
ENGINE

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3.1 ENGINE ELECTRONIC CONTROL SYSTEM

1 Warnings and Precautions

1.1 Precautions

In order to avoid dangerous operation and damage to the vehicle, always follow the instructions below before repair:

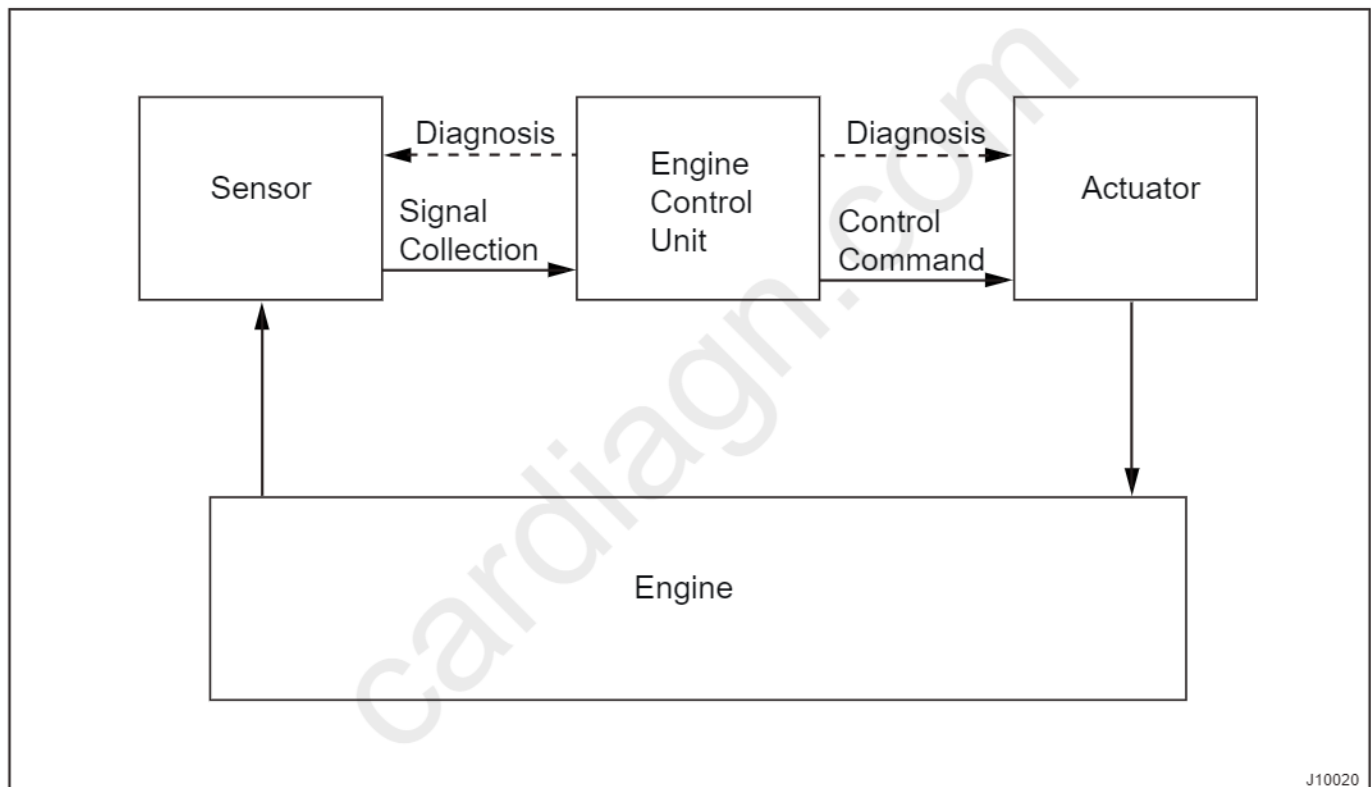
- (1) Digital multimeter can only be used to perform inspection for electronic injection system.
- (2) Use genuine components to perform service work, otherwise appropriate electronic injection system operation cannot be guaranteed.
- (3) Only use unleaded gasoline during service.
- (4) Please observe normative service and diagnostic flowchart to perform service work.
- (5) Never disassemble or remove components of electronic injection system during service.
- (6) When holding electronic elements (electronic control unit, sensor etc.), take extra care not to drop them on the ground.
- (7) Set up a consciousness of environmental protection and dispose of waste effectively that is produced during service.
- (8) Never use an needle multimeter to check electronic fuel injection system circuit.
- (9) Never use high power test light to measure when testing each pin voltage signal of sensor.
- (10) It is recommended that the measurement status when testing each pin voltage signal of sensor is on-line measurement.
- (11) It is recommended to use voltage drop method when measuring sensor, actuator connecting wire harness.
- (12) Do not causally remove any electronic injection system component or its connector from its installation position to prevent damaging accidentally, or foreign matter, such as moisture, oil from entering connectors, which will affect the normal operation of electronic injection system.
- (13) Be sure to turn ignition switch off when disconnecting and connecting connectors. Otherwise electronic elements may be damaged.
- (14) When simulating hot operating condition of malfunction and performing other service work that may cause temperature to rise, never allow temperature of electronic control unit to exceed 80°C.
- (15) As the supplying pressure of electronic injection system is high, high pressure resistant fuel pipes are adopted for all fuel lines. Fuel pressure in fuel lines is still high even when the engine is not running. Therefore, be careful not to casually remove fuel pipes during service; When it is necessary to service fuel system, discharge pressure in the fuel system before removing fuel pipes. The way to discharge pressure is as follows: After removing fuel pump controller power supply fuse, start engine and idle it until the engine stops running by itself. Removal of fuel pipes should be performed in a well-ventilated area by professional service men.
- (16) Do not energize electric fuel pump when removing it from fuel tank to prevent electric sparks, which will cause a fire.
- (17) It is not allowed to perform running test for fuel pump under dry state or in water. Otherwise service life will be reduced. In addition, do not inversely connect fuel pump positive and negative poles.
- (18) When performing inspection to ignition system, perform spark jump test only when necessary and make sure that the test time is as short as possible. Do not open the throttle during detection, otherwise a large amount of unburned gasoline will enter the exhaust pipe, thus damaging the three-way catalytic converter.
- (19) Since the adjustment of idle speed is completely completed by electronic injection system, manual adjustment is not required. Throttle limit screw of throttle body has been adjusted properly at the factory, and users are not allowed to change its original position at will.
- (20) Do not connect battery with its polarity reversed to prevent damage to electronic elements. This system adopts negative ground.
- (21) Never remove battery cable when engine is running.
- (22) The positive, negative battery cable wires and electronic control unit must be removed before performing welding on vehicle.
- (23) Do not puncture wire outer coat to detect electric signals input and output by components.

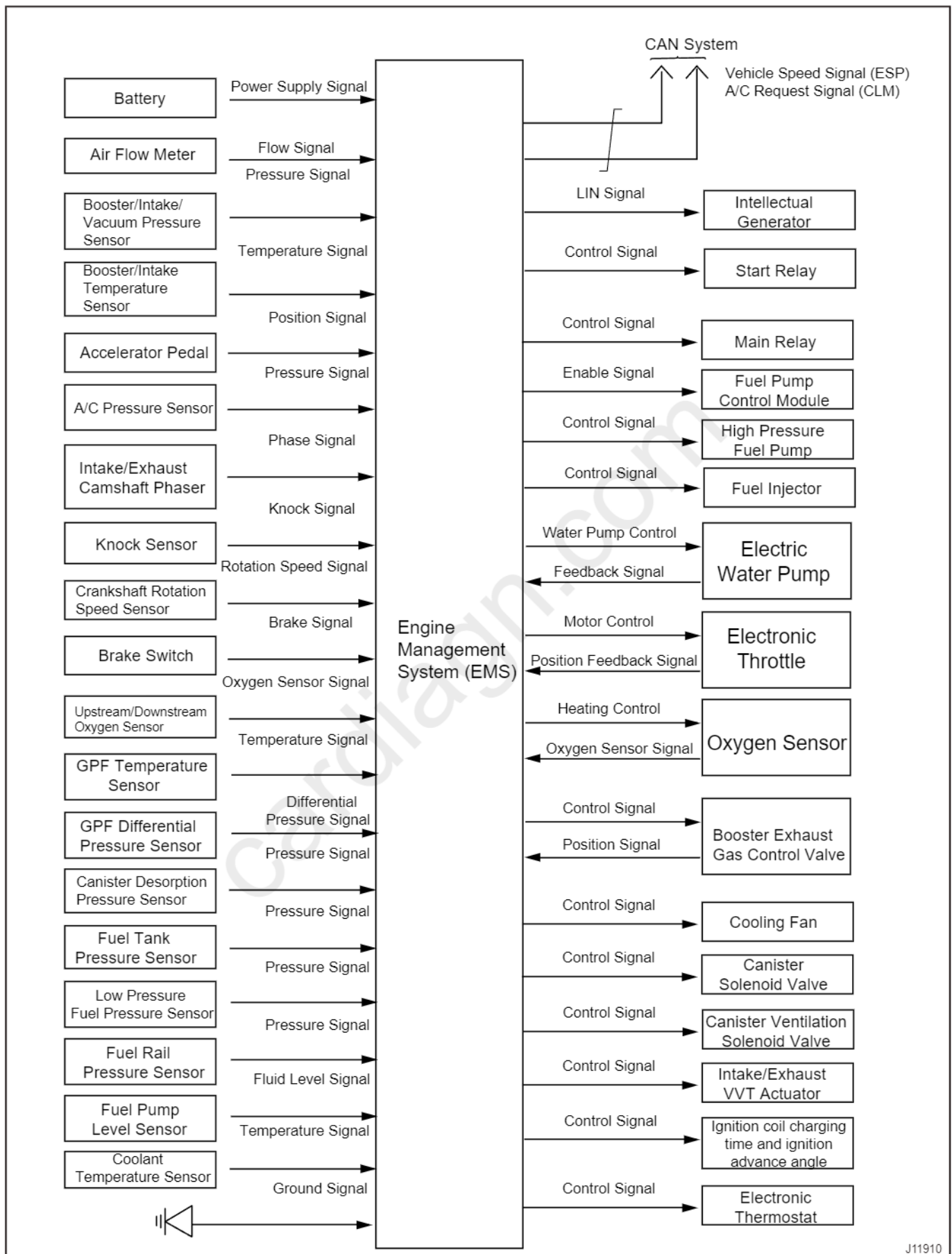
2 System Overview

2.1 System Description

Engine Management System (EMS) 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 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.

2.2 System Schematic Diagram





2.3 Management Function of Engine

■ Basic Function

- System structure based on torque.
- Cylinder load is determined by intake pressure sensor / air flow sensor.
- Improved air-fuel mixture control function in static and dynamic conditions.
- λ closed-loop control.
- Fuel is injected from each cylinder sequentially.
- Ignition timing, including cylinder-by-cylinder knock control.
- Emission control function.
- Catalytic converter heating.
- Canister control.
- Idle control.
- Limp home.

■ Additional function

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

■ Diagnosis On-line OBD

- Complete a series of OBD functions.
- Management system for diagnostic functions.

■ Torque Structure: System based on torque control

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

2.4 Control Signal: Input/Output Signal of Engine Management System

■ Main sensor input signals of ECM in engine management system consists the followings:

- Intake pressure/temperature signal.
- Vacuum pressure signal.
- Electronic throttle position signal.
- Accelerator pedal position signal.
- Coolant temperature signal.
- Intake/exhaust camshaft phase signal.
- Crankshaft rotation angle signal.
- Upstream/downstream oxygen sensor signal.
- Knock signal.
- High pressure fuel rail pressure signal.
- Canister desorption pressure signal.
- Brake switch signal.
- Vehicle speed signal.
- A/C request signal.
- A/C pressure sensor signal.

■ **Required actuator control signals which are generated via ECM from sensor input signals in engine management system:**

- Main relay control.
- Fuel pump/high pressure pump control.
- Injection timing and fuel injection duration.
- Ignition coil charging time and ignition advance angle.
- Electronic throttle motor control.
- Oxygen sensor heating control.
- High/low speed cooling fan relay control.
- Canister solenoid valve/switch water pump/electronic thermostat control.
- A/C compressor relay control.
- Engine speed output.
- Malfunction light control.
- Turbocharged exhaust gas valve/intake relief valve control.
- Electric vacuum pump relay/electric water pump control.
- Intake/exhaust VVT actuator control signal.

2.5 System Function Description

■ Start control

- (1) 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.
- (2) The specific “injection timing” is designated as the initial injection pulse in a similar process.
- (3) 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 to completely cancel the start and thicken.
- (4) 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 catalytic converter

- (1) For a period of time after the engine has been started at low temperature, additional injections are still required to be supplied, there may be several times depending on the operating conditions, and cylinder filling amount and ignition angle are adjusted to compensate for the higher torque requirements of engine; And this process continues until temperature rises to a proper threshold.
- (2) 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 operating condition, use exhaust gas to perform “three-way catalytic converter heating” by adopting methods of appropriate fuel injection mode (multiple injections) and a moderate delay in the ignition advance angle.

■ Acceleration/deceleration and motored fuel cut-off control

- (1) In fact, a small part of the fuel injected into the cylinder will not be combusted in time. Conversely, it forms a layer of oil film on the cylinder wall or piston. When the throttle opening increases, a small part of the injected fuel is absorbed by the 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 will be released again, so the corresponding injection duration must be reduced during deceleration.
- (2) 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 set 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 dynamic changes of parameters such as engine temperature, gear position and engine speed, and prevent the speed from falling to the specified minimum threshold by calculation. Once the injection system is resupplied, the system begins to use the initial injection pulse to supply the fuel. After recovery of fuel injection, the torque-based control system increases the engine torque slowly and smoothly (smooth transition).

■ Idle control

- (1) 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.
- (2) Engine management 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.

■ Closed-loop control

- (1) 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_x) 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 $\lambda=1$, λ closed loop control is aimed to ensure mixture concentration within this range.
- (2) 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 ($\lambda > 1$) will generate about 100 mV sensor voltage, and rich mixture ($\lambda < 1$) will generate about 900 mV sensor voltage. When ($\lambda = 1$), sensor voltage will jump. λ closed loop control responses to input signal ($\lambda > 1$ = lean mixture, $\lambda < 1$ = rich mixture) to correct control variable, a correction factor is generated as a multiplier to correct the fuel injection duration.

■ Evaporative emission control

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

■ Knock control

- (1) 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.

■ High pressure oil pump control

- (1) 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.

■ Idle start and stop (if equipped)

- (1) Idle automatic start and stop function can realize the automatic start-stop function when the vehicle stops briefly (such as red traffic light) during driving. The system can judge whether the driver has parking or driving intention according to the information of vehicle speed, engine speed, transmission chain state and vehicle body state, and automatically controls the starting and stopping of engine. So as to achieve the purposes of fuel saving and emission reduction, and fuel consumption reduction of end users.

2.6 System Malfunction Diagnosis Function Introduction

■ Malfunction information record

- (1) 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.

- (2) 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

- (1) 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; Activation of MIL light follows the below principles:
 - ENGINE START STOP switch is turned to ON (not started), and MIL remains on.
 - After the engine is started, if there is no malfunction request for turning on MIL in malfunction memory, MIL goes off.
 - 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.
 - 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 (- electronic accelerator and electronic throttle) related faults in general; Activation of EPC indicator light follows the below principles:
 - ENGINE START STOP switch is turned to ON (not started), and EPC remains on.
 - 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.
 - 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.

■ 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. A/C control will restore when temperature is below 112 degrees.
- (3) When engine speed exceeds 7000 rpm or below 560 rpm, A/C is powered off.
- (4) When the battery voltage is lower than 9.5 V, A/C is powered off, and A/C control resumes when battery voltage is higher than 11 V; When the battery voltage is higher than 16 V, A/C is powered off, and A/C control resumes when battery voltage is lower than 15 V.
- (5) Engine is in the high power operating status, and A/C system torque decreased.

■ 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 operating 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:
 - Engine coolant temperature is higher than 55°C.
 - Engine air-fuel ratio control has entered the closed loop.
 - Canister solenoid valve trouble-free.

(2) Canister solenoid valve scour time control

- 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

- 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**

- (1) 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.
- (2) Dew point mark is an important input for oxygen sensor heating, mainly to protect the oxygen sensor.
- (3) 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.

■ **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 for 5s.
- (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.

■ **Switch type water pump control strategy**

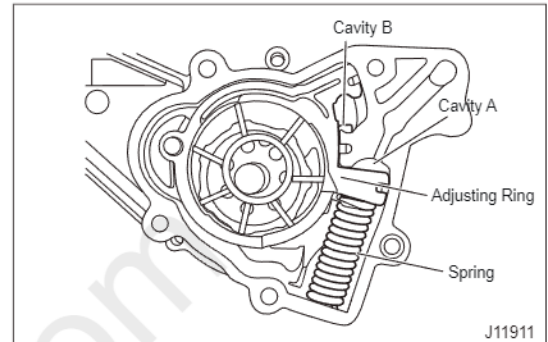
- (1) When the engine water temperature is low, the control solenoid coil is turned on and the water pump stops operating. When the engine water temperature exceeds a certain value, the control solenoid coil is disconnected and the water pump starts operating.
- (2) Under the condition of cold start at normal temperature, the control mode is basically entered from the beginning: it is normally closed for most of the time and occasionally rotated. With the increase of water temperature, the normally closed time is shortened and the normally rotated time is longer and longer. After reaching a certain temperature, it is switched to the normally rotated mode.

■ **Electronic thermostat control strategy**

- (1) Electronic thermostat technology is also a major innovation. It can calculate the target temperature according to the engine operating speed, load status, intake air temperature, coolant temperature, etc., accurately adjust and control the water temperature, and ensure that the engine always works at a reasonable temperature.
- (2) In electronic control system, operation of the electronic thermostat shall meet the following conditions at the same time:
 - Under low speed and low load, electronic thermostat starts to control opening at 105°C to improve fuel economy.
 - Under high speed and high load, electronic thermostat starts to control opening at 95°C to ensure engine safety.
 - Initial opening temperature: 100°C ± 2°C, full opening temperature: 110°C ± 2°C (Temperature is the temperature at the wax pack of the thermostat).
 - If there is fault in line, electronic thermostat can be opened mechanically.
 - Full opening stroke of thermostat: 8mm.

■ Variable displacement oil pump control strategy

- (1) Oil pump can meet the requirements of various oil components, effectively reduce the pump oil power of the pump within the full speed range, thus reducing oil consumption. Generally, at medium and low speeds, ECM controls the solenoid valve to be electrified, and the control valve is closed, so that the pump enters the low oil pressure control mode; At high speed, ECM controls the solenoid valve to de-energize, and the control valve opens under the action of return spring, making the pump enter the high oil pressure control mode.
- (2) Oil pump adopts a vane type displacement structure, and the main structure is stator and rotor. Two oil pressure chambers are respectively arranged on the outer ring of the stator to control the pressure of the stator so that it can deflect clockwise or counterclockwise around the fulcrum, thus changing the eccentricity of the vane pump and adjusting the displacement.
- (3) In electronic control system, operation of the variable displacement oil pump shall meet the following conditions at the same time:
 - High pressure mode: When ECM determines that it is necessary to enter the high pressure mode, the oil pressure modulating valve is powered off and controlled and close oil path in cavity B. However, cavity A is directly connected to the oil circuit and works with the return spring to maintain the maximum eccentricity and displacement of the oil pump.
 - Low pressure mode: When ECM determines that it is necessary to enter the low pressure mode, the oil pressure modulating valve is powered on and controlled and open oil path in cavity B. When the pressure overcomes the pressure of the return spring and cavity A, the stator deflects counterclockwise, reducing eccentricity and displacement.
 - Initial opening temperature: $100^{\circ}\text{C} \pm 2^{\circ}\text{C}$, full opening temperature: $110^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (Temperature is the temperature at the wax pack of the thermostat).
 - If there is fault in line, electronic thermostat can be opened mechanically.
 - Full opening stroke of thermostat: 8mm.



■ Turbocharger control strategy

- (1) Turbocharger uses the exhaust gas discharged from the engine to push the turbine impeller to rotate, and then drives the compressor impeller to pressurize the air filtered by the air filter and send it to the cylinder. As more air enters the cylinder, more fuel is allowed to be injected, thus generating more power from the engine. In addition, the turbocharger can also make the engine obtain power compensation when working at high altitude.
- (2) In electronic control system, operation of turbocharger shall meet the following conditions at the same time:
 - The required boost pressure after the engine starts is higher than the atmospheric pressure.
 - Boost pressure sensor does not report errors.
 - Boost control actuator does not report errors.
 - Maximum boost fault is not triggered.
 - Safe oil cut-off function is not triggered.

■ Relief valve control strategy

- (1) Fresh air is filtered into the compressor by the air filter, and after compression, it passes through the intercooler to reach the throttle valve, which is a component that keeps opening and closing at any time. In addition to high-speed cruise, the accelerator pedal at the driver's foot is almost always changing, which will cause a problem: when the accelerator is deeply stepped on, the turbocharger works at full speed, continuously delivering compressed air to the throttle valve; However, at the moment when the driver releases the throttle, due to a certain lag in turbine operation, the compressor is still working at full speed even though the throttle valve has been closed, thus the blocked high-pressure air may cause the

compressor blades or throttle valve to be damaged due to impact. Function of the intake relief valve is to release the high pressure at the moment when the throttle is retracted, thus protecting the compressor blades and throttle.

- (2) In electronic control system, operation of relief valve shall meet the following conditions at the same time:
- When the accelerator is released, the pedal change rate is less than a certain limit value.
 - When the accelerator is released, difference between the actual boost pressure and the target boost pressure is greater than a certain limit value.
 - The boost pressure ratio is less than a certain limit value when accelerator is in stable state.

■ VVT solenoid valve control strategy

- (1) VVT timing oil pressure solenoid valve is controlled by ECM, and the ECM control signal is duty ratio control. VVT timing oil pressure control solenoid valve can be in three different stable states through different duty ratios.
- State 1: ECM outputs a duty ratio signal of 0%, that is, VVT solenoid valve is in a power-off state and the valve core is at the rear end under spring force.
 - State 2: ECM outputs a duty ratio signal of 100%, that is, VVT solenoid valve is in a power-on state, valve core is pushed to overcome spring force, thus it moves forward and is at the front end.
 - State 3: ECM outputs a duty ratio signal of 50%, that is, VVT solenoid valve is in a semi-energized state, electromagnetic thrust is balanced with the spring force, and the valve core is in the middle.

■ GPF malfunction light illumination strategy

- (1) Since the combustion of carbon in GPF needs to meet the high temperature oxygen-rich condition, when this condition is not met for a long time, there will be too much carbon accumulated in GPF; Under the condition that oil cut-off is required but the carbon accumulation is too large at the same time, in order to protect GPF from burning, the oil cut-off will be controlled, so that the carbon accumulation will continue to deteriorate; Even more carbon accumulation will increase the engine back pressure, resulting in a decrease in power, torque and fuel economy; With the increase of driving mileage, GPF will eventually be blocked.
- (2) Malfunction light on instrument cluster shows as follows:

Malfunction Light	Color
	Green
	Yellow

Solution methods:

- 1) Malfunction light shown in green: It indicates that particulate filter is full, it is necessary to drive vehicle at a high speed to perform high-speed driving regeneration.
- 2) Malfunction light shown in yellow: It indicates that particulate filter is out of limit, it is necessary to perform GPF regeneration learning; If GPF regeneration failed, it is necessary to replace particulate filter and perform learning again.

■ Start and stop system (if equipped)

- (1) When the vehicle needs to stop at traffic lights or under other conditions, the engine start and stop function will turn off engine. When start-off request is detected, engine will start automatically. Engine start and stop function can improve the fuel economy of vehicle, reduce the exhaust emission pollutant, and also reduce idling noise while waiting.
- (2) When start and stop system operates normally, engine can be turned on or off automatically according to driver's requests and vehicle conditions, ensure fuel saving and emission reduction while also ensuring that the safety and comfort functions of vehicle are not affected (such as normal operation of A/C system, brake system, etc.).
- (3) Activation conditions of automatic engine stop function:
- There is no related faults on engine;
 - Battery power is sufficient;

- Engine start and stop system is in activated state;
 - Emergency braking is not performed;
 - It is not in high attitude area;
 - Since the last starting, the vehicle driving speed exceeds 10 km/h;
 - The steering wheel rotation angle is not excessively large and steering wheel is not in rotation;
 - Engine hood is closed;
 - Driver door is closed;
 - Driver seat belt is fastened;
 - Vehicle is stopped;
 - Starter motor is not overloaded, such as there is no starting overheating caused by multiple consecutive starts;
 - Not parked on slope;
 - For the vehicle models which are equipped hill-start assist control system, hill-start assist control system is turned off;
 - For the vehicle models which are equipped automatic emergency braking system, automatic emergency braking is not activated;
 - A/C is not turned on or although A/C is turned on, the followings are met simultaneously:
 - 1) Not in the MAX. defrosting;
 - 2) Not in the MAX. cooling/heating;
 - 3) Evaporator temperature is lower than 18°C;
 - 4) Ambient temperature is within the range of 3~30°C;
 - 5) Difference between room temperature and required temperature is not more than 2.5°C.
 - 6) When the above conditions are met and any stopping triggering condition is met, the engine will stop automatically:
 - Brake pedal is depressed and accelerator pedal is released.
- (4) Conditions of automatic engine starting:
- Start and stop system is turned on;
 - There is no fault on engine start and stop system;
 - Engine hood is closed;
 - Driver door is closed;
 - Driver seat belt is fastened;
 - Conditions of starter motor are met;
 - Number of consecutive engine start failures is less than 3;
 - Under condition of automatic engine stopping, press start and stop system switch, turn off start and stop system and start the engine;
 - Transmission gear position is moved to D, M positions from P, N positions;
 - Transmission gear position is moved to R position;
 - When automatic parking function is turned off, if engine is stopped after depressing brake pedal at D position or M position, engine will start automatically after releasing brake pedal;
 - Depress the brake pedal when transmission gear position is in P/N position, engine will start automatically;
 - Engine will start automatically when brake system vacuum pump pressure is too low;
 - When accelerator pedal is depressed;
 - Engine will start automatically when rotating steering wheel;
 - When engine temperature is too low;
 - Engine stops automatically for more than a certain period of time;
 - When the difference between room temperature and set temperature is large;
 - When battery power is too low and battery temperature is too high;
 - Vehicle coasting;
 - When A/C is turned on and one of the following conditions is met, A/C requests to start engine.
 - 1) In the MAX. defrosting;
 - 2) In the MAX. cooling/heating;

- 3) Evaporator temperature is higher than 18°C;
- 4) Ambient temperature is not within the range of 3~30°C;
- 5) Difference between room temperature and required temperature is more than 2.5°C.

Hint:

Under condition of automatic engine stopping, engine will not start automatically again if following conditions occur, you can only start engine manually:

- Engine hood is opened;
- Driver door is opened;
- Driver seat belt is unfastened;

2.7 System Components Description

■ Intake pressure sensor

Intake manifold absolute pressure sensing element consists of a piece of silicon chip. Etch a piece of pressure diaphragm on silicon chip. There are 4 piezoresistors on pressure diaphragm, and the 4 piezoresistors form a Wheatstone bridge as strain element. Except for the pressure diaphragm, silicon chip is also integrated with signal processing circuit. Active surface of the silicon chip is subjected to a pressure close to zero, and its surface is subjected to the absolute pressure of the intake manifold to be measured. Thickness of silicon chip is only several micrometer, so the silicon chip will deform mechanically as intake manifold absolute pressure changes, and 4 piezoresistors will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated after processing by signal processing circuit of silicon chip.

Intake temperature sensing element is a negative temperature coefficient (NTC) resistor, whose resistance changes with the intake temperature. This sensor transfers a voltage of intake temperature change to controller.



J10090

(1) Pressure sensor limit parameter

Parameters	Value		
	Minimum	Representative	Maximum
Power supply voltage	/	/	16 V
Pressure	/	/	500 kpa
Operating temperature	-40°C	/	+130°C

(2) Pressure sensor characteristic parameters

Parameters	Value		
	Minimum	Representative	Maximum
Pressure measurement range	10 kpa	/	300 kpa
Operating temperature	-40°C	/	130°C
Power supply voltage	4.75 V	5.0 V	5.25 V
Power supply current when $U_s = 5.0 \text{ V}$	/	/	12.5 mA
Output terminal load current	-1.0 mA	/	0.5mA

Parameters		Value		
		Minimum	Representative	Maximum
Load resistance to voltage U_S or ground	Pull-up resistor	5 k Ω	/	/
	Pull-down resistor	10 k Ω	/	/
Response time $t_{10/90}$		/	/	1.0 ms
Weight		/	24 g	/

(3) Temperature sensor limit parameters

- Storage temperature: -40/+130°C;
- The maximum power at 25°C: 100 mW.

(4) Temperature sensor characteristic parameters

- Operating temperature: -40/+130°C;
- Rated voltage: Pull-up resistor (power is 1 kW) operates at 5 V or operates at a constant current of 1mA;
- Rated power at 20°C: 2.5 kW $\pm$ 5%;

■ Electronic throttle body

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.

DVE 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 (NLP) determined by mechanical way, which is located above mechanical bottom dead center. DVE 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.



J10130

(1) Basic performance parameters:

Test Item	Potentiometer Voltage				Response Time (ms)		Return Time (ms)
	Mechanical Bottom Dead Center (%)		Mechanical Top Dead Center (%)				
	IP1S	IP2S	IP1S	IP2S	Open	Close	
Parameter range	10 ± 4	90 ± 4	93 ± 4	7 ± 4	≤ 100	≤ 100	≤ 300

■ Knock sensor

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 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 A/C voltage signal to output it.

Because intensity of vibration signal caused by engine knocking is far more than that of normal engine vibration signal, ECM can distinguish between knock or non-knock signals by processing these signals from knock sensor.

(1) Limit data

Quantity	Value		
	Minimum	Representative	Maximum
Operating temperature	-40°C	/	130°C

(2) Characteristic data (cable type)

Quantity		Value
Sensitivity of new sensor to 7 kHz signal		23.6~35.4 mV/g
Sensitivity of new sensor to 19kHz signal		28.3~42.4 mV/g
Linearity between 5 and 15 kHz		±10% of 5 kHz (based on 10m/s ²)
Main resonance frequency		> 30 kHz
Impedance	Resistance	> 1 MΩ
	Capacitance	1150 ± 200 pF
Leakage resistance (resistance between two output terminals of sensor)		4.9 ± 20% MΩ
Variation in sensitivity due to temperature (9 kHz)		≤ -0.04 mV/g°C

■ Coolant temperature sensor

Temperature sensor function is used to monitor engine coolant temperature. On the one hand, it makes the electronic system judge the engine operating condition by outputting resistance signal; On the other hand, it also outputs signals to relevant instrument cluster, so that operators can directly judge the engine operating condition through visual inspection. Coolant temperature sensor encapsulates NTC thermistor in temperature sensor, its resistance varies in accordance with ambient temperature, so that the small change of outside temperature can be measured accurately and timely. Temperature of contact medium can be reflected by measuring its output resistance.

(1) Limit data

Quantity	Value
Rated voltage	Operates with ECM connected, standard operating condition is 5 V (power of pull-up resistor is 1 kW)
Rated resistance at 20°C	2.5 ± 5% kΩ
Operating temperature range	-40 ~ +130°C
Vibration level	≤ 600 m/s ²

(2) Characteristic data

Temperature (°C)	Resistance (Ω)
-40	45313
-30	26114
-20	15462
-10	9397
0	5896
10	3792
20	2500
30	1707
40	1175
50	833.9
60	595.5
70	435.7
80	322.5
90	243.2
100	186.6
110	144.2
120	112.7
130	89.30

■ Speed sensor

Speed sensor is a component of the engine management system. This sensor is installed on engine block, which used to detect crankshaft position and speed. Rotation of the signal plate causes the magnetic field at the induction point inside the speed sensor to alternate. The alternating magnetic field is induced by the differential Hall chip, and the induced alternating magnetic signal is converted into an electrical signal by the internal processing circuit of the sensor and output.

(1) Technical characteristic parameters

Parameters	Minimum	Representative	Maximum
Storage temperature	-40°C	/	+80°C
Speed range	20 rpm	/	8000 rpm
Air clearance	0.2 mm	1.0 mm	1.8 mm
Phase accuracy (falling edge of 800 rpm)	-1 deg	/	+1 deg
Operating temperature (- plug area)	-40°C	/	+150°C
Operating temperature (sensor)	-40°C	/	+150°C
Power supply voltage range	4.75 V	5.0 V	16 V
Power supply current	/	4.2 mA	10 mA

Parameters	Minimum	Representative	Maximum
Output signal rising time (Low - High)	/	/	25 us
Output signal falling time (- High - Low)	/	/	1 us
Output signal power supply voltage	/	/	18 V
Output current	/	/	20 mA
Output signal low voltage	/	/	0.5 V
Output signal high voltage	$U_{S,0} - 0.5 \text{ V}$	$U_{S,0} - 0.3 \text{ V}$	/
Power-on time	/	/	250 ms
n: Repeated accuracy at 800 rpm	-0.1 deg	+0.1 deg	/

■ Camshaft position sensor

Camshaft position sensor is a Hall type sensor. A phaser is installed on camshaft. When phaser is in high teeth, the applicable circuit outputs low voltage; when phaser is in missing teeth, the applicable circuit outputs high 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.

■ High pressure fuel distribution pipe assembly

The high pressure fuel distribution pipe assembly is integrated with high pressure fuel distribution pipe (fuel rail), high pressure fuel injector and high pressure sensor. Its operation principle is to optimize design through structure of high pressure fuel distribution pipe, the accurate fuel rail pressure signal feedback can uniformly and precisely distribute fuel for engine through injector.

■ High pressure fuel injector

Operation principle of solenoid valve type high pressure fuel injector: When the electricity is applied, electromagnetic coil generates magnetic force, and the needle valve set is sucked up, and separated from valve seat, so that fuel is injected. When the power is off, compression spring returns and needle valve set moves downwards, so that it contacts valve seat eventually to seal the fuel.

■ Ignition coil

Ignition coil consists of primary winding, secondary winding, iron core and housing etc. When the ground passage of a primary winding is on, this primary winding is charged. If ECM cuts off the primary winding circuit, the charging will be suspended, and a high voltage will be induced in the secondary winding at same time, cause spark plugs to discharge.

(1) Technical Parameters

Primary current	8.5A X (1 ± 8%)
Secondary voltage	≥ 37 KV (40 pF ± 5 pF of load)
Load (Zener diode)	1000 ± 20 V
Ignition energy	≥ 90mJ

■ Upstream oxygen sensor

LSU oxygen sensor is much more advanced in functions than LSH and LSF. It is a combination of ceramic body principle and a "micro pump" for oxygen ion delivery. Sufficient oxygen is supplied to the electrode on contact side of exhaust by the pump to keep the voltage on both sides constant at about 450 mV. Electronic controller converts the electric energy consumption of the pump into the excess air coefficient, and the output current has an almost linear relationship with it, which $\lambda = 0.65 \sim \infty$, so it is also called linear oxygen sensor. Not only can determine λ is more than 1 or less than 1, but also can measure specific values of λ in lean and rich areas, so that excess air coefficient in a large range (that is, wide frequency) can be measured, and enables continuous control from $\lambda < 1$ to $\lambda > 1$.

(1) Characteristic data

Description	New	After platform test
λ signal when $\lambda = 1.7$	1.70 ± 0.077	1.70 ± 0.132
λ signal when $\lambda = 0.8$	0.80 ± 0.012	0.80 ± 0.020

(2) Sensor electrical data

Description		Value
Resistance between housing and each flat insert pieces	Room temperature, 800V DC	$\geq 10 \text{ M}\Omega$
Power supply voltage on connector	Rated voltage	6.8 V
	Continuous operating voltage	$\leq 12 \text{ V}$
	Maximum system power supply voltage	$\leq 16.5 \text{ V}$
	Short time voltage peak value within 60 ms (10 times in life cycle, ceramic temperature $\geq 20^\circ\text{C}$)	$\leq 28 \text{ V}$
	Minimum system power supply voltage	$\geq 9.8 \text{ V}$
Heating power for 6.8V of operating voltage		8.1 W

■ Downstream oxygen sensor

Sensing element of LSF oxygen sensor is a ceramic planar body with pores, and the outside of ceramic body is surrounded by engine exhaust, and the inside is ventilated. Sensing ceramic body wall is a type of solid electrolyte with heating electrodes inside. Operation of oxygen sensor is realized by converting the concentration difference of oxygen ions inside and outside the sensing ceramic body into voltage signals for output. When the temperature of sensing ceramic body reaches 350°C , it will have the characteristics of solid electrolyte. Oxygen ions can freely pass through it due to special material of ceramic body. It is precisely by taking advantage of this characteristic, it converts the concentration difference into the potential difference, thus forming the electrical signal output. If the gas mixture is rich, 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 800 mV-1000 mV); 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 100 mV). Signal voltage changes abruptly at about the theoretical equivalent air fuel ratio ($\lambda=1$).

(1) Characteristic data

Description	New		After 500 hours of platform test	
Exhaust temperature when characteristic data is established	350°C	850°C	350°C	850°C
When I=0.97 (CO=1%): Sensing element voltage (mV)	800 ± 55	700 ± 55	800 ± 60	700 ± 60
When I=1.10: Sensing element voltage (mV)	50 ± 30	50 ± 30	50 ± 40	50 ± 40
Sensing element internal resistance (kΩ)	≤ 0.5	≤ 0.25	≤ 1	≤ 0.5
Response Time (ms) (600 mV to 300 mV)	< 250	< 250	< 400	< 250
Response Time (ms) (300mV to 600mV)	< 100	< 60	< 200	< 60

(2) Sensor electrical data

Description		Value
Between heating circuit and signal circuit	Room temperature, 800V DC	≥ 30
Power supply voltage on connector	Rated voltage	12 V
	Continuous operating voltage	12 to 14 V
	Operating voltage which can be maintained 1% of the total life at most (exhaust temperature ≤ 850°C)	15 V
	Operating voltage which can be maintained 75 seconds at most (-exhaust temperature ≤ 350°C)	18 V
	Test voltage	13 V
Heating power for 13 V of operating voltage, and 350°C of exhaust temperature		7 W
Short time heating current at 13 V of operating voltage and -40°C of ambient temperature		≤ 2.1 A

■ High Pressure Fuel Pump

High pressure fuel pump is an element specially used for direct injection engine. It functions to increase the system pressure and provide high pressure fuel for the fuel rail assembly. High pressure fuel pump supplies fuel for system as demands, thus providing a better fuel economy. It is made of stainless steel material and has a wide fuel application; also, it has the advantages of light weight, small volume, zero evaporative emission, etc. Currently widely used in the world's major vehicle assembly factory high pressure pumps use a single plunger pump design integrated with regulator, flow control valve and pressure relief valve. Its operation principle is to drive high pressure pump plunger to move up and down by cam, thus achieving oil suction and outlet. Using the pressure sensor on fuel rail, ECM controls the flow of high pressure fuel pump through flow control valve according to the set control procedure, so as to perform closed loop control of pressure in high pressure fuel rail. Regulator functions to suppress the pressure pulsation at the low pressure end and improve the stability of system. Pressure relief valve will open when high pressure fuel rail pressure exceeds the safety limit, so as to protect the system.

(1) Characteristic parameters

Items	Target Specifications
Mass	Approx. 0.83 kg
Oil outlet pressure	2-20 MPa
Maximum oil inlet pressure	9.0 bar
Relief valve opening pressure	35 MPa system: 39.9-41.4 for new parts, 36.5-42.4 MPa for durable parts
Driving voltage	10.8-16 V
Control type	Applied to ECM, which adopts current control

■ High pressure fuel rail pressure sensor

Oil pressure acts on metal diaphragm of pressure sensor to deform the diaphragm. There is a Wheatstone bridge composed of 4 metal strain gauge on diaphragm. The deformation of diaphragm causes a change in the resistance of strain gauge. After the signal processing of peripheral circuit, form the voltage signal that is linearly related to the pressure.

(1) Limit data

Parameters	Value		
	Minimum	Representative	Maximum
Power supply voltage (MAX. 1h)	/	/	18 V
Pressure	/	/	32 Mpa
Burst pressure	/	/	375 Mpa
Operating temperature	/	/	150°C

(2) Characteristic data

Parameters	Value		
	Minimum	Representative	Maximum
Pressure measurement range	0 Mpa	/	42 Mpa
Operating temperature	-40°C	/	140°C
Power supply voltage	4.75 V	5.0 V	5.25 V

Parameters	Value		
	Minimum	Representative	Maximum
Power supply current when $U_S = 5.0 \text{ V}$	9 mA	12 mA	15 mA
Response time $t_{10/90}$	/	/	1.0 mS

■ Electronic controller unit

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.

(1) Limit data

Quantity		Value	
		Minimum	Maximum
Battery voltage	Normal operation	10.8 V	16 V
	Limit function	6.5 to 9 V	16 to 28 V
Limits and time for withstanding battery overvoltage	24 V	Keep starting some functions	60 s

■ Canister solenoid valve

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

(1) Technical characteristic parameters

Quantity	Value		
	Minimum	Representative	Maximum
Rated Voltage	10 V	13.5 V	16 V
Resistance at +20°C	14 Ω	16 Ω	18 Ω
Current under rated voltage	/	0.85 A	
Frequency of control pulse	5 Hz	/	30 Hz
Rate of flow when pressure difference is 700 mbar and duty ratio is 100%	6 m ³ /h	6.5 m ³ /h	7 m ³ /h
Permitted operating temperature	-40°C		140°C
Allowable pressure difference between inlet and outlet	/	/	-800 mbar

Quantity	Value		
	Minimum	Representative	Maximum
Permitted vibration acceleration marked on products	/	/	300 m/s ²
Leakage amount when pressure difference is 700 mbar	/	/	33 mL/min

■ Brake vacuum pressure sensor

Absolute pressure sensing element consists of a piece of silicon chip. Etch a piece of pressure diaphragm on silicon chip. There are 4 piezoresistors on pressure diaphragm, and the 4 piezoresistors form a Wheatstone bridge as strain element. Except for the pressure diaphragm, silicon chip is also integrated with signal processing circuit. Active surface of the silicon chip is subjected to a pressure close to zero, and its surface is subjected to the absolute pressure of the intake manifold to be measured. Thickness of silicon chip is only several micrometer, so the silicon chip will deform mechanically as line 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.

(1) Limit parameters

Parameters	Value		
	Minimum	Representative	Maximum
Power supply voltage	/	/	16 V
Pressure	/	/	500 kpa
Operating temperature	-40°C	/	+130°C

(2) Characteristic parameters

Parameters		Value		
		Minimum	Representative	Maximum
Pressure measurement range		20 kpa	/	115 kpa
Operating temperature		-40°C	/	130 °C
Power supply voltage		4.75 V	5.0 V	5.25 V
Power supply current when $U_S = 5.0$ V			/	12.5 mA
Output terminal load current		-1.0 mA	/	0.5 mA
Load resistance to voltage U_S or ground	Pull-up resistor	5 kΩ	/	/
	Pull-down resistor	10 kΩ	/	/
Response time $t_{10/90}$		/		1.0 ms
Weight		/	17 g	

■ GPF temperature sensor

The temperature sensor uses Pt200 type thermal-sensitive platinum resistor sensing element as the temperature sensing element. The outside of the sensing element is encapsulated by a stainless steel shell with high temperature resistance and corrosion resistance. The sensing element and the stainless steel shell are filled with heat conduction materials to facilitate the timely transfer of exhaust gas heat to the surface of sensing element. During operation, the sensor head is placed inside the engine exhaust pipe, and the high temperature airflow transmits heat to the sensing element, so that the temperature of the sensing element interior platinum resistor changes accordingly, and the resistance value of platinum resistor varies with the temperature. Through a specific monitoring circuit, the engine controller (ECU) monitors the resistance signal output by the sensor to calculate the corresponding exhaust gas temperature signal.

(1) Signal accuracy

Signal accuracies of sensor (new parts) are shown as follows:

Temperature Range	Signal accuracy
-40°C ~ 300°C	± 2.5°C
301°C ~ 900°C	± 1.0 % of temperature in °C
901°C ~ 950°C	± 2.0 % of temperature in °C

Signal accuracies of sensor (deteriorated parts) are shown as follows:

Temperature Range	Signal Accuracy
10 °C	± 3.8 Ω (± 5°C)
650 °C	± 8 Ω (± 13°C)

(2) Dynamic response performance

Dynamic response performance of the exhaust temperature sensor is based on the change speed of output signal when the ambient temperature changes abruptly, which should meet the requirements of the following table

Temperature Jump	Air-flow Velocity	Response Time
300°C	11 m/s	< 12 s

■ GPF differential pressure sensor

Differential pressure sensor (double membrane) unit consists of housing, two same LGA (Land Grid Array) sensing element modules, cover plate, sealing glue, connecting glue, bonding wire and other sub components. The values measured by sensor are upstream gas absolute pressure and downstream gas absolute pressure of GPF.

Differential pressure sensor (double membrane) unit consists of housing, two same LGA (Land Grid Array) sensing element modules, cover plate, sealing glue, connecting glue, bonding wire and other sub components. The values measured by sensor are upstream gas absolute pressure and downstream gas absolute pressure of GPF. Sensing element module of differential pressure sensor (LPS4-2ABS) consists of a piece of silicon chip. Etch 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. Silicon chip will deform mechanically as emission gas pressure changes, and 4 piezoresistors will also deform, thus changing the resistance. Output the information in SENT signal format to ECM after processing by signal processing circuit of silicon chip.

■ Electronic control actuator

Electronic control actuator is used to drive exhaust gas by-pass valve of turbocharger. Its main function is to adjust waste gate opening angle and control rotation speed of turbocharger according to driver's driving intention, so as to control intake air demand when the intake air amount meets different engine operating conditions, and feed back the position signal of waste gate to control unit to realize accurate control.

Electronic control actuator consists of four parts: drive module, train module, executive module and feedback module, and all sub components of drive module, train module and feedback module are integrated into the same housing. Feedback module contains non-contact type sensors, which can accurately feedback the valve position according to Hall principle. Electronic control actuator performs control only by corresponding electronic control unit or electronic test circuit. In principle, it is necessary to ensure that the actuator connecting rod does not operate dynamically to the mechanical dead center.

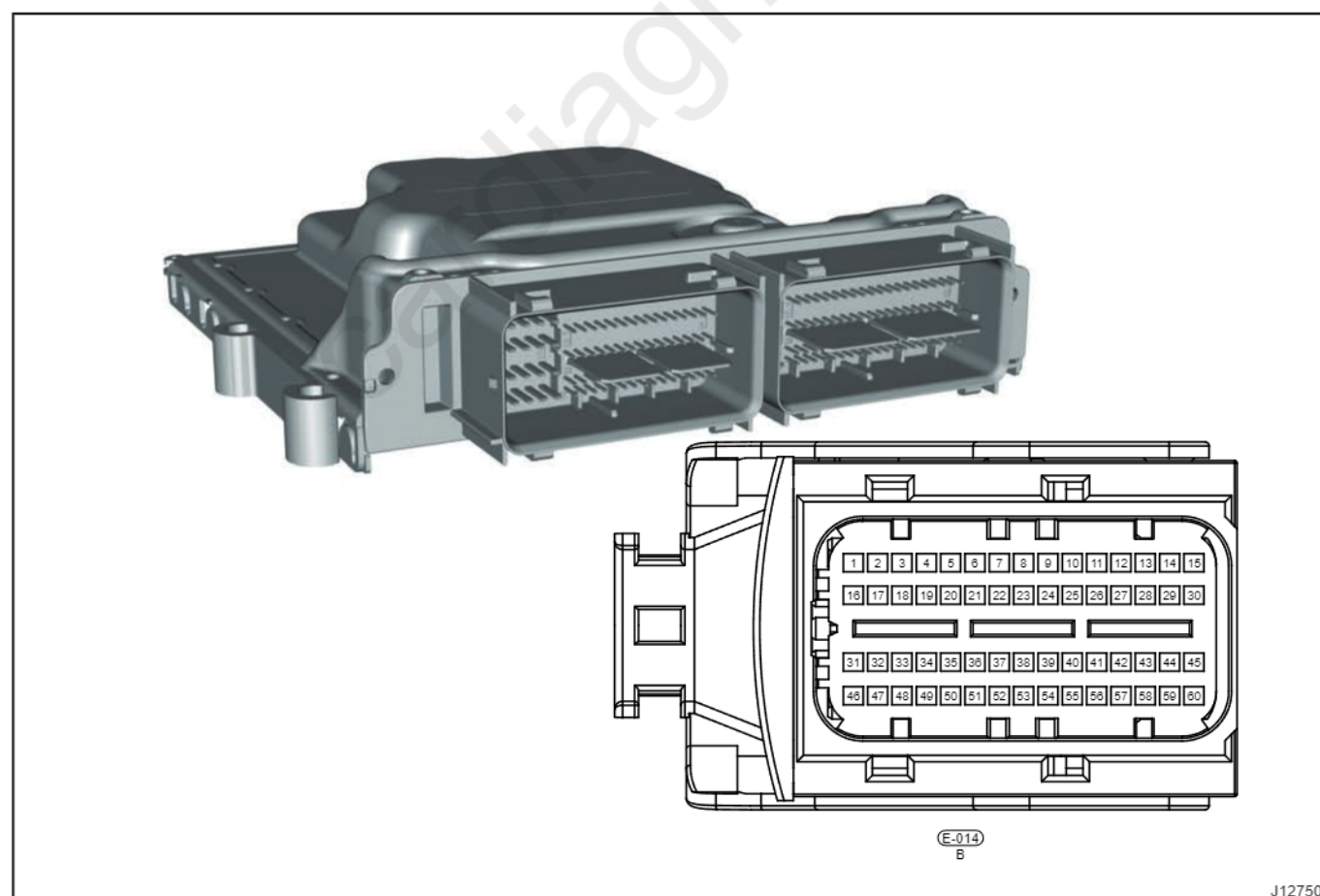
(1) Technical characteristic parameters

Test Item	Potentiometer Voltage		Response Time (ms)		Driving Torque (New Parts) (Nm)
	Mechanical Top Dead Center (%)	Mechanical Bottom Dead Center (%)	Open	Close	
Parameter range	5+/-2.2	95+/-2.2	≤ 200	≤ 200	≥ 0.8

3 System Circuit Diagram

3.1 Module Terminal Definition

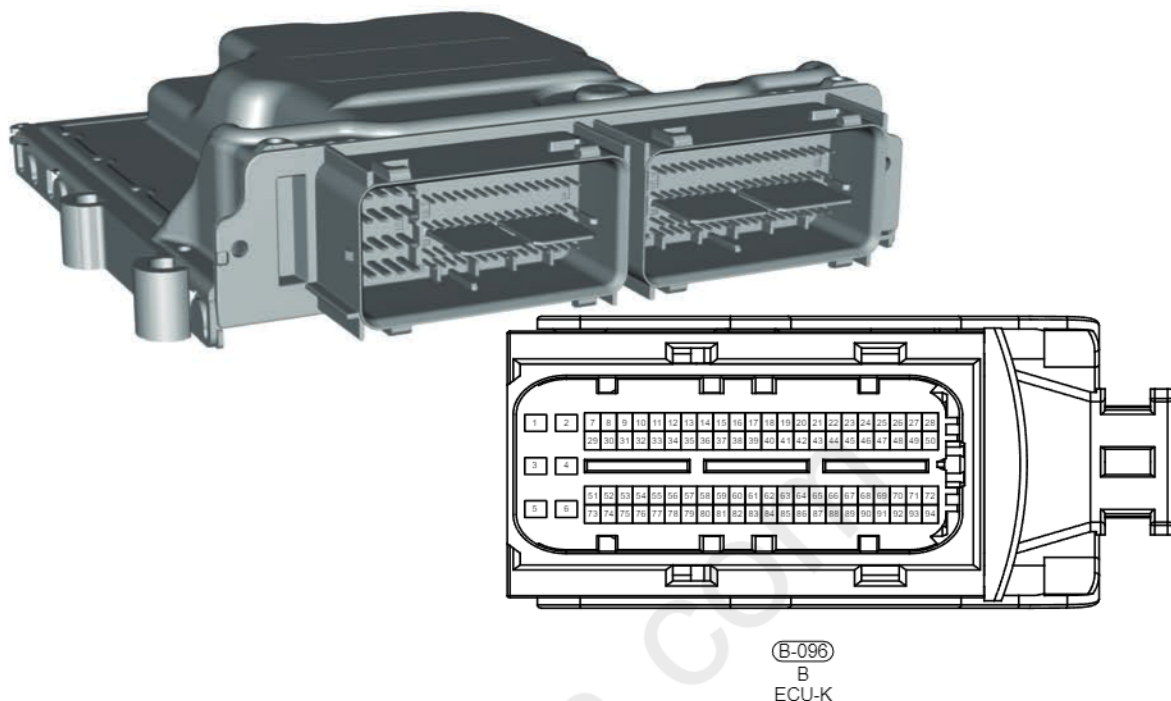
Terminal A Definition



J12750

Pin	Definition	Pin	Definition
A1	Electronic Throttle Control +	A31	1st Cylinder Injection +
A2	Electronic Throttle Control -	A32	4th Cylinder Injection +
A3	Oil Pressure Control Valve -	A33	1st Cylinder Injection -
A4	Oil Pressure Control Valve +	A34	3rd Cylinder Injection -
A5	Variable Valve Timing Valve (Exhaust)	A35	Electronic Wastegate Control +
A6	ECU Shielding Ground	A36	1st GPF Pressure Sensor
A7	5V Power Supply	A37	1st Cylinder Ignition
A8	5V Power Supply	A38	3rd Cylinder Ignition
A9	Sensor Ground	A39	4th Cylinder Ignition
A10	Knock Sensor (-)	A40	2nd Cylinder Ignition
A11	-	A41	Throttle Position Sensor 2
A12	Intake Pressure Sensor	A42	-
A13	Electronic Wastegate Position Signal	A43	Coolant Temperature Sensor Ground
A14	Fuel Rail Pressure Sensor	A44	5V Power Supply
A15	-	A45	-
A16	Variable Oil Pump	A46	3rd Cylinder Injection +
A17	-	A47	2nd Cylinder Injection +
A18	Canister Control Valve	A48	4th Cylinder Injection -
A19	Relief Control Valve	A49	2nd Cylinder Injection -
A20	Variable Valve Timing Valve (Intake)	A50	Electronic Wastegate Control -
A21	-	A51	Sensor Ground
A22	-	A52	5V Power Supply
A23	Engine Speed Sensor (Hall Type)	A53	Phase Sensor (Intake)
A24	Throttle Position Sensor 1	A54	Phase Sensor (Exhaust)
A25	Knock Sensor (+)	A55	-
A26	Sensor Ground	A56	Intake Air Temperature Sensor
A27	5V Power Supply	A57	Water Temperature Sensor
A28	Sensor Ground	A58	Mass Air Flow Signal (HFM7)
A29	-	A59	Sensor Ground
A30	-	A60	-

Terminal K Definition



J12760

Pin	Definition	Pin	Definition
K1	ECU Ground 1	K48	Low Pressure Fuel Rail Pressure Sensor
K2	ECU Ground 2	K49	-
K3	Main Relay Power Supply 1	K50	A/C Compressor Relay
K4	ECU Ground 3	K51	-
K5	Main Relay Power Supply 2	K52	Pedal 2 Ground
K6	Main Relay Power Supply 3	K53	-
K7	Upstream Oxygen Heating	K54	-
K8	Electronic Water Pump Controller	K55	-
K9	-	K56	2nd GPF Differential Pressure Sensor
K10	A/C Pressure Sensor	K57	Canister Ventilation Valve
K11	Sensor Ground	K58	5V Power Supply
K12	-	K59	5V Power Supply
K13	Brake Vacuum Sensor	K60	Immobilizer Input
K14	Clutch Water Pump Solenoid Valve	K61	Accelerator Pedal Position Sensor 2
K15	Fuel Control Enabled Signal	K62	Downstream Oxygen Sensor
K16	Electronic Thermostat	K63	Boost Pressure Sensor

Pin	Definition	Pin	Definition
K17	5V Power Supply	K64	Boost Pressure Temperature Sensor
K18	-	K65	LIN Bus Interface
K19	Brake Light Switch	K66	-
K20	-	K67	-
K21	Sensor Ground	K68	-
K22	-	K69	Main Relay
K23	-	K70	Starter State Feedback
K24	Brake Switch	K71	Sensor Ground
K25	-	K72	-
K26	Brake Vacuum Pump Relay	K73	Crankshaft Ventilation Heater Relay
K27	-	K74	Canister Desorption Pressure Sensor
K28	-	K75	-
K29	Downstream Oxygen Sensor Heater	K76	Upstream Oxygen Virtual Ground Voltage
K30	Continuous Power Supply	K77	Upstream Oxygen Feedback Voltage
K31	Starter Motor Relay	K78	Upstream Oxygen Correction Resistor
K32	GPF Sensor Ground	K79	Upstream Oxygen Control Signal
K33	-	K80	Pedal 1 Ground
K34	Oxygen Sensor Ground	K81	Pedal 5V Power Supply 2
K35	-	K82	Pedal 5 V Power Supply 1
K36	GPF Front Temperature Sensor	K83	Accelerator Pedal Position Sensor 1
K37	Tank Pressure Sensor	K84	-
K38	-	K85	-
K39	Fan Relay 1 (Low Speed)	K86	-
K40	Fuel Level Sensor	K87	Ignition Switch
K41	-	K88	-
K42	Fan Relay 2 (High Speed)	K89	-
K43	-	K90	-
K44	CAN Low for Refreshing and Body	K91	-
K45	CAN High for Refreshing and Body	K92	-
K46	-	K93	-
K47	-	K94	-

4 Diagnosis & Testing

4.1 Problem Symptoms Table

Hint:

Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair, replace or adjust faulty components as necessary.

Symptom	Possible Cause
Engine does not crank or cranks slowly while starting	Battery
	Starter
	Wire harness or ENGINE START STOP switch
	Starter relay
	ECU, TCU
	Engine mechanical
Engine cranks normally but cannot start successfully while starting	No fuel in tank
	Fuel pump
	Fuel injector
	Crankshaft Position Sensor
	Ignition coil
	Engine immobilizer
	ECM
	Engine mechanical
Difficult to start with hot engine	Crankshaft position sensor
	Ignition coil
	Fuel pump
	Coolant temperature sensor
	Engine mechanical
	Camshaft sensor
Difficult to start with cold engine	Fuel pump
	Coolant temperature sensor
	Fuel injector
	Ignition coil
	Engine mechanical
Engine speed is normal, but it is difficult to start at anytime	Fuel quality
	Fuel pump
	Coolant temperature sensor
	Fuel injector

Symptom	Possible Cause
	Ignition coil
	Intake passage
	Ignition timing
	Spark plug
	Engine mechanical
Engine starts normally, but idles roughly at anytime	Fuel quality
	Fuel pump
	Coolant temperature sensor
	Fuel injector
	Electronic throttle body
	Intake passage
	Ignition timing
	Spark plug
Engine starts normally, but idles roughly after warming up	Engine mechanical
	Fuel quality
	Coolant temperature sensor
	Electronic throttle body
	Intake passage
	Spark plug
Engine starts normally, but idles roughly or stalls with part load (for example, A/C is ON)	Engine mechanical
	Electronic throttle
Engine starts normally, but idle speed is too high	Alternator
	Electronic throttle body
	Intake pipe air leaked
Low engine speed or stalls when accelerating	Coolant temperature sensor
	Intake pressure sensor
	Intake pipe
	Exhaust pipe
	Ignition timing
	Throttle position sensor
	Fuel injector
Slow response when accelerating	Spark plug
	Intake pressure sensor

Symptom	Possible Cause
	Intake pipe
	Exhaust pipe
	Ignition timing
	Throttle position sensor
	Fuel injector
	Spark plug
Lack of power and poor performance when accelerating	Intake pressure sensor
	Intake pipe
	Exhaust pipe
	Ignition timing
	Throttle position sensor
	Fuel injector
	Spark plug

4.2 Diagnosis Procedure

Hint:

Use following procedures to troubleshoot the control system.

1	Vehicle brought to workshop
---	-----------------------------

Next

2	Examine vehicle and check basic items
---	---------------------------------------

Check system power supply voltage, and check that fuse, wire harness and connector are connected normally.

OK

Standard voltage: Not less than 12 V.

Result

NG

Check and replace malfunctioning parts

OK

3	Using a diagnostic tester, read related DTC and data stream information.
---	--

Result

Result	Go to
No DTC	A
DTC occurs	B

A

Perform troubleshooting procedure without DTCs according to malfunction symptom

B

4

Troubleshoot according to DTCs troubleshooting procedure

Result

Result	Go to
Problem is not resolved	A
Problem is resolved	B

A

Return to procedure 1 and troubleshoot the process again

B

5

According to airbag system malfunction repair completion inspection and delivery, confirm that malfunction is resolved.

Result

Result	Go to
Delivery inspection is failed	A
Delivery inspection is qualified	B

A

Return to procedure 1 and troubleshoot the process again

B

6

Finished

4.3 DTC Confirmation Procedure

Confirm that battery voltage is normal before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ENGINE START STOP switch to ON.
- Use the diagnostic tester to record and clear DTCs stored in engine system.
- Turn ENGINE START STOP switch to OFF and wait for several seconds.
- Turn ENGINE START STOP switch to ON, and then select Read DTC.
- If DTC is detected, it indicates current malfunction. Go to inspection procedure - Step 1.
- If no DTC is detected, malfunction indicated by the DTC is intermittent.

4.4 Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the followings:

- Check if connector is loose.
- Check if wire harness is worn, pierced, pinched or partially broken.
- Monitor diagnostic tester (the latest software) data that is related to this circuit.
- Wiggle related wire harnesses and connectors and observe if signal is interrupt in related circuit.
- 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.
- Check engine system components and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
- Check and clean all wire harness connectors and ground parts related to DTC.
- If multiple trouble codes were set, refer to circuit diagrams to look for any common ground circuit or power supply circuit applied to DTC.
- Refer to any Technical Bulletin that may apply to this malfunction.

4.5 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) may increase load resistance. This situation may change the way in which a circuit operates. Circuits are very sensitive to proper grounding. A loose or corroded ground can seriously affect the control circuit. Check the ground points as follows:

- (1) Remove ground bolt or nut.
- (2) Check all contact surfaces for tarnish, dirt and rust, etc.
- (3) Clean as necessary to ensure that contact is in good condition.
- (4) Reinstall ground bolt or nut securely.
- (5) Check if any additional accessories interfere with ground circuit.
- (6) If several wire harnesses are crimped into one ground terminal, check for proper crimp condition. Make sure that all wire harnesses are clean and securely fastened while providing a proper ground path.

4.6 Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P049900	EVAP System Vent Valve Control Circuit High	Battery voltage > 8.5 V; Drive level is in operation status; Output voltage > (0.18~0.25) V.	Canister vent valve damaged Wire harness or connector damaged	• Replace canister vent valve • Replace wire harness or connector • Replace engine compartment fuse and relay box
P049800	EVAP System Vent Valve Control Circuit Low	Battery voltage > 8.5 V; Drive level is not in operation status;	Engine compartment fuse and relay box damaged	

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
		Output voltage < 2.5 V.		
P044700	EVAP System Vent Control Circuit Open	Battery voltage > 8.5 V; Drive level is in operation status; 5 V > output voltage > 2.5 V.		
P242200	EVAP System Vent Valve Stuck Closed	Tank pressure after CPV off and AAV on $\leq$ 2599.98 Pa.		
P254029	DECOS Oil Passage Pressure Sensor Circuit Bank 1-Positive Offset	Engine speed is 0 rpm and low pressure oil pump does not operate. After a period of time (not less than 30s), fuel rail pressure change value $\leq$ 10 Kpa, and difference between water temperature and current oil temperature with engine stopped $\geq$ 35°C.	DECOS oil passage pressure sensor damaged Battery damaged ECM damaged	• Replace DECOS oil passage pressure sensor • Replace battery • Replace ECM
P016F00	DECOS Low Pressure Oil Passage PWM Control Deviation Too Large			
P137000	DECOS Oil Passage Pressure Sensor Relative Pressure Too Low			
P137100	DECOS Oil Passage Pressure Sensor Relative Pressure Too High			
P254028	DECOS Oil Passage Pressure Sensor Circuit Bank 1-Negative Offset			
P254100	DECOS Oil Passage Pressure Sensor Circuit Low Voltage	Ignition switch is turned ON		
P008A00	DECOS Low Pressure Oil Passage Pressure Too Low			
P254200	DECOS Oil Passage Pressure Sensor Circuit High Voltage			
P150000	EMS Received Crash Signal	CAN network is normal, ENGINE START STOP switch ON, airbag control unit communication is normal	Battery damaged ECM damaged	• Replace battery • Replace ECM
P150100	Airbag Communicate Message Unplausible			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P209100	"B" Camshaft Position Actuator Control Circuit High Bank 1	Engine speed > 40 rpm, battery voltage > 9 V, ECM is power-on, and drive level is in operation status	Exhaust VVT control valve damaged Wire harness or connector damaged ECM damaged	- Replace exhaust VVT control valve - Replace wire harness or connector - Replace ECM
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	Catalytic converter heating, $-10^{\circ}\text{C} \leq \text{oil temperature} \leq 120^{\circ}\text{C}$, VVT is not in reference position (-camshaft control activated)		
P005A00	"B" Camshaft Profile Control Performance/ Stuck Off Bank 1			
P053300	A/C Refrigerant Pressure Sensor "A" Circuit High	Ambient temperature > -20°C , and engine speed > 600 rpm	ECM damaged Wire harness or connector damaged A/C pressure sensor damaged	- Replace ECM - Replace wire harness or connector - Replace A/C pressure sensor
P053200	A/C Refrigerant Pressure Sensor "A" Circuit Low			
P064500	A/C Clutch Relay Control Circuit	Ignition switch is turned ON, $9\text{ V} < \text{battery voltage} \leq 16\text{ V}$	A/C compressor relay damaged Wire harness or connector damaged Battery damaged ECM damaged	- Replace A/C compressor relay - Replace wire harness or connector - Replace battery - Replace ECM
P064700	A/C Clutch Relay Control Circuit High			
P064600	A/C Clutch Relay Control Circuit Low			
P258D00	Vacuum Pump Control Circuit "A" High	Ignition switch is turned ON, $9\text{ V} < \text{battery voltage} \leq 16\text{ V}$	Brake vacuum pump damaged Wire harness or connector damaged Battery damaged ECM damaged	- Replace brake vacuum pump - Replace wire harness or connector - Replace battery - Replace ECM
P258C00	Vacuum Pump Control Circuit "A" Low			
P258A00	Vacuum Pump Control Circuit Open			
P050F00	Brake Assist Vacuum Too Low			
P057100	Brake Signal Synchronization Error	Brake switch malfunction counter > 20	Brake switch damaged	Replace brake switch

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
U015187	Lost Communication With ABM	ENGINE START STOP switch ON, power-on time > 2.5s, 8.95 V + 0.09 V < battery voltage < 16.02V +0.09 V	Wire harness or connector damaged CAN bus hardware circuit malfunction	- Repair wire harness or connector - Repair CAN bus hardware circuit
U016487	Lost Communication With CLM			
U015587	Lost Communication With ICM			
U021487	Lost Communication With PEPS			
U116387	Lost Communication With Front Radar Module			
U186887	Lost Communication With MFS			
U007388	CAN Busoff Failure			
U010187	Lost Communication With TCM			
U010387	Lost Communication With EGS			
U012287	Lost Communication With ESP Module			
U012887	Lost Communication With EPB			
U014087	Lost Communication With BCM			
U021287	Lost Communication With Steering Column			
P12B100	Particulate Filter Back Pressure Too High	Catalytic converter heating activated, engine oil cut off, GPF temperature exceeds dew-point	Wire harness or connector damaged GPF sensor malfunction ECM damaged	- Repair wire harness or connector - Check GPF sensor - Replace ECM
P226D00	Particulate Filter Removed / Pressure Sensor / Line Abnormal Fault			
P129100	GPF Dynamic Response			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	Performance of Particulate Filter Differential Pressure Sensor Non-plausible / Line Abnormal	condensation of low-temperature water vapor may affect the dynamic response of the differential pressure sensor		
P12E100	GPF Dynamic Response Performance of Particulate Filter Differential Pressure Sensor Non-plausible / Line Abnormal (Downstream)	When ambient temperature is low, condensation of low-temperature water vapor may affect the dynamic response of the differential pressure sensor		
P245500	Particulate Filter Differential Pressure Sensor Circuit Voltage High (Upstream)	ECM is power-on, 2 driving cycles, Type I test driving cycle		
P246100	Particulate Filter Differential Pressure Sensor Circuit Voltage High (Downstream)			
P245400	Particulate Filter Differential Pressure Sensor Circuit Voltage Low (Upstream)			
P246000	Particulate Filter Differential Pressure Sensor Circuit Voltage Low (Downstream)			
U060100	Particulate Filter Differential Pressure Sensor Circuit Voltage Low (Downstream)			
U060200	Particulate Filter Differential Pressure Sensor Sent Communication Failure (Downstream)			
U060141	Particulate Filter Differential Pressure Sensor Data Inspection			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	Non-plausible (Upstream)			
U060241	Particulate Filter Differential Pressure Sensor Data Inspection Non-plausible (Downstream)			
P129300	Particulate Filter Upstream Pressure Sensor Channel 1 Digital Signal Non-plausible (SENT Signal High or Low)			
P12E300	Particulate Filter Downstream Pressure Sensor Channel 1 Digital Signal Non-plausible (SENT Signal High or Low)			
P12A200	Particulate Filter Differential Pressure Sensor Line Connection Error			
P12A300	Particulate Filter Differential Pressure Sensor Rear Pipe Connecting Line Abnormal / Completely Blocked / Sensor Stuck	When engine does not warm up sufficiently, there will be a risk of fault error reporting caused by condensation of low-temperature water vapor in air pressure line		
P059700	Thermostat Heater Control Circuit Open	ECM is power-on, 9 V < battery voltage ≤ 16 V, shutting off path inspection is completed, drive level is in operating status, 2 driving cycles, idling		
P059900	Thermostat Heater Control Circuit High			
P059800	Thermostat Heater Control Circuit Low			
P012800	Coolant Thermostat (- Coolant Temperature Below Thermostat	Speed > 400 rpm, duration after vehicle power-on < 1800 s, ambient temperature ≥ -10°C, -10°C ≤ coolant temperature		

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	Regulating Temperature)	at initial start ≤ calibration amount 58°C		
P012300	Throttle/Pedal Position Sensor/ Switch “A” Circuit High	12s after starting, engine speed > 1200 rpm	Throttle damaged Wire harness or connector damaged Throttle self-learning not performed ECM damaged	• Replace throttle • Replace wire harness or connector • Perform throttle self-learning • Replace ECM
P012200	Throttle/Pedal Position Sensor/ Switch “A” Circuit Low			
P012100	Throttle/Pedal Position Sensor/ Switch “A” / “B” Voltage Correlation	Engine speed > 480 rpm		
P022300	Throttle/Pedal Position Sensor/ Switch “B” Circuit High	12s after starting, engine speed > 1200 rpm		
P022200	Throttle/Pedal Position Sensor/ Switch “B” Circuit Low			
P022100	Throttle/Pedal Position Sensor/ Switch “A” / “B” Voltage Correlation	Engine speed > 480 rpm		
P151000	Diagnostic Fault Check Knock Control Signal Evaluation	1000 rpm < speed < 2500 rpm, gradient of velocity < 1000 rpm/s	Knock sensor damaged Speed sensor damaged	• Replace knock sensor • Replace speed sensor
P019128	Fuel Rail Pressure Sensor Circuit Bank 1-Negative Offset	Running time after starting ≥ 30s	Fuel rail pressure sensor damaged Wire harness or connector damaged ECM damaged	• Replace fuel rail pressure sensor • Replace wire harness or connector • Replace ECM
P019129	Fuel Rail Pressure Sensor Circuit Bank 1-Positive Offset	Engine coolant temperature at last engine stopping > 90°C; Coolant temperature at start < 35°C;		
P019400	Fuel Rail Pressure Sensor Circuit Intermittent/Erratic Bank 1	120 rpm ≤ engine speed ≤ 4520 rpm		
P019300	Fuel Rail Pressure Sensor Circuit High Bank 1	Turn on ignition switch		

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P019200	Fuel Rail Pressure Sensor Circuit Low Bank 1			
P019000	Fuel Rail Pressure Sensor Circuit Bank 1			
P045128	EVAP System Pressure Sensor&Switch Circuit Range Performance	Vehicle speed > 30 km/h; Ambient temperature $\geq -7^{\circ}\text{C}$; 3500Pa $\geq$ fuel tank pressure signal ≥ -2500 Pa; Ratio of manifold pressure to ambient pressure ≤ 0.6016	Fuel tank pressure sensor damaged Wire harness or connector damaged ECM damaged	• Replace fuel tank pressure sensor • Replace wire harness or connector • Replace ECM
P04512A	EVAP System Pressure Sensor&Switch Circuit Range Performance			
P045300	EVAP System Pressure Sensor&Switch Circuit High	Ignition switch ON		
P045200	EVAP System Pressure Sensor&Switch Circuit Low			
P128200	EVAP System Pressure Sensor/ Switch Circuit Range Performance	Engine starts		
P128300	EVAP System Pressure Sensor/ Switch Circuit Range Performance			
P045125	EVAP System Pressure Sensor&Switch Circuit Range Performance	Canister vent valve is opened; Valve canister flushing flow ≤ 0.0005 g; 30 km/h< vehicle speed < 70 km/h; Fuel level < 45%; 45 $^{\circ}\text{C} \geq$ ambient temperature $\geq -7^{\circ}\text{C}$		
P155500	Throttle Actuator Electrical Malfunction	Power-on but not started, engine speed ≤ 250 rpm, engine coolant temperature $\geq 5^{\circ}\text{C}$, intake temperature $\geq 5^{\circ}\text{C}$, vehicle speed ≤ 0 km/h.	Electronic throttle malfunction Wire harness or connector damaged No self-learning ECM damaged	• Replace electronic throttle • Replace wire harness or connector • Perform self-learning • Replace ECM
P210300	Electronic Throttle Drive Level	Power-on		

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	Malfunction (Short Circuit)			
P211800	Electronic Throttle Drive Level Malfunction (- Overheating or Overcurrent)			
P210600	Electronic Throttle Drive Level Malfunction (Non-plausible)			
P210000	Electronic Throttle Drive Level Malfunction (Open Circuit)			
P155400	Return Spring Check Max Error	Power-on but not started, engine speed ≤ 250 rpm, engine coolant temperature $\geq 5^{\circ}\text{C}$, intake temperature $\geq 5^{\circ}\text{C}$, vehicle speed ≤ 0 km/h.		
P156100	Not Plausible Error of DV-E Position Deviation	Power-on		
P155C00	Throttle Limphone Position Self Learning Error	Self-learning		
P155D00	Throttle PID Adjustment Max Error	DVE power driver level not faulty, direction of PID controller		
P155E00	Throttle PID Adjustment Min Error			
P155000	Throttle Self Learning Condition Not Fulfilled	Power-on but not started		
P155F00	System Voltage Cannot Meet the Electronic Throttle Self-learning Condition			
P156600	Throttle Mechanism Bottom Dead Center Relearning Error	Power-on but not started, self-learning, initialize self-learning		

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P155100	Not Plausible Error of UMA Learning			
P013300	O2 Sensor Circuit Slow Response Bank 1 Sensor 1	Upstream READY ON, catalytic converter temperature $\geq 400^{\circ}\text{C}$, 1200 rpm $\leq$ engine speed $\leq$ 2520 rpm, 19.992% < engine load < 100.008%	Upstream oxygen sensor damaged Wire harness or connector damaged	- Replace upstream oxygen sensor - Replace wire harness or connector
P062F42	Internal Control Module EEPROM Error	Always diagnose after power-on	Read and write failed	Try again after vehicle powers off
P062F43	Internal Control Module EEPROM Error			
P208900	"A" Camshaft Position Actuator Control Circuit High Bank 1	Engine speed > 40 rpm, battery voltage > 9 V, ECM is power-on, and drive level is in operation status	Intake VVT control valve damaged Wire harness or connector damaged ECM damaged	- Replace intake VVT control valve - Replace wire harness or connector - Replace ECM
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	Catalytic converter heating, $-10^{\circ}\text{C} \leq$ oil temperature $\leq 120^{\circ}\text{C}$, VVT is not in reference position (- camshaft control activated)		
P003C00	"A" Camshaft Profile Control Performance/ Stuck Off Bank 1			
P260300	Coolant Pump "A" Control Circuit High	Ignition switch ON	Clutch water pump damaged Wire harness or connector damaged ECM damaged	- Replace clutch water pump - Replace wire harness or connector - Replace ECM
P260200	Coolant Pump "A" Control Circuit Low			
P260000	Coolant Pump "A" Control Circuit Open			
P050B00	Cold Start Ignition Timing Performance	Catalytic converter heating activated, time after activation > 3s	Catalytic converter deteriorated Wire harness or connector damaged ECM damaged	- Replace catalytic converter - Replace wire harness or connector - Replace ECM
P050B20	Cold Start Ignition Timing Performance			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P06DC00	Engine Oil Pressure Control Circuit High	Ignition switch ON	Oil pump damaged Wire harness or connector damaged ECM damaged	• Replace oil pump • Replace wire harness or connector • Replace ECM
P06DB00	Engine Oil Pressure Control Circuit Low			
P06DA00	Engine Oil Pressure Control Circuit Open			
P138824	Ambient Air Temperature Sensor "A" Multiple Check	Stopping time ≥ 60s	Ambient Temperature Sensor Error Wire harness or connector damaged	• Replace ambient temperature sensor • Replace wire harness or connector
P138823	Ambient Air Temperature Sensor "A" Multiple Check			
P034100	Camshaft Position Sensor "A" Circuit Range/ Performance Bank 1 or Single Sensor	Crankshaft signal exists and reference point is confirmed; There is no the following DTCs: P0341, P0343, P0342, P0641.	Intake camshaft position sensor damaged Incorrect installation position of intake camshaft position sensor Engine mechanical malfunction Wire harness or connector damaged ECM damaged	• Replace intake camshaft position sensor • Reinstall intake camshaft position sensor • Replace wire harness or connector • Check for engine mechanical malfunction • Replace ECM
P001676	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Crankshaft signal exists and reference point is confirmed		
P034300	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor			
P034200	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor			
P001678	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Crankshaft signal exists and reference point is confirmed; There is no the following DTC: P0016.		
P036600	Camshaft Position Sensor “B” Circuit Range/ Performance (Bank1)	Crankshaft signal exists and reference point is confirmed; There is no the following DTCs: P0366, P0368, P0367, P0641. Camshaft Position Sensor “B” Circuit	Exhaust camshaft position sensor damaged Incorrect installation position of exhaust camshaft position sensor	• Replace exhaust camshaft position sensor • Reinstall exhaust camshaft position sensor • Replace wire harness or connector • Check for engine mechanical malfunction • Replace ECM

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
		Range/Performance (- Bank 1)		
P001776	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B	Crankshaft signal exists and reference point is confirmed	Engine mechanical malfunction Wire harness or connector damaged ECM damaged	
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	Crankshaft signal exists and reference point is confirmed; There is no the following DTCs: P0366, P0368, P0367, P0641. Camshaft Position Sensor "B" Circuit Range/Performance (- Bank 1)		
P033900	Crankshaft Position Sensor "A" Circuit Intermittent	Engine speed > 550 rpm, 1 km/h < vehicle speed < 25 km/h.	Speed sensor damaged Incorrect installation position of speed sensor Engine mechanical malfunction Wire harness or connector damaged ECM damaged	• Replace speed sensor • Reinstall speed sensor • Replace wire harness or connector • Check for engine mechanical malfunction • Replace ECM
P261700	Crankshaft Position Signal Output Circuit Open			
P057500	Clamping Switch of Cruise Control	Vehicle power-on	Button malfunction Wire harness or connector damaged	• Replace wire harness or connector • Replace button
P057800	Clamping Switch of Cruise Control			
P218700	System Too Lean at Idle Bank 1	Number of injection $\geq$ 1000, coolant temperature $\geq$ 70°C, intake temperature < 80°C, 3s after entering closed loop, upstream target air-fuel ratio is 0.98, upstream target air-fuel ratio < 1.02, fluctuation of	Oxygen sensor damaged Wire harness or connector damaged ECM damaged	• Replace oxygen sensor • Replace wire harness or connector • Replace ECM
P218800	System Too Rich at Idle Bank 1			
P217700	System Too Lean Off Idle Bank 1			
P217800	System Too Rich Off Idle Bank 1			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
		multiplicative self-learning values ≤ 0.03, stable time of stability inspection is 10s, deviation between closed loop regulatory factor and $1.0 \leq 0.03$, fluctuation of additive self-learning value ≤ 0.984		
P046300	Fuel Level Sensor "A" Circuit High	System powers on or post operation	Fuel level sensor damaged Wire harness or connector damaged ECM damaged	- Replace fuel level sensor - Replace wire harness or connector - Replace ECM
P046200	Fuel Level Sensor "A" Circuit High			
P25B000	Fuel Level Sensor "A" Stuck	Duration when vehicle speed is $0 < 5$ s, fuel level high-pass filtering < 0.2 L		
P128400	Fuel Level Sensor "A" Circuit Range Performance	There is no the following DTCs: P0460, P0462, P0463, U0676		
P046129	Fuel Level Sensor "A" Circuit Range Performance	Duration when vehicle speed is $0 < 5$ s, fuel level high-pass filtering < 0.2 L		
P209700	Post Catalyst Fuel Trim System Too Rich Bank 1	Upstream signal ready on, no fuel cut-off, catalytic converter oxygen clearing not activated, closed loop adjustment target is 1.0, catalytic converter heating not activated	Oxygen sensor damaged Wire harness or connector damaged ECM damaged	- Replace oxygen sensor - Replace wire harness or connector - Replace ECM
P209600	Post Catalyst Fuel Trim System Too Lean Bank 1			
P048371	Fan Rationality Check Error (Type 1)	Vehicle power-on	Cooling fan malfunction Wire harness or connector damaged ECM damaged	- Check cooling fan - Replace wire harness or connector - Replace ECM
P048372	Fan Rationality Check Error (Type 2)			
P048373	Fan Rationality Check Error (Type 3)			
P048374	Fan Rationality Check Error (Type 4)			
P048013	Cooling Fan Control Circuit Open			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P06344B	Cooling Fan Drive Chip Overheating			
P069212	Cooling Fan Control Circuit Short to Battery			
P069111	Cooling Fan Control Circuit Short to Ground			
P144200	Communication Fault of Generator	Vehicle starts, alternator target voltage ≥ 11 V, battery voltage > 10 V	Alternator damaged Battery damaged ECM damaged	- Replace alternator - Replace battery - Replace ECM
P144100	Mechanical Fault of Generator			
P144000	Electrical Fault of Generator			
P261700	Crankshaft Position Signal Output Circuit Open	Engine speed > 550 rpm, $1 \text{ km/h} < \text{vehicle speed} < 25 \text{ km/h}$	Speed sensor malfunction Wire harness or connector damaged	- Replace speed sensor - Replace wire harness or connector
P033900	Crankshaft Position Sensor "A" Circuit Intermittent			
P053F22	Cold Start Fuel Pressure Performance	A period of time after starting ≥ 8 s, catalytic converter heating activated	Catalytic converter malfunction Mechanical malfunction	- Replace catalytic converter - Check mechanical malfunction
P054A00	Exhaust VVT actual position deviation fault during catalytic converter heating	Catalytic converter heating activated, VVT position is not in reference position (- precondition is that VVT control has been activated)		
P053F21	Cold Start Fuel Pressure Performance	A period of time after starting ≥ 8 s, catalytic converter heating activated		
P008985	Fuel Pressure Regulator 1 Performance-Pressure Too Low	A period of time after starting ≥ 8 s, catalytic converter heating not activated, relative target fuel injection volume = 9.984% , $0.2 \text{ V} \leq \text{fuel rail sensor voltage} \leq 4.8 \text{ V}$	Fuel pump malfunction High pressure fuel rail leaked Wire harness or connector damaged	- Check high pressure fuel rail - Replace wire harness or connector - Replace fuel pump
P008984	Fuel Pressure Regulator 1 Performance-Pressure Too High			
P008800	Fuel Rail/System Pressure - Too High			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P008700	Fuel Rail/System Pressure - Too High			
P013800	O2 Sensor Circuit High Voltage Bank 1 Sensor 2	Downstream oxygen sensor heated sufficiently, downstream oxygen sensor open circuit fault is not detected in last driving cycle, downstream sensing internal resistance is reliable	Wire harness or connector damaged Downstream oxygen sensor damaged ECM damaged	• Replace wire harness or connector • Replace downstream oxygen sensor • Replace ECM
P013700	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	No fuel cut-off, catalytic converter oxygen clearing not activated, duration > 3s		
P223200	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 2	Downstream oxygen sensor heated sufficiently, downstream oxygen sensor open circuit fault is not detected in last driving cycle, downstream sensing internal resistance is reliable		
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	Key ON	Downstream oxygen sensor damaged Wire harness or connector damaged Fuse blown ECM damaged	• Replace downstream oxygen sensor • Replace wire harness or connector • Replace fuse • Replace ECM
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	Downstream oxygen sensor signal is reliable; 6000 rpm ≥ engine speed ≥ 520 rpm		
P227100	O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2	Downstream oxygen sensor signal is reliable; 4000 rpm ≥ engine speed ≥ 1000 rpm		
P227000	O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P010300	Mass or Volume Air Flow Sensor "A" Circuit High	Vehicle powers on, battery voltage > 11 V	Air flow meter damaged Wire harness or connector damaged Fuse blown ECM damaged	• Replace air flow meter • Replace wire harness or connector • Replace ECM
P010200	Mass or Volume Air Flow Sensor "A" Circuit High			
P010000	Mass or Volume Air Flow Sensor "A" Circuit			
P00BD00	Mass or Volume Air Flow "A" Circuit Range/ Performance - Air Flow Too High	Cumulative crankshaft rotation turns since engine starts > 150, no circuit malfunction on HFM		
P00BC00	Mass or Volume Air Flow "A" Circuit Range/ Performance - Air Flow Too Low			
P010122	Mass or Volume Air Flow "A" Circuit Range/ Performance - Air Flow Too High	Cumulative crankshaft rotation turns since engine starts > 150, no circuit malfunction on HFM, calculation condition of flow difference between post gas compressor and throttle is met, condition of model flow calculation is met, and there is no malfunction that inhibits the diagnosis of intake flow rationality		
P010121	Mass or Volume Air Flow Sensor "A" Circuit Range/ Performance - Air Flow Too Low			
P01012A	Mass or Volume Air Flow Sensor "A" Circuit Range/ Performance			
P223100	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1	Exhaust temperature before front catalytic converter < 800°C; 20.0012 % < heating duty ratio < 79.9988 %; engine speed <	Upstream oxygen sensor damaged Wire harness or connector damaged Fuse is damaged ECM damaged	• Replace upstream oxygen sensor • Replace wire harness or connector • Replace fuse • Replace ECM

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
		3000 rpm; engine load < 20.25 %;		
P003200	O2 Sensor Heater Control Circuit High (Upstream of the Catalyzer)	ENGINE START STOP switch ON		
P003100	O2 Sensor Heater Control Circuit Low (Upstream of the Catalyzer)			
P241400	O2 Sensor Exhaust Sample Error Bank 1 Sensor 1			
P003000	HO2S Heater Control Circuit Bank 1 Sensor 1			
P005300	HO2S Heater Resistance Bank 1 Sensor 1	More than dew point temperature; Exhaust temperature at upstream oxygen sensor > 410°C		
P005326	HO2S Heater Resistance Bank 1 Sensor 1	More than dew point temperature; Vehicle starts normally;		
P013500	O2 Sensor Heater Circuit Bank 1 Sensor 1	O2 Sensor Heater Circuit Bank 1 Sensor 1		
P064D17	Internal Control Module O2 Sensor Processor Performance Bank 1	10.7 V ≤ system voltage ≤ 16.1 V, engine speed > 20 rpm	Upstream oxygen sensor damaged Wire harness or connector damaged Fuse is damaged ECM damaged	• Replace upstream oxygen sensor • Replace wire harness or connector • Replace fuse • Replace ECM
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			
P02CD00	Cylinder 1 Fuel Injector Offset Learning At Max Limit	-30°C ≤ engine coolant temperature ≤ 120°C	Wire harness or connector damaged ECM damaged	• Replace wire harness or connector • Replace ECM

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P02D100	Cylinder 3 Fuel Injector Offset Learning At Max Limit			
P02D300	Cylinder 4 Fuel Injector Offset Learning At Max Limit			
P02CF00	Cylinder 2 Fuel Injector Offset Learning At Max Limit			
P02CC00	Cylinder 1 Fuel Injector Offset Learning At Min Limit			
P02D000	Cylinder 3 Fuel Injector Offset Learning At Min Limit			
P02D200	Cylinder 4 Fuel Injector Offset Learning At Min Limit			
P02CE00	Cylinder 2 Fuel Injector Offset Learning At Min Limit			
P062B9A	Internal Control Module Fuel Injector Control Performance - Signal Plausibility Failure			
P062B64	Internal Control Module Fuel Injector Control Performance - Component Internal Failure			
P062B96	Internal Control Module Fuel Injector Control Performance - Component or System Operating Conditions			
P126100	Cylinder 1 Injector Circuit Range/ Performance - Signal Plausibility Failure	System voltage is normal; Engine speed > 1400 rpm; Number of ignition > 4	Ignition coil malfunction Wire harness or connector malfunction	• Check engine mechanical • Replace wire harness or connector • Replace ignition coil • Replace ECM

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P126300	Cylinder 3 Injector Circuit Range/ Performance - Signal Plausibility Failure		Engine mechanical malfunction ECM damaged	
P126400	Cylinder 4 Injector Circuit Range/ Performance - Signal Plausibility Failure			
P126200	Cylinder 2 Injector Circuit Range/ Performance - Signal Plausibility Failure			
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			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P230300	Ignition Coil "B" Primary Control Circuit Low			
P05EC00	Cold Start Injection Timing Performance	Catalytic converter heating activated, actual number of fuel injection is not equal to target number of fuel injection	Wire harness or connector malfunction ECM damaged	- Replace wire harness or connector - Replace ECM
P026300	Cylinder 1 Contribution/ Balance	$15\text{ V} \geq \text{normal}$ $\text{system voltage} \geq 8\text{ V};$	Fuel injector damaged Wire harness or connector damaged ECM damaged	- Replace fuel injector - Replace wire harness or connector - Replace ECM
P026900	Cylinder 3 Contribution/ Balance			
P026600	Cylinder 2 Contribution/ Balance			
P020100	Cylinder 1 - Injector Circuit Open			
P020300	Cylinder 3 - Injector Circuit Open			
P020400	Cylinder 4 - Injector Circuit Open			
P020200	Cylinder 2 - Injector Circuit Open			
P214800	Fuel Injector Group "A" Supply Voltage Circuit High			
P215100	Fuel Injector Group "B" Supply Voltage Circuit High			
P026200	Cylinder 1 Injector Circuit High			
P026800	Cylinder 3 Injector Circuit High			
P027100	Cylinder 4 Injector Circuit High			
P026500	Cylinder 2 Injector Circuit High			
P214700	Fuel Injector Group "A" Supply			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	Voltage Circuit Low			
P215000	Fuel Injector Group "B" Supply Voltage Circuit Low			
P026100	Cylinder 1 Injector Circuit Low			
P026700	Cylinder 3 Injector Circuit Low			
P062900	Fuel Pump Module Control Circuit Low	2 driving cycles, idling	Fuel pump malfunction Wire harness or connector damaged ECM damaged	• Replace fuel pump • Replace wire harness or connector • Replace ECM
P062A00	Fuel Pump Module Control Circuit High			
P062A4B	Fuel Pump Module Control Circuit High			
P062719	Fuel Pump Module "A" Control Circuit Open			
P032600	Knock Sensor Signal Circuit Voltage Too High	Rotation speed > 2800 rpm; Coolant temperature > 40°C	Knock sensor damaged Wire harness or connector damaged ECM damaged	• Replace knock sensor • Replace wire harness or connector • Replace ECM
P032500	Knock Sensor Signal Circuit Voltage Too Low			
P032800	Knock/ Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor	Rotation speed > 1000 rpm;		
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			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P26F000	Starter Relay "A" Stuck On	Starting request completed	Starter relay damaged Engine compartment fuse and relay box damaged Wire harness or connector damaged	- Replace starter relay - Check engine compartment fuse and relay box - Replace wire harness or connector
P26F100	Starter Relay "A" or "B" Stuck Off	Starting request completed, starter operates		
P124A00	Turbocharger/ Supercharger Wastegate Control Valve Control Circuit Voltage Too High	2 driving cycles, idling	Turbocharger damaged Wire harness or connector damaged ECM damaged	- Check turbocharger - Replace wire harness or connector - Replace ECM
P2ABD00	Turbocharger/ Supercharger Wastegate Control Valve Control Circuit Voltage Too Low			
P024300	Turbocharger/ Supercharger Wastegate Solenoid "A"			
P023400	Turbocharger/ Supercharger Overboost Condition	Boost control activated, ambient pressure > 50 kPa, throttle fully opened		
P124B00	Electric Waste Gate (E-WG) Actuator Control Chip SPI Bus Error	2 driving cycles, idling		
P141400	Read Back Time Out Error of LIN Bus (Contact Between EMS and Intellectual Generator)	Battery voltage ≥ 8 V	Alternator damaged Wire harness or connector damaged ECM damaged	- Check alternator - Replace wire harness or connector - Replace ECM
P141500	Response Reception Time Out Error of LIN Bus (Contact Between EMS and Intellectual Generator)			
P141600	Framing Error of LIN Bus (Contact Between EMS and Intellectual Generator)			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P141700	Checksum Error of LIN Bus (- Contact Between EMS and Intellectual Generator)			
P143000	Battery Has Been Changed and Long Time No Tester Confirmation	ECM powers on	Battery damaged Wire harness or connector damaged	- Replace battery - Check wire harness or connector
P143100	EBS or Battery Error			
P143200	EBS Temporary Error			
P050700	Idle Control System RPM - Higher Than Expected	Time after starting $\geq$ 4 s, engine speed $>$ 400 rpm, plateau correction factor $>$ 0.734, engine coolant temperature $>$ -10°C , intake temperature $>$ -10°C	Coolant temperature sensor malfunction Intake temperature sensor malfunction Wire harness or connector damaged ECM malfunction	- Replace coolant temperature sensor - Replace intake temperature sensor - Replace wire harness or connector - Replace ECM
P050600	Idle Control System RPM - Lower Than Expected			
P050500	Idle Control System			
P050A22	Cold Start Idle Control System Performance	Altitude correction factor $>$ 0.734, vehicle speed = 0 km/h, idling activated, catalytic converter activated	Catalytic converter malfunction Wire harness or connector damaged ECM damaged	- Check catalytic converter - Replace wire harness or connector - Replace ECM
P050A21	Cold Start Idle Control System Performance			
P050D00	Cold Start Rough Idle			
P262600	O2 Sensor Pumping Current Trim Circuit Open Bank 1 Sensor 1	More than dew point temperature, duration $>$ 25s, $10.7\text{ V} <$ system voltage $\leq$ 16.1 V, engine speed $>$ 20 rpm, no fuel cut-off	Oxygen sensor damaged Wire harness or connector damaged ECM damaged	- Replace oxygen sensor - Replace wire harness or connector - Replace ECM
P223700	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1	Engine speed $>$ 20 rpm, $10.7\text{ V} <$ system voltage $\leq$ 16.1 V, gas mixture closed-loop control activated, deviation between oxygen sensor temperature and set temperature $<$ 64.992°C , upstream electrical correction not activated,		

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
		accumulated exhaust gas mass > 200 g		
P013200	O2 Sensor Circuit High Voltage Bank 1 Sensor 1	10.7 V ≤ system voltage ≤ 16.1 V, engine speed > 20 rpm		
P013100	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1			
P224300	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1	More than dew point temperature, duration > 25s, 10.7 V < system voltage ≤ 16.1 V, engine speed > 20 rpm		
P225100	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1	More than dew point temperature, duration > 25s, 10.7 V < system voltage ≤ 16.1 V, engine speed > 20 rpm, no fuel cut-off		
P013000	O2 Sensor Circuit Bank 1 Sensor 1	Exhaust temperature of upstream oxygen sensor is 400°C, electric heating activation flag bit and ceramic body temperature is 720°C, no system fuel cut-off, 10.7 V ≤ system voltage ≤ 16 V	Electronic throttle damaged Wire harness or connector damaged ECM damaged	• Replace electronic throttle • Replace wire harness or connector • Replace ECM
P154000	Engine Torque Control Adaption at Limit	Time after starting > 10s		
P030100	Cylinder 1 Misfire Detected	ENGINE START STOP switch ON, vehicle starts	Ignition coil malfunction Fuel system malfunction Wire harness or connector damaged ECM damaged	• Check fuel system • Replace ignition coil • Replace wire harness or connector • Replace ECM
P030300	Cylinder 3 Misfire Detected			
P030400	Cylinder 4 Misfire Detected			
P030200	Cylinder 2 Misfire Detected			
P030000	Random/Multiple Cylinder Misfire Detected			
P036300	Misfire Detected - Fueling Disabled			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P070000	Transmission Control System (MIL Request)	ENGINE START STOP switch ON, vehicle starts	Wire harness or connector damaged ECM damaged TCU damaged	- Replace wire harness or connector - Replace ECM - Replace TCU
P06AA00	Control Module Internal Temperature "B" Too High	Always diagnose after power-on	Wire harness or connector damaged Main relay damaged	- Replace wire harness or connector - Check main relay
P068A00	ECM/PCM Power Relay De-Energized Performance - Too Early			
P068600	ECM/PCM Power Relay Control Circuit Low			
P025100	Injection Pump Fuel Metering Control "A" (Cam/Rotor/Injector)	Ignition switch ON	ECM damaged Wire harness or connector damaged Flow control valve damaged	- Replace wire harness or connector - Check flow control valve - Replace ECM
P025400	Injection Pump Fuel Metering Control "A" High (Cam/Rotor/Injector)			
P025900	Injection Pump Fuel Metering Control "B" High (Cam/Rotor/Injector)			
P025300	Injection Pump Fuel Metering Control "A" Low (Cam/Rotor/Injector)			
P025800	Injection Pump Fuel Metering Control "B" Low (Cam/Rotor/Injector)	System voltage is normal; Engine speed > 40 rpm		
P009000	Fuel Pressure Regulator 1 Control Circuit Open			
P025A00	Fuel Pump "A" Control Circuit Open	Power-on	Relay damaged Fuel pump damaged Wire harness or connector damaged	- Replace relay - Replace fuel pump - Replace wire harness or connector - Replace ECM

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P025D00	Fuel Pump "A" Control Circuit High		ECM damaged	
P152000	Function Monitoring: Check of Predicted Air Mass Failed	Key ON	Wire harness or connector damaged ECM damaged	- Replace wire harness or connector - Replace ECM
P153000	Function Monitoring: Fault of ECU ADC - Null Load Test Pulse			
P153100	Function Monitoring: Fault of ECU ADC - Test Voltage			
P157000	Function Monitoring: Fault of ECU Monitoring Module Error			
P060D00	Internal Control Module Accelerator Pedal Position Performance			
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			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	Comparison of Lambda and Operation Mode			
P152500	Function Monitoring: Fault of ECU or Sensor in rl-Comparison			
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	Crankshaft and camshaft self-learning completed, startup completion time $\leq 2s$	Timing incorrect Wire harness or connector damaged ECM damaged	- Check timing - Replace wire harness or connector - Replace ECM
P001100	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1			
P021900	Engine Overspeed Condition	Engine starts	Wire harness or connector damaged ECM damaged	- Replace wire harness or connector - Replace ECM
P157800	Diagnostic Fault Check to Report "WDA Active"	Vehicle power-on	Wire harness or connector damaged ECM damaged	- Replace wire harness or connector - Replace ECM
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			
P055800	Brake Booster Pressure Sensor Circuit High	Vehicle power-on	Vacuum pressure sensor malfunction Vacuum leakage	- Check for leakage - Replace vacuum pressure sensor

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P055700	Brake Booster Pressure Sensor Circuit Low		Wire harness or connector damaged	Replace wire harness or connector
P145000	Brake Booster Pressure Sensor Circuit Range/ Performance (High)			
P145100	Brake Booster Pressure Sensor Circuit Range/ Performance (Low)			
P14AC00	Starter Damaged or Wire Dropped	Start request sent, starter feedback signal valid, battery voltage drop > 2.8 V, number of crankshaft rotation angle signal ≤ 1	Starter malfunction Battery malfunction Wire harness or connector malfunction	- Check starter - Replace battery - Replace wire harness or connector
P14AD00	Engine Block or Starter is not Engaged			
P14AE00	KL50r Wire Short Circuit to Battery			
P152900	Function Monitoring: Fault of Starter Control			
P061500	Starter Relay “A” Circuit			
P061600	Starter Relay “A” Circuit Low			
P061700	Starter Relay “A” Circuit High			
P14AF00	KL50r Wire Short Circuit to Ground			
P219500	O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1	Upstream ready on, upstream lambda closed-loop control activated; Fuel volume correction activated, exhaust flow is 8.3333 g/s, exhaust flow < 41.6667g/s, exhaust mass ≥ 90 g, 400°C < catalytic converter temperature < 870°C	Oxygen sensor damaged Wire harness or connector damaged ECM damaged	- Replace oxygen sensor - Replace wire harness or connector - Replace ECM
P219600	O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1			
P120000	Manifold Absolute Pressure Sensor Circuit Range/ Performance	Rotation speed > 80 rpm, t: There is no the following DTCs: P0108, P0107	Intake pressure sensor malfunction Wire harness or connector damaged ECM damaged	- Replace intake pressure sensor - Replace wire harness or connector - Replace ECM
P120100	Manifold Absolute Pressure Sensor			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	Circuit Range/ Performance			
P00C721	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1	Engine is in incipient stage of dragging status, engine speed < 400 rpm, stopping time > 5s		
P00C722	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1			
P010800	Manifold Absolute Pressure Sensor Circuit High	Rotation speed > 80 rpm		
P010700	Manifold Absolute Pressure Sensor Circuit Low			
P010622	Manifold Absolute Pressure Sensor Circuit Range/ Performance	Water temperature when starting > -7°C, coolant temperature > 30°C, speed > 2000 rpm		
P010621	Manifold Absolute Pressure Sensor Circuit Range/ Performance			
P01062A	Manifold Absolute Pressure Sensor Circuit Range/ Performance			
P046800	EVAP Purge Flow Sensor Circuit High	Engine starts	Desorption pressure sensor damaged Wire harness or connector damaged ECM damaged	- Replace desorption pressure sensor - Replace wire harness or connector - Replace ECM
P046700	EVAP Purge Flow Sensor Circuit Low			
P128500	EVAP Purge Flow Sensor Circuit Range Performance			
P128600	EVAP Purge Flow Sensor Circuit Range Performance			
P222900	Barometric Pressure Sensor "A" Circuit High	Vehicle power-on	Ambient pressure sensor malfunction Wire harness or connector malfunction	- Replace ambient pressure sensor - Replace wire harness or connector - Replace ECM

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P222800	Barometric Pressure Sensor "A" Circuit Low		ECM damaged	
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	Engine speed $\geq$ 80 rpm	Boost pressure/ temperature sensor damaged Wire harness or connector damaged ECM damaged	• Replace boost pressure/ temperature sensor • Replace wire harness or connector • Replace ECM
P023700	Turbocharger/ Supercharger Boost Sensor "A" Circuit Low			
P120400	Turbocharger/ Supercharger Boost Sensor "A" Circuit Range/ Performance	Engine speed $\geq$ 80 rpm; There is no the following DTCs: P1551, P2229, P2228, P1202, P1203, P2227, P0238, P0237		
P120500	Turbocharger/ Supercharger Boost Sensor "A" Circuit Range/ Performance			
P023622	Turbocharger/ Supercharger Boost Sensor "A" Circuit Range/ Performance			
P029900	Turbocharger/ Supercharger "A" Underboost Condition			
P023621	Turbocharger/ Supercharger Boost Sensor "A" Circuit Range/ Performance			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P226100	Turbocharger/ Supercharger Bypass Valve - Mechanical	Discharge valve control activated		
P00C600	Fuel Rail Pressure Too Low - Engine Cranking Bank 1	Vehicle ignition, -30°C < water temperature when starting < 143°C	Fuel system Wire harness or connector damaged ECM damaged	- Check fuel system - Replace wire harness or connector - Replace ECM
P212300	Throttle/Pedal Position Sensor/ Switch "D" Circuit High	Power-on	Electronic accelerator pedal malfunction Battery malfunction Wire harness or connector damaged ECM damaged	- Replace battery - Check electronic accelerator pedal - Replace wire harness or connector - Replace ECM
P212800	Throttle/Pedal Position Sensor/ Switch "E" Circuit High			
P212200	Throttle/Pedal Position Sensor/ Switch "D" Circuit Low			
P212700	Throttle/Pedal Position Sensor/ Switch "E" Circuit Low			
P213800	Throttle/Pedal Position Sensor/ Switch "D" / "E" Voltage Correlation	Pedal position sensor 2 signal voltage > 0.576 V		
P064100	Sensor Reference Voltage "A" Circuit Open	Always diagnose after power-on	Battery malfunction Wire harness or connector damaged ECM damaged	- Replace battery - Replace wire harness or connector - Replace ECM
P065100	Sensor Reference Voltage "B" Circuit Open			
P063442	Control Module Internal Temperature "A" Too High			
P063443	Control Module Internal Temperature "A" Too High			
P138124	Intake Air Temperature Sensor 3 Multiple Check Bank1	Stopping time is more than 60s	Intake temperature sensor damaged Wire harness or connector damaged ECM damaged	- Replace intake temperature sensor - Replace wire harness or connector - Replace ECM
P138123	Intake Air Temperature Measurement			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
	System - Multiple Sensor Correlation Bank 3			
P00EB00	Intake Air Temperature Sensor 3 Circuit High Bank 1	Ignition switch is turned ON		
P00EA00	Intake Air Temperature Sensor 3 Circuit Low Bank 1			
P00EC00	Intake Air Temperature Sensor 3 Circuit Intermittent Bank 1	Total duration > 20s		
P138024	Intake Air Temperature Sensor 2 Multiple Check Bank1	Stopping time is more than 60s		
P138023	Intake Air Temperature Measurement System - Multiple Sensor Correlation Bank 2			
P009800	Intake Air Temperature Sensor 2 Circuit High Bank 1	Ignition switch is turned ON		
P009700	Intake Air Temperature Sensor 2 Circuit Low Bank 1			
P009900	Intake Air Temperature Sensor 2 Circuit Intermittent Bank 1	Total duration > 20s		
P044200	EVAP System Leak Detected (- Small Leak)	0°C < ambient temperature < 45°C, ratio of intake manifold pressure to ambient pressure < 0.6406, ambient pressure ≥ 70000 Pa, -4000 Pa < fuel tank pressure < 2000 Pa, 11 V < system voltage < 16 V, engine starting time > 700s, gas mixture is stable and there is no fault, engine idling control	Desorption pressure sensor malfunction Line leaked Wire harness or connector damaged	• Replace desorption pressure sensor • Check line • Replace wire harness or connector
P045500	EVAP System Leak Detected (- Large Leak)			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
		activated, vehicle speed ≤ 4 km/h, 2-0.5*1.5 L < fuel level < 45+0.5*1.5 L, all fuel injectors activated, air-fuel ratio closed-loop control activated, mass and flow through canister valve meet the conditions, 0℃ < water temperature when engine starts < 45℃, engine starting time > 150s, delay time for entering diagnosis when canister exits high load ≥ 20s		
P04F000	EVAP System High Pressure Purge	Ignition switch ON	Canister solenoid valve damaged Wire harness or connector damaged ECM damaged	• Replace canister solenoid valve • Replace wire harness or connector • Replace ECM
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	Stopping time > 20s	Engine coolant temperature sensor damaged Wire harness or connector damaged ECM damaged	• Replace engine coolant temperature sensor • Replace wire harness or connector • Replace ECM
P050C23	Cold Start Engine Coolant Temperature Performance			
P011700	Engine Coolant Temperature Sensor 1 Circuit Low	Ignition switch		
P011900	Engine Coolant Temperature Sensor 1 Circuit Intermittent			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P011623	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	Rotation speed ≥ 20 rpm		
P011626	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	$-40^{\circ}\text{C} \leq \text{water temperature when starts} \leq 75^{\circ}\text{C}$, $0 \text{ km/h} \leq \text{vehicle speed (high power stage)} \leq 60 \text{ km/h}$		
P007300	Ambient Air Temperature Sensor Circuit "A" High	Ignition switch	Ambient Temperature Sensor Error Wire harness or connector damaged ECM damaged	- Replace ambient temperature sensor - Replace wire harness or connector - Replace ECM
P007200	Ambient Air Temperature Sensor Circuit "A" Low			
P007000	Ambient Air Temperature Sensor Circuit "A"			
P042000	Catalyst System Efficiency Below Threshold Bank 1	Ignition switch	Three-way catalytic converter damaged Wire harness or connector damaged	- Replace three-way catalytic converter - Replace wire harness or connector
P069000	ECM/PCM Power Relay Sense Circuit High	Vehicle speed > 20 rpm, time after starting $> 180\text{s}$	Wire harness or connector damaged Battery malfunction ECM damaged	- Replace wire harness or connector - Replace battery - Replace ECM
P056300	System Voltage High			
P056200	System Voltage Low			
P056000	System Voltage Unstable			
P003500	Dump Valve Control Circuit High	Vehicle power-on	Boost discharge control valve malfunction Wire harness or connector damaged ECM damaged	- Check boost discharge control valve - Replace wire harness or connector - Replace ECM
P003400	Dump Valve Control Circuit Low			
P003300	Dump Valve Control Circuit Open			
P256500	Turbocharger Boost Control Position Sensor "A" Circuit High			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P011800	Turbocharger/ Supercharger Bypass Valve "A" - Mechanical			
P256400	Turbocharger Boost Control Position Sensor "A" Circuit Low			
P063443	Control Module Internal Temperature "A" Too High	Always diagnose after power-on	Battery malfunction Wire harness or connector damaged ECM damaged	- Replace battery - Replace wire harness or connector - Replace ECM
P065900	Actuator Supply Voltage "A" Circuit High			
P121200	Vehicle Speed Sensor "A" Circuit Range/ Performance	Starting completed	Wire harness or connector damaged ABS controller damaged ECM damaged	- Replace wire harness or connector - Check ABS controller - Replace ECM
P050300	Vehicle Speed Sensor "A" Circuit Intermittent/ Erratic/High	10 km/ < vehicle speed < 250 km/h		
P050000	Vehicle Speed Sensor "A" Circuit			
P050166	Vehicle Speed Sensor "A" Circuit Range/ Performance	Fuel cut-off, engine coolant temperature $\geq 10^{\circ}\text{C}$, 1520 rpm $\leq$ engine speed $\leq$ 4000 rpm		
P050165	Vehicle Speed Sensor "A" Circuit Range/ Performance	Engine coolant temperature $\geq 10^{\circ}\text{C}$, all intake valves are in activated states and two camshaft cycles have elapsed after fuel cutting-off, engine speed > 2000 rpm, intake load > 86.25%		
P161300	Different IMMO Configurations of ECM and Vehicle Models	ENGINE START STOP switch ON	Anti-theft matching not performed Wire harness or connector damaged PEPS module damaged ECM damaged	- Perform anti-theft matching - Replace wire harness or connector - Replace PEPS module - Replace ECM
P161400	PIN Code Entry Error			
P051300	Incorrect Immobilizer Key			
P063300	ECM not Programed (Virgin State)			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
P161000	No Response Received by ECM/PCM After Challenge Sent			
P161200	Internal Error When Writing Data to EEPROM			
P161100	ECM Status Unknown			
P024477	Turbocharger/ Supercharger Wastegate Actuator "A" Range/ Performance	Ignition switch is turned ON, $9\text{ V} \leq \text{battery voltage} \leq 16\text{ V}$	Wire harness or connector damaged ECM damaged Electric water pump malfunction Battery damaged	• Replace wire harness or connector • Replace ECM • Replace electric water pump • Replace battery
P024437	Turbocharger/ Supercharger Wastegate Actuator "A" Range/ Performance			
P003A00	Turbocharger/ Supercharger Boost Control "A" Position Exceeded Learning Limit			
P261D00	Coolant Pump "B" Control Circuit High			
P261C00	Coolant Pump "B" Control Circuit Low			
P130200	Auxiliary Water Pump Low Speed Error			
P130500	Auxiliary Water Pump High Speed Error			
P130800	Auxiliary Water Pump Stall Error			

4.7 DTC Diagnosis Procedure

■ Intake/Exhaust Phaser Operation (Slow, Stuck) Malfunctions

DTC	P049800	"A" Camshaft Profile Control Performance/Stuck Off Bank 1
DTC	P000B00	"B" Camshaft Position Slow Response Bank 1
DTC	P005A00	"B" Camshaft Profile Control Performance/Stuck Off Bank 1
DTC	P001100	"A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1

DTC	P001400	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1
DTC	P054A00	Exhaust VVT actual position deviation fault during catalytic converter heating

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check phaser solenoid valve, valve body bolt components state

- Disconnect the negative battery cable.
- Remove intake/exhaust phaser solenoid valve; Check for blockage or dirty.
- Remove intake/exhaust phaser valve body bolts; Check for blockage or dirt.

NG

Clean or replace phaser solenoid valve and valve body bolts.

OK

2 Check engine maintenance condition

- Check if engine oil level is normal, and check for oil leakage and oil seepage.
- Remove valve trim cover, and check engine lubrication and cleaning conditions, and check for wear or sludge dirty

NG

Clean and maintain the engine, replace the damaged components.

OK

3 Check engine oil pressure

- Remove oil pressure sensor; Connect oil pressure tester to test oil pressure.

Main oil passage pressure: Limit pressure range (0.9 - 10 bar)

NG

Check or replace oil pump assembly.

OK

4	Check intake/exhaust phaser assembly
---	--------------------------------------

(a) Check if operating condition of cam phase regulator is normal (dirt blocked, oil leaked, stuck, etc.).

NG

Replace intake/exhaust phaser assembly.

OK

5	Reconfirm DTCs
---	----------------

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

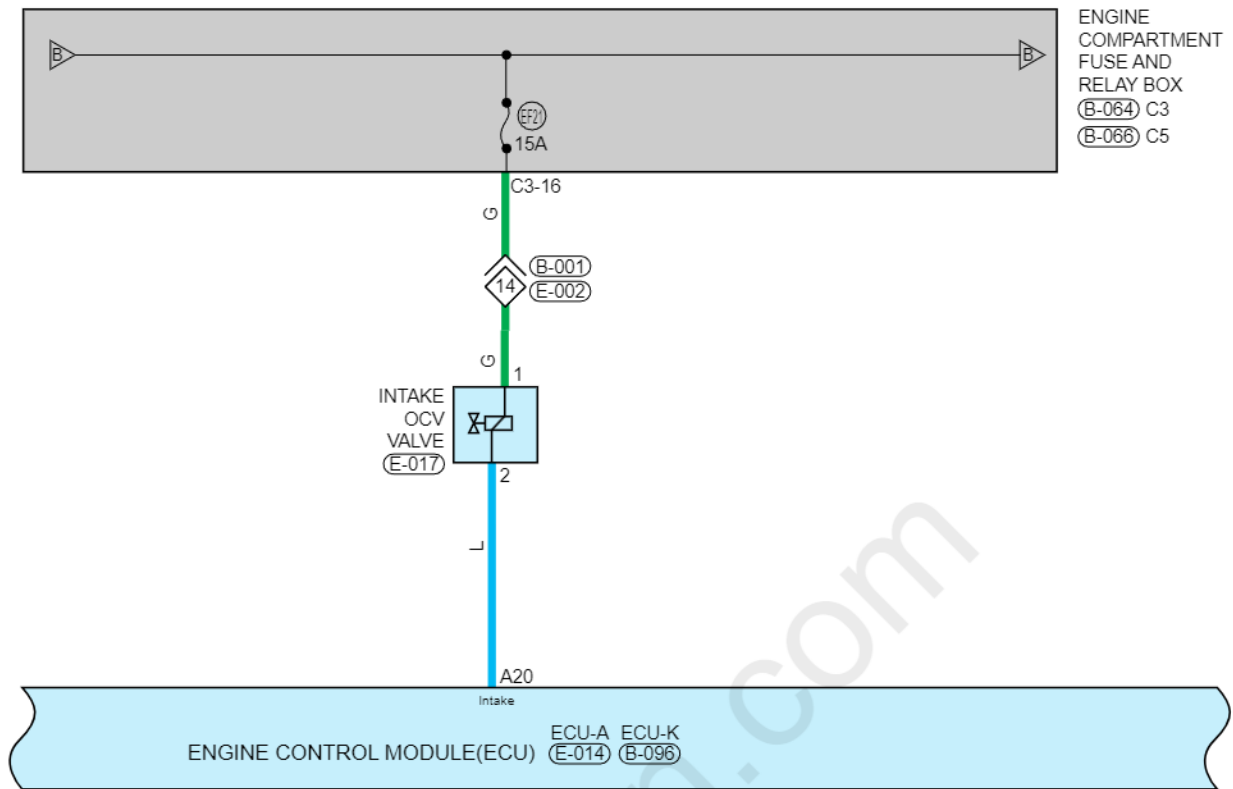
Conduct test and confirm malfunction has been repaired.

■ Intake Phaser Solenoid Valve Control Circuit Open

DTC	P001000	“A” Camshaft Position Actuator Control Circuit Open Bank 1
-----	---------	--

■ Description

Circuit Diagram



J11480

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check intake phaser solenoid valve connector

- Disconnect the negative battery.
- Unplug intake phaser solenoid valve connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

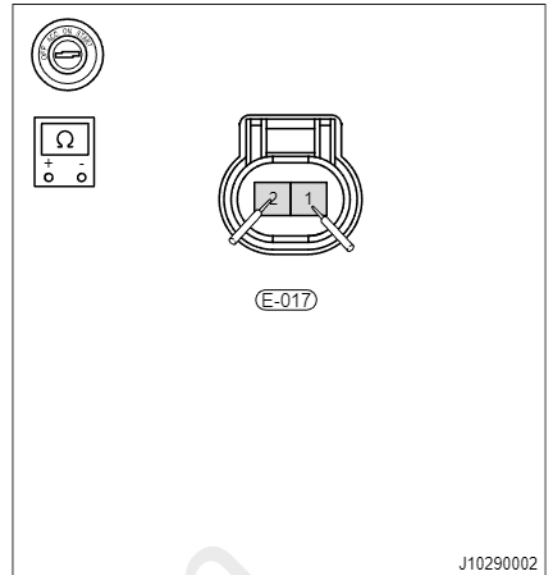
Repair connector or replace intake phaser solenoid valve.

OK

2 Check intake phaser solenoid valve internal resistance

- (a) Using ohm band of multimeter, measure if internal resistances of intake phaser solenoid valve E-017 (1-2) are normal with red and black probes respectively.

Resistance at ambient temperature: 6 Ω



NG

Replace intake phaser solenoid valve assembly.

OK

3

Check intake phaser solenoid valve power supply fuse

- (a) Turn ENGINE START STOP switch to ON.
(b) Check fuse EF21 15A in engine compartment fuse and relay box with 21 W test light.

Test light should be bright

NG

It indicates that there is short to ground in circuit.

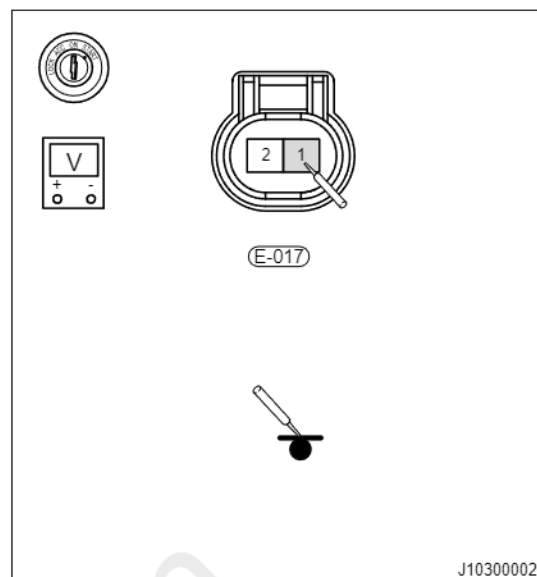
OK

4

Check intake phaser solenoid valve power supply and control terminal

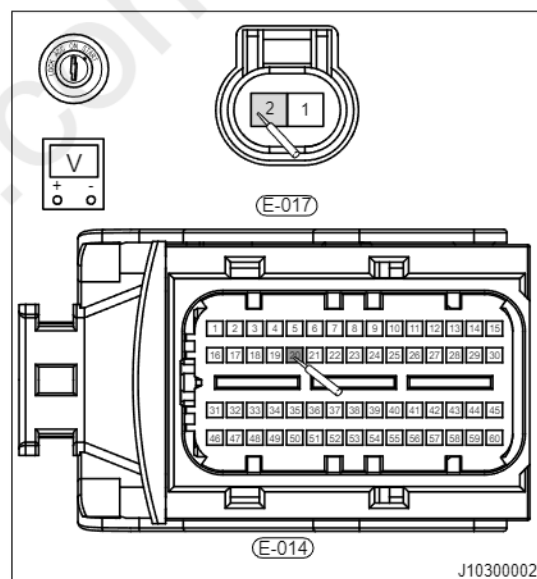
- (a) Connect intake phaser solenoid valve connector.
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of intake phaser solenoid valve E-017 (1, 2) with red probe.

Test voltage is current battery voltage



- (d) Start the engine.
- (e) Using voltage band of multimeter (voltage drop method), connect black probe to E-014 (20), measure voltages of intake phaser solenoid valve E-017 (2) with red probe.

Test voltage drop value should be less approximately 0.2 V



NG

Repair wire harness.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

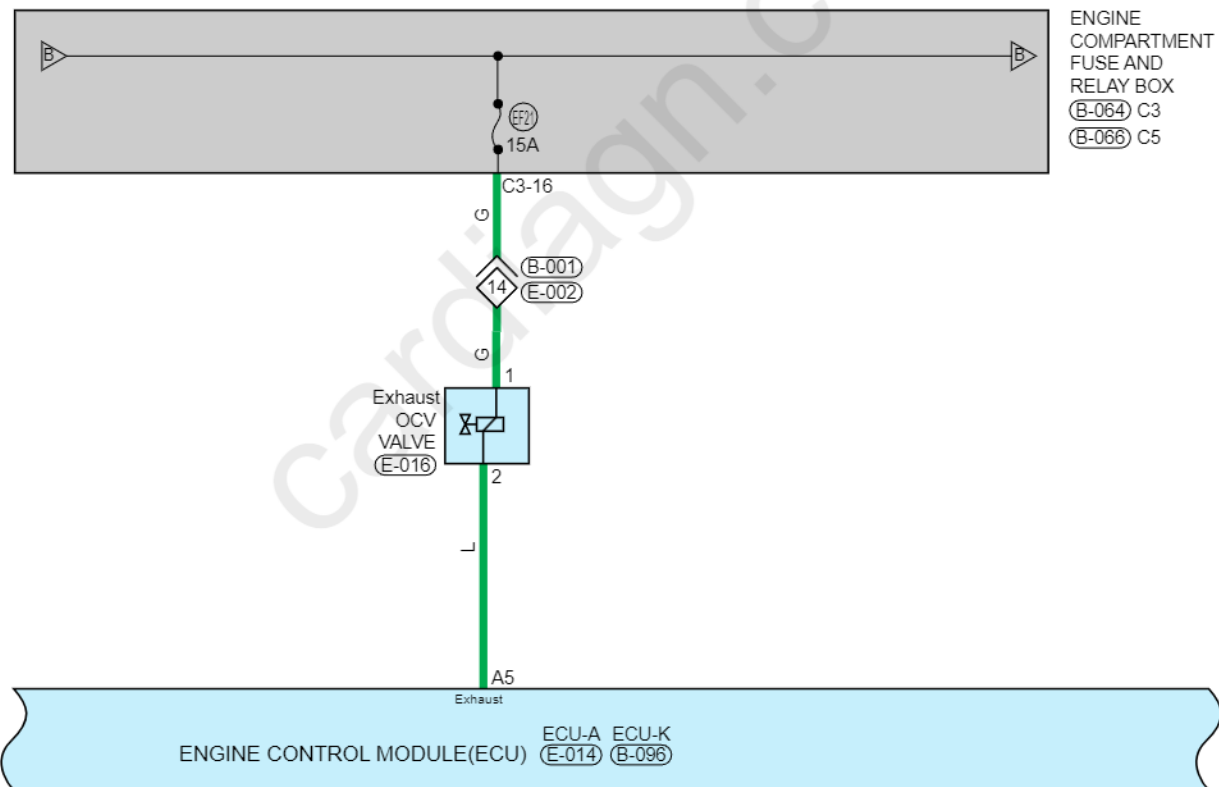
Conduct test and confirm malfunction has been repaired.

Exhaust Phaser Solenoid Valve Control Circuit Open

DTC	P001300	"B" Camshaft Position Actuator Control Circuit Open Bank 1
-----	---------	--

Description

Circuit Diagram



J11530

DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check exhaust phaser solenoid valve connector

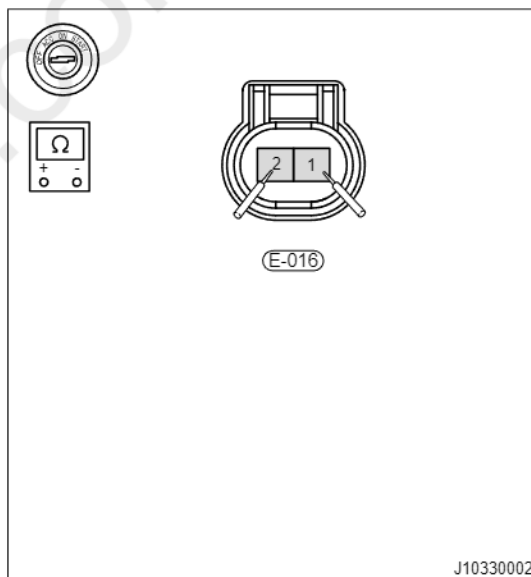
- (a) Disconnect the negative battery.
- (b) Unplug exhaust phaser solenoid valve connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

Repair connector or replace exhaust phaser solenoid valve.

OK**2 Check exhaust phaser solenoid valve internal resistance**

- (a) Using ohm band of multimeter, measure if internal resistances of exhaust phaser solenoid valve E-016 (1-2) are normal with red and black probes respectively.

**NG**

Replace exhaust phaser solenoid valve assembly.

OK**3 Check exhaust phaser solenoid valve power supply fuse**

- (a) Turn ENGINE START STOP switch to ON.
- (b) Check fuse EF21 15A in engine compartment fuse and relay box with 21 W test light.

Test light should be bright

NG

It indicates that there is short to ground in circuit.

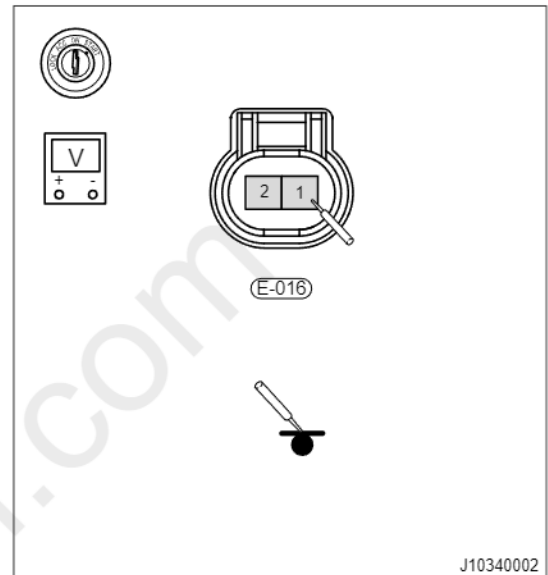
OK

4

Check exhaust phaser solenoid valve power supply and control terminal

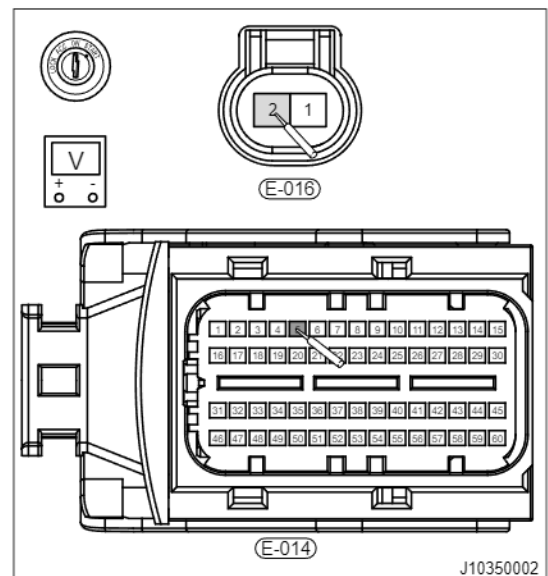
- (a) Connect exhaust phaser solenoid valve connector.
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of exhaust phaser solenoid valve E-016 (1, 2) with red probe.

Test voltage is current battery voltage



- (d) Start the engine.
- (e) Using voltage band of multimeter (voltage drop method), connect black probe to ECM E-014 (5), measure voltages of exhaust phaser solenoid valve E-016 (2) with red probe.

Test voltage drop value should be less approximately 0.2 V



NG

Repair wire harness.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK**Repair or replace new module.****NG****6 Reconfirm DTCs**

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK**Conduct test and confirm malfunction has been repaired.****■ Crankshaft - Intake/Exhaust Camshaft Installation Position Non-plausible/Deviation Excessive Malfunction**

DTC	P001676	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
DTC	P001678	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
DTC	P001776	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B
DTC	P001778	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check phaser solenoid valve, valve body bolt components state

- (a) Disconnect the negative battery cable.
- (b) Remove intake/exhaust phaser solenoid valve; Check for blockage or dirty.
- (c) Remove intake/exhaust phaser valve body bolts; Check for blockage or dirt.

NG**Clean or replace phaser solenoid valve and valve body bolts.**

OK

2 Check engine maintenance condition

- (a) Check if engine oil level is normal, and check for oil leakage and oil seepage.
- (b) Remove valve trim cover, and check engine lubrication and cleaning conditions, and check for wear or sludge dirty

NG

Clean and maintain the engine, replace the damaged components.

OK

3 Check engine oil pressure

- (a) Remove oil pressure sensor; Connect oil pressure tester to test oil pressure.

Main oil passage pressure: Limit pressure range (0.9 - 10 bar)

NG

Check or replace oil pump assembly.

OK

4 Check valve mechanism timing

- (a) Check if valve mechanism timing is normal, and check timing chain for teeth skipping, misalignment, elongation, etc.
- (b) Check camshaft signal plate for misalignment, looseness, etc.

NG

Replace timing chain or camshaft assembly.

OK

5 Check intake/exhaust phaser assembly

- (a) Check if operating condition of cam phase regulator is normal (dirt blocked, oil leaked, stuck, etc.).

NG

Replace intake/exhaust phaser assembly.

OK

6 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

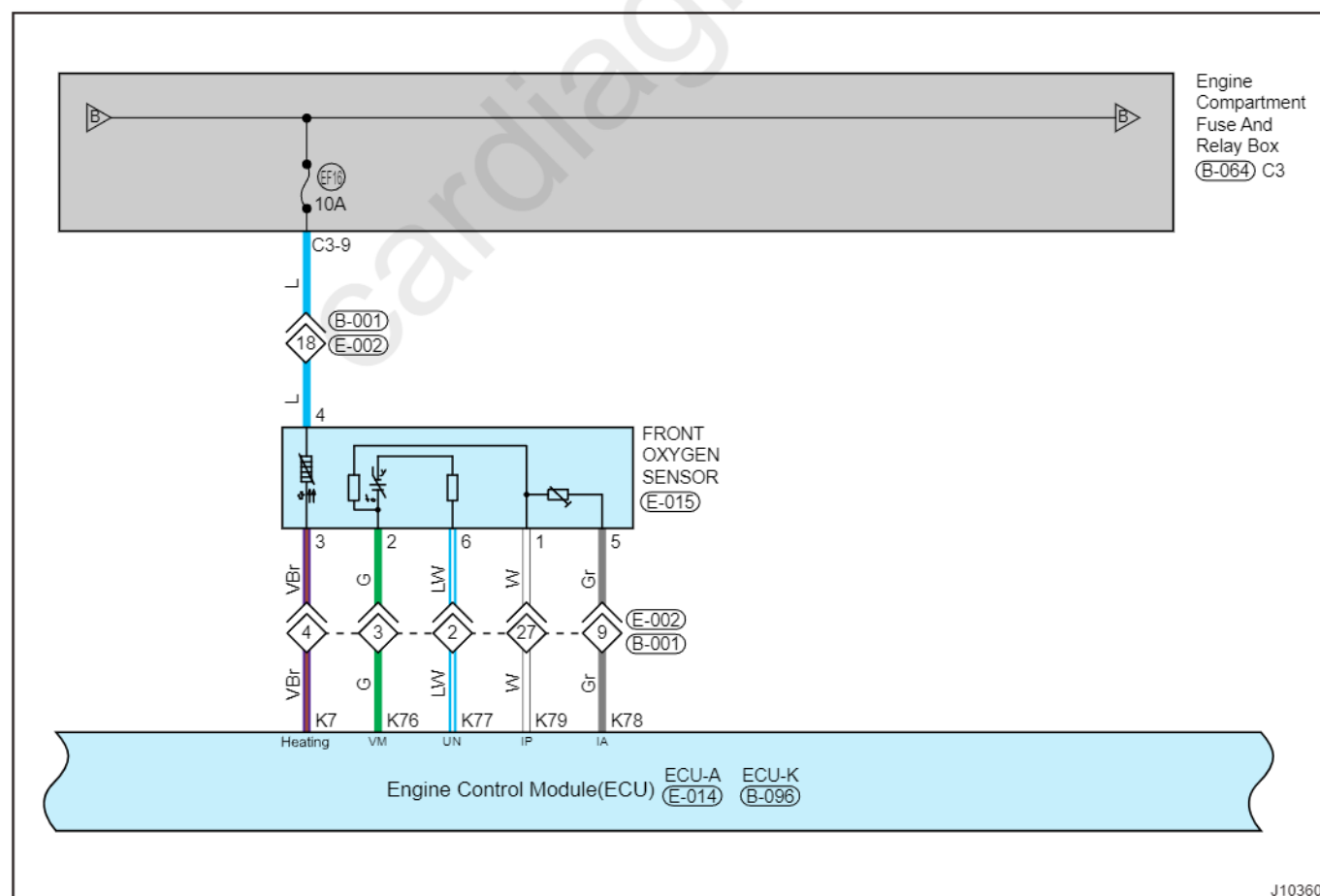
Conduct test and confirm malfunction has been repaired.

■ Upstream Oxygen Sensor Heater Control Circuit Open/Low/High/Faulty

DTC	P003000	HO2S Heater Control Circuit Bank 1 Sensor 1
DTC	P003100	O2 Sensor Heater Control Circuit Low (Upstream of the Catalyzer)
DTC	P003200	O2 Sensor Heater Control Circuit High (Upstream of the Catalyzer)
DTC	P005300	HO2S Heater Resistance Bank 1 Sensor 1
DTC	P064D00	Internal Control Module O2 Sensor Processor Performance Bank 1

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check upstream oxygen sensor connector

- Disconnect the negative battery.
- Unplug upstream oxygen sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

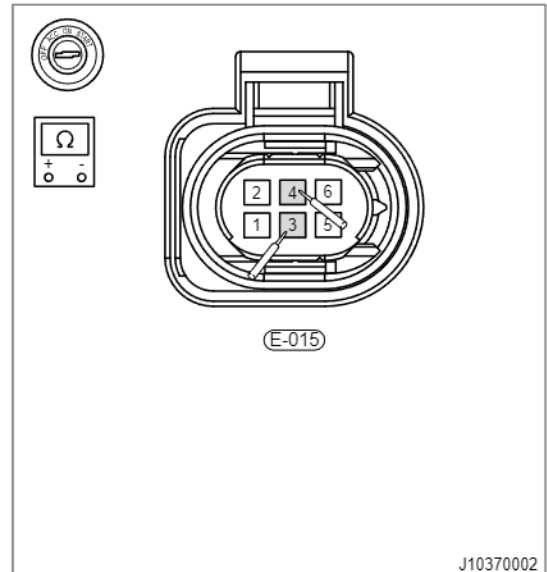
NG

Repair and adjust connector, or replace upstream oxygen sensor.

OK

2 Check upstream oxygen sensor heater internal resistance

- Using ohm band of multimeter, measure if internal resistances of upstream oxygen sensor E-015 (3-4) are normal with red and black probes respectively.



NG

Replace upstream oxygen sensor assembly.

OK

3 Check upstream oxygen sensor heater power supply fuse

- (a) Turn ENGINE START STOP switch to ON.
- (b) Check fuse EF16 10A in engine compartment fuse and relay box with 21 W test light.

Test light should be bright

NG

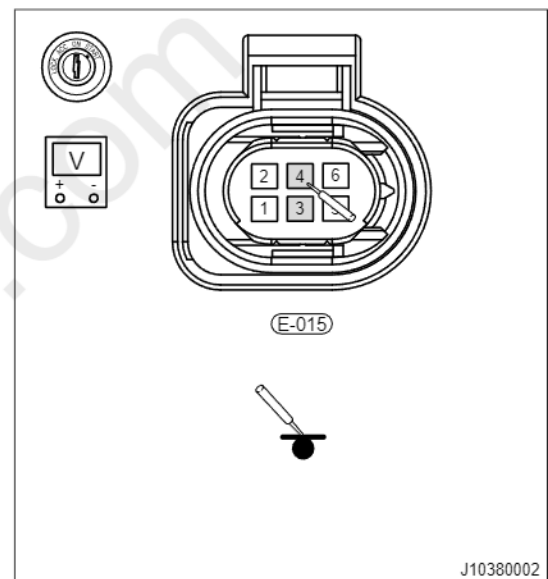
It indicates that there is short to ground in circuit.

OK

4 Check upstream oxygen sensor heater power supply and heater control terminal

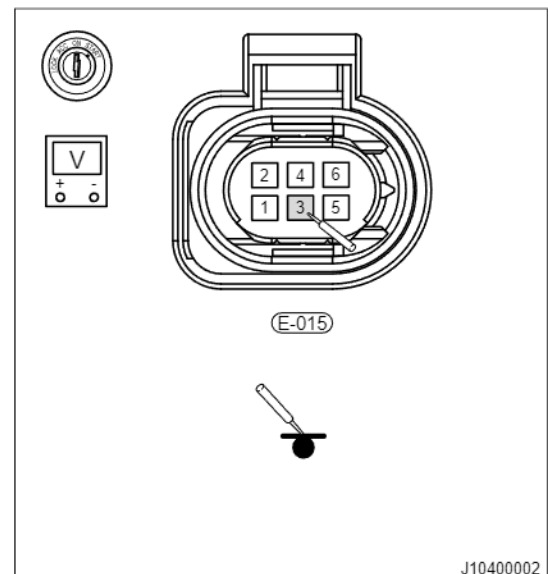
- (a) Install the upstream oxygen sensor connector.
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of upstream oxygen sensor E-015 (3, 4) with red probe.

Test voltage is current battery voltage



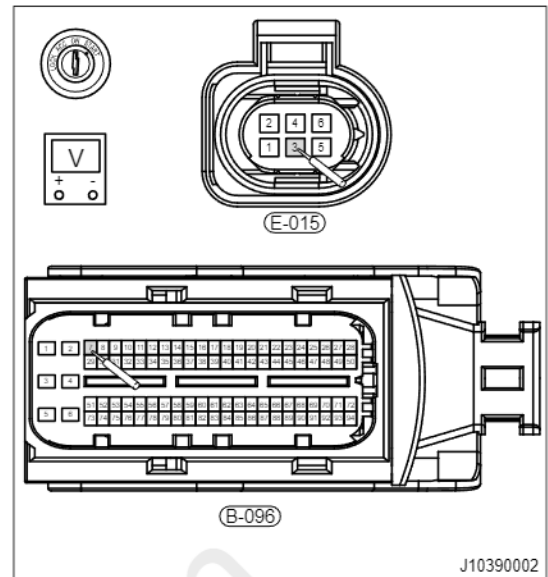
- (d) Start the engine.
- (e) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of upstream oxygen sensor E-015 (3) with red probe.

Control heating voltage should be within 0 V and current battery voltage



- (f) Start the engine.
- (g) Using voltage band of multimeter (voltage drop method), connect black probe to ECM B-096 (7), measure voltage of upstream oxygen sensor E-015 (3) with red probe.

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

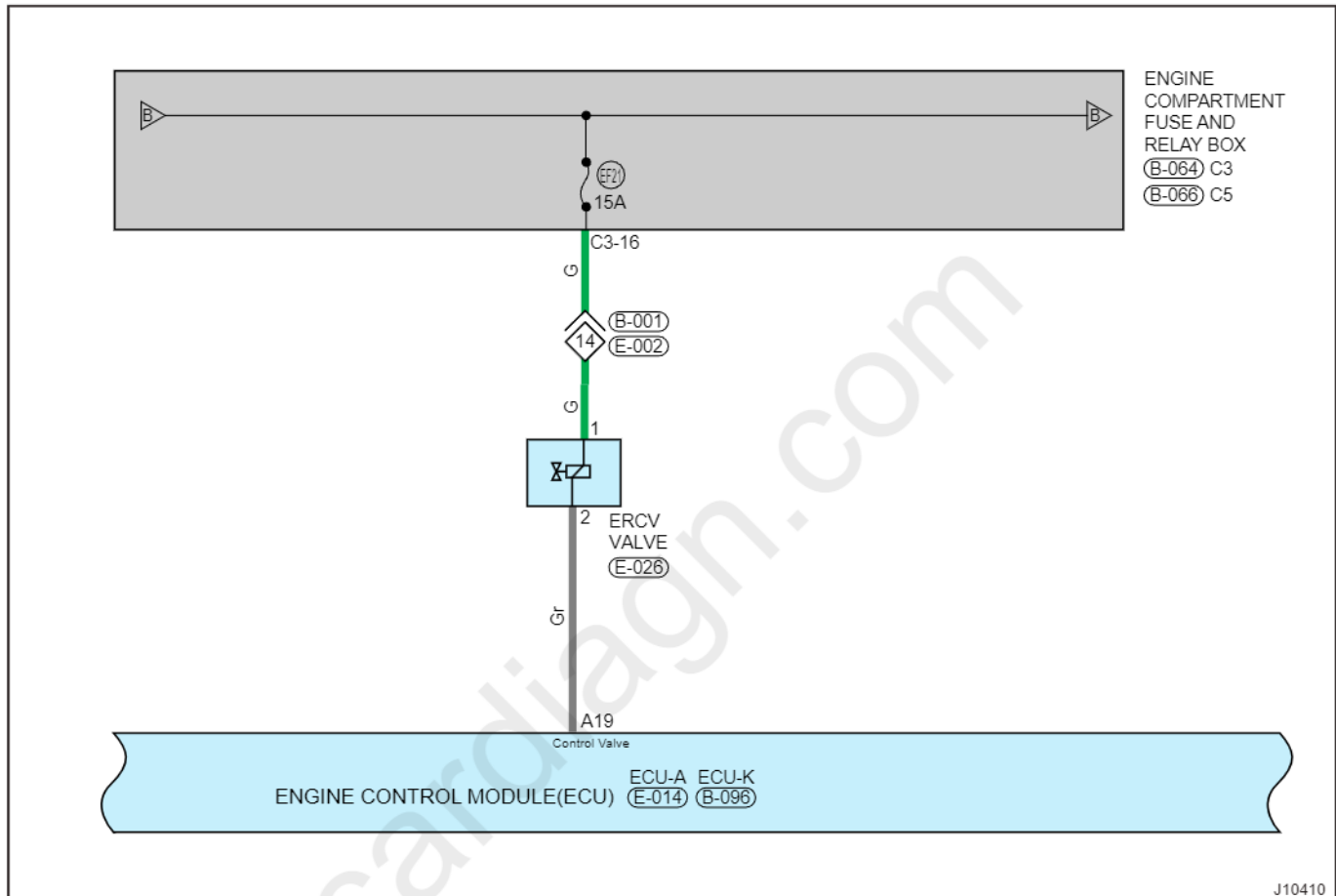
Conduct test and confirm malfunction has been repaired.

■ Boost Discharge Control Valve Drive Circuit Short to Ground/Power Supply

DTC	P003500	Dump Valve Control Circuit High
DTC	P003400	Dump Valve Control Circuit Low
DTC	P003300	Dump Valve Control Circuit Open

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check boost discharge control valve connector
---	---

- (a) Disconnect the negative battery.
- (b) Unplug boost discharge valve connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

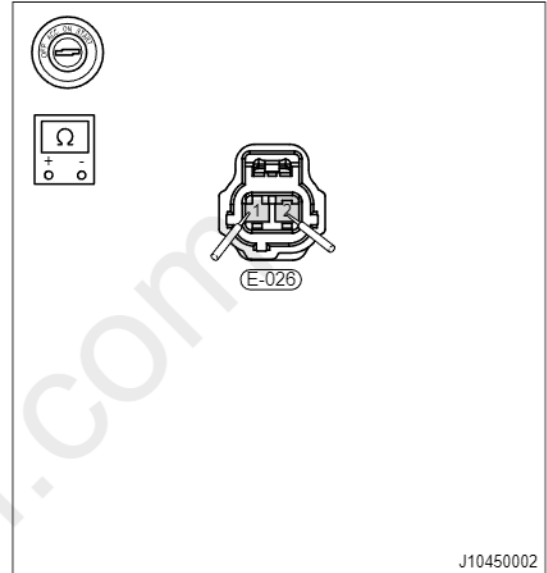
Repair and adjust connector, or replace boost discharge valve connector.

OK

2

Check boost discharge valve internal resistance

- (a) Using ohm band of multimeter, measure if internal resistances of boost discharge valve E-026 (1-2) are normal with red and black probes respectively.



NG

Replace boost discharge valve assembly.

OK

3

Check boost discharge valve power supply fuse

- (a) Turn ENGINE START STOP switch to ON.
(b) Check fuse EF21 15A in engine compartment fuse and relay box with 21 W test light.

Test light should be bright

NG

It indicates that there is short to ground in circuit.

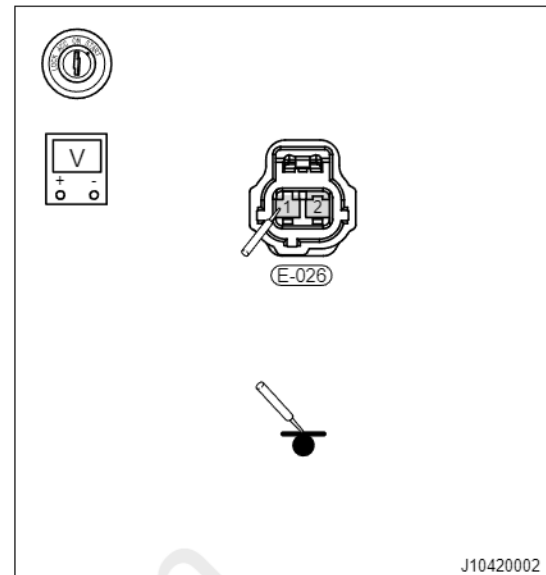
OK

4

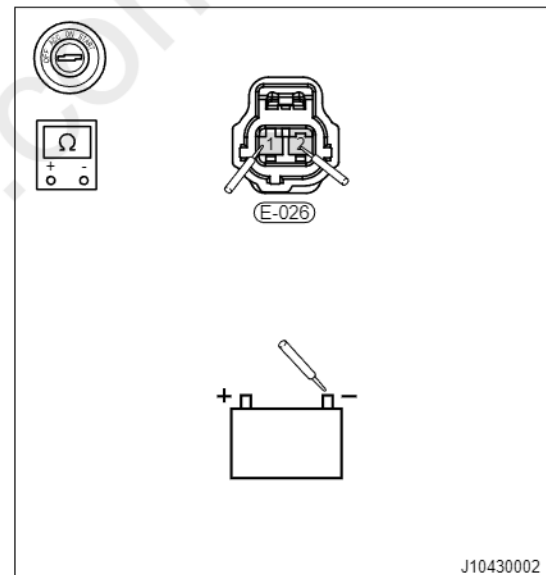
Check boost discharge valve power supply and heater control terminal

- (a) Connect the boost discharge valve connector.
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of boost discharge valve E-026 (1, 2) with red probe.

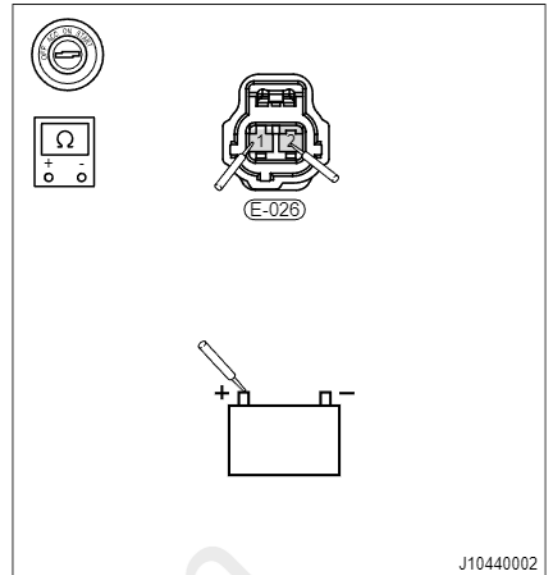
Test voltage is current battery voltage



- (d) Disconnect the boost discharge valve connector.
- (e) Disconnect engine compartment fuse and relay box fuse EF21 15A.
- (f) Disconnect the ECM (E-014) connector.
- (g) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of boost discharge valve E-026 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (h) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of boost discharge valve E-026 (1, 2) with red probe respectively. Check if circuit is short to power supply.



NG

Repair or replace wire harness.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

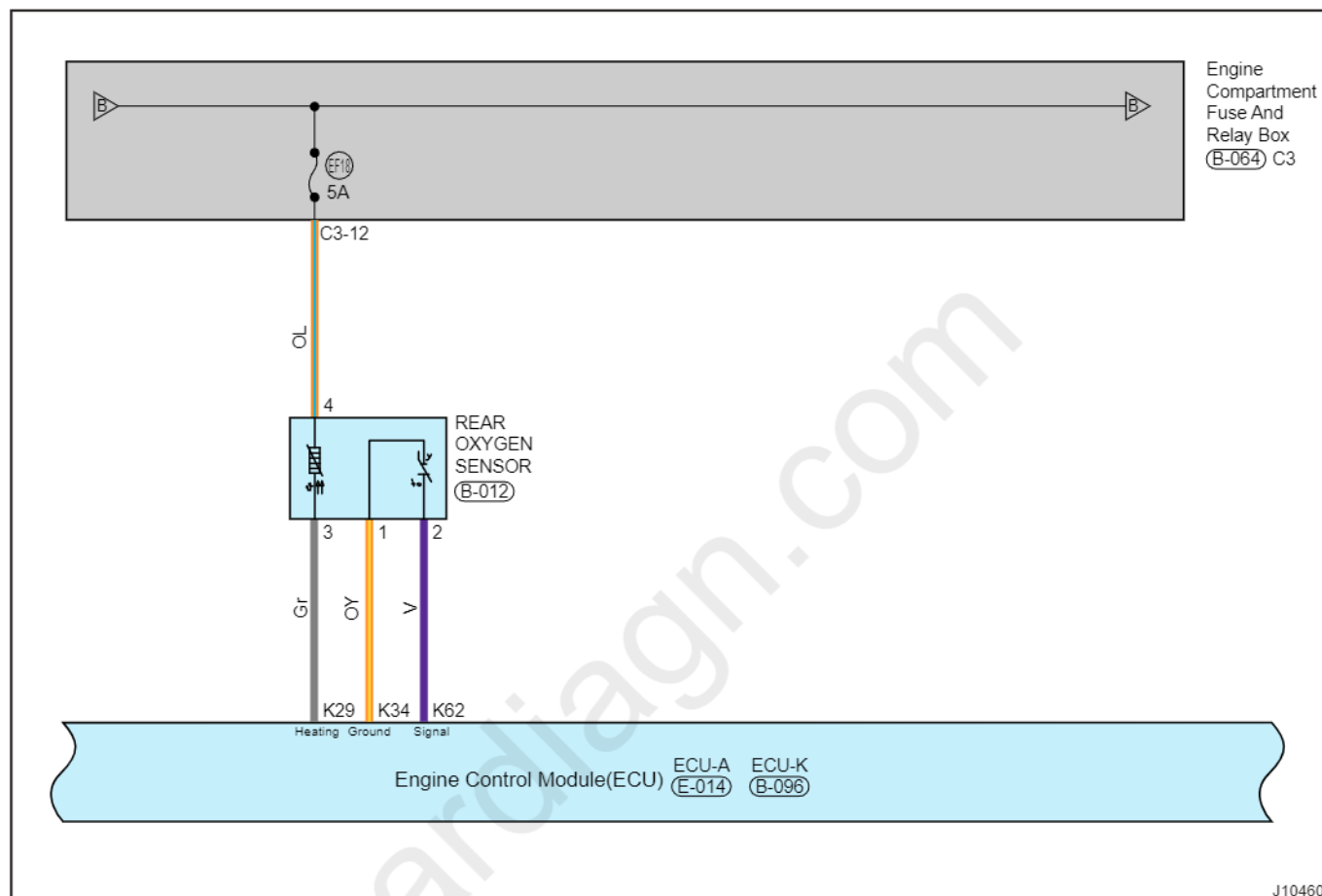
■ Downstream Oxygen Sensor Heater Control Circuit Open/Low/High/Heater Internal Resistance Non-plausible

DTC	P003600	HO2S Heater Control Circuit Bank 1 Sensor 2
DTC	P003700	HO2S Heater Control Circuit Low Bank 1 Sensor 2

DTC	P003800	HO2S Heater Control Circuit High Bank 1 Sensor 2
DTC	P005400	HO2S Heater Resistance Bank 1 Sensor 2
DTC	P223200	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 2

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check downstream oxygen sensor connector
---	--

- Disconnect the negative battery.
- Unplug downstream oxygen sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

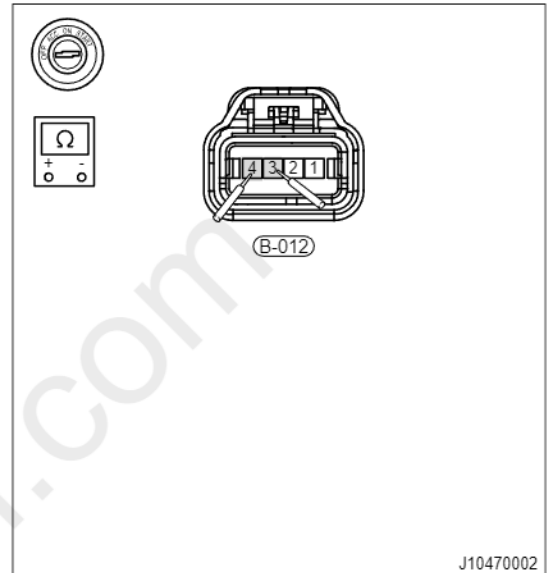
Repair and adjust connector, or replace downstream oxygen sensor.

OK

2

Check downstream oxygen sensor heater internal resistance

- (a) Using ohm band of multimeter, measure if internal resistances of downstream oxygen sensor B-012 (3-4) are normal with red and black probes respectively.



NG

Replace downstream oxygen sensor assembly.

OK

3

Check downstream oxygen sensor heater power supply fuse

- (a) Turn ENGINE START STOP switch to ON.
(b) Check fuse EF18 5A in engine compartment fuse and relay box with 21 W test light.

Test light should be bright

NG

It indicates that there is short to ground in circuit.

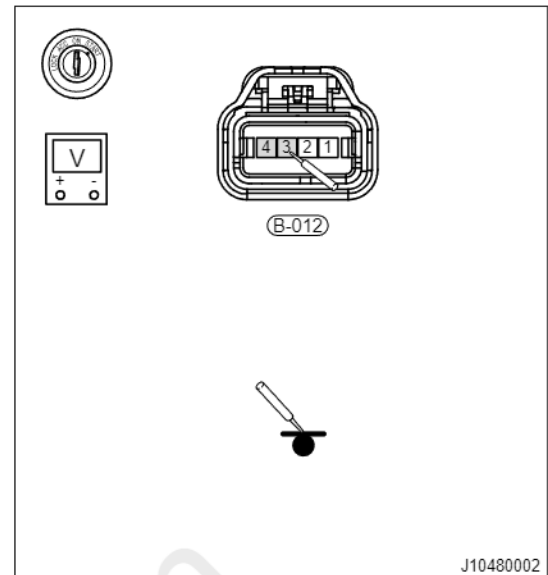
OK

4

Check downstream oxygen sensor heater power supply and heater control terminal

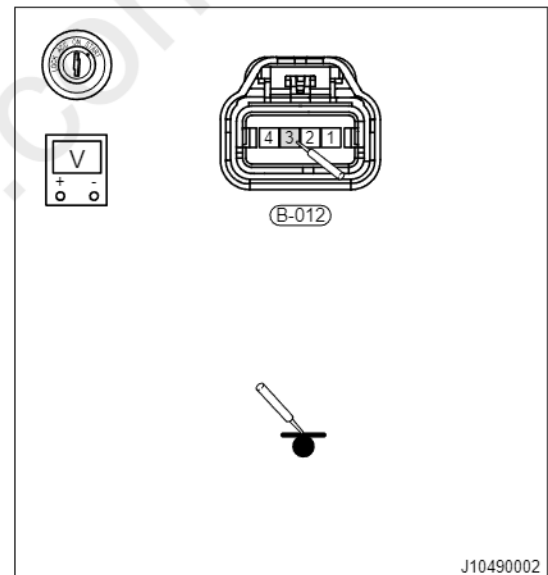
- (a) Install the upstream oxygen sensor connector.
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of downstream oxygen sensor B-012 (3, 4) with red probe.

Test voltage is current battery voltage



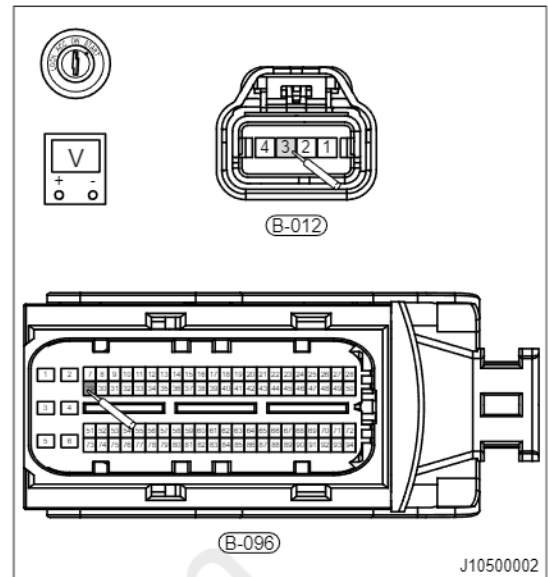
- (d) Start the engine.
- (e) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of downstream oxygen sensor B-012 (3) with red probe.

Control heating voltage should be within 0 V and current battery voltage



- (f) Start the engine.
- (g) Using voltage band of multimeter (voltage drop method), connect black probe to ECM B-096 (29), measure voltage of downstream oxygen sensor B-012 (3) with red probe

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Turbocharger Wastegate Self-learning/Duty Ratio Out of Limit

DTC	P003A00	Turbocharger/Supercharger Boost Control "A" Position Exceeded Learning Limit
DTC	P024477	Turbocharger/Supercharger Wastegate Actuator "A" Range/Performance
DTC	P024437	Turbocharger/Supercharger Wastegate Actuator "A" Range/Performance

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check by-pass valve actuator conditions

- Check for foreign matter near turbocharger closed position.
- Check if electronic waste gate is stuck.
- Push the turbocharger to closed position manually, read position voltage to check if it is out of the range of SPEC.

NG

Clean up foreign matter or replace turbocharger assembly.

OK

2 Check by-pass valve actuator connector

- Check if connector and wire harness are deteriorated.

NG

Repair or replace wire harness.

OK

3 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

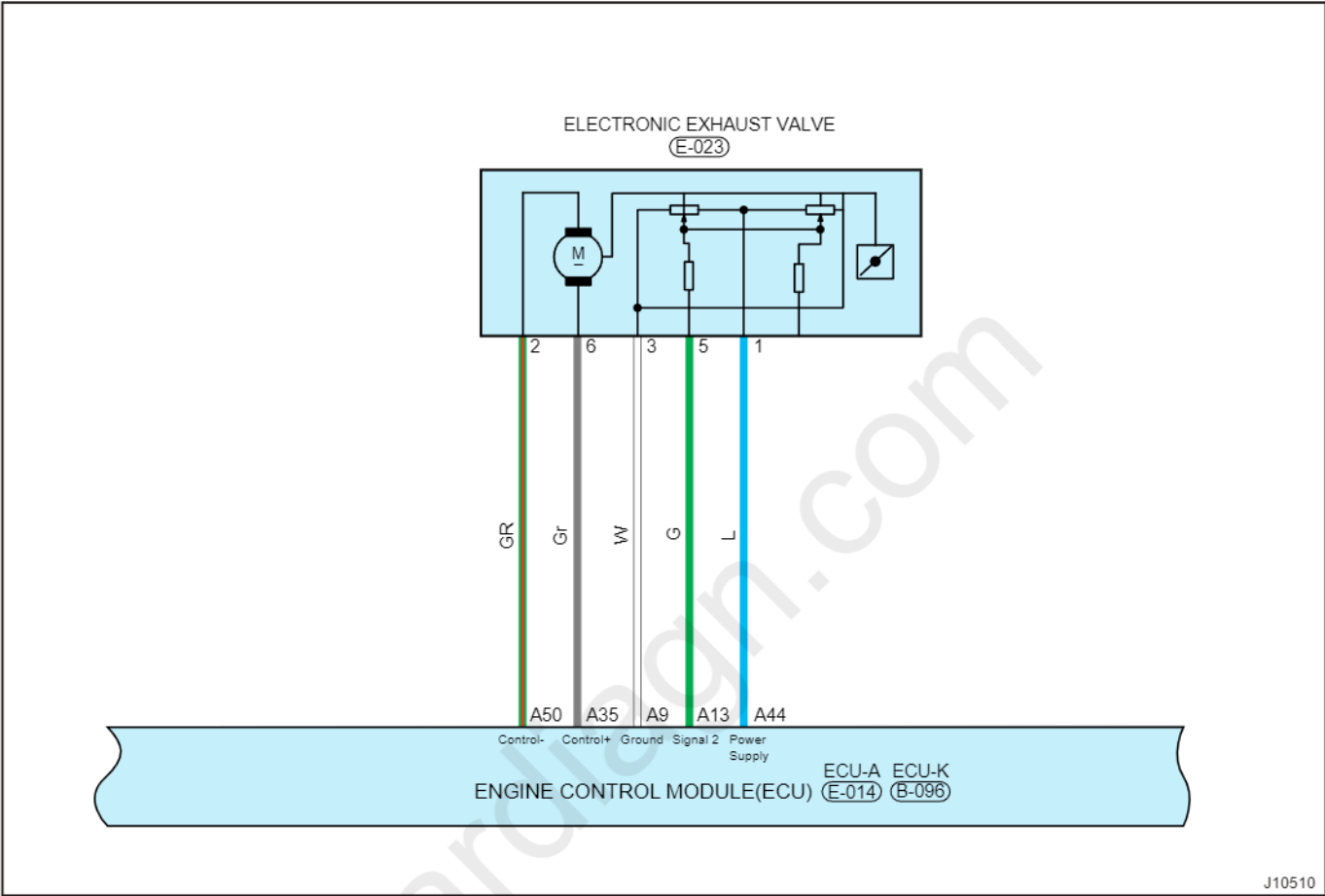
Conduct test and confirm malfunction has been repaired.

■ Turbocharger Electronic Waste Gate Position Sensor Voltage Low/High

DTC	P256400	Turbocharger Boost Control Position Sensor "A" Circuit Low
DTC	P256500	Turbocharger Boost Control Position Sensor "A" Circuit High

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check electronic waste gate connector
---	---------------------------------------

- (a) Disconnect the negative battery.
- (b) Disconnect the electronic waste gate connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

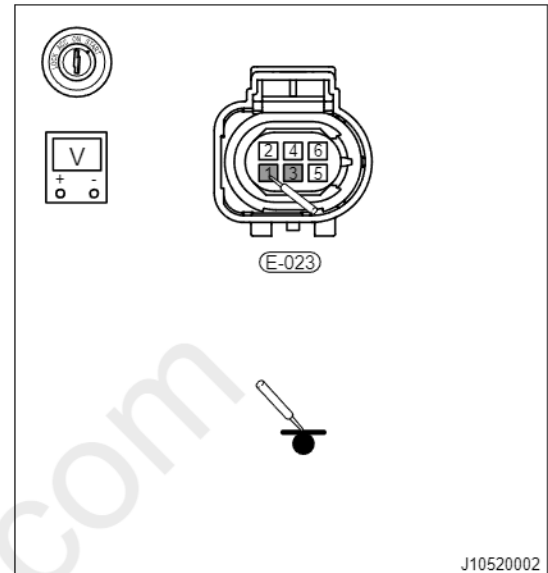
OK

2 Check electronic waste gate position sensor power supply and ground

- (a) Connect electronic waste gate connector.
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of electronic waste gate position sensor E-023 (1, 3) with red probe.

Reference power supply: 5 V

Ground: 0 V



NG

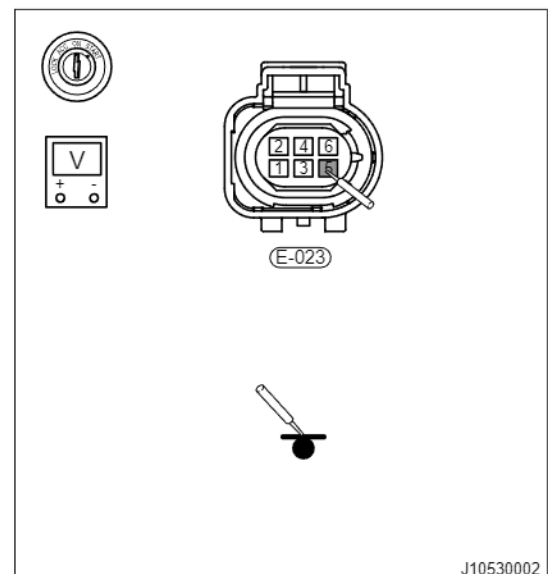
Repair wire harness or replace engine control unit.

OK

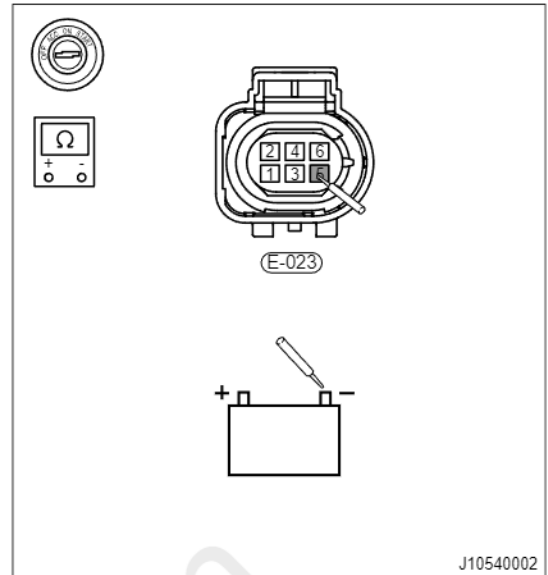
3 Check electronic waste gate position sensor signal terminal

- (a) Connect the boost discharge valve connector.
- (b) Start the engine.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure if voltage of electronic waste gate position sensor E-023 (5) varies according to opening angle with red probe.

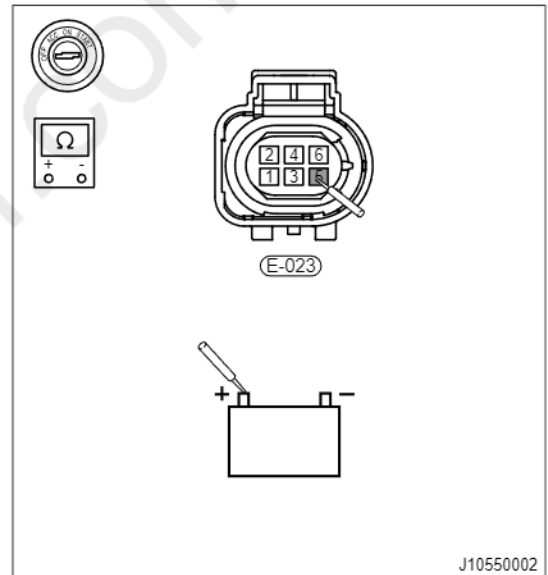
Test voltage is current battery voltage



- (d) Disconnect the electronic waste gate connector.
- (e) Disconnect the ECM (E-014) connector.
- (f) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of electronic waste gate position sensor E-023 (5) with red probe respectively. Check if circuit is short to ground.



- (g) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistance of electronic waste gate position sensor E-023 (5) with red probe respectively. Check if circuit is short to power supply.



NG

Repair or replace wire harness or replace turbocharger assembly.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Ambient pressure sensor malfunction

DTC	P222900	Barometric Pressure Sensor "A" Circuit High
DTC	P222800	Barometric Pressure Sensor "A" Circuit Low
DTC	P222722	Barometric Pressure Sensor "A" Circuit Range/Performance
DTC	P222721	Barometric Pressure Sensor "A" Circuit Range/Performance
DTC	P120200	Barometric Pressure Sensor "A" Circuit Range/Performance
DTC	P120300	Barometric Pressure Sensor "A" Circuit Range/Performance

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check Engine Control Module (ECM)

- (a) The built-in ambient pressure sensor in ECM fails.
- (b) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (c) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

2 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ High Pressure Fuel Supply Control Deviation Too High/Too Low/Fuel Rail Pressure Too Low/Too High

DTC	P008985	Fuel Pressure Regulator 1 Performance-Pressure Too Low
DTC	P008984	Fuel Pressure Regulator 1 Performance-Pressure Too High
DTC	P008700	Fuel Rail/System Pressure - Too Low
DTC	P008800	Fuel Rail/System Pressure - Too High
DTC	P053F21	Cold Start Fuel Pressure Performance
DTC	P053F22	Cold Start Fuel Pressure Performance
DTC	P00C600	Fuel Rail Pressure Too Low - Engine Cranking Bank 1

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check if fuel is insufficient

- (a) Check that fuel in fuel tank is sufficient.

NG

Add the fuel.

OK

2 Check fuel connecting line for leakage

- (a) Check low pressure/high pressure fuel connecting lines for squash, leakage.

NG

Replace the corresponding line.

OK

3 Check low pressure fuel pressure

- (a) Connect fuel pressure gauge to test if low pressure fuel pressure is met the standard.

NG**Replace fuel pump assembly.****OK****4 Check high pressure fuel pump**

- (a) Remove the high pressure fuel pump;
 (b) Check high pressure fuel pump for fuel leakage.
 (c) Check relief valve for blockage or abnormal operation.

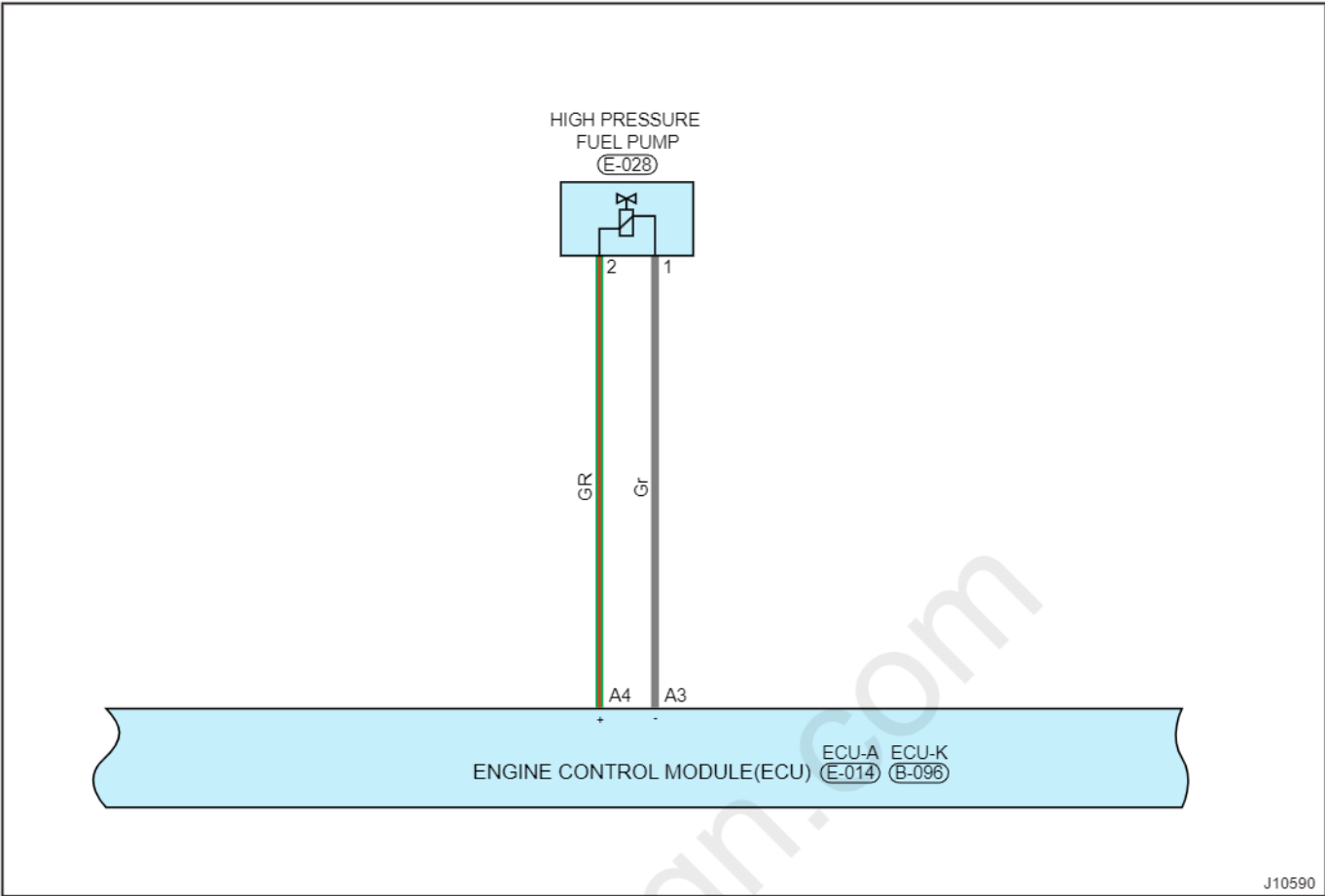
NG**Replace high pressure fuel pump assembly.****OK****5 Reconfirm DTCs**

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK**Conduct test and confirm malfunction has been repaired.****■ Fuel Pressure Regulator 1 Control Circuit Open**

DTC	P009000	Fuel Pressure Regulator 1 Control Circuit Open
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■ Description**Circuit Diagram**



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check flow control valve connector
---	------------------------------------

- (a) Disconnect the negative battery.
- (b) Unplug flow control valve connector, check if this connector is loose, and contact between male and female terminals is in good condition.

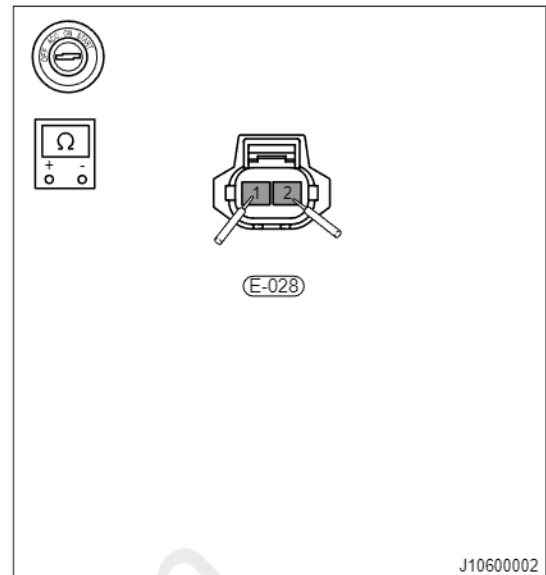
NG

Repair and adjust connector, or replace it.

OK

2	Check flow control valve internal resistance
---	--

- (a) Using ohm band of multimeter, measure if internal resistances of flow control valve E-028 (1-2) are normal with red and black probes respectively.



NG

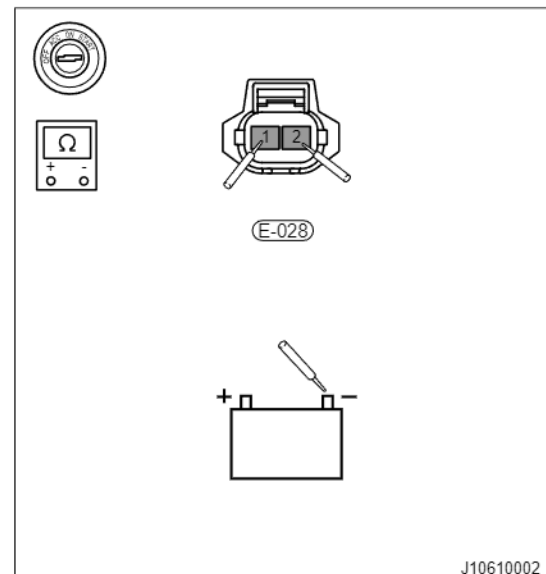
Replace high pressure fuel pump assembly.

OK

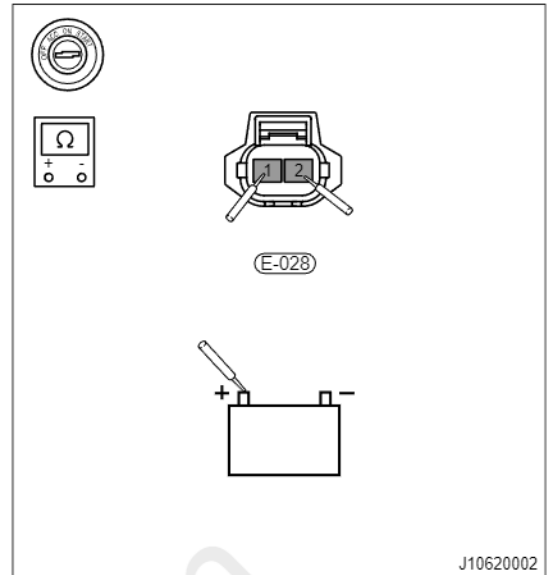
3

Check for short circuit to ground / power supply in flow control valve control circuit

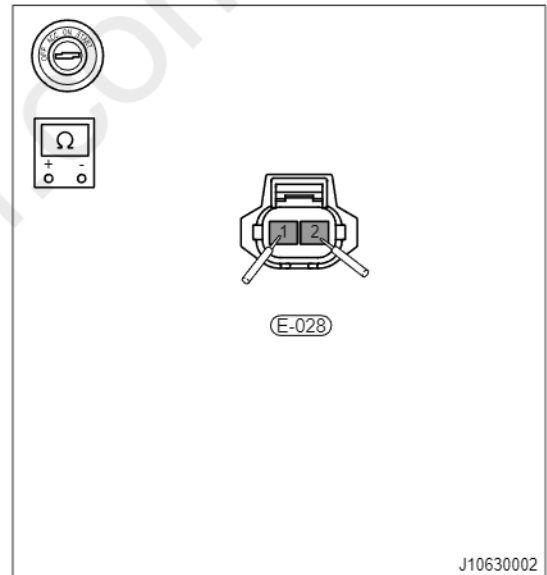
- (a) Disconnect the high pressure fuel pump connector.
 (b) Disconnect the ECM (E-014) connector.
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of high pressure fuel pump E-028 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of high pressure fuel pump E-028 (1, 2) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of high pressure fuel pump E-028 (1, 2) with red and black probes respectively. Check if control circuits are shorted with each other.



NG

Repair or replace wire harness.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5	Reconfirm DTCs
----------	-----------------------

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

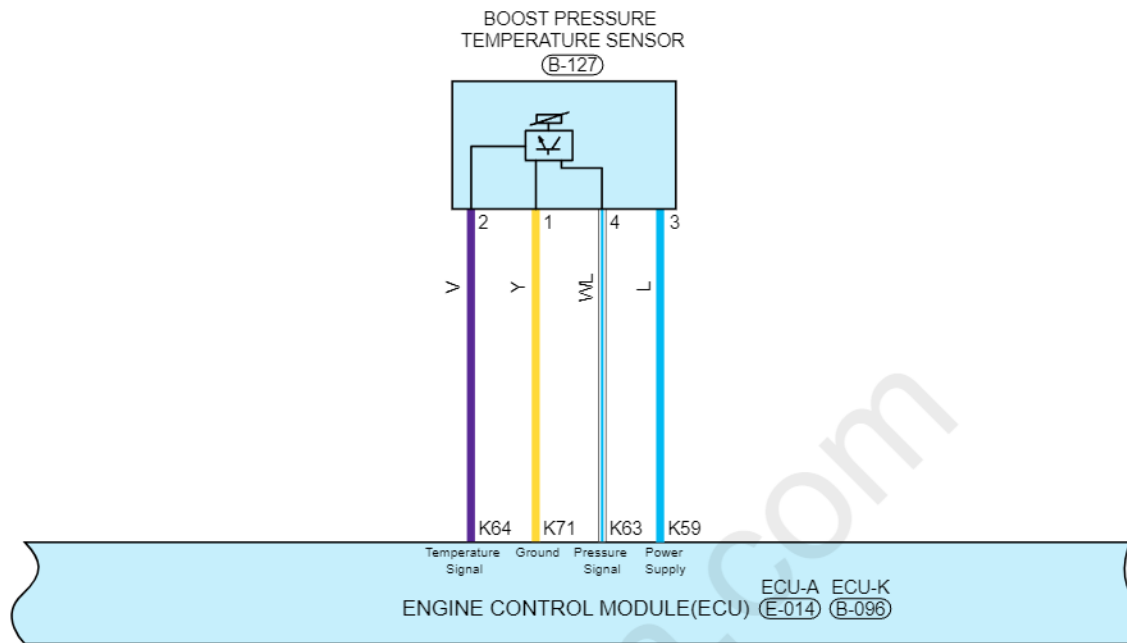
Conduct test and confirm malfunction has been repaired.

■ Intake Air Sensor 2 Voltage Too High/Too Low/Signal Non-plausible

DTC	P009800	Intake Air Temperature Sensor 2 Circuit High Bank 1
DTC	P009700	Intake Air Temperature Sensor 2 Circuit Low Bank 1
DTC	P009900	Intake Air Temperature Sensor 2 Circuit Intermittent Bank 1
DTC	P138024	Intake Air Temperature Sensor 2 Multiple Check Bank1
DTC	P138023	Intake Air Temperature Measurement System - Multiple Sensor Correlation Bank 2

■ Description

Circuit Diagram



J11580

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check boost pressure/temperature sensor connector

- Disconnect the negative battery.
- Unplug boost pressure/temperature sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

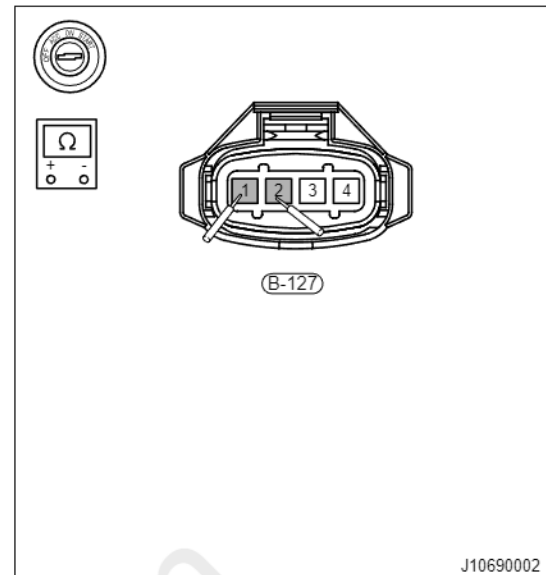
NG

Repair and adjust connector, or replace boost pressure/temperature sensor.

OK

2 Check boost pressure/temperature sensor internal resistance

- (a) Using ohm band of multimeter, measure if resistances of boost pressure/temperature sensor B-127 (1-2) are normal with red and black probes respectively. They should vary in accordance with intake temperature.



NG

Replace boost pressure/temperature sensor assembly.

OK

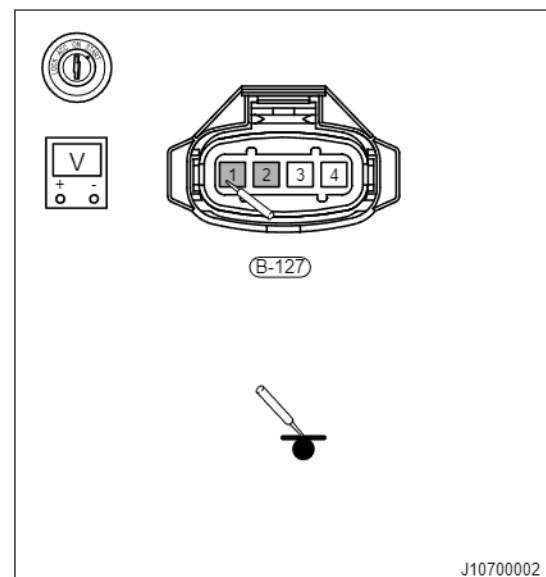
3

Check boost pressure/temperature sensor signal terminal and ground terminal

- (a) Connect boost pressure/temperature sensor connector.
 (b) Start the engine.
 (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of boost pressure/temperature sensor B-127 (1, 2) with red probe.

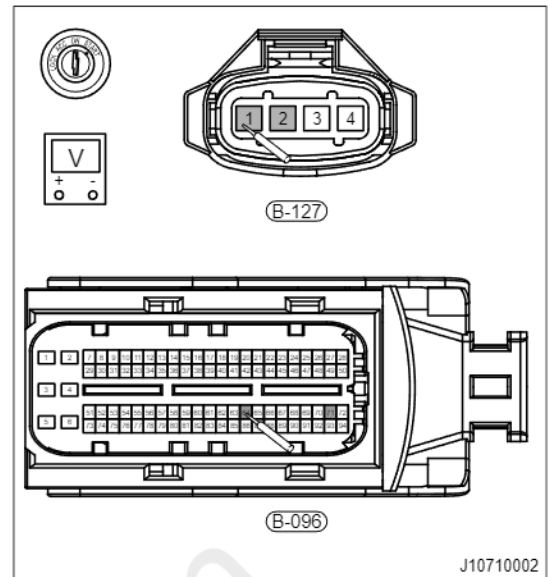
Signal terminal: Voltage signal should vary in accordance with intake temperature.

Ground terminal: Voltage < 0.2 V



- (d) Using voltage band of multimeter (voltage drop method), connect black probe to ECM B-096 (71, 64), measure voltages of boost pressure/temperature sensor B-127 (1, 2) with red probe

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

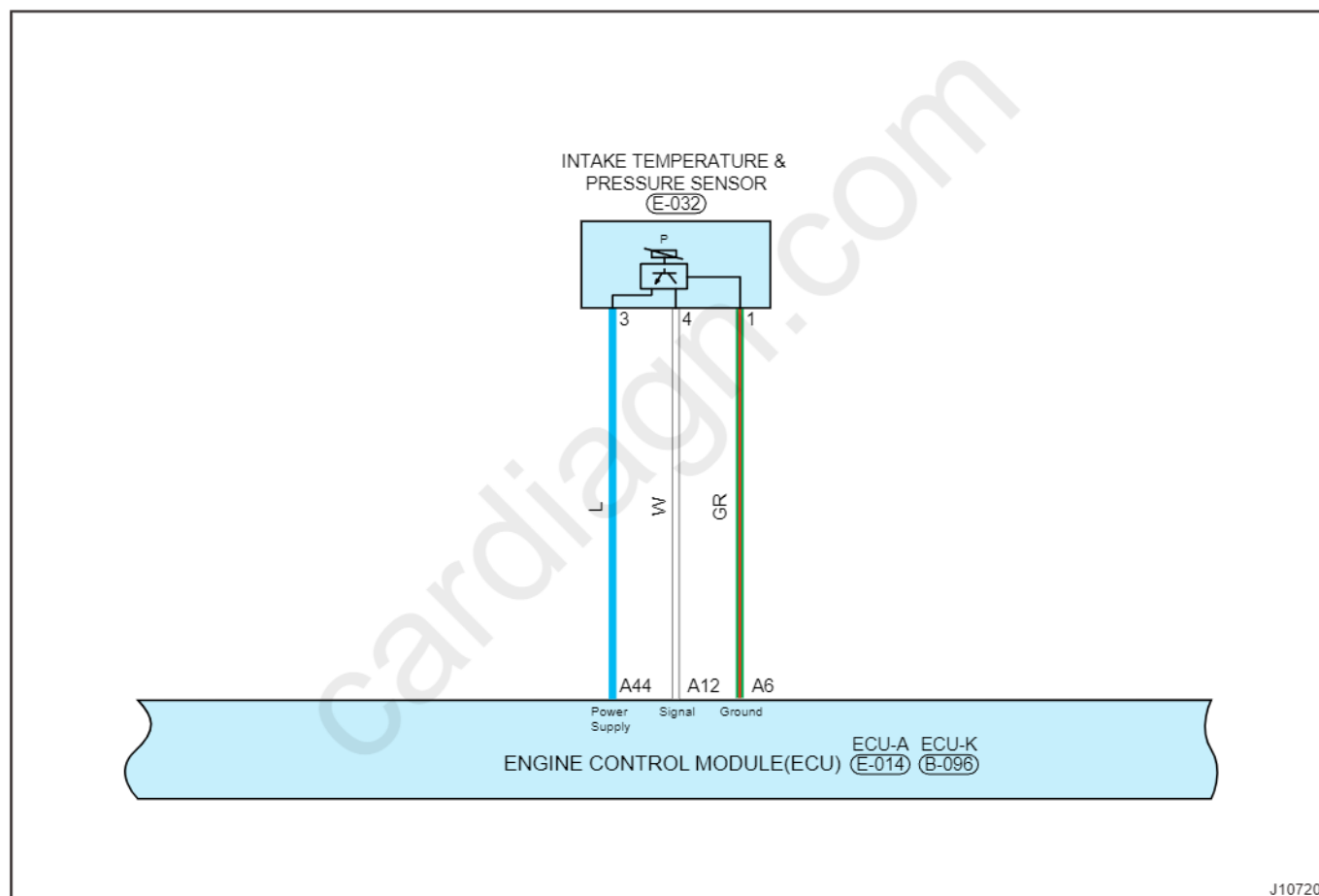
Conduct test and confirm malfunction has been repaired.

■ Intake Pressure/Temperature Sensor Malfunction

DTC	P120000	Manifold Absolute Pressure Sensor Circuit Range/Performance
DTC	P120100	Manifold Absolute Pressure Sensor Circuit Range/Performance

DTC	P00C721	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1
DTC	P00C722	Intake Air Pressure Measurement System - Multiple Sensor Correlation Bank 1
DTC	P010800	Manifold Absolute Pressure Sensor Circuit High
DTC	P010700	Manifold Absolute Pressure Sensor Circuit Low
DTC	P010622	Manifold Absolute Pressure Sensor Circuit Range/Performance
DTC	P010621	Manifold Absolute Pressure Sensor Circuit Range/Performance
DTC	P01062A	Manifold Absolute Pressure Sensor Circuit Range/Performance

■ Description
Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check intake pressure/temperature sensor connector
---	--

- (a) Disconnect the negative battery.
- (b) Unplug intake pressure sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace intake pressure sensor.

OK

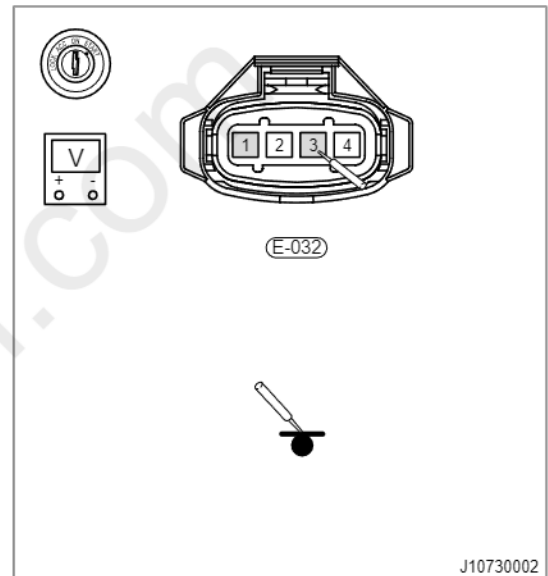
2

Check intake pressure/temperature sensor power supply and ground terminals

- (a) Connect boost pressure/temperature sensor connector.
- (b) Start the engine.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of intake pressure/temperature sensor E-032 (1, 3) with red probe.

Power supply terminal: 5 V

Ground terminal: Voltage < 0.2 V



NG

Repair or replace wire harness.

OK

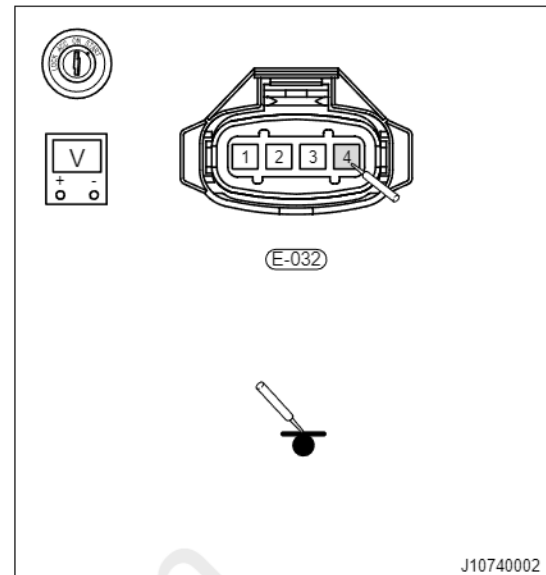
3

Check intake pressure/temperature sensor signal terminal

- (a) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of intake pressure/temperature sensor E-032 (4) with red probe.

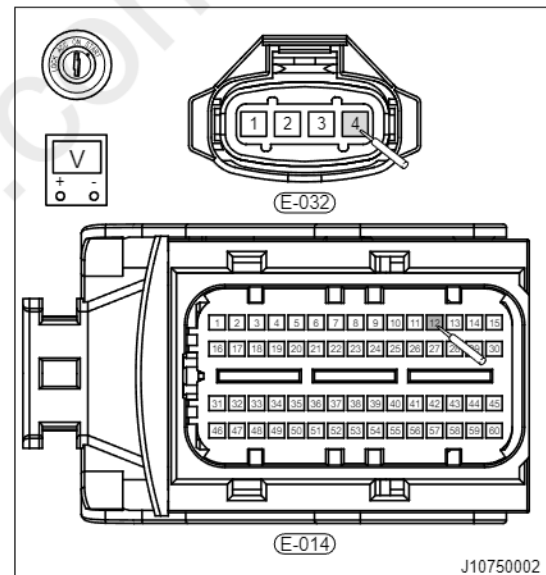
Under idling state: 1 V

When the vehicle accelerates rapidly, voltage can instantly reach 4 V, and then drop to 1.7 V



- (b) Using voltage band of multimeter (voltage drop method), connect black probe to ECM E-014 (12), measure voltage of intake pressure/temperature sensor E-032 (4) with red probe.

Test voltage drop value should be less approximately 0.2 V



NG

Repair and replace wire harness, or replace intake pressure/temperature sensor.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ **Boost Pressure Out of Range High/Low/Non-plausible**

DTC	P120400	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance
DTC	P120500	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance
DTC	P023622	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance
DTC	P023621	Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance

■ **DTC Confirmation Procedure**

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check intake line condition

- (a) Check if intake line is detached or seriously air leaked.

NG

Repair and adjust or replace related connecting lines.

OK

2 Check boost pressure/temperature sensor

- (a) Check boost pressure/temperature sensor connector for looseness or poor contact.
- (b) Check if there is any freeze, oil stain, etc. on measurement terminal of boost pressure/temperature sensor, which will affect normal measurement.

NG

Adjust connector, or replace boost pressure/temperature sensor.

OK

3

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

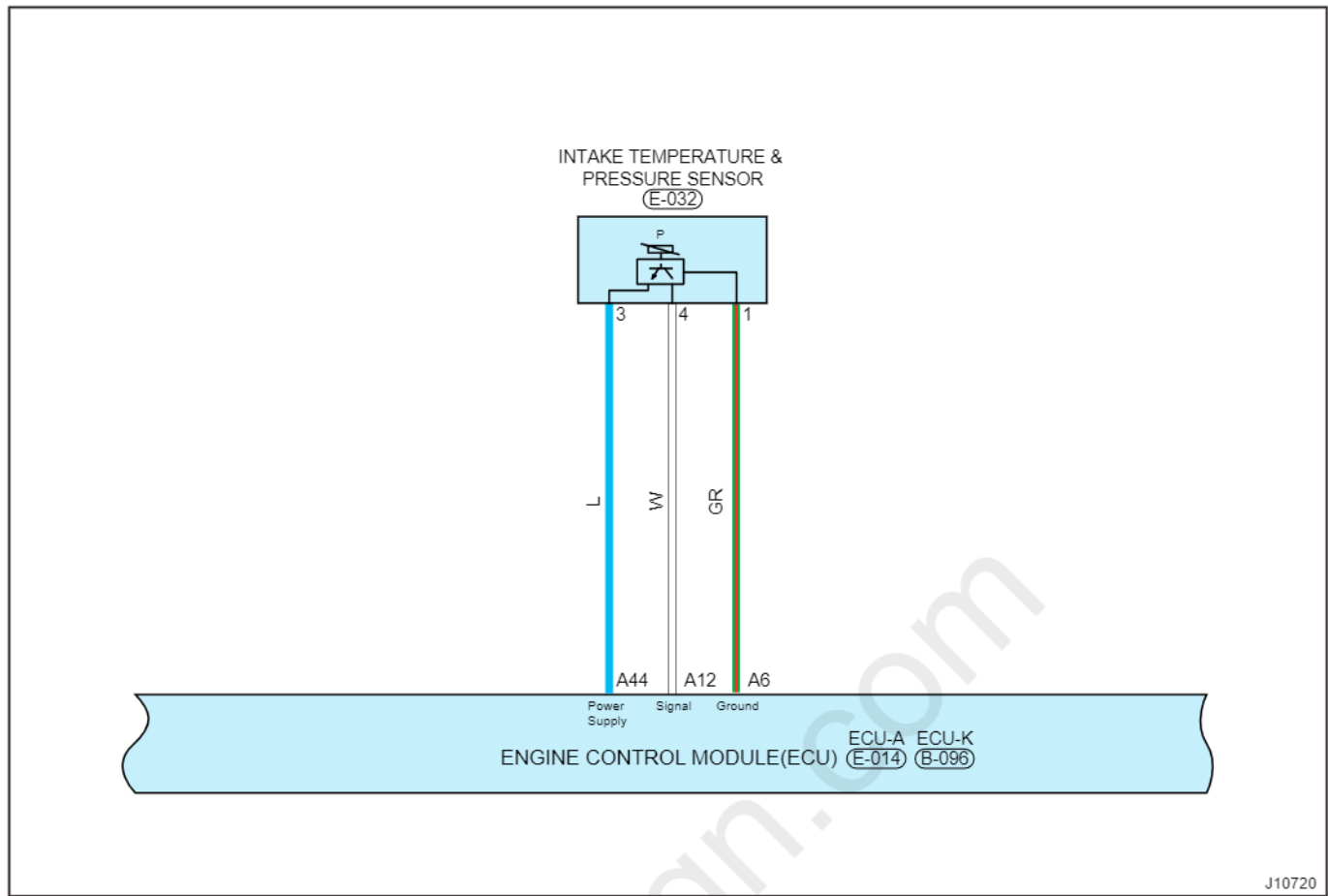
Conduct test and confirm malfunction has been repaired.

■ Intake pressure sensor malfunction

DTC	P138124	Intake Air Temperature Sensor 3 Multiple Check Bank1
DTC	P138123	Intake Air Temperature Measurement System - Multiple Sensor Correlation Bank 3
DTC	P00EB00	Intake Air Temperature Sensor 3 Circuit High Bank 1
DTC	P00EA00	Intake Air Temperature Sensor 3 Circuit Low Bank 1
DTC	P00EC00	Intake Air Temperature Sensor 3 Circuit Intermittent Bank 1

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check intake pressure/temperature sensor connector
---	---

- (a) Disconnect the negative battery.
- (b) Unplug intake pressure/temperature sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

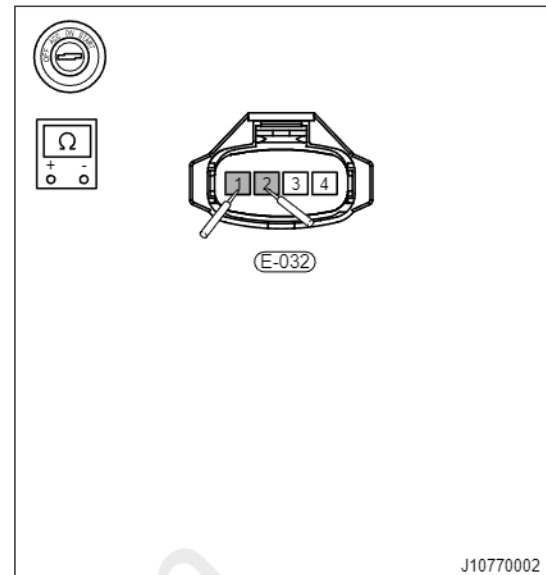
Repair and adjust connector, or replace intake pressure/temperature sensor.

OK

2	Check intake pressure/temperature sensor resistance
---	--

- (a) Using ohm band of multimeter, measure if resistances of intake pressure/temperature sensor E-032 (1-2) are normal with red and black probes respectively.

Rated resistance at 20°C: 2.5 KΩ ± 5%



NG

Replace intake pressure/temperature sensor assembly.

OK

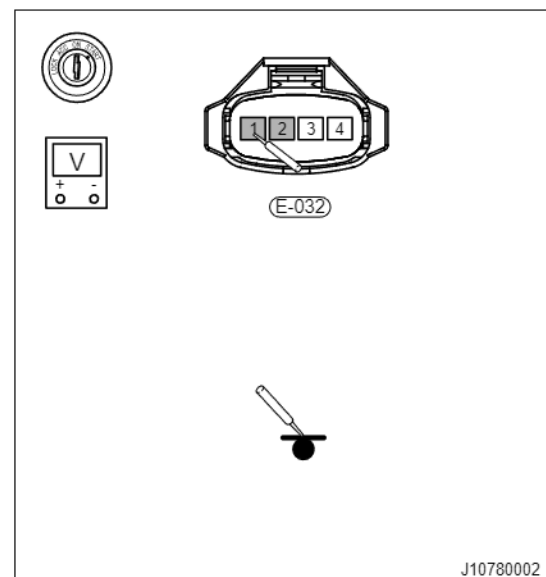
3

Check intake pressure/temperature sensor signal and ground terminals

- (a) Connect the intake pressure/temperature sensor connector.
 (b) Start the engine.
 (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of intake pressure/temperature sensor E-032 (1, 2) with red probe.

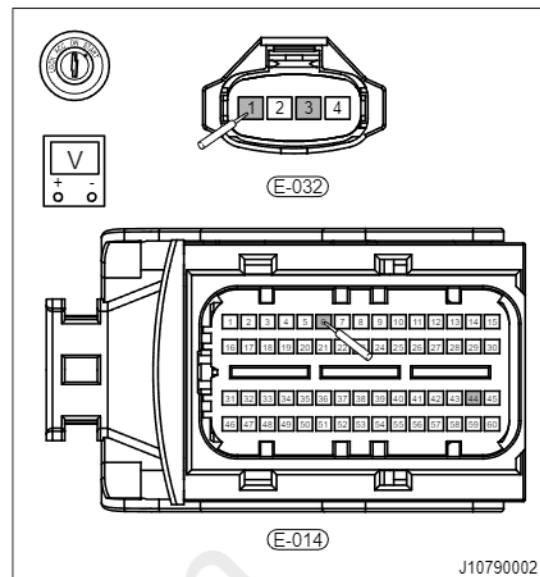
Signal terminal: Signal voltage should vary in accordance with temperature

Ground terminal: Voltage < 0.2 V



- (d) Using voltage band of multimeter (voltage drop method), connect black probe to ECM E-014 (6, 44), measure voltages of intake pressure/temperature sensor E-032 (1, 3) with red probe

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

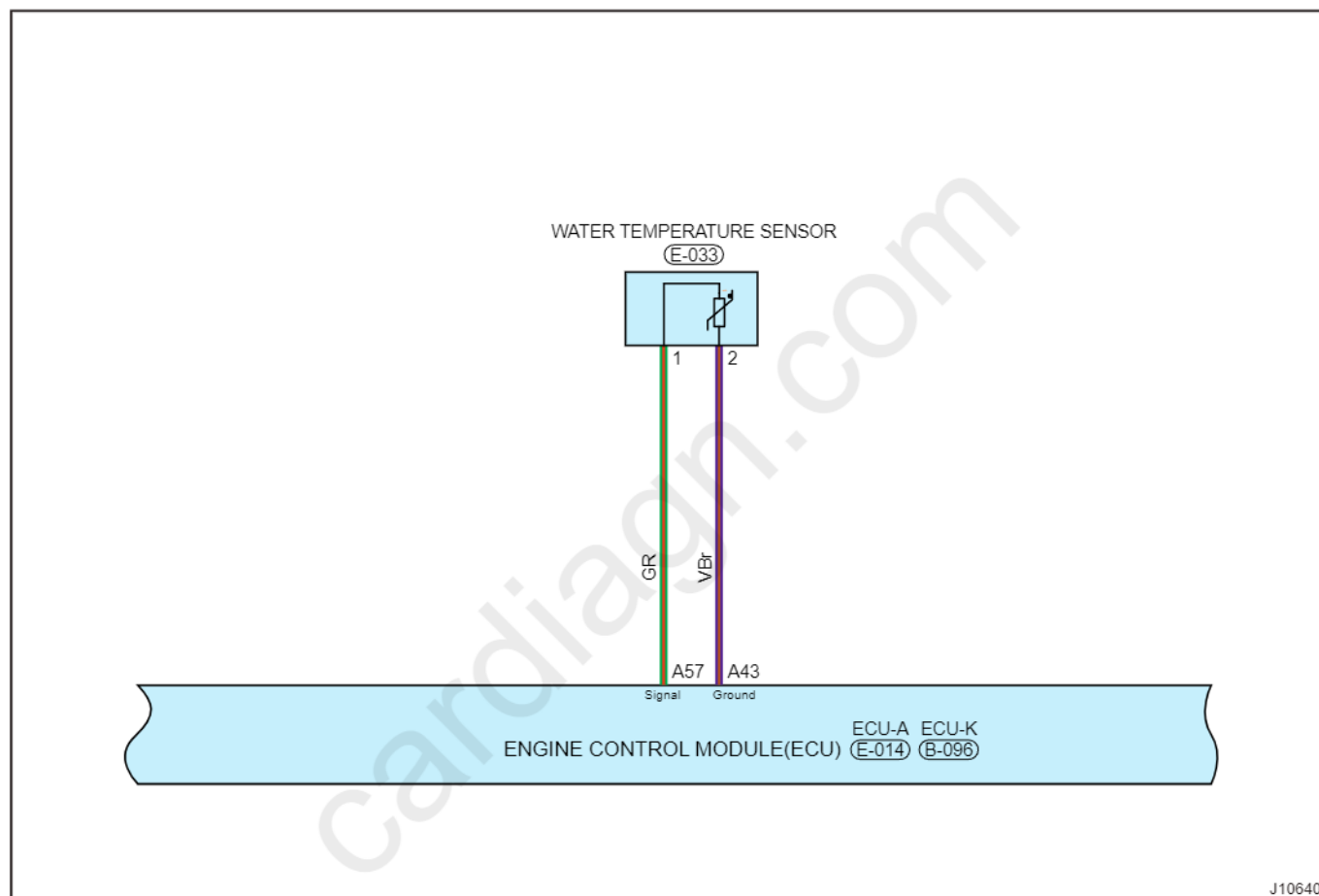
■ Coolant Temperature Sensor 1 Malfunction

DTC	P011623	Engine Coolant Temperature Sensor 1 Circuit Range/Performance
DTC	P011626	Engine Coolant Temperature Sensor 1 Circuit Range/Performance

DTC	P050C24	Cold Start Engine Coolant Temperature Performance
DTC	P050C23	Cold Start Engine Coolant Temperature Performance
DTC	P011700	Engine Coolant Temperature Sensor 1 Circuit Low
DTC	P011800	Engine Coolant Temperature Sensor 1 Circuit High
DTC	P011900	Engine Coolant Temperature Sensor 1 Circuit Intermittent

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check coolant temperature sensor 1 connector
---	--

- (a) Disconnect the negative battery.
- (b) Unplug coolant temperature sensor 1 connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

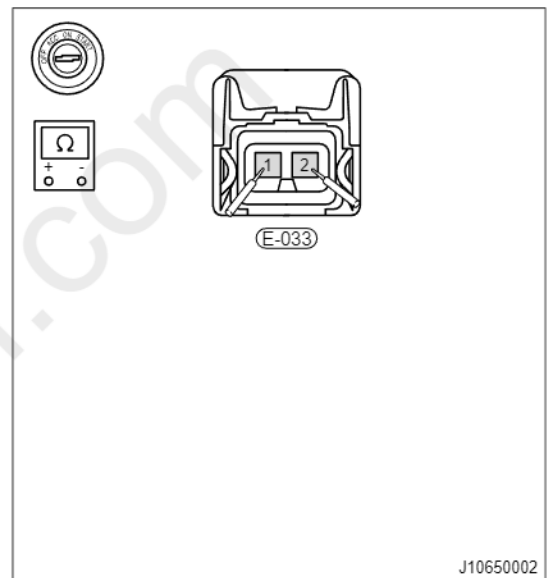
Repair and adjust connector, or replace coolant temperature sensor 1.

OK

2

Check coolant temperature sensor internal resistance

- (a) Using ohm band of multimeter, measure if internal resistances of coolant temperature sensor E-033 (1, 2) are normal with red and black probes respectively. They should vary in accordance with coolant temperature.



J10650002

NG

Replace coolant temperature sensor.

OK

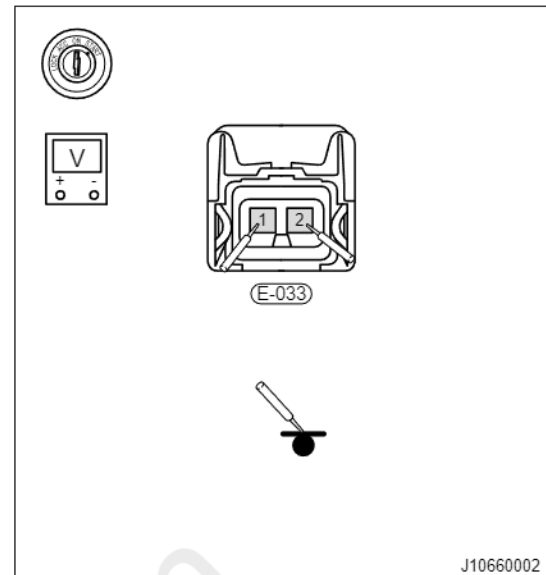
3

Check coolant temperature sensor signal terminal and ground terminal

- (a) Check coolant temperature sensor 1 connector.
- (b) Start the engine.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of coolant temperature sensor E-033 (1, 2) with red probe.

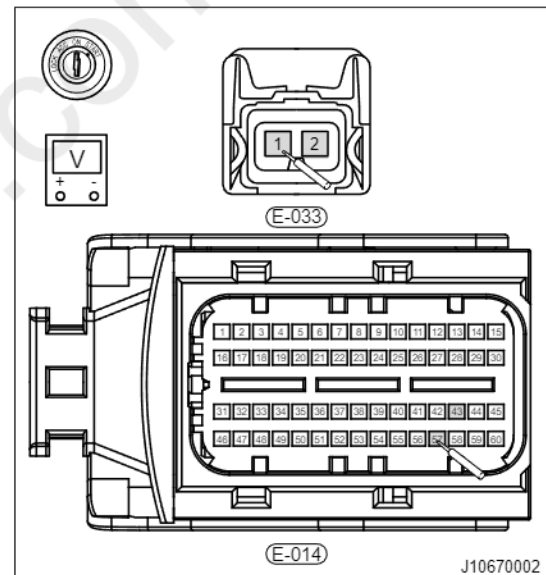
Signal terminal: Voltage signal should vary in accordance with temperature.

Ground terminal: Voltage < 0.2 V



- (d) Using voltage band of multimeter (voltage drop method), connect black probe to ECM E-014 (57, 43), measure voltages of coolant temperature sensor E-033 (1, 2) with red probe

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

5 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

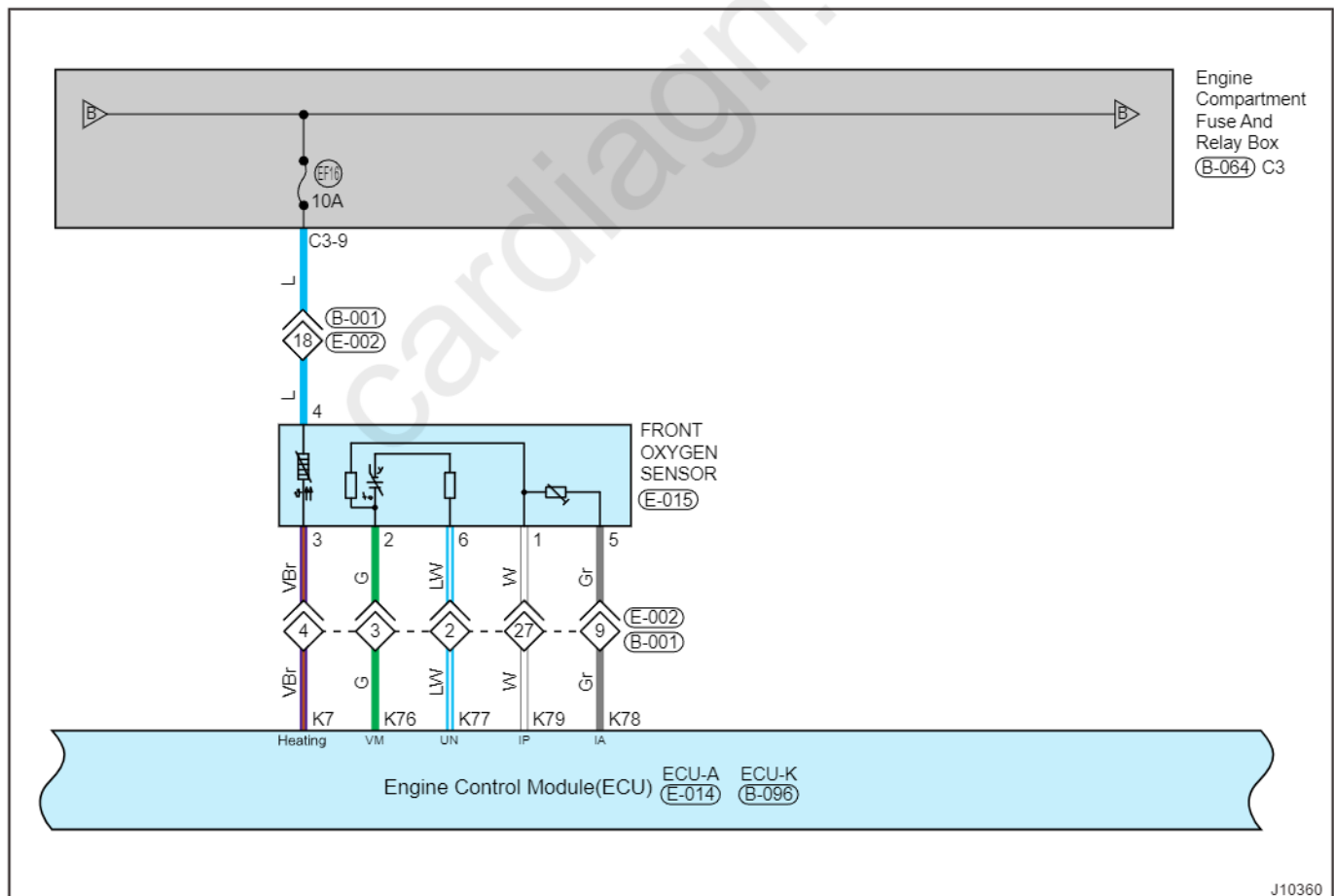
Conduct test and confirm malfunction has been repaired.

■ Upstream Oxygen Sensor Signal Circuit Voltage Low/High (APE IPE RE Line Short to Ground/ Power Supply)

DTC	P013100	O2 Sensor Circuit Low Voltage Bank 1 Sensor 1
DTC	P013200	O2 Sensor Circuit High Voltage Bank 1 Sensor 1
DTC	P223700	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check upstream oxygen sensor connector
----------	---

- (a) Disconnect the negative battery.
- (b) Unplug upstream oxygen sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

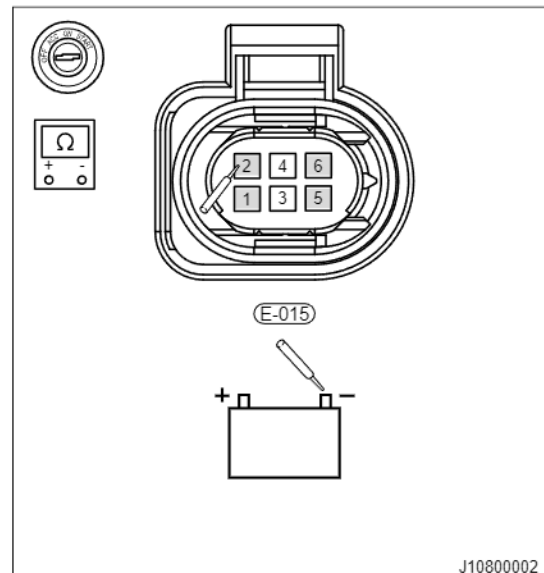
NG

Repair and adjust connector, or replace it.

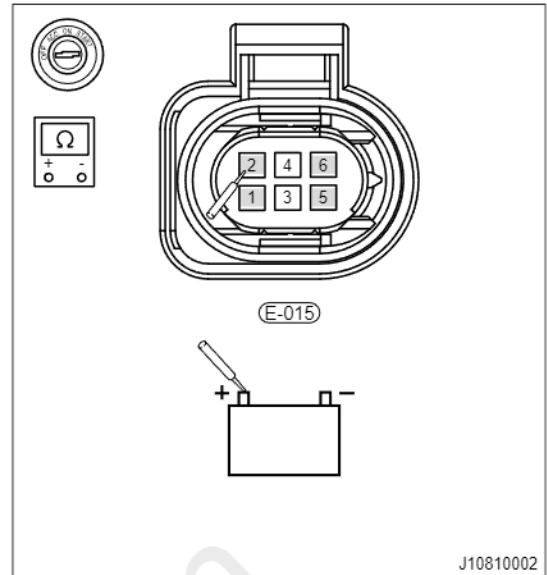
OK

2	Check for short circuit to ground / power supply in upstream oxygen sensor circuit
----------	---

- (a) Disconnect the upstream oxygen sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of upstream oxygen sensor E-015 (2, 6, 1, 5) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of upstream oxygen sensor E-015 (2, 6, 1, 5) with red probe respectively. Check if circuit is short to power supply.



NG

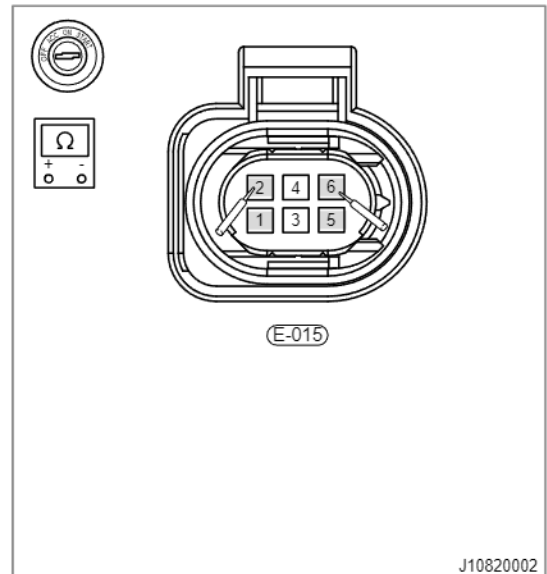
Repair or replace wire harness.

OK

3

Check if circuits of upstream oxygen sensor themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of upstream oxygen sensor E-015 (2, 6, 1, 5) with red and black probes respectively. Check if internal circuits are shorted to each other.



NG

Replace upstream oxygen sensor assembly.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ O2 Sensor Circuit Slow Response Bank 1 Sensor 1

DTC	P013300	O2 Sensor Circuit Slow Response Bank 1 Sensor 1
------------	----------------	--

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check intake/exhaust air for leakage

- (a) Check intake system for air leakage.
 (b) Check exhaust system for air leakage.

NG

Repair and handle parts related to air leakage.

OK

2

Check the upstream oxygen sensor.

- (a) Check if upstream oxygen sensor is deteriorated; Check if response speed is slow.

NG

Replace upstream oxygen sensor assembly.

OK

3 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

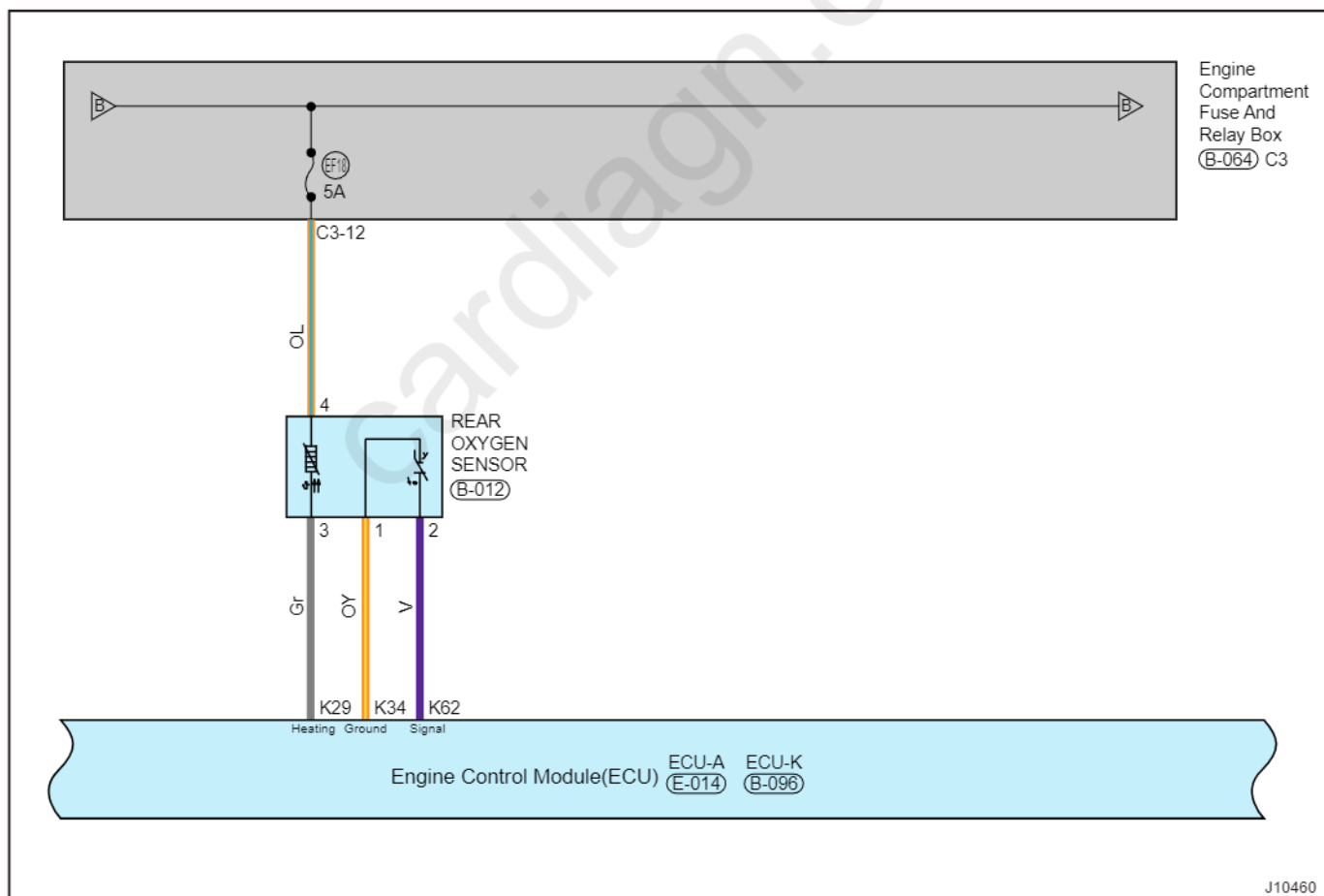
Conduct test and confirm malfunction has been repaired.

■ Downstream Oxygen Sensor Signal Improper/Signal Wire Short to Ground/Power Supply

DTC	P013600	O2 Sensor Circuit Bank 1 Sensor 2
DTC	P013700	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2
DTC	P013800	O2 Sensor Circuit High Voltage Bank 1 Sensor 2

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.

- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check downstream oxygen sensor connector
----------	---

- Disconnect the negative battery.
- Unplug downstream oxygen sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

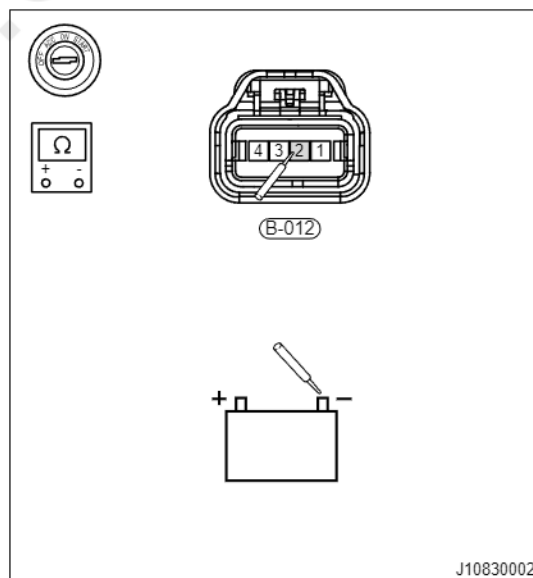
NG

Repair and adjust connector, or replace it.

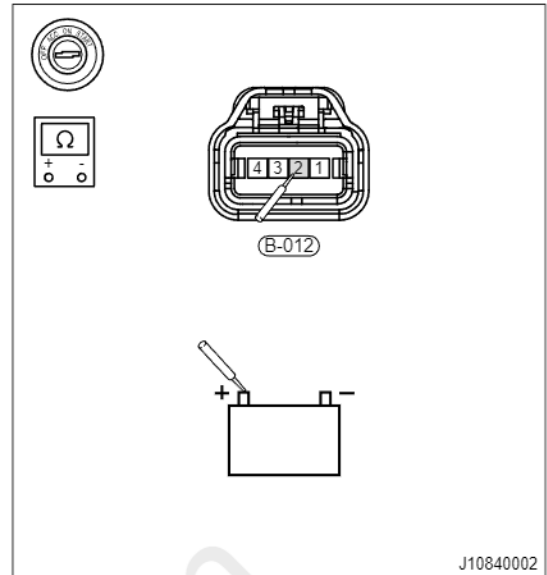
OK

2	Check for short circuit to ground / power supply in downstream oxygen sensor signal
----------	--

- Disconnect the downstream oxygen sensor connector.
- Disconnect the ECM connector (B-096).
- Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of downstream oxygen sensor B-012 (2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistance of downstream oxygen sensor B-012 (2) with red probe respectively. Check if circuit is short to power supply.



NG

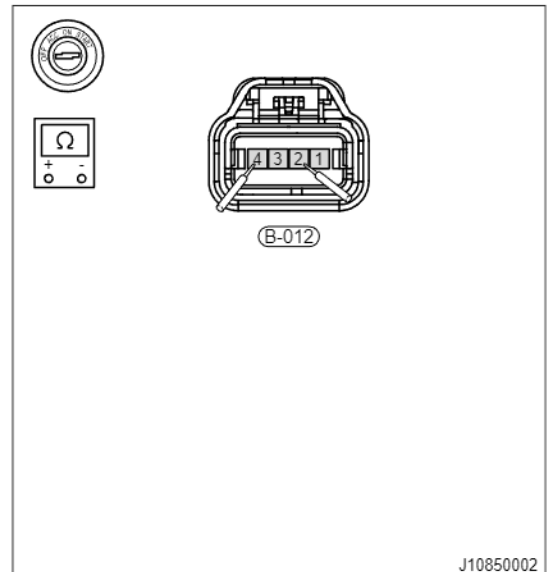
Repair or replace wire harness.

OK

3

Check if circuits of downstream oxygen sensor themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of upstream oxygen sensor B-012 (1, 2, 3, 4) with red and black probes respectively. Check if internal circuits are shorted to each other.



NG

Replace downstream oxygen sensor assembly.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

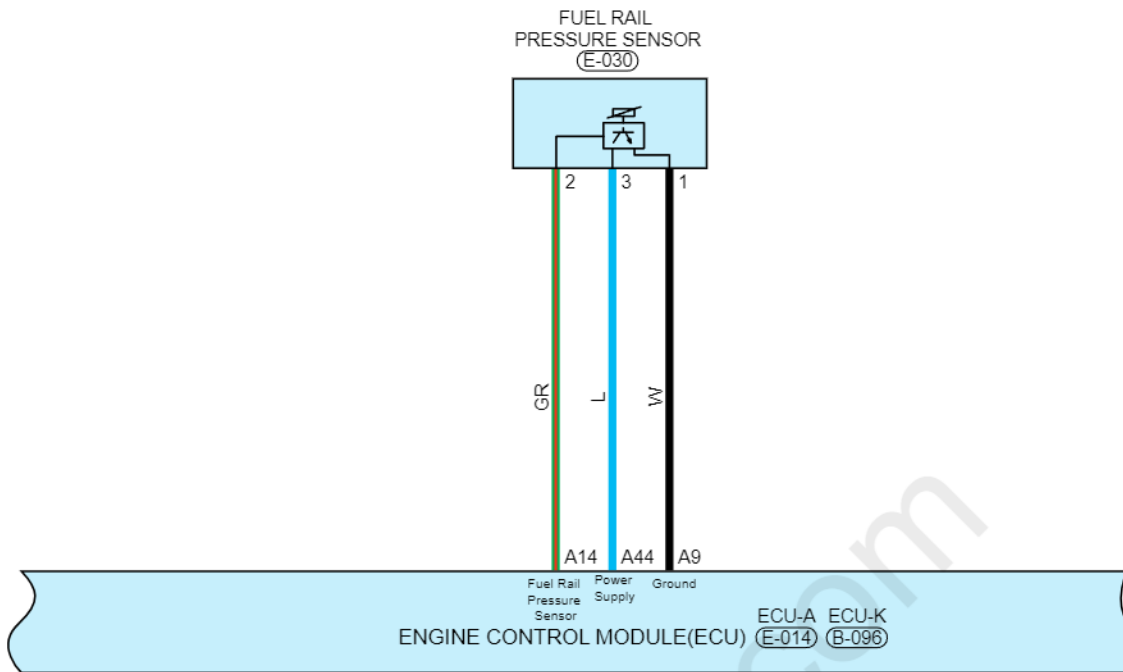
OK**Repair or replace new module.****NG****5 Reconfirm DTCs**

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK**Conduct test and confirm malfunction has been repaired.****■ Fuel Rail Pressure Sensor Voltage Too High/Too Low/Signal Stuck/Signal Non-plausible**

DTC	P019200	Fuel Rail Pressure Sensor Circuit Low Bank 1
DTC	P019300	Fuel Rail Pressure Sensor Circuit High Bank 1
DTC	P019400	Fuel Rail Pressure Sensor Circuit Intermittent/Erratic Bank 1
DTC	P019128	Fuel Rail Pressure Sensor Circuit Bank 1-Negative Offset
DTC	P019129	Fuel Rail Pressure Sensor Circuit Bank 1-Positive Offset
DTC	P019000	Fuel Rail Pressure Sensor Circuit Bank 1
DTC	P254200	DECOS Oil Passage Pressure Sensor Circuit High Voltage
DTC	P254100	DECOS Oil Passage Pressure Sensor Circuit Low Voltage

■ Description**Circuit Diagram**



J10860

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check fuel rail pressure sensor connector

- Disconnect the negative battery.
- Unplug fuel rail pressure sensor connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

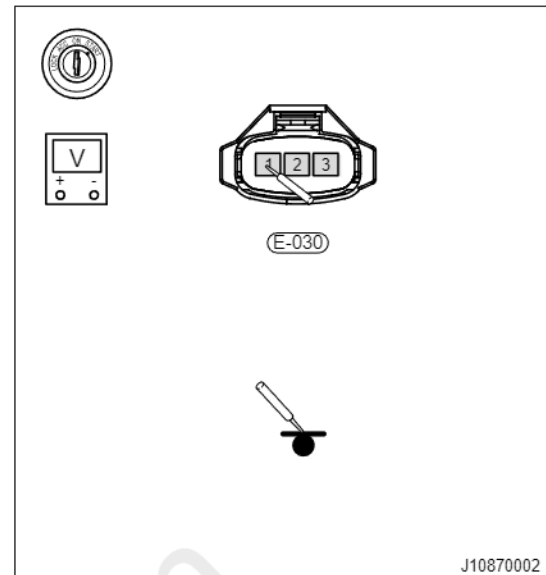
2 Check fuel rail pressure sensor circuit

- (a) Connect the fuel rail pressure sensor connector.
- (b) Ignition switch ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of fuel rail pressure sensor E-030 (1, 2, 3) with red probe respectively.

Power supply: 5 V

Ground: < 0.2 V

Signal: Under atmospheric pressure (100 Kpa), signal output is 0.500 ± 0.048 V



NG

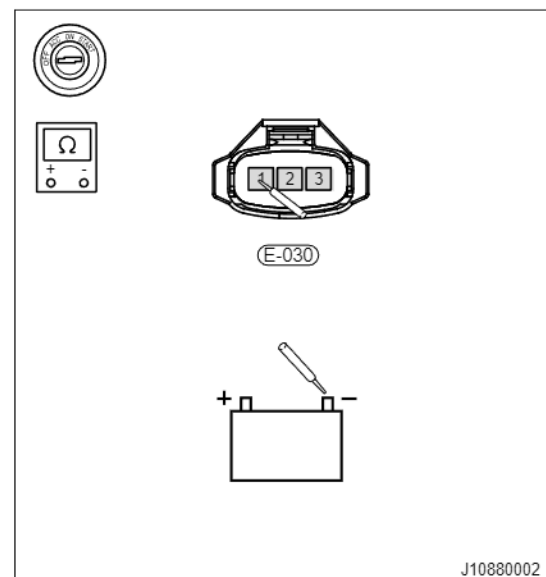
Check and repair wire harness, or replace fuel rail pressure sensor.

OK

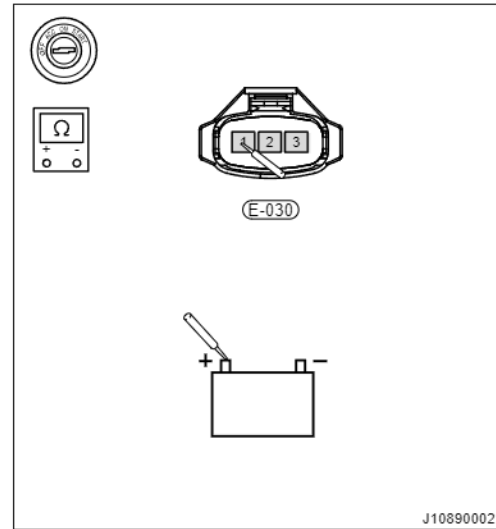
3

Check for short circuit to ground / power supply in fuel rail pressure sensor

- (a) Disconnect the fuel rail pressure sensor connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of fuel rail pressure sensor E-030 (1, 2, 3) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of fuel rail pressure sensor E-030 (1, 2, 3) with red probe respectively. Check if circuit is short to power supply.



NG

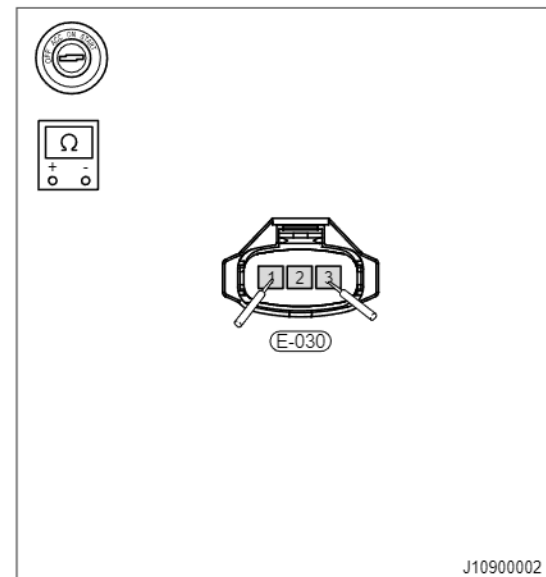
Check and repair wire harness.

OK

4

Check if circuits of fuel rail pressure sensor themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of fuel rail pressure sensor E-030 (1, 2, 3) with red and black probes respectively. Check if internal circuits are shorted to each other.



NG

Replace fuel rail pressure sensor assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

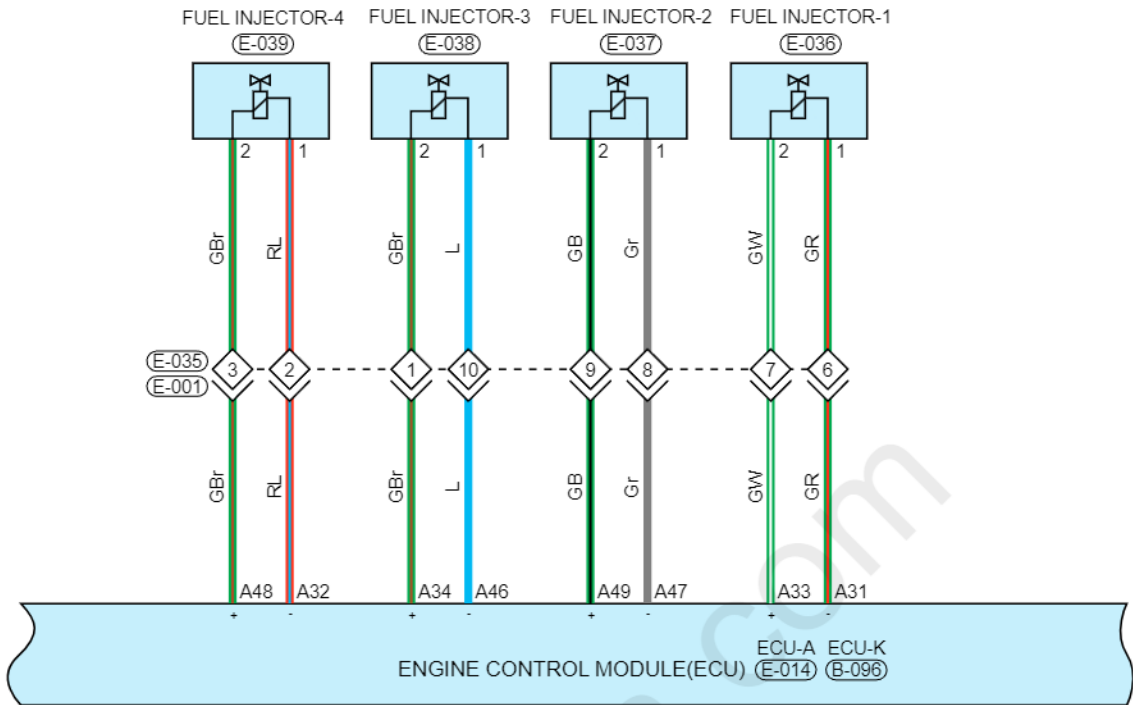
Conduct test and confirm malfunction has been repaired.

■ Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 Fuel Injector Control Circuit Open

DTC	P020100	Cylinder 1 Injector "A" Circuit
DTC	P020300	Cylinder 3 Injector "A" Circuit
DTC	P020400	Cylinder 4 - Injector Circuit Open
DTC	P020200	Cylinder 2 - Injector Circuit Open

■ Description

Circuit Diagram



J10910

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

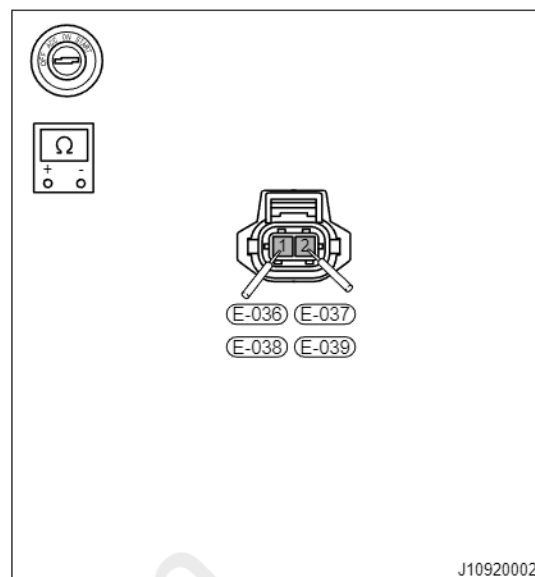
- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.
Take troubleshooting of cylinder 1 fuel injector as an example.

1	Check injector connector
(a) Disconnect the negative battery.	
(b) Check if fuel injector connector is loose, and contact between male and female terminals is in good condition.	
NG	Repair and adjust connector, or replace it.
OK	
2	Check internal resistance of fuel injector

- (a) Disconnect the injector connector.
- (b) Using ohm band of multimeter, measure resistances of fuel injector E-037 (1, 2), E-036 (1, 2), E-038 (1, 2), E-039 (1, 2) with red and black probes respectively.



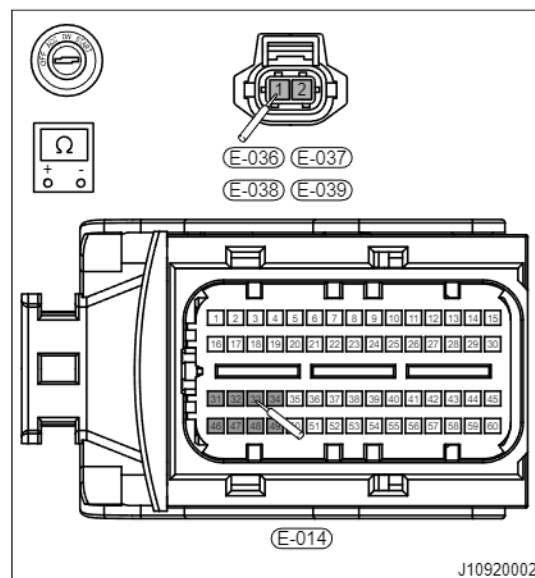
NG

Replace fuel injector assembly.

OK

3 Check fuel injector control circuit

- (a) Disconnect the injector connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to ECM E-014 (49, 47), E-014 (33, 31), E-014 (34, 46), E-014 (48, 32), measure for continuity among fuel injector E-037 (1, 2), E-036 (1, 2), E-038 (1, 2), E-039 (1, 2) with red probe respectively.



NG

Check and repair circuit.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

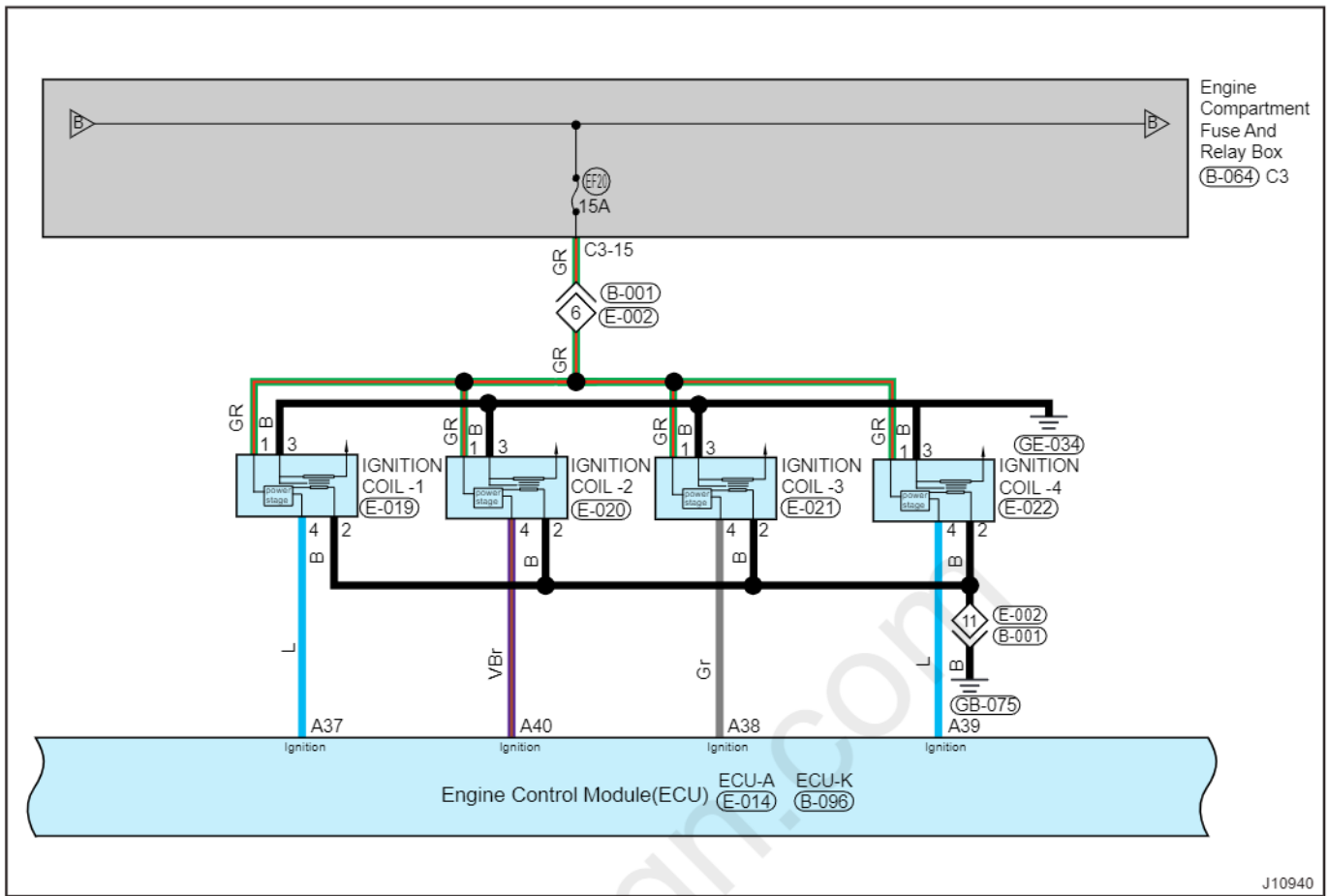
Conduct test and confirm malfunction has been repaired.

■ Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 Ignition Coil Control Circuit Voltage High/Low

DTC	P230100	Ignition Coil "A" Primary Control Circuit High
DTC	P230700	Ignition Coil "C" Primary Control Circuit High
DTC	P231000	Ignition Coil "D" Primary Control Circuit High
DTC	P230400	Ignition Coil "B" Primary Control Circuit High
DTC	P230000	Ignition Coil "A" Primary Control Circuit Low
DTC	P230600	Ignition Coil "C" Primary Control Circuit Low
DTC	P230900	Ignition Coil "D" Primary Control Circuit Low
DTC	P230300	Ignition Coil "B" Primary Control Circuit Low
DTC	P035100	Ignition Coil "A" Primary Control Circuit Open
DTC	P035300	Ignition Coil "C" Primary Control Circuit Open
DTC	P035400	Ignition Coil "D" Primary Control Circuit Open
DTC	P035200	Ignition Coil "B" Primary Control Circuit Open

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

Take troubleshooting of cylinder 1 ignition coil as an example.

1 Check ignition coil connector

- Disconnect the negative battery.
- Unplug ignition coil connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check ignition coil power supply fuse

- (a) Check if fuse EF20 15A of engine compartment fuse and relay box is blown.

NG

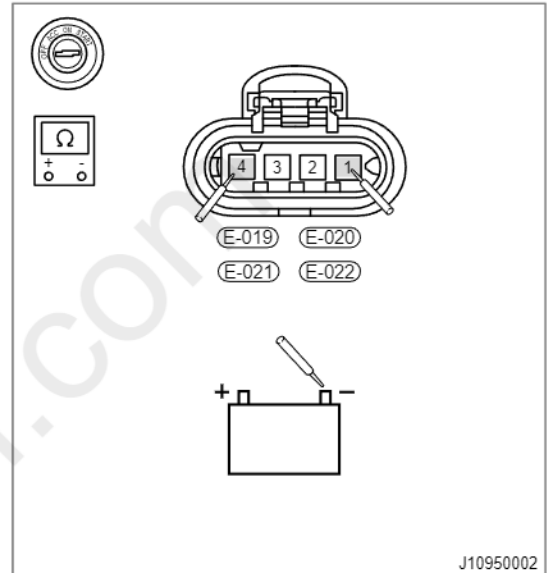
There is short circuit in circuit or ignition coil.

OK

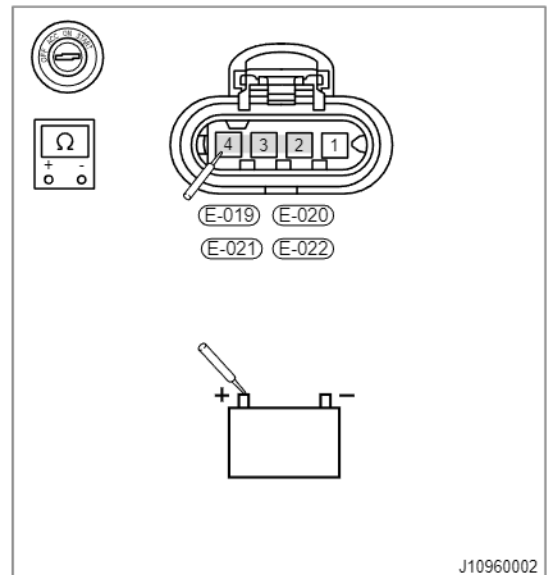
3

Check for short circuit to ground / power supply in ignition coil circuit

- (a) Disconnect the ignition coil connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of ignition coil E-019 (1, 4), E-020 (1, 4), E-021 (1, 4), E-022 (1, 4) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of ignition coil E-019 (2, 3, 4), E-020 (2, 3, 4), E-021 (2, 3, 4), E-022 (2, 3, 4) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair wire harness.

OK

4 Check ignition coil control circuit

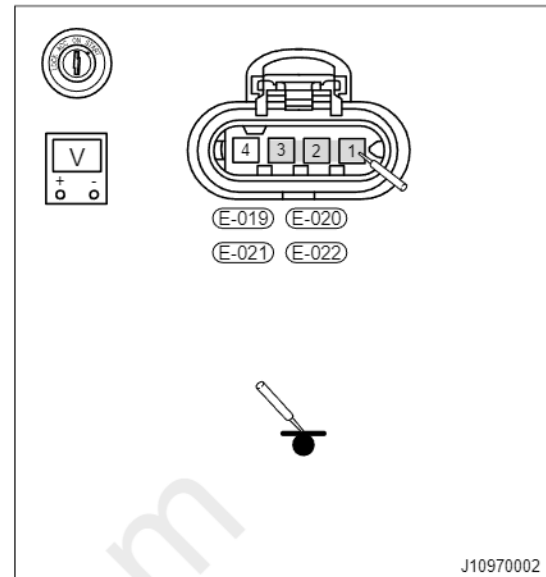
- (a) Connect the ignition coil connector.
- (b) Ignition switch ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of ignition coil E-019 (1, 2, 3), E-020 (1, 2, 3), E-021 (1, 2, 3), E-022 (1, 2, 3) with red probe respectively.

Power supply: 12 V

Ground: < 0.2 V

- (d) Start the engine.
- (e) Using the LED test light, connect clip to battery negative terminal, measure ignition coil E-019 (4), E-020 (4), E-021 (4), E-022 (4) with another end.

Under normal conditions, test light should flash.



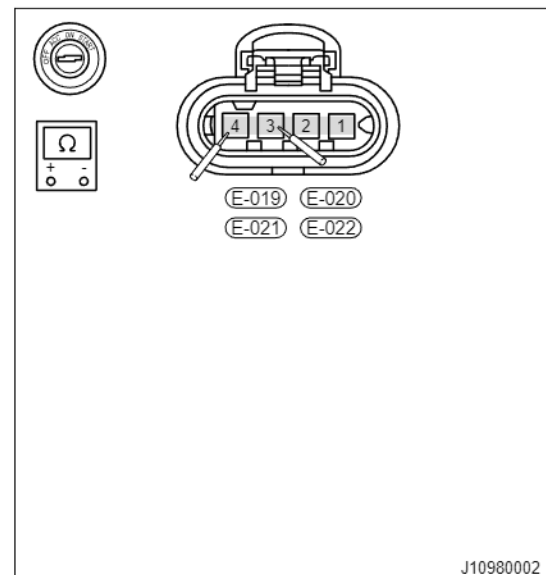
NG

Check and repair wire harness

OK

5 Check if circuits of ignition coil themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of ignition coil (1, 2, 3, 4) with red and black probes respectively. Check if internal circuits are shorted to each other.



NG

Replace ignition coil assembly.

OK

6 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

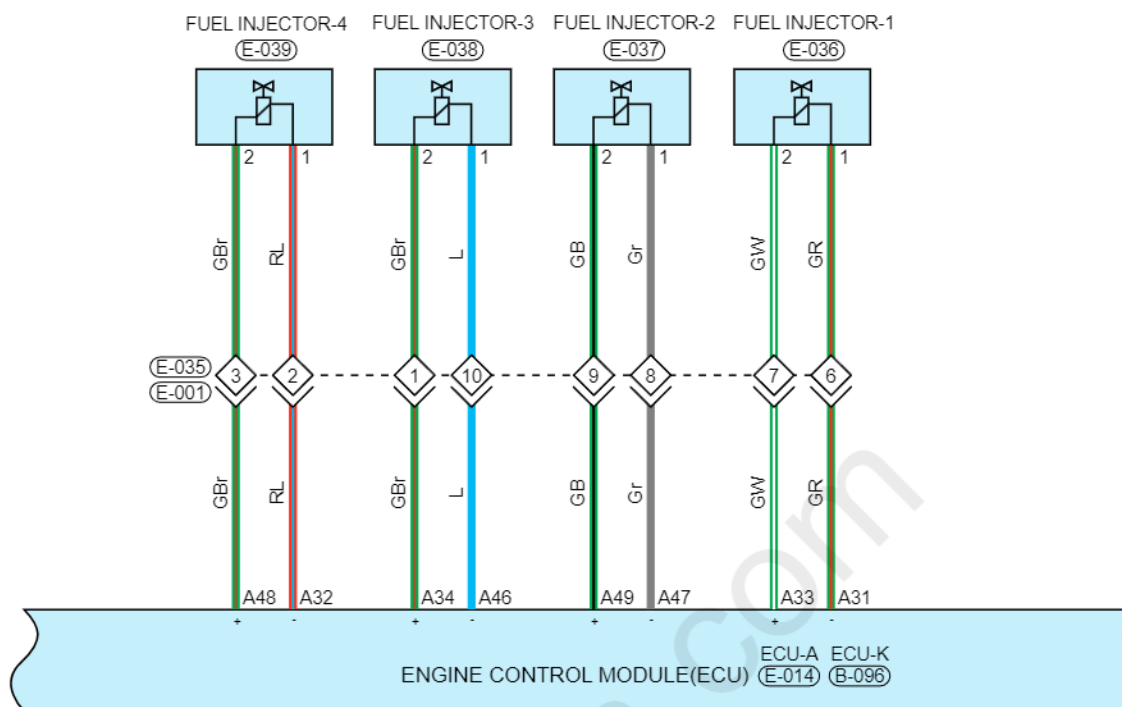
OK**Repair or replace new module.****NG****7 Reconfirm DTCs**

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK**Conduct test and confirm malfunction has been repaired.****■ Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 Fuel Injector Control Circuit Short to Power Supply**

DTC	P026200	Cylinder 1 Injector Circuit High
DTC	P026800	Cylinder 3 Injector Circuit High
DTC	P027100	Cylinder 4 Injector Circuit High
DTC	P026500	Cylinder 2 Injector Circuit High

■ Description**Circuit Diagram**



J10910

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

Take troubleshooting of cylinder 1 fuel injector as an example.

1 Check injector connector

- Disconnect the negative battery.
- Check if fuel injector connector is loose, and contact between male and female terminals is in good condition.

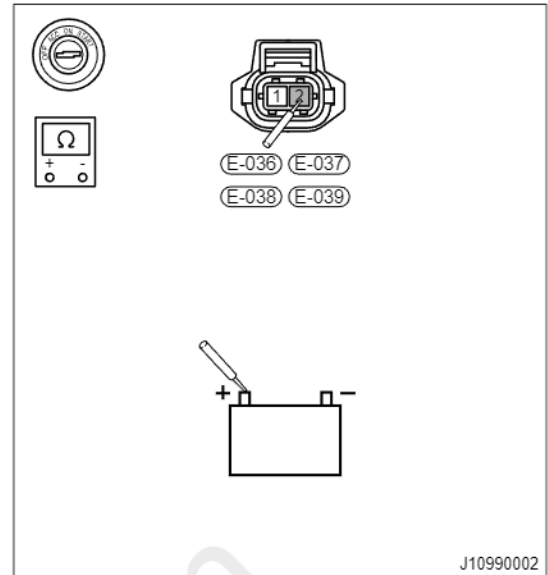
NG

Repair and adjust connector, or replace it.

OK

2 Check if fuel injector control terminal is short to power supply

- (a) Disconnect the injector connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of fuel injector E-037 (2), E-036 (2), E-038 (2), E-039 (2) with red probe respectively. Check if circuit is short to power supply.



J10990002

NG

Check and repair circuit.

OK

3

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

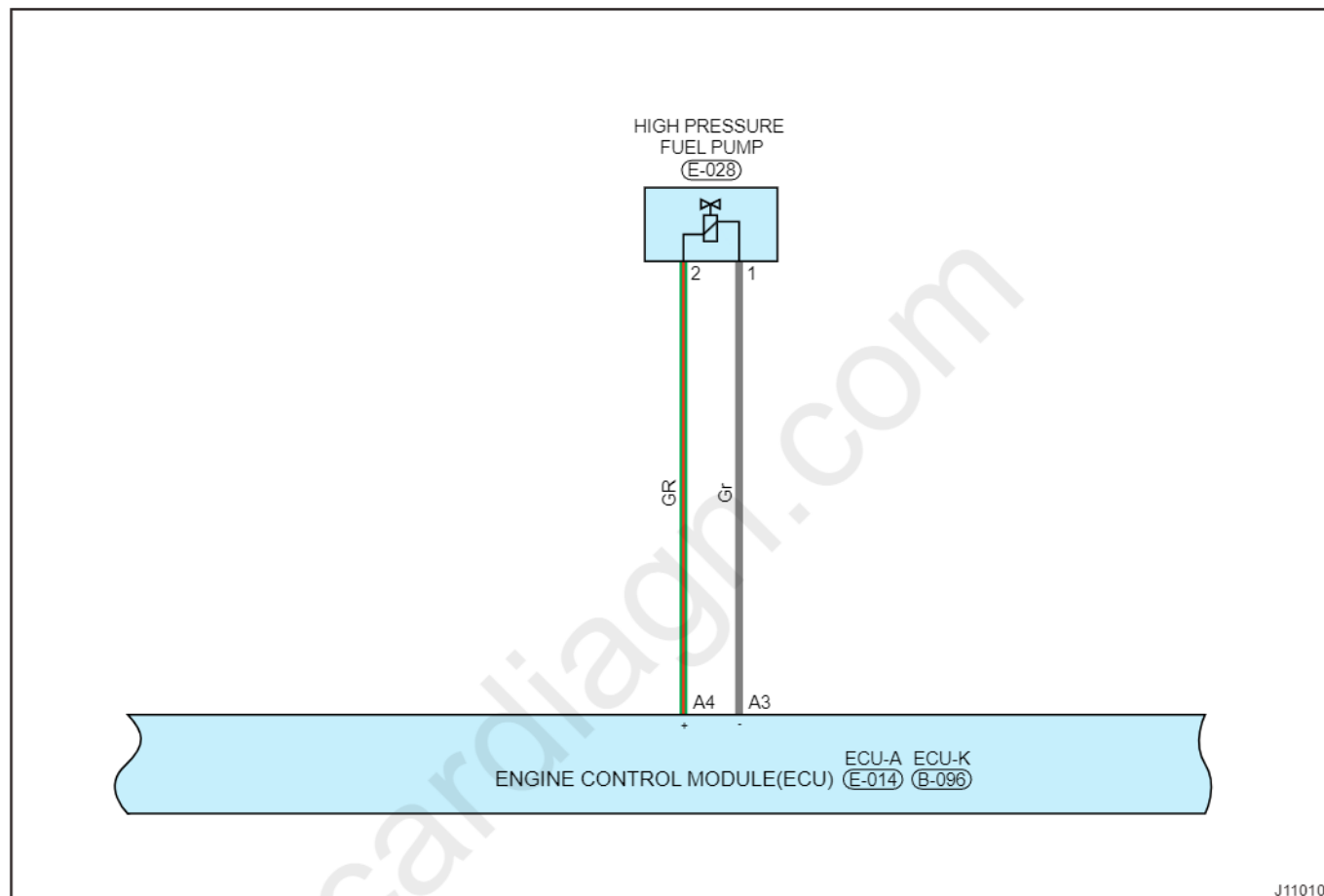
■ Flow Control Valve Control Circuit Open/Too High/Too Low

DTC	P025100	Injection Pump Fuel Metering Control "A" (Cam/Rotor/Injector)
DTC	P025400	Injection Pump Fuel Metering Control "A" High (Cam/Rotor/Injector)

DTC	P025900	Injection Pump Fuel Metering Control "B" High (Cam/Rotor/Injector)
DTC	P025300	Injection Pump Fuel Metering Control "A" Low (Cam/Rotor/Injector)
DTC	P025800	Injection Pump Fuel Metering Control "B" Low (Cam/Rotor/Injector)
DTC	P009000	Fuel Pressure Regulator 1 Control Circuit Open

■ Description

Circuit Diagram



J11010

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check high pressure fuel pump connector
---	--

- Disconnect the negative battery.
- Unplug high pressure fuel pump connector, check if this connector is loose, and contact between male and female terminals is in good condition.

NG

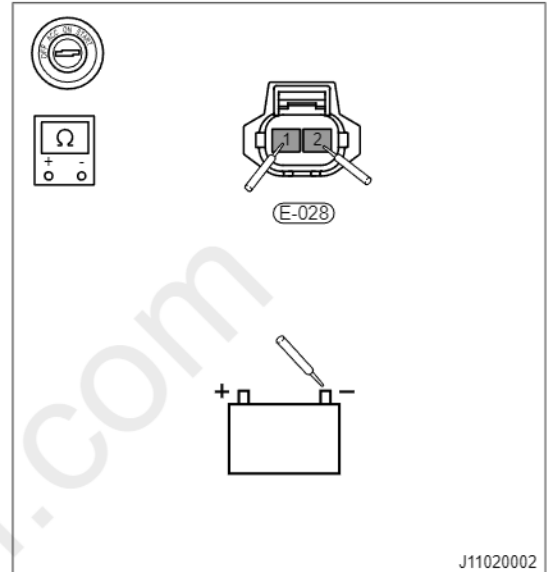
Repair and adjust connector, or replace it.

OK

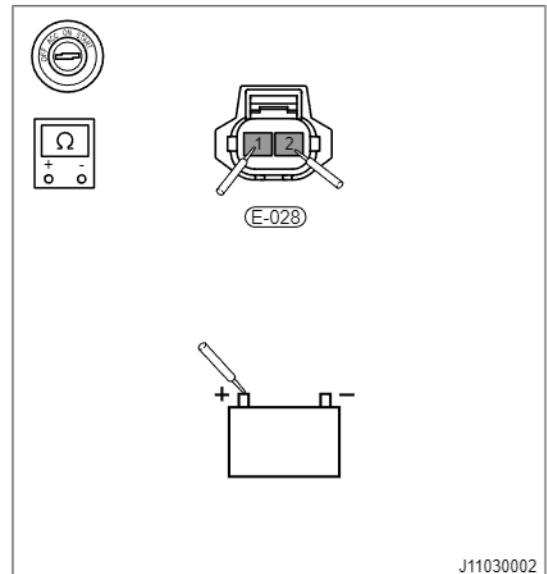
2

Check for short circuit to ground / power supply in high pressure fuel pump circuit

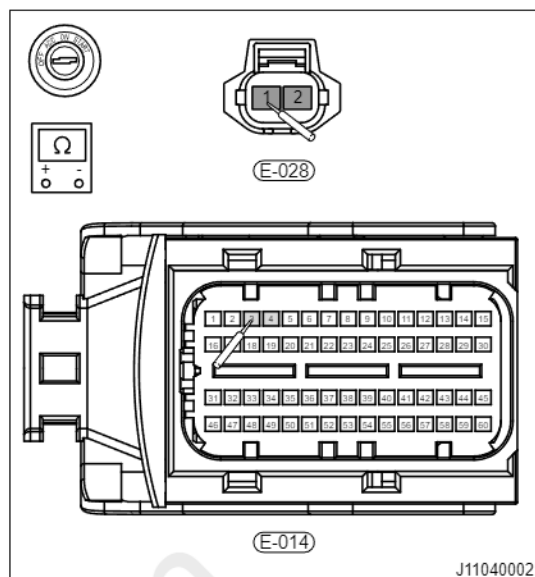
- (a) Disconnect the high pressure fuel pump connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of high pressure fuel pump E-028 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of high pressure fuel pump E-028 (1, 2) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, connect black probe to ECM E-014 (3, 4), measure for continuity between high pressure fuel pump E-028 (1, 2) with red probe respectively; Check for open circuit.



NG

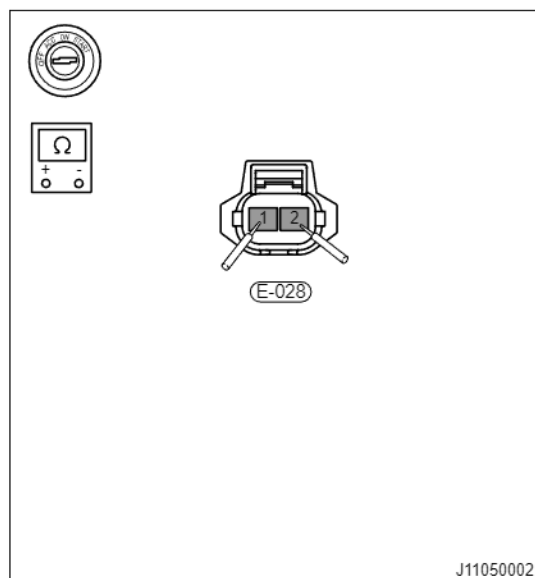
Check and repair wire harness.

OK

3

Check if circuits of flow control valve themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of high pressure fuel pump E-028 (1, 2) with red and black probes respectively. Check if internal circuits are shorted to each other.



NG

Replace high pressure fuel pump assembly.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Multiple Cylinder Misfire Detected

DTC	P030000	Random/Multiple Cylinder Misfire Detected
DTC	P030100	Cylinder 1 Misfire Detected
DTC	P030200	Cylinder 2 Misfire Detected
DTC	P030300	Cylinder 3 Misfire Detected
DTC	P030400	Cylinder 4 Misfire Detected
DTC	P036300	Misfire Detected - Fueling Disabled

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check fuel injector, ignition coil connector

- (a) Disconnect the negative battery.
- (b) Check if fuel injector, ignition coil connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check if ignition coil control circuit is abnormal

- (a) Check if ignition coil control circuit is abnormal.
 (b) Under normal conditions of control circuit, replace ignition coil and perform test.

NG

Check and repair circuit, or replace ignition coil assembly.

OK

3 Check spark plug

- (a) Check spark plug insulating ceramic for cracks;
 (b) Check spark plug head electrode for corrosion, damage;
 (c) Check if clearance between spark plug head side electrode and center electrode is normal.

NG

Replace spark plug assembly.

OK

4 Check if fuel injector control circuit is abnormal

- (a) Check if fuel injector control circuit is abnormal.
 (b) Under normal conditions of control circuit, replace fuel injector and perform test.

NG

Check and repair circuit, or replace fuel injector assembly.

OK

5 Check fuel quality

- (a) Check if fuel quality is abnormal.

NG

Replace fuel.

OK

6 Check engine system for serious carbon deposition

- (a) Check if fuel injector is dirty or blocked.
- (b) Check if electronic throttle is dirty.
- (c) Check intake valve for serious carbon deposition.

NG

Clean engine system.

OK

7 Test engine cylinder pressure

- (a) Test if cylinder pressure of each cylinder is met standard with the cylinder pressure gauge.

NG

Repair the engine.

OK

8 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

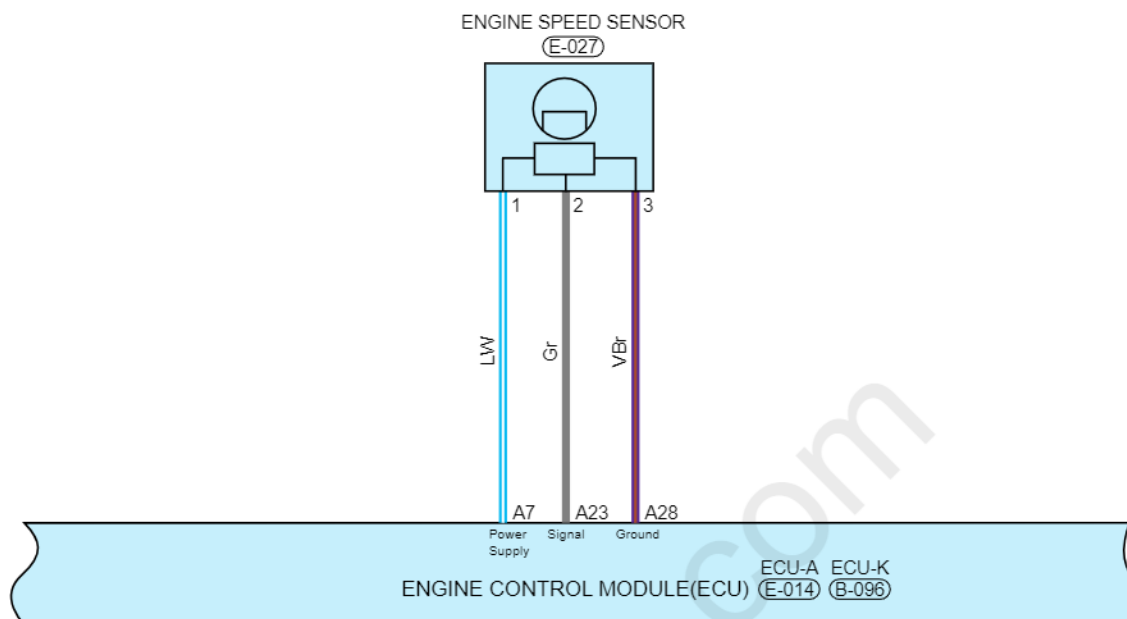
OK

Conduct test and confirm malfunction has been repaired.

■ Crankshaft Position Sensor Signal Improper/Missing

DTC	P033900	Crankshaft Position Sensor "A" Circuit Intermittent
DTC	P261700	Crankshaft Position Signal Output Circuit Open

■ Description**Circuit Diagram**



J11060

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check speed sensor connector

- Disconnect the negative battery.
- Check if speed sensor connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check speed sensor and signal gear ring condition

- (a) Remove the speed sensor.
- (b) Check head of speed sensor for a large amount of iron chips.
- (c) Check signal gear ring for tooth missing, damage or iron chips adhesion.

NG

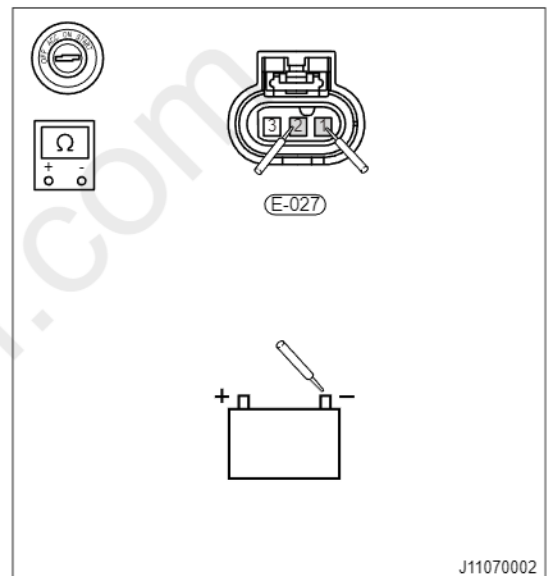
Clean up iron chips or replace damaged flywheel.

OK

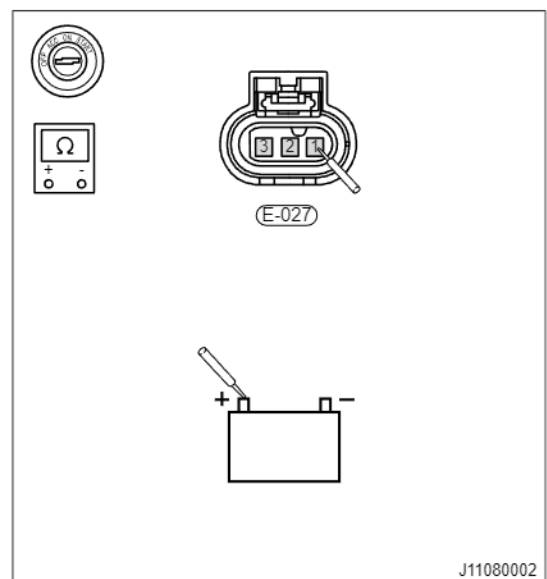
3

Check for short circuit to ground / power supply in speed sensor circuit

- (a) Disconnect the speed sensor connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of speed sensor E-027 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of speed sensor E-027 (1, 2, 3) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair wire harness.

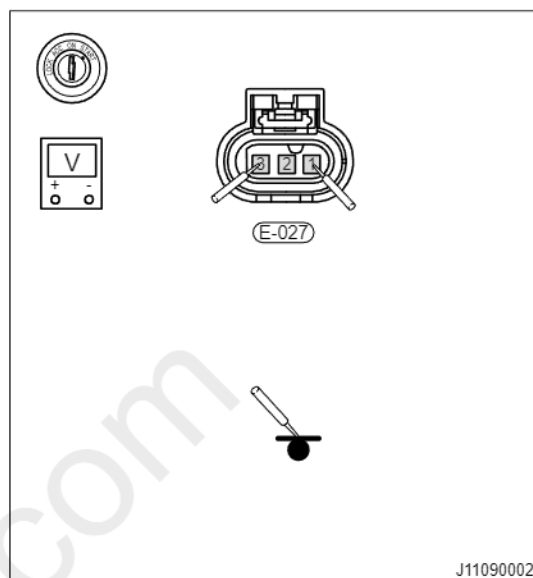
OK

4 Check speed sensor signal circuit

- (a) Connect the speed sensor connector.
- (b) Ignition switch ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of fuel rail pressure sensor E-027 (1, 3) with red probe respectively.

Power supply: 5 V**Ground: < 0.2 V**

- (d) Start the engine.
- (e) Using the LED test light, connect clip to battery negative terminal, measure speed sensor E-027 (2) with another end.

Under normal conditions, test light should flash.

J11090002

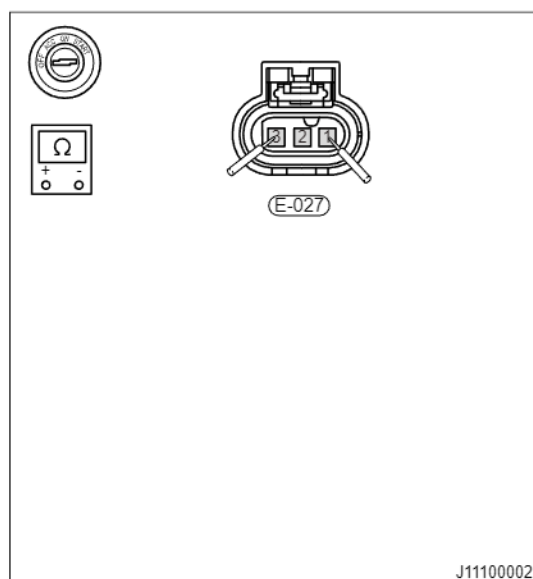
NG

Check and repair wire harness

OK

5 Check if circuits of speed sensor themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of speed sensor E-027 (1, 2, 3) with red and black probes respectively. Check if internal circuits are shorted to each other.



J11100002

NG

Replace speed sensor assembly.

OK

6 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

7 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

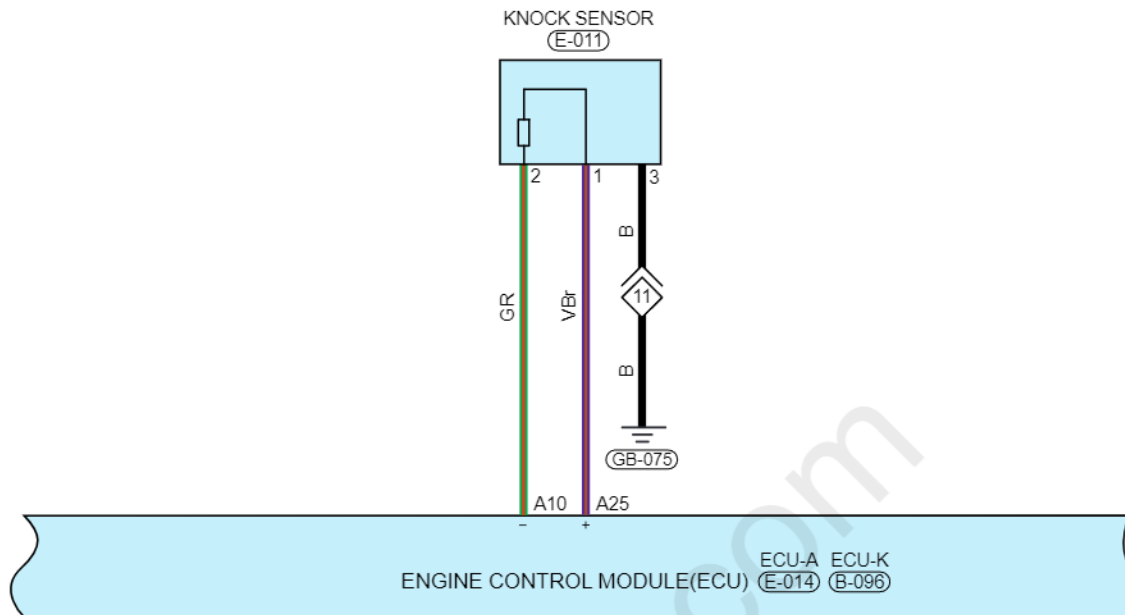
OK

Conduct test and confirm malfunction has been repaired.

■ Knock Sensor (Terminal A/B) Signal Short to Ground/Power Supply/Voltage Too High/Too Low

DTC	P032600	Knock Sensor Signal Circuit Voltage Too High
DTC	P032500	Knock Sensor Signal Circuit Voltage Too Low
DTC	P032800	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
DTC	P032700	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor
DTC	P032815	Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor
DTC	P032714	Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor

■ Description**Circuit Diagram**



J11110

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check knock sensor connector

- Disconnect the negative battery.
- Check if knock sensor connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check knock sensor condition

- (a) Check if knock sensor is exposed to oil, coolant, water, etc. for a long time; Avoid corrosion to sensor.
- (b) Check knock sensor fixing bolts for looseness.

Tightening torque: $20 \pm 5 \text{ N}\cdot\text{m}$

NG

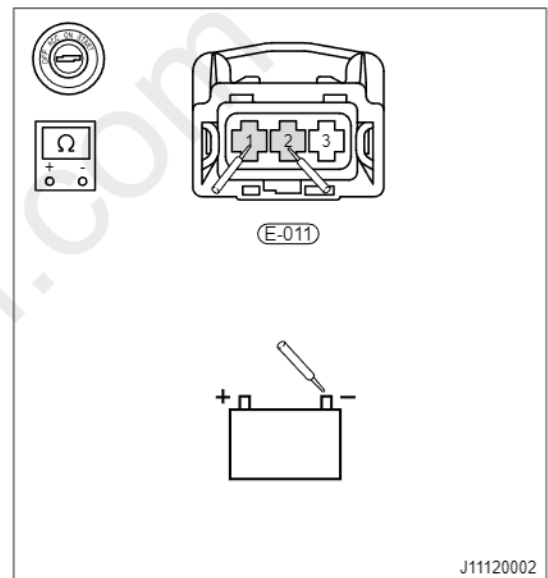
Clean and tighten fixing bolts to specified torque.

OK

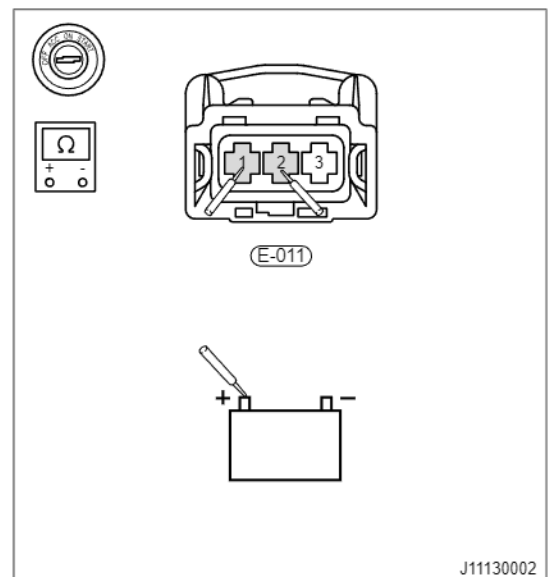
3

Check for short circuit to ground / power supply in knock sensor circuit

- (a) Disconnect the knock sensor connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of knock sensor E-011 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of knock sensor E-011 (1, 2) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair wire harness.

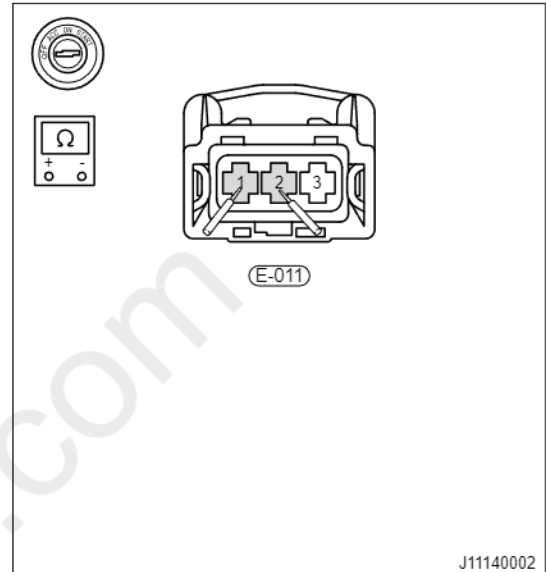
OK

4

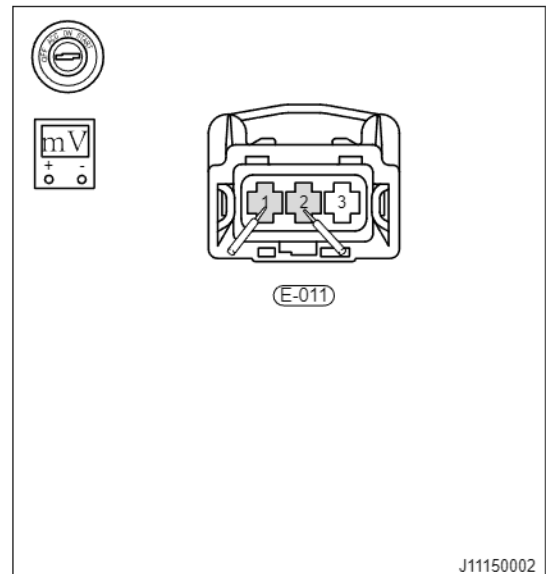
Check knock sensor itself

- (a) Using ohm band of multimeter, measure resistances of knock sensor E-011 (1, 2) with red and black probes respectively.

Resistance at ambient temperature should be $4.9\text{ M}\Omega \pm 20\%$



- (b) Using mV band of multimeter, measure voltages of knock sensor E-011 (1, 2) with red and black probes respectively. Using a small hammer to tap near knock sensor, there should be a voltage signal output at this time.



NG

Replace knock sensor assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Intake/Exhaust Camshaft Phaser Sensor Signal Improper

DTC	P034100	Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor
DTC	P036600	Camshaft Position Sensor "B" Circuit Range/Performance(Bank1)

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check phaser solenoid valve, valve body bolt components state

- (a) Disconnect the negative battery cable.
- (b) Remove intake/exhaust phaser solenoid valve; Check for blockage or dirty.
- (c) Remove intake/exhaust phaser valve body bolts; Check for blockage or dirt.

NG

Clean or replace phaser solenoid valve and valve body bolts.

OK

2

Check engine maintenance condition

- (a) Check if engine oil level is normal, and check for oil leakage and oil seepage.
- (b) Remove valve trim cover, and check engine lubrication and cleaning conditions, and check for wear or sludge dirty

NG

Clean and maintain the engine, replace the damaged components.

OK

3 Check valve mechanism timing

- (a) Check if valve mechanism timing is normal, and check timing chain for teeth skipping, misalignment, elongation, etc.
- (b) Check camshaft signal plate for misalignment, looseness, etc.

NG

Replace timing chain or camshaft assembly.

OK

4 Check intake/exhaust phaser assembly

- (a) Check if operating condition of cam phase regulator is normal (dirt blocked, oil leaked, stuck, etc.).

NG

Replace intake/exhaust phaser assembly.

OK

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

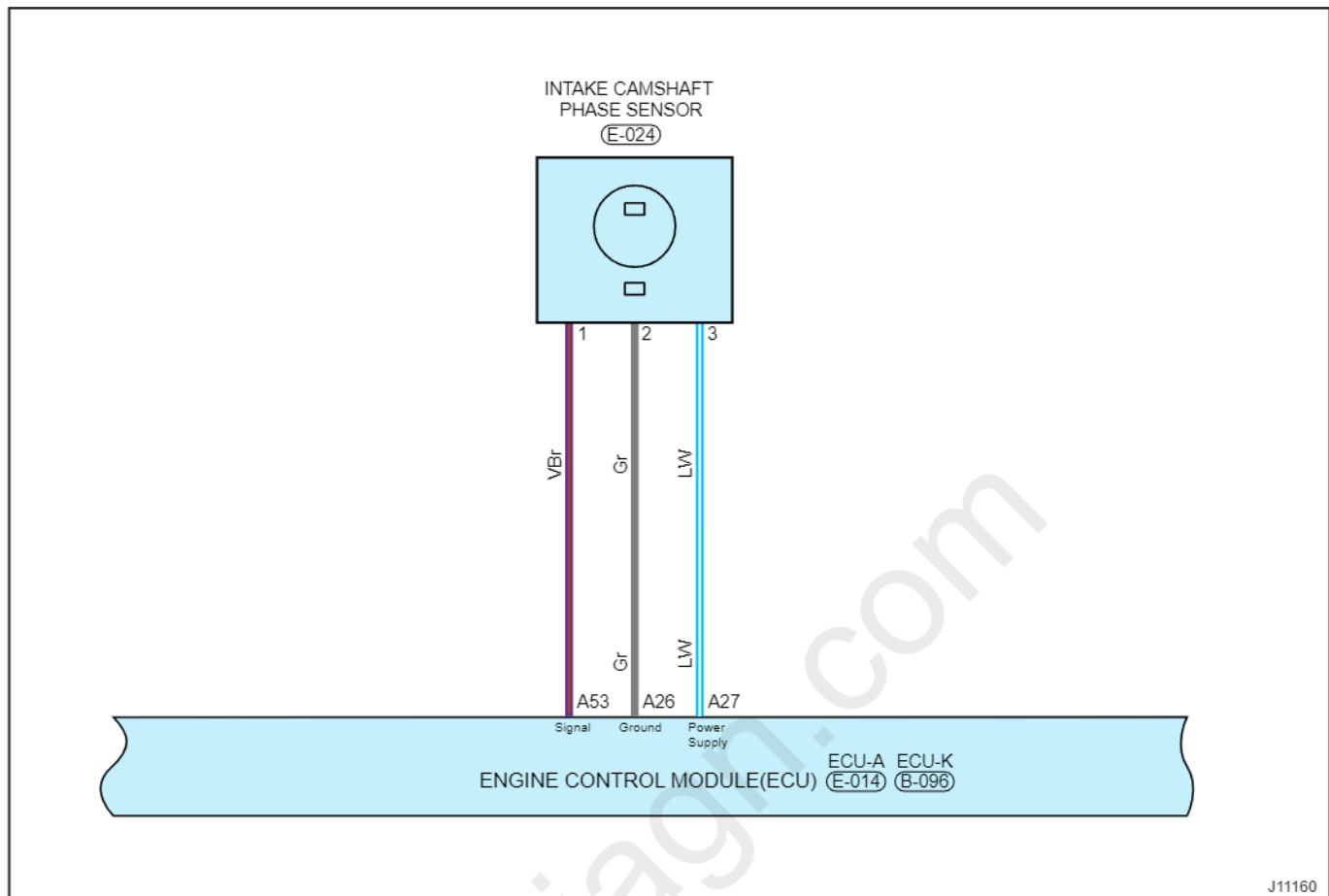
Conduct test and confirm malfunction has been repaired.

■ Intake Camshaft Phaser Signal Short to Ground/Power Supply

DTC	P034200	Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor
DTC	P034300	Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check intake camshaft phaser sensor connector

- Disconnect the negative battery.
- Check if intake camshaft phaser sensor connector is loose, and contact between male and female terminals is in good condition.

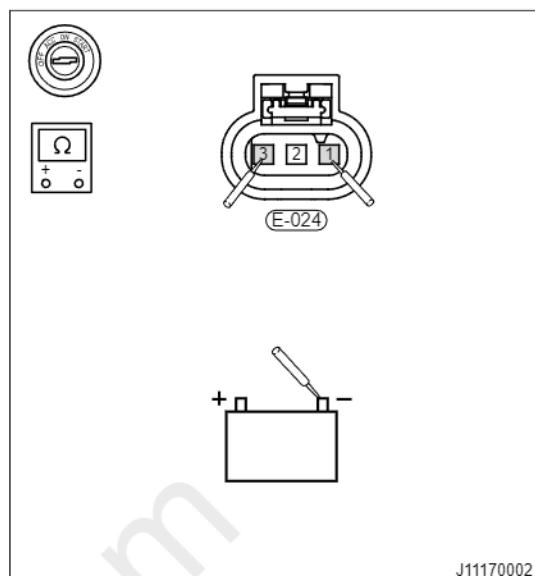
NG

Repair and adjust connector, or replace it.

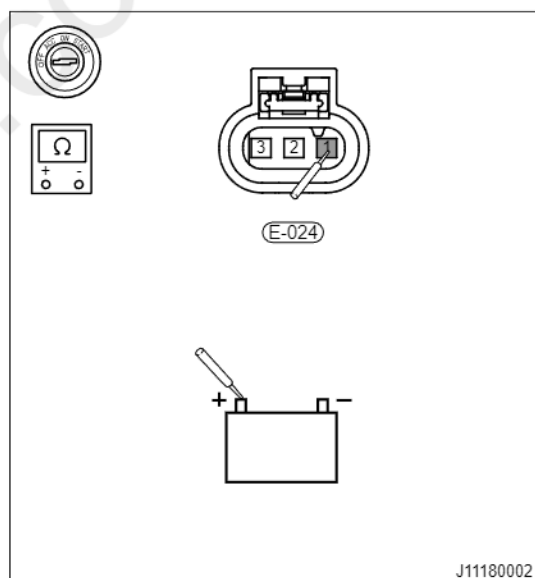
OK

2 Check for short circuit to ground / power supply in intake camshaft phaser sensor circuit

- (a) Disconnect the intake camshaft phaser sensor connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of intake camshaft phaser sensor E-024 (1, 3) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure intake camshaft phaser sensor E-024 (1) with red probe respectively. Check if circuit is short to power supply.


NG
Check and repair wire harness.
OK
3 Check intake camshaft phaser sensor circuit

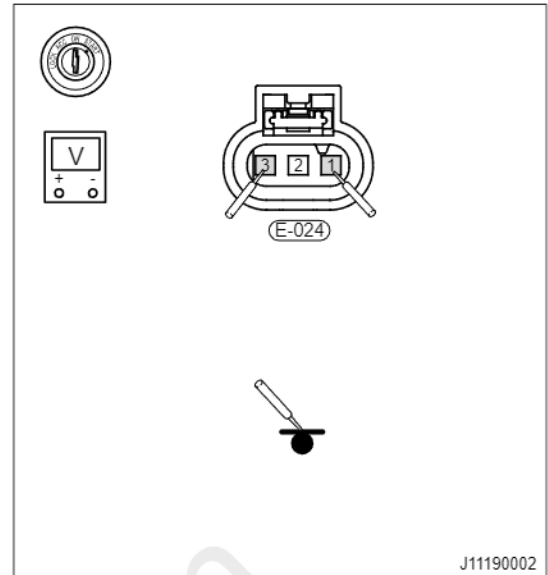
- Connect the intake camshaft phaser sensor connector.
- Start the engine.
- Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of intake camshaft phaser sensor E-024 (1, 3) with red probe respectively.

Power supply: 12 V

Ground: < 0.2 V

- Using the LED test light, connect clip to battery negative terminal, measure intake camshaft phaser sensor E-024 (1) with another end.

Under normal conditions, test light should flash.



NG

Check wire harness or replace intake camshaft phaser sensor assembly.

OK

4 Check Engine Control Module (ECM)

- Remove Engine Control Module (ECM) from malfunctioning vehicle.
- Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

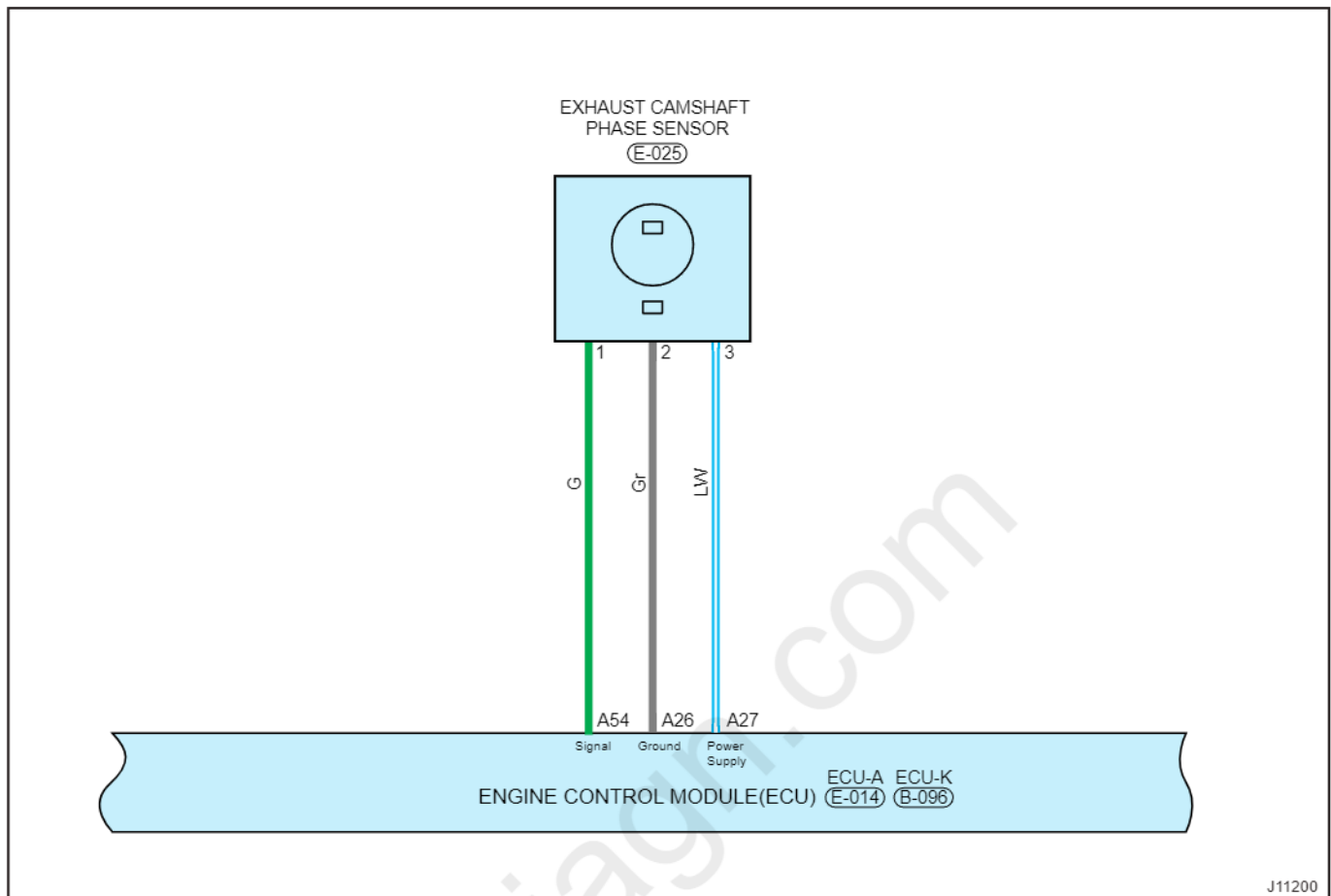
Conduct test and confirm malfunction has been repaired.

■ Exhaust Camshaft Phaser Signal Circuit Voltage Low/High

DTC	P036700	Camshaft Position Sensor "B" Circuit Low (Bank1)
DTC	P036800	Camshaft Position Sensor "B" Circuit High (Bank1)

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check exhaust camshaft phaser sensor connector

- Disconnect the negative battery.
- Check if exhaust camshaft phaser sensor connector is loose, and contact between male and female terminals is in good condition.

NG

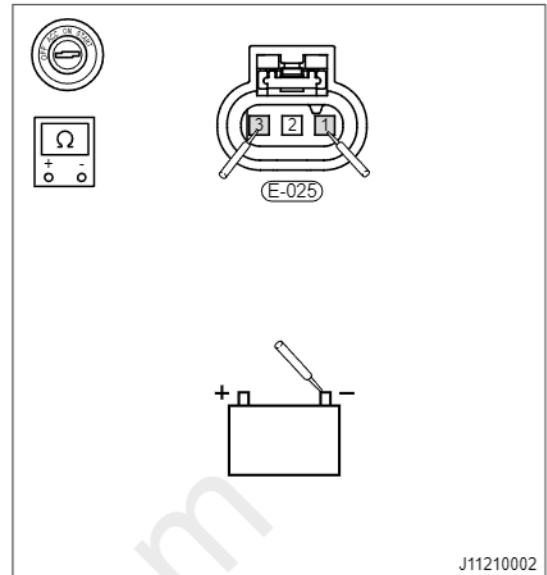
Repair and adjust connector, or replace it.

OK

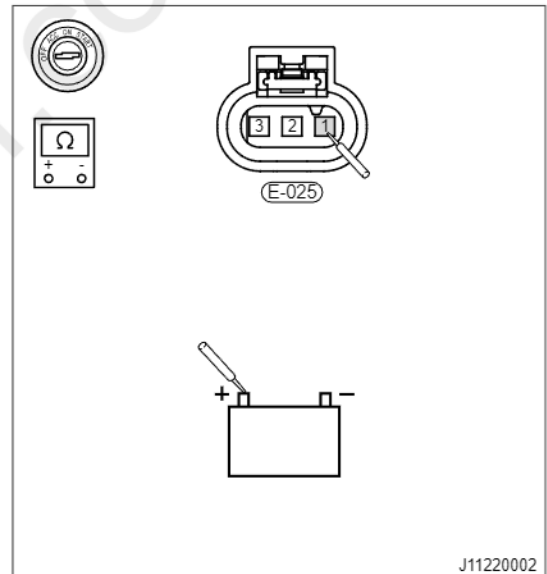
2

Check for short circuit to ground / power supply in exhaust camshaft phaser sensor circuit

- (a) Disconnect the exhaust camshaft phaser sensor connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of exhaust camshaft phaser sensor E-025 (1, 3) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure exhaust camshaft phaser sensor E-025 (1) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair wire harness circuit.

OK

3

Check exhaust camshaft phaser sensor circuit

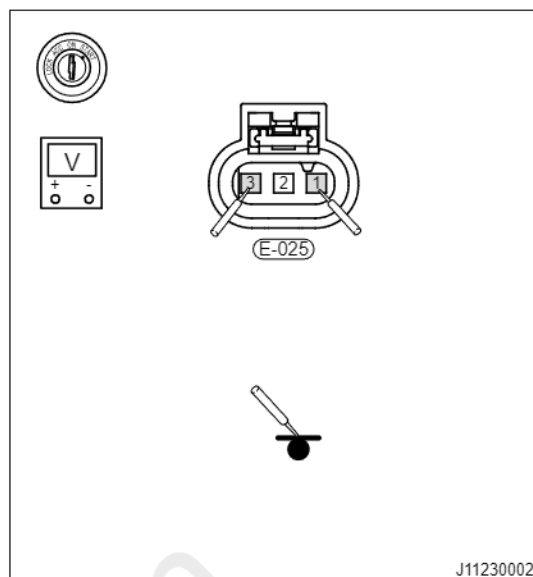
- (a) Connect the exhaust camshaft phaser sensor connector.
- (b) Start the engine.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of exhaust camshaft phaser sensor E-025 (1, 3) with red probe respectively.

Power supply: 12 V

Ground: < 0.2 V

- (d) Using the LED test light, connect clip to battery negative terminal, measure exhaust camshaft phaser sensor E-025 (1) with another end.

Under normal conditions, test light should flash.



J11230002

NG

Check wire harness or replace exhaust camshaft phaser sensor assembly.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Secondary Oil Pump Drive Circuit Open/Short to Ground/Power Supply

DTC	P06DC00	Engine Oil Pressure Control Circuit High
DTC	P06DB00	Engine Oil Pressure Control Circuit Low
DTC	P06DA00	Engine Oil Pressure Control Circuit Open

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check variable oil pump connector
---	-----------------------------------

- Disconnect the negative battery.
- Check if variable oil pump connector is loose, and contact between male and female terminals is in good condition.

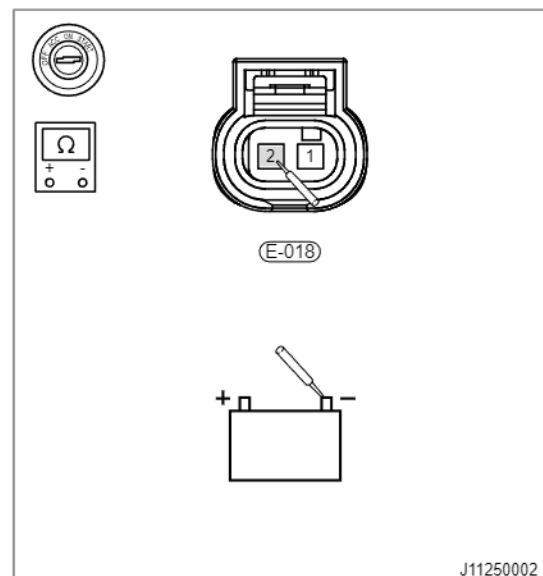
NG

Repair and adjust connector, or replace it.

OK

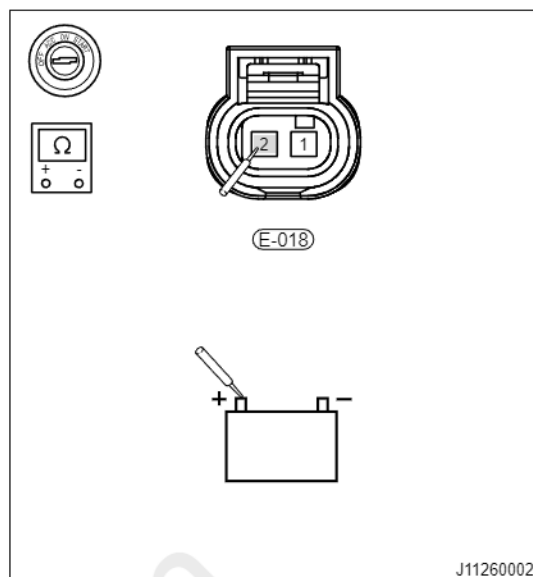
2	Check for short circuit to ground / power supply in variable oil pump circuit
---	---

- Disconnect the variable oil pump connector.
- Disconnect the ECM (E-014) connector.
- Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of variable oil pump E-018 (2) with red probe respectively. Check if circuit is short to ground.



J11250002

- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure variable oil pump E-018 (2) with red probe respectively. Check if circuit is short to power supply.



NG

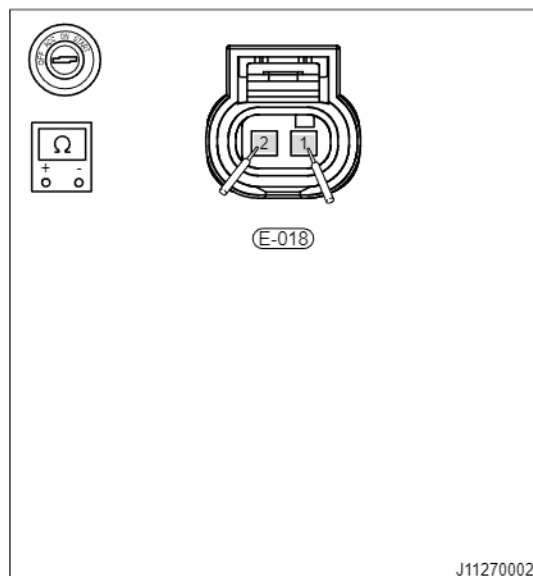
Check and repair control circuit.

OK

3

Check if circuits of variable oil pump themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of variable oil pump E-018 (1, 2) with red and black probes respectively; Check if they are shorted to each other.



NG

Replace variable oil pump assembly.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Catalyst System Efficiency Below Threshold Bank 1

DTC	P042000	Catalyst System Efficiency Below Threshold Bank 1
-----	---------	---

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check pre-catalytic converter

- (a) Check pre-catalytic converter for mechanical damage.
- (b) Check pre-catalytic converter for lead intoxication.

NG

Replace pre-catalytic converter assembly.

OK

2

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

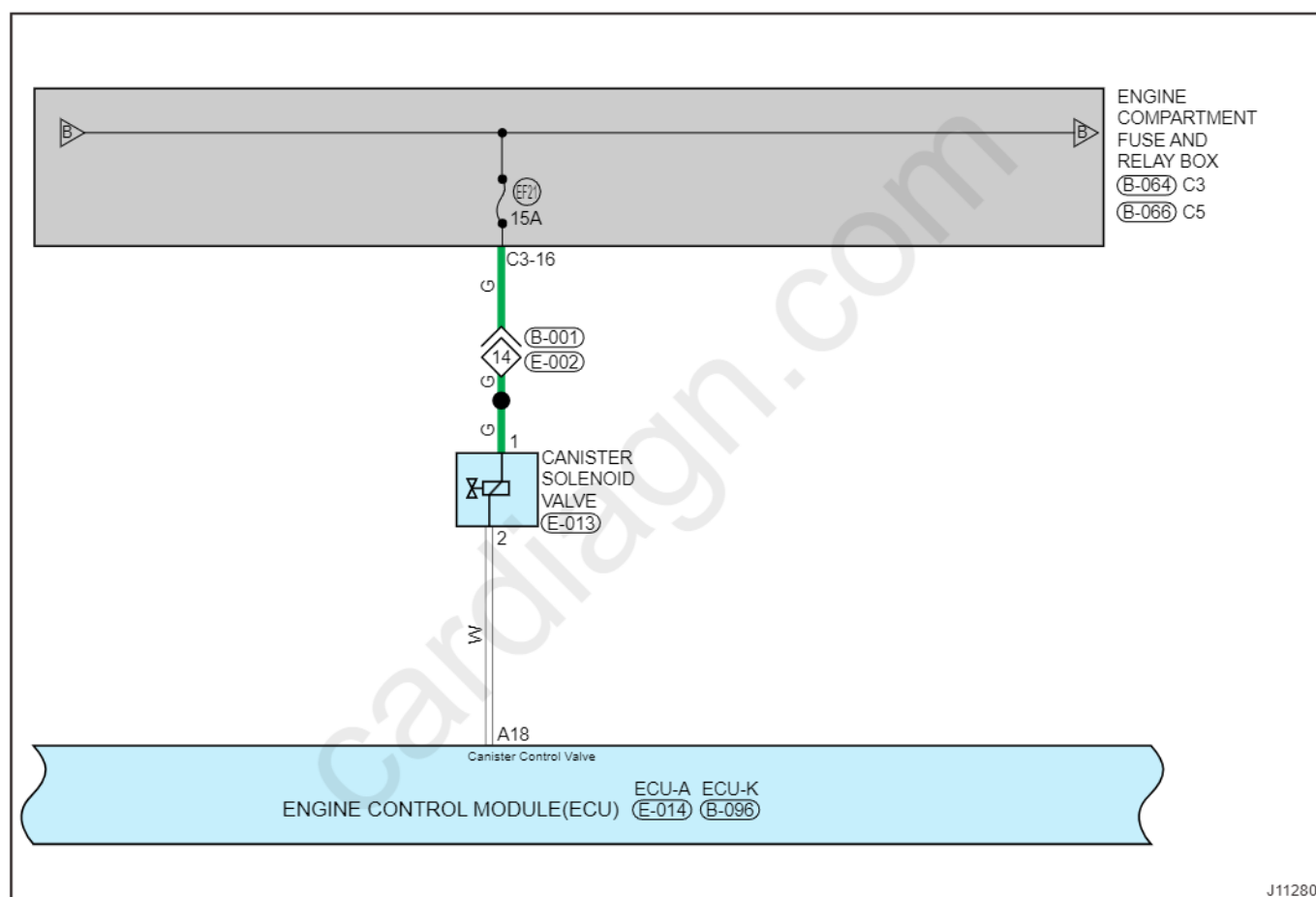
Conduct test and confirm malfunction has been repaired.

■ Canister Control Valve Control Circuit Open/Low/High

DTC	P045900	Evaporative Emission System Purge Control Valve Circuit High
DTC	P045800	Evaporative Emission System Purge Control Valve Circuit Low
DTC	P044400	Evaporative Emission System Purge Control Valve Circuit Open

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check canister solenoid valve connector

- (a) Disconnect the negative battery.
- (b) Check if canister solenoid valve connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2

Check canister solenoid valve power supply fuse

- (a) Check if engine compartment fuse and relay box fuse EF21 15A is damaged.

NG

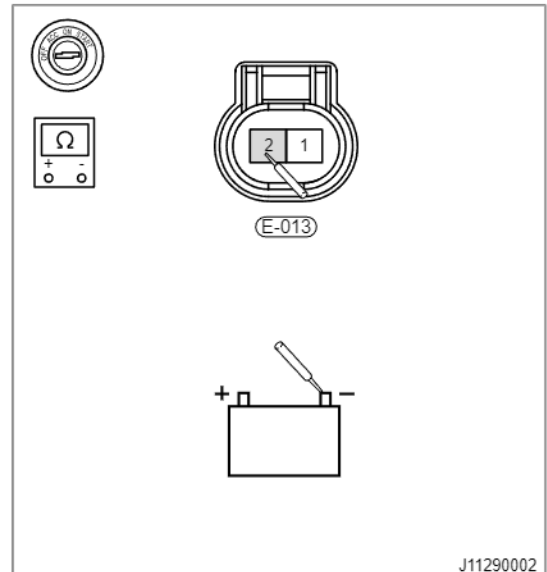
Check and repair short circuit malfunction of circuit.

OK

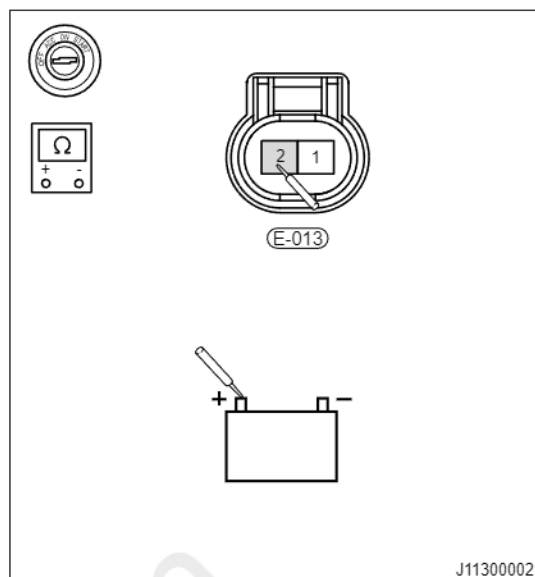
3

Check for short circuit to ground / power supply in canister solenoid valve circuit

- (a) Disconnect the variable oil pump connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of canister solenoid valve E-013 (2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure canister solenoid valve E-013 (2) with red probe respectively. Check if circuit is short to power supply.



NG

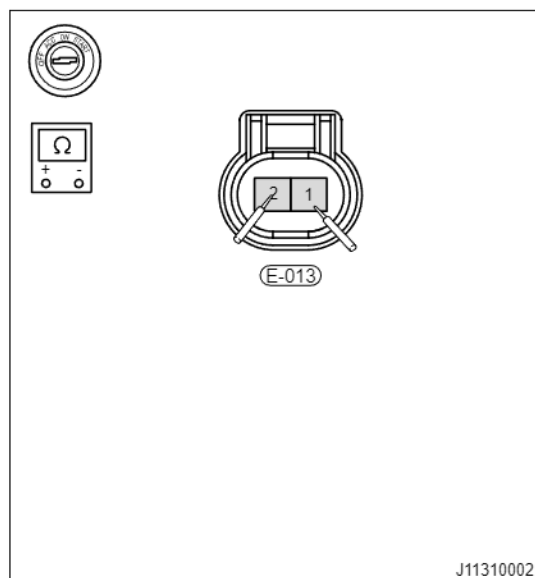
Check and repair control circuit.

OK

4

Check if circuits of canister solenoid valve themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of canister solenoid valve E-013 (1, 2) with red and black probes respectively; Check if they are shorted to each other.



NG

Replace canister solenoid valve assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Idling Too High/Too Low

DTC	P050600	Idle Control System RPM - Lower Than Expected
DTC	P050A21	Cold Start Idle Control System Performance
DTC	P050700	Idle Control System RPM - Higher Than Expected
DTC	P050500	Idle Control System
DTC	P050A22	Cold Start Idle Control System Performance
DTC	P050D00	Cold Start Rough Idle

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check electronic throttle connector

- (a) Disconnect the negative battery.
- (b) Check if electronic throttle connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check electronic throttle condition

- (a) Check if electronic throttle is stuck.
 (b) Check if electronic throttle is dirty.

NG**Clean or replace electronic throttle.****OK****3 Check intake manifold for air leakage**

- (a) Check intake manifold or connecting lines for air leakage.

NG**Replace parts related to air leakage.****OK****4 Check if fuel pressure too low**

- (a) Check if low/high pressure fuel pressure is too low.

NG**Replace parts that cause low fuel pressure****OK****5 Check injector for blockage**

- (a) Check fuel injector for blockage or leakage.

NG**Clean or replace fuel injector assembly.****OK****6 Check if exhaust back pressure is too high**

- (a) Check pre-catalytic converter for blockage.
 (b) Check GPF converter for blockage.

NG**Replace blocked parts or perform regeneration function.**

OK

7 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Battery Voltage Low Malfunction

DTC	P056200	System Voltage Low
------------	----------------	---------------------------

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check battery voltage

- (a) Check that battery voltage should not be lower than 12 V.

NG

It is necessary to recharge or replace the battery assembly.

OK

2 Check generating capacity of alternator

- (a) Check if generating capacity of alternator is normal.

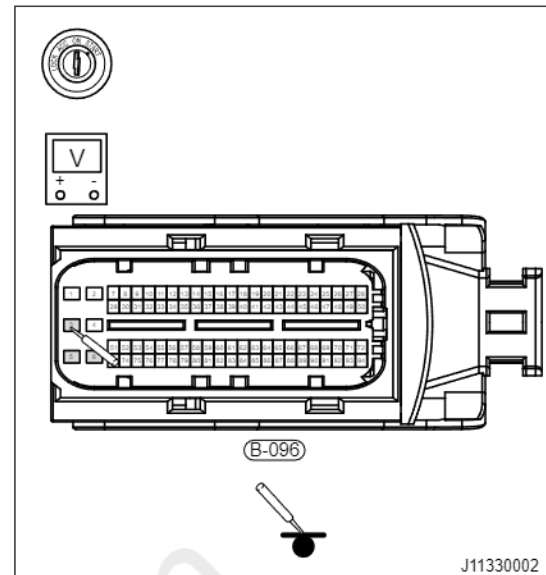
NG

Replace alternator assembly.

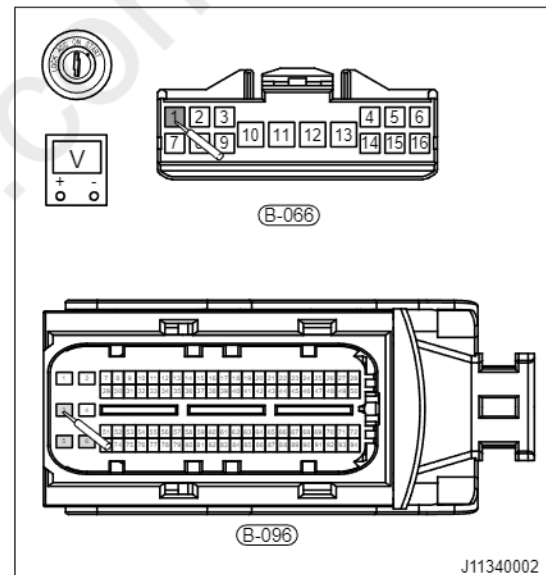
OK

3 Check ECM power supply circuit

- (a) Disconnect the ECM connector (B-096).
- (b) Short the main relay switch side with wire harness.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of ECM B-096 (3, 5, 6) with red probe respectively.
- (d) Or use test light to measure ECM B-096 (3, 5, 6); Test light should be bright.



- (e) Connect the ECM (B-096) connector.
- (f) Using voltage band of multimeter, connect black probe to engine compartment fuse and relay box B-066 (1), measure ECM B-096 (3, 5, 6) with red probe respectively. Check if circuit voltage drop value is too large.



NG

Check and repair control circuit.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5	Reconfirm DTCs
---	----------------

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ System Battery Voltage High

DTC	P056300	System Battery Voltage High
-----	---------	-----------------------------

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check generating capacity of alternator
---	---

- (a) Check if generating capacity of alternator is normal.

NG

Replace alternator assembly.

OK

2	Check Engine Control Module (ECM)
---	-----------------------------------

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

3	Reconfirm DTCs
---	----------------

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Starter Relay Control Terminal Circuit Low/High

DTC	P061500	Starter Relay "A" Circuit
DTC	P061600	Starter Relay "A" Circuit Low
DTC	P061700	Starter Relay "A" Circuit High

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check starter relay coil terminal power supply fuse

- (a) Check if engine compartment fuse and relay box fuse EF23 5A is blown.

NG

Check and repair short circuit malfunction of circuit.

OK

2 Check starter relay

- (a) Replace starter relay.

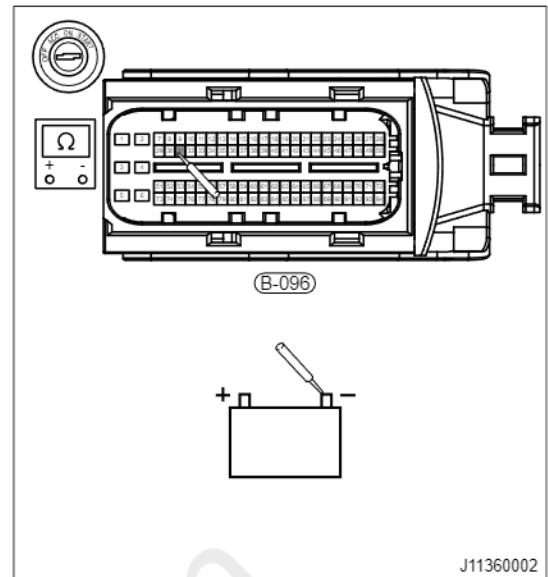
NG

Replace starter relay.

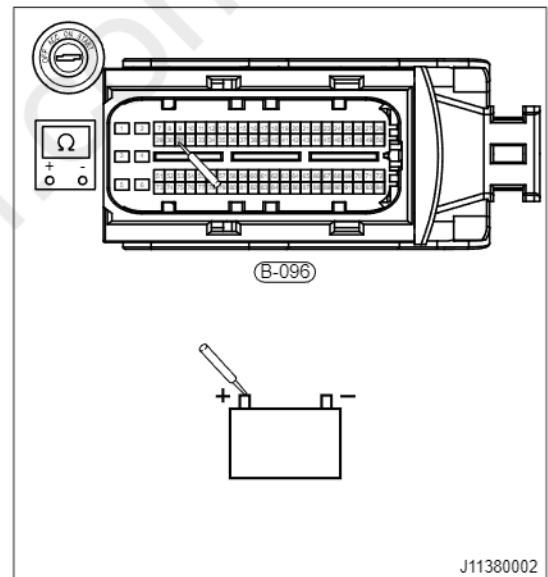
OK

3 Check for short circuit to ground / power supply in ECM control circuit

- (a) Disconnect the engine compartment fuse and relay box connector (B-065).
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of ECM B-096 (31) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure ECM B-096 (31) with red probe respectively. Check if circuit is short to power supply.



NG

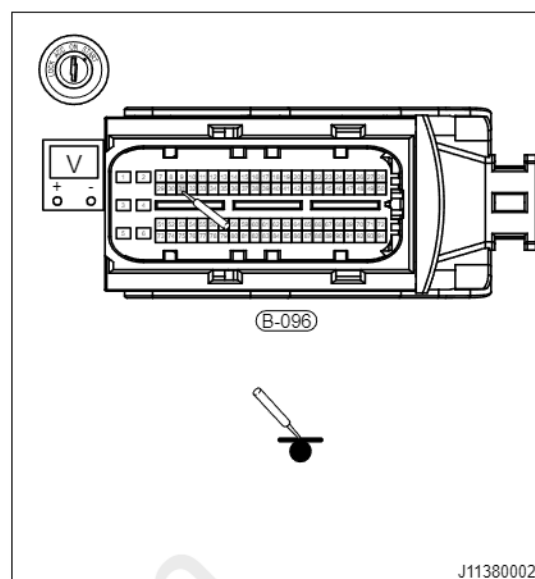
Check and repair control circuit.

OK

4

Check ECM control circuit

- (a) Connect the engine compartment fuse and relay box connector (B-065).
- (b) Short the main relay switch side with wire harness.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of ECM B-096 (31) with red probe respectively.
- (d) Or use test light to measure ECM B-096 (31); Test light should be bright.



NG

Check and repair control circuit.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

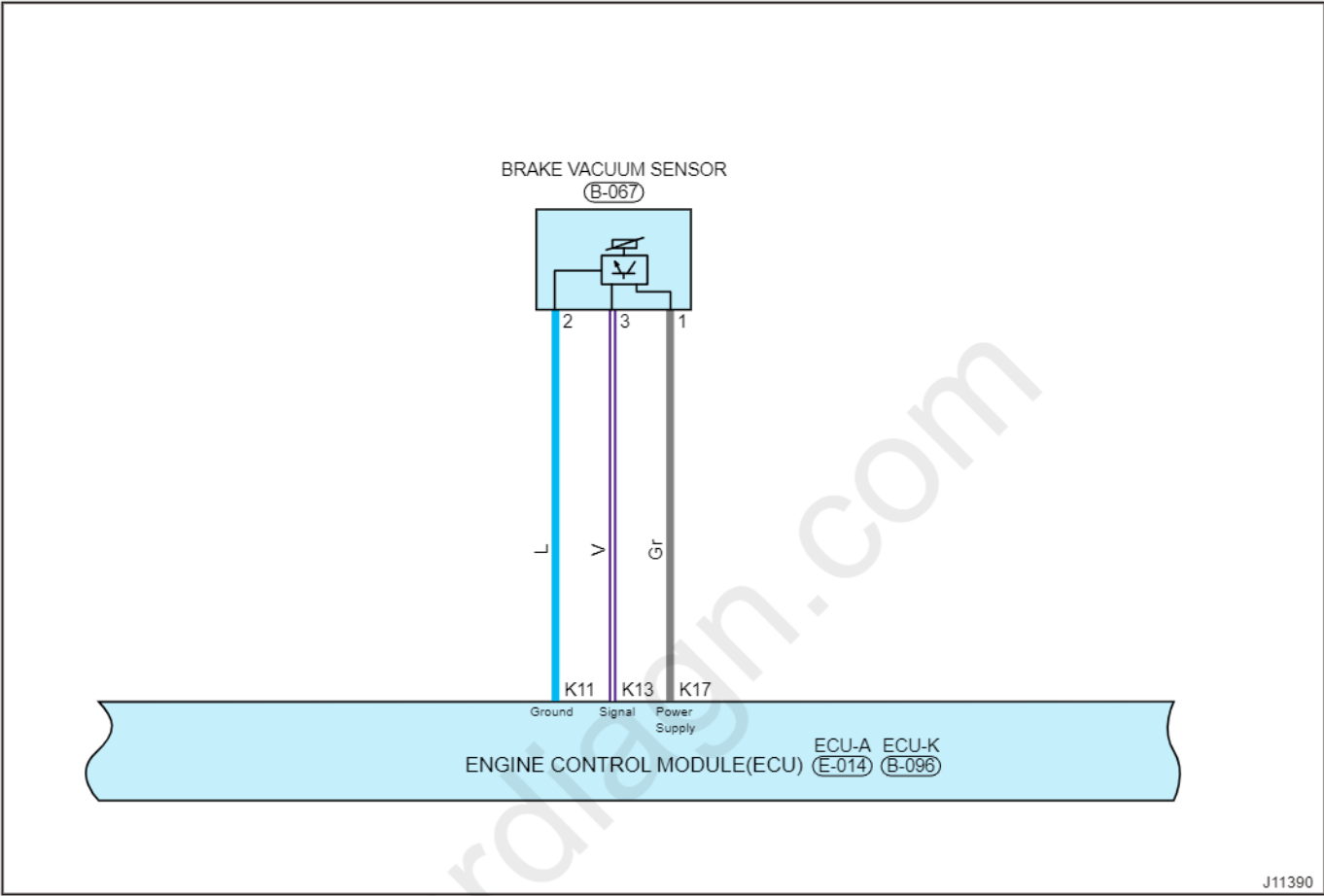
■ Brake Chamber Vacuum Pressure Sensor Voltage High/Low

DTC	P055800	Brake Booster Pressure Sensor Circuit High
DTC	P055700	Brake Booster Pressure Sensor Circuit Low

DTC	P145000	Brake Booster Pressure Sensor Circuit Range/Performance (High)
DTC	P145100	Brake Booster Pressure Sensor Circuit Range/Performance (Low)

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check vacuum pressure sensor connector
---	--

- (a) Disconnect the negative battery.
- (b) Check if vacuum pressure sensor connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check brake vacuum booster system for damage or air leakage

- (a) Check brake vacuum booster system each line for damage, or connecting pipe port for air leakage, vacuum pump for abnormal operation, etc.

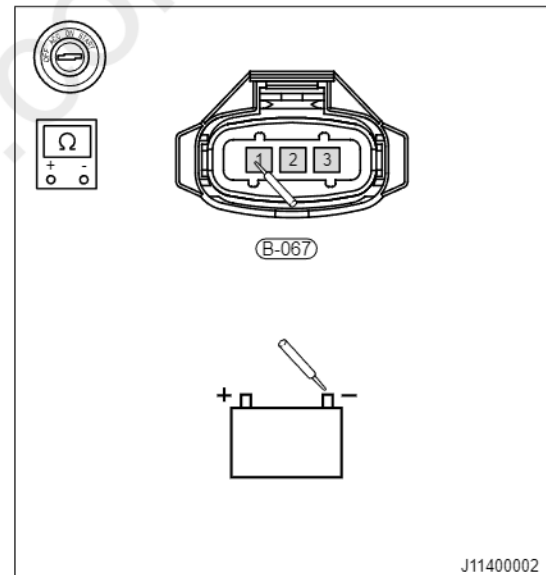
NG

Repair or replace the damaged parts related to brake booster system.

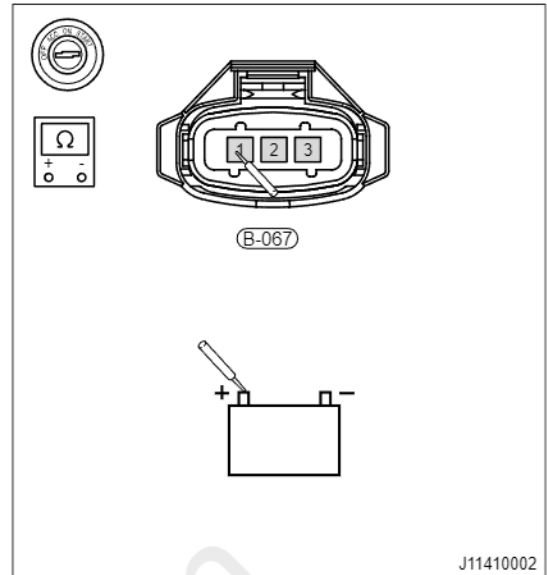
OK

3 Check for short circuit to ground / power supply in vacuum pressure sensor

- (a) Disconnect the vacuum pressure sensor connector.
 (b) Disconnect the ECM connector (B-096).
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of vacuum pressure sensor B-067 (1, 2, 3) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of vacuum pressure sensor B-067 (1, 2, 3) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair wire harness.

OK

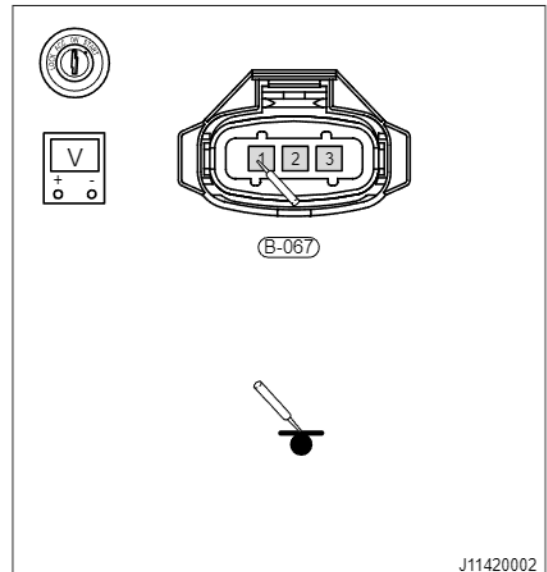
4 Check vacuum pressure sensor voltage signal

- (a) Connect vacuum pressure sensor and ECM connectors.
 (b) Ignition switch ON.
 (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of vacuum pressure sensor B-067 (1, 2, 3) with red probe respectively.

Power supply: 5 V

Ground: < 0.2 V

Depress brake pedal consecutively; Signal voltage should vary in accordance with pressure.



NG

Check and repair wire harness, or replace vacuum pressure sensor.

OK

5 Check vacuum pressure sensor itself

- (a) Using ohm band of multimeter, measure resistance between vacuum pressure sensor (1, 3), and resistance between (1, 2) with red and black probes respectively. Check if internal circuits are shorted to each other.

Resistance at ambient temperature: 1 K Ω ~ 2 K Ω

NG

Replace vacuum pressure sensor assembly.

OK

6 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

7 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

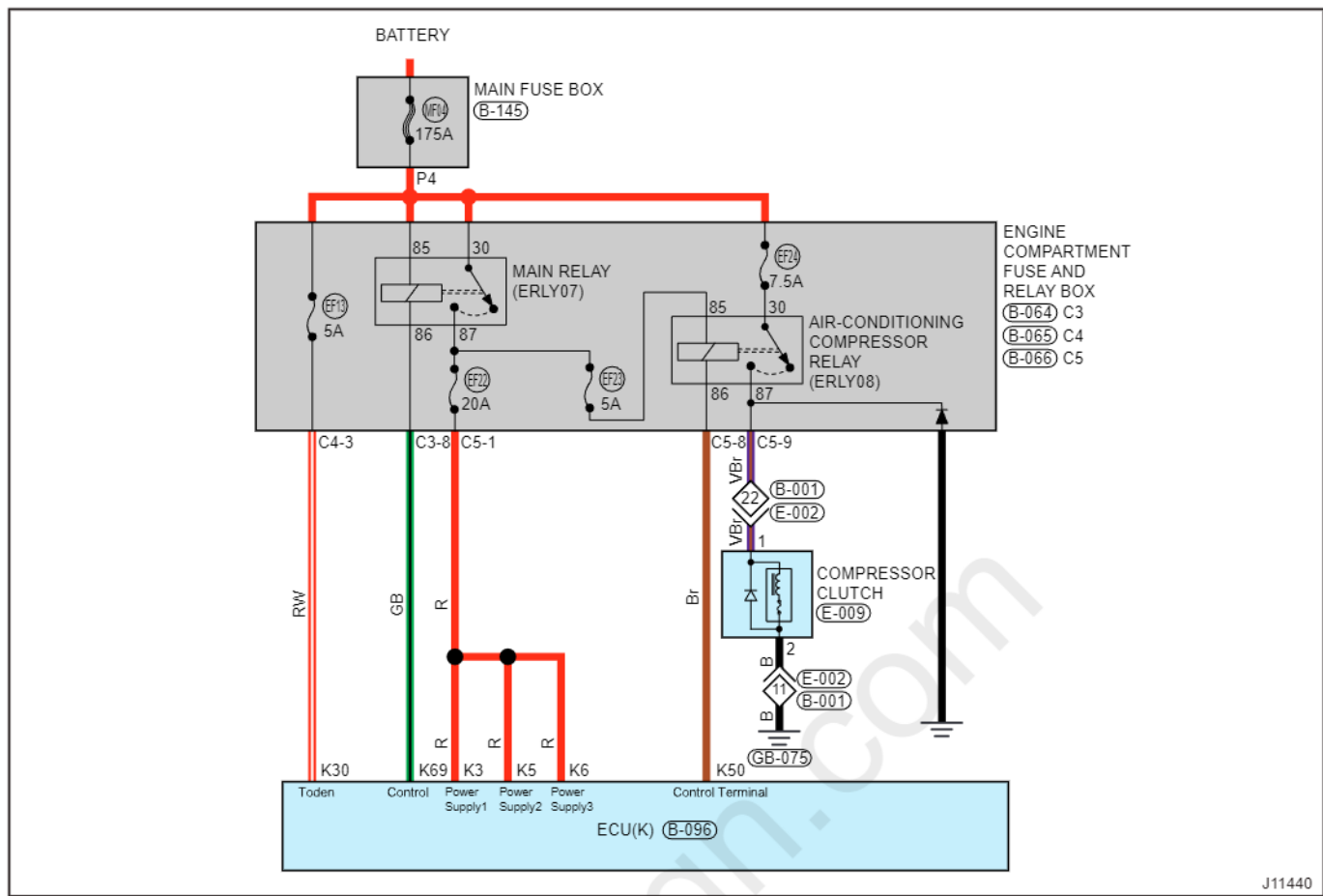
Conduct test and confirm malfunction has been repaired.

■ **A/C Compressor Circuit Voltage Too Low/Too High**

DTC	P064500	A/C Clutch Relay Control Circuit
DTC	P064700	A/C Clutch Relay Control Circuit High
DTC	P064600	A/C Clutch Relay Control Circuit Low

■ **Description**

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check A/C compressor relay coil terminal power supply fuse

- (a) Check if engine compartment fuse and relay box fuse EF23 5A is blown.

NG

Check and repair short circuit malfunction of circuit.

OK

2 Check A/C compressor relay

- (a) Replace A/C compressor relay.

NG

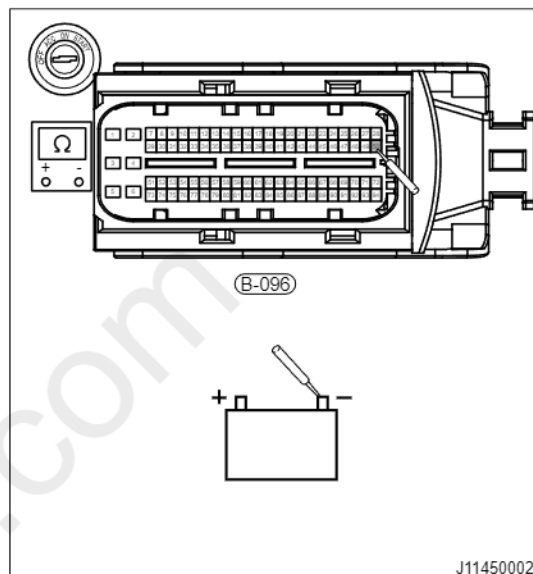
Replace A/C compressor relay.

OK

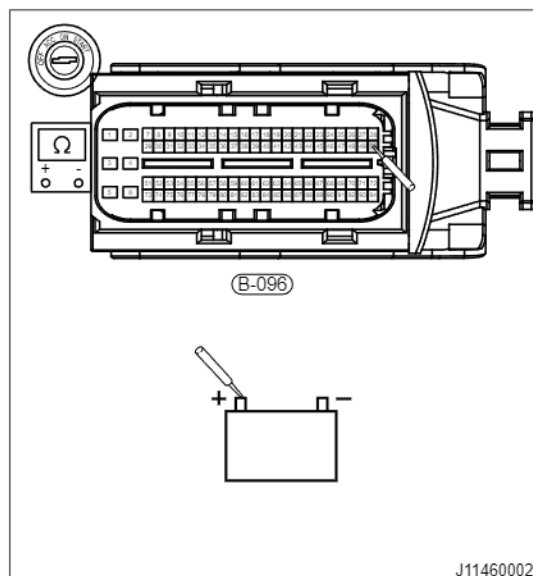
3

Check for short circuit to ground / power supply in ECM control circuit

- (a) Unplug the A/C compressor relay.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of ECM B-096 (50) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure ECM B-096 (50) with red probe respectively. Check if circuit is short to power supply.



NG

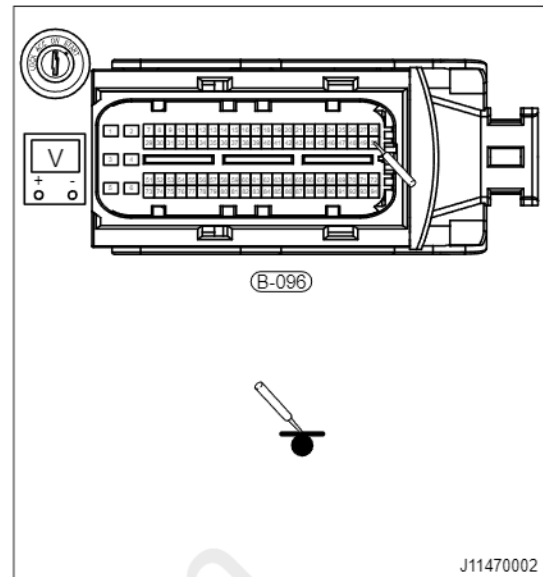
Check and repair control circuit.

OK

4

Check ECM control circuit

- Connect A/C compressor relay.
- Short the main relay switch side with wire harness.
- Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of ECM B-096 (50) with red probe respectively.
- Or use test light to measure ECM B-096 (50); Test light should be bright.



NG

Check and repair control circuit.

OK

5

Check Engine Control Module (ECM)

- Remove Engine Control Module (ECM) from malfunctioning vehicle.
- Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

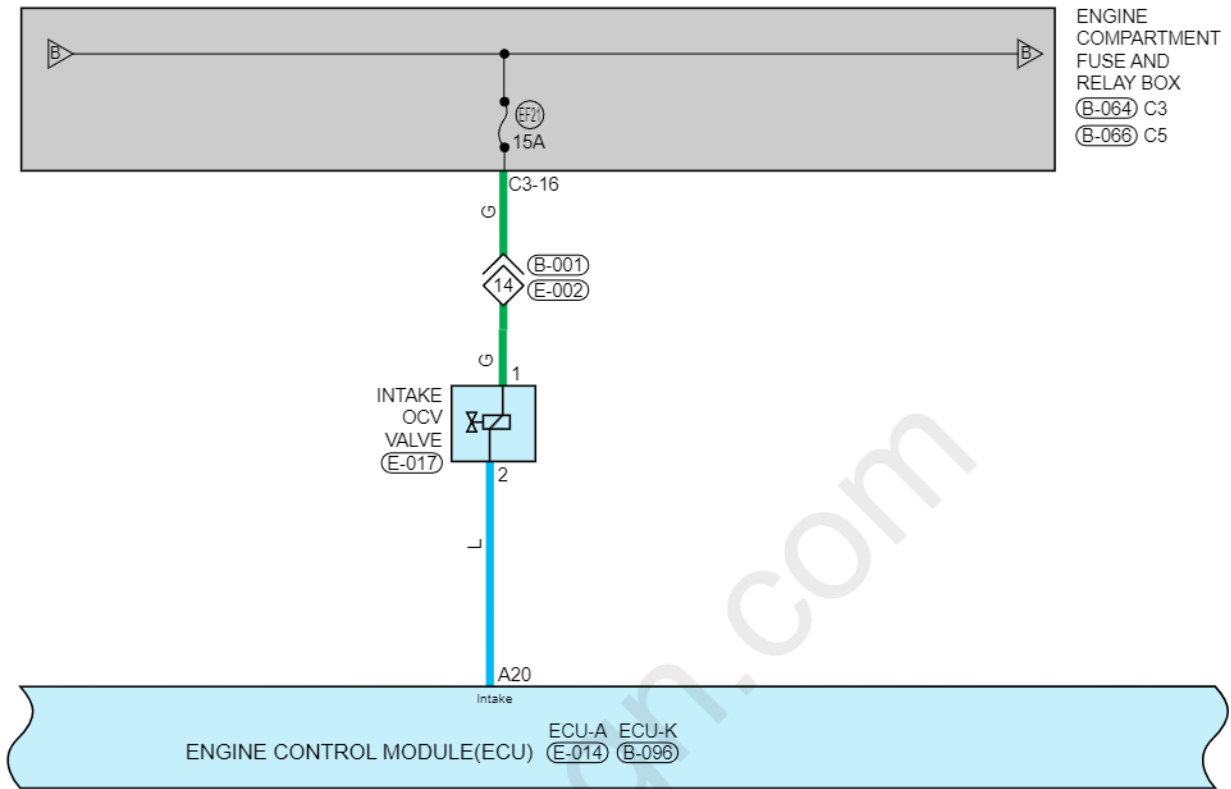
Conduct test and confirm malfunction has been repaired.

■ Intake VVT Control Circuit Voltage Too Low/Too High

DTC	P208800	"A" Camshaft Position Actuator Control Circuit Low Bank 1
DTC	P208900	"A" Camshaft Position Actuator Control Circuit High Bank 1

■ Description

Circuit Diagram



J11480

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check intake phaser solenoid valve connector

- Disconnect the negative battery.
- Check if intake phaser solenoid valve connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check intake phaser solenoid valve power supply fuse

- (a) Check if engine compartment fuse and relay box fuse EF21 15A is blown.

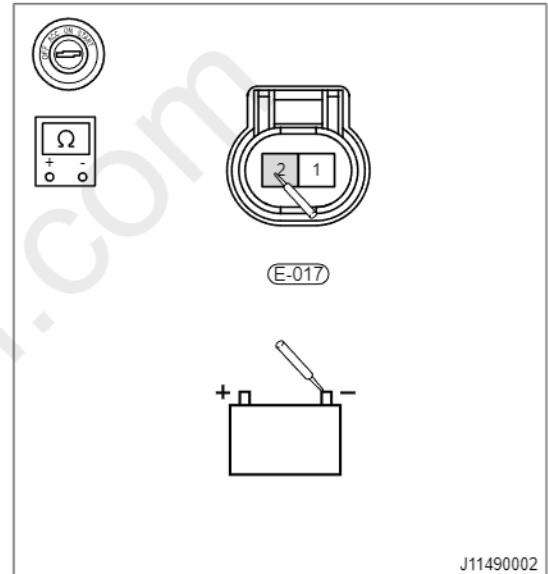
NG

Check and repair short circuit malfunction of circuit.

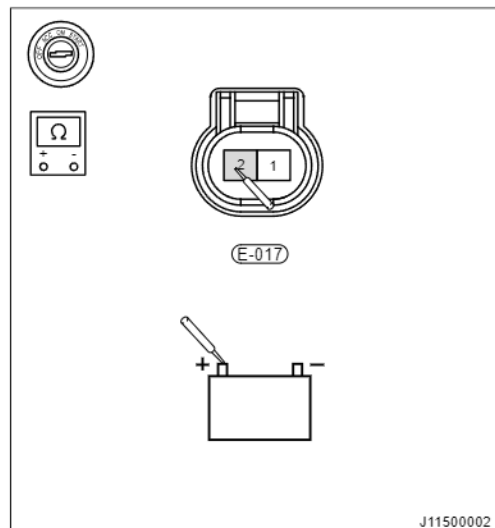
OK

3 Check for short circuit to ground / power supply in intake phaser solenoid valve circuit

- (a) Disconnect the intake phaser solenoid valve connector.
 (b) Disconnect the ECM (E-014) connector.
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of intake phaser solenoid valve E-017 (2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistance of intake phaser solenoid valve E-017 (2) with red probe respectively. Check if circuit is short to power supply.



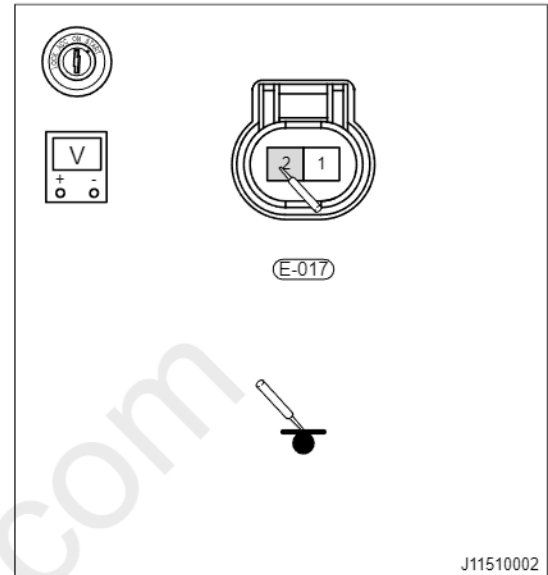
NG

Check and repair control circuit.

OK

4 Check intake phaser solenoid valve control circuit

- (a) Connect the intake phaser solenoid valve connector.
- (b) Turn the ignition switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of intake phaser solenoid valve E-017 (2) with red probe.
- (d) Or use test light to measure intake phaser solenoid valve E-017 (2); Test light should be bright.



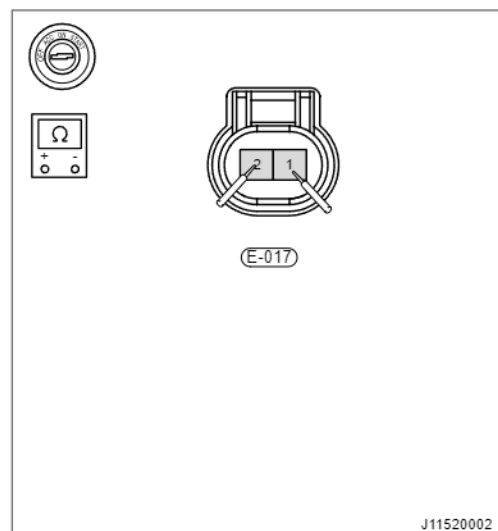
NG

Check and repair control circuit.

OK

5 Check if circuits of intake phaser solenoid valve themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of intake phaser solenoid valve E-017 (1, 2) with red and black probes respectively; Check if they are shorted to each other.



NG

Replace intake phaser solenoid valve assembly.

OK

6 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

7 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

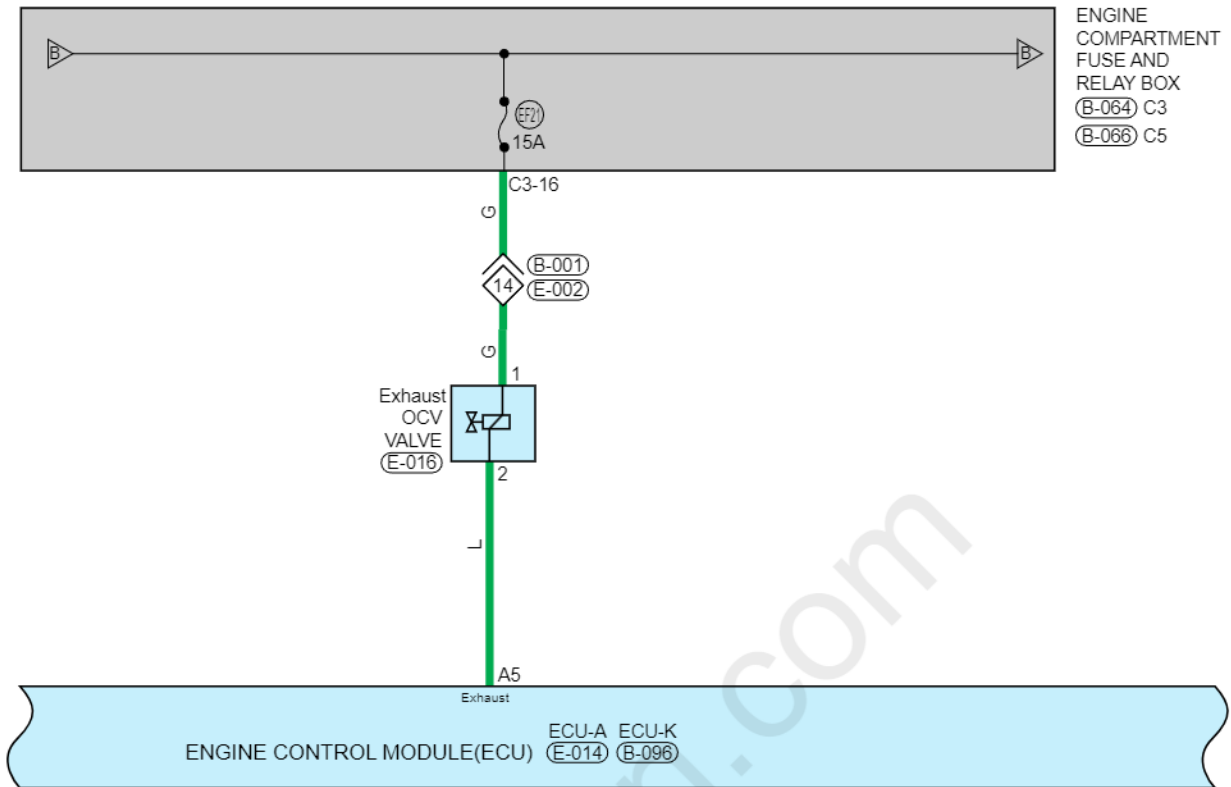
Conduct test and confirm malfunction has been repaired.

■ Exhaust VVT Control Circuit Voltage Too Low/Too High

DTC	P209000	"B" Camshaft Position Actuator Control Circuit Low Bank 1
DTC	P209100	"B" Camshaft Position Actuator Control Circuit High Bank 1

■ Description

Circuit Diagram



J11530

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check exhaust phaser solenoid valve connector

- (a) Disconnect the negative battery.
- (b) Check if exhaust phaser solenoid valve connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check exhaust phaser solenoid valve power supply fuse

- (a) Check if engine compartment fuse and relay box fuse EF21 15A is blown.

NG

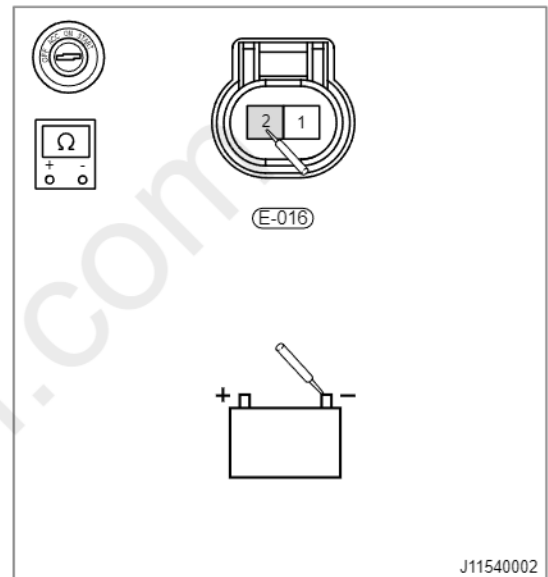
Check and repair short circuit malfunction of circuit.

OK

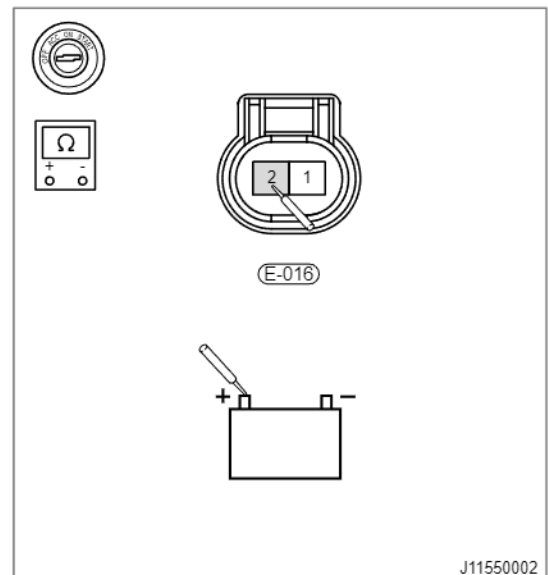
3

Check for short circuit to ground / power supply in exhaust phaser solenoid valve circuit

- (a) Disconnect the exhaust phaser solenoid valve connector.
 (b) Disconnect the ECM (E-014) connector.
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of exhaust phaser solenoid valve E-016 (2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistance of exhaust phaser solenoid valve E-016 (2) with red probe respectively. Check if circuit is short to power supply.



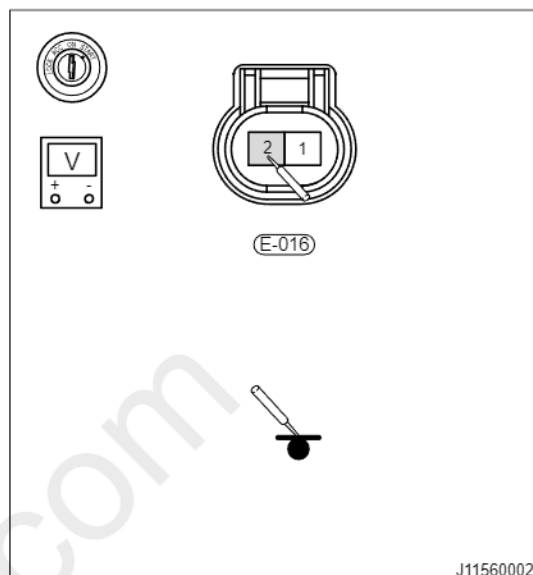
NG

Check and repair control circuit.

OK

4 Check exhaust phaser solenoid valve control circuit

- (a) Connect exhaust phaser solenoid valve connector.
- (b) Turn the ignition switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of exhaust phaser solenoid valve E-016 (2) with red probe.
- (d) Or use test light to measure exhaust phaser solenoid valve E-016 (2); Test light should be bright.



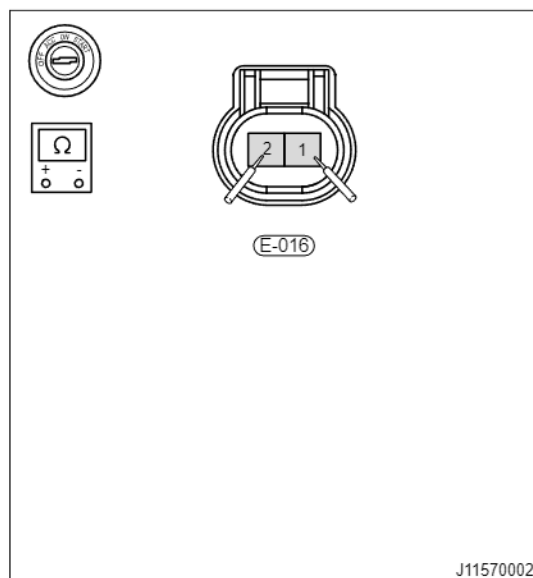
NG

Check and repair control circuit.

OK

5 Check if circuits of exhaust phaser solenoid valve themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of exhaust phaser solenoid valve E-016 (1, 2) with red and black probes respectively; Check if they are shorted to each other.



NG

Replace exhaust phaser solenoid valve assembly.

OK

6 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

7 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Air-fuel Ratio Closed Loop Control Correction

DTC	P217700	System Too Lean Off Idle Bank 1
DTC	P217800	System Too Rich Off Idle Bank 1
DTC	P218700	System Too Lean at Idle Bank 1
DTC	P218800	System Too Lean at Idle Bank 1
DTC	P219500	O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1
DTC	P219600	O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1
DTC	P241400	Upstream Oxygen Sensor Output Voltage Improper
DTC	P209700	Closed Loop Correction Value Based on Downstream Over Threshold - Rich
DTC	P209600	Closed Loop Correction Value Based on Downstream Over Threshold - Lean

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check upstream oxygen sensor

- (a) Depress the accelerator pedal sharply under idling condition, oxygen pump control voltage of oxygen sensor should be lower than 2.5 V at this time.
- (b) Oxygen pump control voltage of oxygen sensor should be higher than 2.5 V when releasing the accelerator pedal quickly.

NG**Replace upstream oxygen sensor assembly.****OK****2 Check intake pressure/temperature sensor**

- (a) Check intake pressure/temperature sensor (pressure signal).

Under idling state: Approximately 1 V**When the vehicle accelerates rapidly, voltage can instantly reach 4 V, and then drop to approximately 1.7 V****NG****Replace intake pressure/temperature sensor.****OK****3 Check fuel system**

- (a) Check if low/high pressure fuel pressure is within the proper range.
- (b) Check if fuel injector is dirty.

NG**Replace fuel system damaged parts or clean fuel injector.****OK****4 Check intake system**

- (a) Check intake manifold, etc. to determine each line for air leakage.

NG**Replace the leaked or damaged parts.**

OK

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Downstream Oxygen Sensor Deteriorated

DTC	P227000	O2 Sensor Signal Biased&Stuck Lean Bank 1 Sensor 2
DTC	P227100	O2 Sensor Signal Biased&Stuck Rich Bank 1 Sensor 2
DTC	P013A00	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check downstream oxygen sensor

- (a) Check if downstream oxygen sensor heating resistance is normal.

Resistance at ambient temperature: 7 ~ 11 Ω

- (b) Check if downstream oxygen sensor signal voltage is normal.

It is normal when signal voltage fluctuates slightly from 0.55 to 0.65 V

NG

Replace downstream oxygen sensor assembly.

OK

2 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Turbocharger Boost Pressure Too High

DTC	P023400	Turbocharger/Supercharger Overboost Condition
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■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check turbocharger relief valve

- (a) Check turbocharger relief valve connector for looseness or poor contact.
- (b) Check if turbocharger relief valve stuck.

NG

Replace turbocharger relief valve assembly.

OK

2 Check exhaust gas by-pass valve

- (a) Pull exhaust gas by-pass valve pulling rod with hand to check that it can move smoothly and there is no stuck.

NG

Replace turbocharger assembly.

OK

3 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

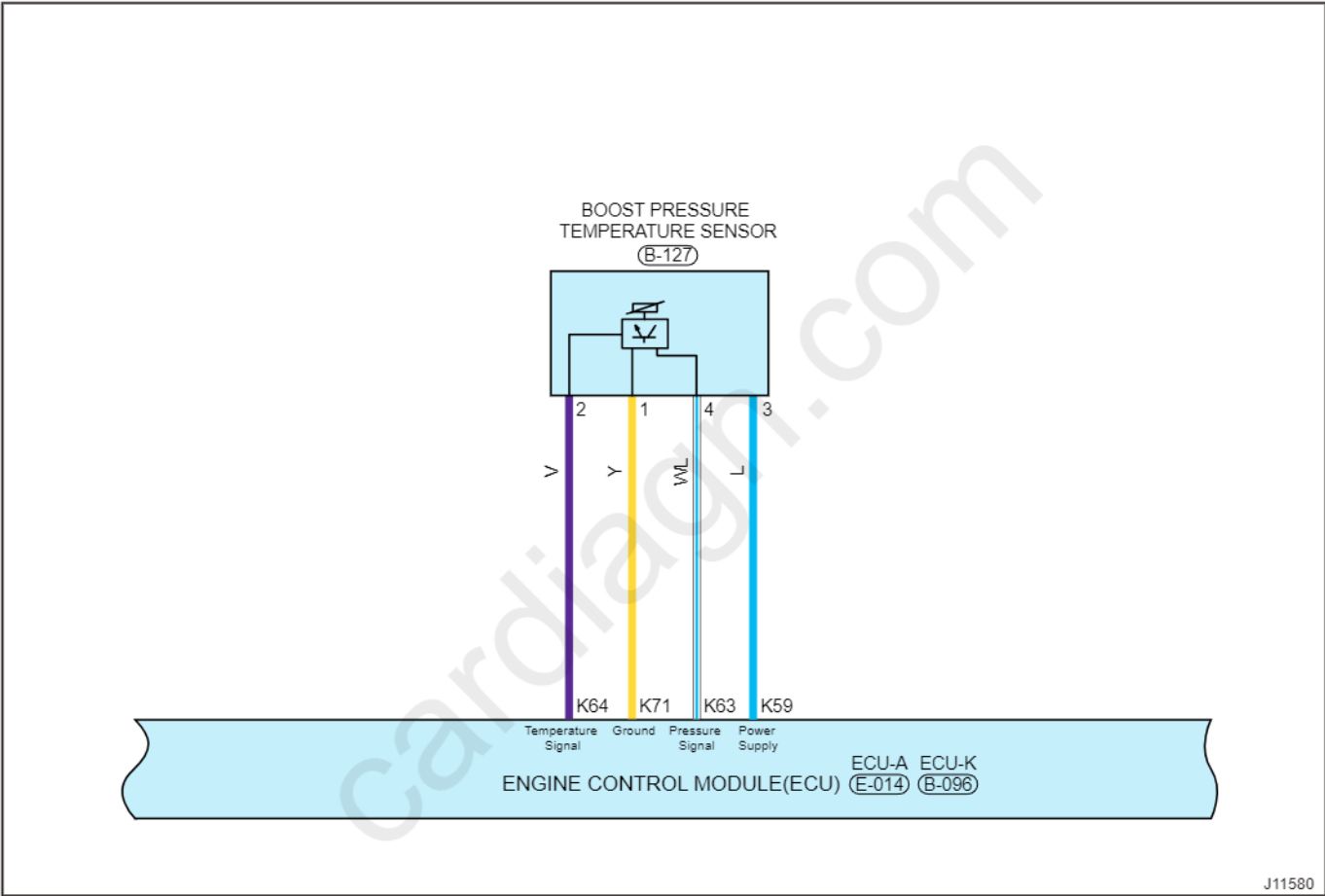
Conduct test and confirm malfunction has been repaired.

■ Turbocharger Pressure Sensor Short to Ground/Power Supply

DTC	P023700	Turbocharger/Supercharger Boost Sensor "A" Circuit Low
DTC	P023800	Turbocharger/Supercharger Boost Sensor "A" Circuit High

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check boost pressure/temperature sensor connector
---	---

- (a) Disconnect the negative battery.
- (b) Check if boost pressure/temperature sensor connector is loose, and contact between male and female terminals is in good condition.

NG

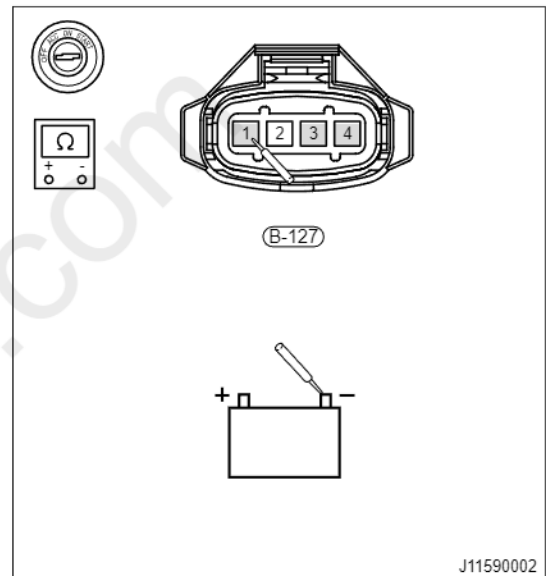
Repair and adjust connector, or replace it.

OK

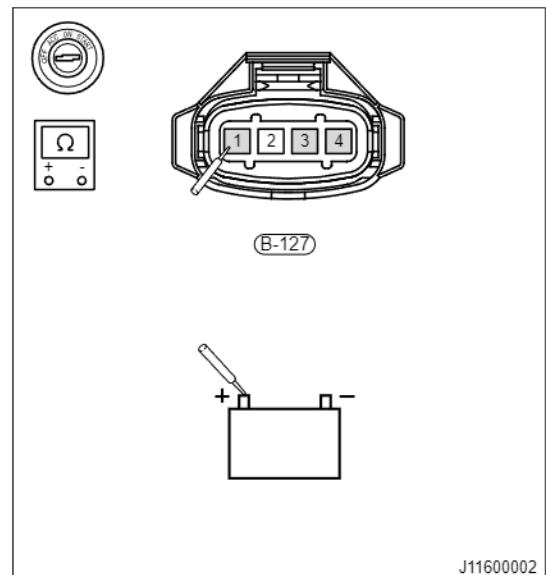
2

Check for short circuit to ground / power supply in boost pressure/temperature sensor circuit

- (a) Disconnect the boost pressure/temperature sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of boost pressure/temperature sensor B-127 (1, 3, 4) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of boost pressure/temperature sensor B-127 (1, 3, 4) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair control circuit.

OK

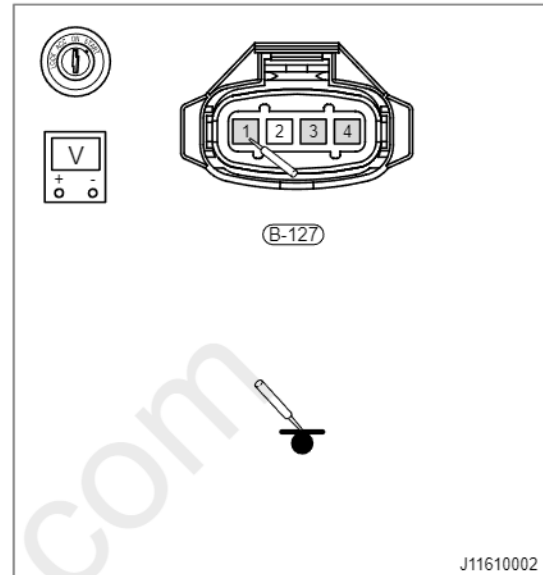
3 Check boost pressure/temperature sensor control circuit

- (a) Connect boost pressure/temperature sensor connector.
- (b) Turn the ignition switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of boost pressure/temperature sensor B-127 (1, 3, 4) with red probe respectively.

Power supply terminal: 5 V

Ground terminal: < 0.2 V

Signal voltage varies in accordance with turbocharger line pressure



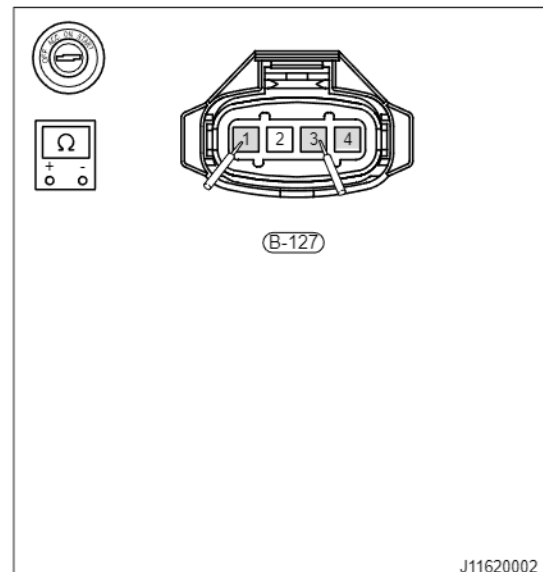
NG

Check and repair control circuit, or replace boost pressure/temperature sensor.

OK

4 Check if circuits of boost pressure/temperature sensor themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of boost pressure/temperature sensor B-127 (1, 3, 4) with red and black probes respectively; Check if they are shorted to each other.



NG

Replace boost pressure/temperature sensor assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ **Turbocharger Boost Pressure Too Low**

DTC

P029900

Turbocharger/Supercharger "A" Underboost Condition

■ **DTC Confirmation Procedure**

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check air filter

- (a) Check if air filter is dirty, blocked, etc.

NG

Replace the air filter assembly.

OK

2	Check each connecting line of turbocharger
----------	---

- (a) Check each connecting line of turbocharger for falling off, damage or air leakage, etc.

NG	Replace the damaged line.
-----------	----------------------------------

OK

3	Check exhaust gas by-pass valve
----------	--

- (a) Pull exhaust gas by-pass valve pulling rod with hand, there should be no stuck.

NG	Replace turbocharger assembly.
-----------	---------------------------------------

OK

4	Check relief solenoid valve
----------	------------------------------------

- (a) Check that relief solenoid valve connector is not loose or does not fall off.
 (b) Check if relief solenoid valve is stuck at normally open position.

NG	Replace relief solenoid valve assembly.
-----------	--

OK

5	Check turbocharger
----------	---------------------------

- (a) Check operation parts such as turbine, impeller for damage or blade missing.

NG	Replace turbocharger assembly.
-----------	---------------------------------------

OK

6	Check if exhaust back pressure is too high
----------	---

- (a) Check pre-catalytic converter for blockage.
 (b) Check GPF particulate filter for blockage.

NG

Replace pre-catalytic converter assembly or perform GPF regeneration.

OK

7

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ **Turbocharger/Supercharger Bypass Valve "A" - Mechanical**

DTC	P226100	Turbocharger/Supercharger Bypass Valve - Mechanical
-----	---------	---

■ **DTC Confirmation Procedure**

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check relief solenoid valve

- (a) Check that relief solenoid valve connector is not loose or does not fall off.
- (b) Check if relief solenoid valve is not stuck.

NG

Replace relief solenoid valve assembly.

OK

2

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

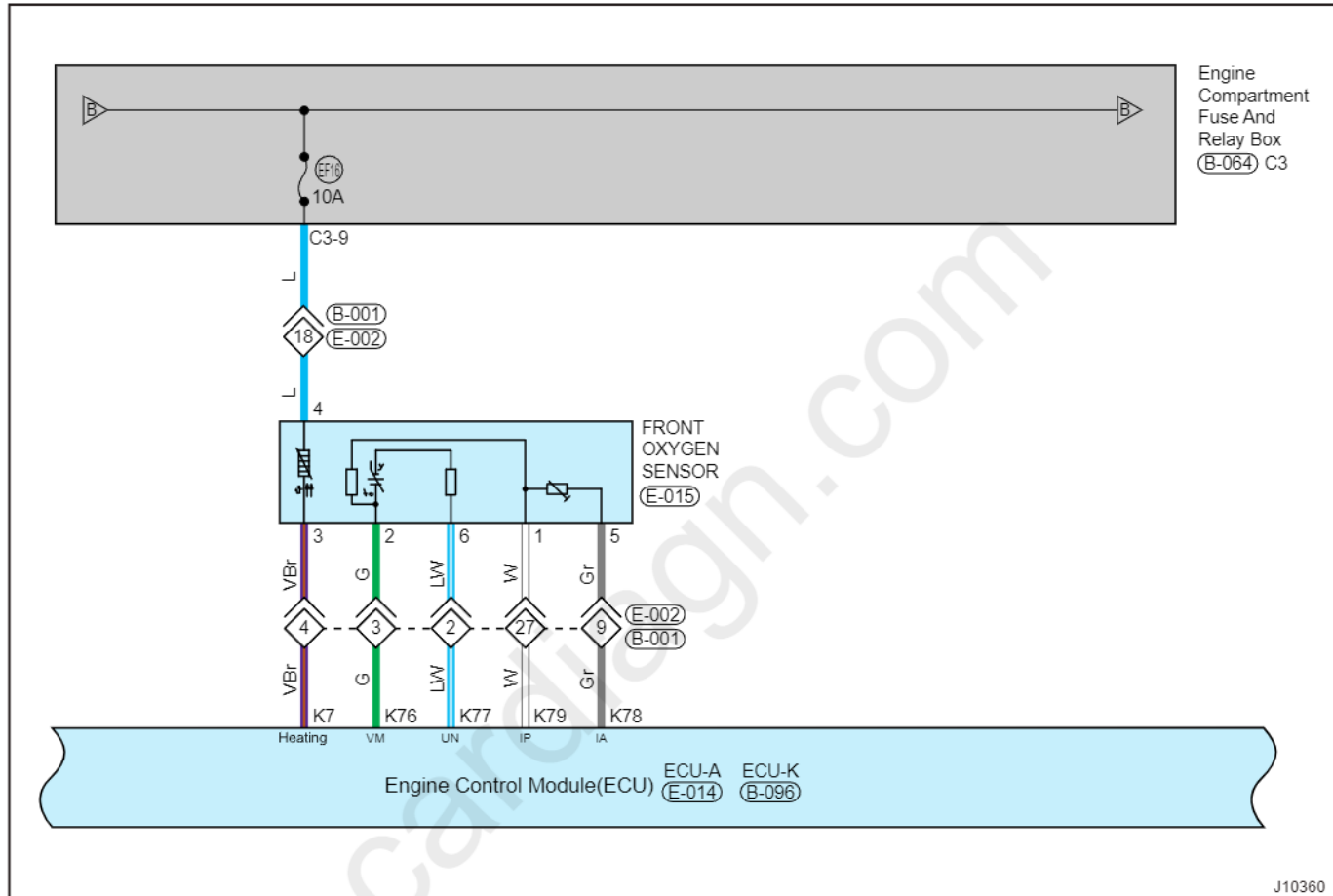
OK

Conduct test and confirm malfunction has been repaired.

■ Upstream Oxygen Sensor RE Line, IPE Line Open

DTC	P224300	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1
DTC	P225100	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1
DTC	P013000	O2 Sensor Circuit Bank 1 Sensor 1
DTC	P223700	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1

■ Description Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check upstream oxygen sensor connector
---	--

- Disconnect the negative battery.
- Check if upstream oxygen sensor connector is loose, and contact between male and female terminals is in good condition.

NG

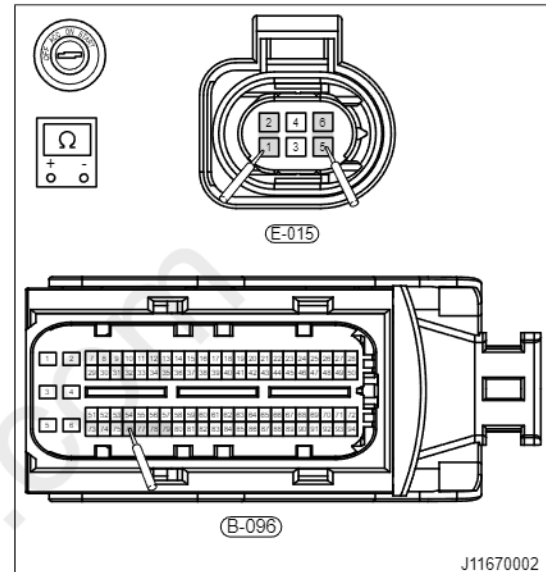
Repair and adjust connector, or replace it.

OK

2

Check upstream oxygen sensor circuit for open

- (a) Disconnect the upstream oxygen sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to ECM B-096 (79, 76, 78, 77), measure resistances of upstream oxygen sensor E-015 (1, 2, 5, 6) with red probe respectively. Check the circuit for open.



NG

Check and repair control circuit.

OK

3

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Network Malfunction

DTC	U015187	Lost Communication With ABM
DTC	U016487	Lost Communication With CLM
DTC	U015587	Lost Communication With ICM
DTC	U021487	Lost Communication With PEPS
DTC	U186887	Lost Communication With MFS
DTC	U007388	Control Module Communication Bus "A" Off
DTC	U010187	Lost Communication With TCM
DTC	U010387	Lost Communication With EGS
DTC	U012287	Lost Communication With ESP Module
DTC	U012887	Lost Communication With EPB
DTC	U014087	Lost Communication With BCM
DTC	U021287	Lost Communication With Steering Column

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

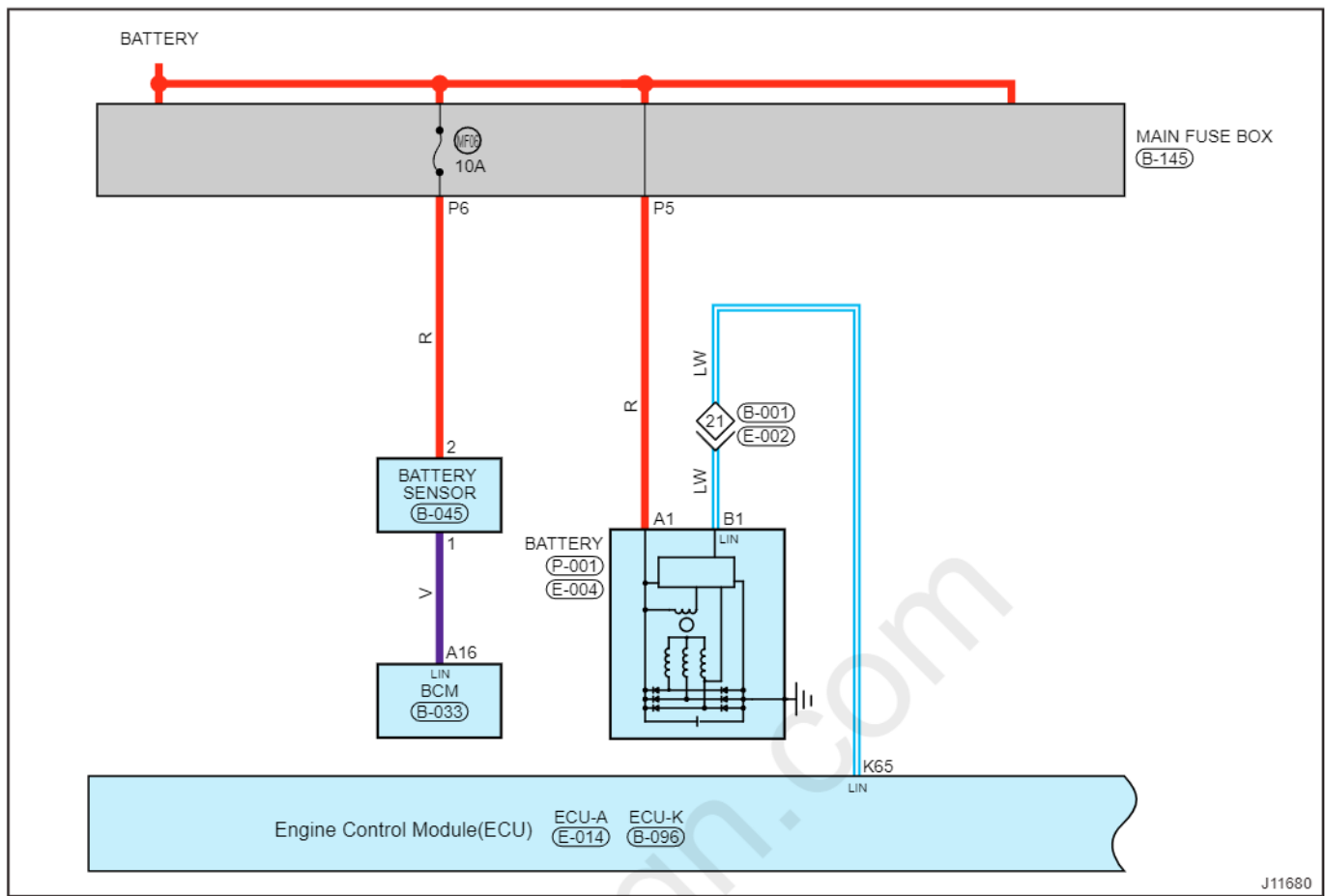
Refer to diagnosis in CAN network section.

■ Response Reception Time Out/Error of LIN Bus (Contact Between EMS and Intellectual Generator)

DTC	P144200	Communication Fault of Generator
DTC	P144100	Mechanical Fault of Generator
DTC	P144000	Electrical Fault of Generator
DTC	P141400	Read Back Time Out Error of LIN Bus (Contact Between EMS and Intellectual Generator)
DTC	P141500	Response Reception Time Out Error of LIN Bus (Contact Between EMS and Intellectual Generator)
DTC	P141600	Framing Error of LIN Bus (Contact Between EMS and Intellectual Generator)
DTC	P141700	Checksum Error of LIN Bus (Contact Between EMS and Intellectual Generator)

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check alternator connector

- Disconnect the negative battery.
- Check if alternator connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check LIN line voltage

- (a) Disconnect the alternator connector.
- (b) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of alternator LIN line with red probe respectively.

Equivalent voltage: Approximately 10 V

OK

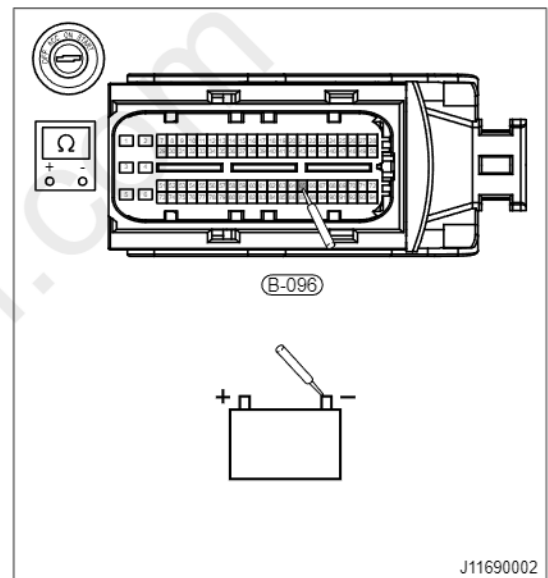
Replace alternator.

NG

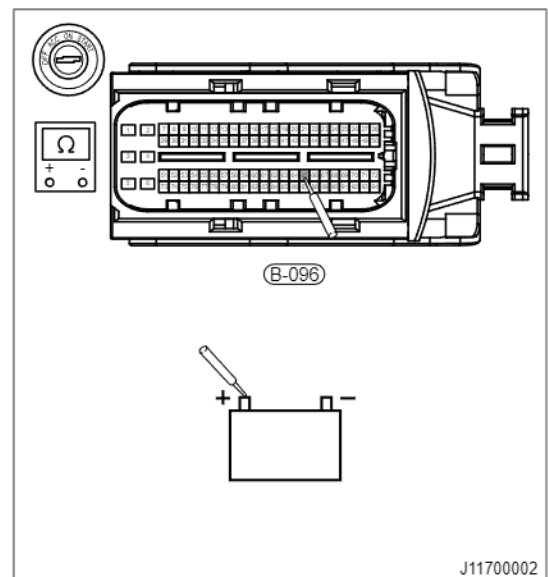
3

Check for short circuit to ground / power supply in LIN line

- (a) Disconnect the alternator connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of ECM B-096 (65) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistance of ECM B-096 (65) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair control circuit.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Immobilizer Malfunction

DTC	P051300	Incorrect Immobilizer Key
DTC	P063300	ECM not Programed (Virgin State)
DTC	P161000	No Response Received by ECM/PCM After Challenge Sent
DTC	P161400	PIN Code Entry Error
DTC	P161200	Internal Error When Writing Data to EEPROM
DTC	P161300	Different IMMO Configurations of ECM and Vehicle Models
DTC	P161100	ECM Status Unknown

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

Refer to diagnosis in immobilizer system section.

■ Canister Vent Valve Stuck Normally Closed

DTC	P242200	EVAP System Vent Valve Stuck Closed
------------	----------------	--

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check canister vent valve
----------	----------------------------------

- (a) Check if line or charcoal canister filter at canister vent valve is blocked.
- (b) Check if canister vent valve is stuck closed position.

NG

Replace charcoal canister filter or canister vent valve.

OK

2	Reconfirm DTCs
----------	-----------------------

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

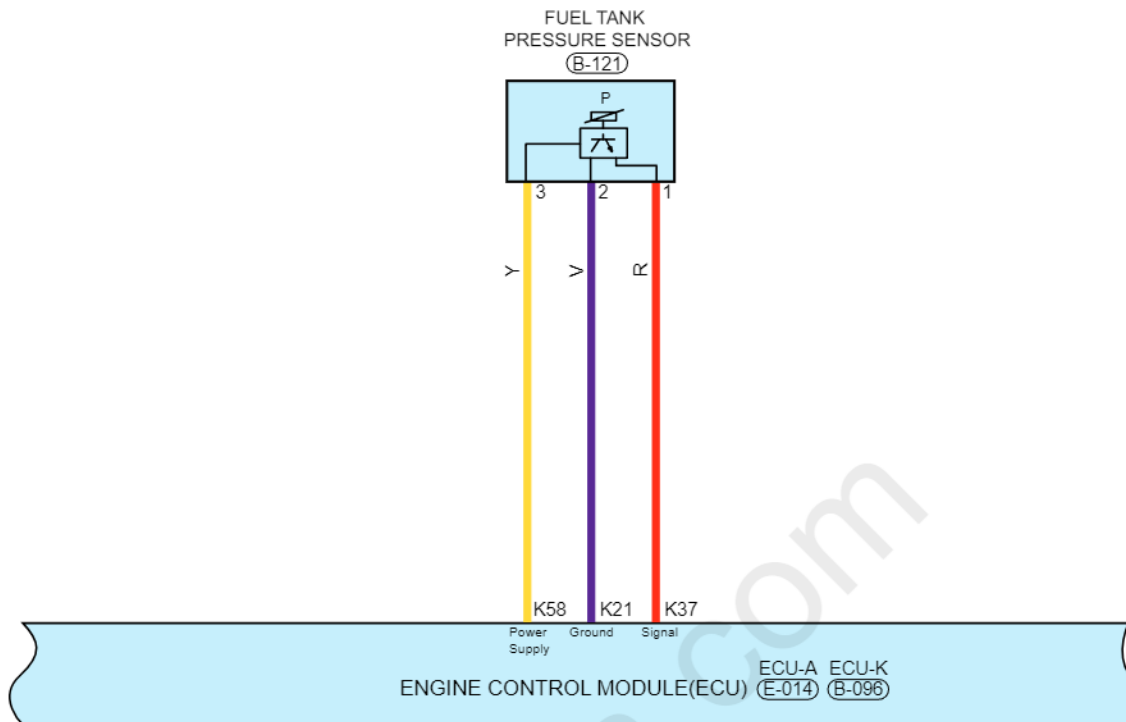
Conduct test and confirm malfunction has been repaired.

■ Fuel Tank Pressure Sensor Malfunction

DTC	P045128	EVAP System Pressure Sensor&Switch Circuit Range Performance
DTC	P04512A	EVAP System Pressure Sensor&Switch Circuit Range Performance
DTC	P045300	EVAP System Pressure Sensor&Switch Circuit High
DTC	P045200	EVAP System Pressure Sensor&Switch Circuit Low
DTC	P128200	EVAP System Pressure Sensor/Switch Circuit Range Performance
DTC	P128300	EVAP System Pressure Sensor/Switch Circuit Range Performance
DTC	P045125	EVAP System Pressure Sensor&Switch Circuit Range Performance

■ Description

Circuit Diagram



J11710

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check fuel tank pressure sensor connector

- Disconnect the negative battery.
- Check if fuel tank pressure sensor connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check canister vent valve

- (a) Check if line or charcoal canister filter at canister vent valve is blocked.
- (b) Check if canister vent valve is stuck closed or normally open position.

NG

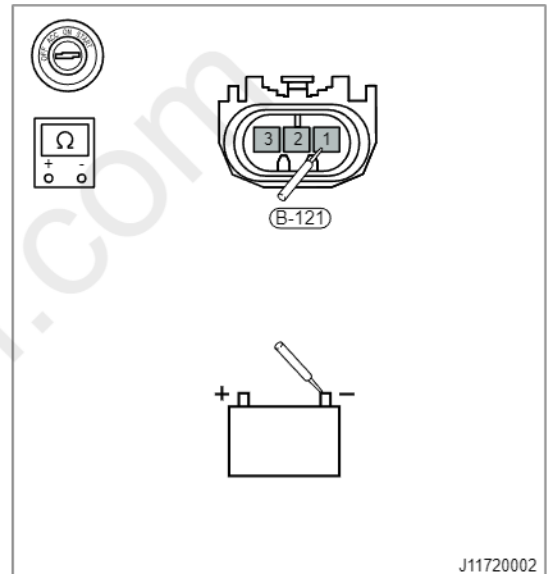
Replace charcoal canister filter or canister vent valve.

OK

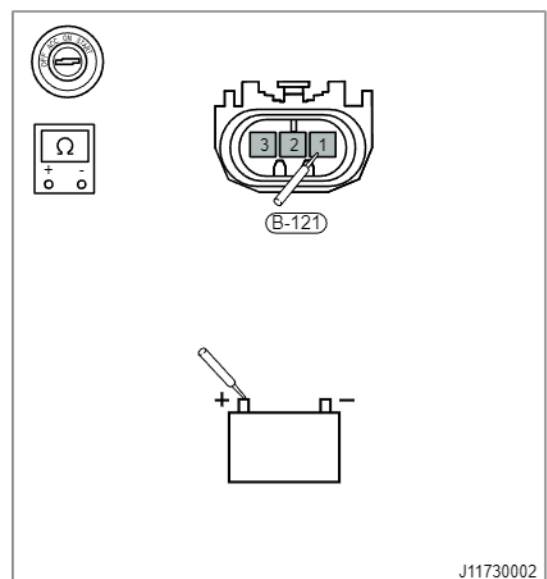
3

Check for short circuit to ground / power supply in fuel tank pressure sensor circuit

- (a) Disconnect fuel tank pressure sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of fuel tank pressure sensor B-121 (1, 2, 3) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of fuel tank pressure sensor B-121 (1, 2, 3) with red probe respectively. Check if circuit is short to power supply.



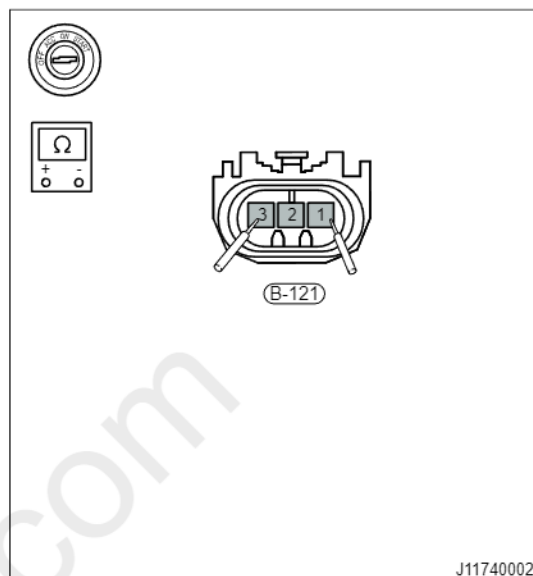
NG

Check and repair control circuit.

OK

4 Check if circuits of fuel tank pressure sensor themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of fuel tank pressure sensor B-121 (1, 2, 3) with red and black probes respectively; Check if they are shorted to each other.



NG

Replace fuel tank pressure sensor assembly.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

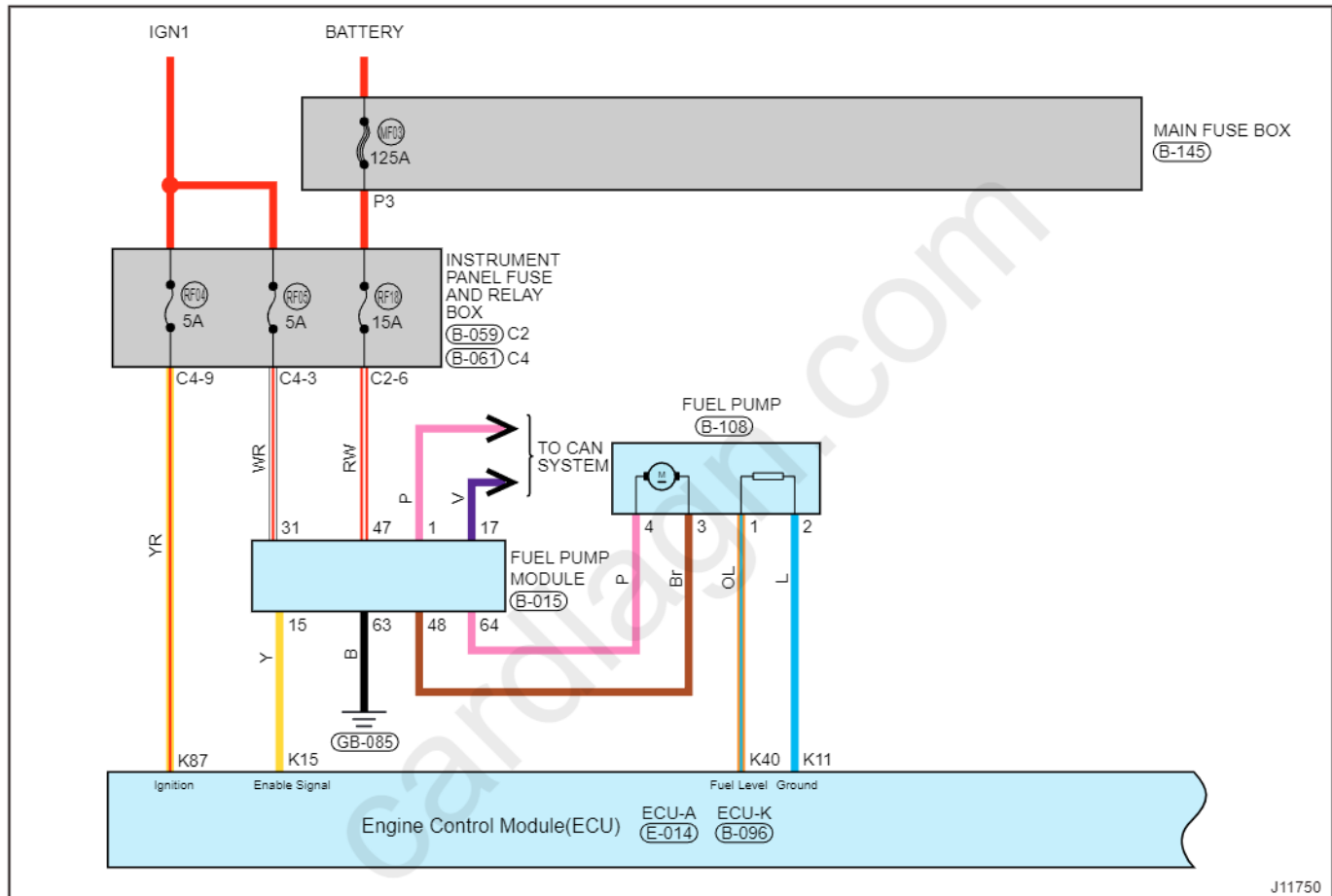
Conduct test and confirm malfunction has been repaired.

■ Fuel Level Sensor Malfunction

DTC	P046300	Fuel Level Sensor "A" Circuit High
DTC	P046200	Fuel Level Sensor "A" Circuit Low
DTC	P25B000	Fuel Level Sensor "A" Stuck
DTC	P128400	Fuel Level Sensor "A" Circuit Range Performance
DTC	P046129	Fuel Level Sensor "A" Circuit Range Performance

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check fuel pump connector
---	---------------------------

- Disconnect the negative battery.
- Check if fuel pump connector is loose, and contact between male and female terminals is in good condition.

NG

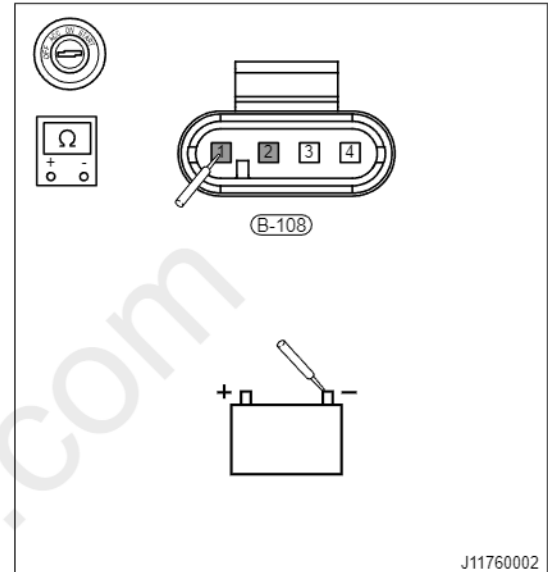
Repair and adjust connector, or replace it.

OK

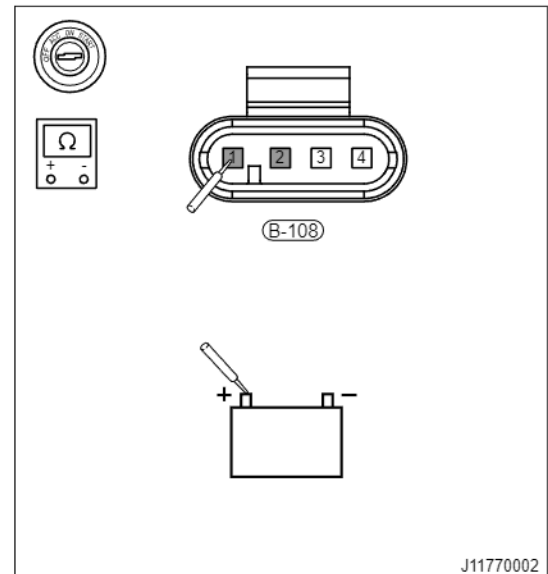
2

Check for short circuit to ground / power supply in fuel level sensor circuit

- (a) Disconnect the fuel level sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of fuel level sensor B-108 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of fuel level sensor B-108 (1, 2) with red probe respectively. Check if circuit is short to power supply.



NG

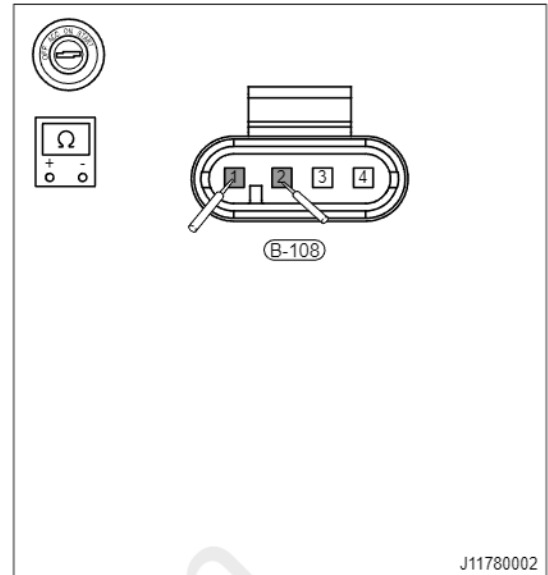
Check and repair control circuit.

OK

3

Check if circuits of fuel level sensor themselves are shorted to each other or opened

- (a) Using ohm band of multimeter, measure resistances of fuel level sensor B-108 (1, 2) with red and black probes respectively; Check if they are shorted to each other or opened.



NG

Replace fuel level sensor assembly.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Evaporation System Leakage Malfunction

DTC	P044200	EVAP System Leak Detected (Small Leak)
DTC	P045500	EVAP System Leak Detected (Large Leak)

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check fuel tank cap

- (a) Check if fuel tank cap is tightened, and check if internal seal ring is deformed.
- (b) Check fuel tank cap for damage or leaked port.

NG

Repair and adjust or replace fuel tank assembly.

OK

2 Check evaporation system connecting line

- (a) Check each line for damage or small hole, etc.
- (b) Check each line joint is clamped into place and check if worm clamp is tightened.

NG

Repair and adjust or replace the damaged parts.

OK

3 Check charcoal canister

- (a) Check charcoal canister for damage or small hole, etc.
- (b) Check if connecting pipe joint is clamped into place.

NG

Repair and adjust or replace charcoal canister assembly.

OK

4 Check canister vent valve

- (a) Check if canister vent valve is not closed tightly or stuck.

NG

Replace canister vent valve assembly.

OK

5

Check canister solenoid valve

(a) Check if canister solenoid valve is not closed tightly or stuck.

NG

Replace canister solenoid valve assembly.

OK

6

Reconfirm DTCs

(a) Connect diagnostic tester and clear DTCs.

(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.

(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ High/Low Load Desorption Pipeline Malfunction - Canister Solenoid Valve

DTC	P049700	EVAP System Low Purge Flow
DTC	P04F000	EVAP System High Pressure Purge

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check low/high load desorption pipeline

(a) Check each connecting line for breakage, damage or small hole, etc.

(b) Check if line check valve is damaged or inoperative.

(c) Check connection position between intake hose and desorption pipeline for blockage.

NG

Repair and adjust or replace the damaged parts.

OK

2 Check canister vent valve

(a) Check if canister vent valve is stuck closed position.

NG

Replace canister vent valve assembly.

OK

3 Check canister solenoid valve

(a) Check if canister solenoid valve is stuck closed position.

NG

Replace canister solenoid valve assembly.

OK

4 Reconfirm DTCs

(a) Connect diagnostic tester and clear DTCs.

(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.

(c) Read the fault information and confirm that the fault has been solved.

OK

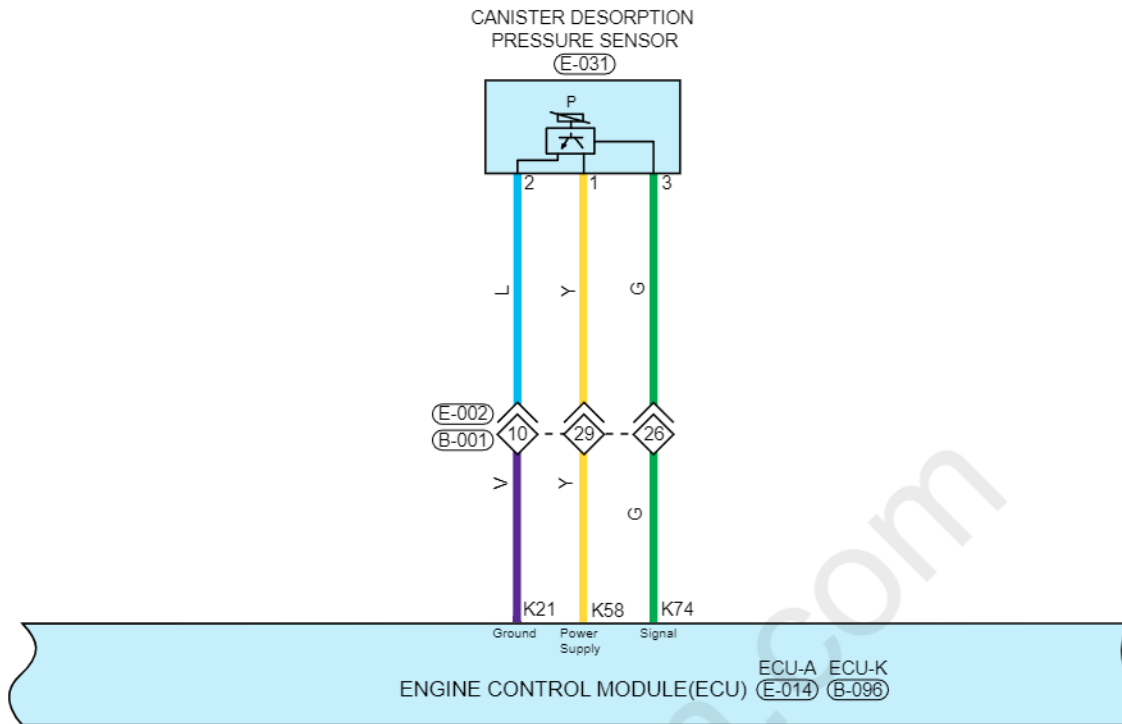
Conduct test and confirm malfunction has been repaired.

■ Desorption pressure sensor malfunction

DTC	P046800	EVAP Purge Flow Sensor Circuit High
DTC	P046700	EVAP Purge Flow Sensor Circuit Low
DTC	P128500	EVAP Purge Flow Sensor Circuit Range Performance
DTC	P128600	EVAP Purge Flow Sensor Circuit Range Performance

■ Description

Circuit Diagram



J11790

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check desorption pressure sensor connector

- Disconnect the negative battery.
- Check if desorption pressure sensor connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check high load desorption pipeline

- (a) Check each connecting line for breakage, damage or small hole, etc.
- (b) Check if line check valve is damaged or inoperative.
- (c) Check connection position between intake hose and desorption pipeline for blockage.

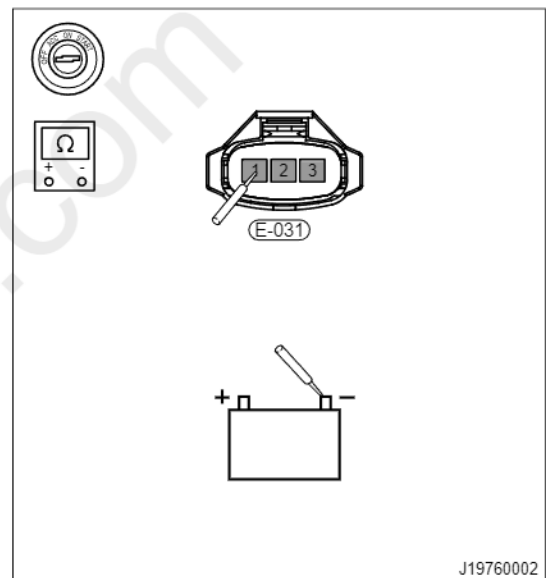
NG

Repair and adjust or replace the damaged parts.

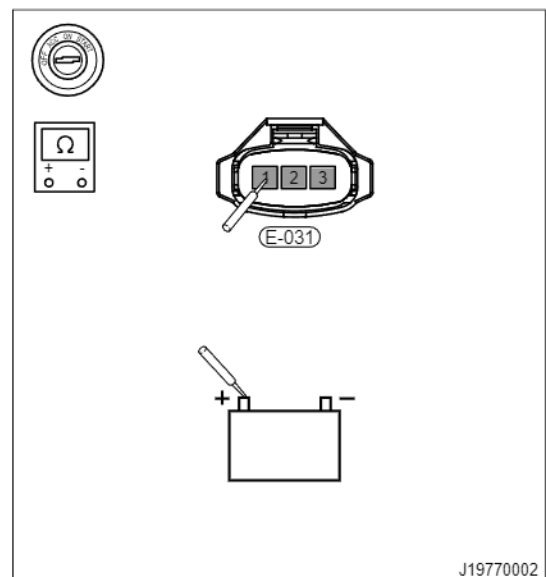
OK

3 Check for short circuit to ground / power supply in desorption pressure sensor circuit

- (a) Disconnect the desorption pressure sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of desorption pressure sensor E-031 (1, 2, 3) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of desorption pressure sensor E-031 (1, 2, 3) with red probe respectively. Check if circuit is short to power supply.



NG

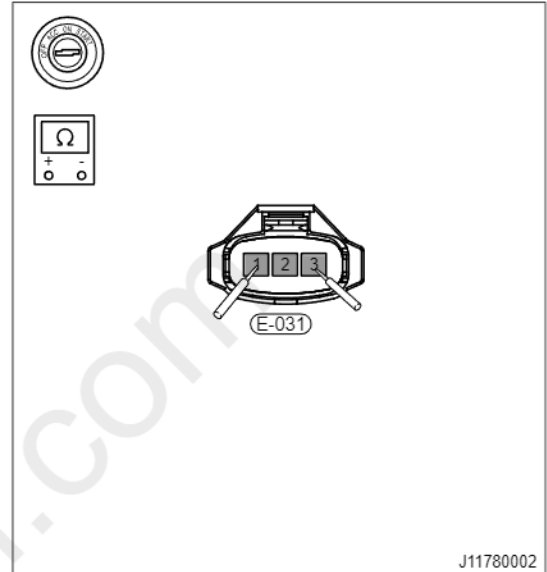
Check and repair control circuit.

OK

4

Check if circuits of desorption pressure sensor themselves are shorted to each other or opened

- (a) Using ohm band of multimeter, measure resistances of desorption pressure sensor E-031 (1, 2, 3) with red and black probes respectively; Check if they are shorted to each other or opened.



NG

Replace desorption pressure sensor assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ **Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 CVO Self-learning Adjustment Reach Upper Limit/Lower Limit Malfunction**

DTC	P02CD00	Cylinder 1 Fuel Injector Offset Learning At Max Limit
DTC	P02D100	Cylinder 3 Fuel Injector Offset Learning At Max Limit
DTC	P02D300	Cylinder 4 Fuel Injector Offset Learning At Max Limit
DTC	P02CF00	Cylinder 2 Fuel Injector Offset Learning At Max Limit
DTC	P02CC00	Cylinder 1 Fuel Injector Offset Learning At Min Limit
DTC	P02D000	Cylinder 3 Fuel Injector Offset Learning At Min Limit
DTC	P02D200	Cylinder 4 Fuel Injector Offset Learning At Min Limit
DTC	P02CE00	Cylinder 2 Fuel Injector Offset Learning At Min Limit
DTC	P062B9A	Internal Control Module Fuel Injector Control Performance - Component or System Operating Conditions
DTC	P062B64	Internal Control Module Fuel Injector Control Performance - Component Internal Failure
DTC	P062B96	Internal Control Module Fuel Injector Control Performance - Component or System Operating Conditions
DTC	P126100	Cylinder 1 Injector Circuit Range/Performance - Signal Plausibility Failure
DTC	P126300	Cylinder 3 Injector Circuit Range/Performance - Signal Plausibility Failure
DTC	P126400	Cylinder 4 Injector Circuit Range/Performance - Signal Plausibility Failure
DTC	P126200	Cylinder 2 Injector Circuit Range/Performance - Signal Plausibility Failure

■ **DTC Confirmation Procedure**

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check injector connector

- Disconnect the negative battery.
- Check fuel injector connector for looseness or poor contact, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check injector

- (a) Remove the fuel injector assembly.
 (b) Check fuel injector for blockage or leakage.

NG

Clean or replace fuel injector assembly.

OK

3 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

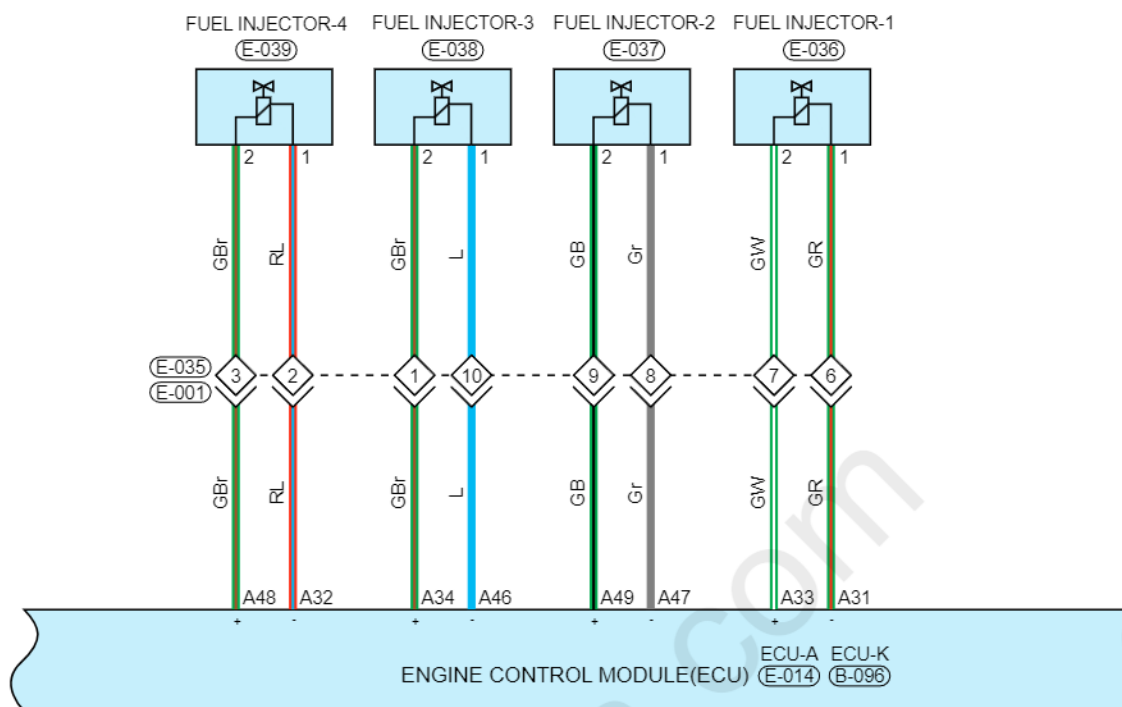
Conduct test and confirm malfunction has been repaired.

■ Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 Fuel Injector Control Circuit Short

DTC	P02EE00	Cylinder 1 Injector Circuit Range/Performance
DTC	P02EF00	Cylinder 2 Injector Circuit Range/Performance
DTC	P02F000	Cylinder 3 Injector Circuit Range/Performance
DTC	P02F100	Cylinder 4 Injector Circuit Range/Performance
DTC	P214800	Fuel Injector Group "A" Supply Voltage Circuit High
DTC	P215100	Fuel Injector Group "B" Supply Voltage Circuit High

■ Description

Circuit Diagram



J10910

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

Take troubleshooting of cylinder 1 fuel injector as an example.

1 Check injector connector

- Disconnect the negative battery.
- Check if fuel injector connector is loose, and contact between male and female terminals is in good condition.

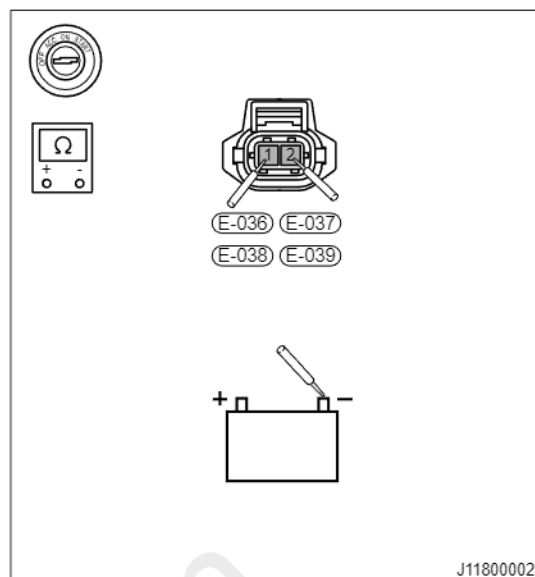
NG

Repair and adjust connector, or replace it.

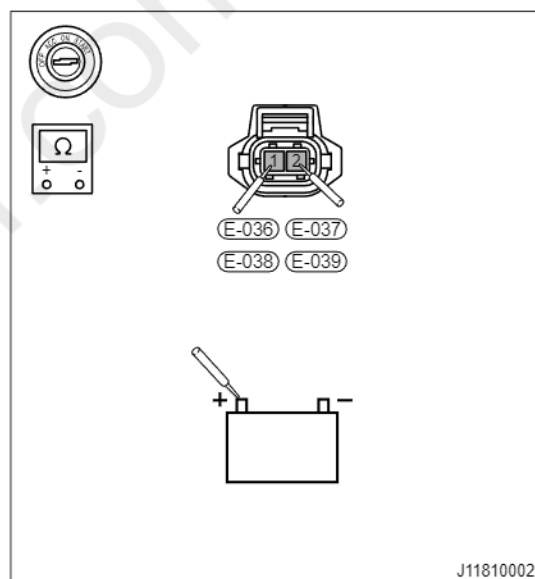
OK

2 Check if fuel injector control terminal is short to ground/power supply or short to each other

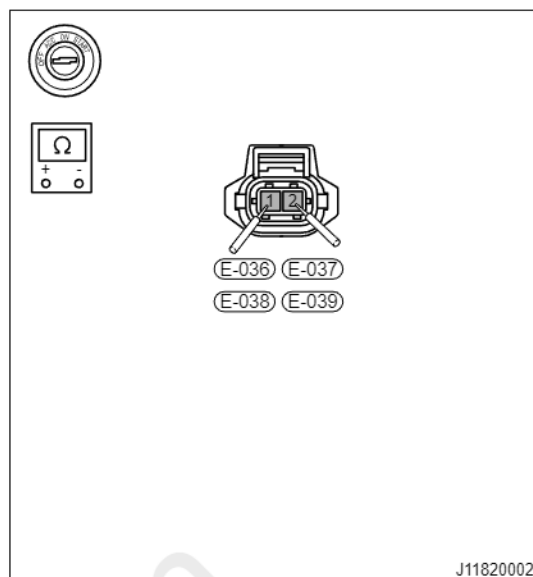
- (a) Disconnect the injector connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of fuel injector E-037 (1, 2), E-036 (1, 2), E-038 (1, 2), E-039 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of fuel injector E-037 (1, 2), E-036 (1, 2), E-038 (1, 2), E-039 (1, 2) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of fuel injector E-037 (1, 2), E-036 (1, 2), E-038 (1, 2), E-039 (1, 2) with red and black probes respectively. Check if circuits are shorted to each other.



NG

Check and repair circuit.

OK

3

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

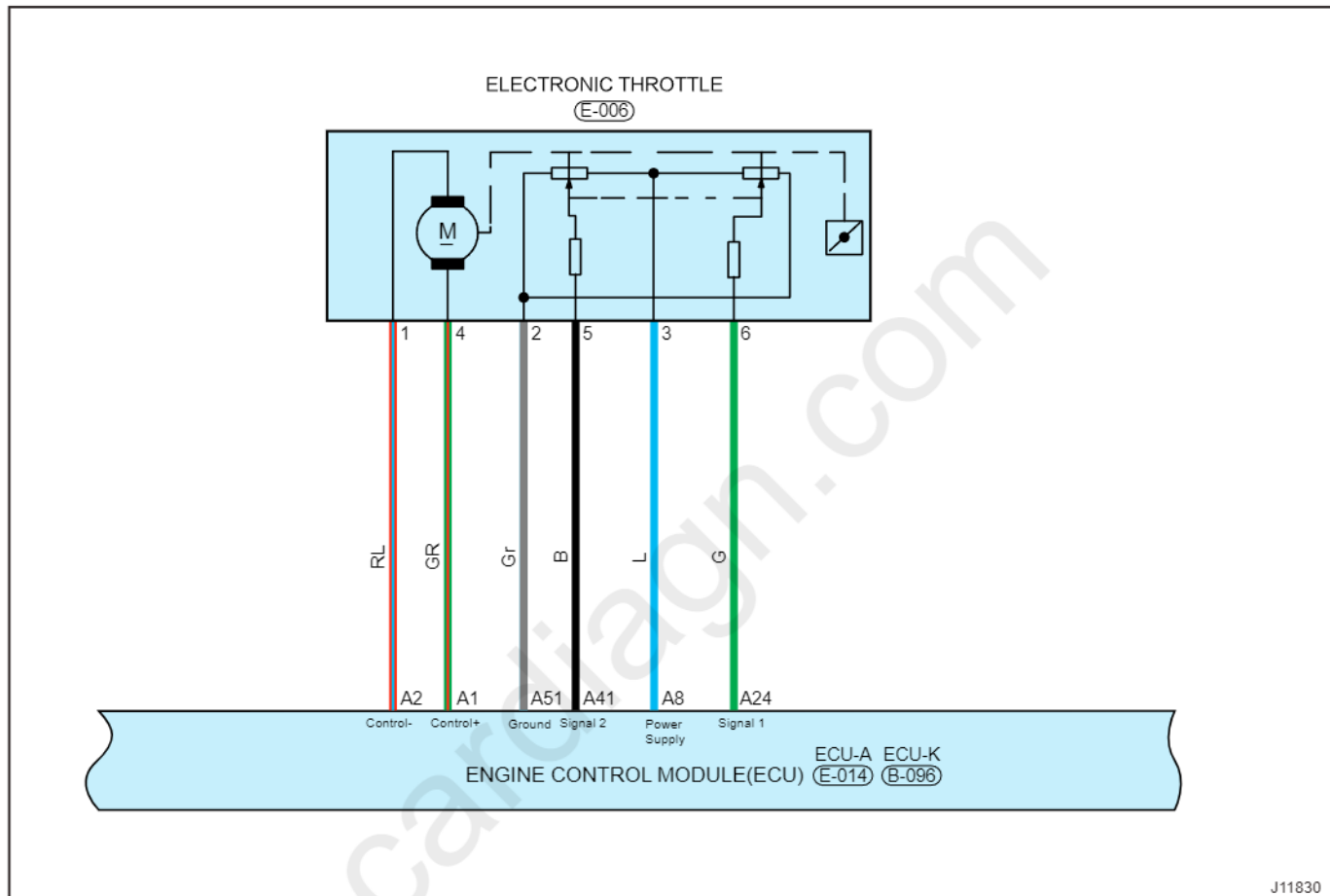
■ **Electronic Throttle 1st Path / 2nd Path Signal Voltage Minimum / Maximum / Improper**

DTC	P012300	Electronic Throttle Position Sensor 1 Signal Circuit Voltage Too High
DTC	P012200	Electronic Throttle Position Sensor 1 Signal Circuit Voltage Too Low

DTC	P012100	Electronic Throttle Position Sensor 1 Signal Improper
DTC	P022300	Electronic Throttle Position Sensor 2 Signal Circuit Voltage Too High
DTC	P022200	Electronic Throttle Position Sensor 2 Signal Circuit Voltage Too Low
DTC	P022100	Throttle/Pedal Position Sensor/Switch "A" / "B" Voltage Correlation

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check electronic throttle connector
---	-------------------------------------

- Disconnect the negative battery.
- Check if electronic throttle connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

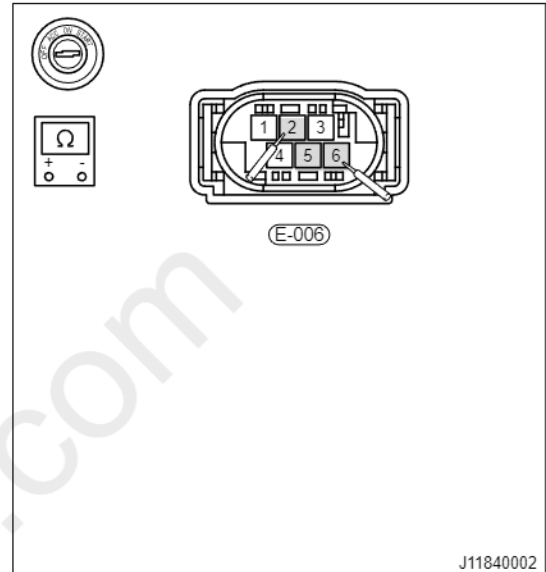
OK

2

Check electronic throttle internal resistance

- (a) Using ohm band of multimeter, measure if resistances of electronic throttle E-006 (2 - 6) and (2 - 5) are normal with red and black probes respectively.

Resistance values should change continuously when the valve plate is toggled by hand



NG

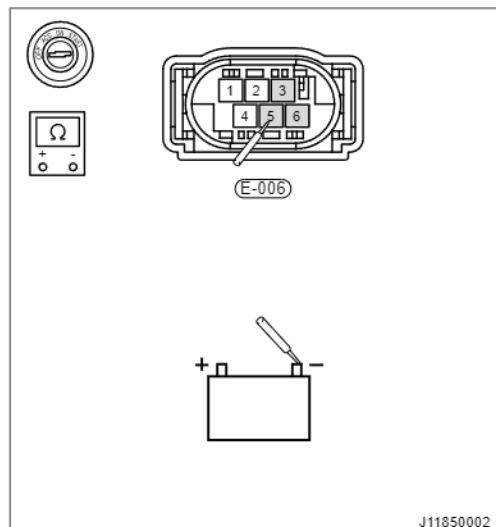
Replace electronic throttle assembly.

OK

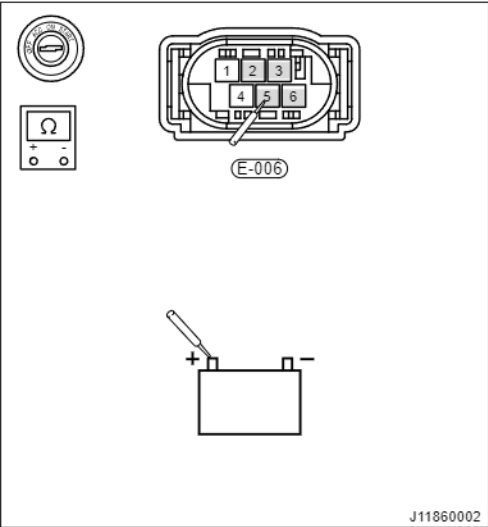
3

Check for short circuit to ground / power supply or short to each other in electronic throttle line

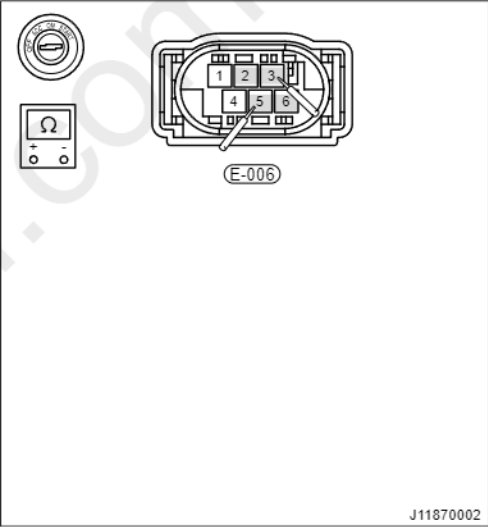
- (a) Disconnect the electronic throttle connector.
- (b) Disconnect the ECM (E-014) connector.
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistances of electronic throttle E-006 (3, 5, 6) with red probe respectively. Check if circuit is short to ground.



(d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistances of electronic throttle E-006 (2, 3, 5, 6) with red probe respectively. Check if circuit is short to power supply.



(e) Using ohm band of multimeter, measure resistances of electronic throttle E-006 (2, 3, 5, 6) with red and black probes respectively. Check if circuits are shorted to each other.



NG Check and repair circuit.

OK

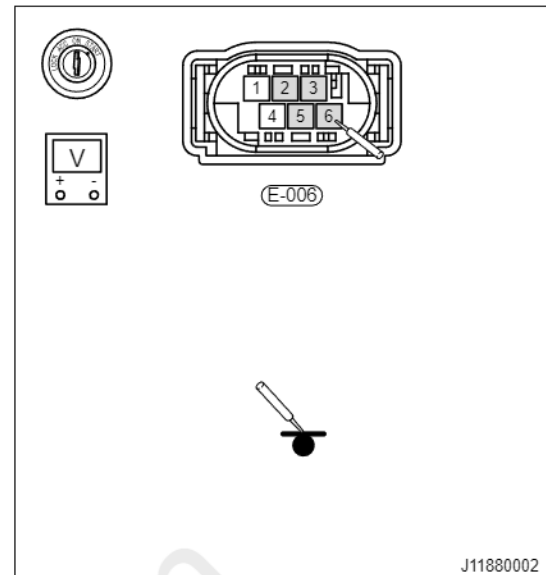
4	Check electronic throttle position sensor power supply / ground / signal
---	--

- (a) Connect electronic throttle and ECM (E-014) connectors
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, and measure voltages of electronic throttle E-006 (2, 3, 5, 6) with red probe respectively.

Power supply terminal: 5 V

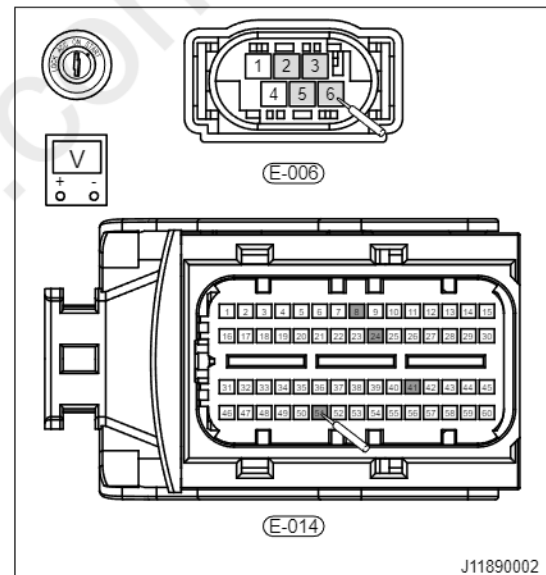
Ground terminal: < 0.2 V

The sum of signal 1 voltage and signal 2 voltage is approximately 5 V



- (d) Using voltage band of multimeter (voltage drop method), connect black probe to ECM E-014 (51, 8, 41, 24), measure electronic throttle E-006 (2, 3, 5, 6) with red probe.

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6	Reconfirm DTCs
---	----------------

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

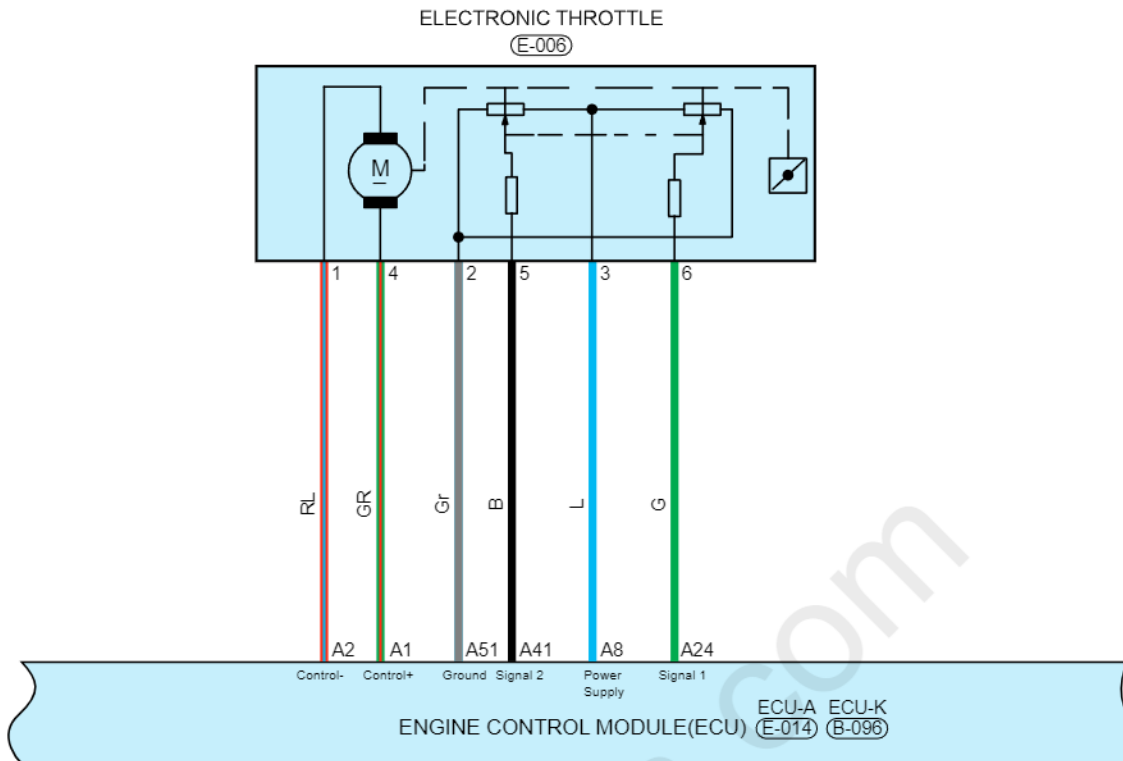
Conduct test and confirm malfunction has been repaired.

■ Electronic Throttle Spring Inspection Malfunction Minimum, Maximum / Deviation Between Throttle Target Opening Angle and Actual Opening Angle / Adjustment / Drive Level Malfunction

DTC	P155400	Max Error of DV-E Return Spring Check Failure
DTC	P155500	
DTC	P156100	
DTC	P156000	Electronic Throttle PID Adjustment Malfunction
DTC	P210000	Electronic Throttle Drive Level Malfunction
DTC	P210300	
DTC	P210600	
DTC	P211800	

■ Description

Circuit Diagram



J11830

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check electronic throttle connector

- Disconnect the negative battery.
- Check if electronic throttle connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check electronic throttle condition

- (a) Electronic throttle body valve plate is dirty or there are foreign matters, so that the valve plate resistance is large or valve plate is stuck.

NG

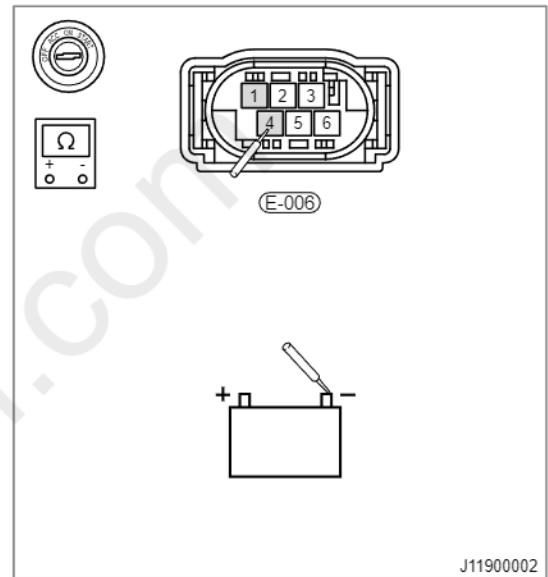
Clean or replace electronic throttle assembly.

OK

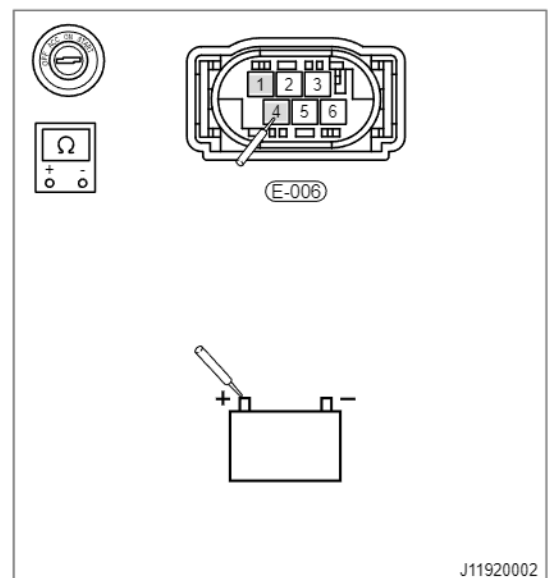
3

Check for short circuit to ground / power supply or short to each other in electronic throttle line

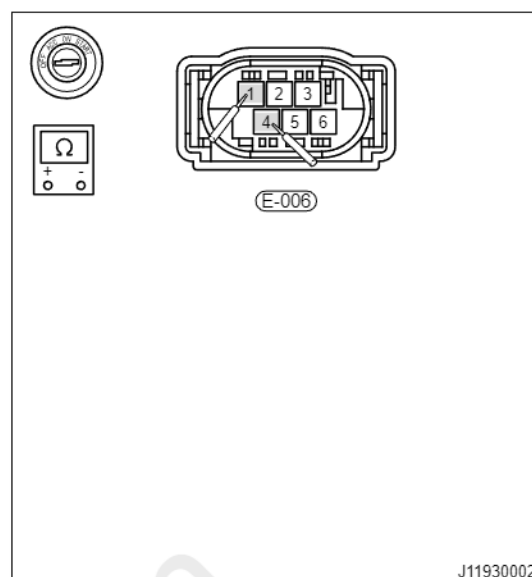
- (a) Disconnect the electronic throttle connector.
(b) Disconnect the ECM (E-014) connector.
(c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistances of electronic throttle E-006 (4, 1) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistances of electronic throttle E-006 (4, 1) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of electronic throttle E-006 (4, 1) with red and black probes respectively. Check if circuits are shorted to each other.



NG

Check and repair circuit.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Electronic Throttle Self-learning Unable to Complete / Throttle Initial Self-learning Unable to Complete

DTC	P155000	Throttle Self Learning Condition Not Fulfilled
DTC	P155100	Not Plausible Error of UMA Learning

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check if electronic throttle self-learning condition is met

- (a) No malfunctions related to DVE or monitoring;
- (b) Rotation speed is 0;
- (c) Vehicle speed is 0;
- (d) Pedal opening angle is 0;
- (e) Battery voltage is higher than 10 V;
- (f) Engine coolant temperature is higher than 5°C;
- (g) Intake temperature is higher than 5°C;

NG

Handle the malfunctions that do not meet the self-learning conditions.

OK

2 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

3 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ ECM Internal Malfunction

DTC	P061A00	Internal Control Module Torque Performance
DTC	P060D00	Internal Control Module Accelerator Pedal Position Performance
DTC	P152000	Function Monitoring: Check of Predicted Air Mass Failed
DTC	P152100	Function Monitoring: Fault of ECU Check of Injection Cut-off
DTC	P152200	Function Monitoring: Fault of ECU in Check of Cylinder Individual Fuel Corrections
DTC	P152700	Function Monitoring: Monitoring of ICO From Level1
DTC	P152800	Function Monitoring: Monitoring of ICO From Level2
DTC	P061C00	Internal Control Module Engine RPM Performance
DTC	P152900	Function Monitoring: Fault of Starter Control
DTC	P153000	Function Monitoring: Fault of ECU ADC - Null Load Test Pulse
DTC	P153100	Function Monitoring: Fault of ECU ADC - Test Voltage
DTC	P157300	Diagnostic Fault Check to Report "WDA active" Due to Errors in Query/Response Communication
DTC	P157500	Diagnostic Fault Check to Report "WDA active" Due to Overvoltage Detection
DTC	P064100	Sensor Reference Voltage "A" Circuit Open
DTC	P065100	Sensor Reference Voltage "B" Circuit Open

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check Engine Control Module (ECM)

- Remove Engine Control Module (ECM) from malfunctioning vehicle.
- Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

2 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

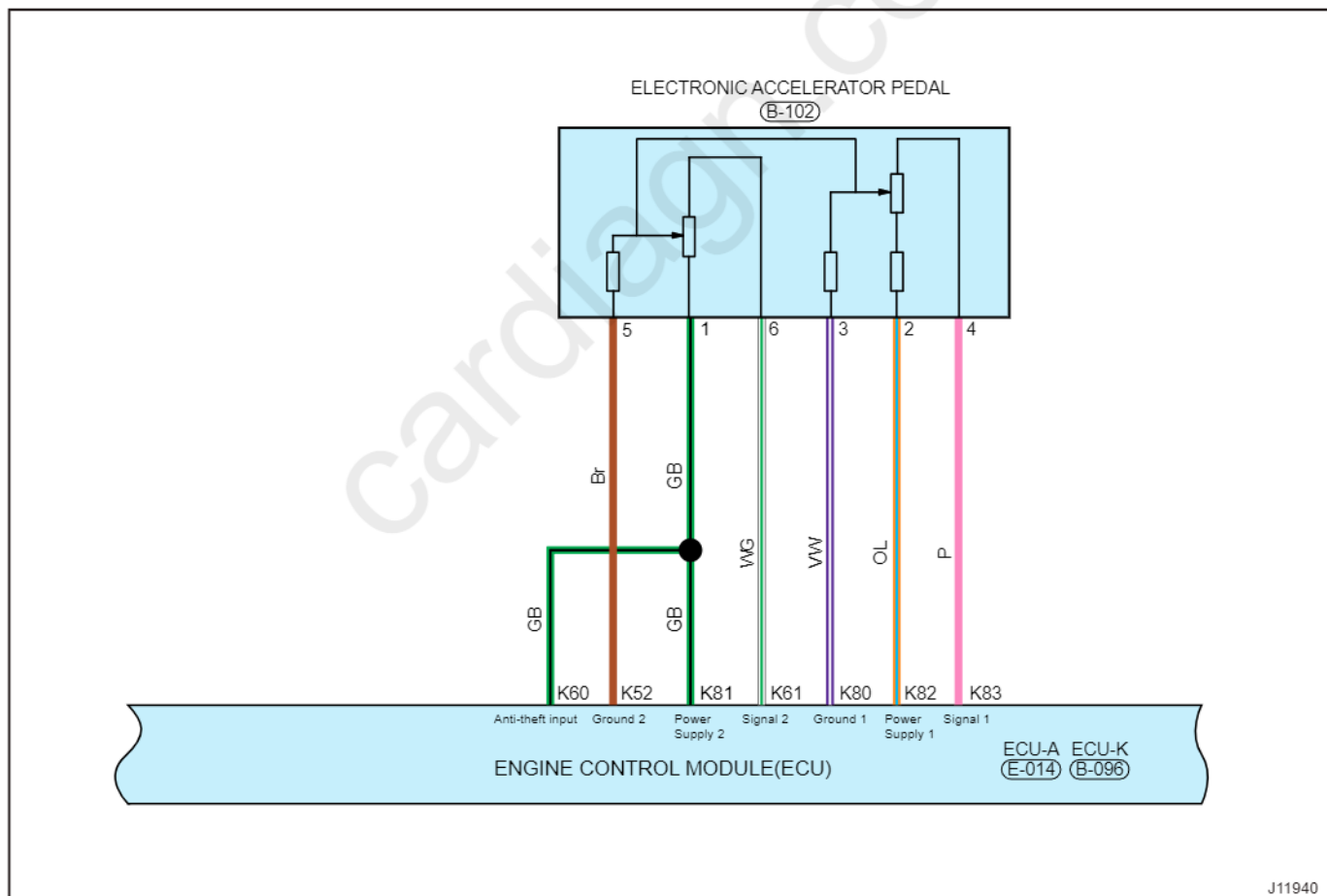
Conduct test and confirm malfunction has been repaired.

■ Deviation Between Both Paths Signal of Accelerator Pedal Out of Limit/Voltage Too High/Too Low

DTC	P213800	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation
DTC	P212300	Pedal Pos.Sensor 1 Circ. High Input
DTC	P212800	Throttle/Pedal Position Sensor/Switch "E" Circuit High
DTC	P212200	Pedal Pos.Sensor 1 Circ. Low Input
DTC	P212700	Throttle/Pedal Position Sensor/Switch "E" Circuit Low

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

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

- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check electronic accelerator pedal connector
----------	---

- (a) Disconnect the negative battery.
- (b) Check if electronic accelerator pedal connector is loose, and contact between male and female terminals is in good condition.

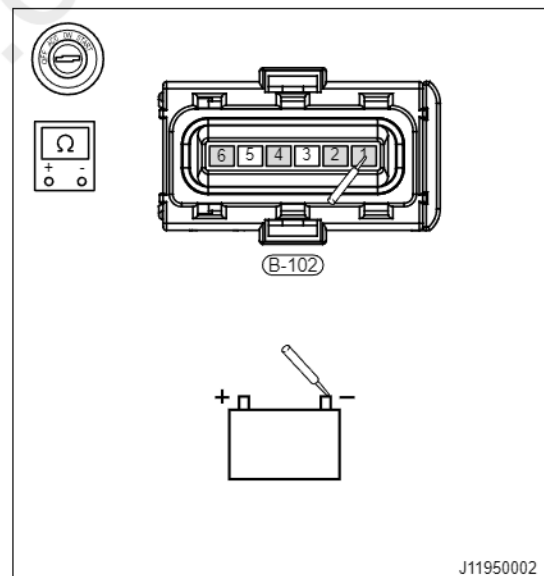
NG

Repair and adjust connector, or replace it.

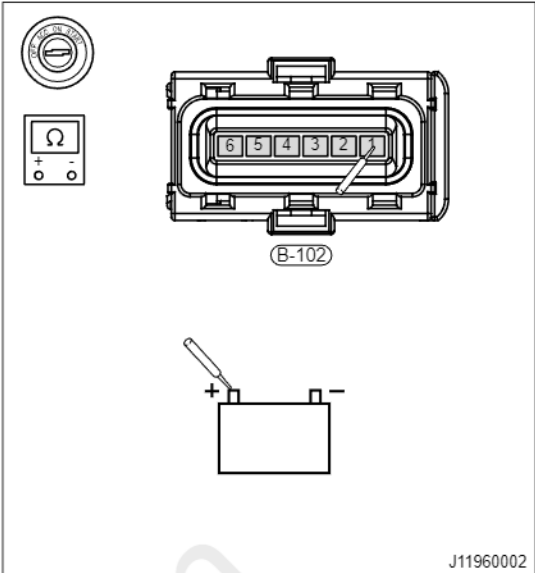
OK

2	Check for short circuit to ground / power supply or short to each other in electronic accelerator pedal line
----------	---

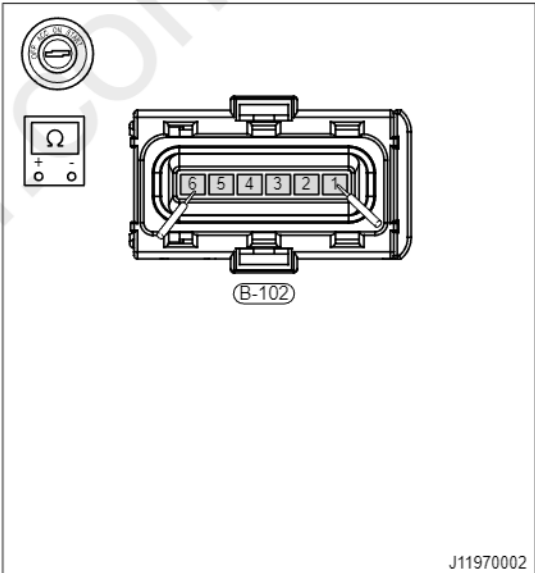
- (a) Disconnect the electronic accelerator pedal connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistances of electronic accelerator pedal B-102 (1, 2, 4, 6) with red probe respectively. Check if circuit is short to ground.



(d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistances of electronic accelerator pedal B-102 (1, 2, 3, 4, 5, 6) with red probe respectively. Check if circuit is short to power supply.



(e) Using ohm band of multimeter, measure resistances of electronic accelerator pedal B-102 (1, 2, 3, 4, 5, 6) with red and black probes respectively. Check if circuits are shorted to each other.



NG Check and repair circuit.

OK

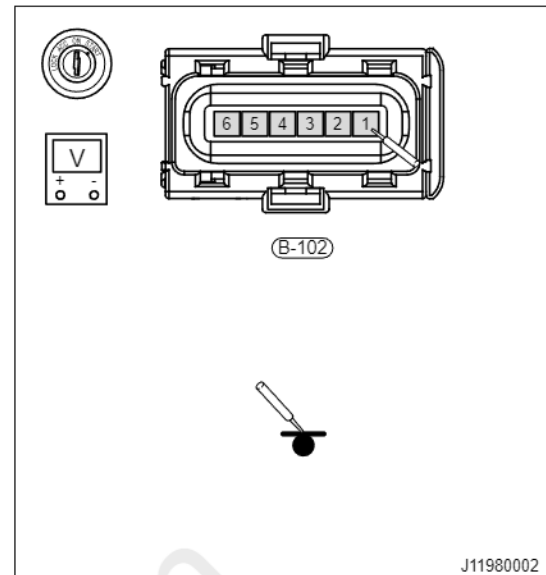
3	Check electronic accelerator pedal position sensor power supply / ground / signal
---	---

- (a) Connect electronic accelerator pedal and ECM (B-096) connectors
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, and measure voltages of electronic accelerator pedal B-102 (1, 2, 3, 4, 5, 6) with red probe respectively.

Power supply terminal: 5 V

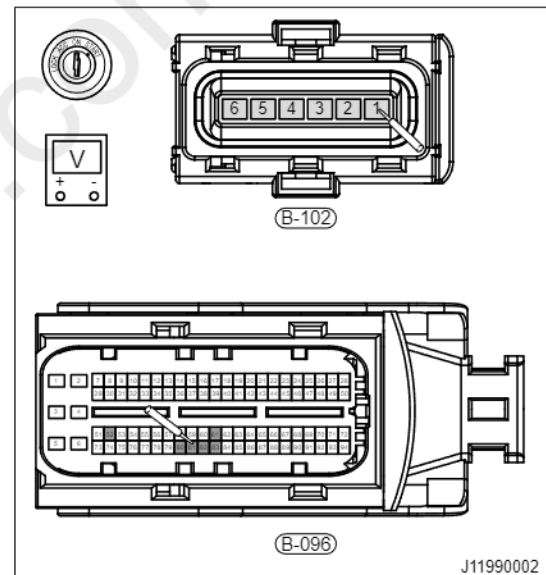
Ground terminal: < 0.2 V

Signal 1 voltage value and signal 2 voltage value maintain a voltage multiplying relationship



- (d) Using voltage band of multimeter (voltage drop method), connect black probe to ECM B-096 (81, 82, 80, 83, 52, 61), measure electronic accelerator pedal B-102 (1, 2, 3, 4, 5, 6) with red probe.

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

5 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

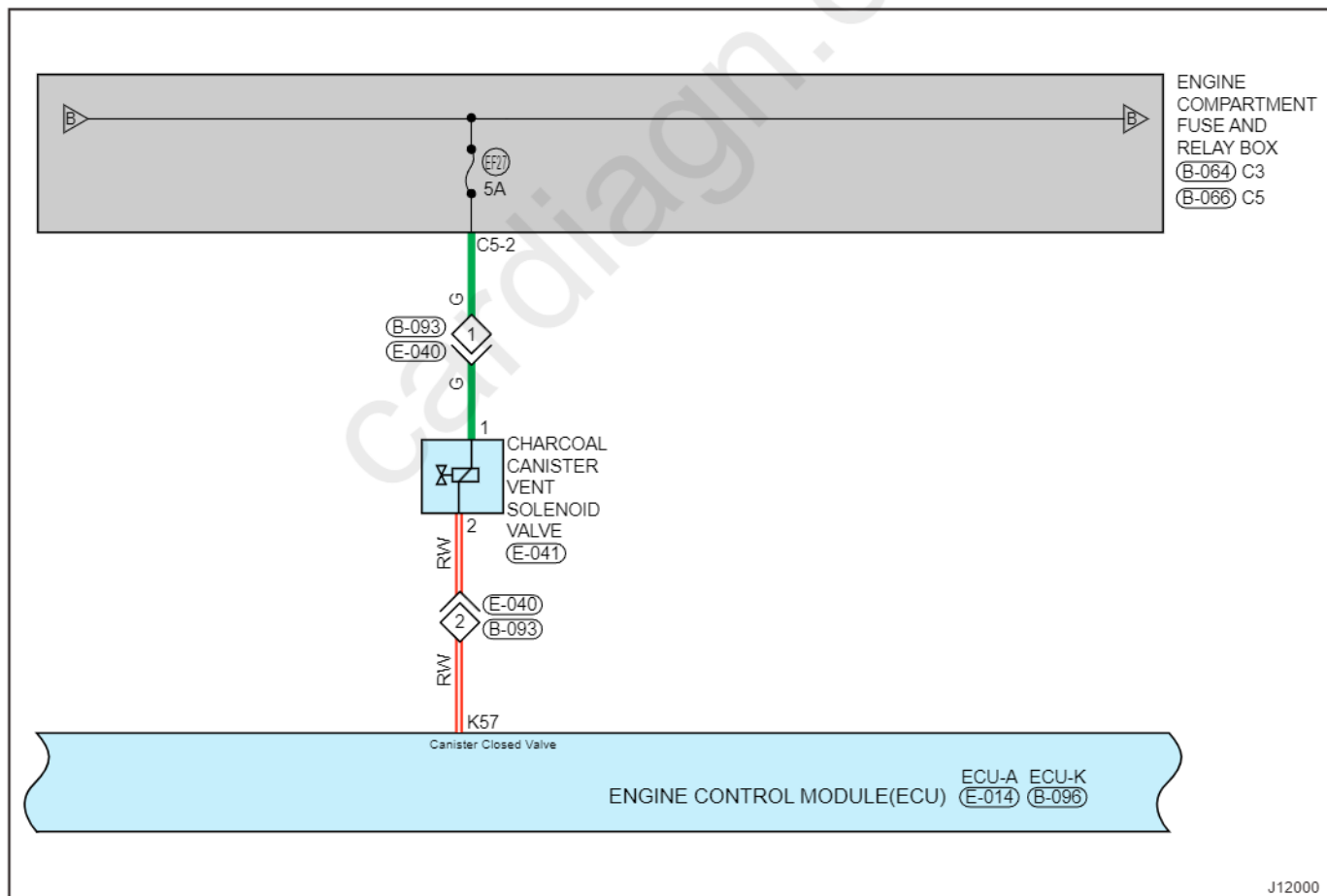
Conduct test and confirm malfunction has been repaired.

Canister Vent Valve Control Circuit Malfunction

DTC	P049900	EVAP System Vent Valve Control Circuit High
DTC	P049800	EVAP System Vent Valve Control Circuit Low
DTC	P044700	EVAP System Vent Control Circuit Open

Description

Circuit Diagram



DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.

- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check canister vent valve connector
----------	--

- (a) Disconnect the negative battery.
- (b) Check if canister vent valve connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2	Check canister vent valve power supply fuse
----------	--

- (a) Check if engine compartment fuse and relay box fuse EF27 5A is blown.

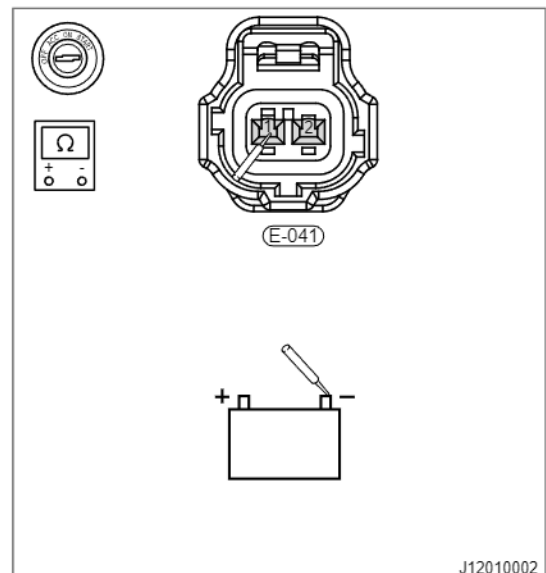
NG

Check and repair short circuit malfunction and replace fuse.

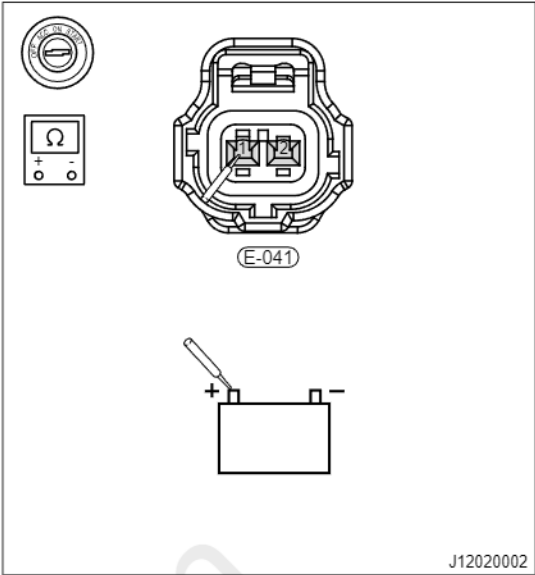
OK

3	Check for short circuit to ground / power supply or short to each other in canister vent valve line
----------	--

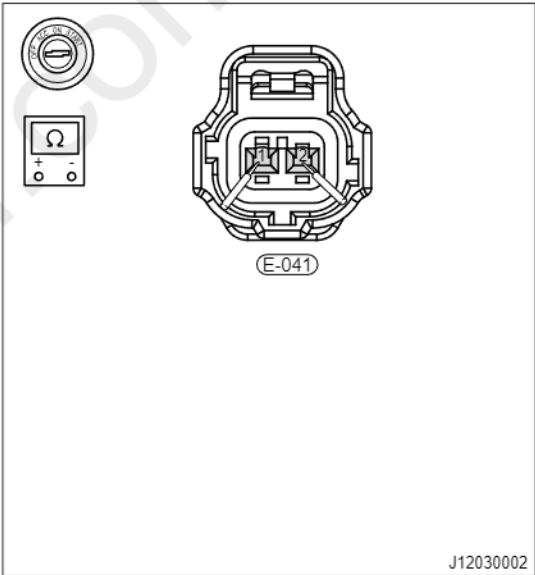
- (a) Disconnect the canister vent valve connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of canister vent valve E-041 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of canister vent valve E-041 (1, 2) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of canister vent valve E-041 (1, 2) with red and black probes respectively. Check if circuits are shorted to each other.



NG

Check and repair circuit.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5	Reconfirm DTCs
----------	-----------------------

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

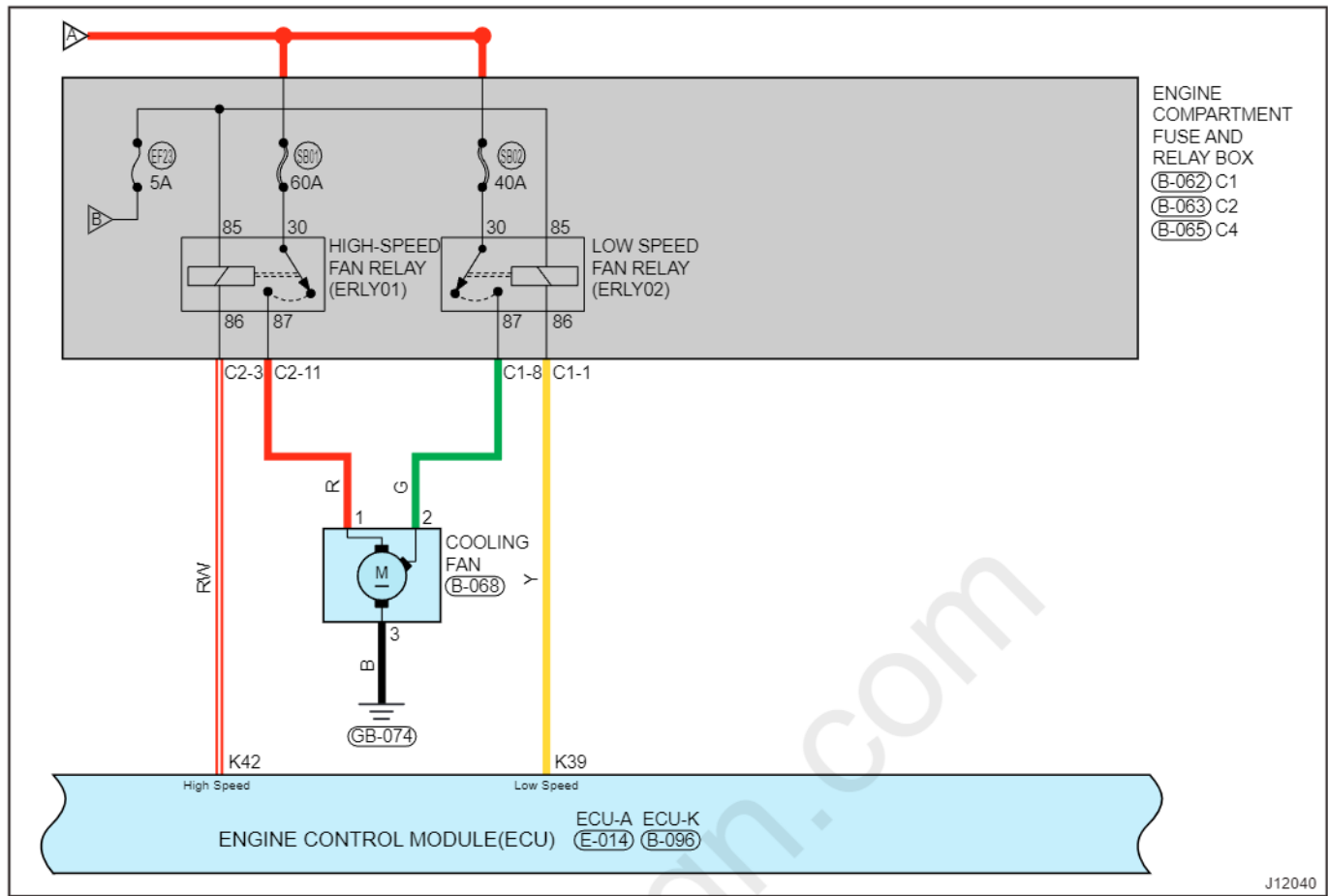
Conduct test and confirm malfunction has been repaired.

■ **Cooling Fan Control Circuit Voltage Too Low/Too High**

DTC	P048371	Fan Rationality Check Error (Type 1)
DTC	P048372	Fan Rationality Check Error (Type 2)
DTC	P048373	Fan Rationality Check Error (Type 3)
DTC	P048374	Fan Rationality Check Error (Type 4)
DTC	P048013	Cooling Fan Control Circuit Open
DTC	P06344B	Cooling Fan Drive Chip Overheating
DTC	P069212	Cooling Fan Control Circuit Short to Battery
DTC	P069111	Cooling Fan Control Circuit Short to Ground

■ **Description**

Circuit Diagram



DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check cooling fan connector

- Disconnect the negative battery.
- Check if cooling fan connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check cooling fan power supply fuse

- (a) Check if engine compartment fuse and relay box fuse EF23 5A is blown.

NG

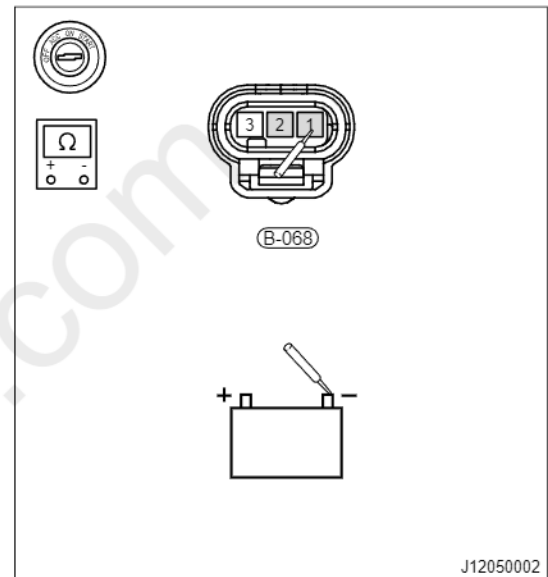
Check and repair short circuit malfunction of circuit.

OK

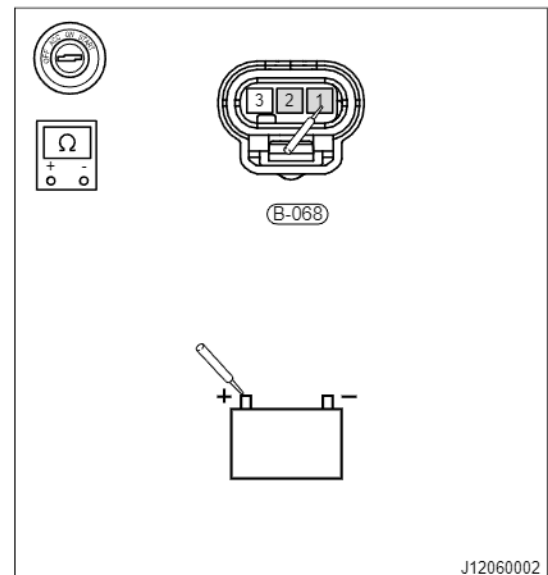
3

Check for short circuit to ground / power supply in cooling fan control circuit

- (a) Disconnect the cooling fan connector.
 (b) Disconnect the ECM connector (B-096).
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistances of cooling fan B-068 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistances of cooling fan B-068 (1, 2) with red probe respectively. Check if circuit is short to power supply.



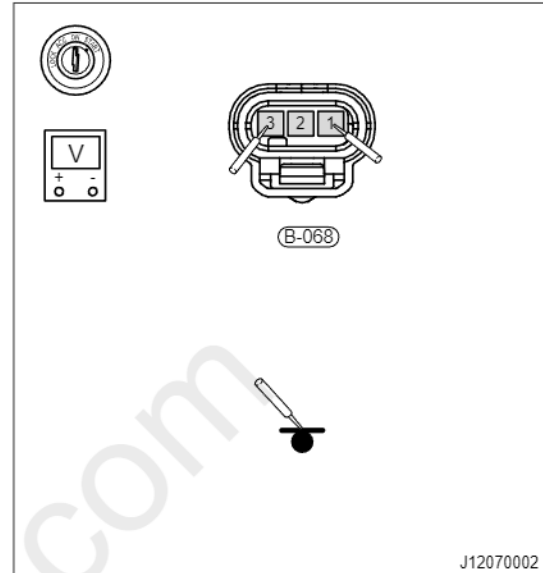
NG

Check and repair circuit.

OK

4 Check cooling fan power supply / ground / control signal

- (a) Connect cooling fan and ECM (B-096) connectors
- (b) Turn ENGINE START STOP switch to ON.
- (c) Using voltage band of multimeter, connect black probe to battery negative terminal, and measure voltages of cooling fan B-068 (1, 2, 3) with red probe.

Power supply terminal: 12 V**Ground terminal: < 0.2 V**

NG

Repair or replace wire harness.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ TCU Requests to Illuminate MIL Light

DTC	P070000	Transmission Control System (MIL Request)
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■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

Read transmission system DTCs and refer to transmission system diagnosis.

■ Vehicle Speed Sensor Performance / Improper / Input Signal Fault

DTC	P121200	Vehicle Speed Sensor "A" Circuit Range/Performance
DTC	P050300	Vehicle Speed Sensor "A" Circuit Intermittent/Erratic/High
DTC	P050000	Vehicle Speed Sensor "A" Circuit
DTC	P050166	Vehicle Speed Sensor "A" Circuit Range/Performance
DTC	P050165	Vehicle Speed Sensor "A" Circuit Range/Performance

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

Read brake control system DTCs and refer to brake control system diagnosis.

■ Ignition Angle Efficiency Monitoring During Catalytic Converter Heating

DTC	P050B00	Cold Start Ignition Timing Performance
DTC	P050B20	Cold Start Ignition Timing Performance

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check electronic throttle condition
----------	--

- (a) Check if electronic throttle is dirty or is stuck at position with a small opening angle.

NG**Clean or replace electronic throttle assembly.****OK****2****Check ignition system**

- (a) Check engine for DTCs related to ignition.
(b) Check ignition coil and spark plug for damage.

NG**Replace the damaged parts.****OK****3****Check intake system**

- (a) Check intake manifold or each connecting line for air leakage.

NG**Replace the leaked or damaged parts.****OK****4****Check fuel system**

- (a) Check if low/high pressure fuel pressure is too low.

NG**Replace the damaged parts.****OK****5****Check if exhaust back pressure is too high**

- (a) Check pre-catalytic converter for blockage.
(b) Check GPF particulate filter for blockage.

NG**Replace pre-catalytic converter assembly or perform GPF regeneration.****OK**

6 Check boost system

- (a) Check each connecting line of boost system for falling off.
 (b) Check if turbocharger can boost normally and each actuator can operate normally.

NG**Replace turbocharger assembly.****OK****7 Check Engine Control Module (ECM)**

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

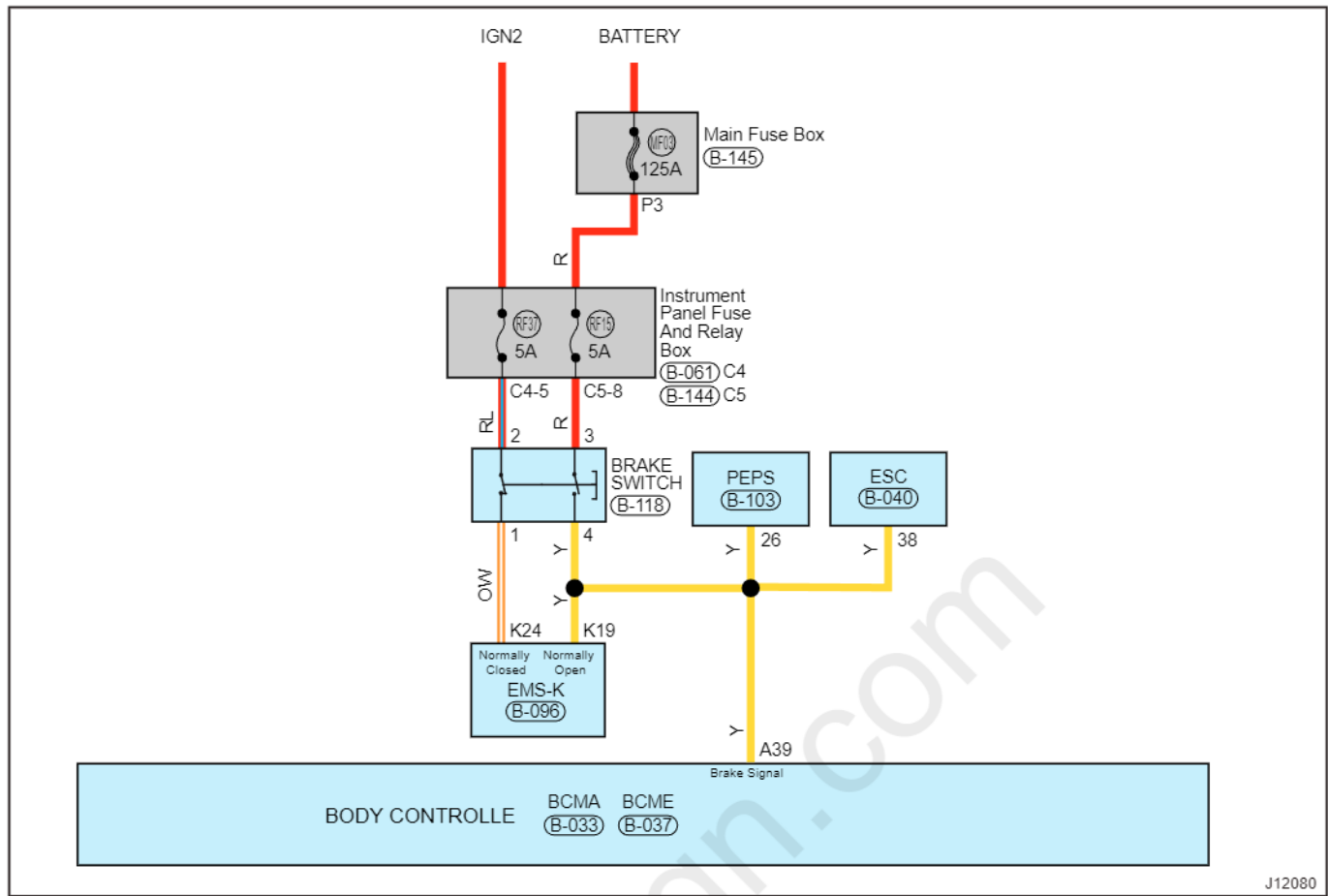
OK**Repair or replace new module.****NG****8 Reconfirm DTCs**

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK**Conduct test and confirm malfunction has been repaired.****■ Brake Pedal Signal Synchronization Malfunction**

DTC	P057100	Brake Signal Synchronization Error
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■ Description**Circuit Diagram**



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check brake switch connector

- Disconnect the negative battery.
- Check if brake switch connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

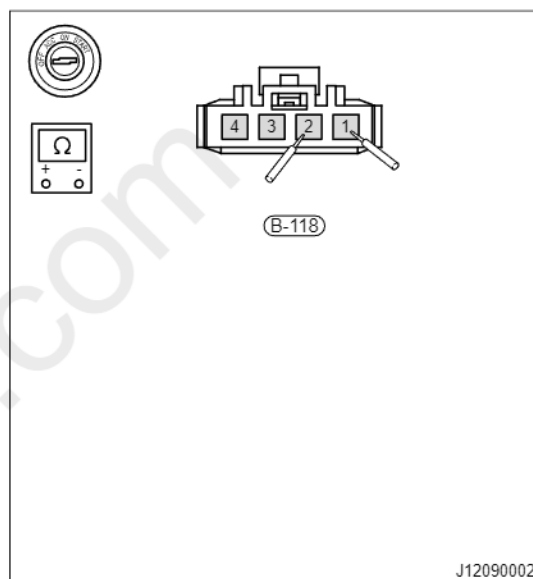
OK

2 Check brake switch power supply fuse

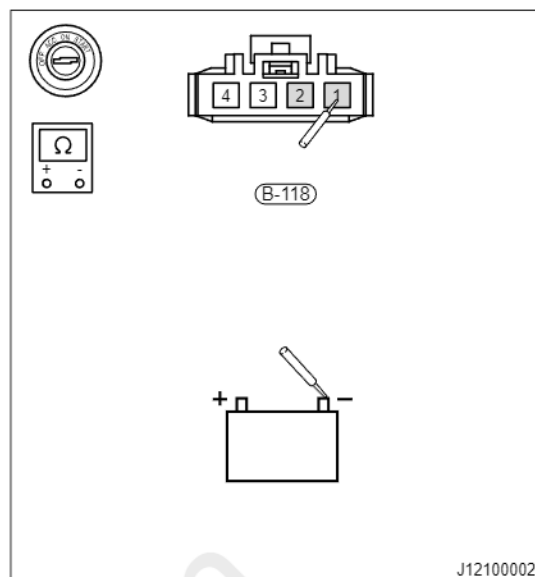
- (a) Check if fuse RF37 5A and fuse RF15 5A in instrument panel fuse and relay box are blown.

NG**Check and repair short circuit malfunction of circuit.****OK****3****Check brake switch condition**

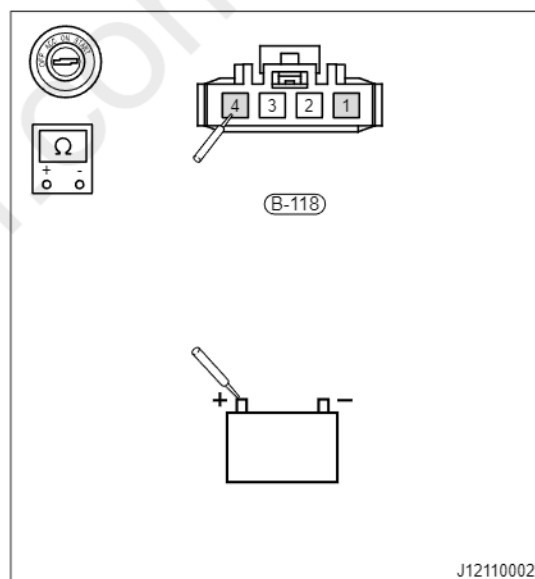
- (a) Unplug the brake switch connector.
- (b) Using ohm band of multimeter, measure brake switch B-118 (1, 2) with red and black probes; There should be continuity without brake pedal depressed and no continuity with brake pedal depressed.
- (c) Using ohm band of multimeter, measure brake switch B-118 (3, 4) with red and black probes; There should be no continuity without brake pedal depressed and there should be continuity with brake pedal depressed.

**NG****Replace brake switch assembly.****OK****4****Check for short circuit to ground / power supply or short to each other in brake switch line**

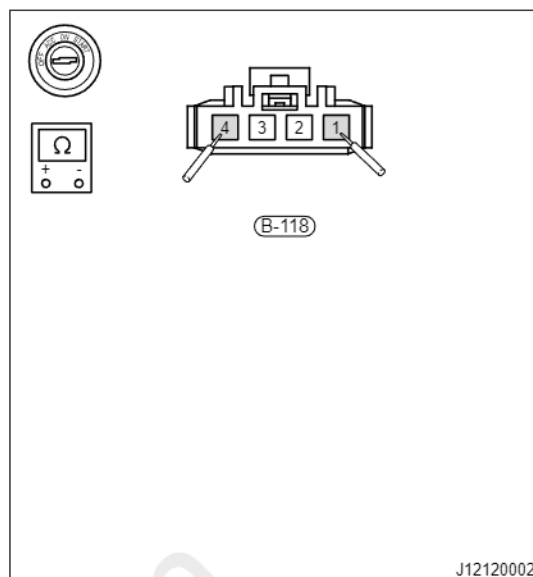
- (a) Disconnect the brake switch connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistances of brake switch B-118 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistances of brake switch B-118 (1, 4) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of brake switch B-118 (1, 4) with red and black probes respectively. Check if circuits are shorted to each other.



NG

Check and repair circuit.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

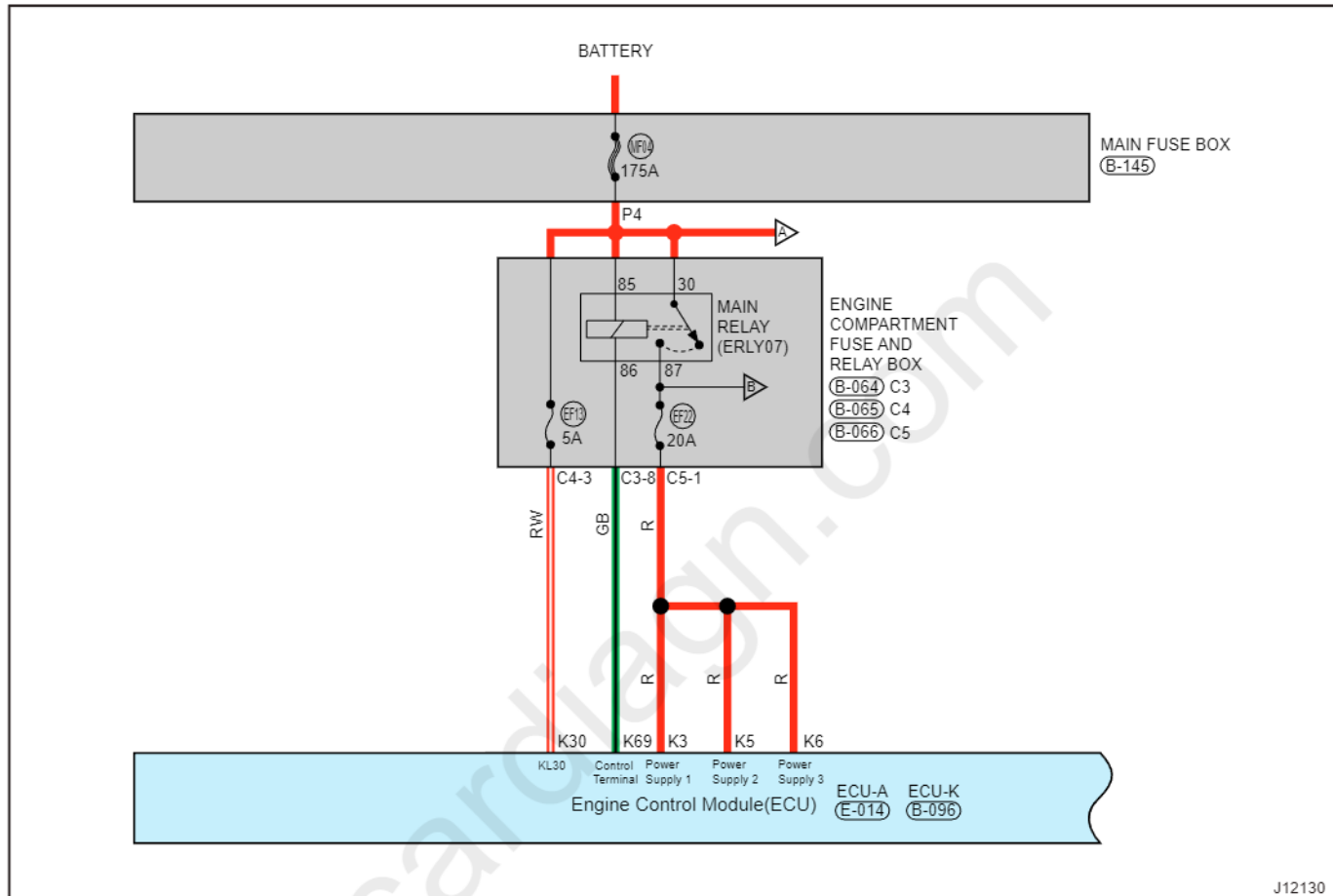
Conduct test and confirm malfunction has been repaired.

■ Main Relay Open / Short to Ground / Power Supply

DTC	P06AA00	Control Module Internal Temperature "B" Too High
DTC	P068A00	ECM/PCM Power Relay De-Energized Performance - Too Early
DTC	P068600	ECM/PCM Power Relay Control Circuit Low

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

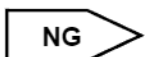
- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check main relay
---	------------------

- (a) Replace the main relay in engine compartment fuse and relay box.



Replace main relay.

OK

2 Check main relay coil terminal power supply fuse

- (a) Check if fuse MF04 175A in engine compartment fuse and relay box is blown.

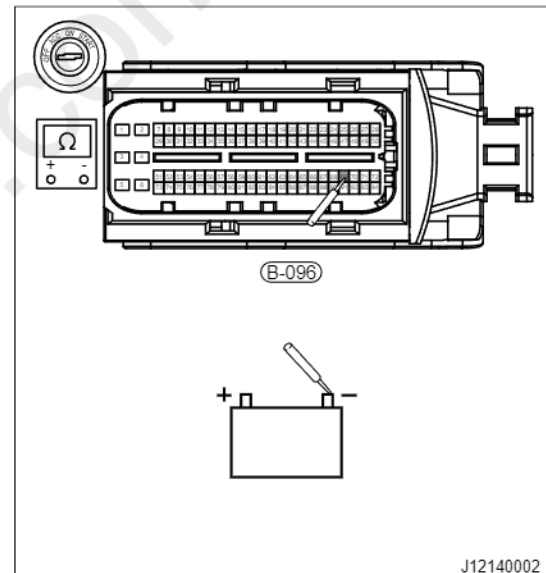
NG

Check and repair short circuit malfunction of circuit.

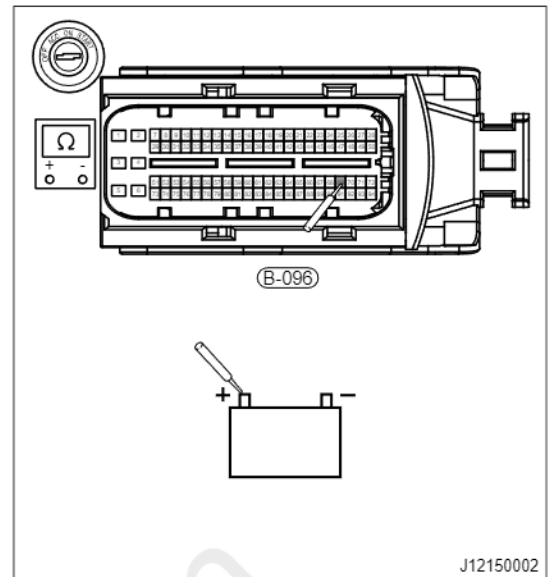
OK

3 Check for short circuit to ground / power source in main relay control circuit

- (a) Disconnect the engine compartment fuse and relay box connector (B-064).
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of ECU B-096 (69) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistance of ECM B-096 (69) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair circuit.

OK

4

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Response Reception Time Out/Error of LIN Bus (Contact Between EMS and Intellectual Generator)

DTC	P143000	Battery Has Been Changed and Long Time No Tester Confirmation
DTC	P143100	EBS or Battery Error
DTC	P143200	EBS Temporary Error

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check battery model
----------	----------------------------

- (a) Check if battery model is in agreement with genuine battery.

NG

Use genuine battery to replace.

OK

2	Check battery sensor connector
----------	---------------------------------------

- (a) Disconnect the negative battery.
 (b) Check if battery sensor connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

3	Check LIN line voltage
----------	-------------------------------

- (a) Disconnect the battery sensor connector.
 (b) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltage of battery sensor LIN line with red probe respectively.

Equivalent voltage: Approximately 10 V

NG

Check and repair LIN line.

OK

4 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ **Starter Relay / Drive Chain State Relay Fault**

DTC	P26F100	Starter Relay "A" or "B" Stuck Off
DTC	P26F000	Starter Relay "A" Stuck On
DTC	P14AD00	Engine Block or Starter is not Engaged
DTC	P14AF00	KL50r Wire Short Circuit to Ground
DTC	P14AE00	KL50r Wire Short Circuit to Battery
DTC	P14AC00	Starter Damaged or Wire Dropped

■ **DTC Confirmation Procedure**

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check drive chain state relay

- (a) Replace the drive chain state relay in engine compartment fuse and relay box.

NG

Replace drive chain state relay.

OK

2 Check drive chain state relay feedback terminal power supply fuse

- (a) Check if fuse in engine compartment fuse and relay box is blown.

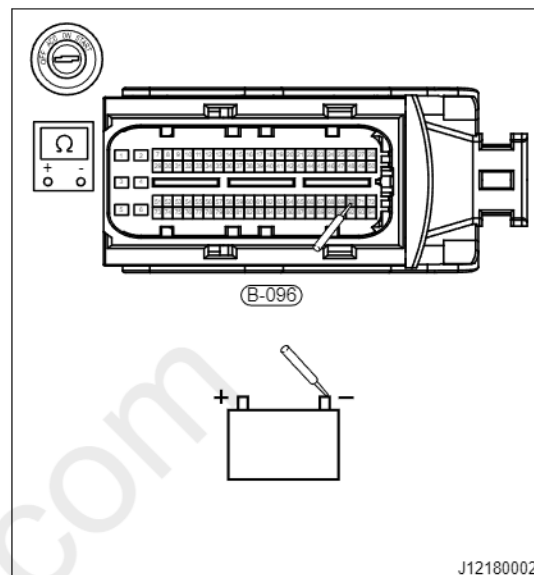
NG

Check and repair short circuit malfunction of circuit.

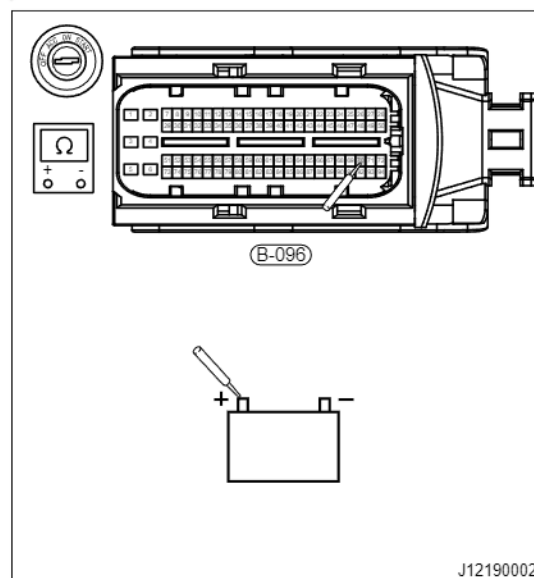
OK

3 Check for short circuit to ground / power supply in drive chain state relay feedback circuit

- (a) Disconnect the engine compartment fuse and relay box connector (B-065).
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of ECU B-096 (70) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistance of ECM B-096 (70) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair circuit.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

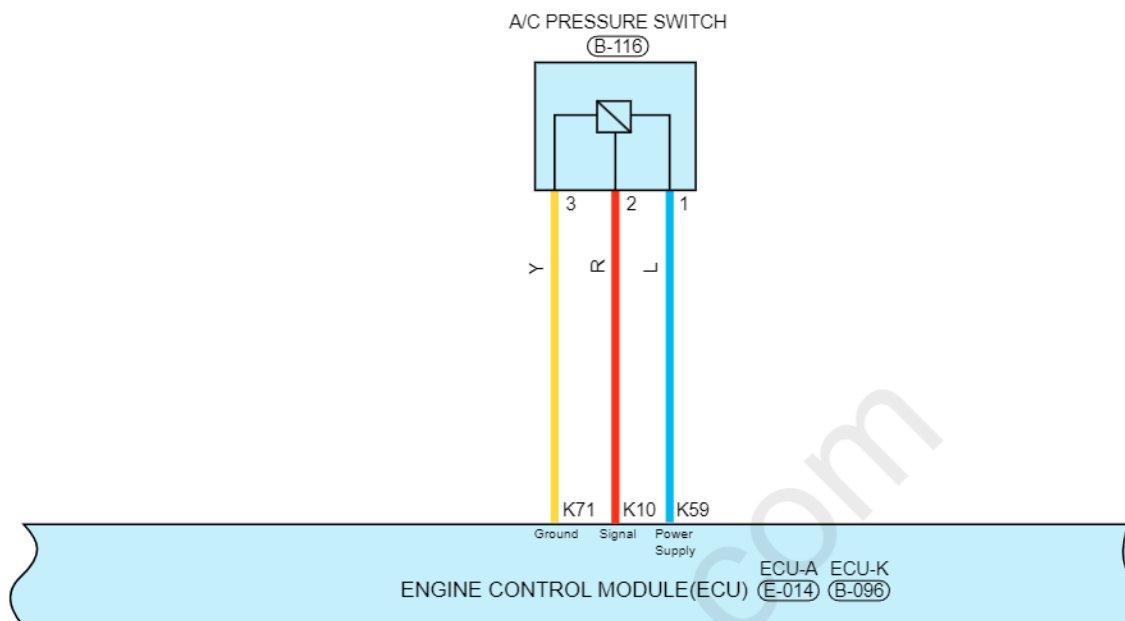
Conduct test and confirm malfunction has been repaired.

■ A/C Pressure Sensor Circuit Voltage High/Low

DTC	P053300	A/C Refrigerant Pressure Sensor "A" Circuit High
DTC	P053200	A/C Refrigerant Pressure Sensor "A" Circuit Low

■ Description

Circuit Diagram



J12200

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check A/C pressure sensor connector

- Disconnect the negative battery.
- Check if A/C pressure sensor connector is loose, and contact between male and female terminals is in good condition.

NG

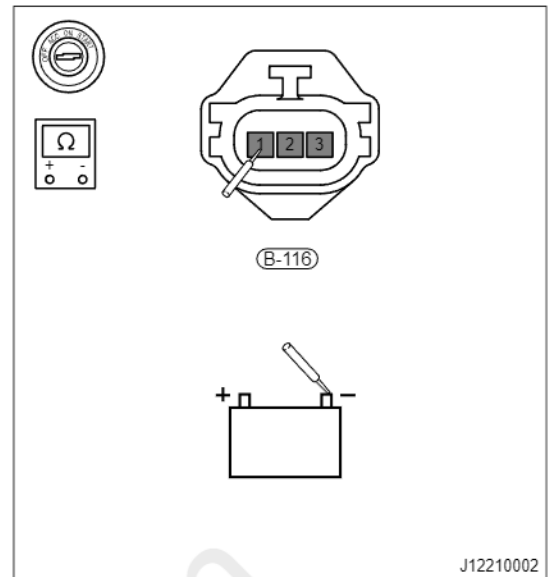
Repair and adjust connector, or replace it.

OK

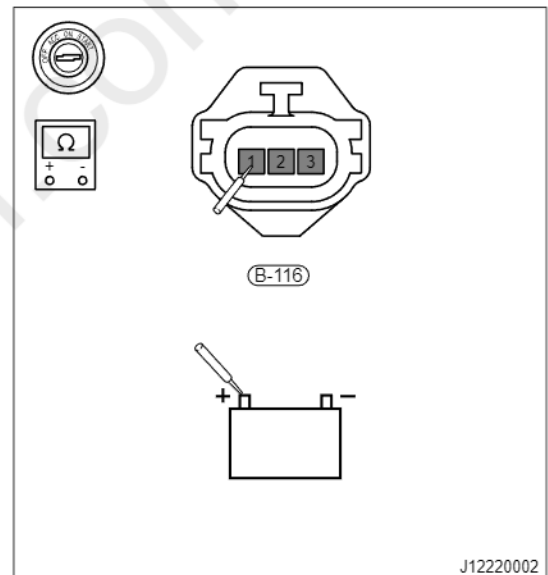
2

Check for short circuit to ground / power supply or short to each other in A/C pressure sensor circuit

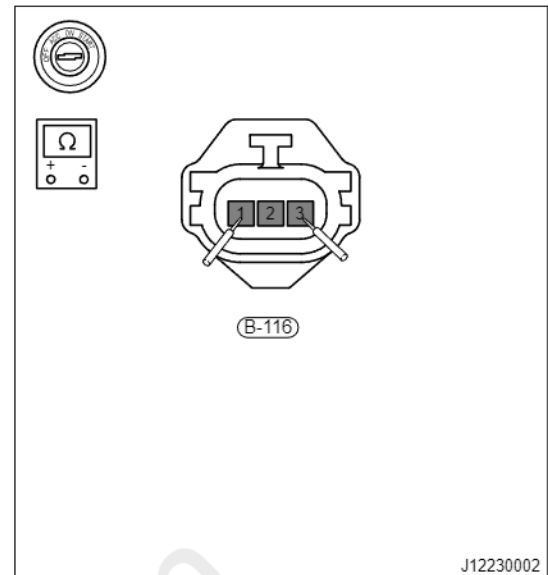
- (a) Disconnect the A/C pressure sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of A/C pressure sensor B-116 (1, 2, 3) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of A/C pressure sensor B-116 (1, 2, 3) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of A/C pressure sensor B-116 (1, 2, 3) with red and black probes respectively. Check if circuits are shorted to each other.



NG

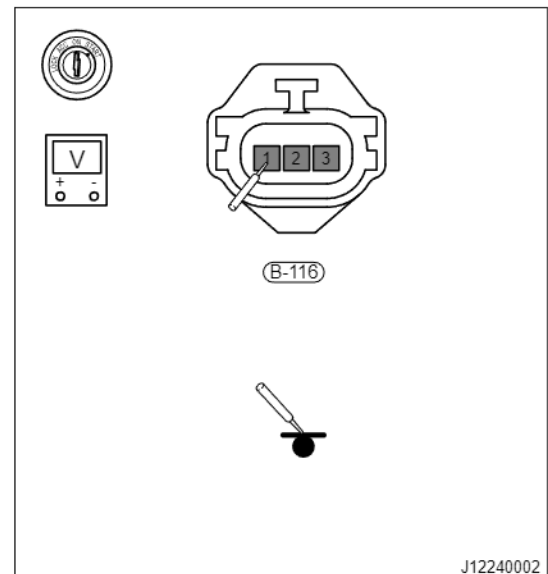
Check and repair circuit.

OK

3

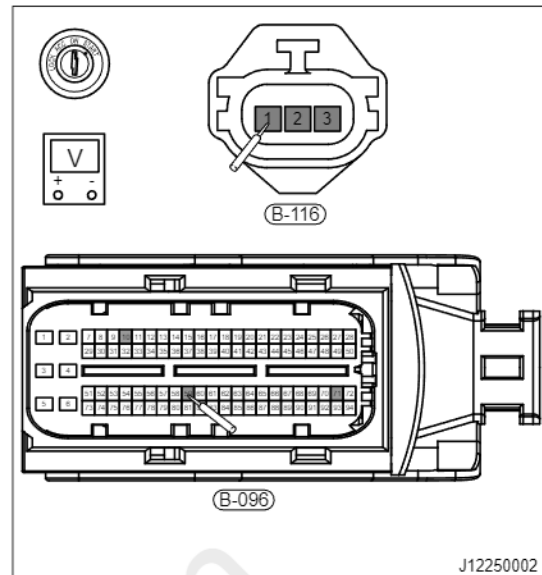
Check A/C pressure sensor power supply / ground / signal

- (a) Connect A/C pressure sensor and ECM (B-096) connectors
 (b) Turn ENGINE START STOP switch to ON.
 (c) Using voltage band of multimeter, connect black probe to battery negative terminal, measure voltages of A/C pressure sensor B-116 (1, 2, 3) with red probe.

Power supply terminal: 5 V**Ground terminal: < 0.2 V****Voltage of signal terminal should increase as the pressure rises**

- (d) Using voltage band of multimeter (voltage drop method), connect black probe to ECM B-096 (59, 10, 71), measure A/C pressure sensor B-116 (1, 2, 3) with red probe.

Test voltage drop value should be less approximately 0.2 V



NG

Repair or replace wire harness.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

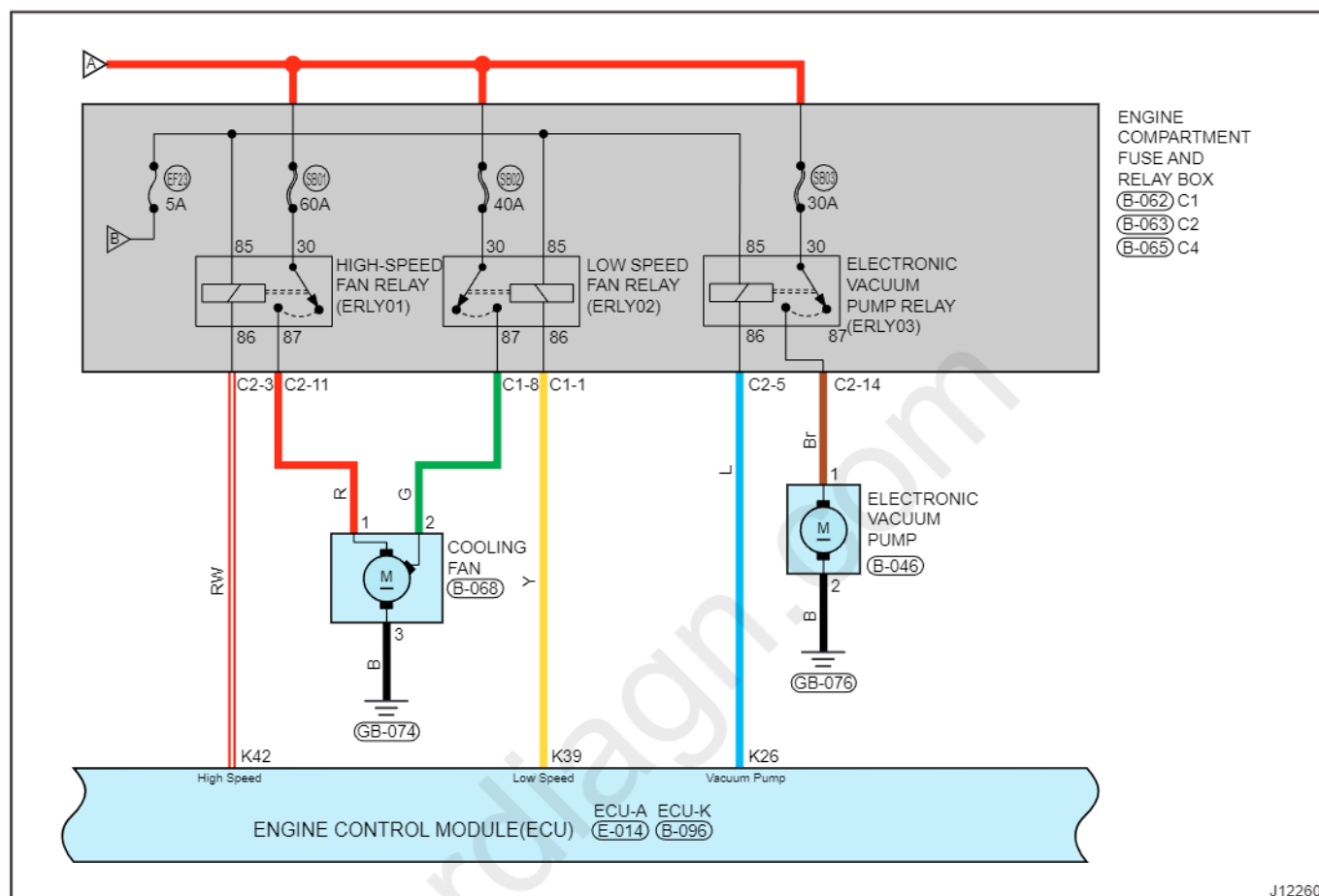
■ Brake Vacuum Pump Control Circuit Open / Voltage Too Low / Too High

DTC	P050F00	Brake Assist Vacuum Too Low
DTC	P258A00	Vacuum Pump Control Circuit Open

DTC	P258C00	Vacuum Pump Control Circuit "A" Low
DTC	P258D00	Vacuum Pump Control Circuit "A" High

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check electric vacuum pump connector

- Disconnect the negative battery.
- Check if electric vacuum pump connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check electric vacuum pump relay

- (a) Replace the electric vacuum pump relay in engine compartment fuse and relay box.

NG

Replace electric vacuum pump relay.

OK

3 Check electric vacuum pump relay coil terminal power supply fuse

- (a) Check if fuse SB03 30A in engine compartment fuse and relay box is blown.

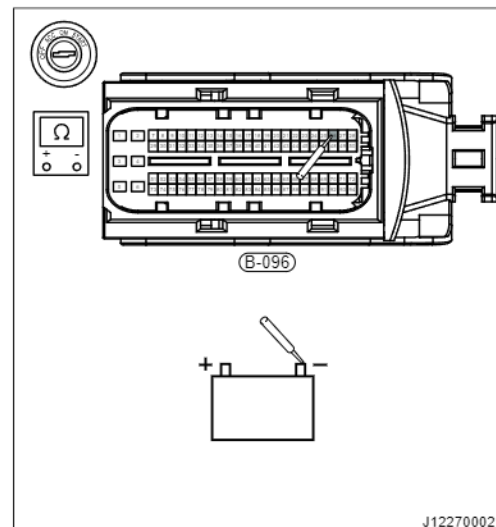
NG

Check and repair short circuit malfunction of circuit.

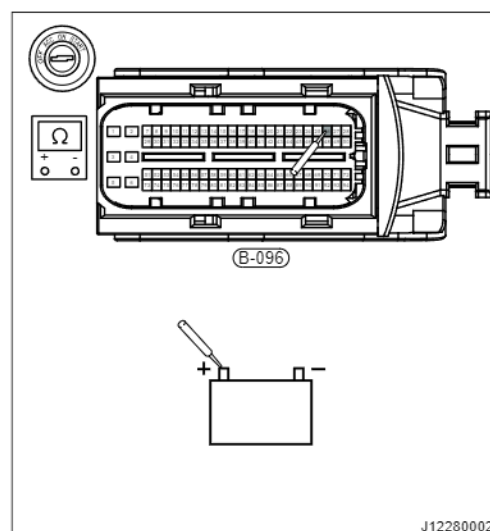
OK

4 Check for short circuit to ground / power supply in electric vacuum pump relay control circuit

- (a) Unplug the electric vacuum pump relay.
 (b) Disconnect the ECM connector (B-096).
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of ECU B-096 (26) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistance of ECM B-096 (26) with red probe respectively. Check if circuit is short to power supply.



NG

Check and repair circuit.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

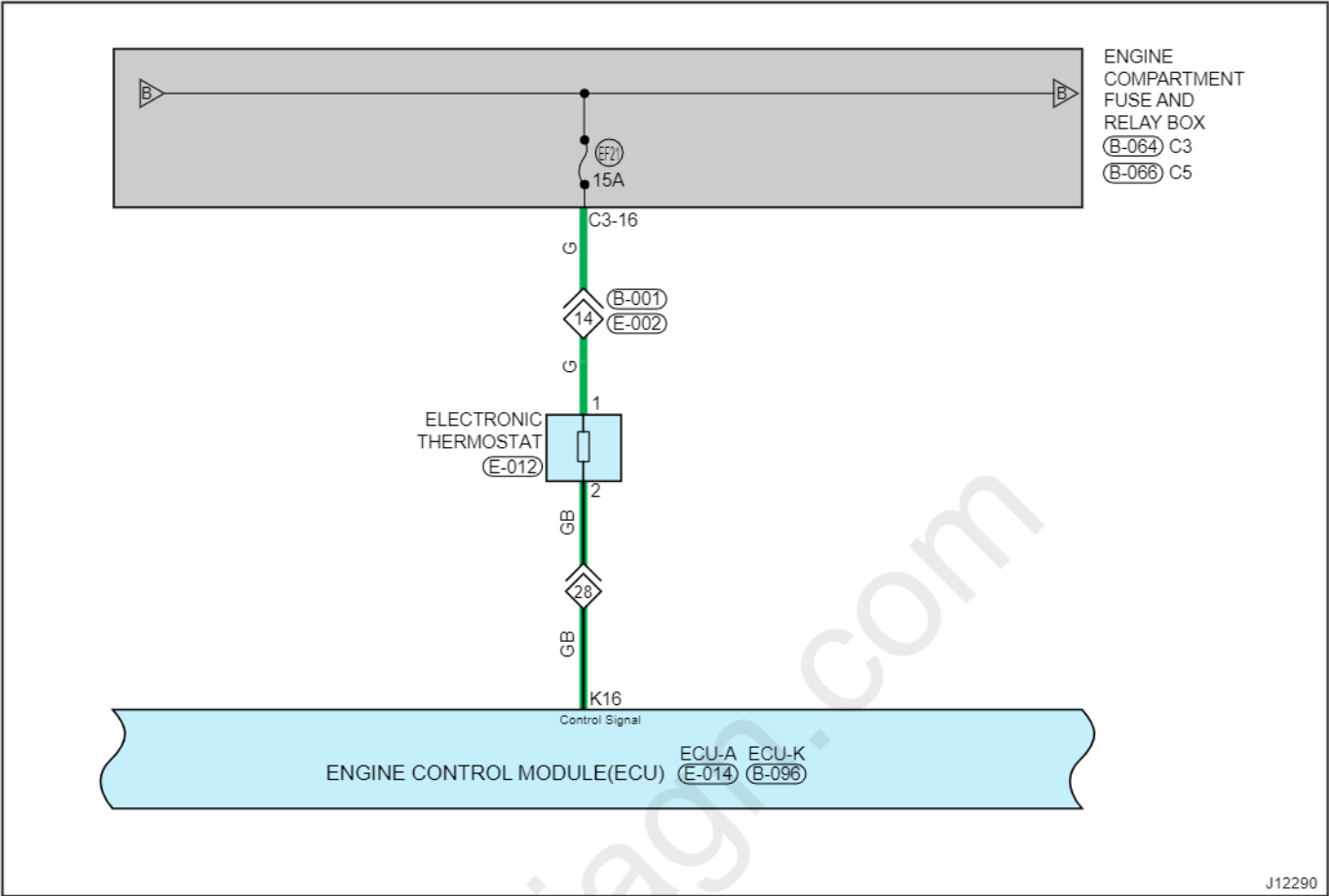
OK

Conduct test and confirm malfunction has been repaired.

■ Electronic Thermostat Control Circuit Open / Voltage Too Low / Too High

DTC	P059700	Thermostat Heater Control Circuit Open
DTC	P059800	Thermostat Heater Control Circuit Low
DTC	P059900	Thermostat Heater Control Circuit High

■ Description
Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check electronic thermostat connector
---	---------------------------------------

- (a) Disconnect the negative battery.
- (b) Check if electronic thermostat connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2	Check electronic thermostat power supply fuse
---	---

- (a) Check if fuse EF21 15A in engine compartment fuse and relay box is blown.

NG

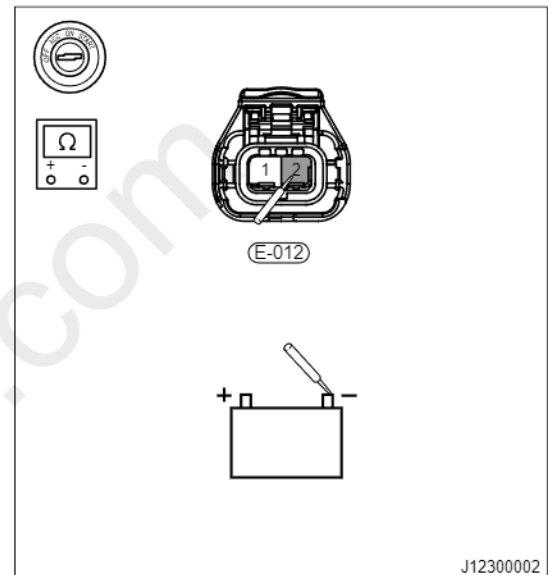
Check and repair short circuit malfunction of circuit.

OK

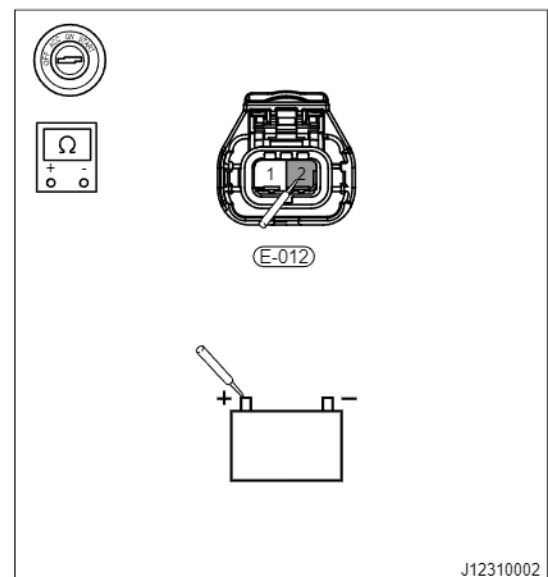
3

Check for short circuit to ground / power supply in electronic thermostat control circuit

- (a) Disconnect the electronic thermostat connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of electronic thermostat E-012 (2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistance of electronic thermostat E-012 (2) with red probe respectively. Check if circuit is short to power supply.



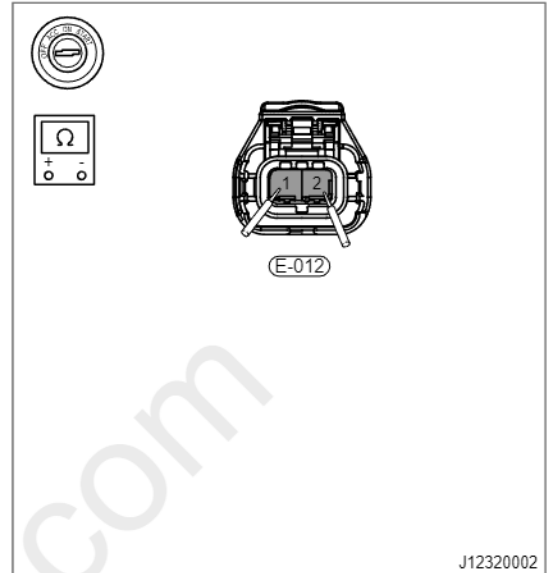
NG

Check and repair circuit.

OK

4 Check if circuits of electronic thermostat themselves are shorted to each other or opened

- (a) Using ohm band of multimeter, measure resistances of electronic thermostat E-012 (1, 2) with red and black probes respectively; Check if they are shorted to each other or opened.



NG

Replace electronic thermostat assembly.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Ambient Temperature Sensor Circuit Voltage Too Low / Too High

DTC	P007200	Ambient Air Temperature Sensor Circuit "A" Low
DTC	P007300	Ambient Air Temperature Sensor Circuit "A" High

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

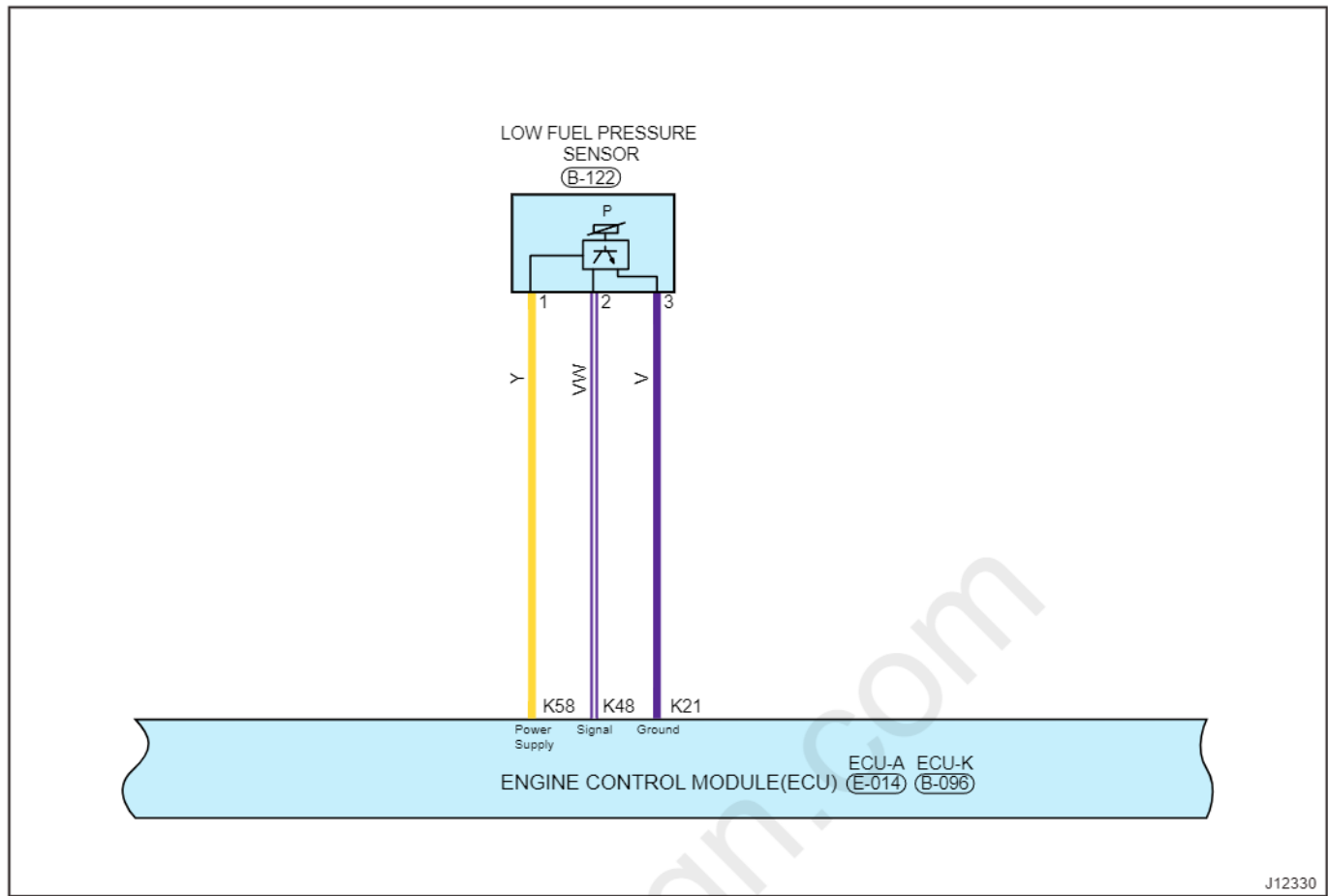
Read A/C system DTCs and refer to A/C system diagnosis.

■ Low Pressure Fuel Pressure Sensor Malfunction

DTC	P254029	DECOS Oil Passage Pressure Sensor Circuit Bank 1-Positive Offset
DTC	P016F00	DECOS Low Pressure Oil Passage PWM Control Deviation Too Large
DTC	P137000	DECOS Oil Passage Pressure Sensor Relative Pressure Too Low
DTC	P137100	DECOS Oil Passage Pressure Sensor Relative Pressure Too High
DTC	P254028	DECOS Oil Passage Pressure Sensor Circuit Bank 1-Negative Offset
DTC	P254100	DECOS Oil Passage Pressure Sensor Circuit Voltage Too Low
DTC	P008A00	DECOS Low Pressure Oil Passage Pressure Too Low
DTC	P254200	DECOS Oil Passage Pressure Sensor Circuit High Voltage

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check low pressure fuel pressure sensor connector
---	--

- (a) Disconnect the negative battery.
- (b) Check if low pressure fuel pressure sensor connector is loose, and contact between male and female terminals is in good condition.

NG Repair and adjust connector, or replace it.

OK

2	Check low pressure end fuel pressure
---	---

- (a) Using the fuel pressure gauge to test if low pressure end fuel pressure is met the standard.

NG

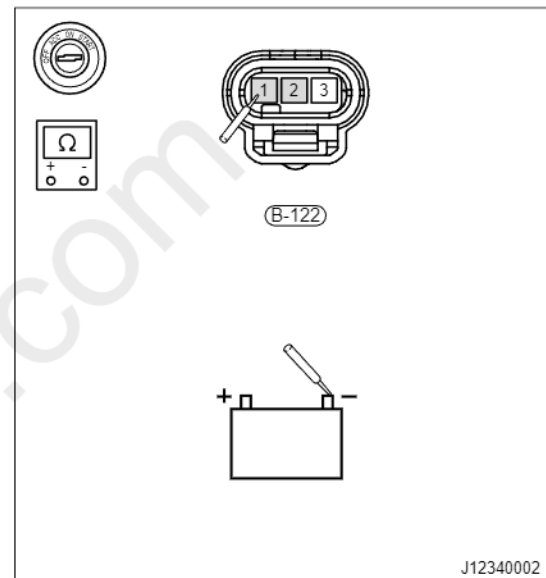
Replace electric fuel pump assembly.

OK

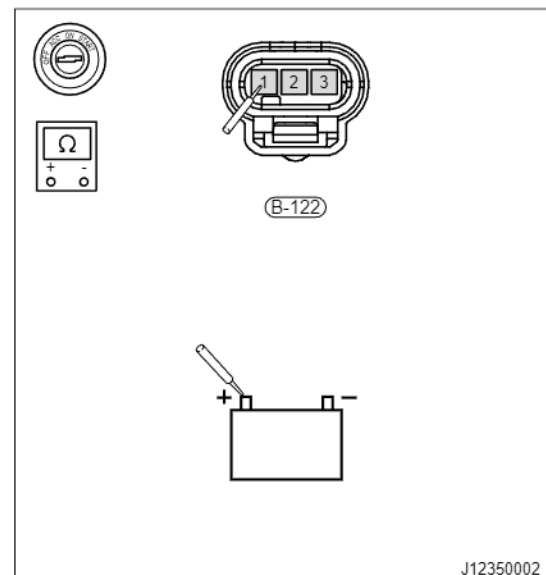
3

Check for short circuit to ground / power supply or short to each other in A/C pressure sensor circuit

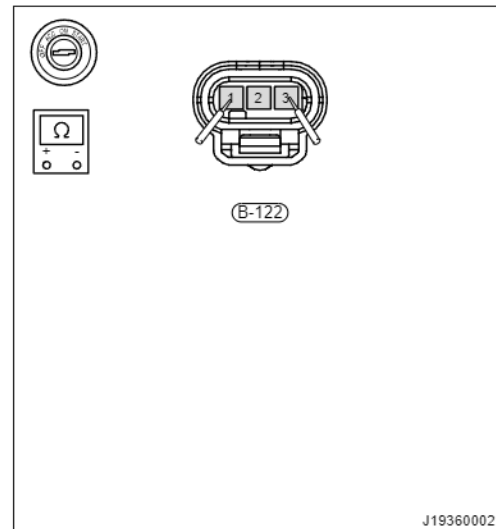
- (a) Disconnect the low pressure fuel pressure sensor connector.
 (b) Disconnect the ECM connector (B-096).
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of low pressure fuel pressure sensor B-122 (1, 2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of low pressure fuel pressure sensor B-122 (1, 2, 3) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of low pressure fuel pressure sensor B-122 (1, 2, 3) with red and black probes respectively. Check if circuits are shorted to each other.

**NG****Check and repair circuit.****OK****4****Check if circuits of low pressure fuel pressure sensor themselves are shorted to each other or opened**

- (a) Using ohm band of multimeter, measure resistances of low pressure fuel pressure sensor (1, 2, 3) with red and black probes respectively; Check if they are shorted to each other or opened.

NG**Replace low pressure fuel pressure sensor assembly.****OK****5****Check Engine Control Module (ECM)**

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK**Repair or replace new module.****NG****6****Reconfirm DTCs**

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

OK

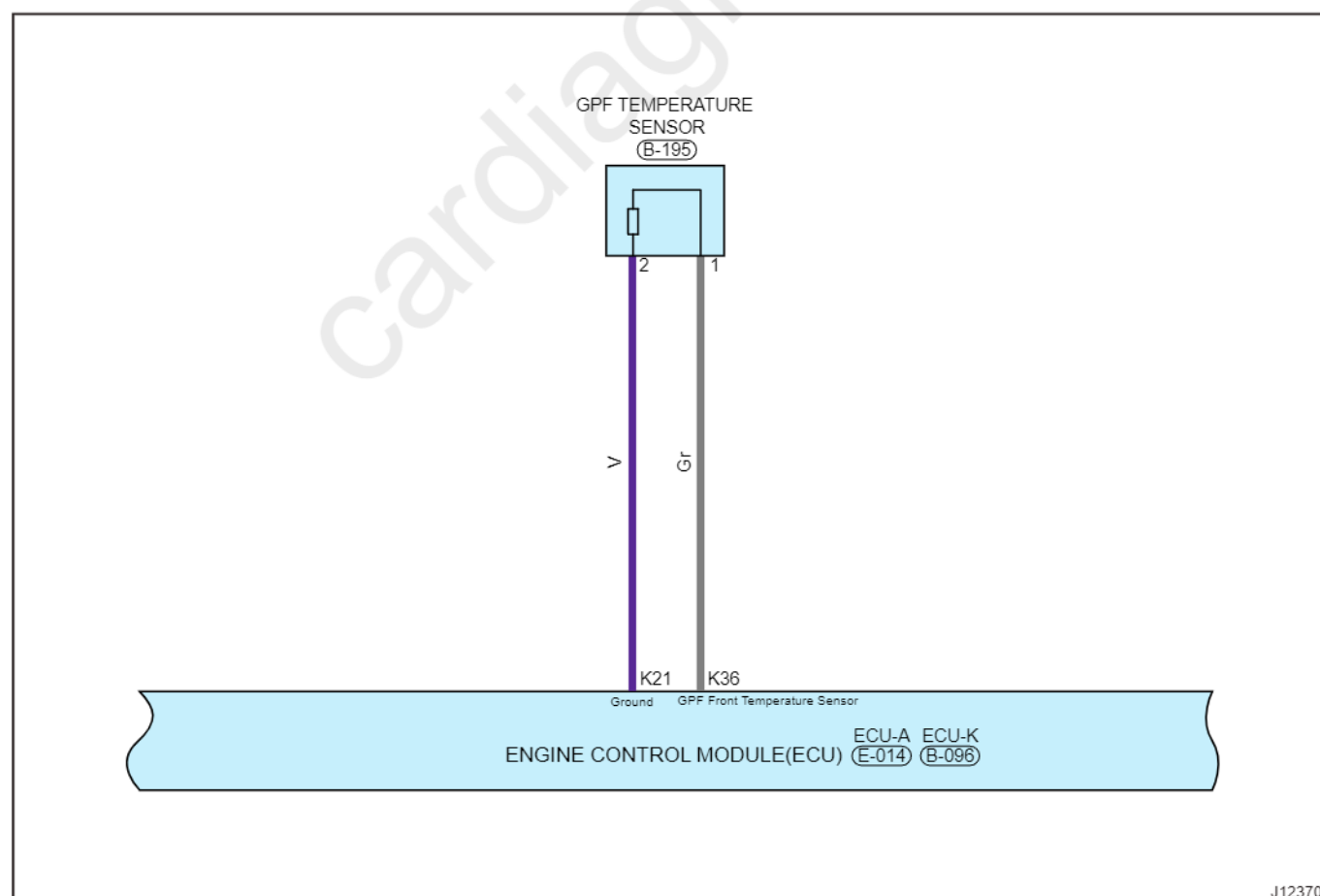
Conduct test and confirm malfunction has been repaired.

■ Particulate Filter Temperature Sensor Error

DTC	P20E224	Particulate Filter Upstream Temperature Sensor Cold Start Correction Improper (Positive Deviation)
DTC	P20E223	Particulate Filter Upstream Temperature Sensor Cold Start Correction Improper (Negative Deviation)
DTC	P208062	Excessive Deviation Between Particulate Filter Upstream Temperature Sensor Signal Model and Actual
DTC	P054600	Particulate Filter Upstream Temperature Sensor Circuit Voltage High
DTC	P054500	Particulate Filter Upstream Temperature Sensor Circuit Voltage Low
DTC	P20802A	Particulate Filter Upstream Temperature Sensor Signal Stuck

■ Description

Circuit Diagram



J12370

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check GPF temperature sensor connector

- (a) Disconnect the negative battery.
- (b) Check if GPF temperature sensor connector is loose, and contact between male and female terminals is in good condition.

NG

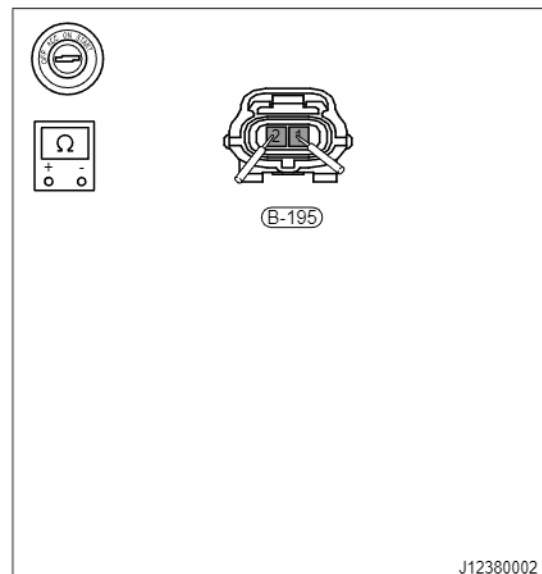
Repair and adjust connector, or replace it.

OK

2 Check GPF temperature sensor internal resistance

- (a) Disconnect the GPF temperature sensor connector
- (b) Using ohm band of multimeter, measure if resistances of GPF temperature sensor B-195 (1, 2) are normal with red and black probes respectively.

Normal resistance value at ambient temperature (10 - 30°C) should be: 200 - 230 Ω.



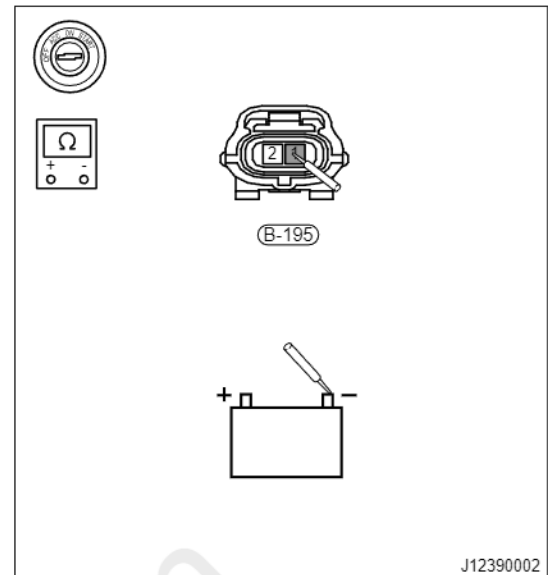
NG

Replace GPF temperature sensor assembly.

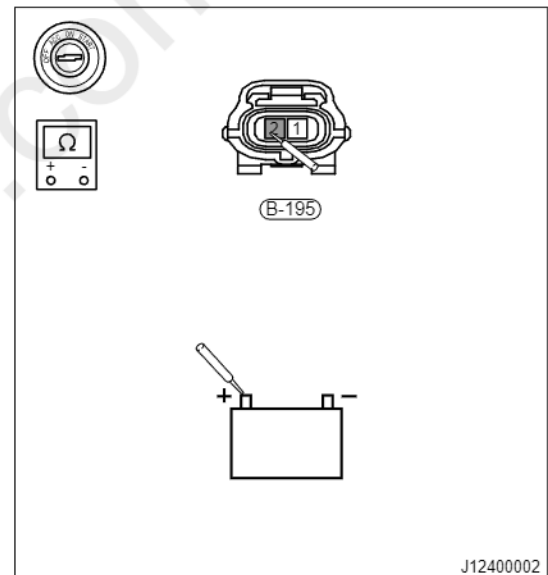
OK

3 Check for short circuit to ground / power supply or short to each other in GPF temperature sensor circuit

- (a) Disconnect the GPF temperature sensor connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of GPF temperature sensor B-195 (1) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of GPF temperature sensor B-195 (1, 2) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of GPF temperature sensor B-195 (1, 2) with red and black probes respectively. Check if circuits are shorted to each other.



NG

Check and repair circuit.

OK

4 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
(b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

5 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

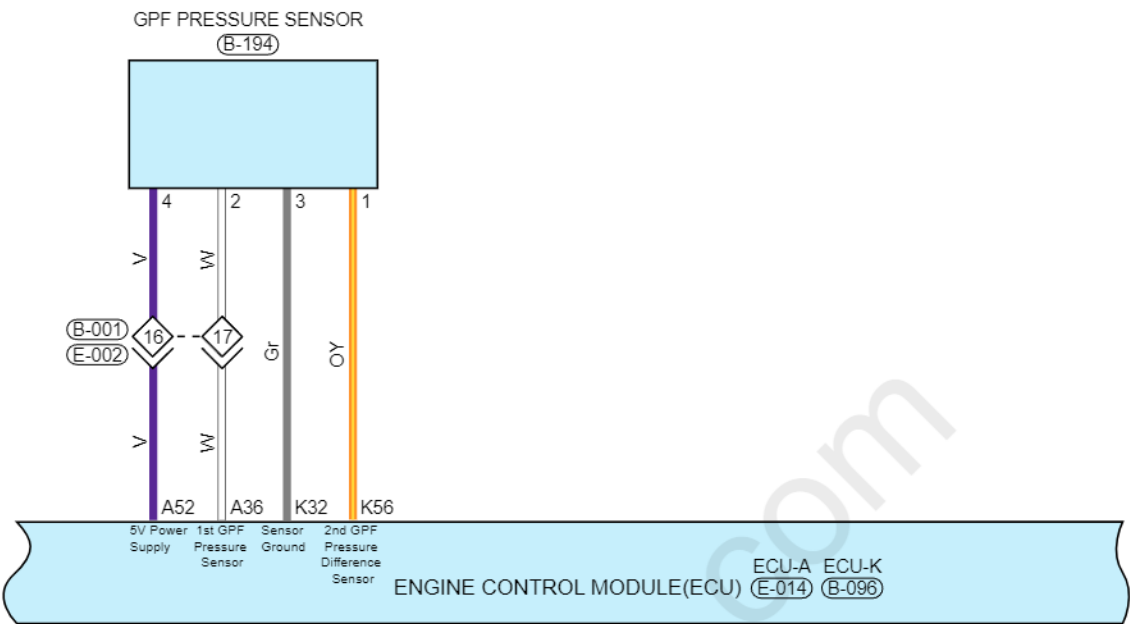
■ Particulate Filter Differential Pressure Sensor Malfunction

DTC	P12A300	Particulate Filter Differential Pressure Sensor Rear Pipe Connecting Line Abnormal / Completely Blocked / Sensor Stuck
DTC	U060100	Particulate Filter Differential Pressure Sensor Circuit Voltage Low (Downstream)

DTC	U060141	Particulate Filter Differential Pressure Sensor Data Inspection Non-plausible (Upstream)
DTC	P129300	Particulate Filter Upstream Pressure Sensor Channel 1 Digital Signal Non-plausible (SENT Signal High or Low)
DTC	P245500	Particulate Filter Differential Pressure Sensor Circuit Voltage High (Upstream)
DTC	P245400	Particulate Filter Differential Pressure Sensor Circuit Voltage Low (Upstream)
DTC	P129100	GPF Dynamic Response Performance of Particulate Filter Differential Pressure Sensor Non-plausible / Line Abnormal
DTC	P12E100	GPF Dynamic Response Performance of Particulate Filter Differential Pressure Sensor Non-plausible / Line Abnormal (Downstream)
DTC	P12E300	Particulate Filter Downstream Pressure Sensor Channel 1 Digital Signal Non-plausible (SENT Signal High or Low)
DTC	P12A200	Particulate Filter Differential Pressure Sensor Line Connection Error
DTC	P246100	Particulate Filter Differential Pressure Sensor Circuit Voltage High (Downstream)
DTC	P246000	Particulate Filter Differential Pressure Sensor Circuit Voltage Low (Downstream)
DTC	U060200	Particulate Filter Differential Pressure Sensor Sent Communication Failure (Downstream)
DTC	U060241	Particulate Filter Differential Pressure Sensor Data Inspection Non-plausible (Downstream)

■ Description

Circuit Diagram



J12460

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check GPF pressure sensor connector
---	-------------------------------------

- (a) Disconnect the negative battery.
- (b) Check if GPF pressure sensor connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2	Check GPF pressure sensor connecting line
---	---

- (a) Check if GPF pressure sensor connecting line falls off or is connected incorrectly.

NG

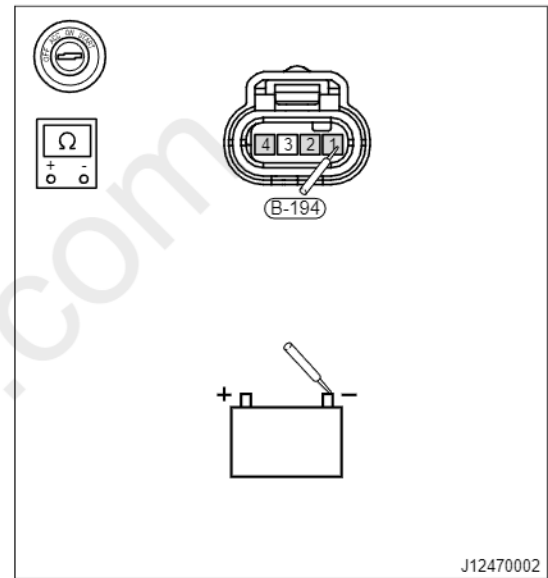
Adjust the connecting line.

OK

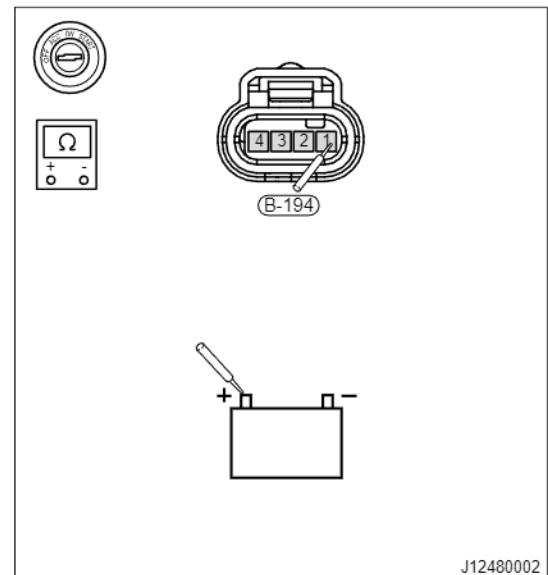
3

Check for short circuit to ground / power supply or short to each other in GPF pressure sensor circuit

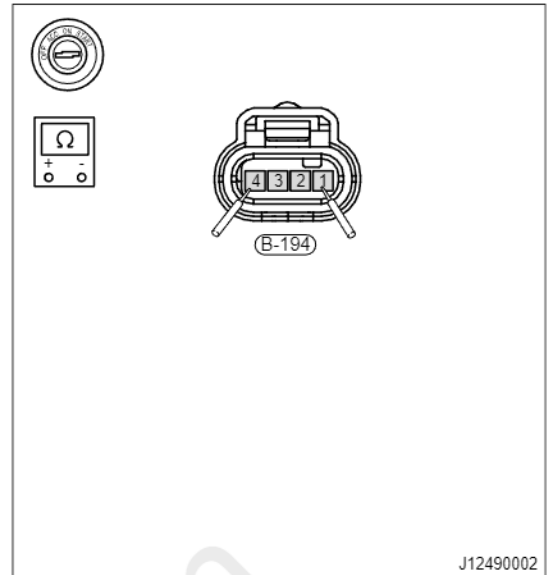
- (a) Disconnect the GPF pressure sensor connector.
 (b) Disconnect the ECM connector (B-096).
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistances of GPF pressure sensor B-194 (1, 2, 4) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistances of GPF pressure sensor B-194 (1, 2, 3, 4) with red probe respectively. Check if circuit is short to power supply.



- (e) Using ohm band of multimeter, measure resistances of GPF pressure sensor B-194 (1, 2, 3, 4) with red and black probes respectively. Check if circuits are shorted to each other.



NG

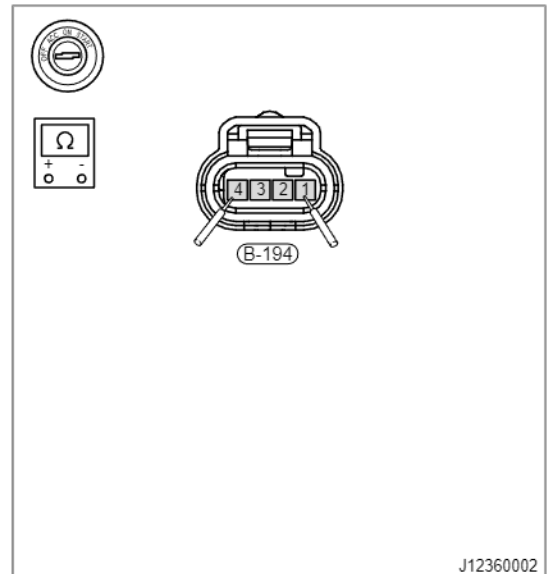
Check and repair circuit.

OK

4

Check if circuits of GPF pressure sensor themselves are shorted to each other

- (a) Using ohm band of multimeter, measure resistances of GPF pressure sensor B-194 (1, 2, 3, 4) with red and black probes respectively; Check if they are shorted to each other.



NG

Replace GPF pressure sensor assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Particulate Filter Removed / Pressure Sensor / Line Abnormal Fault

DTC	P226D00	Particulate Filter Removed / Pressure Sensor / Line Abnormal Fault
-----	---------	--

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Check GPF particulate filter

- (a) Check if GPF particulate filter is removed.
- (b) Check if GPF particulate filter is melted.

NG

Replace GPF particulate filter.

OK

2

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

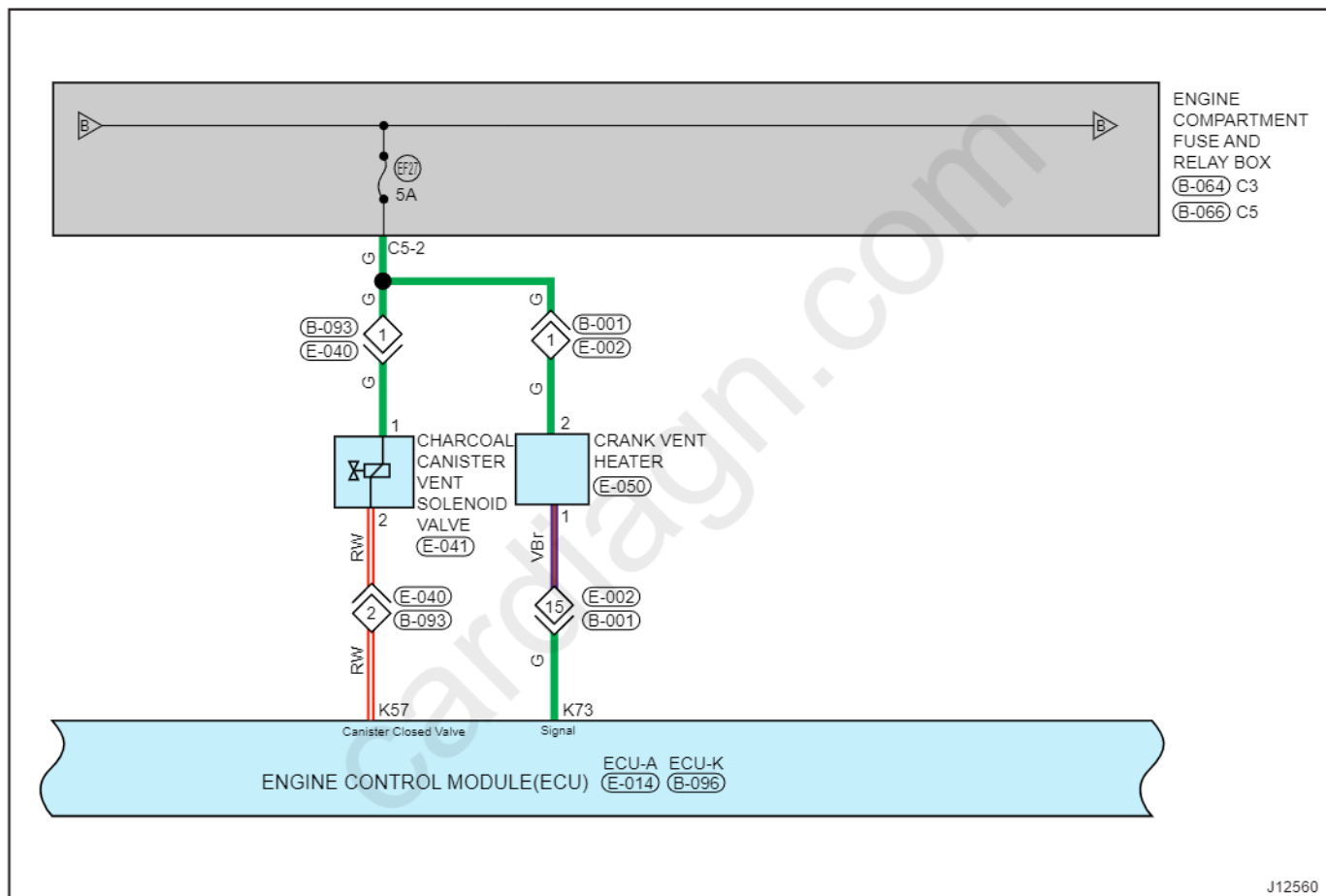
Conduct test and confirm malfunction has been repaired.

■ Crankcase Heating Line Circuit Open / Voltage Too High / Too Low

DTC	P053A00	Crankcase Heating Line Circuit Open
DTC	P053C00	Crankcase Heating Line Circuit Voltage Too High
DTC	P053B00	Crankcase Heating Line Circuit Voltage Too Low

■ Description

Circuit Diagram



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check crankshaft heating valve connector

- (a) Disconnect the negative battery.
- (b) Check if crankshaft heating valve connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2

Check crankshaft heating valve power supply fuse

- (a) Check if fuse EF27 5A in engine compartment fuse and relay box is blown.

NG

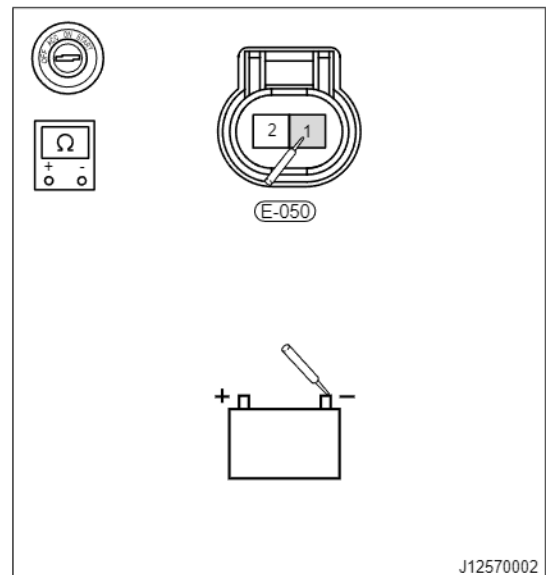
Check and repair short circuit malfunction of circuit.

OK

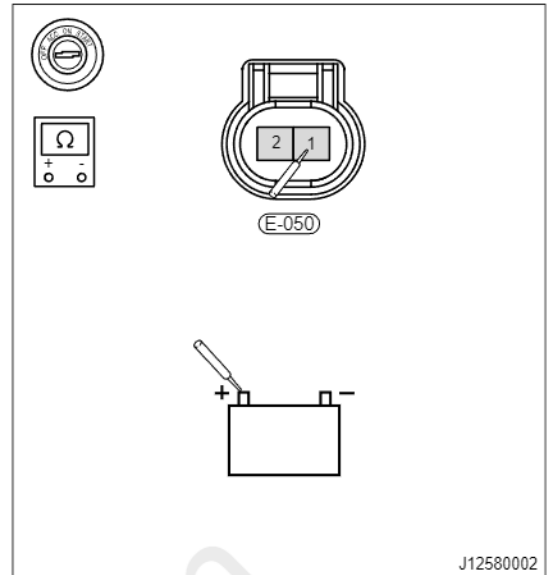
3

Check for short circuit to ground / power supply in crankshaft heating valve control circuit

- (a) Disconnect the crankshaft heating valve connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, and measure resistance of crankshaft heating valve E-050 (1) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, and measure resistances of crankshaft heating valve E-050 (1, 2) with red probe respectively. Check if circuit is short to power supply.



NG

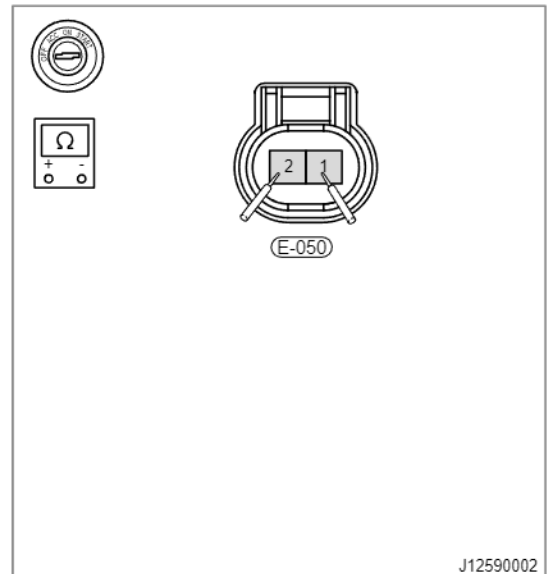
Check and repair circuit.

OK

4

Check if circuits of crankshaft heating valve themselves are shorted to each other or opened

- (a) Using ohm band of multimeter, measure resistances of crankshaft heating valve E-050 (1, 2) with red and black probes respectively; Check if they are shorted to each other or opened.



NG

Replace crankshaft heating valve assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

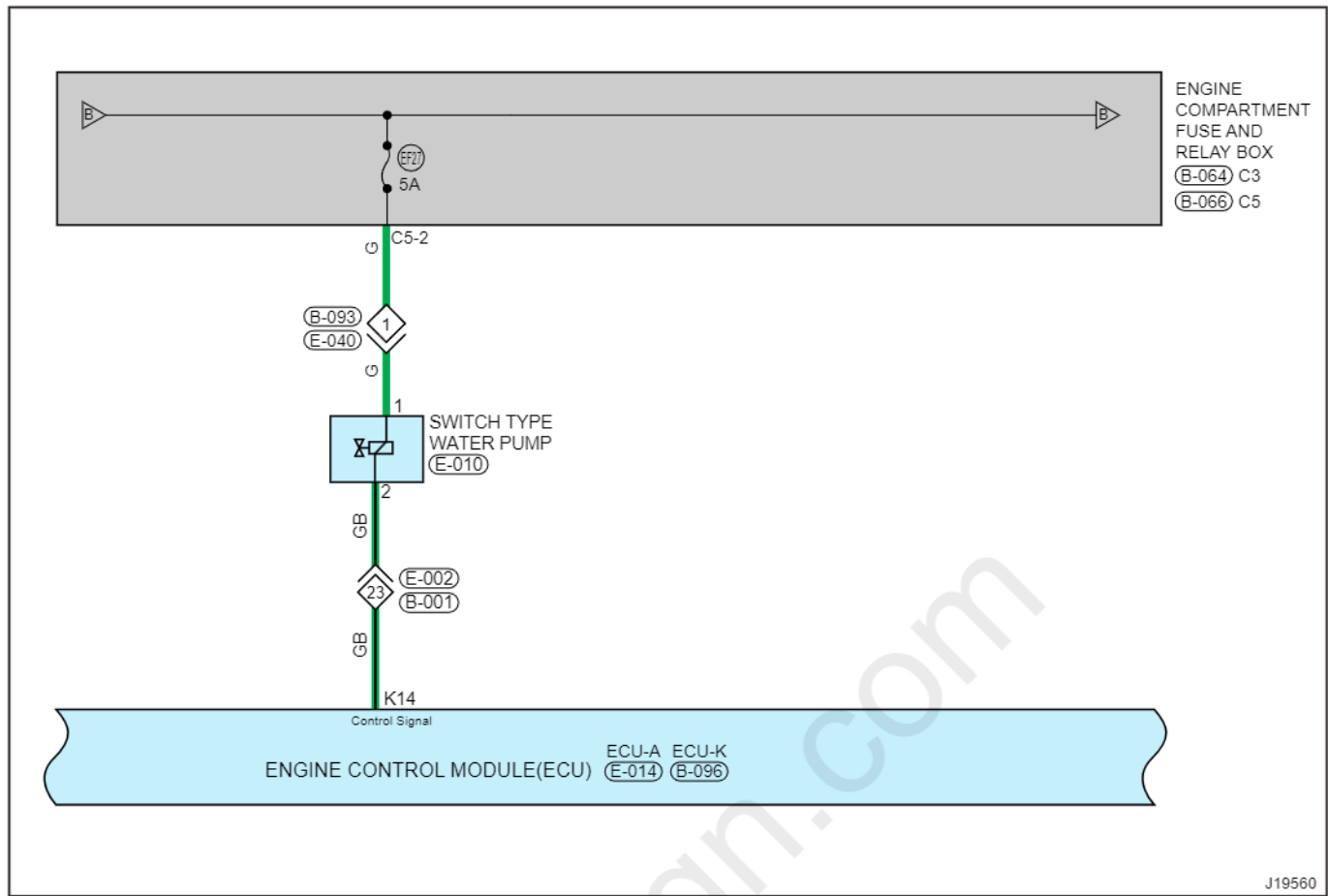
OK

Conduct test and confirm malfunction has been repaired.

■ Clutch Water Pump Control Circuit Malfunction

DTC	P260300	Coolant Pump "A" Control Circuit High
DTC	P260200	Coolant Pump "A" Control Circuit Low
DTC	P260000	Coolant Pump "A" Control Circuit Open

■ Description**Circuit Diagram**



■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check water pump connector
---	-----------------------------------

- (a) Disconnect the negative battery.
- (b) Check if water pump connector is loose, and contact between male and female terminals is in good condition.

NG Repair and adjust connector, or replace it.

OK

2	Check water pump power supply fuse
---	---

- (a) Check if fuse EF21 15A in engine compartment fuse and relay box is blown.

NG

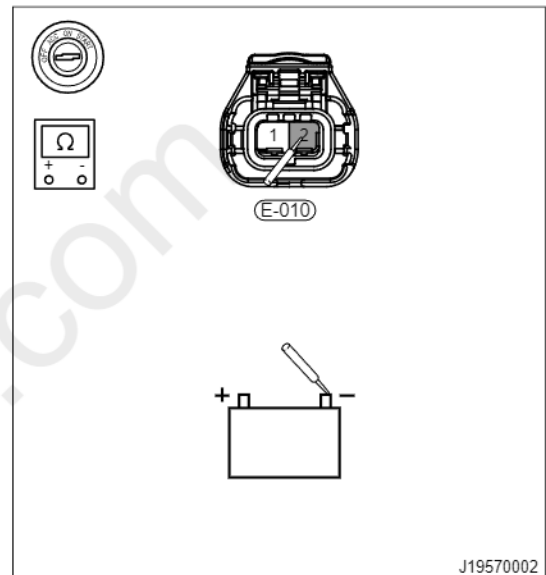
Check and repair short circuit malfunction of circuit.

OK

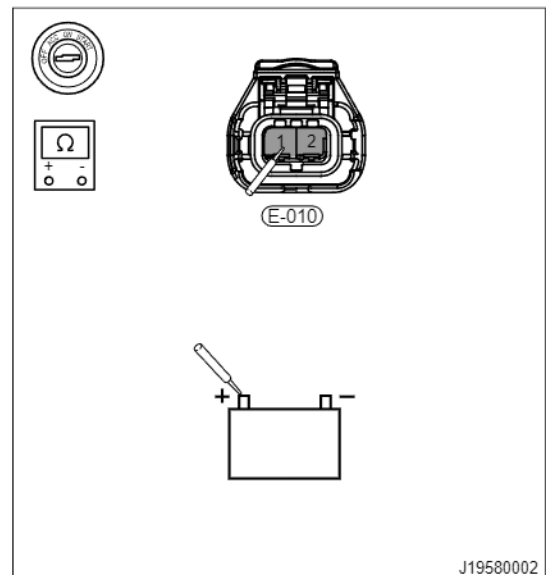
3

Check for short circuit to ground / power supply in water pump control circuit

- (a) Disconnect the water pump connector.
 (b) Disconnect the ECM connector (B-096).
 (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of water pump E-010 (2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistance of water pump E-010 (1, 2) with red probe respectively. Check if circuit is short to power supply.



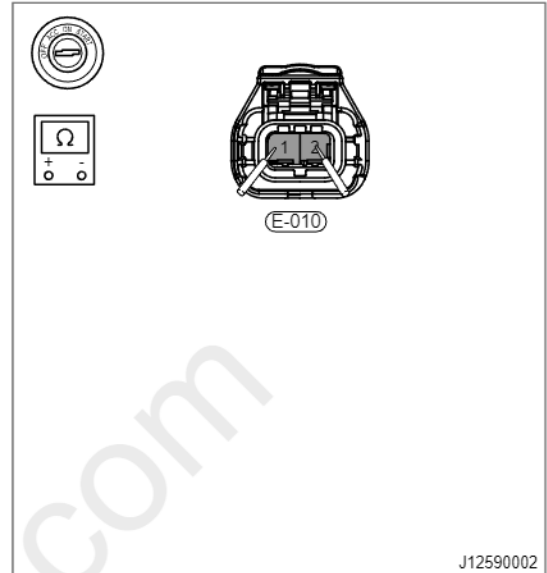
NG

Check and repair circuit.

OK

4 Check if circuits of water pump themselves are shorted to each other or opened

- (a) Using ohm band of multimeter, measure resistances of water pump E-010 (1, 2) with red and black probes respectively; Check if they are shorted to each other or opened.



NG

Replace water pump assembly.

OK

5 Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
 (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

OK

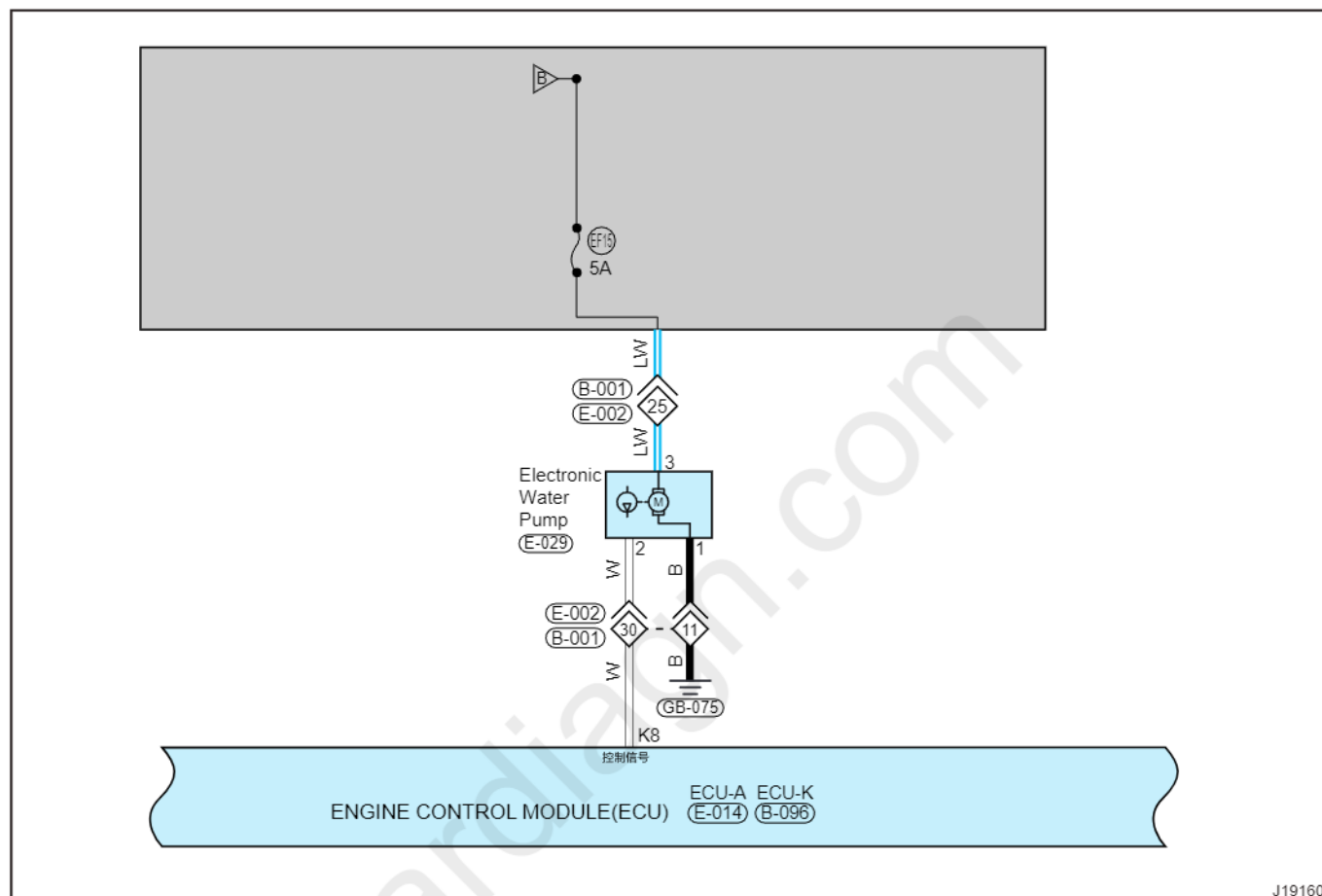
Conduct test and confirm malfunction has been repaired.

■ Electric Water Pump Control Circuit Malfunction

DTC	P261D00	Coolant Pump "B" Control Circuit High
DTC	P261C00	Coolant Pump "B" Control Circuit Low

■ Description

Circuit Diagram



J19160

■ DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check electric water pump connector
---	-------------------------------------

- Disconnect the negative battery.
- Check if electric water pump connector is loose, and contact between male and female terminals is in good condition.

NG

Repair and adjust connector, or replace it.

OK

2 Check electric water pump power supply fuse

- (a) Check if fuse EF15 5A in engine compartment fuse and relay box is blown.

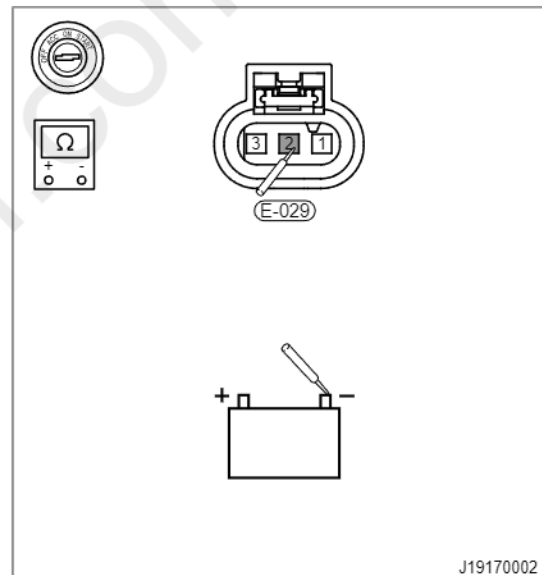
NG

Check and repair short circuit malfunction of circuit.

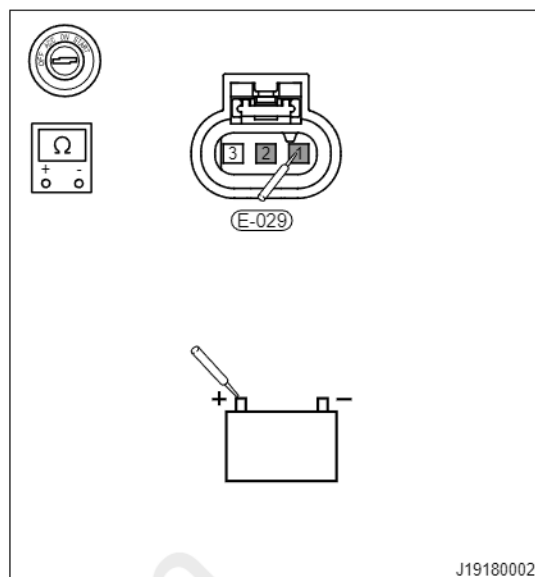
OK

3 Check for short circuit to ground / power supply in electric water pump control circuit

- (a) Disconnect the electric water pump connector.
- (b) Disconnect the ECM connector (B-096).
- (c) Using ohm band of multimeter, connect black probe to battery negative terminal, measure resistance of electric water pump E-029 (2) with red probe respectively. Check if circuit is short to ground.



- (d) Using ohm band of multimeter, connect black probe to battery positive terminal, measure resistance of electric water pump E-029 (1, 2) with red probe respectively. Check if circuit is short to power supply.



NG

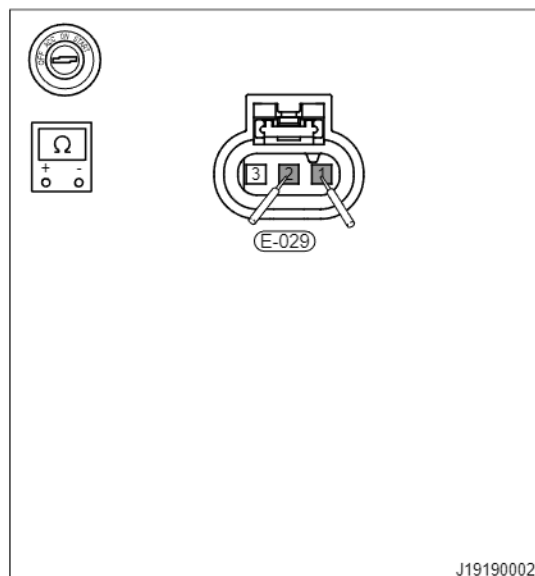
Check and repair circuit.

OK

4

Check if circuits of electric water pump themselves are shorted to each other or opened

- (a) Using ohm band of multimeter, measure resistances of electric water pump E-029 (1, 2) with red and black probes respectively; Check if they are shorted to each other or opened.



NG

Replace electric water pump assembly.

OK

5

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

6

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

OK

Conduct test and confirm malfunction has been repaired.

■ Electric Water Pump Block / Low Speed Error

DTC	P130200	Auxiliary Water Pump Low Speed Error
DTC	P130500	Auxiliary Water Pump Over Temperature Error
DTC	P130800	Auxiliary Water Pump Stall Error

■ Description

Circuit Diagram



Confirm that battery voltage is not less than 12 V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

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

317

- (a) Check if electric water pump speed is normal.
- (b) Check if electric water pump is stuck.

NG

Replace electric water pump assembly.

OK

3

Check Engine Control Module (ECM)

- (a) Remove Engine Control Module (ECM) from malfunctioning vehicle.
- (b) Install a new engine control module to malfunctioning vehicle.

OK

Repair or replace new module.

NG

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

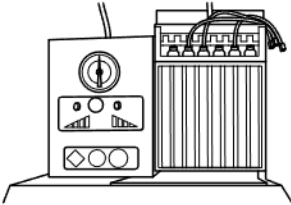
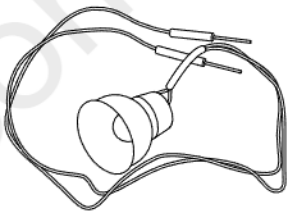
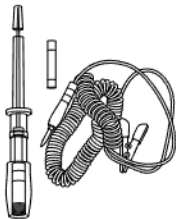
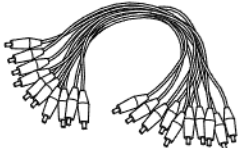
OK

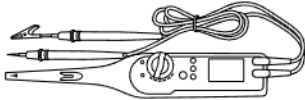
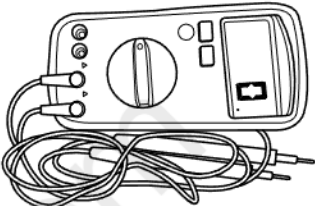
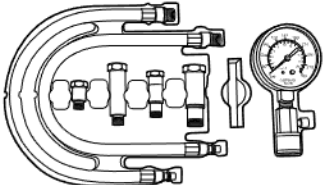
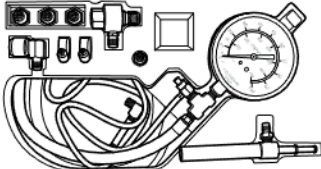
Conduct test and confirm malfunction has been repaired.

5 ON-VEHICLE SERVICE

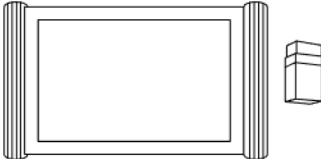
5.1 Tools

■ General Tool

Tool Name	Tool Drawing
Fuel Injector Cleaning Analyzer	 S00043
21 W Test Light	 S00061
LED Test Light	 S00077
Jumper Wire	 S00062

Tool Name	Tool Drawing
Diode Test Light	 S00078
Digital Multimeter	 S00002
Cylinder Pressure Gauge	 S00033
Fuel Pressure Gauge	 S00035

■ Special Tool

Tool Name	Tool Drawing
Diagnostic Tester	 S00001

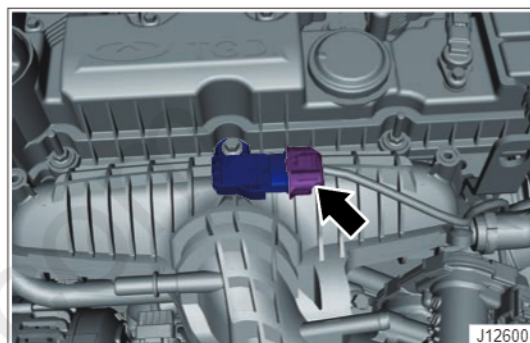
5.2 Intake Pressure/Temperature Sensor

■ Removal

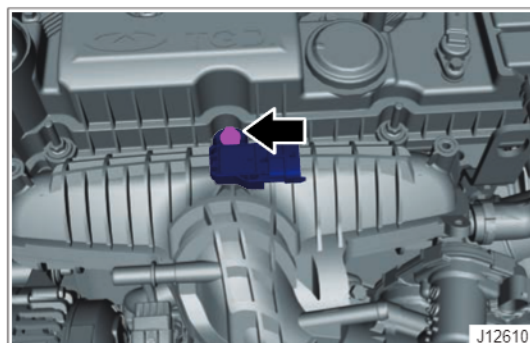
⚠ Warning

- **Be sure to wear necessary safety equipment to prevent accidents, when removing intake pressure/temperature sensor.**
- **Appropriate force should be applied when removing intake pressure/temperature sensor. Be careful not to operate roughly.**

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Disconnect the negative battery cable.
- (4) Disconnect the intake pressure/temperature sensor connector.



- (5) Remove the intake pressure/temperature sensor fixing bolt and take it out carefully.



■ Inspection

- (1) Temperature sensor part: (Remove the connector) Turn digital multimeter to ohm band, connect two probes to sensor pins 1# and 2# respectively, the rated resistance is $2.5\text{ k}\Omega \pm 5\%$ at 20°C . 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.
- (2) Pressure sensor part: (Connect the connector) Turn digital multimeter to DC voltage band, ground the black probe, connect red probe to pins 3# and 4# respectively. Under idling status, there should be 5 V of reference voltage at pin 3#, and about 1 V of voltage at pin 4#; Under unloaded status, slowly open the throttle, the voltage of pin 4# has not changed too much; Quickly open the throttle, the voltage of pin 4# can reach about 4 V instantaneously (value changes with model), and then drops to about 1.7 V (value changes with model).

■ Installation

- (1) Install the intake pressure/temperature sensor fixing bolt.
Torque: $6 \pm 1\text{ N m}$
- (2) Connect the intake pressure/temperature sensor connector.

5.3 Electronic throttle

■ Removal

- (1) For details about removal methods, refer to the removal steps of electronic throttle assembly in intake system.

■ Inspection

- (1) Judgment methods for specific mechanical damage: Valve plate should be in NLP position with power off and can rotate smoothly when flipping it by hand. If stuck occurs, it indicates that internal components may be damaged.
- (2) Simple measurement of internal sensors: (Disconnect the connector) Turn digital multimeter to ohm band.
 - 1) Connect two probes to pin IP1S and pin IPM respectively, flip valve plate by hand, and resistance should change continuously.
 - 2) Connect two probes to pin IP2S and pin IPM respectively, flip valve plate by hand, and resistance should change continuously.
 - 3) If there are conditions, you can fully close or fully open throttle body with constant current source [fully close throttle body with 3A current (UMA), fully open throttle body with 2A current (OMA)], connect 5 V constant voltage source to pins UIP and IPM simultaneously, measure the output voltage values of IP1S and IP2S at fully close and fully open positions.

■ Installation

- (1) For details about installation methods, refer to the installation steps of electronic throttle assembly in intake system.

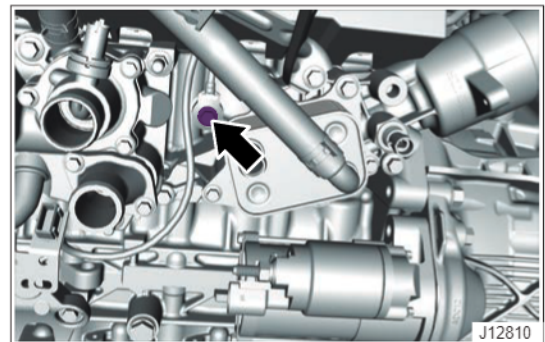
5.4 Knock Sensor

■ Removal

Warning

- **Be sure to wear necessary safety equipment to prevent accidents, when removing knock sensor.**
- **Appropriate force should be applied when removing knock sensor. Be careful not to operate roughly.**

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Disconnect the negative battery cable.
- (4) Remove the intake hose assembly.
- (5) Disconnect knock sensor connector, and remove knock sensor fixing bolt.



■ Inspection

Step	Operation	Test Value	Test Result	Subsequent Step
1	Turn digital multimeter to ohm band, measure resistance between pins 1 and 2 of knock sensor, it should be $4.9 \pm 0.5 \text{ M}\Omega$ at normal temperature	/	Yes	Next
			No	Replace knock sensor
2	digital 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

■ Installation

⚠ Caution

- 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.
- When wiring the sensor signal cable, you should pay attention not to make the signal cable resonate, so as not to break.

- (1) Install the knock sensor fixing bolt.

Torque: $20 \pm 3 \text{ N m}$

- (2) Connect the knock sensor connector.

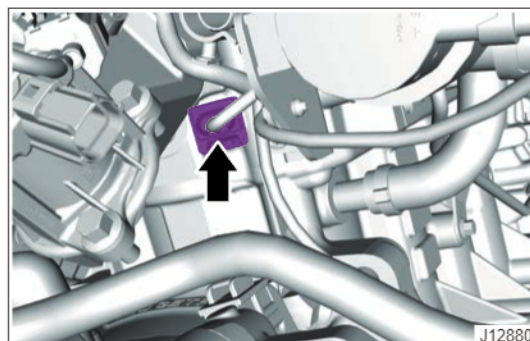
5.5 Coolant Temperature Sensor

■ Removal

⚠ 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.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover.
- (3) Disconnect the negative battery cable.
- (4) Remove the engine trim cover.
- (5) Disconnect coolant temperature sensor connector and remove coolant temperature sensor.



■ Inspection

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.	Rated resistance is $2.5\text{ k}\Omega \pm 10\%$ at 20°C .	Yes	Next
			No	Replace coolant temperature sensor
2	Connect coolant temperature sensor wire harness connector, turn ignition switch to ON, measure the voltage between two pins of coolant temperature sensor wire harness.	$5 \pm 0.5\text{ V}$	Yes	Diagnostic Help
				Check for continuity and ground of wire harness

■ Installation

- (1) Install coolant temperature sensor and connect sensor connector.

Torque: $15 \pm 1\text{ N}\cdot\text{m}$

- (2) Install the engine trim cover.
- (3) Connect the negative battery cable.
- (4) Install the engine compartment trim cover.

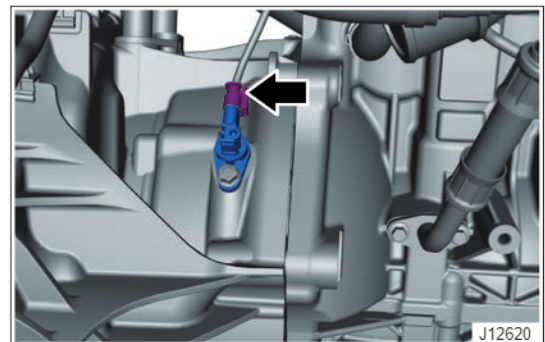
5.6 Speed Sensor

■ Removal

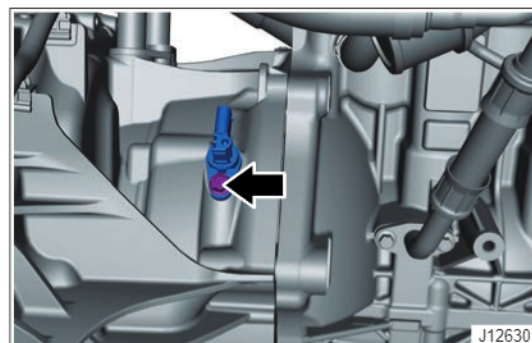
⚠ Warning

- **Be sure to wear necessary safety equipment to prevent accidents, when removing speed sensor.**
- **Appropriate force should be applied when removing speed sensor. Be careful not to operate roughly.**

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



- (5) Remove the speed sensor fixing bolt and take it out carefully.



■ Inspection

- (1) Simple measurement method: (Remove the connector) Turn LCR meter to ohm band (in-line mode, test frequency is 10 kHz), connect two probes to sensor connector terminals 1 and 3, rated resistance is $33\ \Omega \pm 20\%$; Turn LCR meter to capacitance band (in-parallel mode, est frequency is 1 kHz), connect two probes to sensor connector terminals 1 and 3, rated capacitance is $100\ \text{nF} \pm 20\%$; Turn LCR meter to capacitance band (in-parallel mode, est frequency is 1 kHz), connect two probes to sensor connector terminals 2 and 3, rated capacitance is $4.7\ \text{nF} \pm 20\%$.

■ Installation

⚠ 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).

- (1) Install the speed sensor fixing bolt.

Torque: $8 \pm 2\ \text{N m}$

- (2) Connect the speed sensor connector.
 (3) Install the engine compartment trim cover.
 (4) Connect the negative battery cable.

5.7 Camshaft Position Sensor

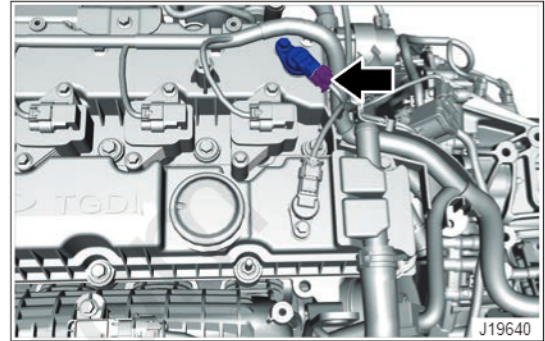
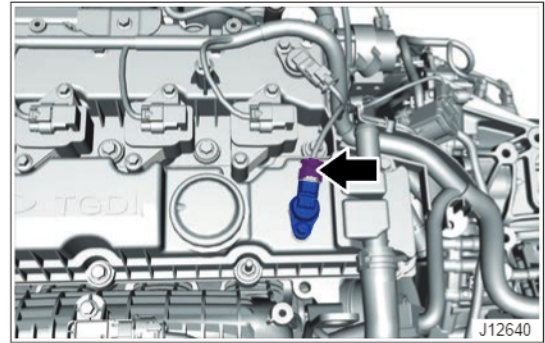
■ Removal

⚠ Warning

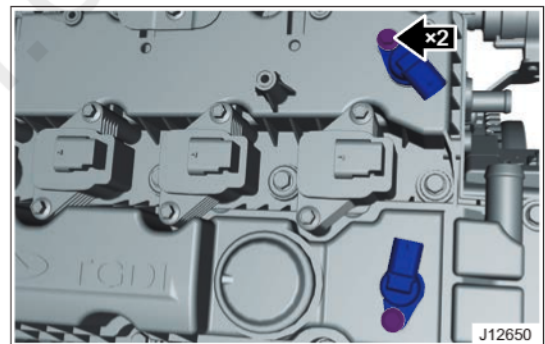
- Be sure to wear necessary safety equipment to prevent accidents, when removing camshaft position sensor.
- Appropriate force should be applied when removing camshaft position sensor. Be careful not to operate roughly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
 (2) Remove the engine compartment trim cover assembly.
 (3) Disconnect the negative battery cable.
 (4) Remove the engine trim cover.

- (5) Disconnect the intake/exhaust phaser sensor connector.



- (6) Remove 2 fixing bolts from intake/exhaust camshaft position sensor and take them out carefully.



■ Installation

⚠ Caution

- 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).

- (1) Install the intake/exhaust camshaft position sensor fixing bolts.

Torque: $8 \pm 3 \text{ N m}$

- (2) Connect the intake/exhaust camshaft position sensor connector.
- (3) Install the engine trim cover.
- (4) Connect the negative battery cable.

5.8 VVT Control Valve

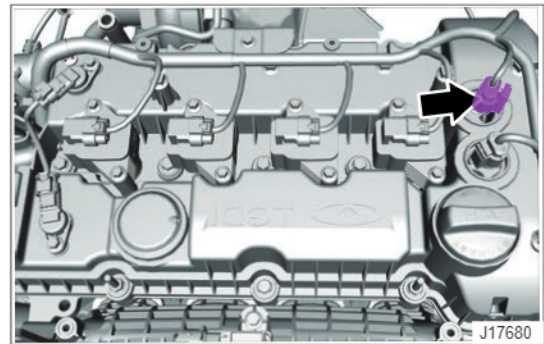
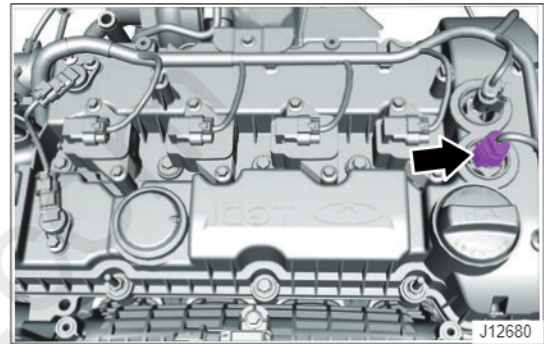
■ Removal

⚠ Warning

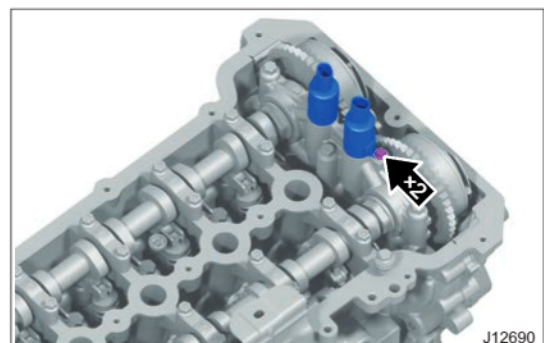
- **Be sure to wear safety equipment to prevent accidents, when removing VVT control valve.**
- **Appropriate force should be applied, when removing VVT control valve. Be careful not to operate roughly.**

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Disconnect the negative battery cable.
- (4) Remove the engine trim cover.

- (5) Disconnect the intake/exhaust VVT control valve connector.



- (6) Remove the cylinder head cover assembly.
- (7) Remove the intake/exhaust VVT control valve fixing bolt respectively and take them out carefully.



■ Inspection

Step	Operation	Test Value	Test Result	Subsequent Step
1	Remove VVT control valve wire harness connector, use a multimeter to measure if resistance between two terminals of sensor is normal.	$8.0 \pm 0.5 \Omega$	Yes	Next
			No	Replace VVT control valve
2	Remove VVT control valve, and check for foreign matter stuck or internal leakage.	/	Yes	Replace VVT control valve
			No	Diagnostic Help

■ Installation

Caution

- Control valve 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).

- (1) Install the intake/exhaust VVT control valve fixing bolt.

Torque: $8 \pm 2 \text{ N m}$

- (2) Install the cylinder head cover assembly.
- (3) Connect the intake/exhaust VVT control valve connector.
- (4) Install the engine trim cover.
- (5) Connect the negative battery cable.
- (6) Install the engine compartment trim cover.

5.9 Fuel Rail Injector

■ Removal

- (1) For details about removal methods, refer to removal steps of fuel rail injector assembly in fuel system.

■ Inspection

- (1) Simple measurement method: (Remove the connector) Turn digital multimeter to ohm band, connect two probes to two terminals of fuel injector respectively, the rated resistance is 1.83Ω at 20°C .

■ Installation

- (1) For details about installation methods, refer to installation steps of fuel rail injector assembly in fuel system.

5.10 High Pressure Fuel Rail Pressure Sensor

■ Removal

- (1) For details about removal methods, refer to removal steps of high pressure fuel rail pressure sensor assembly in fuel system.

■ Inspection

- (1) Simple measurement method: Remove the sensor, connect 5 V power supply at normal temperature and atmospheric pressure, pressure signal output is $0.500 \pm 0.048 \text{ V}$ at this time.

■ Installation

- (1) For details about installation methods, refer to installation steps of high pressure fuel rail pressure sensor in fuel system.

5.11 Canister Control Valve

■ Removal

- (1) For details about removal methods, refer to removal steps of canister control valve assembly in fuel system.

■ Inspection

- (1) Simple measurement method: (Remove the connector) Turn digital multimeter to ohm band, connect two probes to two terminals of canister control valve respectively, resistance is 14~ 18 Ω at 20°C. Replace it if the resistance does not meet the specification.

■ Installation

- (1) For details about installation methods, refer to installation steps of canister control valve assembly in fuel system.

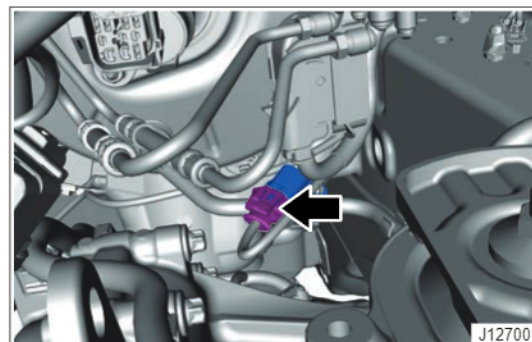
5.12 Brake Vacuum Pressure Sensor

■ Removal

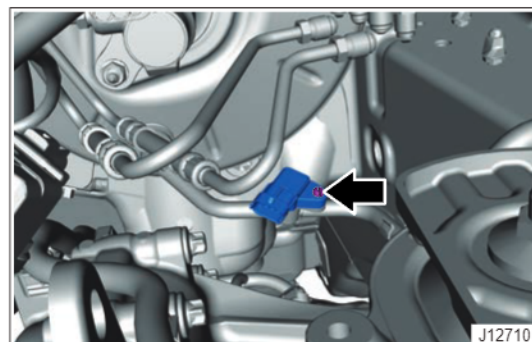
⚠ Warning

- **Be sure to wear necessary safety equipment to prevent accidents, when removing brake vacuum pressure sensor.**
- **Appropriate force should be applied when removing brake vacuum pressure sensor. Be careful not to operate roughly.**

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Disconnect the negative battery cable.
- (4) Remove the engine compartment fuse and relay box main body.
- (5) Disconnect the brake vacuum pressure sensor connector.



- (6) Press brake vacuum pressure sensor fixed clamping area and take out sensor carefully.



■ Inspection

- (1) Simple measurement method: (Remove the connector) Turn digital multimeter to ohm band, you can perform the following simple measurements respectively:

- 1) Connect two probes to sensor pins 1# and 2# respectively, the resistance is 1 k Ω ~ 2 k Ω at normal temperature. There may be short or open circuit in power supply circuit if the resistance is abnormal;
- 2) Connect two probes to sensor pins 1# and 3# respectively, the resistance is 1 k Ω ~ 2 k Ω at normal temperature. There may be short or open circuit in output circuit if the resistance is abnormal.

■ Installation

⚠ Caution

- 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.
- Press sensor detecting sleeve into installation hole manually during installation, and do not install sensor with striking tool.

- (1) Insert the brake vacuum pressure sensor into installation hole carefully, and make sure that fixing clip has been fully clamped.
- (2) Connect the brake vacuum pressure sensor connector.

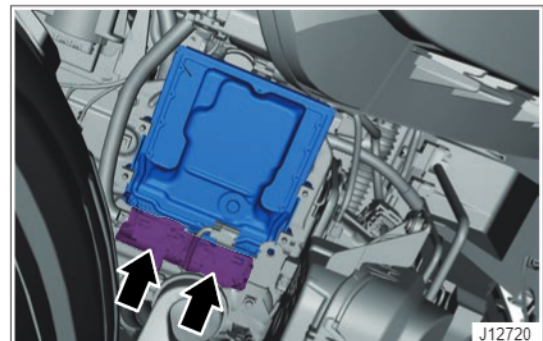
5.13 Engine Control Unit (ECU)

■ Removal

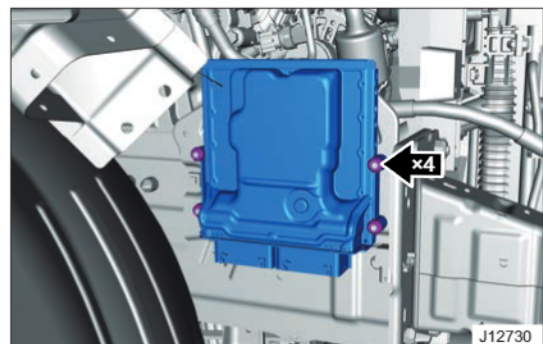
⚠ Warning

- Be sure to wear safety equipment to prevent accidents, when removing engine control unit.
- Appropriate force should be applied, when removing engine control unit. Be careful not to operate roughly.

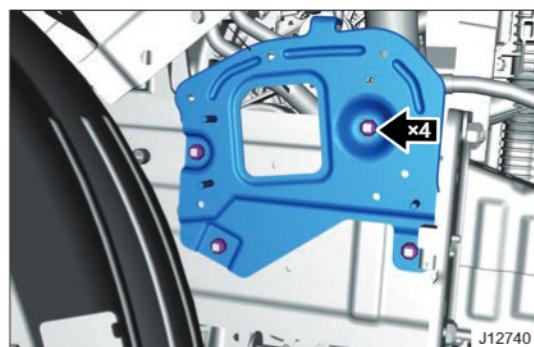
- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Disconnect the negative battery cable.
- (4) Remove the front right wheel.
- (5) Remove the front right wheel house protector.
- (6) Disconnect the engine control module connector.



- (7) Remove 4 fixing bolts from engine control module, and take out engine control module assembly carefully.



- (8) Remove 4 fixing bolts from engine control unit mounting bracket, and take out mounting bracket assembly.



■ Inspection

- (1) Simple measurement method: 1. (Connect the connector) Use engine data CAN line to read engine trouble records; 2. (Remove the connector) Check if ECU connecting wire is in good condition, focusing on if ECU power supply and ground line are normal; 3. Check if the external sensor is operating properly, output signal is reliable and its circuit is in good condition; 4. Check if the actuator is operating properly and its circuit is in good condition; 5. Finally replace ECU and perform test.

■ Installation

⚠ Caution

- Pay attention to static electricity protection during installation; Pay attention to the protection of the connector pin.

- (1) Install 4 fixing bolts to engine control unit mounting bracket.

Torque: 8 ± 2 N m

- (2) Install 4 fixing bolts to engine control unit.

Torque: 8 ± 2 N m

- (3) Connect the engine control unit connector.

5.14 Matching Learning

■ EMS Software Refresh

⚠ Warning

- For the acquisition of refreshed files, contact EXCEED after-sales service department.
- After the refreshed files are acquired, do not modify the files.
- It is necessary to check vehicle battery power before perform refreshing, as the process of refreshing is long, connect the charger if necessary.

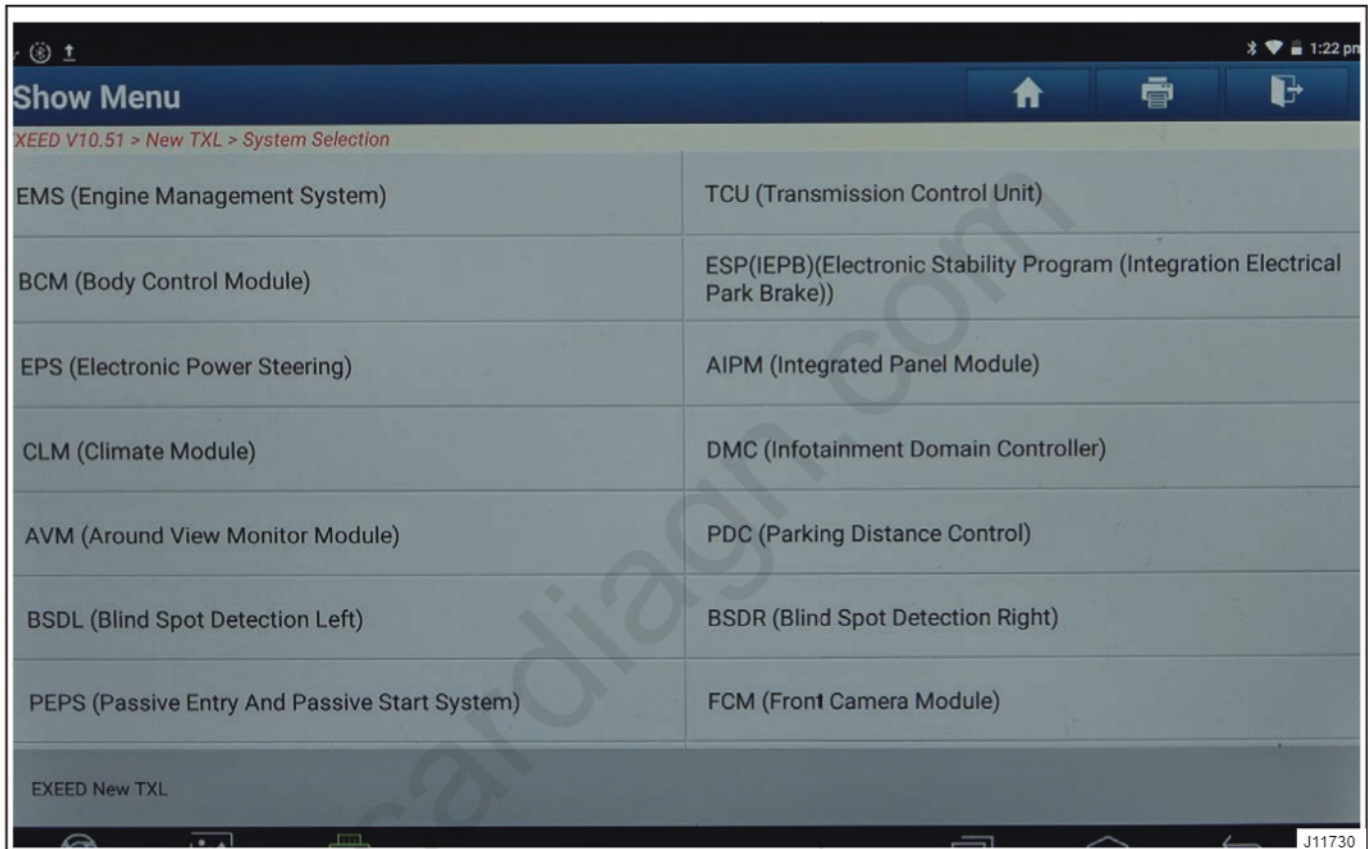
- (1) Connect the diagnostic tester and select "Comprehensive Services" .
- (2) Click "Controller Software Refresh" .
- (3) Click "TXL" vehicle model.
- (4) Click "EMS (Engine Management System)" .
- (5) Click "ECU Refresh" .
- (6) Click "ECU Application Refresh" .
- (7) Confirm and click "OK" .
- (8) Click "Select Refresh Files" , and select the corresponding files in order.
- (9) After selecting the corresponding files, click "Start to Refresh" .
- (10) After confirming the refreshed date is correct, click "Yes" , diagnostic tester will refresh automatically.
- (11) After waiting for a period of time, interface shows "ECU writing-in is successful" , click "OK" .

■ Write in Engine Management System (EMS) Configuration Data

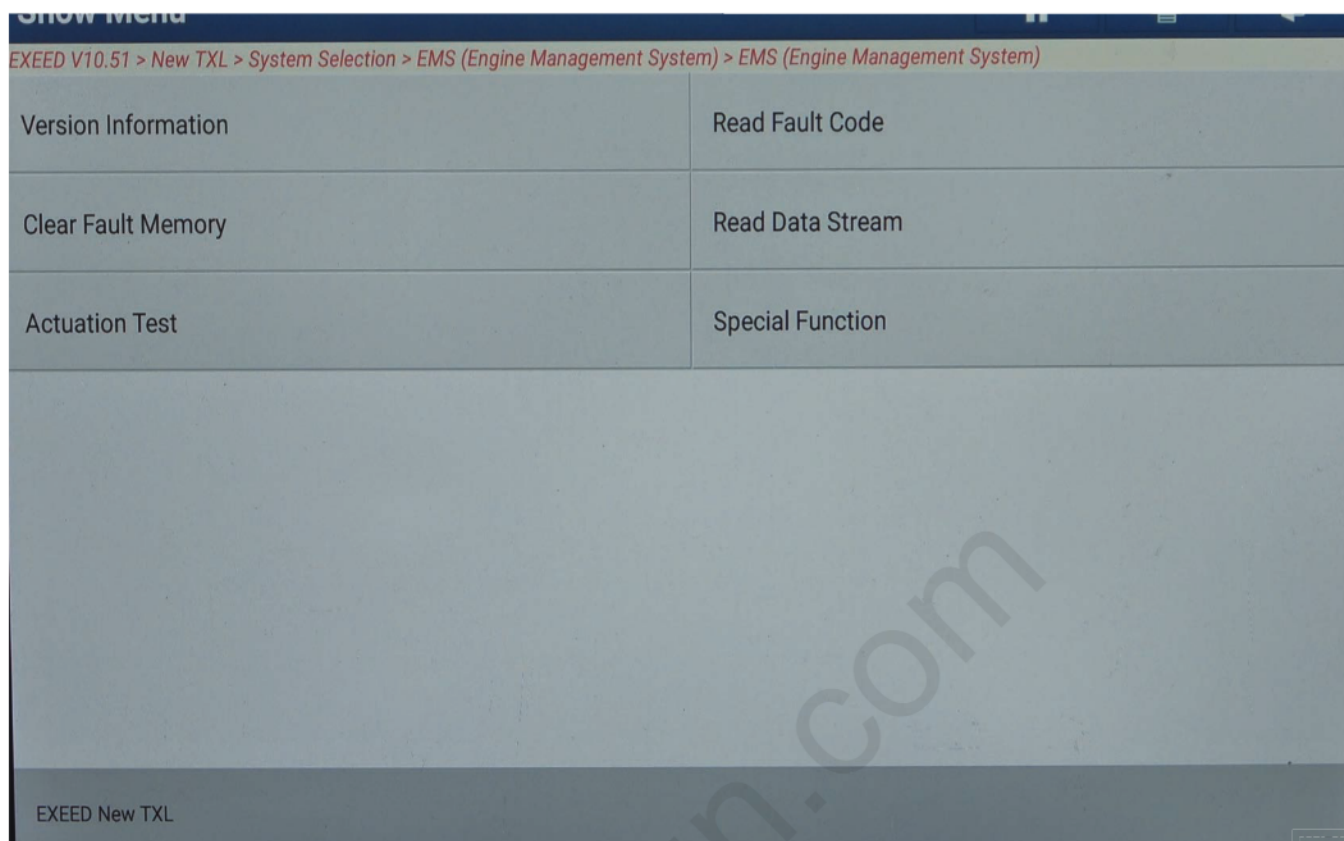
⚠ Caution

- The first 5 digits of the 12-digit repair shop code are the dealer code, and the last 7 digits can be entered at will.
- You must enter correct vehicle configuration codes, or normal functions of vehicle will be affected, verify after entering codes.

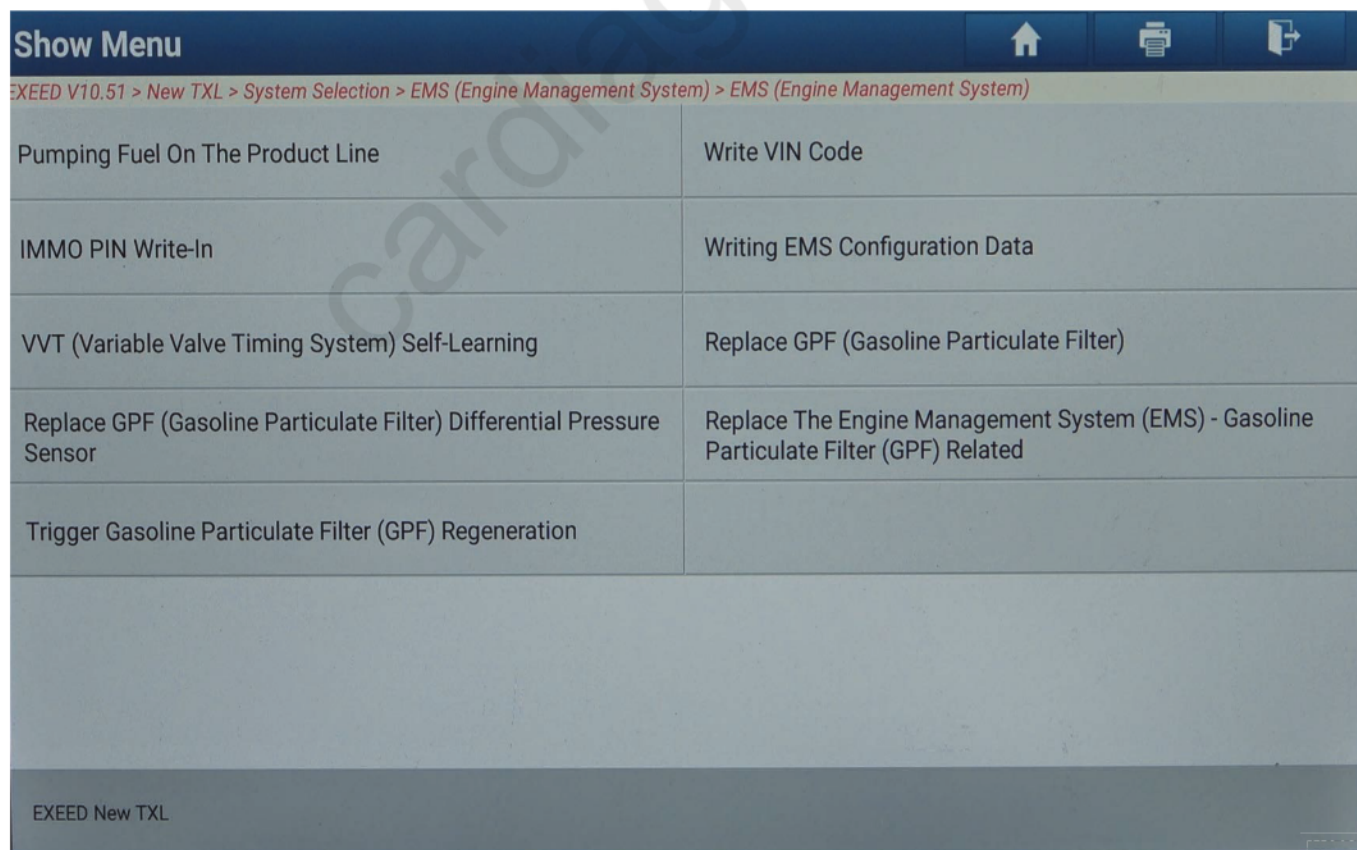
- (1) Connect diagnostic tester, and select “TXL” vehicle model.
- (2) Click “System Selection” .
- (3) Click “EMS (Engine Management System)” .



(4) Click “Special Function” .



(5) Click “Writing EMS Configuration Data” .

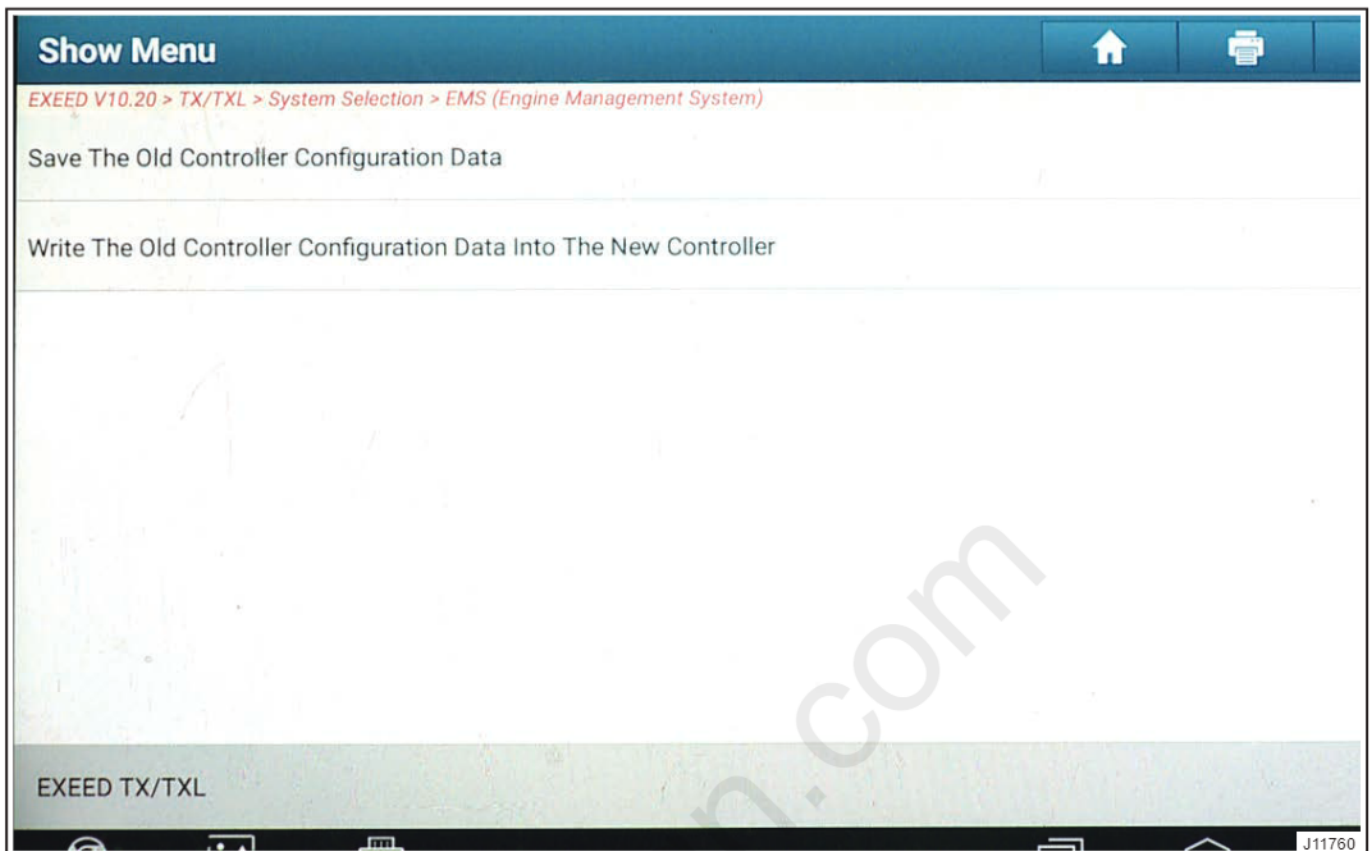


(6) Click “Save The Old Controller Configuration Data” .

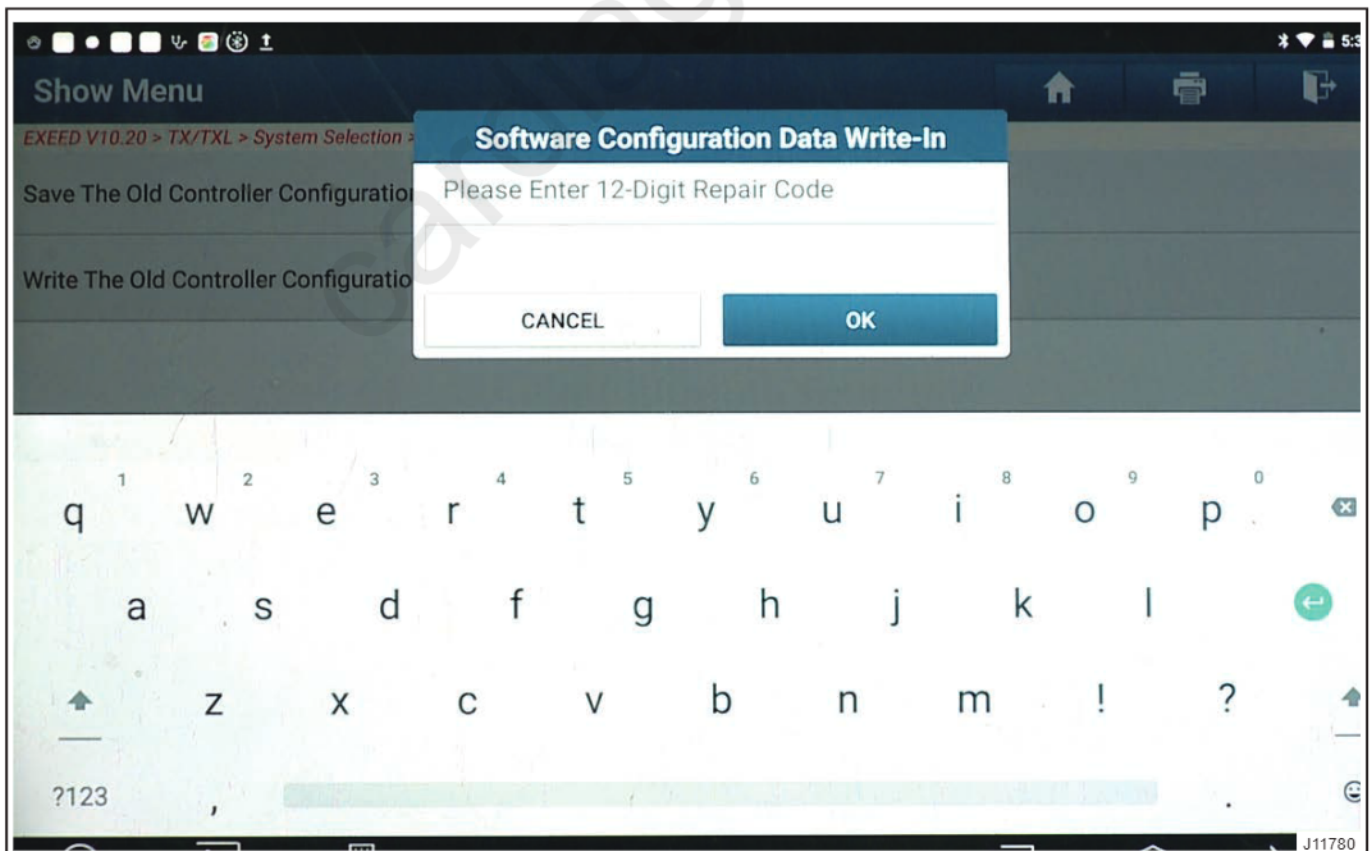


(7) Interface shows “Read and Save Vehicle Configuration Code Successfully!” . Click “OK” .

(8) Click “Write The Old Controller Configuration Data Into The New Controller” .

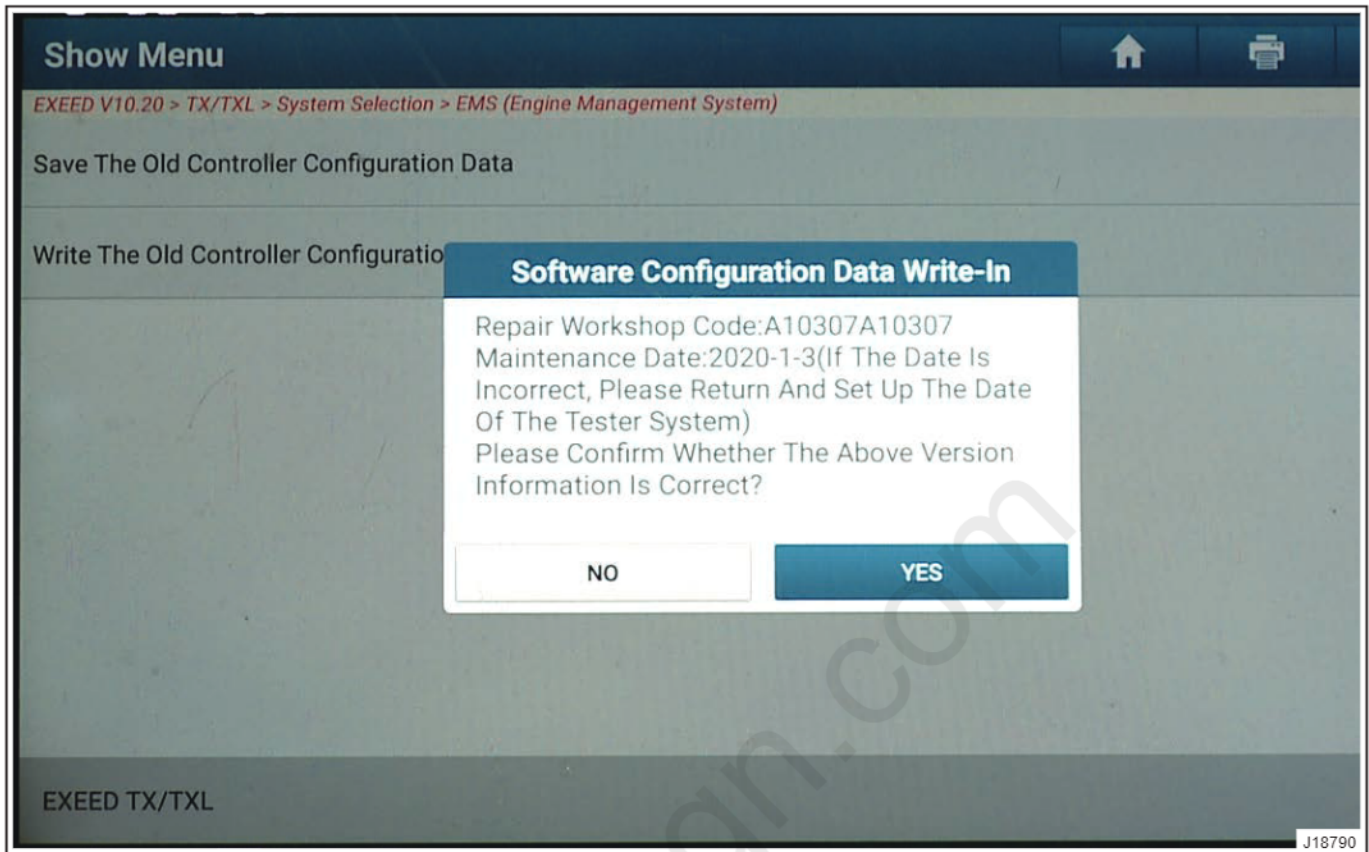


(9) Diagnostic tester interface shows “Please Enter 12-Digit Repair Code” .

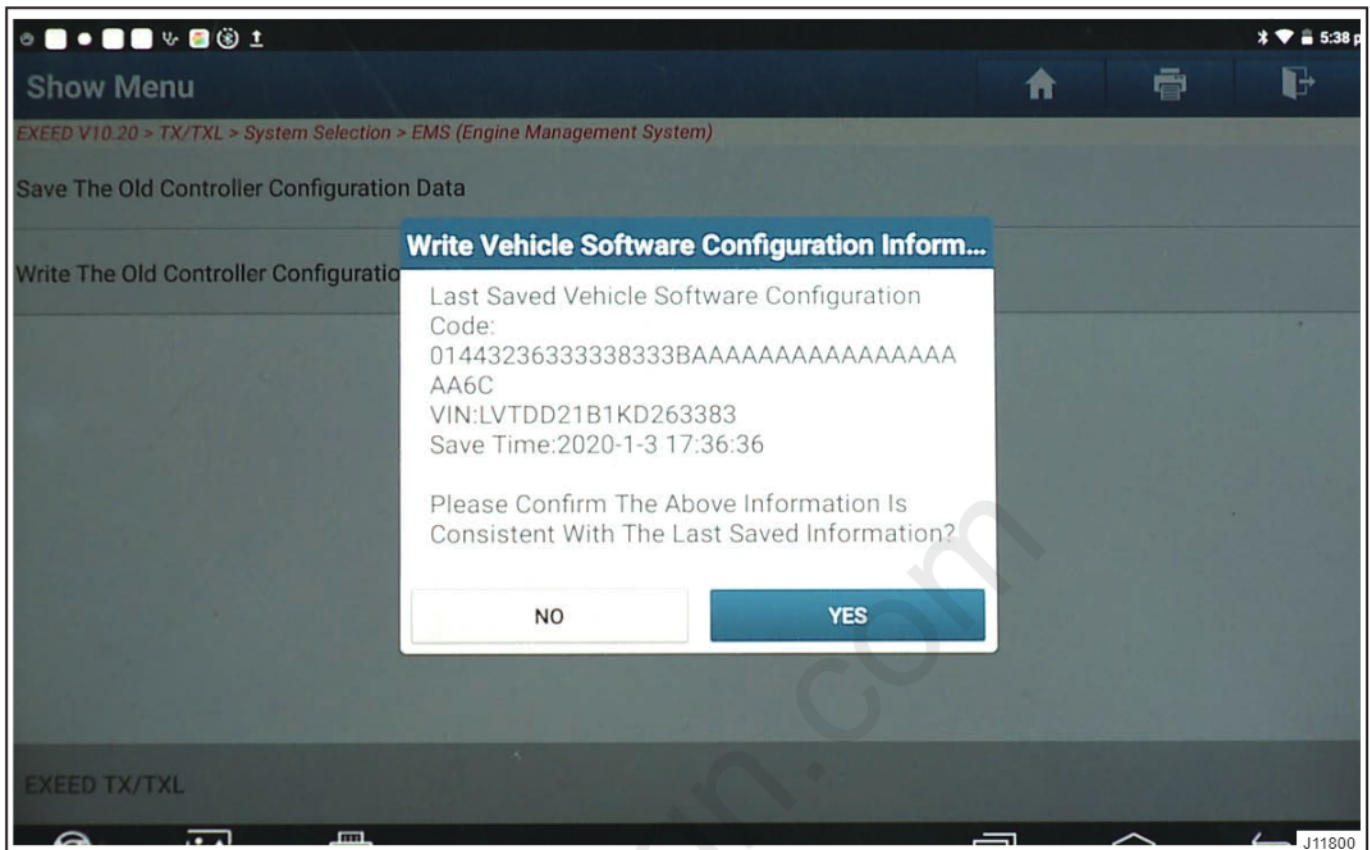


(10) After entering codes, click “OK” .

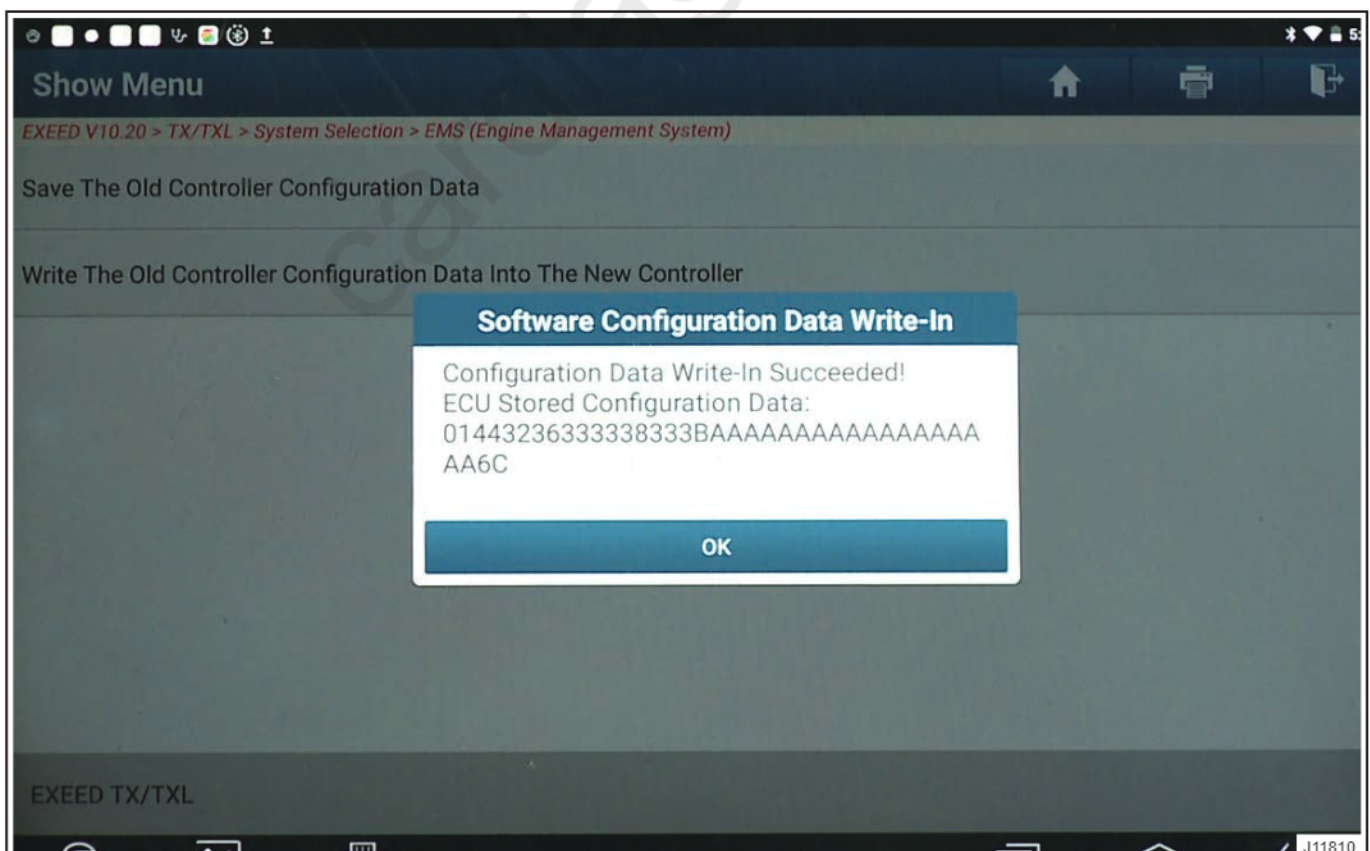
(11) After confirming information is correct again and click “Yes” .



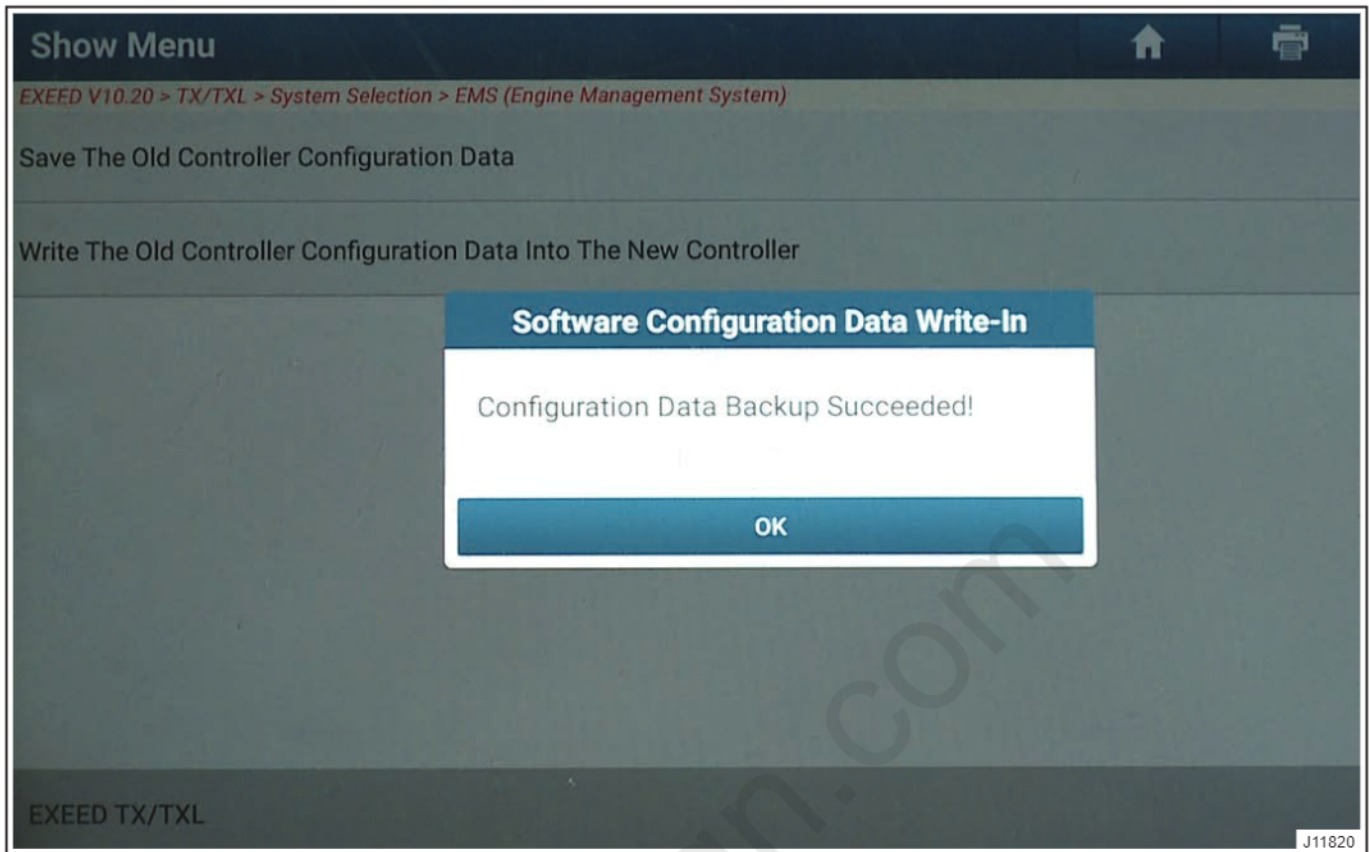
- (12) Diagnostic tester shows “Saved Vehicle Configuration Code” , click “Yes” after confirming the information is consistent.



- (13) Diagnostic tester interface shows “Configuration Data Write-in Succeeded” , click “OK” .



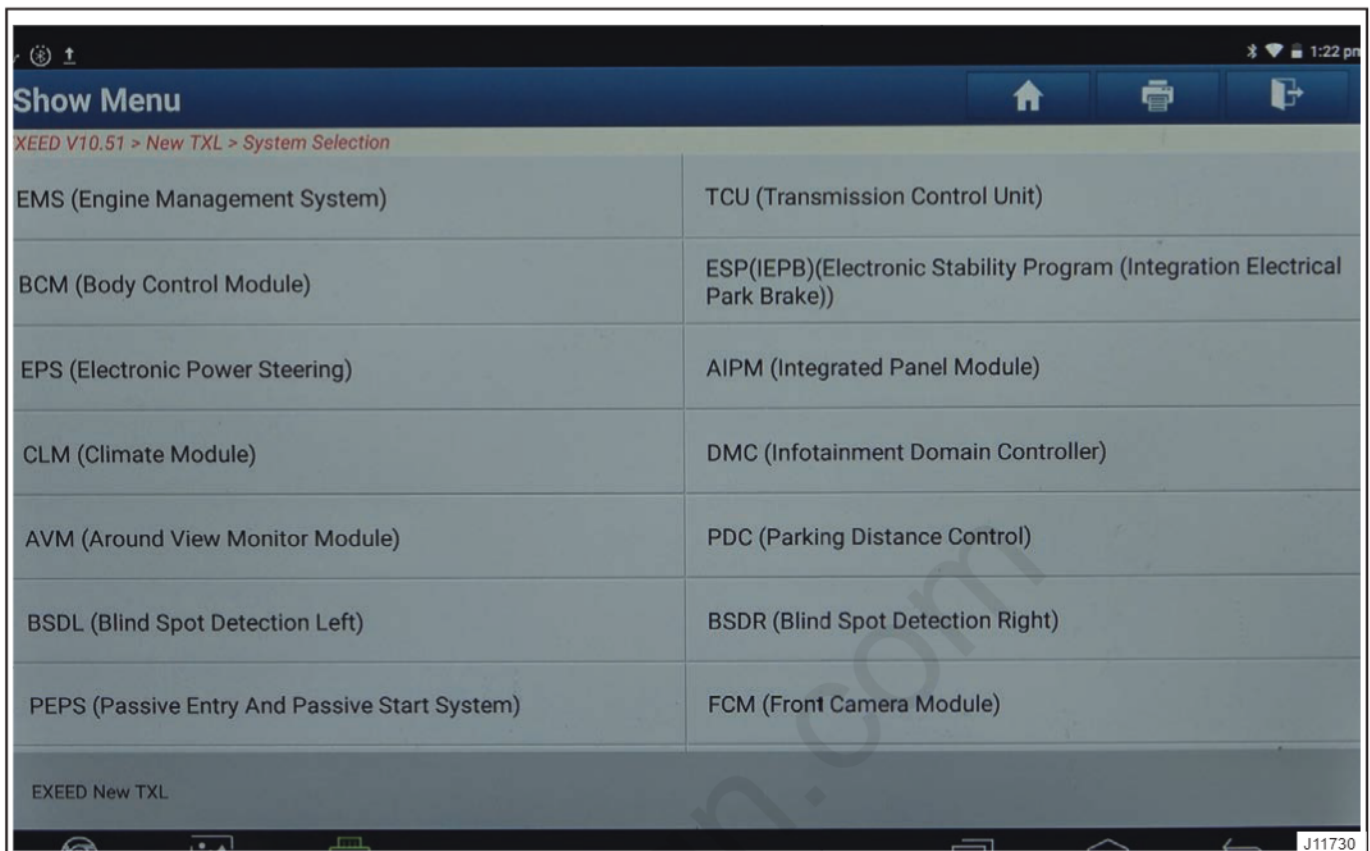
(14) Diagnostic tester interface shows “Configuration Data Backup Succeeded” , click “OK” .



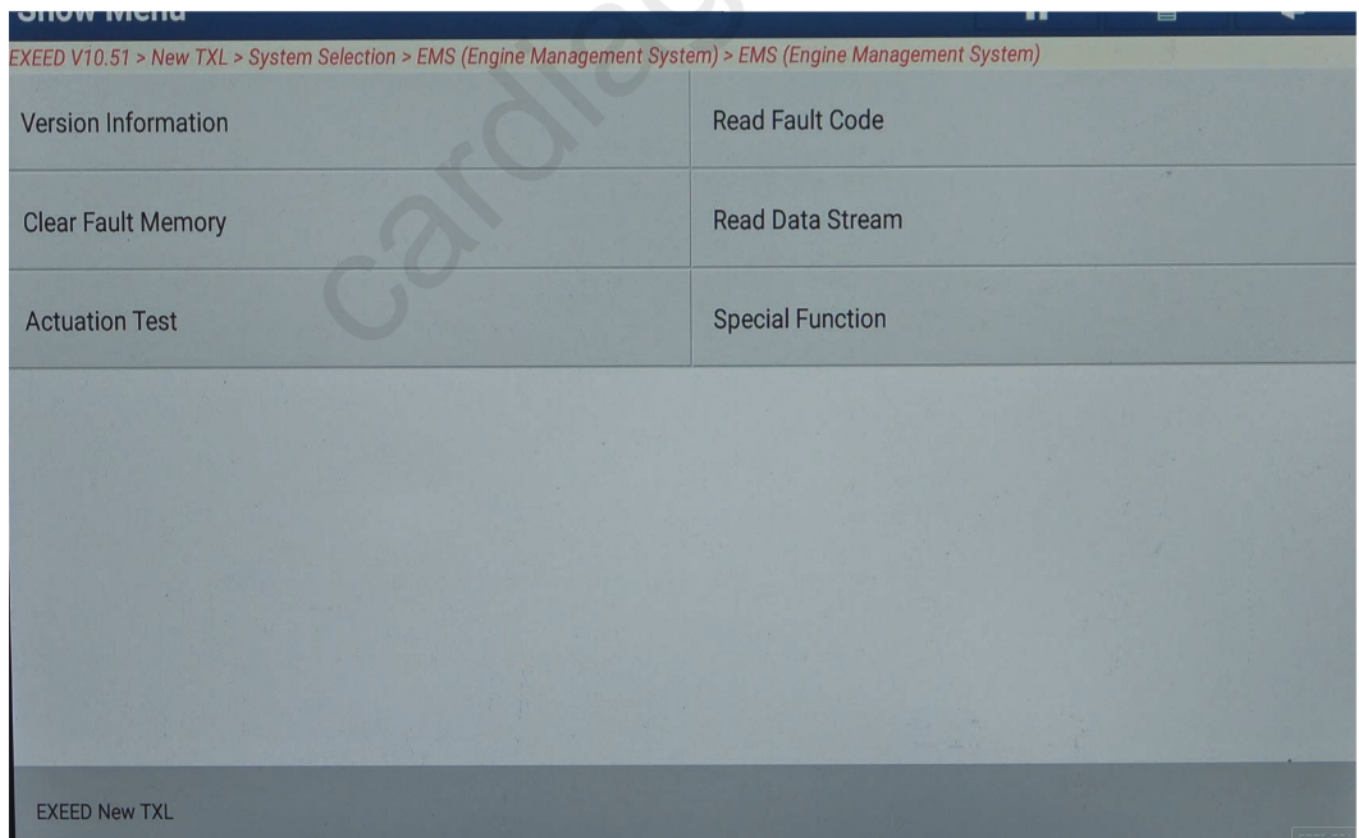
■ ESK Writing

(1) Connect diagnostic tester, and select “TXL” vehicle model.

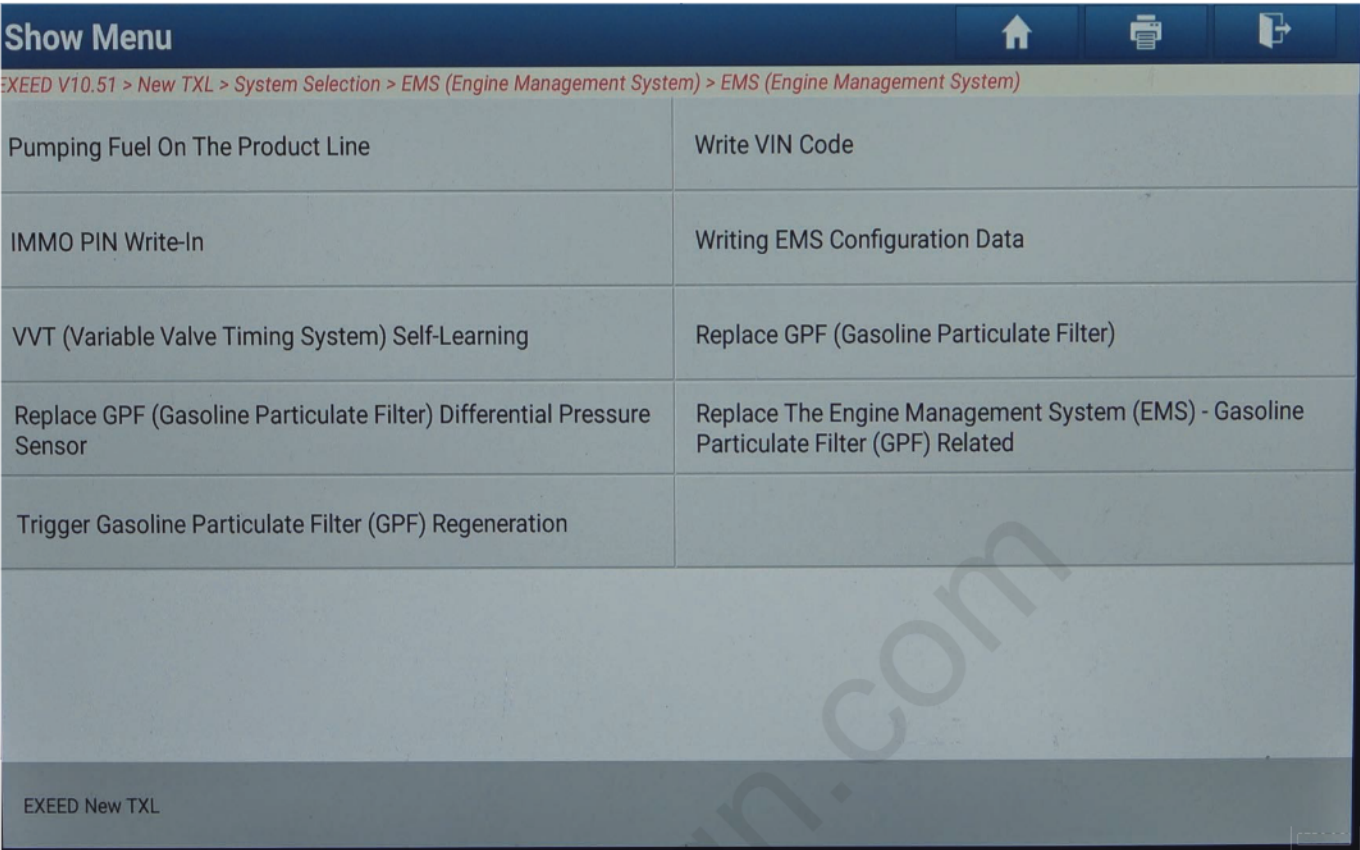
(2) Click “EMS (Engine Management System)” .



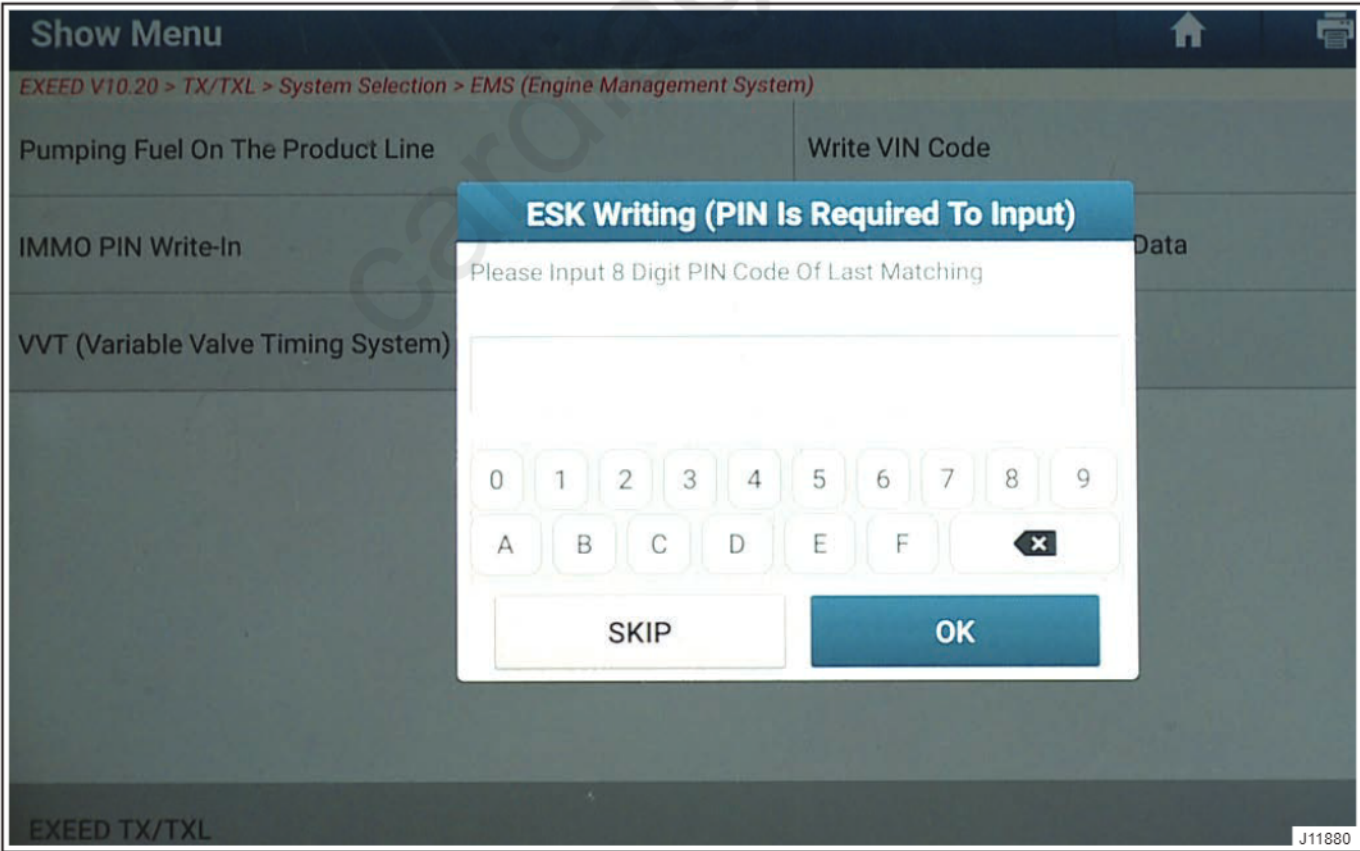
(3) Click “Special Function” .



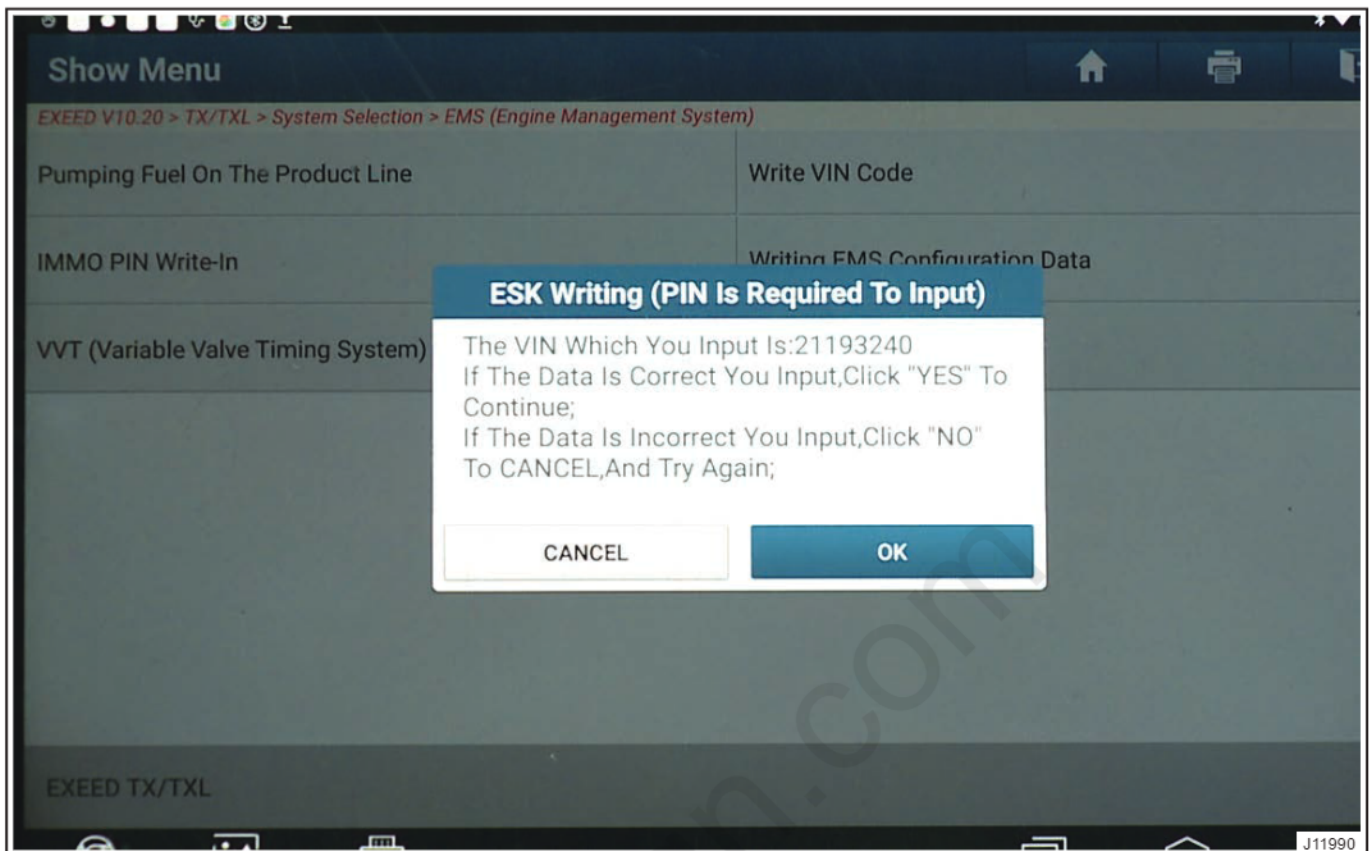
(4) Click “ESK Writing (PIN Is Required To Input)” .



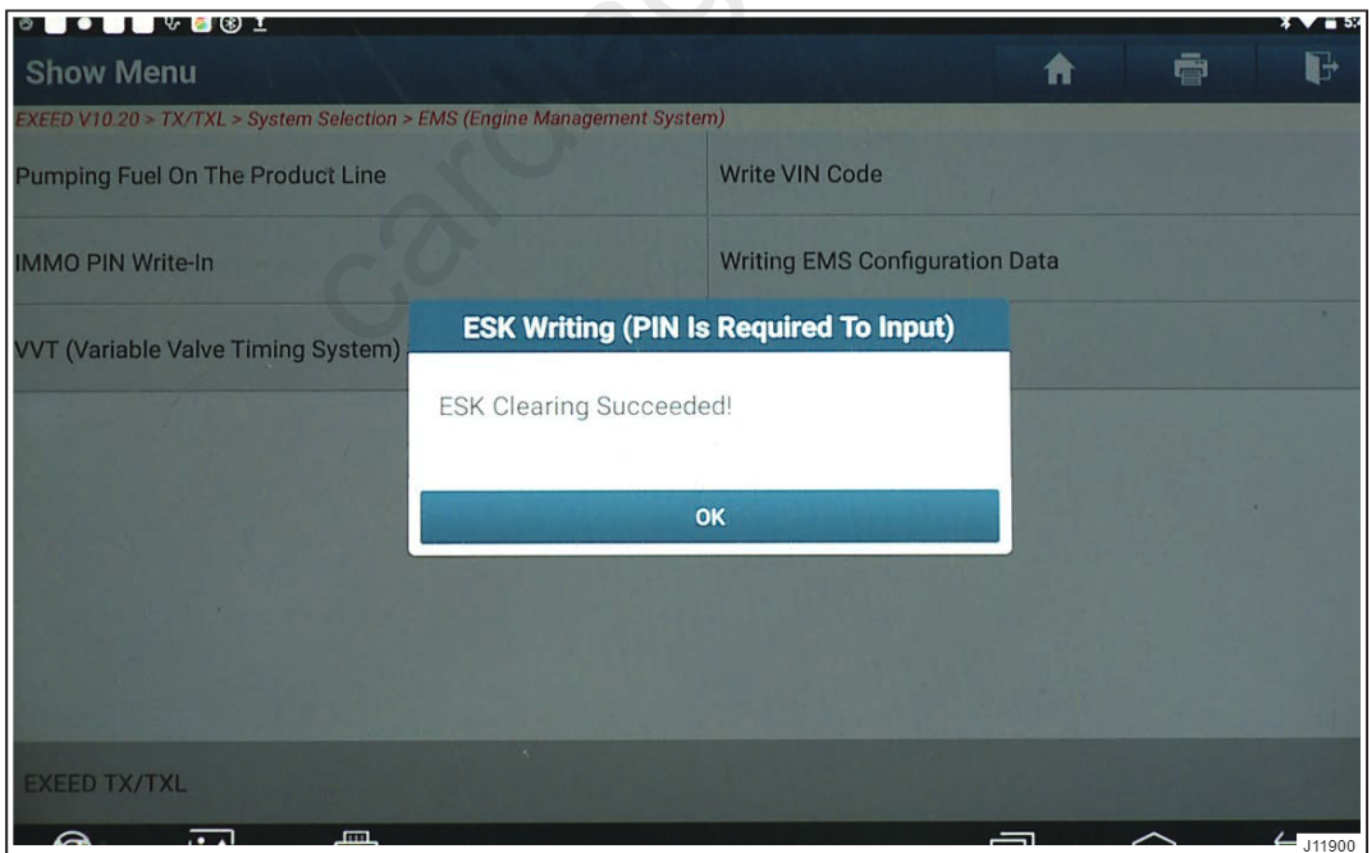
(5) After entering anti-theft security codes, click “OK” .



(6) Verify that the anti-theft security code entered is correct, confirm and click "OK" .

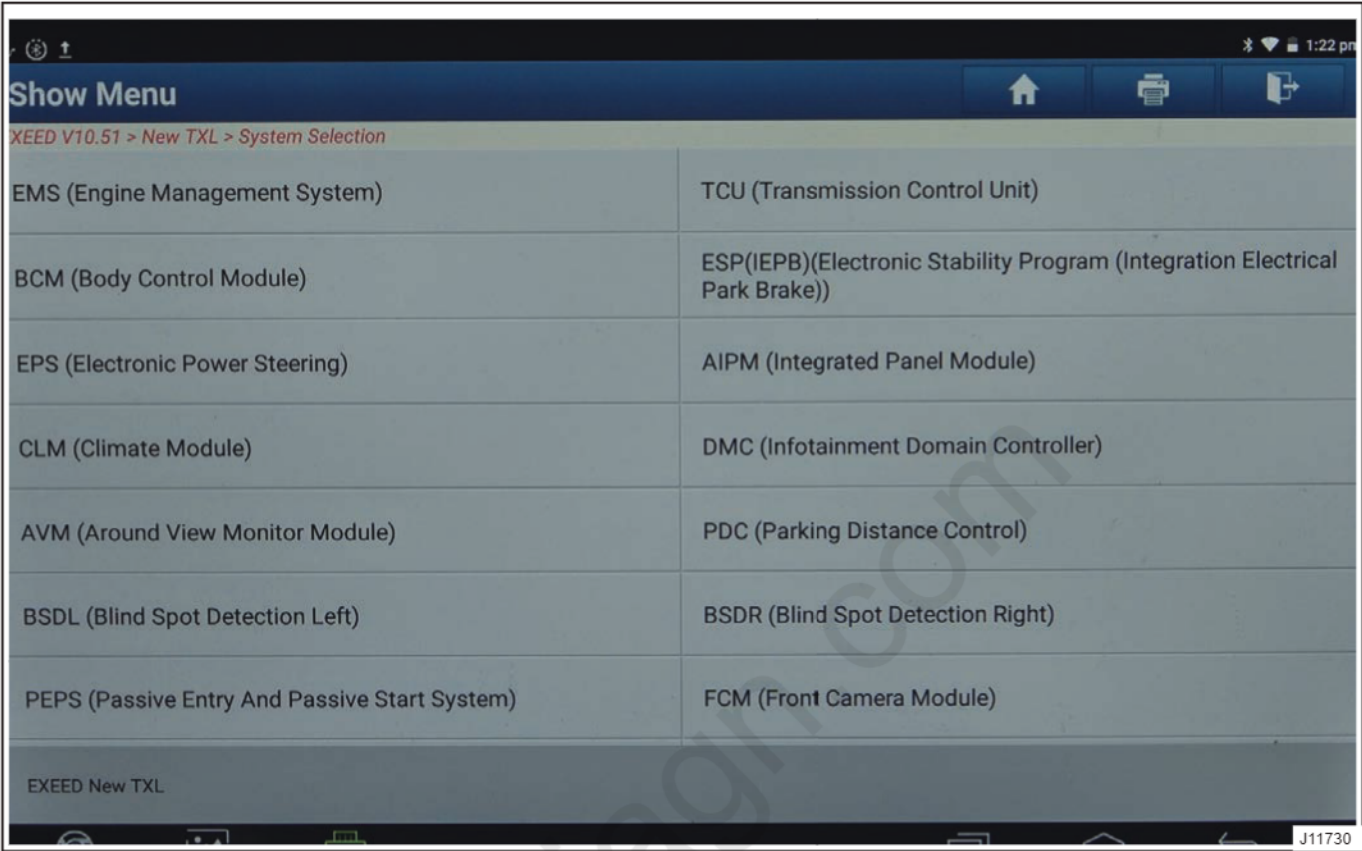


(7) Diagnostic tester interface shows "ESK Writing Succeeded" , click "OK" .

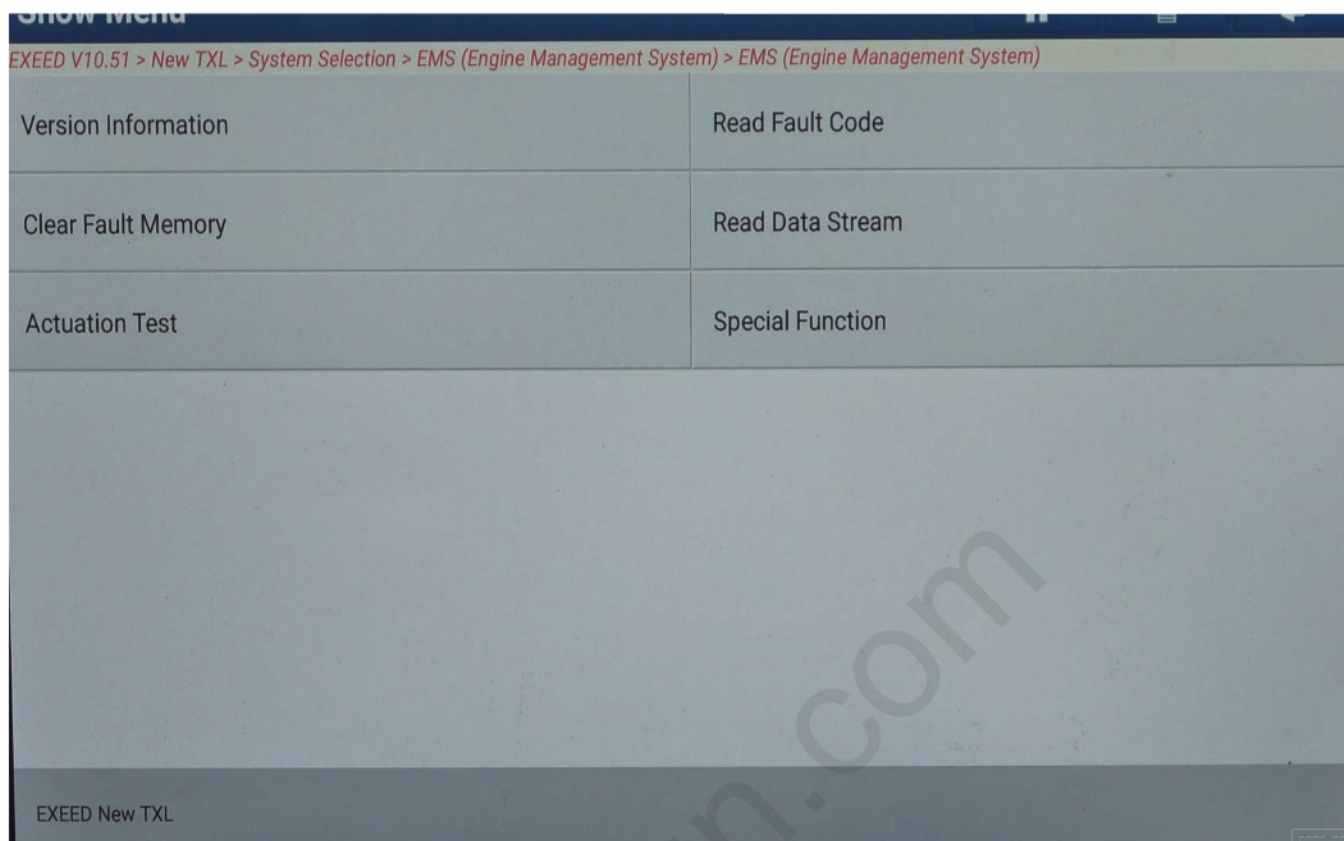


■ GPF Regeneration

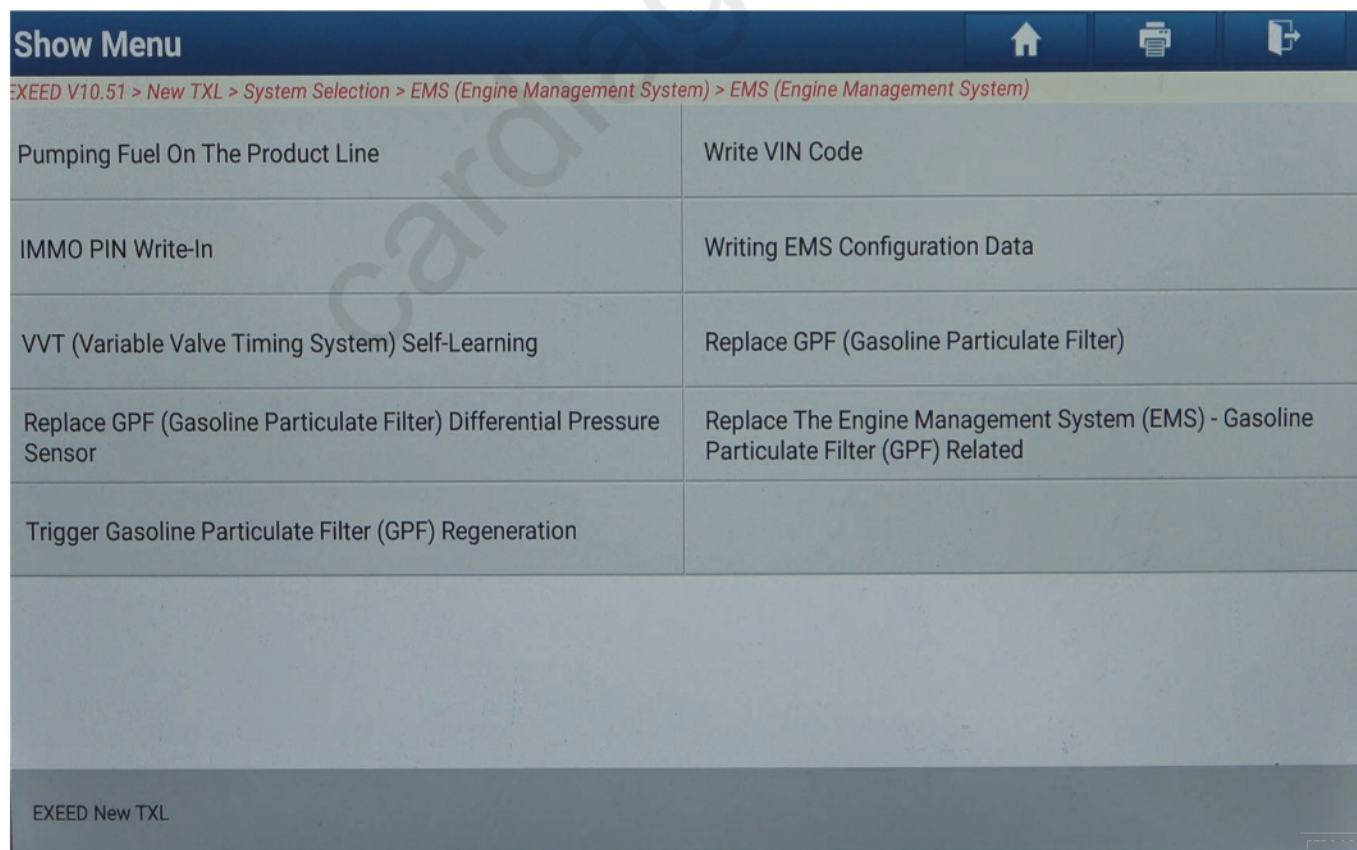
- (1) Connect diagnostic tester, and select “TXL” vehicle model.
- (2) Click “EMS (Engine Management System)” .



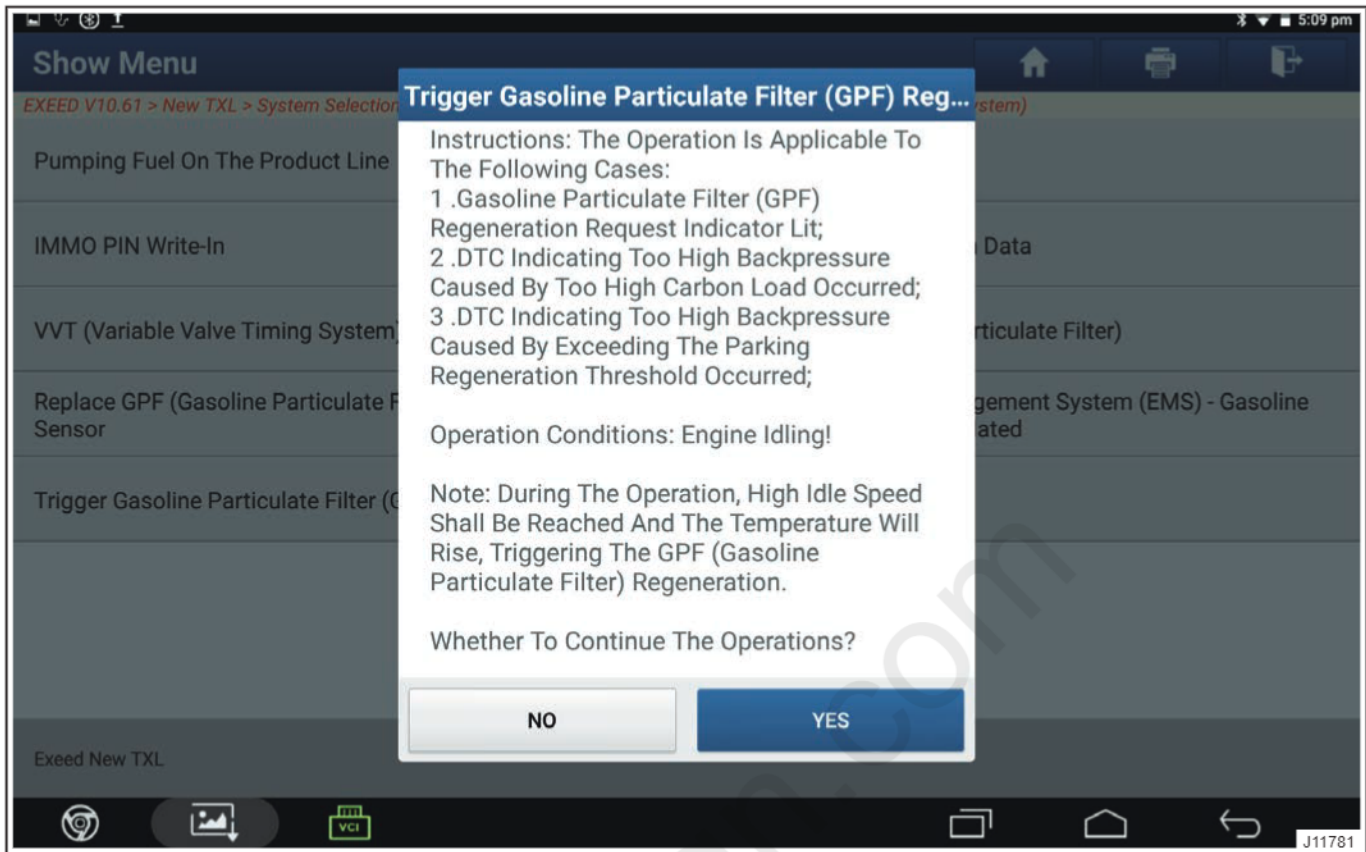
(3) Click “Special Function” .



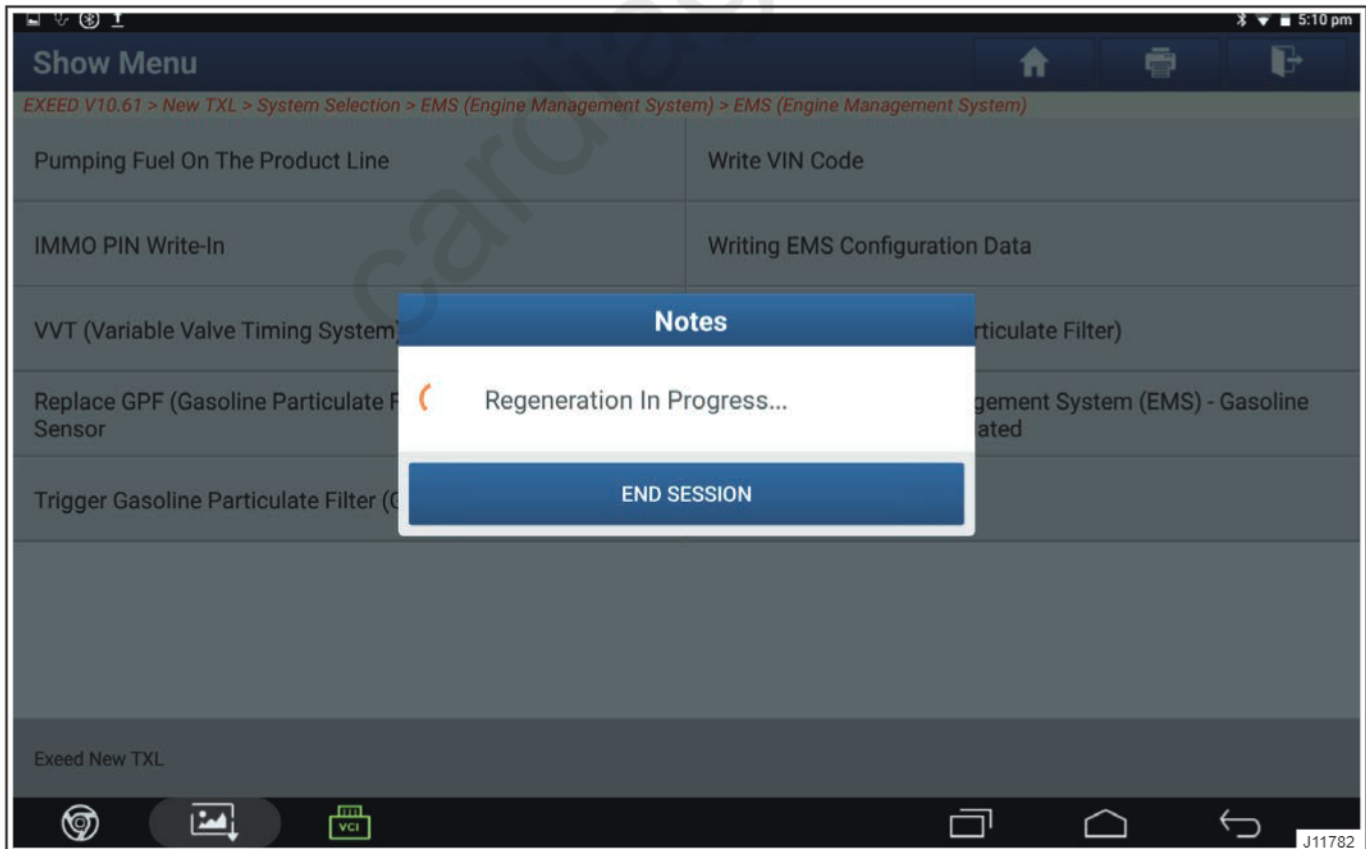
(4) Click “Trigger Gasoline Particulate Filter (GPF) Regeneration” .



(5) Click “Yes” .

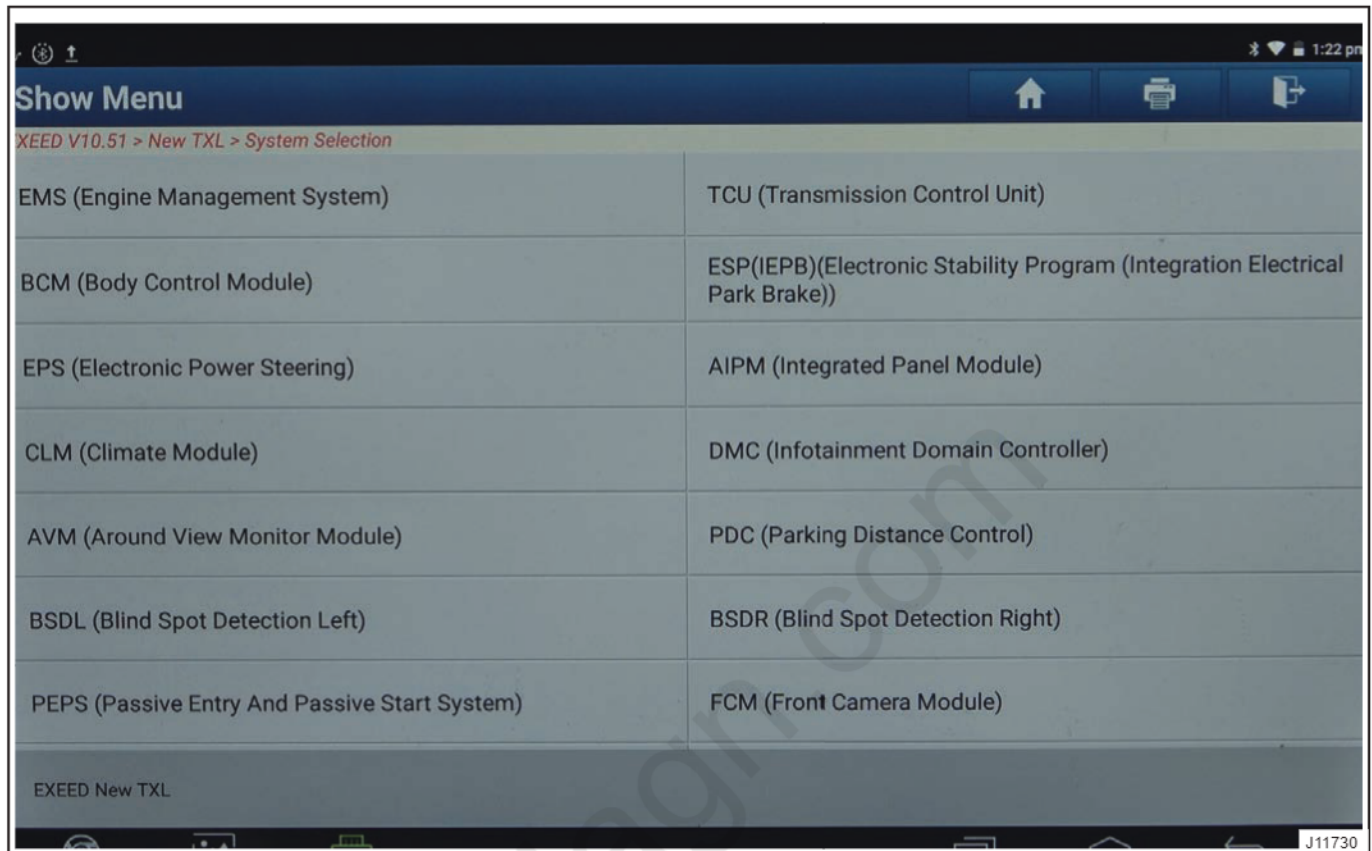


(6) Interface shows “Gasoline Particulate Filter (GPF) Regenerating” , click “OK” after it is completed.

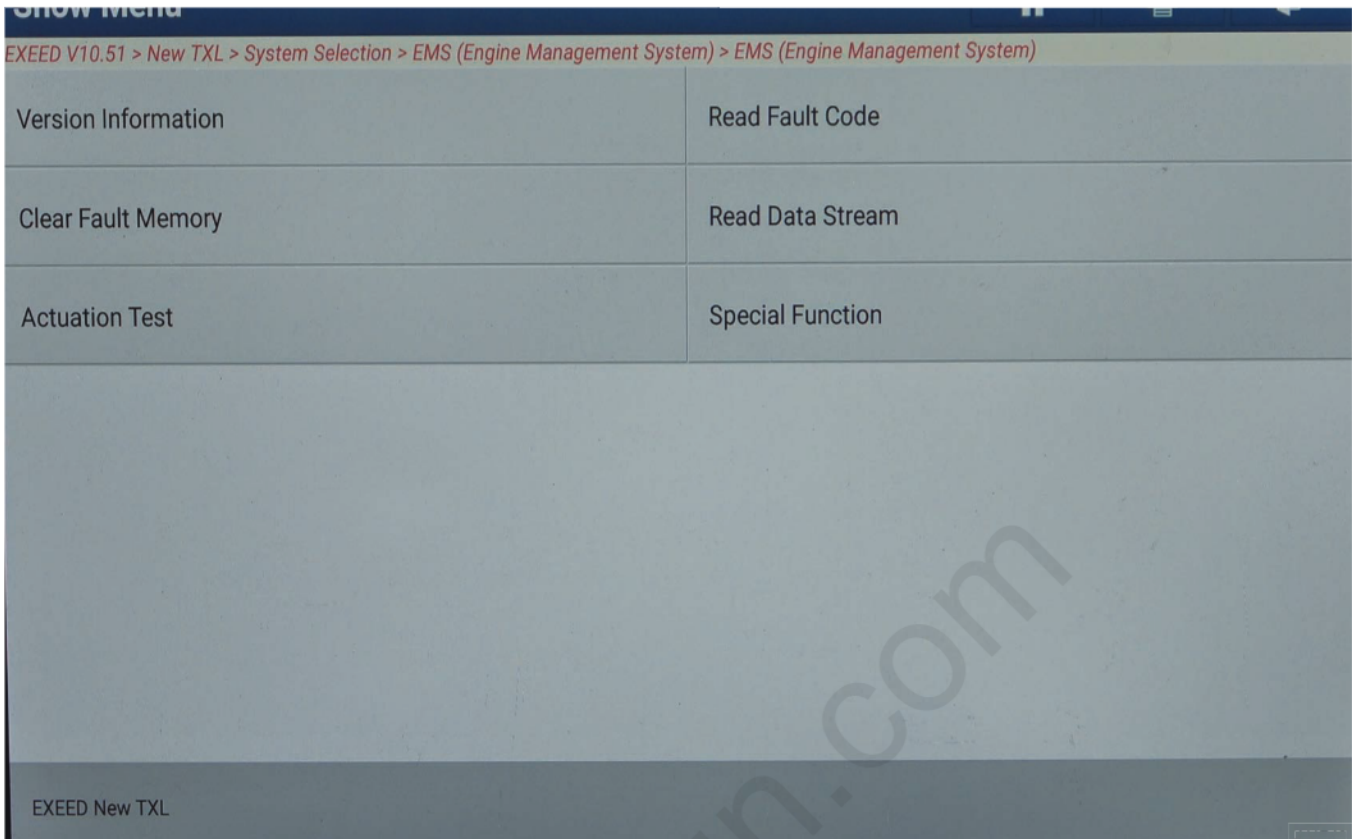


■ Replace GPF Learning

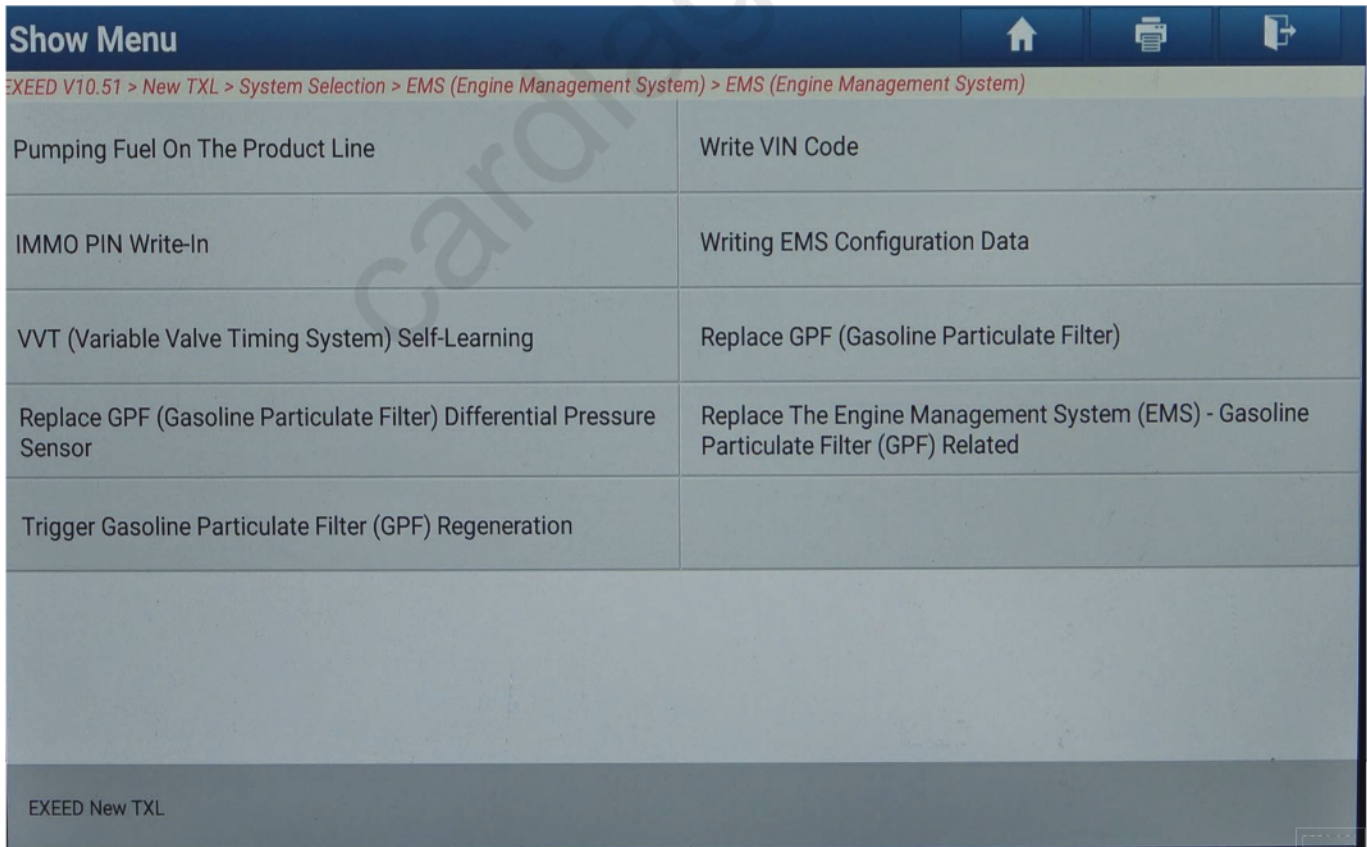
- (1) Connect diagnostic tester, and select “TXL” vehicle model.
- (2) Click “EMS (Engine Management System)” .



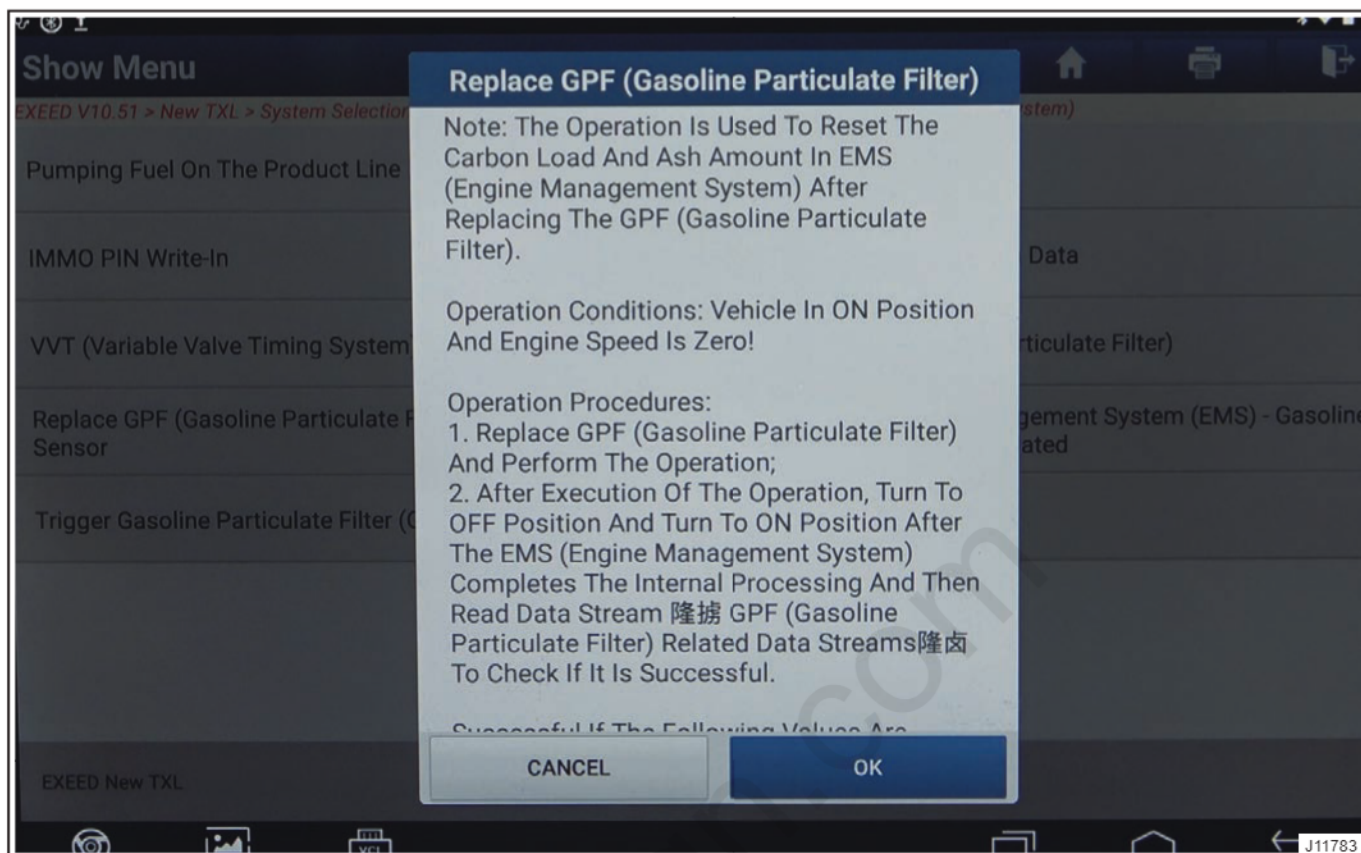
(3) Click “Special Function” .



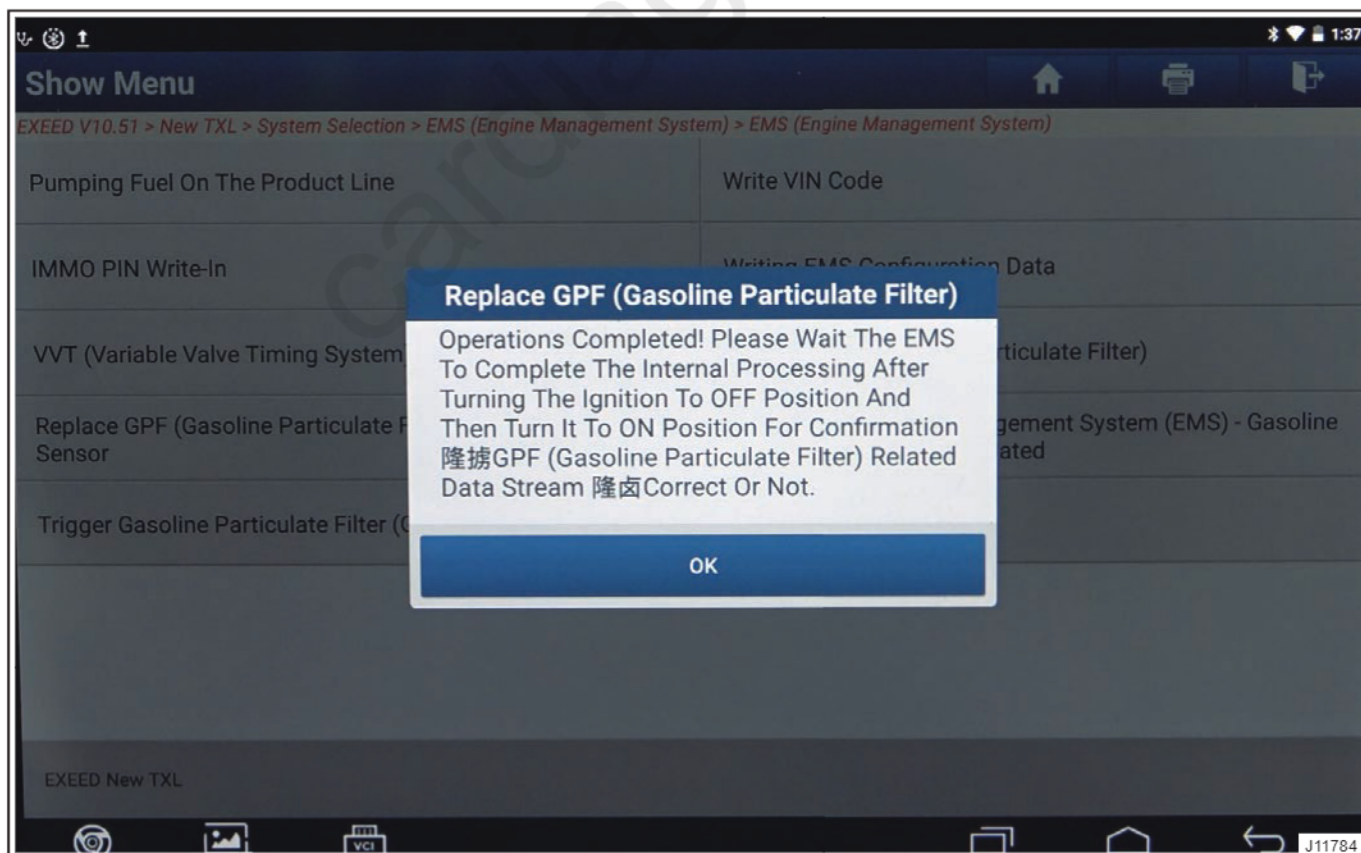
(4) Click “Replace GPF (Gasoline Particulate Filter)” .



(5) Click “OK” .

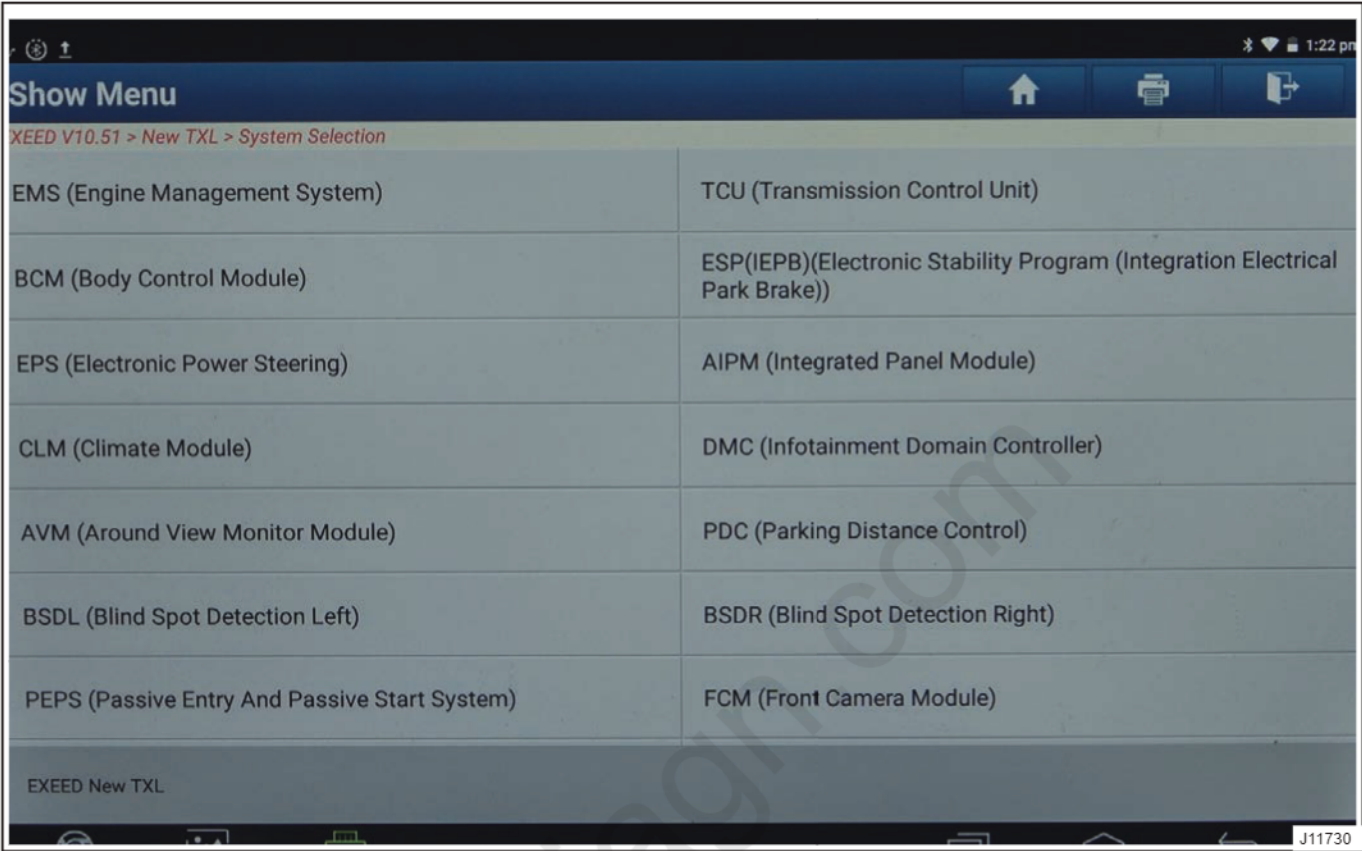


(6) Interface shows “Operation Completed” and click “OK” .

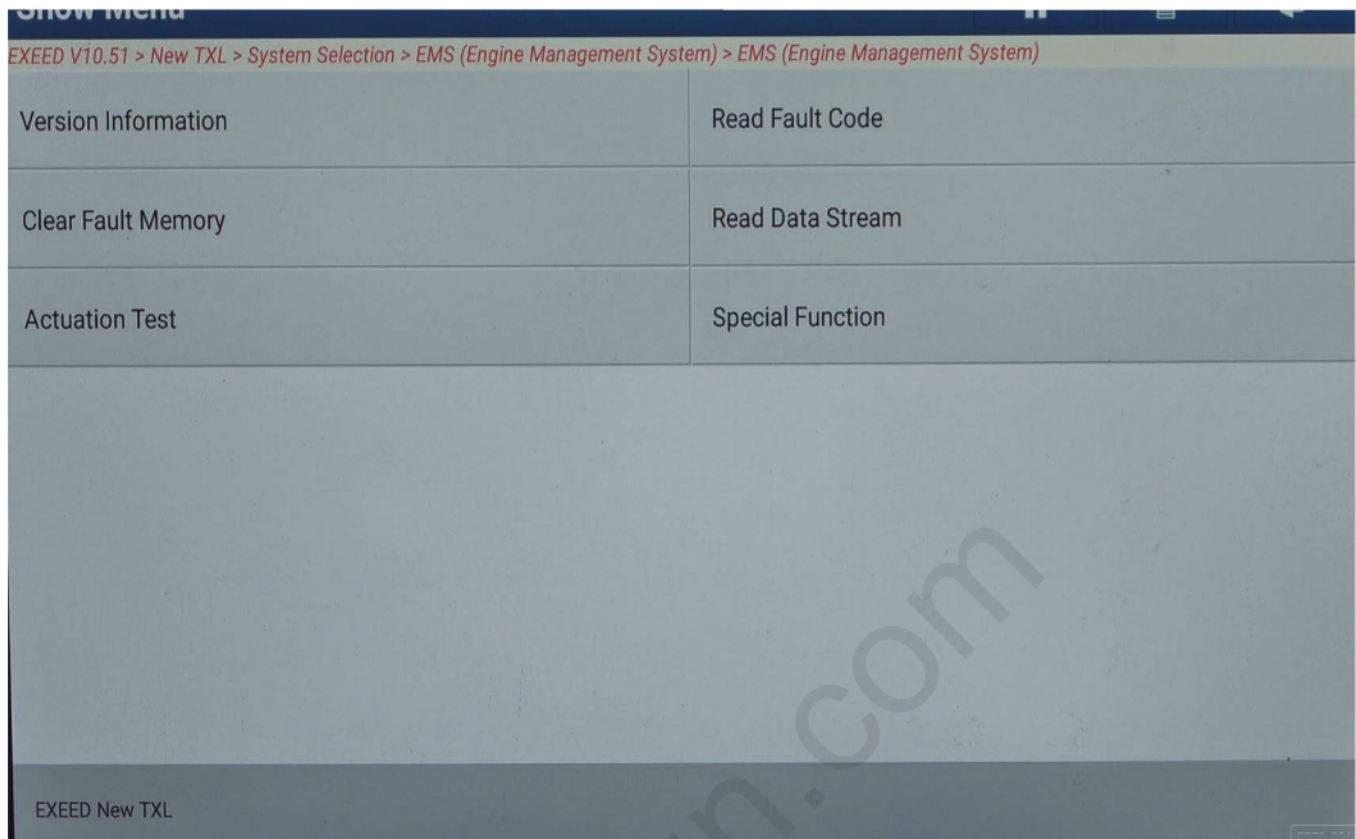


■ Replace Differential Pressure Sensor Learning

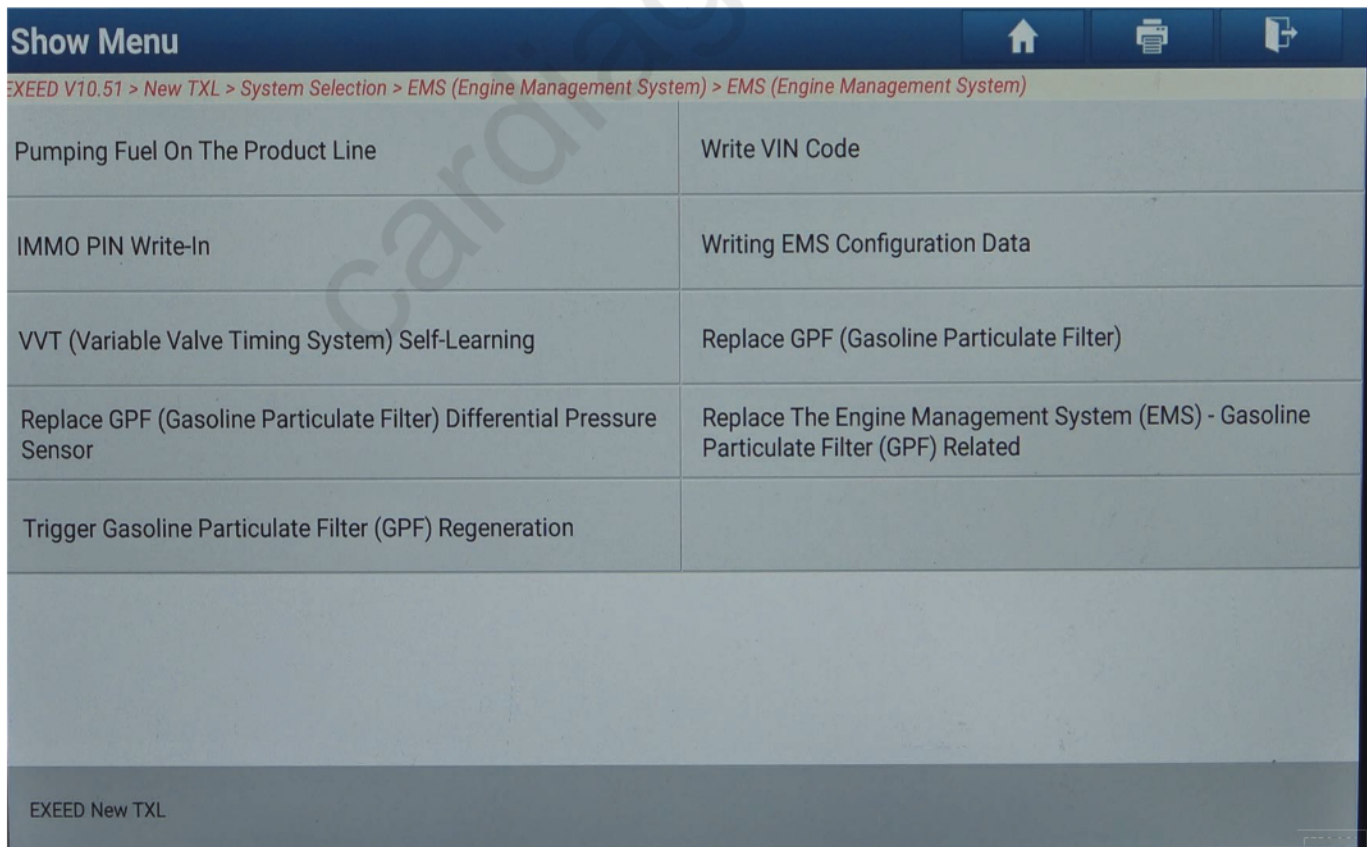
- (1) Connect diagnostic tester, and select “TXL” vehicle model.
- (2) Click “EMS (Engine Management System)” .



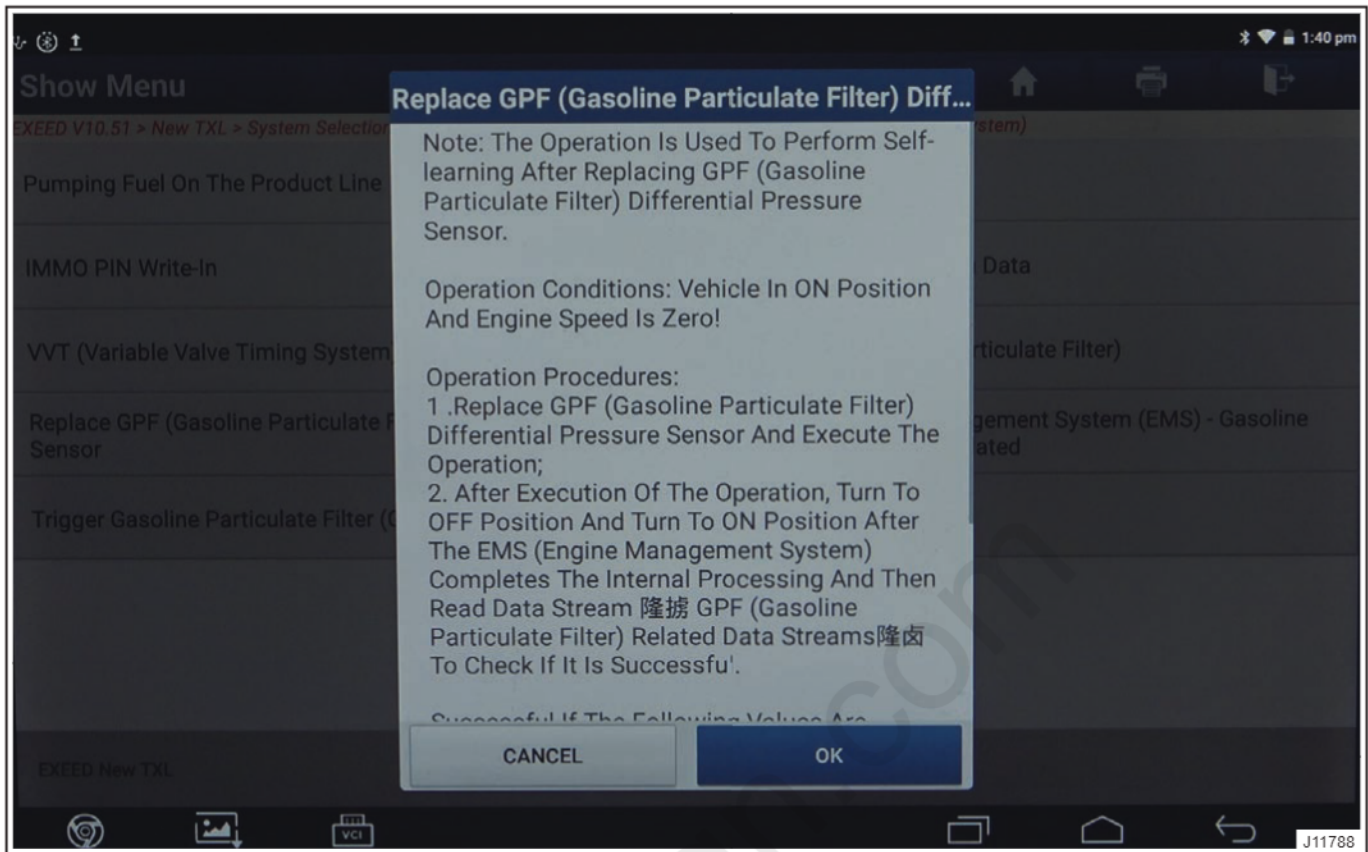
(3) Click “Special Function” .



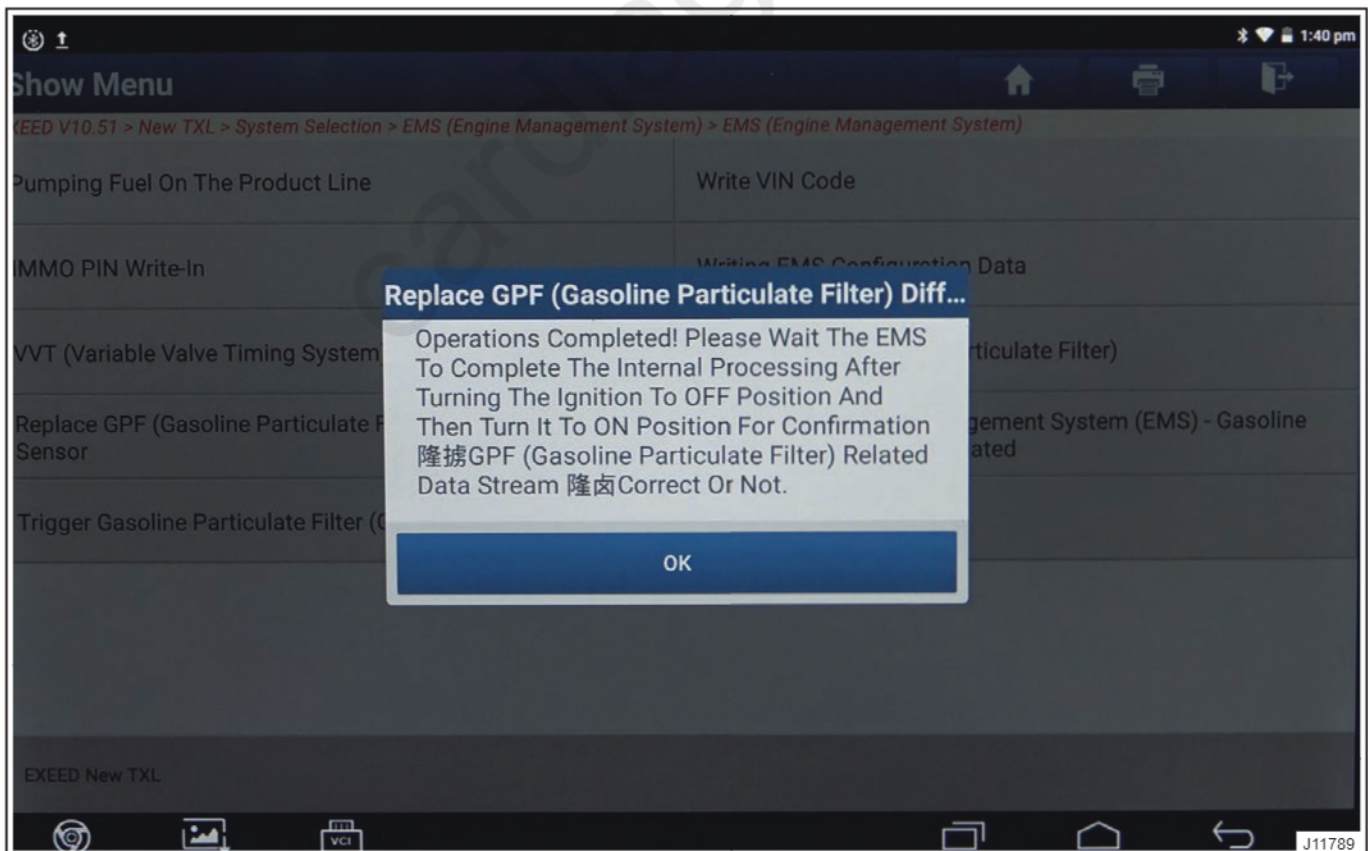
(4) Click “Replace GPF (Gasoline Particulate Filter) Differential Pressure Sensor” .



(5) Click “OK” .

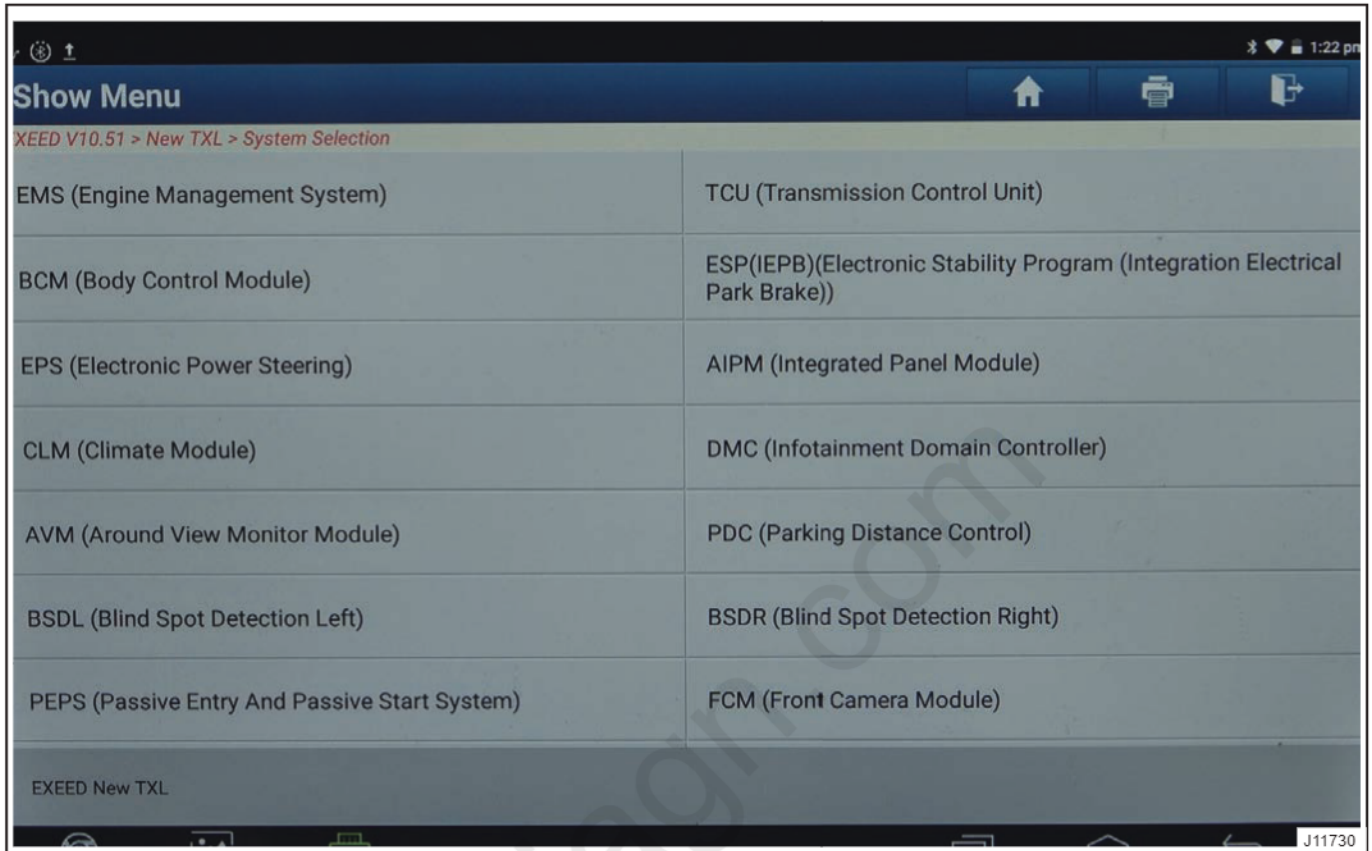


(6) Interface shows “Operation Completed” and click “OK” .

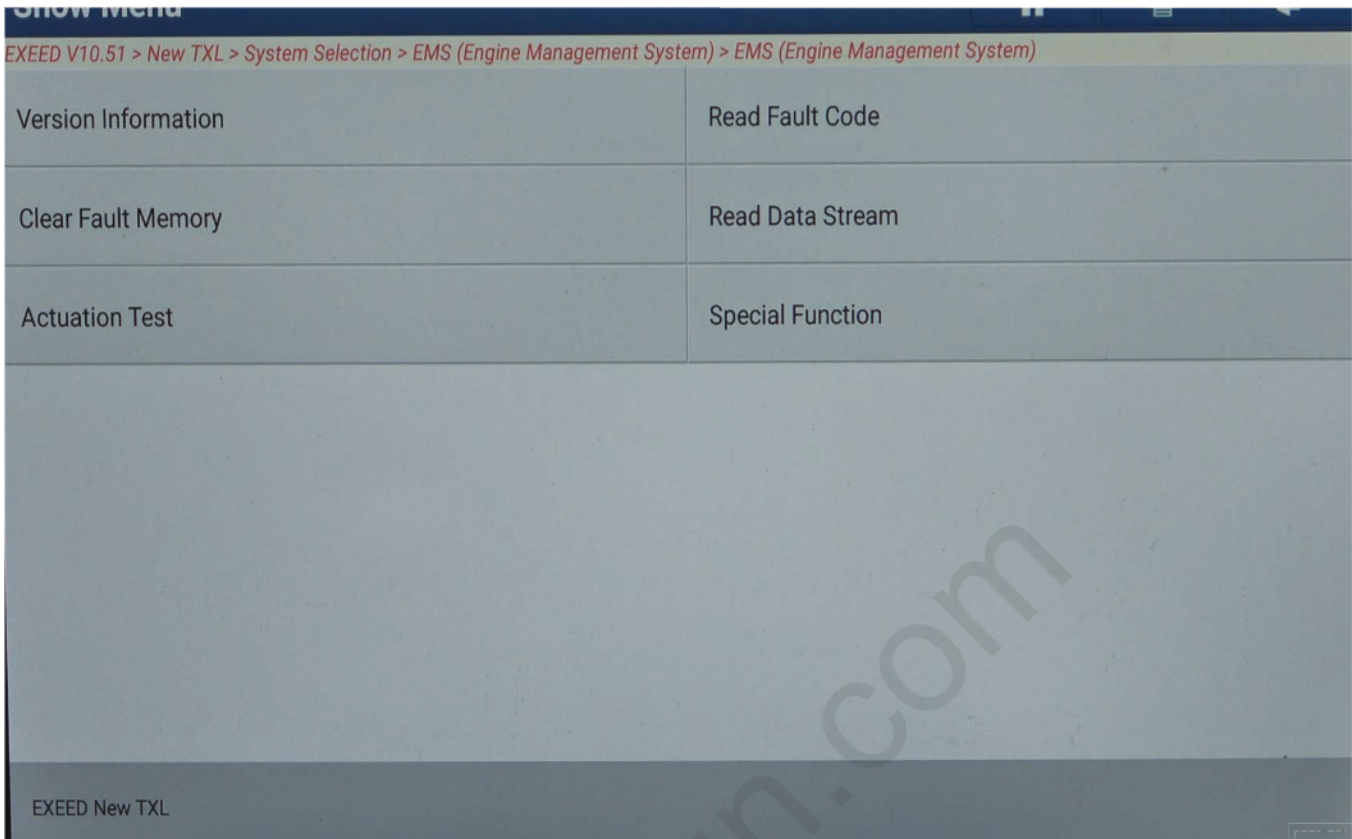


■ EMS GPF - Learning

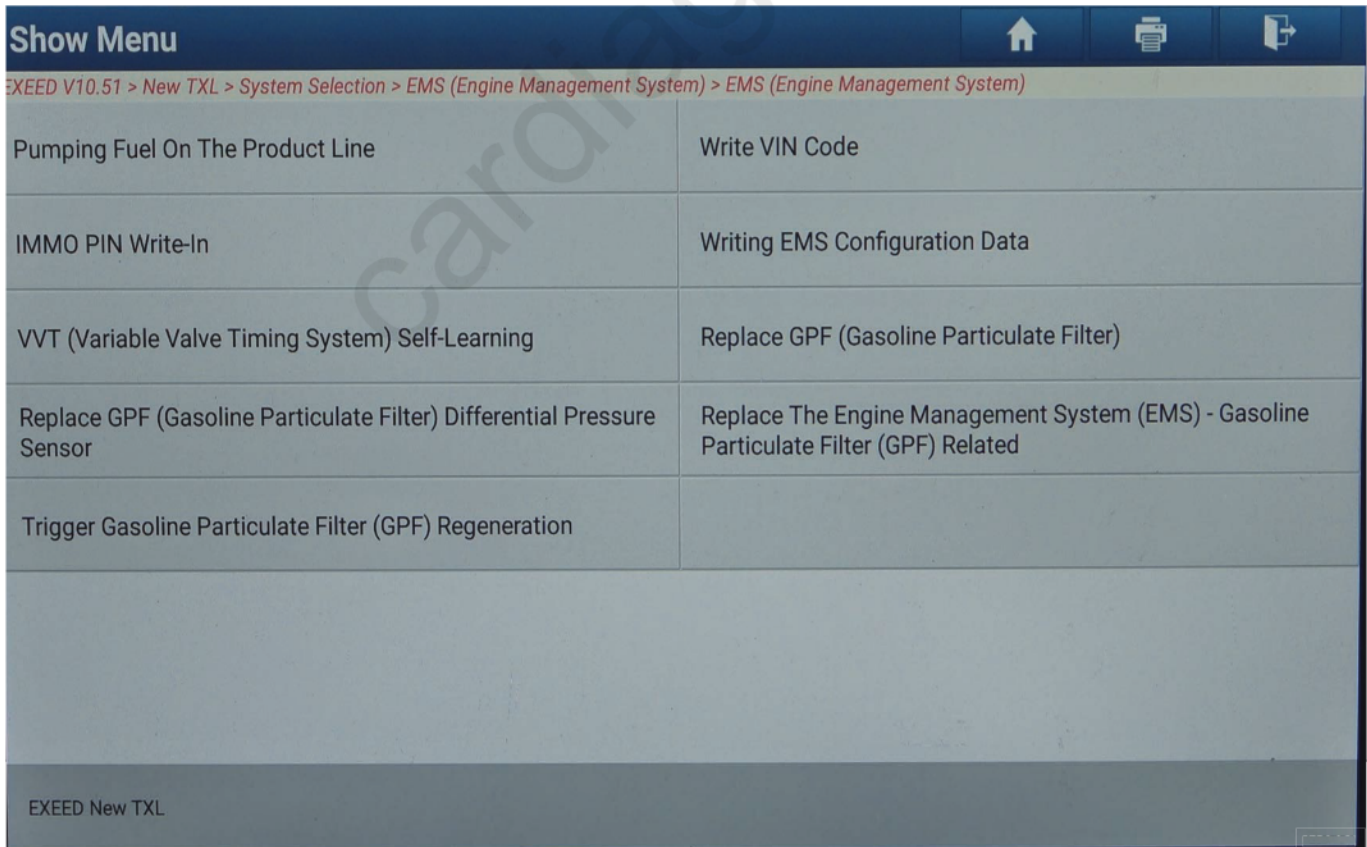
- (1) Connect diagnostic tester, and select “TXL” vehicle model.
- (2) Click “EMS (Engine Management System)” .



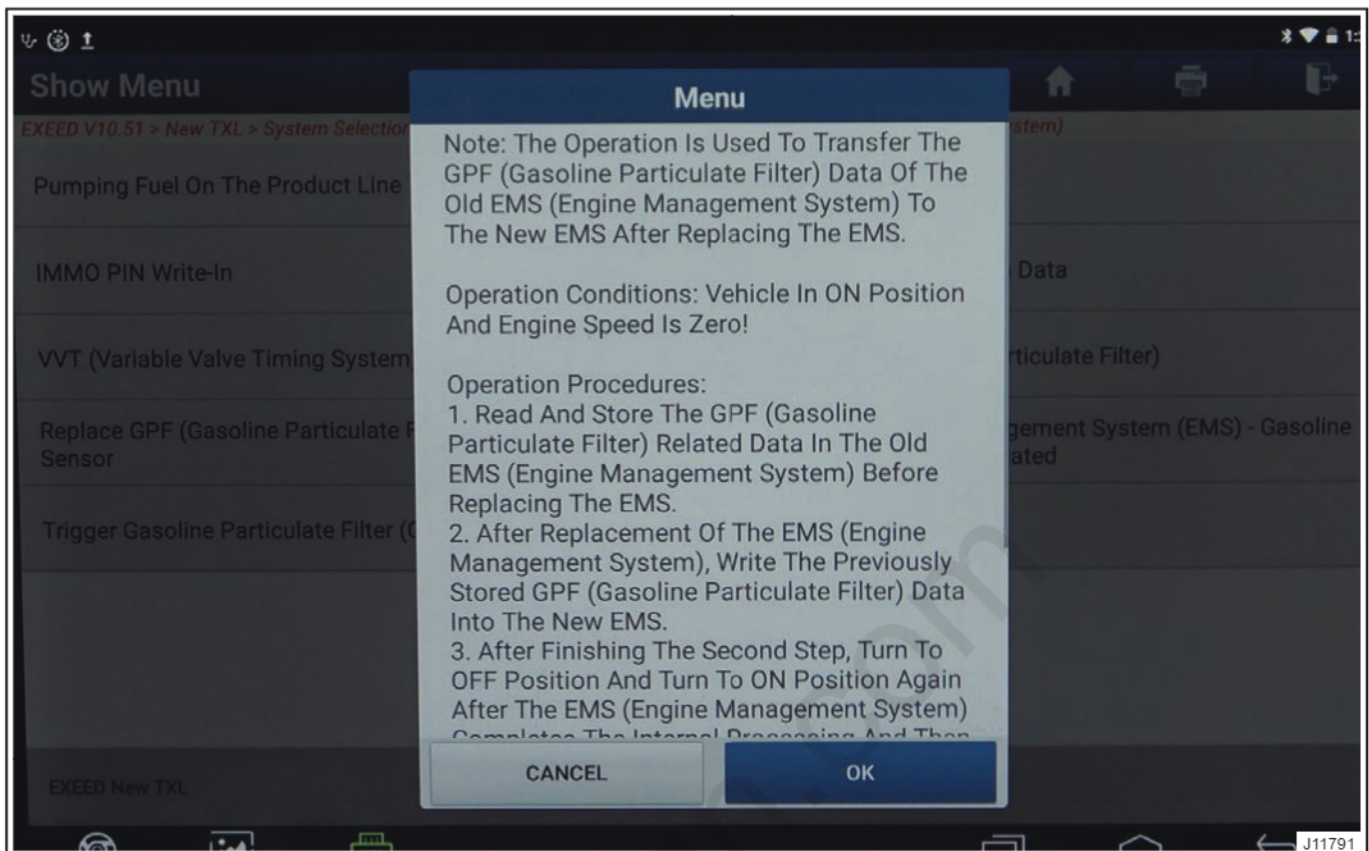
(3) Click “Special Function” .



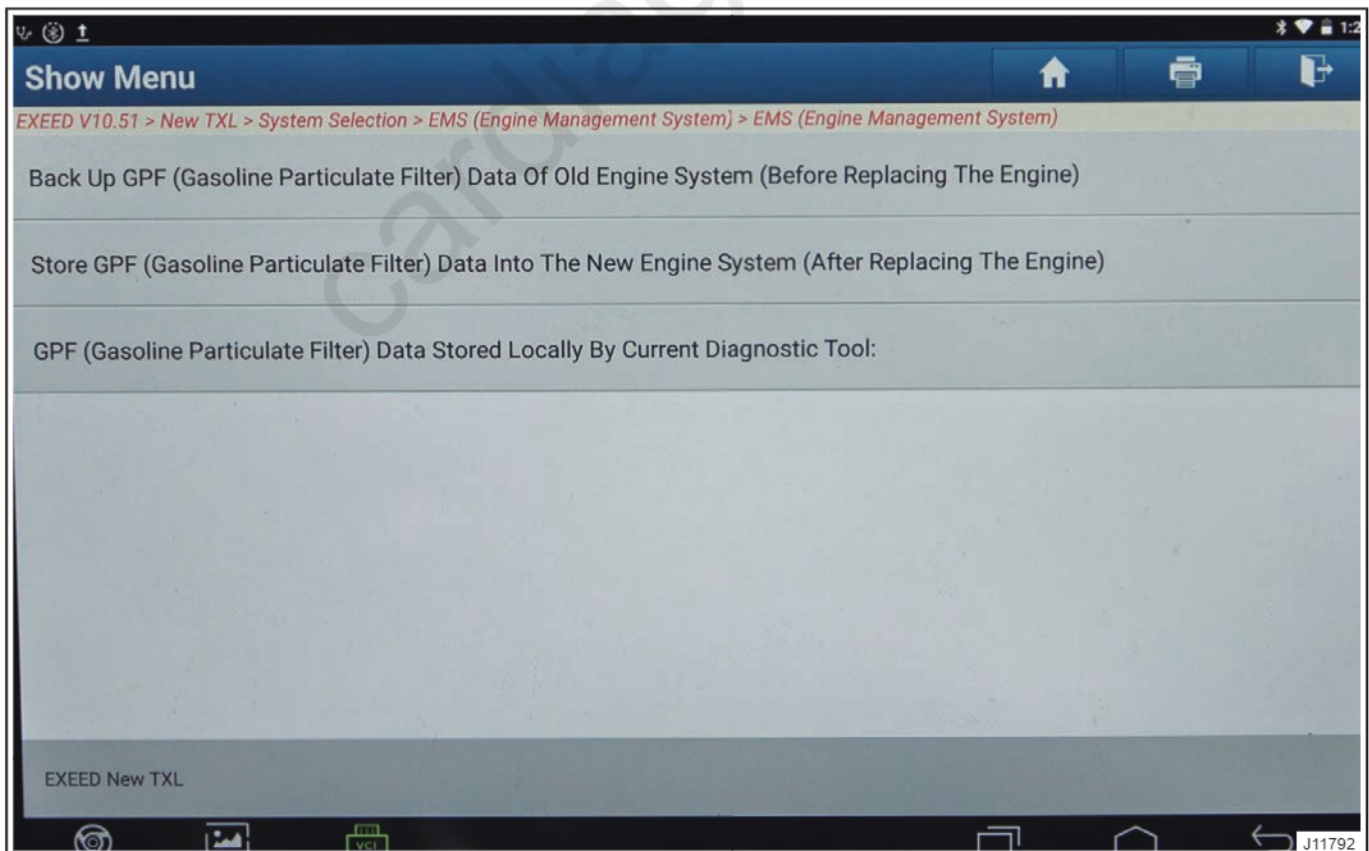
(4) Click “Replace EMS (Engine Management System) - GPF (Gasoline Particulate Filter) Related” .



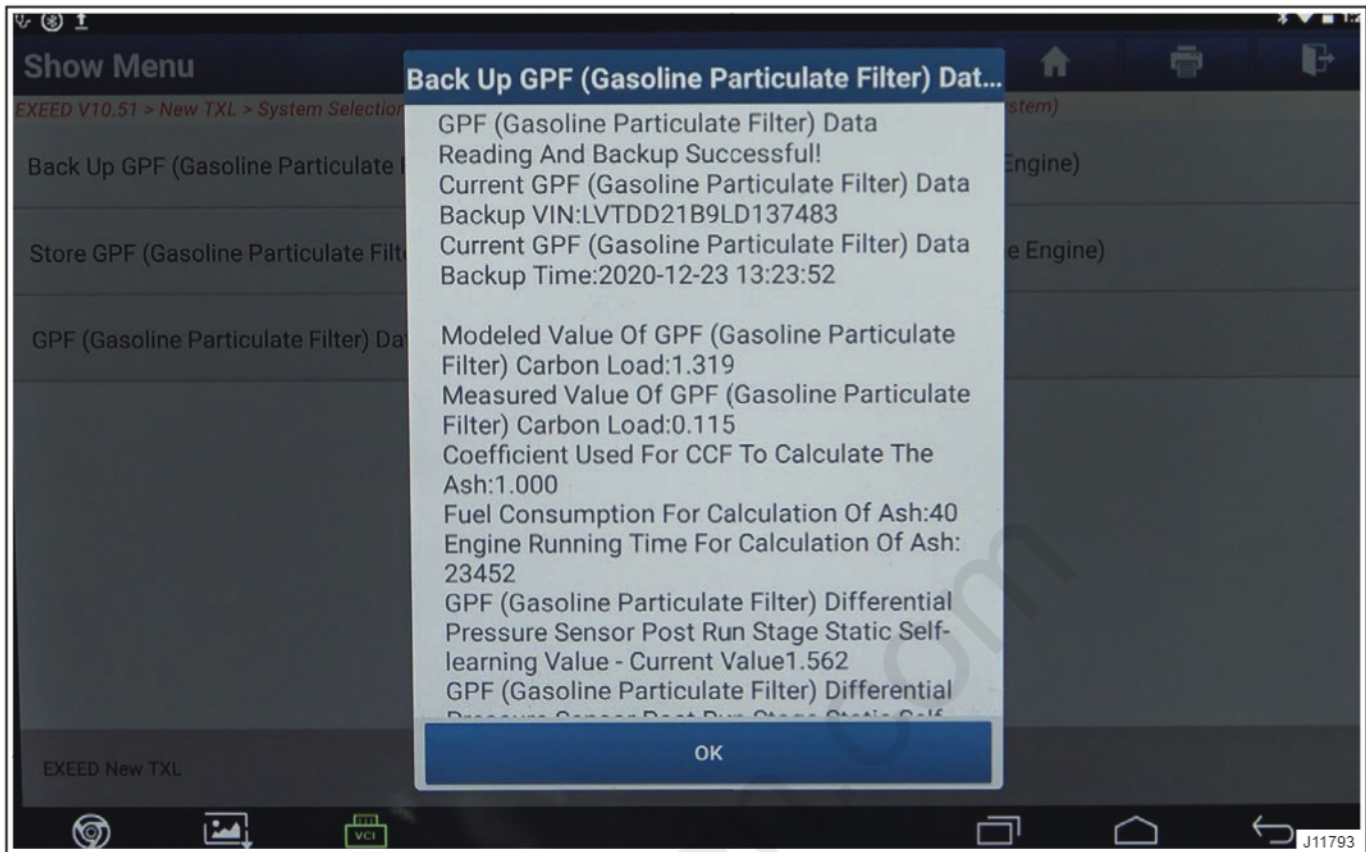
(5) Click "OK" .



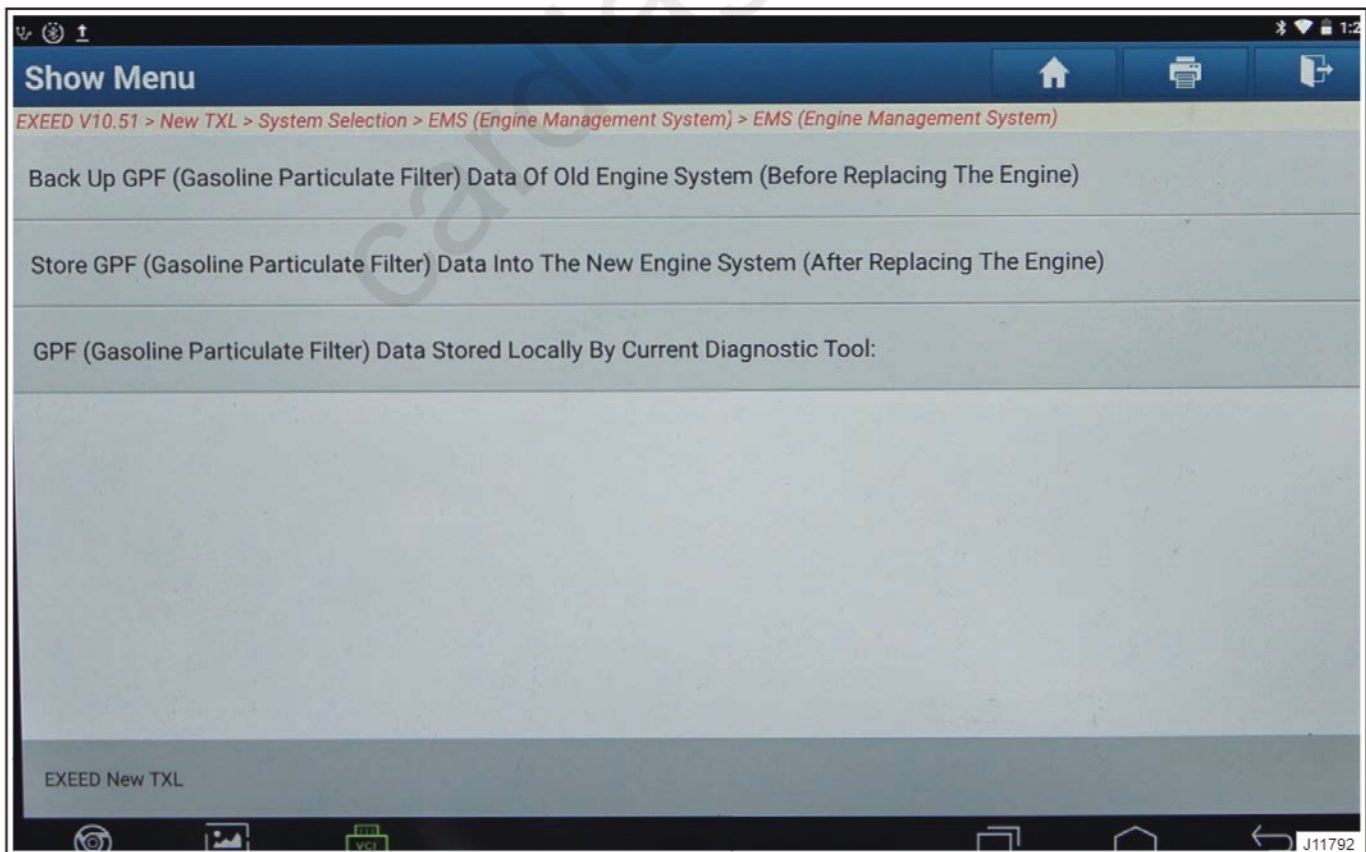
(6) Click "Back Up GPF (Gasoline Particulate Filter) Data (Before Replacing The Engine)" .



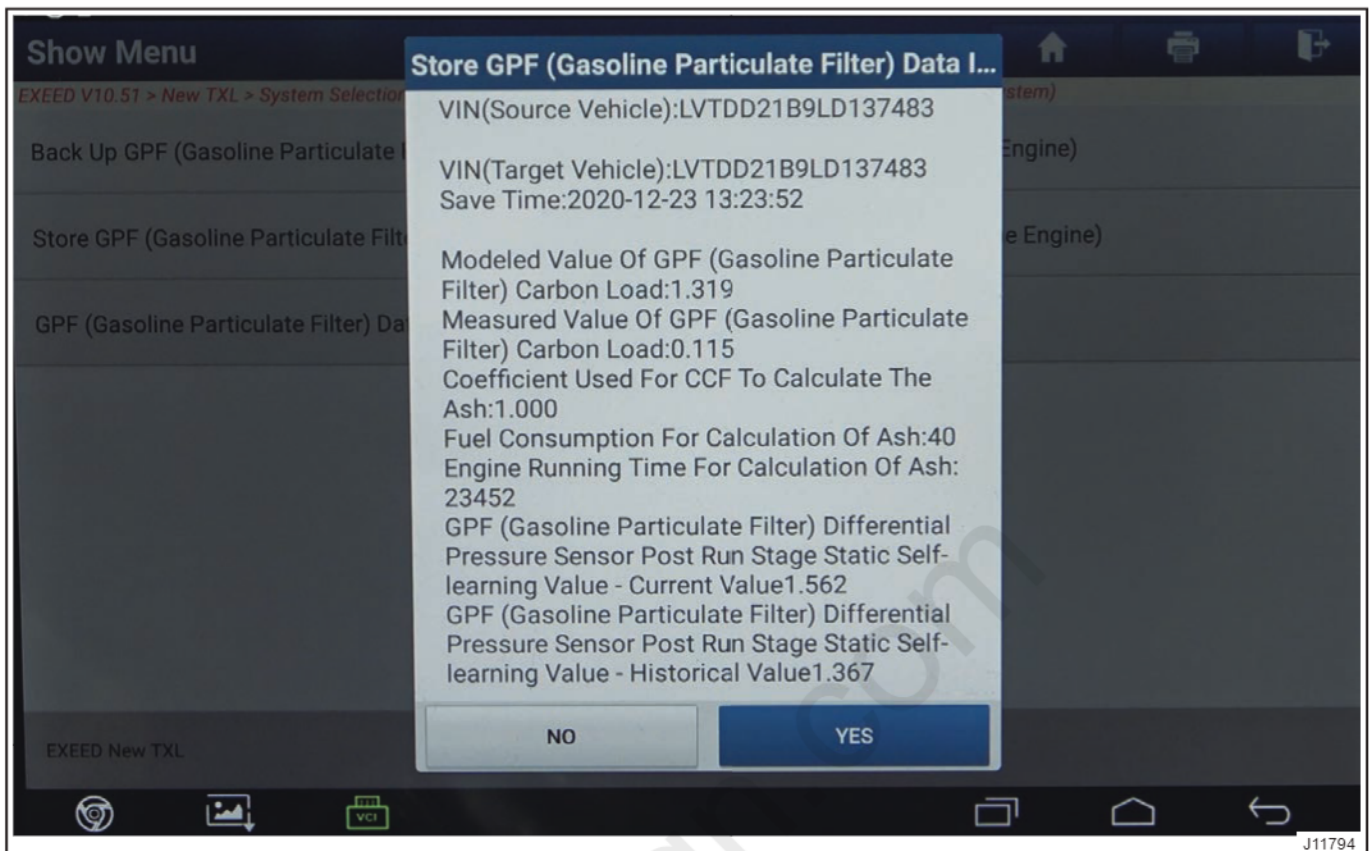
(7) Click “OK” .



(8) Click “Store GPF (Gasoline Particulate Filter) Data Into The New Engine System (After Replacing The Engine)” .



(9) After confirming information is correct, click “Yes” .



(10) Interface shows: Write Status Is Successful, and click “OK” .

