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02- Engine

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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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Engine control system (UMC)

Precautions

General repair instructions

1. It's only allowed to check the electronic injection system with a digital multimeter.
2. Please use the authentic parts for repair, otherwise the normal operation of electronic injection system can't be ensured.
3. Unleaded gasoline can be only applied during the repair.
4. Perform the repair work as per the specified repair and diagnosis procedures.
5. It's prohibited to disassemble the parts of electronic injection system during the repair.
6. During the repair, take the electronic elements (electronic control unit and sensor, etc) carefully, and ensure that they can't fall to ground.
7. Build the environmental awareness, and handle the waste produced during the repair effectively.

Maintenance precautions

1. Don't remove any part or connector of electronic injection system randomly from its mounting position, so as to avoid any unexpected damage or prevent the water or oil dirt, etc from entering into the connector, otherwise the normal operation of electronic injection system will be influenced.
2. In case of disconnecting or connecting the connector, be sure to place the ignition switch in its OFF position, otherwise the electric elements will be damaged.
3. During the simulation of fault at hot state and other repair possible to cause temperature rise, the temperature of electronic control unit shall not exceed 80°C.
4. The fuel supply pressure of electronic injection system is higher (400kPa or so), so all the fuel pipes are high pressure resistant fuel pipes. Therefore, during the maintenance process, the fuel pipe should not be removed Therefore, don't remove the fuel pipes easily during the repair. When it's required to repair the fuel system, relieve the pressure of fuel system before removing the fuel pipe as per the method below: remove the fuel pump relay, start the engine to make it idling until the engine stops automatically.
5. In case of removing the electric fuel pump from the fuel tank, don't power on the fuel pump, so as to avoid any fire accident caused by electric spark.
6. Don't make any running test of fuel pump at dry state or in water, otherwise its service life will be shortened. Additionally, don't connect the positive or negative pole of fuel inversely.
7. During the check of ignition system, carry out a spark-over test only if necessary, and its test time should be the shortest one. Don't open the throttle valve, otherwise a lot of unburned gasoline will enter into the exhaust pipe, thus the three-way catalyst will be damaged.
8. Any manual adjustment isn't required because its idling adjustment is fully finished by electronic injection system. The valve limit screw of throttle valve body has been adjusted by the producer during the shipment, and its initial position shall not be randomly changed.
9. During the connection of battery, don't connect its positive or negative pole wrongly, otherwise the electronic elements will be damaged.
10. In case of running the engine or turning on the ignition switch, don't remove the battery cable.
11. Before welding on the car, be sure to remove positive or negative cable and electronic control unit of battery.
12. Don't test electric input or output signals of parts by piercing the conductor skin.
13. Attentions for starting after disconnecting constant power supply (battery power supply): turn on the ignition switch for at least 30 seconds, and then turn off the ignition switch during the starting; start the car after waiting for 30 seconds. In order to ensure that the electronic injection system can finish the self-learning test of throttle valve, the starting faults of car (starting failure or unstable idling) or faults of electronic injection system will occur if this test can't be finished by the electronic injection system.

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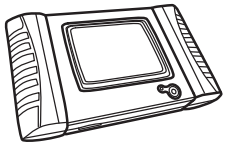
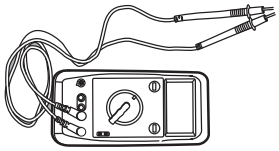
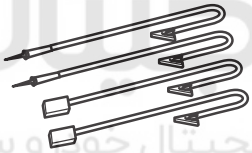
Preparation

General maintenance tools

No.	Tool name	Tool figure	Tool code	Remarks
1	Diagnosis equipment	 LFX60-SM-02802	-	Read the EFI system trouble code, data flow etc
2	Digital universal meter	 LFX60-SM-02800	-	Measure the voltage and resistance
3	Circuit group	 LFX60-SM-02801	-	Testing circuit

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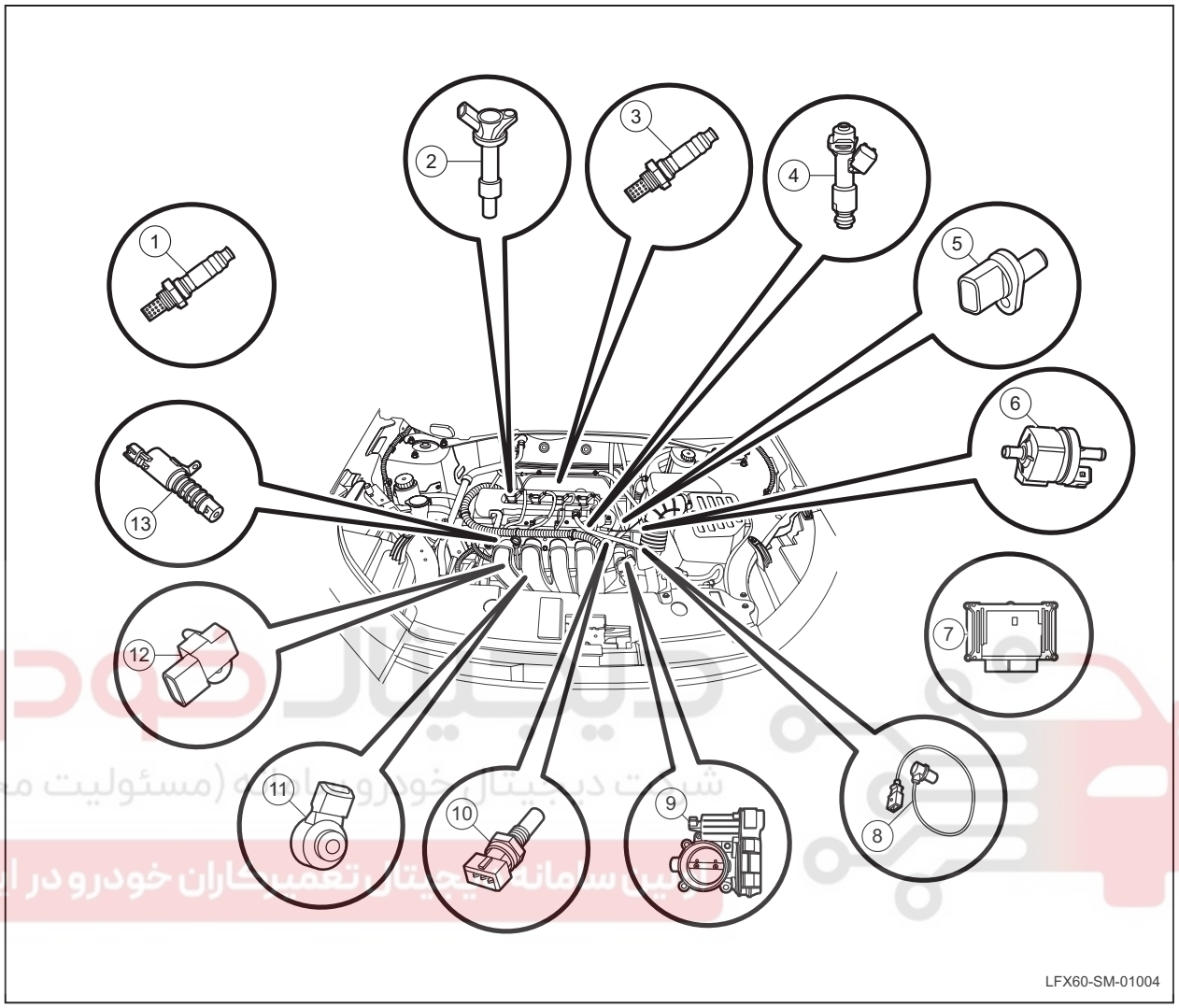
Structure and installation location

Component Location Plan



No.	Part Name
1	Rear oxygen sensor
2	Ignition coil
3	Front oxygen sensor
4	Fuel injector
5	Camshaft position sensor
6	Canister solenoid valve
7	Electronic Control Unit (ECM)

No.	Part Name
8	Crankshaft Position Sensor
9	Electronically controlled throttle valve body
10	Water temperature sensor
11	Knock Sensor
12	Intake air temperature and pressure sensor
13	Intake VVT valve

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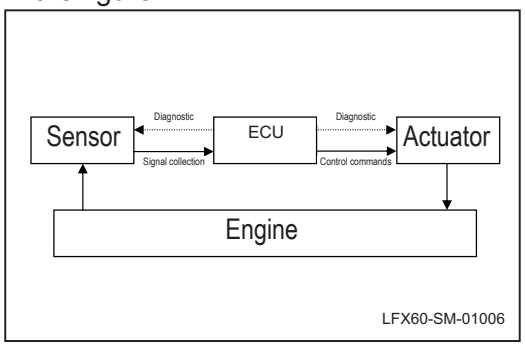
Operating Principle

System overview

The engine management system is usually composed of sensor, electronic control unit (ECU) and actuator, which can control the air suction volume, fuel injection amount and ignition advance angle produced during the operation of engine. Its basic structure is shown in the figure:



In the electronic control system of engine, the sensor is used to measure all kinds of physical signals(temperature and pressure, etc) and convert them into their corresponding electric signals as an input part; ECU is used to receive the input signal of sensor, calculate and process it as per the set program, produce its corresponding control signal, and output it to the power drive circuit, which performs different actions by driving each actuator, so as to make the engine running as per the set control strategies; the fault diagnosis system of ECU monitors each part or control functions of the system. Once any fault is detected and confirmed, its fault code will be stored, and the function of “Limp Home” is invoked. Upon detecting the elimination of fault, its normal value will return to service.

Basic components of engine electronic control system:

- Electronic control unit (ECU)
- Intake pressure and temperature sensor
- Water temperature sensor
- Throttle body assembly
- Phase position (camshaft position) sensor
- Rotating speed (crankshaft position) sensor
- Knock Sensor
- HO2S
- Electronic Accelerator Pedal
- Fuel injector
- Electric fuel pump
- Fuel distribution pipe
- Canister control valve
- Ignition coil

Input signals of ECU main sensor in engine electronic control system include:

- Intake pressure signal
- Electronic accelerator pedal signal
- Intake temperature signal
- Throttle valve turning angle signal
- Water temperature signal
- Engine speed signal
- Phase position signal
- Knock sensor signal
- Oxygen sensor signal
- Vehicle speed signal
- A/C pressure signal

The required actuator control signals are produced after processing the above information entering into ECU, and these signals are amplified in the output drive circuit and transmitted to their respective actuators. These control signals include:

- Opening of electronic throttle valve
- Injection timing and injection duration
- Fuel pump relay
- Opening of carnister control valve
- Dell angle and ignition advance angle of ignition coil
- Air conditioning compressor relay
- Cooling fan relay

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Introduction of system functions

Start control

- In the start-up process, special calculation methods should be used to control charge, fuel injection and ignition timing. At the beginning of the process, the air in the intake manifold is stationary and the internal pressure of the intake manifold is shown as ambient atmospheric pressure.
- In the similar process, special “Injection Timing” is appointed as an initial injection pulse.
- The fuel delivery varies depending on the temperature of the engine to promote the formation of the oil film on the intake manifold and cylinder walls. Thus, the mixture should be enriched before the engine reaches a certain rotational speed.
- Once the engine starts, the system will start a cranking enrichment immediately, until its cranking enrichment is fully canceled at the end of starting process (600…700min-1).
- In the starting conditions, the ignition angle is also constantly adjusted. Change with the engine temperature, intake temperature and engine speed.

Warming up and three-way catalyst heating control

- After the engine starts at low temperature, the air filling capacity of cylinder, fuel injection and electronic ignition shall be adjusted to compensate higher torque of engine; this process lasts until its temperature is increased up to the appropriate threshold value.
- At this stage, the most important is quick heating of three-way catalyst, because the quick transition to operation of three-way catalyst can reduce the exhaust emission greatly. At this state, adopt the exhaust for “three-way catalyst heating” by postponing the ignition advance angle properly.

Acceleration/deceleration and motoring fuel cut-off control

- Some of fuel injected to intake manifold can’t enter into the air cylinder in time to participate in combustion. On the contrary, it forms a layer of oil film on the intake manifold wall. The fuel volume stored in the oil film will quickly increase along with the load increase and the fuel injection duration.
- When the opening of throttle valve is increased, some of injected fuel will be absorbed by this fuel film. Therefore, it is necessary to inject the corresponding supplement fuel to compensate and prevent the gas mixture becoming lean during the engine acceleration. Once its load coefficient is reduced, the additional fuel contained in fuel film on inlet manifold wall will be again released, and its corresponding injection duration must be reduced during the deceleration.
- Reversed towing or traction means the negative power value provided by the flywheel of engine. At this case, the frictions and pumping loss of engine can be used to decelerate the car. With the engine in motoring or towing working condition, the fuel injection is cut off to reduce the fuel consumption and exhaust gas emission and in particular to protect the three-way catalyst.
- The fuel injection system will resume the fuel supply once the rotary speed falls to the specific fuel supply rotary speed above the idle speed.Actually there is a speed reversion range in ECU program, which is different as per the dynamic changes of engine temperature and speed, etc, and prevents the speed from dropping to the specified minimum threshold value via calculation.
- Once the injection system recovers the fuel supply, the system will start the initial injection pulse to refill the fuel, and rebuild the fuel film on the wall of inlet manifold. After the fuel injection is recovered, the torque-based control system will make the torque of engine slowly and stably increased (smooth transition).

Idle speed control system

- At idling speed, the engine doesn’t give the torque to flywheel. In order to ensure the stable running of engine at the minimum idle speed, the closed loop idling control system must maintain the balance of produced torque and engine “power consumption”. At idling speed, it’s required to produce a certain power for meeting all the load requirements. They include the internal frictions from engine crankshaft, valve mechanism and auxiliary parts, e.g. water pump.
- The torque-based control policies of this system are used to determine the output torque of engine required for maintaining the idling speed at any operating condition via the closed loop idling control. This output torque is increased with the reduction of engine speed and reduced with the increase of engine speed. The system responds new “interference factors” with higher torques, e.g. starting/stopping of A/C compressor or automatic transmission shift. At lower temperature of engine, it’s also required to increase the torque for compensating more

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internal friction loss and/or maintaining higher idling speed. The sum of all these output torques is transmitted to the torque coordinator, which processes and calculates it to get the corresponding charge density, mixed gas components and ignition timing.

λ closed-loop control

- The exhaust after-treatment of three-way catalyst is an effective method to reduce the concentration of harmful substances in exhaust. Three-way catalyst can reduce the concentrations of hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxide (NOx) by 98% or more, and convert them into water (H2O), carbon dioxide (CO2) and nitrogen (N2). However, only if the excess air coefficient of engine is equal to 1, such high efficiency can be reached in adjacent narrow space, and the purpose of closed loop control is to ensure the concentration of mixed gas within this range.
- λ closed loop control system can function only if it's equipped with an oxygen sensor. The oxygen sensor monitors the oxygen content of exhaust on the side of three-way catalyst, the diluted mixed gas (λ>1) produces ca. 100mV sensor voltage, and the dense mixed gas (λ>1) produces ca. 900mV sensor voltage. When λ is 1, a jumping will occur to the voltage of sensor. λ closed loop control responds the input signal (the mixed gas is too diluted when λ is 1, and it's too dense when λ is less than 1) to alter the control variable, and produces a correction factor as a multiplier to correct the injection duration.

Evaporative emissions control

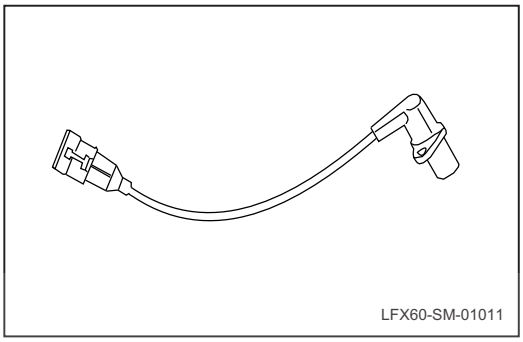
The fuel in the fuel tank is heated to form fuel vapor due to the transmission of outer radiation heat and fuel return heat. Due to the limitations of vapor emission regulations, it's not allowed to emit the vapor containing a lot of HC ingredient into air. In the system, the fuel vapor is collected into the active canister through a guide pipe, and enters into the engine via flushing to participate in combustion at proper time. The flow of flushing air can be realized by ECU control of canister control valve. This control can work only during the operation of closed loop control system.

Principle of knock

- The system detects the characteristic vibrations produced by knock sensor installed in proper position of engine, and converts these vibrations into electronic signals for transmission to ECU and processing. ECU will detect whether any knock occurs in each combustion cycle of each cylinder as per special processing algorithm. The knock closed-loop control will be triggered once the knock is detected. After the knock risk is eliminated, the ignition of influenced cylinder will be gradually advanced to the preset ignition advance angle.
- The threshold values of knock control have good adaptability for different conditions and marks of fuel.

Part description

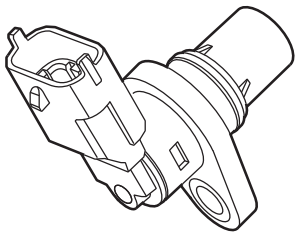
Crankshaft Position Sensor



LFX60-SM-01011

The crankshaft position sensor is a passive speed sensor, whose operating principles are the adoption of magnetoelectric effect. When the crankshaft rotates, it will rotate with the sensor signal wheel together, the teeth of sensor signal wheel will cut the magnetic lines of sensor to cause the alternation of magnetic field at sensed points inside the speed sensor coil, that is to say, the magnetic flux through the coil will be increased when the teeth of signal wheel align to the crankshaft position sensor; the magnetic flux will be reduced when the slot of signal wheel aligns to the crankshaft position sensor. The changes of this flux will cause the changes of output signal voltage. The changes of magnetic field will also cause the changes of magnetic flux in the coil, thus the voltage output will be produced.

Camshaft position sensor



LFX60-SM-01018

The camshaft position sensor fits the crankshaft position sensor to provide the crankshaft phase position data for ECU, i.e. distinguishing compression top dead center and exhaust

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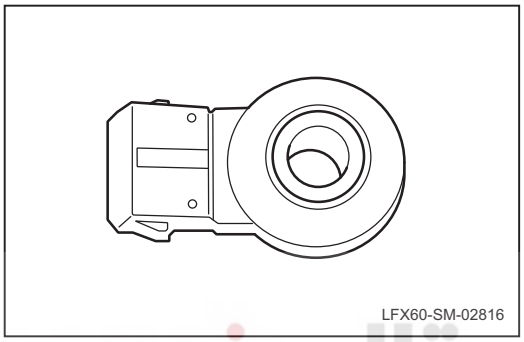
top dead center of #1 cylinder. The phase position (camshaft position) sensor contains a permanent magnet and a hall chip. The rotation of signal wheel causes the alternation of magnetic intensity at the sensed points of sensor. When the gear is in front of sensor, its magnetic intensity will be increased. When its slot is in front of sensor, its magnetic intensity will be reduced. The changes of its magnetic intensity shall be identified by Hall elements. Based on this principle, the signals of mechanical gears and teeth are converted into electric signal output by the sensor.

Knock Sensor

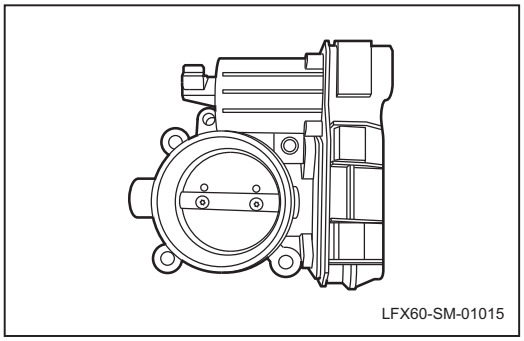

LFX60-SM-02816

The knock sensor is a sensor to monitor the knock signals, and installed on the engine cylinder block.

Its sensitive element is a piezoelectric ceramics. In operation, the vibration of the engine cylinder block is transferred to the piezoelectric ceramics via the mass block in the sensor. The piezoelectric ceramics can produce a voltage between both electrode surfaces due to the pressure produced by mass block vibrations, and convert the vibration signal into a voltage signal output.

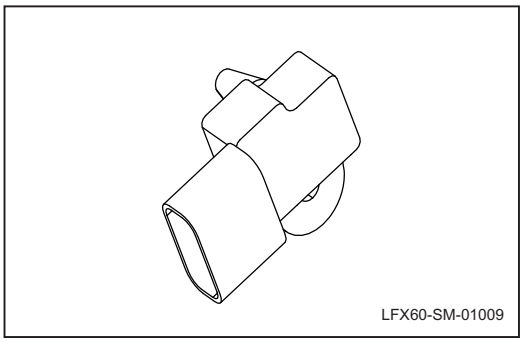
The frequency of vibration signals caused by engine knocking is a lot higher than normal frequency and acceleration speed of engine vibration signals, so its knock and non-knock signals can be distinguished by ECU after processing the signals of knock sensor.

Throttle body assembly


LFX60-SM-01015

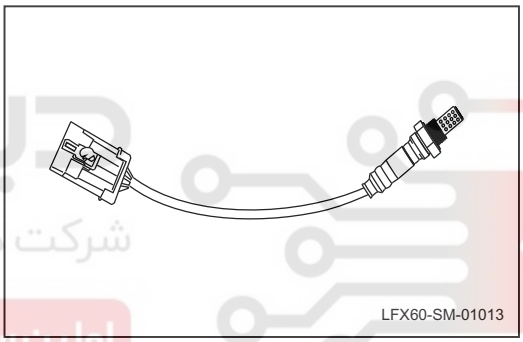
The throttle valve body assembly is mainly used to adjust the area of inlet channel, thus its air inflow can be controlled and different air inflow demands of engine at different conditions can be met, and it can respond the position signal of throttle valve plate to its control unit for precise control at the same time.

Intake air temperature and pressure sensor


LFX60-SM-01009

The inlet pressure/temperature sensor consists of inlet manifold absolute pressure sensor and inlet temperature sensor, and it's installed on the inlet manifold.

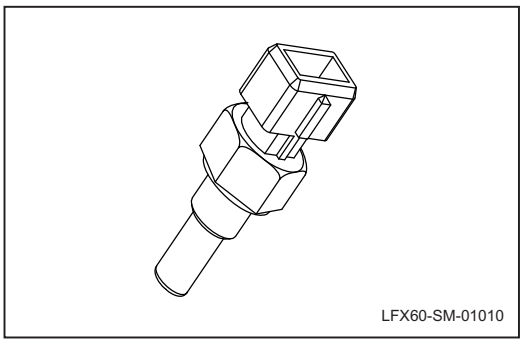
HO2S


LFX60-SM-01013

The oxygen sensor is installed on the exhaust pipe, determines the oxygen content of exhaust, and determines whether the gasoline and air are fully burnt, so as to ensure the maximum conversion efficiency of three-way catalyst to HC, CO and NOx of exhaust.

The operation of oxygen sensor is realized by converting the oxygen concentration difference inside and outside the sensor elements into a voltage signal.

Water temperature sensor


LFX60-SM-01010

The water temperature sensor is mounted on the engine body or cylinder head and is in contact with the cooling liquid to detect the

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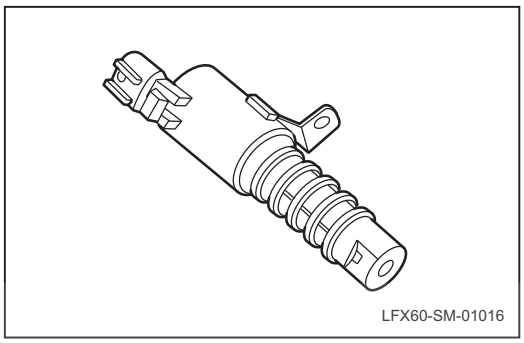
temperature of the engine circulating coolant and transmit the test result to the electronic control unit to correct the fuel delivery and the ignition timing. Water temperature sensors are often made of thermistors that are very sensitive to temperature changes. Negative temperature coefficient resistors are often used for thermistors. The lower the water temperature, the greater the resistance of the thermistor. The electronic control unit, according to this signal, increases the fuel delivery to increase the concentration of the combustible mixture.

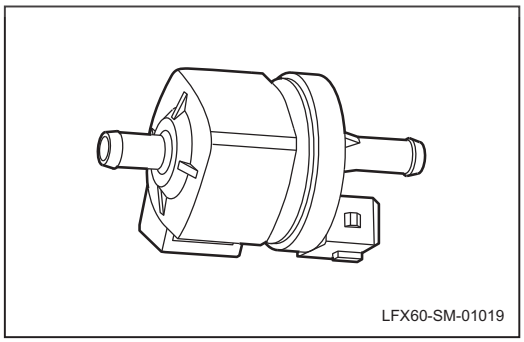
Intake VVT valve



LFX60-SM-01016

The intake VVT solenoid valve is supplied with power from the main relay, and the ECM controls the grounding with a pulse width modulation signal. In this way, the engine oil flow to the camshaft position actuator is controlled. The engine oil pressure makes one of the safety slide valve inside the camshaft position actuator mechanism fixed to the camshaft front act. When the safety slide valve acts, the engine oil is introduced to the camshaft position actuator to make the camshaft rotate.

Canister solenoid valve



LFX60-SM-01019

The charcoal canister control valve consists of an electromagnetic coil, an armature, a valve, etc. The flow of air flowing through the canister control valve is related to the duty ratio of the electrical pulse output to the canister control valve on the one hand, and the pressure difference between the inlet and the outlet of the canister control valve on the other hand. When there is no electric pulse, the canister control valve is closed.

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Diagnostic Information and Procedures

Diagnosis Instructions

Before you diagnose the fault of the engine control system, familiarize yourself with the working principle of the engine control system before starting the engine control system diagnostics, which helps to determine the correct troubleshooting step in the event of a fault. More importantly, this also helps to determine whether the situation as described by the customer is normal operation.

Any fault diagnosis of the engine control system should be based on the engine control system check as a starting point to guide the maintenance staff to take the next logical step, for troubleshooting. Understanding and using the diagnostic flowchart correctly reduces diagnostic time and avoids misjudgment of components.

General equipment

Digital multimeter
Diagnostic equipment of vehicle

Visual Inspection

1. Confirm the problem of the customer.
2. Visually check whether there is any obvious mechanical or electrical damage sign.

Visual inspection table

Electrical
• Fuse • Wire harness • Wiring harness plug • Relay • Sensor • Actuating elements • Engine control module (ECM)

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Troubleshooting process for intermittent failure

ⓘNote:

- **Clear DTC.**
- **Carry out a simulation test.**
- **Check and shake the harness, plugs and terminals.**

If DTC examination cannot confirm the fault and the fault occurs occasionally during the use, In this case, confirm all the circuits and parts that may cause the fault. In many cases, to follow the diagnosis procedure given in the table as follows can effectively and rapidly locate the faulty part Especially the poor contacts of harness plugs, etc.

Definition: the fault does not occur currently but the historical fault diagnosis records show that the fault ever occurred. Or the customer reports this fault while the fault does not relate to the DTC and the fault symptom cannot be reproduced currently.

Test condition	Details/results/measures
1. Vibration method	
	A. If any fault occurs or this fault becomes more serious, or the engine vibrates while driving on a uneven road, please carry out the following steps. B. Several reasons may cause the electric faults of car or engine vibrations. Check the following items: • The plug is not fully in position. • The harness has no sufficient gap. • The harness is laid over the support or moving parts. • The laid harness is too near to high-temperature parts. • Is it OK after checking? C. Incorrect wiring, improper clamping or loosened harness will make the wires squeezed between the parts. D. The focus of inspections is on the plug junctions, vibration parts and passed positions of harness, e.g. the harness through the firewall and car body plate.
2. Method of checking the switch plug or harness.	
	A. Connect the diagnostic equipment to the diagnostic interface. B. Operate the start switch to make the power mode to the N? State (do not start the engine). ⓘ **Note** **If the engine is started, perform the following steps during its operation in idling mode.** C. Access the data flow of the switch you are checking. D. Turn on the switch manually. E. While monitoring the data stream, gently shake each plug or harness horizontally and horizontally. If the data flow is not stable, check whether the connection is bad.

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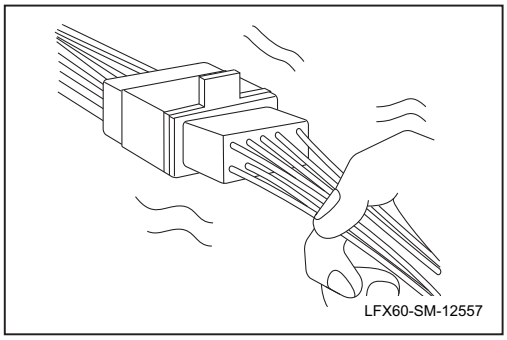
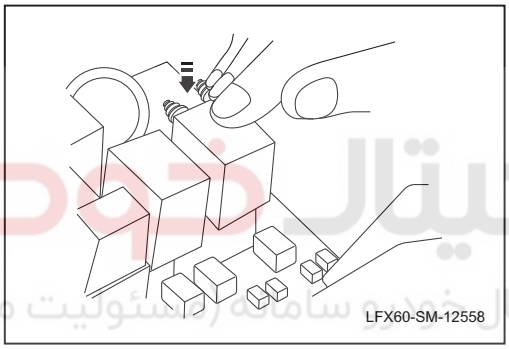
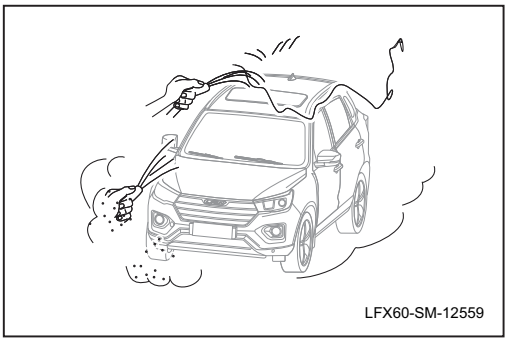
Test condition	Details/results/measures
3. Method of checking the sensor plug or harness.	
 LFX60-SM-12557	A. Connect the diagnostic equipment to the diagnostic interface. B. Operate the start switch to make the power mode to the N? State (do not start the engine). **Note** If the engine is started, perform the following steps during its operation in idling mode. C. Access the data flow of the switch you are checking. D. While monitoring the data stream, gently shake each plug or harness horizontally and horizontally. If the data flow is not stable, check whether the connection is bad.
4. Method of checking the actuator or relay.	
 LFX60-SM-12558	A. Connect the diagnostic equipment to the diagnostic interface. B. Operate the start switch to make the power mode to the N? State (do not start the engine). **Note** **If the engine is started, perform the following steps during its operation in idling mode.** C. Prepare the output status control function well for the actuator or relay you are checking. D. After the output status control function is activated, use a finger to vibrate the actuator or relay 3s. If you hear an unstable “click” sound, check for any improper connection or improper installation of the actuator and/or relay. **Note** **A strongly vibrating relay may cause the relay to be disconnected.**
5. Sprinkling method	
 LFX60-SM-12559	If the fault occurs only when the humidity is high or it rains or snows, then carry out the following procedure. The temperature and humidity are changed indirectly by water spray on the front of the radiator. If the vehicle is likely to leak, this may damage the control module.In case of checking whether the water leakage occurs to a car, be sure to take the special preventive measures. A. In case of checking the sensor or switch, connect the diagnostic unit to diagnostic interface. B. Operate the start switch to make the power mode to the N? State (do not start the engine). **Note** **If the engine is started, perform the following steps during its operation in idling mode.** C. If you want to check the sensor or switch, access the sensor or switch data stream. D. If you want to check the switch, manually turn it on. E. Spray water on the car, or drive the car through the car wash. F. If the data flow is unstable or malfunctioning, repair or replace parts if necessary.

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List of fault symptoms

If any fault occurs to the car, and engine control unit ECM fails to detect any fault code, and no obvious faulted positions can't be found out after visual check or general inspection, it's recommended to remedy the faults as per the diagnostic idea and process described in the table below.

Symptom	Possible point of failure	Recommended Measures
The engine cannot be started at the normal starting speed	• Crankshaft position sensor • Fuel injector • Ignition coils • ECM • Engine mechanical • Immobilizer	**Refer to: the diagnosis process for failure to start the engine at the normal starting speed.**
Difficult cold start	• Water temperature sensor • Spark plugs • Fuel injector • Injector • Throttle body • Engine mechanical • Engine control module circuit	**Refer to: Diagnosis procedure for engine being hard to clod start.**
Hot start is difficult	• Water temperature sensor • Ignition coils • Fuel injector • Injector • Engine control module circuit	**Refer to: Diagnosis procedure for engine being hard to hot start.**
The start is normal while idling is unsteady at any time	• Intake system • Spark plugs • Throttle body • Ignition timing • Engine mechanical • Engine control module circuit	**Refer to: Diagnostic process for unstable idling at any time under the normal starting conditions**
The start is normal while engine idling is unsteady or stalls under partial load	• Air conditioner system • Throttle body • Injector	**Refer to: Diagnosis procedure about idle instability or shutdown under conditions of normal starting and partial load**
The start is normal while idle speed is too high	• Water temperature sensor • Throttle body • Vacuum tube • Ignition timing • Control module circuit	**Refer to: Diagnosis procedure for excessive idle speed in case of normal start.**
• The speed of engine can't increase or it stops during the acceleration. • Difficult acceleration • Slow acceleration response • Forceless acceleration, poor performance	• Intake system • Intake pressure sensor • hrottle body • Injector • Spark plugs • Ignition timing • Fuel • Exhaust blocking • Control module circuit	**Refer to: Diagnosis procedure for acceleration fault.**

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Symptom	Possible point of failure	Recommended Measures
Engine running unstably	• Oxygen Sensor • Injector • Spark plugs • Ignition timing • Fuel pressure • Loosening of fixing bolts or damages of engine suspension • ECM lines	**Refer to: Diagnosis procedure for engine running unstably.**
Tendency to stall during starting	• Crankshaft position sensor • Injector • Spark plugs • Ignition timing • Fuel pressure • A/C system pressure, compressor • Control module circuit	**Refer to: Diagnosis procedure for tendency to stall during starting.**
Vehicle jitter during running	• Intake pressure sensor • Incorrect operation of A/C system • Unstable signals or no signals from camshaft position sensor • Air leakage on the intake system parts • Unstable signals from crankshaft position sensor • Vacuum leakage • Poor fuel quality • Intermittent fault of main relay and fuel pump relay • Faults of throttle valve • Overheated engine • The spark plug has fault • Ignition timing • Exhaust system limitations • Insufficient fuel pressure • Mechanical fault of fuel pump • Injector • Unstable signals of accelerator pedal sensor	**Refer to: Diagnosis procedure for vehicle jitter during running.**

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Symptom	Possible point of failure	Recommended Measures
Stall during neutral-position running	• Vacuum leakage • Air intake system leaks • Improper control of air/fuel mixture ratio • Faults of accelerator pedal sensor or its related wires • Faults of inlet pressure sensor or its related wires • Incorrect operation of A/C electromagnetic clutch • Injector • Spark plugs • Ignition timing • Fuel • Exhaust blocking	**Refer to: Diagnosis procedure for stall during neutral-position running**

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Diagnostic process for starting failure of engine at normal starting speed

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Use the fault diagnosis instrument to detect the engine DTC. Is there a DTC? →**Yes** **Refer to:DTC TROUBLESHOOTING TABLE.** →**No** To step 2**.**
2. Check the ignition system.	
	A. Perform ignition spark test. **Refer to: Ignition spark test** Is the spark plug ignition spark test normal? →**Yes** To step 3**.** →**No** Check the ignition system. **Refer to: Diagnostic process for spark plug failure in jump spark**
3. Check the fuel pressure.	
	A. Connect the fuel pressure gauge. B. Measure fuel pressure. **Refer to: Fuel system pressure test** Is fuel pressure normal? →**Yes** To step 4**.** →**No** Check the fuel system. **Refer to: Diagnostic process for fuel pump failure to work**
4. Check the engine compression pressure.	
	A. Check the engine compression pressure. **Refer to: Cylinder compression pressure check** Is the cylinder compressing pressure normal? →**Yes** To step 5**.** →**No** Check the mechanical system of the engine.

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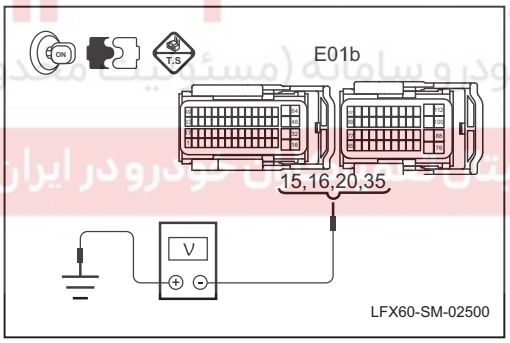
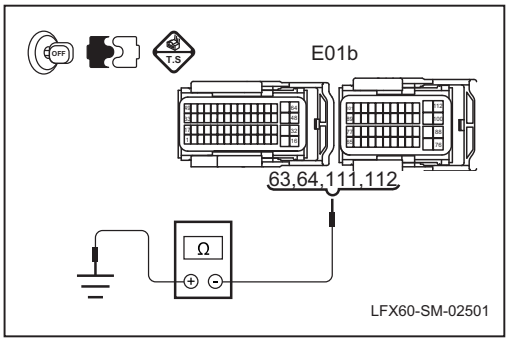
Test condition	Details/results/measures
5. Check the anti-theft system of the engine.	
	A. Check the anti-theft system of engine. Is the anti-theft system of engine activated? →**Yes** Repair the anti-theft system to stop the activation of anti-theft system. →**No** To step 6.
6. Check the moisture in the fuel.	
	A. Remove the joint of fuel filter pipe. **Refer to: Replacement of the oil filter** Discharge the fuel from the fuel filter. Check the moisture inside the fuel. Is fuel check normal? →**Yes** To step 7. →**No** Remove the mixed water from the fuel. Add a clear, high-standard fuel.
7. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 10. →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.
8. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is it OK after checking? →**Yes** To step 11. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.

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Test condition	Details/results/measures
9. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module** Confirm that the fault has been ruled out.

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Diagnosis procedure for engine being hard to clod start

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Diagnose the fault codes. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 2.
2. Check the throttle.	
	A. Step the accelerator lightly to start the engine. Is the engine easy to start? →**Yes** Clean the throttle valve. →**No** To step 3.
3. Check the ignition system.	
	A. Perform ignition spark test. **Refer to: Ignition spark test** Is the spark plug ignition spark test normal? →**Yes** To step 4. →**No** Check the ignition system. **Refer to: Diagnostic process for spark plug failure in jump spark**
4. Check the fuel pressure.	
	A. Connect the fuel pressure gauge. B. Measure fuel pressure. **Refer to: Fuel system pressure test** Is fuel pressure normal? →**Yes** To step 5. →**No** Check for abnormal fuel pressure.

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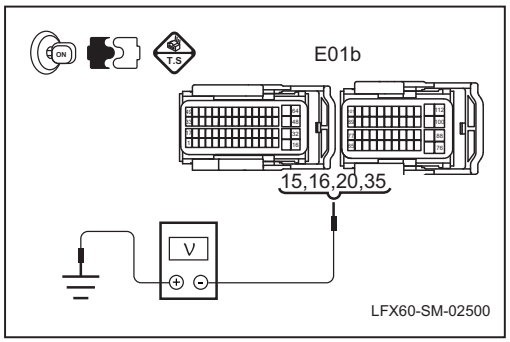
Test condition	Details/results/measures
5. Check the water temperature sensor.	
	A. Disconnect the harness plug E23b of water temperature sensor. B. Connect 2500Ω resistance with the plug of water temperature sensor harness in series to substitute the water temperature sensor. C. The engine starts at cold state. Is the engine easy to start? →**Yes** Replace the water temperature sensor. **Refer to: Replacement of the water temperature sensor** →**No** To step 6.
6. Check the engine compression pressure.	
	A. Check the engine compression pressure. **Refer to: Cylinder compression pressure check** Is the cylinder compressing pressure normal? →**Yes** To step 7. →**No** Check the mechanical system of the engine.
7. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? →**Yes** To step 8. →**No** Replace the injector. **Refer to: Replacement of the injector**
8. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 9. →**No** Check and repair the faults of ECM power circuit.

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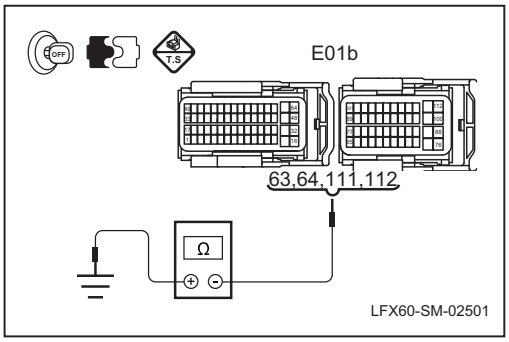
Test condition	Details/results/measures
9. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 10. →**No** Check and remove the faults of ECM grounding circuit.
10. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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Diagnosis procedure for engine being hard to hot start

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Make a diagnosis of the trouble code. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 2**.**
2. Check the ignition system.	
	A. Perform ignition spark test. **Refer to: Ignition spark test** Is the spark plug ignition spark test normal? →**Yes** To step 3**.** →**No** Check the ignition system. **Refer to: Diagnostic process for spark plug failure in jump spark**
3. Check the fuel pressure.	
	A. Connect the fuel pressure gauge. B. Measure fuel pressure. **Refer to: Fuel system pressure test** Is fuel pressure normal? →**Yes** To step 4**.** →**No** Check for abnormal fuel pressure.

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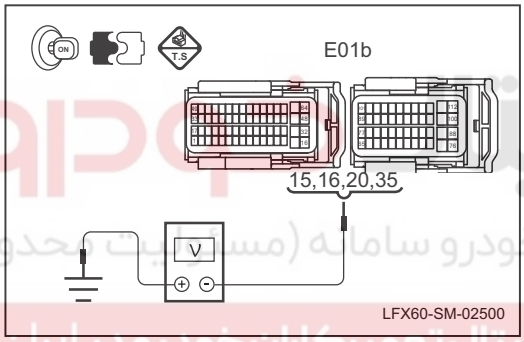
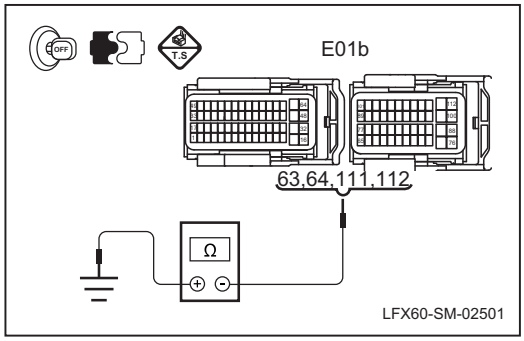
Test condition	Details/results/measures
4. Check the water temperature sensor.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the water temperature sensor harness connector E23b. D. Connect 2500Ω resistance with the plug of water temperature sensor harness in series to substitute the water temperature sensor. E. The engine starts at cold state. Is the engine easy to start? **→Yes** Replace the water temperature sensor. **Refer to: Replacement of the water temperature sensor** **→No** To step 5.
5. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the "on" state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** To step 10. **→No** Troubleshoot the ECM power supply line and replace the harness if necessary.
6. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 11. **→No** Troubleshoot the ECM grounding line and replace the harness if necessary.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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Diagnostic process for unstable idling at any time under the normal starting conditions

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Make a diagnosis of the trouble code. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 2.
2. Check the intake system.	
	A. Check whether the intake system is blocked. B. Check whether the intake system is leaking. **Refer to: Air intake leak diagnosis process** Is the intake system normal? →**Yes** To step 3. →**No** Remove the faults of inlet system.
3. Check the throttle.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Check whether the throttle valve is blocked or its carbon deposit exist. Is the throttle normal? →**Yes** To step 4. →**No** Clean the throttle or replace the throttle. **Refer to: Replacement of the throttle body assembly**

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Test condition	Details/results/measures
4. Check the spark plug.	
	A. Remove the spark plug. B. Check the spark plugs of each cylinder to see if the model and clearance are in compliance with the specifications. **Refer to: Spark plug test** Is the spark plug ignition spark test normal? →**Yes** To step 5. →**No** Replace the spark plug **Refer to: Spark plug replacement**
5. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? →**Yes** To step 6. →**No** Replace the injector. **Refer to: Replacement of the injector**
6. Check the fuel.	
	A. Remove the fuel filter plug. **Refer to: Replacement of the oil filter** B. Drain the fuel out of fuel filter, and check the moisture in fuel. Is fuel check normal? →**Yes** To step 7. →**No** Remove the mixed water from the fuel. Add a clear, high-standard fuel.
7. Check the engine compression pressure.	
	A. Check the engine compression pressure. **Refer to: Cylinder compression pressure check** Is the cylinder compressing pressure normal? →**Yes** To step 8. →**No** Check the mechanical system of the engine.

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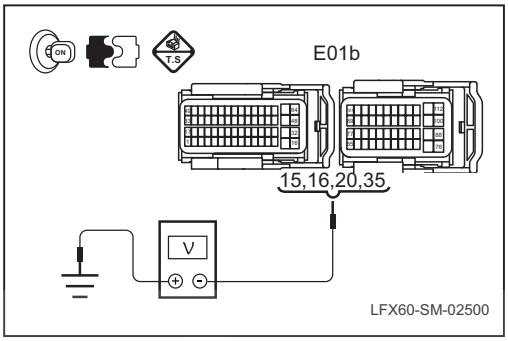
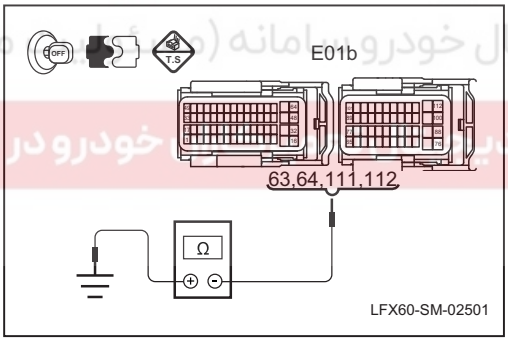
Test condition	Details/results/measures
8. Check the ignition timing.	
	A. Check the ignition timing. **Refer to: Checking the timing** Is the ignition timing normal? **→Yes** To step 9. **→No** Adjust the ignition timing.
9. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** To step 10. **→No** Troubleshoot the ECM power supply line and replace the harness if necessary.
10. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 11. **→No** Troubleshoot the ECM grounding line and replace the harness if necessary.
11. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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Diagnostic process for normal starting but unstable idling or stopping (e.g. starting A/C)

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? **→Yes** **Refer to: DTC TROUBLESHOOTING TABLE** **→No** To step 2**.**
2. Check the throttle.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Check the throttle valve for seizure or carbon deposits. Is the throttle valve normal? **→Yes** To step 3**.** **→No** Clean the throttle or replace the throttle. **Refer to: Replacement of the throttle body assembly**
3. Check whether the output power of engine increases in case of starting A/C.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Connect the diagnostic equipment. C. Start the engine, and enter into the data flow menu of engine to select the ignition advance angle, injection pulse width and inlet pressure sensor parameters. D. Turn on A/C, and observe the changes of data flow parameters. Are the parameters of data flow changed? **→Yes** To step 4**.** **→No** Check A/C system.

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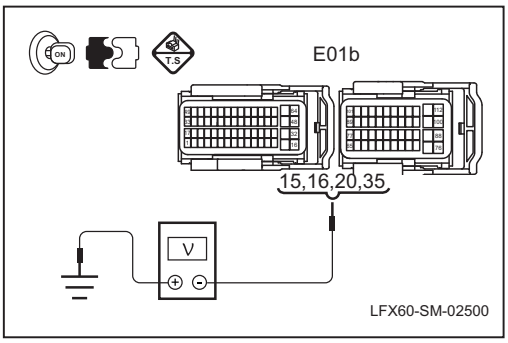
Test condition	Details/results/measures
4. Check the starting signals of engine module A/C.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Remove A/C compressor relay. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the “on” state. F. Adopt a multimeter to measure #2 terminal of A/C compressor relay K12, and measure the level signal of harness terminal in case of starting A/C. G. Is the voltage of #2 terminal of K12 A/C compressor relay 0V in case of stopping A/C? **→Yes** To step 5. **→No** Remove the abnormal open voltage of A/C compressor relay.
5. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? **→Yes** To step 6. **→No** Replace the injector. **Refer to: Replacement of the injector**
6. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** To step 7. **→No** Troubleshoot the ECM power supply line and replace the harness if necessary.

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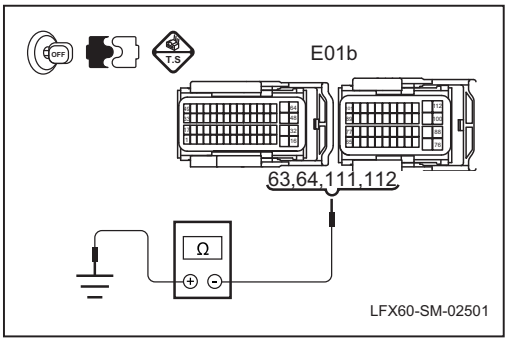
Test condition	Details/results/measures
7. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 8. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.
8. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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Diagnosis procedure for excessive idle speed in case of normal start.

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Make a diagnosis of the trouble code. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 2**.**
2. Check whether the accelerator pedal is seized or too tight.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Check whether the accelerator pedal is seized or too tight. Is the accelerator pedal seized or too tight? →**Yes** Replace the accelerator pedal. **Refer to "Replacement of Accelerator Pedal Assembly".** →**No** To step 3**.**
3. Check the vacuum pipe.	
	A. Check the air inlet system for leakage. **Refer to: Air intake leak diagnosis process** Is the air inlet system leaked? →**Yes** Overhaul the intake system. →**No** To step 4**.**
4. Check the water temperature sensor.	
	A. Start the engine, and read the data of water temperature sensor. Are the data of water temperature sensor normal? →**Yes** To step 7**.** →**No** To step 5**.**

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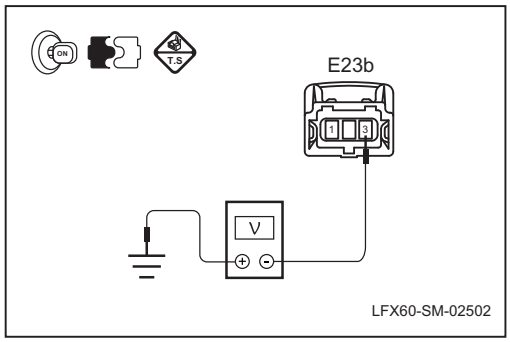
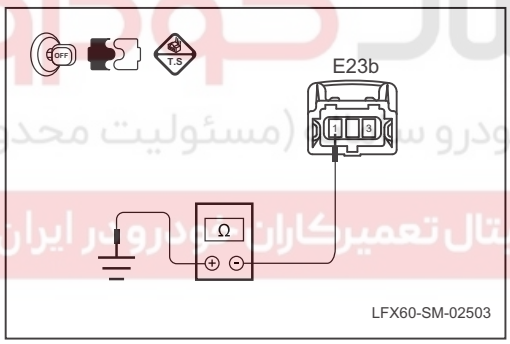
Test condition	Details/results/measures
5. Check the signal circuit of water temperature sensor.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the water temperature sensor harness connector E23b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #3 terminal of water temperature sensor harness plug E23b to reliable ground. **Standard value: 4.7 ~ 5.5V** Is the voltage normal? →**Yes** To step 6. →**No** Check and remove the faults of water temperature sensor signal circuit, and replace the harness if necessary.
6. Check the circuit of water temperature sensor to ground.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the water temperature sensor harness connector E23b. D. Adopt a multimeter to measure the resistance of #1 terminal of water temperature sensor harness plug E23b to reliable ground. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 7. →**No** Troubleshoot the water temperature sensor grounding line. If necessary, replace the harness.
7. Check the ignition timing.	
	A. Check the ignition timing. **Refer to: Checking the timing** Is the ignition timing normal? →**Yes** To step 8. →**No** Adjust the ignition timing.

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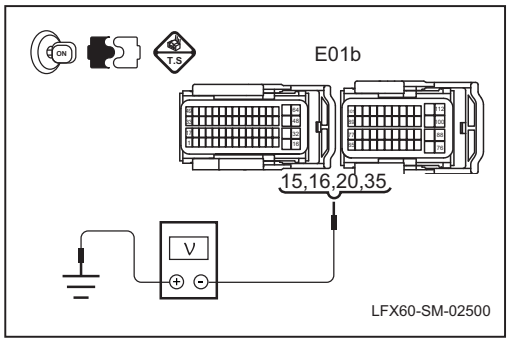
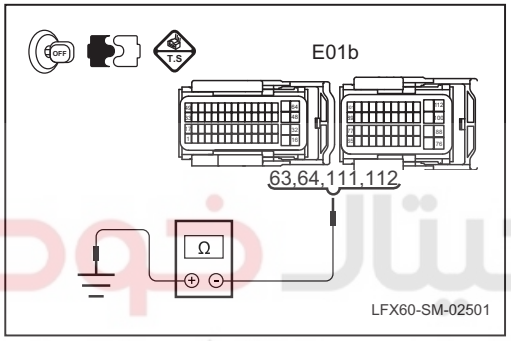
Test condition	Details/results/measures
8. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** To step 9. **→No** Troubleshoot the ECM power supply line and replace the harness if necessary.
9. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 10. **→No** Troubleshoot the ECM grounding line and replace the harness if necessary.
10. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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Diagnosis procedure for acceleration fault

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Make a diagnosis of the trouble code. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 2**.**
2. Check the intake system.	
	A. Check whether the intake system is blocked. B. Check whether the intake system is leaking. **Refer to: Air intake leak diagnosis process** Is the intake system normal? →**Yes** To step 3**.** →**No** Overhaul the intake system.
3. Check the throttle.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Check the throttle valve for seizure. C. Check the throttle valve for carbon deposits. Is the throttle normal? →**Yes** To step 4**.** →**No** Clean the throttle or replace the throttle.

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Test condition	Details/results/measures
4. Check the spark plug.	
	A. Remove the spark plug. B. Check the spark plugs of each cylinder to see if the model and clearance are in compliance with the specifications. **Refer to: Spark plug test** Is the spark plug ignition spark test normal? **→Yes** To step 5. **→No** Replace the spark plug **Refer to: Spark plug replacement**
5. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? **→Yes** To step 6. **→No** Replace the injector. **Refer to: Replacement of the injector**
6. Check the fuel.	
	A. Remove the fuel filter plug. **Refer to: Replacement of the oil filter** B. Discharge the fuel from the fuel filter. Check the moisture inside the fuel. Is fuel check normal? **→Yes** Remove the mixed water from the fuel. Add a clear, high-standard fuel. **→No** To step 7.
7. Check the intake pressure sensor, and throttle position sensor.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Connect the diagnostic equipment. C. Start the engine. View the intake pressure sensor and throttle position sensor data flow. Is the intake pressure sensor and throttle position sensor data flow normal? **→Yes** To step 8. **→No** Replace the intake pressure sensor and throttle position sensor or service the sensor line.

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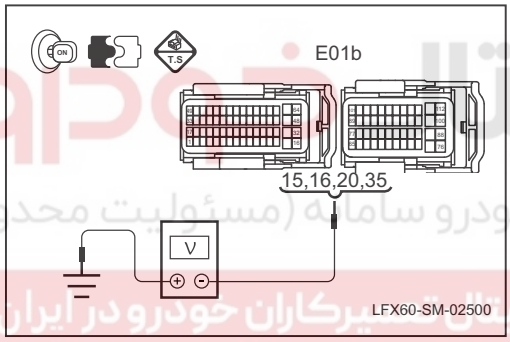
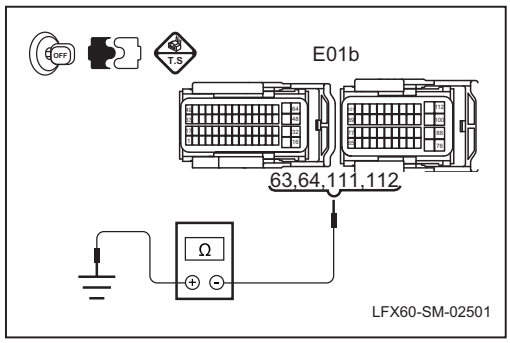
Test condition	Details/results/measures
8. Check the ignition timing.	
	A. Check the ignition timing. **Refer to: Checking the timing** Is the ignition timing normal? →**Yes** To step 9. →**No** Adjust the ignition timing.
9. Check the exhaust back pressure.	
	A. Check the exhaust back pressure. Is the exhaust back pressure normal? →**Yes** To step 10. →**No** Overhaul the exhaust system.
10. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 11. →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.
11. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 12. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.

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Test condition	Details/results/measures
12. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module** Confirm that the fault has been ruled out.

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Diagnosis procedure for engine running unstably

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Make a diagnosis of the trouble code. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 2.
2. Check the intake system.	
	A. Check whether the intake system is blocked. B. Check whether the intake system is leaking. **Refer to: Air intake leak diagnosis process** Is the intake system normal? →**Yes** To step 3. →**No** Overhaul the intake system.
3. Check the oxygen sensor.	
	A. Connect the diagnostic equipment. B. Start the starting switch to turn the power mode to “ON”, and adopt a diagnostic unit to enter into the engine data flow and read “Voltages of Front or Rear Oxygen Sensor”. Is the data stream normal? →**Yes** To step 4. →**No** Replace front or rear oxygen sensor. **Refer to: Replacement of the front oxygen sensor** **Refer to: Replacement of the rear oxygen sensor**

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Test condition	Details/results/measures
4. Check the spark plug.	
	A. Remove the spark plug. B. Check the spark plugs of each cylinder to see if the model and clearance are in compliance with the specifications. **Refer to: Spark plug test** Is the spark plug ignition spark test normal? →**Yes** To step 5. →**No** Replace the spark plug **Refer to: Spark plug replacement**
5. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? →**Yes** To step 6. →**No** Replace the injector. **Refer to: Replacement of the injector**
6. Check the fuel pressure.	
	A. Connect the fuel pressure gauge. B. Measure fuel pressure. **Refer to: Fuel system pressure test** Is fuel pressure normal? →**Yes** To step 7. →**No** Check the fuel system. **Refer to:Diagnostic process for fuel pump failure to work**

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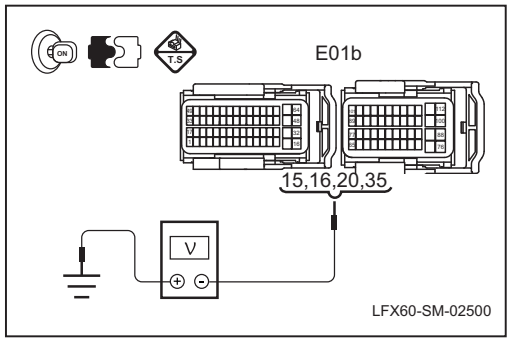
Test condition	Details/results/measures
7. Check the intake pressure sensor, and throttle position sensor.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Connect the diagnostic equipment. C. Start the engine. View the intake pressure sensor and throttle position sensor data flow. Is the intake pressure sensor and throttle position sensor data flow normal? →**Yes** To step 8. →**No** Replace the intake pressure sensor and throttle position sensor or service the sensor line.
8. Check the ignition timing.	
	A. Check the ignition timing. **Refer to: Checking the timing** Is the ignition timing normal? →**Yes** To step 9. →**No** Adjust the ignition timing.
9. Check the engine suspension.	
	A. Check the fasteners of engine suspension for loosening. B. Check the engine suspension for damages. C. Are the support parts of engine cracked or damaged, its bolts loosened or missed? →**Yes** Repair the fault parts. →**No** To step 10.
10. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the "on" state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 11. →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.

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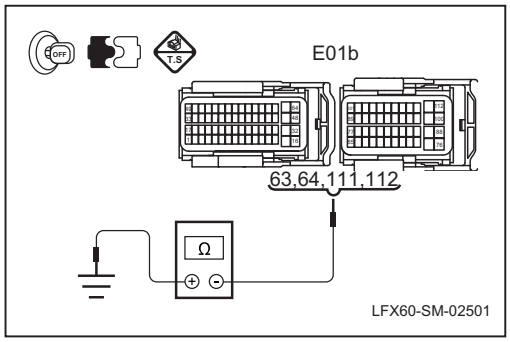
Test condition	Details/results/measures
11. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 12. **→No** Troubleshoot the ECM grounding line and replace the harness if necessary.
12. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

02

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Diagnosis procedure for tendency to stall during starting

Test condition	Details/results/measures
1. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Make a diagnosis of the trouble code. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 2.
2. Check the intake system.	
	A. Check whether the intake system is blocked. B. Check whether the intake system is leaking. **Refer to: Air intake leak diagnosis process** Is the intake system normal? →**Yes** To step 3. →**No** Overhaul the intake system.
3. Check the crankshaft position sensor.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the crankshaft position sensor harness connector E25b. D. Adopt a multimeter to measure the resistance between #1 and #2 terminals of crankshaft position sensor. **Standard value: 731~989Ω** Is the resistance normal? →**Yes** To step 4. →**No** Replace the crankshaft position sensor. **Refer to: Replacement of the crankshaft position sensor**

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Test condition	Details/results/measures
4. Check the crankshaft position signal circuit.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the crankshaft position sensor harness connector E25b. D. Disconnect the ECM harness connector E01b. E. Connect the battery negative terminal. F. Adopt a multimeter to measure the resistance between #1 terminal of crankshaft position sensor harness plug E25b and #96 terminal of ECM harness plug E01b. G. Adopt a multimeter to measure the resistance between #2 terminal of crankshaft position sensor harness plug E25b and #97 terminal of ECM harness plug E01b. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 5. **→No** Remove the faults of crankshaft position sensor signal circuit, and replace the harness if necessary.
5. Check the spark plug.	
	A. Remove the spark plug. B. Check the spark plugs of each cylinder to see if the model and clearance are in compliance with the specifications. **Refer to: Spark plug test** Is the spark plug ignition spark test normal? **→Yes** To step 6. **→No** Replace the spark plug **Refer to: Spark plug replacement**
6. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? **→Yes** To step 7. **→No** Replace the injector. **Refer to: Replacement of the injector**

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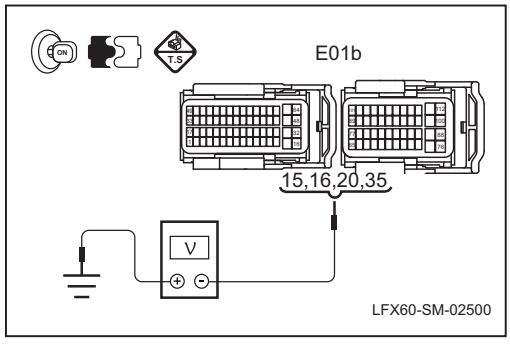
Test condition	Details/results/measures
7. Check the fuel pressure.	
	A. Connect the fuel pressure gauge. B. Measure fuel pressure. **Refer to: Fuel system pressure test** Is fuel pressure normal? →**Yes** To step 8. →**No** Check the fuel system. **Refer to: Diagnostic process for fuel pump failure to work**
8. Check the intake pressure sensor, and throttle position sensor.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Connect the diagnostic equipment. C. Start the engine. View the intake pressure sensor and throttle position sensor data flow. Is the intake pressure sensor and throttle position sensor data flow normal? →**Yes** To step 9. →**No** Replace the intake pressure sensor and throttle position sensor or service the sensor line.
9. Check the ignition timing.	
	A. Check the ignition timing. **Refer to: Checking the timing** Is the ignition timing normal? →**Yes** To step 10. →**No** Adjust the ignition timing.
10. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the "on" state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 11 →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.

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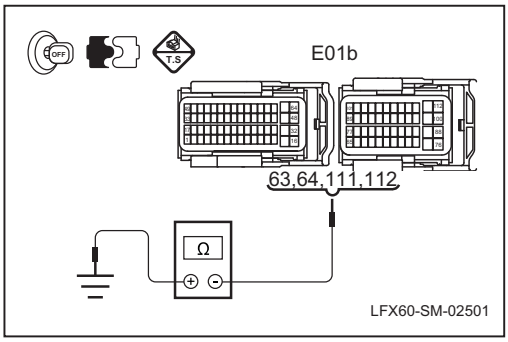
Test condition	Details/results/measures
11. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 12. **→No** Troubleshoot the ECM grounding line and replace the harness if necessary.
12. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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Diagnosis procedure for vehicle jitter during running

Test condition	Details/results/measures
1. General inspection.	
	A. Check the following items: • Vacuum tube connection • Air filter cartridge • Air leakage of inlet system • Correct seals of the intake manifold and its components • Ignition line • Appropriate fuel quality (e.g. appropriate octane value, sundries, mixture in winter/summer) • Electrical connection • Stable operation of the throttle B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is it OK after checking? **→Yes** To step 2. **→No** Repair the fault parts.
2. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? **→Yes** Make a diagnosis of the trouble code. **Refer to: DTC TROUBLESHOOTING TABLE** **→No** To step 3.
3. Check the data flows.	
	A. Connect the diagnostic equipment. B. Start the engine, and check the following data flows of engine with a diagnostic unit: • Engine speed • Actual intake manifold pressure • 1# throttle potentiometer voltage • 2# throttle potentiometer voltage Are the changes of data flows normal within the specified range? **→Yes** To step 4. **→No** Remove the corresponding faults of data flows.

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Test condition	Details/results/measures
4. Check the spark plug.	
	A. Remove the spark plug. B. Check the spark plugs of each cylinder to see if the model and clearance are in compliance with the specifications. **Refer to: Spark plug test** Is the spark plug ignition spark test normal? **→Yes** To step 5. **→No** Replace the spark plug **Refer to: Spark plug replacement**
5. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? **→Yes** To step 6. **→No** Replace the injector. **Refer to: Replacement of the injector**
6. Check the fuel pressure.	
	A. Connect the fuel pressure gauge. B. Measure fuel pressure. **Refer to: Fuel system pressure test** Is fuel pressure normal? **→Yes** To step 7. **→No** Check the fuel system. **Refer to: Diagnostic process for fuel pump failure to work**
7. Check the ignition timing.	
	A. Check the ignition timing. **Refer to: Checking the timing** Is the ignition timing normal? **→Yes** To step 8. **→No** Adjust the ignition timing.

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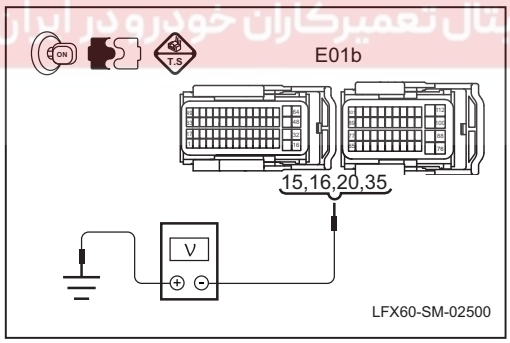
Test condition	Details/results/measures
8. Check the fuel evaporative emission system (EVAP).	
	A. Check the fuel evaporative emission system. **Refer to: Check of canister** Is the fuel evaporative emission system normal? **→Yes** To step 9. **→No** Repair the fuel evaporative emission system.
9. Check the exhaust recirculation system.	
	A. Check the exhaust recirculation system. Is the exhaust recirculation system normal? **→Yes** To step 10. **→No** Repair the exhaust recirculation system.
10. Check the exhaust back pressure.	
	A. Check the exhaust back pressure. Is the exhaust back pressure normal? **→Yes** To step 12. **→No** Overhaul the exhaust system.
12. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** To step 13. **→No** Troubleshoot the ECM power supply line and replace the harness if necessary.

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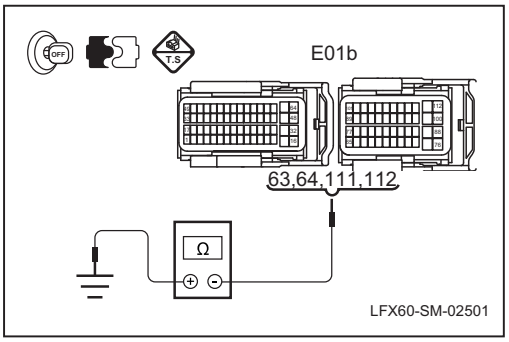
Test condition	Details/results/measures
13. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 14. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.
14. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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Sliding flameout diagnosis procedure

Test condition	Details/results/measures
1. General inspection.	
	A. Ensure correct layout and no damages of vacuum pipe. B. Ensure no leakage of inlet system. Is it OK after checking? →**Yes** To step 2. →**No** Repair the fault parts.
2. Check the idling of engine.	
	A. Check the engine idling. Is the engine idling unstable? →**Yes** Diagnose its unstable idling. **Refer to: Diagnostic Process for Normal Starting but Unstable Idling or Stopping at Some Load** →**No** To step 3.
3. Check A/C compressor.	
	A. Activate the starting switch to make the power mode OFF. B. Disconnect CA40 harness plug of A/C compressor electromagnetic clutch. C. Check whether the test of A/C system is normal. D. Recover CA40 harness plug of electromagnetic clutch. Is it normal to disconnect the electromagnetic clutch system? →**Yes** Remove the disconnection failure of compressor electromagnetic clutch. →**No** To step 4.
4. Check the trouble code.	
	A. Connect the diagnostic equipment. B. Operate the start switch to make the power mode to the N? State. Diagnose the engine system. Is there a trouble code? →**Yes** Perform the fault diagnosis. **Refer to: DTC TROUBLESHOOTING TABLE** →**No** To step 5.

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Test condition	Details/results/measures
5. Check the spark plug.	
	A. Remove the spark plug. B. Check the spark plugs of each cylinder to see if the model and clearance are in compliance with the specifications. **Refer to: Spark plug test** Is the spark plug ignition spark test normal? **→Yes** To step 6. **→No** Replace the spark plug **Refer to: Spark plug replacement**
6. Check the injector.	
	A. Remove the injector. B. Check the injector for leaks or clogging with an injector-specific cleaning analyzer. Is the injector normal? **→Yes** To step 7. **→No** Replace the injector. **Refer to: Replacement of the injector**
7. Check the fuel.	
	A. Remove the fuel filter plug. **Refer to: Replacement of the oil filter** B. Discharge the fuel from the fuel filter. Check the moisture inside the fuel. Is fuel check normal? **→Yes** Replace the fuel. **→No** To step 8.
8. Check the intake pressure sensor, and throttle position sensor.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Connect the diagnostic equipment. C. Start the engine. View the intake pressure sensor and throttle position sensor data flow. Is the intake pressure sensor and throttle position sensor data flow normal? **→Yes** To step 9. **→No** Replace the intake pressure sensor and throttle position sensor or service the sensor line.

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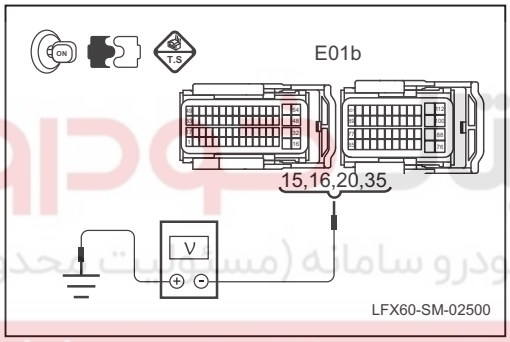
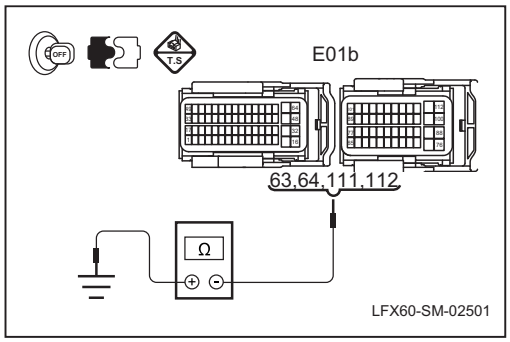
Test condition	Details/results/measures
9. Check the ignition timing.	
	A. Check the ignition timing. **Refer to: Checking the timing** Is the ignition timing normal? **→Yes** To step 10. **→No** Adjust the ignition timing.
10. Check the exhaust back pressure.	
	A. Check the exhaust back pressure. Is the exhaust back pressure normal? **→Yes** To step 11. **→No** Overhaul the exhaust system.
11. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** To step 12. **→No** Troubleshoot the ECM power supply line and replace the harness if necessary.
12. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 13. **→No** Troubleshoot the ECM grounding line and replace the harness if necessary.

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Test condition	Details/results/measures
13. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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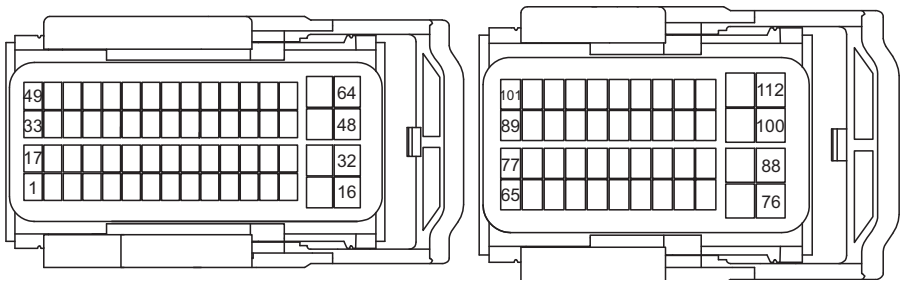
Control module terminal list



E01b

LFX60- SM -02627

Pin number	Wire size/color	Function
1	0.50 R/W	PCAN-H
2	-	-
3	-	-
4	-	-
5	0.50 Y	Main relay control signal
6	-	-
7	0.50 Bl/W	Accelerator pedal position sensor signal ground 1
8	-	-
9	0.50 O/G	Cruise switch signal
10	-	-
11	-	-
12	-	-
13	-	-
14	-	-
15	1.50 Bl/R	Main relay power supply
16	1.50 Bl/R	Main relay power supply
17	0.50 B/W	PCAN-L
18	-	-
19	-	-
20	0.50 R	Storage battery power supply
21	0.50 P	Rear oxygen sensor signal signal high

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Pin number	Wire size/color	Function
22	-	-
23	0.50 Gr/W	Normally open signal of the brake switch
24	0.50 G	A/C switch signal
25	0.50 Gr/R	Normally closed signal of the brake switch
26	-	-
27	-	-
28	0.50 Gr/V	A/C switch feedback signal
29	0.50 Bl/G	Steering power switch
30	0.50 G/R	Throttle pedal position sensor signal 2
31	0.85 V/W	High speed fan control signal
32	-	-
33	-	-
34	-	-
35	0.50 B/W	IG power supply
36	0.50 R/W	Accelerator pedal position sensor 5V power supply
37	0.50 O/Bl	Accelerator pedal position sensor 5V power supply
38	-	-
39	-	-
40	-	-
41	0.50 Gr/Y	Oil pump relay control signal
42	-	-
43	0.50 V/B	The rear oxygen sensor signal is low
44	-	-
45	0.50 R/Y	Throttle pedal position sensor signal 1
46	-	-
47	0.75 B/W	Pilot switch signal ground
48	0.75 G/O	Rear oxygen sensor heating signal
49	-	-
50	-	-
51	-	-
52	-	-
53	-	-
54	-	-
55	-	-

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Pin number	Wire size/color	Function
56	0.50 Gr/O	Low speed fan control signal
57	-	-
58	0.50 B/O	Compressor control signal
59	0.50 W/B	Throttle pedal position sensor signal 1
60	-	-
61	-	-
62	-	-
63	1.50 B	Grounding
64	1.50 B	Grounding
65	-	-
66	-	-
67	0.50 Y/R	Two cylinder fuel injection signal
68	0.50 O/B	One cylinder fuel injection signal
69	-	-
70	-	-
71	0.50 Y/W	Inlet VVT valve signal
72	0.50 P/Y	Three cylinder fuel injection signal
73	0.50 V/W	-
74	0.50 G/Y	Four cylinder fuel injection signal
75	0.75 P	Electronically controlled throttle valve motor power supply +
76	1.50 Br	Four-cylinder ignition signal
77	0.50 W/P	Electronically controlled throttle valve signal 1
78	0.50 Bl/G	Electronically controlled throttle valve signal 2
79	-	-
80	0.50 V/B	The front oxygen sensor’s signal is low
81	-	-
82	-	-
83	-	-
84	-	-
85	0.50 G/R	Sensor signal ground
86	0.50 V	-
87	0.75 R/GW	Electronically controlled throttle valve motor power supply -
88	1.50 P/G	Two-cylinder ignition signal
89	0.50 Bl/O	The knock sensor signal is high

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Pin number	Wire size/color	Function
90	0.50 Bl/B	The knock sensor signal is low
91	0.50 P/B	Intake pressure sensor signal
92	-	-
93	0.50 R/Bl	Air intake camshaft position sensor signal
94	0.50 W/G	Canister solenoid valve signal
95	0.50 G/W	Inlet camshaft position sensor signal ground
96	0.50 Bl	Crankshaft position sensor signal high
97	0.50 G	Crankshaft position sensor signal low
98	0.50 Y/G	Inlet camshaft position sensor 5V power supply
99	1.50 G/W	Three-cylinder ignition signal
100	1.50 G/R	One-cylinder ignition signal
101	0.50 Y/B	Water temperature sensor signal
102	0.50 Bl	Intake pressure sensor signal
103	-	-
104	0.50 O/Y	The front oxygen sensor signal is high
105	-	-
106	-	-
107	0.50 R/B	Electric control throttle valve 5V power supply
108	-	-
109	0.50 Y/Bl	Inlet temperature &pressure sensor 5V power supply
110	1.50 B	Grounding
111	1.50 B	Grounding

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DTC troubleshooting table

DTC	Trouble code information	Diagnostic process
P000A	Intake VVT slow response	**Refer to: P000A, P0010, P0012, P0016, P2088, P2089**
P0010	VVT intake control valve circuit fault	
P0012	Intake VVT not in default position when starting	
P0016	Improper relative installation position of camshaft and crankshaft	
P2088	VVT intake control valve circuit voltage low	
P2089	VVT intake control valve circuit voltage high	
P0030	Fault of upstream oxygen sensor heating control circuit	**Refer to: P0030, P0031, P0032, P0053**
P0031	Overlow voltage of upstream oxygen sensor heating control circuit	
P0032	Overhigh voltage of upstream oxygen sensor heating control circuit	
P0053	Upstream oxygen sensor heating circuit internal resistance unreasonable	
P0036	Fault of downstream oxygen sensor heating control circuit	**Refer to: P0036, P0037, P0038, P0054**
P0037	Overlow voltage of downstream oxygen sensor heating control circuit	
P0038	Overhigh voltage of downstream oxygen sensor heating control circuit	
P0054	Downstream oxygen sensor heating circuit internal resistance unreasonable	
P0105	Intake pressure sensor signal no fluctuation	**Refer to: P0105, P0106, P0107, P0108**
P0106	Intake pressure sensor unreasonable	
P0107	Intake pressure sensor signal circuit voltage low	
P0108	Intake pressure sensor signal circuit voltage high	
P0112	Intake temperature sensor signal circuit voltage low	**Refer to: P0112, P0113**
P0113	Intake temperature sensor signal circuit voltage high	
P0117	Engine coolant temperature sensor circuit voltage low	**Refer to: P0117, P0118**
P0118	Engine coolant temperature sensor circuit voltage high	
P0121	Electronic throttle position sensor 1 signal unreasonable	**Refer to: P0121, P0122, P0123**
P0122	Electronic throttle position sensor 1 signal circuit voltage low	
P0123	Electronic throttle position sensor 1 signal circuit voltage high	
P0130	Upstream oxygen sensor signal unreasonable	**Refer to: P0130, P0131, P0132, P0133, P0134, P2195, P2196**
P0131	Upstream oxygen sensor signal circuit voltage low	
P0132	Upstream oxygen sensor signal circuit voltage high	
P0133	Response delay of upstream oxygen sensor to dense and diluted mixed gas	
P0134	Faults of upstream oxygen sensor circuit signal circuit	
P2195	Response delay of upstream oxygen sensor to diluted mixed gas	
P2196	Response delay of upstream oxygen sensor to dense mixed gas	

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DTC	Trouble code information	Diagnostic process
P0136	Downstream oxygen sensor signal unreasonable	Refer to: P0136, P0137, P0138, P0140, P2270, P2271
P0137	Downstream oxygen sensor signal circuit voltage low	
P0138	Downstream oxygen sensor signal circuit voltage high	
P0140	Faults of downstream oxygen sensor circuit signal circuit	
P2270	Response delay of downstream oxygen sensor to diluted mixed gas	
P2271	Response delay of downstream oxygen sensor to dense mixed gas	
P0201	Cylinder 1 injector control circuit faults	Refer to: P0201, P0261, P0262
P0261	Cylinder 1 injector control circuit voltage low	
P0262	Cylinder 1 injector control circuit voltage high	
P0202	Cylinder 2 injector control circuit faults	Refer to: P0202, P0264, P0265
P0264	Cylinder 2 injector control circuit voltage low	
P0265	Cylinder 2 injector control circuit voltage high	
P0203	Cylinder 3 injector control circuit faults	Refer to: P0203, P0267, P0268
P0267	Cylinder 3 injector control circuit voltage low	
P0268	Cylinder 3 injector control circuit voltage high	
P0204	Cylinder 4 injector control circuit faults	Refer to: P0204, P0270, P0271
P0270	Cylinder 4 injector control circuit voltage low	
P0271	Cylinder 4 injector control circuit voltage high	
P0219	Engine speed exceeding maximum speed limit	Refer to: P0219
P0221	Electronic throttle position sensor 2 signal unreasonable	Refer to: P0221, P0222, P0223
P0222	Electronic throttle position sensor 2 signal circuit voltage low	
P0223	Electronic throttle position sensor 2 signal circuit voltage high	
P0300	Multi-cylinder misfire	Refer to: P0300, P0301, P0302, P0303, P0304
P0301	Cylinder 1 misfire	
P0302	Cylinder 2 misfire	
P0303	Cylinder 3 misfire	
P0304	Cylinder 4 misfire	
P0322	Non-speed (crankshaft position) sensor pulse signal	Refer to: P0322
P0327	Overhigh voltage of knock sensor circuit	Refer to: P0327, P0328
P0328	Overlow voltage of knock sensor circuit	
P0341	Poor contact of phase position (camshaft position) sensor	Refer to: P0341
P0420	Aged oxygen storing capacity of three-way catalyst (emission overlimit)	Refer to: P0420

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DTC	Trouble code information	Diagnostic process
P0444	Faults of canister control valve circuit	**Refer to: P0444, P0458, P0459**
P0458	Overlow voltage of canister control valve circuit	
P0459	Canister control valve control circuit voltage high	
P0480	Signal faults of cooling fan relay control circuit (low speed)	**Refer to: P0480, P0691, P0692**
P0691	Overlow voltage of cooling fan relay control circuit (low speed)	
P0692	Cooling fan relay control circuit voltage high (low speed)	
P0481	Faults of cooling fan relay control circuit (high speed)	**Refer to: P0481, P0693, P0694**
P0693	Cooling fan relay control circuit voltage low (low speed)	
P0694	Cooling fan relay control circuit voltage high (low speed)	
P0506	Idle speed control speed below target	**Refer to: P0506, P0507**
P0507	Idle speed control speed above target	
P0560	System battery voltage signal unreasonable	**Refer to: P0560, P0562, P0563**
P0562	System battery voltage low	
P0563	System battery voltage high	
P0571	Fault or non-synchronous relevance of brake switch signal circuit	**Refer to: P0571**
P0604	ECU RAM fault	**Refer to: P0604, P0605, P0606**
P0605	ECU ROM fault	
P0606	Faults of electronic throttle safety monitoring function	
P2106	Electronic throttle drive stage fault	
P0627	Faults of fuel pump relay circuit	**Refer to: P0627, P0628, P0629**
P0628	Overlow voltage of fuel pump relay control circuit	
P0629	Fuel pump relay control circuit voltage high	
P0645	Faults of A/C compressor relay circuit	**Refer to: P0645, P0646, P0647**
P0646	A/C compressor relay control circuit voltage low	
P0647	Overhigh voltage of A/C compressor relay	
P0688	Main relay output voltage unreasonable	**Refer to: P0688**
P1336	Lectronic throttle safety monitoring torque restriction	**Refer to: P1336, P1545, P1559,**
P1545	Electronic throttle actual position deviation from target exceeding limit	
P1559	Electronic throttle self-learning process fault	
P1565	Self-learning fault of electronic throttle lower limit position initialization	**P1564, P1565, P1568, P1579**
P1568	Overhigh return resistance of electronic throttle valve	
P1579	Electronic throttle not meeting self-learning condition	

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DTC	Trouble code information	Diagnostic process
P1610	ECM fails to finish anti-theft matching or error of eeprom status	**Refer to: P1610, P1626, P1631, P1632**
P1626	Anti-theft certification commission error or response failure of anti-theft alarm	
P1631	Secret key error	
P1632	checksum error in anti-theft certification	
P2122	Electronic throttle pedal position sensor 1 signal voltage lower	**Refer to: P2122, P2123, P2138**
P2123	Electronic throttle pedal position sensor 1 signal voltage high	
P2138	Electronic throttle pedal position sensor signal unreasonable	
P2127	Electronic throttle pedal position sensor 2 signal voltage lower	**Refer to: P2127, P2128, P2138**
P2128	Electronic throttle pedal position sensor 2 signal voltage high	
P2138	Electronic throttle pedal position sensor signal unreasonable	
P2177	Air fuel ratio closed-loop control self-learning value exceeding upper limit	**Refer to: P2177, P2178**
P2178	Air fuel ratio closed-loop control self-learning value exceeding lower limit	
U0001	Faults of CAN high-speed transmission lines	**Refer to: U0001, U0121, U0140**
U0121	Commission missing between ECM and ABS control module	
U0140	Commission missing or abnormal signals between ECM and BCM	

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DTC P000A, P0010, P0012, P0016, P2088, P2089

DTC description

DTC	Description	Definition
P000A	Slow response speed to inlet VVT movement	• Engine control module controls the operation of inlet VCP hydraulic control valve, drives VVT sprocket via oil, and changes its timing phase as per the running conditions. When the control circuit of inlet VCP hydraulic control valve is abnormal, engine control module will set this fault code. #1 terminal of inlet VCP hydraulic control valve harness plug E06b is the power supply of control valve. #2 terminal of E06b is the drive signal of control valve.
P0010	Open circuit of inlet VVT control solenoid valve	
P0012	Inlet VVT is not in default locking position while starting	
P2088	Overlow voltage of inlet VVT control solenoid valve circuit	
P2089	Overhigh voltage of inlet VVT control solenoid valve circuit	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P000A P0010 P0012 P2088 P2089	• Check of hardware and circuits	• Incorrect signal relevance	• Phaser • Inlet VVT control solenoid valve • Inlet VVT control solenoid valve circuit • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the inlet VVT control solenoid valve harness plug and engine control module for damages, poor contact, aging or loosening, etc. Is it OK after checking? →Yes **To step 2.** **→No** Repair the fault parts.

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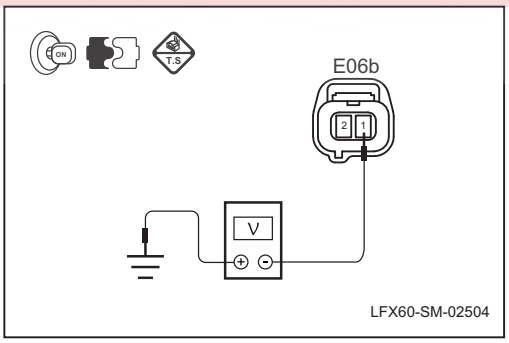
Test condition	Details/results/measures
2. Check the oil.	
	A. Check the oil for chippings or serious pollution, etc. B. Check the oil pressure. **Refer to: Check the oil pressure.** Is the oil pressure normal? →**Yes** Step 3. →**No** Repair the fault parts.
3. Timing check	
	A. Check the accuracy of timing. B. Check the timing chain, timing sprocket or timing chain tensioner for damages or wears. Is it OK after checking? →**Yes** Step 4. →**No** Repair the fault parts.
4. Replace the timing phase modulator.	
	A. Replace the timing phase modulator. Is the troubleshooting successful? →**Yes** Replace the timing phase modulator. →**No** Step 5.
5. Check the power circuit of inlet VVT control solenoid valve.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the intake VVT control solenoid valve harness connector E06b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the “on” state. F. Adopt a multimeter to measure the voltage of #1 terminal of inlet VVT control solenoid valve harness plug E06b to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 6. →**No** Check and remove the faults of inlet VVT control solenoid valve power circuit, and replace the harness if necessary.

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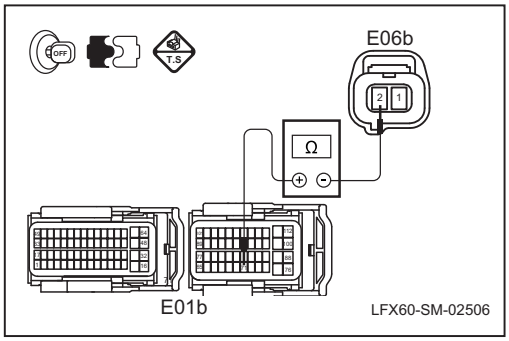
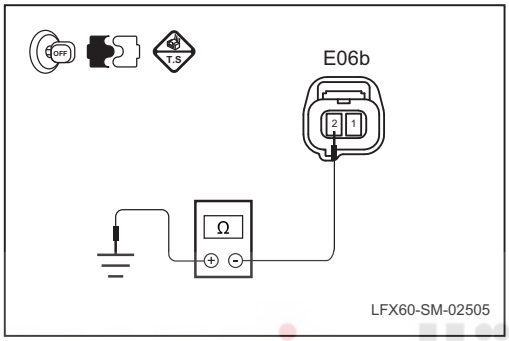
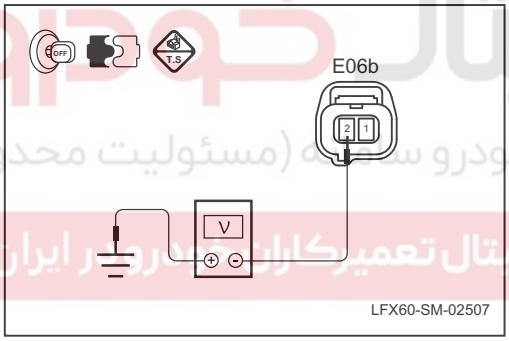
Test condition	Details/results/measures
6. Check the control circuit of inlet VVT control solenoid valve.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the intake VVT control solenoid valve harness connector E06b. D. Disconnect the ECM harness connector E01b. E. Adopt a multimeter to measure the resistance between #1 terminal of inlet VVT control solenoid valve harness plug E06b and #71 terminal of ECM harness plug E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #2 terminal of inlet VVT control solenoid valve harness plug E06b to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #2 terminal of inlet VVT control solenoid valve harness plug E06b to reliable ground. **Standard value: 0V** Is it OK after checking? →**Yes** To step 7. →**No** Check and remove the faults of inlet VVT control solenoid valve control circuit, and replace the harness if necessary.
7. Check the inlet VVT control solenoid valve.	
	A. Replace the inlet VVT control solenoid valve. Is the troubleshooting successful? →**Yes** Replace the inlet VVT control solenoid valve. **Refer to: Replacement of inlet VVT valve** →No **To step 8.**
8. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0030, P0031, P0032, P0053

DTC description

DTC	Description	Definition
P0030	• Fault of upstream oxygen sensor heating control circuit	• The heated oxygen sensor must reach the operating temperature to provide accurate voltage signals. The heating element inside the heated oxygen sensor makes the sensor reach the operating temperature quickly. Main relay provides the operating voltage for upstream sensor via A terminal of upstream oxygen sensor harness plug E04a. The engine control module provides grounding for B terminal of upstream oxygen sensor harness plug E04a.
P0031	• Overlow voltage of upstream oxygen sensor heating control circuit	
P0032	• Overhigh voltage of upstream oxygen sensor heating control circuit	
P0053	• Upstream oxygen sensor heating circuit internal resistance unreasonable	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0030	• Hardware or line check	• The fact that the corresponding heated oxygen sensor heater control circuit voltage is not within the specified range is observed by the engine control module	• Front oxygen sensor • Front oxygen sensor line • ECM
P0031			
P0032			
P0053			

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the front oxygen sensor and the engine control module harness connect for damage, poor contact, aging, loosening and other similar signs. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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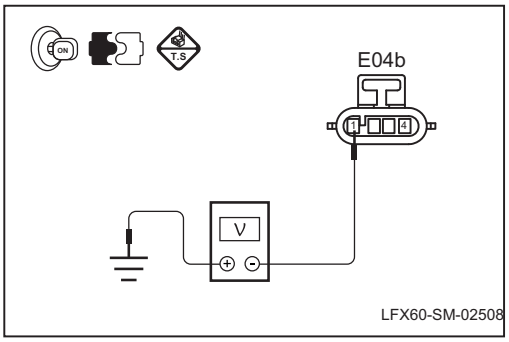
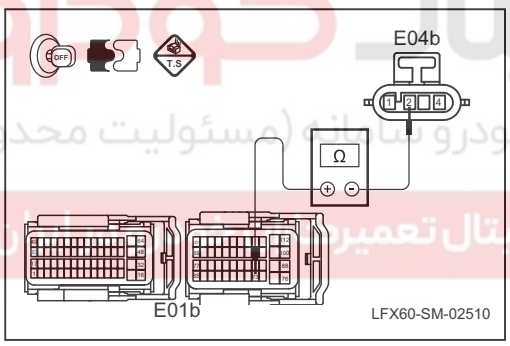
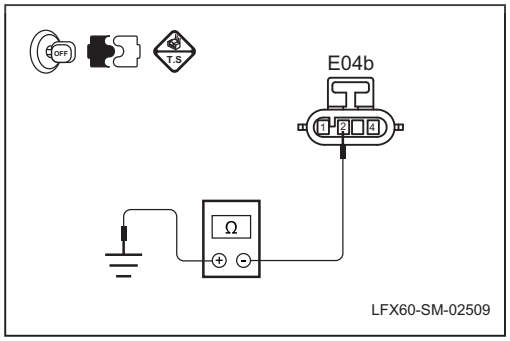
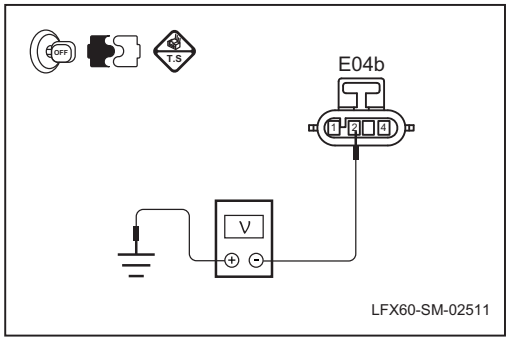
Test condition	Details/results/measures
3. Check the power circuit of front oxygen sensor heater.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the front oxygen sensor harness connector E04b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #1 terminal of front oxygen sensor harness plug E04b to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Check and remove the faults of front oxygen sensor heater power circuit, and replace the harness if necessary.
4. Check the control circuit of front oxygen sensor heater.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the front oxygen sensor harness connector E04b. D. Disconnect the ECM harness connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of front oxygen sensor harness plug E04b and #73 terminal of ECM harness plug E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #2 terminal of front oxygen sensor harness plug E04b to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the resistance of #2 terminal of front oxygen sensor harness plug E04b to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of front oxygen sensor heater power circuit, and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check the front oxygen sensor.	
	A. Measure the resistance between the front oxygen sensor terminals 4 and 3 with a multimeter at room temperature. **Standard value: 7Ω~11Ω** Is it OK after checking? →**Yes** Step 6 →**No** Replace the front oxygen sensor. **Refer to: Replace the front oxygen sensor.**
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0036, P0037, P0038, P0054

DTC description

DTC	Description	Definition
P0036	• Fault of downstream oxygen sensor heating control circuit	• The heated oxygen sensor must reach the operating temperature to provide accurate voltage signals. The heating element inside the heated oxygen sensor makes the sensor reach the operating temperature quickly. • Main relay provides the operating voltage for downstream sensor via 1 terminal of downstream oxygen sensor harness plug I41. The engine control module provides grounding for 2 terminal of downstream oxygen sensor harness plug E04a.
P0037	• Overlow voltage of downstream oxygen sensor heating control circuit	
P0038	• Overhigh voltage of downstream oxygen sensor heating control circuit	
P0054	• Downstream oxygen sensor heating circuit internal resistance unreasonable	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0036 P0037 P0038 P0054	• Hardware or line check	• The fact that the corresponding heated oxygen sensor heater control circuit voltage is not within the specified range is observed by the engine control module	• Rear oxygen sensor • Rear oxygen sensor line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check rear oxygen sensor harness plug for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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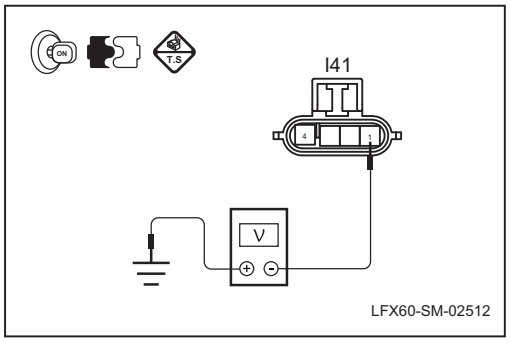
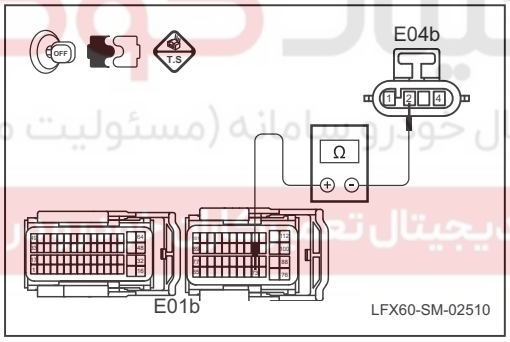
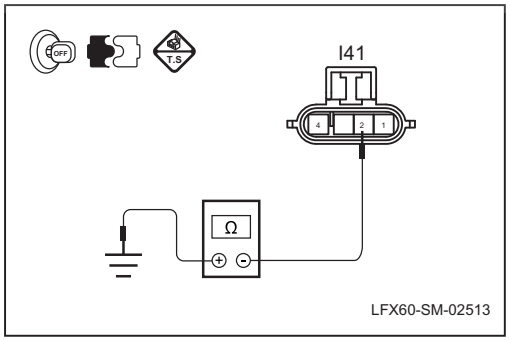
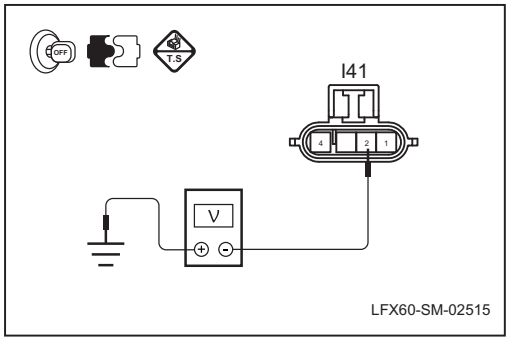
Test condition	Details/results/measures
3. Check the power circuit of rear oxygen sensor heater.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the rear oxygen sensor harness connectorI41. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #1 terminal of rear oxygen sensor harness plug I41 to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Check and remove the faults of rear oxygen sensor heater power circuit, and replace the harness if necessary.
4. Check the control circuit of rear oxygen sensor heater.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the rear oxygen sensor harness connectorI41. D. Disconnect the ECM harness connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of rear oxygen sensor harness plug I41 and #48 terminal of ECM harness plug E01b. **Standard value: Less than 5** F. Measure the resistance between the 2nd terminal of the oxygen sensor harness connector I41 and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the resistance of #2 terminal of rear oxygen sensor harness plug I41 to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of rear oxygen sensor heater power circuit, and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check the front oxygen sensor.	
	A. Measure the resistance between the rear oxygen sensor terminals 1 and 3 with a multimeter at room temperature. **Standard value: 7Ω~11Ω** Is it OK after checking? →**Yes** Step 6 →**No** Replace the rear oxygen sensor. **Refer to: Replacement of the rear oxygen sensor**
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0105, P0106, P0107, P0108

DTC description

DTC	Description	Definition
P0105	• No changes of inlet pressure sensor signals	• The engine control module provides a 5V reference voltage to the intake pressure sensor and provides the ground to the low level reference voltage circuit.According to the changes of inlet pressure, the inlet manifold pressure sensor provide voltage signals for engine control module via its signal circuit. #3 terminal of inlet pressure/ temperature sensor harness plug E10b is 5V power supply of inlet pressure/temperature sensor, its #1 terminal is the ground of inlet pressure/ temperature sensor, and its #4 terminal is the inlet pressure signal of inlet pressure sensor.
P0106	• Inappropriate measurement signals of inlet pressure sensor	
P0107	• Overlow voltage of inlet manifold pressure sensor circuit	
P0108	• Overhigh voltage of inlet manifold pressure sensor circuit	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0105 P0106 P0107 P0108	• Hardware or line check	• The engine control module monitors that its corresponding inlet pressure voltage and signal are not within the specified range.	• Fuel guide rail assembly • Intake pressure temperature sensor line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A.Check the intake pressure temperature sensor and engine control module harness connectors for damage, poor contact, aging, loosening and other similar signs. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A.Connect the equipment for diagnosing faults to the diagnostic interface. B.Operate the start switch to set the power mode to the “on” state. C.Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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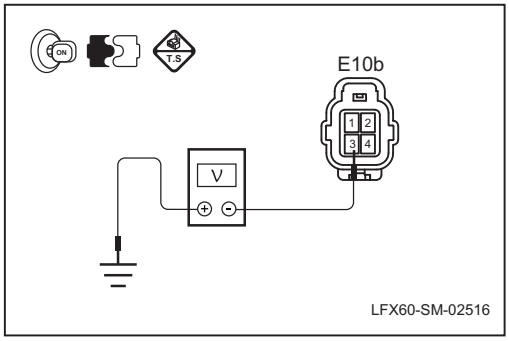
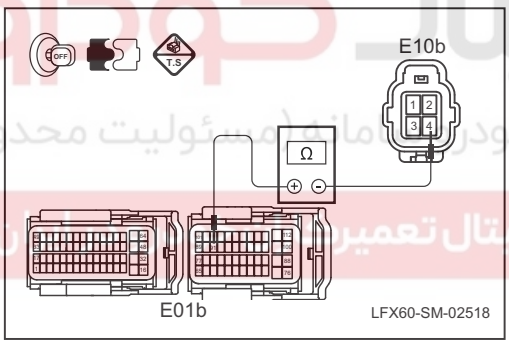
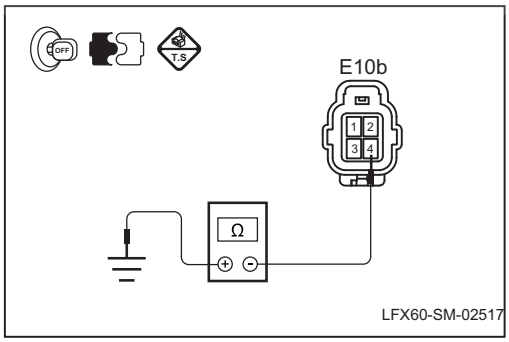
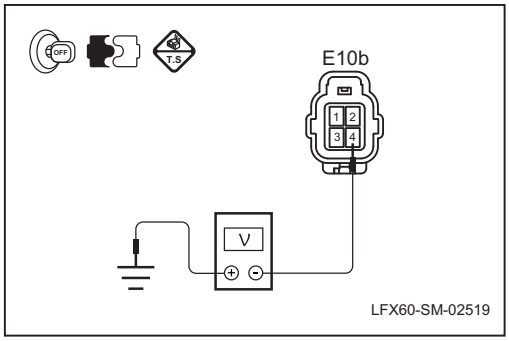
Test condition	Details/results/measures
3. Check the sensor power supply line for intake pressure.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the intake pressure temperature sensor harness connector E10b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Measure the voltage between the 3rd terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with the multimeter. Is the voltage normal? **Standard value: 4.5 ~ 5.5 V** **→Yes** Step 4. **→No** Overhaul the intake pressure sensor power supply line and replace the harness if necessary.
4. Check the signal circuit of inlet pressure sensor.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the intake pressure temperature sensor harness connector E10b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 4th terminal of the intake pressure temperature sensor harness connector E10b and the 91th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 4th terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the 4th terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of inlet pressure sensor signal circuit, and replace the harness if necessary.

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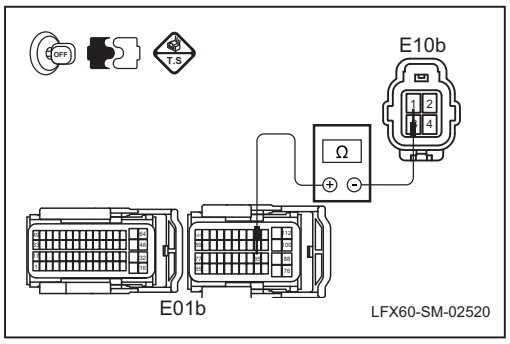
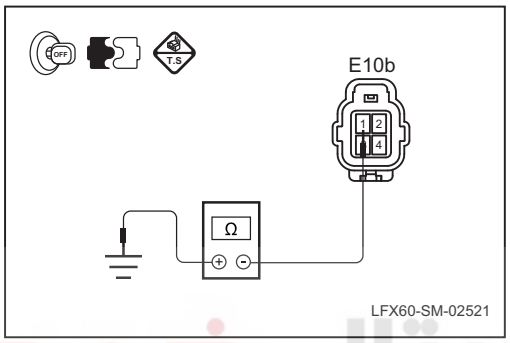
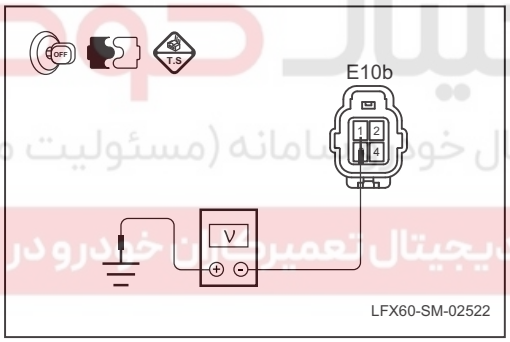
Test condition	Details/results/measures
5. Check the ground circuit of inlet pressure sensor.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the intake pressure temperature sensor harness connector E10b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 1th terminal of the intake pressure temperature sensor harness connector E10b and the 85th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 4th terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the 4th terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 6. **→No** Check and remove the faults of inlet pressure sensor ground circuit, and replace the harness if necessary.
6. Check the intake pressure temperature sensor.	
	A. Plug the inlet pressure/temperature sensor harness plug. B. Plug the engine control module harness plug. C. Connect the fault diagnostic unit to the diagnostic interface D. Activate the starting switch to make its power mode "ON". E. Adopt a diagnostic unit to read the data flows. **Standard value: ~101 kPa** Is it OK after checking? **→Yes** To step 7. **→No** Finish.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0112, P0113

DTC description

DTC	Description	Definition
P0112	• Overlow signal voltage of inlet manifold temperature sensor	• The engine control module provides a 5V reference voltage to the intake pressure sensor and provides the ground to the low level reference voltage circuit.Inlet temperature sensor is a negative temperature coefficient resistance. #3 terminal of inlet pressure/ temperature sensor harness plug E10b is 5V power supply of inlet pressure/temperature sensor, its #1 terminal is the ground of of inlet pressure/temperature sensor, and its #2 terminal is the inlet temperature signal of inlet temperature sensor.
P0113	• Overhigh signal voltage of inlet manifold temperature sensor	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0112 P0113	• Hardware or line check	• The engine control module monitors that its corresponding temperature voltage and signal are not within the specified range.	• Fuel guide rail assembly • Intake pressure temperature sensor line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the intake pressure temperature sensor and engine control module harness connectors for damage, poor contact, aging, loosening and other similar signs. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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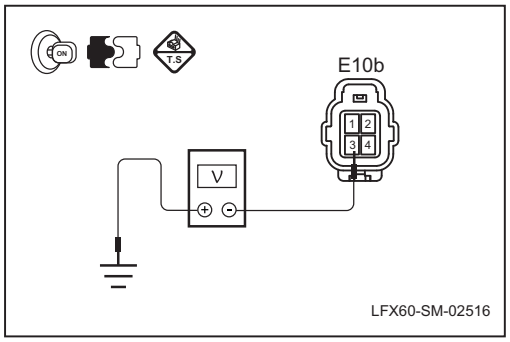
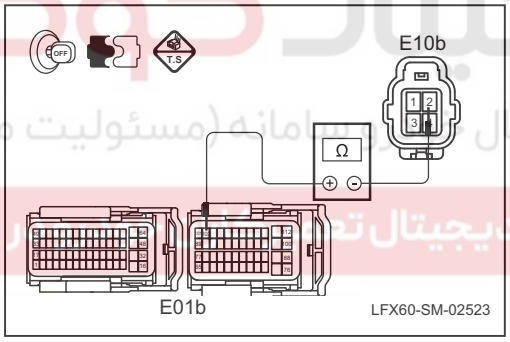
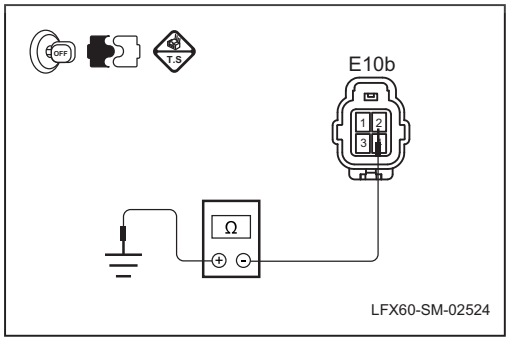
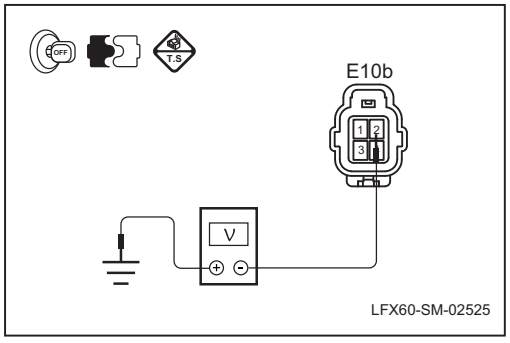
Test condition	Details/results/measures
3. Check the sensor power supply line for intake pressure.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the intake pressure temperature sensor harness connector E10b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Measure the voltage between the 3rd terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with the multimeter. Is the voltage normal? **Standard value: 4.5 ~ 5.5 V** **→Yes** Step 4. **→No** Overhaul the intake pressure sensor power supply line and replace the harness if necessary.
4. Check the signal circuit of inlet temperature sensor.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the intake pressure temperature sensor harness connector E10b. E. Disconnect the ECM harness connector E01b. F. Measure the resistance between the 2th terminal of the intake pressure temperature sensor harness connector E10b and the 102th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 2th terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the resistance between the 2th terminal of the intake pressure temperature sensor harness connector E10b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Troubleshoot the intake temperature sensor signal line and replace the harness if necessary.

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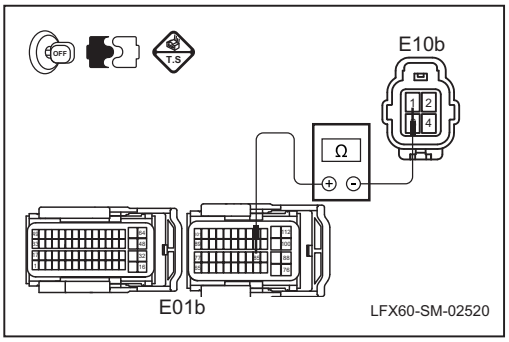
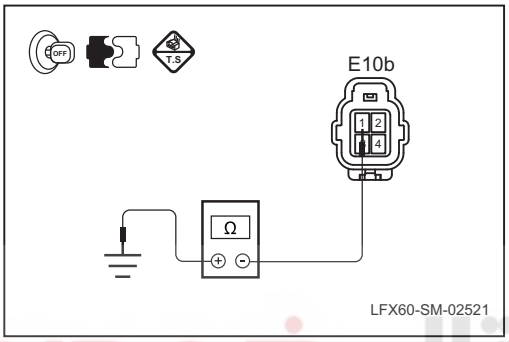
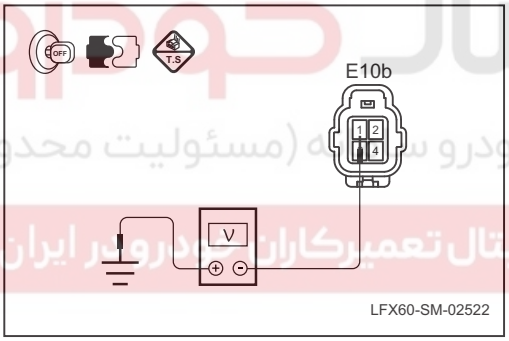
Test condition	Details/results/measures
5. Check the ground circuit of inlet temperature sensor.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the intake pressure temperature sensor harness connector E10b. D. Disconnect the ECM harness connector E01b. E. Connect the battery negative terminal. F. Adopt a multimeter to measure the resistance between #1 terminal of inlet pressure/temperature sensor harness plug E10b and #85 terminal of ECM harness plug E01b. **Standard value: Less than 5** G. Adopt a multimeter to measure the resistance of #1 terminal of inlet pressure/temperature sensor harness plug E10b to reliable ground. **Standard value: 10MΩ or higher** H. Connect the battery negative terminal. I. Adopt a multimeter to measure the voltage of #1 terminal of inlet pressure/temperature sensor harness plug E10b to reliable ground. **Standard value: 0V** Is it OK after checking? →**Yes** To step 6. →**No** Check and remove the faults of inlet temperature sensor ground circuit, and replace the harness if necessary.
6. Check the intake pressure temperature sensor.	
	A. Adopt a multimeter to measure the resistance between #2 and #1 terminals of inlet pressure/temperature sensor. **Standard value: Its rated resistance is 2.5kΩ±5% at 20°C.** Is it OK after checking? →**Yes** To step 7. →**No** Replace the inlet pressure/temperature sensor.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0117, P0118

DTC description

DTC	Description	Definition
P0117	• Overlow signal voltage of water temperature sensor	• Water temperature sensor is a variable resistor used to measure the temperature of engine cooling fluid. #3 terminal of water temperature sensor harness plug E23b is the signal of sensor, and #1 terminal of sensor harness plug E23b is the ground of sensor.
P0118	• Overhigh signal voltage of water temperature sensor	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0117	• Hardware or line check	• Engine control module monitors that water temperature is over its lower limit or below its upper limit.	• Fuel guide rail assembly • Intake pressure temperature sensor line • ECM
P0118			

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the harness plugs of water temperature sensor and engine control module for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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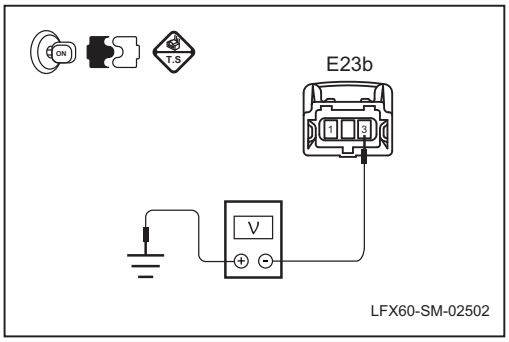
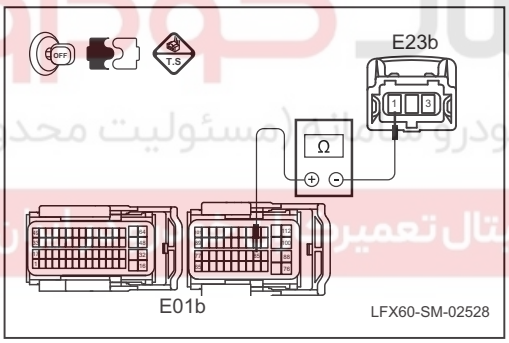
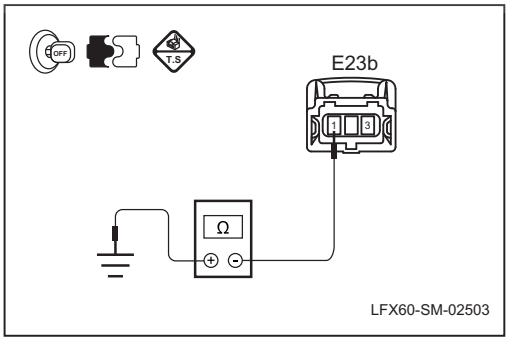
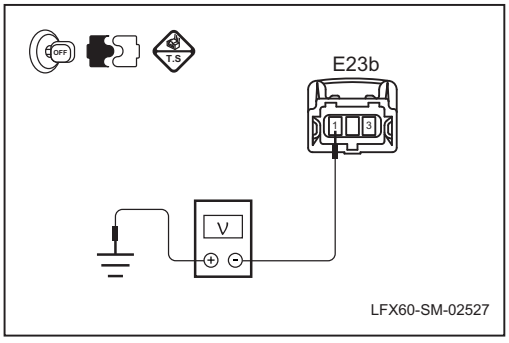
Test condition	Details/results/measures
3. Check the power circuit of water temperature sensor.	
	A .Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the water temperature sensor harness connector E23b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. Adopt a multimeter to measure the voltage of #3 terminal of water temperature sensor harness plug E23b to reliable ground. **Standard value: 4.5 ~ 5.5 V** Is the voltage normal? →**Yes** Step 4. →**No** Check and remove the faults of water temperature sensor power circuit, and replace the harness if necessary.
4. Check the ground circuit of water temperature sensor.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect water temperature sensor harness plug E32b. D. Disconnect the ECM harness connector E01b. E. Adopt a multimeter to measure the resistance between #1 terminal of water temperature sensor harness plug E23b and #85 terminal of ECM harness plug E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #1 terminal of water temperature sensor harness plug E23b to reliable ground. **Standard value: 10MΩ or higher** Connect the battery negative terminal. Adopt a multimeter to measure the resistance of #1 terminal of water temperature sensor harness plug E23b to reliable ground. **Standard value: 0V** Is it OK after checking? →**Yes** To step 5. →**No** Troubleshoot the water temperature sensor grounding line. If necessary, replace the harness.

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Test condition	Details/results/measures
5. Check the water temperature sensor.	
	A. Adopt a multimeter to measure the resistance between #2 and #1 terminals of water temperature sensor. **Standard value: (XXX) Ω** Is the resistance normal? →**Yes** To step 6. →**No** Replace the water temperature sensor. **Refer to: Replacement of the water temperature sensor**
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0121, P0122, P0123

DTC description

DTC	Description	Definition
P0121	• The electronic throttle position sensor 1 signal is unreasonable	• The engine control module monitors the throttle position sensor 1# and the sensor 2# signal to determine the position of the throttle. When the throttle position sensor signal line is abnormal, the engine control module sets this fault. The electronic-controlled throttle harness connector E22b terminal 3 is the throttle position sensor 5V power supply; terminal 6, throttle position sensor 1# signal; terminal 2, throttle position sensor ground.
P0122	• The throttle position sensor 1 signal circuit voltage exceeds the low limit	
P0123	• The electronic-controlled throttle position sensor 1 signal circuit voltage is too high	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0121	• Hardware or line check	• The fact that the electronically controlled throttle valve signal line is not within a reasonable range is detected by the engine control module	• Electronically controlled throttle valve • Electronically controlled throttle valve line • ECM
P0122			
P0123			

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the electronically controlled throttle valve and engine control module harness connectors for damage, poor contact, aging, loosening and other similar signs. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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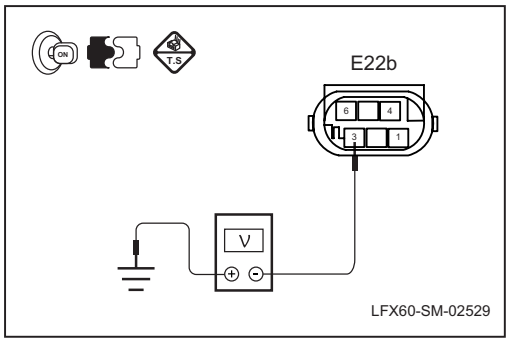
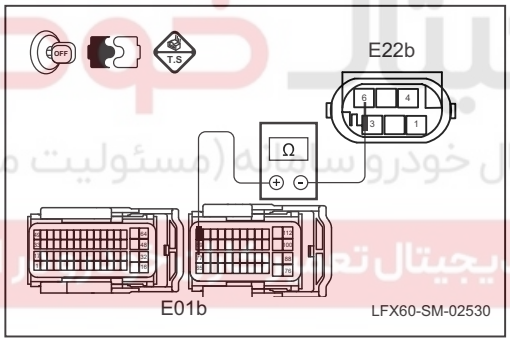
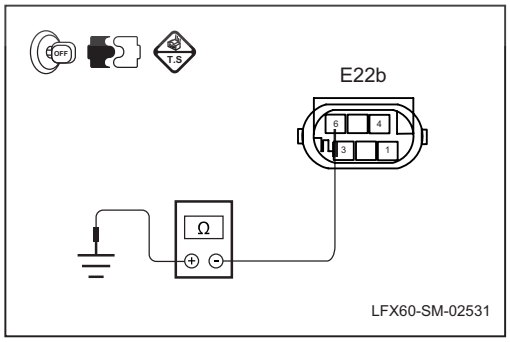
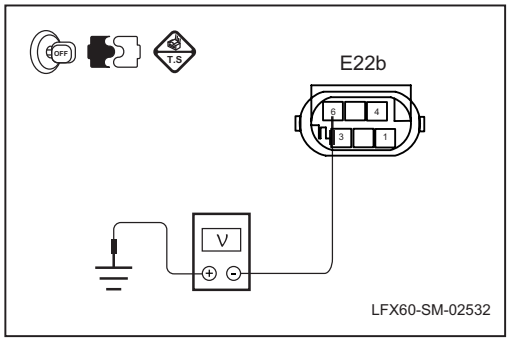
Test condition	Details/results/measures
3. Check the throttle valve position sensor power supply line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the electronically controlled throttle valve harness connector E22b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F.Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 3 and the reliable ground point with a multimeter. **Standard value: 4.5 ~ 5.5 V** Is the voltage normal? **→Yes** Step 4. **→No** Troubleshoot the throttle position sensor power supply line and replace the harness if necessary.
4. Check the throttle position sensor 1 signal line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the electronically controlled throttle valve harness connector E22b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 6th terminal of the electronically controlled throttle valve harness connector E22a and the 77th terminal of the ECM harness connector E01a with a multimeter. **Standard value: Less than 5** F. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 6 and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 6 and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Troubleshoot the throttle valve position sensor power supply line and replace the harness if necessary.

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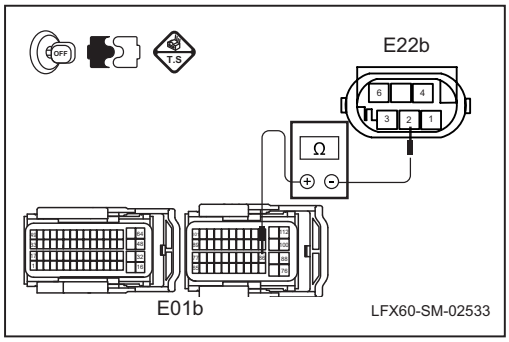
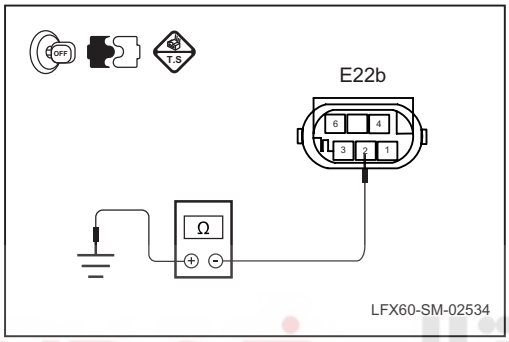
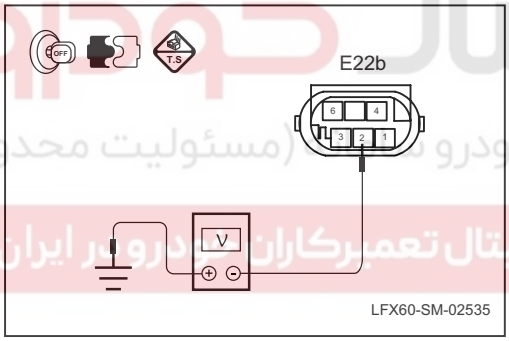
Test condition	Details/results/measures
5. Check the throttle position sensor 1 ground line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the electronically controlled throttle valve harness connector E22b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 2th terminal of the electronically controlled throttle valve harness connector E22a and the 86th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 2 and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** F. Connect the battery negative terminal. G. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 2 and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 6. **→No** Troubleshoot the electronically controlled throttle valve sensor ground line and replace the harness if necessary.
6. Check the throttle valve.	
	A. Replace the electronically controlled throttle valve. **Refer to: Replacement of electronically controlled throttle valve** Is it OK after checking? **→Yes** Replace the electronically controlled throttle valve. **→No** Step 7.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0130, P0131, P0132, P0133, P0134, P2195, P2196

DTC description

DTC	Description	Definition
P0130	• Inappropriate signals of upstream oxygen sensor	• Engine control module provides a ca.450mV reference voltage for front oxygen sensor. Front oxygen sensor heats and produces a 0 to 1V voltage signal while the engine is running. This voltage fluctuates above or below its reference voltage. The engine control module will enter into closed loop mode upon finding out that the voltage of front oxygen sensor exceeds its set threshold value, and the engine control module can determine its air-fuel ratio as per the voltage of front oxygen sensor. C terminal of front oxygen sensor harness plug EN10 is the signal of front oxygen sensor, and its D terminal is the ground of front oxygen sensor.
P0131	• Overlow voltage of upstream oxygen sensor signal circuit	
P0132	• Upstream oxygen sensor signal circuit voltage high	
P0133	• Aging of upstream oxygen sensor	
P0134	• Signal fault of upstream oxygen sensor circuit	
P2195	• Aging of upstream oxygen sensor (diluted)	
P2196	• Upstream oxygen sensor aging (dense)	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0130	• Checking the hardware or harness	• Engine control module detects that the signal voltage of front oxygen sensor is not within the appropriate range.	• Front oxygen sensor • Front oxygen sensor line • ECM
P0131			
P0132			
P0133			
P0134			
P2195			
P2196			

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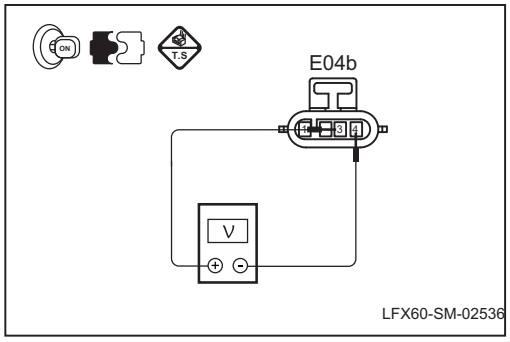
Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the front oxygen sensor and the engine control module harness connect for damage, poor contact, aging, loosening and other similar signs. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.
3. Check the heating circuit of front oxygen sensor.	
	A. Check the heating circuit of front oxygen sensor. **Refer to: P0030, P0031, P0032, P0053 troubleshooting** Is it OK after checking? →**Yes** Step 4. →**No** Check and repair the heating circuit of front oxygen sensor.
4. Check the voltage between the signal lines of the front oxygen sensor.	
	A. Operate the start switch to set the power mode to the “on” state. B. Adopt a multimeter to measure the voltage between #3 and #4 terminals of front oxygen sensor harness plug E04b. **Standard value: ~450mV** Is the voltage normal? →**Yes** To step 5. →**No** Troubleshoot the front oxygen sensor single line and replace the harness if necessary.

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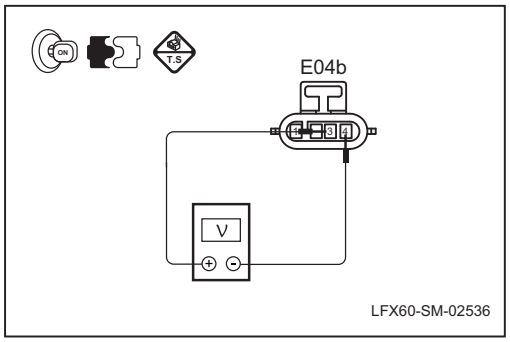
Test condition	Details/results/measures
5. Check the voltage between the signal lines of the front oxygen sensor.	
	A. Start the engine. B. Run until the temperature is the normal temperature, in idling mode. C. Adopt a multimeter to measure the voltage fluctuation between #3 and #4 terminals of front oxygen sensor harness plug E04b. **Standard value: 0 ~ 1V** Is the voltage normal? **→Yes** To step 6. **→No** Replace the front oxygen sensor.
6. Check the front oxygen sensor.	
	A. Measure the resistance between the front oxygen sensor terminals 3 and 4 with a multimeter at room temperature. **Standard value: 10MΩ or higher** Is the resistance normal? **→Yes** Step 7 **→No** Replace the front oxygen sensor.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0136, P0137, P0138, P0140, P2270 or P2271

DTC description

DTC	Description	Definition
P0136	• Rear oxygen sensor deceleration fuel cut-off response slow	• Engine control module provides a ca.450mV reference voltage for rear oxygen sensor. Rear oxygen sensor heats and produces a 0 to 1V voltage signal while the engine is running. This voltage fluctuates above or below its reference voltage. The engine control module will enter into closed loop mode upon finding out that the voltage of rear oxygen sensor exceeds its set threshold value, and the engine control module can determine its air-fuel ratio as per the voltage of rear oxygen sensor. 3 terminal of rear oxygen sensor harness plug I41 is the signal of rear oxygen sensor, and its 4 terminal is the ground of rear oxygen sensor.
P0137	• Downstream oxygen sensor signal circuit voltage low	
P0138	• Downstream oxygen sensor signal circuit voltage high	
P0140	• Downstream oxygen sensor circuit signal fault	
P2270	• Aging of downstream oxygen sensor (diluted)	
P2271	• Downstream oxygen sensor aging	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0136 P0137 P0138 P0140 P2270 P227	• Checking the hardware or harness	• Engine control module detects that the signal voltage of rear oxygen sensor is not within the appropriate range.	• Front oxygen sensor • Front oxygen sensor line • ECM

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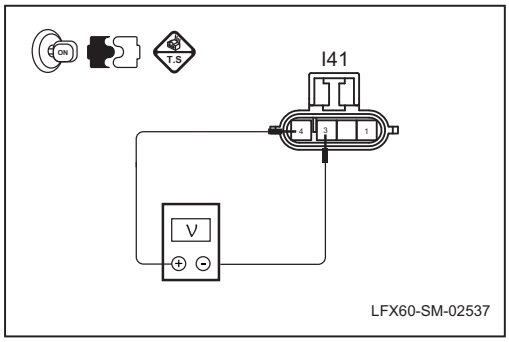
Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the rear oxygen sensor and the engine control module harness connect for damage, poor contact, aging, loosening and other similar signs. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.
3. Check the heating circuit of rear oxygen sensor.	
	A. Check the heating circuit of rear oxygen sensor.. **Refer to: P0036, P0037, P0038, P0054 troubleshooting** Is it OK after checking? →**Yes** Step 4. →**No** Check and repair the heating circuit of rear oxygen sensor.
4. Check the voltage between the signal lines of the rear oxygen sensor.	
	A. Operate the start switch to set the power mode to the “on” state. B. Adopt a multimeter to measure the voltage between #3 and #4 terminals of rear oxygen sensor harness plug I41. **Standard value: ~450mV** Is it OK after checking? →**Yes** To step 5. →**No** Troubleshoot the rear oxygen sensor single line and replace the harness if necessary.

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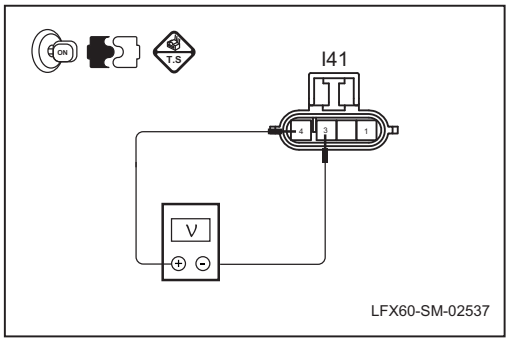
Test condition	Details/results/measures
5. Check the voltage between the signal lines of the rear oxygen sensor.	
	A. Start the engine. Run until the temperature is the normal temperature, in idling mode. Adopt a multimeter to measure the voltage fluctuation between #3 and #4 terminals of rear oxygen sensor harness plug I41. **Standard value: 0 ~ 1V** Is it OK after checking? **→Yes** To step 6. **→No** Replace the rear oxygen sensor.
6. Check the front oxygen sensor.	
	A. Measure the resistance between the rear oxygen sensor terminals 3 and 4 with a multimeter at room temperature. **Standard value: 10MΩ or higher** Is the resistance normal? **→Yes** Step 7. **→No** Replace the rear oxygen sensor.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0201, P0261, P0262

DTC description

DTC	Description	Definition
P0201	• Signal fault of #1 cylinder fuel injector	• The engine control module controls the main relay to supply power to the injector. The engine control module is directly connected to the injector to provide a grounding signal to drive the injector to operate. The engine control module monitors the status of each injector drive line. If the fact that the voltage corresponding to the drive line command status is incorrect is detected, the trouble code of the relevant injector control circuit fault will be set.#1 terminal of #1 cylinder fuel injector harness plug E13b is the power supply of fuel injector, and its #2 terminal is a drive signal.
P0261	• #1 cylinder fuel injector control circuit short to ground	
P0262	• #1 cylinder fuel injector control circuit short to power supply	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0201 P0261 P0262	• Checking the hardware or harness	• The fact that the voltage corresponding to the injector drive line command status is incorrect is detected by the engine control module.	• Injector • Injector line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the harness plugs of #1 cylinder fuel injector and engine control module for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A.Connect the equipment for diagnosing faults to the diagnostic interface. B.Operate the start switch to set the power mode to the “on” state. C.Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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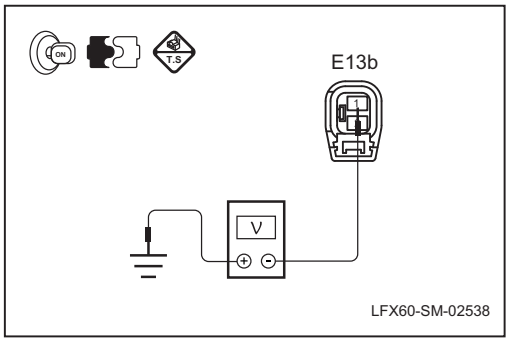
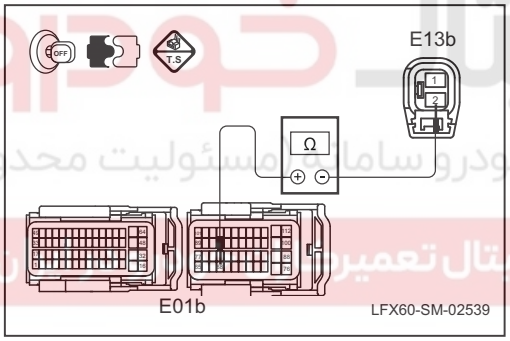
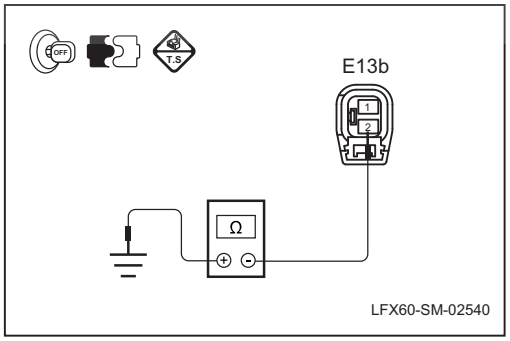
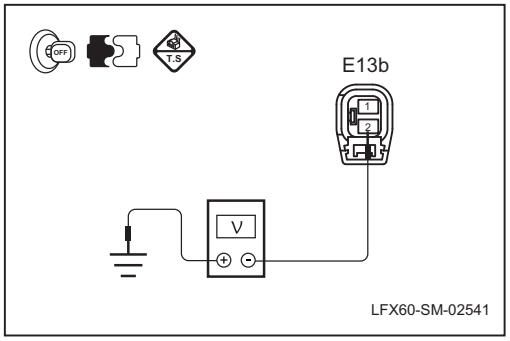
Test condition	Details/results/measures
3. Check the power circuit of #1 cylinder fuel injector.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #1 cylinder fuel injector plug E13b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #1 terminal of #1 cylinder fuel injector harness plug E13b to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Check and remove the faults of #1 cylinder fuel injector power circuit, and replace the harness if necessary.
4. Check the drive signal circuit of #1 cylinder fuel injector.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #1 cylinder fuel injector harness plug E13b. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of #1 cylinder fuel injector harness plug E13b and #68 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #1 terminal of #2 cylinder fuel injector harness plug E13b to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #1 terminal of #2 cylinder fuel injector harness plug E13b to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of #1 cylinder fuel injector drive signal circuit, and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check #1 cylinder fuel injector.	
	A. Adopt a multimeter to measure the resistance between #1 and #2 terminals of #1 cylinder fuel injector. **Standard value: Injector resistance 12 at 20°C** Is the voltage normal? →Yes Step 6. →No Replace #1 cylinder fuel injector. **Refer to: Replacement of the injector**
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0202, P0264, P0265

DTC description

DTC	Description	Definition
P0202	• Signal fault of #2 cylinder fuel injector	• The engine control module controls the main relay to supply power to the injector. The engine control module is directly connected to the injector to provide a grounding signal to drive the injector to operate. The engine control module monitors the status of each injector drive line. If the fact that the voltage corresponding to the drive line command status is incorrect is detected, the trouble code of the relevant injector control circuit fault will be set. #2 terminal of #1 cylinder fuel injector harness plug E14b is the power supply of fuel injector, and its #2 terminal is a drive signal.
P0264	• Cylinder 2 injector control circuit short to ground	
P0265	• Cylinder 2 injector control circuit short to power	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0202 P0264 P0265	• Checking the hardware or harness	• The fact that the voltage corresponding to the injector drive line command status is incorrect is detected by the engine control module.	• Injector • Injector line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the harness plugs of #2 cylinder fuel injector and engine control module for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A.Connect the equipment for diagnosing faults to the diagnostic interface. B.Operate the start switch to set the power mode to the “on” state. C.Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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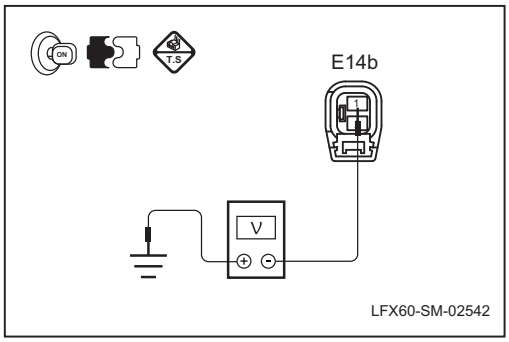
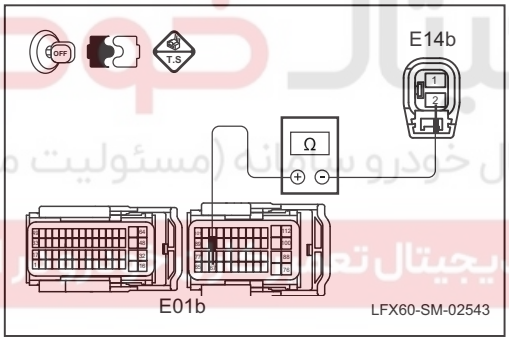
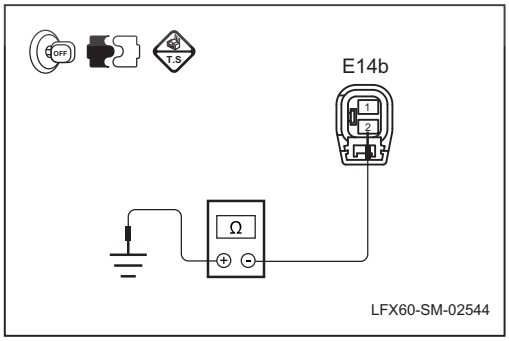
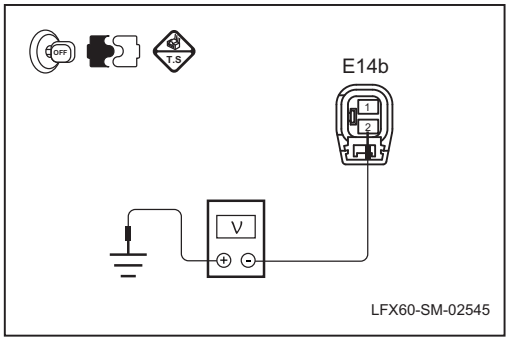
Test condition	Details/results/measures
3. Check the power circuit of #2 cylinder fuel injector.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #2 cylinder fuel injector plug E14b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #2 terminal of #1 cylinder fuel injector harness plug E14b to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Check and remove the faults of #2 cylinder fuel injector power circuit, and replace the harness if necessary.
4. Check the drive signal circuit of #2 cylinder fuel injector.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #2 cylinder fuel injector harness plug E14b. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of #2 cylinder fuel injector harness plug E14b and #67 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #2 terminal of #2 cylinder fuel injector harness plug E14b to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #2 terminal of #2 cylinder fuel injector harness plug E14b to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of #2 cylinder fuel injector drive signal circuit, and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check #2 cylinder fuel injector.	
	A. Adopt a multimeter to measure the resistance between #1 and #2 terminals of #2 cylinder fuel injector. **Standard value: Injector resistance 12 at 20°C** Is the voltage normal? →**Yes** Step 6. →**No** Replace #2 cylinder fuel injector.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0203, P0267, P0268

DTC description

DTC	Description	Definition
P0203	• Signal fault of #3 cylinder fuel injector	• The engine control module controls the main relay to supply power to the injector. The engine control module is directly connected to the injector to provide a grounding signal to drive the injector to operate. The engine control module monitors the status of each injector drive line. If the fact that the voltage corresponding to the drive line command status is incorrect is detected, the trouble code of the relevant injector control circuit fault will be set. #3 terminal of #1 cylinder fuel injector harness plug E15b is the power supply of fuel injector, and its #2 terminal is a drive signal.
P0267	• Cylinder 3 injector control circuit short to ground	
P0268	• Cylinder 3 injector control circuit short to power	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0203	• Checking the hardware or harness	• The fact that the voltage corresponding to the injector drive line command status is incorrect is detected by the engine control module.	• Injector • Injector line • ECM
P0267			
P0268			

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A.Check the harness plugs of #3 cylinder fuel injector and engine control module for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A.Connect the equipment for diagnosing faults to the diagnostic interface. B.Operate the start switch to set the power mode to the “on” state. C.Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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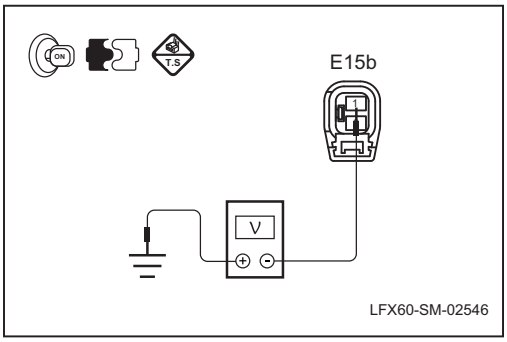
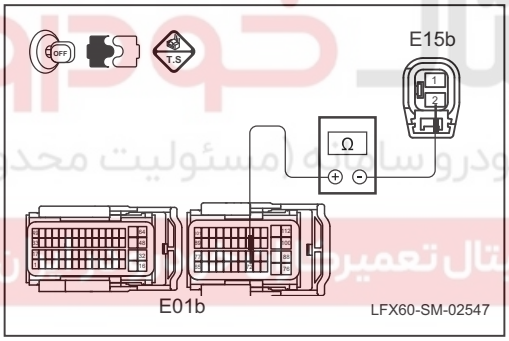
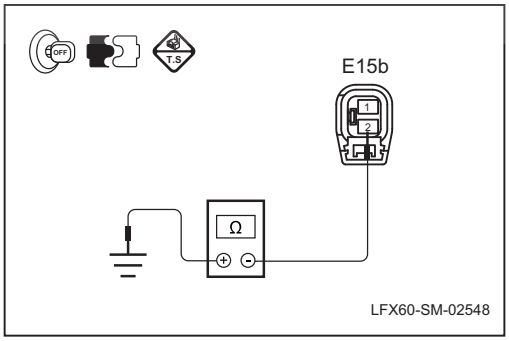
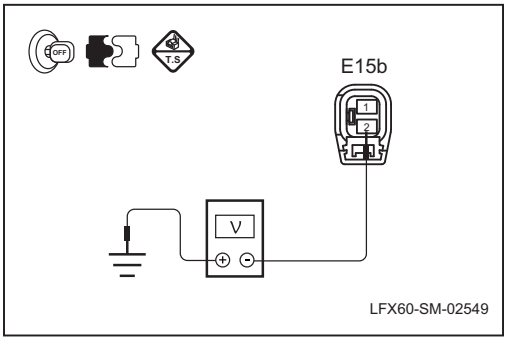
Test condition	Details/results/measures
3. Check the power circuit of #3 cylinder fuel injector.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #3 cylinder fuel injector plug E15b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #3 terminal of #1 cylinder fuel injector harness plug E15b to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** Step 4. →**No** Check and remove the faults of #3 cylinder fuel injector power circuit, and replace the harness if necessary.
4. Check the drive signal circuit of #3 cylinder fuel injector.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #3 cylinder fuel injector plug E15b. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #3 terminal of #2 cylinder fuel injector harness plug E15b and #72 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #3 terminal of #2 cylinder fuel injector harness plug E15b to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #3 terminal of #2 cylinder fuel injector harness plug E15b to reliable ground. **Standard value: 0V** Is it OK after checking? →**Yes** To step 5. →**No** Check and remove the faults of #3 cylinder fuel injector drive signal circuit, and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check #3 cylinder fuel injector.	
	A. Adopt a multimeter to measure the resistance between #1 and #2 terminals of #3 cylinder fuel injector. **Standard value: Injector resistance 12 at 20°C** Is the resistance normal? →**Yes** Step 6. →**No** Replace #3 cylinder fuel injector.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0204, P0270, P0271

DTC description

DTC	Description	Definition
P0204	• Signal fault of #4 cylinder fuel injector	• The engine control module controls the main relay to supply power to the injector. The engine control module is directly connected to the injector to provide a grounding signal to drive the injector to operate. The engine control module monitors the status of each injector drive line. If the fact that the voltage corresponding to the drive line command status is incorrect is detected, the trouble code of the relevant injector control circuit fault will be set. #4 terminal of #1 cylinder fuel injector harness plug E15b is the power supply of fuel injector, and its #2 terminal is a drive signal.
P0270	• Cylinder 4 injector control circuit short to ground	
P0271	• Cylinder 2 injector control circuit short to power	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0204 P0270 P0271	• Checking the hardware or harness	• The fact that the voltage corresponding to the injector drive line command status is incorrect is detected by the engine control module.	• Injector • Injector line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A.Check the harness plugs of #4 cylinder fuel injector and engine control module for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A.Connect the equipment for diagnosing faults to the diagnostic interface. B.Operate the start switch to set the power mode to the “on” state. C.Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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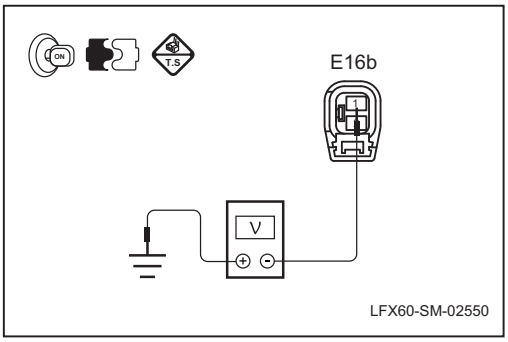
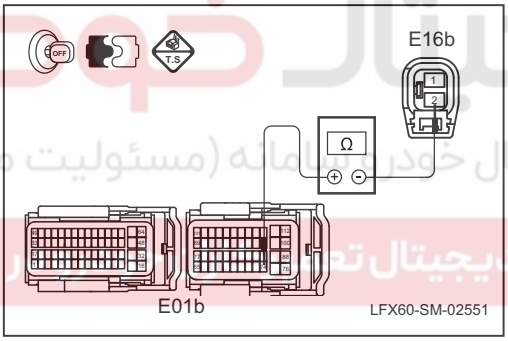
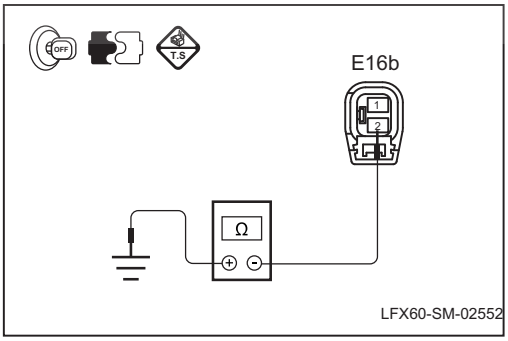
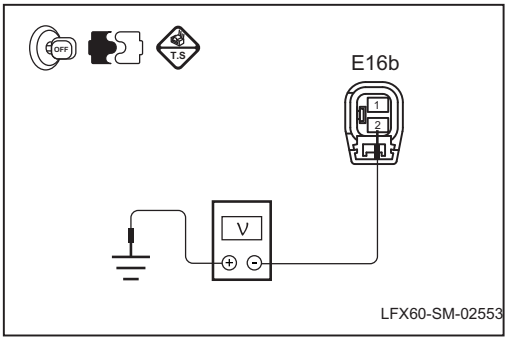
Test condition	Details/results/measures
3. Check the power circuit of #4 cylinder fuel injector.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #4 cylinder fuel injector plug E16b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #4 terminal of #1 cylinder fuel injector harness plug E16b to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** Step 4. →**No** Check and remove the faults of #4 cylinder fuel injector power circuit, and replace the harness if necessary.
4. Check the drive signal circuit of #4 cylinder fuel injector.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect #4 cylinder fuel injector plug E16b. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #4 terminal of #2 cylinder fuel injector harness plug E01b and #74 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #4 terminal of #2 cylinder fuel injector harness plug E16b to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #4 terminal of #2 cylinder fuel injector harness plug E15b to reliable ground. **Standard value: 0V** Is it OK after checking? →**Yes** To step 5. →**No** Check and remove the faults of #4 cylinder fuel injector drive signal circuit, and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check #4 cylinder fuel injector.	
	A. Adopt a multimeter to measure the resistance between #1 and #2 terminals of #4 cylinder fuel injector. **Standard value: Injector resistance 12 at 20°C** Is the voltage normal? →**Yes** Step 6. →**No** Replace #4 cylinder fuel injector.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0219

DTC description

DTC	Description	Definition
P0219	• The speed of engine exceeds its maximum speed limit.	• The engine control module detects the speed of engine via its crankshaft position sensor. When the speed of engine is over its upper limit, this fault code is set. When the electronic accelerator pedal or throttle valve is seized in higher opening position, the speed of engine will exceed its upper limit.

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0219	• Checking the hardware or harness	• Engine control module detects that its speed signal exceeds its upper limit.	• Electronic accelerator pedal or its circuit • Electronic throttle valve or its circuit • Crankshaft position sensor or its circuit • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the electronic accelerator pedal, electronic throttle valve, crankshaft position sensor and engine control module harness plugs for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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Test condition	Details/results/measures
3. Check the faults of electronic accelerator pedal.	
	A. Check the faults of electronic accelerator pedal. **Refer to: DTC TROUBLESHOOTING TABLE** Is it OK after checking? →**Yes** Step 4. →**No** Troubleshoot the electronic accelerator pedal.
4. Check the electronically controlled throttle valve for faults.	
	A. Check the electronically controlled throttle valve for faults. **Refer to: "P0121, P0122, P0123", "P0221, P0222, P0223"** Fault diagnosis Is it OK after checking? →**Yes** Step 5. →**No** Troubleshoot the electronic accelerator pedal.
5. Check the faults of crankshaft position sensor.	
	A. Check the faults of crankshaft position sensor. **Refer to: "P0322" troubleshooting** Is it OK after checking? →**Yes** Step 6. →**No** Remove the faults of crankshaft position sensor.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0221, P0222, P0223

DTC description

DTC	Description	Definition
P0221	• The electronic throttle position sensor 2 signal is unreasonable	• The engine control module monitors the throttle position sensor 1# and the sensor 2# signal to determine the position of the throttle. When the throttle position sensor signal line is abnormal, the engine control module sets this fault. The electronic-controlled throttle harness connector E22b terminal 3 is the throttle position sensor 5V power supply; terminal 5, throttle position sensor 2Ib signal; terminal 2, throttle position sensor ground.
P0222	• The throttle position sensor 2 signal circuit voltage exceeds the low limit	
P0223	• The electronic-controlled throttle position sensor 2 signal circuit voltage is too high	

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0221	• Hardware or line check	• The fact that the electronically controlled throttle valve signal line is not within a reasonable range is detected by the engine control module	• Electronically controlled throttle valve • Electronically controlled throttle valve line • ECM
P0222			
P0223			

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the electronically controlled throttle valve and engine control module harness connectors for damage, poor contact, aging, loosening and other similar signs. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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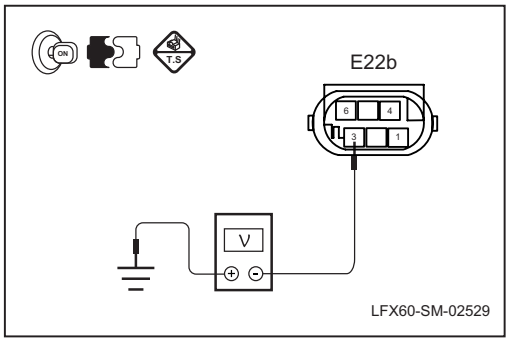
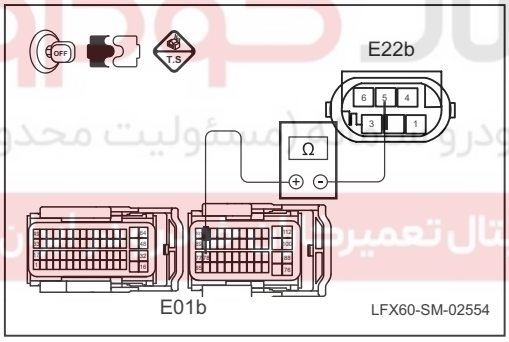
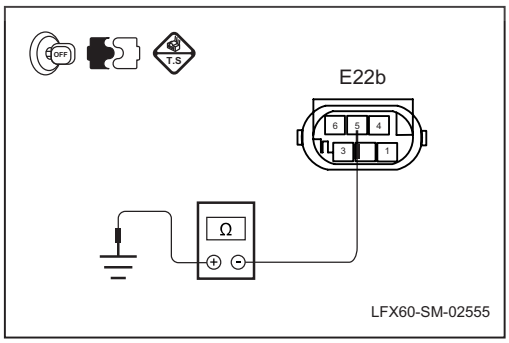
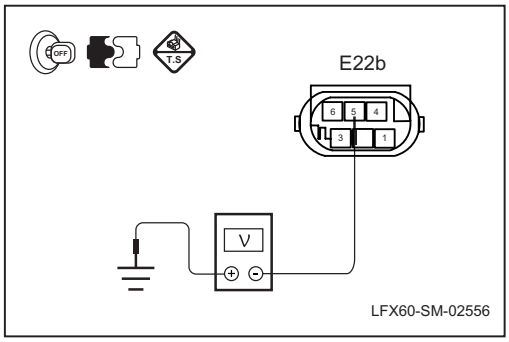
Test condition	Details/results/measures
3. Check the throttle valve position sensor power supply line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the electronically controlled throttle valve harness connector E22b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 3 and the reliable ground point with a multimeter. **Standard value: 4.5 ~ 5.5 V** Is the voltage normal? →**Yes** Step 4. →**No** Troubleshoot the throttle position sensor power supply line and replace the harness if necessary.
4. Check the throttle position sensor 2 signal line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the electronically controlled throttle valve harness connector E22b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 5th terminal of the electronically controlled throttle valve harness connector E22a and the 78th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 5 and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 5 and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? →**Yes** To step 5. →**No** Troubleshoot the throttle valve position sensor 2 power supply line and replace the harness if necessary.

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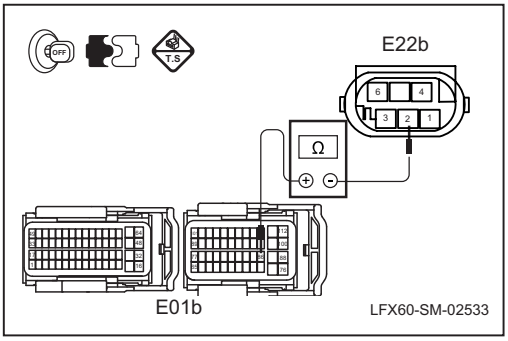
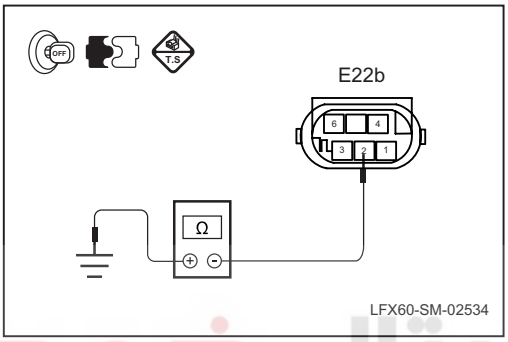
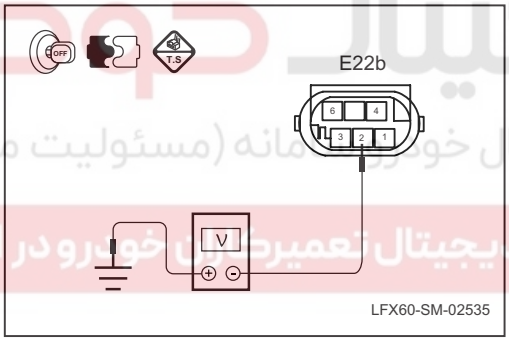
Test condition	Details/results/measures
5. Check the throttle position sensor 1 ground line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the electronically controlled throttle valve harness connector E22b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 2th terminal of the electronically controlled throttle valve harness connector E22a and the 86th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 2 and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the electronically controlled throttle valve harness connector E22b terminal 2 and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 6. **→No** Troubleshoot the electronically controlled throttle valve sensor ground line and replace the harness if necessary.
6. Check the throttle valve.	
	A. Replace the electronically controlled throttle valve. **Refer to: Replacement of electronically controlled throttle valve** Is it OK after checking? **→Yes** Replace the electronically controlled throttle valve. **→No** Step 7.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0300, P0301, P0302, P0303 or P0304

DTC description

DTC	Description
P0300	• Multi-cylinder misfire
P0301	• Cylinder 1 misfire
P0302	• Cylinder 2 misfire
P0303	• Cylinder 3 misfire
P0304	• Cylinder 4 misfire

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0300 P0301 P0302 P0303 P0304	• Hardware or line check	• Misfire rate of damaged catalyst • Misfire rate for causing deteriorated emission • Incredible error	• Ignition coils • Ignition coil circuit • Spark plugs • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the ignition coil and engine control module harness plugs for damages, poor contact, aging or loosening, etc. B. Check the spark plug for damages. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Check the fault codes.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Adopt a diagnostic unit to check whether any fault code of fuel injector exists. Is it OK after checking? →**Yes** **Refer to: Diagnosis of relevant fuel injector faults** →**No** To step 3.

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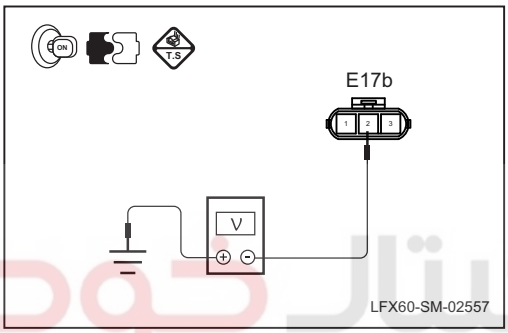
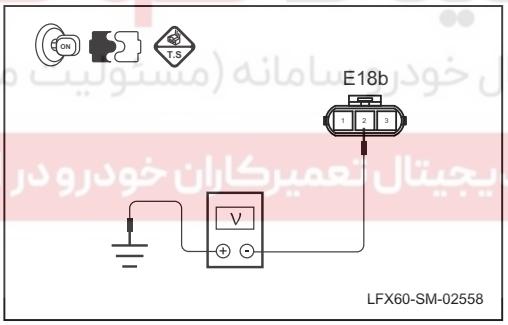
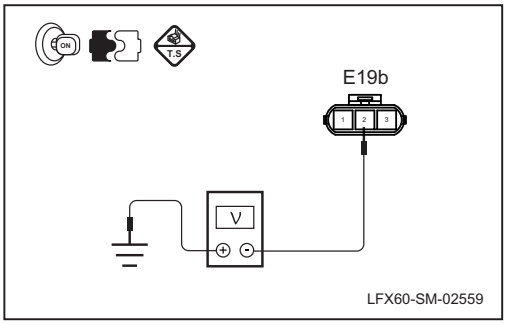
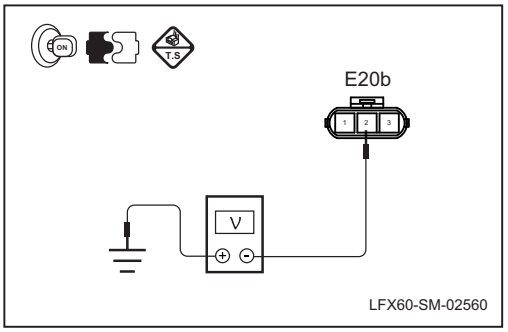
Test condition	Details/results/measures
3. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 4. →**No** Finish.
4. Check the ignition coil power supply line.	
   	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ignition coil 1 harness connector E17b. D. Disconnect the ignition coil 2 harness connector E18b. E. Disconnect the ignition coil 3 harness connector E19b. F. Disconnect the ignition coil 4 harness connector E20b. G. Connect the battery negative terminal. H. Operate the start switch to set the power mode to the “on” state. I. Measure the voltage between the ignition coil harness connector E17a terminal 2 and the reliable ground point with a multimeter. J. Measure the voltage between the ignition coil harness connector E18b terminal 2 and the reliable ground point with a multimeter. K. Measure the voltage between the ignition coil harness connector E19b terminal 2 and the reliable ground point with a multimeter. L. Measure the voltage between the ignition coil harness connector E20b terminal 1 and the reliable ground point with a multimeter. **Standard value: 10 ~ 14V** Is the voltage normal? →**Yes** Step 5. →**No** Troubleshoot the ignition coil power supply line and replace the harness if necessary.

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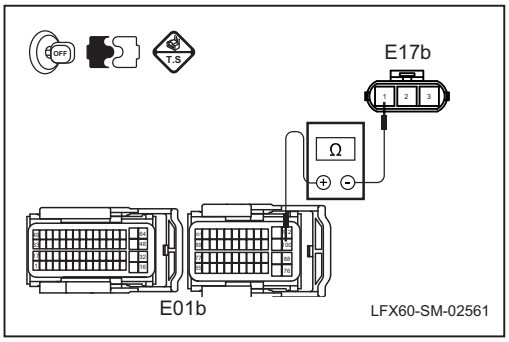
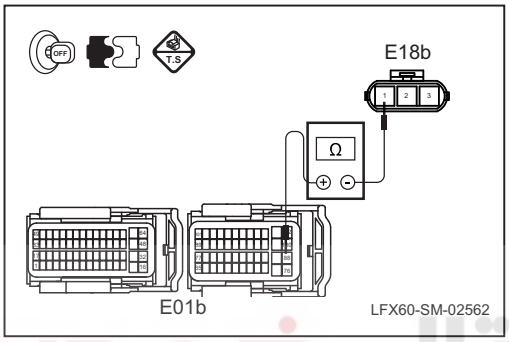
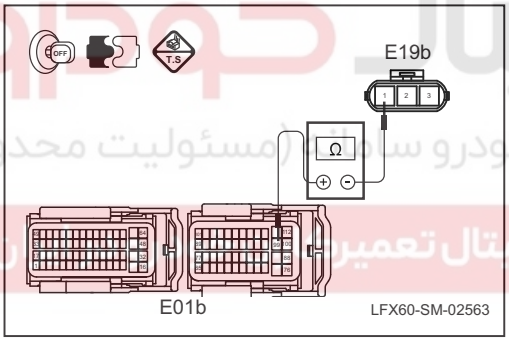
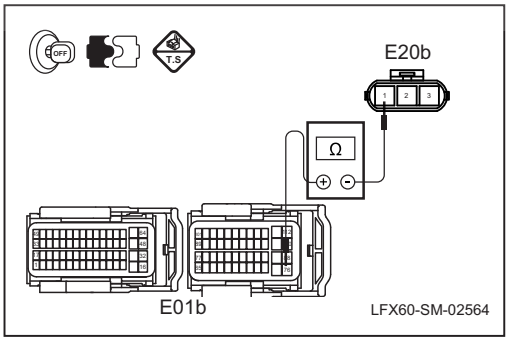
Test condition	Details/results/measures
5. Check whether the control circuit of ignition coil is open.	
   	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ignition coil 1 harness connector E17b. D. Disconnect the ignition coil 2 harness connector E18b. E. Disconnect the ignition coil 3 harness connector E19b. F. Disconnect the ignition coil 4 harness connector E20b. G. Disconnect the ECM harness connector E01b. H. Adopt a multimeter to measure the resistance between #1 terminal of ignition coil harness plug E17b and #100 terminal of ECM harness plug E01b. I. Adopt a multimeter to measure the resistance between #1 terminal of ignition coil harness plug E18b and #88 terminal of ECM harness plug E01b. J. Adopt a multimeter to measure the resistance between #1 terminal of ignition coil harness plug E19b and #99 terminal of ECM harness plug E01b. K. Adopt a multimeter to measure the resistance between #1 terminal of ignition coil harness plug E20b and #76 terminal of ECM harness plug E01b. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 6. →**No** Check and remove the open circuit fault of ignition coil control circuit, and replace the harness if necessary.

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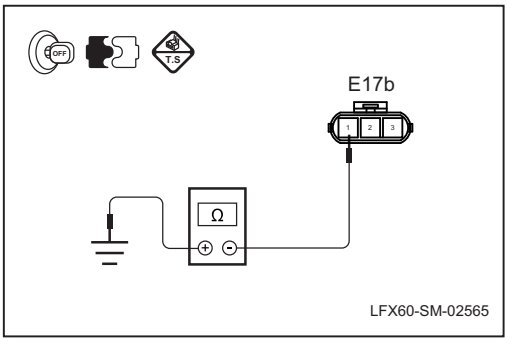
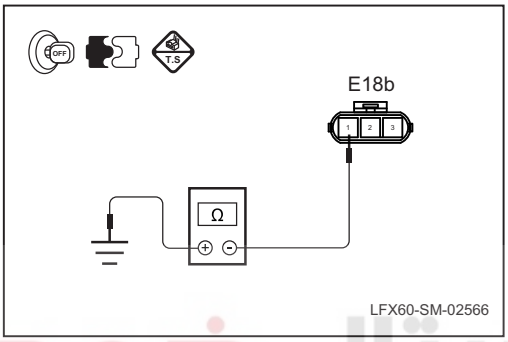
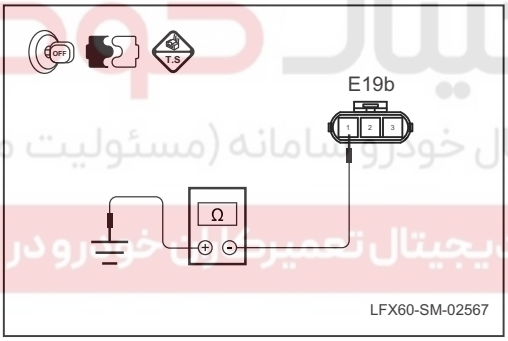
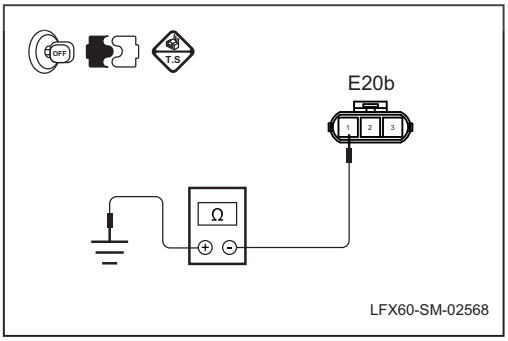
Test condition	Details/results/measures
6. Check whether the ignition coil control circuit is short to ground.	
   	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ignition coil 1 harness connector E17b. D. Disconnect the ignition coil 2 harness connector E18b. E. Disconnect the ignition coil 3 harness connector E19b. F. Disconnect the ignition coil 4 harness connector E20b. G. Disconnect the ECM harness connector E01b. H. Adopt a multimeter to measure the resistance of #1 terminal of ignition coil harness plug E17b to reliable ground. I. Adopt a multimeter to measure the resistance of #1 terminal of ignition coil harness plug E18b to reliable ground. J. Adopt a multimeter to measure the resistance of #1 terminal of ignition coil harness plug E19b to reliable ground. K. Adopt a multimeter to measure the resistance of #1 terminal of ignition coil harness plug E20b to reliable ground. **Standard value: 10MΩ or higher** Is the resistance normal? →**Yes** To step 7. →**No** Check the ignition coil power supply line for the short-to-ground fault and repair it. Replace the harness if necessary.

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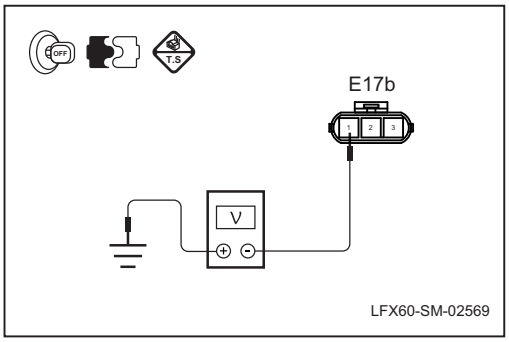
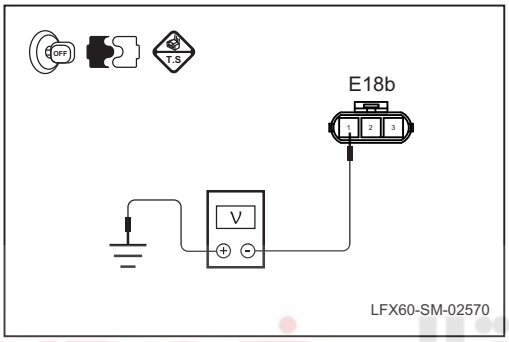
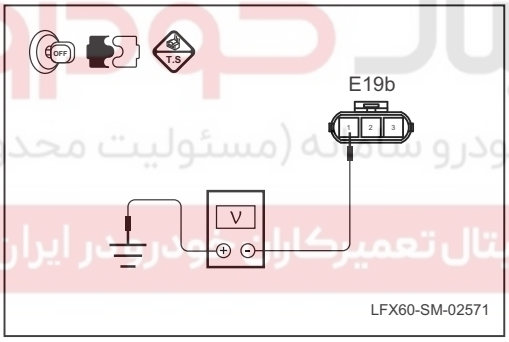
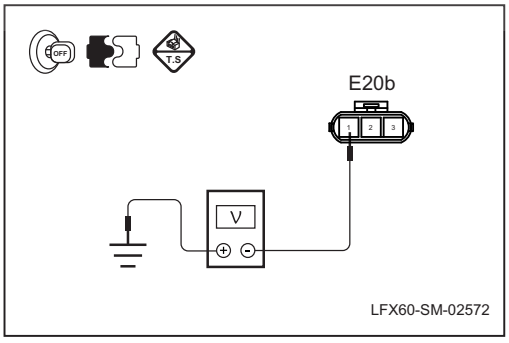
Test condition	Details/results/measures
7. Check whether the control circuit of ignition coil is short to power supply.	
   	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ignition coil 1 harness connector E17b. D. Disconnect the ignition coil 2 harness connector E18b. E. Disconnect the ignition coil 3 harness connector E19b. F. Disconnect the ignition coil 4 harness connector E20b. G. Disconnect the ECM harness connector E01b. H. Connect the battery negative terminal. I. Measure the voltage between the ignition coil harness connector E17a terminal 1 and the reliable ground point with a multimeter. J. Measure the voltage between the ignition coil harness connector E18b terminal 1 and the reliable ground point with a multimeter. K. Measure the voltage between the ignition coil harness connector E19b terminal 1 and the reliable ground point with a multimeter. L. Measure the voltage between the ignition coil harness connector E20b terminal 1 and the reliable ground point with a multimeter. **Standard value: 0V** Is the voltage normal? **→Yes** To step 8. **→No** Check and remove the short circuit fault of ignition coil control circuit to power supply, and replace the harness if necessary.

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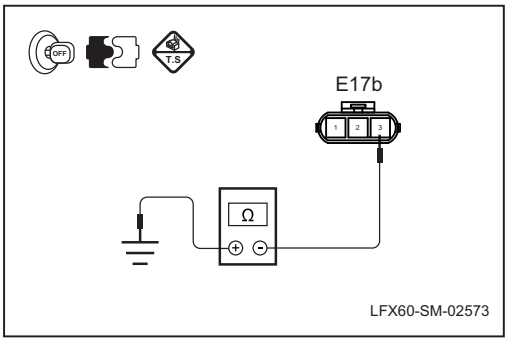
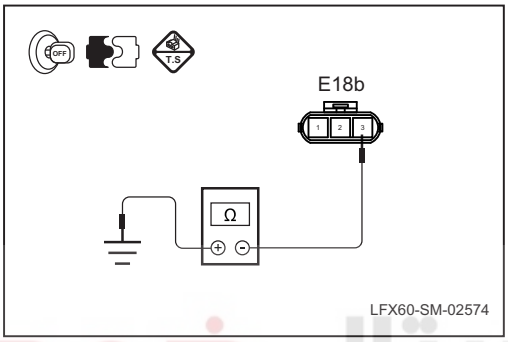
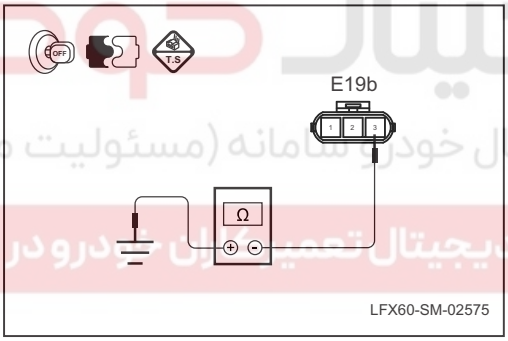
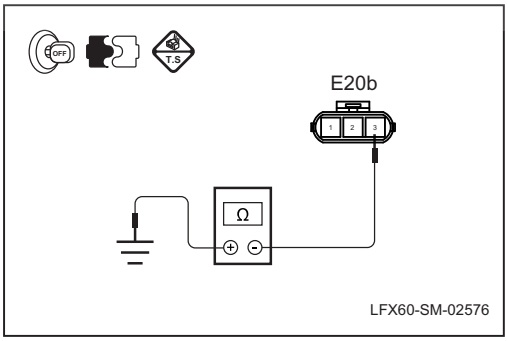
Test condition	Details/results/measures
8. Check the ignition coil ground line.	
   	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ignition coil 1 harness connector E17b. D. Disconnect the ignition coil 2 harness connector E18b. E. Disconnect the ignition coil 3 harness connector E19b. F. Disconnect the ignition coil 4 harness connector E20b. G. Adopt a multimeter to measure the resistance of #3 terminal of ignition coil harness plug E17b to reliable ground. H. Adopt a multimeter to measure the resistance of #3 terminal of ignition coil harness plug E18b to reliable ground. I. Adopt a multimeter to measure the resistance of #3 terminal of ignition coil harness plug E19b to reliable ground. J. Adopt a multimeter to measure the resistance of #3 terminal of ignition coil harness plug E20b to reliable ground. **Standard value: Less than 5** Is the voltage normal? →**Yes** To step 9. →**No** Check the ignition coil power supply line for the short-to-ground fault and repair it. Replace the harness if necessary.

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Test condition	Details/results/measures
9. Check the ignition coil.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the harness plug of ignition coil. D. Measure the initial coil resistance and secondary coil resistance of ignition coil. **Standard value: Initial coil resistance: 530mΩX (1±12%)** **Standard value: Secondary coil resistance: 9.3kΩX(1±12%)** Is it OK after checking? →**Yes** Step 10. →**No** Replace Ignition coils. **Refer to: Ignition coil replacement**
10. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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DTC P0322

DTC description

DTC	Description
P0322	• Signal faults of speed sensor

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0322	• Checking the hardware or harness	• The number of detected signal faults of speed sensor is more than 5.	• Crankshaft position sensor • Crankshaft position sensor circuit • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the crankshaft position sensor and engine control module harness plugs for damages, poor contact, aging or loosening, etc. B. Check whether the crankshaft position sensor is wrong installed or its disc is damaged. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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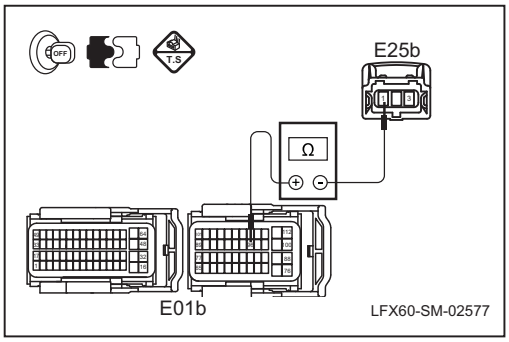
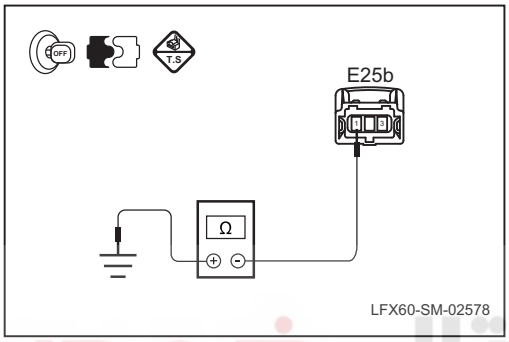
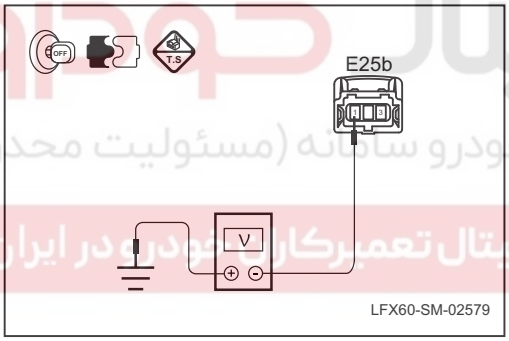
Test condition	Details/results/measures
3. Check the signal+circuit of crankshaft position sensor.	
 LFX60-SM-02577  LFX60-SM-02578  LFX60-SM-02579	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the crankshaft position sensor harness connector E25b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 1st terminal of the crankshaft position sensor harness connector E25b and the 96th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 1st terminal of the crankshaft position sensor harness connector E25b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the 1st terminal of the crankshaft position sensor harness connector E25b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? →**Yes** Step 4. →**No** Check and remove signal+circuit fault of crankshaft position sensor, and replace its harness if necessary.

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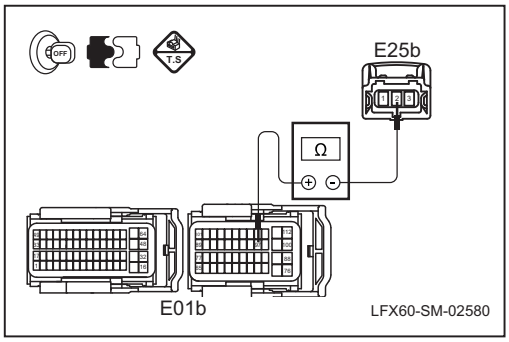
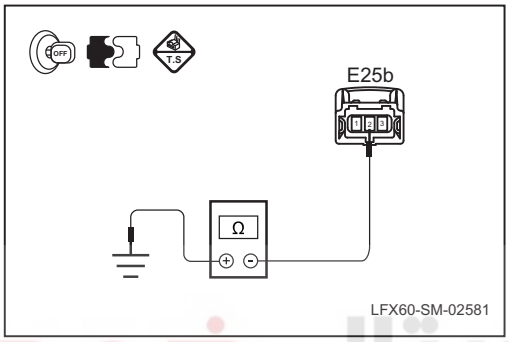
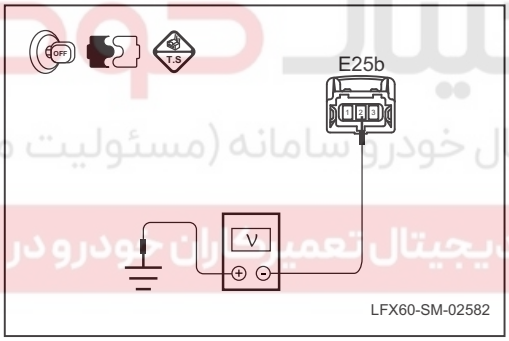
Test condition	Details/results/measures
4. Check the signal-circuit of crankshaft position sensor.	
 LFX60-SM-02580  LFX60-SM-02581  LFX60-SM-02582	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the crankshaft position sensor harness connector E25b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 2st terminal of the crankshaft position sensor harness connector E25b and the 97th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 2st terminal of the crankshaft position sensor harness connector E25b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the 2st terminal of the crankshaft position sensor harness connector E25b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** Step 4. **→No** Check and remove signal-circuit fault of crankshaft position sensor, and replace its harness if necessary.
5. Check the crankshaft position sensor.	
	A. Adopt a multimeter to measure the resistance between #1 and #2 terminals of crankshaft position sensor. **Standard value: 731 to 989Ω at room temperature of 20 °C** Is the resistance normal? **→Yes** Step 6. **→No** Replace the crankshaft position sensor.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0327, P0328

DTC description

DTC	Description
P0327	• Overlow voltage of knock sensor circuit
P0328	• Overhigh voltage of knock sensor circuit

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0327	• Checking the hardware or harness	• Low detected value of signal range	• Knock sensor • Knock sensor circuit • ECM
P0328		• High detected value of signal range	

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the knock sensor and engine control module harness plugs for damages, poor contact, aging and loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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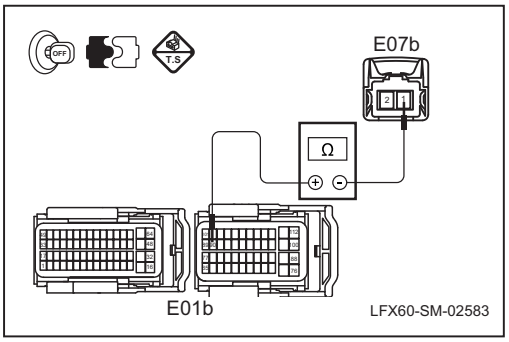
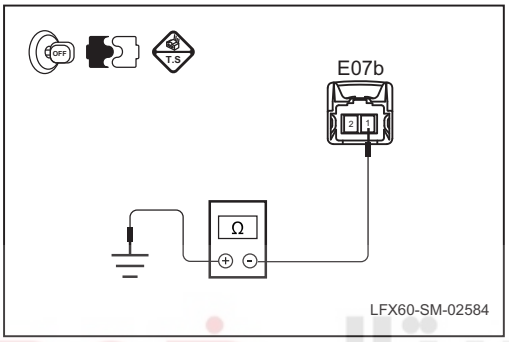
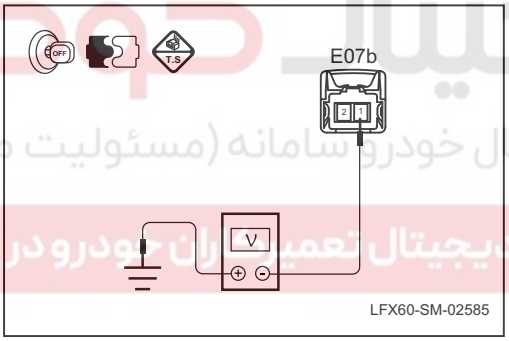
Test condition	Details/results/measures
3. Check signal+circuit of knock sensor.	







A. Operate the start switch to set the power mode to the "OFF" state.
B. Disconnect the battery negative connector.
C. Disconnect knock sensor harness plug E07b.
D. Disconnect the ECM harness connector E01b.
E. Measure the resistance between the 1st terminal of the knock sensor harness connector E07b and the 90th terminal of the ECM harness connector E01b with a multimeter.
Standard value: Less than 5
F. Measure the resistance between the 1st terminal of the knock sensor harness connector E07b and the reliable ground point with a multimeter.
Standard value: 10MΩ or higher
G. Connect the battery negative terminal.
H. Measure the voltage between the 1st terminal of the knock sensor harness connector E07b and the reliable ground point with a multimeter.
Standard value: 0V
Is it OK after checking?
→**Yes**
Step 4.
→**No**
Check and remove signal+circuit fault of knock sensor, and replace its harness if necessary.

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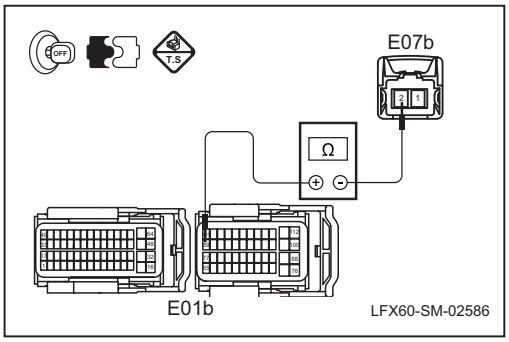
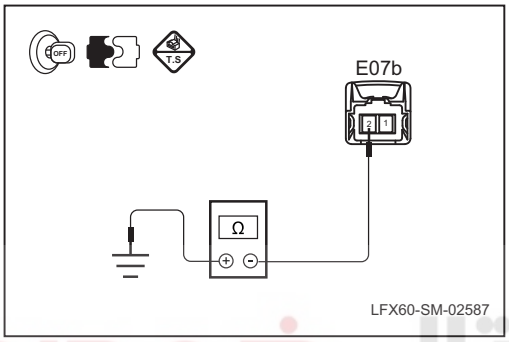
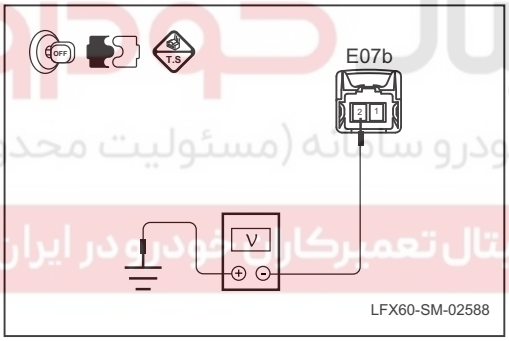
Test condition	Details/results/measures
4. Check signal-circuit of knock sensor.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect crankshaft position sensor harness plug E07b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 2st terminal of the knock sensor harness connector E07b and the 89th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 2st terminal of the knock sensor harness connector E07b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the 2st terminal of the knock sensor harness connector E07b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? →**Yes** Step 4. →**No** Check and remove signal-circuit fault of knock sensor, and replace its harness if necessary.
5. Check the knock sensor.	
	A. Adopt a multimeter to measure the resistance between #1 and #2 terminals of knock sensor. **Standard value: > 1 MΩ** Is it OK after checking? →**Yes** Step 6. →**No** Replace the knock sensor. **Refer to: Replacement of the knock sensor**
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0341

DTC description

DTC	Description
P0341	• Inappropriate signal of phase sensor

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0341	• Hardware or line check	• The number of detected signal faults of phase sensor is more than 5.	• Camshaft position sensor • Camshaft position sensor circuit • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	Check the camshaft position sensor and engine control module harness plugs for damages, poor contact, aging or loosening, etc. Check whether the camshaft position sensor is wrongly installed. Check whether its disc is chipped. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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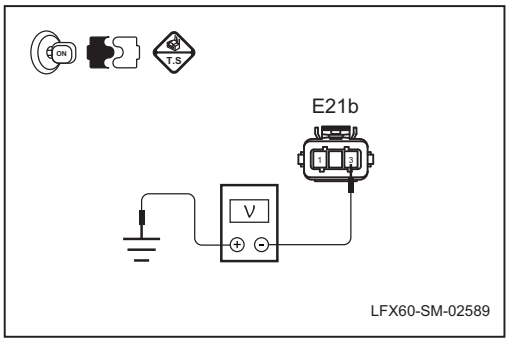
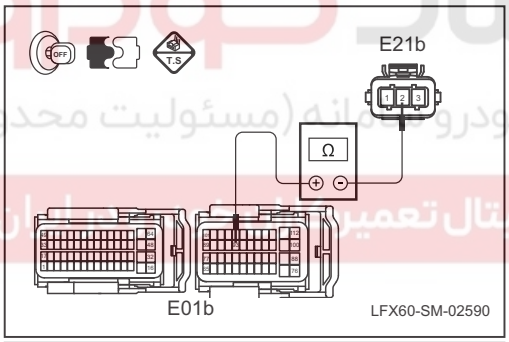
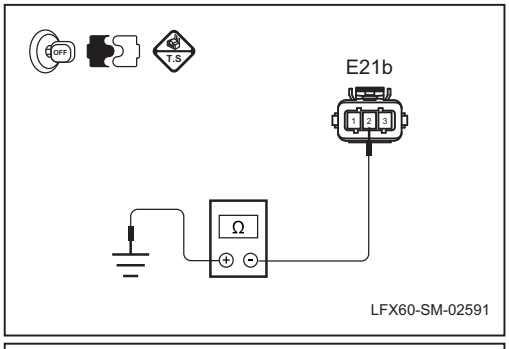
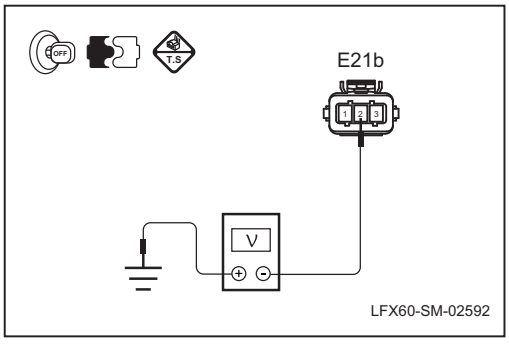
Test condition	Details/results/measures
3. Check the power circuit of camshaft position sensor.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the camshaft position sensor harness connector E21b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #3 terminal of camshaft position sensor harness plug E21b to reliable ground. **Standard value: 4.5 ~ 5.5 V** Is the voltage normal? →**Yes** Step 4. →**No** Check and remove the faults of camshaft position sensor power circuit, and replace its harness if necessary.
4. Check the signal circuit of camshaft position sensor.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the camshaft position sensor harness connector E21b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 2nd terminal of the camshaft position sensor harness connector E21b and the 93th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 2th terminal of the camshaft position sensor harness connector E21b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the 2nd terminal of the camshaft position sensor harness connector E21b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? →**Yes** To step 5. →**No** Check and remove the faults of camshaft position sensor signal circuit, and replace its harness if necessary.

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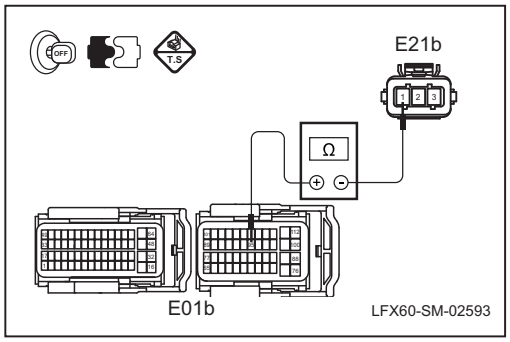
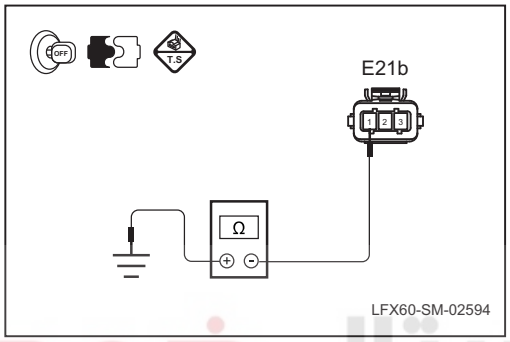
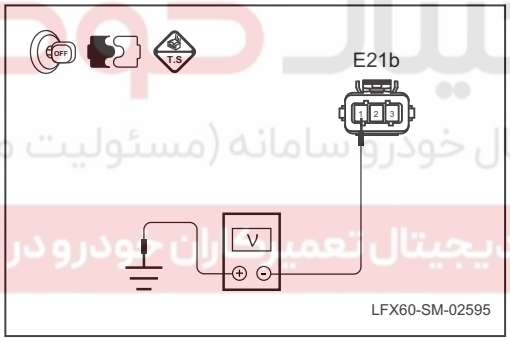
Test condition	Details/results/measures
5. Check the ground circuit of camshaft position sensor.	
 LFX60-SM-02593  LFX60-SM-02594  LFX60-SM-02595	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the camshaft position sensor harness connector E21b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the 1nd terminal of the camshaft position sensor harness connector E21b and the 95th terminal of the ECM harness connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 1th terminal of the camshaft position sensor harness connector E21b and the reliable ground point with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the 1th terminal of the camshaft position sensor harness connector E21b and the reliable ground point with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 6. **→No** Check and remove the faults of camshaft position sensor ground circuit, and replace its harness if necessary.
6. Check the camshaft position sensor.	
	A. Replace the camshaft position sensor. **Refer to: Replacement of camshaft position sensor** Is it OK after checking? **→Yes** To step 7. **→No** Finish.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0420

DTC description

DTC	Description
P0420	• Three-way catalyst oxygen reservoir capacity aging (emission exceeding limit)

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0420	• Checking the hardware or harness	• Exhaustion over its maximum limit	• Three-way catalytic converter • Oxygen sensor or circuit • Exhaust system

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the oxygen sensor and engine control module harness plugs for damages, poor contact, aging or loosening, etc. B. Check the exhaust system for blockage or leakage. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.
3. Check the faults of oxygen sensor.	
	A. Adopt a diagnostic unit to read the parameters of oxygen sensor. Is it OK after checking? →**Yes** **Step 4.** →No Remove the faults of oxygen sensor. **Refer to: P0030, P0031, P0032, P0036, P0037, P0038**

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Test condition	Details/results/measures
4. Check three-way catalyst.	
	A. Replace three-way catalyst. **Refer to: Replacement of three-way catalyst** Confirm that the fault has been ruled out.

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DTC P0444, P0458, P0459

DTC description

DTC	Description
P0444	• Faults of canister control valve circuit
P0458	• Overlow voltage of canister control valve circuit
P0459	• Overhigh voltage of canister control valve circuit

Possible reasons

DTC	Detection strategy	Define the fault location
P0444	• Checking the hardware or harness	• Canister solenoid valve • Canister solenoid valve circuit • ECM
P0458		
P0459		

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the canister solenoid valve and engine control module harness plugs for damages, poor contact, aging and loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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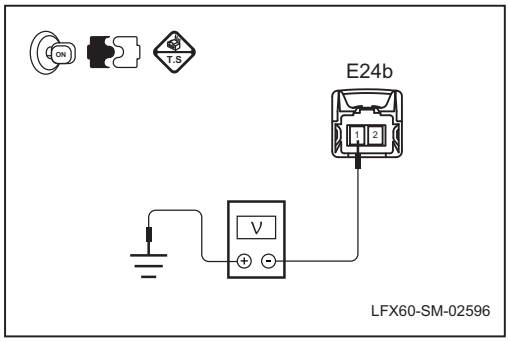
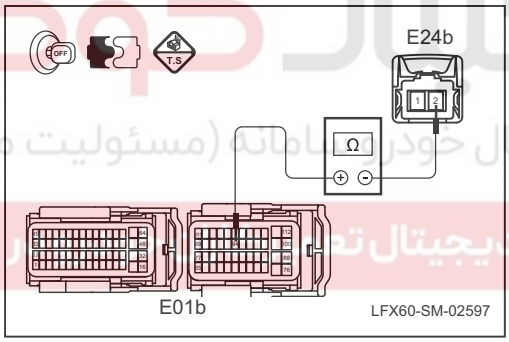
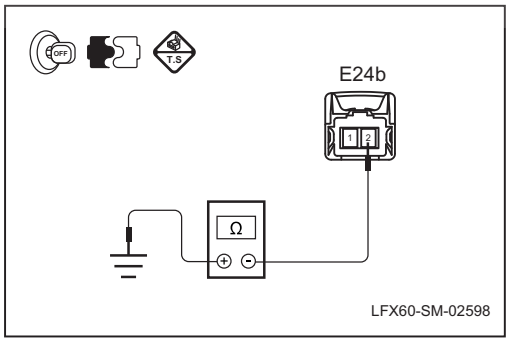
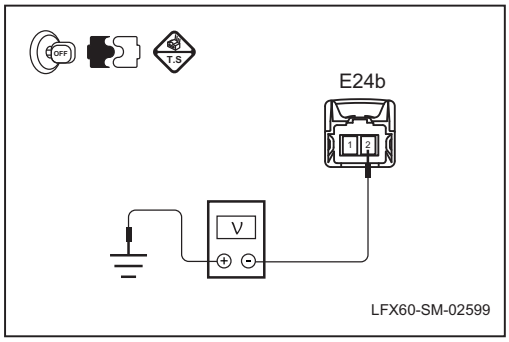
Test condition	Details/results/measures
3. Check the canister solenoid valve power supply line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect canister solenoid valve plug E24b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #1 terminal of canister solenoid valve harness plug E24b to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Troubleshoot the canister solenoid valve power supply line. If necessary, replace the harness.
4. Check the drive signal circuit of canister solenoid valve.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect canister solenoid valve harness plug E24b. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of canister solenoid valve harness plug E24b and #94 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #2 terminal of canister solenoid valve harness plug E24b to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the resistance of #2 terminal of canister solenoid valve harness plug E24b to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of canister solenoid valve drive signal circuit, and replace its harness if necessary.

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Test condition	Details/results/measures
5. Canister solenoid valve.	
	A. Adopt a multimeter to measure the resistance between #1 and #2 terminals of canister solenoid valve at normal temperature. **Standard value: 26±4Ω** Is it OK after checking? →**Yes** Step 6. →**No** Replace the canister solenoid valve. **Refer to: Replace the canister solenoid valve.**
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0480, P0691, P0692

DTC description

DTC	Description
P0480	• Signal faults of cooling fan relay control circuit (at low speed)
P0691	• Overlow voltage of cooling fan relay control circuit (low speed)
P0692	• Cooling fan relay control circuit voltage high (low speed)

Possible reasons

DTC	Detection strategy	Define the fault location
P0480	• Checking the hardware or harness	• Cooling fan relay • Cooling fan relay line • ECM
P0692		
P0693		

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check #1 fan relay K16 and engine control module harness plugs for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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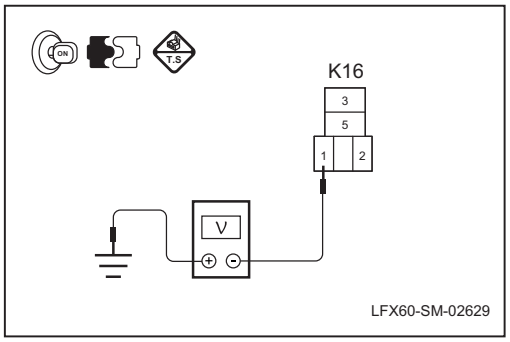
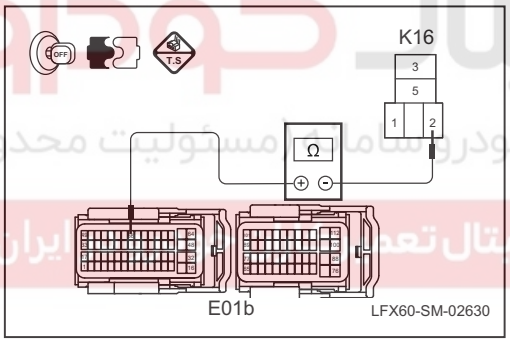
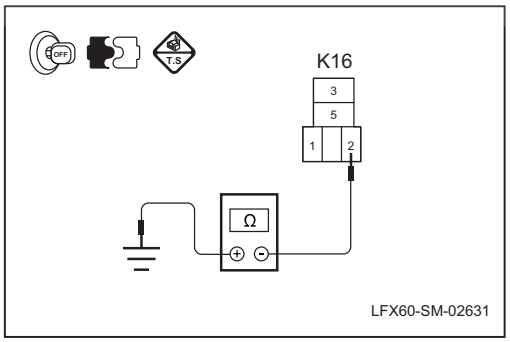
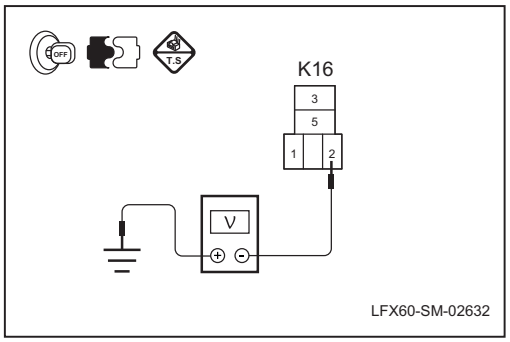
Test condition	Details/results/measures
3. Check the 1st fan relay power supply line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the 1st fan relay K16. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Measure the voltage between the 1st terminal of the 1st fan relay harness terminal and the reliable ground terminal with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Troubleshoot the 1st fan relay power supply line and replace the harness if necessary.
4. Check the 1st fan relay drive signal line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the 1st fan relay K16. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of #1 fan relay K16 and #56 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #2 terminal of #1 fan relay K16 to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #2 terminal of #1 fan relay K16 to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Troubleshoot the 1st fan relay drive line and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check the 1st fan relay.	
	A. Apply 12V voltage to #1 and #2 terminals of #1 fan relay K16, and adopt a multimeter to measure the resistance between its #3 and #5 terminals. **Standard value: Less than1** Is it OK after checking? →**Yes** Step 6. →**No** Replace the 1st fan relay.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0481, P0693 & P0694

DTC description

DTC	Description
P0481	• Faults of cooling fan relay control circuit (high speed)
P0693	• Cooling fan relay control circuit voltage low (high speed)
P0694	• Cooling fan relay control circuit voltage high (high speed)

Possible reasons

DTC	Detection strategy	Define the fault location
P0481	• Checking the hardware or harness	• Cooling fan relay • Cooling fan relay line • ECM
P0693		
P0694		

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check #2 fan relay K15 and engine control module harness plugs for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. D. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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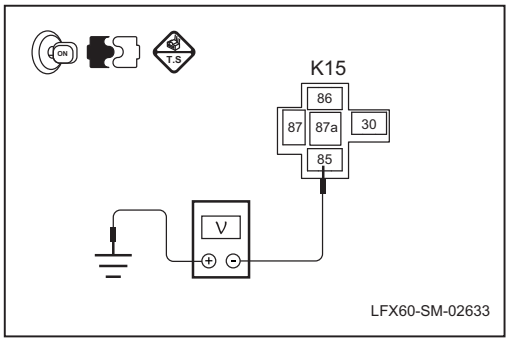
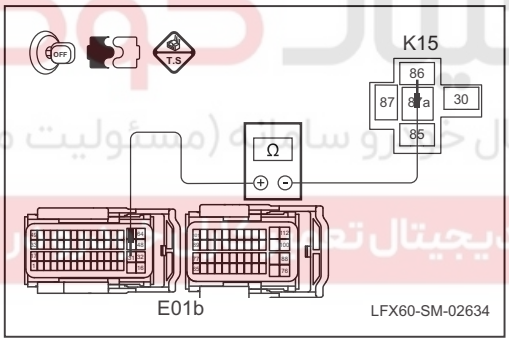
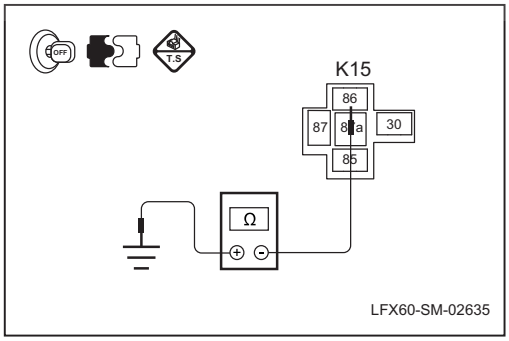
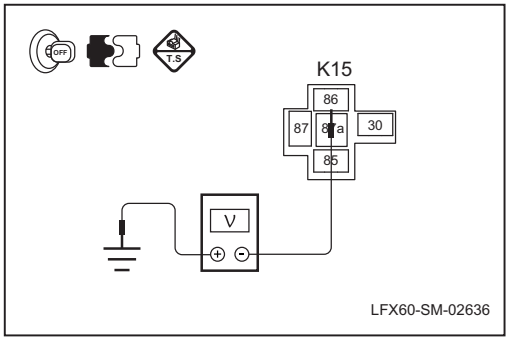
Test condition	Details/results/measures
3. Check the 2st fan relay power supply line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the 2st fan relay K15. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Measure the voltage between the 2st terminal of the 85st fan relay harness terminal and the reliable ground terminal with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Troubleshoot the 2st fan relay power supply line and replace the harness if necessary.
4. Check the 2st fan relay drive signal line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the 2st fan relay K15. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of #31fan relay K15 and #86 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #2 terminal of #86 fan relay K15 to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #2 terminal of #86 fan relay K15 to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Troubleshoot the 2st fan relay drive line and replace the harness if necessary.

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Test condition	Details/results/measures
5. Check the 2st fan relay.	
	A. Apply 12V voltage to #86 and #85 terminals of #2 fan relay K16, and adopt a multimeter to measure the resistance between its #30 and #587 terminals. **Standard value: Less than1** Is the resistance normal? →**Yes** Step 6. →**No** Replace the 2st fan relay.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0506, P0507

DTC description

DTC	Description
P0506	• Idling control speed lower its target idling speed
P0507	• Idling control speed above its target idling speed

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0506 P0507	• Idling actuator seized in smaller opening position	• Difference between static target idling speed and actual speed>100 U/min	• Electronic-controlled throttle body • Generator • Injector • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the electronic throttle valve, fuel injector and engine control module harness plugs for damages, poor contact, aging or loosening, etc. B. Check whether the throttle valve keeps sticking and check whether the intake and exhaust, and the injector are blocked. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	Connect the equipment for diagnosing faults to the diagnostic interface. Operate the start switch to set the power mode to the “on” state. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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Test condition	Details/results/measures
3. Check the generator for voltage faults.	
	A. Start the engine so that it rotates at 2000 rpm. B. Check whether the generator output voltage is within the range. Is it OK after checking? →**Yes** Step 4. →**No** Troubleshoot the generator.
4. Check the electronically controlled throttle valve for faults.	
	A. Check the electronically controlled throttle valve for faults. **Refer to: "P0121, P0122, P0123, P0221, P0222, P0223"** Is it OK after checking? →**Yes** Step 5. →**No** Remove the faults of electronic throttle valve.
5. Check the faults of fuel injector.	
	A. Check the faults of fuel injector. **Refer to: "P0201, P0261, P0262""P0202, P0264, P0265""P0203, P0267, P0268""P0204, P0270, P0271"** Is it OK after checking? →**Yes** Step 6. →**No** Remove the faults of fuel injector.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0560, P0562, P0563

DTC description

DTC	Description
P0560	• Inappropriate voltage signal of system battery
P0562	• Overlow voltage of system battery
P0563	• Overhigh voltage of system battery

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0560	• Appropriateness check	• The battery voltage is less than 2.5V	• Charging system • ECM
P0562	• Below lower limit	• The battery voltage is less than 10.02V	
P0563	• Over upper limit	• Battery voltage over 17.02 V	

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the charging circuit and engine control module harness plugs for damages, poor contact, aging or loosening, etc. B. Check whether the throttle valve keeps sticking and check whether the intake and exhaust, and the injector are blocked. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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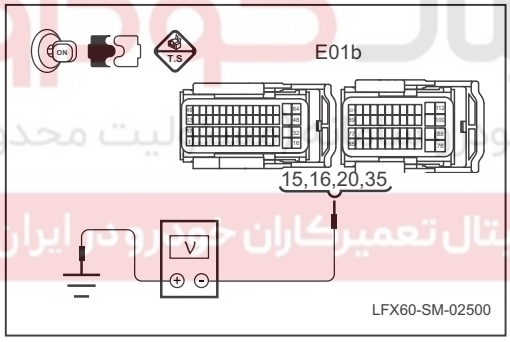
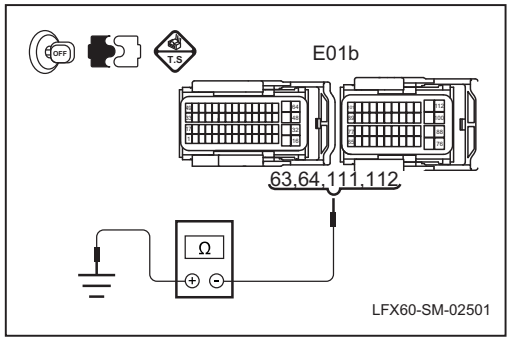
Test condition	Details/results/measures
3. Check the generator for voltage faults.	
	A. Start the engine so that it rotates at 2000 rpm. B. Check whether the generator output voltage is within the range. Is the voltage normal? →**Yes** Step 4. →**No** Troubleshoot the generator.
4. Check the battery voltage.	
	A. Measure the battery voltage with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** Step 5. →**No** Replace the battery.
5. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 6. →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.
6. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 7. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.

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Test condition	Details/results/measures
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0571

DTC description

DTC	Description
P0571	• Inappropriate brake signal

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P0571	• Checking the hardware or harness	• The ratio of battery voltage and brake lamp switch signal pin response voltage is less than 1.133 or over 0.469.	• Brake switch • Brake switch line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the brake switch plug and engine control module for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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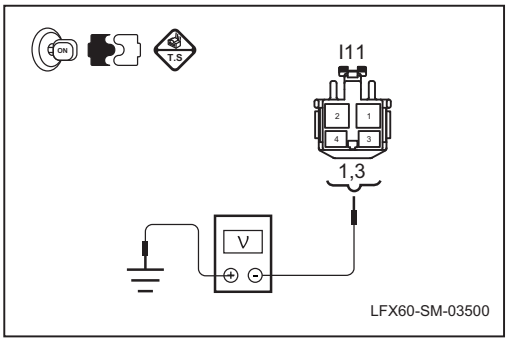
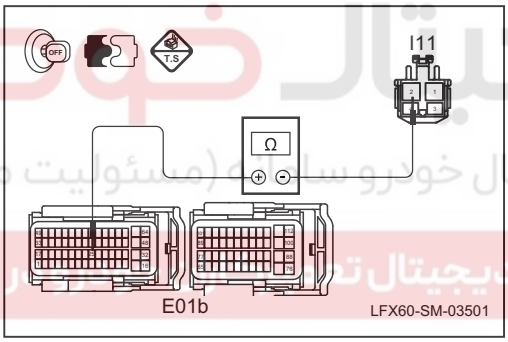
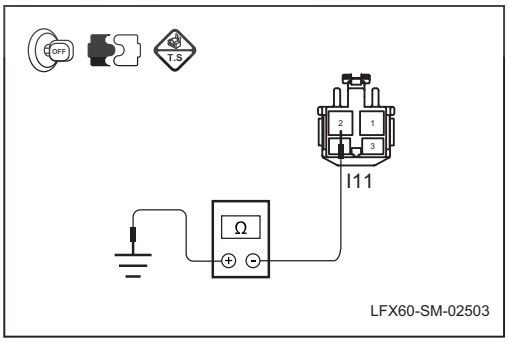
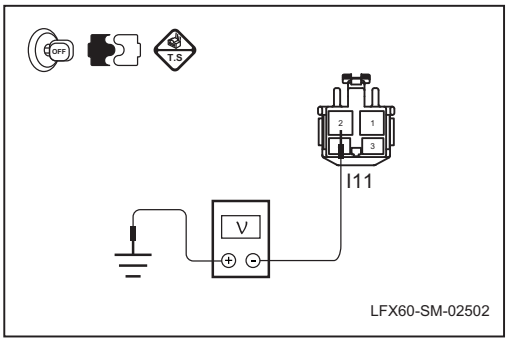
Test condition	Details/results/measures
3. Check the power circuit of brake switch.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect brake switch plug I11. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #1 or #3 terminal of brake switch harness plug to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Check and remove the faults of brake switch power circuit, and replace its harness if necessary.
4. Check the brake switch power supply line output signal 1 circuit.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect brake switch plug I11. D. Disconnect the engine control module connector E01b. E. Measure the resistance between the 2nd terminal of the brake switch harness connector I11 and the 25th terminal of the engine control module connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 2nd terminal of the brake switch power supply line harness connector I11 and the ground with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the resistance between the 2nd terminal of the brake switch power supply line harness connector I11 and the ground with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Provide a breakdown service for the brake switch output signal 1 failure. If necessary, replace the harness.

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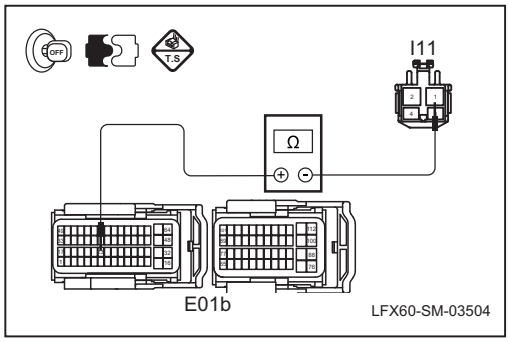
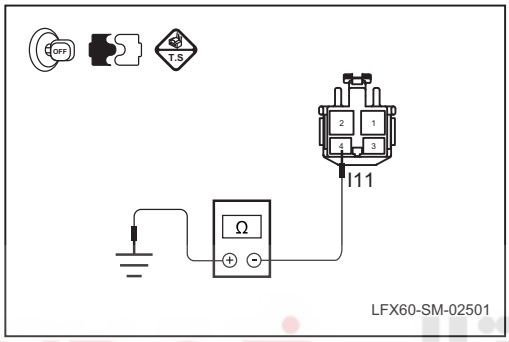
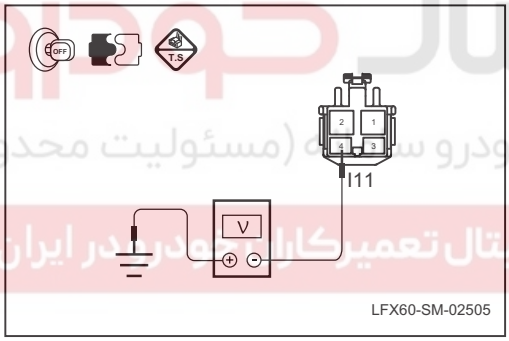
Test condition	Details/results/measures
5. Check the brake switch power supply line output signal 2 circuit.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect brake switch power circuit plug I11. D. Disconnect the engine control module connector E01b. E. Measure the resistance between the 4nd terminal of the brake switch harness connector I11 and the 23th terminal of the engine control module connector E01b with a multimeter. **Standard value: Less than 5** F. Measure the resistance between the 4nd terminal of the brake switch power supply line harness connector I11 and the ground with a multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the resistance between the 4nd terminal of the brake switch power supply line harness connector I11 and the ground with a multimeter. **Standard value: 0V** Is it OK after checking? →**Yes** To step 6. →**No** Provide a breakdown service for the brake switch output signal 2 failure. If necessary, replace the harness.

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Test condition	Details/results/measures
6. Check the brake switch.	
	A. Step down the brake pedal, and adopt a multimeter to measure the resistance between #1 and #3 terminals of brake switch power circuit. **Standard value: 10MΩ or higher** B. Step down the brake pedal, and adopt a multimeter to measure the resistance between #2 and #4 terminals of brake switch power circuit. **Standard value: Less than1** C. Release the brake pedal, and adopt a multimeter to measure the resistance between #1 and #3 terminals of brake switch power circuit. **Standard value: Less than1** D. Release the brake pedal, and adopt a multimeter to measure the resistance between #2 and #4 terminals of brake switch power circuit. **Standard value: 10MΩ or higher** Is the resistance normal? →**Yes** Step 7. →**No** Replace the brake switch.
7. Check ECM.	
	A.Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0604, P0605 & P0606

DTC description

DTC	Description
P0604	• RAM faults of electronic control unit
P0605	• ROM faults of electronic control unit
P0606	• Faults of electronic throttle valve safety monitoring function
P2106	• Drive stage faults of electronic throttle valve

Possible reasons

DTC	Detection strategy	Define the fault location
P0604	• Checking the hardware or harness	• ECM • ECM lines
P0605		
P0606		
P2106		

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the harness plugs of engine control module for damages, poor contact, aging or loosening, etc. B. Check whether the battery voltage is too low. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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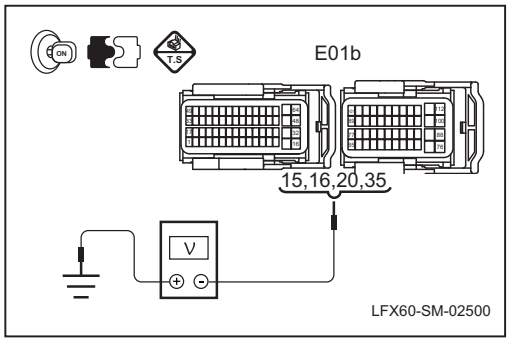
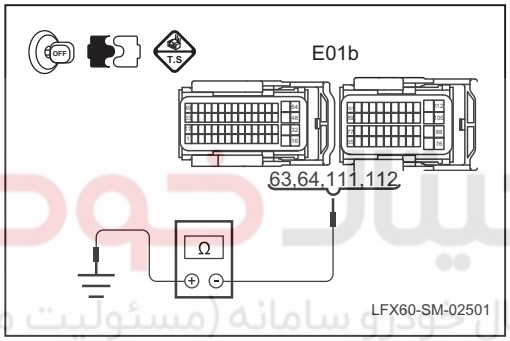
Test condition	Details/results/measures
3. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** To step 4. **→No** Troubleshoot the ECM power supply line and replace the harness if necessary.
4. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the “OFF” state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? **→Yes** To step 5. **→No** Troubleshoot the ECM grounding line and replace the harness if necessary.
5. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0627, P0628, P0629

DTC description

DTC	Description
P0627	• Faults of fuel pump relay circuit
P0628	• Overlow voltage of fuel pump relay control circuit
P0629	• Overhigh voltage of fuel pump relay control circuit

Possible reasons

DTC	Detection strategy	Define the fault location
P0627	• Checking the hardware or harness	• Fuel pump relay • Fuel pump relay circuit • ECM
P0628		
P0629		

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the fuel pump relay and engine control module harness plugs for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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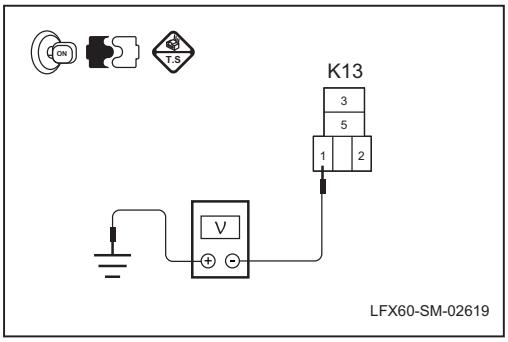
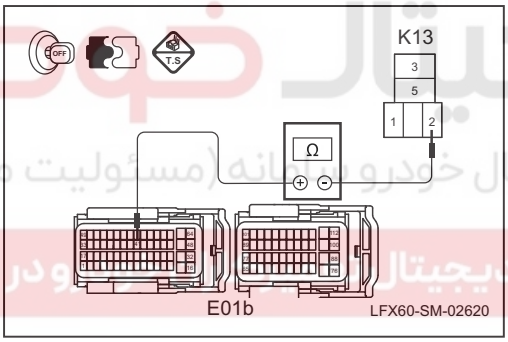
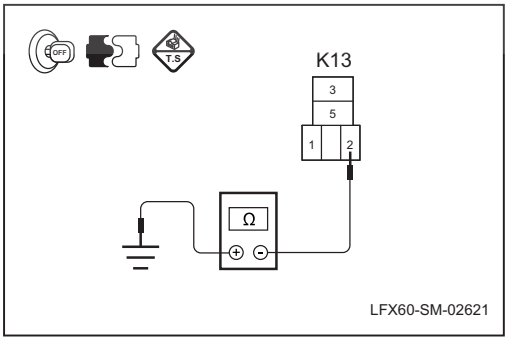
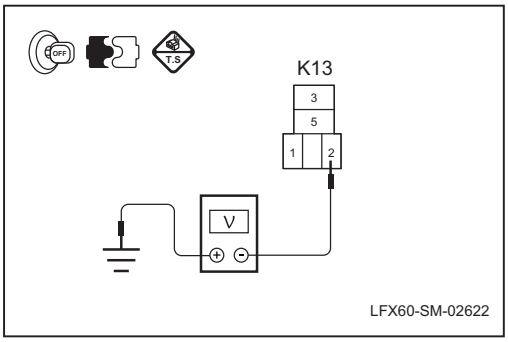
Test condition	Details/results/measures
3. Check the power circuit of fuel pump relay.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the pump relay K13. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #1 terminal of fuel pump relay harness to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Check and remove the faults of fuel pump relay power circuit, and replace its harness if necessary.
4. Check the pump relay drive signal line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the pump relay K13. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of fuel pump relay K13 and #41 terminal of E01b. **Standard value: Less than 5** F .Adopt a multimeter to measure the resistance of #2 terminal of fuel pump relay K13 to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #2 terminal of fuel pump relay K13 to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of fuel pump relay drive signal circuit, and replace its harness if necessary.

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Test condition	Details/results/measures
5. Check the fuel pump relay.	
	A. Apply 12V voltage to #1 and #2 terminals of fuel pump relay K13, and adopt a multimeter to measure the resistance between its #3 and #5 terminals. **Standard value: Less than1** Is the resistance normal? →**Yes** Step 6. →**No** Replace the fuel pump relay.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0645, P0646, P0647

DTC description

DTC	Description
P0645	• Faults of A/C compressor relay circuit
P0646	• Overlow voltage of A/C compressor relay control circuit
P0647	• Overhigh voltage of A/C compressor relay

Possible reasons

DTC	Detection strategy	Define the fault location
P0645	• Checking the hardware or harness	• Air conditioner compressor relay • A/C compressor rely circuit • ECM
P0646		
P0647		

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check A/C compressor relay and engine control module harness plugs for damages, poor contact, aging or loosening, etc. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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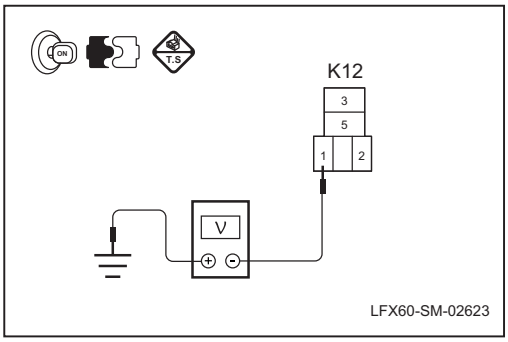
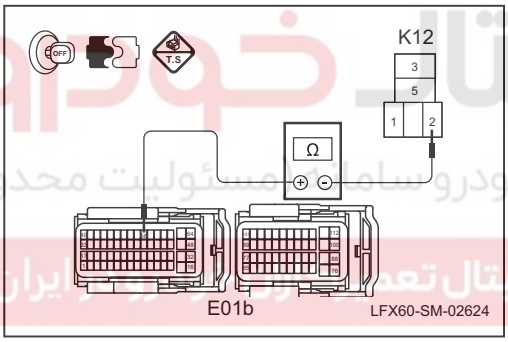
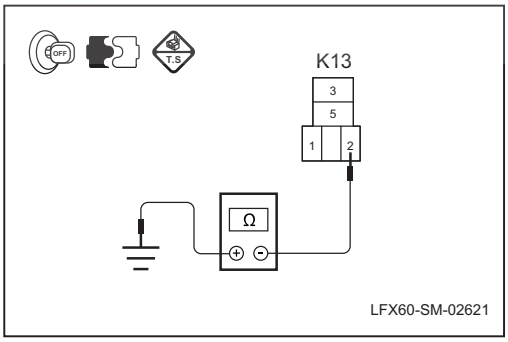
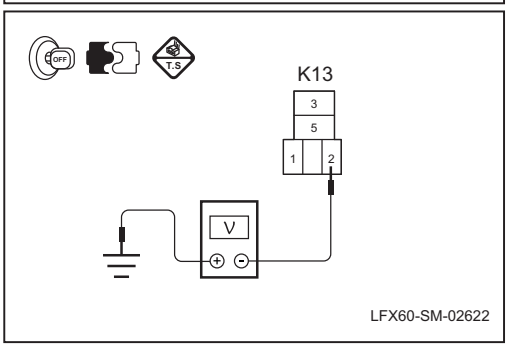
Test condition	Details/results/measures
3. Check the air conditioning compressor relay power supply line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the air conditioning compressor relay K12. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #1 terminal of A/C compressor relay harness to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** Step 4. →**No** Check and remove the faults of A/C compressor relay power circuit, and replace its harness if necessary.
4. Check the dive signal circuit of A/C compressor relay.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the air conditioning compressor relay K12. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #2 terminal of A/C compressor relay K12 and #58 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #2 terminal of A/C compressor relay K12 to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #2 terminal of A/C compressor relay K12 to reliable ground. **Standard value: 0V** Is it OK after checking? →**Yes** To step 5. →**No** Check and remove the faults of A/C compressor relay drive signal circuit, and replace its harness if necessary.

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Test condition	Details/results/measures
5. Check the air conditioning compressor relay.	
	A. Apply 12V voltage to #1 and #2 terminals of A/C compressor relay K12, and adopt a multimeter to measure the resistance between its #3 and #5 terminals. **Standard value: Less than1** Is the resistance normal? →**Yes** Step 6. →**No** Replace the air conditioner compressor relay.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P0688

DTC description

DTC	Description
P0688	• Inappropriate output voltage of main relay

Possible reasons

DTC	Detection strategy	Define the fault location
P0688	• Checking the hardware or harness	• Main relay • Main relay circuit • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the main compressor relay and engine control module harness connectors for damage, poor contact, aging, loosening and other similar signs. B. Check whether the battery voltage is too low. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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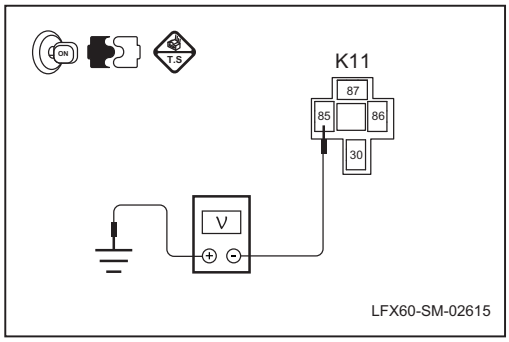
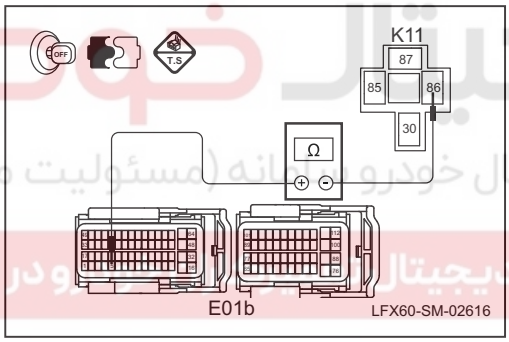
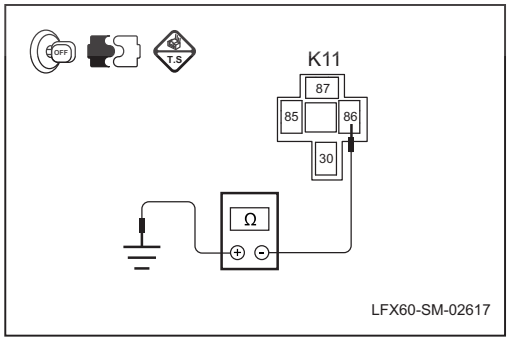
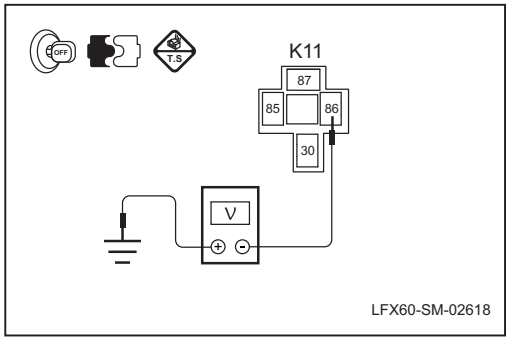
Test condition	Details/results/measures
3. Check the power circuit of main relay.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the main relay K11. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Adopt a multimeter to measure the voltage of #85 terminal of main relay harness to reliable ground. **Standard value: 11 ~ 14V** Is the voltage normal? **→Yes** Step 4. **→No** Check and remove the faults of main relay power circuit, and replace its harness if necessary.
4. Check the drive signal circuit of main relay.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Remove the main relay K11. D. Disconnect the engine control module connector E01b. E. Adopt a multimeter to measure the resistance between #86 terminal of main relay K11 and #5 terminal of E01b. **Standard value: Less than 5** F. Adopt a multimeter to measure the resistance of #86 terminal of main relay K11 to reliable ground. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Adopt a multimeter to measure the voltage of #86 terminal of main relay K11 to reliable ground. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Check and remove the faults of main relay drive signal circuit, and replace its harness if necessary.

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Test condition	Details/results/measures
5. Check main relay.	
	A. Apply 12V voltage to #85 and #86 terminals of A/C compressor relay K12, and adopt a multimeter to measure the resistance between its #30 and #87 terminals. **Standard value: Less than1** Is the resistance normal? →**Yes** Step 6. →**No** Replace main relay.
6. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P1336, P1545, P1559, P1564, P1565, P1568, P1579

DTC description

DTC	Description
P1336	• Limitation of electronic throttle valve safety monitoring torque
P1545	• Over-limit tolerance between actual position and target position of electronic throttle valve
P1559	• Faults of electronic throttle valve self-learning process
P1564	• Failure of system voltage of meeting the self-learning conditions of electronic throttle valve.
P1565	• Initialized self-learning faults of electronic throttle valve lower limit position
P1568	• Overhigh return resistance of electronic throttle valve
P1579	• Failure of meeting the self-learning conditions of electronic throttle valve

Possible reasons

DTC	Detection strategy	Define the fault location
P1336 P1545 P1559 P1564 P1565 P1568 P1579	• Checking the hardware or harness	• Electronic-controlled throttle • Self learning of electronic throttle valve

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Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the main compressor relay and engine control module harness connectors for damage, poor contact, aging, loosening and other similar signs. B. Check whether the battery voltage is too low. C. Check whether the throttle valve is seized. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.

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Test condition	Details/results/measures
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.
3. Check the faults of throttle valve circuit.	
	A. Check the faults of throttle valve circuit. **Refer to: “P0121, P0122, P0123, P0221, P0222, P0223”** **Fault diagnosis** Is it OK after checking? →**Yes** To step 4. →**No** Check and remove the faults of throttle valve circuit, and replace its harness if necessary.
4. Check the self-learning conditions of throttle valve.	
	A. Engine air inlet temperature **Standard value: >5°C** B. Engine water temperature **Standard value: 5°C~100.5°C** C. Engine speed **Standard value: ≤ 250rpm** D. Car speed **Standard value: =0** E. Battery voltage **Standard value: >10V** F. Opening of electronic accelerator pedal **Standard value: <14.9%** Are its self-learning conditions normal? →**Yes** To step 5. →**No** Ensure that all self-learning conditions are met.
5. Throttle valve self-learning	
	A. Perform the self-learning of throttle valve. Confirm that the fault has been ruled out.

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DTC P1610, P1626, P1631, P1632

DTC description

DTC	Description	Definition
P1610	• Anti-theft matching failure of ECM or eeprom status error	• While the ignition switch is ON, the engine control module (ECM) and body control module (BCM) communicate and certify the information with each other via CAN high-speed bus. After passing the certification, BCM allows the operation of starting motor. In case of turning off the key for starting, ECM controls the ignition and fuel injection, and the engine starts. If BCM can't receive the certification information from ECM, the starting motor can't work, and the engine will fail to start.
P1626	• Anti-theft certification communication error or response failure of anti-theft alarm	
P1631	• Failure of anti-theft certification	
P1632	• checksum error during anti-theft certification	

Possible reasons

DTC	Detection strategy	Define the fault location
P1610	• Checking the hardware or harness	• Harness or circuit faults • BCM • ECM
P1626		
P1631		
P1632		

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the body control module and engine control module harness plugs for damages, poor contact, aging or loosening, etc. B. Check whether the voltage of battery or remote-control key is too low. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.

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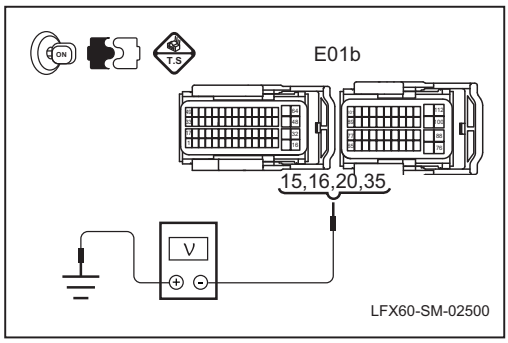
Test condition	Details/results/measures
2. Read the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Read the trouble code by using diagnostic equipment. D. Check the body control module for relevant faults. Do their fault codes exist? →**Yes** Remove the relevant faults of body control module. →**No** To step 3.
3. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 4. →**No** Finish.
4. Check the communications between the body control module and engine control module.	
	A. Check CAN communications between the body control module and engine control module. **Refer to: “U140” troubleshooting** Is it OK after checking? →**Yes** To step 5. →**No** Remove its relevant faults.
5. Check the ECM power supply line.	
	A. Operate the start switch to set the power mode to the “on” state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage normal? →**Yes** To step 6. →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.

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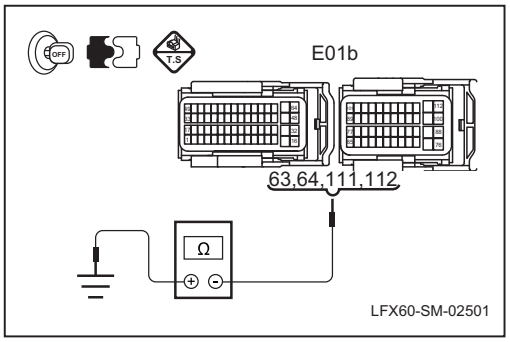
Test condition	Details/results/measures
6. Check the ECM grounding line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5** Is the resistance normal? →**Yes** To step 7. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.
7. Replace ECM.	
	A. Replace ECM. **Refer to: Replacement of engine control module** B. Set or program the anti-theft system. Is the system normal? →**Yes** Finish. →**No** To step 8.
8. Replace the body control module.	
	A. Replace the body control module. **Refer to: Replacement of body control module** B. Set or program the anti-theft system. Ensure that the system faults have been removed.

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DTC P2122, P2123, P2138

DTC description

DTC	Description
P2122	• Electronic accelerator pedal position sensor 1 signal voltage is too low
P2123	• Electronic accelerator pedal position sensor 1 signal voltage is too high
P2138	• The electronic accelerator pedal position sensor signal is unreasonable

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P2122 P2123 P2138	• Hardware or line check	• The fact that the electronically controlled throttle valve signal line is not within a reasonable range is detected by the engine control module	• Throttle pedal position sensor • Accelerator pedal position sensor line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the throttle pedal position sensor and engine control module harness plug for breakage, loose contact, aging or looseness. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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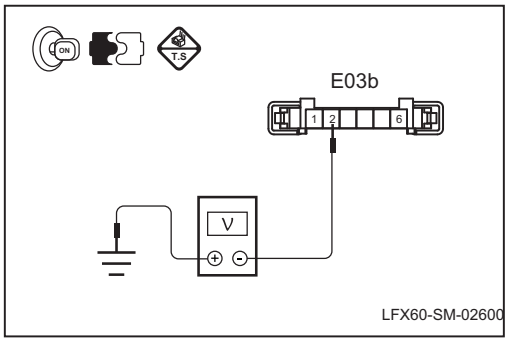
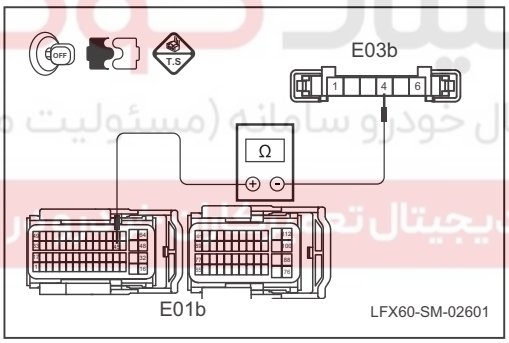
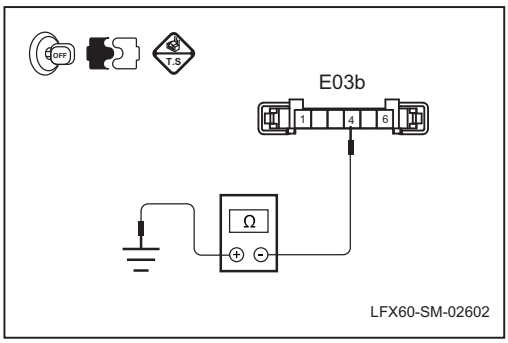
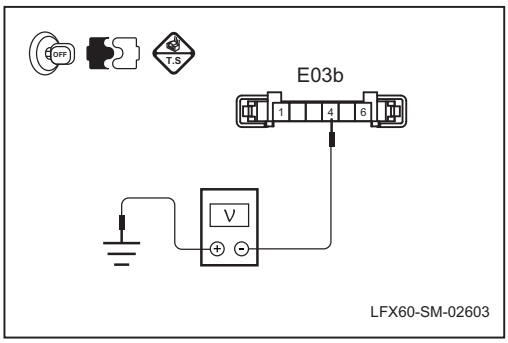
Test condition	Details/results/measures
3. Check the throttle pedal position sensor 1 power line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the throttle pedal position sensor harness plug E03b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Measure the voltage between the throttle pedal position sensor harness plug E03b terminal 2 and fixed ground point with the multimeter. **Standard value: 4.5 ~ 5.5 V** Is the voltage normal? **→Yes** Step 4. **→No** Repair the throttle pedal position sensor 1 power line fault and replace the harness if necessary.
4. Check the throttle pedal position sensor 1 signal line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the throttle pedal position sensor harness plug E03b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 4 and ECM harness plug E01b terminal 45 with the multimeter. **Standard value: Less than 5** F. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 4 and fixed ground point with the multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the throttle pedal position sensor harness plug E03b terminal 4 and fixed ground point with the multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Repair the throttle pedal position sensor 1 signal line fault and replace the harness if necessary.

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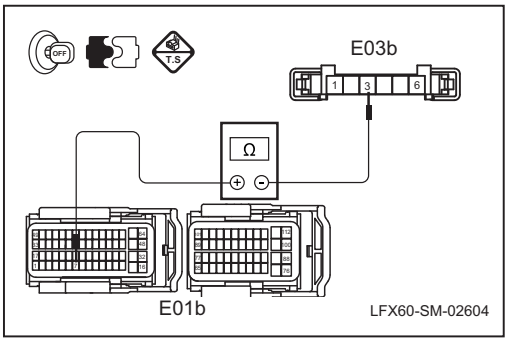
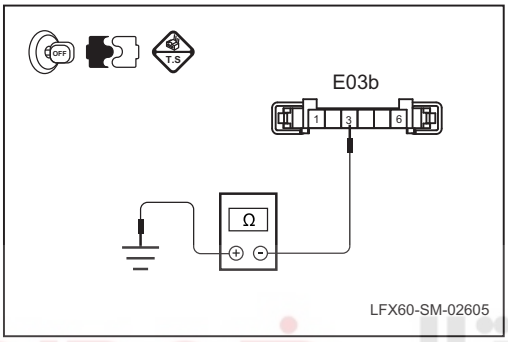
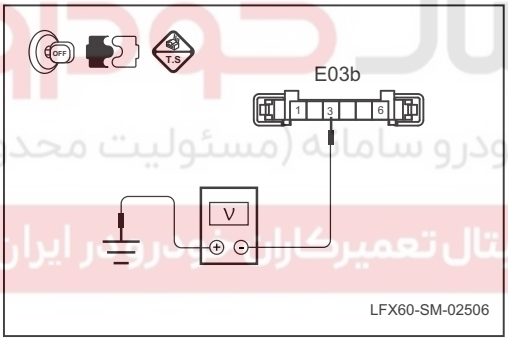
Test condition	Details/results/measures
5. Check the throttle pedal position sensor 1 ground circuit.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the throttle pedal position sensor harness plug E03b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 3 and ECM harness plug E01b terminal 7 with the multimeter. **Standard value: Less than 5** F. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 3 and fixed ground point with the multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between the throttle pedal position sensor harness plug E03b terminal 3 and fixed ground point with the multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 6. **→No** Repair the throttle pedal position sensor 1 ground circuit fault and replace the harness if necessary.
6. Check the throttle pedal position sensor.	
	A. Replace the throttle pedal position sensor. **Refer to: Replacement of accelerator pedal position sensor** Is it OK after checking? **→Yes** Replace the throttle pedal position sensor. **→No** Step 7.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module (ECM)** Confirm that the fault has been ruled out.

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DTC P2127, P2128 & P2138

DTC description

DTC	Description
P2127	• Electronic accelerator pedal position sensor 2 signal voltage is too low
P2128	• Electronic accelerator pedal position sensor 2 signal voltage is too high
P2138	• The electronic accelerator pedal position sensor signal is unreasonable

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P2127 P2128 P2138	• Hardware or line check	• The fact that the electronically controlled throttle valve signal line is not within a reasonable range is detected by the engine control module	• Throttle pedal position sensor • Accelerator pedal position sensor line • ECM

Diagnostic process

Test condition	Details/results/measures
1. General inspection.	
	A. Check the throttle pedal position sensor and engine control module harness plug for breakage, loose contact, aging or looseness. B. Is it OK after checking? →**Yes** To step 2. →**No** Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to set the power mode to the “on” state. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →**Yes** To step 3. →**No** Finish.

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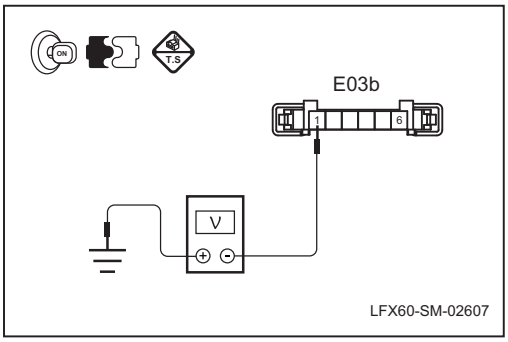
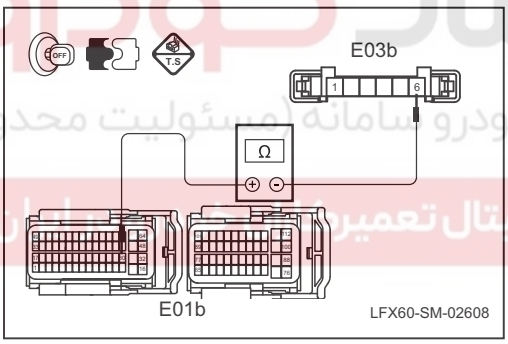
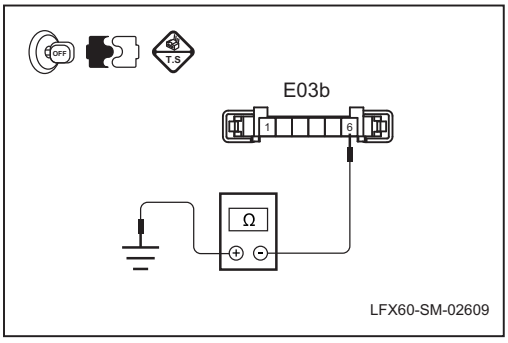
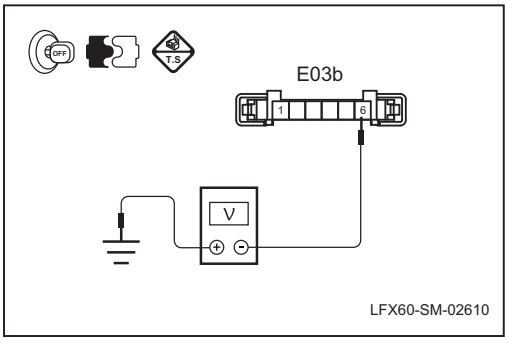
Test condition	Details/results/measures
3. Check the throttle pedal position sensor 2 power line.	
	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the throttle pedal position sensor harness plug E03b. D. Connect the battery negative terminal. E. Operate the start switch to set the power mode to the "on" state. F. Measure the voltage between the throttle pedal position sensor harness plug E03b terminal 1 and fixed ground point with the multimeter. **Standard value: 4.5 ~ 5.5 V** Is the voltage normal? **→Yes** Step 4. **→No** Repair the throttle pedal position sensor 2 power line fault and replace the harness if necessary.
4. Check the throttle pedal position sensor 2 signal line.	
  	A. Operate the start switch to set the power mode to the "OFF" state. B. Disconnect the battery negative connector. C. Disconnect the throttle pedal position sensor harness plug E03b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 6 and ECM harness plug E01b terminal 30 with the multimeter. **Standard value: Less than 5** F. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 6 and fixed ground point with the multimeter. **Standard value: 10MΩ or higher** G. Connect the battery negative terminal. H. Measure the voltage between terminals 6 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 0V** Is it OK after checking? **→Yes** To step 5. **→No** Repair the throttle pedal position sensor 2 signal line fault and replace the harness if necessary.

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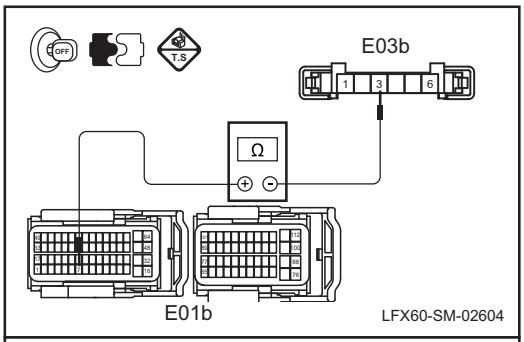
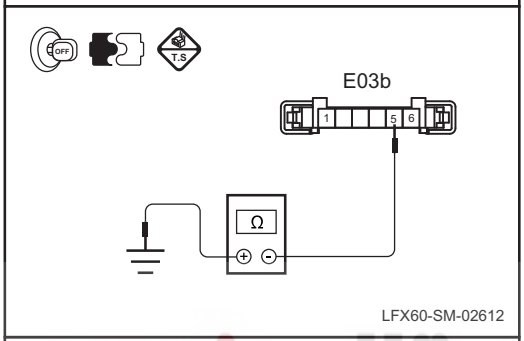
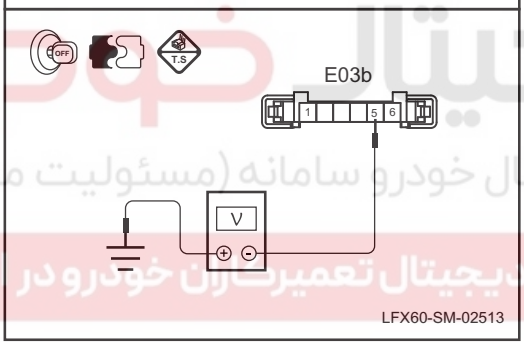
Test condition	Details/results/measures
5. Check the throttle pedal position sensor 2 ground circuit.	
  	A. Operate the start switch to turn the power to OFF state B. Disconnect the battery negative connector. C. Disconnect the throttle pedal position sensor harness plug E03b. D. Disconnect the ECM harness connector E01b. E. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 5 and ECM harness plug E01b terminal 59 with the multimeter. Standard value:Less than 5Ω F. Measure the resistance between the throttle pedal position sensor harness plug E03b terminal 5 and fixed ground point with the multimeter. Standard value:10 MΩ or higher G. Connect the battery negative terminal. H. Measure the voltage between the throttle pedal position sensor harness plug E03b terminal 5 and fixed ground point with the multimeter. **Standard value:0V** Is it OK after checking? →Yes To step 6. →No Repair the throttle pedal position sensor 2 ground circuit fault and replace the harness if necessary.
6. Check the throttle pedal position sensor.	
	A. Replace the throttle pedal position sensor. Refer to: Is the replacement of the accelerator pedal position sensor checked properly? →Yes Replace the throttle pedal position sensor. →No Step 7.
7. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module(ECM)** Confirm that the fault has been ruled out.

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DTC P2177, P2178, P2187, P2188

DTC description

DTC	Description
P2177	• Too lean mixture (medium load area) as diagnosed with the fuel supply system
P2178	• Too rich mixture (medium load area) as diagnosed with the fuel supply system
P2187	• Too lean mixture (low load area) as diagnosed with the fuel supply system
P2188	• Too rich mixture (low load area) as diagnosed with the fuel supply system

Possible reasons

DTC	Detection strategy	Set the condition (control strategy)	Define the fault location
P2177	• Checking the hardware or harness	• The fuel correction exceeds the upper limit and the threshold exceeds 1. 23	• Front oxygen sensor • Front oxygen sensor line • Rear oxygen sensor • Rear oxygen sensor line
P2178		• Fuel correction exceeds lower limit and the threshold is less than 0. 77	
P2187		• The fuel correction exceeds the upper limit and the threshold exceeds 10	
P2188		• Fuel correction exceeds lower limit and the threshold is less than -10	

Diagnostic process

Test condition	Details/results/measures
1. General Inspection.	
	A. Check front/rear oxygen sensor and engine control module harness connectors for signs of damage, poor contact, aging, working loose, etc. Is it OK after checking? →Yes To step 2. →No Examine and repair the fault location.
2. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to turn the power to ON state C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →Yes To step 3. →No Finish.

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Test condition	Details/results/measures
3. Look for the front oxygen sensor signal fault.	
	A. Look for the front oxygen sensor signal fault. **Refer to: DTC TROUBLESHOOTING TABLE** Is it OK after checking? →Yes To step 4. →No Repair the front oxygen sensor signal fault.
4. Look for the rear oxygen sensor signal fault.	
	A. Look for the rear oxygen sensor signal fault. **Refer to: DTC TROUBLESHOOTING TABLE** Confirm that the fault has been ruled out.

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DTC U0001, U0121, U0140

DTC description

DTC	Description
U0001	• CAN high speed transmission line fault
U0121	• ECU-ABS control module communication is lost
U0140	• The communication between ECU and BCM is lost or signal is abnormal

Possible reasons

DTC	Detection strategy	Define the fault location
U0001	• Checking the hardware or harness	• CAN communication fault • Module fault
U0121		
U0140		

Diagnostic process

Test condition	Details/results/measures
1. General Inspection.	
	A. Check the engine control module, body control module, and ABS control module plugs for signs of damage, poor contact, aging, working loose, etc. Is it OK after checking? →Yes To step 2. →No Examine and repair the fault location.
2. Read the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to turn the power to ON state C. Read the trouble code by using diagnostic equipment. Is there any other DTC? →Yes Eliminate other DTCs first. **Refer to: List of relevant DTCs** →No To step 3.

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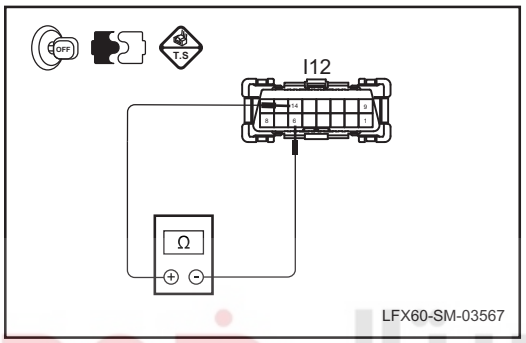
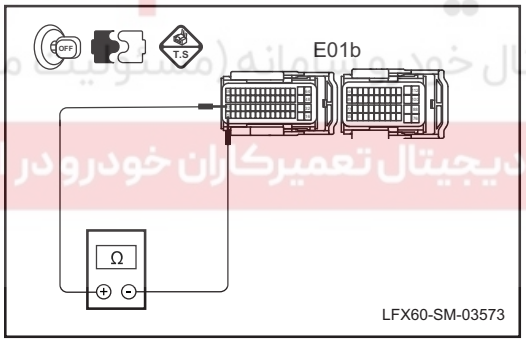
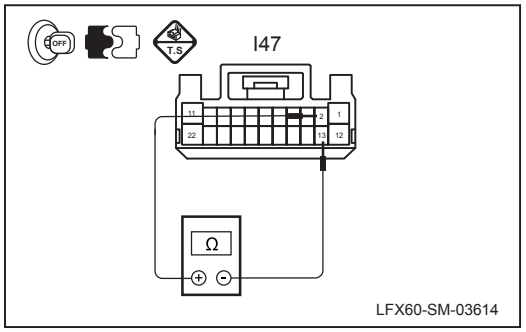
Test condition	Details/results/measures
3. Clear the trouble code.	
	A. Connect the equipment for diagnosing faults to the diagnostic interface. B. Operate the start switch to turn the power to ON state C. Clear the trouble code by using diagnostic equipment. Does the trouble code reappear? →Yes To step 4. →No Finish.
4. Check CAN bus terminal resistance.	
	A. Operate the start switch to turn the power to OFF state B. Measure the resistance between the 6th and 14th terminals of the OBD diagnostic interface I12 with a multimeter. **Standard value:60±5Ω** →Yes Step 5. →No Examine and repair the fault location.
5. Check the CAN line of each control module.	
 	A. Operate the start switch to turn the power to OFF state B. Disconnect the battery negative cable. C. Disconnect the engine control module harness connector E01b. D. Measure the resistance between the 1st and 17th terminals of the engine control module harness connector E01b with a multimeter. **Standard value:120±5Ω** E. Plug the engine control module connector E01b. F. Disconnect the BCM plug I47. G. Measure the resistance between the 2nd and 13th terminals of the BCM harness connector I47 with a multimeter. **Standard value:120±5Ω** H. Plug the BCM plug I47. I. Disconnect the ABS control module plug U10. J. Measure the resistance between the ABS control module harness plug U10 terminal 14 and terminal 26 with the multimeter. **Standard value:60±5Ω** Is it OK after checking? →Yes Step 6. →No Examine and repair the fault location.

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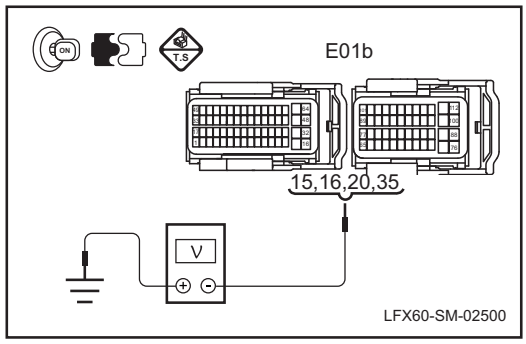
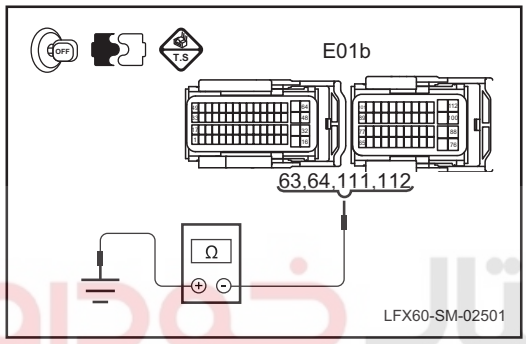
Test condition	Details/results/measures
6. Check the ECM power supply line.	
	A. Operate the start switch to turn the power to ON state B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value:11 ~ 14V** Is the voltage normal? →Yes To step 7. →No Troubleshoot the ECM power supply line and replace the harness if necessary.
7. Check the ECM grounding line.	
	A. Operate the start switch to turn the power to OFF state B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value:Less than 5Ω** Is the resistance normal? →Yes To step 8. →No Troubleshoot the ECM grounding line and replace the harness if necessary.
8. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of the engine control module(ECM)** Is the system normal? →Yes Replace ECM. →No Step 9.
9. Check the ABS control module or body control module.	
	A. Replace the ABS control module or body control module. **Refer to:Replacement of body control module or replacement of ABS** Confirm that the fault has been ruled out.

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Removal and installation

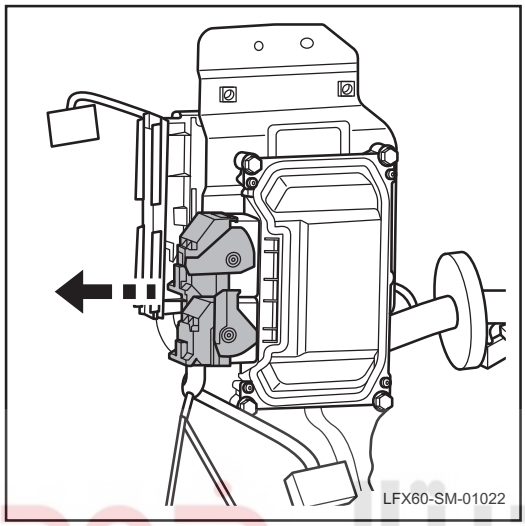
Electronic control unit (ECU)

Removal

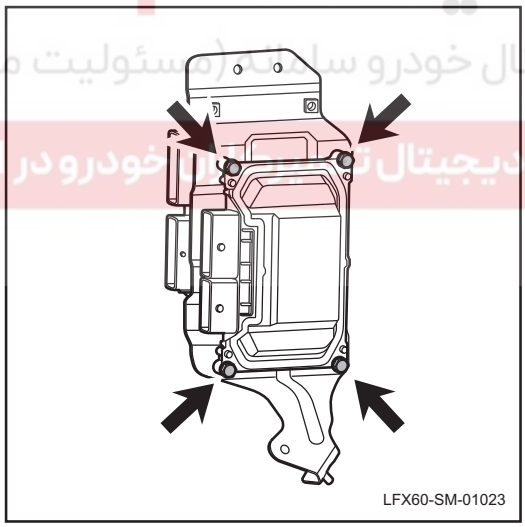
1. Remove the electronic control unit (ECU).

(a). Disconnect the battery negative connector.

(b). Remove the glove box. See: Replacement of dashboard assembly.



(c). Disconnect the electronic control unit (ECU) harness plug.



(d). Remove the four ECU fixing bolts.

(e). Take down the electronic control unit (ECU).

Note:

After the removal, protect ECU against water and do not soak it in water. Handle ECU gently while removing it.

Installation

1. Install the electronic control unit (ECU).

(a). The installation sequence is the reverse of the disassembly order.

Note:

Pay attention to static electricity protection during installation.

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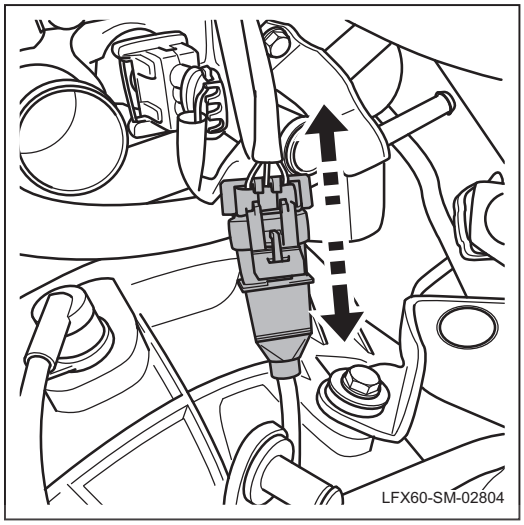
Replacement of the crankshaft position sensor

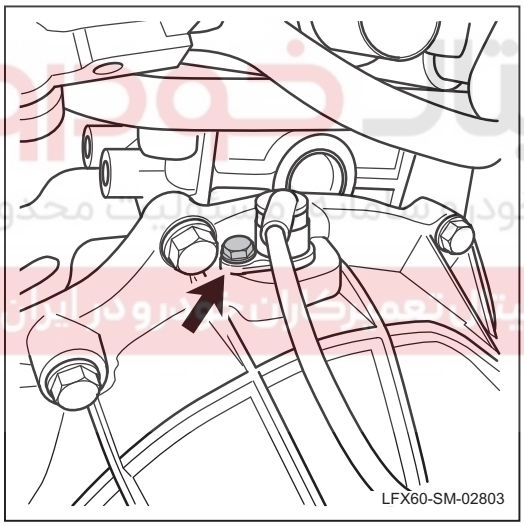
Removal

1. Remove the crankshaft position sensor.

(a). Disconnect the battery negative connector.



(b). Disconnect the crankshaft position sensor harness plug.



(c). Remove the crankshaft position sensor fixing bolt.

(d). Take down the crankshaft position sensor.

Note:

Screen the sensor notch to prevent the foreign body falling in the engine and causing damage.

Installation

1. Install the crankshaft position sensor.

(a). The installation sequence is the reverse of the disassembly order.

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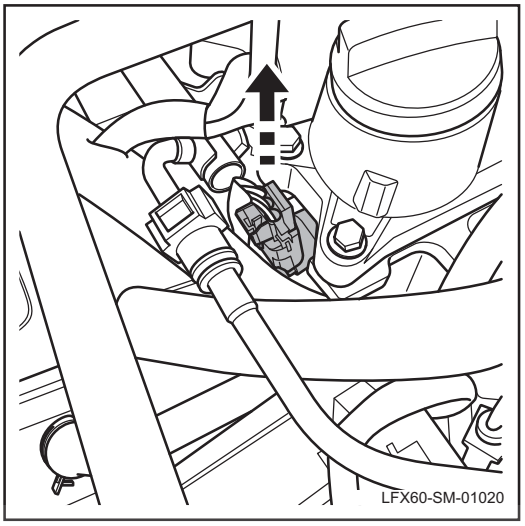
Camshaft position sensor

Removal

1. Remove the camshaft position sensor.

(a). Disconnect the battery negative connector.



(b). Disconnect the camshaft position sensor harness plug.

(c). Remove the camshaft position sensor fixing bolt.

(d). Take down the camshaft position sensor.

Note:

Screen the sensor notch to prevent the foreign body falling in the engine and causing damage.

After the removal, clean the installation face and ensure there is no oil stain.

Installation

1. Install the camshaft position sensor.

(a). The installation sequence is the reverse of the disassembly order.

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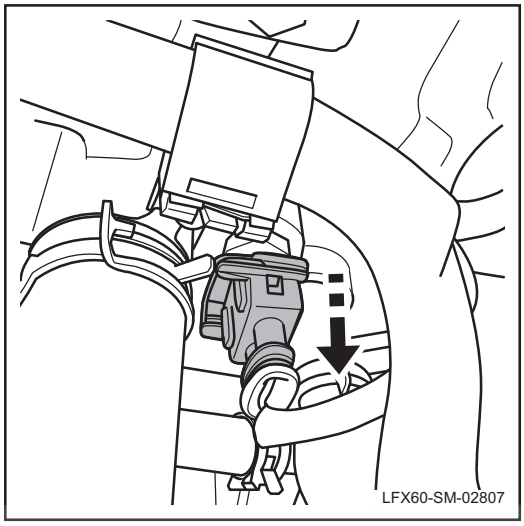
Water temperature sensor

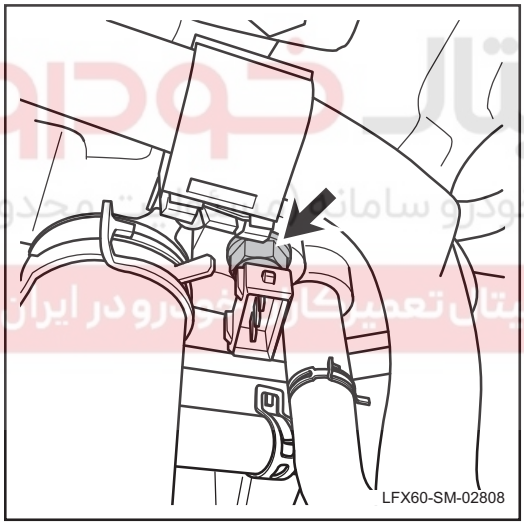
Removal

1. Remove the water temperature sensor.

(a). Disconnect the battery negative connector.



(b). Disconnect the water temperature sensor harness connector.



(c). Remove the water temperature sensor.

Note:

Screen the sensor notch to prevent the foreign body falling in the engine and causing damage.

Installation

1. Install the water temperature sensor.

(a). The installation sequence is the reverse of the disassembly order.

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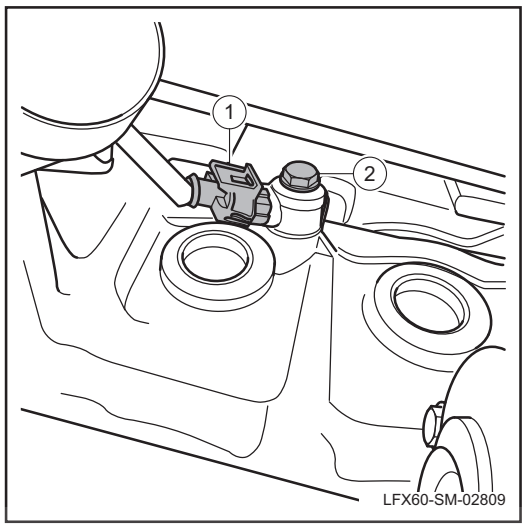
Knock Sensor

Removal

1. Remove the knock sensor.

(a). Disconnect the battery negative connector.



(b). Disconnect the knock sensor harness plug 1.

(c). Remove the knock sensor fixing bolt 2.

(d). Take down the knock sensor.

Installation

1. Install the knock sensor.

(a). The installation sequence is the reverse of the disassembly order.

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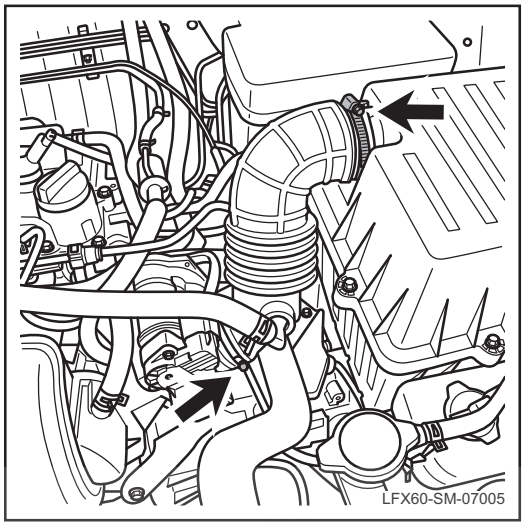
Replacement of electronic throttle body assembly

Removal

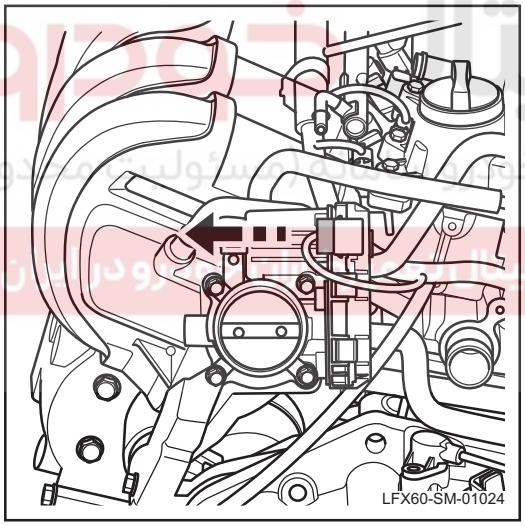
1. Remove the electronic throttle body assembly.

(a). Open the engine compartment door.

(b). Disconnect the battery negative connector.



(c). Disconnect the air intake duct fixing clamp.



(d). Disconnect the electronic throttle body assembly harness plug.

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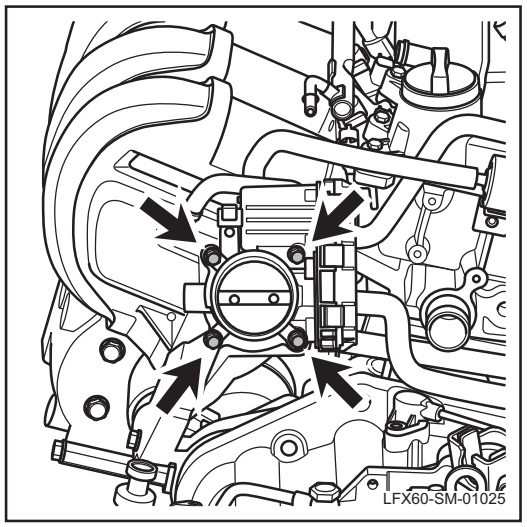

(e). Remove the electronic-controlled throttle body fixing bolts.

(f). Loosen the electronic-controlled throttle bracket lower-side fixing bolts.

(g). Take down the electronic throttle body assembly.

Installation

1. Install the electronic throttle body assembly.

(a). The installation sequence is the reverse of the disassembly order.

Inspection

a. When not powered on, the valve plate should be at the mechanical LDC position. When being turned by hand, the valve plate should rotate smoothly. If the valve plate seizing occurs, it means the inside parts may be damaged.

b. Replace the electronic throttle body assembly if necessary.

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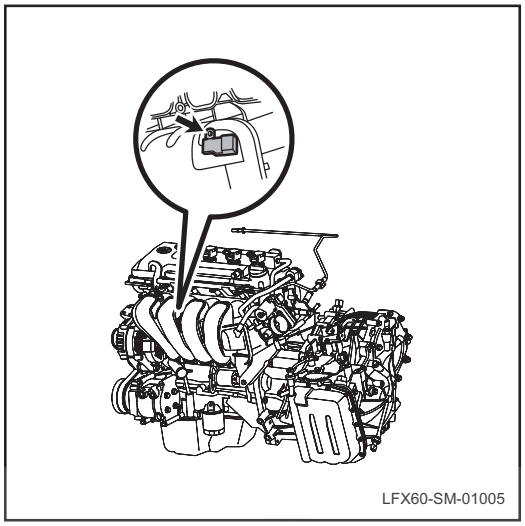
Replacement of intake pressure/temperature sensor

Removal

1. Remove the intake pressure temperature sensor

(a). Disconnect the battery negative connector.

(b). Remove the intake manifold. Refer to the replacement of intake manifold.



(c). Disconnect the intake pressure/ temperature sensor harness plug.

(d). Remove the intake pressure/ temperature sensor fixing bolt.

(e). Take out the intake pressure/ temperature sensor.

Installation

1. Install the intake pressure temperature sensor

(a). The installation sequence is the reverse of the disassembly order.

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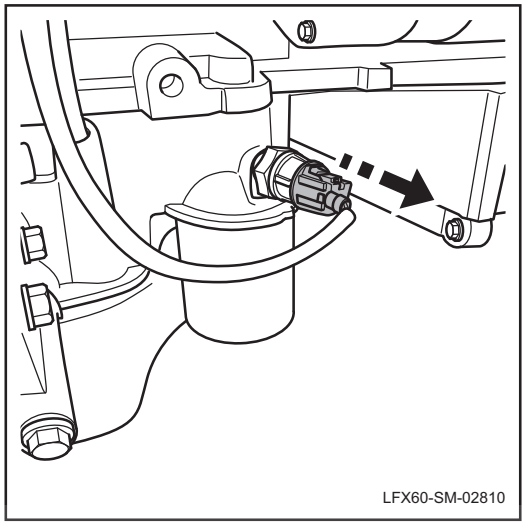
Replacement of oil pressure sensor

Removal

1. Remove the oil pressure sensor.

(a). Disconnect the battery negative connector.



(b). Disconnect the oil pressure sensor harness plug.

(c). Remove the oil pressure sensor.

Installation

1. Install the oil pressure sensor.

(a). The installation sequence is the reverse of the disassembly order.

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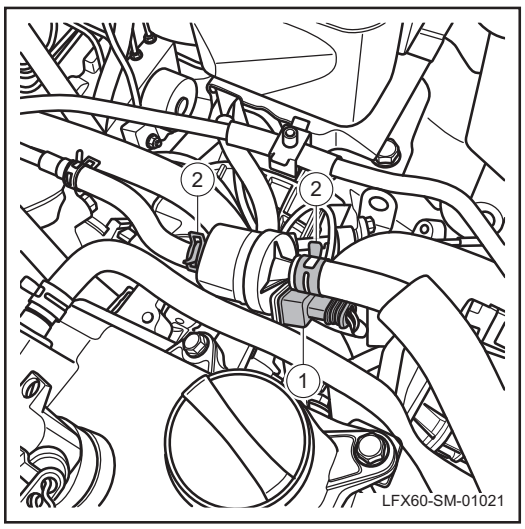
Replacement of canister control valve

Removal

1. Remove the canister control valve.



(a). Disconnect the battery negative connector.
(b). Disconnect the canister control valve harness plug 1.
(c). Remove the charcoal canister solenoid valve connection hose clamp 2.
(d). Disengage the charcoal tank solenoid valve connection hose.
(e). Take down the canister control valve.

Installation

1. Install the canister control valve.

(a). The installation sequence is the reverse of the disassembly order.

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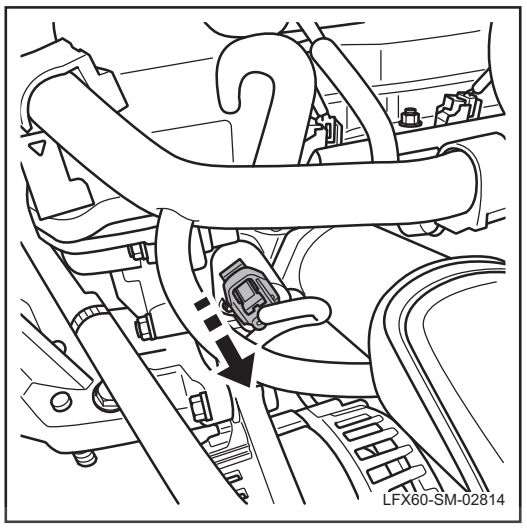
Replacement of air intake VVT valve

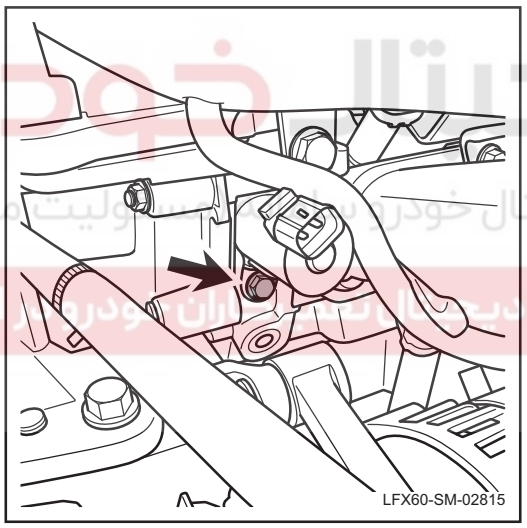
Removal

1. Remove the air intake VVT valve.

(a). Disconnect the battery negative connector.



(b). Disconnect the air intake VVT valve harness plug.



(c). Remove the air intake VVT valve fixing bolt and take down the VVT valve.

Installation

1. Install the air intake VVT valve.

(a). The installation sequence is the reverse of the disassembly order.

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