SQRE4T15C ENGINE MANAGEMENT SYSTEM

04

GENERAL INFORMATION

Overview

System Basic Principle

SQRE4T15C engine electronic control system of T1E model adopts UAES ME17U6.1. This system mainly consists of Engine Control Module (ECM), sensors and actuators, which controls intake air amount, injection volume and ignition timing, etc. when engine is operating.
In the engine management system, sensors are used as the input part to measure various physical signals (temperature and pressure, etc.), and converts them into corresponding electrical signals; the function of ECM is to receive the input signals from sensors and perform calculation according to set procedure, producing corresponding control signals and outputting them to power drive circuit. The power drive circuit drives each actuator to perform various actions, thus making the engine run according to the preset program. Also, the trouble diagnosis system of ECM monitors each component and control function in this system. Once detecting and confirming a fault, it will store the trouble code. When detecting that fault has been eliminated, it will return to use normal value.
The basic characteristic of ME17U6.1 engine electronic control management system is the use of torque based control strategy. The main purpose of the torque based control strategy is to associate a large number of different control objectives. This is the only way to flexibly choose to integrate various functions into different variants of ECM according to engine and vehicle model.

Basic Management Function of Engine

Basic Management Function of Engine

1. System structure based on torque.
2. Cylinder load is determined by intake pressure sensor / air flow sensor.
3. Improved air-fuel mixture control function in static and dynamic conditions.
4. Closed-loop control.
5. Fuel is injected from each cylinder sequentially.
6. Ignition timing, including cylinder-by-cylinder knock control.
7. Emission control function.
8. Catalytic converter heating.
9. Canister control.
10. Idle control.
11. Limp home.
12. Perform speed sensing by increment system.

Additional function

1. Immobilizer function.
2. Communication with torque and external system (example: gear train or vehicle dynamic control).
3. Controls of several engine components.
4. Interfaces of matching, EOL-programming tools and service tools are provided.

Diagnosis On-line OBD

1. Complete a series of OBD functions.
2. Management system for diagnostic functions.

Torque structure: ME17U6.1 system based on torque control

In ME17U6.1 torque-based engine management system, all internal and external demands of engine are defined with the torque or efficiency requirements of the engine as shown in figure 2-3. By converting the various demands of engine into control variables for torque or efficiency, these variables are then first processed in central torque demand coordinator module. ME17U6.1 system can prioritize these conflicting requirements and execute the most important requirement. Obtain engine control parameters such as required fuel injection time and ignition timing with torque conversion module. The execution of this control variable has no effect on other variables. This is the advantage of the torque-based control system.

Similarly, when engine matching is performed, due to the variable independence of the torque control system, only the engine data is relied on when matching the engine characteristic curve and pulse diagram, and there is no interference with other functional functions and variables, thus avoiding repeated calibration, simplifying the matching process and reducing the matching cost.

Compared with the previous M series engine electronic fuel injection management system, the main features of ME17U6.1 system

- New torque-variable engine functional structure is most compatible with other systems and has strong expandability.
- New modular software structure and hardware structure with strong portability.
- Model-based engine basic characteristic diagram is independent of each other, and simplifies the calibration process.
- Sequential fuel injection with phase sensor is used to improve emissions.
- Anti-theft function is incorporated in system.
- Improve driving performance through centralized coordination of various torque requirements.
- 32 bits CPU, 40 MHz clock frequency.

Control Signal: Input/Output Signal of ME17U6.1 System

Main sensor input signals of ECM in ME17U6.1 system include:

- Intake pressure signal.
- Electronic accelerator pedal signal.
- Intake temperature signal.
- Throttle rotation angle signal.
- Coolant temperature signal.
- Engine speed signal.
- Phase signal.
- Knock sensor signal.
- Oxygen sensor signal.
- Vehicle speed signal.
- A/C pressure signal.

Required actuator control signals which are generated via ECM from sensor input signals in ME17U6.1 system include

- Electronic throttle opening.
- Injection timing and fuel injection duration.
- Fuel pump relay.
- Canister control valve opening.
- Ignition coil closing angle and ignition advance angle.
- A/C compressor relay.
- Cooling fan relay.

System Function

Start control

During starting, special calculation methods are used to control the filling, fuel injection and ignition timing. At the beginning of the process, the air in intake manifold is still, and the internal pressure of intake manifold is shown to be ambient pressure.

The specific "injection timing" is designated as the initial injection pulse in a similar process.

The fuel injection is changed according to engine temperature to promote the formation of oil film on intake manifold and cylinder wall, so the mixture should be enriched when the engine reaches a certain speed. Once the engine starts to run, the system starts to reduce the start and thicken immediately, until the start condition ends (600-700min^{-1}) to completely cancel the start and thicken.

Ignition angle is constantly adjusted with starting conditions. It varies with engine temperature, intake air temperature and engine speed.

Heating control of engine warm-up and three-way catalyst

After engine is started at low temperature, cylinder volume, fuel injection and electronic ignition are adjusted to compensate higher engine torque request; And this process continues until temperature rises to proper threshold.

In this stage, rapid heating of three-way catalytic converter is the most important, since rapid transition to operation of three-way catalytic converter can greatly reduce exhaust emissions. Under this working condition, adopt moderate retard ignition advanced angle and use exhaust gas to perform "three-way catalytic converter heating".

Acceleration/deceleration and motored fuel cut-off control

When the throttle opening increases, some of the injected fuel is absorbed by oil film. Therefore, it is necessary to inject the corresponding fuel amount to compensate and prevent the mixture from becoming lean during acceleration. Once the load factor is reduced, the additional fuel contained in the oil film on intake manifold wall will be released again, so the corresponding injection duration must be reduced during deceleration.

Motored or traction condition indicates that the power provided by engine at the flywheel is negative. In this case, engine friction and pump air loss can be used to slow down the vehicle. When the engine is in motored or traction condition, the fuel is cut off to reduce fuel consumption and exhaust emissions, and more importantly to protect the three-way catalyst.

Once the speed has been reduced to a specific recovery of the fuel supply speed above idle speed, the fuel injection system is resupplied. In fact, the ECM program has a range of recovery speed. They vary according to engine temperature, dynamic change of engine speed, etc., and they are calculated to prevent the speed from falling to the specified minimum threshold.

Once the injection system is resupplied, the system begins to use the initial injection pulse to supply the fuel and rebuild the oil film on the intake manifold wall. After recovery of fuel injection, the torque-based control system increases the engine torque slowly and smoothly (smooth transition).

Idle control

Engine does not provide torque to the flywheel at idle. To ensure stable operation of the engine at as low an idle speed as possible, the closed-loop idle speed control system must maintain the balance between the generated torque and the engine power consumption. The idle speed requires a certain amount of power to meet the load requirements of all aspects. They include internal friction from the engine crankshaft and valve gear and auxiliary components such as the water pump.

ME17U6.1 system uses torque based control strategy to determine engine output torque requested by maintaining required idling speed in all working conditions according to closed loop idle control. This output torque increases as engine speed reduces, and reduces as engine speed increases. System responses to the new "interference factor" through requesting higher torque, such as turning on/off air conditioning compressor or shifting of automatic transmission. When engine temperature is low, torque is also needed to be increased to compensate higher internal friction and/or maintain higher idling speed. The sum of these required output torque will be transmitted to torque coordinator which will process, calculate and obtain corresponding volumetric density, mixture contents and ignition timing.

λ closed-loop control

Exhaust aftertreatment in three-way catalytic converter is an effective method for reducing concentration of harmful substance in exhaust gas. Three-way catalytic converter can reduce hydrocarbon (HC), carbon monoxide (CO) and nitric oxide (NO_2) up to 98% or more, and convert them into water (H_2O), carbon dioxide (CO_2) and nitrogen (N_2). However, such high efficiency can be achieved only within small range of engine excess air coefficient λ=1, λ closed loop control is aimed to ensure mixture concentration within this range.

λ closed loop control system functions only when oxygen sensor is equipped. Oxygen sensor on side of three-way catalytic converter monitors oxygen content in exhaust gas, lean mixture (λ > 1) will generate about 100 mV sensor voltage, and rich mixture (λ < 1) will generate about 900 mV sensor voltage. When λ = 1, sensor voltage will jump. λ closed loop control responses to input signal (λ > 1 = lean mixture, λ < 1 = rich mixture) to correct control variable, a correction factor is generated as a multiplier to correct the fuel injection duration.

Evaporative emission control

Due to external transfer of radiant heat and returned fuel heat, the fuel in fuel tank is heated and forms fuel vapor. Due to limits of evaporative emission regulations, these vapors containing a large amount of HC components are not allowed to be discharged directly into the atmosphere. In system, fuel vapor will be collected in activated carbon canister through guide pipe and enters into engine and participates in the combustion process through scour at the right moment. Flow rate of scour airflow is realized by ECM controlling canister control valve. This control operates only under closed loop working condition of λ closed loop control system.

Knock control

System detects characteristic vibration at moment knock occurs through knock sensor installed in proper position of engine, and converts it into electrical signal to transmit it to ECM for processing. ECM uses special processing method to detect if knock occurs in each combustion cycle in each cylinder. Once knock is detected, knock closed loop control is triggered. After knock danger is eliminated, ignition of affected cylinder will be gradually advanced to predetermined ignition advance angle.

Knock control threshold has good adaptability to different working conditions and different grades of fuel.

System Malfunction Diagnosis Function Introduction

Malfunction information record

Electronic control unit constantly monitors sensors, actuators, related circuits, malfunction indicator light, battery voltage and so on, and even electronic control unit itself. And it performs reliability detection for sensor output signal, actuator drive signal and internal signals (such as λ closed loop control, coolant temperature, knock control, idle speed control and battery voltage control, etc.). Once a certain step failure or untrusted signal value is found, electronic control unit will immediately set malfunction information record in RAM malfunction memory. Malfunction information record is stored in the form of trouble code and displays in the order in which malfunctions occurred.

Frequency of malfunction can be divided into "steady state malfunction" and "intermittent malfunction" (for example, due to a short break of the wire harness or poor contact of the connector).

Malfunction light description and its control strategy

In general, component related to emission or the indication when system failed is an indicator light (MIL) which can be displayed on instrument panel and its shape is complied with standard requirements of regulation.

1. Activation of MIL light follows the below principles:
    1. ENGINE START STOP switch is turned to ON (not started), and MIL remains on.
    2. After the engine is started, if there is no malfunction request for turning on MIL in malfunction memory, MIL goes off.
    3. There is malfunction request for turning on MIL in malfunction memory, or there is request for turning on MIL at outside of ECM, MIL will turn on.
    4. When there is a MIL flashing request at outside of ECM, or there is a MIL flashing request in misfire cause, or there is malfunction request that flashes MIL as necessary in malfunction memory, MIL will flash at a frequency of 1Hz.
2. On vehicles equipped with an electronic throttle system, there is EPC indicator light that used to indicate engine electronic control system related faults besides MIL light. EPC indicator light is used to indicate E-GAS system (electronic accelerator and electronic throttle) related faults in general.
3. Activation of EPC indicator light follows the below principles
    1. ENGINE START STOP switch is turned to ON (not started), and EPC remains on.
    2. After the engine is started, if there is no malfunction request for turning on EPC indicator light in malfunction memory, EPC indicator light goes off.
    3. There is malfunction request for turning on EPC in malfunction memory, or there is request for turning on EPC at outside of ECM, EPC will turn on.

Diagnostic tester display

1. Engine Parameter Display
    1. Engine speed, coolant temperature, throttle opening, ignition advance angle, injection pulse width, intake pressure, intake temperature, vehicle speed, system voltage, injection correction, canister scour rate, idle air control, oxygen sensor waveform;
    2. Target speed, relative engine load, ambient temperature, ignition closing time, evaporator temperature, intake air flow, fuel consumption amount;
    3. Throttle valve position sensor signal voltage, coolant temperature sensor signal voltage, intake temperature sensor signal voltage, intake pressure sensor signal voltage, knock sensor terminal 1 signal voltage, knock sensor terminal 2 signal voltage.
2. Electronic Fuel Injection System State Display
    (a) Immobilizer system state, safety state, program state, cooling system state, stable working condition state, dynamic working condition state, emission control state, oxygen sensor state, idling state, malfunction indicator light state, emergency working condition state, A/C system state, automatic transmission/torque request state.
3. Actuator Test Function
    (a) Malfunction light, fuel pump, A/C relay, fan, canister purge valve and throttle opening.
4. Version Information Display
    (a) Frame number (VIN), ECM hardware number, ECM software number.
5. Malfunction Display
    (a) Air flow meter, intake temperature sensor, engine coolant temperature sensor, throttle valve position sensor, oxygen sensor, oxygen sensor heating line, air-fuel ratio correction, fuel injector of each cylinder, fuel pump, knock sensor, speed sensor, phase sensor, canister control valve, cooling fan relay, vehicle speed signal, idle speed, electronic throttle body, system voltage, ECM, A/C compressor relay, malfunction light.

System features

- Multi-point sequential injection system.
- New torque-variable engine functional structure is most compatible with other systems and has strong expandability.
- New modular software structure and hardware structure with strong portability.
- Phase sensor signal is adopted (phase sensor).
- Signal plate with 60-2 teeth is used to identify speed signal (speed sensor).
- Electronic throttle body idle speed control is used.
- Realized idle torque closed-loop control.
- Cylinder-by-cylinder independent knock control (knock sensor).
- Equipped with function of heating and protecting catalytic converter.
- Equipped with limp home function, etc.

Control Strategy

A/C control strategy

1. 8s after engine is started, A/C compressor is allowed to operate. Within 8s of engine starting, even if the A/C request switch is pressed, A/C compressor will not engaged.
2. When coolant temperature is higher than 115 degrees, A/C is powered off. When coolant temperature is below 113 degrees, A/C control resumes. When coolant temperature is between 106 and 114 degrees, A/C control status does not change.
3. When engine speed exceeds 6520 rpm or below 560 rpm, A/C is powered off. A/C control resumes when engine speed is between 640rpm and 6320rpm. When the engine speed is in range of 6320-6520rpm and 560-640rpm, A/C maintains the previous state.
4. When the battery voltage is lower than 9.5V, A/C is powered off, and A/C control resumes when battery voltage is higher than 11V; When the battery voltage is higher than 16V, A/C is powered off, and A/C control resumes when battery voltage is lower than 15V.

5. Due to the large A/C engine torque consumption, T1E + E4T15C model has developed an accelerated disconnection A/C strategy. When the accelerator pedal is depressed firmly, A/C will be powered off to ensure dynamic property when overtaking. When the A/C is disconnected for more than a certain period of time or the driver accelerator pedal opening is reduced, A/C will be turned on again.

Fan control strategy

1. Fan control strategy when engine is running normally

   Hint:

   - T1E + E4T15C model equipped with a two-speed fan, and ECM judges and controls different fan speeds based on water temperature, A/C pressure signal and vehicle speed signal.

   (a) Speed limit thresholds of fan to stop rotation in each state are as follows:
   1. When coolant temperature is higher than 94°C and vehicle speed is lower than 80, low speed fan operates; After coolant temperature is lower than 91°C, low speed fan stops operating.
   2. When coolant temperature is higher than 105°C and vehicle speed is lower than 80, high speed fan operates; After coolant temperature is lower than 102°C, high speed fan stops operating.
   3. When coolant temperature is higher than 110°C and vehicle speed is higher than 80, high speed fan operates; After coolant temperature is lower than 107°C, high speed fan stops operating.

2. Fan control strategy after stalling
   1. If coolant temperature is higher than 101°C or air temperature in manifold is higher than 70°C after engine stalling, fan will operate at high speed.
   2. If coolant temperature is lower than 98°C or air temperature in manifold is higher than 67°C, fan stops operating at high speed.
   3. Fan operates at most 40s after stalling.

Three-way catalytic converter protection control strategy

1. When engine is operating normally, if exhaust pipe model temperature exceeds 880°C, exhaust temperature concentration protection function is activated, and ECM reduces the exhaust temperature by increasing the air-fuel ratio.
2. When exhaust pipe temperature drops below 830°C, concentration protection stops working and the air-fuel ratio returns to normal.
3. When engine is operating normally, if catalytic converter central model temperature exceeds 900°C, catalytic converter protection function is activated and ECM reduces the catalytic converter temperature by increasing the air-fuel ratio.
4. When catalytic converter central temperature drops below 850°C, concentration protection stops operating and air-fuel ratio returns to normal.

Canister control valve control strategy

1. Canister control valve opening conditions
   1. Engine coolant temperature is higher than 55°C.
   2. Engine air-fuel ratio control has entered the closed loop.
   3. Canister control valve trouble-free.
2. Canister control valve scour time control

   (a) Since canister scour and air-fuel ratio self-learning cannot be performed at the same time, Bosch system uses a software to rationally allocate the time for opening canister control valve and air-fuel ratio self-learning time to ensure that the functions are normal. Canister scour and air-fuel ratio self-learning are performed alternately during normal engine operation.
3. Canister control valve opening control

   (a) Openings of canister control valve are different at different engine speeds and loads. ECM calculates the current opening of canister control valve according to the conditions such as engine speed, load, and air-fuel ratio fluctuation.

Oxygen sensor heating logic

- Oxygen sensor must reach a certain temperature in order to work normally, usually at 350°C to 900°C. It is not enough to heat by exhaust temperature only. Therefore, there is a fuse inside oxygen sensor for heating specially. Heating with low power before dew point and heating with high power or even full-power after the dew point. So that the oxygen sensor can reach the operating temperature as soon as possible.
- Dew point mark is an important input for oxygen sensor heating, mainly to protect the oxygen sensor.
- Physical background of dew point. After the engine is started and exhaust system temperature is lower for a certain period of time, water vapor may condense on exhaust system. If the oxygen sensor ceramic body exceeds a certain temperature during this period, and condensation splashes on oxygen sensor ceramic body, condensation may cause the ceramic body to break. Therefore, it is necessary to monitor oxygen sensor temperature and exhaust pipe wall temperature near the oxygen sensor in real time when engine is started. Waste water is always condensing on the exhaust pipe wall in general. When the temperature of exhaust pipe wall reaches a certain value, it will stagnate for a period of time or the rate of rise will be slower due to the condensation of water vapor and overlap of the evaporation process. Temperature at this point is called the dew point temperature. If the wall temperature continues to rise, water vapor in the exhaust will no longer condense and evaporate on exhaust pipe wall.

Knock control strategy

1. Knock control is activated when engine coolant temperature exceeds 40°C and engine load is more than 36%.
2. ECM performs knock control through feedback signal from knock sensor. When knock is detected, ECM delays the ignition angle by a fixed step of -3 degrees, and the maximum delay of ignition angle is 12 degrees. If no new knock is detected for several consecutive combustions, the delayed ignition angle will recover with a step size of 0.75 until the delayed ignition angle is fully recovered or a new knock is detected.
3. If there is a knock sensor failure, ECM will reduce the output ignition angle of the engine to ensure the safety of engine.

Ignition control strategy

1. Ignition coil charging control
   (b) Ignition coil magnetization time determines the ignition energy of the spark plug. Normally the supply voltage is close to 14V when the vehicle is working normally. If the vehicle generator is not working properly, the supply voltage may be much lower than 14V, and may even drop to 6V or lower. In order to get the same ignition energy, the ECM will change the charging time of primary coil.
2. Ignition advance angle calculation
   1. Ignition angle control when starting.
      During the start-up stage of engine, system uses a separated ignition angle MAP to control the starting reliability of engine. When engine is started, system switches to normal ignition angle control mode.
   2. Ignition advance angle control at idle speed.
      Engine ignition angle does not operate at the optimum ignition angle when idling, but instead operates at an angle less than the optimal ignition angle. If the engine idle fluctuates or the external impact occurs, ECM can quickly correct the ignition angle to ensure the stability of idle speed.
   3. Ignition advance angle control during normal driving.
      When the engine is running at a constant speed, the engine is operated at the maximum ignition angle allowed under this operating condition.
   4. Acceleration and deceleration process ignition advance angle control
      In order to ensure the smoothness during acceleration and deceleration, the ECM controls the ignition angle for torque intervention during acceleration and deceleration.

Idle control strategy

Relationship between water temperature, speed, and altitude are as follows (abscissa is water temperature, and ordinate is altitude)

	-30	-15	-6.8	0	20.3	39.8	80.3	90	110.3
0.5	1200	1100	1100	1050	1050	1050	1050	1050	1050
0.594	1200	1100	1100	1050	1050	1000	1000	1000	1000
0.703	1200	1100	1100	1050	1000	900	900	900	900
0.844	1200	1100	1100	1050	900	850	800	800	800
0.953	1200	1100	1100	1050	850	750	700	700	700
1	1200	1100	1100	1050	850	750	700	700	700

Comments

1 stands for plains; 0.9 stands for altitude 1000m; 0.8 stands for altitude 2000m; and so on, 0.5 stands for altitude 5000m

- Warm engine normal idle speed 700±50rpm.
- In order to protect the safety of the engine and the vehicle, the maximum speed of the neutral is limited to 4500rpm and the duration exceeds 40S and then returns to idling.
- Under normal conditions, the normal idling speed of the warm engine is 700rpm; it is raised to 880rpm after A/C turning on.

Oil pump control strategy

1. When the ignition switch is turned to ON for the first time, ECM controls the operation of oil pump. After the oil pump flow reaches the set fuel supply, oil pump stops working. If the engine has not been started, after the engine has been stopped for more than 100 seconds, oil pump will operate again after the ignition switch turned to ON each time and after three consecutive operations, oil pump will no longer operate after ignition switch turned to ON.
2. When ECM detects the engine starting, it will control the operation of oil pump.
3. When the engine is running normally, ECM controls oil pump to work continuously.

Starter protection function

1. When the starting speed is higher than 720rpm, system forcibly disengages the starter and confirms that the start is successful.
2. In order to prevent the engine from starting during operation, when the speed is higher than 50rpm, system considers the engine to be running and does not drag the starter.
3. The maximum time to start and drag according to the water temperature limit to prevent starter from overheat damaging. The maximum working time of the starter is limited as shown in the figure below:

X	-39.8	-20.3	-20	0	20	30
Y	25	15	12	8	6	4

4. Determine the speed of the starter at different water temperatures and voltages by matching the values of the starter disengagement speed (as show below).

	-39.8	-20.3	0	15	45	80.3
8	880	880	880	880	720	720
16	880	880	880	880	720	720
25	880	880	880	880	720	720

Specifications

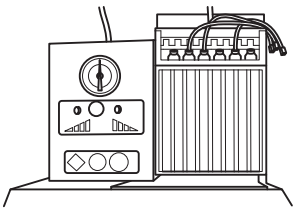
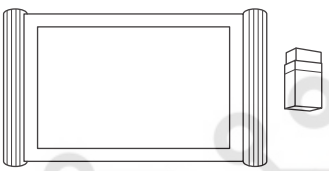
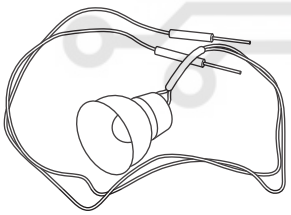
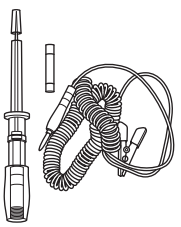
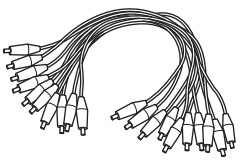
Torque Specifications

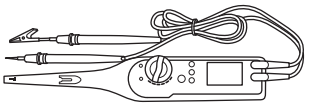
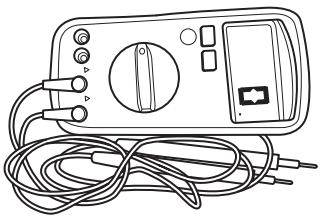
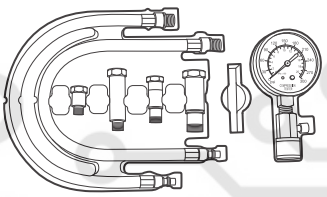
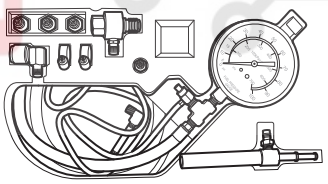
Description	Torque (N·m)
Coolant Temperature Sensor	14 ± 1
Intake Pressure/Temperature Sensor Fixing Bolt	6 ± 1
Knock Sensor Fixing Bolt	20 ± 5
Crankshaft Position Sensor Fixing Bolt	8 ± 2

Description	Torque (N·m)
Camshaft Position Sensor Fixing Bolt	8 ± 1
VVT Control Valve Fixing Bolt	8 ± 2
ECM Fixing Bolt	8 ± 2

Tools

General Tools

Tool Name	Tool Drawing
Fuel Injector Cleaning Analyzer	 RCH0062006
X-431 PAD Diagnostic Tester	 RCH000106
21 W Test Lamp	 RCH008706
LED Test Light	 RCH0960006
Jumper Wire	 RCH0088006

Tool Name	Tool Drawing
Diode Test Light	 RCH0970006
Digital Multimeter	 RCH0002006
Cylinder Pressure Gauge	 RCH0044006
Fuel Pressure Gauge	 RCH0048006
Oscilloscope	 RCH0061006

ECM Terminal Definition

ECM Connector

Terminal No.	Description	Terminal No.	Description
1	CAN Bus 1 High	57	-
2	Upstream Oxygen Sensor Feedback Voltage	58	Starter Control
3	-	59	Electronic Accelerator Pedal Sensor 2 Ground
4	-	60	2nd Coolant Temperature Sensor Signal
5	Main Relay	61	-
6	Clutch Switch	62	Boost Pressure Sensor 2
7	Electronic Accelerator Pedal Sensor 1 Ground	63	ECM Ground 2
8	-	64	ECM Ground 1
9	Cruise Control	65	-
10	High/Low Pressure Switch	66	Canister Closed Valve
11	Upstream Oxygen Sensor Virtual Ground Voltage	67	Cylinder 2 Injector
12	Absolute Brake Vacuum Sensor Pressure Signal	68	Cylinder 1 Injector
13	3rd Coolant Temperature Sensor Signal	69	Variable Camshaft Timing Valve (Exhaust)
14	Upstream Oxygen Sensor Control Signal	70	ERCV Valve
15	Power Supply	71	Variable Camshaft Timing Valve (Intake)
16	Power Supply	72	Cylinder 3 Injector
17	CAN Bus 1 Low	73	Ignition Coil 2
18	-	74	Cylinder 4 Injector
19	5 V Power Supply 1	75	Throttle Actuator (+)
20	Power Supply	76	Upstream Oxygen Sensor Heating
21	Downstream Oxygen Sensor Signal	77	Throttle Position Sensor 1
22	Desorption Pressure Sensor Signal	78	Throttle Position Sensor 2
23	Brake Switch	79	Exhaust By-pass Valve Sensor Signal
24	Medium Pressure Switch	80	Upstream Oxygen Sensor Ground
25	Brake Light Switch	81	Ignition Coil 1
26	-	82	Ignition Coil 3
27	-	83	Ignition Coil 4
28	Upstream Oxygen Sensor Correction Resistance	84	Analog Ground
29	-	85	Intake Pressure/Temperature Sensor Ground
30	Electronic Accelerator Pedal Sensor	86	Throttle Position Sensor Ground
31	Exhaust By-pass Valve Motor+	87	Immobilizer Input
32	Exhaust By-pass Valve Motor-	88	Electronic Thermostat
33	-	89	Knock Sensor B
34	-	90	Knock Sensor A
35	ENGINE START STOP Switch	91	Intake Pressure/Temperature Sensor Signal
36	Electronic Accelerator Pedal Sensor 2 Ground	92	Electric Water Pump
37	5V Power Supply of Electronic Accelerator Pedal Sensor 1	93	Intake Phase Sensor Signal
38	-	94	Canister Control Valve
39	-	95	Intake Phase Sensor Ground
40	-	96	Engine Speed Sensor Input
41	Fuel Pump Relay	97	Engine Speed Sensor Ground
42	A/C Compressor Relay	98	Phaser Sensor (+5V)
43	Downstream Oxygen Sensor Ground	99	Electronic Throttle Actuator Motor+
44	Clutch Bottom Switch	100	Electronic Throttle Actuator Motor-
45	Electronic Accelerator Pedal Sensor 1	101	Coolant Temperature Sensor 1

Terminal No.	Description	Terminal No.	Description
46	Boost Pressure Sensor Signal 1	102	Intake Temperature Sensor Signal
47	Analog Ground	103	Fuel Tank Pressure Sensor
48	Downstream Oxygen Sensor Heating	104	Upstream Oxygen Sensor Signal
49	-	105	Phaser Sensor 2 Signal
50	-	106	Signal Feedback
51	Fan Control High Speed	107	5V Power Supply of Throttle Valve
52	-	108	Speed Sensor Power Supply
53	A/C High/Low Pressure Switch	109	5 V Power Supply of Intake Pressure Sensor
54	Vacuum Pump Relay	110	-
55	-	111	ECM Ground 4
56	Fan Control Low Speed	112	ECM Ground 3

Diagnostic Content

Problem Symptoms Table

Symptom	Suspected Area
Engine Does Not Crank or Cranks Slowly While Starting	Battery Starter motor Wire harness or ENGINE START STOP switch Starter relay ECM Engine mechanical
Engine Cranks Normally But Cannot Start Successfully While Starting	No fuel in tank Fuel pump Fuel injector Engine speed sensor Ignition coil Engine immobilizer ECM Engine mechanical
Difficult to Start With Hot Engine	Water in fuel Fuel pump Coolant temperature sensor Engine speed sensor Ignition coil Camshaft position sensor Fuel injector Engine mechanical
Difficult to Start With Cold Engine	Fuel quality Fuel pump Coolant temperature sensor Fuel injector Ignition coil Electronic throttle body Engine mechanical
Engine Speed is Normal, But it is Difficult to Start at Anytime	Fuel quality Fuel pump Coolant temperature sensor Fuel injector Ignition coil Electronic throttle body Ignition timing Spark plug Engine mechanical
Engine Starts Normally, But Idles Roughly at Anytime	Fuel quality Fuel pump Coolant temperature sensor Fuel injector Electronic throttle body Intake passage Ignition timing Spark plug Engine mechanical
Engine Starts Normally, But Idles Roughly During Warming up	Fuel quality Coolant temperature sensor Electronic throttle body Intake manifold Spark plug Engine mechanical
Engine Starts Normally, But Idles Roughly after Warming up	Fuel quality Coolant temperature sensor Electronic throttle body Intake manifold Spark plug Engine mechanical

Symptom	Suspected Area
Engine Starts Normally, But Idles Roughly or Stalls with Part Load (for Example, A/C is ON)	A/C system Fuel injector
Engine Starts Normally, But Idle Speed is Too High	Throttle Vacuum tube Coolant temperature sensor Ignition timing
Low Engine Speed or Stalls When Accelerating	Water in fuel Intake pressure sensor Intake manifold Exhaust pipe Ignition timing Throttle position sensor Fuel injector Spark plug
Slow Response When Accelerating	Water in fuel Intake pressure sensor Intake manifold Exhaust pipe Ignition timing Throttle position sensor Fuel injector Spark plug
Lack of Power and Poor Performance When Accelerating	Fuel quality Intake pressure sensor Electronic throttle body Spark plug Ignition coil Ignition timing Fuel injector

Diagnosis Procedure

Hint

Use following procedures to troubleshoot the engine management system.

1	Vehicle brought to workshop

Result

Proceed to
NEXT

NEXT

2	Check battery voltage

Check if battery voltage is normal.

OK

Standard voltage: Not less than 12V.

Result

Proceed to
OK
NG

NG → Replace battery

OK

3	Customer problem analysis

Result

Proceed to
NEXT

NEXT

4	Read DTCs

Result

Proceed to
DTC occurs
No DTC

No DTC → Perform repair according to Problem Symptoms Table

DTC occurs

5	Read DTCs (current DTC and history DTC)

Result

Proceed to
Current DTC
History DTC

History DTC → **Troubleshoot according to intermittent DTCs malfunction procedures**

Current DTC

6	Perform repair according to Diagnostic Trouble Code (DTC) Chart

Result

Proceed to
NEXT

NEXT

7	Adjust, repair or replace

Result

Proceed to
NEXT

NEXT

8	Conduct test and confirm malfunction has been repaired

Result

Proceed to
NEXT

NEXT → **End**

DTC Confirmation Procedure

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up to normal operating temperature, and then select Read DTC.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Perform check and repair diagnosis procedure according to DTC

Caution:

- The following check and repair has been confirmed as the current steady-state malfunction, otherwise it will lead to a diagnosis error.
- The "Multimeter" mentioned below refers to a digital multimeter, which prohibits the use of an needle multimeter to check electronic fuel injection system circuit.
- Check and repair the vehicle with the anti-theft system. If there is "replace a new ECM to check if fault reproduces" in "Subsequent Step" column, be careful to program the ECM after replacement.
- If the DTC indicates that the voltage of a circuit is too low, it means that the circuit may be shorted to ground. If the DTC indicates that the voltage of a circuit is too high, it means that the circuit may be shorted to power supply; If the DTC is described as a circuit malfunction, it means that there may be open in the circuit or a variety of circuits malfunction.

Diagnostic steps

1. If DTC cannot be cleared, the malfunction is steady state malfunction;
2. If it is intermittent malfunction, the focus of inspection shall be put on whether wiring harness connector is loose.
3. There are no abnormal conditions after performing inspection according to above procedures;
4. During servicing, do not ignore vehicle maintenance condition, cylinder pressure and mechanical ignition timing, etc. that can affect the system.
5. Replace with a new ECM to check if fault reoccurs, and perform test.

Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the following:

- Check if connector is loose.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Monitor diagnostic tester (the latest software) data that is related to this circuit.
- Wiggle related wire harness and connector and observe if signal in related circuit is interrupted.
- If possible, try to duplicate the conditions under which DTC was set.
- Look for data that has changed or DTC to reset during wiggle test.
- Check terminals for broken, bent, protruded or corroded.
- Inspect sensors and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
- Use data recorder and/or oscilloscope to help diagnose intermittent malfunctions.
- Remove the Engine Control Module (ECM) from malfunctioning vehicle and install it to a new vehicle to perform a test. If DTC cannot be cleared, ECM is malfunctioning. If DTC can be cleared, reinstall ECM to original vehicle.

Ground Inspection

Ground points are very important to the proper operation of circuits. Ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) can increase resistance which will change the way in which a circuit works.

Electrical control circuits are very sensitive to proper grounding. A loose or corroded ground point can seriously affect control circuit. Check ground points as follows:

1. Remove ground bolt or nut.
2. Check all contact surfaces for tarnish, dirt and rust, etc.
3. Clean as necessary to ensure that contact is in good condition.
4. Reinstall ground bolt or nut securely.
5. Check if add-on accessories interfere with ground circuit.
6. If several wire harnesses are crimped into one ground terminal, check for proper crimps. Make sure that all wires are clean, securely fastened and good contacted without crimping any excessive insulation coat.

Throttle Self-learning

Perform throttle self-learning in the following conditions:

- Battery is removed and negative battery cable is disconnected.
- Replace with a new ECM to check if fault reoccurs
- ECM is disconnected and reconnected.
- Throttle is replaced or cleaned.

Throttle self-learning conditions:

- Engine intake temperature > 5°C
- 100.5°C > engine coolant temperature > 5°C
- Engine speed ⩽ 250 rpm
- Vehicle speed = 0 km/h
- Battery voltage > 10 V
- Accelerator pedal opening angle < 14.9%

Throttle self-learning procedures: Turn ENGINE START STOP switch to ON and then turn to OFF after waiting for 15 seconds. After self-learning is completed, start the vehicle and check for proper operation.

Diagnostic Trouble Code (DTC) Chart

Hint:

History trouble code cannot be reported, otherwise it will affect customer for using.

No.	DTC	Description
1	P049900	EVAP System Vent Valve Control Circuit High
2	P049800	EVAP System Vent Valve Control Circuit Low
3	P044700	EVAP System Vent Control Circuit Open
4	P242200	EVAP System Vent Valve Stuck Closed
5	P150000	EMS Received Crash Signal
6	P150100	Airbag Communicate Message Unplausible
7	P209100	"B" Camshaft Position Actuator Control Circuit High Bank 1
8	P209000	"B" Camshaft Position Actuator Control Circuit Low Bank 1
9	P001300	"B" Camshaft Position Actuator Control Circuit Open Bank 1
10	P000B00	"B" Camshaft Position Slow Response Bank 1
11	P005A	"B" Camshaft Profile Control Performance/Stuck Off Bank 1
12	P064500	A/C Clutch Relay Control Circuit
13	P064700	A/C Clutch Relay Control Circuit High
14	P064600	A/C Clutch Relay Control Circuit Low
15	P258D00	Vacuum Pump Control Circuit "A" High
16	P258C00	Vacuum Pump Control Circuit "A" Low
17	P258A00	Vacuum Pump Control Circuit Open
18	P050F00	Brake Assist Vacuum Too Low
19	P057100	Brake Switch "A" Circuit
20	U015187	Lost Communication With Restraints Control Module
21	U016487	Lost Communication With HVAC Control Module
22	U014087	Lost Communication With Body Control Module
23	U015587	Lost Communication With Instrument Panel Cluster (IPC) Control Module
24	U021487	Lost Communication With Remote Function Actuation
25	U012687	Lost Communication With "Door Switch B"
26	P218324	Engine Coolant Temperature Sensor 2 Circuit Range/Performance
27	P218323	Engine Coolant Temperature Sensor 2 Circuit Range/Performance
28	P218500	Engine Coolant Temperature Sensor 2 Circuit High
29	P218400	Engine Coolant Temperature Sensor 2 Circuit Low

No.	DTC	Description
30	P059700	Thermostat Heater Control Circuit Open
31	P059900	Thermostat Heater Control Circuit High
32	P059800	Thermostat Heater Control Circuit Low
33	P012800	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)
34	U012987	Lost Communication With Vehicle Dynamics Control Module
35	U010187	Lost Communication With TCM
36	P012300	Throttle/Pedal Position Sensor/Switch "A" Circuit High
37	P012200	Throttle/Pedal Position Sensor/Switch "A" Circuit Low
38	P012100	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance
37	P057500	Cruise Control Input Signal Not Plausible
38	P057800	Clamping Switch of Cruise Control
39	P022300	Throttle/Pedal Position Sensor/Switch "B" Circuit High
40	P022200	Throttle/Pedal Position Sensor/Switch "B" Circuit Low
41	P022100	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance
42	P151000	Knock Control Signal Evaluation Check Diagnostic Fault Detected
43	P045128	EVAP System Pressure Sensor&Switch Circuit Range Performance
44	P045300	EVAP System Pressure Sensor&Switch Circuit High
45	P045200	EVAP System Pressure Sensor&Switch Circuit Low
46	P04512A	EVAP System Pressure Sensor&Switch Circuit Range Performance
47	P045125	EVAP System Pressure Sensor&Switch Circuit Range Performance
48	P155500	Throttle Actuator Electrical Malfunction
49	P210300	Throttle Actuator "A" Control Motor Circuit High
50	P211800	Throttle Actuator "A" Control Motor Current Range/Performance
51	P210600	Throttle Actuator Control System Forced Limited Power
52	P210000	Throttle Actuator "A" Control Motor Circuit/Open
53	P155400	Max Error of DV-E Return Spring Check Failure
54	P156100	Not Plausible Error of DV-E Position Deviation
55	P155C00	Not Plausible Error of DV-E Limphome Learning Position
56	P155D	Max Error of DV-E Control Range
57	P155E00	Min Error of DV-E Control Range
58	P155000	Break of DV-E Adaption Due to Ambient Conditions
59	P155F00	DV-E Break of Adaption Due to System Voltage
60	P156600	Not Plausible Error of DV-E Fault During Relearning of UMA
61	P155100	Not Plausible Error of UMA Learning
62	P013300	O2 Sensor Circuit Slow Response Bank 1 Sensor 1
63	P062F41	Internal Control Module EEPROM Error
64	P062F42	Internal Control Module EEPROM Error
65	P062F43	Internal Control Module EEPROM Error
66	P208900	"A" Camshaft Position Actuator Control Circuit High Bank 1
67	P208800	"A" Camshaft Position Actuator Control Circuit Low Bank 1
68	P001000	"A" Camshaft Position Actuator Control Circuit Open Bank 1
69	P000A00	"A" Camshaft Position Slow Response Bank 1
70	P003C00	"A" Camshaft Profile Control Performance/Stuck Off Bank 1
71	P050B00	Cold Start Ignition Timing Performance
72	P050B20	Cold Start Ignition Timing Performance
73	P026200	Cylinder 1 Injector "A" Circuit High
74	P026100	Cylinder 1 Injector "A" Circuit Low
75	P020100	Cylinder 1 Injector "A" Circuit

No.	DTC	Description
76	P026800	Cylinder 3 Injector "A" Circuit High
77	P026700	Cylinder 3 Injector "A" Circuit Low
78	P020300	Cylinder 3 Injector "A" Circuit
79	P027100	Cylinder 4 Injector "A" Circuit High
80	P027000	Cylinder 4 Injector "A" Circuit Low
81	P020400	Cylinder 4 Injector "A" Circuit
82	P026500	Cylinder 2 Injector "A" Circuit High
83	P026400	Cylinder 2 Injector "A" Circuit Low
84	P020200	Cylinder 2 Injector "A" Circuit
85	P138824	Ambient Air Temperature Sensor "A" Multiple Check
86	P138823	Intake Air Temperature Sensor 3 Multiple Check Bank1
87	P034100	Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor
88	P001676	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
89	P034300	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor
90	P034200	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor
91	P001678	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
92	P036600	Camshaft Position Sensor "B" Circuit Range/Performance(Bank1)
93	P001776	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
94	P036800	Camshaft Position Sensor "B" Circuit High(Bank1)
95	P036700	Camshaft Position Sensor "B" Circuit Low (Bank1)
96	P001778	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
97	P033900	Crankshaft Position Sensor "A"
98	P261700	Crankshaft Position Signal Output Circuit Open
99	P057500	Cruise Control Input Signal Not Plausible
100	P057800	Clamping Switch of Cruise Control
101	P058500	Cruise Control A/D Conversion Malfunction
102	P217700	System Too Lean Off Idle Bank 1
103	P217800	System Too Rich Off Idle Bank 1
104	P046300	Fuel Level Sensor "A" Circuit High
105	P046200	Fuel Level Sensor "A" Circuit Low
106	U067600	Lost Communication With Fuel Level Sensor "A"
107	P25B000	Fuel Level Sensor "A" Stuck
108	P128400	Fuel Level Sensor "A" Circuit Range Performance
109	P046129	Fuel Level Sensor "A" Circuit Range Performance
110	P048000	Fan 1 Control Circuit
111	P048100	Fan 2 Control Circuit
112	P069200	Fan 1 Control Circuit High
113	P069400	Fan 2 Control Circuit High
114	P069100	Fan 1 Control Circuit Low
115	P069300	Fan 2 Control Circuit Low
116	P013400	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 1
117	P219600	O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1
118	P219500	O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1
119	P013800	O2 Sensor Circuit High Voltage Bank 1 Sensor 2
120	P013700	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2
121	P223200	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 2
122	P013600	O2 Sensor Circuit Bank 1 Sensor 2
123	P005400	HO2S Heater Resistance Bank 1 Sensor 2

No.	DTC	Description
124	P003800	HO2S Heater Control Circuit High Bank 1 Sensor 2
125	P003700	HO2S Heater Control Circuit Low Bank 1 Sensor 2
126	P003600	HO2S Heater Control Circuit Bank 1 Sensor 2
127	P013A00	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2
128	P227100	O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2
129	P227000	O2 Sensor Signal Biased&Stuck Lean Bank 1 Sensor 2
130	P223100	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1
131	P003200	HO2S Heater Control Circuit High Bank 1 Sensor 1
132	P003100	HO2S Heater Control Circuit Low Bank 1 Sensor 1
133	P003000	HO2S Heater Control Circuit Bank 1 Sensor 1
134	P005300	HO2S Heater Resistance Bank 1 Sensor 1
135	P005326	HO2S Heater Resistance Bank 1 Sensor 1
136	P013500	O2 Sensor Heater Circuit Bank 1 Sensor 1
137	P064D17	Internal Control Module O2 Sensor Processor Performance Bank 1
138	P064D16	Internal Control Module O2 Sensor Processor Performance Bank 1
139	P064D81	Internal Control Module O2 Sensor Processor Performance Bank 1
140	P064D00	Internal Control Module O2 Sensor Processor Performance Bank 1
141	P035100	Ignition Coil "A" Primary Control Circuit0Open
142	P035300	Ignition Coil "C" Primary Control Circuit0Open
143	P035400	Ignition Coil "D" Primary Control Circuit0Open
144	P035200	Ignition Coil "B" Primary Control Circuit0Open
145	P230100	Ignition Coil "A" Primary Control Circuit High
146	P230700	Ignition Coil "C" Primary Control Circuit High
147	P231000	Ignition Coil "D" Primary Control Circuit High
148	P230400	Ignition Coil "B" Primary Control Circuit High
149	P230000	Ignition Coil "A" Primary Control Circuit Low
150	P230600	Ignition Coil "C" Primary Control Circuit Low
151	P230900	Ignition Coil "D" Primary Control Circuit Low
152	P230300	Ignition Coil "B" Primary Control Circuit Low
153	P062900	Fuel Pump "A" Control Circuit High
154	P062800	Fuel Pump "A" Control Circuit Low
155	P062700	Fuel Pump "A" Control Circuit Open
156	P032600	Knock/Combustion Vibration Sensor 1 Circuit Bank 1 or Single Sensor
157	P032500	Knock/Combustion Vibration Sensor 1 Circuit Bank 1 or Single Sensor
158	P070400	Clutch Switch Input Circuit
159	P032800	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
160	P032700	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor
161	P032815	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
162	P032714	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor
163	P124A00	Waste Gate Actuator "A" Control Circuit Shorted
164	P2ABD00	Turbocharger/Supercharger Waste Gate Actuator "A" Driver Current/ Temperature Too High
165	P124B00	Electric Waste Gate (E-WG) Actuator Control Chip SPI Bus Error
166	P024300	Turbocharger/Supercharger Waste Gate Solenoid "A"
167	P023400	Turbocharger/Supercharger "A" Overboost Condition
168	P029900	Turbocharger/Supercharger "A" Underboost Condition

No.	DTC	Description
169	P050A22	Cold Start Idle Control System Performance
170	P050A21	Cold Start Idle Control System Performance
171	P050D00	Cold Start Rough Idle
172	P050700	Idle Control System RPM - Higher Than Expected
173	P050600	Idle Control System RPM - Lower Than Expected
174	P050500	Idle Control System
175	P262600	O2 Sensor Pumping Current Trim Circuit Open Bank 1 Sensor 1
176	P223700	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1
177	P013200	O2 Sensor Circuit High Voltage Bank 1 Sensor 1
178	P013100	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1
179	P224300	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1
180	P225100	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1
181	P013000	O2 Sensor Circuit Bank 1 Sensor 1
182	P030000	Random/Multiple Cylinder Misfire Detected
183	P154000	Engine Torque Control Adaption at Limit
184	P030100	Cylinder 1 Misfire Detected
185	P030300	Cylinder 3 Misfire Detected
186	P030400	Cylinder 2 Misfire Detected
187	P030200	Cylinder 2 Misfire Detected
188	P036300	Misfire Detected - Fueling Disabled
189	P070000	Transmission Control System (MIL Request)
190	P06AA00	Control Module Internal Temperature "B" Too High
191	P068600	ECM/PCM Power Relay Control Circuit Low
192	P153000	Function Monitoring: Fault of ECU ADC - Null Load Test Pulse
193	P153100	Function Monitoring: Fault of ECU ADC - Test Voltage
194	P157000	Function Monitoring: Fault of ECU Monitoring Module Error
195	P060D00	Internal Control Module Accelerator Pedal Position Performance
196	P152000	Function Monitoring: Check of Predicted Air Mass Failed
197	P152100	Function Monitoring: Fault of ECU Check of Injection Cut-off
198	P152200	Function Monitoring: Fault of ECU in Check of Cylinder Individual Fuel Corrections
199	P061C00	Internal Control Module Engine RPM Performance
200	P152300	Function Monitoring: Fault of ECU or Sensor in Mixture Check
201	P152700	Function Monitoring: Monitoring of ICO From Level1
202	P152800	Function Monitoring: Monitoring of ICO From Level2
203	P152400	Function Monitoring: Fault of ECU Comparison of Lambda and Operation Mode
204	P152500	Function Monitoring: Fault of ECU or Sensor in rl-Comparison
205	P152900	Function Monitoring: Fault of Starter Control
206	P061A00	Internal Control Module Torque Performance
207	P152600	Function Monitoring: Fault of ECU Ignition Timing
208	P157600	OverVoltage of ECU VDD5
209	P157700	UnderVoltage of ECU VDD5
210	P001400	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
211	P001100	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
212	P021900	Engine Overspeed Condition
213	P157800	Diagnostic Fault Check to Report "WDA Active"

No.	DTC	Description
214	P157300	Diagnostic Fault Check to Report "WDA active" Due to Errors in Query/Response Communication
215	P157500	Diagnostic Fault Check to Report "WDA active" Due to Overvoltage Detection
216	P218700	System Too Lean at Idle Bank 1
217	P218800	System Too Rich at Idle Bank 1
218	P055800	Brake Booster Pressure Sensor Circuit High
219	P055700	Brake Booster Pressure Sensor Circuit Low
220	P145000	Brake Booster Pressure Sensor Circuit Range/Performance (High)
221	P145100	Brake Booster Pressure Sensor Circuit Range/Performance (Low)
222	P120000	Manifold Absolute Pressure Sensor Circuit Range/Performance
223	P120100	Manifold Absolute Pressure Sensor Circuit Range/Performance
224	P00C721	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1
225	P00C722	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1
226	P010800	Manifold Absolute Pressure Sensor Circuit High
227	P010700	Manifold Absolute Pressure Sensor Circuit Low
228	P010621	Manifold Absolute Pressure Sensor Circuit Range/Performance
229	P010601	Manifold Absolute Pressure Sensor Circuit Range/Performance
230	P01062A	Manifold Abs.Pressure Performance Non-plausible
231	P046800	EVAP Purge Flow Sensor Circuit High
232	P046700	EVAP Purge Flow Sensor Circuit Low
233	P128500	EVAP Purge Flow Sensor Circuit Range Performance
234	P128600	EVAP Purge Flow Sensor Circuit Range Performance
235	P222900	Barometric Pressure Sensor "A" Circuit High
236	P222800	Barometric Pressure Sensor "A" Circuit Low
237	P223000	Barometric Pressure Sensor "A" Circuit Intermittent/Erratic
238	P120200	Barometric Pressure Sensor "A" Circuit Range/Performance
239	P120300	Barometric Pressure Sensor "A" Circuit Range/Performance
240	P222722	Barometric Pressure Sensor "A" Circuit Range/Performance
241	P222721	Barometric Pressure Sensor "A" Circuit Range/Performance
242	P023800	Turbocharger/Supercharger Boost Sensor "A" Circuit High
243	P023700	Turbocharger/Supercharger Boost Sensor "A" Circuit Low
244	P120400	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
245	P120500	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
246	P023622	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
247	P023621	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
248	P212300	Throttle/Pedal Position Sensor/Switch "D" Circuit High
249	P212800	Throttle/Pedal Position Sensor/Switch "E" Circuit High
250	P212200	Throttle/Pedal Position Sensor/Switch "D" Circuit Low
251	P212700	Throttle/Pedal Position Sensor/Switch "E" Circuit Low
252	P201000	Intake Manifold Runner Control Circuit High Bank 1
253	P200900	Intake Manifold Runner Control Circuit Low Bank 1
254	P200800	Intake Manifold Runner Control Circuit/Open Bank 1
255	P261000	ECM/PCM Engine Off Timer Performance
256	P061500	Starter Relay "A" Circuit

No.	DTC	Description
257	P061700	Starter Relay "A" Circuit High
258	P213800	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation
259	P064100	Sensor Reference Voltage "A" Circuit Open
260	P065100	Sensor Reference Voltage "B" Circuit Open
261	P063442	Control Module Internal Temperature "A" Too High
262	P00CE24	Intake Air Temperature Measurement System - Multiple Sensor Correlation Bank 1
263	P00CE23	Intake Air Temperature Measurement System - Multiple Sensor Correlation Bank 1
264	P011300	Intake Air Temperature Sensor 1 Circuit High Bank 1
265	P011200	Intake Air Temperature Sensor 1 Circuit Low Bank 1
266	P011400	Intake Air Temperature Sensor 1 Circuit Intermittent Bank 1
267	P138024	Intake Air Temperature Sensor 2 Multiple Check Bank1
268	P138023	Intake Air Temperature Measurement System - Multiple Sensor Correlation Bank 2
269	P009800	Intake Air Temperature Sensor 2 Circuit High Bank 1
270	P009700	Intake Air Temperature Sensor 2 Circuit Low Bank 1
271	P009900	Intake Air Temperature Sensor 2 Circuit Intermittent Bank 1
272	P044200	EVAP System Leak Detected (Small Leak)
273	P045500	EVAP System Leak Detected (Large Leak)
274	P04F000	EVAP System High Pressure Purge
275	P049600	EVAP System High Purge Flow
276	P049700	EVAP System Low Purge Flow
277	P045900	Evaporative Emission System Purge Control Valve Circuit High
278	P045800	Evaporative Emission System Purge Control Valve Circuit Low
279	P044400	Evaporative Emission System Purge Control Valve Circuit Open
280	P01E424	Engine Coolant Temperature Sensor 3 Circuit Range/Performance
281	P01E423	Engine Coolant Temperature Sensor 3 Circuit Range/Performance
282	P01E600	Engine Coolant Temperature Sensor 3 Circuit High
283	P01E500	Engine Coolant Temperature Sensor 3 Circuit Low
284	P050C24	Cold Start Engine Coolant Temperature Performance
285	P050C23	Cold Start Engine Coolant Temperature Performance
286	P011800	Engine Coolant Temperature Sensor 1 Circuit High
287	P011700	Engine Coolant Temperature Sensor 1 Circuit Low
288	P011900	Engine Coolant Temperature Sensor 1 Circuit Intermittent
289	P011623	Engine Coolant Temperature Sensor 1 Circuit Range/Performance
290	P011626	Engine Coolant Temperature Sensor 1 Circuit Range/Performance
291	P007200	Ambient Air Temperature Sensor Circuit "A" Low
292	P007300	Ambient Air Temperature Sensor Circuit "A" High
293	P007000	Ambient Air Temperature Sensor Circuit "A" Ambient Temperature Sensor Lost Communication
294	P209700	Post Catalyst Fuel Trim System Too Rich Bank 1
295	P209600	Post Catalyst Fuel Trim System Too Lean Bank 1
296	P042000	Catalyst System Efficiency Below Threshold Bank 1
297	P069000	ECM/PCM Power Relay Sense Circuit High
298	P056300	System Voltage High
299	P056200	System Voltage Low
300	P056000	System Voltage Unstable
301	P241400	O2 Sensor Exhaust Sample Error Bank 1 Sensor 1

No.	DTC	Description
302	P256500	Turbocharger Boost Control Position Sensor "A" Circuit High
303	P256400	Turbocharger Boost Control Position Sensor "A" Circuit Low
304	P063443	Control Module Internal Temperature "A" Too High
305	P121200	Vehicle Speed Sensor "A" Circuit Range/Performance
306	P050300	Vehicle Speed Sensor "A" Circuit Intermittent/Erratic/High
307	P050000	Vehicle Speed Sensor "A" Circuit
308	P050166	Vehicle Speed Sensor "A" Circuit Range/Performance
309	P050165	Vehicle Speed Sensor "A" Circuit Range/Performance
310	P161300	This symbol means that ECM and vehicle has different immo configurations
311	P051300	Incorrect Immobilizer Key
312	P063300	Immobilizer Key Not Programmed-ECM/PCM
313	P161000	No Response Received by ECM/PCM After Challenge Sent
314	P161200	Internal Error When Writing Data to EEPROM
315	P161100	Unexpected Initial Value in EEPROM
316	P024477	Turbocharger/Supercharger Wastegate Actuator "A" Range/ Performance
317	P024437	Turbocharger/Supercharger Wastegate Actuator "A" Range/ Performance
318	P003A00	Turbocharger/Supercharger Boost Control "A" Position Exceeded Learning Limit
319	P130100	Auxiliary Water Pump Dry Run Error
320	P261D00	Coolant Pump "B" Control Circuit High
321	P261C00	Coolant Pump "B" Control Circuit Low
322	P261A00	Coolant Pump "B" Control Circuit Open
323	P130300	Auxiliary Water Pump Out Of Voltage Error
324	P130400	Auxiliary Water Pump Over Current
325	P130500	Auxiliary Water Pump Over Temperature Error
326	P130600	Auxiliary Water Pump Feedback Signal High
327	P130700	Auxiliary Water Pump Feedback Signal Low
328	P130800	Auxiliary Water Pump Stall Error
329	P130900	Auxiliary Water Pump Under Voltage

P000A "A" Camshaft Position Slow Response Bank 1

1. DTC operating condition
   - Camshaft self-learning state has been completed;
   - Engine oil temperature is in range of 40°C - 130°C;
   - Coolant temperature is in range of 40°C - 120°C;
   - Engine speed is in range of 600 and 6000rpm;
   - ECM does not detect VVT intake control valve circuit fault.
2. DTC setting condition
   (a) ECM detects that difference between intake VVT actual angle and target angle is 10° crank angle.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles.
   - Using diagnostic tester to clear DTCs until all DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if operating condition of cam phase regulator is normal (dirt blocked, oil leaked, stuck)	Yes	Next
		No	Perform necessary check, repair and maintenance
2	Check if operating condition of OCV oil control valve is normal	Yes	Diagnostic Help
		No	Perform necessary check, repair and maintenance

P000B "B" Camshaft Position Slow Response Bank 1

1. DTC operating condition
   - Camshaft self-learning state has been completed;
   - Engine oil temperature is in range of 40°C - 130°C;
   - Coolant temperature is in range of 40°C - 120°C;
   - Engine speed is in range of 600 and 6000rpm;
   - ECM does not detect VVT intake control valve circuit fault.
2. DTC setting condition
   (a) ECM detects that difference between intake VVT actual angle and target angle is 10° crank angle.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles.
   - Using diagnostic tester to clear DTCs until all DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if operating condition of cam phase regulator is normal (dirt blocked, oil leaked, stuck)	Yes	Next
		No	Perform necessary check, repair and maintenance
2	Check if operating condition of OCV oil control valve is normal	Yes	Diagnostic Help
		No	Perform necessary check, repair and maintenance

P0010 "A" Camshaft Position Actuator Control Circuit Open Bank 1

1. DTC operating condition
   - Engine is running.
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   (a) ECM detected open circuit in control terminal pin.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Open circuit in intake VVT control circuit corresponding pin	Yes	Repair, replace wire harness
		No	Next
2	Connector looseness or poor contact	Yes	Reconnect
		No	Next

No.	Operation Step	Test Result	Subsequent Step
3	Intake VVT circuit damaged	Yes	Replace VVT actuator
		No	Next
4	Control pin fault of VVT corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0013 "B" Camshaft Position Actuator Control Circuit Open Bank 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   (a) ECM detected open circuit in control terminal pin.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Open circuit in exhaust VVT control circuit corresponding pin	Yes	Repair, replace wire harness
		No	Next
2	Connector looseness or poor contact	Yes	Reconnect
		No	Next
3	Exhaust VVT circuit damaged	Yes	Replace VVT actuator
		No	Next
4	Control pin fault of VVT corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0016 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A

1. DTC operating condition
   - Start relative positions self-learning of camshaft and crankshaft (self-learning will be completed about 10 seconds after 1st starting).
2. DTC setting condition
   - ECM detects that deviations between crankshaft and intake camshaft relative crankshaft position self-learning value and intake camshaft relative crankshaft position design value is more than 15°crank angle;
   - ECM detects that deviations between crankshaft & intake camshaft synchronous learning value and reference value is less than -15°crank angle;
   - ECM detects that actual measurement value of crank and camshaft position changes suddenly.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if relative installation position of crankshaft and camshaft is correct	Yes	Next
		No	Reinstall correctly

No.	Operation Step	Test Result	Subsequent Step
2	Check drive gear, belt, etc. between crankshaft and camshaft for faults	Yes	Perform necessary check and repair
		No	Diagnostic Help

P0018 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A

1. DTC operating condition
   - Start relative positions self-learning of camshaft and crankshaft (self-learning will be completed about 10 seconds after 1st starting).
2. DTC setting condition
   - ECM detects that deviations between crankshaft and exhaust camshaft relative crankshaft position self-learning value and exhaust camshaft relative crankshaft position design value is more than 15°crank angle;
   - ECM detects that deviations between crankshaft & intake camshaft synchronous learning value and reference value is less than -15°crank angle;
   - ECM detects that actual measurement value of crank and camshaft position changes suddenly.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if relative installation position of crankshaft and camshaft is correct	Yes	Next
		No	Reinstall correctly
2	Check drive gear, belt, etc. between crankshaft and camshaft for faults	Yes	Perform necessary check and repair
		No	Diagnostic Help

P0030 HO2S Heater Control Circuit Bank 1 Sensor 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - ECM detects open circuit in control terminal pin (it is detected that voltage UCE of output terminal is 6 V with driver switch off).
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Open circuit in upstream oxygen sensor heater control circuit pin terminal	Yes	Repair wire harness
		No	Next

No.	Operation Step	Test Result	Subsequent Step
3	Upstream oxygen sensor heater control circuit power supply terminal is not connected to main relay	Yes	Repair wire harness
		No	Next
4	Sensor is damaged	Yes	Replace sensor
		No	Next
5	Open circuit or internal circuit damage in upstream oxygen sensor heater pin circuit corresponding to ECM terminal	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0031 HO2S Heater Control Circuit Low Bank 1 Sensor 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Upstream oxygen sensor heater control circuit pin terminal is short to ground	Yes	Repair wire harness
		No	Next
2	Upstream oxygen sensor heater control circuit power supply terminal is grounded	Yes	Repair wire harness
		No	Next
3	Upstream oxygen sensor heater pin corresponding to ECM terminal is short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0032 HO2S Heater Control Circuit High Bank 1 Sensor 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to power source (it is detected that voltage UCE of output terminal is 12 V with driver switch on).
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Upstream oxygen sensor heater control circuit pin terminal is short to power source	Yes	Repair wire harness
		No	Next
2	Upstream oxygen sensor heater pin corresponding to ECM terminal is short to power source	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0036 HO2S Heater Control Circuit Bank 1 Sensor 2

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - ECM detects open circuit in control terminal pin (it is detected that voltage UCE of output terminal is 6 V with driver switch off).
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Open circuit in downstream oxygen sensor heater control pin	Yes	Repair wire harness
		No	Next
3	Downstream oxygen sensor heater circuit power supply terminal is not connected to main relay	Yes	Repair wire harness
		No	Next
4	Sensor is damaged	Yes	Replace sensor
		No	Next
5	Open circuit or internal circuit damage in downstream oxygen sensor heater pin circuit corresponding to ECM terminal	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0037 HO2S Heater Control Circuit Low Bank 1 Sensor 2

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Downstream oxygen sensor heater control circuit pin terminal is short to ground	Yes	Repair wire harness
		No	Next
2	Downstream oxygen sensor heater control circuit power supply terminal is grounded	Yes	Repair wire harness
		No	Next
3	Downstream oxygen sensor heater pin corresponding to ECM terminal is short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0038 HO2S Heater Control Circuit High Bank 1 Sensor 2

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to power source (it is detected that voltage UCE of output terminal is 12 V with driver switch on).
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Downstream oxygen sensor heater control circuit pin terminal is short to power source	Yes	Repair wire harness
		No	Next
2	Downstream oxygen sensor heater pin corresponding to ECM terminal is short to power source	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0054 HO2S Heater Resistance Bank 1 Sensor 2

1. DTC operating condition
   - Exhaust temperature (ECM calculated value) of downstream oxygen sensor (upstream oxygen) is in range of 300 ~ 550 deg;
   - Battery voltage is between 10 and 16 V steadily;
   - Keep engine fuel supply;
   - Ambient temperature is not less than -7 deg;
   - No high temperature and high resistance failure P0140 [Recommended operating conditions: Vehicle can be operated at a lower vehicle speed (less than 50 km/h) when malfunction is reproduced. If the interval between two starts is short, it takes a long time to diagnose].
2. DTC setting condition
   - ECM detects that internal resistance of downstream oxygen sensor heater exceeds threshold value (different exhaust temperatures correspond to different threshold values, MT is 4600 Ω ~ 16000 Ω and CVT is 2760 Ω ~ 16000 Ω), it indicates that downstream oxygen sensor heater internal resistance is improper.
3. Operation required for DTC setting
   (a) Input malfunction memory once malfunction occurs;
   (b) If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
   (c) Diagnostic tester will be visible.

4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information.	/	Next
3	(Remove the connector) Turn digital multimeter to ohm band, connect two probes to sensor pin 1# (white) and pin 2# (white) respectively, the resistance should be 7 ~ 11 Ω at normal temperature.	Yes	Next
		No	Check wire harness and connector
4	(Connect the connector) Under idling status and waiting until temperature of oxygen sensor reaches to its operation temperature (350°C), turn digital multimeter to DC voltage band, connect two probes to sensor pin 3# (gray) and pin 4# (black) respectively, voltage should rapidly fluctuates between 0.1 and 0.9 V at the same time.	Yes	Replace oxygen sensor
		No	Diagnostic Help

Oxygen sensor resistance measurement must be performed when temperature of oxygen sensor cools down to room temperature, as resistance is related to temperature.

P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - ECM detects that intake temperature measured value is higher than 129.75°C.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON" Do not start engine, and observe if "Intake Temperature Sensor Measured Value" in data flow is too high. If value is higher than normal condition, observe maximum intake manifold temperature range. You can also use a multimeter to measure if intake temperature sensor signal terminal voltage is close to or equal to 0 V	Yes	Next

No.	Operation Step	Test Result	Subsequent Step
2	Turn ENGINE START STOP switch "OFF", and check if intake manifold temperature sensor signal terminal is short to ground	Yes	Repair wire harness
		No	Next
3	Sensor is damaged	Yes	Replace sensor
		No	Next
4	Intake manifold temperature sensor signal pin terminal corresponding to ECM terminal is short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1

1. DTC operating condition
   - 240 seconds have elapsed after engine starting;
   - Engine is idling;
   - Engine is not in fuel cut off state.
2. DTC setting condition
   - ECM detects that intake temperature measured value is lower than -39.75°C.
3. Operation required for DTC setting
   (a) After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON" Do not start engine, and observe if "Intake Temperature Sensor Measured Value" in data flow is too low. If value is lower than normal condition, observe minimum intake manifold temperature range. You can also use a multimeter to measure if voltage between intake manifold temperature sensor signal terminal and ground is close to or equal to 5V	Yes	Next
2	Turn ENGINE START STOP switch "OFF" and check if connector is loosen or has poor contact	Yes	Reconnect
		No	Next
3	Check if there is short circuit to power source or open circuit in sensor signal terminal	Yes	Repair wire harness
		No	Next
4	Open circuit in sensor reference ground	Yes	Repair, replace wire harness or sensor
		No	Next
5	Sensor is damaged	Yes	Replace sensor
		No	Next

No.	Operation Step	Test Result	Subsequent Step
6	Short circuit to power source, open circuit or internal circuit damage in intake manifold temperature sensor signal pin corresponding to ECM terminal	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0116 Engine Coolant Temperature Sensor 1 Circuit Range/Performance

1. DTC operating condition
   - Coolant temperature is lower than 60°C.
2. DTC setting condition
   - ECM detects that difference between coolant measured value and analog value (calculated by iterative algorithm according to intake air volume) is 50°C.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON" Do not start engine, and observe if "Coolant Temperature Sensor Measured Value" in data flow is in proper temperature range	No	Next
2	Turn ENGINE START STOP switch "OFF" and check if resistance of coolant temperature sensor signal pin is proper	Yes	Repair wire harness
		No	Next
3	Sensor is damaged	Yes	Replace sensor
		No	Next
4	Malfunction occurs in coolant temperature sensor signal pin corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0117 Engine Coolant Temperature Sensor 1 Circuit Low

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - ECM detects that coolant temperature measured value is 140°C.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON" Do not start engine, and observe if "Coolant Temperature Sensor Measured Value" in data flow is much higher than proper temperature range. You can also use a multimeter to measure if coolant temperature sensor signal terminal voltage is close to or equal to 0 V	Yes	Next
2	Turn ENGINE START STOP switch "OFF" and check if coolant temperature sensor signal terminal is short to ground	Yes	Repair wire harness
		No	Next
3	Sensor is damaged	Yes	Replace sensor
		No	Next
4	Coolant temperature sensor signal pin terminal corresponding to ECM is short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0118 Engine Coolant Temp.Circ. High Input

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - ECM detects that coolant temperature measured value is lower than -39.75°C.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON" Do not start engine and observe if "Intake Temperature Sensor Measured Value" in data flow is much lower than current ambient temperature. You can also use a multimeter to measure if voltage between coolant temperature sensor signal terminal and ground is close to or equal to 5 V	Yes	Next
2	Turn ENGINE START STOP switch "OFF" and check if connector is loosen or has poor contact	Yes	Reconnect
		No	Next
3	Check if there is short circuit to power source or open circuit in sensor signal terminal	Yes	Repair wire harness
		No	Next
4	Open circuit in sensor reference ground	Yes	Repair wire harness
		No	Next
5	Sensor is damaged	Yes	Replace sensor
		No	Next

No.	Operation Step	Test Result	Subsequent Step
6	Short circuit to power source, open circuit or internal circuit damage in coolant temperature sensor signal pin terminal corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0121 Throttle Pos.Sensor 1 Circ. Performance Non-plausible

1. DTC operating condition
   - Engine speed is 1200 rpm.
2. DTC setting condition
   - ECM detects that opening angles of throttle position sensor 1 and sensor signal 2 exceed a certain threshold value (6%), and opening angle of sensor 1 is improper (compared with virtual 3rd circuit opening angle inside of ECM, deviation of 1st circuit signal is more than 2nd circuit signal)
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	Reconnect
2	Check if there is short circuit to power source or open circuit in sensor signal terminal	Yes	Next
		No	End
3	Remove the connector from throttle position sensor on wire harness, check if resistance of throttle circuit 1 signal is in proper range	Yes	Next
		No	Repair or replace wire harness
4	Remove the connector from throttle position sensor on wire harness, check if resistance between throttle circuit 1 signal and other signals is within proper range	Yes	Replace throttle
		No	Repair or replace wire harness
5	Clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0122 Throttle Pos.Sensor 1 Circ. Low Input

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - ECM detects that voltage of throttle position sensor 1 signal circuit is less than 0.176 V.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from throttle position sensor on wire harness and check if there is open circuit or short circuit to ground in throttle circuit 1 signal	Yes	Repair or replace wire harness
		No	Next
4	Turn ENGINE START STOP switch to ON, check if throttle 5V power source is normal	Yes	Replace throttle
		No	Repair or replace wire harness
5	Clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0123 Throttle Pos.Sensor 1 Circ. High Input

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - ECM detects that voltage of throttle position sensor 1 signal circuit is 4.629 V.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.

4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from throttle position sensor on wire harness, check if throttle 1 circuit signal is short to 5 V power source	Yes	Repair or replace wire harness
		No	Replace throttle
4	Clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0130 O2 Sensor Circuit Bank 1 Sensor 1

1. DTC operating condition
   - Battery voltage is higher than 11V;
   - Engine is running;
   - Upstream oxygen sensor has been heated sufficiently (Time depends on operating conditions, recommended operating conditions: operated at a lower speed (less than 50 km/h) for more than 3 minutes);
   - No fuel injector DTCs P0201, P0202, P0203, P0204;
   - Air-fuel ratio closed loop control effect (enter closed loop mode when 30 seconds after starting generally).
2. DTC setting condition
   - ECM detects that upstream oxygen sensor signal voltage difference between heater on and off is higher than 2V for more than a certain times (4 times);
   - ECM detects that voltage of upstream oxygen sensor signal is between 0.6 and 1.2 V, but downstream oxygen sensor signal voltage is less than 0.1 V for more than a certain times (10 s);
   - ECM detects that voltage of upstream oxygen sensor signal is between 0.06 ~ 0.4 V, but downstream oxygen sensor signal voltage is higher than 0.5 V for more than a certain times (30 s).
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;

- Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
5	After the oxygen sensor is replaced with a new one, clear DTCs, and then check if the fault still exists	Yes	Check wire harness
		No	Replace oxygen sensor

P0131 O2 Sensor Circuit Low Voltage Bank 1 Sensor 1

1. DTC operating condition
   - Battery voltage is higher than 11V;
   - Engine is running;
   - Upstream oxygen sensor has been heated sufficiently [Time depends on operating conditions, recommended operating conditions: operated at a lower speed (less than 50 km/h) for more than 3 minutes];
   - No fuel injector DTCs P0201, P0202, P0203, P0204;
   - Air-fuel ratio closed loop control effect;
   - Carbon canister diagnosis not operated.
2. DTC setting condition
   - ECM detects that upstream oxygen sensor signal voltage is lower than 0.06 V continually for more than a certain time (depending on intake air flow, time varied by different operating conditions).
3. Operation required for DTC setting
   - Input malfunction memory once malfunction occurs;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
5	After the oxygen sensor is replaced with a new one, clear DTCs, and then check if the fault still exists	Yes	Check wire harness
		No	Replace oxygen sensor

P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1

1. DTC operating condition
   - Battery voltage is higher than 11V;
   - Engine is running;
   - No fuel injector malfunction;
   - Upstream oxygen sensor has been heated sufficiently.
2. DTC setting condition
   - ECM detected that upstream oxygen sensor signal voltage is higher than 1.2V continually for more than a certain period of time (5s after heated sufficiently).
3. Operation required for DTC setting
   - Input malfunction memory once malfunction occurs;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
5	After the oxygen sensor is replaced with a new one, clear DTCs, and then check if the fault still exists	Yes	Check wire harness
		No	Replace oxygen sensor

P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1

1. DTC operating condition
   - Engine speed is: for MT: 1360 - 2520 rpm , for CVT: 1200 - 2200 rpm;
   - Engine load is: for MT: 21.75 - 54.75, for CVT: 24 - 62.25 and it is stable;
   - Temperature of upstream oxygen sensor is higher than 440 deg;
   - Keep engine fuel supply;
   - No high load on carbon canister;
   - Heating diagnosis is completed and no other malfunctions are detected (mainly for fuel supply system malfunction, misfire malfunction (P2177, P2178, P0300~P0304, etc.)) Recommended operating condition: Keep the engine stable at 5th gear (70 km/h) for 5 to 10 minutes, especially for load (accelerator pedal).
2. DTC setting condition
   - ECM detects that upstream oxygen sensor cycle delay time exceeds a certain value (0.9 s), which indicates deterioration for upstream oxygen sensor, causing emission level exceeds OBD limiting value.
3. Operation required for DTC setting
   - Input malfunction memory once malfunction occurs;

- After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
- Diagnostic tester will be visible.

4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
5	After the oxygen sensor is replaced with a new one, clear DTCs, and then check if the fault still exists	Yes	Check wire harness
		No	Replace oxygen sensor

P0134 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 1

1. DTC operating condition
   - Battery voltage is higher than 11V;
   - Engine is running;
   - Upstream oxygen sensor has been heated sufficiently;
   - Air-fuel ratio closed loop control effect;
   - No fuel injector malfunction.
2. DTC setting condition
   - ECM detects that upstream oxygen sensor cycle delay time exceeds a certain value (0.9 s), which indicates deterioration for upstream oxygen sensor, causing emission level exceeds OBD limiting value.
3. Operation required for DTC setting
   - ECM detects that voltage of upstream oxygen sensor signal is between 0.4 and 0.6V for more than a certain period of time (25s after heated sufficiently);
   - (Or) ECM detects that voltage of upstream oxygen sensor and voltage of downstream oxygen sensor are both higher than 0.2V for more than a certain period of time (3.1 s) when the oil is cutting;
   - (Or) When the exhaust temperature is higher than 600 degrees, the internal resistance of the oxygen sensor is greater than 20000 ohm.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next

3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
5	After the oxygen sensor is replaced with a new one, clear DTCs, and then check if the fault still exists	Yes	Check wire harness
		No	Replace oxygen sensor

Oxygen sensor resistance measurement must be performed when temperature of oxygen sensor cools down to room temperature, as resistance is related to temperature.

P0136 O2 Sensor Circuit Bank 1 Sensor 2

1. DTC operating condition
   - Battery voltage is higher than 11V;
   - Engine is running;
   - Upstream oxygen sensor has been heated sufficiently;
   - Exhaust temperature of rear oxygen sensor is lower than 800°C;
   - 2nd air or carbon canister diagnosis not operated.
2. DTC setting condition
   - ECM detects that downstream oxygen sensor signal voltage difference between heater on and off is higher than 2V for more than a certain times (4 times).
3. Operation required for DTC setting
   - Input malfunction memory once malfunction occurs;
   - If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information.	/	Next
3	(Remove the connector) Turn digital multimeter to ohm band, connect two probes to sensor pin 1# (white) and pin 2# (white) respectively, the resistance should be 7 ~ 11 Ω at normal temperature.	Yes	Next
		No	Check wire harness and connector
4	(Connect the connector) Under idling status and waiting until temperature of oxygen sensor reaches to its operation temperature (350°C), turn digital multimeter to DC voltage band, connect two probes to sensor pin 3# (gray) and pin 4# (black) respectively, voltage should rapidly fluctuates between 0.1 and 0.9 V at the same time.	Yes	Replace oxygen sensor
		No	Diagnostic Help

P0137 O2 Sensor Circuit Low Voltage Bank 1 Sensor 2

1. DTC operating condition
   - Battery voltage is higher than 11V;
   - Engine is running;
   - Upstream oxygen sensor has been heated sufficiently;
   - Exhaust temperature of rear oxygen sensor is lower than 800°C;
   - 2nd air or carbon canister diagnosis not operated;
   - Rear oxygen closed loop control effect.
2. DTC setting condition
   - ECM detects that downstream oxygen sensor signal voltage is lower than 0.06V continually for more than a certain time (25s during rear oxygen closed loop).
3. Operation required for DTC setting
   - Input malfunction memory once malfunction occurs;
   - If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information.	/	Next
3	(Remove the connector) Turn digital multimeter to ohm band, connect two probes to sensor pin 1# (white) and pin 2# (white) respectively, the resistance should be 7 ~ 11 Ω at normal temperature.	Yes	Next
		No	Check wire harness and connector
4	(Connect the connector) Under idling status and waiting until temperature of oxygen sensor reaches to its operation temperature (350°C), turn digital multimeter to DC voltage band, connect two probes to sensor pin 3# (gray) and pin 4# (black) respectively, voltage should rapidly fluctuates between 0.1 and 0.9 V at the same time.	Yes	Replace oxygen sensor
		No	Diagnostic Help

P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2

1. DTC operating condition
   - Battery voltage is higher than 11V;
   - Engine is running;
   - Downstream oxygen sensor has been heated sufficiently;
   - Exhaust temperature of rear oxygen sensor is lower than 800°C;
   - 2nd air or carbon canister diagnosis not operated.
2. DTC setting condition
   - ECM detects that downstream oxygen sensor signal voltage difference between heater on and off is higher than 2V for more than a certain times (4 times).

3. Operation required for DTC setting
   - Input malfunction memory once malfunction occurs;
   - If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information.	/	Next
3	(Remove the connector) Turn digital multimeter to ohm band, connect two probes to sensor pin 1# (white) and pin 2# (white) respectively, the resistance should be 7 ~ 11 Ω at normal temperature.	Yes	Next
		No	Check wire harness and connector
4	(Connect the connector) Under idling status and waiting until temperature of oxygen sensor reaches to its operation temperature (350°C), turn digital multimeter to DC voltage band, connect two probes to sensor pin 3# (gray) and pin 4# (black) respectively, voltage should rapidly fluctuates between 0.1 and 0.9 V at the same time.	Yes	Replace oxygen sensor
		No	Diagnostic Help

P0201 Injector Circuit Open - Cylinder 1 P0202 Injector Circuit Open - Cylinder 2 P0203 Injector Circuit Open - Cylinder 3 P0204 Injector Circuit Open - Cylinder 4

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - ECM detected open circuit in control terminal pin.
   - (P0201: The detected voltage UCE of output terminal is 6 V with driver switch off);
   - (P0202: The detected voltage UCE of output terminal is 6 V with driver switch off);
   - (P0203: The detected voltage UCE of output terminal is 6 V with driver switch off);
   - (P0204: The detected voltage UCE of output terminal is 6 V with driver switch off);
3. Operation required for DTC setting
   - If the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next

2	Open circuit in corresponding fuel injector circuit	Yes	Repair, replace wire harness or fuel injector
		No	Next
3	Open circuit or fuel injector damage in corresponding fuel injector power supply terminal	Yes	Repair, replace wire harness or fuel injector
		No	Next
4	Open circuit or internal circuit damage in fuel injector control pin corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0221 Throttle Position Sensor 2 Performance Non-plausible

1. DTC operating condition
   - Engine speed is ＞ 1200 rpm.
2. DTC setting condition
   - ECM detected that opening angles of throttle position sensor 1 and sensor signal 2 exceed a certain threshold value (6%), and opening angle of sensor 2 is improper. (Compared with virtual 3rd circuit opening angle inside of ECM, deviation of 1st circuit signal is less than that of 2nd circuit signal).
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Depress accelerator pedal slowly until throttle is fully open, observe if value of item "Absolute Throttle Opening Angle" in data flow increases to about 95%-100% as the throttle opening angle increases	Yes	Next
		No	Proceed to step 4
4	Remove the connector from throttle position sensor on wire harness, check if resistance of throttle circuit 2 signal is in proper range	Yes	Repair or replace wire harness
		No	Next

5	Remove the connector from throttle position sensor on wire harness, check if resistance between throttle circuit 2 signal and other signals is within proper range	Yes	Replace throttle
		No	Repair or replace wire harness
6	Clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0222 Throttle Position Sensor 2 Performance Low Input

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - ECM detects that voltage of throttle position sensor 2 signal circuit is less than 0.156V.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from throttle position sensor on wire harness and check if there is open circuit or short circuit to ground in throttle circuit 2 signal	Yes	Repair or replace wire harness
		No	NEXT
4	Turn ENGINE START STOP switch to ON, check if throttle 5V power source is normal	Yes	Replace throttle
		No	Repair or replace wire harness
5	Clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0223 Throttle Position Sensor 2 Performance High Input

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - ECM detects that voltage of throttle position sensor 2 signal circuit is 4.883V.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from throttle position sensor on wire harness, check if throttle 2 circuit signal is short to 5 V power source	Yes	Repair or replace wire harness
		No	Replace throttle
4	Clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0261 Cylinder 1 - Injector Circuit Low P0264 Cylinder 2 - Injector Circuit Low P0267 Cylinder 3 - Injector Circuit Low P0270 Cylinder 4 - Injector Circuit Low

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin short to ground;
   - (P0261: It is detected that voltage UCE of output terminal is 0V with driver switch off);
   - (P0264: It is detected that voltage UCE of output terminal is 0V with driver switch off);
   - (P0267: It is detected that voltage UCE of output terminal is 0V with driver switch off);
   - (P0270: It is detected that voltage UCE of output terminal is 0 V with driver switch off).
3. Operation required for DTC setting
   - If the fault is detected in 3 consecutive driving cycles, MIL light will come on.

4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Corresponding fuel injector circuit short to ground	Yes	Repair wire harness
		No	Next
2	Corresponding fuel injector circuit power supply terminal short to ground	Yes	Repair wire harness
		No	Next
3	Fuel injector control pin corresponding to ECM short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0327 Knock Sensor 1 Circ. Low Input

1. DTC operating condition
   - Load is greater than 40%;
   - Coolant temperature is higher than 40°C;
   - Speed is more than 2600 rpm;
   - Cylinder 1 identification is valid.
2. DTC setting condition
   - Knock identification reference voltage in 30 consecutive cycles is lower than threshold value, threshold value is 0.2 ~ 0.8V. Threshold values vary with different rotation speeds.
3. Operation required for DTC setting
   - Ignition angle is delayed by 7.5 deg within safety angle;
   - After 3 driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Knock identification reference voltage in 30 consecutive cycles is higher than threshold value;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect or replace connector
		No	Next
2	Check if there is short circuit to ground or open circuit in knock sensor signal terminal	Yes	Repair wire harness
		No	Next
3	Knock sensor connecting wire is non-standard shielding wire, is subjected to electromagnetic interference	Yes	Use standard shielding wire
		No	Next
4	Knock sensor damaged	Yes	Replace sensor
		No	Next
5	Knock sensor pin or circuit corresponding to ECM terminal damaged	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0328 Knock Sensor 1 Circ. High Input

1. DTC operating condition
   - Load is greater than 40%;
   - Coolant temperature is higher than 40°C;
   - Speed is more than 2600 rpm;
   - Cylinder 1 identification is valid.

2. DTC setting condition
   - Knock identification reference voltage in 30 consecutive cycles is higher than threshold value which is 15 ~ 150 V. Threshold values vary with different rotation speeds.
3. Operation required for DTC setting
   - Ignition angle is delayed by 7.5 deg within safety angle;
   - After 3 driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Knock identification reference voltage in 30 consecutive cycles is higher than threshold value;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if knock sensor signal terminal is short to power source	Yes	Repair wire harness
		No	Next
2	Knock sensor pin or circuit corresponding to ECM terminal damaged	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0341 Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor

1. DTC operating condition
   - Start vehicle.
2. DTC setting condition
   - ECM detects that intake phase sensor signal is abnormal for several times (about 10 times).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Check if there is external interference on wire	Yes	Shielded wire
		No	Next
3	Relative installation position between phase sensor and its signal plate do not meet the installation requirements (such as too far, misaligned, etc.)	Yes	Reinstall
		No	Next
4	Phase signal plate teeth mechanical malfunction	Yes	Replace phase signal plate
		No	Diagnostic Help

P0444 Evaporative Emission System Purge Control Valve Circuit Open

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - ECM detects open circuit in control terminal pin (it is detected that voltage UCE of output terminal is 6 V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.

4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Open circuit in canister control valve signal terminal pin	Yes	Repair wire harness
		No	Next
3	Open circuit in canister control valve power supply terminal pin	Yes	Repair wire harness
		No	Next
4	Canister control valve damaged	Yes	Replace canister control valve
		No	Next
5	Open circuit or internal circuit damage in canister control terminal pin corresponding to ECM terminal	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0458 Evaporative Emission System Purge Control Valve Circuit Low

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Canister control valve signal terminal short to ground	Yes	Repair wire harness
		No	Next
2	Canister control valve power supply terminal pin short to ground	Yes	Repair wire harness
		No	Next
3	Canister control terminal pin corresponding to ECM terminal short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0459 Evaporative Emission System Purge Control Valve Circuit High

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to power source (it is detected that voltage UCE of output terminal is 12 V with driver switch on).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.

4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Canister control valve signal terminal short to power source	Yes	Repair wire harness
		No	Next
2	Canister control terminal pin corresponding to ECM terminal short to power source	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0480 Fan 1 Control Circuit

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - ECM detects open circuit in control terminal pin (it is detected that voltage UCE of output terminal is 6 V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Open circuit in cooling fan relay circuit signal terminal	Yes	Repair wire harness
		No	Next
3	Cooling fan relay malfunction (fuse blown or damaged)	Yes	Repair wire harness
		No	Next
4	Open circuit or internal circuit damage in cooling fan relay pin corresponding to ECM terminal	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0506 Idle Control System RPM - Lower Than Expected

1. DTC operating condition
   - Carbon canister is not in high scour rate;
   - Engine is idling;
   - Vehicle speed sensor has been inspected and has no fault with P0501 (coast the vehicle and cut off fuel for 5 seconds or more after vehicle speed is more than 20 km/h);
   - Vehicle speed is 0;
   - Plateau correction factor is higher than 0.703 (it meas that not at high altitude area);
2. DTC setting condition
   - Difference between static target idle speed and actual speed is less than 200 rpm;
   - Idle control integral part reaches minimum value (idle control function is normal).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;

- Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if electronic throttle is stuck in smaller opening position due to ice or oil	Yes	Repair or replace electronic throttle
		No	Next
2	Check if intake manifold is blocked, fuel injector is blocked, exhaust resistance is too large, oil supply pressure is too low	Yes	Perform necessary repair
		No	Diagnostic Help

P0571 Brake Switch "A" Circuit

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - E two brake signal of double circuits is out of synchronization for more than 1 second and 20 consecutive times;
   - Brake light voltage signal is improper [brake light signal voltage exceeds ECM calculated model voltage range (not fixed value)]
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if connection of brake pedal wire is normal	Yes	Next
		No	Reconnect
2	Check if there is open circuit, short circuit to ground or short circuit to power source in brake signal of double circuits	Yes	Repair or replace wire harness
		No	Next
3	Connect the diagnostic tester and adapter	/	Next
4	Turn ENGINE START STOP switch to ON and use 2 multimeters to measure if voltages between brake switch signal and ground, brake light signal and ground are 12 V and 0 V separately without brake pedal depressed.	Yes	Next
		No	Adjust pedal travel or replace brake pedal
5	Depress brake pedal slowly to observe if voltages of 2 multimeters change at about the same time	Yes	Next
		No	Adjust pedal travel or replace brake pedal
6	Clear DTCs, start and keep engine idling. Depress brake pedal continuously for 25 times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0645 A/C Clutch Relay Control Circuit

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.

2. DTC setting condition
   - ECM detects open circuit in control terminal pin (it is detected that voltage UCE of output terminal is 6 V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Open circuit in A/C compressor relay control circuit	Yes	Repair wire harness
		No	Next
3	Open circuit or short circuit to ground in A/C compressor relay control circuit	Yes	Repair wire harness
		No	Next
4	A/C compressor relay fuse blown or damaged	Yes	Repair relay
		No	Next
5	Open circuit or internal circuit damage in A/C compressor control pin corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0646 A/C Clutch Relay Control Circuit Low

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Short circuit to ground or open circuit in A/C compressor relay control circuit	Yes	Repair wire harness
		No	Next
3	Open circuit or short circuit to ground in A/C compressor relay control circuit	Yes	Repair wire harness
		No	Next
4	A/C compressor relay fuse blown or damaged	Yes	Repair relay
		No	Next
5	Short circuit to ground, open circuit or internal circuit damage in A/C compressor control pin corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0647 A/C Clutch Relay Control Circuit High

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to power source (it is detected that voltage UCE of output terminal is 12 V with driver switch on).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	A/C compressor relay circuit short to power source	Yes	Repair wire harness
		No	Next
2	A/C compressor relay pin corresponding to ECM terminal short to power source	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0691 Fan 1 Control Circuit Low

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Short circuit to ground or open circuit in cooling fan relay circuit signal terminal	Yes	Repair wire harness
		No	Next
3	Cooling fan relay circuit malfunction (fuse blown or damaged)	Yes	Repair wire harness
		No	Next
4	Short circuit to ground, open circuit or internal circuit damage in cooling fan relay pin corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0692 Fan 1 Control Circuit High

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.

2. DTC setting condition
   - Control terminal pin is short to power source (it is detected that voltage UCE of output terminal is 12 V with driver switch on).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Cooling fan relay control circuit short to power source	Yes	Repair wire harness
		No	Next
2	Cooling fan relay control pin corresponding to ECM terminal short to power source	Yes	Inspect and repair ECM
		No	Diagnostic Help

P2088 "A" Camshaft Position Actuator Control Circuit Low Bank 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Intake VVT control solenoid valve signal terminal short to ground	Yes	Repair wire harness
		No	Next
2	Intake VVT control solenoid valve power supply terminal short to ground	Yes	Repair wire harness
		No	Next
3	Intake VVT control solenoid valve signal terminal pin corresponding to ECM short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P2089 "A" Camshaft Position Actuator Control Circuit High Bank 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to power source (it is detected that voltage UCE of output terminal is 12 V with driver switch on).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;

- Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Intake VVT control solenoid valve signal terminal short to power source	Yes	Repair wire harness
		No	Next
2	Intake VVT control solenoid valve signal terminal pin corresponding to ECM terminal short to power source	Yes	Inspect and repair ECM
		No	Diagnostic Help

P2090 "B" Camshaft Position Actuator Control Circuit Low Bank 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Exhaust VVT control solenoid valve signal terminal short to ground	Yes	Repair wire harness
		No	Next
2	Exhaust VVT control solenoid valve power supply terminal short to ground	Yes	Repair wire harness
		No	Next
3	Exhaust VVT control solenoid valve signal terminal pin corresponding to ECM short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P2091 "B" Camshaft Position Actuator Control Circuit High Bank 1

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to power source (it is detected that voltage UCE of output terminal is 12 V with driver switch on).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Exhaust VVT control solenoid valve signal terminal short to power source	Yes	Repair wire harness
		No	Next

No.	Operation Step	Test Result	Subsequent Step
2	Exhaust VVT control solenoid valve signal terminal pin corresponding to ECM terminal short to power source	Yes	Inspect and repair ECM
		No	Diagnostic Help

P2106 Throttle Actuator Control System Forced Limited Power

1. DTC operating condition
   - Engine is running (starting is completed) Internal subdivision fault of corresponding ECM is:
     - Improper electronic throttle drive level faults;
     - Maximum electronic throttle drive level malfunction (short circuit);
     - Electronic throttle drive level signal malfunction (open circuit);
     - Minimum electronic throttle drive level malfunction (overheat or overcurrent).
   - Engine speed is higher than 1200rpm (Internal subdivision faults of corresponding ECM: load monitoring faults)
2. DTC setting condition
   - Electronic throttle drive level malfunction (ECM internal drive chip feedback fault condition);
     - (Internal subdivision faults of corresponding ECM: Improper electronic throttle drive level faults.
   - Short circuit between positive and negative of electronic throttle drive level (short circuit between positive and negative of ECM internal drive chip feedback chip);
     - Internal subdivision DTCs of corresponding ECM: Maximum electronic throttle drive level faults (short circuit).
   - There is open circuit between positive and negative terminals of electronic throttle drive level (there is open circuit between positive and negative terminals of ECM internal drive chip feedback chip);
     - Internal subdivision DTCs of corresponding ECM: Electronic throttle drive level signal faults (open circuit).
   - ECM monitors and detects that load signal is improper (load signal exceeds load monitoring signal calculated by ECM internal model);
     - (Internal subdivision DTCs of corresponding ECM: load monitoring faults).
   - Electronic throttle drive overheating or overcurrent.
     - Internal subdivision DTCs of corresponding ECM: Minimum electronic throttle drive level faults (overheating or overcurrent).
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
2	Clear DTCs	/	Next

No.	Operation Step	Test Result	Subsequent Step
3	Turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Observe if DTCs are reproduced	Yes	Next
		No	End
4	Replace with a new ECM to check if fault reoccurs	NEXT	
5	Turn ENGINE START STOP switch to ON, and wait for 1 minute to finish the throttle self-learning. Then start engine and depress accelerator pedal for several times in neutral to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P2122 Throttle/Pedal Position Sensor/Switch "D" Circuit Low

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - Voltage of 1st signal circuit is less than lower limit threshold value 0.586V.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from electronic accelerator pedal position sensor on wire harness key, check if there is open circuit or short circuit to ground in accelerator pedal circuit 2 signal	Yes	Repair or replace wire harness
		No	Replace accelerator pedal
4	Turn ENGINE START STOP switch to ON, clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P2123 Throttle/Pedal Position Sensor/Switch "D" Circuit High

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - Voltage of circuit 1 signal circuit is more than upper limit threshold value 4.824 V
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from throttle position sensor on wire harness, check if accelerator pedal circuit 2 signal is short to 5V power source	Yes	Repair or replace wire harness
		No	Replace accelerator pedal
4	Turn ENGINE START STOP switch to ON, clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P2127 Throttle/Pedal Position Sensor/Switch "E" Circuit Low

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - Voltage of 2nd circuit signal is less than lower limit threshold value 0.43V.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;

- Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from electronic accelerator pedal position sensor on wire harness key, check if there is open circuit or short circuit to ground in accelerator pedal circuit 5 signal	Yes	Repair or replace wire harness
		No	Replace accelerator pedal
4	Turn ENGINE START STOP switch to ON, clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P2128 Throttle/Pedal Position Sensor/Switch "E" Circuit High

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - Voltage of 2nd signal circuit is more than upper limit threshold value 4.961 V.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Check if wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect a diagnostic tester and adapter, turn ENGINE START STOP switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Remove the connector from throttle position sensor on wire harness, check if accelerator pedal circuit 5 signal is short to 5V power source	Yes	Repair or replace wire harness
		No	Replace accelerator pedal

No.	Operation Step	Test Result	Subsequent Step
4	Turn ENGINE START STOP switch to ON, clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P2138 Pedal Movement Check Error

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - One circuit signal is at the idle point (signal 1 is less than 0.88V), signal of another circuit is far away idle point (twice of the signal 2 value is 0.92V). Data will vary with different items;
     - Internal subdivision faults of corresponding ECM: Accelerator pedal movement inspection faults.
   - Voltage signal deviation of 1st circuit and 2nd circuit exceeds a certain range (difference between signal 1 and twice of signal 2 value is out of range 0.03 V - 1.15 V according to voltage).
     - Internal subdivision faults of corresponding ECM: Improper electronic accelerator pedal position sensor signal.
3. Operation required for DTC setting
   - No light comes on;
     - Internal subdivision faults of corresponding ECM: Accelerator pedal movement inspection faults.
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
   - Diagnostic tester will be visible.
     - Internal subdivision faults of corresponding ECM: Improper electronic accelerator pedal position sensor signal.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs until all DTCs are cleared;
     - Internal subdivision faults of corresponding ECM: Accelerator pedal movement inspection faults.
   - After fault is repaired, SVS light will go off immediately;
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.
     - Internal subdivision faults of corresponding ECM: Improper electronic accelerator pedal position sensor signal.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	NEXT
3	Clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End

4	Remove the connector from electronic accelerator pedal sensor on wire harness key, check if resistance of accelerator pedal circuit 1 signal or circuit 2 signal is in proper range	Yes	Next
		No	Repair or replace wire harness
5	Remove the connector from electronic accelerator pedal sensor on wire harness key, check if resistance between accelerator pedal circuit 1 signal or circuit 2 signal and other signals is in proper range	Yes	Repair or replace wire harness
		No	Replace accelerator pedal
6	Turn ENGINE START STOP switch to ON, clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P2271 O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2

1. DTC operating condition
   - Rear oxygen closed loop control effect for more than a certain period of time;
   - Diagnostic enrichment for more than a certain period of time; [Recommended operating condition: After vehicle is driving at a low speed (lower than 50 km/h) for 10 minutes, drive vehicle at 5th (70 km/h) for 5-10 minutes steadily].
2. DTC setting condition
   - ECM detects that rear oxygen sensor voltage is higher than 0.681 V continually.
3. Operation required for DTC setting
   - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
   - If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
   - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check exhaust system for leakage, gasket for damage	Yes	Repair leaking area
		No	Next
4	Downstream oxygen sensor: Puncture wire harness connector near ECM terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECM terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is in range of 0.44 V - 0.46 V	Yes	Next
		No	Replace oxygen sensor

No.	Operation Step	Test Result	Subsequent Step
5	Start and keep vehicle idling until coolant temperature reaches normal value. downstream oxygen sensor: Puncture wire harness connector near ECM terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECM terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage changes in range of 0 V - 1 V	Yes	Next
		No	Replace oxygen sensor
6	Start and keep vehicle idling until coolant temperature reaches normal value. Depress and release accelerator pedal frequently and alternately for 90 s, at the same time, puncture downstream oxygen sensor wire harness connector near ECM terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECM terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is beyond ② range of 0.55 V - 0.65 V	Yes	End
		No	Diagnostic Help

Beyond range of 0.55 V - 0.65 V means: Detected voltage was once higher than 0.55 V - 0.65 V and also was once lower than 0.55 V - 0.65 V.

U0101 Lost Communication With TCM

1. DTC operating condition
   - ECM does not detect CAN line BUSOFF fault;
   - Engine is running.
2. DTC setting condition
   - ECM detects that information from TCU control module is missing.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	TCU connector looseness or poor contact	Yes	Reconnect
		No	Next
2	There is wire harness signal interference	Yes	Shielded wire
		No	Next
3	Transmission line between TCU and ECM damaged or interrupted	Yes	Repair wire harness
		No	Next

No.	Operation Step	Test Result	Subsequent Step
4	Check if there is CAN hardware circuit fault	Yes	Refer to repair procedures of U0001
		No	Next
5	TCU is damaged and signal cannot be transmitted to ECM normally	Yes	Consult the TCU supplier
		No	Diagnostic Help

U0129 Lost Communication With Vehicle Dynamics Control Module

1. DTC operating condition
   - ECM does not detect CAN line BUSOFF fault;
   - Engine is running.
2. DTC setting condition
   - ECM detects that information from ESP control module is missing.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	ESP connector looseness or separation	Yes	Reconnect
		No	Next
2	There is wire harness signal interference	Yes	Shielded wire
		No	Next
3	Transmission line between ESP and ECM damaged or interrupted	Yes	Repair wire harness
		No	Next
4	Check if there is CAN hardware circuit fault	Yes	Refer to repair procedures of U0001
		No	Next
5	ESP is damaged and signal cannot be transmitted to ECM normally	Yes	Consult the ESP supplier
		No	Diagnostic Help

U0155 Lost Communication With Instrument Panel Cluster (IPC) Control Module

1. DTC operating condition
   - ECM does not detect CAN line BUSOFF fault;
   - Engine is running.
2. DTC setting condition
   - ECM detects that information from IPC control module is missing.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	IPC connector looseness or separation	Yes	Reconnect
		No	Next

2	There is wire harness signal interference	Yes	Shielded wire
		No	Next
3	Transmission line between IPC and ECM damaged or interrupted	Yes	Repair wire harness
		No	Next
4	Check if there is CAN hardware circuit fault	Yes	Refer to repair procedures of U0001
		No	Next
5	IPC is damaged and signal cannot be transmitted to ECM normally	Yes	Consult the IPC supplier
		No	Diagnostic Help

P0106 Manifold Absolute Pressure Sensor Circuit Range/Performance

1. DTC operating condition
   - Engine is running.
2. DTC setting condition
   - ECM detected that intake temperature value is not within upper and lower limit range. (Maximum and minimum reasonable threshold pressure), the upper and lower limits of intake manifold pressure are variables, non-fixed values.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Do not start engine, and observe if "Intake Pressure" item in data flow is seriously deviated from ambient pressure by about 101 kpa (specific value is related to current pressure)	Yes	Repair or replace sensor
		No	Next
3	Turn ENGINE START STOP switch "OFF", and check if there is any freeze, oil stain, etc. on measurement terminal, which will affect normal measurement	Yes	Repair or replace sensor
		No	Next
4	Check if intake pressure sensor installation position is incorrect, intake pipe is disconnected or seriously leaked	Yes	Repair intake pipe, sensor
		No	Diagnostic Help

P0107 Manifold Absolute Pressure Sensor Circuit Low

1. DTC operating condition
   - More than 1 second has elapsed after engine starting.
2. DTC setting condition
   - ECM detects that voltage value of intake manifold pressure sensor is less than 0.195 V.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;

- Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
- Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect the diagnostic tester and start vehicle. Use a multimeter to measure if sensor signal terminal voltage is close to or equal to 0 V	Yes	Next
2	Turn ENGINE START STOP switch "OFF", check if sensor signal terminal is short to ground	Yes	Repair wire harness
		No	Next
3	Sensor is damaged	Yes	Replace sensor
		No	Next
4	Sensor signal pin terminal corresponding to ECM short to ground	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0108 Manifold Absolute Pressure Sensor Circuit High

1. DTC operating condition
   - More than 1 second has elapsed after engine starting.
2. DTC setting condition
   - ECM detected that voltage value of intake manifold pressure sensor is more than 4.88 V.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON" Do not start engine, and observe if "Intake Temperature Sensor Measured Value" in data flow is too low. If value is lower than normal condition, observe minimum intake manifold temperature range. You can also use a multimeter to measure if voltage between intake manifold temperature sensor signal terminal and ground is close to or equal to 5V	Yes	Next
2	Turn ENGINE START STOP switch "OFF" and check if connector is loosen or has poor contact	Yes	Reconnect
		No	Next
3	Check if there is short circuit to power source or open circuit in sensor signal terminal	Yes	Repair wire harness
		No	Next
4	Open circuit in sensor reference ground	Yes	Repair, replace wire harness or sensor
		No	Next
5	Sensor is damaged	Yes	Replace sensor
		No	Next

No.	Operation Step	Test Result	Subsequent Step
6	Short circuit to power source, open circuit or internal circuit damage in intake manifold temperature sensor signal pin corresponding to ECM terminal	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0481 Fan 2 Control Circuit

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - ECM detects open circuit in control terminal pin (it is detected that voltage UCE of output terminal is 6 V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Short circuit to ground or open circuit in cooling fan relay circuit signal terminal	Yes	Repair wire harness
		No	Next
3	Cooling fan relay circuit malfunction (fuse blown or damaged)	Yes	Repair wire harness
		No	Next
4	Short circuit to ground, open circuit or internal circuit damage in cooling fan relay pin corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

P0693 Fan 2 Control Circuit Low

1. DTC operating condition
   - Engine is running;
   - Battery voltage is in range of 8 ~ 18V.
2. DTC setting condition
   - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0V with driver switch off).
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Short circuit to ground or open circuit in cooling fan relay circuit signal terminal	Yes	Repair wire harness
		No	Next

No.	Operation Step	Test Result	Subsequent Step
3	Cooling fan relay circuit malfunction (fuse blown or damaged)	Yes	Repair wire harness
		No	Next
4	Short circuit to ground, open circuit or internal circuit damage in cooling fan relay pin corresponding to ECM	Yes	Inspect and repair ECM
		No	Diagnostic Help

U0140 Lost Communication With Body Control Module

1. DTC operating condition
   - ECM does not detect CAN line BUSOFF fault;
   - Engine is running.
2. DTC setting condition
   - ECM detects that information from BCM control module is missing.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	BCM connector looseness or disengagement	Yes	Repair wire harness
		No	Next
2	There is wire harness signal interference	Yes	Shielded wire
		No	Next
3	Transmission line between BCM and ECM damaged or interrupted	Yes	Repair wire harness
		No	Next
4	Check if there is CAN hardware circuit fault	Yes	Refer to repair procedures of U0001
		No	Next
5	BCM is damaged and signal cannot be transmitted to ECM normally	Yes	Consult the BCM supplier
		No	Diagnostic Help

P2228 Barometric Pressure Sensor "A" Circuit Low

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - Ambient pressure sensor voltage is lower than 0.195V.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Do not start engine, observe if "Ambient Pressure Value" item in data flow deviated from normal value (current pressure should be equal to atmospheric pressure)	Yes	Replace with a new ECM to check if fault reoccurs
		No	Next
3	Start engine and drive vehicle at normal environment, observe if "Ambient Pressure Value" item in data flow deviated from normal value (current pressure should be equal to atmospheric pressure)	Yes	Replace ECM to perform real-vehicle check
		No	Diagnostic Help

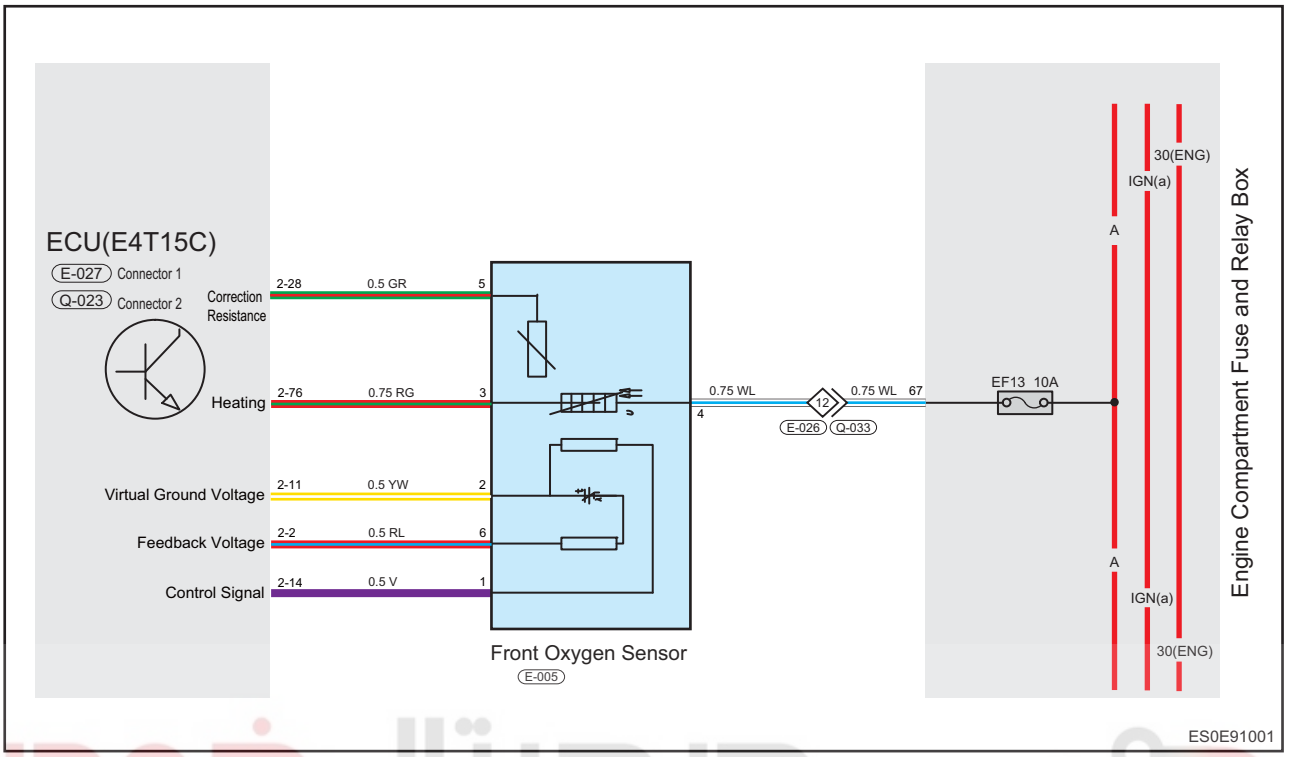
P2229 Barometric Pressure Sensor "A" Circuit High

1. DTC operating condition
   - Ignition switch ON.
2. DTC setting condition
   - Ambient pressure sensor voltage is higher than 4.883V.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
   - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
   - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Do not start engine, observe if "Ambient Pressure Value" item in data flow deviated from normal value (current pressure should be equal to atmospheric pressure)	Yes	Replace with a new ECM to check if fault reoccurs
		No	Next
3	Start engine and drive vehicle at normal environment, observe if "Ambient Pressure Value" item in data flow deviated from normal value (current pressure should be equal to atmospheric pressure)	Yes	Replace ECM to perform real-vehicle check
		No	Diagnostic Help

DTC	P0133 00	O2 Sensor Circuit Slow Response Bank 1 Sensor 1
DTC	P0134 00	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 1
DTC	P2196 00	O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1
DTC	P2195 00	O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1
DTC	P2231 00	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1
DTC	P0032 00	HO2S Heater Control Circuit High Bank 1 Sensor 1
DTC	P0031 00	HO2S Heater Control Circuit Low Bank 1 Sensor 1
DTC	P0030 00	HO2S Heater Control Circuit Bank 1 Sensor 1
DTC	P0053 00	HO2S Heater Resistance Bank 1 Sensor 1
DTC	P0053 26	HO2S Heater Resistance Bank 1 Sensor 1
DTC	P0135 00	O2 Sensor Heater Circuit Bank 1 Sensor 1
DTC	P2626 00	O2 Sensor Pumping Current Trim Circuit Open Bank 1 Sensor 1
DTC	P0132 00	O2 Sensor Circuit High Voltage Bank 1 Sensor 1
DTC	P0131 00	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1
DTC	P2243 00	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1
DTC	P2251 00	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0133 00	O2 Sensor Circuit Slow Response Bank 1 Sensor 1	ENGINE START STOP switch ON, engine running	• Upstream oxygen sensor • Wire harness or connector • Fuse • ECM
P0134 00	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 1		
P2196 00	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1		
P2195 00	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1		
P2231 00	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1		
P0032 00	HO2S Heater Control Circuit High Bank 1 Sensor 1		
P0031 00	HO2S Heater Control Circuit Low Bank 1 Sensor 1		
P0030 00	HO2S Heater Control Circuit Bank 1 Sensor 1		
P0053 00	HO2S Heater Resistance Bank 1 Sensor 1		
P0135 00	O2 Sensor Heater Circuit Bank 1 Sensor 1		
P2626 00	O2 Sensor Pumping Current Trim Circuit Open Bank 1 Sensor 1		
P0132 00	O2 Sensor Circuit High Voltage Bank 1 Sensor 1		
P0131 00	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1		
P2243 00	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1		
P2251 00	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1		

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

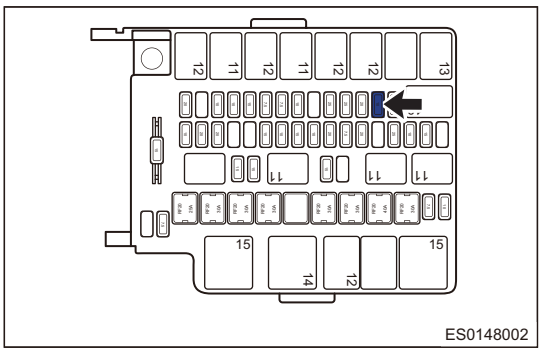
Procedure

1	Check fuse EF13

(a) Check if fuse EF13 is blown or no power.

Result

Proceed to
OK
NG



04

NG → **Replace fuse or check the cause for no power**

OK

2	Check upstream oxygen sensor connector

(a) Check if upstream oxygen sensor connector is connected infirmly or loose.

OK

Upstream oxygen sensor connector is installed normally

Result

Proceed to
OK
NG

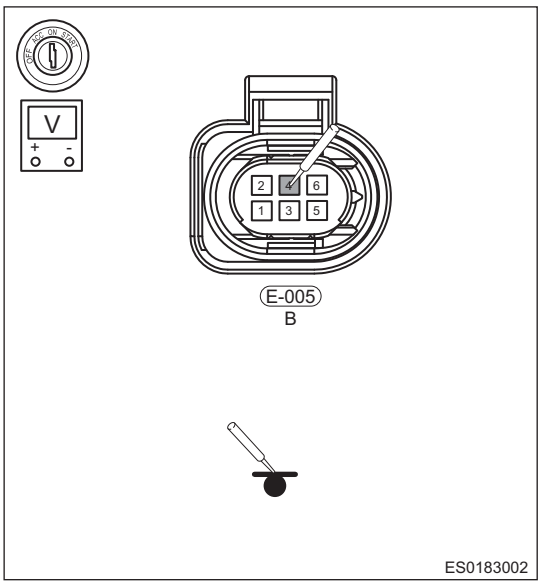
NG → **Reinstall or repair, replace connector**

OK

3	Check upstream oxygen sensor heater power supply voltage

(a) Turn ENGINE START STOP switch to ON.

(b) Check voltage of terminal 4 of upstream oxygen sensor connector E-005 (using a digital multimeter) (online detection).



Multimeter Connection	Condition	Specified Condition
E-005 (4) - Body ground	ENGINE START STOP switch ON	Not less than 12V

Result

Proceed to
OK
NG

04

NG → **Check wire harness between E-005 (4) and engine compartment fuse and relay box**

OK

4 Check upstream oxygen sensor heater voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Check voltage of terminal 2 of upstream oxygen sensor connector E-005 (using a digital multimeter) (online detection).

Multimeter Connection	Condition	Specified Condition
E-005 (2) - Body ground	ENGINE START STOP switch ON	Changed between 0.8 and 0.9V

Result

Proceed to
OK
NG

NG → **Repair or replace upstream oxygen sensor wire harness**

OK

5 Check upstream oxygen sensor heater heating wire harness

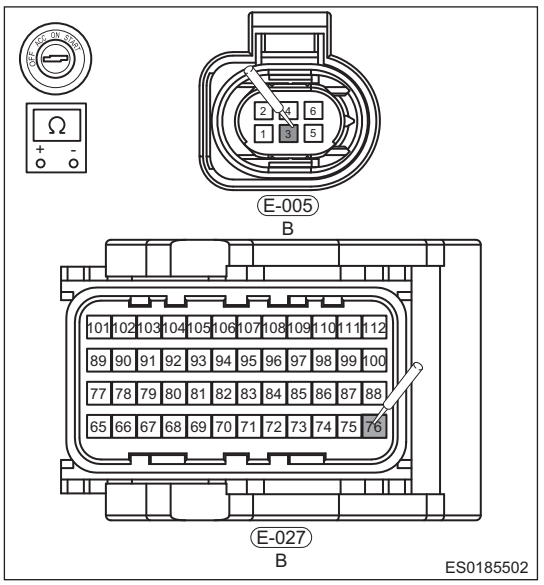
(a) Turn ENGINE START STOP switch to OFF. Disconnect the negative battery cable.
(b) Disconnect upstream oxygen sensor connector E-005 and ECM connector E-027.

(c) Check heating wire harness between upstream oxygen sensor connector E-005 and ECM connector E-027.

Multimeter Connection	Condition	Specified Condition
E-005 (3) - E-027 (76)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG



NG → **Repair or replace wire harness**

OK

6 Check upstream oxygen sensor heating resistance

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the upstream oxygen sensor connector.
(d) Check heating resistance between terminals 3 and 4 of upstream oxygen sensor.

Multimeter Connection	Condition	Specified Condition
(3) - (4)	At room temperature	4 - 5 Ω

OK
Upstream oxygen sensor heating resistance is normal

Result

Proceed to
OK
NG

NG → **Replace upstream oxygen sensor**

OK

7 Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, clear DTCs.
(d) Check if DTC still exists.

OK
No same DTC is output

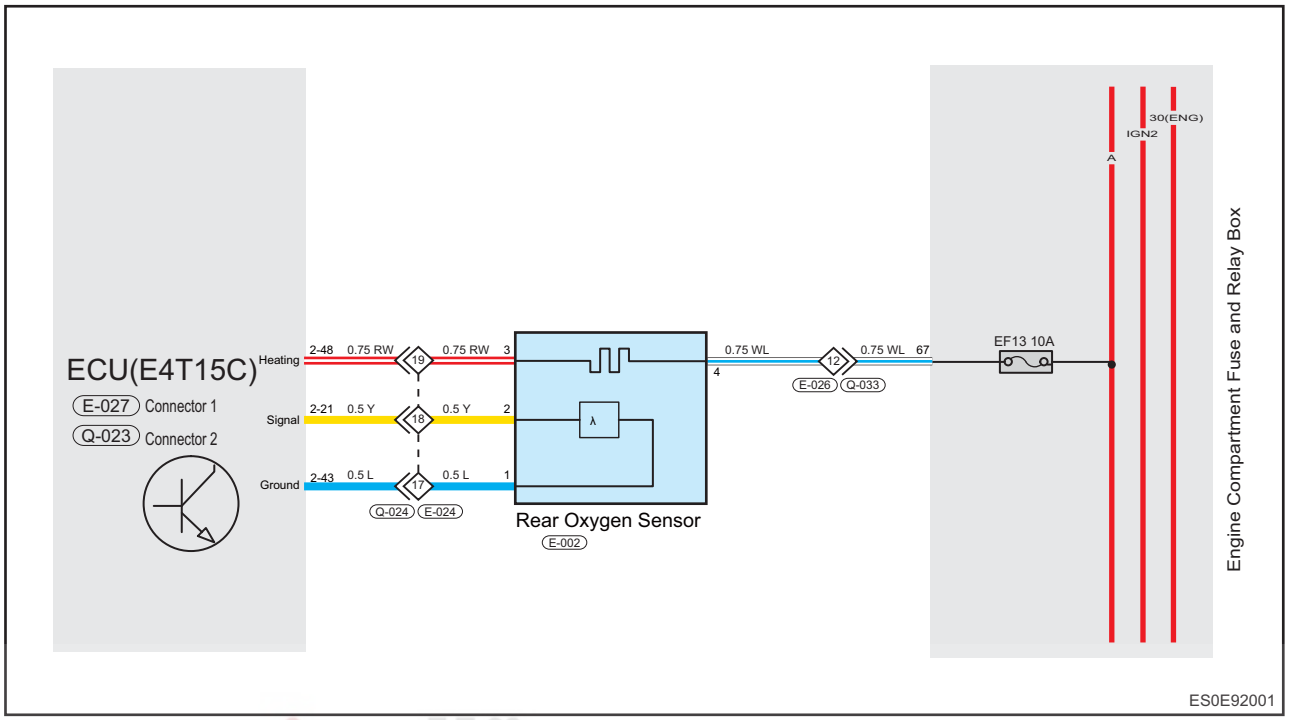
Result

Proceed to
OK
NG

OK	System operates normally
NG	Replace ECM to perform real-vehicle check

DTC	P0138 00	O2 Sensor Circuit High Voltage Bank 1 Sensor 2
DTC	P0137 00	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2
DTC	P2232 00	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 2
DTC	P0136 00	O2 Sensor Circuit Bank 1 Sensor 2
DTC	P0054 00	HO2S Heater Resistance Bank 1 Sensor 2
DTC	P0038 00	HO2S Heater Control Circuit High Bank 1 Sensor 2
DTC	P0037 00	HO2S Heater Control Circuit Low Bank 1 Sensor 2
DTC	P0036 00	HO2S Heater Control Circuit Bank 1 Sensor 2
DTC	P013A 00	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2
DTC	P2271 00	O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2
DTC	P2270 00	O2 Sensor Signal Biased&Stuck Lean Bank 1 Sensor 2

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0138 00	O2 Sensor Circuit High Voltage Bank 1 Sensor 2	ENGINE START STOP switch ON, engine running	• Downstream oxygen sensor • Wire harness or connector • Fuse • ECM
P0137 00	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2		
P2232 00	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 2		
P0136 00	O2 Sensor Circuit Bank 1 Sensor 2		
P0054 00	HO2S Heater Resistance Bank 1 Sensor 2		
P0038 00	HO2S Heater Control Circuit High Bank 1 Sensor 2		
P0037 00	HO2S Heater Control Circuit Low Bank 1 Sensor 2		
P0036 00	HO2S Heater Control Circuit Bank 1 Sensor 2		
P013A 00	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2		
P2271 00	O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2		
P2270 00	O2 Sensor Signal Biased&Stuck Lean Bank 1 Sensor 2		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.

- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

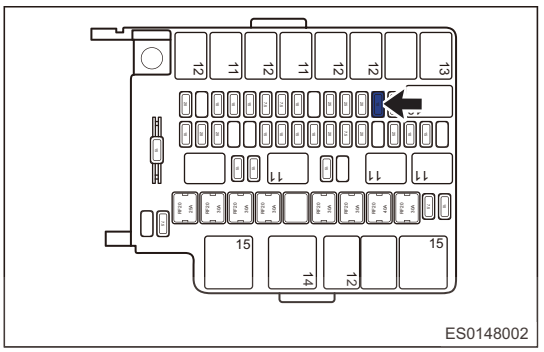
Procedure

1	Check fuse EF13

(a) Check if fuse EF13 is blown or no power.

Result

Proceed to
OK
NG



NG → **Replace fuse or check the cause for no power**

OK

2	Check downstream oxygen sensor connector

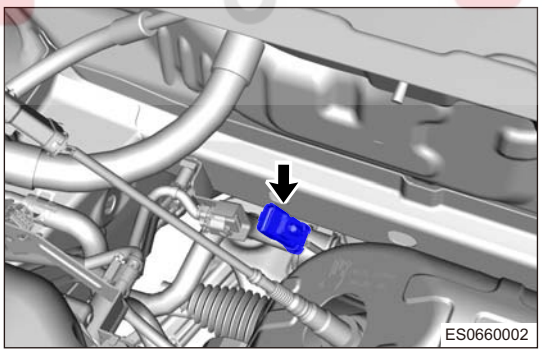
(a) Check if downstream oxygen sensor is connected infirmly or loose.

OK

Downstream oxygen sensor connector is installed normally

Result

Proceed to
OK
NG



NG → **Reinstall or repair, replace connector**

OK

3	Check downstream oxygen sensor heater power supply voltage

(a) Turn ENGINE START STOP switch to ON.

(b) Check voltage of terminal 4 of downstream oxygen sensor connector E-002 (using a digital multimeter) (online detection).

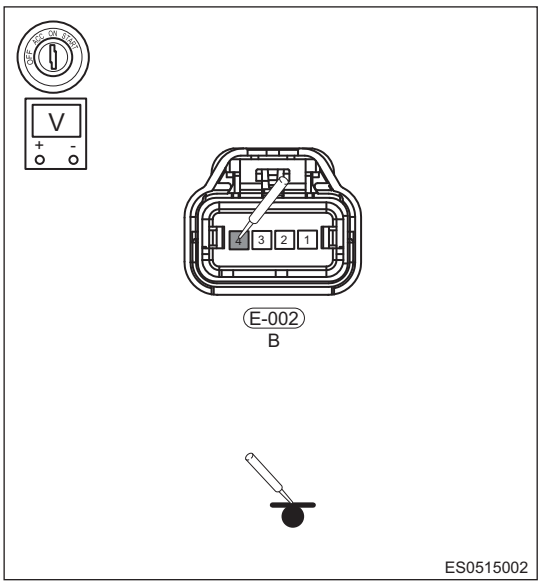
Multimeter Connection	Condition	Specified Condition
E-002 (4) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Voltage between downstream oxygen sensor connector and body ground is normal

Result

Proceed to
OK
NG



NG → **Check wire harness between E-002 (4) and engine compartment fuse and relay box**

OK

4	Check downstream oxygen sensor heater voltage

(a) Turn ENGINE START STOP switch to ON.

(b) Check voltage of terminal 3 of downstream oxygen sensor connector E-002 (using a digital multimeter) (online detection).

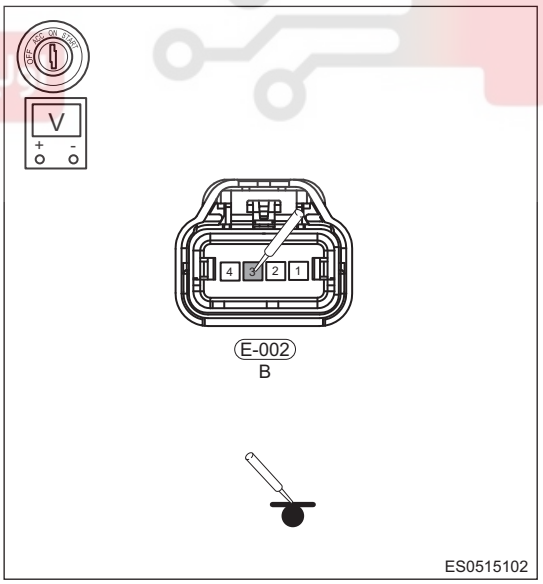
Multimeter Connection	Condition	Specified Condition
E-002 (3) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Voltage between terminal 3 of downstream oxygen sensor and body ground is normal

Result

Proceed to
OK
NG



OK → **Go to step**

NG

5	Check downstream oxygen sensor heating resistance

(a) Turn ENGINE START STOP switch to OFF.

(b) Disconnect the negative battery cable.
(c) Disconnect the downstream oxygen sensor connector.
(d) Check heating resistance between terminals 3 and 4 of downstream oxygen sensor.

Multimeter Connection	Condition	Specified Condition
(3) - (4)	At room temperature	Not more than 10 Ω

OK
Voltage between downstream oxygen sensor connector and body ground is normal

Result

Proceed to
OK
NG

NG → **Replace oxygen sensor**

OK

6 Check downstream oxygen sensor heater heating wire harness

(a) Turn ENGINE START STOP switch to OFF. Disconnect the negative battery cable.
(b) Disconnect downstream oxygen sensor connector and ECM connector Q-023.
(c) Check heating wire harness between downstream oxygen sensor connector E-002 (3) and ECM connector Q-023 (48).

Multimeter Connection	Condition	Specified Condition
E-542 (3) - Q-023 (48)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

7 Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK
No same DTC is output

Result

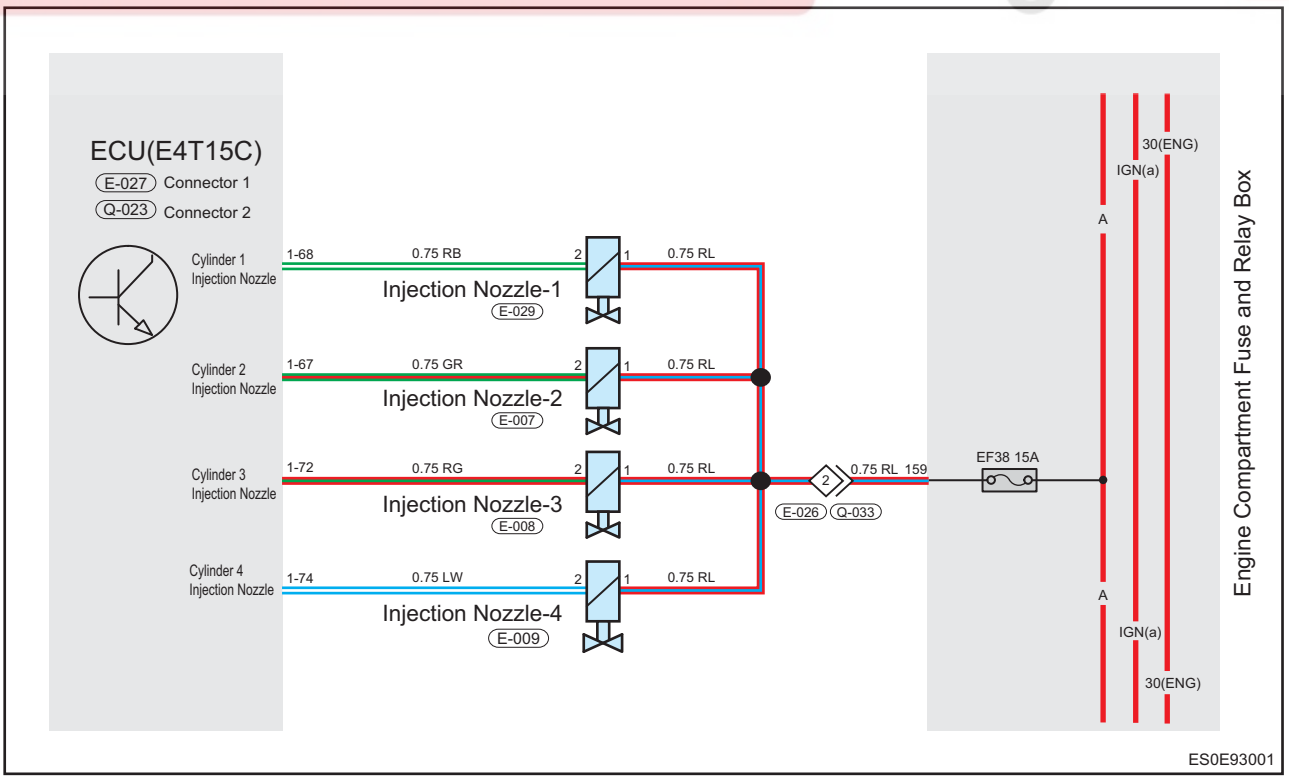
Proceed to
OK
NG

OK → **System operates normally**

NG	Replace with a new ECM to check if fault reoccurs

DTC	P0201 13	Cylinder 1 - Injector Circuit
DTC	P0202 13	Cylinder 2 - Injector Circuit
DTC	P0203 13	Cylinder 3 - Injector Circuit
DTC	P0204 13	Cylinder 4 - Injector Circuit
DTC	P0261 11	Cylinder 1 - Injector Circuit Low
DTC	P0262 12	Cylinder 1 - Injector Circuit High
DTC	P0264 11	Cylinder 2 - Injector Circuit Low
DTC	P0265 12	Cylinder 2 - Injector Circuit High
DTC	P0267 11	Cylinder 3 - Injector Circuit Low
DTC	P0268 12	Cylinder 3 - Injector Circuit High
DTC	P0270 11	Cylinder 4 - Injector Circuit Low
DTC	P0271 12	Cylinder 4 - Injector Circuit High

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0201 13	Cylinder 1 - Injector Circuit	ENGINE START STOP switch ON, engine running	• Fuel injector • Wire harness or connector • ECM
P0202 13	Cylinder 2 - Injector Circuit		
P0203 13	Cylinder 3 - Injector Circuit		
P0204 13	Cylinder 4 - Injector Circuit		
P0261 11	Cylinder 1 - Injector Circuit Low		
P0262 12	Cylinder 1 - Injector Circuit High		
P0264 11	Cylinder 2 - Injector Circuit Low		
P0265 12	Cylinder 2 - Injector Circuit High		
P0267 11	Cylinder 3 - Injector Circuit Low		
P0268 12	Cylinder 3 - Injector Circuit High		
P0270 11	Cylinder 4 - Injector Circuit Low		
P0271 12	Cylinder 4 - Injector Circuit High		

04

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

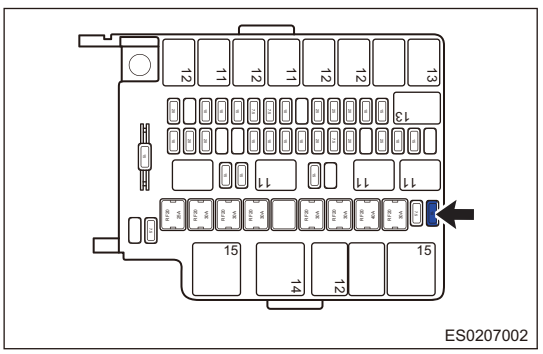
Procedure

1	**Check engine compartment fuse EF38**

(a) Check if fuse EF38 (15 A) is blown or no power.

Result

Proceed to
OK
NG

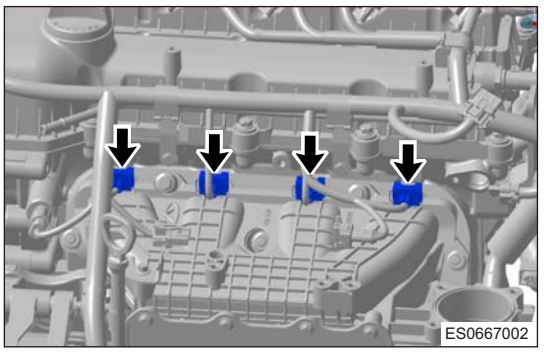


NG → **Replace fuse or check the cause for no power**

OK

2	Check injector connector

(a) Check if injector connectors of cylinders 1, 2, 3 and 4 are connected infirmly, damaged or cracked.



Result

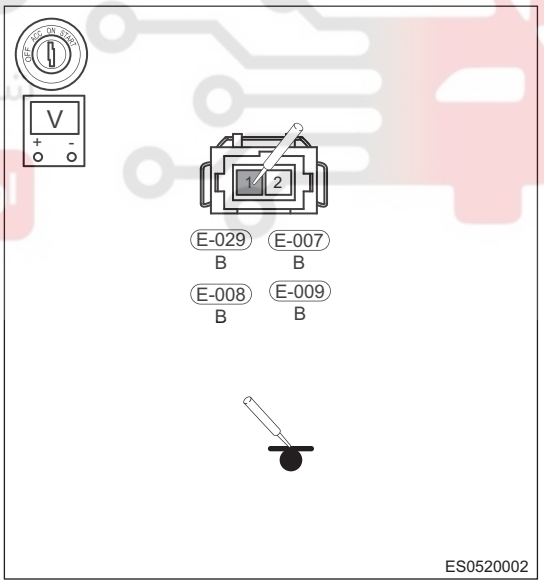
Proceed to
OK
NG

NG → **Reconnect or replace connector**

OK

3	Check injector power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Check voltage between injector connector terminals of cylinders 1, 2, 3, 4 and body ground (using a digital multimeter).



Multimeter Connection	Condition	Specified Condition
E-029 (1), E-007 (1), E-008 (1), E-009 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK
Voltage between injector connector terminals of cylinders 1, 2, 3, 4 and body ground is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness between injector and engine compartment fuse and relay box**

OK

4	Check ECM terminal voltage corresponding to injector

(a) Start the engine.
(b) Connect LED test light to injector connector in parallel, check if LED test light blinks.

Blink

ECM control terminal corresponding to injector is normal

Result

Proceed to
OK
NG

OK → **Go to step**

NG

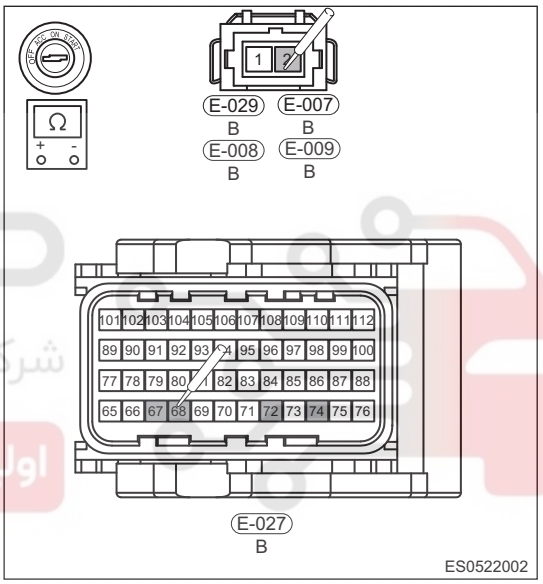
04

5 Check injector control circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect ECM connector E-027 and 4 injector connectors.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-029 (2) - E-027 (68)	Always	Resistance ⩽ 1 Ω
E-007 (2) - E-027 (67)		
E-008 (2) - E-027 (72)		
E-009 (2) - E-027 (74)		



OK

Continuity between each terminal of ECM connector is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness or connector (injector - ECM)**

OK

6 Check injector

(a) Remove the injector.
(b) Check injector for damage or blockage.
(c) Measure injector resistance, check for a short or open circuit in injector.

Result

Proceed to
OK
NG

NG → **Clean or replace injector**

OK

7	Reconfirm DTCs

(a) Using diagnostic tester, read ECM DTC.
(b) Check if DTC still exists.

OK

No same DTC is output

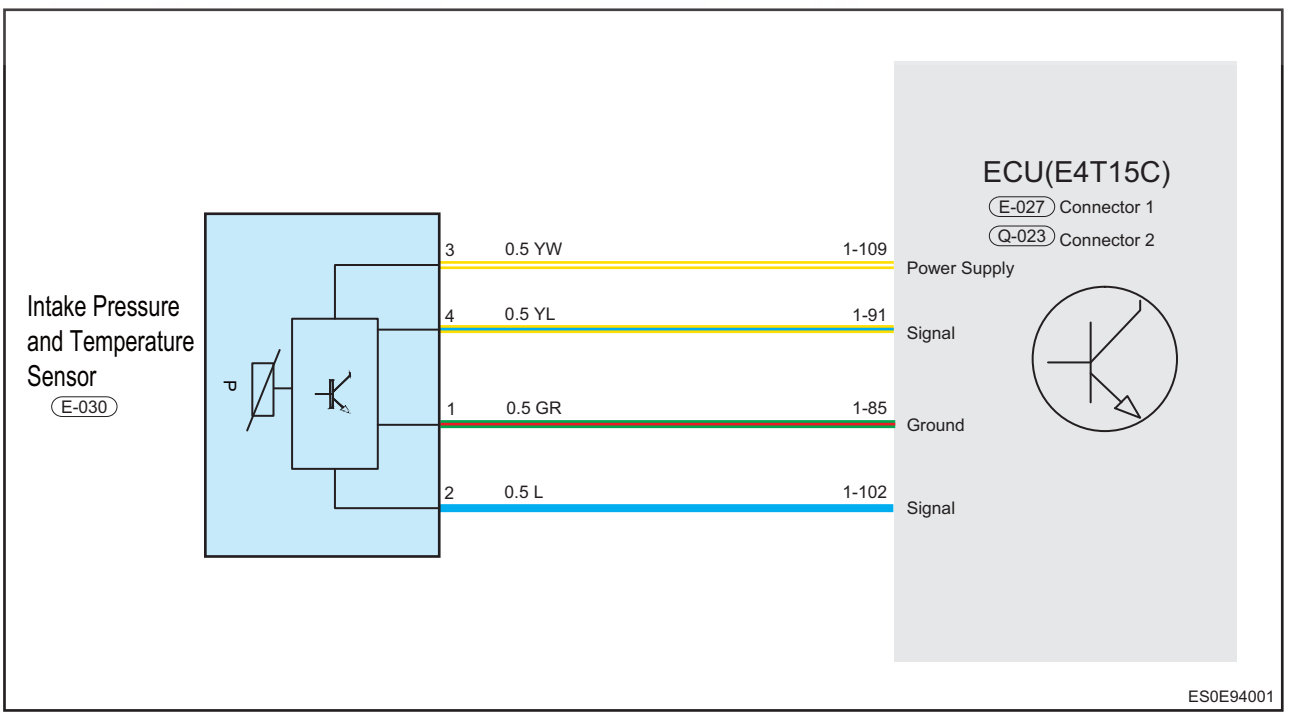
Result

Proceed to
OK
NG

OK	**System operates normally**
NG	**Replace with a new ECM to check if fault reoccurs**

DTC	P1200 00	Manifold Absolute Pressure Sensor Circuit Range/ Performance
DTC	P1201 00	Manifold Absolute Pressure Sensor Circuit Range/ Performance
DTC	P00C7 21	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1
DTC	P00C7 22	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1
DTC	P0108 00	Manifold Absolute Pressure Sensor Circuit High
DTC	P0107 00	Manifold Absolute Pressure Sensor Circuit Low
DTC	P0106 22	Manifold Absolute Pressure Sensor Circuit Range/ Performance
DTC	P0106 21	Manifold Absolute Pressure Sensor Circuit Range/ Performance
DTC	P0106 2A	Manifold Abs.Pressure Performance Non-plausible

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P1200 00	Manifold Absolute Pressure Sensor Circuit Range/ Performance	ENGINE START STOP switch ON, engine running	• Intake pressure/temperature sensor • Wire harness or connector • ECM
P1201 00	Manifold Absolute Pressure Sensor Circuit Range/ Performance		
P00C7 21	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1		
P00C7 22	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1		
P0108 00	Manifold Absolute Pressure Sensor Circuit High		
P0107 00	Manifold Absolute Pressure Sensor Circuit Low		
P0106 21	Manifold Absolute Pressure Sensor Circuit Range/ Performance		
P0106 22	Manifold Absolute Pressure Sensor Circuit Range/ Performance		
P0106 2A	Manifold Abs.Pressure Performance Non-plausible		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

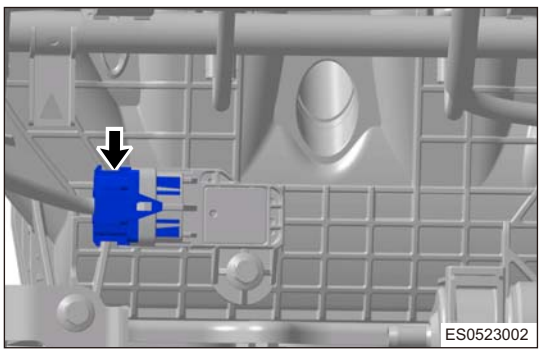
Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check installation of intake pressure/temperature sensor

(a) Check intake pressure/temperature sensor connector (arrow) for poor contact or looseness.



Result

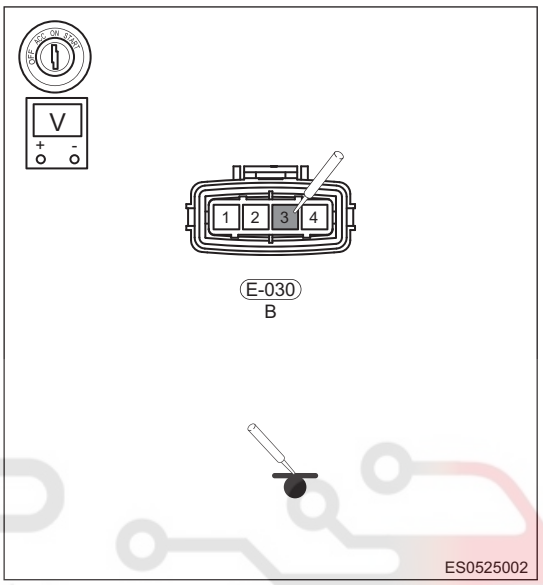
Proceed to
OK
NG

NG → **Reinstall or repair or replace intake pressure/temperature sensor**

OK

2 Check intake pressure/temperature sensor power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Intake pressure/temperature sensor connector E-030 (using a digital multimeter) (online detection).



Multimeter Connection	Condition	Specified Condition
E-030 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK
Intake pressure/temperature sensor power supply voltage is normal

Result

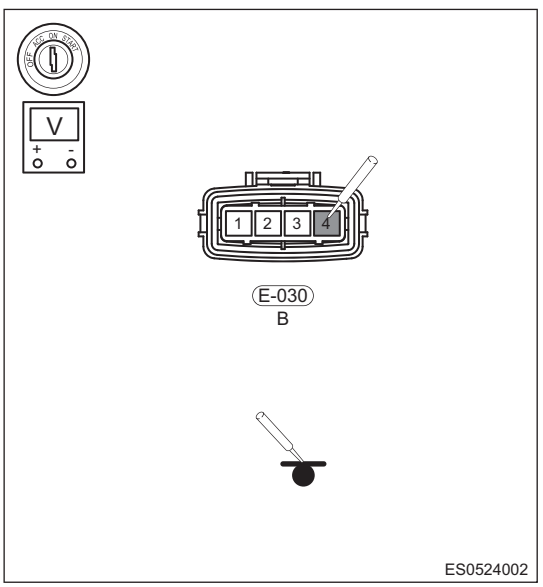
Proceed to
OK
NG

NG → **Check and repair wire harness between intake pressure/temperature sensor power supply wire and ECM**

OK

3 Check intake pressure/temperature sensor pressure signal voltage

(a) Turn ENGINE START STOP switch to ON and start engine.
(b) Measure voltage between terminal 4 of connector E-030 and body ground (using a digital multimeter).



Multimeter Connection	Condition	Specified Condition
E-030 (4) - Body ground	Engine Idling Speed	Voltage is about 1.4 V (value changes with model)
	High engine speed	Maximum instantaneous voltage is about 4.1 V (value changes with model)

OK
Intake pressure/temperature sensor voltage is normal

Result

Proceed to
OK

Proceed to
NG

NG → **Check wire harness or connector or replace sensor to test vehicle**

OK

4 Check intake pressure/temperature sensor signal circuit

(a) Turn off ENGINE START STOP switch and disconnect the negative battery cable.
(b) Disconnect the intake pressure/temperature sensor and ECM connectors.
(c) Measure wire harness between connectors E-030 (2) and E-027 (102).

Multimeter Connection	Condition	Specified Condition
E-030 (2) - E-027 (102)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

5 Read data flow of intake pressure/temperature sensor

(a) Turn ENGINE START STOP switch to ON and do not start engine.
(b) Observe if "Intake Pressure" item in data flow seriously deviated from ambient pressure by about 101 kpa (value changes with current atmospheric pressure).

OK

Intake pressure/temperature sensor voltage is normal

Result

Proceed to
OK
NG

NG → **Reinstall or replace intake pressure/ temperature sensor**

OK

6 Check intake pressure/temperature sensor

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the intake pressure/temperature sensor connector (arrow).
(d) Check sensor connection part for debris, ice, oil and damage.

OK

Intake pressure/temperature sensor itself has no malfunction

Result

Proceed to
OK
NG

NG → **Replace intake pressure/temperature sensor**

OK →

7	Check intake system

(a) Check if intake pressure/temperature sensor installation position is incorrect, intake pipe is disconnected or seriously leaked.

OK

Intake pressure/temperature sensor itself has no malfunction

Result

Proceed to
OK
NG

NG → **Repair faulty components of intake system**

OK →

8	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC still exists.

OK

No same DTC is output

Result

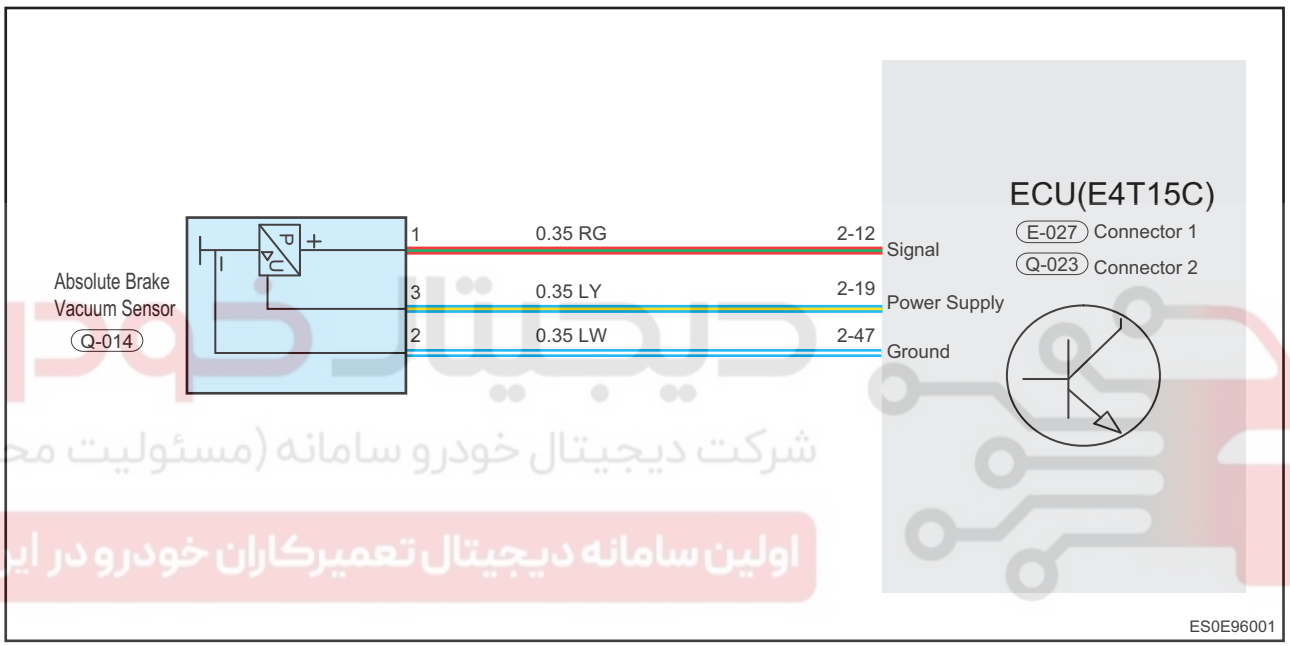
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0558 00	Brake Booster Pressure Sensor Circuit High
DTC	P0557 16	Brake Booster Pressure Sensor Circuit Low
DTC	P1450 00	Brake Booster Pressure Sensor Circuit Range/ Performance (High)
DTC	P1451 00	Brake Booster Pressure Sensor Circuit Range/ Performance (Low)

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0558 00	Brake Booster Pressure Sensor Circuit High	ENGINE START STOP switch ON, engine running	• Brake vacuum pressure sensor • Wire harness or connector • ECM
P0557 16	Brake Booster Pressure Sensor Circuit Low		
P1450 00	Brake Booster Pressure Sensor Circuit Range/ Performance (High)		
P1451 00	Brake Booster Pressure Sensor Circuit Range/ Performance (Low)		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check vacuum pressure sensor power supply voltage

(a) Measure voltage between connector terminal and body ground (using a digital multimeter) (online detection).

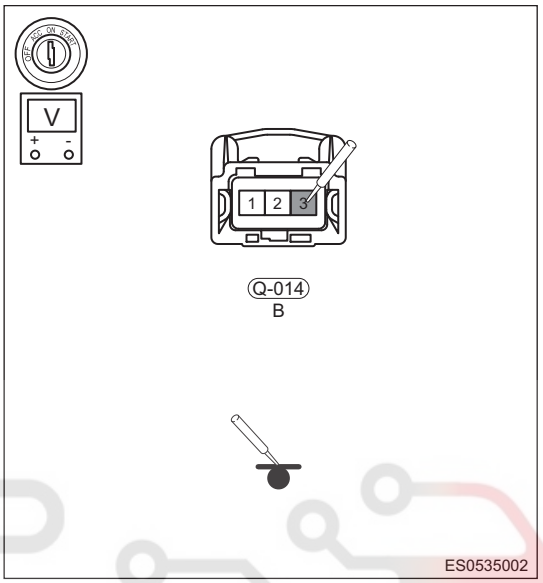
Multimeter Connection	Condition	Specified Condition
Q-014 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Vacuum pressure sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG → **Check and repair wire harness between vacuum pressure sensor and ECM**

OK

2	Check vacuum pressure sensor signal circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect vacuum pressure sensor connector Q-014 and ECM connector Q-023.

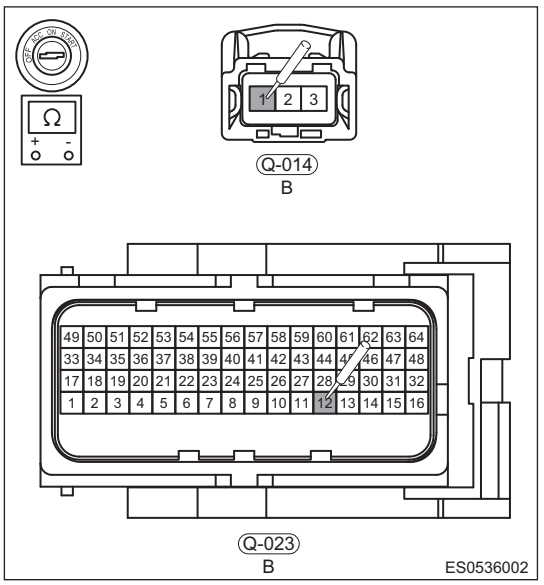
(d) Check the wire harness between connector.

Check for Open

Multimeter Connection	Condition	Specified Condition
Q-014 (1) - Q-023 (12)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG



NG → **Check and repair wire harness between vacuum pressure sensor and ECM**

OK

3 Check vacuum pressure sensor

(a) Disconnect the vacuum pressure sensor connector Q-014.
(b) Check sensor connection part for debris and damage.

OK

Vacuum pressure sensor itself has no malfunction

Result

Proceed to
OK
NG

NG → **Clean or replace vacuum pressure sensor**

OK

4 Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

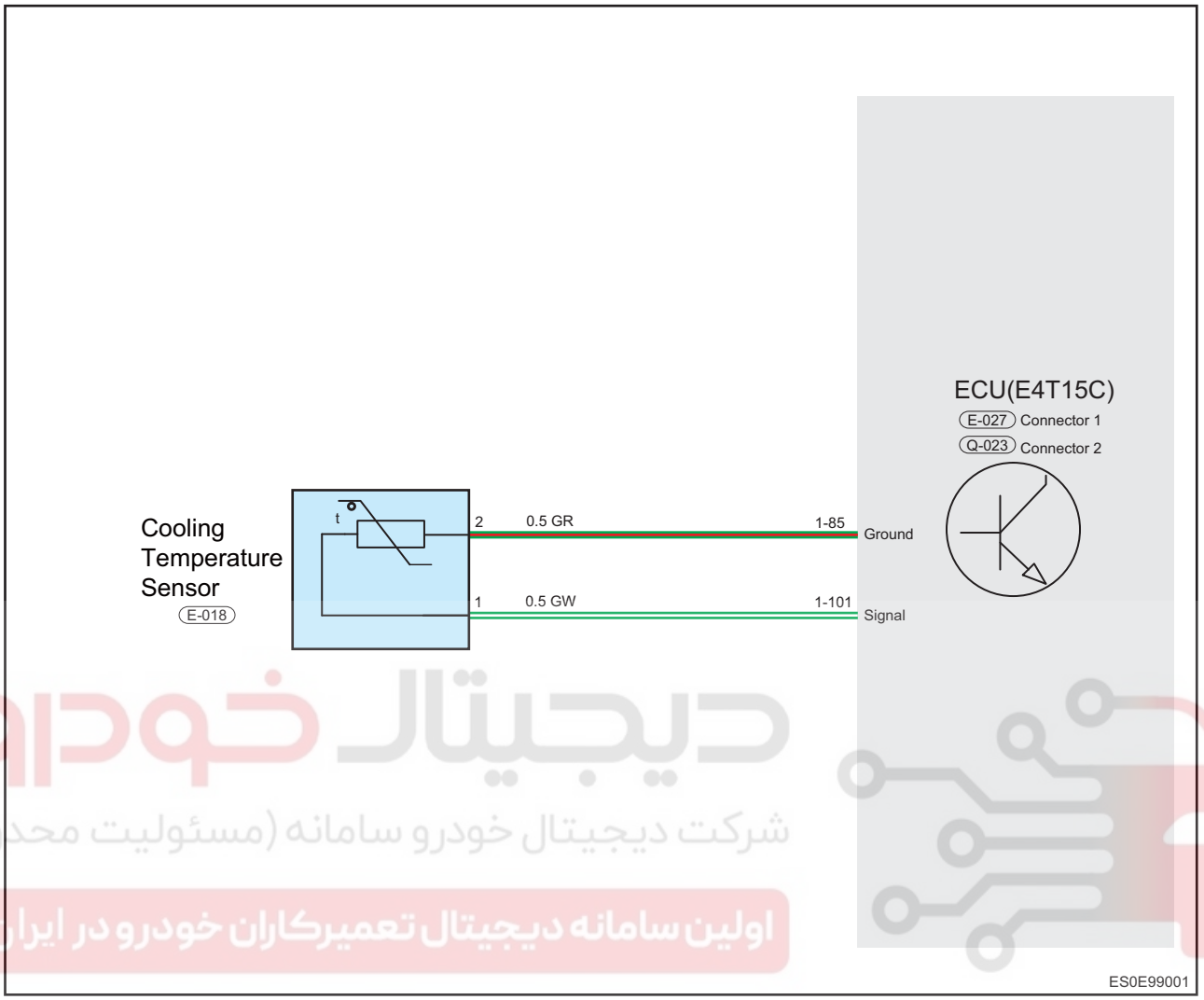
Result

Proceed to
OK
NG

OK	System operates normally
NG	Replace with a new ECM to check if fault reoccurs

DTC	P050C 24	Cold Start Engine Coolant Temperature Performance
DTC	P050C 23	Cold Start Engine Coolant Temperature Performance
DTC	P0118 00	Engine Coolant Temperature Sensor 1 Circuit High
DTC	P0117 00	Engine Coolant Temperature Sensor 1 Circuit Low
DTC	P0119 00	Engine Coolant Temperature Sensor 1 Circuit Intermittent
DTC	P0116 23	Engine Coolant Temperature Sensor 1 Circuit Range/Performance
DTC	P0116 26	Engine Coolant Temperature Sensor 1 Circuit Range/Performance

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P050C 24	Cold Start Engine Coolant Temperature Performance	ENGINE START STOP switch ON, engine running	• Engine coolant temperature sensor 1 • Wire harness or connector • ECM
P050C 23	Cold Start Engine Coolant Temperature Performance		
P0118 00	Engine Coolant Temperature Sensor 1 Circuit High		
P0117 00	Engine Coolant Temperature Sensor 1 Circuit Low		
P0119 00	Engine Coolant Temperature Sensor 1 Circuit Intermittent		
P0116 23	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance		
P0116 26	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.

- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

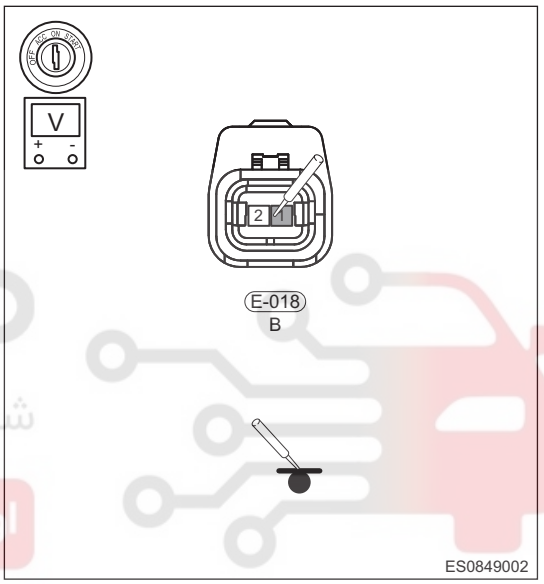
Procedure

1	Check coolant temperature sensor 1 power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between engine coolant temperature sensor 1 terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-018 (1) - Body ground	ENGINE START STOP switch ON	5 V



OK

Engine coolant temperature sensor 1 voltage is normal

Result

Proceed to
OK
NG

NG → **Check and repair wire harness between coolant temperature sensor and ECM**

OK

2	Check engine coolant temperature sensor 1

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the engine coolant temperature sensor 1 connector.
(d) Remove the engine coolant temperature sensor 1.
(e) Measure resistance of engine coolant temperature sensor 1.

Check for Open

Multimeter Connection	Specified Condition
Terminal 1 - Terminal 2	Resistance is 2.5 kΩ ± 5% at normal temperature (20°C), 300 - 400 Ω in boiled water (80°C) (value changes with boiled water temperature)

Result

Proceed to
OK
NG

NG → **Clean or replace engine coolant temperature sensor 1**

OK →

04

3	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

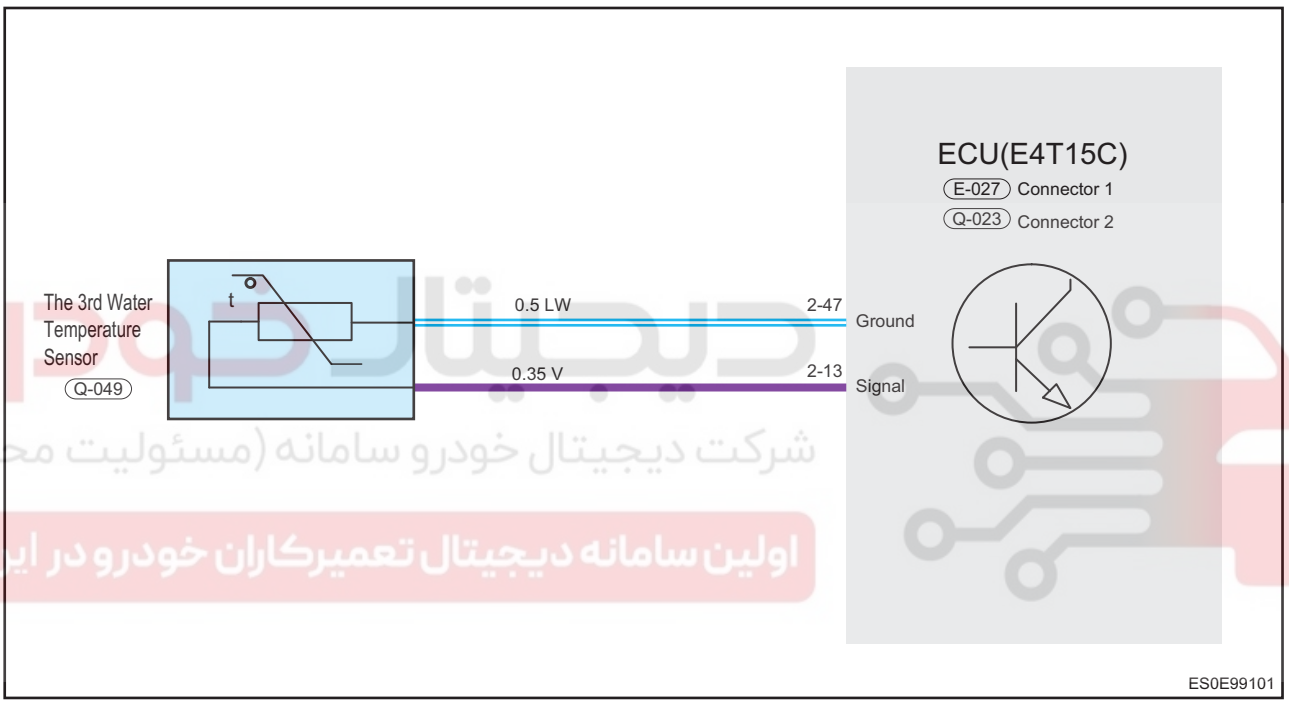
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace ECM to perform real-vehicle check**

DTC	P2183 24	Cold Start Engine Coolant Temperature Performance
DTC	P2183 23	Cold Start Engine Coolant Temperature Performance
DTC	P2185 00	Engine Coolant Temperature Sensor 2 Circuit High
DTC	P2184 00	Engine Coolant Temperature Sensor 2 Circuit Low

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2183 24	Cold Start Engine Coolant Temperature Performance	ENGINE START STOP switch ON, engine running	• Engine coolant temperature sensor 2 • Wire harness or connector • ECM
P2183 23	Cold Start Engine Coolant Temperature Performance		
P2185 00	Engine Coolant Temperature Sensor 2 Circuit High		
P2184 00	Engine Coolant Temperature Sensor 2 Circuit Low		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

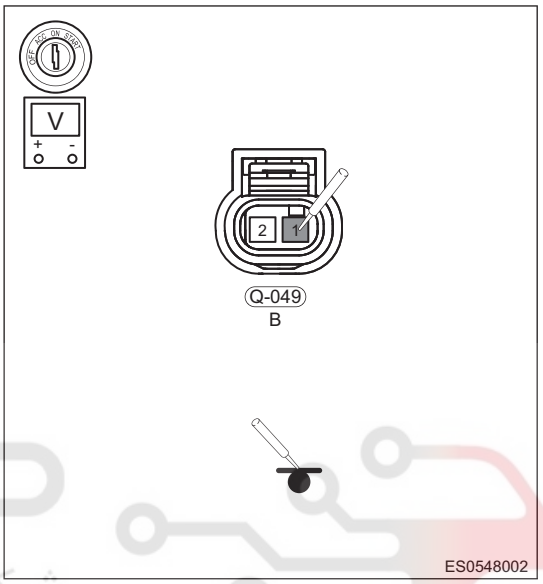
Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check coolant temperature sensor 2 power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between engine coolant temperature sensor terminal and body ground (using a digital multimeter).



Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Q-049 (1) - Body ground	ENGINE START STOP switch ON	5 V

OK

Engine coolant temperature sensor 2 voltage is normal

Result

Proceed to
OK
NG

NG → **Check and repair wire harness between coolant temperature sensor 2 and ECM**

OK

2	Read data flow of coolant temperature sensor 2

(a) Connect diagnostic tester, turn ignition switch to ON.
(b) Do not start engine, read "Coolant Temperature Sensor Measured Value" and check if it is within the normal range.

OK

Data flow of coolant temperature sensor 2 is normal

Result

Proceed to
OK
NG

OK → **End**

NG

3	Check engine coolant temperature sensor 2

(a) Turn ENGINE START STOP switch to OFF.

(b) Disconnect the negative battery cable.
(c) Disconnect the engine coolant temperature sensor 2 connector Q-049.
(d) Remove the engine coolant temperature sensor 2.
(e) Measure resistance of engine coolant temperature sensor 2.
Check for Open

Multimeter Connection	Specified Condition
Terminal 1 - Terminal 2	Resistance is 2.5 kΩ ± 5% at normal temperature (20°C), 300 - 400 Ω in boiled water (80°C) (value changes with boiled water temperature)

Result

Proceed to
OK
NG

NG → **Clean or replace engine coolant temperature sensor 2**

OK

4	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK
No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace ECM to perform real-vehicle check**

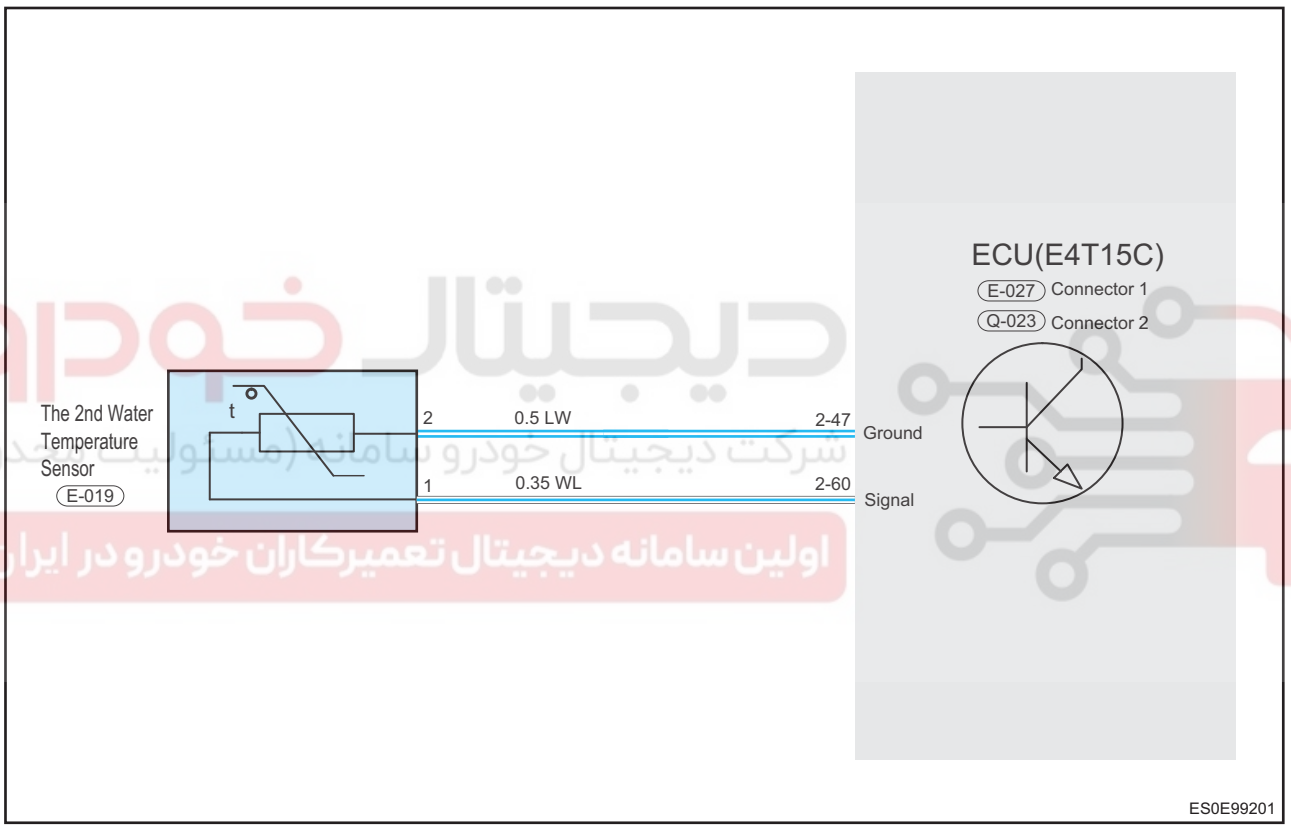
DTC	P01E4 24	Cold Start Engine Coolant Temperature Performance

DTC	P01E4 23	Cold Start Engine Coolant Temperature Performance

DTC	P01E6 00	Engine Coolant Temperature Sensor 3 Circuit High

DTC	P01E5 00	Engine Coolant Temperature Sensor 3 Circuit Low

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P01E4 24	Cold Start Engine Coolant Temperature Performance	ENGINE START STOP switch ON, engine running	• Engine coolant temperature sensor 3 • Wire harness or connector • ECM
P01E4 23	Cold Start Engine Coolant Temperature Performance		
P01E6 00	Engine Coolant Temperature Sensor 3 Circuit High		
P01E5 00	Engine Coolant Temperature Sensor 3 Circuit Low		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.

- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

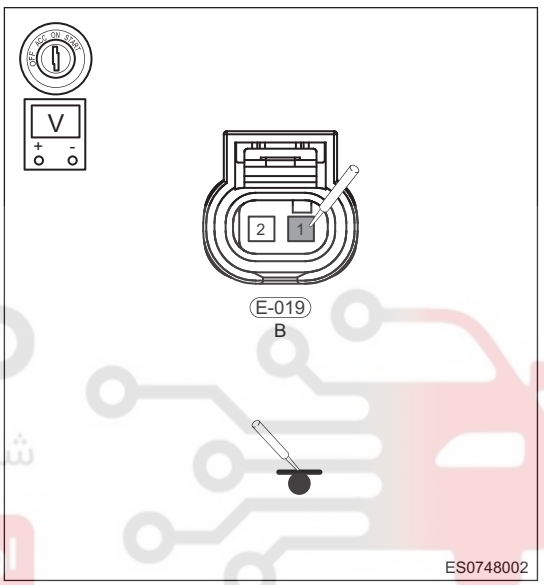
Procedure

1	Check coolant temperature sensor 3 power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between engine coolant temperature sensor 3 terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-019 (1) - Body ground	ENGINE START STOP switch ON	5 V



OK
Engine coolant temperature sensor 3 voltage is normal

Result

Proceed to
OK
NG

NG → **Check and repair wire harness between coolant temperature sensor 3 and ECM**

OK →

2	Read data flow of coolant temperature sensor 3

(a) Connect diagnostic tester, turn ignition switch to ON.
(b) Do not start engine, read "Coolant Temperature Sensor Measured Value" and check if it is within the normal range.

OK
Data flow of coolant temperature sensor 3 is normal

Result

Proceed to
OK
NG

OK → **End**

NG

3	Check engine coolant temperature sensor 3

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the engine coolant temperature sensor 3 connector E-019.
(d) Remove the engine coolant temperature sensor 3.
(e) Measure resistance of engine coolant temperature sensor 3.
Check for Open

Multimeter Connection	Specified Condition
Terminal 1 - Terminal 2	Resistance is 2.5 kΩ ± 5% at normal temperature (20°C), 300 - 400 Ω in boiled water (80°C) (value changes with boiled water temperature)

Result

Proceed to
OK
NG

NG → **Clean or replace engine coolant temperature sensor 3**

OK

4	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK
No same DTC is output

Result

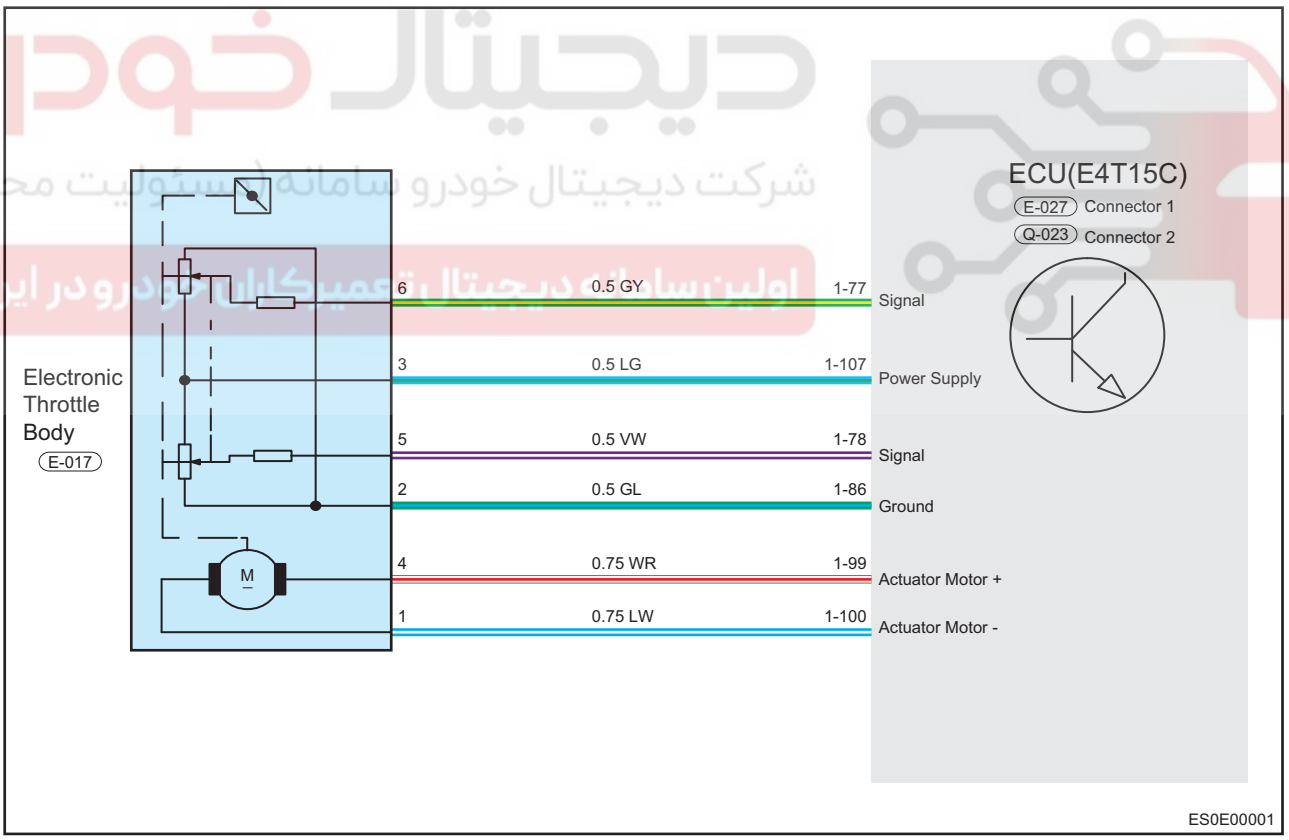
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace ECM to perform real-vehicle check**

DTC	P0123 00	Throttle Pos.Sensor 1 Circ. High Input
DTC	P0122 00	Throttle Pos.Sensor 1 Circ. Low Input
DTC	P0121 00	Throttle Pos.Sensor 1 Circ. Performance Non-plausible
DTC	P0223 00	Electronic Throttle Position Sensor 2 Signal Circuit Voltage Too High
DTC	P0222 00	Electronic Throttle Position Sensor 2 Signal Circuit Voltage Too Low
DTC	P0221 00	Electronic Throttle Position Sensor 2 Signal Improper

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0123 00	Throttle Pos.Sensor 1 Circ. High Input	ENGINE START STOP switch ON, engine running	• Throttle position sensor 1 • Throttle position sensor 2 • Wire harness or connector • ECM
P0122 00	Throttle Pos.Sensor 1 Circ. Low Input		
P0121 00	Throttle Pos.Sensor 1 Circ. Performance Non-plausible		
P0223 00	Electronic Throttle Position Sensor 2 Signal Circuit Voltage Too High		
P0222 00	Electronic Throttle Position Sensor 2 Signal Circuit Voltage Too Low		
P0221 00	Electronic Throttle Position Sensor 2 Signal Improper		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check installation of electronic throttle connector**

(a) Check electronic throttle connector for poor contact or improper installation.

Result

Proceed to
OK
NG

NG → **Reconnect electronic throttle connector**

OK

2	**Check throttle position sensor power supply voltage**

(a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage between electronic throttle connector E-017 (3) terminal and body ground (using a digital multimeter) (online detection).

Voltage Inspection

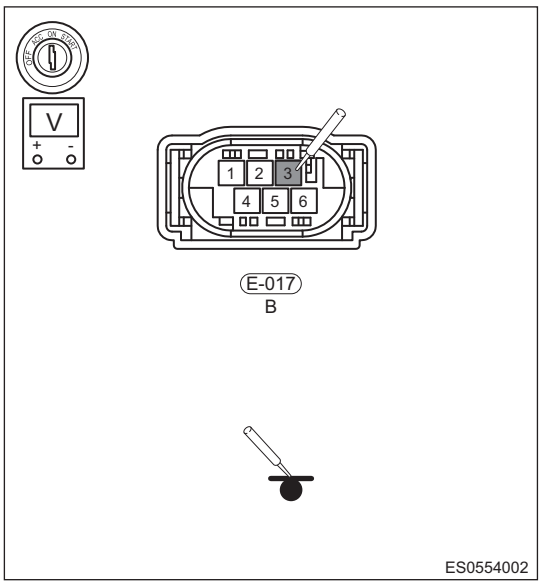
Multimeter Connection	Condition	Specified Condition
E-017 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Throttle position sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG → **Check and repair power supply wire harness between throttle and ECM**

OK

3 Check throttle position sensor signal voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure the throttle position sensor signal voltage (using a digital multimeter) (online detection).

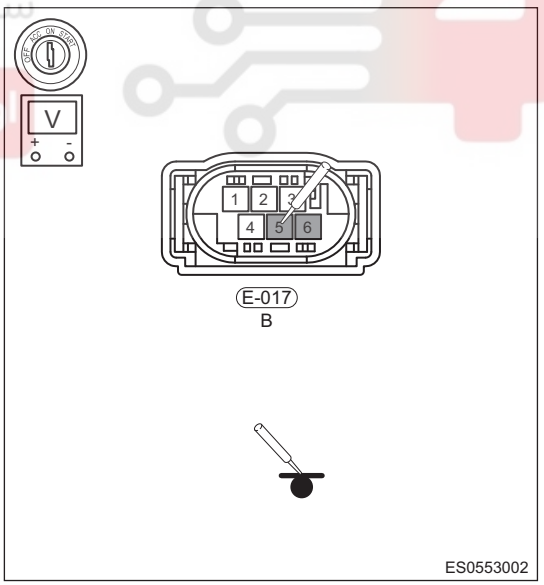
Multimeter Connection	Condition	Specified Condition
E-017 (6) - Body ground	ENGINE START STOP switch ON, idling	0.74V
	ENGINE START STOP switch ON, throttle fully opened	4.24V
E-017 (5) - Body ground	ENGINE START STOP switch ON, idling	4.24V
	ENGINE START STOP switch ON, throttle fully opened	0.36V

OK

Throttle position sensor voltage is normal

Result

Proceed to
OK
NG



NG → **Check and repair signal wire harness between throttle and ECM**

OK

4	Clear and read DTCs again

(a) Connect diagnostic tester, and then turn ENGINE START STOP switch to ON.
(b) Clear DTCs, and then slowly and quickly depress the accelerator pedal several times.
(c) Read DTCs again.

OK

DTCs do not recur, diagnosis is completed

Result

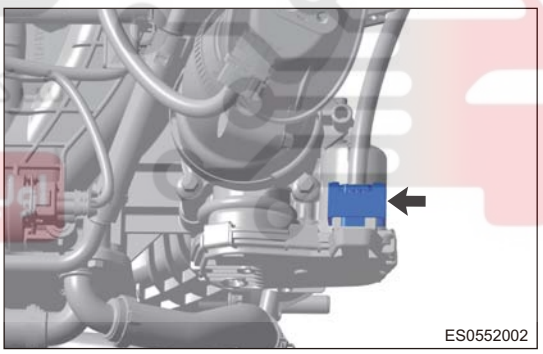
Proceed to
OK
NG

OK → **OK**
End

NG

5	Check electronic throttle

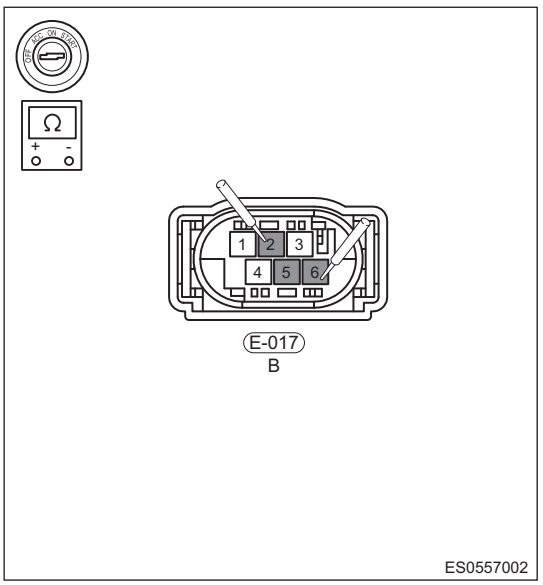
(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the electronic throttle connector E-017 (arrow).



(d) Check electronic throttle for carbon deposits and foreign matter accumulation inside.
(e) Check if electronic throttle valve body is stuck.
(f) Check the resistance of electronic throttle.

Throttle Inspection

Multimeter Connection	Condition	Specified Condition
Terminal 5 - Terminal 2	Throttle turned	Resistance values should change continuously
Terminal 6 - Terminal 2		
Terminal 5 - Terminal 2 and Terminal 6 - Terminal 2	On same position of valve at normal temperature	Sum of resistance in two groups is 1.9 kΩ ± 0.2 kΩ



OK

Each throttle position sensor terminal resistance is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness or connector (electronic throttle - ECM)**

OK

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0506 00	Idle Control System RPM Lower than Expected

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0506 00	Idle Control System RPM Lower than Expected	· Carbon canister is not in high scour rate; · Engine is idling; · Vehicle speed sensor has been inspected and has no fault, P0501 (coast and fuel cut-off for 5 seconds or more when vehicle speed is more than 20 km/h); · Vehicle speed is 0;	• Throttle • Intake system • Fuel injector • Fuel pump

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check electronic throttle

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Remove the electronic throttle assembly.
(d) Check if electronic throttle is stuck in smaller open position due to ice or oil.

OK

Electronic throttle is normal

Result

Proceed to
OK
NG

NG → **Repair or replace electronic throttle assembly**

OK →

2	Check intake system for blockage

(a) Check intake system for blockage.

OK

Intake system is normal

Result

Proceed to
OK
NG

NG → **Repair or replace components that result in intake system blockage and air intake volume reduction**

OK → 04

3	Check injector for blockage

(a) Check injector for blockage.

OK

Injector is normal

Result

Proceed to
OK
NG

NG → **Replace or clean injector**

OK

4	Check for excessive exhaust resistance

(a) Check for excessive exhaust resistance.

OK

Exhaust system is normal

Result

Proceed to
OK
NG

NG → **Repair or replace faulty exhaust system components**

OK

5	Check for low fuel pressure

(a) Check for low fuel pressure.

OK

Fuel pressure is normal

Result

Proceed to
OK
NG

NG → **Repair or replace faulty fuel system components**

OK

6	Check for weak spark plug ignition

(a) Check for weak spark plug ignition.

OK

Spark plug ignition is normal

Result

Proceed to
OK
NG

NG → **Replace spark plug**

OK

7	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0507 00	Idle Control System RPM Higher than Expected

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0507 00	Idle Control System RPM Higher than Expected	• Carbon canister is not in high scour rate; • Engine is idling; • Vehicle speed sensor has been inspected and has no fault, P0501 (coast and fuel cut-off for 5 seconds or more when vehicle speed is more than 20 km/h); • Vehicle speed is 0;	• Throttle • Intake system • Fuel injector • Fuel pump

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check electronic throttle

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Remove the electronic throttle assembly.
(d) Check if electronic throttle is stuck in larger open position due to ice or oil.

OK

Electronic throttle is normal

Result

Proceed to
OK
NG

NG → **Repair or replace electronic throttle assembly**

OK →

2	Check intake system for air leakage

(a) Check intake system for air leakage.

OK
Intake manifold is normal
Result

Proceed to
OK
NG

NG → **Repair or replace faulty intake system components**

OK →

3	Check injector for oil dripping

(a) Check injector for oil dripping.
OK
Injector is normal
Result

Proceed to
OK
NG

NG → **Replace or clean injector**

OK →

4	Check if fuel pressure is too high

(a) Check if fuel pressure is too high.
OK
Fuel pressure is normal
Result

Proceed to
OK
NG

NG → **Repair or replace faulty fuel system components**

OK →

5	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK	System operates normally
NG	Replace with a new ECM to check if fault reoccurs

DTC	P0219 00	Engine Overspeed Condition

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0219 00	Engine Overspeed Condition	/	• Throttle • Accelerator pedal • Speed sensor • ECM

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check electronic throttle

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Remove the electronic throttle assembly.
(d) Check if electronic throttle is stuck in larger open position due to ice or oil.

OK

Electronic throttle is normal

Result

Proceed to
OK
NG

NG → **Repair or replace electronic throttle assembly**

OK

2	Check accelerator pedal

(a) Remove the accelerator pedal assembly.
(b) Check if accelerator pedal is stuck in larger open position.

OK

Accelerator pedal is normal

Result

Proceed to
OK
NG

NG → **Repair or replace accelerator pedal assembly**

OK

3	Check speed sensor for malfunction

(a) Check speed sensor for malfunction.

OK

Speed sensor is normal

Result

Proceed to
OK
NG

NG → **Repair or replace speed sensor**

OK

4	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

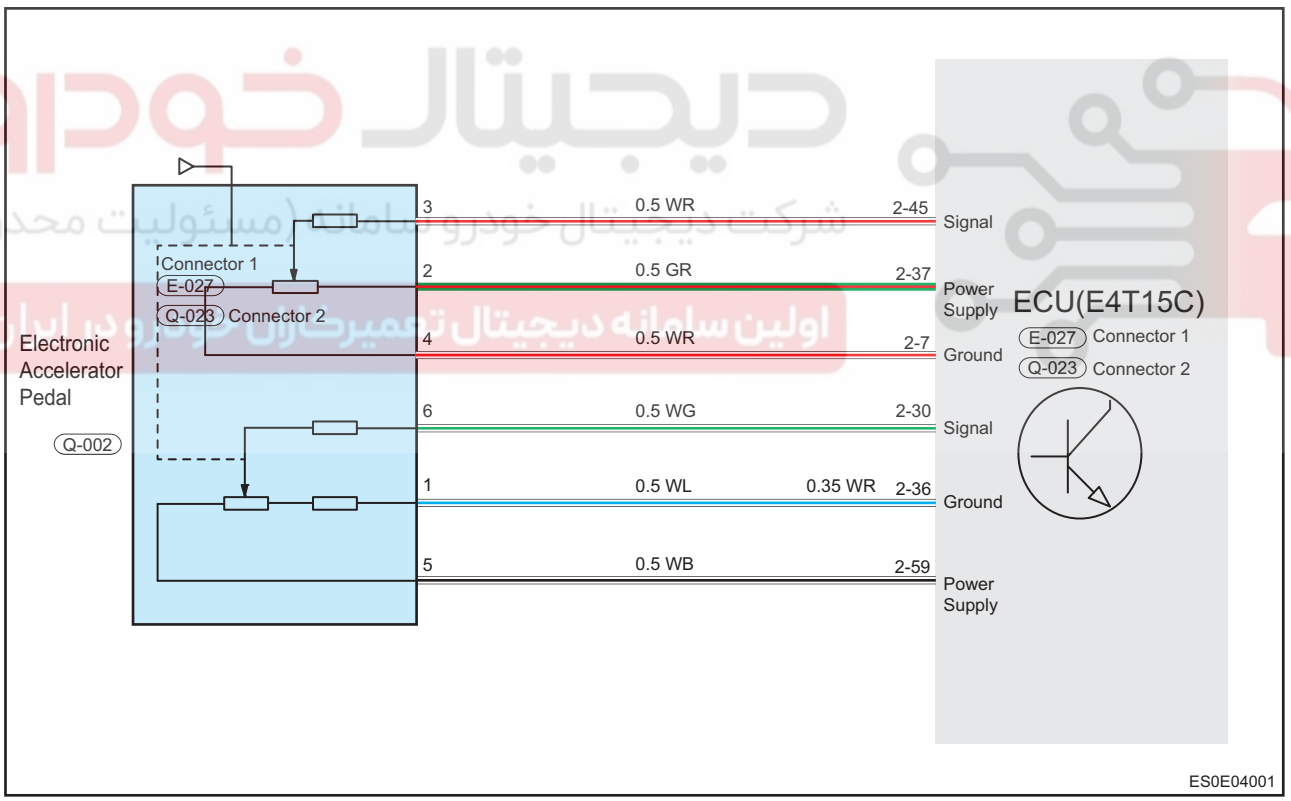
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P2123 00	Throttle/Pedal Position Sensor/Switch "D" Circuit High
DTC	P2128 00	Throttle/Pedal Position Sensor/Switch "E" Circuit High
DTC	P2122 00	Throttle/Pedal Position Sensor/Switch "D" Circuit Low
DTC	P2127 00	Throttle/Pedal Position Sensor/Switch "E" Circuit Low
DTC	P2138 00	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2123 00	Throttle/Pedal Position Sensor/Switch "D" Circuit High	ENGINE START STOP switch ON, engine running	• Accelerator pedal position sensor • Wire harness or connector • ECM
P2128 00	Throttle/Pedal Position Sensor/Switch "E" Circuit High		
P2122 00	Throttle/Pedal Position Sensor/Switch "D" Circuit Low		
P2127 00	Throttle/Pedal Position Sensor/Switch "E" Circuit Low		
P2138 00	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check electronic accelerator pedal position sensor**

(a) Check if electronic accelerator pedal position sensor is connected normally.

Result

Proceed to
OK
NG

NG → **Reinstall or repair, replace connector**

OK

2	**Clear and read DTCs again**

(a) Connect diagnostic tester, and then turn ENGINE START STOP switch to ON.
(b) Clear DTCs, and then slowly and quickly depress the accelerator pedal several times.
(c) Read DTCs again.

OK

DTCs do not recur, diagnosis is completed

Result

Proceed to
OK

Proceed to
NG

OK → End

NG

3	Read data flow of accelerator pedal voltage signal

(a) Turn ENGINE START STOP switch to ON.
(b) Connect diagnostic tester connector, read data flow of accelerator pedal 1 and 2 voltage signal.
(c) Then slowly depress the accelerator pedal, observe if the voltage values displayed on two digital multimeters change with the depression amount of accelerator pedal.

OK

Voltage values displayed on two digital multimeters are changed

Result

Proceed to
OK
NG

NG → **Repair or replace wiring harness corresponding to unchanged voltage signal**

OK

4	Replace electronic accelerator pedal, reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

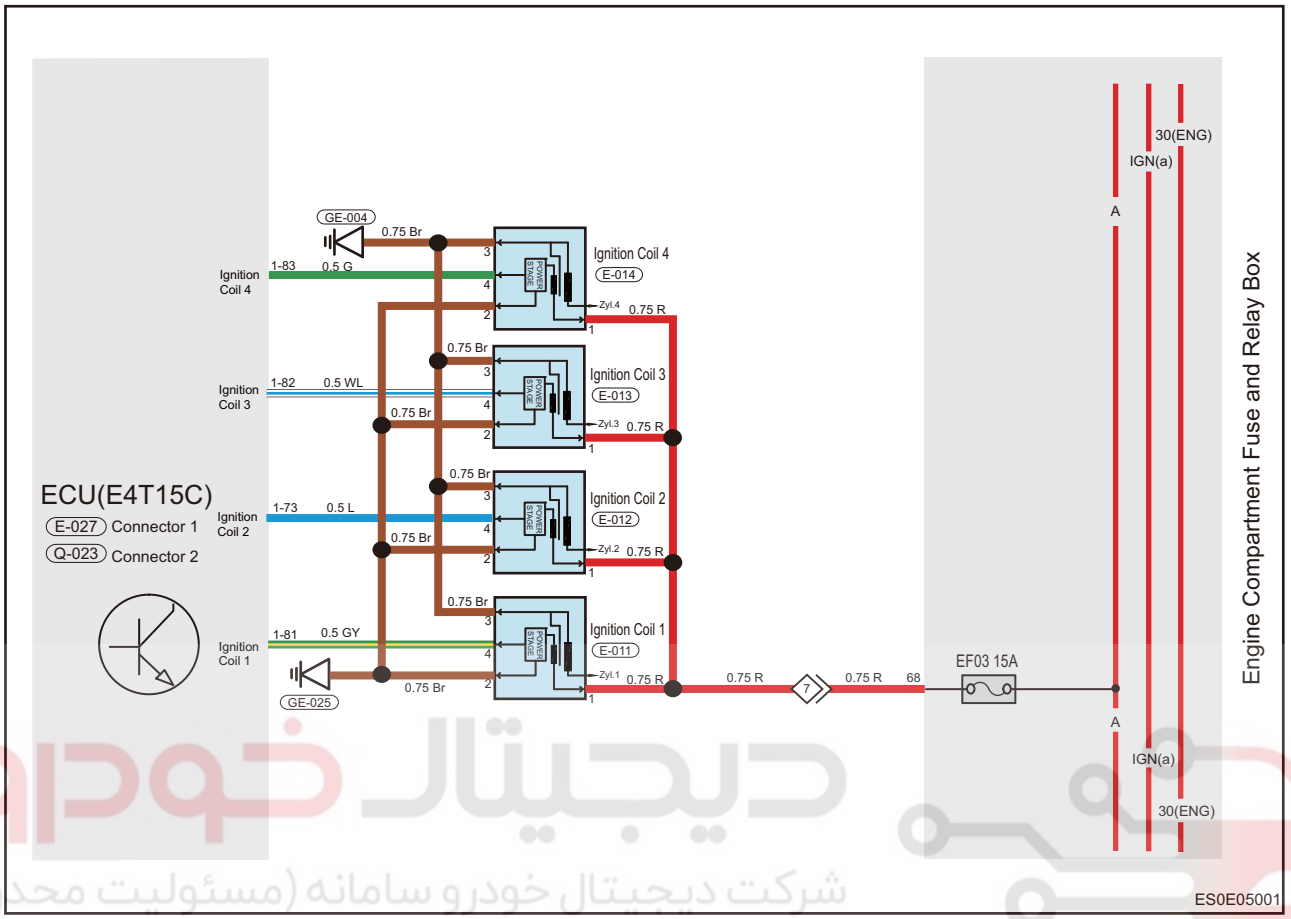
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0351 00	Ignition Coil "A" Primary Control Circuit0Open
DTC	P0353 00	Ignition Coil "C" Primary Control Circuit0Open
DTC	P0354 00	Ignition Coil "D" Primary Control Circuit0Open
DTC	P0352 00	Ignition Coil "B" Primary Control Circuit0Open
DTC	P2301 00	Ignition Coil "A" Primary Control Circuit High
DTC	P2307 00	Ignition Coil "C" Primary Control Circuit High
DTC	P2310 00	Ignition Coil "D" Primary Control Circuit High
DTC	P2304 00	Ignition Coil "B" Primary Control Circuit High
DTC	P2300 00	Ignition Coil "A" Primary Control Circuit Low
DTC	P2306 00	Ignition Coil "C" Primary Control Circuit Low
DTC	P2309 00	Ignition Coil "D" Primary Control Circuit Low
DTC	P2303 00	Ignition Coil "B" Primary Control Circuit Low

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0351 00	Ignition Coil "A" Primary Control Circuit0Open	ENGINE START STOP switch ON, engine running	• Ignition coil • Wire harness or connector • Engine mechanical • ECM
P0353 00	Ignition Coil "C" Primary Control Circuit0Open		
P0354 00	Ignition Coil "D" Primary Control Circuit0Open		
P0352 00	Ignition Coil "B" Primary Control Circuit0Open		
P2301 00	Ignition Coil "A" Primary Control Circuit High		
P2307 00	Ignition Coil "C" Primary Control Circuit High		
P2310 00	Ignition Coil "D" Primary Control Circuit High		
P2304 00	Ignition Coil "B" Primary Control Circuit High		
P2300 00	Ignition Coil "A" Primary Control Circuit Low		
P2306 00	Ignition Coil "C" Primary Control Circuit Low		
P2309 00	Ignition Coil "D" Primary Control Circuit Low		
P2303 00	Ignition Coil "B" Primary Control Circuit Low		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

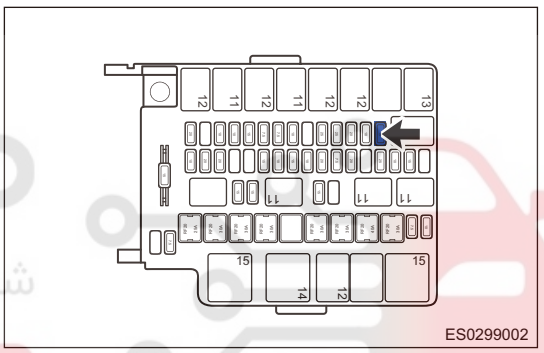
Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check fuse EF14

(a) Check if fuse EF14 is blown or no power.



Result

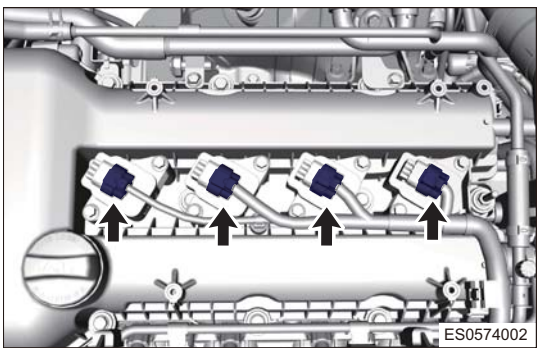
Proceed to
OK
NG

NG → **Replace fuse or check the cause for no power**

OK

2	Check ignition coil connector

(a) Check ignition coil connector for poor contact or improper installation (arrow).



OK

Ignition coil connector is normal

Result

Proceed to
OK
NG

NG → **Reinstall or repair, replace connector**

OK

3	Check ignition coil power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Using a digital multimeter, measure voltage between ignition coil and ground.

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-011 (1) - Ground	ENGINE START STOP switch ON	Not less than 12V
E-012 (1) - Ground		
E-013 (1) - Ground		
E-014 (1) - Ground		

Result

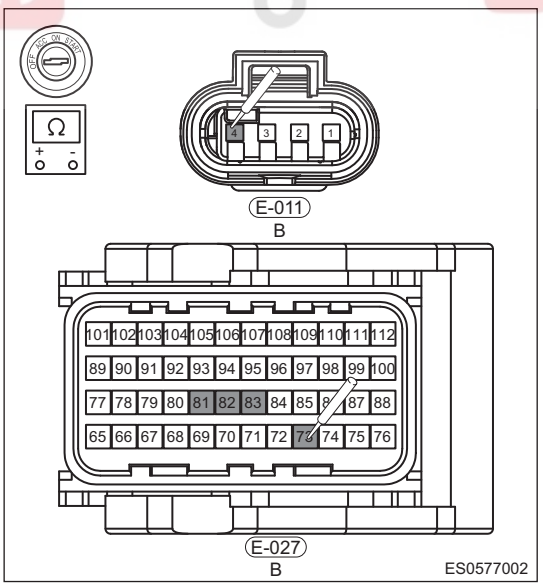
Proceed to
OK
NG

NG → **Replace wire harness or connector (ignition coil - engine compartment fuse and relay box)**

OK

4	Check ignition coil control circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect ECM connector E-027 and 4 ignition coil connectors.
(d) Check wire harness between ignition coil connector terminal and ECM connector terminal.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-014 (4) - E-027 (83)	Always	Resistance ⩽ 1 Ω
E-013 (4) - E-027 (82)		
E-012 (4) - E-027 (73)		
E-011 (4) - E-027 (81)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-014 (4), E-013 (4), E-012 (4), E-011 (4) or E-027 (81, 73, 82, 83) - Body ground	Always	Resistance ∞

OK

Continuity between ignition coil connector terminal and ECM connector terminal is normal

Result

Proceed to
OK

Proceed to
NG

NG → **Repair or replace wire harness or connector (ignition coil - ECM)**

OK

5	Check appearance of ignition coil

(a) Remove the ignition coil.
(b) Check appearance of ignition coil for cracks or bumps.

OK

Ignition coil itself has no malfunction

Result

Proceed to
OK
NG

NG → **Replace ignition coil**

OK

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

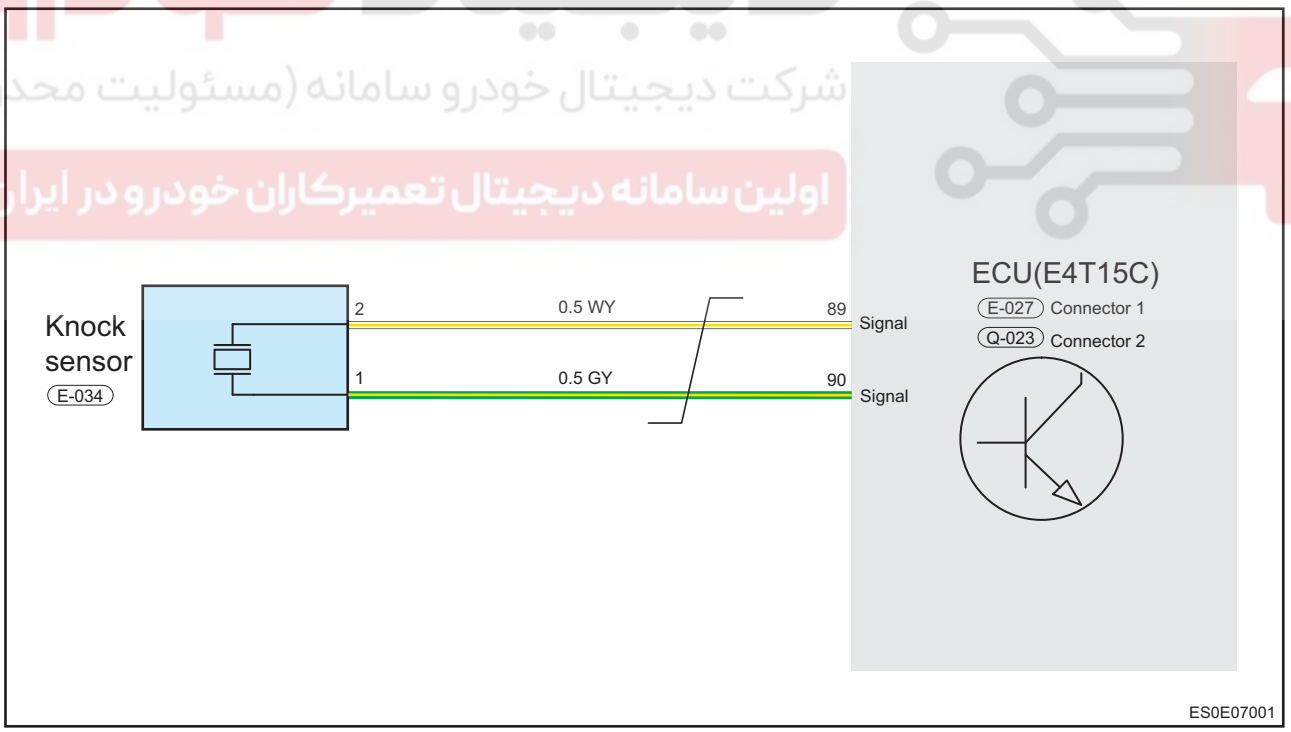
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0326 00	Knock/Combustion Vibration Sensor 1 Circuit Bank 1 or Single Sensor
DTC	P0325 00	Knock/Combustion Vibration Sensor 1 Circuit Bank 1 or Single Sensor
DTC	P0328 00	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
DTC	P0327 00	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor
DTC	P0328 15	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
DTC	P0327 14	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0326 00	Knock/Combustion Vibration Sensor 1 Circuit Bank 1 or Single Sensor	Load is greater than 40%; Coolant temperature is higher than 40°C; Speed is more than 2600 rpm; Cylinder 1 identification is valid	• Knock sensor • Wire harness or connector • ECM
P0325 00	Knock/Combustion Vibration Sensor 1 Circuit Bank 1 or Single Sensor		
P0328 00	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor		
P0327 00	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor		
P0328 15	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor		
P0327 14	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor		

04

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check knock sensor connector

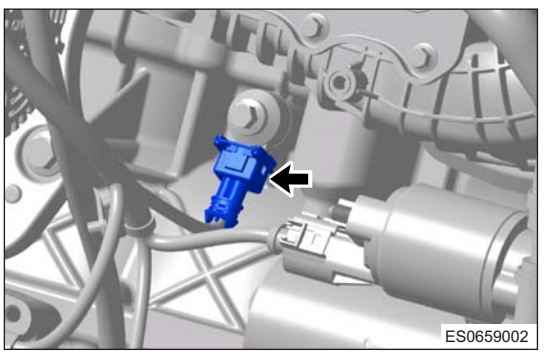
(a) Check knock sensor connector E-534 (arrow) for poor connection, cracks or damage.

OK

Knock sensor connector is normal

Result

Proceed to
OK
NG

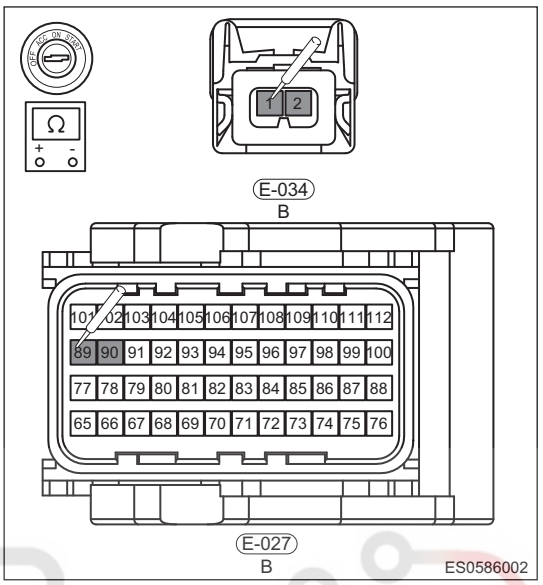


NG → **Repair or replace wire harness or connector**

OK

2	Check knock sensor signal circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the ECM wire harness connector E-027.
(d) Check wire harness between terminals of connector E-027 and connector E-034.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-027 (90) - E-534 (1)	Always	Resistance ⩽ 1 Ω
E-027 (89) - E-034 (2)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-027 (90, 89) or E-034 (1, 2) - Body ground	Always	Resistance ∞

Result

Proceed to
OK
NG

NG → **Replace wire harness or connector (knock sensor - ECM)**

OK

3	Check installation of knock sensor

(a) Remove the knock sensor.
(b) Check installation area of knock sensor, and check for damage, foreign matter, excessive movement or magnetic field nearby etc. that cause signal incorrectness.

OK

Knock sensor is installed normally

Result

Proceed to
OK
NG

NG → **Clean installation area or replace knock sensor**

OK

4	Check knock sensor signal

(a) Install the knock sensor.

(b) Connect the negative battery cable.
(c) Turn ENGINE START STOP switch to ON.
(d) Slightly tap around the knock sensor with a rubber hammer, and measure if voltage is generated between 2 terminals of knock sensor with multimeter (mV) at the same time.

OK

Voltage is generated by knock sensor

Result

Proceed to
OK
NG

NG → **Replace knock sensor**

OK →

5	Reconfirm DTCs

(a) Using diagnostic tester, read ECM DTC.
(b) Refer to "DTC Confirmation Procedure".
(c) Check if DTC still exists.

OK

No same DTC is output

Result

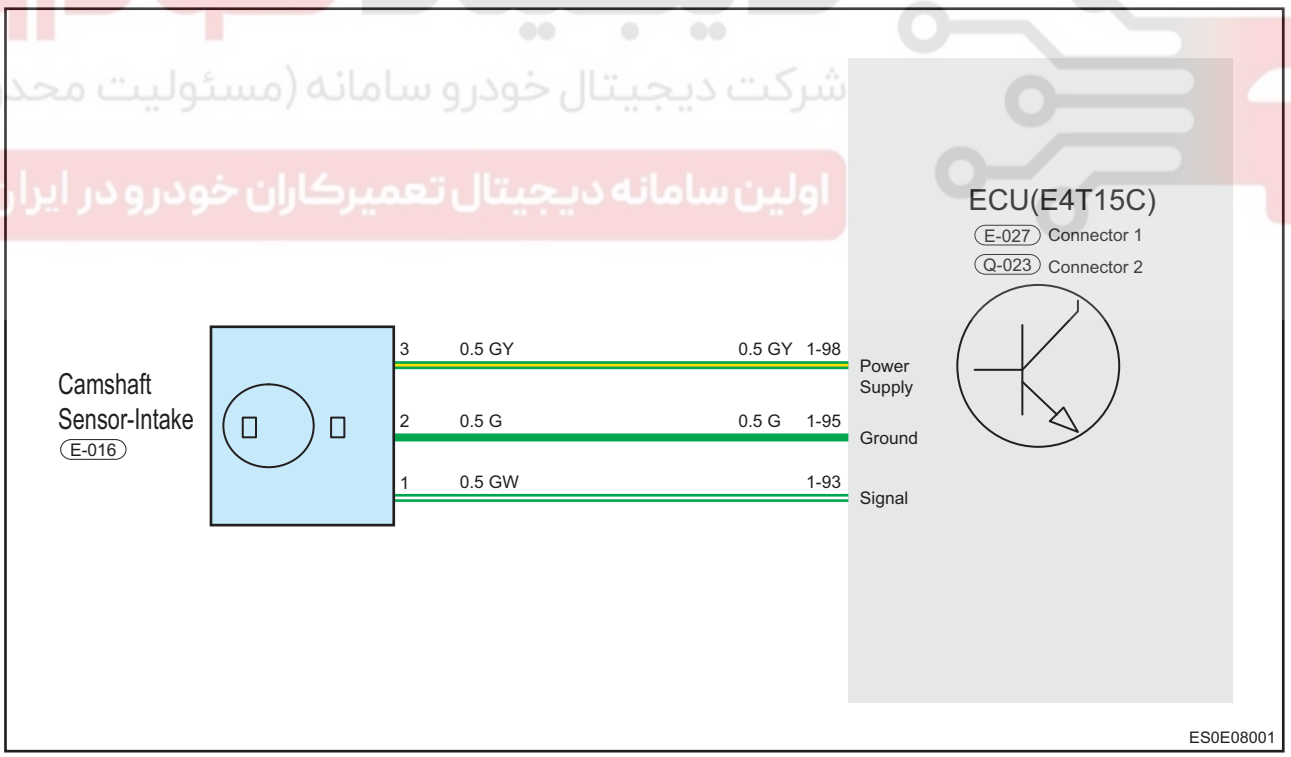
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0341 00	Camshaft Position Sensor "A" Circuit Range/ Performance Bank 1 or Single Sensor
DTC	P001676	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
DTC	P034300	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor
DTC	P034200	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor
DTC	P001678	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
DTC	P0011 00	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0341 00	Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	ENGINE START STOP switch ON, engine running	• Camshaft position sensor • Incorrect installation position of camshaft position sensor • Engine mechanical fault • Wire harness or connector • ECM
P001676	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A		
P034300	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor		
P034200	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor		
P001678	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A		
P0011 00	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

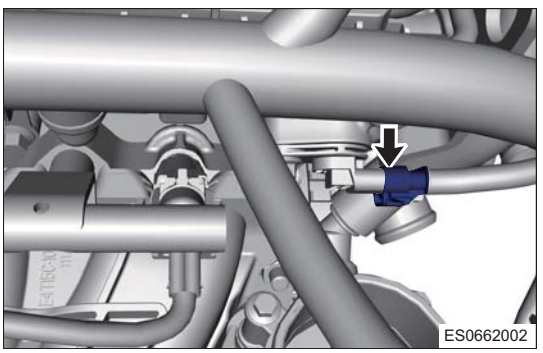
Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check installation of intake camshaft position sensor

(a) Check if intake camshaft position sensor connector E-016 (arrow) is infirmly connected or poorly contacted.



OK

Intake camshaft position sensor is installed normally

Result

Proceed to
OK
NG

NG → **Reconnect connector**

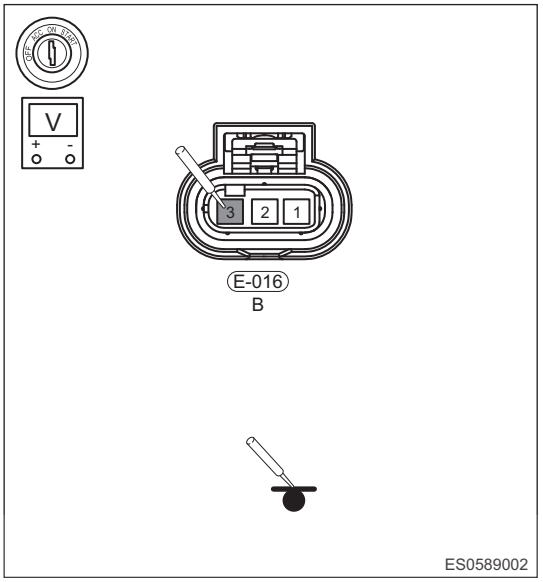
OK

2	Check intake camshaft position sensor power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between terminal 3 of intake camshaft position sensor connector E-016 and ground (using a digital multimeter or 21 W test light).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-016 (3) - Body ground	ENGINE START STOP switch ON	5 V



OK

Intake camshaft position sensor power supply voltage is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

3	Check intake camshaft position sensor signal circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect intake camshaft position sensor connector E-016 and ECM connector E-027.
(d) Check intake camshaft position sensor connector E-016 (1) and ECM connector E-027 (93).

Check for Open

Multimeter Connection	Condition	Specified Condition
E-016 (1) - E-027 (93)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

4	Check if relative installation position between intake camshaft position sensor and its signal plate is as specified

(a) Remove the intake camshaft position sensor.
(b) Obverse if installation of intake camshaft position sensor signal plate is proper.

OK

Relative installation position between intake camshaft position sensor and its signal plate is normal

Result

Proceed to
OK
NG

NG → **Install intake camshaft position sensor to proper position as specified**

OK → 04

5	Check for mechanical fault

(a) Check if the oil level and oil quality are normal.
(b) Check drive gear, belt between crankshaft and camshaft for malfunctions.
(c) Check and clean intake camshaft position sensor and installation area, and check for damage, foreign matter or excessive movement, etc. that cause signal incorrectness.
(d) Check intake camshaft ring gear for damage or foreign matter (such as debris), etc. that cause signal incorrectness.

OK

Intake camshaft gear ring is normal

Result

Proceed to
OK
NG

NG → **Repair or replace malfunctioning components**

OK →

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

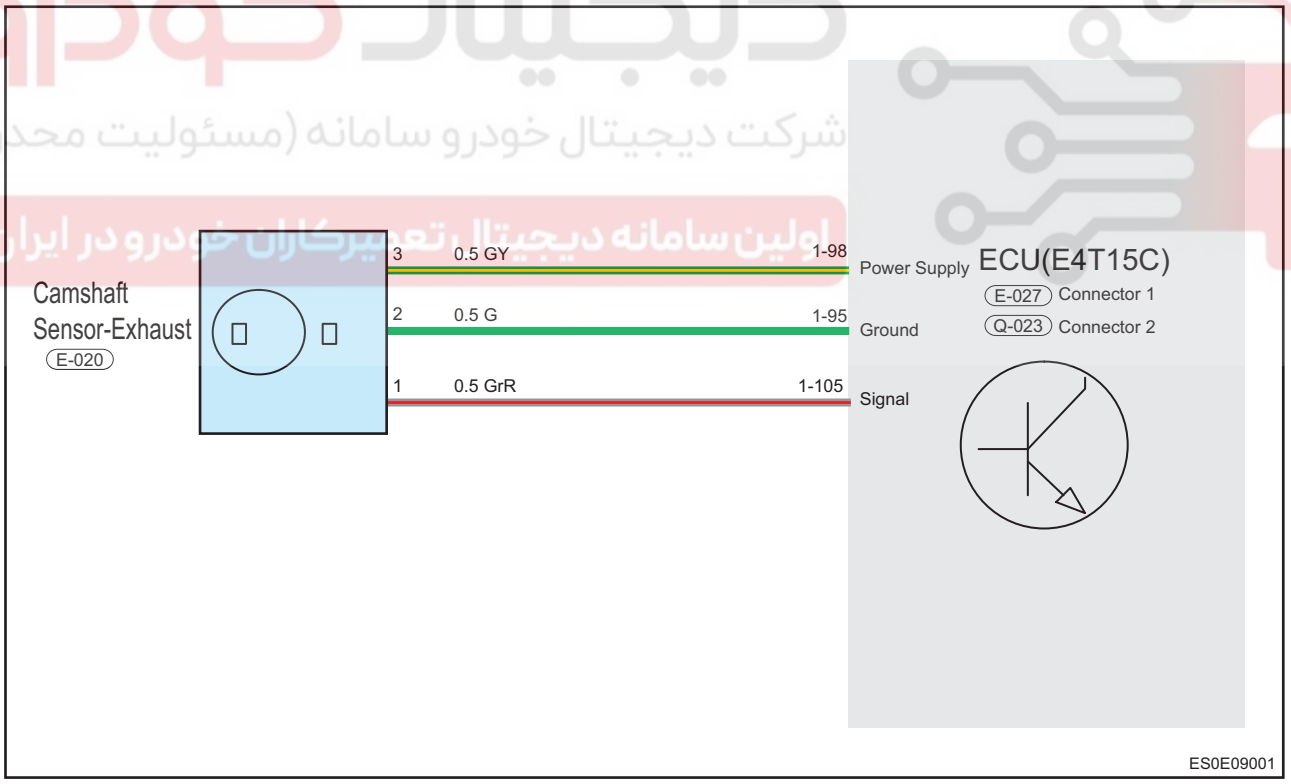
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0366 00	Camshaft Position Sensor "B" Circuit Range/ Performance(Bank1)
DTC	P0017 76	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
DTC	P0368 00	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor
DTC	P0367 00	Camshaft Position Sensor "B" Circuit Low (Bank1)
DTC	P001778	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
DTC	P0014 00	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0366 00	Camshaft Position Sensor "B" Circuit Range/ Performance(Bank1)	ENGINE START STOP switch ON, engine running	• Camshaft position sensor • Incorrect installation position of camshaft position sensor • Engine mechanical fault • Wire harness or connector • ECM
P0017 76	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B		
P0368 00	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor		
P0367 00	Camshaft Position Sensor "B" Circuit Low (Bank1)		
P001778	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A		
P0014 00	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check installation of exhaust camshaft position sensor

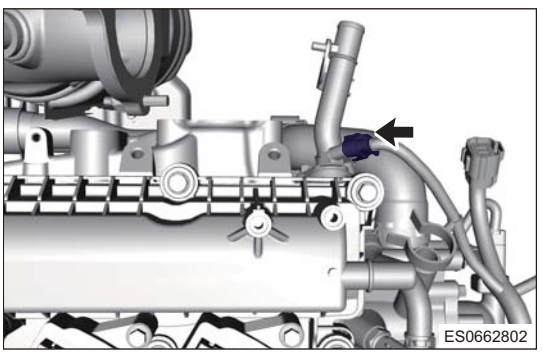
(a) Check if exhaust camshaft position sensor connector E-020 (arrow) is infirmly connected or poorly contacted.

OK

Exhaust camshaft position sensor is installed normally

Result

Proceed to
OK
NG



NG → Reconnect connector

OK

2	Check exhaust camshaft position sensor power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between terminal 3 of exhaust camshaft position sensor connector E-020 and ground (using a digital multimeter).

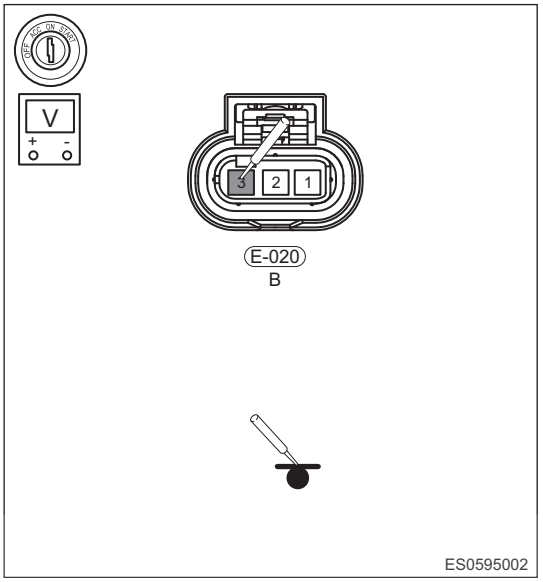
Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-020 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK
Exhaust camshaft position sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG → **Check and repair wire harness between exhaust camshaft position sensor power supply terminal and ECM**

OK

3	Check exhaust camshaft position sensor signal circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect intake camshaft position sensor connector E-020 and ECM connector E-027.
(d) Check intake camshaft position sensor connector E-020 (1) and ECM connector E-027 (105).
Check for Open

Multimeter Connection	Condition	Specified Condition
E-020 (1) - E-027 (105)	Always	Resistance ≤ 1 Ω

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

4	Check if relative installation position between exhaust camshaft position sensor and its signal plate is as specified

(a) Remove the exhaust camshaft position sensor.

(b) Obverse if installation of exhaust camshaft position sensor signal plate is proper.

OK

Relative installation position between exhaust camshaft position sensor and its signal plate is normal

Result

Proceed to
OK
NG

NG → **Install exhaust camshaft position sensor to proper position as specified**

OK

5	Check for mechanical fault

(a) Check drive gear, belt between crankshaft and camshaft for malfunctions.
(b) Check and clean exhaust camshaft position sensor and installation area, and check for damage, foreign matter or excessive movement, etc. that cause signal incorrectness.
(c) Check exhaust camshaft ring gear for damage or foreign matter (such as debris), etc. that cause signal incorrectness.

OK

Exhaust camshaft gear ring is normal

Result

Proceed to
OK
NG

NG → **Repair or replace malfunctioning components**

OK

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

NG	Replace with a new ECM to check if fault reoccurs

DTC	P0496 00	EVAP System High Purge Flow

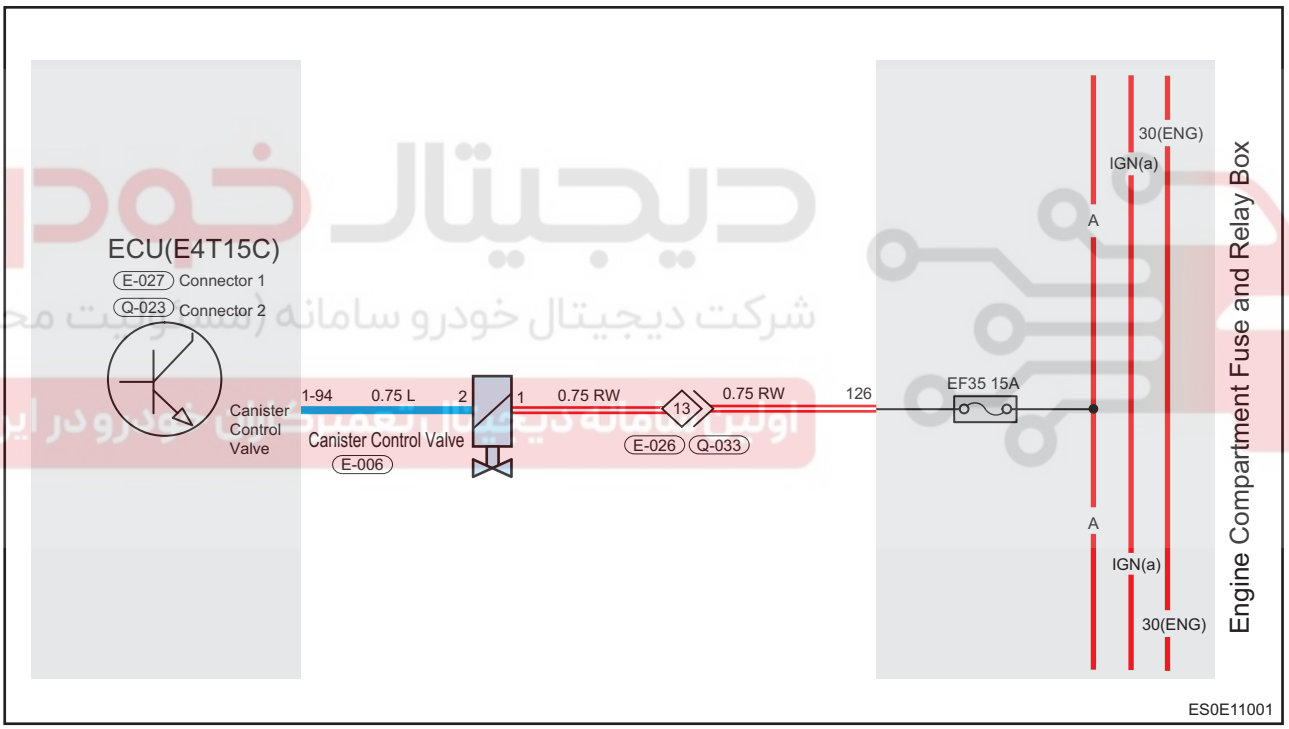
DTC	P0497 00	EVAP System Low Purge Flow

DTC	P0459 00	Evaporative Emission System Purge Control Valve Circuit High

DTC	P0458 00	Evaporative Emission System Purge Control Valve Circuit Low

DTC	P0444 00	Evaporative Emission System Purge Control Valve Circuit Open

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0496 00	EVAP System High Purge Flow	ENGINE START STOP switch ON, engine running	• Canister control valve • Wire harness or connector • ECM
P0497 00	EVAP System Low Purge Flow		
P0459 00	Evaporative Emission System Purge Control Valve Circuit High		
P0458 00	Evaporative Emission System Purge Control Valve Circuit Low		
P0444 00	Evaporative Emission System Purge Control Valve Circuit Open		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

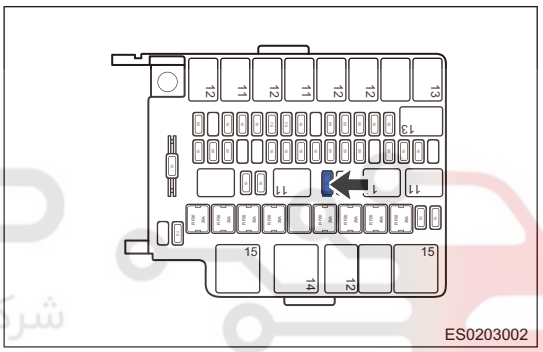
Procedure

1	Check canister control valve fuse EF35

(a) Check if fuse EF35 is blown or no power.

Result

Proceed to
OK
NG



NG → **Replace fuse or check the cause for no power**

OK

2	Check canister control valve connector

(a) Check if canister control valve connector E-006 is infirmly connected or poorly contacted.

OK

Canister control valve connector is normal

Result

Proceed to
OK
NG

NG → **Repair or replace connector**

OK

3	Check canister control valve power supply voltage

(a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage between canister control valve connector terminal and body ground (using a digital multimeter).

Voltage Inspection

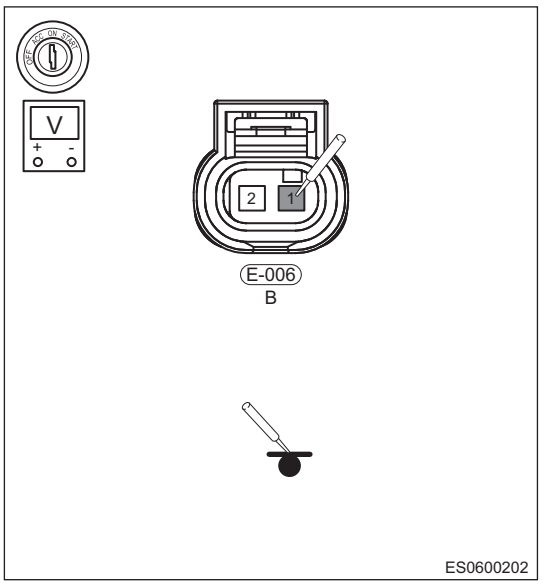
Multimeter Connection	Condition	Specified Condition
E-006 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Canister control valve power supply voltage is normal

Result

Proceed to
OK
NG



04

NG → **Repair or replace wire harness between canister control valve and engine compartment fuse and relay box**

OK

4 Check canister control valve control circuit

(a) Disconnect the ECM connector E-027.

(b) Check wire harness between canister control valve connector terminal and ECM connector terminal.

Check for Open

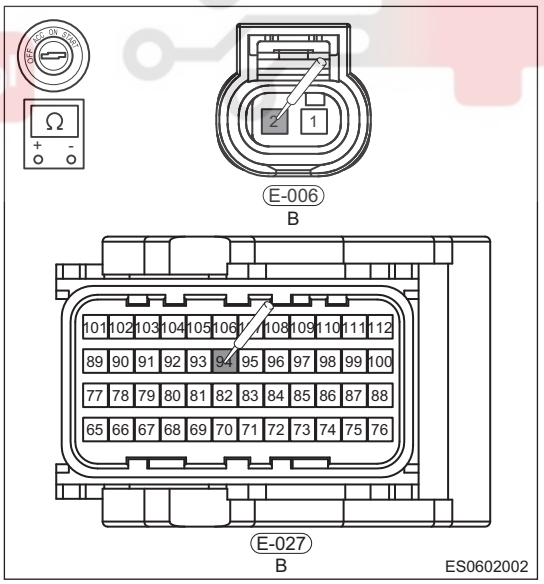
Multimeter Connection	Condition	Specified Condition
E-027 (94) - E-006 (2)	Always	Resistance ⩽ 1 Ω

OK

Continuity between canister control valve connector terminal and ECM connector terminal is normal

Result

Proceed to
OK
NG



NG → **Replace wire harness or connector (canister control valve - ECM)**

OK

5	Check canister control valve

(a) With battery voltage applied between terminals 1 and 2, valve should open when air is sucked into the valve; with battery voltage not applied, valve should close when air is not sucked into the valve.

OK

Canister control valve is normal

Result

Proceed to
OK
NG

NG → **Replace canister control valve**

OK

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

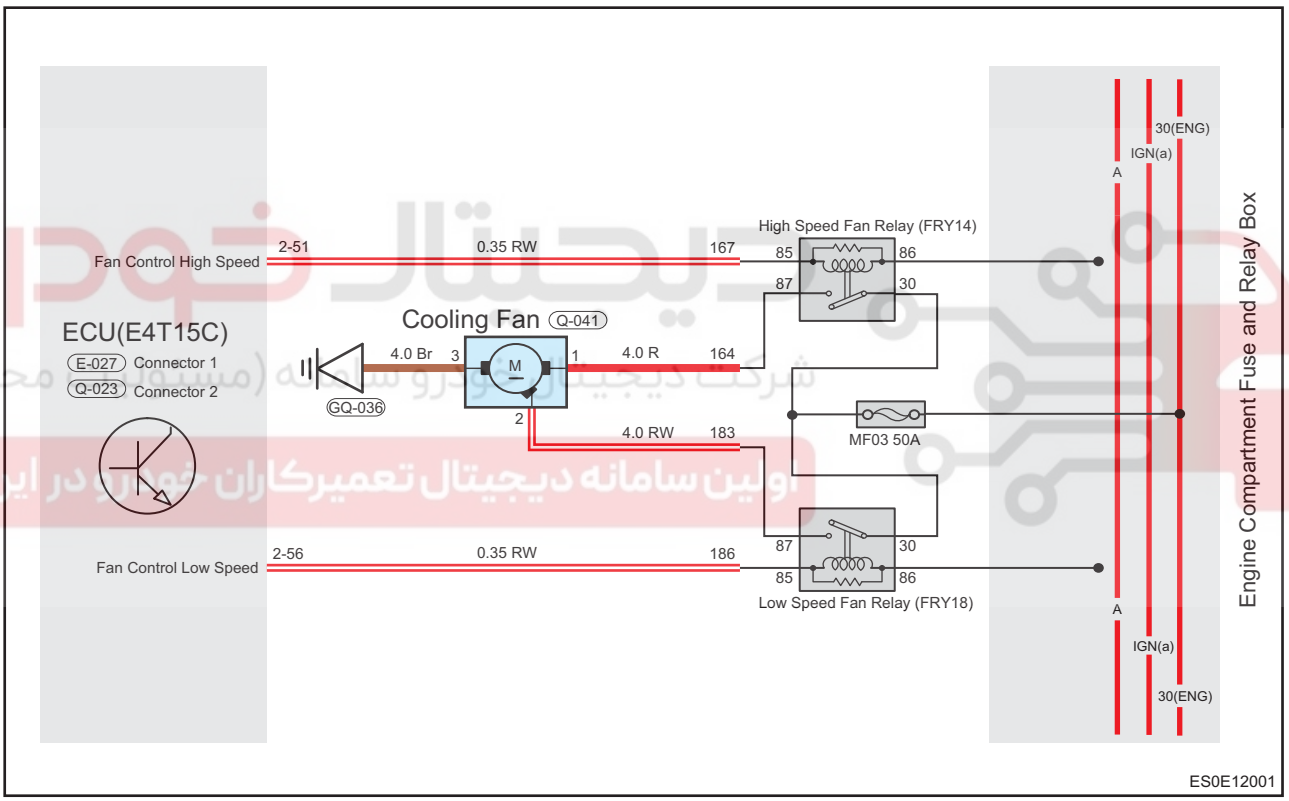
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0480 00	Fan 1 Control Circuit
DTC	P0481 00	Fan 2 Control Circuit
DTC	P0692 00	Fan 1 Control Circuit High
DTC	P0694 00	Fan 2 Control Circuit High
DTC	P0691 00	Fan 1 Control Circuit Low
DTC	P0693 00	Fan 2 Control Circuit Low

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0480 00	Fan 1 Control Circuit	ENGINE START STOP switch ON, engine running	• Wire harness connector • Cooling fan control relay • ECM
P0481 00	Fan 2 Control Circuit		
P0692 00	Fan 1 Control Circuit High		
P0694 00	Fan 2 Control Circuit High		
P0691 00	Fan 1 Control Circuit Low		
P0693 00	Fan 2 Control Circuit Low		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.

- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check cooling fan fuse

(a) Check if cooling fan fuse MF03 is blown or no power.

Result

Proceed to
OK
NG

NG → **Replace fuse or check the cause for no power**

OK →

2	Check cooling fan control relay power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage of cooling fan high and low speed control relay connector terminal (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Relay (30) - Body ground	Always	Not less than 12V
Relay (85) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Cooling fan control relay connector terminal voltage is normal.

Result

Proceed to
OK
NG

NG → **Repair or replace engine compartment fuse and relay box**

OK →

3	Check cooling fan control circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the cooling fan motor connector.

(c) Disconnect the cooling fan ECM connector Q-023.
(d) Check the cooling fan control circuit.
Disconnect inspection

Multimeter Connection	Condition	Specified Condition
B-015 (51) - Q-023 (38)	Always	Resistance ⩽ 1 Ω
B-015 (56) - Q-023 (37)	Always	Resistance ⩽ 1 Ω

(e) Check cooling fan ECM corresponding terminal for short circuit to ground.
Check for Short

Multimeter Connection	Condition	Specified Condition
B-020 (37 or 58) - Body ground	Always	Resistance ∞
B-015 (56 or 51) - Body ground	Always	Resistance ∞

Result

Proceed to
OK
NG

NG → **Repair or replace ECM**

OK

4 Check circuit between cooling fan and engine compartment fuse and relay box

(a) Disconnect the cooling fan connector Q-009.
(b) Check circuit between cooling fan and engine compartment fuse and relay box.
Check for Open

Multimeter Connection	Condition	Specified Condition
Q-009 (3) - Q-004	Always	Resistance ⩽ 1 Ω
Q-009 (2) - Q-003	Always	Resistance ⩽ 1 Ω

(c) Check circuit between cooling fan and engine compartment fuse and relay box for short circuit to ground.
Check for Short

Multimeter Connection	Condition	Specified Condition
Q-009 (3 or 2) - Body ground	Always	Resistance ∞
Q-003 or Q-004 - Body ground	Always	Resistance ∞

Result

Proceed to
OK
NG

NG → **Repair or replace ECM**

OK

5	Check cooling fan motor

(a) Directly apply battery voltage to cooling fan motor, check if cooling fan motor operates (do not run the motor in dry state or water for a long time).

Result

Proceed to
OK
NG

NG → **Repair or replace cooling fan motor**

OK

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0420 00	Catalyst System Efficiency Below Threshold Bank 1

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0420 00	Catalyst Conversion Insufficient	ENGINE START STOP switch ON, engine running	• Three-way catalytic converter • Leakage in exhaust system • Upstream oxygen sensor • Downstream oxygen sensor • ECM

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check for any other DTCs output (in addition to DTC P0420 00)

(a) Connect diagnostic tester to diagnostic interface.
(b) Turn ENGINE START STOP switch to ON, start engine and warm it up to normal operating temperature, and then select Read DTC.

Display (DTC Output)	Proceed to
Other DTCs	A
P0420 00	B

Other DTCs are displayed
Proceed to A

P0420 00 is displayed
Proceed to B

Result

Proceed to
A
B

A → **A**
Go to DTC chart, and perform troubleshooting for other DTCs first

B → **B**
NEXT

2	Read datastream

(a) Using diagnostic tester, select Read Datastream.
(b) Check datastream below.

Item	OK (Idling)	If it is NG, proceed to
Upstream Oxygen Sensor Voltage	Quickly fluctuates between 0.1 to 1V	A
Downstream Oxygen Sensor Voltage	Fluctuates slightly at about 0.45 V	B
Average Injection Pulse Width	Approximately 2.15 ms	C

Upstream oxygen sensor voltage is normal
Upstream oxygen sensor is normal

Average injection pulse width is normal
Injector, fuel pressure and other causes for abnormal injection pulse width is normal

Downstream oxygen sensor voltage value
Exhaust system is normal

Result

Proceed to
A
B
C

A → **A**
Replace upstream oxygen sensor

B → **C**
Check injector, fuel pressure and other causes for abnormal injection pulse width

C → **B**
NEXT

3	Check exhaust system

(a) Turn ENGINE START STOP switch to ON and start engine.
(b) Check exhaust system for leakage.

OK
Exhaust system is normal

Result

Proceed to
OK
NG

NG → **Repair exhaust system**

OK

4	Check downstream oxygen sensor

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Check the downstream oxygen sensor.

OK

Downstream oxygen sensor is normal, replace three-way catalytic converter, and go to next step

Result

Proceed to
OK
NG

NG → **Replace downstream oxygen sensor**

OK →

5	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC P0420 00 still exists.

OK

No same DTC is output

Result

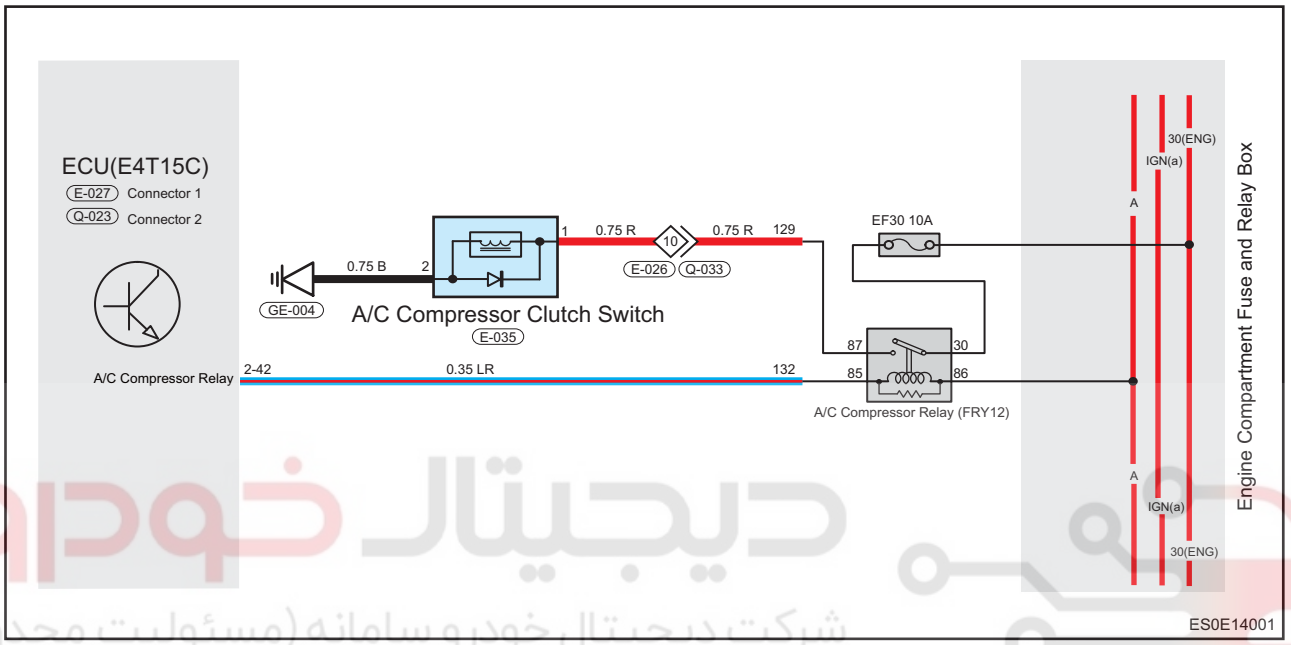
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0645 00	A/C Clutch Relay Control Circuit
DTC	P0647 00	A/C Clutch Relay Control Circuit High
DTC	P0646 00	A/C Clutch Relay Control Circuit Low

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0645 00	A/C Clutch Relay Control Circuit	ENGINE START STOP switch ON, engine running	• A/C compressor relay • Wire harness or connector • Battery • ECM
P0647 00	A/C Clutch Relay Control Circuit High		
P0646 00	A/C Clutch Relay Control Circuit Low		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check battery voltage

(a) Check if battery terminals are corroded or loose.
(b) Check battery voltage with a digital multimeter.

OK

Not less than 12V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

OK →

2	Check A/C compressor relay and fuse

(a) Check if fuse EF30 (10 A) is blown or no power.
(b) Check if relay terminal is corroded or broken.
(c) Directly apply battery voltage to 2 relay control terminals, check if relay closes.
(d) Turn ENGINE START STOP switch to ON.
(e) Measure voltage between engine compartment fuse and relay box terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-501 (5) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

A/C compressor relay and fuse are normal

Result

Proceed to
OK
NG

NG → **Repair or replace fuse or relay or check the cause for no power**

OK →

3	Check A/C compressor clutch connector

(a) Check if A/C compressor clutch connector is loose or poorly contacted.

Result

Proceed to
OK
NG

NG → **Repair or replace connector**

OK

4	Check A/C compressor control circuit

(a) Disconnect the ECM connector Q-023.
(b) Check wire harness between ECM connector terminal and engine compartment fuse and relay box terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
Q-023 (23) - Engine compartment fuse and relay box (42)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
Q-023 (23) or engine compartment fuse and relay box (42) - Body ground	Always	Resistance ∞

OK
A/C compressor relay control circuit is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness or connector (ECM - engine compartment fuse and relay box)**

OK

5	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK
No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

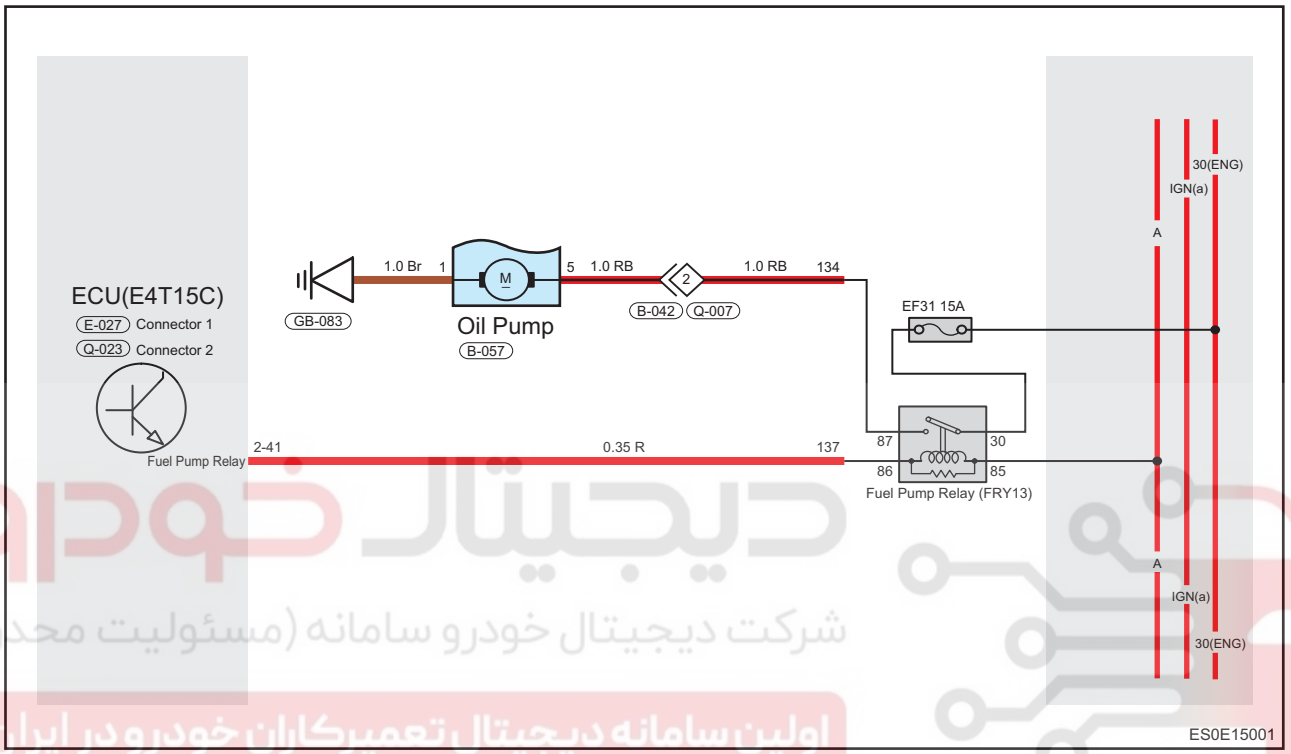
NG	Replace with a new ECM to check if fault reoccurs

DTC	P0629 00	Fuel Pump "A" Control Circuit High

DTC	P0628 00	Fuel Pump "A" Control Circuit Low

DTC	P0627 00	Fuel Pump "A" Control Circuit Open

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0629 00	Fuel Pump "A" Control Circuit High	ENGINE START STOP switch ON, engine running	• Fuel pump relay • Wire harness or connector • Battery • ECM
P0628 00	Fuel Pump "A" Control Circuit Low		
P0627 00	Fuel Pump "A" Control Circuit Open		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check battery voltage

(a) Check if battery terminals are corroded or loose.
(b) Check battery voltage with a digital multimeter.

OK

Not less than 12V

Result

Proceed to
OK
NG

NG → Check and repair battery

OK →

2	Check fuel pump relay and fuse

(a) Check if fuel pump fuse EF31 (15 A) is blown or no power.
(b) Check if relay terminal is corroded or broken.
(c) Directly apply battery voltage to 2 relay control terminals, check if relay closes.
(d) Turn ENGINE START STOP switch to ON.
(e) Measure voltage between engine compartment fuse and relay box terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Engine compartment fuse and relay box (137) - Body ground	Always	Not less than 12V
Engine compartment fuse and relay box (134) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Fuel pump relay and fuse are normal

Result

Proceed to
OK
NG

NG → Repair or replace fuse or relay

OK →

3	Check fuel pump circuit voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Check the fuel pump relay terminal voltage.

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Fuel pump B-057 (5) - Body ground	ENGINE START STOP switch ON	Not less than 12V

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

4 Check fuel pump connector

(a) Check if fuel pump connector is infirmly connected or poorly contacted.

Result

Proceed to
OK
NG

NG → **Repair or replace connector**

OK

5 Check fuel pump relay control circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the ECM connector Q-023.
(d) Check wire harness between ECM connector terminal and engine compartment fuse and relay box terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
Engine compartment fuse and relay box (137) - Q-023 (41)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
Engine compartment fuse and relay box (137) or Q-023 (41) - Body ground	Always	Resistance ∞

OK

Fuel pump relay control circuit is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness or connector (ECM - engine compartment fuse and relay box)**

OK

6	Check fuel pump

(a) Directly apply battery voltage to fuel pump, check if fuel pump operates (do not run the motor in dry state or water for a long time).

Result

Proceed to
OK
NG

NG → **Repair or replace fuel pump**

OK

7	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC P0629 00, P0628 00 or P0627 00 still exists.

OK

No same DTC is output

Result

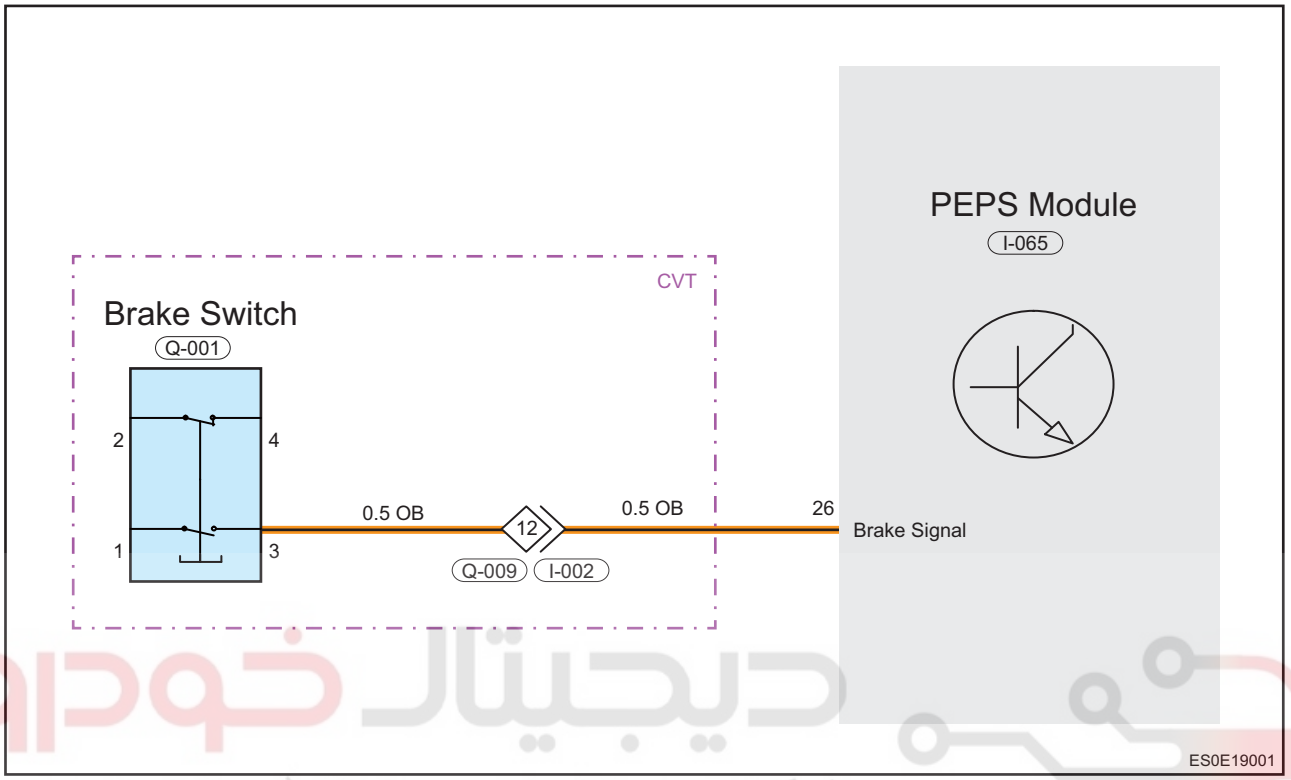
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0571 00	Brake Switch "A" Circuit

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0571 00	Brake Switch "A" Circuit	ENGINE START STOP switch ON	• Fuse • Brake switch • Wire harness or connector • ECM

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

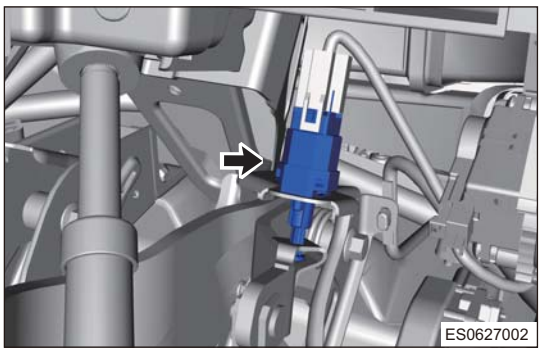
Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check brake switch and brake pedal connector

(a) Check if brake pedal connector (arrow) and brake switch connector are connected infirmly, damaged or cracked.



Result

Proceed to
OK
NG

NG → **Repair or replace connector**

OK

2	Check brake switch signal circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect brake switch connector B-058 and ECM connector B-015.
(d) Check for Open

Multimeter Connection	Condition	Specified Condition
B-058 (4) - B-015 (23)	Always	Resistance ⩽ 1 Ω

Result

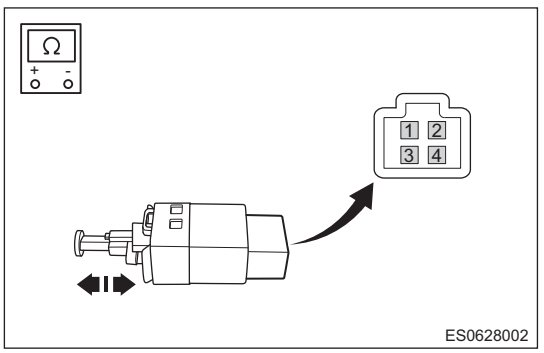
Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

3	Check brake switch

(a) Remove the brake switch.



(b) Check the brake switch.

Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 3	Brake pedal depressed (switch pin released)	Resistance ⩽ 1 Ω
Terminal 4 - Terminal 2		Resistance ∞
Terminal 1 - Terminal 3	Brake pedal released (switch pin pushed)	Resistance ∞
Terminal 4 - Terminal 2		Resistance ⩽ 1 Ω

OK

Brake switch is normal

Result

Proceed to
OK
NG

NG → **Replace brake switch**

OK

4 Check pedal travel

(a) Connect the diagnostic tester connector.
(b) Connect negative battery cable, and turn ignition switch to ON.
(c) Using 2 multimeters, separately measure voltage between brake switch signal and ground, brake light signal and ground without brake pedal depressed.

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
B-058(4) - ground	Brake pedal not depressed	12V
B-058(3) - ground	Brake pedal not depressed	0V

Result

Proceed to
OK
NG

NG → **Adjust pedal travel or replace brake pedal**

OK

5 Check pedal travel again

(a) Using 2 multimeters, separately measure voltage between brake switch signal and ground, brake light signal and ground with brake pedal depressed slightly.

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
B-058(4) - ground	Brake pedal depressed slightly	Voltage of two circuit changes simultaneously
B-058(3) - ground	Brake pedal depressed slightly	

Result

Proceed to
OK
NG

NG → **Adjust pedal travel or replace brake pedal**

OK

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read and clear DTCs.
(d) Depress brake pedal 25 times continuously, observe if DTCs appear again.
(e) Check if DTC P0571 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

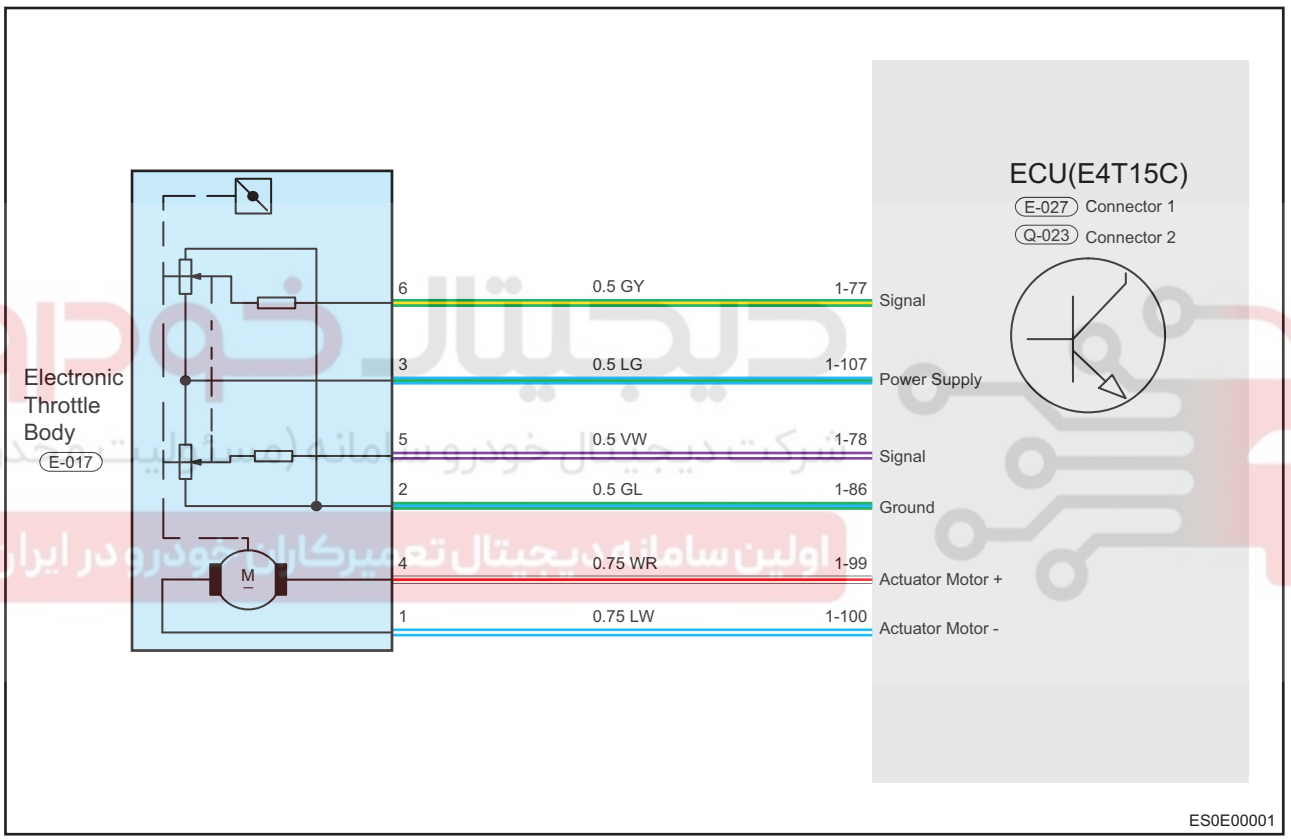
DTC	P2103 00	Throttle Actuator "A" Control Motor Circuit High

DTC	P2118 00	Throttle Actuator "A" Control Motor Current Range/Performance

DTC	P2106 00	Throttle Actuator Control System Forced Limited Power

DTC	P2100 00	Throttle Actuator "A" Control Motor Circuit/Open

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2103 00	Throttle Actuator "A" Control Motor Circuit High	ENGINE START STOP switch ON, engine running Engine speed is 1200 rpm	• Throttle position sensor 1 • Throttle position sensor 2 • Wire harness or connector • ECM
P2118 00	Throttle Actuator "A" Control Motor Current Range/ Performance		
P2106 00	Throttle Actuator Control System Forced Limited Power		
P2100 00	Throttle Actuator "A" Control Motor Circuit/Open		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.

- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Clear and read DTCs again

(a) Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON, and then clear DTCs.
(b) Turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning.
(c) Run engine, slightly depress accelerator pedal several times, and read DTCs again.

OK

DTCs are cleared

Result

Proceed to
OK
NG

NG → **Replace with new ECM to perform real-vehicle test**

OK

2	Reconfirm DTCs

(a) Using diagnostic tester, read ECM DTC.
(b) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **End**

NG

3	Perform electronic throttle self-learning again

(a) Turn ENGINE START STOP switch to ON.
(b) Wait for about 1 minute to finish throttle self-learning, and then start the engine.
(c) Depress accelerator pedal several times with shift level in N, and read DTCs again.

OK

DTCs do not recur

Result

Proceed to
OK
NG

OK	**System operates normally**
NG	**End**

DTC	U015187	Lost Communication With ABM
DTC	U016487	Lost Communication With HVAC Control Module
DTC	U0140 87	Lost Communication With Body Control Module
DTC	U0155 87	Lost Communication With Instrument Panel Cluster (IPC) Control Module
DTC	U0214 87	Lost Communication With Remote Function Actuation
DTC	U0126 87	Lost Communication With SAM
DTC	U0129 87	Lost Communication With Vehicle Dynamics Control Module
DTC	U0101 87	Lost Communication With TCM

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
U015187	Lost Communication With ABM	ECM does not detect CAN line BUSOFF fault; Engine is running	• Connector or wire harness • ABS malfunction • CAN bus hardware circuit malfunction
U016487	Lost Communication With HVAC Control Module		
U0140 87	Lost Communication With Body Control Module		
U0155 87	Lost Communication With Instrument Panel Cluster (IPC) Control Module		
U0214 87	Lost Communication With Remote Function Actuation		
U0126 87	Lost Communication With SAM		
U0129 87	Lost Communication With Vehicle Dynamics Control Module		
U0101 87	Lost Communication With TCM		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

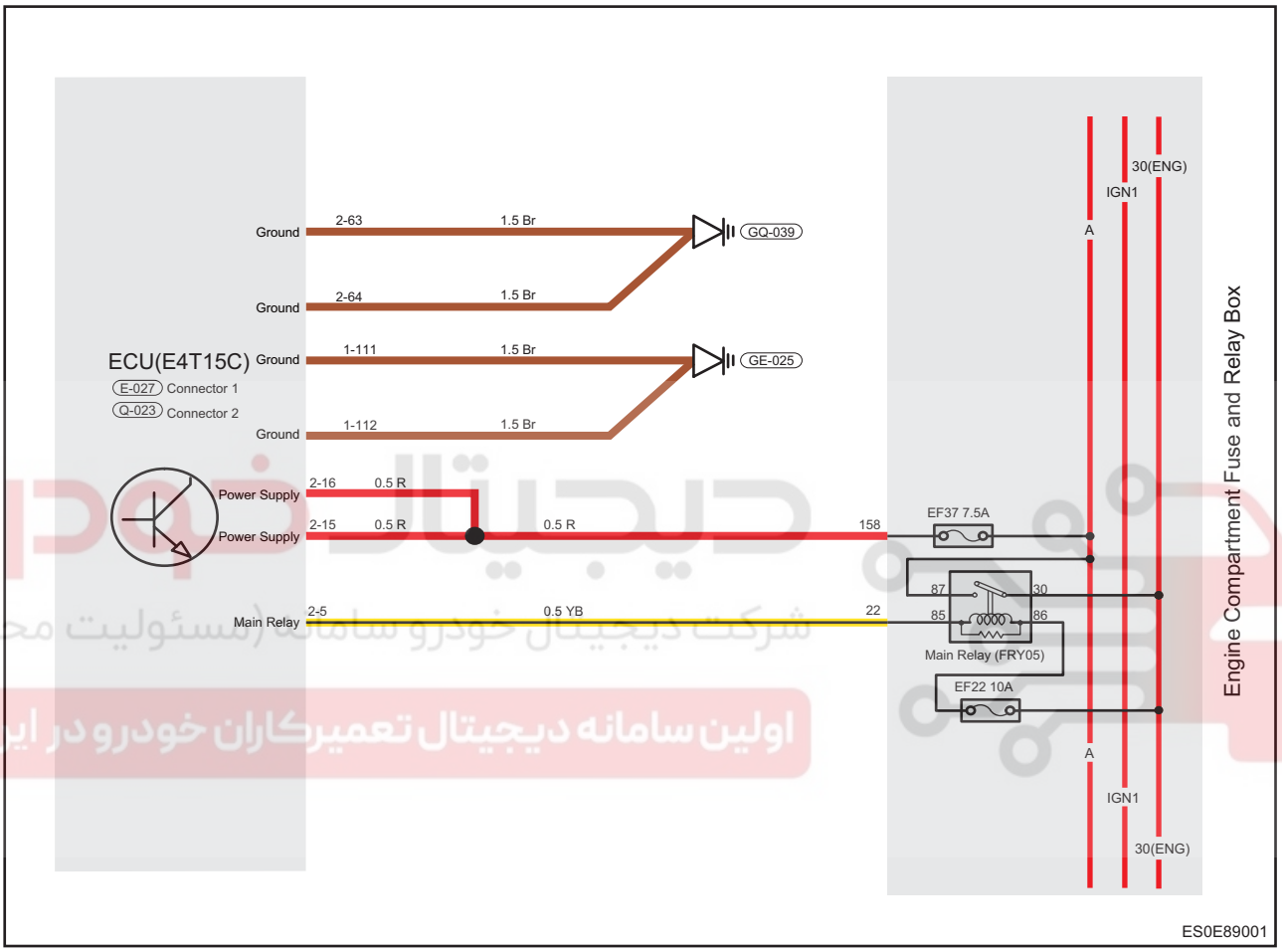
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Diagnosis

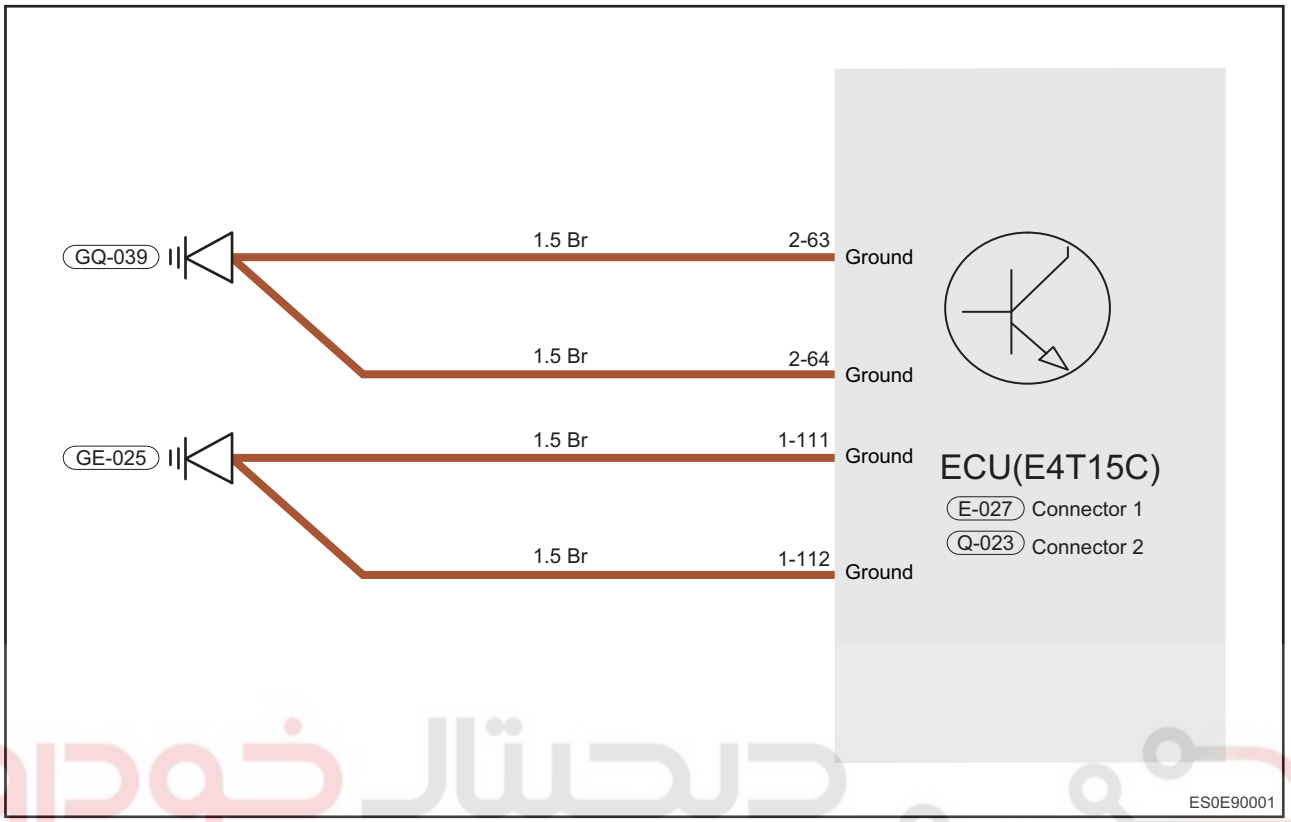
1	**(Refer to CAN system)**

DTC	P0690 00	ECM/PCM Power Relay Sense Circuit High
DTC	P06AA 00	Control Module Internal Temperature "B" Too High
DTC	P0686 00	ECM/PCM Power Relay Control Circuit Low

Power Supply Circuit



Ground Circuit



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0690 00	ECM/PCM Power Relay Sense Circuit High	ENGINE START STOP switch ON, engine running	• Main relay • Wire harness or connector • Battery • ECM
P06AA 00	Control Module Internal Temperature "B" Too High		
P0686 00	ECM/PCM Power Relay Control Circuit Low		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Procedure

1	**Check battery voltage**

(a) Check if battery terminals are corroded or loose.
(b) Check battery voltage with a digital multimeter.

OK

Not less than 12V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

OK →

2	Check ECM fuse

(a) Check if ECM fuses EF37 (7.5A) and EF22 (10A) are blown or no power.
(b) Check if main relay terminal is corroded or broken.
(c) Unplug main relay, directly apply battery voltage to main relay control terminal, and check if main relay closes.

OK
Close

Result

Proceed to
OK
NG

NG → **Check the cause for fuse no power or repair or replace fuse or relay**

OK →

3	Check ECM power supply circuit voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between terminal of ECM connector Q-023 and body ground (using a digital multimeter or 21 W test light).

Multimeter Connection	Condition	Specified Condition
Q-023 (20) - Body ground	Always	Not less than 12V
Q-023 (15) - Body ground	ENGINE START STOP switch ACC	Not less than 12V

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK →

4	Reconfirm DTCs

(a) Connect the negative battery cable.

(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC still exists.

OK

No same DTC is output

Result

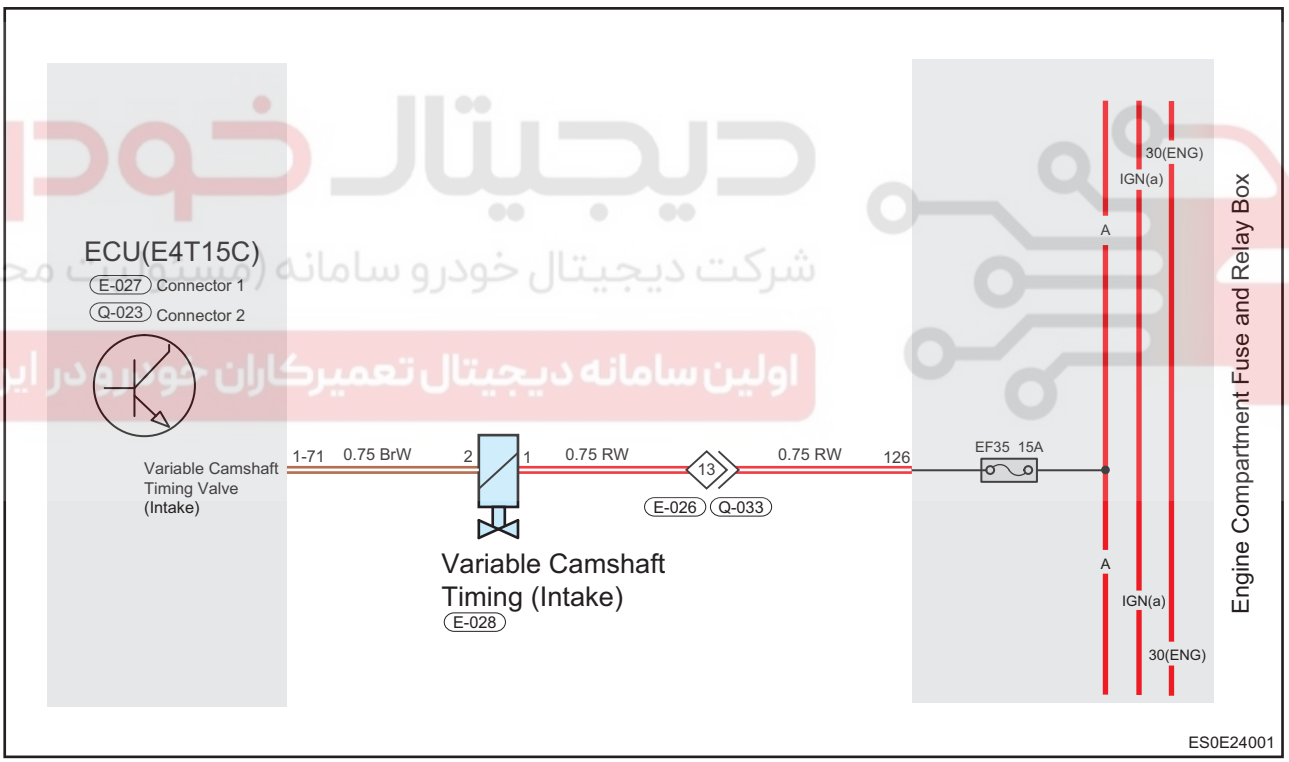
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P2089 00	"A" Camshaft Position Actuator Control Circuit High Bank 1
DTC	P2088 00	"A" Camshaft Position Actuator Control Circuit Low Bank 1
DTC	P0010 00	"A" Camshaft Position Actuator Control Circuit Open Bank 1
DTC	P000A 00	"A" Camshaft Position Slow Response Bank 1
DTC	P003C 00	"A" Camshaft Profile Control Performance/Stuck Off Bank 1

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2089 00	"A" Camshaft Position Actuator Control Circuit High Bank 1	ENGINE START STOP switch ON, engine running	• Intake VVT solenoid valve • Wire harness or connector • ECM
P2088 00	"A" Camshaft Position Actuator Control Circuit Low Bank 1		
P0010 00	"A" Camshaft Position Actuator Control Circuit Open Bank 1		
P000A 00	"A" Camshaft Position Slow Response Bank 1		
P003C 00	"A" Camshaft Profile Control Performance/Stuck Off Bank 1		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check intake VVT control valve fuse EF35**

(a) Check if fuse EF35 is blown or no power.

Result

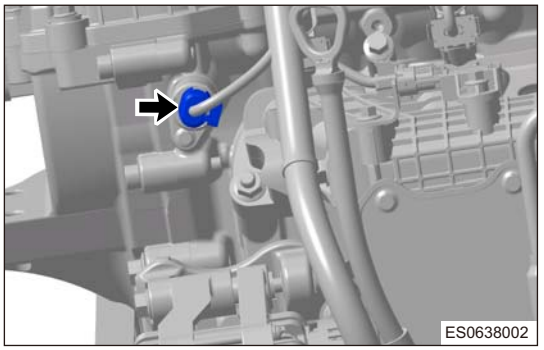
Proceed to
OK
NG

NG → **Replace fuse or check the cause for no power**

OK

2	Check intake VVT control valve connector

(a) Check if intake VVT control valve connector E-028 (arrow) is infirmly connected or poorly contacted.



OK

Intake VVT control valve connector is normal

Result

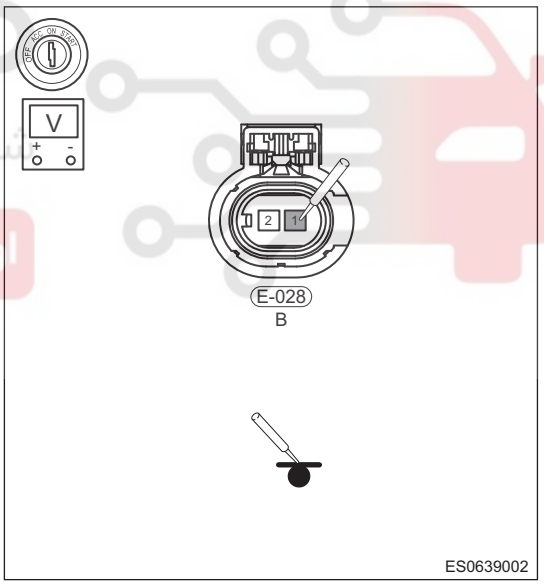
Proceed to
OK
NG

NG → **Repair or replace connector**

OK

3	Check intake VVT control valve power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between intake VVT control valve connector terminal and body ground (using a digital multimeter).



Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-028 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Intake VVT control valve power supply voltage is normal

Result

Proceed to
OK
NG

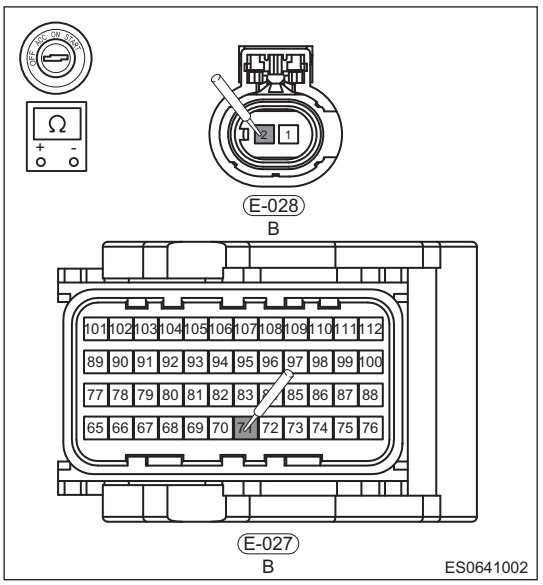
NG → **Repair or replace wire harness between intake VVT control valve and engine compartment fuse and relay box**

OK

4	Check wire harness between intake VVT control valve and ECM

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect intake VVT control valve and ECM connector.

(d) Check wire harness between intake VVT control valve E-028 (2) terminal and ECM.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-028 (2) - E-027 (71)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
E-027 (71) or E-028 (2) - Body ground	Always	Resistance ∞
E-027 (71) or E-028 (2) - Battery positive	Always	Resistance ∞

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness between intake VVT control valve and ECM**

OK

5 Check intake VVT control valve mechanical fault

(a) Remove intake VVT control valve, and check if connector is damaged or cracked.
(b) Check intake VVT control valve for blockage, oil leakage or seizing.

OK

Intake VVT control valve is normal

Result

Proceed to
OK
NG

NG → **Repair or replace VVT control valve**

OK

6 Check intake VVT control valve

(a) Remove the intake VVT control valve.

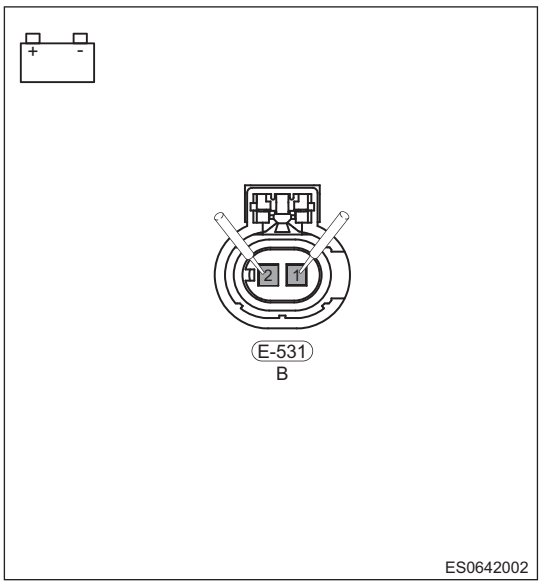
(b) When battery voltage is applied between terminals 1 and 2, control valve should move quickly.

OK

Intake VVT control valve is normal

Result

Proceed to
OK
NG



NG → **Replace intake VVT control valve**

OK

7	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC still exists.

OK

No same DTC is output

Result

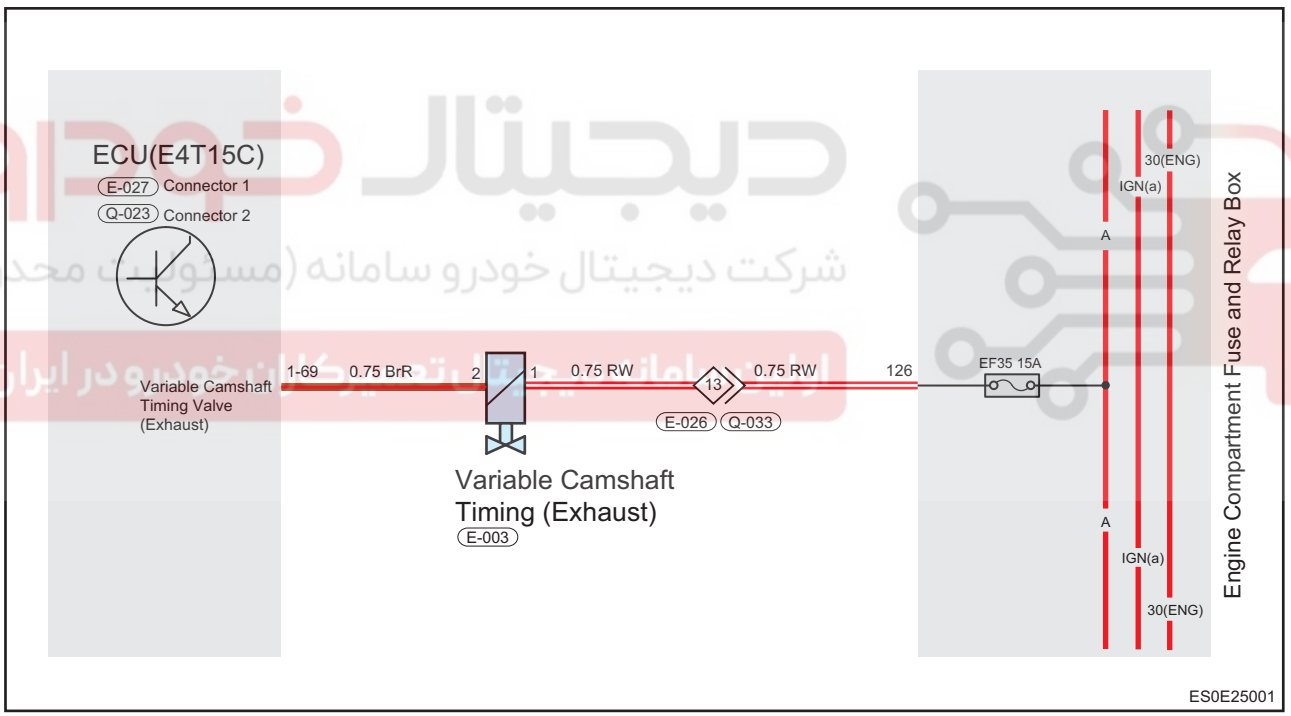
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P2091 00	"B" Camshaft Position Actuator Control Circuit High Bank 1
DTC	P2090 00	"B" Camshaft Position Actuator Control Circuit Low Bank 1
DTC	P0013 00	"B" Camshaft Position Actuator Control Circuit Open Bank 1
DTC	P000B 00	"B" Camshaft Position Slow Response Bank 1
DTC	P005A 00	"B" Camshaft Profile Control Performance/Stuck Off Bank 1

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2091 00	"B" Camshaft Position Actuator Control Circuit High Bank 1	ENGINE START STOP switch ON, engine running	• Exhaust VVT solenoid valve • Wire harness or connector • ECM
P2090 00	"B" Camshaft Position Actuator Control Circuit Low Bank 1		
P0013 00	"B" Camshaft Position Actuator Control Circuit Open Bank 1		
P000B 00	"B" Camshaft Position Slow Response Bank 1		
P005A 00	"B" Camshaft Profile Control Performance/Stuck Off Bank 1		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check exhaust VVT control valve fuse EF04**

(a) Check if fuse EF04 is blown or no power.

Result

Proceed to
OK
NG

NG → **Replace fuse or check the cause for no power**

OK

2	**Check exhaust VVT control valve connector**

(a) Check if exhaust VVT control valve connector E-532 is infirmly connected or poorly contacted.

OK

Exhaust VVT control valve connector is normal

Result

Proceed to
OK
NG

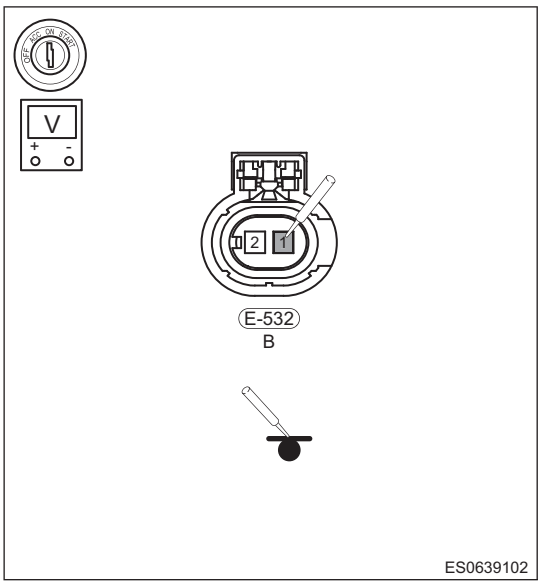
NG → **Repair or replace connector**

OK

3	**Check exhaust VVT control valve power supply voltage**

(a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage between exhaust VVT control valve connector terminal and body ground (using a digital multimeter).



Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-532 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Exhaust VVT control valve power supply voltage is normal

Result

Proceed to
OK
NG

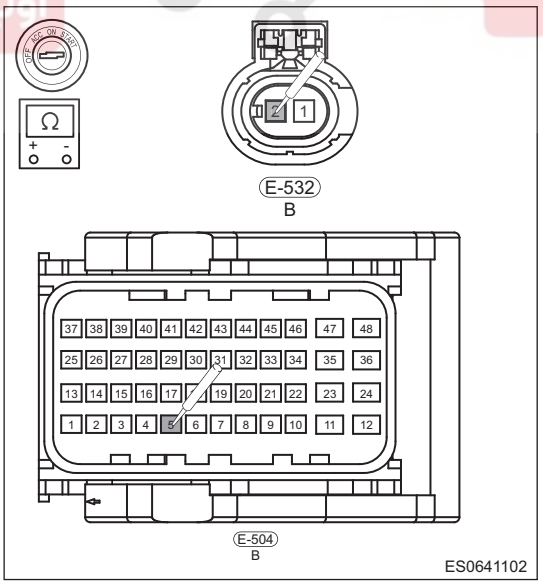
04

NG → **Repair or replace wire harness between exhaust VVT control valve and engine compartment fuse and relay box**

OK

4 Check exhaust VVT control valve control circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect ECM connector E-504 and exhaust VVT control valve connector E-532.
(d) Check wire harness between exhaust VVT control valve connector terminal and ECM connector terminal.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-504 (69) - E-532 (2)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
E-504 (69) or E-532 (2) - Body ground	Always	Resistance ∞

OK

Wire harness between exhaust VVT control valve connector terminal and ECM connector terminal is normal

Result

Proceed to
OK
NG

NG → **Replace wire harness or connector (exhaust VVT control valve - ECM)**

OK

5	Check exhaust VVT control valve mechanical fault

(a) Remove exhaust VVT control valve, and check if connector is cracked or damaged.
(b) Check exhaust VVT control valve for blockage, oil leakage or seizing.

OK

Exhaust VVT control valve is normal

Result

Proceed to
OK
NG

NG → **Repair or replace VVT control valve**

OK

6	Check exhaust VVT control valve

(a) Remove the exhaust VVT control valve.
(b) When battery voltage is applied between terminals 1 and 2, control valve should move quickly.

OK

Exhaust VVT control valve is normal

Result

Proceed to
OK
NG

NG → **Replace exhaust VVT control valve**

OK

7	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

NG	Replace with a new ECM to check if fault reoccurs

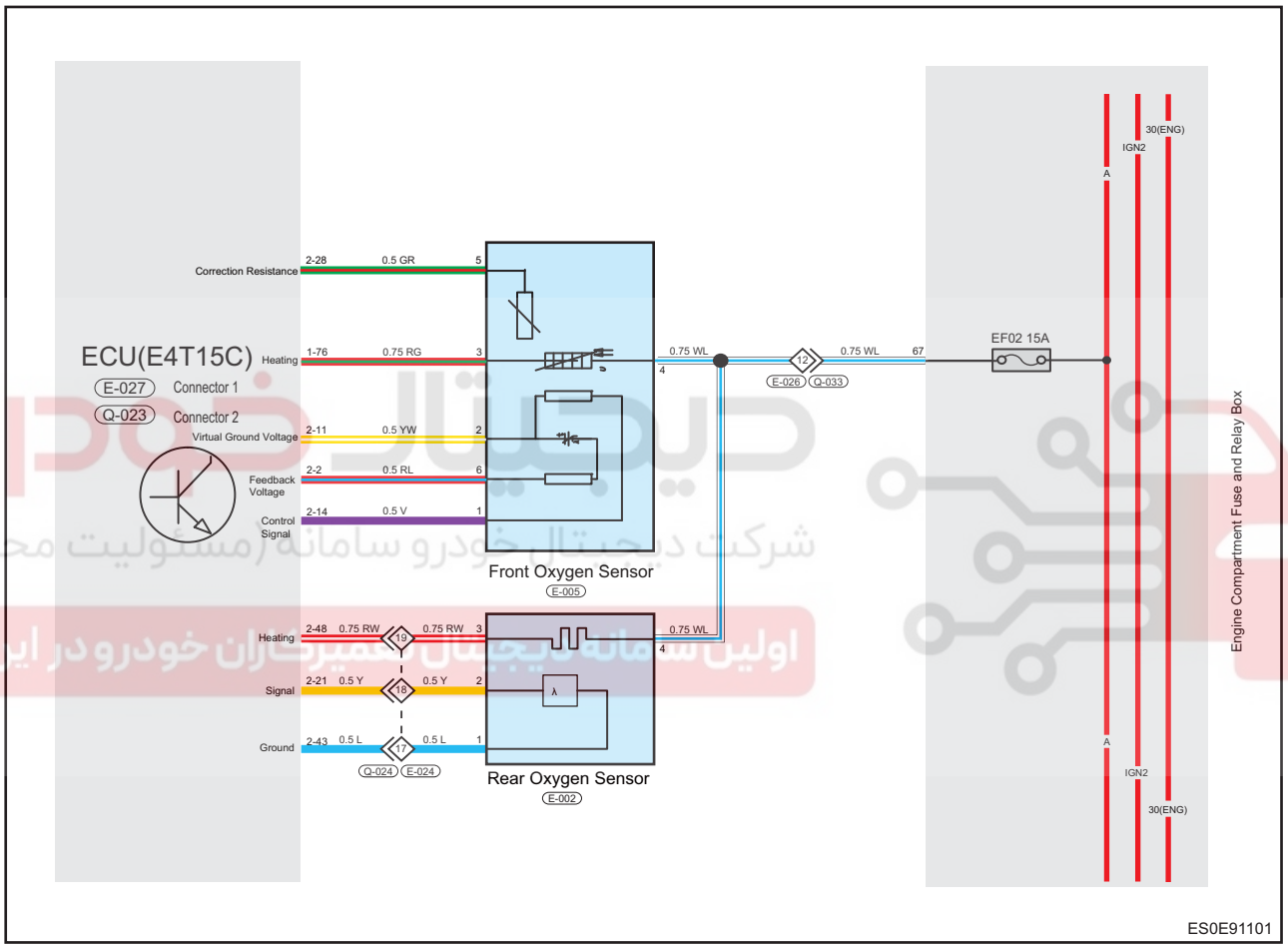
DTC	P2177 00	System Too Lean Off Idle Bank 1

DTC	P2178 00	System Too Rich Off Idle Bank 1

DTC	P2187 00	System Too Lean at Idle Bank 1

DTC	P2188 00	System Too Rich at Idle Bank 1

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2177 00	System Too Lean Off Idle Bank 1	• Air-fuel ratio self-learning is enable • Engine speed is between 1400 and 4000 rpm (or between 1440 and 3320 rpm); • Engine load is between 18 and 70.5% (between 18 and 57.75% for MT) • Engine intake flow is between 18 and 140 kg/h (between 24 and 110kg/h for MT);	• Oxygen sensor • Wire harness or connector • Fuel system components • Carbon canister • ECM
P2178 00	System Too Rich Off Idle Bank 1		
P2187 00	System Too Lean at Idle Bank 1		
P2188 00	System Too Rich at Idle Bank 1		
P2178 00	System Too Rich Off Idle		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check fuse EF02

(a) Check if fuse EF02 is blown or no power.

Result

Proceed to
OK
NG

NG → Replace fuse or check the cause for no power

OK

2	Check upstream oxygen sensor power supply voltage

(a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage between terminal 4 of connector E-005 and ground (using a digital multimeter or 21 W test light).

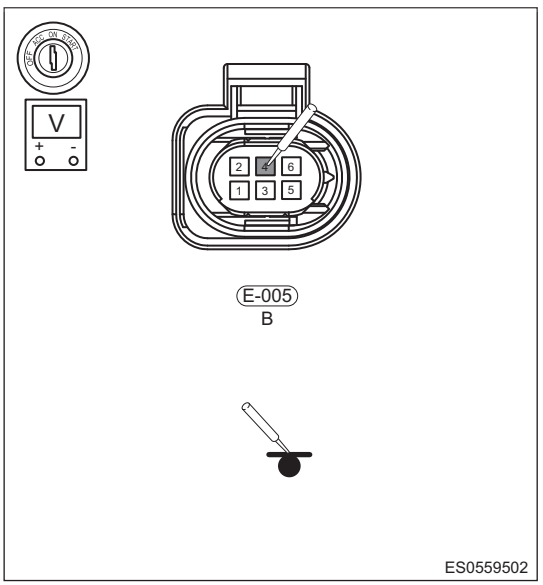
Multimeter Connection	Condition	Specified Condition
E-005 (4) - Body ground	ON	Not less than 12V

OK

Upstream oxygen sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG → End

OK

3	**Check voltage between downstream oxygen sensor power source and heater control circuit**

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between terminals 4 and 3 of connector E-002 (using a digital multimeter or 21 W test light).

Multimeter Connection	Condition	Specified Condition
E-002 (4) - E-002 (3)	Engine running	0.45V

OK
Voltage between downstream oxygen sensor power source and heater control circuit

Result

Proceed to
OK
NG

NG → **End**

OK

4	**Check voltage between downstream oxygen sensor signal wire and ground wire with engine running**

(a) Turn ENGINE START STOP switch to ON, start engine and idle it until engine coolant temperature is normal.
(b) Measure voltage between terminals 2 and 1 of connector E-002.

Multimeter Connection	Condition	Specified Condition
E-002 (2) - E-002 (1)	Engine running	Fluctuates rapidly between 0.1 and 0.9V (coolant temperature is normal)

OK
Downstream oxygen sensor signal is normal

Result

Proceed to
OK
NG

NG → **End**

OK

5	**Check for short between upstream oxygen sensor heater control circuit and signal circuit with engine running**

(a) Turn ENGINE START STOP switch to ON, start engine and idle it until engine coolant temperature is normal, and leave the vehicle in idle state.

(b) Turn ENGINE START STOP switch to OFF.
(c) Disconnect the negative battery cable.
(d) Disconnect the upstream oxygen sensor connector E-005.
(e) Check for short between terminals 3 and 2 of connector E-541.

Multimeter Connection	Condition	Specified Condition
E-005 (2) - E-005 (6)	Engine running	Resistance ⩽ 1 Ω

OK
Upstream oxygen sensor signal is normal
Result

Proceed to
OK
NG

NG → **Replace upstream oxygen sensor**

OK

6	Check ECM ground point

(a) Disconnect ECM ground points GQ-039 and GE-025.
(b) Check the ECM ground points GQ-039 and GE-025.
OK
Ground point is normal
Result

Proceed to
OK
NG

NG → **Repair or replace ground wire harness or ground point**

OK

7	Check for fuel system malfunction

(a) Check each component and supplying pressure of fuel system for malfunctions.
OK
Each component of fuel system is normal
Result

Proceed to
OK
NG

NG → **Repair or replace faulty fuel system components**

OK

8	Check if malfunction is caused by canister control valve

(a) Check canister control valve for sticking or other malfunctions.

OK

Canister control valve operates normally

Result

Proceed to
OK
NG

NG → **Repair or replace canister control valve**

OK

9	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC still exists.

OK

No same DTC is output

Result

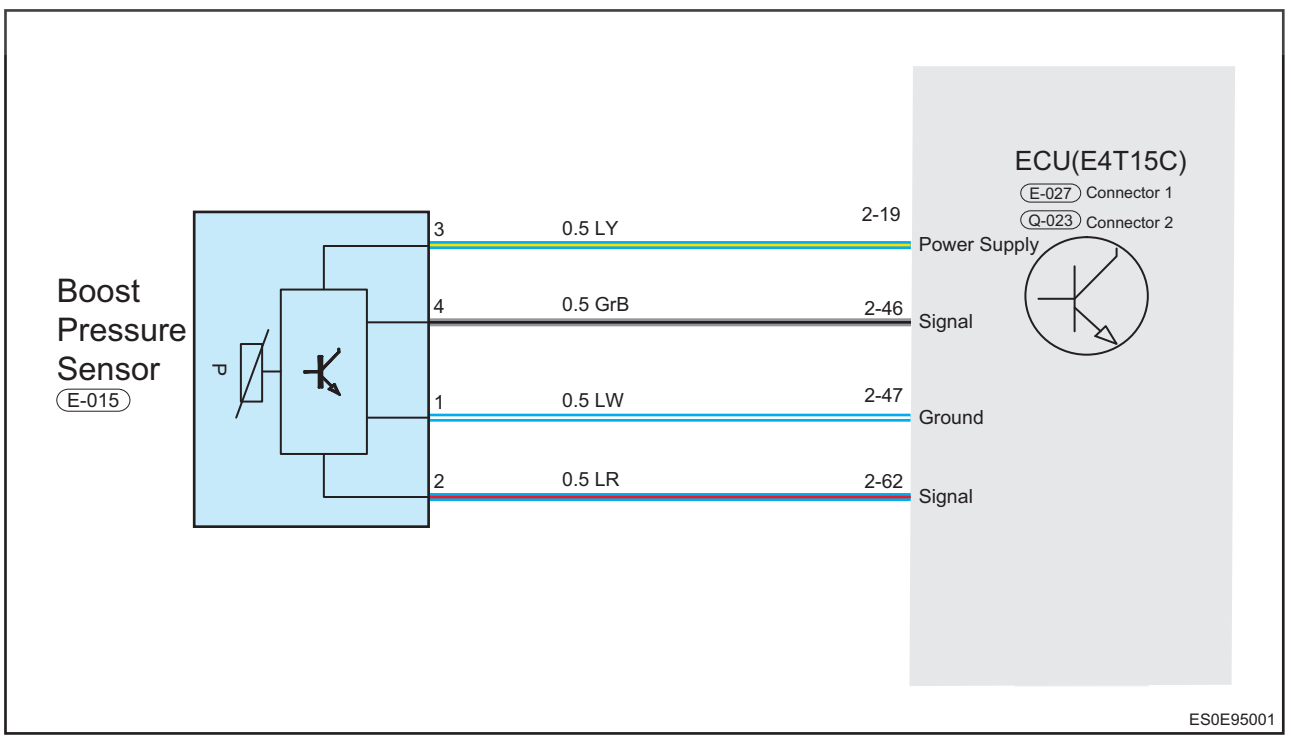
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0234 00	Turbocharger/Supercharger "A" Overboost Condition
DTC	P0299 00	Turbocharger/Supercharger "A" Underboost Condition
DTC	P0238 00	Turbocharger/Supercharger Boost Sensor "A" Circuit High
DTC	P0237 00	Turbocharger/Supercharger Boost Sensor "A" Circuit Low
DTC	P1204 00	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance
DTC	P1205 00	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance
DTC	P0236 22	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance
DTC	P0236 21	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0234 00	Turbocharger/Supercharger "A" Overboost Condition	ENGINE START STOP switch ON, engine running	• Boost pressure/temperature sensor • Wire harness or connector • ECM
P0299 00	Turbocharger/Supercharger "A" Underboost Condition		
P0238 00	Turbocharger/Supercharger Boost Sensor "A" Circuit High		
P0237 00	Turbocharger/Supercharger Boost Sensor "A" Circuit Low		
P1204 00	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance		
P1205 00	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance		
P0236 22	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance		
P0236 21	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.
  Click here

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check turbocharger assembly line**

(a) Check if boost pressure sensor is installed in place.
(b) Check each turbocharger assembly line for cracks, detachment, etc.

OK

Boost pressure sensor power supply is normal

Result

Proceed to
OK
NG

NG → **Check and repair wire harness between boost pressure sensor and ECM**

OK

2	Check boost pressure/temperature sensor power supply circuit voltage

(a) Turn ENGINE START STOP switch to ON and start engine.
(b) Check voltage between connector terminal and body ground (using a digital multimeter).

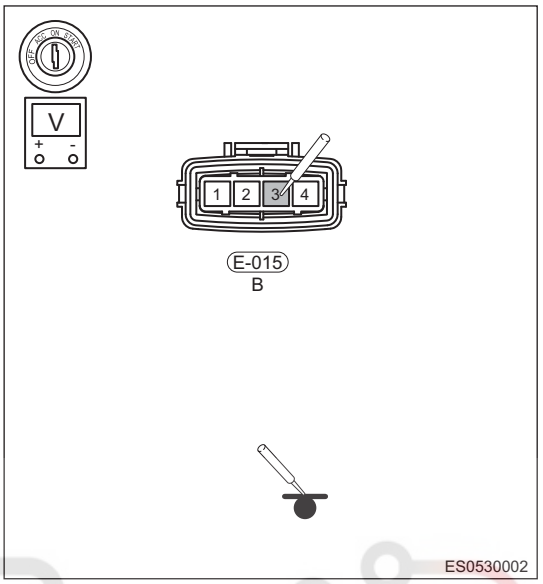
Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-015 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK
Boost pressure sensor power supply is normal

Result

Proceed to
OK
NG



NG → **Check and repair wire harness between boost pressure sensor and ECM**

OK

3	Check boost pressure/temperature sensor signal circuit

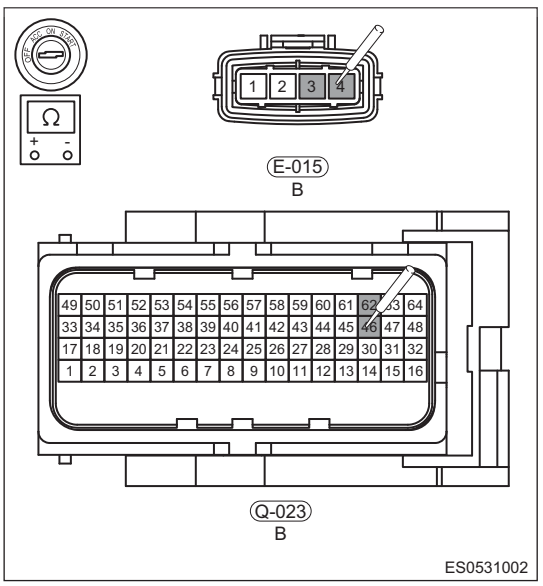
(a) Turn ENGINE START STOP switch to ON and start engine.
(b) Measure wire harness between connector E-015 terminal and ECM.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-015 (4) - Q-023 (46)	Always	Resistance ⩽ 1 Ω
E-523 (3) - Q-023 (62)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG

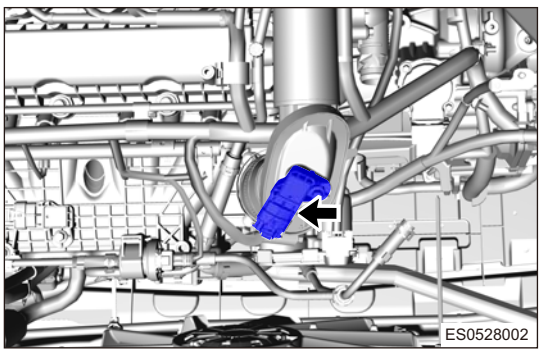


NG → **Check and repair wire harness between boost pressure sensor and ECM**

OK

4	Check boost pressure/temperature sensor

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the boost pressure/temperature sensor connector E-015 (arrow).



(d) Check sensor connection part for debris and damage.

OK

Boost pressure/temperature sensor itself has no malfunction

Result

Proceed to
OK
NG

NG → **Clean or replace boost pressure/ temperature sensor**

OK

5	Check boost relief valve

(a) Remove the boost discharge control valve connector.
(b) Check boost relief valve for damage or poor connection.

OK

Boost relief valve itself has no malfunction

Result

Proceed to
OK
NG

NG → **Clean or replace boost relief valve**

OK

6	Check exhaust by-pass valve

(a) Remove the exhaust by-pass valve connector.
(b) Check exhaust by-pass valve for damage or poor connection.

OK

Boost relief valve itself has no malfunction

Result

Proceed to
OK
NG

NG → **Clean or replace exhaust by-pass valve**

OK →

7	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

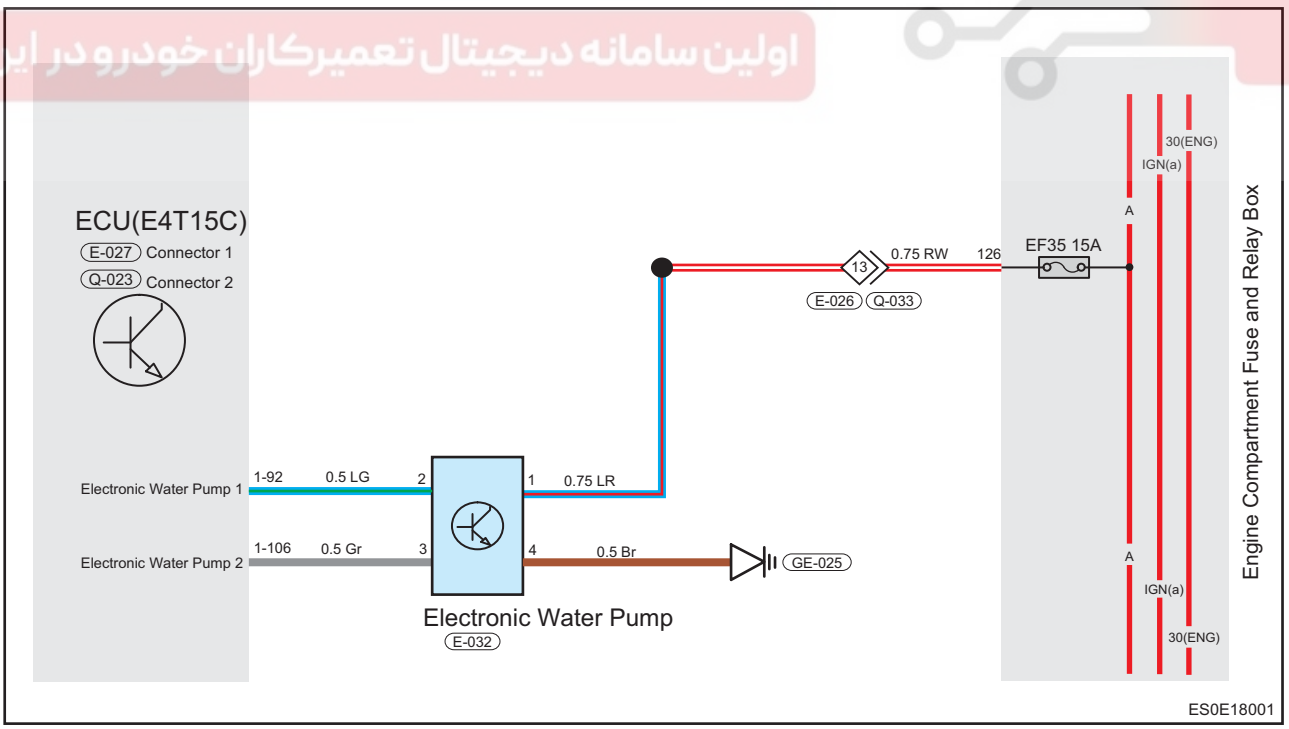
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P1301 00	Auxiliary Water Pump Dry Run Error
DTC	P261D 00	Coolant Pump "B" Control Circuit High
DTC	P261C 00	Coolant Pump "B" Control Circuit Low
DTC	P261A 00	Coolant Pump "B" Control Circuit Open
DTC	P1303 00	Auxiliary Water Pump Out Of Voltage Error
DTC	P1304 00	Auxiliary Water Pump Over Current
DTC	P1305 00	Auxiliary Water Pump Over Temperature Error
DTC	P1306 00	Auxiliary Water Pump Feedback Signal High
DTC	P1307 00	Auxiliary Water Pump Feedback Signal Low
DTC	P1308 00	Auxiliary Water Pump Stall Error
DTC	P1309 00	Auxiliary Water Pump Under Voltage

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P1301 00	Auxiliary Water Pump Dry Run Error	ENGINE START STOP switch ON, engine running	• Electric water pump • Wire harness or connector • Battery • ECM
P261D 00	Coolant Pump "B" Control Circuit High		
P261C 00	Coolant Pump "B" Control Circuit Low		
P261A 00	Coolant Pump "B" Control Circuit Open		
P1303 00	Auxiliary Water Pump Out Of Voltage Error		
P1304 00	Auxiliary Water Pump Over Current		
P1305 00	Auxiliary Water Pump Over Temperature Error		
P1306 00	Auxiliary Water Pump Feedback Signal High		
P1307 00	Auxiliary Water Pump Feedback Signal Low		
P1308 00	Auxiliary Water Pump Stall Error		
P1309 00	Auxiliary Water Pump Under Voltage		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.
  Click here

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check battery voltage**

(a) Check if battery terminals are corroded or loose.
(b) Check battery voltage with a digital multimeter.

OK

Not less than 12V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

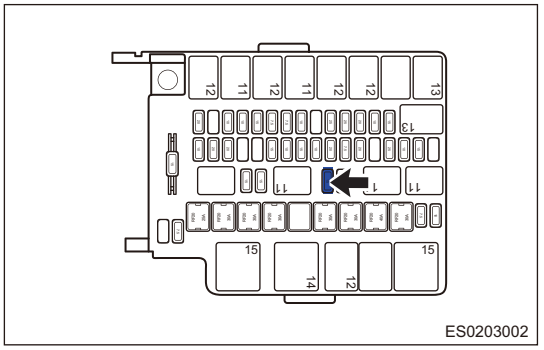
OK

2	Check electric water pump fuse

(a) Check if electric water pump fuse EF04 (15A) is blown or no power.

Result

Proceed to
OK
NG



04

NG → **Replace electric water pump fuse or check the cause for no power**

OK

3	Check electric water pump power supply

(a) Turn ENGINE START STOP switch to ON.
(b) Check voltage between electric water pump connector terminal and body ground (using a digital multimeter or 21 W test light).

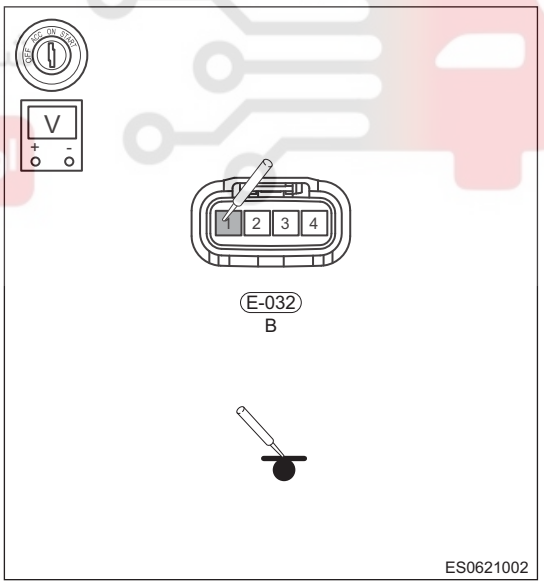
Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-032 (1) - Body ground	Always	Not less than 12V

OK
Electric water pump is normal

Result

Proceed to
OK
NG

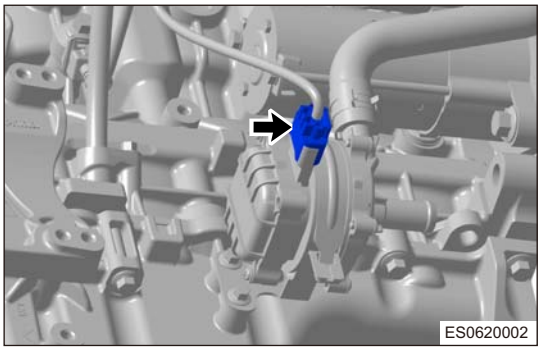


NG → **Repair or replace wire harness between electric water pump terminal (1) and engine compartment fuse and relay box**

OK

4	Check electric water pump connector

(a) Check if electric water pump connector E-032 (arrow) is connected infirmly, damaged or cracked.



Result

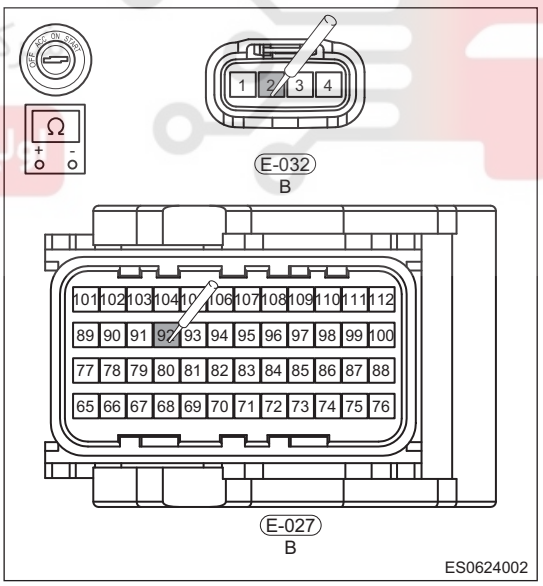
Proceed to
OK
NG

NG → **Repair or replace electric water pump connector**

OK

5	Check electric water pump relay control circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect ECM connector E-027 and electric water pump connector E-032.
(d) Check wire harness between ECM connector terminal and electric water pump connector.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-027 (92) - E-032 (2)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
E-027 (92) or E-032 (2) - Body ground	Always	Resistance ∞
E-027 (92) or E-032 (2) - Battery positive	Always	Resistance ∞

OK
Electric water pump relay control circuit is normal

Result

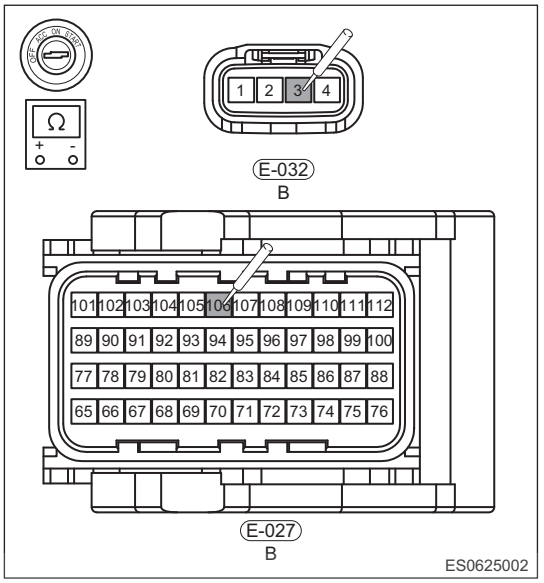
Proceed to
OK
NG

NG → **Repair or replace wire harness or connector (ECM - electric water pump)**

OK

6	Check electric water pump signal feedback circuit

(a) Check wire harness between ECM connector terminal and electric water pump connector.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-027 (106) - E-032 (3)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
E-027 (106) or E-032 (3) - Body ground	Always	Resistance ∞

OK

Electric water pump signal feedback circuit is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness or connector (ECM - electric water pump)**

OK

7	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

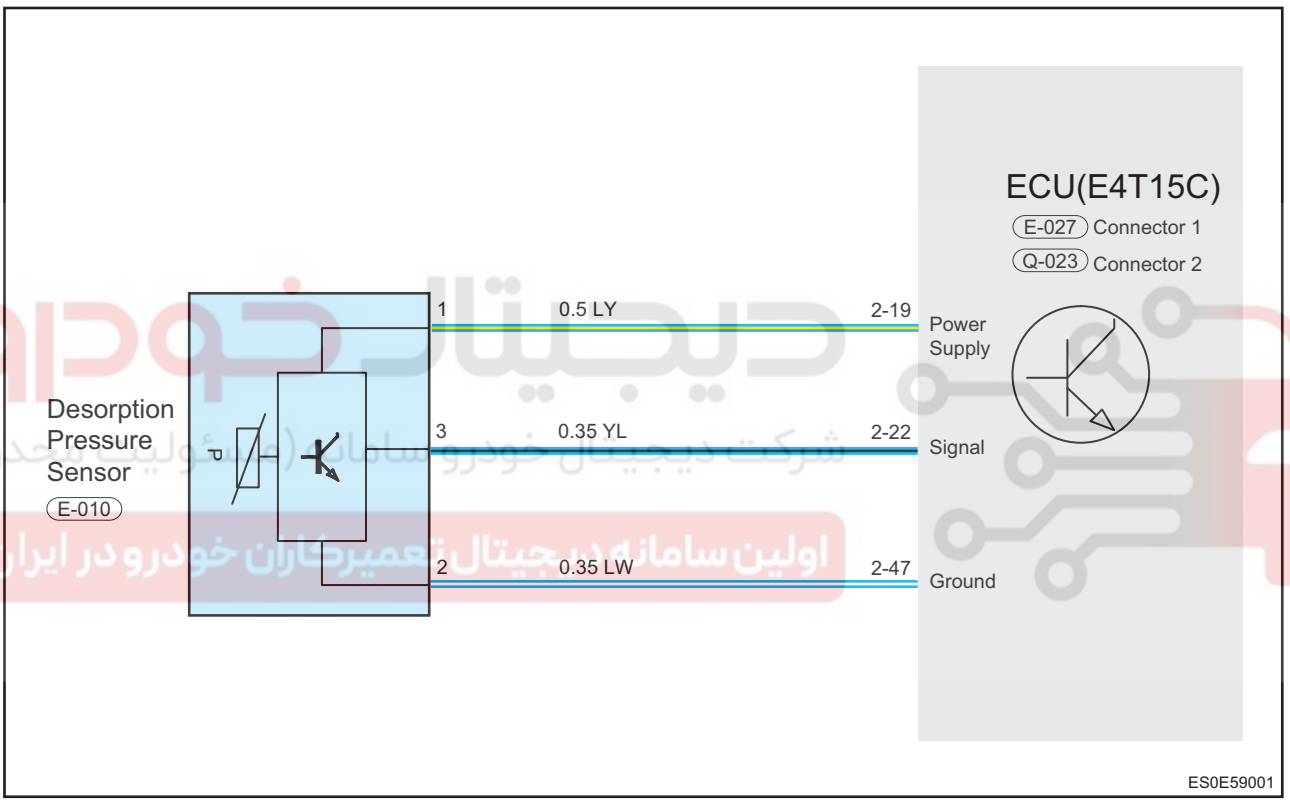
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0468 00	EVAP Purge Flow Sensor Circuit High
DTC	P0467 00	EVAP Purge Flow Sensor Circuit Low
DTC	P1285 00	EVAP Purge Flow Sensor Circuit Range Performance
DTC	P1286 00	EVAP Purge Flow Sensor Circuit Range Performance

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0468 00	EVAP Purge Flow Sensor Circuit High	ENGINE START STOP switch ON, engine running	• Desorption pressure sensor • Wire harness or connector • ECM
P0467 00	EVAP Purge Flow Sensor Circuit Low		
P1285 00	EVAP Purge Flow Sensor Circuit Range Performance		
P1286 00	EVAP Purge Flow Sensor Circuit Range Performance		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.

- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

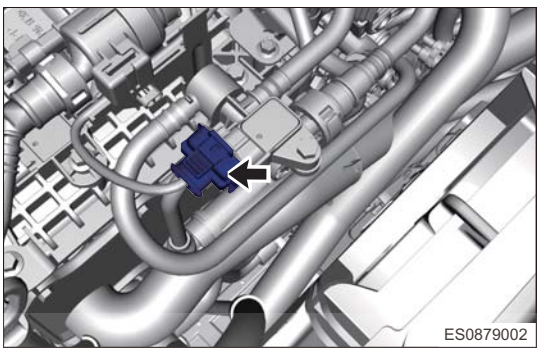
Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check installation of desorption pressure sensor**

(a) Check desorption pressure sensor connector for looseness or poor contact.



Result

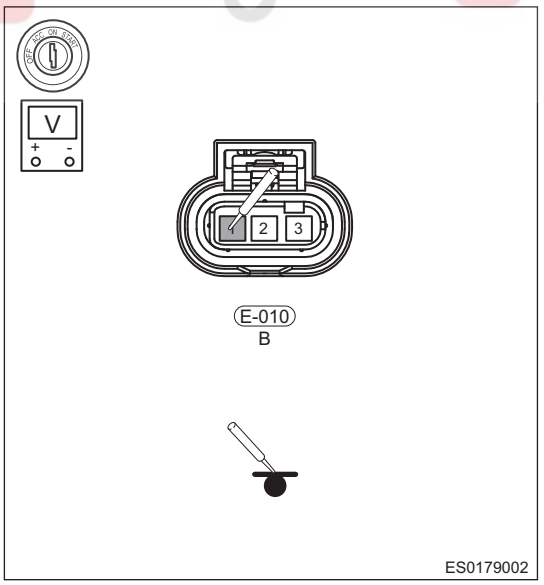
Proceed to
OK
NG

NG → **Reinstall, repair or replace fuel tank pressure sensor**

OK

2	**Check desorption pressure sensor power supply voltage**

(a) Turn ENGINE START STOP switch to ON.
(b) Desorption pressure sensor connector E-010 (using a digital multimeter) (online detection).



Multimeter Connection	Condition	Specified Condition
E-010 (1) - Body ground	ENGINE START STOP switch ON	5 V

OK

Desorption pressure sensor power supply voltage is normal

Result

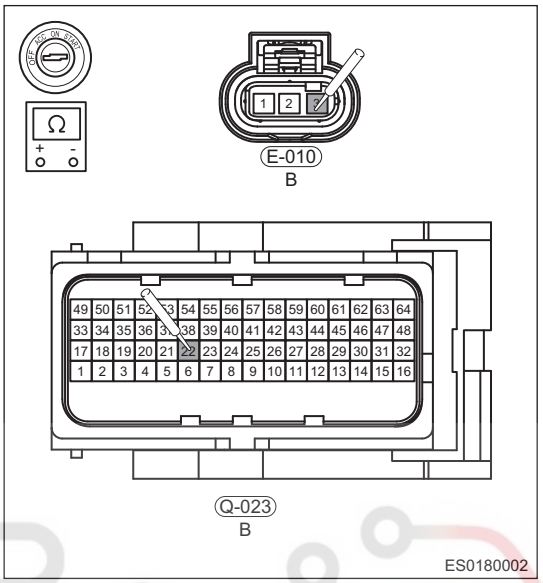
Proceed to
OK
NG

NG → **Check and repair wire harness between desorption pressure sensor power supply wire and ECM**

OK

3	Check desorption pressure sensor signal circuit

(a) Turn off ENGINE START STOP switch and disconnect the negative battery cable.
(b) Disconnect the desorption pressure sensor and ECM connectors.
(c) Measure wire harness between connector E-010 and ECM Q-023.



Multimeter Connection	Condition	Specified Condition
E-010 (3) - Q-023 (22)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

4	Check desorption pressure sensor

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the desorption pressure sensor connector.
(d) Check sensor connection part for debris, ice, oil and damage.

OK

Desorption pressure sensor itself has no malfunction

Result

Proceed to
OK
NG

NG → **Replace desorption pressure sensor**

OK

5	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.

(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC still exists.

OK

No same DTC is output

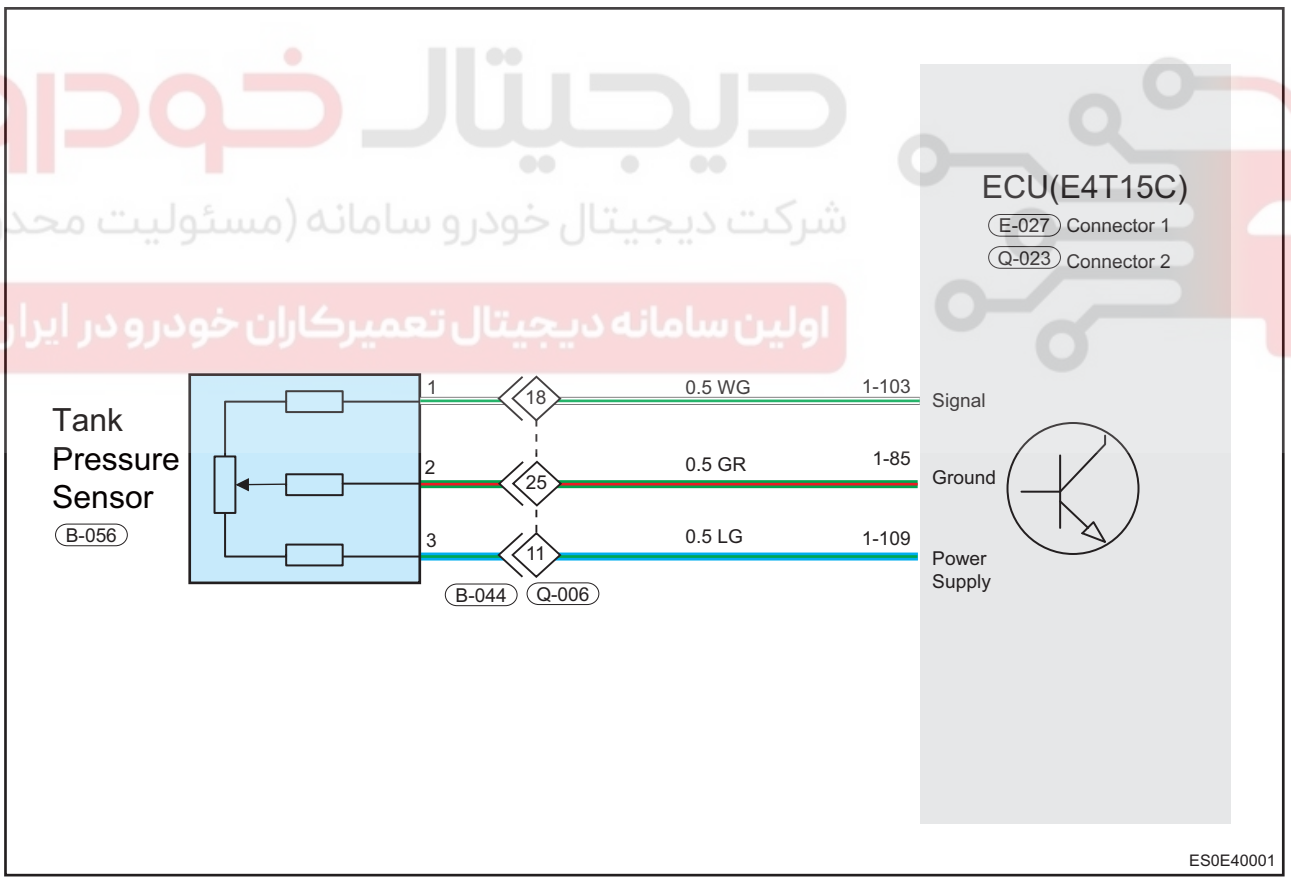
Result

Proceed to
OK
NG

OK	**System operates normally**
NG	**Replace with a new ECM to check if fault reoccurs**

DTC	P0451 28	EVAP System Pressure Sensor&Switch Circuit Range Performance
DTC	P0452 00	EVAP System Pressure Sensor&Switch Circuit Low
DTC	P0453 00	EVAP System Pressure Sensor&Switch Circuit High
DTC	P0451 2A	EVAP System Pressure Sensor&Switch Circuit Range Performance
DTC	P0451 25	EVAP System Pressure Sensor&Switch Circuit Range Performance

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0451 28	EVAP System Pressure Sensor&Switch Circuit Range Performance	ENGINE START STOP switch ON, engine running	• Fuel tank pressure sensor • Wire harness or connector • ECM
P0452 00	EVAP System Pressure Sensor&Switch Circuit Low		
P0453 00	EVAP System Pressure Sensor&Switch Circuit High		
P0451 2A	EVAP System Pressure Sensor&Switch Circuit Range Performance		
P0451 25	EVAP System Pressure Sensor&Switch Circuit Range Performance		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check installation of fuel tank pressure sensor**

(a) Check fuel tank pressure sensor connector for looseness or poor contact.

Result

Proceed to
OK
NG

NG → **Reinstall fuel tank pressure sensor**

OK

2	**Check fuel tank pressure sensor power supply voltage**

(a) Turn ENGINE START STOP switch to ON.

(b) Fuel tank pressure sensor connector B-056 (using a digital multimeter) (online detection).

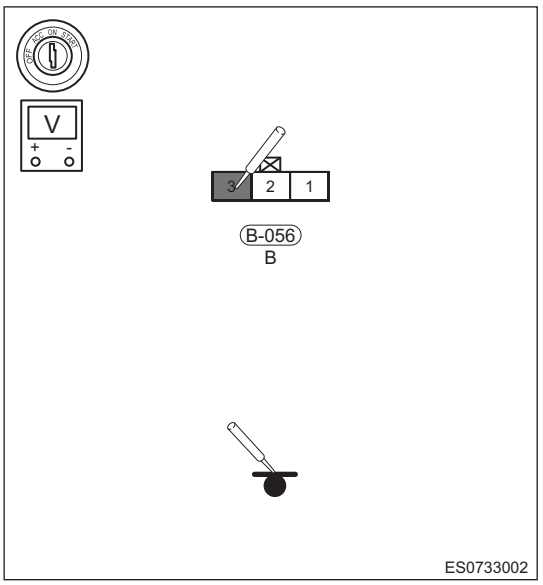
Multimeter Connection	Condition	Specified Condition
B-056 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Fuel rail pressure/temperature sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG → **Check and repair wire harness between fuel tank pressure sensor power supply wire and ECM**

OK

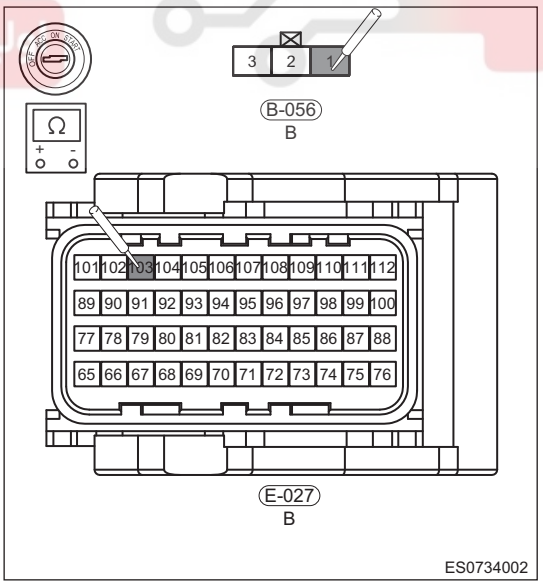
3 Check fuel tank pressure sensor signal circuit

(a) Turn off ENGINE START STOP switch and disconnect the negative battery cable.
(b) Disconnect fuel tank pressure sensor connector and ECM connectors.
(c) Measure wire harness between connector B-056 and ECM E-027.

Multimeter Connection	Condition	Specified Condition
B-056 (1) - E-027 (103)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG



NG → **Repair or replace wire harness**

OK

4	Check fuel tank pressure sensor

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect fuel tank pressure sensor connector.
(d) Check sensor connection part for debris, ice, oil and damage.

OK

Fuel tank pressure sensor itself has no malfunction

Result

Proceed to
OK
NG

NG → **Replace fuel tank pressure sensor**

OK →

5	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK → **System operates normally**

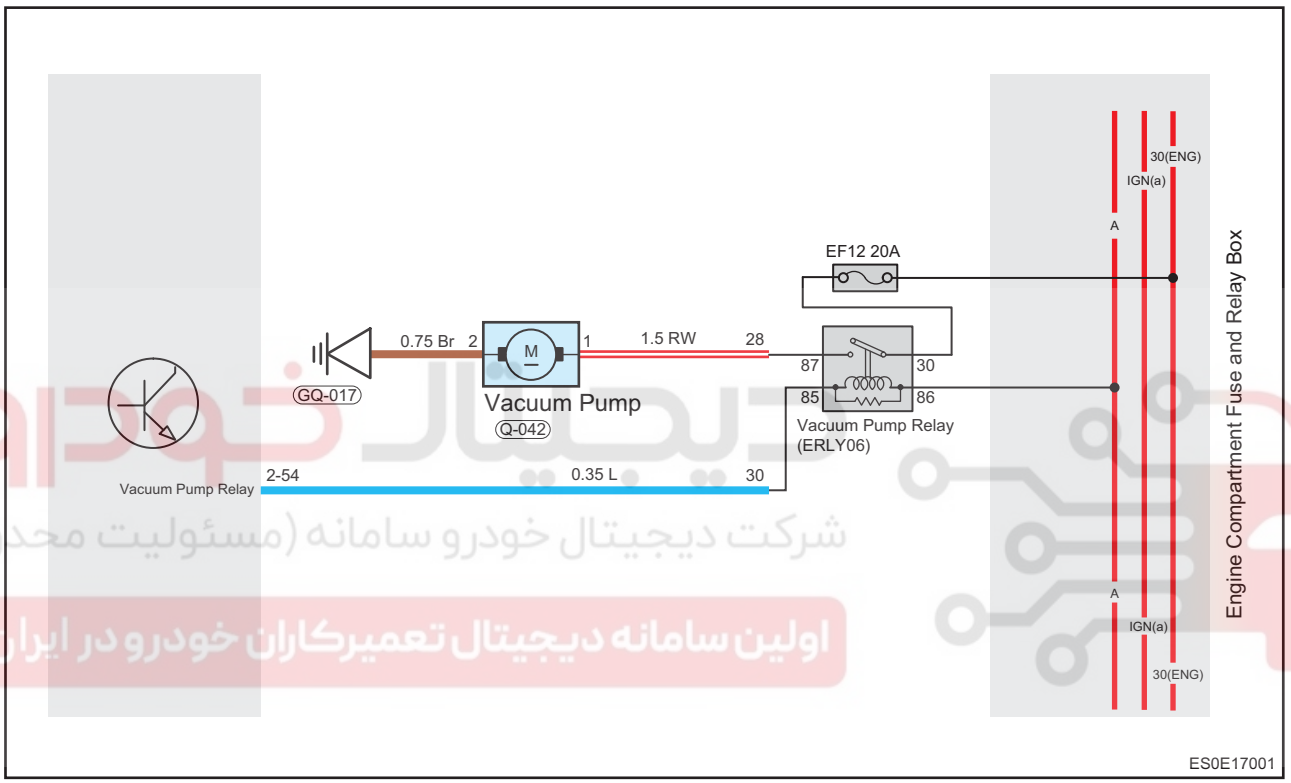
NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P258D 00	Diagnosis of Brake Booster Pump Malfunction

DTC	P258C 00	Diagnosis of Brake Booster Pump Control Circuit High

DTC	P258A 00	Diagnosis of Brake Booster Pump Control Circuit Low

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P258D 00	Diagnosis of Brake Booster Pump Malfunction	ENGINE START STOP switch ON, engine running	• Brake vacuum booster pump relay • Wire harness or connector • Battery • ECM
P258C 00	Diagnosis of Brake Booster Pump Control Circuit High		
P258A 00	Diagnosis of Brake Booster Pump Control Circuit Low		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction is intermittent.

Caution:
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check battery voltage**

(a) Check if battery terminals are corroded or loose.
(b) Check battery voltage with a digital multimeter.

OK
Not less than 12V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

OK ↓

2	**Check brake vacuum booster pump fuse and relay**

(a) Check if brake vacuum booster pump fuse EF12 (20A) is blown or no power.
(b) Unplug the brake vacuum booster pump relay, check if relay terminal is corroded or broken.
(c) Directly apply battery voltage to relay control terminal, check if relay closes.

Result

Proceed to
OK
NG

NG → **Replace fuse or relay or check the cause for no power**

OK ↓

3	**Check brake vacuum booster pump connector**

(a) Check if brake vacuum booster pump connector Q-042 is infirmly connected or poorly contacted.

OK
Brake vacuum booster pump connector is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness or connector**

OK

4	Check brake vacuum booster pump relay power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Check voltage between brake vacuum booster pump relay terminals 2, 3 and body ground (using a digital multimeter).
Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Brake vacuum booster pump relay (2, 3) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK
Brake vacuum booster pump relay power supply voltage is normal

Result

Proceed to
OK
NG

NG → **Check and repair battery or other abnormal factors affecting voltage**

OK

5	Check vacuum pump power supply terminal voltage

(a) Disconnect the vacuum pump connector.
(b) Check the vacuum pump Q-042 (1) terminal voltage.
Check for Open

Multimeter Connection	Condition	Specified Condition
Q-042 (1) - Ground	ENGINE START STOP switch ON	Not less than 12V

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness between vacuum pump and engine compartment fuse and relay box**

OK

6	Replace brake vacuum pump and reconfirm DTCs

(a) Using diagnostic tester, read ECM DTC.
(b) Check if DTC still exists.

OK

No same DTC is output

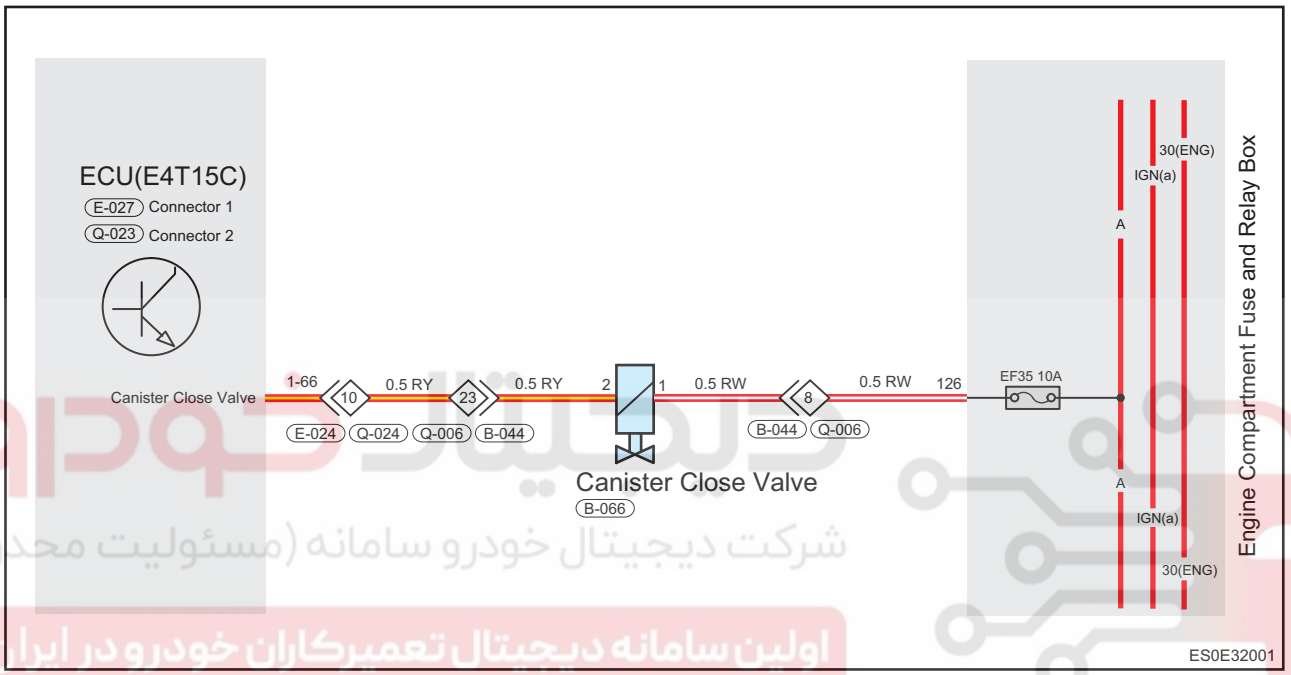
Result

Proceed to
OK
NG

OK	System operates normally
NG	Replace with a new ECM to check if fault reoccurs

DTC	P0499 00	EVAP System Vent Valve Control Circuit High
DTC	P0498 00	EVAP System Vent Valve Control Circuit Low
DTC	P0477 00	EVAP System Vent Control Circuit Open
DTC	P2422 00	EVAP System Vent Valve Stuck Closed

Circuit Diagram



Canister Vent Valve = Canister Closed Valve

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0499 00	EVAP System Vent Valve Control Circuit High	ENGINE START STOP switch ON, engine running	• Canister vent valve • Wire harness or connector • Engine compartment fuse and relay box
P0498 00	EVAP System Vent Valve Control Circuit Low		
P0477 00	EVAP System Vent Control Circuit Open		
P2422 00	EVAP System Vent Valve Stuck Closed		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

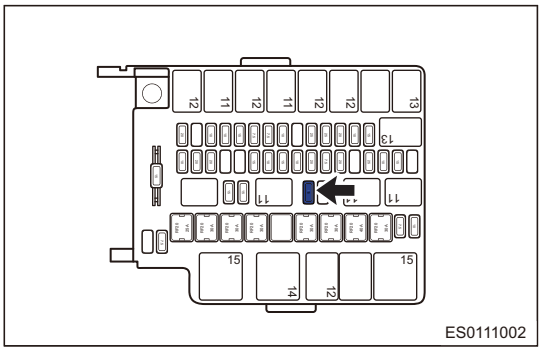
Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	Check canister ventilation solenoid valve fuse EF35

(a) Check if fuse EF35 (arrow) is blown or no power



Result

Proceed to
OK
NG

NG → **Replace fuse or check the cause for no power**

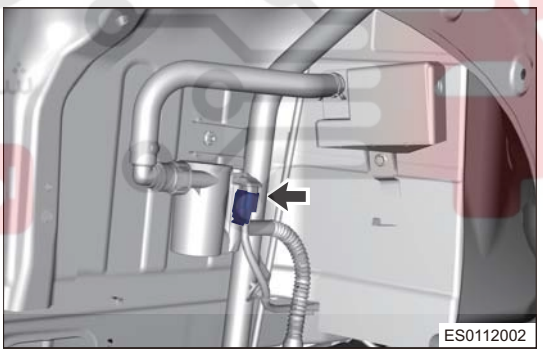
OK

2	Check canister ventilation solenoid valve connector

(a) Check if canister ventilation solenoid valve connector B-066 (arrow) is infirmly connected or poorly contacted.

OK

Canister ventilation solenoid valve connector is installed normally



Result

Proceed to
OK
NG

NG → **Reinstall or repair, replace connector**

OK

3	Check canister ventilation solenoid valve power supply voltage

(a) Turn ENGINE START STOP switch to ON.

(b) Check voltage of canister ventilation solenoid valve connector B-066 terminal 1 (using a digital multimeter) (online detection).

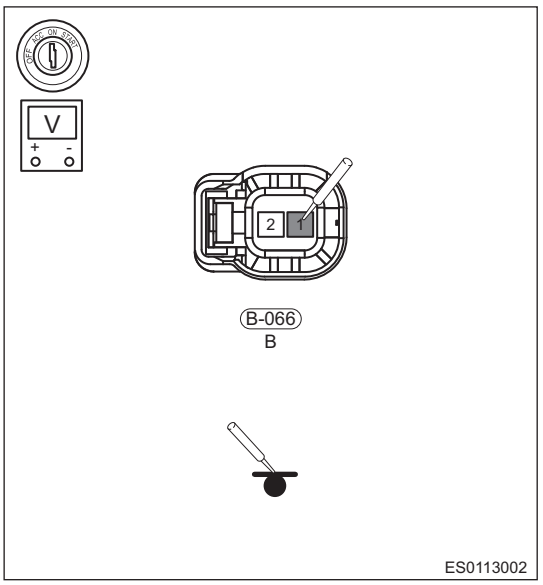
Multimeter Connection	Condition	Specified Condition
B-066 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12V

OK

Voltage between canister ventilation solenoid valve connector and body ground is normal

Result

Proceed to
OK
NG



NG → **Check wire harness between B-066 (1) and engine compartment fuse and relay box**

OK

4 Check canister ventilation solenoid valve control circuit

(a) Disconnect ECM connector E-027

(b) Check wire harness between canister ventilation solenoid valve connector terminal and ECM connector terminal.

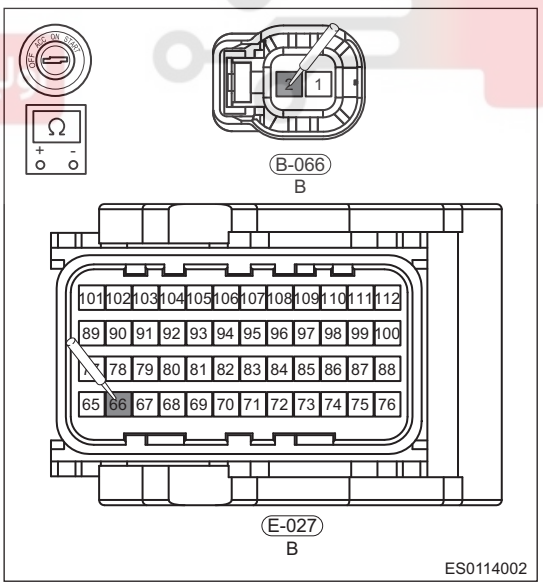
Multimeter Connection	Condition	Specified Condition
B-066 (2) - E-027 (66)	Always	Resistance ⩽ 1 Ω

OK

Continuity between canister ventilation solenoid valve connector terminal and ECM connector terminal is normal

Result

Proceed to
OK
NG



NG → **Replace wire harness or connector (canister ventilation solenoid valve - ECM)**

OK

5	Check canister ventilation solenoid valve

(a) Replace canister ventilation solenoid valve with a new one, check if DTC exists

OK

Canister ventilation solenoid valve is normal

Result

Proceed to
OK
NG

NG → **Replace canister ventilation solenoid valve**

OK →

6	Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

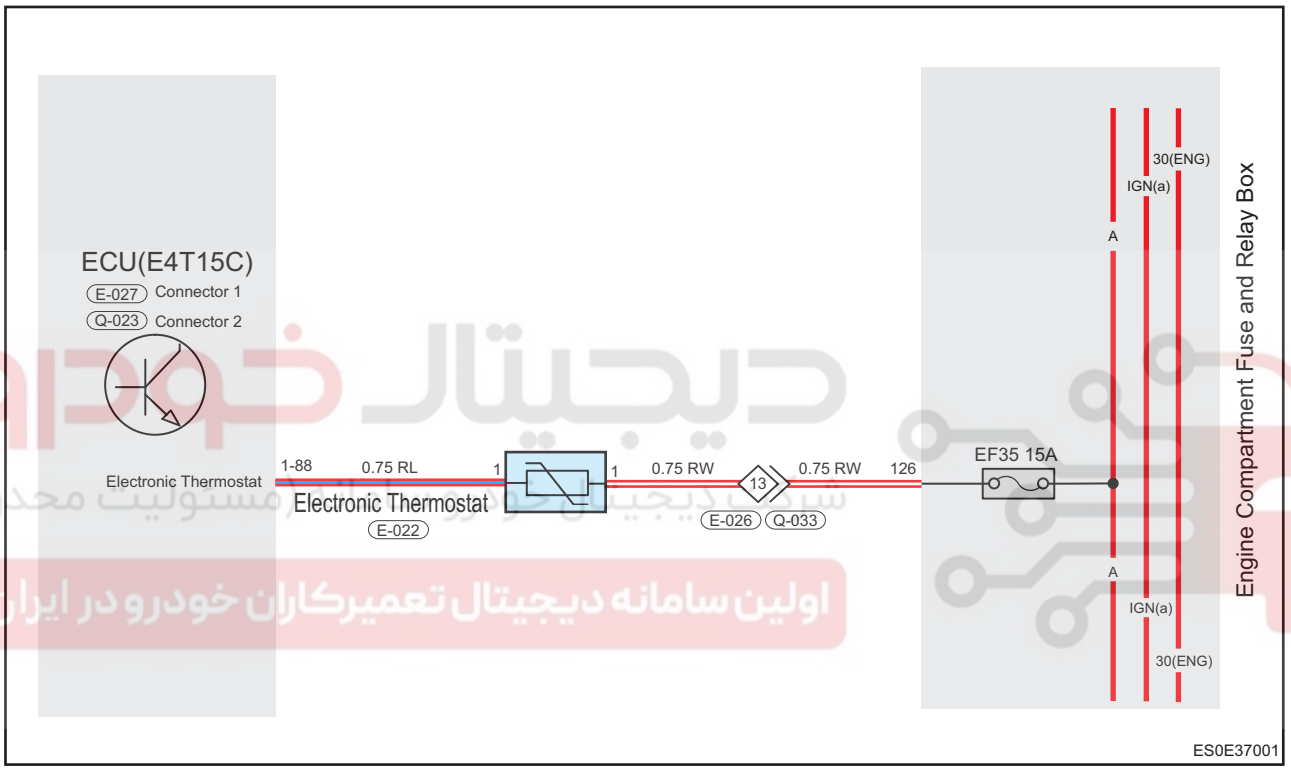
Proceed to
OK
NG

OK → **System operates normally**

NG → **Replace with a new ECM to check if fault reoccurs**

DTC	P0597 00	Thermostat Heater Control Circuit Open
DTC	P0599 00	Thermostat Heater Control Circuit High
DTC	P0598 00	Thermostat Heater Control Circuit Low
DTC	P0128 00	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0597 00	Thermostat Heater Control Circuit Open	ENGINE START STOP switch ON, engine running	• Electronic thermostat • Wire harness or connector • Battery • ECM
P0599 00	Thermostat Heater Control Circuit High		
P0598 00	Thermostat Heater Control Circuit Low		
P0128 00	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)		

Confirmation Procedure

Confirm that battery voltage is no less than 12V before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.

- If DTC is not detected, malfunction is intermittent.

Caution:

- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure

1	**Check battery voltage**

(a) Check if battery terminals are corroded or loose.
(b) Check battery voltage with a digital multimeter.

OK

Not less than 12V

Result

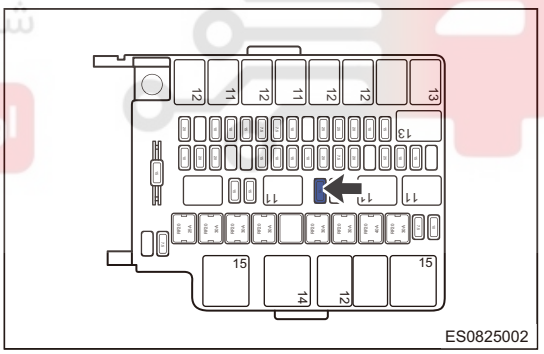
Proceed to
OK
NG

NG → **Check and repair battery**

OK

2	**Check electronic thermostat fuse**

(a) Check if fuse EF35 (15A) is blown or no power.



Result

Proceed to
OK
NG

NG → **Replace fuse or check the cause for no power**

OK

3	**Check electronic thermostat connector**

(a) Check electronic thermostat connector for looseness or poor connection.

Result

Proceed to
OK
NG

NG → **Repair or replace connector**

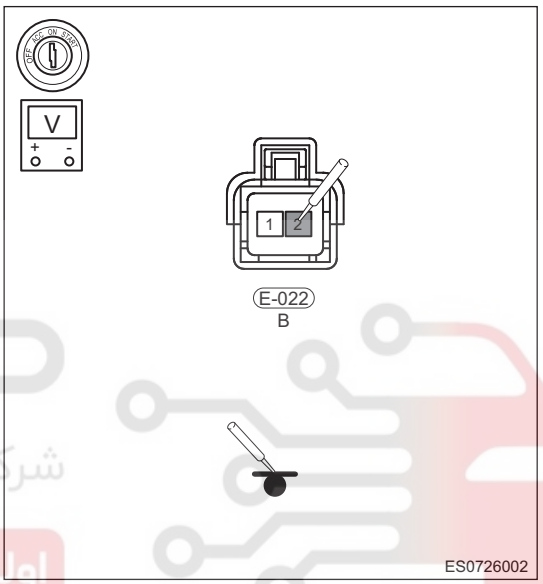
OK

4 Check electronic thermostat power supply voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Check voltage between electronic thermostat connector terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-022 (2) - Body ground	ENGINE START STOP switch ON	Not less than 12V



OK

Check if electronic thermostat power supply voltage is normal

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness between electronic thermostat and engine compartment fuse and relay box**

OK

5 Check electronic thermostat control circuit

(a) Disconnect the ECM connector E-504.

(b) Check wire harness between electronic thermostat connector terminal and ECM connector terminal.

Check for Open

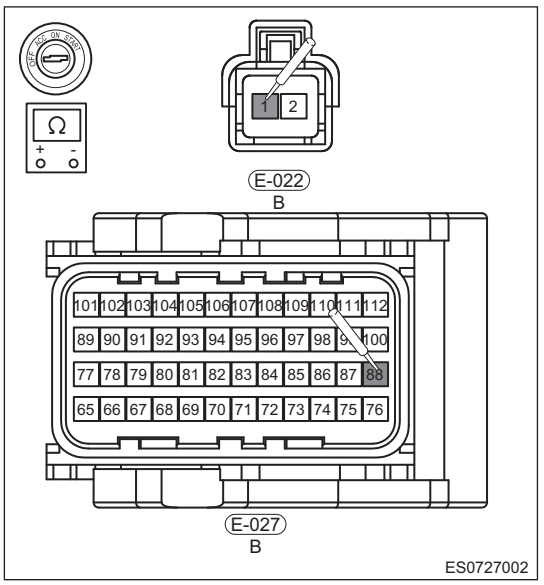
Multimeter Connection	Condition	Specified Condition
E-022 (1) - E-027 (88)	Always	Resistance ⩽ 1 Ω

OK

Continuity between electronic thermostat connector terminal and ECM connector terminal is normal

Result

Proceed to
OK
NG



NG → **Replace wire harness or connector (electronic thermostat - ECM)**

OK

6 Check electronic thermostat

(a) Measure electronic thermostat resistance, check for a short or open circuit in electronic thermostat.

OK

Electronic thermostat is normal

Result

Proceed to
OK
NG

NG → **Replace electronic thermostat**

OK

7 Reconfirm DTCs

(a) Connect the negative battery cable.
(b) Turn ENGINE START STOP switch to ON.
(c) Using diagnostic tester, read ECM DTC.
(d) Check if DTC still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK	System operates normally
NG	Replace with a new ECM to check if fault reoccurs

Diagnosis Process of Electronic Fuel Injection System According to Trouble Symptom

Fuel Pressure Test

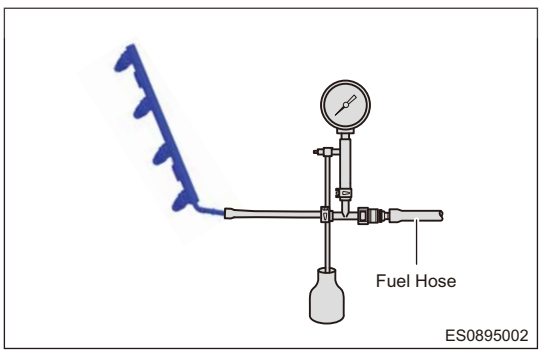
1. Fuel Pressure Specifications

SQRE4T15C	Pressure (kpa)
Fuel Rail Fuel Pressure (ENGINE START STOP switch ON)	400 (When power is on, pressure of fuel supply system is kept at 400 kPa - key (ON). For the new vehicle, after it is added with a certain fuel, make sure that measured fuel pressure on fuel rail at 13 s can reach 90% or higher of rated pressure.)
Fuel Rail Fuel Pressure (Engine Idling)	400
Fuel Rail Fuel Pressure (ENGINE START STOP switch OFF)	400 (Turn off oil pump after it runs for 5 minutes, test changes of pressure in oil outlet of oil pump within 48 hours, the pressure should be not less than 100 kPa; When system pressure is 80%, turn power and oil outlet off, the maximum pressure will not drop more than 10% in 1min.)

Caution:
- When operating the fuel supply system, work area should be in good ventilation and keep fire sources or open flames away from the work area, in which fire extinguisher should be equipped.
- Before operating the fuel supply system, please touch the vehicle body to discharge static electricity; failure to do so will cause a fire, even result in an explosion.
- Before removing and installing fuel pipes, release the fuel supply system pressure.

Warning:
- Make sure that battery voltage is not less than 12V.
- The service life of fuel filter assembly should be within 30000 km.
- Fuel amount is at least 25% of fuel tank capacity.
- Make sure that fuel supply system lines are securely connected, preventing the fuel supply system from leaking.

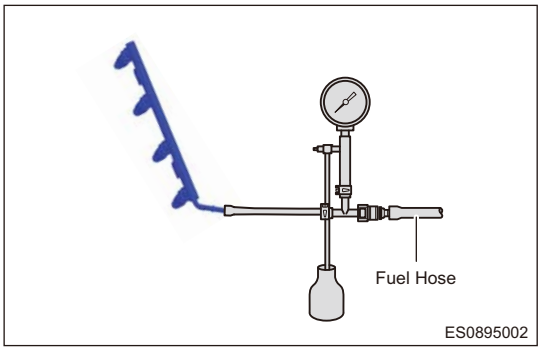
2. Check fuel pressure process
   (a) Fuel system pressure release.
   (b) Remove the engine trim cover.
   (c) Disconnect the inlet pipe II connector and connect the fuel supply system pressure tester between inlet pipe II and fuel rail.



   (d) Start engine and run it at idle, and then read the value on pressure tester.
   Warning:
   - Standard pressure at idle should be 400 kPa.
   - If measured pressure value is lower than 380 kPa or higher than 420 kPa, check vehicle fuel supply line for leakage or kink, check fuel filter or injector for blockage, function of electric fuel pump for abnormality.
   - Replace fuel filter, injector or electric fuel pump assembly if necessary.

3. Fuel flow test method

(a) Disconnect the inlet pipe II connector and connect the fuel supply system pressure tester between inlet pipe II and fuel rail.



(b) Start engine, increase engine speed (such as throttle fully opens), and observe if the reading of pressure gauge is lower than 0.1 Mpa (100 kPa) of system pressure to judge that flow is insufficient.

(c) If flow is insufficient, fuel filter blockage, line blockage or bend, fuel pump wear or mesh blockage may be the problem cause.

Hint:

- Replace the fuel filter firstly if necessary. If line is blocked or bend, repair or replace it and retest flow, if it is eligible, the problem is eliminated. If it is ineligible, replace fuel pump and wash impurities in fuel tank.

Diagnosis Process of Electronic Fuel Injection System According to Trouble Symptom

1. Perform primary inspection first before starting the procedure for troubleshooting based on the engine problem symptoms
   (a) Confirm that engine malfunction indicator operates normally;
   (b) Using diagnostic tester, check that no error messages are recorded;
   (c) Confirm that malfunction complained by customer is present, and confirm the condition under which malfunction occurs.
2. Then, perform appearance inspection
   (a) Check fuel line for leakage;
   (b) Check if vacuum line is broken or twisted, and if connection is correct;
   (c) Check intake line for blockage, air leakage, crush or damage;
   (d) Check if high-voltage cable of ignition system is broken or deteriorated, and if ignition sequence is correct;
   (e) Check if wire harness ground points are clean and secure;
   (f) Check each sensor or actuator connector for looseness or poor contact.

Caution:

If above conditions exist, repair the trouble areas first. Otherwise it will affect the repair work for following trouble diagnosis.

3. Diagnostic Help
   - Confirm that there are no trouble records for engine;
   - Confirm that the trouble conditions exist;
   - There are no abnormal conditions after performing inspection according to above procedures;
   - During service, do not ignore vehicle maintenance condition, cylinder pressure, mechanical ignition timing and fuel condition, etc. that can affect the system;
   - Replace ECM and perform real-vehicle check and test.

   If trouble symptom can be eliminated, trouble area is in ECM; if trouble symptom still exists, reuse the original ECM, repeat the procedures, and perform service again.

Engine Does Not Crank or Cranks Slowly While Starting

1. Check voltage between two battery posts when engine starts
   - OK: Voltage is 13.5 to 14.8V

   NG
   Replace battery
   OK
2. Check voltage of starter motor positive post
   (a) ENGINE START STOP switch remains in START position and check the voltage of starter motor positive post.
   - OK: Voltage is 13.5 to 14.8V

   NG
   Repair or replace starter relay, wire harness or ECM
   OK
3. Check operation of starter motor
   (a) Remove the starter.
   (b) Check if there is an open circuit or if it is stuck due to poor lubrication.

   NG
   Repair or replace starter
   OK
4. Check engine lubricant and gear oil
   (a) If malfunction only occurs in winter, check if starter motor resistance is too strong because of improper engine lubricant and gear oil selection.

   NG
   Replace lubricant with appropriate number
   OK
5. Check engine internal mechanical resistance
   (a) Check if engine internal mechanical resistance is too strong, causing starter motor not to run or run slowly.

   NG
   Check and repair engine internal resistance malfunction

   OK
   Go to Diagnostic Help

Engine Cranks Normally But Cannot Start Successfully While Starting

1. Engine cranks normally but cannot start successfully while starting
   (a) Check fuel pressure.

   NG
   Repair or replace fuel system
   OK
2. Using diagnostic tester, observe if any speed signal is output
   (a) Connect diagnostic tester, start engine and select Read Datastream.
   (b) Observe if any speed signal is output.

   NG
   Check crankshaft position sensor wire harness
   OK
3. Check ignition system

(a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

4. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

Difficult to Start With Hot Engine

1. Check fuel pressure

(a) Check fuel pressure.

NG

Repair or replace fuel system

OK

2. Check ignition system

(a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.

- OK: Spark is generated

NG

Check ignition system

OK

3. Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

NG

Check engine to confirm cause of low compression

OK

4. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

5. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

OK

Go to Diagnostic Help

Difficult to Start With Cold Engine

1. Check fuel pressure

(a) Check fuel pressure.

NG

Repair or replace fuel system

OK

2. Check ignition system

(a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.
- OK: Spark is generated

NG
Check ignition system
OK

3. Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

NG
Check engine to confirm cause of low compression
OK

4. Depress accelerator pedal slightly, and observe if it is easy to start

NG
Clean or replace throttle
OK

5. Check injector for leakage or blockage

NG
Clean or replace injector nozzle
OK

6. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG
Replace fuel
OK

7. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG
Check engine to confirm cause of low compression

OK
Go to Diagnostic Help

Engine Speed is Normal, But it is Difficult to Start at Anytime

1. Check air filter for blockage, and intake pipe for air leakage

NG
Check and repair intake system
OK

2. Check fuel pressure

(a) Check fuel pressure.

NG
Repair or replace fuel system
OK

3. Check spark plug

(a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG
Replace spark plug
OK

4. Check ignition system

(a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.
OK: Spark is generated

NG
Replace ignition system
OK

5. Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

NG
Check and repair circuit or replace sensor
OK

6. Depress accelerator pedal slightly, and observe if it is easy to start

NG
Clean or replace throttle
OK

7. Check injector for leakage or blockage

NG
Clean or replace injector nozzle
OK

8. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG
Replace fuel
OK

9. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG
Check engine to confirm cause of low compression

OK
Go to Diagnostic Help

10. Check engine ignition sequence and ignition timing

(a) Check if engine ignition sequence and ignition timing are as specified.

NG
Check and repair ignition timing

OK
Go to Diagnostic Help

Engine Starts Normally, But Idles Roughly at Anytime

1. Check air filter for blockage, and intake pipe for air leakage

NG
Check and repair intake system
OK

2. Check if throttle is stuck

NG
Repair or replace throttle
OK

3. Check spark plug

(a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Repair or replace spark plug

OK

4. Check throttle for carbon deposits

NG

Clean throttle

OK

5. Check injector for leakage or blockage

NG

Clean or replace injector

OK

6. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

OK

7. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

8. Check engine ignition sequence and ignition timing

(a) Check if engine ignition sequence and ignition timing are as specified.

NG

Check and repair ignition timing

OK

Go to Diagnostic Help

Engine Starts Normally, But Idles Roughly During Warming up

1. Check air filter for blockage, and intake pipe for air leakage

NG

Check and repair intake system

OK

2. Check spark plug

(a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Repair or replace spark plug

OK

3. Check throttle for carbon deposits

NG

Clean throttle

OK

4. Unplug coolant temperature sensor connector, start engine and observe if engine idles normally during warming up

NG

Check and repair circuit or replace sensor

OK

5. Check injector for leakage or blockage

NG

Clean or replace injector

OK

6. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

OK

7. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

Engine Starts Normally, But Idles Roughly after Warming up

1. Check air filter for blockage, and intake pipe for air leakage

NG

Check and repair intake system

OK

2. Check spark plug

(a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Repair or replace spark plug

OK

3. Unplug coolant temperature sensor connector, start engine and observe if engine idles normally during warming up

NG

Check and repair circuit or replace sensor

OK

4. Check injector for leakage or blockage

NG

Clean or replace injector

OK

5. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

OK

6. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

Engine Starts Normally, But Idles Roughly Or Stalls With Part Load (For Example, A/C is ON)

1. Check throttle for carbon deposits
   NG
   Clean throttle
   OK
2. Observe if engine output increases when A/C is turned on. In other words, observe changes of ignition advance angle, injection pulse width and intake air volume using diagnostic tester
   NG
   NEXT
   OK
3. Check if A/C compressor pump resistance increases
   NG
   Check and repair or replace A/C system
   OK
4. Observe if engine speed increases when A/C is turned on
   NG
   Replace ECM to perform real-vehicle check
   OK
5. Check injector for leakage or blockage
   NG
   Clean or replace injector
   OK
   Go to Diagnostic Help

Engine Starts Normally, But Idle Speed is Too High

1. Check if accelerator pedal is stuck
   NG
   Adjust or replace accelerator pedal
   OK
2. Check intake system and connected vacuum pipe for air leakage
   NG
   Check and repair intake system
   OK
3. Check throttle for carbon deposits
   NG
   Clean or replace throttle
   OK
4. Disconnect coolant temperature sensor connector, start engine and observe if engine idle is normal
   NG
   Check and repair circuit or replace sensor
   OK
5. Check engine ignition timing
   NG
   Check and repair ignition timing
   OK
   Go to Diagnostic Help

Low Engine Speed or Stalls When Accelerating

1. Check air filter for blockage, and intake pipe for air leakage

NG

Check and repair intake system

OK

2. Check fuel pressure

(a) Check fuel pressure.

NG

Repair or replace fuel system

OK

3. Check spark plug

(a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Replace spark plug

OK

4. Check throttle for carbon deposits

NG

Clean throttle

OK

5. Check intake pressure/temperature sensor, throttle position sensor and circuit

NG

Check and repair circuit or replace sensor

OK

6. Check injector for leakage or blockage

NG

Clean or replace injector

OK

7. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

NG

8. Check engine ignition sequence and ignition timing

(a) Check if engine ignition sequence and ignition timing are as specified.

NG

Check and repair ignition timing

OK

9. Check exhaust system

(a) Check exhaust system for leakage or blockage.

NG

Check and repair ignition timing

OK

Go to Diagnostic Help

Slow Response When Accelerating

1. Check air filter for blockage, and intake pipe for air leakage

NG

Check and repair intake system

OK

2. Check fuel pressure

(a) Check fuel pressure.

NG

Repair or replace fuel system

OK

3. Check spark plug

(a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Replace spark plug

OK

4. Check throttle for carbon deposits

NG

Clean throttle

OK

5. Check intake pressure/temperature sensor, throttle position sensor and circuit

NG

Check and repair circuit or replace sensor

OK

6. Check injector for leakage or blockage

NG

Clean or replace injector

OK

7. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

NG

8. Check engine ignition sequence and ignition timing

(a) Check if engine ignition sequence and ignition timing are as specified.

NG

Check and repair ignition timing

OK

9. Check exhaust system

(a) Check exhaust system for leakage or blockage.

NG

Check and repair ignition timing

OK

Go to Diagnostic Help

Lack of Power and Poor Performance When Accelerating

1. Check if malfunctions that clutch slipping, low tire inflation pressure, brake dragging, incorrect tire size, and incorrect four-wheel alignment are present

NG
Check and repair faulty components
OK

2. Check air filter for blockage, and intake pipe for air leakage

NG
Check and repair intake system
OK

3. Check fuel pressure

(a) Check fuel pressure.

NG
Repair or replace fuel system
OK

4. Check spark plug

(a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG
Replace spark plug
OK

5. Check ignition system

(a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.

- OK: Spark is generated

NG
Check and repair ignition system
OK

6. Check throttle for carbon deposits

NG
Clean throttle
OK

7. Check intake pressure/temperature sensor, throttle position sensor and circuit

NG
Check and repair circuit or replace sensor
OK

8. Check injector for leakage or blockage

NG
Clean or replace injector
OK

9. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG
Replace fuel
NG

10. Check engine ignition sequence and ignition timing

(a) Check if engine ignition sequence and ignition timing are as specified.

NG
Check and repair ignition timing
OK

11. Check exhaust system
    (a) Check exhaust system for leakage or blockage.
        NG
        Check and repair ignition timing
        OK
        Go to Diagnostic Help

Electronic Throttle Body

Function

Electronic throttle body is a critical part for engine intake system. Its main function is to control intake air volume by adjusting intake passage area according to driver's driving intention to meet intake requirements in different engine operating conditions, and send back position signals of throttle valve plate to control unit to achieve accurate control.

1 - Motor Negative	2 - Sensor Ground
3 - Sensor Power Supply	4 - Motor Positive
5 - Signal 2	6 - Signal 1

Operation

Electric throttle body consists of four parts: drive module, train module, executive module and feedback module, and all components are integrated into the same throttle valve housing. Throttle feedback module uses two redundant structures. When malfunction occurs, throttle valve plate will stop at the limp home position (above mechanical bottom dead center) determined by mechanical way. Electronic throttle body performs control only by corresponding electronic control unit or electronic test circuit. In principle, it is necessary to ensure that the throttle valve plate does not operate dynamically to the mechanical dead center.

Throttle Self-learning

Perform throttle body self-learning once after installing electronic throttle body (turn ENGINE START STOP switch to ON and then turn to OFF after waiting for 15 seconds, and then perform ignition normally). Start vehicle and observe if it operates normally after self-learning is finished.

Common Problem Symptoms and Judgment Methods

Common problem symptoms caused by electronic throttle body itself are: lack of power when accelerating, seizure or frequent return of throttle valve plate. EPC light comes on (use diagnostic tester to read related electronic throttle DTCs), vehicle speed does not increase even if accelerator pedal is fully depressed.

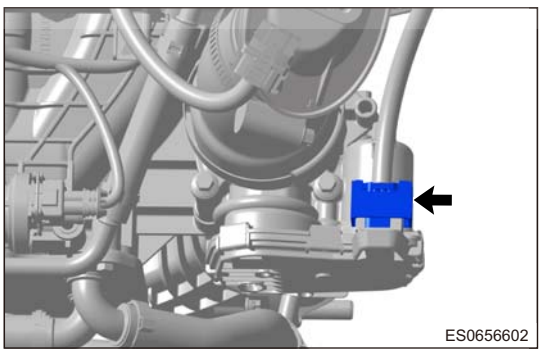
1. General problem causes
   - ECM detects incorrectly due to improper harness or sensor operation, and electronic throttle is forcibly controlled in small opening condition;
   - Internal components (such as magnetic steel) are cracked due to dropping or hitting during use or repair;
   - Vibration level at engine manifold is out of specified range;
   - Excessive carbon deposit in electronic throttle body due to use of engine or vehicle.
2. Repair precaution
   - Never hit electronic throttle body during service, and never use it after dropping;
   - It can be verified by simply measuring resistance change of terminals and crossover test if malfunction occurs caused by electronic throttle body.
3. Simple detection method for electronic throttle body malfunction
   (a) Judgment methods for specific mechanical damage
      - Valve plate should be in default position with power off and can rotate smoothly when flipping it by hand. If catching occurs, it indicates that internal components may be damaged.
   (b) Perform the simple measurement for throttle internal sensor in following steps:

Step	Operation	Test Value	Test Result	Subsequent Step
1	Apply 5V direct current to terminal 3 (+) and 2 (-), close valve plate to full close manually, and measure voltages between terminals 5 and 2, and between terminals 6 and 2 with voltage band of multimeter. Voltage between terminals 6 and 2 is within 0.25 V and 0.75 V, voltage between terminals 5 and 2 is within 4.25 V and 4.75 V, and the sum of both voltages is about 5 V	/	Yes	Next
		/	No	Replace throttle body
2	Apply 5V direct current to terminal 3 (+) and 2 (-), turn valve plate to full open manually, and measure voltages between terminals 5 and 2, and between terminals 6 and 2 with voltage band of multimeter. Voltage between terminals 6 and 2 is within 4.4 V and 4.9 V, voltage between terminals 5 and 2 is within 0.1 V and 0.6 V, and the sum of both voltages is about 5 V	/	Yes	Next
		/	No	Replace throttle body
3	Turn the multimeter to ohm band, directly measure resistance of copper windings on DC motor between terminals 1 and 4. It is usually between 1.5 and 3.0 Ω at normal temperature, this value does not change with the valve plate opening.	/	Yes	Check wire harness or diagnostic help
		/	No	Replace throttle body

4. DTC troubleshooting
   (a) If DTC P0121, P0122, P0123, P221, P222 or P223 is output, refer to methods in previous DIAGNOSIS & TESTING section to perform test.
   (b) If DTC P0606 or P2106 is output, it indicates that electronic throttle is not malfunctioning, perform ECM and throttle self-learning again, and do not replace electronic throttle.
   (c) If it is other malfunction related to electronic throttle, unplug and plug connector again, remove carbon on throttle, to confirm that there is no foreign matter during valve plate opening or closing. Perform other related inspection.

Removal

1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the electronic throttle



   (a) Disconnect electronic throttle connector (arrow), remove 4 fixing bolts and throttle.
   Caution:
   - Before removing throttle, make sure the ENGINE START STOP switch is turned to OFF and always keep vehicle power off, otherwise it will cause idling problems.
   - Do not remove the electrified electronic throttle body.
   - Do not remove the electronic throttle body until the vehicle is cooled to room temperature to prevent the overheating antifreeze from wetting the black cap and connectors etc.
   - During the removal, the mounting bolts shall be removed diagonally and the force shall be uniform and vertical. The upper and lower mounting surfaces shall not be damaged, and also ensure that the electronic throttle body does not drop or hit.

- The power of return spring inside electronic throttle body is greater, be careful not to clamp your hand during pushing valve plate slightly.

(b) Remove the electronic throttle.

Installation

1. Installation is in the reverse order of removal.

Absolute Brake Vacuum Sensor

Description

1 - Sensor Voltage Signal Output	2 - Ground
3 - to 5 V Power Supply	

Installation Position

Installation Position

It is installed on vacuum tube of vacuum system unit, close to vacuum booster.

Caution:

Installation Precautions

1. Always make sure the O-ring is not damaged during installation. Apply a light coat of oil to O-ring surface before installation, and do not use silicon grease.
2. Press sensor detecting sleeve into installation hole manually during installation, and do not install sensor with striking tool.
3. Tightening torque during installation: 4 ~ 7 N·m is recommended.
4. Connect wire harness with specified matched connector.

Operation

Absolute pressure sensing element consists of a piece of silicon chip. Print a piece of pressure diaphragm on silicon chip. There are 4 piezoresistors on pressure diaphragm, and the 4 piezoresistors form a Wheatstone bridge as strain element. Except for the pressure diaphragm, silicon chip is also integrated with signal processing circuit and temperature compensating circuit. Reference vacuum chamber is integrated into silicon chip, and absolute pressure in reference space is near zero. This will form a microelectronic mechanical system. The pressure to be measured acts on side which can sense pressure on silicon film from top side. Thickness of silicon chip is only several micrometer (μm), so the silicon chip will deform mechanically as pressure changes, and 4 piezoresistors will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated after processing by signal processing circuit of silicon chip.

Common Problem Symptoms and Judgment Methods

Problem symptom: vacuum booster does not operate properly.

1. General problem causes
   - Chip is damaged due to abnormal high voltage or reverse large current during operation;
   - Pressure component is damaged during service;
   - Chip is corroded and damaged due to external environment;
   - Sensor itself malfunction.
2. Precautions during service
   - Do not impact pressure component with high pressure gas during service;
   - Check if alternator output voltage and current are normal when there is a fault and replacing sensor.

Camshaft Phaser Assembly Solenoid Valve

Operation

Hint:

- There are two camshaft phaser assembly solenoid valves which are located in front of intake and exhaust camshaft.

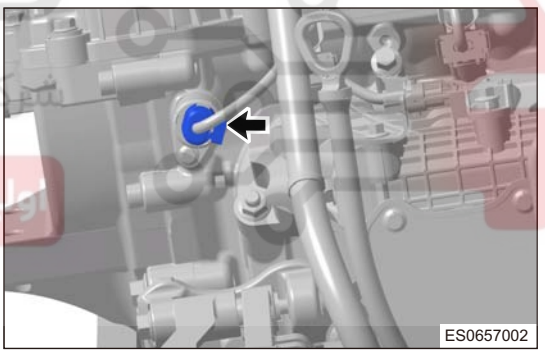
Solenoid valve is controlled by ECM, different oil passages can be opened and the phase can be changed ultimately depending on operating conditions; Variable valve timing technology can improve the power performance of engine and fuel economy by adjusting the timing of valve closing according to different operating status of engine.

Simple measurement method for VVT control valve

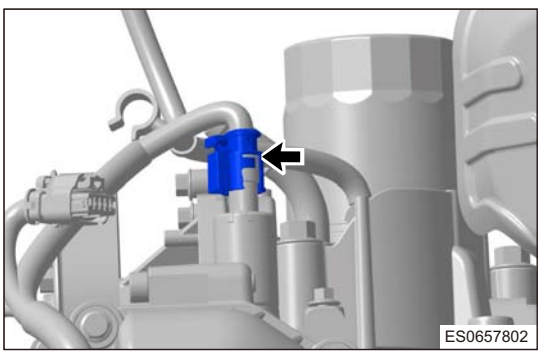
1. Unplug intake/exhaust camshaft phaser assembly solenoid valve connector, and measure solenoid valve resistance with a multimeter. Normal value: 8 ± 0.5 Ω (20°C).
2. Remove intake/exhaust camshaft phaser assembly solenoid valve, and observe if there is oil stain or oil sludge. If so, clean it in time.

Removal

1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Camshaft Phaser Assembly Solenoid Valve
   (a) Disconnect intake camshaft phaser assembly solenoid valve connector (arrow) and remove intake camshaft phaser assembly solenoid valve fixing bolt.
   Tightening torque
   8 ± 2 N·m



5. Remove exhaust camshaft phaser assembly solenoid valve
   (a) Disconnect exhaust camshaft phaser assembly solenoid valve connector and remove exhaust camshaft phaser assembly solenoid valve fixing bolt.
   Tightening torque
   8 ± 2 N·m



Installation

1. Installation is in the reverse order of removal.

Coolant Temperature Sensor

Description

Coolant temperature sensor is a negative temperature coefficient sensor.
Coolant temperature sensor terminal: sensor has 2 terminals, and they can be interchanged.

Installation Position

Coolant temperature sensors are installed on engine thermostat seat and engine inlet pipe respectively.

Operation

NTC thermistor packaged inside temperature sensor is used for coolant temperature sensor, its resistance changes in accordance with ambient temperature, thus accurately reflecting the small changes in outside temperature. The temperature of contact medium can be reflected by measuring its output resistance, and the signals from both terminals of resistor are output to ECM. Engine load can be obtained by ECM according to output signal of the sensor, thus judging the engine operating condition.

Installation Precautions

1. Uniformly apply anaerobic seal gum to threads before installation.
2. Pre-tighten it manually when installation, so as to avoid sensor thread damage caused by wrong tooth of thread. Tighten it with socket wrench after manual pre-tightening.
3. If the coolant temperature sensor is installed with level wrench, make sure that the wrench is perpendicular to the axis of sensor during installation, to avoid damage to coolant temperature sensor due to excessive lateral force.

Common Problem Symptoms and Judgment Methods

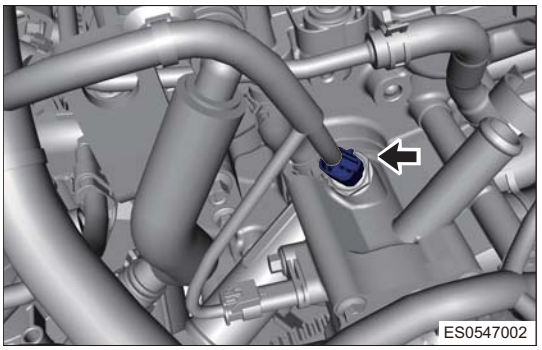
Common problem symptoms related to this sensor: abnormal water temperature indication, difficult to start, fan constantly runs, etc.

1. General problem causes
   - Abnormal high voltage or reverse large current during operation;
   - Sensor housing is damaged, water enters inside during service.
2. Precautions during service: check if alternator output voltage and current are normal when there is a fault and replacing sensor.
3. Simple detection method for oxygen sensor malfunction
   (a) Disconnect wire harness connector (remove connector), turn digital multimeter to ohm band, connect two probes to two terminals of sensor respectively, rated resistance is 2.5 KΩ ± 5% at 20°C, blow air to sensor with a hair dryer (be careful not to get too close), obverse the changes of resistance, it should decrease with the increase of temperature.

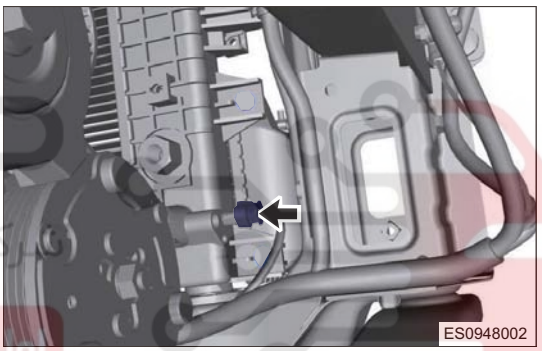
Step	Operation	Test Value	Test Result	Subsequent Step
1	Remove coolant temperature sensor wire harness connector, use a multimeter to measure if resistance between two terminals of sensor is normal	The resistance between the two terminals is determined according to ambient temperature near sensor when testing, and refer to temperature characteristic curve graph below for details.	Yes	Next
			No	Replace coolant temperature sensor
2	Remove coolant temperature sensor wire harness connector, turn ENGINE START STOP switch to ON, measure the voltage between two terminals of coolant temperature sensor wire harness	5 ± 0.5 V	Yes	Diagnostic Help
			No	Check for continuity and ground of wire harness

Removal

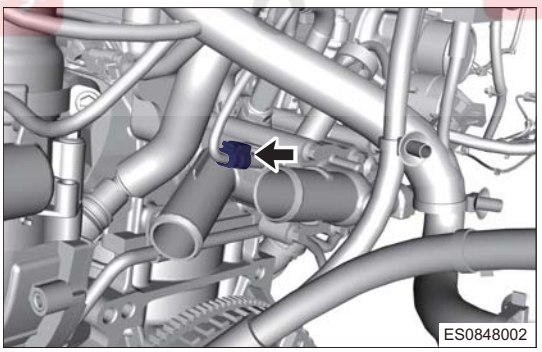
1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
   Caution:
   - Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
3. Remove the engine trim cover.
4. Disconnect coolant temperature sensor 1 connector (arrow) and remove coolant temperature sensor.



5. Disconnect coolant temperature sensor 2 connector (arrow) and remove coolant temperature sensor.



6. Disconnect coolant temperature sensor 3 connector (arrow) and remove coolant temperature sensor.



Installation

1. Installation is in the reverse order of removal.

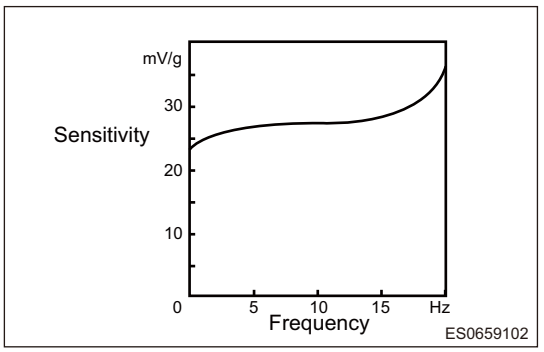
Knock Sensor

Description

Knock sensor is installed on cylinder block. It is used to detect engine vibration caused by detonation.

Installation Position

It is installed between cylinder 2 and cylinder 3.



Operation

Knock sensor is installed on cylinder block, and used to detect engine vibration caused by detonation. You can install one or more.

The sensitive element of knock sensor is a piezoelectric ceramic. Vibration of engine cylinder block is transferred to the piezoelectric ceramic through a mass block in the sensor. Due to the pressure generated by vibration of mass block, the piezoelectric ceramic generates a voltage at both electrode faces, and converts the vibration signal to an AC voltage signal to output it. As intensity of vibration increases, knock sensor output voltage increases accordingly.

Because frequency of vibration signal caused by engine knocking is far more than that of normal engine vibration signal, Engine Control Module (ECM) can distinguish between knock or non-knock signals by processing these signals from knock sensor.

Knock sensor frequency response characteristic curve diagram

Technical Characteristic Parameters

1. Characteristic Data

Quantity		Value	Unit
Sensitivity of new sensor to 7 kHz signal		23.0 - 35.9	mV/g
Sensitivity of new sensor to 19 kHz signal		24.4 - 46.2	mV/g
Linearity between 5 and 15 kHz		±10% of 5 kHz (based on $10m/s^2$)	
Main resonance frequency		＞ 30	kHz
Impedance	Resistance (terminal and copper bush)	＞ 1	MΩ
	Capacitance (probe)	1150 ± 200	pF
Leakage resistance (resistance between two output terminals of sensor)		4.9 ± 20%	MΩ
Variation in sensitivity due to temperature (9 kHz)		⩽ -0.04	mV/g°C

Installation Precautions

Tighten knock sensor to cylinder block through the hole on middle of knock sensor with bolt, and tightening torque is 20 ± 5 N·m. Be careful not to allow liquids such as oil, coolant, brake fluid and water to contact the sensor for a long periods of time. Do not use any type of gasket during installation. The sensor must be pressed against the cylinder block with its metal surface.

Common Problem Symptoms and Judgment Methods

2. Problem symptom: poor acceleration, etc.
3. General problem causes
   - Liquids such as oil, coolant, brake fluid and water contacted with sensor will cause corrosion to the sensor.

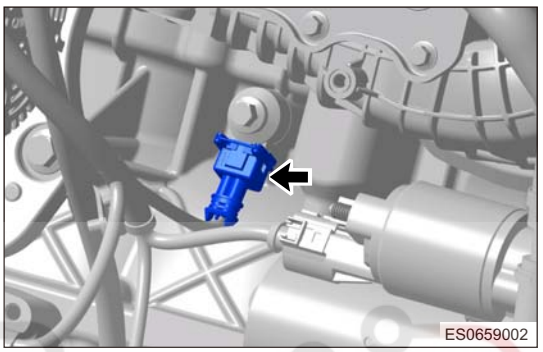
4. Simple detection method for knock sensor malfunction

Step	Operation	Test Value	Test Result	Subsequent Step
1	Turn multimeter to ohm band, detect resistance between terminals 1 and 2 of knock sensor, resistance is (4.9 ± 20%) MΩ at normal temperature	/	Yes	Next
		/	No	Replace knock sensor
2	Turn multimeter to mV band, use a small hammer to tap near knock sensor, there should be a voltage signal	/	Yes	Check wire harness or diagnostic help
		/	No	Replace sensor

Removal

1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Disconnect knock sensor connector, and remove knock sensor.

Tightening torque
20 ± 5 N·m



Installation

1. Installation is in the reverse order of removal.

Caution:

- Never install any kinds of gasket and washer between sensor and engine block. Only the metal part of sensor can contact with engine block directly.
- Be careful not to allow liquids such as oil, coolant and brake fluid to contact the sensor for a long periods of time.
- DO NOT apply lubricant, grease or seal gum when installing knock sensor. Keep engine block clean and dry, and never allow any foreign matter (such as oil) on the installation area of knock sensor.
- Never tap knock sensor when installing it.

Oxygen Sensor

Description

Upstream oxygen sensor is LSU 4.9 and downstream oxygen sensor is LSF 4.2.

Operation

Sensing element of LSF oxygen sensor is a ceramic planar body with pores, and the outside of ceramic body is surrounded by engine exhaust, and the inside is ventilated. Sensing ceramic body wall is a type of solid electrolyte with heating electrodes inside. Operation of oxygen sensor is realized by converting the concentration difference of oxygen ions inside and outside the sensing ceramic body into voltage signals for output. When the temperature of sensing ceramic body reaches 350 °C, it will have the characteristics of solid electrolyte. Oxygen ions can freely pass through it due to special material of ceramic body. It is precisely by taking advantage of this characteristic, it converts the concentration difference into the potential difference, thus forming the electrical signal output. If the gas mixture is rich, the concentration difference of oxygen ions inside and outside of ceramics body is higher, potential difference is higher, a large amount of oxygen ions move from inside to outside, and the output voltage is higher (approximately 800 mV - 1000 mV); If the gas mixture is lean, the concentration difference of oxygen ions inside and outside of ceramics body is lower, potential difference is lower, only a few oxygen ions move from inside to outside, and the output voltage is lower (approximately 100 mV). Signal voltage changes suddenly when near the theoretical equivalent air-fuel ratio (λ = 1).

LSU oxygen sensor is much more advanced in functions than LSH and LSF. It is a combination of ceramic body principle and a "micro pump" for oxygen ion delivery. Sufficient oxygen is supplied to the electrode on contact side of exhaust by the pump to keep the voltage on both sides constant at about 450 mV. Electronic controller converts the electric energy consumption of the pump into the excess air coefficient, and the output current has an almost linear relationship with it, which λ = 0.65 ~ ∞ , so it is also called linear oxygen sensor. Not only can determine λ is more than 1 or less than 1, but also can measure specific values of λ in lean and rich areas, so that excess air coefficient in a large range (that is, wide frequency) can be measured, and enables continuous control from λ<1 to λ>1.

Installation Position

Upstream oxygen sensor is installed at front end of exhaust pipe rear end catalytic converter. For the existing exhaust system, the sensor should be installed as close to the engine as possible on the premise of ensuring that the sensor works below the maximum allowable temperature and continuous working temperature, which is helpful to reduce the open-loop control time of the system and enable the oxygen sensor to work as soon as possible. Exhaust gas entering the oxygen sensor activation ceramic should be representative of the gas in each cylinder, especially when installed at the exhaust manifold or double-pipe joint.

Downstream oxygen sensor is installed inside or behind the catalytic converter. Downstream oxygen sensor is used to monitor the operation of the three-way catalytic converter. In order to ensure that representative exhaust gas reaches the activated ceramic body, if installed in the three-way catalytic converter, consideration should be given to reducing the housing of the three-way catalytic converter where the oxygen sensor is planned to be installed. When installed at the outlet cone of the three-way catalytic converter, the sensor should be perpendicular to the exhaust gas flow as far as possible, and the ceramic should be in the center of the exhaust gas flow as far as possible.

Installation Precautions

1. Applying detergent, oily liquid or volatile solid to the oxygen sensor connector is prohibited.
2. Oxygen sensor shall be installed on the exhaust pipe at a position that can represent the exhaust gas composition and can meet the specified temperature limit. Installation position should be as close to the engine as possible. Upstream oxygen sensor is installed on front of exhaust pipe three-way catalytic converter, and downstream oxygen sensor is installed behind the three-way catalytic converter.
3. Installation method of oxygen sensor: Oxygen sensor shall be installed at an included angle of 10 degrees or more to the horizontal plane with the sensor tip facing downward to prevent condensed water from accumulating between the sensor housing and the sensing ceramic tube during cold start.
4. The sensor mounting probe does not face the airflow direction.

5. When installing the oxygen sensor, it should be handled with care and not allowed to fall to the ground, because there are ceramics inside the oxygen sensor and it is fragile.
6. During installation, do not wipe off the special anti-high temperature grease in the tightening thread.

LSF Technical Parameters

1. Characteristic Data

Description	New		After 500 hours of platform test	
Exhaust temperature when characteristic data is established	350°C	850°C	350°C	850°C
When λ = 0.97 (CO = 1%) Sensing element voltage (mV)	800 ± 55	700 ± 55	800 ± 60	700 ± 60
When λ = 1.10 Sensing element voltage (mV)	50 ± 30	50 ± 30	50 ± 40	50 ± 40
Sensing element internal resistance (kW)	⩽ 0.5	⩽ 0.25	⩽ 1	⩽ 0.5
Response time (ms) (600 mV - 300 mV)	< 250	< 250	< 400	< 250
Response time (ms) (300mV - 600mV)	< 100	< 60	< 200	< 60

2. Sensor electrical data

Description		Value	Unit
Power supply voltage on connector	Rated voltage	12	V
	Continuous operating voltage	12 - 14	V
	Operating voltage which can be maintained 1% of the total life at most (exhaust temperature ⩽ 850°C)	15	V
	Operating voltage which can be maintained 75 seconds at most (exhaust temperature ⩽ 350°C)	18	V
	Test voltage	13	V
Heating power for 13 V of operating voltage, and 350°C of exhaust temperature		7	W
Short time heating current at 13 V of operating voltage and -40°C of ambient temperature		⩽ 2.1	A

LSU Technical Parameters

1. Characteristic Data

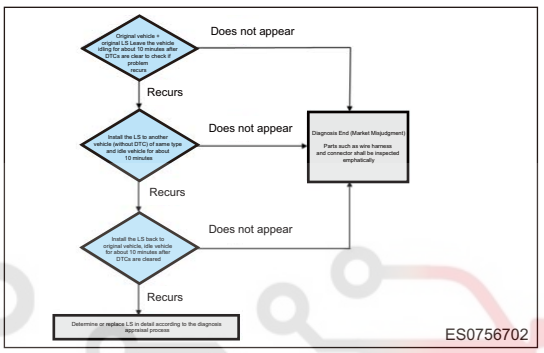
Description	New	After platform test
λ signal accuracy when λ = 1.7	1.70 ± 0.05	1.70 ± 0.15
λ signal accuracy when λ = 0.8	0.80 ± 0.01	0.80 ± 0.04

2. Sensor electrical data

Description		Value	Unit
Power supply voltage on connector	Rated voltage	7.5	V
	Continuous operating voltage	⩽ 12	V
	Maximum system power supply voltage	⩽ 16.5	V
	Short time voltage peak value within 60 ms (10 times in life cycle, ceramic temperature ⩾ 20°C)	18	V
	Minimum system power supply voltage	⩾ 10.8	V
Heating power for 7.5 V of operating voltage		7.5	W

Common Problem Symptoms and Judgment Methods

1. Problem symptoms: poor engine idle, poor acceleration, emissions exceeding, excessive fuel consumption, etc.
2. General problem causes
   - Moisture enters the internal of sensor, temperature changes greatly or probe is broken
   - Oxygen sensor "poisoning" (such as Pb, S, Br, Si or Mn).
3. Simple measurement method for downstream oxygen sensor
   - (Remove the connector) Turn digital multimeter to ohm band, connect two probes to sensor pin 1# (white) and pin 2# (white) respectively, the resistance should be 7 ~ 11 Ω at normal temperature.
   - (Connect the connector) Under idling status and waiting until temperature of oxygen sensor reaches its operation temperature (350°C), turn digital multimeter to DC voltage band, connect two probes to sensor pin 3# (gray) and pin 4# (black) respectively, voltage should rapidly fluctuates between 0.1 and 0.9 V at the same time.
4. There is no simple measurement method for upstream oxygen sensor at service station
   - In order to avoid misjudgment, for LS with good appearance, cross-verification method should be adopted to further confirm whether LS itself fails. The cross-verification method is shown in the figure



Removal

1. Refer to Emission Control System

Caution:

- Applying detergent, oily liquid or volatile liquid to the oxygen sensor connector is prohibited.
- The oxygen sensor wire harness must not be twisted, taut, or attached to objects with sharp edge or high temperature.

Installation

1. Refer to Emission Control System

Caution:

- Applying detergent, oily liquid or volatile liquid to the oxygen sensor connector is prohibited.
- The oxygen sensor wire harness must not be twisted, taut, or attached to objects with sharp edge or high temperature.

Camshaft Position Sensor

Description

There are two camshaft position sensors, which are installed on cylinder head behind camshaft.

1 - Output Signal Wire	2 - Ground Wire
3 - to 5 V Power Supply	

Operation

Camshaft position sensor is a Hall type sensor. A phaser is installed on camshaft. When phaser is in high teeth, the applicable circuit outputs high voltage; when phaser is in missing teeth, the applicable circuit outputs low voltage. As a result, the crankshaft phase information is provided to Engine Control Module (ECM), so that the compression top dead center and exhaust top dead center of crankshaft can be distinguished.

Installation Precautions

1. The sensor must always be in the original packaging material before installation or test.
2. Take out the sensor from packaging material, check the sensor and ensure that it must not be damaged or contaminated.
3. Apply mineral oil to phase sensor O-ring, then press the sensor (do not tap with tool) and tighten with fixing bolt.
4. Never repair the sensor.

Caution:

- The sensor contains strong magnet. Since most electronic storage devices (such as disk, tape.) are sensitive to magnetic fields, they must be stored separately from the permanent magnets. Users with cardiac pacemakers should take precautions before operation.

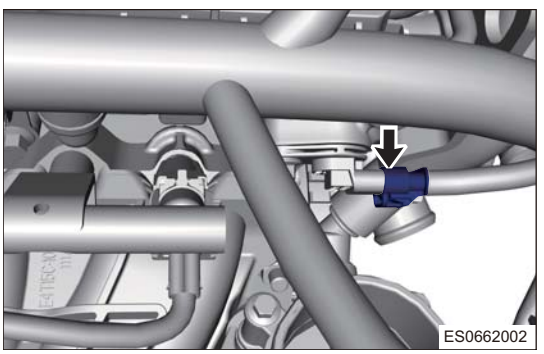
Common Problem Symptoms and Judgment Methods

1. Problem symptoms: difficult to start engine, engine speed limited, etc.

Removal

1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the intake camshaft position sensor connector.
   (a) Disconnect intake camshaft position sensor connector (arrow) and remove camshaft position sensor fixing bolt.

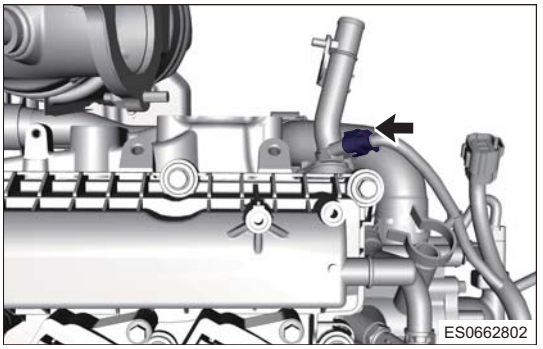
   Tightening torque
   8 ± 1N·m



5. Remove the exhaust camshaft position sensor connector.

   (a) Disconnect exhaust camshaft position sensor connector (arrow) and remove exhaust camshaft position sensor fixing bolt.

   Tightening torque
   8 ± 1N·m



Installation

1. Installation is in the reverse order of removal.

   Caution:
   - Sensor should be pressed into mounting hole. Never use tools (such as a hammer) to strike sensor into mounting hole forcibly.

Engine Speed Sensor

Description

Crankshaft position sensor is installed on clutch case, against flywheel teeth. It is used to detect the speed and position of crankshaft.

1 - Positive Power Supply Wire	2 - Output Signal Wire
3 - Ground Wire	

Operation

DG-U1 sensor is a component of the engine management system. This sensor is installed on engine block, which used to detect crankshaft position and speed. Rotation of the signal plate causes the magnetic field at the induction point inside the speed sensor to alternate. The alternating magnetic field is induced by the differential Hall chip, and the induced alternating magnetic signal is converted into an electrical signal by the internal processing circuit of the sensor and output.

Installation Precautions

1. The sensor must always be in the original packaging material before installation or test.
2. Take out the sensor from packaging material, check the sensor and ensure that it must not be damaged or contaminated.
3. Before the sensor is installed in the engine, it is required to apply lubricant to O-ring, then press it into sensor (do not tap into with tools), and finally use inner hexagon socket cap screws GB/T 70.1 M6X12-8.8 with local self-locking function fix the sensor. Tightening torque is 10 N·m ± 2 N·m.
4. After inserting the female connector, distance between wire harness fixing point and sensor shall not be more than 150 mm (straight distance of the straightened wire harness), and the fixing point and the sensor mounting point must be on the same object or rigidly connected object.
5. Any repair of the sensor is prohibited. If the sensor is removed from the mounting hole after working under a certain temperature and pressure load, it is not allowed to return it to the original mounting hole. A new sensor must be installed to ensure firmness.
6. Only after the appropriate connector is matched, the normal operation of the sensor can be ensured. All wires and connectors must be waterproof. Make sure that connectors and wire harnesses of sensor are dry and dustproof during assembly.
7. The sensor contains strong magnet. Since most electronic storage devices (such as disk, tape.) are sensitive to magnetic fields, they must be stored separately from the permanent magnets. Users with cardiac pacemakers should take precautions before operation.
8. Storage requirements
   Storage temperature (in warehouse): -40 °C ~ +80 °C
   Storage temperature (on vehicle): -40 °C ~ +150 °C
   Relative humidity: 0 ~ 80%
   Storage life (from the production date): 3 years
   Storage area must be kept dry, free of dust and free from direct sunlight at the allowable storage temperature.
9. External magnetic field strength: The environmental magnetic field affects the performance of the sensor chip. When the sensor is not working, the environmental magnetic field is required to be no more than 125mT, and when working, the environmental magnetic field is required to be no more than 1mT.

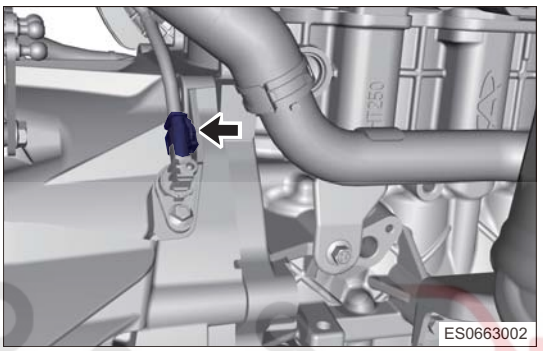
Common Problem Symptoms and Judgment Methods

1. Problem symptoms: engine cannot start
2. Repair precaution
   - Never repair the sensor.
   - Press in crankshaft position sensor rather than tapping during service.

3. Simple detection method for fuel rail injector assembly malfunction
   (a) (Remove the connector) Turn LCR meter to ohm band (in-line mode, test frequency is 10 kHz), connect two probes to sensor connector terminals 1 and 3, rated resistance is 100 Ω ± 20%; Turn LCR meter to capacitance band (in-parallel mode, test frequency is 1 kHz), connect two probes to sensor connector terminals 1 and 3, rated capacitance is 100 nF ± 20%; Turn LCR meter to capacitance band (in-parallel mode, test frequency is 1 kHz), connect two probes to sensor connector terminals 2 and 3, rated capacitance is 4.7 nF ± 20%.

Removal

1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the crankshaft position sensor.
   (a) Disconnect crankshaft position sensor connector (arrow), and remove crankshaft position sensor fixing bolt.
   Tightening torque
   8 ± 2 N·m



Installation

1. Installation is in the reverse order of removal.
   Caution:
   - Ensure that the sensor is clean and the sensor is allowed to be removed from the package before it is installed in the engine or test bench. Users with cardiac pacemakers should take precautions before operation.
   - The sensor is only allowed to be pressed into installation hole by press-in. It is not allowed to install the sensor with a tapping tool (such as hammer).

Warning:
If the engine speed sensor falls, never pick it up to install and it need to return to factory for testing.

Fuel Rail Injector Assembly

Operation

Fuel distribution pipe assembly is installed to intake manifold or cylinder head to store or distribute fuel. Fuel distribution pipe assembly consists of fuel distribution pipe and fuel injector etc. Fuel distribution pipe is connected to fuel supply pipe through pipe joint to receive the fuel from fuel tank. Fuel injector sprays fuel into the intake passage accurately under the control of ECM electric pulse.

Fuel requirements

Fuel distribution pipe assembly can only use fuel that specified in accordance with National Standard Unleaded Gasoline for Motor Vehicle and Alcohol Gasoline for Motor Vehicle of People's Republic of China. It should be pointed out in particular that excessive long storage of gasoline can cause it to oxidize and deteriorate, which may cause the injector to become clogged or even damaged.

Caution:

- Excessive storage of gasoline can cause it to oxidize and deteriorate, which may cause the injector to become clogged or even damaged.

Installation Precautions

1. Installation Precautions

   Caution:

   - Make sure the fuel distribution pipe assembly is intact, undamaged, or uncontaminated, and there are no cracks, scars, grooves, burrs and rust on tube joint surface before use. Do not install fuel distribution pipe assembly that does not meet the requirement.
   - Lubricate the lower O-ring of fuel injector with clean lubricant before assembly.
   - Fuel injector should be prevented from being subjected to excessive impact during assembly, and tighten the mounting bolt until fuel injector is installed in place.
   - If it is necessary to secure wire harness, avoid deformation or damage of wire harnesses bracket caused by excessive shock to fuel distribution pipe assembly during installation.
   - When removing fuel distribution pipe assembly from engine and reinstalling it, it is necessary to replace fuel injector lower O-ring.
   - When the temperature is below zero, try to avoid installation or maintenance of fuel distribution pipe assembly, so as to avoid fuel leakage.
   - For after-sale maintenance, it is only allowed to replace the assembly.

Common Problem Symptoms and Judgment Methods

1. Problem symptoms: fuel leaks into engine compartment, which may cause vehicle burning in severe case.
2. Repair precaution
   - Weld cracking of fuel distribution pipe;
   - Aging of injector o-ring;
   - Poor connection between fuel pipe and fuel distribution pipe assembly.
3. Simple detection method for injector malfunction

   Remove fuel distribution pipe assembly from engine, apply compressed air of 4.5 bar from inlet port, place the injector connector upward, and immerse the fuel distribution pipe assembly into water so that the injection end of the injector does not contact with water. Observe if there is air bubble in the fuel rail injector assembly.

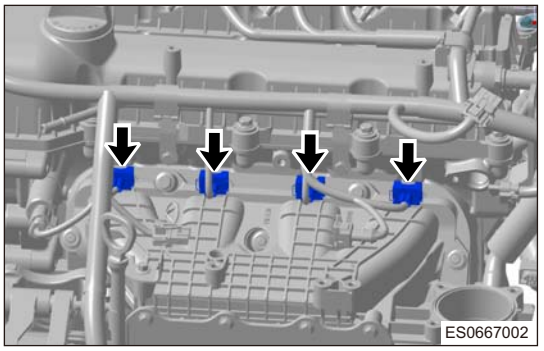
   If there are air bubbles in the fuel rail, there is a risk of fuel rail leakage.

Removal

1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.

4. Remove the fuel rail injector assembly.
   (a) Disconnect 4 injector connectors (arrow), and remove fixing bolts from fuel rail injector assembly.

   Tightening torque
   8 ± 2 N·m



Installation

1. Installation is in the reverse order of removal.

Intake Pressure/Temperature Sensor

Description

Intake pressure/temperature sensor consists of intake manifold absolute pressure sensor and intake temperature sensor, which are installed on intake manifold.

1 - Pressure Signal	2 - to 5 V Power Supply
3 - Temperature Signal	4 - Ground Wire

Installation Position

Intake pressure/temperature sensor consists of intake manifold absolute pressure sensor and intake temperature sensor, which are installed on intake manifold.

Operation

Intake manifold absolute pressure sensing element consists of a piece of silicon chip. Print a piece of pressure diaphragm on silicon chip. There are 4 piezoresistors on pressure diaphragm, and the 4 piezoresistors form a Wheatstone bridge as strain element. Except for the pressure diaphragm, silicon chip is also integrated with signal processing circuit. Active surface of the silicon chip is subjected to a pressure close to zero, and its surface is subjected to the absolute pressure of the intake manifold to be measured. Thickness of silicon chip is only several micrometer, so the silicon chip will deform mechanically as intake manifold absolute pressure changes, and 4 piezoresistors will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated after processing by signal processing circuit of silicon chip.

Intake temperature sensing element is a negative temperature coefficient (NTC) resistor, whose resistance changes with the intake temperature. This sensor transfers a voltage of intake temperature change to controller.

Installation Precautions

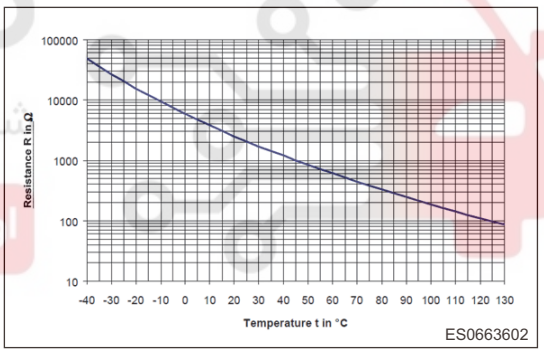
1. The sensor is designed to be installed on the plane of intake manifold of engine. The pressure connecting pipe protrudes into the intake manifold, sealing the atmosphere with an O-ring.
2. If it is installed to the vehicle in a suitable way (if extracting pressure from intake manifold, pressure connecting pipe will tilt downward, etc.), thus ensuring that no condensation will form on the pressure sensitive element.
3. Drilling and fixing on intake manifold must be performed in accordance with the delivery drawings to ensure long-term sealing and be able to withstand erosion of media.
4. The reliable contact of the connector electrical connection is related to the material quality and dimension accuracy of the matching connector on the wire harness, expect for the influence of component connector.

Common Problem Symptoms and Judgment Methods

1. Common problem symptoms related to this sensor: flameout, poor engine idle, etc.
2. General problem causes
   - Abnormal high voltage or reverse large current during operation;
   - Pressure chip is damaged during service.
3. Precautions during service
   - Never impact vacuum element with high pressure gas during service;
   - Check if alternator output voltage and current are normal when there is a fault and replacing sensor.
4. Simple detection method for intake pressure/temperature sensor malfunction

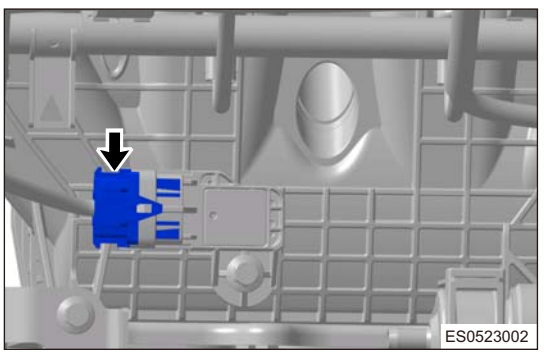
Step	Operation	Test Value	Test Result	Subsequent Step
1	Temperature sensor part: Remove intake pressure/temperature sensor wire harness connector, and measure resistance of terminals 1 and 2 of sensor separately with a multimeter; Measurement can also be performed by simulating. Specific operations are to send wind to the sensor with blow drier (be careful that blow drier shouldn't be too close to the sensor) and observe the changes of sensor resistance. The resistance should reduce at the moment.	The resistance of terminals 1 and 2 are determined according to ambient temperature near the sensor at the time of test. (rated resistance is 2.5 kΩ ± 5% at 20°C, and refer to temperature-resistance characteristic curve below for details;)	Yes	Next
			No	Replace intake pressure/temperature sensor
3	Pressure sensor part: (Connect the connector) Turn digital multimeter to DC voltage band, ground the black probe, connect red probe to pins 3# and 4# respectively. Under idling status, there should be 5 V of reference voltage at pin 3#, and about 1.3 V of voltage at pin 4#; Under unloaded status, slowly open the throttle, the voltage of 4# has not changed too much; quickly open the throttle, the voltage of 4# can reach about 4 V instantaneously (value changes with model), and then drops to about 1.5V.	/	Yes	Diagnostic Help
			No	Check for continuity and ground of wire harness

5. Temperature - resistance curve of intake pressure/ temperature sensor



Removal

1. Disconnect the intake pressure/temperature sensor connector (arrow).



2. Remove fixing bolt and intake pressure/temperature sensor.

Installation

1. Installation is in the reverse order of removal.

Fuel Tank Pressure Sensor

Installation Position

Fuel tank pressure sensor is installed on fuel tank line.

Operation

Fuel tank pressure sensor (low pressure) sensing element consists of a piece of silicon chip. Print a piece of pressure diaphragm on silicon chip. There are 4 piezoresistors on pressure diaphragm, and the 4 piezoresistors form a Wheatstone bridge as strain element. Except for the pressure diaphragm, silicon chip is also integrated with signal processing circuit. Upper surface of the silicon chip is subjected to an atmospheric pressure, and lower surface is subjected to the fuel tank steam pressure to be measured. Thickness of silicon chip is only several micrometer, so the silicon chip will deform mechanically as fuel tank pressure changes, and 4 piezoresistors will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated after processing by signal processing circuit of silicon chip.

Technical Characteristic Parameters

1. Pressure sensor limit parameter

Parameters	Value			Unit
	Minimum	Representative	Maximum	
Power supply voltage	/	/	16	V
Pressure	/	/	± 68	kPa
Burst pressure	/	/	± 150	kPa

2. Pressure sensor characteristic parameters

Parameters	Value			Unit
	Minimum	Representative	Maximum	
Pressure measurement range	-3.75	/	3.5	kPa
Operating temperature	-40	/	115	°C
Power supply voltage	4.75	5	5.25	V
Power supply current when U S = 5.0 V	6	9	13	mA
Output terminal load current	-1	/	0.5	mA

Installation Precautions

- DAE film in the cover plate assembly cannot directly contact with media such as fuel and oil. Installation position can avoid direct mechanical damage of the filter membrane. The angle between the sensor probe axis and the vertical direction shall meet the drawing requirements to prevent water accumulation.
- The inlet of ambient air needs to be unobstructed so that ambient pressure can be applied. Installation position can protect sensor from water and dirt
- The reliable contact of the connector electrical connection is related to the material quality and dimension accuracy of the matching connector on the wire harness, expect for the influence of component connector.

Ignition Coil

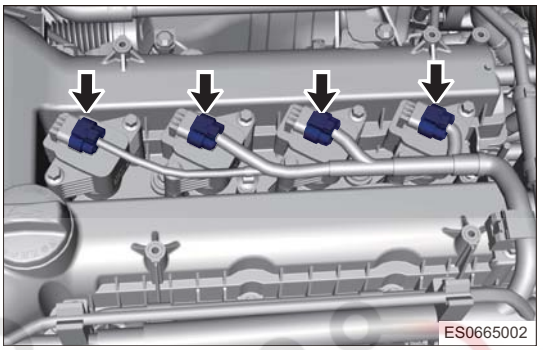
Description

Ignition coil converts low voltage of primary winding into high voltage of secondary winding, and discharges spark plug electrode to produce sparks which will ignite the combustible air-fuel mixture in cylinder.

1 - Positive Power Supply Wire	2 - Ground Wire
3 - Ground Wire	4 - ECM Control Signal

Installation Position

It is installed on engine and mounting holes must be grounded. Installation torque is 8 ± 2 N·m. Make sure that the connection of high-voltage connecting rod and spark plug is reliable, or it may cause high-voltage leakage, resulting in poor ignition.



Operation

Ignition coil consists of primary winding, secondary winding, iron core and housing etc. When the ground passage of a primary winding is on, this primary winding is charged. If ECM cuts off the primary winding circuit, the charging will be suspended, and a high voltage will be induced in the secondary winding at same time, cause spark plugs to discharge.

Technical Characteristic Parameters

Primary current	8.5A X (1 ± 8%)
Secondary voltage	⩾ 37 KV (40 pF ± 5 pF of load)
Load (Zener diode)	1000 ± 20V
Ignition energy	⩾ 90mJ

Application Guide

In order for the ignition coil to work normally and have good EMC performance, the power supply wire and signal wire for the coil should be as far away from the conductor of other parts as possible.

During using, do not remove ignition coil from spark plug with bare hands with power on, and do not contact the metal part and high voltage wire harness directly, which will cause the unnecessary personal injury.

You should disconnect battery negative first when removing ignition coil.

Problem Symptoms and Judgment Methods

1. Problem symptoms: engine jitter, engine cannot start normally, misfire, etc.
2. General problem causes: burned due to excessive current, damaged by external force, etc.
3. Service precautions: It is prohibited to use high-voltage cable to perform ignition spark test during repair; otherwise it may cause damage to electronic controller
4. Simple measurement method
   - Turn digital multimeter to ohm band (remove connector), connect two probes to two terminals of primary winding respectively, the resistance should be 0.5 ~ 0.64 Ω at normal temperature.
   - When connecting to secondary winding, the resistance is 8.36 ~ 10.64 kΩ.

Fuel Injector

Description

Fuel injector is located on the cylinder head near intake valve, and nozzle end is located directly above the intake port.

1 - Positive Power Supply Wire	2 - ECM Control Ground

Operation

In the non-operating condition, the injector spring presses the needle valve set against the valve seat and seals the fuel injection port. When the ECM drives the fuel injector to operate, the electromagnetic coil energizes and generates electromagnetic force, and the needle valve set is sucked up, and separated from valve seat set, and the fuel is atomized and sprayed through the orifice plate. When the injection pulse is cut off, the pressure of return spring returns and closes the needle valve.

Problem Symptoms and Judgment Methods

1. Problem symptoms: poor engine idle, poor acceleration, engine cannot start (different to start), etc.

   Caution:

   - A failure phenomenon is that injector body surface is wet after the vehicle is running for a while, customer will misunderstand that "leakage" occurs in injector, in fact, it is the phenomenon of thermal diffusion of lubricant (applied to injector O-ring) on the injector body. It does not affect the use of injector. This phenomenon will not occur again after drying.

2. General problem causes

   (a) Lack of maintenance. Since the fuel added to fuel tank last time is stored too long, and it is more than 2 months, fuel colloidal material is produced due to fuel oxidation, so that abnormal injection or no fuel injection due to accumulation of colloidal material in fuel injector, resulting in injector failure.

   Caution:

   - If the customer does not drive the vehicle frequently, it is suggested to store a small amount of fuel in the tank. The purpose is to consume the fuel in the tank in time, try to avoid fuel deterioration in tank.

3. Simple detection method for injector malfunction

Step	Operation	Test Value	Test Result	Step
1	Check if injector wire harness is worn, connector is damaged, terminal pin is deformed or loose.	Wire harness is worn, connector is damaged, terminal pin is deformed or loose.	OK	Next
			Abnormal	Repair wire harness, connector or terminal
2	Turn vehicle ignition switch to OFF, remove fuel injector connector, turn digital multimeter to ohm band, and connect two probes to two terminals of fuel injector respectively to detect fuel injector resistance	12 ± 1 Ω	Yes	Next
			No	Replace fuel rail injector assembly
3	Remove the fuel rail injector assembly, and connect wire harness connector. Turn ignition switch ON to start the engine, check for abnormal injection or no fuel injection. (Pay special attention to safety)	Fuel injection	OK	Check wire harness and other components or diagnostic help
			Abnormal	Next
4	Pull out the fuel injection nozzle wire harness connector of the corresponding cylinder with abnormal fuel injection, start the engine, and observe whether there is fuel injection.	Fuel injection	Fuel injection occurs	Replace fuel rail injector assembly
			No fuel injection occurs	Check wire harness and other components or diagnostic help

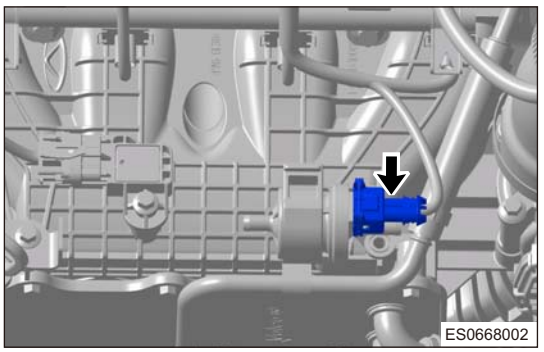
Caution:

Steps 3 and 4 are not recommended for operation. If operation is necessary, you must pay attention to safety!

Canister Control Valve

Description

Canister control valve opens when power is on, and closes when power is off.
Canister control valve terminal: two terminals in total, and can be interchanged.



Operation

Canister control valve consists of solenoid coil, armature, valve and other parts. Air volume through canister control valve is related to the electric pulse duty ratio output from ECM to canister control valve and the pressure difference between canister control valve inlet and outlet. When there is no electric pulse, canister control valve closes.

Technical Characteristic Parameters

Quantity	Value			Unit
	Minimum	Representative	Maximum	
Rated voltage	10	13.5	16	V
Resistance at +20°C	14	16	18	Ω
Current under rated voltage	/	0.85	/	A
Frequency of control pulse	5	/	30	Hz
Rate of flow when pressure difference is 700 mbar and duty ratio is 100%	6	6.5	7	m^3/h
Permitted operating temperature	-40	/	140	°C
Allowable pressure difference between inlet and outlet	/	/	-800	mbar
Permitted vibration acceleration marked on products	/	/	300	m/s^2
Leakage amount when pressure difference is 700 mbar	/	/	33	mL/min

Installation Precautions

- Airflow direction must be in accordance with the regulations during installation of canister control valve.
- When reverse pressure is generated on the intake manifold side (such as turbocharged engines), it is necessary to install a check valve between canister control valve air outlet and intake system air inlet. This check valve shall ensure that no reverse pressure exceeding 0.2 bar is generated at the canister control valve air outlet.
- It is necessary to fix hose and electrical wire harness which connected the canister control valve within 100mm from the front and rear of the canister control valve, and the fixed point shall have the same vibration magnitude as the canister control valve.

Problem Symptoms and Judgment Methods

1. Problem symptoms: normal open, function failure, etc.
2. General problem causes: rust or poor sealing due to foreign matter enters into the valve.
3. Simple detection method for canister solenoid valve malfunction

Step	Operation	Test Value	Test Result	Subsequent Step
1	Remove the canister control valve, blow air to canister control valve in direction of airflow arrow on solenoid valve housing, check if the canister control valve is ventilated	Ventilation or not	Yes	Canister control valve is faulty, replace it
			No	Next
2	Apply 12 V battery voltage to two terminals of canister control valve, and blow air to canister control valve in direction of airflow arrow on solenoid valve housing, check if the canister control valve is ventilated	Ventilation or not	Yes	Next
			No	Perform this inspection with a new canister control valve, the testing equipment failure has been eliminated. If the fault does not recur, the canister control valve is faulty, replace it
3	If there is obvious black substance in connecting pipe between canister control valve and canister	Is there any black substance	Yes	If solenoid valve is faulty due to black particles inside the valve body and it is necessary to replace the solenoid valve, mainly check the canister for carbon dust leakage
			No	Next
4	Remove canister control valve wire harness connector, and measure resistance of coil	16 ± 2 Ω	Yes	Next
			No	Perform this inspection with a new canister control valve, the testing equipment failure has been eliminated. If the fault does not recur, the canister control valve is faulty, replace it
5	Connect diagnostic tester, and read DTCs	• P0444 • P0458 • P0459 Others	Yes	Disconnect and reconnect connector, check if there is still current DTC related to canister control valve. If trouble is eliminated, it is most likely that poor connection may occurs. Focus on wire harness and connector inspection

Repair precaution

- Airflow direction must be in accordance with the regulations during installation.
- If solenoid valve is faulty due to black particles inside the valve body, it is necessary to replace solenoid valve and check the canister condition.
- Try to avoid water, oil and other liquids entering into the valve during service.

Installation

1. Installation

   Caution:

   - Airflow direction must be in accordance with the regulations during installation.
   - If canister control valve is faulty due to black particles inside the valve body, it is necessary to replace canister control valve and check the canister condition.
   - Try to avoid water, oil and other liquids into the canister control valve during servicing.

Engine Control Module (ECM)

Function

Operation

Engine Control Module (ECM) is a pre-programmed microprocessor digital computer, which is used to adjust ignition timing, air-fuel ratio, emission control device, speed control, A/C compressor and idle speed etc. Engine Control Module (ECM) enables the program to suit ever-changing operation conditions.

Installation Position

Engine Control Module (ECM), mounted on the engine compartment left rail wheel house assembly, can be removed only as a unit for replacement. Tightening torque is 8 ± 2 N·m.

Installation Precautions

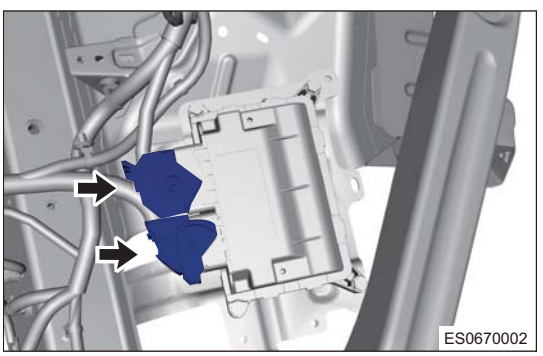
- Pay attention to static electricity protection during installation.
- Take care to protect connector terminals.
- Avoid water stains entering the connector during installation.

Common Problem Symptoms and Judgment Methods

1. Problem symptoms: Engine idles roughly, poor acceleration, engine cannot start, too high idle speed, exhaust exceeding, different to start, A/C failure, injector control failure, stalls, etc.
2. General problem causes
   - ECM internal parts are burned and faulty due to the electrical overload of external device;
   - Circuit board is rusted due to water enters ECM
3. Repair precaution
   - Do not remove ECM casually during service;
   - Disconnect the negative battery cable for more than 1 minute before removing ECM.
   - Remove ECM before performing welding operation, and the removed ECM should be stored;
   - Do not install any wire on ECM connecting wire.
4. Simple measurement method
   (a) Connect ECM connector, turn ENGINE START STOP switch to ON, use diagnostic tester to read engine DTCs and datastream or record;
   (b) Remove ECM connector, check if ECM and its connecting wire are in good condition, mainly check if ECM power supply wire and ground wire are normal;
   (c) Check if the external sensor is operating properly, output signal is reliable and its circuit is in good condition;
   (d) Check if the actuator is operating properly and its circuit is in good condition;
   (e) Perform test with a new ECM to check if fault reoccurs.

Removal

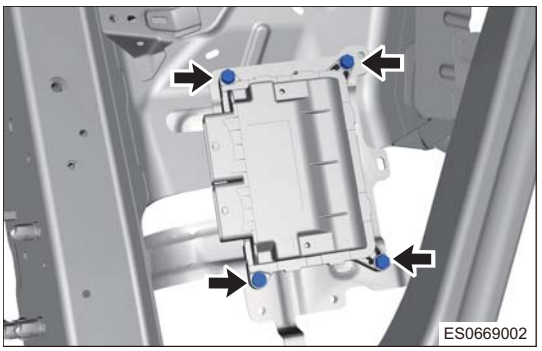
1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the Engine Control Module (ECM).
   (a) Disconnect the ECM connectors (arrow).



(b) Remove 4 fixing bolts (arrow) and ECM.

Tightening torque

8 ± 2 N·m



04 Installation

1. Installation is in the reverse order of removal.

Caution:

- Pay attention to static electricity protection during installation.
- Take care to protect connector terminals.
- To prevent water droplets from accumulating on connector joint, face it down.

Common Electronic Fuel Injection Data and Reference Range

Common electronic fuel injection data and reference range

These data are actual vehicles detected, for reference only.

Operating conditions: Engine idling after warm-up		
Datastream Name	**Value Range**	**Description and Note**
Engine coolant temperature	It is usually at about 80 ~ 96 °C	Engine coolant temperature after warm-up, which is detected by engine coolant temperature sensor
Engine speed	At about 750 ~ 850rpm	Engine idling speed after warm-up (refer to Engine Speed Maintenance)
Ambient pressure	About 1013 hpa	Plain area
Battery voltage	About 13V ~ 15V	When the headlight and other electrical loads are turned on, it may be lower than 13V
Intake temperature	It is as same as environment temperature during cold start	It is higher than current temperature and varies with environment temperature
Accelerator pedal opening	0 ~ 100%	During idling, accelerator pedal opening is 0
Actual torque	It is about 11% ~ 17% at normal idling	The torque that actually produced in engine combustion should be mostly equal to target torque
Target torque	It is about 11% ~ 17% at normal idling	After turning on A/C and other loads, engine target torque and target demand torque will be increased
Relative load	It is about 10% ~ 25% at idling	The relative air charge amount of engine cylinder, which will be increased after turning on A/C and other loads, and slightly reduced on highland area
Rear oxygen signal voltage	Fresh catalyst rear oxygen voltage should be between 0.58 ~ 0.75V	Fresh catalytic converter rear oxygen voltage should be between 0.58 ~ 0.75V and change slowly. If the voltage continues to fluctuate and amplitude is close to front oxygen, it means three-way catalytic converter fails
Target throttle opening	It is about 0% ~ 8% at normal idling	It will be increased after turning on A/C
Throttle opening	It is about 0% ~ 8% at normal idling	Actual throttle body opening at idling should be equal to target throttle body opening
Gear position	For the model with manual transmission, the gear position signal is 0	/
Actual ignition angle	It is about 3 ~ 5 deg. at normal idling	If there is interference from outside, the ignition angle may fluctuate to maintain stable idling
Intake manifold pressure	It is about 300 ~ 500 hpa at idling without load	It will be increased after turning on A/C and other loads, and is slightly reduced on high altitude area
Temperature when engine starts	It is usually real-time temperature (not warm-up start)	If the standing time of vehicle before start is long enough, the coolant temperature value is approximately equal to ambient temperature
Front oxygen signal voltage	After warm up the engine is normally changed from 0.05V ~ 0.9V and jumping back and forth	Experience valve: more than 5 times within 10s
Idling torque self-learning value	Usually 5% ~ 10%	The higher the engine idle torque self-learning value, the greater the engine idle torque consumption, the lower the valve, the smaller the engine idle torque consumption
Control duty ratio of canister control valve	It is about 0% ~ 40% at idling	/
Intake air volume	It is about 5kg/h ~ 12kg/h at idling	Turn the A/C on and other loads will increase the amount of air intake
Throttle pressure	/	Slightly less than ambient pressure
Oxygen sensor closed loop adjustment	Between 0.75 ~ 1.25	The output adjustment according to the oxygen sensor signal feedback

Air-fuel mixture multiplication self-learning value	Between 0.75 ~ 1.25	Air-fuel ratio self-learning is value
Air-fuel mixture addition self-learning value	It is usually between -7.5% and 7.5%	Air-fuel ratio addition self-learning value

Electronic Fuel Injection System Diagnostic Tester Functional Requirements

1. Self-diagnostic
   (a) Mainly include: Read the DTC and clean the DTC;
2. System parameter display
   (a) Mainly include: Coolant temperature, intake temperature, throttle opening, engine speed, ignition angle, air-fuel radio short term correct, air-fuel radio long term addition and multiplication correct, intake pressure, intake flow, oxygen sensor signal, system voltage, torque demand value, etc.
3. System condition
   (a) Mainly include: It displays 10 conditions such as program condition, cooling system, stable condition, dynamic condition, emission control, oxygen sensor, idle speed, malfunction indicator, emergency condition, A/C, etc.
4. Actuator test
   (a) Mainly include: malfunction indicator, fuel pump, A/C relay, fan control, ignition test, single cylinder with fuel cut-off, etc. 6 functions test
5. System initialization reset (adaptive reset)
   (a) After the engine stalling, initialization command is sent and system resets the previous self-adaption.
6. Odometer
   (a) Mainly include: Display of vehicle driving distance and driving time.
7. Edition information
   (a) Mainly include: Display of vehicle identification number (selectable), ECM hardware number and ECM software number.