SQRD4T20 ENGINE MANAGEMENT SYSTEM

P0204 13	04-98	P2304 00	04-137
P0261 11	04-98	P2300 00	04-137
P0262 12	04-98	P2306 00	04-137
P0264 11	04-98	P2309 00	04-137
P0265 12	04-98	P2303 00	04-137
P0267 11	04-98	P0326 00	04-143
P0268 12	04-98	P0325 00	04-143
P0270 11	04-98	P0328 00	04-143
P0271 12	04-98	P0327 00	04-143
P1200 00	04-104	P0328 15	04-143
P1201 00	04-104	P0327 14	04-143
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P00C7 22	04-104	P0016 76	04-148
P0108 00	04-104	P0343 00	04-148
P0107 00	04-104	P0342 00	04-148
P0106 22	04-104	P0016 78	04-148
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P0106 2A	04-104	P0366 00	04-153
P0558 00	04-111	P0017 76	04-153
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P1450 00	04-111	P0367 00	04-153
P1451 00	04-111	P0017 78	04-153
P050C 24	04-115	P0014 00	04-153
P050C 23	04-115	P0496 00	04-159
P0118 00	04-115	P0497 00	04-159
P0117 00	04-115	P0459 00	04-159
P0119 00	04-115	P0458 00	04-159
P0116 23	04-115	P0444 00	04-159
P0116 26	04-115	P0480 00	04-164
P0123 00	04-119	P0481 00	04-164
P0122 00	04-119	P0692 00	04-164
P0121 00	04-119	P0694 00	04-164
P0223 00	04-119	P0691 00	04-164
P0222 00	04-119	P0693 00	04-164
P0221 00	04-119	P0420 00	04-168
P0506 00	04-125	P0645 00	04-171
P0507 00	04-128	P0647 00	04-171
P0219 00	04-131	P0646 00	04-171
P2123 00	04-133	P0629 00	04-175
P2128 00	04-133	P0628 00	04-175
P2122 00	04-133	P0627 00	04-175
P2127 00	04-133	P0571 00	04-180
P2138 00	04-133	P2103 00	04-184
P0351 00	04-137	P2118 00	04-184
P0353 00	04-137	P2106 00	04-184
P0354 00	04-137	P2100 00	04-184
P0352 00	04-137	U0151 87	04-187
P2301 00	04-137	U0164 87	04-187
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04

GENERAL INFORMATION

Overview

System Basic Principle

D4T20 engine management 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 D4T20 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.

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. λ 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.

Additional function

1. Immobilizer function.
2. Communication with torque and external system (example: gear train or vehicle dynamic control).

Diagnosis On-line OBD

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

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 raises 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

Part of the fuel injected into the intake manifold will not reach the cylinder in time to participate in the subsequent combustion process. Conversely, it forms an oil film on the intake manifold wall. Depending on the increase of load and injection duration, the fuel amount that stored in the oil film will increase sharply.

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.

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 purging at the right moment. ECM will control canister control valve to achieve purge gas flow. 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

4. 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.
5. 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.
6. Actuator Test Function
   (a) Malfunction light, fuel pump, A/C relay, fan, canister purge valve and throttle opening.
7. Version Information Display
   (a) Frame number (VIN), ECM hardware number, ECM software number.
8. Malfunction Display
   (a) 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, evaporator temperature sensor, malfunction light.

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, this 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 reengaged.

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 solenoid valve control strategy

1. Canister solenoid valve opening conditions
   1. Engine coolant temperature is higher then 55°C.
   2. Engine air-fuel ratio control has entered the closed loop.
   3. Canister solenoid valve trouble-free.
2. Canister solenoid 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 solenoid 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 solenoid valve opening control
   (a) Openings of canister solenoid valve are different at different engine speeds and loads. ECM calculates the current opening of canister solenoid 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

4. Ignition coil charging control
   (a) 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.
5. 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 operate 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 ENGINE START STOP 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 ENGINE START STOP switch turned to ON each time and after three consecutive operations, oil pump will no longer operate after ENGINE START STOP 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 confirm 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

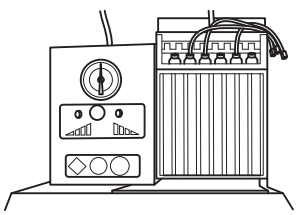
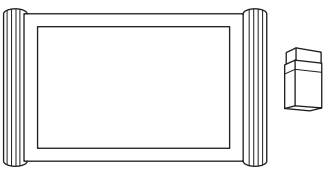
Specifications

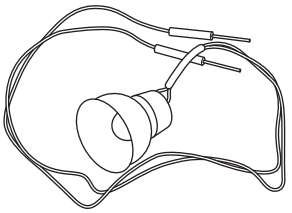
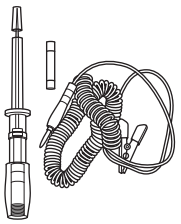
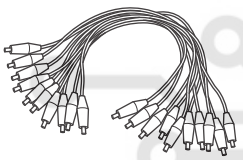
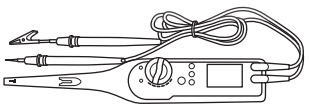
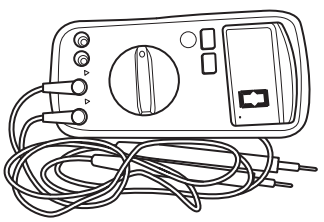
Torque specifications

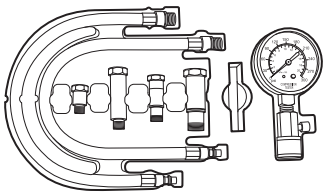
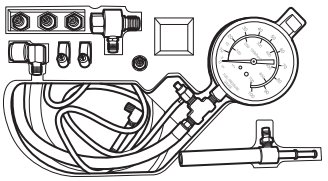
Description	Torque (N·m)
Coolant Temperature Sensor	14 ± 1
Intake Pressure/Temperature Sensor Fixing Bolt	6 ± 1
Knock Sensor Fixing Bolt	20 ± 5
Crankshaft Position Sensor Fixing Bolt	8 ± 2
Camshaft Position Sensor Fixing Bolt	8 ± 1
VVT Control Valve Fixing Bolt	8 ± 2
ECM Fixing Bolt	8 ± 2

Tool Drawing

General Tools

Tool Name	Tool Drawing
Fuel Injector Cleaning Analyzer	 062
X-431 PAD Diagnostic Tester	 001

Tool Name	Tool Drawing
21 W Test Lamp	 087
LED Test Light	 960
Jumper Wire	 088
Diode Test Light	 970
Digital Multimeter	 002

Tool Name	Tool Drawing
Cylinder Pressure Gauge	 044
Fuel Pressure Gauge	 048
Oscilloscope	 061

Trouble Diagnosis and Analysis

ECM Terminal Definition

ECM Connector

Terminal No.	Description	Terminal No.	Description
1	CAN Bus 1 High	57	-
2	Upstream Oxygen UN	58	—
3	-	59	Electronic Accelerator Pedal Sensor 2 Ground
4	-	60	—
5	Main Relay	61	-
6	—	62	Boost Temperature Sensor
7	Electronic Accelerator Pedal Sensor 1 Ground	63	ECM Ground 2
8	LIN Bus Interface	64	ECM Ground 1
9	Cruise Control	65	-
10	—	66	—
11	Downstream Oxygen Sensor	67	Fuel Injector 4 (No.2 Cylinder)
12	Brake Vacuum Sensor	68	Fuel Injector 1 (No.1 Cylinder)
13	—	69	Variable Camshaft Timing Valve (Exhaust)
14	Upstream Oxygen Sensor Ground	70	—
15	UBR Noncontinuous Power Supply	71	Variable Camshaft Timing Valve (Intake)
16	UBR Noncontinuous Power Supply	72	Fuel Injector 2 (No.3 Cylinder)
17	CAN Bus 1 Low	73	Ignition Coil (No.2 Cylinder)
18	-	74	Fuel Injector 3 (No.4 Cylinder)
19	5 V Power Supply 1	75	—
20	UBD Continuous Power Supply	76	Upstream Oxygen Sensor Heater
21	Downstream Oxygen Sensor	77	Throttle Position Sensor 1
22	—	78	Throttle Position Sensor 2
23	Brake Switch	79	Electronic Wastegate Position Signal
24	A/C Pressure Sensor	80	Oxygen Sensor Ground (Upstream Oxygen)
25	Brake Light	81	Ignition Coil (No.1 Cylinder)
26	-	82	Ignition Coil (No.3 Cylinder)
27	-	83	Ignition Coil (No.4 Cylinder)
28	Upstream Oxygen IN	84	Engine speed sensor
29	-	85	Intake Pressure Sensor
30	Accelerator Pedal Sensor	86	Throttle Ground
31	Electronic Wastegate Control+	87	-
32	Electronic Wastegate Control-	88	-
33	-	89	Knock Sensor B
34	-	90	Knock Sensor A
35	Ignition Switch	91	Intake Pressure Sensor
36	5V Power Supply of Electronic Accelerator Pedal Sensor 2	92	—
37	5V Power Supply of Electronic Accelerator Pedal Sensor 1	93	Camshaft Position Sensor No.1 Signal
38	-	94	Canister solenoid valve
39	-	95	Camshaft Position Sensor Ground
40	-	96	Engine Speed Sensor Input
41	Fuel Pump relay	97	—
42	A/C Compressor Relay	98	5 V Power Supply 1

Terminal No.	Description	Terminal No.	Description
43	Oxygen Sensor Ground	99	Throttle Actuator
44	—	100	Throttle Actuator
45	Accelerator Pedal Sensor	101	Engine Coolant Sensor
46	Boost Pressure Sensor	102	Intake Temperature Sensor
47	Analog Ground	103	—
48	Downstream Oxygen Sensor Heater	104	Upstream Oxygen Sensor
49	-	105	Camshaft Position Sensor No.2 Signal
50	-	106	—
51	—	107	Throttle 5 V Power Supply
52	-	108	5 V Power Supply
53	—	109	Intake Manifold 5 V Power Supply
54	Electronic Vacuum Pump	110	-
55	-	111	ECM Ground 4
56	PWM Cooling Fan	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, TCU 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 Intake passage Ignition timing Spark plug Engine mechanical

Symptom	Suspected Area
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 passage Spark plug Engine mechanical
Engine starts normally, but idles roughly after warming up	Fuel quality Coolant Temperature Sensor Electronic throttle body Intake passage Spark plug Engine mechanical
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 pipe Exhaust pipe Ignition timing Throttle position sensor Fuel injector Spark plug
Slow response when accelerating	Water in fuel Intake Pressure Sensor Intake pipe 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 Intake passage Spark plug Ignition coil Ignition timing Exhaust passage Fuel Injector

Diagnosis Procedure

Hint

Use following procedures to troubleshoot the engine control 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 12 V.

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 → 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 DTC fault procedure**

Current DTC

6	Repair according to DTC list

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. Perform test with new ECM to check if malfunction reoccurs.

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.
- Look for broken, bent, protruded or corroded terminals.
- 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 ECU 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 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.

DTC	Description
P209100	"B" Camshaft Position Actuator Control Circuit High Bank 1
P209000	"B" Camshaft Position Actuator Control Circuit Low Bank 1
P001300	"B" Camshaft Position Actuator Control Circuit Open Bank 1
P000B00	"B" Camshaft Position Slow Response Bank 1
P005A	"B" Camshaft Profile Control Performance/Stuck Off Bank 1
P064500	A/C Clutch Relay Control Circuit
P064700	A/C Clutch Relay Control Circuit High
P064600	A/C Clutch Relay Control Circuit Low
P258D00	Vacuum Pump Control Circuit "A" High
P258C00	Vacuum Pump Control Circuit "A" Low
P258A00	Vacuum Pump Control Circuit Open
P050F00	Brake Assist Vacuum Too Low
P057100	Brake Switch "A" Circuit
U015187	Lost Communication With ABM
U016487	Lost Communication With CLM
U014087	Lost Communication With BCM
U015587	Lost Communication With ICM
U021487	Lost Communication With PEPS
U012687	Lost Communication With SAM
U012987	Lost Communication With BSM
U010187	Lost Communication with TCU
P012300	Throttle/Pedal Position Sensor/Switch "A" Circuit High
P012200	Throttle/Pedal Position Sensor/Switch "A" Circuit Low
P012100	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance
P057500	Cruise Control Input Signal Not Plausible
P057800	Clamping Switch of Cruise Control
P022300	Throttle/Pedal Position Sensor/Switch "B" Circuit High
P022200	Throttle/Pedal Position Sensor/Switch "B" Circuit Low
P022100	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance

DTC	Description
P151000	Knock Control Signal Evaluation Check Diagnostic Fault Detected
P045128	EVAP System Pressure Sensor&Switch Circuit Range Performance
P045300	EVAP System Pressure Sensor&Switch Circuit High
P045200	EVAP System Pressure Sensor&Switch Circuit Low
P04512A	EVAP System Pressure Sensor&Switch Circuit Range Performance
P045125	EVAP System Pressure Sensor&Switch Circuit Range Performance
P155500	Throttle Actuator Electrical Malfunction
P210300	Throttle Actuator "A" Control Motor Circuit High
P211800	Throttle Actuator "A" Control Motor Current Range/Performance
P210600	Throttle Actuator Control System Forced Limited Power
P210000	Throttle Actuator "A" Control Motor Circuit/Open
P155400	Max Error of DV-E Return Spring Check Failure
P156100	Not Plausible Error of DV-E Position Deviation
P155C00	Not Plausible Error of DV-E Limp Home Learning Position
P155D00	Max Error of DV-E Control Range
P155E00	Min Error of DV-E Control Range
P155000	Break of DV-E Adaptation Due to Ambient Conditions
P155F00	DV-E Break of Adapation Due to System Voltage
P156600	Not Plausible Error of DV-E Fault During Relearning of UMA
P155100	Not Plausible Error of UMA Learning
P013300	O2 Sensor Circuit Slow Response Bank 1 Sensor 1
P062F41	Internal Control Module EEPROM Error
P062F42	Internal Control Module EEPROM Error
P062F43	Internal Control Module EEPROM Error
P208900	"A" Camshaft Position Actuator Control Circuit High Bank 1
P208800	"A" Camshaft Position Actuator Control Circuit Low Bank 1
P001000	"A" Camshaft Position Actuator Control Circuit Open Bank 1
P000A00	"A" Camshaft Position Slow Response Bank 1
P003C00	"A" Camshaft Profile Control Performance/Stuck Off Bank 1
P050B00	Cold Start Ignition Timing Performance
P050B20	Cold Start Ignition Timing Performance
P026200	Cylinder 1 Injector "A" Circuit High
P026100	Cylinder 1 Injector "A" Circuit Low
P020100	Cylinder 1 Injector "A" Circuit
P026800	Cylinder 3 Injector "A" Circuit High
P026700	Cylinder 3 Injector "A" Circuit Low
P020300	Cylinder 3 Injector "A" Circuit
P027100	Cylinder 4 Injector "A" Circuit High
P027000	Cylinder 4 Injector "A" Circuit Low
P020400	Cylinder 4 Injector "A" Circuit
P026500	Cylinder 2 Injector "A" Circuit High
P026400	Cylinder 2 Injector "A" Circuit Low
P020200	Cylinder 2 Injector "A" Circuit
P138824	Ambient Air Temperature Sensor <A> Multiple Check
P138823	Ambient Air Temperature Sensor <A> Multiple Check
P034100	Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor
P001676	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
P034300	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor

DTC	Description
P034200	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor
P001678	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
P036600	Camshaft Position Sensor "B" Circuit Range/Performance(Bank1)
P001776	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
P036800	Camshaft Position Sensor "B" Circuit High (Bank1)
P036700	Camshaft Position Sensor "B" Circuit Low (Bank1)
P001778	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
P033900	Crankshaft Position Sensor "A" Circuit Intermittent
P261700	Crankshaft Position Signal Output Circuit Open
P057500	Cruise Control Input Signal Not Plausible
P057800	Clamping Switch of Cruise Control
P058500	Cruise Control A/D Conversion Malfunction
P217700	System Too Lean Off Idle Bank 1
P217800	System Too Rich Off Idle Bank 1
P046300	Fuel Level Sensor "A" Circuit High
P046200	Fuel Level Sensor "A" Circuit Low
U067600	Lost Communication With Fuel Level Sensor <A>
P25B000	Fuel Level Sensor <A> Stuck
P128400	Fuel Level Sensor <A> Circuit Range Performance
P046129	Fuel Level Sensor <A> Circuit Range Performance
P048000	Fan 1 Control Circuit
P048100	Fan 2 Control Circuit
P069200	Fan 1 Control Circuit High
P069400	Fan 2 Control Circuit High
P069100	Fan 1 Control Circuit Low
P069300	Fan 2 Control Circuit Low
P013400	O2 Sensor Circ. No Activity Detected (Upstream of the Catalyzer)
P219600	O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1
P219500	O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1
P013800	O2 Sensor Circuit High Voltage Bank 1 Sensor 2
P013700	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2
P223200	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 2
P013600	O2 Sensor Circuit Bank 1 Sensor 2
P005400	HO2S Heater Resistance Bank 1 Sensor 2
P003800	HO2S Heater Control Circuit High Bank 1 Sensor 2
P003700	HO2S Heater Control Circuit Low Bank 1 Sensor 2
P003600	HO2S Heater Control Circuit Bank 1 Sensor 2
P013A00	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2
P227100	O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2
P227000	O2 Sensor Signal Biased&Stuck Lean Bank 1 Sensor 2
P223100	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1
P003200	HO2S Heater Control Circuit High Bank 1 Sensor 2
P003100	HO2S Heater Control Circuit Low Bank 1 Sensor 2
P003000	HO2S Heater Control Circuit Bank 1 Sensor 2
P005300	HO2S Heater Resistance Bank 1 Sensor 1
P005326	HO2S Heater Resistance Bank 1 Sensor 1
P013500	O2 Sensor Heater Circuit Bank 1 Sensor 1
P064D17	Internal Control Module O2 Sensor Processor Performance Bank 1

DTC	Description
P064D16	Internal Control Module O2 Sensor Processor Performance Bank 1
P064D81	Internal Control Module O2 Sensor Processor Performance Bank 1
P064D00	Internal Control Module O2 Sensor Processor Performance Bank 1
P035100	Ignition Coil "A" Primary Control Circuit Open
P035300	Ignition Coil "C" Primary Control Circuit Open
P035400	Ignition Coil "D" Primary Control Circuit Open
P035200	Ignition Coil "B" Primary Control Circuit Open
P230100	Ignition Coil "A" Primary Control Circuit High
P230700	Ignition Coil "C" Primary Control Circuit High
P231000	Ignition Coil "D" Primary Control Circuit High
P230400	Ignition Coil "B" Primary Control Circuit High
P230000	Ignition Coil "A" Primary Control Circuit Low
P230600	Ignition Coil "C" Primary Control Circuit Low
P230900	Ignition Coil "D" Primary Control Circuit Low
P230300	Ignition Coil "B" Primary Control Circuit Low
P062900	Fuel Pump "A" Control Circuit High
P062800	Fuel Pump "A" Control Circuit Low
P062700	Fuel Pump "A" Control Circuit Open
P032600	Knock Sensor 1 Circ. High Input
P032500	Knock Sensor 1 Circ. Low Input
P070400	Clutch Switch Input Circuit Non-plausible
P032800	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
P032700	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor
P032815	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
P032714	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor
P124A00	Wastegate Actuator "A" Control Circuit Shorted
P2ABD00	Turbocharger/Supercharger Wastegate Actuator "A" Driver Current/ Temperature Too High
P124B00	Electric Waste Gate (E-WG) Actuator Control Chip SPI Bus Error
P024300	Turbocharger/Supercharger Wastegate Solenoid "A"
P023400	Turbocharger/Supercharger "A" Overboost Condition
P029900	Turbocharger/Supercharger "A" Underboost Condition
P050A22	Cold Start Idle Control System Performance
P050A21	Cold Start Idle Control System Performance
P050D00	Cold Start Rough Idle
P050700	Idle Control System RPM - Higher Than Expected
P050600	Idle Control System RPM - Lower Than Expected
P050500	Idle Control System
P262600	O2 Sensor Pumping Current Trim Circuit Open Bank 1 Sensor 1
P223700	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1
P013200	O2 Sensor Circuit High Voltage Bank 1 Sensor 1
P013100	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1
P224300	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1
P225100	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1
P013000	O2 Sensor Circuit Bank 1 Sensor 1
P030000	Random/Multiple Cylinder Misfire Detected

DTC	Description
P154000	Engine Torque Control Adaption at Limit
P030100	Cylinder 1 Misfire Detected
P030300	Cylinder 3 Misfire Detected
P030400	Cylinder 2 Misfire Detected
P030200	Cylinder 2 Misfire Detected
P036300	Misfire Detected - Fueling Disabled
P070000	Transmission Control System (MIL Request)
P06AA00	Control Module Internal Temperature "B" Too High
P068600	ECM/PCM Power Relay Control Circuit Low
P153000	Function Monitoring: Fault of ECU ADC - Null Load Test Pulse
P153100	Function Monitoring: Fault of ECU ADC - Test Voltage
P157000	Monitoring Module Feedback Malfunction
P060D00	2nd Layer Accelerator Pedal Signal Reasonable Malfunction
P152000	Function Monitoring: Check of Predicted Air Mass Failed
P152100	Function Monitoring: Fault of ECU Check of Injection Cut-off
P152200	Function Monitoring: Fault of ECU in Check of Cylinder Individual Fuel Corrections
P061C00	Internal Control Module Engine RPM Performance
P152300	Function Monitoring: Fault of ECU or Sensor in Mixture Check
P152700	Function Monitoring: Monitoring of ICO From Level1
P152800	Function Monitoring: Monitoring of ICO From Level2
P152400	Function Monitoring: Fault of ECU Comparison of Lambda and Operation Mode
P152500	Function Monitoring: Fault of ECU or Sensor in rl-Comparison
P152900	Function Monitoring: Fault of Starter Control
P061A00	Internal Control Module Torque Performance
P152600	Function Monitoring: Fault of ECU Ignition Timing
P157600	OverVoltage of ECU VDD5
P157700	UnderVoltage of ECU VDD5
P001400	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
P001100	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
P021900	Engine Overspeed Condition
P157800	Diagnostic Fault Check to Report WDA Active
P157300	Diagnostic Fault Check to Report WDA Active Due to Errors in Query/ Response Communication
P157500	Diagnostic Fault Check to Report WDA Active Due to Overvoltage Detection
P218700	System Too Lean at Idle Bank 1
P218800	System Too Rich at Idle Bank 1
P055800	Brake Booster Pressure Sensor Circuit High
P055700	Brake Booster Pressure Sensor Circuit Low
P145000	Brake Booster Pressure Sensor Circuit Range/Performance (High)
P145100	Brake Booster Pressure Sensor Circuit Range/Performance (Low)
P120000	Manifold Absolute Pressure Sensor Circuit Range/Performance
P120100	Manifold Absolute Pressure Sensor Circuit Range/Performance
P00C721	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1
P00C722	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1

DTC	Description
P010800	Manifold Absolute Pressure Sensor Circuit High
P010700	Manifold Absolute Pressure Sensor Circuit Low
P010621	Manifold Absolute Pressure Sensor Circuit Range/Performance
P010601	Manifold Absolute Pressure Sensor Circuit Range/Performance
P01062A	Manifold Absolute Pressure Sensor Circuit Range/Performance
P222900	Barometric Pressure Sensor "A" Circuit High
P222800	Barometric Pressure Sensor "A" Circuit Low
P223000	Barometric Pressure Sensor "A" Circuit Intermittent/Erratic
P120200	Barometric Pressure Sensor "A" Circuit Range/Performance
P120300	Barometric Pressure Sensor "A" Circuit Range/Performance
P222722	Barometric Pressure Sensor "A" Circuit Range/Performance
P222721	Barometric Pressure Sensor "A" Circuit Range/Performance
P023800	Turbocharger/Supercharger Boost Sensor "A" Circuit High
P023700	Turbocharger/Supercharger Boost Sensor "A" Circuit Low
P120400	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
P120500	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
P023622	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
P023621	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/ Performance
P212300	Electronic Accelerator Position Sensor 1 Signal Voltage Too High
P212800	Electronic Accelerator Position Sensor 2 Signal Voltage Too High
P212200	Electronic Accelerator Position Sensor 1 Signal Voltage Too Low
P212700	Electronic Accelerator Position Sensor 2 Signal Voltage Too Low
P201000	Intake Manifold Runner Control Circuit High Bank 1
P200900	Intake Manifold Runner Control Circuit Low Bank 1
P200800	Intake Manifold Runner Control Circuit/Open Bank 1
P261000	ECM/PCM Engine Off Timer Performance
P061500	Starter Relay Control Circuit Error
P061700	Starter Relay Control Circuit High
P213800	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation
P064100	Sensor Reference Voltage "A" Circuit Open
P065100	Sensor Reference Voltage "B" Circuit Open
P063442	Control Module Internal Temperature "A" Too High
P138024	Intake Air Temperature Sensor 2 Multiple Check Bank1
P138023	Intake Air Temperature Sensor 2 Multiple Check Bank1
P009800	Intake Air Temperature Sensor 2 Circuit High Bank 1
P009700	Intake Air Temperature Sensor 2 Circuit Low Bank 1
P009900	Intake Air Temperature Sensor 2 Circuit Intermittent/Erratic Bank 1
P044200	EVAP System Leak Detected (Small Leak)
P045500	EVAP System Leak Detected (Large Leak)
P049600	EVAP System High Purge Flow
P049700	EVAP System Low Purge Flow
P045900	Evaporative Emission System Purge Control Valve Circuit High
P045800	Evaporative Emission System Purge Control Valve Circuit Low
P044400	Evaporative Emission System Purge Control Valve Circuit Open
P050C24	Cold Start Engine Coolant Temperature Performance

DTC	Description
P050C23	Cold Start Engine Coolant Temperature Performance
P011800	Engine Coolant Temperature Sensor 1 Circuit High
P011700	Engine Coolant Temperature Sensor 1 Circuit Low
P011900	Engine Coolant Temperature Sensor 1 Circuit Intermittent
P011623	Engine Coolant Temperature Sensor 1 Circuit Range/Performance
P011626	Engine Coolant Temperature Sensor 1 Circuit Range/Performance
P007200	Ambient Air Temperature Sensor Circuit <A> Low
P007300	Ambient Air Temperature Sensor Circuit <A> High
P007000	Ambient Air Temperature Sensor Circuit <A>
P209700	Post Catalyst Fuel Trim System Too Rich Bank 1
P209600	Post Catalyst Fuel Trim System Too Lean Bank 1
P042000	Catalyst System Efficiency Below Threshold Bank 1
P069000	ECM/PCM Power Relay Sense Circuit High
P056300	System Voltage High
P056200	System Voltage Low
P056000	System Voltage Unstable
P241400	O2 Sensor Exhaust Sample Error Bank 1 Sensor 1
P256500	Turbocharger Boost Control Position Sensor "A" Circuit High
P256400	Turbocharger Boost Control Position Sensor "A" Circuit Low
P063443	Control Module Internal Temperature "A" Too High
P121200	Vehicle Speed Sensor "A" Circuit Range/Performance
P050300	Vehicle Speed Sensor "A" Circuit Intermittent/Erratic/High
P050000	Vehicle Speed Sensor "A" Circuit
P050166	Vehicle Speed Sensor "A" Circuit Range/Performance
P050165	Vehicle Speed Sensor "A" Circuit Range/Performance
P161300	This symbol means that ECM and vehicle has different immo configurations (Deactivate ECM's immo function, while activating vehicle's immo function)
P051300	Incorrect immobilizer key
P063300	Immobilizer Key Not Programmed-ECM/PCM
P161000	No Response Received by ECM/PCM After Challenge Sent
P161200	Internal Error When Writing Data to Eeprom
P161100	Unexpected Initial Value In Eeprom
P25B300	Turbocharger/Supercharger Wastegate "A" Stuck Open
P25B400	Turbocharger/Supercharger Wastegate "A" Stuck Closed
P003A00	Turbocharger/Supercharger Boost Control "A" Position Exceeded Learning Limit

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
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
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 B

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 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 upstream oxygen sensor heater control circuit pin terminal	Yes	Repair wire harness
		No	Next
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 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	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 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	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

P0053 HO2S Heater Resistance Bank 1 Sensor 1

1. DTC operating condition
   - Exhaust temperature (ECM calculated value) of upstream oxygen sensor (front 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 P0134 (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 upstream oxygen sensor heater exceeds threshold value (different exhaust temperatures correspond to different threshold values, MT is 1840 Ω ～ 13600 Ω and CVT is 1012 Ω ～ 8000 Ω), it indicates that upstream oxygen sensor heater internal resistance (equivalent resistance calculated by ECM) is improper, causing emission level higher than OBD limit.
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	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12V.	Yes	Next
		No	Check wire harness and connector

No.	Operation Step	Test Result	Subsequent Step
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12V.	Yes	Next
		No	Check wire harness and connector
5	Disconnect upstream oxygen sensor wire connector to remove upstream oxygen sensor. Place the oxygen sensor at room temperature to cool it down. Measure if resistance between sensor terminal No.4 interface (white, heater power source positive) and No.3 interface (white, heater power source grounded) is higher than 15 Ω with a multimeter when temperature of oxygen sensor cools down to room temperature.	Yes	Replace oxygen sensor
		No	Diagnostic Help

P0054 HO2S Heater Resistance Bank 1 Sensor 2

1. DTC operating condition
   - Exhaust temperature (ECM calculated value) of downstream oxygen sensor (front 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	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12V.	Yes	Next
		No	Check wire harness and connector

No.	Operation Step	Test Result	Subsequent Step
4	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12V.	Yes	Next
		No	Check wire harness and connector
5	Disconnect upstream oxygen sensor wire connector to remove upstream oxygen sensor. Place the oxygen sensor at room temperature to cool it down. Measure if resistance between sensor terminal No.4 interface (white, heater power source positive) and No.3 interface (white, heater power source grounded) is higher than 15 Ω with a multimeter when temperature of oxygen sensor cools down to room temperature.	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
   - ENGINE START STOP 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
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

No.	Operation Step	Test Result	Subsequent Step
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
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 Temp.Circ. Performance Non-plausible

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
   - ENGINE START STOP 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

No.	Operation Step	Test Result	Subsequent Step
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
   - ENGINE START STOP 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
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
   - ENGINE START STOP 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/Pedal Position Sensor/Switch "A" Circuit High

1. DTC operating condition
   - ENGINE START STOP 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 downstream 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 (white, heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45V	Yes	Next
		No	Check wire harness and connector
6	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECM terminal 2 wire (black, oxygen sensor signal wire) and 1 wire (gray, oxygen sensor signal grounded) is changed in range of 0V - 1V.	Yes	Next
		No	Replace oxygen sensor
7	Start and keep vehicle idling until coolant temperature reaches normal value. Disconnect upstream oxygen sensor connector. Measure if oxygen sensor terminal No. 3 wire (white, heater power grounded) and No. 2 wire (black, oxygen sensor signal wire) are short circuit.	Yes	Replace oxygen sensor
		No	Diagnostic Help
8	Connect upstream oxygen sensor connector properly, repeat step 5-6 and check if voltage signal is changed in range of 0.44 V - 0.46 V and 0 V - 1 V respectively.	Yes	End
		No	Diagnostic Help

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, measure if voltage between upstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45V	Yes	Next
		No	Check wire harness and connector
4	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECM terminal 2 wire (black, oxygen sensor signal wire) and 1 wire (gray, oxygen sensor signal grounded) is changed in range of 0V - 1V.	Yes	Next
		No	Replace oxygen sensor
5	Disconnect upstream oxygen sensor connector and measure if sensor terminal 1 wire (gray, oxygen sensor signal grounded) and 2 wire (black, oxygen sensor signal wire) are short circuit with a multimeter.	Yes	Replace oxygen sensor
		No	Diagnostic Help

No.	Operation Step	Test Result	Subsequent Step
6	Connect upstream oxygen sensor connector properly, repeat step 3-4 and check if voltage signal is changed in range of 0.44 V - 0.46 V and 0 V - 1 V respectively.	Yes	End
		No	Diagnostic Help

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 (white, heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45V	Yes	Next
		No	Replace oxygen sensor

No.	Operation Step	Test Result	Subsequent Step
6	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECM terminal 2 wire (black, oxygen sensor signal wire) and 1 wire (gray, oxygen sensor signal grounded) is changed in range of 0 V - 1 V.	Yes	Next
		No	Replace oxygen sensor
7	Disconnect upstream oxygen sensor connector and measure if there is short circuit between sensor terminal No. 4 wire (white, heater power source positive) and No. 2 wire (black, oxygen sensor signal wire) with a multimeter.	Yes	Replace oxygen sensor
		No	Next
8	Connect upstream oxygen sensor connector properly, repeat step 5-6 and check if voltage signal is changed in range of 0.44 V - 0.46 V and 0 V - 1 V respectively.	Yes	End
		No	Diagnostic Help

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

No.	Operation Step	Test Result	Subsequent Step
3	Replace upstream oxygen sensor and connect wire harness connector properly. 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 between 0.44 V and 0.46 V.	Yes	Next
		No	Replace oxygen sensor
4	Start and keep vehicle idling until coolant temperature reaches normal value. 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 between 0 V and 1 V.	Yes	Diagnostic Help
		No	Replace oxygen sensor

P0134 O2 Sensor Circ. No Activity Detected (Upstream of the Catalyzer)

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 0.2 V 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

No.	Operation Step	Test Result	Subsequent Step
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 (white, heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, check connection of No.2 wire (black, oxygen sensor signal wire) for open circuit with a multimeter	Yes	Check wire harness and connector
		No	Next
6	Do not disconnect oxygen sensor connector, check connection of No.1 wire (gray, oxygen sensor signal grounded) for open circuit with a multimeter	Yes	Check wire harness and connector
		No	Next
7	Disconnect upstream oxygen sensor wire connector to remove upstream oxygen sensor. Place the oxygen sensor at room temperature to cool it down. Measure if resistance between sensor terminal No.4 interface (white, heater power source positive) and No.3 interface (white, heater power source grounded) is higher than 15 Ω with a multimeter when temperature of oxygen sensor cools down to room temperature.	Yes	Replace oxygen sensor
		No	Next
8	Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45V	Yes	Next
		No	Replace oxygen sensor
9	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECM terminal 2 wire (black, oxygen sensor signal wire) and 1 wire (gray, oxygen sensor signal grounded) is changed in range of 0V - 1V.	Yes	Next
		No	Replace oxygen sensor
10	Connect upstream oxygen sensor connector properly, repeat steps 8 and 9 and check if voltage signal changes between 0.44 V and 0.46 V, 0 V - 1 V respectively.	Yes	End
		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.

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	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECM terminal No.2 wire [black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded] is about 0.45V	Yes	Next
		No	Check wire harness and connector
6	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is changed in range of 0V - 1V.	Yes	Next
		No	Replace oxygen sensor

No.	Operation Step	Test Result	Subsequent Step
7	Start and keep vehicle idling until coolant temperature reaches normal value. Disconnect downstream oxygen sensor connector, measure if oxygen sensor terminal No.3 wire (white, heater power grounded) and No.2 wire (black, oxygen sensor signal wire) are short circuit.	Yes	Replace oxygen sensor
		No	Diagnostic Help
8	Connect downstream oxygen sensor connector properly, repeat steps 5-6 and check if voltage signal changes between 0.44 V and 0.46 V, 0 V and 1 V respectively.	Yes	End
		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	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45V	Yes	Next
		No	Check wire harness and connector

No.	Operation Step	Test Result	Subsequent Step
4	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is changed in range of 0V - 1V.	Yes	Next
		No	Replace oxygen sensor
5	Disconnect downstream oxygen sensor connector and measure if sensor terminal 1 wire (gray, oxygen sensor signal grounded) and 2 wire (black, oxygen sensor signal wire) are short circuit with a multimeter.	Yes	Replace oxygen sensor
		No	Diagnostic Help
6	Connect downstream oxygen sensor connector properly, repeat steps 3-4 and check if voltage signal changes between 0.44 V and 0.46 V, 0 V and 1 V respectively.	Yes	End
		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	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12V	Yes	Next
		No	Check wire harness and connector

No.	Operation Step	Test Result	Subsequent Step
4	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45V	Yes	Next
		No	Check wire harness and connector
6	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECM terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is changed in range of 0V - 1V.	Yes	Next
		No	Replace oxygen sensor
7	Start and keep vehicle idling until coolant temperature reaches normal value. Disconnect downstream oxygen sensor connector, measure if oxygen sensor terminal No.3 wire (white, heater power grounded) and No.2 wire (black, oxygen sensor signal wire) are short circuit.	Yes	Replace oxygen sensor
		No	Diagnostic Help
8	Connect downstream oxygen sensor connector properly, repeat steps 5-6 and check if voltage signal changes between 0.44 V and 0.46 V, 0 V and 1 V respectively.	Yes	End
		No	Diagnostic Help

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

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 more than 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

No.	Operation Step	Test Result	Subsequent Step
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
   - ENGINE START STOP 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
   - ENGINE START STOP 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 Circuit Low

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 Circuit High

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 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

P0420 Catalyst System Efficiency Below Threshold Bank 1

1. DTC operating condition
   - Engine speed is in range of 1360 and 2520 rpm;
   - Engine load is in range of 22.5 and 48%/(for MT: 21.75 - 54.75, for CVT: 24 - 60) steadily;
   - Catalytic converter temperature is in range of 500 - 720 deg steadily;
   - Ambient temperature is not less than -10°C;
   - Keep engine fuel supply;
   - No high load on carbon canister;
   - Oxygen sensor and misfire malfunctions are not detected (A: P0140, P2177, P2178, P0300 ~ P0304, etc.)
2. DTC setting condition
   - ECM detects that aging coefficient of catalytic converter exceeds a certain value (0.2), which indicates deterioration for catalytic converter, causing emission level exceeds OBD limiting value.
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, 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	Replace the catalytic converter. Check if malfunction reappears after returning vehicle to customer	Yes	Diagnostic Help
		No	End

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

No.	Operation Step	Test Result	Subsequent Step
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 solenoid valve damaged	Yes	Replace canister solenoid 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
   - ENGINE START STOP 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

No.	Operation Step	Test Result	Subsequent Step
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
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 faults 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

No.	Operation Step	Test Result	Subsequent Step
2	Clear DTCs	/	Next
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
   - ENGINE START STOP 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 1 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
   - ENGINE START STOP 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 1 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
   - ENGINE START STOP 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 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

P2128 Pedal Pos.Sensor 2 Circ. High Input

1. DTC operating condition
   - ENGINE START STOP 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 2 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
   - ENGINE START STOP 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

No.	Operation Step	Test Result	Subsequent Step
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

P2195 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1

1. DTC operating condition
   - Engine speed is in a certain range(for MT: 1120 - 3120 rpm , for CVT: 1400 - 2320 rpm);
   - Engine load is in range of 20.25 - 69.75% steadily;
   - Temperature of upstream oxygen sensor is higher than 500 deg;
   - Rear oxygen closed loop control effect; [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 10-15 minutes steadily].
2. DTC setting condition
   - ECM detects that rear oxygen control integration (an integration compensation of rear oxygen closed loop control) exceeds a certain value (0.95 s), it indicates unilateral deterioration for upstream oxygen sensor (indicates a response of one direction), causing emission level exceeds OBD limiting value.
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

No.	Operation Step	Test Result	Subsequent Step
4	Upstream 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
5	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
6	Start and keep vehicle idling until coolant temperature reaches normal value. Upstream 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
7	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
8	Clear DTCs. Check if malfunction reappears after returning vehicle to customer	Yes	Next
		No	End
9	Replace the catalytic converter, and check according to above steps 3-7. Clear DTCs. Check if malfunction reappears after returning vehicle to customer	Yes	Diagnostic Help
		No	End

P2196 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1

1. DTC operating condition
   - Engine speed is in a certain range(for MT: 1120 - 3120 rpm , for CVT: 1400 - 2320 rpm);
   - Engine load is in range of 20.25 - 69.75% steadily;
   - Temperature of upstream oxygen sensor is higher than 500 deg;
   - Rear oxygen closed loop control effect; [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 10-15 minutes steadily].
2. DTC setting condition
   - ECM detects that rear oxygen control integration (an integration compensation of rear oxygen closed loop control) exceeds a certain value (0.95 s), it indicates unilateral deterioration for upstream oxygen sensor (indicates a response of one direction), causing emission level exceeds OBD limiting value.
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	Upstream 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
5	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
6	Start and keep vehicle idling until coolant temperature reaches normal value. Upstream 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
7	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
8	Clear DTCs. Check if malfunction reappears after returning vehicle to customer	Yes	Next
		No	End
9	Replace the catalytic converter, and check according to above steps 3-7. Clear DTCs. Check if malfunction reappears after returning vehicle to customer	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
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 TCU

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
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 BSM

1. DTC operating condition
   - ECM does not detect CAN line BUSOFF fault;
   - Engine is running.
2. DTC setting condition
   - ECM detects that information from ABS 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	ABS connector looseness or separation	Yes	Reconnect
		No	Next
2	There is wire harness signal interference	Yes	Shielded wire
		No	Next
3	Transmission line between ABS and ECM is 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

No.	Operation Step	Test Result	Subsequent Step
5	ABS is damaged and signal cannot be transmitted to ECM normally	Yes	Consult the ABS supplier
		No	Diagnostic Help

U0155 Lost Communication With ICM

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 manifold pressure 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

No.	Operation Step	Test Result	Subsequent Step
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
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

P0237 Turbocharger/Supercharger Boost Sensor "A" Circuit Low

1. DTC operating condition
   - ENGINE START STOP switch ON.
2. DTC setting condition
   - Boost pressure sensor measured voltage is less than 0.097V for more than 2 seconds.
3. Operation required for DTC setting
   - After the fault is detected in 1 driving cycle that meets DTC operating condition, 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	Sensor signal terminal pin short to ground	Yes	Repair wire harness
2	Sensor power supply terminal pin short to ground	No	Next
		Yes	Repair wire harness
3	Offset or damage to sensor resistance and other characteristics	No	Next
		Yes	Replace sensor
4	Sensor signal terminal pin corresponding to ECM short to ground	No	Next
		Yes	Inspect and repair ECM

P0238 Turbocharger/Supercharger Boost Sensor "A" Circuit High

1. DTC operating condition
   - ENGINE START STOP switch ON.
2. DTC setting condition
   - Boost pressure sensor measured voltage is less than 0.097V for more than 2 seconds.
3. Operation required for DTC setting
   - After the fault is detected in 1 driving cycle that meets DTC operating condition, 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 disengagement	Yes	Reconnect
2	Sensor signal terminal pin short to power source or open	No	Next
		Yes	Repair wire harness
3	Sensor power supply terminal, grounded terminal pin open	No	Next
		Yes	Repair wire harness
4	Offset or damage to sensor resistance and other characteristics	No	Next
		Yes	Replace sensor
5	Short circuit to power source, open circuit or internal circuit damage in sensor signal terminal pin terminal corresponding to ECM	No	Next
		Yes	Inspect and repair ECM

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

No.	Operation Step	Test Result	Subsequent Step
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
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 BCM

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

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	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
   - ENGINE START STOP 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

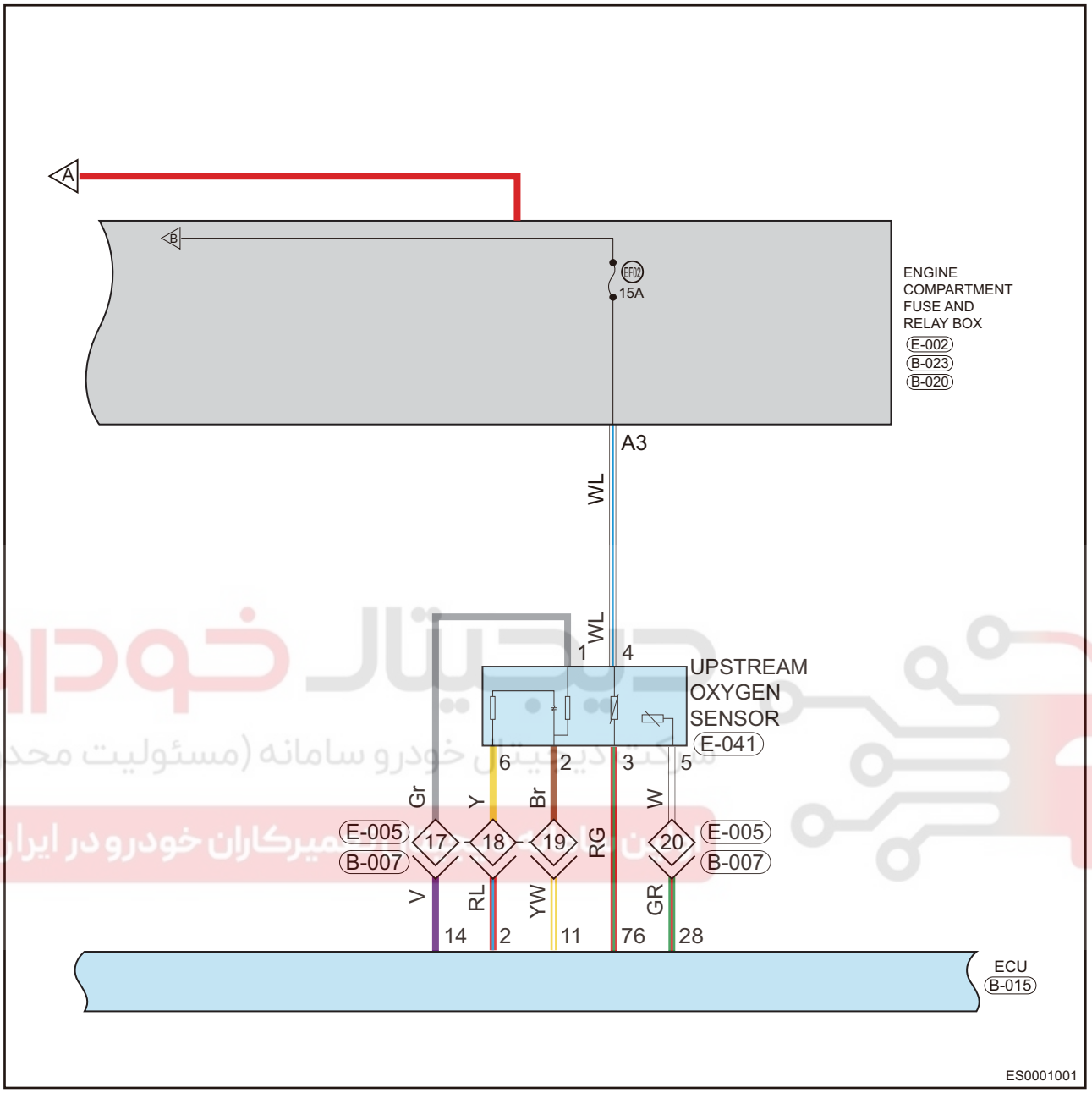
1. DTC operating condition
   - ENGINE START STOP switch ON.
2. DTC setting condition
   - Ambient pressure sensor voltage is higher than 4.883V.
3. Operation required for DTC setting
   - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions 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

No.	Operation Step	Test Result	Subsequent Step
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 Circ. No Activity Detected (Upstream of the Catalyzer)
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 2
DTC	P0031 00	HO2S Heater Control Circuit Low Bank 1 Sensor 2
DTC	P0030 00	HO2S Heater Control Circuit Bank 1 Sensor 2
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 Circ. No Activity Detected (Upstream of the Catalyzer)		
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 2		
P0031 00	HO2S Heater Control Circuit Low Bank 1 Sensor 2		
P0030 00	HO2S Heater Control Circuit Bank 1 Sensor 2		
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 not 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 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.

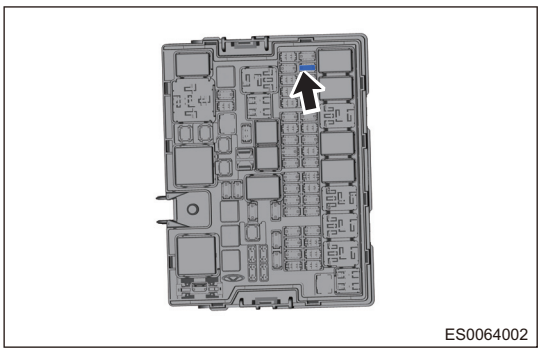
Procedure

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 connector

(a) Check if upstream oxygen sensor 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

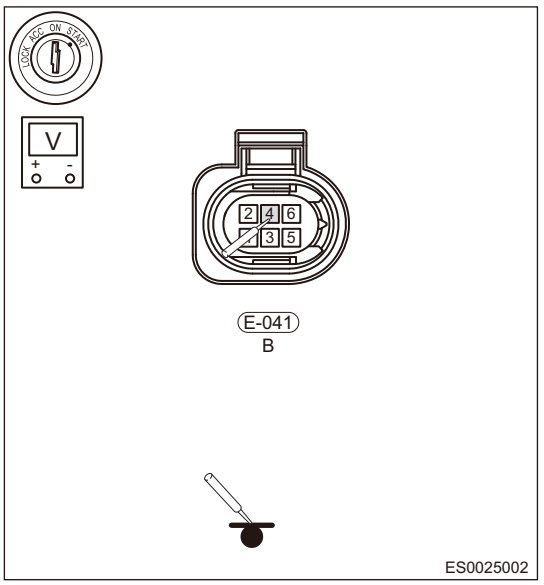
(a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage of terminal 4 of upstream oxygen sensor connector E-041 (using a digital multimeter) (online detection).

Multimeter Connection	Condition	Specified Condition
E-041 (4) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

Result

Proceed to
OK
NG



NG → **Check wire harness between E-041 (4) and front compartment fuse and relay box E-002 (3)**

OK

4 Check upstream oxygen sensor heater voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage of terminal 2 of upstream oxygen sensor connector E-041 (using a digital multimeter) (online detection).

Multimeter Connection	Condition	Specified Condition
E-041 (2) - Body ground	ENGINE START STOP switch ON	8 - 9 V

Result

Proceed to
OK
NG

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

OK

5 Check upstream oxygen sensor heater heating wire harness

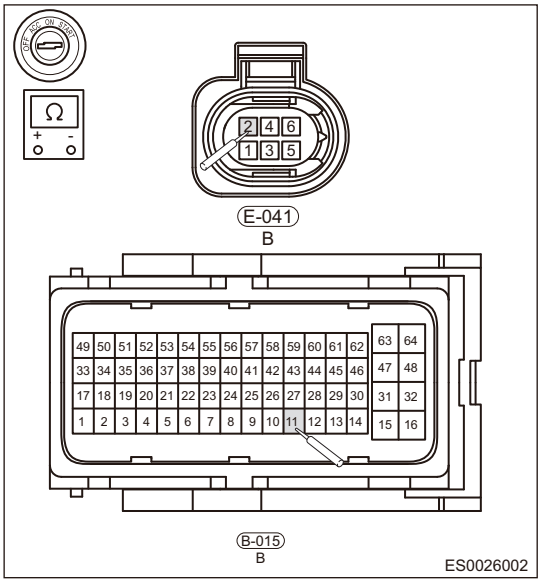
(a) Turn ENGINE START STOP switch to OFF. Disconnect the negative battery cable.
(b) Disconnect upstream oxygen sensor connector E-041 and ECM connector B-015.

(c) Check heating wire harness between upstream oxygen sensor connector E-041 and ECM connector B-015.

Multimeter Connection	Condition	Specified Condition
E-041 (2) - B-015 (11)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG



NG → **Repair or replace wire harness**

OK

6 Check upstream oxygen sensor heating resistance

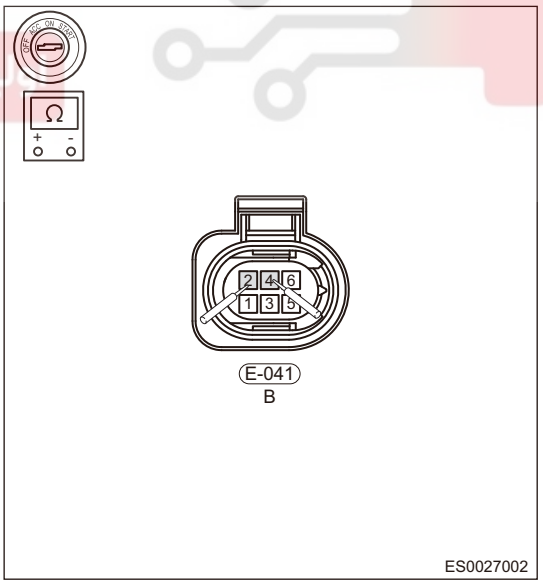
(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the upstream oxygen sensor connector.
(d) Check heating resistance between terminals of upstream oxygen sensor.

Multimeter Connection	Condition	Specified Condition
E-041 (2) - E-041 (4)	At room temperature	4 – 5 Ω

OK
Upstream oxygen sensor heating resistance is normal

Result

Proceed to
OK
NG



NG → **Replace 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

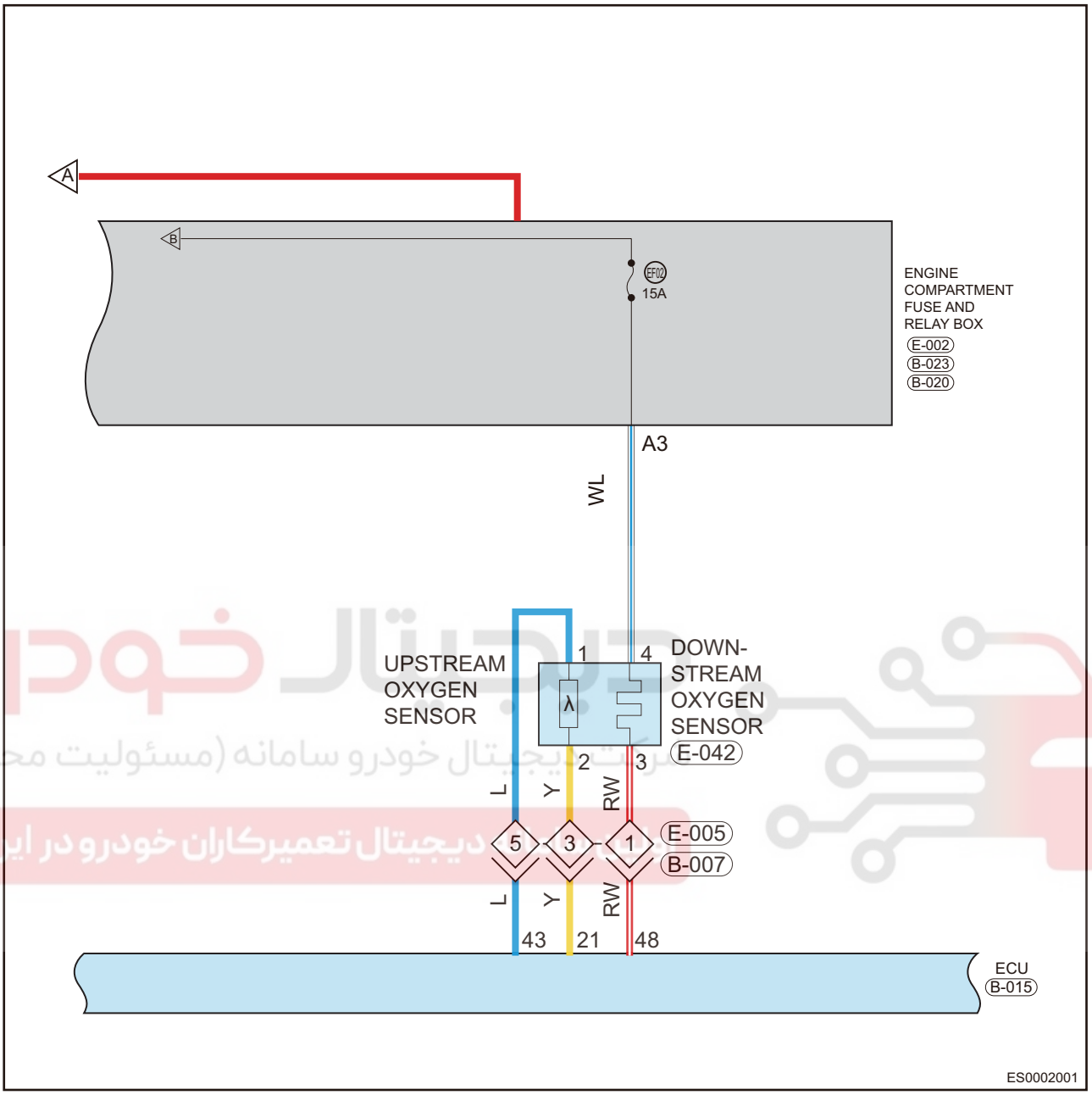
Result

Proceed to
OK
NG

System operates normally
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 not 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 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.

Caution:

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

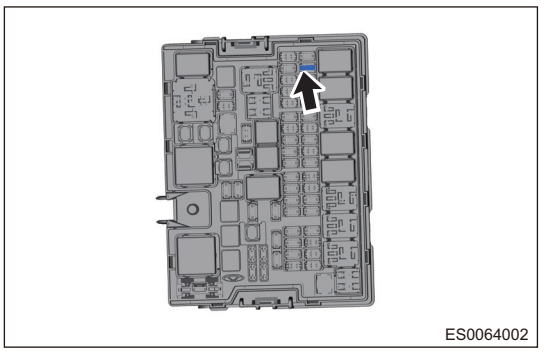
Procedure

1	Check fuse EF02

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

Result

Proceed to
OK
NG



04

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) Measure voltage of terminal 4 of downstream oxygen sensor connector E-042 (using a digital multimeter) (online detection).

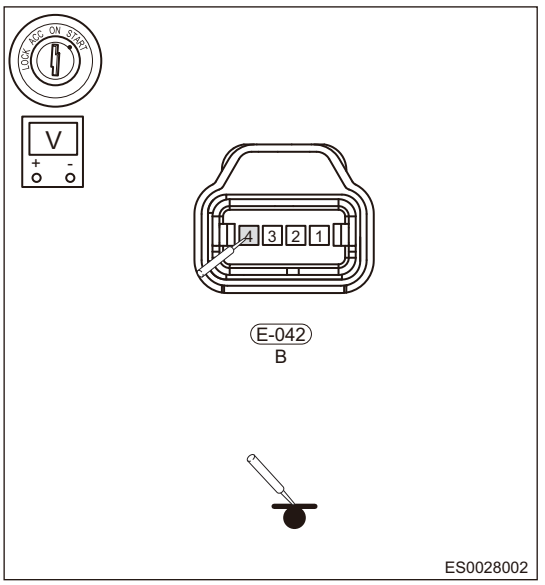
Multimeter Connection	Condition	Specified Condition
E-042 (4) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Voltage between downstream oxygen sensor connector and body ground is normal

Result

Proceed to
OK
NG



NG → **Check wire harness between E-042 (4) and front compartment fuse and relay box**

OK

4 Check downstream oxygen sensor heater voltage

(a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage of terminal 3 of downstream oxygen sensor connector E-042 (using a digital multimeter) (online detection).

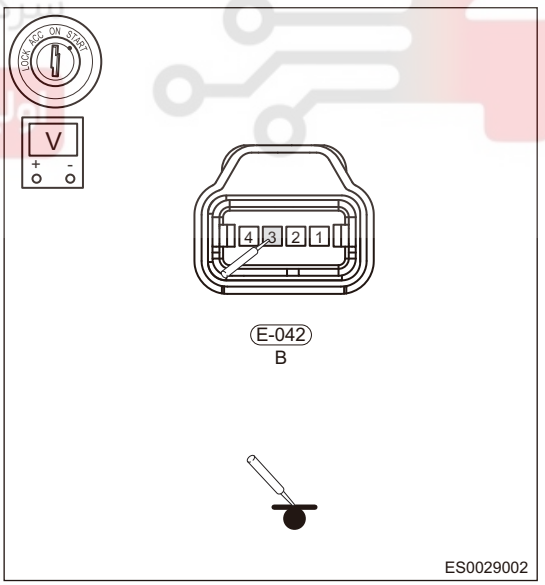
Multimeter Connection	Condition	Specified Condition
E-042 (3) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

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 E-042.

Multimeter Connection	Condition	Specified Condition
E-042 (3) - E-042 (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 B-015.
(c) Check heating wire harness between downstream oxygen sensor connector E-042 (3) and ECM connector B-015 (48).

Multimeter Connection	Condition	Specified Condition
E-042 (3) - B-015 (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

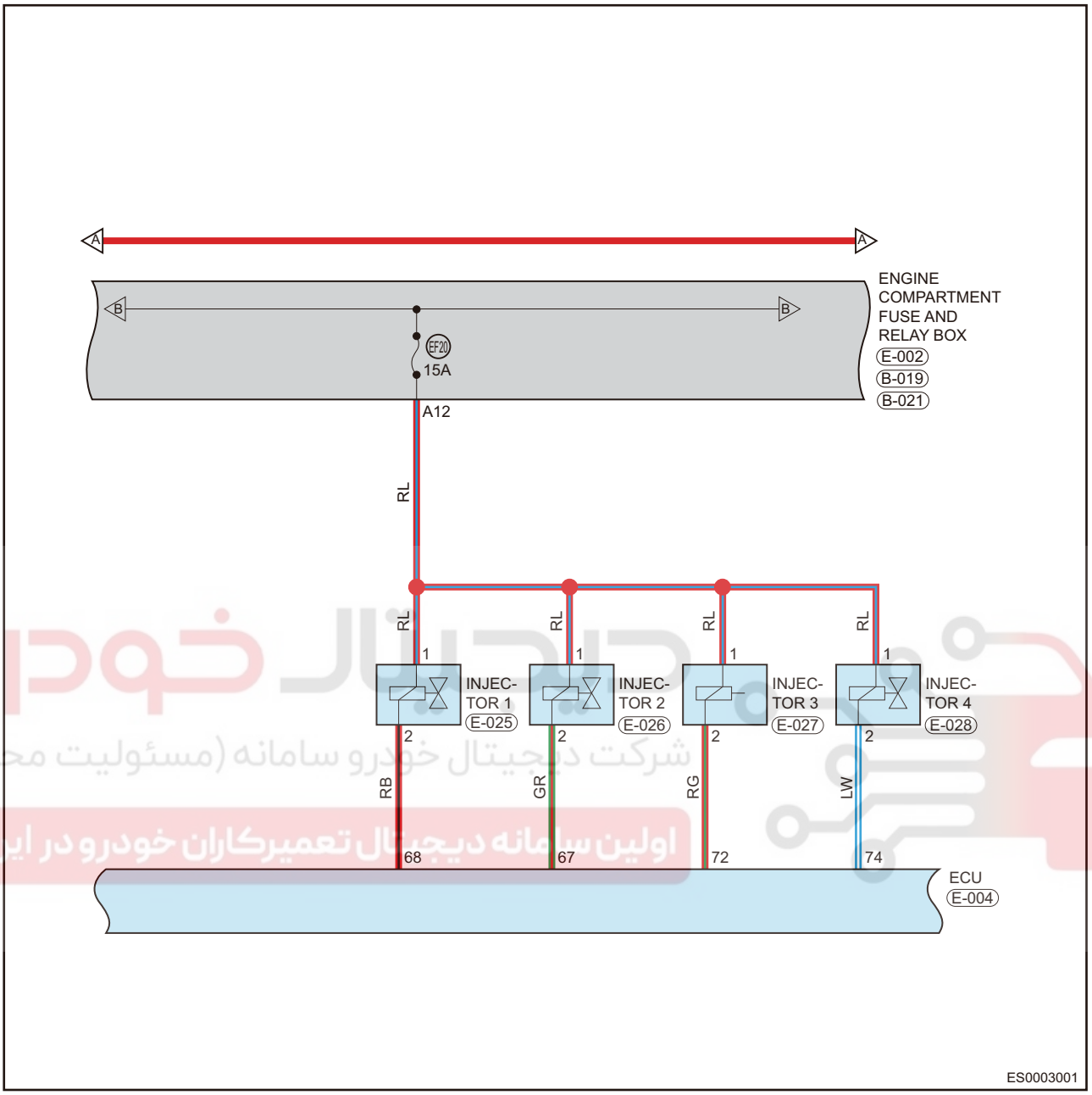
Result

Proceed to
OK
NG

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

DTC	P0201 13	Cylinder 1 - Injector Circuit Error
DTC	P0202 13	Cylinder 2 - Injector Circuit Error
DTC	P0203 13	Cylinder 3 - Injector Circuit Error
DTC	P0204 13	Cylinder 4 - Injector Circuit Error
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 Error	ENGINE START STOP switch ON, engine running	Fuel injector Wire harness or connector ECM
P0202 13	Cylinder 2 - Injector Circuit Error		
P0203 13	Cylinder 3 - Injector Circuit Error		
P0204 13	Cylinder 4 - Injector Circuit Error		
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 not 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.

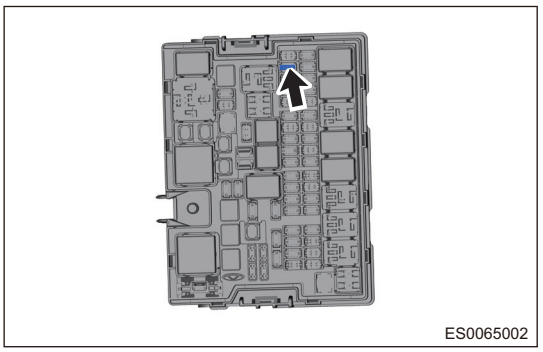
Procedure

1	Check front compartment fuse EF20

(a) Check if fuse EF20 (15A) is blown or no power.

Result

Proceed to
OK
NG

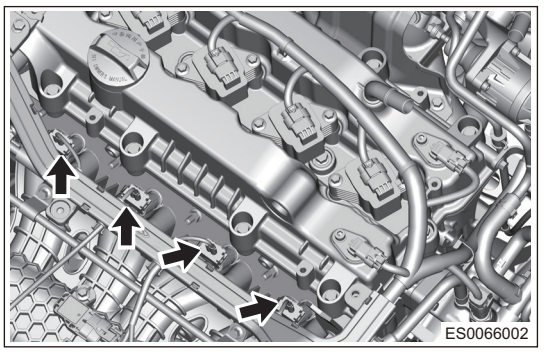


NG → **Replace fuse or check the cause for no power**

OK

2	Check injector connector

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



Result

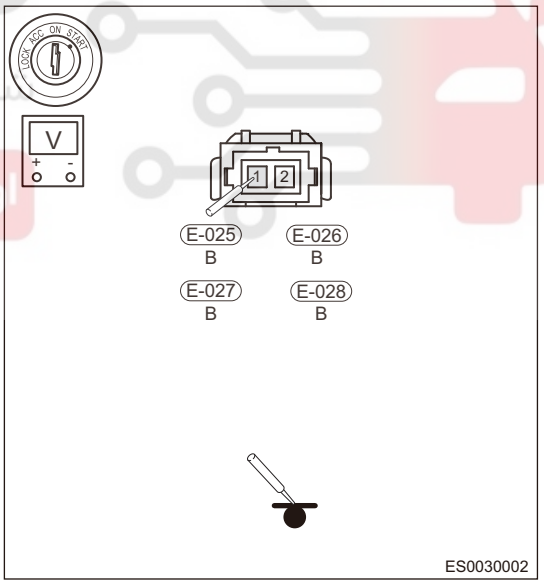
Proceed to
OK
NG

NG → **Reconnect or replace connector**

OK

3	Check injector power supply voltage

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



Multimeter Connection	Condition	Specified Condition
E-025 (1), E-026 (1), E-027 (1), E-028 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

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 front 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

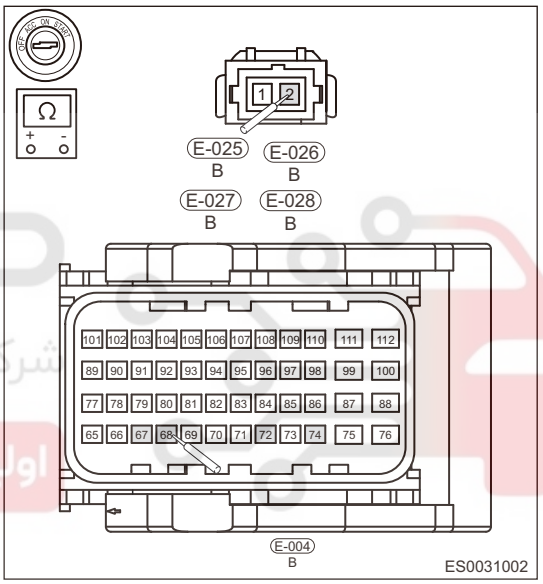
04

5 Check injector control circuit

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect ECM connector E-004 and 4 injector connectors.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-025 (2) - E-004 (68)	Always	Resistance ⩽ 1 Ω
E-026 (2) - E-004 (67)		
E-027 (2) - E-004 (72)		
E-028 (2) - E-004 (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

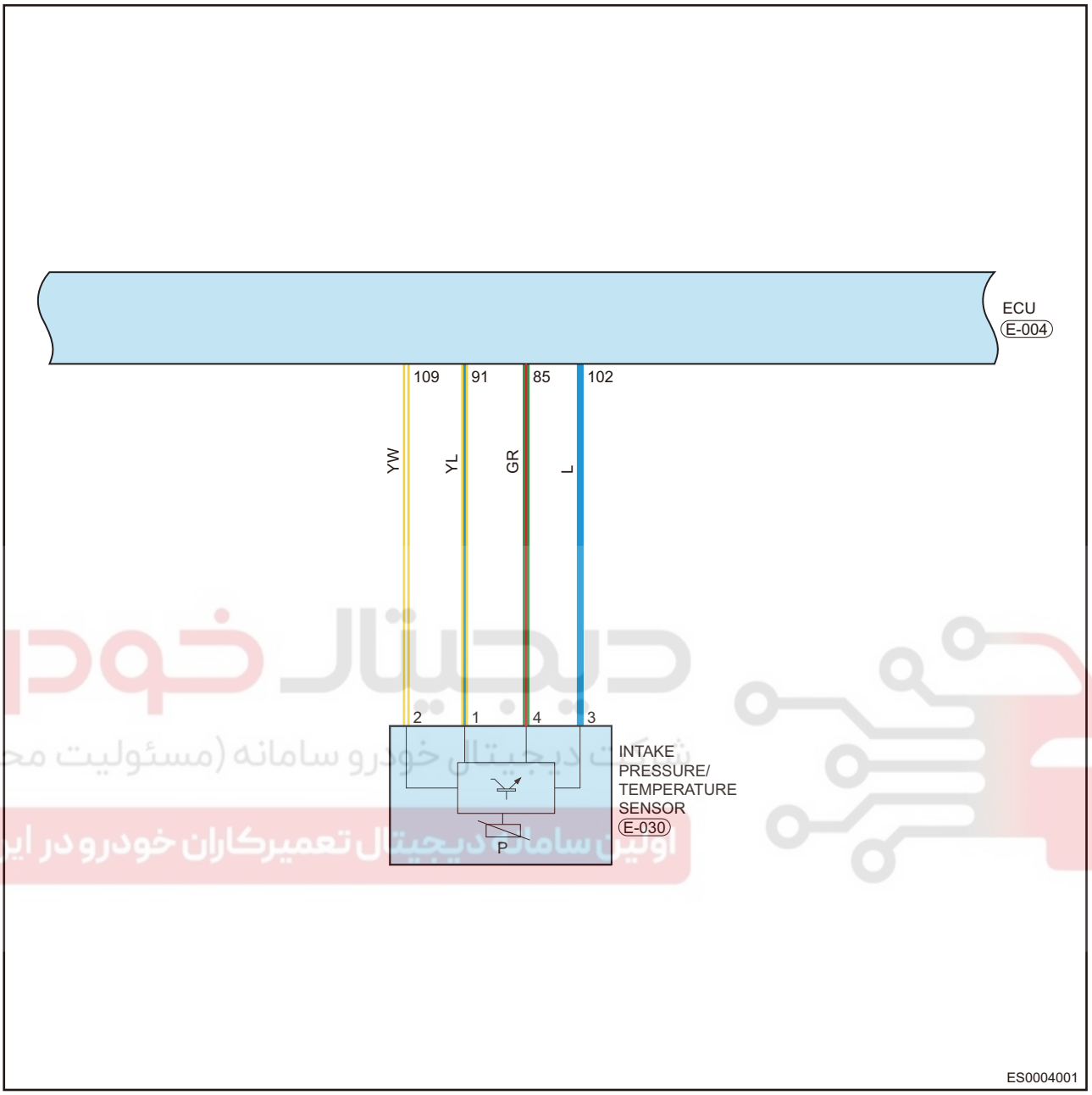
Result

Proceed to
OK
NG

System operates normally
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 Absolute Pressure Sensor Circuit Range/ Performance

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 Absolute Pressure Sensor Circuit Range/ Performance		

Confirmation Procedure

Confirm that battery voltage is not 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.

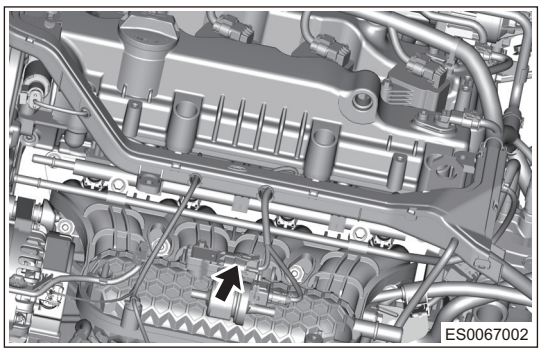
Caution:

- 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

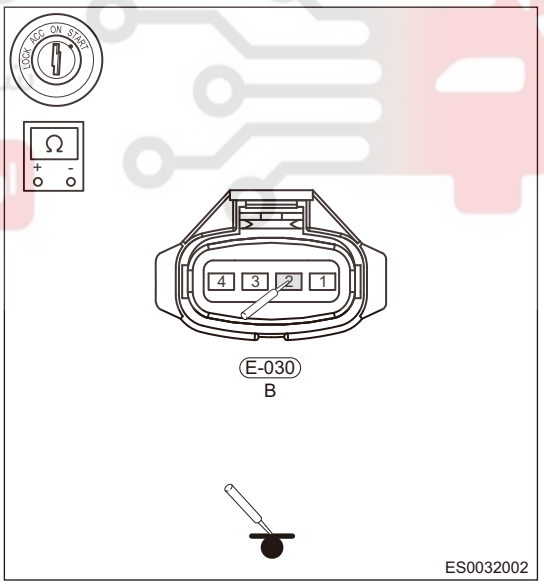
(a) Turn ENGINE START STOP switch to ON.
(b) Intake pressure/temperature sensor connector E-030 (using a digital multimeter)(online detection).

Multimeter Connection	Condition	Specified Condition
E-030 (2) - 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 sensor power supply and ECM**

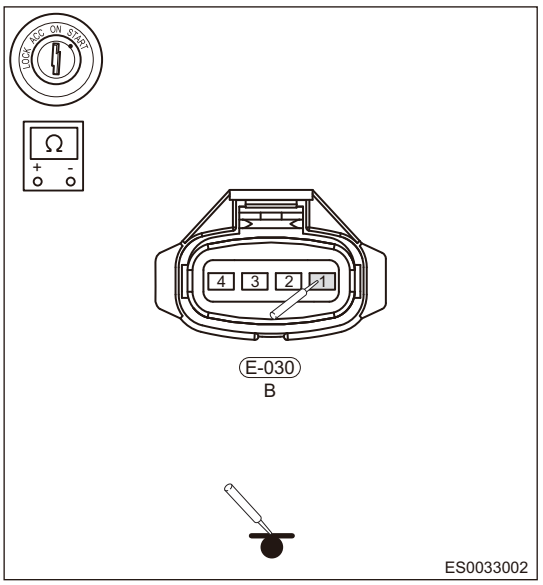
OK

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 1 of connector E-030 and body ground (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-030 (1) - Body ground	Idle	Voltage is about 1.3V (value changes with model)
	Rapidly depress accelerator pedal	Maximum instantaneous voltage is about 4 V (value changes with model)



OK

Intake pressure/temperature sensor voltage is normal

Result

Proceed to
OK
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 connector E-030 (3) and E-004 (102).

Multimeter Connection	Condition	Specified Condition
E-030 (3) - E-004 (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

Proceed to
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

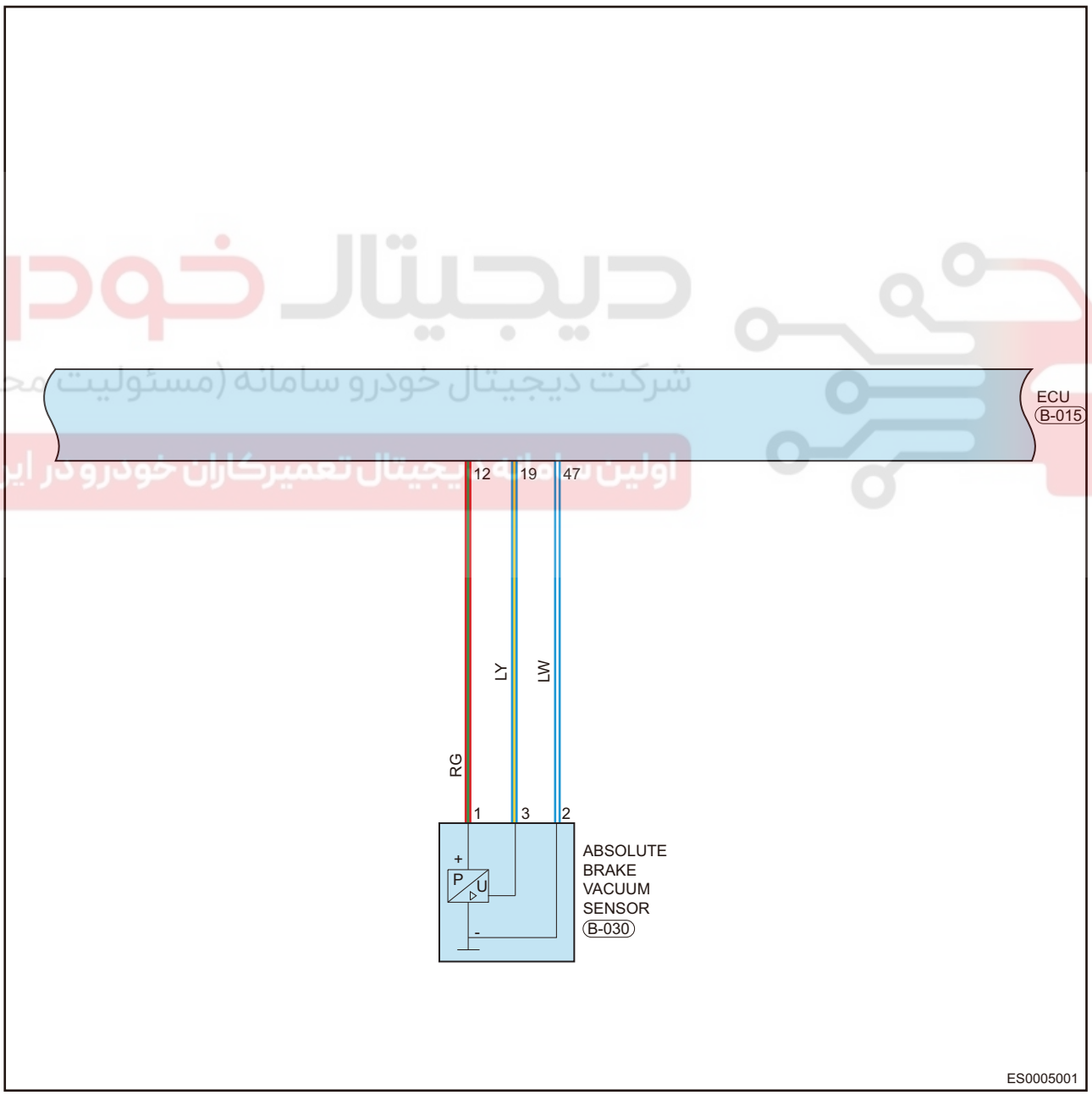
Proceed to
OK
NG

System operates normally

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 not 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:

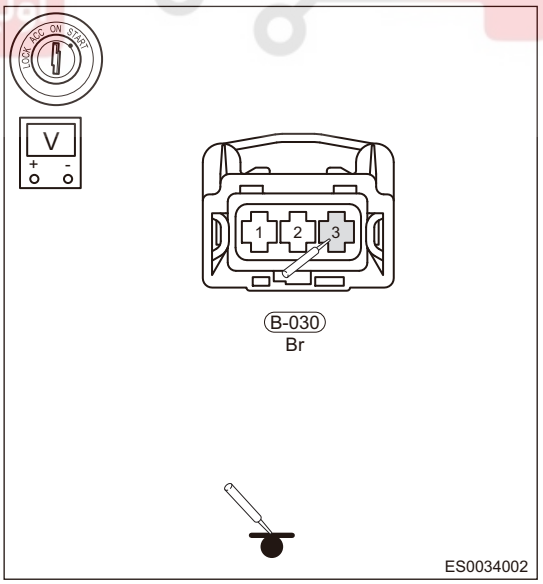
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

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
B-030 (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

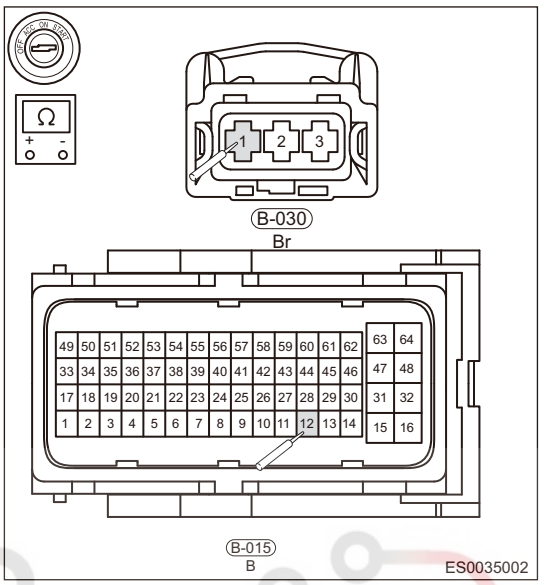
(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect vacuum pressure sensor connector B-030 and ECM connector B-015.
(d) Check the wire harness between connector.

Check for Open

Multimeter Connection	Condition	Specified Condition
B-030 (1) - B-015 (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 B-030.
(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

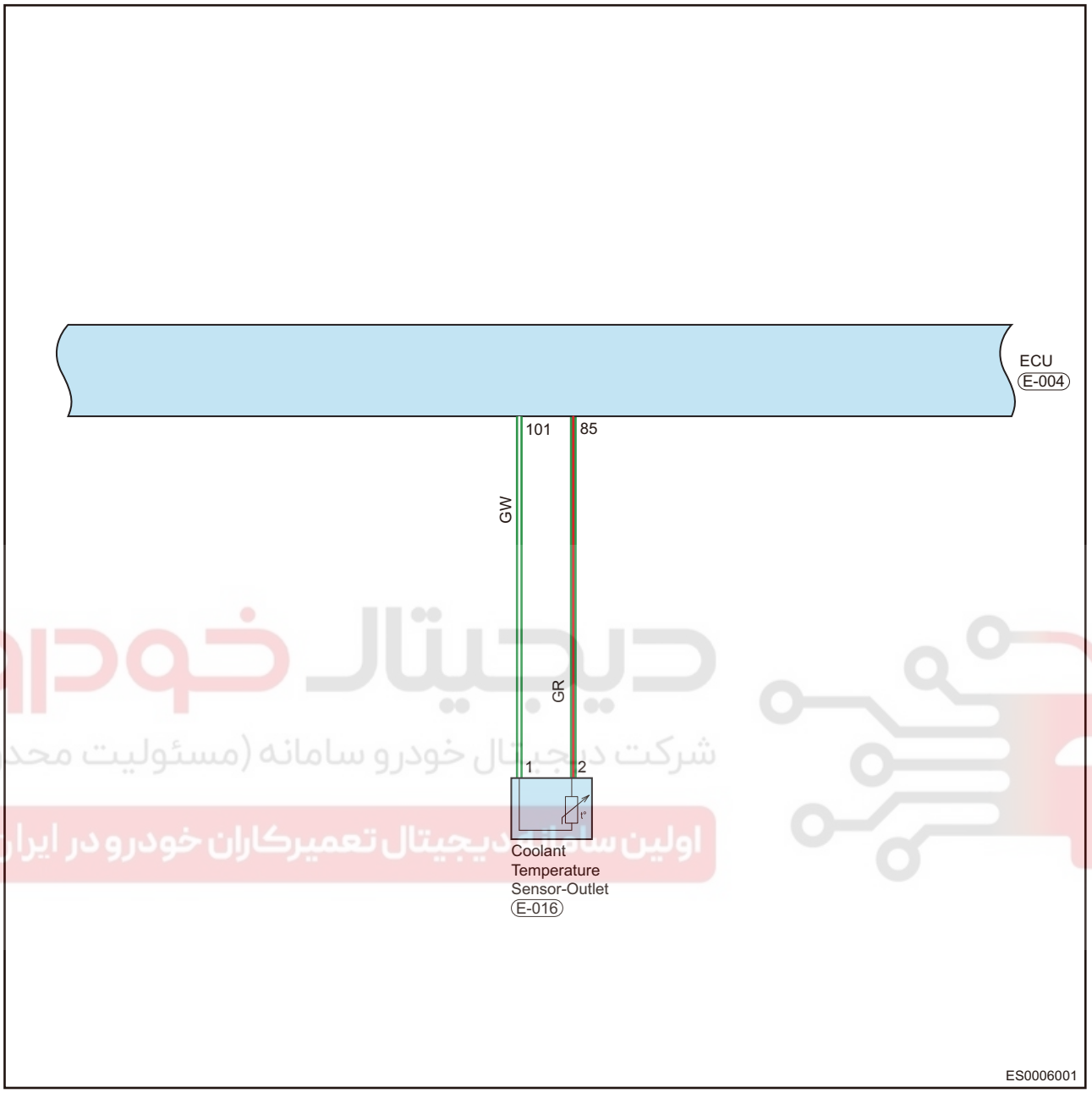
Proceed to
OK
NG

System operates normally

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		

04

Confirmation Procedure

Confirm that battery voltage is not 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

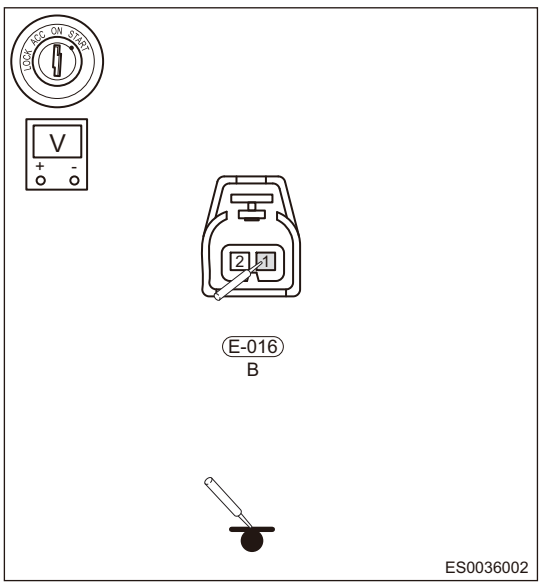
1	Check coolant temperature sensor power supply voltage

(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
E-016 (1) - Body ground	ENGINE START STOP switch ON	5 V



OK

Engine coolant temperature sensor voltage is normal

Result

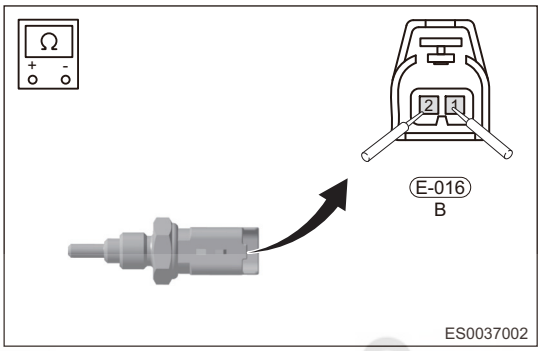
Proceed to
OK
NG

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

OK →

2	Check engine coolant temperature sensor

(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the engine coolant temperature sensor connector E-016 (arrow).
(d) Remove the engine coolant temperature sensor.
(e) Measure resistance of engine coolant temperature sensor.



Check for Open

Multimeter Connection	Specified Condition
Terminal 1 - Terminal 2	Resistance is 2.5 kΩ ± 5% at normal temperature (20°C), 300 Ω - 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**

OK →

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

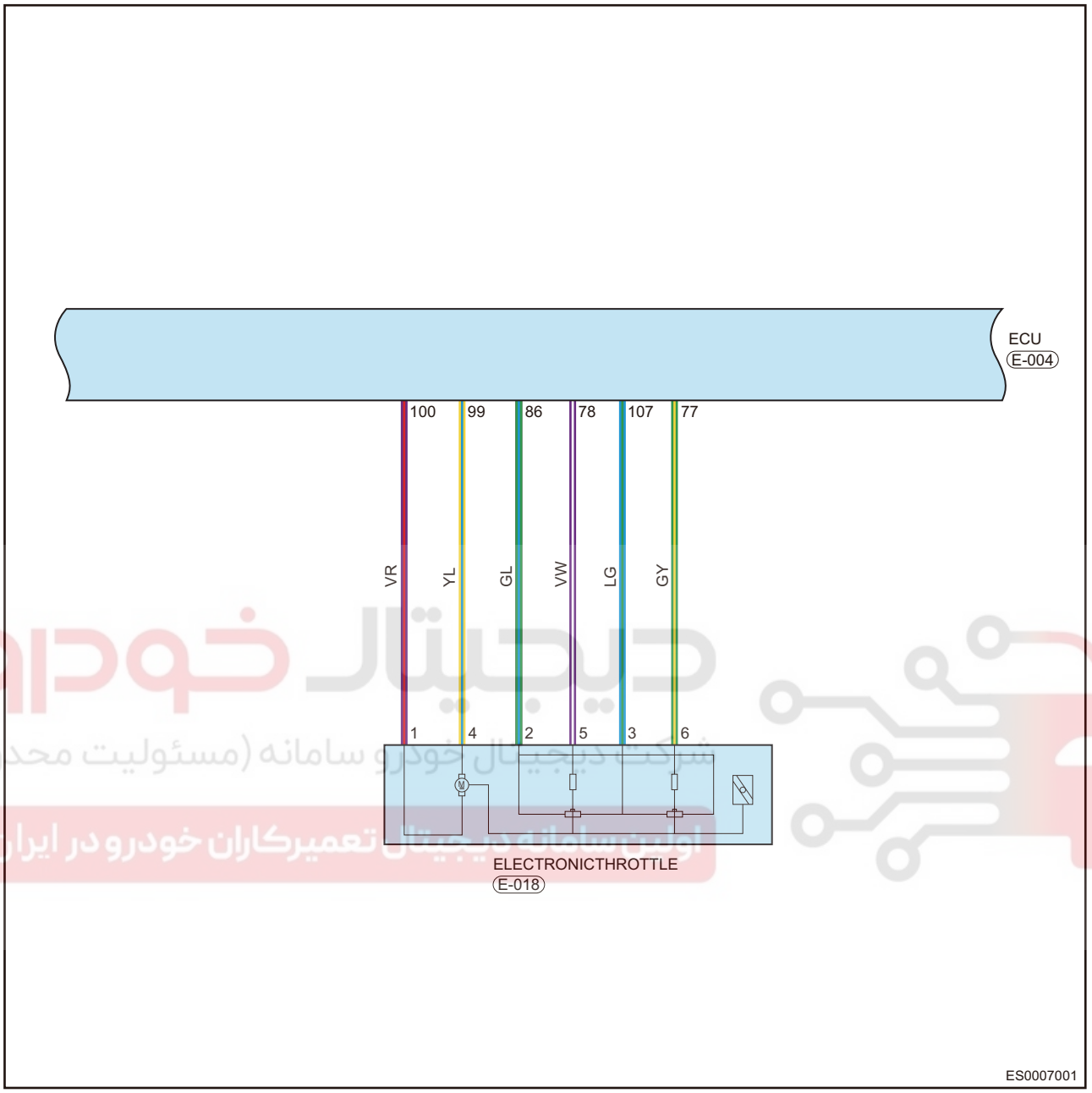
Proceed to
OK
NG

OK → **System operates normally**

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

DTC	P0123 00	Throttle/Pedal Position Sensor/Switch "A" Circuit High
DTC	P0122 00	Throttle/Pedal Position Sensor/Switch "A" Circuit Low
DTC	P0121 00	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance
DTC	P0223 00	Throttle/Pedal Position Sensor/Switch "B" Circuit High
DTC	P0222 00	Throttle/Pedal Position Sensor/Switch "B" Circuit Low
DTC	P0221 00	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0123 00	Throttle/Pedal Position Sensor/Switch "A" Circuit High	ENGINE START STOP switch ON, engine running	Throttle position sensor 1 Throttle position sensor 2 Wire harness or connector ECM
P0122 00	Throttle/Pedal Position Sensor/Switch "A" Circuit Low		
P0121 00	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance		
P0223 00	Throttle/Pedal Position Sensor/Switch "B" Circuit High		
P0222 00	Throttle/Pedal Position Sensor/Switch "B" Circuit Low		
P0221 00	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance		

Confirmation Procedure

Confirm that battery voltage is not 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-018 (3) terminal and body ground (using a digital multimeter) (online detection).

Voltage Inspection

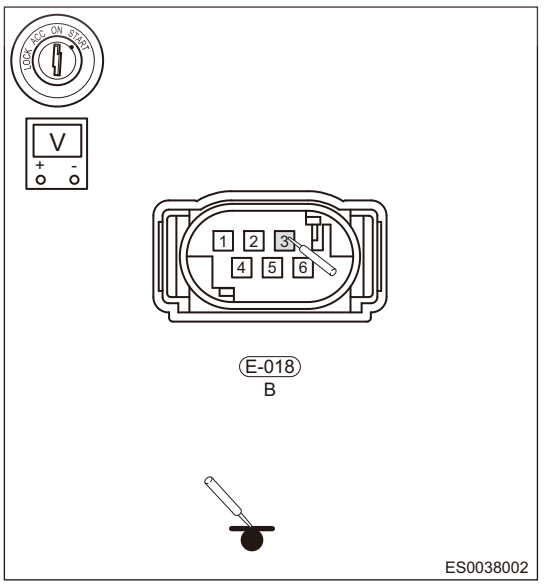
Multimeter Connection	Condition	Specified Condition
E-018 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Throttle position sensor power supply voltage is normal

Result

Proceed to
OK
NG

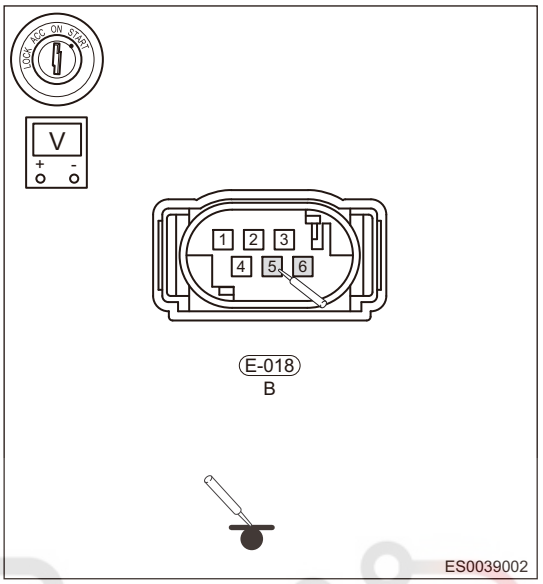


NG → **Check and repair power supply wire harness between throttle and ECM**

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-018 (6) - Body ground	ENGINE START STOP switch ON, idling	0.74V
	ENGINE START STOP switch ON, throttle fully opened	4.24V
E-018 (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

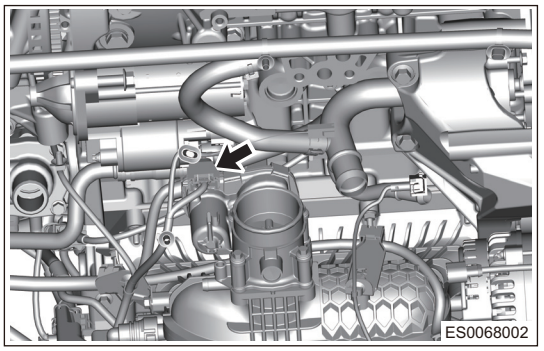
OK → **End**

NG

5	Check electronic throttle

(a) Turn ENGINE START STOP switch to OFF.

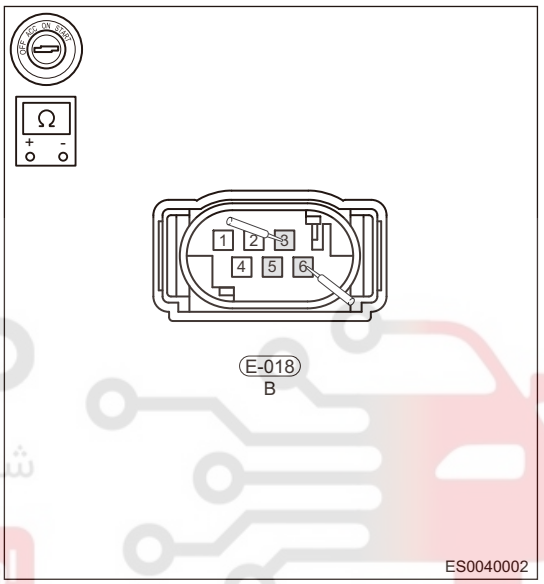
(b) Disconnect the negative battery cable.
(c) Disconnect the electronic throttle connector E-018 (arrow).



(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 3	Throttle turned	Resistance between terminals 5 and 3 increases as throttle valve opens
Terminal 6 - Terminal 3		Resistance between terminals 6 and 3 decreases as throttle valve opens
Terminal 5 - Terminal 3 and Terminal 6 -Terminal 3	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

Proceed to
NG

System operates normally
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 not 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 →

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

04

(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

System operates normally
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 not 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 → 04

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 for hight fuel pressure

(a) Check for hight fuel pressure.
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

System operates normally

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 not 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

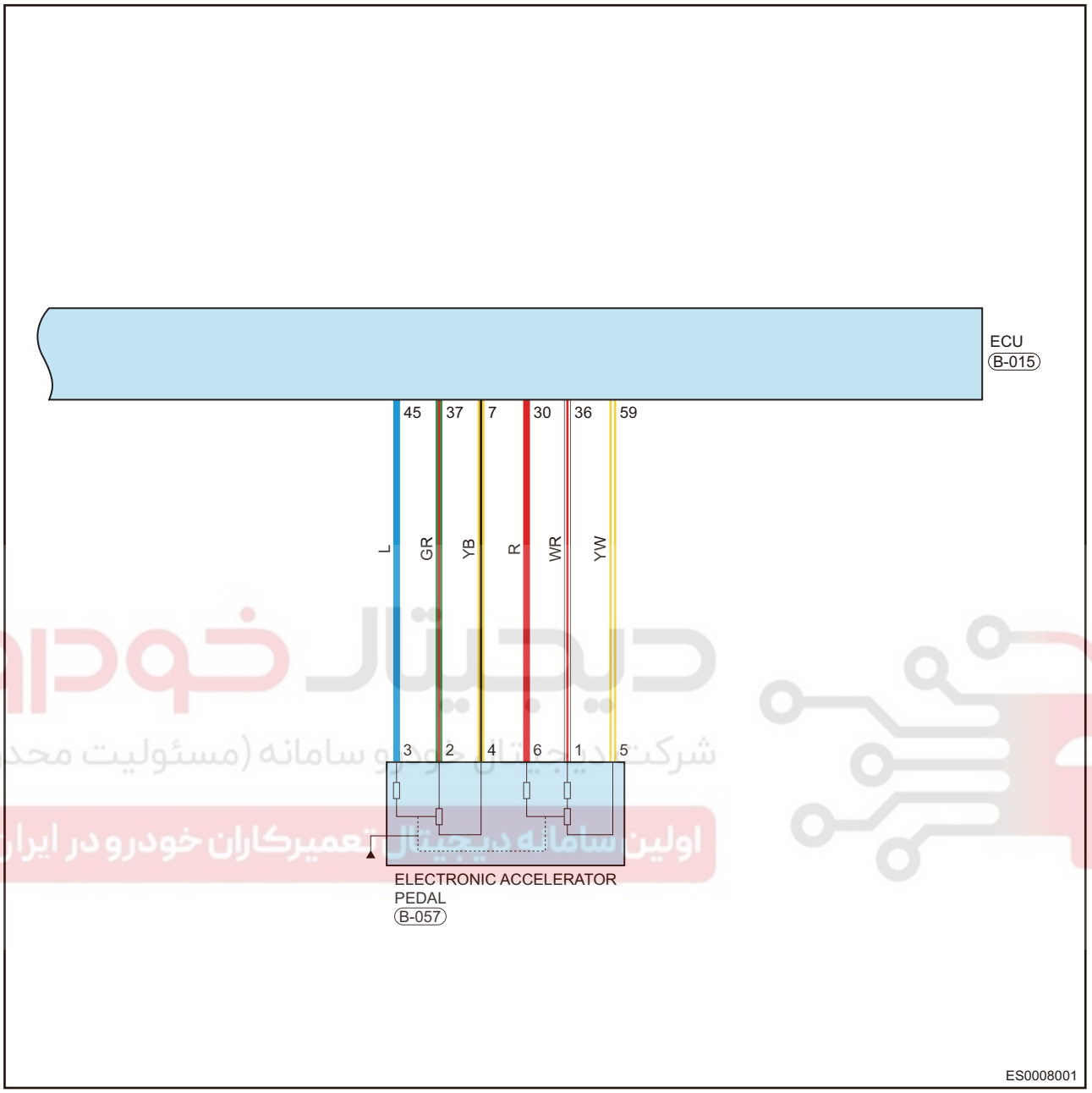
Result

Proceed to
OK
NG

System operates normally
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 not 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
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

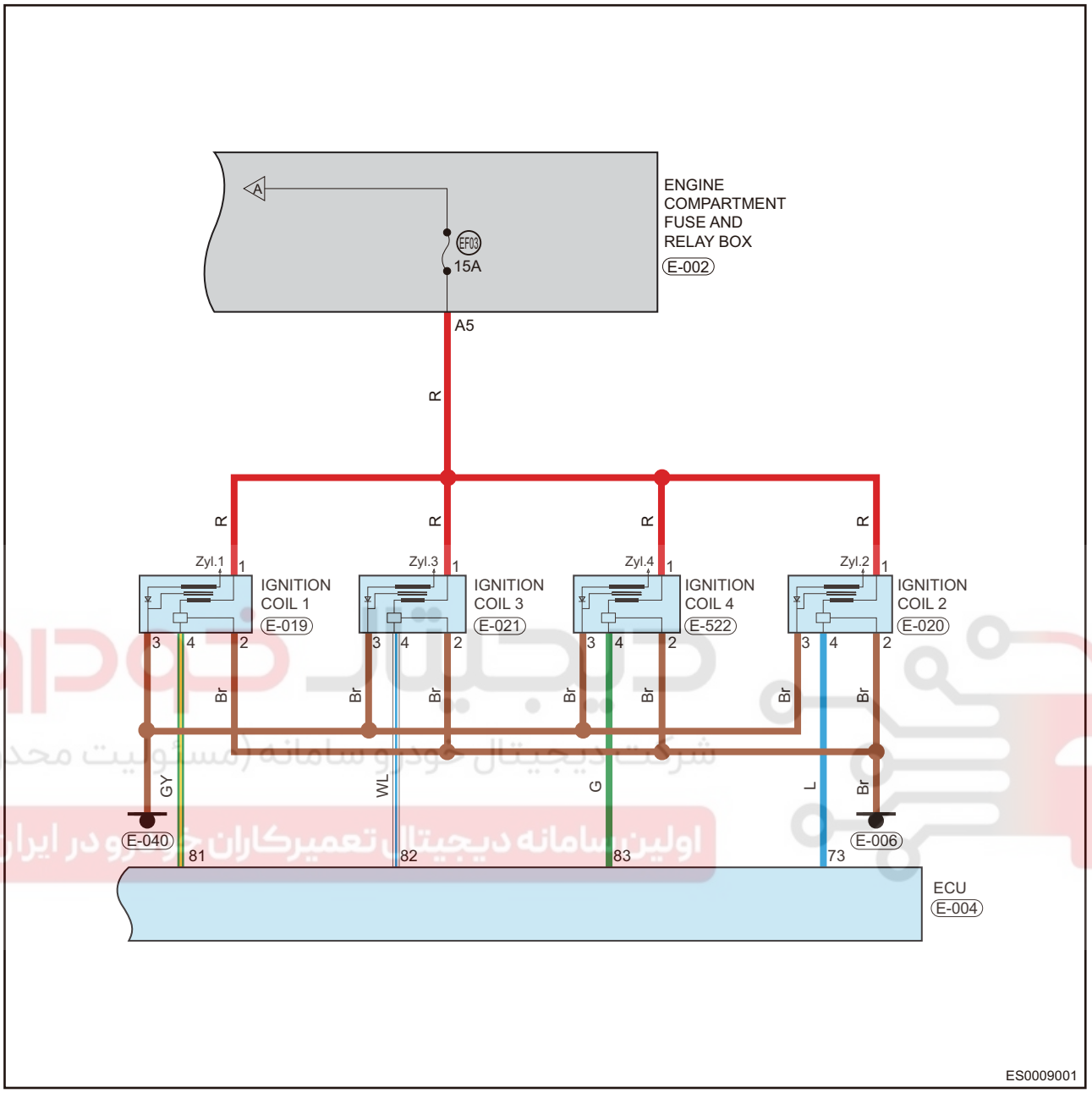
Proceed to
OK
NG

OK → **System operates normally**

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

DTC	P0351 00	Ignition Coil "A" Primary Control Circuit Open
DTC	P0353 00	Ignition Coil "C" Primary Control Circuit Open
DTC	P0354 00	Ignition Coil "D" Primary Control Circuit Open
DTC	P0352 00	Ignition Coil "B" Primary Control Circuit Open
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 Circuit Open	ENGINE START STOP switch ON, engine running	Ignition coil Wire harness or connector Engine mechanical ECM
P0353 00	Ignition Coil "C" Primary Control Circuit Open		
P0354 00	Ignition Coil "D" Primary Control Circuit Open		
P0352 00	Ignition Coil "B" Primary Control Circuit Open		
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 not 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.

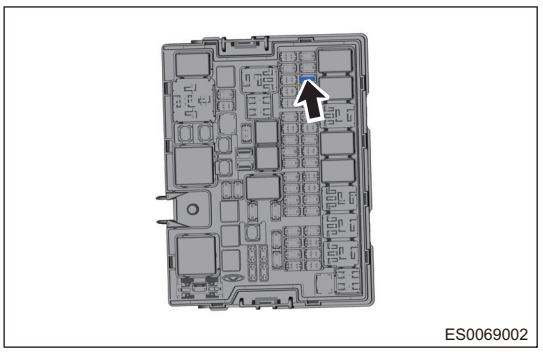
Caution:

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

Procedure

1	Check fuse EF03

(a) Check if fuse EF03 is blown or no power.



Result

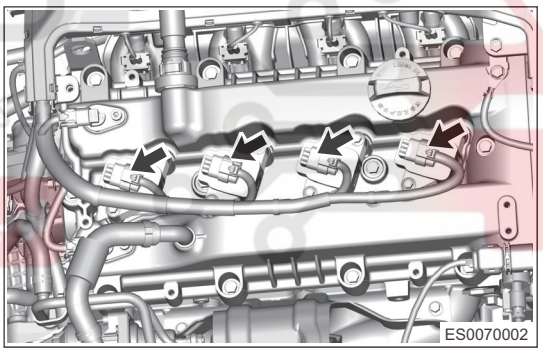
Proceed to
OK
NG

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

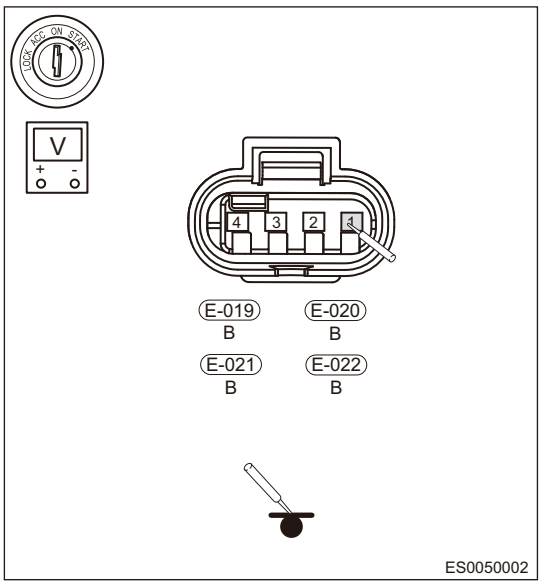
NG → **Reinstall or repair, replace connector**

OK

3	Check ignition coil power supply voltage

(a) Turn ignition switch to ON.

(b) Using a digital multimeter, measure voltage between ignition coil and ground.



Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-019 (1) - Ground	ENGINE START STOP switch ON	Not less than 12 V
E-020 (1) - Ground		
E-021 (1) - Ground		
E-022 (1) - Ground		

Result

Proceed to
OK
NG

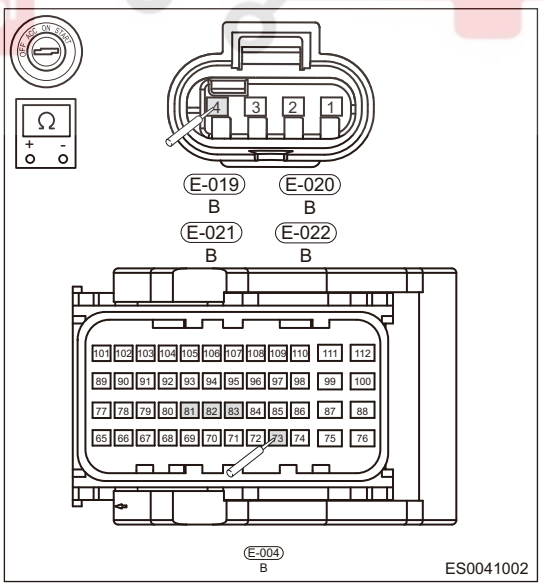
04

NG → **Replace wire harness or connector (ignition coil - front 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-004 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-019 (4) - E-004 (81)	Always	Resistance ⩽ 1 Ω
E-020 (4) - E-004 (73)		
E-021 (4) - E-004 (82)		
E-022 (4) - E-004 (83)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-019 (4), E-020 (4), E-021 (4), E-022 (4) or E-004 (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
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

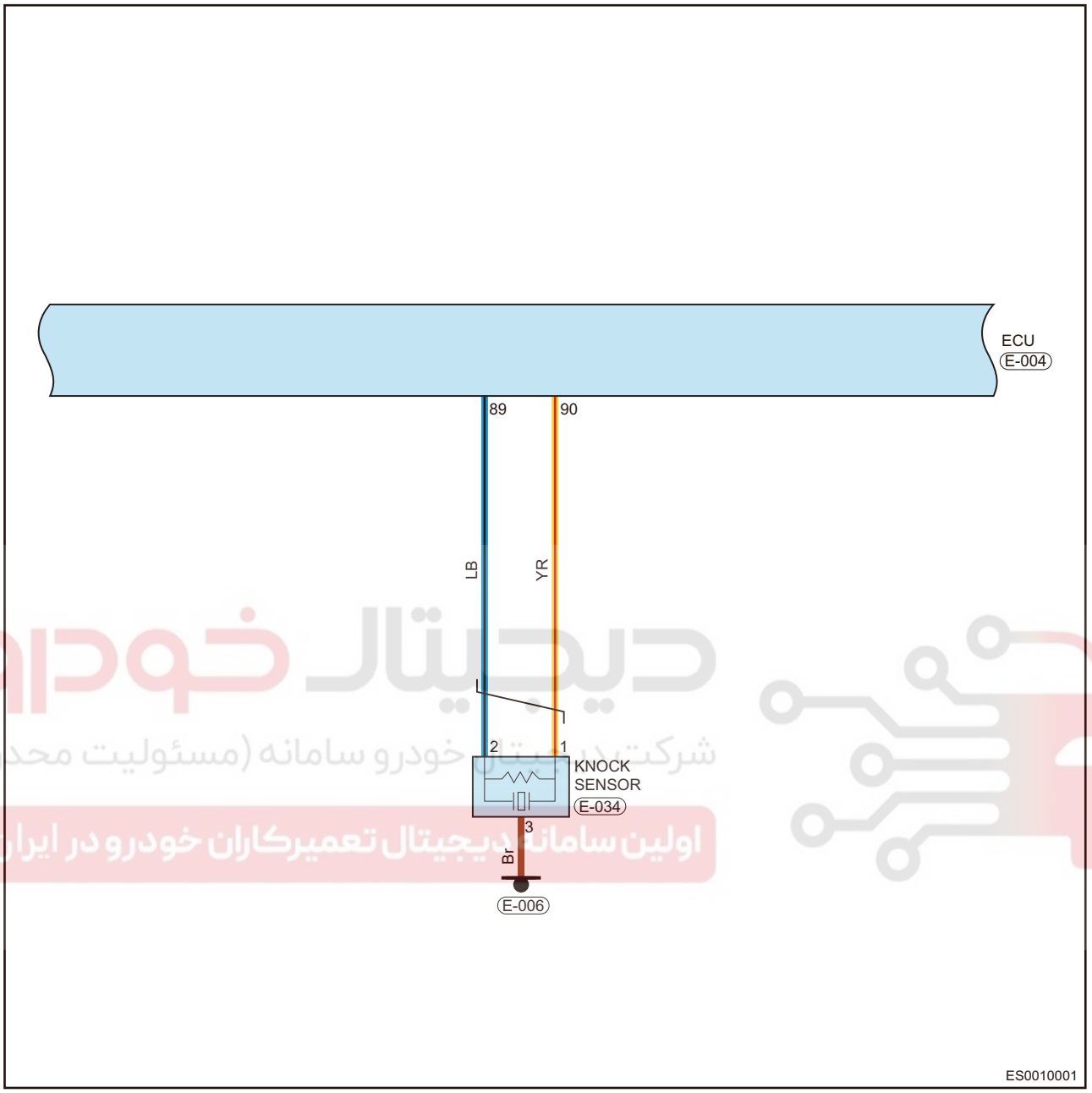
Result

Proceed to
OK
NG

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

DTC	P0326 00	Knock Sensor 1 Circ. High Input
DTC	P0325 00	Knock Sensor 1 Circ. Low Input
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 Sensor 1 Circ. High Input	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 Sensor 1 Circ. Low Input		
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		

Confirmation Procedure

Confirm that battery voltage is not 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.

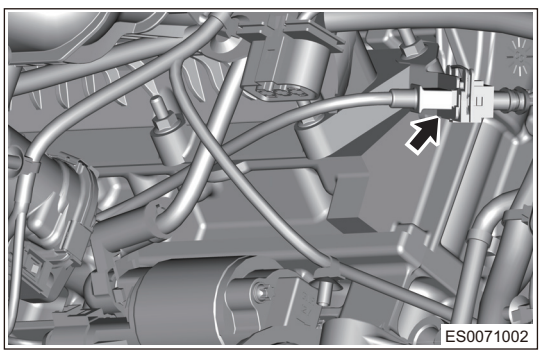
Caution:

- 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-034 (arrow) for poor connection, cracks or damage.



OK

Knock sensor connector is normal

Result

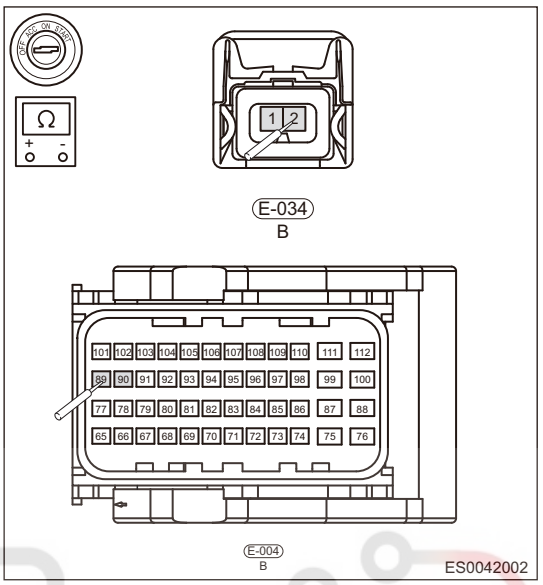
Proceed to
OK
NG

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-004.
(d) Check wire harness between terminals of connector E-004 and connector E-034.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-004 (90) - E-034 (1)	Always	Resistance ⩽ 1 Ω
E-004 (89) - E-034 (2)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-004 (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

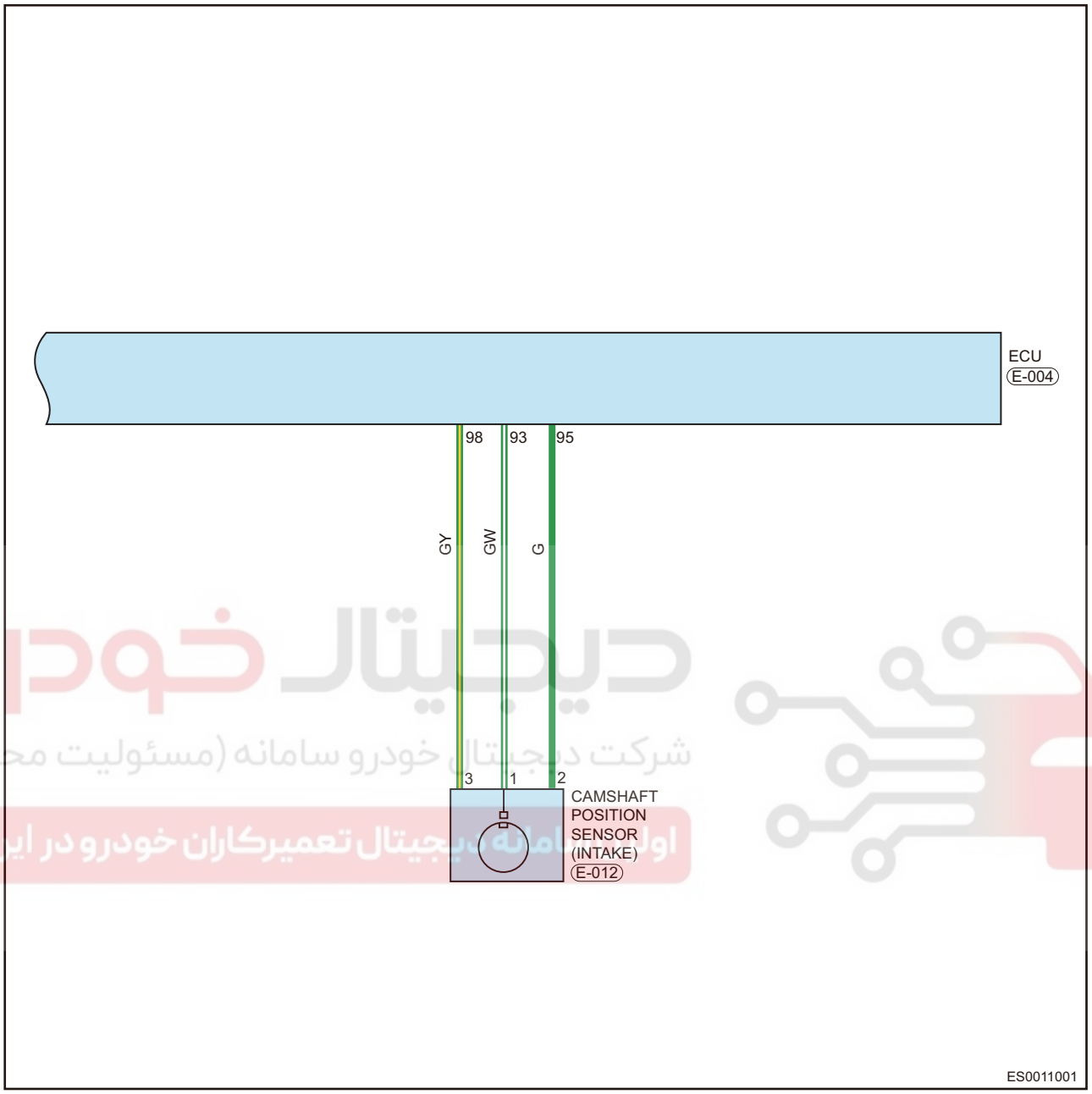
Result

Proceed to
OK
NG

System operates normally
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	P0016 76	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
DTC	P0343 00	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor
DTC	P0342 00	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor
DTC	P0016 78	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
P0016 76	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A		
P0343 00	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor		
P0342 00	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor		
P0016 78	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 not 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

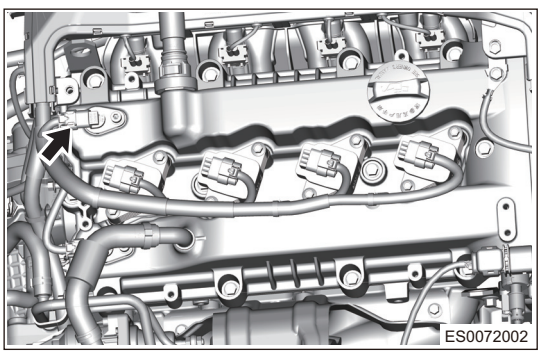
(a) Check intake camshaft position sensor connector E-012 (arrow) for poor connection or contact.

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-012 and ground (using a digital multimeter or 21 W test light).

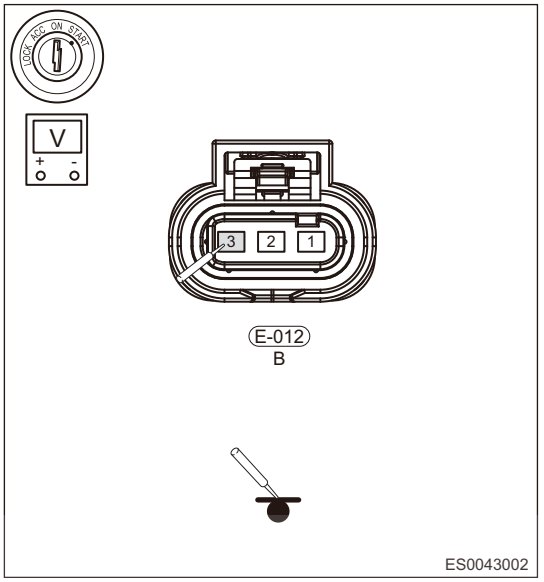
Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E - 012(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-012 and ECM connector E-004.
(d) Check intake camshaft position sensor connector E-012 (1) and ECM connector E-004 (93).

Check for Open

Multimeter Connection	Condition	Specified Condition
E-012 (1) - E-004 (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

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

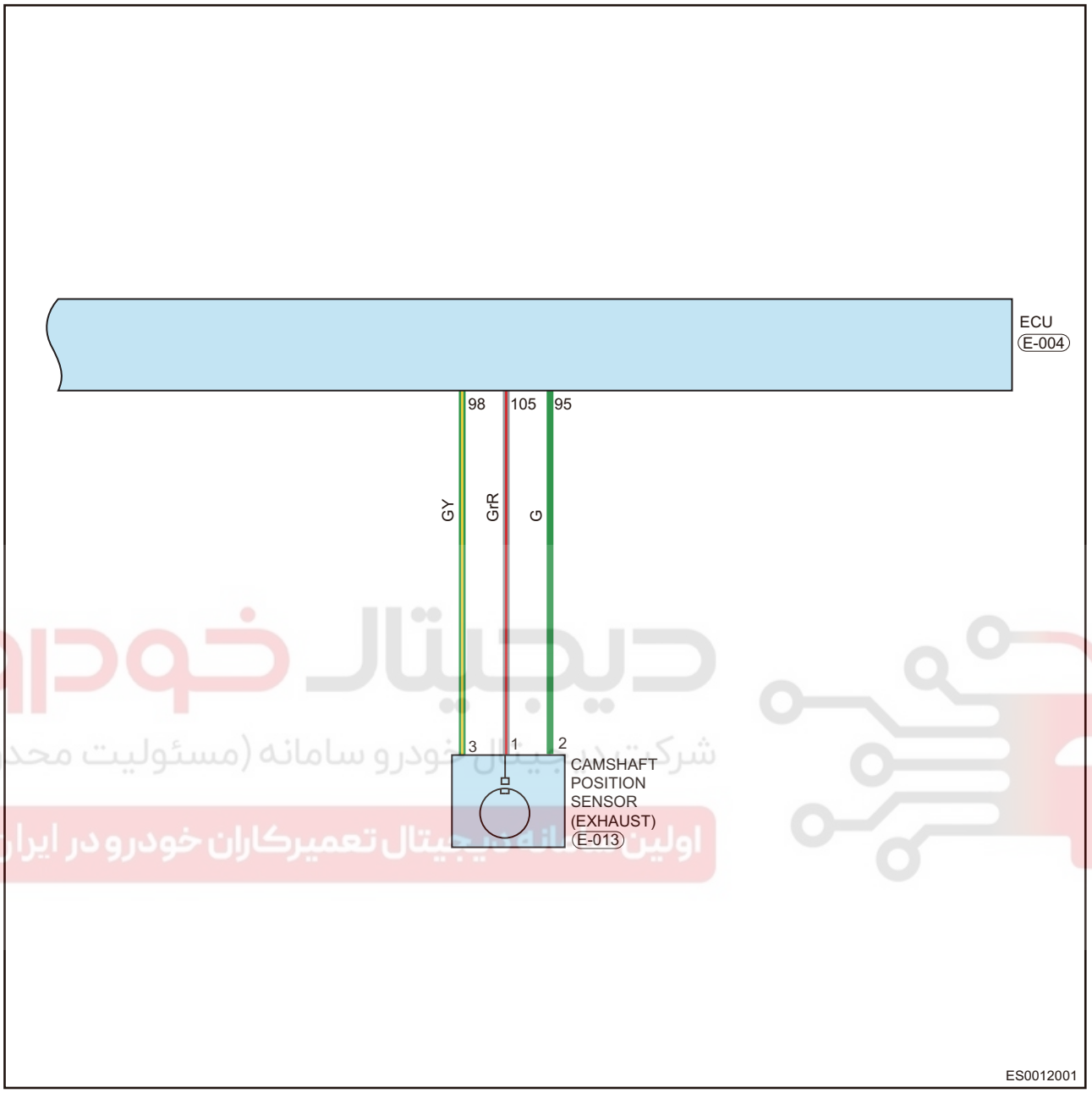
Result

Proceed to
OK
NG

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

DTC	P0366 00	Camshaft Position Sensor "B" Circuit Range/ Performance (Bank 1)
DTC	P0017 76	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
DTC	P0368 00	Camshaft Position Sensor "B" Circuit High (Bank 1)
DTC	P0367 00	Camshaft Position Sensor "B" Circuit Low (Bank 1)
DTC	P0017 78	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
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 (Bank 1)	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 "B" Circuit High (Bank 1)		
P0367 00	Camshaft Position Sensor "B" Circuit Low (Bank 1)		
P0017 78	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B		
P0014 00	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1		

Confirmation Procedure

Confirm that battery voltage is not 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

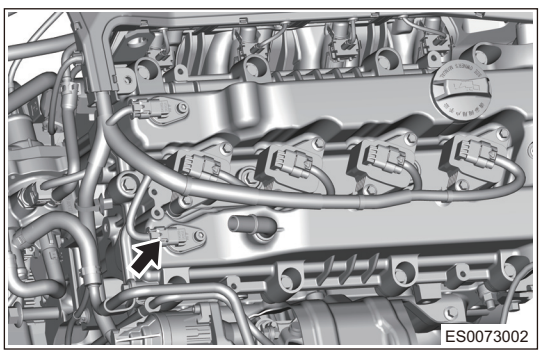
(a) Check exhaust camshaft position sensor connector E-013 (arrow) for poor connection or contact.

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-013 and ground (using a digital multimeter).

Voltage Inspection

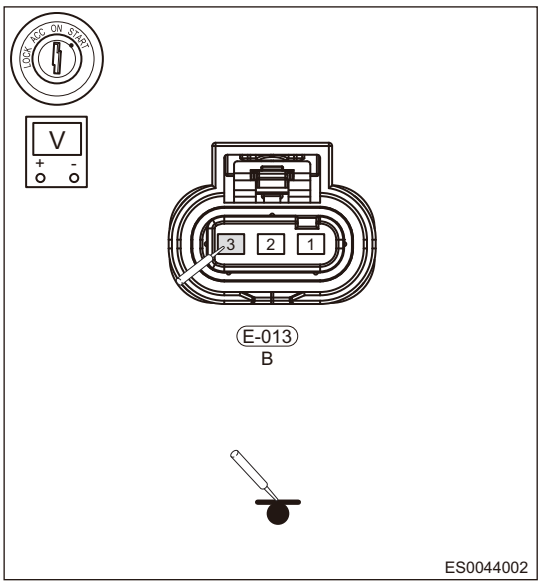
Multimeter Connection	Condition	Specified Condition
E - 013(3) - Body ground	ENGINE START STOP switch ON	5 V

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

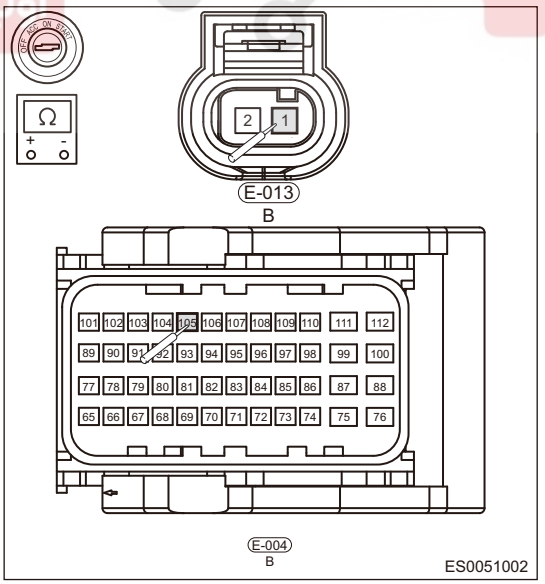
(a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect intake camshaft position sensor connector E-013 and ECM connector E-004.
(d) Check intake camshaft position sensor connector E-013 (1) and ECM connector E-004 (105).

Check for Open

Multimeter Connection	Condition	Specified Condition
E - 013(1) - E-004 (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

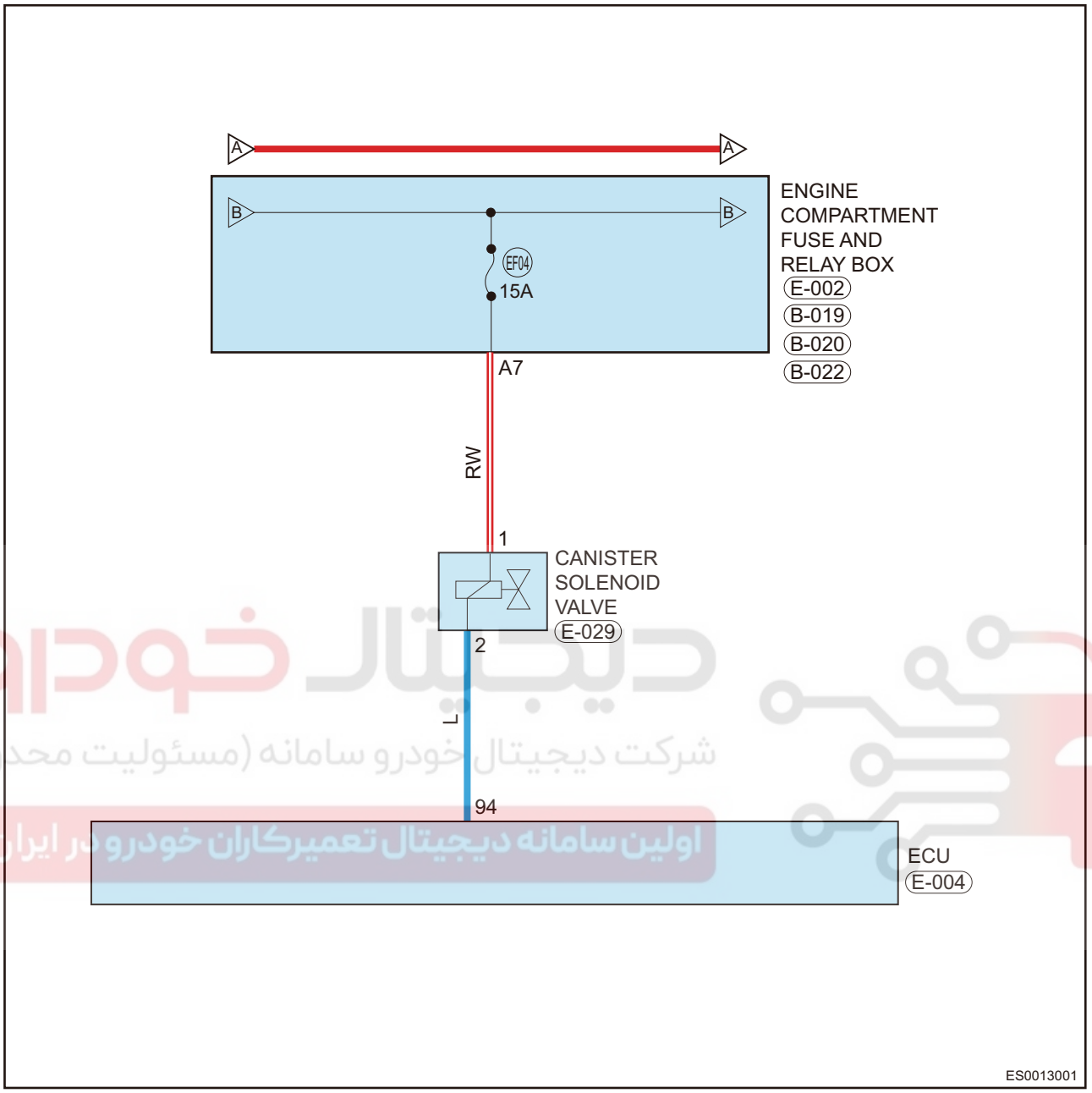
Proceed to
OK

Proceed to
NG

System operates normally
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 solenoid 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 not 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.

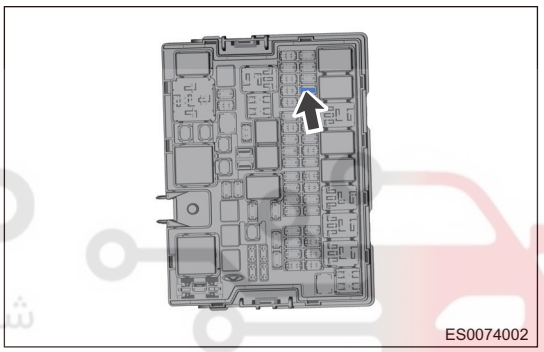
Procedure

1	Check canister solenoid 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 canister solenoid valve connector

(a) Check canister solenoid valve connector E-029 (arrow) for poor connection or contact.

OK

Canister solenoid valve connector is normal

Result

Proceed to
OK
NG

NG → **Repair or replace connector**

OK →

3	Check canister solenoid valve power supply voltage

(a) Turn ENGINE START STOP switch to ON.

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

Voltage Inspection

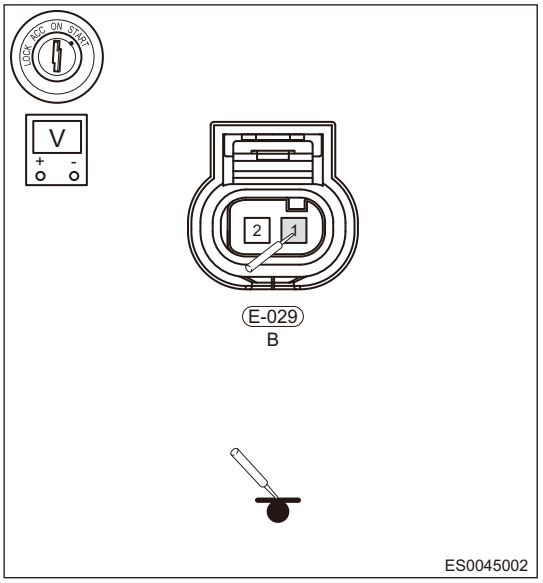
Multimeter Connection	Condition	Specified Condition
E-029 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Canister solenoid valve power supply voltage is normal

Result

Proceed to
OK
NG



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

OK

4 Check canister solenoid valve control circuit

(a) Disconnect the ECM connector E-004.

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

Check for Open

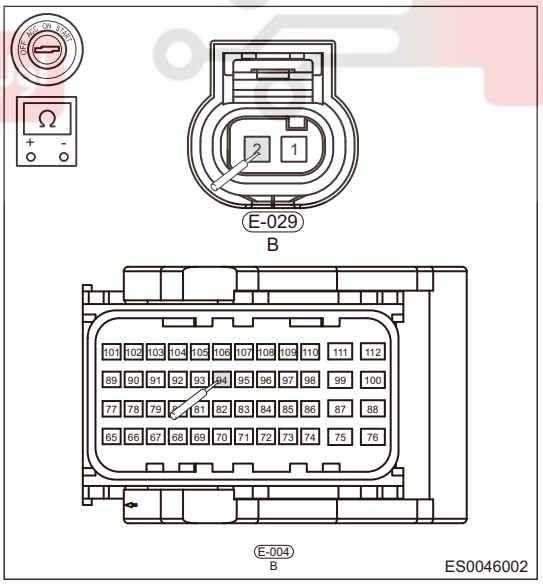
Multimeter Connection	Condition	Specified Condition
E-004 (94) - E-029 (2)	Always	Resistance ⩽ 1 Ω

OK

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

Result

Proceed to
OK
NG



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

OK

5	Check canister solenoid 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 solenoid valve is normal

Result

Proceed to
OK
NG

NG → **Replace canister 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

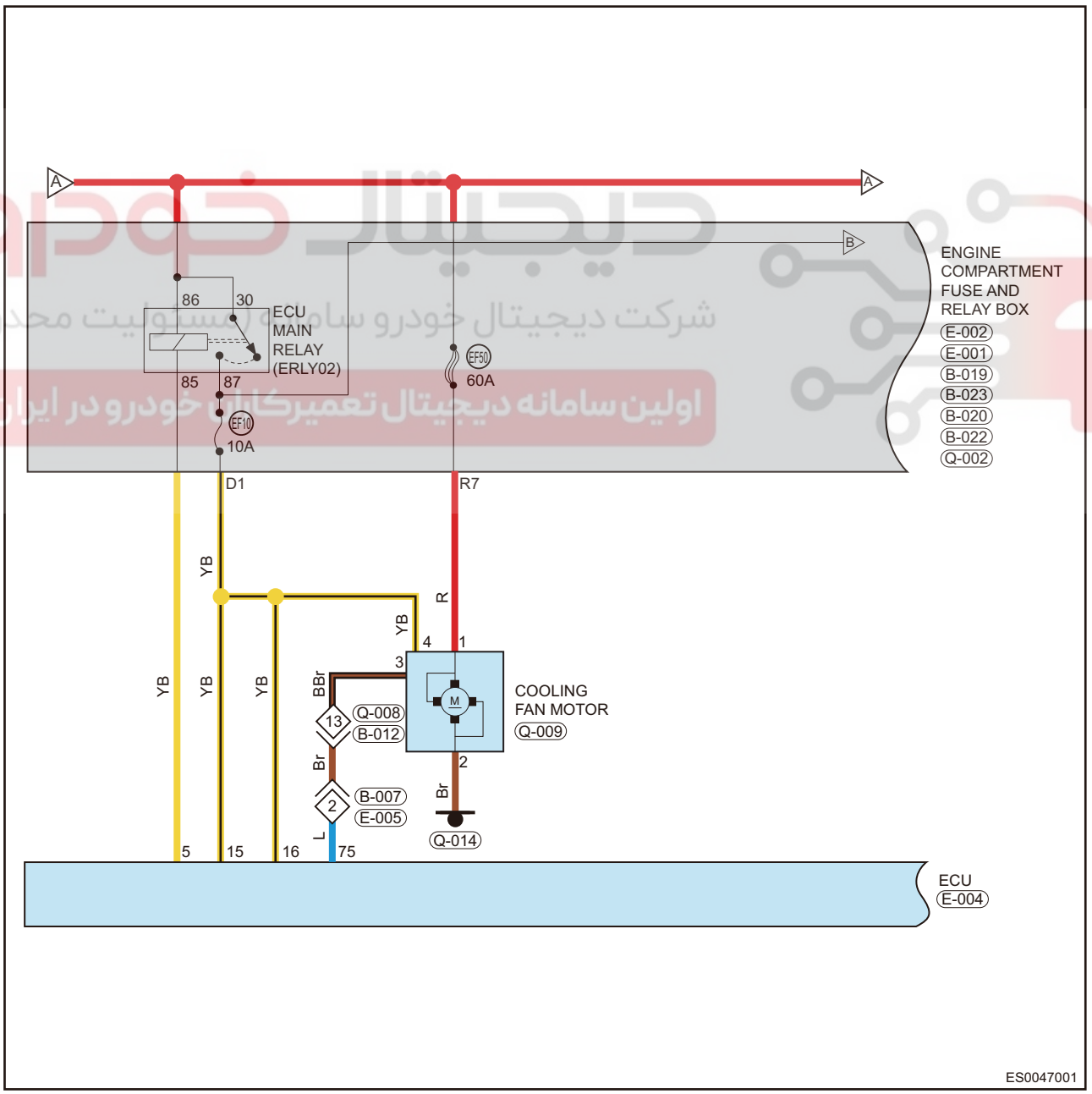
Proceed to
OK
NG

System operates normally

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 not 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 fuses EF10 and EF50 are 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 12 V
Relay (85) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Cooling fan control relay connector terminal voltage is normal.

Result

Proceed to
OK
NG

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

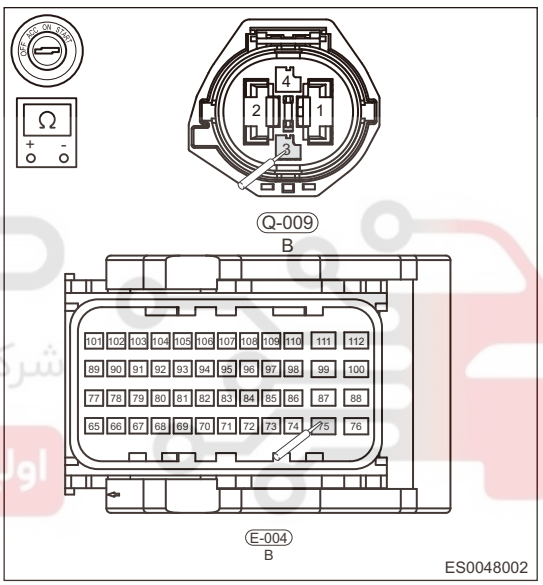
OK

04

3 Check cooling fan control circuit

(a) Turn ENGINE START STOP switch to OFF
(b) Disconnect the cooling fan motor connector.
(c) Disconnect the ECM connector E-004.
(d) Check the cooling fan control circuit.

Multimeter Connection	Condition	Specified Condition
E–004 (75) - Q-009 (3)	Always	Resistance ⩽ 1 Ω



Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

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

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

Multimeter Connection	Condition	Specified Condition
Q-009 (1) - Q-002 (7)	Always	Resistance ⩽ 1 Ω
Q-009 (4) - E-001 (1)	Always	Resistance ⩽ 1 Ω

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

Check for Short

Multimeter Connection	Condition	Specified Condition
Q-009 (1 or 4) - Body ground	Always	Resistance ∞
Q-002 (7) or E-001 (1) - 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

System operates normally
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 not 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
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, 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

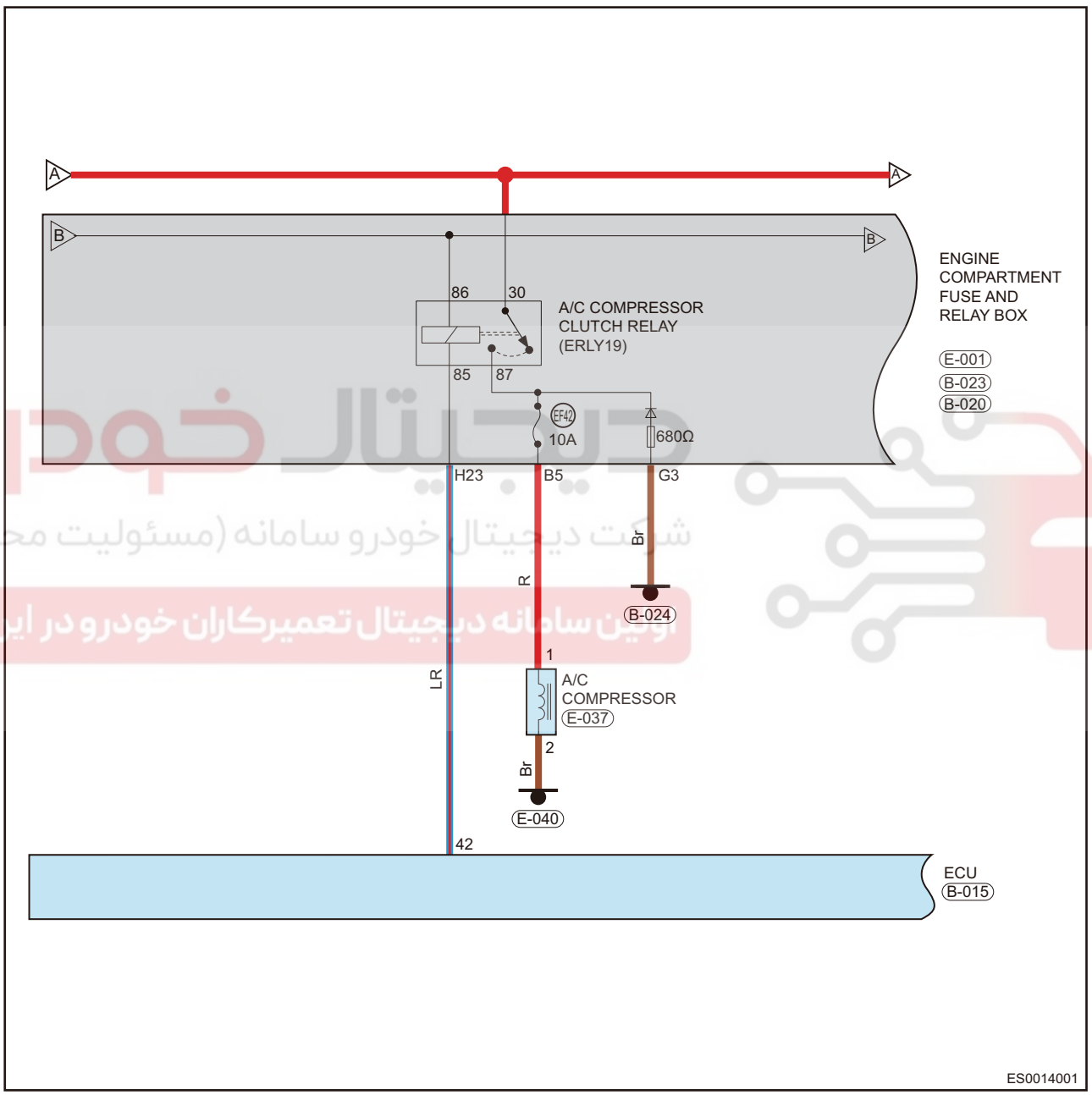
Result

Proceed to
OK
NG

System operates normally
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 not 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 12 V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

OK

2	**Check A/C compressor relay and fuse**

(a) Check if fuse EF42 (10A) 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 front compartment fuse and relay box terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-001 (5) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

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 ECM connector B-015.

(b) Check wire harness between ECM connector terminal and front compartment fuse and relay box terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
B-020 (23) - B-015 (42)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
B-020 (23) or B-015 (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 - front 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

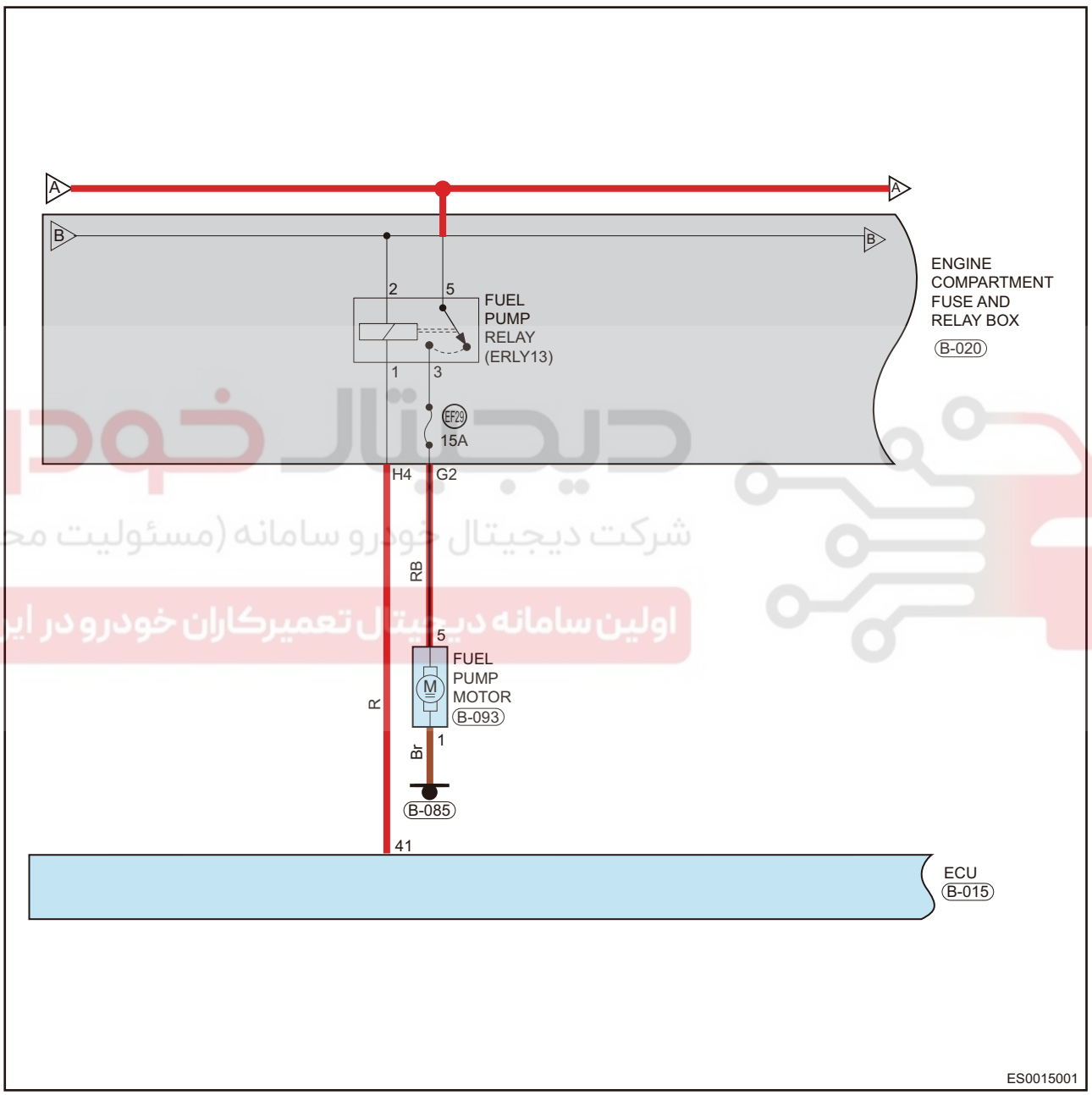
Result

Proceed to
OK
NG

System operates normally
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 not 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 12 V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

OK

2	**Check fuel pump relay and fuse**

(a) Check if fuel pump fuse EF29 (15A) 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 front compartment fuse and relay box terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Relay ERLY13 (5) - Body ground	Always	Not less than 12 V

Multimeter Connection	Condition	Specified Condition
Relay ERLY13 (2) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

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.

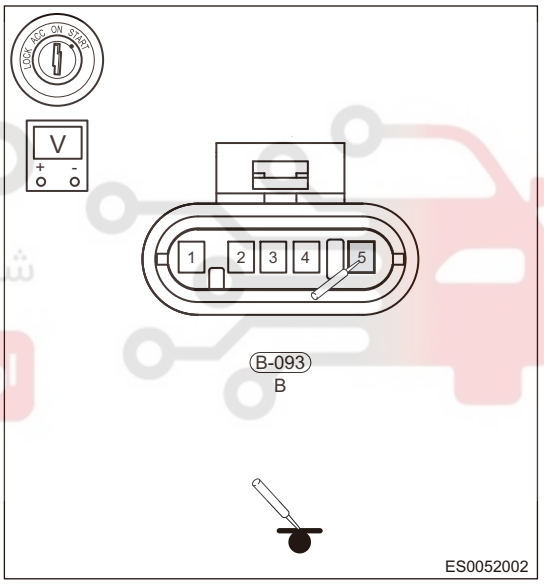
(b) Check the fuel pump relay terminal voltage.

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Fuel pump B-093 (5) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

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 ECM connector B-015.
(d) Check wire harness between ECM connector terminal and front compartment fuse and relay box terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
B-020 (4) - B-015 (41)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
B-020 (4) or B-015 (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 - front 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

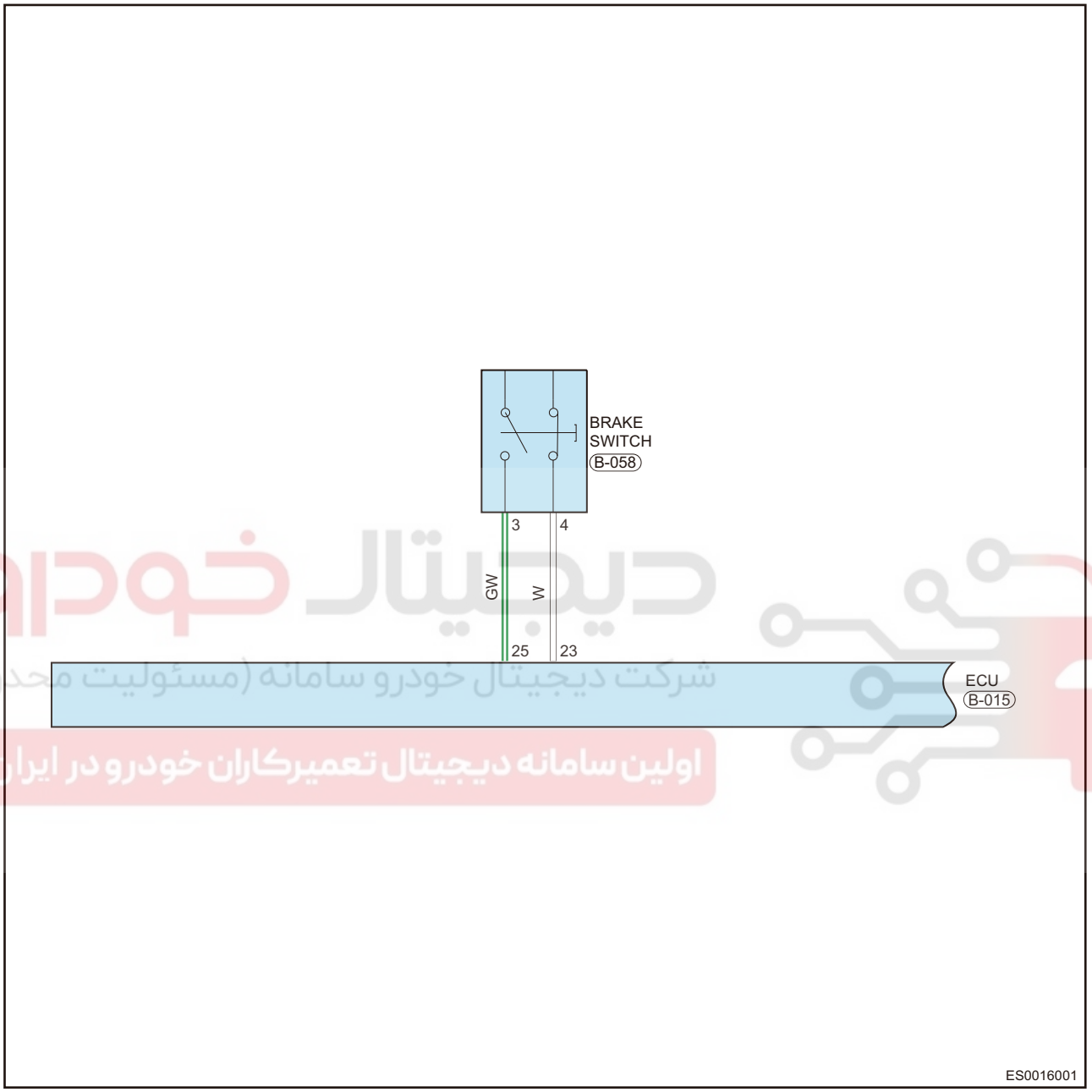
Proceed to
OK
NG

System operates normally

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 not 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.

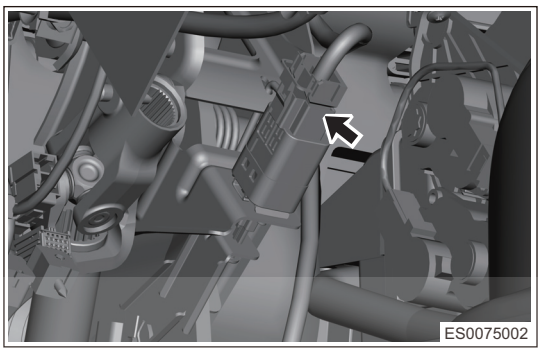
Caution:

- 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

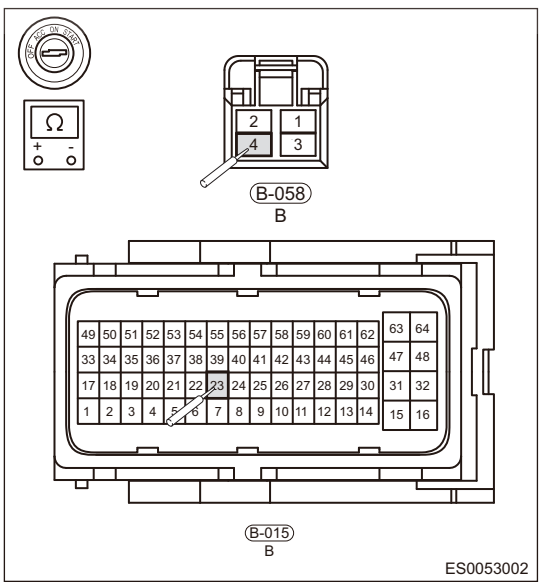
Proceed to
OK
NG

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

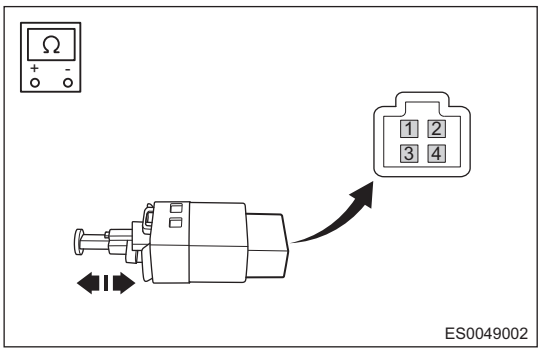
Proceed to
OK
NG

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

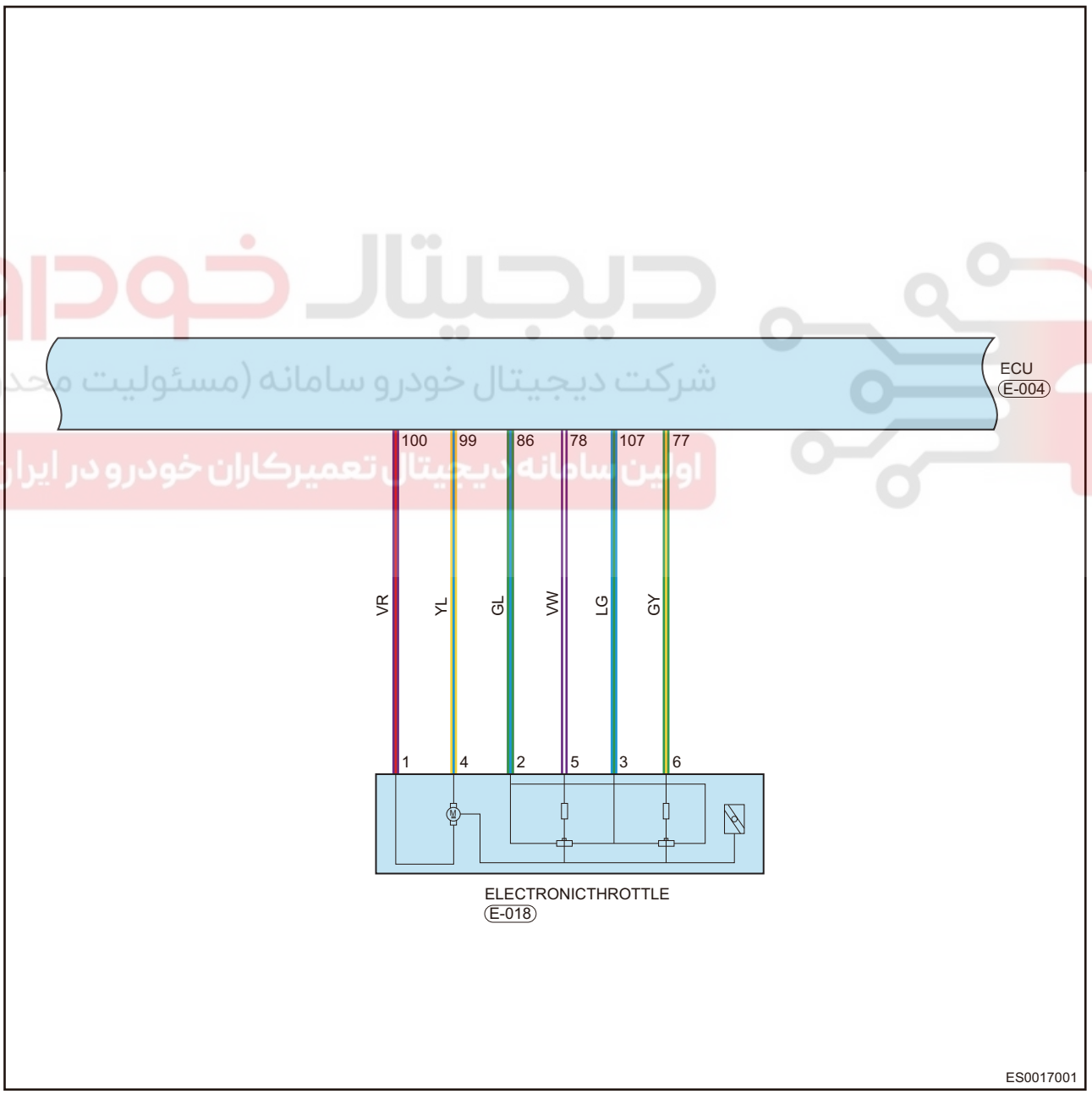
Result

Proceed to
OK
NG

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

DTC	P2103 00	Throttle Power Stage Max Error
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 Power Stage Max Error	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 not 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 → **Repair or 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	U0151 87	Lost Communication With ABM

DTC	U0164 87	Lost Communication With CLM

DTC	U0140 87	Lost Communication With BCM

DTC	U0155 87	Lost Communication With ICM

DTC	U0214 87	Lost Communication With PEPS

DTC	U0126 87	Lost Communication With SAM

DTC	U0129 87	Lost Communication With BSM

DTC	U0101 87	Lost Communication with TCU

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
U0151 87	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
U0164 87	Lost Communication With CLM		
U0140 87	Lost Communication With BCM		
U0155 87	Lost Communication With ICM		
U0214 87	Lost Communication With PEPS		
U0126 87	Lost Communication With SAM		
U0129 87	Lost Communication With BSM		
U0101 87	Lost Communication with TCU		

Confirmation Procedure

Confirm that battery voltage is not 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:

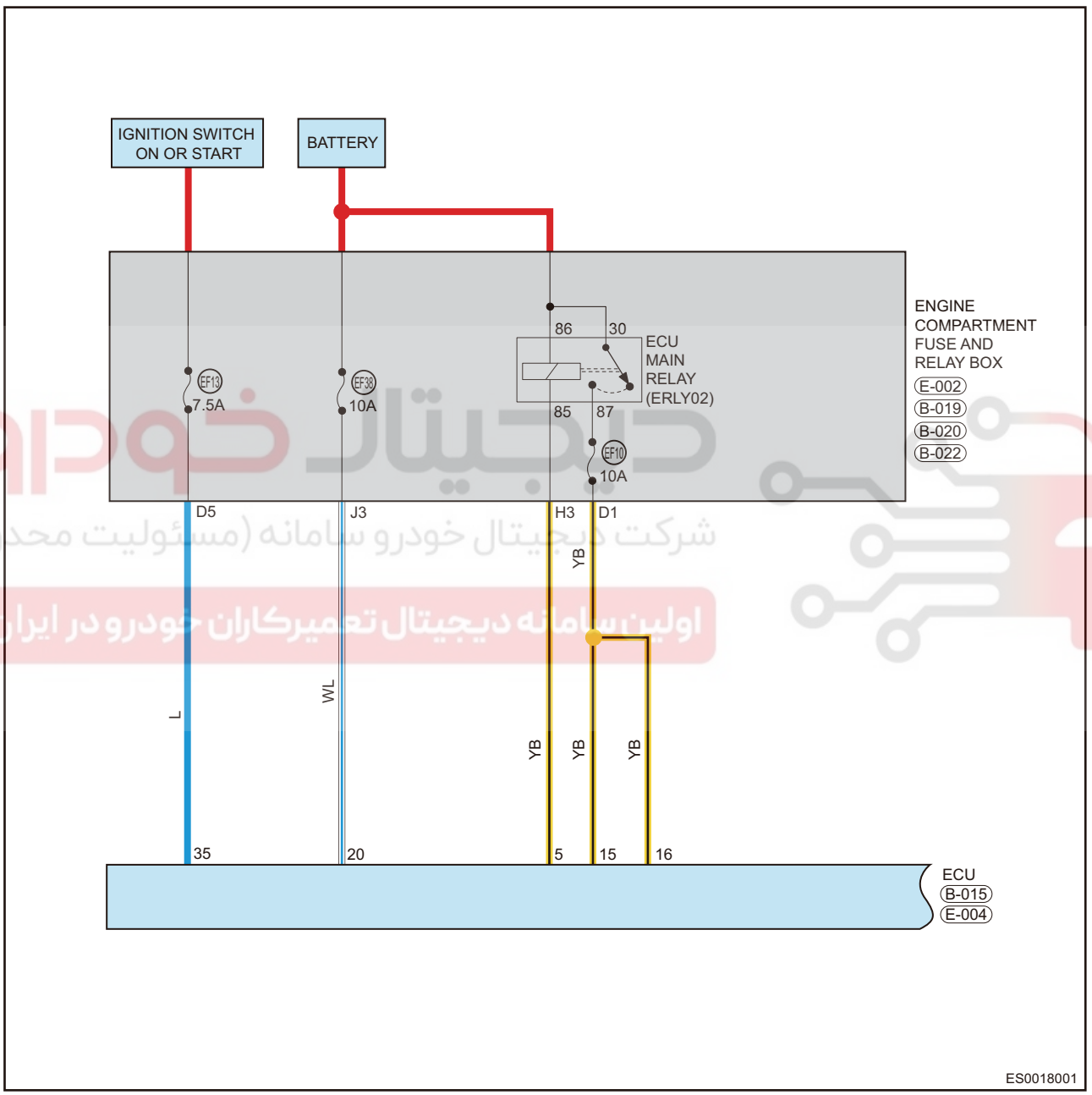
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Diagnosis

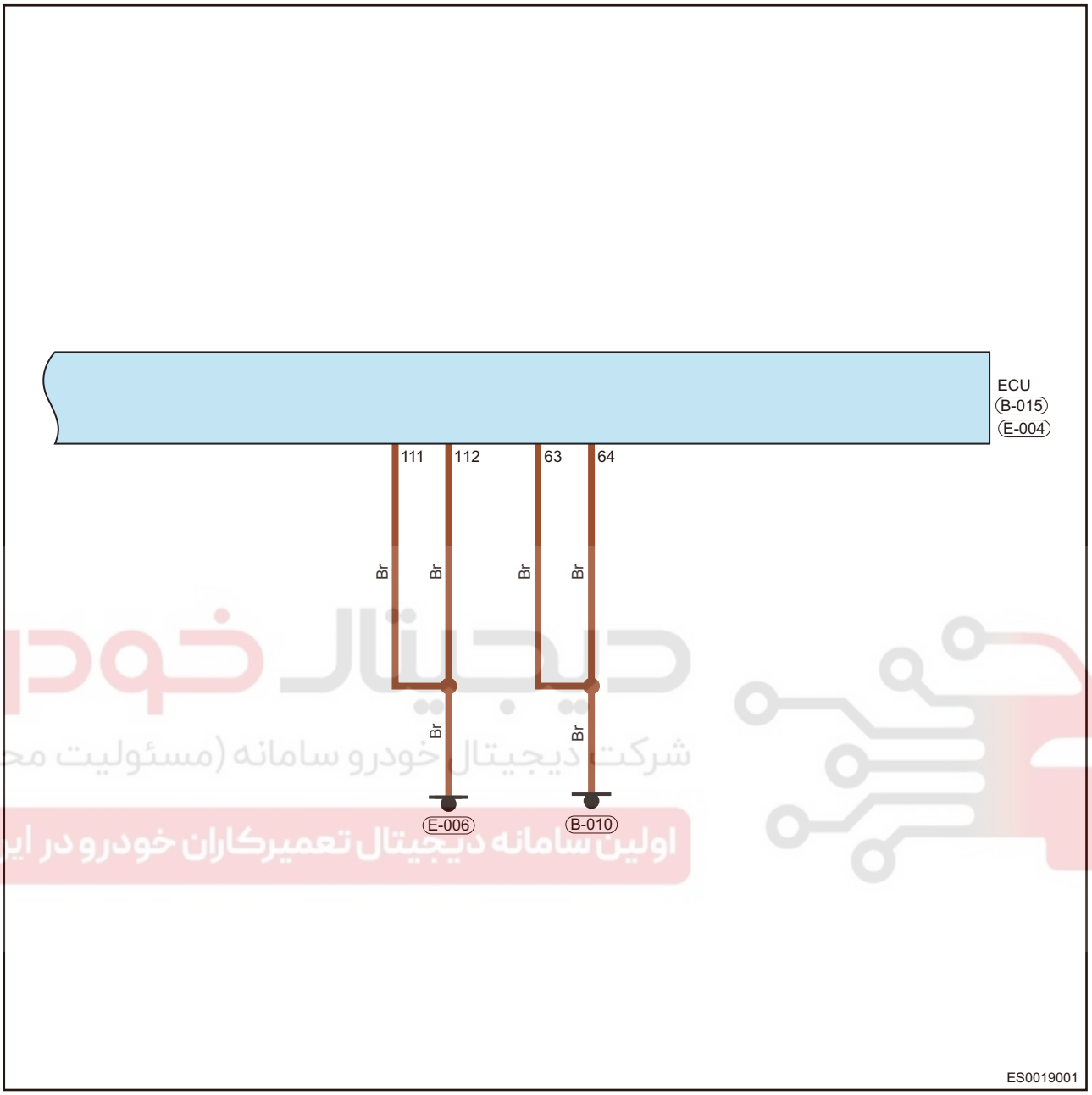
1	(Refer to CAN system)

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 not 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 12 V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

OK ↓

2	**Check ECM fuse**

(a) Check if ECM fuses EF13 (7.5A), EF38 (10A), EF10 (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, 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 20 of ECM connector B-015 and body ground (using a digital multimeter or 21 W test light).

Multimeter Connection	Condition	Specified Condition
B-015 (20) - Body ground	Always	Not less than 12 V
B-015 (35) - Body ground	ENGINE START STOP switch ACC	Not less than 12 V

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness**

OK

4	Check ECM wire harness (ECM - front compartment fuse and relay box)

(a) Check wire harness between ECM connector terminals 15, 16 and fuse box terminals.

Multimeter Connection	Condition	Specified Condition
B-015 (15, 16) - Fuse box (D1)	Always	Resistance ⩽ 1 Ω

(b) Check wire harness between connector terminal 5 and fuse box terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
B-015 (5) - Front compartment fuse and relay box (H3)	Always	Resistance ⩽ 1 Ω

Result

Proceed to
OK
NG

Replace fuse or main relay

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

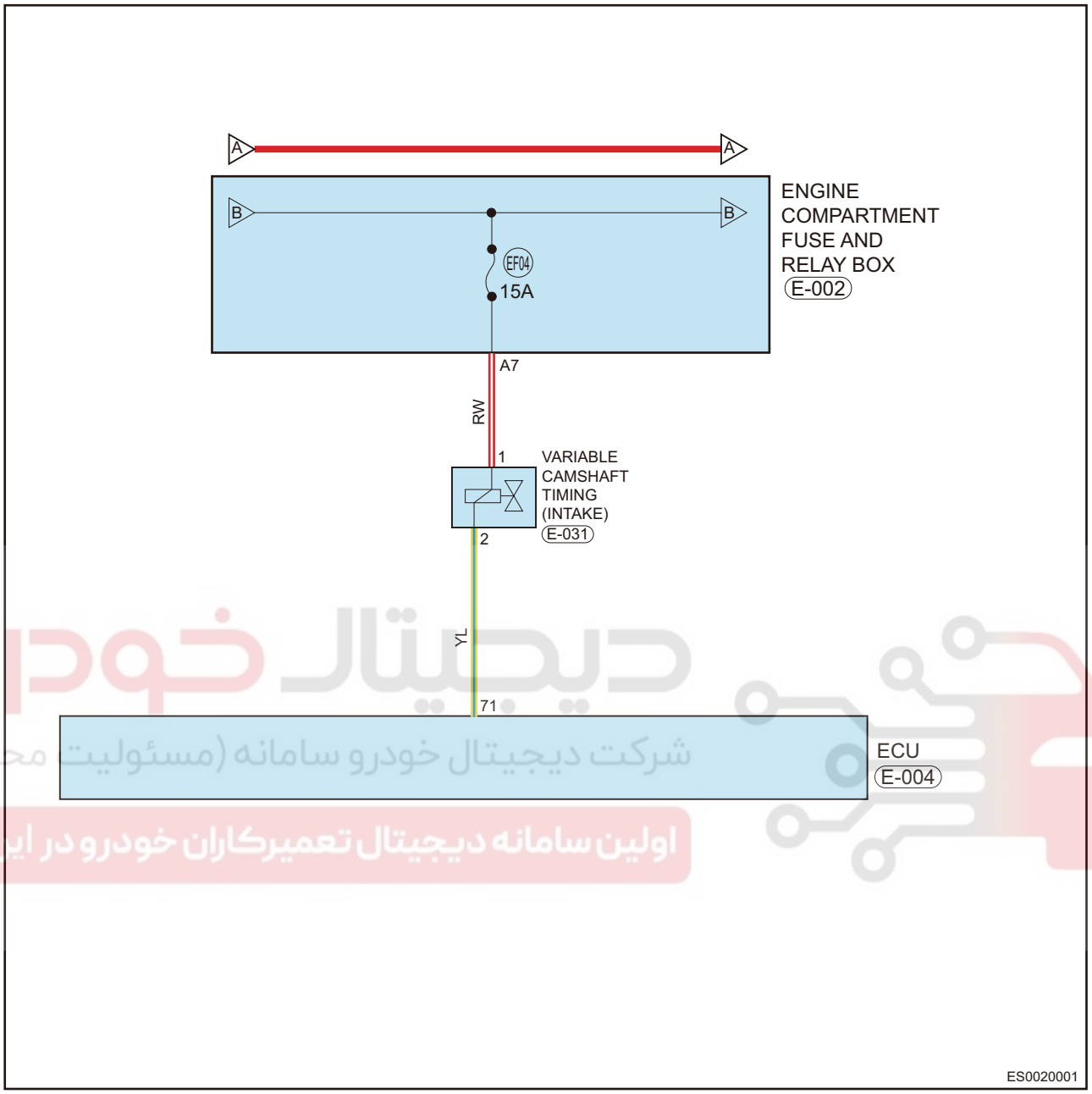
Result

Proceed to
OK
NG

System operates normally
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 not 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.

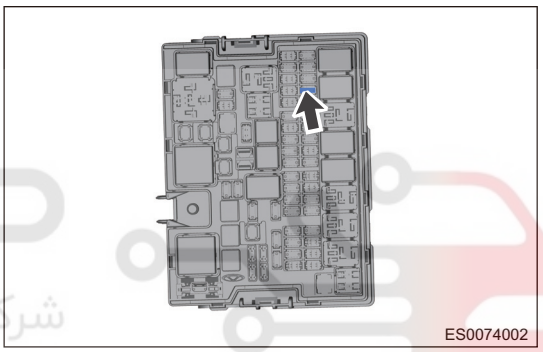
Caution:

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 EF04

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



Result

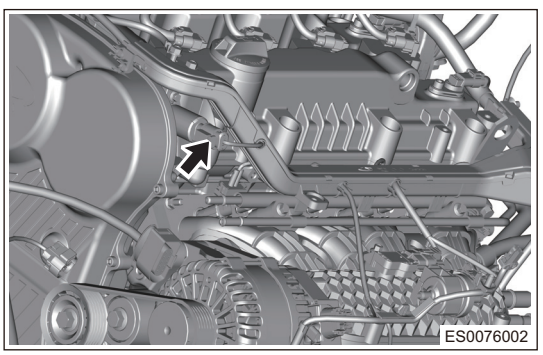
Proceed to
OK
NG

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

OK

2	Check intake VVT control valve connector

(a) Check if intake VVT control valve connector E-031 (arrow) is infirmly connected or poorly contacted.



OK

Intake VVT control valve connector is normal

Result

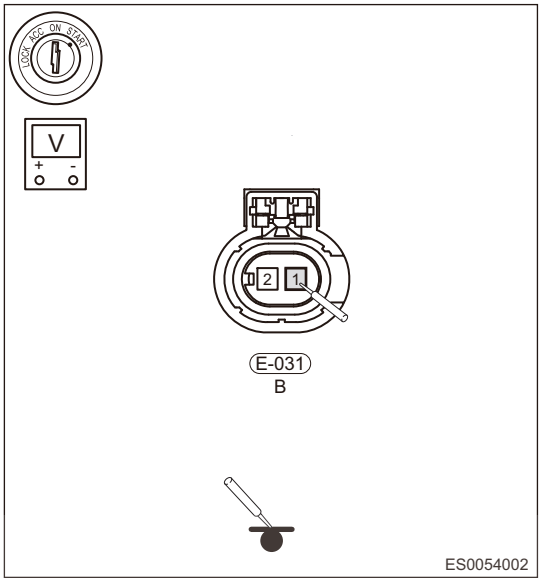
Proceed to
OK
NG

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-031 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Intake VVT control valve power supply voltage is normal

Result

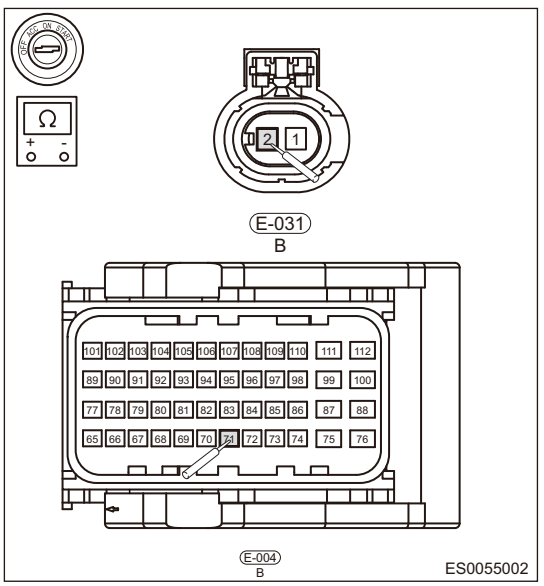
Proceed to
OK
NG

NG → **Repair or replace wire harness between intake VVT control valve and front 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 connectors.
(d) Check wire harness between intake VVT control valve E-031 (2) terminal and ECM.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-031 (2) - E-004 (71)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
E-004 (71) or E-031 (2) - Body ground	Always	Resistance ∞
E-004 (71) or E-031 (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

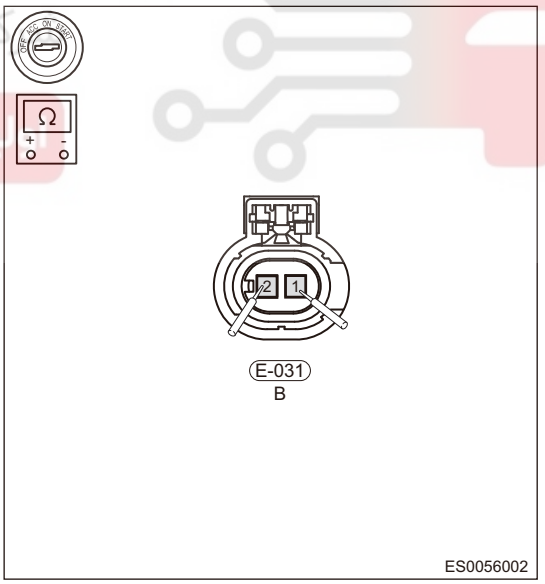
(a) Remove the intake VVT control valve.
(b) When battery voltage is applied between terminals 1 and 2, control valve should move quickly.

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

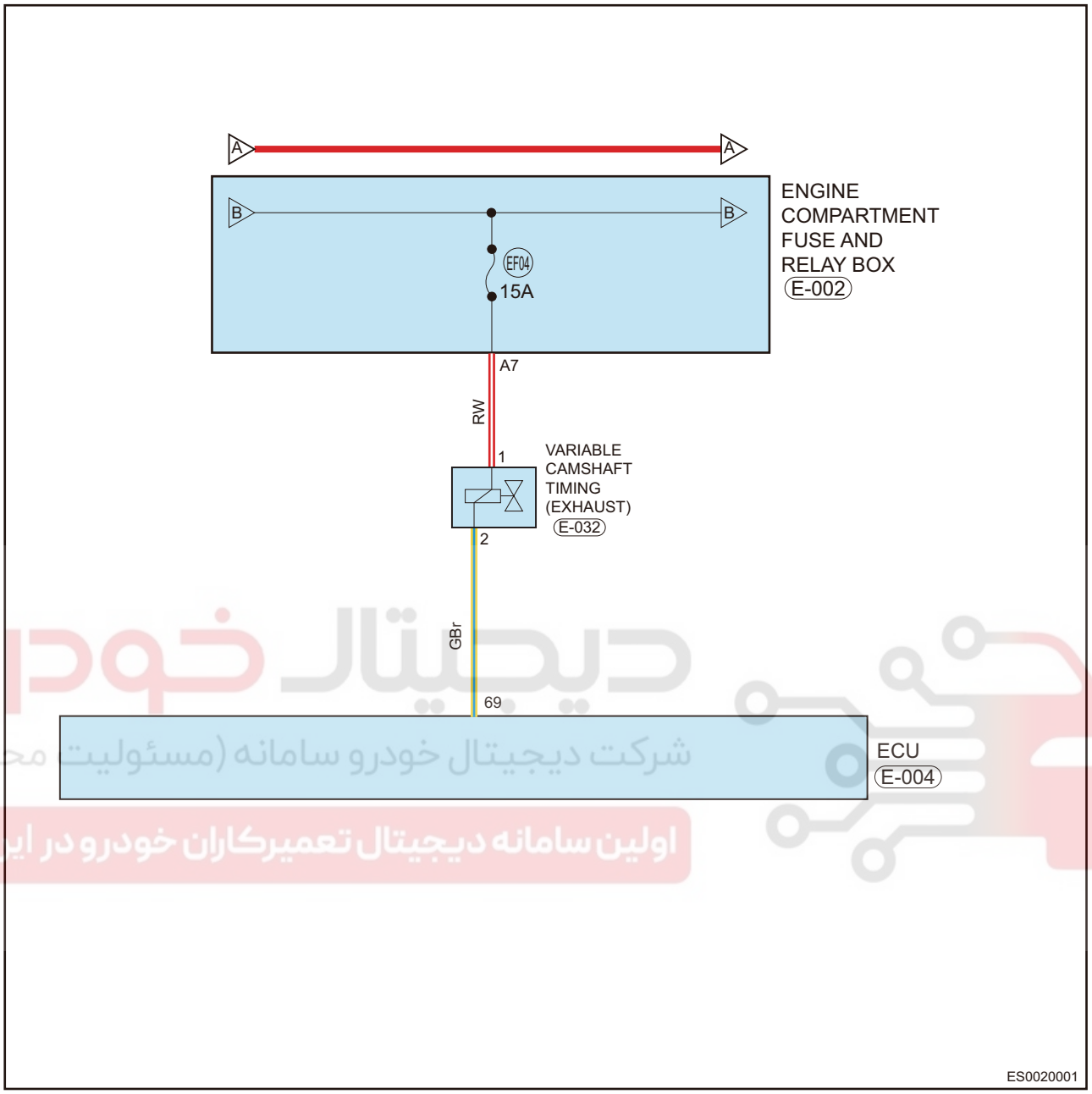
Result

Proceed to
OK
NG

System operates normally
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 not 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.

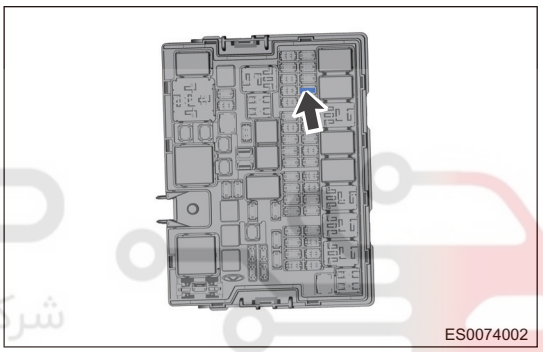
Caution:

- 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**

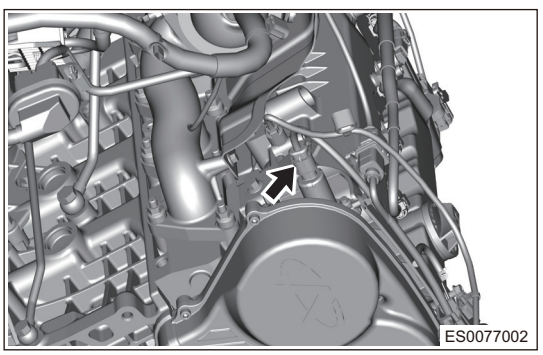
OK

2	Check exhaust VVT control valve connector

(a) Check if exhaust VVT control valve connector E-032 is infirmly connected or poorly contacted.

OK

Exhaust VVT control valve connector is normal



Result

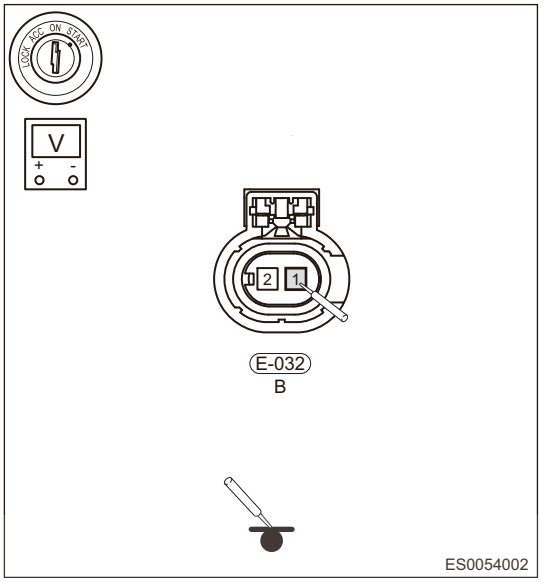
Proceed to
OK
NG

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-032 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK
Exhaust VVT control valve power supply voltage is normal

Result

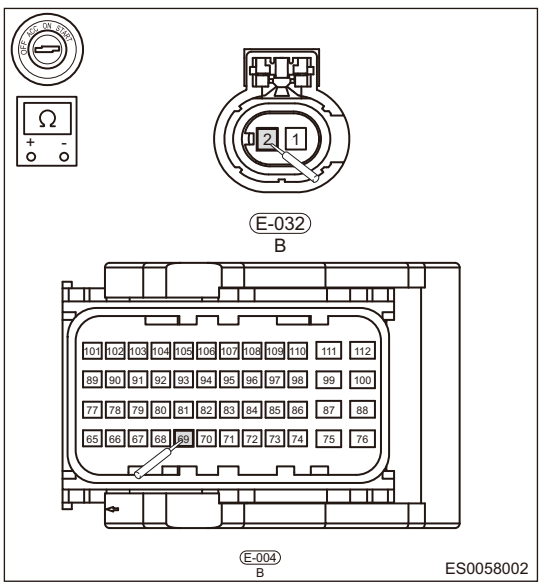
Proceed to
OK
NG

NG → **Repair or replace wire harness between exhaust VVT control valve and front 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-004 and exhaust VVT control valve connector E-032.
(d) Check wire harness between exhaust VVT control valve connector terminal and ECM connector terminal.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-004 (69) - E-032 (2)	Always	Resistance ⩽ 1 Ω

Check for Short

Multimeter Connection	Condition	Specified Condition
E-004 (69) or E-032 (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

Proceed to
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

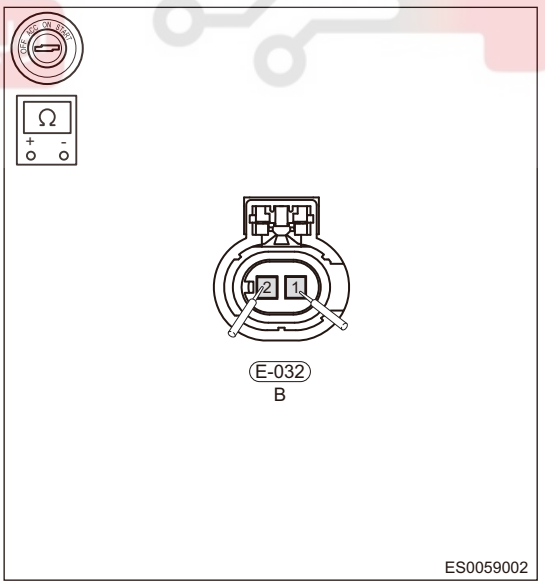
(a) Remove the exhaust VVT control valve.
(b) When battery voltage is applied between terminals 1 and 2, control valve should move quickly.

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

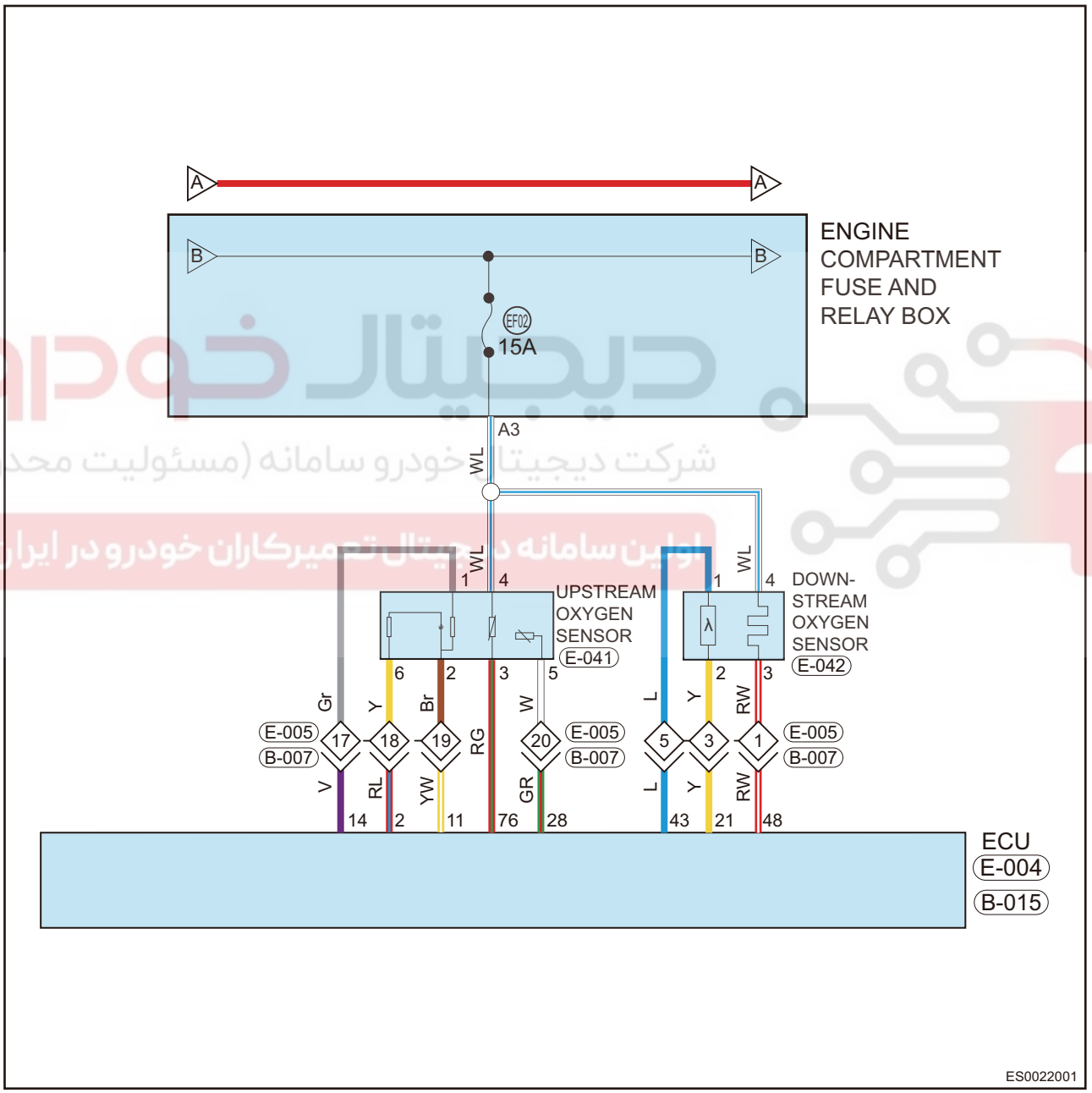
Result

Proceed to
OK
NG

System operates normally
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/(1440 - 3320 rpm, for DCT: 1440 - 2720 rpm); Engine load is between 18 and 70.5%/(for MT: 18 - 57.75, for DCT: 24.75 - 69.75); · Engine intake flow is between 18 and 140 kg/h/ (for MT: 24 - 110 kg/h, for DCT: 22 - 110 kg/h);	Oxygen sensor Wire harness or connector Fuel system components 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		

04

Confirmation Procedure

Confirm that battery voltage is not 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-041 and ground (using a digital multimeter or 21 W test light).

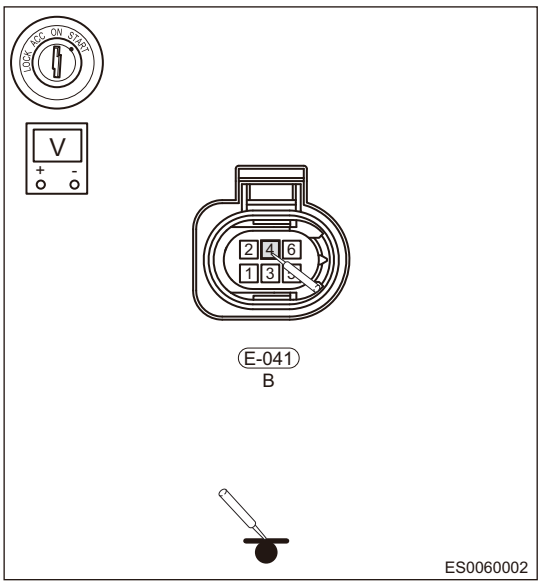
Multimeter Connection	Condition	Specified Condition
E-041 (4) - Body ground	ON	Not less than 12 V

OK

Upstream oxygen sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG → **End**

OK

3	Check upstream oxygen sensor heater control circuit voltage

(a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage between terminal 2 of connector E-041 and ground (using a digital multimeter or 21 W test light).

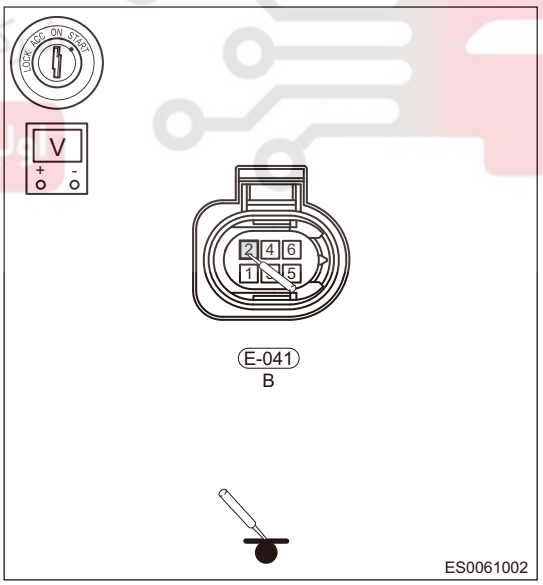
Multimeter Connection	Condition	Specified Condition
E-041 (2) - Body ground	ON	Not less than 12 V

OK

Upstream oxygen sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG → **End**

OK

4	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-042 (using a digital multimeter or 21 W test light).

Multimeter Connection	Condition	Specified Condition
E-0042 (4) - E-042 (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

5	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-042.

Multimeter Connection	Condition	Specified Condition
E-042 (2) - E-042 (1)	Engine running	Fluctuates rapidly between 0.1 and 0.9V (coolant temperature is normal)

OK

Upstream oxygen sensor signal is normal

Result

Proceed to
OK
NG

NG → **End**

OK

6	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-041.
(e) Check for short between terminals 6 and 2 of connector E-041.

Multimeter Connection	Condition	Specified Condition
E-041 (2) - E-041 (6)	Engine running	Resistance ⩽ 1 Ω

OK

Upstream oxygen sensor signal is normal

Result

Proceed to
OK
NG

NG → **Replace upstream oxygen sensor**

OK →

7	Check the ECM ground point

(a) Disconnect ECM ground points B-010 and E-006.
(b) Check the ECM ground points B-010 and E-006.

OK

Ground point is normal

Result

Proceed to
OK
NG

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

OK →

8	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 →

9	Check if malfunction is caused by canister solenoid valve

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

OK

Canister solenoid valve operates normally

Result

Proceed to
OK
NG

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

OK

10	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

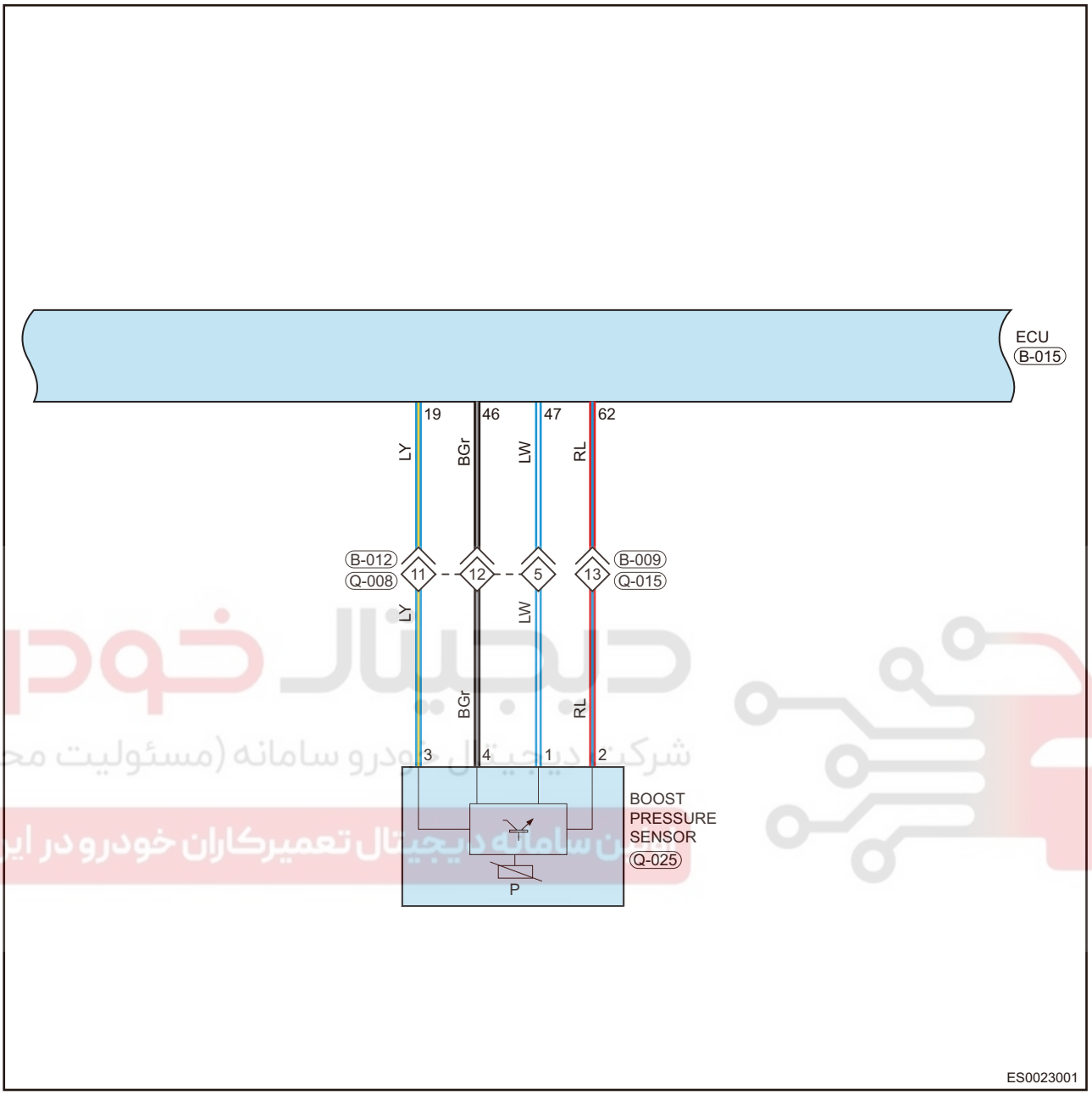
Proceed to
OK
NG

System operates normally

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 not 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 pipeline of turbocharger assembly**

(a) Check if boost pressure sensor is installed in place.
(b) Check each pipeline of turbocharger assembly for cracks or falling off.

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 ignition switch to ON and start engine.
(b) Measure voltage between connector terminal and body ground (using a digital multimeter).

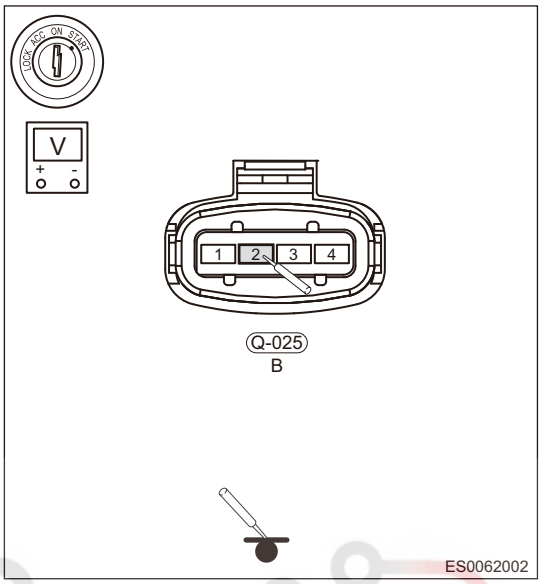
Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Q-025 (2) - 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

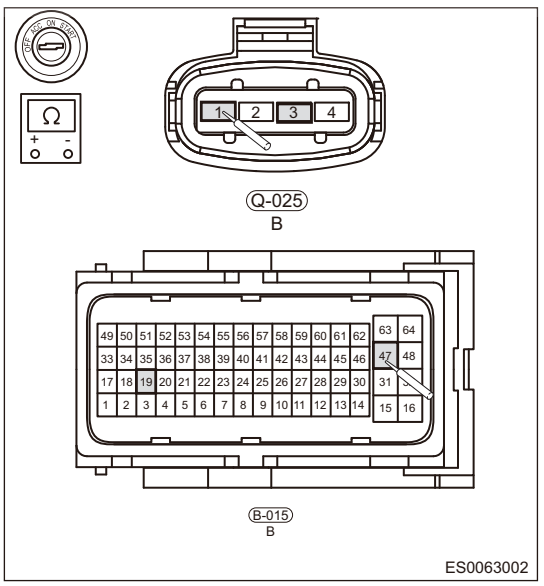
(a) Turn ENGINE START STOP switch to ON and start engine.
(b) Measure wire harness between connector terminal Q-025 and ECM.

Check for Open

Multimeter Connection	Condition	Specified Condition
Q-025 (1) - B-015 (47)	Always	Resistance ⩽ 1 Ω
Q-025 (3) - B-015 (19)	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 Q-025 (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 relief control valve connector.
(b) Check if boost relief valve is damaged or poorly contacted.

OK

Boost relief valve itself has no malfunction

Result

Proceed to
OK
NG

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

OK

6	Check exhaust gas bypass valve

(a) Remove the exhaust gas bypass valve connector.
(b) Check if exhaust gas bypass valve is damaged or poorly contacted.

OK

Boost relief valve itself has no malfunction

Result

Proceed to
OK
NG

NG → **Clean or replace exhaust gas bypass 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

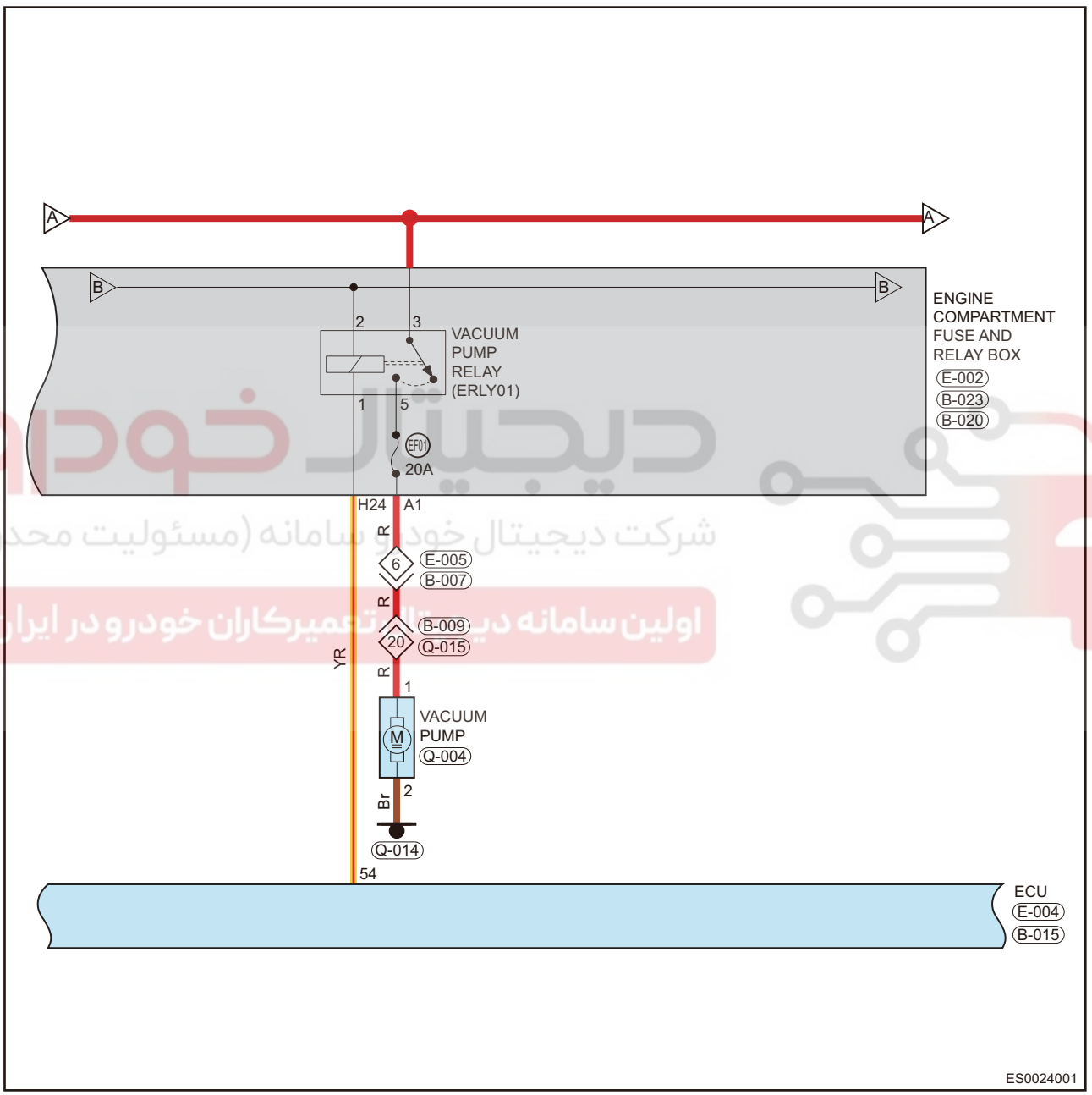
Result

Proceed to
OK
NG

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

DTC	P258D 00	Vacuum Pump Control Circuit "A" High
DTC	P258C 00	Vacuum Pump Control Circuit "A" Low
DTC	P258A 00	Vacuum Pump Control Circuit Open

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P258D 00	Vacuum Pump Control Circuit "A" High	ENGINE START STOP switch ON, engine running	Brake vacuum booster pump relay Wire harness or connector Battery ECM
P258C 00	Vacuum Pump Control Circuit "A" Low		
P258A 00	Vacuum Pump Control Circuit Open		

Confirmation Procedure

Confirm that battery voltage is not 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 12 V

Result

Proceed to
OK
NG

NG → **Check and repair battery**

OK →

2	**Check brake vacuum booster pump fuse and relay**

(a) Check brake vacuum booster pump fuse EF01 (20A) is blown or no power.
(b) Remove 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-004 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

(a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage between terminals 2 and 3 of brake vacuum booster pump relay 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 12 V

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 vacuum pump terminal Q-004 (1) voltage.

Check for Open

Multimeter Connection	Condition	Specified Condition
Q-004 (1) - Ground	ENGINE START STOP switch ON	Not less than 12 V

Result

Proceed to
OK
NG

NG → **Repair or replace wire harness between vacuum pump and front compartment fuse and relay box**

OK

6	Replace brake vacuum pump, 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**

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.)

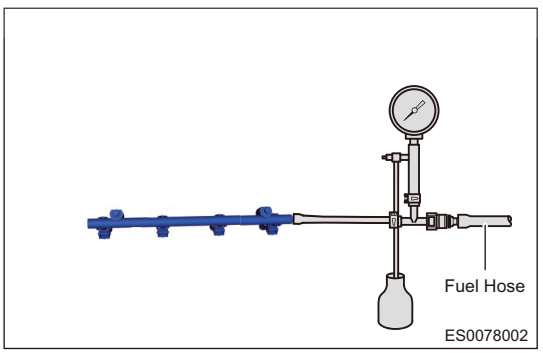
Caution:

- 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.

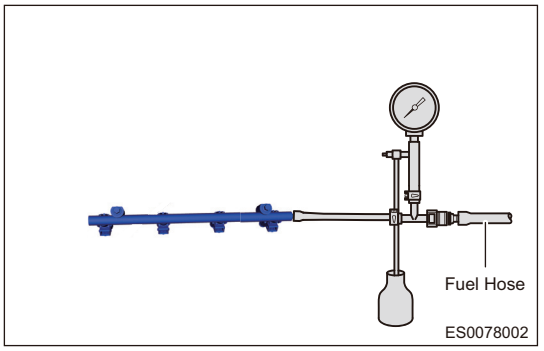
2. Check fuel pressure process
   (a) Fuel system pressure release.
   (b) Remove the engine trim cover.
   (c) Disconnect the inlet pipe Ⅱ connector and connect the fuel supply system pressure tester between inlet pipe Ⅱ and fuel rail.



   (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), if the pressure of pressure gauge is lower than 0.1 Mpa (100 kPa) of system pressure, 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. Inspection of 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. Inspection of 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. Inspection of 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. Inspection of 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. Inspection of 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. Inspection of 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. Inspection of 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

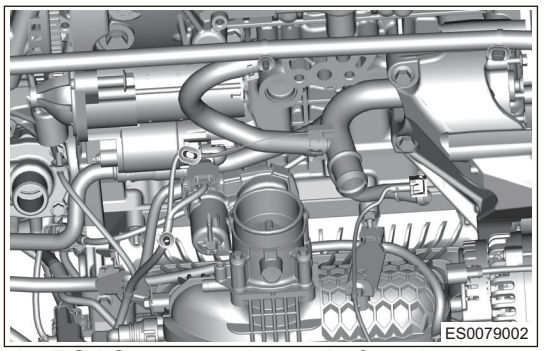
OK

Go to Diagnostic Help

System Components Description

Electronic Throttle Body

Function



Electronic throttle body is a critical part for engine intake system in EGAS 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.

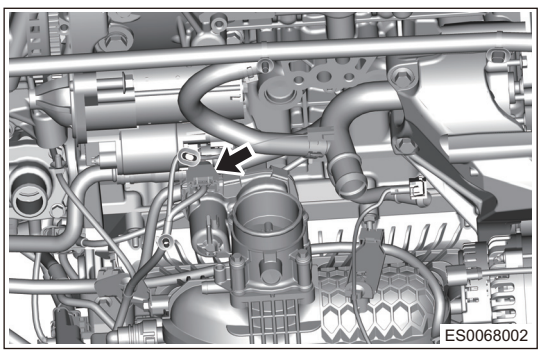
   (b) Perform the simple measurement for throttle internal sensor in following steps:

Step	Operation	Test Value	Test Result	Subsequent Step
1	Turn digital multimeter to ohm band (remove connector), connect two probes to terminals 6 and 2 respectively, flip valve plate by hand, and resistance should change continuously.	/	Yes	Next
		/	No	Replace throttle body
2	Connect two probes to terminals 5 and 2 respectively, flip valve plate by hand, and resistance should change continuously. (valve plate is in the same position at normal temperature, the sum of two resistance values in steps 1 and 2 is usually 1.9 kΩ ± 0.2 kΩ).	/	Yes	Next
		/	No	Replace throttle body
3	Directly measure resistance of copper windings on DC motor between terminals 1 and 4. It is usually between 2.0 and 2.5 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

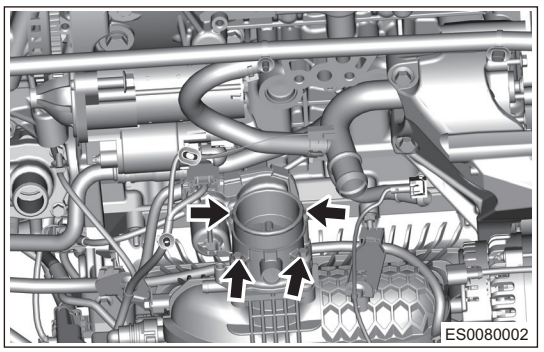
4. DTC troubleshooting
   (a) If DTC P0121, P0122, P0123, P221, P222 or P223 is output, refer to methods in previous DIAGNOSIS & TESTING section to perform test.
   (b) If DTC P0606 or P2106 is output, it indicates that electronic throttle is not malfunctioning, perform ECM and throttle self-learning 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 the electronic throttle connector.



(b) 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.

Installation

1. Installation is in the reverse order of removal.

Absolute Brake Vacuum Sensor

Description

Absolute brake vacuum sensor is installed on gasket of vacuum booster, which is separated from outside atmosphere by the gasket.

1 - Sensor Voltage Signal Output	2 - Ground
3 - to 5 V Power Supply	

Installation Position

Installation Position

Pressure sensor is installed on gasket of vacuum booster, which is separated from outside atmosphere by the gasket.

Caution:

Installation Precautions

1. Always make sure the O-ring is not damaged during installation. Apply a light coat of oil (such as 5W20) 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.
3. Simple detection method for intake pressure/temperature sensor malfunction

Step	Operation	Test Value	Test Result	Subsequent Step
1	Pressure sensor part: connect intake pressure/temperature sensor wire harness connector, turn ENGINE START STOP switch to ON, the voltage between terminals 2 and 3 of intake pressure/temperature sensor wire harness should be 5 ± 0.5 V;	5 ± 0.5 V	Yes	Next
			No	Check for continuity and ground of wire harness
2	Pressure sensor part: Measure resistance between terminals 1 and 2, terminals 1 and 3 of pressure sensor	Resistance between terminals 1 and 2, terminals 1 and 3 is 1.5 ± 0.5 kΩ	Yes	Check ECM control unit
			No	Replace sensor

VVT Control Valve

Operation

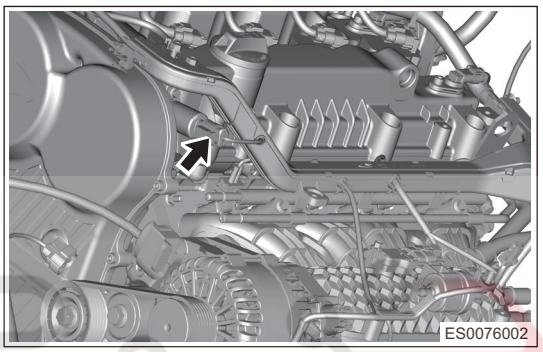
Hint:

- There are two VVT control valves which are located in front of intake and exhaust camshaft.

ECM controls VVT solenoid valves depending on engine conditions, changes the flowing direction of oil in phasers to advance or retard camshaft, thus changing the timing of intake valve and exhaust valve.

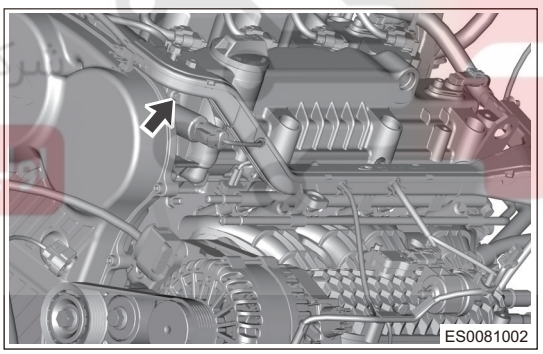
Removal

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 VVT control valve.
   (a) Disconnect the intake VVT control valve connector (arrow).

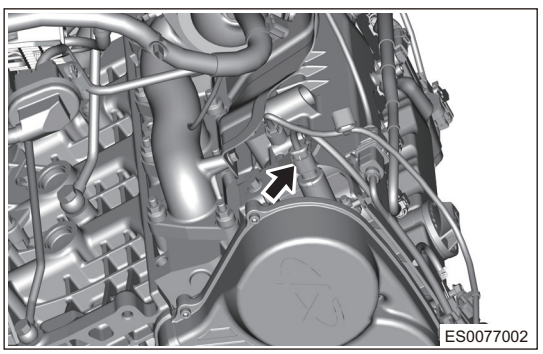


   (b) Then remove the intake VVT control valve fixing bolt.

   Tightening torque
   8 ± 2 N•m

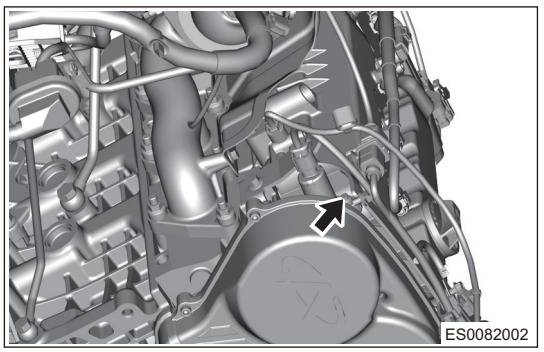


5. Remove the exhaust VVT control valve.
   (a) Disconnect the exhaust VVT control valve connector.



(b) Then remove the exhaust VVT control 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, and the tightening torque is 15 ± 1 N•m.
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

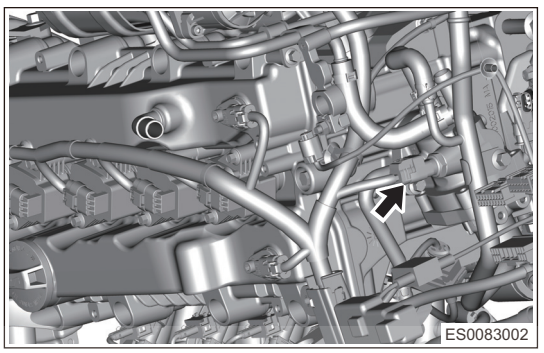
Common problem symptoms related to this sensor: abnormal water temperature indication, difficult to start, fan constantly runs, etc.

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 coolant temperature 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 connector (arrow) and remove coolant temperature sensor.



Installation

1. Installation is in the reverse order of removal.

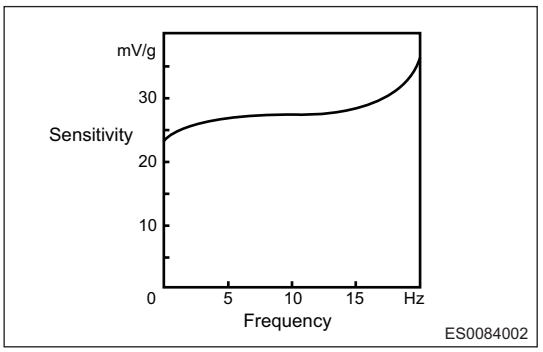
Knock Sensor

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

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.

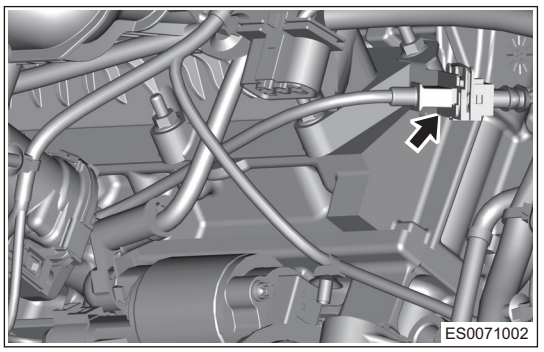
Common Problem Symptoms and Judgment Methods

1. Problem symptom: poor acceleration, etc.
2. General problem causes
   - Liquids such as oil, coolant, brake fluid and water contacted with sensor will cause corrosion to the sensor.
3. Simple detection method for knock sensor malfunction

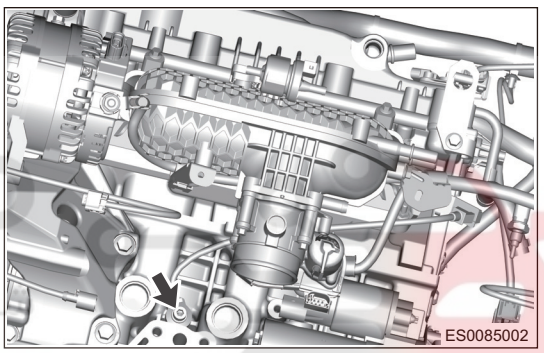
Step	Operation	Test Value	Test Result	Subsequent Step
1	Turn multimeter to ohm band, measure resistance between terminals 1 and 2 of knock sensor, it should be more than 1 MΩ at normal temperature	/	Yes	Next
		/	No	Replace knock sensor
2	Turn multimeter to mV band, use a small hammer to tap near knock 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 the knock sensor connector.



4. Remove bolt and 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, downstream oxygen sensor is LSF 4.2.

1. Front oxygen sensor

   Input signal from front universal exhaust gas oxygen sensor informs Engine Control Module (ECM) of the oxygen content in exhaust gas. Based on this input signal, Engine Control Module (ECM) adjusts air-fuel ratio finely by adjusting injector pulse width.

2. Rear oxygen sensor

   Rear heated oxygen sensor signal is used to detect the catalytic converter deterioration. As converter deteriorates, signal from downstream oxygen sensor begins to match signal from upstream oxygen sensor except for a slight delay. By comparing the signals from upstream heated oxygen sensor to the signal from downstream oxygen sensor, Engine Control Module (ECM) calculates the efficiency of catalytic converter.

Operation

Sensing element of LSF oxygen sensor is a ceramic flat body with pores. Outside of ceramic is surrounded by engine exhaust, and inside is open to the atmosphere. Sensing ceramic body wall is a solid electrolyte with heated electrodes. The work of the oxygen sensor is realized by converting the difference of oxygen ion concentration in and out of the sensing ceramic body into voltage signal output. When the temperature of sensing ceramic body reaches 350°C, it has the characteristics of solid electrolyte. Because of its special material, oxygen ions can freely pass through the ceramic body. Using this characteristic, the concentration difference can be converted into potential difference, thus forming electrical signal output. If the mixture concentration is too rich, oxygen ion concentration difference in and out of the ceramic is high, electric potential difference is high, a large number of oxygen ions move from the inside to the outside, and the output voltage is higher (approximately 800mV-1000mV); If the mixture concentration is too lean, oxygen ion concentration difference in and out of the ceramic is low, electric potential difference is low, only a small amount of oxygen ion moves from the inside to the outside, and the output voltage is lower (approximately 100mV). Signal voltage changes abruptly at about the theoretical equivalent air fuel ratio (λ=1).

LSU oxygen sensor is much more advanced than LSH and LSF in function. It is a ceramic body principle and a "micro pump" for oxygen ion transportation. Pump provides enough oxygen to the electrodes on the contact side of the exhaust to maintain a constant voltage on both sides, about 450mV. Electric energy consumption of the pump is converted into the excess air coefficient by the electronic controller, output current is almost linear with λ. λ = 0.65 ~ ∞ , so it is also called linear oxygen sensor. It can not only determine whether λ is greater than 1 or less than 1, but also measure in the thin and thick areas The specific value of λ can be determined, so the excess air coefficient in a wide range (broadband) can be measured, and the continuous control of λ < 1 to λ > 1 can be realized.

Proper air-fuel ratio.

Installation Position

Upstream oxygen sensor is installed on front of exhaust manifold three-way catalytic converter, and downstream oxygen sensor is installed behind the three-way catalytic converter.

Installation Precautions

1. Applying detergent, oily liquid or volatile solid to the oxygen sensor connector is prohibited.
2. Tightening torque for oxygen sensor is 40 to 60 N·m. The new sensor has been applied with grease during installation without application. The specified grease must be used during reassembly of oxygen sensor: BOSCH material number 5964080112 (120 g/can) or 5964080145 (450 g/can). Use of other grease will lead to oxygen sensor poisoning.
3. The oxygen sensor wire harness must not be twisted, taut, or attached to objects with sharp edge or high temperature.
4. Oxygen sensors must not be thrown at will, and avoid any impact or strike.

Common Problem Symptoms and Judgment Methods

3. Problem symptoms: poor engine idle, poor acceleration, emissions exceeding, excessive fuel consumption, etc.
4. Main problem causes:
   - Poor wire harness: connector terminal looseness, rust, terminal uneven; or wire breakage, poor connection, etc., resulting in oxygen sensor signal failure and oxygen sensor heating failure displayed on diagnostic tester;
   - Mechanical shock (such as flying rock) damage to the sensor;
   - Moisture, condensation or contaminants enters inside the sensor, causing the sensor failure or poor signal;
   - Post-combustion of exhaust pipe due to the misfire, causing the oxygen sensor sensing element to be burned;
   - Oxygen sensor "poisoning" (such as Pb, S, Br, Si or Mn).
5. Simple detection method for oxygen sensor malfunction
   (a) LSF simple measurement method
   Turn digital multimeter to ohm band (remove connector), connect two probes to sensor terminal 1# (white) and terminal 2# (white) respectively, the resistance should be 7 ～ 11 Ω at normal temperature.
   Under idling state (connector is reconnected), wait until oxygen sensor reaches its operating temperature (350°C), turn digital multimeter to DC voltage band, connect two probes to sensor terminal 3# (gray) and terminal 4# (black) respectively, voltage should fluctuate rapidly between 0.1 and 0.9V at this moment.
   (b) There is no simple measurement method for LSF in service station
   In order to avoid misjudgment, for LSU with intact appearance, cross validation method should be used to further confirm whether LS itself is invalid.

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

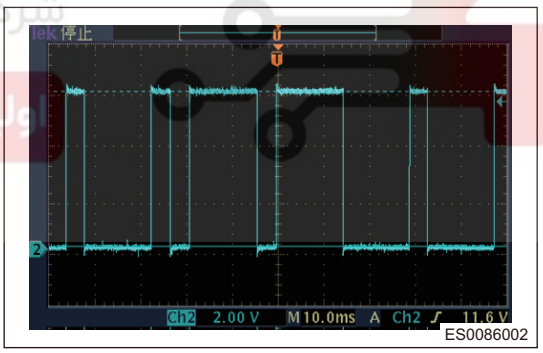
1. The sensor must always be in the original packaging material before installation or test.
2. Take out the sensor from packaging material, check the sensor and ensure that it must not be damaged or contaminated.
3. Apply mineral oil to phase sensor O-ring, then press the sensor (do not tap with tool) and tighten with fixing bolt. Tightening torque is 8 ± 1 N•m.
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 section



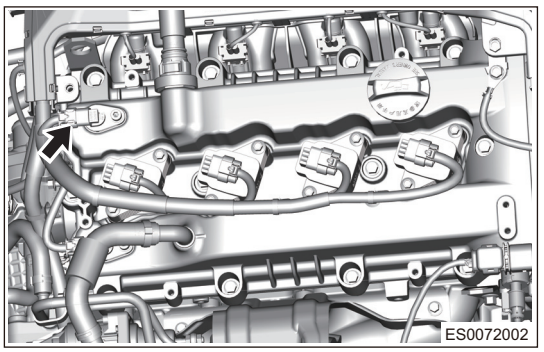
Simple measurement method

Turn ignition switch ON but do not start engine (connector is reconnected), turn the digital multimeter to DC voltage band, connect two probes to sensor signal ground and input voltage terminal, and make sure that there is 12V reference voltage. Start engine, output pin signal can be checked if is normal by the oscilloscope at this moment.

Removal

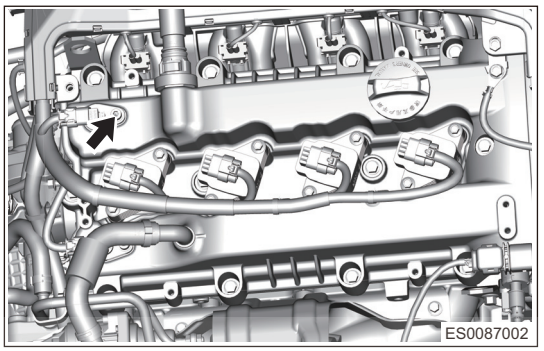
1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the intake camshaft position sensor.

(a) Disconnect the intake camshaft position sensor connector (arrow).



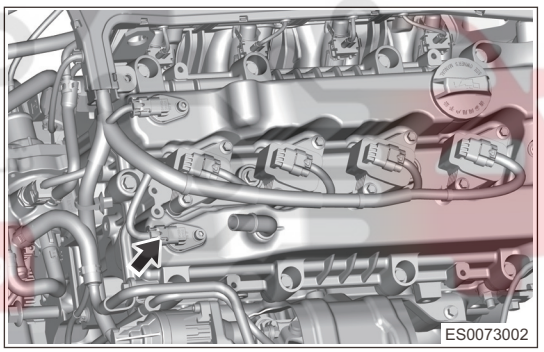
(b) Then remove camshaft position sensor fixing bolt.

Tightening torque
8 ± 1 N·m



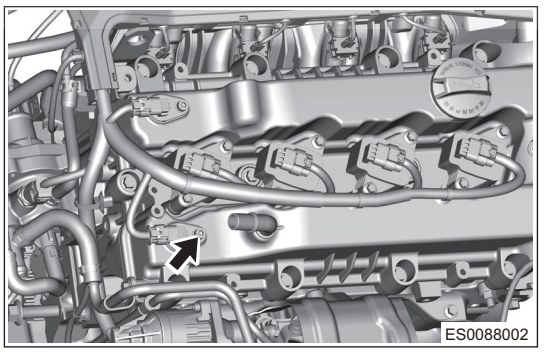
5. Remove the exhaust camshaft position sensor connector.

(a) Disconnect the exhaust camshaft position sensor connector (arrow).



(b) Then remove camshaft position sensor fixing bolt.

Tightening torque
8 ± 1 N·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

Crankshaft position sensor is Hall sensor. When crankshaft rotates, it drives flywheel to rotate. Flywheel teeth will change the magnetic field intensity of sensor, change of magnetic flux causes sensor output signal voltage change, which is output to Engine Control Module (ECM). And output signal can indicate the speed and position of crankshaft.

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. Press the sensor (do not tap with tool), and then secure it with fixing bolt and gasket. Tightening torque is 8 ± 2 N·m.
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

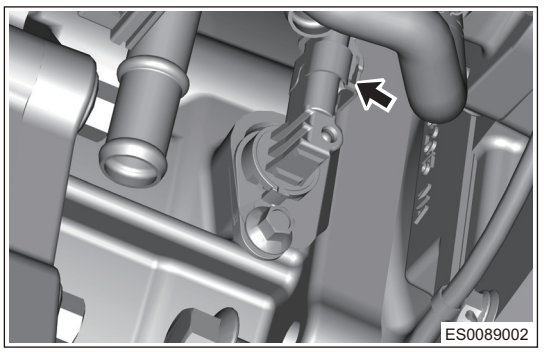
1. Problem symptoms: engine cannot start
2. Repair precaution
   - Never repair the sensor.
   - Press in crankshaft position sensor rather than tapping during service.
3. Simple detection method for fuel rail injector assembly malfunction

Step	Operation	Test Value	Test Result	Subsequent Step
1	Turn ENGINE START STOP switch to ON, and do not start engine, turn digital multimeter to DC voltage band, connect two probes to terminals 3, 1 of sensor wire harness connector respectively, make sure that power supply voltage is 5 V	/	Yes	Next
			No	Troubleshoot power supply problems
2	Connect connector, start engine, measure voltage waveform between terminals 1 and 2 of sensor with an oscilloscope, and waveform is shown in following illustration	/	Yes	Check wire harness or diagnostic help
		/	No	Replace sensor

Removal

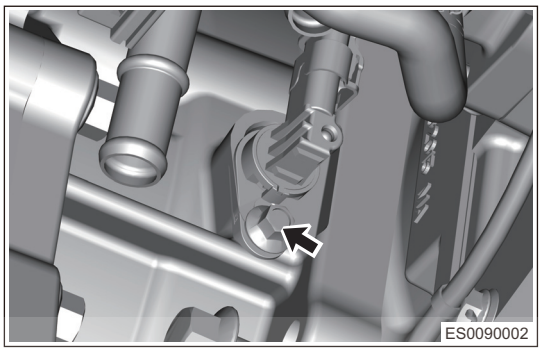
1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the engine speed sensor.

(a) Disconnect the engine speed sensor connector (arrow).



(b) Remove the engine speed 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 GB 17930-2006 Unleaded Gasoline for Motor Vehicle and GB 18351-2004 Alcohol Gasoline for Motor Vehicle of People's Republic of China, and the National Environmental Protection Standards GWKB 1-1999 Hazardous Materials Control Standard for Motor Vehicle Gasoline.

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. Removal precautions

   Caution:

   - If it is necessary to remove the fuel rail assembly, unplug the fuel injector connector, remove fuel rail assembly mounting screw, and remove the wire harness from wire harness clamp; then grasp the injector with both hands and gently remove the fuel rail assembly from intake manifold, and the O-ring should not remain in cylinder head.
   - Clean the dirt on the outer surface of fuel rail assembly to prevent the dirt from being introduced into the fuel rail assembly during reassembly, resulting in damage to other components.
   - If the injector O ring is damaged during reassembly, never use it.

2. 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 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 the 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.

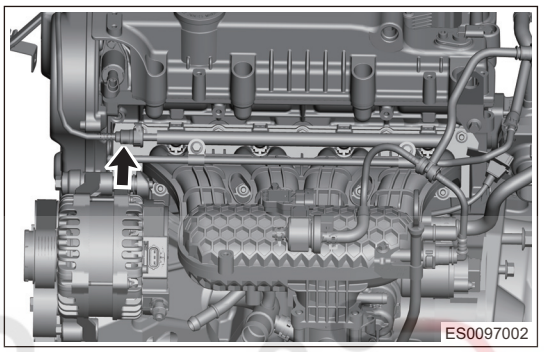
Common Problem Symptoms and Judgment Methods

3. Problem symptoms: fuel leaks into engine compartment, which may cause vehicle burning in severe case.
4. Repair precaution
   - Weld cracking of fuel distribution pipe;
   - Aging of injector o-ring;
   - Poor connection between fuel pipe and fuel distribution pipe assembly.

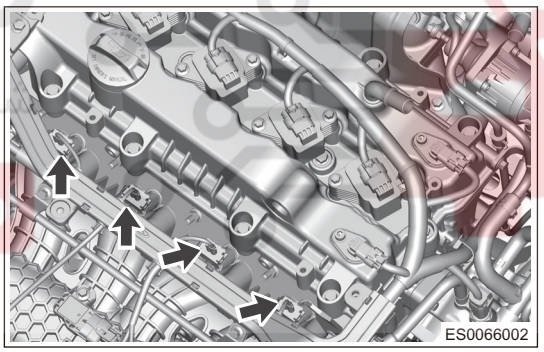
5. Simple detection method for injector malfunction
   Remove fuel distribution pipe assembly from engine, apply compressed air of 4.5 bar from inlet port, place the injector connector upward, and immerse the fuel distribution pipe assembly into water so that the injection end of the injector does not 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

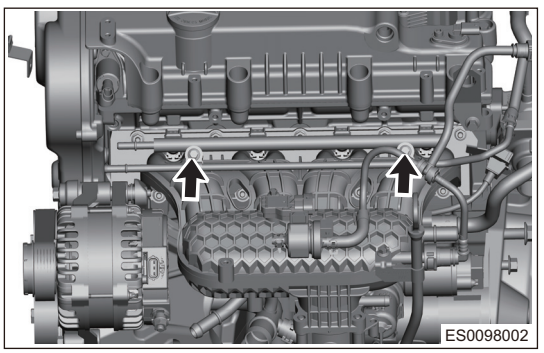
1. Turn off all electrical equipment and ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the fuel rail injector assembly.
   (a) Disconnect joint between fuel pipe and fuel rail injector assembly.



   (b) Disconnect 4 injector connectors (arrow).



   (c) Remove the fuel rail injector assembly fixing bolts.
   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 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. Intake manifold absolute 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 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 sends a voltage of intake temperature change to controller.

In other words, pressure sensing element and temperature sensing element are integrated into intake pressure/temperature sensor, which are used to detect actual intake pressure and temperature in intake manifold during engine running, and engine electronic control unit module calculates instantaneous intake air volume of engine quickly based on data provided by intake pressure/temperature sensor and signals from other sensors of engine electronic control system.

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.

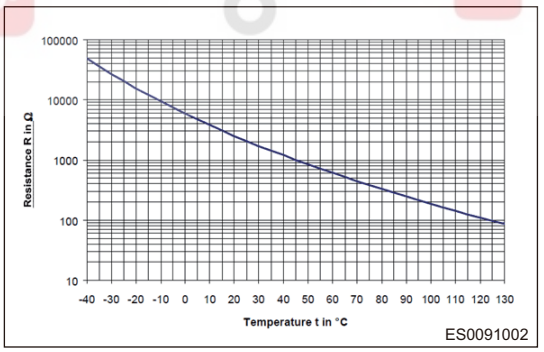
Common Problem Symptoms and Judgment Methods

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

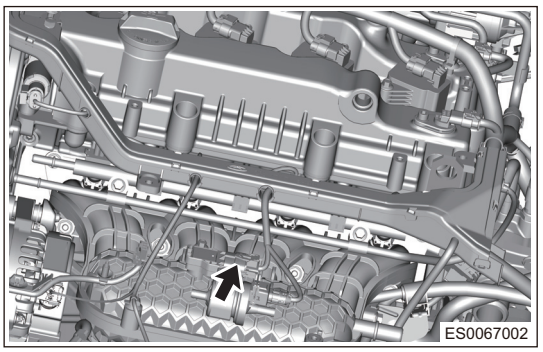
Step	Operation	Test Value	Test Result	Subsequent Step
1	Temperature sensor part: Remove intake pressure/temperature sensor wire harness connector, and measure resistance of terminals 1 and 2 of sensor separately with a multimeter; Measurement can also be performed by simulating. Specific operations are 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
2	Pressure sensor part: measure resistance between terminals 1 and 4, terminals 3 and 4 of intake pressure/temperature sensor	Resistance between terminals 1 and 4, terminals 3 and 4 is 1.5 ± 0.5 kΩ	Yes	Next
			No	Replace intake pressure/ temperature sensor
3	Pressure sensor part: Connect intake pressure/temperature sensor wire harness connector, turn ENGINE START STOP switch to ON, the voltage between terminals 1 and 3 of intake pressure/ temperature sensor wire harness should be 5 ± 0.5 V; Under idling status, measure voltage of terminal 4 of sensor with a multimeter, the voltage should be about 0.7 V (value changes with model); under unloaded status, slowly open the throttle, the voltage of terminal 4 has not changed too much; quickly open the throttle, the voltage of terminal 4 can reach about 4 V instantaneously (value changes with model), and then drops to about 1.8 V (value changes with model).	/	Yes	Diagnostic Help
			No	Check for continuity and ground of wire harness

5. Temperature - resistance curve of intake pressure/ temperature sensor

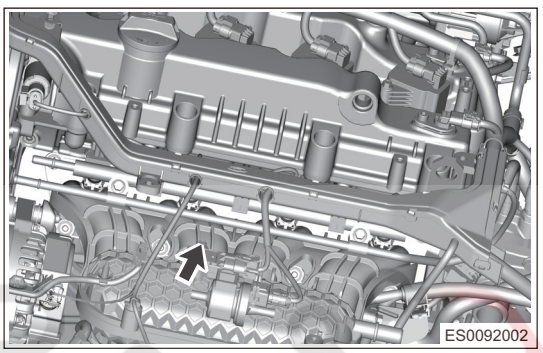


Removal

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.

Ignition Coil

Description

Caution:

- The primary and secondary winding of ignition coil has a dangerous voltage, confirm the installation environment during operation to avoid unnecessary loss caused by electricity leakage.

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

Operation

Ignition coil consists of primary winding, secondary winding, iron core and housing etc. The primary and secondary windings form an induced circuit. An instant induced voltage generated by turning primary circuit switch on and off, and an instant high voltage generated by secondary circuit will cause spark plugs to discharge, thus igniting the combustible air-fuel mixture. The primary winding will energize when its ground passage is on through an Engine Control Module (ECM) signal. If Engine Control Module (ECM) cuts off the control signal to primary winding circuit, it will stop energizing and a high voltage will be induced in the secondary winding.

Application Guide

Ignition coil is installed on the engine and secured with fixing bolt, the tightening torque is 8 ~ 10 N•m. Make sure that the connection between high-voltage connecting rod, ignition wire and ignition coil high-voltage terminal, spark plug is reliable, or it may cause high-voltage leakage, resulting in poor ignition.

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

   (a) Check if the injector itself is malfunctioning.
   (b) Check the cause of fuel leakage in the injector.
   (c) Check if the fuel injector is leaked oil.
   (d) Check if the fuel leakage is caused by fuel rail.
   (e) Turn digital multimeter to ohm band (remove connector), connect two probes to two terminals of fuel injector respectively, the rated resistance should be 12 ± 1 Ω at 20°C. Resistance is 12 ± 3 Ω at normal temperature.

Canister solenoid valve

Description

Canister solenoid valve opens when power is on, and closes when power is off.
Canister solenoid valve terminal: two terminals in total, and can be interchanged.

Operation

Canister solenoid valve consists of solenoid coil, armature, valve and other parts. Air volume through canister solenoid valve is related to the electric pulse duty ratio output from ECM to canister solenoid valve and the pressure difference between canister solenoid valve inlet and outlet. When there is no electric pulse, canister solenoid valve closes.

Installation Precautions

- The canister solenoid valve and sheath should be installed properly before assembly; assemble the canister solenoid valve and sheath according to the assembly position illustration.
- Secure the assembled assembly on canister solenoid valve bracket.
- Connect inlet port to canister, and outlet port to intake manifold according to airflow arrow on canister control valve housing.
- After installation, check if the airflow direction arrow on canister control valve housing is the same direction as the airflow direction.

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 control valve malfunction

Step	Operation	Test Value	Test Result	Subsequent Step
1	Remove the canister solenoid valve, blow air to canister solenoid valve in direction of airflow arrow on solenoid valve housing, check if the canister solenoid valve is ventilated	Ventilation or not	Yes	Canister solenoid valve fault, replace it
			No	Next
2	Apply 12 V battery voltage to two terminals of canister solenoid valve, and blow air to canister solenoid valve in direction of airflow arrow on solenoid valve housing, check if the canister solenoid valve is ventilated	Ventilation or not	Yes	Next
			No	Perform this inspection with a new canister solenoid valve, the testing equipment failure has been eliminated. If the fault does not recur, the canister solenoid valve is faulty, replace it
3	If there is obvious black substance in connecting pipe between canister solenoid 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 solenoid valve wire harness connector, and measure resistance of coil	26 ± 4 Ω	Yes	Next
			No	Perform this inspection with a new canister solenoid valve, the testing equipment failure has been eliminated. If the fault does not recur, the canister solenoid valve is faulty, replace it

Step	Operation	Test Value	Test Result	Subsequent Step
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 solenoid valve. If trouble is eliminated, it is most likely that poor connection may occurs. Focus on wire harness and connector inspection

DTC definition:

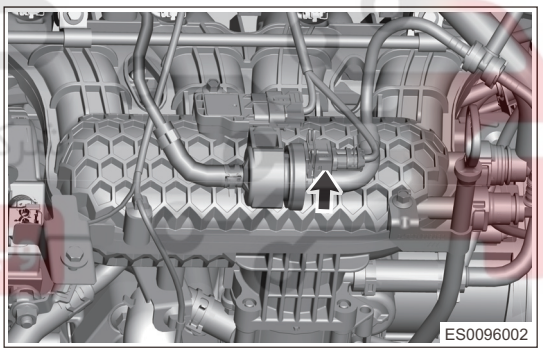
- P0444 Evaporative Emission System Purge Control Valve Circuit Open.
- P0458 Evaporative Emission System Purge Control Valve Circuit Low.
- P0459 Evaporative Emission System Purge Control Valve Circuit High.

Repair precaution

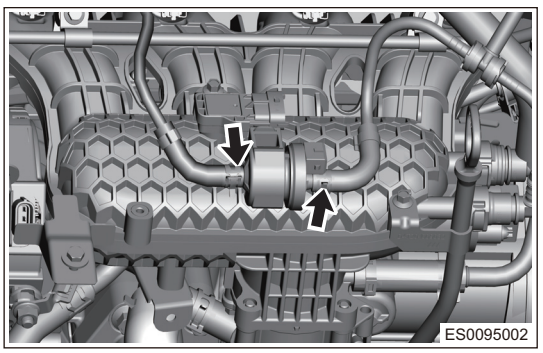
- Airflow direction must be in accordance with the regulations during installation.
- If solenoid valve is faulty due to black particles inside the valve body, it is necessary to replace solenoid valve and check the canister condition.
- Try to avoid water, oil and other liquids entering into the valve during service.

Removal

1. Disconnect the negative battery.
2. Unplug the canister solenoid valve wire harness connector.



3. Loosen and remove air pipes at both ends of canister solenoid valve.



4. Remove the canister solenoid valve from bracket.

Installation

1. Installation is in the reverse order of removal.

   Caution:
   - Airflow direction must be in accordance with the regulations during installation.
   - If canister solenoid valve is faulty due to black particles inside the valve body, check the canister condition when canister solenoid valve needs to be replaced.
   - Try to avoid water, oil and other liquids into the canister solenoid 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 front compartment left rail wheel house assembly, can be removed only as a unit for replacement. Tightening torque is 8 ± 2 N•m.

Installation Precautions

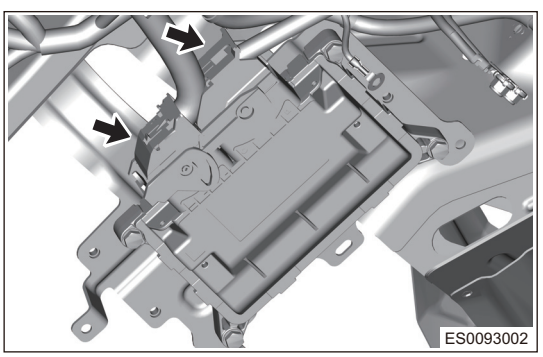
- Pay attention to static electricity protection during installation.
- Take care to protect connector terminals.
- Avoid water stains entering the connector during installation.

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;
   - 2. 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 ECU removal.
   - Remove ECU before performing welding operation, and the removed ECU should be stored;
   - Do not install any wire on ECU 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 new ECM to check if malfunction reoccurs.

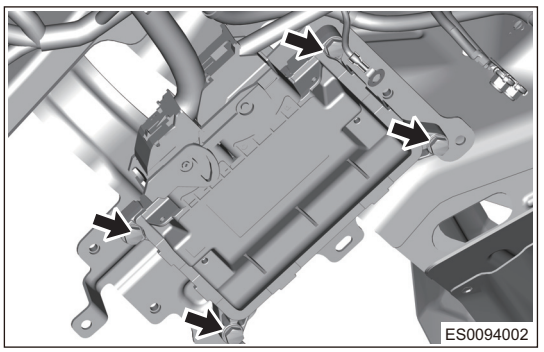
Removal

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 connector (arrow).



(b) Remove 4 fixing bolts (arrow) and ECM.

Tightening torque
8 ± 2 N•m



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.

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