

SQRE4T15B ENGINE MANAGEMENT SYSTEM

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GENERAL INFORMATION

Overview

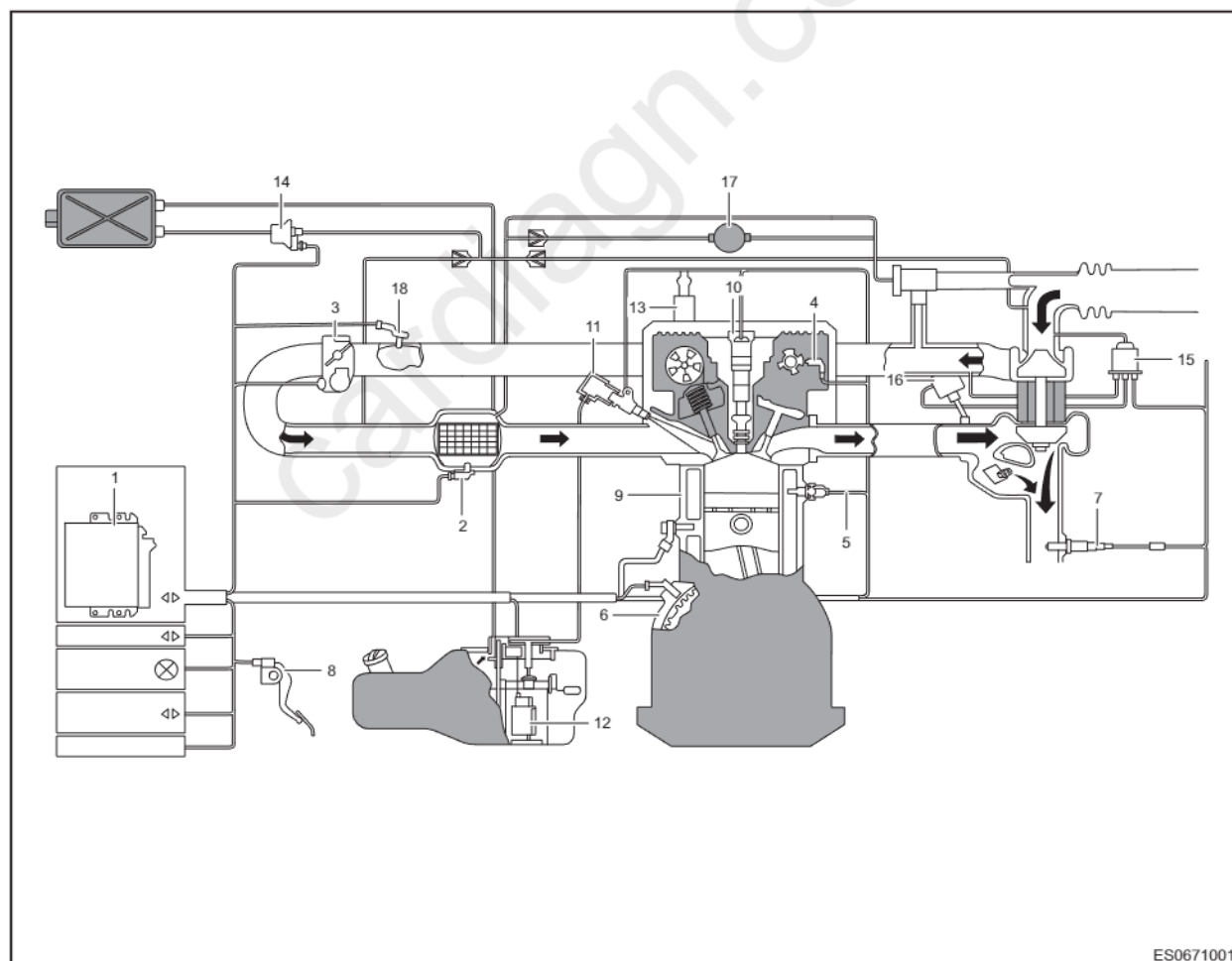
System Basic Principle

Engine of Tiggo 8 model adopts Bosch ME17.U.6 engine management system. This system mainly consists of Engine Control Module (ECM), sensors and actuators, which controls intake air amount, injection volume and ignition timing, etc. when engine is operating.

In the engine management system, sensors are used as the input part to measure various physical signals (temperature and pressure, etc.), and converts them into corresponding electrical signals; the function of ECU 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 ECU 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 ME17.U.6 engine electronic control management system is the use of torque based control strategy. The main purpose of the torque based control strategy is to associate a large number of different control objectives.

Basic Components of Engine Management System



ES0671001

1 - Engine Control Module	2 - Intake Pressure/Temperature Sensor
3 - Electronic Throttle	4 - Camshaft Position Sensor



5 - Coolant Temperature Sensor	6 - Crankshaft Position Sensor
7 - Oxygen Sensor	8 - Electronic Accelerator Pedal
9 - Knock Sensor	10 - Ignition Coil
11 - Fuel Injector	12 - Electric Fuel Pump
13 - VVT Control Valve	14 - Canister Solenoid Valve
15 - Exhaust By-pass Solenoid Valve	16 - Inlet Relief Solenoid Valve
17 - Electrical Water Pump	18 - Boost Pressure Sensor

1. Precautions

(a) General service requirements

- Digital multimeter, LED test light, jumper cable and diode test light can be used to perform inspection for engine management system.
- Use genuine components to perform service work, otherwise appropriate engine management system operation cannot be guaranteed.
- Only use unleaded gasoline during service.
- Please observe normative service and diagnostic flowchart to perform service work.
- Never disassemble components of engine management system during servicing.
- When holding electronic elements (ECU and sensor etc.) during service, take extra care not to drop them on the ground.
- Set up a consciousness of environmental protection and dispose of the waste effectively that is produced during servicing.

2. Precautions during service

- Do not causally remove any engine management 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 engine management system.
- Be sure to turn ENGINE START STOP switch off when disconnecting and connecting connectors. Otherwise electronic elements may be damaged.
- When simulating hot operating condition of malfunction and performing other service work that may cause temperature to rise, never allow ECU temperature to exceed 80°C.
- As the supplying pressure of fuel system is high (approximately 400 kPa), all fuel pipes are high pressure resistant pipe. 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:
 - Remove fuel pump relay, start engine and idle it until the engine stops running by itself. Then try to start engine 2 - 3 times to ensure fuel pressure is discharged completely. Removal of fuel pipes and replacement of fuel filter should be performed in a well-ventilated area by professional service men.
- Do not energize electric fuel pump when removing it from fuel tank to prevent electric sparks, which will cause a fire.
- Running test for fuel pump is prohibited when it is empty or in water; otherwise it will shorten the service life. Never connect the positive and negative of fuel pump in reverse.
- Do not connect battery with its polarity reversed to prevent damage to electronic elements. This system adopts negative ground.
- Never remove battery cable when engine is running.
- The positive, negative battery cables and ECU must be removed before performing welding on vehicle.
- Do not puncture wire outer coat to detect electric signals input and output by components.

Basic Management Function of Engine

Basic Management Function of Engine

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

Additional function

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

Diagnosis On-line OBD

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

Torque structure: ME17.U.6 system based on torque control

In ME17.U.6 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. ME17.U.6 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.

Compared with the previous M series engine electronic fuel injection management system, the main features of ME17.U.6 system

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

Control Signal: Input/Output Signal of ME17.U.6 System

Main sensor input signal of ECU in ME17.U.6 system include

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



Required actuator control signals which are generated via ECU from sensor input signals in ME17.U.6 system include

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

System Function

Start control

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

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

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

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

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

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

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

Acceleration/deceleration and motored fuel cut-off control

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

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

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

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

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

Idle control

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

ME17.U.6 system uses torque based control strategy to determine engine output torque requested by maintaining required idling speed in all working conditions according to closed loop idle control. This output torque increases as engine speed reduces, and reduces as engine speed increases. System responses to the new "interference factor" through requesting higher torque, such as turning on/off air conditioning compressor or shifting of automatic transmission. When engine temperature is low, torque is also needed to be increased to compensate higher internal friction and/or maintain higher idling speed. The sum of these required output torque will be transmitted to torque coordinator which will process, calculate and obtain corresponding volumetric density, mixture contents and ignition timing.

λ closed-loop control

Exhaust aftertreatment in three-way catalytic converter is an effective method for reducing concentration of harmful substance in exhaust gas. Three-way catalytic converter can reduce hydrocarbon (HC), carbon monoxide (CO) and nitric oxide (NO₂) up to 98% or more, and convert them into water (H₂O), carbon dioxide (CO₂) and nitrogen (N₂). 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.

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

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

Knock control

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

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

System Malfunction Diagnosis Function Introduction

Malfunction information record

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



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

Malfunction light description and its control strategy

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

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

Diagnostic tester connection

This system uses ISO 15765 ISO 15031-5 CAN communication protocol and adopts OBD II standard diagnostic connector. This standard diagnostic connector is fixedly attached on engine wire harness. Pins used for engine management system EMS are terminals 4, 6, 14 and 16 of standard diagnostic connector. Terminal 4 of standard diagnostic connector is connected to ground wire of vehicle; Terminal 6 is connected to terminal 1 of ECU, that is the engine data CAN - BUS high speed diagnostic line (H line); Terminal 14 is connected to terminal 17 of ECU, that is the engine data CAN - BUS high speed diagnostic line (L line); Terminal 16 is connected to the battery positive.

The Tiggo 8+ E4T15B vehicle diagnostic port is under the steering wheel on the driver side.

Diagnostic tester display

1. Engine Parameter Display
 - (a) Engine speed, coolant temperature, throttle opening, ignition advance angle, injection pulse width, intake pressure, intake temperature, vehicle speed, system voltage, injection correction, canister scour rate, idle air control, oxygen sensor waveform;
 - (b) Target speed, relative engine load, ambient temperature, ignition closing time, evaporator temperature, intake air flow, fuel consumption amount;
 - (c) Throttle valve position sensor signal voltage, coolant temperature sensor signal voltage, intake temperature sensor signal voltage, intake pressure sensor signal voltage, knock sensor terminal 1 signal voltage, knock sensor terminal 2 signal voltage.
2. Electronic Fuel Injection System State Display
 - (a) Immobilizer system state, safety state, program state, cooling system state, stable working condition state, dynamic working condition state, emission control state, oxygen sensor state, idling state, malfunction indicator light state, emergency working condition state, A/C system state, automatic transmission/torque request state.
3. Actuator Test Function
 - (a) Malfunction light, fuel pump, A/C relay, fan, canister purge valve and throttle opening.

4. Version Information Display
 - (a) Frame number (VIN), ECU hardware number, ECU software number.
5. Malfunction Display
 - (a) Air flow meter, intake temperature sensor, engine coolant temperature sensor, throttle valve position sensor, oxygen sensor, oxygen sensor heating line, air-fuel ratio correction, fuel injector of each cylinder, fuel pump, knock sensor, speed sensor, phase sensor, canister control valve, cooling fan relay, vehicle speed signal, idle speed, electronic throttle body, system voltage, ECU, A/C compressor relay, evaporator temperature sensor, malfunction light.

System features

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

Control Strategy

A/C control strategy

1. 8 s after engine is started, A/C compressor is allowed to operate. Within 8 s of engine starting, even if the A/C request switch is pressed, A/C compressor will not engaged.
2. When coolant temperature is higher than 115 degrees, A/C is powered off. When coolant temperature is below 113 degrees, A/C control resumes. When coolant temperature is between 106 and 114 degrees, A/C control status does not change.
3. When engine speed exceeds 6520 rpm or below 560 rpm, A/C is powered off. A/C control resumes when engine speed is between 640 rpm and 6320 rpm. When the engine speed is in range of 6320-6520 rpm and 560-640 rpm, A/C maintains the previous state.
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. Due to the large A/C engine torque consumption, Tiggo 8+ E4T15B model has developed an accelerated disconnection A/C strategy. When the accelerator pedal is depressed firmly, A/C will be powered off to ensure dynamic property when overtaking. When the A/C is disconnected for more than a certain period of time or the driver accelerator pedal opening is reduced, A/C will reengaged.

Fan control strategy

1. Fan control strategy when engine is running normally

Hint:

- Tiggo 8+ E4T15B model equipped with a two-speed fan, and ECU judges and control different fan speeds based on water temperature, A/C pressure signal and vehicle speed signal.
- (a) Speed limit thresholds of fan to stop rotation in each state are as follows:
 1. When coolant temperature is higher than 94°C and vehicle speed is lower than 80, low speed fan operates; After coolant temperature is lower than 91°C, low speed fan stops operating.
 2. When coolant temperature is higher than 105°C and vehicle speed is lower than 80, high speed fan operates; After coolant temperature is lower than 102°C, high speed fan stops operating.
 3. When coolant temperature is higher than 110°C and vehicle speed is higher than 80, high speed fan operates; After coolant temperature is lower than 107°C, high speed fan stops operating.



2. Fan control strategy after stalling

- (a) If coolant temperature is higher than 101°C or air temperature in manifold is higher than 70°C after engine stalling, fan will operate at high speed.
- (b) If coolant temperature is lower than 98°C or air temperature in manifold is higher than 67°C, fan stops operating at high speed.
- (c) Fan operates at most 40 s after stalling.

Three-way catalytic converter protection control strategy

1. When engine is operating normally, if exhaust pipe model temperature exceeds 880°C, exhaust temperature concentration protection function is activated, and ECU reduces the exhaust temperature by increasing the air-fuel ratio.
2. When exhaust pipe temperature drops below 830°C, concentration protection stops working and the air-fuel ratio returns to normal.
3. When engine is operating normally, if catalytic converter central model temperature exceeds 900°C, catalytic converter protection function is activated and ECU 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
 - (a) Engine coolant temperature is higher than 55°C.
 - (b) Engine air-fuel ratio control has entered the closed loop.
 - (c) Canister solenoid valve trouble-free.
2. Canister solenoid valve scour time control
 - (a) Since canister scour and air-fuel ratio self-learning cannot be performed at the same time, Bosch system uses a software to rationally allocate the time for opening canister solenoid valve and air-fuel ratio self-learning time to ensure that the functions are normal. Canister scour and air-fuel ratio self-learning are performed alternately during normal engine operation.
3. Canister solenoid valve opening control
 - (a) Openings of canister solenoid valve are different at different engine speeds and loads. ECU calculates the current opening of canister solenoid valve according to the conditions such as engine speed, load, and air-fuel ratio fluctuation.

Oxygen sensor heating logic

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

Knock control strategy

1. Knock control is activated when engine coolant temperature exceeds 40°C and engine load is more than 36%.

2. ECU performs knock control through feedback signal from knock sensor. When knock is detected, ECU delays the ignition angle by a fixed step of -3 degrees, and the maximum delay of ignition angle is 12 degrees. If no new knock is detected for several consecutive combustions, the delayed ignition angle will recover with a step size of 0.75 until the delayed ignition angle is fully recovered or a new knock is detected.
3. If there is a knock sensor failure, ECU will reduce the output ignition angle of the engine to ensure the safety of engine.

Ignition control strategy

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

Brake override strategy

1. Prerequisites for activating "brake override" function
 1. Engine speed is more than 1200 rpm;
 2. Vehicle speed is more than 10 km/h;
 3. Accelerator pedal opening is greater than 0 and opening changes of accelerator pedal cannot be too rapid (accelerator pedal cannot be depressed rapidly), not that driver intends to accelerate rapidly;
 4. Brake switch signal is set, that is, ECU gets the action intention to depress the brake pedal;
 5. Depress the accelerator pedal first, then depress the brake pedal.
2. "Brake override" function activation manifestation
 - (a) Accelerator pedal opening does not exceed 6% even if the accelerator pedal is at the lowest mechanical position. The limitation of engine torque output is achieved, and the establishment of brake vacuum is also achieved (throttle opening is reduced and intake manifold vacuum is increased).
3. Condition for "Brake override" function exit
 - (a) Accelerator pedal opening is 0 (that is, when the accelerator pedal is released and then depressed again);
 - (b) Opening changes of accelerator pedal is rapid (when accelerator pedal is depressed rapidly), that is, driver intends to accelerate rapidly;
 - (c) Brake switch signal reset (brake pedal is released).



Idle control strategy

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

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

Comments

- 1 stands for plains; 0.9 stands for altitude 1000 m; 0.8 stands for altitude 2000 m; and so on, 0.5 stands for altitude 5000 m
- Warm engine normal idle speed 700±50 rpm.
- In order to protect the safety of the engine and the vehicle, the maximum speed of the neutral is limited to 4500 rpm and the duration exceeds 40 s and then returns to idling.
- Under normal conditions, the normal idling speed of the warm engine is 700 rpm; it is raised to 880 rpm after A/C turning on.

Start assist function

Tiggo 8 is equipped with a clutch bottom switch. The start assist function is: clutch pedal is fully depressed or released until the top switch is engaged. Speed is still at normal idle speed. When the clutch pedal is lifted from the bottom, engine idle speed is increased to 1000 rpm. Water temperature increases slightly with the altitude, and this function is turned off when the speed is higher than 10 km/h, and this function is also turned off when vehicle speed or brake signal failure.

Electronic vacuum pump control strategy

For model equipped with an electronic vacuum pump, to prevents the phenomenon of poor braking effect due to the positive pressure generated in the intake manifold after the turbocharger operates, the specific operating conditions are as follows:

Mode	Pressure when start working (KPa) / absolute pressure	Pressure when stop working (KPa) / absolute pressure	Expected working time (S)
Plain	55%P	40%P	2.8
Highland	50%P	40%P	2.5

Comments

Plain mode: Altitude ≤ 2000 MH or P ≥ 80 KPa

Highland mode: Altitude > 2000 MH or P < 80 KPa

P: Local ambient pressure

Electrical water pump control strategy

For the models equipped with electrical water pump, to prevent the performance of the turbocharger degradation due to high temperatures after stalling, so the working time of electronic water pump is related to the water temperature at the time of stalling. The specific relationship is shown in the following table:

Water temperature (°C)	60	80	100	120
Duration (S)	60	180	300	400

Oil pump control strategy

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

3. When the engine is running normally, ECU controls oil pump to work continuously.

Starter protection function

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

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

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

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

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Turbocharger control strategy

Turbocharger use exhaust gas that is discharges during engine running to turn the turbo impeller, and then drive compressor impeller to send the air pressed through air filter into cylinder. As more air enters into cylinder, more fuel is allowed to be injected so that more engine power is generated. In addition, the turbocharger can also make the engine get power compensation when it works in highland. In the electronic control system, the supercharger work must satisfy the following conditions simultaneously:

1. Required boost pressure after engine starting is higher than atmospheric pressure.
2. Boost pressure sensor before throttle does not report an error.
3. Boost control actuator does not report an error.
4. Not trigger the maximum boost failure.
5. Not trigger the limp function.
6. Not trigger the safety fuel-cut function

Relief solenoid valve control strategy

Fresh air passes through the air filter and enters the compressor. After being compressed, it passes through the intercooler to reach the throttle and the throttle is a component that is constantly opening and closing. In addition to high-speed cruising, the accelerator pedal under the driver almost always changes, which creates a problem: Turbocharger operates at full speed when the accelerator pedal is fully depressed, delivering a continuous supply of compressed air to the throttle; At the instant of the driver releasing the accelerator pedal, due to the hysteresis of the turbine operation, compressor is still operating at full speed despite the throttle being closed. As a result, the blocked high-pressure air may cause compressor blade or throttle is damaged by impact. The purpose of the inlet relief solenoid valve is to release the high pressure when release the accelerator pedal, thus protecting the compressor blade and throttle.

In the electronic control system, the inlet relief solenoid valve must satisfy the following conditions simultaneously:

1. Rate of pedal change is less than a certain limit when the accelerator pedal is released.
2. The difference between actual boost pressure and target boost pressure is greater than a certain limit when accelerator pedal is released.
3. The ratio of boost pressure in accelerator pedal steady state is less than a certain limit.

Smart grille

1. Advantages of smart grille
 - Improve the aerodynamic characteristics of the vehicle, improve the vehicle wind resistance, and improve fuel economy.



- When the variable grille system is completely closed, reducing wind resistance can reduce carbon dioxide emissions and improve emission performance.
- Keep the engine in a good temperature state and improve the dynamic performance of the vehicle.
- When the vehicle is started from cold state, it keeps the blades closed for as long as possible, ensuring that the engine warms up quickly, while helping to reduce wear and reduce fuel consumption.
- After a cold start, the engine oil and the three-way catalytic converter can reach the operating temperature more quickly, allowing the air-fuel mixture to burn more efficiently. The system automatically monitors the engine temperature and automatically opens or closes the vents as needed to ensure an ideal operating temperature to achieve reserve engine power and significantly reduce emissions.

2. Smart grille control strategy

(a) Working conditions

- When the vehicle is powered off, it is fully open.
- When the vehicle is powered on, the self-test is performed first. The self-test process is: full open - fully closed - fully open, and then the open position is determined according to the current engine coolant temperature.
- It is fully open when there is a system coolant temperature failure.
- It is fully open when the control line is failure.
- It is fully open when the air conditioner is working.

(b) Operation method

- There are 4 opening angles: 0°, 15°, 36°, 90°.
- 0° when the coolant temperature is below 87 degrees.
- 15° when the coolant temperature is between 87 - 89 degrees.
- 36° when the coolant temperature is between 89 - 91 degrees.
- 90° when the coolant temperature is above 91 degrees.

Specifications

Torque Specifications

Description	Torque (N·m)
Coolant Temperature Sensor	14 ± 1
Intake Pressure/Temperature Sensor Fixing Bolt	6 ± 1
Knock Sensor Fixing Bolt	20 ± 5
Crankshaft Position Sensor Fixing Bolt	8 ± 2
Camshaft Position Sensor Fixing Bolt	8 ± 1
VVT Control Valve Fixing Bolt	8 ± 2
ECU Fixing Bolt	7 ± 1

ECU Terminal Definition**ECU Connector**

Terminal No.	Description	Terminal No.	Description
1	CAN Bus 1 High	57	-
2	-	58	Starter Control
3	-	59	Electronic Accelerator Pedal Sensor 2 Ground
4	-	60	-
5	Main Relay	61	-
6	Clutch Top Switch	62	Boost Pressure Sensor Temperature Signal
7	Electronic Accelerator Pedal Sensor 1 Ground	63	ECU Ground 2
8	-	64	ECU Ground 1
9	Cruise Control	65	Waste control valve
10	A/C High/Low Pressure Switch	66	-
11	-	67	Cylinder 2 Injector
12	Brake Vacuum Sensor	68	Cylinder 1 Injector
13	KL50 Status	69	Variable Camshaft Timing Valve (Exhaust)
14	-	70	ERCV Valve
15	UBR Noncontinuous Power Supply	71	Variable Camshaft Timing Valve (Intake)
16	UBR Noncontinuous Power Supply	72	Cylinder 3 Injector
17	CAN Bus 1 Low	73	Upstream Oxygen Sensor Heater
18	-	74	Cylinder 4 Injector
19	5 V Power Supply 1	75	Throttle Actuator (+)
20	UBD Continuous Power Supply	76	Ignition Coil 4
21	Downstream Oxygen Sensor	77	Throttle Position Sensor 1
22	-	78	Throttle Position Sensor 2
23	Brake Switch	79	-
24	A/C Compressor Medium-Pressure Switch	80	Oxygen Sensor Ground
25	Brake Light Switch	81	-
26	-	82	-
27	-	83	-
28	A/C Switch	84	Engine Speed Sensor Ground
29	-	85	Intake Pressure/Temperature Sensor (-)
30	Electronic Accelerator Pedal Sensor 2	86	Throttle Position Sensor (-)
31	High Speed Fan Control	87	Throttle Actuator
32	Immobilizer Input	88	Ignition Coil 2
33	-	89	Knock Sensor B
34	-	90	Knock Sensor A
35	Ignition Switch	91	Intake Pressure/Temperature Sensor
36	5 V Power Supply of Electronic Accelerator Pedal Sensor 2	92	PWM Electrical Water Pump
37	5 V Power Supply of Electronic Accelerator Pedal Sensor 1	93	Phaser Sensor 1
38	-	94	TEV Canister Valve
39	-	95	Intake Phase Sensor Ground
40	-	96	Engine Speed Sensor Signal
41	Fuel Pump Relay	97	-
42	A/C Compressor Relay	98	Phaser Sensor (+5 V)
43	Downstream Oxygen Sensor Ground	99	Ignition Coil Drive 2
44	Clutch Bottom Switch	100	Ignition Coil Drive 1
45	Electronic Accelerator Pedal Sensor 1	101	Engine Coolant Temperature Sensor

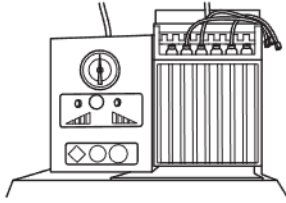
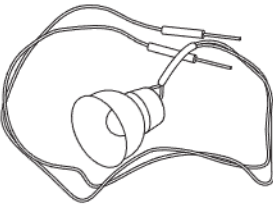
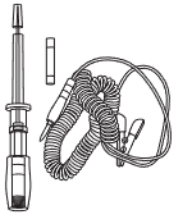


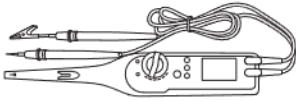
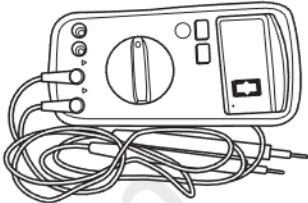
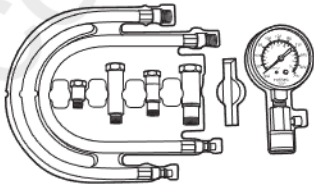
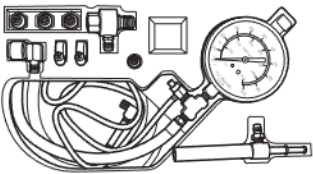
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Terminal No.	Description	Terminal No.	Description
46	Boost pressure sensor	102	Intake Temperature Sensor
47	Analog Ground	103	-
48	Downstream Oxygen Sensor Heater	104	Upstream Oxygen Sensor
49	-	105	Phaser Sensor 2
50	-	106	PWM Electrical Water Pump Feedback Signal
51	-	107	Throttle 5 V Power Supply
52	-	108	5 V Power Supply of Engine Speed Sensor
53	-	109	Intake Manifold 5 V Power Supply
54	Electronic Vacuum Pump	110	
55	-	111	ECU Ground 4
56	Low Speed Fan Control	112	ECU Ground 3

Tools

General Tools

Fuel Injector Cleaning Analyzer	 062
X-431 PAD Diagnostic Tester	 001
21 W Test Lamp	 087
LED Test Light	 960
Jumper Wire	 088

Diode Test Light	 970
Digital Multimeter	 002
Cylinder Pressure Gauge	 044
Fuel Pressure Gauge	 048
Oscilloscope	 061

DTC Operation and Setting Conditions

DTC operation and setting conditions query method and content

1. Use the first five digits of the DTC to query the operation and setting of it
2. The DTC content that can be queried in this section
 - (a) Find the DTC definition in DTC chart.
 - (b) DTC operating condition.
 - (c) DTC setting condition.
 - (d) Operation required for DTC setting.
 - (e) Conditions for malfunction indicator light off / DTC clearing.

Perform check and repair diagnosis procedure according to DTC

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

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Diagnostic Help

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

Basic definition and conditions of DTC

1. Driving cycle definition
 - (a) A driving cycle includes engine starting, operating conditions (which should be detected if there is a malfunction in vehicle) and engine stalling. For specific malfunction, operate vehicle under the specified parameter conditions in "DTC Operating Condition" to complete the required driving cycle for the DTC.
2. Warm-up cycle definition
 - (a) Fully run the vehicle so that the engine coolant temperature is at least 22K higher than that of starting and reaches at least 343K (70°C).
3. DTC operating condition
 - (a) If it is "none", it can be understood as the operating status of all ECU, including the operation after turning the ENGINE START STOP switch OFF.



Diagnostic Trouble Code (DTC) Chart

Hint:

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

No.	DTC	Description
1	P000A 00	Camshaft Control Slow Response (Inlet)
2	P000A 77	Camshaft Control Target Error (Inlet)
3	P000B 00	Camshaft Control Slow Response (Outlet)
4	P000B 77	Camshaft Control Target Error (Outlet)
5	P0010 13	Control Circuit of Camshaft Control Valve (Inlet)
6	P0012 00	Inlet Camshaft not in Locking Position during Start
7	P0013 13	Control Circuit of Camshaft Control Valve (Outlet)
8	P0015 00	Outlet Camshaft not in Locking Position during Start
9	P0016 29	Npl Error for Alignment between Camshaft (Inlet) and Crankshaft
10	P0016 22	Retard Error for Alignment between Camshaft (Inlet) and Crankshaft
11	P0016 21	Advance Error for Alignment between Camshaft (Inlet) and Crankshaft
12	P0016 76	Crankshaft Position - Camshaft (Inlet) Installation Error
13	P0016 78	Crankshaft Position - Camshaft (Inlet) Position Error
14	P0017 76	Crankshaft Position - Camshaft (Outlet) Installation Error
15	P0017 78	Crankshaft Position - Camshaft (Outlet) Position Error
16	P0018 29	Npl Error for Alignment Between Camshaft (Outlet) and Crankshaft
17	P0018 22	Retard Error for Alignment Between Camshaft (Outlet) and Crankshaft
18	P0018 21	Advance Error for Alignment between Camshaft (Outlet) and Crankshaft
19	P0030 13	O2 Sensor Heater Control Circuit Open (Upstream of the Catalyzer)
20	P0031 11	O2 Sensor Heater Control Circuit Low (Upstream of the Catalyzer)
21	P0032 12	O2 Sensor Heater Control Circuit High (Upstream of the Catalyzer)
22	P0033 13	Dump Valve Control Circuit Open
23	P0034 11	Dump Valve Control Circuit Low
24	P0035 12	Dump Valve Control Circuit High
25	P0036 13	O2 Sensor Heater Control Circuit Open (Downstream of the Catalyzer)
26	P0037 11	O2 Sensor Heater Control Circuit Low (Downstream of the Catalyzer)
27	P0038 12	O2 Sensor Heater Control Circuit High (Downstream of the Catalyzer)
28	P0053 1E	O2 Sensor Heater Resistance too Large (Upstream of the Catalyzer)
29	P0054 1E	O2 Sensor Heater Resistance too Large (Downstream of the Catalyzer)
30	P006D 00	Barometric Pressure Circuit Error
31	P006D 17	Barometric Pressure - Higher than Upper Limit Error
32	P006D 16	Barometric Pressure - Lower than Lower Limit Error
33	P0096 00	Air Temperature Sensor (after Throttle Valve) Circuit Performance Non-plausible
34	P0097 16	Air Temperature Sensor (after Throttle Valve) Circuit Low
35	P0098 17	Air Temperature Sensor (after Throttle Valve) Circuit High
36	P0105 28	Manifold Absolute Pressure Circuit No Change
37	P0106 00	Manifold Abs.Pressure Performance Non-plausible
38	P0107 11	Manifold Abs.Pressure Low Input
39	P0108 12	Manifold Abs.Pressure High Input
40	P0111 00	Intake Air Temp.Circ. Performance Non-plausible
41	P0112 16	Intake Air Temp.Circ. Low Input
42	P0113 17	Intake Air Temp.Circ. High Input

No.	DTC	Description
43	P0116 00	Engine Coolant Temp.Circ. Performance Non-plausible
44	P0117 16	Engine Coolant Temp.Circ. Low Input
45	P0118 17	Engine Coolant Temp.Circ. High Input
46	P0121 29	Throttle Pos.Sensor 1 Circ. Performance Non-plausible
47	P0122 16	Throttle Pos.Sensor 1 Circ. Low Input
48	P0123 17	Throttle Pos.Sensor 1 Circ. High Input
49	P0130 00	O2 Sensor Circ. Malfunction (Upstream of the Catalyzer)
50	P0131 16	O2 Sensor Circ. Low Voltage (Upstream of the Catalyzer)
51	P0132 17	O2 Sensor Circ. High Voltage (Upstream of the Catalyzer)
52	P0133 00	O2 Sensor Circ. Slow Response (Upstream of the Catalyzer)
53	P0134 00	O2 Sensor Circ. No Activity Detected (Upstream of the Catalyzer)
54	P0136 00	O2 Sensor Circ. Malfunction (Downstream of the Catalyzer)
55	P0137 16	O2 Sensor Circ. Low Voltage (Downstream of the Catalyzer)
56	P0138 17	O2 Sensor Circ. High Voltage (Downstream of the Catalyzer)
57	P0140 00	O2 Sensor Circ. No Activity Detected (Downstream of the Catalyzer)
58	P0170 00	Fuel Trim Malfunction
59	P0171 00	Fuel Trim System too Lean
60	P0172 00	Fuel Trim System too Rich
61	P0201 13	Cylinder 1 - Injector Circuit Error
62	P0202 13	Cylinder 2 - Injector Circuit Error
63	P0203 13	Cylinder 3 - Injector Circuit Error
64	P0204 13	Cylinder 4 - Injector Circuit Error
65	P0219 00	Engine Overspeed Condition
66	P0221 29	Throttle Position Sensor 2 Performance Non-plausible
67	P0222 16	Throttle Position Sensor 2 Performance Low Input
68	P0223 17	Throttle Position Sensor 2 Performance High Input
69	P0234 00	Turbo/Super Charger Overboost Condition
70	P0237 16	Turbocharger Boost Sensor (A) Circ. Low Input
71	P0238 17	Turbocharger Boost Sensor (A) Circ. High Input
72	P023A 00	Charge Air Cooler Coolant Pump Control Circuit
73	P023B 00	Charge Air Cooler Coolant Pump Control Circuit Low
74	P023C 00	Charge Air Cooler Coolant Pump Control Circuit High
75	P0243 13	Turbo/Super Charger Wastegate Solenoid Open
76	P0245 11	Turbo/Super Charger Wasteg.Solenoid Low
77	P0246 12	Turbo/Sup.Charger Wasteg.Solenoid High
78	P0261 11	Cylinder 1 - Injector Circuit Low
79	P0262 12	Cylinder 1 - Injector Circuit High
80	P0264 11	Cylinder 2 - Injector Circuit Low
81	P0265 12	Cylinder 2 - Injector Circuit High
82	P0267 11	Cylinder 3 - Injector Circuit Low
83	P0268 12	Cylinder 3 - Injector Circuit High
84	P0270 11	Cylinder 4 - Injector Circuit Low
85	P0271 12	Cylinder 4 - Injector Circuit High
86	P0299 00	Turbo/Super Charger Underboost
87	P0300 00	Misfire Detected
88	P0300 21	Random/Multiple Cylinder Misfire Detected (Over Emission Limit)
89	P0300 22	Random/Multiple Cylinder Misfire Detected (Harmful to Catalyst)
90	P0300 29	Random/Multiple Cylinder Misfire Detected (during First Statistic Cycle)



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No.	DTC	Description
91	P0301 00	Misfire Detected on Cylinder 1
92	P0301 21	Cylinder 1 Misfire Detected (over Emission Limit)
93	P0301 22	Cylinder 1 Misfire Detected (Harmful to Catalyst)
94	P0301 29	Cylinder 1 Misfire Detected (during First Statistic Cycle)
95	P0302 00	Misfire Detected on Cylinder 2
96	P0302 21	Cylinder 2 Misfire Detected (over Emission Limit)
97	P0302 22	Cylinder 2 Misfire Detected (Harmful to Catalyst)
98	P0302 29	Cylinder 2 Misfire Detected (during First Statistic Cycle)
99	P0303 00	Misfire Detected on Cylinder 3
100	P0303 21	Cylinder 3 Misfire Detected (over Emission Limit)
101	P0303 22	Cylinder 3 Misfire Detected (Harmful to Catalyst)
102	P0303 29	Cylinder 3 Misfire (during First Statistic Cycle)
103	P0304 00	Misfire Detected on Cylinder 4
104	P0304 21	Cylinder 4 Misfire Detected (over Emission Limit)
105	P0304 22	Cylinder 4 Misfire Detected (Harmful to Catalyst)
106	P0304 29	Cylinder 4 Misfire Detected (during First Statistic Cycle)
107	P0321 00	Crankshaft Signal Disturbance
108	P0322 00	EPM - Crankshaft Signal fault
109	P0327 00	Knock Sensor 1 Circuit Low
110	P0327 14	Knock Sensor 1 Circuit Low
111	P0327 16	Knock Sensor 1 Circ. Low Input
112	P0328 00	Knock Sensor 1 Circuit High
113	P0328 15	Knock Sensor 1 Circuit High
114	P0328 17	Knock Sensor 1 Circ. High Input
115	P0341 00	EPM - Camshaft signal fault
116	P0342 00	Camshaft Position Sensor (inlet) Circuit Low
117	P0343 00	Camshaft Position Sensor (Inlet) Circuit High
118	P0346 00	EPM - Camshaft2 signal fault
119	P0366 00	Camshaft Position Sensor (Outlet) Circuit Performance Non-plausible
120	P0367 00	Camshaft Position Sensor (Outlet) Circuit Low
121	P0368 00	Camshaft Position Sensor (Outlet) Circuit High
122	P0420 00	Catalyst Conversion Insufficient
123	P0444 13	Evaporative Emiss.System Purge Control Valve Circuit Open
124	P0458 16	Evaporative Emission System Purge Control Valve Circuit Low
125	P0458 11	Evaporative Emission System Purge Control Valve Circuit Low
126	P0459 17	Evaporative Emission System Purge Control Valve Circuit High
127	P0459 12	Evaporative Emission System Purge Control Valve Circuit High
128	P0480 13	Cooling Fan 1 Control Circuit error
129	P0481 13	Cooling Fan 2 Control Circuit error
130	P0501 00	Vehicle Speed Sensor Signal Fault
131	P0506 00	Idle Control System RPM Lower than Expected
132	P0507 00	Idle Control System RPM Higher than Expected
133	P0532 16	A/C Refrigerant Pressure Sensor Circuit Low
134	P0533 17	A/C Refrigerant Pressure Sensor Circuit High
135	P0537 16	A/C Evaporator Temperature Sensor Circuit Low
136	P0538 17	A/C Evaporator Temperature Sensor Circuit High
137	P0556 00	Non-plausible Error for Brake Booster Diagnosis
138	P0557 16	Brake Booster Pressure Sensor Circuit Low

No.	DTC	Description
139	P0558 17	Brake Booster Pressure Sensor Circuit High
140	P0560 00	Non-plausible Error of Battery Voltage
141	P0562 16	System Battery Voltage Too Low
142	P0563 17	System Voltage High
143	P0568 1C	Cruise Control
144	P0568 86	Cruise Control
145	P0568 81	Cruise Control
146	P0571 29	Brake Signal Synchronization Error
147	P0571 1C	Brake Light Signal Circuit Error
148	P0600 00	MSC/COM-Errors of the TLE8888
149	P0601 00	Safety Monitoring Function Error (ECU EEPROM error)
150	P0604 43	Internal Contr.Module RAM Error
151	P0605 43	Internal Contr.Module ROM error
152	P0606 96	AD Converter Monitoring Error
153	P0606 97	Function Monitoring: Fault of ECU ADC - Test Voltage
154	P0606 47	Monitoring Module Feedback Error
155	P0606 17	Reported Over Voltage of VDD5
156	P0606 16	Reported Under Voltage of VDD5
157	P0606 49	Monitoring Module Inquiry Error
158	P0606 48	Monitoring Fault Reaction Error
159	P0606 75	Shut off Path Test Error
160	P0606 91	Diagnostic Fault Check to Report
161	P0606 42	Safety Monitoring Function Error (ECU EEPROM error)
162	P0606 45	Visibility of Software Resets in DSM
163	P0606 94	Torque Monitoring Error in Level 2
164	P0606 92	Engine Speed Monitoring Error in Level 2
165	P0606 64	Load Signal, Wiring Harness or ECU Error
166	P0606 61	Ignition Angle Signal, Wiring Harness or ECU Error
167	P0606 67	ECU Fault Reaction Monitoring Error
168	P0606 1C	Throttle Signal, Wiring Harness or ECU Error
169	P0606 55	Variant Coding Monitoring Error
170	P0606 00	Safety Monitoring Fuel Cutoff Error
171	P0606 62	Pedal Signal Unplausibility Error in Level 2
172	P0606 63	Safety Monitoring Function Error (SSM System Monitoring Error)
173	P0615 13	Starter Relay Circuit Open
174	P0616 11	Starter Relay Circuit Low
175	P0617 12	Starter Relay Circuit High
176	P0627 13	Fuel Pump Control Circuit Open
177	P0628 11	Fuel Pump Control Circuit Low
178	P0629 12	Fuel Pump Control Circuit High
179	P0634 48	Over Temperature on T5V
180	P0634 00	Over Temperature on V5V
181	P0641 00	Error Tracker Output1
182	P0645 13	AC Clutch Relais Circuit Open
183	P0646 11	A/C Clutch Relay Control Circuit Low
184	P0647 12	A/C Clutch Relay Control Circuit High
185	P0650 11	Malfunction Indicator Lamp (MIL) Control Circuit Low
186	P0650 12	Malfunction Indicator Lamp (MIL) Control Circuit High



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No.	DTC	Description
187	P0650 13	Malfunction Indicator Lamp (MIL) Control Circuit Open
188	P0651 00	Error Tracker Output2
189	P0659 00	Over Voltage on V6V
190	P0688 91	Power Relay Sense Circuit Non-plausible error
191	P0688 92	Power Relay Sense Circuit Signal Error
192	P0691 11	Fan 1 Control Circuit Low
193	P0692 12	Fan 1 Control Circuit High
194	P0693 11	Fan 2 Control Circuit Low
195	P0694 12	Fan 2 Control Circuit High
196	P0700 00	Transmission Control System (MIL Request)
197	P0704 00	Clutch Switch Input Circuit Non-plausible
198	P081D 00	Neutral Input Circuit Error
198	P083F 00	Bottom Clutch Switch "A"/"B" Correlation
200	P1011 01	Diagnosis of Electrical Water Pump Control Circ.Error
201	P1009 7A	Leakage Detection Upstream the Throttle Valve
202	P1100 00	Engine Torque Control Adaption at Limit
203	P1101 00	System Voltage can not Fulfill Throttle Self Learning Condition
204	P1102 00	Throttle Limhome Position Self Learning Error
205	P1102 29	Throttle Lower Mechanic Stop Re-learning Error
206	P1103 00	Throttle Lower Mechanic Stop First Learning Error
207	P1104 00	Throttle Self Learning Condition not Fulfilled
208	P1106 00	Throttle Position Deviation Error
209	P1106 22	Throttle PID Adjustment Max Error
210	P1106 21	Throttle PID Adjustment Min Error
210	P1111 00	Return Spring Check Max Error
211	P1122 77	Torque Limitation when Throttle-valve Error Happen
212	P1130 00	Diagnosis of Brake Booster Pump Malfunction
213	P1131 17	Diagnosis of Brake Booster Pump Control Circuit High
214	P1132 16	Diagnosis of Brake Booster Pump Control Circuit Low
215	P1133 13	Diagnosis of Brake Booster Pump Control Circ.Open
216	P1137 17	Diagnosis of Pressure Sensor in Brake Booster Pump Circuit High
217	P1138 16	Diagnosis of Pressure Sensor in Brake Booster Pump Circuit Low
218	P1139 7A	Diagnosis of Pressure Sensor in Brake Booster Pump Leakage Detection
219	P130A 00	Cylinder Selective Fuel Cutoff Active due To Catalyst Damaging Misfire
220	P1386 00	Diagnostic Fault Check Knock Control Signal Evaluation
221	P1427 12	Diagnosis of Brake Booster Pump Control Circ.High
222	P1428 11	Diagnosis of Brake Booster Pump Control Circ.Low
223	P1429 13	Diagnosis of Brake Booster Pump Control Circ.Open
224	P1479 00	Non-plausible Error for Brake Booster Diagnosis
225	P1614 00	Immo Transferred Transponder Response was Corrupted
226	P1615 00	ECM Status Unknown
227	P1616 00	Authentication not OK
228	P1617 00	No Response from SIM during Challenge Period
229	P1618 00	Fail to Write EOL Confidential Data into EEPROM
230	P1619 00	ECM not Programed (Virgin State)
231	P1651 13	Service Vehicle Soon (SVS) Control Circuit
232	P1651 11	Service Vehicle Soon (SVS) Control Circuit low

No.	DTC	Description
233	P1651 12	Service Vehicle Soon (SVS) Control Circuit high
234	P1701 00	Power Train State Signal Wire Open
235	P1702 00	Bottom Clutch Switch error
236	P1700 00	Charge Air Cooler Coolant Pump Dry Run
237	P1703 00	Charge Air Cooler Coolant Pump Over Voltage
238	P1704 00	Charge Air Cooler Coolant Pump Over Current
239	P1705 00	Charge Air Cooler Coolant Pump Over Temperature
240	P1706 00	Charge Air Cooler Coolant Pump Stall
241	P1707 00	Charge Air Cooler Coolant Pump Under Voltage
242	P1708 00	Charge Air Cooler Coolant Pump Feedback Signal Error Circ.High
243	P1709 00	Charge Air Cooler Coolant Pump Feedback Signal Error Circ.Low
244	P2088 11	Control Circuit Low of Camshaft Control Valve (Inlet)
245	P2089 12	Control Circuit High of Camshaft Control Valve (Inlet)
246	P2090 11	Control Circuit Low of Camshaft Control Valve (Outlet)
247	P2091 12	Control Circuit High of Camshaft Control Valve (Outlet)
248	P2106 12	Throttle Power Stage Max Error
249	P2106 19	Throttle Power Stage Min Error
250	P2106 92	Throttle Power Stage Non-plausible Error
251	P2106 13	Throttle Power Stage Signal Error
252	P2106 29	Load Monitoring Error
253	P2122 16	Pedal Pos.Sensor 1 Circ. Low Input
254	P2123 17	Pedal Pos.Sensor 1 Circ. High Input
255	P2127 16	Pedal Pos.Sensor 2 Circ. Low Input
256	P2128 17	Pedal Pos.Sensor 2 Circ. High Input
257	P2138 00	Pedal Movement Check Error
258	P2138 29	Pedal Pos.Sensor 1/2 Unplausible
259	P2177 00	System Too Lean Off Idle
260	P2178 00	System Too Rich Off Idle
261	P2187 00	System Too Lean at Idle
262	P2188 00	System Too Rich at Idle
263	P2195 00	O2 Sensor Signal Stuck Lean (Upstream of the Catalyzer)
264	P2196 00	O2 Sensor Signal Stuck Rich (Upstream of the Catalyzer)
265	P2228 16	Barometric Pressure Low Input
266	P2229 17	Barometric Pressure High Input
267	P2261 00	Dump Valve - Mechanical error
268	P2270 00	O2 Sensor Signal Stuck Lean (Downstream of the Catalyzer)
269	P2271 00	O2 Sensor Signal Stuck Rich (Downstream of the Catalyzer)
270	P2600 13	Diagnosis of Electrical Water Pump Control Circ.Open
271	P2602 11	Diagnosis of Electrical Water Pump Control Circ.Low
272	P2603 12	Diagnosis of Electrical Water Pump Control Circ.high
273	P3406 13	Starter Relay1 Closed Stick Defect
274	P3050 00	Starter Relay1 Closed Stick Defect
275	P3052 00	Starter Relay1 Closed Stick Defect
276	P3054 00	Engine Blocked/Starter not Engaged
277	P3055 11	Starter State Line S_kl50r Short to UB
278	P3056 12	Starter State Line S_kl50r Short to UB
279	P3088 93	Starter Damaged or Wire Dropped
280	U0001 88	Error Busoff on CAN-bus



No.	DTC	Description
281	U0129 87	Lost Communication with ABS
282	U0104 87	Lost Communication with CCU (Cruise Control Module)
283	U0121 87	Lost Communication with ABS
284	U0126 87	Lost Communication with Steering Angle Sensor Module
285	U0140 00	Lost Communication with Body Control Module (Immo)
286	U0155 87	Lost Communication with Instrument Panel Cluster (IPC) Control Module
287	U0293 87	Lost Communication with HCU
288	U0140 87	Lost Communication with Body Control Module (BCM)
289	U0214 87	Lost Communication with Passive Entry Passive Start (PEPS)
290	U0101 87	Lost Communication with TCM

P000A Camshaft Control Slow Response (Inlet)

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

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

P000B Camshaft control Slow Response (outlet)

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

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

P0010 Control Circuit of Camshaft Control Valve (Inlet)

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

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



P0012 Inlet Camshaft not In Locking Position during Start

1. DTC operating condition
 - Camshaft self-learning state has been completed;
 - Engine running start time <1.5 s;
 - Engine oil temperature is in range of -40°C - 130°C;
 - Coolant temperature is in range of 0°C - 105°C;
 - Engine speed is in range of 600 and 6000 rpm;
 - ECU does not detect VVT intake control valve circuit fault.
2. DTC setting condition
 - (a) ECU detects that difference between intake VVT actual angle and default position angle is 10° crank angle.
3. Operation required for DTC setting
 - (a) After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Intake VVT phase regulator and oil control valve operating status (Blocked by dirt, stuck, oil pressure not completely relieved, lock pin invalid, etc.)	Yes	Perform necessary check, repair and maintenance
		No	Diagnostic Help

P0013 Control Circuit of camshaft control valve (outlet)

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

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

P0015 Outlet camshaft not in locking position during start

1. DTC operating condition
 - (a) Camshaft self-learning state has been completed;
 - (b) Engine running start time <1.5 s;
 - (c) Engine oil temperature is in range of -40°C - 130°C;
 - (d) Coolant temperature is in range of 0°C - 105°C;
 - (e) Engine speed is in range of 600 and 6000 rpm;
 - (f) ECU does not detect VVT exhaust control valve circuit fault.
2. DTC setting condition
 - (a) ECU detects that difference between exhaust VVT actual angle and VVT default locking angle is 25° crank angle.
3. Operation required for DTC setting
 - (a) After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - (a) Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - (b) Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Exhaust VVT phase regulator and oil control valve operating status (Blocked by dirt, stuck, oil pressure not completely relieved, lock pin invalid, etc.)	Yes	Perform necessary check, repair and maintenance
		No	Diagnostic Help

P0016 Npl error for alignment between camshaft (inlet) and crankshaft

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

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



P0018 Npl error for alignment between camshaft (outlet) and crankshaft

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

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

P0030 O2 Sensor Heater Control Circuit Open (upstream of the catalyzer)

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

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

P0031 O2 Sensor Heater Control Circuit Low (upstream of the catalyzer)

1. DTC operating condition
 - Engine is running;
 - Battery voltage is in range of 8~18 V.
2. DTC setting condition
 - Control terminal pin is short to ground (it is detected that voltage UCE of output terminal is 0 V with driver switch off).
3. Operation required for DTC setting

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

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

06**P0032 O2 Sensor Heater Control Circuit High (upstream of the catalyzer)**

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

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

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



P0036 O2 Sensor Heater Control Circuit Open (downstream of the catalyzer)

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

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

P0037 O2 Sensor Heater Control Circuit Low (downstream of the catalyzer)

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

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

P0038 O2 Sensor Heater Control Circuit High (downstream of the catalyzer)

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

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

06**P0053 O2 Sensor Heater Resistance too large (upstream of the catalyzer)**

1. DTC operating condition
 - (a) Exhaust temperature (ECU calculated value) of upstream oxygen sensor (front oxygen) is in range of 300 ~ 550 deg;
 - (b) Battery voltage is between 10 and 16 V steadily;
 - (c) Keep engine fuel supply;
 - (d) Ambient temperature is not less than -7 deg;
 - (e) No high temperature and high resistance failure P0134 (Recommended operating conditions: Vehicle can be operated at a lower vehicle speed (less than 50 km/h) when malfunction is reproduced. If the interval between two starts is short, it takes a long time to diagnose)
2. DTC setting condition
 - (a) ECU detects that internal resistance of upstream oxygen sensor heater exceeds threshold value (different exhaust temperatures correspond to different threshold values, MT is 1840 Ω ~13600 Ω , it indicates that upstream oxygen sensor heater internal resistance (equivalent resistance calculated by ECU) is improper, causing emission level higher than OBD limit.
3. Operation required for DTC setting
 - (a) Input malfunction memory once malfunction occurs;
 - (b) If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
 - (c) Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
 - (a) Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - (b) Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - (c) Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.



No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information.	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V.	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V.	Yes	Next
		No	Check wire harness and connector
5	Disconnect upstream oxygen sensor wire connector to remove upstream oxygen sensor. Place the oxygen sensor at room temperature to cool it down. Measure if resistance between sensor terminal No.4 interface (white, heater power source positive) and No.3 interface (white, heater power source grounded) is higher than 15 Ω with a multimeter when temperature of oxygen sensor cools down to room temperature ①.	Yes	Replace oxygen sensor
		No	Diagnostic Help

P0054 O2 Sensor Heater Resistance too large (downstream of the catalyzer)

1. DTC operating condition
 - (a) Exhaust temperature (ECU calculated value) of downstream oxygen sensor (front oxygen) is in range of 300 ~ 550 deg;
 - (b) Battery voltage is between 10 and 16 V steadily;
 - (c) Keep engine fuel supply;
 - (d) Ambient temperature is not less than -7 deg;
 - (e) No high temperature and high resistance failure P0140 (Recommended operating conditions: Vehicle can be operated at a lower vehicle speed (less than 50 km/h) when malfunction is reproduced. If the interval between two starts is short, it takes a long time to diagnose)
2. DTC setting condition
 - (a) ECU detects that internal resistance of downstream oxygen sensor heater exceeds threshold value (different exhaust temperatures correspond to different threshold values, MT is 4600 Ω ~16000 Ω , it indicates that downstream oxygen sensor heater internal resistance is improper.
3. Operation required for DTC setting
 - (a) Input malfunction memory once malfunction occurs;
 - (b) If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
 - (c) Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
 - (a) Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - (b) Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - (c) Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information.	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V.	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V.	Yes	Next
		No	Check wire harness and connector
5	Disconnect upstream oxygen sensor wire connector to remove upstream oxygen sensor. Place the oxygen sensor at room temperature to cool it down. Measure if resistance between sensor terminal No.4 interface (white, heater power source positive) and No.3 interface (white, heater power source grounded) is higher than 15 Ω with a multimeter when temperature of oxygen sensor cools down to room temperature.	Yes	Replace oxygen sensor
		No	Diagnostic Help

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

P0112 Intake Air Temp.Circ. Low Input

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

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



P0113 Intake Air Temp.Circ. High Input

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

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

P0116 Engine Coolant Temp.Circ. Performance Non-plausible

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

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

P0117 Engine Coolant Temp.Circ. Low Input

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

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



P0118 Engine Coolant Temp.Circ. High Input

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

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

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

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

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

P0122 Throttle Pos.Sensor 1 Circ. Low Input

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

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



P0123 Throttle Pos.Sensor 1 Circ. High Input

1. DTC operating condition
 - Ignition switch ON.
2. DTC setting condition
 - ECU detects that voltage of throttle position sensor 1 signal circuit is 4.629 V.
3. Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
 - After fault is repaired, SVS light will go off immediately;
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

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

P0130 O2 Sensor Circ. Malfunction (upstream of the catalyzer)

1. DTC operating condition
 - Battery voltage is higher than 11 V;
 - Engine is running;
 - Upstream oxygen sensor has been heated sufficiently (Time depends on operating conditions, recommended operating conditions: operated at a lower speed (less than 50 km/h) for more than 3 minutes);
 - No fuel injector DTCs P0201, P0202, P0203, P0204;
 - Air-fuel ratio closed loop control effect (enter closed loop mode when 30 seconds after starting generally).
2. DTC setting condition
 - ECU detects that downstream oxygen sensor signal voltage difference between heater on and off is higher than 2V for more than a certain times (4 times);
 - ECU detects that voltage of upstream oxygen sensor signal is between 0.6 and 1.2 V, but downstream oxygen sensor signal voltage is less than 0.1 V for more than a certain times (10 s);
 - ECU detects that voltage of upstream oxygen sensor signal is between 0.06 ~ 0.4 V, but downstream oxygen sensor signal voltage is higher than 0.5 V for more than a certain times (30 s).

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Check wire harness and connector
6	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECU terminal 2 wire (black, oxygen sensor signal wire) and 1 wire (gray, oxygen sensor signal grounded) is changed in range of 0 V-1 V.	Yes	Next
		No	Replace oxygen sensor
7	Start and keep vehicle idling until coolant temperature reaches normal value. Disconnect upstream oxygen sensor connector. Measure if oxygen sensor terminal No. 3 wire (white, heater power grounded) and No. 2 wire (black, oxygen sensor signal wire) are short circuit.	Yes	Replace oxygen sensor
		No	Diagnostic Help
8	Connect upstream oxygen sensor connector properly, repeat step 5-6 and check if voltage signal is changed in range of 0.44 V - 0.46 V and 0 V - 1 V respectively.	Yes	End
		No	Diagnostic Help



P0131 O2 Sensor Circ. Low Voltage (upstream of the catalyzer)

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Check wire harness and connector
4	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECU terminal 2 wire (black, oxygen sensor signal wire) and 1 wire (gray, oxygen sensor signal grounded) is changed in range of 0 V-1 V.	Yes	Next
		No	Replace oxygen sensor
5	Disconnect upstream oxygen sensor connector and measure if sensor terminal 1 wire (gray, oxygen sensor signal grounded) and 2 wire (black, oxygen sensor signal wire) are short circuit with a multimeter.	Yes	Replace oxygen sensor
		No	Diagnostic Help
6	Connect upstream oxygen sensor connector properly, repeat step 3-4 and check if voltage signal is changed in range of 0.44 V - 0.46 V and 0 V - 1 V respectively	Yes	End
		No	Diagnostic Help

P0132 O2 Sensor Circ. High Voltage (upstream of the catalyzer)

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

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No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Replace oxygen sensor
6	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECU terminal B wire (black, oxygen sensor signal wire) and A wire (gray, oxygen sensor signal grounded) is changed in range of 0 V-1 V.	Yes	Next
		No	Replace oxygen sensor
7	Disconnect upstream oxygen sensor connector and measure if there is short circuit between sensor terminal No. 4 wire (white, heater power source positive) and No. 2 wire (black, oxygen sensor signal wire) with a multimeter.	Yes	Replace oxygen sensor
		No	Next
8	Connect upstream oxygen sensor connector properly, repeat step 5-6 and check if voltage signal is changed in range of 0.44 V- 0.46 V and 0 V - 1 V respectively.	Yes	End
		No	Diagnostic Help



P0133 O2 Sensor Circ. Slow Response (upstream of the catalyzer)

1. DTC operating condition
 - Engine speed is: for MT: 1360 - 2520 rpm;
 - Engine load is: for MT: 21.75 - 57.75;
 - Temperature of upstream oxygen sensor is higher than 440 deg;
 - Keep engine fuel supply;
 - No high load on carbon canister;
 - Heating diagnosis is completed and no other malfunctions are detected (mainly for fuel supply system malfunction, misfire malfunction (P2177, P2178, P0300~P0304, etc.)) Recommended operating condition: Keep the engine stable at 5th gear (70 km/h) for 5 to 10 minutes, especially for load (accelerator pedal).
2. DTC setting condition
 - ECU detects that upstream oxygen sensor cycle delay time exceeds a certain value (0.9 s), which indicates deterioration for upstream oxygen sensor, causing emission level exceeds OBD limiting value.
3. Operation required for DTC setting
 - Input malfunction memory once malfunction occurs;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Replace upstream oxygen sensor and connect wire harness connector properly. Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is between 0.44 V and 0.46 V.	Yes	Next
		No	Replace oxygen sensor
4	Start and keep vehicle idling until coolant temperature reaches normal value. Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is between 0 V and 1 V.	Yes	Diagnostic Help
		No	Replace oxygen sensor

P0134 O2 Sensor Circ. No Activity Detected (upstream of the catalyzer)

1. DTC operating condition
 - Battery voltage is higher than 11 V;
 - Engine is running;
 - Upstream oxygen sensor has been heated sufficiently;
 - Air-fuel ratio closed loop control effect;
 - No fuel injector malfunction.
2. DTC setting condition
 - ECU detects that upstream oxygen sensor cycle delay time exceeds a certain value (0.9 s), which indicates deterioration for upstream oxygen sensor, causing emission level exceeds OBD limiting value.
3. Operation required for DTC setting
 - ECU detects that voltage of upstream oxygen sensor signal is between 0.4 and 0.6 V for more than a certain period of time (5 s after heated sufficiently);
 - (Or) ECU detects that voltage of upstream oxygen sensor and voltage of downstream oxygen sensor are both higher than 0.2V for more than a certain period of time (3.1 s) when the oil is cutting;
 - (Or) When the exhaust temperature is higher than 600 degrees, the internal resistance of the oxygen sensor is greater than 20000 ohm.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

06

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, check connection of No.2 wire (black, oxygen sensor signal wire) for open circuit with a multimeter	Yes	Check wire harness and connector
		No	Next
6	Do not disconnect oxygen sensor connector, check connection of No.1 wire (gray, oxygen sensor signal grounded) for open circuit with a multimeter	Yes	Check wire harness and connector
		No	Next
7	Disconnect upstream oxygen sensor wire connector to remove upstream oxygen sensor. Place the oxygen sensor at room temperature to cool it down. Measure if resistance between sensor terminal No.4 interface (white, heater power source positive) and No.3 interface (white, heater power source grounded) is higher than 15 Ω with a multimeter when temperature of oxygen sensor cools down to room temperature.	Yes	Replace oxygen sensor
		No	Next
8	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Replace oxygen sensor



No.	Operation Step	Test Result	Subsequent Step
9	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between upstream oxygen sensor wire ECU terminal 2 wire (black, oxygen sensor signal wire) and 1 wire (gray, oxygen sensor signal grounded) is changed in range of 0 V-1 V.	Yes	Next
		No	Replace oxygen sensor
10	Connect upstream oxygen sensor connector properly, repeat steps 8 and 9 and check if voltage signal changes between 0.44 V and 0.46 V, 0 V - 1 V respectively.	Yes	End
		No	Diagnostic Help

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

P0136 O2 Sensor Circ. Malfunction (downstream of the catalyzer)

06

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire [black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Check wire harness and connector

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

P0137 O2 Sensor Circ. Low Voltage (downstream of the catalyzer)

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Check wire harness and connector
4	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is changed in range of 0 V - -1 V.	Yes	Next
		No	Replace oxygen sensor



No.	Operation Step	Test Result	Subsequent Step
5	Disconnect downstream oxygen sensor connector and measure if sensor terminal 1 wire (gray, oxygen sensor signal grounded) and 2 wire (black, oxygen sensor signal wire) are short circuit with a multimeter.	Yes	Replace oxygen sensor
		No	Diagnostic Help
6	Connect downstream oxygen sensor connector properly, repeat steps 3-4 and check if voltage signal changes between 0.44 V and 0.46 V, 0 V and 1 V respectively.	Yes	End
		No	Diagnostic Help

P0138 O2 Sensor Circ. High Voltage (downstream of the catalyzer)

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Check wire harness and connector
6	Start and keep vehicle idling until coolant temperature reaches normal value. Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is changed in range of 0 V - 1 V.	Yes	Next
		No	Replace oxygen sensor

No.	Operation Step	Test Result	Subsequent Step
7	Start and keep vehicle idling until coolant temperature reaches normal value. Disconnect downstream oxygen sensor connector, measure if oxygen sensor terminal No.3 wire (white, heater power grounded) and No.2 wire (black, oxygen sensor signal wire) are short circuit.	Yes	Replace oxygen sensor
		No	Diagnostic Help
8	Connect downstream oxygen sensor connector properly, repeat steps 5-6 and check if voltage signal changes between 0.44 V and 0.46 V, 0 V and 1 V respectively.	Yes	End
		No	Diagnostic Help

P0140 O2 Sensor Circ. No Activity Detected (downstream of the catalyzer)

- DTC operating condition
 - Battery voltage is higher than 11 V;
 - Engine is running;
 - Upstream oxygen sensor has been heated sufficiently;
 - Exhaust temperature of rear oxygen is lower than 800deg;
 - 2nd air or carbon canister diagnosis not operated.
- DTC setting condition
 - ECU detects that voltage of downstream oxygen sensor signal is between 0.4 and 0.5 V for more than a certain period of time (600 s);
 - (Or) When the exhaust temperature is higher than 600 degrees, the internal resistance of the oxygen sensor is greater than 40000 ohm.
- Operation required for DTC setting
 - Input malfunction memory once malfunction occurs;
 - If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
 - Diagnostic tester will be visible.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of downstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector, check connection of No.2 wire (black, oxygen sensor signal wire) for open circuit with a multimeter	Yes	Check wire harness and connector
		No	Next
6	Do not disconnect oxygen sensor connector, check connection of No.1 wire (gray, oxygen sensor signal grounded) for open circuit with a multimeter	Yes	Check wire harness and connector
		No	Next



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

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

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

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Open circuit in corresponding fuel injector circuit	Yes	Repair, replace wire harness or fuel injector
		No	Next
3	Open circuit or fuel injector damage in corresponding fuel injector power supply terminal	Yes	Repair, replace wire harness or fuel injector
		No	Next

No.	Operation Step	Test Result	Subsequent Step
4	Open circuit or internal circuit damage in fuel injector control pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0219 Engine Overspeed Condition

- DTC operating condition
 - None.
- DTC setting condition
 - The ECU monitored the engine speed > 7000 rpm.
- Operation required for DTC setting
 - No light comes on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Is the engine speed increased artificially beyond the maximum safe speed?	Yes	Clear DTCs. End.
		No	Next
2	Accelerator pedal is stuck in the position with large opening angel, and cannot return to initial position	Yes	Check and repair accelerator pedal
		No	Next
3	Throttle is stuck in the position with large opening angel, and cannot close	Yes	Check and repair throttle
		No	Next
4	Check if speed sensor and speed calculation are correct	Yes	Correct error
		No	Diagnostic Help

P0221 Throttle Position Sensor 2 Performance Non-plausible

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

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect



No.	Operation Step	Test Result	Subsequent Step
2	Connect a diagnostic tester and adapter, turn ignition switch to ON; clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
3	Depress accelerator pedal slowly until throttle is fully open, observe if value of item "Absolute Throttle Opening Angle" in data flow increases to about 95%-100% as the throttle opening angle increases	Yes	Next
		No	Proceed to step 4
4	Remove the connector from throttle position sensor on wire harness, check if resistance of throttle circuit 2 signal is in proper range	Yes	Repair or replace wire harness
		No	Next
5	Remove the connector from throttle position sensor on wire harness, check if resistance between throttle circuit 2 signal and other signals is within proper range	Yes	Replace throttle
		No	Repair or replace wire harness
6	Clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0222 Throttle Position Sensor 2 Performance Low Input

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

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

P0223 Throttle Position Sensor 2 Performance High Input

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

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

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

1. DTC operating condition
 - Engine is running;
 - Battery voltage is in range of 8~18 V.
2. DTC setting condition
 - Control terminal pin short to ground;
 - (P0261: It is detected that voltage UCE of output terminal is 0 V with driver switch off);
 - (P0264: It is detected that voltage UCE of output terminal is 0 V with driver switch off);
 - (P0267: It is detected that voltage UCE of output terminal is 0 V with driver switch off);
 - (P0270: It is detected that voltage UCE of output terminal is 0 V with driver switch off).
3. Operation required for DTC setting
 - If the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.



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

P0262 Cylinder 1 - Injector Circuit High P0265 Cylinder 2 - Injector Circuit High P0268 Cylinder 3 - Injector Circuit High P0271 Cylinder 4 - Injector Circuit High

- DTC operating condition
 - Engine is running;
 - Battery voltage is in range of 8~18 V.
- DTC setting condition
 - Control terminal pin short to power supply;
 - (P0262: It is detected that voltage UCE of output terminal is 12 V with driver switch on);
 - (P0265: It is detected that voltage UCE of output terminal is 12 V with driver switch on);
 - (P0268: It is detected that voltage UCE of output terminal is 12 V with driver switch on);
 - (P0271: It is detected that voltage UCE of output terminal is 12 V with driver switch on).
- Operation required for DTC setting
 - If the fault is detected in 3 consecutive driving cycles, MIL light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

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

P0300 Misfire detected

- DTC operating condition
 - Engine speed is in range of 560-6000 rpm steadily;
 - Intake temperature is not less than -28°C;
 - Engine load is not less than zero torque (MIN) load line;
 - Keep engine fuel supply;
 - Faulty circuit is not detected;
 - Torque intervention is not activated (torque intervention is activated when there are torque requirements for driveability, TCU and ESP).
- DTC setting condition
 - ECU detects that changes of crankshaft acceleration caused by misfire, it indicates that misfire is sufficient to cause emission level exceeds OBD limiting value or causing damage to catalytic converter.
- Operation required for DTC setting
 - Input malfunction memory once malfunction occurs;
 - For misfire fault which will cause damage to catalytic converter, MIL light will flash immediately to inform driver;

- For the misfire fault that may cause the deterioration of emission, if the relative level of misfire is fully detected in 3 consecutive driving cycles, then MIL light will come on;
 - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
- Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if there is any DTC related to injector	Yes	Go to corresponding fuel injector DTCs
		No	Go to single cylinder misfire fault DTCs which had been output

P0301 Misfire detected on cylinder 1 P0302 Misfire detected on cylinder 2 P0303 Misfire detected on cylinder 3 P0304 Misfire detected on cylinder 4

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- DTC operating condition
 - Engine speed is in range of 560-6000 rpm steadily;
 - Intake temperature is not less than -28°C;
 - Engine load is not less than zero torque (MIN) load line;
 - Keep engine fuel supply;
 - Faulty circuit is not detected;
 - Torque intervention is not activated (torque intervention is activated when there are torque requirements for driveability, TCU and ESP).
- DTC setting condition
 - ECU detects that changes of crankshaft acceleration caused by misfire, it indicates that misfire is sufficient to cause emission level exceeds OBD limiting value or causing damage to catalytic converter.
- Operation required for DTC setting
 - Input malfunction memory once malfunction occurs;
 - For misfire fault which will cause damage to catalytic converter, MIL light will flash immediately to inform driver;
 - For the misfire fault that may cause the deterioration of emission, if the relative level of misfire is fully detected in 3 consecutive driving cycles, then MIL light will come on;
 - Diagnostic tester will be visible.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Check if there is any DTC related to corresponding cylinder and injector	Yes	Go to DTCs related to corresponding cylinder injector
		No	Next
2	Connector looseness or separation	Yes	Reconnect
		No	Next
3	Check if there is open circuit or short circuit to power source in ignition coil signal terminal	Yes	Repair or replace wire harness
		No	Next
4	Check if there is open circuit or short circuit to ground in ignition coil power supply terminal	Yes	Repair or replace wire harness
		No	Next
5	Check if there is open circuit or short circuit to power source in ignition coil grounded terminal	Yes	Repair or replace wire harness
		No	Next



No.	Operation Step	Test Result	Subsequent Step
6	Check ignition coil for malfunction	Yes	Replace ignition coil
		No	Next
7	Check if spark plug is abnormal	Yes	Replace spark plug
		No	Next
8	Open circuit or internal circuit damage in ignition coil control pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0322 EPM - Crankshaft signal fault

- DTC operating condition
 - Start vehicle.
- DTC setting condition
 - ECU detects that rotation speed is abnormal for several times (about 20 times, it only means cranking instead of starting for 20 times).
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs. After the DTCs are cleared, the fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or separation	Yes	Reconnect
		No	Next
2	Open circuit in speed sensor signal terminal	Yes	Repair or replace wire harness or sensor
		No	Next
3	Sensor signal terminal pin is short to power source or ground, or short circuit between pins	Yes	Repair wire harness
		No	Next
4	Sensor is damaged	Yes	Replace sensor
		No	Next
5	Pin corresponding to speed sensor signal on ECU fault	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0327 Knock Sensor 1 Circuit Low

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

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

P0328 Knock Sensor 1 Circuit High

- DTC operating condition
 - Load is greater than 40%;
 - Coolant temperature is higher than 40°C;
 - Speed is more than 2600 rpm;
 - Cylinder 1 identification is valid.
- DTC setting condition
 - Knock identification reference voltage in 30 consecutive cycles is higher than threshold value which is 15~150 V. Threshold values vary with different rotation speeds.
- Operation required for DTC setting
 - Ignition angle is delayed by 7.5 deg within safety angle;
 - After 3 driving cycles, MIL light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Knock identification reference voltage in 30 consecutive cycles is higher than threshold value;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

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

P0341 EPM - Camshaft signal fault

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



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

P0346 EPM - Camshaft2 signal fault

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

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

P0420 Catalyst conversion insufficient

- DTC operating condition
 - Engine speed is in range of 1360 and 2520 rpm;
 - Engine load is in range of 22.5 and 48%/ (for MT: 21.75 - 57.75) steadily;
 - Catalytic converter temperature is in range of 500 - 720 deg steadily;
 - Ambient temperature is not less than -10°C;
 - Keep engine fuel supply;
 - No high load on carbon canister;
 - Oxygen sensor and misfire malfunctions are not detected (A: P0140, P2177, P2178, P0300 ~ P0304, etc.)
- DTC setting condition
 - ECU detects that aging coefficient of catalytic converter exceeds a certain value (0.2), which indicates deterioration for catalytic converter, causing emission level exceeds OBD limiting value.
- Operation required for DTC setting
 - Input malfunction memory once malfunction occurs;
 - If the fault is detected in 3 consecutive driving cycles, MIL light will come on;
 - Diagnostic tester will be visible.

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check exhaust system for leakage, gasket for damage	Yes	Repair leaking area
		No	Next
4	Replace the catalytic converter. Check if malfunction reappears after returning vehicle to customer	Yes	Diagnostic Help
		No	End

P0444 Evaporativ Emiss.System Purge Control Valve Circuit Open

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

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

P0458 Evaporative Emission System Purge Control Valve Circuit Low

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



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

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

P0459 Evaporative Emission System Purge Control Valve Circuit High

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

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

P0480 Cooling Fan 1 Control Circuit Error

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

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

P0501 Vehicle Speed Sensor signal fault

- DTC operating condition
 - Fuel cut-off signal activation (coast and fuel cut-off for 5 seconds or more when vehicle speed is more than 20 km/h);
 - Coolant temperature is 64.5°C;
 - Engine speed is between 1520 rpm and 4000 rpm.
- DTC setting condition
 - Malfunction is output when vehicle speed signal is lower than 5 km/h.
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Sensor installation location is improper or separation	Yes	Reinstall
		No	Next
2	Sensor connector looseness or poor contact	Yes	Reconnect
		No	Next
3	Check if there is short circuit to ground or open circuit in vehicle speed signal terminal	Yes	Repair wire harness
		No	Next
4	Vehicle speed sensor is damaged	Yes	Replace sensor
		No	Next
5	Short circuit to ground, open circuit or internal circuit damage in vehicle speed sensor pin corresponding to ECU terminal	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0506 Idle Control System RPM Lower than Expected

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



4. Conditions for malfunction indicator light off / DTC clearing

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

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

P0507 Idle Control System RPM Higher than Expected

1. DTC operating condition

- Carbon canister is not in high scour rate;
- Engine is idling;
- Vehicle speed sensor has been inspected and has no fault (coast the vehicle and cut off the fuel for 5 seconds or more when vehicle speed is more than 20 km/h);
- Vehicle speed is 0;
- Plateau correction factor is higher than 0.703;

2. DTC setting condition

- Difference between static target idle speed and actual speed is 100 rpm;
- Idle control integral part reaches maximum value;

3. Operation required for DTC setting

- After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.

4. Conditions for malfunction indicator light off / DTC clearing

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

No.	Operation Step	Test Result	Subsequent Step
1	Check if electronic throttle is stuck in larger open position due to ice or oil	Yes	Repair or replace electronic throttle
		No	Next
2	Check if system is air leaked, fuel injector is leaked, fuel supply pressure is too high	Yes	Perform necessary repair
		No	Diagnostic Help

P0532 A/C Refrigerant Pressure Sensor Circuit Low

1. DTC operating condition

- Starting is completed.

2. DTC setting condition

- A/C pressure sensor signal voltage is lower than 0.1 V.

3. Operation required for DTC setting

- After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.

4. Conditions for malfunction indicator light off / DTC clearing

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

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

P0560 Non-plausible error of battery voltage

- DTC operating condition
 - None.
- DTC setting condition
 - ECU detects that ADC value of battery voltage is lower than 2.5 V.
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "OFF". Measure battery voltage with a multimeter and check if it is too low	Yes	Next
2	Check if there are open circuits in all pins on ECU which connected with battery or main relay	Yes	Repair wire harness
		No	Next
3	Check engine wire grounded point for malfunction	Yes	Repair wire harness
		No	Next
4	Battery electric leakage or damage	Yes	Replace battery
		No	Next
5	Alternator malfunction	Yes	Repair alternator
		No	Diagnostic Help

P0562 System Voltage Low

- DTC operating condition
 - More than 180 second has elapsed after starting;
- DTC setting condition
 - ECU detects that ADC value of battery voltage is lower than 10.02V.
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.



No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "OFF". Measure battery voltage with a multimeter and check if it is too low	Yes	Next
2	Check if there are open circuits in all pins on ECU which are connected with battery or main relay	Yes	Repair wire harness
		No	Next
3	Check engine wire grounded point for malfunction	Yes	Repair wire harness
		No	Next
4	Alternator regulator malfunction	Yes	Repair regulator
		No	Next
5	Battery electric leakage or damage	Yes	Replace battery
		No	Next
6	Alternator malfunction	Yes	Repair alternator
		No	Diagnostic Help

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P0563 System Voltage High

- DTC operating condition
 - Vehicle speed > 25km/h;
 - More than 180 second has elapsed after starting.
- DTC setting condition
 - ECU detects that ADC value of battery voltage is higher than 17.02 V.
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "OFF". Measure battery voltage with a multimeter and check if it is too high	Yes	Next
2	Check engine wire grounded point for malfunction	Yes	Repair wire harness
		No	Next
3	Alternator regulator malfunction, motor power generation cannot be controlled effectively	Yes	Repair regulator
		No	Diagnostic Help

P0571 Brake Signal Synchronization Error or Brake Light Signal Circuit Error

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

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

P0604 Internal contr.module RAM error

- DTC operating condition
 - Ignition switch ON.
- DTC setting condition
 - ECU detects internal malfunction in RAM.
- Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.
- Conditions for malfunction indicator light off / DTC clearing
 - After fault is repaired, SVS light will go off immediately;
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
2	Clear DTCs and confirm if this malfunction is a stable state malfunction again	Yes	Next
		No	End
3	Replace with new ECU to check if malfunction reoccurs	/	Next
4	Turn ENGINE START STOP switch to ON, and wait for 1 minute to finish the throttle self-learning. Then start engine and depress accelerator pedal for several times in neutral to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End



P0605 Internal contr.module ROM error

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
2	Clear DTCs and confirm if this malfunction is a stable state malfunction again	Yes	Next
		No	End
3	Replace with new ECU to check if malfunction reoccurs	/	Next
4	Turn ENGINE START STOP switch to ON, and wait for 1 minute to finish the throttle self-learning. Then start engine and depress accelerator pedal for several times in neutral to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0606 Safety monitoring fuel cutoff error

1. DTC operating condition
 - (a) Ignition switch ON (Internal subdivision faults of corresponding ECU):
 - Throttle body signal, wire harness or ECU malfunction;
 - Morphing code monitoring malfunction;
 - 2nd layer accelerator pedal signal reasonable malfunction;
 - Close path test malfunction;
 - AD converter monitoring malfunction.
 - (b) Engine is running (Internal subdivision faults of corresponding ECU):
 - Safe monitoring oil cut-off malfunction;
 - Monitoring module feedback malfunction;
 - Monitoring wrongly responds malfunction;
 - Monitoring module inquiry malfunction;
 - Ignition angle signal, wire harness or ECU malfunction;
 - Load signal, wire harness or ECU malfunction;
 - ECU wrongly responds monitoring malfunction;
 - 2nd layer engine speed monitoring malfunction.
 - (c) Engine speed is 1200 rpm (Internal subdivision faults of corresponding ECU):
 - 2nd layer torque monitoring malfunction.
2. DTC setting condition
 - ECU monitors internal faults (ECU internal faults) - except for subdivision DTCs: other subdivision DTCs except for throttle body signal, wire or ECU faults;

- ECU monitors internal faults (throttle body signal, wire or ECU faults) - subdivision DTCs: throttle body signal, wire or ECU faults.
3. Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.
 4. Conditions for malfunction indicator light off / DTC clearing
 - After fault is repaired, SVS light will go off immediately;
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
2	Clear DTCs and confirm if this malfunction is a stable state malfunction again	Yes	Next
		No	End
3	Replace with new ECU to check if malfunction reoccurs	/	Next
4	Turn ENGINE START STOP switch to ON, and wait for 1 minute to finish the throttle self-learning. Then start engine and depress accelerator pedal for several times in neutral to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P0627 Fuel Pump Control Circuit Open

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Open circuit in fuel pump relay control circuit	Yes	Repair wire harness
		No	Next
3	Open circuit in fuel pump relay control circuit power supply terminal	Yes	Repair wire harness
		No	Next
4	Fuel pump relay fuse blown or damaged	Yes	Repair relay
		No	Next
5	Open circuit or internal circuit damage in fuel pump control pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help



P0628 Fuel Pump Control Circuit Low

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

No.	Operation Step	Test Result	Subsequent Step
1	Fuel pump relay control circuit is short to ground	Yes	Repair wire harness
		No	Next
5	Fuel pump control pin corresponding to ECU terminal short to ground	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0629 Fuel Pump Control Circuit High

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

No.	Operation Step	Test Result	Subsequent Step
1	Fuel pump relay control circuit short to power source	Yes	Repair wire harness
		No	Next
5	Fuel pump control pin corresponding to ECU terminal short to power source	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0645 AC Clutch Relais Circuit Open

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

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

P0646 A/C Clutch Relay Control Circuit Low

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

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

P0647 A/C Clutch Relay Control Circuit High

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



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

P0688 Power Relay Sense Circuit Non-plausible Error

- DTC operating condition
 - Battery voltage is normal (internal subdivision faults of corresponding ECU: improper output voltage of main relay);
 - Battery voltage is normal and main relay close test command (internal subdivision faults of corresponding ECU: output voltage signal faults of main relay)
- DTC setting condition
 - ECU detects that voltage ADC (analog signal converts to digital signal value) behind main relay is lower than 3 V (internal subdivision faults of corresponding ECU: output voltage improper of main relay)
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on;
 - ECU detects that voltage ADC (analog signal converts to digital signal value) behind main relay is 3 V (internal subdivision faults of corresponding ECU: output voltage signal faults of main relay).
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Main relay looseness	Yes	Reconnect
		No	Next
2	Relay fuse blown or damaged	Yes	Repair, replace main relay
		No	Next
3	Battery voltage is too low due to electric leakage, insufficient electrolyte, damage, etc.	Yes	Charge or repair, replace battery
		No	Next
4	Alternator or regulator damaged	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0691 Fan 1 Control Circuit Low

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

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

P0692 Fan 1 Control Circuit High

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

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

P0704 Clutch Switch Input Circuit Non-plausible

- DTC operating condition
 - Vehicle speed is higher than 50 km/h;
 - The interval between two gear shift is greater than 4 seconds;
 - The absolute value of the calculated gear change is 1.
- DTC setting condition
 - The number of shifts calculated by ECU is more than 20 times, and the number of changes in the clutch switch signal is less than 2 times.
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Clutch switch signal terminal pin open circuit or short circuit to ground	Yes	Repair wire harness
		No	Next
2	Clutch switch signal terminal pin corresponding to ECU terminal open circuit or short circuit to ground	Yes	Inspect and repair ECU
		No	Diagnostic Help



P1100 Engine Torque Control Adaption at Limit

1. DTC operating condition
 - Engine speed > 1200 rpm
2. DTC setting condition
 - ECU detects that torque is limited (driver needs the torque that exceeds the 1st layer monitoring torque calculated by ECU internal model) for more than 10 minutes.
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
2	Clutch switch signal terminal pin open circuit or short circuit to ground	Yes	Step 3
		No	Next
3	Clutch switch signal terminal pin corresponding to ECU terminal open circuit or short circuit to ground	Yes	Inspect and repair ECU
		No	End
4	Turn ENGINE START STOP switch to ON, and wait for 1 minute to finish the throttle self-learning. Then start engine and depress accelerator pedal for several times in neutral to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P1101 System Voltage can not Fulfill Throttle Self Learning Condition

1. DTC operating condition
 - Ignition switch ON.
2. DTC setting condition
 - Battery voltage is lower than 10 V during throttle self-learning.
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Measure if battery voltage is lower than 10 V	Yes	Recharge or replace battery
		No	Next
2	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
3	Clear DTCs, turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Observe if DTCs are reproduced	Yes	Recharge or replace battery
		No	System is normal

P1102 Throttle Limphome Position Self Learning Error

1. DTC operating condition
 - Ignition switch ON.
2. DTC setting condition
 - Improper throttle limp position (limp position exceeds [1.8%-13%]) signal is detected when throttle self-learning (Internal subdivision faults of corresponding ECU: throttle limp position self-learning fault).
 - Improper throttle mechanism bottom dead center signal is detected when throttle self-learning is performed again. [Voltage of signal 1 is out of range (0.212~0.865 V) and voltage of signal 2 are out of range (4.142~4.841 V) at bottom dead center] (Internal subdivision faults of corresponding ECU: throttle mechanism bottom dead center self-learning again fault).
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
2	Clear DTCs	/	Next
3	Turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P1103 Throttle Lower Mechanic Stop First Learning Error

1. DTC operating condition
 - Ignition switch ON;
 - Initial ECU self-learning.
2. DTC setting condition
 - Improper throttle lower limit position [Voltage of signal 1 is out of range (0.212~0.865 V) and voltage of signal 2 are out of range (4.142~4.841 V) at bottom dead center] is detected when initial ECU self-learning is performed.
3. Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
 - After fault is repaired, SVS light will go off immediately;
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.



No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
2	Clear DTCs	/	Next
3	Turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Observe if DTCs are reproduced	Yes	Next
		No	End
4	Check if the following self-learning conditions are met at the same time, as follows: Engine intake temperature is 5°C, 100.5°C > engine coolant temperature 5°C Engine speed ≤ 250 rpm Vehicle speed = 0. Battery voltage is 10 V Accelerator pedal opening angle < 14.9%	Yes	Next
		No	To meet all self-learning conditions
5	Clear DTCs, then turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Observe if DTCs are reproduced	Yes	Next
		No	End
6	Remove the connector from throttle position sensor on wire harness, check if there is open circuit or short circuit between each signal of throttle	Yes	Repair or replace wire harness
		No	Replace throttle
7	Clear DTCs, turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P1104 Throttle self learning condition not fulfilled

- DTC operating condition
 - Ignition switch ON.
- DTC setting condition
 - Other conditions of throttle (DVE) self-learning do not meet, all conditions as follow:
 - Engine coolant temperature is 5°C < 100°C;
 - Intake temperature is 5°C;
 - Accelerator pedal opening angle is 0;
 - Vehicle speed is 0;
 - Engine speed is 0;
 - Connection of wire is proper, DVE and ECU is normal.
- Operation required for DTC setting
 - Items that no malfunction are come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	None	Next
2	Clear DTCs	None	Next
3	Turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Then depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Next
		No	End
4	Check if the following self-learning conditions are met at the same time, as follows: Engine intake temperature is 5°C, 100.5°C > engine coolant temperature 5°C Engine speed ≤ 250 rpm Vehicle speed = 0. Battery voltage is 10 V Accelerator pedal opening angle < 14.9%	Yes	Next
		No	To meet all self-learning conditions
5	Clear DTCs, turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P1106 Throttle position deviation error

- DTC operating condition
 - Engine is running (starting is completed).
- DTC setting condition
 - Throttle actual opening angle and target opening angle are out of limit (difference exceeds 4~50 % according to different opening angle);
 - Throttle body PID regulation parameter is less than threshold value (throttle PID control duty ratio signal is higher than 80%, and control motor negative direction);
 - Throttle body PID regulation parameter is more than threshold value (throttle PID control duty ratio signal is higher than 80%, and control motor positive direction).
- Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.
- Conditions for malfunction indicator light off / DTC clearing
 - After fault is repaired, SVS light will go off immediately;
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.



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

P1111 Return spring check max error

- DTC operating condition
 - Ignition switch ON.
- DTC setting condition
 - When the throttle body is powered off, valve plate cannot return limp position (throttle powered off position) in time.
- Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.
- Conditions for malfunction indicator light off / DTC clearing
 - After fault is repaired, SVS light will go off immediately;
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	None	Next
2	Clear DTCs	None	Next
3	Turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Observe if DTCs are reproduced	Yes	Next
		No	End
4	Check if throttle valve plate is stuck	Yes	Clean or replace throttle
		No	Next
5	Remove the connector from throttle position sensor on wire harness, check if there is open circuit in ground signal or power source signal of throttle motor; check if there is short circuit between ground signal and power source signal of motor	Yes	Repair or replace wire harness
		No	Replace throttle
6	Clear DTCs, turn ENGINE START STOP switch to OFF and then to ON, and wait for 1 minute to finish the throttle self-learning. Depress accelerator pedal lightly for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P1615 ECM Status Unknown P1616 Authentication not OK P1617 No Response from SIM during Challenge Period P1618 Fail to Write EOL Confidential Data into EEPROM P1619 ECM not Programmed (Virgin State)

1. DTC operating condition
 - None.
2. DTC setting condition
 - P1615 - ECU detects eeprom state error (chip fault in general);
 - P1616 - ECU detects that authentication reply of immobilizer is incorrect and anti-theft authentication fails;
 - P1617 - ECU detects anti-theft authentication communication error or no response from immobilizer;
 - P1618 - ECU detects that key written fails when anti-theft matching;
 - P1619 - ECU detects that ECU does not perform anti-theft matching.
3. Operation required for DTC setting
 - P1615 - Fault occurs and is confirmed immediately, ECU does not illuminate any light;
 - P1617 - ECU does not illuminate any light (anti-theft malfunction light is illuminated by theft deterrent system);
 - P1617 - ECU does not illuminate any light (anti-theft malfunction light is illuminated by theft deterrent system);
 - P1619 - Fault occurs and be confirmed immediately. ECU does not illuminate any light (anti-theft malfunction light is illuminated by theft deterrent system).
 - P1619 - Fault occurs and be confirmed immediately. ECU does not illuminate any light (anti-theft malfunction light is illuminated by theft deterrent system).
4. Conditions for malfunction indicator light off / DTC clearing
 - P1615 - After fault is repaired, fault is deleted;
 - P1617 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - P1617 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - P1618 - After fault is repaired, fault is deleted;
 - P1619 - After fault is repaired, fault is deleted.

No.	Operation Step	Test Result	Subsequent Step
1	Immobilizer connector looseness or separation	Yes	Reconnect
		No	Next
2	Immobilizer circuit fault	Yes	Repair wire harness
		No	Next
3	If ECU has been replaced, check if anti-theft authentication code is incorrect or not updated	Yes	Refresh anti-theft code
		No	Next
4	Immobilizer fault	Yes	Check immobilizer
		No	Next
5	Anti-theft module circuit fault corresponding to ECU terminal	Yes	Inspect and repair ECU
		No	Diagnostic Help



P2088 Control Circuit Low Of Camshaft Control Valve (Inlet)

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

06

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

P2089 Control Circuit High of Camshaft Control Valve (Inlet)

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

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

P2090 Control Circuit Low of Camshaft Control Valve (Outlet)

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

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

06

P2091 Control Circuit High of Camshaft Control Valve (Outlet)

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

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



P2106 Throttle Power Stage Non-plausible Error

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

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

P2122 Pedal Pos.Sensor 1 Circ. Low Input

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

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

P2123 Pedal Pos.Sensor 1 Circ. High Input

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



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

P2127 Pedal Pos.Sensor 2 Circ. Low Input

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

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

P2128 Pedal Pos.Sensor 2 Circ. High Input

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

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

P2138 Pedal Movement Check Error

1. DTC operating condition
 - Ignition switch ON.
2. DTC setting condition
 - One circuit signal is at the idle point (signal 1 is less than 0.88 V), signal of another circuit is far away idle point (twice of the signal 2 value is 0.92V). Data will vary with different items;
 - Internal subdivision faults of corresponding ECU: Accelerator pedal movement inspection faults.
 - Voltage signal deviation of 1st circuit and 2nd circuit exceeds a certain range (difference between signal 1 and twice of signal 2 value is out of range 0.03 V-1.15 V according to voltage).
 - Internal subdivision faults of corresponding ECU: Improper electronic accelerator pedal position sensor signal.
3. Operation required for DTC setting
 - No light comes on;
 - Internal subdivision faults of corresponding ECU: Accelerator pedal movement inspection faults.
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.



- Internal subdivision faults of corresponding ECU: Improper electronic accelerator pedal position sensor signal.
4. Conditions for malfunction indicator light off / DTC clearing
- Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs until all DTCs are cleared;
 - Internal subdivision faults of corresponding ECU: Accelerator pedal movement inspection faults.
 - After fault is repaired, SVS light will go off immediately;
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.
 - Internal subdivision faults of corresponding ECU: Improper electronic accelerator pedal position sensor signal.

No.	Operation Step	Test Result	Subsequent Step
1	Check if the related wire harnesses are connected properly	Yes	Next
		No	Reconnect
2	Connect diagnostic tester and adapter, turn ENGINE START STOP switch to ON	/	Next
3	Clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Next
		No	End
4	Remove the connector from electronic accelerator pedal sensor on wire harness key, check if resistance of accelerator pedal circuit 1 signal or circuit 2 signal is in proper range	Yes	Next
		No	Repair or replace wire harness
5	Remove the connector from electronic accelerator pedal sensor on wire harness key, check if resistance between accelerator pedal circuit 1 signal or circuit 2 signal and other signals is in proper range	Yes	Repair or replace wire harness
		No	Replace accelerator pedal
6	Turn ENGINE START STOP switch to ON, clear DTCs, quickly and slowly depress accelerator pedal separately for several times to observe if DTCs are reproduced	Yes	Diagnostic Help
		No	End

P2177 System Too Lean Off Idle

1. DTC operating condition
 - Air-fuel ratio self-learning is enable;
 - Engine speed is between 1440 and 4000 rpm/ (for MT: 1440 - 3320 rpm)
 - Engine load is between 18 and 70.5%/ (for MT: 18 - 57.75);
 - Engine intake air flow is in range of 18-140 kg/h/ (MT: 24-110 kg/h;
(Recommended operating condition: Drive vehicle at 4th (60 km/h) or 5th (70 km/h) for 0.5 ~ 1 hour until fault is output. Specific time depends on the oil-gas load of canister, longer at summer in general).
2. DTC setting condition
 - ECU detects that air-fuel ratio closed loop control self-learning value exceeds 1.23.
3. Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After one fault is detected in 3 consecutive driving cycles, MIL light will come on, and SVS light will go off;
 - Diagnostic tester will be visible.

4. Conditions for malfunction indicator light off / DTC clearing

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Puncture wire harness connector near ECU terminal No. 4 wire insulation layer (white, heater power source positive) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 3 wire insulation layer (white, heater power source grounded) with black pole of multimeter. Check if voltage between two ends is about 12 V	Yes	Next
		No	Check relay fuse
6	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Replace oxygen sensor
7	Start and keep vehicle idling until coolant temperature reaches normal value. Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is between 0 V and 1 V.	Yes	Next
		No	Replace oxygen sensor
8	Disconnect upstream oxygen sensor connector and measure if sensor terminal 1 connector (gray, oxygen sensor signal grounded) and 2 connector (black, oxygen sensor signal wire) are short circuit with a multimeter	Yes	Replace oxygen sensor
		No	Next
9	Connect upstream oxygen sensor connector properly, repeat step 6-7 and check if voltage signal is changed in range of 0.44 V- 0.46 V and 0 V - 1 V respectively	Yes	End
		No	Diagnostic Help

P2178 System Too Rich Off Idle

1. DTC operating condition

- Air-fuel ratio self-learning is enable.
- Engine speed is between 1440 and 4000 rpm/ (for MT: 1440 - 3320 rpm)
- Engine load is between 18 and 70.5%/ (for MT: 18 - 57.75);
- Engine intake air flow is in range of 18-140 kg/h/ (MT: 24-110 kg/h);
(Recommended operating condition: Drive vehicle at 4th (60 km/h) or 5th (70 km/h) for 0.5 ~ 1 hour until fault is output. Specific time depends on the oil-gas load of canister, longer at summer in general).

2. DTC setting condition

- ECU detects that air-fuel ratio closed loop control self-learning value is less than 0.77.



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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check if fuel supply system is abnormal. Check if injector valve leaks, injection pressure is abnormal, canister valve is stuck or check if there is any other fault	Yes	Troubleshooting
		No	Next
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
6	Puncture wire harness connector near ECU terminal No. 4 wire insulation layer (white, heater power source positive) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 3 wire insulation layer (white, heater power source grounded) with black pole of multimeter. Check if voltage between two ends is about 12 V	Yes	Next
		No	Check relay fuse
7	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Replace oxygen sensor
8	Start and keep vehicle idling until coolant temperature reaches normal value. Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is between 0 V and 1 V.	Yes	Next
		No	Replace oxygen sensor
9	Disconnect upstream oxygen sensor connector and measure if sensor terminal 1 connector (gray, oxygen sensor signal grounded) and 2 connector (black, oxygen sensor signal wire) are short circuit with a multimeter	Yes	Replace oxygen sensor
		No	Next
10	Connect upstream oxygen sensor connector properly, repeat step 6-7 and check if voltage signal is changed in range of 0.44 V- 0.46 V and 0 V - 1 V respectively	Yes	End
		No	Diagnostic Help

P2187 System Too Lean at Idle

1. DTC operating condition
 - Air-fuel ratio self-learning is enable;
 - Engine speed is less than 920 rpm;
 - Engine intake air flow is less than a certain value (MT: 10 kg/h); (Perform operation between the 4th (60 km/h) or 5th (70 km/h) and the parking idling alternately for 5-10 minutes respectively. After above operation is performed for 30 minutes respectively, perform parking idling until fault is output).
2. DTC setting condition
 - ECU detects that air-fuel ratio closed loop control self-learning value exceeds a certain value (8%).
3. Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - If the fault is detected in 3 consecutive driving cycles, MIL light will come on
 - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Puncture wire harness connector near ECU terminal No. 4 wire insulation layer (white, heater power source positive) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 3 wire insulation layer (white, heater power source grounded) with black pole of multimeter. Check if voltage between two ends is about 12 V	Yes	Next
		No	Check relay fuse
6	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Replace oxygen sensor
7	Start and keep vehicle idling until coolant temperature reaches normal value. Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is between 0 V and 1 V.	Yes	Next
		No	Replace oxygen sensor



No.	Operation Step	Test Result	Subsequent Step
8	Disconnect upstream oxygen sensor connector and measure if sensor terminal 1 connector (gray, oxygen sensor signal grounded) and 2 connector (black, oxygen sensor signal wire) are short circuit with a multimeter	Yes	Replace oxygen sensor
		No	Next
9	Connect upstream oxygen sensor connector properly, repeat step 6-7 and check if voltage signal is changed in range of 0.44 V- 0.46 V and 0 V - 1 V respectively	Yes	End
		No	Diagnostic Help

P2188 System Too Rich at Idle

- DTC operating condition
 - Air-fuel ratio self-learning is enable;
 - Engine speed is less than 920 rpm;
 - Engine intake air flow is less than a certain value (MT: 10 kg/h); (Perform operation between the 4th (60 km/h) or 5th (70 km/h) and the parking idling alternately for 5-10 minutes respectively. After above operation is performed for 30 minutes respectively, perform parking idling until fault is output).
- DTC setting condition
 - ECU detects that air-fuel ratio closed loop control self-learning value is less than a certain value (-8%).
- Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - After the fault is detected in 3 consecutive driving cycles, MIL light will come on;
 - Diagnostic tester will be visible.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check if fuel supply system is abnormal. Check if injector valve leaks, injection pressure is abnormal, canister valve is stuck or check if there is any other fault	Yes	Troubleshooting
		No	Next
4	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.4 wire (white, heater power source positive) is 12 V	Yes	Next
		No	Check wire harness and connector
5	Do not disconnect oxygen sensor connector and measure if voltage of upstream oxygen sensor wire oxygen sensor terminal No.3 wire (white, heater power source grounded) is 12 V	Yes	Next
		No	Check wire harness and connector
6	Puncture wire harness connector near ECU terminal No. 4 wire insulation layer (white, heater power source positive) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 3 wire insulation layer (white, heater power source grounded) with black pole of multimeter. Check if voltage between two ends is about 12 V	Yes	Next
		No	Check relay fuse

No.	Operation Step	Test Result	Subsequent Step
7	Do not disconnect oxygen sensor connector, measure if voltage between downstream oxygen sensor wire ECU terminal No.2 wire (black, oxygen sensor signal wire) and No.1 wire (gray, oxygen sensor signal grounded) is about 0.45 V	Yes	Next
		No	Replace oxygen sensor
8	Start and keep vehicle idling until coolant temperature reaches normal value. Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is between 0 V and 1 V.	Yes	Next
		No	Replace oxygen sensor
9	Disconnect upstream oxygen sensor connector and measure if sensor terminal 1 connector (gray, oxygen sensor signal grounded) and 2 connector (black, oxygen sensor signal wire) are short circuit with a multimeter	Yes	Replace oxygen sensor
		No	Next
10	Connect upstream oxygen sensor connector properly, repeat step 6-7 and check if voltage signal is changed in range of 0.44 V - 0.46 V and 0 V - 1 V respectively	Yes	End
		No	Diagnostic Help

P2195 O2 Sensor Signal Stuck Lean (Upstream of the Catalyzer)

- DTC operating condition
 - Engine speed is in a certain range (for MT: 1120 - 3120 rpm);
 - Engine load is in range of 20.25 - 69.75% steadily;
 - Temperature of upstream oxygen sensor is higher than 500 deg;
 - Rear oxygen closed loop control effect; [Recommended operating condition: After vehicle is driving at a low speed (lower than 50 km/h) for 10 minutes, drive vehicle at 5th (70 km/h) for 5-10 minutes steadily].
- DTC setting condition
 - ECU detects that rear oxygen control integration (an integration compensation of rear oxygen closed loop control) exceeds a certain value (0.95 s), it indicates unilateral deterioration for upstream oxygen sensor (indicates a response of one direction), causing emission level exceeds OBD limiting value.
- Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - If the fault is detected in 3 consecutive driving cycles, MIL light will come on
 - Diagnostic tester will be visible.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check exhaust system for leakage, gasket for damage	Yes	Repair leaking area
		No	Next



No.	Operation Step	Test Result	Subsequent Step
4	Upstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is in range of 0.44 V - 0.46 V	Yes	Next
		No	Replace oxygen sensor
5	Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is in range of 0.44 V - 0.46 V	Yes	Next
		No	Replace oxygen sensor
6	Start and keep vehicle idling until coolant temperature reaches normal value. Upstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage changes in range of 0 V - 1 V	Yes	Next
		No	Replace oxygen sensor
7	Start and keep vehicle idling until coolant temperature reaches normal value. Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage changes in range of 0 V - 1 V	Yes	Next
		No	Replace oxygen sensor
8	Clear DTCs. Check if malfunction reappears after returning vehicle to customer	Yes	Next
		No	End
9	Replace the catalytic converter, and check according to above steps 3-7. Clear DTCs. Check if malfunction reappears after returning vehicle to customer	Yes	Diagnostic Help
		No	End

P2196 O2 Sensor Signal Stuck Rich (Upstream of the Catalyzer)

- DTC operating condition
 - Engine speed is in a certain range (for MT: 1120 - 3120 rpm);
 - Engine load is in range of 20.25 - 69.75% steadily;
 - Temperature of upstream oxygen sensor is higher than 500 deg;
 - Rear oxygen closed loop control effect; [Recommended operating condition: After vehicle is driving at a low speed (lower than 50 km/h) for 10 minutes, drive vehicle at 5th (70 km/h) for 5-10 minutes steadily].
- DTC setting condition
 - ECU detects that rear oxygen control integration (an integration compensation of rear oxygen closed loop control) exceeds a certain value (0.95 s), it indicates unilateral deterioration for upstream oxygen sensor (indicates a response of one direction), causing emission level exceeds OBD limiting value.
- Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;

- If the fault is detected in 3 consecutive driving cycles, MIL light will come on
- Diagnostic tester will be visible.

4. Conditions for malfunction indicator light off / DTC clearing

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

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check exhaust system for leakage, gasket for damage	Yes	Repair leaking area
		No	Next
4	Upstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is in range of 0.44 V - 0.46 V	Yes	Next
		No	Replace oxygen sensor
5	Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is in range of 0.44 V - 0.46 V	Yes	Next
		No	Replace oxygen sensor
6	Start and keep vehicle idling until coolant temperature reaches normal value. Upstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage changes in range of 0 V - 1 V	Yes	Next
		No	Replace oxygen sensor
7	Start and keep vehicle idling until coolant temperature reaches normal value. Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage changes in range of 0 V - 1 V	Yes	Next
		No	Replace oxygen sensor
8	Clear DTCs. Check if malfunction reappears after returning vehicle to customer	Yes	Next
		No	End
9	Replace the catalytic converter, and check according to above steps 3-7. Clear DTCs. Check if malfunction reappears after returning vehicle to customer	Yes	Diagnostic Help
		No	End



P2270 O2 Sensor Signal Stuck Lean (Downstream of the Catalyzer)

1. DTC operating condition
 - Rear oxygen closed loop control effect for more than a certain period of time;
 - Diagnostic enrichment for more than a certain period of time; [Recommended operating condition: After vehicle is driving at a low speed (lower than 50 km/h) for 10 minutes, drive vehicle at 5th (70 km/h) for 5-10 minutes steadily].
2. DTC setting condition
 - ECU detects that rear oxygen sensor voltage is less than 0.582V continually.
3. Operation required for DTC setting
 - Once the fault is confirmed, SVS light will come on immediately, and the system will enter the fault memory;
 - If the fault is detected in 3 consecutive driving cycles, MIL light will come on
 - Diagnostic tester will be visible.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check exhaust system for leakage, gasket for damage	Yes	Repair leaking area
		No	Next
4	Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is in range of 0.44 V - 0.46 V	Yes	Next
		No	Replace oxygen sensor
5	Start and keep vehicle idling until coolant temperature reaches normal value. Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. B wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. A wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage changes in range of 0 V - 1 V	Yes	Next
		No	Replace oxygen sensor
6	Start and keep vehicle idling until coolant temperature reaches normal value. Depress and release accelerator pedal frequently and alternately for 90 s, at the same time, puncture downstream oxygen sensor wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is beyond ① range of 0.55 V - 0.65 V	Yes	End
		No	Diagnostic Help

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

P2271 O2 Sensor Signal Stuck Rich (Downstream of the Catalyzer)

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

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No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Read and store fault freeze frame information	/	Next
3	Check exhaust system for leakage, gasket for damage	Yes	Repair leaking area
		No	Next
4	Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is in range of 0.44 V - 0.46 V	Yes	Next
		No	Replace oxygen sensor
5	Start and keep vehicle idling until coolant temperature reaches normal value. Downstream oxygen sensor: Puncture wire harness connector near ECU terminal No. B wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. A wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage changes in range of 0 V - 1 V	Yes	Next
		No	Replace oxygen sensor
6	Start and keep vehicle idling until coolant temperature reaches normal value. Depress and release accelerator pedal frequently and alternately for 90 s, at the same time, puncture downstream oxygen sensor wire harness connector near ECU terminal No. 2 wire insulation layer (black, oxygen sensor signal wire) with red pole of multimeter, and puncture wire harness connector near ECU terminal No. 1 wire insulation layer (gray, oxygen sensor signal grounded) with black pole of multimeter. Check if voltage is beyond ② range of 0.55 V - 0.65 V	Yes	End
		No	Diagnostic Help

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



U0001 Error busoff on CAN-bus

1. DTC operating condition
 - Ignition switch ON for more than 0.5 s;
 - Battery voltage is in range of 9~16 V.
2. DTC setting condition
 - CAN controller detects CAN hardware fault.
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	CAN bus connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Short circuit to power source / ground or open circuit in CAN bus connector pin	Yes	Repair wire harness
		No	Next
3	There is wire harness signal interference	Yes	Shielded wire
		No	Next
4	Short circuit to power source / ground, open circuit or internal circuit damage in CAN bus connector pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help

U0101 Lost Communication with TCM

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

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

U0129 Lost Communication With Brake System Control Module

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

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

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

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

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



P0033 Dump Valve Control Circuit Open

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

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No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or separation	Yes	Reconnect
		No	Next
2	Open circuit in supercharging discharge control valve circuit pin	Yes	Repair wire harness
		No	Next
3	Open circuit in supercharging discharge control valve power supply terminal	Yes	Repair wire harness
		No	Next
4	Open circuit or internal circuit damage in supercharging discharge control valve pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0034 Dump Valve Control Circuit Low

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or separation	Yes	Reconnect
		No	Next
2	Supercharging discharge control valve circuit pin short to ground	Yes	Repair wire harness
		No	Next
3	Supercharging discharge control valve power supply terminal short to ground	Yes	Repair wire harness
		No	Next
4	Supercharging discharge control valve pin corresponding to ECU terminal short to ground	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0035 Dump Valve Control Circuit High

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or separation	Yes	Reconnect
		No	Next
2	Supercharging discharge control valve circuit pin short to power source	Yes	Repair wire harness
		No	Next
3	Supercharging discharge control valve pin corresponding to ECU terminal short to power source	Yes	Inspect and repair ECU
		No	Diagnostic Help

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P0105 Manifold Absolute Pressure Circuit No Change

1. DTC operating condition
 - Engine speed > 800 rpm.
2. DTC setting condition
 - ECU detects that pressure value of intake manifold drops below 20 hpa.
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

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



P0106 Manifold Abs.Pressure Performance Non-plausible

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

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

P0107 Manifold Abs.Pressure Low Input

1. DTC operating condition
 - More than 1 second has elapsed after engine starting.
2. DTC setting condition
 - ECU detects that voltage value of intake manifold pressure sensor is less than 0.195 V.
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

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

P0108 Manifold Abs.Pressure High Input

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

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

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P0111 Intake Air Temp.Circ. Performance Non-plausible

1. DTC operating condition
 - More than 1 second has elapsed after engine starting.
2. DTC setting condition
 - ECU detected that intake temperature value is not within upper and lower limit range.
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.



No.	Operation Step	Test Result	Subsequent Step
1	Connect diagnostic tester and turn ENGINE START STOP switch to "ON"	/	Next
2	Do not start engine, observe if "Intake Temperature" item in data flow seriously deviated from actual temperature (value changes with current atmospheric pressure)	Yes	Repair, replace sensor
		No	Next
3	Turn ENGINE START STOP switch "OFF", and check if there is any freeze, oil stain, etc. on measurement terminal, which will affect normal measurement	Yes	Repair, replace sensor
		No	Next
4	Check if installation position of intake temperature sensor is incorrect	Yes	Repair sensor
		No	Diagnostic Help

P0234 Turbu/Super Charger Overboost Condition

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- DTC operating condition
 - Pressure before throttle valid;
 - No fault in ambient pressure sensor.
- DTC setting condition
 - Actual boost pressure is higher than target pressure value excessively (high about 300 ~ 650 hPa).
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles, MIL light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Turbocharger relief solenoid damaged	Yes	Replace relief solenoid
		No	Next
2	Exhaust by-pass solenoid valve damaged (normally closed state)	Yes	Replace exhaust gas valve
		No	Diagnostic Help

P0237 Turbocharger Boost Sensor (A) Circ. Low Input

- DTC operating condition
 - Ignition switch ON.
- DTC setting condition
 - Boost pressure sensor measurement voltage is lower than 0.097 V for more than 2 seconds.
- Operation required for DTC setting
 - As long as one fault is detected in each driving cycle which meets DTC operating condition, MIL light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Sensor signal terminal pin short to ground	Yes	Repair wire harness
2	Sensor power supply terminal pin short to ground	No	Next
		Yes	Repair wire harness
3	Offset or damage to characteristics such as sensor resistance	No	Next
		Yes	Replace sensor
4	Sensor signal terminal pin corresponding to ECU short to ground	No	Next
		Yes	Inspect and repair ECU

P0238 Turbocharger Boost Sensor (A) Circ. High Input

- DTC operating condition
 - Ignition switch ON.
- DTC setting condition
 - Boost pressure sensor measurement voltage is lower than 0.097 V for more than 2 seconds.
- Operation required for DTC setting
 - As long as one fault is detected in each driving cycle which meets DTC operating condition, MIL light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or separation	Yes	Reconnect
2	Short circuit to power source or open circuit in sensor signal terminal pin	No	Next
		Yes	Repair wire harness
3	Open circuit in sensor power supply terminal and ground terminal pin	No	Next
		Yes	Repair wire harness
4	Offset or damage to characteristics such as sensor resistance	No	Next
		Yes	Replace sensor
5	Short circuit to power source, open circuit or internal circuit damage in sensor signal terminal pin corresponding to ECU terminal	No	Next
		Yes	Inspect and repair ECU

P0243 Turbo/Super Charger Wastegate Solenoid Open

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



No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or separation	Yes	Reconnect
		No	Next
2	Open circuit in exhaust gas control valve drive circuit pin	Yes	Repair wire harness
		No	Next
3	Open circuit in exhaust gas control valve power supply terminal	Yes	Repair wire harness
		No	Next
4	Open circuit or internal circuit damage in drive pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0245 Turbo/Super Charger Wasteg.Solonoid Low

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Exhaust gas control valve drive circuit pin short to ground	Yes	Repair wire harness
		No	Next
3	Short circuit to ground or internal circuit damage in drive pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0246 Turbo/Sup.Charger Wasteg.Solonoid High

- DTC operating condition
 - Engine is running;
 - Battery voltage is in range of 8~18 V.
- DTC setting condition
 - ECU detects short circuit to ground in control terminal pin (it is detected that voltage UCE of output terminal is 12 V with driver switch off).
- Operation required for DTC setting
 - As long as one fault is detected in each driving cycle which meets DTC operating condition, MIL light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault is detected to be repaired successfully in 3 consecutive driving cycles, MIL light will go off;
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Exhaust gas control valve drive circuit pin short to power source	Yes	Repair wire harness
		No	Next
3	Short circuit to power source or internal circuit damage in drive pin corresponding to ECU	Yes	Inspect and repair ECU
		No	Diagnostic Help

P0481 Cooling Fan 2 Control Circuit Error

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

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

P0693 Fan 2 Control Circuit Low

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



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

P0694 Fan 2 Control Circuit High

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

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

P2261 Dump Valve - Mechanical Error

- DTC operating condition
 - Surge is detected;
 - Discharge valve is opened;
 - Release accelerator pedal suddenly.
- DTC setting condition
 - Discharge valve is stuck in OFF position.
- Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
- Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

No.	Operation Step	Test Result	Subsequent Step
1	Discharge control valve wire harness interrupted	Yes	Repair wire harness
		No	Next
2	Discharge control valve damaged	Yes	Replace discharge valve
		No	Diagnostic Help
3	Discharge control valve pin or circuit corresponding to ECU is damaged	Yes	Inspect and repair ECU
		No	Diagnostic Help

U0140 Lost Communication With Body Control Module (Immo)

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

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

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P0615 Starter Relay Circuit Open

1. DTC operating condition
 - Starting signal is sent (sent from key or PEPS);
 - Battery voltage is in range of 8~18 V.
2. DTC setting condition
 - ECU detected open circuit in control terminal pin.
3. Operation required for DTC setting
 - After the fault is detected in 3 consecutive driving cycles and is confirmed, no light will come on.
4. Conditions for malfunction indicator light off / DTC clearing
 - Fault will be deleted after 40 consecutive trouble-free warm-up cycles;
 - Using diagnostic tester to clear DTCs, malfunction light will go off and DTCs are cleared.

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



P0616 Starter Relay Circuit Low

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

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

P0617 Starter Relay Circuit High

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

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

P2228 Barometric Pressure Low Input

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

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

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P2229 Barometric Pressure High Input

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

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



P2600 Diagnosis of Electrical Water Pump Control Circ.Open

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Short circuit to ground, open circuit in electrical water pump control relay circuit signal terminal	Yes	Repair wire harness
		No	Next
3	Electrical water pump control relay circuit fault (fuse blown or damaged)	Yes	Repair wire harness
		No	Next
4	Short circuit to ground, open circuit or internal circuit damage in relay pin corresponding to ECU	Yes	Replace with new ECU to check if malfunction reoccurs
		No	Diagnostic Help

P2602 Diagnosis of Electrical Water Pump Control Circ.Low

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Short circuit to ground or open circuit in electrical water pump control relay circuit signal terminal	Yes	Repair wire harness
		No	Next
3	Electrical water pump control relay circuit fault (fuse blown or damaged)	Yes	Repair wire harness
		No	Next
4	Short circuit to ground, open circuit or internal circuit damage in relay pin corresponding to ECU	Yes	Replace with new ECU to check if malfunction reoccurs
		No	Diagnostic Help

P2603 Diagnosis of Electrical Water Pump Control Circ.high

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

No.	Operation Step	Test Result	Subsequent Step
1	Electrical water pump relay control circuit short to power source	Yes	Repair wire harness
		No	Next
2	Relay control pin corresponding to ECU terminal short to power source	Yes	Inspect and repair ECU

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P1427 Diagnosis of Brake Booster Pump Control Circ.High

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Brake vacuum booster pump control valve circuit pin short to power source	Yes	Repair wire harness
		No	Next
3	Brake vacuum booster pump control valve power supply terminal short to ground	Yes	Repair wire harness
		No	Next
4	Brake vacuum booster pump control valve pin corresponding to ECU terminal short to power source	Yes	Replace with new ECU to check if malfunction reoccurs
		No	Diagnostic Help



P1428 Diagnosis of Brake Booster Pump Control Circ.Low

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or poor contact	Yes	Reconnect
		No	Next
2	Brake vacuum booster pump control valve circuit pin short to ground	Yes	Repair wire harness
		No	Next
3	Brake vacuum booster pump control valve power supply terminal short to ground	Yes	Repair wire harness
		No	Next
4	Brake vacuum booster pump control valve pin corresponding to ECU terminal short to ground	Yes	Replace with new ECU to check if malfunction reoccurs
		No	Diagnostic Help

P1429 Diagnosis of Brake Booster Pump Control Circ.Open

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

No.	Operation Step	Test Result	Subsequent Step
1	Connector looseness or separation	Yes	Reconnect
		No	Next
2	Open in brake vacuum booster pump control valve circuit pin	Yes	Repair wire harness
		No	Next
3	Open circuit in brake vacuum booster pump control valve power supply terminal	Yes	Repair wire harness
		No	Next
4	Open circuit or internal circuit damage in brake vacuum booster pump control valve pin corresponding to ECU	Yes	Replace with new ECU to check if malfunction reoccurs
		No	Diagnostic Help

DIAGNOSIS & TESTING

Diagnosis Contents

DTC Confirmation Procedure

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

Perform check and repair diagnosis procedure according to DTC

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Caution:

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

Diagnostic steps

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

Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the following:

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



Ground Inspection

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

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

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

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Throttle Self-learning

Perform throttle self-learning in the following conditions:

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

Throttle self-learning conditions:

- Engine intake temperature $> 5^{\circ}\text{C}$
- $100.5^{\circ}\text{C} > \text{engine coolant temperature} > 5^{\circ}\text{C}$
- Engine speed $\leq 250 \text{ rpm}$
- Vehicle speed = 0 km/h
- Battery voltage $> 10 \text{ V}$
- Accelerator pedal opening angle $< 14.9\%$

Throttle self-learning procedures:

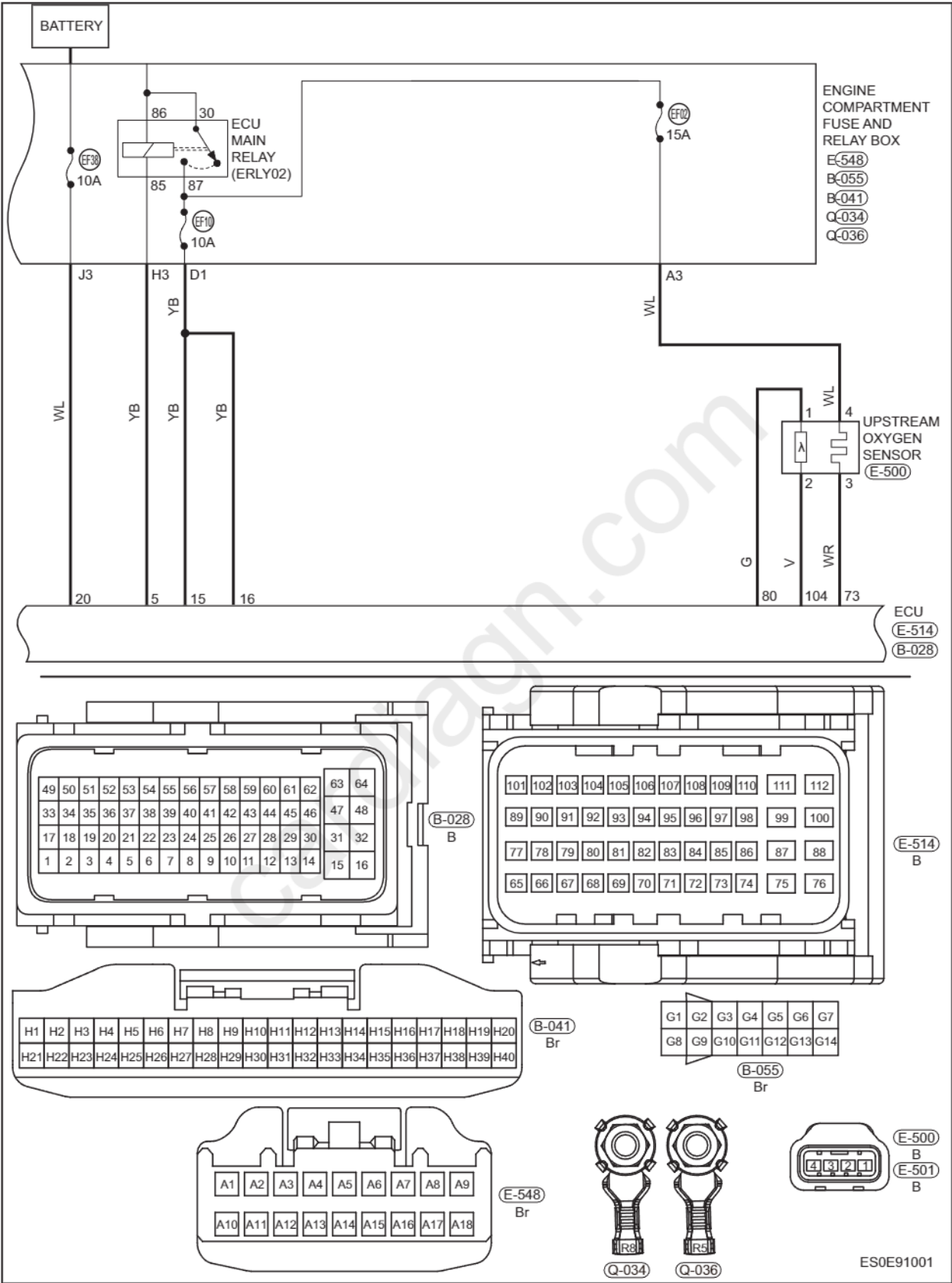
Turn ignition switch to ON and then turn to OFF after waiting for 15 seconds. After self-learning is completed, start the vehicle and check for proper operation.

DTC	P0030 13	O2 Sensor Heater Control Circuit Open (Upstream of the Catalyzer)
DTC	P0031 11	O2 Sensor Heater Control Circuit Low (Upstream of the Catalyzer)
DTC	P0132 12	O2 Sensor Heater Control Circuit High (Upstream of the Catalyzer)
DTC	P0053 1E	O2 Sensor Heater Resistance too large (Upstream of the Catalyzer)

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Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0030 13	O2 Sensor Heater Control Circuit Open (Upstream of the Catalyzer)	ENGINE START STOP switch ON, engine running	- Upstream Oxygen Sensor - Wire harness or connector - Fuse - ECU
P0031 11	O2 Sensor Heater Control Circuit Low (Upstream of the Catalyzer)		
P0132 12	O2 Sensor Heater Control Circuit High (upstream of the catalyzer)		
P0053 1E	O2 Sensor Heater Resistance too large (Upstream of the Catalyzer)		

Caution:

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

Confirmation Procedure

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

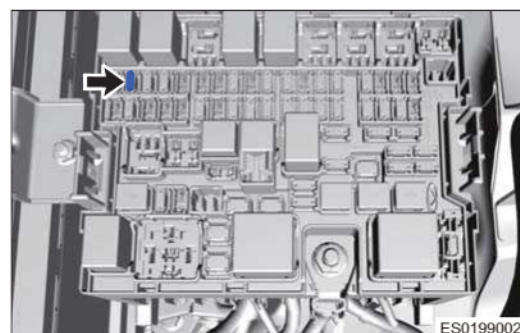
- Turn ENGINE START STOP switch to OFF
- Connect diagnostic tester (the latest software) to diagnostic interface.
- ENGINE START STOP switch ON
- Using diagnostic tester, record and clear DTCs.
- Start engine and warm it up to normal operating temperature, and then select Read DTC.
- Start engine and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

Procedure**1 Check fuse EF02**

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

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power

OK**2 Check upstream oxygen sensor connector**

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



OK

Upstream oxygen sensor connector is installed normally

Result

Proceed to
OK
NG

NG

Reinstall or repair, replace connector

OK

3 Check upstream oxygen sensor heater power supply voltage

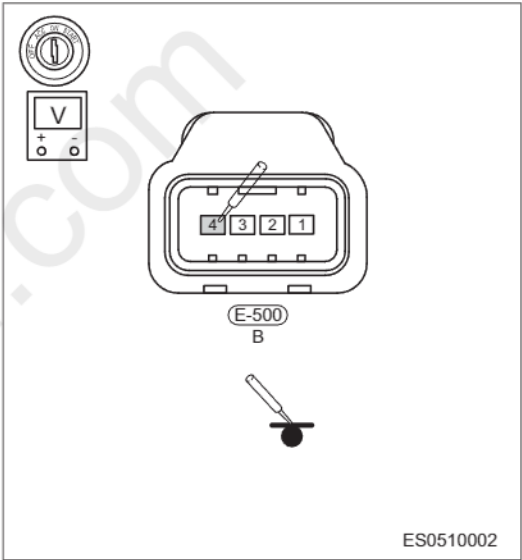
06

- (a) Turn ignition switch to ON.
- (b) Measure voltage of terminal 4 of upstream oxygen sensor connector E-500 (using a digital multimeter) (online detection).

Multimeter Connection	Condition	Specified Condition
E-500 (4) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

Result

Proceed to
OK
NG



NG

Check wire harness between E-500 (4) and terminal 3 engine compartment fuse and relay box A connector

OK

4 Check upstream oxygen sensor heater voltage

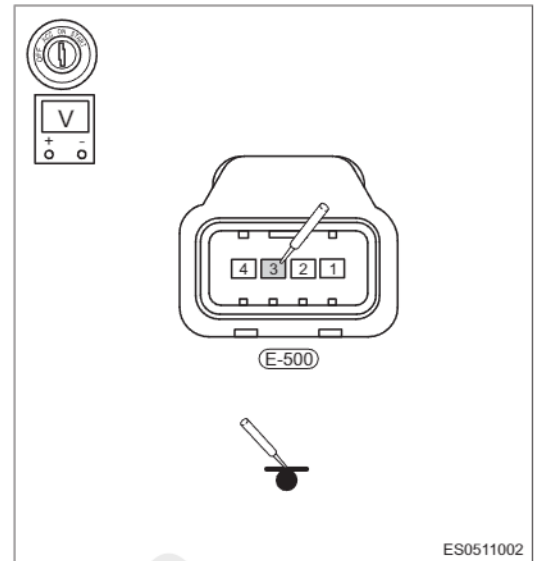
- (a) Turn ignition switch to ON.

- (b) Measure voltage of terminal 3 of upstream oxygen sensor connector E-500 (using a digital multimeter) (online detection).

Multimeter Connection	Condition	Specified Condition
E-500 (3) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

Result

Proceed to
OK
NG



06

OK

Go to step 6

NG

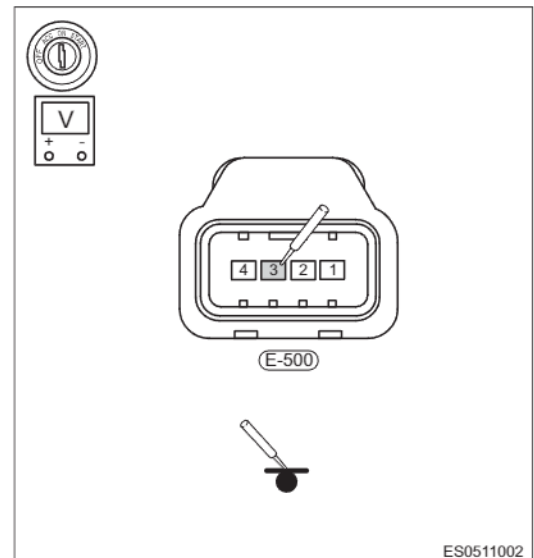
5 Check upstream oxygen sensor heating resistance

- (a) Turn ignition switch to ON, start engine and idle it for about 3 minutes.
 (b) Check heating resistance between terminals 3 and 4 of upstream oxygen sensor E-500.

Multimeter Connection	Condition	Specified Condition
E-500 (3) - E-500 (4)	At room temperature	Not more than 15 Ω

Result

Proceed to
OK
NG



NG

Replace upstream oxygen sensor

OK

6 Check upstream oxygen sensor heater heating wire harness

- (a) Turn ignition switch to OFF. Disconnect the negative battery cable.
 (b) Disconnect upstream oxygen sensor connector and ECU connector E-514.



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- (c) Check heating wire harness between upstream oxygen sensor connector E-500 (3) and ECU connector E-514 (73).

Multimeter Connection	Condition	Specified Condition
E-500 (3) - E-514 (73)	Always	Resistance $\leq 1 \Omega$

Result

Proceed to
OK
NG

NG

Repair or replace wire harness

OK

06

7

Reconfirm DTCs

- (a) Connect the negative battery cable.
(b) ENGINE START STOP switch ON
(c) Using diagnostic tester, clear DTCs.
(d) Check if DTC P0030 13, P0031 11, P0032 12 or P0053 1E still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

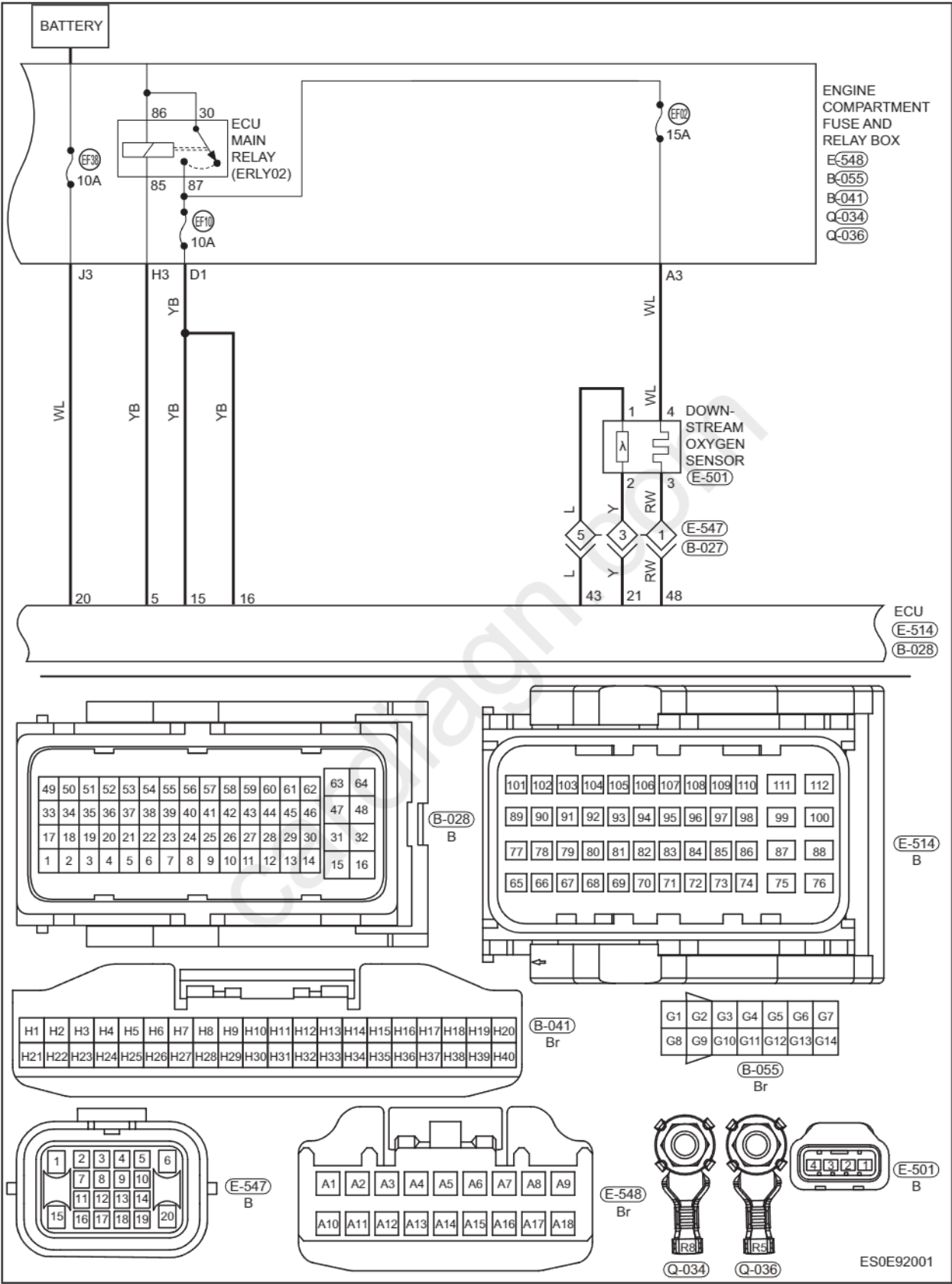
NG

Replace ECU to perform real-vehicle check

DTC	P0036 13	O2 Sensor Heater Control Circuit Open (Downstream of the Catalyzer)
DTC	P0037 11	O2 Sensor Heater Control Circuit Low (Downstream of the Catalyzer)
DTC	P0038 12	O2 Sensor Heater Control Circuit High (Downstream of the Catalyzer)
DTC	P0054 1E	O2 Sensor Heater Resistance too large (Downstream of the Catalyzer)



Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0036 13	O2 Sensor Heater Control Circuit Open (Downstream of the Catalyzer)	Ignition switch ON, engine running	- Downstream Oxygen Sensor - Wire harness or connector - Fuse - ECU
P0037 11	O2 Sensor Heater Control Circuit Low (Downstream of the Catalyzer)		
P0038 12	O2 Sensor Heater Control Circuit High (Downstream of the Catalyzer)		
P0054 1E	O2 Sensor Heater Resistance too large (Downstream of the Catalyzer)		

Confirmation Procedure

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

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

Caution:

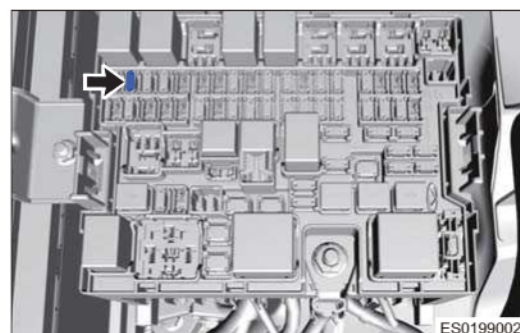
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check fuse EF02**

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

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power

OK

2 Check downstream oxygen sensor connector

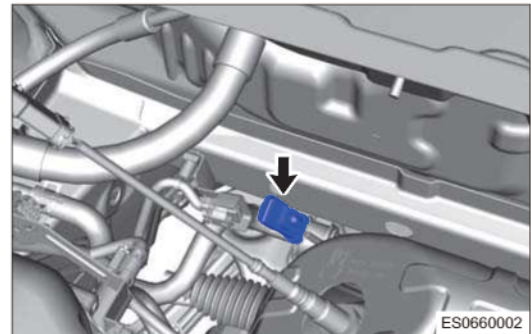
- (a) Check if downstream oxygen sensor is connected infirmly or loose.

OK

Downstream oxygen sensor connector is installed normally

Result

Proceed to
OK
NG



06

NG

Reinstall or repair, replace connector

OK

3 Check downstream oxygen sensor heater power supply voltage

- (a) Turn ignition switch to ON.
 (b) Measure voltage of terminal 4 of downstream oxygen sensor connector E-501 (using a digital multimeter) (online detection).

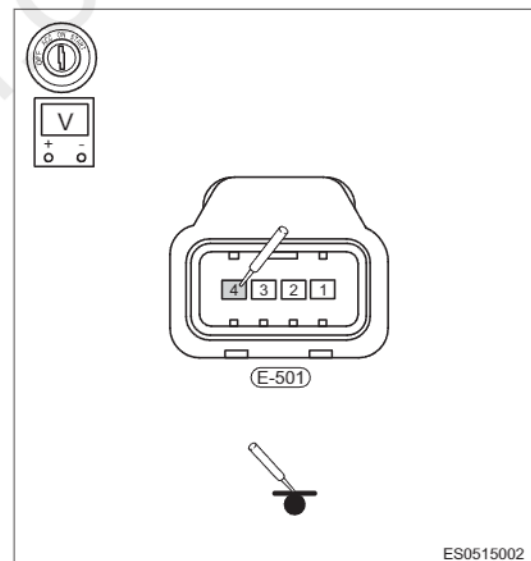
Multimeter Connection	Condition	Specified Condition
E-501 (4) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Voltage between downstream oxygen sensor connector and body ground is normal

Result

Proceed to
OK
NG



NG

Check wire harness between E-501 (4) and terminal 3 engine compartment fuse and relay box A connector

OK

4 Check downstream oxygen sensor heater voltage

- (a) Turn ignition switch to ON.

- (b) Measure voltage of terminal 3 of downstream oxygen sensor connector E-501 (using a digital multimeter) (online detection).

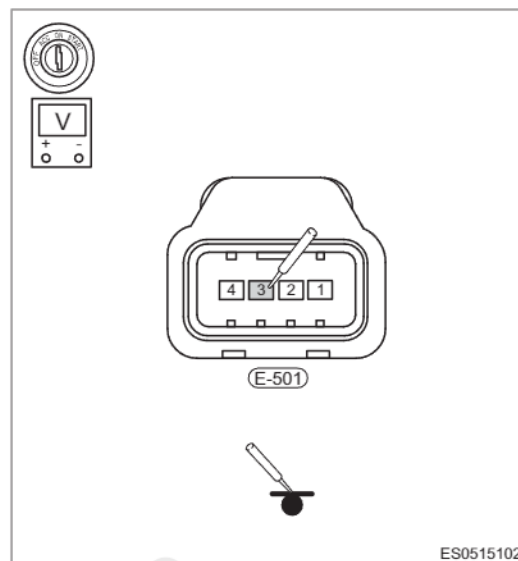
Multimeter Connection	Condition	Specified Condition
E-501 (3) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

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

Result

Proceed to
OK
NG



06

OK

Go to step 6

NG

5 Check downstream oxygen sensor heating resistance

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect the downstream oxygen sensor connector.
 (d) Check heating resistance between terminals 3 and 4 of downstream oxygen sensor E-501.

Multimeter Connection	Condition	Specified Condition
E-501 (3) - E-501 (4)	At room temperature	Not more than 15 Ω

OK

Voltage between downstream oxygen sensor connector and body ground is normal

Result

Proceed to
OK
NG

NG

Replace oxygen sensor

OK

6 Check downstream oxygen sensor heater heating wire harness

- (a) Turn ignition switch to OFF. Disconnect the negative battery cable.
 (b) Disconnect downstream oxygen sensor connector and ECU connector E-514.
 (c) Check heating wire harness between downstream oxygen sensor connector E-501 (3) and ECU connector E-514 (48).

Multimeter Connection	Condition	Specified Condition
E-501 (3) - E-514 (48)	Always	Resistance $\leq 1 \Omega$



Result

Proceed to
OK
NG

NG**Repair or replace wire harness****OK****7****Reconfirm DTCs**

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

OK

No same DTC is output

Result

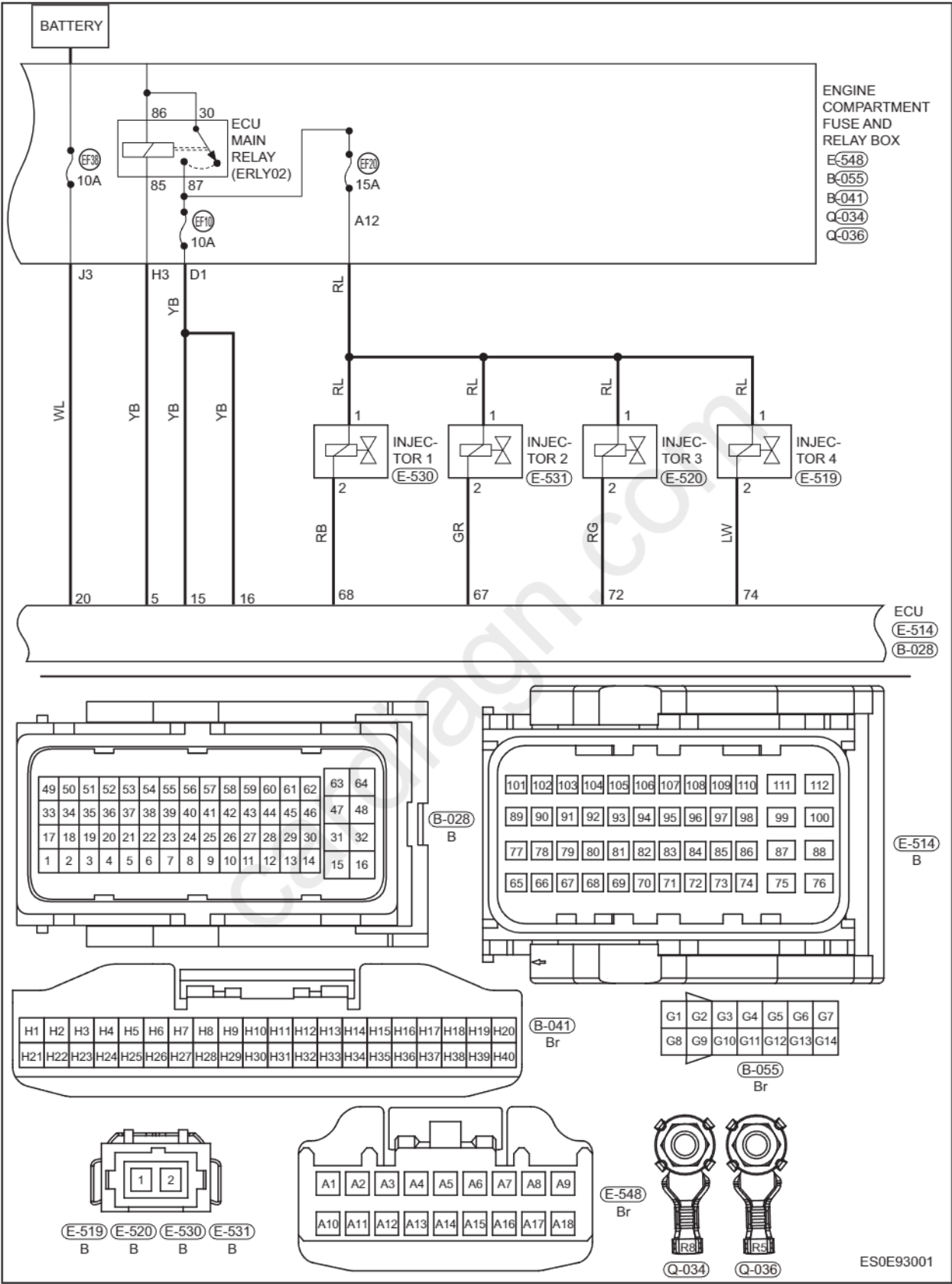
Proceed to
OK
NG

OK**System operates normally****NG****Replace with new ECU to check if malfunction reoccurs**

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



Circuit Diagram



Description

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

Confirmation Procedure

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

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

Caution:

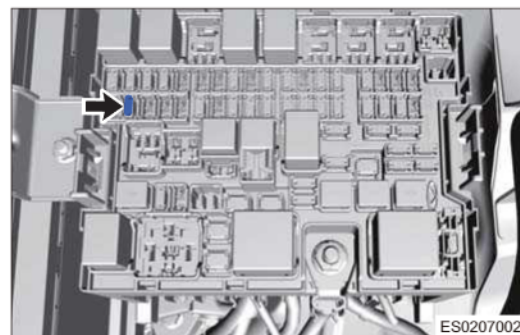
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check engine compartment fuse EF20**

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

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power



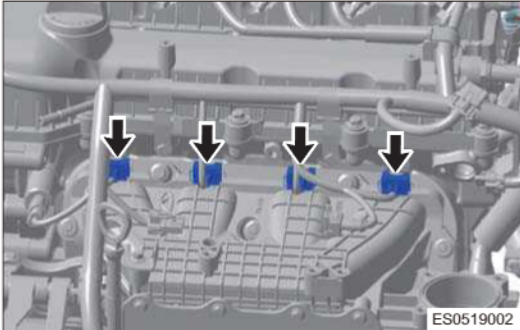
OK

2 Check injector connector

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

Result

Proceed to
OK
NG



06

NG Reconnect or replace connector

OK

3 Check injector power supply voltage

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

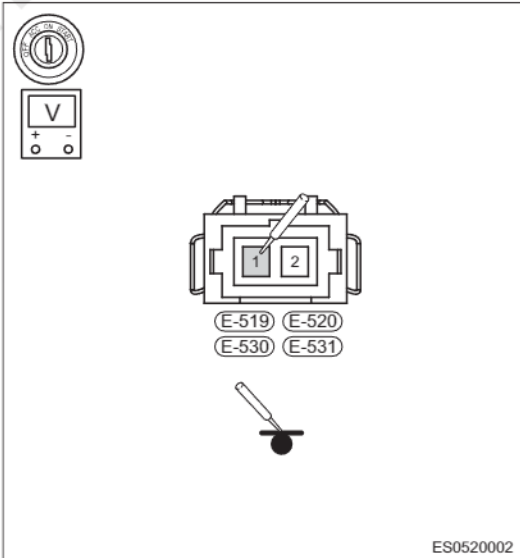
Multimeter Connection	Condition	Specified Condition
E-530 (1), E-531 (1), E-520 (1), E-519 (1) - Body ground	Ignition switch ON	Not less than 12 V

OK

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

Result

Proceed to
OK
NG



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

OK

4 Check ECU terminal voltage corresponding to injector

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

Blink

ECU control terminal corresponding to injector is normal

Result

Proceed to
OK
NG

OK

Go to step 6

NG

5 Check injector control circuit

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect ECU connector E-514 and 4 injector connectors.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-530 (2) - E-514 (68)	Always	Resistance $\leq 1 \Omega$
E-531 (2) - E-514 (67)		
E-520 (2) - E-514 (72)		
E-519 (2) - E-514 (74)		

OK

Continuity between each terminal of ECU connector is normal

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (injector - ECU)

OK

6 Check injector

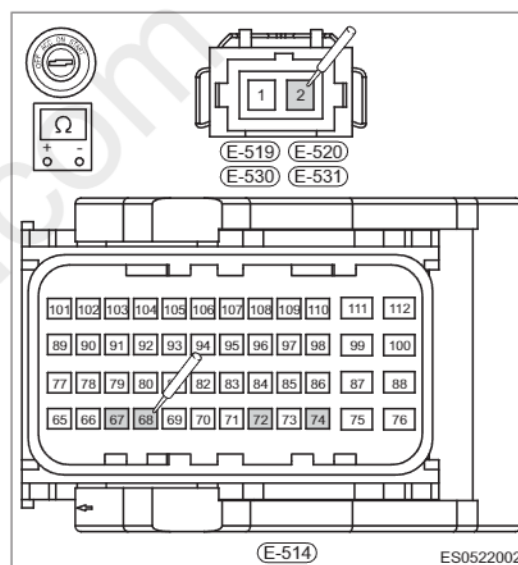
- (a) Remove the injector.
 (b) Check injector for damage or blockage.
 (c) Measure injector resistance, check for a short or open circuit in injector.

Result

Proceed to
OK
NG

NG

Clean or replace injector



OK

7 **Reconfirm DTCs**

- (a) Using diagnostic tester, read ECU DTC.
- (b) Check if DTC P0201 13, P0202 13, P0203 13, P0204 13, P0261 11, P0262 12, P0264 11, P0265 12, P0267 11, P0268 12, P0270 11, P0271 12 still exists.

OK
No same DTC is output

Result

Proceed to
OK
NG

06

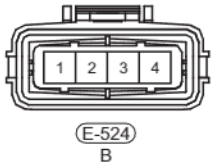
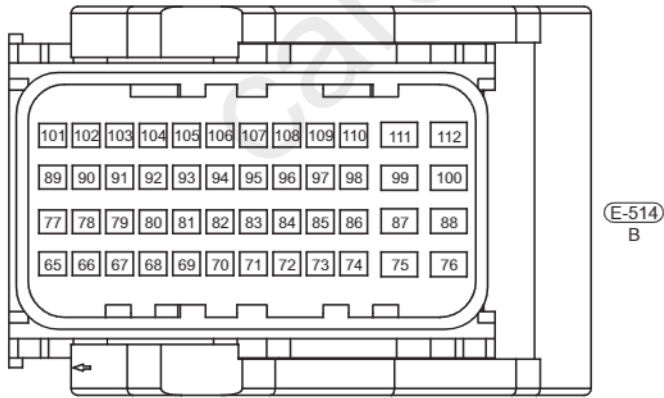
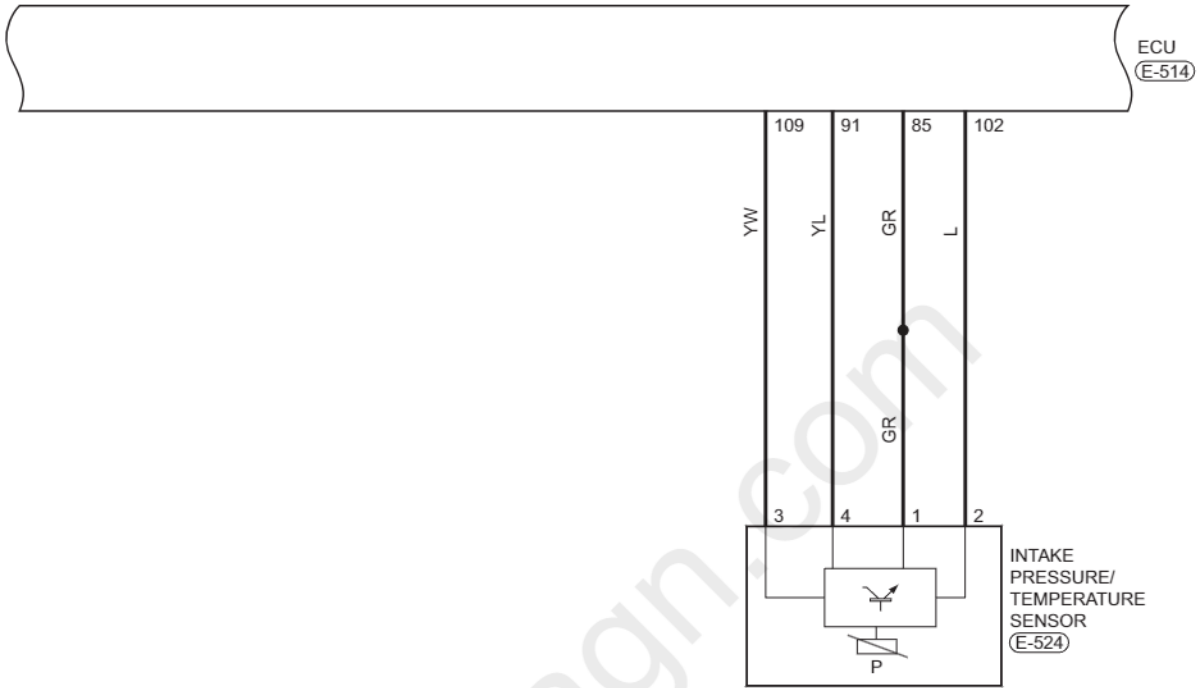
OK	System operates normally
NG	Replace with new ECU to check if malfunction reoccurs

DTC	P0105 28	Manifold Absolute Pressure Circuit No Change
DTC	P0106 00	Manifold Abs.Pressure Performance Non-plausible
DTC	P0107 11	Manifold Abs.Pressure Low Input
DTC	P0108 12	Manifold Abs.Pressure High Input
DTC	P0111 00	Intake Air Temp.Circ. Performance Non-plausible
DTC	P0112 16	Intake Air Temp.Circ. Low Input
DTC	P0113 17	Intake Air Temp.Circ. High Input



Circuit Diagram

06



ES0E94001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0105 28	Manifold Absolute Pressure Circuit No Change	ENGINE START STOP switch ON, engine running	- Intake Pressure/Temperature Sensor - Wire harness or connector - ECU
P0106 00	Manifold Abs.Pressure Performance Non-plausible		
P0107 11	Manifold Abs.Pressure Low Input		
P0108 12	Manifold Abs.Pressure High Input		
P0111 00	Intake Air Temp.Circ. Performance Non-plausible		
P0112 16	Intake Air Temp.Circ. Low Input		
P0113 17	Intake Air Temp.Circ. High Input		

06

Confirmation Procedure

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

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

Caution:

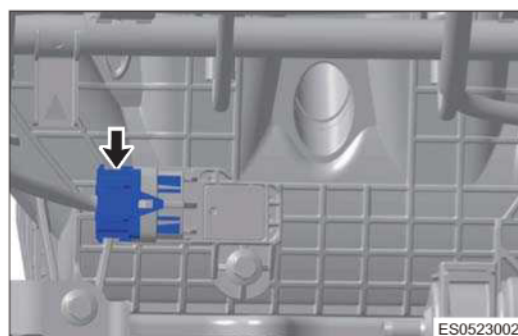
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check installation of intake pressure/temperature sensor**

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

Result

Proceed to
OK
NG



NG

Reinstall or repair or replace intake pressure/temperature sensor

OK

2 Check intake pressure/temperature sensor power supply voltage

- (a) Turn ignition switch to ON.



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- (b) Measure voltage between terminal 3 of intake pressure/temperature sensor connector E-524 and body ground (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-524 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Intake pressure/temperature sensor power supply voltage is normal

Result

Proceed to
OK
NG

06

NG

Check and repair wire harness between intake pressure/temperature sensor power supply and ECU

OK

3

Check intake pressure/temperature sensor pressure signal voltage

- (a) Turn ignition switch to ON and start engine.
(b) Measure voltage between terminal 4 of connector E-524 and body ground (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-524 (4) - Body ground	Idle	Voltage is about 1.3 V (value changes with model)
	Rapidly depress accelerator pedal	Maximum instantaneous voltage is about 4 V (value changes with model)

OK

Intake pressure/temperature sensor voltage is normal

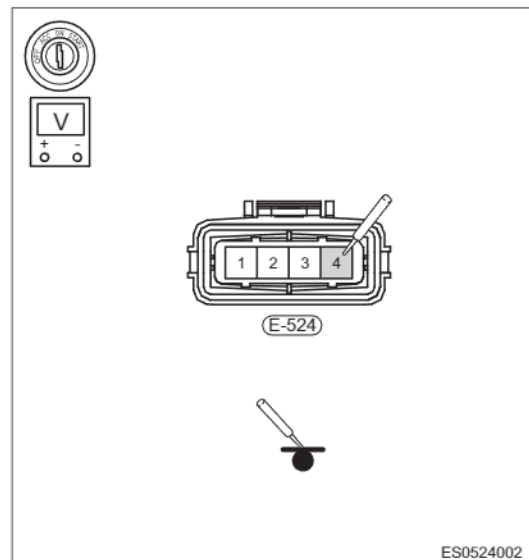
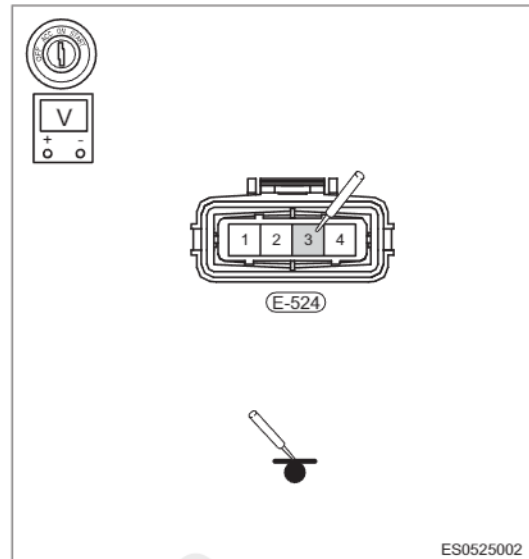
Result

Proceed to
OK
NG

NG

Check wire harness or connector or replace sensor to test vehicle

OK



4 Check intake pressure/temperature sensor signal circuit

- (a) Turn off ignition switch and disconnect the negative battery cable.
 (b) Disconnect the intake pressure/temperature sensor and ECU connectors.
 (c) Measure wire harness between connector E-524 (2, 4) and ECU E-514 (91, 102).

Multimeter Connection	Condition	Specified Condition
E-524 (2) - E-514 (91)	Always	Resistance $\leq 1 \Omega$
E-524 (4) - E-514 (102)	Always	Resistance $\leq 1 \Omega$

Result

Proceed to
OK
NG

NG**Repair or replace wire harness****OK****5 Read data flow of intake pressure/temperature sensor**

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

OK

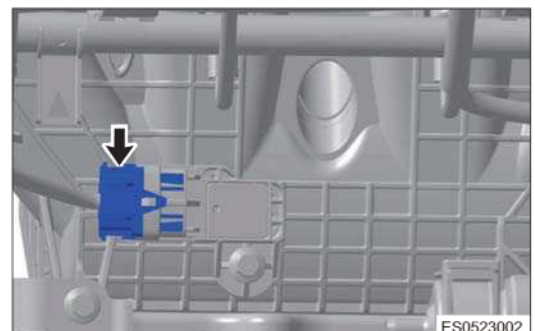
Intake pressure/temperature sensor voltage is normal

Result

Proceed to
OK
NG

NG**Reinstall or replace intake pressure/temperature sensor****OK****6 Check intake pressure/temperature sensor**

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect the intake pressure/temperature sensor connector (arrow).



- (d) Check sensor connection part for debris, ice, oil and damage.

OK

Intake pressure/temperature sensor itself has no malfunction

Result

Proceed to
OK
NG

NG

Replace intake pressure/temperature sensor

OK

06

7

Check intake system

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

OK

Intake pressure/temperature sensor itself has no malfunction

Result

Proceed to
OK
NG

NG

Repair faulty components of intake system

OK

8

Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Refer to "DTC Confirmation Procedure".
 (e) Check if DTC P0105 28, P0106 00, P0107 11 or P0108 12 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

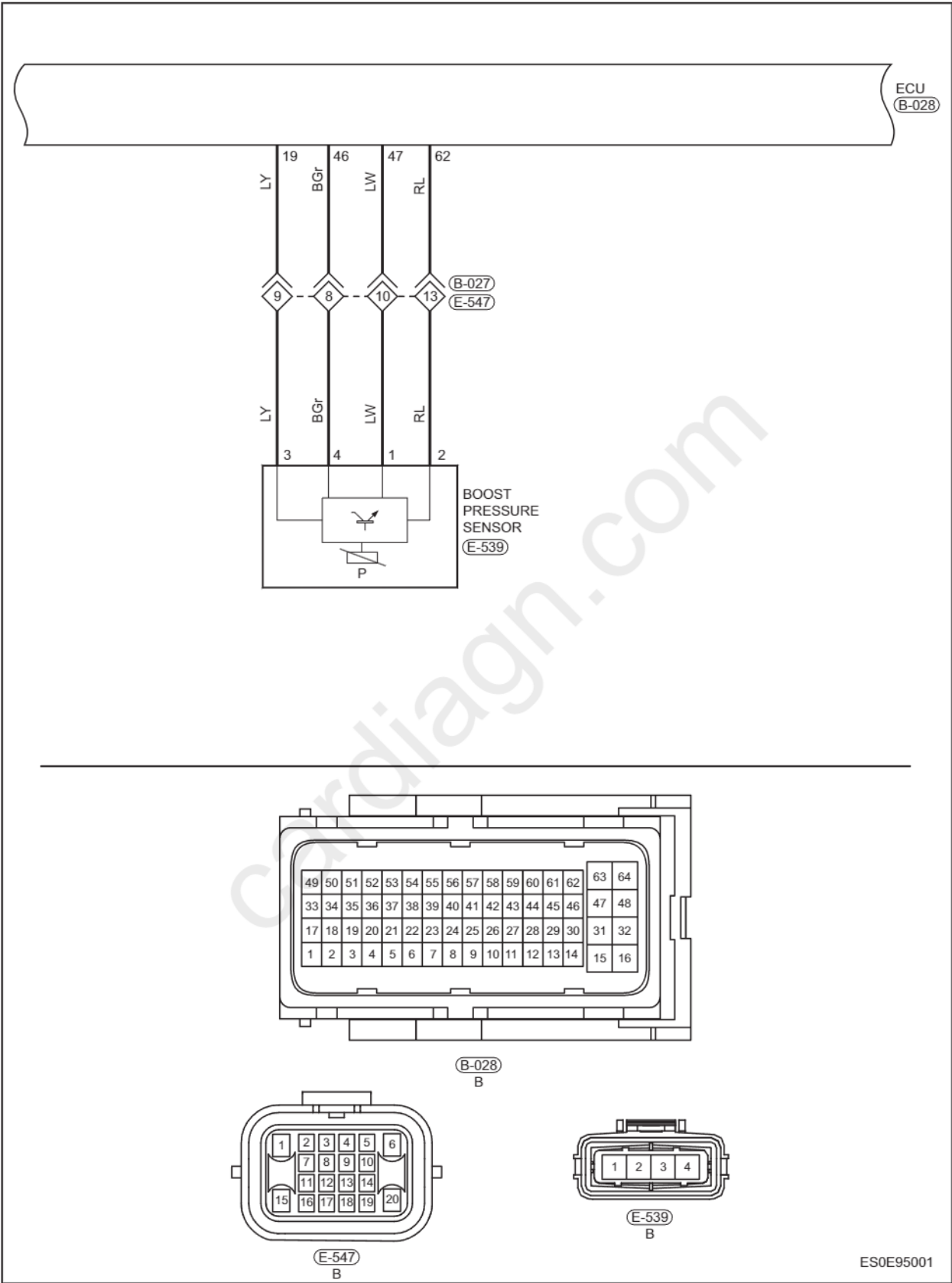
Replace with new ECU to check if malfunction reoccurs

DTC	P0234 00	Turbu/Super Charger Overboost Condition
DTC	P0237 16	Turbocharger Boost Sensor (A) Circ. Low Input
DTC	P0238 17	Turbocharger Boost Sensor (A) Circ. High Input



Circuit Diagram

06



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0234 00	Turbo/Super Charger Overboost Condition	ENGINE START STOP switch ON, engine running	- Boost pressure/temperature sensor - Wire harness or connector - ECU
P0237 16	Turbocharger Boost Sensor (A) Circ. Low Input		
P0238 17	Turbocharger Boost Sensor (A) Circ. High Input		

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Check turbocharger assembly pipe**

- Check if boost pressure sensor is installed in place.
- Check each turbocharger assembly pipe for cracks or disconnection.

OK

Boost pressure sensor power supply is normal

Result

Proceed to
OK
NG

NG

Check and repair wire harness between boost pressure sensor and ECU

OK**2 Check boost pressure/temperature sensor power supply circuit voltage**

- Turn ignition switch to ON and start engine.



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

Voltage Inspection

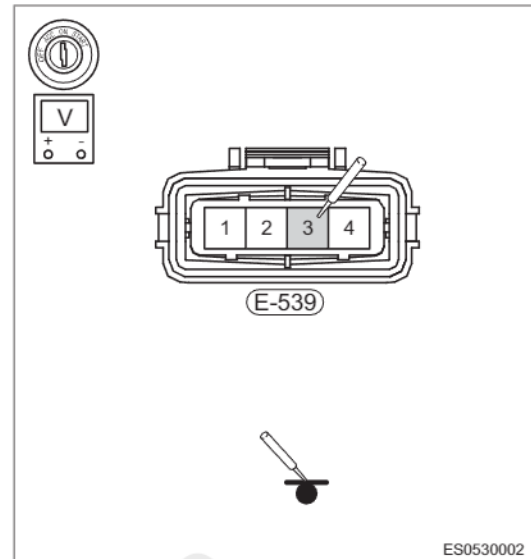
Multimeter Connection	Condition	Specified Condition
E-539 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Boost pressure sensor power supply is normal

Result

Proceed to
OK
NG



ES0530002

NG

Check and repair wire harness between boost pressure sensor and ECU

OK

3 Check boost pressure/temperature sensor signal circuit

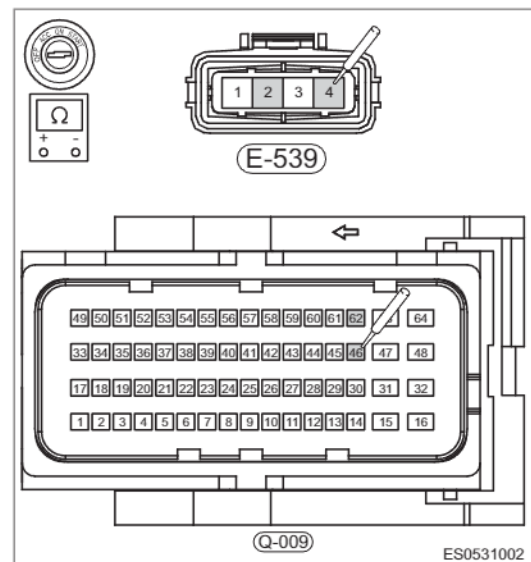
- (a) Turn ignition switch to ON and start engine.
(b) Measure wire harness between terminal 4 of connector E-539 and ECU.

Check for Open

Multimeter Connection	Condition	Specified Condition
F-539 (4) - B-028 (46)	Always	Resistance $\leq 1 \Omega$
E-539 (2) - B-028 (62)	Always	Resistance $\leq 1 \Omega$

Result

Proceed to
OK
NG



ES0531002

NG

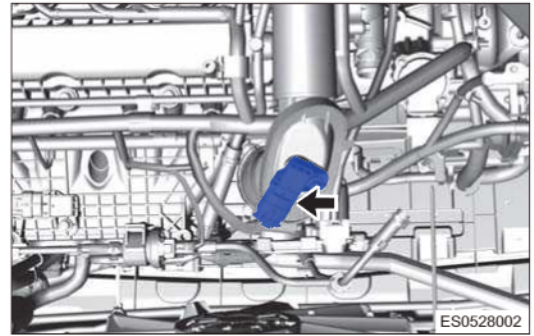
Check and repair wire harness between boost pressure sensor and ECU

OK

4 Check boost pressure/temperature sensor

- (a) Turn ignition switch to OFF.

- (b) Disconnect the negative battery cable.
- (c) Disconnect the boost pressure/temperature sensor connector E-539 (arrow).



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

OK

Boost pressure/temperature sensor itself has no malfunction

Result

Proceed to
OK
NG

NG

Clean or replace boost pressure/
temperature sensor

OK

5 Check ERCV relief solenoid valve

- (a) Remove the ERCV relief solenoid valve connector.
- (b) Check ERCV relief solenoid valve for damage or poor connection.

OK

Exhaust by-pass solenoid valve itself has no malfunction

Result

Proceed to
OK
NG

NG

Clean or replace ERCV relief solenoid
valve

OK

6 Check exhaust by-pass solenoid valve

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

OK

Exhaust by-pass solenoid valve itself has no malfunction

Result

Proceed to
OK



Proceed to
NG

NG	Clean or replace exhaust by-pass solenoid valve
----	---

OK

7	Reconfirm DTCs
---	----------------

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0234 00, P0237 16 or P0238 17 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK	System operates normally
----	--------------------------

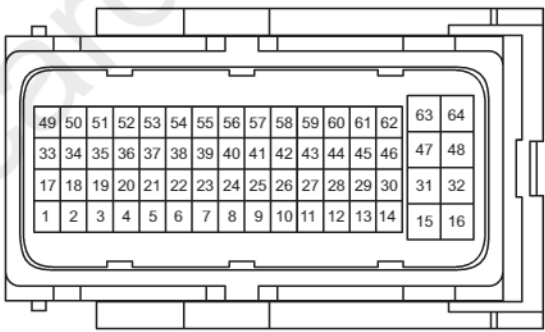
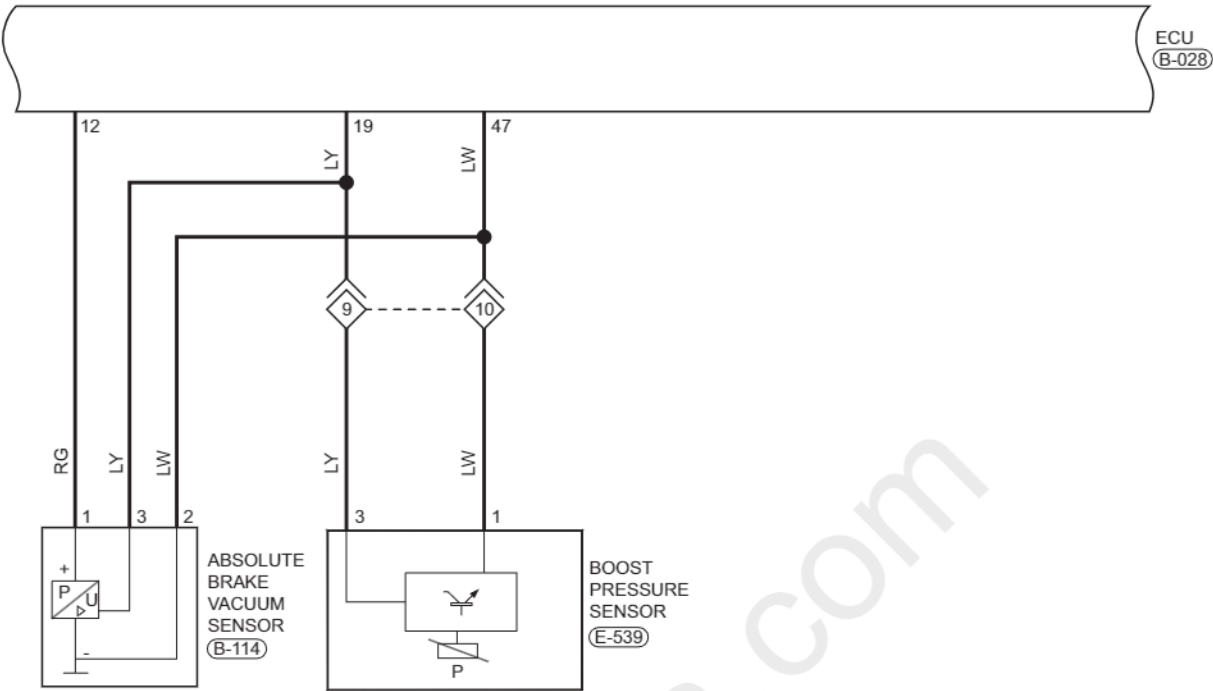
NG	Replace with new ECU to check if malfunction reoccurs
----	---

DTC	P0556 00	Brake Booster Pressure Sensor Circuit Performance Non-plausible
DTC	P0557 16	Brake Booster Pressure Sensor Circuit Low
DTC	P0558 17	Brake Booster Pressure Sensor Circuit High
DTC	P1137 17	Diagnosis of Pressure Sensor in Brake Booster Pump Circuit High
DTC	P1138 16	Diagnosis of Pressure Sensor in Brake Booster Pump Circuit Low

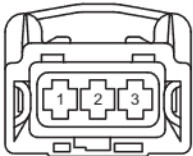


Circuit Diagram

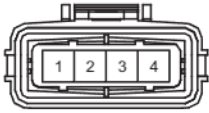
06



(B-028)
B



(B-114)
B



(E-539)
B

ES0E96001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0556 00	Brake Booster Pressure Sensor Circuit Performance Non-plausible	ENGINE START STOP switch ON, engine running	- Brake vacuum pressure sensor - Wire harness or connector - ECU
P0557 16	Brake Booster Pressure Sensor Circuit Low		
P0558 17	Brake Booster Pressure Sensor Circuit High		
P1137 17	Diagnosis of Pressure Sensor in Brake Booster Pump Circuit High		
P1138 16	Diagnosis of Pressure Sensor in Brake Booster Pump Circuit Low		

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Check vacuum pressure sensor power supply voltage**

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

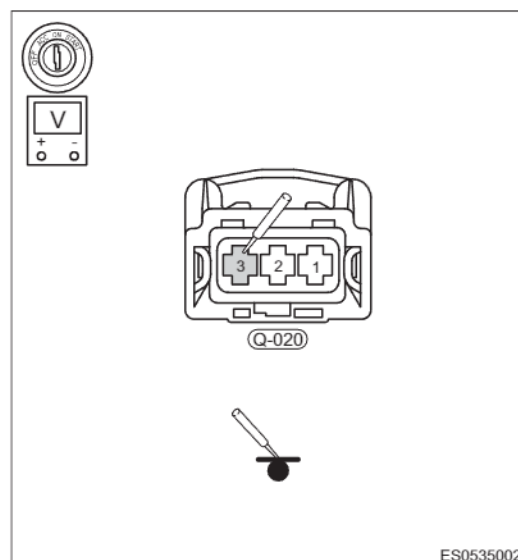
Multimeter Connection	Condition	Specified Condition
Q-020 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Vacuum pressure sensor power supply voltage is normal

Result

Proceed to
OK
NG

**NG**

Check and repair wire harness between vacuum pressure sensor and ECU



OK

2 Check vacuum pressure sensor signal circuit

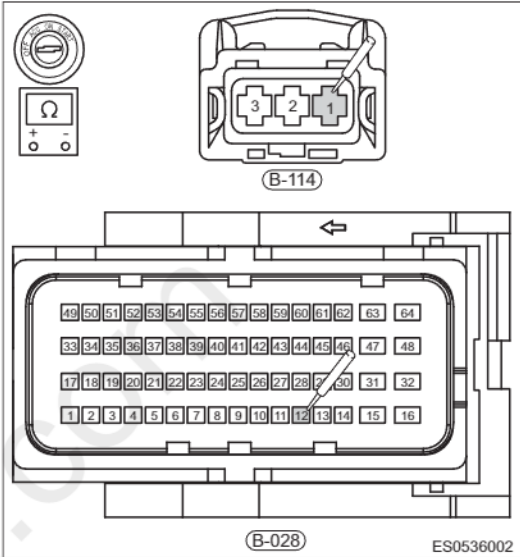
- (a) Turn ignition switch to OFF.
- (b) Disconnect the negative battery cable.
- (c) Disconnect vacuum pressure sensor connector B-114 and ECU connector B-028.
- (d) Check the wire harness between connector.

Check for Open

Multimeter Connection	Condition	Specified Condition
B-114 (1) - B-028 (12)	Always	Resistance ≤ 1 Ω

Result

Proceed to
OK
NG



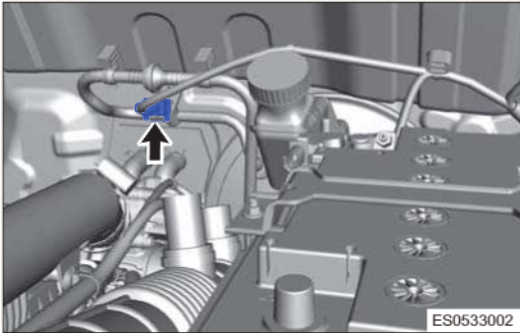
NG

Check and repair wire harness between vacuum pressure sensor and ECU

OK

3 Check vacuum pressure sensor

- (a) Disconnect the vacuum pressure sensor connector B-114 (arrow).



- (b) Check sensor connection part for debris and damage.

OK
Vacuum pressure sensor itself has no malfunction

Result

Proceed to
OK
NG

NG

Clean or replace vacuum pressure sensor

OK

4

Reconfirm DTCs

- (a) Connect the negative battery cable.
- (b) ENGINE START STOP switch ON
- (c) Using diagnostic tester, read ECU DTC.
- (d) Check if DTC P0556 00, P0557 16, P0558 17, P1137 17, P1138 16 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

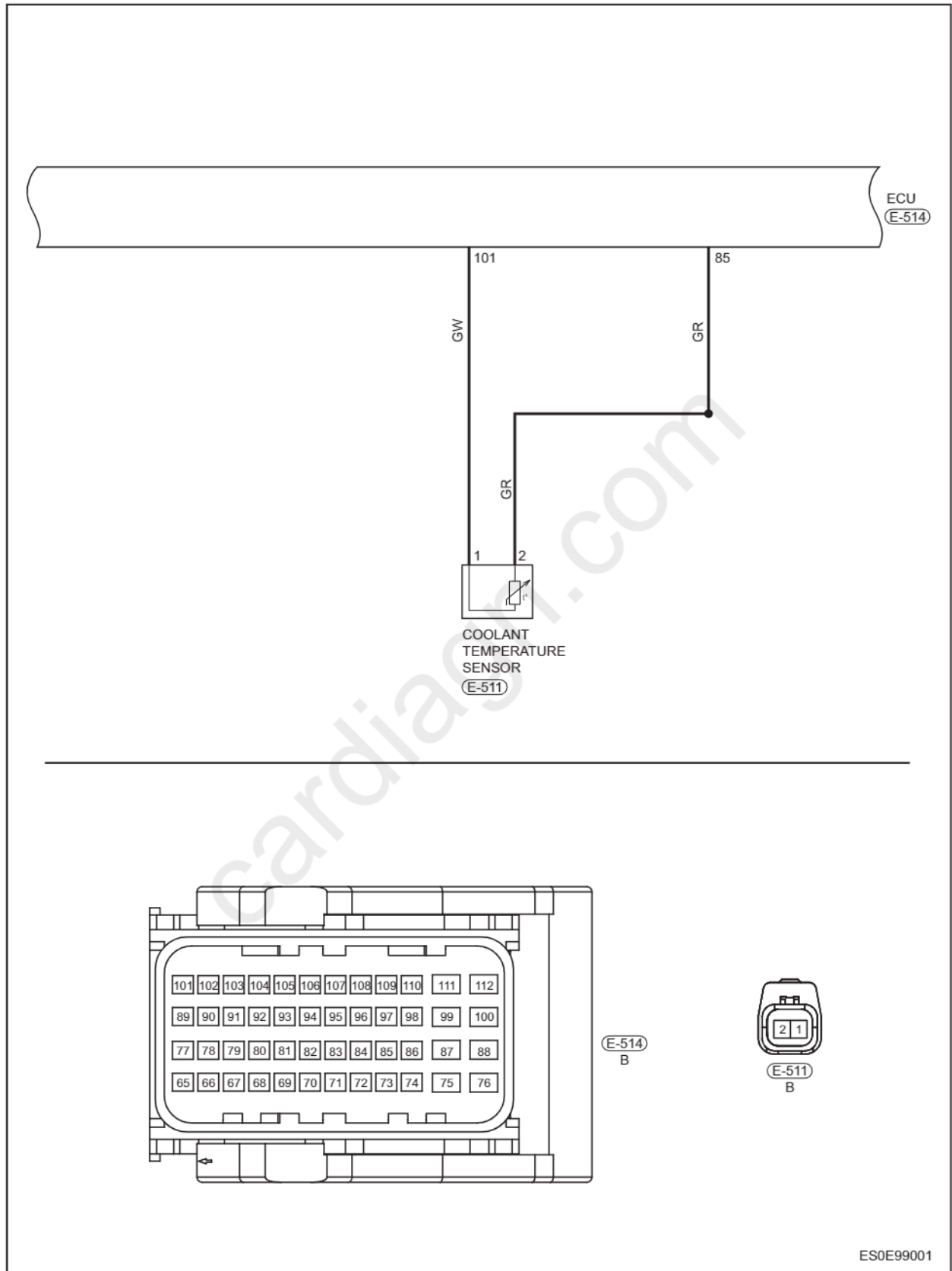
Replace with new ECU to check if malfunction reoccurs

06



DTC	P0116 00	Engine Coolant Temp.Circ. Performance Non-plausible
DTC	P0117 16	Engine Coolant Temp.Circ. Low Input
DTC	P0118 17	Engine Coolant Temp.Circ. High Input

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0116 00	Engine Coolant Temp.Circ. Performance Non-plausible	ENGINE START STOP switch ON, engine running	- Engine coolant temperature sensor - Wire harness or connector - ECU
P0117 16	Engine Coolant Temp.Circ. Low Input		
P0118 17	Engine Coolant Temp.Circ. High Input		

Confirmation Procedure

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

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

Caution:

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

Procedure

1 Check engine coolant temperature sensor power supply voltage

- Turn ignition switch to ON.
- Measure voltage between engine coolant temperature sensor terminal and body ground (using a digital multimeter).

Voltage Inspection

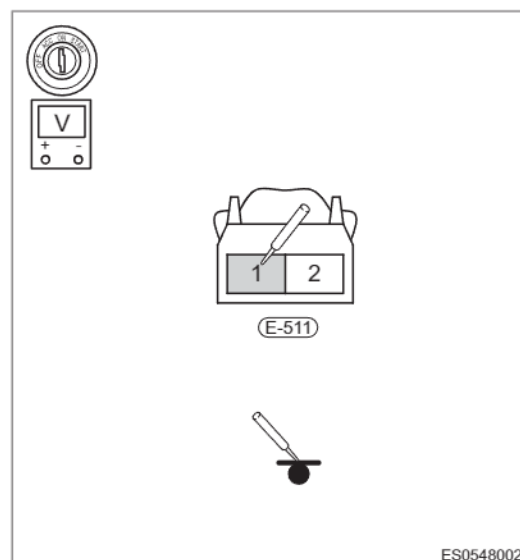
Multimeter Connection	Condition	Specified Condition
E-511 (1) - Body ground	ENGINE START STOP switch ON	5 V

OK

Engine coolant temperature sensor voltage is normal

Result

Proceed to
OK
NG



NG

Check and repair wire harness between coolant temperature sensor and ECU

OK

2 Read data flow of coolant temperature sensor

- Connect diagnostic tester, turn ignition switch to ON.

- (b) Do not start engine, read "Coolant Temperature Sensor Measured Value" and check if it is within the normal range.

OK

Data flow of coolant temperature sensor is normal

Result

Proceed to
OK
NG

OK

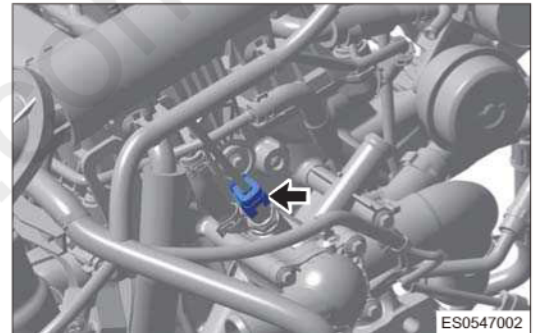
End

NG

3 Check engine coolant temperature sensor

06

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect the engine coolant temperature sensor connector E-511 (arrow).



ES0547002

- (d) Remove the engine coolant temperature sensor.
 (e) Measure resistance of engine coolant temperature sensor.

Check for Open

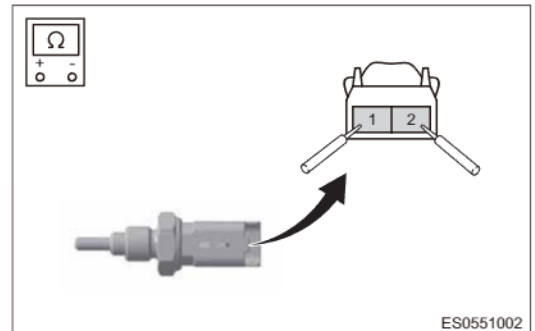
Multimeter Connection	Specified Condition
Terminal 1 - Terminal 2	Resistance is $2.5 \text{ k}\Omega \pm 5\%$ at normal temperature (20°C), $300 \Omega - 400 \Omega$ in boiled water (80°C) (value changes with boiled water temperature)

Result

Proceed to
OK
NG

NG

Clean or replace engine coolant temperature sensor



ES0551002

OK

4 Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON



- (c) Using diagnostic tester, read ECU DTC.
- (d) Check if DTC P0116 00, P0117 16, P0118 17 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

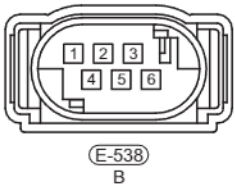
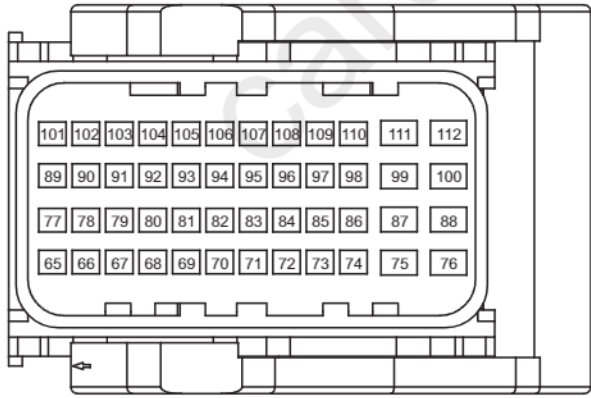
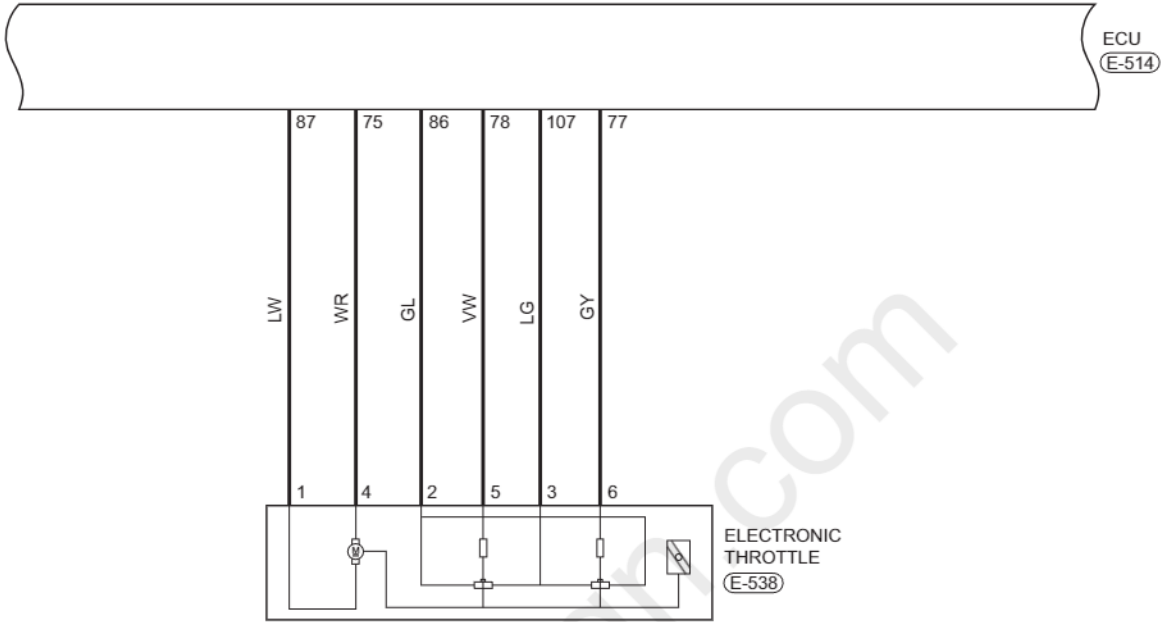
OK	System operates normally
NG	Replace ECU to perform real-vehicle check

DTC	P0121 29	Throttle Pos.Sensor 1 Circ. Performance Non-plausible
DTC	P0122 16	Throttle Pos.Sensor 1 Circ. Low Input
DTC	P0123 17	Throttle Pos.Sensor 1 Circ. High Input
DTC	P0221 29	Throttle Position Sensor 2 Performance Non-plausible
DTC	P0222 16	Throttle Position Sensor 2 Performance Low Input
DTC	P0223 17	Throttle Position Sensor 2 Performance High Input



Circuit Diagram

06



ES0E00001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0121 29	Throttle Pos.Sensor 1 Circ. Performance Non-plausible	ENGINE START STOP switch ON, engine running	- Throttle position sensor 1 - Throttle Position Sensor 2 - Wire harness or connector - ECU
P0122 16	Throttle Pos.Sensor 1 Circ. Low Input		
P0123 17	Throttle Pos.Sensor 1 Circ. High Input		
P0221 29	Throttle Position Sensor 2 Performance Non-plausible		
P0222 16	Throttle Position Sensor 2 Performance Low Input		
P0223 17	Throttle Position Sensor 2 Performance High Input		

Confirmation Procedure

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

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

Caution:

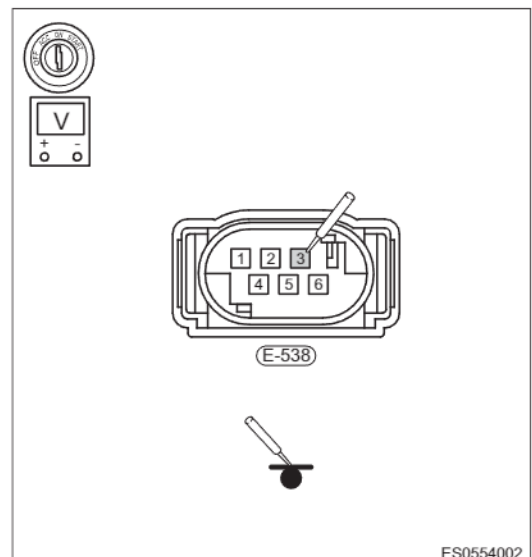
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check installation of electronic throttle connector**

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

Result

Proceed to
OK
NG

**NG****Reconnect electronic throttle connector****OK**

2 Check throttle position sensor power supply voltage

- Turn ignition switch to ON.
- Measure voltage between electronic throttle connector E-538 (3) terminal and body ground (using a digital multimeter) (online detection).

Voltage Inspection

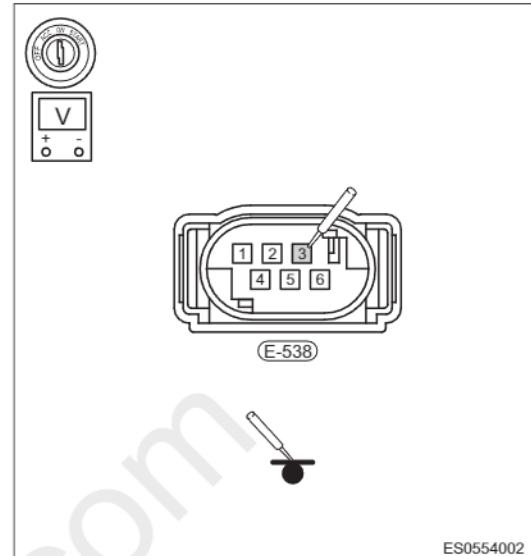
Multimeter Connection	Condition	Specified Condition
E-538 (3) - Body ground	ENGINE START STOP switch ON	5 V

OK

Throttle position sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG

Check and repair power supply wire harness between throttle and ECU

OK

3 Check throttle position sensor signal voltage

- Turn ignition switch to ON.
- Measure the throttle position sensor signal voltage (using a digital multimeter) (online detection).

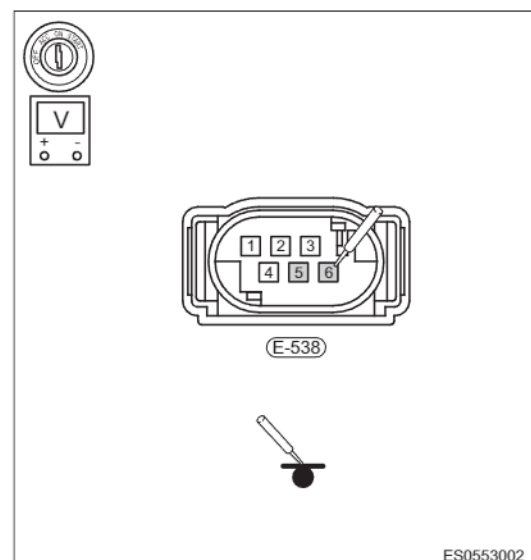
Multimeter Connection	Condition	Specified Condition
E-538 (6) - Body ground	Ignition switch ON, idling	0.74 V
	ENGINE START STOP switch ON, throttle fully opened	4.24 V
E-538 (5) - Body ground	Ignition switch ON, idling	4.24 V
	ENGINE START STOP switch ON, throttle fully opened	0.36 V

OK

Throttle position sensor voltage is normal

Result

Proceed to
OK
NG



NG

Check and repair signal wire harness between throttle and ECU

OK

4 Clear and read DTCs again

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

OK

DTCs do not recur, diagnosis is completed

Result

Proceed to
OK
NG

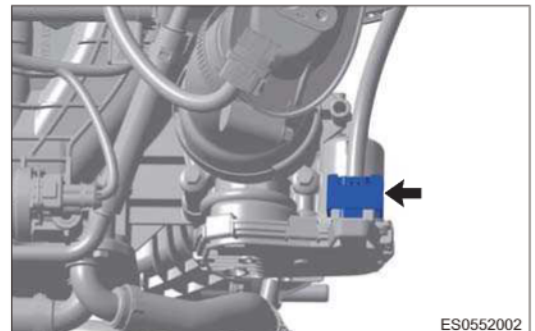
OK

OK
End

NG

5 Check electronic throttle

- (a) Turn ignition switch to OFF.
- (b) Disconnect the negative battery cable.
- (c) Disconnect the electronic throttle connector E-538 (arrow).



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



(f) Check the resistance of electronic throttle.

Throttle Inspection

Multimeter Connection	Condition	Specified Condition
Terminal 5 - Terminal 3	Throttle turned	Resistance between terminals 5 and 3 increases as throttle valve opens
Terminal 6 - Terminal 3		Resistance between terminals 6 and 3 decreases as throttle valve opens
Terminal 5 - Terminal 3 and Terminal 6 - Terminal 3	On same position of valve at normal temperature	Sum of resistance in two groups is $1.9\text{ k}\Omega \pm 0.2\text{ k}\Omega$

OK

Each throttle position sensor terminal resistance is normal

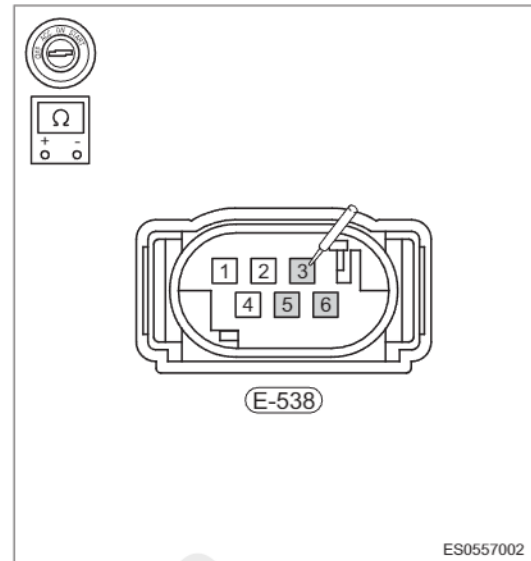
Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (electronic throttle - ECU)

OK



6

Reconfirm DTCs

- Connect the negative battery cable.
- ENGINE START STOP switch ON
- Using diagnostic tester, read ECU DTC.
- Check if DTC P0121 29, 0122 16, 0123 17, 0221 29, 0222 16 or P0223 17 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

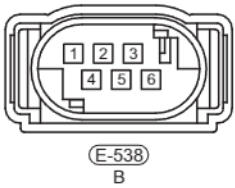
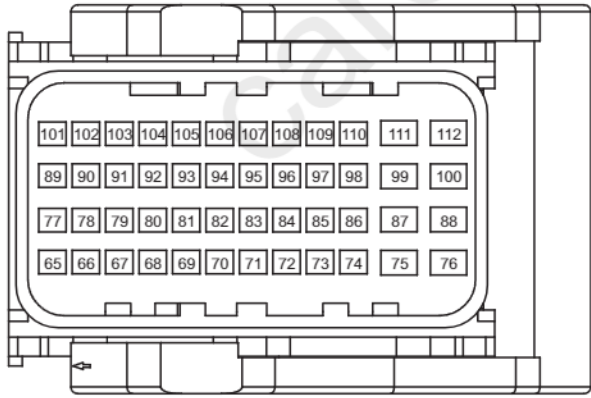
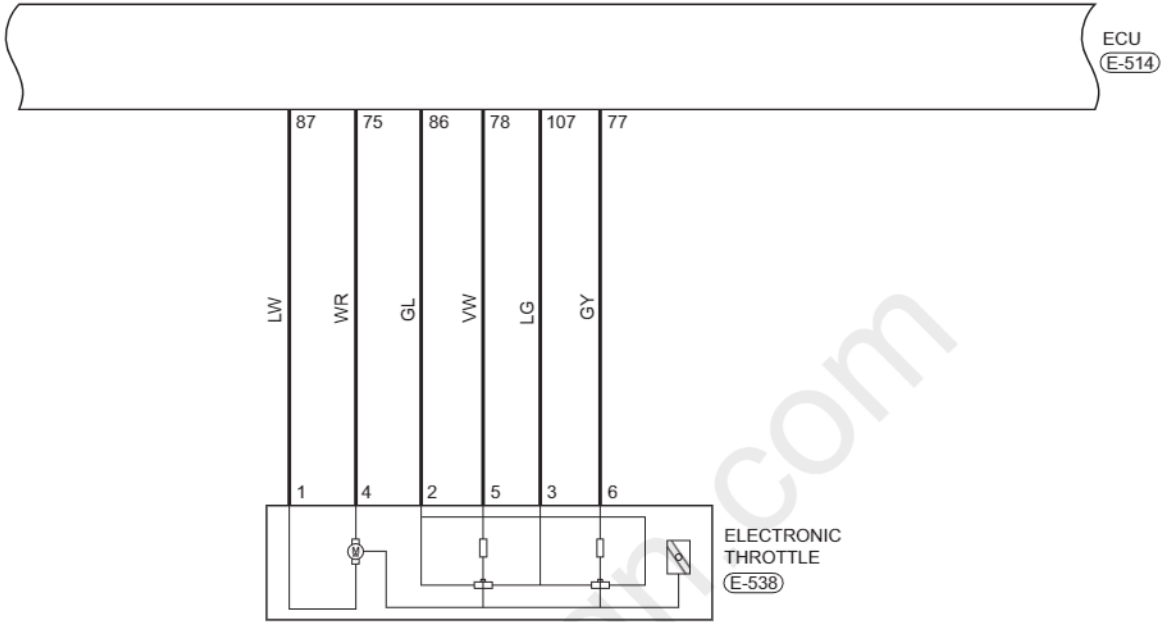
Replace with new ECU to check if malfunction reoccurs

DTC	P1102 00	Throttle limphome position self learning error
DTC	P1102 29	Throttle lower mechanic stop re-learning error
DTC	P1103 00	Throttle lower mechanic stop first learning error
DTC	P1104 00	Throttle self learning condition not fulfilled
DTC	P1106 00	Throttle position deviation error
DTC	P1106 22	Throttle PID adjustment max error
DTC	P1106 21	Throttle PID adjustment min error
DTC	P1111 00	Return spring check max error
DTC	P1122 77	Torque Limitation when Throttle-valve Error happen



Circuit Diagram

06



ES0E00001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P1102 00	Throttle limp-home position self learning error	ENGINE START STOP switch ON, engine running	- Throttle position sensor 1 - Throttle Position Sensor 2 - Wire harness or connector - ECU
P1102 29	Throttle lower mechanic stop re-learning error		
P1103 00	Throttle lower mechanic stop first learning error		
P1104 00	Throttle self learning condition not fulfilled		
P1106 00	Throttle position deviation error		
P1106 21	Throttle PID adjustment min error		
P1106 22	Throttle PID adjustment max error		
P1111 00	Return spring check max error		
P1122 77	Torque Limitation when Throttle-valve Error happen		

06

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Do electronic throttle self-learning**

- Connect diagnostic tester, clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute.
- Perform electronic throttle self-learning.

OK

Throttle self-learning is finished

Result

Proceed to
OK
NG

OK

Check electronic throttle signal voltage

NG



2 Check if conditions of throttle self-learning are met

(a) Check if conditions of throttle self-learning are met

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

OK

Throttle self-learning is finished

Result

06

Proceed to

OK

NG

NG

Find and repair faulty components

OK

3 Perform electronic throttle self-learning

- (a) Connect diagnostic tester, clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute.
- (b) Perform electronic throttle self-learning, after self-learning is finished, slightly depress accelerator pedal several times, observe if DTCs appear again.

OK

Throttle self-learning is finished

Result

Proceed to

OK

NG

NG

Repair or replace wire harness or connector (electronic throttle - ECU)

OK

4 Check throttle position sensor signal voltage

- (a) Turn ignition switch to ON.

- (b) Measure the throttle position sensor signal voltage (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-538 (6) - Body ground	Ignition switch ON, idling	0.74 V
	ENGINE START STOP switch ON, throttle fully opened	4.24 V
E-538 (5) - Body ground	Ignition switch ON, idling	4.24 V
	ENGINE START STOP switch ON, throttle fully opened	0.36 V

OK

Throttle position sensor voltage is normal

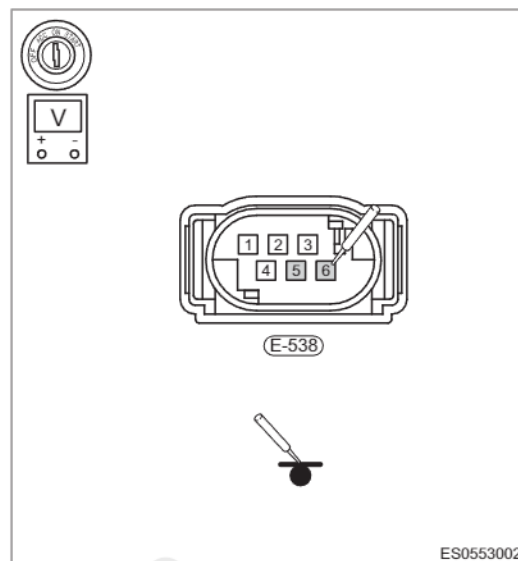
Result

Proceed to
OK
NG

NG

Check and repair signal wire harness between electronic throttle and ECU

OK

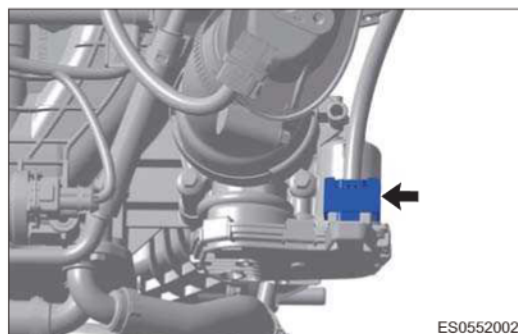


06

5

Check electronic throttle

- Turn ignition switch to OFF.
- Disconnect the negative battery cable.
- Disconnect the electronic throttle connector E-538 (arrow).



- Check electronic throttle for carbon deposits and foreign matter accumulation inside.
- Check if electronic throttle valve body is stuck.



(f) Check the resistance of electronic throttle.

Throttle Inspection

Multimeter Connection	Condition	Specified Condition
Terminal 5 - Terminal 3	Throttle turned	Resistance between terminals 6 and 2 increases as throttle valve opens
Terminal 6 - Terminal 3		Resistance between terminals 6 and 3 decreases as throttle valve opens
Terminal 5 - Terminal 3 and Terminal 6 - Terminal 3	On same position of valve at normal temperature	Sum of resistance in two groups is $1.9\text{ k}\Omega \pm 0.2\text{ k}\Omega$

OK

Each throttle position sensor terminal resistance is normal

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (electronic throttle - ECU)

OK

6

Check throttle position sensor actuator motor wire harness

(a) Check the throttle position sensor actuator motor wire harness.

Result

Proceed to
OK
NG

NG

Check and repair actuator motor wire harness between electronic throttle and ECU

OK

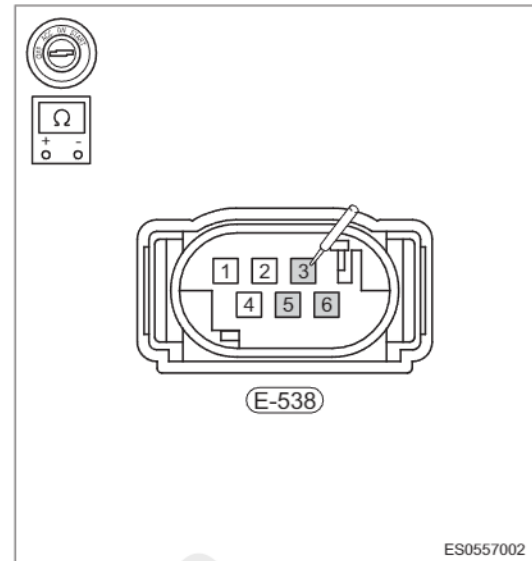
7

Perform electronic throttle self-learning again

- Install throttle assembly, connect throttle connector and ECU connector securely.
- Connect the negative battery cable.
- Connect diagnostic tester, clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute.
- Perform electronic throttle self-learning.

OK

Throttle self-learning is finished



Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (electronic throttle - ECU)

OK**8****Reconfirm DTCs**

- (a) Slowly and quickly depress the accelerator pedal several times, and then read DTCs again to check if malfunction reoccurs.
- (b) Check if DTC P1102 00, P1102 29, P1103 00, P1104 00, P1106 00, P1106 21, P1106 22, P1111 00, P1122 77 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

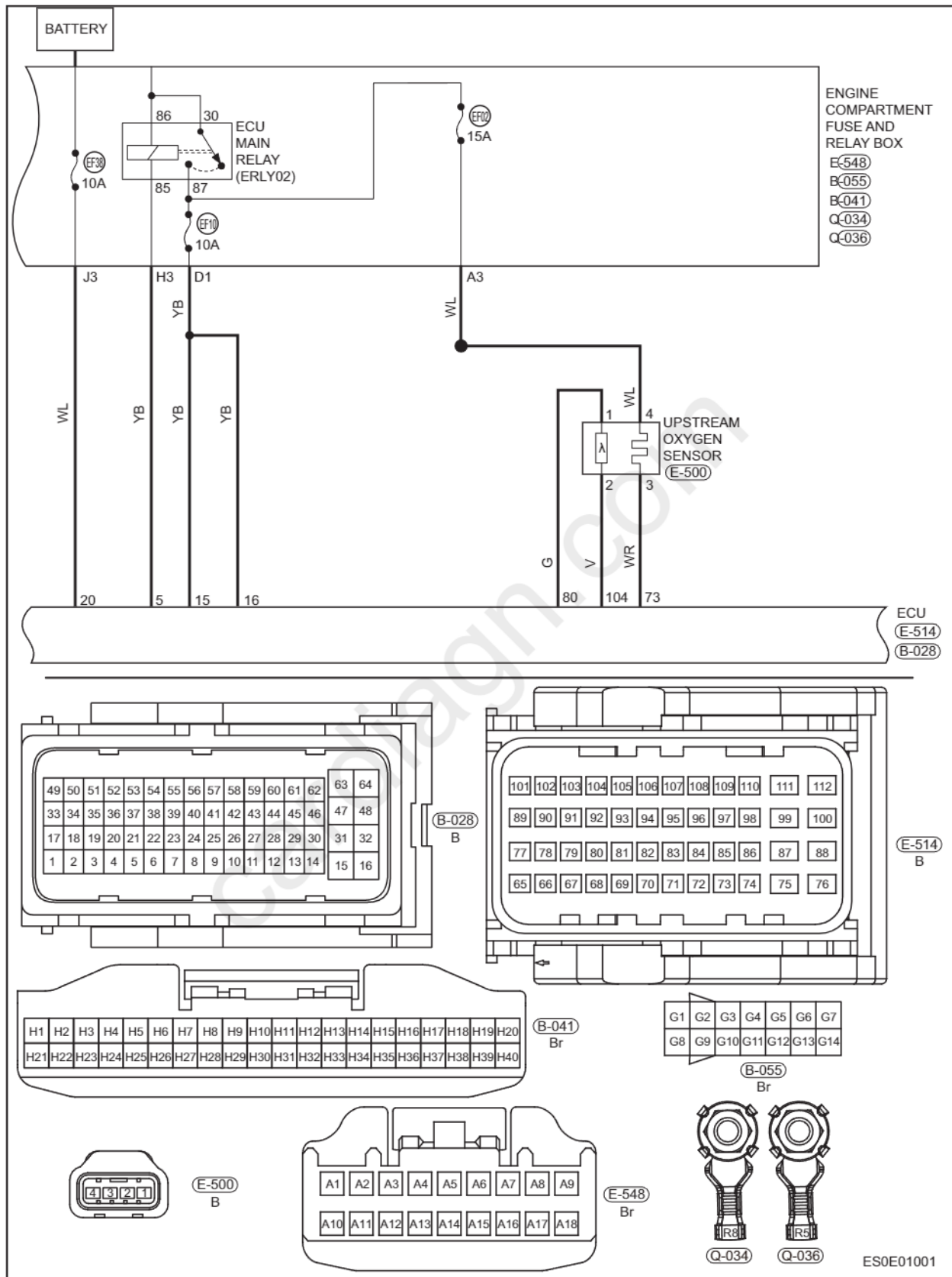
NG

End

06

DTC	P0130 00	O2 Sensor Circ. Malfunction (Upstream of the Catalyzer)
DTC	P0131 16	Upstream Oxygen Sensor Signal Circuit Voltage Too Low
DTC	P0132 17	O2 Sensor Circ. High Voltage (Upstream of the Catalyzer)
DTC	P0133 00	O2 Sensor Circ. Slow Response (Upstream of the Catalyzer)
DTC	P0134 00	O2 Sensor Circ. No Activity Detected (upstream of the catalyzer)
DTC	P2195 00	O2 Sensor Signal Stuck Lean (upstream of the catalyzer)
DTC	P2196 00	O2 Sensor Signal Stuck Rich (upstream of the catalyzer)

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0130 00	O2 Sensor Circ. Malfunction (Upstream of the Catalyzer)	Ignition switch ON, engine running	- Upstream Oxygen Sensor - Wire harness or connector - ECU
P0131 16	Upstream Oxygen Sensor Signal Circuit Voltage Too Low		
P0132 17	O2 Sensor Circ. High Voltage (Upstream of the Catalyzer)		
P0133 00	O2 Sensor Circ. Slow Response (Upstream of the Catalyzer)		
P0134 00	O2 Sensor Circ. No Activity Detected (upstream of the catalyzer)		
P2195 00	O2 Sensor Signal Stuck Lean (upstream of the catalyzer)		
P2196 00	O2 Sensor Signal Stuck Rich (upstream of the catalyzer)		

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check fuse EF02
----------	------------------------

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

Result

Proceed to
OK
NG

NG

Replace fuse or check the cause for no power

OK

2	Check upstream oxygen sensor power supply voltage
----------	--

- (a) Turn ENGINE START STOP switch to ON.

- (b) Measure voltage between terminal 4 of connector E-500 and ground (using a digital multimeter).

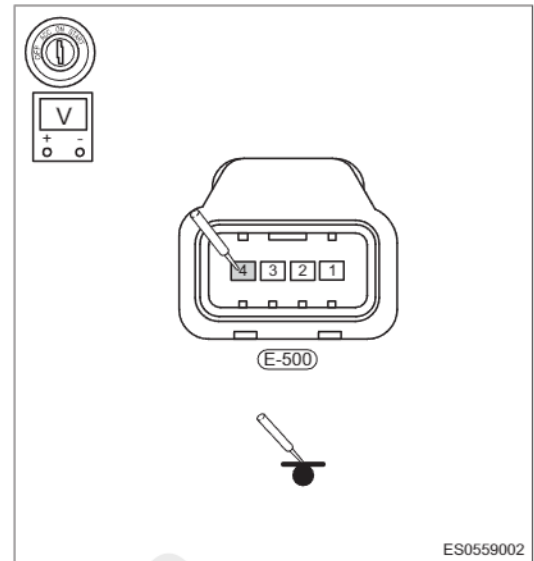
Multimeter Connection	Condition	Specified Condition
E-500 (4) - Body ground	ON	Not less than 12 V

OK

Upstream oxygen sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG

Check and repair wire harness between upstream oxygen sensor power supply and engine compartment fuse and relay box

OK

3 Check voltage between upstream oxygen sensor signal wire and ground wire

- (a) Turn ignition switch to ON.
(b) Measure voltage between terminals 2 and 1 of connector E-500 (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-500 (2) - E-500 (1)	ON	Approximately 0.45 V

OK

Upstream oxygen sensor signal is normal

Result

Proceed to
OK
NG

NG

Check and repair wire harness or connector

OK

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

- (a) Turn ignition switch to ON, start engine and idle it until engine coolant temperature is normal.



(b) Measure voltage between terminals 2 and 1 of connector E-500 (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-500 (2) - E-500 (1)	Engine running	Fluctuates rapidly between 0.1 and 1 V (coolant temperature is normal)

Result

Proceed to
OK
NG

NG

Repair or replace upstream oxygen sensor

06

OK

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

- Start engine and idle it until engine coolant temperature is normal, and leave the vehicle in idle state.
- Stop engine and disconnect upstream oxygen sensor connector.
- Check for short between terminals 3 and 2 of connector E-500.

Multimeter Connection	Condition	Specified Condition
E-500 (2) - E-500 (3)	Engine running	No short circuit

Result

Proceed to
OK
NG

NG

Replace upstream oxygen sensor

OK

6 Check the upstream oxygen sensor.

- Turn ignition switch to OFF.
- Disconnect the negative battery cable.
- Remove the upstream oxygen sensor.
- Check upstream oxygen sensor for the following problems.
 - Moisture enters the internal of sensor, temperature changes greatly or probe is broken or deteriorated.

OK

Upstream oxygen sensor is normal

Result

Proceed to
OK
NG

NG

Repair or replace upstream oxygen sensor

OK

7

Reconfirm DTCs

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

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs

06



DTC	P0136 00	O2 Sensor Circ. Malfunction (Downstream of the Catalyzer)
DTC	P0137 16	O2 Sensor Circ. Low Voltage (Downstream of the Catalyzer)
DTC	P0138 17	O2 Sensor Circ. High Voltage (Downstream of the Catalyzer)
DTC	P0140 00	O2 Sensor Circ. No Activity Detected (Downstream of the Catalyzer)
DTC	P2270 00	O2 Sensor Signal Stuck Lean (downstream of the catalyzer)
DTC	P2271 00	O2 Sensor Signal Stuck Rich (downstream of the catalyzer)

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0136 00	O2 Sensor Circ. Malfunction (Downstream of the Catalyzer)	Ignition switch ON, engine running	- Downstream Oxygen Sensor - Wire harness or connector - ECU
P0137 16	O2 Sensor Circ. Low Voltage (Downstream of the Catalyzer)		
P0138 17	O2 Sensor Circ. High Voltage (Downstream of the Catalyzer)		
P0140 00	O2 Sensor Circ. No Activity Detected (Downstream of the Catalyzer)		
P2270 00	O2 Sensor Signal Stuck Lean (downstream of the catalyzer)		
P2271 00	O2 Sensor Signal Stuck Rich (downstream of the catalyzer)		

06

Confirmation Procedure

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

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

Caution:

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

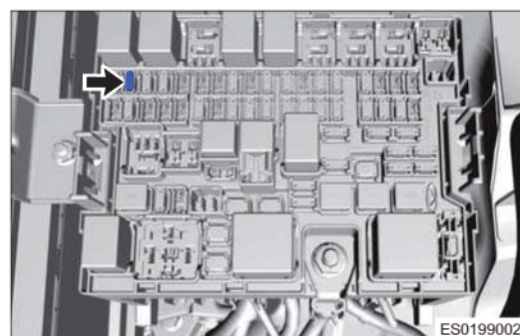
Procedure

1 Check fuse EF02

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

Result

Proceed to
OK
NG



NG

Replace fuse or check the cause for no power

OK

2 Check downstream oxygen sensor power supply voltage

- (a) Turn ENGINE START STOP switch to ON.

- (b) Measure voltage between terminal 4 of connector E-501 and ground (using a digital multimeter) (online detection).

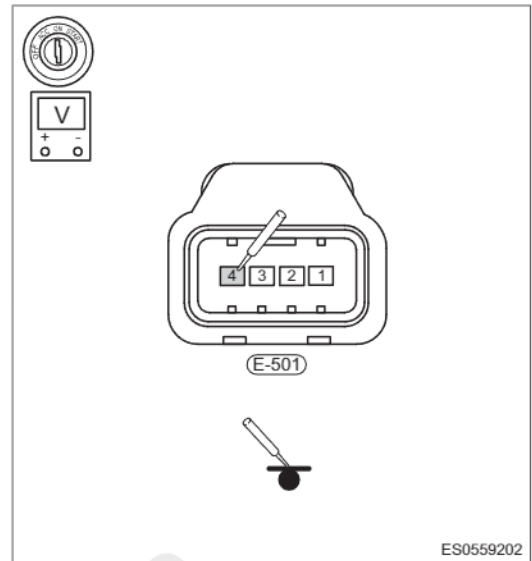
Multimeter Connection	Condition	Specified Condition
E-501 (4) - Body ground	ON	Not less than 12 V

OK

Downstream oxygen sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG

Repair or replace wire harness or connector

OK

3

Check voltage between downstream oxygen sensor signal wire and ground wire

- (a) Turn ignition switch to ON.
(b) Measure voltage between terminals 2 and 1 of connector E-501 (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-501 (2) - E-501 (1)	ON	0.45 V

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector

OK



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

- (a) Start engine and idle it until engine coolant temperature is normal.
 (b) Measure voltage between terminals 2 and 1 of connector E-501 (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
E-501 (2) - E-501 (1)	Engine running	Fluctuates rapidly between 0.1 and 1 V (coolant temperature is normal)

Result

Proceed to
OK
NG

NG

Repair or replace downstream oxygen sensor

OK

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

- (a) Start engine and idle it until engine coolant temperature is normal.
 (b) Stop engine and disconnect downstream oxygen sensor connector.
 (c) Check for short between terminals 3 and 2 of connector E-501.

Multimeter Connection	Condition	Specified Condition
E-501 (2) - E-501 (3)	Always	No short circuit

Result

Proceed to
OK
NG

NG

Repair or replace downstream oxygen sensor

OK

6 Reconfirm DTCs

- (a) Turn ignition switch to ON.
 (b) Using diagnostic tester, read ECU DTC.
 (c) Check if P0136 00, P0137 16, P0138 17, P0140 00, P2270 00, P2271 00 still exists.

OK

No same DTC is output

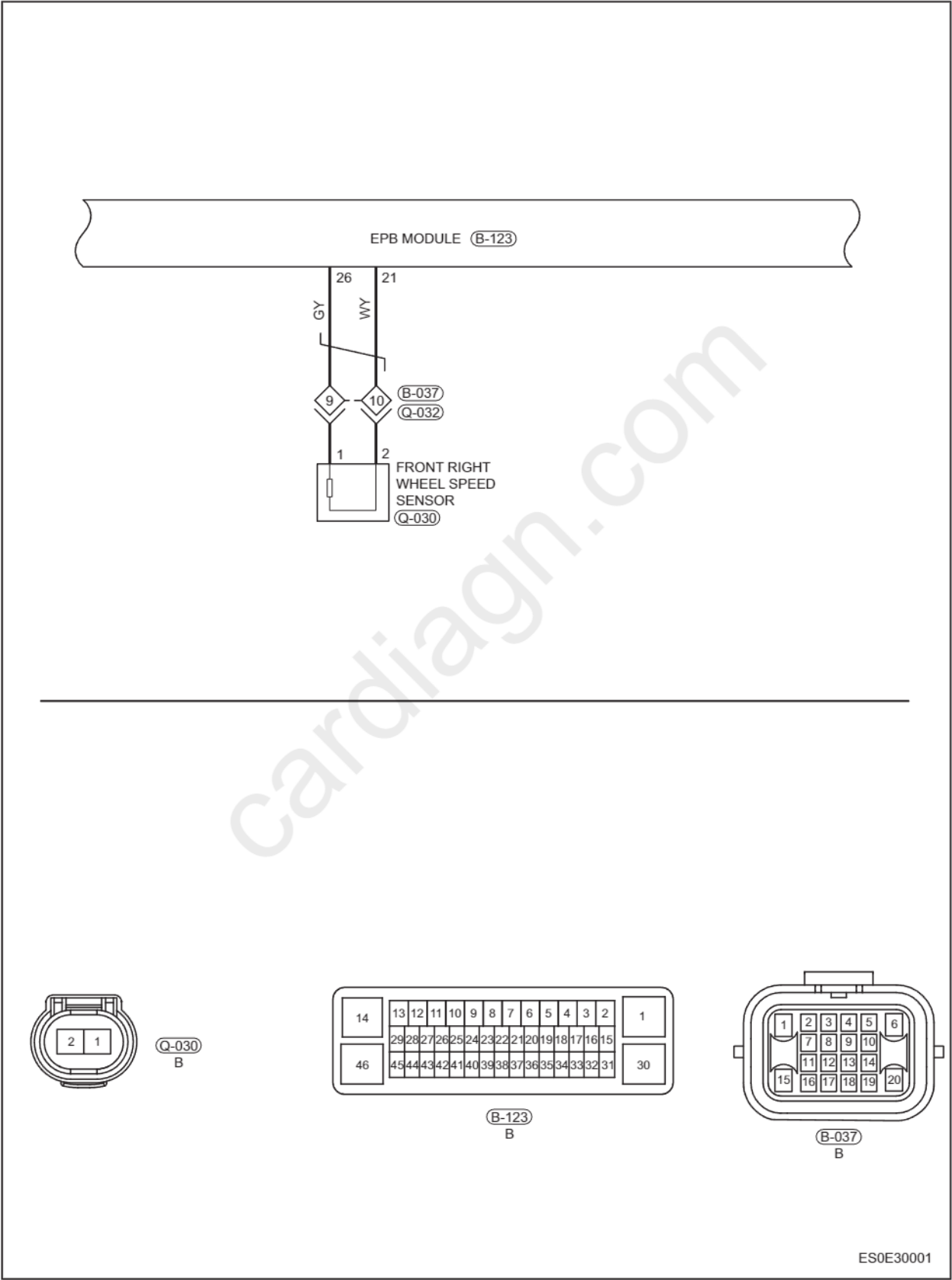
Result

Proceed to
OK
NG

OK**System operates normally****NG****Replace with new ECU to check if malfunction reoccurs**

DTC	P0501 00	Vehicle Speed Sensor Signal Fault
-----	----------	-----------------------------------

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0501 00	Vehicle Speed Sensor Signal Fault	Fuel cut-off signal activation (coast and fuel cut-off for 5 seconds or more when vehicle speed is more than 20 km/h); • Coolant temperature is 64.5°C; • Engine speed is between 1520 rpm and 4000 rpm	- Vehicle speed sensor - Wire harness or connector - ECU

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Check vehicle speed sensor (front right wheel speed sensor) connector**

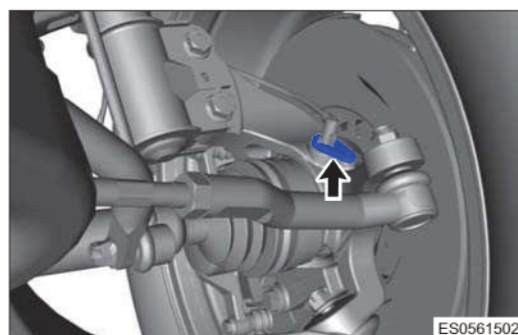
- Check vehicle speed sensor (front right wheel speed sensor) connector for improper installation or poor contact.
- Turn ENGINE START STOP switch to OFF
- Disconnect the negative battery cable.
- Disconnect vehicle speed sensor connector, and check connector for damage or terminal corrosion.

OK

Vehicle speed sensor (front right wheel speed sensor) is normal

Result

Proceed to
OK
NG

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

2**Check vehicle speed sensor (front right wheel speed sensor) signal circuit**

- (a) Check wire harness between vehicle speed sensor (front right wheel speed sensor) connector terminal and ESP module connector Q-015 terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
B-123 (26) - Q-030 (1)	Always	Resistance $\leq 1 \Omega$
B-123 (21) - Q-030 (2)		

Check for Short

Multimeter Connection	Condition	Specified Condition
B-123 (26) or Q-030 (1) or B-123 (21) or Q-030 (2) - Body ground	Always	Resistance ∞

OK

Vehicle speed sensor (front right wheel speed sensor) signal circuit is normal

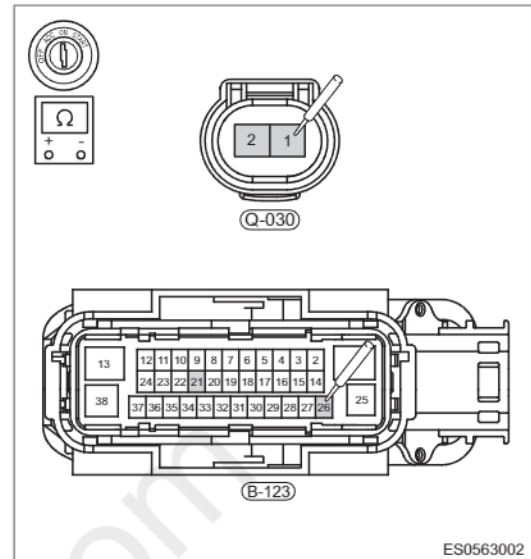
Result

Proceed to
OK
NG

NG

Repair or replace wire harness

OK



ES0563002

3**Reconfirm DTCs**

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0501 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs

DTC	P0506 00	Idle Control System RPM Lower than Expected
------------	-----------------	--

Description

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

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check electronic throttle
----------	----------------------------------

- Turn ignition switch to OFF.
- Disconnect the negative battery cable.
- Remove the electronic throttle assembly.
- Check if electronic throttle is stuck in smaller open position due to ice or oil.

OK

Electronic throttle is normal

Result

Proceed to
OK
NG

NG

Repair or replace electronic throttle assembly

OK

2	Check intake system for blockage
----------	---

- Check intake system for blockage.



OK

Intake system is normal

Result

Proceed to
OK
NG

NG

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

OK**06****3 Check injector for blockage**

(a) Check injector for blockage.

OK

Injector is normal

Result

Proceed to
OK
NG

NG

Replace or clean injector

OK**4 Check for excessive exhaust resistance**

(a) Check for excessive exhaust resistance.

OK

Exhaust system is normal

Result

Proceed to
OK
NG

NG

Repair or replace faulty exhaust system components

OK**5 Check for low fuel pressure**

(a) Check for low fuel pressure.

OK

Fuel pressure is normal

Result

Proceed to
OK
NG

NG

Repair or replace faulty fuel system components

OK**6****Check for weak spark plug ignition**

- (a) Check for weak spark plug ignition.

OK

Spark plug ignition is normal

Result

Proceed to
OK
NG

NG

Replace spark plug

OK**7****Reconfirm DTCs**

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0506 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs



DTC	P0507 00	Idle Control System RPM Higher than Expected
------------	-----------------	---

Description

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

06 Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check electronic throttle
----------	----------------------------------

- Turn ignition switch to OFF.
- Disconnect the negative battery cable.
- Remove the electronic throttle assembly.
- Check if electronic throttle is stuck in larger open position due to ice or oil.

OK

Electronic throttle is normal

Result

Proceed to
OK
NG

NG

Repair or replace electronic throttle assembly

OK

2	Check intake system for air leakage
----------	--

- Check intake system for air leakage.

OK

Intake manifold is normal

Result

Proceed to
OK
NG

NG

Repair or replace faulty intake system components

OK

3 Check injector for oil dripping

(a) Check injector for oil dripping.

OK

Injector is normal

Result

Proceed to
OK
NG

NG

Replace or clean injector

OK

4 Check for high fuel pressure

(a) Check for high fuel pressure.

OK

Fuel pressure is normal

Result

Proceed to
OK
NG

NG

Repair or replace faulty fuel system components

OK

5 Reconfirm DTCs

- (a) Connect the negative battery cable.
- (b) ENGINE START STOP switch ON
- (c) Using diagnostic tester, read ECU DTC.
- (d) Refer to "DTC Confirmation Procedure".
- (e) Check if DTC P0507 00 still exists.



OK
No same DTC is output
Result

Proceed to
OK
NG

OK	System operates normally
NG	Replace with new ECU to check if malfunction reoccurs

DTC	P0219 00	Engine Overspeed Condition
------------	-----------------	-----------------------------------

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0219 00	Engine Overspeed Condition	/	- Throttle - Accelerator pedal - Speed Sensor - ECU

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check electronic throttle
----------	----------------------------------

- Turn ignition switch to OFF.
- Disconnect the negative battery cable.
- Remove the electronic throttle assembly.
- Check if electronic throttle is stuck in larger open position due to ice or oil.

OK

Electronic throttle is normal

Result

Proceed to
OK
NG

NG

Repair or replace electronic throttle assembly

OK

2	Check accelerator pedal
----------	--------------------------------

- Remove the accelerator pedal assembly.
- Check if accelerator pedal is stuck in larger open position.

OK

Accelerator pedal is normal



Result

Proceed to
OK
NG

NG

Repair or replace accelerator pedal assembly

OK**3 Check speed sensor for malfunction**

- (a) Check speed sensor for malfunction.

OK

Speed sensor is normal

Result

Proceed to
OK
NG

NG

Repair or replace speed sensor

OK**4 Reconfirm DTCs**

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0219 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

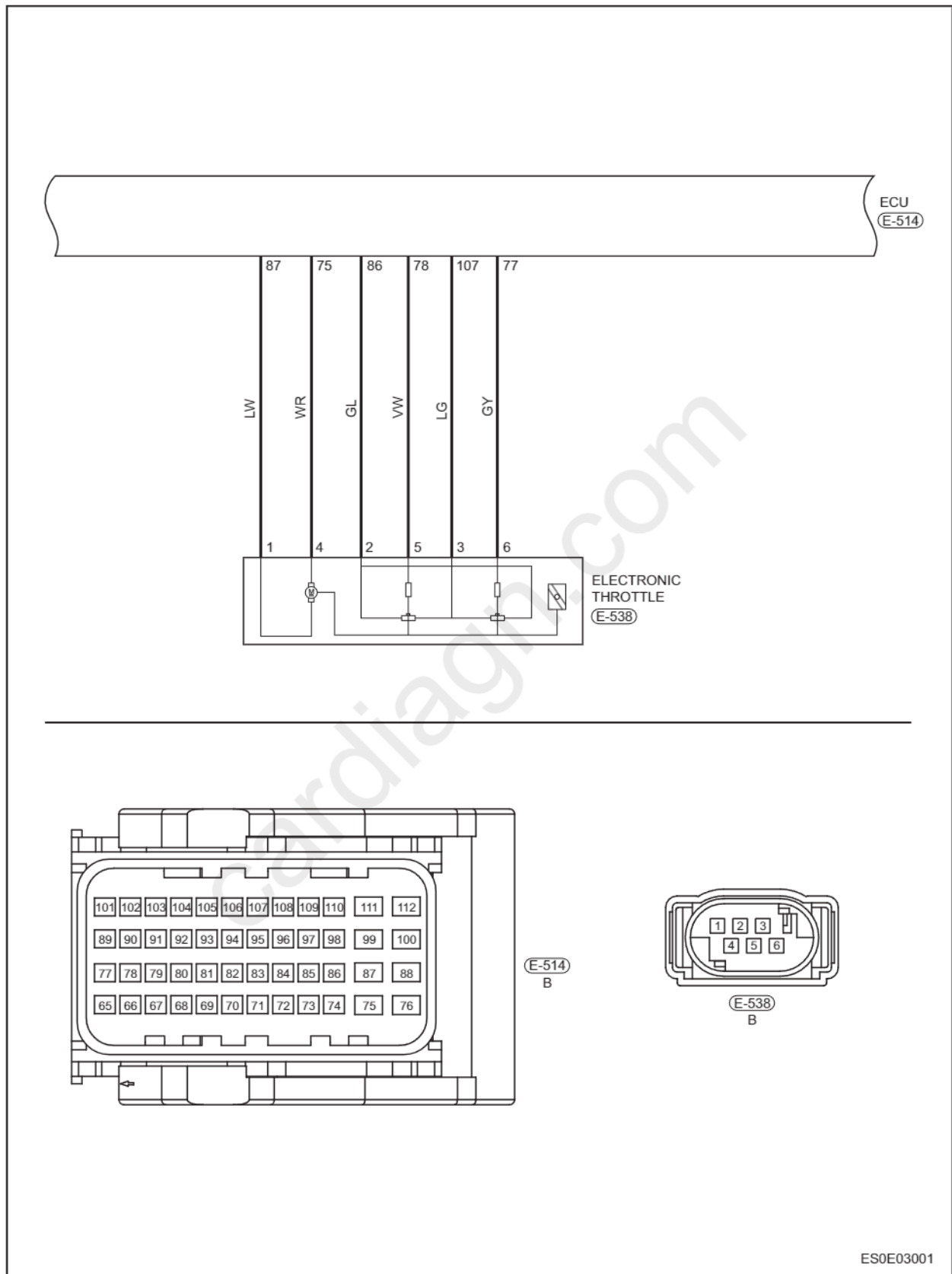
Replace with new ECU to check if malfunction reoccurs

DTC	P0606 1C	Throttle signal, wiring harness or ECU error
DTC	P0606 00	Safety monitoring fuel cutoff error
DTC	P0606 16	Reported UnderVoltage of VDD5
DTC	P0606 17	Reported OverVoltage of VDD5
DTC	P0606 42	Safety monitoring function error (ECU EEPROM error)
DTC	P0606 45	Visibility of SoftwareResets in DSM
DTC	P0606 47	Monitoring module feedback error
DTC	P0606 48	Monitoring fault reaction error
DTC	P0606 49	Monitoring module inquiry error
DTC	P0606 55	Variant coding monitoring error
DTC	P0606 61	Ignition angle signal, wiring harness or ECU error
DTC	P0606 62	Pedal signal unavailability error in level 2
DTC	P0606 63	Safety monitoring function error (SSM system monitoring error)
DTC	P0606 64	Load signal, wiring harness or ECU error
DTC	P0606 67	ECU fault reaction monitoring error
DTC	P0606 75	Shut off path test error
DTC	P0606 91	Diagnostic fault check to report
DTC	P0606 92	Engine speed monitoring error in level 2
DTC	P0606 94	Torque Monitoring Error in Level 2
DTC	P0606 96	AD Converter Monitoring Error



DTC	P0606 97	Function Monitoring: Fault of ECU ADC - Test Voltage
DTC	P1100 00	Engine Torque Control Adaption at Limit

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0606 1C	Throttle Signal, Wiring Harness or ECU Error	ENGINE START STOP switch ON, engine running	• Throttle • Low battery voltage • Throttle mechanical fault • Wire harness or connector • ECU
P0606 00	Safety Monitoring Fuel Cutoff Error		
P0606 16	Reported UnderVoltage of VDD5		
P0606 17	Reported OverVoltage of VDD5		
P0606 42	Safety Monitoring Function Error (ECU EEPROM Error)		
P0606 45	Visibility of Software Resets in DSM		
P0606 47	Monitoring module feedback error		
P0606 48	Monitoring Fault Reaction Error		
P0606 49	Monitoring module inquiry error		
P0606 55	Variant Coding Monitoring Error		
P0606 61	Ignition Angle Signal, Wiring Harness or ECU Error		
P0606 62	Pedal Signal Unplausibility Error in Level 2		
P0606 63	Safety Monitoring Function Error (SSM System Monitoring Error)		
P0606 64	Laod Signal, Wiring Harness or ECU Error		
P0606 67	ECU Fault Reaction Monitoring Error		
P0606 75	Shut Off Path Test Error		
P0606 91	Diagnostic Fault Check to Report		
P0606 92	Engine Speed Monitoring Error in Level 2		
P0606 94	Torque Monitoring Error in Level 2		
P0606 96	AD Converter Monitoring Error		
P0606 97	Function Monitoring: Fault of ECU ADC - Test Voltage		
P1100 00	Engine Torque Control Adaption at Limit		

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Clear and read DTCs again**

- Connect diagnostic tester and clear DTCs.
- Start and run engine for a while, and then read DTCs again to check if DTCs appear.

OK

Each throttle position sensor terminal resistance is normal

Result

Proceed to
OK
NG

OK

Check throttle position sensor actuator motor wire harness

NG**2 Perform electronic throttle self-learning**

- Install throttle assembly, connect throttle connector and ECU connector securely.
- Connect the negative battery cable.
- Connect diagnostic tester, clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute.
- Perform electronic throttle self-learning.

OK

Throttle self-learning is finished

Result

Proceed to
OK
NG

NG

Replace with new ECU to perform real-vehicle test

OK**3 Reconfirm DTCs**

- Turn ignition switch to OFF and then to ON, and wait for 1 minute to finish the electronic throttle self-learning.
- Slowly and quickly depress the accelerator pedal several times, and then read DTCs again to check if DTC P1102 00, P1102 29, P1103 00, P1104 00, P1106 00, P1106 21, P1106 22, P1111 00 or P1122 77 still exists.



OK
No same DTC is output
Result

Proceed to
OK
NG

OK	End
NG	Seek help from manufacturer

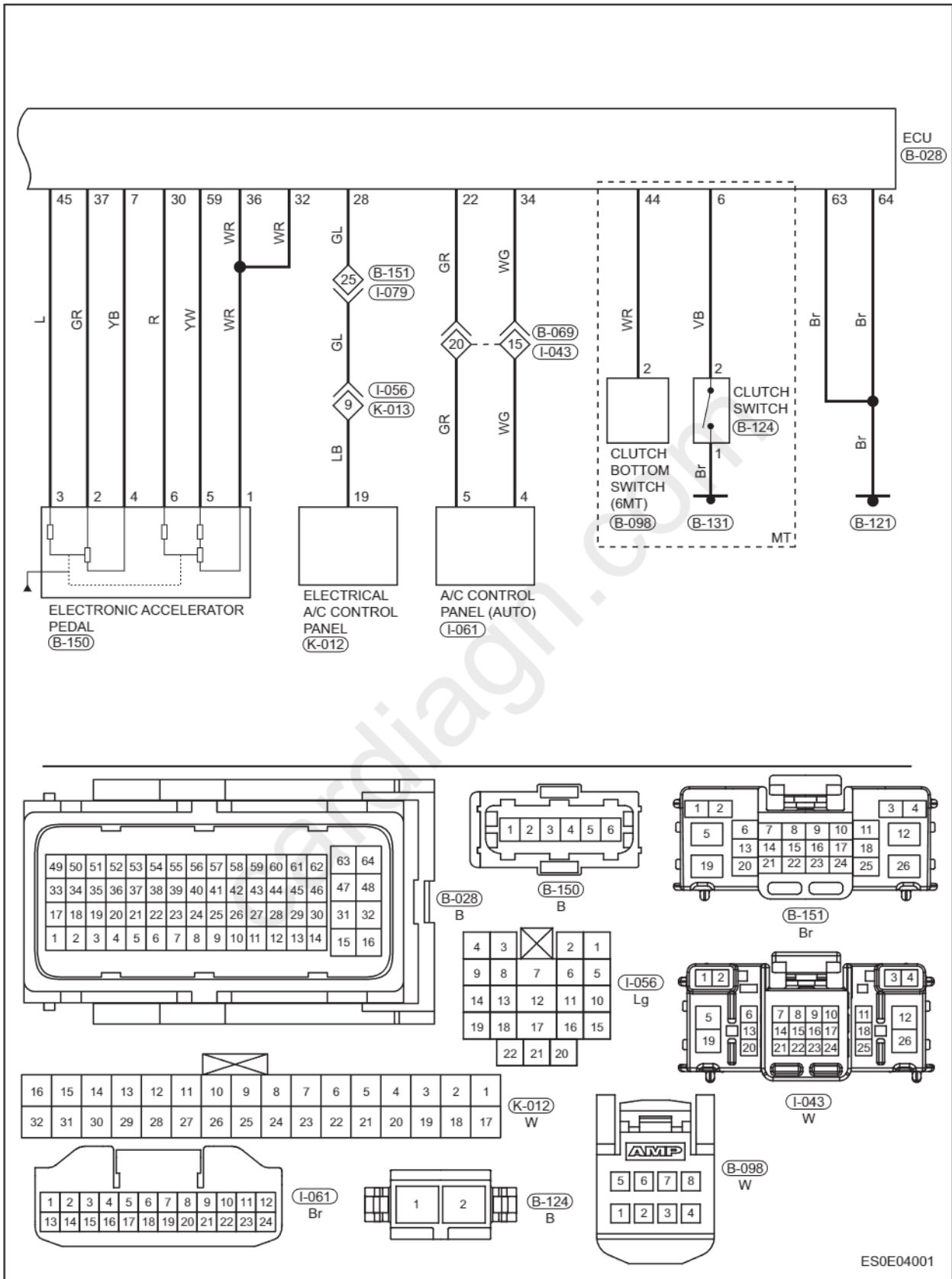
DTC	P2122 16	Pedal Pos.Sensor 1 Circ. Low Input
DTC	P2123 17	Pedal Pos.Sensor 1 Circ. High Input
DTC	P2127 16	Pedal Pos.Sensor 2 Circ. Low Input
DTC	P2128 17	Pedal Pos.Sensor 2 Circ. High Input
DTC	P2138 00	Pedal movement check error
DTC	P2138 29	Pedal Pos.Sensor 1/2 unplausable

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Circuit Diagram

06



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2122 16	Pedal Pos.Sensor 1 Circ. Low Input	ENGINE START STOP switch ON, engine running	- Accelerator pedal position sensor - Wire harness or connector - ECU
P2123 17	Pedal Pos.Sensor 1 Circ. High Input		
P2127 16	Pedal Pos.Sensor 2 Circ. Low Input		
P2128 17	Pedal Pos.Sensor 2 Circ. High Input		
P2138 00	Pedal movement check error		
P2138 29	Pedal Pos.Sensor 1/2 unplausible		

Confirmation Procedure

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

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

Caution:

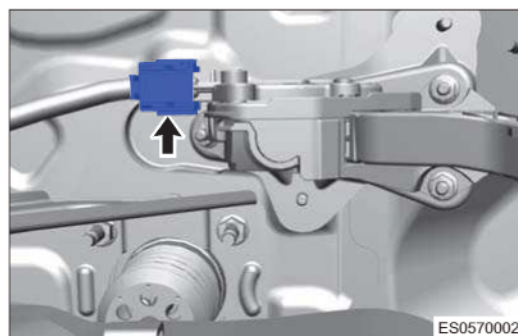
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check electronic accelerator pedal position sensor**

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

Result

Proceed to
OK
NG

**NG****Reinstall or repair, replace connector****OK****2 Clear and read DTCs again**

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



OK

DTCs do not recur, diagnosis is completed

Result

Proceed to
OK
NG

OK**End****NG****3****Read data flow of accelerator pedal voltage signal****06**

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

OK

Voltage values displayed on two digital multimeters are changed

Result

Proceed to
OK
NG

NG

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

OK**4****Replace electronic accelerator pedal, reconfirm DTCs**

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if P2122 16, P2123 17, P2127 16, P2128 17, P2138 00 or P2138 29 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

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

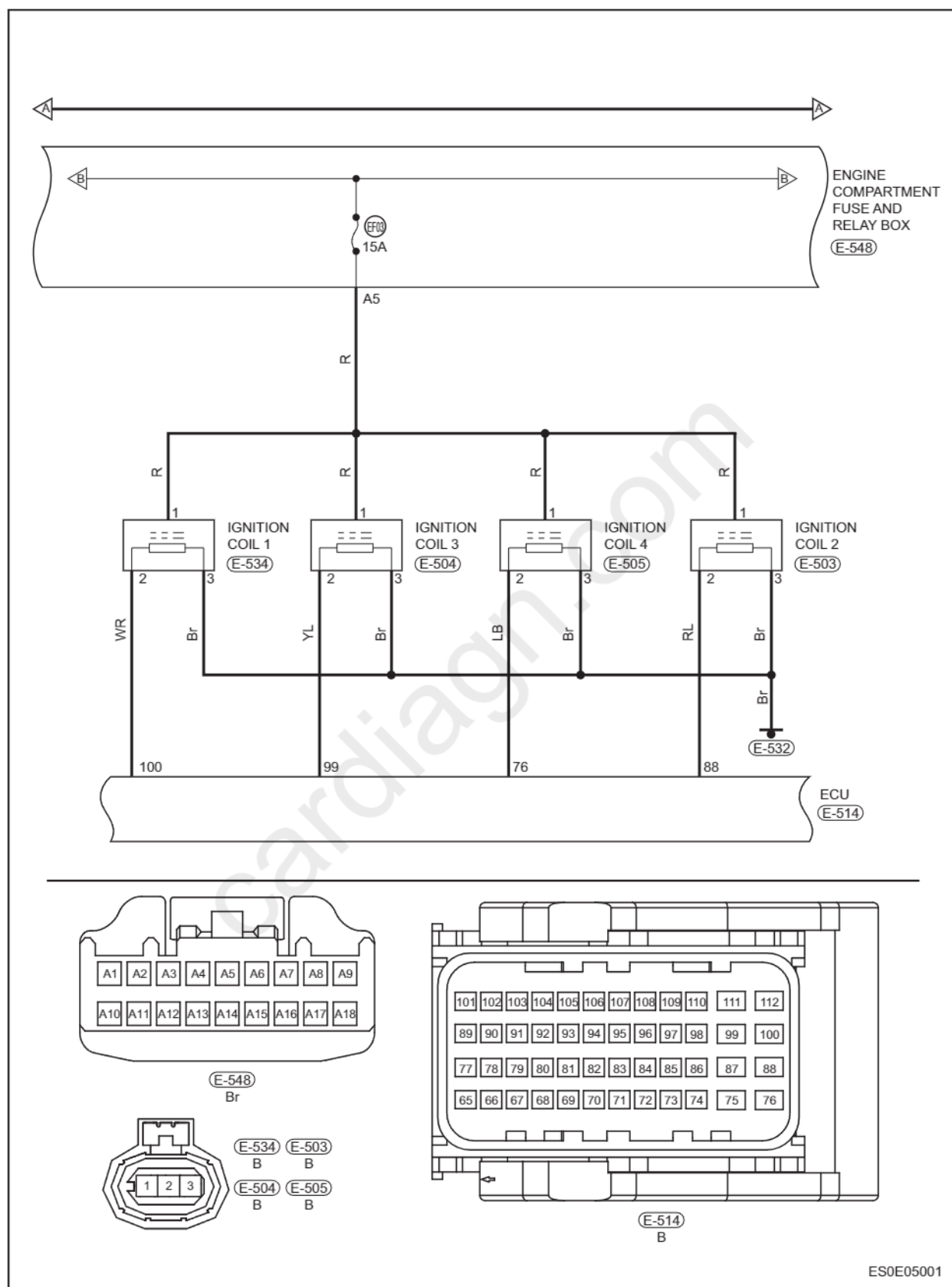
**Replace with new ECU to check if
 malfunction reoccurs**

DTC	P0300 00	Misfire Detected
DTC	P0300 21	Random/Multiple Cylinder Misfire Detected (over Emission Limit)
DTC	P0300 22	Random/Multiple Cylinder Misfire Detected (Harmful to Catalyst)
DTC	P0300 29	Random/Multiple Cylinder Misfire Detected (during First Statistic Cycle)
DTC	P0301 00	Misfire Detected on Cylinder 1
DTC	P0301 21	Cylinder 1 Misfire Detected (over Emission Limit)
DTC	P0301 22	Cylinder 1 Misfire Detected (Harmful to Catalyst)
DTC	P0301 29	Cylinder 1 Misfire Detected (during First Statistic Cycle)
DTC	P0302 00	Misfire Detected on Cylinder 2
DTC	P0302 21	Cylinder 2 Misfire Detected (over Emission Limit)
DTC	P0302 22	Cylinder 2 Misfire Detected (Harmful to Catalyst)
DTC	P0302 29	Cylinder 2 Misfire Detected (during First Statistic Cycle)
DTC	P0303 00	Misfire Detected on Cylinder 3
DTC	P0303 21	Cylinder 3 Misfire Detected (over Emission Limit)
DTC	P0303 22	Cylinder 3 Misfire Detected (Harmful to Catalyst)
DTC	P0303 29	Cylinder 3 Misfire (during First Statistic Cycle)
DTC	P0304 00	Misfire Detected on Cylinder 4
DTC	P0304 21	Cylinder 4 Misfire Detected (over Emission Limit)
DTC	P0304 22	Cylinder 4 Misfire Detected (Harmful to Catalyst)



DTC	P0304 29	Cylinder 4 Misfire Detected (during First Statistic Cycle)
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Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0300 00	Misfire detected	ENGINE START STOP switch ON, engine running	• Ignition coil • Wire harness or connector • Engine mechanical • ECU
P0300 21	Random/Multiple Cylinder Misfire Detected (over Emission Limit)		
P0300 22	Random/Multiple Cylinder Misfire Detected (Harmful to Catalyst)		
P0300 29	Random/Multiple Cylinder Misfire Detected (during First Statistic Cycle)		
P0301 00	Misfire Detected on Cylinder 1		
P0301 21	Cylinder 1 Misfire Detected (over Emission Limit)		
P0301 22	Cylinder 1 Misfire Detected (Harmful to Catalyst)		
P0301 29	Cylinder 1 Misfire Detected (during First Statistic Cycle)		
P0302 00	Misfire Detected on Cylinder 2		
P0302 21	Cylinder 2 Misfire Detected (over Emission Limit)		
P0302 22	Cylinder 2 Misfire Detected (Harmful to Catalyst)		
P0302 29	Cylinder 2 Misfire Detected (during First Statistic Cycle)		
P0303 00	Misfire Detected on Cylinder 3		
P0303 21	Cylinder 3 Misfire Detected (over Emission Limit)		
P0303 22	Cylinder 3 Misfire Detected (Harmful to Catalyst)		
P0303 29	Cylinder 3 Misfire (during First Statistic Cycle)		
P0304 00	Misfire Detected on Cylinder 4		
P0304 21	Cylinder 4 Misfire Detected (over Emission Limit)		
P0304 22	Cylinder 4 Misfire Detected (Harmful to Catalyst)		
P0304 29	Cylinder 4 Misfire Detected (during First Statistic Cycle)		

Confirmation Procedure

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

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

Caution:

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

Procedure

1 Check if there is any DTC related to corresponding cylinder and injector

- (a) Turn ignition switch to ON.
 (b) Connect diagnostic tester, check if there is any DTC related to corresponding cylinder injector.

OK

There is no DTC related to corresponding cylinder and injector

Result

Proceed to
OK
NG

NG

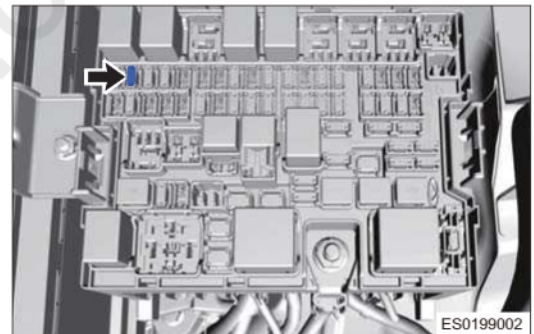
Troubleshooting DTC related to corresponding cylinder injector

OK**2 Check fuse EF03**

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

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power

OK**3 Check ignition coil connector**

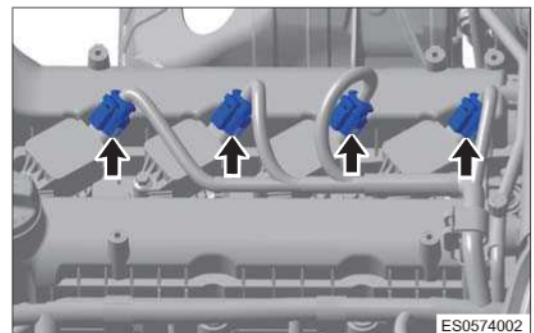
- (a) Check ignition coil connector for poor contact or improper installation.

OK

Ignition coil connector is normal

Result

Proceed to
OK
NG

**NG**

Reinstall or repair, replace connector



OK

4 Check ignition coil power supply voltage

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

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-534 (1) - Ground point E-532	Ignition switch ON	Not less than 12 V
E-504 (1) - Ground point GE-532		
E-505 (1) - Ground point GE-532		
E-503 (1) - Ground point GE-532		

Result

Proceed to
OK
NG

NG

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

OK

5 Check ignition coil control circuit

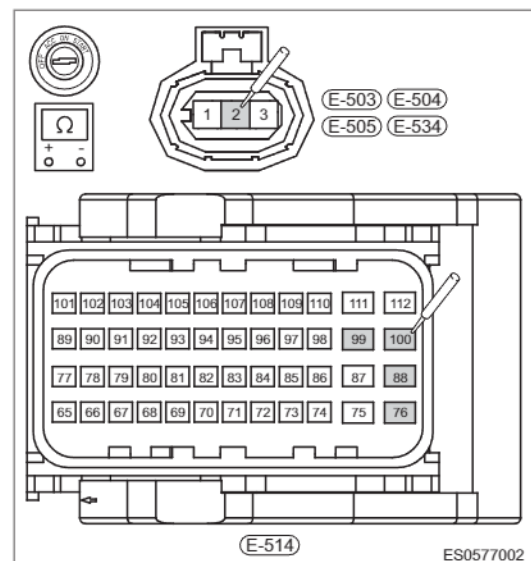
- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect ECU connector E-514 and 4 ignition coil connectors.
 (d) Check wire harness between ignition coil connector terminal and ECU connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-534 (2) - E-514 (100)	Always	Resistance $\leq 1 \Omega$
E-504 (2) - E-514 (99)		
E-505 (2) - E-514 (76)		
E-503 (2) - E-514 (88)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-534 (2), E-504 (2), E-505 (2), E-503 (2) or E-514 (100, 99, 76, 88) - Body ground	Always	Resistance ∞



OK

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

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (ignition coil - ECU)

OK

6 Check ignition coil ground circuit

06

- Check the ground point GE-532.
- Check wire harness between ignition coil connector terminal and ground point GE-532.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-534 (3) - GE-532	Always	Resistance $\leq 1 \Omega$
E-504 (3) - GE-532		
E-505 (3) - GE-532		
E-503 (3) - GE-532		

OK

Continuity between ignition coil connector terminal and ground is normal

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (ignition coil - ground point GE-532)

OK

7 Check appearance of ignition coil

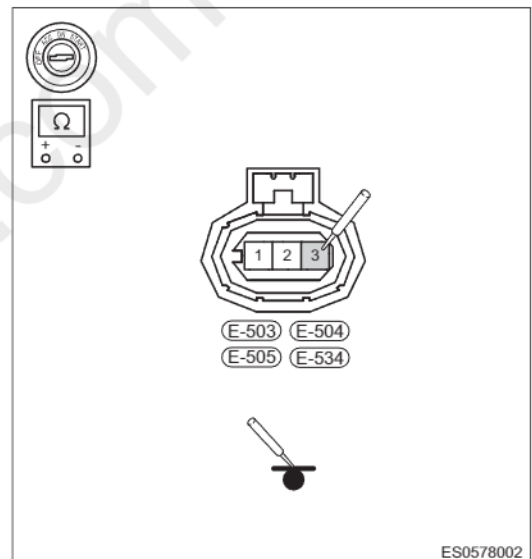
- Remove the ignition coil.
- Check appearance of ignition coil for cracks or bumps.

OK

Ignition coil itself has no malfunction

Result

Proceed to
OK
NG



NG

Replace ignition coil

OK

8

Inspection of spark plug

- (a) Remove the spark plug.
 (b) Check spark plug for electricity leakage, air leakage and clearance.

OK

Spark plug is normal

Result

Proceed to

OK

NG

06

NG

Repair or replace spark plug

OK

9

Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0300 00, P0301 00, P0302 00, P0303 00, P0304 00 still exists.

OK

No same DTC is output

Result

Proceed to

OK

NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs

DTC	P0615 13	Starter Relay Circuit Open
DTC	P0616 11	Starter Relay Circuit Low
DTC	P0617 12	Starter Relay Circuit High
DTC	P3046 13	Starter Relay1 Closed Stick Defect
DTC	P3050 00	Starter Relay1 Closed Stick Defect
DTC	P3052 00	Starter Relay1 Closed Stick Defect
DTC	P3054 00	Engine blocked/Starter not Engaged
DTC	P3055 11	Starter State Line S_kl50r Short to UB
DTC	P3056 12	Starter State Line S_kl50r Short to UB
DTC	P3088 93	Starter Damaged or Wire Dropped



DCT



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0615 13	Starter Relay Circuit Open	ENGINE START STOP switch ON, engine running	• Starter • Starter relay • Wire harness or connector • ECU
P0616 11	Starter Relay Circuit Low		
P0617 12	Starter Relay Circuit High		
P3046 13	Starter Relay1 Closed Stick Defect		
P3050 00	Starter Relay1 Closed Stick Defect		
P3052 00	Starter Relay1 Closed Stick Defect		
P3054 00	Engine Blocked/Starter not Engaged		
P3055 11	Starter State Line S_kl50r Short to UB		
P3056 12	Starter State Line S_kl50r Short to UB		
P3088 93	Starter Damaged or Wire Dropped		

Confirmation Procedure

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

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

Caution:

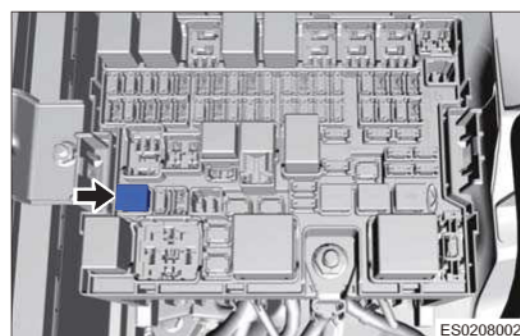
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check fuse SB03**

- (a) Check if fuse SB03 (30) is blown or no power.

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power

OK

2 Check starter relay

- (a) Unplug the starter relay.
 (b) Check the starter relay.

OK

Starter relay is normal

Result

Proceed to
OK
NG

NG**Repair or replace relay****OK****3 Check starter connector**

- (a) Check starter connector for poor contact or improper installation.

Result

Proceed to
OK
NG

NG**Reinstall or repair, replace connector****OK****4 Check starter relay signal circuit**

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect PEPS module connector J1.
 (d) Check wire harness between terminal on engine compartment fuse and relay box corresponding to starter relay and PEPS module connector J1 terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
J1-(10) Engine Compartment Fuse and Relay Box (H28)	Always	Resistance $\leq 1 \Omega$
J1-(13) - Engine Compartment Fuse and Relay Box (H34)		

Check for Short

Multimeter Connection	Condition	Specified Condition
J1-(13), Engine Compartment Fuse and Relay Box (H34), J1-(10), Engine Compartment Fuse and Relay Box (H28) - Body ground	Always	Resistance ∞

Result

Proceed to
OK
NG

NG

Replace wire harness or connector

OK

06

5**Starter control relay power supply circuit malfunction**

- (a) Unplug fuse SB03 and starter relay from engine compartment fuse and relay box.
 (b) Check wire harness between engine compartment fuse and relay box and starter E-523.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-523 (1) - Engine Compartment Fuse and Relay Box (B12)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
E-523 (1) or Engine Compartment Fuse and Relay Box (B12) - Body ground	Always	Resistance ∞

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector

OK

6**Reconfirm DTCs**

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Refer to "DTC Confirmation Procedure".
 (e) Check if DTC P0615 13, P0617 12 still exists.



OK
No same DTC is output
Result

Proceed to
OK
NG

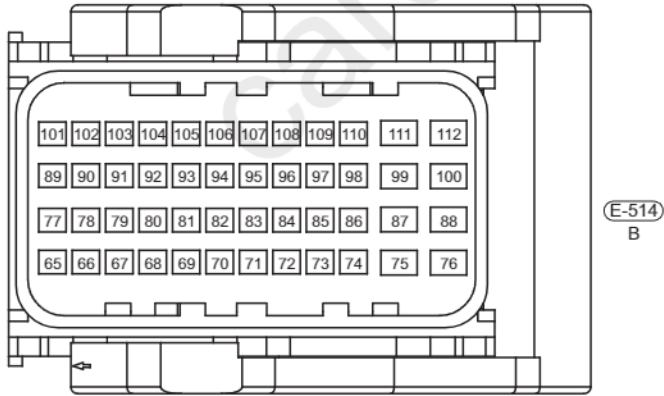
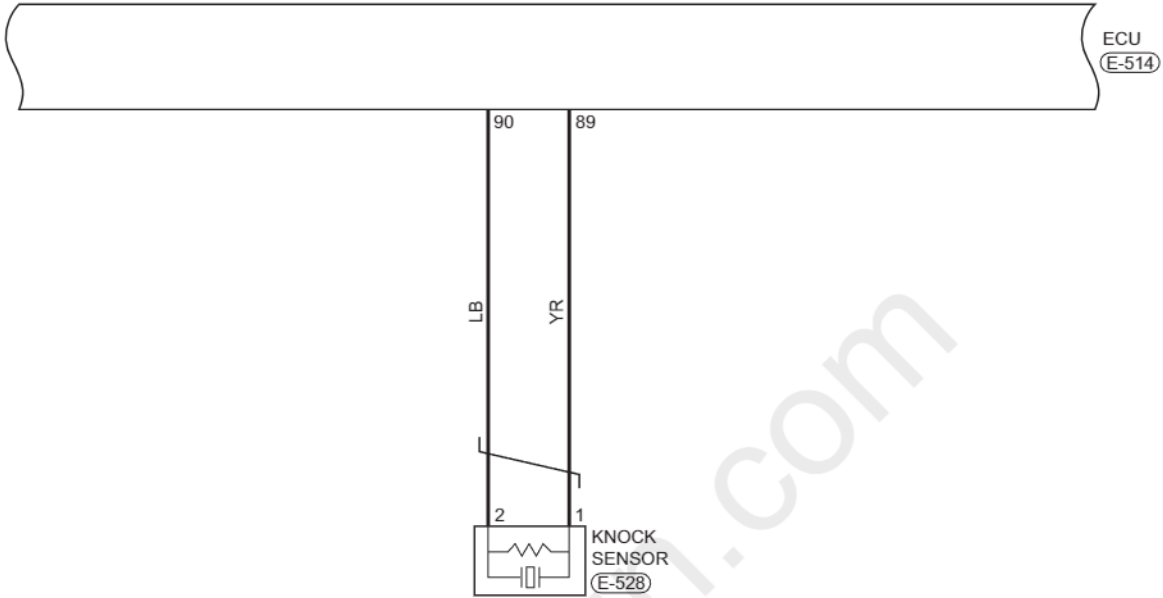
OK	System operates normally
NG	Replace with new ECU to check if malfunction reoccurs

DTC	P0327 00	Knock Sensor 1 Circuit Low
DTC	P0327 14	Knock Sensor 1 Circuit Low
DTC	P0327 16	Knock Sensor 1 Circ. Low Input
DTC	P0328 00	Knock Sensor 1 Circuit High
DTC	P0328 15	Knock Sensor 1 Circuit High
DTC	P0328 17	Knock Sensor 1 Circ. High Input



Circuit Diagram

06



ES0E07001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0327 00	Knock Sensor 1 Circuit Low	Load is greater than 40%; Coolant temperature is higher than 40°C; Speed is more than 2600 rpm; Cylinder 1 identification is valid	- Knock sensor - Wire harness or connector - ECU
P0327 14	Knock Sensor 1 Circuit Low		
P0327 16	Knock Sensor 1 Circ. Low Input		
P0328 00	Knock Sensor 1 Circuit High		
P0328 15	Knock Sensor 1 Circuit High		
P0328 17	Knock Sensor 1 Circ. High Input		

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Check knock sensor connector**

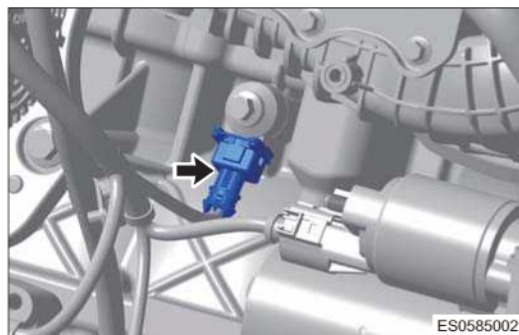
- (a) Check knock sensor connector E-528 (arrow) for poor connection, cracks or damage.

OK

Knock sensor connector is normal

Result

Proceed to
OK
NG

**NG**

Repair or replace wire harness or connector

OK**2 Check knock sensor signal circuit**

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect the ECU wire harness connector E-514.



- (d) Check wire harness between terminals of connector E-514 and connector E-528.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-514 (90) - E-528 (1)	Always	Resistance $\leq 1 \Omega$
E-514 (89) - E-528 (2)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-514 (90, 89) or E-528 (1, 2) - Body ground	Always	Resistance ∞

OK

Continuity between terminals of connector E-514 and connector E-528 is normal

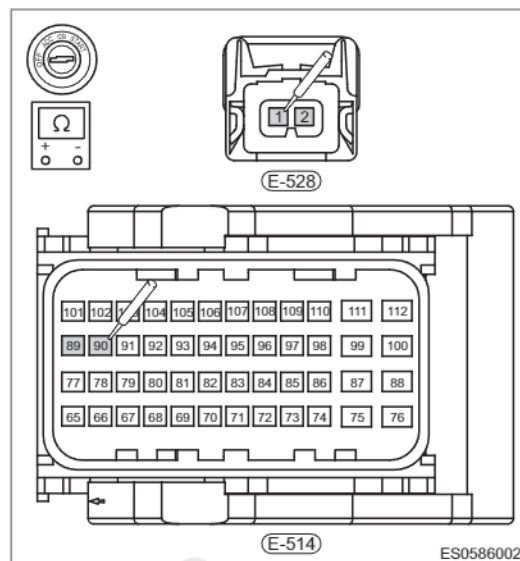
Result

Proceed to
OK
NG

NG

Replace wire harness or connector (knock sensor - ECU)

OK



3

Check installation of knock sensor

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

OK

Knock sensor is installed normally

Result

Proceed to
OK
NG

NG

Clean installation area or replace knock sensor

OK

4

Check knock sensor signal

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

OK

Voltage is generated by knock sensor

Result

Proceed to
OK
NG

NG**Replace knock sensor****OK****5****Reconfirm DTCs**

- (a) Using diagnostic tester, read ECU DTC.
 (b) Refer to "DTC Confirmation Procedure".
 (c) Check if DTC P0327 00, P0327 14, P0327 16, P0328 00, P0328 15 still exists.

OK

No same DTC is output

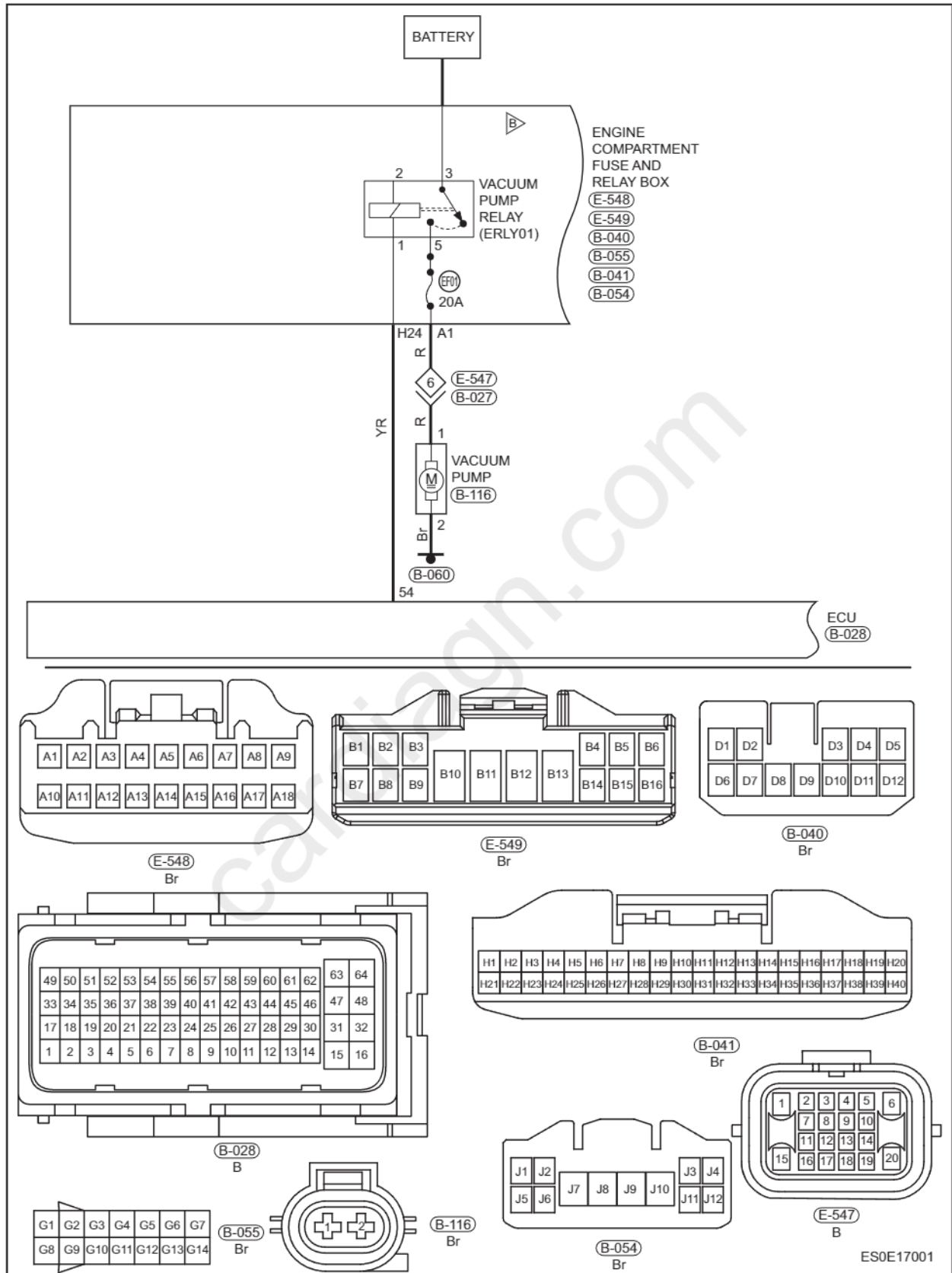
Result

Proceed to
OK
NG

OK**System operates normally****NG****Replace with new ECU to check if malfunction reoccurs****06**

DTC	P1130 00	Diagnosis of Brake Booster Pump Malfunction
DTC	P1131 17	Diagnosis of Brake Booster Pump Control Circuit High
DTC	P1132 16	Diagnosis of Brake Booster Pump Control Circuit Low
DTC	P1133 13	Diagnosis of Brake Booster Pump Control Circ.Open
06 DTC	P1139 7A	Diagnosis of Pressure Sensor in Brake Booster Pump Leakage Detection
DTC	P1427 12	Diagnosis of Brake Booster Pump Control Circ.High
DTC	P1428 11	Diagnosis of Brake Booster Pump Control Circ.Low
DTC	P1429 13	Diagnosis of Brake Booster Pump Control Circ.Open
DTC	P1479 00	Non-plausible Error for Brake Booster Diagnosis

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P1133 00	Diagnosis of Brake Booster Pump Malfunction	ENGINE START STOP switch ON, engine running	• Brake vacuum booster pump relay • Wire harness or connector • Battery • ECU
P1131 17	Diagnosis of Brake Booster Pump Control Circuit High		
P1132 16	Diagnosis of Brake Booster Pump Control Circuit Low		
P1133 13	Diagnosis of Brake Booster Pump Control Circ.Open		
P1139 7A	Diagnosis of Pressure Sensor in Brake Booster Pump Leakage Detection		
P1427 12	Diagnosis of Brake Booster Pump Control Circ.High		
P1428 11	Diagnosis of Brake Booster Pump Control Circ.Low		
P1429 13	Diagnosis of Brake Booster Pump Control Circ.Open		
P1479 00	Non-plausible Error for Brake Booster Diagnosis		

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check battery voltage
----------	------------------------------

- Check if battery terminals are corroded or loose.
- Check battery voltage with a digital multimeter.

OK

Not less than 12 V

Result

Proceed to
OK
NG

NG

Check and repair battery

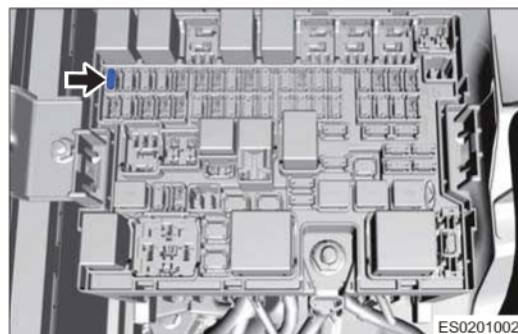
OK

2 Check brake vacuum booster pump fuse and relay

- Check if brake vacuum booster pump fuse EF01 (20 A) is blown or no power.
- Unplug brake vacuum booster pump relay, check if relay terminal is corroded or broken.
- Directly apply battery voltage to relay control terminal, check if relay closes.

Result

Proceed to
OK
NG



ES0201002

06

NG

Replace fuse or relay or check the cause for no power

OK

3 Check brake vacuum booster pump connector

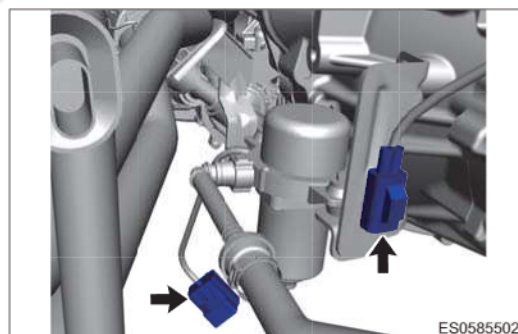
- Check brake vacuum booster pump connector B-116 (arrow) is poor connection or contact.

OK

Brake vacuum booster pump connector is normal

Result

Proceed to
OK
NG



ES0585502

NG

Repair or replace wire harness or connector

OK

4 Check brake vacuum booster pump relay power supply voltage

- Turn ignition switch to ON.
- Measure voltage between terminals 30, 85 of brake vacuum booster pump relay and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Brake vacuum booster pump relay (30, 85) - Body ground	Ignition switch ON	Not less than 12 V



OK

Brake vacuum booster pump relay power supply voltage is normal

Result

Proceed to
OK
NG

NG

Check and repair battery or other causes for abnormal voltage

OK

5 Check vacuum pump power supply terminal voltage

06

- (a) Disconnect the vacuum pump connector.
 (b) Measure the vacuum pump Q-116 (1) terminal voltage.
 Check for Open

Multimeter Connection	Condition	Specified Condition
B-116 (1) - ground	Ignition switch ON	Not less than 12 V

Result

Proceed to
OK
NG

NG

Repair or replace wire harness between vacuum pump and engine compartment fuse and relay box

OK

6 Replace brake vacuum pump, reconfirm DTCs

- (a) Using diagnostic tester, read ECU DTC.
 (b) Check if DTC P1427 12, P1428 11, P1429 13 or P1479 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

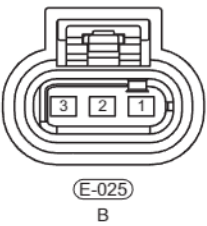
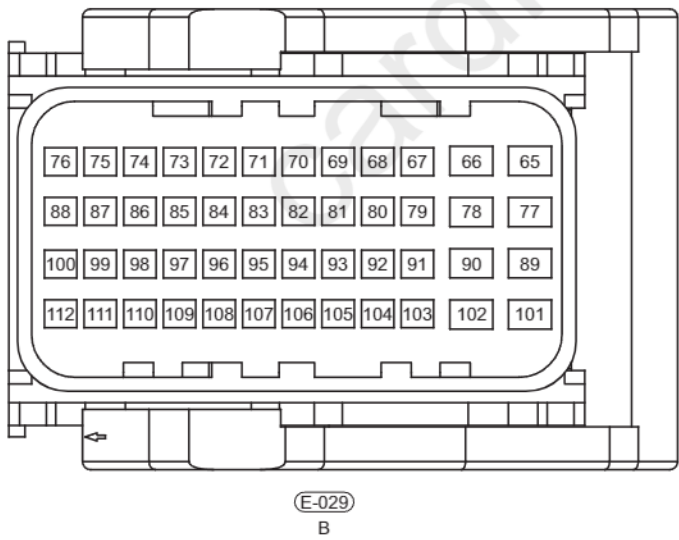
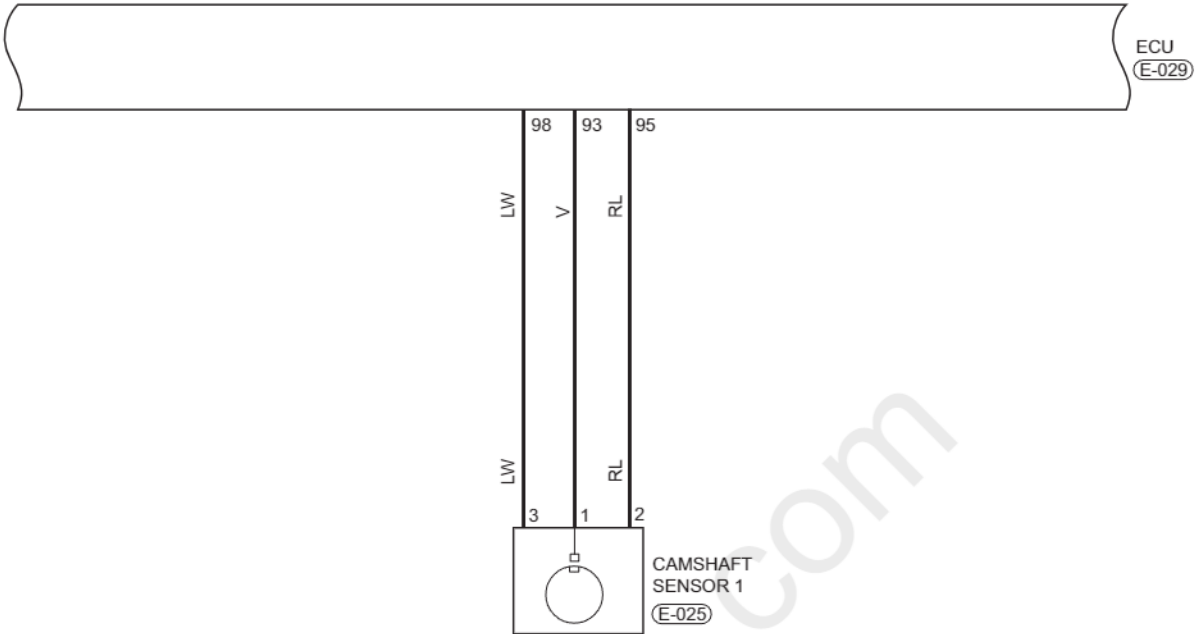
Replace with new ECU to check if malfunction reoccurs

DTC	P0016 21	Advance Error For Alignment between Camshaft (Inlet) and Crankshaft
DTC	P0016 22	Retard Error for Alignment Between Camshaft (Inlet) and Crankshaft
DTC	P0016 29	Npl Error for Alignment Between Camshaft (Inlet) and Crankshaft
DTC	P0341 00	EPM - Camshaft Signal Fault
DTC	P0342 00	Camshaft Position Sensor (Inlet) Circuit Low
DTC	P0343 00	Camshaft Position Sensor (Inlet) Circuit High
DTC	P0016 76	Crankshaft Position - Camshaft (Inlet) Installation Error
DTC	P0016 78	Crankshaft Position - Camshaft (Inlet) Position Error



Circuit Diagram

06



ES0E08001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0016 21	Advance Error For Alignment between Camshaft (Inlet) and crankshaft	ENGINE START STOP switch ON, engine running	- Camshaft position sensor - Incorrect installation position of camshaft position sensor - Engine mechanical fault - Wire harness or connector - ECU
P0016 22	Retard Error for Alignment Between Camshaft (Inlet) and Crankshaft		
P0016 29	Npl Error for Alignment between Camshaft (Inlet) and Crankshaft		
P0341 00	EPM - Camshaft signal fault		
P0342 00	Camshaft Position Sensor (inlet) Circuit Low		
P0343 00	Camshaft Position Sensor (inlet) Circuit High		
P0016 76	Crankshaft Position - Camshaft (Inlet) Installation Error		
P0016 78	Crankshaft Position - Camshaft (Inlet) Position Error		

06**Confirmation Procedure**

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

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

Caution:

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

Procedure**1 Check installation of intake camshaft position sensor**

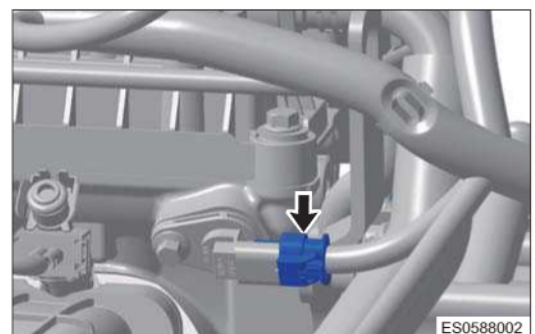
- (a) Check intake camshaft position sensor connector E-535 (arrow) for poor connection or contact.

OK

Intake camshaft position sensor is installed normally

Result

Proceed to
OK
NG

**NG****Reconnect connector****OK**

2 Check intake camshaft position sensor power supply voltage

- Turn ignition switch to ON.
- Measure voltage between terminal 3 of intake camshaft position sensor connector E-535 and ground (using a digital multimeter or 21 W test light).

Voltage Inspection

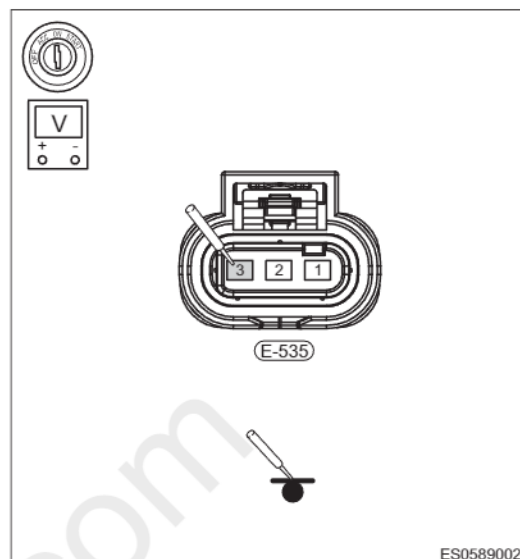
Multimeter Connection	Condition	Specified Condition
E-535 (3) - Body ground	Ignition switch ON	5 V

OK

Intake camshaft position sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG

Repair or replace wire harness

OK

3 Check intake camshaft position sensor signal circuit

- Turn ignition switch to OFF.
- Disconnect the negative battery cable.
- Disconnect intake camshaft position sensor connector E-535 and ECU connector E-514.
- Check intake camshaft position sensor connector E-535 (1) and ECU connector E-514 (93).
Check for Open

Multimeter Connection	Condition	Specified Condition
E-535 (1) - E-514 (93)	Always	Resistance $\leq 1 \Omega$

Result

Proceed to
OK
NG

NG

Repair or replace wire harness

OK

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

- Remove the intake camshaft position sensor.
- Obverse if installation of intake camshaft position sensor signal plate is proper.

OK

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

Result

Proceed to
OK
NG

NG

Install intake camshaft position sensor to proper position as specified

OK**5****Check for mechanical fault****06**

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

OK

Intake camshaft gear ring is normal

Result

Proceed to
OK
NG

NG

Repair or replace malfunctioning components

OK**6****Reconfirm DTCs**

- (a) Connect the negative battery cable.
- (b) ENGINE START STOP switch ON
- (c) Using diagnostic tester, read ECU DTC.
- (d) Check if DTC P0341 00, P0342 00, P0343 00, P0016 76, P0016 78 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

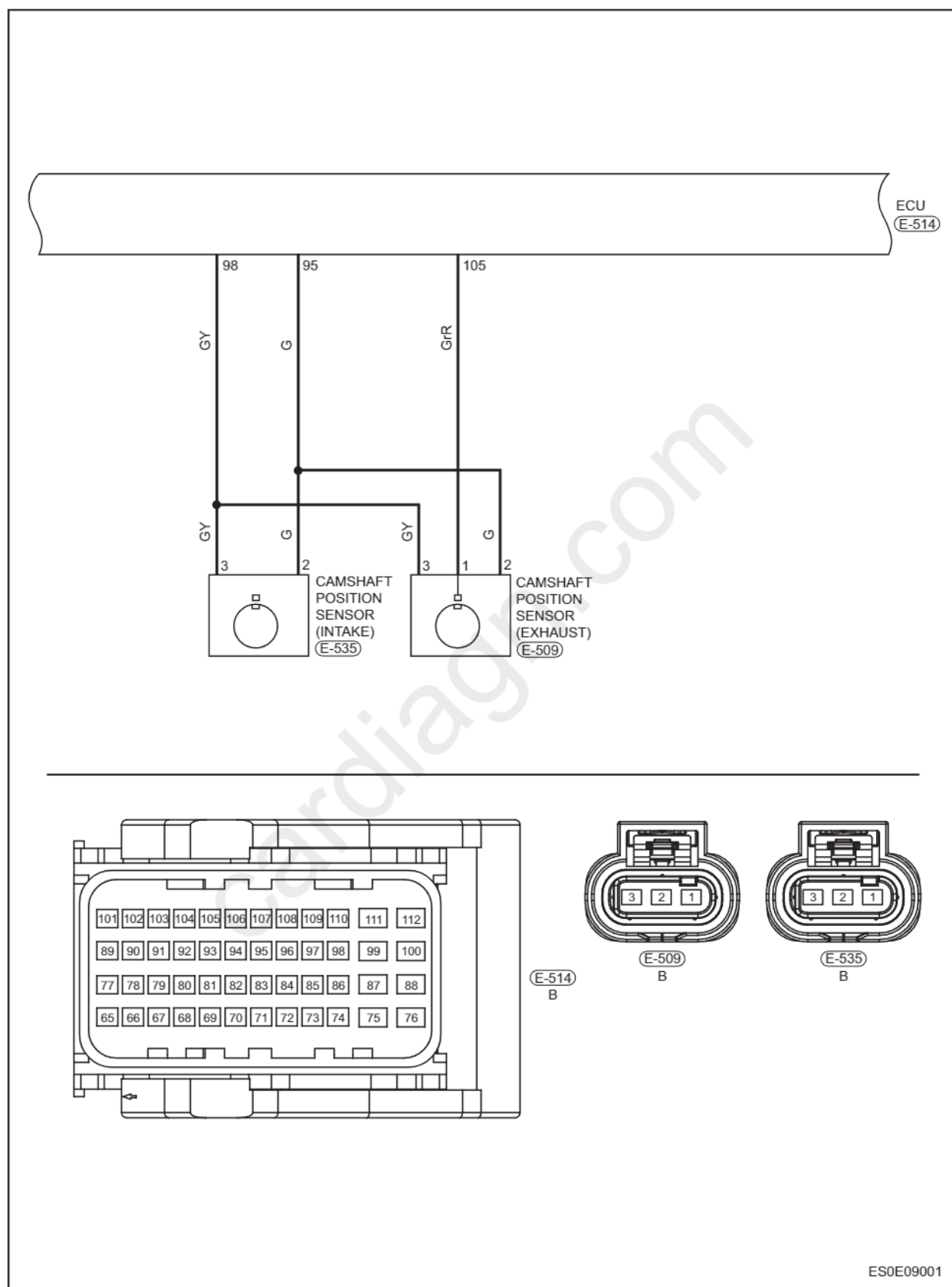
NG

Replace with new ECU to check if malfunction reoccurs



DTC	P0018 21	Advance Error For Alignment between Camshaft (Outlet) and Crankshaft
DTC	P0018 22	Retard Error for Alignment Between Camshaft (Outlet) and Crankshaft
DTC	P0018 29	Npl Error for Alignment Between Camshaft (Outlet) and Crankshaft
DTC	P0017 76	Crankshaft Position - Camshaft (Outlet) Installation Error
DTC	P0017 78	Crankshaft Position - Camshaft (Outlet) Position Error
DTC	P0346 00	EPM - Camshaft2 Signal Fault
DTC	P0366 00	Camshaft Position Sensor (outlet) Circuit Performance Non-plausible
DTC	P0367 00	Camshaft Position Sensor (outlet) Circuit Low
DTC	P0368 00	Camshaft Position Sensor (outlet) Circuit High

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0018 21	Advance Error For Alignment between Camshaft (Outlet) and Crankshaft	Ignition switch ON, engine running	- Camshaft position sensor - Incorrect installation position of camshaft position sensor - Engine mechanical fault - Wire harness or connector - ECU
P0018 22	Retard Error for Alignment Between Camshaft (Outlet) and Crankshaft		
P0018 29	Npl Error for Alignment between Camshaft (Outlet) and Crankshaft		
P0017 76	Crankshaft Position - Camshaft (Outlet) Installation Error		
P0017 78	Crankshaft Position - Camshaft (Outlet) Position Error		
P0346 00	EPM - Camshaft2 Signal Fault		
P0366 00	Camshaft Position Sensor (Outlet) Circuit Performance Non-plausible		
P0367 00	Camshaft Position Sensor (Outlet) Circuit Low		
P0368 00	Camshaft Position Sensor (Outlet) Circuit High		

Confirmation Procedure

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

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

Caution:

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

Procedure

1 Check installation of exhaust camshaft position sensor

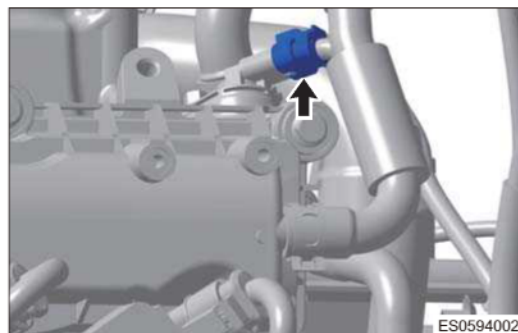
- (a) Check exhaust camshaft position sensor connector E-509 (arrow) for poor connection or contact.

OK

Exhaust camshaft position sensor is installed normally

Result

Proceed to
OK
NG



NG

Reconnect connector

OK

2 Check exhaust camshaft position sensor power supply voltage

- (a) Turn ignition switch to ON.
 (b) Measure voltage between terminal 3 of exhaust camshaft position sensor connector E-509 and ground (using a digital multimeter).

Voltage Inspection

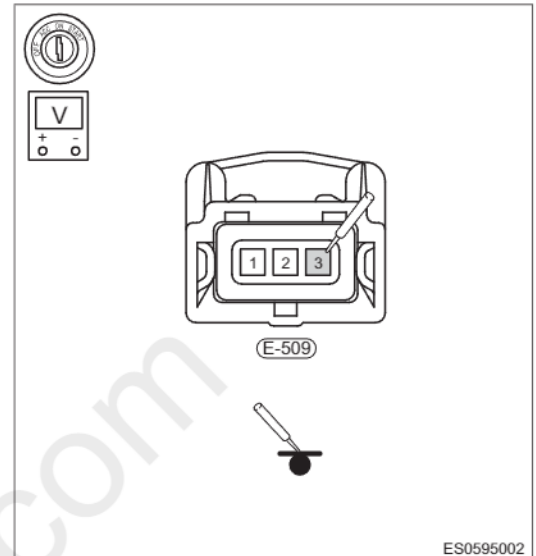
Multimeter Connection	Condition	Specified Condition
E-509 (3) - Body ground	Ignition switch ON	5 V

OK

Exhaust camshaft position sensor power supply voltage is normal

Result

Proceed to
OK
NG



06

NG

Check and repair wire harness between exhaust camshaft position sensor power supply terminal and ECU

OK

3 Check exhaust camshaft position sensor signal circuit

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect intake camshaft position sensor connector E-509 and ECU connector E-514.
 (d) Check intake camshaft position sensor connector E-509 (1) and ECU connector E-514 (105).
 Check for Open

Multimeter Connection	Condition	Specified Condition
E-509 (1) - E-514 (105)	Always	Resistance $\leq 1 \Omega$

Result

Proceed to
OK
NG

NG

Repair or replace wire harness

OK



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

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

OK

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

Result

Proceed to
OK
NG

06**NG**

Install exhaust camshaft position sensor to proper position as specified

OK

5	Check for mechanical fault
----------	-----------------------------------

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

OK

Exhaust camshaft gear ring is normal

Result

Proceed to
OK
NG

NG

Repair or replace malfunctioning components

OK

6	Reconfirm DTCs
----------	-----------------------

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0017 76, P0017 78, P0366 00, P0367 00 or P0368 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK**System operates normally****NG****Replace with new ECU to check if
malfunction reoccurs**

DTC	P0444 13	Evaporative Emiss.System Purge Control Valve Circuit Open
DTC	P0458 11	Evaporative Emission System Purge Control Valve Circuit Low
DTC	P0458 16	Evaporative Emission System Purge Control Valve Circuit Low
DTC	P0459 17	Evaporative Emission System Purge Control Valve Circuit High
DTC	P0459 12	Evaporative Emission System Purge Control Valve Circuit High

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0444 13	Evaporative Emiss. System Purge Control Valve Circuit Open	ENGINE START STOP switch ON, engine running	• Canister solenoid valve • Wire harness or connector • ECU
P0458 11	Evaporative Emission System Purge Control Valve Circuit Low		
P0458 19	Evaporative Emission System Purge Control Valve Circuit Low		
P0459 17	Evaporative Emission System Purge Control Valve Circuit High		
P0459 12	Evaporative Emission System Purge Control Valve Circuit High		

06

Confirmation Procedure

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

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

Caution:

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

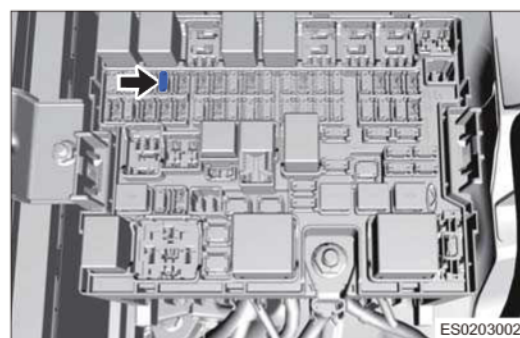
Procedure

1 Check canister solenoid valve fuse EF04

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

Result

Proceed to
OK
NG



NG

Replace fuse or check the cause for no power

OK

2 Check canister solenoid valve connector

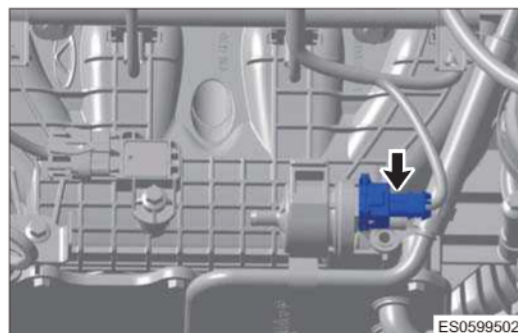
- (a) Check canister solenoid valve connector E-518 (arrow) for poor connection or contact.

OK

Canister solenoid valve connector is normal

Result

Proceed to
OK
NG



NG

Repair or replace connector

06

OK

3 Check canister solenoid valve power supply voltage

- (a) Turn ignition switch to ON.
 (b) Measure voltage between canister solenoid valve connector terminal and body ground (using a digital multimeter).

Voltage Inspection

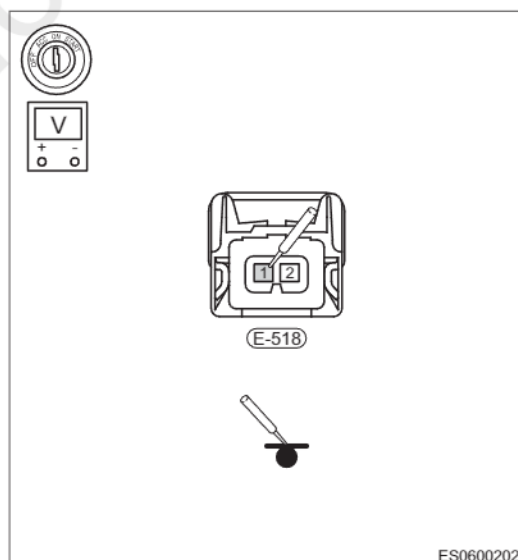
Multimeter Connection	Condition	Specified Condition
E-518 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Canister solenoid valve power supply voltage is normal

Result

Proceed to
OK
NG



NG

Repair or replace wire harness between canister solenoid valve and engine compartment fuse and relay box

OK

4 Check canister solenoid valve control circuit

- (a) Disconnect the ECU wire harness connector E-514.



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

Check for Open

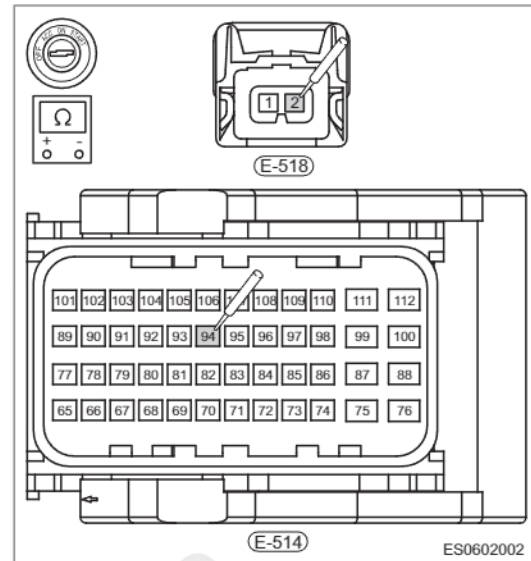
Multimeter Connection	Condition	Specified Condition
E-514 (94) - E-518 (2)	Always	Resistance $\leq 1 \Omega$

OK

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

Result

Proceed to
OK
NG



06

NG

**Replace wire harness or connector
(canister solenoid valve - ECU)**

OK

5 Check canister solenoid valve

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

OK

Canister solenoid valve is normal

Result

Proceed to
OK
NG

NG

Replace canister solenoid valve

OK

6 Reconfirm DTCs

- Connect the negative battery cable.
- ENGINE START STOP switch ON
- Using diagnostic tester, read ECU DTC.
- Check if DTC P0444 13, P0458 11, P0459 12 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

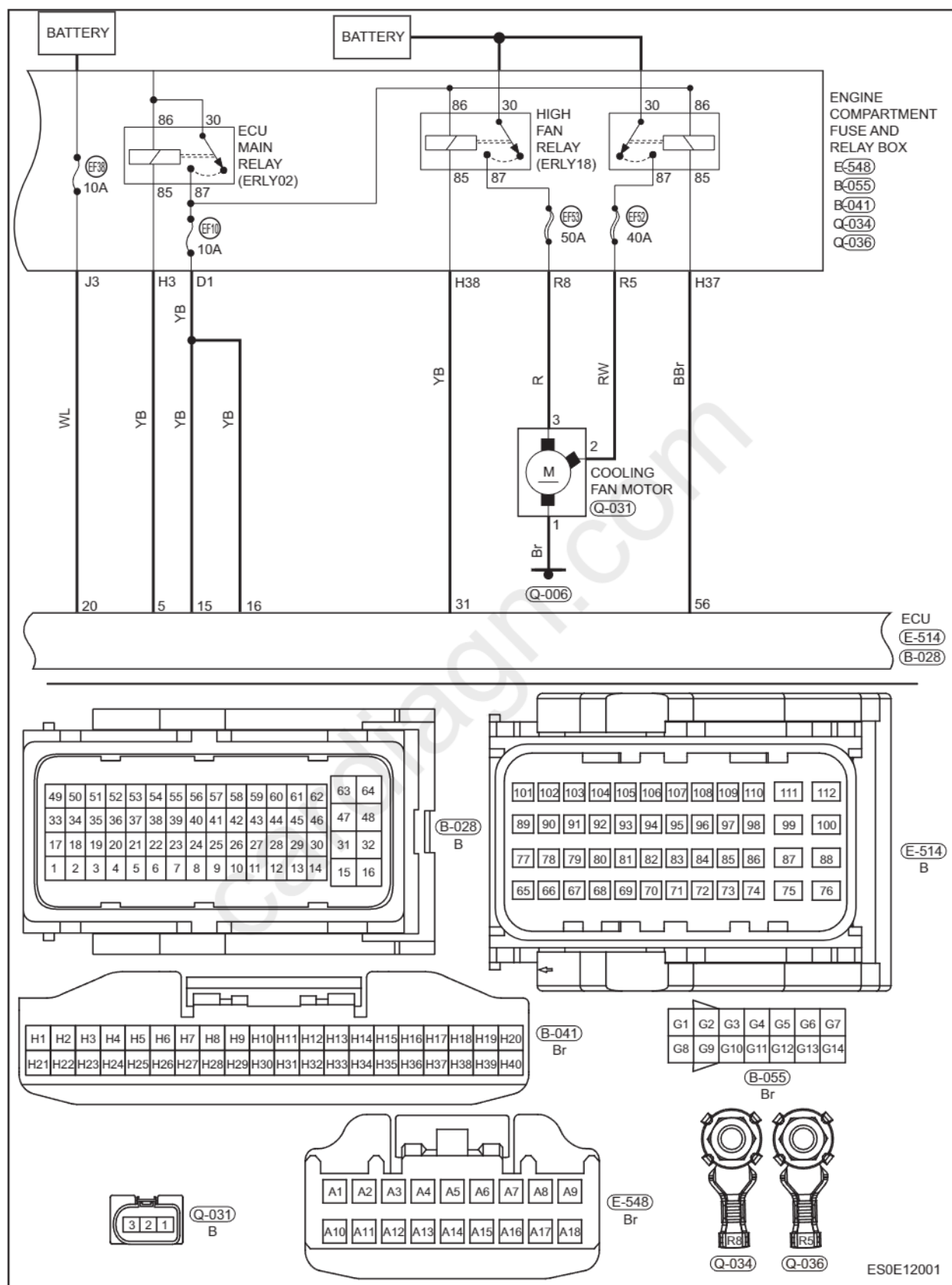
OK	System operates normally
NG	Replace with new ECU to check if malfunction reoccurs



DTC	P0480 13	Cooling Fan 1 Control Circuit Error
DTC	P0481 13	Cooling Fan 2 Control Circuit Error
DTC	P0691 11	Fan 1 Control Circuit Low
DTC	P0692 12	Fan 1 Control Circuit High
DTC	P0693 11	Fan 2 Control Circuit Low
DTC	P0694 12	Fan 2 Control Circuit High

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Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0480 13	Cooling Fan 1 Control Circuit error	ENGINE START STOP switch ON, engine running	• Wire harness connector • Cooling fan control relay • ECU
P0481 13	Cooling Fan 2 Control Circuit Error		
P0691 11	Fan 1 Control Circuit Low		
P0692 12	Fan 1 Control Circuit High		
P0693 11	Fan 2 Control Circuit Low		
P0694 12	Fan 2 Control Circuit High		

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check cooling fan fuse
----------	-------------------------------

- (a) Check if cooling fan fuses EF52 and EF53 are blown or no power.

Result

Proceed to
OK
NG

NG

Replace fuse or check the cause for no power

OK

2	Check cooling fan control relay power supply voltage
----------	---

- (a) Turn ignition switch to ON.

- (b) Measure voltage of cooling fan high and low speed control relay connector terminal (using a digital multimeter).

Voltage Inspection

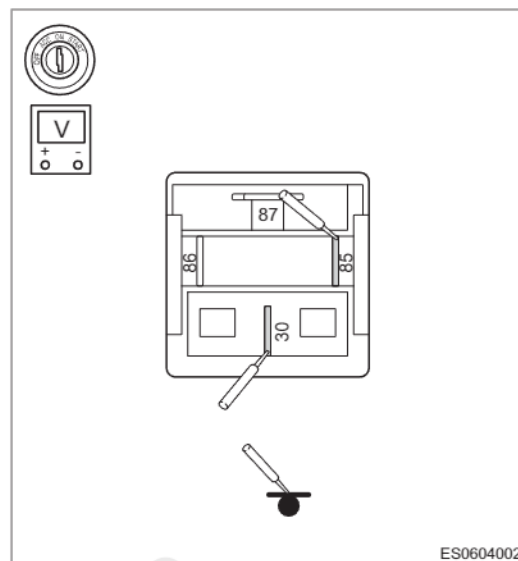
Multimeter Connection	Condition	Specified Condition
Relay (30) - Body ground	Always	Not less than 12 V
Relay (86) - Body ground	Ignition switch ON	Not less than 12 V

OK

Cooling fan control relay connector terminal voltage is normal.

Result

Proceed to
OK
NG



NG

Repair or replace engine compartment fuse and relay box

OK

3 Check cooling fan control circuit

- (a) Turn ENGINE START STOP switch to OFF
 (b) Disconnect the cooling fan motor connector.
 (c) Disconnect the cooling fan ECU connector B-028.
 (d) Check the cooling fan control circuit.

Disconnect inspection

Multimeter Connection	Condition	Specified Condition
B-028 (31) - Engine Compartment Fuse and Relay Box (H38)	Always	Resistance $\leq 1 \Omega$
B-028 (56) - Engine Compartment Fuse and Relay Box (H37)	Always	Resistance $\leq 1 \Omega$

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

Multimeter Connection	Condition	Specified Condition
Engine Compartment Fuse and Relay Box (H38 or H37) - Body ground	Always	Resistance ∞
B-028 (56 or 31) - Body ground	Always	Resistance ∞

Result

Proceed to
OK
NG

NG

Repair or replace ECU



OK

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

- (a) Disconnect the cooling fan connector Q-031.
 (b) Check circuit between cooling fan and engine compartment fuse and relay box.
 Check for Open

Multimeter Connection	Condition	Specified Condition
Q-031 (3) - Engine Compartment Fuse and Relay Box (R8)	Always	Resistance $\leq 1 \Omega$
Q-031 (2) - Engine Compartment Fuse and Relay Box (R5)	Always	Resistance $\leq 1 \Omega$

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

Multimeter Connection	Condition	Specified Condition
Q-031 (3 or 2) - Body ground	Always	Resistance ∞
Engine Compartment Fuse and Relay Box (R8 or R5) - Body ground	Always	Resistance ∞

Result

Proceed to
OK
NG

NG

Repair or replace ECU

OK

5 Check cooling fan motor

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

Result

Proceed to
OK
NG

NG

Repair or replace cooling fan motor

OK

6 Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON

- (c) Using diagnostic tester, read ECU DTC.
(d) Check if DTC P0480 13, P0481 13, P0691 11, P0692 12, P0693 11, P0694 12 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs



DTC	P0420 00	Catalyst conversion insufficient
------------	-----------------	---

Description

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

Confirmation Procedure

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

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

Caution:

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

Procedure

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

- Connect diagnostic tester to diagnostic interface.
- Turn ignition switch to ON, start engine and warm it up to normal operating temperature, and then select Read DTC.

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

Other DTCs are displayed

Proceed to A

P0420 00 is displayed

Proceed to B

Result

Proceed to
A
B

A	Go to DTC chart, and perform troubleshooting for other DTCs first
B	Next

2 Read datastream

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

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

Upstream oxygen sensor voltage is normal

Upstream oxygen sensor is normal

Average injection pulse width is normal

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

Downstream oxygen sensor voltage

Exhaust system is normal

Result

Proceed to
A
B
C

A**Replace upstream oxygen sensor****B****Check injector, fuel pressure and other causes for abnormal injection pulse width****C****Next****3 Check exhaust system**

- (a) Turn ignition switch to ON and start engine.
 (b) Check exhaust system for leakage.

OK

Exhaust system is normal

Result

Proceed to
OK
NG

NG**Repair exhaust system****OK**

4 Check downstream oxygen sensor

- (a) Turn ignition switch to OFF.
- (b) Disconnect the negative battery cable.
- (c) Check the downstream oxygen sensor.

OK

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

Result

Proceed to
OK
NG

06**NG****Replace downstream oxygen sensor****OK****5 Reconfirm DTCs**

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

OK

No same DTC is output

Result

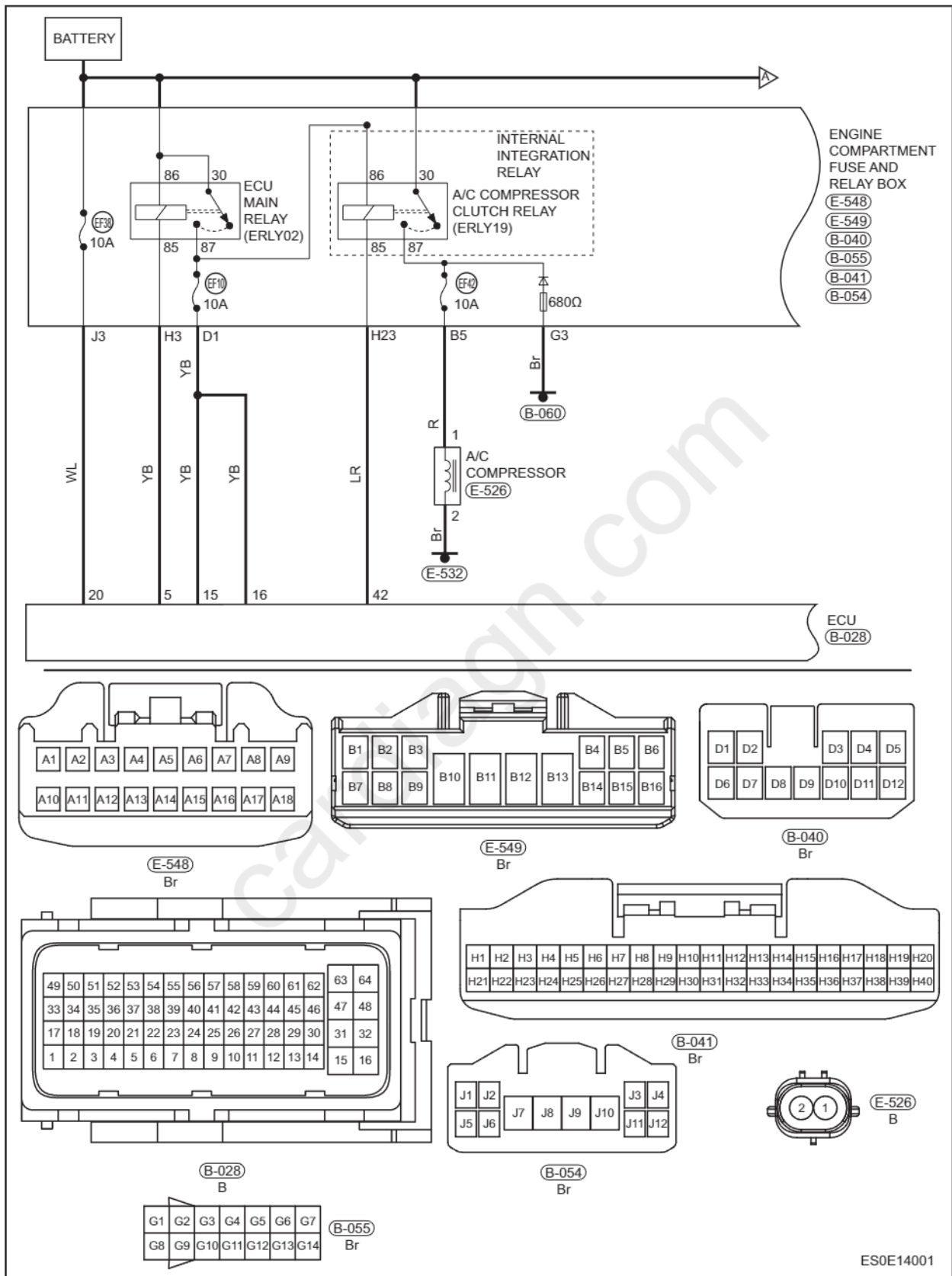
Proceed to
OK
NG

OK**System operates normally****NG****Replace with new ECU to check if malfunction reoccurs**

DTC	P0645 13	AC Clutch Relais Circuit Open
DTC	P0646 11	A/C Clutch Relay Control Circuit Low
DTC	P0647 12	A/C Clutch Relay Control Circuit High



Circuit Diagram



ES0E14001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0645 13	AC Clutch Relais Circuit Open	ENGINE START STOP switch ON, engine running	• A/C compressor relay • Wire harness or connector • Battery • ECU
P0646 11	A/C Clutch Relay Control Circuit Low		
P0647 12	A/C Clutch Relay Control Circuit High		

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Check battery voltage**

- Check if battery terminals are corroded or loose.
- Check battery voltage with a digital multimeter.

OK

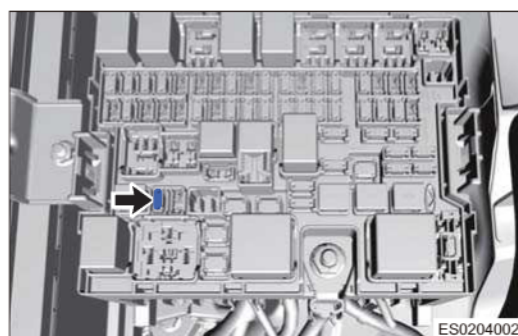
Not less than 12 V

Result

Proceed to
OK
NG

NG**Check and repair battery****OK****2 Check A/C compressor relay and fuse**

- Check if fuse EF42 (10 A) is blown or no power.



ES0204002

- Check if relay terminal is corroded or broken.



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- (c) Directly apply battery voltage to 2 relay control terminals, check if relay closes.
- (d) Turn ignition switch to ON.
- (e) Measure voltage between engine compartment fuse and relay box terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Engine Compartment Fuse and Relay Box (B5) - Body ground	Ignition switch ON	Not less than 12 V

OK

A/C compressor relay and fuse are normal

Result

Proceed to
OK
NG

06

NG

Repair or replace fuse or relay or check the cause for no power

OK

3 Check A/C compressor clutch connector

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

Result

Proceed to
OK
NG

NG

Repair or replace connector

OK

4 Check A/C compressor control circuit

- (a) Disconnect the ECU wire harness connector B-028.
- (b) Check wire harness between ECU connector terminal and engine compartment fuse and relay box terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
Engine Compartment Fuse and Relay Box (H23) - B-028 (42)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
Engine Compartment Fuse and Relay Box (H23) or B-028 (42) - Body ground	Always	Resistance ∞

OK

A/C compressor relay control circuit is normal

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (ECU - engine compartment fuse and relay box)

OK**5****Reconfirm DTCs****06**

- (a) Connect the negative battery cable.
- (b) ENGINE START STOP switch ON
- (c) Using diagnostic tester, read ECU DTC.
- (d) Check if DTC P0645 13, P0646 11, P0647 12 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

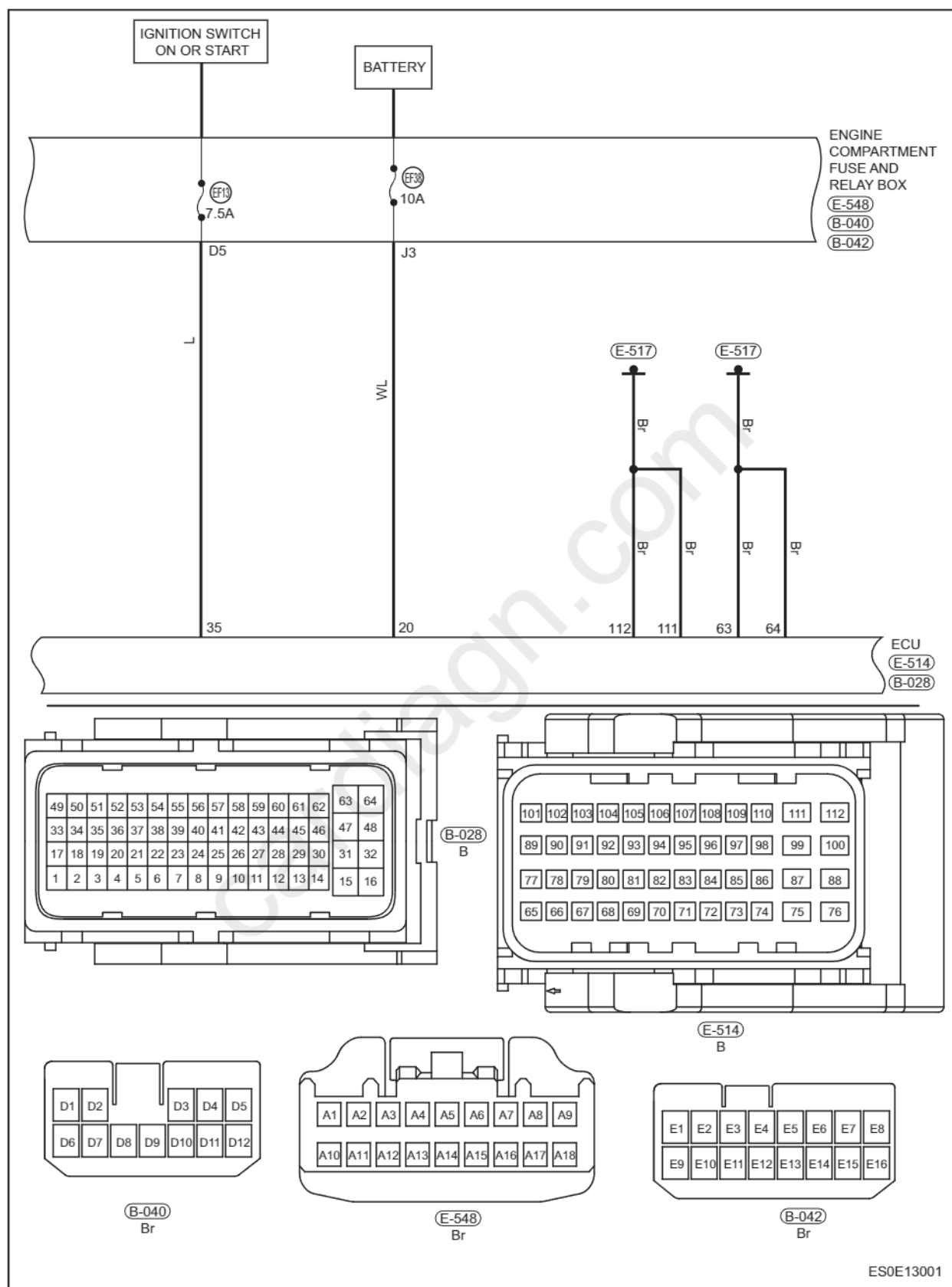
NG

Replace with new ECU to check if malfunction reoccurs



DTC	P0560 00	Non-plausible Error of Battery Voltage
DTC	P0562 16	System Battery Voltage Too Low
DTC	P0563 17	System Voltage High
DTC	P1101 00	System Voltage can not Fulfill Throttle Self Learning Condition

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0560 00	Non-plausible Error of Battery Voltage	Ignition switch ON, engine running	• Fuse • Wire harness or connector • Battery • Battery terminal • ECU
P0562 16	System Battery Voltage Too Low		
P0563 17	System Voltage High		
P1101 00	System Voltage can not Fulfill Throttle Self Learning Condition		

Confirmation Procedure

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

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

Caution:

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

Procedure

1 Check battery voltage

- (a) Check if battery voltage is normal.

OK

Not less than 12 V

- (b) Check if battery terminals are loose or corroded.

Result

Proceed to
OK
NG

NG

Check and repair battery

OK

2 Check generating capacity of alternator

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

Result

Proceed to
OK
NG

NG

Repair or replace alternator regulator or alternator

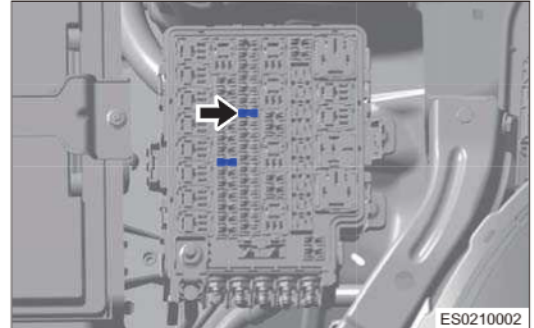
OK

3 Check fuse

- (a) Check if fuses EF38 (10 A) and EF13 (7.5 A) are blown or no power.

Result

Proceed to
OK
NG



ES0210002

06

NG

Replace fuse or check the cause for no power

OK

4 Check ECU ground point

- (a) Disconnect ECU ground points GB-121 and GE-517.
 (b) Check the ECU ground points GB-121 and GE-517.

OK

Ground point is normal

Result

Proceed to
OK
NG

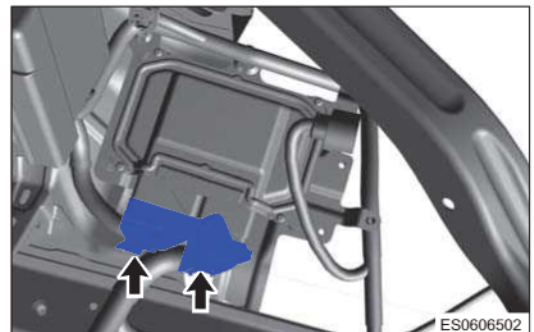
NG

Repair or replace ground wire harness or ground point

OK

5 Check ECU connector

- (a) Disconnect the ECU connector B-028 (arrow).



ES0606502

- (b) Check the ECU connector.



OK

ECM connector is normal

Result

Proceed to
OK
NG

NG

Repair or replace with new ECU to check if malfunction reoccurs

OK**6****Reconfirm DTCs****06**

- (a) Connect the negative battery cable.
- (b) ENGINE START STOP switch ON
- (c) Using diagnostic tester, read ECU DTC.
- (d) Check if DTC P0560 00, P0562 16, P0563 17, P1101 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

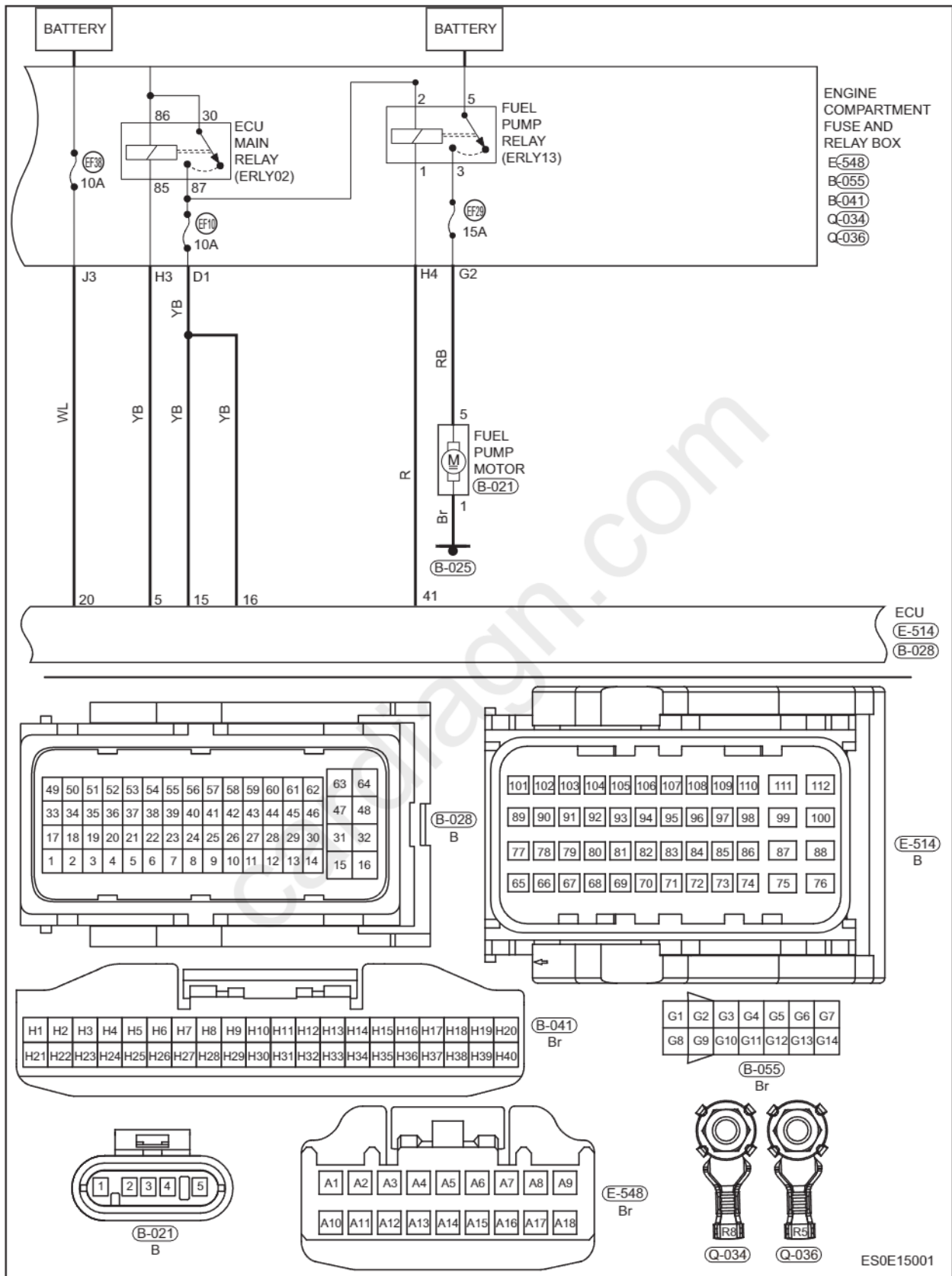
NG

Replace with new ECU to check if malfunction reoccurs

DTC	P0627 13	Fuel Pump Control Circuit Open
DTC	P0628 11	Fuel Pump Control Circuit Low
DTC	P0629 12	Fuel Pump Control Circuit High



Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0627 13	Fuel Pump Control Circuit Open	Ignition switch ON, engine running	- Fuel Pump relay - Wire harness or connector - Battery - ECU
P0628 11	Fuel Pump Control Circuit Low		
P0629 12	Fuel Pump Control Circuit High		

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Check battery voltage**

- Check if battery terminals are corroded or loose.
- Check battery voltage with a digital multimeter.

OK

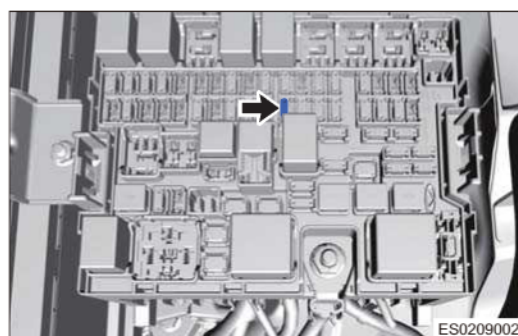
Not less than 12 V

Result

Proceed to
OK
NG

NG**Check and repair battery****OK****2 Check fuel pump relay and fuse**

- Check if fuel pump fuse EF39 (15 A) is blown or no power.



ES0209002

- Check if relay terminal is corroded or broken.



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- (c) Directly apply battery voltage to 2 relay control terminals, check if relay closes.
- (d) Turn ignition switch to ON.
- (e) Measure voltage between engine compartment fuse and relay box terminal and body ground (using a digital multimeter).

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Relay ER13 (30) - Body ground	Always	Not less than 12 V
Relay ER13 (85) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Fuel pump relay and fuse are normal

Result

06

Proceed to
OK
NG

NG

Repair or replace fuse or relay

OK

3 Check fuel pump circuit voltage

- (a) Turn ignition switch to ON.
- (b) Check the fuel pump relay terminal voltage.

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
Fuel pump B-021 (5) - Body ground	Ignition switch ON	Not less than 12 V

Result

Proceed to
OK
NG

NG

Repair or replace wire harness

OK

4 Check fuel pump connector

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

Result

Proceed to
OK
NG

NG

Repair or replace connector

OK

5 Check fuel pump relay control circuit

- (a) Turn ignition switch to OFF.
- (b) Disconnect the negative battery cable.
- (c) Disconnect the ECU wire harness connector B-028.
- (d) Check wire harness between ECU connector terminal and engine compartment fuse and relay box terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
Engine Compartment Fuse and Relay Box (H4) - B-028 (41)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
Engine Compartment Fuse and Relay Box (H4) or B-028 (41) - Body ground	Always	Resistance ∞

OK

Fuel pump relay control circuit is normal

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (ECU - engine compartment fuse and relay box)

OK

6 Check fuel pump

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

Result

Proceed to
OK
NG

NG

Repair or replace fuel pump

OK



7	Reconfirm DTCs
----------	-----------------------

- (a) Connect the negative battery cable.
- (b) ENGINE START STOP switch ON
- (c) Using diagnostic tester, read ECU DTC.
- (d) Check if DTC P0627 13, P0628 11, P0629 12 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

06

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs

DTC	P0704 00	Clutch Switch Input Circuit Non-plausible
DTC	P083F 00	Bottom Clutch Switch "A"/"B" Correlation

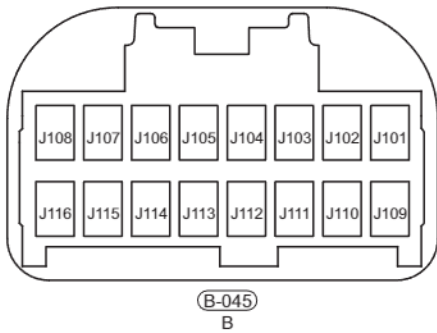
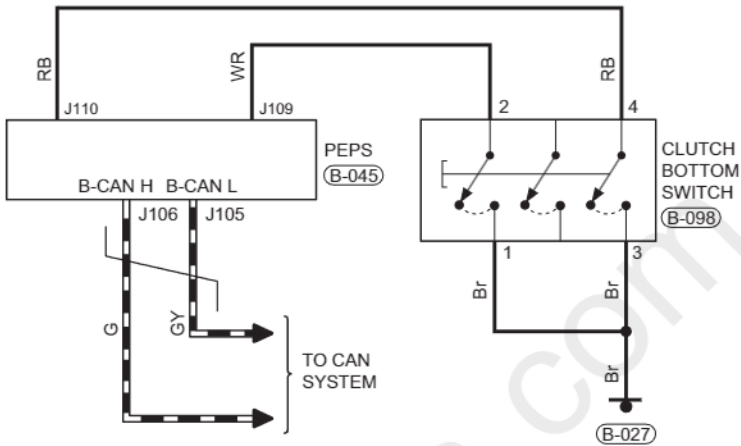
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Circuit Diagram

MT

06



ES0E32001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0704 00	Clutch Switch Input Circuit Non-plausible	Vehicle speed is more than 50 km/h	- Wire harness or connector - ECU
P083F 00	Bottom Clutch Switch "A"/"B" Correlation	The interval between two gear shift is greater than 4 seconds The absolute value of the calculated gear change is 1	

Confirmation Procedure

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

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

Caution:

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

Procedure**1 Check clutch bottom switch connector**

- (a) Check if clutch bottom switch connector is connected infirmly, damaged or cracked.

OK

Clutch bottom switch connector is normal

Result

Proceed to
OK
NG

NG

Repair or replace clutch bottom switch connector

OK**2 Check clutch switch control circuit**

- (a) Disconnect the PEPS module connector B-045.
 (b) Check wire harness between clutch bottom switch connector terminal and PEPS module connector J1.

Check for Open

Multimeter Connection	Condition	Specified Condition
J1-(10) - B-0984 (4)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
J1-(10), B-098 (4) - Body ground	Always	Resistance ∞



OK

Clutch switch circuit is normal

Result

Proceed to
OK
NG

NG

Repair or replace wire harness (ECU - engine compartment fuse and relay box)

OK**3****Reconfirm DTCs****06**

- (a) Connect the negative battery cable.
- (b) ENGINE START STOP switch ON
- (c) Using diagnostic tester, read ECU DTC.
- (d) Refer to "DTC Confirmation Procedure".
- (e) Check if DTC P0704 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

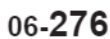
NG

Replace with new ECU to check if malfunction reoccurs

DTC	P023A 00	Charge Air Cooler Coolant Pump Control Circuit
DTC	P023B 00	Charge Air Cooler Coolant Pump Control Circuit Low
DTC	P023C 00	Charge Air Cooler Coolant Pump Control Circuit High
DTC	P1011 01	Diagnosis of electrical water pump Control Circ.error
DTC	P1700 00	Charge Air Cooler Coolant Pump Dry Run
DTC	P1703 00	Charge Air Cooler Coolant Pump Over Voltage
DTC	P1704 00	Charge Air Cooler Coolant Pump Over Current
DTC	P1705 00	Charge Air Cooler Coolant Pump Over Temperature
DTC	P1706 00	Charge Air Cooler Coolant Pump Stall
DTC	P1707 00	Charge Air Cooler Coolant Pump Under Voltage
DTC	P1708 00	Charge Air Cooler Coolant Pump feedback signal error Circ.High
DTC	P1709 00	Charge Air Cooler Coolant Pump feedback signal error Circ.Low
DTC	P2600 13	Diagnosis of electrical water pump Control Circ.Open
DTC	P2602 11	Diagnosis of electrical water pump Control Circ.Low
DTC	P2603 12	Diagnosis of electrical water pump Control Circ.high



Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P023A 00	Charge Air Cooler Coolant Pump Control Circuit	ENGINE START STOP switch ON, engine running	• Electrical Water Pump • Wire harness or connector • Battery • ECU
P023B 00	Charge Air Cooler Coolant Pump Control Circuit Low		
P023C 00	Charge Air Cooler Coolant Pump Control Circuit High		
P1011 01	Diagnosis of electrical water pump Control Circ.error		
P1700 00	Charge Air Cooler Coolant Pump Dry Run		
P1703 00	Charge Air Cooler Coolant Pump Over Voltage		
P1704 00	Charge Air Cooler Coolant Pump Over Current		
P1705 00	Charge Air Cooler Coolant Pump Over Temperature		
P1706 00	Charge Air Cooler Coolant Pump Stall		
P1707 00	Charge Air Cooler Coolant Pump Under Voltage		
P1708 00	Charge Air Cooler Coolant Pump feedback signal error Circ.High		
P1709 00	Charge Air Cooler Coolant Pump feedback signal error Circ.Low		
P2600 13	Diagnosis of electrical water pump Control Circ.Open		
P2602 11	Diagnosis of electrical water pump Control Circ.Low		
P2603 12	Diagnosis of electrical water pump Control Circ.high		

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check battery voltage
----------	------------------------------

- Check if battery terminals are corroded or loose.
- Check battery voltage with a digital multimeter.



OK

Not less than 12 V

Result

Proceed to
OK
NG

NG

Check and repair battery

OK

2

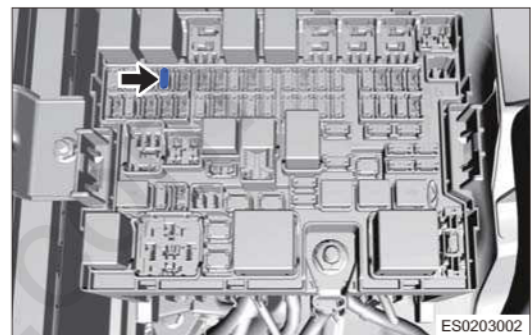
Check electrical water pump fuse

06

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

Result

Proceed to
OK
NG



ES0203002

NG

Replace electrical water pump fuse or check the cause for no power

OK

3

Check electrical water pump power supply

- (a) Turn ignition switch to ON.
(b) Measure voltage between electrical water pump connector terminal and body ground (using a digital multimeter or 21 W test light) (online detection).

Voltage Inspection

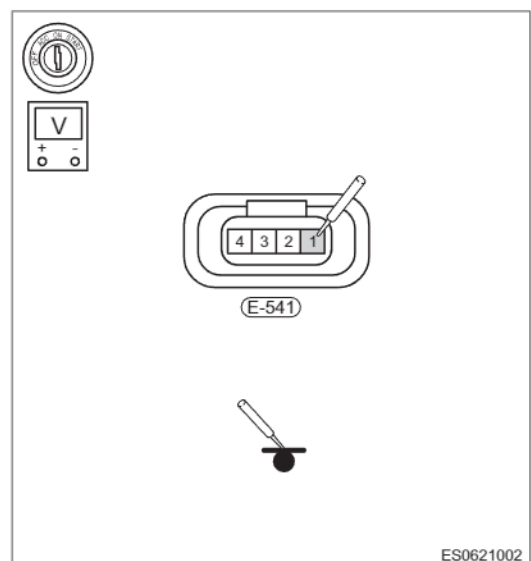
Multimeter Connection	Condition	Specified Condition
E-541 (4) - Body ground	Always	Not less than 12 V

OK

Electrical water pump power supply is normal

Result

Proceed to
OK
NG



ES0621002

NG

Repair or replace wire harness between terminal 4 of electrical water pump and engine compartment fuse and relay box

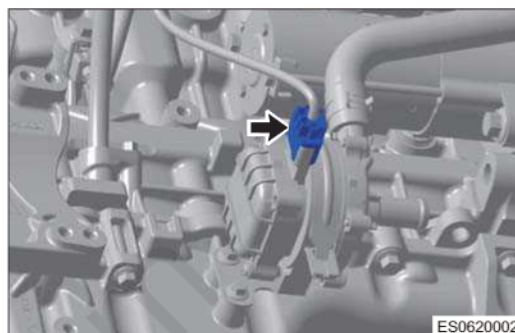
OK

4 Check electrical water pump connector

- (a) Check if electrical water pump connector E-541 (arrow) is connected infirmly, damaged or cracked.

Result

Proceed to
OK
NG



06

NG

Repair or replace electrical water pump connector

OK

5 Check electrical water pump relay control circuit

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect ECU connector E-514 and electrical water pump connector E-541.
 (d) Check wire harness between ECU connector terminal and electrical water pump connector.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-514 (92) - E-541 (3)	Always	Resistance $\leq 1 \Omega$

Check for Short

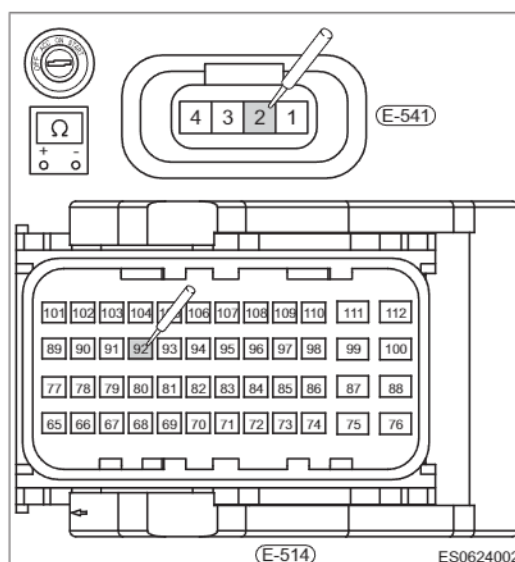
Multimeter Connection	Condition	Specified Condition
E-514 (92) or E-541 (3) - Body ground	Always	Resistance ∞
B-514 (92) or B-541 (3) - Battery positive	Always	Resistance ∞

OK

Electrical water pump relay control circuit is normal

Result

Proceed to
OK
NG



NG

Repair or replace wire harness or connector (ECU - electrical water pump)

OK

6

Check electrical water pump signal feedback circuit

- (a) Check wire harness between ECU connector terminal and electrical water pump connector.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-514 (106) - E-541 (2)	Always	Resistance $\leq 1 \Omega$

06

Check for Short

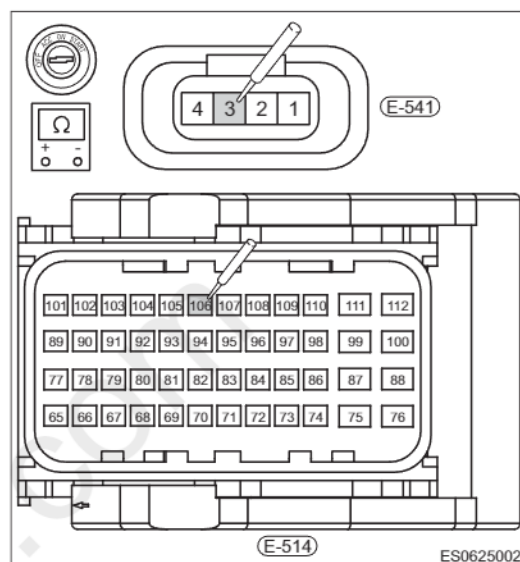
Multimeter Connection	Condition	Specified Condition
E-514 (106) or E-541 (32) - Body ground	Always	Resistance ∞

OK

Electrical water pump signal feedback circuit is normal

Result

Proceed to
OK
NG



ES0625002

NG

Repair or replace wire harness or connector (ECU - electrical water pump)

OK

7

Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P023A 00, P023B 00, P023C 00, P1700 00, P1703 00, P1704 00, P1705 00, P1706 00, P1707 00, P1708 00, P1709 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs

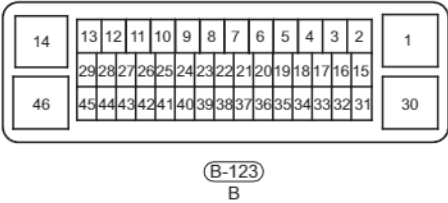
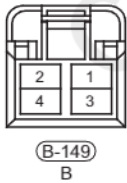
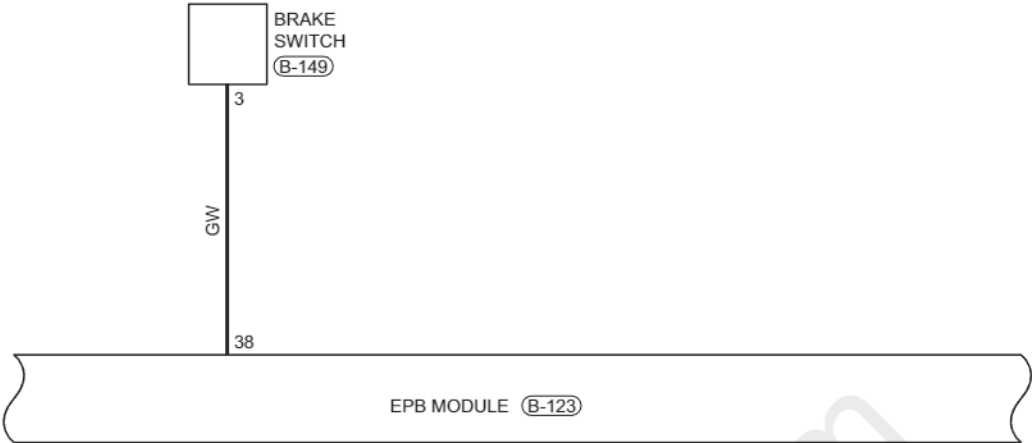
DTC	P0571 29	Brake Signal Synchronization Error
DTC	P0571 1C	Brake Light Signal Circuit error

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Circuit Diagram

06



ES0E19001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0571 29	Brake Signal Synchronization Error	ENGINE START STOP switch ON	- Fuse - Brake switch - Wire harness or connector - ECU
P0571 1C	Brake Light Signal Circuit Error		

Confirmation Procedure

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

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

Caution:

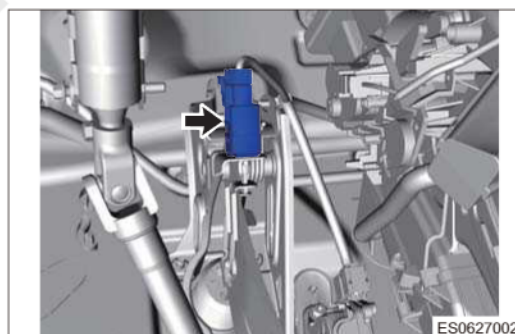
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check brake switch and brake pedal connector**

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

Result

Proceed to
OK
NG



NG

Repair or replace connector

OK

2 Check brake switch signal circuit

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect brake switch connector B-149 and EPB module connector B-123.
 (d) Check for Open

Multimeter Connection	Condition	Specified Condition
B-149 (3) - B-123 (38)	Always	Resistance $\leq 1 \Omega$

Result

Proceed to
OK
NG



NG

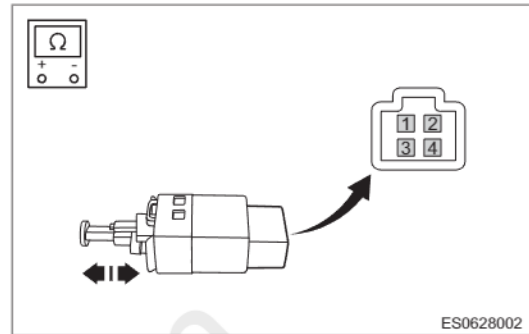
Repair or replace wire harness

OK

3

Check brake switch

(a) Remove the brake switch.



(b) Check the brake switch.

Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 3	Brake pedal depressed (switch pin released)	Resistance $\leq 1 \Omega$
Terminal 4 - Terminal 2		Resistance ∞
Terminal 1 - Terminal 3	Brake pedal released (switch pin pushed)	Resistance ∞
Terminal 4 - Terminal 2		Resistance $\leq 1 \Omega$

OK

Brake switch is normal

Result

Proceed to
OK
NG

NG

Replace brake switch

OK

4

Check pedal travel

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

Multimeter Connection	Condition	Specified Condition
B-149 (4) - Ground	Brake pedal not depressed	12 V
B-149 (3) - Ground	Brake pedal not depressed	0 V

Result

Proceed to
OK

Proceed to
NG

NG

Adjust pedal travel or replace brake pedal

OK

5 Check pedal travel again

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

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
B-149 (4) - Ground	Brake pedal depressed slightly	Voltage of two circuit changes simultaneously
B-149 (3) - Ground	Brake pedal depressed slightly	

Result

Proceed to
OK
NG

NG

Adjust pedal travel or replace brake pedal

OK

6 Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read and clear DTCs.
 (d) Depress brake pedal 25 times continuously, observe if DTCs appear again.
 (e) Check if DTC P0571 29, P0571 1C still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

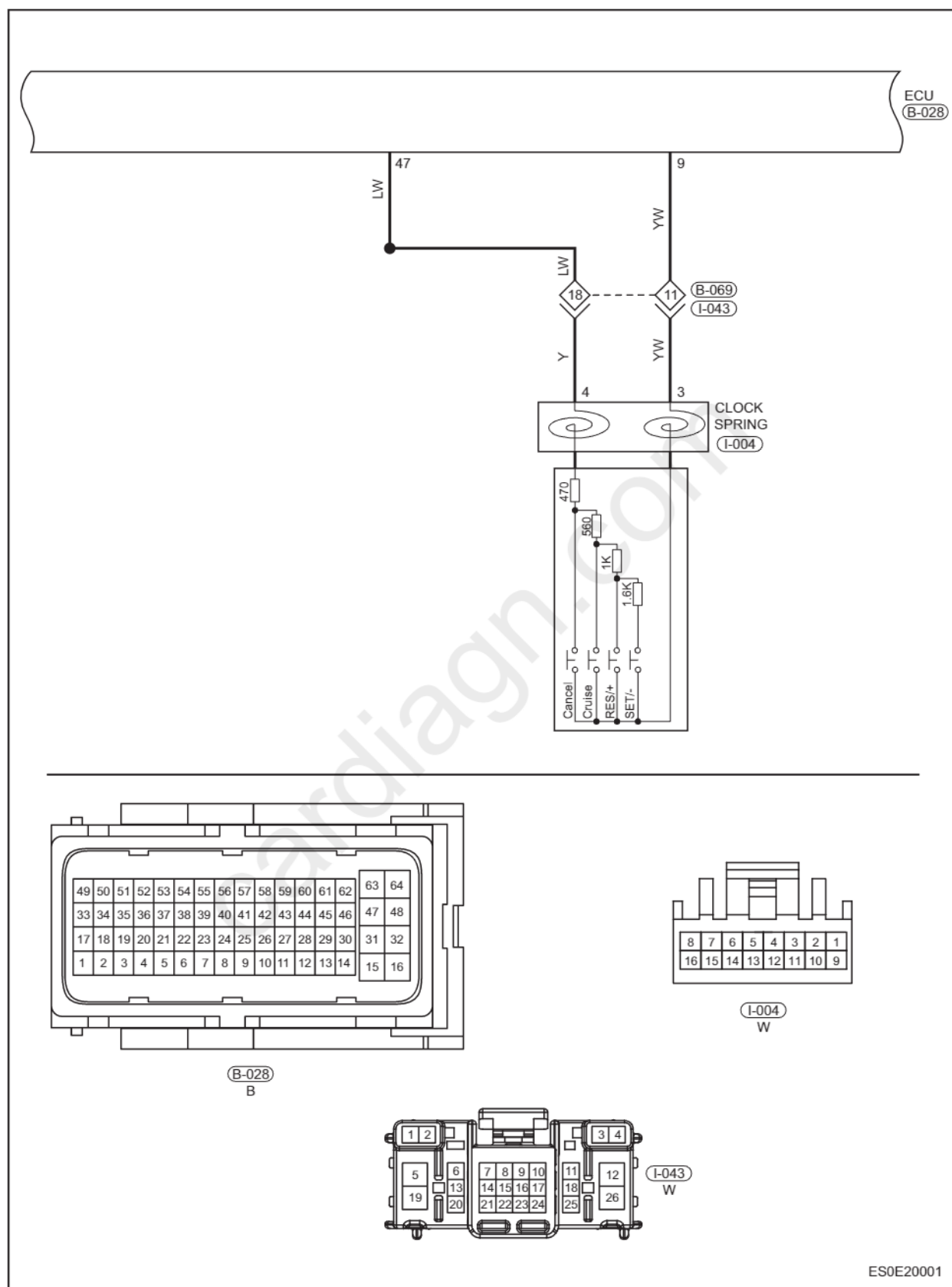
NG

Replace with new ECU to check if malfunction reoccurs



DTC	P0568 1C	Cruise Control
DTC	P0568 86	Cruise Control
DTC	P0568 81	Cruise Control

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0568 1C	Cruise Control	Ignition switch ON	- Cruise switch - Wire harness or connector - ECU
P0568 86	Cruise Control		
P0568 81	Cruise Control		

Confirmation Procedure

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

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

Caution:

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

Procedure

1 Check cruise switch connector

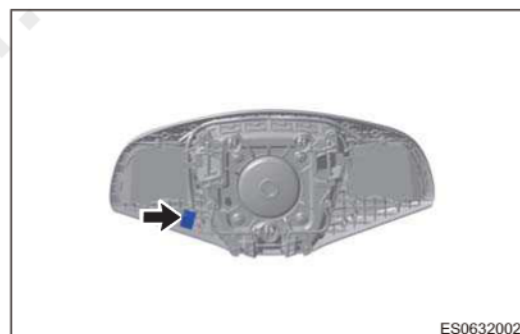
- (a) Check if cruise switch connector I-071 (arrow) is connected infirmly, damaged or cracked.

OK

Cruise switch connector is normal

Result

Proceed to
OK
NG



NG

Repair or replace connector

OK

2 Check circuit between cruise switch to ECU

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Disconnect the cruise switch and ECU connectors.

- (d) Check wire harness between cruise switch connector terminal and ECU connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
I-004 (3) - I-043 (11) - B-069 (11) - B-028 (9)	Always	Resistance $\leq 1 \Omega$
I-004 (4) - I-043 (18) - B-069 (18) - B-028 (47)		

Check for Short

Multimeter Connection	Condition	Specified Condition
I-004 (3, 4) or B-028 (9, 47) - Body ground	Always	Resistance ∞

OK

Circuit between cruise switch to ECU is normal

Result

Proceed to
OK
NG

NG

Repair or replace wire harness or connector (cruise switch - ECU)

OK

3

Check cruise switch

- (a) Remove the cruise switch.
(b) Check cruise switch.

OK

Cruise switch is normal

Result

Proceed to
OK
NG

NG

Replace cruise switch

OK

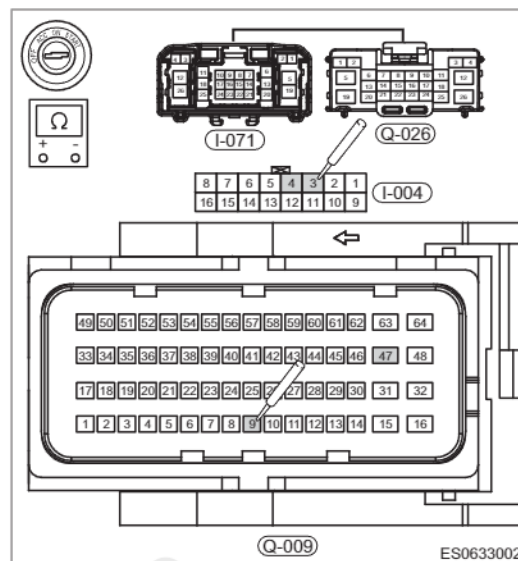
4

Reconfirm DTCs

- (a) Connect the negative battery cable.
(b) ENGINE START STOP switch ON
(c) Using diagnostic tester, read ECU DTC.
(d) Refer to "DTC Confirmation Procedure".
(e) Check if DTC P0568 1C, P0568 86, P0568 81 still exists.

OK

No same DTC is output



06



Result	
Proceed to	
OK	
NG	

OK	System operates normally
NG	Replace with new ECU to check if malfunction reoccurs

DTC	P0601 00	Safety monitoring function error (ECU EEPROM error)
DTC	P0604 43	Internal contr.module RAM error
DTC	P0605 43	Internal contr.module ROM error

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0601 00	Safety monitoring function error (ECU EEPROM error)	ENGINE START STOP switch ON	- Wire harness or connector - ECU
P0604 43	Internal contr.module RAM error		
P0605 43	Internal contr.module ROM error		

06

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Clear and read DTCs again
----------	----------------------------------

- Turn ignition switch to ON.
- Clear DTCs, start and run engine for a period of time, and read DTCs again.

OK

DTCs do not recur

Result

Proceed to
OK
NG

NG

Replace with new ECU to perform real-vehicle test

OK

2	Check electronic throttle connector
----------	--

- Check electronic throttle connector for poor contact or improper installation.



Result

Proceed to
OK
NG

NG**Reinstall or repair, replace connector****OK****3****Electronic throttle self-learning**

- (a) Connect diagnostic tester, clear DTCs, turn ignition switch to OFF and then to ON, and wait for 1 minute.
- (b) Perform electronic throttle self-learning.

OK

Throttle self-learning is finished

Result

Proceed to
OK
NG

NG**Repair or replace wire harness or connector (electronic throttle - ECU)****OK****4****Reconfirm DTCs**

- (a) Using diagnostic tester, read ECU DTC.
- (b) Check if DTC P0601 00, 0604 43, 0605 43 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK**No same DTC is output
End****NG****5****Perform throttle self-learning again**

- (a) Turn ignition switch to ON.
- (b) Finish throttle self-learning after waiting for 1 minute.
- (c) Start the engine, and depress the accelerator pedal several times with shift lever in N.
- (d) Read DTCs again, observe if DTCs appear again.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK	System operates normally
NG	End



DTC	P1614 00	Immo Transferred Transponder Response was Corrupted
DTC	P1615 00	ECM Status Unknown
DTC	P1616 00	Authentication not OK
DTC	P1617 00	No Response from SIM during Challenge Period
DTC	P1618 00	Fail to Write EOL Confidential Data into EEPROM
06 DTC	P1619 00	ECM not Programed (Virgin State)

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P1614 00	Immo Transferred Transponder Response was Corrupted	/	• Immobilizer module • ECU • Wire harness or connector
P1615 00	ECM Status Unknown		
P1616 00	Authentication not OK		
P1617 00	No Response from SIM during Challenge Period		
P1618 00	Fail to Write EOL Confidential Data into EEPROM		
P1619 00	ECM not Programed (Virgin State)		

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Check immobilizer connector
----------	------------------------------------

- (a) Check if immobilizer connector is connected infirmly.

Result

Proceed to
OK
NG

NG

Repair or replace connector

OK

2 Check ECU circuit

- (a) Turn ignition switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Check ECU power supply and ground.
 Voltage Inspection (using a digital multimeter or 21 W test light).

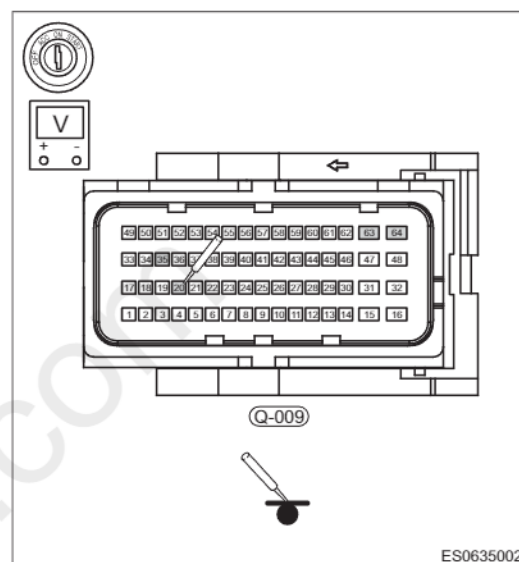
Multimeter Connection	Condition	Specified Condition
B-028 (20, 35) - Body ground	ENGINE START STOP switch ON	Not less than 12 V
B-028 (63, 64) - Body ground		0 V

OK

ECU power supply voltage and ground is normal

Result

Proceed to
OK
NG



06

NG

Repair or replace connector and ground

OK

3 Read SK codes in ECU

- (a) Connect the diagnostic tester.
 (b) Turn ignition switch to ON.
 (c) Read SK codes in ECU.

OK

SK codes in ECU can be read normally

Result

Proceed to
OK
NG

NG

Program ECU again

OK

4 Check if SK codes in ECU and immobilizer module are the same

- (a) Check if SK codes in ECU and immobilizer module are the same.



OK

SK codes in ECU and immobilizer module are the same

Result

Proceed to
OK
NG

NG**Program ECU again after resetting ECU****OK****5 Rematch immobilizer system**

- 06** (a) Check if information in immobilizer module can be read.

OK

Matched immobilizer system operates normally

Result

Proceed to
OK
NG

NG**Replace a new immobilizer module and match it****OK****6 Check if SK codes in ECU and immobilizer module are the same again**

- (a) Check if SK codes in ECU and immobilizer module are the same again.

OK

SK codes in ECU and immobilizer module are the same

Result

Proceed to
OK
NG

NG**Replace with new ECU to check if malfunction reoccurs, and program it again****OK****7 Reconfirm DTCs**

- (a) Using diagnostic tester, read ECU DTC.
 (b) Refer to "DTC Confirmation Procedure".
 (c) Check if P1614 00, P1615 00, P1616 00, P1617 00, P1618 00 or P1619 00 still exists.

OK

No same DTC is output

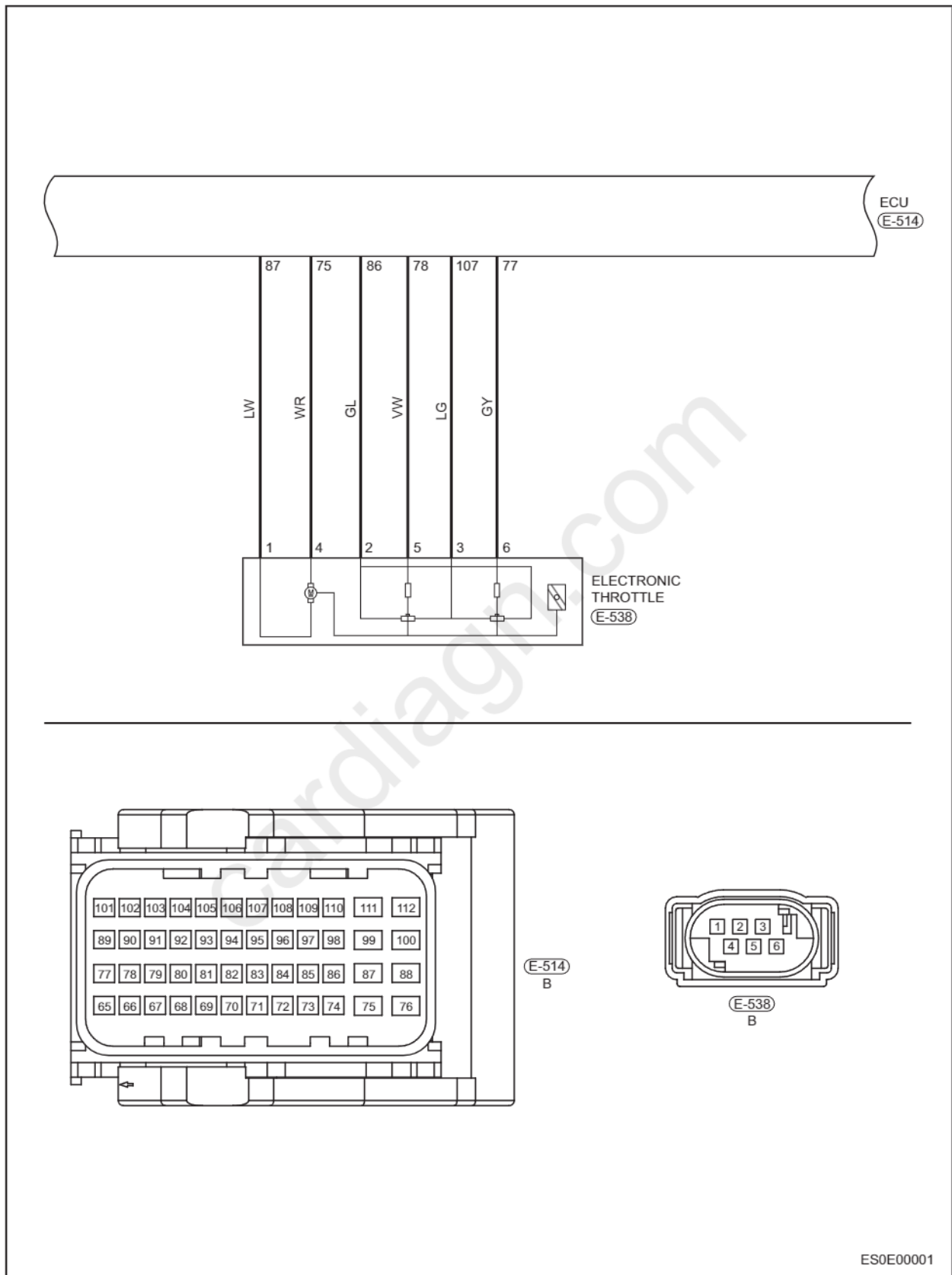
Result

Proceed to
OK
NG

OK**System operates normally****NG****Replace with new ECU to check if
malfunction reoccurs**

DTC	P2106 12	Throttle Power Stage Max Error
DTC	P2106 19	Throttle Power Stage Min Error
DTC	P2106 92	Throttle Power Stage Non-plausible Error
DTC	P2106 13	Throttle Power Stage Signal Error
DTC	P2106 29	Load Monitoring Error

Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P2106 12	Throttle Power Stage Max Error	ENGINE START STOP switch ON, engine running Engine speed is 1200 rpm	- Throttle position sensor 1 - Throttle Position Sensor 2 - Wire harness or connector - ECU
P2106 13	Throttle Power Stage Signal Error		
P2106 19	Throttle Power Stage Min Error		
P2106 29	Load Monitoring Error		
P2106 92	Throttle Power Stage Non-plausible Error		

Confirmation Procedure

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

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

Caution:

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

Procedure

1	Clear and read DTCs again
----------	----------------------------------

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

OK

DTCs are cleared

Result

Proceed to
OK
NG

NG

Repair or replace with new ECU to perform real-vehicle test

OK

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

- Using diagnostic tester, read ECU DTC.
- Check if DTC P2106 12, P2106 13, P2106 19, P2106 29, P2106 92 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK**End****NG****3 Perform electronic throttle self-learning again**

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

OK

DTCs do not recur

Result

Proceed to
OK
NG

OK**System operates normally****NG****End****06**

DTC	U0129 87	Lost Communication with ABS
DTC	U0001 88	Error Busoff on CAN-bus
DTC	U0104 87	Lost Communication with CCU (Cruise Control Module)
DTC	U0121 87	Lost Communication with ABS
DTC	U0126 87	Lost Communication with Steering Angle Sensor Module
DTC	U0140 00	Lost Communication With Body Control Module (Immo)
DTC	U0155 87	Lost Communication With Instrument Panel Cluster (IPC) Control Module
DTC	U0293 87	Lost Communication with HCU
DTC	U0140 87	Lost Communication with Body Control Module (BCM)
DTC	U0214 87	Lost Communication with Passive Entry Passive Start (PEPS)
DTC	U0101 87	Lost Communication with TCM

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
U0129 87	Lost Communication with ABS	ECU does not detect CAN line BUSOFF fault; Engine is running	- Connector or wire harness - ABS malfunction - CAN bus hardware circuit malfunction
U0001 88	Error Busoff on CAN-bus		
U0104 87	Lost Communication with CCU (Cruise Control Module)		
U0121 87	Lost Communication with ABS		
U0126 87	Lost Communication with Steering Angle Sensor Module		
U0140 00	Lost Communication with Body Control Module (Immo)		
U0155 87	Lost Communication With Instrument Panel Cluster (IPC) Control Module		
U0293 87	Lost Communication with HCU		
U0140 87	Lost Communication with Body Control Module (BCM)		
U0214 87	Lost Communication with Passive Entry Passive Start (PEPS)		
U0101 87	Lost Communication with TCM		

Confirmation Procedure

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

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

Caution:

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

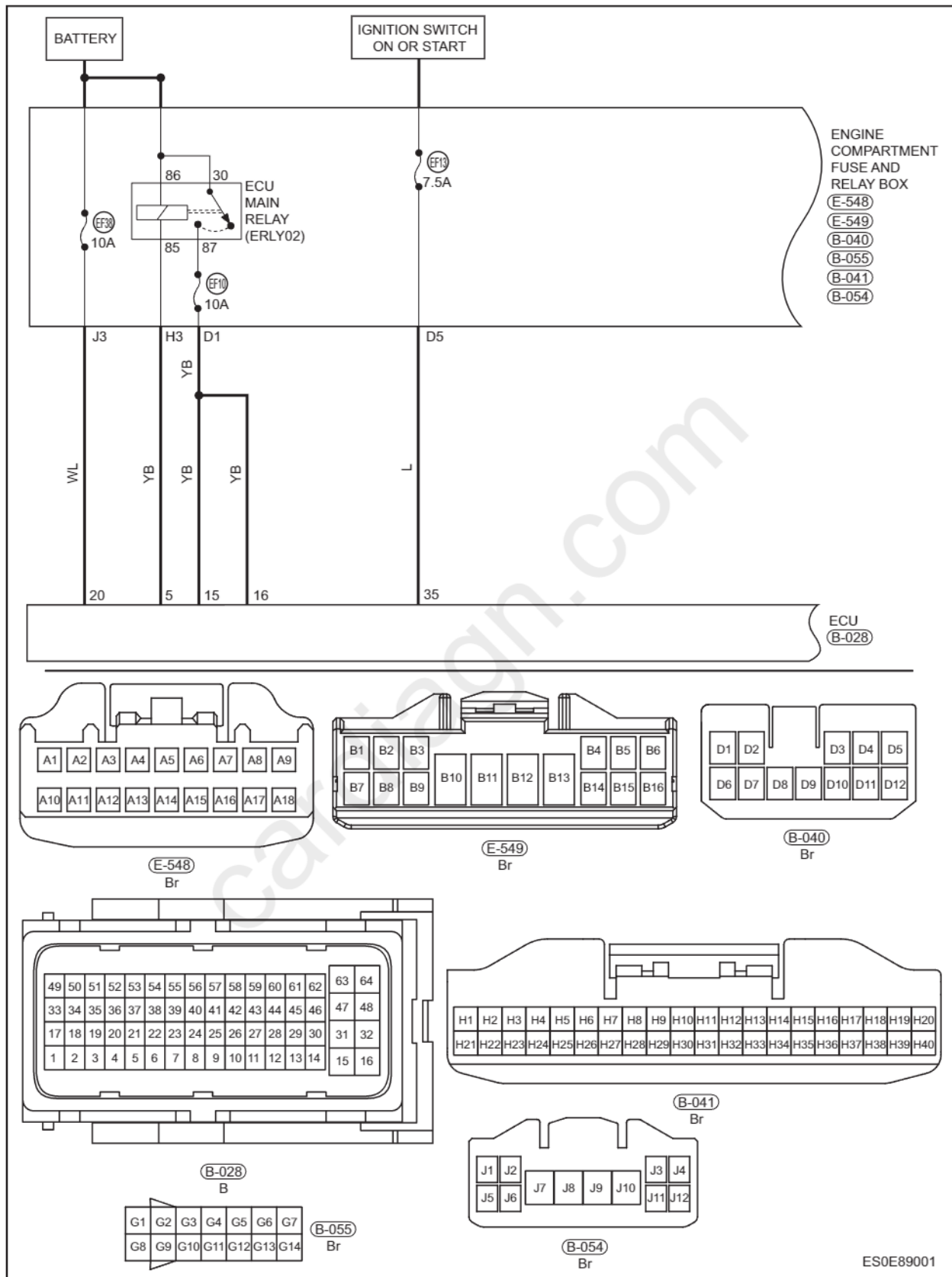
Diagnosis

1	(Refer to CAN system)
---	-----------------------



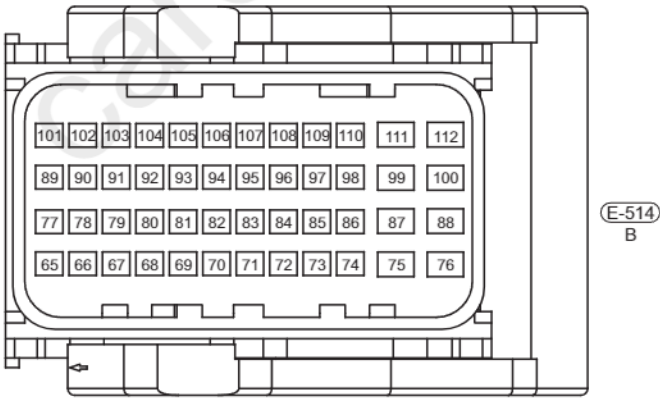
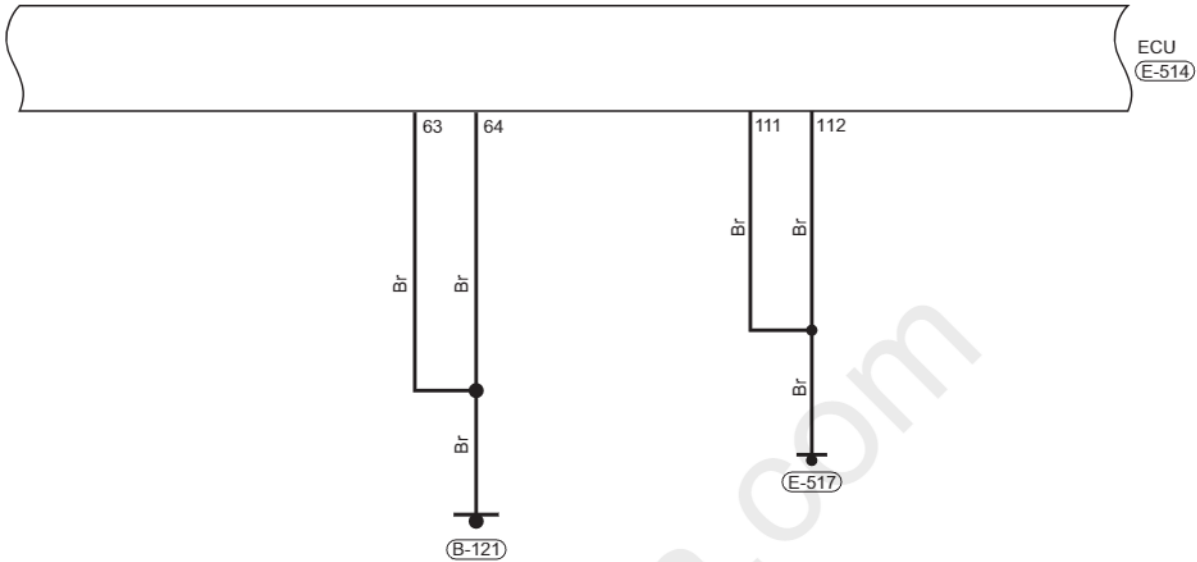
DTC	ECU Power Supply Circuit & Ground Circuit Testing	Auxiliary Power Software Overvoltage
DTC	P0688 91	Power Relay Sense Circuit Non-plausible error
DTC	P0688 92	Power Relay Sense Circuit Signal Error

Power Supply Circuit



Ground Circuit

06



ES0E90001

Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0688 91	Power Relay Sense Circuit Non-plausible Error	ENGINE START STOP switch ON, engine running	• Main Relay • Wire harness or connector • Battery • ECU
P0688 92	Power Relay Sense Circuit Signal Error		

Confirmation Procedure

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

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

06**Procedure****1 Check battery voltage**

- Check if battery terminals are corroded or loose.
- Check battery voltage with a digital multimeter.

OK

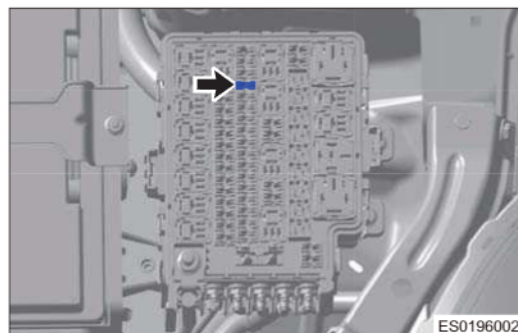
Not less than 12 V

Result

Proceed to
OK
NG

NG**Check and repair battery****OK****2 Check ECU fuse**

- Check if ECU fuses EF38 (10 A), EF13 (7.5 A), EF10 (10 A) are blown or no power.



- Check if main relay terminal is corroded or broken.
- Unplug main relay, directly apply battery voltage to main relay control terminal, check if main relay closes.

OK

Close



Result

Proceed to
OK
NG

NG

Check the cause for fuse no power or repair or replace fuse or relay

OK

3

Check ECU power supply circuit voltage

- 06
- (a) Turn ENGINE START STOP switch to ON.

(b) Measure voltage between terminal 20 of ECU connector B-028 and body ground (using a digital multimeter or 21 W test light).

Multimeter Connection	Condition	Specified Condition
B-028 (20) - Body ground	Always	Not less than 12 V
B-028 (35) - Body ground	ENGINE START STOP switch ACC	Not less than 12 V

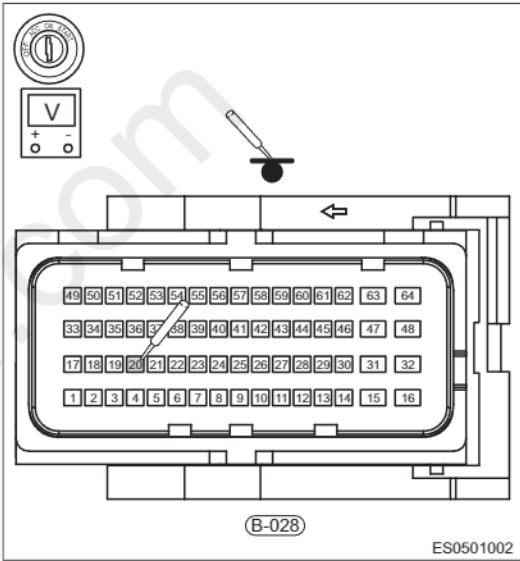
Result

Proceed to
OK
NG

NG

Repair or replace wire harness

OK

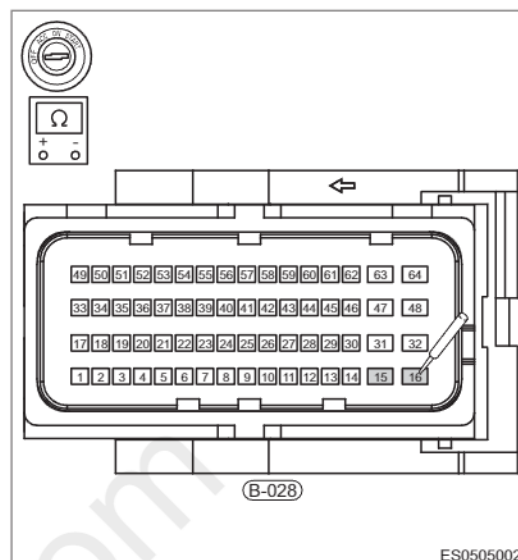


4 Check ECU wire harness (ECU - engine compartment fuse and relay box)

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

Check for Open

Multimeter Connection	Specified Condition
B-028 (15, 16) - Engine Compartment Fuse and Relay Box (D1)	Resistance $\leq 1 \Omega$



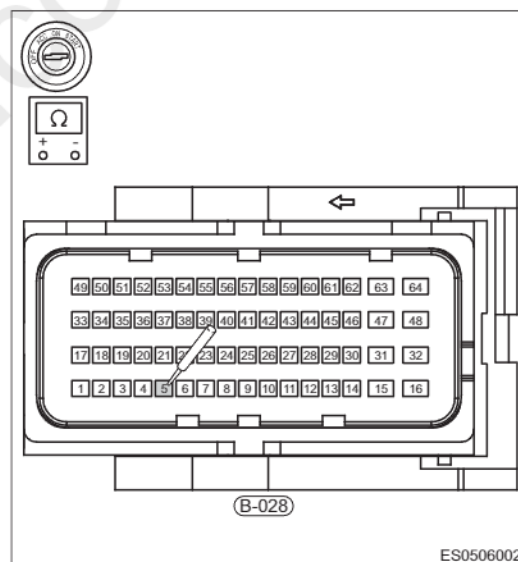
- (b) Check wire harness between connector terminal 5 and fuse box terminal.

Check for Open

Multimeter Connection	Specified Condition
Engine Compartment Fuse and Relay Box (H3) - B-028 (5)	Resistance $\leq 1 \Omega$

Result

Proceed to
OK
NG



NG

Replace fuse or main relay

OK

5 Reconfirm DTCs

- Connect the negative battery cable.
- ENGINE START STOP switch ON
- Using diagnostic tester, read ECU DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC still exists.

OK

No same DTC is output



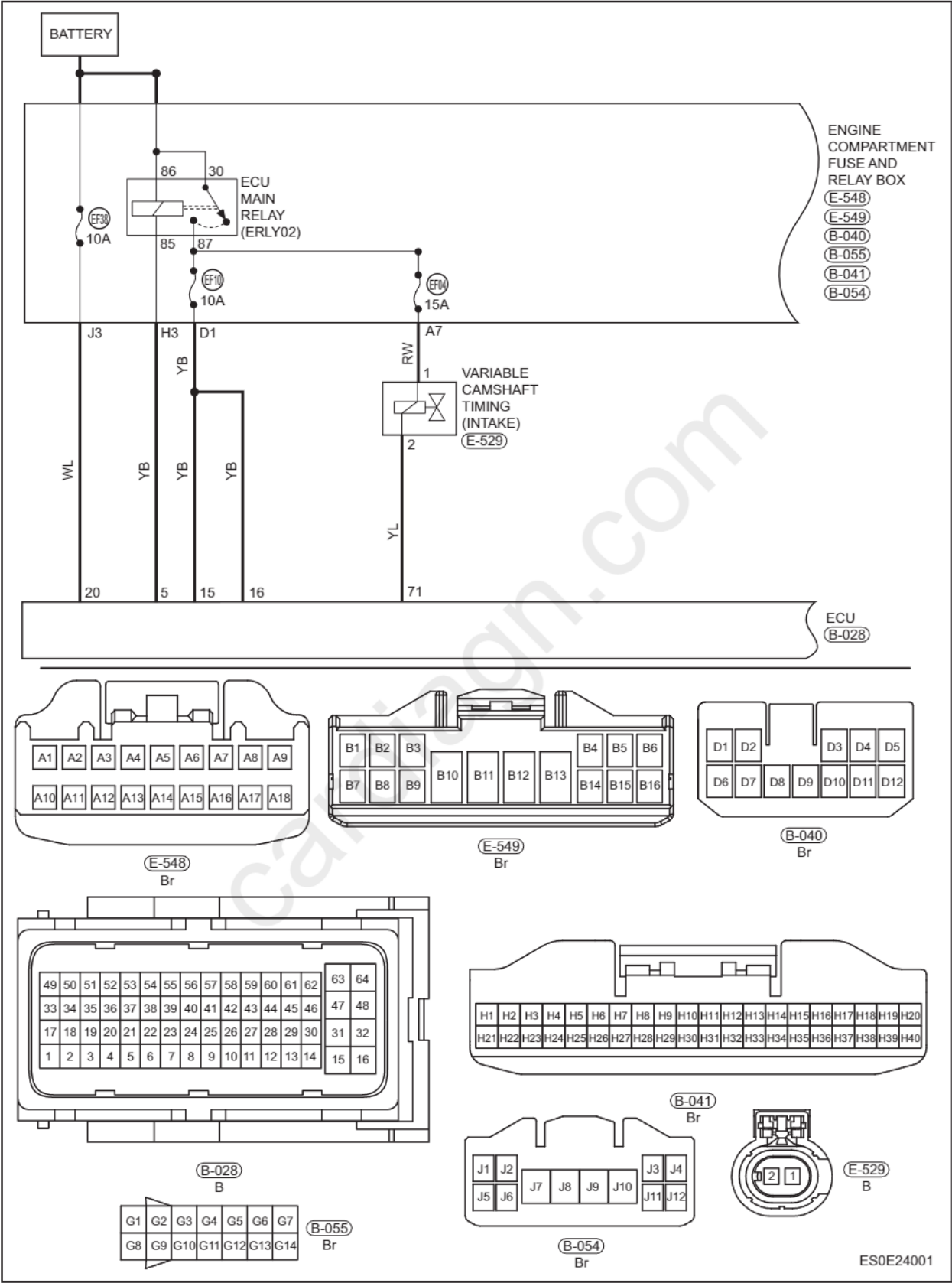
Result	
Proceed to	
OK	
NG	

OK	System operates normally
NG	Replace with new ECU to check if malfunction reoccurs

DTC	P000A 00	Camshaft Control Slow Response (Inlet)
DTC	P000A 77	Camshaft Control Target Error (Inlet)
DTC	P0010 13	Control Circuit of Camshaft control Valve (Inlet)
DTC	P0012 00	Inlet Camshaft not In Locking Position during Start
DTC	P2088 11	Control Circuit Low of Camshaft Control Valve (Inlet)
DTC	P2089 12	Control Circuit High of Camshaft Control Valve (Inlet)



Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P000A 00	Camshaft Control Slow Response (Inlet)	ENGINE START STOP switch ON, engine running	- VVT solenoid valve - Wire harness or connector - ECU
P000A 77	Camshaft Control Target Error (Inlet)		
P0010 13	Control Circuit of Camshaft Control Valve (Inlet)		
P0012 00	Inlet Camshaft not In Locking Position during Start		
P2088 11	Control Circuit Low of Camshaft Control Valve (Inlet)		
P2089 12	Control Circuit High of Camshaft Control Valve (Inlet)		

Confirmation Procedure

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

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

Caution:

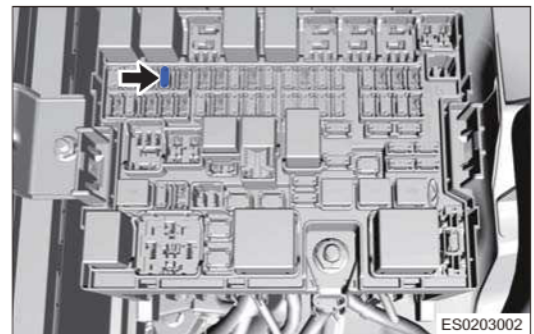
When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check intake VVT control valve fuse EF04**

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

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power

OK

2

Check intake VVT control valve connector

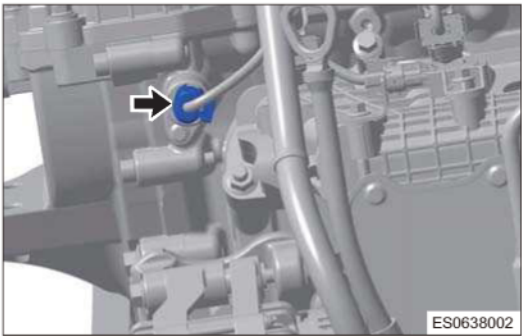
- (a) Check if intake VVT control valve connector E-529 (arrow) is infirmly connected or poorly contacted.

OK

Intake VVT control valve connector is normal

Result

Proceed to
OK
NG



06

NG

Repair or replace connector

OK

3

Check intake VVT control valve power supply voltage

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

Voltage Inspection

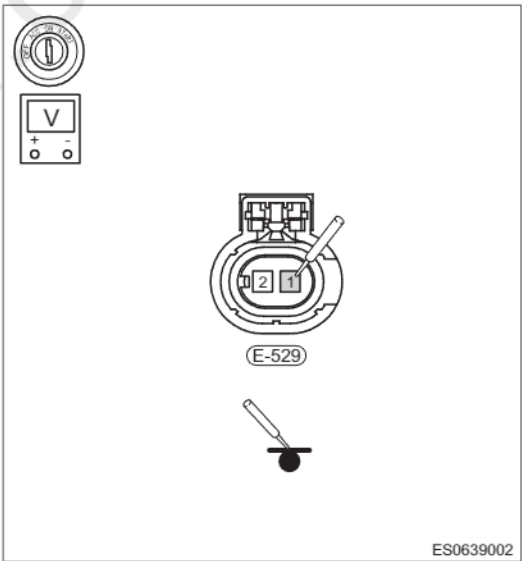
Multimeter Connection	Condition	Specified Condition
E-529 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Intake VVT control valve power supply voltage is normal

Result

Proceed to
OK
NG



NG

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

OK

4

Check wire harness between intake VVT control valve and ECU

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

- (d) Check wire harness between intake VVT control valve E-529 (2) terminal and ECU.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-529 (2) - E-514 (71)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
E-514 (71) or E-529 (2) - Body ground	Always	Resistance ∞
B-514 (71) or B-529 (2) - Battery positive	Always	Resistance ∞

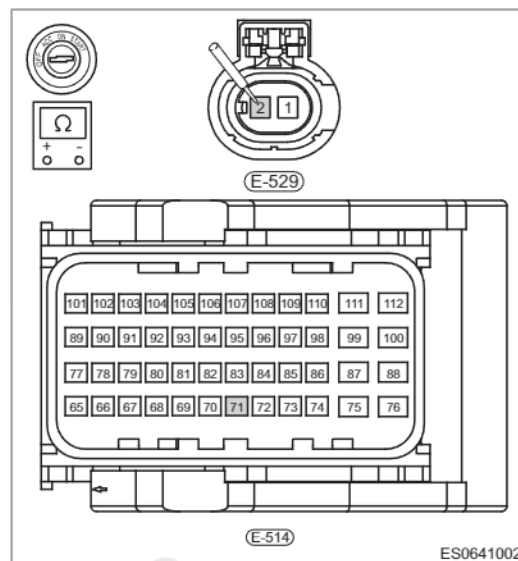
Result

Proceed to
OK
NG

NG

Repair or replace wire harness between intake VVT control valve and ECU

OK



06

5 Check intake VVT control valve mechanical fault

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

OK

Intake VVT control valve is normal

Result

Proceed to
OK
NG

NG

Repair or replace VVT control valve

OK

6 Check intake VVT control valve

- (a) Remove the intake VVT control valve.



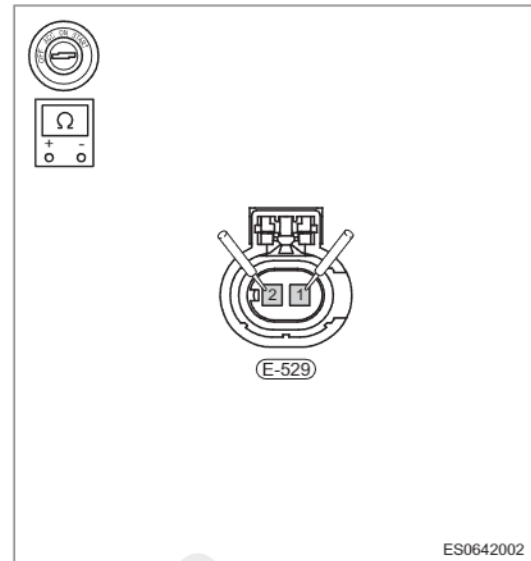
- (b) When battery voltage is applied between terminals 1 and 2, control valve should move quickly.

OK

Intake VVT control valve is normal

Result

Proceed to
OK
NG



06

NG

Replace intake VVT control valve

OK

7

Reconfirm DTCs

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

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

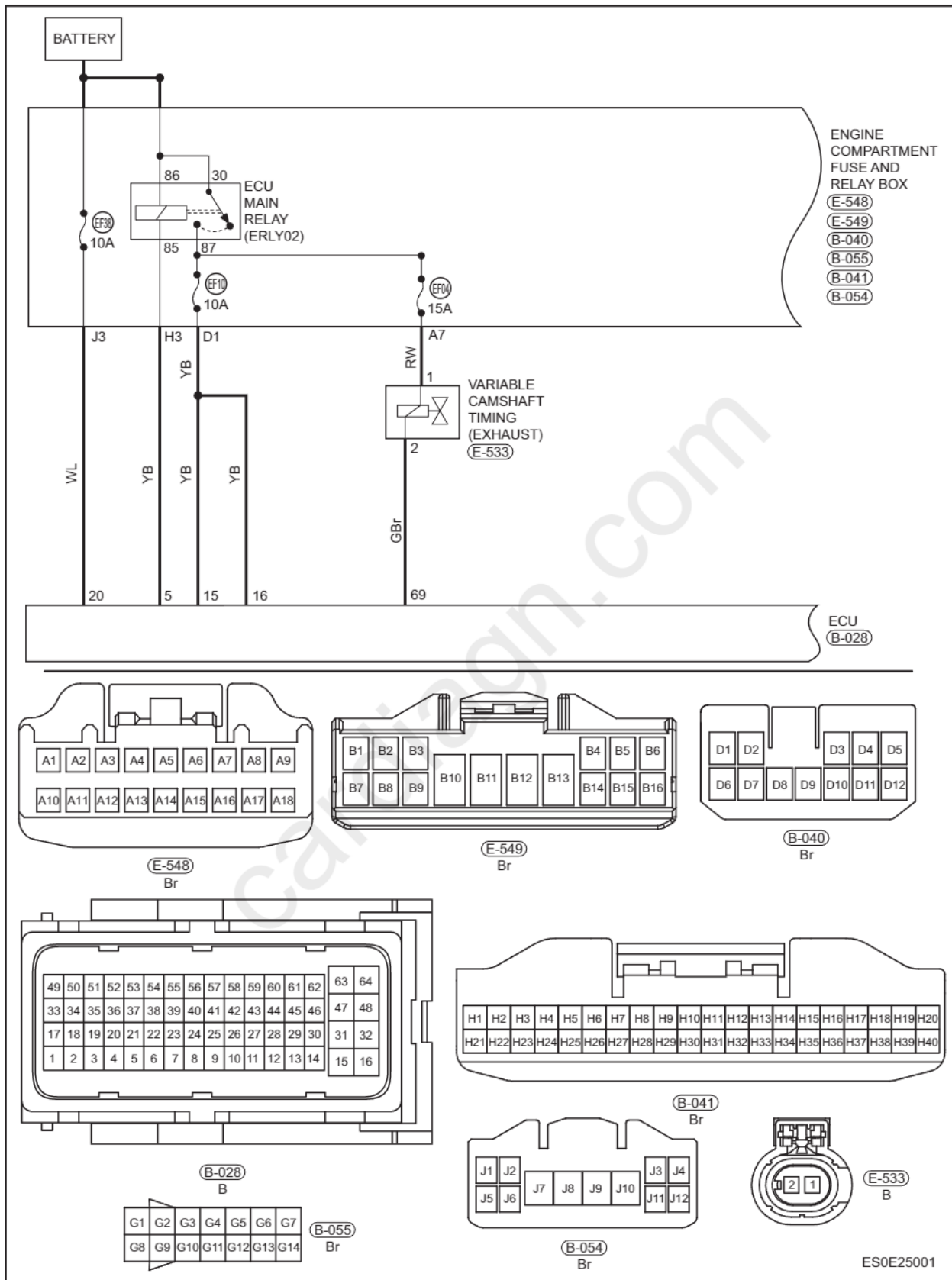
NG

Replace with new ECU to check if malfunction reoccurs

DTC	P000B 00	Camshaft Control Slow Response (Outlet)
DTC	P000B 77	Camshaft Control Target Error (Outlet)
DTC	P0013 13	Control Circuit of Camshaft Control Valve (Outlet)
DTC	P0015 00	Outlet Camshaft not In Locking Position during Start
DTC	P2090 11	Control Circuit Low of Camshaft Control Valve (Outlet)
DTC	P2091 12	Control Circuit High of Camshaft Control Valve (Outlet)



Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P000B 00	Camshaft Control Slow Response (Outlet)	ENGINE START STOP switch ON, engine running	- VVT Solenoid Valve - Wire harness or connector - ECU
P000B 77	Camshaft Control Target Error (Outlet)		
P0013 13	Control Circuit of Camshaft Control Valve (Outlet)		
P0015 00	Outlet Camshaft not In Locking Position during Start		
P2090 11	Control Circuit Low of Camshaft Control Valve (Outlet)		
P2091 12	Control Circuit High of Camshaft Control Valve (Outlet)		

06

Confirmation Procedure

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

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

Caution:

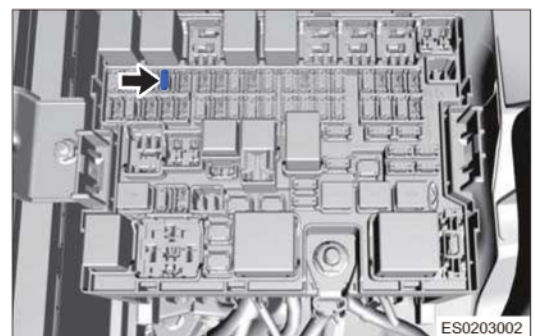
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

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

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

Result

Proceed to
OK
NG



NG

Replace fuse or check the cause for no power

OK



2

Check exhaust VVT control valve connector

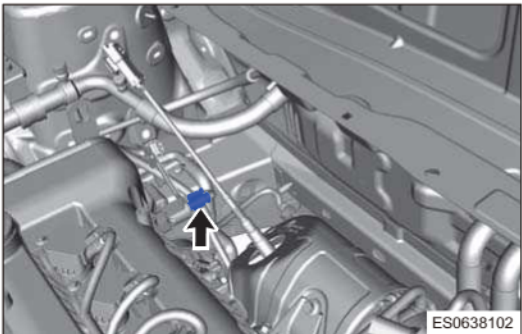
- (a) Check if exhaust VVT control valve connector E-533 (arrow) is infirmly connected or poorly contacted.

OK

Exhaust VVT control valve connector is normal

Result

Proceed to
OK
NG



06

NG

Repair or replace connector

OK

3

Check exhaust VVT control valve power supply voltage

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

Voltage Inspection

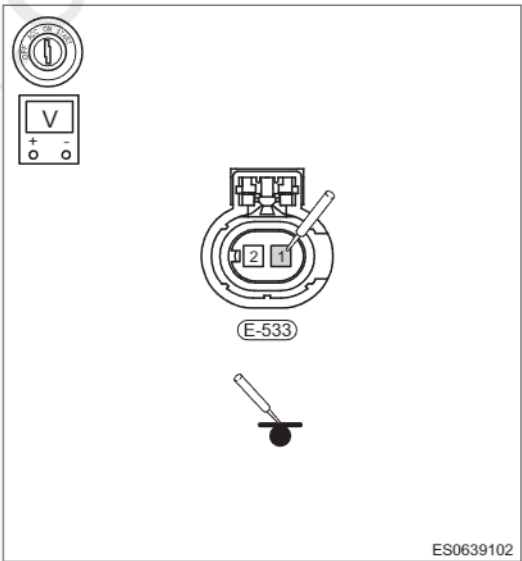
Multimeter Connection	Condition	Specified Condition
E-533 (1) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Exhaust VVT control valve power supply voltage is normal

Result

Proceed to
OK
NG



NG

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

OK

4

Check exhaust VVT control valve control circuit

- (a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect ECU connector E-514 and exhaust VVT control valve connector E-533.

- (d) Check wire harness between exhaust VVT control valve connector terminal and ECU connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-514 (69) - E-533 (2)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
E-514 (69) or E-533 (2) - Body ground	Always	Resistance ∞

OK

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

Result

Proceed to
OK
NG

NG

**Replace wire harness or connector
(exhaust VVT control valve - ECU)**

OK

5

Check exhaust VVT control valve mechanical fault

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

OK

Exhaust VVT control valve is normal

Result

Proceed to
OK
NG

NG

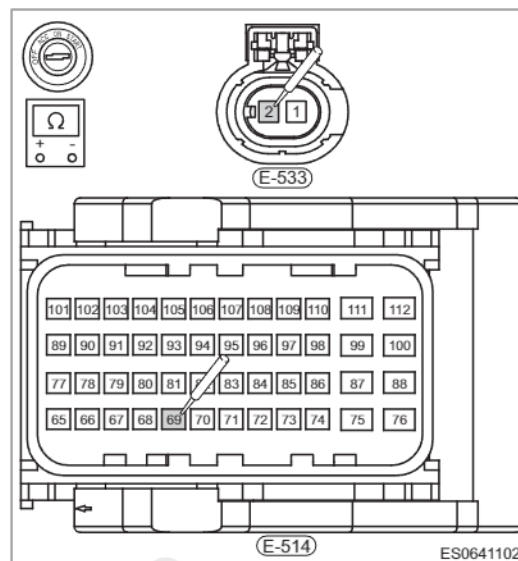
Repair or replace VVT control valve

OK

6

Check exhaust VVT control valve

- (a) Remove the exhaust VVT control valve.



06



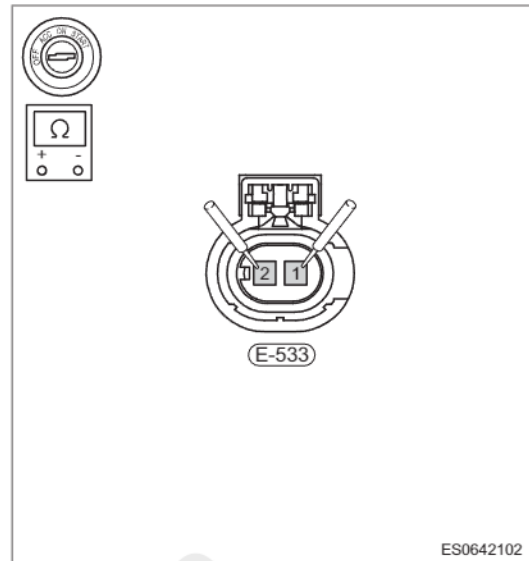
- (b) When battery voltage is applied between terminals 1 and 2, control valve should move quickly.

OK

Exhaust VVT control valve is normal

Result

Proceed to
OK
NG



06

NG

Replace exhaust VVT control valve

OK

7

Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P000B 00, P000B 77, P0013 13, P0015 00, P2090 11 or P2090 12 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs

DTC	P0033 13	Dump Valve Control Circuit Open
DTC	P0034 11	Dump Valve Control Circuit Low
DTC	P0035 12	Dump Valve Control Circuit High
DTC	P2261 00	Dump Valve - Mechanical Error



06-324



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0033 13	Dump Valve Control Circuit Open	ENGINE START STOP switch ON, engine running	• ERCV relief solenoid valve • Wire harness or connector • ECU
P0034 11	Dump Valve Control Circuit Low		
P0035 12	Dump Valve Control Circuit High		
P2261 00	Dump Valve - Mechanical Error		

Confirmation Procedure

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

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

Caution:

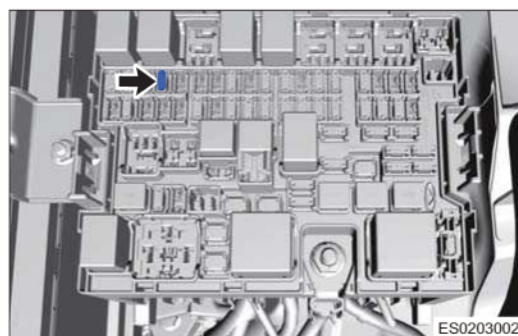
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check ERCV relief solenoid valve fuse EF04**

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

Result

Proceed to
OK
NG



NG

Replace fuse or check the cause for no power

OK



2

Check ERCV relief solenoid valve connector

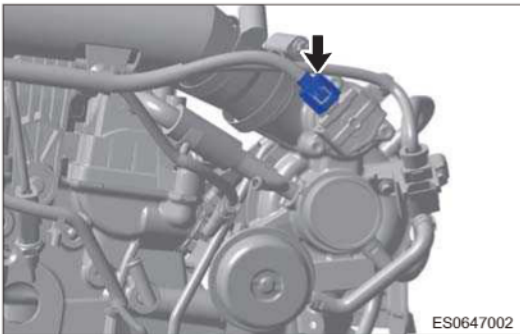
- (a) Check if ERCV relief solenoid valve connector E-507 (arrow) is infirmly connected or poorly contacted.

OK

ERCV relief solenoid valve connector is normal

Result

Proceed to
OK
NG



06

NG

Repair or replace connector

OK

3

Check ERCV relief solenoid valve power supply voltage

- (a) Turn ENGINE START STOP switch to ON.
(b) Measure voltage between ERCV relief solenoid valve connector terminal and body ground (using a digital multimeter).

Voltage Inspection

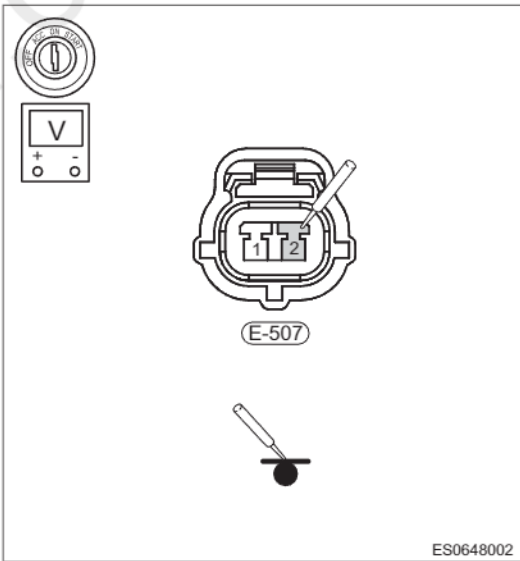
Multimeter Connection	Condition	Specified Condition
E-507 (2) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

ERCV relief solenoid valve power supply voltage is normal

Result

Proceed to
OK
NG



NG

Repair or replace wire harness between ERCV relief solenoid valve and engine compartment fuse and relay box

OK

4

Check ERCV relief solenoid valve control circuit

- (a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the negative battery cable.
(c) Disconnect the ECU wire harness connector E-514.

- (d) Check wire harness between ERCV relief solenoid valve connector terminal and ECM connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-507 (1) - E-514 (70)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
E-507 (1) or E-514 (70) - Ground	Always	Resistance ∞
B-507 (1) or B-514 (70) - Battery positive	Always	Resistance ∞

OK

Wire harness between ERCV relief solenoid valve connector terminal and ECU connector terminal is normal

Result

Proceed to
OK
NG

NG

Replace wire harness or connector (ERCV relief solenoid valve - ECU)

OK

5 Check ERCV relief solenoid valve mechanical fault

- (a) Remove ERCV relief solenoid valve, and check ERCV relief solenoid valve for sticking.

OK

ERCV relief solenoid valve is normal

Result

Proceed to
OK
NG

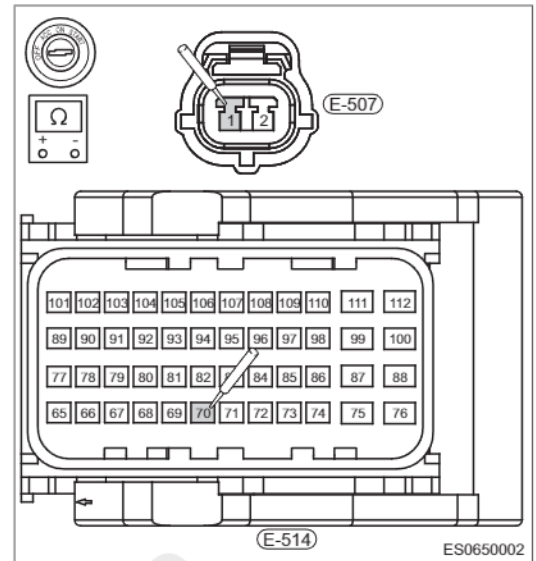
NG

Repair or replace ERCV relief solenoid valve

OK

6 Check ERCV relief solenoid valve

- (a) Remove the ERCV relief solenoid valve.



06



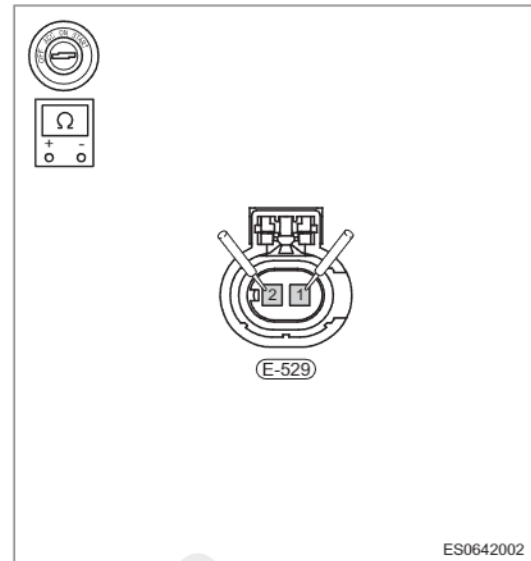
- (b) Measure resistance of ERCV relief solenoid valve, to determine if there is internal short or open.

OK

ERCV relief solenoid valve is normal

Result

Proceed to
OK
NG



06

NG

Replace ERCV relief solenoid valve

OK

7

Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0033 13, P0034 11, P0035 12, P2261 00 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

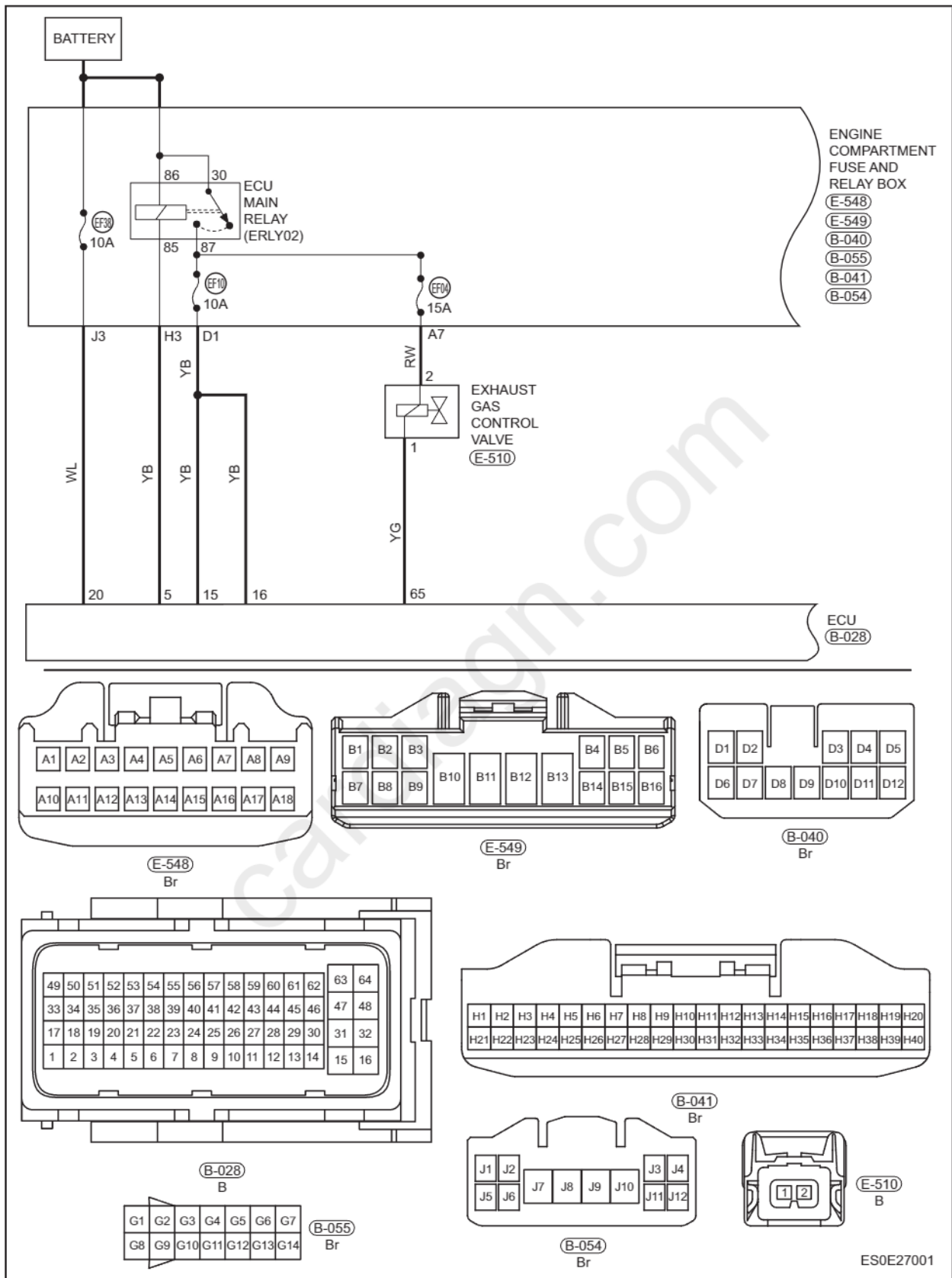
NG

Replace with new ECU to check if malfunction reoccurs

DTC	P0243 13	Turbo/Super Charger Wastegate Solenoid open
DTC	P0245 11	Turbo/Super Charger Wasteg.Solenoid Low
DTC	P0246 12	Turbo/Sup.Charger Wasteg.Solenoid High



Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0243 13	Turbo/Super Charger Wastegate Solenoid open	ENGINE START STOP switch ON, engine running	- Waste control valve - Wire harness or connector - ECU
P0245 11	Turbo/Super Charger Wasteg. Solenoid Low		
P0246 12	Turbo/Sup.Charger Wasteg. Solenoid High		

Confirmation Procedure

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

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

Caution:

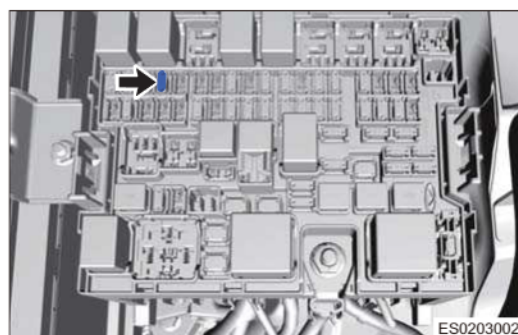
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check turbocharger waste control valve fuse EF04**

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

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power

OK

2

Check turbocharger waste control valve connector

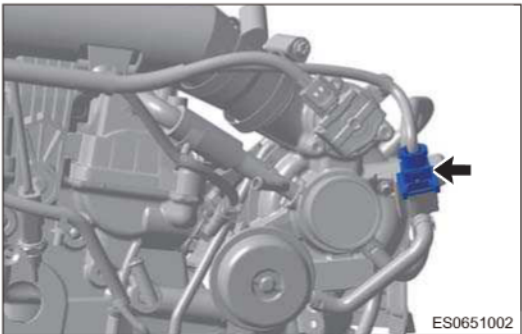
- (a) Check if turbocharger waste control valve connector E-510 (arrow) is infirmly connected or poorly contacted.

OK

Turbocharger waste control valve connector is normal

Result

Proceed to
OK
NG



06

NG

Repair or replace connector

OK

3

Check turbocharger waste control valve power supply voltage

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

Voltage Inspection

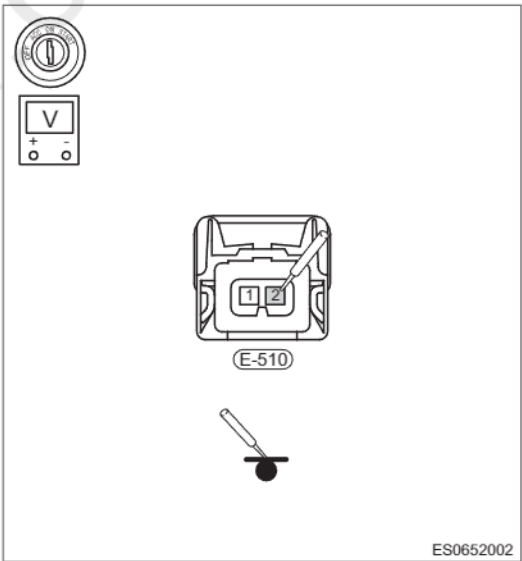
Multimeter Connection	Condition	Specified Condition
E-510 (2) - Body ground	ENGINE START STOP switch ON	Not less than 12 V

OK

Turbocharger waste control valve power supply voltage is normal

Result

Proceed to
OK
NG



NG

Repair or replace wire harness between turbocharger waste control valve and engine compartment fuse and relay box

OK

4

Check turbocharger waste control valve control circuit

- (a) Disconnect the ECU wire harness connector E-514.

- (b) Check wire harness between turbocharger waste control valve connector terminal and ECU connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-510 (1) - E-514 (65)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
E-510 (1) or E-514 (65) - Ground	Always	Resistance ∞
B-510 (1) or E-514 (65) - Battery positive	Always	Resistance ∞

OK

Continuity between turbocharger waste control valve connector terminal and ECU connector terminal is normal

Result

Proceed to
OK
NG

NG

Replace wire harness or connector
(turbocharger waste control valve - ECU)

OK

5

Check turbocharger waste control valve mechanical fault

- (a) Remove turbocharger waste control valve, and check turbocharger waste control valve for sticking.

OK

Turbocharger waste control valve is normal

Result

Proceed to
OK
NG

NG

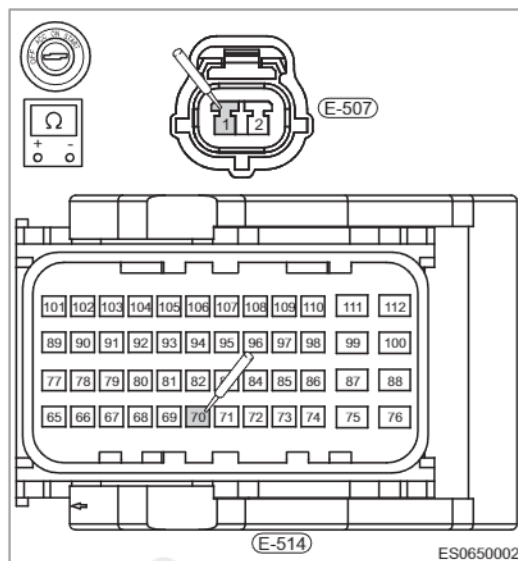
Repair or replace turbocharger waste control valve

OK

6

Check turbocharger waste control valve

- (a) Remove the turbocharger waste control valve.



06



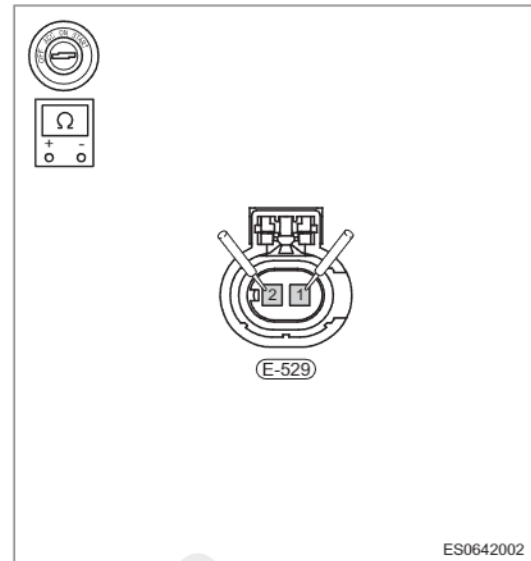
- (b) Using a multimeter, measure resistance between terminals 1 and 2 of turbocharger waste control valve, to determine if there is internal short or open.

OK

Turbocharger waste control valve is normal

Result

Proceed to
OK
NG



06

NG

Replace turbocharger waste control valve

OK

7

Reconfirm DTCs

- (a) Connect the negative battery cable.
 (b) ENGINE START STOP switch ON
 (c) Using diagnostic tester, read ECU DTC.
 (d) Check if DTC P0234 13, P0245 11, P0246 12 still exists.

OK

No same DTC is output

Result

Proceed to
OK
NG

OK

System operates normally

NG

Replace with new ECU to check if malfunction reoccurs

DTC	P0170 00	Fuel Trim Malfunction
DTC	P0171 00	Fuel Trim System too Lean
DTC	P0172 00	Fuel Trim System too Rich
DTC	P2177 00	System Too Lean Off Idle
DTC	P2178 00	System Too Rich Off Idle
DTC	P2187 00	System Too Lean at Idle
DTC	P2188 00	System Too Rich at Idle



Circuit Diagram



Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0170 00	Fuel Trim Malfunction	Air-fuel ratio self-learning is enable - Engine speed is between 1400 and 4000 rpm/ (1440 - 3320 rpm); - Engine load is between 18 and 70.5%/(for MT: 18 - 57.75); - Engine intake flow is between 8 and 140 kg/h/ (for MT: 24 - 110 kg/h);	- Oxygen Sensor - Wire harness or connector - Fuel system components - Carbon canister - ECU
P0171 00	Fuel Trim System too Lean		
P0172 00	Fuel Trim System too Rich		
P2177 00	System Too Lean Off Idle		
P2178 00	System Too Rich Off Idle		
P2187 00	System Too Lean at Idle		
P2188 00	System Too Rich at Idle		

Confirmation Procedure

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

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

Caution:

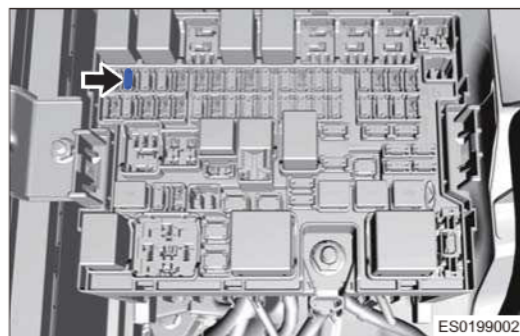
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

Procedure**1 Check fuse EF02**

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

Result

Proceed to
OK
NG

**NG**

Replace fuse or check the cause for no power

OK**2 Check upstream oxygen sensor power supply voltage**

- (a) Turn ENGINE START STOP switch to ON.



06-SQRE4T15B ENGINE MANAGEMENT SYSTEM

- (b) Measure voltage between terminal 4 of connector E-500 and ground (using a digital multimeter or 21 W test light).

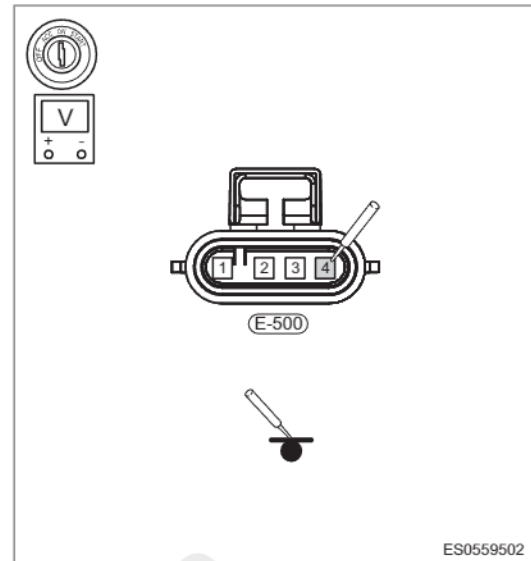
Multimeter Connection	Condition	Specified Condition
E-500 (4) - Body ground	ON	Not less than 12 V

OK

Upstream oxygen sensor power supply voltage is normal

Result

Proceed to
OK
NG



06

NG

End

OK

3

Check upstream oxygen sensor heater control circuit voltage

- (a) Turn ENGINE START STOP switch to ON.
 (b) Measure voltage between terminal 3 of connector E-500 and ground (using a digital multimeter or 21 W test light).

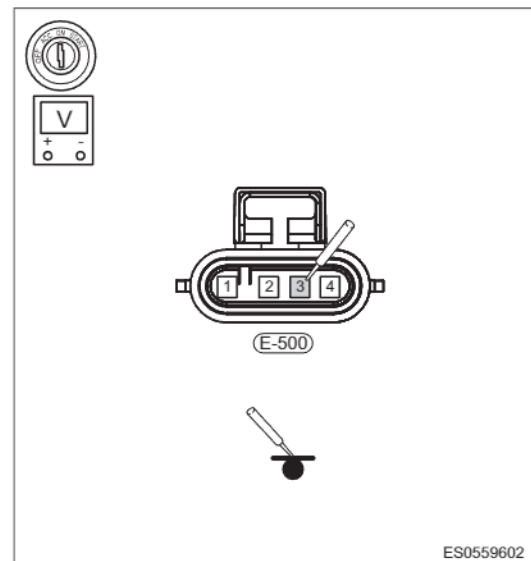
Multimeter Connection	Condition	Specified Condition
E-500 (3) - Body ground	ON	Not less than 12 V

OK

Upstream oxygen sensor power supply voltage is normal

Result

Proceed to
OK
NG



NG

Wire harness

OK

4

Check voltage between downstream oxygen sensor signal wire and ground wire

- (a) Turn ENGINE START STOP switch to ON.

- (b) Measure voltage between terminals 2 and 1 of connector E-501 (using a digital multimeter or 21 W test light).

Multimeter Connection	Condition	Specified Condition
E-501 (2) - E-501 (1)	Engine running	Not less than 12 V

OK

Voltage between downstream oxygen sensor signal and ground wire is normal

Result

Proceed to
OK
NG

NG

Check relay box fuse

OK

06

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

- (a) Turn ENGINE START STOP switch to ON.
 (b) Measure voltage between terminals 4 and 3 of connector E-501 (using a digital multimeter or 21 W test light).

Multimeter Connection	Condition	Specified Condition
E-501 (4) - E-500 (3)	Engine running	0.45 V

OK

Voltage between downstream oxygen sensor power source and heater control circuit

Result

Proceed to
OK
NG

NG

End

OK

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

- (a) Turn ENGINE START STOP switch to ON, start engine and idle it until engine coolant temperature is normal.
 (b) Measure voltage between terminals 2 and 1 of connector E-501.

Multimeter Connection	Condition	Specified Condition
E-501 (2) - E-501 (1)	Engine running	Fluctuates rapidly between 0.1 and 0.9 V (coolant temperature is normal)

OK

Upstream oxygen sensor signal is normal



Result

Proceed to
OK
NG

NG

End

OK

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

- (a) Turn ENGINE START STOP switch to ON, start engine and idle it until engine coolant temperature is normal, and leave the vehicle in idle state.
- (b) Turn ENGINE START STOP switch to OFF.
- (c) Disconnect the negative battery cable.
- (d) Disconnect the upstream oxygen sensor connector E-500.
- (e) Check for short between terminals 3 and 2 of connector E-500.

Multimeter Connection	Condition	Specified Condition
E-500 (2) - E-500 (3)	Engine running	Resistance $\leq 1 \Omega$

OK

Upstream oxygen sensor signal is normal

Result

Proceed to
OK
NG

NG

Replace upstream oxygen sensor

OK

8**Check ECU ground point**

- (a) Disconnect ECU ground points GB-121 and GE-517.
- (b) Check the ECU ground points GB-121 and GE-517.

OK

Ground point is normal

Result

Proceed to
OK
NG

NG

Repair or replace ground wire harness or ground point

OK

9 Check upstream oxygen sensor signal circuit

- Disconnect the upstream oxygen sensor connector E-500.
- Check wire harness between upstream oxygen sensor connector terminal and ECU connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-500 (2) - E-514 (104) or E-500 (1) - E-514 (80)	Always	Resistance $\leq 1 \Omega$

Check for Short

Multimeter Connection	Condition	Specified Condition
E-500 (2) or E-514 (104) - Body ground or battery positive	Always	Resistance ∞
E-500 (1) or E-514 (80) - Body ground or battery positive		

OK

Upstream oxygen sensor signal circuit is normal

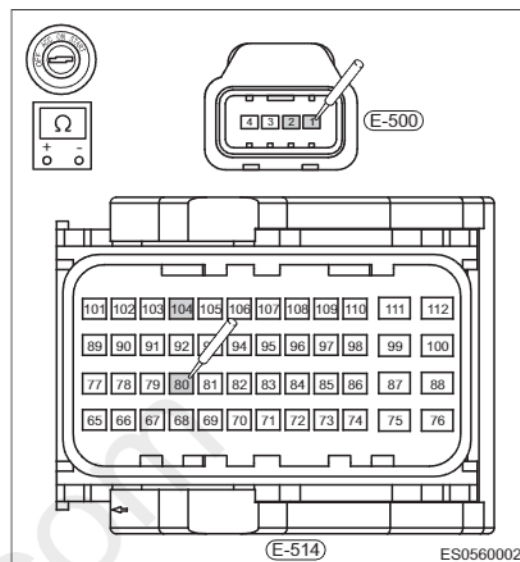
Result

Proceed to
OK
NG

NG

Replace wire harness or connector
(upstream oxygen sensor - ECU)

OK



10 Check for fuel system malfunction

- Check each component and supplying pressure of fuel system for malfunctions.

OK

Each component of fuel system is normal

Result

Proceed to
OK
NG

NG

Repair or replace faulty fuel system
components

OK

11 Check if malfunction is caused by canister solenoid valve

- Check canister solenoid valve for sticking or other malfunctions.



OK

Canister solenoid valve operates normally

Result

Proceed to
OK
NG

NG**Repair or replace canister solenoid valve****OK****12****Reconfirm DTCs****06**

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

OK

No same DTC is output

Result

Proceed to
OK
NG
-

OK**System operates normally****NG****Replace with new ECU to check if malfunction reoccurs**

Diagnosis Process of Electronic Fuel Injection system According to Trouble Symptom

Fuel pressure test

1. Fuel Pressure Specifications

SQRE4T15B	Pressure (kpa)
Fuel Rail Fuel Pressure (ENGINE START STOP switch ON)	400 (When power is on, pressure of fuel supply system is kept at 400 kPa - key (ON). For the new vehicle, after it is added with a certain fuel, make sure that measured fuel pressure on fuel rail at 13 s can reach 90% or higher of rated pressure.)
Fuel Rail Fuel Pressure (Engine Idling)	400
Fuel Rail Fuel Pressure (ENGINE START STOP switch OFF)	400 (Turn off oil pump after it runs for 5 minutes, test changes of pressure in oil outlet of oil pump within 48 hours, the pressure should be not less than 100 kPa; When system pressure is 80%, turn power and oil outlet off, the maximum pressure will not drop more than 10% in 1min.)

06

Caution:

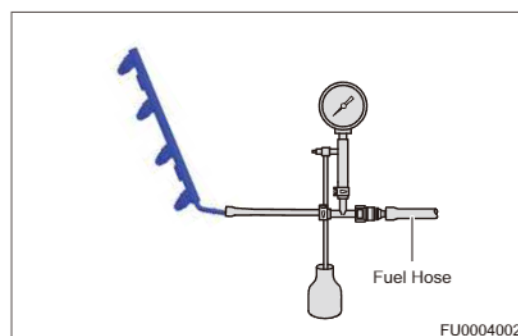
- When operating the fuel supply system, work area should be in good ventilation and keep fire sources or open flames away from the work area, in which fire extinguisher should be equipped.
- Before operating the fuel supply system, please touch the vehicle body to discharge static electricity; failure to do so will cause a fire, even result in an explosion.
- Before removing and installing fuel pipes, release the fuel supply system pressure.

Warning:

- Make sure that battery voltage is not less than 12 V.
- The service life of fuel filter assembly should be within 30000 km.
- Fuel amount is at least 25% of fuel tank capacity.
- Make sure that fuel supply system lines are securely connected, preventing the fuel supply system from leaking.

2. Check fuel pressure process

- Fuel system pressure release.
- Remove the engine trim cover.
- Disconnect the inlet pipe II connector and connect the fuel supply system pressure tester between inlet pipe II and fuel rail.



- Start engine and run it at idle, and then read the value on pressure tester.

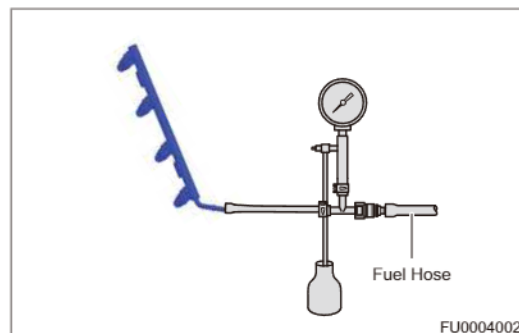
Warning:

- Standard pressure at idle should be 400 kPa.
- If measured pressure value is lower than 380 kPa or higher than 420 kPa, check vehicle fuel supply line for leakage or kink, check fuel filter or injector for blockage, function of electric fuel pump for abnormality.
- Replace fuel filter, injector or electric fuel pump assembly if necessary.



3. Fuel flow test method

- (a) Disconnect the inlet pipe II connector and connect the fuel supply system pressure tester between inlet pipe II and fuel rail.



- (b) Start engine, increase engine speed (such as throttle fully opens), if the pressure of pressure gauge is lower than 0.1 Mpa (100 kPa) of system pressure, flow is insufficient.
- (c) If flow is insufficient, fuel filter blockage, line blockage or bend, fuel pump wear or mesh blockage may be the problem cause.

Hint:

- Replace the fuel filter firstly if necessary. If line is blocked or bend, repair or replace it and retest flow, if it is eligible, the problem is eliminated. If it is ineligible, replace fuel pump and wash impurities in fuel tank.

Diagnosis Process of Electronic Fuel Injection system According to Trouble Symptom

1. Perform primary inspection first before starting the procedure for troubleshooting based on the engine problem symptoms
 - (a) Confirm that engine malfunction indicator operates normally;
 - (b) Using diagnostic tester, check that no error messages are recorded;
 - (c) Confirm that malfunction complained by customer is present, and confirm the condition under which malfunction occurs.
2. Then, perform appearance inspection
 - (a) Check fuel line for leakage;
 - (b) Check if vacuum line is broken or twisted, and if connection is correct;
 - (c) Check intake line for blockage, air leakage, crush or damage;
 - (d) Check if high-voltage cable of ignition system is broken or deteriorated, and if ignition sequence is correct;
 - (e) Check if wire harness ground points are clean and secure;
 - (f) Check each sensor or actuator connector for looseness or poor contact.

Caution:

If above conditions exist, repair the trouble areas first. Otherwise it will affect the repair work for following trouble diagnosis.

3. Diagnostic Help

- Confirm that there are no trouble records for engine;
- Confirm that the trouble conditions exist;
- There are no abnormal conditions after performing inspection according to above procedures;
- During service, do not ignore vehicle maintenance condition, cylinder pressure, mechanical ignition timing and fuel condition, etc. that can affect the system;
- Replace ECU and perform real-vehicle check and test.

If trouble symptom can be eliminated, trouble area is in ECU; if trouble symptom still exists, reuse the original ECU, repeat the procedures, and perform service again.

Problem Symptoms Table

Symptom	Suspected Area
Engine Does Not Crank or Cranks Slowly While Starting	• Battery • Starter motor • Wire harness or ENGINE START STOP switch • Starter relay • ECU, TCM • Gear switch • Engine mechanical
Engine cranks normally but cannot start successfully while starting	• No fuel in tank • Fuel pump • Fuel Injector • Engine speed sensor • Ignition coil • Engine immobilizer • ECU • Engine mechanical
Difficult to Start With Hot Engine	• Water in fuel • Fuel pump • Coolant Temperature Sensor • Engine speed sensor • Ignition coil • Camshaft position sensor • Fuel Injector • Engine mechanical
Difficult to start with cold engine	• Fuel quality • Fuel pump • Coolant Temperature Sensor • Fuel Injector • Ignition coil • Electronic throttle body • Engine mechanical
Engine speed is normal, but it is difficult to start at anytime	• Fuel quality • Fuel pump • Coolant Temperature Sensor • Fuel Injector • Ignition coil • Electronic throttle body • Intake passage • Ignition timing • Spark plug • Engine mechanical
Engine starts normally, but idles roughly at anytime	• Fuel quality • Fuel pump • Coolant Temperature Sensor • Fuel Injector • Electronic throttle body • Intake passage • Ignition timing • Spark plug • Engine mechanical
Engine starts normally, but idles roughly during warming up	• Fuel quality • Coolant Temperature Sensor • Electronic throttle body • Intake passage • Spark plug • Engine mechanical
Engine starts normally, but idles roughly after warming up	• Fuel quality • Coolant Temperature Sensor • Electronic throttle body • Intake passage • Spark plug • Engine mechanical



Symptom	Suspected Area
Engine Starts Normally, But Idles Roughly Or Stalls With Part Load (For Example, A/C Is ON)	• A/C system • Fuel Injector
Engine starts normally, but idle speed is too high	• Throttle • Vacuum tube • Coolant Temperature Sensor • Ignition timing
Low engine speed or stalls when accelerating	• Water in fuel • Intake pressure/temperature sensor • Intake pipe • Exhaust pipe • Ignition timing • Throttle position sensor • Fuel injector • Spark plug
Slow response when accelerating	• Water in fuel • Intake pressure/temperature sensor • Intake pipe • Exhaust pipe • Ignition timing • Throttle position sensor • Fuel injector • Spark plug
Lack of Power and Poor Performance When Accelerating	• Fuel quality • Intake pressure/temperature sensor • Electronic throttle body • Intake passage • Spark plug • Ignition coil • Ignition timing • Exhaust passage • Fuel Injector

Engine Does Not Crank or Cranks Slowly While Starting

- Check voltage between two battery posts when engine starts
 - OK: Voltage is 11.5 to 12.5 V

NG
Replace the battery
OK
- Check voltage of starter motor positive post
 - ENGINE START STOP switch remains in START position and check the voltage of starter motor positive post.
 - OK: Voltage is 11.5 to 12.5 V

NG
Repair or replace starter relay, wire harness or ECU
OK
- Check operation of starter motor
 - Remove the starter.
 - Check if there is an open circuit or if it is stuck due to poor lubrication.

NG
Repair or replace starter
OK

4. Check engine lubricant and gear oil
 - (a) If malfunction only occurs in winter, check if starter motor resistance is too strong because of improper engine lubricant and gear oil selection.

NG
Replace lubricant with appropriate number
OK
5. Check engine internal mechanical resistance
 - (a) Check if engine internal mechanical resistance is too strong, causing starter motor not to run or run slowly.

NG
Check and repair engine internal resistance malfunction
OK
Go to Diagnostic Help

Engine cranks normally but cannot start successfully while starting

06

1. Engine cranks normally but cannot start successfully while starting
 - (a) Check fuel pressure.

NG
Repair or replace fuel system
OK
2. Using diagnostic tester, observe if any speed signal is output
 - (a) Connect diagnostic tester, start engine and select Read Datastream.
 - (b) Observe if any speed signal is output.

NG
Check crankshaft position sensor wire harness
OK
3. Check ignition system
 - (a) Measure compression of misfiring cylinder

NG
Check engine to confirm cause of low compression
OK
4. Check pressure of cylinder
 - (a) Measure compression of misfiring cylinder

NG
Check engine to confirm cause of low compression
OK
5. Check ECU power supply and ground



- (a) Disconnect the ECU wire harness connector B-028.
- (b) Turn engine switch to ON and check ECU connector terminals.

Voltage Inspection

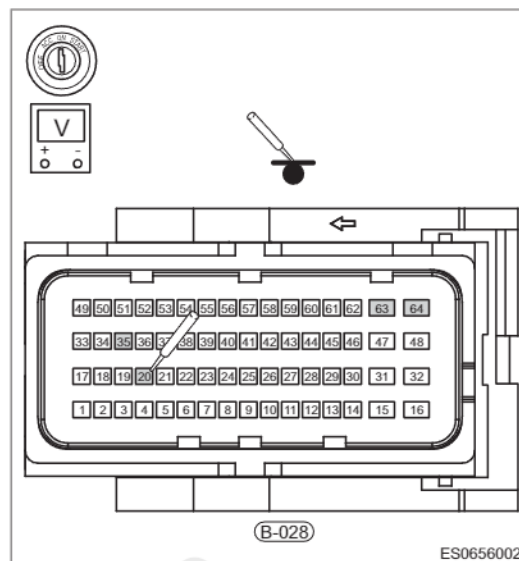
Multimeter Connection	Condition	Specified Condition
B-028 (35, 20)	ENGINE START STOP switch ON	Not less than 12 V
B-028 (63, 64)		0 V

NG

Repair or replace related wire harness

OK

Go to Diagnostic Help



06

Difficult to Start With Hot Engine

1. Check fuel pressure
 - (a) Check fuel pressure.

NG

Repair or replace fuel system

OK
2. Check ignition system
 - (a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.
 - OK: Spark is generated

NG

Check ignition system

OK
3. Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

NG

Check engine to confirm cause of low compression

OK
4. Check pressure of cylinder
 - (a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK
5. Check fuel condition
 - (a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

OK

Go to Diagnostic Help

Difficult to Start With Cold Engine

1. Check fuel pressure
 - (a) Check fuel pressure.

NG
Repair or replace fuel system
OK
2. Check ignition system
 - (a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.
 - OK: Spark is generated

NG
Check ignition system
OK
3. Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

NG
Check engine to confirm cause of low compression
OK
4. Depress accelerator pedal slightly, and observe if it is easy to start

NG
Clean or replace throttle
OK
5. Check injector for leakage or blockage

NG
Clean or replace injector nozzle
OK
6. Check fuel condition
 - (a) Observe if trouble occurs just after fuel is filled.

NG
Replace fuel
OK
7. Check pressure of cylinder
 - (a) Measure compression of misfiring cylinder

NG
Check engine to confirm cause of low compression
OK
Go to Diagnostic Help

Engine speed is normal, but it is difficult to start at anytime

1. Check air filter for blockage, and intake pipe for air leakage

NG
Check and repair intake system
OK
2. Check fuel pressure
 - (a) Check fuel pressure.

NG
Repair or replace fuel system
OK
3. Inspection of spark plug



- (a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Replace spark plug

OK

4. Check ignition system

- (a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.

- OK: Spark is generated

NG

Replace ignition system

OK

5. Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

NG

Check and repair circuit or replace sensor

OK

6. Depress accelerator pedal slightly, and observe if it is easy to start

NG

Clean or replace throttle

OK

7. Check injector for leakage or blockage

NG

Clean or replace injector nozzle

OK

8. Check fuel condition

- (a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

OK

9. Check pressure of cylinder

- (a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

10. Check engine ignition sequence and ignition timing

- (a) Check if engine ignition sequence and ignition timing are as specified.

NG

Check and repair ignition timing

OK

Go to Diagnostic Help

Engine starts normally, but idles roughly at anytime

1. Check air filter for blockage, and intake pipe for air leakage
NG
 Check and repair intake system
 OK
2. Check if throttle is stuck
NG
 Repair or replace throttle
 OK
3. Inspection of spark plug
 (a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.
NG
 Repair or replace spark plug
 OK
4. Check throttle for carbon deposits
NG
 Clean throttle
 OK
5. Check injector for leakage or blockage
NG
 Clean or replace injector
 OK
6. Check fuel condition
 (a) Observe if trouble occurs just after fuel is filled.
NG
 Replace fuel
 OK
7. Check pressure of cylinder
 (a) Measure compression of misfiring cylinder
NG
 Check engine to confirm cause of low compression
OK
 Go to Diagnostic Help
8. Check engine ignition sequence and ignition timing
 (a) Check if engine ignition sequence and ignition timing are as specified.
NG
 Check and repair ignition timing
OK
 Go to Diagnostic Help



Engine Starts Normally, But Idles Roughly During Warming Up

1. Check air filter for blockage, and intake pipe for air leakage
NG
 Check and repair intake system
 OK
2. Inspection of spark plug
 (a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.
NG
 Repair or replace spark plug
 OK
3. Check throttle for carbon deposits
NG
 Clean throttle
 OK
4. Unplug coolant temperature sensor connector, start engine and observe if engine idles normally during warming up
NG
 Check and repair circuit or replace sensor
 OK
5. Check injector for leakage or blockage
NG
 Clean or replace injector
 OK
6. Check fuel condition
 (a) Observe if trouble occurs just after fuel is filled.
NG
 Replace fuel
 OK
7. Check pressure of cylinder
 (a) Measure compression of misfiring cylinder
NG
 Check engine to confirm cause of low compression
OK
 Go to Diagnostic Help

Engine Starts Normally, But Idles Roughly After Warming Up

1. Check air filter for blockage, and intake pipe for air leakage
NG
 Check and repair intake system
 OK
2. Inspection of spark plug
 (a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.
NG
 Repair or replace spark plug
 OK
3. Unplug coolant temperature sensor connector, start engine and observe if engine idles normally during warming up

NG

Check and repair circuit or replace sensor
OK

4. Check injector for leakage or blockage

NG

Clean or replace injector
OK

5. Check fuel condition

(a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel
OK

6. Check pressure of cylinder

(a) Measure compression of misfiring cylinder

NG

Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

06

Engine Starts Normally, But Idles Roughly Or Stalls With Part Load (For Example, A/C Is ON)

1. Check throttle for carbon deposits

NG

Clean throttle
OK

2. Observe if engine output increases when A/C is turned on. In other words, observe changes of ignition advance angle, injection pulse width and intake air volume using diagnostic tester

NG

Next
OK

3. Check if A/C compressor pump resistance increases

NG

Check and repair or replace A/C system
OK

4. Observe if engine speed increases when A/C is turned on

NG

Replace ECU to perform real-vehicle check
OK

5. Check injector for leakage or blockage

NG

Clean or replace injector

OK

Go to Diagnostic Help



Engine Starts Normally, But Idle Speed Is Too High

1. Check if accelerator pedal is stuck
NG
 Adjust or replace accelerator pedal
 OK
2. Check intake system and connected vacuum pipe for air leakage
NG
 Check and repair intake system
 OK
3. Check throttle for carbon deposits
NG
 Clean or replace throttle
 OK
- 06 4. Disconnect coolant temperature sensor connector, start engine and observe if engine idle is normal
NG
 Check and repair circuit or replace sensor
 OK
5. Check engine ignition timing
NG
 Check and repair ignition timing
OK
 Go to Diagnostic Help

Low Engine Speed Or Stalls When Accelerating

1. Check air filter for blockage, and intake pipe for air leakage
NG
 Check and repair intake system
 OK
2. Check fuel pressure
 (a) Check fuel pressure.
NG
 Repair or replace fuel system
 OK
3. Inspection of spark plug
 (a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.
NG
 Replace spark plug
 OK
4. Check throttle for carbon deposits
NG
 Clean throttle
 OK
5. Check intake pressure/temperature sensor, throttle position sensor and circuit
NG
 Check and repair circuit or replace sensor
 OK
6. Check injector for leakage or blockage

NG

Clean or replace injector

OK

7. Check fuel condition

- (a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

NG

8. Check engine ignition sequence and ignition timing

- (a) Check if engine ignition sequence and ignition timing are as specified.

NG

Check and repair ignition timing

OK

9. Check exhaust system

- (a) Check exhaust system for leakage or blockage.

NG

Check and repair ignition timing

OK

Go to Diagnostic Help

06

Slow Response When Accelerating

1. Check air filter for blockage, and intake pipe for air leakage

NG

Check and repair intake system

OK

2. Check fuel pressure

- (a) Check fuel pressure.

NG

Repair or replace fuel system

OK

3. Inspection of spark plug

- (a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Replace spark plug

OK

4. Check throttle for carbon deposits

NG

Clean throttle

OK

5. Check intake pressure/temperature sensor, throttle position sensor and circuit

NG

Check and repair circuit or replace sensor

OK

6. Check injector for leakage or blockage

NG

Clean or replace injector

OK

7. Check fuel condition



- (a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel

NG

8. Check engine ignition sequence and ignition timing

- (a) Check if engine ignition sequence and ignition timing are as specified.

NG

Check and repair ignition timing

OK

9. Check exhaust system

- (a) Check exhaust system for leakage or blockage.

NG

Check and repair ignition timing

OK

Go to Diagnostic Help

06

Lack Of Power And Poor Performance When Accelerating

1. Check if malfunctions that clutch slipping, low tire inflation pressure, brake dragging, incorrect tire size, and incorrect four-wheel alignment are present

NG

Check and repair faulty components

OK

2. Check air filter for blockage, and intake pipe for air leakage

NG

Check and repair intake system

OK

3. Check fuel pressure

- (a) Check fuel pressure.

NG

Repair or replace fuel system

OK

4. Inspection of spark plug

- (a) Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG

Replace spark plug

OK

5. Check ignition system

- (a) Remove ignition coil and spark plug of one cylinder, and ground spark plug housing. Start engine, and check if spark is generated.

- **OK:** Spark is generated

NG

Check and repair ignition system

OK

6. Check throttle for carbon deposits

NG

Clean throttle

OK

7. Check intake pressure/temperature sensor, throttle position sensor and circuit

NG

Check and repair circuit or replace sensor
OK

8. Check injector for leakage or blockage

NG

Clean or replace injector
OK

9. Check fuel condition

- (a) Observe if trouble occurs just after fuel is filled.

NG

Replace fuel
NG

10. Check engine ignition sequence and ignition timing

- (a) Check if engine ignition sequence and ignition timing are as specified.

NG

Check and repair ignition timing
OK

11. Check exhaust system

- (a) Check exhaust system for leakage or blockage.

NG

Check and repair ignition timing

OK

Go to Diagnostic Help

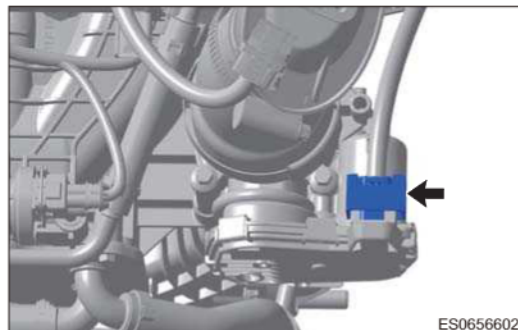


ON-VEHICLE SERVICE

Electronic Throttle Body

Function

Electronic throttle body is a critical part for engine intake system in EGAS system. Its main function is to control intake air volume by adjusting intake passage area according to driver's driving intention to meet intake requirements in different engine operating conditions, and send back position signals of throttle valve plate to control unit to achieve accurate control.



06

1 - Motor Negative	2 - Sensor Ground
3 - Sensor Power Supply	4 - Motor Positive
5 - Signal 2	6 - Signal 1

Operation

Electric throttle body consists of four parts: drive module, train module, executive module and feedback module, and all components are integrated into the same throttle valve housing. Throttle feedback module uses two redundant structures. When malfunction occurs, throttle valve plate will stop at the limp home position (above mechanical bottom dead center) determined by mechanical way. Electronic throttle body performs control only by corresponding electronic control unit or electronic test circuit. In principle, it is necessary to ensure that the throttle valve plate does not operate dynamically to the mechanical dead center.

Throttle Self-learning

Perform throttle body self-learning once after installing electronic throttle body (turn ENGINE START STOP switch to ON and then turn to OFF after waiting for 15 seconds, and then perform ignition normally). Start vehicle and observe if it operates normally after self-learning is finished.

Common Problem Symptoms and Judgment Methods

Common problem symptoms caused by electronic throttle body itself are: lack of power when accelerating, seizure or frequent return of throttle valve plate. EPC light comes on (use diagnostic tester to read related electronic throttle DTCs), vehicle speed does not increase even if accelerator pedal is fully depressed.

1. General problem causes
 - ECU detects incorrectly due to improper harness or sensor operation, and electronic throttle is forcibly controlled in small opening condition;
 - Internal components (such as magnetic steel) are cracked due to dropping or hitting during use or repair;
 - Vibration level at engine manifold is out of specified range;
 - Excessive carbon deposit in electronic throttle body due to use of engine or vehicle.
2. Repair precaution
 - Never hit electronic throttle body during service, and never use it after dropping;
 - It can be verified by simply measuring resistance change of terminals and crossover test if malfunction occurs caused by electronic throttle body.
3. Simple detection method for electronic throttle body malfunction
 - (a) Judgment methods for specific mechanical damage
 - Valve plate should be in default position with power off and can rotate smoothly when flipping it by hand. If catching occurs, it indicates that internal components may be damaged.

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

Step	Operation	Test Value	Test Result	Subsequent Step
1	Turn digital multimeter to ohm band (remove connector), connect two probes to terminals 6 and 2 respectively, flip valve plate by hand, and resistance should change continuously.	/	Yes	Next
		/	No	Replace throttle body
2	Connect two probes to terminals 5 and 2 respectively, flip valve plate by hand, and resistance should change continuously. (valve plate is in the same position at normal temperature, the sum of two resistance values in steps 1 and 2 is usually $1.9\text{ k}\Omega \pm 0.2\text{ k}\Omega$).	/	Yes	Next
		/	No	Replace throttle body
3	Directly measure resistance of copper windings on DC motor between terminals 1 and 4. It is usually between 2.0 and $2.5\ \Omega$ at normal temperature, this value does not change with the valve plate opening.	/	Yes	Check wire harness or diagnostic help
		/	No	Replace throttle body

4. DTC troubleshooting

- If DTC P0121, P0122, P0123, P221, P222 or P223 is output, refer to methods in previous DIAGNOSIS & TESTING section to perform test.
- If DTC P0606 or P2106 is output, it indicates that electronic throttle is not malfunctioning, perform ECU and throttle self-learning again, and do not replace electronic throttle.
- If it is other malfunction related to electronic throttle, unplug and plug connector again, remove carbon on throttle, to confirm that there is no foreign matter during valve plate opening or closing. Perform other related inspection.

Removal

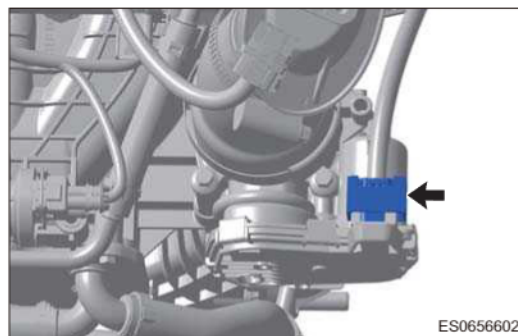
- Turn off all electrical equipment and the ENGINE START STOP switch.
- Disconnect the negative battery cable.
- Remove the engine trim cover.
- Remove the electronic throttle

- Disconnect electronic throttle connector, remove 4 fixing bolts and throttle.

Caution:

- Before removing throttle, make sure the ENGINE START STOP switch is turned to OFF and always keep vehicle power off, otherwise it will cause idling problems.
- Do not remove the electrified electronic throttle body.
- Do not remove the electronic throttle body until the vehicle is cooled to room temperature to prevent the overheating antifreeze from wetting the black cap and connectors etc.
- During the removal, the mounting bolts shall be removed diagonally and the force shall be uniform and vertical. The upper and lower mounting surfaces shall not be damaged, and also ensure that the electronic throttle body does not drop or hit.
- The power of return spring inside electronic throttle body is greater, be careful not to clamp your hand during pushing valve plate slightly.

- Disconnect electronic throttle connector, remove 4 fixing bolts and throttle.



Installation

- Installation is in the reverse order of removal.



Absolute Brake Vacuum Sensor

Description

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

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



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Installation Position

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

Caution:

Installation Precautions

1. Always make sure the O-ring is not damaged during installation. Apply a light coat of oil (such as 5W20) to O-ring surface before installation, and do not use silicon grease.
2. Press sensor detecting sleeve into installation hole manually during installation, and do not install sensor with striking tool.
3. Tightening torque during installation: 4 ~ 7 N·m is recommended.
4. Connect wire harness with specified matched connector.

Operation

Absolute pressure sensing element consists of a piece of silicon chip. Print a piece of pressure diaphragm on silicon chip. There are 4 piezoresistors on pressure diaphragm, and the 4 piezoresistors form a Wheatstone bridge as strain element. Except for the pressure diaphragm, silicon chip is also integrated with signal processing circuit and temperature compensating circuit. Reference vacuum chamber is integrated into silicon chip, and absolute pressure in reference space is near zero. This will form a microelectronic mechanical system. The pressure to be measured acts on side which can sense pressure on silicon film from top side. Thickness of silicon chip is only several micrometer (μm), so the silicon chip will deform mechanically as pressure changes, and 4 piezoresistors will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated after processing by signal processing circuit of silicon chip.

Common Problem Symptoms and Judgment Methods

Problem symptom: vacuum booster does not operate properly.

1. General problem causes
 - Chip is damaged due to abnormal high voltage or reverse large current during operation;
 - Pressure component is damaged during service;
 - Chip is corroded and damaged due to external environment;
 - Sensor itself malfunction.

2. Precautions during service

- Do not impact pressure component with high pressure gas during service;
- Check if alternator output voltage and current are normal when there is a fault and replacing sensor.

3. Simple detection method for intake pressure/temperature sensor malfunction

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



VVT Control Valve

Operation

Hint:

- There are two VVT control valves which are located in front of intake and exhaust camshaft. ECU controls VVT control valves depending on engine conditions, changes the flowing direction of oil in phasers to advance or retard camshaft, thus changing the timing of intake valve and exhaust valve.

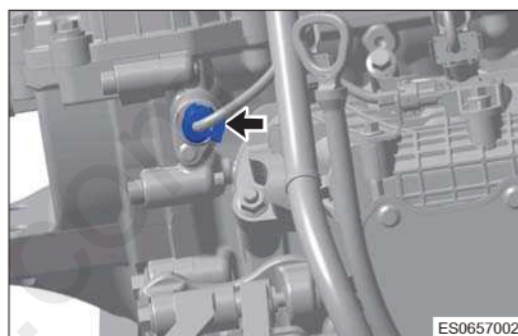
Removal

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

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- (a) Disconnect intake VVT control valve connector (arrow), and then remove intake VVT control valve fixing bolt.

Tightening torque

 $8 \pm 2 \text{ N}\cdot\text{m}$ 

5. Remove the exhaust VVT control valve.
 - (a) Disconnect exhaust VVT control valve connector (arrow), and then remove exhaust VVT control valve fixing bolt.

Tightening torque

 $8 \pm 2 \text{ N}\cdot\text{m}$ 

Installation

1. Installation is in the reverse order of removal.

Coolant Temperature Sensor

Description

Coolant temperature sensor is a negative temperature coefficient sensor, which is installed on engine thermostat seat.

Coolant temperature sensor terminal: sensor has 2 terminals, and they can be interchanged.

Installation Position

Coolant temperature sensor is installed on engine thermostat seat.

Operation

NTC thermistor packaged inside temperature sensor is used for coolant temperature sensor, its resistance changes in accordance with ambient temperature, thus accurately reflecting the small changes in outside temperature. The temperature of contact medium can be reflected by measuring its output resistance, and the signals from both terminals of resistor are output to ECU. Engine load can be obtained by ECU according to output signal of the sensor, thus judging the engine operating condition.

Installation Precautions

1. Uniformly apply anaerobic seal gum to threads before installation.
2. Pre-tighten it manually when installation, so as to avoid sensor thread damage caused by wrong tooth of thread. Tighten it with socket wrench after manual pre-tightening, and the tightening torque is 15 ± 1 N·m.
3. If the coolant temperature sensor is installed with level wrench, make sure that the wrench is perpendicular to the axis of sensor during installation, to avoid damage to coolant temperature sensor due to excessive lateral force.

Common Problem Symptoms and Judgment Methods

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

1. General problem causes
 - Abnormal high voltage or reverse large current during operation;
 - Sensor housing is damaged, water enters inside during service.
2. Precautions during service: check if alternator output voltage and current are normal when there is a fault and replacing sensor.
3. Simple detection method for oxygen sensor malfunction
 - (a) Disconnect wire harness connector (remove connector), turn digital multimeter to ohm band, connect two probes to two terminals of sensor respectively, rated resistance is $2.5 \text{ K}\Omega \pm 5\%$ at 20°C , blow air to sensor with a hair dryer (be careful not to get too close), observe the changes of resistance, it should decrease with the increase of temperature.

Step	Operation	Test Value	Test Result	Subsequent Step
1	Remove coolant temperature sensor wire harness connector, use a multimeter to measure if resistance between two terminals of sensor is normal	The resistance between the two terminals is determined according to ambient temperature near sensor when testing, and refer to temperature characteristic curve graph below for details.	Yes	Next
			No	Replace coolant temperature sensor
2	Remove coolant temperature sensor wire harness connector, turn ENGINE START STOP switch to ON, measure the voltage between two terminals of coolant temperature sensor wire harness	$5 \pm 0.5 \text{ V}$	Yes	Diagnostic Help
			No	Check for continuity and ground of wire harness



Removal

1. Turn off all electrical equipment and the ENGINE START STOP switch.
2. Disconnect the negative battery cable.

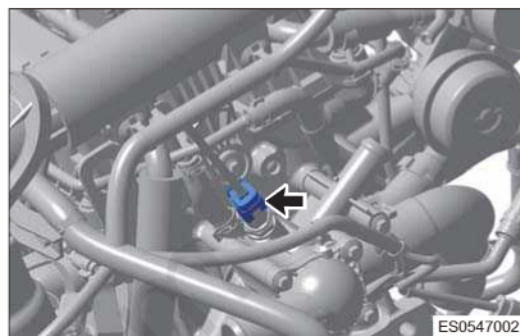
Caution:

- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.

3. Remove the engine trim cover.
4. Disconnect coolant temperature sensor connector and remove coolant temperature sensor.

Tightening torque

14 ± 1 N·m



Installation

1. Installation is in the reverse order of removal.

Knock sensor

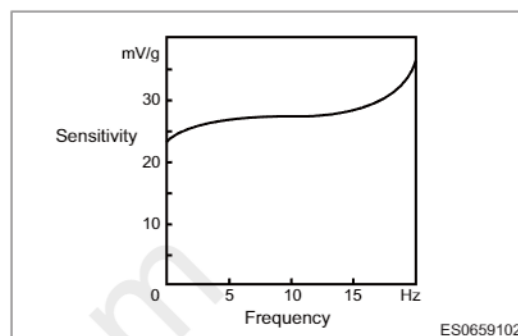
Description

Knock sensor is installed on cylinder block. It is used to detect engine vibration caused by detonation.

1 - Signal Wire	2 - Signal Wire
3 - Grounded Shielded Wire	

Installation Position

It is installed between cylinder 2 and cylinder 3.



Operation

Knock sensor is installed on cylinder block, and used to detect engine vibration caused by detonation. You can install one or more.

The sensitive element of knock sensor is a piezoelectric ceramic. Vibration of engine cylinder block is transferred to the piezoelectric ceramic through a mass block in the sensor. Due to the pressure generated by vibration of mass block, the piezoelectric ceramic generates a voltage at both electrode faces, and converts the vibration signal to an AC voltage signal to output it. As intensity of vibration increases, knock sensor output voltage increases accordingly.

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

Knock sensor frequency response characteristic curve diagram

Installation Precautions

Tighten knock sensor to cylinder block through the hole on middle of knock sensor with bolt, and tightening torque is 20 ± 5 N·m. Be careful not to allow liquids such as oil, coolant, brake fluid and water to contact the sensor for a long periods of time. Do not use any type of gasket during installation. The sensor must be pressed against the cylinder block with its metal surface.

Common Problem Symptoms and Judgment Methods

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

Step	Operation	Test Value	Test Result	Subsequent Step
1	Turn multimeter to ohm band, measure resistance between terminals 1 and 2 of knock sensor, it should be more than 1 MΩ at normal temperature	/	Yes	Next
		/	No	Replace knock sensor
2	Turn multimeter to mV band, use a small hammer to tap near knock sensor, there should be a voltage signal	/	Yes	Check wire harness or diagnostic help
		/	No	Replace sensor

Removal

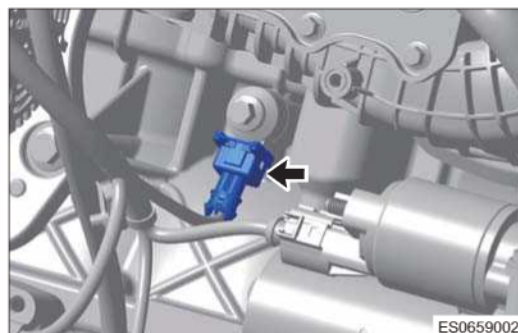
1. Turn off all electrical equipment and the ENGINE START STOP switch.



2. Disconnect the negative battery cable.
3. Disconnect knock sensor connector, and remove knock sensor.

Tightening torque

$20 \pm 5 \text{ N}\cdot\text{m}$



Installation

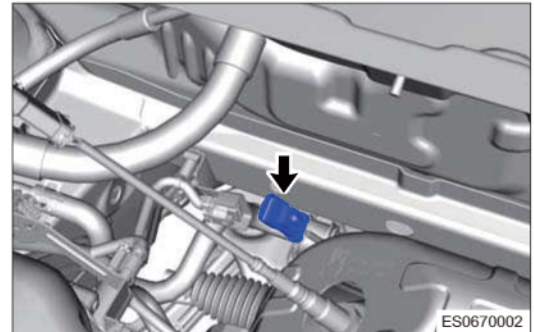
1. Installation is in the reverse order of removal.

Caution:

- Never install any kinds of gasket and washer between sensor and engine block. Only the metal part of sensor can contact with engine block directly.
- Be careful not to allow liquids such as oil, coolant and brake fluid to contact the sensor for a long periods of time.
- DO NOT apply lubricant, grease or seal gum when installing knock sensor. Keep engine block clean and dry, and never allow any foreign matter (such as oil) on the installation area of knock sensor.
- Never tap knock sensor when installing it.

Oxygen Sensor

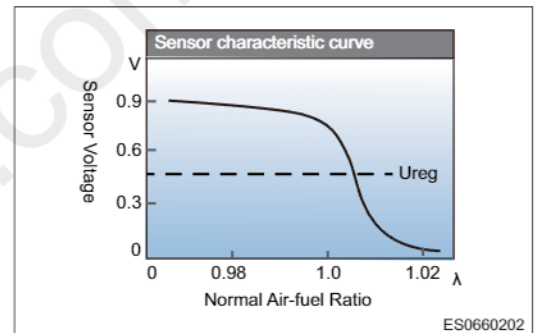
Description



This vehicle is equipped with upstream oxygen sensor and downstream oxygen sensor. Oxygen sensors continually monitor the oxygen concentration in exhaust gas.

06

1 - Grey Wire, to Sensor Signal Ground	2 - Black Wire, to Sensor Signal
3 - White Wire, to Sensor Heater Negative	4 - White Wire, to Sensor Heater Positive



Operation

Oxygen sensors monitor oxygen content and convert it into voltage. Sensor generates low voltage when oxygen content is high, and high voltage when oxygen content is low. Therefore, sensor can control injection volume by closed-loop.

Oxygen sensor is equipped with a heating element that keeps sensor at proper operating temperature under all operating conditions.

Proper air-fuel ratio.

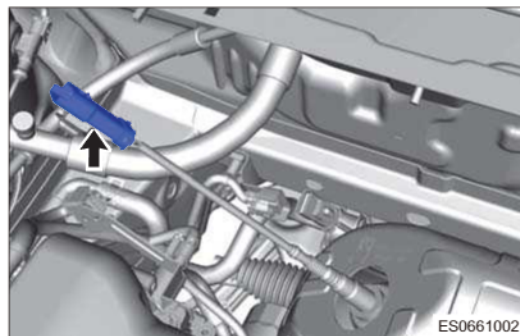
Installation Position

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

Installation Precautions

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

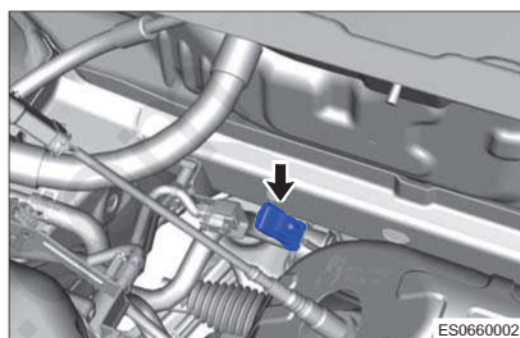




Upstream Oxygen Sensor

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

06



Downstream Oxygen Sensor

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

Common Problem Symptoms and Judgment Methods

1. Problem symptoms: poor engine idle, poor acceleration, emissions exceeding, excessive fuel consumption, etc.
2. Main problem causes:
 - Poor wire harness: connector terminal looseness, rust, terminal uneven; or wire breakage, poor connection, etc., resulting in oxygen sensor signal failure and oxygen sensor heating failure displayed on diagnostic tester;
 - Mechanical shock (such as flying rock) damage to the sensor;
 - Moisture, condensation or contaminants enters inside the sensor, causing the sensor failure or poor signal;
 - Post-combustion of exhaust pipe due to the misfire, causing the oxygen sensor sensing element to be burned;
 - Oxygen sensor "poisoning" (such as Pb, S, Br, Si or Mn).
3. Simple detection method for oxygen sensor malfunction

Step	Operation	Test Value	Test Result	Subsequent Step
1	Visually check oxygen sensor wire harness for obvious damage, broken, and oxygen sensor for mechanical damage (such as dents caused by impact), sensor wire harness male and female terminal for rust, terminal for level	/	Yes	Replace oxygen sensor
		/	No	Next
2	Turn ENGINE START STOP switch to OFF, disconnect and reconnect faulty oxygen sensor connector, clear DTCs, check if the fault still exists according to dynamic test cycle of this DTC (refer to "Maintenance Flow According to DTC" below)	/	Yes	Next
		/	No	End, track user usage later
3	Turn ENGINE START STOP switch to OFF, disconnect the oxygen sensor connector, measure the resistance between heating + (terminal D) and heating - (terminal C) of oxygen sensor connector (two white wires), check if the resistance is between 5 and 25 Ω	5 ~ 25 Ω	Yes	Next
			No	Replace oxygen sensor
4	Start vehicle, idle engine for about 3 to 4 minutes, use diagnostic tester to measure the upstream oxygen sensor signal voltage, check if voltage rapidly fluctuates between 0.1 V and 0.9 V (upper limit is 0.9, it may be 0.7 - 0.8) (fluctuation number within one minute ≥ 6 times)	/	Yes	Check wire harness or diagnostic help
			No	Replace oxygen sensor
5	Start vehicle, idle engine for about 3 to 4 minutes, use diagnostic tester to measure the downstream oxygen sensor signal voltage, check if voltage fluctuates around 0.6 V (it may be a value between 0.4 and 0.8 V)	/	Yes	Replace oxygen sensor
			No	Check wire harness or diagnostic help

- If there are no problems in the above troubleshooting items, it can be determined that there is no malfunction in oxygen sensor, it is necessary to troubleshoot the other parts, and the corresponding vehicle wire harness should be mainly inspected.

Removal

- Refer to Emission Control System

Caution:

- Applying detergent, oily liquid or volatile liquid to the oxygen sensor connector is prohibited.
- The oxygen sensor wire harness must not be twisted, taut, or attached to objects with sharp edge or high temperature.

Installation

- Refer to Emission Control System

Caution:

- Applying detergent, oily liquid or volatile liquid to the oxygen sensor connector is prohibited.
- The oxygen sensor wire harness must not be twisted, taut, or attached to objects with sharp edge or high temperature.



Camshaft position sensor

Description

There are two camshaft position sensors, which are installed on cylinder head behind camshaft.

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

Operation

Camshaft position sensor is a Hall type sensor. A phaser is installed on camshaft. When phaser is in high teeth, the applicable circuit outputs high voltage; when phaser is in missing teeth, the applicable circuit outputs low voltage. As a result, the crankshaft phase information is provided to Engine Control Module (ECM), so that the compression top dead center and exhaust top dead center of crankshaft can be distinguished.

Installation Precautions

06

1. The sensor must always be in the original packaging material before installation or test.
2. Take out the sensor from packaging material, check the sensor and ensure that it must not be damaged or contaminated.
3. Apply mineral oil to phase sensor O-ring, then press the sensor (do not tap with tool) and tighten with fixing bolt. Tightening torque is $8\text{ N}\cdot\text{m}\pm 1\text{ N}\cdot\text{m}$.
4. Never repair the sensor.

Caution:

- The sensor contains strong magnet. Since most electronic storage devices (such as disk, tape.) are sensitive to magnetic fields, they must be stored separately from the permanent magnets. Users with cardiac pacemakers should take precautions before operation.

Common Problem Symptoms and Judgment Methods

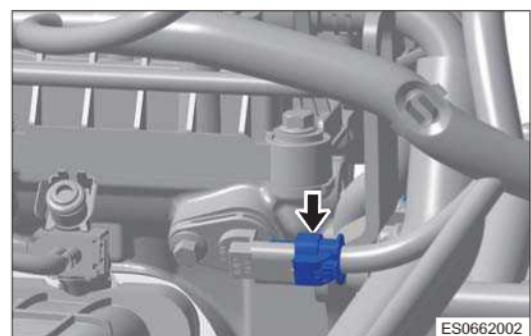
1. Problem symptoms: difficult to start engine, engine speed limited, etc section

Removal

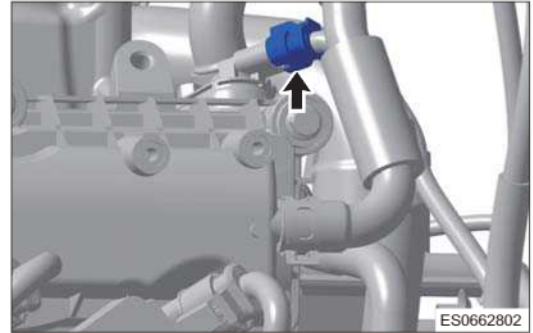
1. Turn off all electrical equipment and the ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the intake camshaft position sensor connector.
 - (a) Disconnect intake camshaft position sensor connector (arrow) and remove camshaft position sensor fixing bolt.

Tightening torque

$8 \pm 1\text{ N}\cdot\text{m}$



5. Remove the exhaust camshaft position sensor connector.
 - (a) Disconnect exhaust camshaft position sensor connector (arrow) and remove exhaust camshaft position sensor fixing bolt.

Tightening torque $8 \pm 1 \text{ N}\cdot\text{m}$ **Installation**

1. Installation is in the reverse order of removal.

Caution:

- Sensor should be pressed into mounting hole. Never use tools (such as a hammer) to strike sensor into mounting hole forcibly.

Engine speed sensor

Description

Crankshaft position sensor is installed on clutch case, against flywheel teeth. It is used to detect the speed and position of crankshaft.

1 - Positive Power Supply Wire	2 - Output Signal Wire
3 - Ground Wire	

Operation

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

Installation Precautions

06

1. The sensor must always be in the original packaging material before installation or test.
2. Take out the sensor from packaging material, check the sensor and ensure that it must not be damaged or contaminated.
3. Press the sensor (do not tap with tool), and then secure it with fixing bolt and gasket. Tightening torque is 8 ± 2 N·m.
4. Never repair the sensor.

Caution:

- The sensor contains strong magnet. Since most electronic storage devices (such as disk, tape.) are sensitive to magnetic fields, they must be stored separately from the permanent magnets. Users with cardiac pacemakers should take precautions before operation.

Common Problem Symptoms and Judgment Methods

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

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

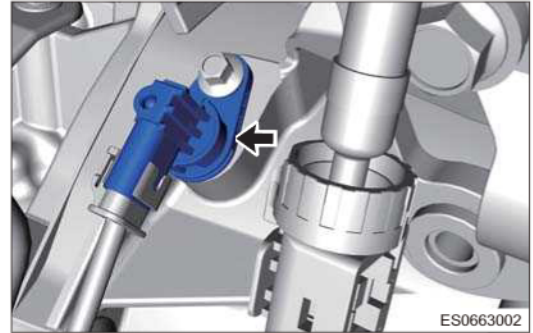
Removal

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

4. Remove the crankshaft position sensor.
 - (a) Disconnect crankshaft position sensor connector (arrow), and remove crankshaft position sensor fixing bolt.

Tightening torque

$8 \pm 2 \text{ N}\cdot\text{m}$

**Installation**

1. Installation is in the reverse order of removal.

Caution:

- Ensure that the sensor is clean and the sensor is allowed to be removed from the package before it is installed in the engine or test bench. Users with cardiac pacemakers should take precautions before operation.
- The sensor is only allowed to be pressed into installation hole by press-in. It is not allowed to install the sensor with a tapping tool (such as hammer).

Warning:

If the engine speed sensor falls, never pick it up to install and it need to return to factory for testing.



Fuel rail injector assembly

Operation

Fuel distribution pipe assembly is installed to intake manifold or cylinder head to store or distribute fuel. Fuel distribution pipe assembly consists of fuel distribution pipe and fuel injector etc. Fuel distribution pipe is connected to fuel supply pipe through pipe joint to receive the fuel from fuel tank. Fuel injector sprays fuel into the intake passage accurately under the control of ECU electric pulse.

Fuel requirements

Fuel distribution pipe assembly can only use fuel that specified in accordance with National Standard GB 17930-2006 Unleaded Gasoline for Motor Vehicle and GB 18351-2004 Alcohol Gasoline for Motor Vehicle of People's Republic of China, and the National Environmental Protection Standards GWKB 1-1999 Hazardous Materials Control Standard for Motor Vehicle Gasoline.

Caution:

- Excessive storage of gasoline can cause it to oxidize and deteriorate, which may cause the injector to become clogged or even damaged.

Installation Precautions

1. Removal precautions

Caution:

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

2. Installation Precautions

Caution:

- Make sure the fuel distribution pipe assembly is intact, undamaged, or uncontaminated, and there are no cracks, scars, grooves, burrs and rust on tube joint surface before use. Do not install fuel distribution pipe assembly that does not meet the requirement.
- Lubricate the lower O-ring of injector with clean lubricant before assembly.
- Fuel injector should be prevented from being subjected to excessive impact during assembly, and tighten the mounting bolt until fuel injector is installed in place.
- If it is necessary to secure wire harness, avoid deformation or damage of wire harnesses bracket caused by excessive shock to fuel distribution pipe assembly during installation.
- When removing fuel distribution pipe assembly from engine and reinstalling it, it is necessary to replace the injector lower o-ring.
- When the temperature is below zero, try to avoid installation or maintenance of fuel distribution pipe assembly, so as to avoid fuel leakage.
- For after-sale maintenance, it is only allowed to replace the assembly.

Common Problem Symptoms and Judgment Methods

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

3. Simple detection method for fuel rail injector assembly malfunction

Remove fuel distribution pipe assembly from engine, apply compressed air of 4.5 bar from inlet port, place the injector connector upward, and immerse the fuel distribution pipe assembly into water so that the injection end of the injector does not contact with water. Observe if there is air bubble in the fuel rail injector assembly.

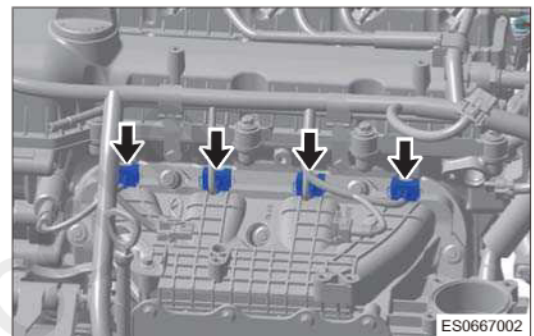
If there are air bubbles in the fuel rail, there is a risk of fuel rail leakage.

Removal

1. Turn off all electrical equipment and the ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the fuel rail injector assembly.
 - (a) Disconnect 4 injector connectors (arrow), and remove fixing bolts from fuel rail injector assembly.

Tightening torque

$8 \pm 2 \text{ N}\cdot\text{m}$



06

Installation

1. Installation is in the reverse order of removal.



Intake Pressure/Temperature Sensor

Description

Intake pressure/temperature sensor consists of intake manifold absolute pressure sensor and intake temperature sensor, which are installed on intake manifold.

1 - Ground Wire	2 - Intake Temperature Output Signal Wire
3 - to 5 V Power Supply	4 - Intake Pressure Output Signal Wire

Installation Position

Intake pressure/temperature sensor consists of intake manifold absolute pressure sensor and intake temperature sensor, which are installed on intake manifold.

Same as intake pressure/temperature sensor, boost pressure sensor is install on intercooler outlet pipe.

Operation

Intake manifold absolute pressure sensing element consists of a piece of silicon chip. Print a piece of pressure diaphragm on silicon chip. There are 4 piezoresistors on pressure diaphragm, and the 4 piezoresistors form a Wheatstone bridge as strain element. Except for the pressure diaphragm, silicon chip is also integrated with signal processing circuit and temperature compensating circuit. Reference vacuum chamber is integrated into silicon chip, and absolute pressure in reference space is near zero. This will form a microelectronic mechanical system. Intake manifold absolute pressure to be measured acts on side which can sense pressure on silicon film from top side. Thickness of silicon chip is only several micrometer (μm), so the silicon chip will deform mechanically as intake manifold absolute pressure changes, and 4 piezoresistors will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated after processing by signal processing circuit of silicon chip. Intake temperature sensing element is a negative temperature coefficient (NTC) resistor, whose resistance changes with the intake temperature. This sensor sends a voltage of intake temperature change to controller.

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

Installation Precautions

1. The sensor is designed to be installed on the plane of intake manifold of engine. The pressure connecting pipe protrudes into the intake manifold, sealing the atmosphere with an O-ring.
2. If it is installed to the vehicle in a suitable way (if extracting pressure from intake manifold, pressure connecting pipe will tilt downward, etc.), thus ensuring that no condensation will form on the pressure sensitive element.
3. Drilling and fixing on intake manifold must be performed in accordance with the delivery drawings to ensure long-term sealing and be able to withstand erosion of media.
4. The reliable contact of the connector electrical connection is related to the material quality and dimension accuracy of the matching connector on the wire harness, expect for the influence of component connector.

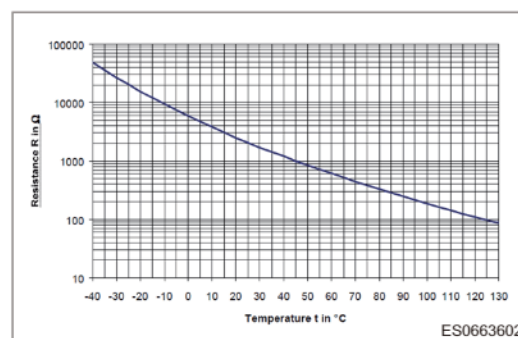
Common Problem Symptoms and Judgment Methods

1. Common problem symptoms related to this sensor: flameout, poor engine idle, etc.
2. General problem causes
 - Abnormal high voltage or reverse large current during operation;
 - Pressure chip is damaged during service.
3. Precautions during service
 - Never impact vacuum element with high pressure gas during service;
 - Check if alternator output voltage and current are normal when there is a fault and replacing sensor.

4. Simple detection method for intake pressure/temperature sensor malfunction

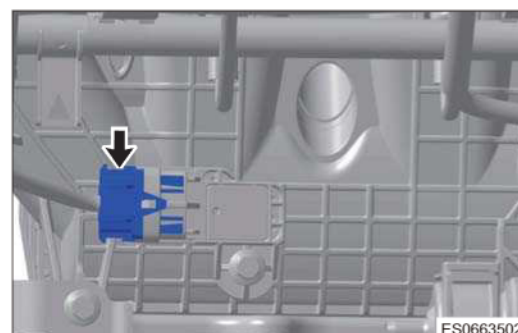
Step	Operation	Test Value	Test Result	Subsequent Step
1	Temperature sensor part: Remove intake pressure/temperature sensor wire harness connector, and measure resistance of terminals 1 and 2 of sensor separately with a multimeter; Measurement can also be performed by simulating. Specific operations are to send wind to the sensor with blow drier (be careful that blow drier shouldn't be too close to the sensor) and observe the changes of sensor resistance. The resistance should reduce at the moment.	The resistance of terminals 1 and 2 are determined according to ambient temperature near the sensor at the time of test. (rated resistance is $2.5\text{ k}\Omega \pm 5\%$ at 20°C , and refer to temperature-resistance characteristic curve below for details;)	Yes	Next
			No	Replace intake pressure/temperature sensor
2	Pressure sensor part: measure resistance between terminals 1 and 4, terminals 3 and 4 of intake pressure/temperature sensor	Resistance between terminals 1 and 4, terminals 3 and 4 is $1.5 \pm 0.5\text{ k}\Omega$	Yes	Next
			No	Replace intake pressure/temperature sensor
3	Pressure sensor part: Connect intake pressure/temperature sensor wire harness connector, turn ENGINE START STOP switch to ON, the voltage between terminals 1 and 3 of intake pressure/temperature sensor wire harness should be $5 \pm 0.5\text{ V}$; Under idling status, measure voltage of terminal 4 of sensor with a multimeter, the voltage should be about 0.7 V (value changes with model); under unloaded status, slowly open the throttle, the voltage of terminal 4 has not changed too much; quickly open the throttle, the voltage of terminal 4 can reach about 4 V instantaneously (value changes with model), and then drops to about 1.8 V (value changes with model).		Yes	Diagnostic Help
			No	Check for continuity and ground of wire harness

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



Removal

1. Disconnect the intake pressure/temperature sensor connector.



2. Remove fixing bolt and intake pressure/temperature sensor.

Installation

1. Installation is in the reverse order of removal.

Ignition coil

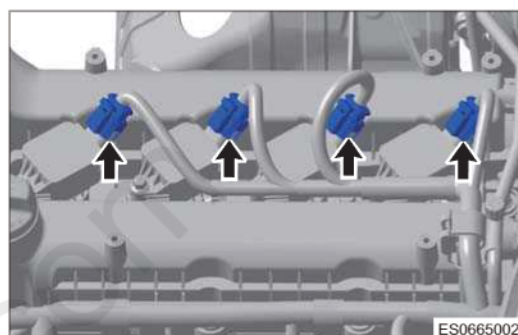
Description

Caution:

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

Ignition coil converts low voltage of primary winding into high voltage of secondary winding, and discharges spark plug electrode to produce sparks which will ignite the combustible air-fuel mixture in cylinder.

1 - Positive Power Supply Wire	2 - ECU Control Signal
3 - Ground Wire	



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Operation

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

Technical Characteristic Parameters

- The following data are measured at room temperature ($25 \pm 5^{\circ}\text{C}$)

Measurement	Measured Value			Unit
	Minimum	Representative	Maximum	
Primary resistance	0.50	0.57	0.64	Ω
Secondary resistance	8.36	9.5	10.64	k Ω

- Test conditions for following data: rated voltage is 14 V, wire resistance is $0.15 \pm 0.05 \Omega$, energizing time is $2.8 \pm 0.025 \text{ ms}$

Measurement	Measured Value			Unit
	Minimum	Representative	Maximum	
Primary current	8.0	8.5	9.0	A
Secondary voltage (load of 50 pF)	30	/	/	kV

Application Guide

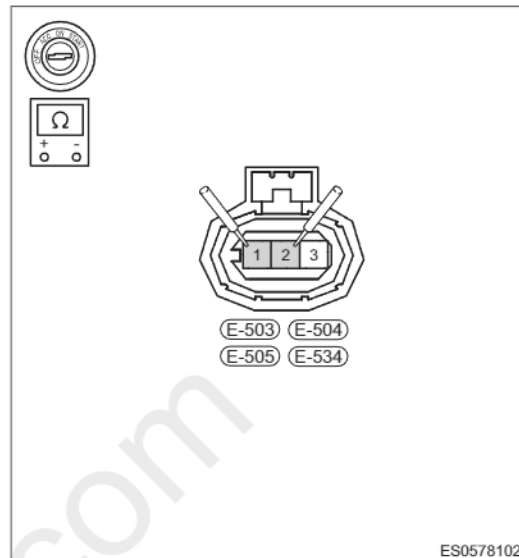
Ignition coil is installed on the engine and secured with fixing bolt, the tightening torque is $8 \sim 10 \text{ N}\cdot\text{m}$. Make sure that the connection between high-voltage connecting rod, ignition wire and ignition coil high-voltage terminal, spark plug is reliable, or it may cause high-voltage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

Problem Symptoms and Judgment Methods

- Problem symptoms: engine jitter, engine cannot start normally, misfire, etc.
- General problem causes: burned due to excessive current, damaged by external force, etc



3. Service precautions: It is prohibited to use high-voltage cable to perform ignition spark test during repair; otherwise it may cause damage to electronic controller
4. Simple measurement method
 - Turn digital multimeter to ohm band (remove connector), connect two probes to two terminals of primary winding respectively, the resistance should be $0.5 \sim 0.64 \Omega$ at normal temperature.
 - When connecting to secondary winding, the resistance is $8.36 \sim 10.64 \text{ k}\Omega$.



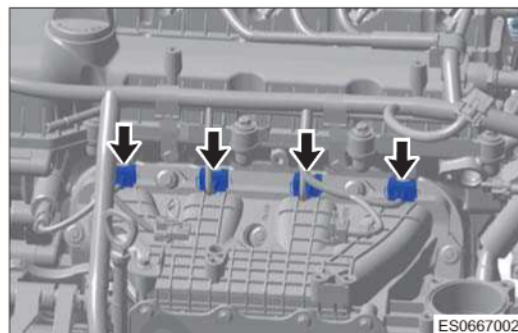
Fuel Injector

Description

Fuel injector is located on the cylinder head near intake valve, and nozzle end is located directly above the intake port.

1 - Positive Power Supply Wire

2 - ECU Control Ground



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Operation

In the non-operating condition, the injector spring presses the needle valve set against the valve seat and seals the fuel injection port. When the ECU drives the fuel injector to operate, the electromagnetic coil energizes and generates electromagnetic force, and the needle valve set is sucked up, and separated from valve seat set, and the fuel is atomized and sprayed through the orifice plate. When the injection pulse is cut off, the pressure of return spring returns and closes the needle valve.

Problem Symptoms and Judgment Methods

1. Problem symptoms: poor engine idle, poor acceleration, engine cannot start (different to start), etc.

Caution:

- A failure phenomenon is that injector body surface is wet after the vehicle is running for a while, customer will misunderstand that "leakage" occurs in injector, in fact, it is the phenomenon of thermal diffusion of lubricant (applied to injector O-ring) on the injector body. It does not affect the use of injector. This phenomenon will not occur again after drying.

2. General problem causes

- (a) Lack of maintenance. Since the fuel added to fuel tank last time is stored too long, and it is more than 2 months, fuel colloidal material is produced due to fuel oxidation, so that abnormal injection or no fuel injection due to accumulation of colloidal material in fuel injector, resulting in injector failure.

Caution:

- If the customer does not drive the vehicle frequently, it is suggested to store a small amount of fuel in the tank. The purpose is to consume the fuel in the tank in time, try to avoid fuel deterioration in tank.

3. Simple detection method for injector malfunction

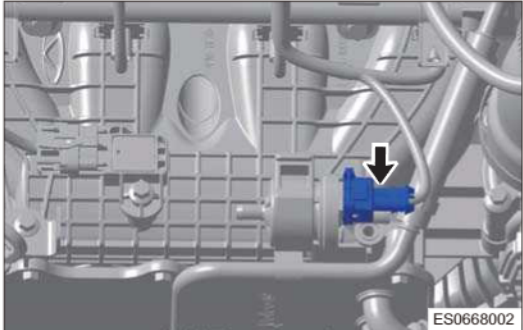
- (a) Check if the injector itself is malfunctioning.
- (b) Check the cause of fuel leakage in the injector.
- (c) Check if the fuel injector is leaked oil.
- (d) Check if the fuel leakage is caused by fuel rail.
- (e) Turn digital multimeter to ohm band (remove connector), connect two probes to two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



Canister solenoid valve

Description

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



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Operation

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

Installation Precautions

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

Problem Symptoms and Judgment Methods

1. Problem symptoms: normal open, function failure, etc.
2. General problem causes: rust or poor sealing due to foreign matter enters into the valve.
3. Simple detection method for canister solenoid valve malfunction

Step	Operation	Test Value	Test Result	Subsequent Step
1	Remove the canister solenoid valve, blow air to canister solenoid valve in direction of airflow arrow on solenoid valve housing, check if the canister solenoid valve is ventilated	Ventilation or not	Yes	Canister solenoid valve fault, replace it
			No	Next
2	Apply 12 V battery voltage to two terminals of canister solenoid valve, and blow air to canister solenoid valve in direction of airflow arrow on solenoid valve housing, check if the canister solenoid valve is ventilated	Ventilation or not	Yes	Next
			No	Perform this inspection with a new canister solenoid valve, the testing equipment failure has been eliminated. If the fault does not recur, the canister solenoid valve is faulty, replace it

Step	Operation	Test Value	Test Result	Subsequent Step
3	If there is obvious black substance in connecting pipe between canister solenoid valve and canister	Is there any black substance	Yes	If solenoid valve is faulty due to black particles inside the valve body and it is necessary to replace the solenoid valve, mainly check the canister for carbon dust leakage
			No	Next
4	Remove canister solenoid valve wire harness connector, and measure resistance of coil	$26 \pm 4 \Omega$	Yes	Next
			No	Perform this inspection with a new canister solenoid valve, the testing equipment failure has been eliminated. If the fault does not recur, the canister solenoid valve is faulty, replace it
5	Connect diagnostic tester, and read DTCs	• P0444 • P0458 • P0459 Others	Yes	Disconnect and reconnect connector, check if there is still current DTC related to canister solenoid valve. If trouble is eliminated, it is most likely that poor connection may occurs. Focus on wire harness and connector inspection

DTC definition:

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

Repair precaution

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

Installation

1. Installation

Caution:

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



Engine Control Module (ECM)

Function

1 way of ignition signal (KL.15)
 1 way of wakeup signal (ACC_WAKEUP)
 1 way of continuous power supply voltage (UBD)
 2 ways of non-continuous power supply voltage (UBR)
 7 ways of external voltage of 5 V
 2 sets of CAN communication interface (CAN2 is only used for calibration)
 1 way of K line communication
 1 way of LIN communication (optional)
 1 way of crankshaft position sensor signal input
 1 way of knock signal input
 12 ways of digital signal input port (included brake switch signal, brake light signal, 1 way of camshaft signal, clutch switch signal, clutch bottom switch signal, A/C switch signal, A/C medium pressure switch signal, neutral switch, electronic load signal, starter condition signal, power steering input switch signal, immobilizer code signal), and there are another 7 ways reserved
 14 ways of analog signal input port (included DSS/HFM signal, intake temperature, engine coolant temperature, boost pressure/temperature, boost pressure signal, 2 ways of oxygen sensor signal, 2 ways of pedal position signal, 2 ways of electronic throttle position signal, 1 way of exhaust valve position feedback signal, atmospheric pressure signal, etc, two of them are used as digital ports, and there are another 3 ways reserved
 4 ways of injector drive control output
 4 ways of ignition drive control output (3 ways of output control can be selected)
 2 ways of electronic throttle motor drive control output
 2 ways of exhaust solenoid valve motor drive control output
 1 way of main relay control output
 1 way of oil pump relay control output
 1 way of canister control output
 2 ways of upstream and downstream oxygen sensor heating control output
 2 ways of high and low speed fan relay control output
 1 way of A/C compressor relay control output
 1 way of engine speed output
 1 way of VVT control output (intake side)
 2 ways of 4.5 A output reserved
 3 ways of 3A output reserved
 4 ways of 0.6 A small signal output reserved

Description

Engine Control Module (ECM), mounted on the engine compartment left rail wheel house assembly, can be removed only as a unit for replacement.

Operation

Engine Control Module (ECM) is a pre-programmed microprocessor digital computer, which is used to adjust ignition timing, air-fuel ratio, emission control device, speed control, A/C compressor and idle speed etc. Engine Control Module (ECM) enables the program to suit ever-changing operation conditions.

Installation Position

ECU bracket is integrated and welded to drain channel inner bracket, and ECU is secured with 4 fixing bolts, the tightening torque is 7 ± 1.5 N·m.

Installation Precautions

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

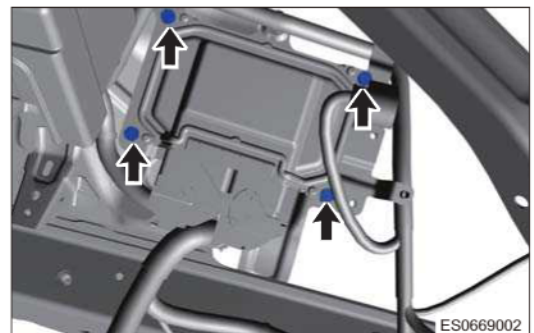
Common Problem Symptoms and Judgment Methods

1. Problem symptoms: Engine idles roughly, poor acceleration, engine cannot start, too high idle speed, exhaust exceeding, different to start, A/C failure, injector control failure, stalls, etc.
2. General problem causes
 - ECU internal parts are burned and faulty due to the electrical overload of external device;
 - Circuit board is rusted due to water enters ECU.
3. Repair precaution
 - Do not remove ECU casually during service;
 - Disconnect the negative battery cable for more than 1 minute before ECU removal.
 - Remove ECU before performing welding operation, and the removed ECU should be stored;
 - Do not install any wire on ECU connecting wire.
4. Simple measurement method
 - (a) Connect ECU connector, turn ENGINE START STOP switch to ON, use diagnostic tester to read engine DTCs and datastream or record;
 - (b) Remove ECU connector, check if ECU and its connecting wire are in good condition, mainly check if ECU power supply wire and ground wire are normal;
 - (c) Check if the external sensor is operating properly, output signal is reliable and its circuit is in good condition;
 - (d) Check if the actuator is operating properly and its circuit is in good condition;
 - (e) Perform test with new ECU to check if malfunction reoccurs.

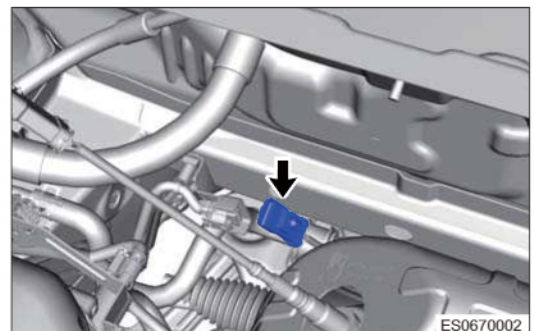
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Removal

1. Turn off all electrical equipment and the ENGINE START STOP switch.
2. Disconnect the negative battery cable.
3. Remove the Engine Control Module (ECM).
 - (a) Remove 4 fixing bolts (arrow) from ECU.



- (b) Disconnect the ECU wire harness connectors (arrow), and remove ECU.



Tightening torque

$7 \pm 1 \text{ N}\cdot\text{m}$



Installation

1. Installation is in the reverse order of removal.

Caution:

- Pay attention to static electricity protection during installation.
- Take care to protect connector terminals.
- To prevent water droplets from accumulating on connector joint, face it down.

Common electronic fuel injection data and reference range

Common electronic fuel injection data and reference range

These data are actual vehicles detected, for reference only.

Operation condition: Engine idling after warm-up		
Datastream Name	Value Range	Description and Note
Engine coolant temperature	It is usually at about 80 ~ 96°C	Engine coolant temperature after warm-up, which is detected by engine coolant temperature sensor
Engine speed	At about 650 ~ 850rpm	Engine idling speed after warm-up (refer to Engine Speed Maintenance)
Ambient pressure	About 1013 hpa	Plain area
Battery voltage	About 13V~ 15V	When the headlight and other electrical loads are turned on, it may be lower than 13V
Intake temperature	It is as same as environment temperature during cold start	It is higher than current temperature and varies with environment temperature
Accelerator pedal opening	0 ~ 100%	During idling, accelerator pedal opening is 0
Actual torque	It is about 11% ~ 17% at normal idling	The torque that actually produced in engine combustion should be mostly equal to target torque
Target torque	It is about 11% ~ 17% at normal idling	After turning on A/C and other loads, engine target torque and target demand torque will be increased
Relative load	It is about 10% ~ 25% at idling	The relative air charge amount of engine cylinder, which will be increased after turning on A/C and other loads, and slightly reduced on highland area
Rear oxygen signal voltage	Fresh catalyst rear oxygen voltage should be between 0.58 ~ 0.75V	Fresh catalytic converter rear oxygen voltage should be between 0.58 ~ 0.75V and change slowly. If the voltage continues to fluctuate and amplitude is close to front oxygen, it means three-way catalytic converter fails
Target throttle opening	It is about 0% ~ 8% at normal idling	It will be increased after turning on A/C
Throttle opening	It is about 0% ~ 8% at normal idling	Actual throttle body opening at idling should be equal to target throttle body opening
Gear position	For the model with manual transmission, the gear position signal is 0	/
Actual ignition angle	It is about 3 ~ 5 deg. at normal idling	If there is interference from outside, the ignition angle may fluctuate to maintain stable idling
Intake manifold pressure	It is about 300 ~ 500 hpa at idling without load	It will be increased after turning on A/C and other loads, and is slightly reduced on high altitude area
Temperature when engine starts	It is usually real-time temperature (not warm-up start)	If the standing time of vehicle before start is long enough, the coolant temperature value is approximately equal to ambient temperature
Front oxygen signal voltage	After warm up the engine is normally changed from 0.05V ~ 0.9V and jumping back and forth	Experience valve: more than 5 times within 10s
Idling torque self-learning value	Usually -5% ~ 10%	The higher the engine idle torque self-learning value, the greater the engine idle torque consumption, the lower the value, the smaller the engine idle torque consumption
Control duty ratio of canister control valve	It is about 0% ~ 40% at idling	/
Intake air volume	It is about 5kg/h ~ 12kg/h at idling	Turn the A/C on and other loads will increase the amount of air intake
Throttle pressure	/	Slightly less than ambient pressure
Oxygen sensor closed loop adjustment	Between 0.75 ~ 1.25	The output adjustment according to the oxygen sensor signal feedback



Operation condition: Engine idling after warm-up		
Datastream Name	Value Range	Description and Note
Air-fuel mixture multiplication self-learning value	Between 0.75 ~ 1.25	Air-fuel ratio self-learning is value
Air-fuel mixture addition self-learning value	It is usually at about -7.5% ~ 7.5	Air-fuel ratio addition self-learning value

Electronic Fuel Injection System Diagnostic Tester Functional Requirements

1. Self-diagnostic
 - (a) Mainly include: Read the DTC and clean the DTC;
2. System parameter display
 - (a) Mainly include: Coolant temperature, intake temperature, throttle opening, engine speed, ignition angle, air-fuel ratio short term correct, air-fuel ratio long term addition and multiplication correct, intake pressure, intake flow, oxygen sensor signal, system voltage, torque demand value, etc.
3. System condition
 - (a) Mainly include: It displays 10 conditions such as program condition, cooling system, stable condition, dynamic condition, emission control, oxygen sensor, idle speed, malfunction indicator, emergency condition, A/C, etc.
4. Actuator test
 - (a) Mainly include: malfunction indicator, fuel pump, A/C relay, fan control, ignition test, single cylinder with fuel cut-off, etc. 6 functions test
5. System initialization reset (adaptive reset)
 - (a) After the engine stalling, initialization command is sent and system resets the previous self-adaption.
6. Odometer
 - (a) Mainly include: Display of vehicle driving distance and driving time.
7. Edition information
 - (a) Mainly include: Display of vehicle identification number (selectable), ECU hardware number, ECU software number.

SQRE4T15B ENGINE MECHANICAL

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Removal	07-30		
Installation	07-30		
Engine Timing Chain	07-32		
Description	07-32		



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GENERAL INFORMATION

Overview

Description

SQRE4T15B engine has the following features:

- DVVT
- Water cooled vertical
- In-line DOHC with 4 cylinders
- Four valves per cylinder
- Aluminum cylinder head
- Cast iron cylinder block
- Turbocharged water-cooled

Operation

- SQRE4T15B engine adopts design of vertical, in-line 4-cylinder, water-cooled, 4-stroke, 4 valves per cylinder, DOHC, turbocharged water-cooled, VVT and electronic controlled sequential multiport fuel injection. Engine adopts individual ignition.
- SQRE4T15B engine adopts a cast iron cylinder block. Aluminum oil pan is fixed to aluminum frame with bolts. And aluminum cylinder head is fixed to the cylinder block with bolts. Camshaft is installed in cylinder head. Camshaft is driven by timing chain, so the power output from crankshaft passes through crankshaft sprocket, thus the camshaft works together with valve lifter to open and close valve. Piston assembly is an aluminum piston with cast iron connecting rod. This engine has characteristics of reliable structure and excellent performance.

07

Specifications

Engine Specifications

Item	Specifications
Engine Type	Vertical, in-line 4-cylinder, water-cooled, 4-stroke, DOHC, turbocharged water-cooled
Engine Model	SQRE4T15B
Valve Number Per Cylinder	4
Cylinder Diameter (mm)	77
Piston Stroke (mm)	80.5
Displacement (ml)	1498
Compression Ratio	9.5:1
Ignition Type	Individual ignition
Ignition Sequence	1 - 3 - 4 - 2
Rated Power (kW)	108
Max. Torque (N·m)	210
Max. Torque Speed (r/min)	1750 - 4000
Rated Power Speed (r/min)	5500
Min. Fuel Consumption Rate (g/kW·h)	275
Fuel Octane Number (Not Less Than)	Unleaded gasoline, octane number 92
Oil Grade	SM SAE-5W-30 SM SAE-5W-40 SM SAE-10W-40
Oil Capacity (L)	4.7 ± 0.2
Starting Type	Electrical starting
Cooling Type	Forced circulation type antifreeze cooling
Lubrication Type	Compound type (pressure, splash lubrication)



07-SQRE4T15B ENGINE MECHANICAL

Item	Specifications	
Cylinder Compression Pressure (bar) (180 - 250) r/min	7 - 10	
Oil Pressure (bar)	Idling speed (700 ± 50 r/min)	Not less than 0.7
	High speed (2000 r/min)	Not less than 2.5

Engine Mechanical Specifications

Item			Specifications
Camshaft	Cam height	Intake cam (mm)	37.07 - 37.31
		Exhaust cam (mm)	36.94 - 37.18
	Camshaft diameter (it is same for intake and exhaust camshafts) (mm)	1st journal	33.934 - 33.95
		2nd ~ 5th journal	23.947 - 23.96
	Camshaft axial clearance	Intake cam (mm)	0.15 - 0.2
		Exhaust cam (mm)	0.15 - 0.2
Cylinder Head	Lower surface flatness (mm)		0.04
	Overall height (mm)		141.05
	Surface grinding limit		Never grind
Valve	Valve head margin thickness	Intake valve (mm)	0.68 - 1.1
		Exhaust valve (mm)	0.48 - 0.9
	Valve stem diameter	Intake valve (mm)	5.98 ± 0.008
		Exhaust valve (mm)	5.96 ± 0.008
	Valve face sealing width	Intake valve (mm)	1.154
		Exhaust valve (mm)	1.307
	Clearance between valve stem and guide	Intake valve (mm)	0.012 - 0.043
		Exhaust valve (mm)	0.032 - 0.063
	Angle between conical surfaces of valve face	Intake valve	90°
		Exhaust valve	90°
	Height	Intake valve (mm)	107.75 - 108.25
		Exhaust valve (mm)	106.07 - 106.57
Valve Spring	Free height (mm)		47.8
	Operating preload (N)/operating height (mm)		229 - 251/41
Valve Guide	Inner diameter (mm)		6 - 6.015
	Depression depth (mm)		16 ± 0.3
Piston	Piston skirt diameter (mm)		76.947 - 76.907
	Piston pin hole diameter (mm)		18.010 - 18.025
Piston Ring	Piston ring side clearance (mm)	First ring	0.02 - 0.065
		Second ring	0.02 - 0.06
	Piston ring end gap (mm)	First ring	0.2 - 0.3
		Second ring	0.3 - 0.5
Piston Pin	Diameter (mm)		17.995 - 18
	Length (mm)		45/0/-0.3
Crankshaft	Crankshaft main journal	Diameter (mm)	Standard value: 50 Limit value: 49.979
		Coaxially (mm)	0.05
		Cylindricity (mm)	0.007
		Roundness (mm)	0.004
	Connecting rod journal	Diameter (mm)	Standard value: 50 Limit value: 49.984
		Parallelism to main journal (mm)	0.008

Item		Specifications
Cylinder Block	Overall height (mm)	274.9
	Bore roundness/straightness (mm)	0.008/0.01
	Upper surface flatness (mm)	0.04
	Surface grinding limit	Never grind
Connecting Rod	Connecting rod big end hole axial clearance (mm)	0.15 - 0.40
	Connecting rod bearing shell radial clearance (mm)	0.026 - 0.075

Engine Torque Specifications

Description	Torque (N·m)
Ignition Coil Fixing Bolt	8 ± 1
Idler Pulley Fixing Bolt	50 + 5
Tensioner Fixing Bolt	50 + 5
Cylinder Head Cover Fixing Bolt	1st step: 3 + 2 2nd step: 8 + 3
Crankshaft Pulley Fixing Bolt	1st step: 100 ± 10 2nd step: 120° ± 10°
Crankshaft Timing Hole Fixing Bolt	40 + 5
Hydraulic Tensioner Fixing Bolt	9 + 3
Movable Guide Rail Fixing Bolt	12 + 2
Fixing Guide Rail Fixing Bolt	9 + 3
Upper Guide Rail Fixing Bolt	9 + 3
Phaser Fixing Bolt	105 + 5
Camshaft Bearing Cap Fixing Bolt	1st step: 9.5 ± 1.5 2nd step: 9.5 ± 1.5
Cylinder Head Fixing Bolt	1st step: 40 ± 5 2nd step: 90° ± 5° 90° ± 5°
Variable Timing Control Solenoid Valve	6 + 2
Camshaft Position Sensor Fixing Bolt	8 + 3
Lifting Eye Fixing Bolt	20 + 5
Coupling Bolt Between Rear Mounting Upper Body and Lower Body	105 ± 10
Coupling Bolt Between Rear Mounting Upper Body and Transmission	80 ± 5
Coupling Bolt Between Rear Mounting Lower Body and Sub Frame	150 ± 10
Coupling Bolt and Nut Between Left Mounting Cushion and Bracket	80 ± 5
Coupling Bolt Between Left Mounting Cushion and Body	70 ± 5
Coupling Bolt Between Left Mounting Bracket and Transmission	60 ± 5
Coupling Bolt Between Right Mounting Cushion and Engine	80 ± 5
Coupling Bolt Between Right Mounting Cushion and Body	70 ± 5
Knock Sensor Fixing Bolt	20 ± 5
Cooling Pipe Assembly I Fixing Bolt	20 + 5
Oil Pump Movable Guide Rail Fixing Bolt	12 + 2
Oil Deflector Fixing Bolt	8 + 3
Crankshaft Frame Fixing Bolt	27 + 3
Crankshaft Main Bearing Fixing Bolt (Frame)	1st step: 45 ± 5 180° ± 10°
Connecting Rod Bearing Cap Fixing Bolt	1st step: 15 + 3 2nd step: 60° ± 2°



Lubrication Areas During Engine Assembly

Lubrication Area	Note
Valve Guide Bottom Hole	SM 10W - 40
Intake Valve Retainer Bottom Hole	SM 10W - 40
Exhaust Valve Retainer Bottom Hole	SM 10W - 40
Cylinder Head OCV Valve Opening	SM 10W - 40
Check Valve	SM 10W - 40
Valve Stem Part	SM 10W - 40
Valve Oil Seal Lip	SM 10W - 40
Valve Lifter Circumcircle and Lifter Hole	SM 10W - 40
Camshaft Journal and Bearing Seat Hole	SM 10W - 40
Cam Surface	SM 10W - 40
Camshaft Phaser Assembly Front Control Valve	SM 10W - 40
Rocker Arm Roller	SM 10W - 40
Timing System	SM 10W - 40
Cylinder Bore	SM 10W - 40
Main Bearing Cap Bolt	SM 10W - 40
Connecting Rod Bearing Shell and Connecting Rod Journal	SM 10W - 40
Main Bearing Shell and Crankshaft Main Journal	SM 10W - 40
Piston Pin Circumcircle Surface	SM 10W - 40
Crankshaft Front and Rear Oil Seal Journal and Oil Seal Lip	SM 10W - 40
Piston Ring Groove	SM 10W - 40
Cylinder Bore Inner Wall	SM 10W - 40
Crankshaft Front and Rear Oil Seal External Circular Surface	SM 10W - 40
Strainer O-ring	SM 10W - 40
Oil Pump Inlet	SM 10W - 40
Oil Filter Module Oil Inlet on Cylinder Block	SM 10W - 40
Oil Filter O-ring	SM 10W - 40
Dipstick Tube O-ring	SM 10W - 40

Areas with Seal Gum Applied During Engine Assembly

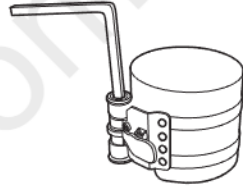
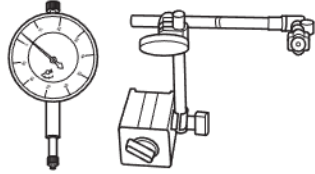
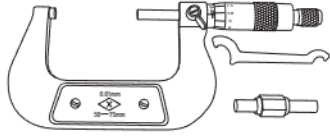
Area with Seal Gum Applied	Seal Gum
Coolant Temperature Sensor	Loctite 243
Bowl Plug	Loctite 11747
"T" Position of Junction Area Between Timing Chain Cover and Cylinder	Loctite 5900H
Timing Chain Cover	Loctite 5900H
Upper Guide Rail Bolt	Loctite 243
Cylinder Block Plug	Loctite 577
Cylinder Block Frame Assembly	Loctite 518/5182
Deflector Mounting Bolt Thread	Loctite 243
Strainer Mounting Bolt Thread	Loctite 243
Oil Pump Mounting Bolt Thread	Loctite 243
Oil Pan Installation Surface Frame	Loctite 5900H
Oil Pressure Switch Thread	Loctite 577

Non-reusable Part

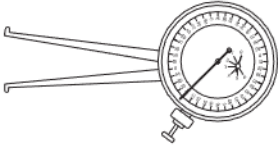
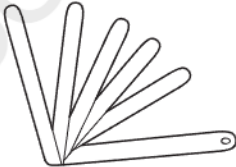
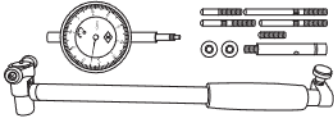
Non-reusable Part	
Valve Oil Seal	Replace it
Cylinder Head Bolt and Gasket	Replace it
Cylinder Gasket	Replace it
Crankshaft Rear Oil Seal	Replace it
Crankshaft Front Oil Seal	Replace it
Connecting Rod Bearing Cap Fixing Bolt	Replace it
Flywheel Fixing Bolt (MT + DCT)	Replace it
Main Bearing Cap Fixing Bolt (Frame)	Replace it
O-ring (Installation Surface Between Frame and Cylinder Block)	Replace it

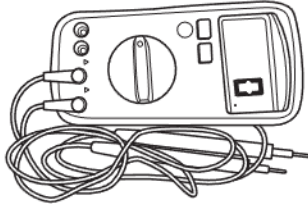
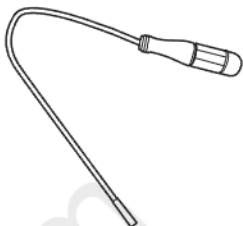
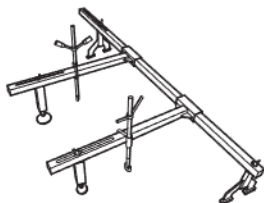
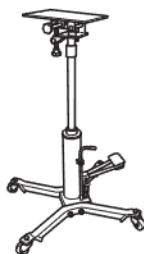
Tools

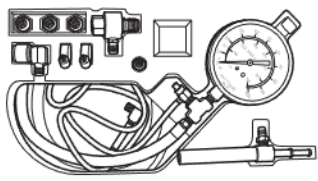
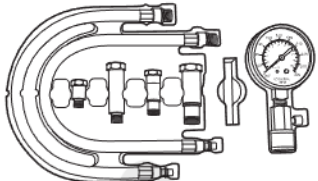
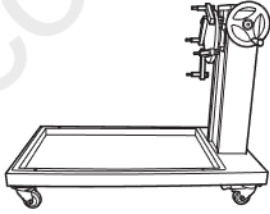
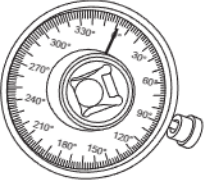
General Tools

Piston Installer	-	 039
Dial Indicator and Magnetic Holder	-	 023
Outer Diameter Micrometer	-	 064
Vernier Caliper	-	 019

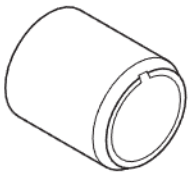


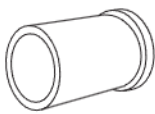
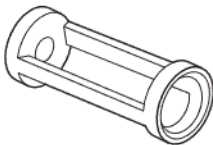
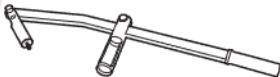
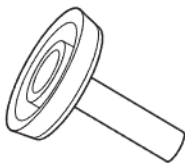
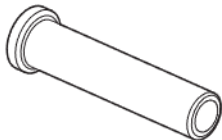
Inner Diameter Micrometer	-	 069
Precision Straightedge	-	 063
Feeler Gauge	-	 060
Piston Ring Remover	Part No.: CH-20080	 066
Cylinder Gauge	-	 065

Digital Multimeter	-	 002
Flexional Magnetic Rod	Part No.: CH-20053	 042
Engine Hoist	-	 043
Engine Equalizer	Part No.: CH-30040	 026
Transmission Carrier	-	 005

Fuel System Pressure Tester	-	 048
Cylinder Pressure Gauge	-	 044
Engine Service Platform	-	 057
Angle Gauge	-	 091

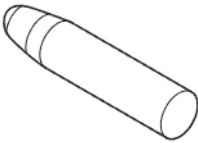
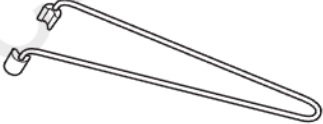
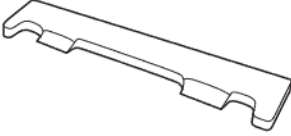
Special Tools

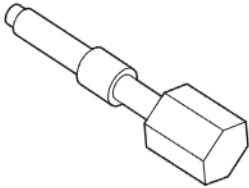
Crankshaft Front Oil Seal Guide Tool	Part No.: CH-20007	 049
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Crankshaft Front Oil Seal Installer	Part No.: CH-20008	 067
Valve Spring Compression Adapter	Part No.: CH-20018-B	 050
Valve Spring Compressor	Part No.: CH-20017-A	 028
Crankshaft Rear Oil Seal Installer	Part No.: CH-20006	 031
Valve Oil Seal Installer	Part No.: CH-20011-A	 034



07-SQRE4T15B ENGINE MECHANICAL

Valve Oil Seal Guide Sleeve	Part No.: CH-20012	 035
Valve Oil Seal Remover	Part No.: CH-20013-A	 037
Valve Cotter Installer	Part No.: CH-20017-A	 029
Crankshaft Rear Oil Seal Installer	Part No.: CH-20005-A	 070
Camshaft Timing Tool	Part No.: CH-20010	 033

Crankshaft Timing Tool	Part No.: CH-20089	 027
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DIAGNOSIS & TESTING

Diagnosis Content

Problem Symptoms Table

Hint:

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

Symptom	Suspected Area
Valve mechanism noise	Engine oil (oil level high or low, oil lean or rich)
	Cam
	Valve spring seat (excessive runout)
	Valve (excessive clearance between valve and guide)
Connecting rod noise	Engine oil (low pressure)
	Engine oil (lean)
	Connecting rod bearing cap (loose fixing bolt)
	Connecting rod (misaligned)
	Connecting rod bearing shell (excessive radial clearance)
	Connecting rod journal (out-of roundness)
Main bearing noise	Engine oil (low pressure)
	Engine oil (lean)
	Main bearing shell (excessive clearance)
	Crankshaft axial clearance (excessive)
	Crankshaft journal (out-of roundness or worn)
	Flywheel or clutch (loose)
Oil loss or spark plug blockage	Piston ring (worn, scratched or damaged)
	Piston ring groove (carbon deposited)
	Valve oil seal (worn or damaged)
	Valve (excessive clearance between valve and guide)
Engine power loss	Spark plug (dirty, burnt or incorrect clearance)
	Electric fuel pump assembly
	Ignition coil
	Valve timing (incorrect)
	Cylinder head (leaked)
	Valve (burnt, deformation or excessive clearance)
	Cylinder pressure (low)
	Fuel system (dirty)
	Exhaust system (blocked)
Water in engine	Cylinder gasket (leakage)
	Cylinder liner (cracked)
	Drive through water
	Oil filter module (internal leakage)

Inspection

1. Check the coolant.
2. Check the engine oil.
3. Check the battery ([See page 16-11](#)).
4. Check the air filter element.
 - (a) Remove the air filter element ([See page 10-7](#)).

- (b) Visually check that there is no dirt, blockage or damage in the air filter element.

Hint:

- If there is any dirt or blockage in air filter element, clean it with compressed air.
- If any dirt or blockage remains, even after cleaning air filter element with compressed air, replace it.

5. Check the spark plug (See page 14-10).

6. Test the cylinder compression pressure.

- Cylinder pressure is the main index to judge engine operation and also can be used to definitely judge whether some system of engine operates well or not. Therefore, it is necessary to perform cylinder pressure measurement when servicing engine.
- Ensure battery is fully charged and engine starter is in good operating condition. Otherwise, indicated compression pressure used for diagnosis may be invalid.

Caution:

- Recommended compression pressure is only used as a guide for diagnosing engine malfunction.
- Never determine cause of low pressure by disassembling engine unless there are some malfunctions.

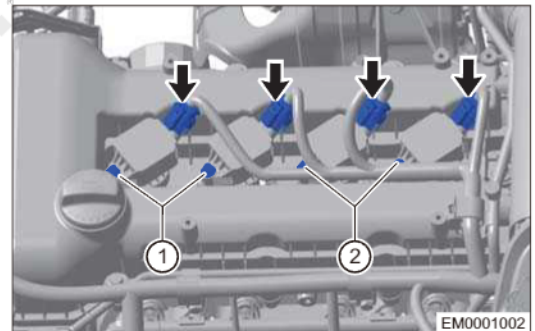
Measurement procedures:

Caution:

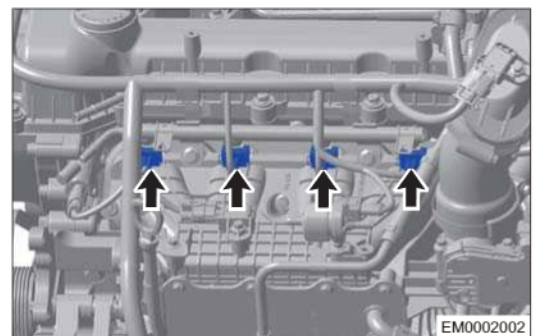
- Use a cylinder pressure gauge with accurate reading and reset it to zero, or it will influence accuracy of reading.
- (a) Turn off all electrical equipment and the ignition switch.
- (b) Remove the engine trim cover.
- (c) Remove the ignition coil.
- Disconnect the ignition coil connectors (arrow).
 - Remove 4 fixing bolts (1) and (2) from ignition coil, and remove 4 ignition coils.

Tightening torque

$8 \pm 1 \text{ N}\cdot\text{m}$



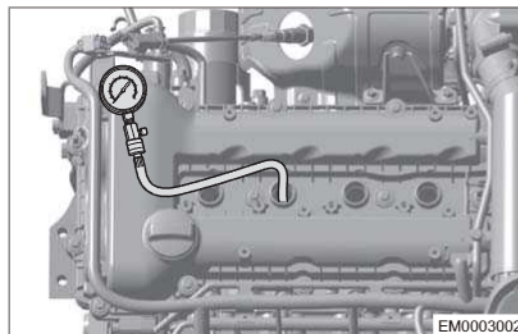
- (d) Disconnect all injector connectors (arrow).



- (e) Remove spark plug in each cylinder (See page 14-10).



- (f) Slowly screw the cylinder pressure gauge connector vertically into the spark plug mounting hole. Do not tighten it excessively to prevent difficult removal.



- (g) With transmission in P/N position (for DCT models) or neutral position (for 6MT models), depress accelerator pedal fully, then start engine and keep it racing for 3 to 5 seconds; record the measured pressure value.
- (h) Press the bleeder button of cylinder pressure gauge to reset it to zero. Use same method to repeat this test three times and then calculate average value. Cylinder pressure value is within 7 - 10 bar (180 - 250 r/min).

Caution:

- DO NOT screw the cylinder pressure gauge excessively to prevent difficult removal.
- During measurement, do not turn ignition switch to "START" for more than 10 seconds. Otherwise, engine may be damaged.
- Ensure battery is fully charged when cranking engine. Correct cylinder pressure can be measured only when engine is running at 180 - 250 r/min.
- Use same method to measure pressure of other cylinders.

Cylinder pressure value judgment:

- Correct cylinder pressure
 - Standard cylinder pressure value is 7 - 10 bar (180 - 250 r/min). The value will drop slightly with usage of engine, but lowest value cannot be below 9 bar and pressure difference between each cylinder should not be above 3 bar.
 - If engine cylinder pressure is lower than standard value, it indicates that cylinder pressure is insufficient. Add a small amount of engine oil to cylinder through spark plug hole and perform measurement again.
 - If pressure increases after adding oil, piston ring or cylinder bore may be worn or damaged.
 - If pressure remains low, the valve may be stuck or damaged, or there may be air leakage in cylinder head gasket.
- (i) Install the spark plug ([See page 14-13](#)).
- Caution:**
- Be sure to check spark plugs, and apply a proper amount of lubricant to spark plug mounting threads before installing spark plugs. During installation, do not put spark plugs directly through mounting holes, as high dropping may cause the side electrode to deform, thus reducing the gap. Spark jump may affect the engine operation. Installation torque: $20 \pm 3 \text{ N}\cdot\text{m}$.
- (j) Connect all injector connectors.
- (k) Install the ignition coil ([See page 14-9](#)).

7. Test cylinder head gasket for leakage.

Cylinder head gasket leakage may be present between adjacent cylinder and water jacket or from an oil passage to the external of engine.

- Possible trouble symptoms caused by cylinder head gasket leakage between adjacent cylinders are as follows:
 - Engine power loss.
 - Engine stall.
 - Low fuel economy.
- Possible trouble symptoms caused by cylinder head gasket leakage between cylinder and adjacent water jacket are as follows:

- Engine overheats.
- Coolant loss.
- Excessive steam (white smoke) emitted from exhaust system.
- Coolant foaming.

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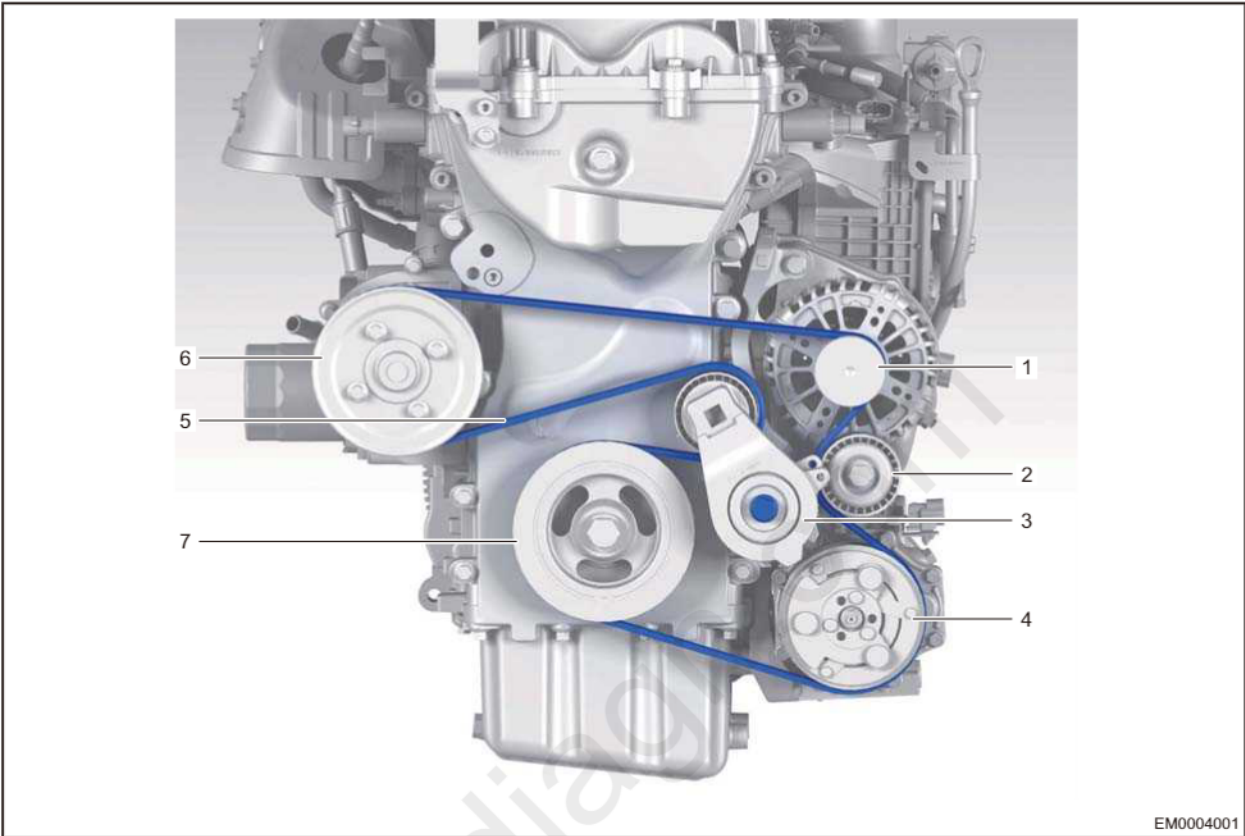


ON-VEHICLE SERVICE

Accessory Pulley

Description

07



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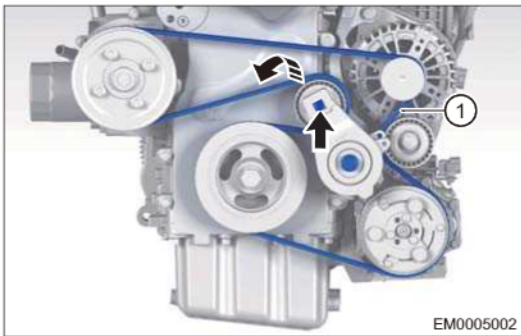
1 - Alternator Assembly	2 - Idler Pulley Assembly
3 - Tensioner Assembly	4 - Compressor Assembly
5 - Accessory Drive Belt	6 - Water Pump Pulley
7 - Crankshaft Pulley	

Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the accessory drive belt.
 - (a) Insert tip of ratchet rod into tensioner pin hole (arrow) and pull it downward in direction of arrow as shown in illustration, then remove accessory drive belt assembly (1).

Caution:

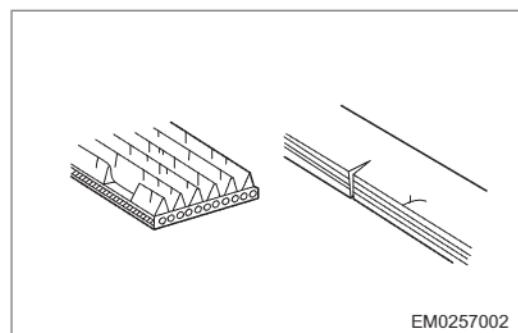
- Prevent hand from contacting belt tensioner when raising it upward.



EM0005002

Inspection

1. Visually check accessory drive belt for excessive wear and cords for wear, etc. If any of these defects is found, replace accessory drive belt.



Hint:

- If accessory drive belt has chunks missing from ribs, it should be replaced.
- After installing accessory drive belt, check that it fits properly in the ribbed grooves. Check that belt has not slipped out of grooves on bottom of the crankshaft pulley by hand.

07

Installation

Warning/Caution/Hint

Caution:

- Before installation, remove the dirt from accessory drive belt.
 - Rotate crankshaft after installation, make sure that accessory drive belt is installed in place and does not contact with other separate parts.
1. Installation is in the reverse order of removal.



Idler Pulley Assembly

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the accessory drive belt ([See page 07-18](#)).
5. Remove the idler pulley assembly.

- (a) Remove fixing bolt (arrow) from idler pulley assembly.

Tightening torque

50 + 5 N·m



- (b) Remove the idler pulley assembly.

Inspection

1. Rotate idler pulley by hands and check if rotation is smooth and if abnormal noise occurs.
2. Wiggle idler pulley in axial and radial directions to check bearing for looseness.
3. Check if there is damage on idler pulley assembly operating surface.

Installation

Warning/Caution/Hint

Caution:

- After installation, turn crankshaft to run accessory drive belt several circles, and check if crankshaft turns smoothly and belt runs well. If it does not turn smoothly, reinstall accessory drive belt.
 - Make sure to correctly install accessory drive belt, and it does not interfere with other components.
1. Installation is in the reverse order of removal.

Tensioner Assembly

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the engine trim cover.
 4. Remove the accessory drive belt (See page 07-18).
 5. Remove the tensioner assembly.
- (a) Remove the tensioner assembly fixing bolt (arrow).

Tightening torque

50 + 5 N·m



07

- (b) Remove the tensioner assembly.

Inspection

1. Rotate tensioner pulley assembly by hands and check if rotation is smooth and if abnormal noise occurs.
2. Wiggle tensioner pulley assembly in axial and radial directions to check for looseness.
3. Check if there is damage on tensioner pulley operating surface.

Installation

Warning/Caution/Hint

Caution:

- After installation, turn crankshaft to run accessory drive belt several circles, and check if crankshaft turns smoothly and belt runs well. If it does not turn smoothly, reinstall accessory drive belt.
 - Make sure to correctly install accessory drive belt, and it does not interfere with other components.
1. Installation is in the reverse order of removal.



Cylinder Head Cover

Removal

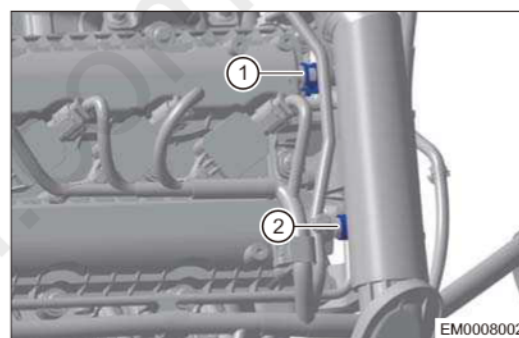
Warning/Caution/Hint

Caution:

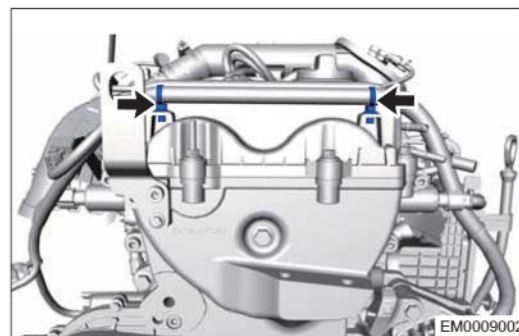
- Blow dirt and debris away from surface of cylinder head cover with compressed air.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the ignition coil ([See page 14-7](#)).
5. Drain the coolant ([See page 12-10](#)).
6. Remove the turbocharger water outlet pipe set ([See page 11-10](#)).
7. Remove the discharge steel pipe ([See page 12-24](#)).
8. Remove the cylinder head cover.

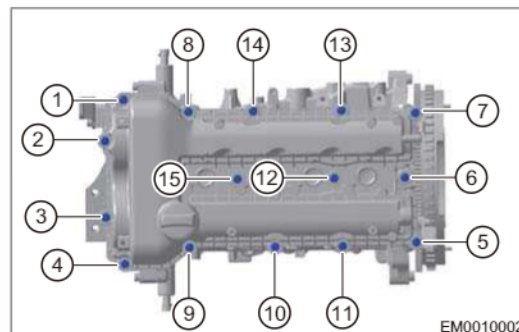
- (a) Loosen clamping ring (2) and elastic clamp (1), disconnect connection between crankcase ventilation hose and cylinder head cover.



- (b) Remove engine wire harness fixing clips (arrow) from cylinder head cover.

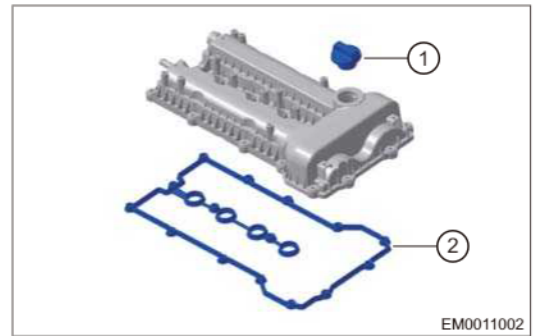


- (c) Remove 15 cylinder head cover fixing bolts in order shown in illustration.



- (d) Remove the cylinder head cover assembly.

- (e) Remove fuel filler cap (1) and cylinder head cover gasket (2) from cylinder head cover assembly.



Installation

Warning/Caution/Hint

Caution:

- Remove oil and seal gum on cylinder head cover and cylinder head before installation.
- Check if gasket is damaged or loses elasticity, if so, replace it.

1. Install the cylinder head cover assembly.

- (a) As shown in illustration, apply seal gum to "T" position of junction area between timing chain cover and cylinder head.

Seal gum

Loctite 5900H

Hint:

- Pay attention that seal gum should not be applied too thick, to prevent excessive seal gum entering into inside of engine when press fitting the cylinder head cover.
- Install cylinder head cover assembly 15 minutes elapse after applying seal gum.

Diameter of seal gum line:

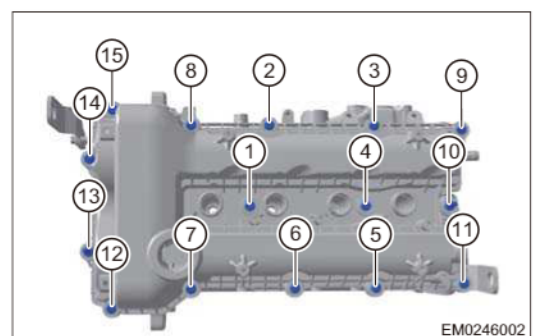
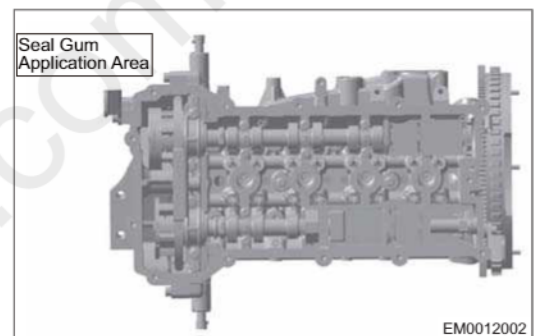
2.5 - 5 mm

- (b) Install cylinder head cover and manually install bolts to 1 to 2 threads.
- (c) Tighten 15 cylinder head cover fixing bolts in order shown in illustration.

Tightening torque

1st step: 3 + 2 N·m

2nd step: 8 + 3 N·m



2. Other installation procedures are in the reverse order of removal.



Crankshaft Front Oil Seal

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the accessory drive belt (See page 07-18).
5. Remove the crankshaft front oil seal assembly.

- (a) Remove fixing bolt (arrow) from crankshaft pulley.

Tightening torque

1st step: 100 ± 10 N·m

2nd step: $120^\circ \pm 10^\circ$

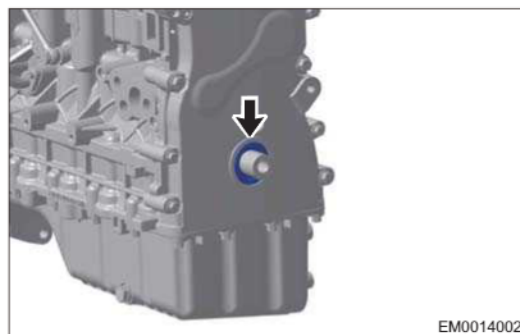
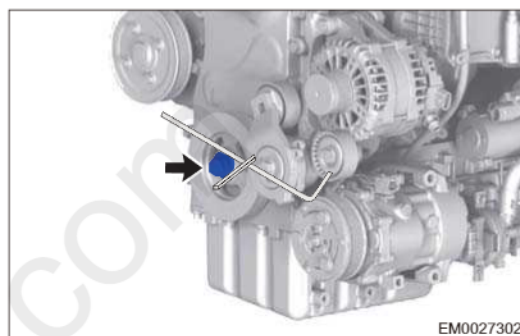
Hint:

- Use a rigid iron rod with proper right-angle bending, and insert the bent part into clearance on lower part of alternator bracket, use another right-angle iron rod as a fulcrum while inserting it into the crankcase pulley groove to lock crankshaft pulley and remove bolts at the same time.

- (b) Remove the crankshaft pulley.
- (c) Using a flat tip screwdriver wrapped with tape, pry out the crankshaft front oil seal (arrow).

Hint:

Be careful not to scratch junction surface, when removing crankshaft front oil seal.



Installation

Warning/Caution/Hint

Caution:

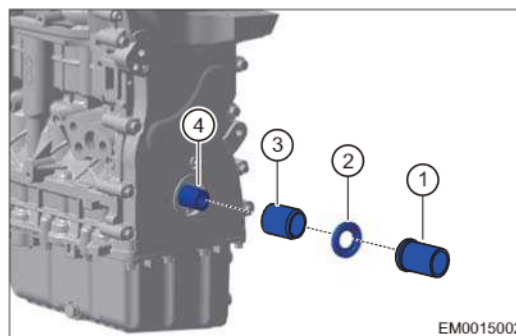
- Apply a coat of engine oil to the crankshaft front oil seal guide tool before installing a new oil seal.
- Remove dirt on junction surface and apply a coat of engine oil to junction surface and oil seal lip (except the oil seal with surface applied wax) before assembly.
- Be sure to prevent the lip of crankshaft front oil seal from being scratched during installation. If it is damaged, replace it immediately.

1. Install the crankshaft front oil seal.
 - (a) Install crankshaft front oil seal guide tool (3) to crankshaft (4).

- (b) Install new oil seal (2) to crankshaft front oil seal guide tool, then install new oil seal evenly and fully into oil seal retainer with a crankshaft front oil seal installer (1).

Caution:

- Make sure oil seal surface is 0 to 1 mm lower than end surface of timing chain cover oil seal hole.
 - Make sure that the oil seal lip is not damaged during assembly.
 - Tilting for 5° or more or squeezing and trimming of oil seal outer retainer rubber are not allowed during assembly of oil seal.
- (c) Other installation procedures are in the reverse order of removal.



Flywheel (for DCT Models)

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the transmission assembly (See page 18-148).
 4. Remove the flywheel assembly.
 - (a) Install flywheel holding tool (1) to lock flywheel.



EM0016002

- (b) Remove 6 fixing bolts (arrow) from flywheel assembly, and remove flywheel assembly.



Non-reusable Part

Tightening torque

1st step: 35 ± 5 N·m

2nd step: $45 \pm 5^\circ$

Warning:

- Pay attention to personal safety during operation.
- DO NOT remove all fixing bolts without any auxiliary measures.

Caution:

- Flywheel fixing bolts must be disposed after removal. Never reuse them.

Inspection

1. Check if crankshaft position signal gear is distorted or deformed. If damaged, replace flywheel. Clean signal gear before installation.
2. Check if starter driven gear ring is worn. If excessively worn, replace flywheel.

Installation

Warning/Caution/Hint

Warning:

- Never reuse flywheel fixing bolts after removal.

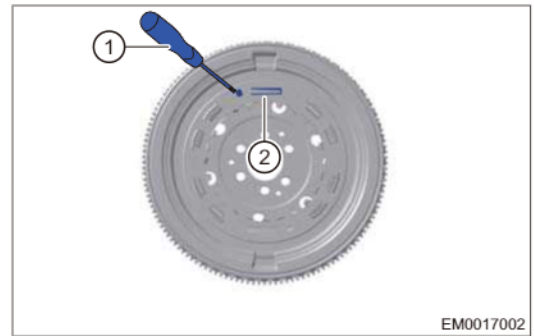
Caution:

- Six bolt holes on the flywheel have asymmetrical positions. During installation, pay attention to that flywheel fixing bolts are aligned with crankshaft bolt holes.

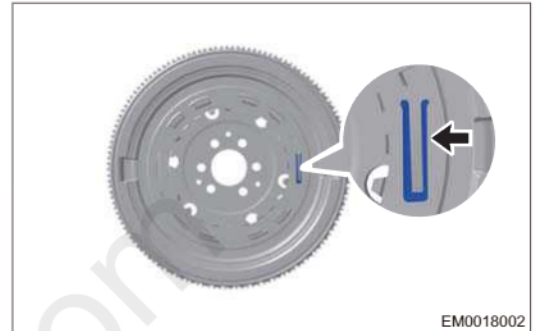
1. It is necessary to reset flywheel before installation.

Resetting procedures:

- (a) Insert flat tip screwdriver (1) into flange slot (arrow), then rotate it clockwise until both the lock levers can be pushed into flange slot (2) downward. Make sure both the lock levers can be pushed downward and locked.



- (b) The flywheel status after reset is shown in illustration.



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2. Install the flywheel.

Caution:

- Lightly push flywheel after alignment during assembly. Do not tap flywheel with a hammer.
- Replace flywheel fixing bolts with new ones.

- (a) When installing flywheel assembly, pretighten fixing bolts (arrow), and install flywheel holding tool (1), then tighten each flywheel bolt diagonally in order.

Tightening torque

1st step: $35 \pm 5 \text{ N}\cdot\text{m}$

2nd step: $45 \pm 5^\circ$



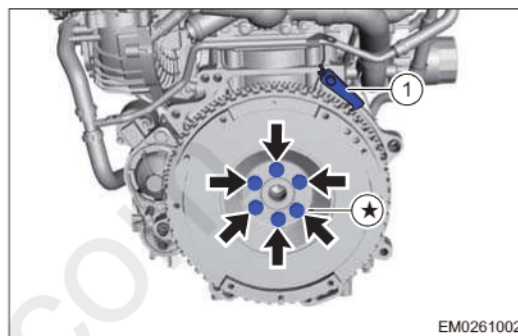
Flywheel (for 6MT Models)

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the transmission assembly (See page 17-22).
 4. Remove the flywheel assembly.
 - (a) Install flywheel holding tool (1) to lock flywheel.



- (b) Remove 6 fixing bolts (arrow) from flywheel assembly, and remove flywheel assembly.

Tightening torque

1st step: 35 ± 5 N·m

2nd step: $30 \pm 5^\circ$



Non-reusable Part

Warning:

- Pay attention to personal safety during operation.
- DO NOT remove all fixing bolts without any auxiliary measures.

Caution:

- Flywheel fixing bolts must be disposed after removal. Never reuse them.

Inspection

1. Check if crankshaft position signal gear is distorted or deformed. If damaged, replace flywheel. Clean signal gear before installation.
2. Check if starter driven gear is worn. If excessively worn, replace flywheel.
3. Check for slits, cracks, color changes, etc. on flywheel surface. If exists, replace flywheel.

Installation

Warning/Caution/Hint

Warning:

- Never reuse flywheel fixing bolts after removal.

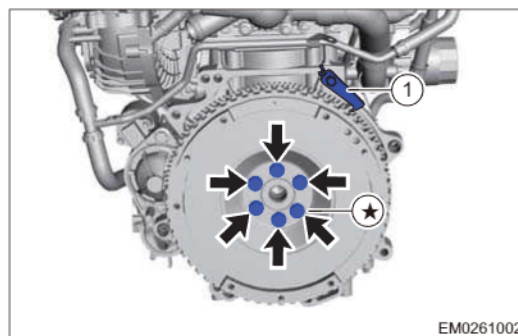
Caution:

- Six bolt holes on the flywheel have asymmetrical positions. During installation, pay attention to that flywheel fixing bolts are aligned with crankshaft bolt holes.
1. Install the flywheel.

Caution:

- Lightly push flywheel after alignment during assembly. Do not tap flywheel with a hammer.
- Replace flywheel fixing bolts with new ones.

- (a) When installing flywheel assembly, pretighten fixing bolts (arrow), and install flywheel holding tool (1), then tighten each flywheel bolt diagonally in order.



Crankshaft Rear Oil Seal

Removal

Warning/Caution/Hint

Caution:

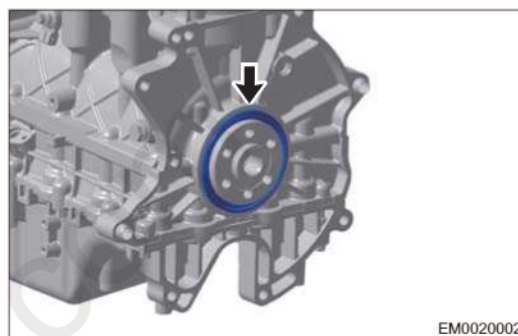
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the transmission assembly (See page 17-22).
4. Remove the flywheel assembly (See page 07-28).
5. Remove the crankshaft rear oil seal.

- (a) Using a screwdriver with the tip wrapped with tape, remove crankshaft rear oil seal (arrow).

Caution:

- Be careful not to scratch cylinder block, when removing oil seal.



EM0020002

Installation

Warning/Caution/Hint

Caution:

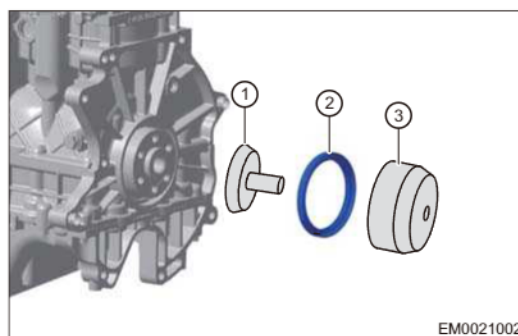
- Be sure to clean dirt around oil seal retainer and on inside wall before installation.
- Check oil seal for damage before installation. If there is any damage, replace it.
- Be sure to prevent the lip of crankshaft rear oil seal from being scratched during installation.
- Be careful not to damage oil seal retainer during installation.

1. Install the crankshaft rear oil seal.
 - (a) Apply engine lubricant to crankshaft oil seal outer retainer and lip.

Hint:

Oil seal with surface applied with wax cannot be applied.

- (b) Install guide tool (1) to crankshaft.



EM0021002

- (c) Install new oil seal (2) to crankshaft rear oil seal guide tool, then install new oil seal evenly and fully into oil seal retainer with a crankshaft rear oil seal installer (3).

Caution:

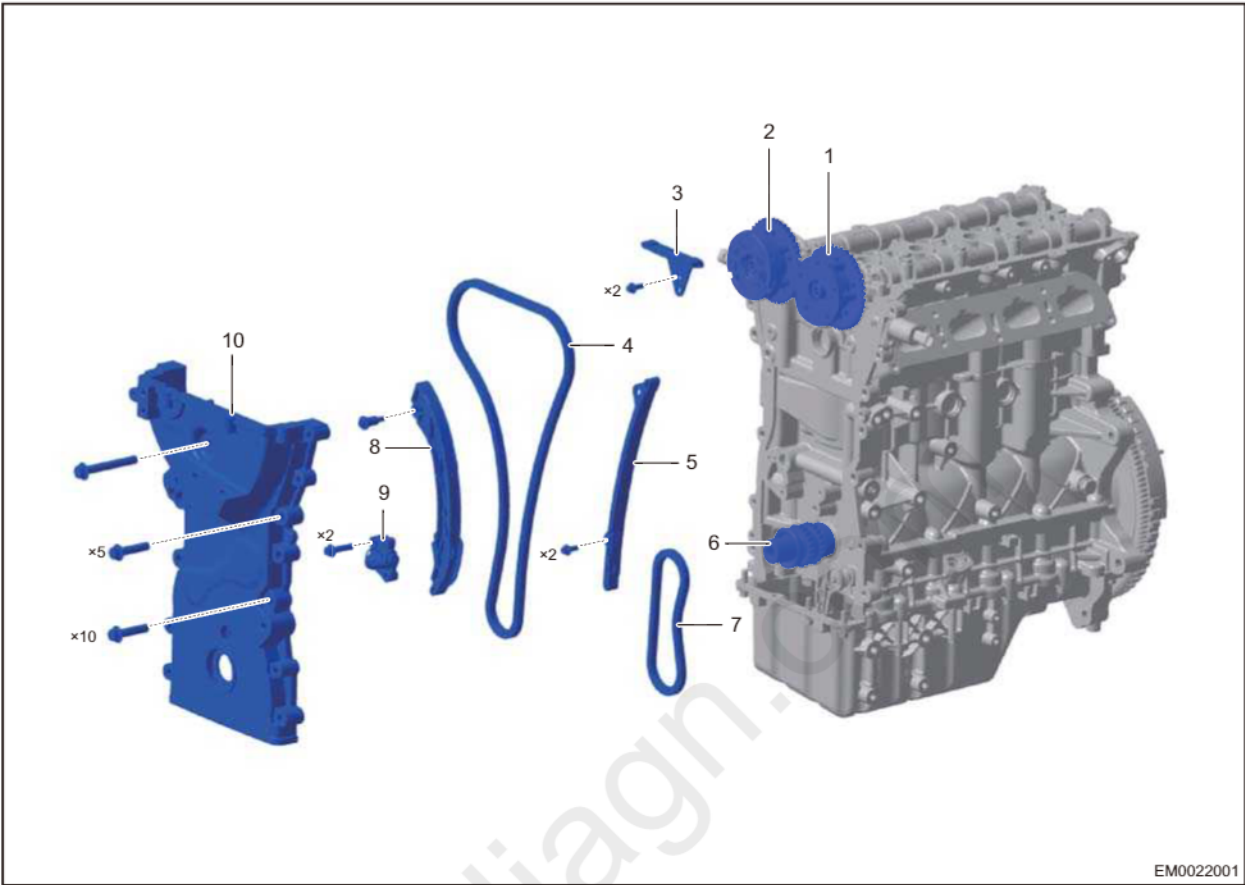
- Oil seal surface lowering 0 ~ 1 mm than rear end surface of cylinder block mounting seat hole is enough.
- Make sure that the oil seal lip is not damaged during assembly.
- Tilting for 5° or more or squeezing and trimming of oil seal outer retainer rubber are not allowed during assembly of oil seal.



Engine Timing Chain

Description

07



1 - Intake Phaser Assembly	2 - Exhaust Phaser Assembly
3 - Upper Fixing Guide Rail	4 - Engine Timing Chain
5 - Fixing Guide Rail	6 - Crankshaft Assembly
7 - Oil Pump Drive Chain	8 - Movable Guide Rail
9 - Tensioner Assembly	10 - Timing Chain Cover

Removal

Warning/Caution/Hint

Caution:

- Blow dirt and debris away from surface of cylinder head cover with compressed air.
 - Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the engine trim cover.
 4. Remove the ignition coil ([See page 14-7](#)).
 5. Remove the cylinder head cover ([See page 07-22](#)).
 6. Remove the accessory drive belt ([See page 07-18](#)).
 7. Remove the idler pulley assembly ([See page 07-20](#)).
 8. Remove the tensioner assembly ([See page 07-21](#)).
 9. Remove the crankshaft pulley ([See page 07-24](#)).

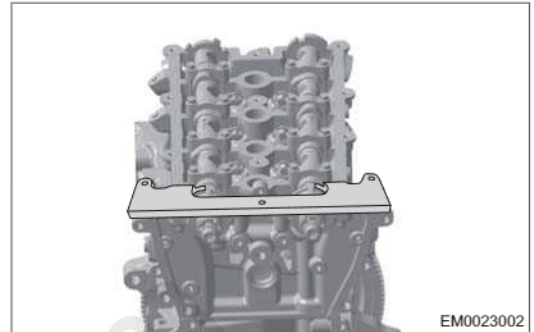
10. Remove the water pump pulley (See page 12-30).
11. Use an engine equalizer to hang engine assembly.

Hint:

Use engine equalizer to hang lifting eye of engine when supporting the engine oil pan with jack. Avoid engine tilting to right side for easy removal of engine right mounting cushion assembly.

12. Remove the engine right mounting cushion assembly (See page 07-61).
13. Install the camshaft timing tool.

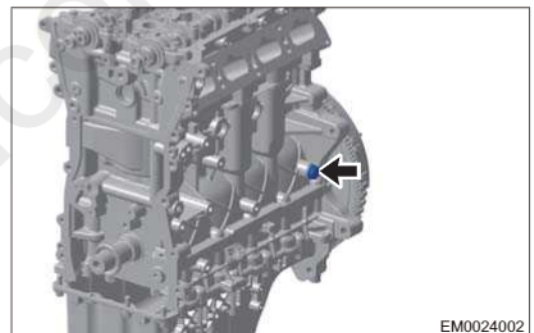
- (a) Place camshaft timing positioning special tool on the back of cylinder head upper plane, rotate intake and exhaust camshafts separately in order to clamp the special tool into slots on rear end of both camshafts.



- (b) Remove the starter assembly (See page 15-9).
- (c) Remove crankshaft timing tool installation hole fixing bolt (arrow) from engine block.

Tightening torque

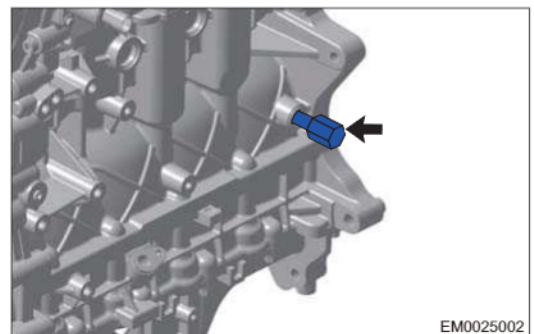
40 + 5 N·m



- (d) Install crankshaft timing positioning pin to cylinder block through thread hole on intake side of cylinder block, and insert front end of positioning pin into positioning hole of crankshaft balancer (each cylinder piston should be in the same plane).

Caution:

- It takes patience to perform this operation and pay more attention to avoid damage to crankshaft.

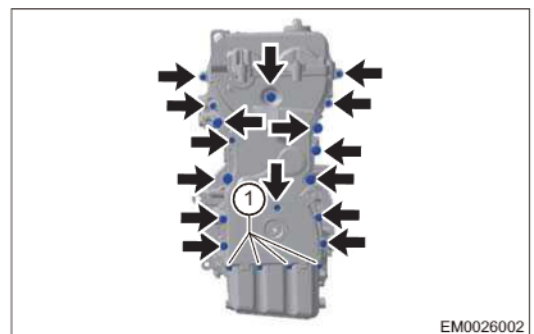


14. Remove the engine timing chain cover.

- (a) Remove 4 fixing bolts (1) between engine timing chain cover and oil pan assembly.

Tightening torque

20 + 5 N·m



- (b) Remove fixing bolts (arrow) from timing chain cover.

Tightening torque

M8 x 45 (6): 20 + 5 N·m

M8 x 40 - 10.9 (4): 30 + 5 N·m

M10 x 45 (5): 40 + 5 N·m

M10 x 80 (1): 40 + 5 N·m

- (c) Remove the timing chain cover.

Caution:

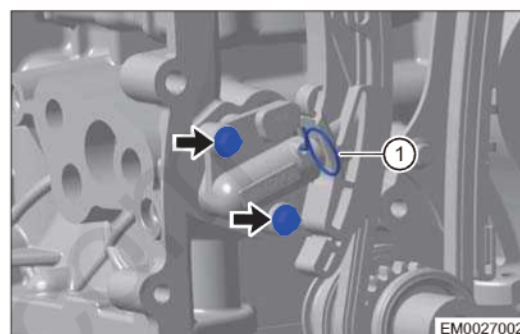
- Remove oil and seal gum with a special tool.
- Carefully observe timing chain cover for cracks or oil leakage. If exists, replace timing chain cover assembly.

15. Remove the timing chain.

- (a) Push movable guide rail to keep tensioner plunger at maximum compression position, and insert plunger snap pin (1) to stick tensioner plunger.

Caution:

- Since tensioner plunger has large elastic force, never remove tensioner assembly fixing bolts when plunger snap pin is not installed, to prevent plunger from popping out suddenly and cause accidental injuries.



- (b) Remove 2 fixing bolts (arrow) and tensioner assembly.

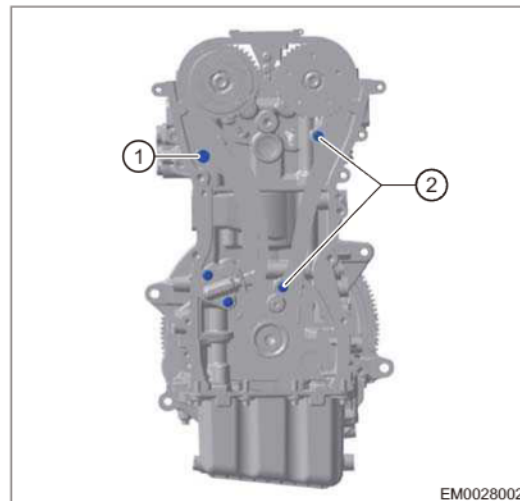
Tightening torque

9 + 3 N·m

- (c) Remove movable guide rail fixing bolt (1), and remove movable guide rail assembly.

Tightening torque

12 + 2 N·m



- (d) Remove 2 fixing guide rail fixing bolts (2), and remove fixing guide rail assembly.

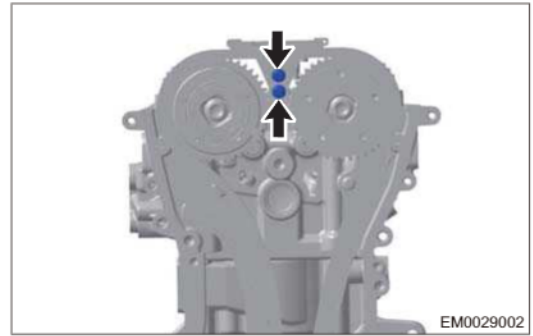
Tightening torque

9 + 3 N·m

- (e) Remove 2 upper guide rail fixing bolts (arrow), and remove upper guide rail assembly.

Tightening torque

9 + 3 N·m



- (f) Remove the engine timing chain assembly.

Caution:

- Mark front side and back side of chain with a marking pen after removing chain, so as to keep same direction during installation. Long time movement in one direction of timing chain will cause wear difference between two sides of chain, so it is necessary to remove and install the chain in same direction.

Inspection

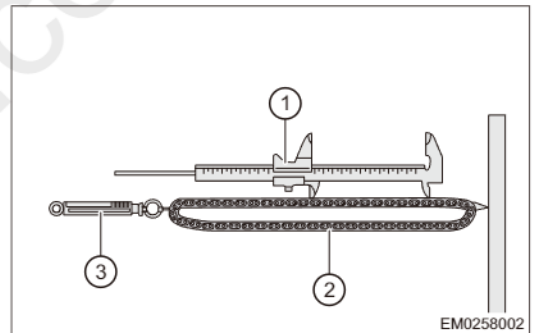
1. Check the timing chain.

- (a) Carefully check timing chain for serious wear or cracks. If exists, replace timing chain assembly.
- (b) Pull chain with a force of 147 N, and select 15 chain links to measure with a vernier caliper. Maximum elongation is 120.84 mm.

Hint:

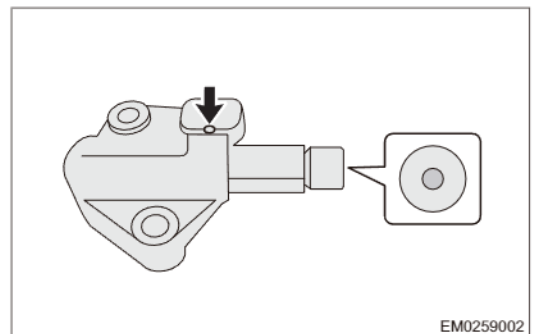
Measure at any three positions, and average the measurements. If the value is larger than the maximum elongation, replace timing chain assembly.

If it is not as specified, replace timing chain assembly.

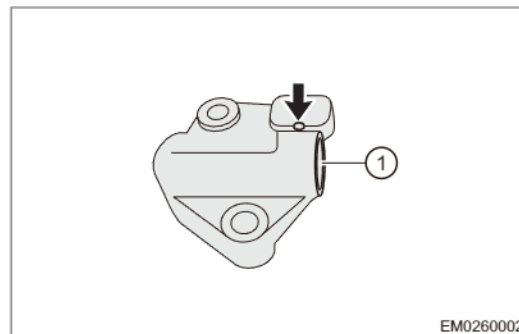


2. Check the tensioner.

- (a) Press piston by hand and release it, and spring should have abundant elastic force without sticking. If sticking exists, replace tensioner assembly.
- (b) Plug the two hold-down pin holes (arrow) with figures, and blow air to piston hole, there should have no any air leakage. If leakage exists, replace tensioner assembly.



- (c) Remove check valve, piston, spring, plug hold-down pin hole (arrow) with figures, and blow air to housing (1) with mouth, there should have no air to pass, and air should pass during inspiration, otherwise, replace hydraulic tensioner.



3. Check the movable guide rail.

- (a) Measure depth of movable guide rail with a vernier caliper.

Hint:

If wear limit is more than 2 mm, replace movable guide rail assembly.

Installation

07

Warning/Caution/Hint

Caution:

- Apply seal gum to edge of engine timing chain cover, and apply seal gum to inside of timing chain cover mounting bolt hole.

Seal gum

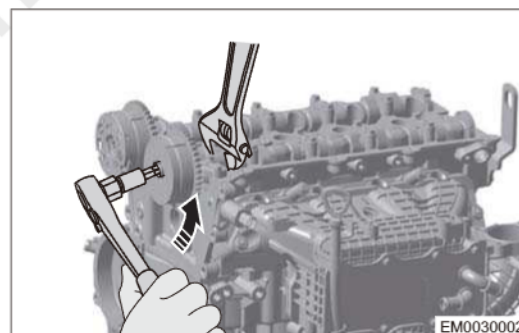
Loctite 5900H

1. Install the timing chain.

- (a) Use a proper wrench to hold intake camshaft and loosen fixing bolt from intake phaser assembly.

Tightening torque

105 + 5 N·m



- (b) Loosening method for exhaust phaser fixing bolt is the same as that of intake phaser fixing bolt.

Hint:

It is only necessary to loosen intake and exhaust phaser fixing bolts without removing phaser.

- (c) Apply seal gum to 2 - 3 threads of two upper guide rail assembly bolts, and screw them into camshaft 1st bearing cap.

Hint:

Do not tighten the bolts.

Seal gum

Loctite 243

- (d) Install the timing chain assembly.

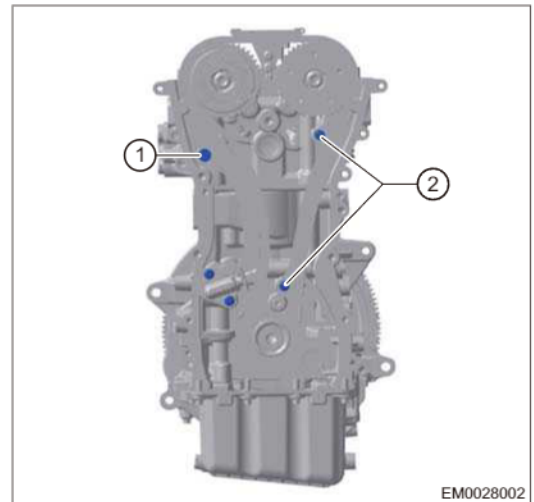
Caution:

- Ensure to install according to marks on timing chain correctly.
- Ensure to hang timing chain to intake and exhaust phasers and crankshaft sprocket. Make sure that timing chain and upper guide rail are in level.

- (e) Install fixing guide rail and tighten 2 bolts (2).

Tightening torque

9 + 3 N·m



- (f) Install movable guide rail and tighten bolt (1).

Tightening torque

12 + 2 N·m

Caution:

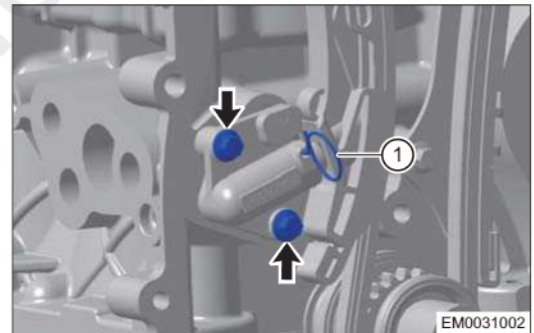
- Check if movable guide rail can rotate smoothly around the bolt after tightening movable guide rail fixing bolt, if not, check bolt and movable guide rail assembly.

- (g) Install the tensioner assembly.

- (1) Install tensioner assembly, and tighten 2 fixing bolts (arrow).

Tightening torque

9 + 3 N·m



- (2) Push movable guide rail to chock against tensioner plunger, then remove hold-down pin (1).

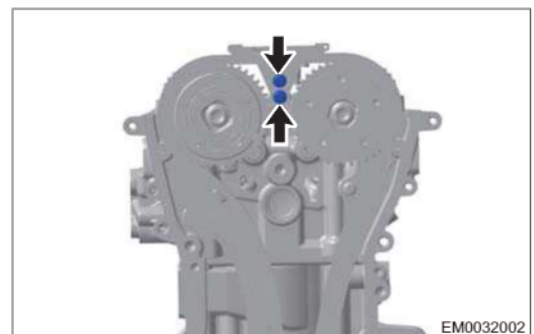
Caution:

- Make sure to keep tensioner assembly clean during installation. Otherwise, poor lubrication will cause abnormal engine noise and damage to timing chain and guide rail.
- Check if chain is in tension status.
- Check if chain is pressed in the fixing guide rail and movable guide rail, and engages normally with crankshaft sprocket, intake and exhaust phasers.
- Check that contact areas between chain and upper guide rail are in level without any looseness.

- (h) Tighten 2 upper guide rail fixing bolts (arrow).

Tightening torque

9 + 3 N·m



- (i) Tighten intake and exhaust phaser assembly fixing bolts.

Tightening torque

105 + 5 N·m

Warning:

- Tighten exhaust phaser fixing bolt first, and then tighten intake phaser fixing bolt. Failure to tighten in order may cause "tooth jump" phenomenon in timing chain.

- (j) Remove crankshaft timing tool and camshaft timing tool, then rotate crankshaft clockwise 2 turns at least, to check if timing system can operate normally.

Caution:

- Never rotate crankshaft counterclockwise.

2. Install the timing chain cover.

- (a) Apply seal gum to edge of engine timing chain cover, and apply seal gum to inside of timing chain cover mounting bolt hole.

Seal gum

Loctite 5900H



- (b) Install and tighten timing chain cover fixing bolts (arrow).

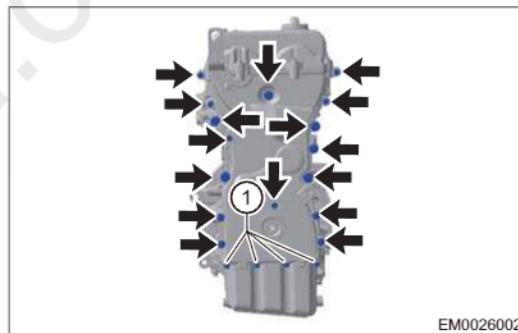
Tightening torque

M8 x 45 (6): 20 + 5 N·m

M8 x 40 - 10.9 (4): 30 + 5 N·m

M10 x 45 (5): 40 + 5 N·m

M10 x 80 (1): 40 + 5 N·m



- (c) Install 4 fixing bolts (1) between timing chain cover and oil pan.

Tightening torque

20 + 5 N·m

Caution:

- Apply seal gum to oil pan before installing timing chain cover, and apply seal gum to inside of mounting bolt hole.

Seal gum

Loctite 5900H

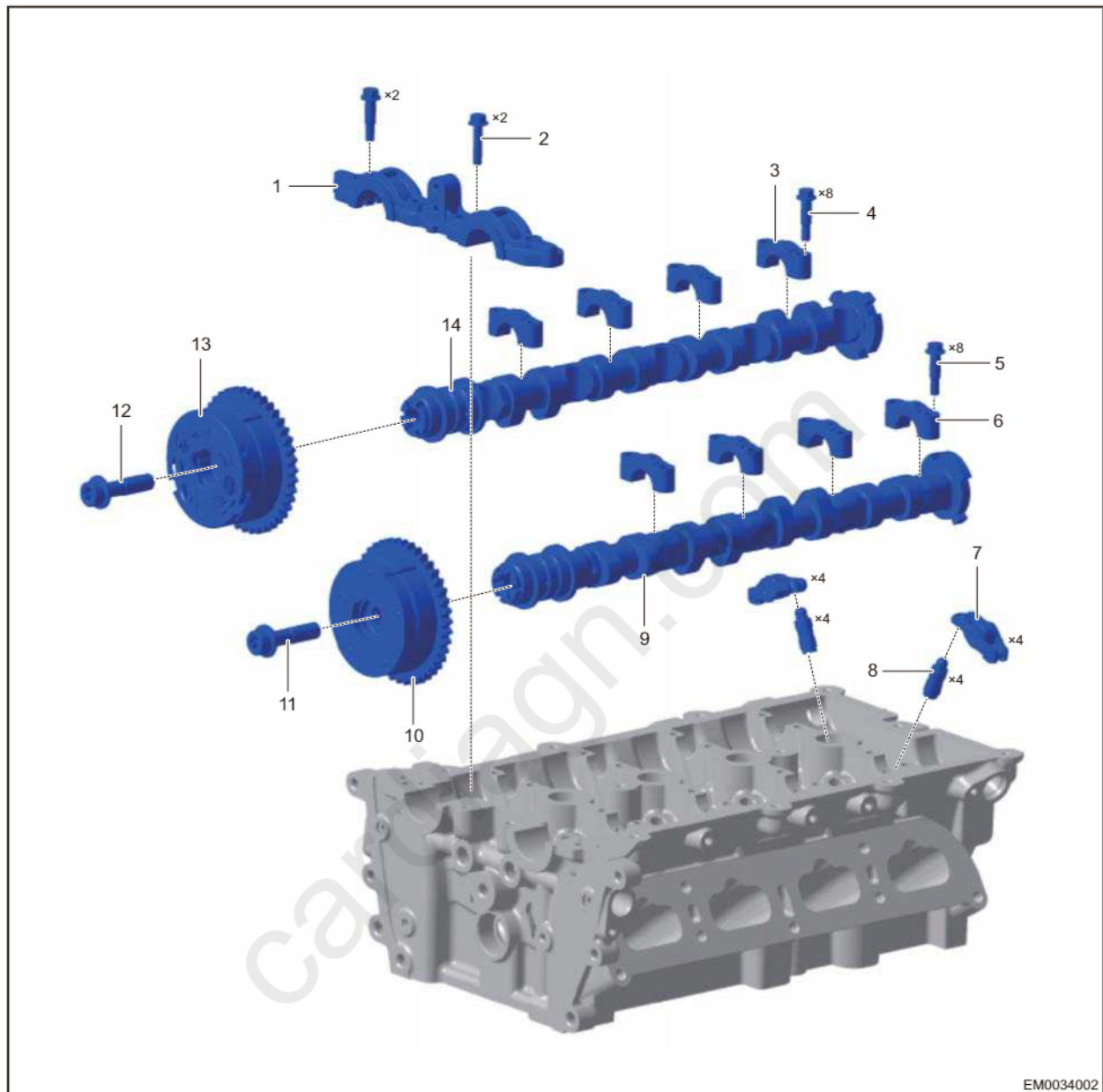
Diameter of seal gum line:

1.5 - 3 mm

3. Other installation procedures are in the reverse order of removal.

Camshaft & Rocker Arm

Description



EM0034002

1 - 1st Bearing Cap	2 - 1st Bearing Cap Fixing Bolt
3 - Exhaust Camshaft Bearing Cap	4 - Exhaust Camshaft Bearing Cap Fixing Bolt
5 - Intake Camshaft Bearing Cap Fixing Bolt	6 - Intake Camshaft Bearing Cap
7 - Rocker Arm	8 - Hydraulic Lifter
9 - Intake Camshaft Assembly	10 - Intake Phaser Assembly
11 - Intake Phaser Fixing Bolt	12 - Exhaust Phaser Fixing Bolt
13 - Exhaust Phaser Assembly	14 - Exhaust Camshaft Assembly



Removal

Warning/Caution/Hint

Caution:

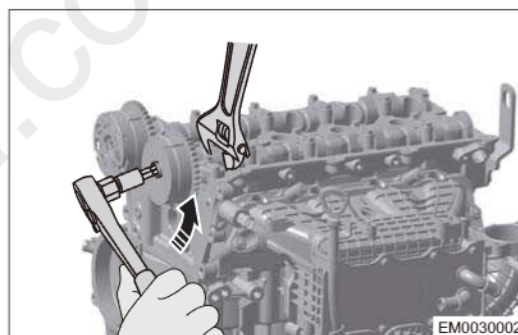
- Blow dirt and debris away from surface of cylinder head cover with compressed air.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the ignition coil (See page 14-7).
5. Remove the cylinder head cover assembly (See page 07-22).
6. Remove the accessory drive belt (See page 07-18).
7. Remove the tensioner assembly (See page 07-21).
8. Remove the idler pulley assembly (See page 07-20).
9. Remove the water pump pulley (See page 12-30).
10. Remove the timing chain cover.
11. Remove the timing chain assembly (See page 07-32).
12. Remove intake and exhaust phaser assemblies.

- (a) Use a proper wrench to hold intake camshaft, and remove fixing bolt from intake phaser assembly in direction of arrow.

Tightening torque

105 ± 5 N·m



- (b) Removal method for exhaust phaser assembly is the same as that of intake phaser assembly.

13. Remove intake and exhaust camshafts.

- (a) Remove intake and exhaust camshaft bearing cap fixing bolts in order shown in illustration.

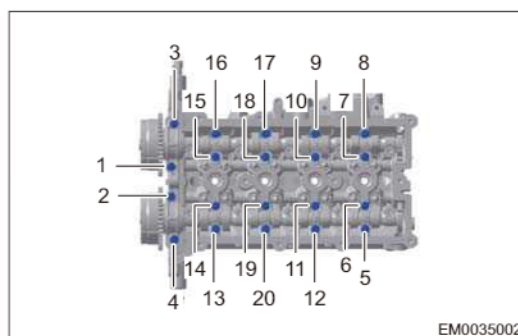
Hint:

During removal, loosen fixing bolts in order shown in illustration first, and then remove bolts thoroughly in order.

Tightening torque

1st step: 9.5 ± 1.5 N·m

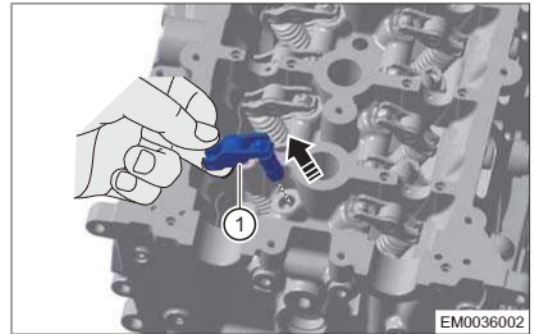
2nd step: 9.5 ± 1.5 N·m



- (b) Remove intake and exhaust camshaft bearing caps.
- (c) Remove intake and exhaust camshaft assemblies.

14. Remove rocker arm and hydraulic lifter.

- (a) Remove rocker arm and hydraulic lifter set (1) in direction of arrow.



- (b) Remove elastic clip (1) and separate rocker arm and hydraulic lifter in direction of arrow as shown in illustration.



07

Inspection

1. Check the camshaft.

- (a) Check the appearance.

- Check if there are scratches on camshaft surface. If there are scratches, replace camshaft.
- Check if there are leaking holes and cracks on camshaft bearing caps. If there are leaking holes or cracks, replace camshaft.

- (b) Check the camshaft journal diameter.
Measure camshaft journal diameter with a micrometer.

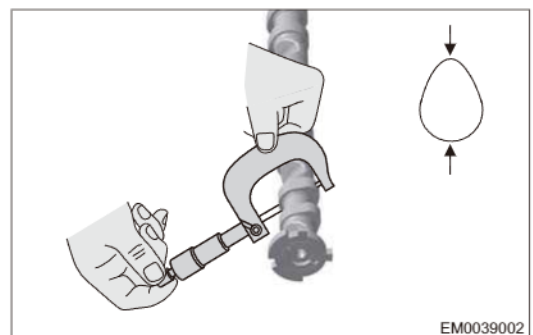
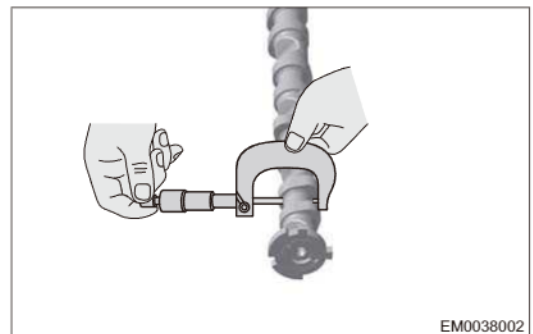
Measurement Item	Specification (mm)
1st Journal Diameter (Same for Intake and Exhaust)	33.934 - 33.95
2nd ~ 5th Journal Diameter (Same for Intake and Exhaust)	23.947 - 23.96

If camshaft journal diameter is not within specified range, replace intake/exhaust camshaft assembly.

- (c) Check the cam height.
Measure highest point of cam with a micrometer.

Measurement Item	Specification (mm)
Cam Height (Highest)	Intake: 37.07 - 37.31
	Exhaust: 36.94 - 37.18

If cam height is not within specified range, replace intake/exhaust camshaft assembly.



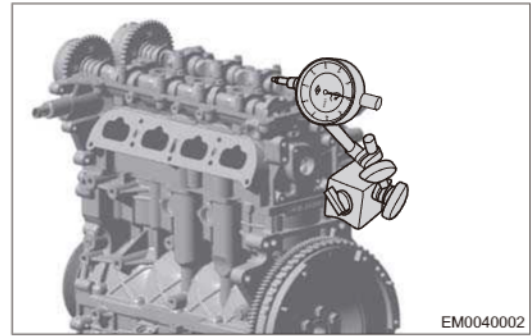
- (d) Check the camshaft axial clearance.
- Reinstall intake and exhaust camshaft assemblies.
 - Keep dial indicator plunger contact with front end of camshaft, and reset dial indicator to zero.
 - Push camshaft forward and backward lightly (do not rotate camshaft), then read value on dial indicator.

Measurement Item	Specification (mm)
Intake Camshaft Axial Clearance	0.15 - 0.20
Exhaust Camshaft Axial Clearance	0.15 - 0.20

If camshaft axial clearance is not within specified range, replace intake/exhaust camshaft assembly.

2. Check the hydraulic lifter.

- (a) Check if end surface and cylindrical operating surface of hydraulic lifter are normal.
- (b) Check if hydraulic lifter slides properly in cylinder head guide hole.
- (c) Check each hydraulic lifter for weakness. If exists, remove and soak it in 15W-30 oil for 24 hours, then press the hydraulic lifter plunger. If plunger can be pressed obviously, it indicates that lifter is weak, replace hydraulic lifter.



EM0040002

Installation

Warning/Caution/Hint

Caution:

- Adjust timing and adjust 4 pistons to same level before installing camshaft.
- When installing intake and exhaust phaser assemblies, tighten bolts on exhaust side first, and then tighten bolts on intake side.

1. Install the camshaft.

- (a) Clean intake and exhaust camshafts and camshaft bearing caps.
- (b) Apply engine oil to camshaft cam surface. Apply a proper amount of engine oil to camshaft bearing hole.
- (c) Install intake, exhaust camshaft assemblies and intake and exhaust camshaft bearing caps.

Caution:

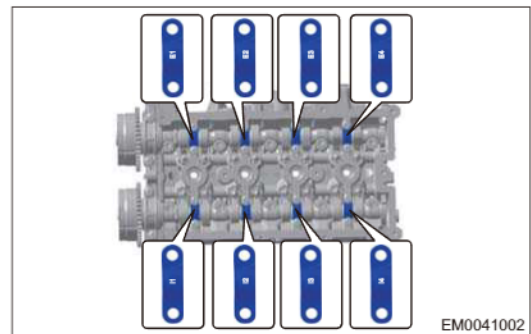
- Install according to marks on bearing cap.

I

Intake camshaft bearing cap

E

Exhaust camshaft bearing cap



EM0041002

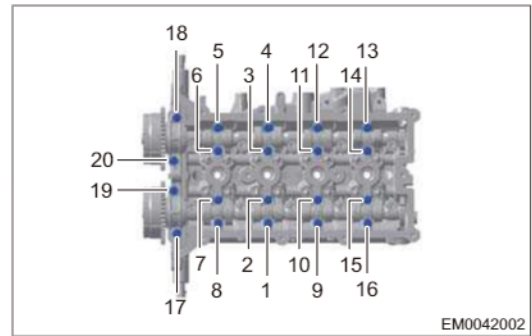
- (d) Install intake and exhaust camshaft fixing bolts by hand.

- (e) Tighten intake and exhaust camshaft bearing cap fixing bolts in order shown in illustration.

Tightening torque

1st step: $9.5 \pm 1.5 \text{ N}\cdot\text{m}$

2nd step: $9.5 \pm 1.5 \text{ N}\cdot\text{m}$

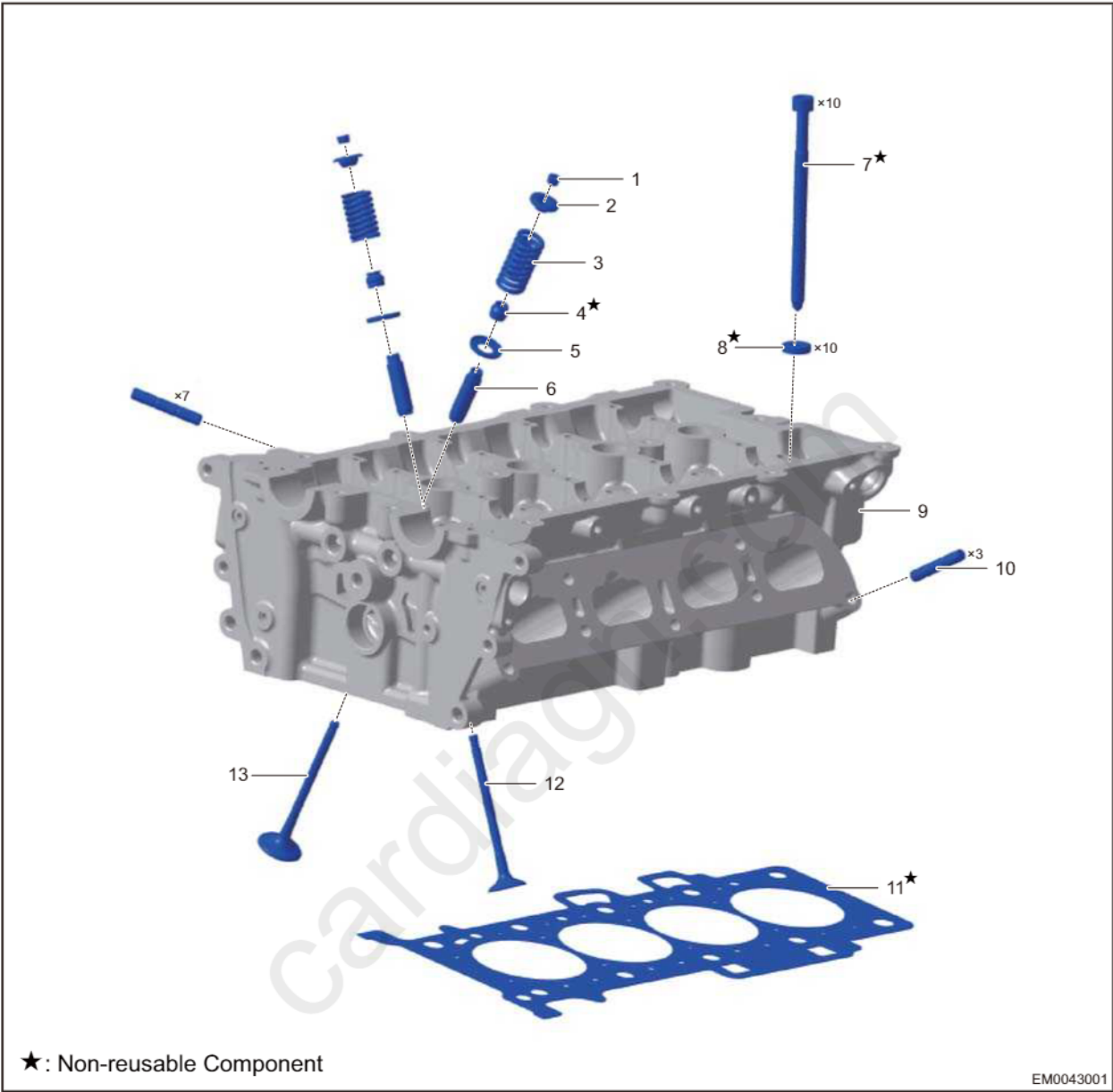


2. Other installation procedures are in the reverse order of removal.

Cylinder Head

Description

07

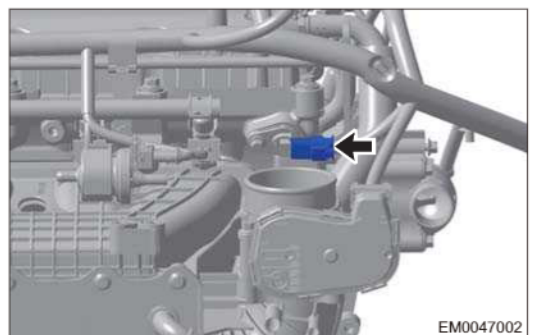
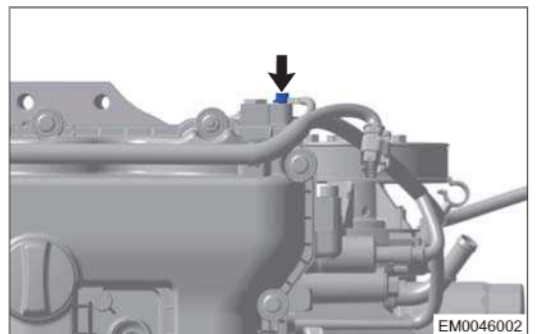
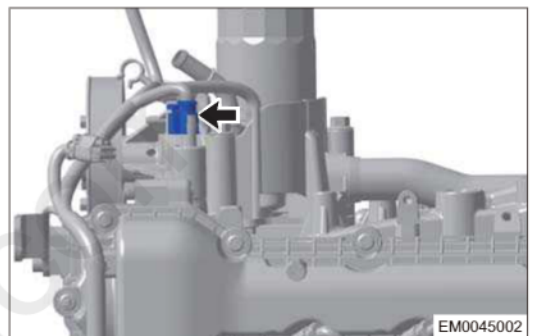
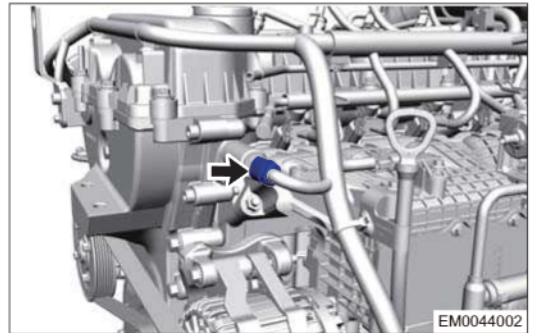


1 - Valve Cotter	2 - Valve Spring Upper Seat
3 - Valve Spring	4 - Valve Oil Seal
5 - Valve Spring Lower Seat	6 - Valve Guide
7 - Cylinder Head Fixing Bolt	8 - Cylinder Head Fixing Bolt Washer
9 - Cylinder Head	10 - Stud
11 - Cylinder Head Gasket	12 - Intake Valve
13 - Exhaust Valve	★ - Non-reusable Parts

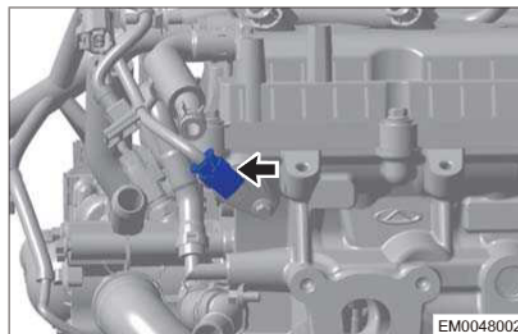
Removal

1. Release the fuel system pressure (See page 08-8).
2. Turn off all electrical equipment and the ignition switch.
3. Disconnect the negative battery cable.

4. Drain the engine oil (See page 13-10).
5. Drain the coolant (See page 12-10).
6. Disconnect the wire harness connector.
 - (a) Disconnect the intake variable timing control valve connector (arrow).
 - (b) Disconnect the exhaust variable timing control valve connector (arrow).
 - (c) Remove the engine wire harness ground wire fixing bolt (arrow).
Tightening torque
 $7 \pm 1 \text{ N}\cdot\text{m}$
 - (d) Disconnect the intake camshaft position sensor connector (arrow).



- (e) Disconnect the exhaust camshaft position sensor connector (arrow).



7. Remove the air filter assembly (See page 10-8).
8. Remove the battery assembly (See page 16-11).
9. Remove the battery tray (See page 16-15).
10. Remove the ignition coil (See page 14-7).
11. Remove the spark plug (See page 14-10).
12. Remove the fuel rail injector assembly (See page 08-22).
13. Remove the engine discharge steel pipe assembly (See page 12-24).
14. Remove the intake manifold assembly (See page 10-18).
15. Remove the thermostat seat (See page 12-22).
16. Remove the turbocharger assembly (See page 11-10).
17. Remove the accessory drive belt (See page 07-18).
18. Remove the idler pulley assembly (See page 07-20).
19. Remove the tensioner assembly (See page 07-21).
20. Remove the water pump pulley.
21. Remove the cylinder head cover assembly (See page 07-22).
22. Use an engine equalizer to hang engine assembly.

Hint:

Use an engine equalizer to hang engine assembly, while supporting engine oil pan with a jack. Avoid engine tilting to right side.

23. Remove the engine timing chain (See page 07-32).
24. Remove camshaft and rocker arm (See page 07-36).
25. Remove the engine equalizer.
26. Remove the cylinder head assembly.

- (a) Remove 10 cylinder head assembly fixing bolts in order shown in illustration.

Tightening torque

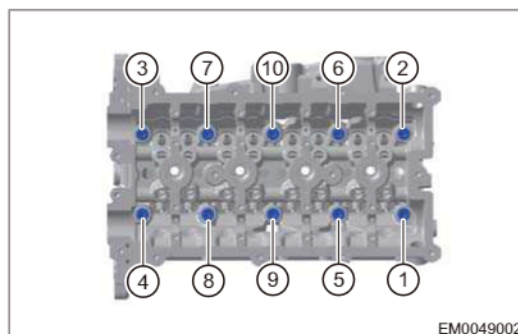
1st step: 40 ± 5 N·m

2nd step: $90^\circ + 5^\circ$

3rd step: $90^\circ \pm 5^\circ$

Caution:

- Removal and installation with engine at high temperature may cause cylinder head to deform, so perform operations at normal temperature.
- Failure to remove cylinder head fixing bolts in order, may cause cylinder head deformation.
- Make scraping marks on removed bolts and gasket, and they cannot be reused.



- (b) Remove cylinder head and cylinder head gasket.

Caution:

- DO NOT reuse the removed cylinder head gasket, and it is necessary to replace it with new one. Be careful not to lose cylinder head mounting dowel pin during removal.



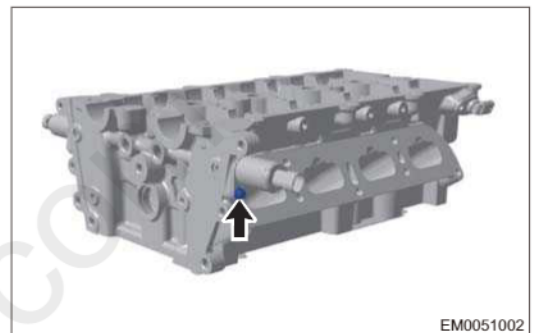
Disassembly

1. Disassemble the cylinder head.

- (a) Remove intake variable timing control valve fixing bolt (arrow), and remove intake variable timing control valve assembly.

Tightening torque

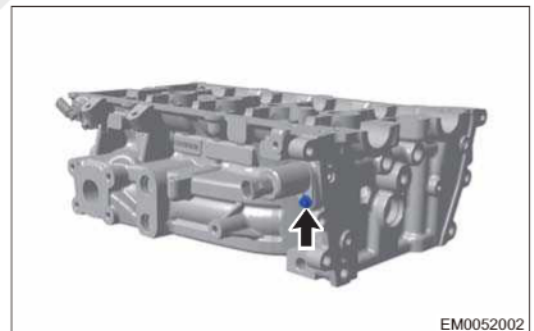
6 + 2 N·m



- (b) Remove exhaust variable timing control valve fixing bolt (arrow), and remove exhaust variable timing control valve assembly.

Tightening torque

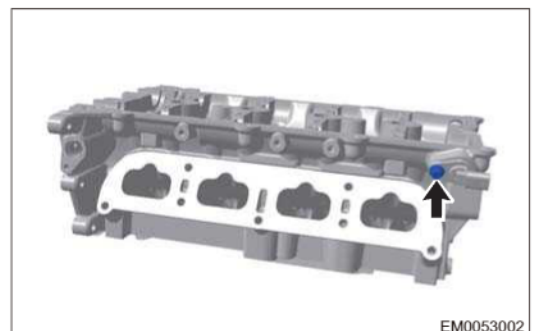
6 + 2 N·m



- (c) Remove intake camshaft position sensor fixing bolt (arrow), and remove sensor assembly.

Tightening torque

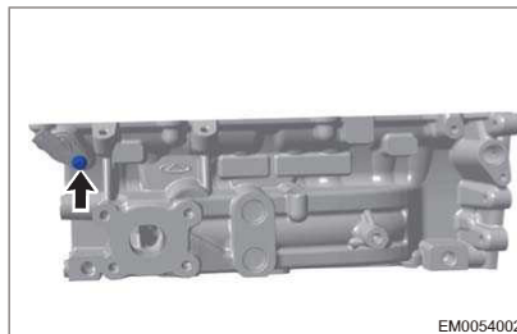
8 + 3 N·m



- (d) Remove exhaust camshaft position sensor fixing bolt (arrow), and remove sensor assembly.

Tightening torque

8 + 3 N·m



EM0054002

- (e) Remove 2 rear lifting eye fixing bolts.

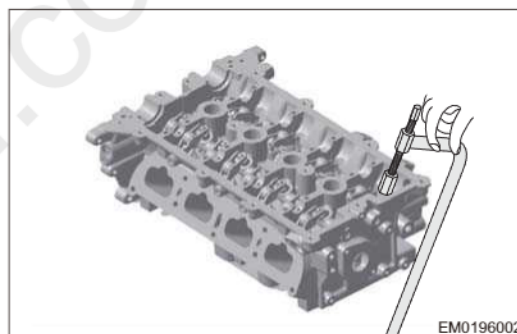
Tightening torque

20 + 5 N·m



EM0247002

- (f) Using a valve spring compressor, compress valve spring to a position so that valve cotter can be removed.



EM0196002

- (g) Using a magnetic rod, remove valve cotter.

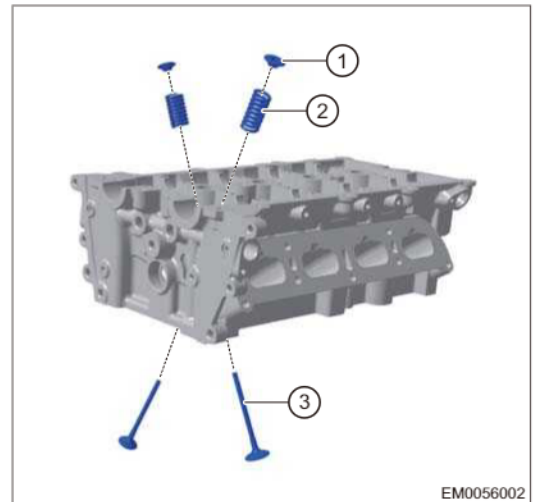
Caution:

- Due to the valve cotter is small, please operate carefully when removing it to avoid loss.



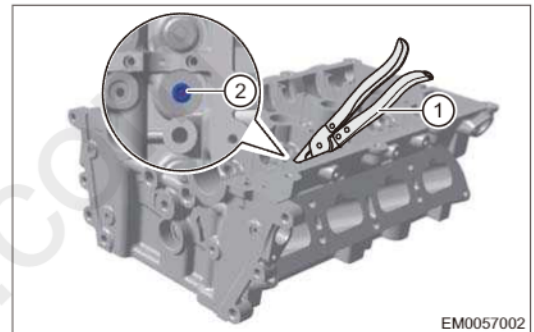
EM0197002

- (h) Remove valve spring upper seat (1), valve spring (2) and intake and exhaust valve (3) from cylinder head.



EM0056002

- (i) Using a valve oil seal remover (1), remove the valve oil seal (2).



EM0057002

- (j) Using a magnetic rod, remove valve spring lower seat.

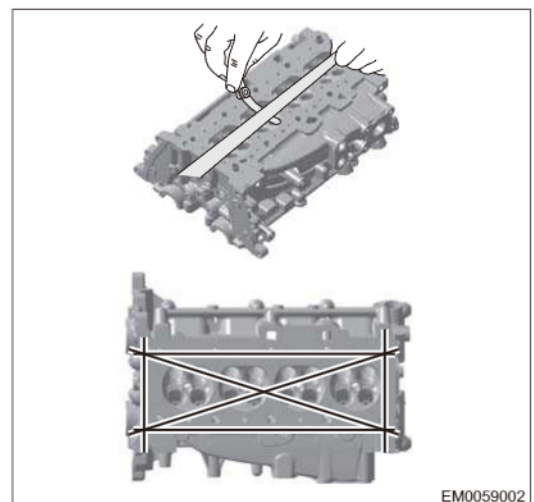
Inspection

1. Check the cylinder head assembly.
 - (a) Check the appearance.
 - Check if there are scratches on camshaft bearing journals.
 - Remove carbon deposits inside valve guides with cleaner.
 - Make sure valve stem can move and rotate freely in its mounting hole.
 - (b) Check the cylinder head flatness.

Using a precision straightedge and feeler gauge, check cylinder head flatness.

Measurement Item	Specification (mm)	Limit Value (mm)
Cylinder Head Flatness	0.04	0.04

If cylinder head flatness is not within specified range, replace cylinder head assembly.



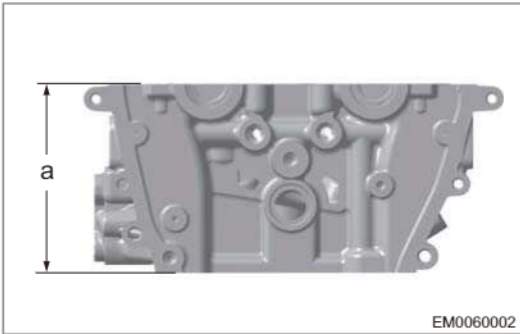
EM0059002



- (c) Check the cylinder head height.
Using a precision straightedge, measure cylinder head height.

Measurement Item	Specification (mm)
Cylinder Head Height	141.05

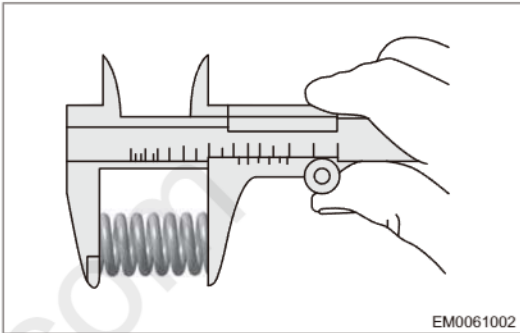
If cylinder head height is not within specified range, replace cylinder head assembly.



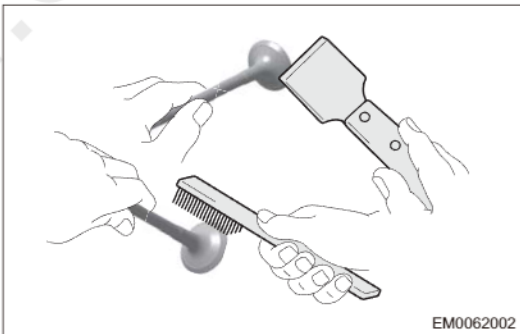
2. Check the valve spring.
Using a vernier caliper, measure free length of valve spring and length of valve spring under the pre-pressure of 229 - 251 N.

Measurement Item	Specification (mm)
Valve Spring Free Length	47.8
Valve Spring Length Under Pre-pressure of 229 - 251 N	41

If valve spring length is not within specified range, replace valve spring.



3. Check the valve.
- (a) Clean the valve.
- Using a scraper, remove carbon deposited on valve head.
 - Using a wire brush, clean the valve thoroughly.



- (b) Check the valve height.
Using a micrometer, measure the valve height.

Measurement Item	Specification (mm)
Intake Valve Height	107.75 - 108.25
Exhaust Valve Height	106.07 - 106.57

If valve height is less than specified value, replace valve.



- (c) Check the valve head.
- Measure margin thickness (a) of valve head.
 - Measure width (b) of valve face.

Measurement Item	Specification (mm)
Intake Valve Head Margin Thickness	0.68 - 1.1
Exhaust Valve Head Margin Thickness	0.48 - 0.9
Intake Valve Face Width	1.154
Exhaust Valve Face Width	1.307

If valve head margin thickness and face width are not within specified range, replace valve.

- (d) Check the valve stem diameter.
Using a micrometer, measure the valve stem diameter.

Measurement Item	Specification (mm)
Intake Valve Stem Diameter	5.98 ± 0.008
Exhaust Valve Stem Diameter	5.96 ± 0.008

If valve stem diameter is not within specified range, check clearance between valve stem and valve guide.

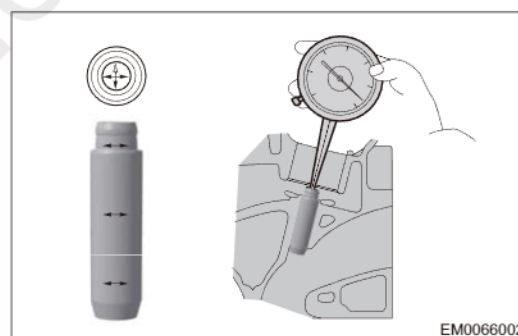
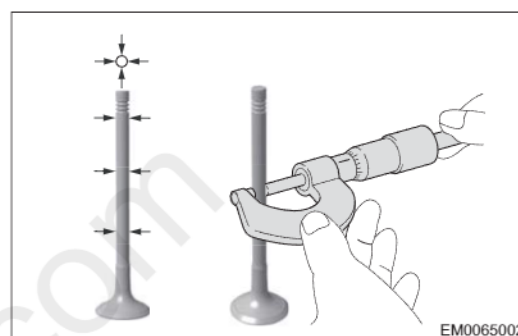
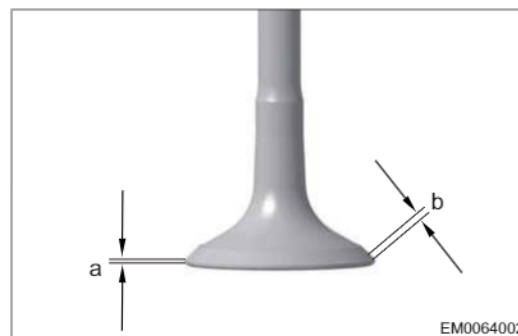
- (e) Check clearance between valve stem and valve guide.
Using a caliper gauge, measure inner diameter of valve guide.

Measurement Item	Specification (mm)
Valve Guide Inner Diameter	6.0 - 6.015

Clearance between valve stem and valve guide =
Valve guide inner diameter - Valve stem diameter

Measurement Item	Specification (mm)
Clearance Between Intake Valve and Valve Guide	0.012 - 0.043
Clearance Between Exhaust Valve and Valve Guide	0.032 - 0.063

If clearance between valve and valve guide is not within specified range, replace valve or valve guide.



Assembly

Warning/Caution/Hint

Caution:

- Soak valve oil seal in oil for several minutes before installing valve oil seal.
- Check if valve spring lower seat is installed properly before installing valve spring.

Hint:

Clean all components to be assembled thoroughly before assembly.

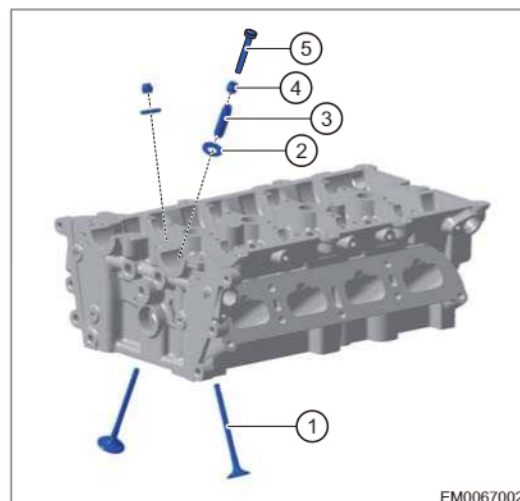
1. Assemble the cylinder head.



- (a) Install valve (1) into cylinder head.

Hint:

- Distinguish intake valves and exhaust valves during installation. Diameter of intake valve head is larger than that of exhaust valve head.
- Apply engine oil to valve stem end, when assembling valve.



EM0067002

- (b) Install new valve spring lower seat (2) if necessary.

Caution:

- Bottom plane of valve spring lower seat should contact with cylinder head with flange facing upward.

- (c) Install the valve oil seal.

Hint:

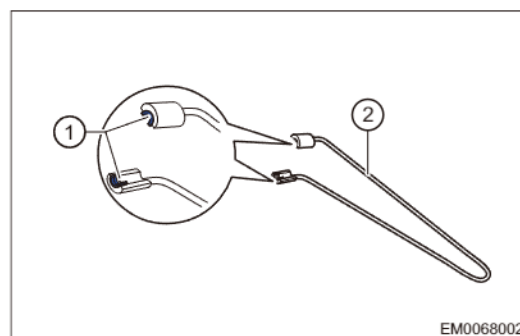
Apply engine oil to valve oil seal lip, when assembling valve oil seal.

- (1) Install valve oil seal guide sleeve (3) to valve.
- (2) Install valve oil seal (4) to valve oil seal guide sleeve.
- (3) Press valve oil seal installer (5) lightly by hand to install valve oil seal (4) in place.

Caution:

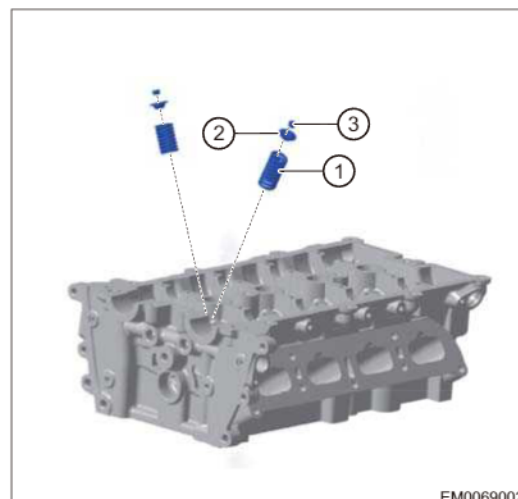
- Check valve spring lower seat and valve oil seal for wrong installation, neglected installation and over installation.

- (d) Install valve cotter (1) to valve cotter installer (2).



EM0068002

- (e) Install valve spring (1) and valve spring upper seat (2). Using a valve spring compressor, compress valve spring to a position so that valve cotter can be installed. Using a valve cotter installer, install valve cotter (3) in place.



EM0069002

- (f) Tap tip of valve stem lightly with a rubber hammer to make sure valve cotter is installed in place after assembly.

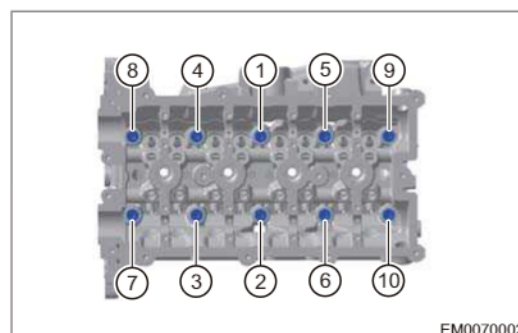
07

Installation

Warning/Caution/Hint

Caution:

- DO NOT damage or lose dowel pin on cylinder block.
 - Remove residual seal gum and oil on cylinder head and cylinder block.
 - Replace the cylinder head gasket.
 - Check that cylinder head gasket is neat and clean without any chips and scratches, and the side stamped with part number faces upward.
 - Install cylinder head gasket to flat surface of cylinder block with a dowel pin.
 - Clean junction surface between cylinder head and combustion chamber, and remove any accumulated oil at bottom of cylinder block thread hole.
 - During installation, piston should not be located at the top dead center, in order to prevent it from being impacted by opening valve, when installing the camshaft.
 - Replace cylinder head fixing bolt and washer, and make scraping marks on removed bolt.
 - Install the cylinder head bolt washer with chamfering surface facing upward and flat side facing cylinder head.
1. Tighten cylinder head fixing bolts in order from (1) to (10) shown in illustration:
- (a) Tighten bolts in place by hands.



EM0070002



(b) Tighten cylinder head fixing bolts according to following procedures:

- (1) 1st step: Tighten bolts to 40 ± 5 N·m in order from (1) to (10) shown in illustration.
- (2) 2nd step: Rotate bolts clockwise by $90 \pm 5^\circ$ in tightening order.
- (3) 3rd step: Rotate bolts clockwise by $90 \pm 5^\circ$ in tightening order again.

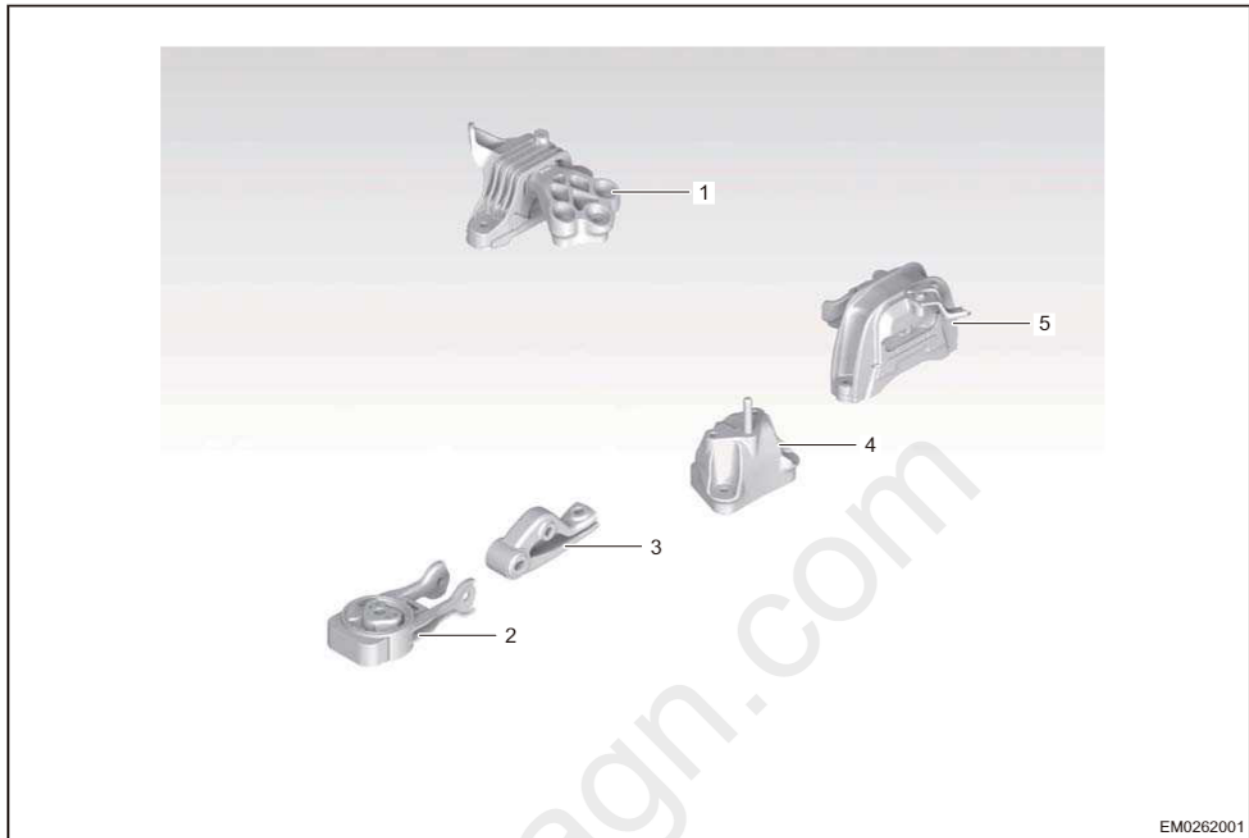
Caution:

- Check cylinder head fixing bolts before installation. If damaged, replace them immediately.
- Be sure to tighten cylinder head bolts strictly according to operating procedures above, to achieve the technology standard for vehicle usage.

2. Other installation procedures are in the reverse order of removal.

Engine Mounting Assembly

For DCT Models



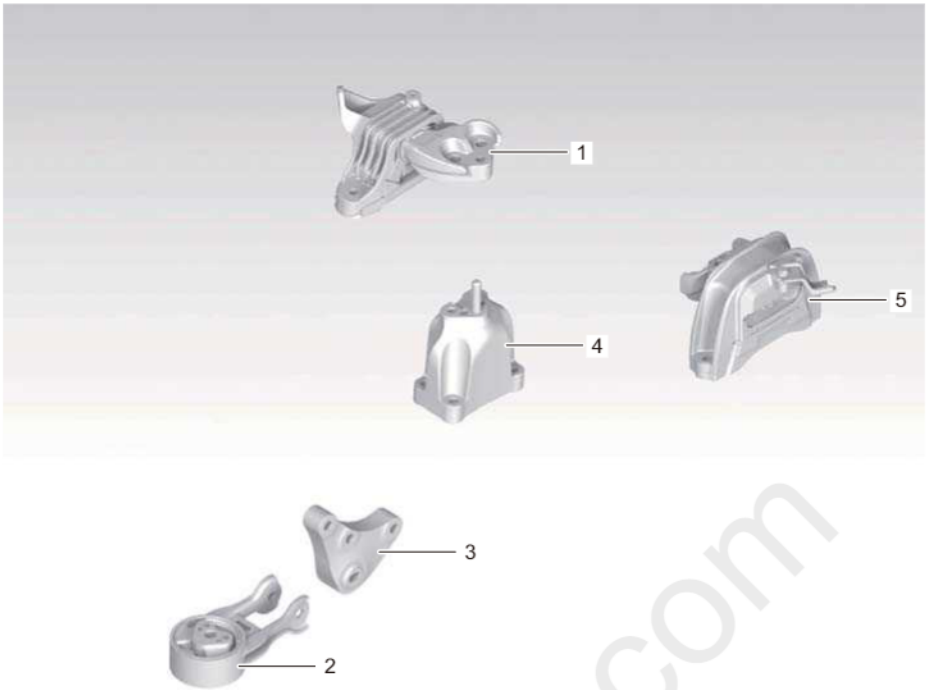
07

1 - Right Mounting Cushion	2 - Rear Mounting Lower Body
3 - Rear Mounting Upper Body	4 - Left Mounting Bracket
5 - Left Mounting Cushion	



For MT Models

07



EM0301001

1 - Right Mounting Cushion	2 - Rear Mounting Lower Body
3 - Rear Mounting Upper Body	4 - Left Mounting Bracket
5 - Left Mounting Cushion	

Removal & Installation - Rear Mounting Assembly (for DCT models)

Warning/Caution/Hint

Caution:

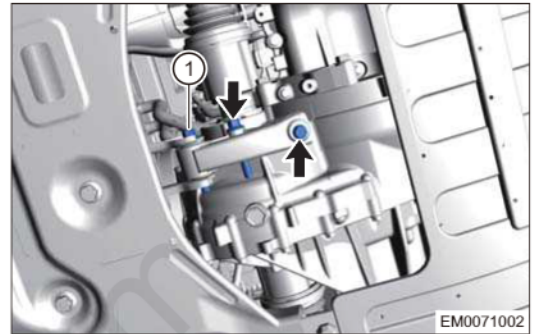
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the rear mounting upper body.

- (a) Remove coupling bolt (1) between rear mounting upper body and lower body.

Tightening torque

$105 \pm 10 \text{ N}\cdot\text{m}$



- (b) Remove coupling bolts (arrow) between rear mounting upper body and transmission.

Tightening torque

$80 \pm 5 \text{ N}\cdot\text{m}$

- (c) Remove the rear mounting upper body.

4. Remove the rear mounting lower body.

- (a) Remove coupling bolt (arrow) between rear mounting lower body and sub frame.

Tightening torque

$150 \pm 10 \text{ N}\cdot\text{m}$



- (b) Remove the rear mounting lower body.

Installation

1. Installation is in the reverse order of removal.

Caution:

- Pre-tighten 2 or 3 threads manually first during assembly of bolts and nuts, then pre-tighten and tighten it to specified torque with a tool.



Removal & Installation - Rear Mounting Assembly (for MT models)

Warning/Caution/Hint

Caution:

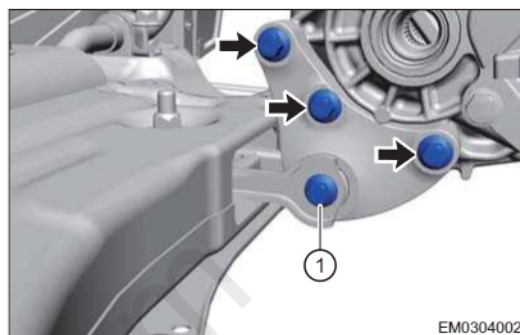
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the rear mounting upper body.

- (a) Remove coupling bolt (1) between rear mounting upper body and lower body.

Tightening torque

$105 \pm 10 \text{ N}\cdot\text{m}$



- (b) Remove 3 coupling bolts (arrow) between rear mounting upper body and transmission.

Tightening torque

$80 \pm 5 \text{ N}\cdot\text{m}$

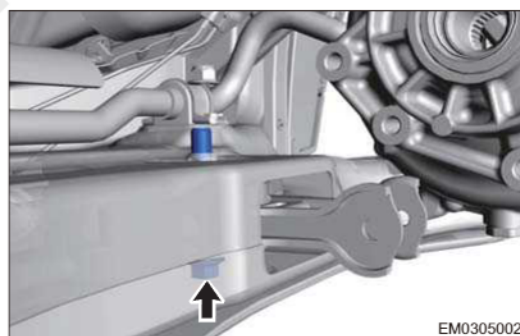
- (c) Remove the rear mounting upper body.

4. Remove the rear mounting lower body.

- (a) Remove coupling bolt (arrow) between rear mounting lower body and sub frame.

Tightening torque

$150 \pm 10 \text{ N}\cdot\text{m}$



- (b) Remove the rear mounting lower body.

Installation

1. Installation is in the reverse order of removal.

Caution:

- Pre-tighten 2 or 3 threads manually first during assembly of bolts and nuts, then pre-tighten and tighten it to specified torque with a tool.

Removal & Installation - Left Mounting Assembly (for DCT models)

Warning/Caution/Hint

Caution:

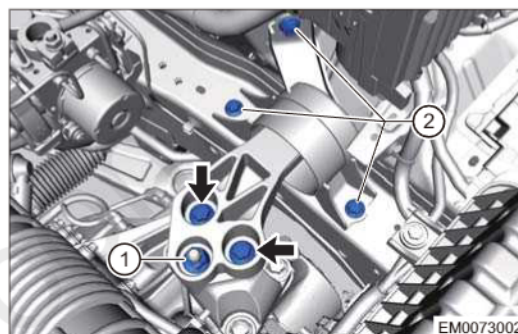
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Use an engine equalizer to hang engine assembly.
4. Remove the air filter assembly (See page 10-7).
5. Remove the battery assembly (See page 16-12).
6. Remove the battery tray (See page 16-15).
7. Remove the left mounting cushion assembly.

- (a) Remove 2 coupling bolts (arrow) and 1 coupling nut (1) between left mounting cushion assembly and left mounting bracket.

Tightening torque

$80 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove 3 fixing bolts (2) between left mounting cushion assembly and left side rail wheel house assembly.

Tightening torque

$60 \pm 5 \text{ N}\cdot\text{m}$

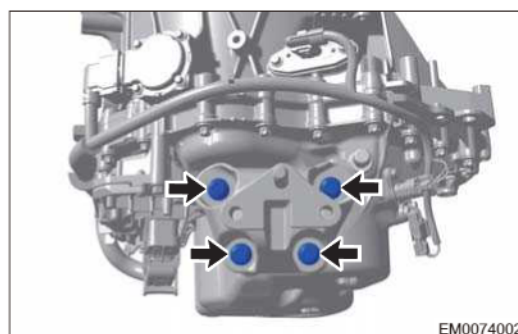
- (c) Remove the left mounting cushion assembly.

8. Remove the left mounting bracket.

- (a) Remove 4 coupling bolts (arrow) between left mounting bracket and transmission.

Tightening torque

$60 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove the left mounting bracket.

Installation

1. Installation is in the reverse order of removal.

Caution:

- When installing left mounting cushion assembly to left side rail wheel house assembly, tighten locating bolt on side rail first, then tighten the other bolt on side rail, and then the bolt on wheel house.
- Pre-tighten 2 or 3 threads manually first during assembly of bolts and nuts, then pre-tighten and tighten it to specified torque with a tool.



Removal & Installation - Left Mounting Assembly (for MT models)

Warning/Caution/Hint

Caution:

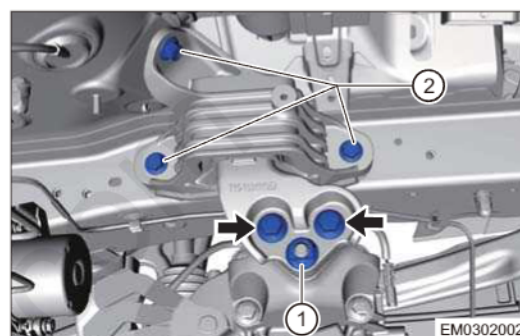
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Use an engine equalizer to hang engine assembly.
4. Remove the air filter assembly (See page 10-8).
5. Remove the battery assembly (See page 16-12).
6. Remove the battery tray (See page 16-15).
7. Remove the left mounting cushion assembly.

- (a) Remove 2 coupling bolts (arrow) and 1 coupling nut (1) between left mounting cushion assembly and left mounting bracket.

Tightening torque

$80 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove 3 fixing bolts (2) between left mounting cushion assembly and left side rail wheel house assembly.

Tightening torque

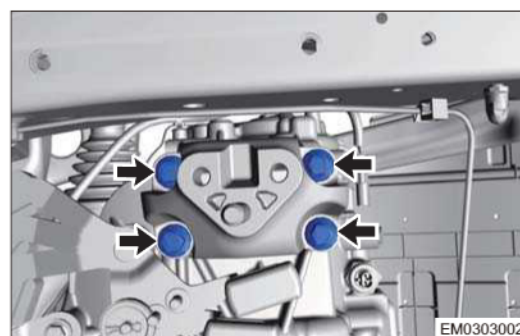
$60 \pm 5 \text{ N}\cdot\text{m}$

- (c) Remove the left mounting cushion assembly.
8. Remove the left mounting bracket.

- (a) Remove 4 coupling bolts (arrow) between left mounting bracket and transmission.

Tightening torque

$60 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove the left mounting bracket.

Installation

1. Installation is in the reverse order of removal.

Caution:

- When installing left mounting cushion assembly to left side rail wheel house assembly, tighten locating bolt on side rail first, then tighten the other bolt on side rail, and then the bolt on wheel house.
- Pre-tighten 2 or 3 threads manually first during assembly of bolts and nuts, then pre-tighten and tighten it to specified torque with a tool.

Removal & Installation - Right Mounting Assembly

Warning/Caution/Hint

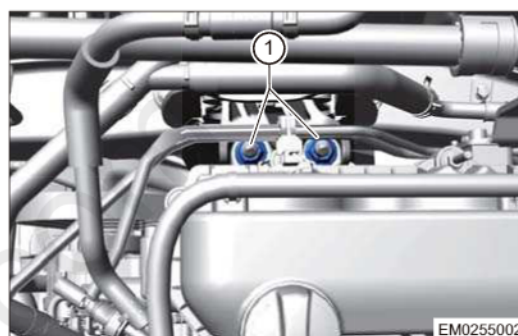
Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the engine trim cover.
 4. Drain the coolant (See page 12-10).
 5. Remove the expansion tank assembly (See page 12-18).
 6. Use an engine equalizer to hang engine assembly.
 7. Remove the engine right mounting cushion assembly.

- (a) Remove 2 coupling nuts (1) between right mounting cushion assembly and engine.

Tightening torque

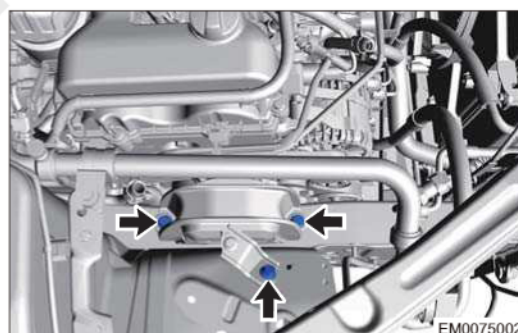
$80 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove 3 coupling bolts (arrow) between right mounting cushion assembly and body.

Tightening torque

$60 \pm 5 \text{ N}\cdot\text{m}$



- (c) Remove the engine right mounting cushion assembly.

Installation

1. Installation is in the reverse order of removal.

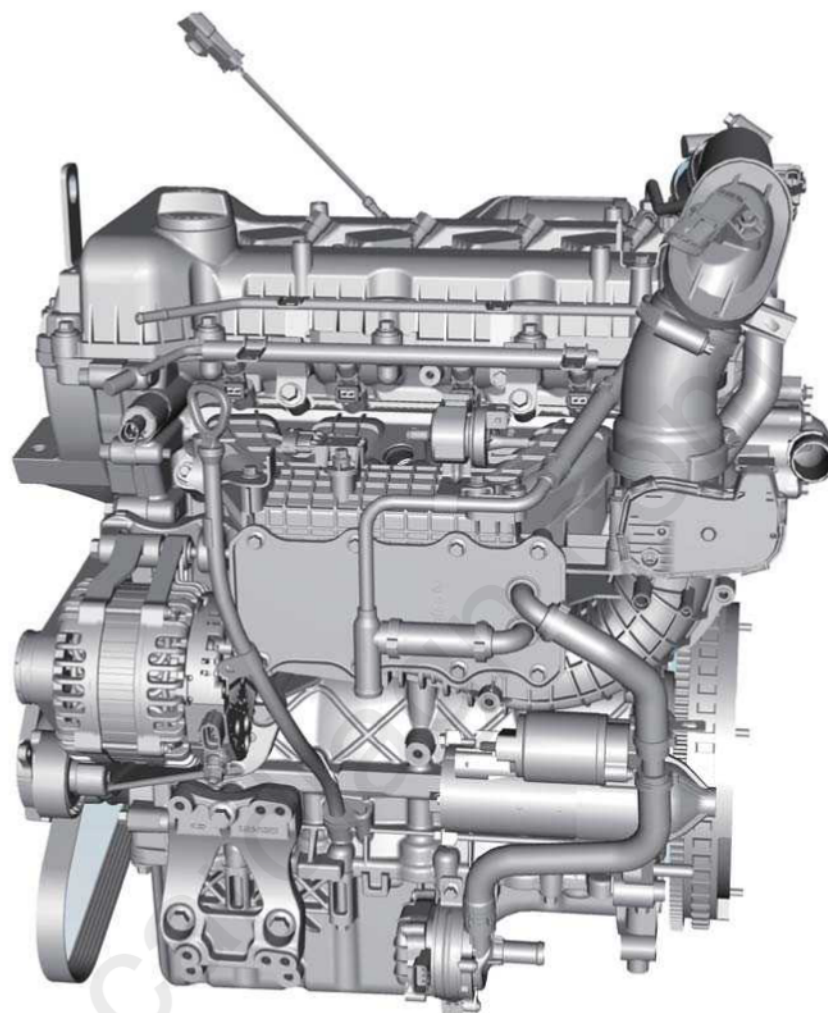
Caution:

- When installing right mounting cushion assembly to right side rail wheel house assembly, tighten locating bolt on side rail first, then tighten the other bolt on side rail, and then the bolt on wheel house.
- Pre-tighten 2 or 3 threads manually first during assembly of bolts and nuts, then pre-tighten and tighten it to specified torque with a tool.



Engine Assembly

Description



EM0263001

Removal

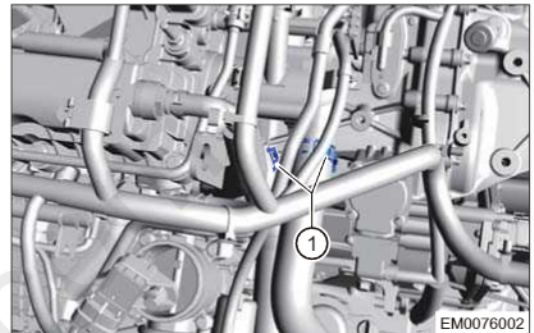
Warning/Caution/Hint

Caution:

- Remove engine and transmission as an assembly.
 - Install protector to prevent body from being scratched.
 - Plug inlet port of intake pipe to prevent foreign matter from entering after removing intake system components. Or the foreign matter will block cylinder intake passage when starting to seriously damage the engine.
1. Remove the engine trim cover.
 2. Release the fuel system pressure ([See page 08-8](#)).
 3. Turn off all electrical equipment and the ignition switch.
 4. Remove the battery assembly ([See page 16-12](#)).
 5. Remove the battery tray ([See page 16-15](#)).

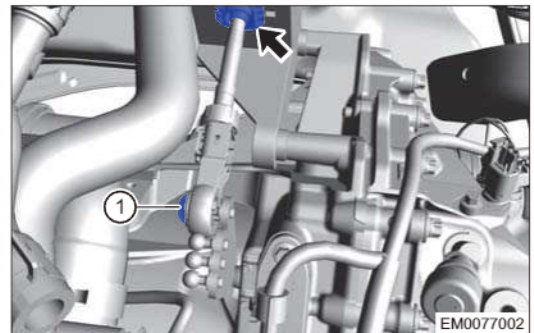
6. Remove the air filter assembly (See page 10-8).
7. Remove brake vacuum pump and its mounting bracket.
8. Remove electric water pump and its mounting bracket (See page 12-31).
9. Remove the intake manifold assembly (See page 10-18).
10. Remove the turbocharger assembly (See page 11-10).
11. Remove the precatalytic converter assembly (See page 11-16).
12. Drain the engine oil (See page 13-10).
13. Drain the transmission oil (See page 18-144).
14. Drain the coolant (See page 12-10).
15. Recover the refrigerant (See page 29-82).
16. Disconnect engine inlet and outlet hoses.

- (a) Loosen elastic clamps (1) and disconnect connections between engine inlet and outlet hoses and thermostat seat.



17. Disconnect connection between shift cable and transmission (for DCT models).

- (a) Loosen fixing lock pin (1), and disconnect connection between shift cable and outer shift lever.



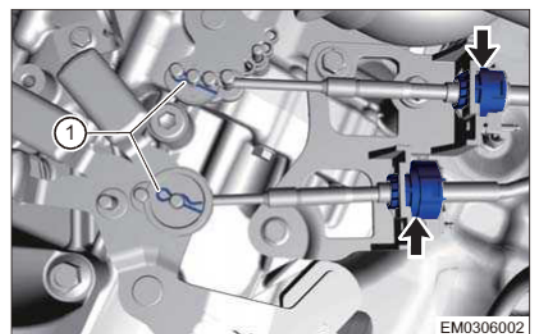
- (b) Detach shift cable damper from bracket limit hole.
- (c) Move shift cable to one side.

Caution:

- For details of removal and installation, refer to (DCT) section.

18. Disconnect connection between shift cable and transmission (for MT models).

- (a) Remove gear select and shift cable pins (1) separately, and remove gear select and shift cable joints from transmission rocker arm.



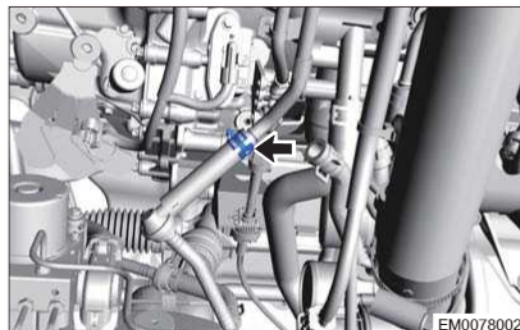
- (b) Detach gear select and shift cable dampers (arrow) from flexible shaft bracket limit hole. Then move cables to one side.

Caution:

- For details of removal and installation, refer to (6MT) section.

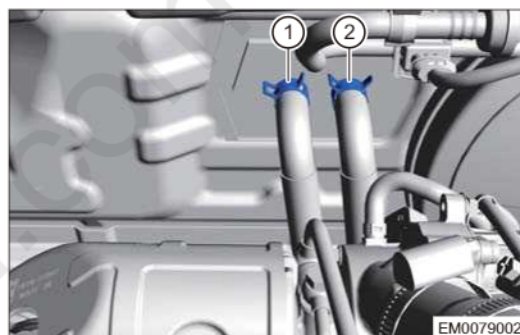
19. Disconnect the vacuum pipe.

- (a) Loosen elastic clamp (arrow) and disconnect connection between brake vacuum hose and brake vacuum steel pipe.



20. Disconnect connection between hose and heater core.

- (a) Loosen elastic clamp (1) and disconnect connection between heater core inlet hose and heater core.

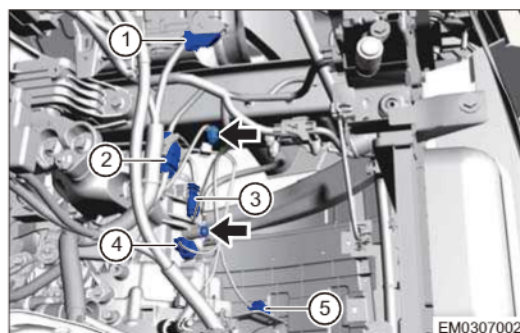


- (b) Loosen elastic clamp (2) and disconnect connection between heater core outlet hose and heater core.

21. Remove the expansion tank assembly (See page 12-18).

22. Disconnect the following wire harnesses (for MT models).

- (a) Disconnect the ECU wire harness connector (1).



- (b) Disconnect wire harness connector (2) between engine and engine compartment.
- (c) Disconnect the neutral switch connector (3).
- (d) Disconnect the back-up light switch connector (4).
- (e) Disconnect the electronic vacuum pump connector (5).
- (f) Remove the power assembly ground wire fixing bolt (arrow).

Tightening torque

45 ± 5 N·m

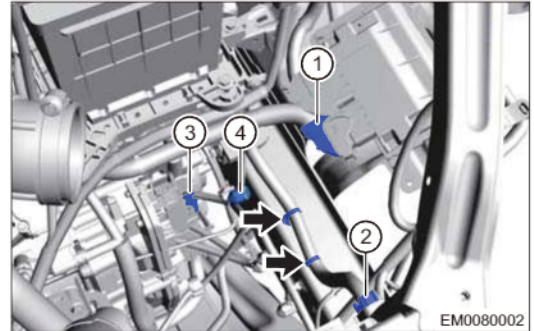
- (g) Remove the engine ground wire fixing nut (arrow).

Tightening torque

15 ± 2.5 N·m

23. Disconnect the following wire harnesses (for DCT models).

- (a) Disconnect the ECU wire harness connector (1).



- (b) Disconnect wire harness connector (2) between engine and engine compartment.

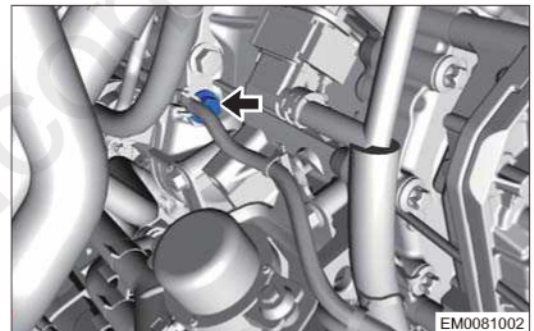
- (c) Disconnect the engine wire harness fixing clip (arrow).

- (d) Disconnect the transmission control unit wire harness connector (3).

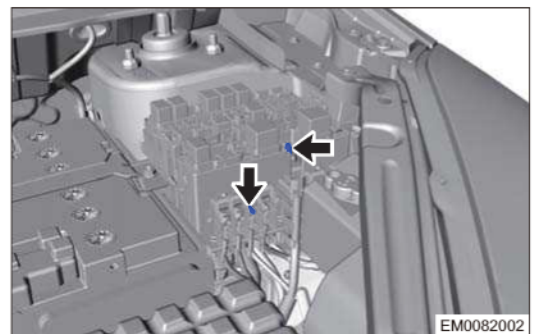
- (e) Remove the engine ground wire fixing nut (4).

Tightening torque $15 \pm 2.5 \text{ N}\cdot\text{m}$

- (f) Remove the power assembly ground wire fixing bolt (arrow).

Tightening torque $45 \pm 5 \text{ N}\cdot\text{m}$ 

- (g) Remove fixing nuts (arrow) between engine compartment fuse and relay box and battery wire harness, and disconnect the connection.

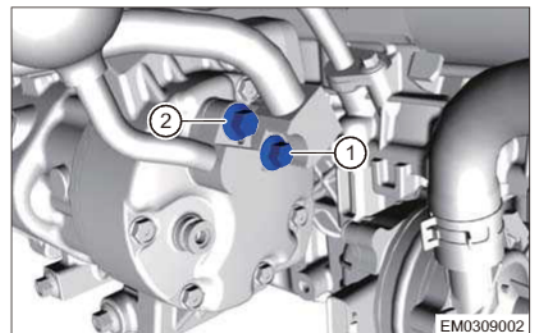
Tightening torque $13 \pm 2 \text{ N}\cdot\text{m} / 6 \pm 1 \text{ N}\cdot\text{m}$ 

24. Remove the front wheel (See page 24-8).

25. Remove the drive shaft (See page 20-5).

26. Remove A/C compressor high and low pressure pipes.

- (a) Remove coupling bolt (1) between low pressure pipe and A/C compressor assembly, and disconnect low pressure pipe.

Tightening torque $25 \pm 3 \text{ N}\cdot\text{m}$ 

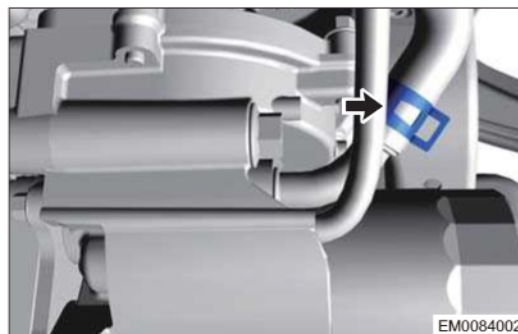
- (b) Remove coupling bolt (2) between high pressure pipe and A/C compressor assembly, and disconnect high pressure pipe.

Tightening torque

$25 \pm 3 \text{ N}\cdot\text{m}$

- 27. Disconnect the water supply pipe.

- (a) Loosen elastic clamp (arrow) and disconnect connection between expansion tank water supply pipe and oil filter module assembly.



- 07 28. Use an engine equalizer to hang engine assembly.
- 29. Remove the rear mounting assembly (See page 07-58).
- 30. Remove the left mounting assembly (See page 07-60).
- 31. Remove the right mounting assembly (See page 07-61).
- 32. Check that engine assembly is separated with external components.
- 33. Hang out engine assembly from engine compartment.
- 34. Remove engine wire harness and battery wire harness from engine.
- 35. Separate engine assembly and transmission assembly.
- 36. Install engine assembly to engine service platform.

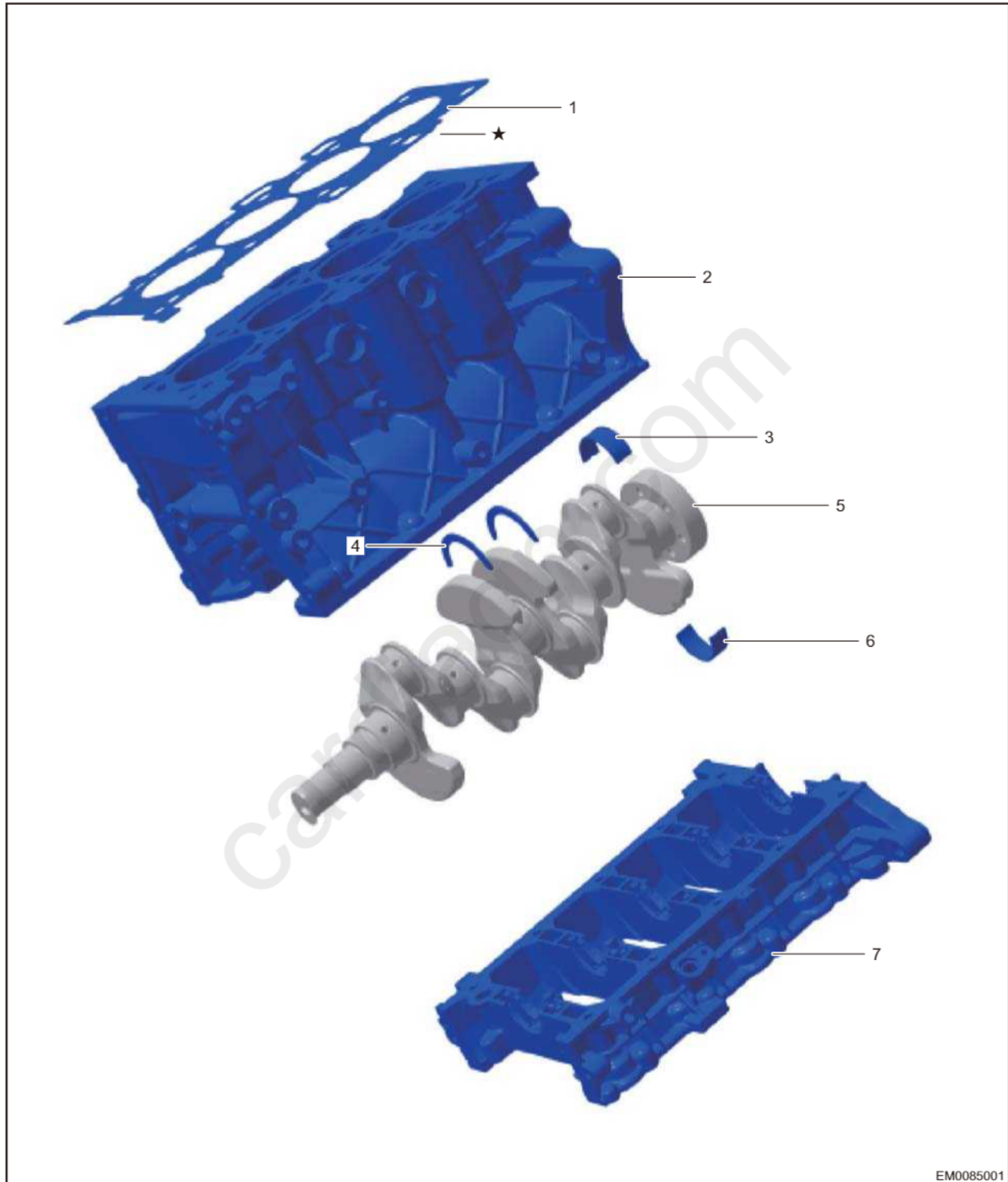
Installation

- 1. Installation is in the reverse order of removal.

CYLINDER BLOCK UNIT REPAIR

Cylinder Block

Description



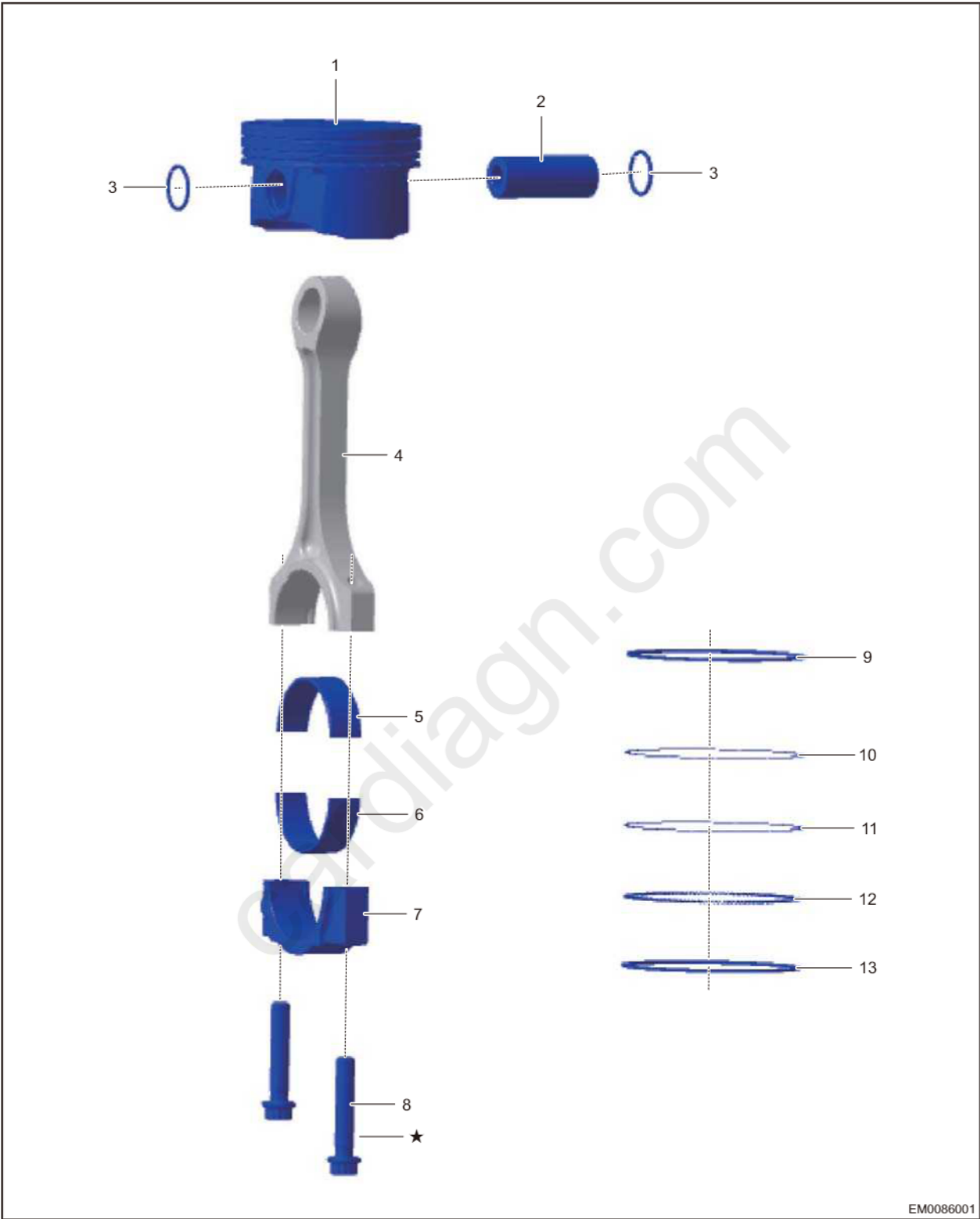
EM0085001

1 - Cylinder Head Gasket	2 - Cylinder Block
3 - Crankshaft Main Bearing Upper Shell	4 - Thrust Washer
5 - Crankshaft	6 - Crankshaft Main Bearing Lower Shell
7 - Cylinder Block Frame Assembly	★ - Non-reusable Parts



Description

07



EM0086001

1 - Piston	2 - Piston Pin (Semi-floating)
3 - Elastic Circlip	4 - Connecting Rod Assembly
5 - Connecting Rod Bearing Upper Shell	6 - Connecting Rod Bearing Lower Shell
7 - Connecting Rod Bearing Cap	8 - Connecting Rod Bearing Cap Fixing Bolt
9 - First Compression Ring	10 - Second Compression Ring

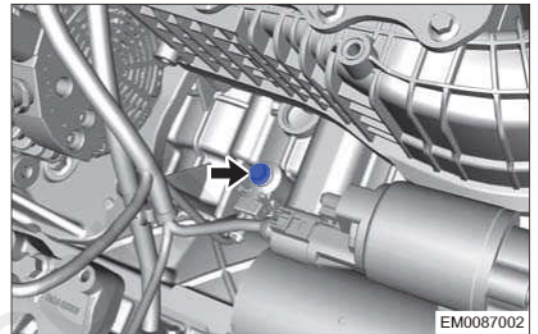
11 - Upper Rail	12 - Expander
13 - Lower Rail	★ - Non-reusable Parts

Disassembly

1. Remove the accessory drive belt (See page 07-18).
2. Remove the idler pulley assembly (See page 07-20).
3. Remove the tensioner assembly (See page 07-21).
4. Remove the thermostat assembly (See page 12-20).
5. Remove the thermostat seat assembly (See page 12-22).
6. Remove the knock sensor.

- (a) Remove knock sensor fixing bolt (arrow), and remove knock sensor.

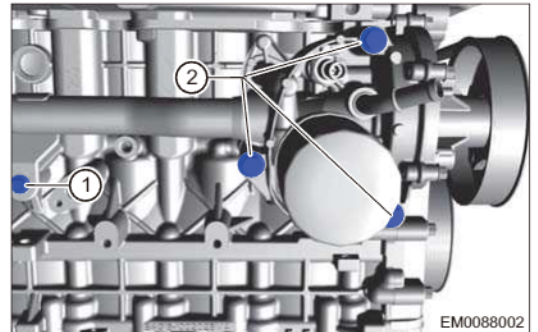
Tightening torque
 $20 \pm 5 \text{ N}\cdot\text{m}$



7. Remove alternator assembly and mounting bracket (See page 16-16).
8. Remove A/C compressor assembly and mounting bracket (See page 29-122).
9. Remove the engine discharge pipe (See page 12-24).
10. Remove the oil filter module.

- (a) Remove fixing bolt (1) from cooling pipe assembly I.

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



- (b) Remove 3 fixing bolts (2) from oil filter module.

Tightening torque
 $40 \pm 5 \text{ N}\cdot\text{m}$

Caution:

- There will be residual coolant inside engine during removal and installation, if your skin contacts coolant directly, clean it with water immediately. If it is serious, please go to hospital.
- Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.
- There will be coolant residue inside engine. Coolant should be handled according to local environmental regulations.



11. Remove the crankshaft pulley.

- (a) Install flywheel special tool (1) to lock flywheel as shown in illustration.



- (b) Remove fixing bolt (arrow) from crankshaft pulley.

Tightening torque

1st step: $100 \pm 10 \text{ N}\cdot\text{m}$

2nd step: $120^\circ \pm 10^\circ$



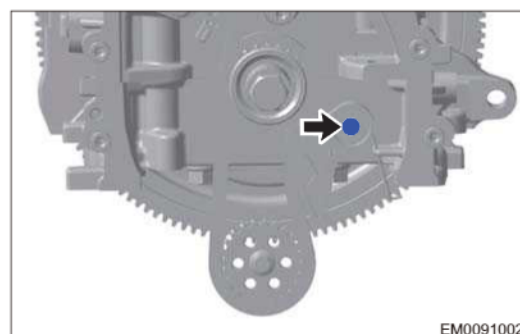
- (c) Remove the crankshaft pulley.

12. Remove the crankshaft front oil seal ([See page 07-24](#)).
13. Remove the flywheel assembly ([See page 07-26](#)).
14. Remove the crankshaft rear oil seal ([See page 07-30](#)).
15. Remove the cylinder head cover assembly ([See page 07-22](#)).
16. Remove the oil pan assembly ([See page 13-17](#)).
17. Remove the timing chain ([See page 07-32](#)).
18. Remove intake and exhaust camshaft assemblies ([See page 07-36](#)).
19. Remove the cylinder head assembly ([See page 07-44](#)).
20. Remove the oil strainer assembly ([See page 13-19](#)).
21. Remove the oil pump assembly ([See page 13-20](#)).
22. Remove the oil pump chain.

- (a) Remove oil pump movable guide rail fixing bolt (arrow), and remove movable guide rail.

Tightening torque

$12 + 2 \text{ N}\cdot\text{m}$



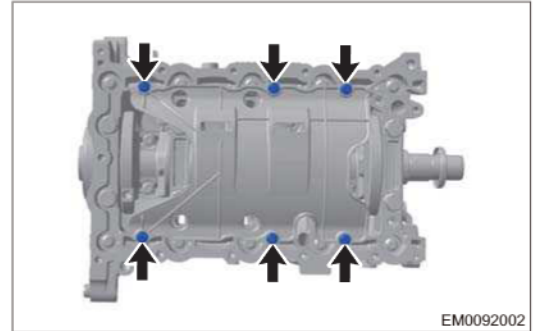
- (b) Remove the oil pump chain.

23. Remove the oil deflector assembly.

- (a) Remove 6 oil deflector fixing bolts (arrow).

Tightening torque

8 + 3 N·m



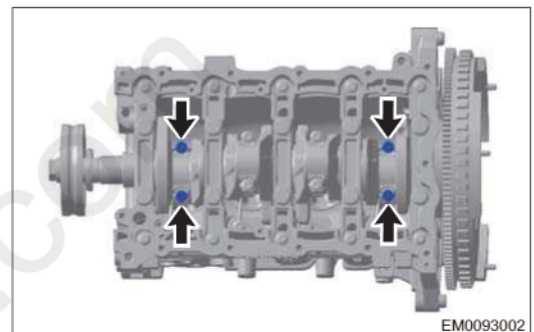
EM0092002

- (b) Remove the oil deflector assembly.

24. Remove the piston connecting rod assembly.

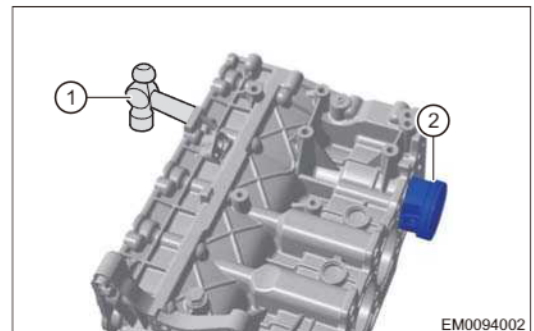
- (a) Using a ridge reamer or equivalent, remove all the carbon deposit from top of cylinder.

- (b) Turn crankshaft, so that pistons of cylinders 1 and 4 are at bottom dead center, remove fixing bolts (arrow) from connecting rod bearing caps of cylinders 1 and 4, and remove connecting rod bearing caps of cylinders 1 and 4.



EM0093002

- (c) Using a hammer handle (1), push out piston connecting rod assembly (2) of cylinders 1 and 4 from cylinder block.



EM0094002

- (d) Removal procedures for piston connecting rod assembly of cylinders 2 and 3 are the same as above.

Caution:

- Please operate carefully when pushing out piston, to avoid cylinder liner damage.
- Mark the removed piston connecting rod assemblies, so as to distinguish them.
- Connecting rod bolts and connecting rod bolt holes must correspond one to one without exchange.
- Replace with new bolts during assembly.

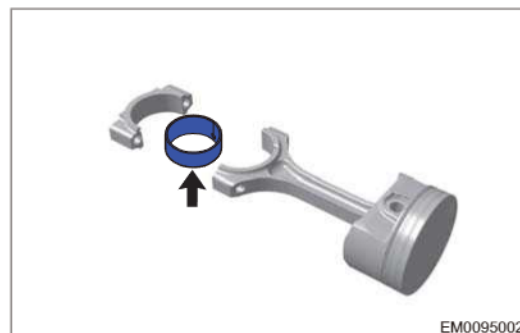


25. Remove the connecting rod bearing shell.

- (a) Remove the connecting rod bearing shell (arrow).

Hint:

Arrange removed parts in correct order.

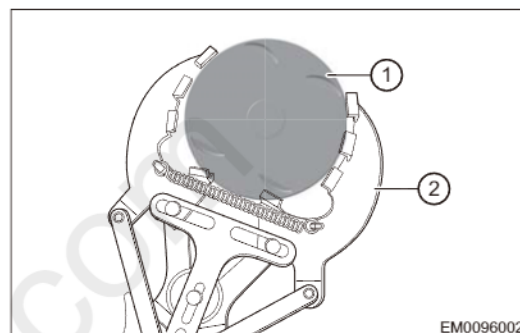


26. Remove the piston rings.

- (a) Using a piston ring remover (1), remove 2 compression rings (2).

Caution:

- Before removing piston ring, check piston ring side clearance. If it is necessary to be reused, be sure to mark piston ring position.



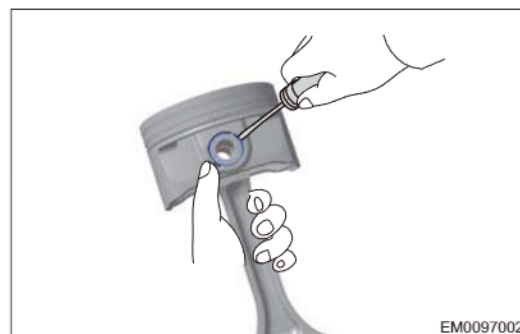
- (b) Remove oil ring rail and expander by hands.

27. Separate piston and connecting rod.

- (a) Using a flat tip screwdriver, pry out elastic circlips at both sides of piston pin carefully from the notch. Carefully pry out elastic circlips on both ends of piston pin.

Caution:

- Elastic circlip has a large tensile force. Be careful during removal to prevent personal injury.



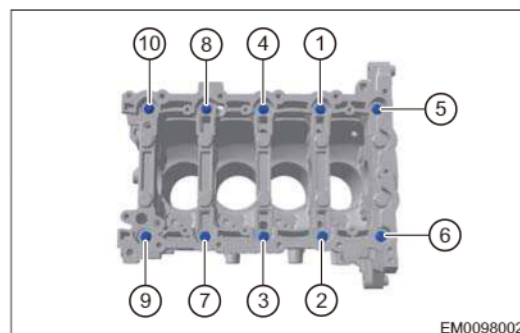
- (b) Remove the piston pin assembly.

28. Remove the crankshaft.

- (a) Evenly loosen and remove crankshaft frame fixing bolts in order shown in illustration.

Tightening torque

27 + 3 N·m



- (b) Evenly loosen and remove crankshaft main bearing cap fixing bolts in order shown in illustration.

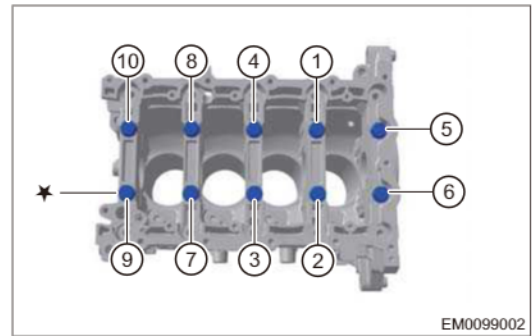
Tightening torque

1st step: $45 \pm 5 \text{ N}\cdot\text{m}$

2nd step: $180^\circ \pm 10^\circ$



Non-reusable Part



- (c) Remove the crankshaft frame assembly.

Hint:

If it is difficult to remove crankshaft frame due to seal gum, lightly tap it with a rubber hammer to loosen it. Be sure not to damage surrounding components.

- (d) Remove the crankshaft assembly.

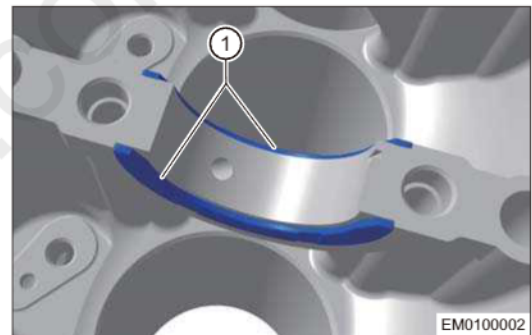
Caution:

- Take care when removing crankshaft, as it is heavy. If necessary, ask other operators to assist. Avoid scratching contact surfaces between crankshaft and bearing shell.

07

29. Remove the thrust washers.

- (a) Remove crankshaft thrust washers (1) from cylinder block.

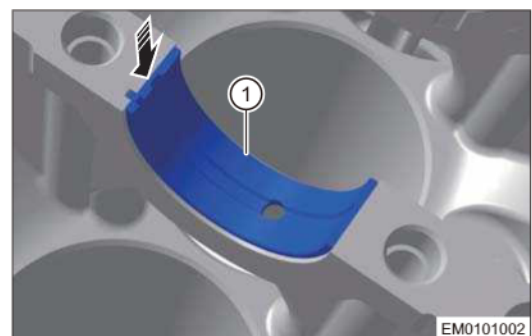


30. Remove the crankshaft main bearing shell.

- (a) Push out crankshaft main bearing upper shell (1) slightly in direction of arrow to remove it.

Hint:

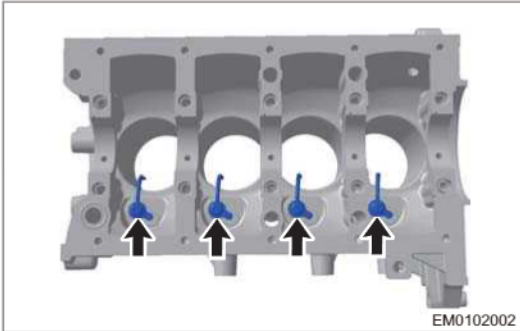
- Remove other crankshaft main bearing upper shells from cylinder block in the same way.
- Pay attention to the notch position. Push out bearing shell carefully as shown in illustration. It is difficult to push out bearing shell and parts may be damaged if pushing in opposite direction.



- (b) Remove crankshaft main bearing lower shell from crankshaft frame in the same way.



31. Remove the piston cooling nozzles.
- (a) Remove piston cooling nozzle fixing bolts (arrow), and remove piston cooling nozzles from cylinder block.
- Tightening torque**
20 + 5 N·m

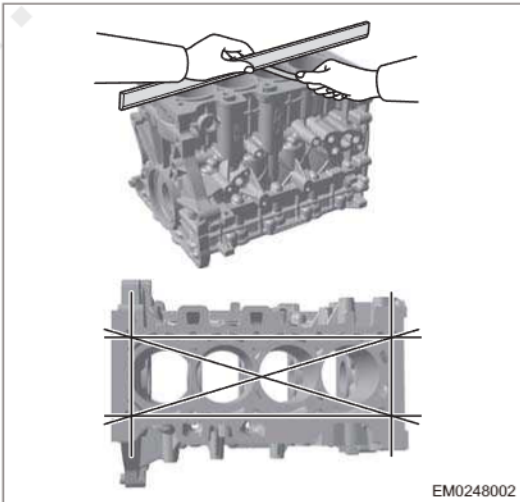


Inspection

1. Check the cylinder block.
- Clean engine block thoroughly and check all hole passages for leakage.
 - Check cylinder liner for cracks.
 - Check cylinder block for cracks.
- Caution:**
- DO NOT wash cylinder at high temperature; otherwise, cylinder liner will stick out beyond cylinder block.
2. Check the cylinder block upper surface flatness.
- (a) Clean the cylinder block upper surface.
- (b) Using precision straightedge and feeler gauge, measure cylinder block upper surface flatness.

Measurement Item	Specification (mm)	Limit Value (mm)
Cylinder Block Upper Surface Flatness	0.04	0.1

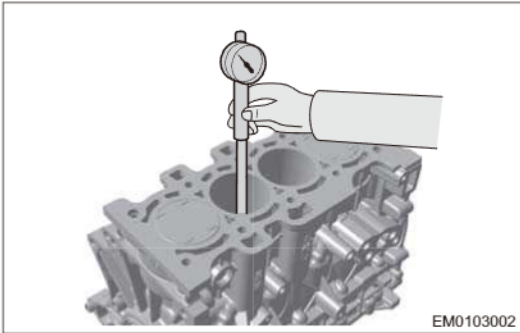
Never grind the cylinder block upper surface. If cylinder block upper surface flatness exceeds limit, replace cylinder block.



3. Check cylinder diameter and piston clearance.
- (a) Using a cylinder gauge, measure cylinder diameter and calculate piston clearance.

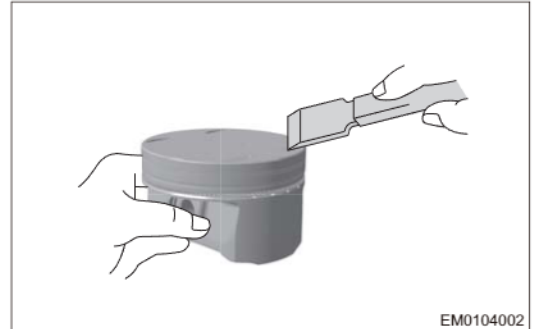
Measurement Item	Specification (mm)	Limit Value (mm)
Cylinder Diameter	77	77.105
Clearance Between Piston and Cylinder	0.04	0.115

If cylinder diameter exceeds the limit, replace cylinder block. If clearance between piston and cylinder exceeds specified value, check cylinder diameter and piston diameter, and replace if necessary.

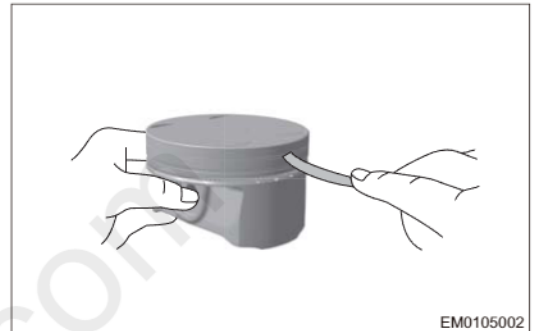


4. Check the piston.

- (a) Using a scraper, remove carbon deposits on piston top.



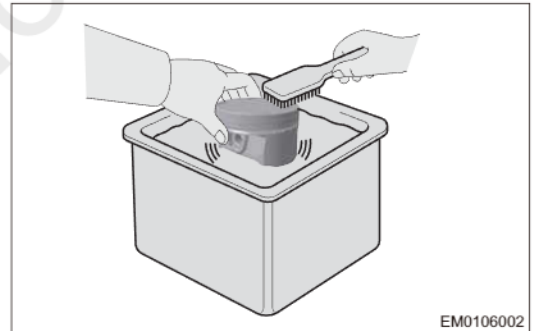
- (b) Using a piston ring, remove carbon deposits from piston ring grooves.



- (c) Using a brush and solvent, thoroughly clean piston.

Caution:

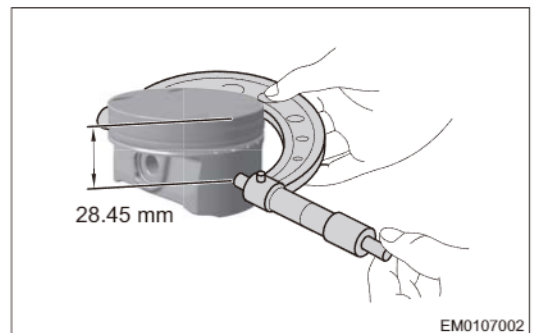
- DO NOT use a wire brush to clean.



- (d) Measure piston diameter with a micrometer at a position, that is 28.45 mm below piston skirt in vertical direction of piston pin.

Measurement Item	Specification (mm)
Piston Diameter	76.955 - 76.965

If piston diameter is not within specified range, replace the piston connecting rod assembly.



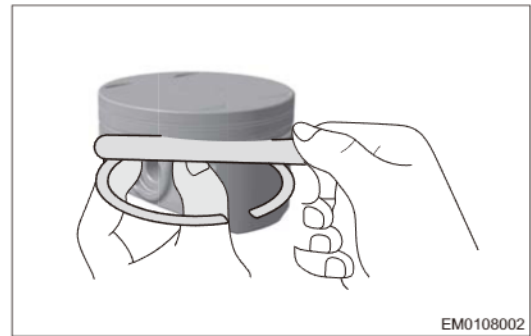
5. Check clearance between piston ring and ring groove side.



- (a) Using a feeler gauge, measure clearance between new piston ring and ring groove side.

Measurement Item	Specification (mm)	Limit Value (mm)
First Compression Ring Groove Side Clearance	0.02 - 0.065	0.13
Second Compression Ring Groove Side Clearance	0.02 - 0.06	0.12

If piston ring side clearance exceeds specified range, replace piston ring and piston assembly.



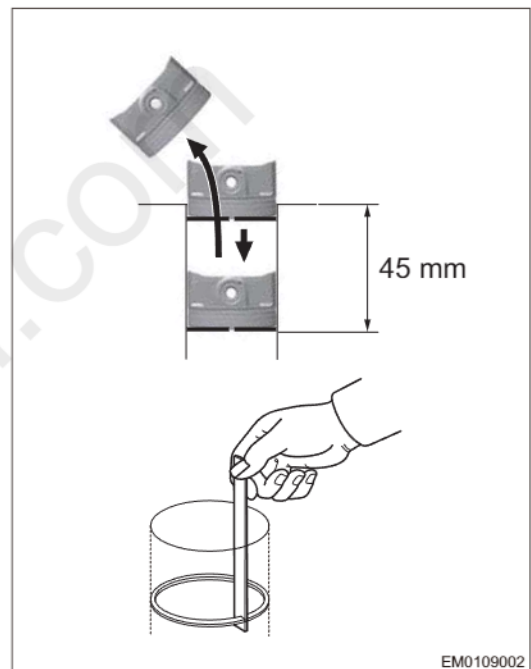
6. Check the piston ring end gap.

- (a) Using a piston, push piston ring from top of cylinder to a position, that is 45 mm from bottom of cylinder bore. Keep the piston ring level.
- (b) Measure at the specified position, which has the minimum piston ring wear with a feeler gauge.

Measurement Item	Specification (mm)
Piston Ring End Gap	First Ring 0.2 - 0.3
	Second Ring 0.3 - 0.5

If piston ring end gap is not within specified range, replace piston ring with a new set.

If end gap is still not within specified range after replacement, replace cylinder block assembly.



7. Check the piston pin.

- (a) Using a feeler gauge, measure diameter of piston pin hole.

Measurement Item	Specification (mm)
Piston Pin Hole Diameter	18.004 - 18.009

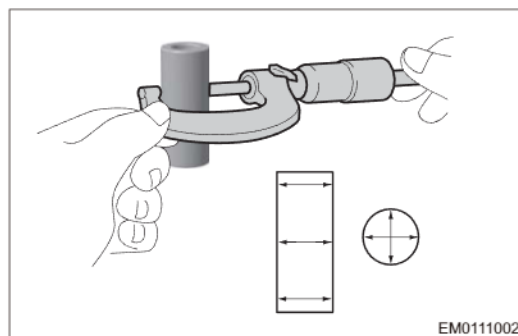
If piston pin hole diameter is not within specified range, replace piston.



- (b) Using an outer diameter micrometer, measure diameter of piston pin.

Measurement Item	Specification (mm)
Piston Pin Diameter	17.995 - 18

If piston pin diameter is not within specified range, replace piston pin.



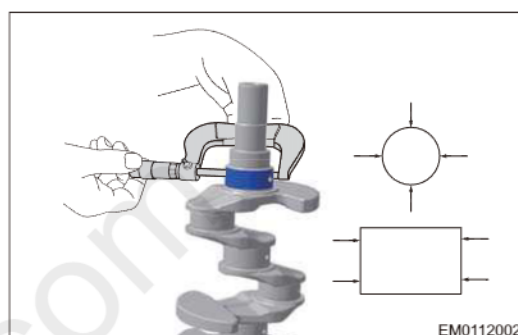
8. Check the crankshaft main journal diameter.

- (a) Measure crankshaft main journal diameter with an outer diameter micrometer, and measure again after rotating the crankshaft 90°.

Measurement Item	Specification (mm)	Limit Value (mm)
Crankshaft Main Journal Diameter	50	49.984
Taper and Out-of-roundness	0	0.008

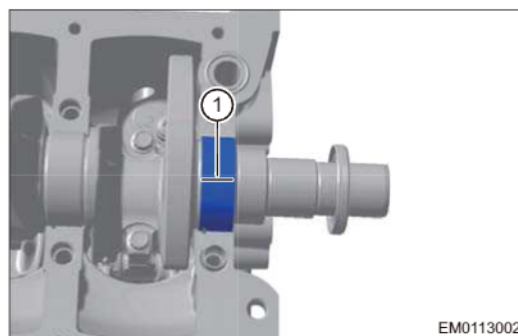
If crankshaft main journal diameter is not within specified range, replace main bearing shells with new ones and check matching clearance of crankshaft main bearing.

If matching clearance of main bearing is still not within specified range after replacing with new main bearing shells, replace crankshaft.



9. Check matching clearance of crankshaft main bearing.

- (a) Clean crankshaft main journals and main bearing shells.
- (b) Install the crankshaft. Place feeler gauge (1) on crankshaft main journal, parallel to crankshaft center axis and as wide as distance covered by main bearing cap.



- (c) Install crankshaft frame assembly and tighten main bearing cap fixing bolts to specified torque in order.

Tightening torque

1st step: $45 \pm 5 \text{ N}\cdot\text{m}$

2nd step: $180^\circ \pm 10^\circ$



- (d) Remove the crankshaft frame assembly. Using a feeler gauge, measure widest part of compressed feeler gauge. Measured value is matching clearance of crankshaft main bearing.

Measurement Item	Specification (mm)
Matching Clearance of Crankshaft Main Bearing	0.023 - 0.075

If matching clearance of crankshaft main bearing is not within specified range, install new main bearing shells. Replace crankshaft assembly if necessary.

Caution:

- Replace bearing shells in pairs.

10. Check the crankshaft axial clearance.

- (a) Clean crankshaft main journals and main bearing shells.
(b) Install crankshaft frame and tighten main bearing cap fixing bolts to specified torque in order.

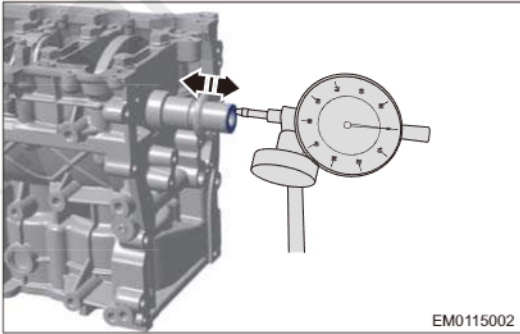
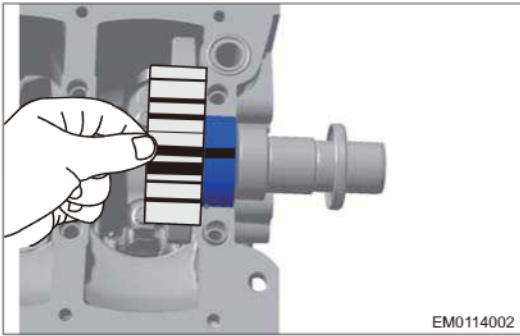
Tightening torque

- 1st step: $45 \pm 5 \text{ N}\cdot\text{m}$
2nd step: $180^\circ \pm 10^\circ$

- (c) Using a flat tip screwdriver, pry crank position left and right, and read value on dial indicator.

Measurement Item	Specification (mm)	Limit Value (mm)
Crankshaft Axial Clearance	0.07 - 0.265	0.295

If crankshaft axial clearance is not within specified range, replace the thrust washers as a set.



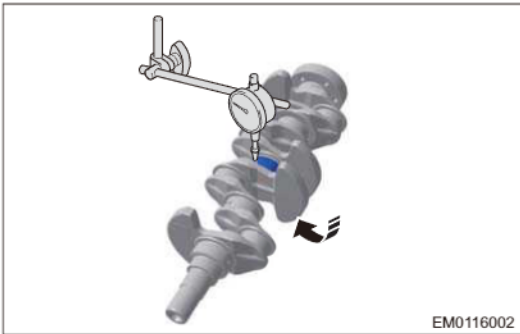
11. Check the crankshaft main journal coaxiality.

- (a) Install crankshaft onto tester and keep it level as shown in illustration.
(b) Rotate crankshaft slowly and read maximum change value from dial indicator. (Readings on dial indicator)/2 is the coaxiality of crankshaft main journal.

Measurement Item	Specification (mm)	Limit Value (mm)
Crankshaft Main Journal Coaxiality	0	0.05

If crankshaft main journal coaxiality is not within specified range, replace crankshaft assembly.

12. Check diameter of crankshaft connecting rod journal.



- (a) Using an outer diameter micrometer, measure diameter of crankshaft connecting rod journal.

Measurement Item	Specification (mm)	Limit Value (mm)
Crankshaft Connecting Rod Journal Diameter	46	45.984

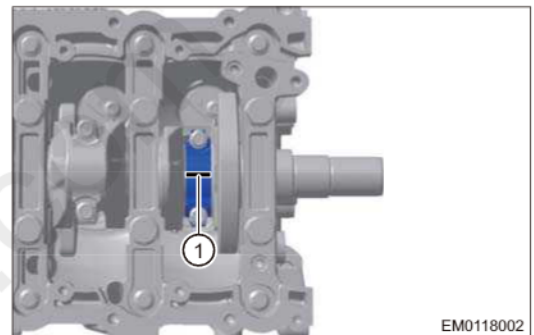
If connecting rod journal diameter is not within specified range, replace connecting rod bearing shells with new ones, and check radial clearance of connecting rod bearing shell.

If radial clearance of connecting rod bearing shell is still not within specified range after replacement, replace crankshaft.



13. Check radial clearance of crankshaft connecting rod bearing shell.

- (a) Clean connecting rod journals and connecting rod bearing shells.
 (b) Place a feeler gauge (1) on connecting rod journal as shown in illustration.



- (c) Install connecting rod bearing caps, and tighten connecting rod bearing cap fixing bolts to specified torque.

Tightening torque

1st step: $15 + 3 \text{ N}\cdot\text{m}$

2nd step: $60^\circ \pm 2^\circ$

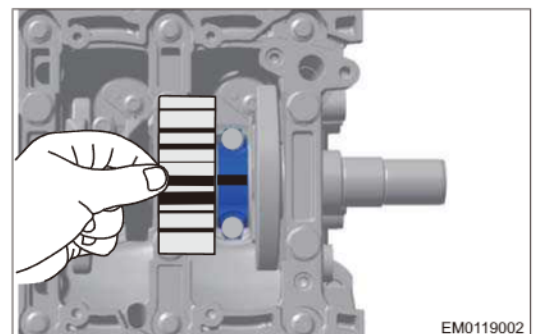
Caution:

- DO NOT turn crankshaft during installation.

- (d) Remove the connecting rod bearing cap.
 (e) Using gauge scale of feeler gauge, measure the widest part of compressed feeler gauge to obtain radial clearance of connecting rod bearing shell as shown in illustration.

Measurement Item	Specification (mm)
Connecting Rod Bearing Shell Radial Clearance	0.026 - 0.075

If radial clearance of connecting rod bearing shell is not within specified range, replace connecting rod bearing shells. Replace crankshaft assembly if necessary.



14. Check axial clearance of connecting rod.

- (a) Install connecting rod bearing caps, and tighten connecting rod bearing cap fixing bolts to specified torque.

Tightening torque

1st step: $15 + 3 \text{ N}\cdot\text{m}$

2nd step: $60^\circ \pm 2^\circ$

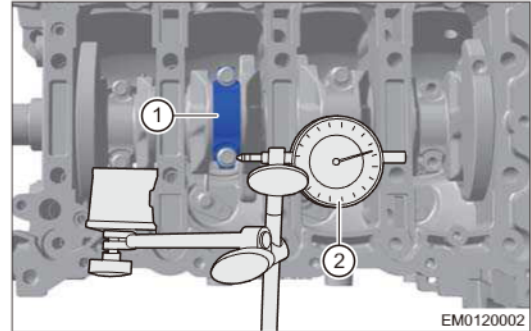
- (b) Install a dial indicator (2) with its plunger contacting the side of connecting rod cap (1).



- (c) Reset dial of dial indicator to zero.
- (d) Push connecting rod cap forward and backward (do not move crankshaft forward and backward) and read value on dial indicator.

Measurement Item	Specification (mm)
Connecting Rod Axial Clearance	0.15 - 0.40

If axial clearance of connecting rod is not within specified range, replace piston connecting rod assembly. Replace crankshaft assembly if necessary.

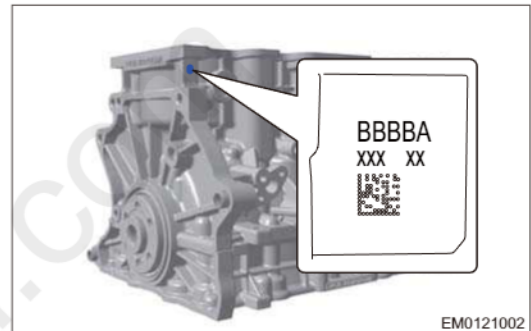


Selection of Main Bearing Shell

1. Selection of crankshaft main bearing upper shell

- (a) Related letter marks are available on cylinder block (consisting of A and B). Such as "BBBBA" in illustration, each letter from left to right is for one type of crankshaft main bearing upper shell. First letter "B" is for upper shell type of crankshaft main bearing first journal, and so on; fifth letter "A" is for upper shell type of crankshaft main bearing fifth journal.

Name	Type	Letter Mark
Crankshaft Main Bearing Upper Shell	Red shell	A
	Blue shell	B



2. Selection of crankshaft main bearing lower shell

- (a) Related marks are available on first balancer at front end of crankshaft (consisting of A and B). Such as "BBBBBA" on first balancer at front end of crankshaft shown in illustration, first letter "B" is for first journal of crankshaft main bearing lower shell, and so on; fifth letter "A" is for fifth journal of crankshaft main bearing lower shell.

Name	Type	Letter Mark
Crankshaft Main Bearing Lower Shell	Red shell	A
	Blue shell	B



3. Precautions for crankshaft main bearing shell assembly:

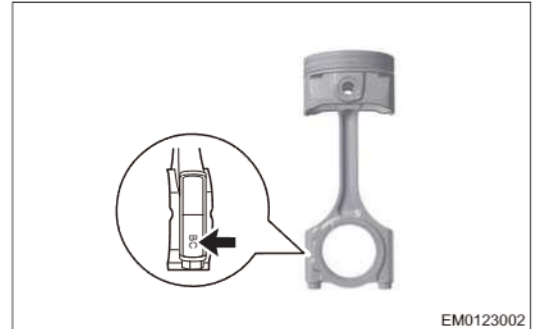
Caution:

- There is a shell groove and oil hole on the main bearing upper shell, and oil hole should be aligned with that on the engine block, but the main bearing lower shell has no oil hole.
- Apply a coat of engine oil to inner surface of main bearing shell before installation. Back side of bearing shell should be clean without any oil or foreign matter during assembly, and make sure that back side and inner surface are clean.

Selection of Connecting Rod Bearing Shell

1. Selection of connecting rod bearing upper shell
 - (a) Connecting rod bearing upper shells are divided into red shell and blue shell. Related marks are available on connecting rod bearing shell cap. Select related connecting rod bearing shell according to marks.
 - (b) As shown in illustration, among mark "BC" on connecting rod, "B" indicates blue shell.

Name	Type	Letter Mark
Connecting Rod Bearing Upper Shell	Red shell	A
	Blue shell	B



2. Selection of connecting rod bearing lower shell
 - (a) Related digital marks are available on first balancer at front end of crankshaft (consisting of 1 and 2). Such as "1221" on first balancer at front end of crankshaft shown in illustration, first digit "1" is for lower shell type of cylinder 1 piston connecting rod bearing, and so on; fourth digit "1" is for lower shell type of cylinder 4 piston connecting rod bearing.

Name	Type	Digital Mark
Connecting Rod Bearing Lower Shell	Red shell	1
	Blue shell	2



3. Precautions for connecting rod bearing shell assembly:

Caution:

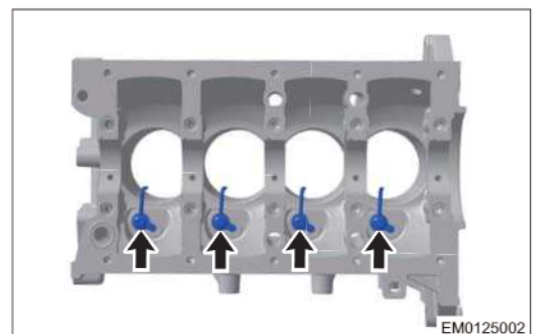
- Connecting rod upper and lower bearing shells without oil grooves are universal, but one of the connecting rod bearing shells has an oil hole.
- It is necessary to use a set of connecting rod bearing shells that are provided by the same manufacturer on the same engine.
- Apply a coat of engine oil to inner surface of connecting rod bearing shell before installation. Back side of bearing shell should be clean without any oil or foreign matter during assembly, and make sure that back side and inner surface are clean.

Assembly

1. Install the piston cooling nozzles.
 - (a) Install piston cooling nozzles and tighten fixing bolts (arrow).

Tightening torque

20 + 5 N·m

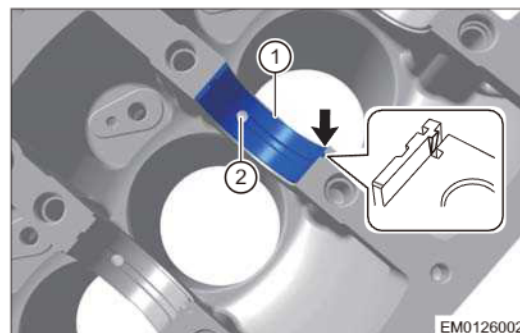


2. Install the crankshaft main bearing shells.

- Carefully install crankshaft main bearing upper shell (1) in direction of arrow, and notch of each main bearing upper shell should be aligned with cylinder block. Oil passage hole (2) on crankshaft main bearing upper shell should be aligned with passage hole on cylinder block after installation.

Caution:

- Apply a coat of engine oil to inner surface of the main bearing shell before installation.

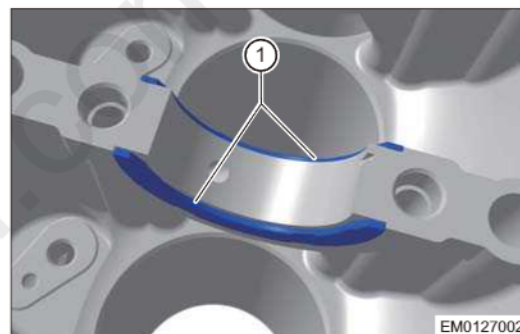


EM0126002

- Install crankshaft main bearing lower shell to crankshaft frame in the same way.

3. Install the thrust washers.

- Clean thrust washers and cylinder block inner wall before installation.
- Apply engine oil to thrust washers.
- There are 2 thrust washers on the cylinder, which are installed on the front and rear thrust surfaces of 3rd main bearing seat respectively.
- As shown in illustration, the side of crankshaft thrust washers (1) without groove should face cylinder block side while the other side with groove should face crankshaft side.



EM0127002

4. Install the crankshaft.

- Apply seal gum to installation surface of crankshaft frame before installation.

Seal gum

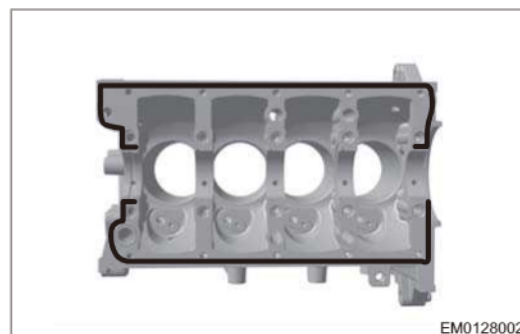
Loctite 518/5182

Diameter of seal gum line:

1.5 - 3 mm

Caution:

- DO NOT apply seal gum to bearing shell when applying seal gum.
- Seal gum should not be applied too thick. Avoid seal gum entering bearing shell installation area due to compression.



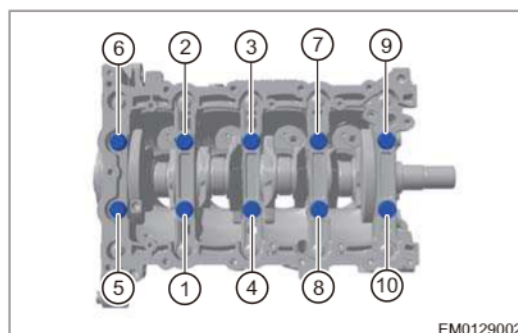
EM0128002

- (b) Place crankshaft on cylinder block carefully.
- (c) Install crankshaft main bearing cap fixing bolts in place by hands, and then tighten 10 crankshaft main bearing cap fixing bolts in order shown in illustration.

Tightening torque

1st step: $45 \pm 5 \text{ N}\cdot\text{m}$

2nd step: $180^\circ \pm 10^\circ$



- (d) Evenly tighten 10 crankshaft frame fixing bolts in order shown in illustration.

Tightening torque

$27 + 3 \text{ N}\cdot\text{m}$

5. Assemble piston and piston connecting rod.

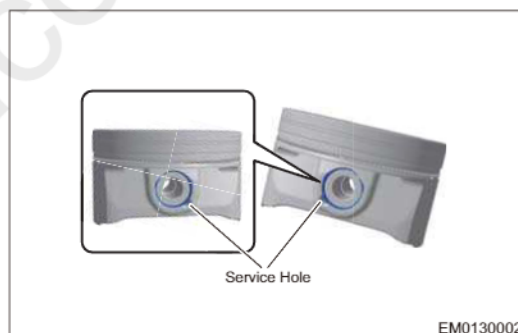
Caution:

- Apply clean engine oil to outer surface of piston pin and inner surface of piston hole before assembly.

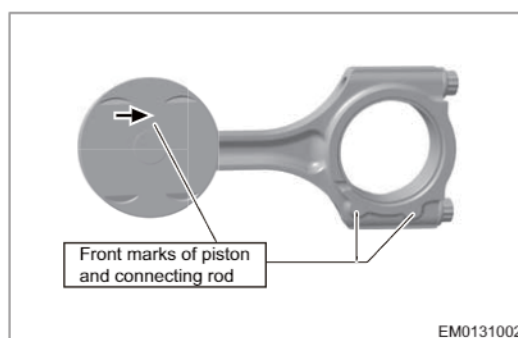
- (a) Using a small screwdriver, install new elastic circlip to one end of piston pin hole.

Warning:

- Relative angle between elastic circlip opening and removed notch is $180^\circ \pm 40^\circ$.



- (b) Align front marks on piston and connecting rod, push piston pin with thumb until it contacts with elastic circlip.

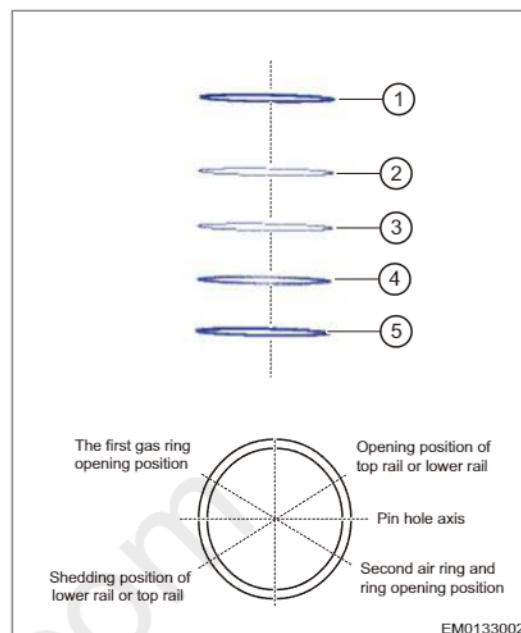


- (c) Install elastic circlip to the other end of piston pin hole, and check for free rotation between piston and connecting rod assembly.



6. Install the piston rings.

- (a) Apply a small amount of engine oil to piston ring groove and piston. Pay attention that the sides with words of first compression ring (1) and second compression ring (2) should face upward.



- (b) Oil ring is steel band combination oil ring and composed of upper rail (3), lower rail (5) and expander (4). When installing the oil ring, first install the expander into oil groove, then install upper and lower rails with opening staggered by 90° from the expander closed gap, and the upper and lower rails at 180°. Then install the second compression ring, and install the first compression ring finally with two compression rings staggered by 90° from upper rail opening. The piston ring should rotate in the ring groove freely without any stuck condition.
- (c) Rotate piston ring several turns after adding engine oil to piston ring groove, and note that the position of ring notch should be the same with that described above; clean crankshaft connecting rod journal and cylinder with a non-woven fabric cloth.

7. Install the connecting rod bearing shells.

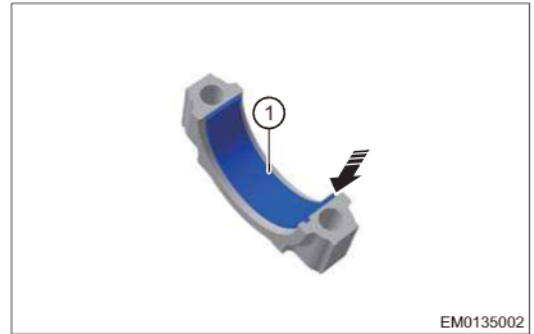
Caution:

- Apply a coat of engine oil to inner surface of connecting rod bearing shell before installation.
- Back side of connecting rod bearing shell should be clean without any foreign matter during assembly.

- (a) Carefully install the connecting rod bearing upper shell (1) in direction of arrow, and keep notch of each connecting rod bearing upper shell face the cutout of connecting rod bearing.



- (b) Carefully install connecting rod bearing lower shell (1) in direction of arrow, and keep notch of each connecting rod bearing lower shell face the cutout of connecting rod bearing cap.

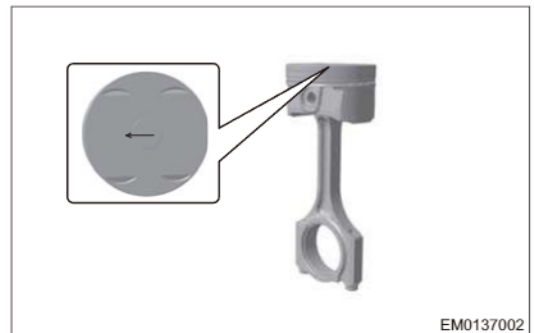


8. Install the piston connecting rod assembly.
- Rotate crankshaft to top dead center of cylinder 1 and cylinder 4.
 - Apply a coat of engine oil to piston surface and cylinder inner wall.
 - As shown in illustration, install piston connecting rod assembly to cylinder with piston installer (1).



Caution:

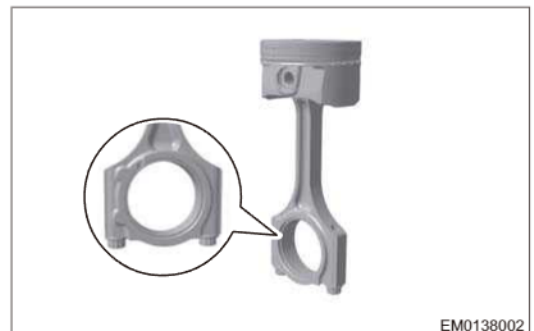
- Pay attention to front marks on piston and connecting rod during assembly, without being reversed.



9. Install the connecting rod bearing cap.

Hint:

Protrusion points on connecting rod and connecting rod bearing cap are in same side.



- (a) Install connecting rod bearing caps in place, and screw connecting rod bearing cap fixing bolts (arrow) by hands, then tighten connecting rod bearing cap fixing bolts in 2 steps with a torque wrench.

Tightening torque

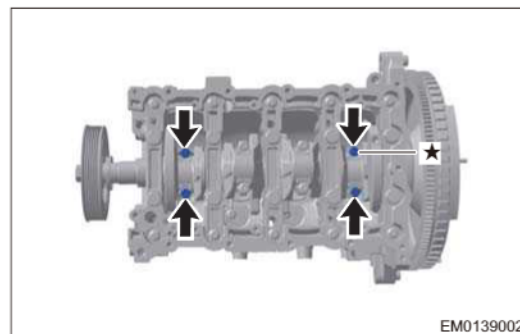
1st step: $5 + 3 \text{ N}\cdot\text{m}$

2nd step: $60^\circ \pm 5^\circ$

Caution:

- Apply a small amount of engine lubricant to connecting rods, connecting rod bearing caps and thread joint surfaces.

10. Other assembly is in the reverse order of disassembly.



SQRE4T15B FUEL SUPPLY SYSTEM

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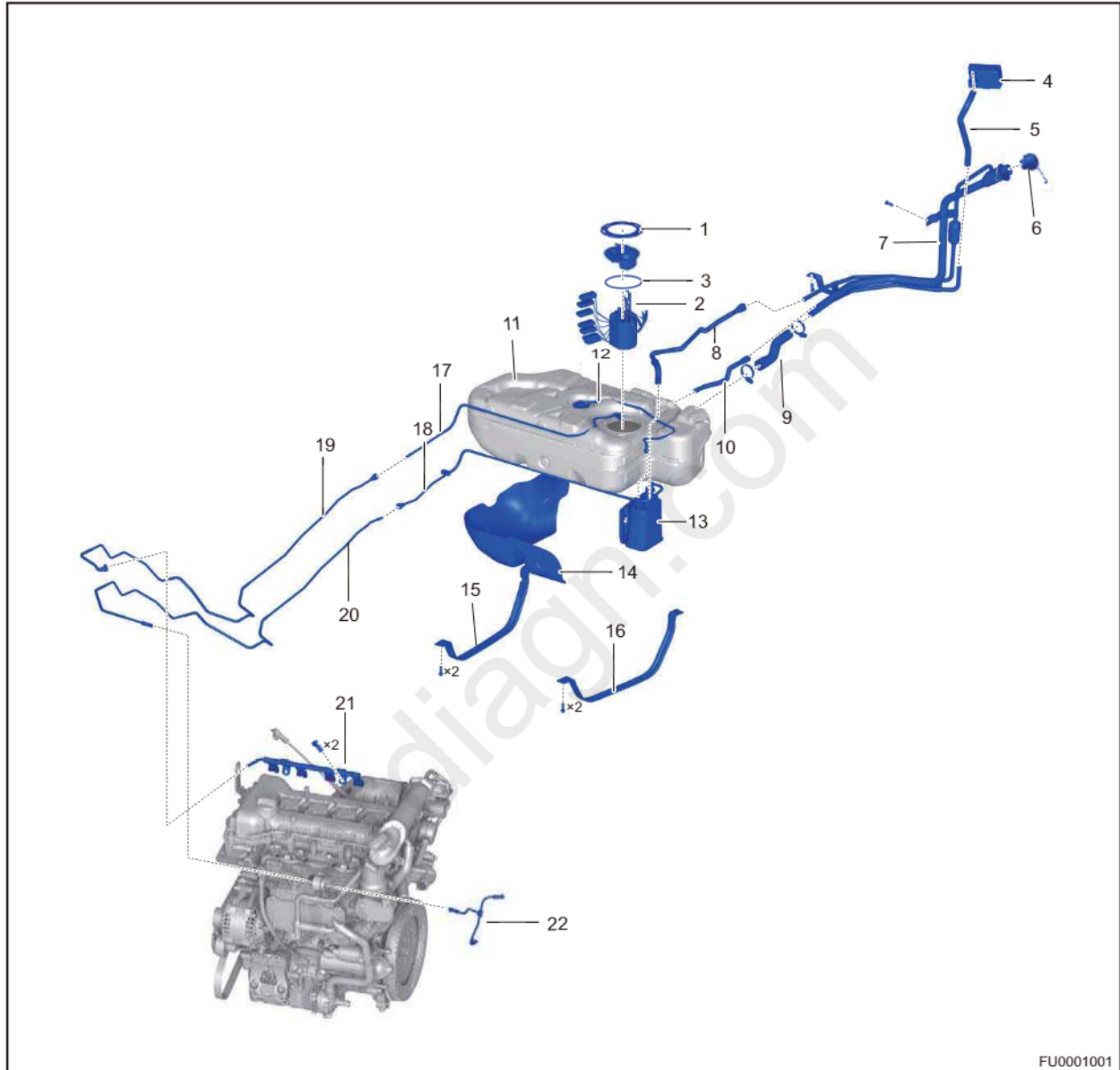


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GENERAL INFORMATION

Overview

Description



FU0001001

1 - Fuel Pump Pressure Cap	2 - Electric Fuel Pump Assembly
3 - Fuel Tank Seal Ring	4 - Activated Charcoal Canister Filter
5 - Activated Charcoal Canister Breather Pipe II	6 - Fuel Tank Cap Assembly
7 - Filler Tube Assembly	8 - Activated Charcoal Canister Breather Pipe
9 - Fuel Filler Hose	10 - Fuel Breather Hose
11 - Fuel Tank Assembly	12 - Fuel Vapor Pipe I
13 - Activated Charcoal Canister Assembly	14 - Fuel Tank Heat Insulator
15 - Fuel Tank Right Fixing Strap	16 - Fuel Tank Left Fixing Strap
17 - Inlet Pipe I	18 - Fuel Vapor Pipe II
19 - Inlet Pipe II	20 - Fuel Vapor Pipe V
21 - Fuel Rail Injector Assembly	22 - Charcoal Canister Solenoid Valve Outlet Pipe



Operation

Fuel supply system consists of fuel tank, electric fuel pump assembly, delivery pipes, fuel rail and injectors, which is used for fuel storage, filtration, delivery and injection. The function of fuel supply system is to provide gasoline with sufficient pressure to fuel injectors by using electric fuel pump assembly, and the injector sprays a certain amount of gasoline which burnt mixed with gas to the top of intake valve in intake manifold in accordance with control signals from ECM.

Specifications

Torque Specifications

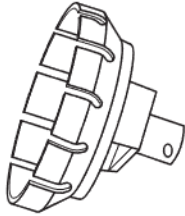
Description	Torque (N·m)
Fuel Pump Pressure Cap Tightening Torque	400
Filler Tube Assembly Fixing Bolt	7 + 1
Filler Tube End Bracket Fixing Bolt	7 ± 1
Activated Charcoal Canister Filter	7 ± 1
Fuel Tank Fixing Strap Fixing Bolt	23 ± 2
Fuel Rail Fixing Bolt	20 + 5
Worm Clamp	3 ± 0.5

Fuel Pressure Specifications

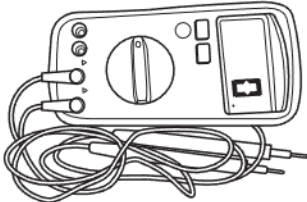
SQRE4T15B	Pressure (kPa)
Fuel Rail Fuel Pressure - Key (ON)	400
Fuel Rail Fuel Pressure - Engine Idling	400
Fuel Rail Fuel Pressure - Key (OFF)	400 (pressure is not less than 1 kPa within 48 hours)

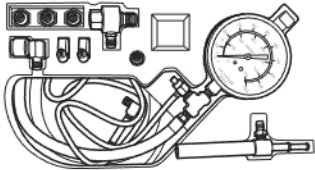
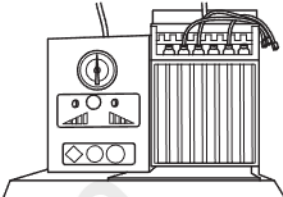
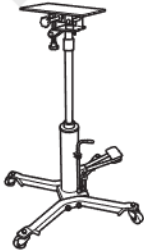
Tools

Special Tool

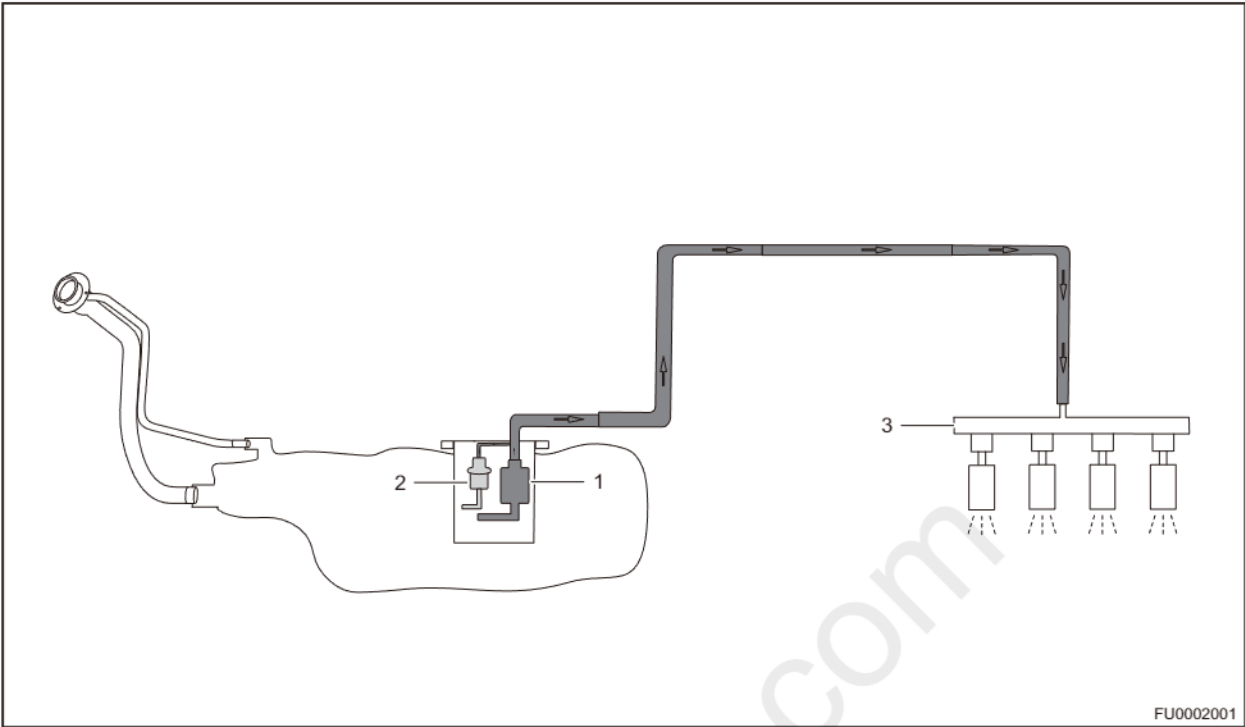
Fuel Pump Pressure Cap Remover	Part No.: CH-20032	 004
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General Tools

Digital Multimeter	 002
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Fuel System Pressure Tester	 048
Injector Tester	 062
Transmission Carrier	 005

Fuel Supply System Line Connection Diagram



1 - Electric Fuel Pump Assembly	2 - Electric Fuel Pump Assembly Pressure Regulator
3 - Fuel Rail Injector Assembly	

When engine operates properly, the electric fuel pump assembly (1) sucks fuel from fuel tank. Some fuel enters the fuel rail (3) and is supplied to injectors, some fuel flows back to the electric fuel pump assembly pressure regulator (2) directly. When fuel supply system pressure is high, the diaphragm spring in the regulator is jacked up by pressure, then the valve opens and fuel flows out from regulator. When pressure reaches normal value, the regulator shuts off and fuel stops flowing out. Finally, the system pressure reaches a steady state.

DIAGNOSIS & TESTING

Diagnosis Content

Problem Symptoms Table

Hint:

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

Symptom	Suspected Area
Fuel pressure in fuel supply system is too low	Electric fuel pump assembly (strainer blocked or fuel pressure regulator damaged)
	Low fuel level
Fuel pressure in fuel supply system is too high	Fuel injector (clogged)
	Electric fuel pump assembly (fuel pressure regulator damaged)
Electric fuel pump assembly has loud noise or a delay in operating	Low fuel level
	Electric fuel pump assembly relay
	Electric fuel pump assembly
Fuel tank flat	Canister solenoid valve operates all the time
	Canister blocked
	Filter ineffective
	Fuel tank ineffective
Fuel injector is clogged or leaked	Fuel injector
	Poor fuel quality
	Excessive impurities in fuel tank
Fuel injector does not work	Fuel supply system line (broken)
	Fuel injector (short in coil)
	Electric fuel pump assembly (damaged)
	Wire harness



ON-VEHICLE SERVICE

Fuel System Pressure Release

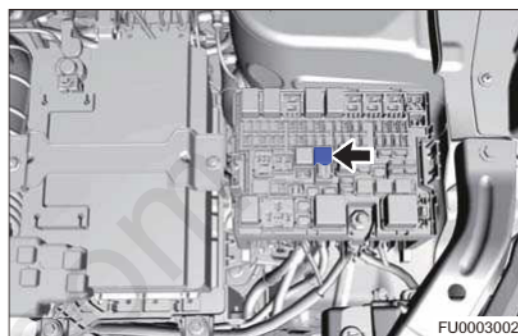
Operation Step

Warning:

- When engine is not operating, the fuel pressure in fuel supply system is still high. Before repairing or disconnecting the fuel line or fuel supply system components, it is necessary to release the fuel supply system pressure to prevent fuel from spraying out accidentally. Failure to follow these instructions may result in serious personal injury.

1. Perform the following procedures to release the fuel pressure in fuel supply system:

- (a) Recognize and remove the electric fuel pump assembly relay from engine compartment fuse and relay box.



- (b) Start and run the engine until it stalls.
(c) Restart the engine until it does not run.
(d) Turn ignition switch to OFF.
(e) Disconnect the negative battery cable.
(f) Insert the electric fuel pump relay into the original place.

Fuel Supply System Pressure Test

Fuel Pressure Specifications

SQRE4T15B	Pressure (kPa)
Fuel Rail Fuel Pressure - Key (ON)	When power is on, pressure of fuel supply system is kept at 400 kPa - key (ON). For the new vehicle, after it is added with a certain fuel, make sure that measured fuel pressure on fuel rail at 13 s can reach 90% or higher of rated pressure.
Fuel Rail Fuel Pressure - Engine Idling	Make sure that supply fuel under normal system pressure (at least 400 kPa).
Fuel Rail Fuel Pressure - Key (OFF)	Turn off oil pump after it runs for 5 minutes, test changes of pressure in oil outlet of oil pump within 48 hours, the pressure should be not less than 1 kPa; When system pressure is 80%, turn power and oil outlet off, the maximum pressure will not drop more than 10% in 1 min.

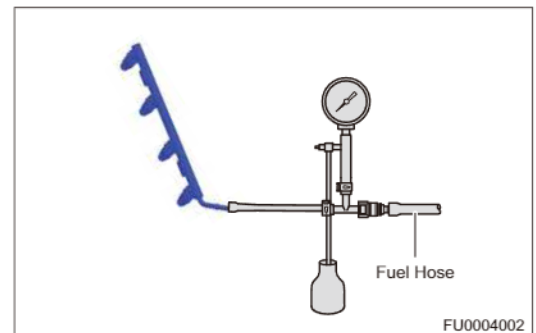
Warning:

- When operating the fuel supply system, work area should be in good ventilation and keep fire sources or open flames away from the work area, in which fire extinguisher should be equipped.
- Before operating the fuel supply system, please touch the vehicle body to discharge static electricity; failure to do so will cause a fire, even result in an explosion.
- Before removing and installing fuel pipes, release the fuel supply system pressure.

Caution:

- Make sure that battery voltage is not less than 12 V.
- There is sufficient fuel in fuel tank for test.
- Make sure that fuel supply system lines are securely connected, preventing the fuel supply system from leaking.

1. Detect the fuel system pressure.
2. Remove the engine trim cover.
3. Disconnect the inlet pipe II connector and connect the fuel supply system pressure tester between inlet pipe II and fuel rail.



4. Start engine and run it at idle, and then read the value on pressure tester.
 - (a) Standard pressure at idle should be 400 kPa.
 - (b) If measured pressure value is lower than 380 kPa or higher than 420 kPa, check vehicle fuel supply line for leakage or kink, injector for blockage, function of electric fuel pump for abnormality.

Hint:

Replace injector or electric fuel pump assembly if necessary.



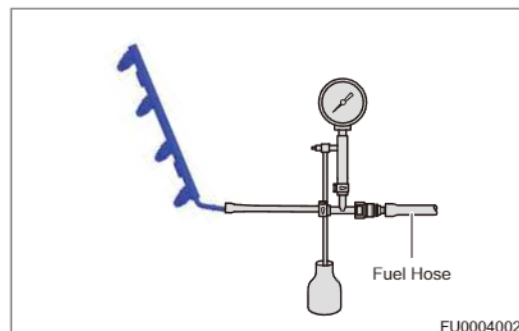
Fuel Flow Test

Caution:

- When fuel pressure is in normal during idling, the test of fuel flow can be performed.

1. Test method:

- (a) Disconnect the inlet pipe II connector and connect the fuel supply system pressure tester between inlet pipe II and fuel rail.



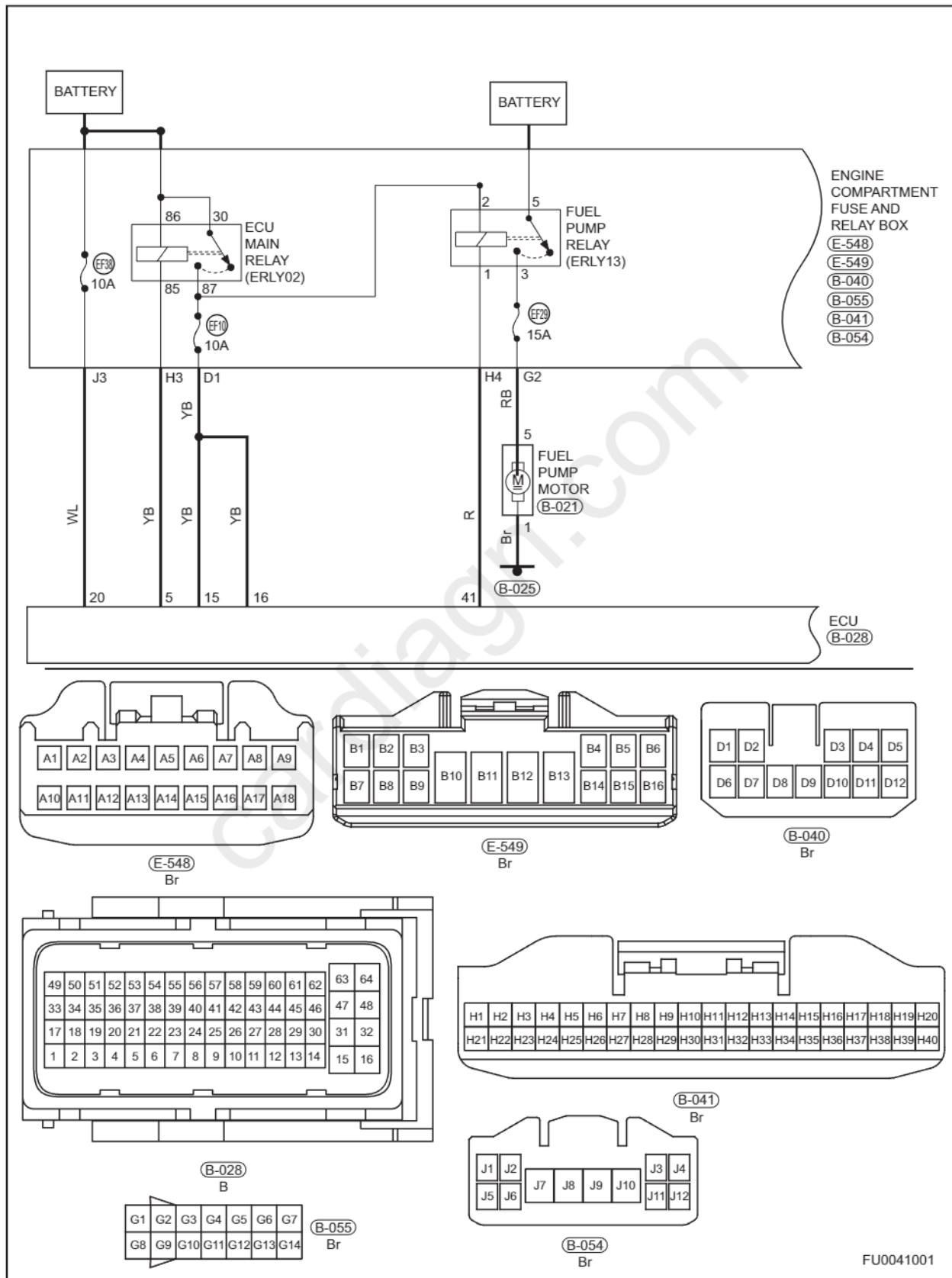
- (b) Start engine, increase engine speed (such as throttle fully opens), if the pressure of pressure gauge is lower than 0.1 Mpa (100 kPa) of system pressure, flow is insufficient.
- (c) If flow is insufficient, line blockage or bend, fuel pump wear or mesh blockage may be the problem cause.

Hint:

- Replace the electric fuel pump first if necessary. If line is blocked or bent, check, repair or replace it and retest flow, if it is eligible, the problem is eliminated. If it is ineligible, replace fuel pump and wash impurities in fuel tank.

Electric Fuel Pump Assembly

Electric Fuel Pump Circuit Diagram



On-vehicle Inspection

1. Check the electric fuel pump fuel level sensor.
- (a) Using a flat tip screwdriver, pry off electric fuel pump assembly protective cap and disconnect electric fuel pump assembly connector.

(b) Using a digital multimeter, measure resistance of fuel level sensor according to remaining fuel in fuel tank.

Fuel Level Indication	Multimeter Connection	Specification (Ω)
E-stop	Terminal 2 - Terminal 3	325 ± 5
E	Terminal 2 - Terminal 3	310 ± 5
R	Terminal 2 - Terminal 3	280 ± 4
1/4	Terminal 2 - Terminal 3	250 ± 4
3/8	Terminal 2 - Terminal 3	220
1/2	Terminal 2 - Terminal 3	190 ± 3
5/8	Terminal 2 - Terminal 3	160
3/4	Terminal 2 - Terminal 3	130 ± 3
7/8	Terminal 2 - Terminal 3	96.67
F	Terminal 2 - Terminal 3	70 ± 2
F-stop	Terminal 2 - Terminal 3	55 ± 2

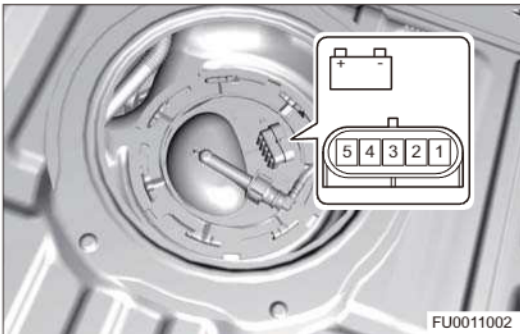
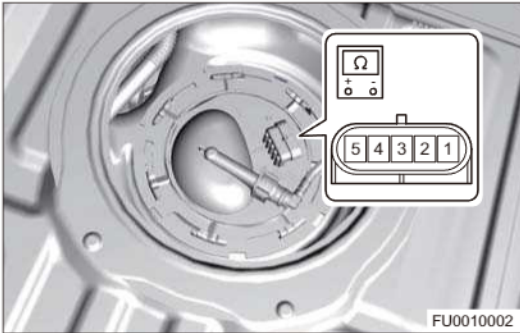
Hint:
If result is not as specified, replace electric fuel pump assembly.

2. Check the electric fuel pump assembly operation.
- (a) Using a flat tip screwdriver, pry off electric fuel pump assembly protective cap and disconnect electric fuel pump connector.

(b) Apply battery voltage to terminals 1 and 5, and check if electric fuel pump operates within 10 seconds.

Battery Connection	Specifications
Battery positive (+) to Terminal 5 Battery negative (-) to Terminal 1	Fuel pump operates

- Hint:**
- These tests must be finished within 10 seconds to prevent the coils from being burnt.
 - Leave the electric fuel pump assembly as far as possible from the battery.
 - Always switch voltage on and off on the battery side, rather than the electric fuel pump assembly side.
 - If the electric fuel pump assembly does not operate, replace it.



Removal

Warning/Caution/Hint

Warning:

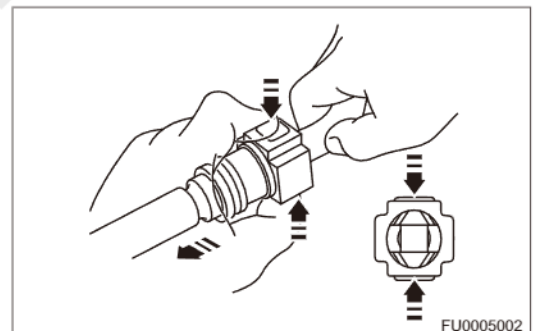
- Before operating the fuel supply system, please touch the vehicle body to discharge static electricity; failure to do so will cause a fire, even result in an explosion.
- When operating the fuel supply system, work area should be in good ventilation and keep fire sources or open flames away from the work area, in which fire extinguisher should be equipped.
- After performing the procedures for fuel system pressure release, there still remains some fuel in fuel line. When disconnecting fuel line, cover the joint with a piece of cloth or equivalent to prevent fuel from spraying out.
- If fuel leakage occurs when operating the fuel supply system, please handle the leaked fuel in time.

Caution:

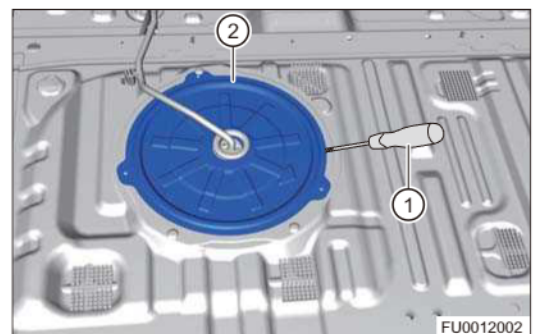
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.
- Operation staff should wear protective glasses and rubber gloves during requirement and avoid inhaling much fuel gas.
- Only use parts approved by Chery Automobile Co., Ltd. to replace the electric fuel pump assembly.
- As electric fuel pump assembly radiates through fuel, low fuel level in fuel tank will directly shorten the service life of electric fuel pump assembly.
- Keep electric fuel pump assembly and work area clean when replacing electric fuel pump assembly; otherwise the electric fuel pump assembly element will be clogged.
- DO NOT damage the disconnected fuel system line or connectors. Cover the line joints or connectors with plastic bags or equivalent, preventing foreign matter from entering.
- Keep fuel tank and line clean.

Hint:

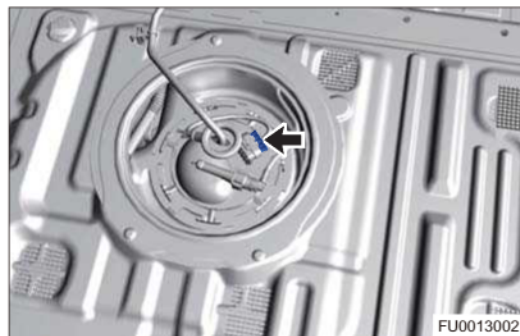
Disconnection way for all fuel pipe coupling joints in following procedures is shown in the illustration.



1. Release the fuel system pressure.
2. Turn off all electrical equipment and the ignition switch.
3. Disconnect the negative battery cable.
4. Open the fuel tank cap assembly and discharge the fuel vapor in fuel tank.
5. Remove the second row seat ([See page 48-15](#)).
6. Remove the electric fuel pump assembly.
 - (a) Using a screwdriver (1) wrapped with protective tape, pry off electric fuel pump assembly protective cap (2).



- (b) Disconnect the electric fuel pump assembly connector (arrow).



- (c) Disconnect inlet pipe coupling joint (1) of electric fuel pump.

Caution:

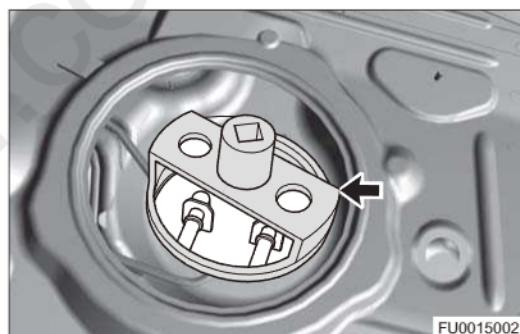
- Before disconnecting the joints, remove all dirt from electric fuel pump assembly pressure cap.
- DO NOT forcefully bend or twist fuel line.



- (d) Using special tool (fuel pump pressure cap remover) (arrow), remove pressure cap as shown in illustration.

Tightening torque

400 N·m



- (e) Take out electric fuel pump assembly.

Caution:

- Operate carefully when taking the electric fuel pump assembly out of fuel tank, preventing damaging lines and floats.
- Cover the electric fuel pump assembly completely with a plastic bag or equivalent to prevent foreign matter from entering.
- Electric fuel pump assembly can be put into a container and taken out of the cabin, thus preventing fuel in the pump from dropping into the cabin.
- It is not allowed to perform running test for electric fuel pump assembly under dry state or in water. Otherwise service life will be reduced. In addition, do not inversely connect electric fuel pump assembly positive and negative poles.

- (f) Dispose the fuel in the electric fuel pump assembly.

Installation

Warning/Caution/Hint

- DO NOT connect the power during installation. Work area should be in good ventilation and keep fire sources or open flames away.
 - Replace fuel tank seal ring with a new one when installing electric fuel pump assembly, align it with installation position of fuel tank and do not run the electric fuel pump assembly with no fuel in fuel tank, preventing damaging electric fuel pump assembly.
 - Before connecting the hose, check if there is any damage or foreign matter on the hose or joint.
 - During installation, push in fuel pipe connector until a click sound is heard, then check that fuel pipe joint clip is on the collar of fuel pipe joint. After installing the pipe joint clip, check that fuel pipe joint cannot be pulled out. Be careful not to damage joint. If clip is damaged, replace it.
 - Turn ignition switch to ON (without starting engine) to apply fuel pressure to fuel supply system, and then check connections for leakage.
1. Installation is in the reverse order of removal.

Caution:

- When installing electric fuel pump assembly into fuel tank. Install float rod assembly into fuel tank carefully at first to avoid deformation as collision.
- Align the installation arrow on electric fuel pump assembly with the corresponding arrow on fuel tank assembly.

Aligned Acceptable Angle

$\pm 3^\circ$



08



Filler Tube Assembly

Removal

Warning/Caution/Hint

Warning:

- Before operating the fuel supply system, please touch the vehicle body to discharge static electricity; failure to do so will cause a fire, even result in an explosion.
- When operating the fuel supply system, work area should be in good ventilation and keep fire sources or open flames away from the work area, in which fire extinguisher should be equipped.
- If fuel leakage occurs when operating the fuel supply system, please handle the leaked fuel in time.

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the rear left tire assembly (See page 24-8).
4. Remove the rear left wheel house protector assembly (See page 50-32).
5. Remove the spare tire (See page 24-10).
6. Remove the rear suspension.
7. Remove the filler tube assembly.

- (a) Open the fuel filler door, rotate the fuel tank cap assembly in the direction of arrow as shown in the illustration.



- (b) Remove the external plastic fuel tank cap plate in direction of arrow as shown in illustration.



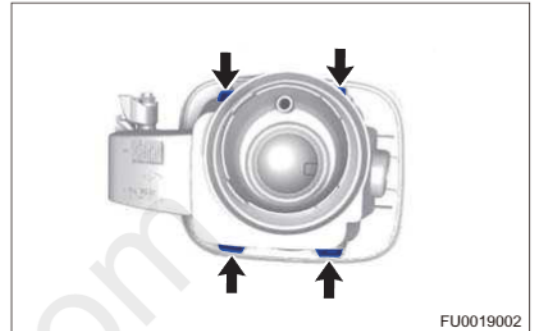
- (c) Carefully pry off rear ventilation frame assembly (arrow), and remove it.



- (d) Rotate and remove fuel tank cap cable lock mechanism in direction of arrow as shown in illustration.

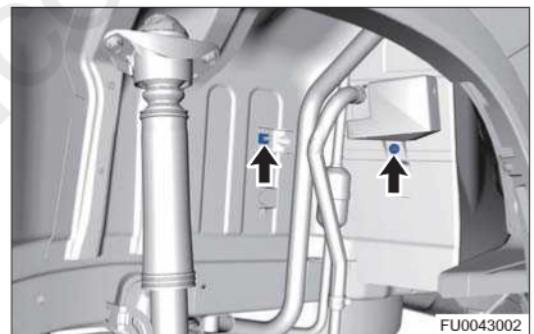


- (e) Carefully pry off and remove fuel filler cap hinge assemblies (arrow).



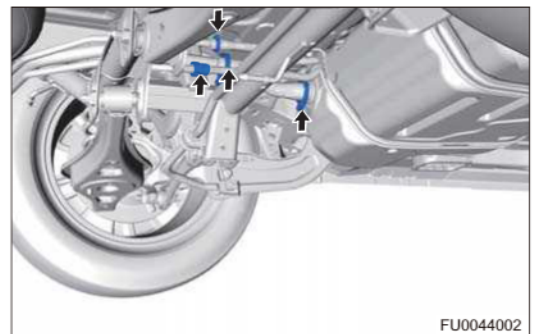
- (f) Remove fixing bolts (arrow) between filler tube assembly and activated charcoal canister filter and body metal plate.

Tightening torque
 $7 \pm 1 \text{ N}\cdot\text{m}$



- (g) Loosen worm clamps (arrow), disconnect the connection between filler tube assembly and fuel filler hose and fuel breather hose.

Tightening torque
 $3 \pm 0.5 \text{ N}\cdot\text{m}$



- (h) Remove the filler tube assembly.

Caution:

- Cover the joints with plastic bags after disconnecting the fuel filler hose and fuel breather hose, in order to prevent foreign matter from entering the fuel tank and fuel from evaporating or leaking.

Installation

1. Installation is in the reverse order of removal.

Caution:

- When installing hose, make sure that hose is not twisted and kinked.
- Turning the fuel tank cap clockwise until a "click" is heard, indicating the cap has been tightened.



Fuel Tank

Removal

Warning/Caution/Hint

Warning:

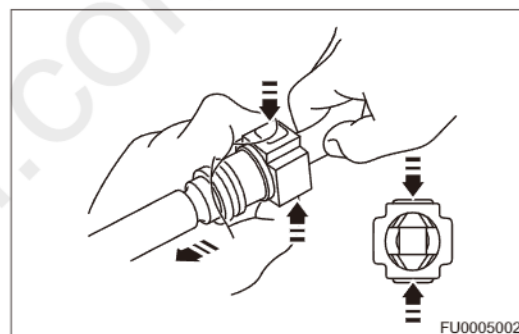
- Before operating the fuel supply system, please touch the vehicle body to discharge static electricity; failure to do so will cause a fire, even result in an explosion.
- When operating the fuel supply system, work area should be in good ventilation and keep fire sources or open flames away from the work area, in which fire extinguisher should be equipped.
- After performing the procedures for fuel system pressure release, there still remains some fuel in fuel line. When disconnecting fuel line, cover the joint with a piece of cloth or equivalent to prevent fuel from spraying out.
- If fuel leakage occurs when operating the fuel supply system, please handle the leaked fuel in time.

Caution:

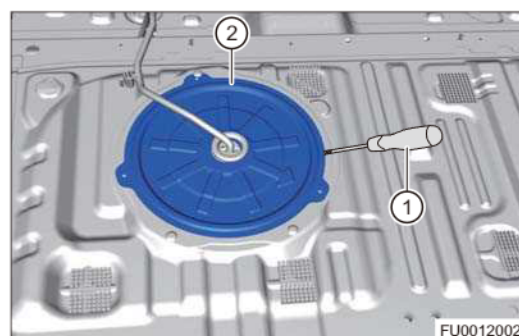
- DO NOT damage the disconnected fuel system line or connectors. Cover the line joints or connectors with plastic bags or equivalent, preventing foreign matter from entering.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

08 Hint:

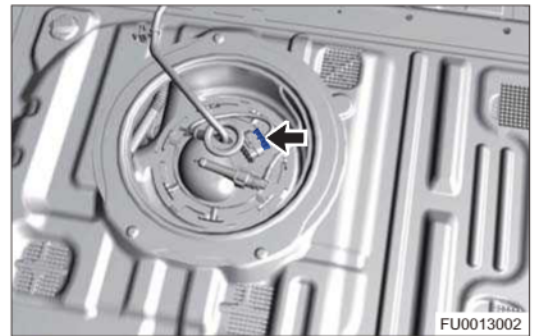
- Disconnection way for all fuel pipe coupling joints in following procedures is shown in the illustration.



1. Release the fuel system pressure.
2. Turn off all electrical equipment and the ignition switch.
3. Disconnect the negative battery cable.
4. Open fuel tank cap to discharge fuel vapor.
5. Disconnect the electric fuel pump assembly line and connector.
 - (a) Remove the second row seat cushion.
 - (b) Using a screwdriver (1) wrapped with protective tape, pry off electric fuel pump assembly protective cap (2).



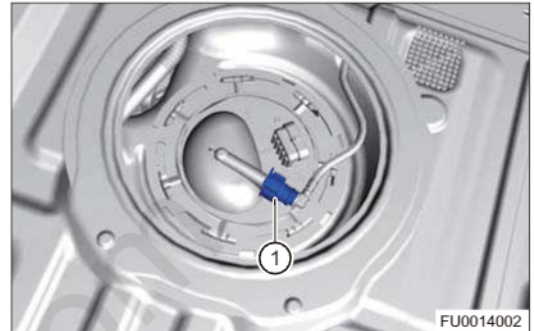
- (c) Disconnect the electric fuel pump assembly connector (arrow).



- (d) Disconnect outlet pipe (1) of electric fuel pump.

Caution:

- Before disconnecting the joints, remove all dirt from electric fuel pump assembly pressure cap.
- DO NOT forcefully bend or twist line.

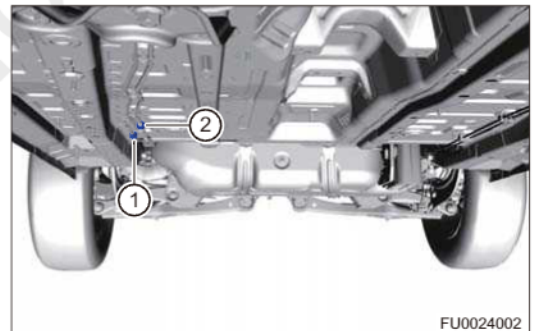


6. Remove the fuel tank assembly.

- (a) Disconnect inlet pipe I joint (1) and fuel vapor pipe II (2).

Caution:

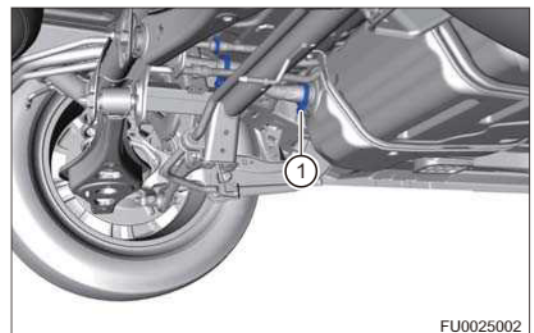
- Before disconnecting the joints, remove any dirt and foreign matter from the retainer. DO NOT forcefully bend or twist delivery pipes.



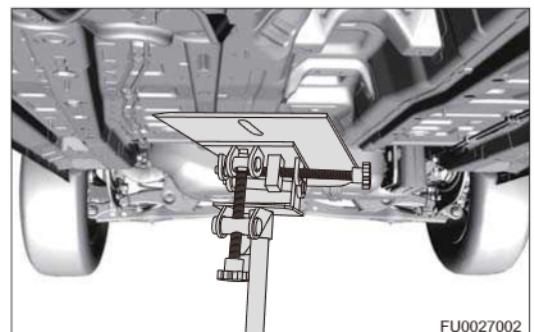
- (b) Loosen the worm clamp (1) and disconnect the connection between fuel filler hose and fuel tank assembly.

Tightening torque

$3 \pm 0.5 \text{ N}\cdot\text{m}$



- (c) Support fuel tank with a transmission carrier.



- (d) Remove 4 coupling bolts (arrow) between fuel tank left and right fixing straps and body.

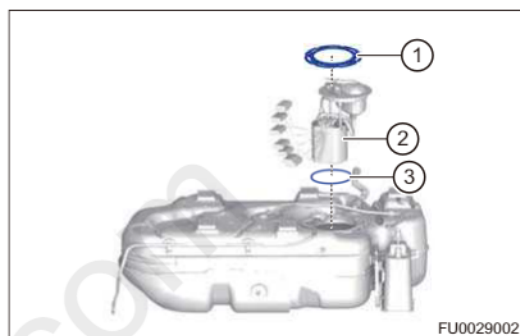
Tightening torque

$23 \pm 2 \text{ N}\cdot\text{m}$



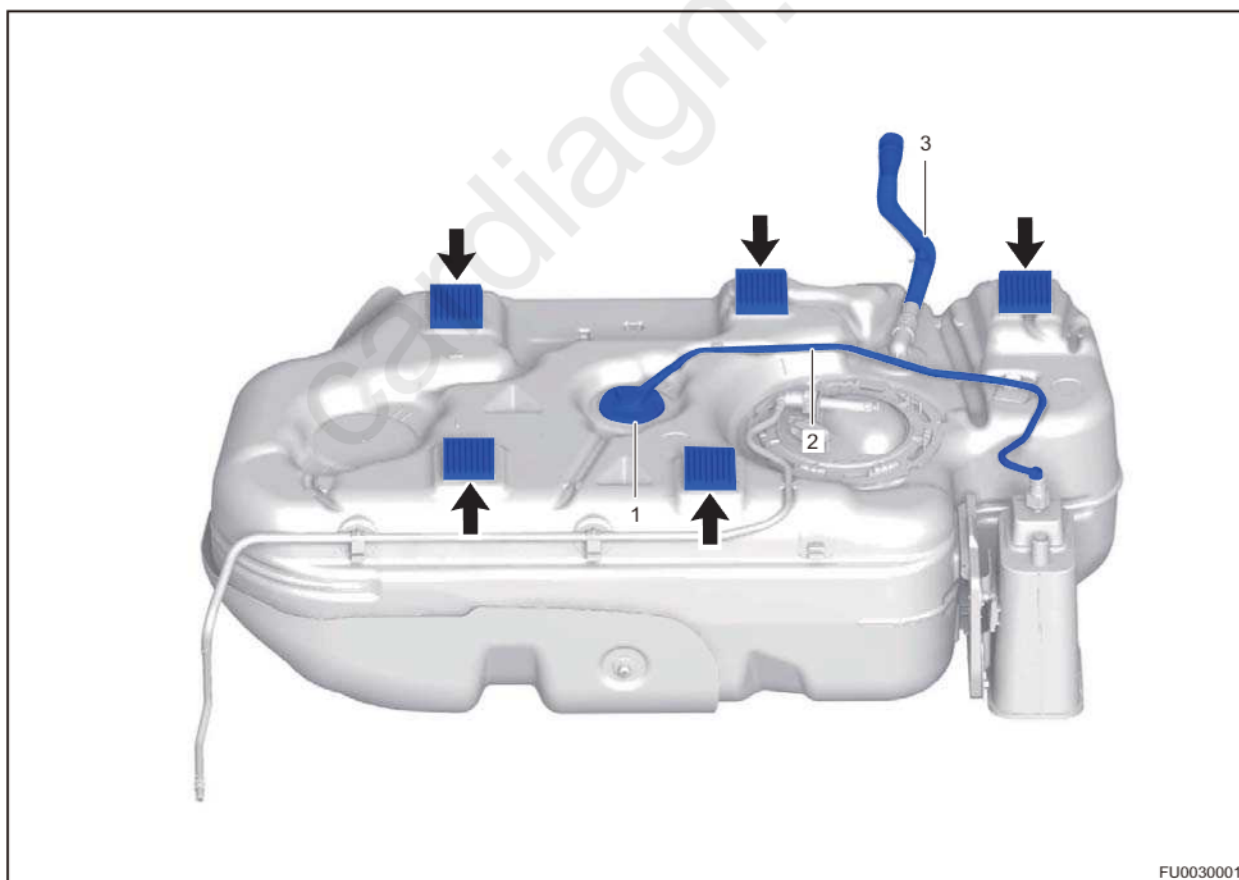
7. Slowly lower transmission carrier to remove fuel tank tank (arrow)

- (a) Remove fuel pump pressure cap (1), electric fuel pump assembly (2) and fuel tank seal ring (3) from fuel tank assembly.



08

Fuel Tank Accessories Description



1. Fuel Vapor Valve

Function of fuel vapor valve:

- (a) When fuel vapor is produced in the fuel tank, the vapor will enter the charcoal canister through fuel vapor valve (1) by fuel vapor pipe I (2). When the vehicle body bumps or overturns, fuel vapor valve will automatically lock to prevent fuel overflow.

2. Fuel Breather Pipe

Function of fuel breather pipe:

- (a) When filling fuel tank through fuel filler, the fuel vapor will get out of fuel tank through fuel breather pipe (3).

3. Fuel Tank Cushion

- (a) Pay attention to the installation positions of fuel tank cushions (arrow). Incorrect installation will damage the fuel tank or fuel lines due to friction between fuel tank and body.

Installation

Warning/Caution/Hint

Caution:

- Return fuel lines and vent line on fuel tank to their original positions, or the fuel lines will be damaged due to friction generated by vehicle body shock, causing fuel leak.
 - Before connecting the hose, check if there is any damage or foreign matter on the hose or joint.
 - During installation, push in fuel pipe connector until a click sound is heard, then check that fuel pipe joint clip is on the collar of fuel pipe joint. After installing the pipe joint clip, check that fuel pipe joint cannot be pulled out. Be careful not to damage joint. If clip is damaged, replace it.
 - Turn ignition switch to ON (without starting engine) to apply fuel pressure to fuel supply system, and then check connections for leakage.
1. Installation is in the reverse order of removal.



Fuel Rail Injector Assembly

Removal

Warning/Caution/Hint

Warning:

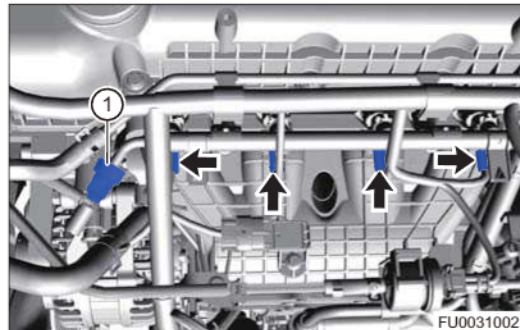
- Before operating the fuel supply system, please touch the vehicle body to discharge static electricity; failure to do so will cause a fire, even result in an explosion.
- When operating the fuel supply system, work area should be in good ventilation and keep fire sources or open flames away from the work area, in which fire extinguisher should be equipped.
- After performing the procedures for fuel system pressure release, there still remains some fuel in fuel line. When disconnecting fuel line, cover the joint with a piece of cloth or equivalent to prevent fuel from spraying out.
- If fuel leakage occurs when operating the fuel supply system, please handle the leaked fuel in time.

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.
- DO NOT damage the disconnected fuel system line or connectors. Cover the line joints or connectors with plastic bags or equivalent, preventing foreign matter from entering.
- Injector is a part of high accuracy, featuring good anti-clogging, anti-pollution and atomization, so be careful not to damage the injector during removal of fuel rail.

1. Release the fuel supply system pressure ([See page 08-8](#)).
2. Turn off all electrical equipment and the ignition switch.
3. Disconnect the negative battery cable.
4. Remove the engine trim cover.
5. Remove the fuel rail injector assembly.

- (a) Disconnect connection (1) between inlet pipe II and fuel rail injector.

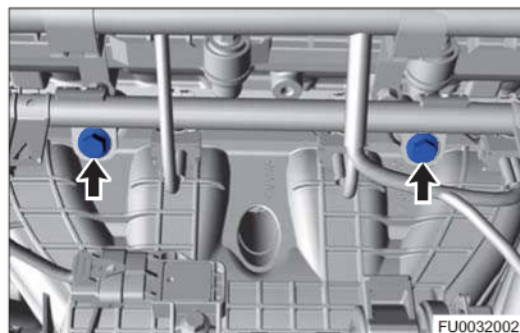


- (b) Disconnect the injector connectors (arrow) of each cylinder.

- (c) Remove 2 fixing bolts (arrow) from fuel rail injector.

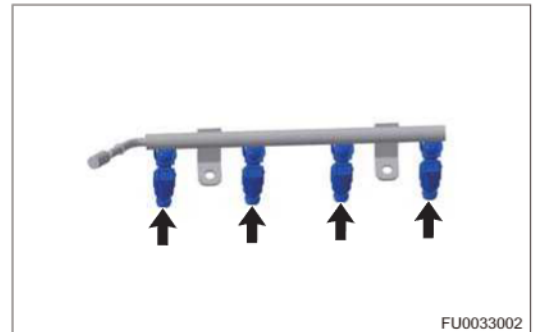
Tightening torque

20 + 5 N·m



- (d) Remove the fuel rail injector assembly.

6. Separate the injector and fuel rail.
 - (a) Remove injector fixing clamps and remove injectors (arrow) from fuel rail.

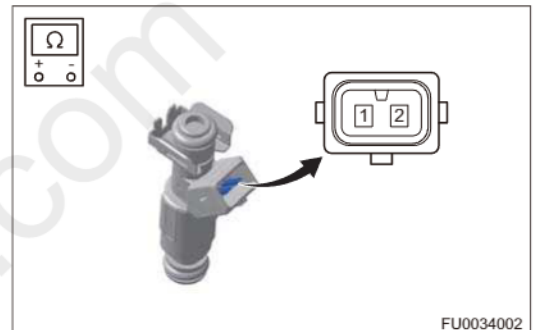


FU0033002

Inspection

1. Check the resistance of injector.
 - (a) Disconnect the injector connector.
 - (b) Measure resistance between 2 terminals (injector side) of injector with a digital multimeter.

Multimeter Connection	Measurement Temperature	Specification (Ω)
Terminal 1 - Terminal 2	20°C	12



FU0034002

2. Check leakage test and injection test of injector.
 - (a) Remove injector and then install the injector to injector cleaning analyzer, adjust the pressure to operation pressure, and observe the injector for leakage, if so, sealing is poor.
 - (b) If there is no cleaning analyzer, a free-unpick cleaning device also can be used, adjust pressure to 4 bar, and place a white paper under injector. Observe the injector for leakage.

Caution:

 - When installing injector, grease will be applied to sealing ring to install injector easily, if the part is in high temperature for a long time, grease will melt, and adsorb around injector, so it may be wrong when judging injector for leakage. It is recommend to clean around injector to check injector for leakage.
 - (c) If the color of one injector nozzle is different from the color of other injector nozzles, the injector may be leaked or have a poor atomization.
 - (d) Fuel injection angle
 - (1) Poor atomization: Fuel injected by injector is radial, and injection angle from injection nozzle is irregular.
 - (2) Good atomization: Fuel injected from injector is fuel mist, and injection angle from injection nozzle is cone.



Installation

Warning/Caution/Hint

Caution:

- Install a new O-ring sealing on injector.
 - Before installing the injector, apply clean grease or oil to the O-ring sealing surface for easy installation, preventing damage to the O-ring.
 - When applying grease or oil, do not contaminate the injector internal and injection holes.
 - It is not allowed to use any tool (hammer, ect.) to strike the injector when installing it.
1. Installation is in the reverse order of removal.

SQRE4T15B EXHAUST SYSTEM

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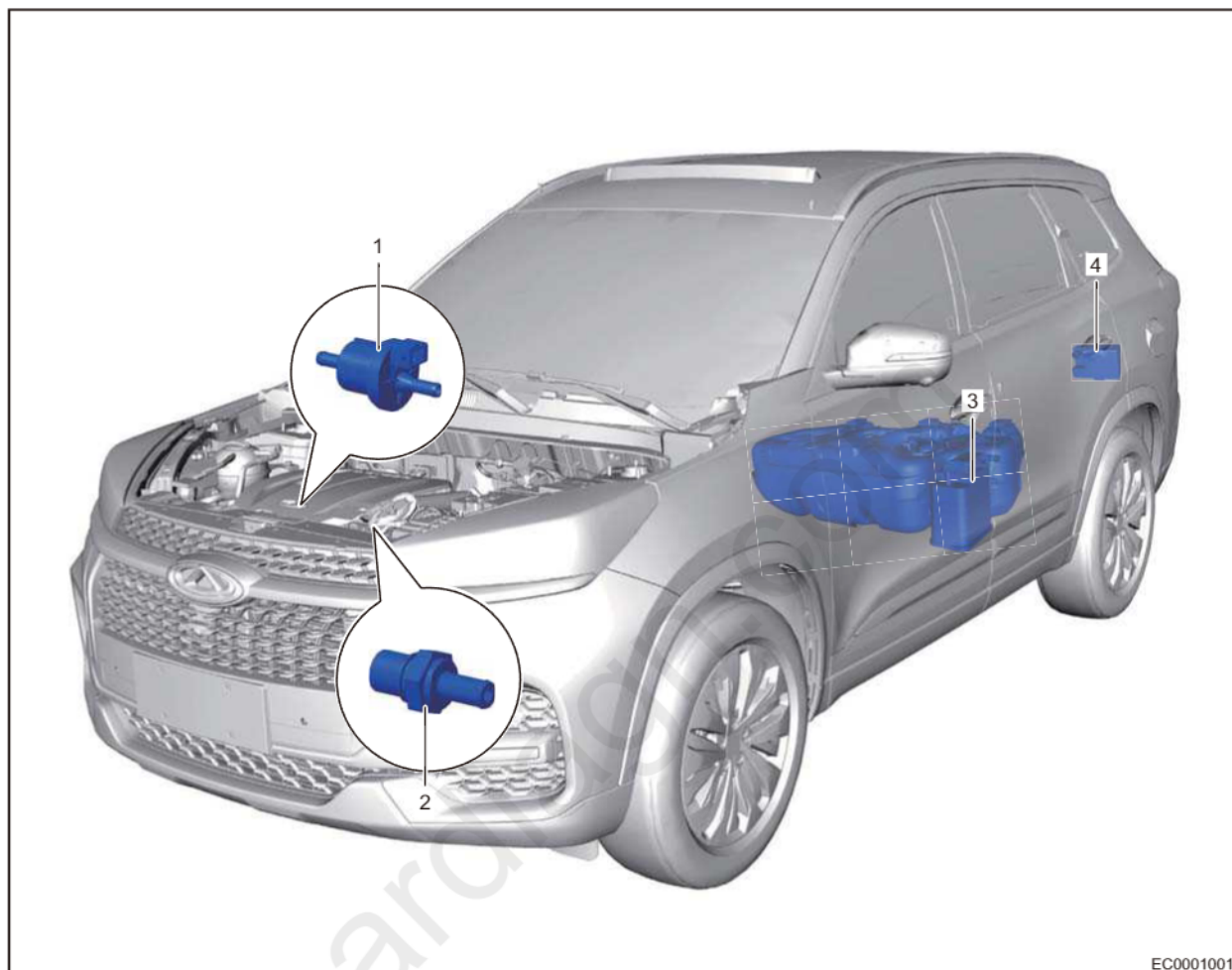


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GENERAL INFORMATION

Overview

Description



EC0001001

1 - Activated Charcoal Canister Solenoid Valve	2 - PCV Valve
3 - Activated Charcoal Canister Assembly	4 - Activated Charcoal Canister Filter

Operation

- Emission control system recovers and burns fuel vapor to prevent the vapor in fuel tank from being discharged into the atmosphere. It monitors the oxygen content in exhaust gas, so as to guarantee the maximum efficiency of catalytic converter assembly in converting the HC, CO and NOx in exhaust gas. Activated charcoal canister assembly plays an important role in the emission control system and it is used to absorb and filter moisture and fuel vapor. Fresh air enters the bottom of activated charcoal canister assembly while fuel vapor enters the top of activated charcoal canister through fuel vapor pipe. When engine stops operating, the fuel vapor and fresh air will be stored in the activated charcoal canister assembly. When engine operation canister solenoid valve opens, the fuel vapor will enter intake manifold and burns in the cylinder.



09–SQRE4T15B EXHAUST SYSTEM

- Oxygen sensor consists of upstream oxygen sensor and downstream oxygen sensor. Upstream oxygen sensor is installed on exhaust manifold assembly, and downstream oxygen sensor is installed on front exhaust pipe assembly. Oxygen sensor can detect the oxygen content in exhaust gas, and determine whether combustible air-fuel mixture is completely burnt out or not, so as to guarantee the maximum efficiency of catalytic converter assembly in converting the HC, CO and NOx in exhaust gas.

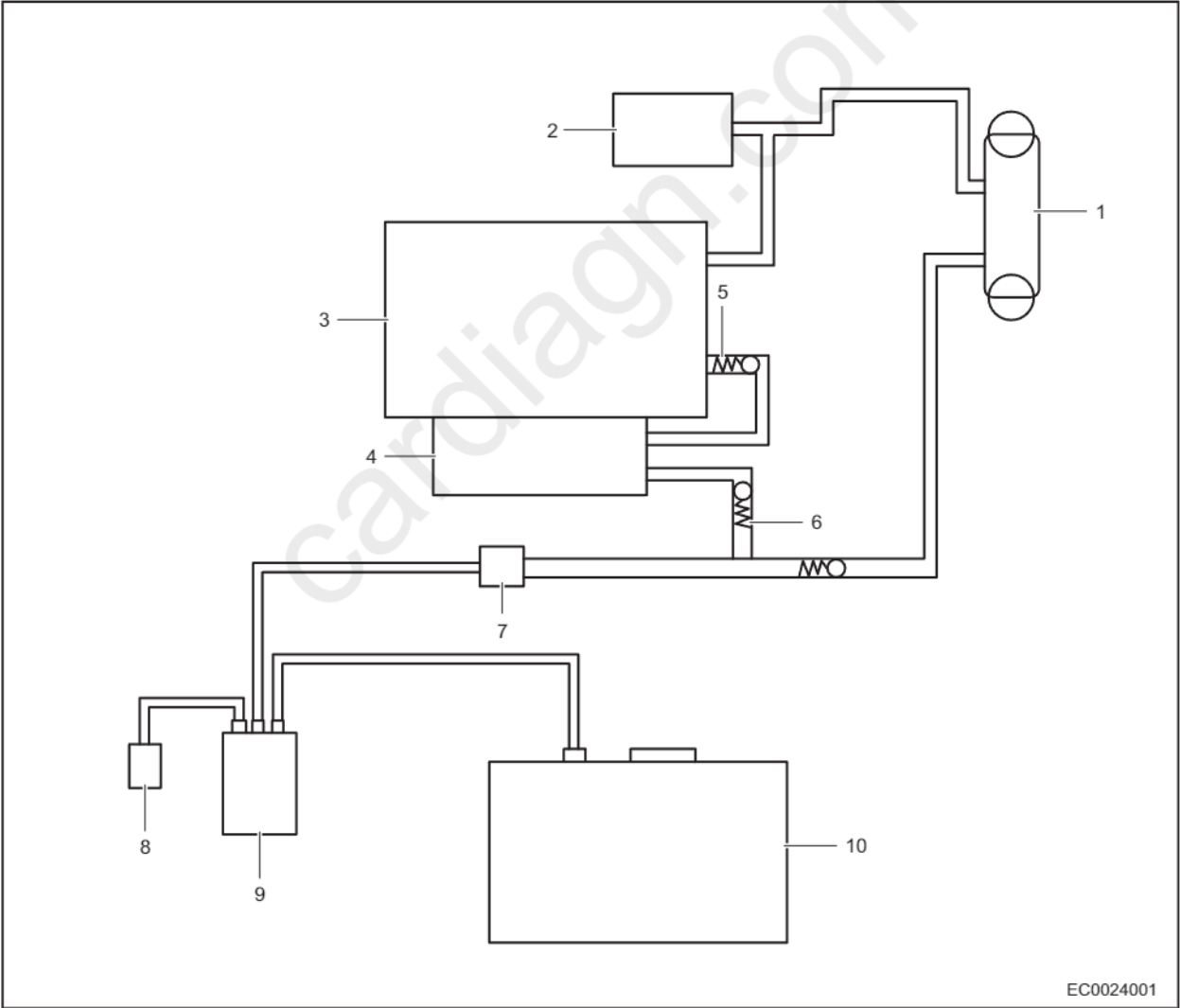
Specifications

Torque Specifications

Description	Torque (N·m)
Coupling Bolt Between Activated Charcoal Canister Assembly and Fuel Tank	7 ± 1
Upstream Oxygen Sensor	45 ± 5
Downstream Oxygen Sensor	45 ± 5
Coupling Bolt Between Activated Charcoal Canister Filter and Body	7 ± 1
PCV Valve Tightening Torque	4 ± 1

Emission Control System Schematic Diagram

09



EC0024001

1 - Intake Hose	2 - Turbocharger
3 - Engine	4 - Intake Manifold
5 - PCV Valve	6 - Check Valve

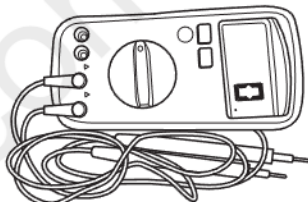
7 - Charcoal Canister Solenoid Valve	8 - Charcoal Canister Filter
9 - Charcoal Canister	10 - Fuel Tank

Tools

Special Tool

Digital Multimeter	 001
--------------------	---

General Tool

Digital Multimeter	 002
--------------------	--



DIAGNOSIS & TESTING

Diagnosis Contents

Leakage Inspection

Visually check that hoses and connections have no leaks or damage.

Caution:

- Removal of engine oil dipstick, filler cap, PCV hose and other components or other problems in them may cause the engine to run improperly. Air suction caused by disconnections, looseness or cracks in intake system pipes related to throttle assembly will result in engine failure or abnormal operation. Replace the parts as necessary.

Activated Charcoal Canister Inspection

1. Close port C and blow compressed air into port A, check that air flows from port B. If result is not as specified, replace the canister.



2. Close port C and blow compressed air into port B, check that air flows from port A. If result is not as specified, replace the canister.
3. Close port A and use vacuum pump to pump the vacuum from port B, check that air enters from port C. If it is not as specified, replace the filter and canister.

Fuel Tank Cap Assembly Inspection

1. Visually check that fuel tank cap assembly is not deformed or damaged.
2. If result is not as specified, replace the fuel tank cap assembly.

ON-VEHICLE SERVICE

Canister Solenoid Valve

Removal

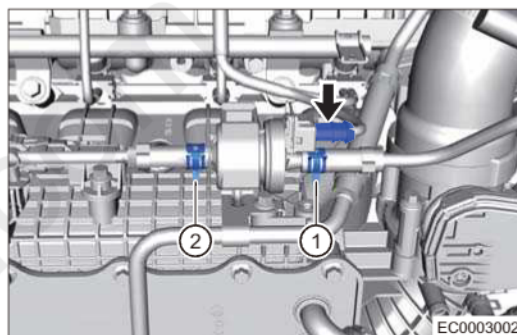
Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.
- Before removal, mark the fuel vapor pipe V assembly and charcoal canister solenoid valve outlet pipes to avoid confusion.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover
4. Remove the charcoal canister solenoid valve.

- (a) Disconnect the charcoal canister solenoid valve connector (arrow)
- (b) Loosen the elastic clamp (1), (2) and disconnect the connection between fuel vapor pipe V assembly and charcoal canister solenoid valve outlet pipes.

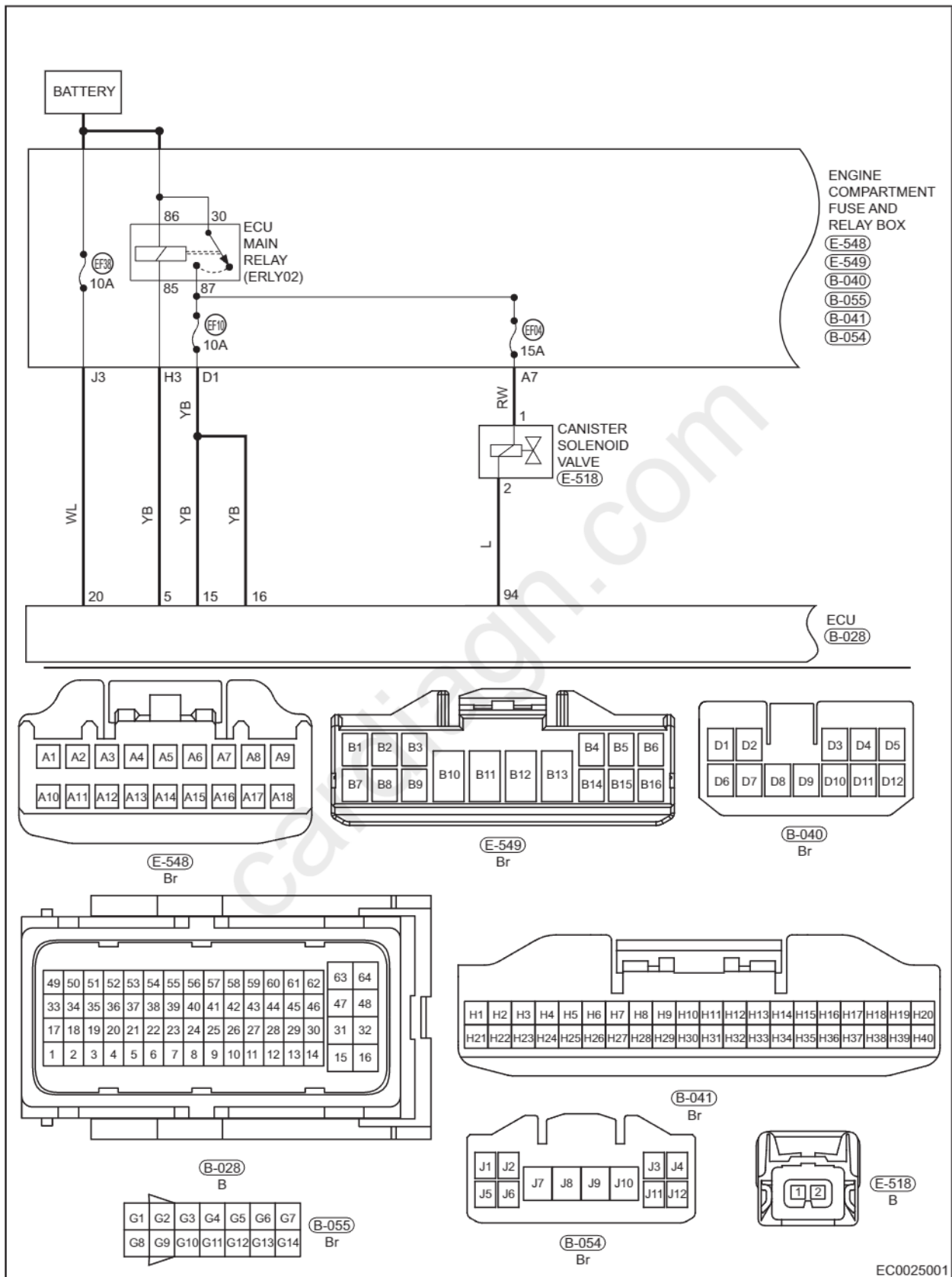


- (c) Remove the charcoal canister solenoid valve assembly from water outlet pipe set.

09



Charcoal Canister Solenoid Valve Circuit Diagram



EC0025001

Inspection

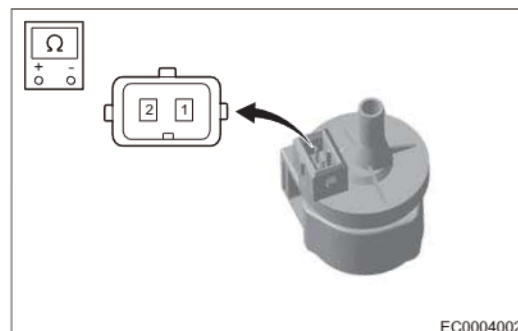
1. Inspect the resistance of ignition coil primary winding

- (a) Measure the resistance between 2 terminals of charcoal canister solenoid valve with a digital multimeter.

Measurement Temperature	Specification (Ω)
20°C	26 $\pm$ 4

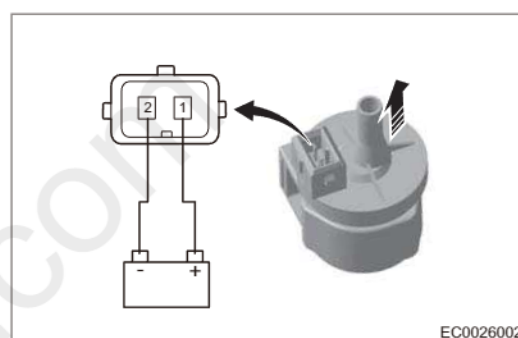
Hint:

If resistance is not as specified, replace the charcoal canister solenoid valve assembly.



2. Check if the charcoal canister solenoid valve opens normally and is blocked.

- (a) Connect the positive battery (+) to charcoal canister solenoid valve pin (1) and connect the negative battery (-) to charcoal canister solenoid valve pin (2). Check if the canister solenoid valve opens. After it opened, bleed air into direction of charcoal canister solenoid valve (arrow), and air flows easily.



09

Installation

1. Installation is in the reverse order of removal.

Caution:

- Positioning distance from hose end to elastic clamp is 3 to 5 mm.



Activated Charcoal Canister Assembly and Filter

Removal

Warning/Caution/Hint

Caution:

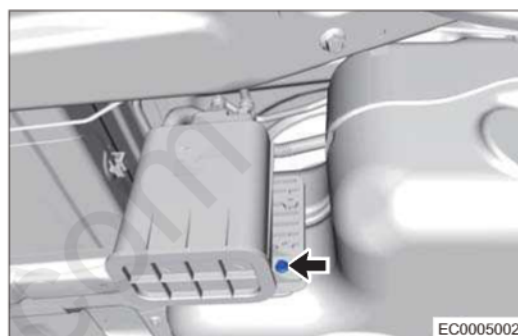
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.
- Before removal, mark the fuel vapor hose II, fuel vapor hose I and charcoal canister breather pipe to avoid confusion.

1. Turn off all electrical equipment and the ignition switch. Wait until engine cools down
2. Disconnect the negative battery cable.
3. Remove the activated charcoal canister assembly.

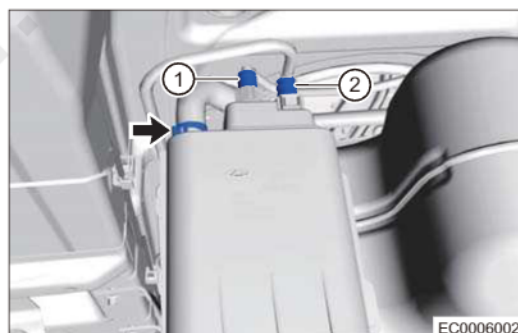
- (a) Remove the coupling bolts (arrow) between activated charcoal canister assembly and mounting bracket.

Tightening torque

$7 \pm 1 \text{ N}\cdot\text{m}$



- (b) Loosen the elastic clamp (arrow), and disconnect the connection between activated charcoal canister assembly and breather hose.

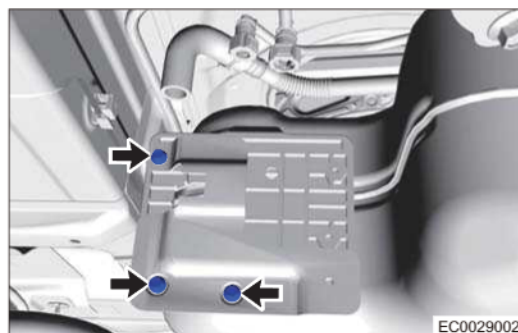


- (c) Disconnect the connection between activated charcoal canister assembly and fuel vapor pipe I (1) and fuel vapor pipe II (2).
 - (d) Remove the activated charcoal canister assembly.
4. Remove the activated charcoal canister mounting bracket.

- (a) Remove 3 fixing bolts (arrow) from mounting bracket.

Tightening torque

$5 \pm 0.5 \text{ N}\cdot\text{m}$



- (b) Remove the charcoal canister mounting bracket.

5. Remove the activated charcoal canister filter.
6. Remove the rear left tire (See page 24-8).
7. Remove the rear left wheel house protector (See page 50-32).

- (a) Remove the fixing bolt from activated charcoal canister filter (arrow).

Tightening torque
 $7 \pm 1 \text{ N}\cdot\text{m}$



- (b) Loosen the elastic clamp (arrow), and disconnect the connection between filter and breather hose.



- (c) Remove the activated charcoal canister filter assembly.

Caution:

- Unneeded activated charcoal canister assembly should be handled by the specialized department according to local laws and regulations. Never discard it at will.

Installation

Warning/Caution/Hint

Caution:

- Positioning distance from hose end to elastic clamp is 3 to 5 mm.
1. Installation is in the reverse order of removal.



PCV Valve

Removal

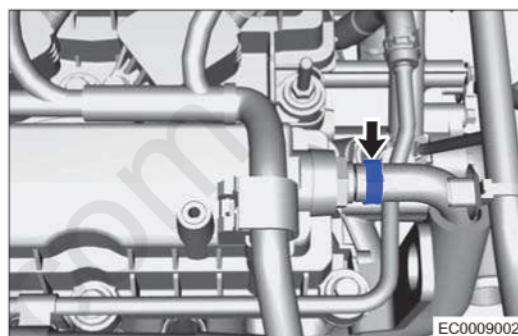
Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover
4. Remove the muffler assembly (See page 10-10).
5. Remove the PCV valve.

- (a) Loosen clamping ring (arrow) and disconnect connection between crankcase ventilation hose and PCV valve.



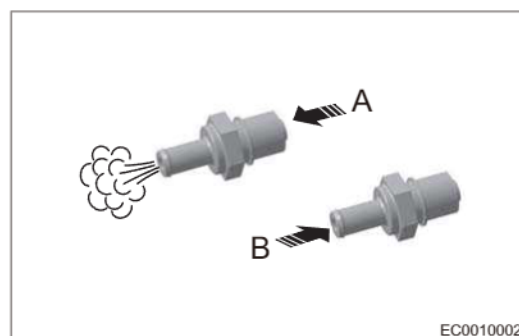
- (b) Loosen and remove the PCV valve from cylinder head cover.

Tightening torque

$4 \pm 1 \text{ N}\cdot\text{m}$

Inspection

1. Install a clean hose to PCV valve.
2. Check the PCV valve operation.
 - (a) Bleed air into the cylinder head cover side, and check that air A flows easily.



- (b) Blow air into the intake manifold side, and check that air B flows difficultly.

Hint:

- If result is not as specified, replace PCV valve.

Caution:

- DO NOT suck air through PCV valve. Petroleum substances inside the PCV valve are hazardous to your health.

3. Remove the clean hose from PCV valve.

Installation

Warning/Caution/Hint

Caution:

- Positioning distance from hose end to clamping ring is 3 to 5 mm.
1. Installation is in the reverse order of removal.



Upstream Oxygen Sensor

Removal

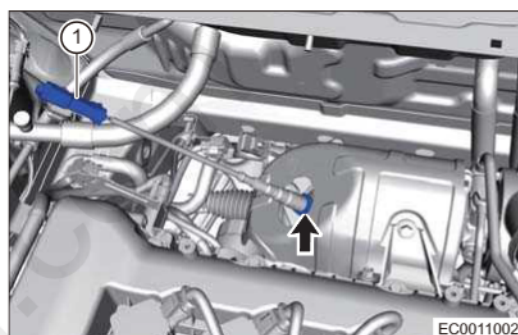
Warning/Caution/Hint

Caution:

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the upstream oxygen sensor.

- (a) Take off and disconnect the upstream oxygen sensor connector (1) from bracket.



- (b) Remove the upstream oxygen sensor (arrow) from tip of pre-catalytic converter.

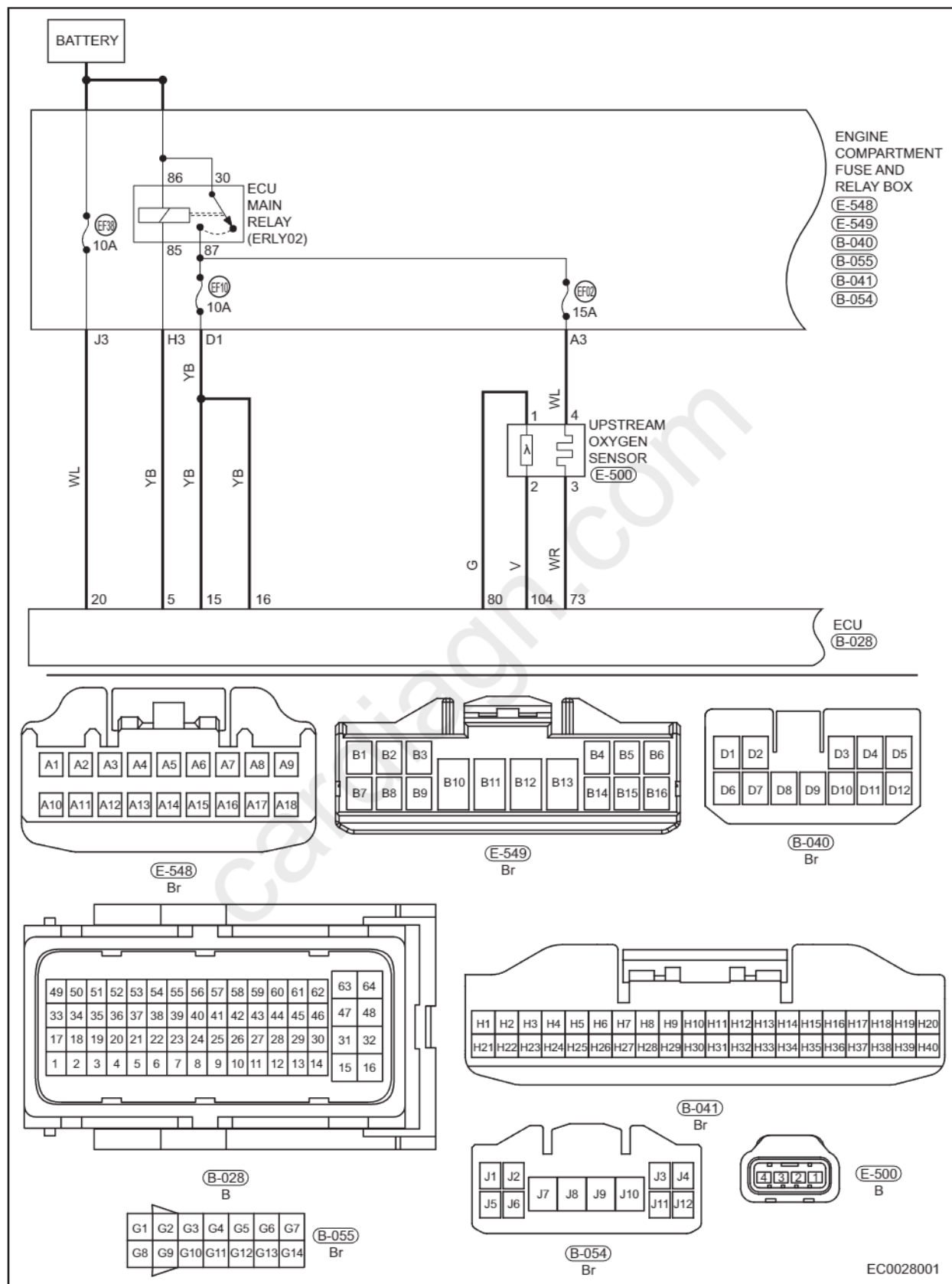
Hint:

Remove it with special tool oxygen sensor socket.

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$

Upstream Oxygen Sensor Circuit Diagram



Inspection

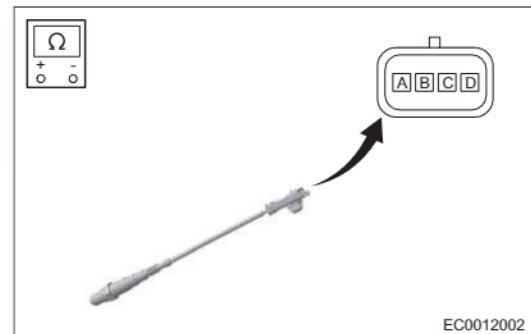
1. Check the upstream oxygen sensor.
 - (a) Measure the resistance of upstream oxygen sensor with a digital multimeter.

Multimeter Connection	Specified Condition
Terminal 1	Ground
Terminal 2	Signal
Terminal 3	Heat Control
Terminal 4	Power supply

Multimeter Connection	Condition	Specified Condition
Terminal 3 - Terminal 4	20°C	5 - 22 Ω
Terminal 1 - Terminal 2 Terminal 1 - Terminal 4 Terminal 2 - Terminal 3 Terminal 2 - Terminal 4	Always	No continuity

Hint:

- If result is not as specified, replace the upstream oxygen sensor.



Installation

1. Installation is in the reverse order of removal.

Caution:

The specified grease must be used, use of other grease will lead to oxygen sensor poisoning. The new part has been applied with grease during installation, it must be applied at the place where the threads are installed during reassembly.

Material Number

5964080112 (120 g/pot) or 5964080145 (450 g/pot)

Warning:

If the oxygen sensor falls, never pick it up to install and it need to return to factory for testing.

Downstream Oxygen Sensor

Removal

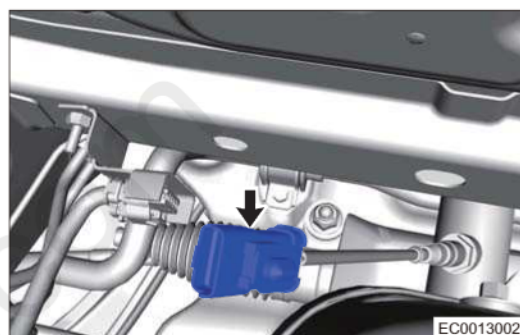
Warning/Caution/Hint

Caution:

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the downstream oxygen sensor.

- (a) Take off and disconnect the downstream oxygen sensor connector (arrow) from bracket.



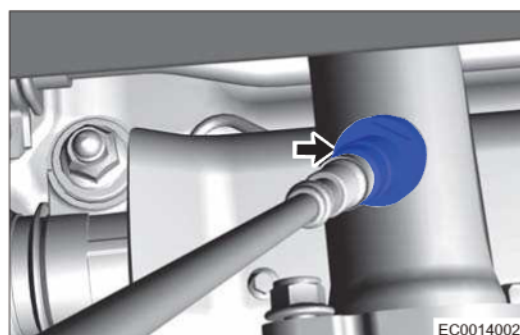
- (b) Raise the vehicle to a proper position.
- (c) Remove downstream oxygen sensor (arrow) from front exhaust pipe assembly.

Hint:

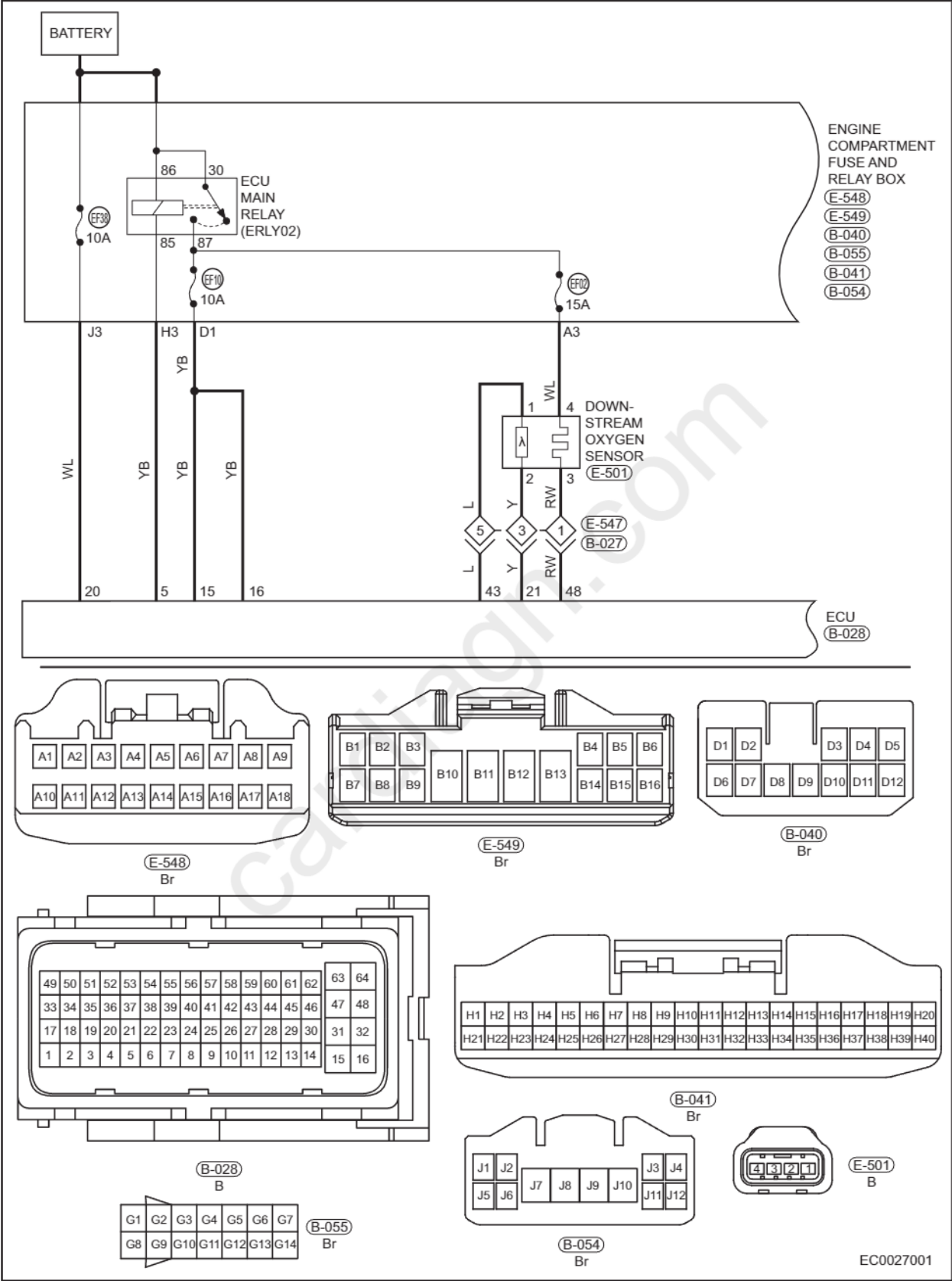
Remove it with special tool oxygen sensor socket.

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$



Downstream Oxygen Sensor Circuit Diagram



Inspection

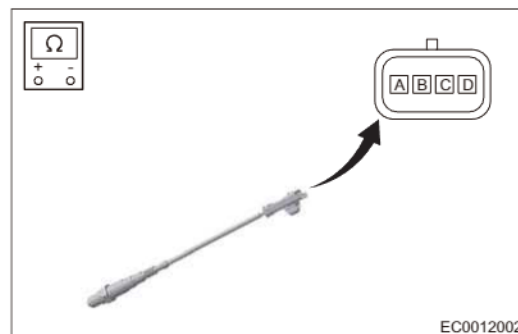
1. Check the downstream oxygen sensor.
 - (a) Measure the resistance of downstream oxygen sensor with a digital multimeter.

Multimeter Connection	Specified Condition
Terminal 1	Ground
Terminal 2	Signal
Terminal 3	Heat Control
Terminal 4	Power supply

Multimeter Connection	Condition	Specified Condition
Terminal 3 - Terminal 4	20°C	5 - 22 Ω
Terminal 1 - Terminal 2 Terminal 1 - Terminal 4 Terminal 2 - Terminal 3 Terminal 2 - Terminal 4	Always	No continuity

Hint:

- If result is not as specified, replace the downstream oxygen sensor.



Installation

1. Installation is in the reverse order of removal.

Caution:

The specified grease must be used, use of other grease will lead to oxygen sensor poisoning. The new part has been applied with grease during installation, it must be applied at the place where the threads are installed during reassembly.

Material Number

5964080112 (120 g/pot) or 5964080145 (450 g/pot)

Warning:

If the oxygen sensor falls, never pick it up to install and it need to return to factory for testing.



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SQRE4T15B INTAKE SYSTEM

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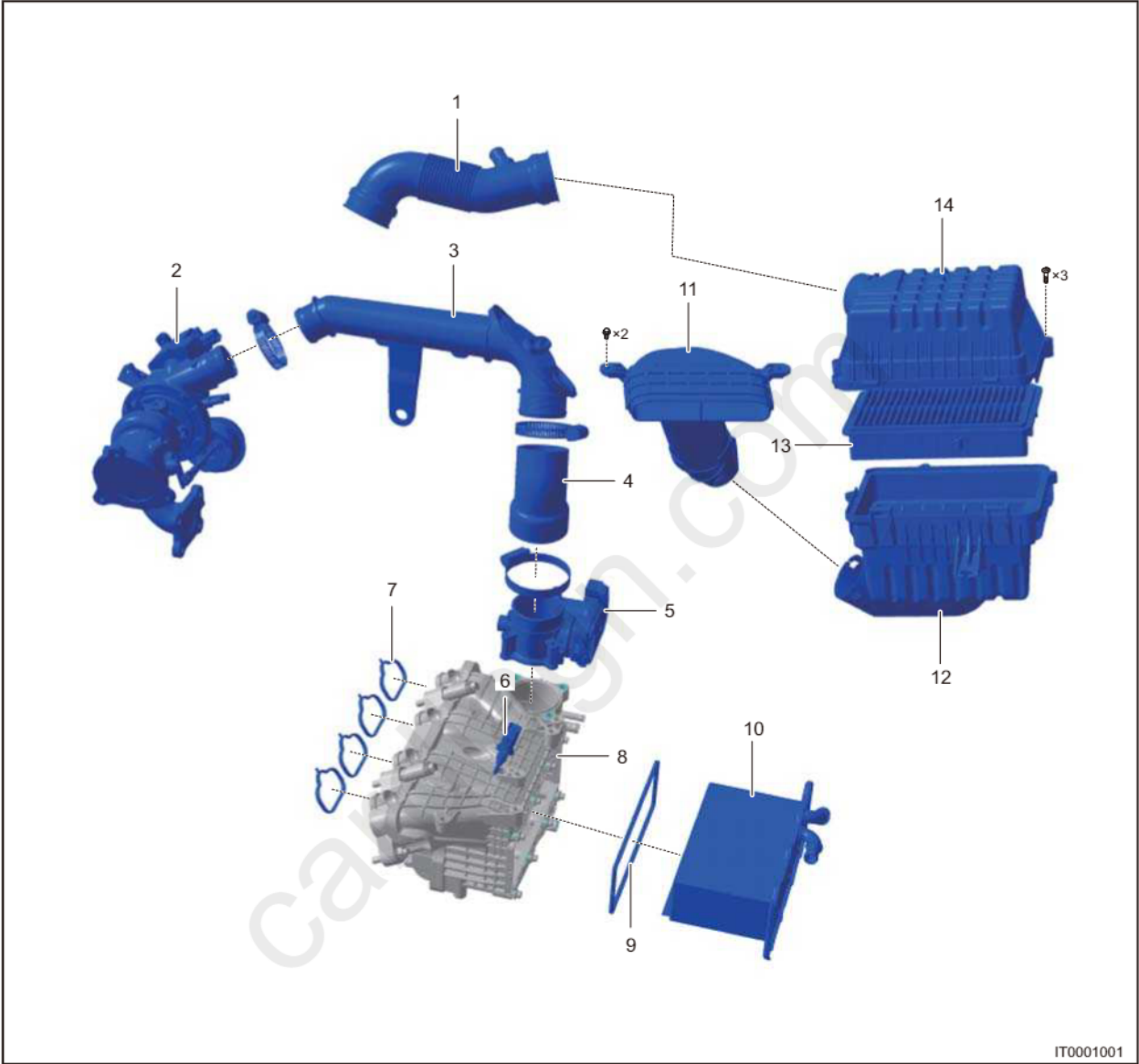


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GENERAL INFORMATION

Overview

Description



10

1 - Intake Hose	2 - Turbocharger
3 - Muffler Assembly	4 - Muffler Hose
5 - Electronic Throttle Assembly	6 - Intake Pressure/Temperature Sensor
7 - Intake Manifold Gasket	8 - Intake Manifold Assembly
9 - Intercooler Gasket	10 - Intercooler Assembly
11 - Air Direct Pipe Assembly	12 - Air Filter Lower Housing
13 - Air Filter Element Assembly	14 - Air Filter Upper Housing

Intake system mainly consists of air direct pipe, air filter assembly, intake hose, turbocharger, booster pressure/temperature sensor, electronic throttle assembly, intake pressure/temperature sensor, and intake manifold with intercooler set, etc.

Operation

Intake system uses air filter to remove particulates and dust in the air. The filtered air is boosted through turbocharger and then flows into intake manifold assembly through electronic throttle assembly. And at the same time, cooling the air with the intercooler built in intake manifold. Then mixes with fuel at the end of intake manifold assembly port to form flammable gas mixture, which is transmitted to each cylinder uniformly to coordinate with engine operation. Electronic throttle assembly is a critical part for engine intake system. Its main function is to control intake air volume by adjusting intake passage area according to driver's driving intention to meet intake requirements in different engine operating conditions, and send back position signals of throttle valve plate to control unit to achieve accurate control and run the engine under optimal control state.

Specifications

Torque Specifications

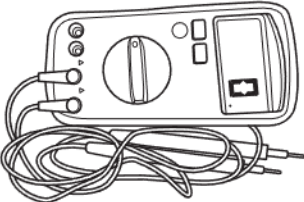
Description	Torque (N·m)
Coupling Screw Between Air Filter Upper Housing and Lower Housing	1.3 ± 0.2
Air Filter Assembly Fixing Bolt	7 ± 1
Air Direct Pipe Fixing Bolt	7 ± 1
Electronic Throttle Assembly Fixing Bolt	8 + 3
Electronic Accelerator Pedal Fixing Bolt	9 ± 1.5
Muffler Assembly Fixing Bolt	9 ± 1.5
Low Temperature Radiator Assembly Fixing Bolt	5 ± 1
Intake Manifold Fixing Bolt	20 + 5
Water Inlet Pipe Fixing Bolt	5 ± 1

Tools

Special Tool

Diagnostic Tester	 001
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General Tools

Digital Multimeter	 002
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Precision Straightedge	 063
Feeler Gauge	 060

DIAGNOSIS & TESTING

Diagnosis Contents

Problem Symptoms Table

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

Symptom	Possible Cause
Engine idles roughly	Electronic throttle assembly (dirty)
	Intake manifold assembly (broken, leaked)
	Activated charcoal canister solenoid valve (remains on)
	Intake Pressure/Temperature Sensor
	Throttle gasket (damaged)
	Fuel rail injector assembly (installed incorrectly)

ON-VEHICLE SERVICE

Air Filter Element

Removal

Warning/Caution/Hint

Caution:

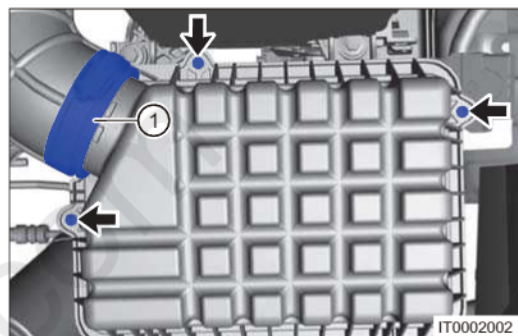
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the air filter element.

- (a) Remove 3 coupling screws (arrow) between air filter upper housing and lower housing.

Tightening torque

$1.3 \pm 0.2 \text{ N}\cdot\text{m}$



- (b) Loosen worm clamp (1) and disconnect connection between air filter and intake hose.

Tightening torque

$3 \pm 0.5 \text{ N}\cdot\text{m}$

- (c) Remove the air filter upper housing.
- (d) Remove the air filter element in the direction of (arrow).



Installation

1. Clean the air filter upper housing and lower housing.
2. Install a new air filter element.
3. Other installation procedures are in the reverse order of removal.

Warning:

- Wasted air filter element should be handled by the specialized department according to local laws and regulations. Never discard it at will.



Air Filter Assembly

Removal

Warning/Caution/Hint

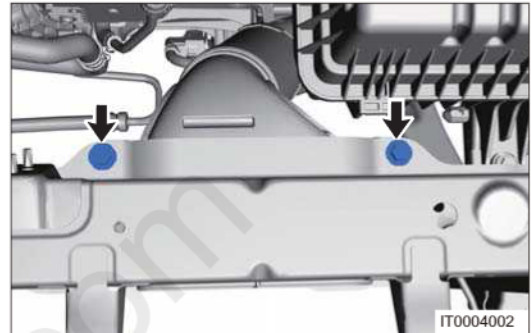
Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch. Wait until engine cools down.
 2. Disconnect the negative battery cable.
 3. Remove the air direct pipe assembly.

- (a) Remove 2 fixing bolts (arrow) from air direct pipe.

Tightening torque

$7 \pm 1 \text{ N}\cdot\text{m}$

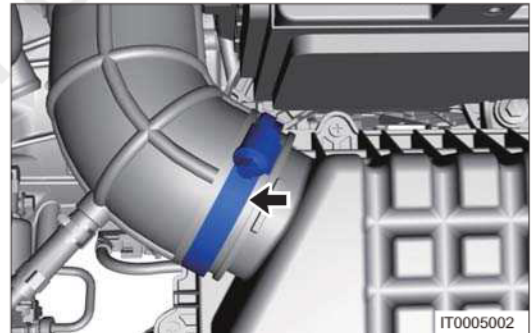


- 10** 4. Remove the air filter assembly.

- (a) Loosen worm clamp (arrow) and disconnect connection between air filter and intake hose.

Tightening torque

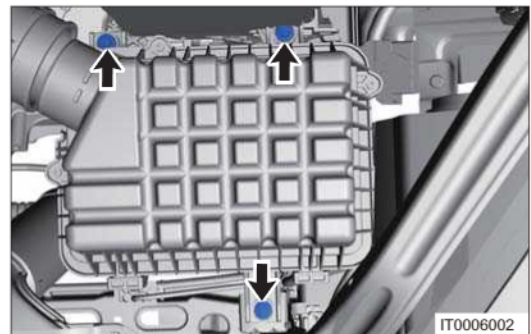
$3 \pm 0.5 \text{ N}\cdot\text{m}$



- (b) Remove 3 fixing bolts (arrow) from air filter.

Tightening torque

$7 \pm 1 \text{ N}\cdot\text{m}$



- (c) Remove the air filter assembly.

Caution:

- After removing air filter assembly, block intake hose with suitable blocking pieces to prevent foreign matter from entering, causing damage to the components.

Installation

1. Installation is in the reverse order of removal.

Caution:

- Check for foreign matter in air filter and hose when installing. Avoid inhaling foreign matter after engine running, causing damage to the components.



Muffler and Muffler Hose

Removal

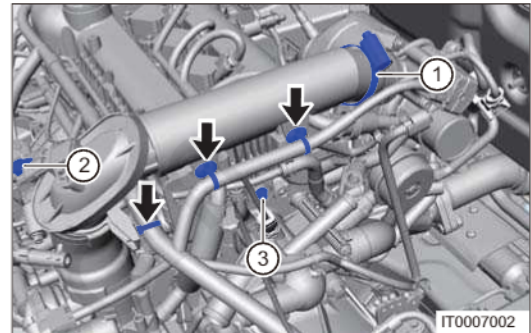
Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the intake hose assembly.
4. Remove the muffler assembly.

- (a) Remove fixing clips (arrow) from engine wire harness and muffler assembly.



- (b) Loosen worm clamp (1) and disconnect connection between muffler assembly and turbocharger.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$

- (c) Disconnect the boost pressure/temperature sensor connector (2).
- (d) Remove the muffler assembly fixing bolt (3).

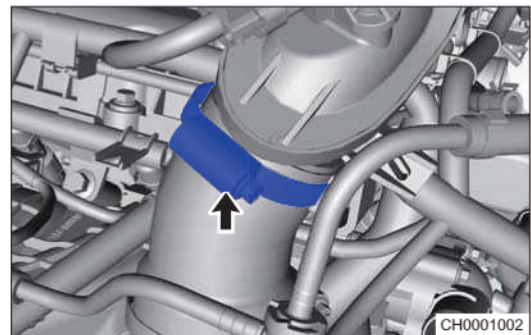
Tightening torque

$9 \pm 1.5 \text{ N}\cdot\text{m}$

- (e) Loosen worm clamp (arrow) and disconnect connection between muffler assembly and muffler hose.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$



- (f) Remove the muffler assembly.

Caution:

- After removing muffler assembly, block turbocharger outlet side with suitable blocking pieces to prevent foreign matter from entering, causing damage to the components.

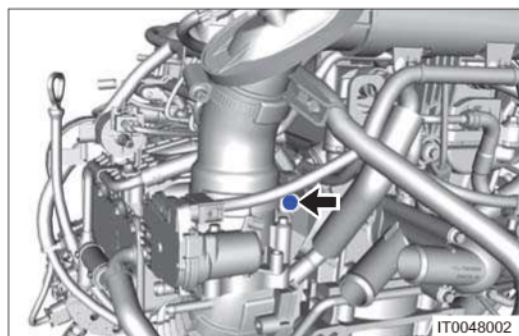
5. Remove the muffler hose.
 - (a) Loosen worm clamp (arrow) and disconnect connection between muffler hose and throttle assembly.

Tightening torque

$3 \pm 0.5 \text{ N}\cdot\text{m}$

Caution:

- After removing muffler hose assembly, block throttle with suitable blocking pieces to prevent foreign matter from entering, causing damage to the components.

**Installation**

1. Installation is in the reverse order of removal.

Caution:

- Check for foreign matter in muffler and hose when installing. Avoid inhaling foreign matter after engine running, causing damage to the components.

Low Temperature Radiator

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

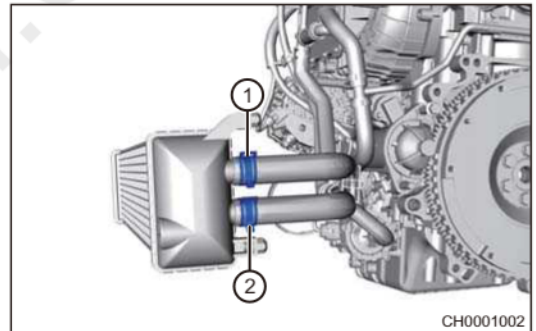
1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove and install the tank lower protector (See page 50-24).
4. Remove the front bumper assembly (See page 50-6).

Caution:

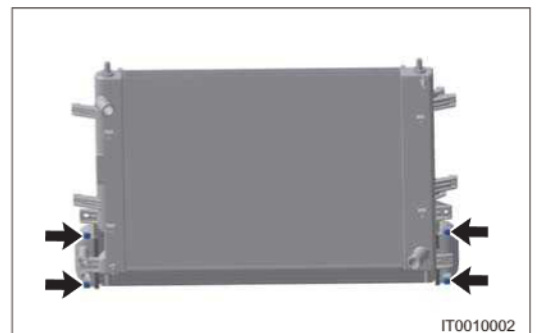
- Prevent scratches or damage to front bumper during removal.
5. Remove the front bumper guard beams assembly (See page 50-12).
 6. Remove left and right air deflectors or intelligent grille assembly.

Caution:

- Intelligent grille is equipped for BlueMotion and deluxe models, and air deflector is equipped for non-BlueMotion models.
7. Remove the low temperature radiator assembly.
 - (a) It is necessary to drain the coolant from intercooler system before removing low temperature radiator (See COOLING SYSTEM).
 - (b) Loosen elastic clamp (1) and disconnect connection between low temperature radiator water inlet pipe and low temperature radiator assembly.



- (c) Loosen the elastic clamp (2). Disconnect connection between low temperature radiator water outlet pipe and low temperature radiator assembly.
- (d) Remove 4 fixing bolts from low temperature radiator assembly.



Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$

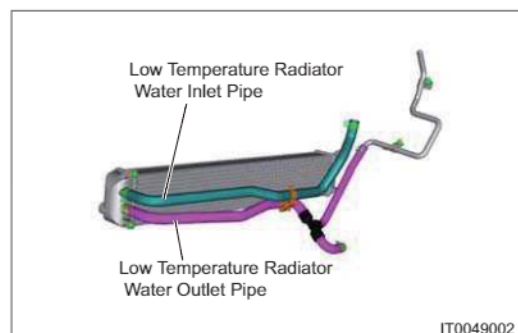
- (e) Take out the low temperature radiator assembly, position it in place.

Installation

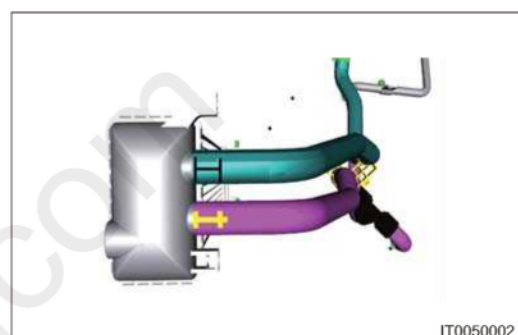
1. Installation is in the reverse order of removal.

Caution:

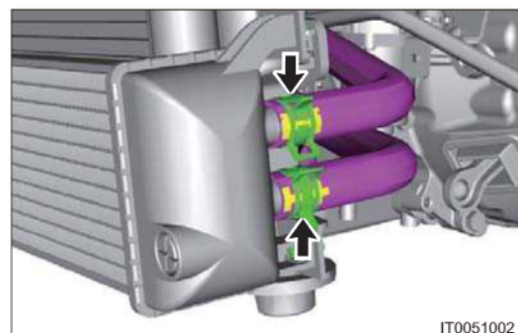
- There are no crossed or twisted conditions occur and never install water inlet pipe and water outlet pipe reversed when installing them. Make sure that elastic clamp is clamped in place with clamp pliers.



- There is "工" mark at port of water inlet pipe, and connected with low temperature radiator upper interface.



- There is "±" mark at port of water outlet pipe, and connected with low temperature radiator lower interface.
- When installing low temperature radiator water inlet pipe, align the "工" mark at port with boss and align center position of elastic clamp tabs with "一" position of "工" mark. Elastic clamp is clamped in "工" mark range, tabs face towards outside and put marks with marking pen.



- When installing low temperature radiator water outlet pipe, align center position of elastic clamp tabs with center position of "±" mark. Elastic clamp is clamped in "±" mark range, tabs face towards outside.
- Pay attention to the connection principle of "Insert, Extract and Confirm" when installing front bumper assembly. And adjust the match between front bumper & headlight and fender.
- Add the coolant and perform bleeding of intercooler system (Refer to Cooling System Chapter).
- After assembly is completed, it is necessary to check relevant function items and clean engine compartment.



Electric Throttle Assembly

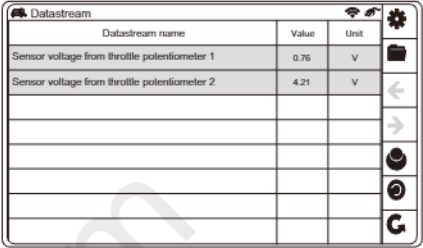
On-vehicle Inspection

1. Check the electronic throttle assembly.
 - (a) When flipping it by hand with power off and it can rotate smoothly. If catching occurs, it indicates that internal components may be damaged, and replace the electronic throttle assembly.
 - (b) Connect the diagnostic tester to diagnostic interface.
 - (c) Turn ignition switch to ON and turn on the diagnostic tester.
 - (d) Read datastream on diagnostic tester.

Hint:

Accelerator pedal released

Datastream Name	Specification (V)
Sensor voltage from throttle potentiometer 1	0.76
Sensor voltage from throttle potentiometer 2	4.21



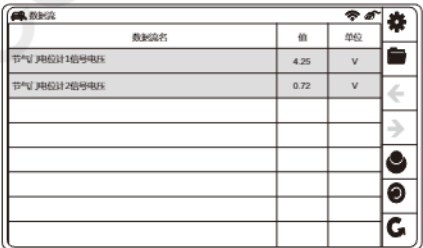
The screenshot shows a diagnostic tool interface with a table of datastream names, values, and units. The first two rows are highlighted in grey. The first row shows 'Sensor voltage from throttle potentiometer 1' with a value of 0.76 and unit 'V'. The second row shows 'Sensor voltage from throttle potentiometer 2' with a value of 4.21 and unit 'V'. The interface also includes navigation buttons like back, forward, and search, and a settings icon.

IT0011002

Hint:

Accelerator pedal depressed fully

Datastream Name	Specification (V)
Sensor voltage from throttle potentiometer 1	4.25
Sensor voltage from throttle potentiometer 2	0.72



The screenshot shows a diagnostic tool interface with a table of datastream names, values, and units. The first two rows are highlighted in grey. The first row shows '节气门 传感器1 电压' (Throttle Sensor 1 Voltage) with a value of 4.25 and unit 'V'. The second row shows '节气门 传感器2 电压' (Throttle Sensor 2 Voltage) with a value of 0.72 and unit 'V'. The interface also includes navigation buttons like back, forward, and search, and a settings icon.

IT0012002

If result is not as specified, check wire harness, ECM, or replace electronic throttle assembly.

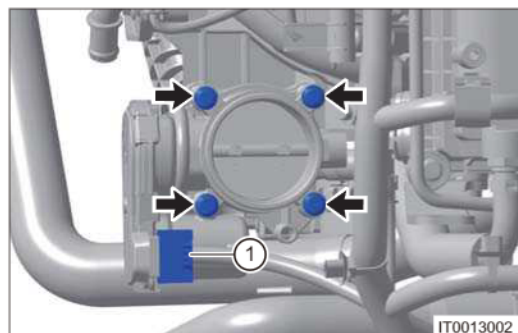
Removal

Warning/Caution/Hint

Caution:

- Temperature in engine compartment is very high when engine is running. Before removal, you must make sure that engine has shut off, and engine compartment has cooled down sufficiently, otherwise, there is a risk of scald injury.
 - Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the engine trim cover.
 4. Remove the muffler and muffler hose ([See page 10-10](#))

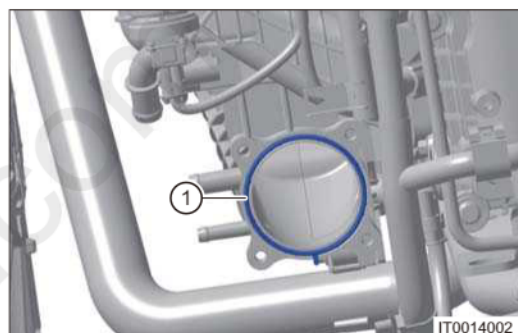
5. Remove the electronic throttle assembly.
 (a) Disconnect the electronic throttle connector (1).



- (b) Remove 4 fixing bolts (arrow) from electronic throttle.
Tightening torque
 $8 + 3 \text{ N}\cdot\text{m}$
 (c) Remove the electronic throttle assembly.
 (d) Remove throttle gasket (1) from intake manifold.

Caution:

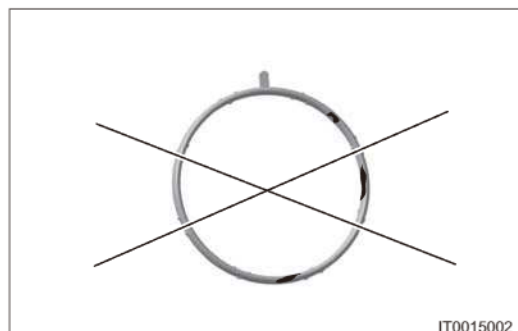
- After removing throttle assembly, block intake manifold intake port with suitable blocking pieces to prevent foreign matter from entering, causing damage to the components.



10

Inspection

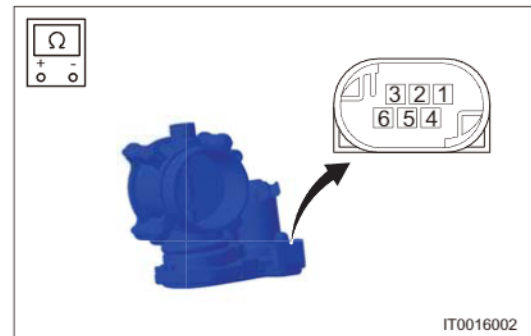
1. Check the electronic throttle assembly gasket.
 Check electronic throttle assembly gasket for wear or deterioration. If there is wear or deterioration, replace electronic throttle assembly gasket.



10-SQRE4T15B INTAKE SYSTEM

2. Check the electronic throttle assembly.
Measure resistance of electronic throttle assembly according to the right table.

Multimeter Connection	Standard Condition
Terminal 2 - Terminal 3	1.067 kΩ (resistance at ambient temperature)
Terminal 6 - Terminal 2 Terminal 6 - Terminal 3	As throttle opens, resistance between terminals 6 and 2 increases. And resistance between terminals 6 and 3 decreases.
Terminal 5 - Terminal 2 Terminal 5 - Terminal 3	As throttle opens, resistance between terminals 5 and 2 decreases. And resistance between terminals 5 and 3 increases.



Cleaning

1. Cleaning Tool

- (a) Thin stick: used to support throttle valve plate for cleaning the carbon deposited on contact wall between valve plate and throttle. Please use plastic, wooden or bamboo thin stick. Do not use metal thin stick to avoid scratching or deforming the valve plate.
- (b) Clean cloth or paper towel.

10

2. Cleaning Process

- (a) Remove electronic throttle assembly, and make the valve plate face upward in free condition. Avoid cleaner flowing into electronic element through valve plate shaft, resulting in functional failure.
- (b) Start to clean when it is as shown in the right illustration.



- (c) Apply appropriate amount of cleaner to the inner wall of throttle valve body, and wipe off the carbon with clean cloth.
- (d) Support the throttle valve plate with a thin stick, and clean the carbon on valve plate and throttle valve body inner wall.



- (e) Turn over the throttle 180°, and clean with the same procedures as above. Repeat several times until it is clean.
- (f) Push the valve plate by hand, and check if it rotates smoothly. If it is stuck, clean again according to the cleaning procedures.

- (g) After cleaning, wipe off the cleaner in throttle valve body with absorbent paper.

Warning:

- Cleaner is a kind of flammable and corrosive fluid. Follow safety cautions to prevent accidents, and avoid skin contacting with cleaner.
- Pay attention to that the amount of cleaner should not be too much, so as to overflows into sensor and motor, resulting in functional failure.

Installation

Warning/Caution/Hint

Caution:

- Clean fitting surface of electronic throttle assembly.
 - Perform throttle self-learning procedures after installation. After self-learning is completed, start the vehicle and check for proper operation.
1. Installation is in the reverse order of removal.



Intake Manifold Assembly

Removal

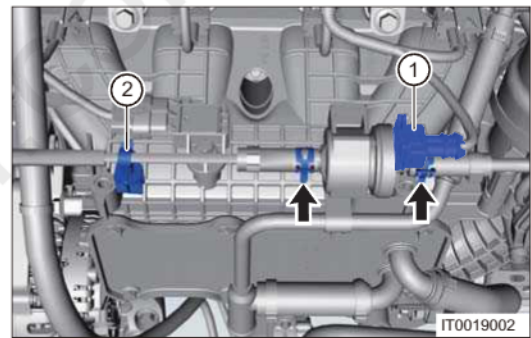
Warning/Caution/Hint

Caution:

- Temperature in engine compartment is very high when engine is running. Before removal, you must make sure that engine has shut off, and engine compartment has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Fuel System Pressure Release (See page 08-8).
2. Turn off all electrical equipment and the ignition switch.
3. Disconnect the negative battery cable.
4. Remove the engine trim cover.
5. Remove the fuel rail injector assembly (See page 08-22).
6. Remove the muffler and muffler hose (See page 10-10).
7. Remove the electronic throttle assembly (See page 10-14).
8. Remove the charcoal canister solenoid valve assembly.

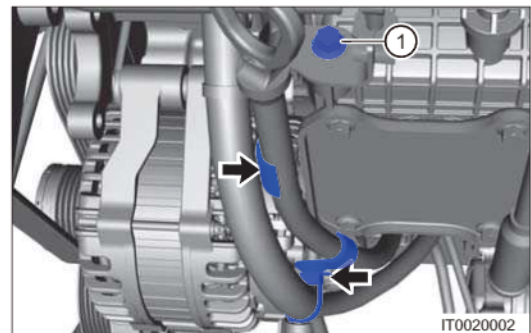
- (a) Disconnect the charcoal canister solenoid valve connector (1).



- (b) Loosen 2 elastic clamps (arrow) and disconnect connection between fuel vapor hose and charcoal canister solenoid valve.
- (c) Remove fuel vapor hose from fixing tube clamp (2).
- (d) Remove the charcoal canister solenoid valve assembly.

9. Remove the oil dipstick guide assembly.

- (a) Disconnect the engine wire harness fixing clip (arrow).

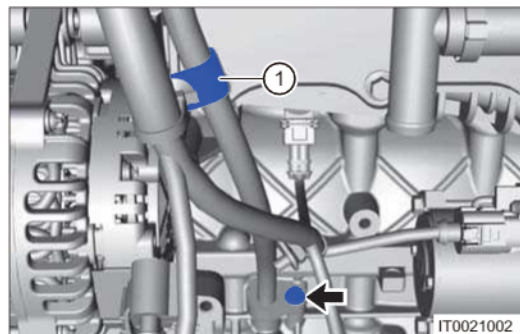


- (b) Remove coupling bolt (1) between oil dipstick guide and intake manifold assembly.

Tightening torque

8 + 3 N·m

- (c) Disconnect the engine wire harness fixing clip (1).



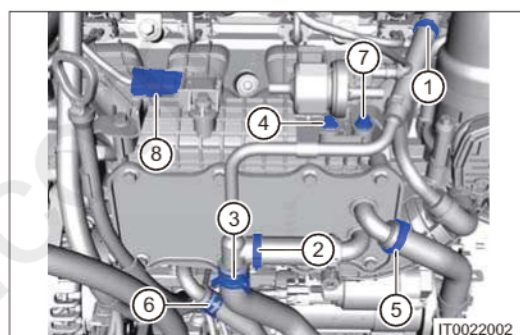
- (d) Remove coupling bolt (arrow) between oil dipstick guide and cylinder block frame assembly.

Tightening torque

8 + 3 N·m

- (e) Remove the oil dipstick guide assembly.

10. Remove the intake manifold assembly.



- (a) Loosen clamping ring (1) and disconnect connection between water outlet pipe set and intercooler water outlet pipe set.
 (b) Loosen clamping ring (2) and disconnect connection between intercooler water outlet pipe set and intercooler assembly.
 (c) Loosen elastic clamp (3) and disconnect connection between intercooler water outlet pipe set and low temperature radiator water inlet pipe set.
 (d) Remove intercooler outlet pipe set fixing bolt (4), and remove intercooler outlet pipe set.

Tightening torque

8 + 3 N·m

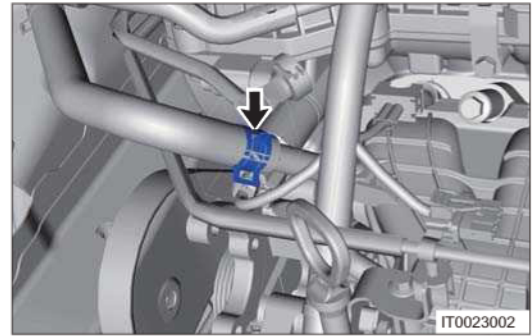
- (e) Loosen clamping ring (5) and disconnect connection between water inlet pipe set and intercooler assembly.
 (f) Loosen elastic clamp (6) and disconnect connection between water inlet pipe and low temperature radiator water outlet pipe set.
 (g) Remove fixing bolt (7) from brake vacuum pipe bracket.

Tightening torque

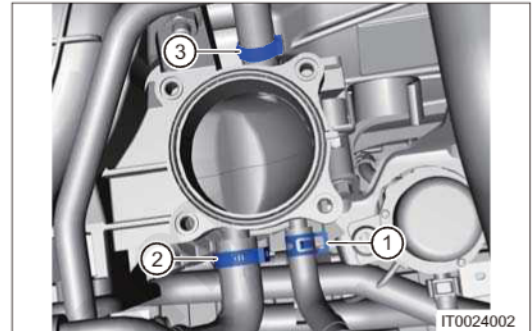
8 + 3 N·m

- (h) Disconnect the intake pressure/temperature sensor connector (8).

- (i) Loosen elastic clamp (arrow) and disconnect connection between expansion tank water outlet pipe set and water inlet pipe.



- (j) Loosen elastic clamp (1) and disconnect connection between fuel vapor outlet pipe set and intake manifold assembly.



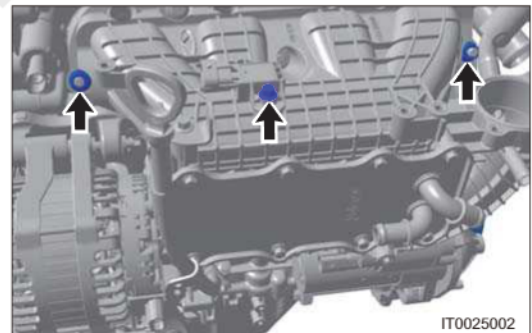
- (k) Loosen elastic clamp (2) and disconnect connection between brake vacuum pipe and intake manifold assembly.

- (l) Loosen clamping ring (3) and disconnect connection between crankcase ventilation tube and intake manifold assembly.

- (m) Remove 3 fixing bolts (arrow) from intake manifold assembly.

Tightening torque

$20 + 5 \text{ N}\cdot\text{m}$



- (n) Remove the intake manifold assembly.

Caution:

- After removing intake manifold assembly, block both ends of intake manifold and intake port of cylinder head with suitable blocking pieces to prevent foreign matter from entering, causing damage to the components.

11. Remove intake pressure/temperature sensor and water inlet pipe.

- (a) Remove 2 fixing bolts (arrow) from water inlet pipe.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$



- (b) Remove the intake pressure/temperature sensor fixing bolt (1).

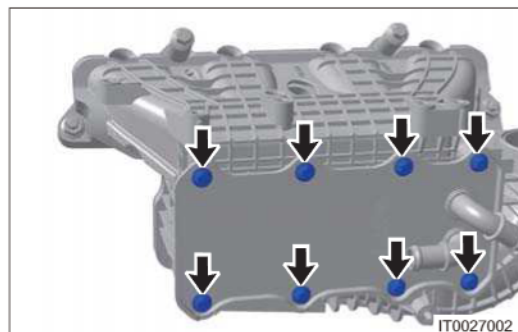
Tightening torque

$7 \pm 1 \text{ N}\cdot\text{m}$

- (c) Remove intake pressure/temperature sensor and water inlet pipe.

12. Remove the intercooler assembly.

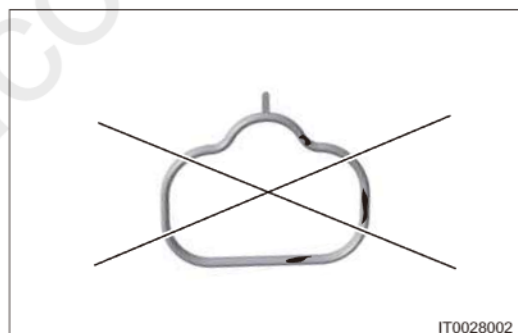
- (a) Remove 8 intercooler fixing bolts (arrow).



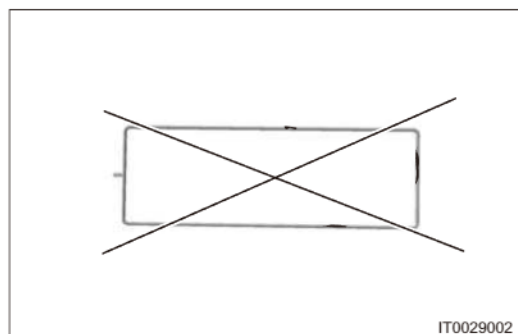
- (b) Remove intercooler assembly and gasket.

Inspection

1. Check the intake manifold gasket.
Check the intake manifold gasket, and replace if it is deteriorated or damaged.



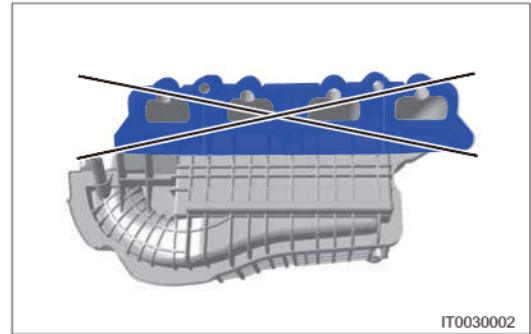
2. Check the intercooler gasket.
Check the intercooler gasket, and replace if it is deteriorated or damaged.



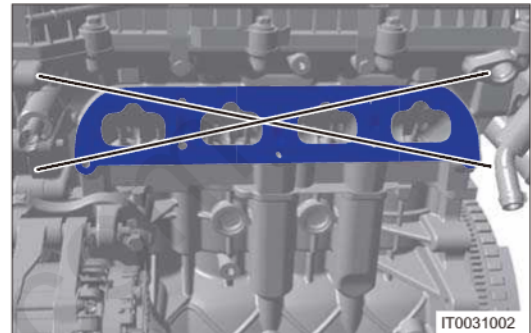
3. Check flatness on intake manifold fitting surface.
(a) Clean and check contact surface between intake manifold assembly side and cylinder head.



- (b) Using a precision straightedge and feeler gauge, measure intake manifold flatness. If warpage on surface is greater than 0.8 mm, replace intake manifold assembly.



4. Check warpage on cylinder head surface on installation side of intake manifold.
- (a) Clean and check contact surface between intake manifold assembly and cylinder head side.
- (b) Using a precision straightedge and feeler gauge, measure warpage on cylinder head side surface. If warpage on surface is greater than 0.04 mm, replace cylinder head assembly.



Installation

Warning/Caution/Hint

Caution:

- Clean the fitting surface of intake manifold assembly.
 - Replace the intake manifold gasket if it is damaged during installation.
1. Installation is in the reverse order of removal.

Caution:

- Check for foreign matter in intake manifold when installing. Avoid inhaling foreign matter after engine running, causing damage to the components.

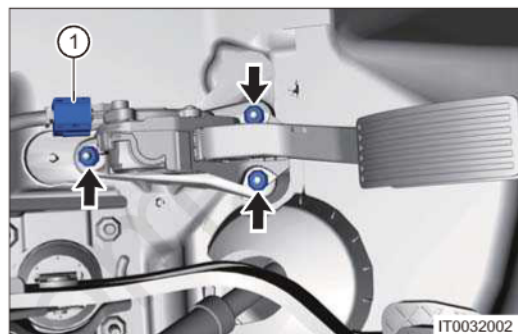
Electronic Accelerator Pedal

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent interior from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the electronic accelerator pedal.
 - (a) Disconnect the electronic accelerator pedal connector (1).



- (b) Remove 3 fixing nuts (arrow) from electronic accelerator pedal.

Tightening torque

$9 \pm 1.5 \text{ N}\cdot\text{m}$

- (c) Remove the electronic accelerator pedal.

Installation

1. Installation is in the reverse order of removal.

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SQRE4T15B EXHAUST SYSTEM

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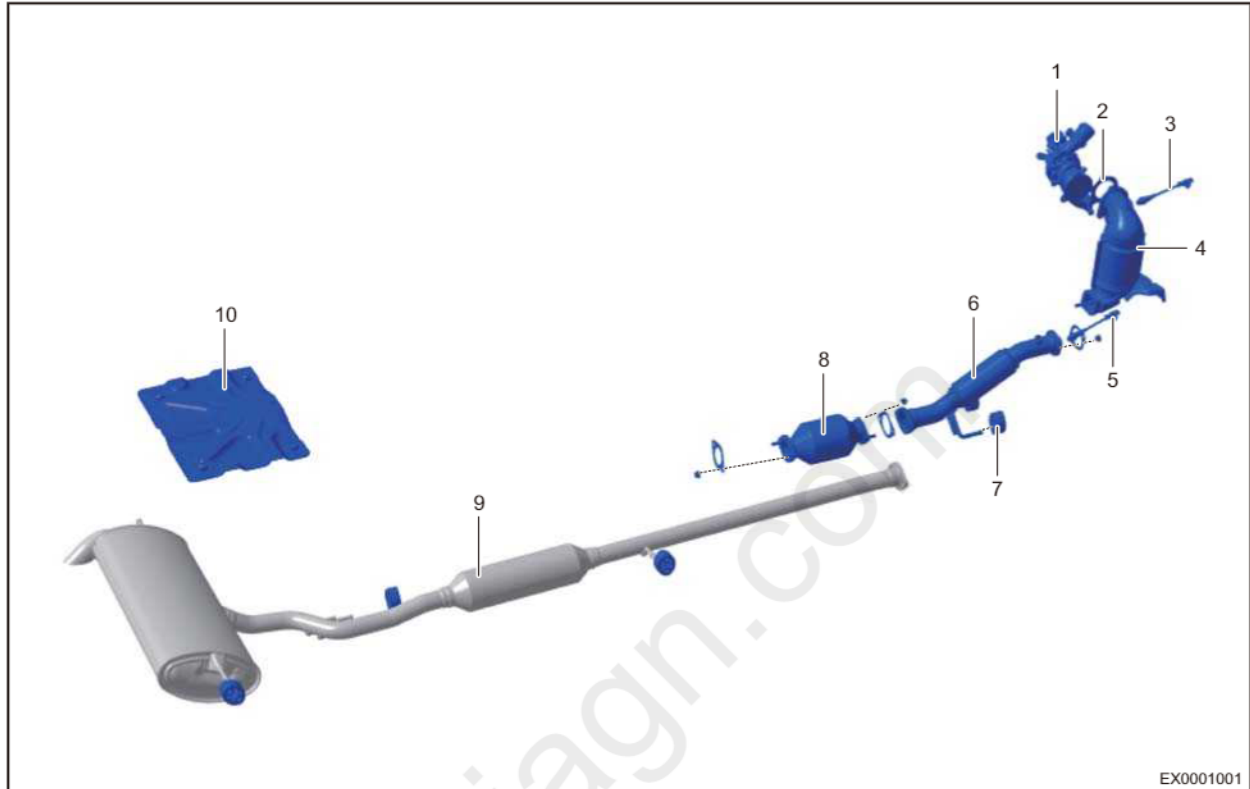


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GENERAL INFORMATION

Overview

Description



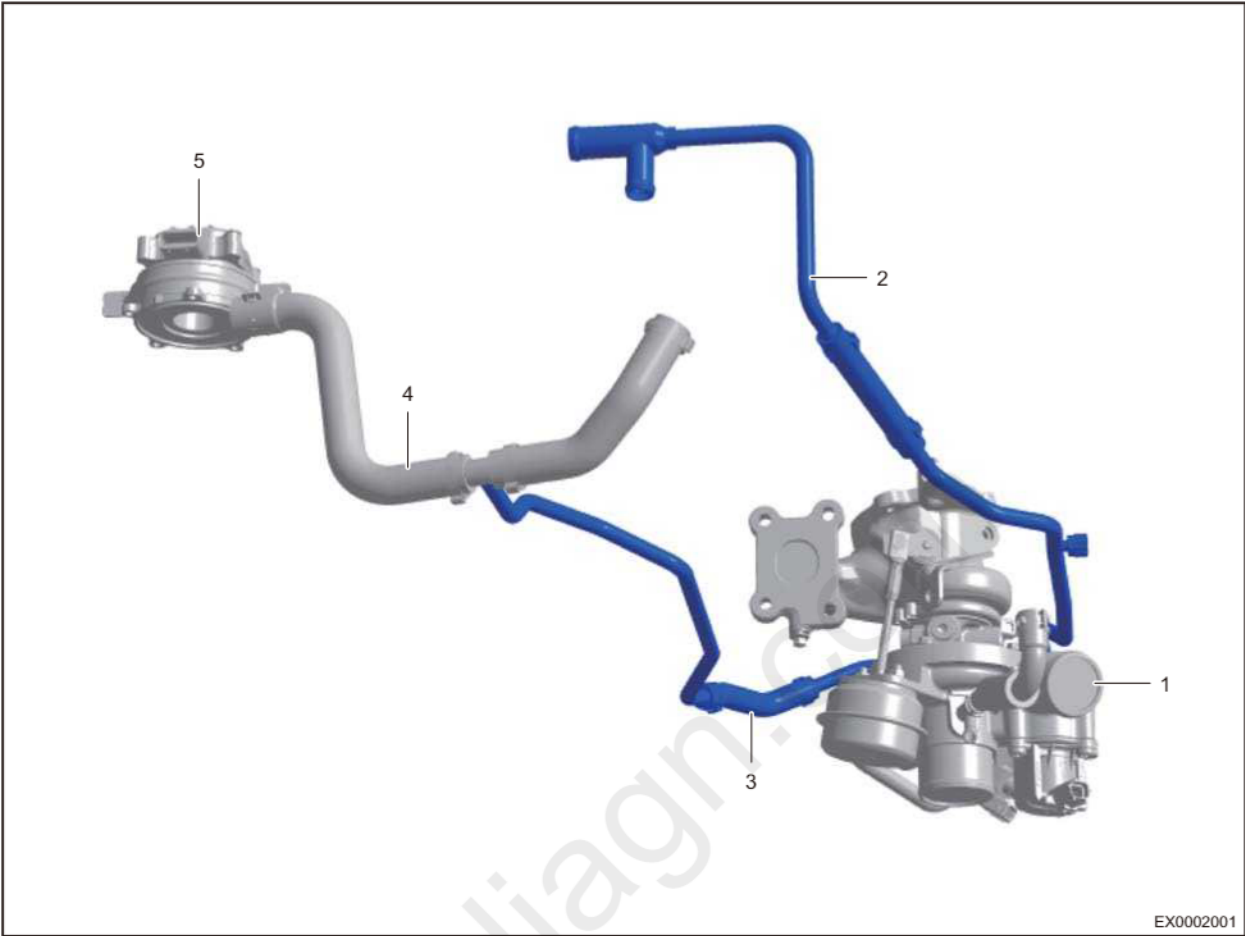
11

1 - Turbocharger Assembly	2 - Precatalytic Converter Mounting Gasket
3 - Upstream Oxygen Sensor	4 - Precatalytic Converter Assembly
5 - Downstream Oxygen Sensor	6 - Front Exhaust Pipe Assembly
7 - Diamond Shaped Hanger Block	8 - Main Catalytic Converter Assembly
9 - Muffler Assembly	10 - Muffler Heat Insulator



Description

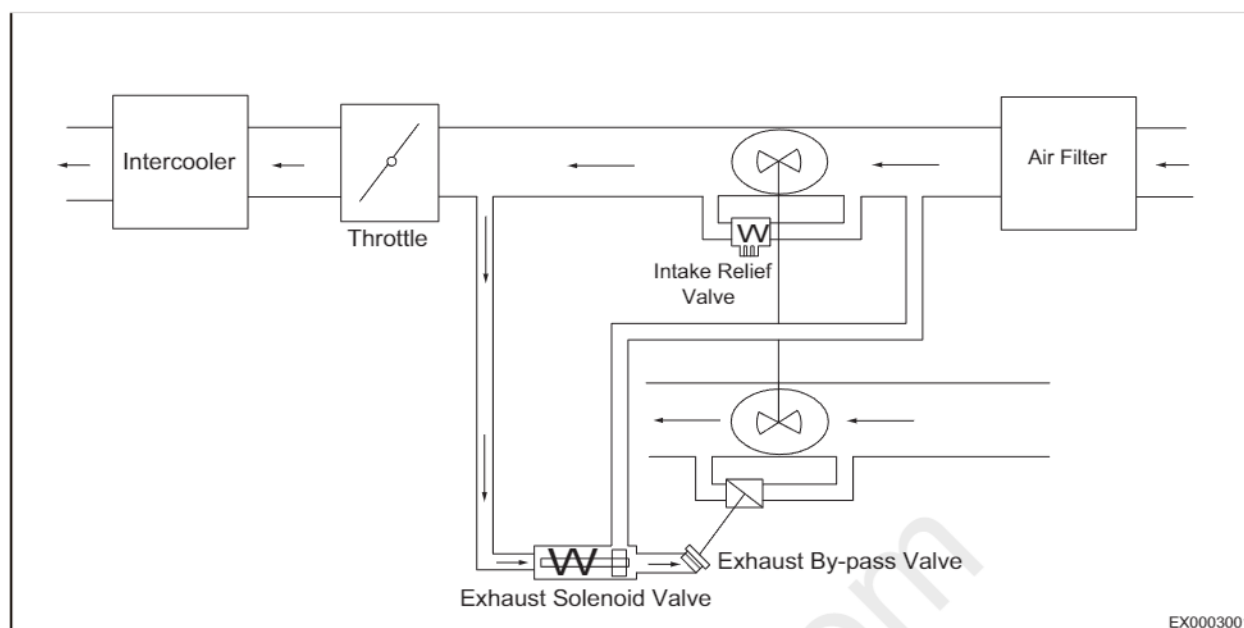
Connection Between Turbocharger and Electric Water Pump



EX0002001

1 - Turbocharger Assembly	2 - Turbocharger Water Outlet Pipe Set
3 - Turbocharger Water Inlet Pipe Set	4 - Electric Water Pump Outlet Pipe
5 - Electric Water Pump Assembly	

Operation



Turbocharger use exhaust gas that is discharges during engine running to turn the turbo impeller, and then drive compressor impeller to send the air pressed through air filter into cylinder. As more air enters into cylinder, more fuel is allowed to be injected so that more engine power is generated. In addition, the turbocharger can also make the engine get power compensation when it works in highland.

11

Specifications

Torque Specifications

Description	Torque (N·m)
Precatalytic Converter Assembly Bracket Fixing Bolt	20 + 5
Upstream Oxygen Sensor	45 ± 5
Downstream Oxygen Sensor	45 ± 5
Coupling Bolt Between Precatalytic Converter Assembly and Front Exhaust Pipe Assembly	45 ± 5
Coupling Nut Between Precatalytic Converter Assembly and Turbocharger	33 ± 3 \ 40 ± 3
Coupling Nut Between Main Catalytic Converter Assembly and Front Exhaust Pipe Assembly	45 ± 5
Coupling Nut Between Main Catalytic Converter Assembly and Front Muffler Assembly	45 ± 5
Coupling Nut Between Front Muffler Assembly and Rear Muffler Assembly	45 ± 5
Turbocharger Bracket Fixing Bolt	23 ± 3.5
Turbocharger Heat Insulator Fixing Bolt	9 ± 1.5
Turbocharger Heat Insulator II Fixing Bolt	8 + 3
Turbocharger Fixing Nut	25 ± 5
Exhaust By-pass Control Solenoid Valve Fixing Bolt	3 + 2
Electric Water Pump Assembly Fixing Bolt	8 + 3
Electric Water Pump Bracket Fixing Bolt	8 + 3
Hollow Bolt Torque	25 + 5

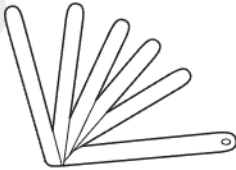


Non-reusable Part

Non-reusable Part	
High Temperature Nut (Turbocharger)	Replace it
Gasket - Turbocharger	Replace it
Gasket (Hollow Bolt)	Replace it
Fluid Return Pipe Gasket	Replace it

Tools

General Tools

Precision Straightedge	 063
Feeler Gauge	 060

DIAGNOSIS & TESTING

Diagnosis Contents

Problem Symptoms Table

Hint:

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

Symptom	Suspected Area
Excessive exhaust noise	Exhaust pipe (loose connection)
	Exhaust manifold assembly (damaged or leaked)
	Main catalytic converter assembly (damaged or leaked)
	Muffler assembly (damaged or leaked)
	Exhaust pipe gasket (damaged)
Excessive exhaust temperature	Exhaust manifold assembly (blocked)
	Main catalytic converter assembly (blocked)
	Precatalytic converter assembly (blocked)
	Incorrect ignition timing in ignition system
	Inadequate gas mixture combustion
Exhaust pipe leakage	Exhaust pipe gasket (damaged)
	Exhaust manifold assembly (damaged or leaked)
	Main catalytic converter assembly (damaged or leaked)
	Muffler assembly (damaged or leaked)

Exhaust System Gas Leakage Inspection

Method to check gas leakage in exhaust system joints: Warm up engine for a while, and check for gas leakage in exhaust system joints. A certain amount of gas leakage at the exhaust pipe joint is allowed, but gas leakage at the joint between turbocharger and cylinder head or precatalytic converter is prohibited. The judging standard is that engine does not shudder and no "poof" sound is heard from the joints.



ON-VEHICLE SERVICE

Turbocharger Heat Insulator Assembly

Removal

Warning/Caution/Hint

Warning:

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.

Caution:

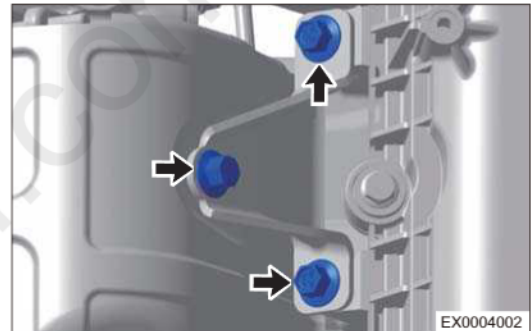
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover
4. Remove the turbocharger fixing bracket.

- (a) Remove 3 fixing bolts (arrow) from turbocharger fixing bracket.

Tightening torque

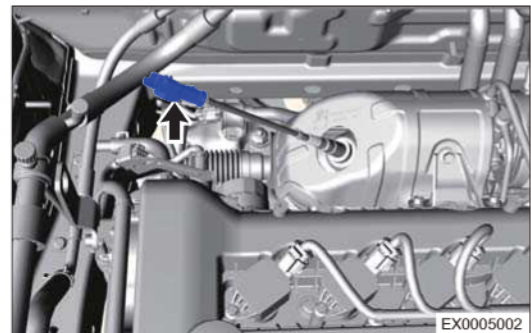
$23 \pm 3.5 \text{ N}\cdot\text{m}$



- (b) Remove the turbocharger fixing bracket.

5. Remove the turbocharger heat insulator assembly.

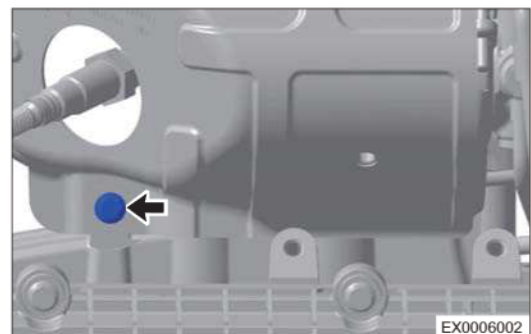
- (a) Disconnect the upstream oxygen sensor connector (arrow).



- (b) Remove the turbocharger heat insulator fixing bolt (arrow).

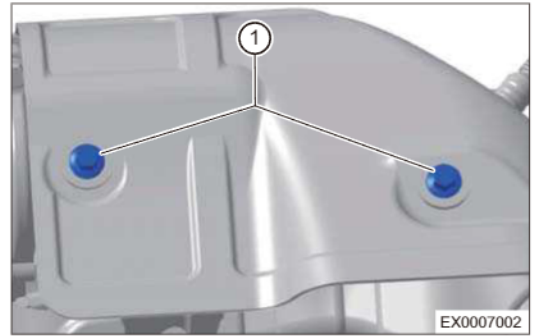
Tightening torque

$9 \pm 1.5 \text{ N}\cdot\text{m}$

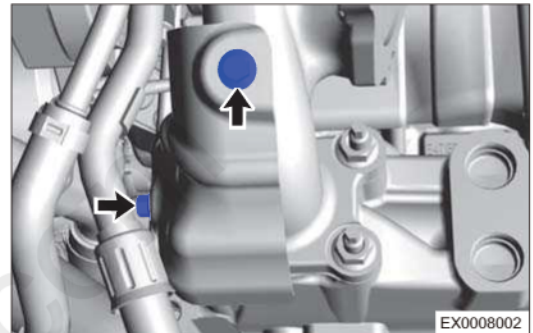


- (c) Remove 2 turbocharger heat insulator fixing bolts (1).

Tightening torque
 $9 \pm 1.5 \text{ N}\cdot\text{m}$



- (d) Remove the turbocharger heat insulator assembly
6. Remove the turbocharger heat insulator II.
- (a) Remove 2 turbocharger heat insulator II fixing bolts (arrow).
- Tightening torque**
 $8 + 3 \text{ N}\cdot\text{m}$



- (b) Remove the turbocharger heat insulator II.

Installation

1. Installation is in the reverse order of removal.

Turbocharger Assembly

Removal

Warning/Caution/Hint

Warning:

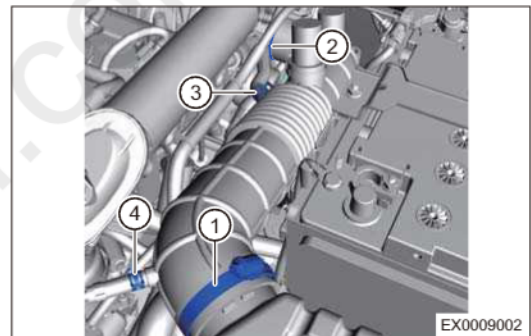
- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Drain the coolant (See page 12-10).
5. Remove the muffler assembly (See page 11-22).
6. Remove the precatytic converter assembly (See page 11-16).
7. Remove the intake hose assembly.

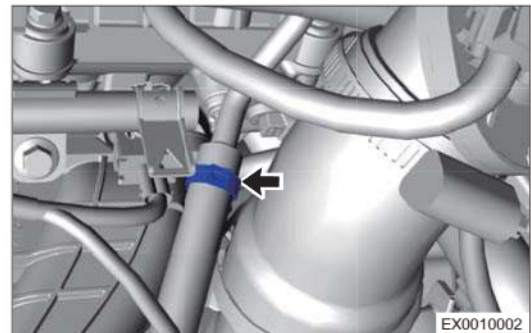
- (a) Loosen worm clamp (1) and disconnect connection between intake hose and air filter assembly.



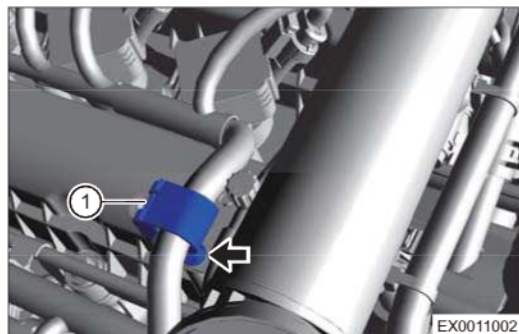
- (b) Loosen worm clamp (2) and disconnect connection between intake hose and turbocharger assembly.
- (c) Loosen elastic clamp (3) and disconnect connection between crankcase ventilation hose and intake hose.
- (d) Loosen elastic clamp (4) and disconnect connection between fuel vapour pipe set and intake hose.
- (e) Remove the intake hose assembly.

8. Remove the turbocharger water outlet pipe set assembly.

- (a) Loosen clamping ring (arrow) and disconnect connection between turbocharger water outlet pipe set and water outlet hose.



- (b) Disconnect the engine wire harness fixing clip (1).



- (c) Remove fixing bolt (arrow) from turbocharger water outlet pipe set bracket.

Tightening torque

8 + 3 N·m

- (d) Remove hollow bolt (arrow) between turbocharger water outlet pipe set and turbocharger assembly.

Tightening torque

25 + 5 N·m



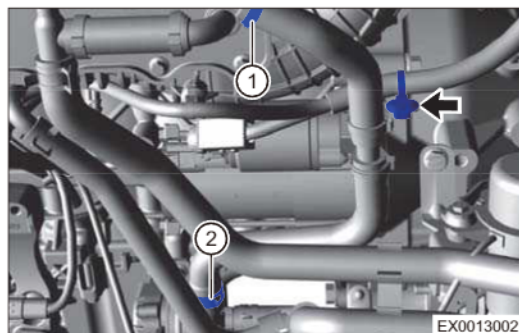
- (e) Remove the turbocharger water outlet pipe set assembly.

Caution:

- Pay attention not to drop upper and lower washers of hollow bolt during removal and do not reuse them.

9. Remove the turbocharger water inlet pipe set assembly.

- (a) Loosen clamping ring (1) and disconnect connection between turbocharger water inlet pipe set hose and intercooler assembly.



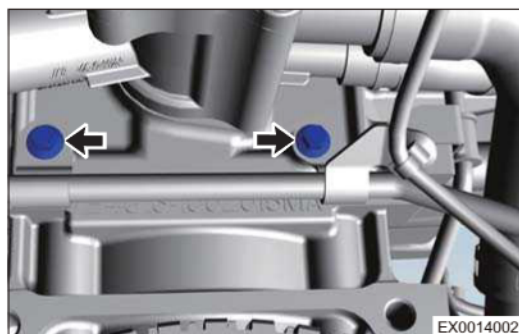
- (b) Loosen clamping ring (2) and disconnect connection between electric water pump assembly and water outlet hose.

- (c) Disconnect the engine wire harness fixing clip (arrow).

- (d) Remove 2 fixing bolts (arrow) from turbocharger water inlet pipe set bracket.

Tightening torque

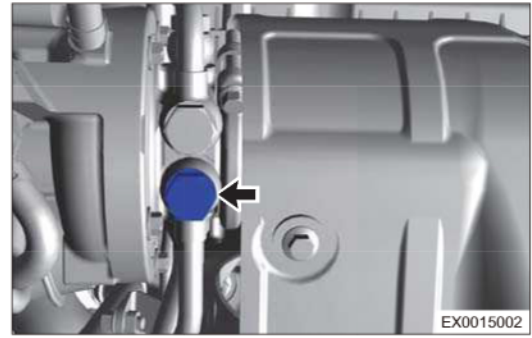
8 + 3 N·m



- (e) Remove hollow bolt (arrow) between turbocharger water inlet pipe and turbocharger assembly.

Tightening torque

$25 + 5 \text{ N}\cdot\text{m}$



- (f) Remove the turbocharger water inlet pipe set assembly.

Caution:

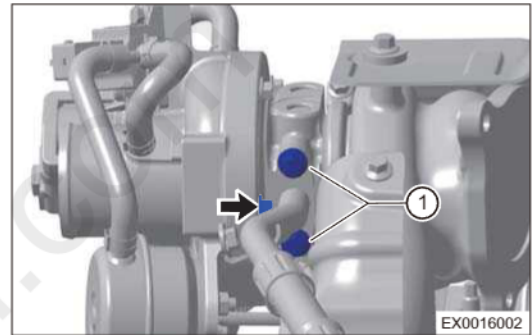
- Pay attention not to drop upper and lower washers of hollow bolt during removal and do not reuse them.

10. Remove the turbocharger fluid return pipe assembly.

- (a) Remove fixing bolt (arrow) from turbocharger fluid return pipe bracket.

Tightening torque

$8 + 3 \text{ N}\cdot\text{m}$



- (b) Remove 2 coupling bolts (1) between turbocharger fluid return pipe and turbocharger assembly.

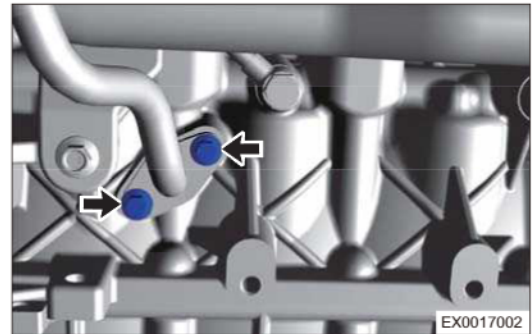
Tightening torque

$8 + 3 \text{ N}\cdot\text{m}$

- (c) Remove 2 coupling bolts (arrow) between turbocharger fluid return pipe and cylinder block assembly.

Tightening torque

$8 + 3 \text{ N}\cdot\text{m}$



- (d) Remove the turbocharger fluid return pipe assembly.

Caution:

- Pay attention not to drop the upper and lower washers and the bolt during removal and do not reuse them.

11. Remove the turbocharger fluid inlet pipe assembly.

- (a) Remove fixing bolt (arrow) from turbocharger fluid inlet pipe bracket.

Tightening torque

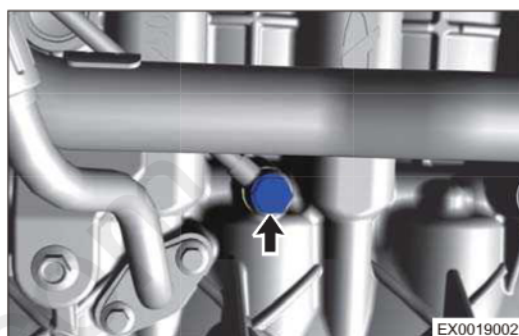
$8 + 3 \text{ N}\cdot\text{m}$



- (b) Remove hollow bolt (arrow) between turbocharger fluid inlet pipe and cylinder block assembly.

Tightening torque

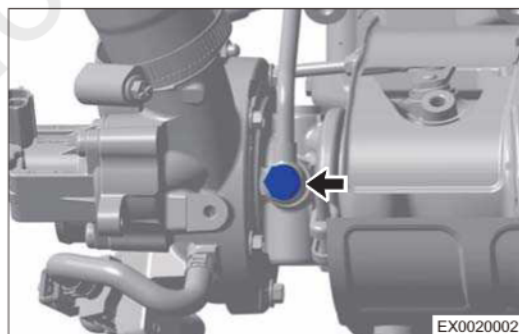
$20 + 5 \text{ N}\cdot\text{m}$



- (c) Remove hollow bolt (arrow) between turbocharger water inlet pipe and turbocharger assembly.

Tightening torque

$20 + 5 \text{ N}\cdot\text{m}$



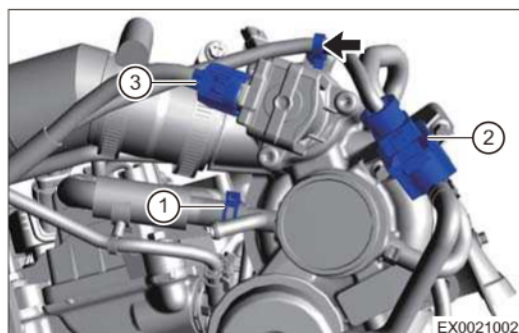
- (d) Remove the turbocharger fluid inlet pipe assembly.

Caution:

- Pay attention not to drop upper and lower washers of hollow bolt during removal and do not reuse them.

12. Remove the turbocharger assembly.

- (a) Loosen elastic clamp (1) and disconnect connection between crankcase ventilation tube and turbocharger assembly.

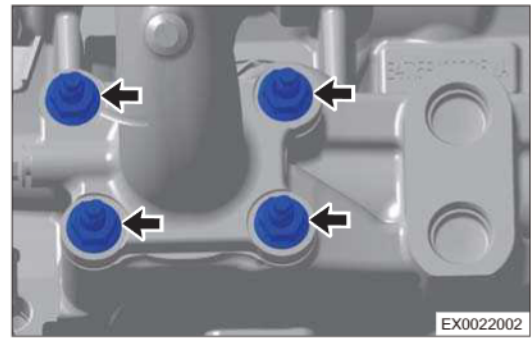


- (b) Disconnect the exhaust by-pass control solenoid valve connector (2).
 (c) Disconnect the engine wire harness fixing clip (arrow).
 (d) Disconnect the relief control solenoid valve connector (3).



- (e) Remove 4 turbocharger fixing nuts (arrow).

Tightening torque
25 + 5 N·m



- (f) Remove the turbocharger assembly.

Inspection

1. Firstly perform basic inspection to turbocharger system during DTC with too high, too low boost pressure or when power lowers

Basic inspection:

- Check there are no cracks causing by overheating, biting, deformation or other damage on exhaust turbocharger turbo housing, otherwise, replace exhaust turbocharger.
- Check there are no deposition and blocking on turbo oil hole.
- Check there are no blockage, squash, deformation or other damage on fluid inlet and return pipes of exhaust turbocharger.
- Check there are no oil leakage (inside leakage and outside leakage) on exhaust turbocharger.
- Check that charcoal canister check valve between charcoal canister and front exhaust turbocharger intake hose and check valve between brake booster and intake manifold are correctly installed with the arrow above to point to conduction direction (fault multiple points).
- Check all lines are connected securely, no leakage, aging, breakage, etc.

2. Turbocharger daily inspection

- (a) Check connecting lines between air filter and turbocharger, turbocharger and engine intake and exhaust pipes for sealing and tightness.
- (b) Check if turbocharger fluid inlet and return pipes are damaged or throttling, connecting bolts of joints are loose.
- (c) Check quality of oil, clean or replace the oil element.
- (d) Check the air filter and clean or replace the element in regular.
- (e) Check if engine crankcase blow-by gas is too large, breather is smooth, ensure crankcase pressure is normal.

3. Other requirements of turbocharger

- (a) Avoid low engine idle for long time (maximum should not exceed 20 minutes).
- (b) Never use the operation with "Accelerate - Stall - Neutral Sliding" before there is oil pressure on the engine, the engine must be kept in idling condition (3 to 5 minutes).
- (c) Before stopping the engine, let it gradually decrease its temperature and speed from maximum value (3 to 5 minutes).

Installation

Warning/Caution/Hint

Caution:

- Replace high temperature nut and washer, and clean foreign matters on connection part.
- Check for air leakage, if so, check if each nut and bolt are tightened; if component is damaged, replace damaged component.

1. Installation is in the reverse order of removal.

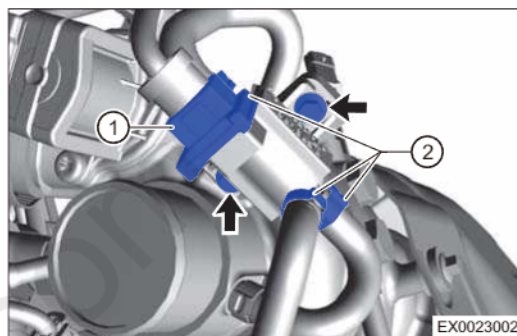
Exhaust By-pass Control Solenoid Valve

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the engine trim cover.
 4. Remove the exhaust by-pass control solenoid valve.
 - (a) Disconnect the exhaust by-pass control solenoid valve connector (1).



- (b) Loosen clamping rings (2) and disconnect 3 connections between hoses and exhaust by-pass control solenoid valve.
 - (c) Remove 2 fixing bolts (arrow) from exhaust by-pass control solenoid valve.

Tightening torque

3 +2 N·m

- (d) Remove the exhaust by-pass control solenoid valve assembly.

Installation

1. Installation is in the reverse order of removal.

Precatalytic Converter Assembly

Removal

Warning/Caution/Hint

Warning:

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.

Caution:

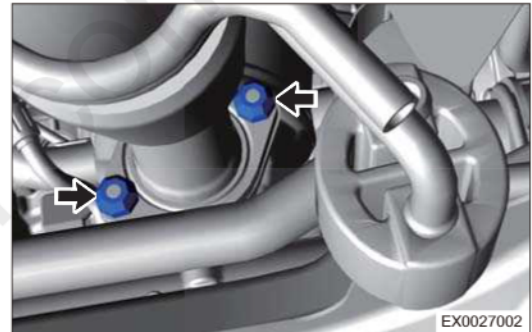
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

- Turn off all electrical equipment and the ignition switch.
- Disconnect the negative battery cable.
- Remove the engine trim cover
- Remove the turbocharger heat insulator assembly (See page 11-8).
- Remove the precatalytic converter assembly.

- Raise vehicle to a proper position.
- Remove 2 coupling nuts (arrow) between front exhaust pipe assembly and precatalytic converter assembly.

Tightening torque

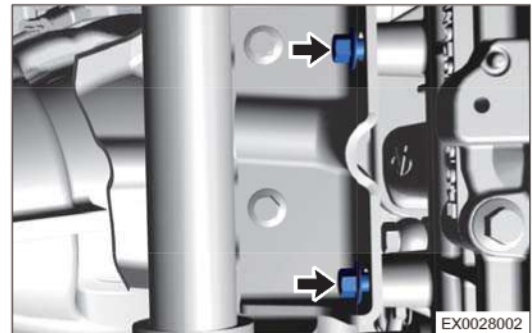
$45 \pm 5 \text{ N}\cdot\text{m}$



- Remove precatalytic converter assembly bracket upper bolt and bracket fixing bolt (arrow).

Tightening torque

$20 \pm 5 \text{ N}\cdot\text{m}$



- Remove coupling nuts (1) (2) (3) between precatalytic converter and turbocharger.

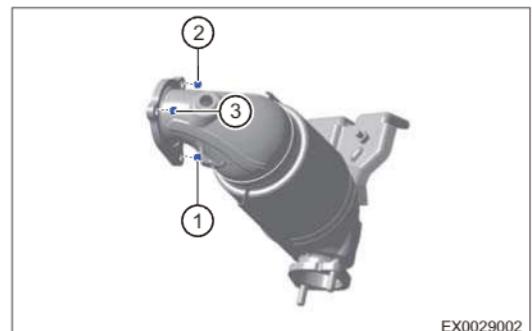
Tightening torque

$33 \pm 3 \text{ N}\cdot\text{m}$

(1) nut torque increases to $40 \pm 3 \text{ N}\cdot\text{m}$

Hint:

After each removal and installation, the nut cannot be reused and replace it with a new one.



- (e) Remove the precatalytic converter assembly.
- (f) Remove the upstream oxygen sensor assembly (arrow).

Tightening torque

45 ± 5 N·m

**Inspection**

1. Check precatalytic converter connection surface warpage.

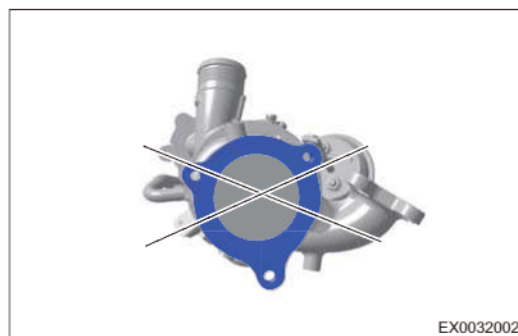
- (a) Using a precision straightedge and feeler gauge, measure connection surface between precatalytic converter and turbocharger, replace it if surface warpage is greater than 0.5 mm.



- (b) Check precatalytic converter internal carrier for cracked or blocked. Replace precatalytic converter assembly if damaged.

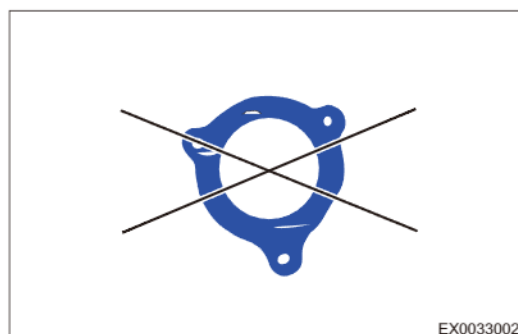
2. Check turbocharger connection surface curvature.

- (a) Using a precision straightedge and feeler gauge, measure connection surface between turbocharger and precatalytic converter, replace it if surface curvature is greater than 0.04 mm.



3. Check sealing gasket.

- (a) Check sealing gasket for scratch or rough, replace it if necessary.



Installation

Warning/Caution/Hint

Caution:

- If gasket is damaged, replace it, and remove foreign matters on joints and threads.
- If there is any crack or leakage in the precatalytic converter assembly, replace it.
- Check that there is no exhaust gas leakage in connecting part of upstream oxygen sensor.
- Check that there is no exhaust gas leakage between precatalytic converter assembly and turbocharger, front exhaust pipe assembly after installation is completed.

1. Installation is in the reverse order of removal.

Front Exhaust Pipe Assembly

Removal

Warning/Caution/Hint

Warning:

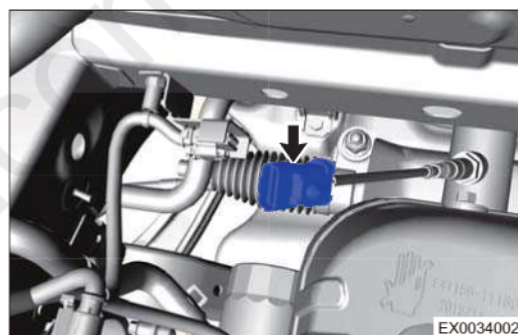
- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.

Caution:

- When removing front exhaust pipe assembly, an assistant is needed to hold it. This can prevent front muffler assembly from dropping during operation, which may cause an accident.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Raise vehicle to a proper height.
4. Remove the front exhaust pipe assembly.

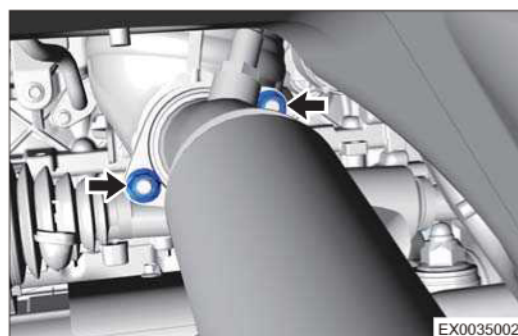
- (a) Take off and disconnect the downstream oxygen sensor connector (arrow) from bracket.



- (b) Remove 2 coupling nuts (arrow), then disconnect connection between front exhaust pipe assembly and precatalytic converter assembly, and take off gasket from connecting part.

Tightening torque

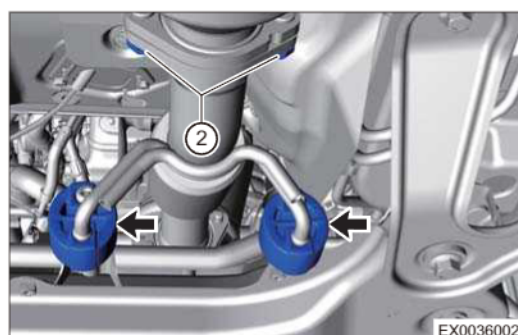
$45 \pm 5 \text{ N}\cdot\text{m}$



- (c) Remove 2 coupling nuts (2), then disconnect connection between front exhaust pipe assembly and main catalytic converter assembly, and take off gasket from connecting part.

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$



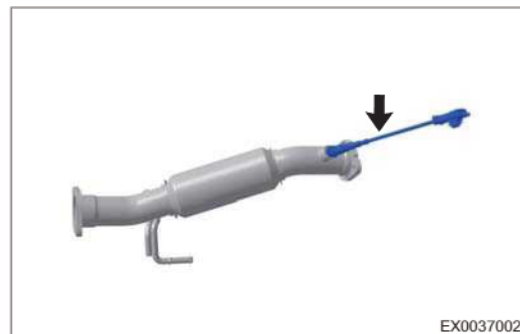
- (d) Separate 2 diamond shaped hanger blocks (arrow) between front exhaust pipe assembly and body hook.
- (e) Remove the front exhaust pipe assembly.



- (f) Remove downstream oxygen sensor (arrow) from front exhaust pipe assembly.

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$



Installation

Warning/Caution/Hint

Warning:

- If gasket is damaged, replace it, and remove foreign matters on joints and threads.
- Check exhaust gas for leakage. If gas leaks, tighten malfunctioning part to prevent leakage. Replace damaged parts as necessary.
- Check that there is no exhaust gas leakage in connecting part of downstream oxygen sensor.

1. Installation is in the reverse order of removal.

Main Catalytic Converter Assembly

Removal

Warning/Caution/Hint

Warning:

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.

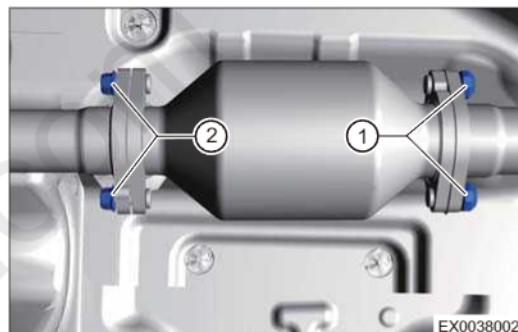
Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Raise vehicle to a proper height.
4. Remove the main catalytic converter assembly.
 - (a) Remove 2 coupling nuts (1), then disconnect connection between front exhaust pipe assembly and main catalytic converter assembly, and take off gasket from connecting part.

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove 2 coupling nuts (2), then disconnect connection between main catalytic converter assembly and muffler assembly, and take off gasket from connecting part.

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$

- (c) Remove the main catalytic converter assembly.

Inspection

1. Check precatalytic converter internal carrier for cracked, detachment, blocked, etc. Replace precatalytic converter assembly if damaged.

Installation

Warning/Caution/Hint

Warning:

- If gasket is damaged, replace it, and remove foreign matters on joints and threads.
 - Check exhaust gas for leakage. If gas leaks, tighten malfunctioning part to prevent leakage. Replace damaged parts as necessary.
 - If there is any crack or leakage in main catalytic converter assembly, replace it.
1. Installation is in the reverse order of removal.



Muffler Assembly

Removal

Warning/Caution/Hint

Warning:

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.

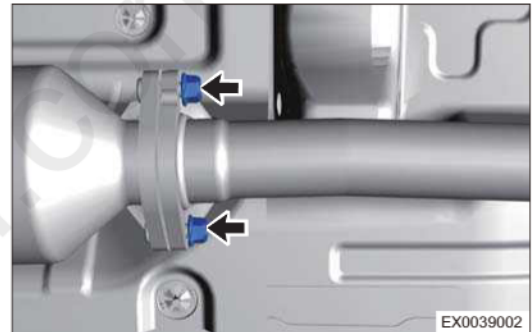
Caution:

- When removing muffler assembly, an assistant is needed to hold it. This can prevent muffler assembly from dropping during operation, which may cause an accident.
 - Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Raise the vehicle to a proper position.
 4. Remove the muffler assembly.

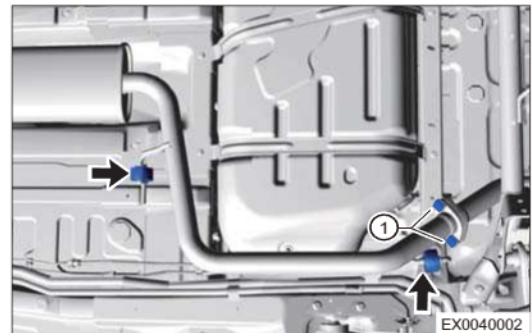
- (a) Remove 2 coupling nuts (arrow), then disconnect connection between muffler assembly and main catalytic converter assembly, and take off gasket from connecting part

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove the coupling nut (1), then separate 2 diamond shaped hanger blocks (arrow) between muffler assembly and body hook.



- (c) Separate 2 diamond shaped hanger blocks (arrow) between rear muffler assembly and body hook.



- (d) Remove the muffler assembly.

Inspection

1. Inspect muffler.
 - (a) Inspect if there are cracks or leakage on muffler assembly surface. Replace it if necessary.
 - (b) Inspect if there are blocked or normal draining on muffler left and right drain holes (arrow). If it can drain water normally.

Hint:

Due to limited position of muffler drain hole and in the cold area, recommend that the customer do not park the vehicle on the slope with excessive angle as this may result in serious hydrops of muffler to freeze while driving the vehicle. Cause icing. It may cause engine to fail to start.



Installation

Warning/Caution/Hint

Caution:

- If gasket is damaged, replace it, and remove foreign matters on joints and threads.
1. Installation is in the reverse order of removal.

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SQRE4T15B COOLING SYSTEM

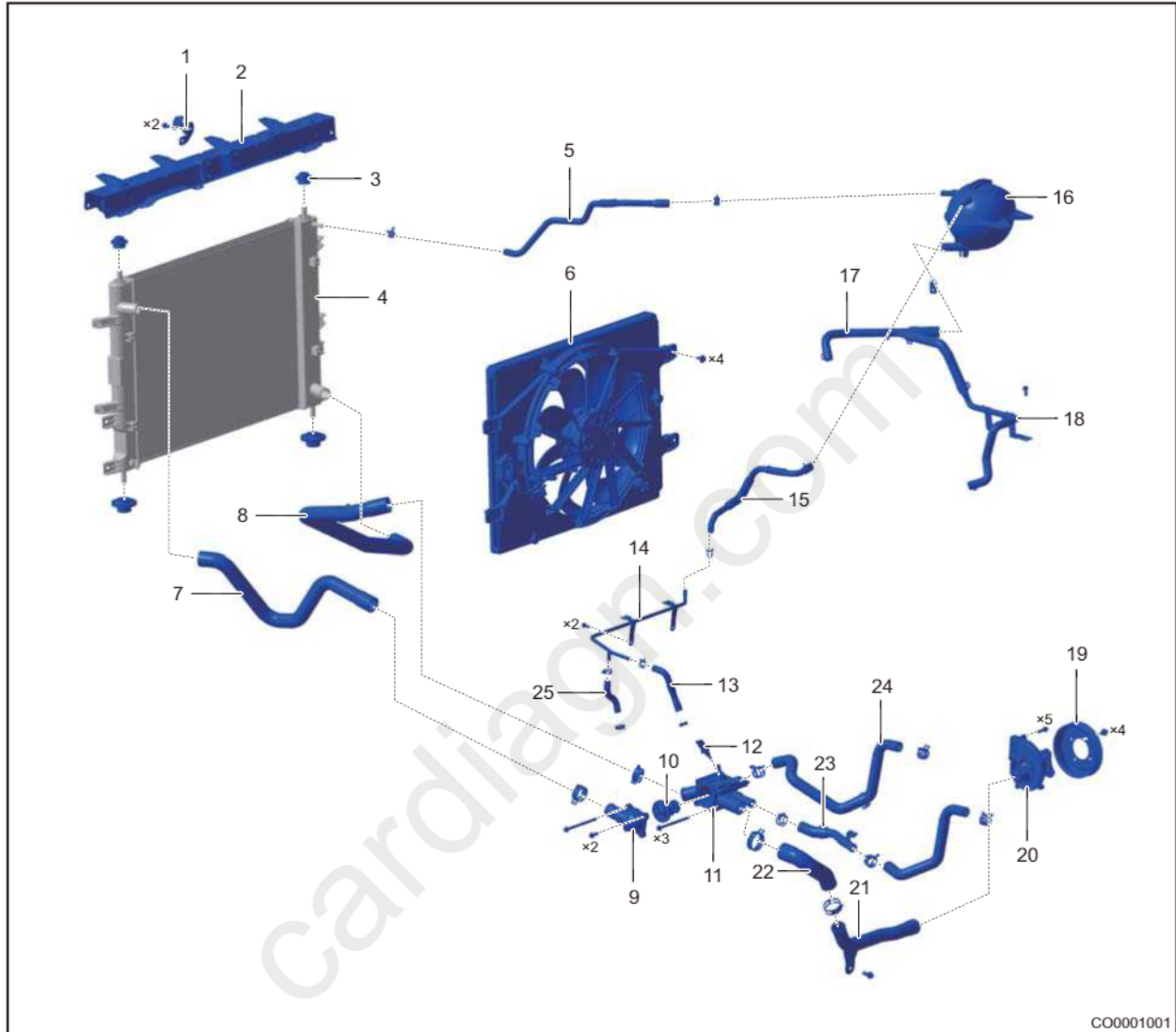
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GENERAL INFORMATION

Overview

Description



CO0001001

1 - Engine Hood Lock Secondary Lock Bracket	2 - Radiator Upper Crossmember Assembly
3 - Rubber Bushing	4 - Radiator
5 - Radiator Discharge Pipe	6 - Radiator Fan
7 - Engine Inlet Hose	8 - Engine Outlet Hose
9 - Thermostat Housing	10 - Thermostat
11 - Thermostat Seat	12 - Coolant Temperature Sensor
13 - Engine Discharge Hose I	14 - Engine Discharge Steel Pipe
15 - Engine Discharge Hose II	16 - Expansion Tank
17 - Expansion Tank Outlet Hose	18 - Expansion Tank Outlet Steel Pipe
19 - Water Pump Pulley	20 - Water Pump Assembly
21 - Cooling Pipe Assembly I	22 - Small Circulation Water Pipe
23 - Heater Core Outlet Pipe	24 - Heater Core Inlet Pipe
25 - Engine Discharge Hose III	



Operation

- Engine cooling system adjusts engine operating temperature by the flow of coolant and makes engine operate normally under various operating conditions.
- Engine cooling system is a forced circulation system, which supplies circulation pressure for cooling system by water pump and forces coolant to circulate in the engine cylinder block, and distributes excessive heat to radiator by the flow of coolant, and radiates it to the air by cooling fan. Also, engine cooling system provides heat to the heater core in cabin to improve driving comfort.

Specifications

Torque Specifications

Description	Torque (N·m)
Expansion Tank Fixing Bolt	5 ± 1
Thermostat Housing Fixing Bolt	8 + 3
Thermostat Seat Fixing Bolt	8 + 3
Coolant Temperature Sensor	15 ± 1
Cooling Fan Fixing Bolt	5 ± 1
Radiator Upper Crossmember Fixing Bolt	9 ± 1
Water Pump Fixing Bolt	8 + 3
Coupling Bolt Between Radiator and Condenser	7 ± 1
Water Pump Pulley Fixing Bolt	20 + 5
Discharge Steel Pipe Fixing Bolt	8 + 3
Intelligent Intake Grille Fixing Bolt	5 ± 1

Coolant Capacity

Item	Capacity (L)
Cooling System	9.0 ± 0.5

Coolant Concentration

G11 Additive	Soft Water
53%	47%

Coolant Freezing Point

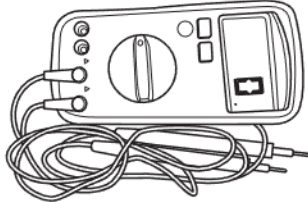
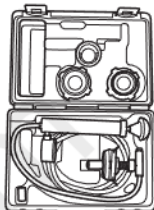
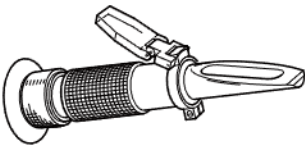
Item	Freezing Point Value (°C)
Coolant	-40

Cooling System Test Pressure

Item	Test Pressure (bar)
Cooling System (Test Pressure)	1.2

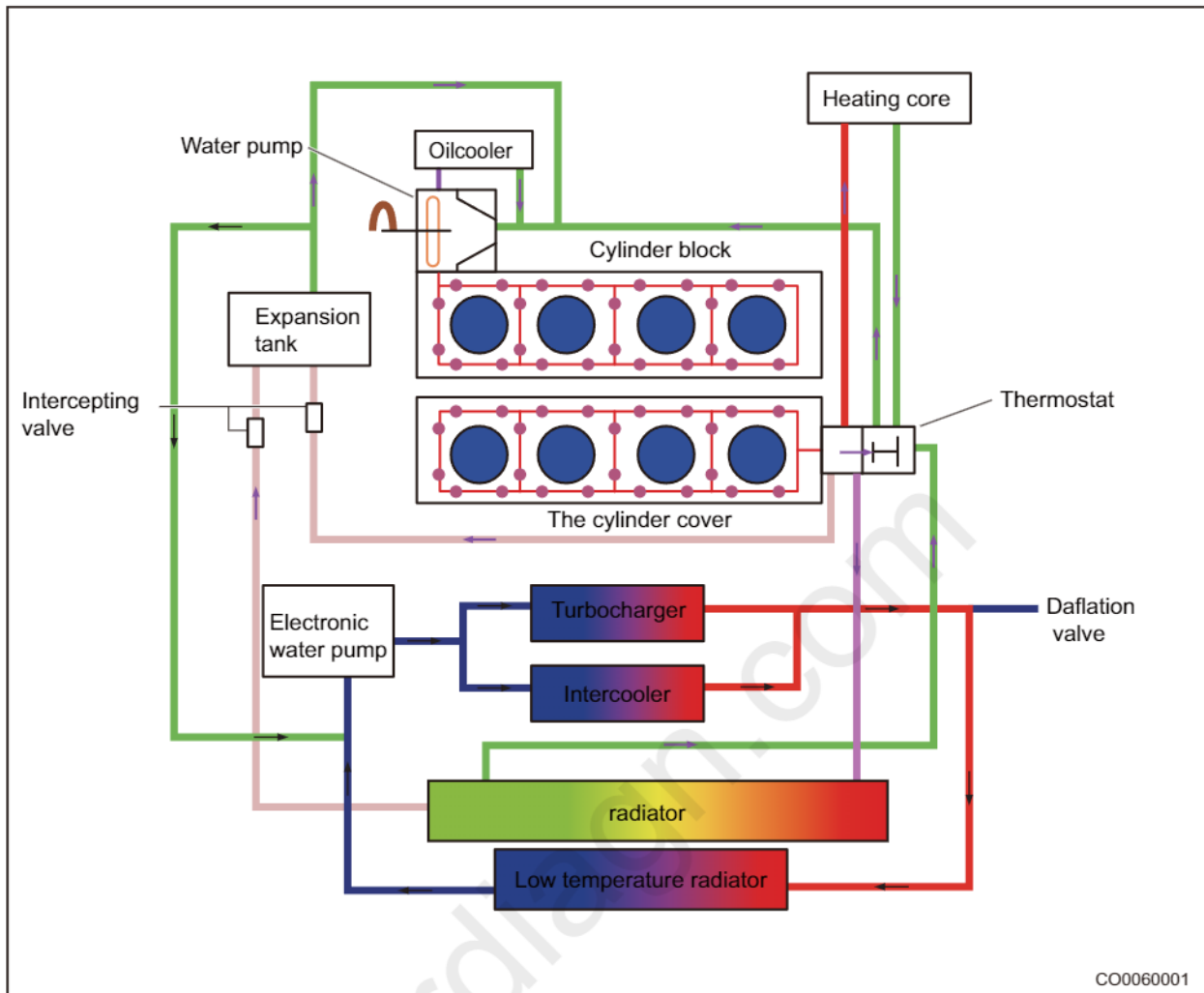
Tools

General Tools

Digital Multimeter	 002
Cooling System Pressure Tester	 055
Freezing Point Tester	 007



Cooling System Operation Flowchart



Small circulation: When coolant temperature is below $82 \pm 2^{\circ}\text{C}$, thermostat assembly closes. Coolant only circulates inside the cylinder block and warms up other engine parts that need heat. Water pump assembly circulates engine coolant through cylinder block, oil cooler assembly, turbocharger and cylinder head. The coolant does not radiate heat through radiator.

Large circulation: When coolant temperature is higher than 95°C , thermostat assembly opens fully and all coolant flowing out of cylinder block enters radiator for radiating. It then returns to cylinder block for circulation by water pump. Due to radiating in radiator, engine coolant temperature decreases quickly to prevent engine from overheating.

DIAGNOSIS & TESTING

Diagnosis Content

Problem Symptoms Table

Hint:

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

Symptom	Suspected Area
Insufficient coolant	Coolant pipe (deteriorated and leaks)
	Expansion tank (leaks)
	Radiator (leaks)
	Heater core (leaks)
	Thermostat assembly (improperly sealed)
	Thermostat seat assembly (cracked and damaged)
	Water pump (leaks)
	Engine cylinder head gasket (damaged)
	Engine cylinder head (cracked and leaks)
	Engine cylinder block (water jacket leaks and cylinder block cracked)
Engine overheating	Low coolant level
	Air resistance exists in pipe
	Expansion tank cap (damaged)
	Engine Control Module (ECM) failure
	Cooling fan
	Radiator
	Thermostat assembly
Engine undercooling	Thermostat assembly
	Cooling fan
Unable to reach normal engine temperature	Cooling fan (constantly operating)
	Thermostat assembly
Cooling fan does not operate or abnormal air speed	Fan controller
	Cooling fan
	Wire harness
	Engine Control Module (ECM) failure



Cooling System Leakage Test

Warning:

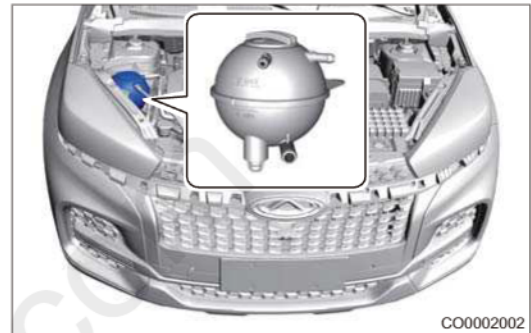
- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.

Caution:

- When testing cooling system, please pressurize the system to specified pressure. Otherwise, system components may be damaged.
- Before testing cooling system, do not perform operation until coolant temperature drops to normal level. Otherwise, it may cause scald.

Test Procedures

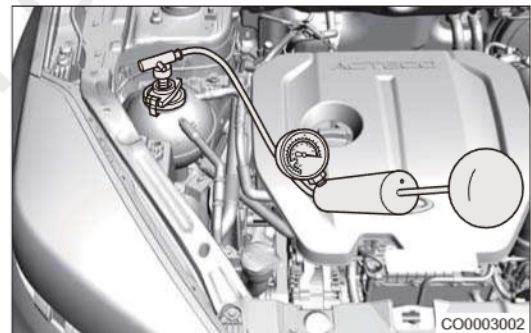
1. Turn off all electrical equipment and the ignition switch.
2. Check if coolant level is between "MAX" and "MIN" lines. If coolant level is below "MIN" line, add coolant.



3. Connect cooling system pressure tester to coolant pressure release cap opening (expansion tank cap opening) and tighten it slowly.

Caution:

Make sure there is no leakage in connecting part of coolant system pressure tester, in order to avoid pressure leakage during test.



4. Pressurize cooling system to 1.2 bar with the cooling system pressure tester, and then observe the pressure changes. If system pressure does not drop within 2 minutes, it indicates there is no leakage in system. If pressure changes greatly, it indicates that there is a leakage in system; find the leaking area and perform troubleshooting.

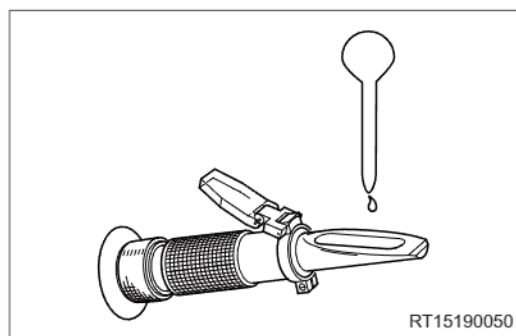
Coolant Freezing Point Test

Caution:

- DO NOT mix different colors or types of coolant.
- Please select coolant which is suitable for local climate in different areas.
- Please read measured value at the scale line. In order to distinguish the scale line more clearly, drip a drop of water on the glass of freezing point tester with a pipette, then the scale line can be clearly distinguished via a "waterline".

Test Procedures

- As shown in illustration, drip a drop of coolant on the glass of freezing point tester with a pipette, and then observe freezing point value of coolant.

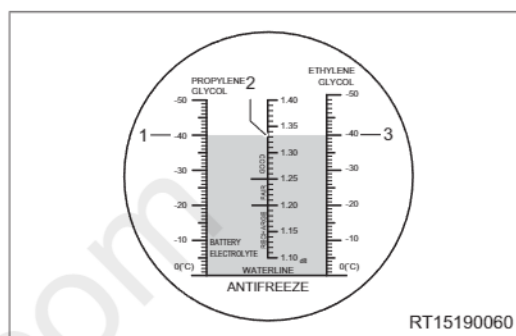


- As shown in illustration, observe scale 3 of freezing point tester to read ethylene glycol coolant freezing point value. The freezing point value must be kept at -40°C (value varies with geography, climate or freezing point).

If freezing point is beyond the specified value, replace the coolant.

Hint:

Scale 1 is used to measure the freezing point value of propylene glycol coolant, and scale 2 is used to measure the battery electrolyte concentration.



ON-VEHICLE SERVICE

Coolant Replacement

Engine System Coolant Draining

Warning/Caution/Hint

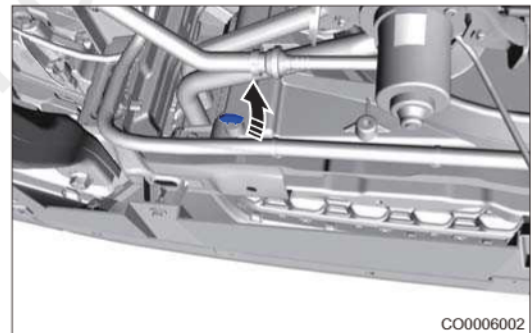
Warning:

- Never remove pressure release cap when engine is operating or temperature is higher. Otherwise, it may cause scald.
 - Be careful when opening pressure release cap, the high-pressurized hot engine coolant and steam may flow out and cause serious burns.
 - Wait until the engine has cooled down, and then cover the pressure release cap with a piece of damp cloth and turn it one turn slowly (counterclockwise). Step back when releasing cooling system pressure. After confirming that all pressure has been released, turn the pressure release cap with cloth covered and remove it.
 - Violating above descriptions may cause serious personal injury.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the expansion tank cap when engine temperature and radiator temperature are low.
 4. Remove the engine lower protector assembly (See page 50-23).
 5. Drain the coolant.

- (a) Put a coolant collector under the vehicle, rotate the radiator drain cock plug (arrow) counterclockwise and drain the coolant in radiator and expansion tank.

Hint:

Put a drainage device or similar tool at the radiator outlet, so that coolant can flow into the collector smoothly.



- (b) After coolant stops flowing, retighten the radiator drain cock plug.

Caution:

- Tighten drain cock plug to prevent leakage.
- Wasted coolant should be handled by the specialized department according to local laws and regulations. Never discard it at will.

Turbocharger Intercooler System Coolant Draining

Warning/Caution/Hint

Warning:

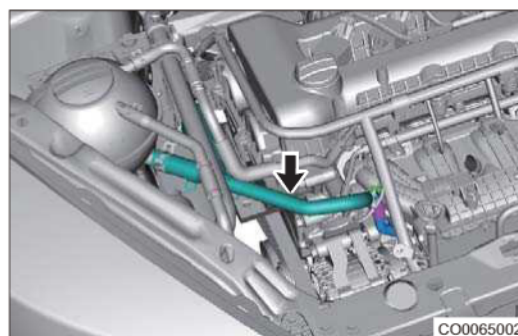
- Never remove pressure release cap when engine is operating or temperature is higher. Otherwise, it may cause scald.
 - Be careful when opening pressure release cap, the high-pressurized hot engine coolant and steam may flow out and cause serious burns.
 - Wait until the engine has cooled down, and then cover the pressure release cap with a piece of damp cloth and turn it one turn slowly (counterclockwise). Step back when releasing cooling system pressure. After confirming that all pressure has been released, turn the pressure release cap with cloth covered and remove it.
 - Violating above descriptions may cause serious personal injury.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.

3. Remove the expansion tank cap when engine temperature and radiator temperature are low.
4. Remove the front bumper assembly (See page 50-3).
5. Drain coolant from turbocharger intercooler system.

- (a) Grip the water pipe (arrow) with pliers to prevent excessive antifreeze from flowing out during the intercooler system antifreeze draining.

Caution:

- When gripping the water pipe with pliers, wrap it with a soft cloth (such as a glove) to prevent the plier from being damaged.



- (b) Put a coolant collector under the vehicle, rotate the low temperature radiator drain cock plug (1) counterclockwise with a cross screwdriver and drain the coolant in turbocharger intercooler device.

Hint:

Put a drainage device or similar tool at the low temperature radiator outlet, so that coolant can flow into the collector smoothly.



- (c) After coolant stops flowing, retighten the low temperature radiator drain cock plug. remove the pliers.

Caution:

- Tighten drain cock plug to prevent leakage.
- Wasted coolant should be handled by the specialized department according to local laws and regulations. Never discard it at will.
- After adding coolant, it is necessary to bleed the turbocharger intercooler system.

Coolant Adding

Caution:

- Only use coolant that meets Chery specifications.

Coolant Capacity

Item	Capacity (L)
Cooling System	9.0 ± 0.5

Coolant Concentration

G11 Additive	Soft Water
53%	47%

Warning:

- If it is necessary to add coolant when engine is hot, loosen expansion tank cap slightly first to release internal pressure and loosen the cap completely after waiting for a while, and then add coolant.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

Caution:

- DO NOT use inferior coolant.
- DO NOT mix different colors or types of coolant.
- Be careful when adding coolant; avoid spilling coolant on any area of engine.



12-SQRE4T15B COOLING SYSTEM

1. Open expansion tank cap and add coolant until coolant level reaches the "MAX" line.



2. Tighten expansion tank cap, start and run engine. Maintain engine speed between 2000 and 2500 rpm to warm up the engine until cooling fan operates.

Caution:

If there is no coolant in expansion tank after engine just starts, perform the followings:

- Stop the engine;
- Wait until coolant cools down;
- Add coolant to "MAX" line on expansion tank.

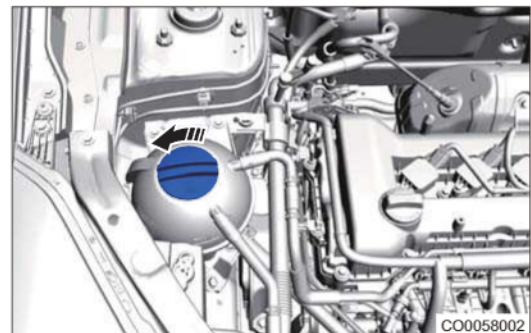
Run the engine at 2500 rpm until coolant level becomes stable.

3. Stop engine and wait until coolant temperature drops to the ambient temperature. Check that coolant level is between "MAX" and "MIN" lines. If coolant level is below the "MIN" line, repeat all the above procedures. If coolant level is above the "MAX" line, drain coolant until the level is between "MAX" and "MIN" lines.

Turbocharger Intercooler System Bleeding

Caution:

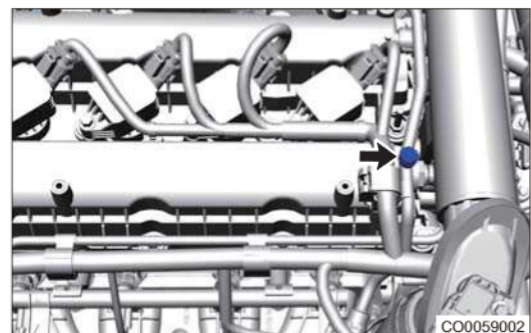
- After replacing coolant or removing and installing turbocharger intercooler system related components, it is necessary to bleed the turbocharger intercooler device cooling system.
 - Never remove pressure cap from outlet pipe set with engine warmed up, to prevent coolant from spilling out, causing burns.
 - Please wear protective clothing and gloves.
1. Unscrew the expansion tank cap counterclockwise with engine in cold status.



2. Unscrew and remove pressure cap (arrow) from outlet pipe set counterclockwise.

Caution:

There is a washer inside the pressure cap, take care not to lose it after removal.



3. Connect one end of the proper pipe to exhaust port, and place the other end to expansion tank.



Hint:

A thin water pipe about 1.5 m and a pipe for gas can be used for antifreeze bleeding.



4. Add the coolant.
5. Keep the engine idling. Wait for electric water pump to operate.
6. When a large amount of coolant flows out (without gas), stop engine, wait until system is cooled, install and tighten the pressure cap.

Caution:

- Clean the spilled coolant to prevent coolant from entering spark plug installation hole.
- Check if pressure cap is properly sealed.

7. Add coolant to between MIN and MAX lines (if the coolant is less).
8. Tighten the expansion tank cap.
9. Start and run the engine. Maintain engine speed between 2000 and 2500 rpm to warm up the engine until cooling fan operates.
10. Check each water pipe for leakage, lack of antifreeze, if so, handle it.

Caution:

- Do not open the expansion tank cap at high engine temperature to prevent burns.

11. Using a diagnostic tester, check for electronic injection system DTCs (especially electric water pump DTCs).

Caution:

- If there is a DTC for electric water pump idling, such as P170000 ISS 2 Supply Voltage Over 13 V, it indicates that coolant is not sufficient in intercooler system, add coolant and perform bleeding.

Intelligent Intake Grille

Removal

Warning/Caution/Hint

Caution:

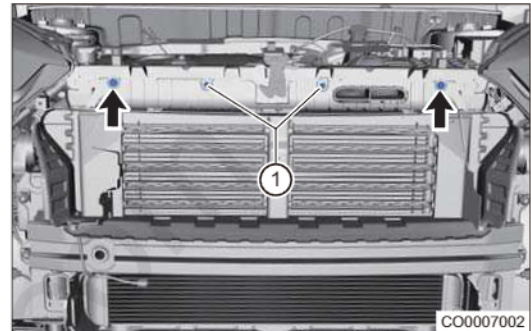
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the front bumper assembly (See page 50-3).
4. Remove the intelligent intake grille assembly.

- (a) Remove 2 coupling bolts (arrow) between intelligent intake grille and tank upper crossmember.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$

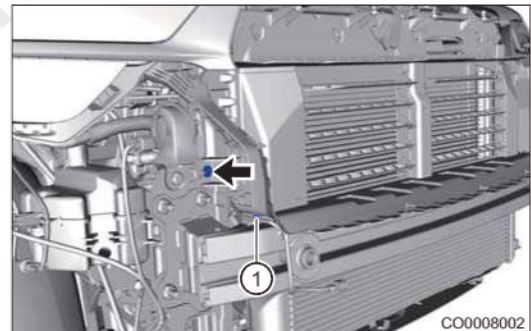


- (b) Remove 2 coupling clips (1) between intelligent intake grille and tank upper crossmember.

- (c) Remove coupling bolt (arrow) between intelligent intake grille and front right crossmember mounting board.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$

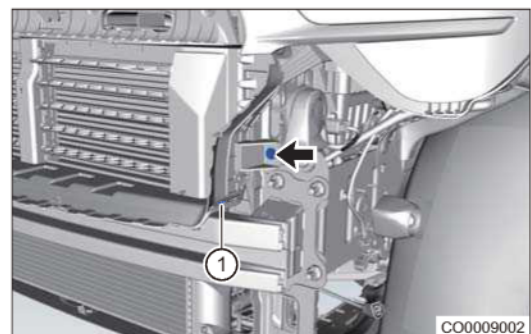


- (d) Disconnect the wire harness fixing clip (1).

- (e) Remove coupling bolt (arrow) between intelligent intake grille and front left crossmember mounting board.

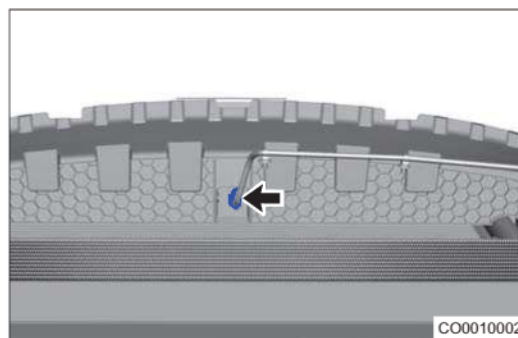
Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$



- (f) Disconnect the wire harness fixing clip (1).

- (g) Disconnect the intelligent intake grille connector (arrow).



- (h) Remove the intelligent intake grille assembly.

Installation

1. Installation is in the reverse order of removal.

Tank Upper Crossmember Assembly

Removal

Warning/Caution/Hint

Warning:

- Perform removal procedures with engine compartment at low temperature, after cooling fan stops completely; otherwise rotating cooling fan or hot components of engine compartment may cause serious injury.

Caution:

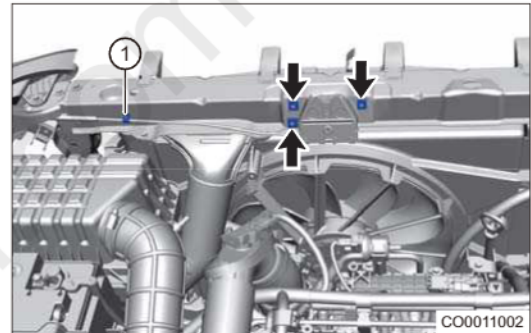
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the front bumper assembly (See page 50-3).
4. Remove the air filter assembly (See page 10-8).
5. Remove the tank upper crossmember assembly.

- (a) Remove 3 fixing nuts (arrow) from engine hood lock assembly.

Tightening torque

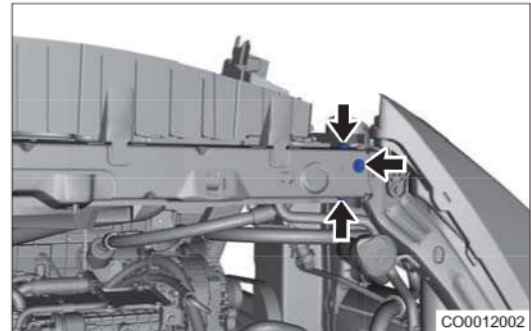
$9 \pm 1 \text{ N}\cdot\text{m}$



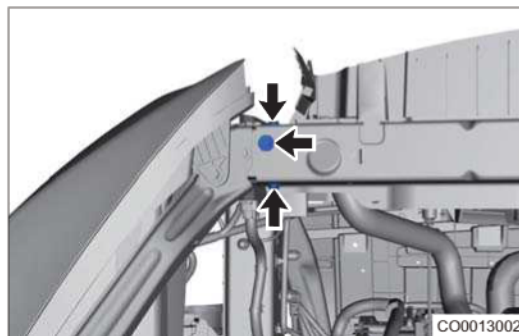
- (b) Remove engine hood lock cable fixing clips (1) from tank upper crossmember.
- (c) Remove 6 fixing bolts (arrow) from tank upper crossmember.

Tightening torque

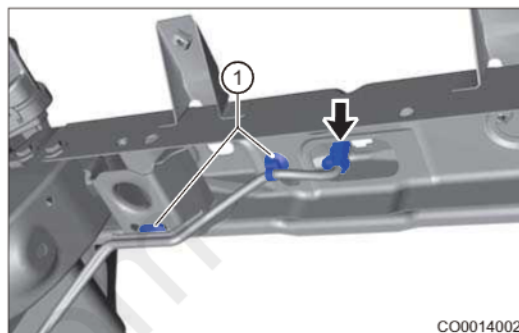
$9 \pm 1 \text{ N}\cdot\text{m}$



- (d) Disconnect the engine hood contact switch connector (arrow).



- (e) Disconnect 2 wire harness fixing clips (1).
(f) Remove the tank upper crossmember assembly.



Installation

1. Installation is in the reverse order of removal.

Expansion Tank

Removal

Warning/Caution/Hint

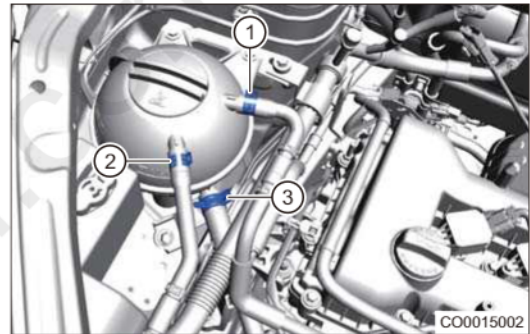
Warning:

- 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.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Drain the coolant ([See page 12-10](#)).
 4. Remove the expansion tank.

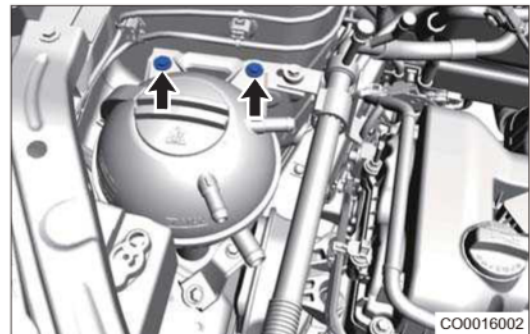
- (a) Loosen elastic clamp (1) and disconnect connection between expansion tank and engine discharge pipe.



- (b) Loosen elastic clamp (2) and disconnect connection between expansion tank and radiator discharge pipe.
- (c) Loosen elastic clamp (3) and disconnect connection between expansion tank and water supply pipe.
- (d) Remove 2 fixing bolts (arrow) from expansion tank.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$



- (e) Remove the expansion tank assembly.

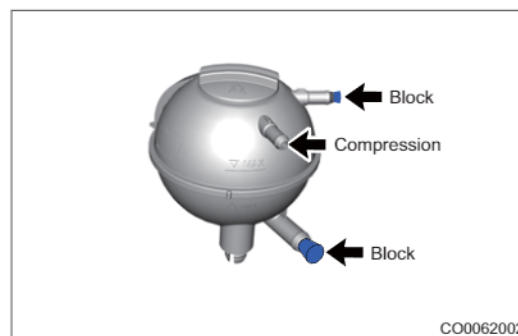
Inspection

Expansion Tank

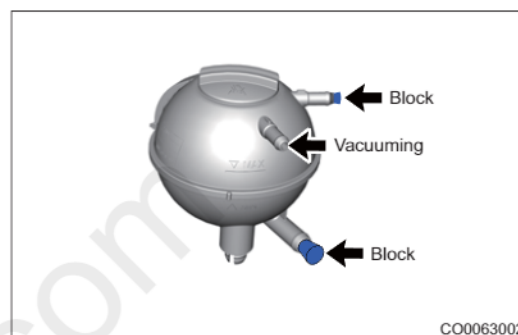
1. Check that the expansion tank is welded firmly, and there are no defects such as fractures and cracks at the weld.
2. The expansion tank should be colorless and transparent. During use of vehicle, expansion tank assembly is not allowed to have discoloration that affects the appearance and function, and scale line should be clearly visible.

Expansion Tank Cap

1. Block two holes of expansion tank and pressurize one of them. When pressure reaches the opening pressure of relief valve (120 - 150 kpa), the pressure in expansion tank should be maintained at the relief valve opening pressure value.



2. Block two holes of expansion tank and vacuumize one of them. When vacuum pressure reaches the opening pressure of vacuum valve (-2 - 10 kpa), vacuum pressure in expansion tank should be maintained at the vacuum valve opening pressure value.



Installation

1. Installation is in the reverse order of removal.

Caution:

- When connecting water supply pipe and expansion tank, align the "±" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "±" mark, align the edge of elastic clamp with lower edge of "二" position of "±" mark.
- When connecting engine discharge pipe and expansion tank, align the "工" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "工" mark, align the edge of elastic clamp with lower edge of "二" position of "工" mark.
- When connecting radiator discharge pipe and expansion tank, align the "工" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "工" mark, align the edge of elastic clamp with lower edge of "二" position of "工" mark.
- Check that coolant has been added to the specified level after installation.

Thermostat Assembly

Removal

Warning/Caution/Hint

Warning:

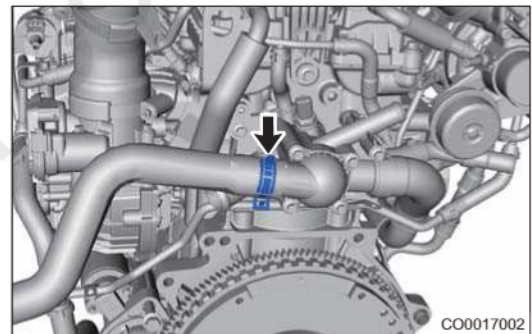
- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

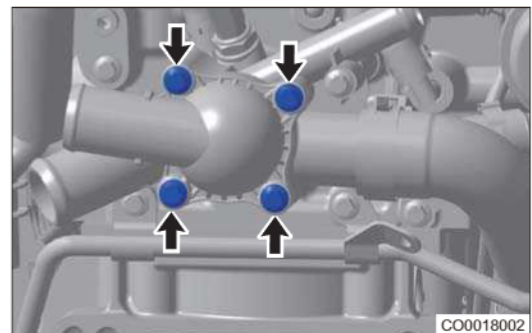
1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the intake hose assembly.
5. Drain the coolant (See page 12-10).
6. Remove the thermostat assembly.

- (a) Loosen elastic clamp (arrow) and disconnect connection between engine inlet pipe and thermostat housing.

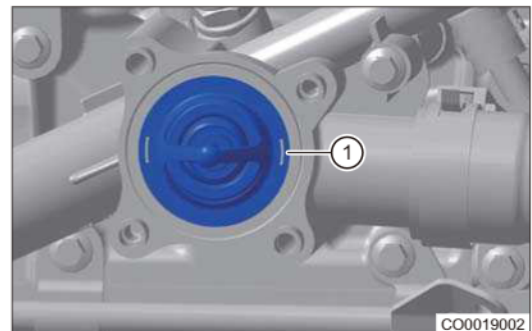


- (b) Remove 4 fixing bolts (arrow) from thermostat housing.

Tightening torque
8 + 3 N·m



- (c) Remove thermostat housing and remove thermostat assembly (1) from thermostat seat.

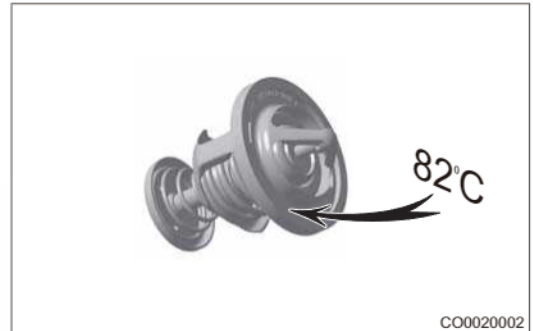


Inspection

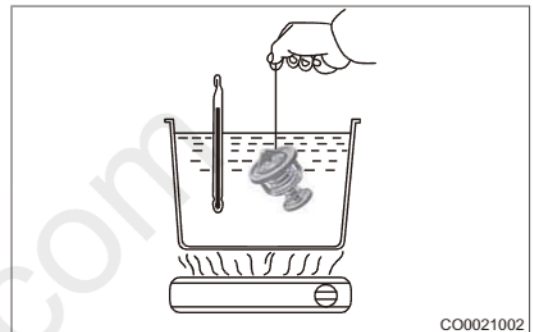
1. Check opening temperature and maximum lift of thermostat assembly.

Hint:

Opening temperature of thermostat is engraved in the thermostat assembly.



- (a) Soak thermostat assembly into water, heat water gradually and perform inspection.
 - Opening temperature of thermostat assembly is $82 \pm 2^{\circ}\text{C}$.
 - Maximum lift of thermostat assembly is no less than 8.5 mm.
 - Temperature is 95°C when thermostat assembly opens fully.



- (b) If above inspection conditions are not met, replace thermostat assembly.

Installation

1. Installation is in the reverse order of removal.

Caution:

- When connecting engine outlet pipe and thermostat housing, position the "±" mark on pipe port right above, and rotate elastic clamp and center line of mark 90° .
- Check that coolant has been added to the specified level after installation.



Thermostat Seat Assembly

Removal

Warning/Caution/Hint

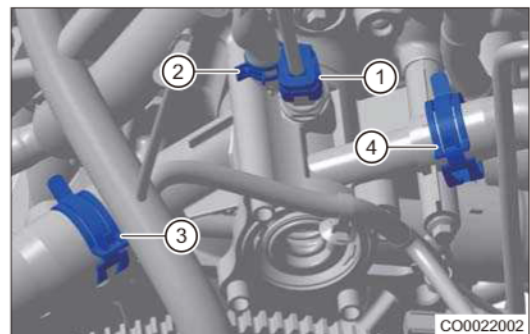
Warning:

- 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.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

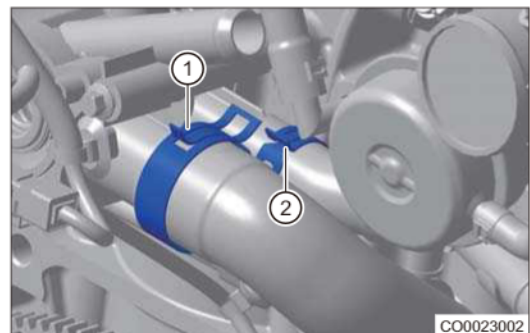
Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the battery (See page 16-12).
5. Remove the battery tray (See page 16-15).
6. Drain the coolant (See page 12-10).
7. Remove the air filter assembly (See page 10-8).
8. Remove the intake hose.
9. Remove the thermostat assembly (See page 12-20).
10. Remove the thermostat seat assembly.
 - (a) Disconnect the coolant temperature sensor connector (1).
 - (b) Loosen elastic clamp (2) and disconnect connection between engine discharge pipe and thermostat seat assembly.



- (c) Loosen elastic clamp (3) and disconnect connection between engine outlet hose and thermostat seat assembly.
- (d) Loosen elastic clamp (4) and disconnect connection between heater core outlet hose and thermostat seat assembly.
- (e) Loosen elastic clamps (1) and disconnect connection between small circulation water pipe and thermostat seat assembly.

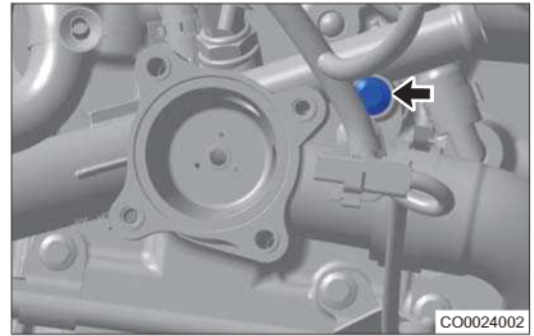


- (f) Loosen elastic clamp (2) and disconnect connection between heater core inlet hose and thermostat seat assembly.

- (g) Remove fixing bolt (arrow) from thermostat seat assembly.

Tightening torque

8 + 3 N·m



- (h) Remove the thermostat seat assembly and O-ring.

- (i) Remove coolant temperature sensor (arrow) from thermostat seat assembly.

Tightening torque

15 ± 1 N·m



Installation

1. Installation is in the reverse order of removal.

Caution:

- Replace thermostat seat O-ring with a new one during installation, and removed thermostat seat O-ring cannot be reused.
- When connecting engine discharge hose and thermostat seat, align the "T" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "T" mark, align the edge of elastic clamp with lower edge of "一" position of "T" mark.
- When connecting small circulation water pipe and thermostat seat, align the "T" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "T" mark, align the edge of elastic clamp with lower edge of "一" position of "T" mark.
- When connecting engine inlet pipe and thermostat seat, align the "工" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "工" mark, align the edge of elastic clamp with lower edge of "二" position of "工" mark.
- When connecting heater inlet pipe and thermostat seat, position the "±" mark on pipe port right above, and align center position of elastic clamp tabs with "I" position of "±" mark, align the edge of elastic clamp with lower edge of "二" position of "±" mark.
- When connecting heater outlet pipe and thermostat seat, align the "工" mark on pipe port with limited post, and align center position of elastic clamp tabs with "I" position of "工" mark, align the edge of elastic clamp with lower edge of "二" position of "工" mark.
- Check that coolant has been added to specified level after installation, and check for leakage at the removal and installation position.



Discharge Steel Pipe Assembly

Removal

Warning/Caution/Hint

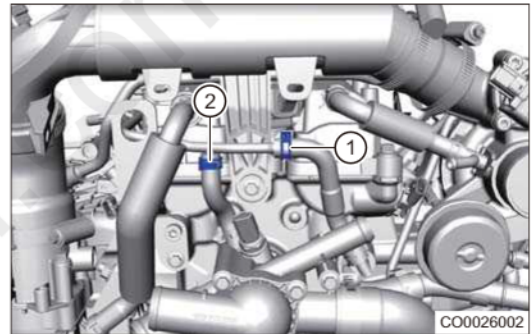
Warning:

- 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.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

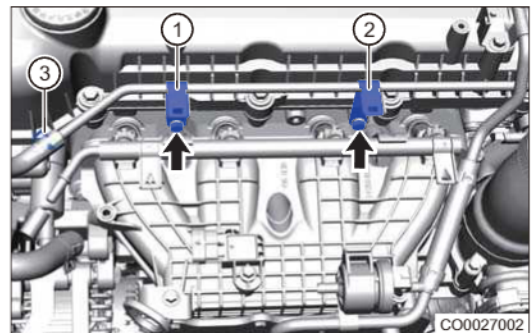
Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the discharge steel pipe assembly.
 - (a) Loosen elastic clamp (1) and disconnect connection between discharge hose I and discharge steel pipe assembly.



- (b) Loosen elastic clamp (2) and disconnect connection between discharge hose III and discharge steel pipe assembly.
- (c) Disconnect engine wire harness fixing clips (1), (2) from discharge steel pipe assembly.



- (d) Loosen elastic clamp (3) and disconnect connection between discharge hose II and discharge steel pipe assembly.
- (e) Remove 2 fixing bolts (arrow) from discharge steel pipe assembly.

Tightening torque

8 + 3 N·m

- (f) Remove the discharge steel pipe assembly.

Installation

1. Installation is in the reverse order of removal.

Caution:

- When connecting discharge hose 1 and discharge steel pipe, align the "T" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "T" mark, align the edge of elastic clamp with lower edge of "一" position of "T" mark.
- When connecting discharge hose 2 and discharge steel pipe, align the "±" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "±" mark, align the edge of elastic clamp with lower edge of "二" position of "±" mark.
- When connecting discharge hose 3 and discharge steel pipe, align the "T" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "T" mark, align the edge of elastic clamp with lower edge of "一" position of "T" mark.
- Check that coolant has been added to specified level after installation, and check for leakage at the removal and installation position.



Cooling Fan Assembly

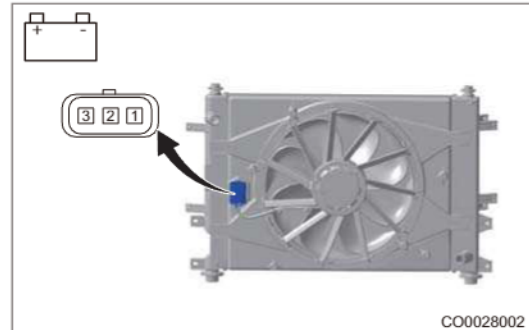
On-vehicle Inspection

- Using a digital multimeter, measure resistance of cooling fan.

(a) Cooling fan

Measurement Condition	Condition	Specification (Ω)
Terminal 1 - Terminal 2	Normal temperature (20°C)	0.8 ± 0.1
Terminal 1 - Terminal 3	Normal temperature (20°C)	0.6 ± 0.1

If inspection result is not as specified, replace cooling fan assembly.

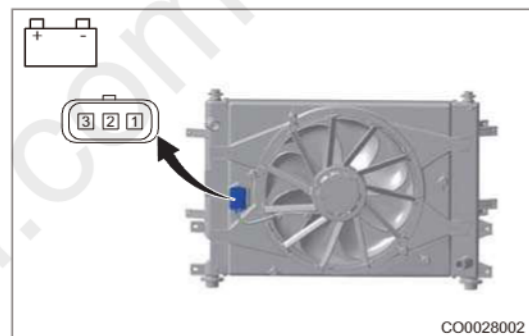


- Connect battery positive (+) and negative (-) to cooling fan connector terminal as shown in table below, to observe if cooling fan runs smoothly.

(a) Cooling fan

Measurement Condition	Condition	Specified Condition
Battery positive (+) - Terminal 2 Battery negative (-) - Terminal 1	Always	Runs at low speed
Battery positive (+) - Terminal 3 Battery negative (-) - Terminal 1	Always	Runs at high speed

If inspection result is not as specified, replace cooling fan assembly.



12

Removal

Warning/Caution/Hint

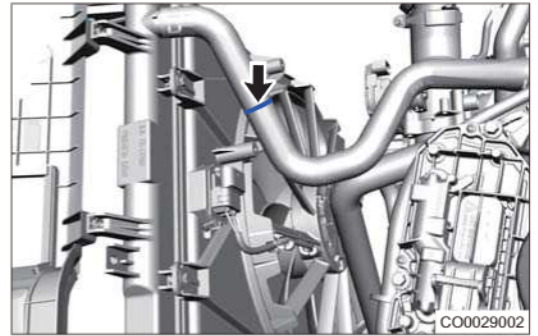
Warning:

- Perform removal procedures with engine compartment at low temperature, after cooling fan stops completely, to prevent accidents.

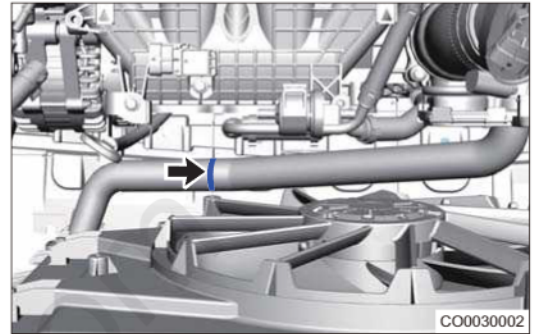
Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
- Turn off all electrical equipment and the ignition switch.
 - Disconnect the negative battery cable.
 - Remove the air filter assembly (See page 10-8).
 - Remove the cooling fan assembly.

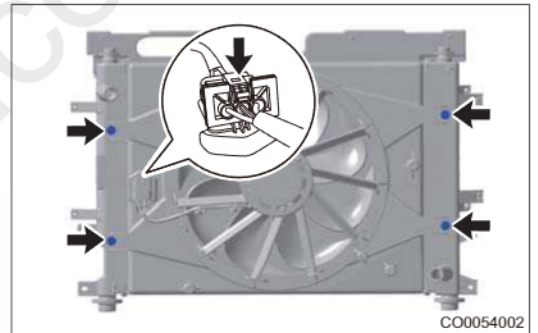
- (a) Remove engine inlet pipe fixing clip (arrow) from cooling fan.



- (b) Remove engine outlet pipe fixing clip (arrow) from cooling fan.



- (c) Disconnect the cooling fan connector (arrow).



- (d) Remove 4 fixing bolts (arrow) from cooling fan assembly.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$

- (e) Remove the cooling fan assembly.

Inspection

1. Check cooling fan blade for dirt. If so, clean the cooling fan.
2. Check cooling fan blade for missing, cracks, etc. If so, replace cooling fan.

Installation

Warning/Caution/Hint

Caution:

- Check that coolant has been added to the specified level after installation.
1. Installation is in the reverse order of removal.



Radiator Assembly

Removal

Warning/Caution/Hint

Warning:

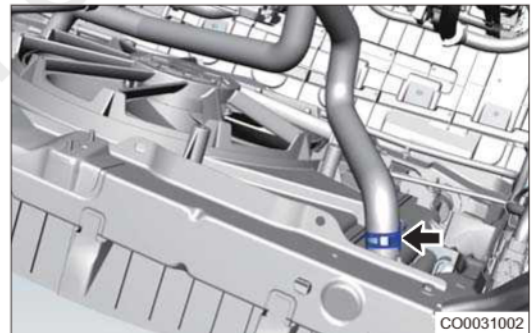
- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

Caution:

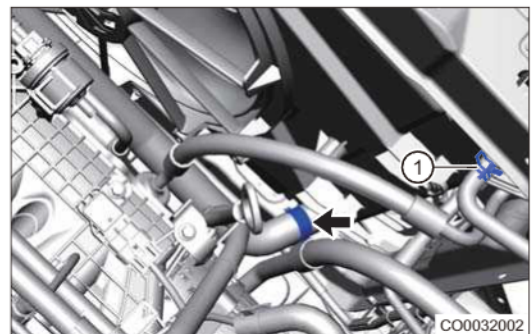
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the front bumper assembly (See page 50-3).
4. Remove the intake grille assembly (See page 12-14).
5. Drain the coolant (See page 12-10).
6. Remove the cooling fan assembly (See page 12-26).
7. Remove the low temperature radiator assembly (See page 10-12).
8. Remove the radiator assembly.

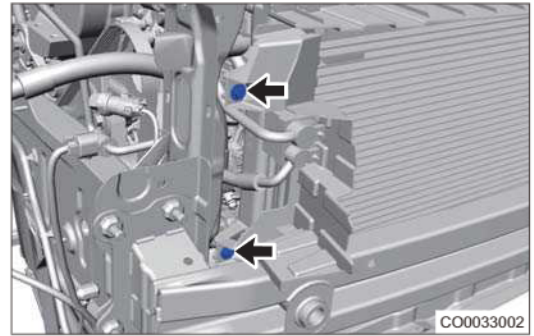
- (a) Loosen elastic clamp (arrow) and disconnect connection between engine inlet hose and radiator assembly.



- (b) Loosen elastic clamp (1) and disconnect connection between radiator discharge hose and radiator assembly.



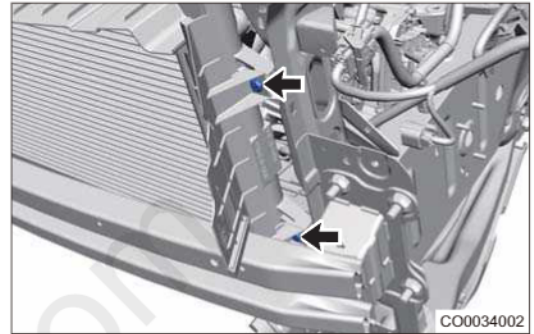
- (c) Loosen elastic clamp (arrow) and disconnect connection between engine outlet hose and radiator assembly.



- (d) Remove 4 coupling bolts (arrow) between radiator assembly and condenser assembly.

Tightening torque

$7 \pm 1 \text{ N}\cdot\text{m}$



- (e) Remove the radiator assembly.

Inspection

1. Check radiator surface for dirt. If so, clean radiator surface.

Installation

1. Installation is in the reverse order of removal.

Caution:

- When connecting engine outlet pipe and radiator, align the "工" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "工" mark, align the edge of elastic clamp with lower edge of "二" position of "工" mark.
- When connecting engine inlet pipe and radiator, align the "±" mark on pipe port with boss, and align center position of elastic clamp tabs with "I" position of "±" mark, align the edge of elastic clamp with lower edge of "二" position of "±" mark.
- Check that coolant has been added to specified level after installation, and check for leakage at the removal and installation position.



Water Pump Assembly

Removal

Warning/Caution/Hint

Warning:

- 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.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Drain the coolant (See page 12-10).
 4. Move away the accessory drive belt (See page 07-18).
 5. Remove the water pump assembly.

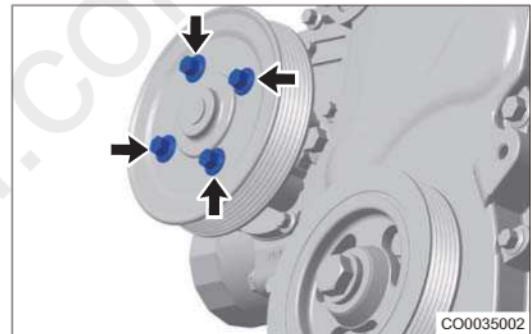
- (a) Remove 4 fixing bolts (arrow) from water pump pulley, and remove water pump pulley assembly.

Tightening torque

20 + 5 N·m

Hint:

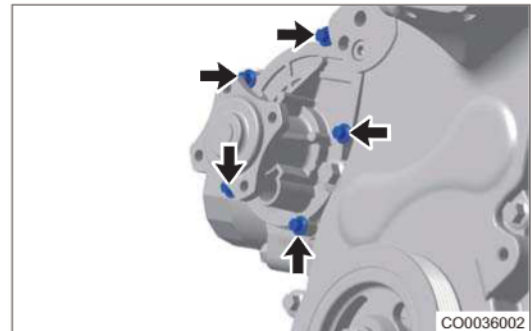
Loosen water pump pulley fixing bolts with a wrench, and then move away accessory drive belt.



- (b) Remove 5 fixing bolts (arrow) from water pump assembly.

Tightening torque

8 + 3 N·m



- (c) Remove the water pump assembly.

Inspection

1. Check water pump bearing for excessive looseness. If so, replace water pump assembly.

Installation

Warning/Caution/Hint

Caution:

- Clean installation surface of water pump assembly.
- If water pump is damaged, replace rather than attempt to repair it.
- Check that coolant has been added to the specified level after installation.
- Perform cooling system pressure test after adding coolant, to check cooling system for leakage.

Electric Water Pump Assembly and Bracket, Water Pipe

Removal

Warning/Caution/Hint

Warning:

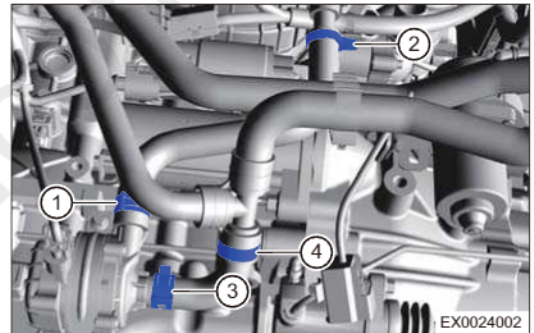
- Be sure that engine cooling system is at low temperature before handling. If engine is in hot status, high-pressurized hot coolant may flow out, causing serious personal injury.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

Caution:

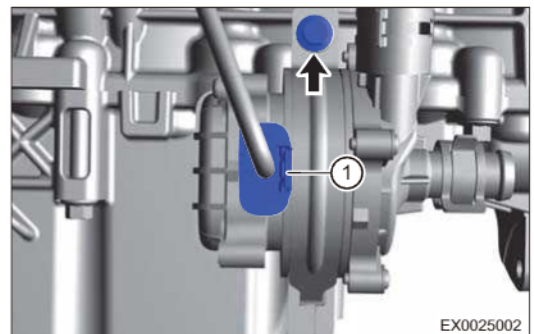
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Drain the coolant (See page 12-10).
5. Remove electric water pump inlet and outlet pipes.

- (a) Loosen elastic clamp (1) and disconnect connection between electric water pump assembly and electric water pump outlet hose.



- (b) Loosen clamping ring (2) and disconnect connection between electric water pump outlet hose and inlet pipe set.
 - (c) Loosen elastic clamp (3) and disconnect connection between electric water pump inlet hose and electric water pump assembly.
 - (d) Loosen elastic clamp (4) and disconnect connection between electric water pump inlet hose and low temperature radiator outlet hose.
 - (e) Remove electric water pump inlet and outlet pipe assembly.
6. Remove the electric water pump assembly.
 - (a) Disconnect the electric water pump assembly connector (1).



- (b) Remove fixing bolt (arrow) from electric water pump assembly.

Tightening torque

8 + 3 N·m

- (c) Remove the electric water pump assembly.

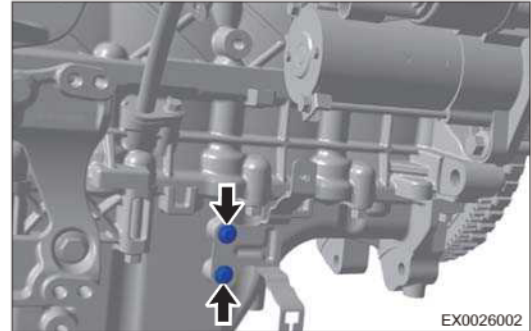


7. Remove the electric water pump assembly mounting bracket.

- (a) Remove 2 fixing bolts (arrow) from electric water pump assembly bracket.

Tightening torque

8 + 3 N·m



- (b) Remove the electric water pump assembly bracket.

Installation

1. Installation is in the reverse order of removal.

Caution:

- Check that coolant has been added to the specified level after installation, perform turbocharger intercooler system bleeding and check for leakage at the removal and installation position.

SQRE4T15B LUBRICATION SYSTEM

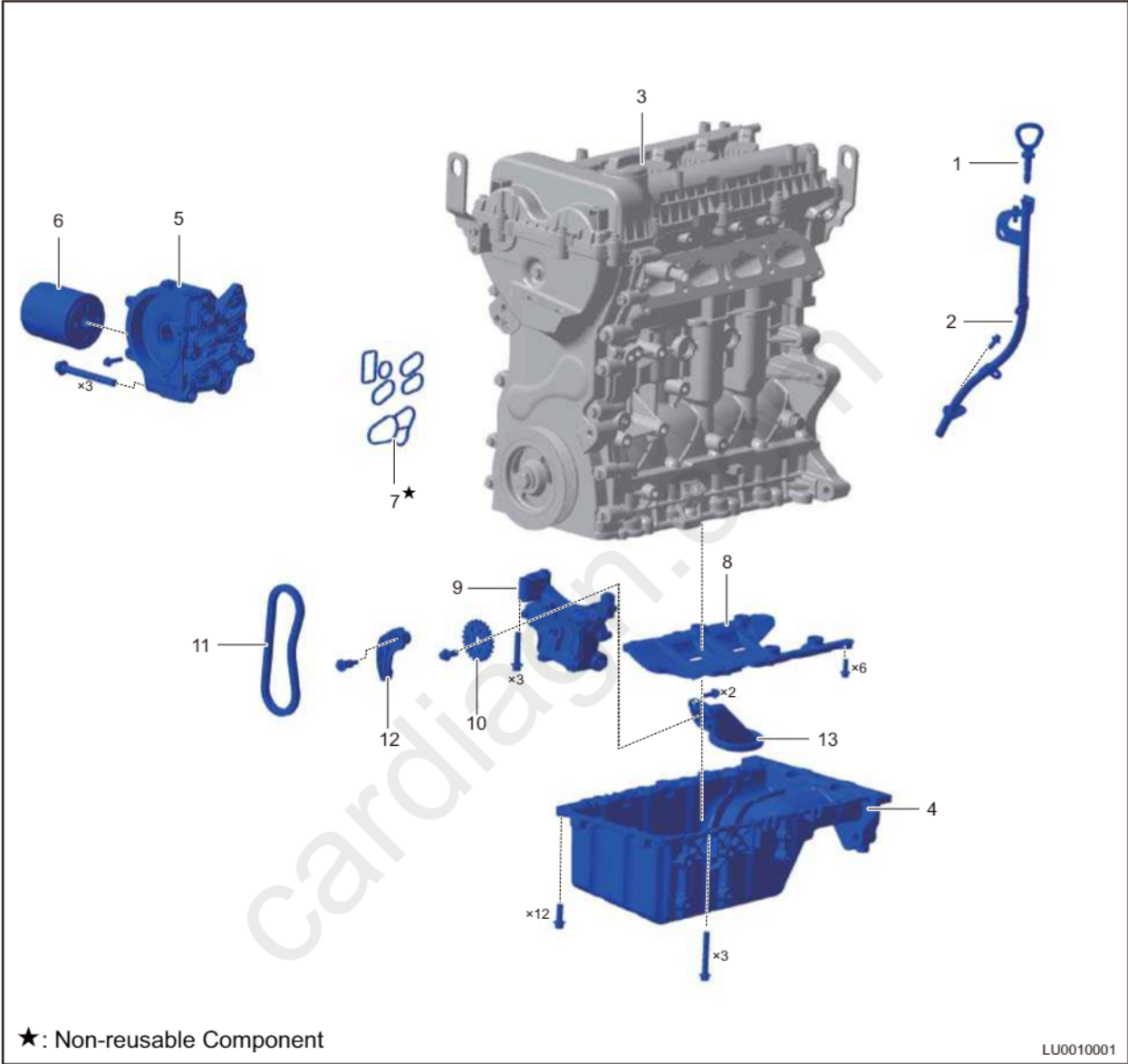
GENERAL INFORMATION	13-3	Installation	13-12
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Specifications	13-4	Installation	13-14
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GENERAL INFORMATION

Overview

Description



13

1 - Oil Dipstick	2 - Oil Dipstick Tube
3 - Fuel Filler Door	4 - Oil Pan
5 - Oil Filter Module Assembly	6 - Oil Filter Assembly
7 - Gasket	8 - Oil Deflector
9 - Oil Pump Assembly	10 - Oil Pump Sprocket
11 - Oil Pump Drive Chain	12 - Movable Rail for Oil Pump Chain
13 - Oil Strainer	★ - Non-reusable Parts

Operation

When engine is operating, an oil pump driven by crankshaft, sucks oil from oil pan and pumps it at pressure through an oil filter. This filtered oil then flows through oil passages, to moving surfaces of all engine drive parts and forms oil films between moving surfaces to reduce friction and finally returns to the oil pan, thus reducing friction resistance between drive parts, power consumption and increasing reliability and durability of engine operation.

Warning:

Prolonged and repeated contact with engine oil will result in the removal of natural oils from skin, leading to dryness, irritation and dermatitis. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Precautions should be followed when replacing engine oil to minimize the risk of your skin making contact with used engine oil.

- Wear protective clothing and gloves;
- Wash your skin thoroughly with soap and water, or use waterless hand cleaner to remove any used engine oil.
- Never use gasoline, thinners or solvents.

Specifications

System pressure

Status	Pressure (bar)
Idling Speed (700 ± 50 r/min)	Higher than 0.7
High Speed (2000 ± 50 r/min)	Higher than 2.5

Oil

Engine Type	E4T15B
Charging Capacity (L)	Replace oil filter and lubricant at same time: 4.7 ± 0.2
Oil Type	SM SAE-5W-30 SM SAE-5W-40 SM SAE-10W-40
Others	1. If lubricant needs to be added during maintenance, it is recommended to add to middle of upper center of dipstick side oil head. 2. Do not exceed upper line of dipstick while adding lubricant, or it will affect the engine performance.

Torque Specifications

Description	Torque (N·m)
Drain Plug	35 ± 3
Oil Filter	22 - 25 or sealing ring contacts with flange, tighten it for 3/4 to 1 turn
Oil Pressure Switch	20 ± 2
Oil Pan Fixing Bolt	20 ± 5
Coolant Tube I Assembly Fixing Bolt	20 ± 5
Oil Filter Module Assembly Fixing Bolt	40 ± 5
Oil Pump Fixing Bolt	20 ± 5
Oil Dipstick Tube Fixing Bolt	8 ± 3

Tools

Special Tool

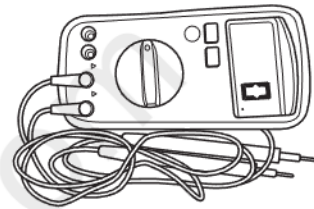
X-431 PAD Diagnostic Tester



001

General Tool

Digital Multimeter



002

DIAGNOSIS & TESTING

Diagnosis Contents

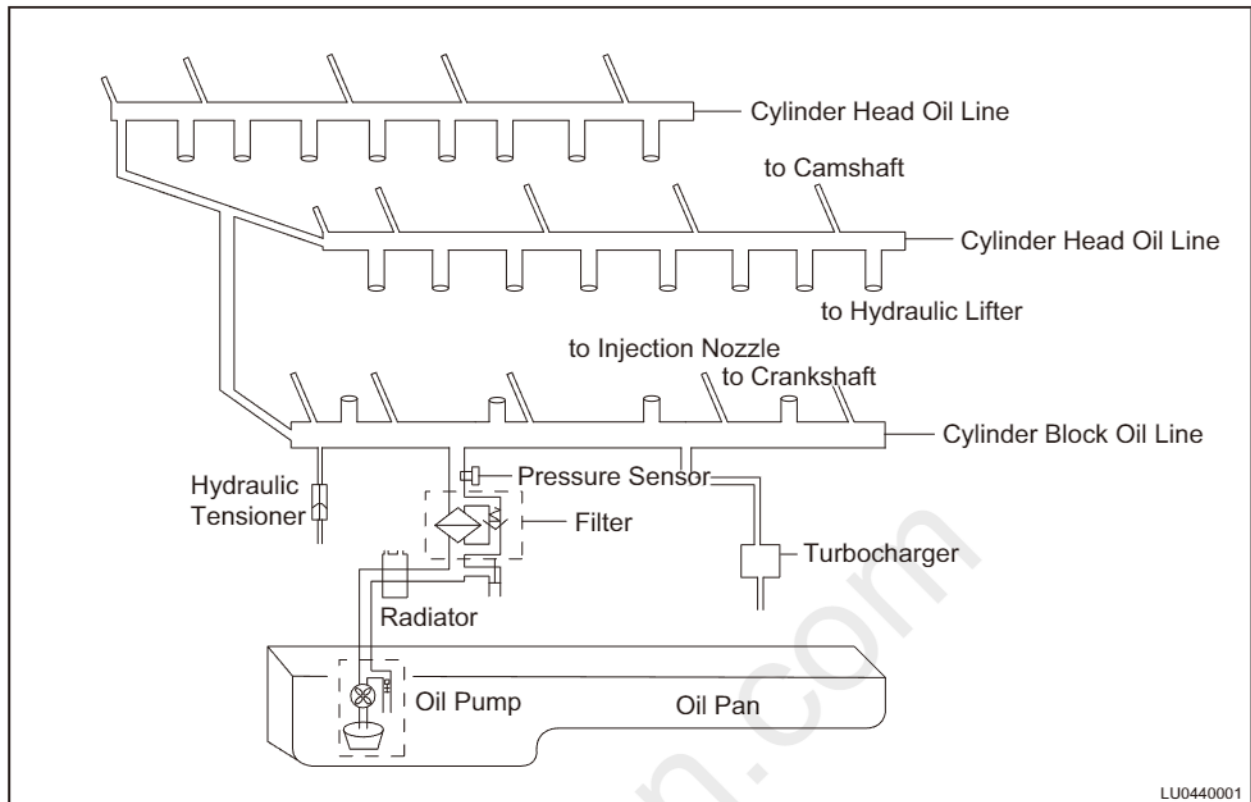
Problem Symptoms Table

Hint:

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

Symptom	Suspected Area
Low pressure in lubrication system	Oil pan (dirty, leaked)
	Oil strainer (mesh dirty, blocked)
	Oil pump
	Line (blocked)
High pressure in lubrication system	Oil with high viscosity
	Oil passages blocked
	By-pass valve stuck
Mix oil with water	Oil filter module internal leakage
	Cylinder head gasket improperly sealed
	Cylinder block cracks
High oil consumption	Engine oil (excessive oil filling capacity)
	Oil filter module (leaked)
	Crankshaft front oil seal (damaged)
	Crankshaft rear oil seal (damaged)
	Oil Pressure Switch
	Oil drain plug (leaked)
	Oil pan (leaked)
	Engine oil leakage (cylinder head gasket damaged)
	Each engine seal surface leakage
Oil pressure warning light comes on	Engine oil (insufficient oil, low oil viscosity)
	Oil filter element (blocked)
	Oil strainer (blocked)
	Crankshaft front oil seal (damaged)
	Crankshaft rear oil seal (damaged)
	Oil pressure switch (damaged)
	Instrument cluster (oil pressure warning light)
	Cylinder block (cracks occur in water jacket, resulting in coolant leaking into oil pan, which will cause oil dilution)
	Line (blocked)
After engine cranked, engine produces clunk sound	Engine oil (high oil viscosity, excessive oil filling capacity)
	Cylinder block (oil passage blocked)

Schematic Diagram of Lubrication



Engine Oil Level Inspection

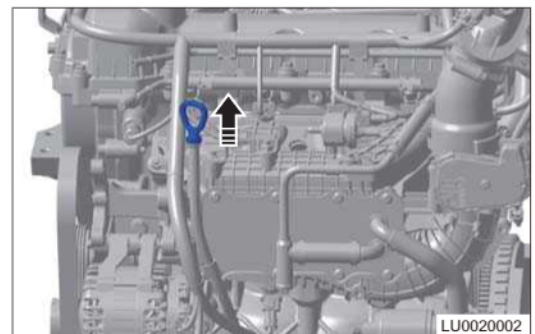
Hint:

Check oil level indicated by oil dipstick, when engine is stopped after it reaches operating temperature.

1. Park vehicle on level ground, stop the engine after warming up and wait for 5 minutes
2. Open the hood and pull out the oil dipstick in the direction (arrow) as shown in the illustration, and wipe it clean with a piece of cloth

Caution:

- Please put a piece of cloth under the oil dipstick end to prevent oil from splashing onto engine and body.



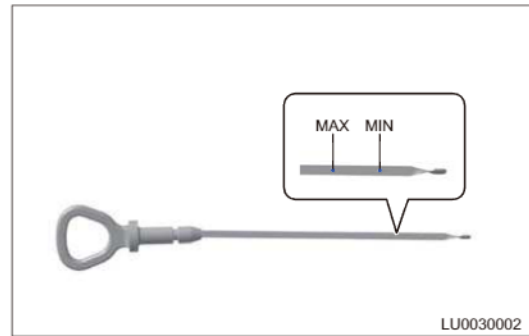
3. Reinsert the oil dipstick in place and leave it for 3 s to 5 s.
4. Pull out the oil dipstick again and check if oil level is proper

Hint:

If engine oil level is too low, check for leakage and add oil up to the level mark



- (a) If oil level is at or above the "MAX" mark, drain the excessive engine oil.



- (b) If oil level is between "MIN" mark and "MAX" mark, it shows that oil level is proper.
 (c) If oil level is below the "MIN" mark, it is necessary to add engine oil.

Caution:

- When adding engine oil, oil level should not be above the "MAX" mark.
- Do not start the engine during the measurement.

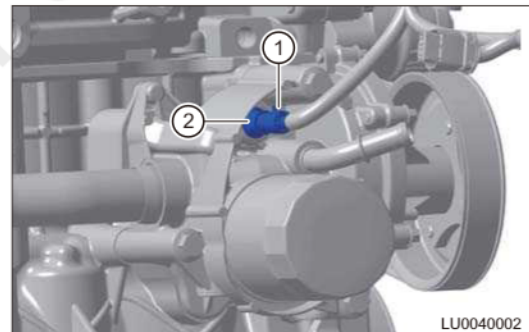
Oil Pressure Inspection

Preconditions

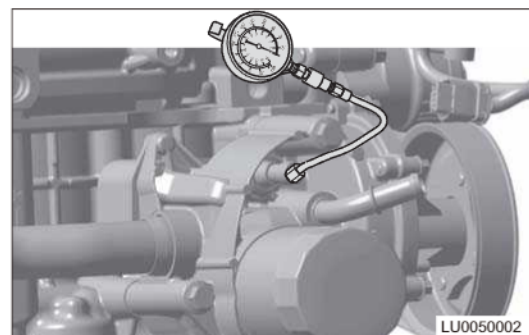
1. Engine oil level is normal
2. Oil filter is used within 5000 km
3. Engine reaches the normal operating temperature

Inspection

1. Disconnect the oil pressure switch connector (1) and remove the oil pressure switch (2).



2. Screw the oil pressure tester into threaded hole of oil pressure switch as shown in the illustration.



3. Start the engine. When the engine inspection conditions are met, read the oil pressure values at idling speed and high speed respectively.

If lubrication system pressure is low, clean the oil pan and oil strainer mesh, and then test again. If lubrication system pressure is still low, replace the oil pump assembly.

Oil pressure at idling speed (700 ± 50 r/min): above 0.7 bar.

Oil pressure at high speed (2000 ± 50 r/min): above 2.5 bar.

4. Install the oil pressure switch.

Hint:

Apply a small amount of seal gum to threads when installing the oil pressure switch.

5. Connect the oil pressure switch connector and check engine oil for leakage.



ON-VEHICLE SERVICE

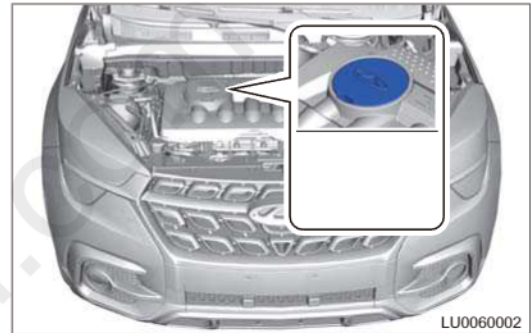
Engine Oil Replacement

Drain the engine oil

Warning/Caution/Hint

Warning:

- DO NOT drain engine oil until engine cools down.
 - Prolonged and repeated contact with engine oil will result in the removal of natural oils from skin, leading to dryness, irritation and dermatitis. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.
1. Turn off all electrical equipments and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Open the oil filler door.
 - (a) Turn the oil filler door counterclockwise to open.

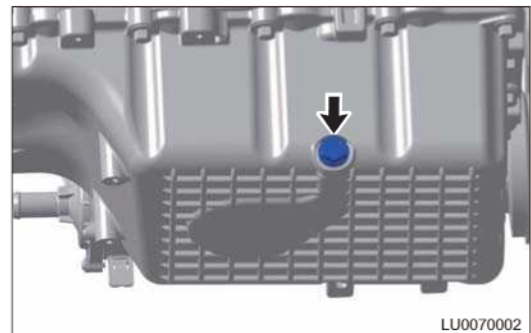


13

4. Raise vehicle to a proper position.
 - (a) Unscrew the drain plug (arrow), and drain the oil into a container.

Caution:

 - Apply a certain pushing force to drain plug while loosening the plug by hand, and have the drain plug attached to thread tightly to prevent oil from overflowing in advance. Move away your hand quickly to prevent burn by oil with a certain temperature.
 - Wasted engine oil should be handled by specialized department according to local laws and regulations. Never discard it at will
 - (b) Wipe off the drain plug and tighten it.



Tightening torque

$35 \pm 3 \text{ N}\cdot\text{m}$

Caution:

- The drain plug gasket must be replaced each time the drain plug is removed.

Engine Oil Adding

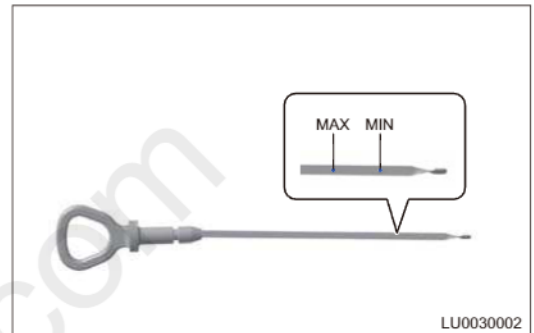
1. Only use engine oil that meets Chery specifications.

Engine Type	E4T15B
Charging Capacity (L)	Replace oil filter and lubricant at same time: 4.7 ± 0.2
Oil Type	SM-SAE 10W - 40 SM-SAE 5W - 40 SM-SAE 10W - 20

Caution:

- DO NOT use inferior engine oil.
- DO NOT mix different types of engine oil.
- Be careful not to spill engine oil on any part of the engine when adding engine oil.

- (a) Add a proper amount of oil, and check that oil level is between "MIN" mark and "MAX" mark with oil dipstick.



- (b) Turn off the engine after running for 1 to 2 minutes, park vehicle on a level surface and wait for approximately 5 minutes. Check if oil level is between "MIN" mark and "MAX" mark. Refill oil if necessary.
- (c) Check the vehicle for leakage after replacing oil.

Oil Filter

Removal

Warning/Caution/Hint

Warning:

- DO NOT remove oil filter element until engine cools down.
- Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.

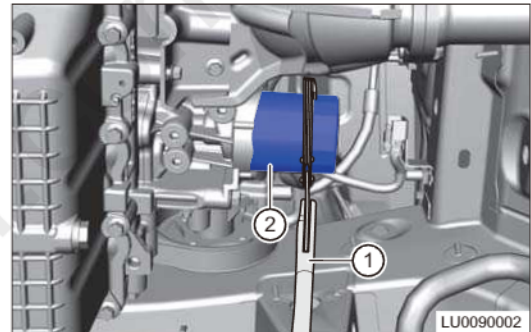
Caution:

- Use oil filter installer when replacing oil filter to avoid deformation.
 - Oil filter is close to exhaust pipe, avoid burns during installation and removal.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Drain the engine oil (See page 13-10).
 4. Remove the oil filter

- (a) Use oil filter remover (1) to remove the oil filter (2).

Tightening torque

22 - 25 N·m



- (b) Remove the fuel filter assembly.

Caution:

- The removed oil filter should be handled by specialized department according to local laws and regulations. Never discard it at will.

Installation

Warning/Caution/Hint

Caution:

- Check and clean installation surface between oil filter and oil filter bracket.
- Apply a coat of clean engine oil to oil filter seal ring.
- Use a special tool to tighten oil filter.

Tightening torque

22 - 25 N·m

- It is necessary to clean oil left on components after installing oil filter.
1. Installation is in the reverse order of removal.

Oil Pressure Switch

Removal

Warning/Caution/Hint

Caution:

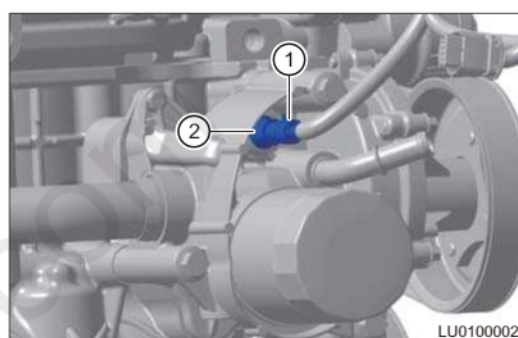
- DO NOT remove oil pressure switch until engine cools down.
- Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the oil pressure switch

- (a) Disconnect the oil pressure switch connector (1) and remove the oil pressure switch (2).

Tightening torque

$20 \pm 2 \text{ N}\cdot\text{m}$



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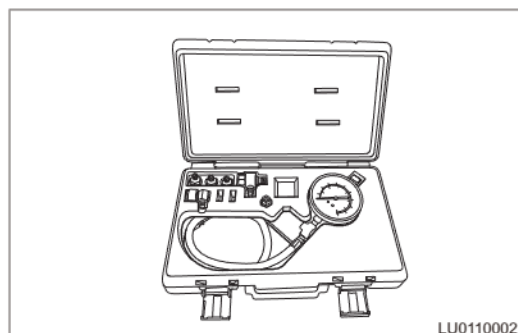
Inspection

Warning/Caution/Hint

Caution:

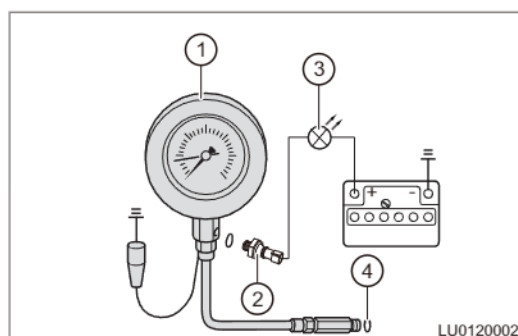
- Before inspecting oil pressure switch, please make sure that oil level is proper and coolant temperature is above 90°C, and that oil filter is used within 5000 km.

1. Inspect the oil pressure switch.
 - (a) Use an oil pressure tester as shown in the illustration.



LU0110002

- (b) Install the oil pressure tester into the threaded hole (4) of oil pressure switch as shown in the illustration.



LU0120002



- (c) Install the oil pressure switch (2) onto the tester (1) and connect the LED lamp (3).
- (d) LED (3) does not turn on when engine is not started. If it turns on, replace the oil pressure switch.
- (e) After starting engine, observe the pressure reading on tester. LED (3) turns on when oil pressure reaches 94 Kpa, if it does not turn on, replace the oil pressure switch.

Installation

1. Remove the oil and impurities on the oil pressure switch and its threaded hole
2. Apply a small amount of seal gum to threads when installing the oil pressure switch
 - (a) Use a torque wrench to tighten it to specified torque, as shown in illustration, there is a gap (a) about 2 to 5 mm between oil pressure switch flange surface and oil filter module housing.

Tightening torque

$20 \pm 2 \text{ N}\cdot\text{m}$



LU0130002

3. Other installation procedures are in the reverse order of removal.

Caution:

- Apply seal gum on threads when assembling oil pressure switch.

Seal Gum

Loctite 577

Oil Filter Module Assembly

Removal

Warning/Caution/Hint

Warning:

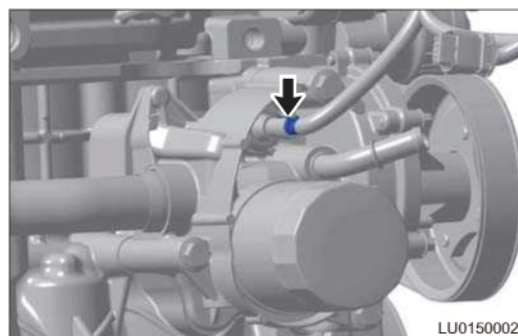
- DO NOT remove oil filter module assembly until engine cools down.
- There will be residual coolant inside engine during removal and installation, if your skin contacts coolant directly, clean it with water immediately. If it is serious, please go to hospital.
- Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the engine accessory belt (See page 07-18).
5. Drain the oil (See page 13-10).
6. Drain the coolant (See page 12-10).
7. Remove the precatlytic converter assembly (See page 11-16).
8. Remove the oil filter module assembly.

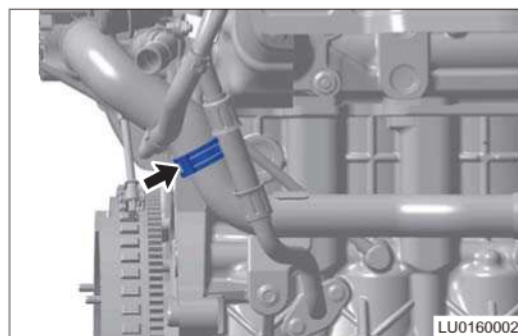
- (a) Loosen elastic clamp (arrow), disconnect connection between water supply hose and oil filter module assembly.



- (b) Disconnect the oil pressure switch connector (arrow).



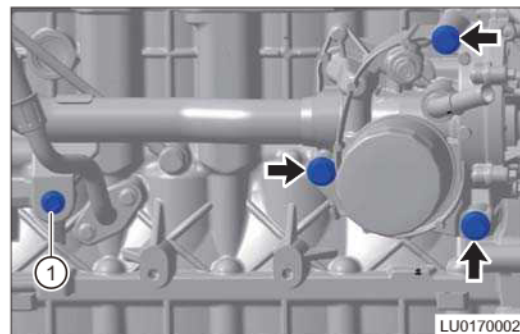
- (c) Loosen the elastic clamp (arrow) and disconnect connection between small circulation hose and cooling pipe I assembly.



- (d) Remove coupling bolt (1) between cooling pipe assembly I and cylinder block.

Tightening torque

20 + 5 N·m



- (e) Remove 3 oil filter module fixing bolts (arrow).

Tightening torque

40 + 5 N·m

- (f) Remove the oil filter module assembly.

Installation

Warning/Caution/Hint

Caution:

- Clean installation surface of oil filter module assembly.
- Seal ring is a disposable part, it need to replace (rubber ring) repair kit.
- Check if oil filter module assembly seal ring is installed to correct position.
- Add oil to specified position.

1. Installation is in the reverse order of removal.

Oil Pan

Removal

Warning/Caution/Hint

Caution:

- DO NOT drain oil and remove oil pan until engine cools down.
- Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service. DO NOT remove oil pan until engine cools down.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Recover the refrigerant (See page 29-82).
4. Drain the engine oil (See page 13-10).
5. Remove the engine accessory belt (See page 07-18).
6. Remove compressor assembly and compressor fixing bracket
7. Remove electronic water pump assembly and electronic water pump bracket

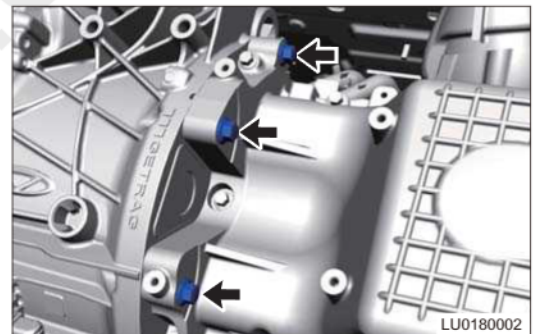
Hint:

Remove electronic water pump assembly without disconnecting inlet/outlet water hose, move it to one side and perform corresponding fixing after removing the bolt.

8. Remove the oil pan assembly.
 - (a) Remove 3 coupling bolts (arrow) between oil pan assembly and transmission assembly.

Tightening torque

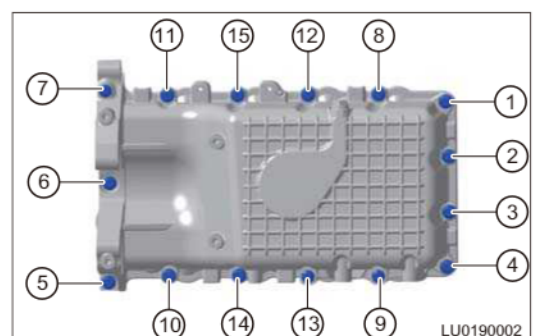
$50 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove 15 fixing bolts from oil pan in order as shown in illustration.

Tightening torque

$20 + 5 \text{ N}\cdot\text{m}$



- (c) Tap all around oil pan slightly with a rubber hammer, remove oil pan.

Caution:

- Because the seal gum is sealed between oil pan and cylinder block, never use hard objects, such as a hammer, to tap it during removal, but it can be tapped slowly from left and right with a rubber hammer.
- A transmission carrier can be used to support the oil pan during removal, to prevent personal injury from sudden dropping of oil pan.
- DO NOT damage or miss dowel pin when removing oil pan.



- (d) Remove the residual seal gum on oil pan and engine frame with flat scraper.

Caution:

- When removing seal gum on installation surface between oil pan and engine frame, threaded hole can be cleaned with cleaner properly.

Installation

Warning/Caution/Hint

Caution:

- When applying seal gum, check the type and expiration date of seal gum.
- Remove impurities, iron chips and residue of seal gum on oil pan.
- Remove oil stain and residue of seal gum on the threaded hole of oil pan and cylinder block.
- Seal gum should not be applied too thick; otherwise it will overflow into oil pan due to squeezing, which will block the oil strainer.
- DO NOT add engine oil until seal gum becomes dry after installing oil pan.

1. Install the oil pan assembly.

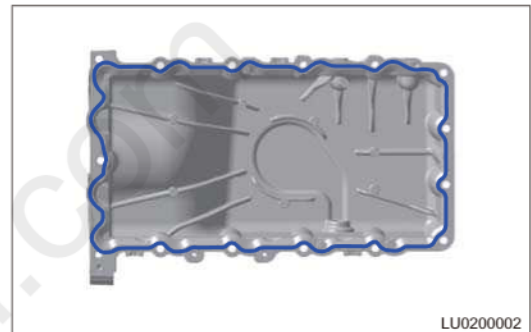
- (a) As shown in illustration, apply seal gum to inside of oil pan installation screw hole evenly.

Recommended seal gum

Loctite 5900H

Seal gum line diameter

1.5 - 3 mm

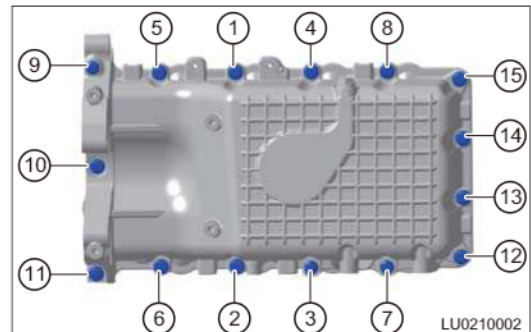


- (b) Align oil pan with frame dowel pin, assemble oil pan and tap it slightly to fit it with frame closely.

- (c) As shown in illustration, pre-tighten oil pan fixing bolts until oil pan is pressed tightly. Then tighten bolts in order.

Tightening torque

20 + 5 N·m



2. Other installation procedures are in the reverse order of removal.

Oil Strainer

Removal

Warning/Caution/Hint

Caution:

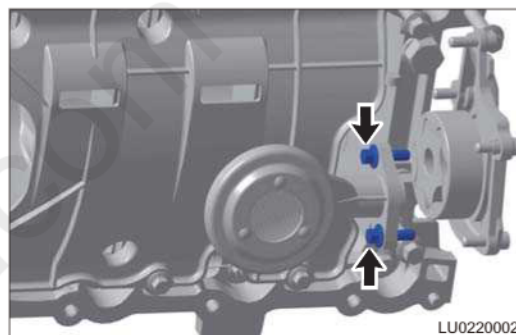
- DO NOT drain engine oil until engine cools down.
- Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Drain the engine oil (See page 13-10).
4. Remove the oil pan assembly (See page 13-17).
5. Remove the oil strainer

- (a) Remove 2 strainer fixing bolts (arrow).

Tightening torque

8 + 3 N·m



LU0220002

- (b) Remove the oil strainer and seal ring.

Installation

Warning/Caution/Hint

Caution:

- Oil strainer seal ring is a disposable part. Replace seal ring before installing oil strainer.
- Apply seal gum to fixing bolt threads after installing oil strainer. Ensure application amount for (3 - 5) tooth.

Seal Gum

Loctite 243

1. Installation is in the reverse order of removal.

Oil Pump Assembly

Removal

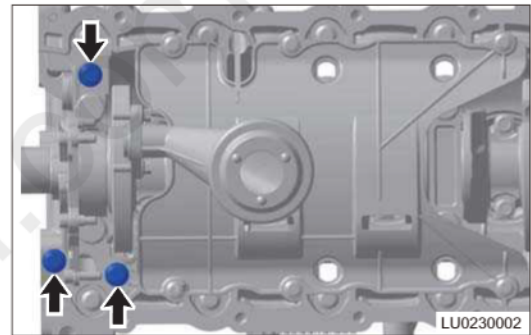
Warning/Caution/Hint

Warning:

- DO NOT drain engine oil until engine cools down.
 - Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Drain the engine oil (See page 13-10).
 4. Remove the oil pan assembly (See page 13-17).
 5. Remove the oil strainer (See page 13-19).
 6. Remove the oil pump assembly
 - (a) Remove 3 oil pump assembly fixing bolts (arrow).

Tightening torque

20 + 5 N·m



- (b) Push chain movable rail, move away chain from oil pump assembly, remove oil pump assembly.

Installation

Warning/Caution/Hint

Warning:

- Wasted engine oil pump assembly should be handled by specialized department according to local laws and regulations. Never discard it at will.
- Rotate sprocket clockwise, check if rotation of oil pump is smooth.
- Apply seal gum to fixing bolt threads after installing oil pump. Ensure application amount for (3 - 5) tooth.

Seal Gum

Loctite 243

1. Installation is in the reverse order of removal.

Oil Tube (Dipstick) Assembly

Removal

Warning/Caution/Hint

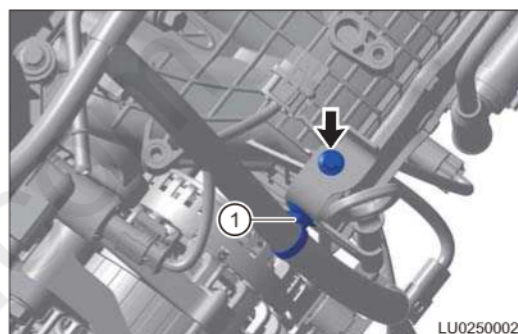
Warning:

- Prolonged and repeated contact with engine oil will be harmful to your skin. If engine oil spills on your skin, wash it off immediately with water. In addition, the used engine oil contains potentially harmful contaminants, which may cause skin cancer. Therefore, always take proper skin protection measures when performing vehicle service.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the oil tube assembly.
 - (a) Disconnect the engine wire harness fixing clip (1).
 - (b) Remove coupling bolt (arrow) between oil tube and intake manifold assembly.

Tightening torque

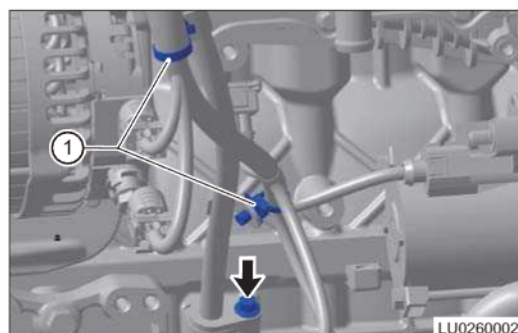
8 + 3 N·m



- (c) Disconnect the engine wire harness fixing clip (1).
- (d) Remove coupling bolt (arrow) between oil tube and engine frame assembly.

Tightening torque

8 + 3 N·m



- (e) Remove the oil tube assembly.

Installation

Warning/Caution/Hint

Caution:

- Check O-ring before assembly to make sure it is not damaged, otherwise replace with a new one.
 - Apply a small amount of lubricant to O-ring before assembly.
 - When inserting dipstick tube into frame installing hole, insert lower end as far as possible along shaft line direction. If it tilts, it may be difficult to assemble O-ring, even damage O-ring.
1. Installation is in the reverse order of removal.



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SQRE4T15B IGNITION SYSTEM

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Problem Symptoms Table	14-5	Inspection	14-10
Service Precautions	14-5	Spark Jump Test Method	14-11
		Spark Plug Common Problems	14-11
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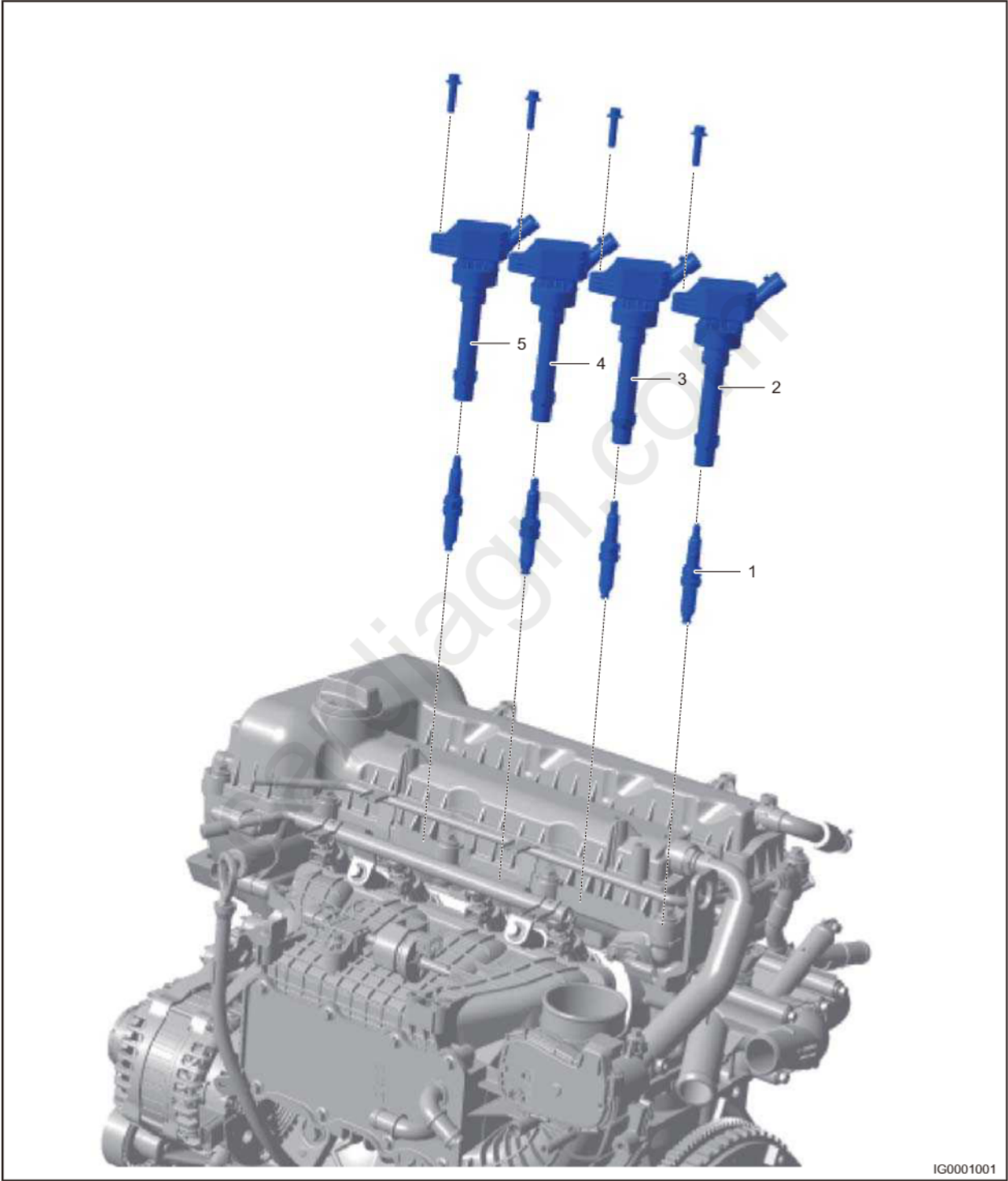


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GENERAL INFORMATION

Overview

Description



14

1 - Spark Plug	2 - Cylinder 4 Ignition Coil Assembly
3 - Cylinder 3 Ignition Coil Assembly	4 - Cylinder 2 Ignition Coil Assembly
5 - Cylinder 1 Ignition Coil Assembly	

Operation

- Ignition system mainly consists of sensors, Engine Control Module (ECM), ignition coils, spark plugs, etc. Ignition advance angle is controlled by Engine Control Module (ECM) directly.
- As an integrated module, the ignition coil cannot be disassembled. SQRE4T15B uses independent ignition system. The secondary high-voltage terminal of each ignition coil is connected to spark plug in engine cylinder via high-voltage connecting rod. Ignition coil primary low-voltage terminal connects to Engine Control Module (ECM) via wire harness.
- Engine Control Module (ECM) receives the Top Dead Center (TDC) position of each cylinder piston via input signal of phase sensor, and uses the speed sensor signal to make ignition coil to operate.

Specifications

Torque Specifications

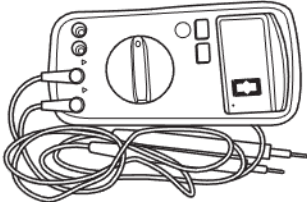
Description	Torque (N·m)
Spark Plug	20 ± 3
Ignition Coil Fixing Bolt	8 ± 2

Spark Plug Specifications

Description	Specifications
Engine Type	SQRE4T15B
Spark Plug Type	3707AAG
Spark Plug Gap (mm)	0.7 - 0.8

Tool

General Tool

Digital Multimeter	 002
--------------------	---

DIAGNOSIS & TESTING

Diagnosis Content

Problem Symptoms Table

Hint:

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

Symptom	Suspected Area
Stall	Ignition coil and high-voltage cable
	Camshaft position sensor
	Spark plug
	Intake camshaft phaser control valve
	Exhaust camshaft phaser control valve
	Wire harness
	ECM
Knock	Ignition coil and ignition high-voltage cable
	Knock sensor
	ECM
Difficult to start	Battery
	Ignition coil and high-voltage cable
	Spark plug
	Engine speed sensor
Engine hesitation, power drop, unstable performance	Ignition coil and high-voltage cable
	Engine speed sensor
	Intake camshaft phaser control valve
	Exhaust camshaft phaser control valve
	Spark plug
	Camshaft position sensor
	ECM
Rough, unstable idling or stall	Ignition coil and high-voltage cable
	Camshaft position sensor
	Spark plug
	ECM

Service Precautions

Visual inspection can reduce the unnecessary test and diagnostic time, so pay attention to the following inspection items:

1. Check line and hose for obvious looseness, and if they are disconnected or routed improperly.
2. Make sure that battery connections are clean and fixed firmly.
3. Check if generator wire and belt are installed correctly and securely.
4. Check if engine wire harness connectors are fully inserted.
5. Check if all electrical connectors are installed correctly and securely.
6. Check the following electrical connections.
 - (a) Engine speed sensor
 - (b) Oxygen sensor
 - (c) Intake pressure/temperature sensor
 - (d) Oil pressure switch
 - (e) Ignition coil



- (f) Canister solenoid valve
 - (g) Camshaft position sensor
 - (h) Electronic throttle
 - (i) Intake Variable Valve Timing (VVT) control valve
 - (j) Exhaust Variable Valve Timing (VVT) control valve
 - (k) Fuel injector
7. Check routing of all vacuum hoses.
 8. Confirm that following vacuum hoses are connected securely without any leakage.
 - (a) Canister solenoid valve
 - (b) PCV valve
 - (c) Brake booster
 9. Check fuel pump hose and wire connection and make sure they are connected securely.

ON-VEHICLE SERVICE

Ignition Coil Assembly

Removal

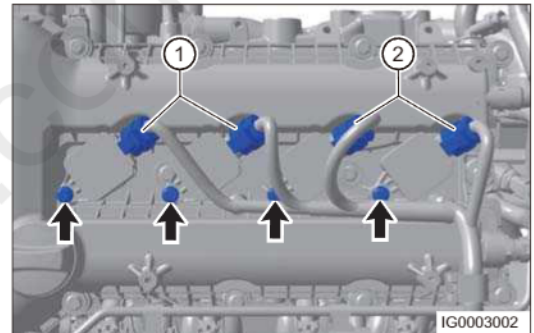
Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.
- It is prohibited to use short circuit spark test to test ignition function during repair, otherwise it may damage the module.
- During using, do not remove ignition coil from spark plug with bare hands with power on, and do not contact the metal part and rubber guide rod directly, to avoid electric shock.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the ignition coil.

- (a) Disconnect ignition coil connectors (1), and move away wire harness from ignition coil.

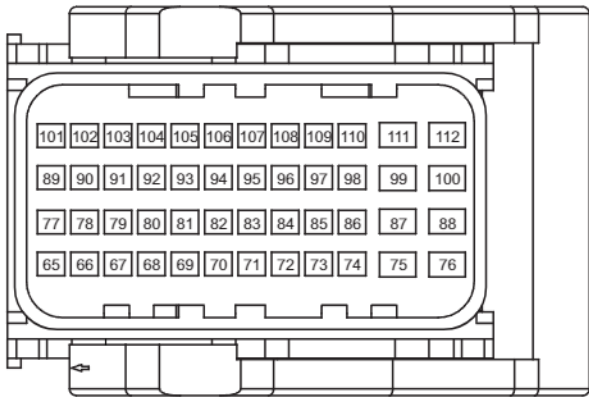
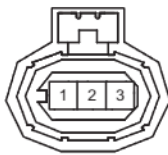
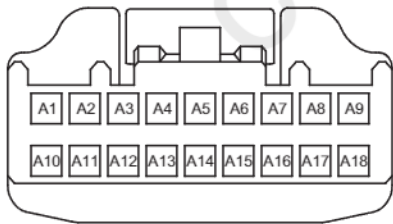
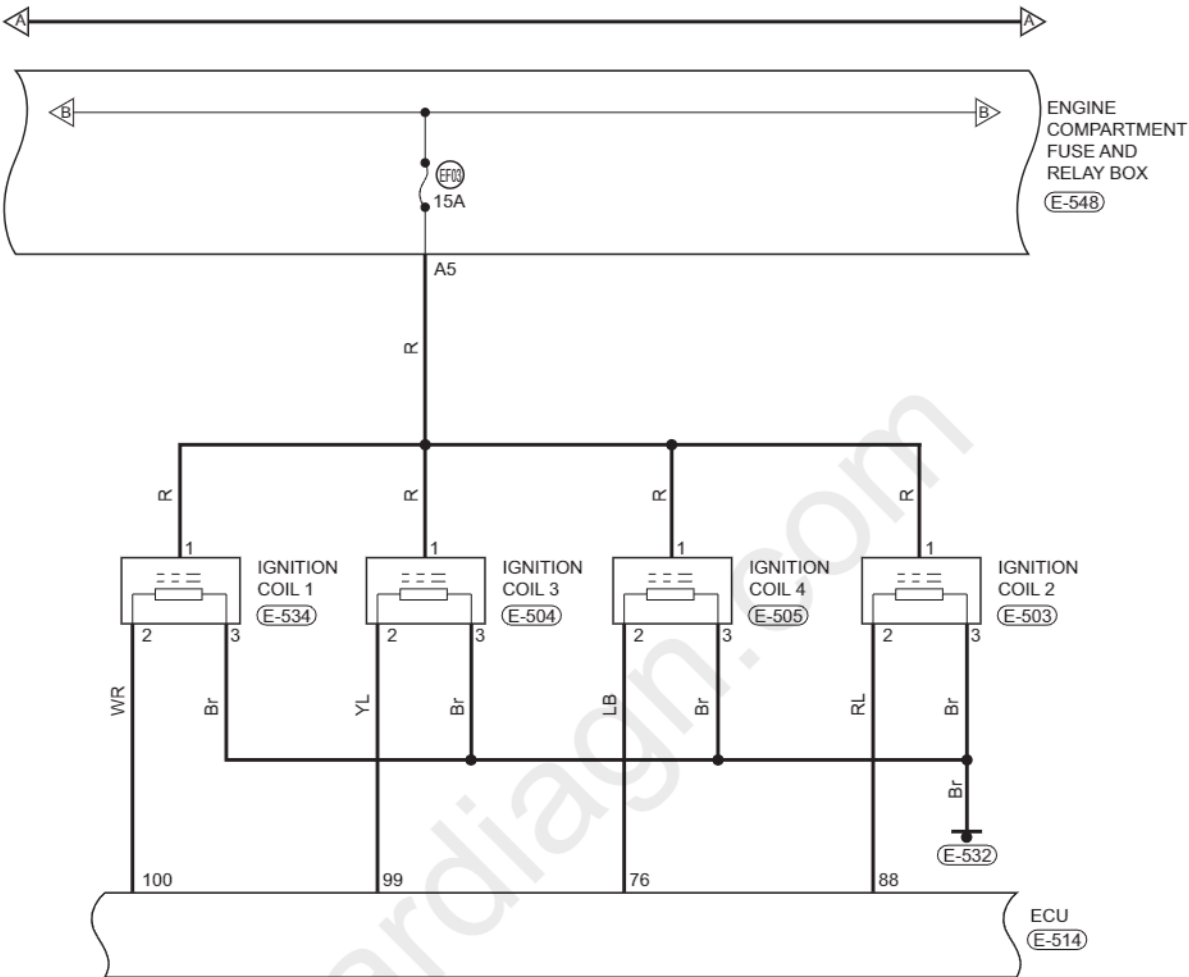


- (b) Disconnect ignition coil connectors (2), and move away wire harness from ignition coil.
- (c) Remove 4 fixing bolts (arrow) from ignition coil.

Tightening torque

$8 \pm 2 \text{ N}\cdot\text{m}$

Ignition Circuit



IG0008001

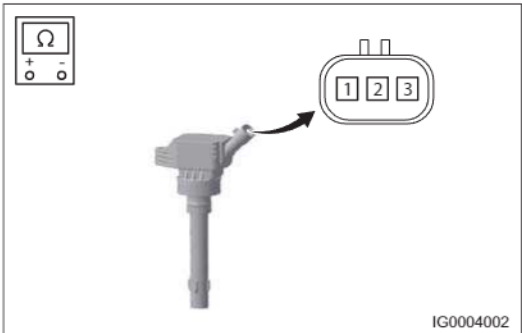
Inspection

- 1. Check resistance of ignition coil primary winding.
 - (a) Turn digital multimeter to ohm band, and check resistance between terminals 1 and 2.

Terminal	Terminal Definition
1	Power Supply
2	Control Signal
3	Ground

Multimeter Connection	Condition	Specification (Ω)
Terminal 1 - Terminal 2	Normal temperature	0.5 - 0.64

Hint:
If result is not as specified, replace ignition coil.



Installation

- 1. Installation is in the reverse order of removal.

Caution:

- Make sure that the connection of ignition coil high-voltage output terminal and spark plug is reliable, or it may cause high-voltage leakage, resulting in poor ignition.
- Inspect cylinder head spark plug mounting hole before installation and foreign matter are prohibited during assembling.
- Install the ignition coil into cylinder head cover mounting hole and press it to close to mounting boss on cylinder head cover. Never turn ignition coil to left/right after pressing and do not tap ignition coil with a hammer etc.

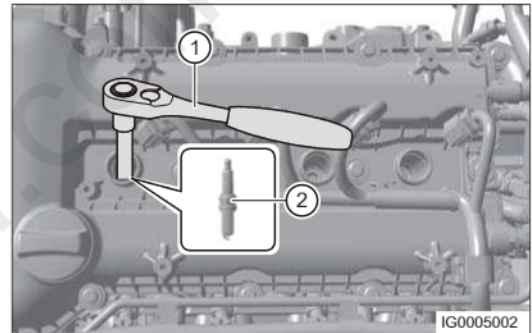
Spark Plug

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
 - DO NOT remove the spark plugs when engine is hot; failure to do this may cause damage to the spark plug thread holes on cylinder head.
 - Before removal, remove the dirt and foreign matter around spark plug holes to prevent them from dropping into cylinders.
1. Turn off all electrical equipment and the ignition switch. Wait until engine cools down and then perform removal to avoid "sliding wire" with hot engine.
 2. Disconnect the negative battery cable.
 3. Remove the engine trim cover assembly.
 4. Remove the ignition coil ([See page 14-7](#)).
 5. Remove the spark plug.
 - (a) Using a special spark plug socket ratchet wrench (1), loosen spark plug.

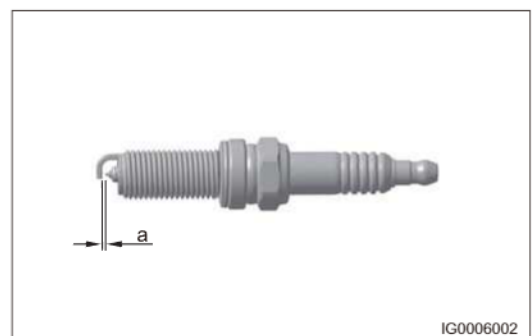


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- (b) Remove the spark plug (2).

Inspection

1. Check the spark plug gap.
 - (a) Check the spark plug gap a: 0.7 - 0.8 mm.
- Hint:**
It is not necessary to adjust the gap.



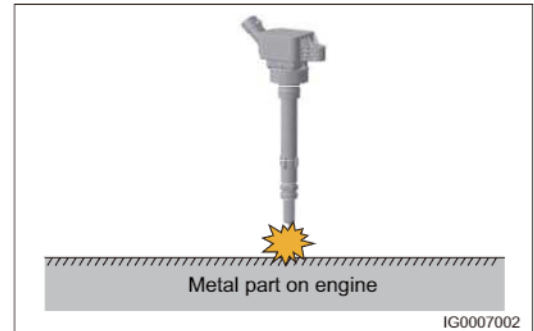
Spark Jump Test Method

1. Remove the spark plug from engine and connect it to high-voltage cable, put the spark plug case 5 - 7 mm away from engine body and start vehicle to check the spark jump.

Warning:

- Always disconnect the injector circuit before test to avoid injection during spark jump test.

- (a) If there is a thick spark with blue-white color and popping occurs between spark plug and engine body and also spark generated between center electrode and side electrode, that indicates ignition system is normal.



- (b) If there is a thick spark with blue-white color between spark plug and engine body and no spark between center electrode and side electrode, but spark is in inside of center electrode, that indicates inside of spark plug is damaged.
- (c) If the spark is red and short or there is no spark, check ignition coil or others.

Spark Plug Common Problems

Normal

- Spark plug porcelain small end is between white and yellowish, gray or brownish.
- Air-fuel ratio and ignition time are normal, there is no misfire, and cold-start enriching function is normal.
- There are no fuel or oil deposits.

Carbon Accumulation

A layer of velvety black charcoal smoke attaches on the insulator small end, motor and spark plug body

Cause	Result	Treatment
Mixture is excessively rich due to improper adjustment of air fuel mixture.	Poor starting ability	Adjust air-fuel ratio and cold starting system, and check air filter.
Traveling distance of vehicle is too short (at high gear and low speed), engine temperature is low, and combustion is incomplete.		
Fuel quality is poor or fuel deteriorates, combustion is incomplete.		
Spark plug type is incorrect.		



14-SQRE4T15B IGNITION SYSTEM

Oil Dirt

A layer of black oily charcoal smoke and dirt attach on the insulator small end, motor and spark plug body		
Cause	Result	Treatment
Piston ring has bad elasticity or is worn excessively, and oil breaks into combustion chamber.	Difficult to start	Check and repair engine, or replace spark plug.
Excessive matching clearance between piston skirt and cylinder wall causes oil breaking and air leakage.		
Air leakage occurs due to incorrect installation of piston ring in direction of inside and outside tangent angle, causing oil breaking into combustion chamber.		
Excessive clearance occurs between valve stem and valve guide due to excessive wear, or valve guide oil seal fails, causing oil leakage.		
Oil level is too high and oil breaks into combustion chamber.		

Lead Deposits

Brownish yellow enamels or greenish deposits exist on the insulator small end		
Cause	Result	Treatment
The fuel additive contains lead, when engine runs under high load conditions with throttle partially opened for a long time, enamel is formed.	Causing misfire	Replace spark plug.

Lead Deposits

There are severe dust deposits from oil additives on the insulator small end, even on the entire insulator skirt and electrode; there are loose cinder deposits on spark plug and combustion chamber		
Cause	Result	Treatment
Additives, especially the oil additives, can form these dust deposits in spark plug and combustion chamber.	Causing misfire, resulting in power loss or engine damage	Check and repair engine, replace spark plug or change oil type.

Red deposits

There are severe red brown deposits on insulator skirt and electrodes, and clear radial discharge traces can be seen on the surface of insulator small end		
Cause	Result	Treatment
In the unleaded gasoline, Mn-based anti-riot agent MMT is used instead of lead tetraethyl, the oxide of Mn after combustion adheres on the surface of insulator and electrode.	At high temperature, these deposits are easily conductive, resulting in flashover on insulator skirt surface, unstable combustion, high engine speed, and jitter under heavy load conditions.	Use qualified fuel, replace spark plug.

Melting on center electrode

Electrode melts, insulator small end softens, expands, and becomes sponge-like		
Cause	Result	Treatment
Overheating caused by self-ignition, excessively large ignition advance angle, deposits in combustion chamber, valve damage, inferior fuel, incorrect spark plug type.	A misfire, power loss or engine damage.	Check engine, ignition, injection and air intake system, and install spark plug with correct type.

Serious Burn in Side Electrode

Serious burn in side electrode		
Cause	Result	Treatment
Corrosive fuel and oil additives, deposits or other factors affect the way of air flowing in combustion chamber, engine knocking without overheating.	A misfire, especially a misfire during acceleration (ignition voltage is insufficient to break through the severely increased electrode gap), it is difficult to start.	Replace spark plug.

Damage on Insulator Small End

Damage on insulator small end		
Cause	Result	Treatment
Mechanical damage (center electrode is stressed due to hitting, dropping, or incorrect handling), caused by severe expansion of deposits between insulator and center electrode or severe corrosion of center electrode.	A misfire, spark occurs at the damage point.	Replace spark plug.

Flashover on Insulator Surface

There is obvious arc burning trace on porcelain surface in axial direction		
Cause	Result	Treatment
Long time use of spark plug, excessive gap, excessive ignition voltage, high-voltage cable jacket aging, poor insulation performance, excessive clearance between high-voltage cable jacket and porcelain.	Spark plug cannot jump properly.	Replace high-voltage cable. Or apply silicone oil to high-voltage cable and replace spark plug.

Cracks on Insulator Big End

Cracks on insulator big end		
Cause	Result	Treatment
Mechanical action, caused by hitting, dropping or use of incorrect handling tool.	Mechanical damage, electrode cannot jump normally.	Replace spark plug.

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Installation**Warning/Caution/Hint****Caution:**

- Check the spark plug type to confirm if it is suitable.
- Please install spark plug with a special spark plug socket, and never damage the normal spark plug gap.
- Avoid to install the spark plug from higher position from mounting hole during installation to prevent spark plug side electrode gap from damaging, resulting in poor ignition.
- Always tighten the spark plug according to specified torque using a torque wrench when installing and replacing it.

1. Install the spark plug.

- (a) Install 4 spark plugs respectively into the cylinder head mounting holes for pre-tightening, and then retighten the spark plugs with a torque wrench.

Tightening torque

20 ± 3 N·m

2. Other installation procedures are in the reverse order of removal.



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SQRE4T15B STARTING SYSTEM

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Starter Relay	15-7	Starting Switch Circuit Diagram	15-16
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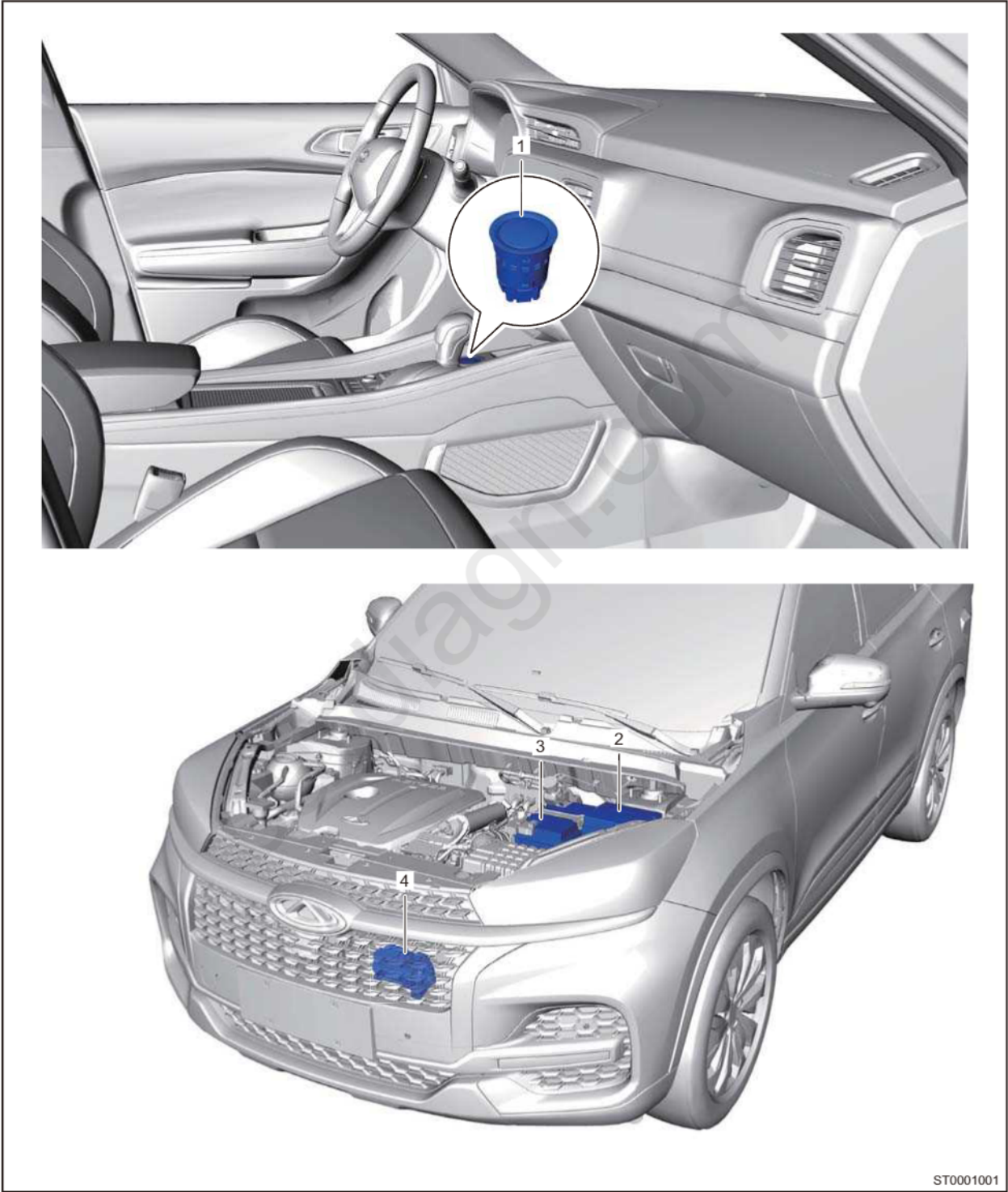


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GENERAL INFORMATION

Overview

Description



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1 - Ignition Starting Switch	2 - Engine Compartment Fuse and Relay Box
3 - Battery	4 - Starter

15–SQRE4T15B STARTING SYSTEM

Starting system consists of battery, ignition switch and starter, etc. Starting system converts electrical energy from battery into mechanical energy, allowing engine to crank initially, and disconnects power transmission between starter and engine when engine runs normally.

Operation

Starter consists of three parts: control mechanism, drive train mechanism and DC motor.

- 1. Control mechanism (solenoid switch): controls engagement and disengagement between starter drive gear and engine flywheel gear and switches on/off the DC circuit; Also the solenoid switch has function of additional resistance of short circuit ignition coil when starting.
- 2. Drive train mechanism: When engine starts, it engages starter drive gear with flywheel gear ring and transmits starter torque to the engine crankshaft; after engine starts, drive gear will automatically disengage from the flywheel gear, so that engine cannot drive starter at high speed, avoiding damage to the starter.
- 3. DC motor: converts electrical energy from battery into electromagnetic moment.

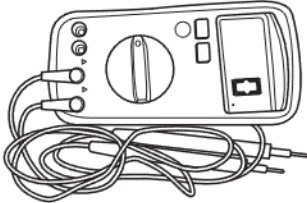
Specifications

Torque Specifications

Description	Torque (N·m)
Starter Power Cable Nut	13 ± 2
Starter Fixing Bolt	45 ± 5

Tool

General Tool

Digital Multimeter	 002
--------------------	---

DIAGNOSIS & TESTING

Diagnosis Contents

Problem Symptoms Table

Hint:

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

Symptom	Suspected Area
When ignition switch is turned to START, solenoid switch makes a "clanking" sound and engine cannot start	Battery (depleted)
	Starter (solenoid switch)
Starter does not run	Battery (depleted)
	Fuse
	Relay
	Starting system wire harness
	Starting switch
	Starter
	ECM
Starter runs weakly	Battery (depleted)
	Starter
Starter is racing	Starter (incorrect installation, internal fault)
	Flywheel ring gear (gear teeth broken)



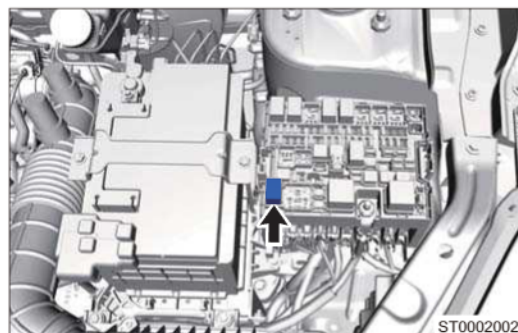
MT



On-vehicle Inspection

Starter Relay

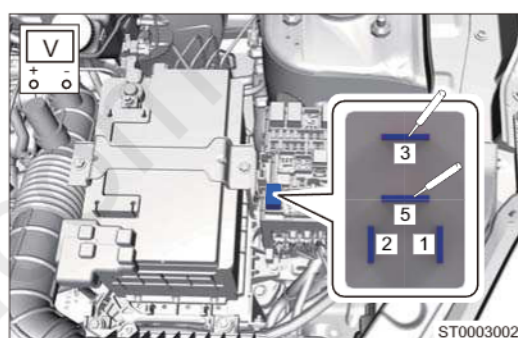
1. Check the starter relay.
 - (a) Remove the starter relay from engine compartment fuse and relay box.



- (b) Using a digital multimeter, measure starter relay resistance according to the table.

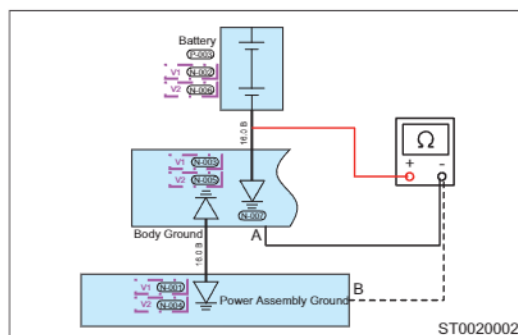
Hint:

If result is not as specified, replace the starter relay.



Ground Inspection

1. Power assembly ground and body ground inspection.
 - (a) Check the power and body ground wire fixing bolts for looseness, and the ground parts should be in good contact with no heat or burnt smell.
 - (b) Using ohm band of digital multimeter, one test lead is connected to the negative cable, and the other test lead is connected to the body ground or power assembly ground. The resistance measured at A is $\leq 0.3 \Omega$, and the resistance measured at B is $\leq 1 \Omega$, the values at A and B cannot differ greatly. If it does not meet the requirements, check the body ground and power assembly ground cable.



Precautions for Starting System

1. Before starting engine, shift transmission to P/N, neutral position (MT), and apply parking brake while depressing clutch pedal.
2. Make sure that battery is fully charged to reduce repeat operating time of starter.
3. Do not start engine for more than 5 seconds each time, repeated starting interval should not be less than 10 - 15 seconds, and consecutive starting is not allowed for more than 3 times.
4. If starter cannot stop, turn off ignition switch immediately, or remove the negative battery cable to find the problem.
5. Check the starter circuit frequently to make sure that each wire of starting system is connected securely and in good insulation.
6. Generally, perform maintainable service for starter when servicing the vehicle. Also, maintenance interval can be shortened or extended depending on actual conditions.
7. Remove the negative battery cable before removing starter.

ON-VEHICLE SERVICE

Starter Assembly (DCT Model)

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the air filter assembly ([See page 10-8](#)).
4. Remove the electric water pump assembly.

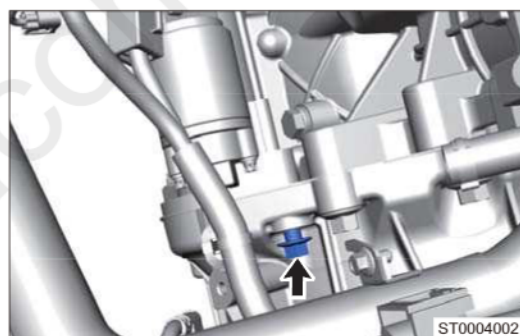
Hint:

Remove electronic water pump fixing bolt. It's not necessary to remove water pipe. After removing, move electronic water pump aside to remove starter assembly.

5. Remove starter assembly.
 - (a) Remove starter fixing bolt (arrow).

Tightening torque

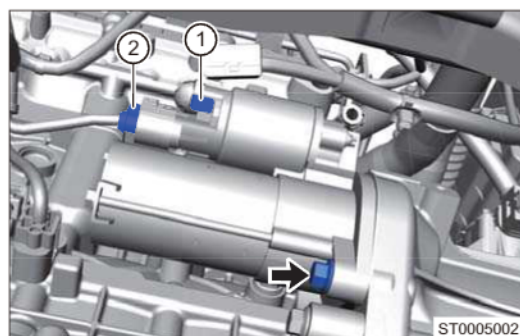
$45 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove positive cable fixing nut (1) from starter.

Tightening torque

$13 \pm 2 \text{ N}\cdot\text{m}$



- (c) Disconnect the starter connector (2).
- (d) Remove starter fixing bolt (arrow).

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$

- (e) Remove starter assembly.



Inspection

1. Check the starter clutch.

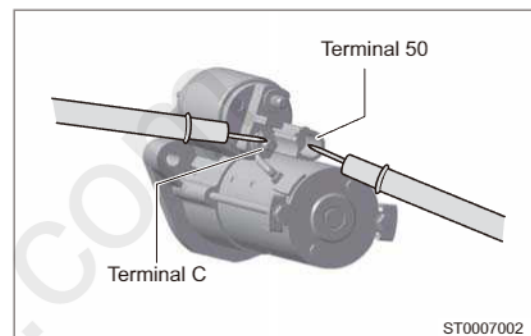
- (a) Rotate the clutch pinion gear clockwise to check that it can turn freely. Rotate the clutch pinion gear counterclockwise to check that it locks. If result is not as specified, replace the starter.



2. Check the starter solenoid switch.

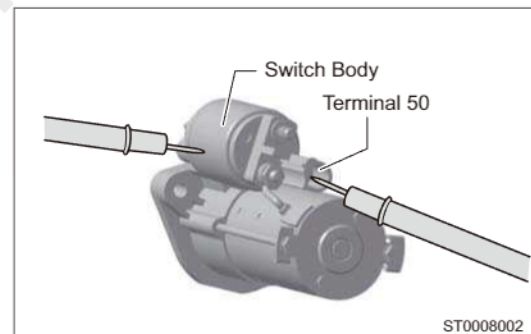
(a) Check the pull-in coil.

- Measure the resistance between terminal 50 and terminal C.
- Standard resistance should be below 2 Ω . If the resistance is abnormal, replace the starter assembly.



(b) Check the hold-in coil.

- Measure the resistance between terminal 50 and starter solenoid switch body.
- Standard resistance should be below 2 Ω . If the resistance is abnormal, replace the starter assembly.



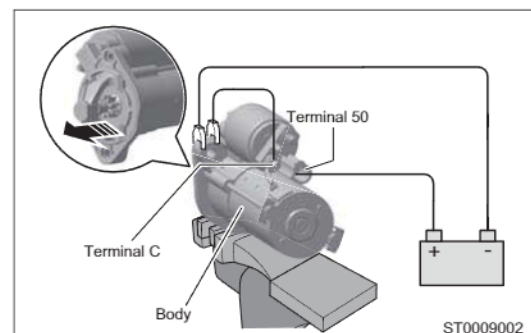
3. Check the starter assembly.

Caution:

- These measurements must be performed within 3 to 5 seconds to avoid coil burnout.
- Place the starter assembly onto a vise. The jaws of vise should be covered by aluminum sheet or brass plate; otherwise, the starter assembly will be easily damaged when clamping it.

(a) Perform pull-in test.

- Remove the nut and disconnect the field coil lead from terminal C.
- As shown in illustration, connect battery to solenoid switch, and check that starter clutch pinion sticks out normally.

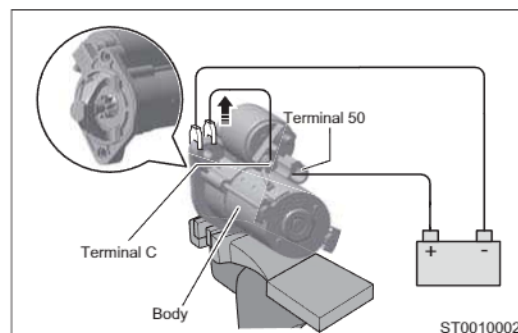


If starter clutch pinion does not move, replace the starter assembly.

(b) Perform hold-in test.

- Keep the starter clutch pinion sticking out and the connection condition of battery mentioned above, and disconnect the negative battery cable from terminal C.

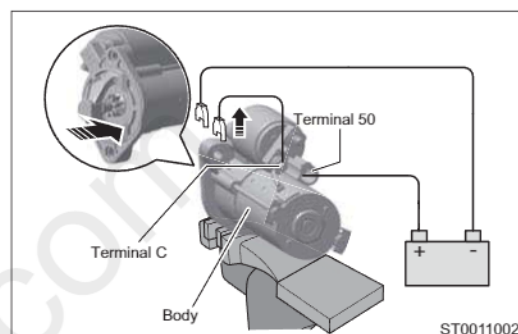
Check if starter clutch pinion keeps sticking out. If starter clutch pinion moves inward, replace the starter assembly.



(c) Check if starter clutch pinion returns back.

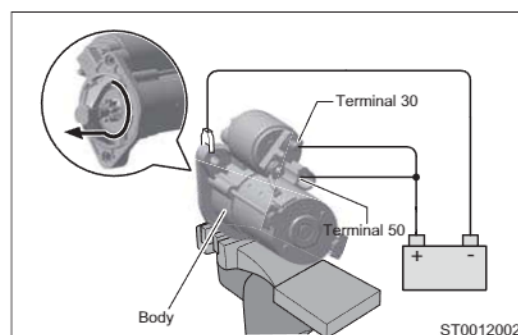
- Disconnect the negative battery cable from starter body. Check that starter clutch pinion returns back.

If starter clutch pinion does not return back, replace the starter assembly.



(d) Check if starter rotates smoothly.

- Connect the field coil lead to terminal C, and tighten it with a nut.
- As shown in illustration, connect battery to starter. Check that starter rotates smoothly when the starter clutch pinion moves outward.



Caution:

- The lead to be connected should avoid the pinion side to prevent lead stuck as pinion rotates. If result is not as specified, replace the starter assembly.

Installation

- Installation is in the reverse order of removal.



Starter Assembly (MT Model)

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the air filter assembly (See page 10-8).
4. Remove the electric water pump assembly.

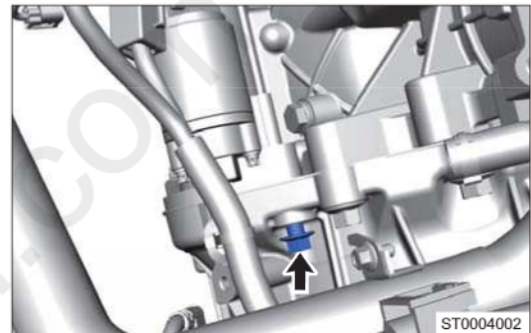
Hint:

Remove electronic water pump fixing bolt. It's not necessary to remove water pipe. After removing, move electronic water pump aside to remove starter assembly.

5. Remove starter assembly.
 - (a) Remove starter fixing bolt (arrow).

Tightening torque

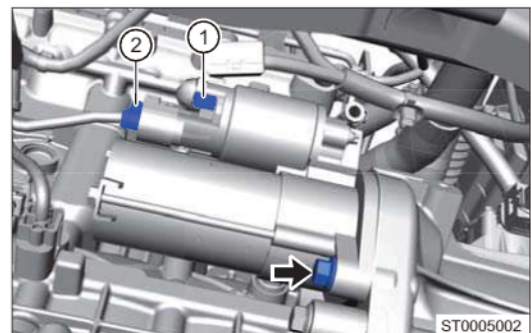
$45 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove positive cable fixing nut (1) from starter.

Tightening torque

$13 \pm 2 \text{ N}\cdot\text{m}$



- (c) Disconnect the starter connector (2).
- (d) Remove starter fixing bolt (arrow).

Tightening torque

$45 \pm 5 \text{ N}\cdot\text{m}$

- (e) Remove starter assembly.

Inspection

1. Check the starter clutch.

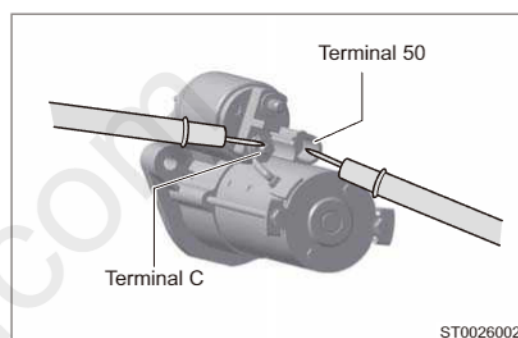
- (a) Rotate the clutch pinion gear clockwise to check that it can turn freely. Rotate the clutch pinion gear counterclockwise to check that it locks. If result is not as specified, replace the starter.



2. Check the starter solenoid switch.

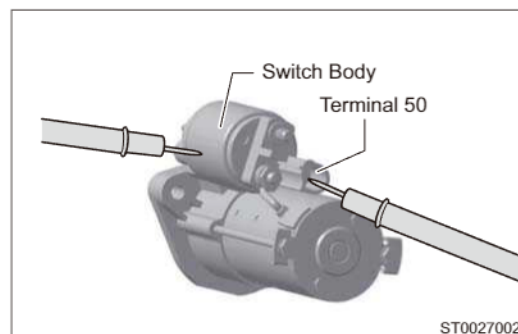
(a) Check the pull-in coil.

- Measure the resistance between terminal 50 and terminal C.
- Standard resistance should be below 2 Ω . If the resistance is abnormal, replace the starter assembly.



(b) Check the hold-in coil.

- Measure the resistance between terminal 50 and starter solenoid switch body.
- Standard resistance should be below 2 Ω . If the resistance is abnormal, replace the starter assembly.



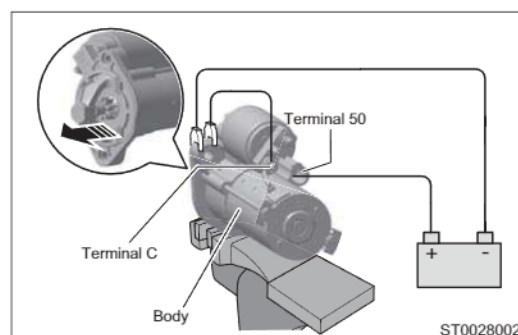
3. Check the starter assembly.

Caution:

- These measurements must be performed within 3 to 5 seconds to avoid coil burnout.
- Place the starter assembly onto a vise. The jaws of vise should be covered by aluminum sheet or brass plate; otherwise, the starter assembly will be easily damaged when clamping it.

(a) Perform pull-in test.

- Remove the nut and disconnect the field coil lead from terminal C.
- As shown in illustration, connect battery to solenoid switch, and check that starter clutch pinion sticks out normally.

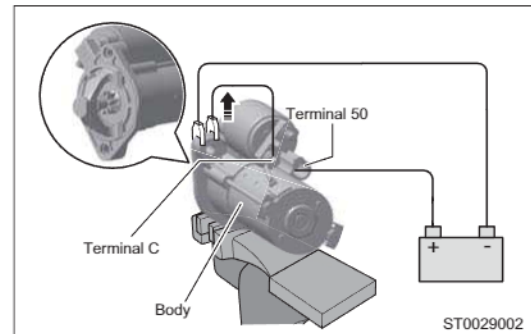


If starter clutch pinion does not move, replace the starter assembly.

(b) Perform hold-in test.

- Keep the starter clutch pinion sticking out and the connection condition of battery mentioned above, and disconnect the negative battery cable from terminal C.

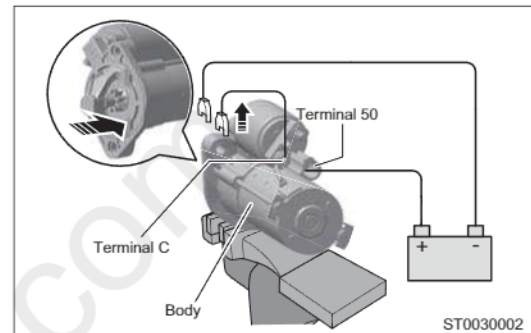
Check if starter clutch pinion keeps sticking out. If starter clutch pinion moves inward, replace the starter assembly.



(c) Check if starter clutch pinion returns back.

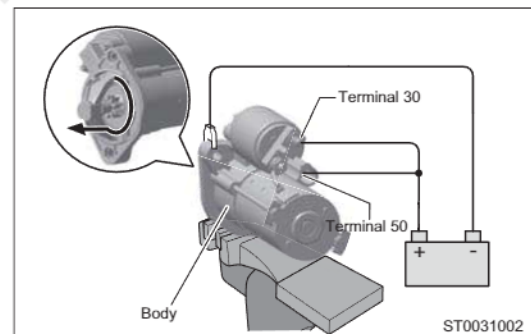
- Disconnect the negative battery cable from starter body. Check that starter clutch pinion returns back.

If starter clutch pinion does not return back, replace the starter assembly.



(d) Check if starter rotates smoothly.

- Connect the field coil lead to terminal C, and tighten it with a nut.
- As shown in illustration, connect battery to starter. Check that starter rotates smoothly when the starter clutch pinion moves outward.



Caution:

- The lead to be connected should avoid the pinion side to prevent lead stuck as pinion rotates. If result is not as specified, replace the starter assembly.

Installation

- Installation is in the reverse order of removal.

Ignition Starting Switch

Removal

Warning/Caution/Hint

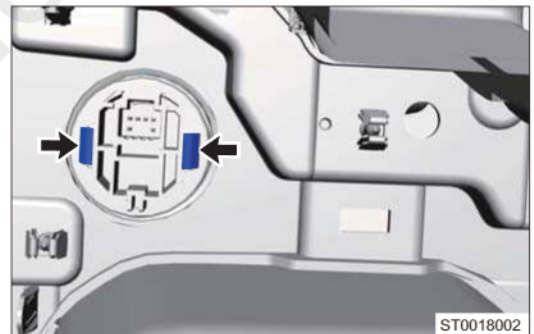
Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent interior from being scratched during removal and installation.

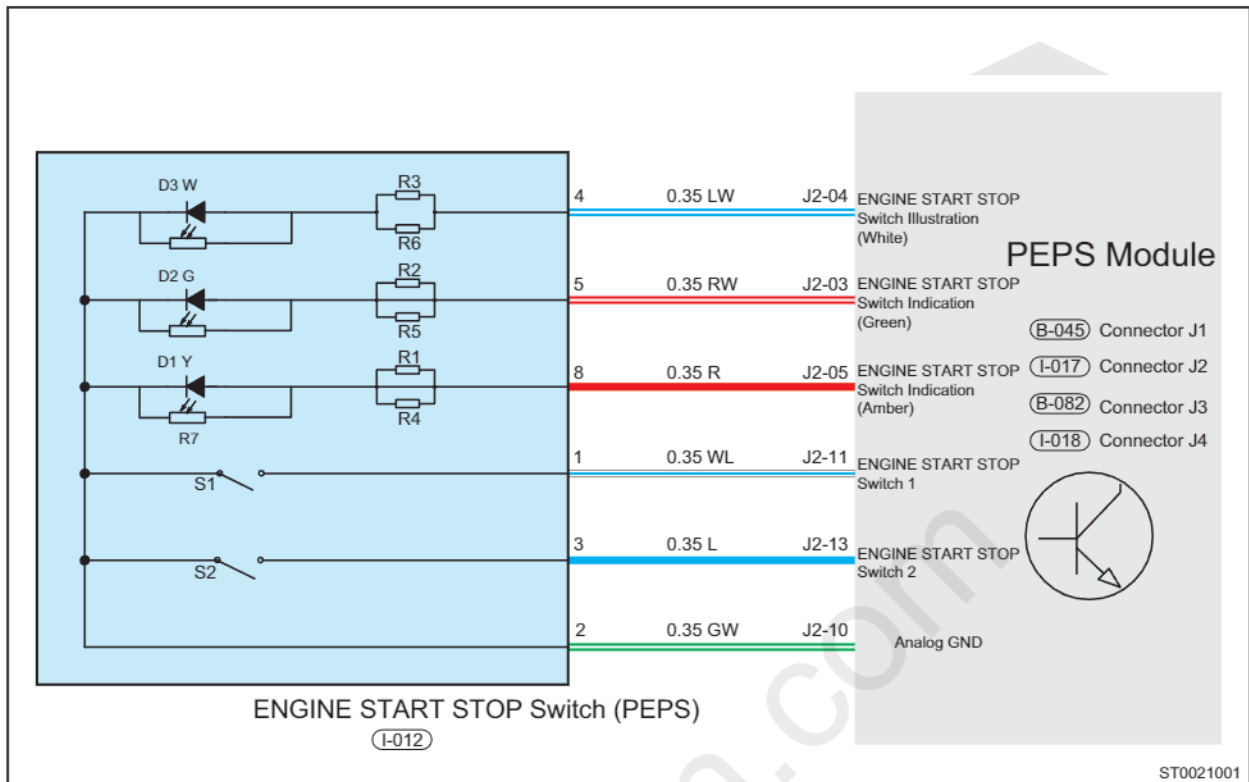
1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove shift panel assembly ([See page 47-7](#)).
4. Remove the ignition starting switch.
 - (a) Insert your hand through opening of the shift panel assembly and disconnect the ignition starting switch connector. (arrow)



- (b) Push fixing clips on both sides of ignition starting switch in direction of arrows and remove ignition starting switch assembly.



Starting Switch Circuit Diagram



Inspection

- Check for continuity of ignition starting switch.
 - Using a digital multimeter, check the continuity of ignition starting switch according to the table below.

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Multimeter Connection	Switch Condition	Specified Condition
Terminal 1 - Terminal 2	Not pressed	No continuity
Terminal 3 - Terminal 2	Not pressed	No continuity
Terminal 1 - Terminal 2	Pushed	Continuity
Terminal 3 - Terminal 2	Pushed	Continuity

If measure result is not as specified, replace the ignition starting switch.

- Check the ignition starting switch indicator.
 - Press the ignition starting switch, observe if switch indicator illuminates normally.

Hint:

- If the positive (+) lead and negative (-) lead are incorrectly connected, the ignition starting switch indicator will not illuminate.
- If the battery voltage is too low, the ignition starting switch indicator will not illuminate.

Multimeter Connection	Specified Condition
Battery positive (+) → Terminal 4 Battery negative (-) → Terminal 2	White (not illuminate)
Battery positive (+) → Terminal 5 Battery negative (-) → Terminal 2	Green
Battery positive (+) → Terminal 8 Battery negative (-) → Terminal 2	Yellow

If measure result is not as specified, replace the ignition starting switch.

Installation

1. Installation is in the reverse order of removal.



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SQRE4T15B CHARGING SYSTEM

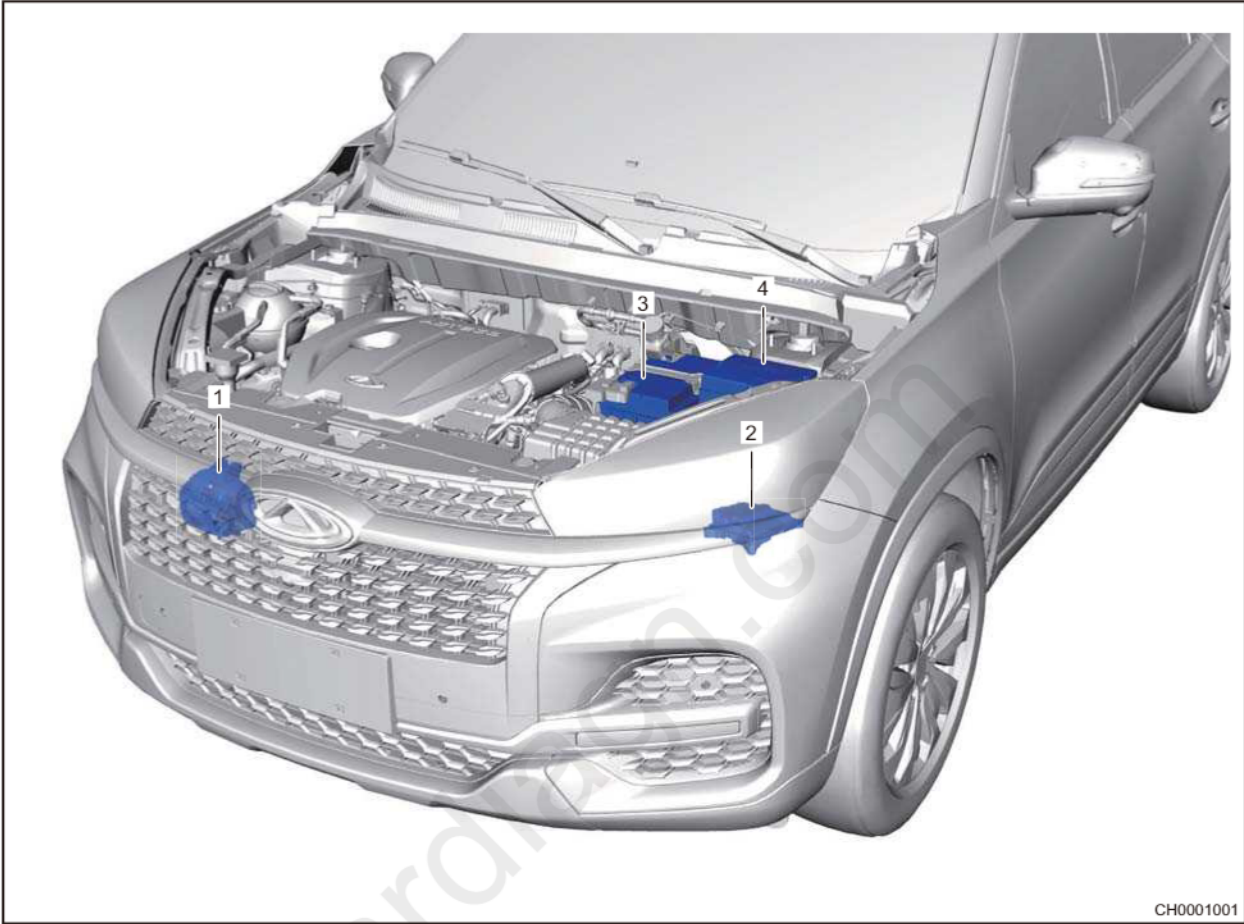
GENERAL INFORMATION	16-3	ON-VEHICLE SERVICE	16-11
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Description	16-3	On-vehicle Inspection	16-11
Operation	16-3	Battery Charging Method	16-11
Specifications	16-4	Battery Handling/Warning Description	16-11
Tools	16-4	and Safety Specification	16-11
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		Removal	16-18
		Installation	16-19

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GENERAL INFORMATION

Overview

Description



CH0001001

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1 - Alternator Assembly	2 - ECU
3 - Battery Assembly	4 - Engine Compartment Fuse and Relay Box

Alternator is a key component of the charging system. It is a device that converts mechanical energy into electrical energy and generates DC voltage through a rectifying circuit, as one of main power sources of the vehicle. The alternator operates as a complete assembly. If alternator fails for any reason, the entire unit must be replaced.

Operation

- Alternator is a silicon rectifying alternator, which mainly consists of rotor, stator and rectifier.
- When direct current flows to rotor winding, rotor claws energize magnetic field to produce alternating induced electromotive force. The stator is installed on the outside of rotor, which is secured together with the front and rear end covers of alternator. When the rotor of the generator is rotated by the drive belt, the magnetic pole lines cut the stator winding, causing a change in the magnetic flux in the stator winding, and an alternating induced electromotive force is generated in the stator winding, thereby generating alternating current. Three-phase alternating current generated by alternator is converted to direct current from alternating current by rectifier, and direct current is transmitted to the vehicle electrical system and battery.

Specifications

Torque Specifications

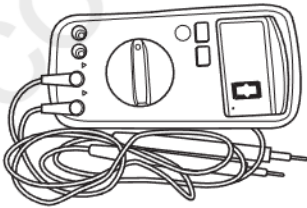
Description	Torque (N·m)
Battery Pressure Plate Fixing Bolt	5 ± 1
Battery Tray Fixing Bolt	25 ± 4
Alternator Output Cable Fixing Nut	13 ± 2
Alternator Fixing Bolt	40 + 5
Alternator Bracket Fixing Nut	40 + 5
Idler Pulley Fixing Bolt	50 + 5

Battery Specification

Engine Type	Type	Specifications
SQRE4T15B	Valve controlled battery	12V 70Ah 720A
SQRE4T15B	Ordinary lead acid battery	12V 60Ah 480A

Tools

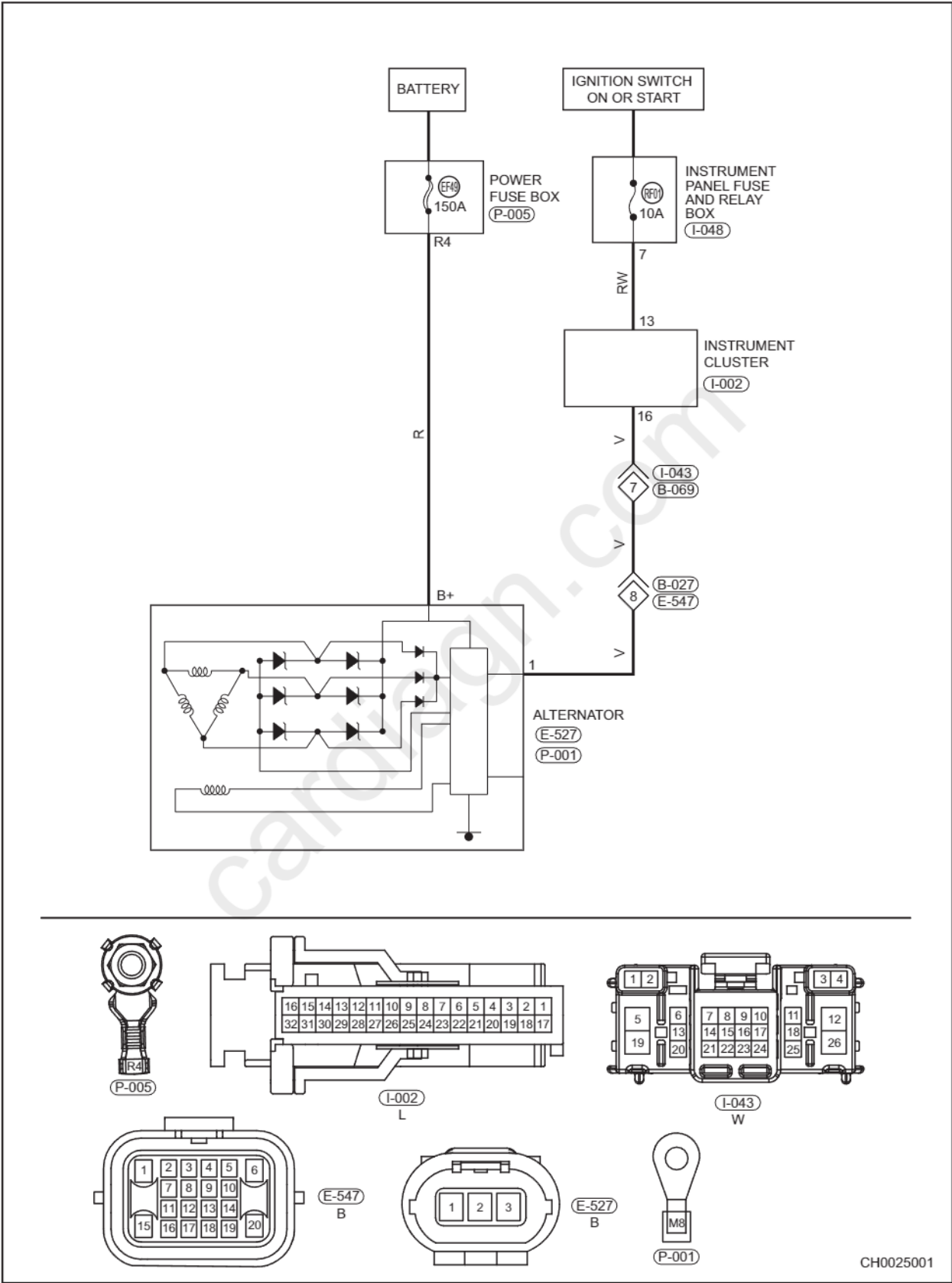
General Tool

Digital Multimeter	 002
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Special Tool

Battery Tester	 090
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Charging Circuit



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DIAGNOSIS & TESTING

Diagnosis Content

Diagnosis Specification for Alternator Malfunction

Hint:

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

Operation Content	Operation Description
Appearance inspection: Confirm if there is any washer fluid, coolant, oil, sludge and other foreign matters adhered.	If the washer fluid, coolant, oil enters rotor slip ring, brush holder, it will cause oxidization to alternator rotor slip ring and poor contact to brush, resulting in charging light remaining on or flashing.
Turn over the the center of alternator belt by hand and observe if the max. turning angle is over 90°.	Loose belt will cause low alternator speed, resulting in low electric energy production or failing to generate energy; if the angle is over 90°, adjust the belt tension.
Measure battery voltage with a multimeter.	Confirm if the battery is depleted (more than 12 V). If so, unplug the generator excitation coil connector and retest the battery voltage (more than 12 V). If such condition still exists, charge the battery.
Confirm if there is any looseness, short circuit, dirt on alternator B+, excitation end, battery pile line and ground line and also confirm if the connectors are connected firmly.	Confirm if the wire harness is connected normally. Poor contact will cause that the alternator voltage is high, the indicator light doesn't come on, remains on or flashes. If there is any looseness, please tighten it firmly.

Charging indicator light remains on (do not generate electricity or power is low, vehicle cannot start, etc.)

Operation Content	Operation Description
Unplug the alternator connector, start the engine and depress the accelerator (engine speed is above 1500 rpm), turn off the vehicle load, measure B+ voltage to ground with multimeter and observe 2-3 minutes.	If B+ voltage is about 13.8 V, the alternator operates normally. It may be LIN communication malfunction. Please check the LIN communication setting in ECU. If B+ voltage is the battery voltage, it indicates alternator malfunction. Replace the alternator.
If the alternator operates normally, reconnect the alternator connector, start the engine and keep it idling, turn on some electrical load on vehicle, such as A/C, headlight, etc. Meanwhile, depress the accelerator pedal or decelerate the vehicle. Measure B+ voltage to ground with multimeter and observe 2-3 minutes.	When vehicle load or speed changes, the alternator normal voltage should change within 10.6-16 V. If the charging indicator remains on, check if LIN communication is normal with an oscilloscope or other test software.

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Charging indicator flashes (unstable electricity generation)

Operation Content	Operation Description
Start the engine and keep it idling, remove alternator excitation coil and observe if the meter indicator flashes.	If the light flashes, it indicates that some excitation coil has outer leakage and intermittently ground. Check the circuit malfunction.

Indicator does not come on during self-check

Operation Content	Operation Description
Turn ENGINE START STOP switch to "ON" position, remove the engine excitation coil and measure the alternator excitation coil terminal voltage to ground with multimeter.	If the voltage is 0, it indicates that the excitation coil circuit is open. Check the excitation coil circuit; if the voltage is equal to battery voltage, it indicates that excitation coil circuit is normal and there may be alternator malfunction. Replace the alternator.

Adjusting voltage is high (headlight and other electrical appliances used on vehicle are burnt out)

Operation Content	Operation Description
Start the engine and keep it idling, measure B+ voltage to ground with multimeter and observe 2-3 minutes to check if the max. value exceeds 16 V.	If so, it indicates that the regulator in alternator is damaged which causes voltage out of control. Replace the alternator.

Abnormal noise occurs in alternator	
Operation Content	Operation Description
Check if the alternator mounting bolt is installed in place and tightened with specified torque.	Improper installation of bolt will cause pulley jumps as alternator operate, resulting in abnormal noise. Tighten the bolt.
Remove the alternator belt, rotate the pulley by hand. Listen and observe near the motor if there is any abnormal noise during alternator rotation.	Excessive belt tension or dirt in alternator will cause alternator bearing failure or poor rotor dynamic balance which causing abnormal noise. Replace the alternator.

Instrument indicator or headlight dims and then goes off during vehicle driving (fail to generate energy, low electric energy production)	
Operation Content	Operation Description
Start the engine and keep it idling for 5 minutes (turn off the electrical appliances with large power, test with light load as possible), measure the alternator B+ voltage.	If the measured voltage is 13 V - 14.8 V, the alternator is normal; if not, the alternator is abnormal. Replace the alternator.

Battery external normal malfunction

1. Housing is cracked
 - (a) Housing cracked is the most serious and destructive malfunction. When vehicle is subjected to strong vibration, lead acid battery overheating, too high pressure or electrolyte frozen expansion, the housing of lead acid battery will be damaged. For such malfunction, replacing battery is the sole way for treatment.
2. Electrode is loose
 - (a) The cause of loosen electrode is that excessive force is applied during removal and installation of wire harness and inspection of contact. It is necessary to replace the battery assembly.
3. Connecting part of electrode is corroded or burnt
 - (a) The cause is that anti-corrosive solvent is not applied when installing battery. You can apply vaseline oil after cleaning up. If the electrode is seriously corroded or burnt, replace it with a new one.
4. Battery swells
 - (a) Check if the generated electricity is normal and if the charging voltage is too high.
 - (b) The causes are that battery is aging and resistance is excessively high. It is necessary to replace the battery.



On-vehicle Inspection

Charging System Charging Voltage Inspection

1. Leave vehicle under no load test condition and idle the engine. Measure battery voltage with a digital multimeter. Standard voltage: 13.5 V - 14.8 V

If result is not as specified, replace the alternator.

2. Leave vehicle under load test condition and idle the engine. Measure battery voltage with a digital multimeter.

Load test condition:

- Set headlight to high beam;
- Turn on blower and adjust blower speed to the highest.
- Turn on the "A/C" switch.

Standard voltage: 13.5 V - 14.8 V

If result is not as specified, replace the alternator.

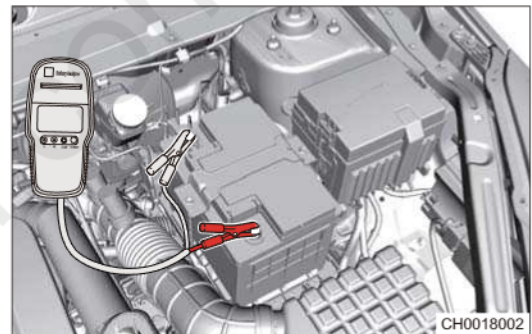
Usage of Battery Tester

1. Check the battery with battery tester to gain the condition of battery. Replace or charge as necessary.

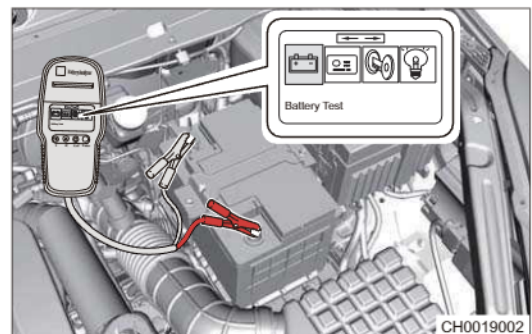
- (a) Connect the tester to battery.

Caution:

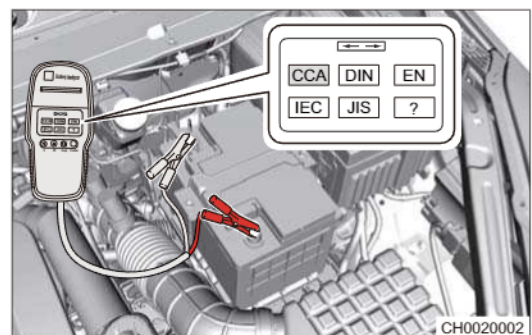
- Connect red tube clamp to battery positive terminal while black tube clamp to battery negative terminal.



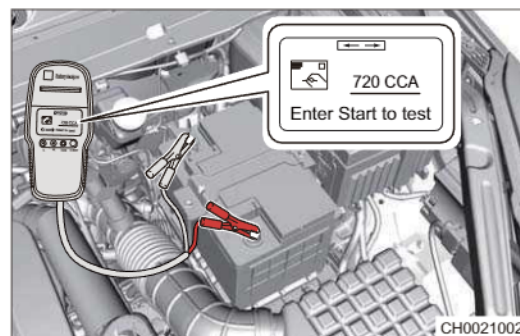
- (b) Operate tester to select "Battery Test" and click "Enter".



- (c) Select "CCA" and click "Enter".



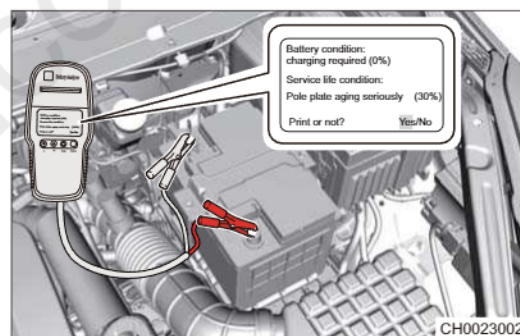
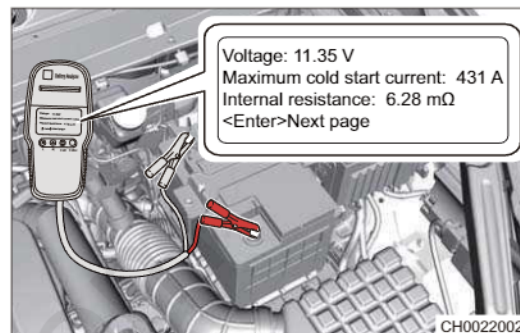
- (d) Operate "L or R Button" on tester to adjust and set the battery capacity (such as 720CCA, this value indicates the battery low temperature starting performance) and click "Enter".



- (e) The battery condition is displayed on tester.

Hint:

Recharge or replace battery according to the tested data.



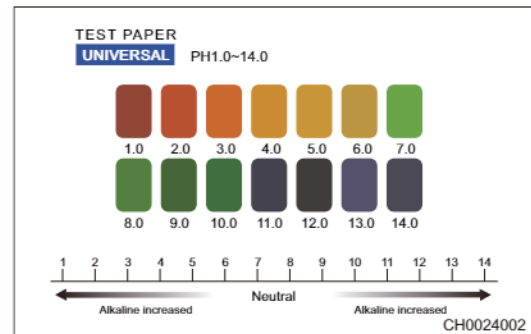
Battery Fluid Leakage Test

1. Test method

- (a) PH paper is used for judgment.

PH paper model definition:

PH 1 - 14



2. Judgment method

- (a) Take a piece of PH paper (never allow it contacting with other fluid before test) to wipe the leaking area, so as to make the fluid adhere on the PH paper. Then compare it with the color bar to judge the PH value.
- (b) If the PH value is less than 7, it is an acidic liquid, which indicates battery leakage.
- (c) If the PH value is 7 or higher, it is non-acidic liquid (neutral or alkaline) which indicates "Petroleum jelly" fluid or other fluids leakage on battery surface.

ON-VEHICLE SERVICE

Battery

On-vehicle Inspection

1. Check that battery terminals are not loose or corroded. If battery terminals are corroded, clean them.
2. Check battery for damage, deformation or leakage. If damage, deformation or leakage is found, replaced the battery.

Check battery voltage.

- (a) Turn ENGINE START STOP switch to ON, and turn it off 20 to 30 seconds after turning on headlight. Release the surface charge on battery. Measure battery voltage with a digital multimeter.

Rated Voltage

12 V - 13 V

Battery Charging Method

Because the battery has the characteristic of self-discharging, even if the battery is not in use, it is necessary to perform regular charging maintenance. When the discharging ratio for battery capacity is lower than 50%, the capacity cannot restore to 100% if charging with small current while the battery temperature increases and the plate active material will fall off easily if charging with large current, affecting the performance and life of battery.

- Charging with constant voltage: Voltage is limited at 14.40 V. During charging, make sure the charger is connected to the maximum charging current so as to get the preset voltage value (14.40 V) according to the current battery status and temperature. After the voltage reaches the limiting value, the charging current will drop gradually until it closes to 0 A (maintain the condition charging current).
- Charging with constant current: charging I: 0.05C
When continue to charge with constant current for 3 to 5 hours after the voltage reaches 16 V.

Caution:

- Battery on vehicles equipped with blue drive configuration can only use the method of charging with constant voltage.

Battery Handling/Warning Description and Safety Specification

1. Following the related specifications on appliances connected with battery, in repair manual and owner's manual.
2. There is risk of corrosiveness (burns).
Battery acid is highly corrosive, so it is necessary to wear protective gloves and goggles when working. Do not dump the battery, because acid may spill from vent hole.
3. Keep away from open fire, spark, light devices without protective measures and no smoking.
Never generate any sparks when operating cable/wire and electrical devices.
Avoid short circuit in battery.
4. Wear eye protective mask/glasses.
5. Never allow the children approaching acid and battery.
6. Recycle the battery.
Deliver the used battery to designated recycling site.
7. Never throw the used battery into household garbage.
8. There is risk of explosion.



Removal

Warning/Caution/Hint

Caution:

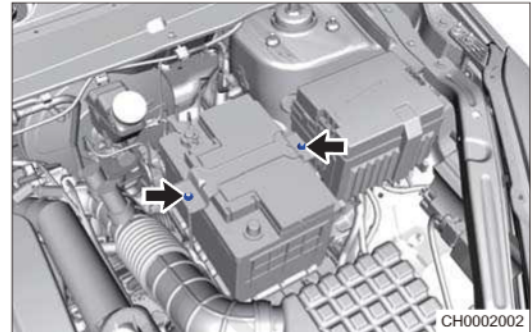
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Remove the battery assembly

- (a) Loosen 2 fixing bolts (arrow) from battery pressure plate, and remove battery pressure plate assembly.

Tightening torque

$5 \pm 1 \text{ N}\cdot\text{m}$



- (b) Loosen the locking nuts of positive and negative battery cables, and remove the positive (+) and negative (-) battery cables (1) (2).

Tightening torque

$7 \pm 1 \text{ N}\cdot\text{m}$

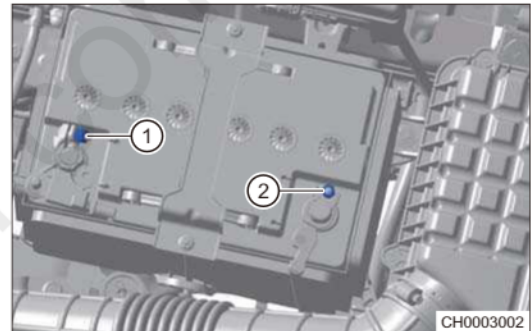
Hint:

When removing the positive battery cable, pay attention to just loosen the locking nuts without removing them, so as to prevent the "T" position at bottom of stud from deforming when tightening the nuts.

- (c) Remove the battery assembly.

Caution:

- During removal, be careful to prevent metal tools from contacting both electrodes of battery at the same time or touching the positive electrode and vehicle body.



Installation

Warning/Caution/Hint

Caution:

- Replace battery with a new one which conforms to the specifications.
- Used battery contains sulfuric acid and lead, so never discard it at will. Please dispose of it at a qualified local waste treatment station.

1. Installation is in the reverse order of removal.

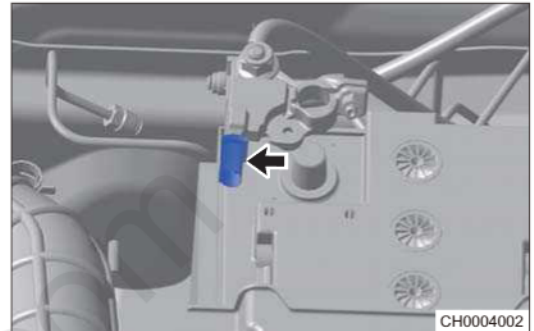
Battery Sensor

Removal

Warning/Caution/Hint

Caution:

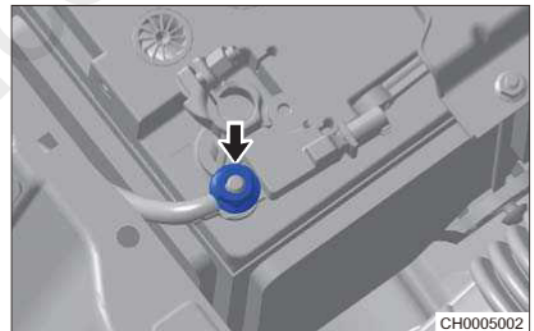
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
 - Try to prevent body paint surface from being scratched during removal and installation.
1. Turn off all electrical equipment and the ignition switch.
 2. Disconnect the negative battery cable.
 3. Remove the battery sensor.
 - (a) Disconnect the battery sensor connector (arrow).



- (b) Remove connecting nut (arrow) between battery sensor and body ground wire.

Tightening torque

$20 \pm 2 \text{ N}\cdot\text{m}$



- (c) Remove the battery sensor.

Inspection

1. Check the battery sensor appearance.
 - (a) Check if there is any corrosion, cracks, etc. on battery sensor surface. If so, replace the battery sensor.



- (b) Check if there is any desoldering trace between battery sensor and negative terminal. If so, replace the battery sensor.



16-SQRE4T15B CHARGING SYSTEM

2. Measure battery sensor

Measure battery sensor resistance with a digital multimeter.

Multimeter Connection	At normal temperature (20°C)
Terminal 1 - Body (Housing)	3 MΩ
Terminal 2 - Body (Housing)	1.6 MΩ
Terminal 1 - Terminal 2	5.5 - 6 MΩ

If it is not as specified, replace the battery sensor assembly.

Installation

1. Installation is in the reverse order of removal.

Battery Tray

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Remove the battery assembly (See page 16-12).
3. Remove the air filter assembly (See page 10-8).
4. Remove the battery tray

- (a) Remove the battery tray fixing bolt (1).

Tightening torque

$9 \pm 1 \text{ N}\cdot\text{m}$

- (b) Remove the battery tray fixing bolt (2) and (3).

Tightening torque

$25 \pm 4 \text{ N}\cdot\text{m}$

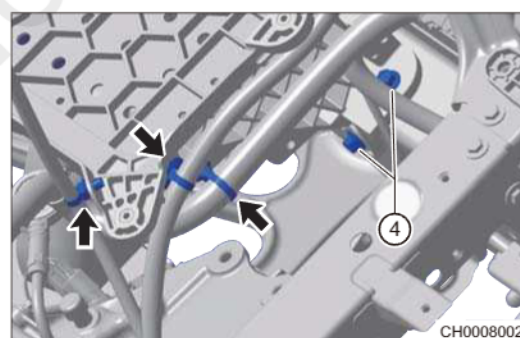
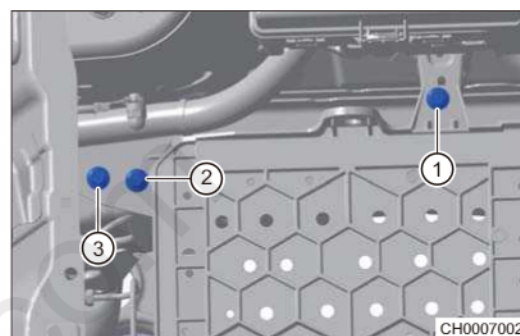
- (c) Remove all the wire harness fixing clips (arrow) from battery tray.

- (d) Remove 2 fixing bolts (4) from battery tray.

Tightening torque

$25 \pm 4 \text{ N}\cdot\text{m}$

- (e) Remove the battery tray.



Installation

1. Installation is in the reverse order of removal.



Alternator (Blue Drive Model)

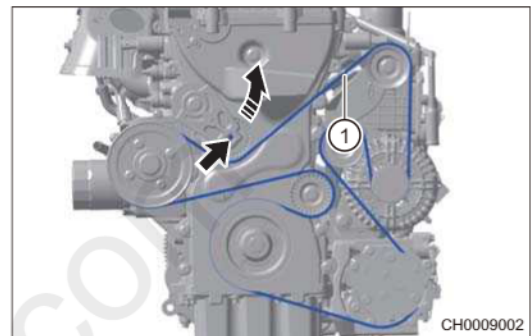
Removal

Warning/Caution/Hint

Caution:

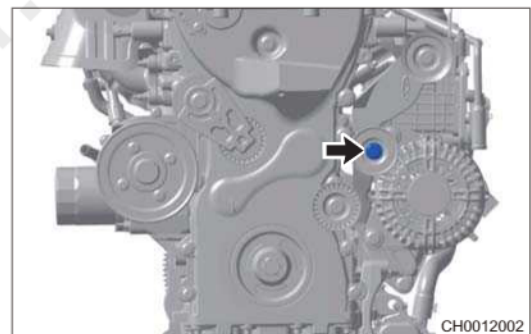
- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Move away the accessory drive belt.
 - (a) Insert ratchet wrench into tensioner pin holes (arrow) in direction of arrow and lift ratchet wrench. Meanwhile, move away the drive belt (1).

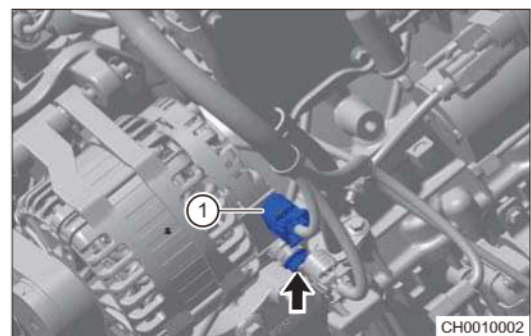


5. Remove the alternator assembly.
 - (a) Remove the idler pulley assembly (arrow).

Tightening torque
50 + 5 N·m



- (b) Disconnect the alternator connector (1).



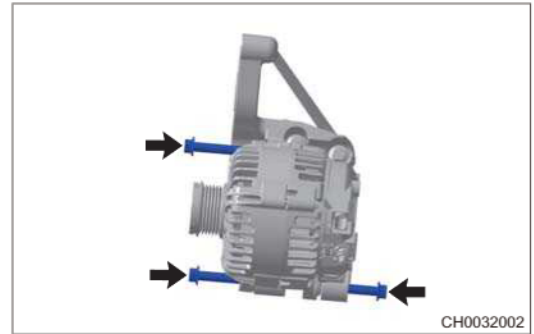
- (c) Open output end protective cap, remove fixing nut (arrow) and remove output cable.

Tightening torque
13 ± 2 N·m

- (d) Remove 3 fixing bolts (arrow) from alternator.

Tightening torque

40 + 5 N·m



- (e) Remove the alternator.

6. Remove the alternator mounting bracket.

- (a) Remove the idler pulley assembly (1).

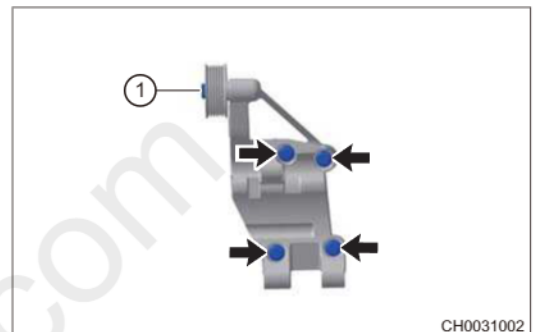
Tightening torque

50 + 5 N·m

- (b) Remove 4 fixing bolts (arrow) from alternator mounting bracket.

Tightening torque

40 + 5 N·m



- (c) Remove the alternator mounting bracket.

Installation

1. Installation is in the reverse order of removal.

2. Inspection

- (a) Start the engine.

Caution:

- If battery warning light comes on, charging system may have a malfunction.

- (b) When engine is running, use digital multimeter to check the output voltage of alternator and record it.

- (c) If the voltage is between 13.5 - 14.8 V, the alternator is normal.

Alternator (Except Blue Drive Model)

Removal

Warning/Caution/Hint

Caution:

- Be sure to wear necessary safety equipment to prevent accidents when repairing.
- Try to prevent body paint surface from being scratched during removal and installation.

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Move away the accessory drive belt (See page 07-18).
5. Remove the idler pulley assembly (See page 07-20).
6. Remove the tensioner assembly (See page 07-21).
7. Remove the alternator assembly.

- (a) Disconnect the alternator connector (1).



- (b) Open output end protective cap, remove fixing nut (arrow) and remove output cable.

Tightening torque

$13 \pm 2 \text{ N}\cdot\text{m}$

- (c) Remove 2 fixing bolts (arrow) from alternator.

Tightening torque

$40 \pm 5 \text{ N}\cdot\text{m}$



- (d) Remove the alternator.

8. Remove the alternator mounting bracket.

- (a) Remove 4 fixing bolts (arrow) from alternator mounting bracket.

Tightening torque

$40 \pm 5 \text{ N}\cdot\text{m}$



- (b) Remove the alternator mounting bracket.

Installation

1. Installation is in the reverse order of removal.
2. Inspection
 - (a) Start the engine.
 - Caution:**
 - If battery warning light comes on, charging system may have a malfunction.
 - (b) When engine is running, use digital multimeter to check the output voltage of alternator and record it.
 - (c) If the voltage is between 13.5 - 14.8 V, the alternator is normal.

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