

SQR477F ENGINE MANAGEMENT SYSTEM

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GENERAL INFORMATION

Description

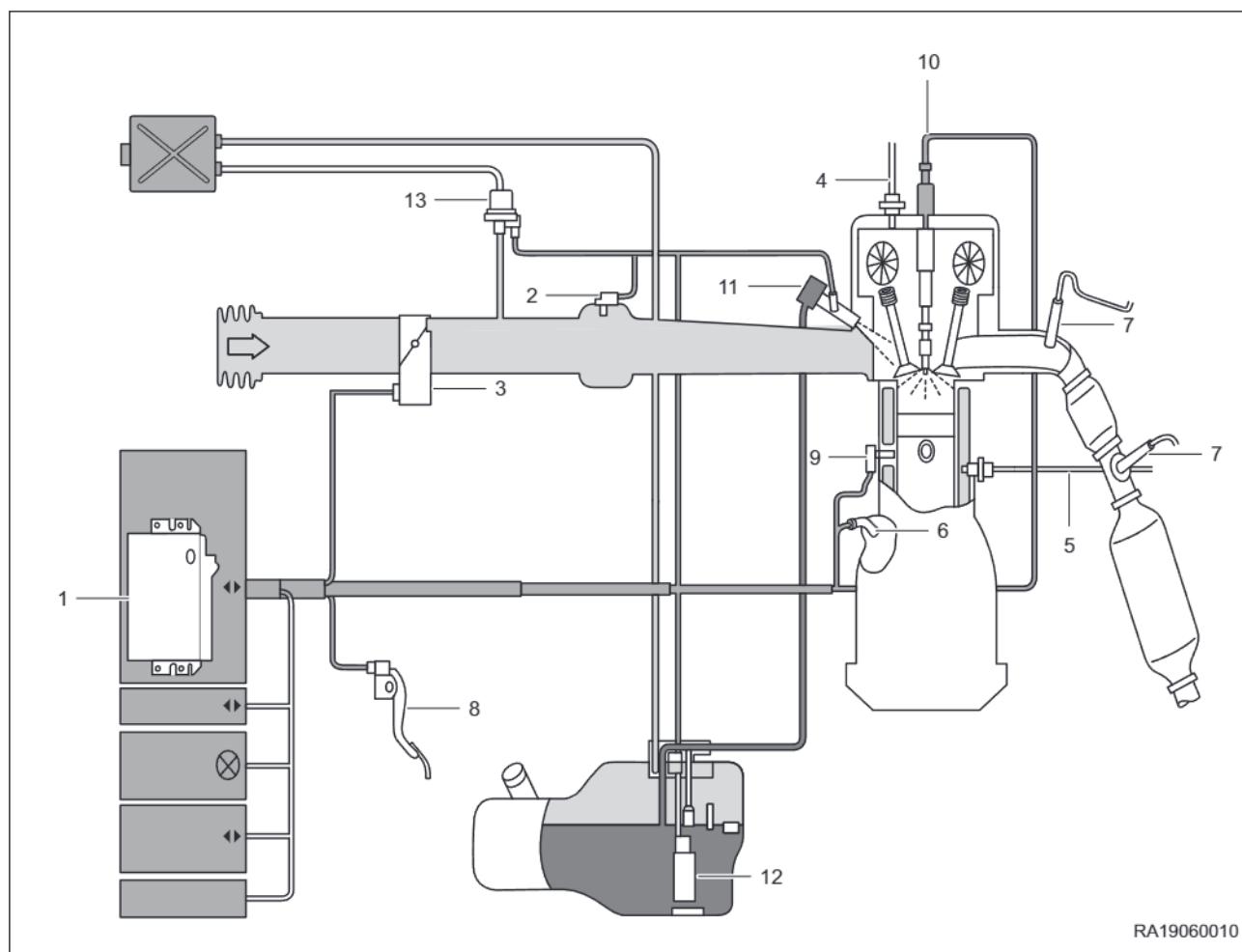
The engine of A19 model adopts UAES engine management system. This system mainly consists Engine Control Module (ECM), sensors and actuators, which controls intake air amount, injection volume and ignition timing, etc. when the engine is operating.

In the engine management system, the sensors are used as the input part to measure the various physical signals (temperature and pressure, etc.), and converts them into corresponding electrical signals; the function of ECM is to receive the input signals from the sensors and perform calculation according to the set procedure, producing corresponding control signals and outputting them to the power drive circuit. The power drive circuit drives each actuator to perform various actions, thus making the engine run according to the preset program.

Also, the trouble diagnosis system of ECM monitors each component and control function in the system. Once detecting and confirming a fault, it will store the trouble code and recall the "Limp Home" function. When detecting that the fault has been eliminated, it will return to use the normal value.

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Basic Components of Engine Management System



1 - Engine Control Module (ECM)	2 - Intake Pressure/Temperature Sensor
3 - Electronic Throttle	4 - Camshaft Position Sensor
5 - Coolant Temperature Sensor	6 - Crankshaft Position Sensor
7 - Oxygen Sensor	8 - Accelerator Pedal Position Sensor
9 - Knock Sensor	10 - Ignition Coil
11 - Fuel Injector	12 - Electric Fuel Pump
13 - Canister Solenoid Valve	

System Function

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- Calculate air flow by engine aerothermodynamics
ECM calculates the air flow entering the cylinder by the signals from intake pressure/temperature sensor, and then adjusts the injection volume to make the air-fuel ratio meet the requirements of various operating conditions.
- Measure crankshaft position and engine speed
ECM determines the crankshaft position and engine speed according to the signals from ring gear and accurately controls the engine ignition and injection timing.
- Determine operating sequence of cylinders
ECM recognizes the top dead center of No.1 cylinder by the camshaft position sensor, so as to determine the operating sequence of cylinders.
- Fuel control
There are two modes of fuel control: closed-loop fuel control and open-loop fuel control. The closed-loop fuel control can accurately regulate the air-fuel ratio of engine, thus effectively controlling emissions. The open-loop fuel control is applied when the engine is starting or warming up and the oxygen sensor is malfunctioning.
- Ignition control
The ignition control system of engine adopts sequential control.
- Knock control
When a knocking is detected by the knock sensor, the system will calculate the ignition advance angle that needs to be delayed or advanced according to current operating conditions and knock intensity and adjusts the ignition angle, thus avoiding or reducing knocking.
- Emission control
The three-way catalytic converter can convert the engine exhaust gas into harmless gas and discharge it into the atmosphere. When the engine temperature becomes normal after warming up, ECM will activate the closed-loop fuel control to correct the air-fuel ratio, thus realizing the optimum conversion efficiency of three-way catalytic converter.
- Three-way catalytic converter protection
The engine management system has the function to protect the three-way catalytic converter. The ECM estimates the three-way catalytic converter temperature according to engine operating conditions. When it is estimated that the exhaust temperature will exceed the converter's maximum permissible temperature for a long time, ECM will automatically activate the protection function of three-way catalytic converter to keep the temperature normal.
- System voltage protection
When the system voltage becomes extremely high due to the charging system malfunction, the engine management system will activate the protection program to limit the engine speed, thus avoiding damage to ECM and battery.

Precautions

General service requirements

- Only digital multimeter can be used to perform inspection for the engine management system.
- Use genuine components to perform service work, otherwise, the appropriate engine management system operation cannot be guaranteed.
- Only use unleaded gasoline during servicing.
- Please observe normative service and diagnostic flowchart to perform service work.
- Never disassemble the components of engine management system during servicing.
- When holding electronic elements (ECM, sensor, etc.) during servicing, 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.

Precautions during servicing

1. Do not causally remove any component or its connector of engine management system from its installation position to prevent damage accidentally, or the foreign matter, such as moisture, oil from entering the connector, which will affect the normal operation of engine management system.
2. Be sure to turn the ignition switch off when disconnecting and connecting the connector. Otherwise, electronic elements may be damaged.
3. When simulating the hot operating condition of malfunction and performing other service work that may cause the temperature to rise, never allow ECM temperature to exceed 80°C.
4. As the supplying pressure of fuel system is high (approximately 400 kPa), all the fuel pipes are high pressure resistant pipe. The fuel pressure in the fuel lines is still high even when the engine is not running. Therefore, be careful not to casually remove the fuel pipe during servicing; when it is necessary to service the fuel system, discharge the pressure in the fuel system before removing the fuel pipe. The way to discharge the pressure is as follows:
Remove the fuel pump relay, start the engine and idle it until the engine stops running by itself. Then attempt to start the engine 2 - 3 times to ensure the fuel pressure is discharged completely. The removal of fuel pipe and replacement of fuel filter should be performed in a well-ventilated area by professional service men.
5. Do not energize the electric fuel pump when removing it from the fuel tank to prevent electric sparks, which will cause a fire.
6. Running test for the fuel pump is prohibited when it is empty or in the water; otherwise, it will shorten the service life. Never connect the positive and negative of fuel pump in reverse.
7. When checking the ignition system, only perform the spark jump test when it is necessary and the time should be shortened as much as possible. Do not open the throttle during test; otherwise, a large amount of unburned gasoline will enter the exhaust pipe, causing damage to the three-way catalytic converter.
8. As the idling adjustment is performed by the engine management system completely, the manual adjustment is not required. The accelerator pedal stopper screw of throttle body has been adjusted at the factory, and the user is not allowed to change its original position.
9. Do not connect the battery with its polarity reversed to prevent damage to electronic elements. This system adopts negative ground.
10. Never remove the battery cable when the engine is running.
11. The positive, negative battery cables and ECM must be removed before performing welding on the vehicle.
12. Do not puncture the wire outer coat to detect the electric signals input and output by the components.

Specifications

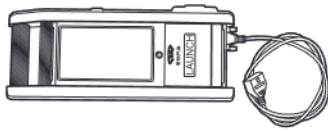
Torque Specifications

Description	Torque (N·m)
Coolant Temperature Sensor	11 - 16
Knock Sensor Mounting Bolt	17 - 23
Oxygen Sensor	45 ± 5
Crankshaft Position Sensor Mounting Bolt	8 ± 2
Camshaft Position Sensor Mounting Bolt	10 ± 2
Accelerator Pedal Mounting Bolt	10 ± 2
Intake Pressure/Temperature Sensor Mounting Bolt	8 ± 1
Engine Control Module Mounting Bolt	7 ± 1

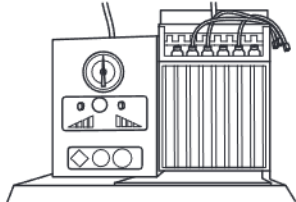
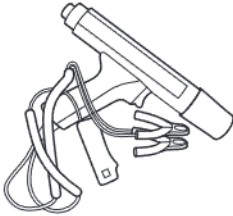
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Tools

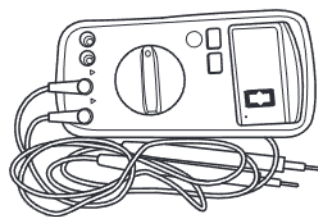
Special Tool

X-431 3G Diagnostic Tester	 RCH0000001
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General Tools

Fuel Injector Cleaning Analyzer	 RCH0000062
Ignition Timing Light	 RCH0000016

Digital Multimeter



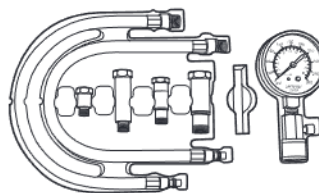
RCH0000002

Vacuum Gauge



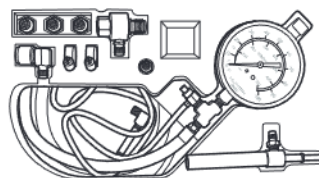
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Cylinder Pressure Gauge



RCH0000044

Fuel Pressure Gauge



RCH0000048

Oscilloscope



RCH0000061

ECM Pin Definition

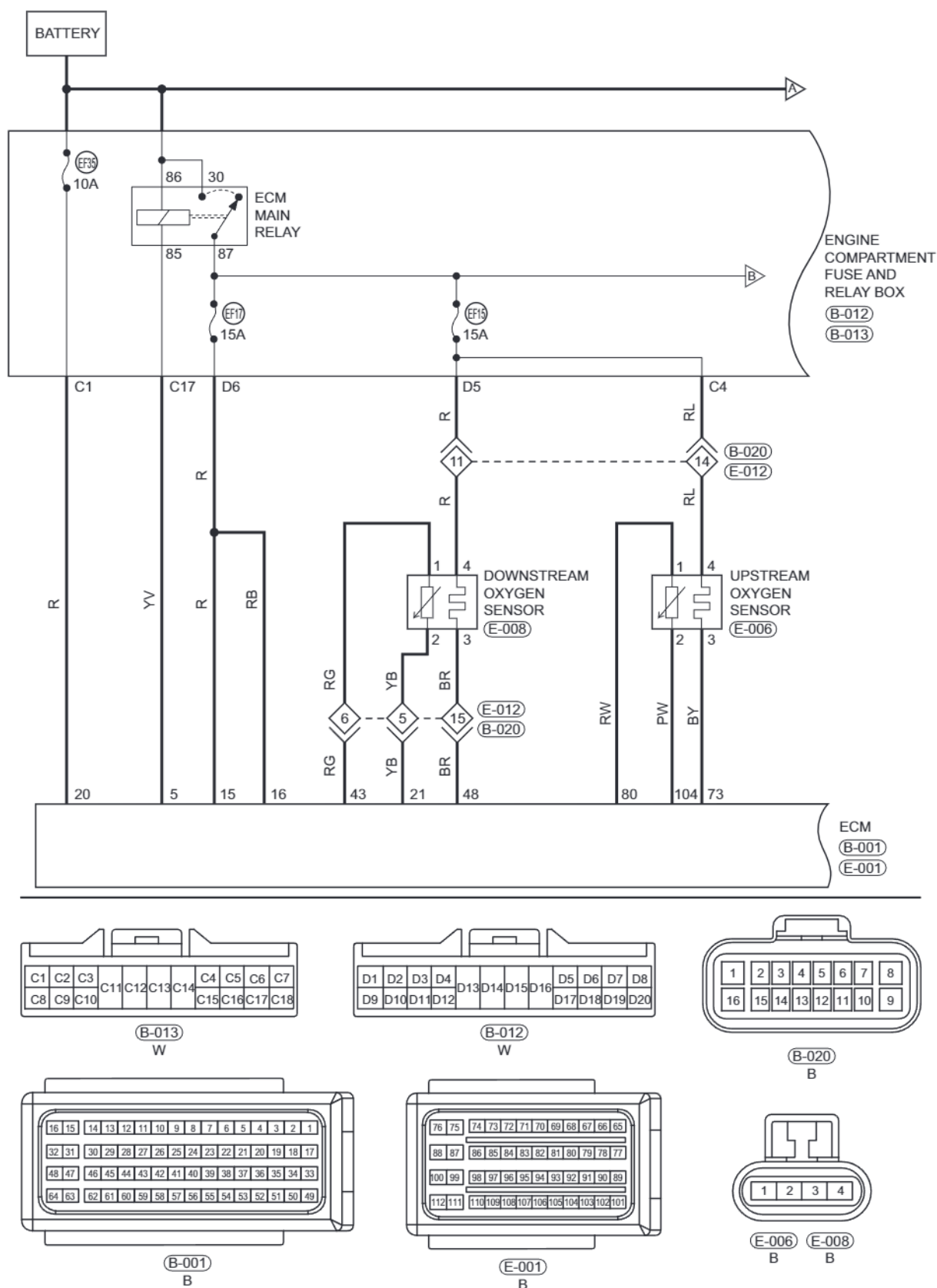
Pin No.	Definition	Pin No.	Definition
1	CAN Bus Line High	33	-
2	-	34	-
3	-	35	Ignition Switch
4	-	36	5 V Power Supply of Accelerator Pedal Position Sensor 2
5	Main Relay	37	5 V Power Supply of Accelerator Pedal Position Sensor 1
6	Clutch Switch	38	-
7	Accelerator Pedal Position Sensor 1 Ground	39	-
8	-	40	-
9	-	41	Fuel Pump Relay
10	-	42	A/C Compressor Relay
11	-	43	Oxygen Sensor Ground
12	-	44	-
13	KL50 State	45	Accelerator Pedal Position Sensor 1
14	Power Steering Pump Switch	46	-
15	Noncontinuous Power Supply	47	-
16	Noncontinuous Power Supply	48	Downstream Oxygen Sensor Heater
17	CAN Bus Line Low	49	-
18	-	50	-
19	-	51	-
20	Continuous Power Supply	52	-
21	Downstream Oxygen Sensor	53	-
22	-	54	-
23	Brake Switch	55	-
24	A/C Compressor Medium Pressure Switch	56	Fan Control 1
25	Brake Light Switch	57	-
26	-	58	Starting Control Relay
27	-	59	Accelerator Pedal Position Sensor 2 Ground
28	A/C Switch	60	-
29	-	61	-
30	Accelerator Pedal Position Sensor 2	62	-
31	Fan Control 2	63	ECU Ground 2
32	-	64	ECU Ground 1

Pin No.	Definition	Pin No.	Definition
65	-	89	Knock Sensor B
66	-	90	Knock Sensor A
67	Fuel Injector 2	91	Intake Pressure Sensor
68	Fuel Injector 1	92	-
69	-	93	Camshaft Position Sensor
70	-	94	Canister Control Valve
71	-	95	Camshaft Position Sensor Ground
72	Fuel Injector 3	96	Crankshaft Position Sensor A
73	Upstream Oxygen Sensor Heater	97	Crankshaft Position Sensor B
74	Fuel Injector 4	98	5 V Power Supply 1
75	Throttle Actuator	99	Ignition Coil Drive 2
76	-	100	Ignition Coil Drive 1
77	Throttle Position Sensor 1	101	Coolant Temperature Sensor
78	Throttle Position Sensor 2	102	Intake Temperature Sensor
79	-	103	-
80	Oxygen Sensor Ground	104	Upstream Oxygen Sensor
81	-	105	-
82	-	106	-
83	-	107	Throttle 5 V Power Supply
84	Coolant Temperature Sensor Ground	108	-
85	Intake Manifold Ground	109	Intake Manifold 5 V Power Supply
86	Throttle Ground	110	-
87	Throttle Actuator	111	ECU Ground 4
88	-	112	ECU Ground 3

Circuit Diagram

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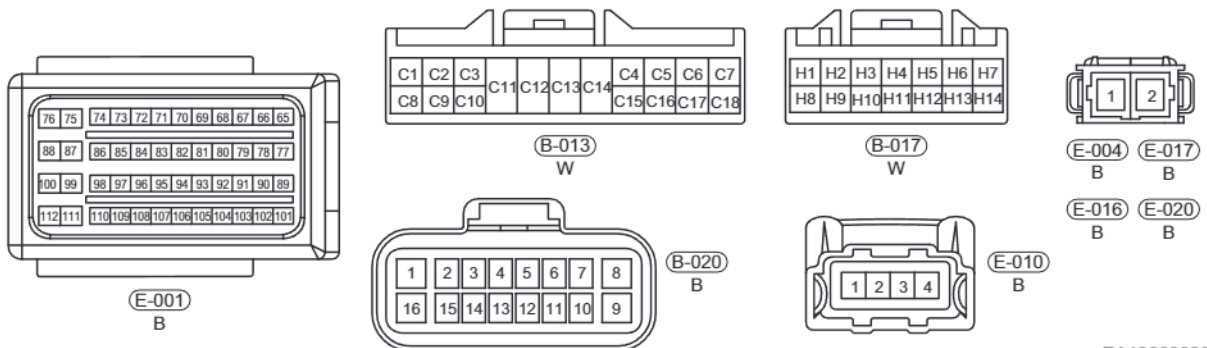
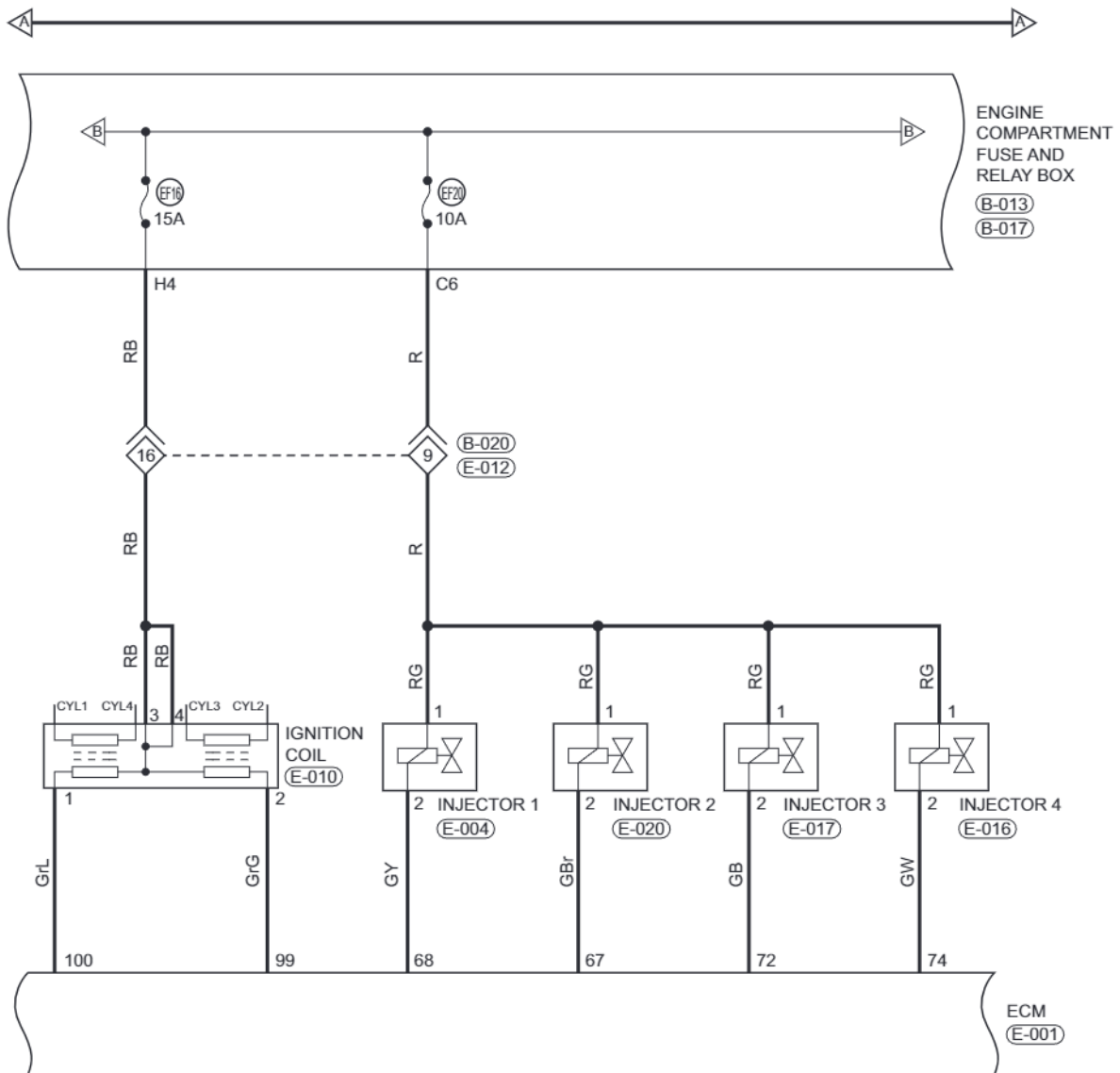
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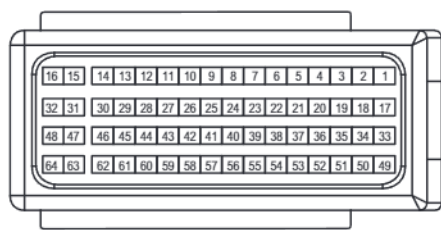
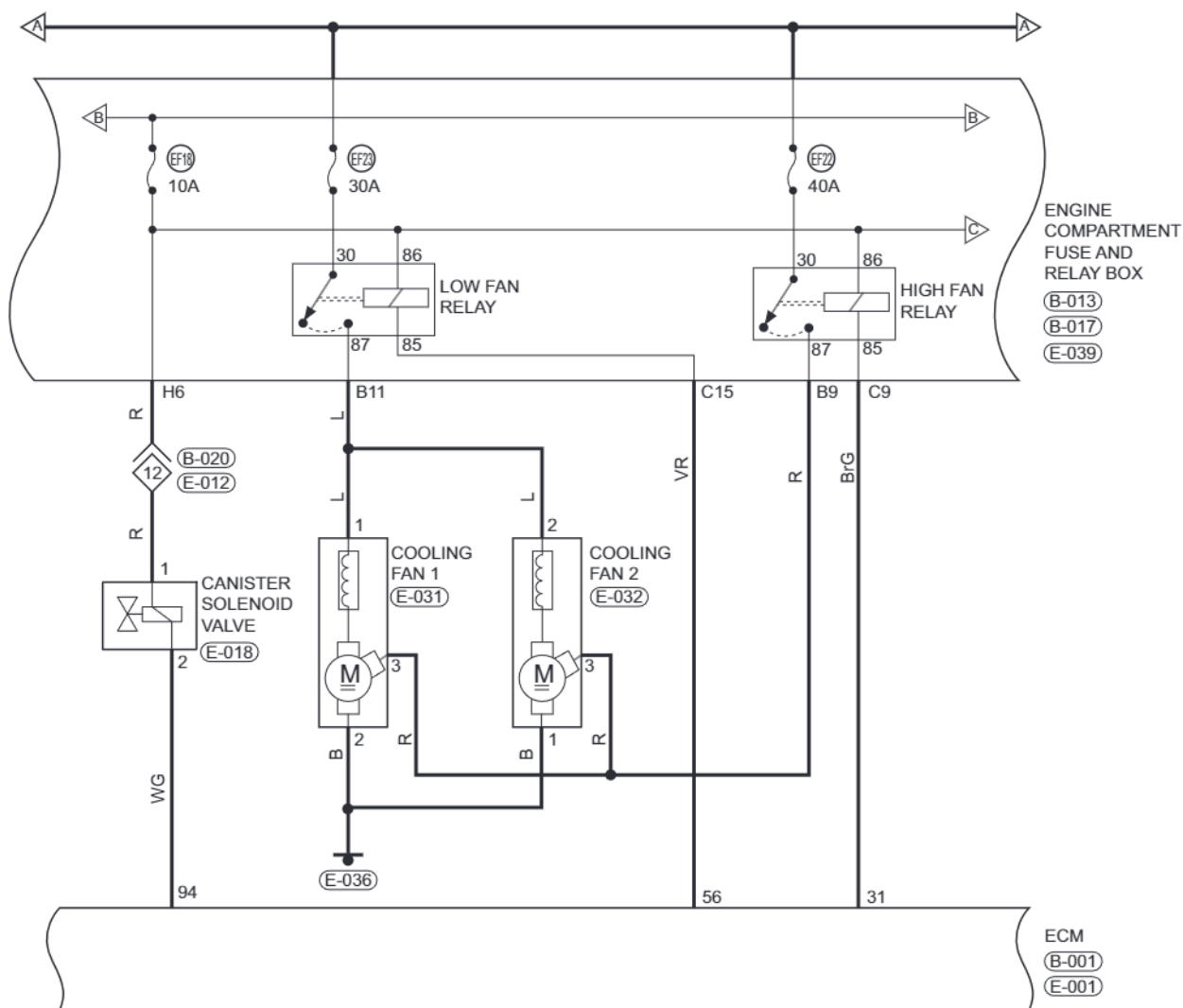
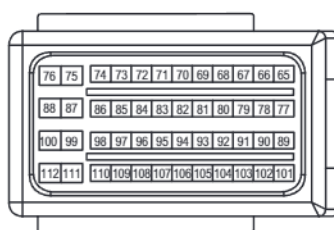
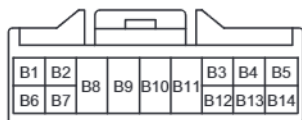
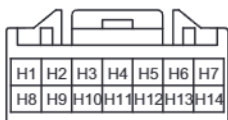
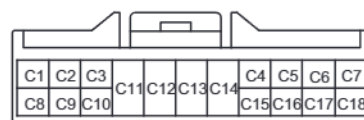


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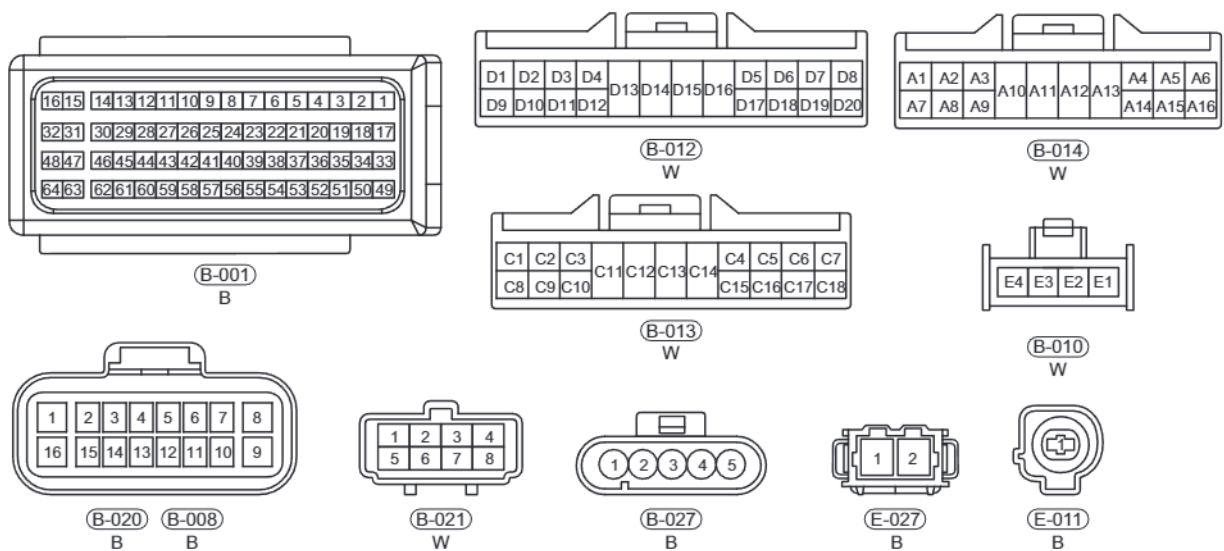
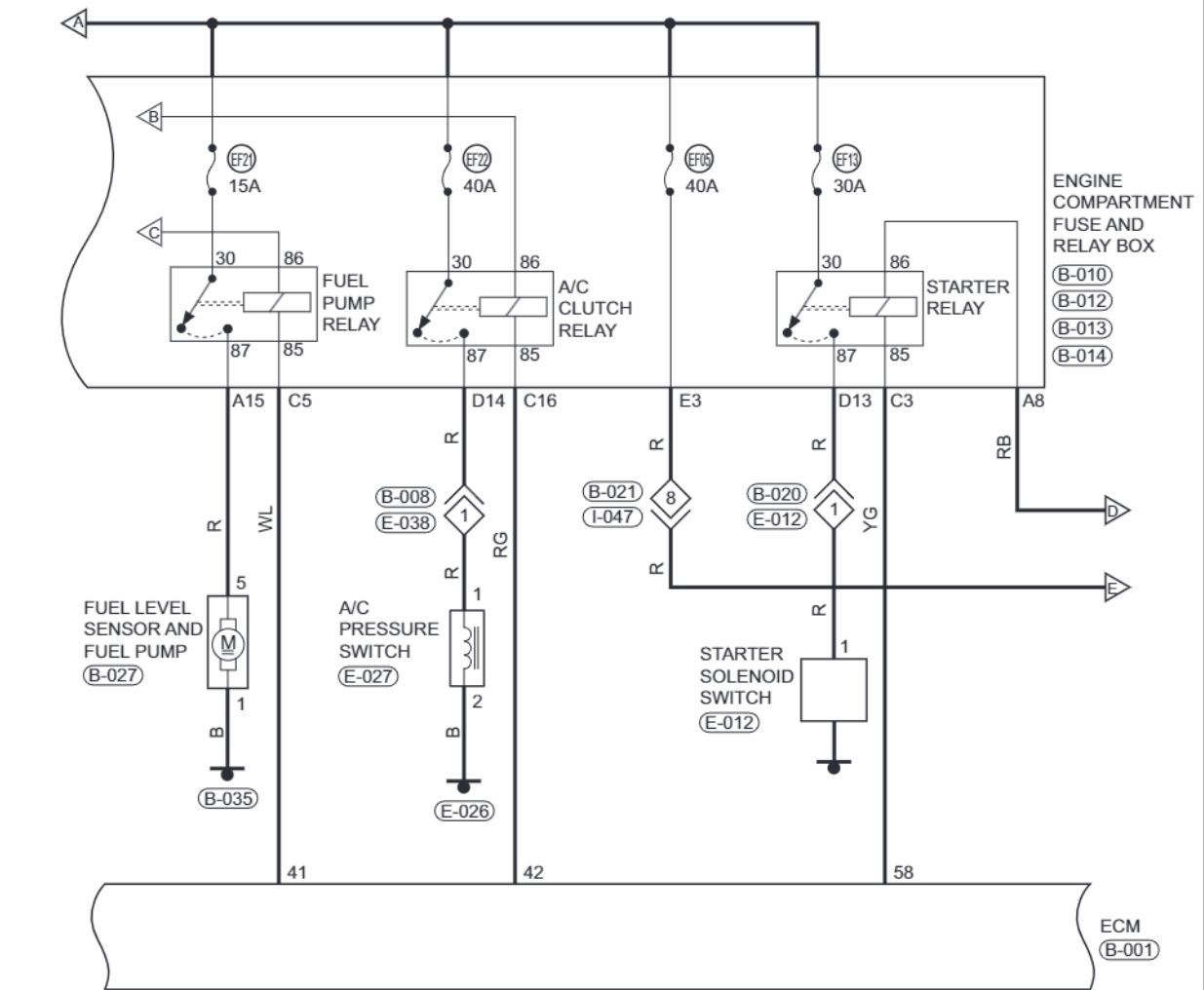
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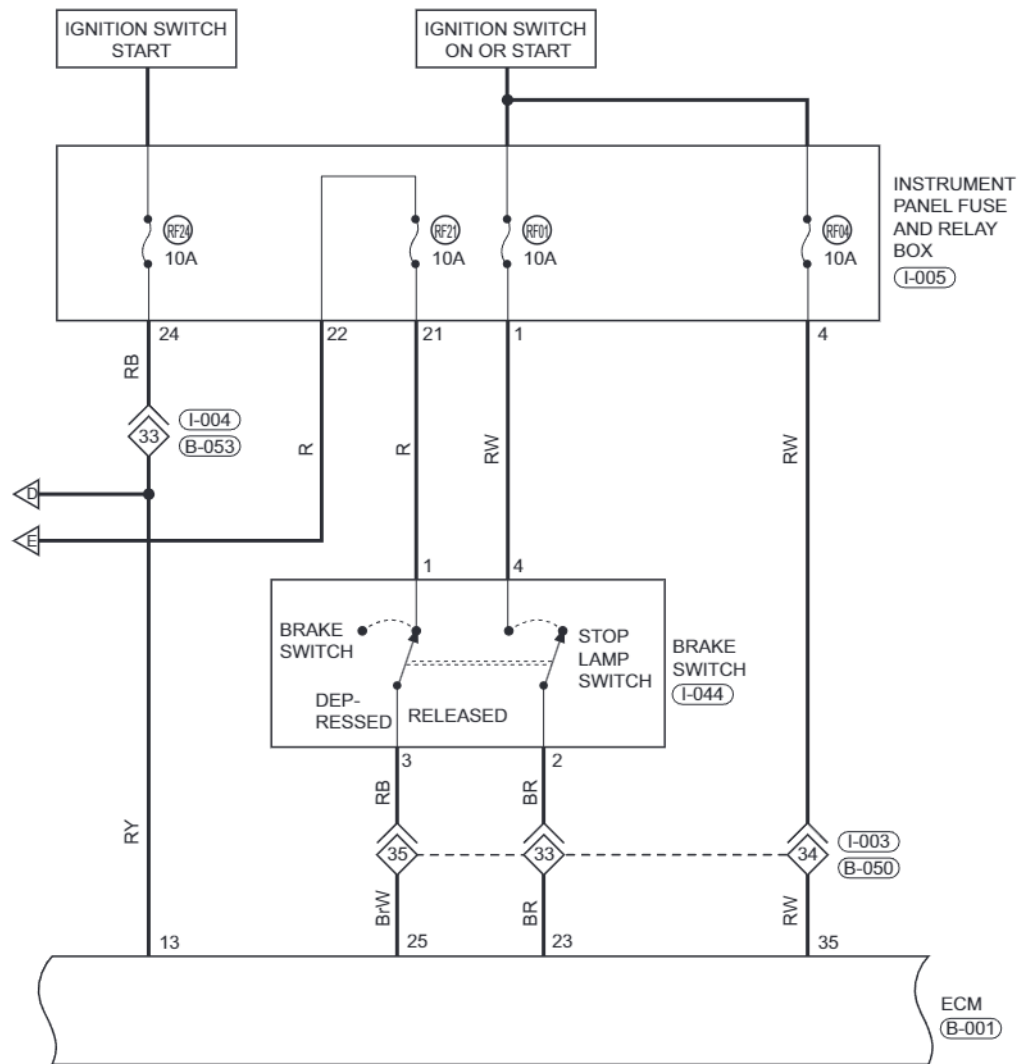
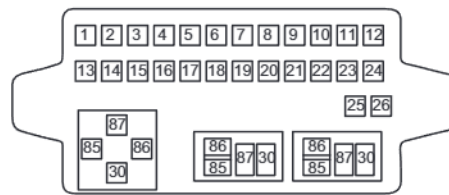
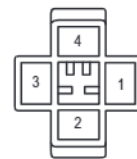
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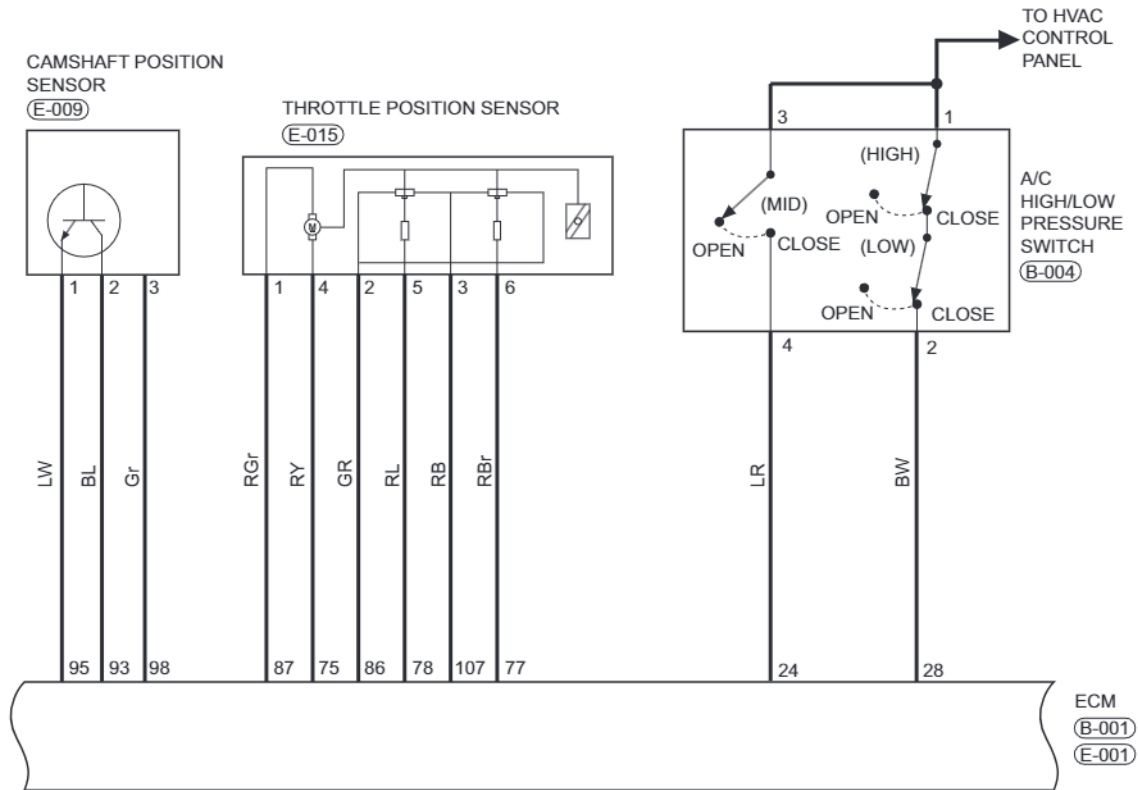
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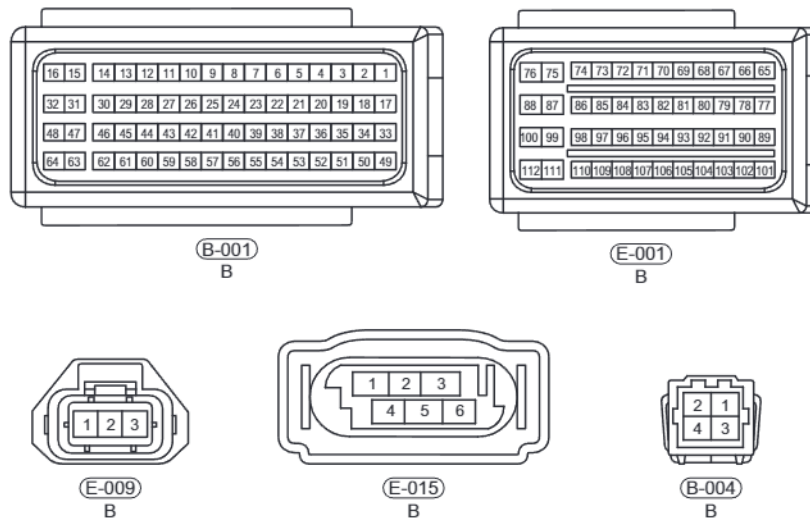
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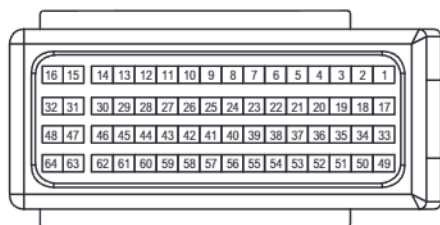
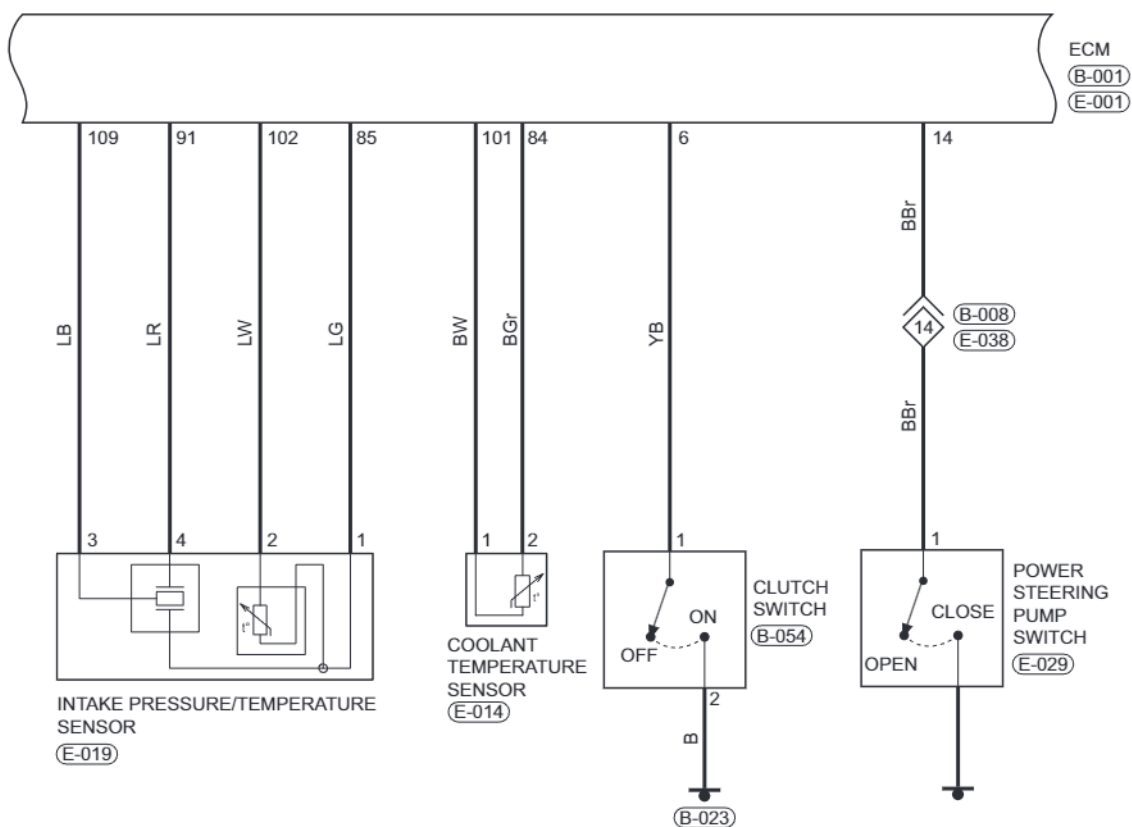
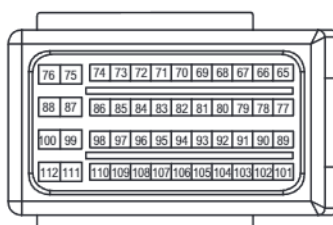
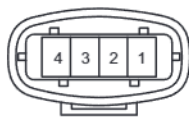
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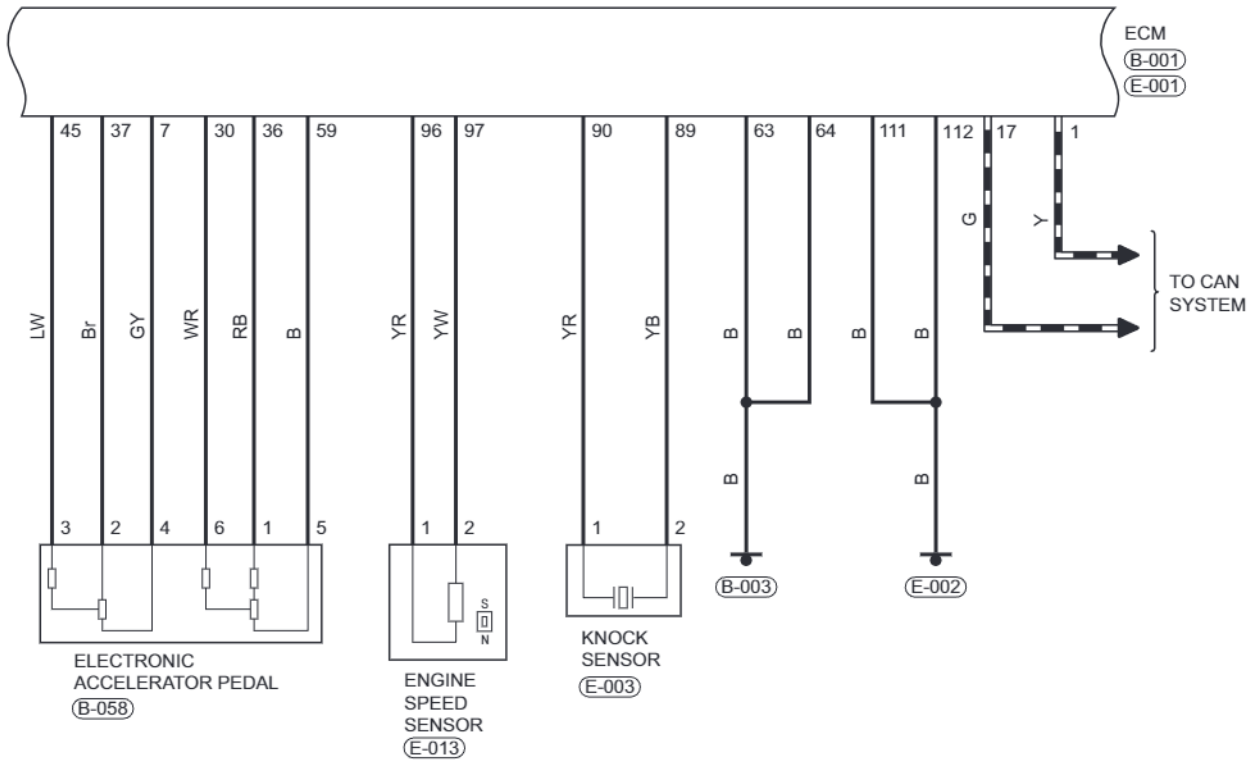
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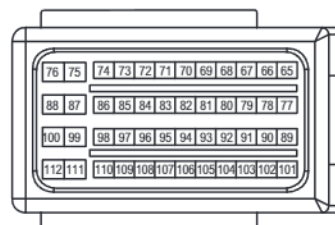
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DIAGNOSIS & TESTING

Diagnostic Help

1. Connect the X-431 3G Diagnostic tester (the latest software) to the Data Link Connector (DLC), and make it communicate with the vehicle electronic module by the data network.
2. Confirm that the malfunction is current, and carry out the diagnostic test and repair procedures.
3. If the DTC cannot be deleted, the malfunction is current.
4. Only use a digital multimeter to measure the voltage of electronic system.
5. Refer to any Technical Bulletin that may apply to the malfunction.
6. Visually check the related wire harness.
7. Check and clean all the Engine Control Module (ECM) grounds related to the current DTC.
8. If multiple trouble codes were set, use the circuit diagrams and look for any common ground circuit or power supply circuit applied to the DTC.

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Intermittent DTC Troubleshooting

If the malfunction is intermittent, perform the following:

- Check if the connectors are loose.
- Check if the wire harnesses are worn, pierced, pinched or partially broken.
- Monitor the X-431 3G diagnostic tester (the latest software) data that is related to this circuit.
- Wiggle the related wire harnesses and connectors and observe if the signal is interrupted in the related circuit.
- If possible, try to duplicate the conditions under which the DTC was set.
- Look for the data that has changed or the DTC to reset during the wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect the 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 the malfunctioning vehicle and install it on a new car to perform test. If the DTC cannot be cleared, ECM is malfunctioning. If the DTC can be cleared, reinstall ECM to the 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.

The electrical control circuits are very sensitive to proper grounding. A loose or corroded ground can affect the control circuit. Perform the following operations when checking the ground points:

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

Throttle Self-learning

Perform the throttle self-learning in the following conditions:

- Battery is removed and negative battery cable is disconnected.
- ECM is replaced.
- ECM is disconnected and reconnected.
- Throttle is replaced or cleaned.

Throttle self-learning conditions:

- Engine intake temperature > 5°C
- 100.5°C > coolant temperature > 5°C
- Engine speed not more than 250 rpm
- Vehicle speed = 0
- Battery voltage > 10 V
- Accelerator pedal opening angle < 14.9%

Throttle self-learning procedures:

Turn the ignition switch off and then to ON. Wait for 1 minute to finish the throttle self-learning.

Diagnostic Trouble Code (DTC) Chart

DTC Code	DTC Definition
P0030-13	HO2S Heater Control Circuit (Upstream of the Catalyzer)
P0031-11	HO2S Heater Control Circuit Low (Upstream of the Catalyzer)
P0032-12	HO2S Heater Control Circuit High (Upstream of the Catalyzer)
P0036-13	HO2S Heater Control Circuit (Downstream of the Catalyzer)
P0037-11	HO2S Heater Control Circuit Low (Downstream of the Catalyzer)
P0038-12	HO2S Heater Control Circuit High (Downstream of the Catalyzer)
P0053-1E	Nernst Resistance Sensor Upstream of the Catalyzer Too Large
P0054-1E	Nernst Resistance Sensor Downstream of the Catalyzer Too Large
P0105-28	Manifold Absolute Pressure/Barometric Pressure Circuit
P0106-00	Manifold Abs. Pressure or Bar. Pressure Range/Performance
P0107-11	Manifold Abs. Pressure or Bar. Pressure Low Input
P0108-12	Manifold Abs. Pressure or Bar. Pressure High Input
P0112-16	Intake Air Temp. Circ. Low Input
P0113-17	Intake Air Temp. Circ. High Input
P0116-00	Engine Coolant Temp. Circ. Range/Performance
P0117-16	Engine Coolant Temp. Circ. Low Input
P0118-17	Engine Coolant Temp. Circ. High Input
P0121-29	Throttle/Pedal Pos. Sensor A Circ. Range/Performance
P0122-16	Throttle/Pedal Pos. Sensor A Circ. Low Input
P0123-17	Throttle/Pedal Pos. Sensor A Circ. Low Input
P0130-00	O2 Sensor Circ. Malfunction (Upstream of the Catalyzer)
P0131-16	O2 Sensor Circ. Low Voltage (Upstream of the Catalyzer)

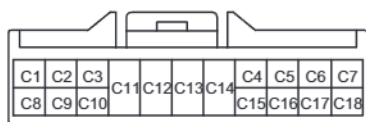
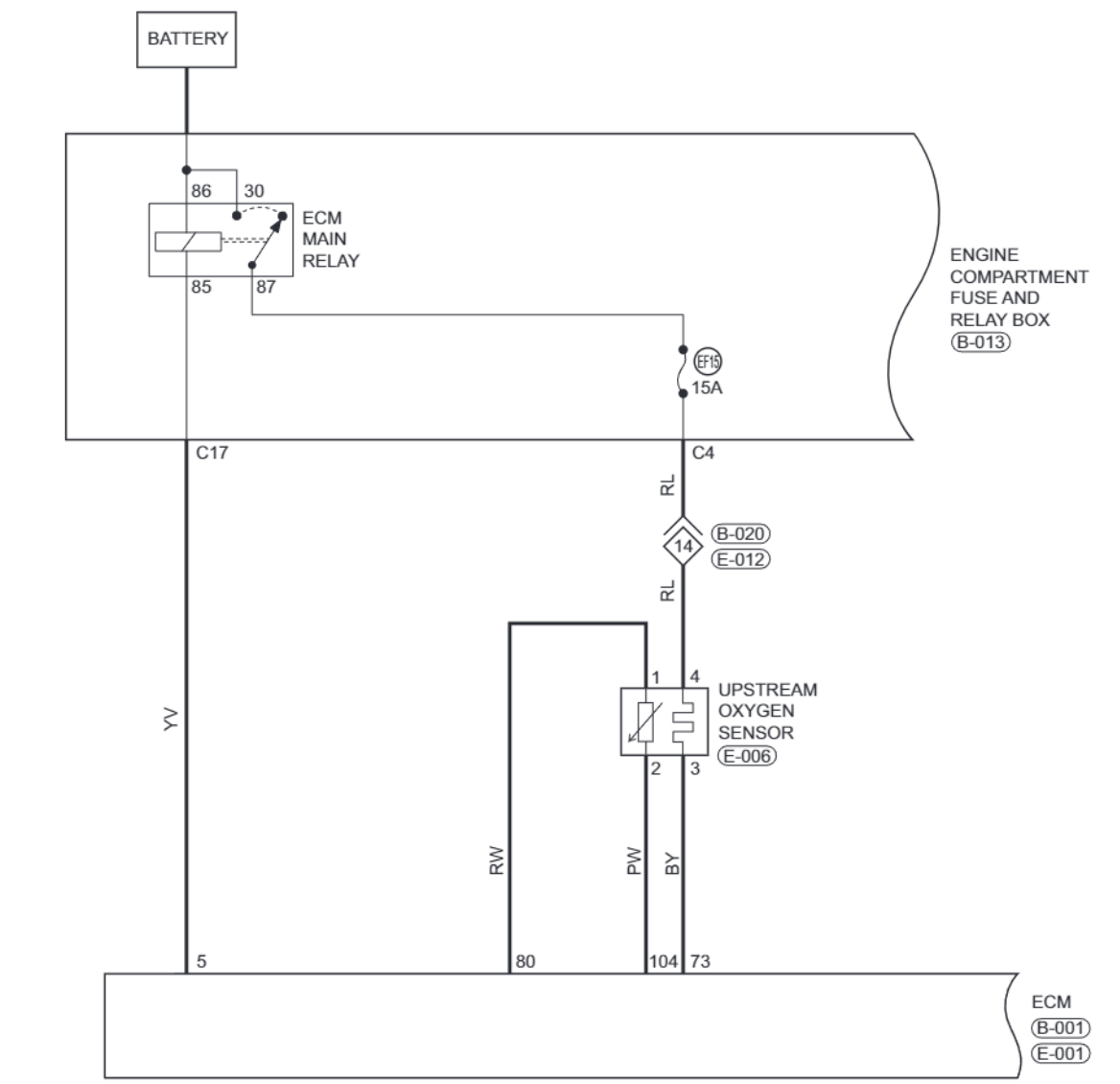
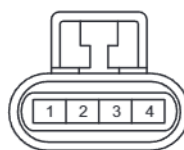
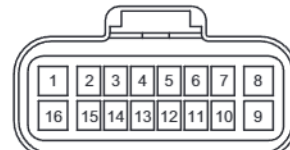
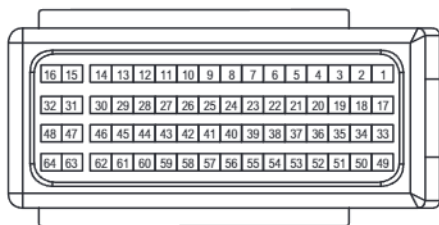
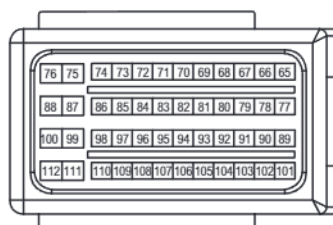
DTC Code	DTC Definition
P0132-17	O2 Sensor Circ. High Voltage (Upstream of the Catalyzer)
P0133-00	O2 Sensor Circ. Slow Response (Upstream of the Catalyzer)
P0134-00	O2 Sensor Circ. No Activity Detected (Upstream of the Catalyzer)
P0136-00	O2 Sensor Circ. Malfunction (Downstream of the Catalyzer)
P0137-16	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)
P0170-00	Fuel Trim, Bank1 Malfunction
P0171-00	Fuel Trim, Bank1 System Too Lean
P0172-00	Fuel Trim,Bank1 System Too Rich
P0201-13	Cylinder 1 - Injector Circuit
P0202-13	Cylinder 2 - Injector Circuit
P0203-13	Cylinder 3 - Injector Circuit
P0204-13	Cylinder 4 - Injector Circuit
P0219-00	Engine Overspeed Condition
P0221-29	Throttle/Pedal Position Sensor/Switch B Range/Performance
P0222-16	Throttle/Pedal Position Sensor/Switch B Low Input
P0223-17	Throttle/Pedal Position Sensor/Switch B High Input
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
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)
P0301-21	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)
P0302-21	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)
P0303-21	Cylinder 3 Misfire Detected (Over Emission Limit)
P0303-22	Cylinder 3 Misfire Detected (Harmful to Catalyst)

DTC Code	DTC Definition
P0303-29	Cylinder 3 Misfire (During First Statistic Cycle)
P0304-21	Cylinder 4 Misfire Detected (Over Emission Limit)
P0304-22	Cylinder 4 Misfire Detected (Harmful to Catalyst)
P0304-29	Cylinder 4 Misfire (During First Statistic Cycle)
P0322-00	EPM - Crankshaft Signal Fault
P0327-16	Knock Sensor 1 Circ. Low Input
P0328-17	Knock Sensor 1 Circ. High Input
P0341-00	EPM - Camshaft Signal Fault
P0420-00	Catalyst Conversion Insufficient
P0444-13	Evaporative Emission System Purge Control Valve Circuit Open
P0458-16	Evaporative Emission System Purge Control Valve Circuit Low
P0459-17	Evaporative Emission System Purge Control Valve Circuit High
P0480-13	Cooling Fan 1 Control Circuit
P0481-13	Cooling Fan 2 Control Circuit
P0501-00	Vehicle Speed Sensor Signal Fault
P0506-00	Idle Control System RPM Lower than Expected
P0507-00	Idle Control System RPM Higher than Expected
P0532-16	A/C Refrigerant Pressure Sensor Circuit Low
P0533-17	A/C Refrigerant Pressure Sensor Circuit High
P0560-00	Non-plausible Error of Battery Voltage
P0562-16	System Voltage Low
P0563-17	System Voltage High
P0571-1C	Brake Light Signal Circuit Error
P0571-29	Brake Signal Synchronization Error
P0604-43	Internal Contr. Module RAM Error
P0605-43	Internal Contr. Module ROM Error
P0606-00	Safety Monitoring Fuel Cutoff Error
P0606-1C	Throttle Signal, Wiring Harness or ECU Error
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 Implausibility Error in Level 2
P0606-64	Load Signal, Wiring Harness or ECU Error
P0606-67	ECU Fault Reaction Monitoring Error
P0606-75	Shut Off Path Test Error

DTC Code	DTC Definition
P0606-92	Engine Speed Monitoring Error in Level 2
P0606-94	Torque Monitoring Error in Level 2
P0606-96	AD Convertor Monitoring Error
P0627-13	Fuel Pump Control Circuit/Open
P0628-11	Fuel Pump Control Circuit Low
P0629-12	Fuel Pump Control Circuit High
P0645-13	A/C Clutch Relay Circuit
P0646-11	A/C Clutch Relay Control Circuit Low
P0647-12	A/C Clutch Relay Control Circuit High
P0688-91	Power Relay Sense Circuit Non-plausible Error
P0688-92	Power Relay Sense Circuit Signal 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
P0704-00	Clutch Switch Input Circuit
P2106-12	Throttle Power Stage Max Error
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
P2122-16	Pedal Pos. Sensor 1 Circ. Low Input
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 Implausible
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
P2195-00	O2 Sensor Signal Stuck Lean Bank 1 Sensor 1
P2196-00	O2 Sensor Signal Stuck Rich Bank 1 Sensor 1
P2270-00	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2
P2271-00	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2

DTC	P0030-13	HO2S Heater Control Circuit (Upstream of the Catalyzer)
DTC	P0031-11	HO2S Heater Control Circuit Low (Upstream of the Catalyzer)
DTC	P0032-12	HO2S Heater Control Circuit High (Upstream of the Catalyzer)
DTC	P0053-1E	Nernst Resistance Sensor Upstream of the Catalyzer Too Large

06

(B-013)
W(E-006)
B(B-020)
B(B-001)
B(E-001)
B

EA19060090

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0030-13	HO2S Heater Control Circuit (Upstream of the Catalyzer)	Ignition switch ON Engine running	- Upstream oxygen sensor - Wire harness or connector - Fuse - ECM
P0031-11	HO2S Heater Control Circuit Low (Upstream of the Catalyzer)		
P0032-12	HO2S Heater Control Circuit High (Upstream of the Catalyzer)		
P0053-1E	Nernst Resistance Sensor Upstream of the Catalyzer Too Large		

06

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 (See page 06-18).

NG

Repair or replace ground wire harness or ground point

OK

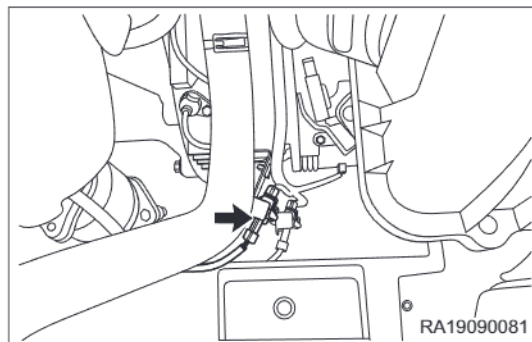
2 Check upstream oxygen sensor connector

06

- Disconnect the upstream oxygen connector E-006.
- Check the upstream oxygen sensor connector.

NG

Repair or replace connector



OK

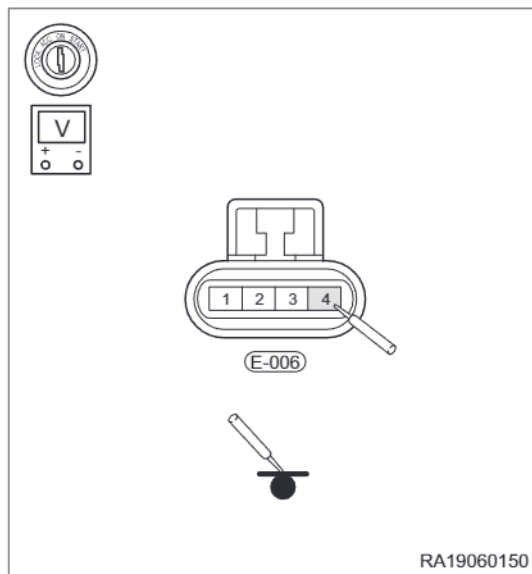
3 Check upstream oxygen sensor heater power supply voltage

- Turn the ignition switch to ON.
- Check the voltage between of upstream oxygen sensor connector E-006 terminal 4 and body ground.

Multimeter Connection	Condition	Specified Condition
E-006 (4) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 5



NG

4 Check upstream oxygen sensor power supply circuit

- Turn the ignition switch to LOCK.
- Check the fuse EF15 and main relay.
- Disconnect the engine compartment fuse and relay box connector B-013.
- Check the wire harness between upstream oxygen sensor connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-006 (4) - B-013 (C4)	Always	Continuity

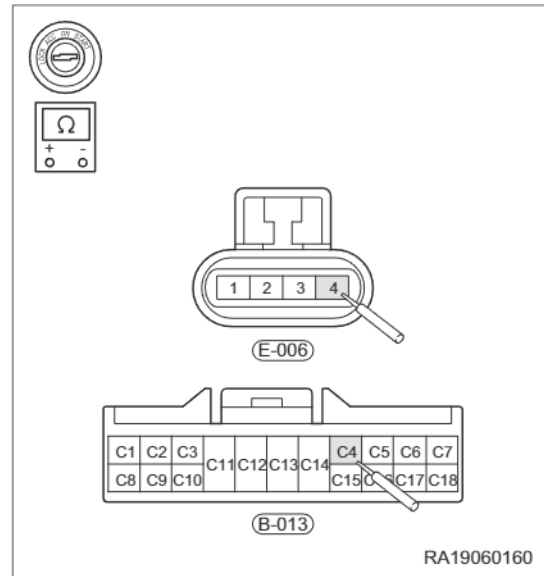
Check for Short

Multimeter Connection	Condition	Specified Condition
E-006 (4) - Body ground	Always	No continuity
E-006 (4) or B-013 (C4) - Battery positive	Always	No continuity

NG

Replace wire harness or connector (upstream oxygen sensor - engine compartment fuse and relay box)

OK

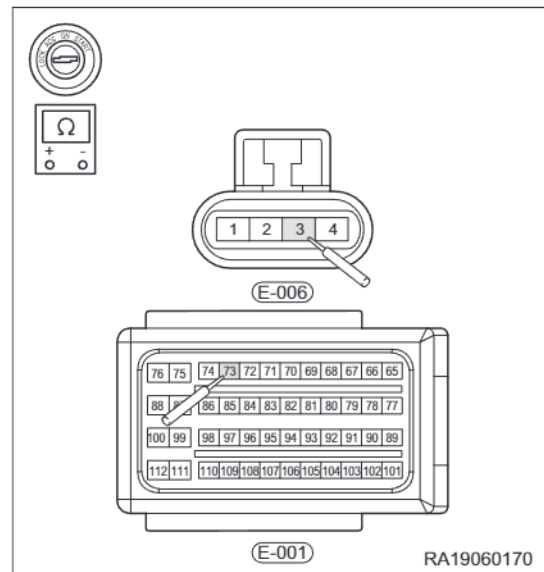


5 Check upstream oxygen sensor heater control circuit

- Disconnect the ECM connector E-001.
- Check the wire harness between upstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-006 (3) - E-001 (73)	Always	Continuity



Check for Short

Multimeter Connection	Condition	Specified Condition
E-006 (3) or E-001 (73) - Body ground	Always	No continuity
E-006 (3) or E-001 (73) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (upstream oxygen sensor - ECM)

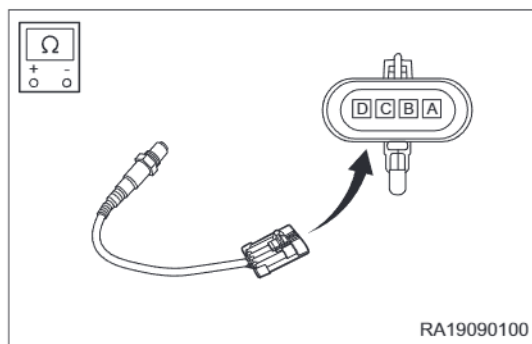
06

OK

6 Check upstream oxygen sensor heater

- a. Measure the resistance of upstream oxygen sensor.

Multimeter Connection	Condition	Specification (Ω)
Terminal C - Terminal D	20°C	7 - 11
Terminal A - Terminal B Terminal A - Terminal C Terminal A - Terminal D Terminal B - Terminal C Terminal B - Terminal D	Always	∞



NG

Replace upstream oxygen sensor

OK

7 Check for DTCs

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
 b. Refer to "DTC Confirmation Procedure".
 c. Check if DTC P0030-13, P0031-11, P0032-12 or P0053-1E still exists.

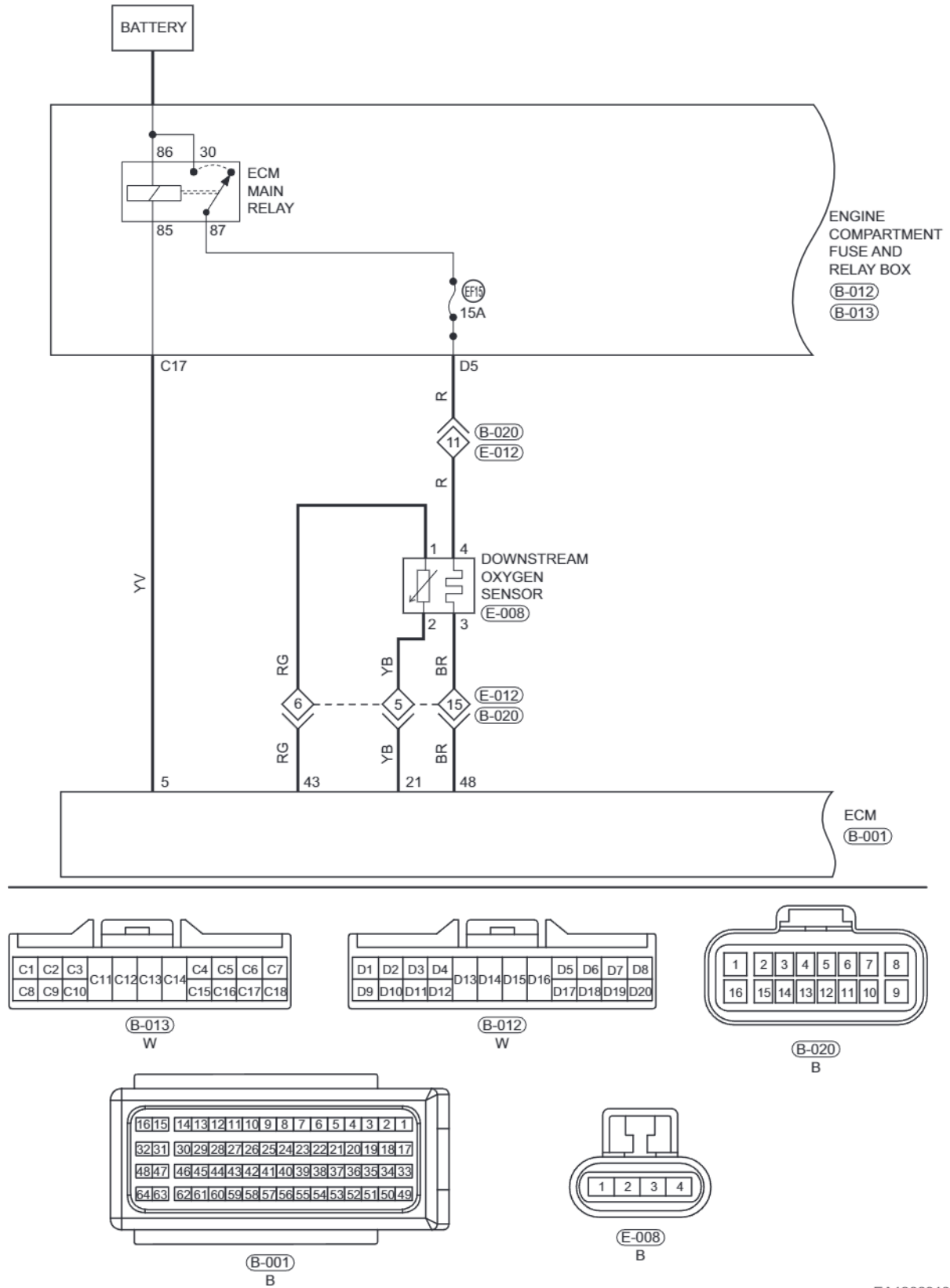
NG

Replace ECM

OK

System is operating normally.
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0036-13	HO2S Heater Control Circuit (Downstream of the Catalyzer)
DTC	P0037-11	HO2S Heater Control Circuit Low (Downstream of the Catalyzer)
DTC	P0038-12	HO2S Heater Control Circuit High (Downstream of the Catalyzer)
DTC	P0054-1E	Nernst Resistance Sensor Downstream of the Catalyzer Too Large



EA19060100

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0036-13	HO2S Heater Control Circuit (Downstream of the Catalyzer)	Ignition switch ON Engine running	- Downstream oxygen sensor - Wire harness or connector - Fuse - ECM
P0037-11	HO2S Heater Control Circuit Low (Downstream of the Catalyzer)		
P0038-12	HO2S Heater Control Circuit High (Downstream of the Catalyzer)		
P0054-1E	Nernst Resistance Sensor Downstream of the Catalyzer Too Large		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

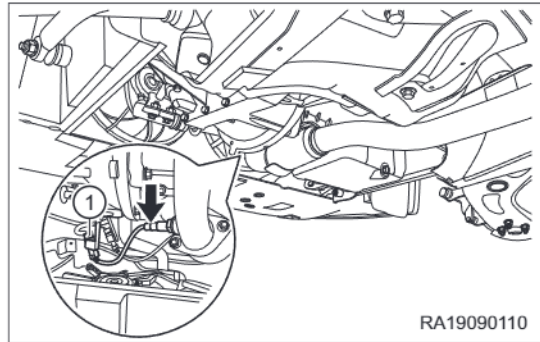
OK

2 Check downstream oxygen sensor connector

- Disconnect the downstream oxygen connector E-008 (1).
- Check the downstream oxygen sensor connector.

NG

Repair or replace connector



OK

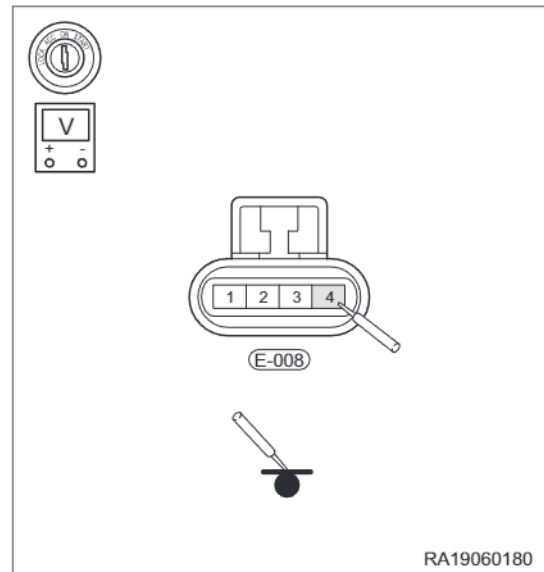
3 Check downstream oxygen sensor heater power supply voltage

- Turn the ignition switch to ON.
- Check the voltage between downstream oxygen sensor connector E-008 terminal 4 and body ground.

Multimeter Connection	Condition	Specified Condition
E-008 (4) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 5



NG

06

4

Check downstream oxygen sensor power supply circuit

- Turn the ignition switch to LOCK.
- Check the fuse EF15 and main relay.
- Disconnect the engine compartment fuse and relay box connector B-012.
- Check the wire harness between downstream oxygen sensor connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-008 (4) - B-012 (D5)	Always	Continuity

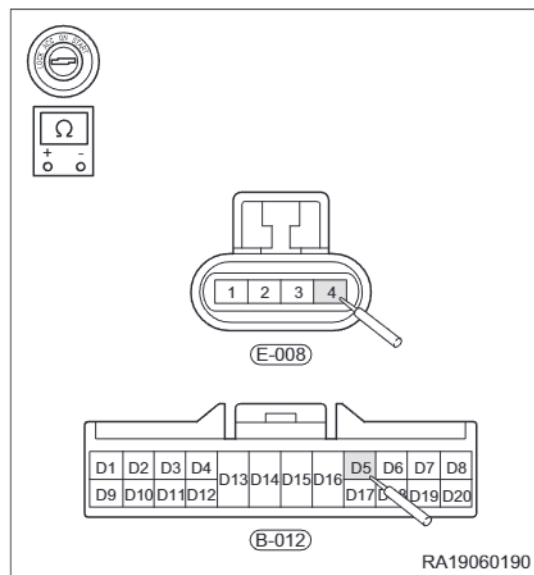
Check for Short

Multimeter Connection	Condition	Specified Condition
E-008 (4) or B-012 (D5) - Body ground	Always	No continuity
E-008 (4) or B-012 (D5) - Battery positive	Always	No continuity

NG

Replace wire harness or connector
(downstream oxygen sensor - engine
compartment fuse and relay box)

OK



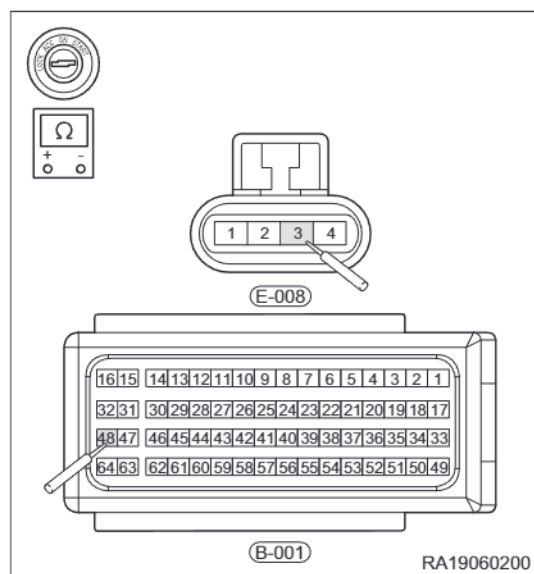
5

Check downstream oxygen sensor heater control circuit

- Disconnect the ECM connector B-001.
- Check the wire harness between downstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-008 (3) - B-001 (48)	Always	Continuity



Check for Short

Multimeter Connection	Condition	Specified Condition
E-008 (3) or B-001 (48) - Body ground	Always	No continuity
E-008 (3) or B-001 (48) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (downstream oxygen sensor - ECM)

OK

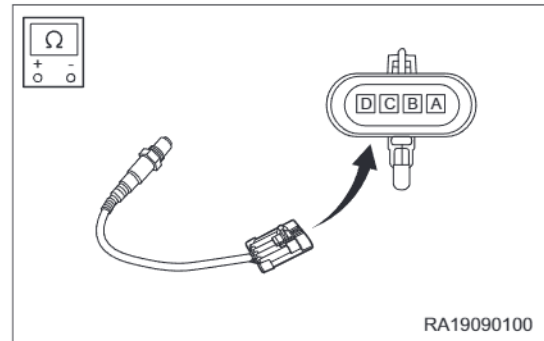
06

6

Check downstream oxygen sensor heater

- a. Measure the resistance of downstream oxygen sensor.

Multimeter Connection	Condition	Specification (Ω)
Terminal C - Terminal D	20°C	7 - 11
Terminal A - Terminal B Terminal A - Terminal C Terminal A - Terminal D Terminal B - Terminal C Terminal B - Terminal D	Always	∞



NG

Replace downstream oxygen sensor

OK

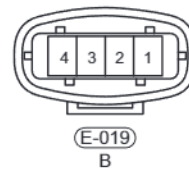
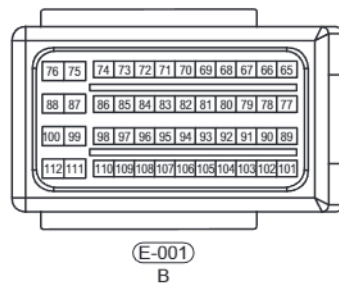
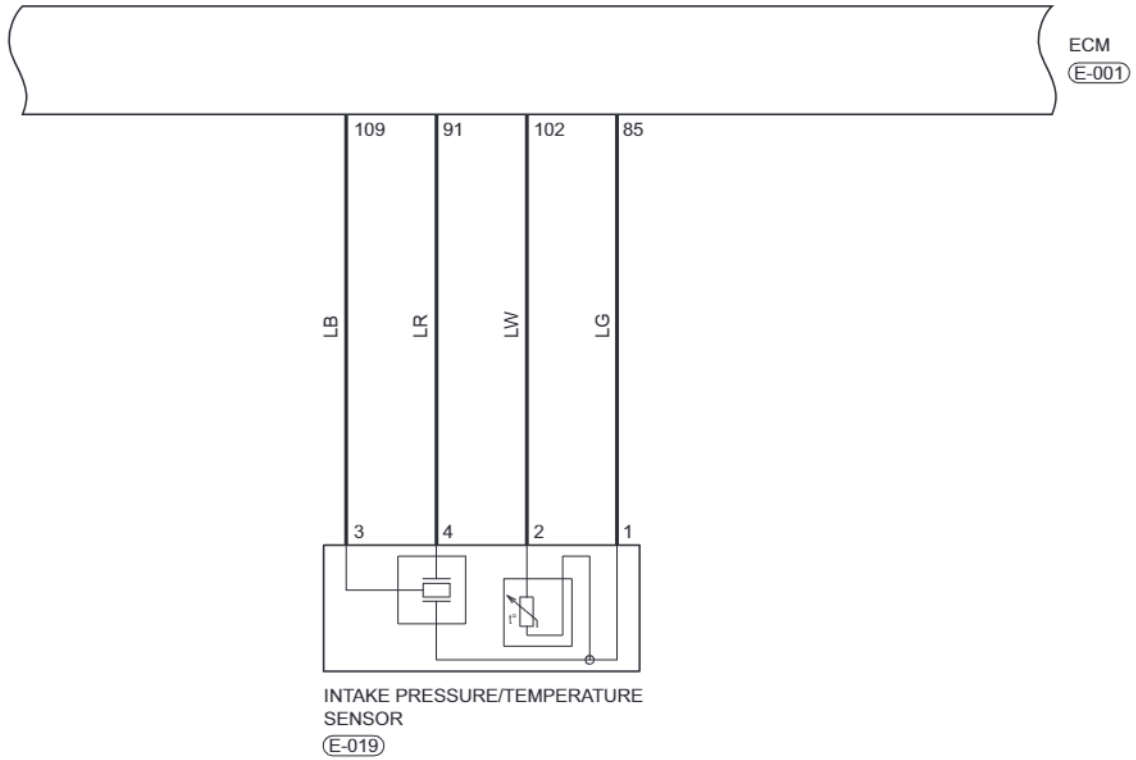
7**Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0036-13, P0037-11, P0038-12 or P0054-1E still exists.

NG**Replace ECM****OK****System is operating normally.****Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.****06**

DTC	P0105-28	Manifold Absolute Pressure/Barometric Pressure Circuit
DTC	P0106-00	Manifold Abs. Pressure or Bar. Pressure Range/ Performance
DTC	P0107-11	Manifold Abs. Pressure or Bar. Pressure Low Input
DTC	P0108-12	Manifold Abs. Pressure or Bar. Pressure High Input

06



EA19060110

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0105-28	Manifold Absolute Pressure/Barometric Pressure Circuit	Ignition switch ON Engine running	• Intake pressure sensor • Wire harness or connector • ECM
P0106-00	Manifold Abs. Pressure or Bar. Pressure Range/Performance		
P0107-11	Manifold Abs. Pressure or Bar. Pressure Low Input		
P0108-12	Manifold Abs. Pressure or Bar. Pressure High Input		

06

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 (See page 06-18).

NG

Repair or replace ground wire harness or ground point

OK

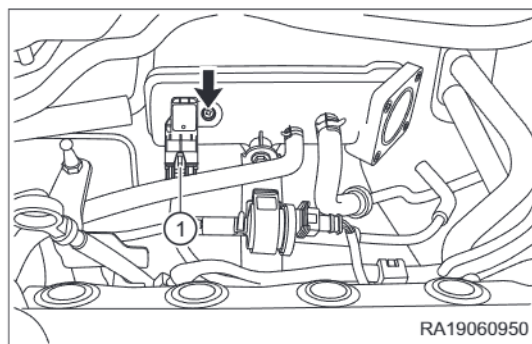
2 Check intake pressure/temperature sensor connector

06

- Disconnect the intake pressure/temperature sensor connector E-019 (1).
- Check the intake pressure/temperature sensor connector.

NG

Repair or replace connector



OK

3 Check intake pressure sensor signal circuit

- Connect the intake pressure/temperature sensor connector E-019.
- Turn the ignition switch to ON and start the engine.
- Using the diagnostic tester, measure the intake pressure sensor signal voltage, or using the multimeter, measure the voltage between connector E-019 terminal 4 and body ground.

Multimeter Connection	Condition	Specified Condition
E-019 (4) - Body ground	Idle	Voltage is about 1.3 V (value changes with model)
	Rapidly depress accelerator pedal	Instantaneous voltage is about 4 V (value changes with model)

OK

Go to step 8

NG

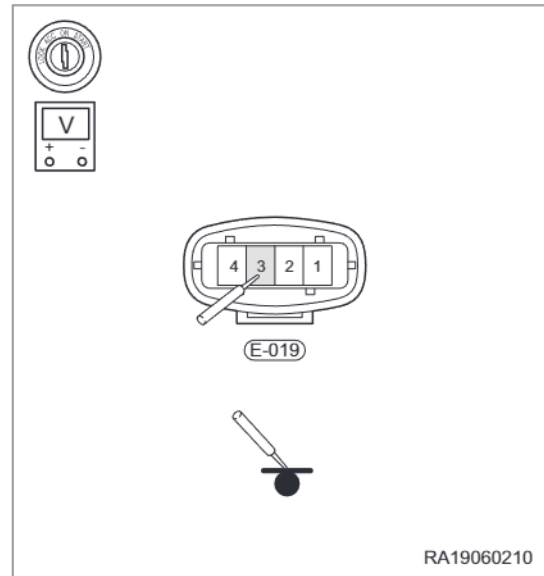
4 Check intake pressure sensor power supply voltage

- Disconnect the intake pressure/temperature sensor connector E-019.
- Check the voltage between intake pressure/temperature sensor connector terminals and body ground.

Multimeter Connection	Condition	Specified Condition
E-019 (3) - Body ground	Ignition switch ON	5 V

NG

Go to step 6



OK

5 Check intake pressure sensor power supply circuit

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Check the wire harness between intake pressure/temperature sensor connector terminals and ECM connector terminals.

Check for Open

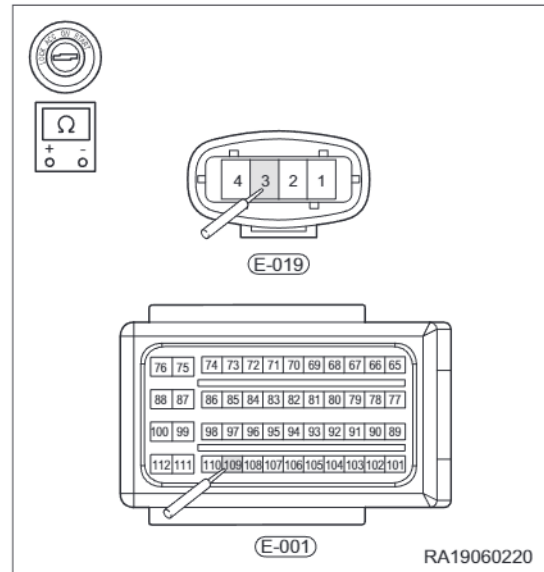
Multimeter Connection	Condition	Specified Condition
E-019 (3) - E-001 (109)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-019 (3) or E-001 (109) - Body ground	Always	No continuity
E-019 (3) or E-001 (109) - Battery positive	Always	No continuity

NG

Replace wire harness or connector (intake pressure/temperature sensor - ECM)



OK

06

6 Check intake pressure sensor signal circuit

- a. Check the wire harness between intake pressure/temperature sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specification
E-019 (4) - E-001 (91)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specification
E-019 (4) or E-001 (91) - Body ground	Always	No continuity
E-019 (4) or E-001 (91) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (intake pressure/temperature sensor - ECM)

OK

7 Check intake pressure sensor

- a. Remove the intake pressure/temperature sensor.
b. Check the inlet of connector for debris and damage.

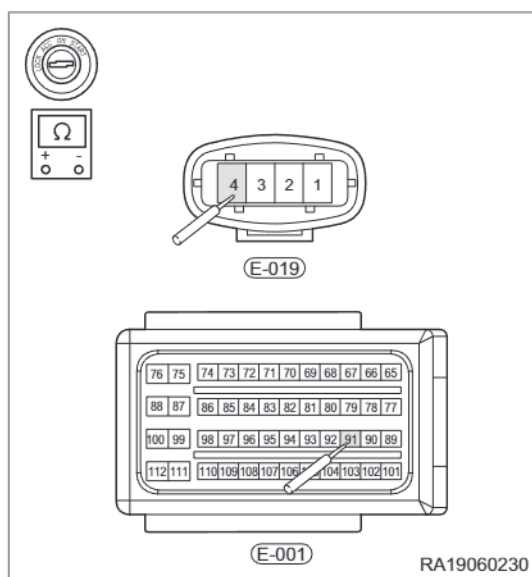
NG

Clean or replace intake pressure/temperature sensor

OK

8 Check for DTCs

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0105-28, P0106-00, P0107-11 or P0108-12 still exists.



NG

Replace ECM

OK

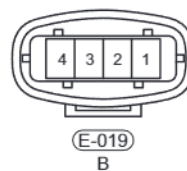
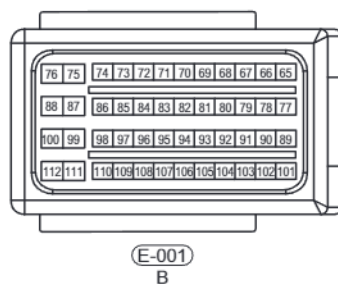
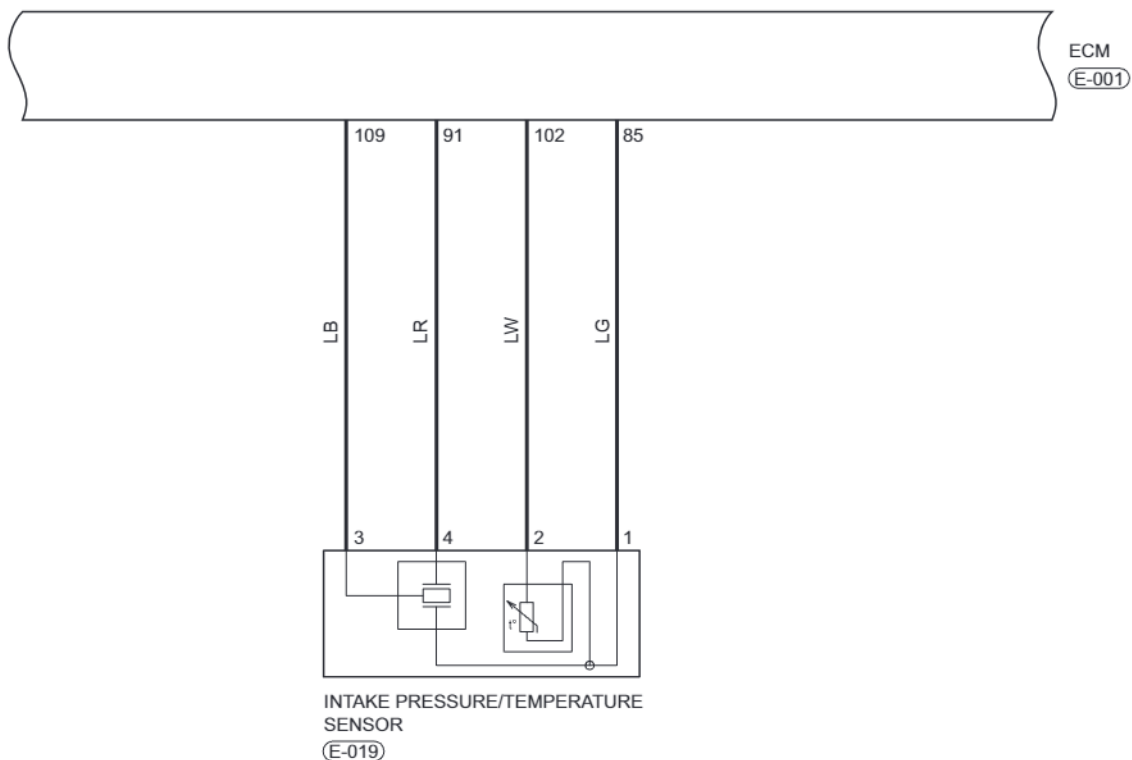
System is operating normally.
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

06

DTC	P0112-16	Intake Air Temp. Circ. Low Input
-----	----------	----------------------------------

DTC	P0113-17	Intake Air Temp. Circ. High Input
-----	----------	-----------------------------------

06



EA19060110

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0112-16	Intake Air Temp. Circ. Low Input	Ignition switch ON Engine running	- Intake temperature sensor - Wire harness or connector - ECM
P0113-17	Intake Air Temp. Circ. High Input		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

06

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

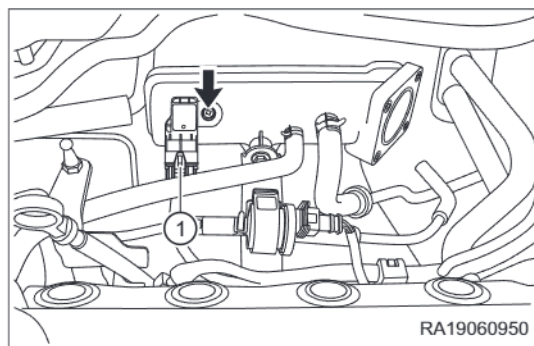
OK

2 Check intake pressure/temperature sensor connector

- Disconnect the intake pressure/temperature sensor connector E-019 (1).
- Check the intake pressure/temperature sensor connector.

NG

Repair or replace connector



RA19060950

OK

3 Check intake temperature sensor signal

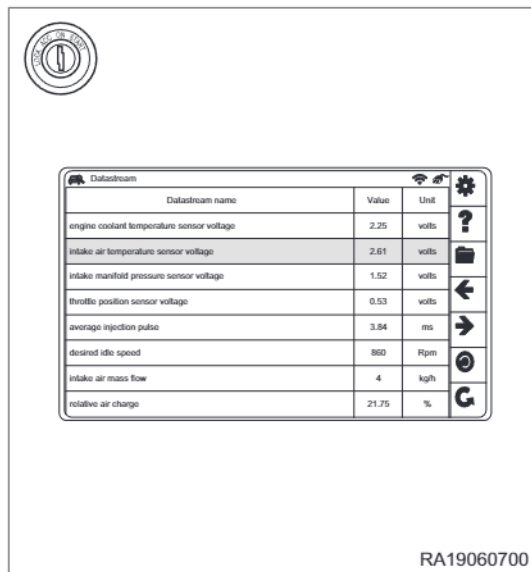
- Connect the intake pressure/temperature sensor connector E-019.
- Turn the ignition switch to ON and start the engine.
- Using the diagnostic tester, measure the intake temperature sensor signal voltage, or using the multimeter, measure the voltage between connector E-019 terminal 2 and body ground.

06

Multimeter Connection	Condition	Specified Condition
E-019 (2) - Body ground	Engine running after warming up	Voltage is about 2.5 V (value changes with model); signal does not change when increasing speed.

OK

Go to step 8



NG

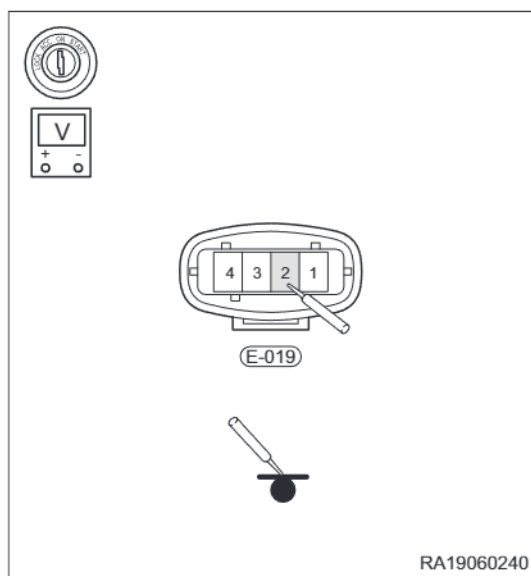
4 Check intake temperature sensor voltage

- Disconnect the intake pressure/temperature sensor connector E-019.
- Turn the ignition switch to ON.
- Check the voltage between intake temperature sensor connector terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-019 (2) - Body ground	Ignition switch ON	5 V

OK

Go to step 6



NG

5 Check intake temperature sensor signal circuit

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Check the wire harness between intake pressure/temperature sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-019 (2) - E-001 (102)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-019 (2) or E-001 (102) - Body ground	Always	No continuity
E-019 (2) or E-001 (102) - Battery positive	Always	No continuity

NG

Replace wire harness or connector (intake pressure/temperature sensor - ECM)

OK

6 Check intake pressure sensor ground circuit

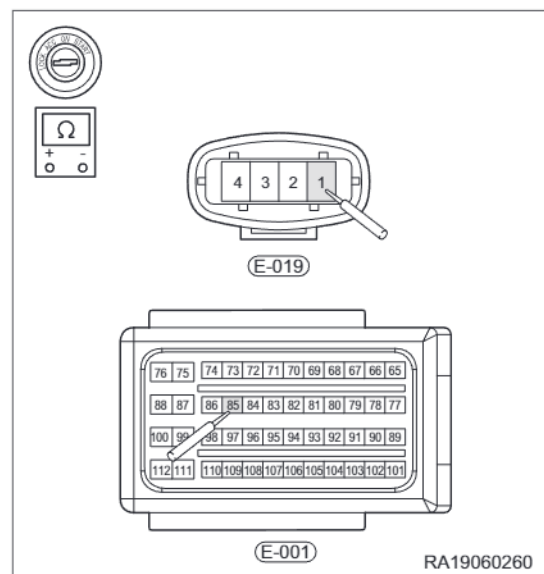
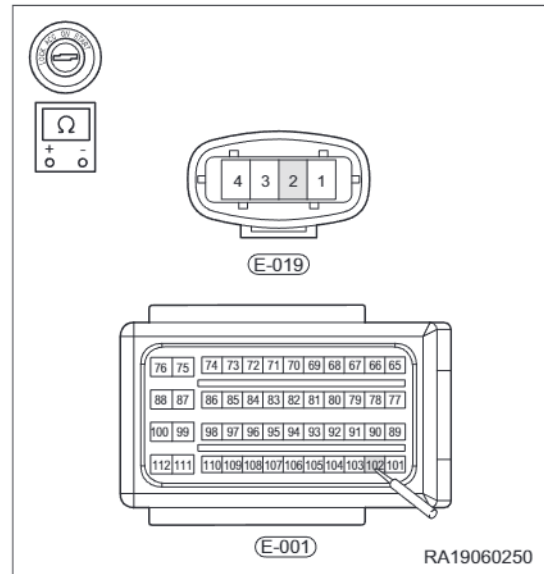
- Check the wire harness between intake pressure/temperature sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-019 (1) - E-001 (85)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-019 (1) or E-001 (85) - Body ground	Always	No continuity



06

Multimeter Connection	Condition	Specified Condition
E-019 (1) or E-001 (85) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (intake pressure/temperature sensor - ECM)

OK

06

7 Check intake temperature sensor

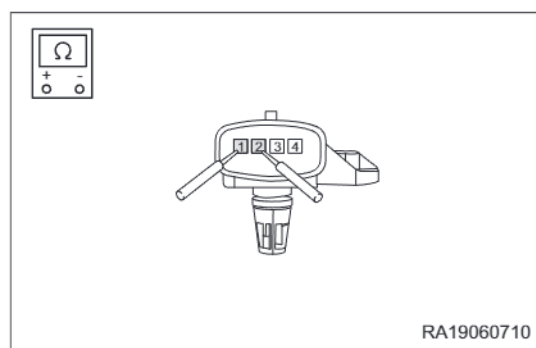
- Remove the intake pressure/temperature sensor.
- Check the resistance of intake temperature sensor.

Check for Open

Multimeter Connection	Specified Condition
1 - 2	Resistance is $2.5\text{ k}\Omega \pm 5\%$ (20°C)

NG

Replace intake pressure/temperature sensor



OK

8 Check for DTCs

- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0112-16 or P0113-17 still exists.

NG

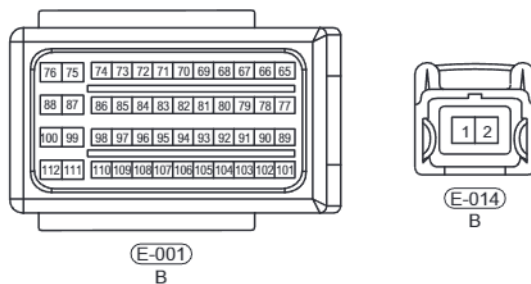
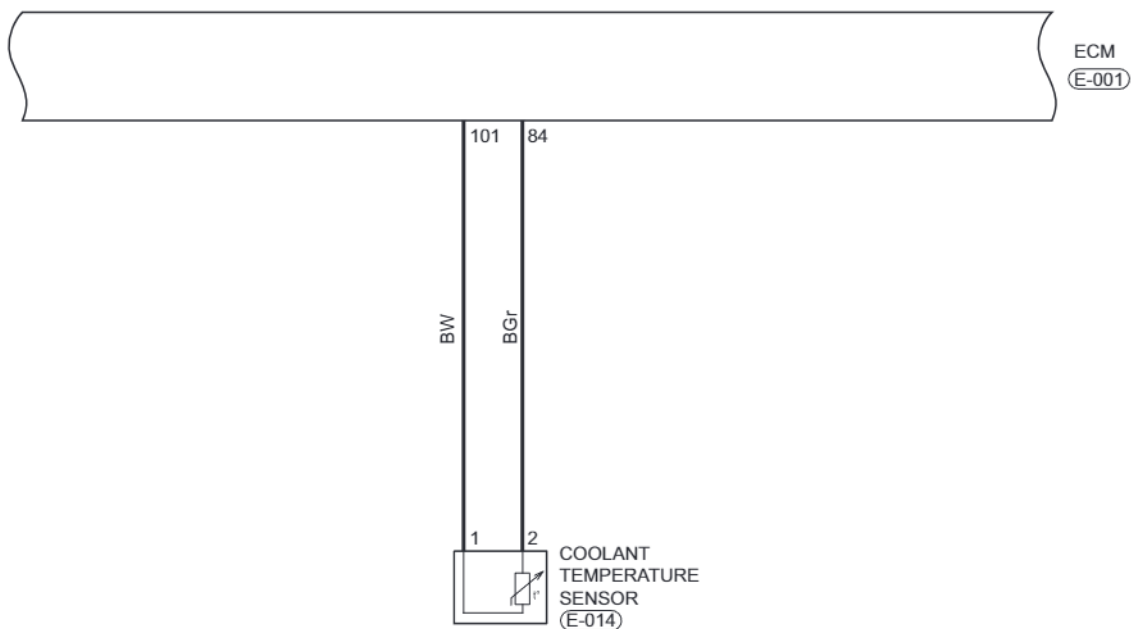
Replace ECM

OK

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

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



EA19060120

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0116-00	Engine Coolant Temp. Circ. Range/ Performance	Ignition switch ON Engine running	- Engine coolant temperature sensor - Wire harness or connector - ECM
P0117-16	Engine Coolant Temp. Circ. Low Input		
P0118-17	Engine Coolant Temp. Circ. High Input		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

06

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

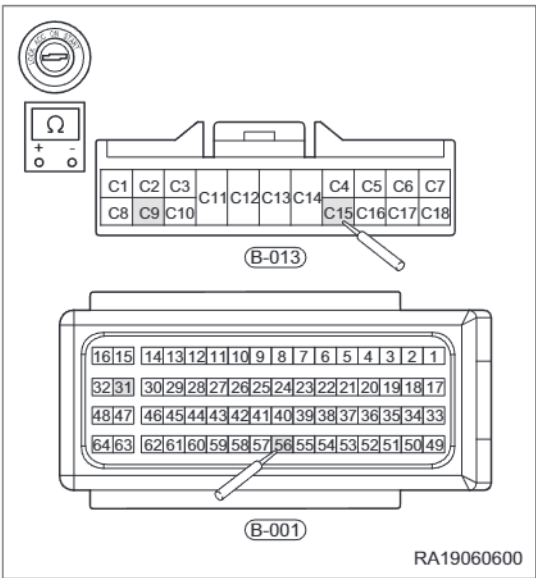
OK

2 Check engine coolant temperature sensor connector

- a. Disconnect the engine coolant temperature sensor connector E-014 (1).
b. Check the engine coolant temperature sensor connector.

NG

Repair or replace connector



OK

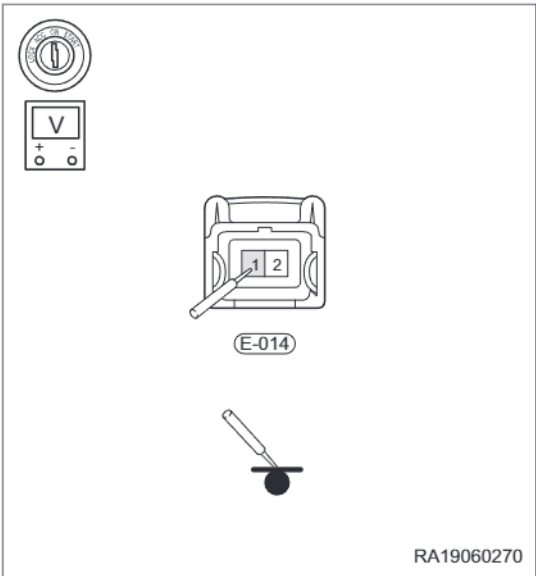
3 Check engine coolant temperature sensor power supply voltage

- a. Turn the ignition switch to ON.
b. Check the voltage between engine coolant temperature sensor terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-014 (1) - Body ground	Ignition switch ON	5 V

OK

Go to step 5



NG

06

4 Check engine coolant temperature sensor power supply

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Check the wire harness between engine coolant temperature sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-014 (1) - E-001 (101)	Always	Continuity

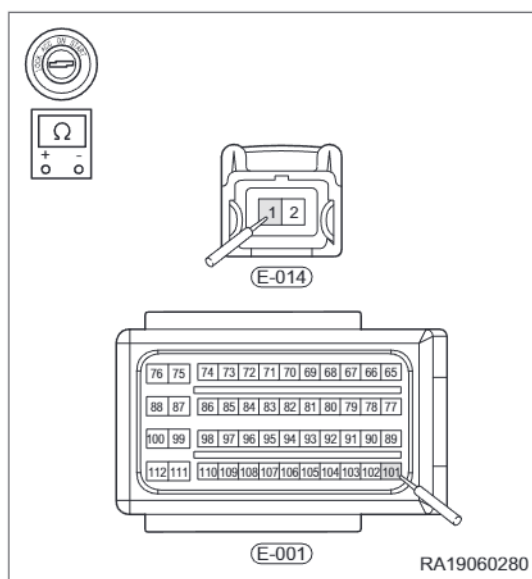
Check for Short

Multimeter Connection	Condition	Specified Condition
E-014 (1) or E-001 (101) - Body ground	Always	No continuity
E-014 (1) or E-001 (101) - Battery positive	Always	No continuity

NG

Replace wire harness or connector
(engine coolant temperature sensor - ECM)

OK



5 Check engine coolant temperature sensor ground circuit

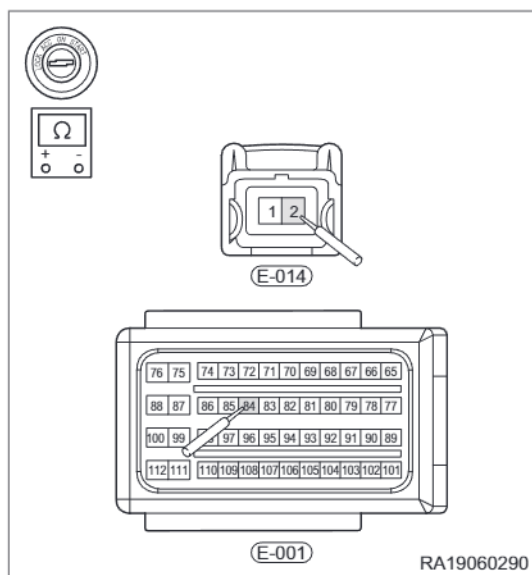
- Check the wire harness between engine coolant temperature sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-014 (2) - E-001 (84)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-014 (2) or E-001 (84) - Body ground	Always	No continuity



Multimeter Connection	Condition	Specified Condition
E-014 (2) or E-001 (84) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (engine coolant temperature sensor - ECM)

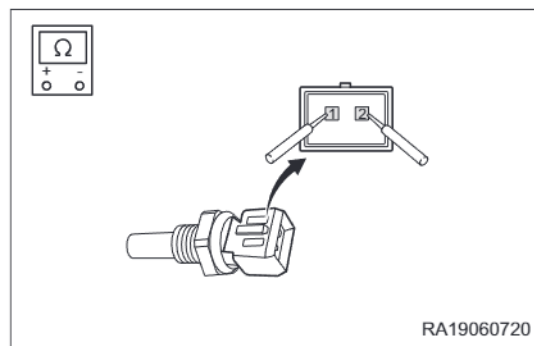
OK

6 Check engine coolant temperature sensor

06

- Remove the engine coolant temperature sensor.
- Check the resistance of engine coolant temperature sensor.

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



NG

Replace engine coolant temperature sensor

OK

7 Check for DTCs

- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0116-00, P0117-16 or P0118-17 still exists.

NG

Replace ECM

OK

System is operating normally.

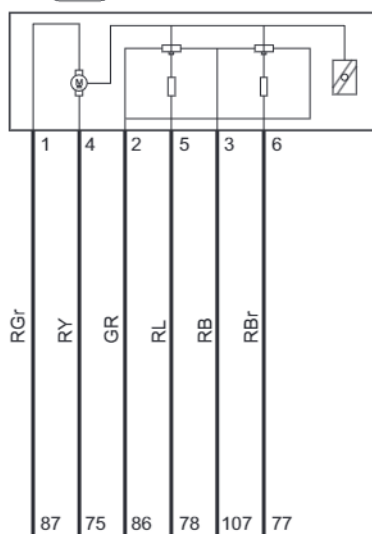
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0121-29	Throttle/Pedal Pos. Sensor A Circ. Range/Performance
-----	----------	--

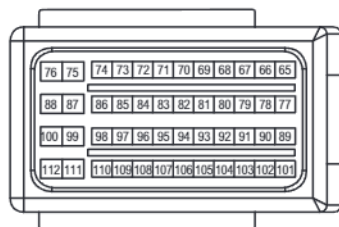
DTC	P0122-16	Throttle/Pedal Pos. Sensor A Circ. Low Input
-----	----------	--

DTC	P0123-17	Throttle/Pedal Pos. Sensor A Circ. Low Input
-----	----------	--

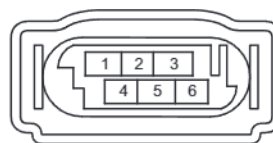
THROTTLE POSITION SENSOR
(E-015)



ECM
(E-001)



(E-001)
B



(E-015)
B

EA19060130

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0121-29	Throttle/Pedal Pos. Sensor A Circ. Range/Performance	Ignition switch ON Engine running	- Throttle position Sensor 1 - Wire harness or connector - ECM
P0122-16	Throttle/Pedal Pos. Sensor A Circ. Low Input		
P0123-17	Throttle/Pedal Pos. Sensor A Circ. Low Input		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

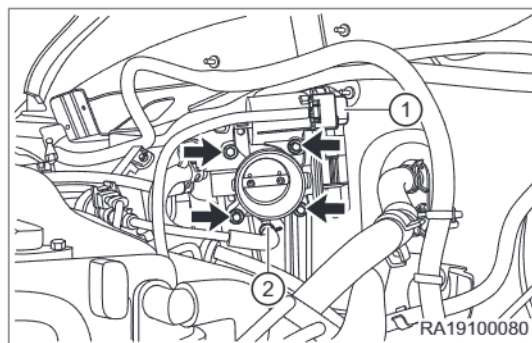
OK

2 Check throttle position sensor connector

- Disconnect the throttle position sensor connector E-015 (1).
- Check the throttle position sensor connector.

NG

Repair or replace connector



OK

06

3 Check throttle position sensor 1 signal voltage

- Connect the throttle position sensor connector E-015.
- Turn the ignition switch to ON.
- Using the diagnostic tester, check the throttle position sensor 1 signal voltage.

Condition	Standard Value (V)
Accelerator pedal released	0.78
Accelerator pedal depressed	4.25

Datastream name	Value	Unit
multiplicative correction of the mixture adaptation	1.00	
Lambda controller output bank 2	0.00	
sensor voltage from throttle potentiometer 1	0.78	V
sensor voltage from throttle potentiometer 2	4.21	V
additive correction of the mixture adaptation	0.00	%
Voltage PWD potentiometer 1	0.99	V
Voltage PWD potentiometer 2	0.50	V
Doubled PWD potentiometer 2 voltage	1.00	V

RA19100071

OK

Go to step 8

NG

4 Check throttle position sensor power supply voltage

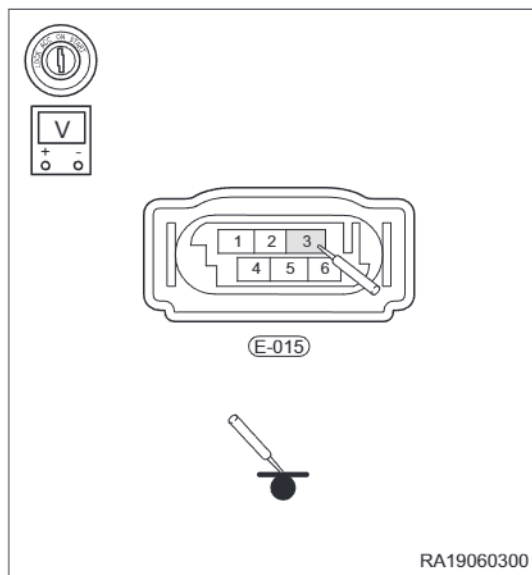
- Turn the ignition switch to LOCK.
- Disconnect the throttle position sensor connector E-015.
- Turn the ignition switch to ON and check the voltage between throttle position sensor connector terminal and body ground.

Check for Open

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

OK

Go to step 6



NG

5 Check throttle position sensor power supply circuit

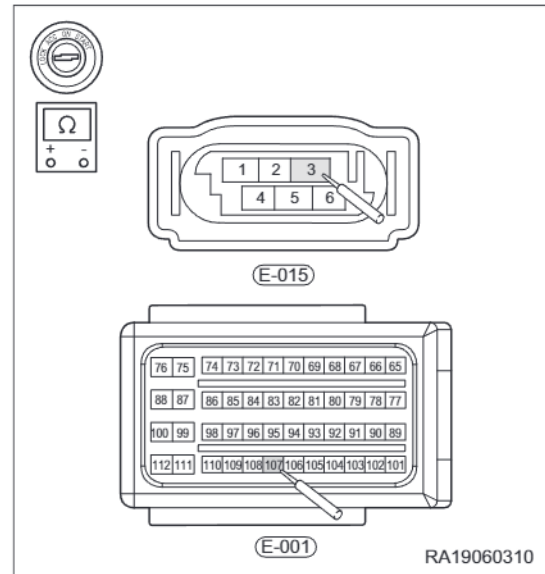
- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Check the wire harness between throttle position sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-015 (3) - E-001 (107)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-015 (3) or E-001 (107) - Body ground	Always	No continuity
E-015 (3) or E-001 (107) - Battery positive	Always	No continuity



NG

Replace wire harness or connector
(throttle position sensor - ECM)

OK

06

6 Check throttle position sensor 1 signal circuit and ground circuit

- a. Check the wire harness between throttle position sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-015 (6) - E-001 (77)	Always	Continuity
E-015 (2) - E-001 (86)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-015 (6) or E-001 (77) - Body ground	Always	No continuity
E-015 (6) or E-001 (77) - Battery positive	Always	No continuity
E-015 (2) or E-001 (86) - Body ground	Always	No continuity
E-015 (2) or E-001 (86) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (throttle position sensor - ECM)

OK

7 Check throttle position sensor 1

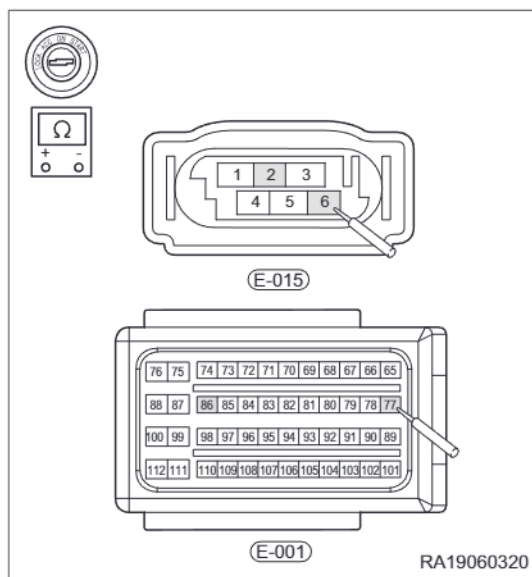
- a. Check the resistance of throttle position sensor 1.

Multimeter Connection	Specified Condition
2 - 6	Resistance changes continuously when throttle valve is moved by hands.

NG

Replace electronic throttle

OK



RA19060320

8**Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0121-29, P0122-16 or P0123-17 still exists.

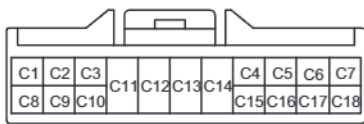
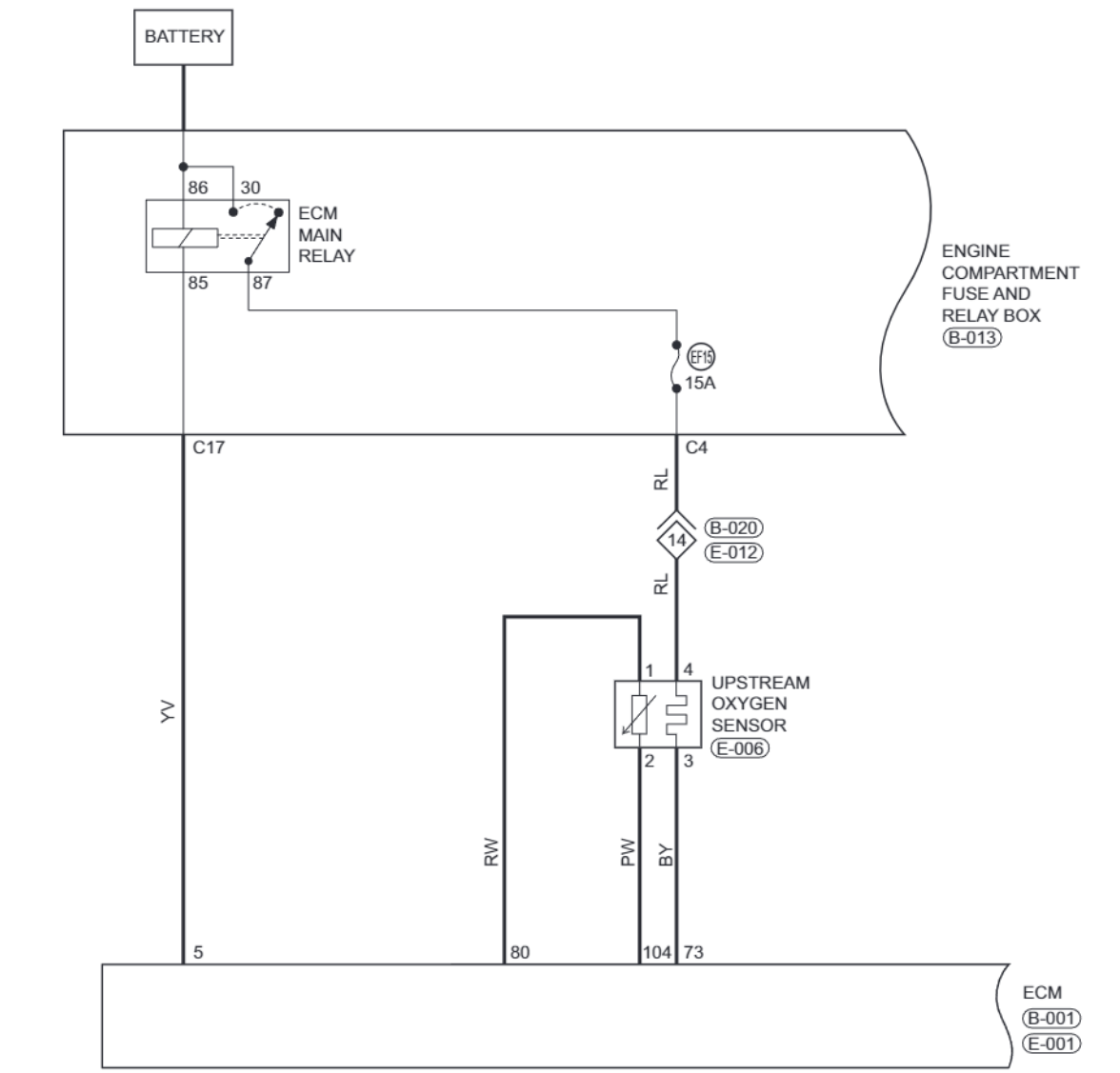
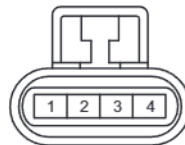
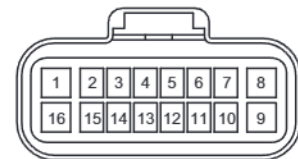
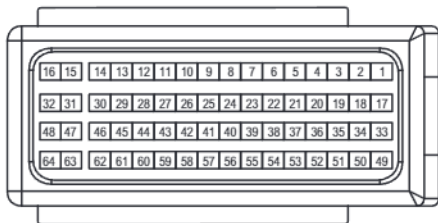
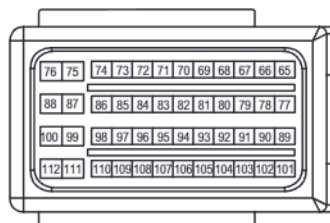
NG**Replace ECM****OK**

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

06

DTC	P0130-00	O2 Sensor Circ. Malfunction (Upstream of the Catalyzer)
DTC	P0131-16	O2 Sensor Circ. Low Voltage (Upstream of the Catalyzer)
DTC	P0132-17	O2 Sensor Circ. High Voltage (Upstream of the Catalyzer)
DTC	P0134-00	O2 Sensor Circ. No Activity Detected (Upstream of the Catalyzer)

(B-013)
W(E-006)
B(B-020)
B(B-001)
B(E-001)
B

EA19060090

DTC Code	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 - ECM
P0131-16	O2 Sensor Circ. Low Voltage (Upstream of the Catalyzer)		
P0132-17	O2 Sensor Circ. High Voltage (Upstream of the Catalyzer)		
P0134-00	O2 Sensor Circ. No Activity Detected (Upstream of the Catalyzer)		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

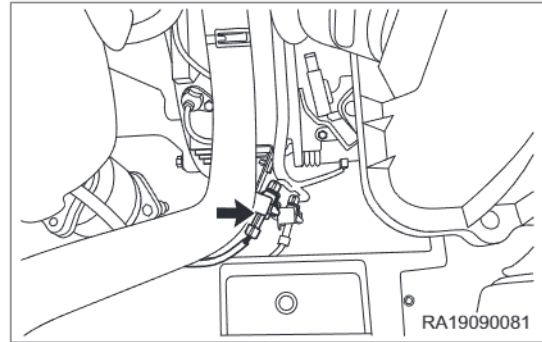
OK

2 Check upstream oxygen sensor connector

- Disconnect the upstream oxygen connector E-006.
- Check the upstream oxygen sensor connector.

NG

Repair or replace connector



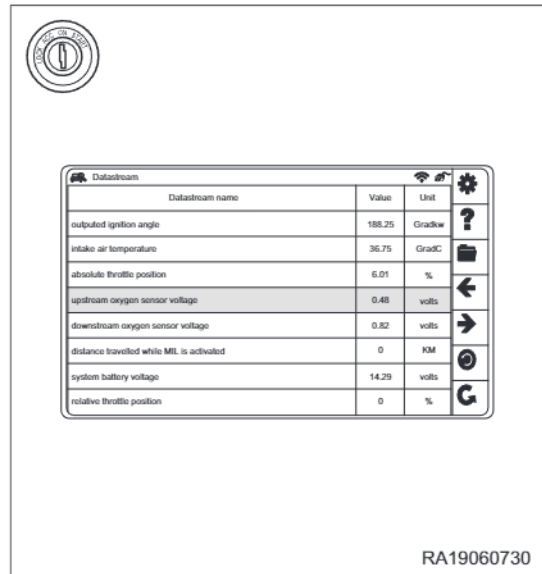
OK

06

3 Check upstream oxygen sensor signal

- Connect the upstream oxygen connector E-006.
- Turn the ignition switch to ON, start the engine and idle it for about 3 minutes.
- Using the diagnostic tester, measure the upstream oxygen sensor signal voltage, or using the multimeter, measure the voltage between terminals 2 and 1 of the connector E-006.

Multimeter Connection Terminal	Condition	Specified Condition
E-006 (2) - E-006 (1)	Engine running	Fluctuates fast between 0.1 and 0.9 V (when operating temperature is 350°C)



OK

Go to step 8

NG

4 Check upstream oxygen sensor signal circuit

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Disconnect the upstream oxygen connector E-006.
- Check the wire harness between upstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-006 (2) - E-001 (104)	Always	Continuity

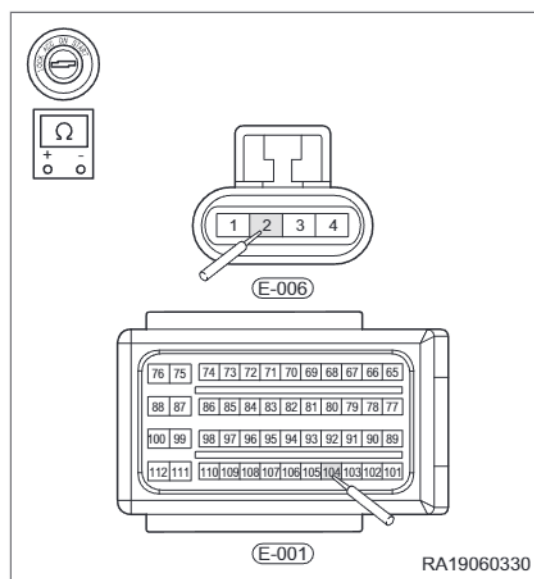
Check for Short

Multimeter Connection	Condition	Specified Condition
E-006 (2) or E-001 (104) - Body ground	Always	No continuity
E-006 (2) or E-001 (104) - Battery positive	Always	No continuity

NG

Replace wire harness or connector
(upstream oxygen sensor - ECM)

OK



5 Check upstream oxygen sensor ground circuit

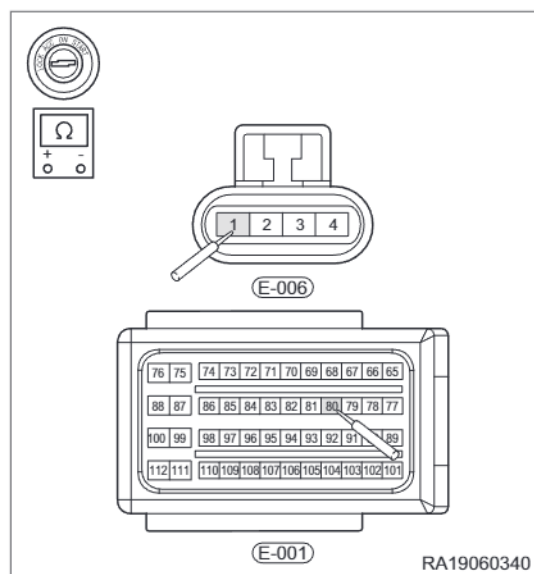
- Check the wire harness between upstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-006 (1) - E-001 (80)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-006 (1) or E-001 (80) - Body ground	Always	No continuity



Multimeter Connection	Condition	Specified Condition
E-006 (1) or E-001 (80) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (upstream oxygen sensor - ECM)

OK

6

Check upstream oxygen sensor

06

- Remove the upstream oxygen sensor.
- Check the upstream oxygen sensor for the following problems.
 - Moisture enters the internal of sensor, temperature changes greatly, and probe is broken.
 - Oxygen sensor is "poisoned" (Pb, S, Br, Si).

NG

Replace upstream oxygen sensor

OK

7

Check for DTCs

- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0130-00, P0131-16, P0132-17 or P0134-00 still exists.

NG

Replace ECM

OK

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

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 Code	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 - ECM
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)		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1

Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

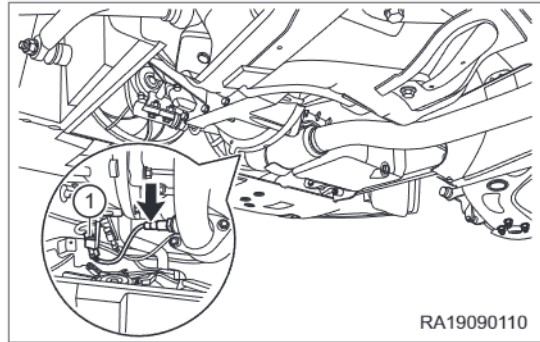
OK

2 Check downstream oxygen sensor connector

- Disconnect the downstream oxygen connector E-008 (1).
- Check the downstream oxygen sensor connector.

NG

Repair or replace connector



RA19090110

OK

06

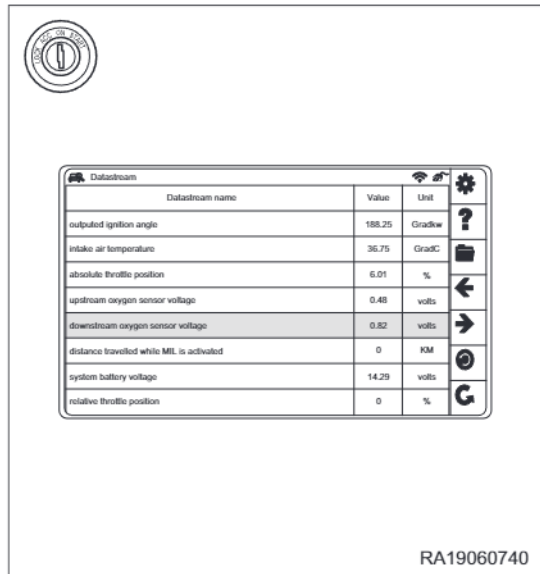
3 Check downstream oxygen sensor signal

- Connect the downstream oxygen connector E-008.
- Turn the ignition switch to ON, start the engine and idle it for about 3 minutes.
- Using the diagnostic tester, measure the downstream oxygen sensor signal voltage, or using the multimeter, measure the voltage between terminals 2 and 1 of the connector E-008.

Multimeter Connection	Condition	Specified Condition
E-008 (2) - E-008 (1)	Engine running	Fluctuates slightly at about 0.45 V

OK

Go to step 8



RA19060740

NG

4 Check downstream oxygen sensor signal circuit

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector B-001.
- Disconnect the downstream oxygen connector E-008.
- Check the wire harness between downstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-008 (2) - B-001 (21)	Always	Continuity

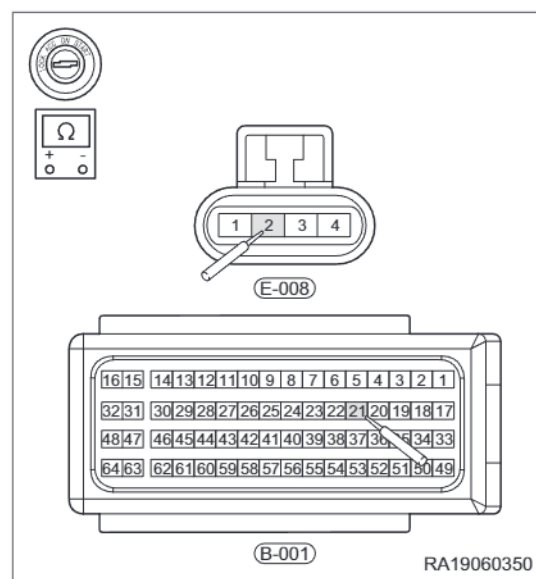
Check for Short

Multimeter Connection	Condition	Specified Condition
E-008 (2) or B-001 (21) - Body ground	Always	No continuity
E-008 (2) or B-001 (21) - Battery positive	Always	No continuity

NG

Replace wire harness or connector
(downstream oxygen sensor - ECM)

OK



5 Check downstream oxygen sensor ground circuit

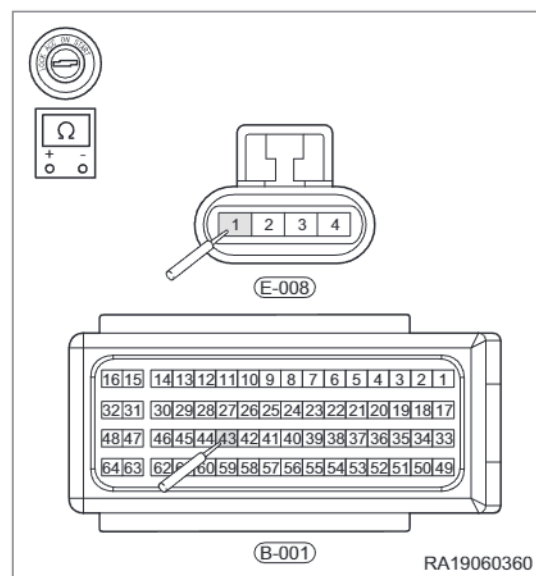
- Check the wire harness between downstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-008 (1) - B-001 (43)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-008 (1) or B-001 (43) - Body ground	Always	No continuity



Multimeter Connection	Condition	Specified Condition
E-008 (1) or B-001 (43) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (downstream oxygen sensor - ECM)

OK

6

Check downstream oxygen sensor

06

- Remove the downstream oxygen sensor.
- Check the upstream oxygen sensor for the following problems.
 - Moisture enters the internal of sensor, temperature changes greatly, and probe is broken.
 - Oxygen sensor is "poisoned" (Pb, S, Br, Si).

NG

Replace downstream oxygen sensor

OK

7

Check for DTCs

- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0136-00, P0137-16, P0138-17 or P0140-00 still exists.

NG

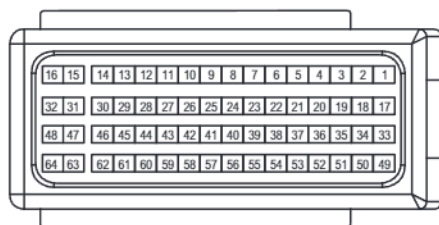
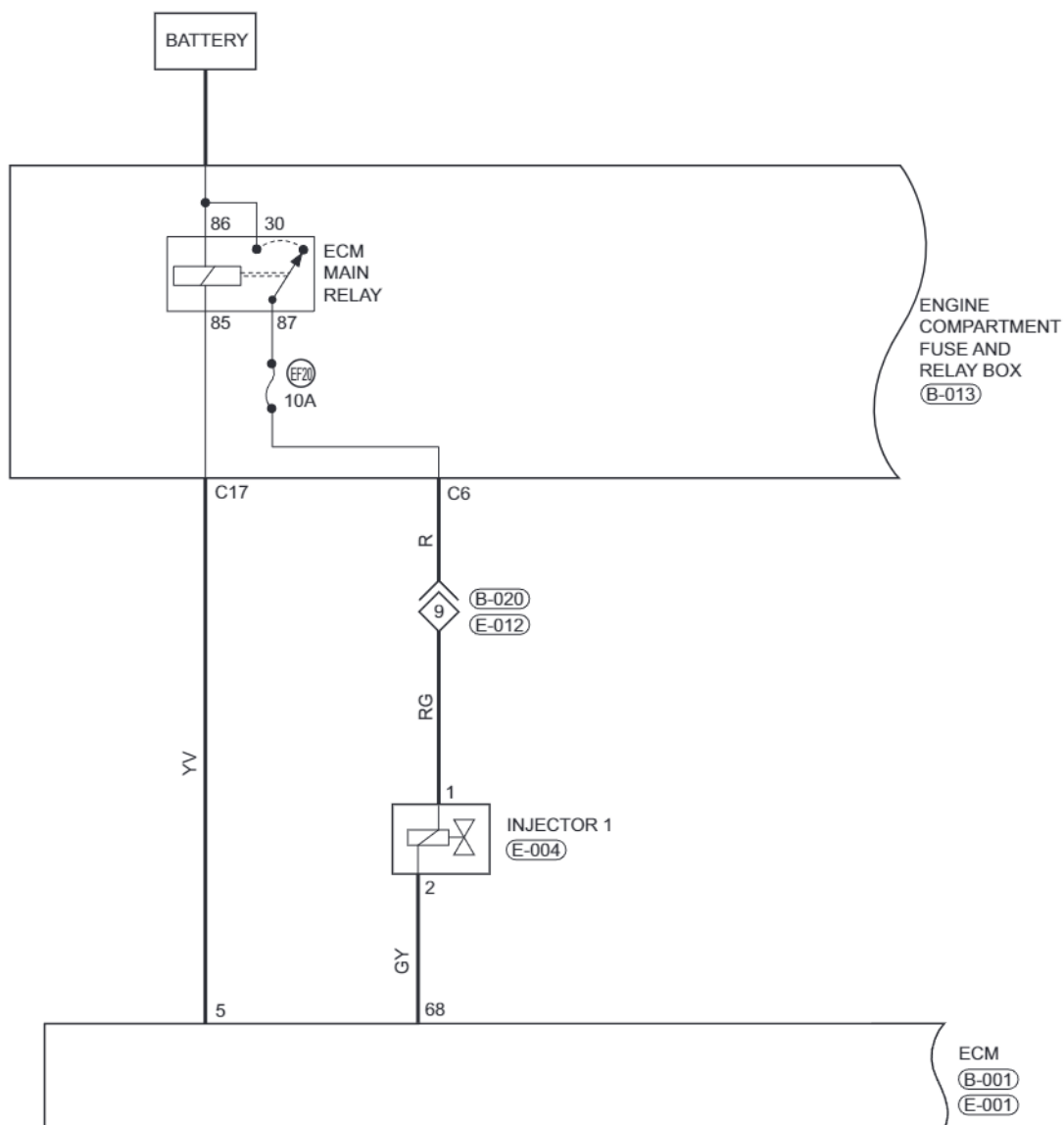
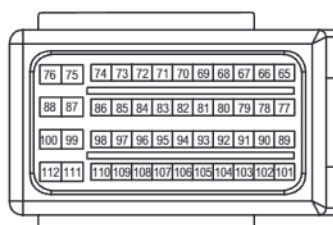
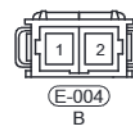
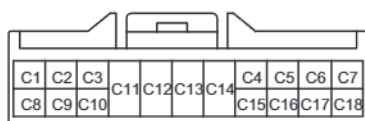
Replace ECM

OK

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0201-13	Cylinder 1- Injector Circuit
DTC	P0261-11	Cylinder 1- Injector Circuit Low
DTC	P0262-12	Cylinder 1- Injector Circuit High

(B-001)
B(E-001)
B(E-004)
B(B-013)
W(B-020)
B

EA19060140

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0201-13	Cylinder 1- Injector Circuit	Engine running	• Injector of cylinder 1 • Wire harness or connector • ECM
P0261-11	Cylinder 1- Injector Circuit Low		
P0262-12	Cylinder 1- Injector Circuit High		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

2 Check injector connector of cylinder 1

- Disconnect the injector connector E-004 of cylinder 1.
- Check the injector connector.

NG

Repair or replace connector

OK

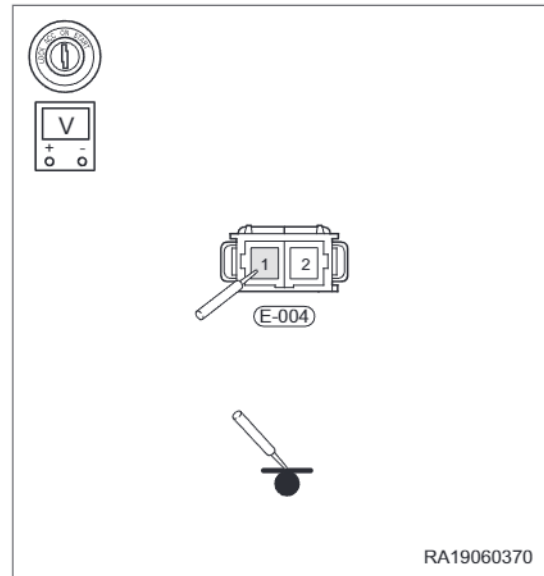
3 Check injector power supply voltage of cylinder 1

- Disconnect the injector connector E-004 of cylinder 1.
- Turn the ignition switch to ON.
- Check the voltage between injector connector terminal of cylinder 1 and body ground.

Multimeter Connection	Condition	Specified Condition
E-004 (1) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 5



RA19060370

NG

4 Check injector power supply circuit of cylinder 1

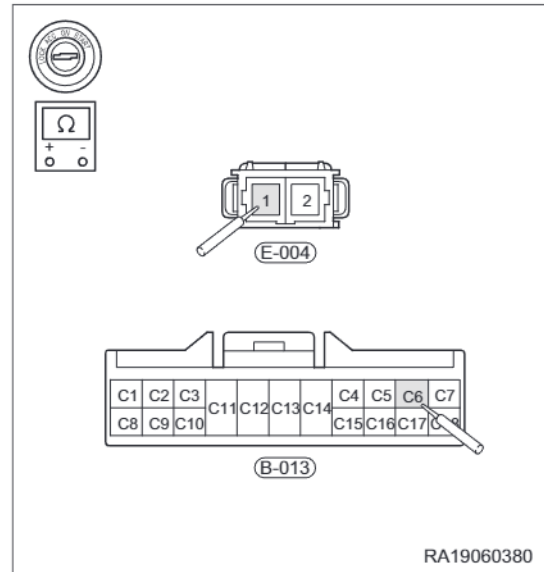
- Turn the ignition switch to LOCK.
- Check the main fuse EF20 and main relay.
- Disconnect the engine compartment fuse and relay box connector B-013.
- Check the wire harness between injector connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-004 (1) - B-013 (C6)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-004 (1) or B-013 (C6) - Body ground	Always	No continuity
E-004 (1) or B-013 (C6) - Battery positive	Always	No continuity



RA19060380

06

NG

Repair or replace wire harness or connector (injector of cylinder 1 - engine compartment fuse and relay box)

OK

5 Check injector control circuit of cylinder 1

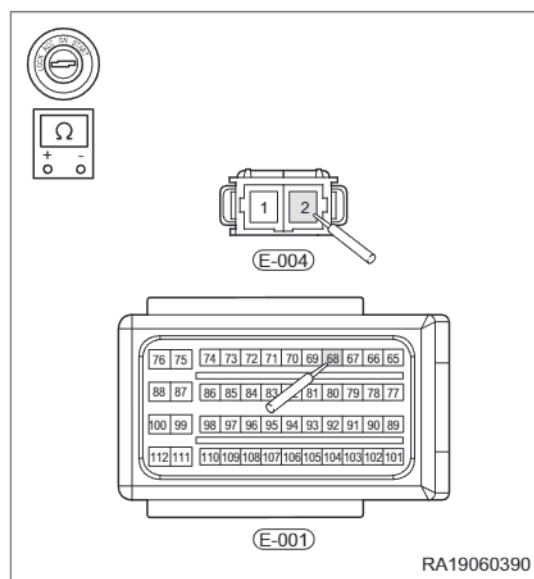
- Disconnect the ECM connector E-001.
- Check the wire harness between injector connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-004 (2) - E-001 (68)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-004 (2) or E-001 (68) - Body ground	Always	No continuity
E-004 (2) or E-001 (68) - Battery positive	Always	No continuity



NG

Repair or replace wire harness or connector (injector of cylinder 1 - ECM)

OK

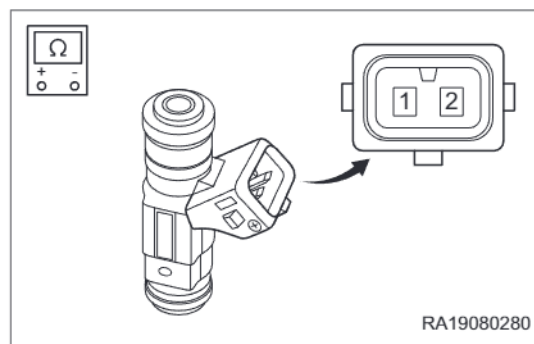
6 Check injector of cylinder 1

- Check the resistance of injector of cylinder 1.

Multimeter Connection	Specified Condition
1 - 2	11 - 16 Ω (at 20°C)

NG

Replace injector of cylinder 1



OK

7**Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0201-13, P0261-11 or P0262-1 still exists.

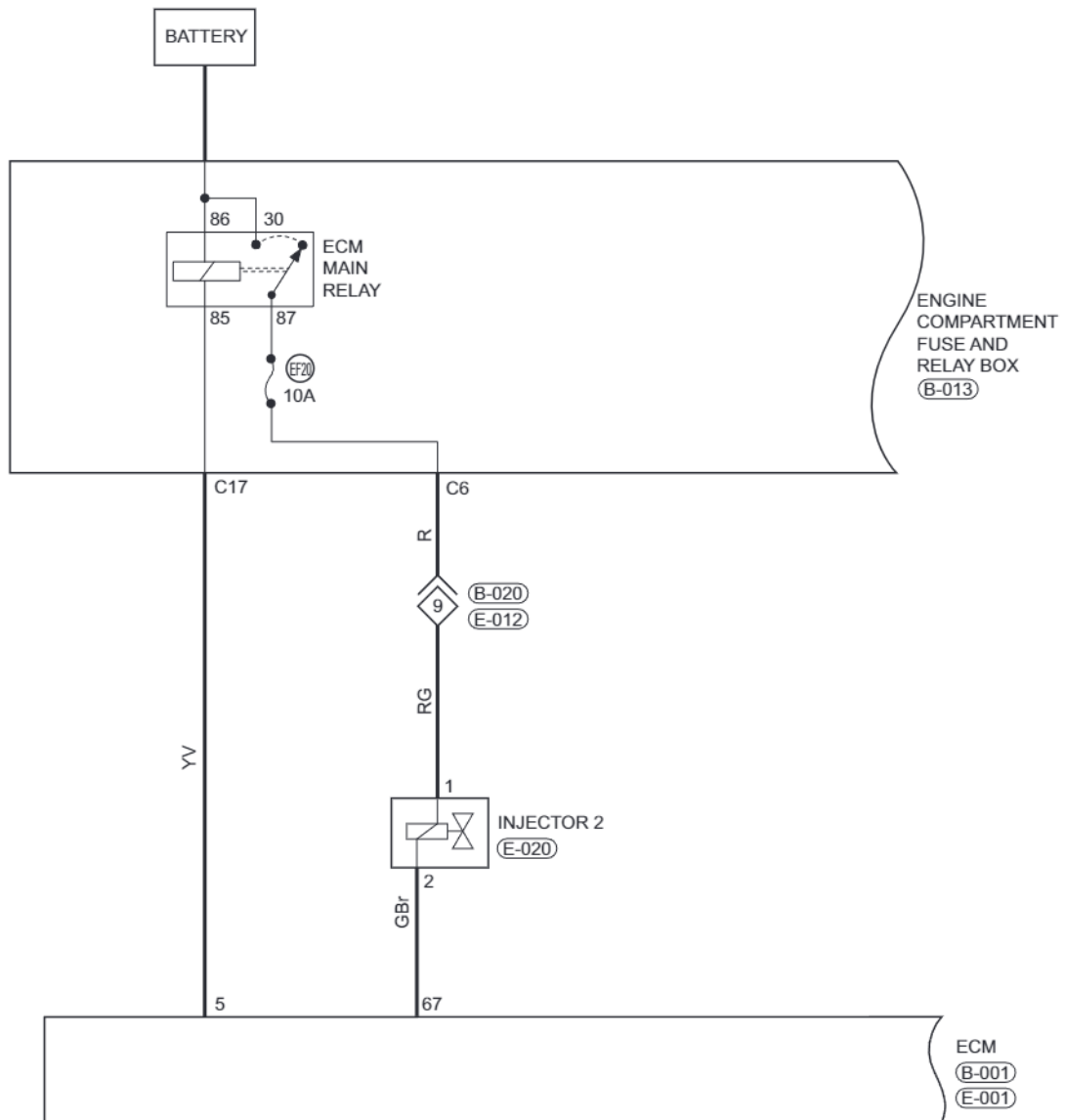
NG**Replace ECM****OK**

System is operating normally.

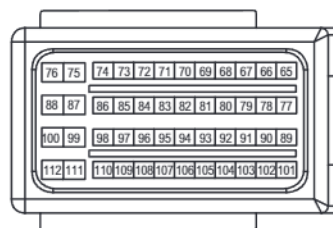
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

06

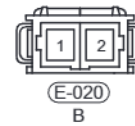
DTC	P0202-13	Cylinder 2- Injector Circuit
DTC	P0264-11	Cylinder 2- Injector Circuit Low
DTC	P0265-12	Cylinder 2- Injector Circuit High



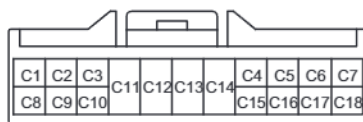
(B-001)
B



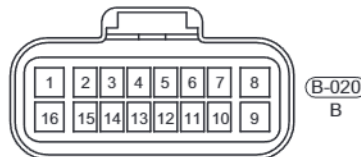
(E-001)
B



(E-020)
B



(B-013)
W



(B-020)
B

EA19060150

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0202-13	Cylinder 2- Injector Circuit	Engine running	• Injector of cylinder 2 • Wire harness or connector • ECM
P0264-11	Cylinder 2- Injector Circuit Low		
P0265-12	Cylinder 2- Injector Circuit High		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

2 Check injector connector of cylinder 2

- Disconnect the injector connector E-020 of cylinder 2.
- Check the injector connector.

NG

Repair or replace connector

OK

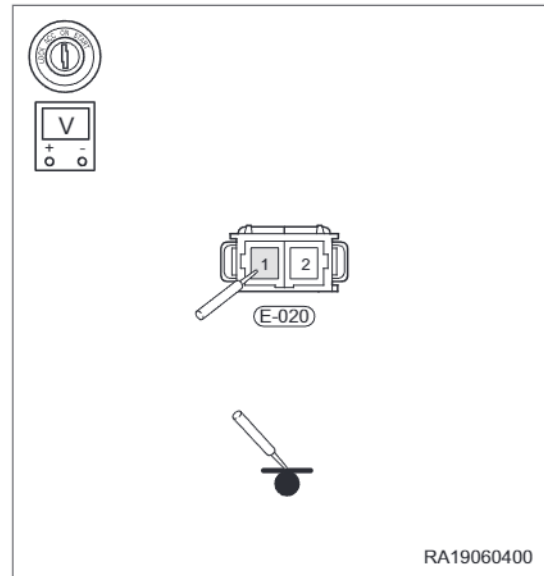
3 Check injector power supply voltage of cylinder 2

- Disconnect the injector connector E-020 of cylinder 2.
- Turn the ignition switch to ON.
- Check the voltage between injector connector terminal of cylinder 2 and body ground.

Multimeter Connection	Condition	Specified Condition
E-020 (1) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 5



RA19060400

NG

4 Check injector power supply circuit of cylinder 2

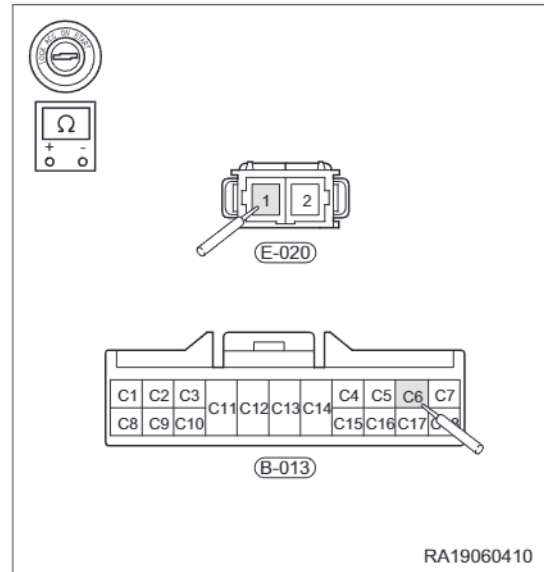
- Turn the ignition switch to LOCK.
- Check the main fuse EF20 and main relay.
- Disconnect the engine compartment fuse and relay box connector B-013.
- Check the wire harness between injector connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-020 (1) - B-013 (C6)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-020 (1) or B-013 (C6) - Body ground	Always	No continuity
E-020 (1) or B-013 (C6) - Battery positive	Always	No continuity



RA19060410

06

NG

Repair or replace wire harness or connector (injector of cylinder 2 - engine compartment fuse and relay box)

OK

5 Check injector control circuit of cylinder 2

- Disconnect the ECM connector E-001.
- Check the wire harness between injector connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-020 (2) - E-001 (67)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-020 (2) or E-001 (67) - Body ground	Always	No continuity
E-020 (2) or E-001 (67) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (injector of cylinder 2 - ECM)

OK

6 Check injector of cylinder 2

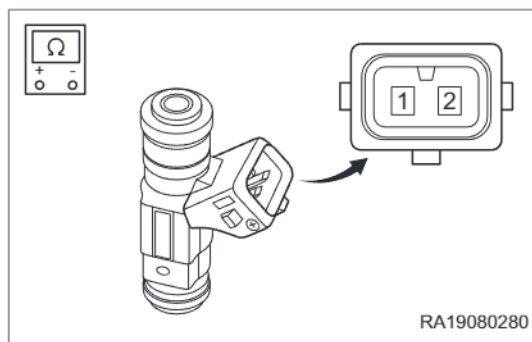
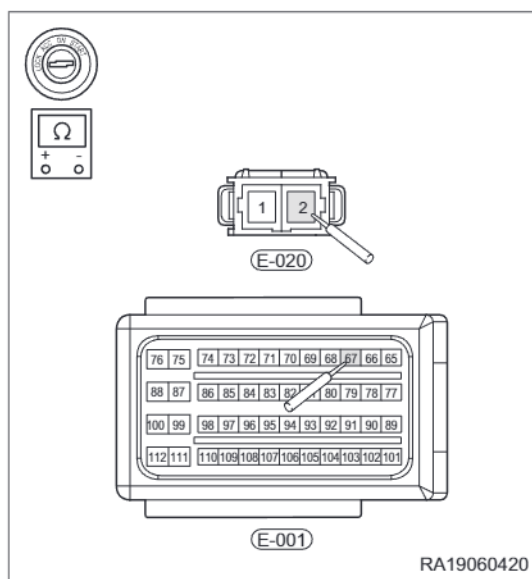
- Check the resistance of injector of cylinder 2.

Multimeter Connection	Specified Condition
1 - 2	11 - 16 Ω (at 20°C)

NG

Replace injector of cylinder 2

OK



7**Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0202-13, P0264-11 or P0265-12 still exists.

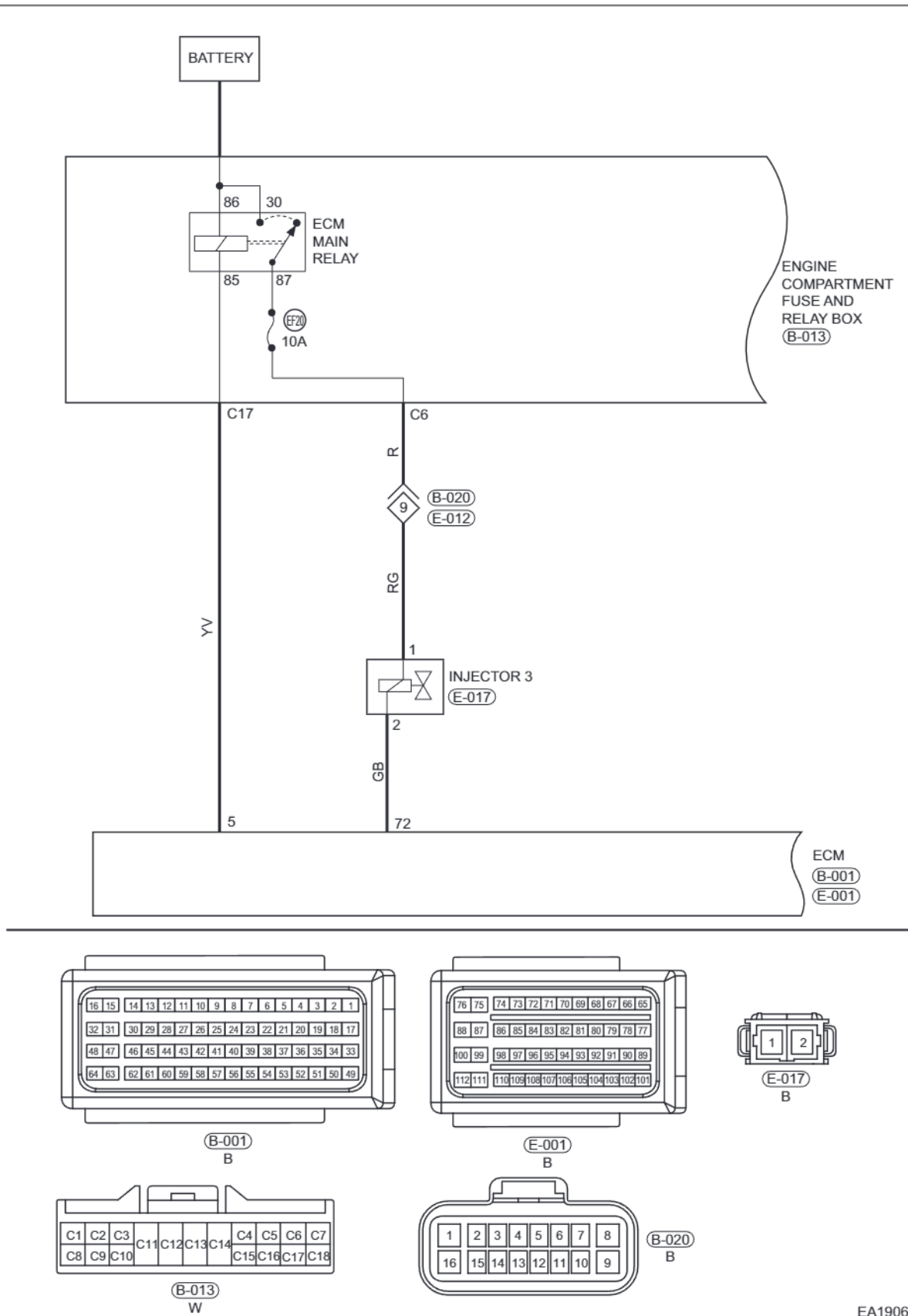
NG**Replace ECM****OK**

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

06

DTC	P0203-13	Cylinder 3- Injector Circuit
DTC	P0267-11	Cylinder 3- Injector Circuit Low
DTC	P0268-12	Cylinder 3- Injector Circuit High



EA19060160

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0203-13	Cylinder 3- Injector Circuit	Engine running	• Injector of cylinder 3 • Wire harness or connector • ECM
P0267-11	Cylinder 3- Injector Circuit Low		
P0268-12	Cylinder 3- Injector Circuit High		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

2 Check injector connector of cylinder 3

- Disconnect the injector connector E-017 of cylinder 3.
- Check the injector connector.

NG

Repair or replace connector

OK

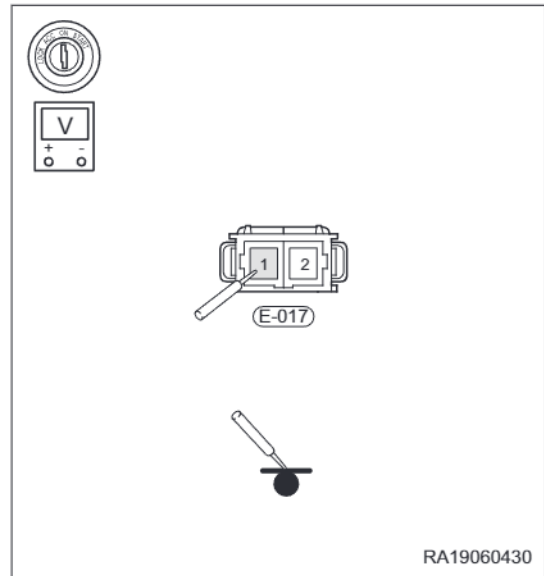
3 Check injector power supply voltage of cylinder 3

- Disconnect the injector connector E-017 of cylinder 3.
- Turn the ignition switch to ON.
- Check the voltage between injector connector terminal of cylinder 3 and body ground.

Multimeter Connection	Condition	Specified Condition
E-017 (1) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 5



RA19060430

NG

4 Check injector power supply circuit of cylinder 3

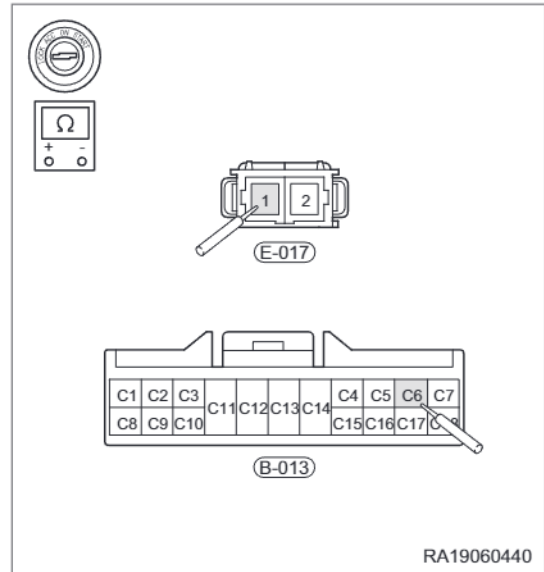
- Turn the ignition switch to LOCK.
- Check the main fuse EF20 and main relay.
- Disconnect the engine compartment fuse and relay box connector B-013.
- Check the wire harness between injector connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-017 (1) - B-013 (C6)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-017 (1) or B-013 (C6) - Body ground	Always	No continuity
E-017 (1) or B-013 (C6) - Battery positive	Always	No continuity



RA19060440

06

NG

Repair or replace wire harness or connector (injector of cylinder 3 - engine compartment fuse and relay box)

OK

5 Check injector control circuit of cylinder 3

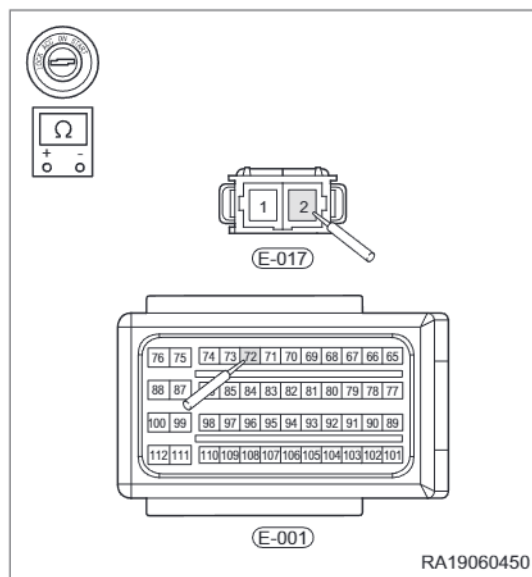
- Disconnect the ECM connector E-001.
- Check the wire harness between injector connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-017 (2) - E-001 (72)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-017 (2) or E-001 (72) - Body ground	Always	No continuity
E-017 (2) or E-001 (72) - Battery positive	Always	No continuity



NG

Repair or replace wire harness or connector (injector of cylinder 3 - ECM)

OK

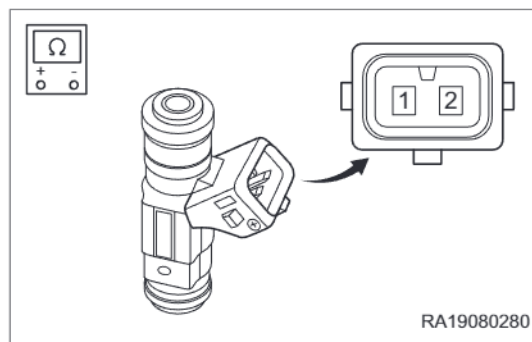
6 Check injector of cylinder 3

- Check the resistance of injector of cylinder 3.

Multimeter Connection	Specified Condition
1 - 2	11 - 16 Ω (at 20°C)

NG

Replace injector of cylinder 3



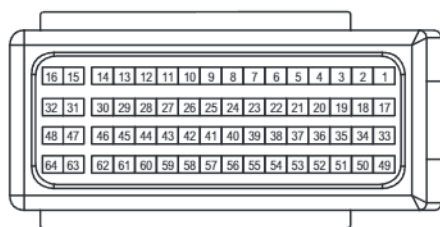
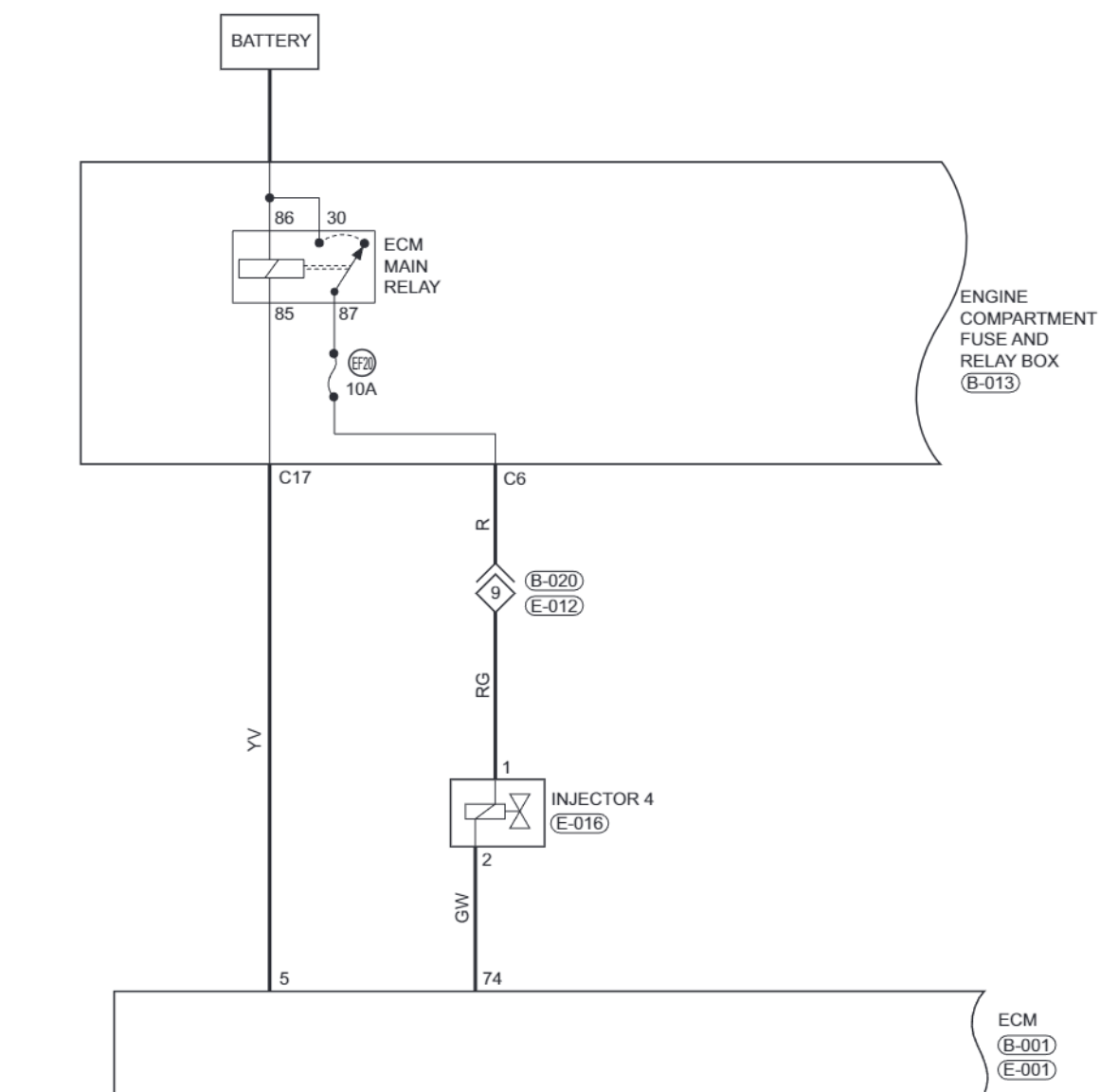
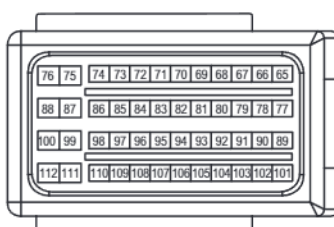
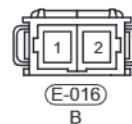
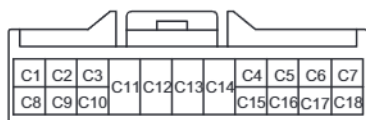
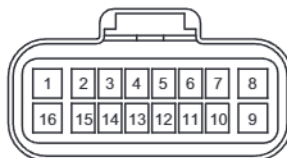
OK

7**Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0203-13, P0267-11 or P0268-12 still exists.

NG**Replace ECM****OK****System is operating normally.****Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.****06**

DTC	P0204-13	Cylinder 4- Injector Circuit
DTC	P0270-11	Cylinder 4- Injector Circuit Low
DTC	P0271-12	Cylinder 4- Injector Circuit High

(B-001)
B(E-001)
B(E-016)
B(B-013)
W(B-020)
B

EA19060170

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0204-13	Cylinder 4- Injector Circuit	Engine running	• Injector of cylinder 4 • Wire harness or connector • ECM
P0270-11	Cylinder 4- Injector Circuit Low		
P0271-12	Cylinder 4- Injector Circuit High		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

2 Check injector connector of cylinder 4

- Disconnect the injector connector E-016 of cylinder 4.
- Check the injector connector.

NG

Repair or replace connector

OK

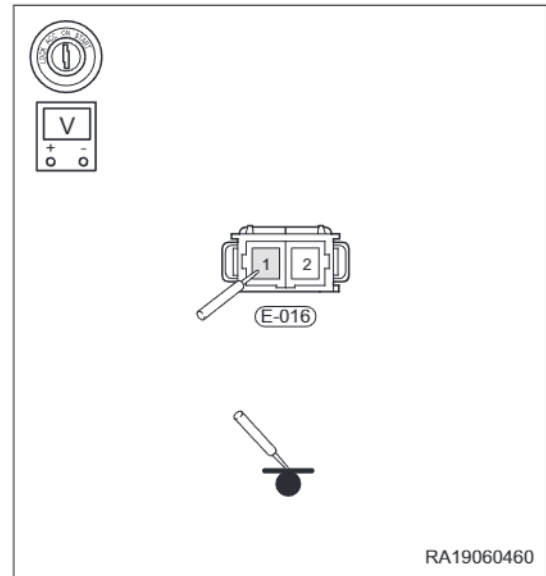
3 Check injector power supply voltage of cylinder 4

- Disconnect the injector connector E-016 of cylinder 4.
- Turn the ignition switch to ON.
- Check the voltage between injector connector terminal of cylinder 4 and body ground.

Multimeter Connection	Condition	Specified Condition
E-016 (1) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 5



RA19060460

NG

4 Check injector power supply circuit of cylinder 4

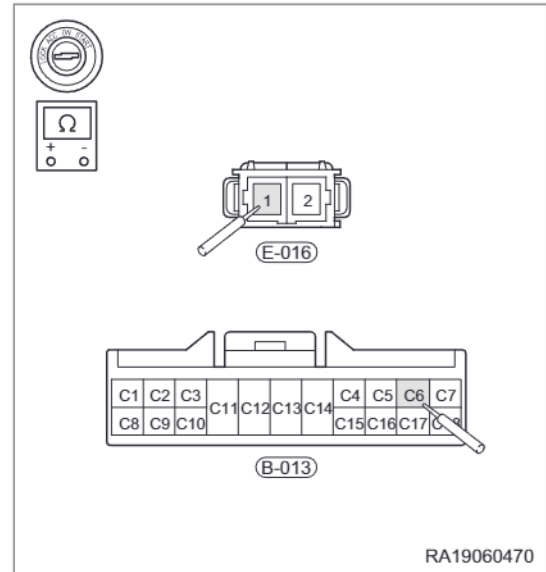
- Turn the ignition switch to LOCK.
- Check the main fuse EF20 and main relay.
- Disconnect the engine compartment fuse and relay box connector B-013.
- Check the wire harness between injector connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-016 (1) - B-013 (C6)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-016 (1) or B-013 (C6) - Body ground	Always	No continuity
E-016 (1) or B-013 (C6) - Battery positive	Always	No continuity



RA19060470

06

NG

Repair or replace wire harness or connector (injector of cylinder 4 - engine compartment fuse and relay box)

OK

5 Check injector control circuit of cylinder 4

- Disconnect the ECM connector E-001.
- Check the wire harness between injector connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-016 (2) - E-001 (74)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-016 (2) or E-001 (74) - Body ground	Always	No continuity
E-016 (2) or E-001 (74) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (injector of cylinder 4 - ECM)

OK

6 Check injector of cylinder 4

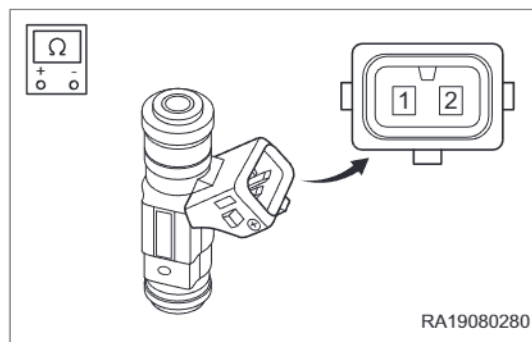
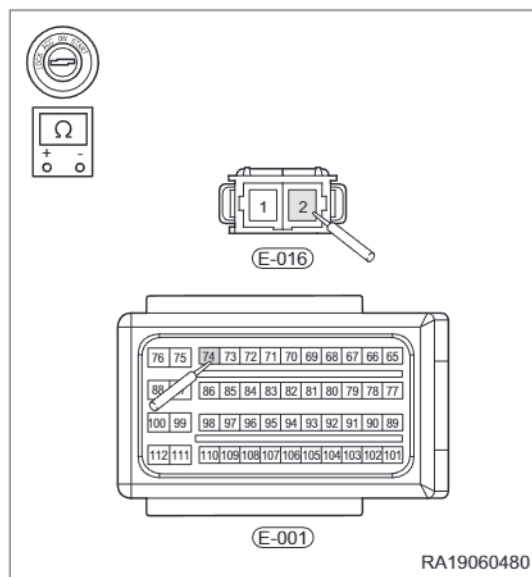
- Check the resistance of injector of cylinder 4.

Multimeter Connection	Specified Condition
1 - 2	11 - 16 Ω (at 20°C)

NG

Replace injector of cylinder 4

OK



7**Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0204-13, P0270-11 or P0271-12 still exists.

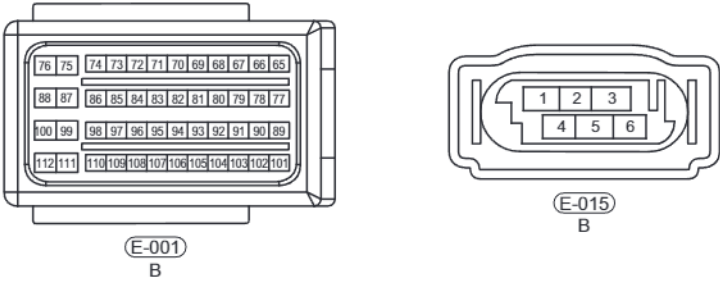
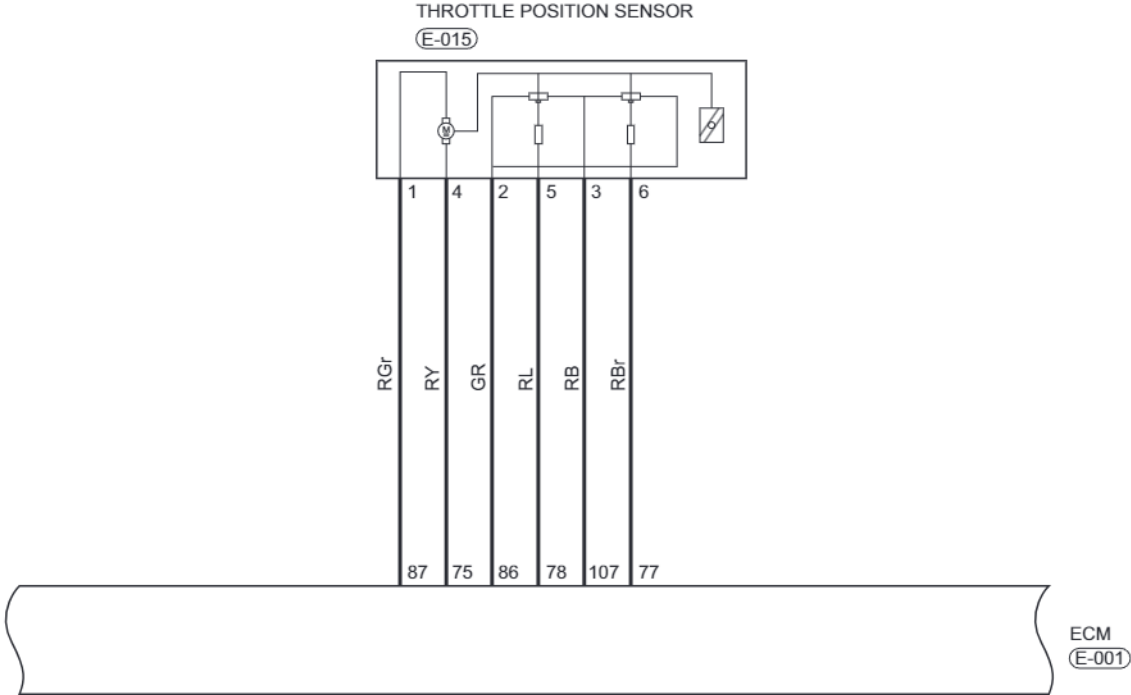
NG**Replace ECM****OK**

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

06

DTC	P0221-29	Throttle/Pedal Position Sensor/Switch B Range/ Performance
DTC	P0222-16	Throttle/Pedal Position Sensor/Switch B Low Input
DTC	P0223-17	Throttle/Pedal Position Sensor/Switch B High Input



EA19060130

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0221-29	Throttle/Pedal Position Sensor/Switch B Range/Performance	Ignition switch ON Engine running	- Throttle position Sensor 2 - Wire harness or connector - ECM
P0222-16	Throttle/Pedal Position Sensor/Switch B Low Input		
P0223-17	Throttle/Pedal Position Sensor/Switch B High Input		

06

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure**1****Check ECM ground point**

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

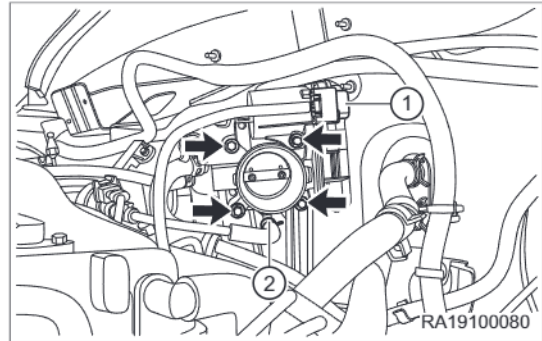
NG

Repair or replace ground wire harness or ground point

OK

2 Check throttle position sensor connector

- Disconnect the throttle position sensor connector E-015 (1).
- Check the throttle position sensor connector.

NG**Repair or replace connector****OK****06****3 Check throttle position sensor 2 signal voltage**

- Connect the throttle position sensor connector E-015.
- Turn the ignition switch to ON.
- Using the diagnostic tester, check the throttle position sensor 2 signal voltage.

Condition	Standard Value (V)
Accelerator pedal released	4.21
Accelerator pedal depressed	0.75

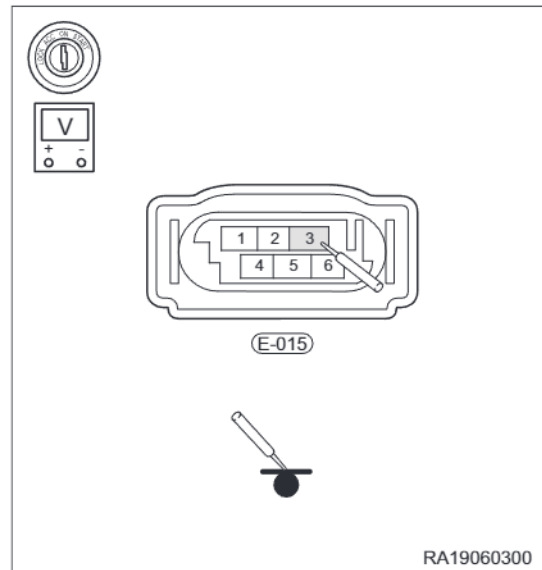
Datastream name	Value	Unit
multiplicative correction of the mixture adaptation	1.00	
Lambda controller output bank 2	0.00	
sensor voltage from throttle potentiometer 1	0.78	V
sensor voltage from throttle potentiometer 2	4.21	V
additive correction of the mixture adaptation	0.00	%
Voltage PWG potentiometer 1	0.99	V
Voltage PWG potentiometer 2	0.50	V
Doubled PWG potentiometer 2 voltage	1.00	V

RA19100071

OK**Go to step 8****NG****4 Check throttle position sensor power supply voltage**

- Turn the ignition switch to LOCK.
- Disconnect the throttle position sensor connector E-015.
- Turn the ignition switch to ON and check the voltage between throttle position sensor connector terminal and body ground.

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

OK**Go to step 6**

NG

5 Check throttle position sensor power supply circuit

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Check the wire harness between throttle position sensor connector terminals and ECM connector terminals.

Check for Open

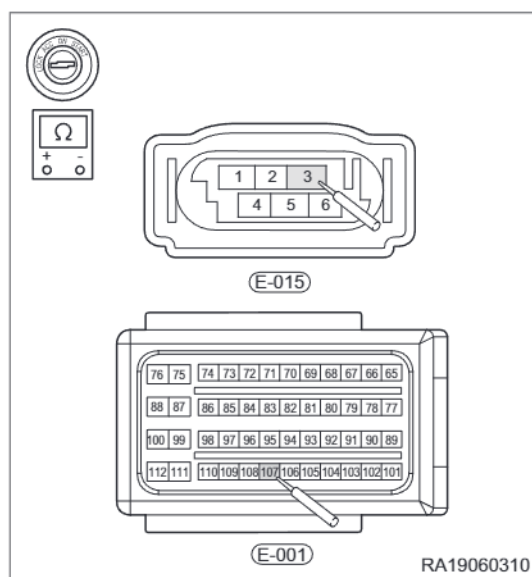
Multimeter Connection	Condition	Specified Condition
E-015 (3) - E-001 (107)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-015 (3) or E-001 (107) - Body ground	Always	No continuity
E-015 (3) or E-001 (107) - Battery positive	Always	No continuity

NG

Replace wire harness or connector
(throttle position sensor - ECM)



RA19060310

OK

6 Check throttle position sensor 2 signal circuit and ground circuit

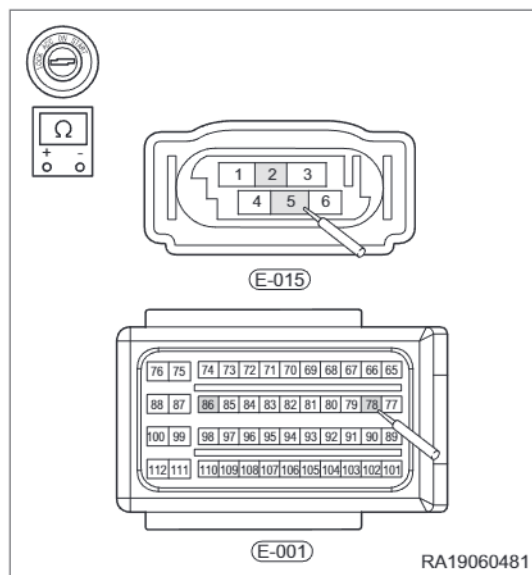
- Check the wire harness between throttle position sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-015 (5) - E-001 (78)	Always	Continuity
E-015 (2) - E-001 (86)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-015 (5) or E-001 (78) - Body ground	Always	No continuity



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Multimeter Connection	Condition	Specified Condition
E-015 (5) or E-001 (78) - Battery positive	Always	No continuity
E-015 (2) or E-001 (86) - Body ground	Always	No continuity
E-015 (2) or E-001 (86) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or
connector (throttle position sensor - ECM)

OK

06

7 Check throttle position sensor 2

- a. Check the resistance of throttle position sensor 2.

Multimeter Connection	Specified Condition
2 - 5	Resistance changes continuously when throttle valve is moved by hands.

NG

Replace electronic throttle

OK

8 Check for DTCs

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0221-29, P0222-16 or P0223-17 still exists.

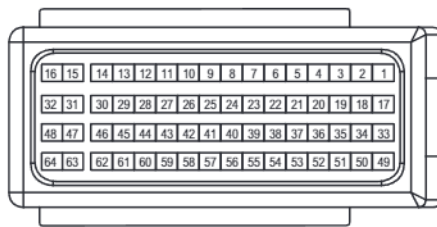
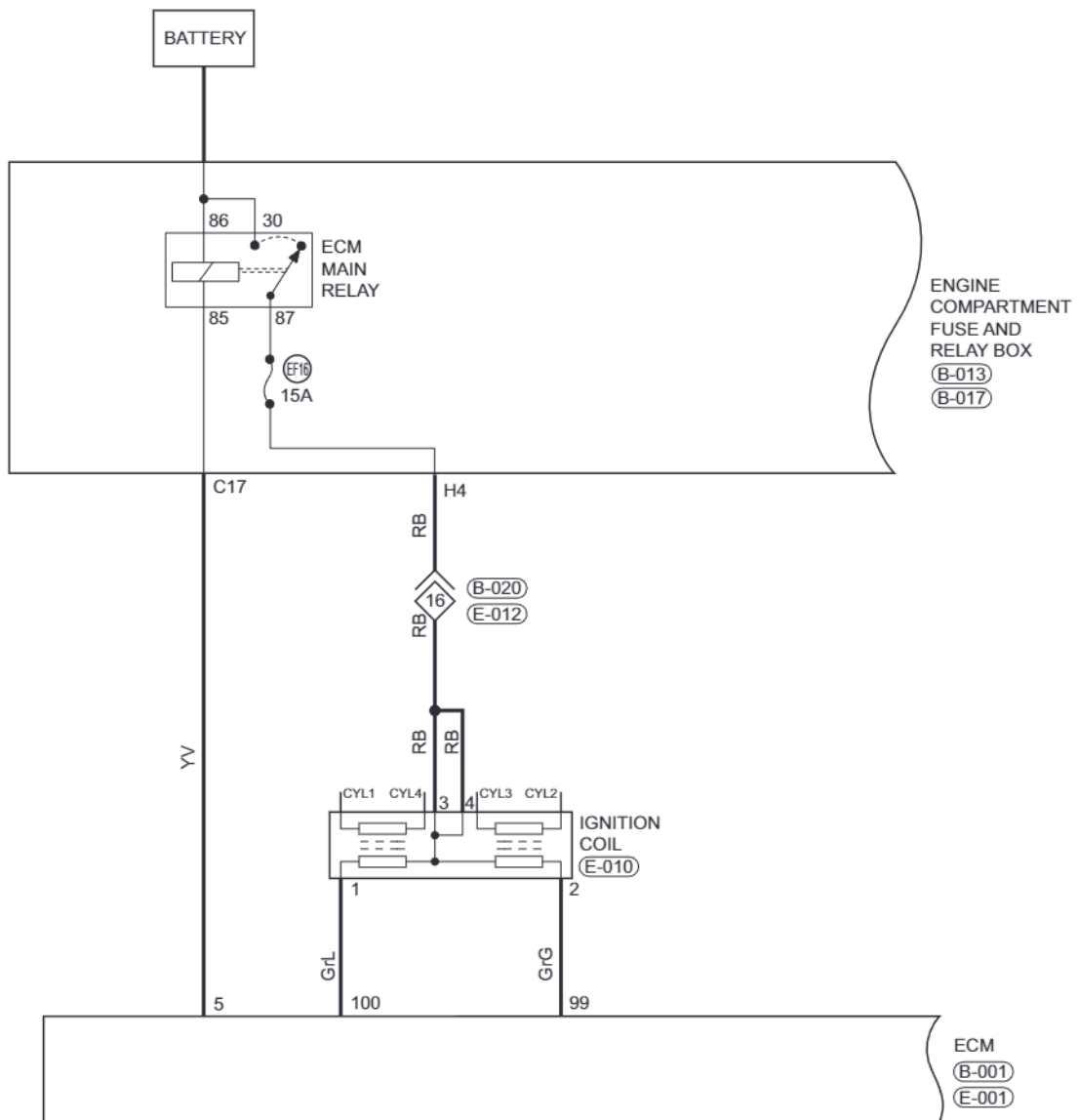
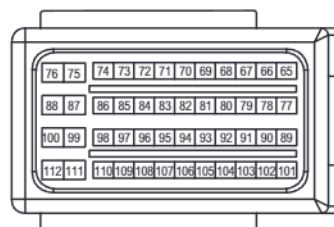
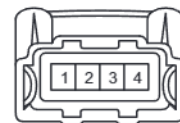
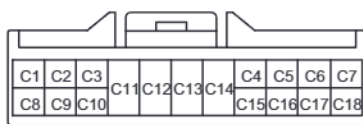
NG

Replace ECM

OK

System is operating normally.
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has
been repaired.

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	P0301-21	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	P0302-21	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	P0303-21	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	P0304-21	Cylinder 4 Misfire Detected (Over Emission Limit)
DTC	P0304-22	Cylinder 4 Misfire Detected (Harmful to Catalyst)
DTC	P0304-29	Cylinder 4 Misfire (During First Statistic Cycle)

(B-001)
B(E-001)
B(E-010)
B(B-013)
W(B-020)
B(B-017)
W

EA19060180

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0300-21	Random/Multiple Cylinder Misfire Detected (Over Emission Limit)	Engine running	• Ignition coil • Spark plug • Wire harness or connector • ECM
P0300-22	Random/Multiple Cylinder Misfire Detected (Harmful to Catalyst)		
P0300-29	Random/Multiple Cylinder Misfire Detected (During First Statistic Cycle)		
P0301-21	Cylinder 2 Misfire Detected (Over Emission Limit)		
P0301-22	Cylinder 2 Misfire Detected (Harmful to Catalyst)		
P0301-29	Cylinder 1 Misfire Detected (During First Statistic Cycle)		
P0302-21	Cylinder 1 Misfire Detected (Over Emission Limit)		
P0302-22	Cylinder 1 Misfire Detected (Harmful to Catalyst)		
P0302-29	Cylinder 2 Misfire Detected (During First Statistic Cycle)		
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)		
P0304-21	Cylinder 4 Misfire Detected (Over Emission Limit)		
P0304-22	Cylinder 4 Misfire Detected (Harmful to Catalyst)		
P0304-29	Cylinder 4 Misfire (During First Statistic Cycle)		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

06

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

2 Check ignition coil connector

- Turn the ignition switch to LOCK.
- Disconnect the ignition coil connector E-010.
- Check the ignition coil connector.

NG

Repair or replace connector

OK

3 Check spark plug of misfiring cylinder

- Remove the spark plug of misfiring cylinder.
- Check the spark plug for burns, cracks or deposits.
- Check the spark plug gap.

OK: 0.8 - 0.9 mm

NG

Clean or replace spark plug

OK

4 Check spark

- Connect the ignition coil connector.
- Connect the spark plug and ignition coil, and ground the spark plug housing.
- Start and run the engine for no more than 2 seconds, and check if spark is generated.

NG**Go to step 6****OK****5 Check compression of misfiring cylinder**

- Measure the compression of misfiring cylinder ([See page 07-17](#)).

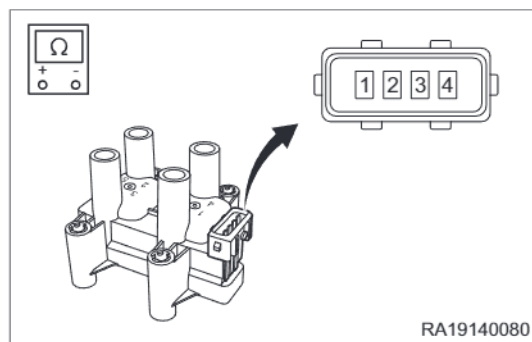
NG**Check engine to confirm cause of low compression****OK****Check injectors, valve clearance, intake system and fuel pressure, etc. of misfiring cylinder****6 Check spark of misfiring cylinder with a normally functioning spark plug**

- Replace the spark plug with a normally functioning one.
- Perform spark test.
 - Connect the ignition coil connector.
 - Connect the spark plug and the ignition coil, and ground the spark plug housing.
 - Start and run the engine for no more than 2 seconds, and check if spark is generated.

OK**Replace spark plug****NG****7 Check ignition coil**

- Check the resistance of primary winding of ignition coil.

Multimeter Connection	Condition	Specification (Ω)
Terminal 1 - Terminal 3	Normal temperature	0.50 - 0.64
Terminal 2 - Terminal 3	Normal temperature	0.50 - 0.64



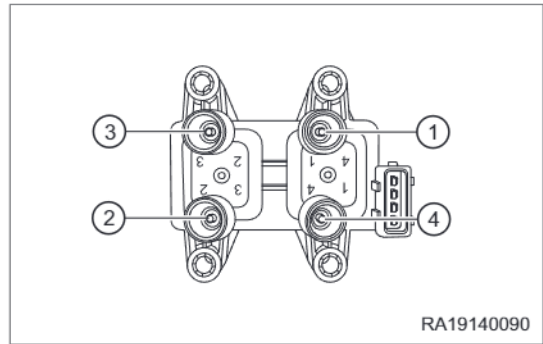
- b. Check the resistance of secondary winding of ignition coil.

Multimeter Connection	Condition	Specification (k Ω)
Post 1 - Post 4	Normal temperature	8.36 - 10.64
Post 2 - Post 3	Normal temperature	8.36 - 10.64

NG

Replace ignition coil

OK



8

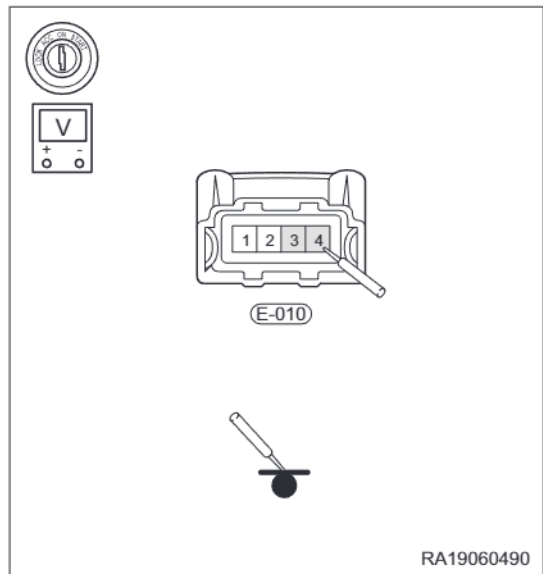
Check ignition coil power supply voltage

- a. Turn the ignition switch to ON.
b. Check the voltage between ignition coil connector terminals and body ground.

Multimeter Connection	Condition	Specified Condition
E-010 (3), E-010 (4) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 10



NG

06

9 Check ignition coil power supply circuit

- Turn the ignition switch to LOCK.
- Check the fuse EF16 and main relay.
- Check the wire harness between ignition coil connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-010 (3), E-010 (4) - B-017 (H4)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-010 (3), E-010 (4) or B-017 (H4) - Body ground	Always	No continuity
E-010 (3), E-010 (4) or B-017 (H4) - Battery positive	Always	No continuity

NG

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

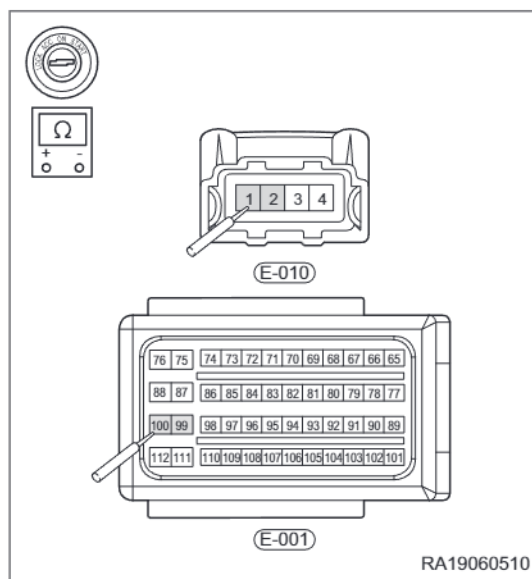
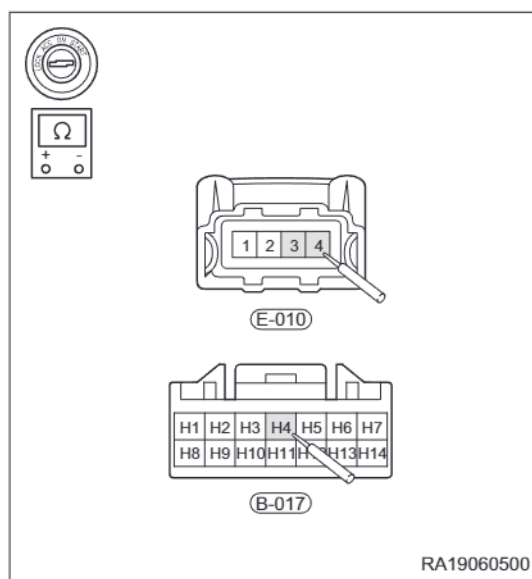
OK

10 Check ignition coil control circuit

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Check the wire harness between ignition coil connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-010 (1) - E-001 (100)	Always	Continuity
E-010 (2) - E-001 (99)		



Check for Short

Multimeter Connection	Condition	Specified Condition
E-010 (1) or E-001 (100) - Body ground	Always	No continuity
E-010 (1) or E-001 (100) - Battery positive	Always	No continuity
E-010 (2) or E-001 (99) - Body ground	Always	No continuity
E-010 (2) or E-001 (99) - Battery positive	Always	No continuity

NG

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

OK

11

Check for DTCs

- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0300-21, P0300-22, P0300-29, P0301-21, P0301-22, P0301-29, P0302-21, P0302-22, P0302-29, P0303-21, P0303-22, P0303-29, P0304-21, P0304-22 or P0304-29 still exists?

NG

Replace ECM

OK

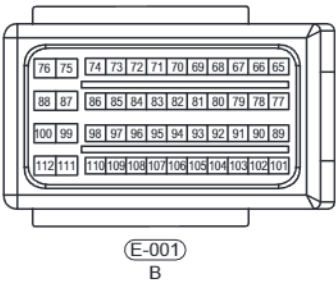
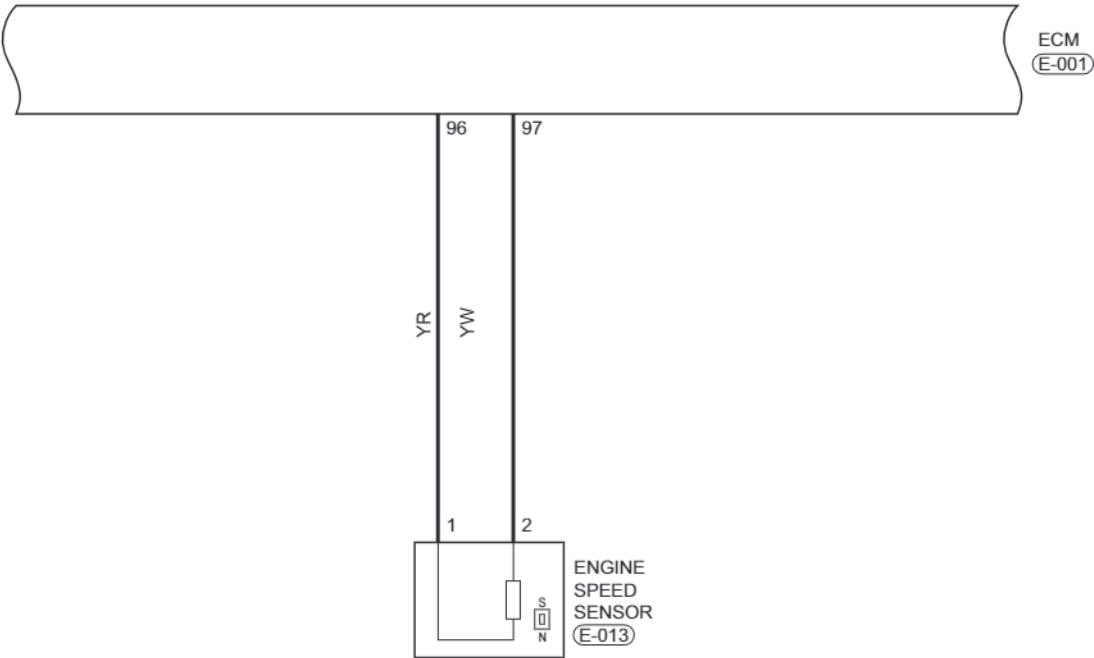
System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

06

DTC	P0322-00	EPM - Crankshaft Signal Fault
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06



EA19060190

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0322-00	EPM - Crankshaft Signal Fault	Engine running	- Engine speed sensor - Flywheel ring gear - Wire harness or connector - ECM

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

06

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

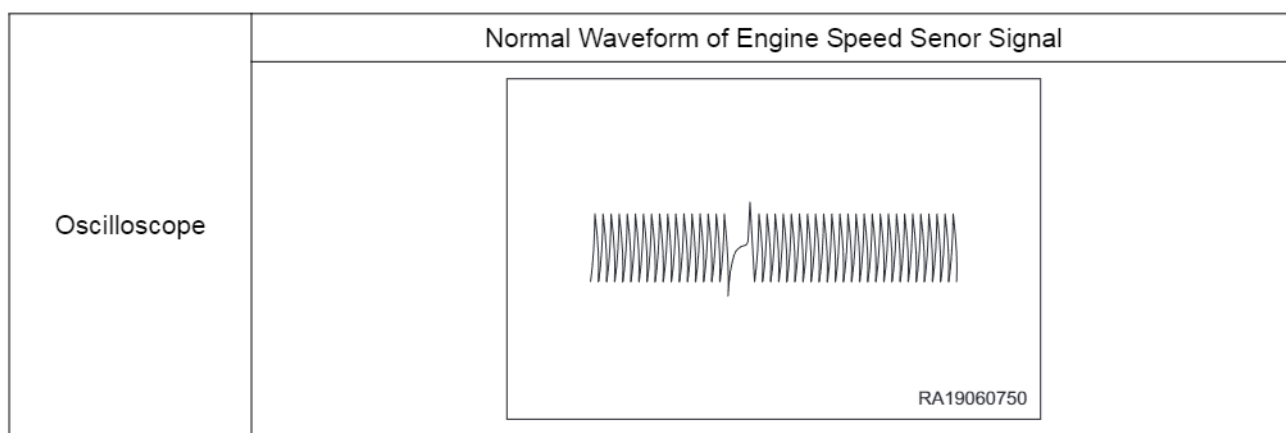
NG

Repair or replace ground wire harness or ground point

OK

2 Check engine speed sensor signal waveform

- Turn the ignition switch to ON, start the engine and observe the signal waveform of engine speed sensor with an oscilloscope.



06

OK

Go to step 9

NG

3

Check engine speed sensor connector

- Turn the ignition switch to LOCK.
- Disconnect the engine speed sensor connector E-013.
- Check the engine speed sensor connector.

NG

Repair or replace engine speed sensor connector

OK

4

Check installation of engine speed sensor

- Remove the engine speed sensor.
- Check and clean the engine speed sensor and installation area, and check for damage, foreign matter or excessive movement, etc. that cause signal incorrectness.

NG

Clean or replace engine speed sensor

OK

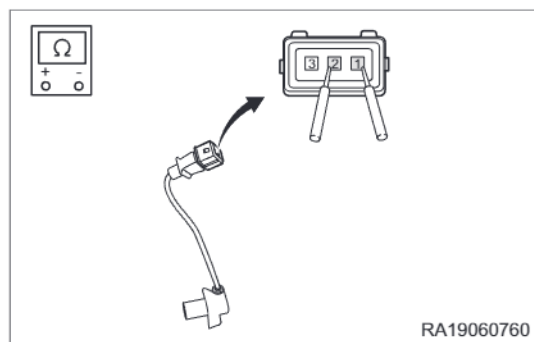
5

Check resistance of engine speed sensor

- Check the resistance between engine speed sensor terminals 1 and 2.
Normal resistance: $860\ \Omega \pm 20\%$ (at normal temperature)

NG

Replace engine speed sensor



RA19060760

OK

6 Check engine speed sensor circuit

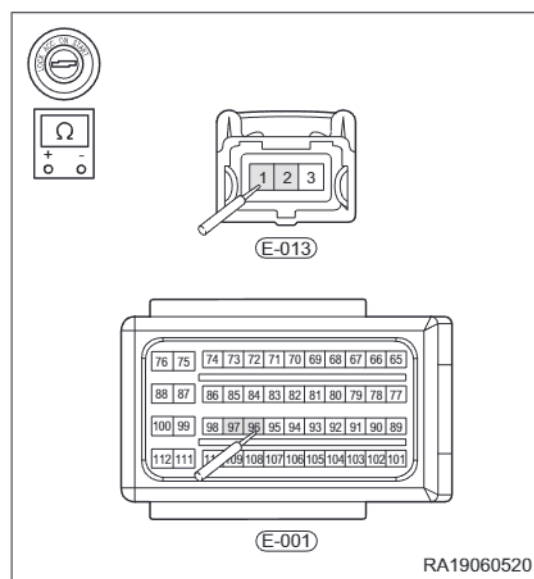
- Disconnect the engine speed sensor connector E-013.
- Disconnect the ECM connector E-001.
- Check the wire harness between engine speed sensor connector terminals and body ground.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-013 (1) - E-001 (96)	Always	Continuity
E-013 (2) - E-001 (97)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-013 (1) or E-001 (96) - Body ground	Always	No continuity
E-013 (1) or E-001 (96) - Battery positive	Always	No continuity
E-013 (2) or E-001 (97) - Body ground	Always	No continuity
E-013 (2) or E-001 (97) - Battery positive	Always	No continuity



06

NG

Replace wire harness or connector
(engine speed sensor - ECM)

OK

7 Install a normal engine speed sensor and observe signal waveform

- Install a normal engine speed sensor.
- Connect the engine speed sensor connector.
- Turn the ignition switch to ON, start the engine and observe the signal waveform of the engine speed sensor with an oscilloscope.

OK

Replace engine speed sensor

NG

8 Check flywheel ring gear

- a. Turn the crankshaft and check the crankshaft and flywheel ring gear for damage and foreign matter, etc. that cause signal incorrectness.

NG

Remove debris and clean flywheel ring gear or replace flywheel ([See page 07-55](#))

OK**9 Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0322 still exists.

NG

Replace ECM

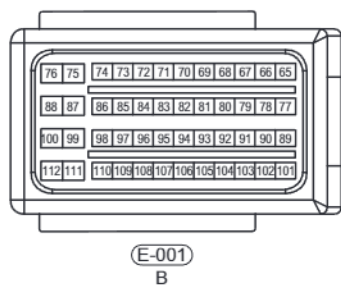
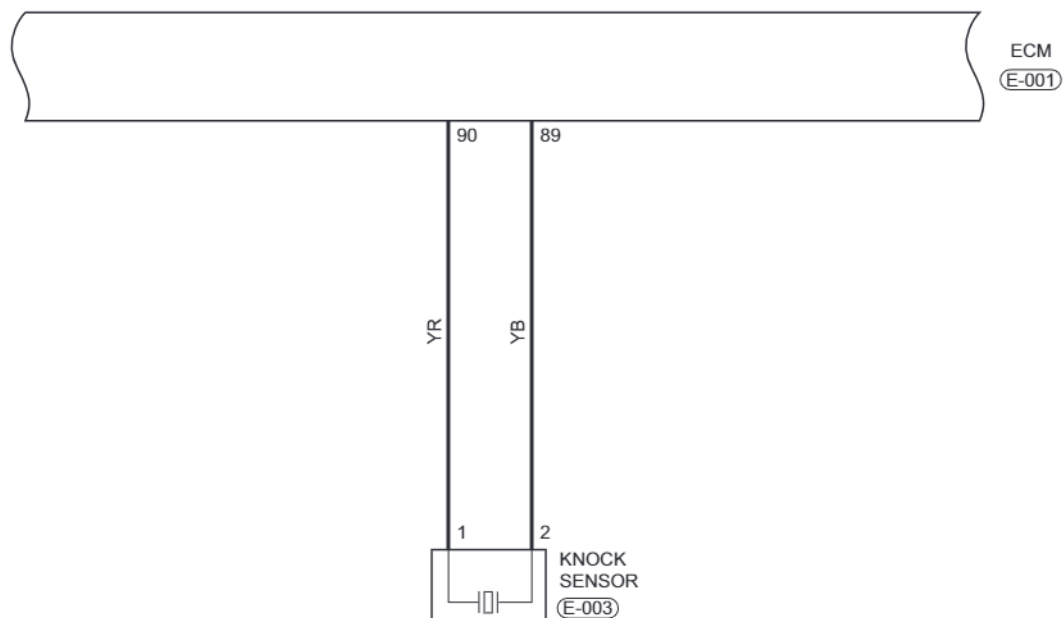
OK

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0327-16	Knock Sensor 1 Circ. Low Input
-----	----------	--------------------------------

DTC	P0328-17	Knock Sensor 1 Circ. High Input
-----	----------	---------------------------------



EA19060200

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0327-16	Knock Sensor 1 Circ. Low Input	Engine running	- Knock sensor - Wire harness or connector - ECM
P0328-17	Knock Sensor 1 Circ. High Input		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

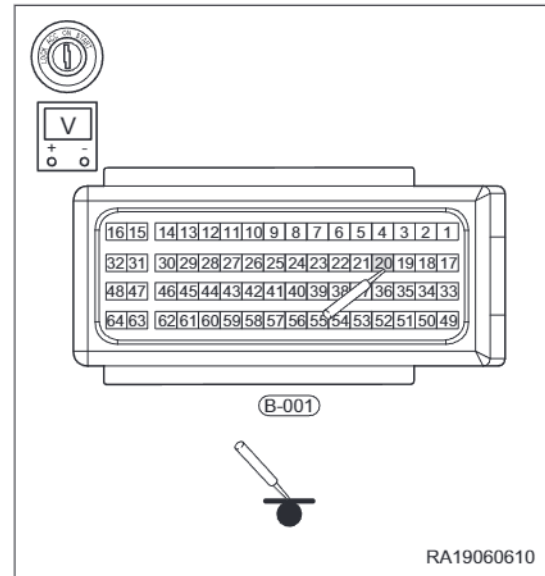
NG

Repair or replace ground wire harness or ground point

OK

2 Check knock sensor connector

- Disconnect the knock sensor connector E-003 (1).
- Check the knock sensor connector.

NG**Repair or replace connector****OK****06****3 Check installation of knock sensor**

- Remove the knock sensor.
- Check the installation area of the knock sensor for damage, foreign matter and excessive movement, etc. that cause signal incorrectness.

NG**Clean installation area or replace knock sensor****OK****4 Check resistance of knock sensor**

- Check the resistance between knock sensor terminals 1 and 2.

OK: Above 1 MΩ (at normal temperature)**NG****Replace knock sensor****OK**

5 Check knock sensor signal circuit

- Disconnect the ECM wire harness connector E-001.
- Check the wire harness between terminals of connector E-001 and connector E-003.

Check for Open

Multimeter Connection	Specified Condition
E-001 (90) - E-003 (1)	Continuity
E-001 (89) - E-003 (2)	Continuity

Check for Short

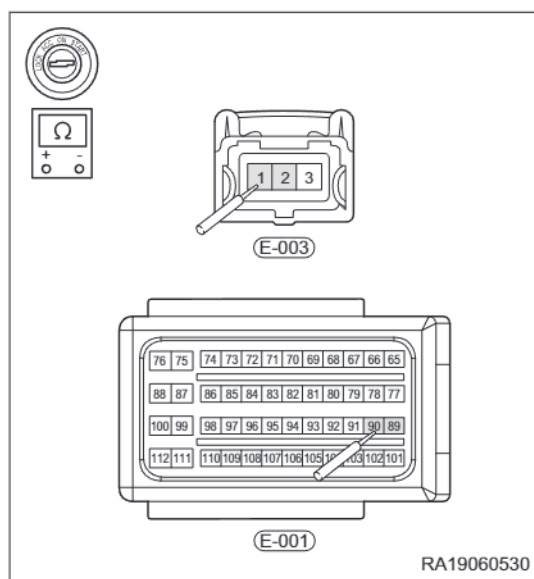
Multimeter Connection	Specified Condition
E-001 (90) or E-003 (1) - Body ground	No continuity
E-001 (90) or E-003 (1) - Battery positive	No continuity
E-001 (89) or E-003 (2) - Body ground	No continuity
E-001 (89) or E-003 (2) - Battery positive	No continuity

NG**Replace wire harness or connector (knock sensor - ECM)****OK****6 Check knock sensor signal**

- Install the knock sensor.
- Slightly strike around the knock sensor with a rubber hammer, and measure if voltage is generated between the 2 terminals of knock sensor with the multimeter at the same time.

NG**Replace knock sensor****OK****7 Check for DTCs**

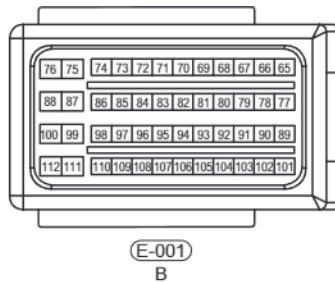
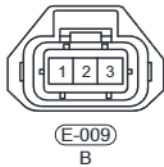
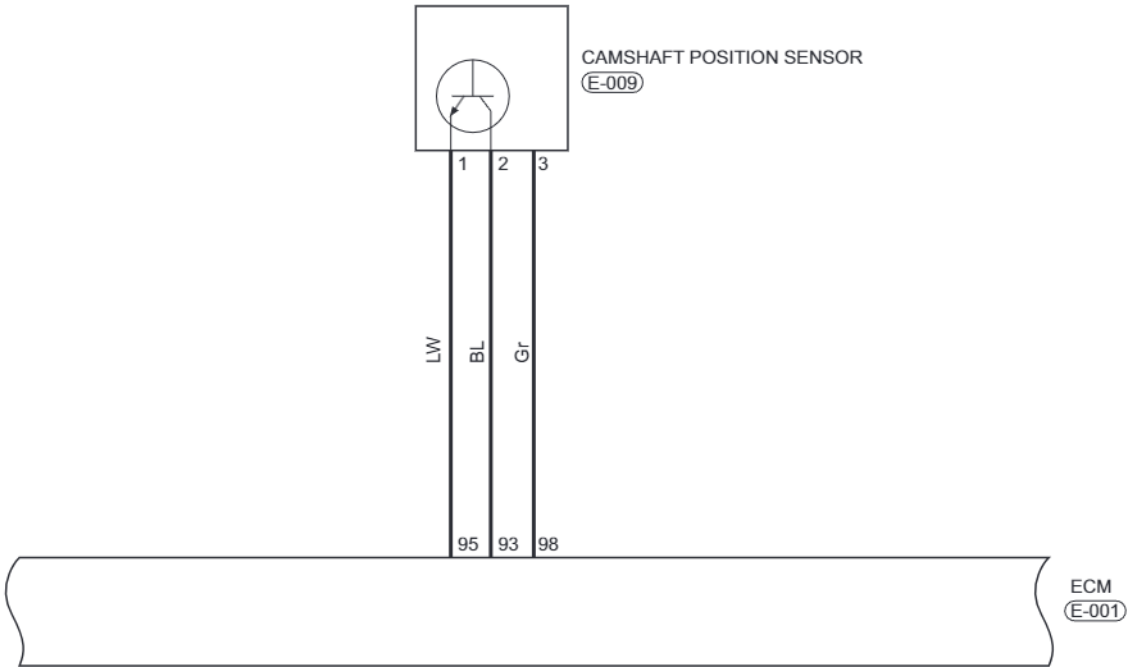
- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0327-16 or P0328-17 still exists.

NG**Replace ECM****OK**

System is operating normally.
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0341-00	EPM - Camshaft Signal Fault
-----	----------	-----------------------------

06



DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0341-00	EPM - Camshaft Signal Fault	Engine running	- Camshaft position sensor - Camshaft - Wire harness or connector - ECM

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

06

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

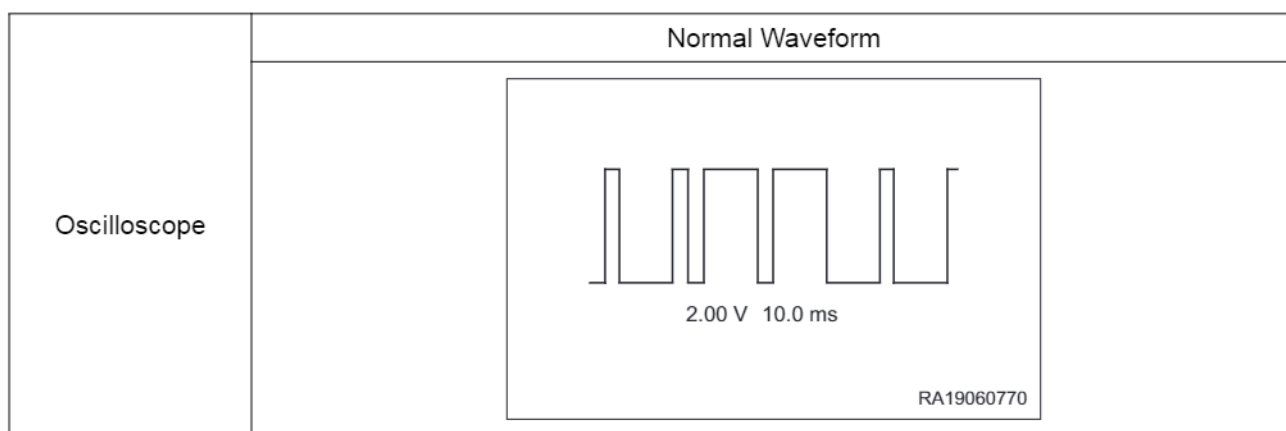
NG

Repair or replace ground wire harness or ground point

OK

2 Check camshaft position sensor signal waveform

- Turn the ignition switch to ON, start the engine and observe the signal waveform of camshaft position sensor with an oscilloscope.



06

OK

Go to step 9

NG

3

Check camshaft position sensor connector

- Turn the ignition switch to LOCK.
- Disconnect the camshaft position sensor connector E-009.
- Check the camshaft position sensor connector.

NG

Repair or replace camshaft position sensor connector

OK

4

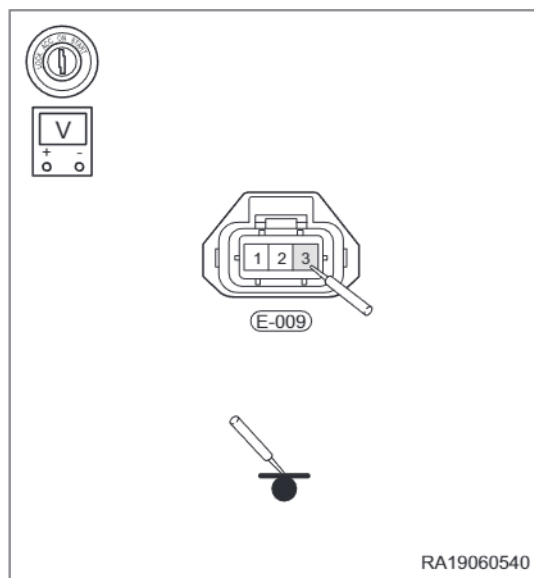
Check camshaft position sensor power supply voltage

- Turn the ignition switch to ON.
- Check the voltage between camshaft position sensor connector E-009 and body ground.

Multimeter Connection	Condition	Specified Condition
E-009 (3) - Body ground	Ignition switch ON	5 V

OK

Go to step 6



NG

5 Check camshaft position sensor power supply circuit

- Turn the ignition switch to LOCK.
- Disconnect the ECM connector E-001.
- Check the wire harness between camshaft position sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-009 (3) - E-001 (98)	Always	Continuity

Check for Short

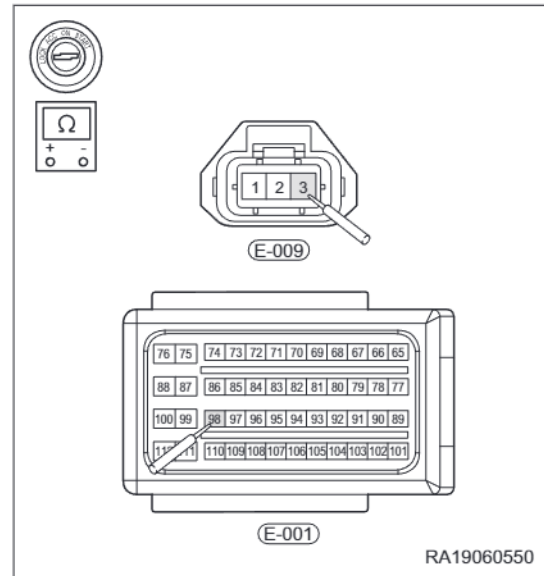
Multimeter Connection	Condition	Specified Condition
E-009 (3) or E-001 (98) - Body ground	Always	No continuity
E-009 (3) or E-001 (98) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (camshaft position sensor - ECM)

OK

Replace ECM



06

6 Check camshaft position sensor signal circuit and ground circuit

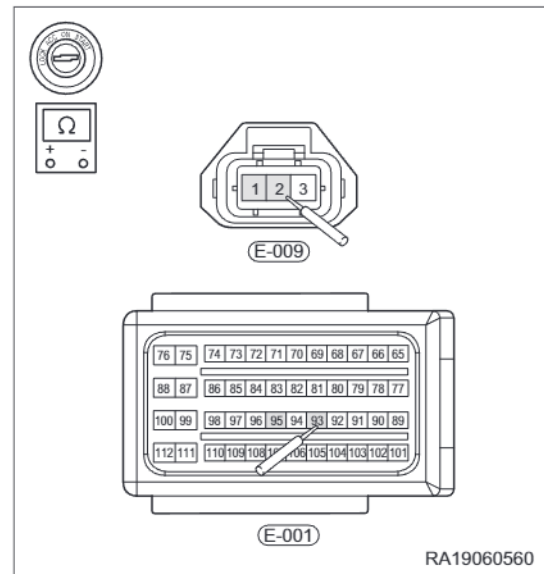
- Check the wire harness between camshaft position sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-009 (2) - E-001 (93)	Always	Continuity
E-009 (1) - E-001 (95)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-009 (2) or E-001 (93) - Body ground	Always	No continuity



Multimeter Connection	Condition	Specified Condition
E-009 (2) or E-001 (93) - Battery positive	Always	No continuity
E-009 (1) or E-001 (95) - Body ground	Always	No continuity
E-009 (1) or E-001 (95) - Battery positive	Always	No continuity

06

NG

Replace wire harness or connector
(camshaft position sensor - ECM)

OK

7

Check installation of camshaft position sensor

- Remove the camshaft position sensor.
- Check and clean the camshaft position sensor and installation area, and check for damage, foreign matter and excessive movement, etc. that cause signal incorrectness.

NG

Clean installation area or replace
camshaft position sensor

OK

8

Check camshaft ring gear

- Check the camshaft ring gear for damage and foreign matter (such as debris), etc. that cause signal incorrectness.

NG

Remove debris and clean camshaft ring
gear or replace camshaft

OK

9

Install a normal camshaft position sensor and observe signal waveform

- Install a normal camshaft position sensor.
- Connect the camshaft position sensor connector.
- Turn the ignition switch to ON, start the engine and observe the signal waveform of the camshaft position sensor with an oscilloscope.

OK

Replace camshaft position sensor

NG

10 Check for DTCs

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0341-00 still exists.

NG**Replace ECM****OK****System is operating normally.****Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.****06**

DTC	P0420-00	Catalyst Conversion Insufficient
------------	-----------------	---

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0420-00	Catalyst Conversion Insufficient	Engine running	• Three-way catalytic converter • Leakage in exhaust system • Upstream oxygen sensor • Downstream oxygen sensor • ECM

DTC Confirmation Procedure

06

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

Diagnosis Procedure

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

- Connect the X-431 3G diagnostic tester to the Data Link Connector (DLC).
- Turn the ignition switch to ON. Start the engine and warm it up to the normal operating temperature, and then select Read Code.

Display (DTC Output)	Proceed to
DTC P0420-00	A
DTC P0420-00 and other DTCs	B

B

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

A

2	Read datastream
----------	------------------------

- Read datastream using the diagnostic tester.

b. Check the datastream below.

Item	OK (Idling)	If it is NG, proceed to
Upstream Oxygen Sensor Voltage	Quickly fluctuates between 0.1 to 0.9 V	A
Downstream Oxygen Sensor Voltage	Fluctuates slightly at about 0.45 V	B
Average Injection Pulse Width	About 3.5 ms	C

A

Replace upstream oxygen sensor

C

Check injector, fuel pressure and other causes for abnormal injection pulse width

B

06

3

Check exhaust system

a. Turn the ignition switch to ON and start the engine.

b. Check the exhaust system for leakage.

NG

Repair or replace related exhaust system components

OK

4

Check downstream oxygen sensor

NG

Replace downstream oxygen sensor

OK

Replace three-way catalytic converter

5

Check for DTCs

a. Use the X-431 3G diagnostic tester to read the ECM DTC.

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0420-00 still exists.

NG

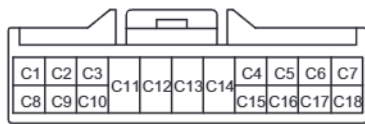
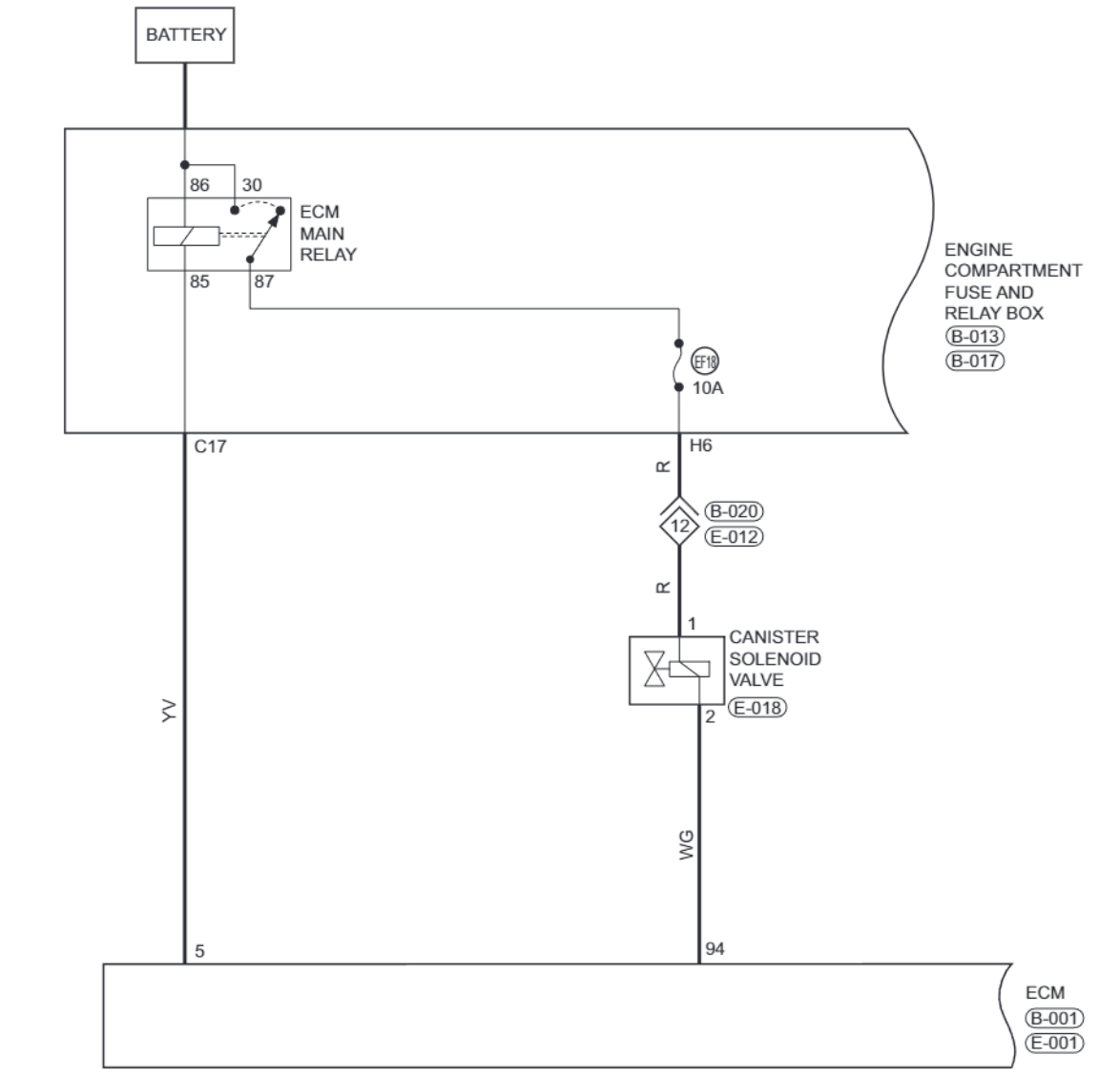
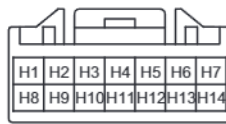
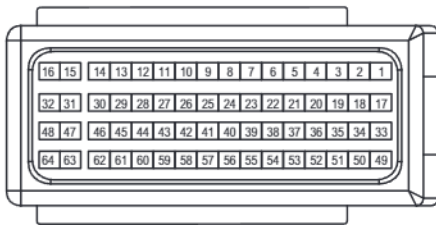
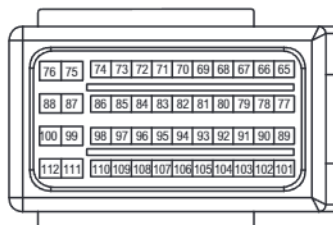
Replace ECM

OK

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0444-13	Evaporative Emission System Purge Control Valve Circuit Open
DTC	P0458-16	Evaporative Emission System Purge Control Valve Circuit Low
DTC	P0459-17	Evaporative Emission System Purge Control Valve Circuit High

(B-013)
W(B-017)
W(B-020)
B(B-001)
B(E-001)
B(E-018)
B

EA19060220

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0444-13	Evaporative Emission System Purge Control Valve Circuit Open	Engine running	- Canister solenoid valve - Wire harness or connector - ECM
P0458-16	Evaporative Emission System Purge Control Valve Circuit Low		
P0459-17	Evaporative Emission System Purge Control Valve Circuit High		

06

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure**1 Check ECM ground point**

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

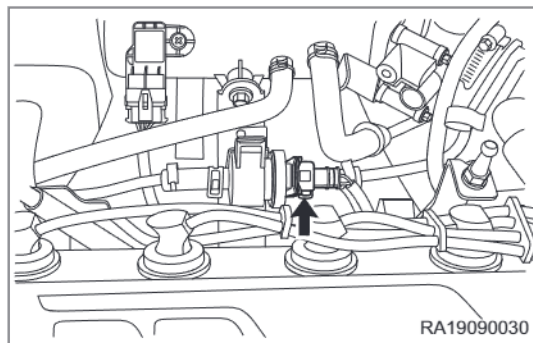
NG

Repair or replace ground wire harness or ground point

NG

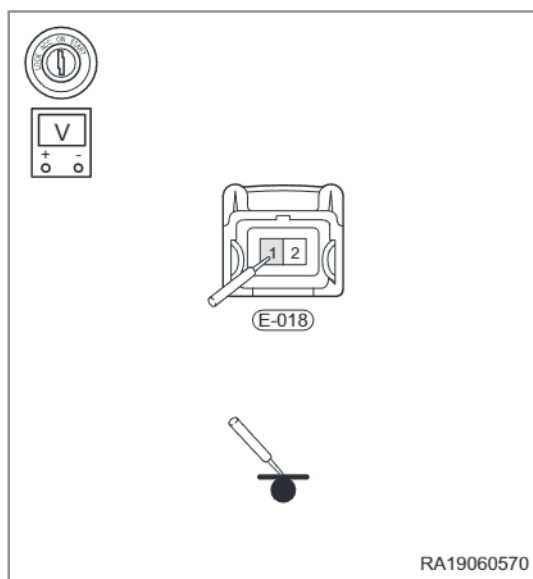
2 Check canister solenoid valve connector

- a. Disconnect the canister solenoid valve connector E-018.
- b. Check the canister solenoid valve connector.

NG**Repair or replace connector****OK****06****3 Check canister solenoid valve power supply voltage**

- a. Turn the ignition switch to ON.
- b. Measure the voltage between canister solenoid valve connector terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-018 (1) - Body ground	Ignition switch ON	11 to 14 V

OK**Go to step 5****NG**

4 Check canister solenoid valve power supply circuit

- Turn the ignition switch to LOCK.
- Check the fuse EF18 and main relay.
- Disconnect the engine compartment fuse and relay box connector B-017.
- Check the wire harness between canister solenoid valve connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

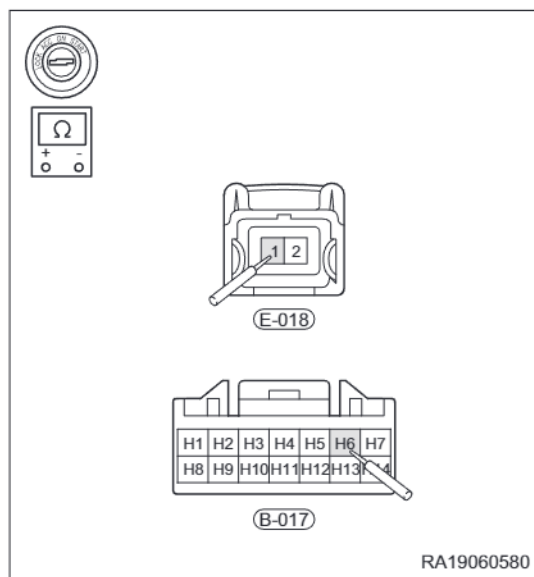
Multimeter Connection	Condition	Specified Condition
E-018 (1) - B-017 (H6)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-018 (1) or B-017 (H6) - Body ground	Always	No continuity

NG

Repair or replace wire harness or connector (canister solenoid valve - engine compartment fuse and relay box)



OK

5 Check canister solenoid valve control circuit

- Disconnect the ECM connector E-001.
- Check the wire harness between canister solenoid valve connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-018 (2) - E-001 (94)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-018 (2) or E-001 (94) - Body ground	Always	No continuity
E-018 (2) or E-001 (94) - Battery positive	Always	No continuity

NG

Repair or replace wire harness or connector (canister solenoid valve - ECM)

OK

6 Check canister solenoid valve

- Check the resistance of canister solenoid valve.

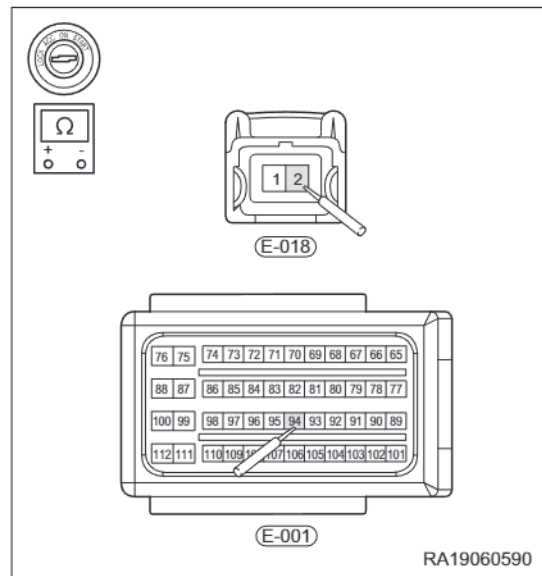
Multimeter Connection	Specified Condition
1 - 2	$26 \pm 4 \Omega$ (at 20°C)

- With battery voltage applied between terminals 1 and 2, the valve should open when air is sucked into the valve; With battery voltage applied, the valve should close when air is sucked into the valve.

NG

Replace canister solenoid valve

OK



06

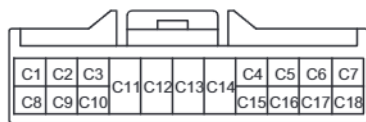
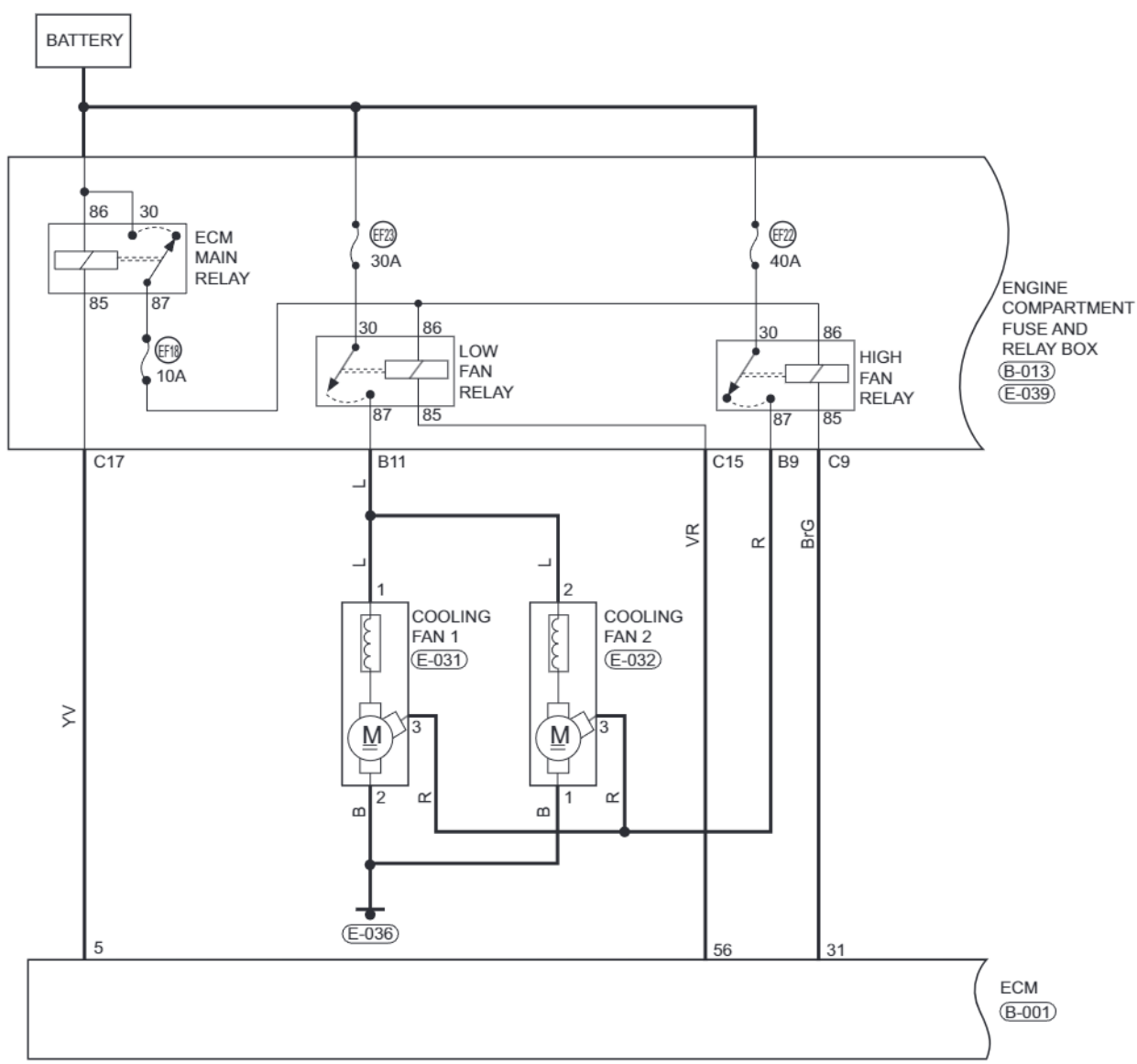
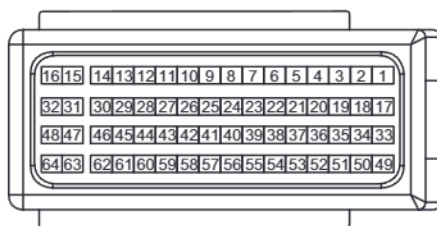
7**Check for DTCs**

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0444-13, P0458-16 or P0459-17 still exists.

NG**Replace ECM****OK****System is operating normally.****Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.****06**

DTC	P0480-13	Cooling Fan 1 Control Circuit
DTC	P0481-13	Cooling Fan 2 Control Circuit
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

06

(B-013)
W(E-039)
W(B-001)
B(E-031)
B(E-032)
B

EA19060230

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0480-13	Cooling Fan 1 Control Circuit	Ignition switch ON	- Cooling fan relay - Fuse - Wire harness or connector - ECM
P0481-13	Cooling Fan 2 Control Circuit		
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		

06

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

2 Check cooling fan connector

- Disconnect the cooling fan connectors E-031 and E-032.
- Check the cooling fan connectors.

NG

Repair or replace connector

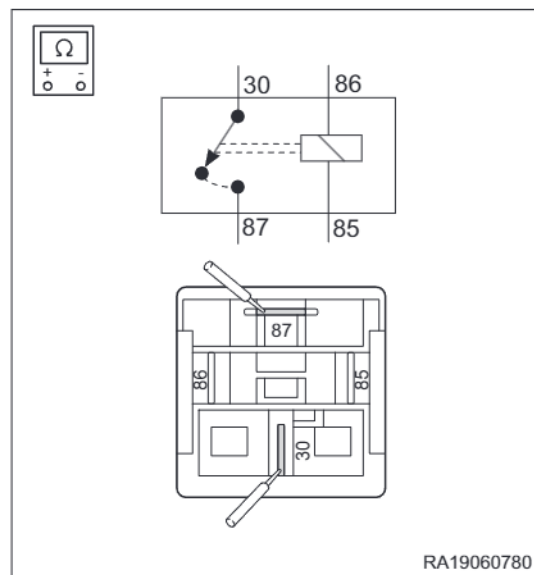
OK

3 Check cooling fan relay

- Unplug the cooling fan high speed and low speed relays from the engine compartment fuse and relay box.
- Check the cooling fan high speed relay.

06

Multimeter Connection	Specified Condition
30 - 87	No continuity
30 - 87	Continuity (when battery voltage is applied between terminals 85 and 86)

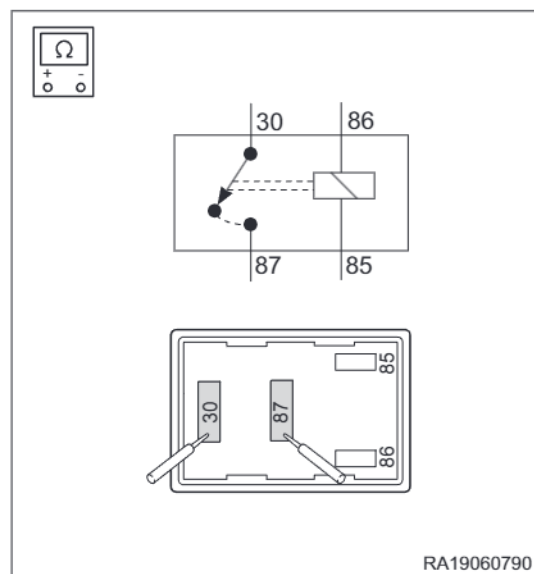


- Check the cooling fan low speed relay.

Multimeter Connection	Specified Condition
30 - 87	No continuity
30 - 87	Continuity (when battery voltage is applied between terminals 85 and 86)

NG

Replace relay



OK

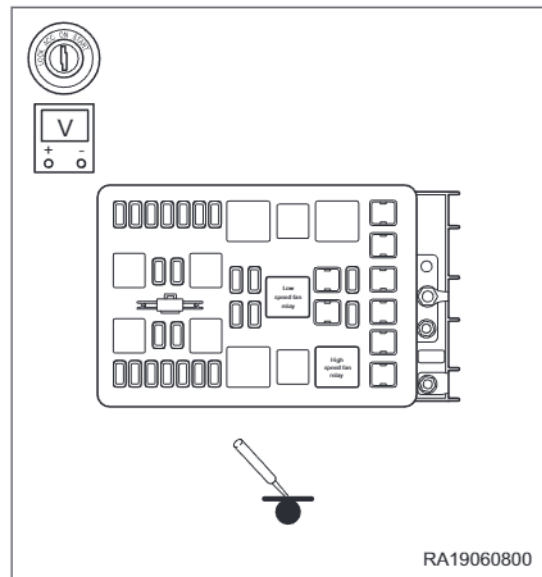
4 Check cooling fan relay circuit voltage

- a. Check the terminal voltage of cooling fan relay (engine compartment fuse and relay box side).

Multimeter Connection	Condition	Specified Condition
Terminal 30 and 86 (low speed fan) - Body ground	Ignition switch ON	11 to 14 V
Terminal 30 and 86 (high speed fan) - Body ground		11 to 14 V

NG

Check cooling fan fuse, repair or replace wire harness or connector (fan relay - battery)



06

OK

5

Check wire harness and connector (engine compartment fuse and relay box - ECM)

- a. Disconnect the engine compartment fuse and relay box connectors B-013.
b. Disconnect the ECM connector B-001.
c. Check the wire harness between ECM connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

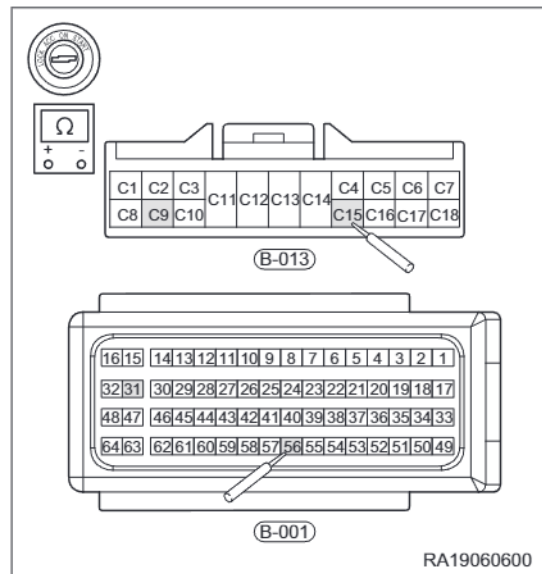
Multimeter Connection	Specified Condition
B-001 (56) - B-013 (C15)	Continuity
B-001 (31) - B-013 (C9)	Continuity

Check for Short

Multimeter Connection	Specified Condition
B-001 (56) or B-013 (C15), B-001 (31) or B-013 (C9) - Body ground	No continuity
B-001 (56) or B-013 (C15), B-001 (31) or B-013 (C9) - Battery positive	No continuity

NG

Repair or replace wire harness or connector



A

6

Check for DTCs



- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0480-13, P0481-13, P0691-11, P0692-12, P0693-11 or P0694-12 still exists.

NG

Replace ECM

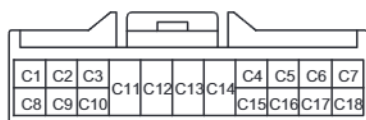
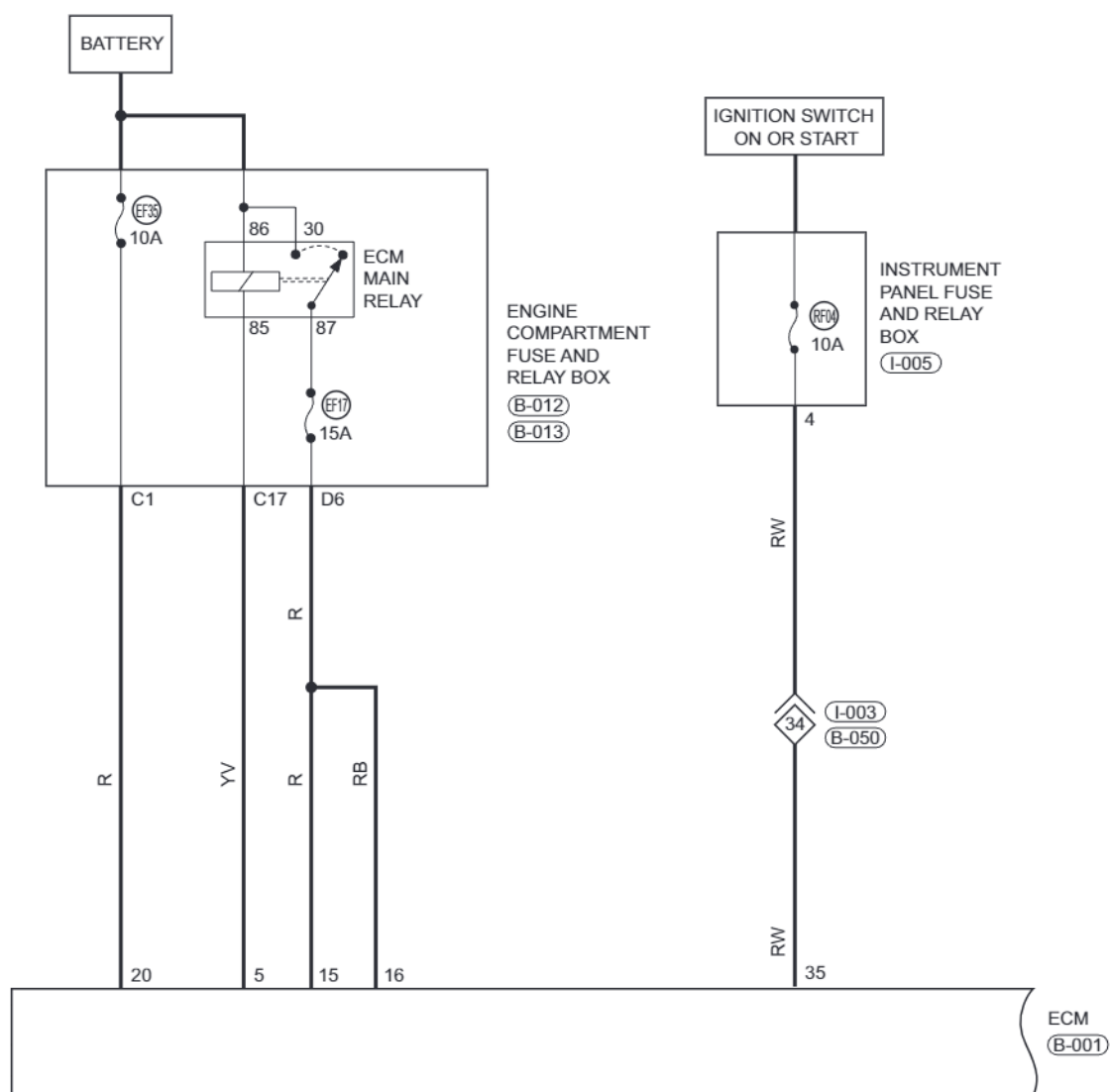
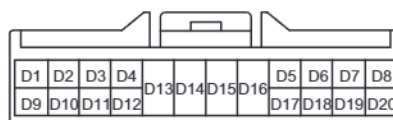
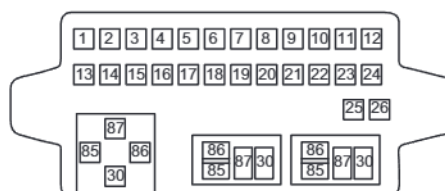
OK

System is operating normally.

Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0560-00	Non-plausible Error of Battery Voltage
DTC	P0562-16	System Voltage Low
DTC	P0563-17	System Voltage High

06

(B-013)
W(B-012)
W(B-001)
B(I-005)
B

EA19060240

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0560-00	Non-plausible Error of Battery Voltage	Ignition switch ON	• Fuse • Wire harness or connector • Battery • Battery terminal • ECM
P0562-16	System Voltage Low		
P0563-17	System Voltage High		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

06

CAUTION

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

Diagnosis Procedure

1 Check battery

- a. Check if the battery voltage is normal.

NG

Recharge or replace battery

OK

2 Check battery terminals

- a. Check if the battery terminals are loose or corroded.

NG

Tighten or replace battery terminals

OK

3 Check ECM ground point

- a. Turn the ignition switch to LOCK.
- b. Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK**4 Check ECM connector****06**

- a. Disconnect the ECM connector B-001.
- b. Check the ECM connector.

NG

Repair or replace ECM connector

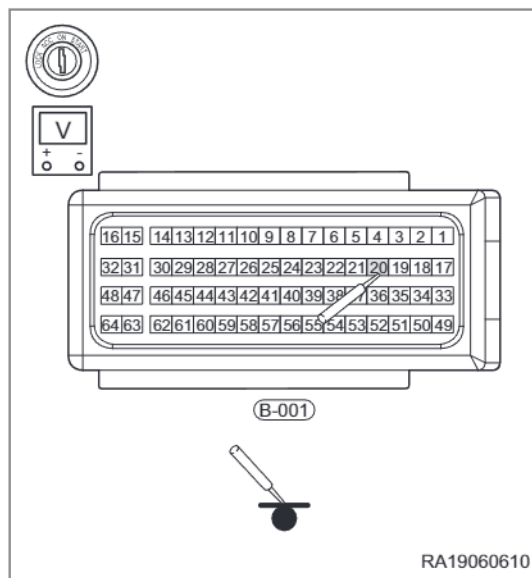
OK**5 Check ECM power supply voltage (battery voltage)**

- a. Measure the voltage between ECM connector B-001 terminal and body ground.

Multimeter Connection	Condition	Specified Condition
B-001 (20) - Body ground	Always	11 to 14 V

NG

Go to step 8

**OK**

6**Check ECM fuse**

- Unplug the ECM fuse EF35 (10 A) from the engine compartment fuse and relay box.
- Check the resistance of fuse EF35.

Standard resistance: less than 1 Ω **NG****Replace ECM fuse****OK****7****Check wire harness and connector (ECM - engine compartment fuse and relay box)**

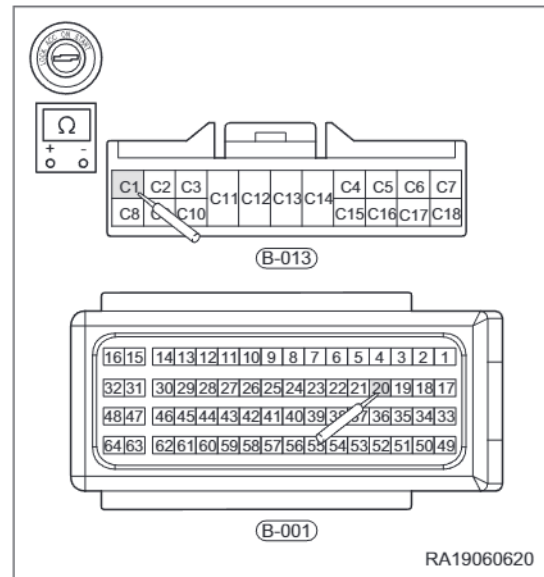
- Disconnect the engine compartment fuse and relay box connector B-013.
- Check the wire harness between the connector terminals.

Check for Open

Multimeter Connection	Specified Condition
B-001 (20) - B-013 (C1)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-001 (20) or B-013 (C1) - Body ground	No continuity
E-001 (20) or B-013 (C1) - Battery positive	No continuity

NG**Repair or replace wire harness or connector****OK****06**

Repair or replace engine compartment fuse and relay box or wire harness (engine compartment fuse and relay box - battery)

8 Check ECM power supply voltage (ignition switch voltage)

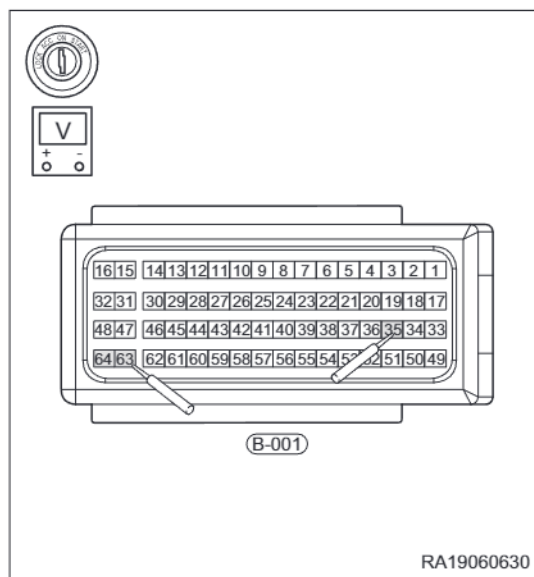
- Turn the ignition switch to ON.
- Check the voltage between terminals of ECM connector B-001.

Multimeter Connection	Condition	Specified Condition
B-001 (35) - B-001 (63) or B-001 (64)	Ignition switch ON	11 to 14 V

NG

Go to step 11

06



OK

9 Check ECM fuse

- Unplug the fuse RF04 (10 A) from the instrument panel fuse and relay box.
- Check the resistance of fuse RF04.

Standard resistance: less than 1 Ω

NG

Replace fuse

OK

10 Check wire harness and connector (ECM - instrument panel fuse and relay box)

- Disconnect the instrument pane fuse and relay box connector I-005.
- Check the wire harness between the terminals of the wire harness side connector.

Check for Open

Multimeter Connection	Specified Condition
B-001 (35) - I-005 (4)	Continuity

Check for Short

Multimeter Connection	Specified Condition
B-001 (35) or I-005 (4) - Body ground	No continuity
B-001 (35) or I-005 (4) - Battery positive	No continuity

NG

Repair or replace wire harness or connector

OK**11 Check ignition switch assembly (See page 15-11)****NG**

Replace ignition switch assembly

OK

Repair or replace instrument panel fuse and relay box or wire harness (instrument panel fuse and relay box - ignition switch)

12 Check for DTCs

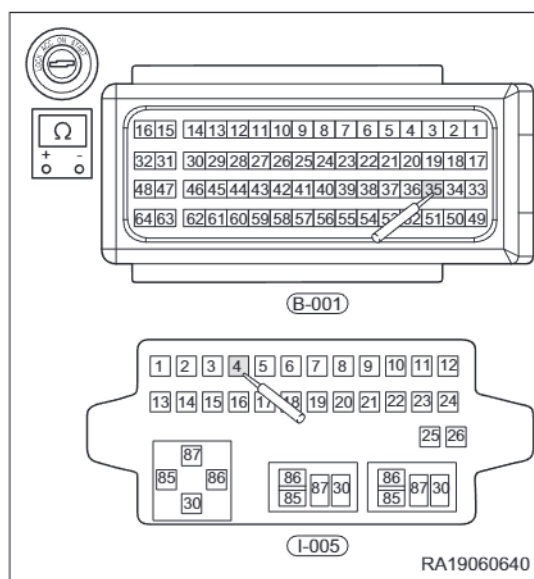
- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0560-00, P0562-16 or P0563-17 still exists.

NG

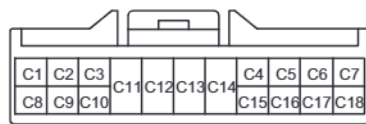
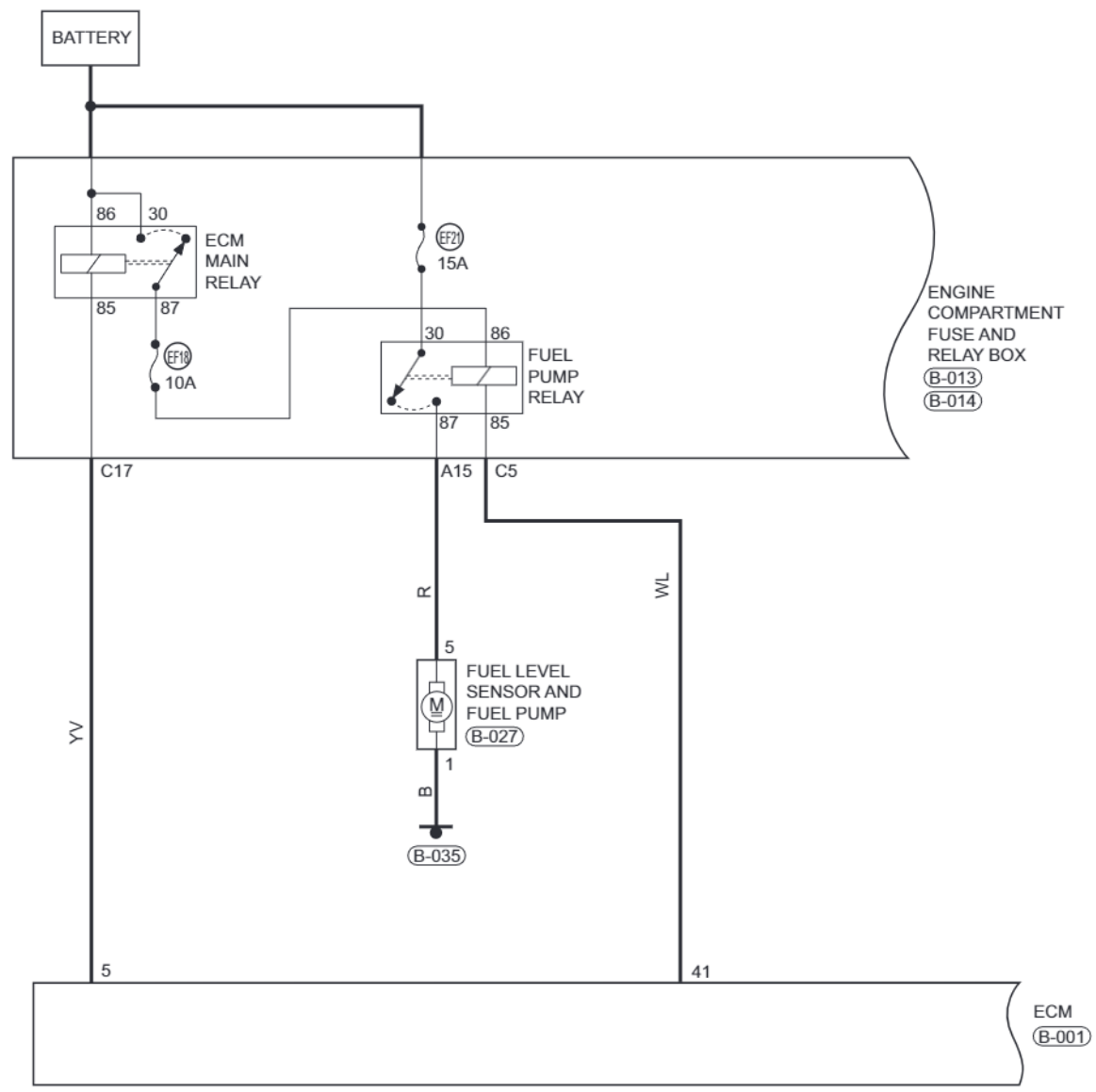
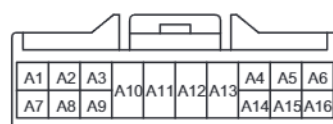
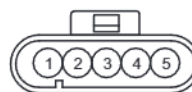
Replace ECM

OK

System is operating normally.
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

**06**

DTC	P0627-13	Fuel Pump Control Circuit/Open
DTC	P0628-11	Fuel Pump Control Circuit Low
DTC	P0629-12	Fuel Pump Control Circuit High

(B-013)
W(B-014)
W(B-001)
B(B-027)
B

EA19060250

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0627-13	Fuel Pump Control Circuit/Open	Ignition switch ON	- Fuel pump relay - Wire harness or connector - ECM - Engine compartment fuse and relay box
P0628-11	Fuel Pump Control Circuit Low		
P0629-12	Fuel Pump Control Circuit High		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

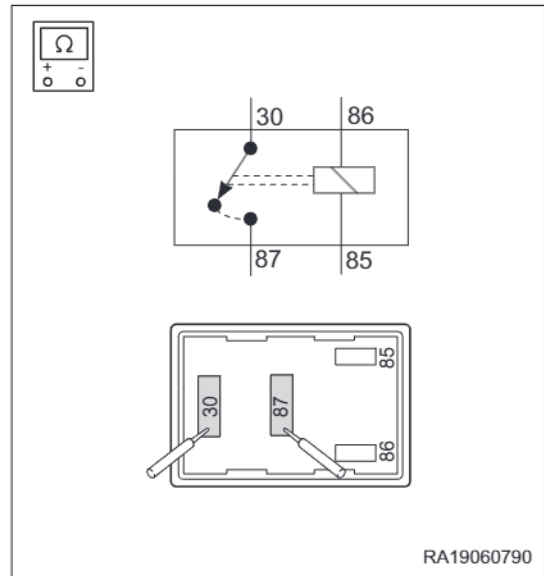
2 Check fuel pump relay

- Unplug the fuel pump relay from the engine compartment fuse and relay box.
- Check the fuel pump relay terminals.

Multimeter Connection	Specified Condition
30 - 87	No continuity
30 - 87	Continuity (when battery voltage is applied between terminals 85 and 86)

NG

Replace fuel pump relay



RA19060790

OK

3 Check fuel pump relay control circuit

- Disconnect the engine compartment fuse and relay box connector B-013.
- Disconnect the ECM connector B-001.
- Check the wire harness between connector terminals.

Check for Open

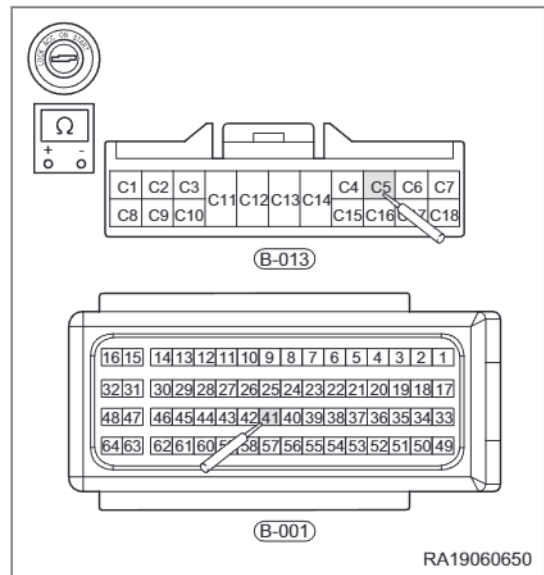
Multimeter Connection	Specified Condition
B-001 (41) - B-013 (C5)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-001 (41) or B-013 (C5) - Body ground	No continuity
E-001 (41) or B-013 (C5) - Battery positive	No continuity

NG

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



RA19060650

OK

06

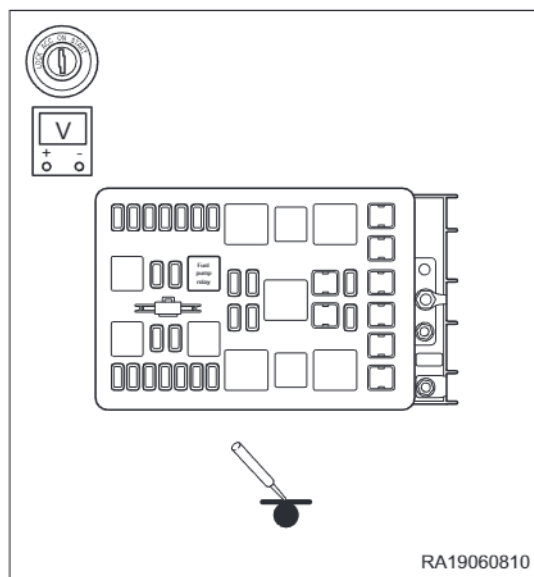
4 Check fuel pump relay terminal voltage

- Turn the ignition switch to ON.
- Measure the voltage between terminal of fuel pump relay and body ground.

Multimeter Connection	Condition	Specified Condition
Fuel pump relay terminal 86 (engine compartment fuse and relay box side) - Body ground	Ignition switch ON	11 to 14 V

NG

Go to step 6



OK

5 Check main relay and fuse EF18

NG

Replace main relay or fuse

OK

Repair or replace engine compartment fuse and relay box or wire harness (engine compartment fuse and relay box - battery)

6 Check for DTCs

- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0627-13, P0628-11 or P0629-12 still exists.

NG

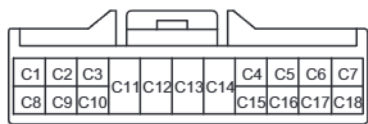
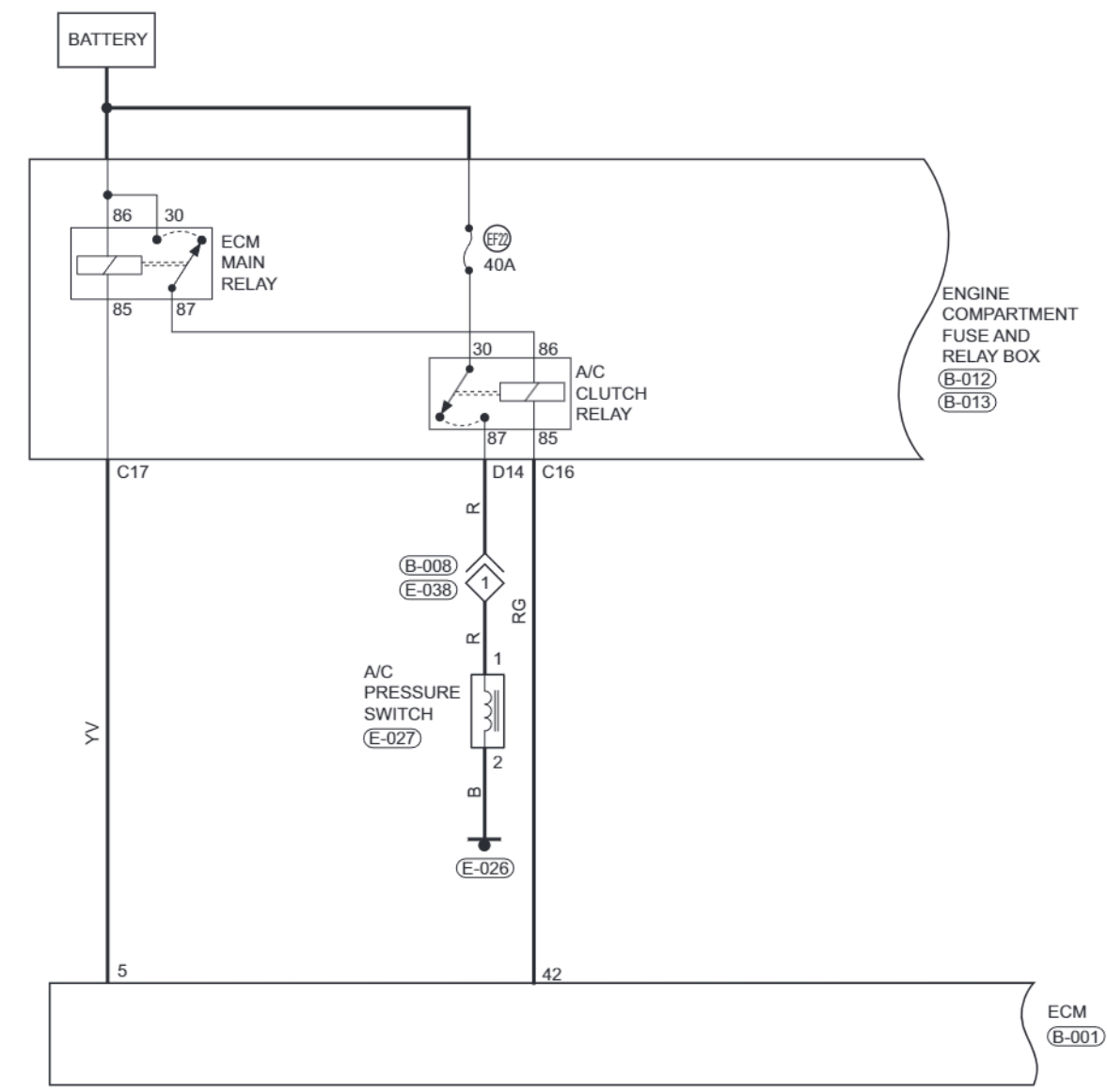
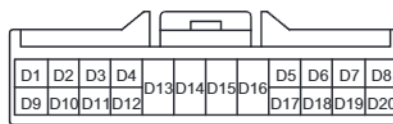
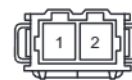
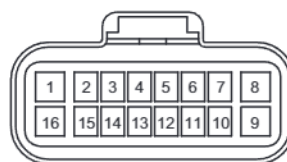
Replace ECM

OK

System is operating normally.
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0645-13	A/C Clutch Relay Circuit
DTC	P0646-11	A/C Clutch Relay Control Circuit Low
DTC	P0647-12	A/C Clutch Relay Control Circuit High

06

(B-013)
W(B-012)
W(E-027)
B(B-001)
B(B-008)
B

EA19060260

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0645-13	A/C Clutch Relay Circuit	Ignition switch ON	• A/C compressor relay • Wire harness or connector • ECM
P0646-11	A/C Clutch Relay Control Circuit Low		
P0647-12	A/C Clutch Relay Control Circuit High		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON.
- Use the X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the DTC is not detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

06

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

2 Check A/C compressor relay

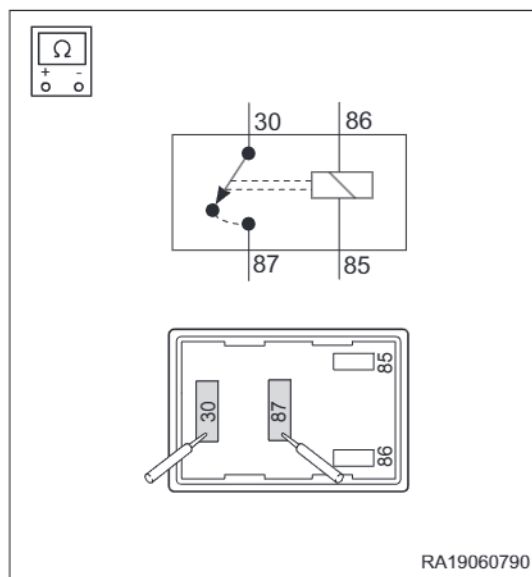
- Unplug the A/C compressor relay from the engine compartment fuse and relay box.
- Check the A/C compressor relay terminals.

Multimeter Connection	Specified Condition
30 - 87	No continuity
30 - 87	Continuity (when battery voltage is applied between terminals 85 and 86)

06

NG

Replace A/C compressor relay



RA19060790

OK

3 Check A/C compressor relay control circuit

- Disconnect the engine compartment fuse and relay box connector B-013.
- Disconnect the ECM connector B-001.
- Check the wire harness between ECM connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

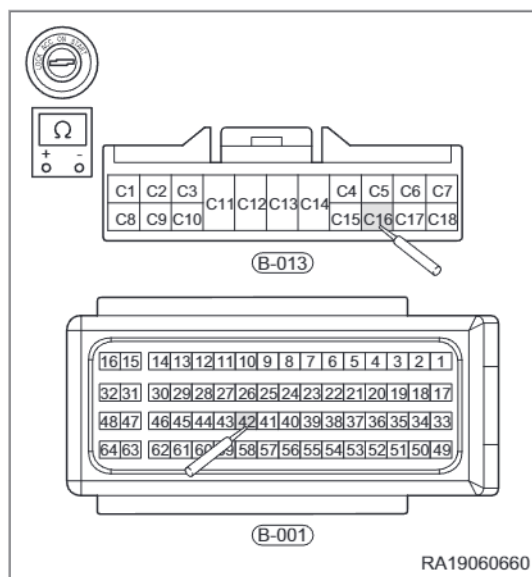
Multimeter Connection	Condition	Specified Condition
B-001 (42) - B-013 (C16)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-001 (42) or B-013 (C16) - Body ground	Always	No continuity
B-001 (42) or B-013 (C16) - Battery positive	Always	No continuity

NG

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



RA19060660

OK

4 Check for DTCs

- a. Use the X-431 3G diagnostic tester to read the ECM DTC.
- b. Refer to "DTC Confirmation Procedure".
- c. Check if DTC P0645-13, P0646-11 or P0647-12 still exists.

NG

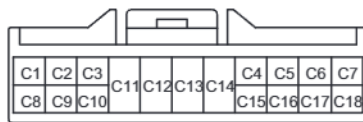
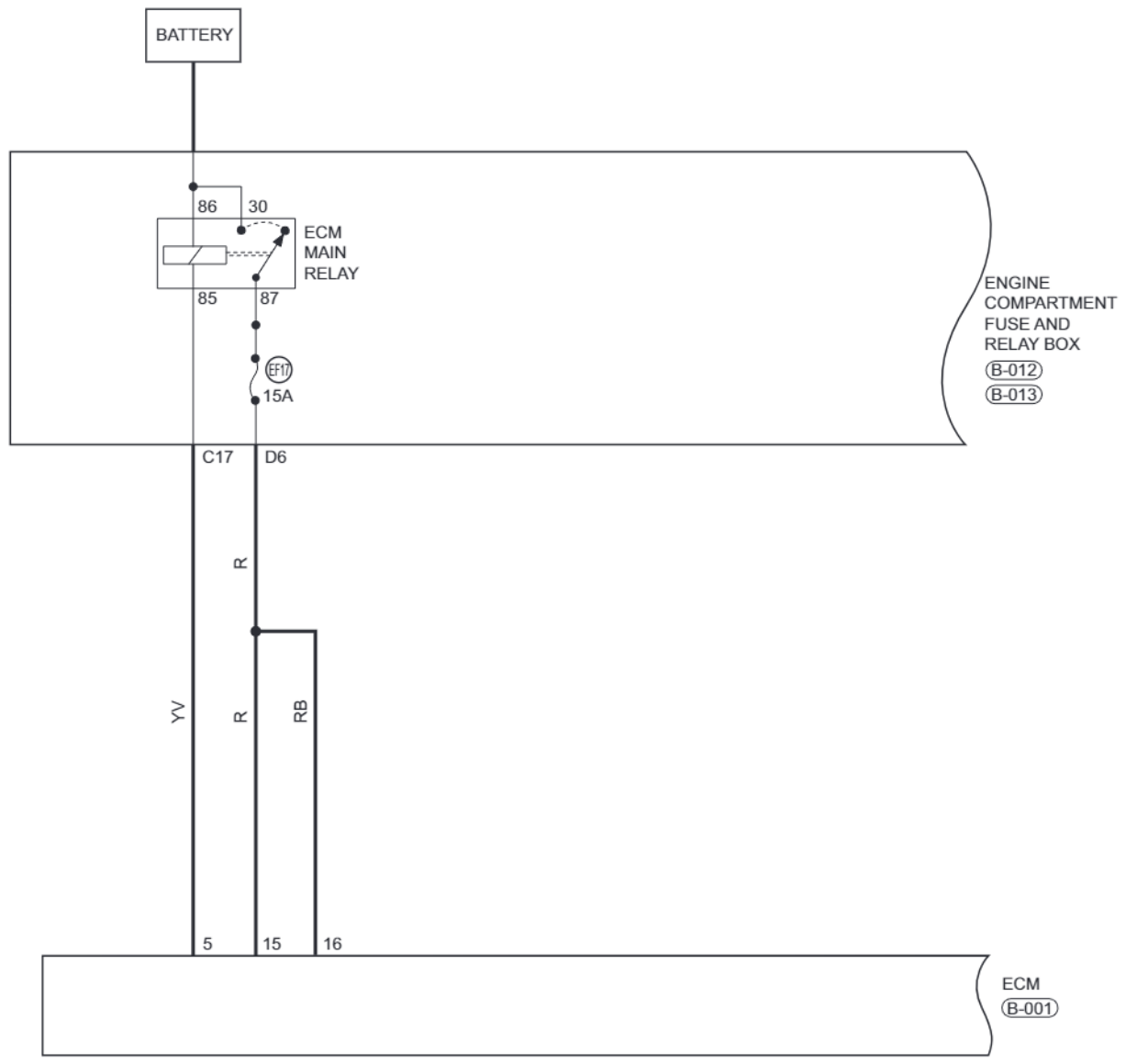
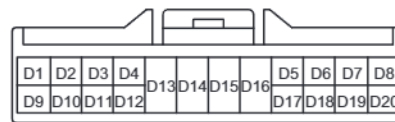
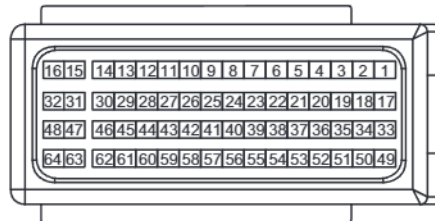
Replace ECM

OK

System is operating normally.
Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

06

DTC	P0688-91	Power Relay Sense Circuit Non-plausible Error
DTC	P0688-92	Power Relay Sense Circuit Signal Error

(B-013)
W(B-012)
W(B-001)
B

EA19060270

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0688-91	Power Relay Sense Circuit Non-plausible Error	Ignition switch ON	• Main Relay • Wire harness or connector • ECM
P0688-92	Power Relay Sense Circuit Signal Error		

DTC Confirmation Procedure

Confirm that the battery voltage is over 12 V before performing the following procedures.

- Turn the ignition switch to LOCK.
- Connect the X-431 3G diagnostic tester (the latest software) to the Data Link Connector (DLC).
- Turn the ignition switch to ON, start the engine and warm it up to the normal operating temperature.
- Using the X-431 3G diagnostic tester to select Read Datastream.
- If the datastream is not detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If the datastream is detected, the malfunction indicated by the DTC is intermittent ([See page 06-18](#)).

CAUTION

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

Diagnosis Procedure

1 Check ECM ground point

- Turn the ignition switch to LOCK.
- Check the ECM grounds GND113 and GND114 ([See page 06-18](#)).

NG

Repair or replace ground wire harness or ground point

OK

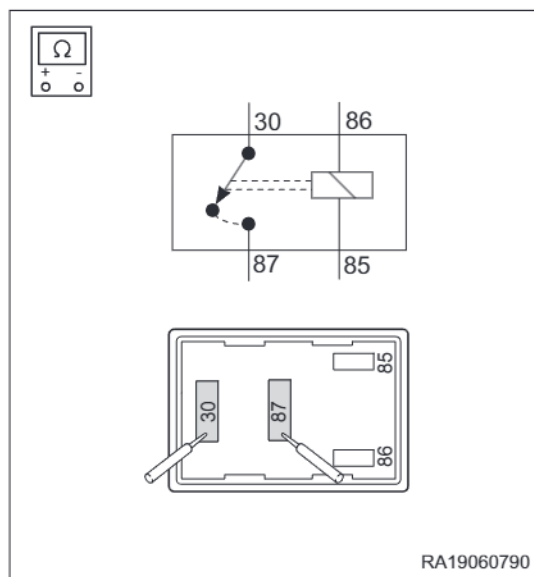
2 Check main relay

- Unplug the main relay from the engine compartment fuse and relay box.
- Check for continuity between the terminals of main relay.

Multimeter Connection	Specified Condition
30 - 87	No continuity
30 - 87	Continuity (when battery voltage is applied between terminals 85 and 86)

NG

Replace main relay



OK

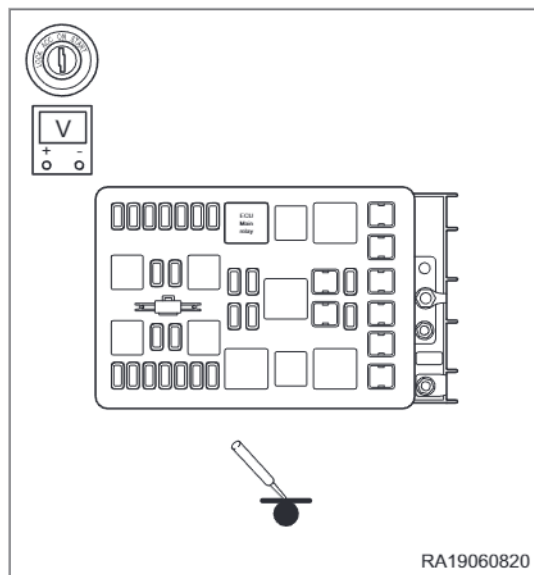
3 Check main relay circuit voltage

- Measure the voltage between the terminals of main relay (engine compartment fuse and relay box side) and body ground.

Multimeter Connection	Condition	Specified Condition
Main relay terminals 30 and 86 (engine compartment fuse and relay box side) - Body ground	Always	11 to 14 V

NG

Repair or replace wire harness or connector (main relay - battery)



OK

06

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

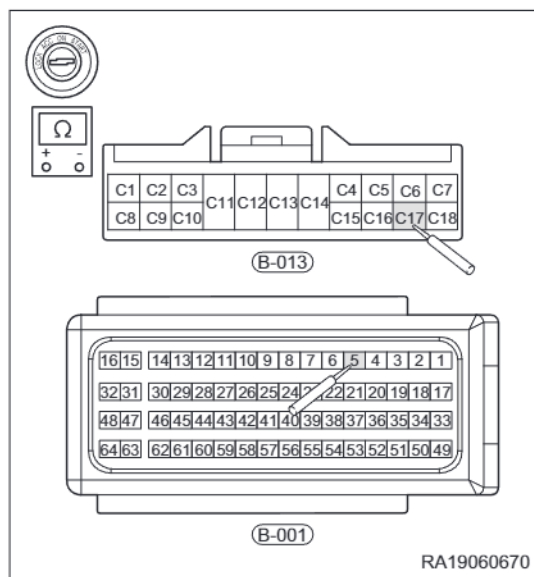
- Disconnect the engine compartment fuse and relay box connectors B-013.
- Disconnect the ECM connector B-001.
- Check the wire harness between the connector terminals.

Check for Open

Multimeter Connection	Specified Condition
B-001 (5) - B-013 (C17)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-001 (5) or B-013 (C17) - Body ground	No continuity
B-001 (5) or B-013 (C17) - Battery positive	No continuity

**NG****Replace ECM****OK****5 Check for DTCs**

- Use the X-431 3G diagnostic tester to read the ECM DTC.
- Refer to "DTC Confirmation Procedure".
- Check if DTC P0688-91 or P0688-92 still exists.

NG**Repair or replace wire harness or connector****OK****System is operating normally.****Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.**

Engine Problem Symptom Diagnosis

Perform the primary inspection first before performing the malfunction diagnosis procedures:

1. Confirm that the engine malfunction indicator operates normally;
2. Using the diagnostic tester, check that no error messages are recorded;
3. Confirm that the malfunction complained by customer is present, and confirm the condition under which the malfunction occurs.

Then, perform appearance inspection:

1. Check the fuel line for leakage;
2. Check if the vacuum line is broken or twisted, and if the connection is correct;
3. Check the intake line for blockage, air leakage, crush or damage;
4. Check if the high-voltage cable of ignition system is broken or deteriorated, and if the ignition order is correct;
5. Check if the wire harness ground points are clean and secure;
6. Check each sensor or actuator connector for looseness or poor contact.

HINT:

If the above conditions exist, repair the trouble areas first. Otherwise, it will affect the repair work for the following trouble diagnosis.

Diagnostic Help

1. Confirm that there are no trouble records for the engine;
2. Confirm that the complained trouble symptoms are present;
3. There are no abnormal conditions after performing the inspection according to the above procedures;
4. During servicing, do not ignore the vehicle maintenance condition, cylinder pressure, mechanical ignition timing and fuel condition, etc. that can affect the system;
5. Replace ECM, and perform the test. If the trouble can be eliminated, the trouble area is in ECM; if the trouble symptom still exists, reuse the original ECM, repeat the procedures, and perform service again.

Problem Symptoms Table

Symptom	Suspected Area	See page
Engine does not crank or cranks slowly while starting	• Battery • Starter motor • Wire harness or ignition switch • Engine mechanical	06-166
Engine cranks normally but cannot start successfully while starting	• No fuel in tank • Fuel pump • Engine speed sensor • Ignition coil • Engine mechanical	06-168
Difficult to start with hot engine	• Water in fuel • Fuel pump • Coolant temperature sensor • Fuel pressure regulator • Ignition coil	06-170

Symptom	Suspected Area	See page
Difficult to start with cold engine	• Water in fuel • Fuel pump • Coolant temperature sensor • Injector • Ignition coil • Throttle • Engine mechanical	06-172
Engine speed is normal, but it is difficult to start at anytime	• Water in fuel • Fuel pump • Coolant temperature sensor • Injector • Ignition coil • Throttle • Intake pipe • Ignition timing • Spark plug • Engine mechanical	06-174
Engine starts normally, but idles roughly at anytime	• Water in fuel • Injector • Spark plug • Throttle • Intake pipe • Ignition timing • Engine mechanical	06-177
Engine starts normally, but idles roughly during warming up	• Water in fuel • Coolant temperature sensor • Spark plug • Throttle • Intake pipe • Engine mechanical	06-179
Engine starts normally, but idles roughly after warming up	• Water in fuel • Coolant temperature sensor • Spark plug • Throttle body • Intake pipe • Engine mechanical	06-181
Engine starts normally, but idles roughly or stalls with part load (for example, A/C is ON)	• Air condition system • Injector	06-183
Engine starts normally, but idle speed is too high	• Throttle • Vacuum pipe • Coolant temperature sensor • Ignition timing	06-185

Symptom	Suspected Area	See page
Low engine speed or stalls when accelerating	• Water in fuel • Intake pressure/temperature sensor and throttle position sensor • Spark plug • Throttle • Intake pipe • Injector • Ignition timing • Exhaust pipe	06-187
Slow response when accelerating	• Water in fuel • Intake pressure sensor and throttle position sensor • Spark plug • Throttle inlet pipe • Injector • Ignition timing • Exhaust pipe	06-190
Lack of power and poor performance when accelerating	• Water in fuel • Intake pressure sensor and throttle position sensor • Spark plug • Ignition coil • Throttle • Intake pipe • Injector • Ignition timing • Exhaust pipe	06-193

Engine does not crank or cranks slowly while starting

Diagnosis Procedure

- 1** Check voltage between two battery posts when engine starts

OK: Voltage is 8 to 12 V.

NG → Replace battery

OK

- 06** **2** Check voltage of positive post of starter motor

a. The ignition switch remains in START position and check the voltage of positive post of starter motor.

OK: Voltage is 8 to 12 V.

NG → Repair or replace wire harness

OK

- 3** Check operation of starter motor

a. Remove the starter motor.

b. Check if there is an open circuit or if it is stuck due to poor lubrication.

NG → Repair or replace starter

OK

- 4** Check engine lubricant and gear oil

a. If the malfunction only occurs in winter, check if the 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 the engine internal mechanical resistance is too strong, causing the starter motor not to run or run slowly.

NG → Check and repair engine internal resistance

OK

Go to Diagnostic Help

06

Engine cranks normally but cannot start successfully while starting

Diagnosis Procedure

1 Check fuel pressure

- a. Using a fuel pressure gauge, check the fuel pressure ([See page 08-12](#)).

Standard Fuel Pressure

Condition	Fuel System Pressure (kPa)
Key ON	400
Engine Idling	400
Key LOCK	400

NG

Repair or replace fuel system

OK

2 Using diagnostic tester, observe if any speed signal is output

- a. Connect the diagnostic tester, start the engine and select Read Datastream.
b. Observe if any speed signal is output.

NG

Check and repair crankshaft position sensor wire harness

OK

3 Check spark

- a. Remove the ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start the engine, and check if spark is generated.

OK: Spark is generated.

NG

Check and repair ignition system

OK

4 Check pressure of cylinder

- a. Measure the compression of misfiring cylinder ([See page 07-17](#)).

NG

Check engine to confirm cause of low compression

OK

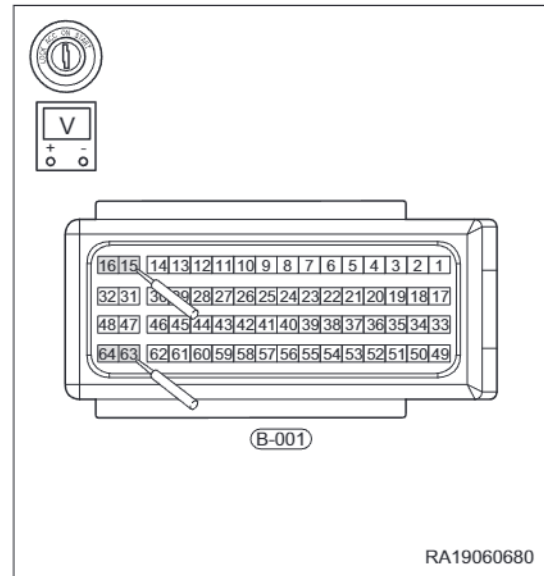
5 Check ECM power supply and ground

- Disconnect the ECM connector B-001.
- Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness



OK

06

Go to Diagnostic Help

Difficult to start with hot engine

Diagnosis Procedure

1 Check fuel pressure

- a. Using a fuel pressure gauge, check the fuel pressure ([See page 08-12](#)).

Standard Fuel Pressure

Condition	Fuel System Pressure (kPa)
Key ON	400
Engine Idling	400
Key LOCK	400

NG

Repair or replace fuel system

OK

2 Check spark

- a. Remove the ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start the engine, and check if spark is generated.

OK: Spark is generated.

NG

Check and repair ignition system

OK

3 Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

NG

Check and repair wire harness or replace sensor

OK

4 Check fuel pressure regulator

NG

Replace fuel pressure regulator

OK

5 Check fuel condition

- a. Observe if the trouble occurs just after fuel is filled.

NG

Replace fuel

OK

6

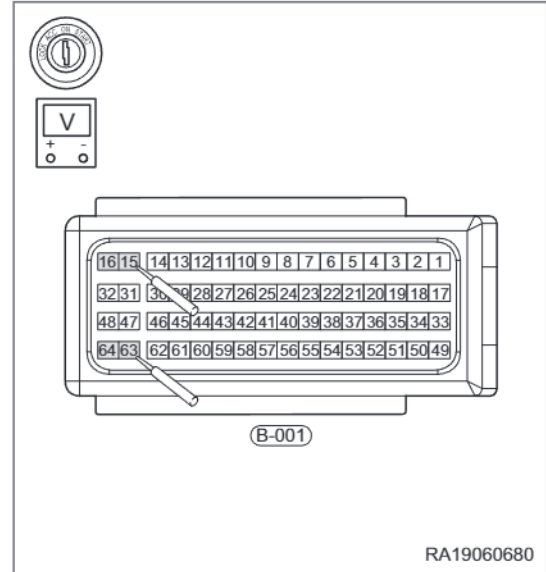
Check ECM power supply and ground

- Disconnect the ECM connector B-001.
- Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness



OK

06

Go to Diagnostic Help

Difficult to start with cold engine

Diagnosis Procedure

1 Check fuel pressure

- a. Using a fuel pressure gauge, check the fuel pressure ([See page 08-12](#)).

Standard Fuel Pressure

Condition	Fuel System Pressure (kPa)
Key ON	400
Engine Idling	400
Key LOCK	400

NG

Repair or replace fuel system

OK

2 Check spark

- a. Remove the ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start the engine, and check if spark is generated.

OK: Spark is generated.

NG

Check and repair ignition system

OK

3 Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

OK

Check and repair wire harness or replace sensor

NG

4 Depress accelerator pedal slightly, and observe if it is easy to start

OK

Clean throttle

NG

5 Check injector for leakage or blockage

NG Clean or replace injector

OK

6 Check fuel condition

a. Observe if the trouble occurs just after fuel is filled.

NG Replace fuel

OK

06**7 Check pressure of cylinder**

a. Measure the compression of misfiring cylinder ([See page 07-17](#)).

NG Check engine to confirm cause of low compression

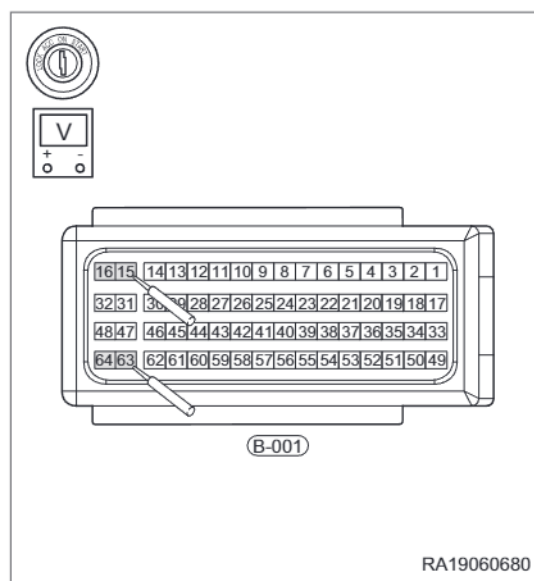
OK

8 Check ECM power supply and ground

- a. Disconnect the ECM connector B-001.
b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG Repair or replace related wire harness



OK

Go to Diagnostic Help

Engine speed is normal, but it is difficult to start at anytime

Diagnosis Procedure

- 1 Check air filter for blockage, and intake pipe for air leakage

NG Check and repair intake system

OK

- 2 Check fuel pressure

- a. Using a fuel pressure gauge, check the fuel pressure (See page 08-12).

Standard Fuel Pressure

Condition	Fuel System Pressure (kPa)
Key ON	400
Engine Idling	400
Key LOCK	400

NG Repair or replace fuel system

OK

- 3 Check spark

- 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 spark

- a. Remove the ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start the engine, and check if spark is generated.

OK: Spark is generated.

NG Check and repair ignition system

OK

5

Disconnect coolant temperature sensor connector, start engine and observe if engine starts successfully at this time

OK

Check and repair wire harness or replace sensor

NG

6

Depress accelerator pedal slightly, and observe if it is easy to start

OK

Clean throttle

NG

06

7

Check injector for leakage or blockage

NG

Clean or replace injector

OK

8

Check fuel condition

a. Observe if the trouble occurs just after fuel is filled.

NG

Replace fuel

OK

9

Check pressure of cylinder

a. Measure the compression of misfiring cylinder ([See page 07-17](#)).

NG

Check engine to confirm cause of low compression

OK

10

Check engine ignition order and ignition timing

a. Check if the engine ignition order and ignition timing are as specified.

NG

Check and repair ignition timing

OK



11

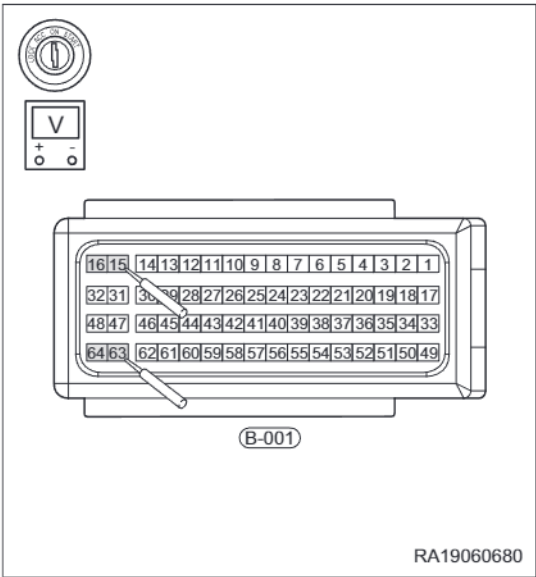
Check ECM power supply and ground

- a. Disconnect the ECM connector B-001.
- b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness



OK

Go to Diagnostic Help

Engine starts normally, but idles roughly at anytime

Diagnosis Procedure

1 Check air filter for blockage, and intake pipe for air leakage

NG Check and repair intake system

OK

2 Check if throttle is stuck

NG Repair or replace throttle

OK

3 Check spark

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 injector for leakage or blockage

NG Clean or replace injector

OK

6 Check fuel condition

a. Observe if the trouble occurs just after fuel is filled.

NG Replace fuel

OK

06

7 Check pressure of cylinder

- a. Measure the compression of misfiring cylinder (See page 07-17).

NG

Check engine to confirm cause of low compression

OK**8 Check engine ignition order and ignition timing**

- a. Check if the engine ignition order and ignition timing are as specified.

06**NG**

Check and repair ignition timing

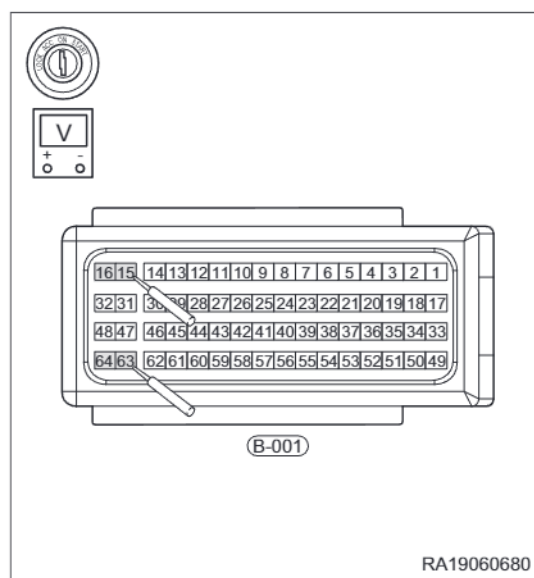
OK**9 Check ECM power supply and ground**

- a. Disconnect the ECM connector B-001.
b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness

**OK**

Go to Diagnostic Help

Engine starts normally, but idles roughly during warming up

Diagnosis Procedure

1 Check air filter for blockage, and intake pipe for air leakage

NG Check and repair intake system

OK

2 Check spark

a. Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG 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

OK Check and repair wire harness or replace sensor

NG

5 Check injector for leakage or blockage

NG Clean or replace injector

OK

06

6 Check fuel condition

- a. Observe if the trouble occurs just after fuel is filled.

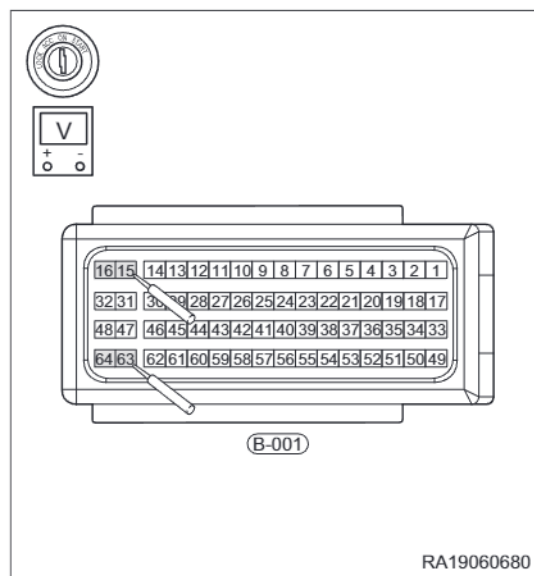
NG**Replace fuel****OK****7 Check pressure of cylinder**

- a. Measure the compression of misfiring cylinder ([See page 07-17](#)).

NG**Check engine to confirm cause of low compression****OK****8 Check ECM power supply and ground**

- a. Disconnect the ECM connector B-001.
b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG**Repair or replace related wire harness****OK****Go to Diagnostic Help**

Engine starts normally, but idles roughly after warming up

Diagnosis Procedure

1 Check air filter for blockage, and intake pipe for air leakage

NG Check and repair intake system

OK

2 Check spark

a. Check the spark plug of each cylinder, and observe if the type and gap are as specified.

NG 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 after warming up

OK Check and repair wire harness or replace sensor

NG

5 Check injector for leakage or blockage

NG Clean or replace injector

OK

06

6 Check fuel condition

- a. Observe if the trouble occurs just after fuel is filled.

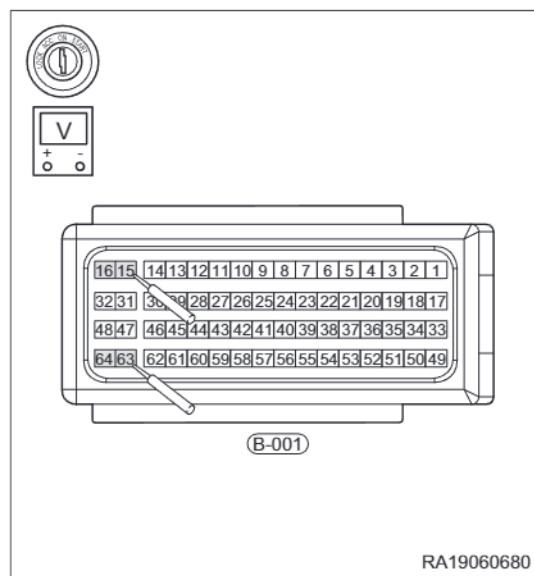
NG**Replace fuel****OK****7 Check pressure of cylinder**

- a. Measure the compression of misfiring cylinder ([See page 07-17](#)).

NG**Check engine to confirm cause of low compression****OK****8 Check ECM power supply and ground**

- a. Disconnect the ECM connector B-001.
b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG**Repair or replace related wire harness****OK****Go to Diagnostic Help**

Engine starts normally, but idles roughly or stalls with part load (for example, A/C is ON)

Diagnosis Procedure

1 Check throttle for carbon deposits

NG → Clean throttle

OK

2 Observe if engine output increases when A/C is turned on. This means that observe changes of ignition advance angle, injection pulse width and intake air volume using diagnostic tester

OK → Go to step 4

NG

3 Connect ECM adapter, and disconnect pin cable of ECM corresponding terminal. Check if wire harness side is HIGH-level signal with A/C ON

NG → Check and repair A/C system

OK

4 Check if A/C system pressure, compressor magnetic clutch and A/C compressor pump are normal

NG → Check and repair A/C system

OK

5 Check injector for leakage or blockage

NG → Clean or replace injector

OK

06

6

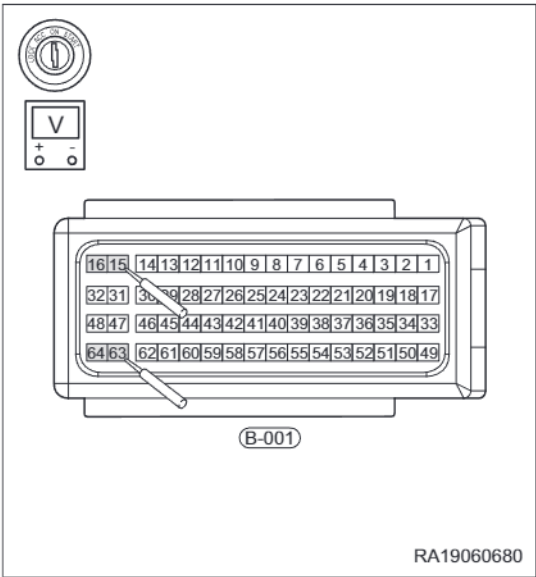
Check ECM power supply and ground

- a. Disconnect the ECM connector B-001.
- b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness



OK

Go to Diagnostic Help

Engine starts normally, but idle speed is too high

Diagnosis Procedure

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 throttle

OK

4 Disconnect coolant temperature sensor connector, start engine and observe if engine idle is normal at this time

OK Check and repair wire harness or replace sensor

NG

5 Check engine ignition timing

a. Check if the engine ignition timing is as specified.

NG Check and repair ignition timing

OK

06

6

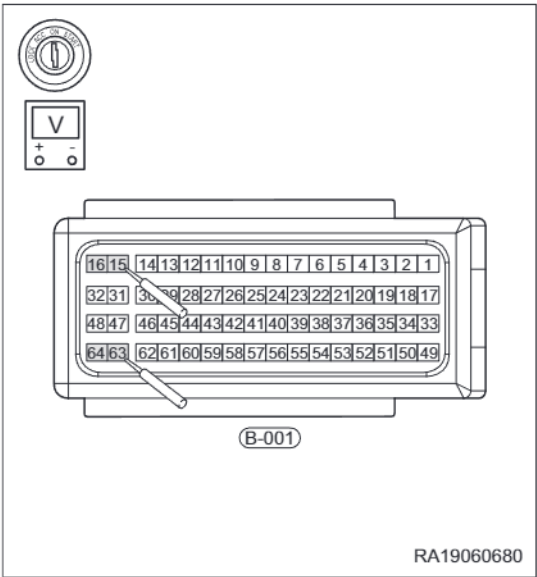
Check ECM power supply and ground

- a. Disconnect the ECM connector B-001.
- b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness



OK

Go to Diagnostic Help

Low engine speed or stalls when accelerating

Diagnosis Procedure

- 1** Check air filter for blockage, and intake pipe for air leakage

NG Check and repair intake system

OK

- 2** Check fuel pressure

- a. Using a fuel pressure gauge, check the fuel pressure ([See page 08-12](#)).

Standard Fuel Pressure

Condition	Fuel System Pressure (kPa)
Key ON	400
Engine Idling	400
Key LOCK	400

NG Repair or replace fuel system

OK

- 3** Check spark

- 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 and throttle position sensor and wire harness

NG Check and repair wire harness or replace sensor

OK

06

6 Check injector for leakage or blockage**NG** Clean or replace injector**OK****7** Check fuel condition

a. Observe if the trouble occurs just after fuel is filled.

NG Replace fuel**OK****06****8** Check engine ignition order and ignition timing

a. Check if the engine ignition order 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.

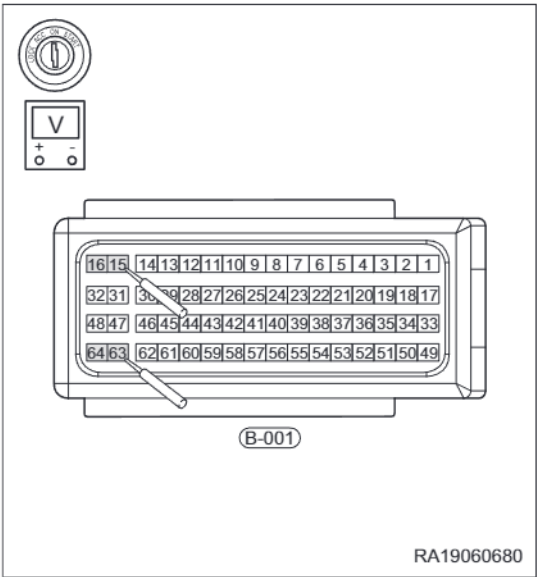
NG Repair or replace related exhaust system components**OK**

10 Check ECM power supply and ground

- a. Disconnect the ECM connector B-001.
- b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG Repair or replace related wire harness



OK

Go to Diagnostic Help

Slow response when accelerating

Diagnosis Procedure

- 1** Check air filter for blockage, and intake pipe for air leakage

NG Check and repair intake system

OK

- 2** Check fuel pressure

- a. Using a fuel pressure gauge, check the fuel pressure ([See page 08-12](#)).

Standard Fuel Pressure

Condition	Fuel System Pressure (kPa)
Key ON	400
Engine Idling	400
Key LOCK	400

NG Repair or replace fuel system

OK

- 3** Check spark

- 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 and throttle position sensor and wire harness

NG Check and repair wire harness or replace sensor

OK

6 Check injector for leakage or blockage

NG Clean or replace injector

OK

7 Check fuel condition

a. Observe if the trouble occurs just after fuel is filled.

NG Replace fuel

OK

06**8** Check engine ignition order and ignition timing

a. Check if the engine ignition order 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 Repair or replace related exhaust system components

OK

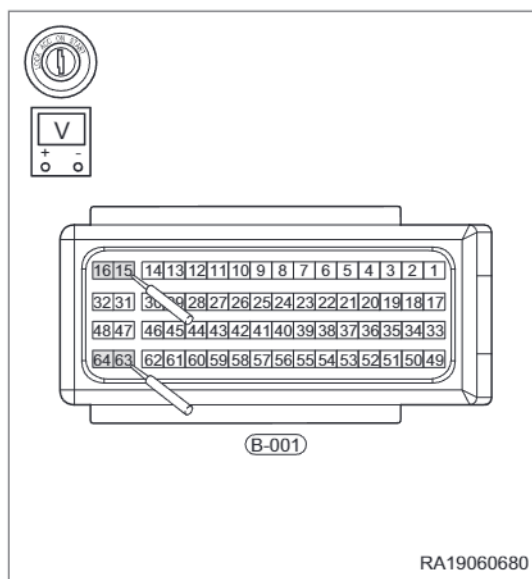
10 Check ECM power supply and ground

- Disconnect the ECM connector B-001.
- Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness



OK

Go to Diagnostic Help

Lack of power and poor performance when accelerating

Diagnosis Procedure

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 malfunctioning component

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. Using a fuel pressure gauge, check the fuel pressure ([See page 08-12](#)).

Standard Fuel Pressure

Condition	Fuel System Pressure (kPa)
Key ON	400
Engine Idling	400
Key LOCK	400

NG

Repair or replace fuel system

OK

4

Check spark

- 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 spark

- a. Remove the ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start the 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 and throttle position sensor and wire harness

NG Check and repair wire harness or replace sensor

OK

8 Check injector for leakage or blockage

NG Clean or replace injector

OK

9 Check fuel condition

- a. Observe if the trouble occurs just after fuel is filled.

NG Replace fuel

OK

10 Check engine ignition order and ignition timing

- a. Check if the engine ignition order 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

Repair or replace related exhaust system components

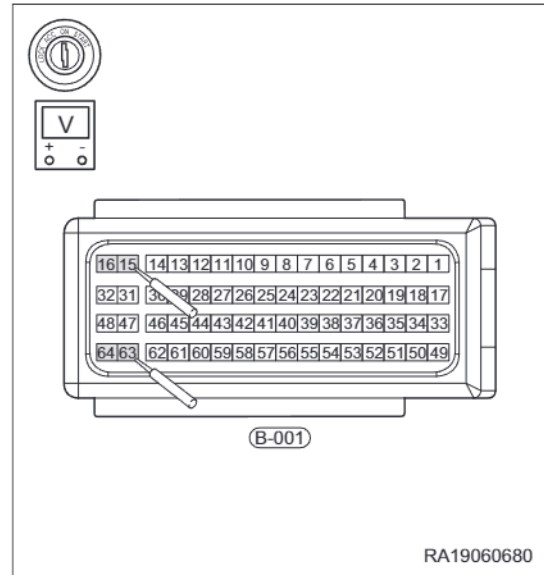
OK**12 Check ECM power supply and ground**

- a. Disconnect the ECM connector B-001.
b. Turn the ignition switch to ON and check the ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
B-001 (15, 16) - B-001 (63, 64)	Ignition switch ON	11 to 14 V

NG

Repair or replace related wire harness

**OK****06**

Go to Diagnostic Help

ON-VEHICLE SERVICE

Coolant Temperature Sensor

Description

The coolant temperature sensor is a negative temperature coefficient sensor, which is installed into the mounting hole in the thermostat holder.

Operation

The coolant temperature sensor provides an input signal for Engine Control Module (ECM). As the temperature increases, the resistance of sensor decreases. As the coolant temperature changes, the resistance of the coolant temperature sensor varies accordingly, resulting in a change in the voltage of coolant temperature sensor signal circuit. The ECM uses the input signal to control the air-fuel mixture, ignition timing, A/C compressor and radiator fan on/off timing.

06

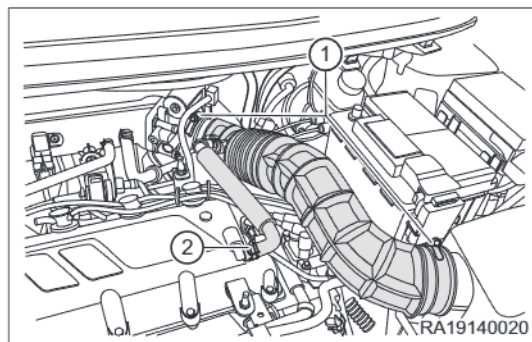
Removal

1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Drain the coolant ([See page 12-14](#)).

WARNING

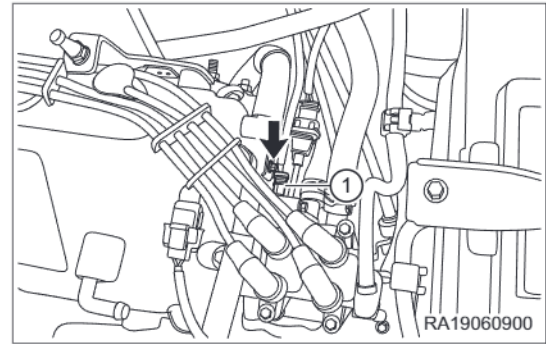
- Make sure the engine is in low temperature before operating the cooling system. Never open the expansion tank cover and remove the drain cock plug when the engine is operating or the cooling system is in high temperature. High-pressurized hot engine coolant and steam may flow out and cause serious injury.

4. Remove the engine trim cover.
5. Remove the intake hose with crankcase ventilation hose assembly.
 - a. Loosen the worm clamps (1) at both ends of intake hose to disconnect the intake hose.
(Tightening torque: $2.5 \pm 0.5 \text{ N}\cdot\text{m}$)
 - b. Loosen the elastic clamp (2) to disconnect the crankcase ventilation hose from the cylinder head cover.



- c. Remove the intake hose with crankcase ventilation hose assembly.

6. Remove the coolant temperature sensor.
 - a. Disconnect the coolant temperature sensor connector (1).
 - b. Remove the fixing bolt (arrow) from the engine speed sensor bracket, and move the sensor bracket to one side.
(Tightening torque: $8 \pm 1 \text{ N}\cdot\text{m}$)



- c. Remove the coolant temperature sensor from the thermostat holder.
(Tightening torque: $11 - 16 \text{ N}\cdot\text{m}$)

WARNING

- Remove the coolant temperature sensor when the engine cools down.

06

Installation

Installation is in the reverse order of removal.

CAUTION

- Perform sealing with the anaerobic seal gum.
- Confirm that the sensor is tightened fully during installation.
- After installing the engine coolant temperature sensor, add coolant and check the coolant level.

Knock Sensor

Description

The knock sensor is installed on the cylinder block, and used to detect the engine vibration caused by detonation.

Operation

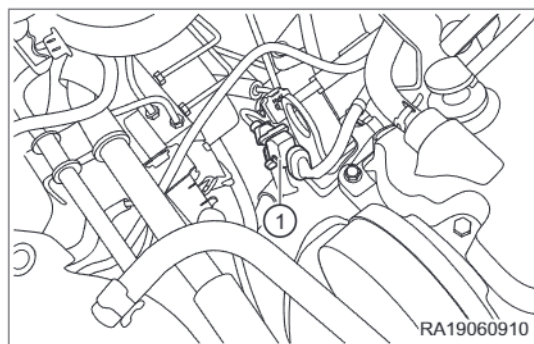
The sensitive element of knock sensor is a piezoelectric ceramic. Vibration of engine cylinder block is transferred to the piezoelectric ceramic through a mass block in the sensor. Due to the pressure generated by vibration of mass block, the piezoelectric ceramic generates a voltage at both electrode faces, and converts the vibration signal to an AC voltage signal to output it. As the intensity of vibration increases, the knock sensor output voltage increases accordingly.

Because the frequency of vibration signal caused by engine knocking is far more than that of normal engine vibration signal, the Engine Control Module (ECM) can distinguish between the knock or non-knock signals by processing these signals from the knock sensor.

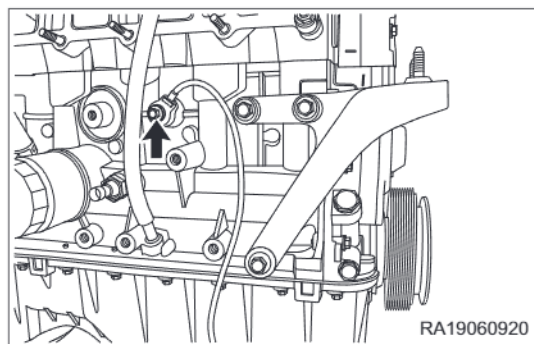
06

Removal

1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the knock sensor.
 - a. Disconnect the knock sensor connector (1), and move away the knock sensor cable from the bracket.



- b. Remove the knock sensor fixing bolt (arrow) and knock sensor.
(Tightening torque: 17 - 23 N·m)



Installation

Installation is in the reverse order of removal.

CAUTION

- Never allow any kinds of gasket and washer between sensor and engine block. Only the metal part of sensor can contact with the engine block directly.
- DO NOT apply lubricant, grease or seal gum when installing the knock sensor. Keep the engine block clean and dry, and never allow any foreign matter (such as oil) on the installation area of knock sensor.
- Never tap the knock sensor when installing it.

Oxygen Sensor

Description

This vehicle is equipped with two oxygen sensors (upstream oxygen sensor and downstream oxygen sensor). The oxygen sensors continually monitor the oxygen concentration in the exhaust gas.

Operation

The oxygen sensor generates voltage depending on the oxygen content in the exhaust gas. The sensor generates low voltage when the oxygen content is high, and high voltage when the oxygen content is low. Therefore, the sensor acts as a rich-lean switch.

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature under all operating conditions.

Upstream Oxygen Sensor

06

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

Downstream Oxygen Sensor

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

Removal & Installation - Upstream Oxygen Sensor

(See page 09-11)

Removal & Installation - Downstream Oxygen Sensor

(See page 09-13)

Camshaft Position Sensor

Description

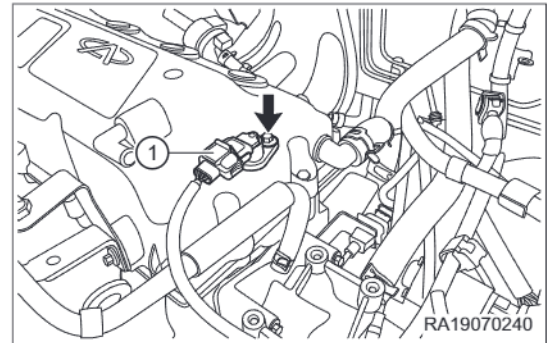
This vehicle is equipped with an intake camshaft position sensor, which is installed on the cylinder head cover.

Operation

The camshaft position sensor is a Hall type sensor. The Hall type sensor is fixed, and the sensor plate is installed on the camshaft. When the sensor plate is in high teeth, the applicable circuit output is low; when the sensor plate is in missing teeth, the applicable circuit output is high. As a result, the crankshaft phase information is provided to the Engine Control Module (ECM) so that the compression top dead center and exhaust top dead center of the crankshaft can be distinguished.

Removal

1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the camshaft position sensor.
 - a. Disconnect the camshaft position sensor connector (1).
 - b. Remove the camshaft position sensor fixing bolt (arrow).
(Tightening torque: $10 \pm 2 \text{ N}\cdot\text{m}$)



- c. Remove the camshaft position sensor from the cylinder head cover.

Installation

Installation is in the reverse order of removal.

CAUTION

- Apply engine oil before installation to ensure that it is installed smoothly.
- The sensor should be pressed into the mounting hole. Never use tools (such as a hammer) to strike the sensor into the mounting hole forcibly.

Engine Speed Sensor

Description

The engine speed sensor is installed on the clutch case, against the flywheel teeth. It is used to detect the speed and position of crankshaft.

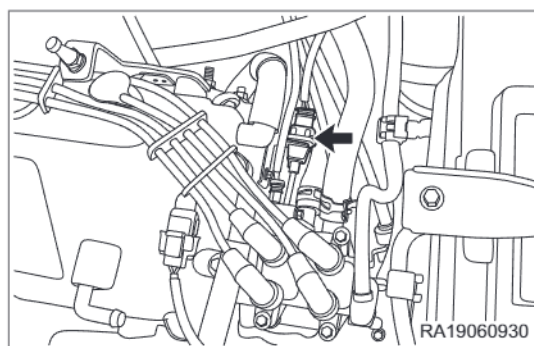
Operation

The engine speed sensor operates by using the magnetoelectric effect. When the crankshaft rotates, it drives the flywheel to rotate. The flywheel teeth will cut the magnetic line of sensor, and the change of magnetic flux causes the both ends of the sensor coil to generate output voltage with a certain frequency that is sent to Engine Control Module (ECM). And the output signal can indicate the speed and position of crankshaft.

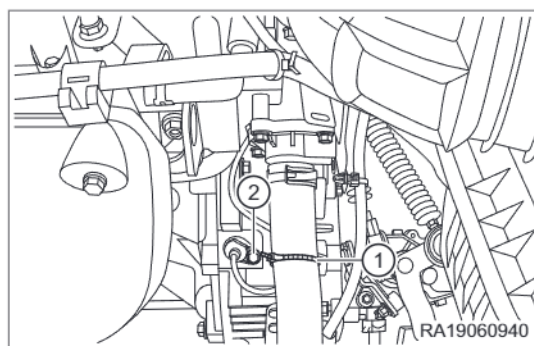
Removal

06

1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the engine speed sensor.
 - a. Disconnect the engine speed sensor connector (arrow), and move away the engine speed sensor cable from the bracket.



- b. Cut the band (1) of engine speed sensor cable and remove the engine speed sensor fixing bolt (2). (Tightening torque: 8 ± 2 N·m)



- c. Remove the engine speed sensor from the transmission.

Installation

Installation is in the reverse order of removal.

CAUTION

- Press in the engine speed sensor rather than tap when installing it.

Intake Pressure/Temperature Sensor

Description

The intake pressure/temperature sensor integrates with the intake manifold absolute pressure sensor and intake temperature sensor, which is installed on the intake manifold upper body assembly.

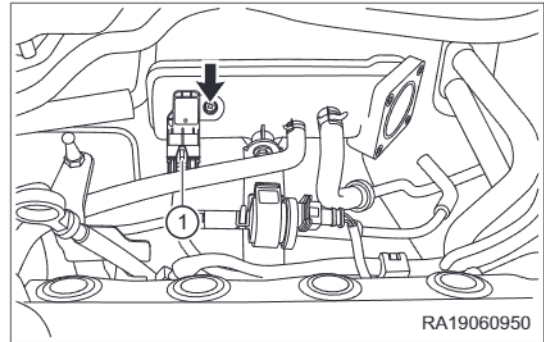
Operation

The intake manifold absolute pressure sensing element consists of a piece of silicon chip, which will deform mechanically as the intake manifold absolute pressure changes. The piezoresistor in the sensor will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated after processing by the signal circuit of the silicon chip.

The intake temperature sensor is a negative temperature coefficient thermistor, whose resistance changes with the intake temperature. This sensor sends the voltage of intake temperature change to the Engine Control Module (ECM), thus monitoring the change of intake temperature.

Removal

1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the intake pressure/temperature sensor.
 - a. Disconnect the intake pressure/temperature sensor connector (1).
 - b. Remove the intake pressure/temperature sensor fixing bolt (arrow).
(Tightening torque: $8 \pm 1 \text{ N}\cdot\text{m}$)



- c. Remove the intake pressure/temperature sensor from the intake manifold.

Installation

Installation is in the reverse order of removal.

CAUTION

- Remove the foreign matter on the sensor before installation.
- Apply grease to the O-ring before installation to prevent it from being damaged during installation.

Ignition Coil

Description

The ignition coil converts the low voltage of primary winding into the high voltage of secondary winding, and discharges the spark plug electrode to produce sparks which will ignite the combustible air-fuel mixture in the cylinder.

Operation

An 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 the primary circuit switch on and off and an instant high voltage generated by secondary circuit will cause the spark plugs to discharge, thus igniting the combustible air-fuel mixture. The primary winding will recharge when its ground passage is on through an Engine Control Module (ECM) signal. If the Engine Control Module (ECM) cuts off the control signal to primary winding circuit, it will stop charging and a high voltage will be induced in the secondary winding.

06

Removal

(See page 14-10)

Installation

(See page 14-10)

Electric Fuel Pump

Description

The electric fuel pump consists of DC motor, vane pump and end cover (integrated with check valve, pressure regulator and anti-electromagnetic interference element) etc. The pump and motor are installed coaxially, and sealed in the same housing. Fuel is filled around the pump and motor in the housing and used for heat dissipation and lubrication.

Operation

The battery supplies power to the electric fuel pump via the electric fuel pump relay, which can turn on the electric fuel pump circuit only when starting and engine running. When the engine stops running because of an accident, the fuel pump stops running automatically. The maximum pressure at the electric fuel pump outlet is adjusted by the pressure regulator to keep the whole fuel system pressure at 400 kPa.

Removal

(See page 08-15)

Installation

(See page 08-15)

Fuel Injector

Description

The fuel injector is located on the cylinder head near to the intake valve, and the nozzle end is located directly above the intake port.

Operation

The Engine Control Module (ECM) sends electric pulse to the injector coil, forming magnetic field force. When the magnetic field force increases enough to overcome the resultant force from return spring pressure, needle gravity and friction force, the needle begins to rise up and the injector starts to inject fuel. The pressure of return spring forces the needle to close again when the injection pulse stops.

Removal

(See page 08-25)

06

Installation

(See page 08-25)

CAUTION

- It is necessary to replace the grommets with new ones during installation.
- Throttle self-learning must be performed after installation (See page 06-19). After self-learning is completed, start the vehicle and check for proper functioning.

Electric Throttle Assembly

Description

The electric throttle assembly is located on the intake manifold assembly.

Operation

The electric throttle assembly is a critical part for the engine intake system. Its main function is to adjust the intake passage area according to the driver's driving intention, and control the intake air volume to meet the intake requirement for the engine in different operating conditions, and send back the position signals of the throttle valve plate to the control unit to achieve accurate control. The throttle valve plate will stop at the limp home position determined in a mechanical way.

The electric throttle assembly consists of four parts: drive module, train module, executive module and feedback module, and all the components are integrated into the same throttle valve housing. Two-way redundant structure is used for throttle feedback module.

Removal

(See page 10-12)

Installation

(See page 10-12)

Canister Solenoid Valve

Description

The canister solenoid valve is located on the canister solenoid valve bracket of the intake manifold assembly. It opens when power is on, and closes when power is off.

Operation

The Engine Control Module (ECM) controls the opening and closing of canister solenoid valve and adjusts the vapor flow speed from the canister to the intake manifold according to the information, such as engine load, temperature and speed.

Removal

(See page 09-7)

06 Installation

(See page 09-7)

Engine Control Module (ECM)

Description

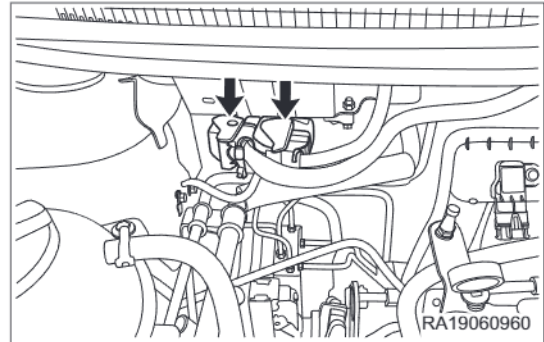
The Engine Control Module (ECM), mounted on the lower right side of engine compartment rain gutter front end panel assembly, can be removed only as a unit for replacement.

Operation

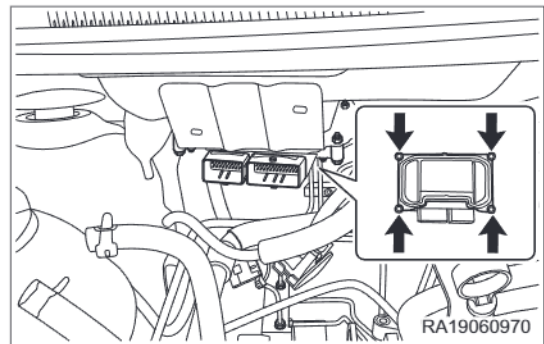
The Engine Control Module (ECM) is a pre-programmed microprocessor digital computer, which is used to adjust the ignition timing, air-fuel ratio, emission control, speed control, A/C compressor and idle speed etc. The Engine Control Module (ECM) enables the program to suit the ever-changing operation conditions.

Removal

1. Turn off all the electrical equipment and ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the Engine Control Module (ECM).
 - a. Remove 2 connectors (arrow) from the Engine Control Module (ECM).



- b. Remove 4 Engine Control Module (ECM) fixing bolts (arrow) and the Engine Control Module (ECM). (Tightening torque: 7 ± 1 N·m)



Installation

Installation is in the reverse order of removal.

CAUTION

- Pay attention to the static electricity protection when installing.
- Take care to protect the connector pins.
- To prevent water droplets from accumulating on the connector joint, face it down.

