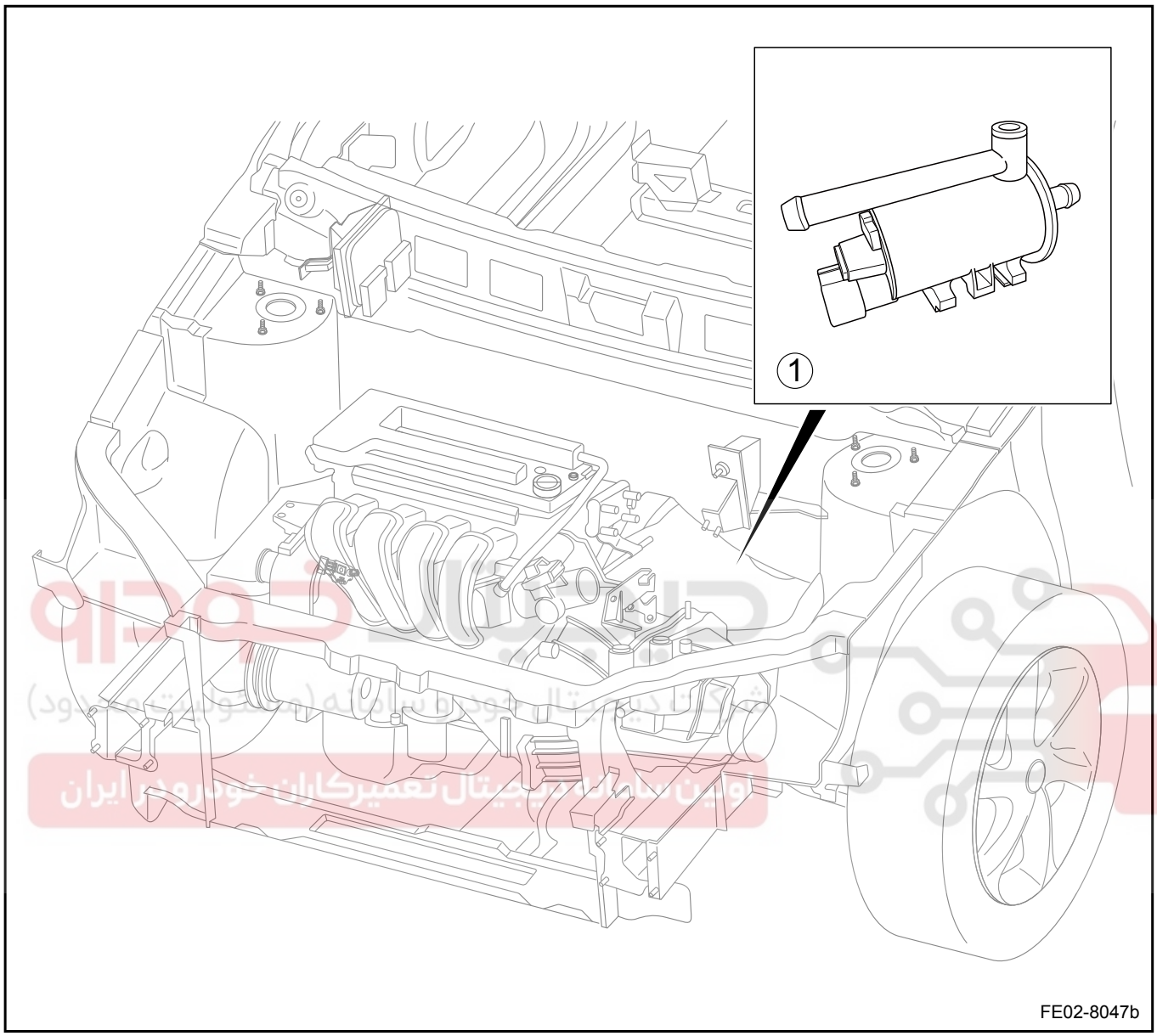
2.14 Auxiliary Emission Control JL4G15-D

2.14.1 4G15-D auxiliary emission control devices, an overview

Compared with 4G18-D, 4G15-D engine auxiliary emission control devices has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

2.14.1 Component Locator

2.14.1.1 Component Locator



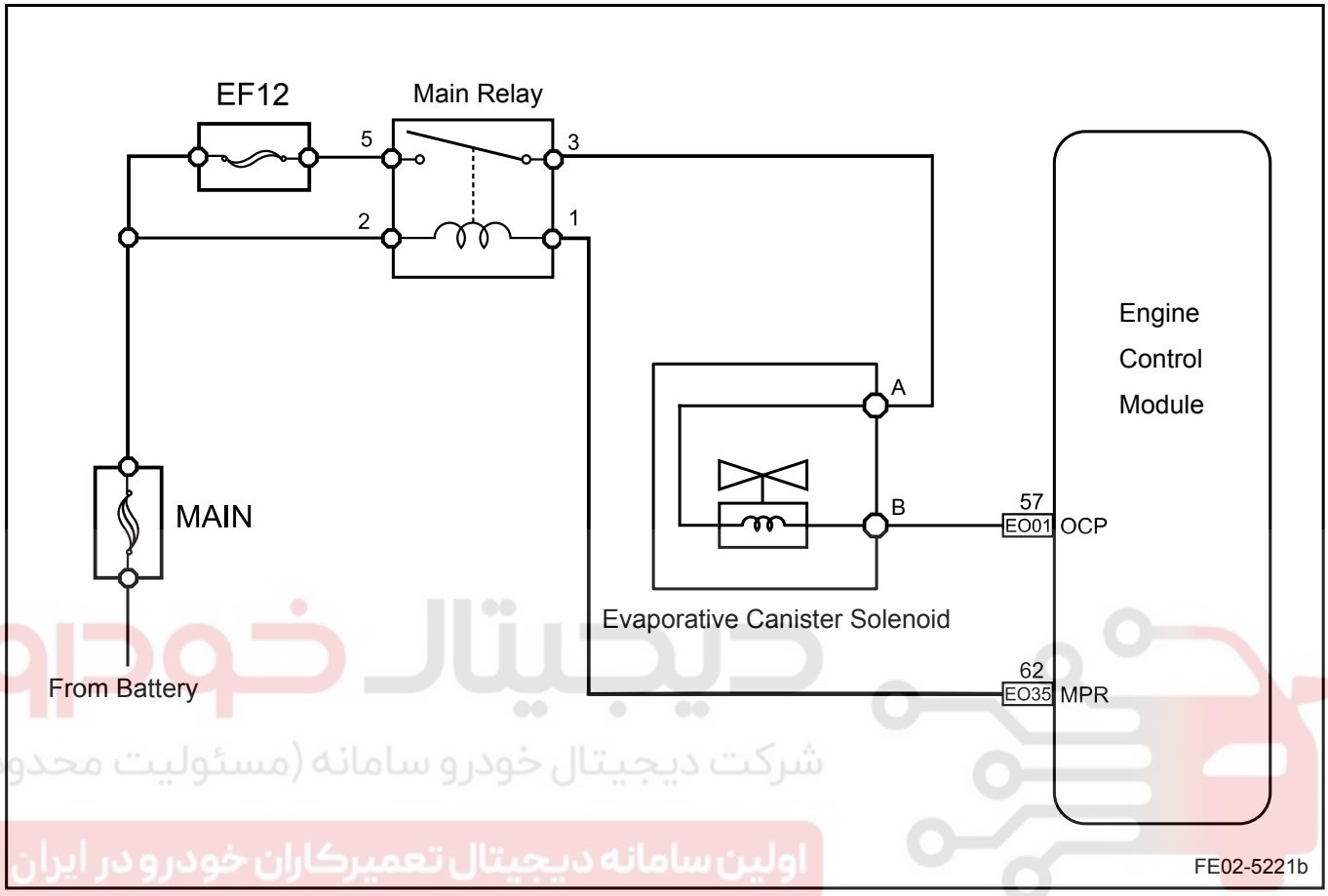
Legend

1. Canister Solenoid Valve

2.14.2 Diagnostic Information and Procedures

2.14.2.1 Canister Solenoid Valve Inoperative

Schematic:



Diagnostic Steps:

Step 1	Check engine emission warning lamp malfunction.

(a) Start the engine.

Check whether engine emissions malfunction warning lamp is lit?

No → Go to step 3

Yes

Step 2	Repair engine control system malfunction.

(a) Repair engine emissions malfunction warning lamp malfunction. Refer to 2.12.7.14 DTC Code Index

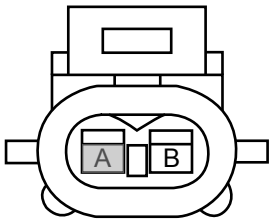
Is Canister solenoid valve working properly?

Yes → System normal

No

Step 3	Check Canister solenoid valve power supply circuit.

Evaporative Canister Solenoid Harness Connector EO24



FE02-5227b

(a) Turn on the ignition switch.
(b) Measure Canister solenoid valve EO24 terminal A voltage with a multimeter.

Standard Voltage: 11-14 V

Is the voltage Standard Value?

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 2.12.7.49 DTC P0685

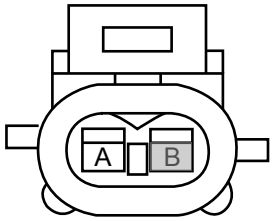
Is Canister solenoid valve working properly?

Yes → System normal

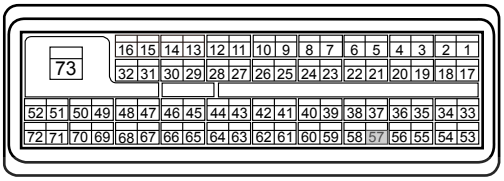
No

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

Evaporative Canister Solenoid Harness Connector EO24



ECM Harness Connector EO01



FE02-5228b

(a) Turn off the ignition switch.
(b) With a multimeter, check resistance between Canister solenoid valve wiring harness connector EO24 terminal B and ECM harness connector EO01 terminals No.57 to determine the continuity.

Standard Resistance: Less than 1 Ω

Is resistance the specified value?

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 Canister solenoid valve wiring harness connector EO24 terminal B and ECM harness connector EO01 terminal No.57 circuit open fault.

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 Canister solenoid valve resistance the specified value?

Yes → System normal

No

Step 8	Replace Canister solenoid valve.

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

Confirm the repair has been completed.

Next

Step 9	System normal.

2.15 Engine Anti-theft System JL4G15-D

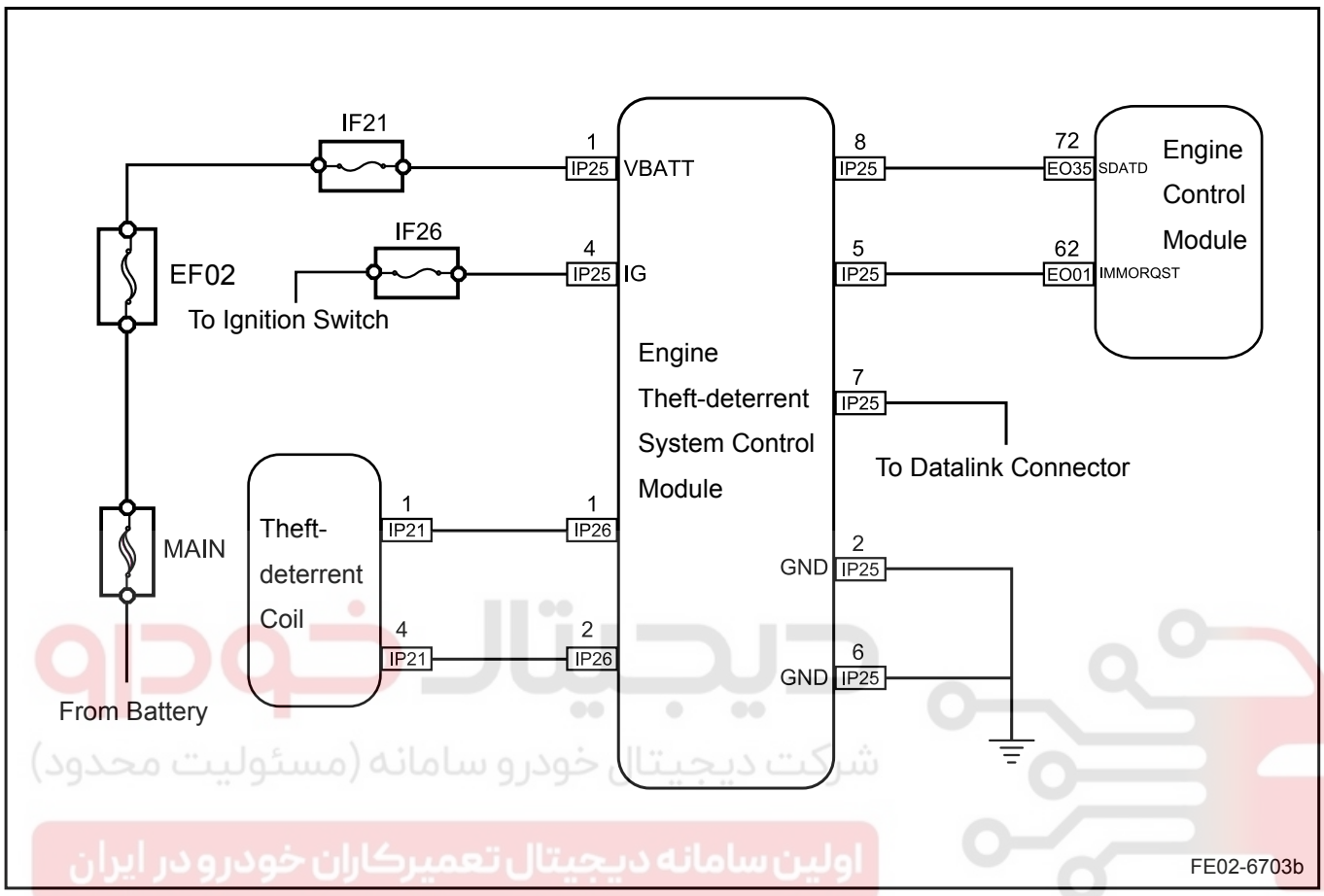
2.15.1 4G15-D Engine Anti-theft System Overview

Compared with 4G18-D, 4G15-D engine anti-theft system has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

2.15.1 Diagnostic Information and Procedures

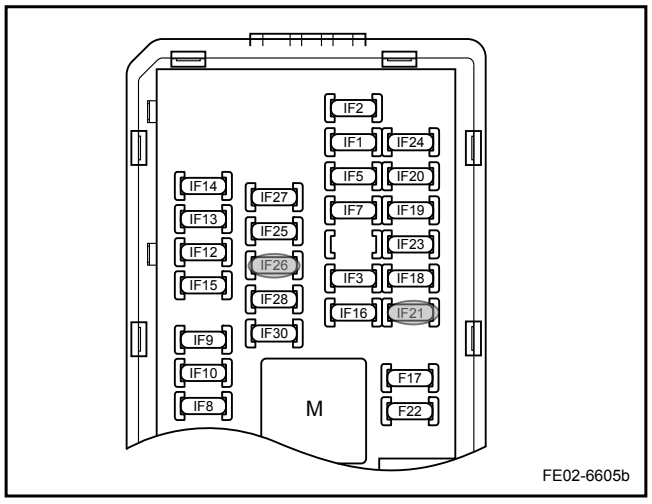
2.15.1.1 Engine Anti-theft System Warning Lamp Flashing, The Vehicle Can Not Be Started

Schematic:



Diagnostic Steps:

Step 1	Check the fuses IF26 and IF21.



(a) Check whether the fuses IF26 and IF21 are broken.

Fuse Rating: IF26 rating is 10 A, IF21 rating is 10 A

No	Go to step 3

Yes

Step 2	Repair fuse IF26 and IF21 circuits.

(a) Check the fuse IF26 circuit, repair short-circuit fault.
(b) Check the fuse IF21 circuit, repair short-circuit fault.
(c) Replace the fuses.

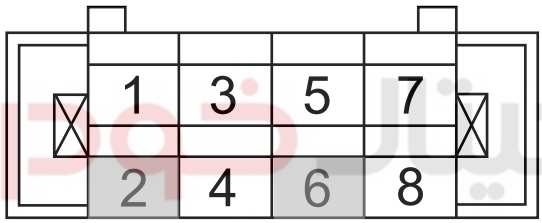
Can vehicles normally start?

Yes → System normal

No

Step 3	Check engine anti-theft system control module ground.

Engine Anti-theft Control Unit 1 Harness Connector IP25



FE02-6606b

(a) With a multimeter, measure resistance between continuity between engine anti-theft system control module terminal IP25 or IP25 and 6 and body ground to determine the continuity.

Standard Resistance: Less than 1 Ω.

Is the resistance specified value?

Yes → Go to step 5

No

Step 4	Repair the engine anti-theft system control module ground circuit.

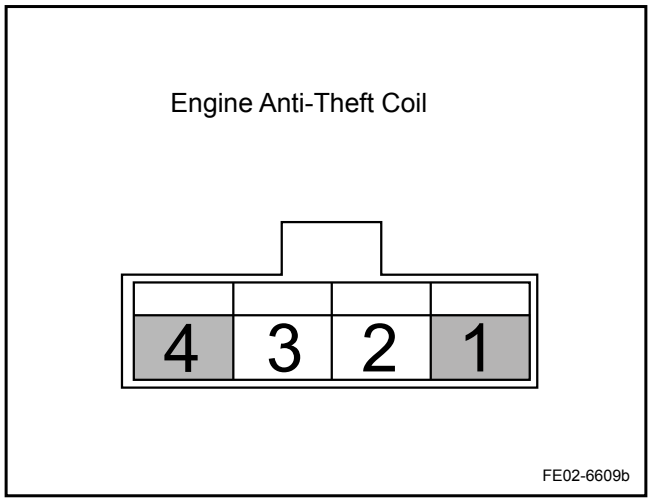
(a) Repair circuit between the engine anti-theft system control module connector IP25 terminal No.2 or 6 and body ground open fault.

Can the vehicle start?

Yes → System normal

No

Step 5	Check EAS coil.



(a) Disconnect electronic Anti-theft coil harness connector.
(b) Measure coil resistance with a multimeter.
Standard Resistance: resistance 5 Ω (68 ºF) at room temperature 20°C

Is EAS coil resistance specified value?

Yes → Go to step 7

No

Step 6	Replace electronic Anti-theft coil.

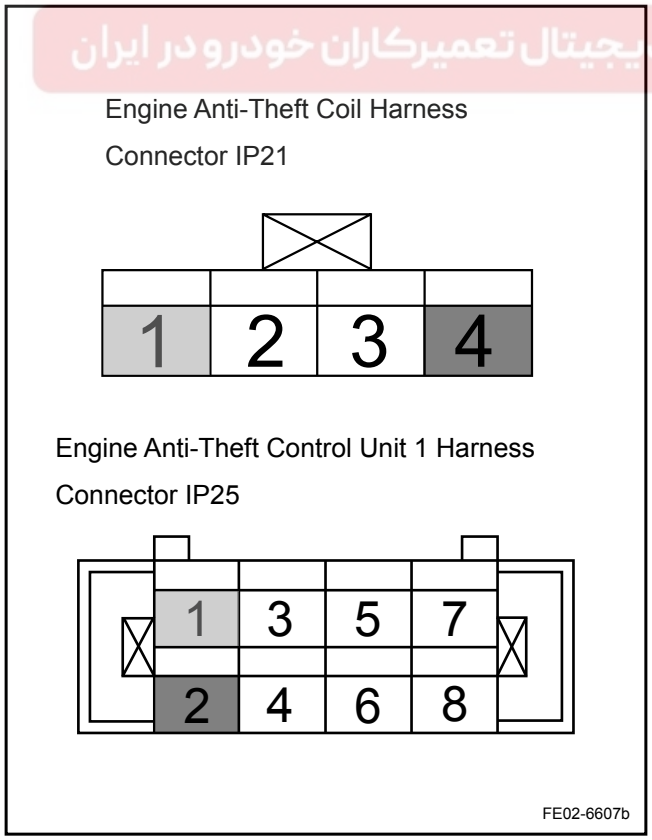
(a) Replace electronic Anti-theft coil. Refer to "2.5.8.1 EAS Coil Replacement."

Can the vehicle start?

Yes → System normal

No

Step 7	Check circuit between EAS coil harness connector and engine anti-theft system control module harness connector.



(a) With a multimeter, measure resistance between EAS coil harness connector IP21 terminal No.1 and engine anti-theft system control module wiring harness connector IP25 terminal No.1 to determine circuit continuity.
Standard Resistance: Less than 1 Ω

(b) With a multimeter, measure resistance between EAS coil harness connector IP21 terminal No.4 and engine anti-theft system control module wiring harness connector IP25 terminal No.2 to determine circuit continuity.
Standard Resistance: Less than 1 Ω

Is the resistance specified value?

Yes → Go to step 9

No

Step 8	Repair circuit between EAS coil harness connector and engine anti-theft system control module harness connector.

(a) Check serial communication circuit resistance between engine anti-theft system control module wiring harness connector IP25 terminals No.5 and engine control module wiring harness connector EO01 terminal No.62 to determine circuit continuity.

(b) Check serial communication circuit resistance between engine anti-theft system control module wiring harness connector IP25 terminals No.8 and engine control module wiring harness connector EO35 terminal No.72 to determine circuit continuity.

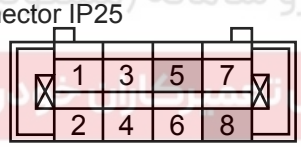
Can the vehicle start?

Yes → System normal

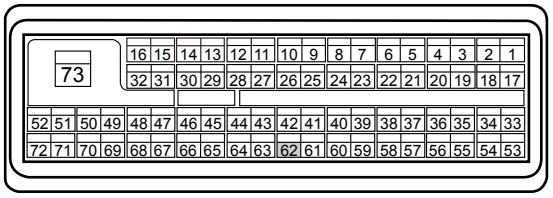
No

Step 9	Repair serial communication circuit between engine anti-theft system control module and engine control module.

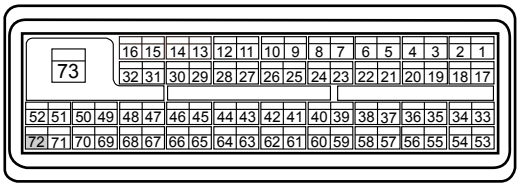
Engine Anti-Theft Unit 1 Harness Connector IP25



ECM Harness Connector EO01



ECM Harness Connector EO35



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(a) Repair serial communication circuit open between engine anti-theft system control module wiring harness connector IP25 terminals No.5 and engine control module wiring harness connector EO01 terminal No.62.

Standard Resistance: Less than 1 Ω

(b) Repair serial communication circuit open resistance between engine anti-theft system control module wiring harness connector IP25 terminals No.8 and engine control module wiring harness connector EO35 terminal No.72.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?

Yes → Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check

No

Step 10	Repair serial communication circuit between engine anti-theft system control module and engine control module.

(a) Repair serial communication circuit open between engine anti-theft system control module wiring harness connector IP25 terminals No.5 and engine control module wiring harness connector EO01 terminal No.62.

(b) Repair serial communication circuit open resistance between engine anti-theft system control module wiring harness connector IP25 terminals No.8 and engine control module wiring harness connector EO35 terminal No.72.

Can the vehicle start?

Yes → System normal

No

Step 11	Replace Anti-theft system control module.

(a) Replace Anti-theft system control module. Refer to 2.5.8.2 Anti-theft System Control Module Replacement.

(b) Carry out engine anti-theft system programming procedures. Refer to 2.5.7.9 Replaced Security Module Programming.

Yes → System normal

No

Step 12	Replace engine control module.

(a) Replace engine control module. Refer to 2.2.8.8 Engine Control Module Replacement.

(b) Carry out engine anti-theft system programming procedures. Refer to 2.5.7.10 Replaced ECM Programming.

Confirm the repair has been completed.

Next

Step 13	System normal.

2.16 Engine Mechanical Systems JL4G15-D

2.16.1 4G15-D Engine Mechanical System Overview

Compared with 4G18-D, 4G15-D engine mechanical system has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

2.16.1 Specifications

2.16.1.1 Fastener Tightening Specifications

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Spark Plug Bolts	M14 × 1.25	20-30	14.8-22.2
Cylinder Head Cover (Short Bolts)	M6	7-11	5.2-8.2
Cylinder Head Cover (Long Bolts, Nuts, Special Bolts)	M6	9-13	6.7-9.6
Knock Sensor Bolt	M8 × 30	14.4-21.6	10.7-16
Cylinder Head Bolts	M10 × 1.25	First Pass 46-52	First Pass 34-38.5
		Second Pass 76-84	Second Pass 56-62.2
VVT Actuator Mounting Bolt	M12 × 1.25	59-81	43.7-60
Intake Manifold Mounting Bolt	M8	24-36	17.8-26.7
Crankcase Mounting Bolt	M8	14.4-21.6	10.7-16
Exhaust Pipe Mounting Bolt	M8	20-30	14.8-22.2
Main Bearing Cap Retaining Bolt	M10 × 1.25	First Pass 42-46	First Pass 31-34
		Second Pass 54-66	Second Pass 40-48.9
Flywheel Mounting Bolt	M10 × 1.25	83-93	61.4-68.8
Water Pump Short Mounting Bolt	M6 × 25	8-10	6-7.4
Water Pump Long Mounting Bolt	M6 × 35	9-13	6.7-9.6
Fuel Rail Retaining Bolts	M6 × 20	7.2-10.8	5.3-8
Connecting Rod Cap Retaining Bolt	M8 × 1	First Pass 19-21	First Pass 14-15.5
		Second Pass 50-52	Second Pass 37-38.5
Camshaft Bearing Cap Retaining Bolts	M8 M6	21.6-24.5 12.2-13.8	16-18.2 9-10.2
Oil Pan Retaining Bolts	M6	7.2-10.8	5.3-8
Oil Filter Mounting Bolt	M6	7.2-10.8	5.3-8
Engine Oil Pressure Alarm Bolts	R1 / 8	10.5-19.5	7.8-14.4
Oil Filter Pipe Joints Bolts	M28 × 1.5	16-24	11.8-17.8
Oil Filter Pipe Fittings Bolts	UNF3 / 4 "-16	33-37	24.4-27.4
Crankshaft Pulley Mounting Bolt	M12 × 1.25	129.7-146.3	96-108.3
Generator Through Screw	M10 × 1.25 × 72	43.2-64.8	32-48
Generator Retaining Bolt	M8 × 30	20-30	14.8-22.2
Clutch Assembly Mounting Bolt	M8	21.6-32.4	16-24

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Water Pump Outlet Components Bolt	M10	25 and Above	18.5 and Above
Oil Pump Mounting Bolt	M6	7.2-10.8	5.3-8
Timing Chain Cover Bolt	M8	14.4-21.6	10.7-16
Timing Chain Cover Bolt	M6	8.8-13.2	6.5-9.8
Engine Right Mounting Bolts	M10 × 55	37.6-56.4	27.8-41.7
Drive Belt Tensioner Bolt	M12	55.2-82.8	40.8-61.3
Drive Belt Tensioner Nut	M8	23.2-34.8	17.2-25.8
Exhaust Camshaft Timing Sprocket Mounting Bolt	M10	43.2-64.8	32-48
Oil Pan Oil Discharge Bolt	M12	25-35	18.5-25.9
Manufacturing Hole Plug	M20	39-49	28.8-36.1
Cylinder Head Oil Drain Plug	M14 × 1.25	24-36	17.7-26.6
Engine Hook Bolt	M10 × 1.25	27-49	19.9-36.1
Heater Outlet Pipe Components Bolt	M6	7-11	5.2-8.1
Timing Chain Rail Mounting Bolt	M6	7-11	5.2-8.1
Timing Chain Tensioner Rail Mount Bolt	M8	15-21	11.1-15.5
Timing Chain Tensioner Mounting Bolt	M6	7-11	5.2-8.1
PCV Valve	NPT 3 / 8	20-30	14.8-22.1
Engine Coolant Inlet Connector Components Retaining Bolt	M6	9-13	6.6-9.6
Oil Stick Tube Assembly Mounting Bolt	M6	9-13	6.6-9.6
Ignition Coil Components	M6	7-11	5.2-8.1
Throttle Body Components Retaining Bolt	M6	15-25	11.1-18.4
Stiffener To Install Intake Manifold Retaining Bolt	M8	24-36	17.7-26.6
Upper (Lower) Heat Shield Components Retaining Bolt	M8	14-22	10.3-16.2
Exhaust Manifold Bracket Retaining Bolts	M10 × 1.25	28-42	20.7-31.0

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Power Steering Pump Mounting Bolt	M10	36-54	26.6-39.8
Compressor Retaining Bolt	M8	20-30	14.8-22.1
VVT Solenoid Valve Components Retaining Bolt	M6	7-11	5.2-8.1

2.16.1.2 Mechanical System Specifications

Items	Specifications
Bore (mm/in)	77.8/3.07
Stroke (mm/in)	78.8/3.10
Displacement (L)	1.498
Compression Ratio	10.3:1
Power (km/rpm)	78/6,000
Torque (Nm/rpm)	135/4,800
Idle Speed (rpm)	750 ± 50 (Air-Conditioning A/C ON, 1,000 ± 50)
Ignition Sequence	1-3-4-2 (Cylinder No.1,4 and Cylinder No.2,3 group ignition)
Fuel	Octane Number 93 and Above Unleaded Motor Gasoline
Engine Coolant Capacity (L/pt)	6.0/10.56
Engine Oil Capacity (L/pt)	4.0/7.04
Engine Coolant Specifications / Grades	Comply With SH0521 (Freezing Point ≤-40°C (-40 ºF)
Lubricant Specification / Grades	SAE10W-30 or 15W-40, API quality grade SJ and above, (winter cold regions use SAE5W-30)
Spark Plug Type	K6RTC
Spark Plug Gap (mm/in)	0.9 ± 0.1/0.04 ± 0.003
Dry Mass (kg/lb)	Without Starter, With Oil, Coolant, Wiring Harness, and Clutch 110 ± 2/242.51 ± 4.41
Overall Size (LxWxH) mm/in	631 × 600 × 620/24.84 × 23.62 × 24.41
Camshaft	
Journal Diameter (mm/in)	23/0.91
Camshaft Axial Clearance (mm/in)	0.05-0.12/0.0020- (-0.0047)
Intake Valve Clearance (mm/in)	0.23 ± 0.03/0.0091 ± 0.0011
Exhaust Valve Clearance (mm/in)	0.32 ± 0.03/0.0126 ± 0.0011
Intake VVT Adjustment Range	± 25 °

Items	Specifications
Valve Timing	
Intake Valve Opening	16 ° Before TDC
Intake Valve Closing	70.5 ° After BDC
Exhaust Valve Opening	55.5 ° Before TDC
Exhaust Valve Closing	17 ° After BDC
Crank Pin	
Connecting Rod Bearing Clearance (mm/in)	0.020-0.044/0.0007-0.0017
Connecting Rod Bearing Axial Clearance (mm/in)	0.16-0.342/0.006-0.0135
Crankshaft	
Axial Clearance (mm/in)	0.04-0.24/0.0015-0.0094
Main Bearing Clearance - All (mm/in)	0.015-0.033/0.0006-0.0013
Spindle Collar Diameter - All (mm/in)	47.982-48/1.8891-1.8898
Top Surface Flatness (mm/in)	0.05/0.0019
Crankshaft Main Journals Roundness (mm/in)	0.003/0.0001
Crankshaft Main Journals Run Out (mm/in)	0.004/0.0002
Cylinder Head	
Machined Minimal Total Height (mm/in)	115-0.05/4.53-0.0019
Overall Height (mm/in)	115 +0.05 / 4.53 +0.0019
Valve Guide Height (mm/in)	34.5/1.36
Pistons	
Gap Between Piston and Cylinder (mm/in)	0.070-0.090/0.0028-0.0035
Diameter (mm/in)	78.9/3.11
Piston Pin	
Gap Between Piston Pin and Piston (mm/in)	0.005-(-0.001) / 0.0002-(-0.00003)
Gap Between Piston Pin and Rod (mm/in)	0.005-0.011/0.0002-0.0004
Diameter (mm/in)	20/0.787
Length (mm/in)	50-0.2/1.969-0.0079
Piston Pin Offset - Thrust Side (mm/in)	0.6 ± 0.1/0.0236 ± 0.0039
Oil Pump	
Safety Valve Opening Pressure (kPa/psi)	500/72.52
Piston Ring	
Oil Ring End Gap (mm/in)	0.20-0.70/0.0079-0.0276

Items	Specifications
Second Compression Ring End Gap (mm/in)	0.20-0.40/0.0079-0.0157
First Compression Ring End Gap (mm/in)	0.25-0.35/0.0098-0.0138
Sealants and Adhesives	
Cylinder Head Cover Mat Sealant	Kesaixin 1596 Flat Silicone Rubber Sealants
Engine Oily Road Conce	Kesaixin 1243-Type Anaerobic Thread Locking Sealant
Oil Pan and Crankcase Mating Surface	Kesaixin 1596 Flat Silicone Rubber Sealants
Crankcase and Cylinder Block Mating Surface	Kesaixin 1596 Flat Silicone Rubber Sealants
Flywheel Bolt	Letai 204 Anaerobic Sealant
Valve System	
Intake Valve Diameter (mm/in)	31/1.2
Exhaust Valve Diameter (mm/in)	26 / 1
Valve Tube Diameter (mm/in)	5.5/0.22
Valve Stem Diameter - Intake Valve (mm/in)	5.5/0.22
Valve Rod Diameter - Exhaust Valve (mm/in)	5.5/0.22

2.16.1.3 Intake and Exhaust Valves Lifter Specifications Table

Packet No.	Thickness (mm/in)	Packet No.	Thickness (mm/in)
06	5.06(0.1992)	42	5.42(0.2134)
08	5.08(0.2000)	44	5.44(0.2142)
10	5.10(0.2008)	46	5.46(0.2150)
12	5.12(0.2016)	48	5.48(0.2157)
14	5.14(0.2024)	50	5.50(0.2165)
16	5.16(0.2031)	52	5.52(0.2173)
18	5.18(0.2039)	54	5.54(0.2181)
20	5.20(0.2047)	56	5.56(0.2189)
22	5.22(0.2055)	58	5.58(0.2197)
24	5.24(0.2063)	60	5.60(0.2205)
26	5.26(0.2071)	62	5.62(0.2213)
28	5.28(0.2079)	64	5.64(0.2220)
30	5.30(0.2087)	66	5.66(0.2236)
32	5.32(0.2094)	68	5.68(0.2236)
34	5.34(0.2102)	70	5.70(0.2252)

Packet No.	Thickness (mm/in)	Packet No.	Thickness (mm/in)
36	5.36(0.2110)	72	5.72(0.2260)
38	5.38(0.2118)	74	5.74(0.2260)
40	5.40(0.2126)		

2.16.1.4 Intake and Exhaust Valves Lifter Selection Table

Intake Valve Selection Table

5.74(0.2260)	5.72(0.2260)	5.70(0.2252)	5.68(0.2236)	5.66(0.2236)	5.64(0.2220)	5.62(0.2213)	5.60(0.2205)	5.58(0.2197)	5.56(0.2189)	5.54(0.2181)	5.52(0.2173)	5.50(0.2165)	5.48(0.2157)	5.46(0.2150)	5.44(0.2142)	5.42(0.2134)	5.40(0.2126)	5.38(0.2118)	5.36(0.2110)	5.34(0.2102)	5.32(0.2094)	5.30(0.2087)	5.28(0.2079)	5.26(0.2071)	5.24(0.2063)	5.22(0.2055)	5.20(0.2047)	5.18(0.2039)	5.16(0.2031)	5.14(0.2024)	5.12(0.2016)	5.10(0.2008)	5.08(0.2000)	5.06(0.1992)	Lifter No. and Thickness (mm/in) / Gap (mm/in)
54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06											0.000-0.030(0.0000-0.0012)
58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06									0.031-0.050(0.0012-0.0020)
60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06								0.051-0.070(0.0020-0.0028)
62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06							0.071-0.090(0.0028-0.0035)
64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06						0.091-0.110(0.0036-0.0043)
66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06					0.111-0.130(0.0044-0.0051)
68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06				0.131-0.150(0.0052-0.0059)
70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06			0.151-0.170(0.0059-0.0067)
72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06		0.171-0.189(0.0067-0.0074)
	74	74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	0.291-0.310(0.0115-0.0122)
		74	74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	0.311-0.330(0.0122-0.0130)
			74	74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	0.331-0.350(0.0130-0.0138)
				74	74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	0.351-0.370(0.0138-0.0146)
					74	74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	0.371-0.390(0.0146-0.0154)
						74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	0.391-0.410(0.0154-0.0161)
							74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	0.411-0.430(0.0162-0.0169)
								74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	0.431-0.450(0.0170-0.0177)
									74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	0.451-0.470(0.0178-0.0185)
										74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	0.471-0.490(0.0185-0.0193)
											74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	0.491-0.510(0.0193-0.0201)
												74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	0.511-0.530(0.0201-0.0209)
													74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	0.531-0.550(0.0209-0.0217)
														74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	0.551-0.570(0.0217-0.0224)
															74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	0.571-0.590(0.0225-0.0232)
																74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	0.591-0.610(0.0233-0.0240)
																	74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	0.611-0.630(0.0241-0.0248)
																		74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	0.631-0.650(0.0248-0.0256)
																			74	74	72	70	68	66	64	62	60	58	56	54	52	50	48	0.651-0.670(0.0256-0.0264)
																				74	74	72	70	68	66	64	62	60	58	56	54	52	50	0.671-0.690(0.0264-0.0272)
																					74	74	72	70	68	66	64	62	60	58	56	54	52	0.691-0.710(0.0272-0.0280)
																						74	74	72	70	68	66	64	62	60	58	56	54	0.711-0.730(0.0280-0.0287)
																							74	74	72	70	68	66	64	62	60	58	56	0.731-0.750(0.0288-0.0295)
																								74	74	72	70	68	66	64	62	60	58	0.751-0.770(0.0296-0.0303)
																									74	74	72	70	68	66	64	62	60	0.771-0.790(0.0304-0.0311)
																											74	72	70	68	66	64	62	0.791-0.810(0.0311-0.0319)
																												74	72	70	68	66	64	0.811-0.830(0.0319-0.0327)
																													74	72	70	68	66	0.831-0.850(0.0327-0.0335)
																														74	72	70	68	0.851-0.870(0.0335-0.0343)
																															74	72	70	0.871-0.890(0.0343-0.0350)
																																74	72	0.891-0.910(0.0351-0.0358)
																																	74	0.891-0.910(0.0351-0.0358)

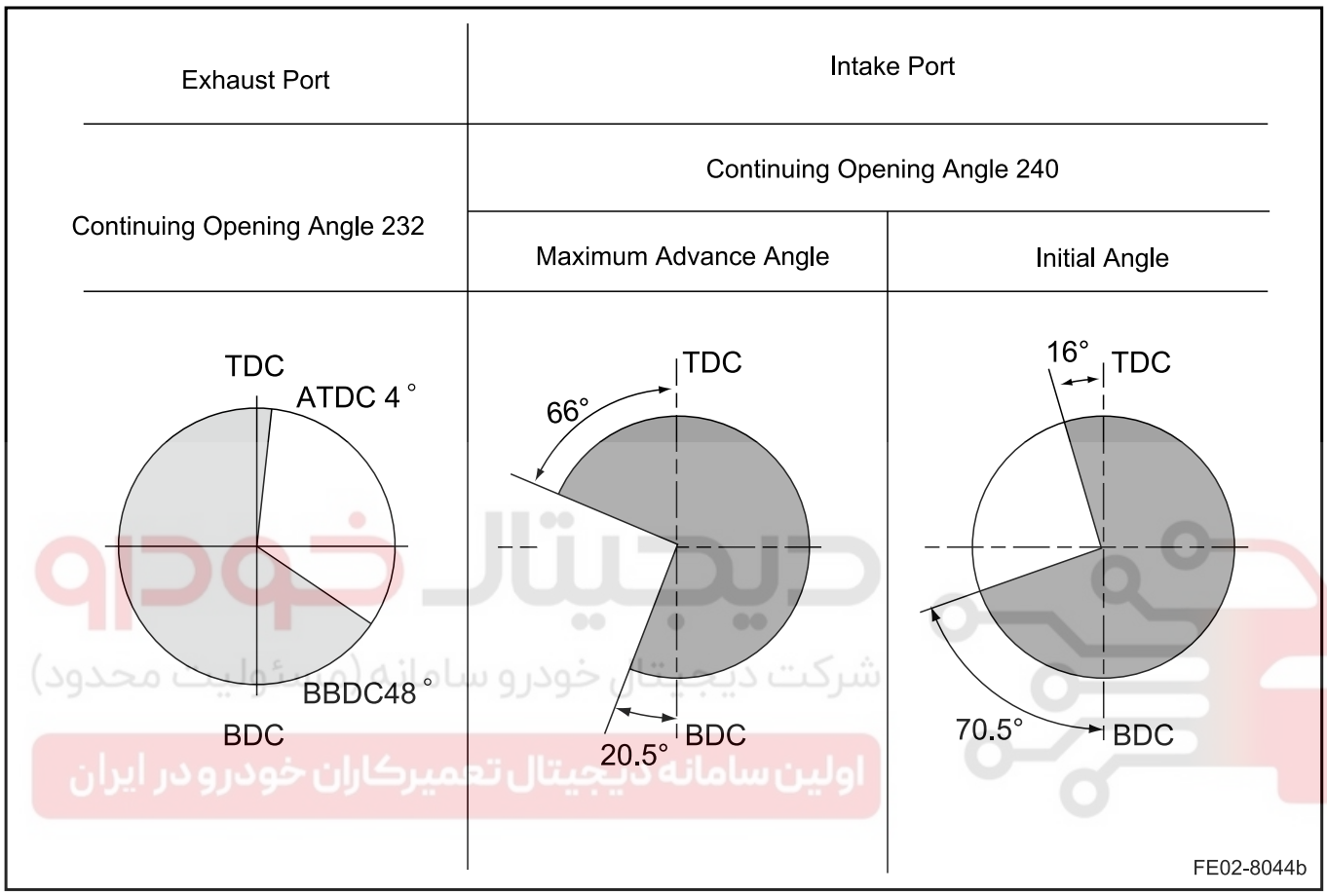
Exhaust Valve Selection Table

5.74(0.2260)	5.72(0.2260)	5.70(0.2252)	5.68(0.2236)	5.66(0.2236)	5.64(0.2220)	5.62(0.2213)	5.60(0.2205)	5.58(0.2197)	5.56(0.2189)	5.54(0.2181)	5.52(0.2173)	5.50(0.2165)	5.48(0.2157)	5.46(0.2150)	5.44(0.2142)	5.42(0.2134)	5.40(0.2126)	5.38(0.2118)	5.36(0.2110)	5.34(0.2102)	5.32(0.2094)	5.30(0.2087)	5.28(0.2079)	5.26(0.2071)	5.24(0.2063)	5.22(0.2055)	5.20(0.2047)	5.18(0.2039)	5.16(0.2031)	5.14(0.2024)	5.12(0.2016)	5.10(0.2008)	5.08(0.2000)	5.06(0.1992)	Lifter No. and Thickness (mm/in) / Gap (mm/in)
54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06											0.000-0.030(0.0000-0.0012)
56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06										0.031-0.050(0.0012-0.0020)
58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06									0.051-0.070(0.0020-0.0028)
60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06								0.071-0.090(0.0028-0.0035)
62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06							0.091-0.110(0.0036-0.0043)
64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06						0.111-0.130(0.0044-0.0051)
66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06					0.131-0.150(0.0052-0.0059)
68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06				0.151-0.170(0.0059-0.0067)
70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06			0.171-0.190(0.0067-0.0075)
70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	08	06		0.191-0.199(0.0075-0.0078)
		74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	0.261-0.280(0.0103-0.0110)
			74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	0.281-0.300(0.0111-0.0118)
				74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	0.301-0.320(0.0119-0.0125)
					74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	0.321-0.340(0.0126-0.0134)
						74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	0.341-0.360(0.0134-0.0142)
							74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	0.361-0.380(0.0142-0.0150)
								74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	0.381-0.400(0.0150-0.0157)
									74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	0.401-0.420(0.0158-0.0165)
										74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	0.421-0.440(0.0166-0.0173)
											74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	0.441-0.460(0.0174-0.0181)
												74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	0.461-0.480(0.0193-0.0201)
													74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	0.481-0.500(0.0189-0.0197)
														74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	0.501-0.520(0.0197-0.0205)
															74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	0.521-0.540(0.0205-0.0213)
																74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	0.541-0.560(0.0213-0.0220)
																	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	0.561-0.580(0.0221-0.0228)
																		74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	0.581-0.600(0.0229-0.0236)
																			74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	0.601-0.620(0.0237-0.0244)
																				74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	0.621-0.640(0.0244-0.0252)
																					74	72	70	68	66	64	62	60	58	56	54	52	50	48	0.641-0.660(0.0252-0.0260)
																						74	72	70	68	66	64	62	60	58	56	54	52	50	0.661-0.680(0.0260-0.0268)
																							74	72	70	68	66	64	62	60	58	56	54	52	0.681-0.700(0.0268-0.0276)
																								74	72	70	68	66	64	62	60	58	56	54	0.701-0.720(0.0276-0.0283)
																									74	72	70	68	66	64	62	60	58	56	0.721-0.740(0.0284-0.0291)
																										74	72	70	68	66	64	62	60	58	0.741-0.760(0.0292-0.0299)
																											74	72	70	68	66	64	62	60	0.761-0.780(0.0300-0.0307)
																												74	72	70	68	66	64	62	0.781-0.800(0.0307-0.0315)
																													74	72	70	68	66	64	0.801-0.820(0.0315-0.0323)
																														74	72	70	68	66	0.821-0.840(0.0323-0.0331)
																															74	72	70	68	0.841-0.860(0.0331-0.0339)
																																74	72	70	0.861-0.880(0.0339-0.0346)
																																	74	72	0.881-0.900(0.0347-0.0354)
																																		74	0.901-0.920(0.0355-0.0362)

2.16.2 System Working Principle

2.16.2.1 System Working Principle

For specific working descriptions, Refer to2.6 Engine Mechanical System JL4G18-Din2.6.3.1 System Working Principle.



Legend

1. TDC: Top Dead Center
2. BDC: Bottom Dead Center
3. ATDC: After Top Dead Center
4. BTDC: Before Top Dead Center
5. ABDC: After Bottom Dead Center
6. BBDC: Before Bottom Dead Center

2.16.3 Removal and Installation

2.16.3.1 4G15-D Mechanical Parts Disassemble Instructions

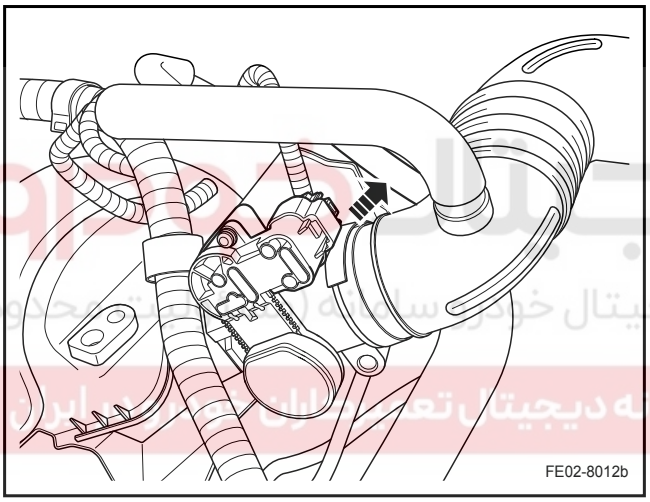
Other than using an electronic throttle body instead of the mechanical throttle body, there is no difference between this engine mechanical parts 4G15-D engine. Therefore this section only lists electronic throttle body replacement. For other parts replacement, Refer to2.6.8Removal and Installationin the "Engine Mechanical System 4G18-D".

2.16.3.2 Electronic Throttle Body Replacement

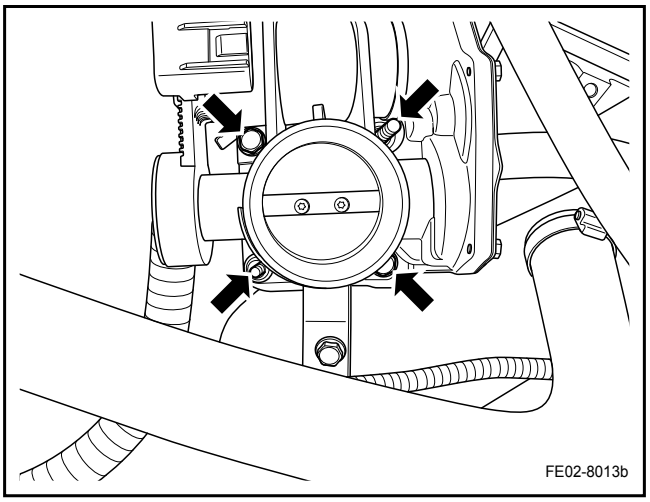
Removal Procedure:

Warning!

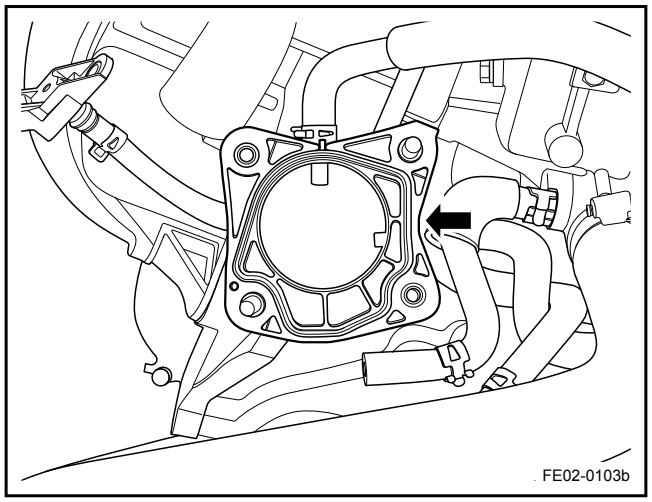
Warning: Refer to "Battery Disconnection Warning" in "Warnings and Notices".



1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove intake manifold from the throttle body.
3. Disconnect throttle control valve wiring harness connector.

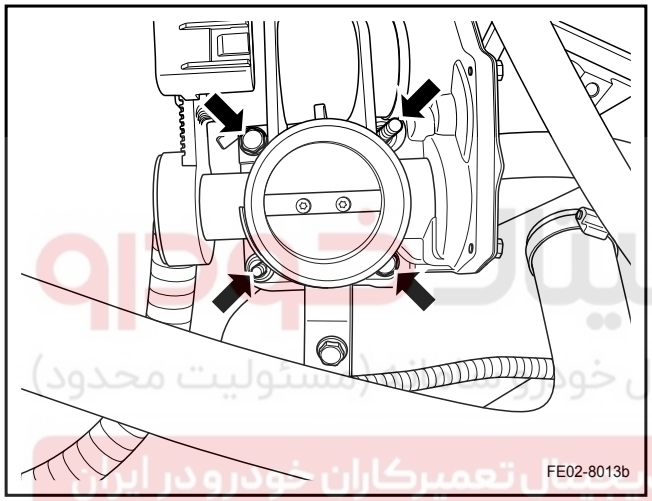


4. Remove throttle body retaining bolts and nuts, and two retaining nuts from the throttle body bracket.



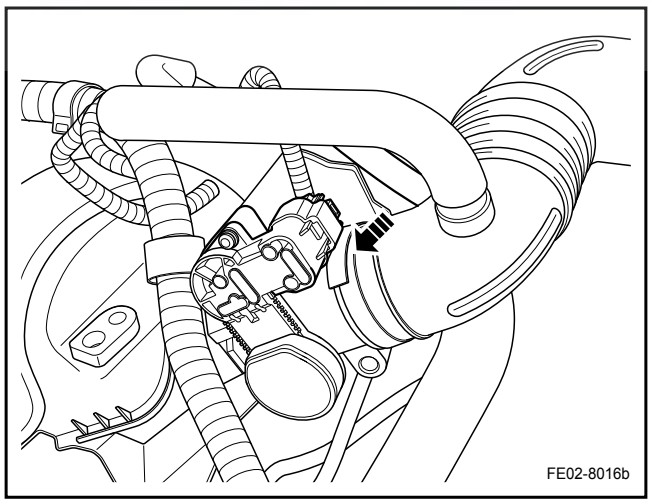
5. Remove throttle body from the intake manifold.
6. Clean the engine throttle body and intake manifold mating surface and replace with a new gasket.

Installation Procedure:



1. Install and tighten throttle body retaining bolts and nuts.

   Torque: 15 Nm (Metric) 11 lbf-ft (US English)



2. Connect throttle control valve wiring harness connector.
3. Install intake manifold.
4. Connect the battery negative cable.

2.17 Exhaust System JL4G15-D

2.17.1 4G15-D Engine Exhaust System Overview

Compared with 4G18-D, 4G15-D engine exhaust system has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

2.17.1 Specifications

2.17.1.1 Fastener Tightening Specifications

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Exhaust Manifold Retaining Nut	M8	20-30	14.8-22.2
Exhaust Manifold Bracket Retaining Bolts	M12 × 1.25 × 28	28-42	20.7-31.1
Heat Shield Retaining Bolts	M8 × 25	14-22	10.4-16.3
Three-Way Catalytic Converter To Front Muffler Retaining Nuts	M12 × 1.25 × 45	47-57	34.8-42.2
Three-Way Catalytic Converter To Front Muffler Retaining Bolts	M12	47-57	34.8-42.2
Front and Rear Muffler Connecting Bolts	M12 × 1.25 × 45	47-57	34.8-42.2
Front and Rear Muffler Connecting Nuts	M12	47-57	34.8-42.2

2.18 Engine Cooling System JL4G15-D

2.18.1 4G15-D Engine Cooling System Overview

Compared with 4G18-D, 4G15-D engine cooling system has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

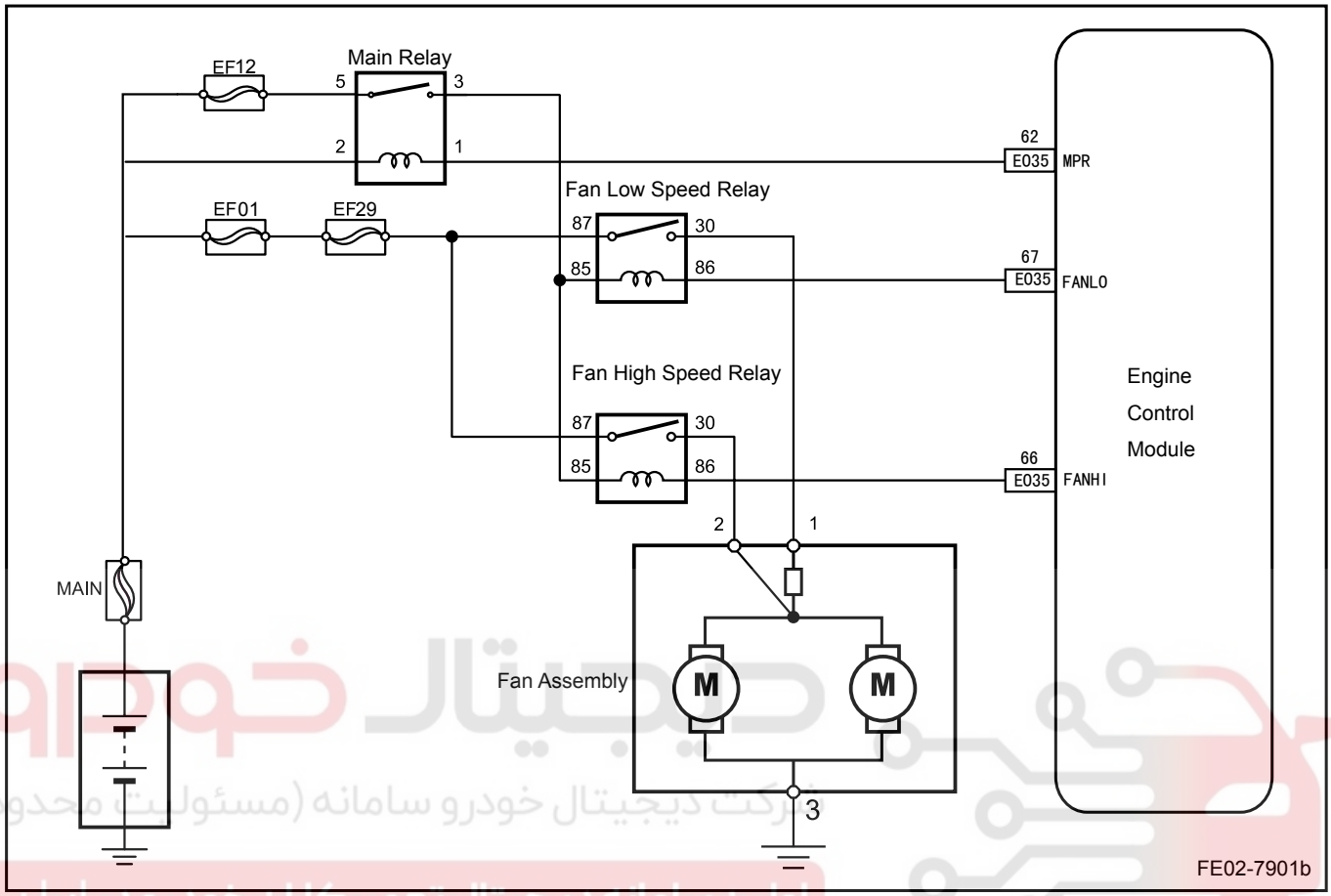
2.18.1 Specifications

2.18.1.1 Cooling System Specifications

Applications	Specifications
Cooling Type	Coolant
Engine Coolant Specifications / Grades	Comply With SH0521 (Freezing Point ≤-40°C /-40 ºF)
Engine Coolant Capacity (Coolant Recovery Reservoir)	6.0 L (10.6 pt)
Thermostat Type	Wax-Type Thermostat
Pump Type	Impeller
Blade Diameter	60 mm (2.36 in)
Blades	6
Thermostat Opening Temperature	82°C (179.6 ºF)
Thermostat Fully Open Temperature	95°C (203 ºF)
Low Speed Cooling Fan On Temperature	95°C (203 ºF)
Low Speed Cooling Fan Off Temperature	90°C (194 ºF)
High Speed Cooling Fan On Temperature	99°C (210.2 ºF)
High Speed Cooling Fan Off Temperature	95°C (203.0 ºF)
Low-Speed Fan Resistor	0.35 Ω

2.18.2 Schematic

2.18.2.1 Schematic



2.18.3 Diagnostic Information and Procedures

2.18.3.1 Cooling Fan Circuit Diagnosis

Diagnostic Tips:

- If there is an overheating complaint, verify whether the it is because the engine coolant boiling or the engine coolant temperature gage indicates the coolant overheating. If the engine is overheating, but the cooling fan is still running, check the engine cooling system.
- If the fuse EF29 in underhood fuse block fuses immediately after installation, check whether the circuit between the cooling fan high or Low-Speed relay and cooling fan motor is to short to ground. If the engine control module has just controlled relay pull-in, EF29 fuses, then the cooling fan motor may be faulty.
- When the Air-Conditioning system is switched on, the engine control module controls the cooling fan run at low speed. When the Air-Conditioning high pressure is 1,520 Pa (220.5 psi), the engine control module will switch cooling fan from low speed to high speed. When the Air-Conditioning high pressure drops back to 1,450 kPa (210.3 psi), the cooling fan will return to low speed.
- Use scan tool "Function Test" to drive high or low speed cooling fan relay pull-in to confirm whether the fan works properly to quickly determine the fault.

Note

Before carry out this diagnostic procedure, make sure check whether fuse EF29 works properly, whether main relay works properly. When using scan tool "action test", make sure the scan tool communicates with ECM properly.

Step 1	Verify the fault.

Next

Step 2	Confirm whether the low speed cooling fan is running.

(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to the datalink connector.
(c) Start the engine to normal working temperature.
(d) Turn off A/C switch.
(e) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(f) When the engine coolant temperature gage displays 95°C (203 ºF) Cooling fan should be running at low speed.

Is cooling fan running at Low speed?

No → Refer to 2.18.3.3 Low Speed Cooling Fan Inoperative

Yes

Step 3	Confirm whether the high speed cooling fan is running.

(a) Turn off A/C switch.
(b) When the engine coolant temperature gage displays 99°C (210.2 ºF) When the cooling fan should be running at high speed.

Is the cooling fan running at high speed?

No → Refer to 2.18.3.2 High Speed Cooling Fan Inoperative

Yes

Step 4	Turn on the A/C switch and confirm whether the low speed cooling fan is running.

(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to datalink connector.
(c) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(d) When the engine coolant temperature is below 90°C (194 ºF), Start the engine, turn on the A/C switch, cooling fan should be running low speed.

Is cooling fan running at Low speed?

No → A/C system malfunction, Refer to 8.2.7 Diagnostic Information and Procedures

Yes

Step 5	Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

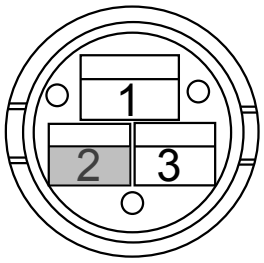
2.18.3.2 High Speed Cooling Fan Inoperative

Note

Before carry out this diagnostic procedure, please Refer to the 2.18.3.1 Cooling Fan Circuit Diagnosis program, which will help with quick diagnostic.

Step 1	Check high speed cooling fan power supply.

Cooling Fan Harness Connector CA16



FE02-7801b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cooling fan wiring harness connector CA16.
(c) Turn the ignition switch to "ON" position.
(d) Connect scan tool to the datalink connector.
(e) Select in sequence: Engine / Action Test / Fan 2.
(f) Make High-Speed relay work.
(g) Measure voltage between cooling fan wiring harness connector CA16 terminal No.2 and a reliable ground.

Standard Voltage: 11-14 V

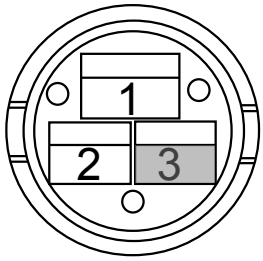
Is the voltage specified Value?

No → Go to step 4

Yes

Step 2	Check the cooling fan ground circuit.

Cooling Fan Harness Connector CA16



FE02-7802b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cooling fan wiring harness connector CA16.
(c) Measure resistance between cooling fan wiring harness connector CA16 terminal No.3 and a reliable ground.

Standard Resistance: Less than 1 Ω

Is the resistance specified Value?

No → CA16 terminal No.3 has poor connection to ground. inspect and repair faulty part.

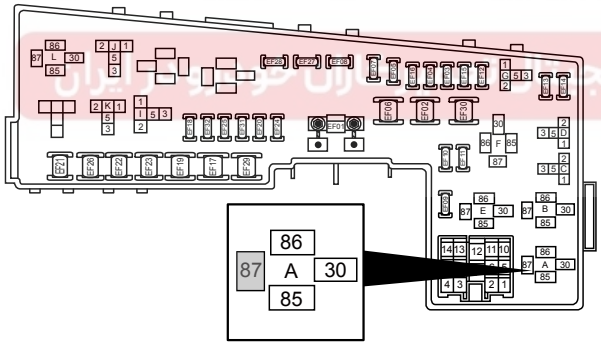
Yes

Step 3	Replace cooling fan.
Step 4	Use scan tool "Action Test" to drive the fan 2. Does high speed relay work?

No → Go to step 8

Yes

Step 5	Check high speed relay A terminal No.87 power supply.



FE02-7803b

(a) Turn the ignition switch to "OFF" position.
(b) Remove the High-Speed cooling fan relay A.
(c) Measure voltage between high speed cooling fan relay A terminal No.87 and a reliable ground.

Standard Voltage: 11-14 V

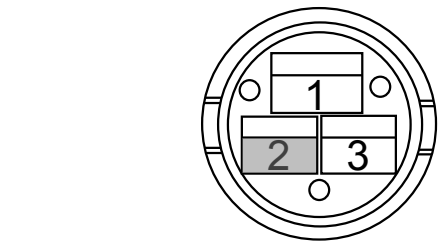
Is the voltage specified Value?

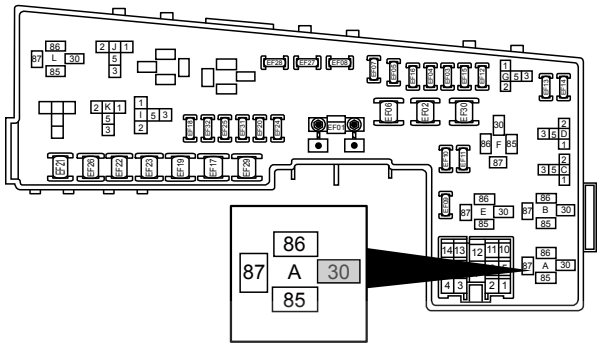
No → Relay A terminal No.87 power supply circuit malfunction. inspect and repair faulty parts.

Yes

Step 6	Check high speed cooling fan relay A and cooling fan harness connector CA16 wiring harnesses.

Cooling Fan Harness Connector CA16





FE02-7804b

(a) Turn the ignition switch to "OFF" position.
(b) Remove the High-Speed cooling fan relay.
(c) Disconnect cooling fan wiring harness connector CA16.
(d) Test continuity between high speed cooling fan relay A terminal No.30 and cooling fan wiring harness connector CA16 terminal No.2.
(e) Measure resistance between high speed cooling fan relay A terminal No.30 and a reliable ground. check whether the circuit is short to ground.

Standard Value:

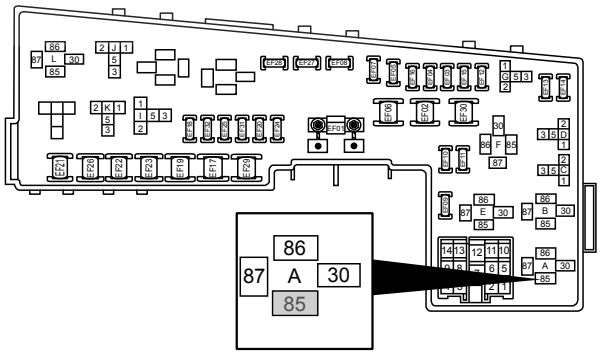
Test Items	Specified Value
Resistance Between Relay A (30) and CA16 (2)	Less than 1 Ω
Resistance Between Relay A (30) and A Reliable Ground	10 kΩ or higher

Are measured values specified values?

No → Circuit between cooling fan relay terminal No. 30 and wiring harness connector CA16 terminal No.2 is faulty. check and Repair the faulty part.

Yes

Step 7	Replace high speed cooling fan relay A. Confirm whether the fault has been fixed.
Step 8	Check high speed relay A coil power supply.



FE02-7805b

(a) Turn the ignition switch to "OFF" position.
(b) Remove the High-Speed cooling fan relay A.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between high speed cooling fan relay A terminal No.85 and a reliable ground.

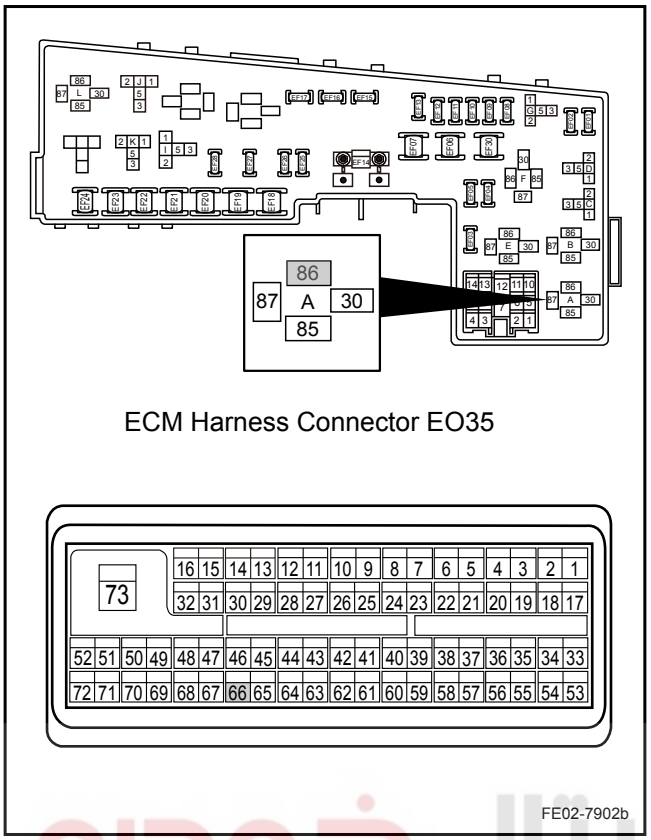
Standard Voltage: 11-14 V

Is the voltage specified value?

No → Circuit between relay terminal No.85 and main relay terminal No.3 is open.

Yes

Step 9	Check high speed relay A control circuit.



ECM Harness Connector EO35

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EO35.
(c) Remove the High-Speed cooling fan relay A.
(d) Test continuity between high speed cooling fan relay A terminal No.86 and EO35 terminal No.66.
(e) Measure voltage between high speed cooling fan relay A terminal No.86 and a reliable ground.

Standard Value:

Test Items	Specified Value
Resistance Between Relay A (86) and EO35 (66)	Less than 1 Ω
Resistance Between Relay A (86) and A Reliable Ground	0 V

Are measured values specified values?

No → Circuit between Relay A terminal No.86 and EO35 terminal No.66 is open. inspect and repair the relevant parts.

Yes

Step 10	Check ECM working circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 11	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 12	Diagnostic completed.

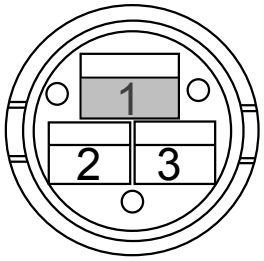
2.18.3.3 Low Speed Cooling Fan Inoperative

Note

Before carry out this diagnostic procedure, please Refer to the2.18.3.1 Cooling Fan Circuit Diagnosisprogram, which will help with quick diagnostic.

Step 1	check low speed cooling fan power supply.

Cooling Fan Harness Connector CA16



FE02-7807b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cooling fan wiring harness connector CA16.
(c) Turn the ignition switch to "ON" position.
(d) Connect scan tool to the datalink connector.
(e) Select in sequence: Engine / Action Test / fan 1.
(f) Make low-speed relay work.
(g) Measure voltage between cooling fan wiring harness connector CA16 terminal No.1 and a reliable ground.

Standard Voltage: 11-14 V

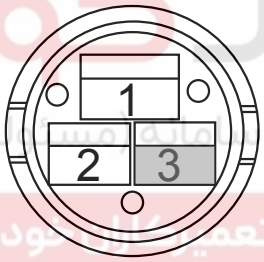
Is the voltage specified Value?

No → Go to step 4

Yes

Step 2	Check the cooling fan ground circuit.

Cooling Fan Harness Connector CA16



FE02-7802b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cooling fan wiring harness connector CA16.
(c) Measure resistance between cooling fan wiring harness connector CA16 terminal No.3 and a reliable ground.

Standard Resistance: Less than 1 Ω

Is the resistance specified Value?

No → CA16 terminal No.3 has poor connection to ground. Inspect and repair faulty part.

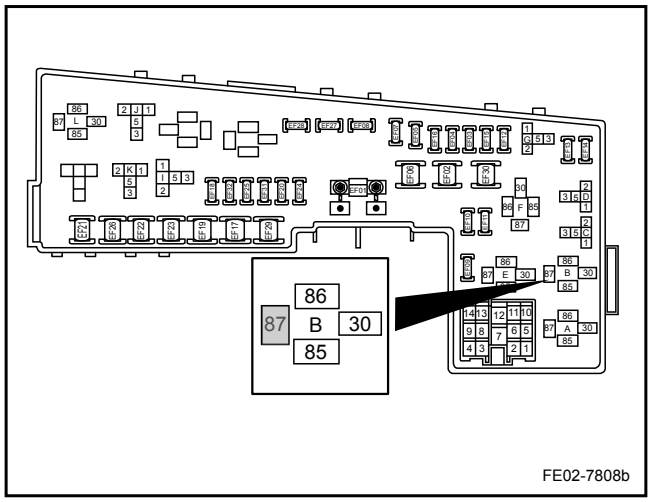
Yes

Step 3	Replace cooling fan assembly.
Step 4	Use scan tool "Action Test" to drive the fan 1. Does low speed relay work?

No → Go to step 8

Yes

Step 5	Check low speed relay B terminal No.87 power supply.



(a) Turn the ignition switch to "OFF" position.
(b) Remove the low-speed cooling fan relay B.
(c) Measure voltage between low speed cooling fan relay B terminal No.87 and a reliable ground.

Standard Voltage: 11-14 V

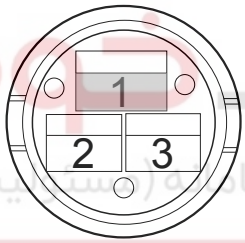
Is the voltage specified Value?

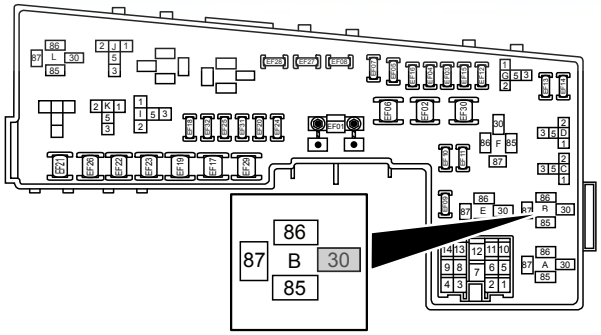
No → Relay B terminal No.87 power supply circuit malfunction. Inspect and repair faulty parts.

Yes

Step 6	Check low speed cooling fan relay and cooling fan harness connector CA16 wiring harnesses.

Cooling Fan Harness Connector CA16





(a) Turn the ignition switch to "OFF" position.
(b) Remove the low-speed cooling fan relay.
(c) Disconnect cooling fan wiring harness connector CA16.
(d) Test continuity between low speed cooling fan relay B terminal No.30 and cooling fan wiring harness connector CA16 terminal No.1.
(e) Measure resistance between low speed cooling fan relay B terminal No.30 and a reliable ground. check whether the circuit is short to ground.

Standard Value:

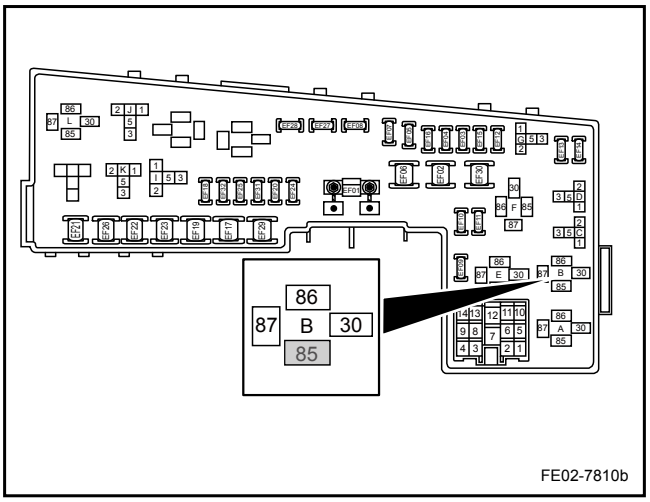
Test Items	Specified Value
Resistance Between Relay B (30) and CA16 (1)	Less than 1 Ω
Resistance Between Relay B (30) and A Reliable Ground	10 kΩ or higher

Are measured values specified values?

No → Circuit between cooling fan relay terminal No. 30 and wiring harness connector CA16 terminal No.1 is faulty. Check and repair the faulty part.

Yes

Step 7	Replace cooling fan Low speed relay B. Confirm whether the fault has been fixed.
Step 8	Check low speed relay B coil power supply.



(a) Turn the ignition switch to "OFF" position.
(b) Remove the low speed cooling fan relay B.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between low speed cooling fan relay B terminal No.85 and a reliable ground.

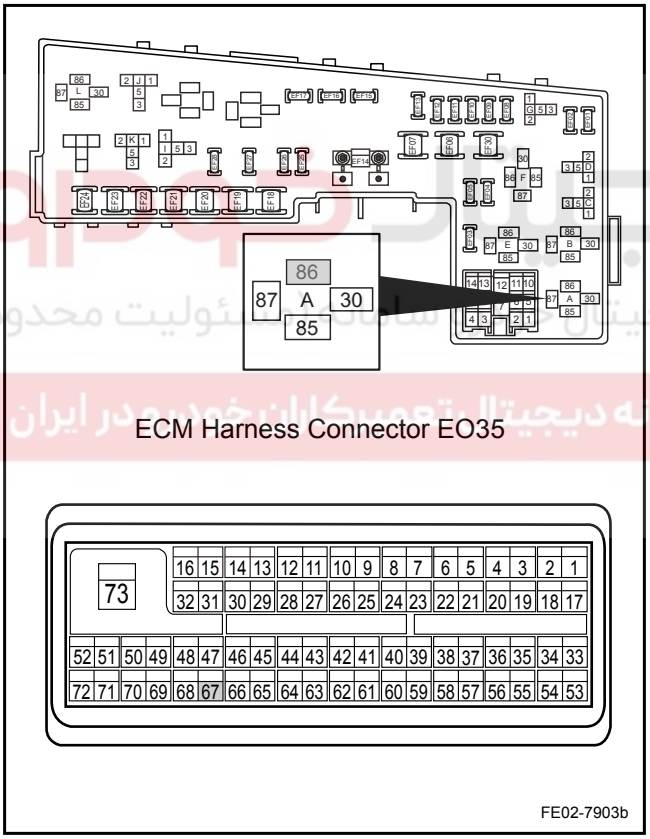
Standard Voltage: 11-14 V

Is the voltage specified value?

No → Circuit between relay terminal No.85 and main relay terminal No.3 is open.

Yes

Step 9	Check low-speed relay B control circuit.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Remove the low-speed cooling fan relay B.
(d) Test continuity between low speed cooling fan relay B terminal No.86 and EO35 terminal No.67.
(e) Measure voltage between low speed cooling fan relay B terminal No.86 and a reliable ground.

Standard Value:

Test Items	Specified Value
Resistance Between Relay B (86) and EO35 (67)	Less than 1 Ω
Resistance Between Relay B (86) and A Reliable Ground	0 V

Are measured values specified values?

No → Circuit between relay A terminal No.86 and EO35 terminal No.66 is open.

Yes

Step 10	Check ECM working circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 11	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 12	Diagnostic completed.

2.18.3.4 Cooling Fan Always Runs At Low-Speed

Note

When this fault is present, it is recommended to carry out diagnostic when engine is completely cooled down.

Step 1	Verify the fault.

Next

Step 2	Check the engine coolant temperature sensor signal.

(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to the datalink connector.
(c) Turn off A/C switch.
(d) Turn the ignition switch to "ON" position.
(e) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(f) Observe the engine coolant temperature sensor displayed temperature, when the engine is completely cooled down, the displayed temperature should be slightly higher than the ambient temperature.

Is displayed temperature normal.

No → Coolant temperature sensor or circuit malfunction. Refer to the2.12.7.20 DTC P0117 P0118

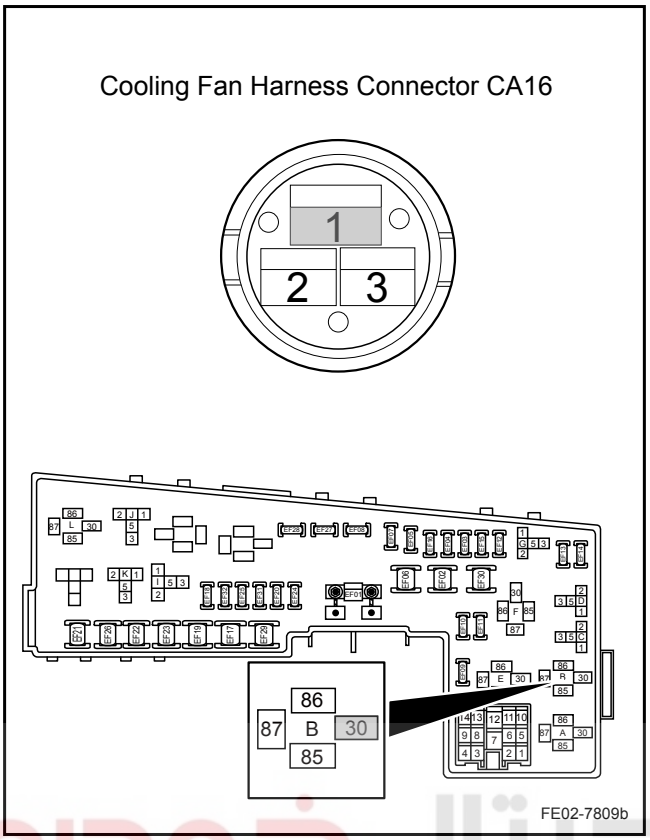
Yes

Step 3	Remove and check the cooling fan low-speed relay, cooling fan still running?

No → Go to step 5

Yes

Step 4	Check and repair circuit between low speed cooling fan relay and cooling fan wiring harness connector CA16.



(a) Turn the ignition switch to "OFF" position.
(b) Remove the low-speed cooling fan relay.
(c) Disconnect cooling fan wiring harness connector CA16.
(d) Check and repair circuit between relay and connector short to power supply fault.

Step 5	Check cooling fan low speed relay.

(a) Measure resistance between relay terminals No.87 and No. 30.

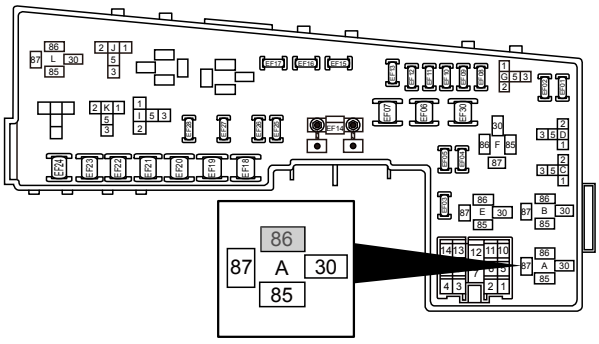
Standard Resistance: 10 kΩ or higher

Is the resistance specified value?

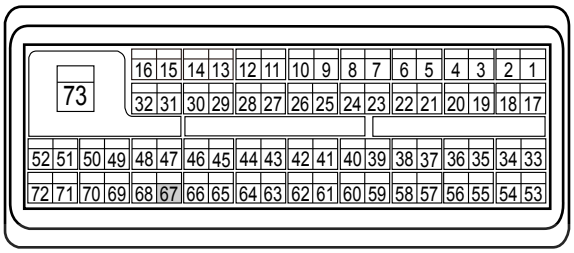
No → Replace relay.

Yes

Step 6	Check low-speed relay B control circuit.



ECM Harness Connector EO35



FE02-7903b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Remove the low-speed cooling fan relay B.
(d) Test continuity between cooling fan low speed relay B terminal No.86 and ECM harness connector EO35 terminal No.67.
(e) Measure resistance between cooling fan low-speed relay B terminal No.86 and a reliable ground. Check whether the circuit is short to ground.

Standard Value:

Test Items	Specified Value
Resistance Between Relay B (86) and EO35 (67)	Less than 1 Ω
Resistance Between Relay B (86) and A Reliable Ground	10 kΩ or higher

Are measured values specified values?

No → Relay B terminal No.86 and EO35 terminal No.67 wiring harnesses are faulty.

Yes

Step 7	Check ECM working circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Diagnostic completed.

2.18.3.5 Cooling Fan Always Runs At High Speed

Note

When this fault is present, it is recommended to carry out diagnostic when engine is completely cooled down.

Step 1	Verify the fault.

Next

Step 2	Check the engine coolant temperature sensor signal.

(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to the datalink connector.
(c) Turn off A/C switch.
(d) Turn the ignition switch to "ON" position.
(e) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(f) Observe the engine coolant temperature sensor displayed temperature, when the engine is completely cooled down, the displayed temperature should be slightly higher than the ambient temperature.

Is displayed temperature normal?

No → Coolant temperature sensor or circuit malfunction. Refer to the2.12.7.20 DTC P0117 P0118

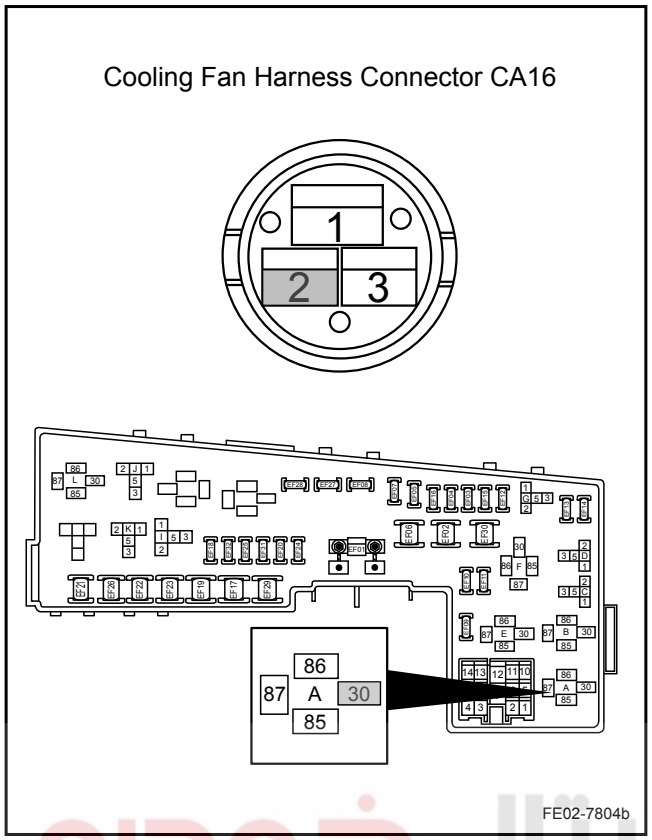
Yes

Step 3	Remove and check the cooling fan low-speed relay, cooling fan still running?

No → Go to step 5

Yes

Step 4	Check and repair circuit between high speed cooling fan relay and cooling fan wiring harness connector CA16.



(a) Turn the ignition switch to "OFF" position.
(b) Remove the high-speed cooling fan relay.
(c) Disconnect cooling fan wiring harness connector CA16.
(d) Check and repair circuit between relay and connector short to power supply fault.

Step 5	Check cooling fan high-speed relay.

(a) Measure resistance between relay terminals No.87 and No. 30.

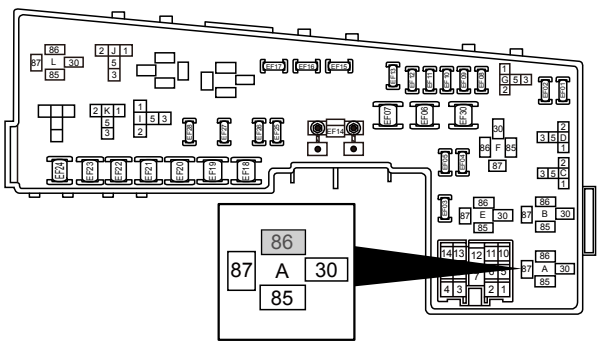
Standard Resistance: 10 kΩ or higher

Is the resistance specified value?

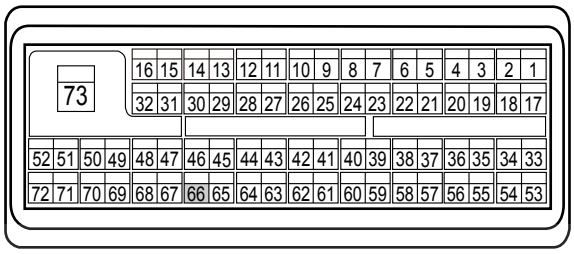
No → Replace relay.

Yes

Step 6	Check high-speed relay a control circuit.



ECM Harness Connector EO35



FE02-7902b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Remove the high-speed cooling fan relay A.
(d) Test continuity between cooling fan high speed relay A terminal No.86 and ECM harness connector EO35 terminal No.66.
(e) Measure resistance between cooling fan high speed relay A terminal No.86 and a reliable ground. Check whether the circuit is short to ground.

Standard Value:

Test Items	Specified Value
Resistance Between Relay A (86) and EO35 (66)	Less than 1 Ω
Resistance Between Relay A (86) and A Reliable Ground	10 kΩ or higher

Are measured values specified values?

No → Relay A terminal No.86 and EO35 terminal No.66 wiring harnesses are faulty.

Yes

Step 7	Check ECM working circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 9	Diagnostic completed.

2.19 Lubrication System JL4G15-D

2.19.1 4G15-D Engine Lubrication System Overview

Compared with 4G18-D, 4G15-D engine lubrication system has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

2.19.1 Specifications

2.19.1.1 Oil Pump Specifications

Applications	Specifications
Side Clearance	0.025-0.062 mm (0.0010-0.0024 in)
Tooth Gap	0.030-0.099 mm (0.0012-0.0039 in)
Engine Oil Pressure Sensor Plug Pressure	≤40 kPa (≤6 psi)
Oil Pump Output Pressure	0.6 MPa (87 psi)
Oil Pump Relief Valve Opening Pressure	0.42-0.58 MPa (61-85 psi)

2.20 Ignition System JL4G15-D

2.20.1 4G15-D Engine Ignition System Overview

Compared with 4G18-D, 4G15-D engine ignition system has the same content in Specification, Description and Operation, the System Working Principle, Component Locator, Schematic, Removal and Installation. For specific information, please refer to2.3 Fuel System JL4G18-D. This chapter described contents are different from 4G18-D. For relevant information. Refer to the following content.

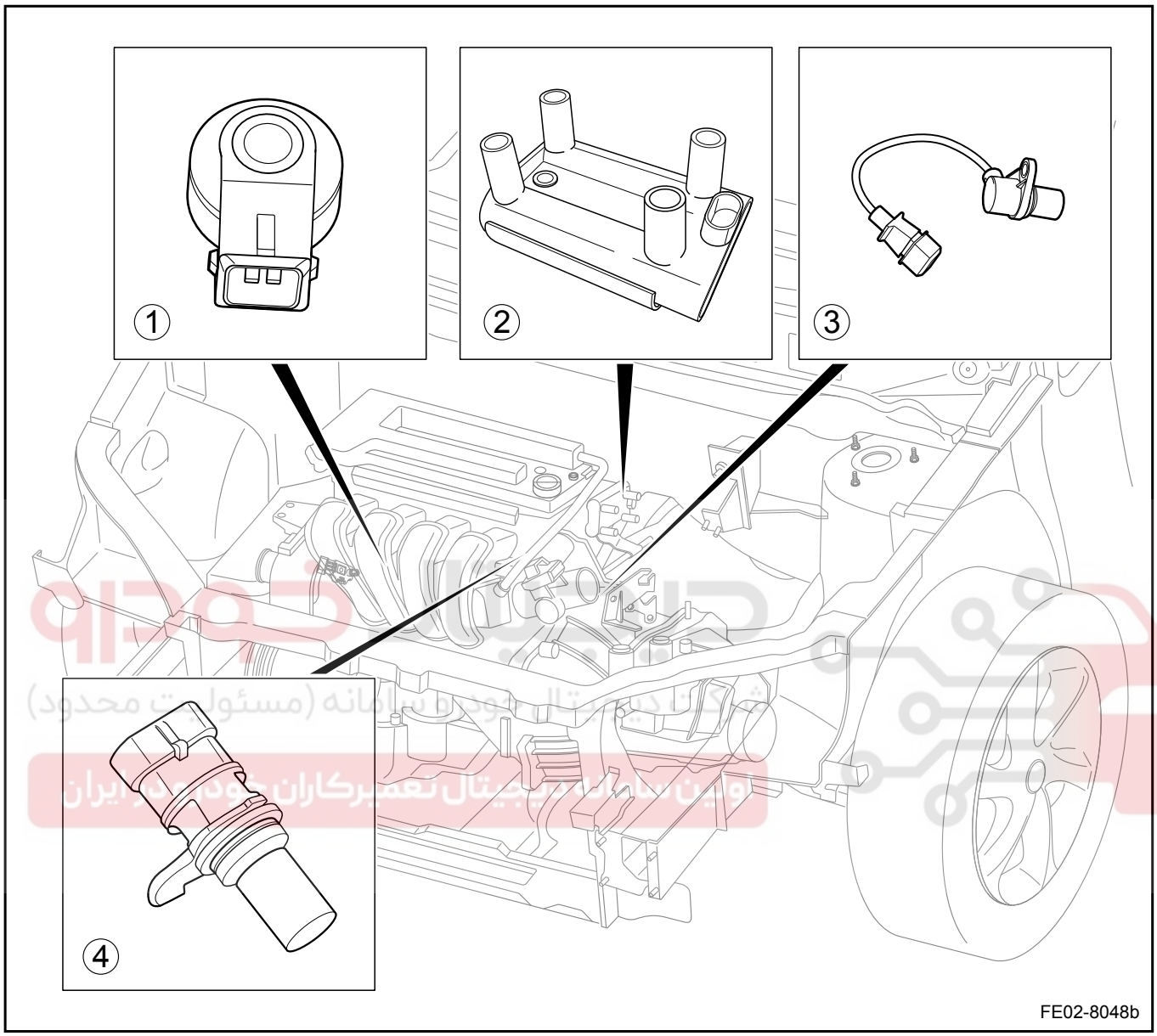
2.20.1 Specifications

2.20.1.1 Ignition System Specification

Applications	Specifications
Ignition Sequence	1-3-4-2
Ignition Timing	8 °-14 °before TDC
Ignition Type	Spark Discharge
Spark Plug Gap	0.8-1.0 mm (0.03-0.04 in)
Spark Plug Manufacturer	Zhuzhou Torch Spark Plug Co., Ltd.
Spark Plug Model	K6RTC

2.20.2 Component Locator

2.20.2.1 Component Locator

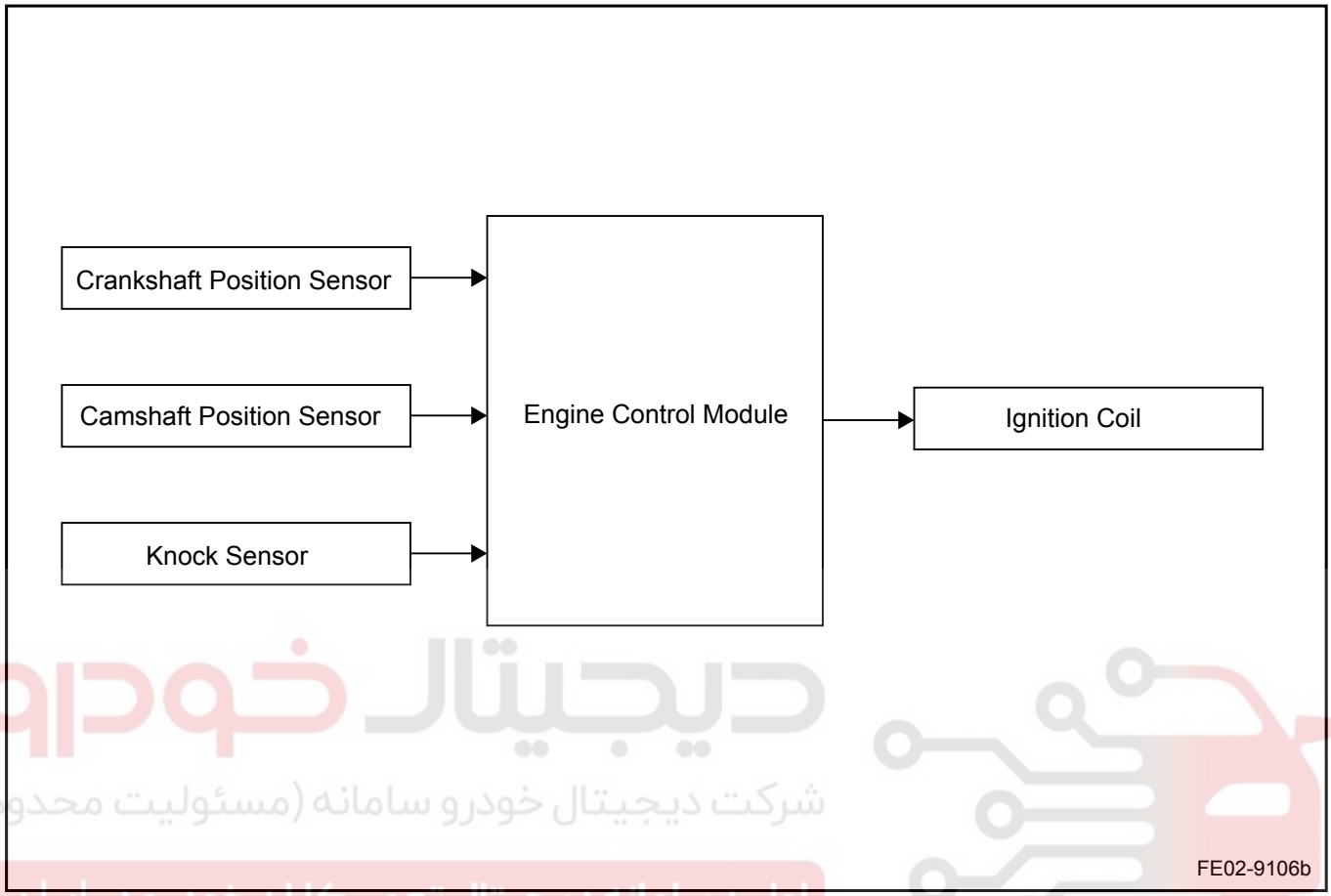


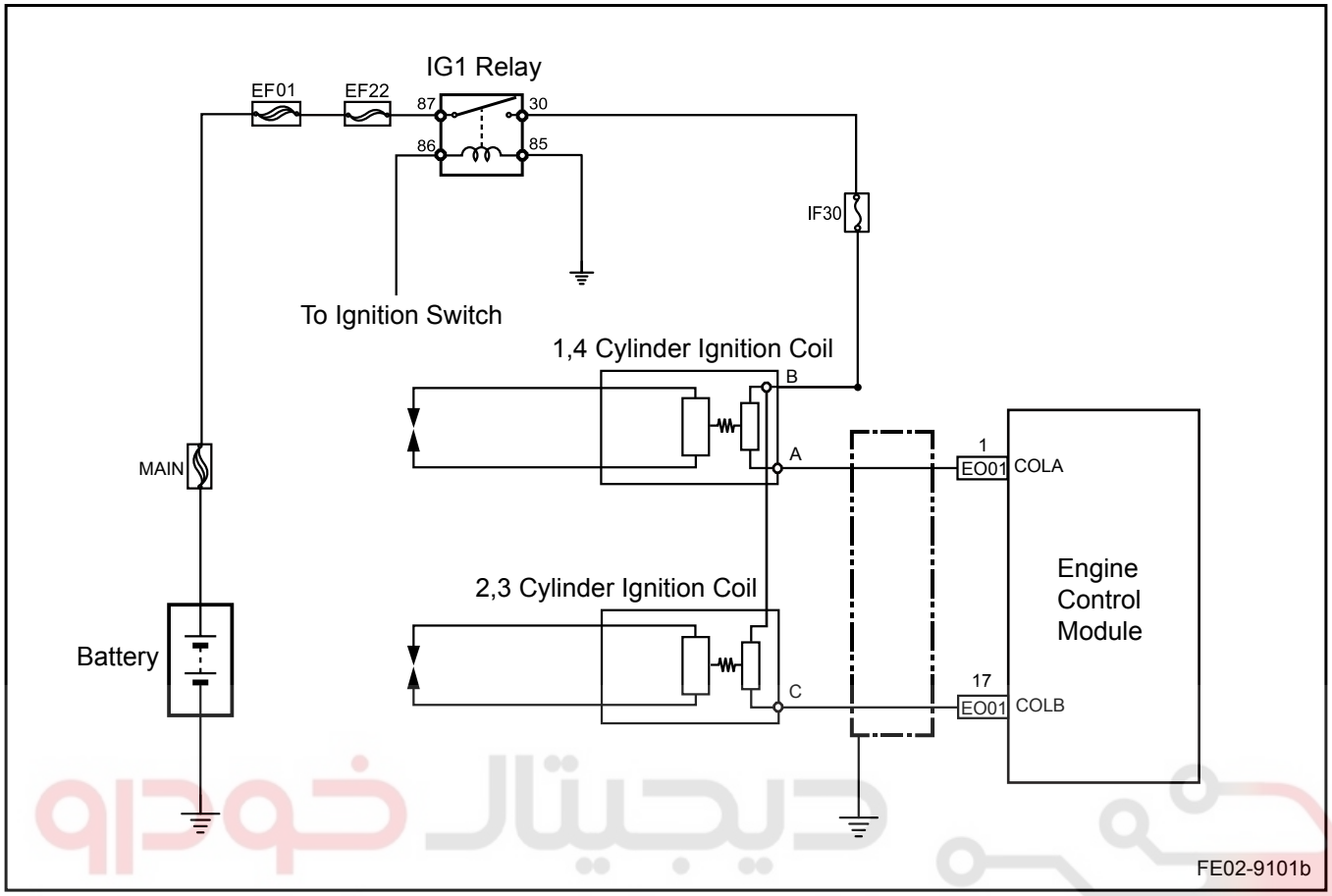
Legend

1. Knock Sensor
2. Ignition Coil
3. Crankshaft Position Sensor
4. Camshaft Position Sensor

2.20.3 Schematic

2.20.3.1 Schematic





2.20.4 Diagnostic Information and Procedures

2.20.4.1 Spark Plug No Arcing

Note

Before carry out this diagnostic procedure, make sure that the engine Anti-theft locking system is not activated and working properly.

Note

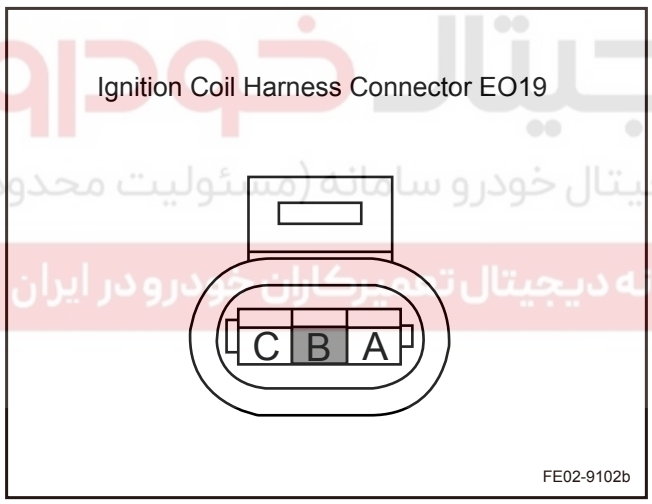
During this test, it is prohibited to connect the high-voltage damping line to ground, as this may damage the ignition coil or the engine control module. The correct approach is to connect spark plug one end to a known good high-voltage damping line, the other end to a reliable ground.

Step 1	Instruments, wiper and other electrical accessories work properly?

No → Ignition relay IG1 is not working properly. Refer to 2.10.7.4 Ignition Relay IG1 No Power Output

Yes

Step 2	Check the ignition coil working power supply.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition coil harness connector EO19.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between ignition coil harness connector EO19 terminal B and a reliable ground.

Standard Voltage: 11-14 V

Voltage normal?

No → Ignition relay IG1 terminal No.30 circuit is open.

Yes

Step 3	Measure the ignition coil primary resistance.

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition coil harness connector EO19.
(c) Measure resistance between ignition coil terminal B and A or between terminal B and C.

Standard Resistance Value: 0.45-0.55 Ω

Is resistance normal?

No → Replace the ignition coil.

Yes

Step 4	Measure the ignition coil secondary resistance.

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the ignition coil harness connector EO19.
(c) Measure resistance between ignition coil secondary terminals.

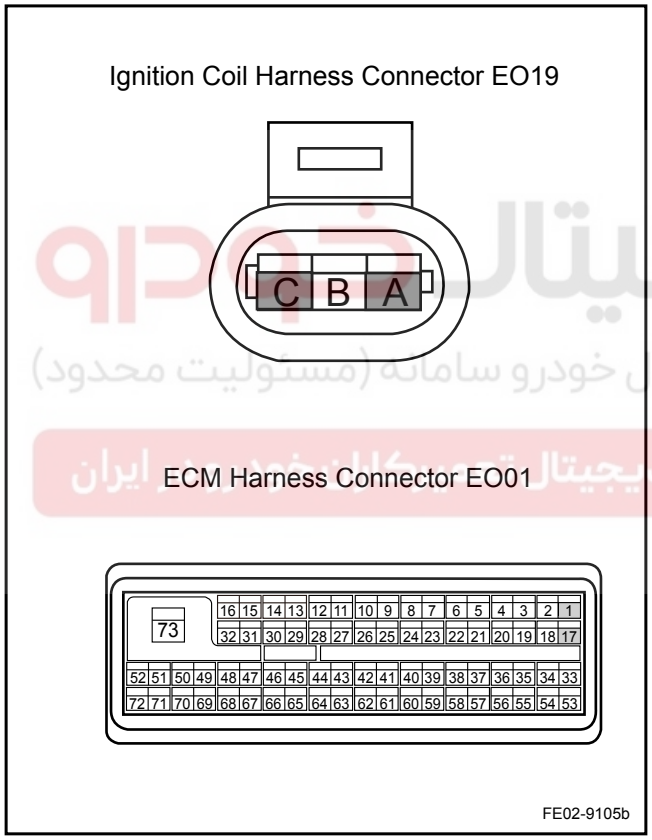
Standard Resistance Value: 8.86-10.82 kΩ

Is resistance normal?

No → Replace the ignition coil.

Yes

Step 5	Check the ignition coil control circuit.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EO01.
(c) Disconnect the ignition coil harness connector EO19.
(d) With a multimeter, measure resistance between ECM harness connector EO01 terminal No.1 and ignition coil harness connector EO19 terminal A, and resistance between EO01 terminal No.17 and EO19 terminal C.
(e) With a multimeter, measure resistance between ignition coil harness connector EO19 terminal A, C and a reliable ground. Check whether the circuit is short to ground.
(f) With a multimeter, measure voltage between ignition coil harness connector EO19 terminal A, C and a reliable ground. Check whether the circuit is short to power supply.

Test Items	Standard Value
EO01 (1)-EO19 (A) / EO01 (17)-EO19 (C) Resistance	0 Ω
Resistance Between EO19 (A, C) and A Reliable Ground	10 kΩ or higher
Voltage Between EO19 (A, C) and A Reliable Ground	0 V

All normal?

No → Repair the circuit fault.

Yes

Note

Each time the ignition switch can not stay at the "ST" position longer than 5 s, otherwise it will damage the starter motor.

Note

Connect scan tool, when the ignition switch is turned to "ST" position, observe the scan tool data: Engine / data list / "engine speed."

Step 6	Turn the ignition switch to the "ST" position, is engine speed showing?

Showing speed?

No → Go to step 10

Yes

Step 7	Check the crankshaft position sensor.

(a) For inspection steps. Refer to 2.12.7.35 DTC P0335 P0336.

Is resistance normal?

No → Replace the crankshaft position sensor.

Yes

Step 8	Check the crankshaft position sensor signal circuit.

(a) For inspection steps. Refer to 2.12.7.35 DTC P0335 P0336.

All normal?

No → Repair the circuit fault.

Yes

Step 9	Check ECM power supply circuit.

(a) For inspection steps. Refer to 2.12.7.43 DTC P0562 P0563.

Is ECM power supply circuit normal?

No → Repair the circuit fault.

Yes

Step 10	Replace ECM.

(a) Carry out crankshaft self learn after ECM replacement. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.

Next

Step 11	Diagnostic completed.

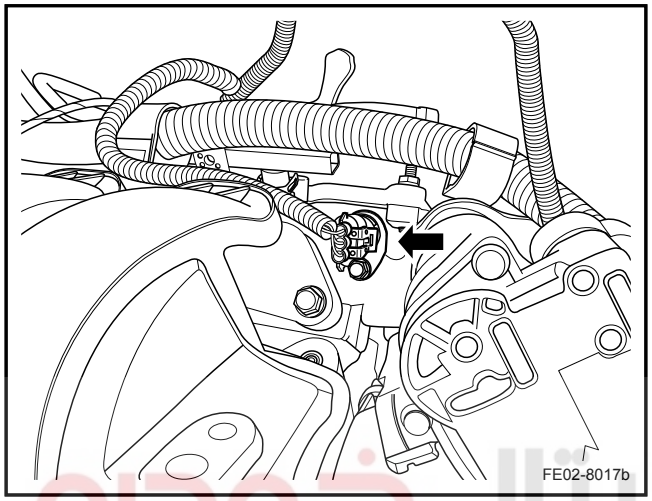
2.20.5 Removal and Installation

2.20.5.1 Camshaft Position Sensor Replacement

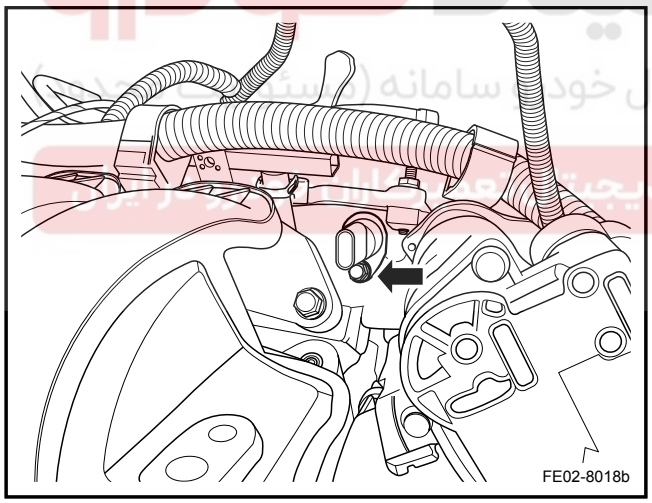
Removal Procedure:

Warning!

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

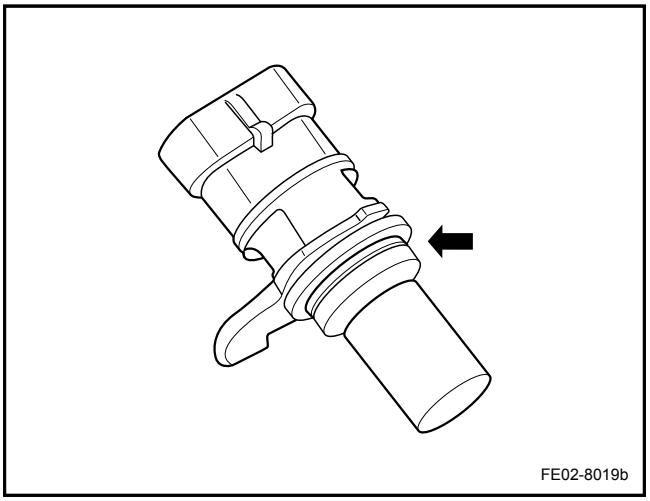


1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect camshaft position sensor wiring harness connector.

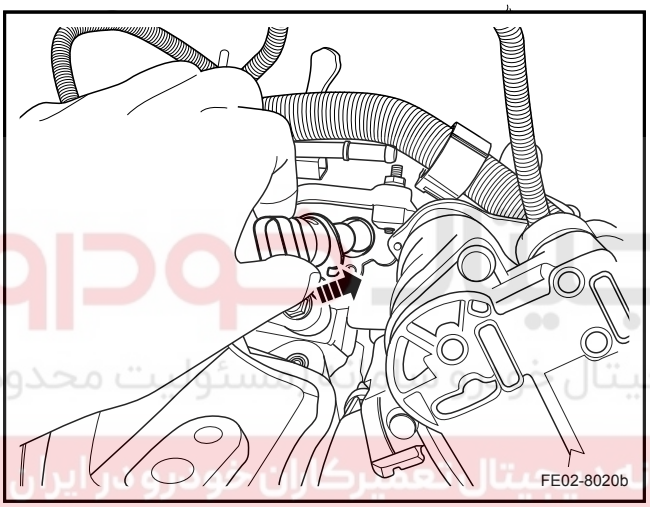


3. Remove camshaft position sensor retaining bolts and remove the sensor.

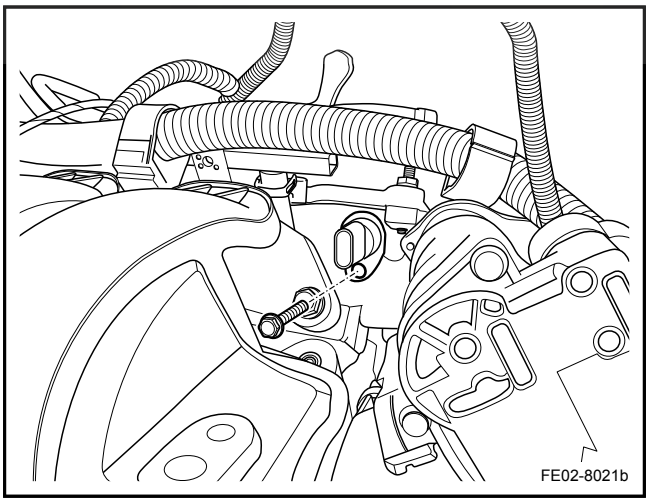
Installation Procedure:



1. Check whether the camshaft position sensor seal is intact.

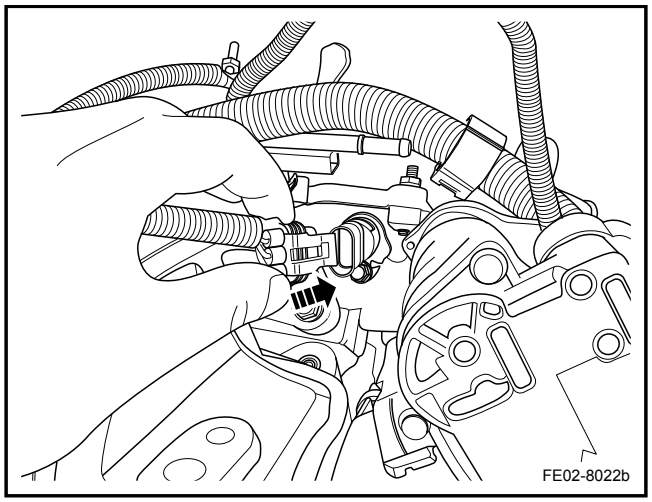


2. Install camshaft position sensor.



3. Install and tighten camshaft position sensor retaining bolts.

   Torque: 10 Nm (Metric) 7.4 lb-ft (US English)

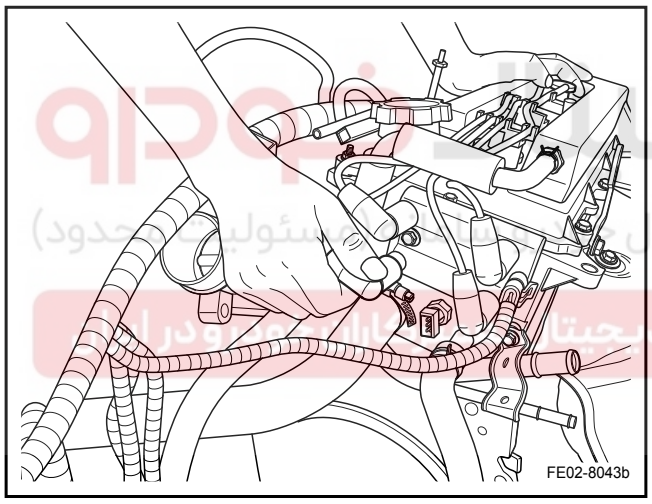


4. Connect camshaft position sensor wiring harness connector.
5. Connect the battery negative cable.

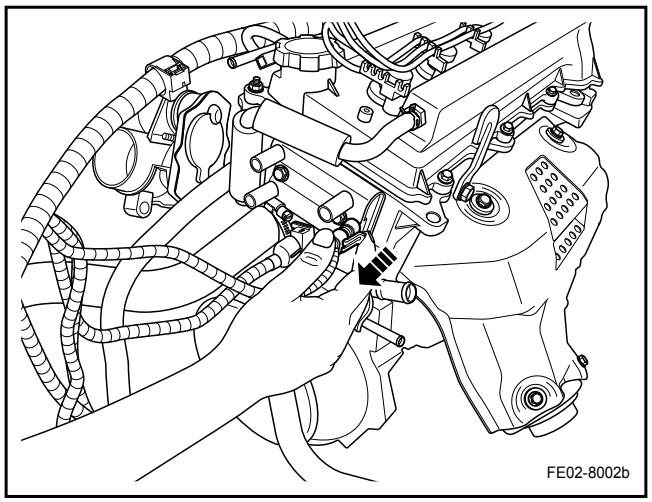
2.20.5.2 Ignition Coil Replacement

Warning!

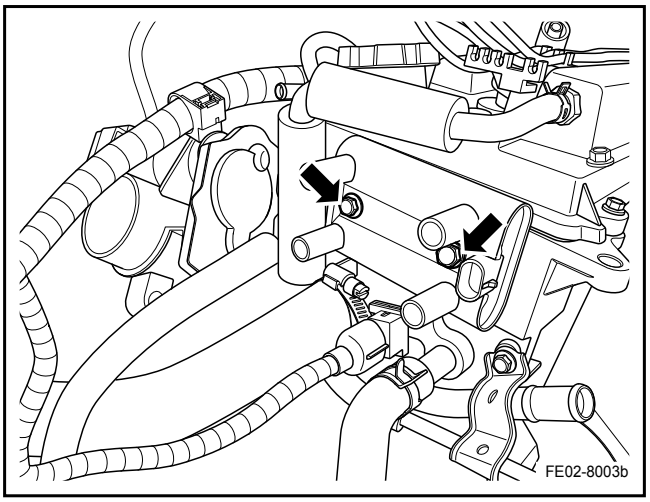
Warning: Refer to "Battery Disconnection Warning" in "Warnings and Notices".



1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect high-voltage damping line from the ignition coil.

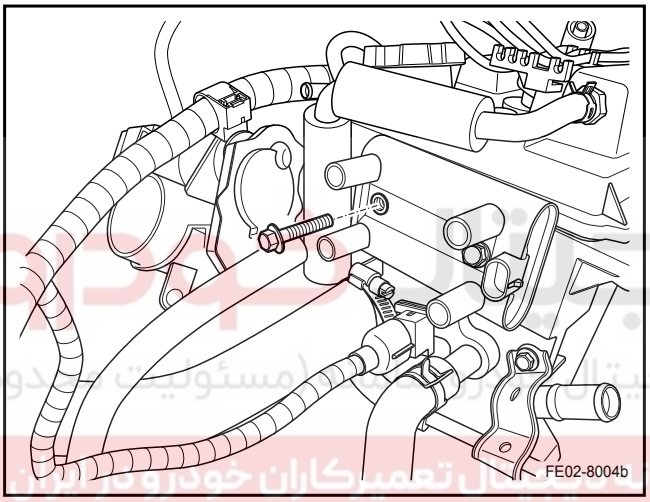


3. Disconnect ignition coil harness connector.



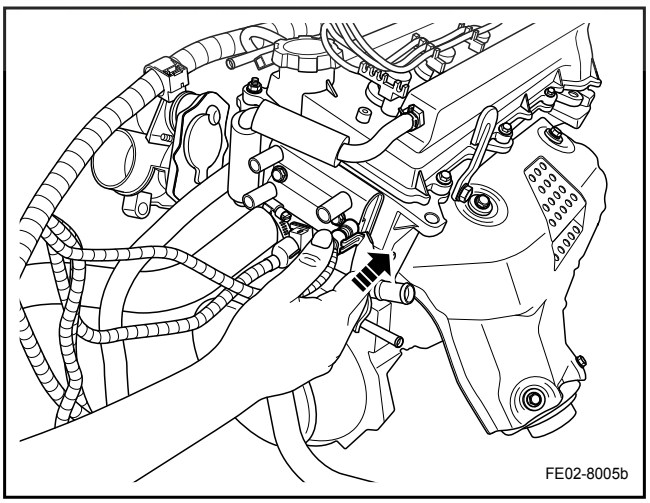
4. Remove the ignition coil bolts and remove the ignition coil.

Installation Procedure:

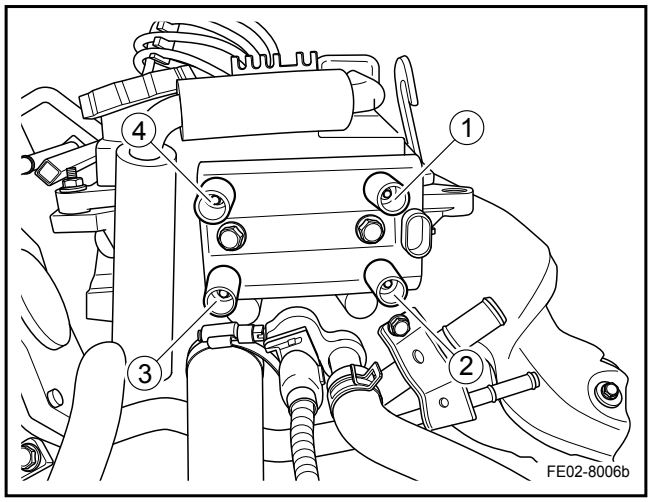


1. Install the ignition coil and tighten retaining bolts.

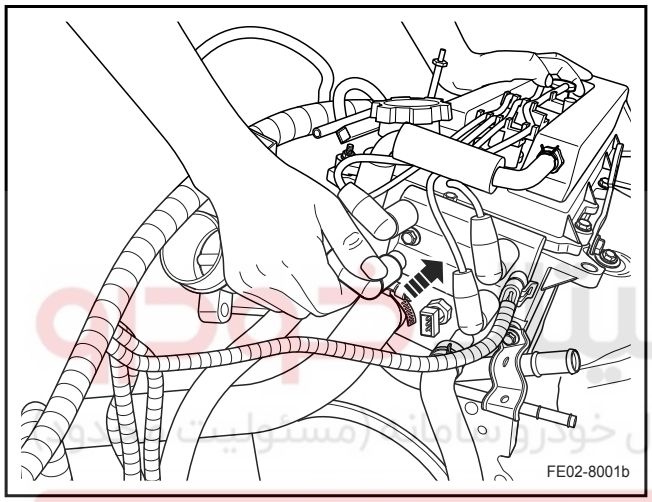
   Torque: 10 Nm (Metric) 7.4 lb-ft (US English)



2. Connect the ignition coil harness connector.



3. Connect high-voltage damping line according to the number of labels on the ignition coil.



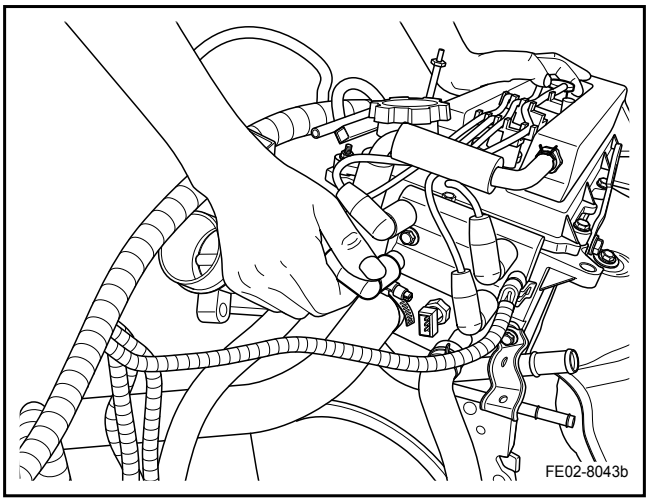
4. Connect high-voltage damping line.
5. Connect the battery negative cable.

2.20.5.3 High-voltage Damping Line Replacement

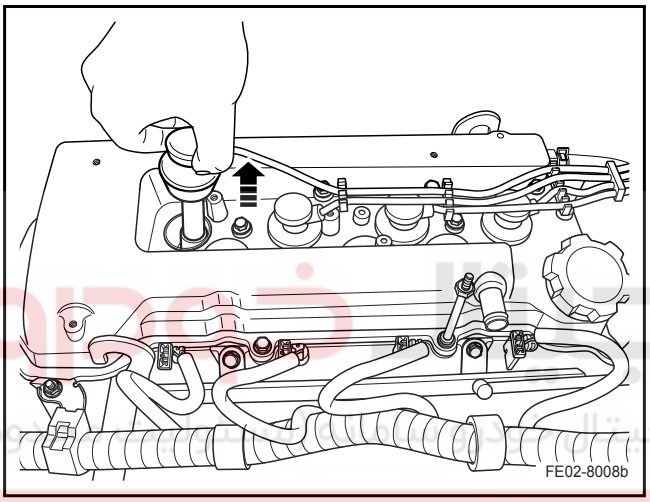
Removal Procedure:

Warning!

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

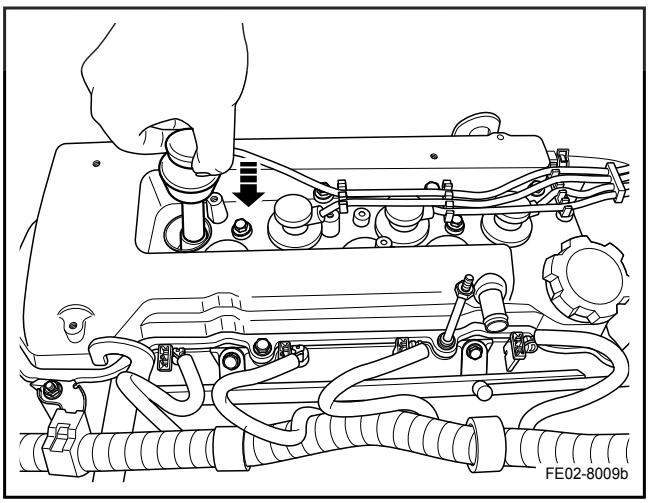


1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Disconnect high-voltage damping line from the ignition coil.

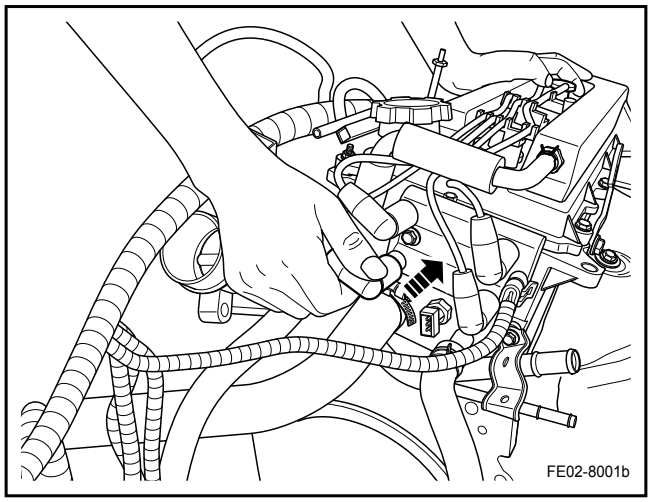


3. Unplug the high-voltage damping line and remove from the high-voltage wire mount.

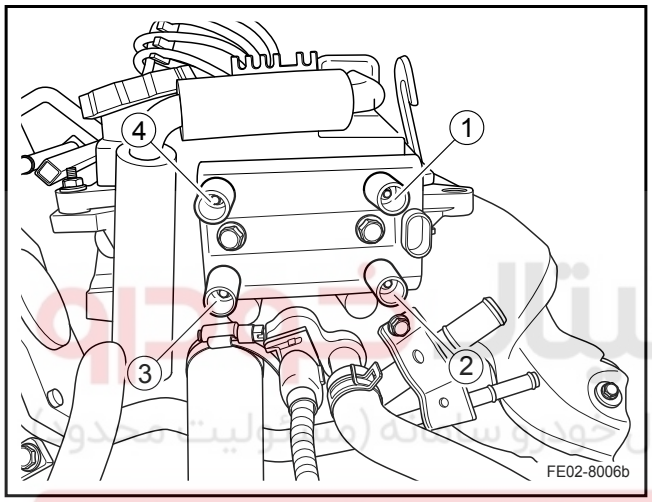
Installation Procedure:



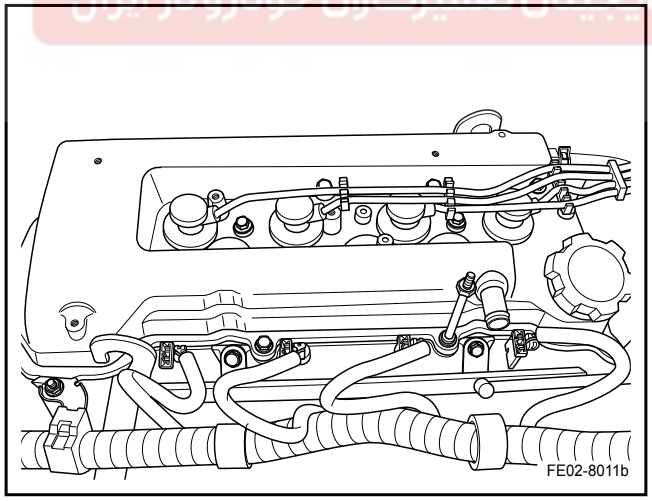
1. Install the high-voltage damping line to the engine.



2. Connect the high-voltage damping line to the ignition coil.



3. Connect high-voltage damping line according to the number of labels on the ignition coil.



4. As shown in graphic, fix the high-voltage damping line on the mount in order to avoid high-voltage damping line interference with each other.

5. Connect the battery negative cable.