# SQRE4T15B ENGINE MANAGEMENT SYSTEM

# GENERAL INFORMATION

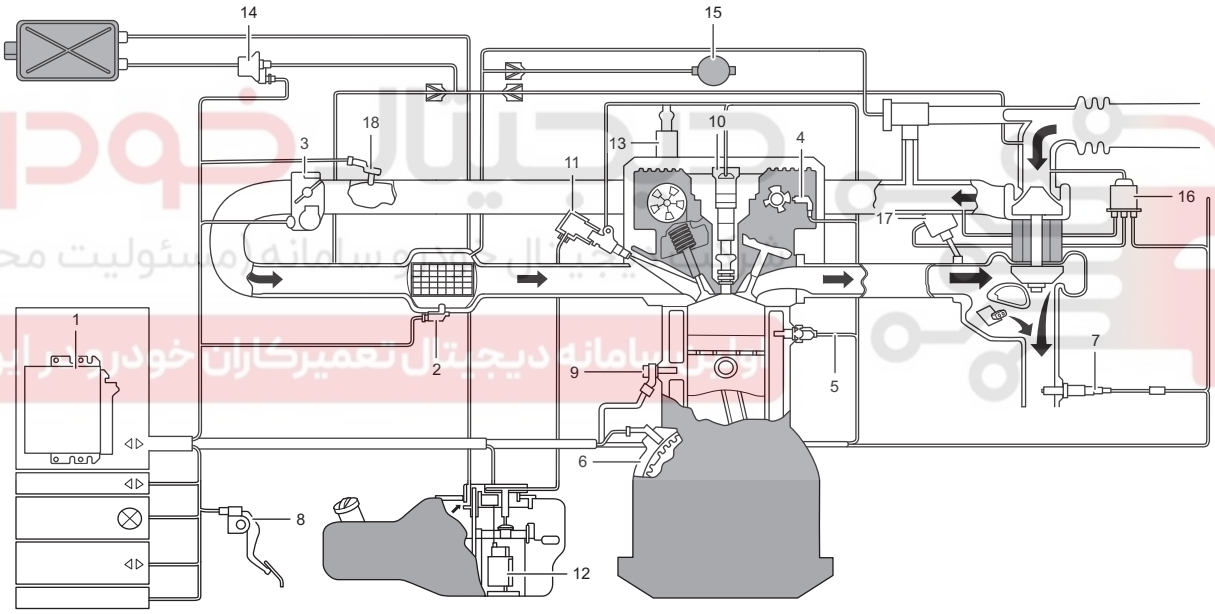
## Description

Engine of M1A model adopts Bosch ME1788 engine management system. This system mainly consists of Engine Control Module (ECM), sensors and actuators, which controls intake air amount, injection volume and ignition timing, etc. when engine is operating.

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

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

### 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 - Electronic Accelerator Pedal |
| 9 - Knock Sensor | 10 - Ignition Coil |
| 11 - Fuel Injector | 12 - Electric Fuel Pump |
| 13 - VVT Control Valve | 14 - Canister Solenoid Valve |
| 15 - Electrical Water Pump | 16 - Turbocharger Control Valve |
| 17 - Boost Actuator | 18 - Boost Pressure Sensor |

## System Function

- Calculate air flow

  ECM calculates air flow entering the cylinder by signals from intake pressure/temperature sensor, and then adjusts injection volume to make 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 signals from crankshaft position sensor, and accurately controls the engine ignition and injection timing.
- Determine operating sequence of cylinders

  ECM recognizes the top dead center of cylinder 1 by 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. Closed-loop fuel control can accurately regulate the air-fuel ratio of engine, thus effectively controlling emissions. Open-loop fuel control is applied when engine is starting or warming up and when oxygen sensor is malfunctioning.
- Ignition control

  Ignition control system of this engine adopts individual control.
- Knock control

  When a knocking is detected by knock sensor, system will calculate the ignition advance angle that needs to be delayed or advanced according to current operating conditions and knock intensity and adjust the ignition angle, thus avoiding or reducing knocking.
- Emission control

  Three-way catalytic converter can convert engine exhaust gas into harmless gas and discharge it into atmosphere. When engine temperature becomes normal after warming up, ECM will activate 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

  Engine management system has the function to protect three-way catalytic converter. ECM estimates the three-way catalytic converter temperature according to engine operating conditions. When it is estimated that 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 system voltage becomes extremely high due to charging system malfunction, engine management system will activate the protection program to limit engine speed, thus avoiding damage to ECM and battery.

# Precautions

## General service requirements

- Only digital multimeter can be used to perform inspection for engine management system.
- Use genuine components to perform service work, otherwise appropriate engine management system operation cannot be guaranteed.
- Only use unleaded gasoline during servicing.
- Please observe normative service and diagnostic flowchart to perform service work.
- Never disassemble components of engine management system during servicing.
- When holding electronic elements (ECM and 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 engine management system component or its connector from its installation position to prevent damaging accidentally, or foreign matter, such as moisture, oil from entering connectors, which will affect the normal operation of engine management system.
2. Be sure to turn ignition switch to OFF when disconnecting and connecting connectors. Otherwise electronic elements may be damaged.
3. When simulating hot operating condition of malfunction and performing other service work that may cause temperature to rise, never allow temperature of ECM to exceed 80°C.
4. As the supplying pressure of fuel system is high (approximately 400 kPa), all fuel pipes are high pressure resistant pipe. Fuel pressure in fuel lines is still high even when engine is not running. Therefore, be careful not to casually remove fuel pipes during servicing; when it is necessary to service fuel system, discharge pressure in the fuel system before removing fuel pipes. The way to discharge pressure is as follows:
   - Remove fuel pump relay, start engine and idle it until the engine stops running by itself. Then try to start engine 2 - 3 times to ensure fuel pressure is discharged completely. Removal of fuel pipes and replacement of fuel filter should be performed in a well-ventilated area by professional service men.
5. Do not energize electric fuel pump when removing it from fuel tank to prevent electric sparks, which will cause a fire.
6. Running test for fuel pump is prohibited when it is empty or in water; otherwise it will shorten the service life. Never connect the positive and negative of fuel pump in reverse.
7. When checking ignition system, only perform spark jump test when it is necessary and duration should be shortened as much as possible. Do not open throttle during test; otherwise a large amount of unburned gasoline will enter the exhaust pipe, causing damage to the three-way catalytic converter.
8. Do not connect battery with its polarity reversed to prevent damage to electronic elements. This system adopts negative ground.
9. Never remove battery cable when engine is running.
10. The positive, negative battery cables and ECM must be removed before performing welding on vehicle.
11. Do not puncture wire outer coat to detect electric signals input and output by components.

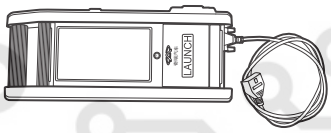
# Specifications

## Torque Specifications

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

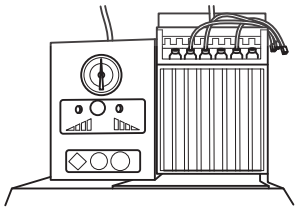
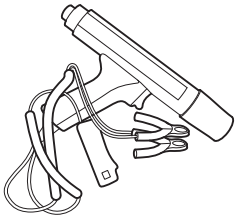
# Tools

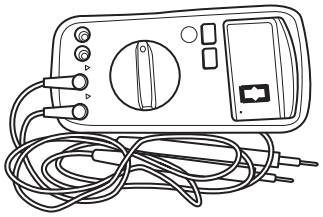
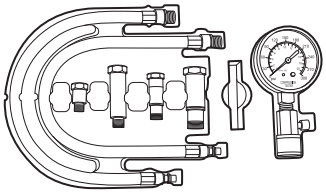
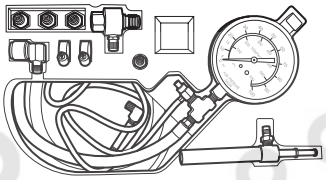
## Special Tool

| | |
|---|---|
| X-431 3G Diagnostic Tester |  RCH0000001 |



## General Tools

| | |
|---|---|
| Fuel Injector Cleaning Analyzer |  RCH0000062 |
| Ignition Timing Light |  RCH0000016 |

| | |
|---|---|
| Digital Multimeter |  RCH0000002 |
| Cylinder Pressure Gauge |  RCH0000044 |
| Fuel Pressure Gauge |  RCH0000048 |
| Oscilloscope |  RCH0000061 |

# ECM Terminal Definition

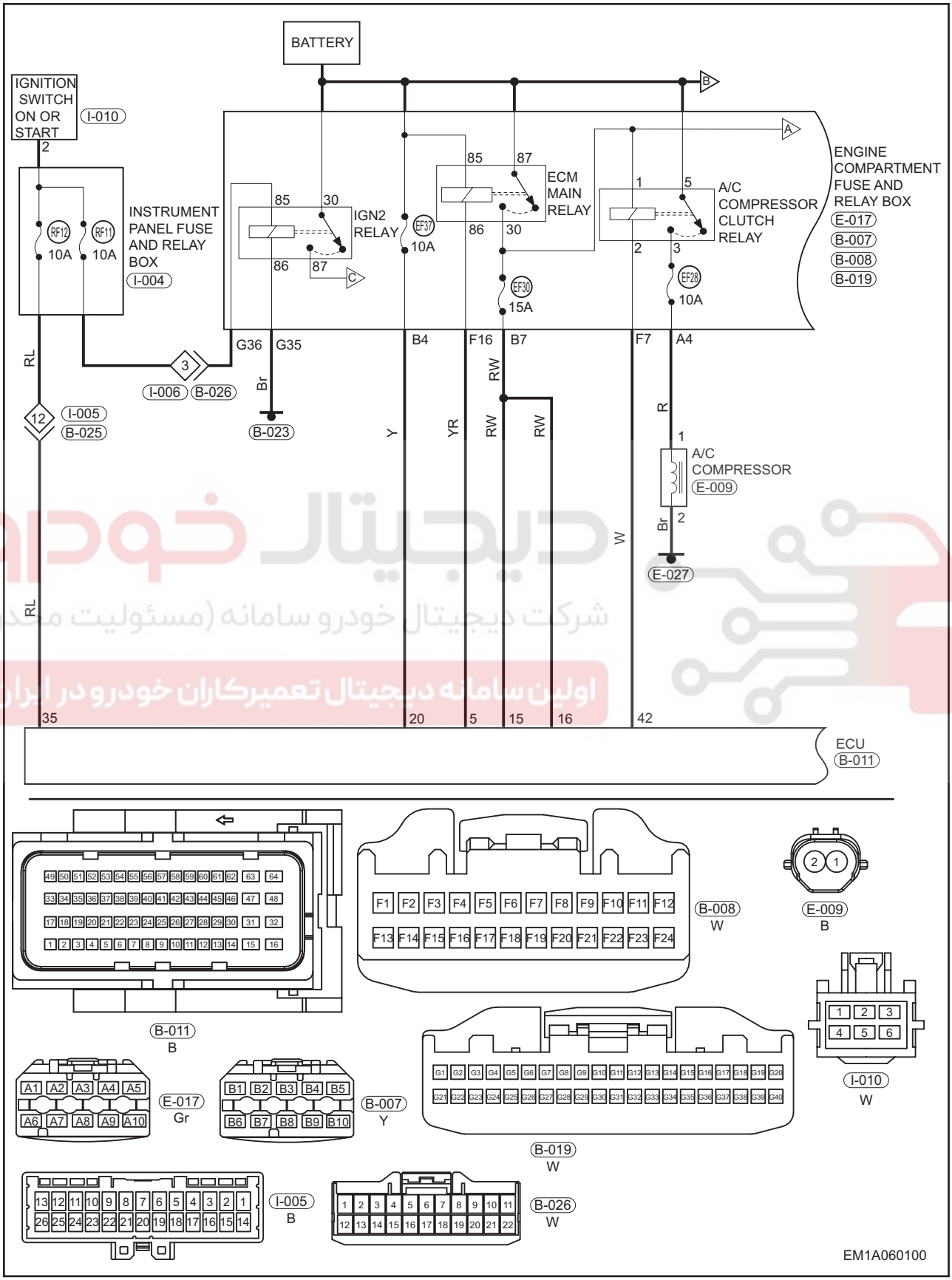
## ECM Connector

| Terminal No. | Description | Terminal No. | Description |
|---|---|---|---|
| 1 | CAN Bus 1 High | 57 | - |
| 2 | - | 58 | - |
| 3 | - | 59 | Electronic Accelerator Pedal Sensor 2 Ground |
| 4 | - | 60 | - |
| 5 | Main Relay | 61 | - |
| 6 | Clutch Switch | 62 | Boost Pressure Sensor Temperature Signal |
| 7 | Electronic Accelerator Pedal Sensor 1 Ground | 63 | ECM Ground 2 |
| 8 | - | 64 | ECM Ground 1 |
| 9 | Constant Speed Cruise Signal | 65 | Exhaust Emission Valve |
| 10 | A/C High/Low Pressure Switch Signal | 66 | - |
| 11 | - | 67 | Injector in Cylinder 2 |
| 12 | Brake Vacuum Sensor Signal | 68 | Injector in Cylinder 1 |
| 13 | - | 69 | Variable Camshaft Timing Valve (Exhaust) |
| 14 | - | 70 | ERCV Valve |
| 15 | UBR Noncontinuous Power Supply | 71 | Variable Camshaft Timing Valve (Intake) |
| 16 | UBR Noncontinuous Power Supply | 72 | Injector in Cylinder 3 |
| 17 | CAN Bus 1 Low | 73 | Upstream Oxygen Sensor Heater |
| 18 | - | 74 | Injector in Cylinder 4 |
| 19 | 5 V Power Supply 1 | 75 | Throttle Actuator (+) |
| 20 | UBD Continuous Power Supply | 76 | Ignition Coil 4 |
| 21 | Downstream Oxygen Sensor | 77 | Throttle Position Sensor 1 |
| 22 | - | 78 | Throttle Position Sensor 2 |
| 23 | Brake Switch | 79 | - |
| 24 | A/C Compressor Medium Pressure Switch | 80 | Oxygen Sensor Ground |
| 25 | Brake Light Switch | 81 | - |
| 26 | - | 82 | - |
| 27 | - | 83 | - |
| 28 | A/C Switch | 84 | Engine Speed Sensor Ground |
| 29 | - | 85 | Intake Pressure Sensor (-) |
| 30 | Electronic Accelerator Pedal Sensor 2 | 86 | Throttle Position Sensor (-) |

| Terminal No. | Description | Terminal No. | Description |
|---|---|---|---|
| 31 | High Speed Fan Control | 87 | Throttle Actuator (-) |
| 32 | Anti-theft Input | 88 | Ignition Coil 2 |
| 33 | - | 89 | Knock Sensor B |
| 34 | - | 90 | Knock Sensor A |
| 35 | Ignition Switch | 91 | Intake Pressure Sensor |
| 36 | 5 V Power Supply of Electronic Accelerator Pedal Sensor 2 | 92 | PWM Control |
| 37 | 5 V Power Supply of Electronic Accelerator Pedal Sensor 1 | 93 | Camshaft Position Sensor 1 |
| 38 | - | 94 | TEV Carbon Canister Valve |
| 39 | - | 95 | Intake Camshaft Position Sensor Ground |
| 40 | - | 96 | Engine Speed Sensor Signal |
| 41 | Fuel Pump Relay | 97 | - |
| 42 | A/C Compressor Relay | 98 | Camshaft Position Sensor (+5 V) |
| 43 | Downstream Oxygen Sensor Ground | 99 | Ignition Coil 3 |
| 44 | Bottom Clutch Switch | 100 | Ignition Coil 1 |
| 45 | Electronic Accelerator Pedal Sensor 1 | 101 | Engine Coolant Temperature Sensor |
| 46 | Boost Pressure Sensor | 102 | - |
| 47 | Analog Ground | 103 | - |
| 48 | Downstream Oxygen Sensor Heater | 104 | Upstream Oxygen Sensor |
| 49 | - | 105 | Exhaust Camshaft Position Sensor |
| 50 | - | 106 | Electric Water Pump Signal |
| 51 | - | 107 | 5 V Power Supply of Throttle |
| 52 | - | 108 | Engine Speed Sensor Power Supply |
| 53 | - | 109 | 5 V Power Supply of Intake Manifold |
| 54 | Electric Vacuum Pump | 110 | - |
| 55 | - | 111 | ECM Ground 4 |
| 56 | Low Speed Fan Control | 112 | ECM Ground 3 |

# Circuit Diagram

## Engine Management System (Page 1 of 10)



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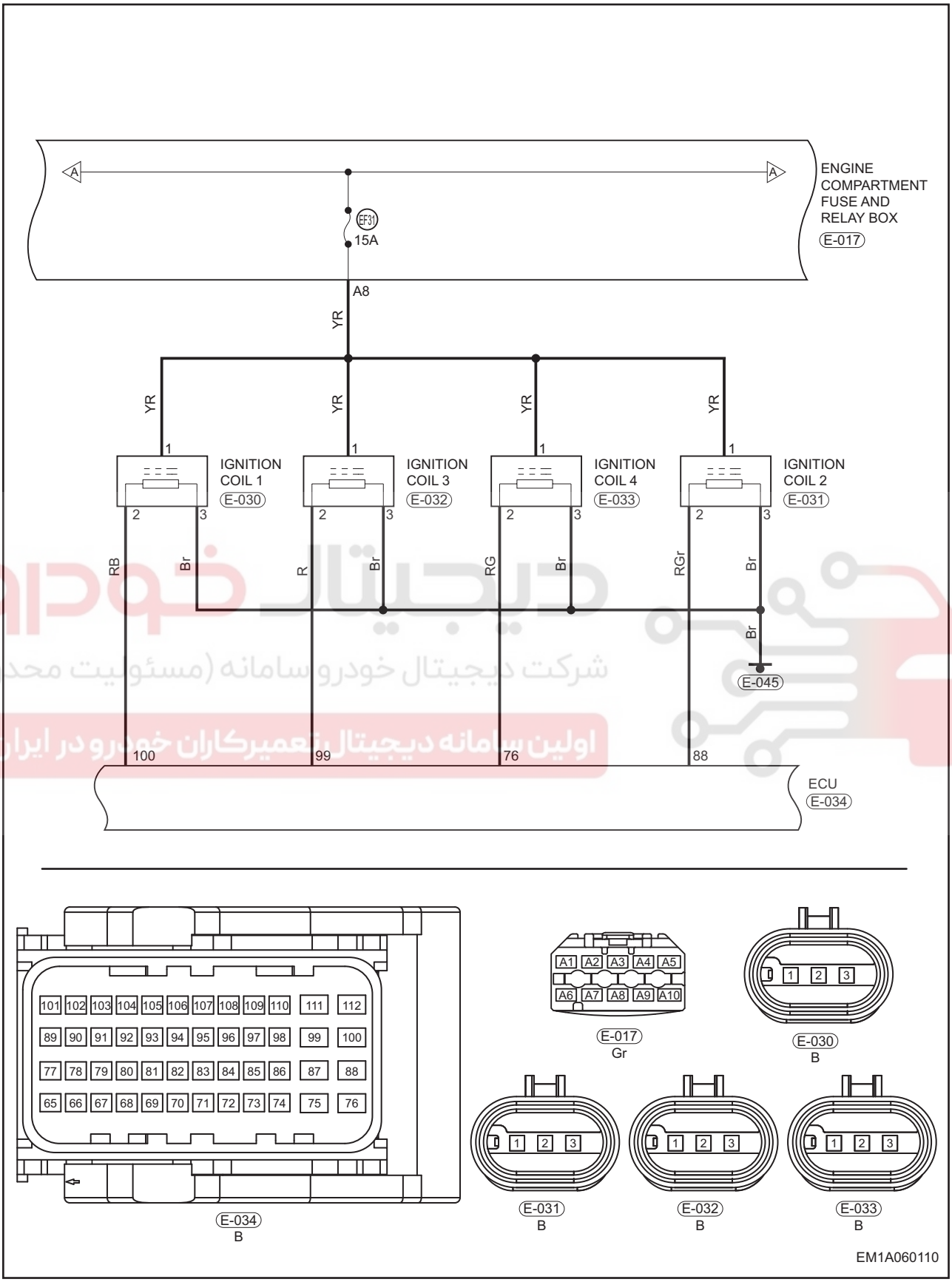

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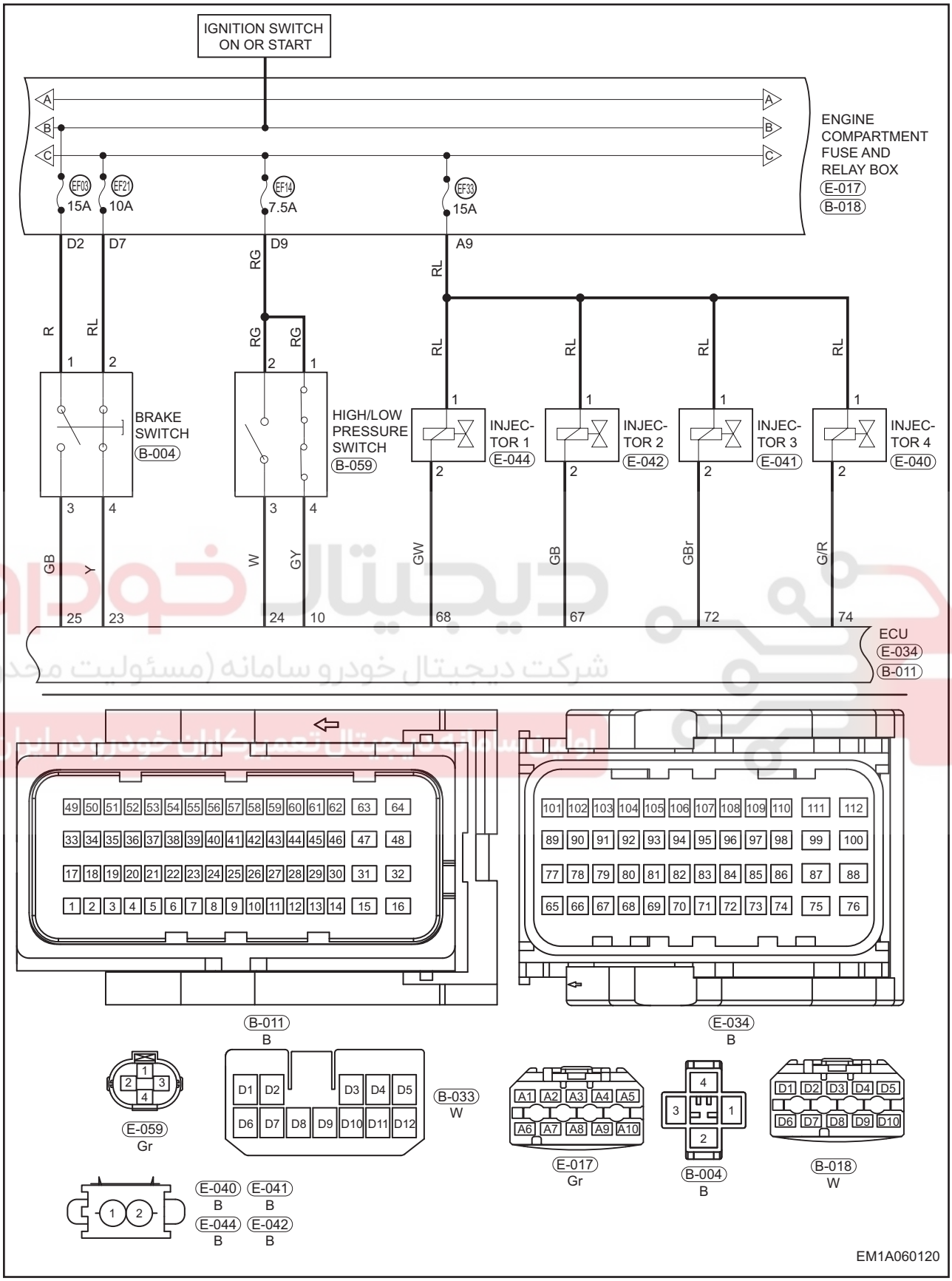

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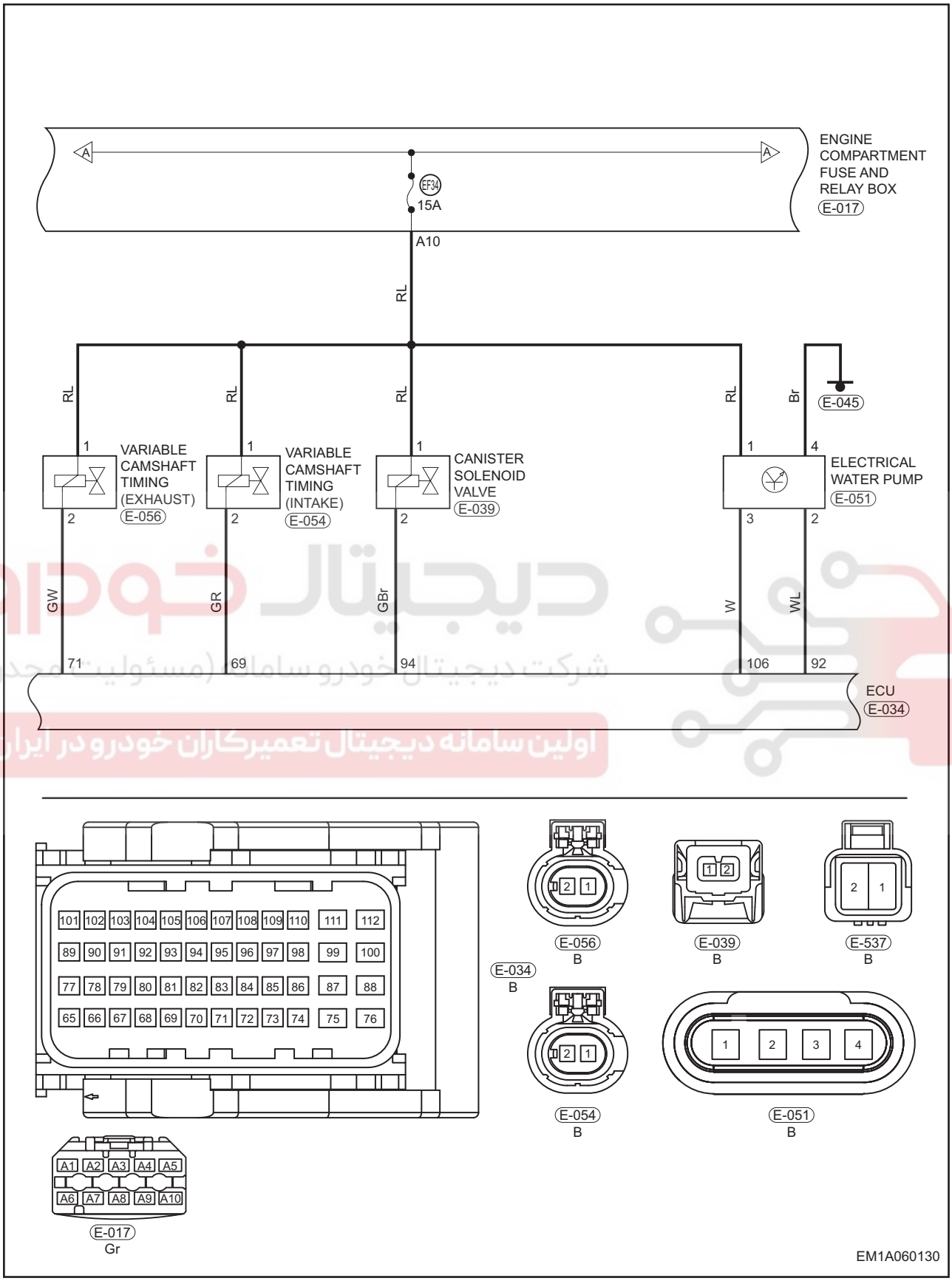

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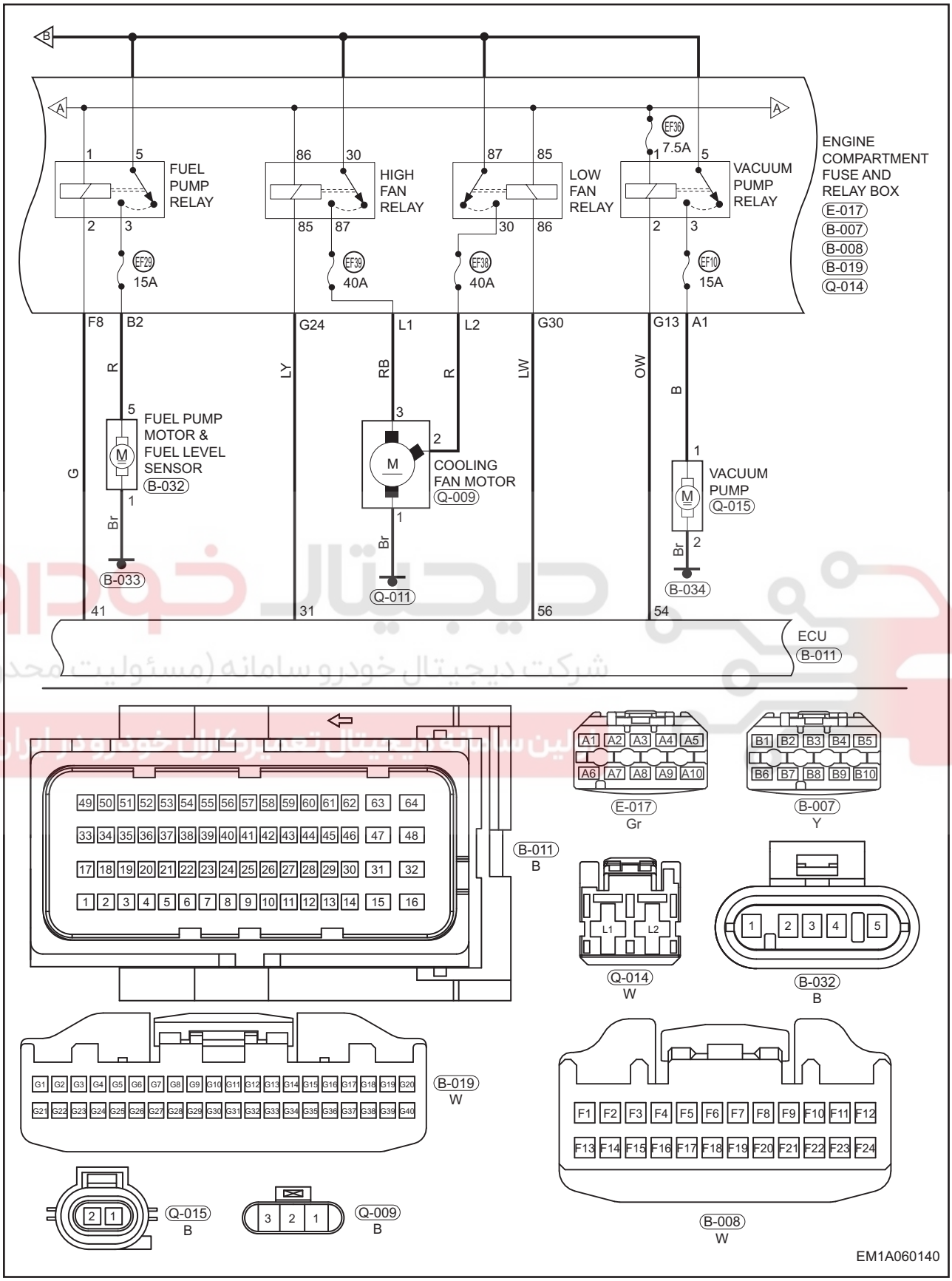

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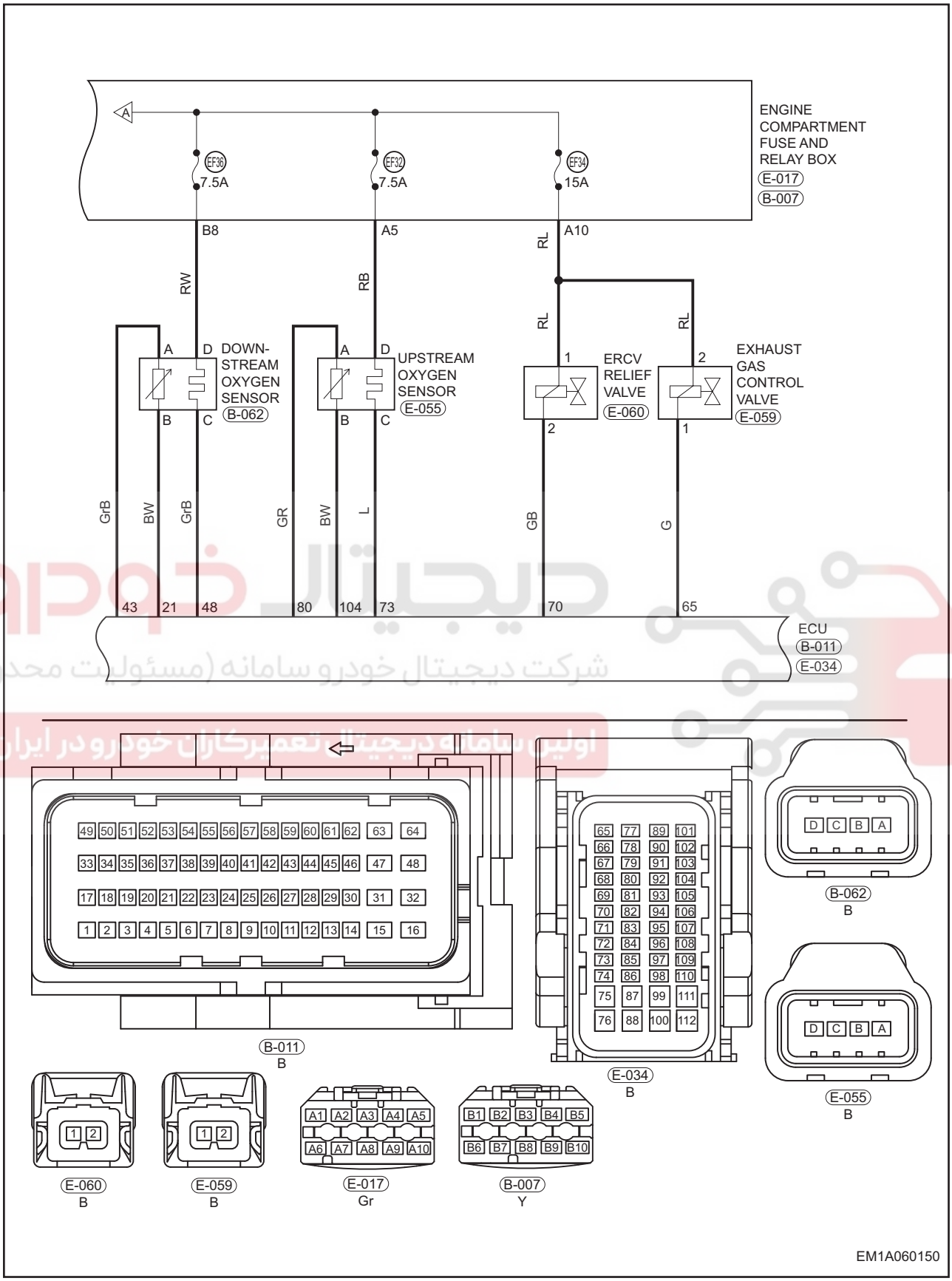

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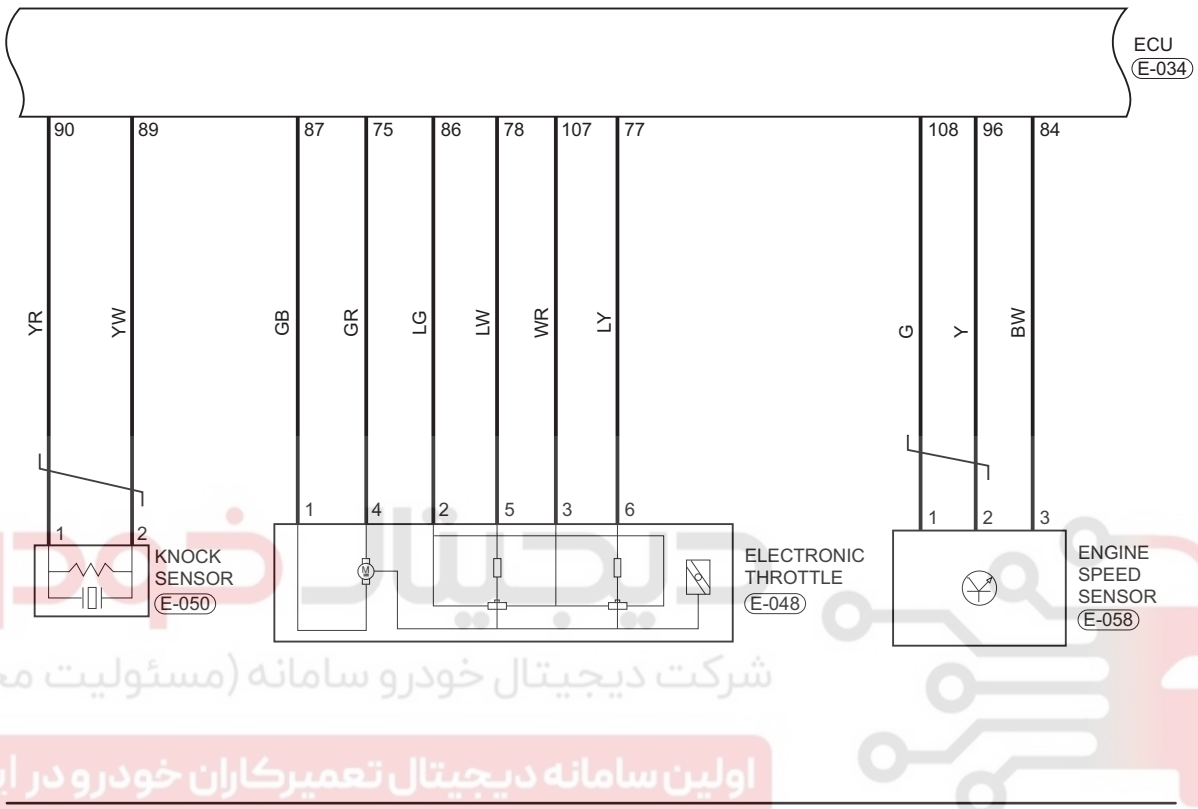
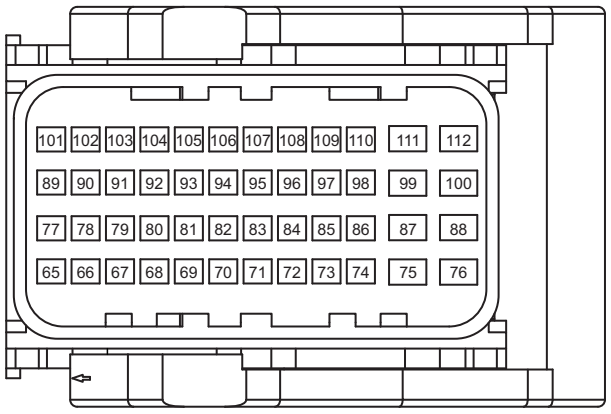
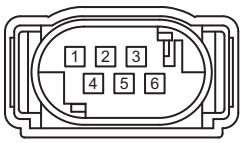



E-034
B


E-050
B




E-048
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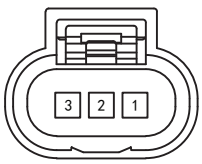


E-058
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EM1A060160

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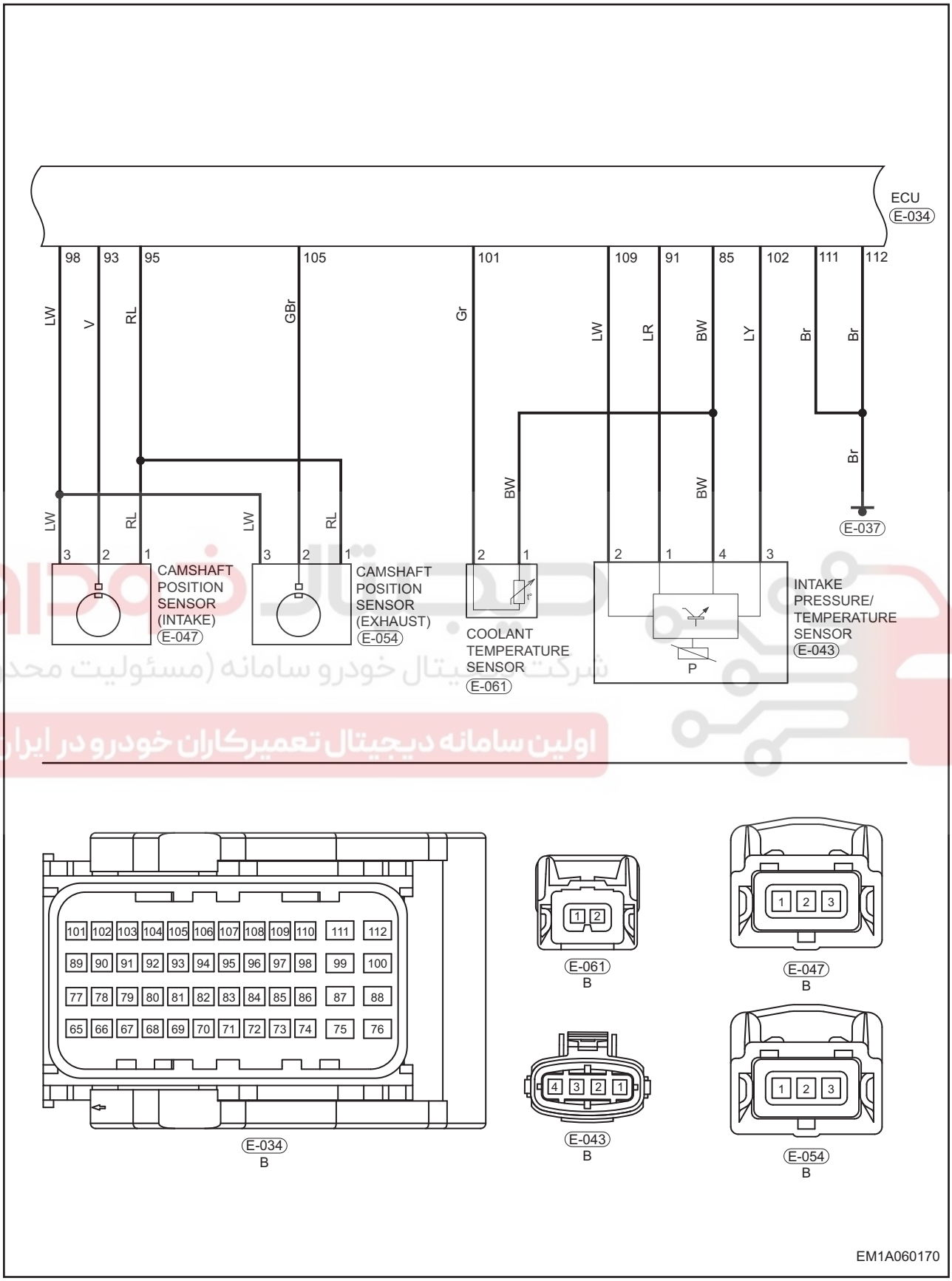

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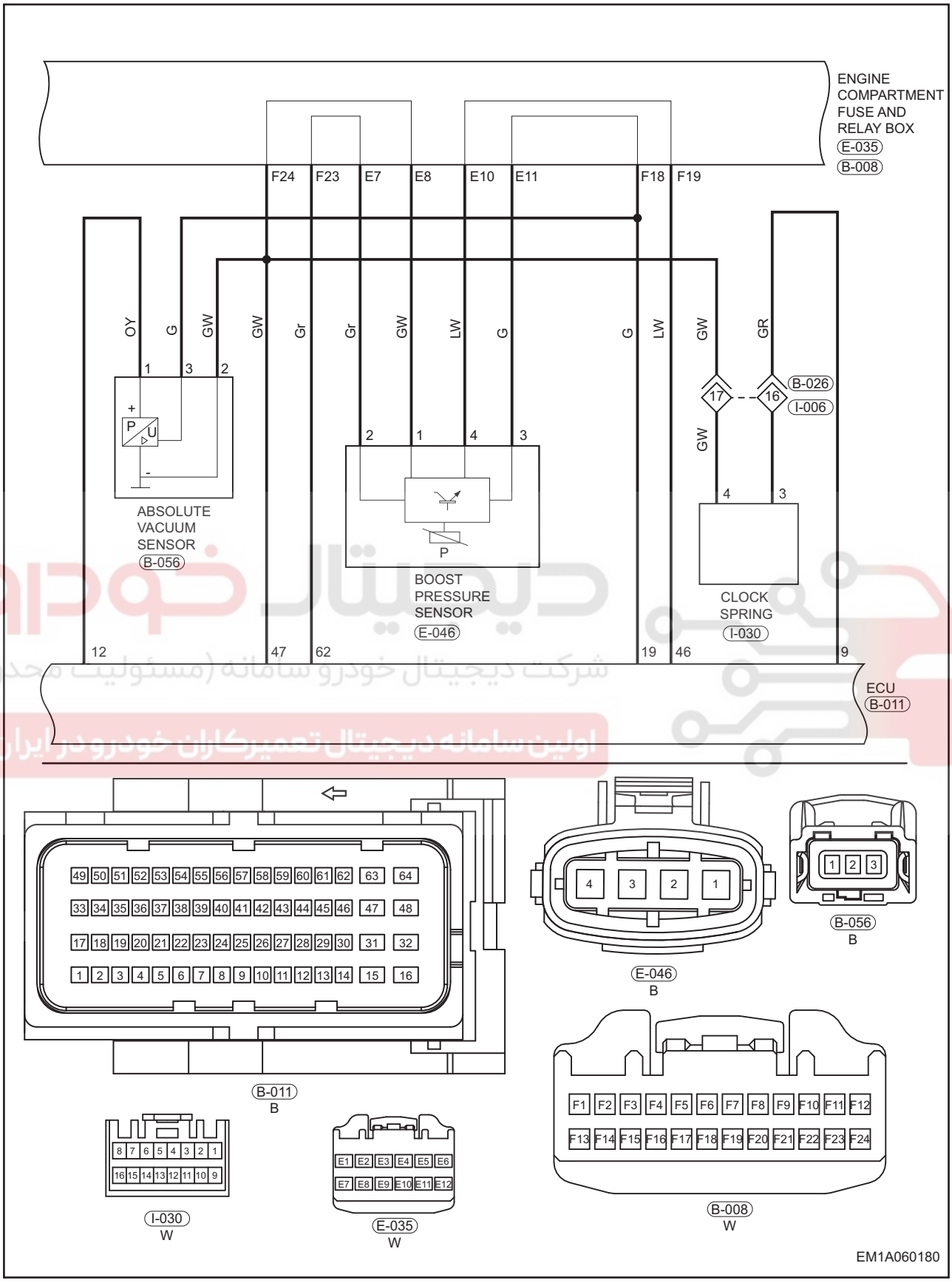

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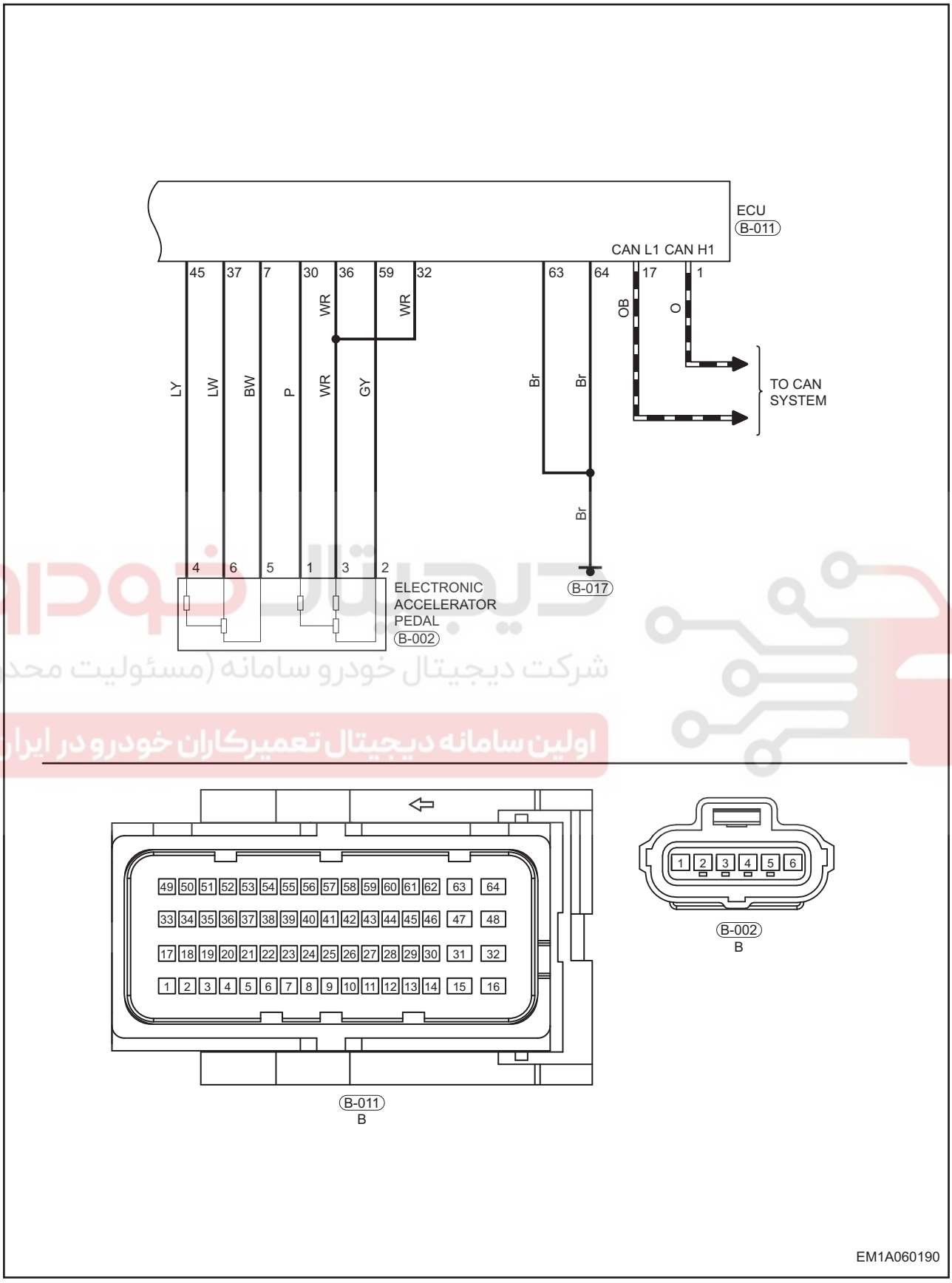


# DIAGNOSIS & TESTING

## Diagnostic Help

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

## Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the following:

- Check if connectors are loose.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Monitor X-431 3G diagnostic tester (the latest software) data that is related to this circuit.
- Wiggle related wire harness and connector and observe if signal in related circuit is interrupted.
- If possible, try to duplicate the conditions under which DTC was set.
- Look for data that has changed or DTC to reset during wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect sensors and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
- Use data recorder and/or oscilloscope to help diagnose intermittent malfunctions.
- Remove Engine Control Module (ECM) from malfunctioning vehicle and install it to a new vehicle to perform a test. If DTC cannot be cleared, ECM is malfunctioning. If DTC can be cleared, reinstall ECM to original vehicle.

## Ground Inspection

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

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

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

## Throttle Self-learning

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

Throttle self-learning procedures:

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

## Diagnostic Trouble Code (DTC) Chart

| | |
|---|---|
| P000A 00 | Camshaft Control Slow Response (Inlet) |
| P000A 77 | Camshaft Control Target Error (Inlet) |
| P000B 00 | Camshaft Control Slow Response (Outlet) |
| P000B 77 | Camshaft Control Target Error (Outlet) |
| P0010 13 | Control Circuit of Camshaft Control Valve (Inlet) |
| P0012 00 | Inlet Camshaft not in Locking Position During Start |
| P0013 13 | Control Circuit of Camshaft Control Valve (Outlet) |
| P0015 00 | Outlet Camshaft not in Locking Position During Start |
| P0016 29 | Npl Error for Alignment Between Camshaft (Inlet) and Crankshaft |
| P0016 22 | Retard Error for Alignment Between Camshaft (Inlet) and Crankshaft |
| P0016 21 | Advance Error for Alignment Between Camshaft (Inlet) and Crankshaft |
| P0018 29 | Npl Error for Alignment Between Camshaft (Outlet) and Crankshaft |
| P0018 22 | Retard Error for Alignment Between Camshaft (Outlet) and Crankshaft |
| P0018 21 | Advance Error for Alignment Between Camshaft (Outlet) and Crankshaft |
| P0030 13 | O2 Sensor Heater Control Circuit Open (Upstream of the Catalyzer) |
| P0031 11 | O2 Sensor Heater Control Circuit Low (Upstream of the Catalyzer) |
| P0032 12 | O2 Sensor Heater Control Circuit High (Upstream of the Catalyzer) |
| P0033 13 | Dump Valve Control Circuit Open |
| P0034 11 | Dump Valve Control Circuit Low |
| P0035 12 | Dump Valve Control Circuit High |
| P0036 13 | O2 Sensor Heater Control Circuit Open (Downstream of the Catalyzer) |
| P0037 11 | O2 Sensor Heater Control Circuit Low (Downstream of the Catalyzer) |
| P0038 12 | O2 Sensor Heater Control Circuit High (Downstream of the Catalyzer) |

| | |
|---|---|
| P0053 1E | O2 Sensor Heater Resistance Too Large (Upstream of the Catalyzer) |
| P0054 1E | O2 Sensor Heater Resistance Too Large (Downstream of the Catalyzer) |
| P0105 28 | Manifold Absolut Pressure Circuit No Change |
| P0106 00 | Manifold Abs. Pressure Performance Non-plausible |
| P0107 11 | Manifold Abs. Pressure Low Input |
| P0108 12 | Manifold Abs. Pressure High Input |
| P0111 00 | Intake Air Temp. Circ. Performance Non-plausible |
| P0112 16 | Intake Air Temp. Circ. Low Input |
| P0113 17 | Intake Air Temp. Circ. High Input |
| P0116 00 | Engine Coolant Temp. Circ. Performance Non-plausible |
| P0117 16 | Engine Coolant Temp. Circ. Low Input |
| P0118 17 | Engine Coolant Temp. Circ. High Input |
| P0121 29 | Throttle Pos. Sensor 1 Circ. Performance Non-plausible |
| P0122 16 | Throttle Pos. Sensor 1 Circ. Low Input |
| P0123 17 | Throttle Pos. Sensor 1 Circ. High Input |
| P0130 00 | O2 Sensor Circ. Malfunction (Upstream of the Catalyzer) |
| P0131 16 | O2 Sensor Circ. Low Voltage (Upstream of the Catalyzer) |
| 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, Malfunction |
| P0171 00 | Fuel Trim, System Too Lean |
| P0172 00 | Fuel Trim, System Too Rich |
| P0201 13 | Cylinder 1 - Injector Circuit Error |
| P0202 13 | Cylinder 2 - Injector Circuit Error |
| P0203 13 | Cylinder 3 - Injector Circuit Error |
| P0204 13 | Cylinder 4 - Injector Circuit Error |
| P0219 00 | Engine Overspeed Condition |
| P0221 29 | Throttle Position Sensor 2 Performance Non-plausible |
| P0222 16 | Throttle Position Sensor 2 Performance Low Input |
| P0223 17 | Throttle Position Sensor 2 Performance High Input |
| P0234 00 | Turbu/Super Charger Overboost Condition |
| P0237 16 | Turbocharger Boost Sensor (A) Circ. Low Input |
| P0238 17 | Turbocharger Boost Sensor (A) Circ. High Input |

| | |
|---|---|
| P0243 13 | Turbo/Super Charger Wastegate Solonoid Open |
| P0245 11 | Turbo/Super Charger Wasteg. Solonoid Low |
| P0246 12 | Turbo/Sup. Charger Wasteg. Solonoid High |
| 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 |
| P0299 00 | Turbo/Super Charger Underboost |
| 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) |
| 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 Detected (During First Statistic Cycle) |
| P0318 00 | Rough Road Sensor Signal Circuit |
| P0322 00 | EPM - Crankshaft Signal Fault |
| P0327 16 | Knock Sensor 1 Circ. Low Input |
| P0327 14 | Knock Sensor 1 Circuit Low |
| P0327 00 | Knock Sensor 1 Circuit Low |
| P0328 17 | Knock Sensor 1 Circ. High Input |
| P0328 15 | Knock Sensor 1 Circuit High |
| P0328 00 | Knock Sensor 1 Circuit High |
| P0341 00 | EPM - Camshaft Signal Fault |
| P0346 00 | EPM - Camshaft 2 Signal Fault |
| P0420 00 | Catalyst Conversion Insufficient |

| | |
|---|---|
| P0444 13 | Evaporativ Emiss. 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 Error |
| P0481 13 | Cooling Fan 2 Control Circuit Error |
| 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 |
| P0537 16 | A/C Evaporator Temperature Sensor Circuit Low |
| P0538 17 | A/C Evaporator Temperature Sensor Circuit High |
| P0556 00 | Brake Booster Pressure Sensor Circuit Performance Non-plausible |
| P0557 16 | Brake Booster Pressure Sensor Circuit Low |
| P0558 17 | Brake Booster Pressure Sensor Circuit High |
| P0560 00 | Non-plausible Error of Battery Voltage |
| P0562 16 | System Voltage Low |
| P0563 17 | System Voltage High |
| P0568 1C | Cruise Control Set Signal Non-plausible |
| P0568 86 | Cruise Control Set Signal Stuck |
| P0568 81 | Cruise Control Set Signal Error |
| P0571 29 | Brake Signal Synchronization Error |
| P0571 1C | Brake Light Signal Circuit Error |
| P0601 00 | Safety Monitoring Function Error (ECU EEPROM 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 28 | Safety Monitoring Function Error (CAN Sending Monitoring Error) |
| P0606 42 | Safety Monitoring Function Error (ECU EEPROM 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 Unplausibility Error in Level 2 |
| P0606 63 | Safety Monitoring Function Error (SSM System Monitoring Error) |
| P0606 64 | Load Signal, Wiring Harness or ECU Error |

| | |
|---|---|
| P0606 67 | ECU Fault Reaction Monitoring Error |
| P0606 75 | Shut Off Path Test Error |
| P0606 92 | Engine Speed Monitoring Error in Level 2 |
| P0606 94 | Torque Monitoring Error in Level 2 |
| P0606 96 | AD Convertor Monitoring Error |
| P0615 13 | Starter Relay Circuit Open |
| P0616 11 | Starter Relay Circuit Low |
| P0617 12 | Starter Relay Circuit High |
| P0627 13 | Fuel Pump Control Circuit Open |
| P0628 11 | Fuel Pump Control Circuit Low |
| P0629 12 | Fuel Pump Control Circuit High |
| P0645 13 | AC Clutch Relais Circuit Open |
| P0646 11 | A/C Clutch Relay Control Circuit Low |
| P0647 12 | A/C Clutch Relay Control Circuit High |
| P0650 13 | Malfunction Indicator Lamp (MIL) Control Circuit/Open |
| P0650 11 | Malfunction Indicator Lamp (MIL) Control Circuit Low |
| P0650 12 | Malfunction Indicator Lamp (MIL) 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 |
| P0700 00 | Transmission Control System (MIL Request) |
| P0704 00 | Clutch Switch Input Circuit Non-plausible |
| P083F 00 | Bottom Clutch Switch 'A'/'B' Correlation |
| P2088 11 | Control Circuit Low of Camshaft Control Valve (Inlet) |
| P2089 12 | Control Circuit High of Camshaft Control Valve (Inlet) |
| P2090 11 | Control Circuit Low of Camshaft Control Valve (Outlet) |
| P2091 12 | Control Circuit High of Camshaft Control Valve (Outlet) |
| P2106 92 | Throttle Power Stage Non-plausible Error |
| P2106 12 | Throttle Power Stage Max Error |
| P2106 13 | Throttle Power Stage Signal Error |
| P2106 29 | Load Monitoring Error |
| P2106 19 | Throttle Power Stage Min 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 Unplausible |
| 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 (Upstream of the Catalyzer) |
| P2196 00 | O2 Sensor Signal Stuck Rich (Upstream of the Catalyzer) |
| P2261 00 | Dump Valve - Mechanical Error |
| P2270 00 | O2 Sensor Signal Stuck Lean (Downstream of the Catalyzer) |
| P2271 00 | O2 Sensor Signal Stuck Rich (Downstream of the Catalyzer) |
| P2600 13 | Diagnosis of Electrical Water Pump Control Circ. Open |
| P2602 11 | Diagnosis of Electrical Water Pump Control Circ. Low |
| P2603 12 | Diagnosis of Electrical Water Pump Control Circ. High |
| P3046 13 | Starter Relay Open Defect |
| P3050 00 | Starter Relay 2 Closed Stick Defect |
| P3052 00 | Starter Relay 1 Closed Stick Defect |
| P3054 00 | Engine Blocked/Starter Not Engaged |
| P3055 11 | Starter State Line S_kl50r Short to Ground |
| P3056 12 | Starter State Line S_kl50r Short to UB |
| P3088 93 | Starter Damaged or Wire Dropped |
| U0001 88 | Error Busoff on CAN-bus |
| U0101 87 | Lost Communication with TCM |
| U0129 87 | Lost Communication with Brake System Control Module |
| U0121 87 | Lost Communication with ABS |
| U0140 00 | Lost Communication with Body Control Module (Immo) |
| U0140 87 | Lost Communication with Body Control Module (BCM) |
| U0155 87 | Lost Communication with Instrument Panel Cluster (IPC) Control Module |
| U0214 87 | Lost Communication with Passive Entry Passive Start (PEPS) |
| P1011 01 | Diagnosis of Electrical Water Pump Control Circ. Error |
| P1009 7A | Leakage Detection Upstream the Throttle Valve |
| P1100 00 | Engine Torque Control Adaption at Limit |
| P1101 00 | System Voltage Can Not Fulfill Throttle Self Learning Condition |
| P1102 00 | Throttle Limphome Position Self Learning Error |
| P1102 29 | Throttle Lower Mechanic Stop Re-learning Error |
| P1103 00 | Throttle Lower Mechanic Stop First Learning Error |
| P1104 00 | Throttle Lower Mechanic Stop First Learning Error |

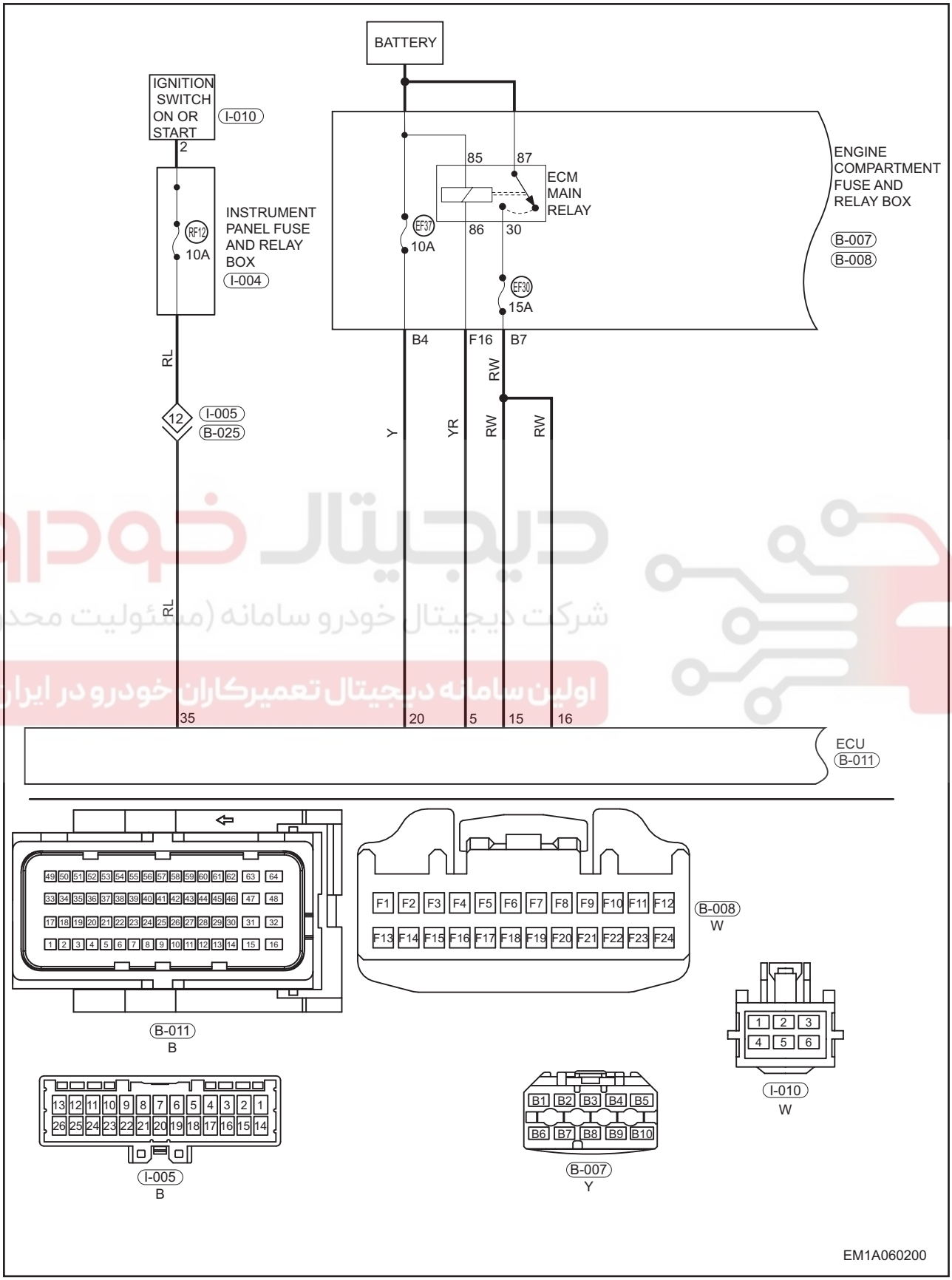
| | |
|---|---|
| P1106 00 | Throttle Position Deviation Error |
| P1106 21 | Throttle PID Adjustment Min Error |
| P1106 22 | Throttle PID Adjustment Max Error |
| P1111 00 | Return Spring Check Max Error |
| P1122 77 | Torque Limitation When Throttle-valve Error Happen |
| P1130 00 | Diagnosis of Brake Booster Pump Malfunction |
| P1131 17 | Diagnosis of Brake Booster Pump Control Circuit High |
| P1132 16 | Diagnosis of Brake Booster Pump Control Circuit Low |
| P1133 13 | Diagnosis of Brake Booster Pump Control Circ. Open |
| P1137 17 | Diagnosis of Pressure Sensor in Brake Booster Pump Circuit High |
| P1138 16 | Diagnosis of Pressure Sensor in Brake Booster Pump Circuit Low |
| P1139 7A | Diagnosis of Pressure Sensor in Brake Booster Pump Leakage Detection |
| P1427 12 | Diagnosis of Brake Booster Pump Control Circ. High |
| P1428 11 | Diagnosis of Brake Booster Pump Control Circ. Low |
| P1429 13 | Diagnosis of Brake Booster Pump Control Circ. Open |
| P1479 00 | Non-plausible Error for Brake Booster Diagnosis |
| P1500 00 | Checksum Error of LIN Message from EBS |
| P1501 00 | Framing Error of LIN Message from EBS |
| P1502 00 | Reponse Reception Time Out Error of LIN Message from EBS |
| P1503 00 | Read Back Time Out Error of LIN Message from EBS |
| P1512 92 | EBS or Battery Error |
| P1513 00 | Battery has been Changed and Long Time No Tester Confirmation |
| P1520 00 | Framing Error of LIN Message from AGS |
| P1521 00 | Checksum Error of LIN Message from AGS |
| P1522 00 | Reponse Reception Time Out Error of LIN Message from AGS |
| P1523 00 | Read Back Time Out Error of LIN Message from AGS |
| P1530 00 | Checksum Error of LIN Message from Generator |
| P1531 00 | Framing Error of LIN Message from Generator |
| P1532 00 | Reponse Reception Time Out Error of LIN Message from Generator |
| P1533 00 | Read Back Time Out Error of LIN Message from Generator |
| P1541 00 | Communication Error of Generator |
| P1542 00 | Mechanical Status Error of Generator |
| P1543 00 | Electrical Status Error of Generator |
| P1600 00 | S/S Main Switch Stick Error |
| P1610 00 | Immo Secret Key and Security Code Not Programmed |
| P1611 00 | Immo Wrong Security Code Received |
| P1612 00 | Immo Challenge Service Not Received |
| P1613 00 | Immo Immo-code Service Not Received |

| | |
|---|---|
| P1614 00 | Immo Transferred Transponder Response was Corrupted |
| P1615 00 | ECM Status Unknown |
| P1616 00 | Authentication Not OK |
| P1617 00 | No Response from SIM During Challenge Period |
| P1618 00 | Fail to Write EOL Confidtional Data into EEProm |
| P1619 00 | ECM Not Programed (Virgin State) |
| P1651 13 | Service Vehicle Soon (SVS) Control Circuit |
| P1651 11 | Service Vehicle Soon (SVS) Control Circuit Low |
| P1651 12 | Service Vehicle Soon (SVS) Control Circuit High |
| P1701 00 | Power Train State Signal Wire Open |
| P1702 00 | Bottom Clutch Switch Error |
| P0016-76 | Crankshaft Position-Camshaft (inlet) Installation Error |
| P0016-78 | Crankshaft Position-Camshaft (Inlet) Position Error |
| P0017-76 | Crankshaft Position-Camshaft (Outlet) Installation Error |
| P0017-78 | Crankshaft Position-Camshaft (Outlet) Position Error |
| P0096-00 | Air Temperature Sensor (After Throttle Valve) Circuit Performance Non-plausible |
| P0097-16 | Air Temperature Sensor (After Throttle Valve) Circuit Low |
| P0098-17 | Air Temperature Sensor (After Throttle Valve) Circuit High |
| P0300-00 | Misfire Detected |
| P0301-00 | Misfire Detected on Cylinder 1 |
| P0302-00 | Misfire Detected on Cylinder 2 |
| P0303-00 | Misfire Detected on Cylinder 3 |
| P0304-00 | Misfire Detected on Cylinder 4 |
| P0321-00 | Crankshaft Signal Disturbance |
| P0342-00 | Camshaft Position Sensor (Inlet) Circuit Low |
| P0343-00 | Camshaft Position Sensor (Inlet) Circuit High |
| P0366-00 | Camshaft Position Sensor (Outlet) Circuit Performance Non-plausible |
| P0367-00 | Camshaft Position Sensor (Outlet) Circuit Low |
| P0368-00 | Camshaft Position Sensor (Outlet) Circuit High |
| P0600-00 | MSC/COM-Errors of the TLE8888 |
| P0606-97 | Function Monitoring: Fault of ECU ADC - Test Voltage |
| P0606-17 | Reported OverVoltage of VDD5 |
| P0606-16 | Reported UnderVoltage of VDD5 |
| P0606-91 | Diagnostic Fault Check to Report WDA Active Due to Overvoltage Detection |
| P0606-45 | Visibility of Software Resets in DSM |
| P130A-00 | Cylinder Selective Fuel Cutoff Active Due to Catalyst Damaging Misfire |
| P1386-00 | Diagnostic Fault Check Knock Control Signal Evaluation |
| P023A 00 | Charge Air Cooler Coolant Pump Control Circuit |

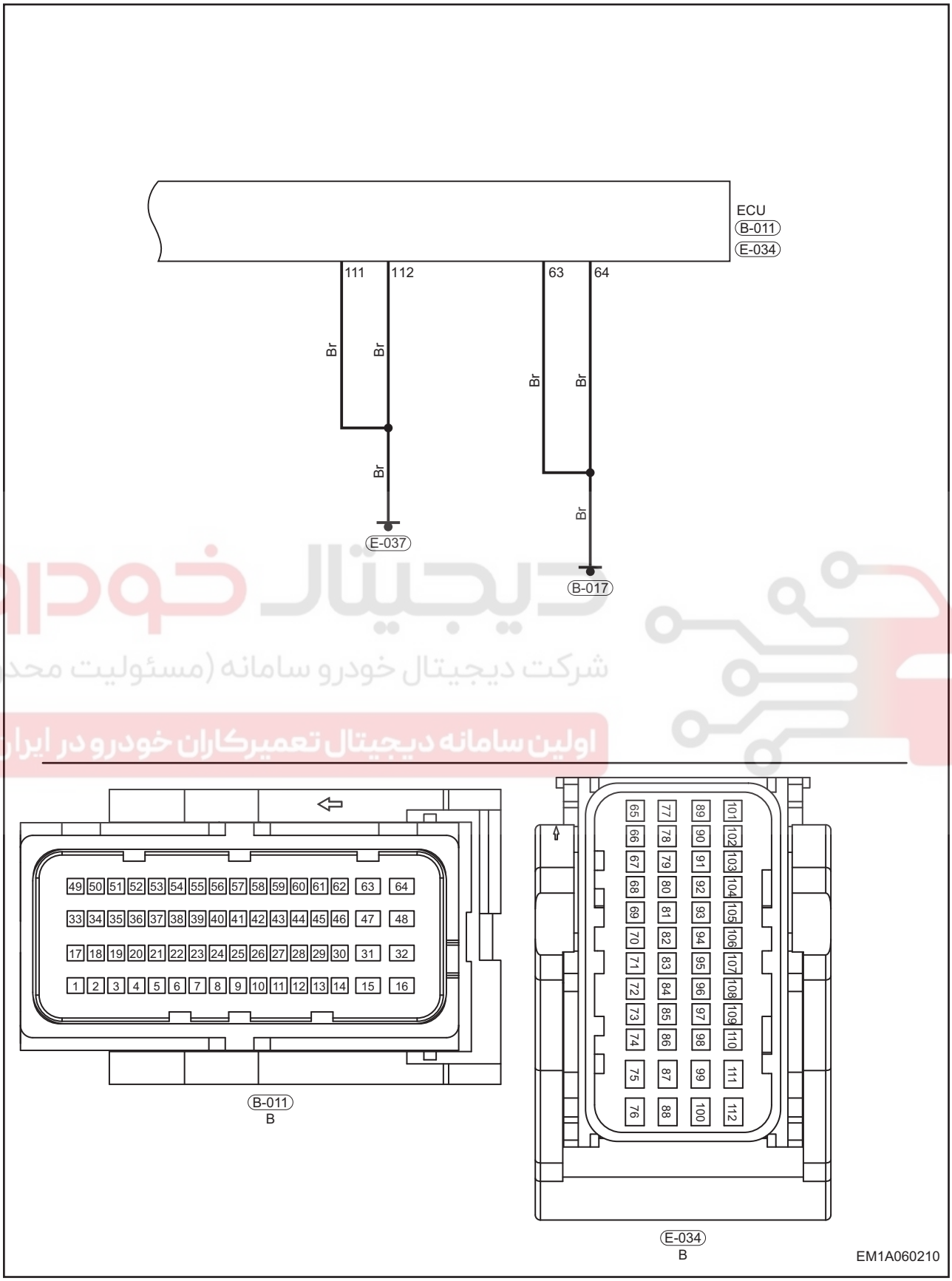
| | |
|---|---|
| P023B 00 | Charge Air Cooler Coolant Pump Control Circuit Low |
| P023C 00 | Charge Air Cooler Coolant Pump Control Circuit High |
| P0458 11 | Evaporative Emission System Purge Control Valve Circuit Low |
| P0459 12 | Evaporative Emission System Purge Control Valve Circuit High |
| P0606 47 | Monitoring Module Feedback Error |
| P1700 00 | Charge Air Cooler Coolant Pump Dry Run |
| P1703 00 | Charge Air Cooler Coolant Pump Over Voltage |
| P1704 00 | Charge Air Cooler Coolant Pump Over Current |
| P1705 00 | Charge Air Cooler Coolant Pump Over Temperature |
| P1706 00 | Charge Air Cooler Coolant Pump Stall |
| P1707 00 | Charge Air Cooler Coolant Pump Under Voltage |
| P1708 00 | Charge Air Cooler Coolant Pump Feedback Signal Error Circ. High |
| P1709 00 | Charge Air Cooler Coolant Pump Feedback Signal Error Circ. Low |

# ECM Power Supply Circuit & Ground Circuit Testing

## Power Supply Circuit



## Ground Circuit



## Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using diagnostic tester, select Read Datastream.
- If datastream is not detected, malfunction indicated by datastream is current. Go to diagnosis procedure - Step 1.
- If datastream is detected, malfunction indicated by datastream is intermittent (See page 06-23).

## Diagnosis Procedure

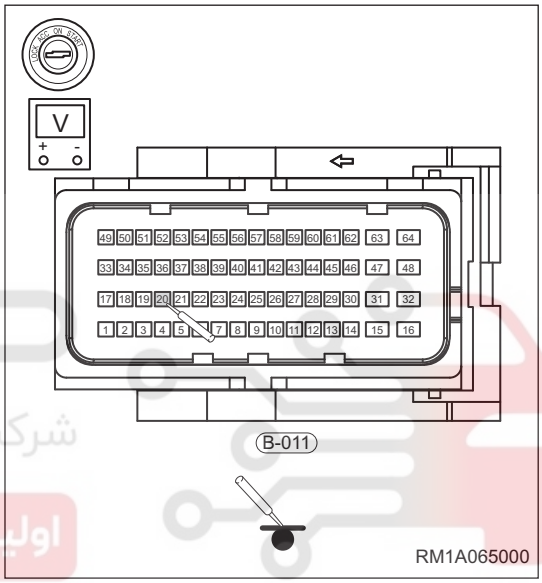
| 1 | Check ECM power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector B-011.

c. Check voltage between terminal of ECM connector B-011 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (20) - Body ground | Always | 11 to 14 V |




**OK** → **Go to step 4**

**NG**

| 2 | Check ECM fuse |
|---|---|

a. Unplug ECM fuse EF37 (10 A) from engine compartment fuse and relay box.

b. Check resistance of fuse.

**Standard resistance: less than 1 Ω**

**NG** → **Replace ECM fuse**

**OK**

| 3 | Check wire harness and connector (ECM - engine compartment fuse and relay box) |
|---|---|

a. Disconnect the engine compartment fuse and relay box connector B-007.

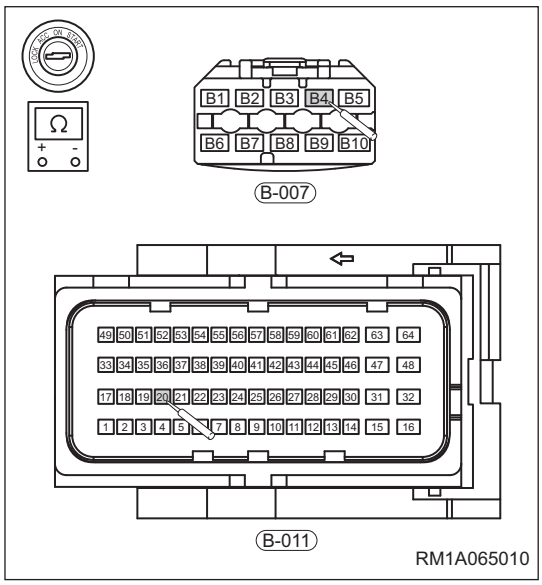
b. Check wire harness between connector terminals on wire harness side.

**Check for Open**

| Multimeter Connection | Specified Condition |
|---|---|
| B-007 (B4) - B-011 (20) | Continuity |

**Check for Short**

| Multimeter Connection | Specified Condition |
|---|---|
| B-007 (B4) or B-011 (20) - Body ground | No continuity |
| B-007 (B4) or B-011 (20) - Battery positive | No continuity |




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

OK →

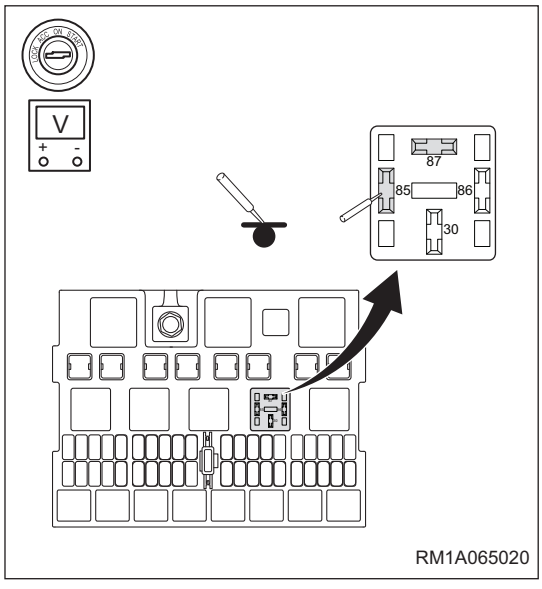
**Repair or replace engine compartment fuse and relay box or wire harness (engine compartment fuse and relay box - battery)**

| 4 | Check main relay circuit voltage |
|---|---|

a. Remove the main relay from engine compartment fuse and relay box.

b. Check voltage between terminals of main relay and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Main relay terminals 85 and 87 (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

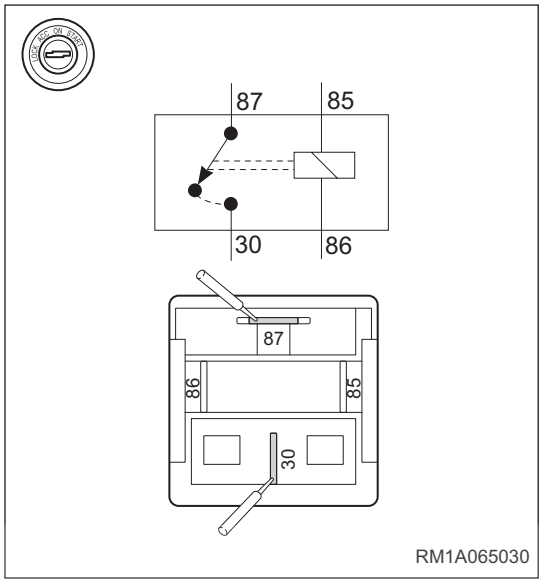
| 5 | Check main relay and fuse EF30 |
|---|---|

a. Check if fuse EF30 is normal.

b. Check for continuity between terminals of main relay.

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

NG → Replace fuse or main relay




OK

| 6 | Check wire harness and connector (ECM - engine compartment fuse and relay box) |
|---|---|

a. Disconnect the engine compartment fuse and relay box connector B-007.

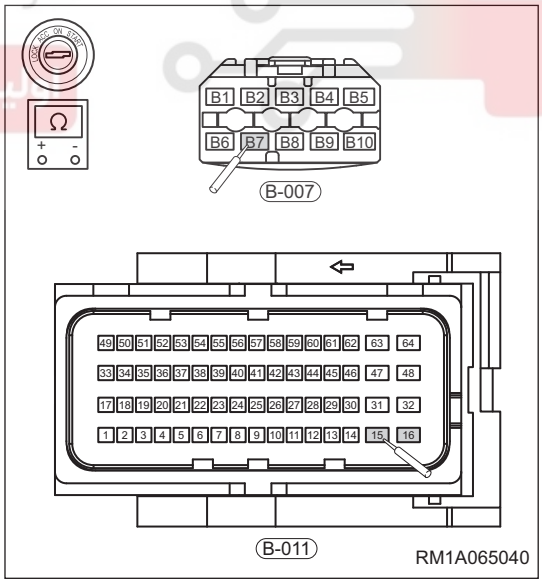
b. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Specified Condition |
|---|---|
| B-011 (15, 16) - B-007 (B7) | Continuity |

**Check for Short**

| Multimeter Connection | Specified Condition |
|---|---|
| B-011 (15, 16) or B-007 (B7) - Body ground | No continuity |
| B-011 (15, 16) or B-007 (B7) - Battery positive | No continuity |

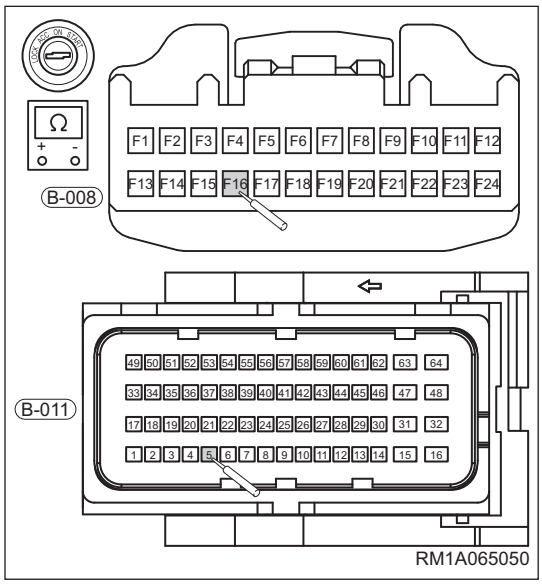


**Check for Open**

| Multimeter Connection | Specified Condition |
|---|---|
| B-008 (F16) - B-011 (5) | Continuity |

**Check for Short**

| Multimeter Connection | Specified Condition |
|---|---|
| B-008 (F16) or B-011 (5) - Body ground | No continuity |
| B-008 (F16) or B-011 (5) - Battery positive | No continuity |




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

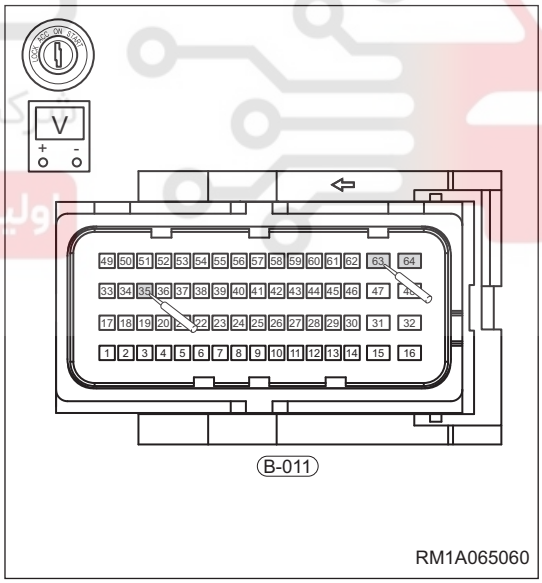
OK

| 7 | Check ECM power supply circuit (ignition switch voltage) |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between terminals of ECM connector.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (35) - B-011 (63, 64) | Ignition switch ON | 11 to 14 V |




OK → **Replace ECM**

NG

| 8 | Check ECM fuse |
|---|---|

a. Unplug fuse RF1 (10 A) from instrument panel fuse box.

b. Check resistance of fuse.

**Standard resistance: less than 1 Ω**

NG → **Replace ECM fuse**

OK

| 9 | Check wire harness and connector (ECM - instrument panel fuse box and body ground) |
|---|---|

a. Disconnect the instrument panel fuse box connector I-030.

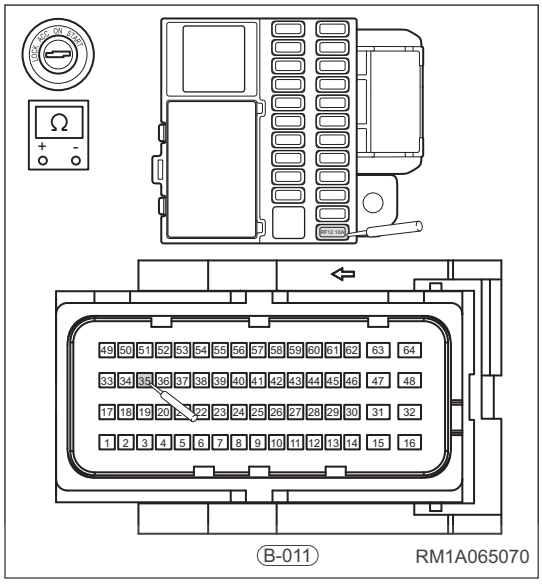
b. Check wire harness between connector terminals on wire harness side.

**Check for Open**

| Multimeter Connection | Specified Condition |
|---|---|
| B-011 (35) - I-030 (RF12) | Continuity |

**Check for Short**

| Multimeter Connection | Specified Condition |
|---|---|
| B-011 (35) or I-030 (RF12) - Body ground | No continuity |
| B-011 (35) or I-030 (RF12) - Battery positive | No continuity |



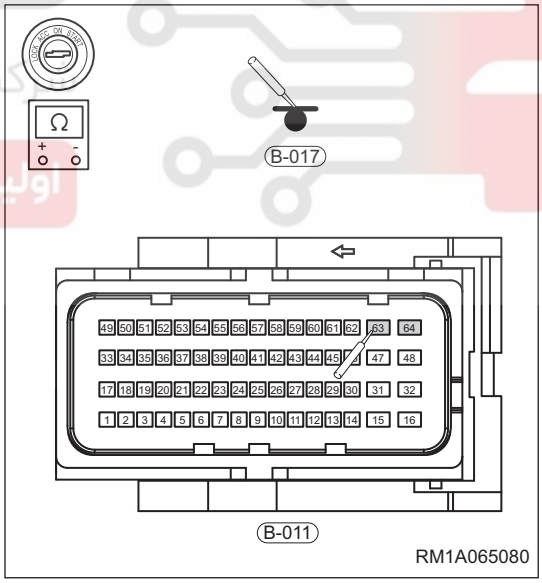

c. Disconnect the ground point B-017.

d. Check the ECM ground point (See page 06-23).

e. Check the ECM ground wire harness.

**Check for Open**

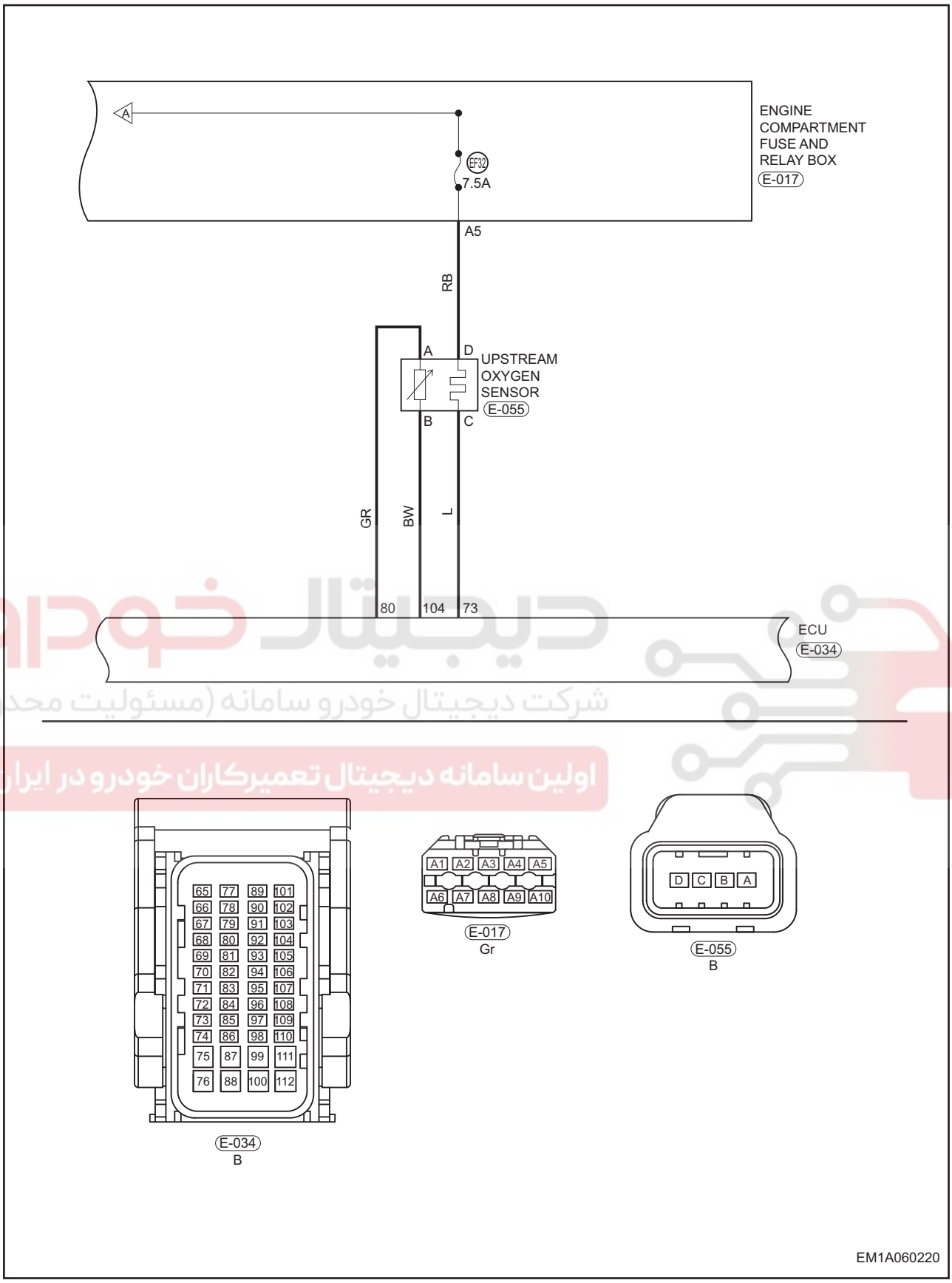
| Multimeter Connection | Specified Condition |
|---|---|
| B-011 (63, 64) - B-017 | Continuity |




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

OK

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



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0030 13 | O2 Sensor Heater Control Circuit Open (Upstream of the Catalyzer) | Ignition switch ON Engine running | • Upstream Oxygen Sensor<br>• Wire harness or connector<br>• Fuse<br>• ECM |
| P0031 11 | O2 Sensor Heater Control Circuit Low (Upstream of the Catalyzer) | | |
| P0132 12 | O2 Sensor Heater Control Circuit High (Upstream of the Catalyzer) | | |
| P0053 1E | O2 Sensor Heater Resistance Too Large (Upstream of the Catalyzer) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

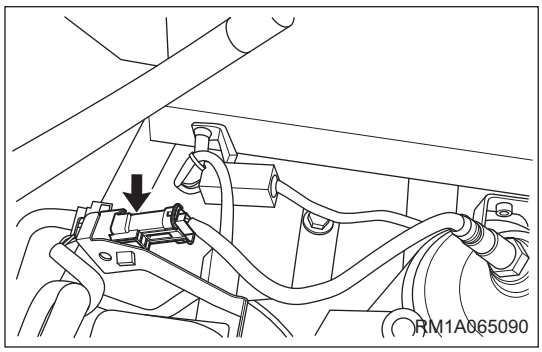
NG → **Repair or replace ground wire harness or ground point**

OK →

| 2 | Check upstream oxygen sensor connector |
|---|---|

a. Disconnect the upstream oxygen sensor connector E-055 (arrow).

b. Check the upstream oxygen sensor connector.




NG → Repair or replace connector

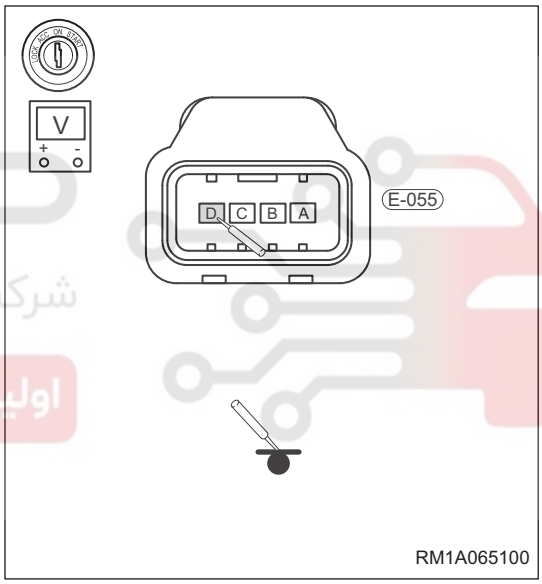
OK

| 3 | Check upstream oxygen sensor heater power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between terminal D of upstream oxygen sensor connector E-055 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-055 (D) - Body ground | Ignition switch ON | 11 to 14 V |




OK → Go to step 5

NG

| 4 | Check upstream oxygen sensor power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Check the fuse EF32 and main relay.

c. Disconnect the engine compartment fuse and relay box connector E-017.

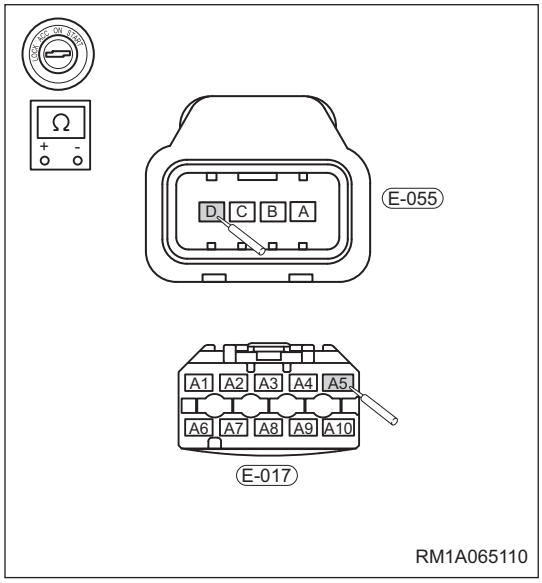
d. Check wire harness between upstream oxygen sensor connector terminal and engine compartment fuse and relay box connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-017 (A5) - E-055 (D) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-055 (D) or E-017 (A5) - Body ground | Always | No continuity |
| E-055 (D) or E-017 (A5) - Battery positive | Always | No continuity |




**NG** → **Replace fuse, main relay, wire harness or connector (upstream oxygen sensor - engine compartment fuse and relay box)**

**OK**

| 5 | Check upstream oxygen sensor heater control circuit |
|---|---|

a. Disconnect the ECM connector E-034.

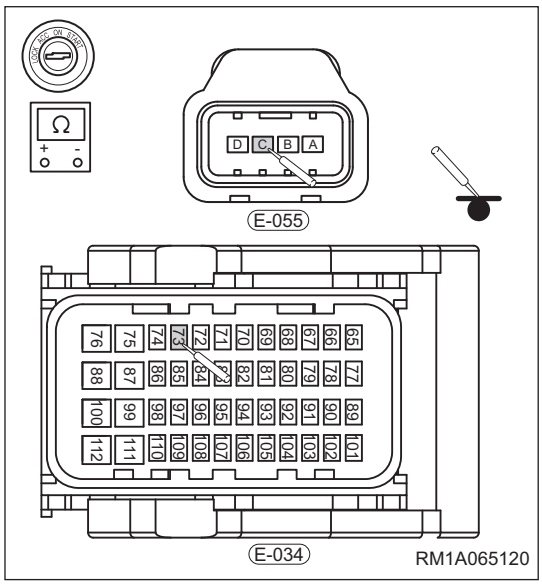
b. Check wire harness between upstream oxygen sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (73) - E-055 (C) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (73) or E-055 (C) - Body ground | Always | No continuity |
| E-034 (73) or E-055 (C) - Battery positive | Always | No continuity |



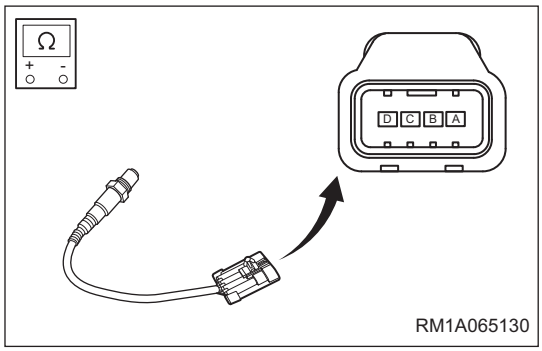

NG → **Repair or replace wire harness or connector (upstream oxygen sensor - ECM)**

OK →

| 6 | Check upstream oxygen sensor heater |
|---|---|

a. Measure resistance of upstream oxygen sensor.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal C - Terminal D | 20°C | 7 to 11 Ω |
| Terminal A - Terminal C | Always | No continuity |
| Terminal A - Terminal D | | |
| Terminal B - Terminal C | | |
| Terminal B - Terminal D | | |




NG → **Replace upstream oxygen sensor**

OK

| 7 | Check appearance of upstream oxygen sensor |
|---|---|

a. Remove the upstream oxygen sensor.

b. Check upstream oxygen sensor for following problems.

- Moisture enters internal of sensor, temperature changes greatly or probe is broken.
- Oxygen sensor is "poisoned" (Pb, S, Br and Si etc.).

NG → **Replace upstream oxygen sensor**

OK

| 8 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTC.

b. Refer to "DTC Confirmation Procedure".

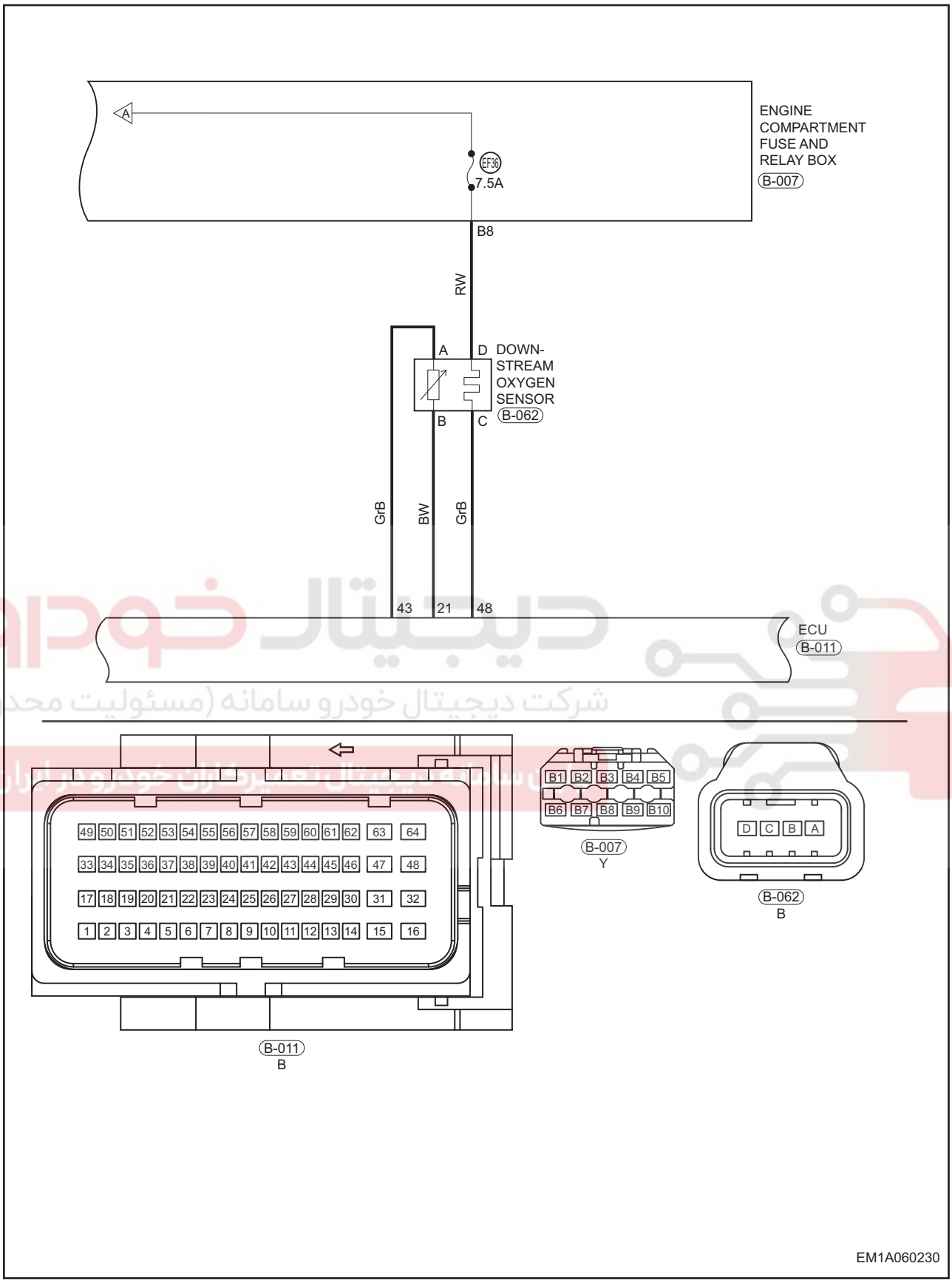
c. Check if DTC P0030 13, P0031 11, P0032 12 or P0053 1E still exists.

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 | O2 Sensor Heater Control Circuit Open (Downstream of the Catalyzer) |
| DTC | P0037 11 | O2 Sensor Heater Control Circuit Low (Downstream of the Catalyzer) |
| DTC | P0038 12 | O2 Sensor Heater Control Circuit High (Downstream of the Catalyzer) |
| DTC | P0054 1E | O2 Sensor Heater Resistance Too Large (Downstream of the Catalyzer) |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0036 13 | O2 Sensor Heater Control Circuit Open (Downstream of the Catalyzer) | Ignition switch ON Engine running | • Downstream Oxygen Sensor<br>• Wire harness or connector<br>• Fuse<br>• ECM |
| P0037 11 | O2 Sensor Heater Control Circuit Low (Downstream of the Catalyzer) | | |
| P0038 12 | O2 Sensor Heater Control Circuit High (Downstream of the Catalyzer) | | |
| P0054 1E | O2 Sensor Heater Resistance Too Large (Downstream of the Catalyzer) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point B-017 (See page 06-23).

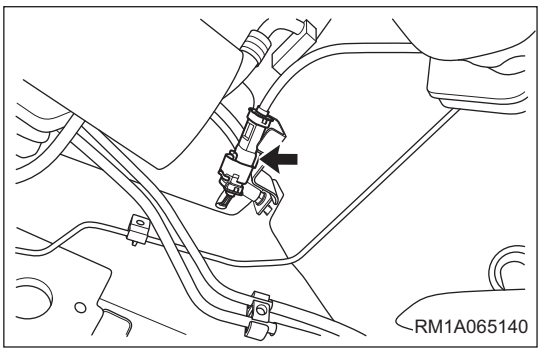
NG → **Repair or replace ground wire harness or ground point**

OK →

| 2 | Check downstream oxygen sensor connector |
|---|---|

a. Disconnect the downstream oxygen sensor connector (arrow).

b. Check the downstream oxygen sensor connector




NG → **Repair or replace connector**

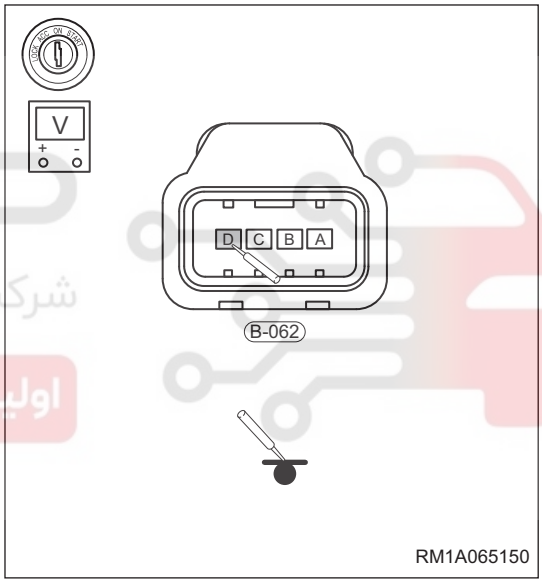
OK

| 3 | Check downstream oxygen sensor heater power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between terminal D of downstream oxygen sensor connector B-062 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-002 (D) - Body ground | Ignition switch ON | 11 to 14 V |




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

OK

| 4 | Check downstream oxygen sensor power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Check the fuse EF36 and main relay.

c. Disconnect the engine compartment fuse and relay box connector B-007.

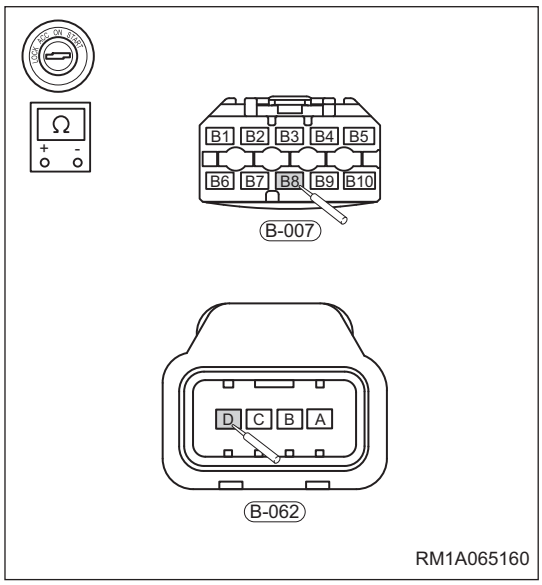
d. Check wire harness between downstream oxygen sensor connector terminal and engine compartment fuse and relay box connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-062 (D) - B-007 (B8) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-062 (D) or B-007 (B8) - Body ground | Always | No continuity |
| B-062 (D) or B-007 (B8) - Battery positive | Always | No continuity |

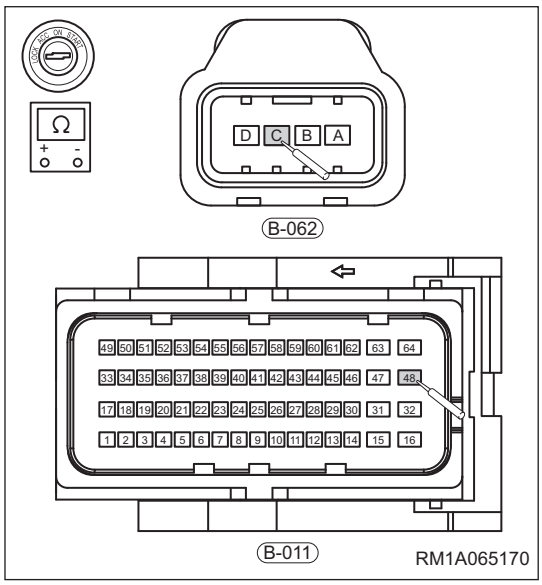



**NG** → **Replace fuse, main relay, wire harness or connector (downstream oxygen sensor - engine compartment fuse and relay box)**

**OK**

| 5 | Check downstream oxygen sensor heater control circuit |
|---|---|

a. Check wire harness between downstream oxygen sensor connector terminal and ECM connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-062 (C) - B-011 (48) | Always | Continuity |

**Check for Short**

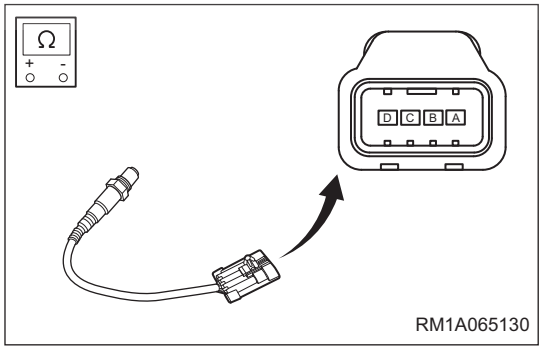
| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-062 (C) or B-011 (48) - Body ground | Always | No continuity |
| B-062 (C) or B-011 (48) - Battery positive | Always | No continuity |

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

OK →

| 6 | Check downstream oxygen sensor heater |
|---|---|

a. Measure resistance of downstream oxygen sensor.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal C - Terminal D | 20°C | 7 to 11 Ω |
| Terminal A - Terminal C | Always | No continuity |
| Terminal A - Terminal D | | |
| Terminal B - Terminal C | | |
| Terminal B - Terminal D | | |

NG → **Replace downstream oxygen sensor**

OK

| 7 | Check appearance of downstream oxygen sensor |
|---|---|

a. Remove the downstream oxygen sensor.

b. Check downstream oxygen sensor for following problems.

- Moisture enters internal of sensor, temperature changes greatly or probe is broken.
- Oxygen sensor is "poisoned" (Pb, S, Br and Si etc.).

NG → **Replace downstream oxygen sensor**

OK

| 8 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTC.

b. Refer to "DTC Confirmation Procedure".

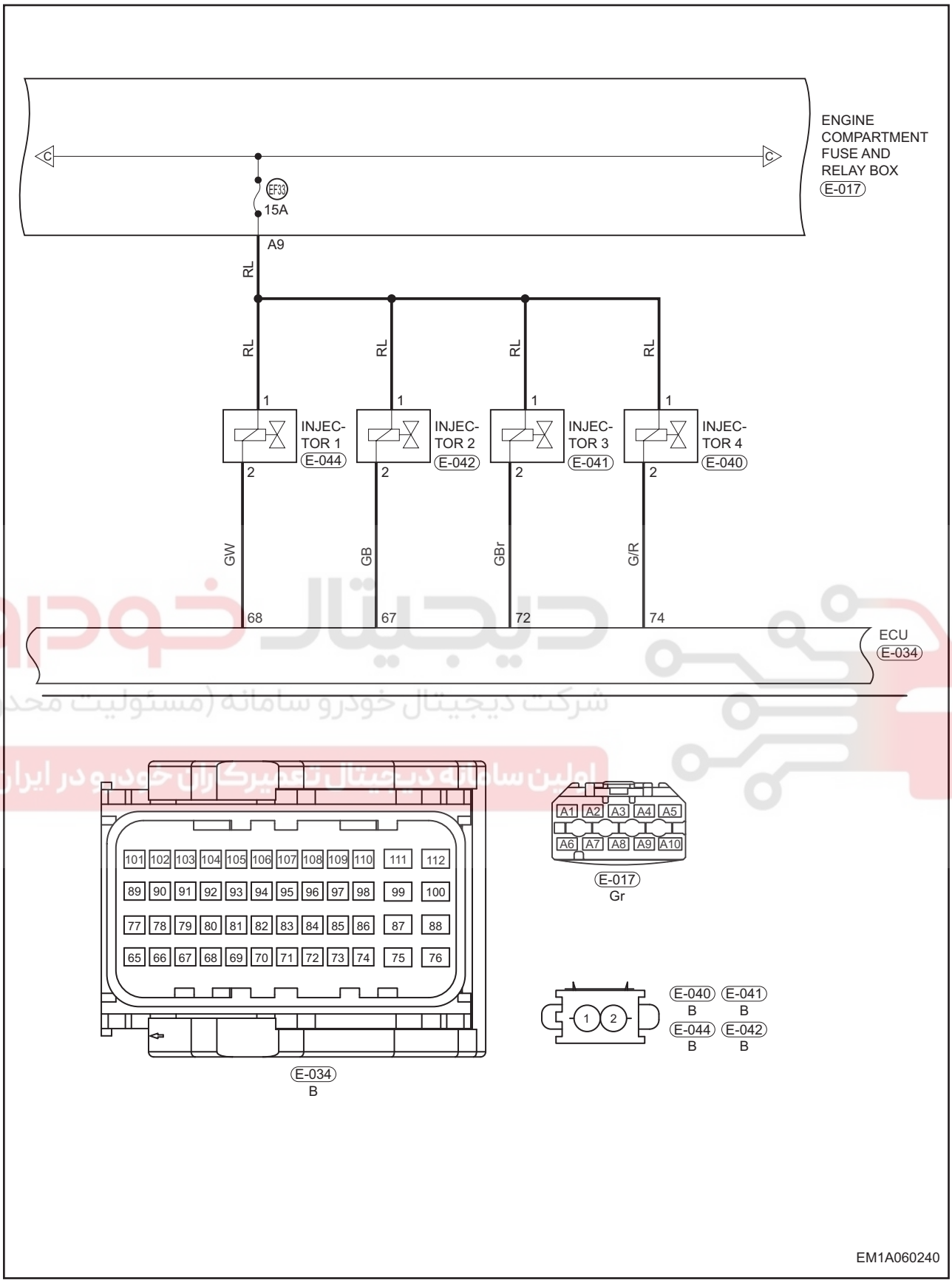
c. Check if DTC P0036 13, P0037 11, P0038 12 or P0054 1E still exists.

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.**

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



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0201 13 | Cylinder 1 - Injector Circuit Error | Ignition switch ON<br>Engine running | • Fuel injector<br>• Wire harness or connector<br>• ECM |
| P0202 13 | Cylinder 2 - Injector Circuit Error | | |
| P0203 13 | Cylinder 3 - Injector Circuit Error | | |
| P0204 13 | Cylinder 4 - Injector Circuit Error | | |
| P0261 11 | Cylinder 1 - Injector Circuit Low | | |
| P0262 12 | Cylinder 1 - Injector Circuit High | | |
| P0264 11 | Cylinder 2 - Injector Circuit Low | | |
| P0265 12 | Cylinder 2 - Injector Circuit High | | |
| P0267 11 | Cylinder 3 - Injector Circuit Low | | |
| P0268 12 | Cylinder 3 - Injector Circuit High | | |
| P0270 11 | Cylinder 4 - Injector Circuit Low | | |
| P0271 12 | Cylinder 4 - Injector Circuit High | | |



## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

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

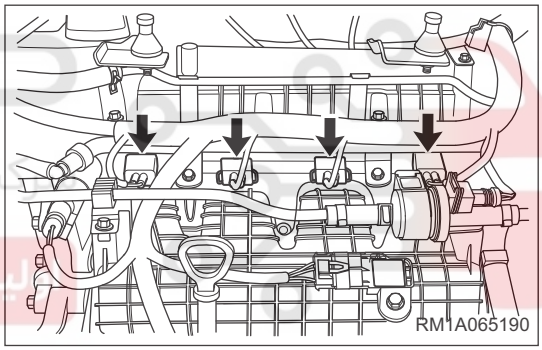
OK ↓

| 2 | Check injector connector |
|---|---|

a. Turn ignition switch to OFF.

b. Separately disconnect injector connectors (arrow) in cylinders 1, 2, 3, 4.

c. Check terminals of injector connectors.




NG → **Repair or replace connector**

OK ↓

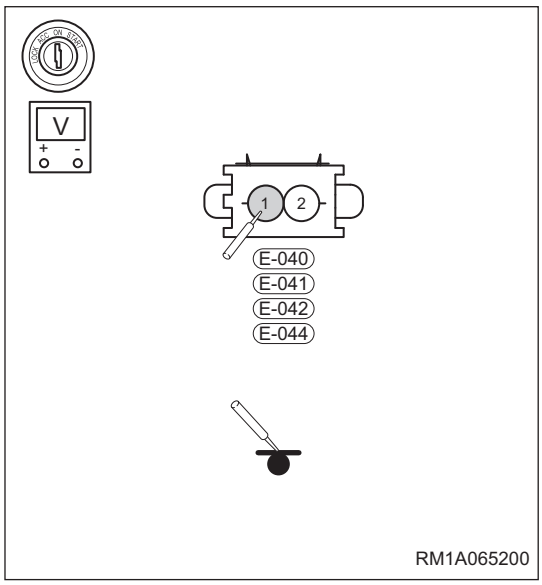
| 3 | Check injector power supply voltage |
|---|---|

a. Separately disconnect injector connectors in cylinders 1, 2, 3, 4.

b. Turn ignition switch to ON.

c. Check voltage between injector connector terminals in cylinders 1, 2, 3, 4 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-040 (1), E-041 (1), E-042 (1), E-044 (1) - Body ground | Ignition switch ON | 11 to 14 V |




NG → Go to step 5

OK

| 4 | Check injector power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Check fuse EF33 and main relay.

c. Disconnect the engine compartment fuse and relay box connector E-017.

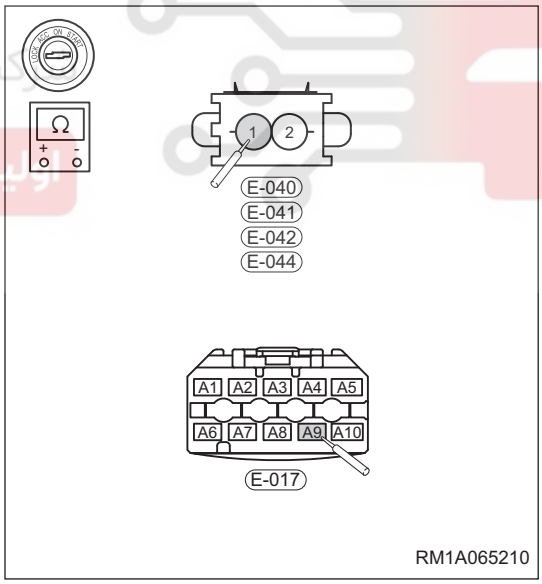
d. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-040 (1), E-041 (1), E-042 (1), E-044 (1) - E-017 (A9) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-040 (1), E-041 (1), E-042 (1), E-044 (1) or E-017 (A9) - Body ground | Always | No continuity |



| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-040 (1), E-041 1), E-042 (1), E-044 (1) or E-017 (A9) - Battery positive | Always | No continuity |

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

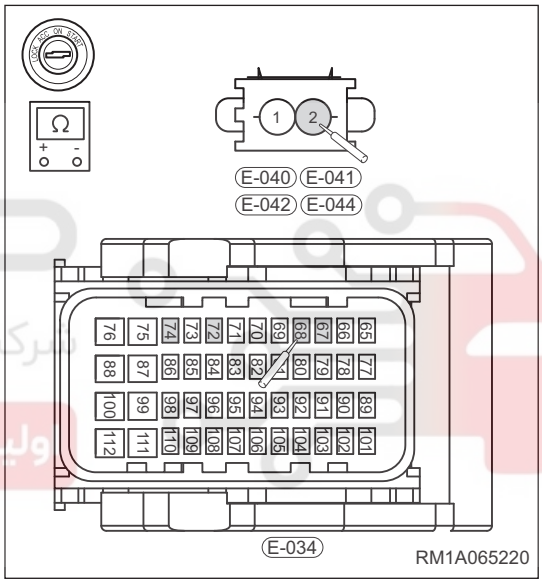
OK →

| 5 | Check injector control circuit |
|---|---|

a. Disconnect the ECM connector E-034.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-044 (2) - E-034 (68) | Always | Continuity |
| E-042 (2) - E-034 (67) | | |
| E-041 (2) - E-034 (72) | | |
| E-040 (2) - E-034 (74) | | |




**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-044 (2), E-042 (2), E-041 (2), E-040 (2) - Body ground or power supply | Always | No continuity |
| E-044 (2), E-042 (2), E-041 (2), E-040 (2) - Body ground or power supply | Always | No continuity |

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

OK

| | |
|---|---|
| 6 | Check injector |

a. Check resistance of injector (12 ± 1 Ω).

NG → Replace injector

OK

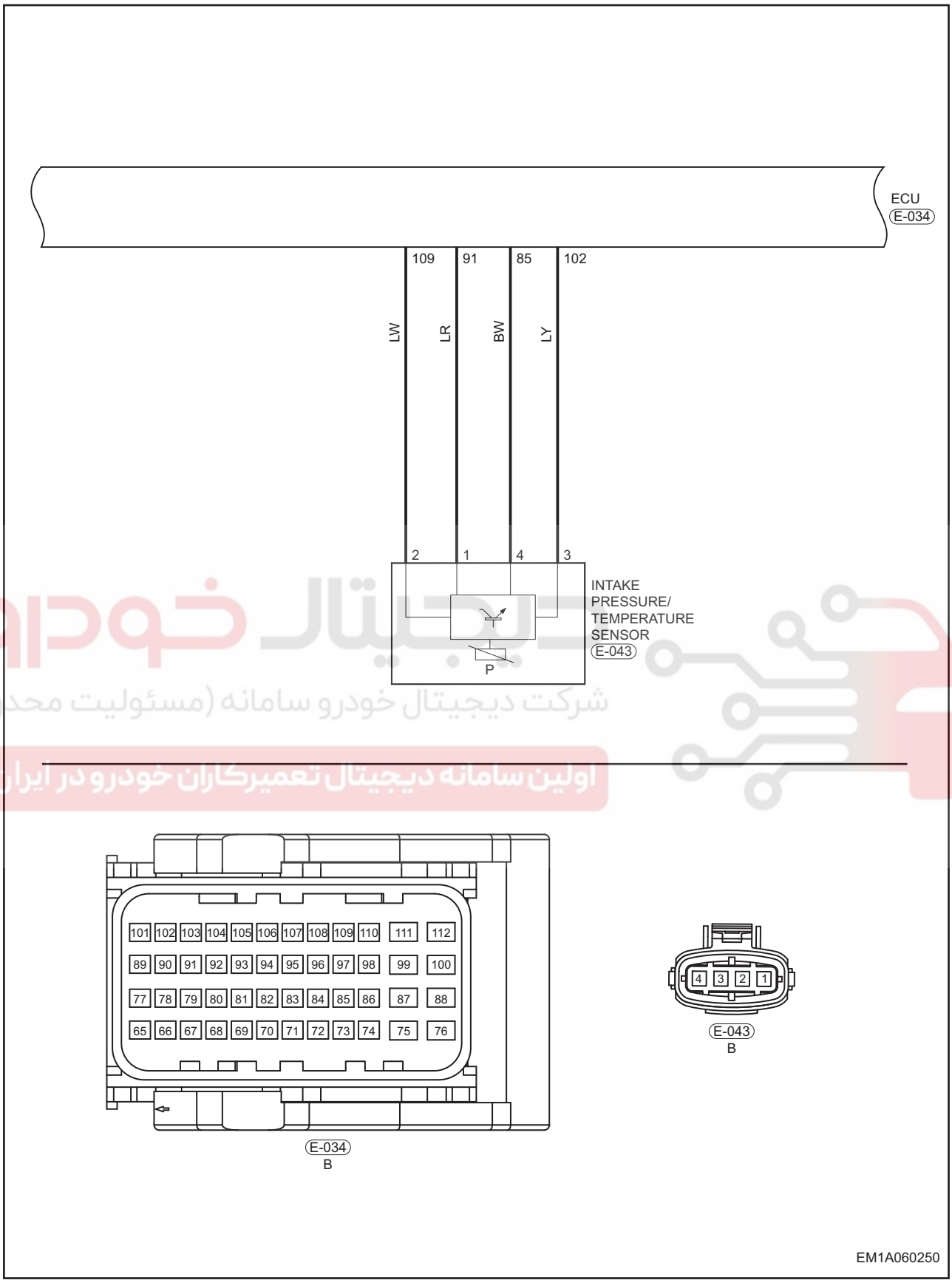
| | |
|---|---|
| 7 | Check for DTCs |

a. Using X-431 3G diagnostic tester, read ECM DTC.

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0201 13, P0202 13, P0203 13, P0204 13, P0261 11, P0262 12, P0264 11, P0265 12, P0267 11, P0268 12, P0270 11 or P0271 12 still exists.

| | | |
|---|---|---|
| DTC | P0105 28 | Manifold Absolut Pressure Circuit No Change |
| DTC | P0106 00 | Manifold Abs. Pressure Performance Non-plausible |
| DTC | P0107 11 | Manifold Abs. Pressure Low Input |
| DTC | P0108 12 | Manifold Abs. Pressure High Input |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0105 28 | Manifold Absolut Pressure Circuit No Change | Ignition switch ON Engine running | • Intake pressure sensor<br>• Wire harness or connector<br>• ECM |
| P0106 00 | Manifold Abs. Pressure Performance Non-plausible | | |
| P0107 11 | Manifold Abs. Pressure Low Input | | |
| P0108 12 | Manifold Abs. Pressure High Input | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

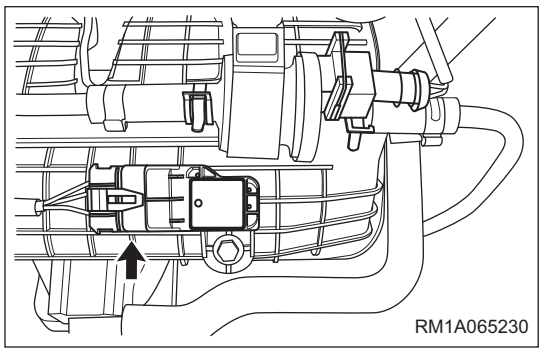
NG → **Repair or replace ground wire harness or ground point**

OK

| 2 | Check intake pressure sensor connector |
|---|---|

a. Disconnect the intake pressure sensor connector E-043 (arrow).

b. Check the intake pressure sensor connector.




NG → Repair or replace connector

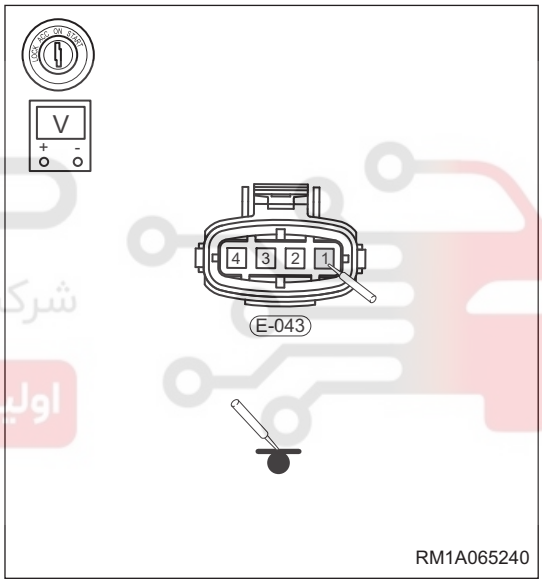
OK

| 3 | Check intake pressure sensor signal voltage |
|---|---|

a. Connect the intake pressure sensor connector E-043.

b. Turn ignition switch to ON and start engine.

c. Using a multimeter, measure voltage between terminal 1 of connector E-043 and body ground.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-043 (1) - Body ground | Idling | Voltage is about 1.3 V (value changes with model) |
| | Accelerator pedal depressed rapidly | Maximum instantaneous voltage is about 4 V (value changes with model) |

NG → Go to step 8

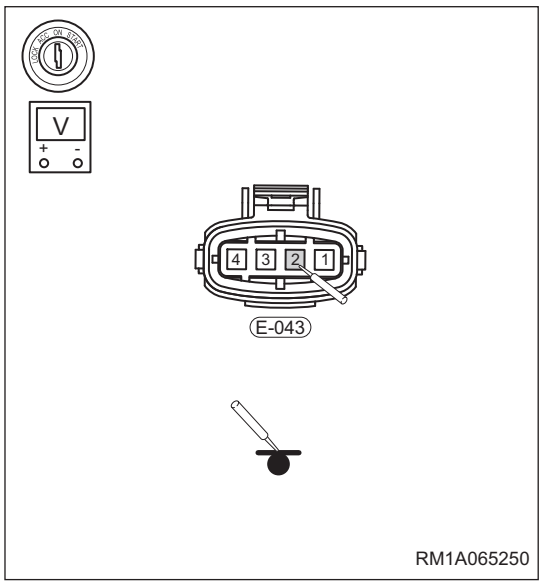
OK

| 4 | Check intake pressure sensor power supply voltage |
|---|---|

a. Disconnect the intake pressure/temperature sensor connector E-043.

b. Check voltage between connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-043 (2) - Body ground | Ignition switch ON | 5 V |




**OK** → **Go to step 6**

**NG**

| 5 | Check intake pressure sensor signal circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

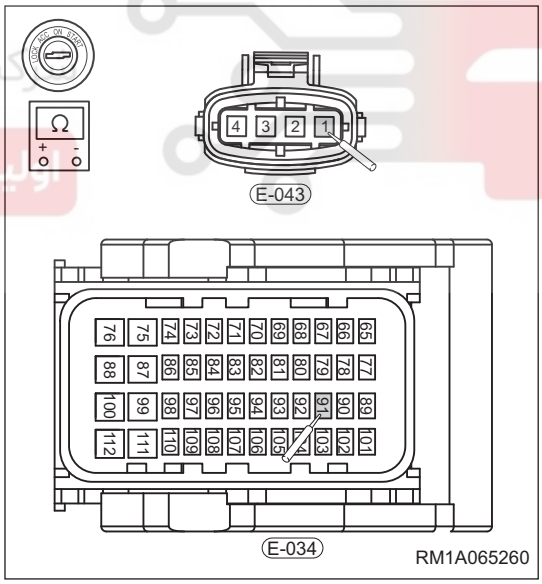
c. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (91) - E-043 (1) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (91) - E-043 (1) - Body ground | Always | No continuity |
| E-034 (91) - E-043 (1) - Battery positive | Always | No continuity |




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

**OK**

| 6 | Check intake pressure sensor power supply circuit |
|---|---|

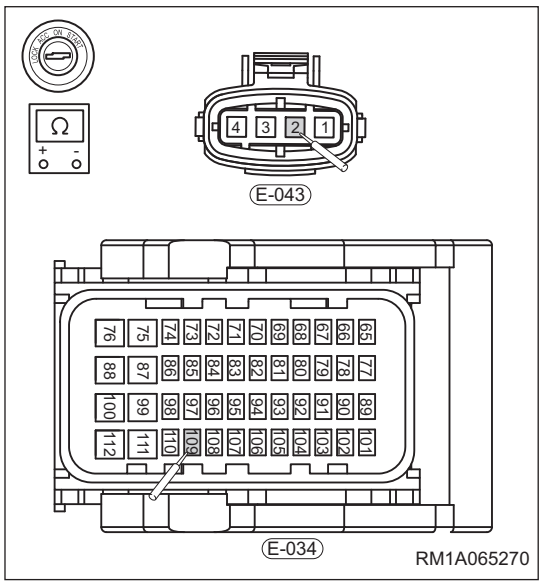
a. Check wire harness between intake pressure sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (109) - E-043 (2) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (109) or E-043 (2) - Body ground | Always | No continuity |
| E-034 (109) or E-043 (2) - Battery positive | Always | No continuity |




NG → **Repair or replace wire harness or connector (intake pressure sensor - ECM)**

OK →

| 7 | Check intake pressure sensor |
|---|---|

a. Remove the intake pressure sensor.

b. Check sensor connection part for debris and damage.

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

OK →

| 8 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

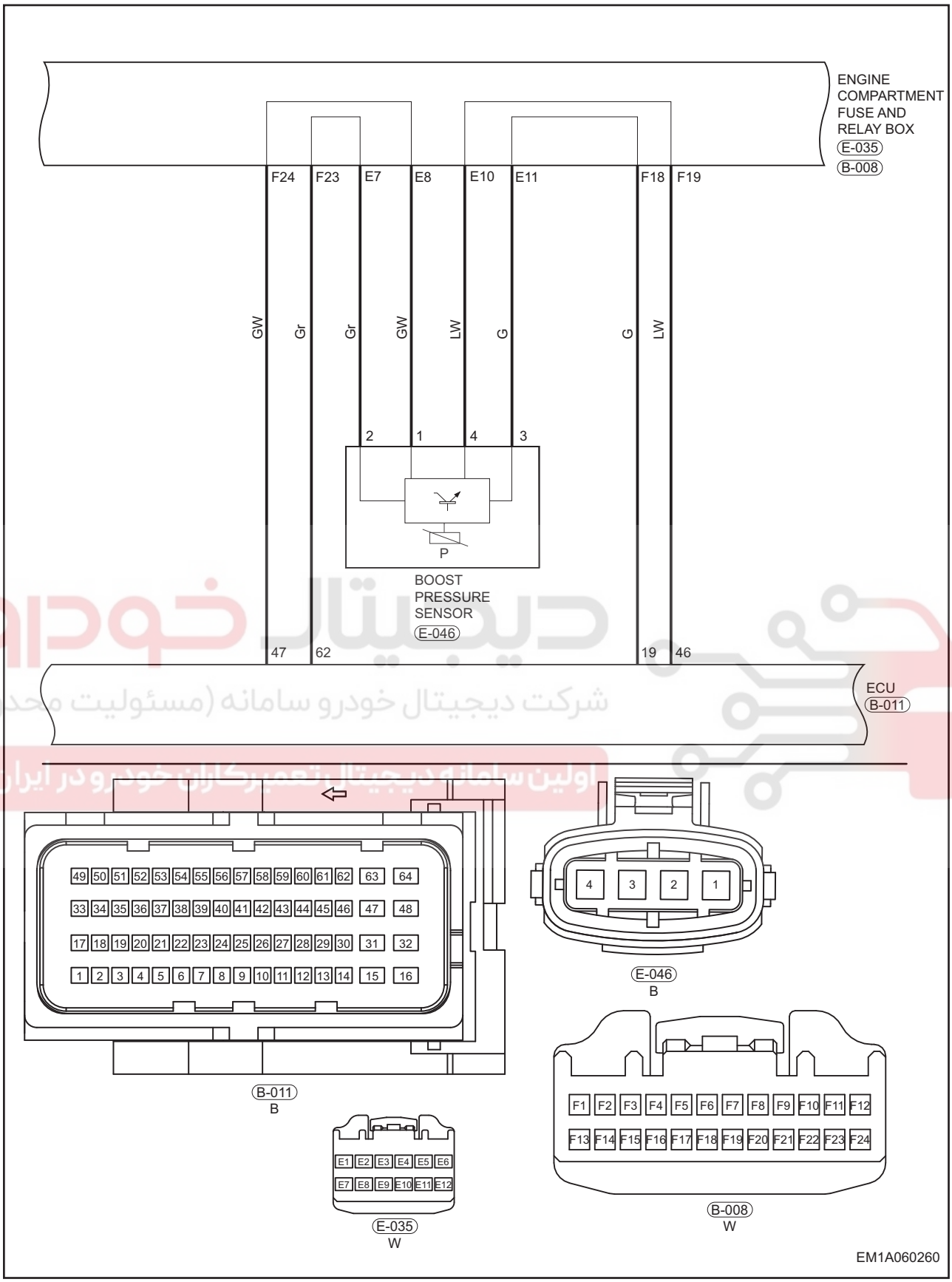
c. Check if DTC P0105 28, P0106 00, P0107 11 or P0108 12 still exists.

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.**

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



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0234 00 | Turbu/Super Charger Overboost Condition | Ignition switch ON Engine running | • Boost pressure/temperature sensor<br>• Wire harness or connector<br>• ECM |
| P0237 16 | Turbocharger Boost Sensor (A) Circ. Low Input | | |
| P0238 17 | Turbocharger Boost Sensor (A) Circ. High Input | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

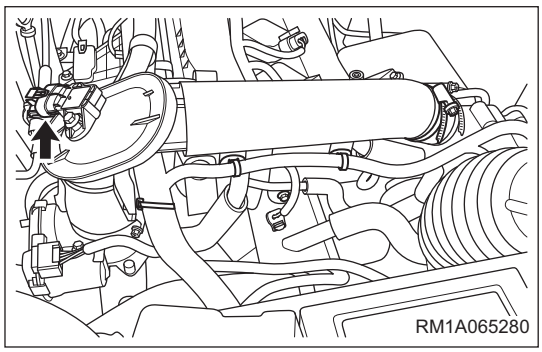
NG → **Repair or replace ground wire harness or ground point**

OK

| 2 | Check boost pressure sensor connector |
|---|---|

a. Disconnect the boost pressure/temperature sensor connector E-046 (arrow).

b. Check the boost pressure/temperature sensor connector.




NG → **Repair or replace connector**

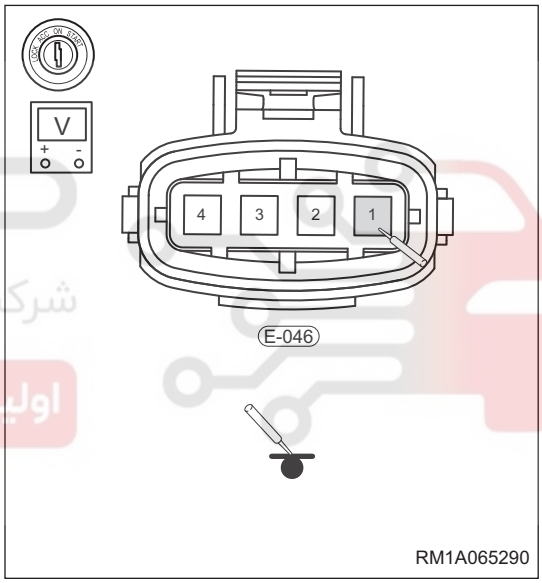
OK

| 3 | Check boost pressure sensor signal voltage |
|---|---|

a. Connect the boost pressure/temperature sensor connector E-046.

b. Turn ignition switch to ON and start engine.

c. Using a multimeter, measure voltage between terminal 1 of connector E-046 and body ground.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-046 (1) - Body ground | Idling | Voltage is about 1.3 V (value changes with model) |
| | Accelerator pedal depressed rapidly | Maximum instantaneous voltage is about 4 V (value changes with model) |

OK → **Go to step 8**

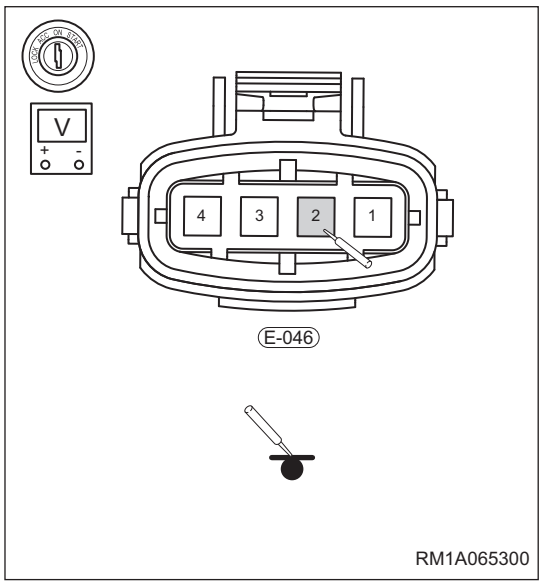
NG

| 4 | Check boost pressure sensor power supply voltage |
|---|---|

a. Disconnect the boost pressure/temperature sensor connector E-046.

b. Check voltage between connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-046 (2) - Body ground | Ignition switch ON | 5 V |




**OK** → **Go to step 6**

**NG**

| 5 | Check boost pressure sensor signal circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector B-011.

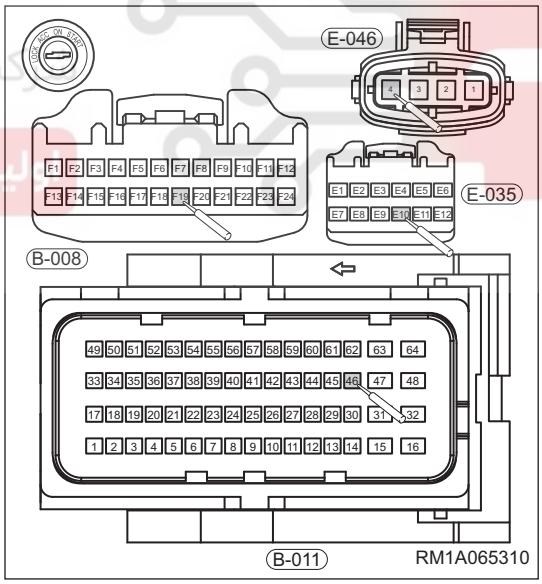
c. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (46) - B-008 (F19) - E-035 (E10) - E-046 (4) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (46) or E-046 (4) - Body ground | Always | No continuity |
| B-011 (46) or E-046 (4) - Battery positive | Always | No continuity |




**NG** → **Replace wire harness or connector (boost pressure/temperature sensor - ECM)**

OK

| 6 | Check boost pressure sensor power supply voltage |
|---|---|

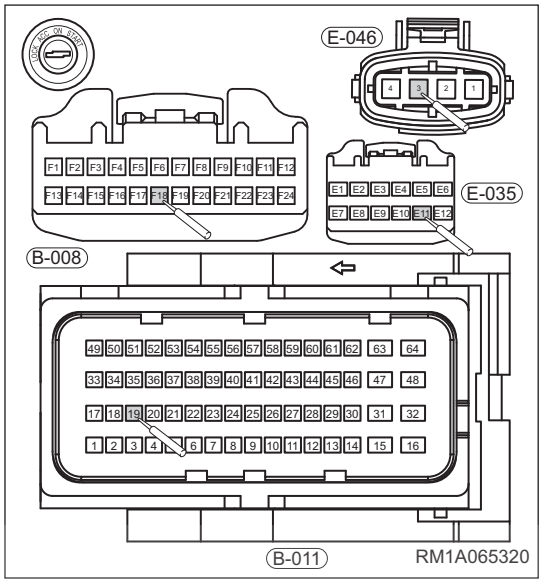
a. Check wire harness between boost pressure/temperature sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (19) - B-008 (F18) - E-035 (E11) - E-046 (3) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (19) or E-046 (3) - Body ground | Always | No continuity |
| B-011 (19) or E-046 (3) - Battery positive | Always | No continuity |




NG → **Repair or replace wire harness or connector (boost pressure/temperature sensor - ECM)**

OK

| 7 | Check boost pressure/temperature sensor |
|---|---|

a. Remove the boost pressure/temperature sensor.

b. Check sensor connection part for debris and damage.

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

OK

| 8 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

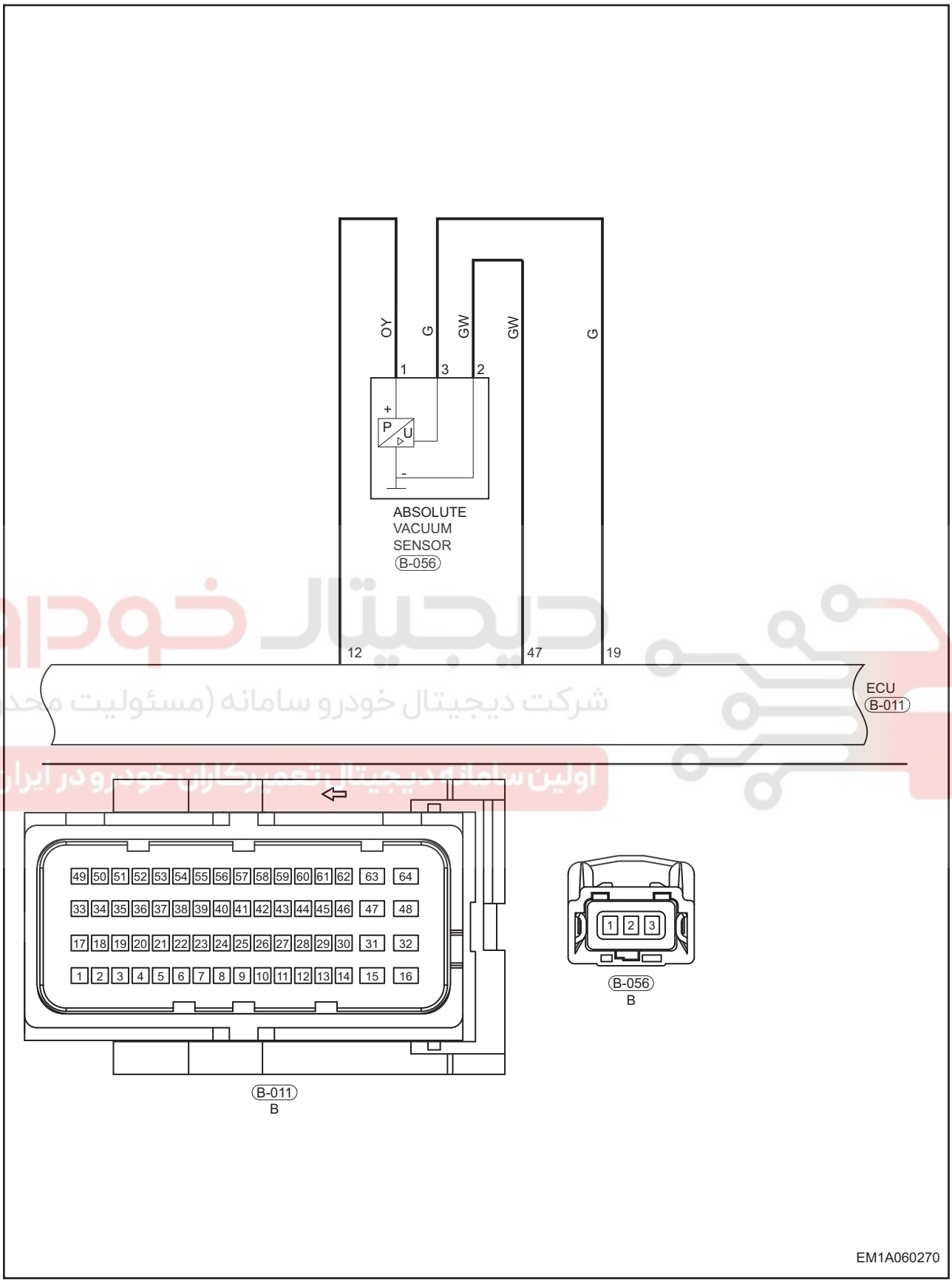
c. Check if DTC P0234 00, P0237 16 or P0238 17 still exists.

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 | P0556 00 | Brake Booster Pressure Sensor Circuit Performance Non-plausible |
| DTC | P0557 16 | Brake Booster Pressure Sensor Circuit Low |
| DTC | P0558 17 | Brake Booster Pressure Sensor Circuit High |
| DTC | P1137 17 | Diagnosis of Pressure Sensor in Brake Booster Pump Circuit High |
| DTC | P1138 16 | Diagnosis of Pressure Sensor in Brake Booster Pump Circuit Low |
| DTC | P1139 7A | Diagnosis of Pressure Sensor in Brake Booster Pump Leakage Detection |
| DTC | P1479 00 | Non-plausible Error for Brake Booster Diagnosis |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0556 00 | Brake Booster Pressure Sensor Circuit Performance Non-plausible | Ignition switch ON Engine running | • Vacuum pressure sensor<br>• Wire harness or connector<br>• ECM |
| P0557 16 | Brake Booster Pressure Sensor Circuit Low | | |
| P0558 17 | Brake Booster Pressure Sensor Circuit High | | |
| P1137 17 | Diagnosis of Pressure Sensor in Brake Booster Pump Circuit High | | |
| P1138 16 | Diagnosis of Pressure Sensor in Brake Booster Pump Circuit Low | | |
| P1139 7A | Diagnosis of Pressure Sensor in Brake Booster Pump Leakage Detection | | |
| P1479 00 | Non-plausible Error for Brake Booster Diagnosis | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point B-019 (See page 06-23).

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

OK

| 2 | Check vacuum pressure sensor connector |
|---|---|

a. Disconnect the vacuum pressure sensor connector B-056.

b. Check the vacuum pressure sensor connector.

NG → **Repair or replace connector**

OK

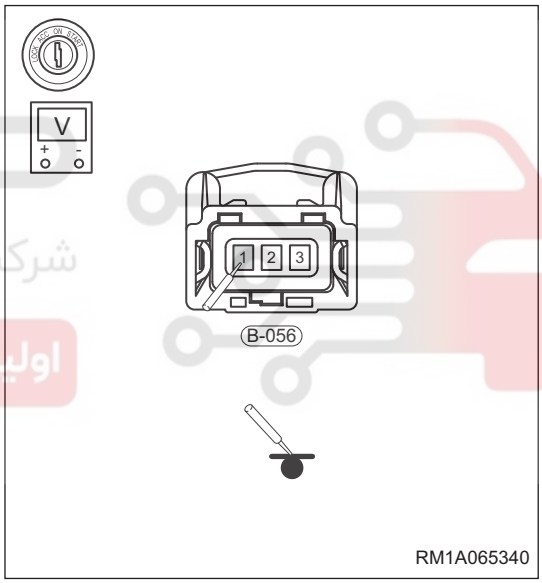
| 3 | Check vacuum pressure sensor signal voltage |
|---|---|

a. Connect the vacuum pressure sensor connector B-056.

b. Turn ignition switch to ON and start engine.

c. Using a multimeter, measure voltage between terminal 1 of connector B-056 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-056 (1) - Body ground | When vacuum degree is maximum (70) | Voltage is about 1.3 V (value changes with model) |
| | When vacuum degree is minimum (0) | Voltage is about 4 V (value changes with model) |




OK → **Go to step 8**

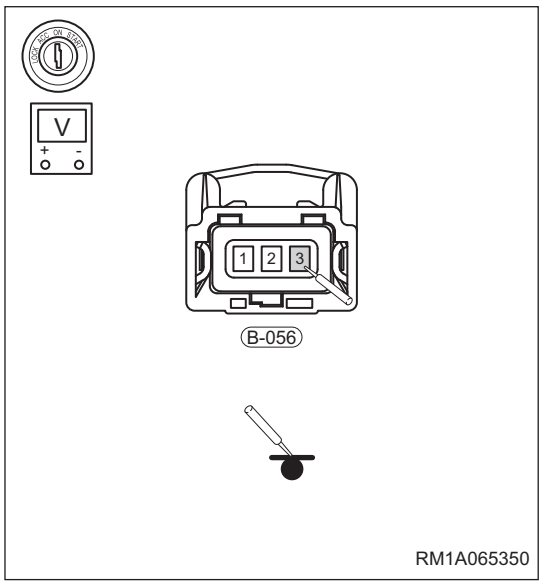
NG

| 4 | Check vacuum pressure sensor power supply voltage |
|---|---|

a. Disconnect the vacuum pressure sensor connector B-056.

b. Check voltage between connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-056 (3) - Body ground | Ignition switch ON | 5 V |




OK → Go to step 6

NG

| 5 | Check vacuum pressure sensor signal circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector B-011.

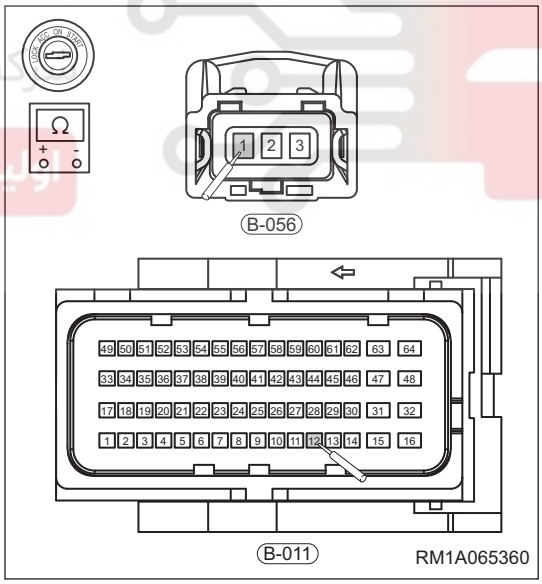
c. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (12) - B-056 (1) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (12) or B-056 (1) - Body ground | Always | No continuity |
| B-011 (12) or B-056 (1) - Battery positive | Always | No continuity |




NG → Replace wire harness or connector (vacuum pressure sensor - ECM)

OK

| 6 | Check vacuum pressure sensor power supply circuit |
|---|---|

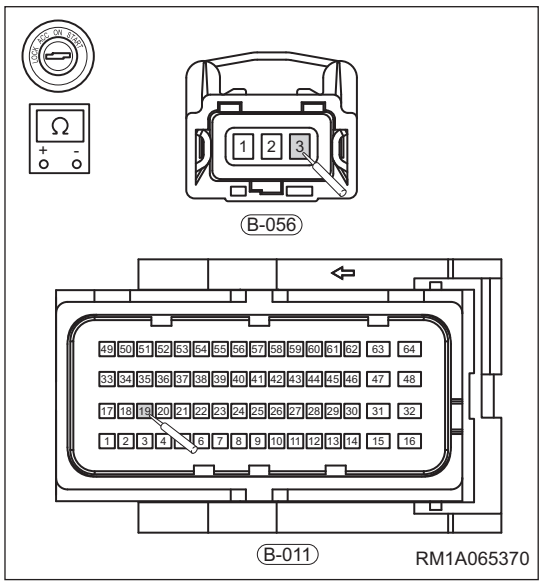
a. Check wire harness between vacuum pressure sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (19) - B-056 (3) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (19) or B-056 (3) - Body ground | Always | No continuity |
| B-011 (19) or B-056 (3) - Battery positive | Always | No continuity |




NG → **Repair or replace wire harness or connector (vacuum pressure/temperature sensor - ECM)**

OK

| 7 | Check vacuum pressure sensor |
|---|---|

a. Remove the vacuum pressure sensor.

b. Check sensor connection part for debris and damage.

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

OK

| 8 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

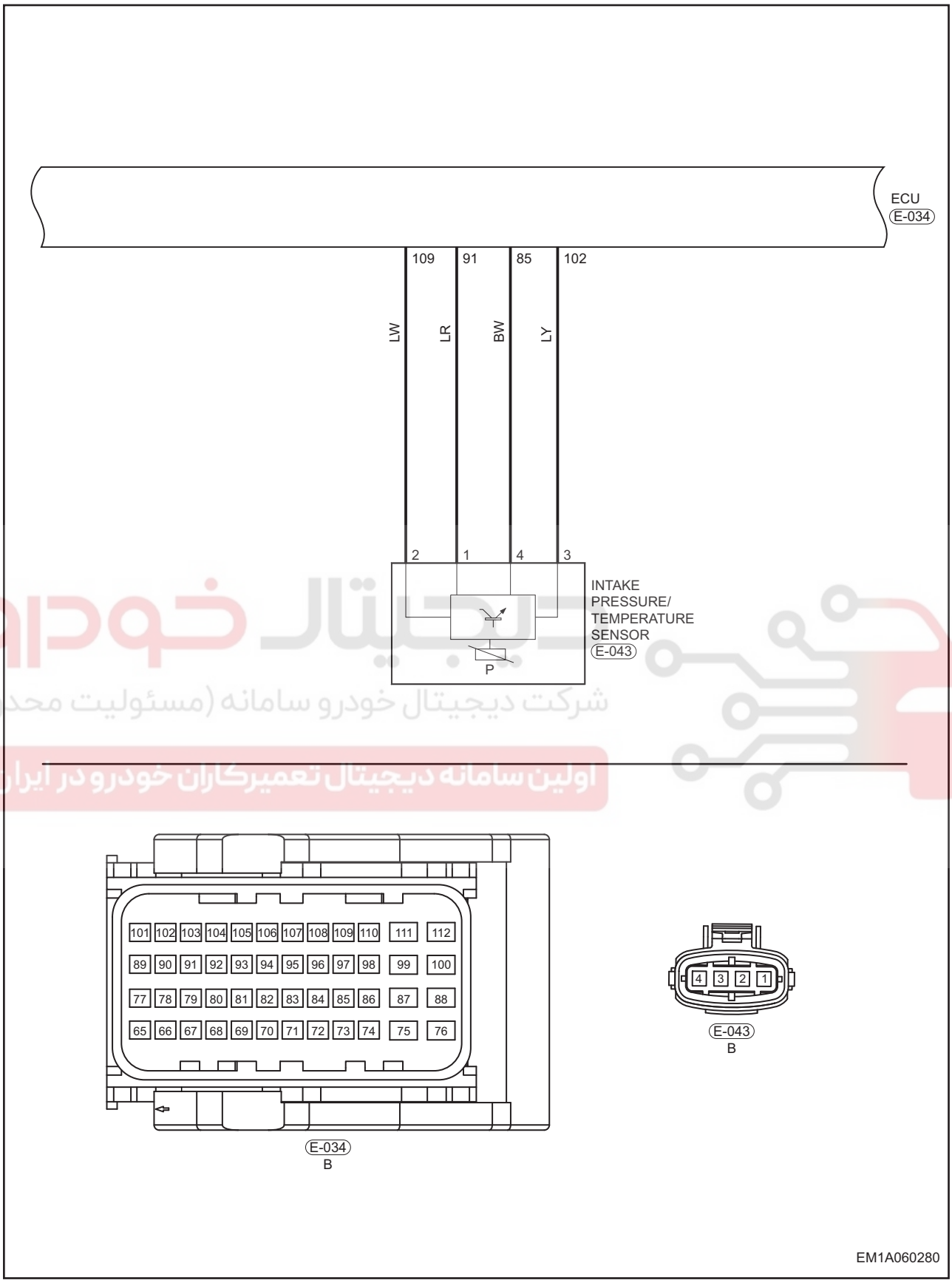
c. Check if DTC P0556 00, P0557 16, P0558 17, P1137 17, P1138 16, P1139 7A or P1479 00 still exists.

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 | P0111 00 | Intake Air Temp. Circ. Performance Non-plausible |
| DTC | P0112 16 | Intake Air Temp. Circ. Low Input |
| DTC | P0113 17 | Intake Air Temp. Circ. High Input |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0111 00 | Intake Air Temp. Circ. Performance Non-plausible | Ignition switch ON Engine running | • Intake pressure/temperature sensor<br>• Wire harness or connector<br>• ECM |
| P0112 16 | Intake Air Temp. Circ. Low Input | | |
| P0113 17 | Intake Air Temp. Circ. High Input | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

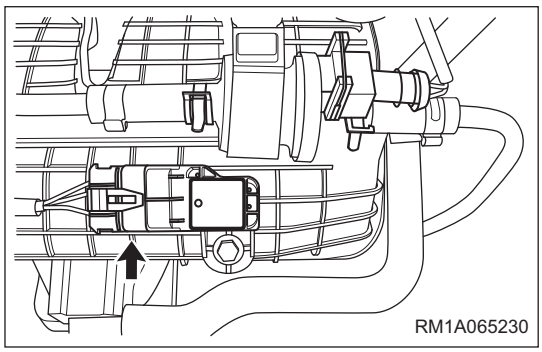
**NG** → **Repair or replace ground wire harness or ground point**

**OK**

| 2 | Check intake pressure/temperature sensor connector |
|---|---|

a. Disconnect the intake pressure/temperature sensor connector E-043 (arrow).

b. Check the intake pressure/temperature sensor connector.




NG → Repair or replace connector

OK

| 3 | Check intake pressure/temperature sensor signal voltage |
|---|---|

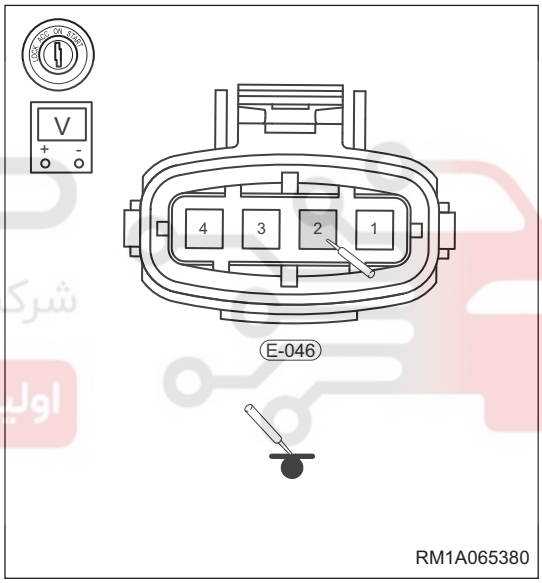
a. Connect the intake pressure/temperature sensor connector E-043.

b. Turn ignition switch to ON and start engine.

c. Using a multimeter, measure voltage between terminal 2 of connector E-043 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-046 (2) - Body ground | Ignition switch ON | 5 V |

OK → Go to step 5



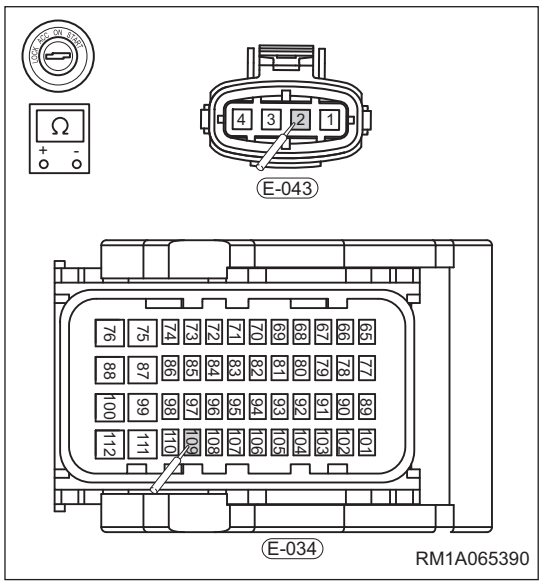

NG

| 4 | Check intake pressure/temperature sensor signal circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector B-011.

c. Check wire harness between connector terminal and ECM connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-043 (2) - E-034 (109) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-043 (2) or E-034 (109) - Body ground | Always | No continuity |
| E-043 (2) or E-034 (109) - Battery positive | Always | No continuity |

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

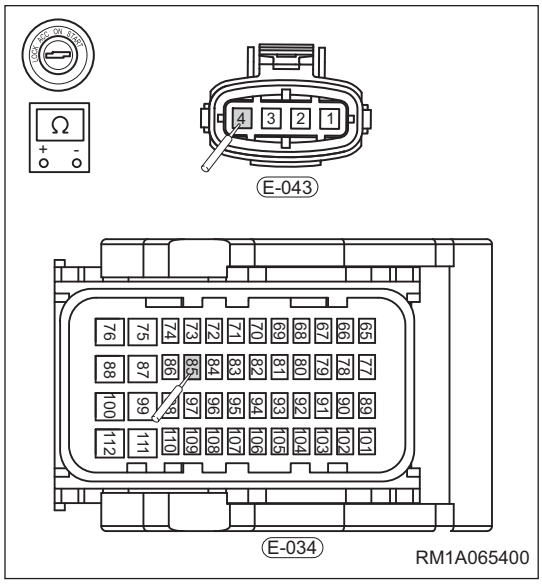
OK

| 5 | Check intake pressure/temperature sensor ground circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector B-011.

c. Check wire harness between connector terminal and ECM connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (85) - E-043 (4) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (85) or E-043 (4) - Body ground | Always | No continuity |

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (85) or E-043 (4) - Battery positive | Always | No continuity |

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

OK

| 6 | Check intake pressure/temperature sensor |
|---|---|

a. Remove the intake pressure/temperature sensor.

b. Check resistance of intake pressure/temperature sensor.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 3 - Terminal 4 | Always | 2.5 kΩ ± 5% (at 20°C) |

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

OK

| 7 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

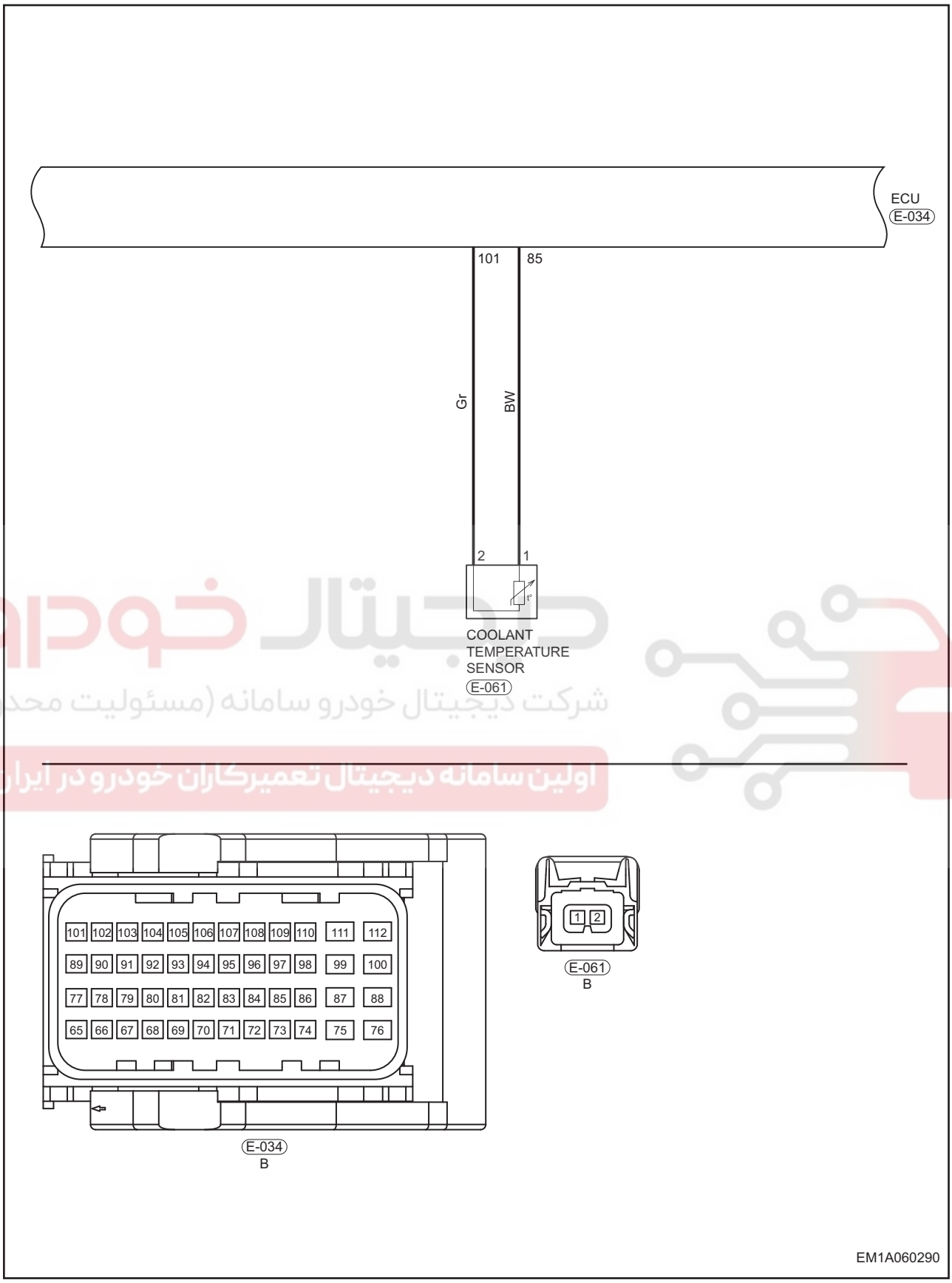
c. Check if DTC P0111 00, P0112 16 or P0113 17 still exists.

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



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0116 00 | Engine Coolant Temp. Circ. Performance Non-plausible | Ignition switch ON Engine running | • Engine coolant temperature sensor<br>• Wire harness or connector<br>• ECM |
| P0117 16 | Engine Coolant Temp. Circ. Low Input | | |
| P0118 17 | Engine Coolant Temp. Circ. High Input | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

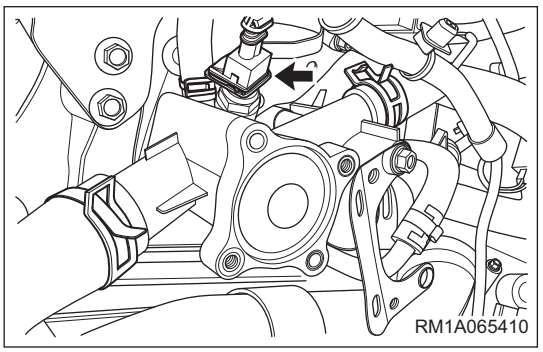
**NG** → **Repair or replace ground wire harness or ground point**

**OK**

| 2 | Check engine coolant temperature sensor connector |
|---|---|

a. Disconnect the engine coolant temperature sensor connector E-061 (arrow).

b. Check the engine coolant temperature sensor connector.




NG → **Repair or replace connector**

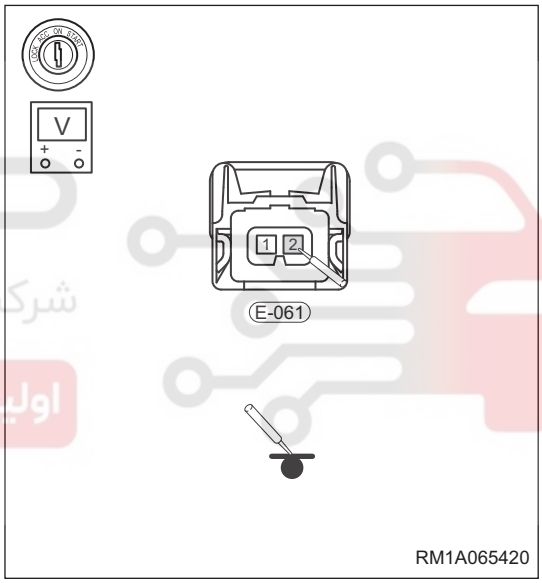
OK

| 3 | Check engine coolant temperature sensor power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between engine coolant temperature sensor terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-061 (2) - Body ground | Ignition switch ON | 5 V |




OK → **Go to step 5**

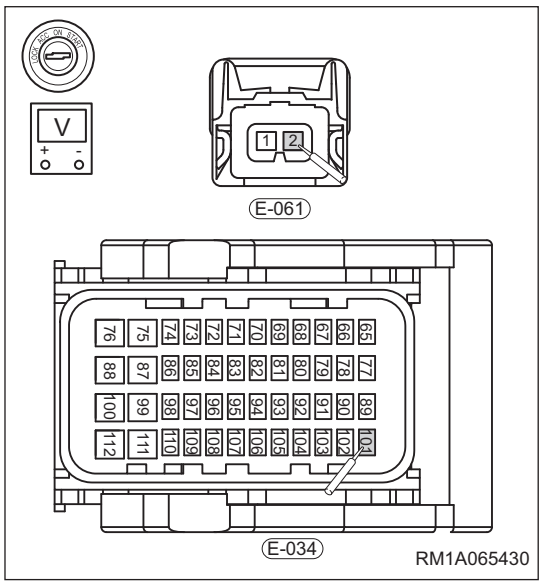
NG

| 4 | Check engine coolant temperature sensor power supply circuit |
|---|---|

a. Disconnect the engine coolant temperature sensor connector E-061.

b. Check voltage between connector terminal and body ground.

c. Check wire harness between engine coolant temperature sensor connector terminal and ECM connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-061 (2) - E-034 (101) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-061 (2) or E-034 (101) - Body ground | Always | No continuity |
| E-061 (2) or E-034 (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 |
|---|---|

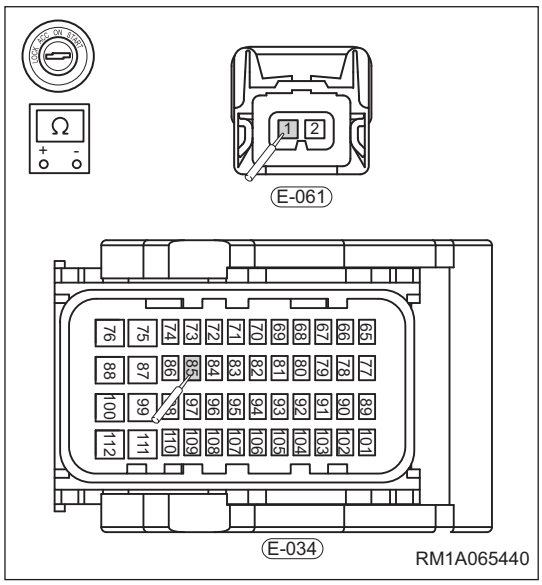
a. Check wire harness between engine coolant temperature sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-061 (1) - E-034 (85) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-061 (1) or E-034 (85) - Body ground | Always | No continuity |
| E-061 (1) or E-034 (85) - Battery positive | Always | No continuity |




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

**OK**

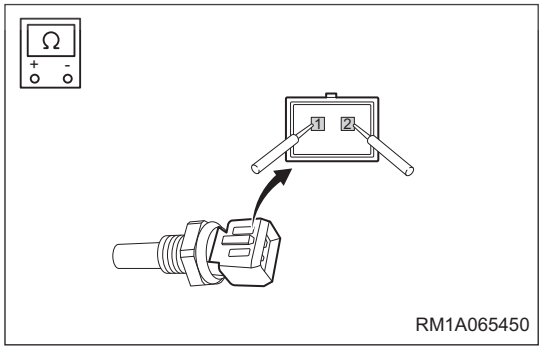
| 6 | Check engine coolant temperature sensor |
|---|---|

a. Remove the engine coolant temperature sensor.

b. Check resistance of engine coolant temperature sensor.

**Check for Open**

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




**NG** → **Replace engine coolant temperature sensor**

**OK**

| 7 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

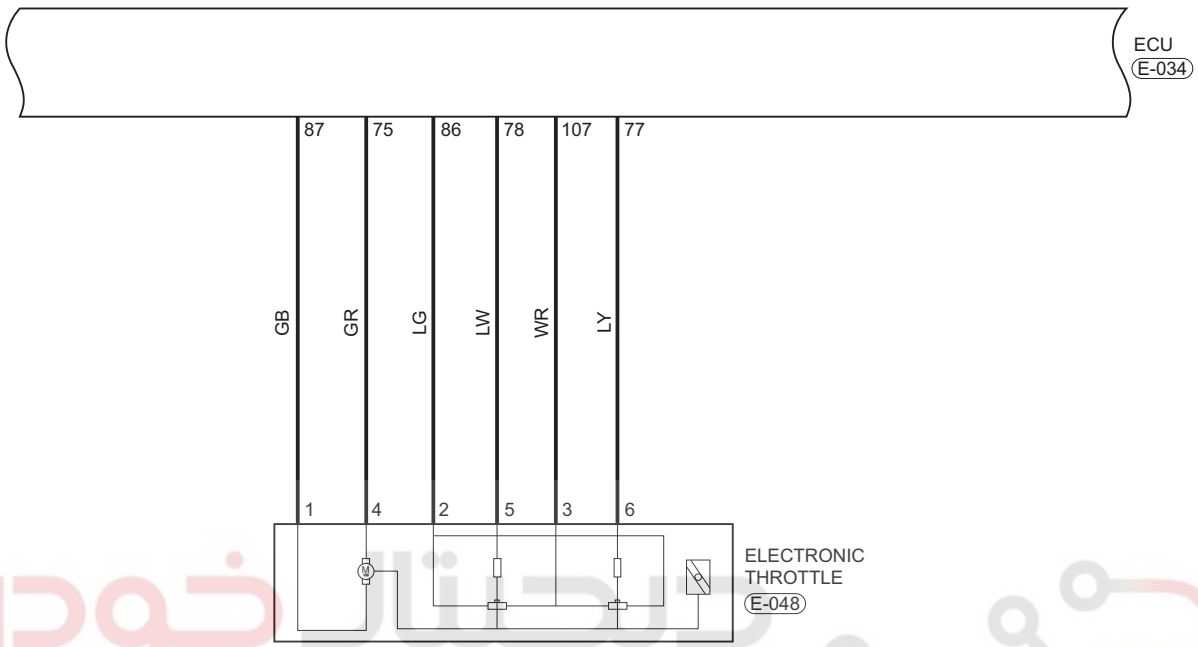
c. Check if DTC P0116 00, P0117 16 or P0118 17 still exists.

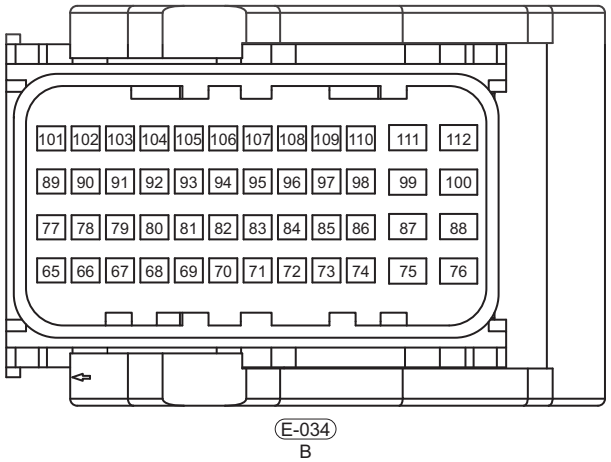
NG → Replace ECM

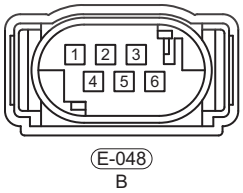
OK

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




EM1A060300

| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0121 29 | Throttle Pos. Sensor 1 Circ. Performance Non-plausible | Ignition switch ON Engine running | • Throttle position sensor 1<br>• Throttle position sensor 2<br>• Wire harness or connector<br>• ECM |
| P0122 16 | Throttle Pos. Sensor 1 Circ. Low Input | | |
| P0123 17 | Throttle Pos. Sensor 1 Circ. High Input | | |
| P0221 29 | Throttle Position Sensor 2 Performance Non-plausible | | |
| P0222 16 | Throttle Position Sensor 2 Performance Low Input | | |
| P0223 17 | Throttle Position Sensor 2 Performance High Input | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

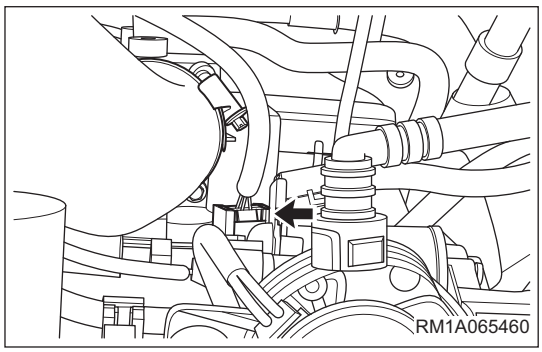
NG → **Repair or replace ground wire harness or ground point**

OK →

| 2 | Check electronic throttle position sensor connector |
|---|---|

a. Disconnect the electronic throttle position sensor connector E-048 (arrow).

b. Check the electronic throttle connector.




NG → Repair or replace connector

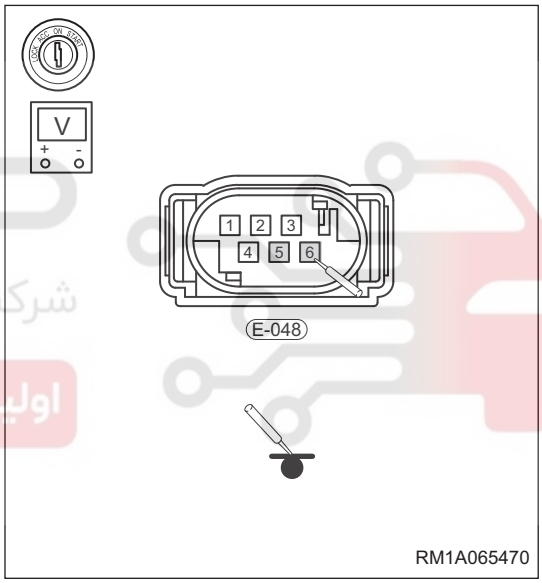
OK

| 3 | Check throttle position sensor signal voltage |
|---|---|

a. Turn ignition switch to ON.

b. Connect the electronic throttle position sensor connector E-048.

c. Using diagnostic tester, check signal voltage of throttle position sensor.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-048 (6) - Body ground | Ignition switch ON, idling | 0.74 V |
| | Ignition switch ON, throttle fully opened | 4.24 V |
| E-048 (5) - Body ground | Ignition switch ON, idling | 4.24 V |
| | Ignition switch ON, throttle fully opened | 0.36 V |

NG → Go to step 8

OK

| 4 | Check throttle position sensor power supply voltage |
|---|---|

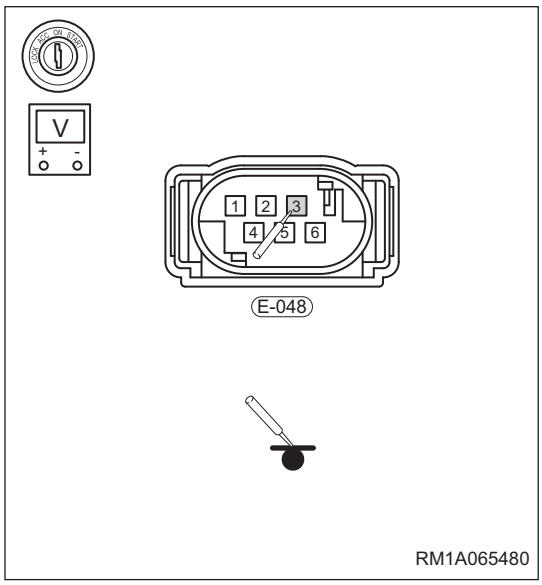
a. Turn ignition switch to OFF.

b. Disconnect the electronic throttle position sensor connector E-048.

c. Turn ignition switch to ON and check voltage between electronic throttle position sensor connector terminal and body ground.

**Voltage Inspection**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-048 (3) - Body ground | Ignition switch ON | 5 V |




**NG** → **Go to step 6**

**OK**

| 5 | Check throttle position sensor power supply circuit and ground circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

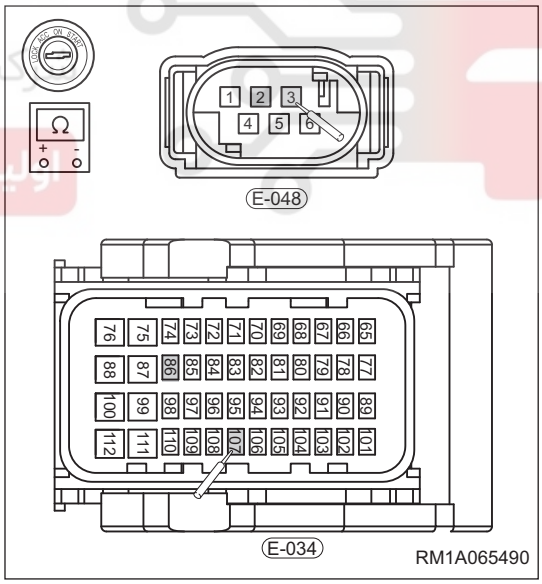
c. Check wire harness between electronic throttle position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-048 (3) - E-034 (107) or E-048 (2) - E-034 (86) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-048 (3), E-034 (107) - Body ground or battery positive | Always | No continuity |
| E-048 (2), E-034 (86) - Body ground or battery positive | | |




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

OK

| 6 | Check throttle position sensor signal circuit |
|---|---|

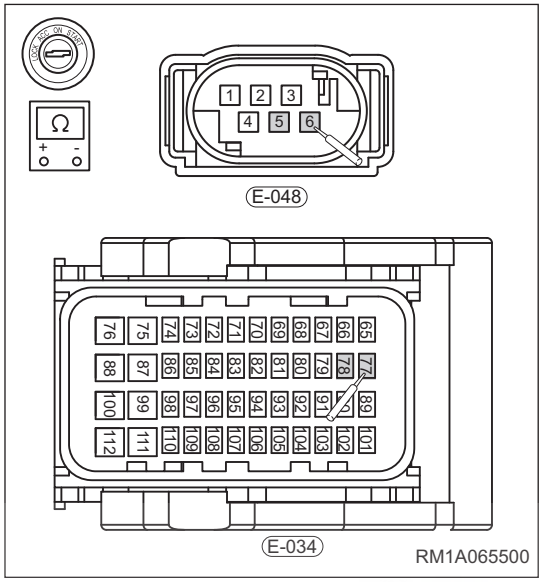
a. Check wire harness between electronic throttle position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-048 (6) - E-034 (77) | Always | Continuity |
| E-048 (5) - E-034 (78) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-048 (6), E-034 (77) - Body ground or battery positive | Always | No continuity |
| E-048 (5), E-034 (78) - Body ground or battery positive | | |




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

OK

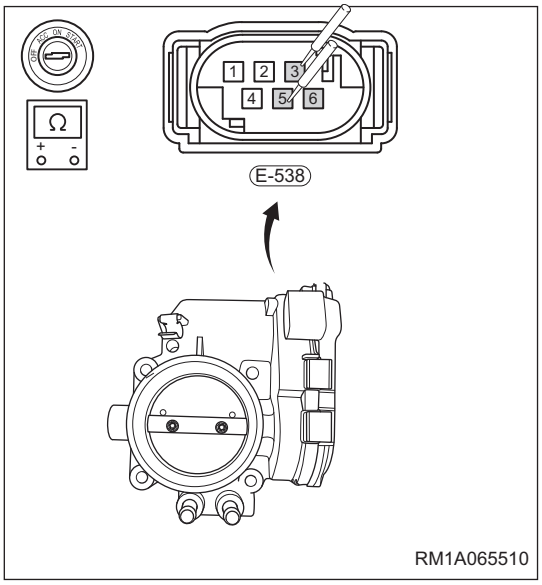
| 7 | Check electronic throttle |
|---|---|

a. Check electronic throttle for carbon deposits and foreign matter accumulation inside.

b. Check if electronic throttle valve body is stuck.

c. Check resistance of electronic throttle.

**Throttle Inspection**




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 5 - Terminal 3 | Throttle turned | Resistance between terminals 5 and 3 increases as throttle valve opens |
| Terminal 6 - Terminal 3 | | Resistance between terminals 6 and 3 decreases as throttle valve opens |
| Terminal 5 - Terminal 3 and Terminal 6 - Terminal 3 | On same position of valve at normal temperature | Sum of resistance in two groups is 1.9 kΩ ± 0.2 kΩ |

NG → **Clean or replace electronic throttle assembly, and go to next step**

OK

| 8 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

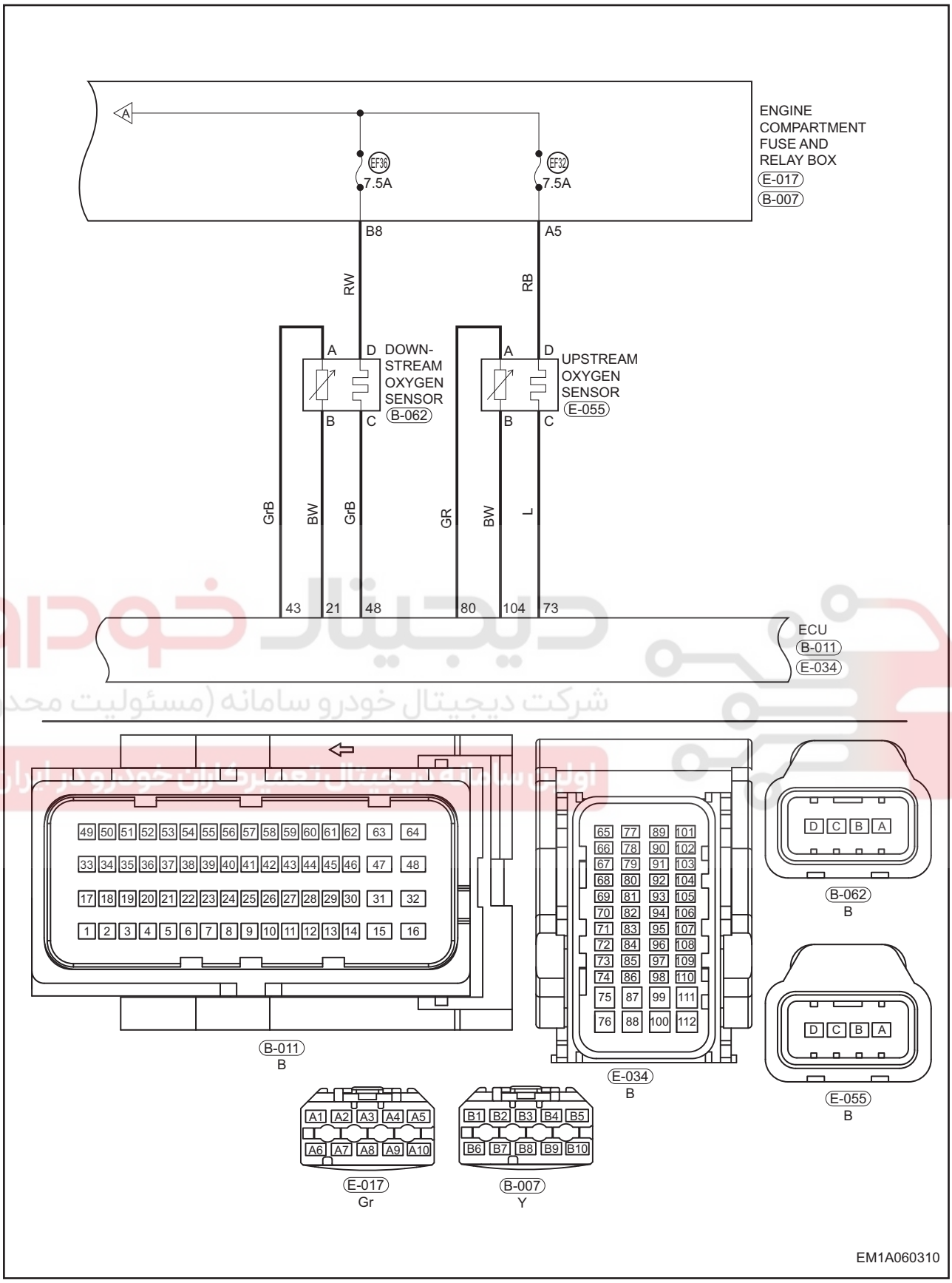
c. Check if DTC P0121 29, P0122 16, P0123 17, P0221 29, P0222 16 or P0223 17 still exists.

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 | 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 | P0133 00 | O2 Sensor Circ. Slow Response (Upstream of the Catalyzer) |
| DTC | P0134 00 | O2 Sensor Circ. No Activity Detected (Upstream of the Catalyzer) |
| DTC | P0170 00 | Fuel Trim, Malfunction |
| DTC | P0171 00 | Fuel Trim, System Too Lean |
| DTC | P0172 00 | Fuel Trim, System Too Rich |
| DTC | P2195 00 | O2 Sensor Signal Stuck Lean (Upstream of the Catalyzer) |
| DTC | P2196 00 | O2 Sensor Signal Stuck Rich (Upstream of the Catalyzer) |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0130 00 | O2 Sensor Circ. Malfunction (Upstream of the Catalyzer) | Ignition switch ON Engine running | • Upstream oxygen sensor<br>• Wire harness or connector<br>• ECM |
| P0131 16 | O2 Sensor Circ. Low Voltage (Upstream of the Catalyzer) | | |
| 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) | | |
| P0170 00 | Fuel Trim, Malfunction | | |
| P0171 00 | Fuel Trim, System Too Lean | | |
| P0172 00 | Fuel Trim, System Too Rich | | |
| P2195 00 | O2 Sensor Signal Stuck Lean (Upstream of the Catalyzer) | | |
| P2196 00 | O2 Sensor Signal Stuck Rich (Upstream of the Catalyzer) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

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

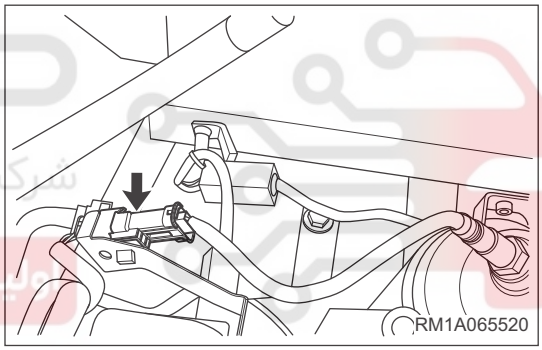
OK ↓

| 2 | Check upstream oxygen sensor connector |
|---|---|

a. Disconnect the upstream oxygen sensor connector E-055 (arrow).

b. Check the upstream oxygen sensor connector.

NG → **Repair or replace connector**




OK ↓

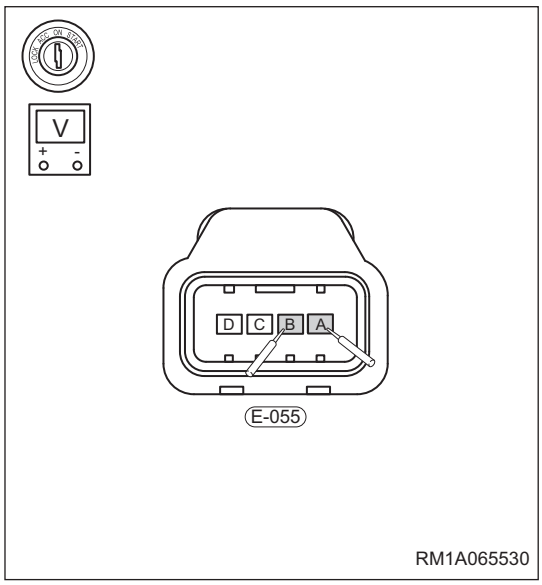
| 3 | Check upstream oxygen sensor signal |
|---|---|

a. Connect the upstream oxygen sensor connector E-055.

b. Turn ignition switch to ON, start engine and idle it for about 3 minutes.

c. Using a multimeter, measure voltage between terminals A and B of connector E-055.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-055 (A) - E-055 (B) | Engine running | Fluctuates rapidly between 0.1 and 0.9 V (when operating temperature is 350°C) |




NG → Go to step 4

OK

| 4 | Check upstream oxygen sensor signal circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

c. Disconnect the upstream oxygen sensor connector E-055.

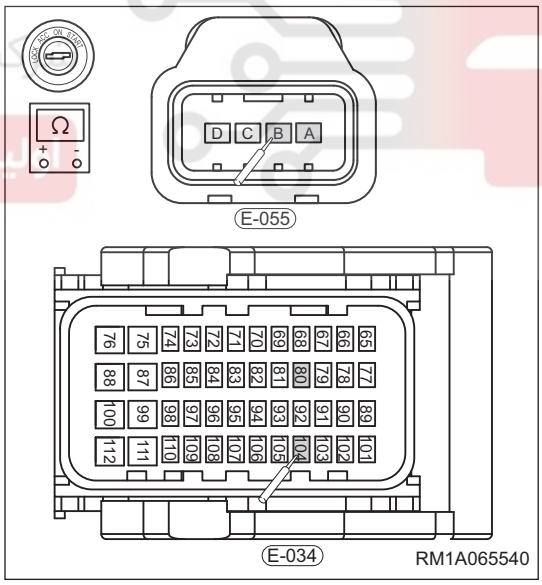
d. Check wire harness between upstream oxygen sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-055 (B) - E-034 (104) or E-055 (A) - E-034 (80) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-055 (B), E-034 (104) - Body ground or battery positive | Always | No continuity |
| E-055 (A), E-034 (80) - Body ground or battery positive | | |



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

OK

| 5 | Check upstream oxygen sensor |
|---|---|

a. Remove the upstream oxygen sensor.

b. Check upstream oxygen sensor for following problems.

- Moisture enters internal of sensor, temperature changes greatly or probe is broken.
- Oxygen sensor is "poisoned" (Pb, S, Br and Si etc.).

NG → **Replace upstream oxygen sensor**

OK

| 6 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0130 00, P0131 16, P0132 17, P0133 00, P0134 00, P2177 00, P2178 00, P2187 00, P2188 00, P2195 00 or P2196 00 still exists.

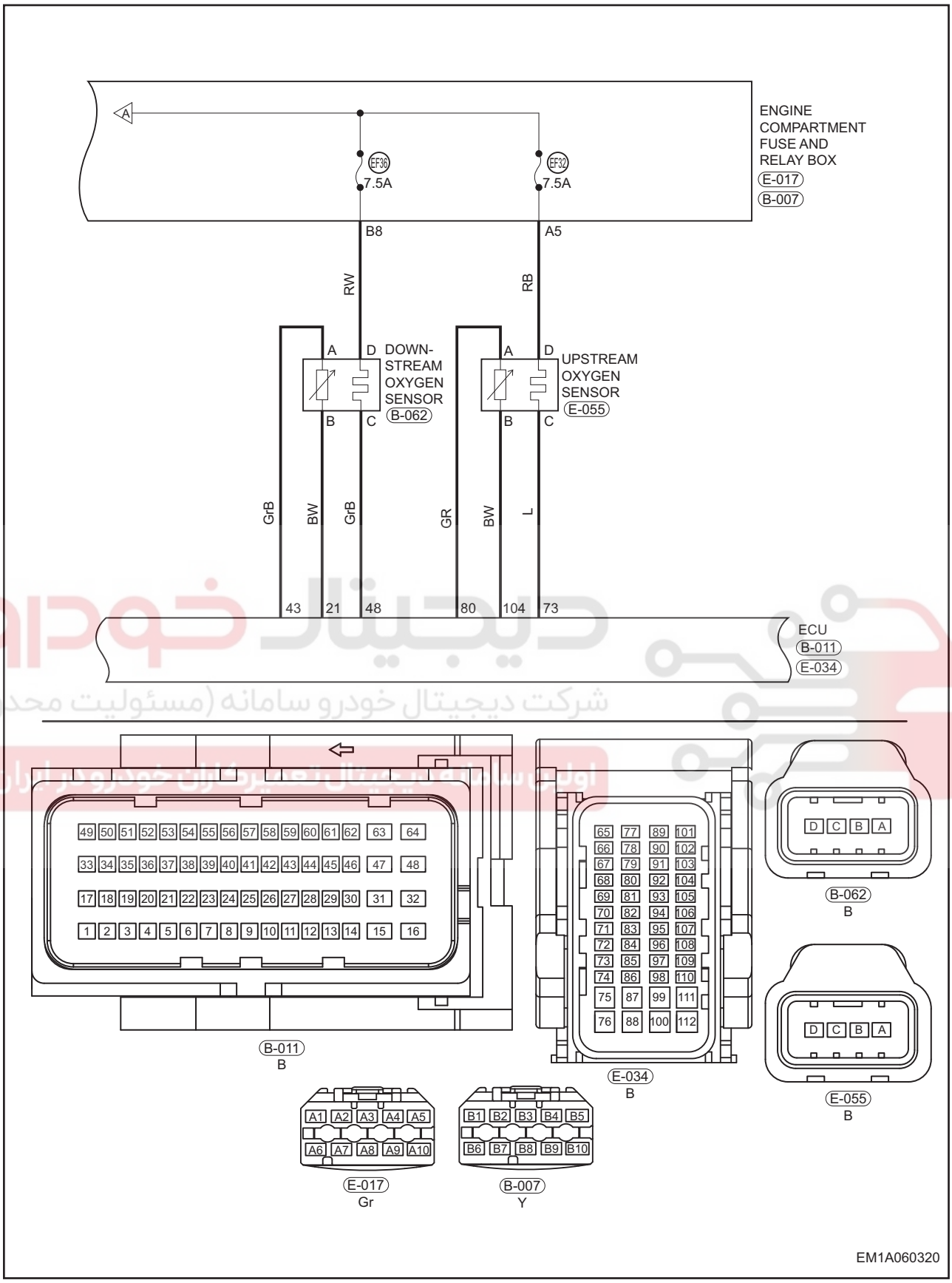
NG → **Replace ECM**



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 | P2270 00 | O2 Sensor Signal Stuck Lean (Downstream of the Catalyzer) |
| DTC | P2271 00 | O2 Sensor Signal Stuck Rich (Downstream of the Catalyzer) |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0136 00 | O2 Sensor Circ. Malfunction (Downstream of the Catalyzer) | Ignition switch ON Engine running | • Downstream oxygen sensor<br>• Wire harness or connector<br>• 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) | | |
| P2270 00 | O2 Sensor Signal Stuck Lean (Downstream of the Catalyzer) | | |
| P2271 00 | O2 Sensor Signal Stuck Rich (Downstream of the Catalyzer) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point B-017 (See page 06-23).

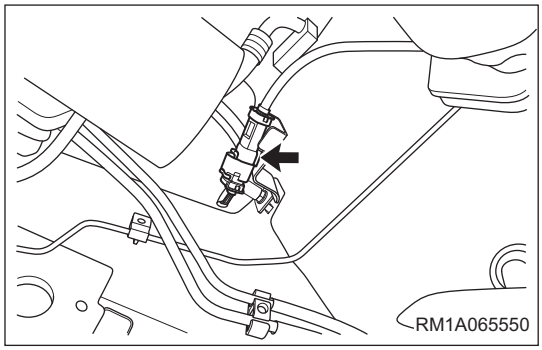
NG → **Repair or replace ground wire harness or ground point**

OK

| 2 | Check downstream oxygen sensor connector |
|---|---|

a. Disconnect the downstream oxygen sensor connector B-062 (arrow).

b. Check the downstream oxygen sensor connector.




NG → Repair or replace connector

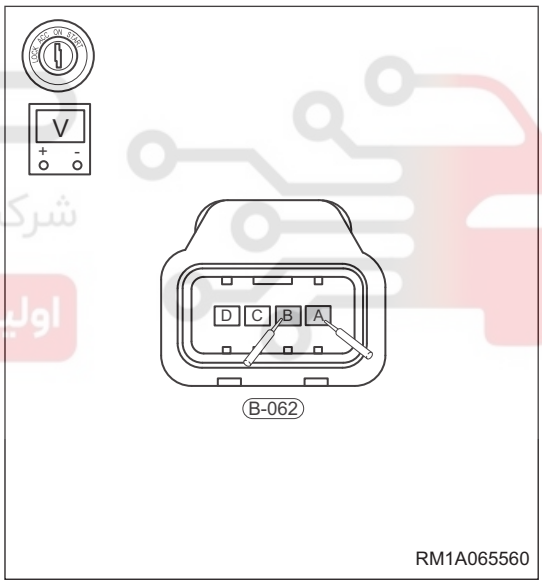
OK

| 3 | Check downstream oxygen sensor signal |
|---|---|

a. Connect the downstream oxygen sensor connector B-062.

b. Turn ignition switch to ON, start engine and idle it for about 3 minutes.

c. Use diagnostic tester to check downstream oxygen sensor signal voltage, or use multimeter to measure voltage between terminals B and A of connector B-062.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-062 (A) - B-062 (B) | Engine running | Fluctuates slightly at about 0.45 V |

NG → Go to step 4

OK

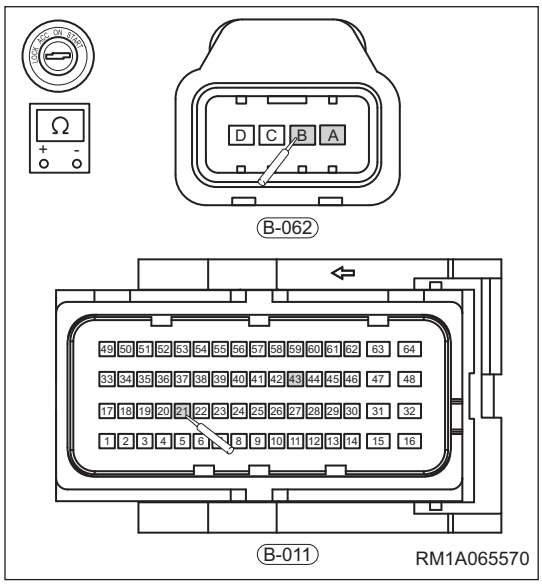
| 4 | Check downstream oxygen sensor signal circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector B-011.

c. Disconnect the downstream oxygen sensor connector B-062.

d. Check wire harness between downstream oxygen sensor connector terminal and ECM connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-062 (B) - B-011 (21) or B-062 (A) - B-011 (43) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-062 (B), B-011 (21) - Body ground or battery positive | Always | No continuity |
| B-062 (A), B-011 (43) - Body ground or battery positive | | |

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

OK

| 5 | Check downstream oxygen sensor |
|---|---|

a. Remove the downstream oxygen sensor.

b. Check downstream oxygen sensor for following problems.

- Moisture enters internal of sensor, temperature changes greatly or probe is broken.
- Oxygen sensor is "poisoned" (Pb, S, Br and Si etc.).

NG → **Replace downstream oxygen sensor**

OK

| 6 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

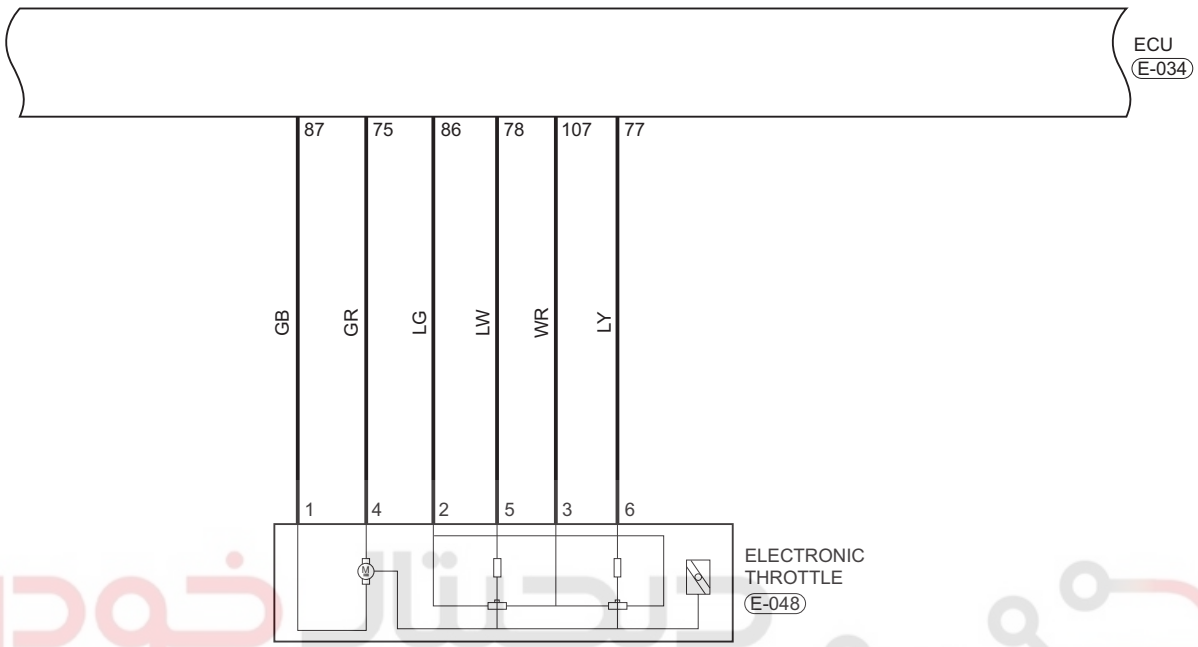
c. Check if DTC P0136 00, P0137 16, P0138 17, P0140 00, P2270 00 or P2271 00 still exists.

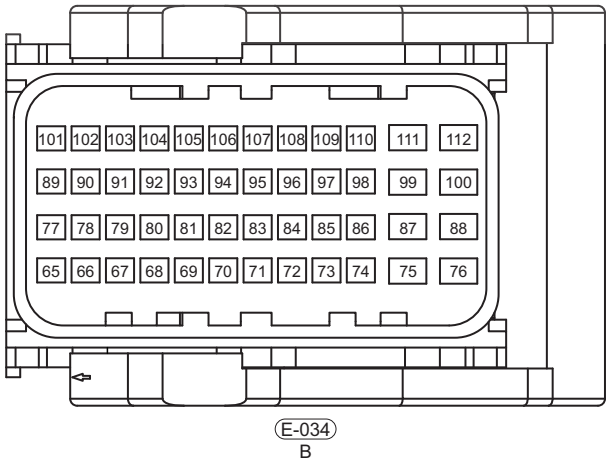
NG → **Replace ECM**

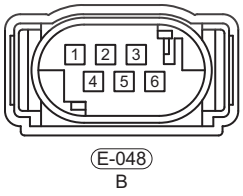
OK

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

| | | |
|---|---|---|
| DTC | P0606 94 | Torque Monitoring Error in Level 2 |
| DTC | P0606 92 | Engine Speed Monitoring Error in Level 2 |
| DTC | P0606 64 | Load Signal, Wiring Harness or ECU Error |
| DTC | P0606 61 | Ignition Angle Signal, Wiring Harness or ECU Error |
| DTC | P0606 67 | ECU Fault Reaction Monitoring Error |
| DTC | P0606 96 | AD Convertor Monitoring Error |
| DTC | P0606 1C | Throttle Signal, Wiring Harness or ECU Error |
| DTC | P0606 55 | Variant Coding Monitoring Error |
| DTC | P0606 00 | Safety Monitoring Fuel Cutoff Error |
| DTC | P0606 62 | Pedal Signal Unplausibility Error in Level 2 |
| DTC | P0606 63 | Safety Monitoring Function Error (SSM System Monitoring Error) |
| DTC | P0606 48 | Monitoring Fault Reaction Error |
| DTC | P0606 47 | Monitoring Module Feedback Error |
| DTC | P0606 75 | Shut Off Path Test Error |
| DTC | P0606 49 | Monitoring Module Inquiry Error |
| DTC | P1100 00 | Engine Torque Control Adaption at Limit |




EM1A060300

| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0606 94 | Torque Monitoring Error in Level 2 | Ignition switch ON Engine running | • Throttle<br>• Low battery voltage<br>• Throttle mechanical malfunction<br>• Wire harness or connector<br>• ECM |
| P0606 92 | Engine Speed Monitoring Error in Level 2 | | |
| P0606 64 | Load Signal, Wiring Harness or ECU Error | | |
| P0606 61 | Ignition Angle Signal, Wiring Harness or ECU Error | | |
| P0606 67 | ECU Fault Reaction Monitoring Error | | |
| P0606 96 | AD Convertor Monitoring Error | | |
| P0606 1C | Throttle Signal, Wiring Harness or ECU Error | | |
| P0606 55 | Variant Coding Monitoring Error | | |
| P0606 00 | Safety Monitoring Fuel Cutoff Error | | |
| P0606 62 | Pedal Signal Unplausibility Error in Level 2 | | |
| P0606 63 | Safety Monitoring Function Error (SSM System Monitoring Error) | | |
| P0606 48 | Monitoring Fault Reaction Error | | |
| P0606 47 | Monitoring Module Feedback Error | | |
| P0606 75 | Shut Off Path Test Error | | |
| P0606 49 | Monitoring Module Inquiry Error | | |
| P1100 00 | Engine Torque Control Adaption at Limit | | |



## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.

- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

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

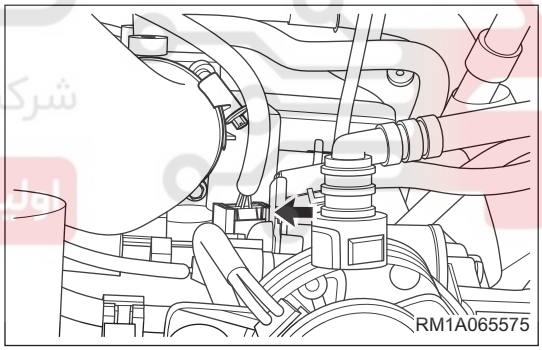
OK ↓

| 2 | Check electronic throttle position sensor connector |
|---|---|

a. Disconnect the electronic throttle position sensor connector E-048 (arrow).

b. Check the electronic throttle connector.

NG → **Repair or replace connector**




OK ↓

| 3 | Clear DTCs |
|---|---|

a. Use X-431 3G diagnostic tester to clear ECM DTCs.

b. Start engine and depress accelerator pedal for several times in neutral condition.

c. Using X-431 3G diagnostic tester, read ECM DTCs.

d. Check if DTC P0606 94, P0606 92, P0606 64, P0606 61, P0606 67, P0606 96, P0606 1C, P0606 55, P0606 00, P0606 62, P0606 63, P0606 48, P0606 47, P0606 75, P0606 49 or P1100 00 still exists.

NG → **Replace ECM**

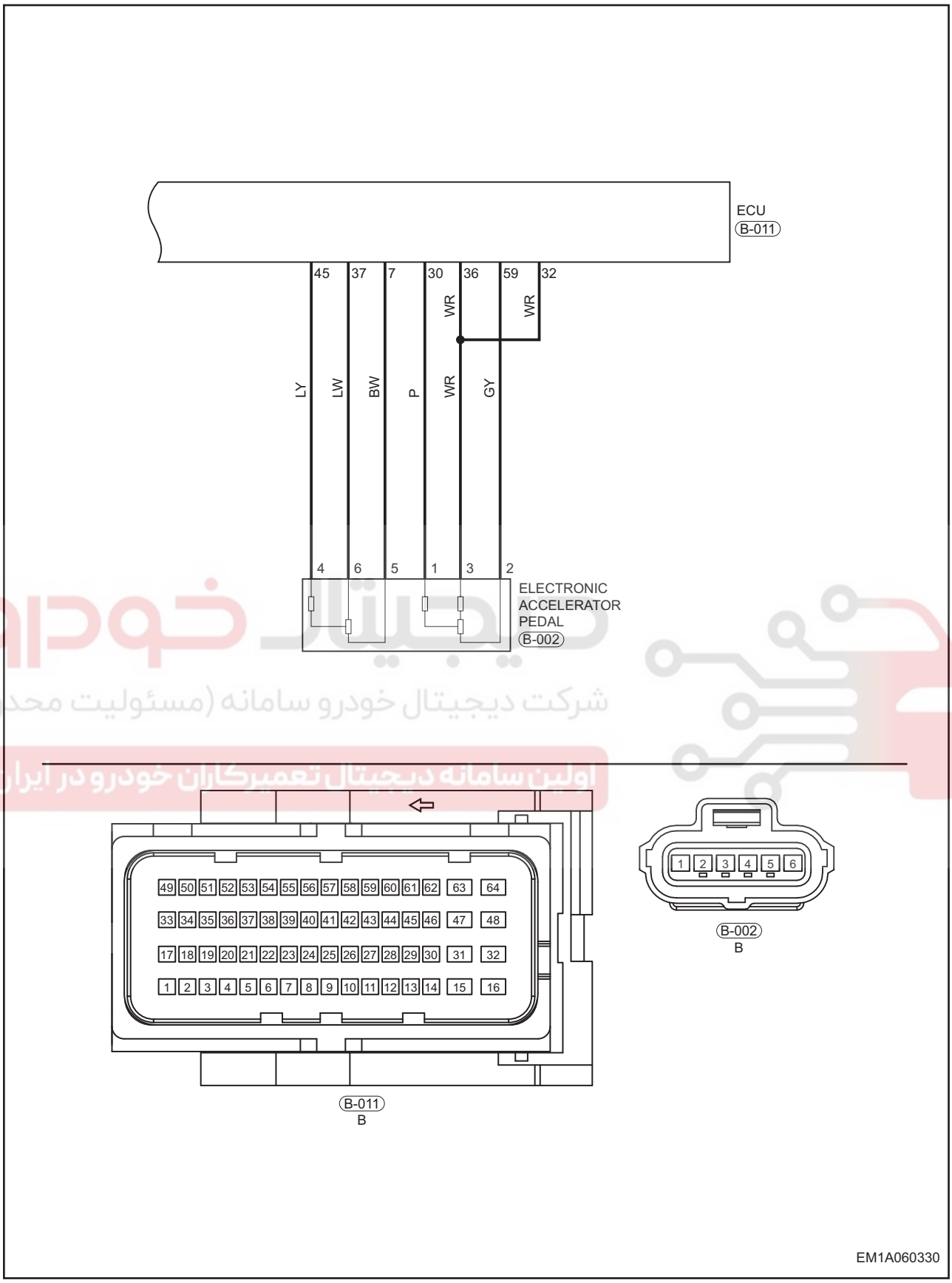
OK ↓

| | |
|---|---|
| **4** | **Perform electronic throttle self-learning procedures** |

a. Perform the electronic throttle self-learning procedures (See page 06-24).

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

| | | |
|---|---|---|
| DTC | P2122 16 | Pedal Pos. Sensor 1 Circ. Low Input |
| DTC | P2123 17 | Pedal Pos. Sensor 1 Circ. High Input |
| DTC | P2127 16 | Pedal Pos. Sensor 2 Circ. Low Input |
| DTC | P2128 17 | Pedal Pos. Sensor 2 Circ. High Input |
| DTC | P2138 00 | Pedal Movement Check Error |
| DTC | P2138 29 | Pedal Pos. Sensor 1/2 Unplausible |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P2122 16 | Pedal Pos. Sensor 1 Circ. Low Input | Ignition switch ON Engine running | • Accelerator pedal position sensor<br>• Wire harness or connector<br>• ECM |
| P2123 17 | Pedal Pos. Sensor 1 Circ. High Input | | |
| P2127 16 | Pedal Pos. Sensor 2 Circ. Low Input | | |
| P2128 17 | Pedal Pos. Sensor 2 Circ. High Input | | |
| P2138 00 | Pedal Movement Check Error | | |
| P2138 29 | Pedal Pos. Sensor 1/2 Unplausible | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point B-017 (See page 06-23).

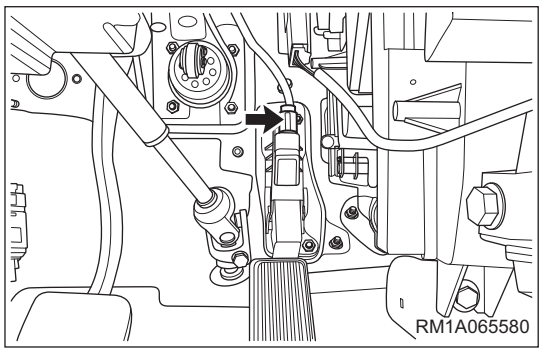
NG → **Repair or replace ground wire harness or ground point**

OK →

| 2 | Check electronic accelerator pedal connector |
|---|---|

a. Disconnect the electronic accelerator pedal connector B-002 (arror).

b. Check the electronic accelerator pedal connector.




NG → Repair or replace connector

OK

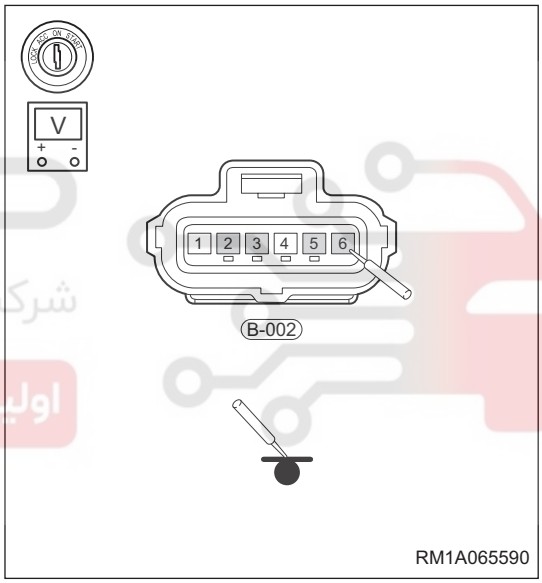
| 3 | Check electronic accelerator pedal voltage |
|---|---|

a. Turn ignition switch to ON.

b. Connect the electronic accelerator pedal sensor connector B-002.

c. Check electronic accelerator pedal sensor signal voltage and ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-002 (3, 6) - Body ground | Ignition switch ON | 5 V |
| B-002 (2, 5) - Body ground | | 0 V |




NG → Repair or replace related wire harness

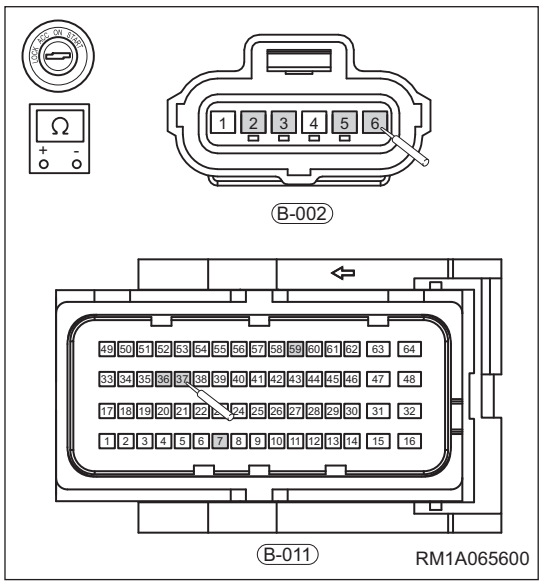
OK

| 4 | Check electronic accelerator pedal circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect electronic accelerator pedal sensor connector B-002 and ECM connector B-011.

c. Check wire harness between connector terminals.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-002 (6) - B-011 (37) | Always | Continuity |
| B-002 (5) - B-011 (7) | | |
| B-002 (3) - B-011 (36) | | |
| B-002 (2) - B-011 (59) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-002 (6, 5, 3, 2) or B-011 (37, 7, 36, 59) - Body ground | Always | No continuity |
| B-002 (6, 5, 3, 2) or B-011 (37, 7, 36, 59) - Battery positive | | |

NG → **Repair or replace related wire harness (electronic accelerator pedal - ECM)**

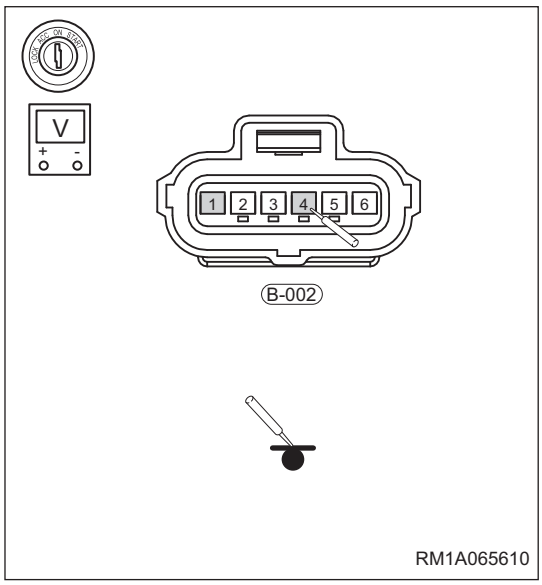
OK →

| 5 | Check electronic accelerator pedal sensor signal circuit |
|---|---|

a. Connect the electronic accelerator pedal sensor connector.

b. Turn ignition switch to ON.

c. Using a multimeter, measure voltage between terminals 4, 1 of connector B-002 and body ground.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-002 (4) - Body ground | Accelerator pedal not depressed | 0.72 V |
| | Accelerator pedal fully depressed | 3.95 V |
| B-002 (1) - Body ground | Accelerator pedal not depressed | 0.36 V |
| | Accelerator pedal fully depressed | 1.97 V |

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-002 (4) - B-011 (45) | Always | Continuity |
| B-002 (1) - B-011 (30) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-002 (4, 1) or B-011 (45, 30) - Body ground | Always | No continuity |
| B-002 (4, 1) or B-011 (45, 30) - Battery positive | | |

**NG** → **Replace wire harness or connector (electronic accelerator pedal - ECM)**

**OK**

| 6 | Replace electronic accelerator pedal and recheck DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

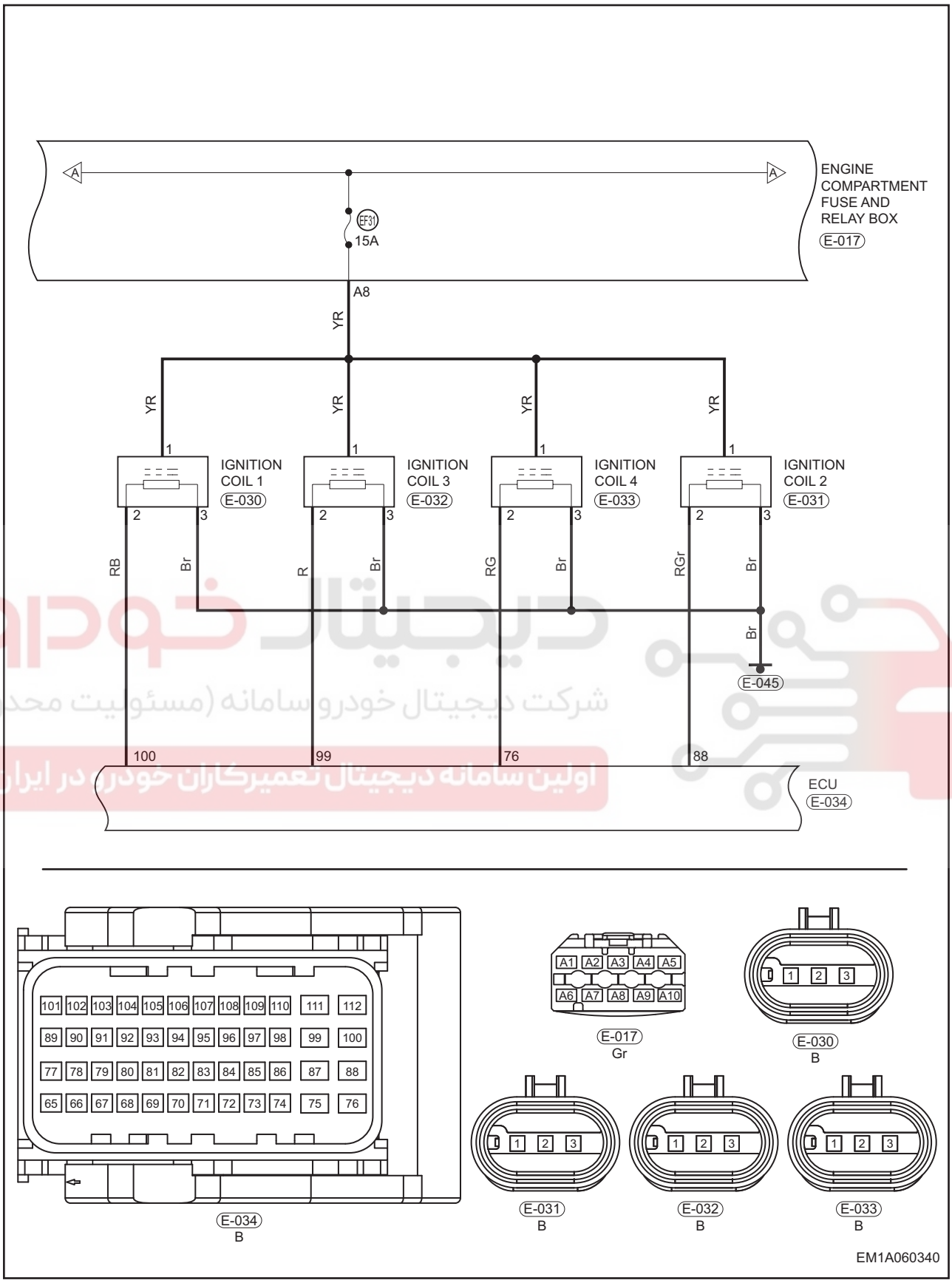
c. Check if DTC P2122 16, P2123 17, P2127 16, P2128 17, P2138 00 or P2138 29 still exists.

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.**

| | | |
|---|---|---|
| DTC | P0300-00 | Misfire Detected |
| DTC | P0301-00 | Misfire Detected on Cylinder 1 |
| DTC | P0302-00 | Misfire Detected on Cylinder 2 |
| DTC | P0303-00 | Misfire Detected on Cylinder 3 |
| DTC | P0304-00 | Misfire Detected on Cylinder 4 |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0300-00 | Misfire Detected | Ignition switch ON<br>Engine running | • Ignition coil<br>• Wire harness or connector<br>• Engine mechanical<br>• ECM |
| P0301-00 | Misfire Detected on Cylinder 1 | | |
| P0302-00 | Misfire Detected on Cylinder 2 | | |
| P0303-00 | Misfire Detected on Cylinder 3 | | |
| P0304-00 | Misfire Detected on Cylinder 4 | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point B-037 (See page 06-23).

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

OK

| 2 | Check for DTCs related to injector in corresponding cylinder |
|---|---|

a. Connect diagnostic tester, and check for DTCs related to injector in corresponding cylinder.

NG → **Repair DTCs related to injector in corresponding cylinder (See page 06-54)**

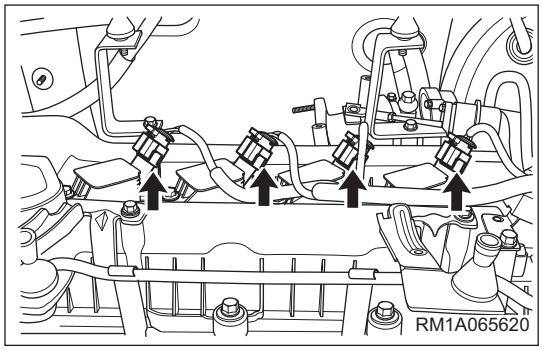
OK

| 3 | Check ignition coil connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ignition coil connectors (arrow).

c. Check the ignition coil connectors.




NG → Repair or replace connector

OK

| 4 | Check compression of misfiring cylinder |
|---|---|

a. Measure compression of misfiring cylinder (See page 07-20).

NG → Check engine to confirm cause of low compression

OK

Check injectors, valve clearance, intake system and fuel pressure, etc. of misfiring cylinder

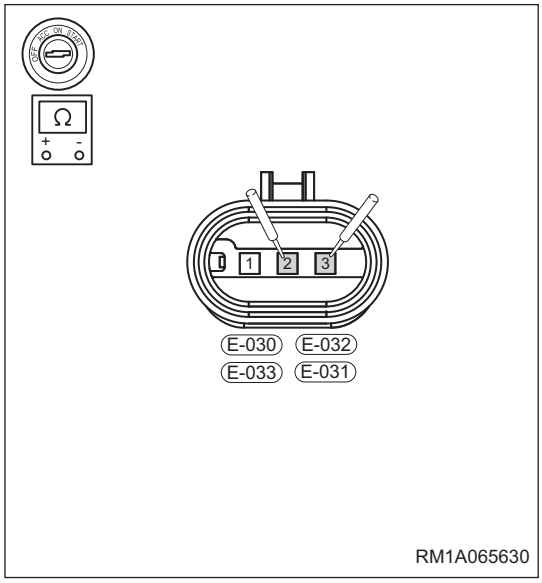
| 5 | Check ignition coil |
|---|---|

a. Check resistance of ignition coil primary winding with an oscilloscope.

b. Check resistance of ignition coil secondary winding.

**Secondary Ignition Coil Inspection**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 2 - Terminal 3 | At normal temperature (25°C ± 5°C) | 0.5 Ω - 0.64 Ω |




NG → Replace ignition coil in corresponding cylinder

OK

| 6 | Check ignition coil |
|---|---|

a. Turn ignition switch to ON.

b. Remove the ignition coil.

c. Visually check ignition coil for cracks or bumps.

NG → Replace ignition coil

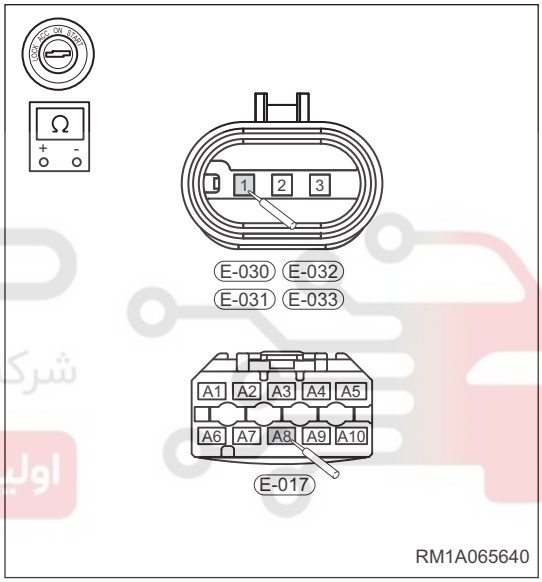
OK

| 7 | Check ignition coil power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Check the fuse EF31 and main relay.

c. Check wire harness between ignition coil connector terminal and engine compartment fuse and relay box connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-030 (1) - E-017 (A8) | Always | Continuity |
| E-032 (1) - E-017 (A8) | | |
| E-033 (1) - E-017 (A8) | | |
| E-031 (1) - E-017 (A8) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-030 (1), E-032 (1), E-033 (1), E-031 (1) or E-017 (A8) - Body ground | Always | No continuity |
| E-030 (1), E-032 (1), E-033 (1), E-031 (1) or E-017 (A8) - Battery positive | | |

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

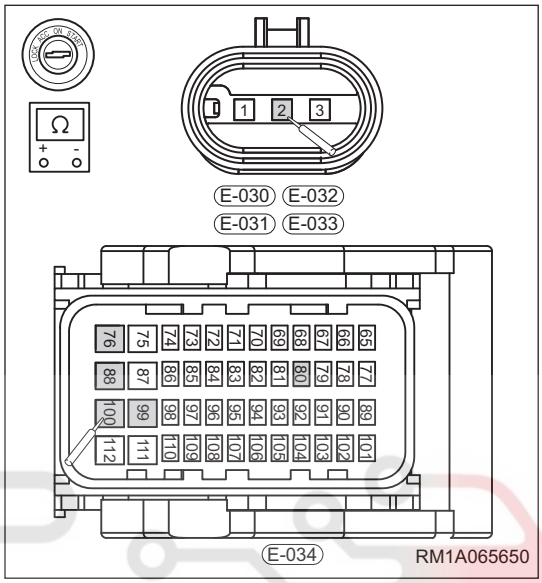
OK

| 8 | Check ignition coil control circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

c. Check wire harness between ignition coil connector terminal and ECM connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-030 (2) - E-034 (100) | Always | Continuity |
| E-032 (2) - E-034 (99) | | |
| E-033 (2) - E-034 (76) | | |
| E-031 (2) - E-034 (88) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-030 (2), E-032 (2), E-033 (2), E-031 (2) or E-034 (100, 99, 76, 88) - Body ground | Always | No continuity |
| E-030 (2), E-032 (2), E-033 (2), E-031 (2) or E-034 (100, 99, 76, 88)- Battery positive | | |

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

OK

| 9 | Check ignition coil ground circuit |
|---|---|

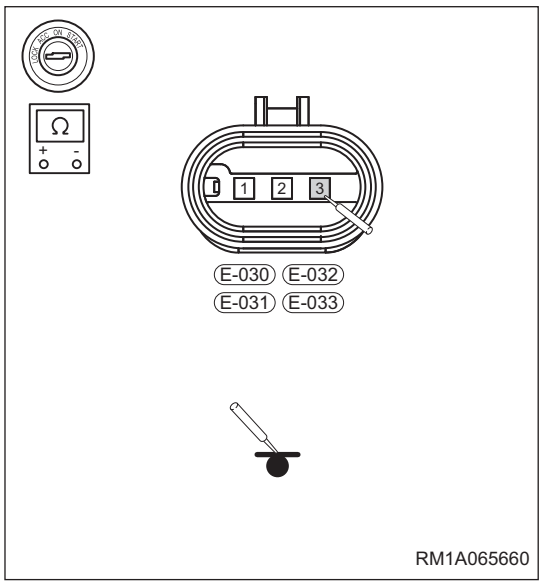
a. Turn ignition switch to OFF.

b. Check the E-045 ground point.

c. Check wire harness between ignition coil connector terminal and E-045 ground point.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-030 (3) - E-045 | Always | Continuity |
| E-032 (3) - E-045 | | |
| E-033 (3) - E-045 | | |
| E-031 (3) - E-045 | | |




**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-030 (3), E-032 (3), E-033 (3), E-031 (3) or E-045 - Battery positive | Always | No continuity |

**NG** → **Repair or replace wire harness or connector (ignition coil - E-045 ground point)**

**OK**

| 10 | Check spark plug |
|---|---|

a. Turn ignition switch to ON.

b. Remove the spark plug.

c. Check spark plug for electric leakage, air leakage and clearance.

**NG** → **Replace spark plug**

**OK**

| 11 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

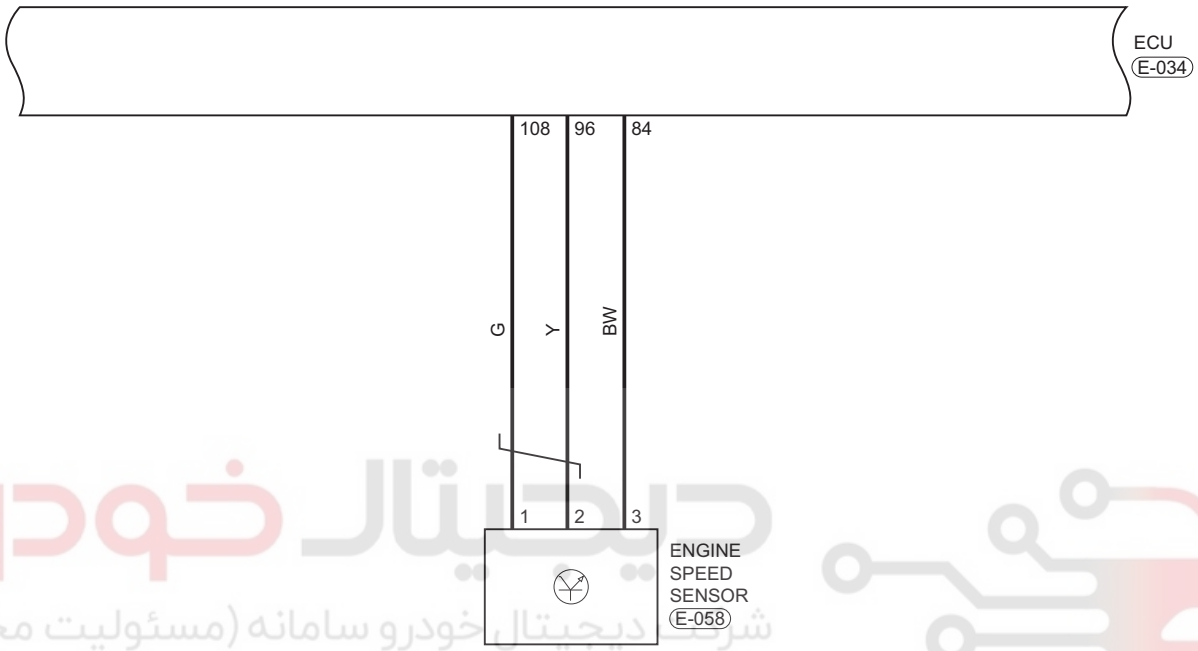
c. Check if DTC P0300-00、 P0301-00、 P0302-00、 P0303-00 or P0304-00 still exists.

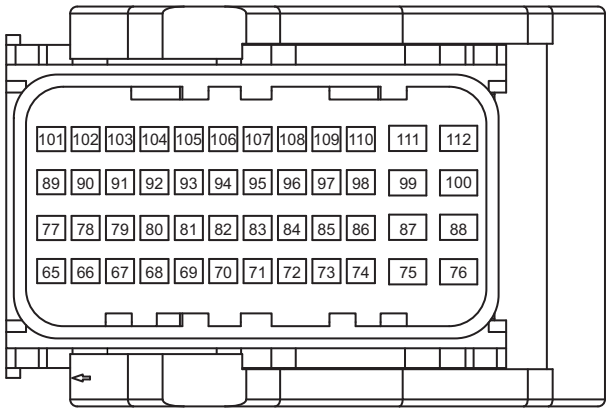
**NG** → **Replace ECM**

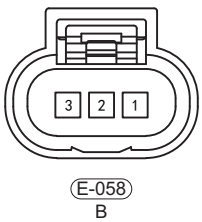
OK

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

| DTC | P0322 00 | EPM - Crankshaft Signal Fault |
|---|---|---|




EM1A060350

| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0322 00 | EPM - Crankshaft Signal Fault | Ignition switch ON Engine running | • Speed sensor<br>• Wire harness or connector<br>• ECM |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

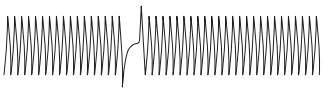
NG → **Repair or replace ground wire harness or ground point**

OK ↓

| | |
|---|---|
| 2 | **Check engine speed sensor signal waveform** |

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

OK → **Go to step 9**



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NG ↓

| 3 | Check engine speed sensor connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the engine speed sensor connector E-058.

c. Check the engine speed sensor connector.

NG → **Repair or replace engine speed sensor connector**

OK ↓

| 4 | Check installation of engine speed sensor |
|---|---|

a. Remove the engine speed sensor.

b. Check and clean 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 engine speed sensor power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between terminal 1 of engine speed sensor connector E-058 and body ground.

Voltage Inspection

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-058 (1) - Body ground | Ignition switch ON | 5 V |

NG → **Go to step 6**

OK ↓

| 6 | Check engine speed sensor circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the engine speed sensor connector E-058.

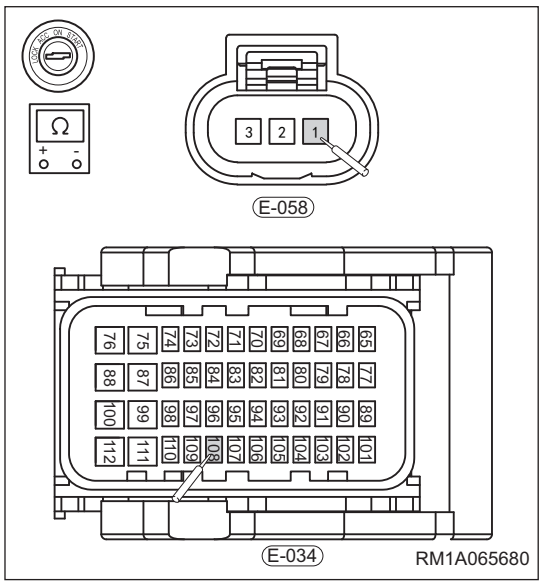
c. Check wire harness between engine speed sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (108) - E-058 (1) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (108) or E-058 (1) - Body ground | Always | No continuity |
| E-034 (108) or E-058 (1) - Battery positive | | |




NG → **Repair or replace wire harness or connector (engine speed sensor - ECM)**

OK →

**Replace ECM**

| 7 | Check engine speed sensor ground circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

c. Check wire harness between engine speed sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (84) - E-058 (3) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (84) or E-058 (3) - Body ground | Always | No continuity |
| E-034 (84) or E-058 (3) - Battery positive | | |

**NG** → **Repair or replace wire harness or connector (engine speed sensor - ECM)**

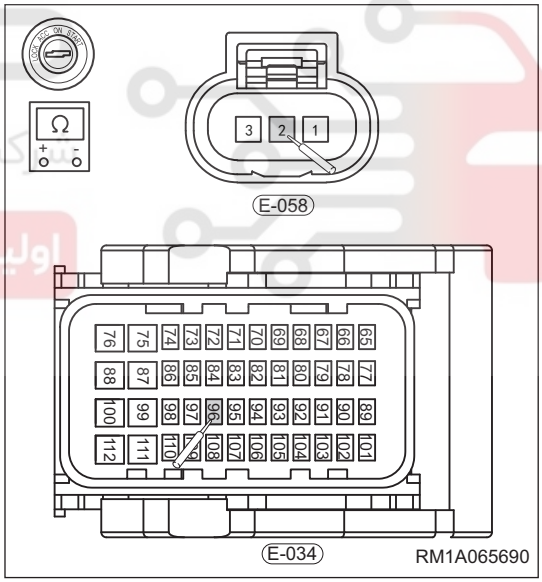
**OK**

**Replace ECM**

| 8 | Check engine speed sensor signal circuit |
|---|---|

a. Disconnect the ECM connector E-034.

b. Check wire harness between engine speed sensor connector terminal and ECM connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-058 (2) - E-034 (96) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-058 (2) or E-034 (96)- Body ground | Always | No continuity |
| E-058 (2) or E-034 (96)- Battery positive | | |

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

**OK**

| 9 | Check flywheel ring gear |
|---|---|

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

NG → **Clear off debris and clean flywheel gear ring. Replace flywheel if necessary**

OK ↓

| 10 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

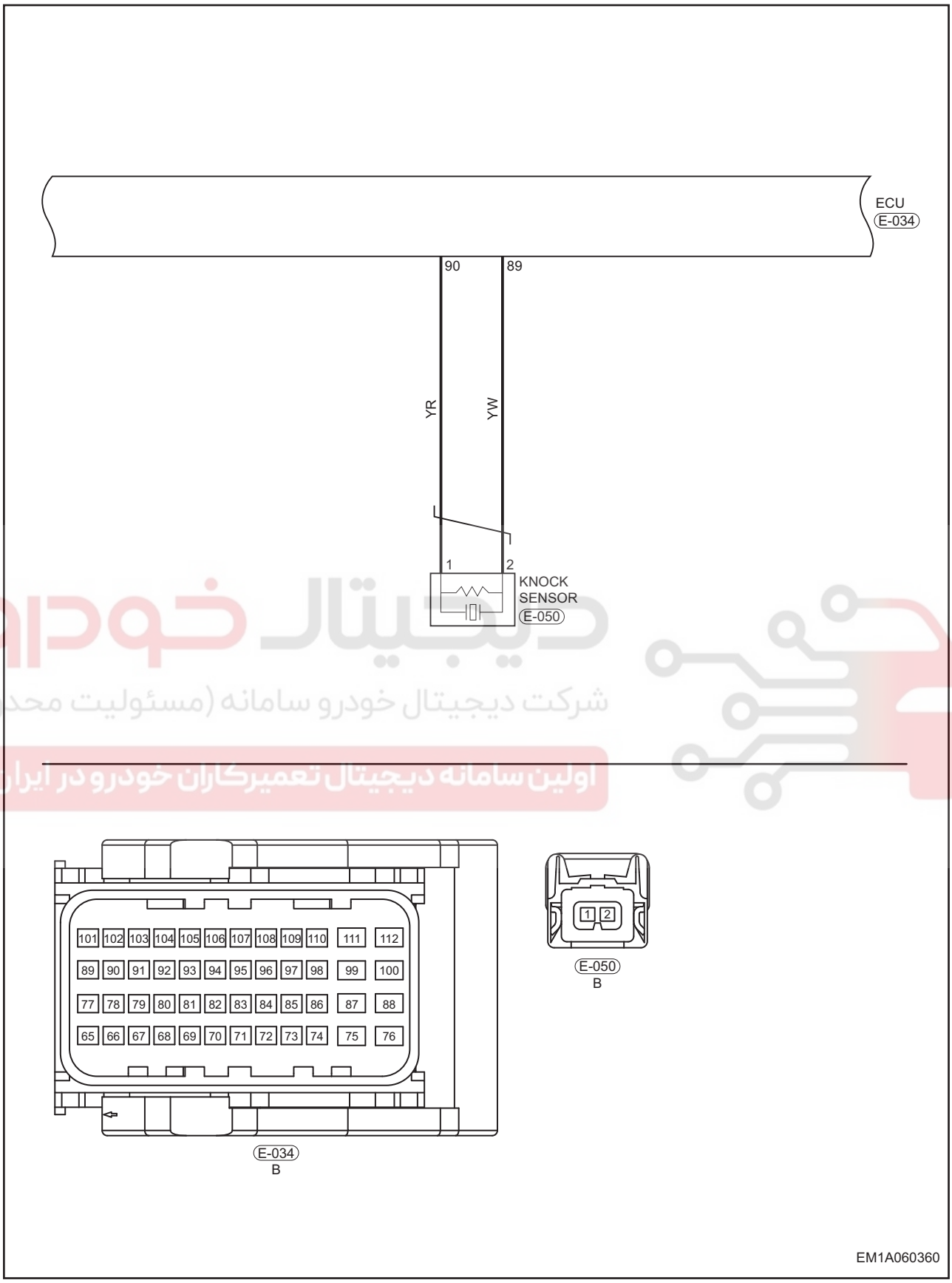
c. Check if DTC P0322 00 still exists.

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



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0327 16 | Knock Sensor 1 Circ. Low Input | Ignition switch ON Engine running | • Knock sensor<br>• Wire harness or connector<br>• ECM |
| P0327 14 | Knock Sensor 1 Circuit Low | | |
| P0327 00 | Knock Sensor 1 Circuit Low | | |
| P0328 17 | Knock Sensor 1 Circ. High Input | | |
| P0328 15 | Knock Sensor 1 Circuit High | | |
| P0328 00 | Knock Sensor 1 Circuit High | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| **1** | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

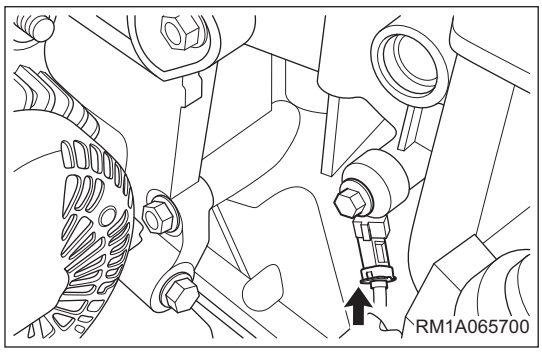
**NG** → **Repair or replace ground wire harness or ground point**

**OK**

| 2 | Check knock sensor connector |
|---|---|

a. Disconnect the knock sensor connector E-050 (arrow).

b. Check the knock sensor connector.



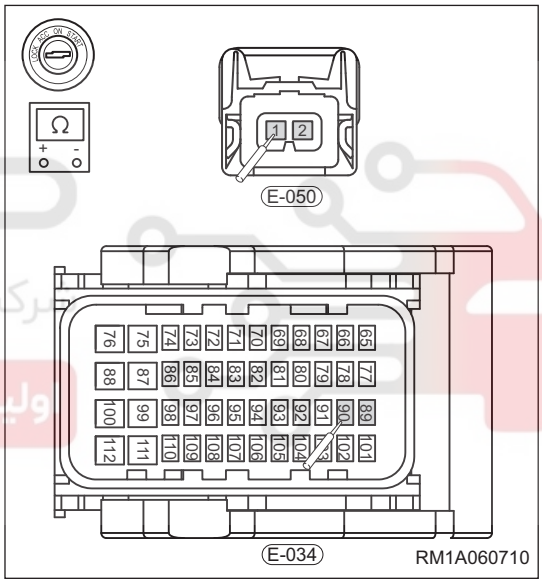

NG → Repair or replace wire harness connector

OK

| 3 | Check knock sensor signal circuit |
|---|---|

a. Disconnect the ECM wire harness connector E-034.

b. Check wire harness between terminals of connector E-034 and connector E-050.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (90) - E-050 (1) | Always | Continuity |
| E-034 (89) - E-050 (2) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (90, 89) or E-050 (1, 2) - Body ground | Always | No continuity |
| E-034 (90, 89) or E-050 (1, 2) - Battery positive | | |

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

OK

| 4 | Check installation of knock sensor |
|---|---|

a. Remove the knock sensor.

b. Check installation area of knock sensor, and check for damage, foreign matter or excessive movement, etc. that cause signal incorrectness.

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

OK

| 5 | Check resistance of knock sensor |
|---|---|

a. Check resistance between terminals 1 and 2 of knock sensor.

**HINT:**

OK: Resistance should be more than 1 MΩ (at normal temperature).

NG → **Replace knock sensor**

OK

| 6 | Check knock sensor signal |
|---|---|

a. Install the knock sensor.

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

NG → **Replace knock sensor**

OK

| 7 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

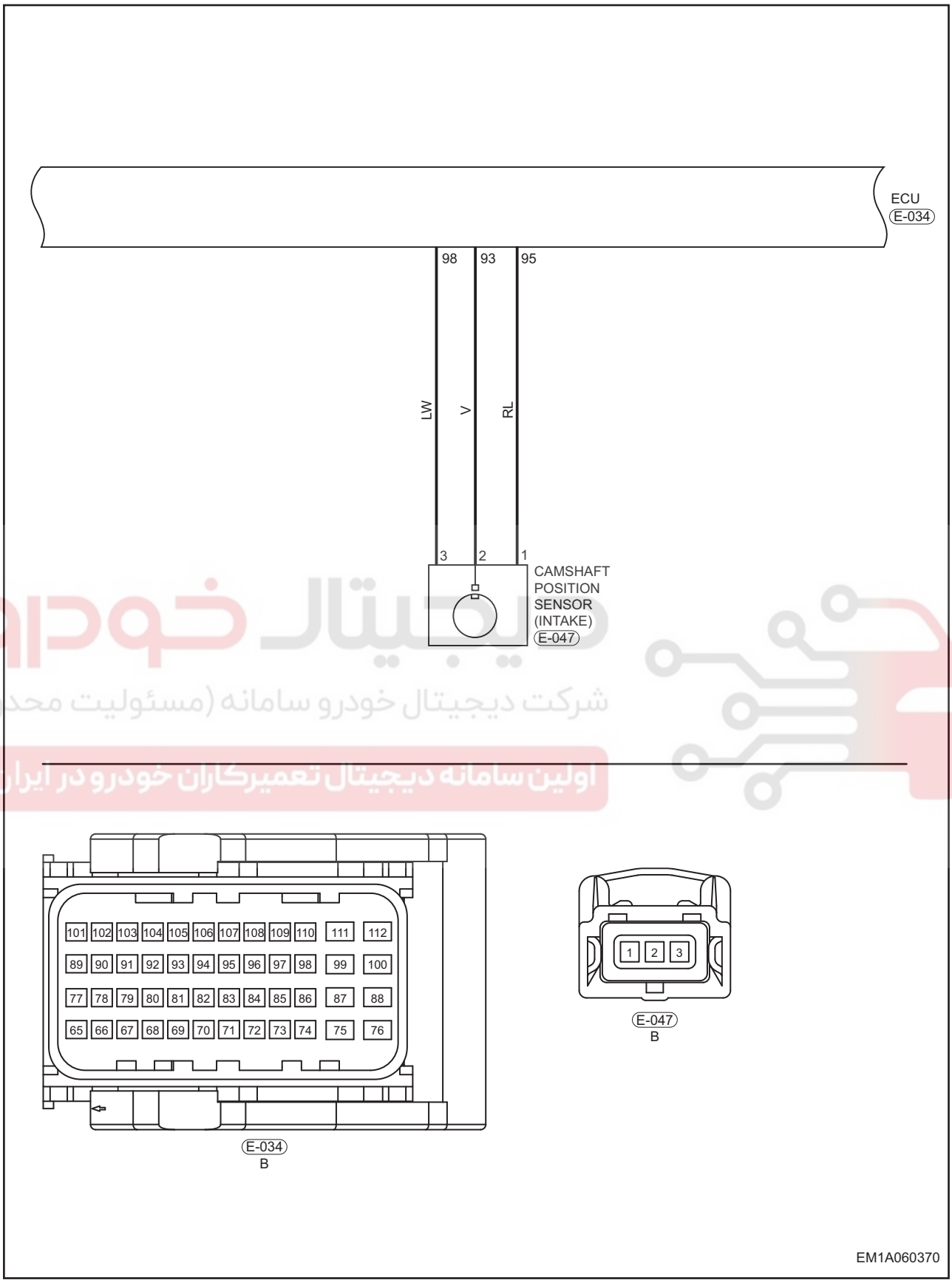
c. Check if DTC P0327 16, P0327 16, P0327 14, P0327 00, P0328 17, P0328 15, P0328 00 still exists.

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 | P0341 00 | EPM - Camshaft Signal Fault |
| DTC | P0012 00 | Inlet Camshaft not in Locking Position During Start |
| DTC | P0016 22 | Retard Error for Alignment Between Camshaft (Inlet) and Crankshaft |
| DTC | P0016 21 | Advance Error for Alignment Between Camshaft (Inlet) and Crankshaft |
| DTC | P0016 29 | Npl Error for Alignment Between Camshaft (Inlet) and Crankshaft |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0341 00 | EPM - Camshaft Signal Fault | Ignition switch ON Engine running | • Camshaft position sensor<br>• Wrong camshaft position sensor installation position<br>• Engine mechanical malfunction<br>• Wire harness or connector<br>• ECM |
| P0012 00 | Inlet Camshaft not in Locking Position During Start | | |
| P0016 22 | Retard Error for Alignment Between Camshaft (Inlet) and Crankshaft | | |
| P0016 21 | Advance Error for Alignment Between Camshaft (Inlet) and Crankshaft | | |
| P0016 29 | Npl Error for Alignment Between Camshaft (Inlet) and Crankshaft | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

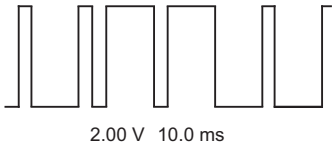
NG → **Repair or replace ground wire harness or ground point**

OK

| 2 | Check intake camshaft position sensor signal waveform |
|---|---|

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

NG → Go to step 10




RM1A065720

OK

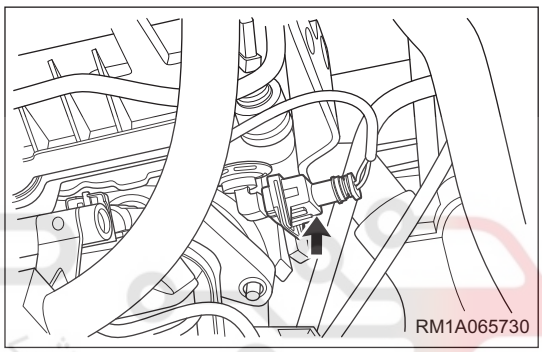
| 3 | Check intake camshaft position sensor connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the intake camshaft position sensor connector E-047 (arrow).

c. Check the intake camshaft position sensor connector.

NG → Repair or replace intake camshaft position sensor connector



RM1A065730

OK

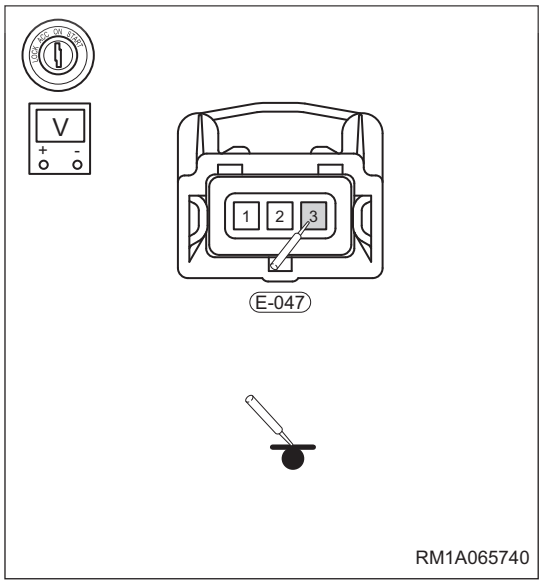
| 4 | Check intake camshaft position sensor power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between terminal 3 of intake camshaft position sensor connector E-047 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-047 (3) - Body ground | Ignition switch ON | 5 V |

NG → Go to step 6




RM1A065740

OK

| 5 | Check intake camshaft position sensor power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

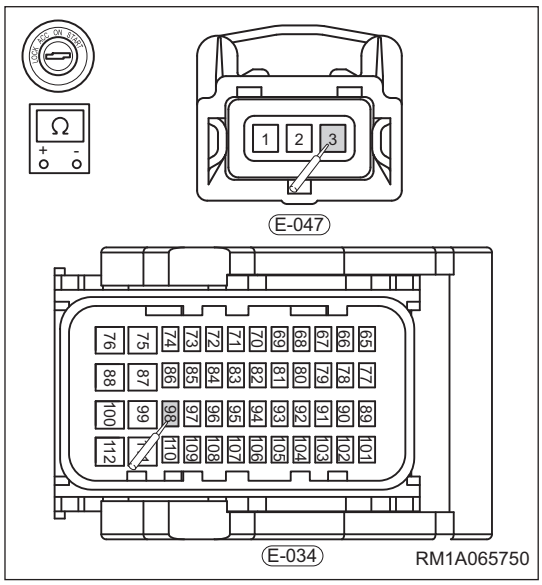
c. Check wire harness between intake camshaft position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-047 (3) - E-034 (98) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-047 (3) or E-034 (98) - Body ground | Always | No continuity |
| E-047 (3) or E-034 (98) - Battery positive | | |




NG → **Repair or replace wire harness or connector (intake camshaft position sensor - ECM)**

OK →

| 6 | Check intake camshaft position sensor ground circuit |
|---|---|

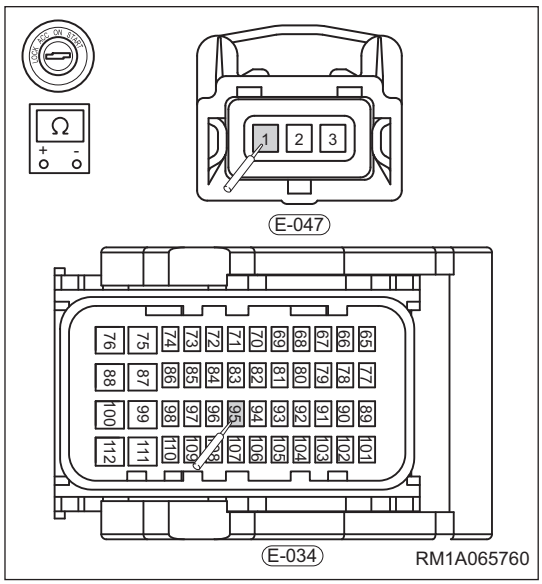
a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

c. Check wire harness between intake camshaft position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-047 (1) - E-034 (95) | Always | Continuity |



**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-047 (1) or E-034 (95) - Body ground | Always | No continuity |
| E-047 (1) or E-034 (95) - Battery positive | | |

NG → **Repair or replace wire harness or connector (intake camshaft position sensor - ECM)**

OK

| 7 | Check intake camshaft position sensor signal circuit |
|---|---|

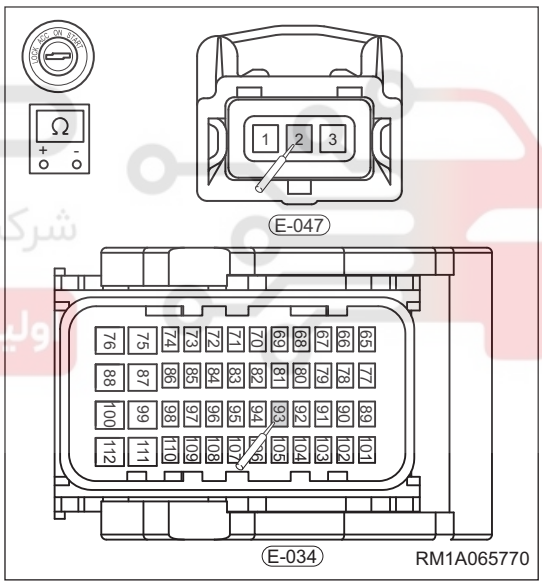
a. Check wire harness between intake camshaft position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-047 (2) - E-034 (93) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-047 (2) or E-034 (93) - Body ground | Always | No continuity |
| E-047 (2) or E-034 (93) - Battery positive | | |




NG → **Replace wire harness or connector (intake camshaft position sensor - ECM)**

OK

| 8 | Check installation of intake camshaft position sensor |
|---|---|

a. Remove the intake camshaft position sensor.

b. Check and clean intake camshaft position sensor and installation area, and check for damage, foreign matter or excessive movement, etc. that cause signal incorrectness.

NG → **Clean installation area or replace intake camshaft position sensor**

OK ↓

| 9 | Check intake camshaft ring gear |
|---|---|

a. Check intake camshaft ring gear for damage or foreign matter (such as debris) that cause signal incorrectness.

NG → **Remove debris and clean intake camshaft ring gear or replace camshaft**

OK ↓

| 10 | Install a normal intake camshaft position sensor and observe signal waveform |
|---|---|

a. Install a normal intake camshaft position sensor.

b. Connect the intake camshaft position sensor connector.

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

NG → **Replace intake camshaft position sensor**

OK ↓

| 11 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

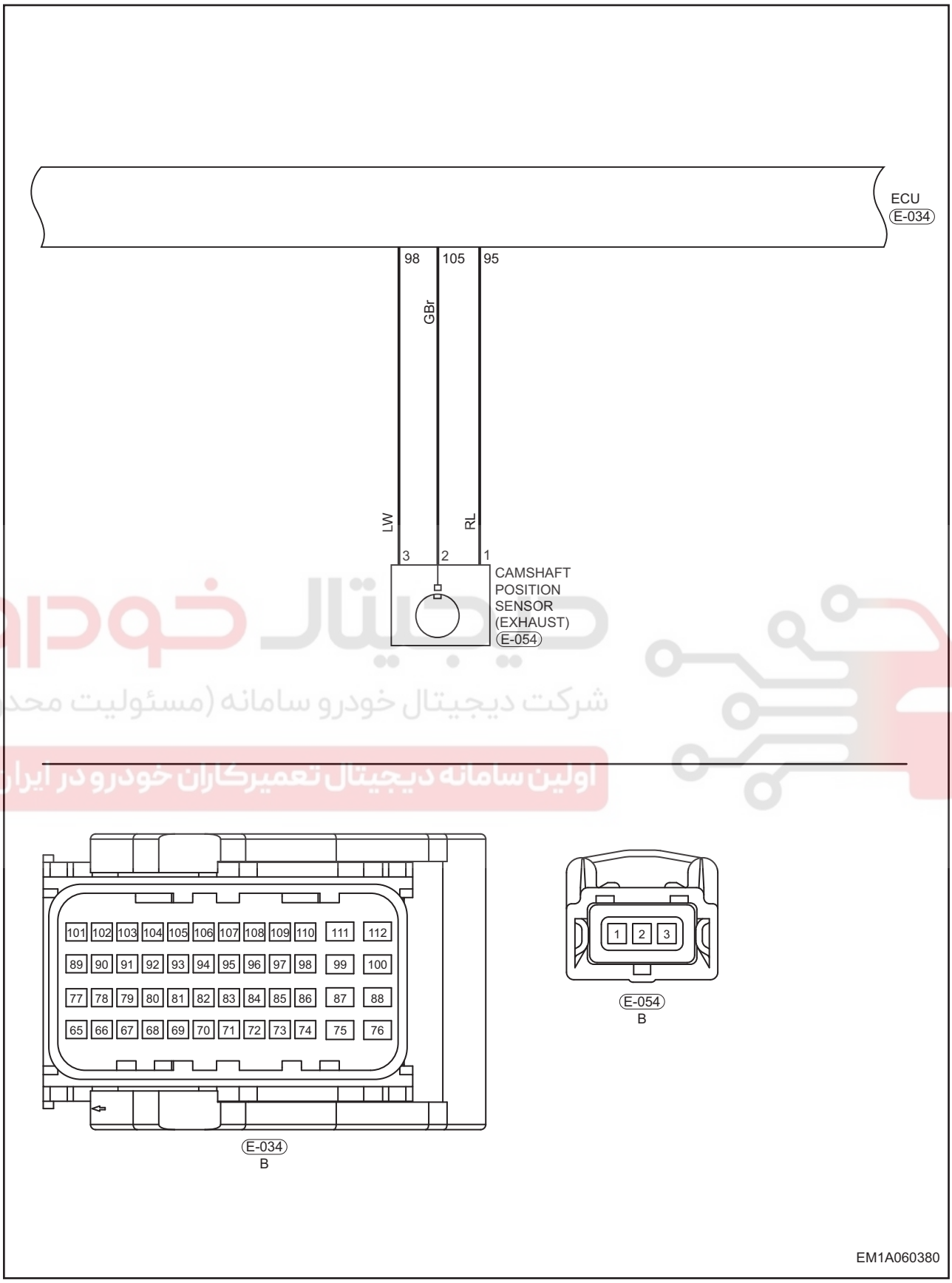
c. Check if DTC P0341 00, P0012 00, P0016 22, P0016 21 or P0016 29 still exists.

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.**

| | | |
|---|---|---|
| DTC | P0018 22 | Retard Error for Alignment Between Camshaft (Outlet) and Crankshaft |
| DTC | P0018 21 | Advance Error for Alignment Between Camshaft (Outlet) and Crankshaft |
| DTC | P0018 29 | Npl Error for Alignment Between Camshaft (Outlet) and Crankshaft |
| DTC | P0346 00 | EPM - Camshaft2 Signal Fault |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0018 22 | Retard Error for Alignment Between Camshaft (Outlet) and Crankshaft | Ignition switch ON Engine running | • Camshaft position sensor<br>• Wrong camshaft position sensor installation position<br>• Engine mechanical malfunction<br>• Wire harness or connector<br>• ECM |
| P0018 21 | Advance Error for Alignment Between Camshaft (Outlet) and Crankshaft | | |
| P0018 29 | Npl Error for Alignment Between Camshaft (Outlet) and Crankshaft | | |
| P0346 00 | EPM - Camshaft2 Signal Fault | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | **Check ECM ground point** |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

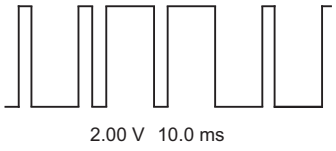
**NG** → **Repair or replace ground wire harness or ground point**

**OK**

| 2 | Check exhaust camshaft position sensor signal waveform |
|---|---|

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

NG → Go to step 10




RM1A065720

OK

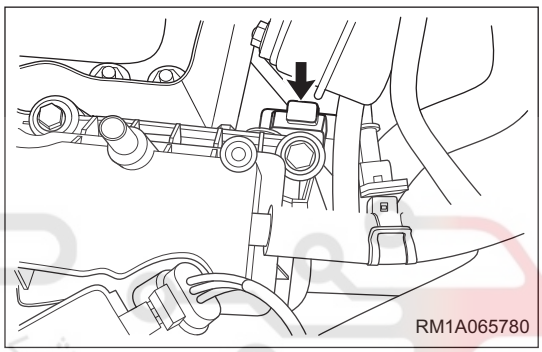
| 3 | Check exhaust camshaft position sensor connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the exhaust camshaft position sensor connector E-054 (arrow).

c. Check the exhaust camshaft position sensor connector.

NG → Repair or replace exhaust camshaft position sensor connector



RM1A065780

OK

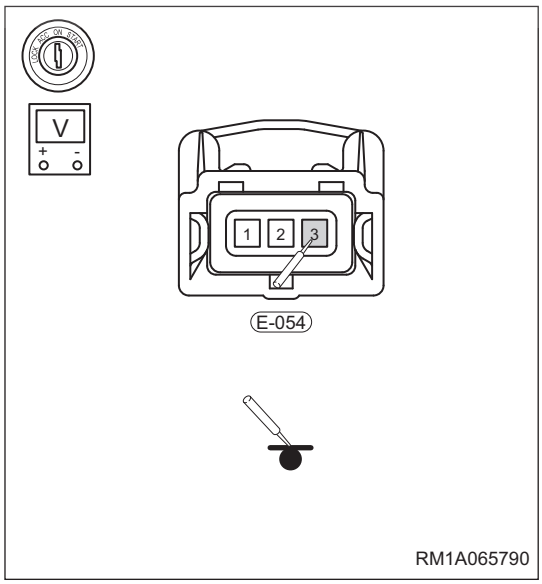
| 4 | Check exhaust camshaft position sensor power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between terminal 3 of exhaust camshaft position sensor connector E-054 and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (3) - Body ground | Ignition switch ON | 5 V |

NG → Go to step 6




RM1A065790

OK

| 5 | Check exhaust camshaft position sensor power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

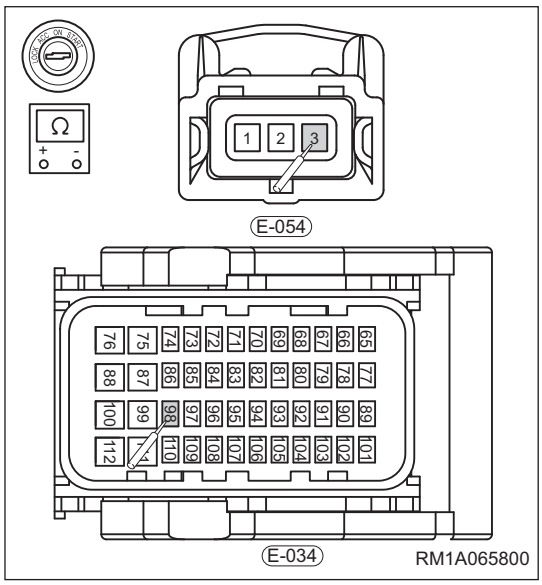
c. Check wire harness between exhaust camshaft position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (3) - E-034 (98) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (3) or E-034 (98) - Body ground | Always | No continuity |
| E-054 (3) or E-034 (98) - Battery positive | | |




NG → **Repair or replace wire harness or connector (exhaust camshaft position sensor - ECM)**

OK

| 6 | Check exhaust camshaft position sensor ground circuit |
|---|---|

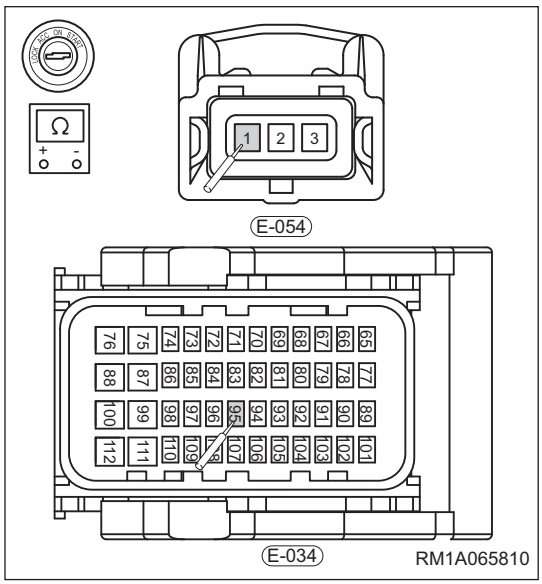
a. Turn ignition switch to OFF.

b. Disconnect the ECM connector E-034.

c. Check wire harness between exhaust camshaft position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (1) - E-034 (95) | Always | Continuity |



**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (1) or E-034 (95) - Body ground | Always | No continuity |
| E-054 (1) or E-034 (95) - Battery positive | | |

**NG** → **Repair or replace wire harness or connector (exhaust camshaft position sensor - ECM)**

**OK**

| 7 | Check exhaust camshaft position sensor signal circuit |
|---|---|

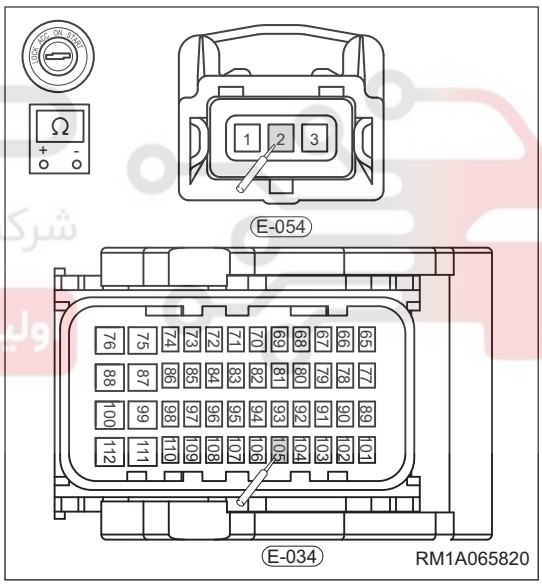
a. Check wire harness between exhaust camshaft position sensor connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (2) - E-034 (105) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (2) or E-034 (105) - Body ground | Always | No continuity |
| E-054 (2) or E-034 (105) - Battery positive | | |




**NG** → **Replace wire harness or connector (exhaust camshaft position sensor - ECM)**

**OK**

| 8 | Check installation of exhaust camshaft position sensor |
|---|---|

a. Remove the exhaust camshaft position sensor.

b. Check and clean exhaust camshaft position sensor and installation area, and check for damage, foreign matter or excessive movement, etc. that cause signal incorrectness.

NG → **Clean installation area or replace exhaust camshaft position sensor**

OK

| 9 | Check exhaust camshaft ring gear |
|---|---|

a. Check exhaust camshaft ring gear for damage or foreign matter (such as debris) that cause signal incorrectness.

NG → **Remove debris and clean exhaust camshaft ring gear or replace camshaft**

OK

| 10 | Install a normal exhaust camshaft position sensor and observe signal waveform |
|---|---|

a. Install a normal exhaust camshaft position sensor.

b. Connect the exhaust camshaft position sensor connector.

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

NG → **Replace exhaust camshaft position sensor**

OK

| 11 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0346 00, P0018 22, P0018 21 or P0018 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.**

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

| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0420 00 | Catalyst Conversion Insufficient | Ignition switch ON<br>Engine running | • Three-way catalytic converter<br>• Leakage in exhaust system<br>• Upstream oxygen sensor<br>• Downstream oxygen sensor<br>• ECM |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

## Diagnosis Procedure

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

a. Connect X-431 3G diagnostic tester to Data Link Connector (DLC).

b. Turn ignition switch to ON, start engine and warm it up to normal operating temperature, and then select Read Code.

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

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

**B**

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

a. Using diagnostic tester, select Read Datastream.

b. Check the datastream below.

| Item | OK (Idling) | If NG, proceed to |
|---|---|---|
| Upstream Oxygen Sensor Voltage | Fluctuates rapidly between 0.1 and 0.9 V | A |

| Item | OK (Idling) | If NG, proceed to |
|---|---|---|
| Downstream Oxygen Sensor Voltage | Fluctuates slightly at about 0.45 V | B |
| Average Injection Pulse Width | Approximately 2.15 ms | C |

A → **Replace upstream oxygen sensor**

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

B

| 3 | Check exhaust system |
|---|---|

a. Turn ignition switch to ON and start engine.

b. Check 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, and go to step 5**

| 5 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

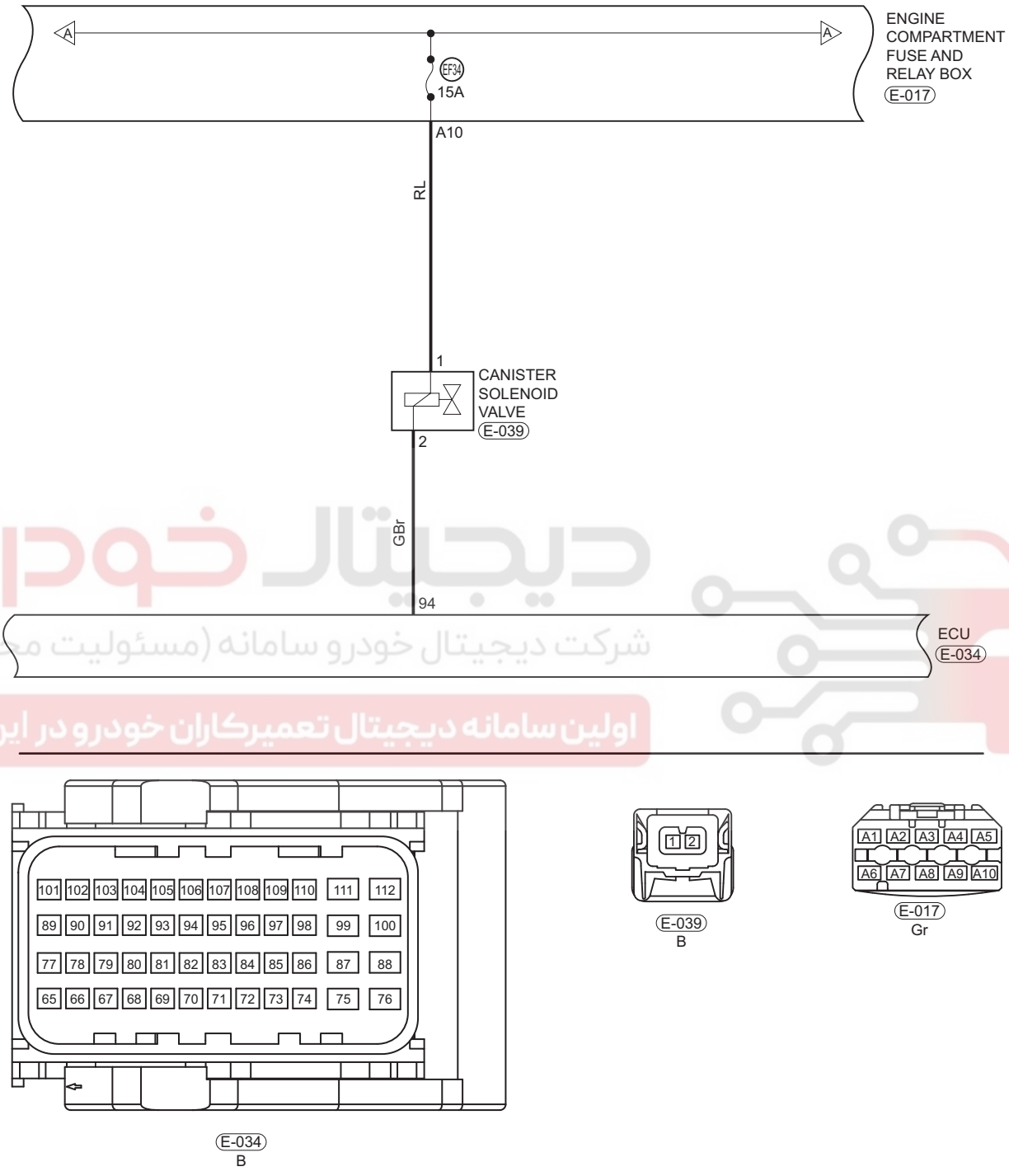
c. Check if DTC P0420 00 still exists.

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 | Evaporativ Emiss. 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 |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0444 13 | Evaporativ Emiss. System Purge Control Valve Circuit Open | Ignition switch ON Engine running | • Canister solenoid valve<br>• Wire harness or connector<br>• ECM |
| P0458 16 | Evaporative Emission System Purge Control Valve Circuit Low | | |
| P0459 17 | Evaporative Emission System Purge Control Valve Circuit High | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

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

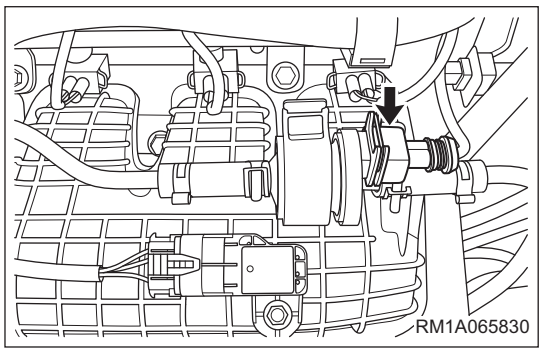
OK →

| 2 | Check canister solenoid valve connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the canister solenoid valve connector E-060 (arrow).

c. Check the canister solenoid valve connector.




NG → **Repair or replace connector**

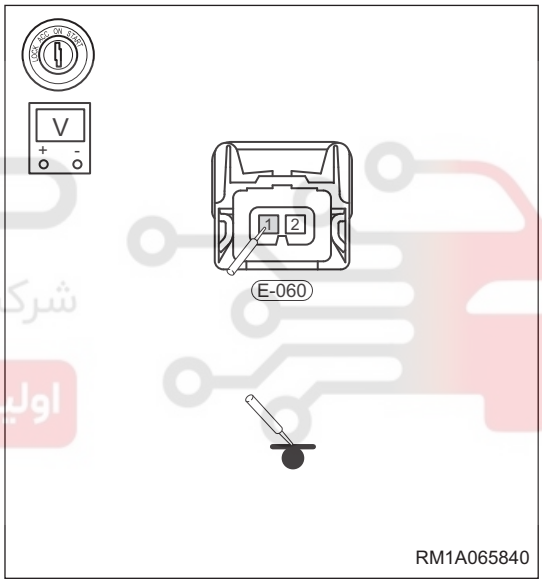
OK

| 3 | Check canister solenoid valve power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between canister solenoid valve connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-060 (1) - Body ground | Ignition switch ON | 12 to 14 V |




NG → **Go to step 5**

OK

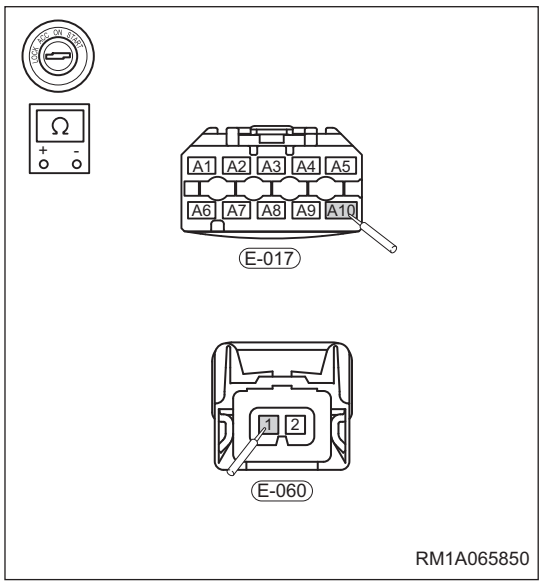
| 4 | Check canister solenoid valve power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Check fuse EF34 and main relay.

c. Disconnect the engine compartment fuse and relay box connector E-017.

d. Check wire harness between canister solenoid valve connector terminal and engine compartment fuse and relay box connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-017 (A10) - E-060 (1) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-017 (A10) or E-060 (1) - Body ground | Always | No continuity |
| E-017 (A10) or E-060 (1) - Battery positive | | |

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 |
|---|---|

a. Disconnect the ECM connector E-034.

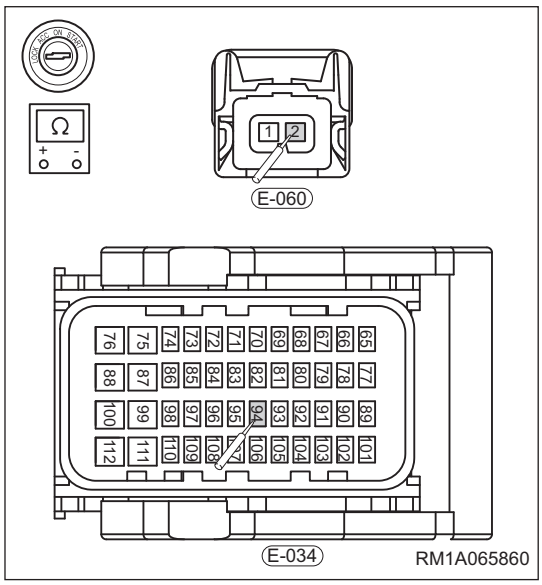
b. Check wire harness between canister solenoid valve connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (94) - E-060 (2) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (94) or E-060 (2) - Body ground | Always | No continuity |
| E-034 (94) or E-060 (2) - Battery positive | | |




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

| 6 | Check canister solenoid valve |
|---|---|

a. Check resistance of canister solenoid valve.

| Multimeter Connection | Specified Condition |
|---|---|
| Terminal 1 - Terminal 2 | 26 ± 4 Ω (at 20°C) |

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

**NG** → **Replace canister solenoid valve**

**OK**

| 7 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

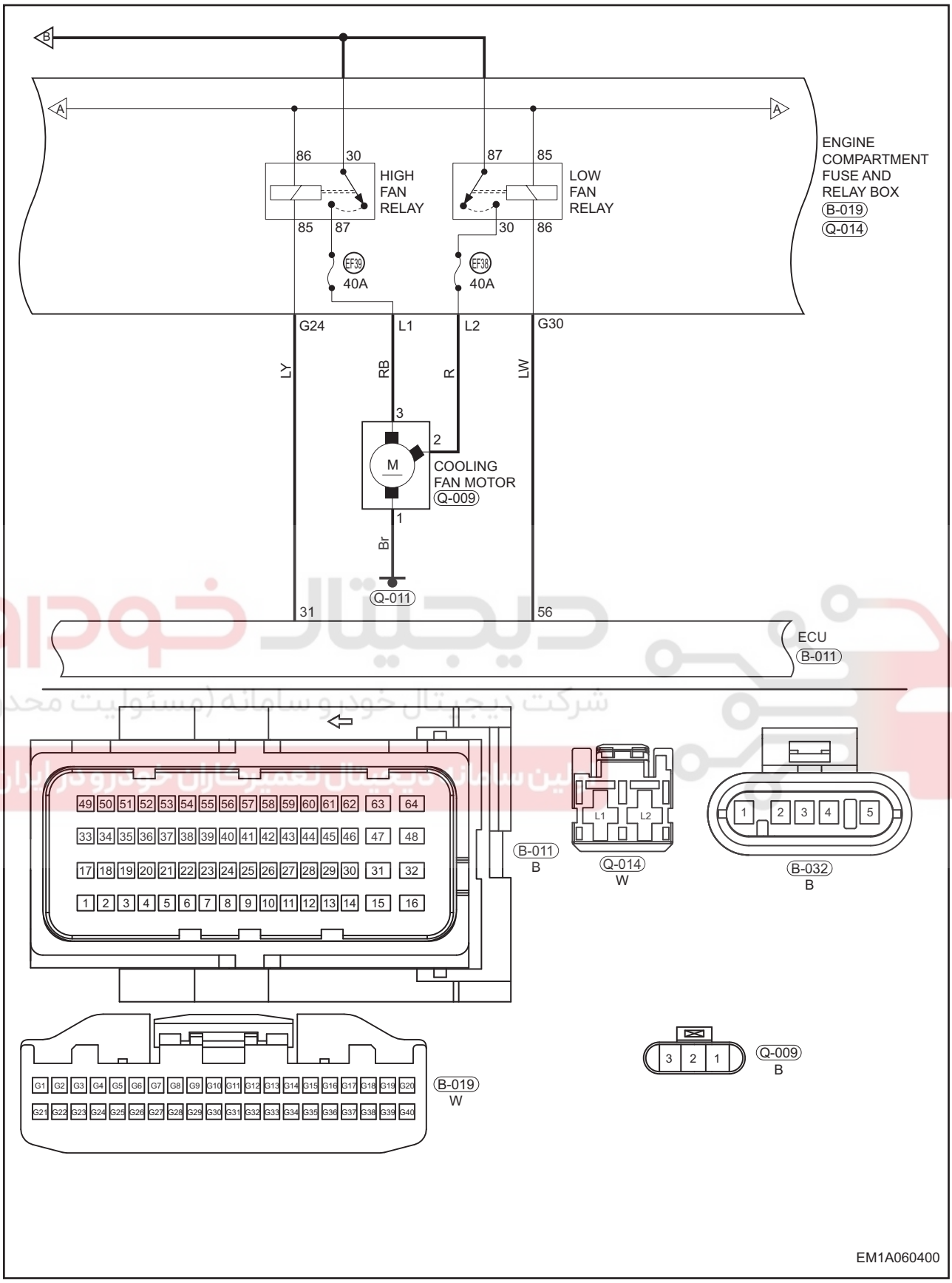
c. Check if DTC P0444 13, P0458 16 or P0459 17 still exists.

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.

| | | |
|---|---|---|
| DTC | P0480 13 | Cooling Fan 1 Control Circuit Error |
| DTC | P0691 11 | Fan 1 Control Circuit Low |
| DTC | P0692 12 | Fan 1 Control Circuit High |
| DTC | P0481 13 | Cooling Fan 2 Control Circuit Error |
| DTC | P0693 11 | Fan 2 Control Circuit Low |
| DTC | P0694 12 | Fan 2 Control Circuit High |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0480 13 | Cooling Fan 1 Control Circuit Error | Ignition switch ON Engine running | • Wire harness connector<br>• Cooling fan control relay<br>• ECM |
| P0691 11 | Fan 1 Control Circuit Low | | |
| P0692 12 | Fan 1 Control Circuit High | | |
| P0481 13 | Cooling Fan 2 Control Circuit Error | | |
| P0693 11 | Fan 2 Control Circuit Low | | |
| P0694 12 | Fan 2 Control Circuit High | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

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

OK →

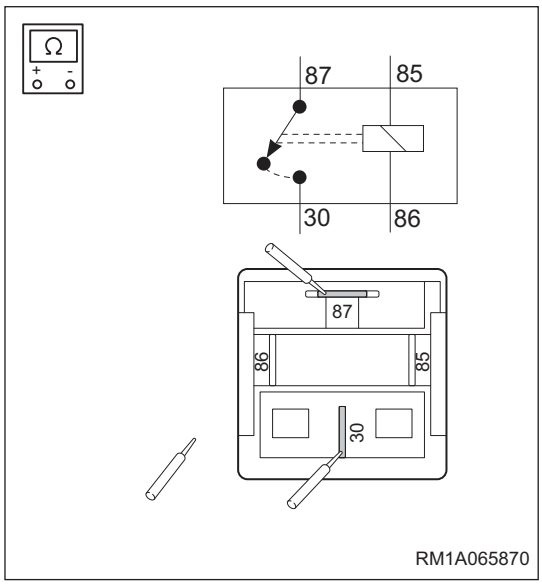
| 2 | Check cooling fan control relay |
|---|---|

a. Turn ignition switch to OFF.

b. Remove low speed fan relay and high speed fan relay from engine compartment fuse and relay box.

c. Check the fan relay.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 87 - Terminal 30 | Always | No continuity |
| Terminal 87 - Terminal 30 | Continuity (When battery voltage is applied between terminal 85 and terminal 86) | Continuity |



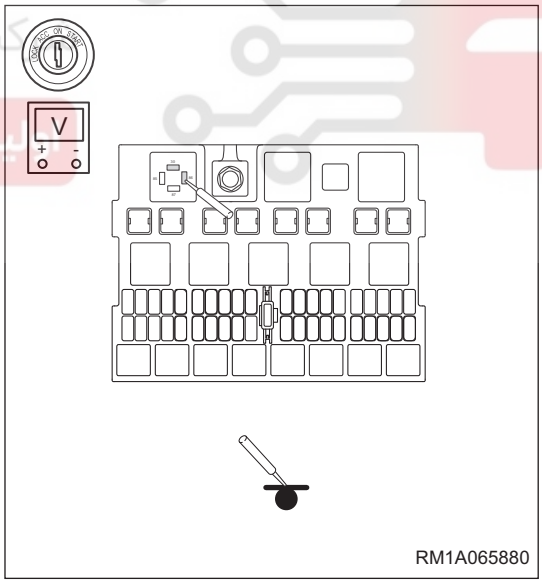

NG → **Repair or replace relay**

OK

| 3 | Check cooling fan control relay circuit voltage |
|---|---|

a. Check voltage of cooling fan control relay connector terminals.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Relay (86, 30) - Body ground | Ignition switch ON | 11 to 14 V |




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

OK

| 4 | Check cooling fan high speed control circuit |
|---|---|

a. Disconnect the ECM connector B-011.

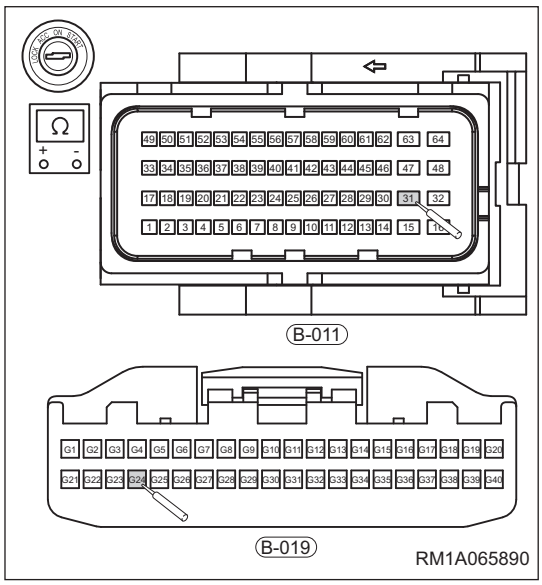
b. Check wire harness between high speed fan control relay connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (31) - B-019 (G24) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (31) or B-019 (G24) - Body ground | Always | No continuity |
| B-011 (31) or B-019 (G24) - Battery positive | | |




NG → Repair or replace wire harness

OK

| 5 | Check cooling fan low speed control circuit |
|---|---|

a. Disconnect the ECM connector B-011.

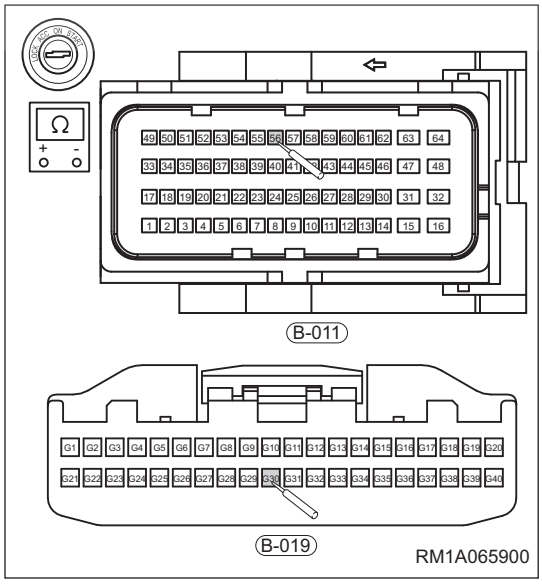
b. Check wire harness between low speed fan control relay connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (56) - B-019 (G30) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (56) or B-019 (G30) - Body ground | Always | No continuity |
| B-011 (56) or B-019 (G30) - Battery positive | | |



NG → **Repair or replace wire harness**

OK

| 6 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

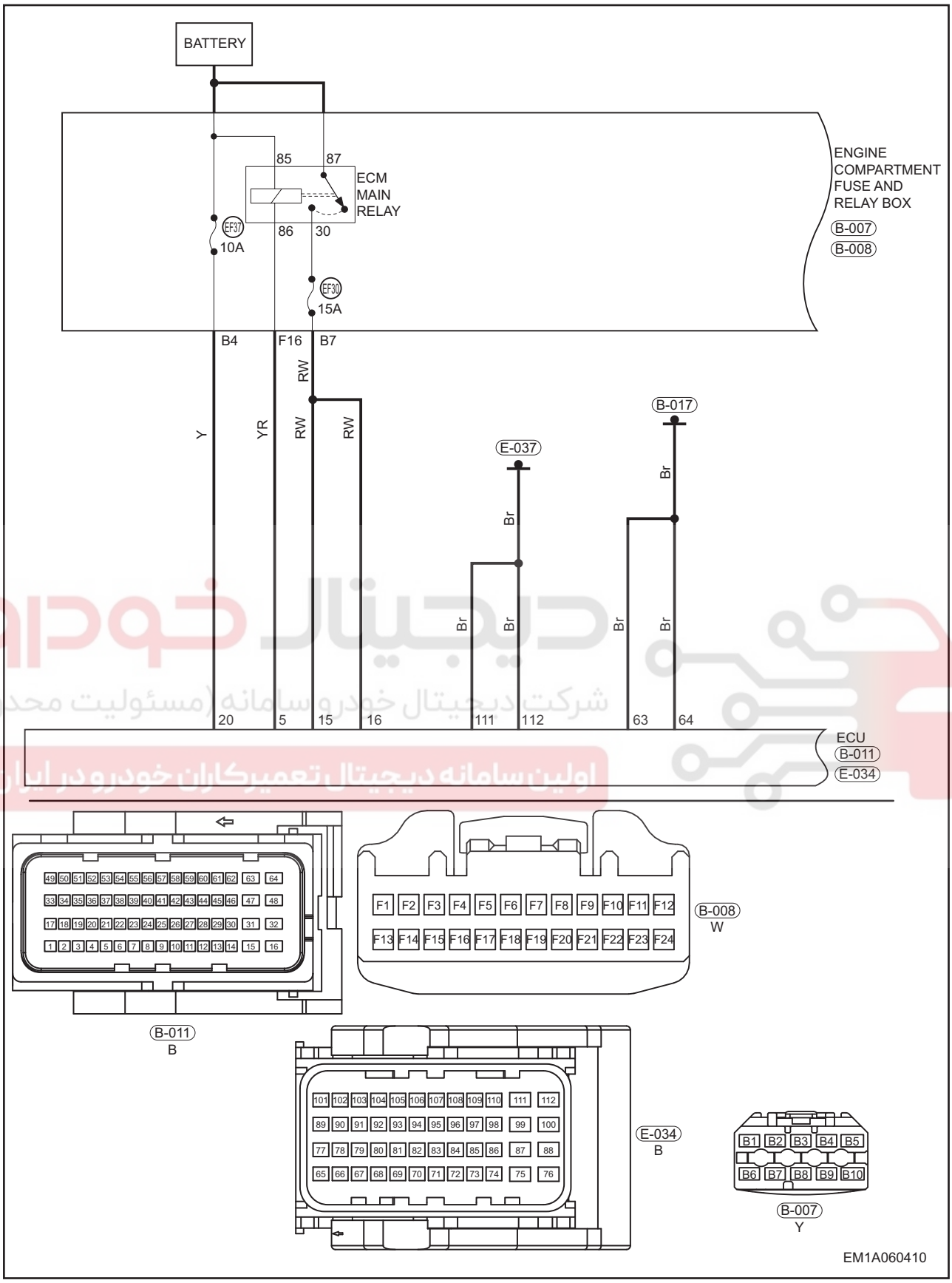
c. Check if DTC P0480 13, P0481 13, P0691 11, P0692 12, P0693 11 or P0694 12 still exists.

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 |
| DTC | P1101 00 | System Voltage Can Not Fulfill Throttle Self Learning Condition |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0560 00 | Non-plausible Error of Battery Voltage | Ignition switch ON Engine running | • Fuse<br>• Wire harness or connector<br>• Battery<br>• Battery terminal<br>• ECM |
| P0562 16 | System Voltage Low | | |
| P1101 00 | System Voltage Can Not Fulfill Throttle Self Learning Condition | | |
| P0563 17 | System Voltage High | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check battery voltage** |

a. Check if battery voltage is normal.

**NG** → **Recharge or replace battery**

**OK**

| | |
|---|---|
| 2 | **Check battery terminal** |

a. Check if battery terminal is loose or corroded.

**NG** → **Tighten or replace battery terminal**

**OK**

| | |
|---|---|
| 3 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground points B-017, E-037 (See page 06-23).

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

OK

| 4 | Check ECM connector |
|---|---|

a. Disconnect the ECM connector B-011.

b. Check the ECM connector

NG → **Repair or replace ECM connector**

OK

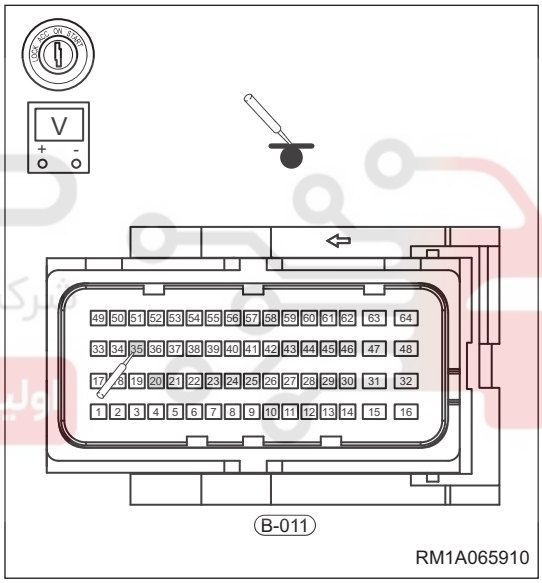
| 5 | Check ECM power supply voltage |
|---|---|

a. Check voltage between terminals 35, 20 of ECM connector B-011 and body ground.

**Voltage Inspection**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (35, 20) - Body ground | Always | 11 to 14 V |

NG → **Go to step 8**




OK

| 6 | Check ECM fuse |
|---|---|

a. Unplug ECM fuses EF37 (10 A), EF30 (15A) from engine compartment fuse and relay box.

b. Check resistance of fuse.

**Standard resistance: less than 1 Ω**

NG → **Replace ECM fuse**

OK

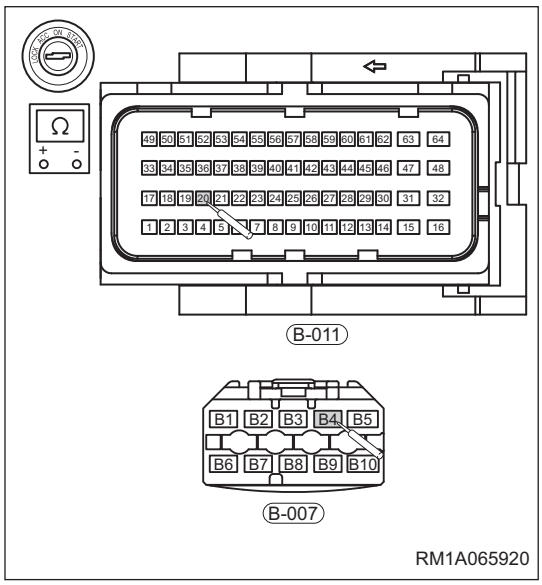
| 7 | Check wire harness and connector (ECM - engine compartment fuse and relay box) |
|---|---|

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (35) - I-030 (RF12) or B-011 (20) - B-007 (B4) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (35, 20) or I-030 (RF12), B-007 (B4) - Body ground | Always | No continuity |
| B-011 (35, 20) or I-030 (RF12), B-007 (B4) - Battery positive | | |




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

OK

| 8 | Check ignition switch (See page 15-14). |
|---|---|

NG → **Repair ignition switch**

OK

| 9 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

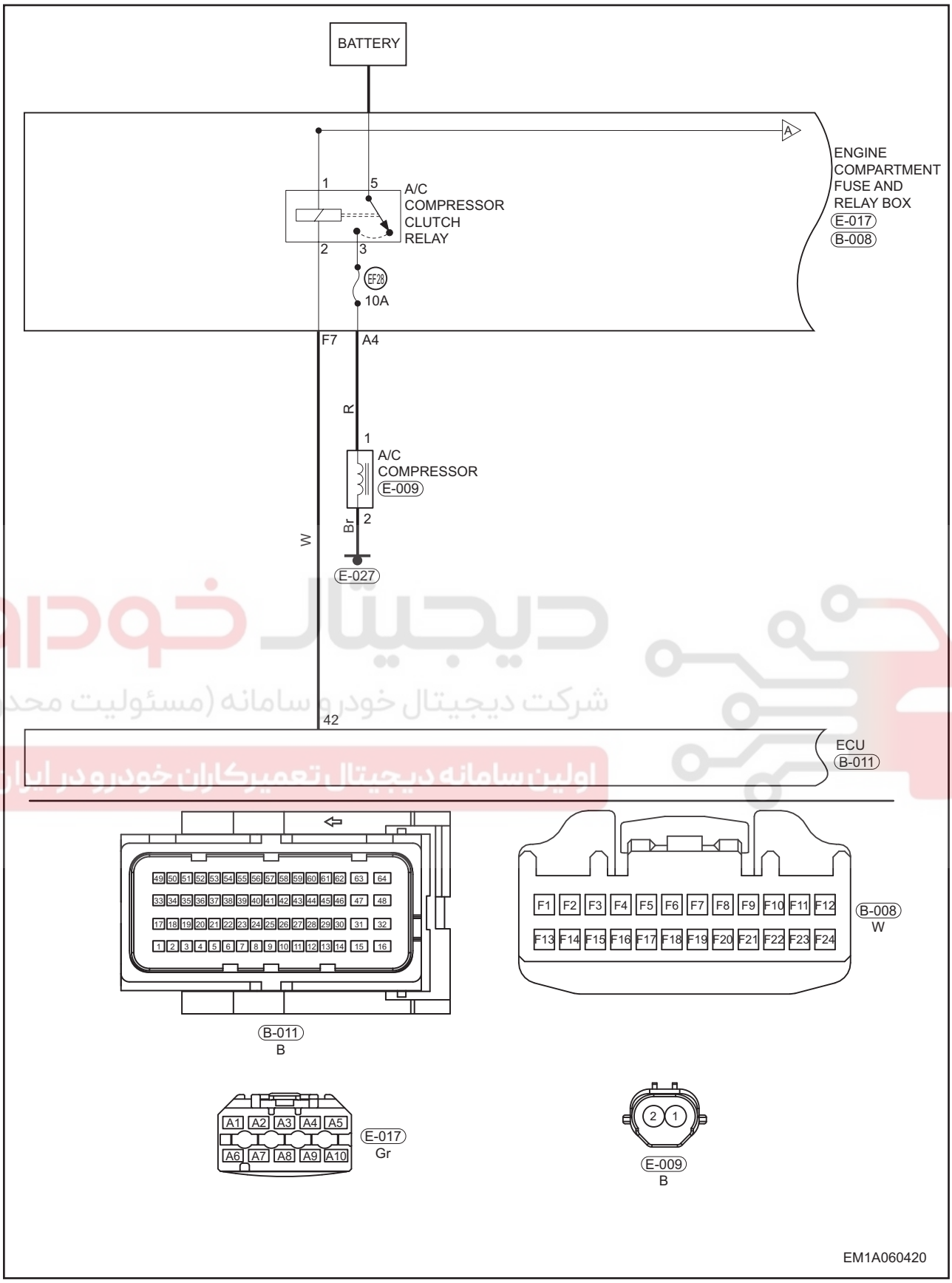
c. Check if DTC P0560 00, P0562 16, P0563 17 or P1101 00 still exists.

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 | P0645 13 | AC Clutch Relais Circuit Open |
| DTC | P0646 11 | A/C Clutch Relay Control Circuit Low |
| DTC | P0647 12 | A/C Clutch Relay Control Circuit High |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0645 13 | AC Clutch Relais Circuit Open | Ignition switch ON Engine running | • A/C compressor relay<br>• Wire harness or connector<br>• Battery<br>• ECM |
| P0646 11 | A/C Clutch Relay Control Circuit Low | | |
| P0647 12 | A/C Clutch Relay Control Circuit High | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

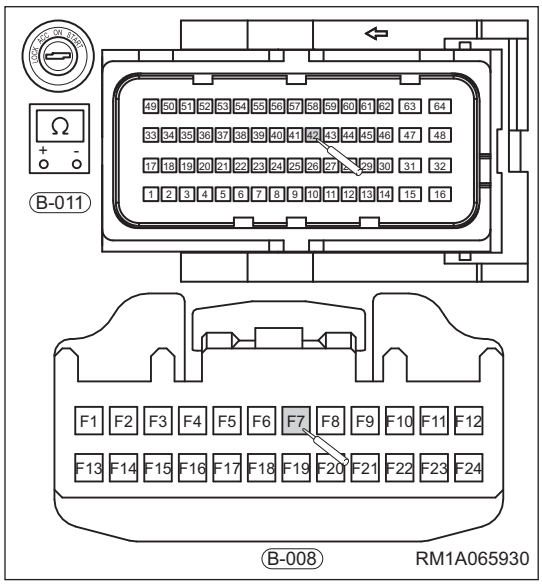
**OK**

| 2 | Check A/C compressor relay control circuit |
|---|---|

a. Disconnect the engine compartment fuse and relay box connector B-008.

b. Disconnect the ECM connector B-011.

c. Check wire harness between ECM connector terminal and engine compartment fuse and relay box connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-008 (F7) - B-011 (42) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-018 (F7) or B-011 (42) - Body ground | Always | No continuity |
| B-008 (F7) or B-011 (42) - Battery positive | Always | No continuity |

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

OK

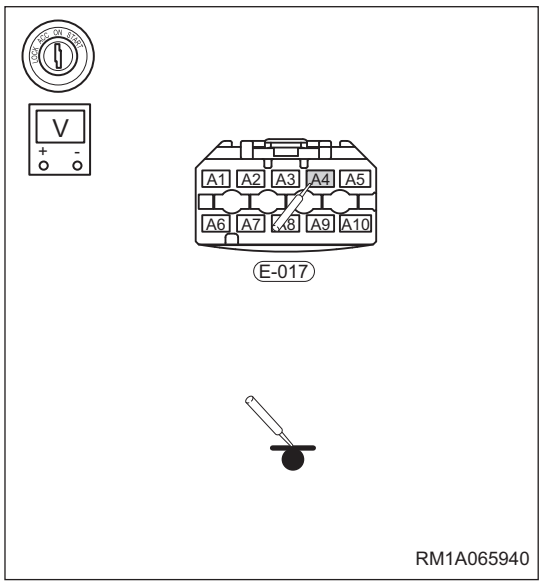
| 3 | Check A/C compressor relay and fuse |
|---|---|

a. Turn ignition switch to ON.

b. Check the fuse EF28 (10A).

c. Check voltage between engine compartment fuse and relay box connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-017 (A4) - Body ground | Always | 12 to 14 V |




NG → **Replace engine compartment fuse and relay box**

OK

| 4 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

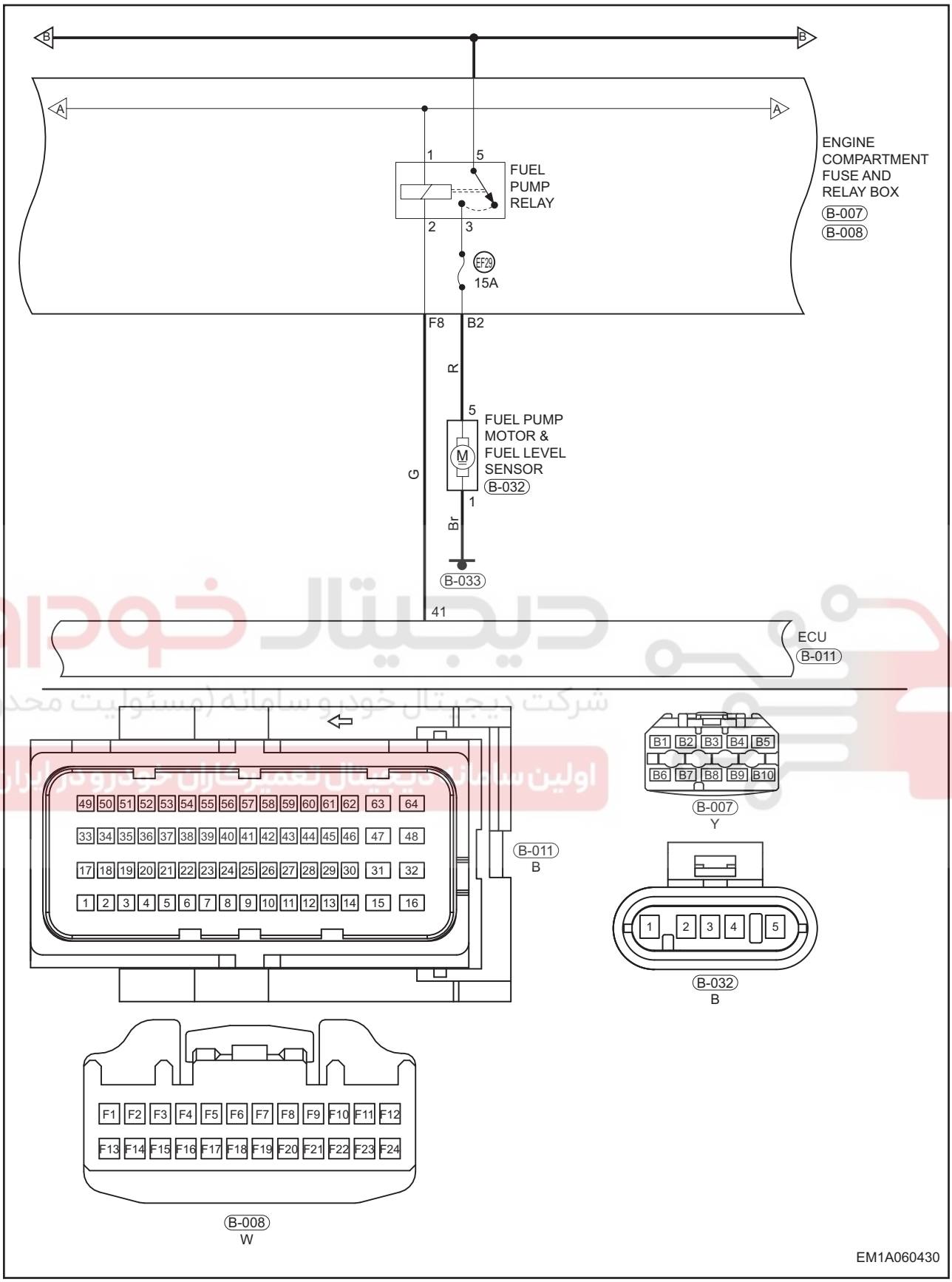
c. Check if DTC P0645 13, P0646 11 or P0647 12 still exists.

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.**

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



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0627 13 | Fuel Pump Control Circuit Open | Ignition switch ON Engine running | • Fuel pump relay<br>• Wire harness or connector<br>• Battery<br>• ECM |
| P0628 11 | Fuel Pump Control Circuit Low | | |
| P0629 12 | Fuel Pump Control Circuit High | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

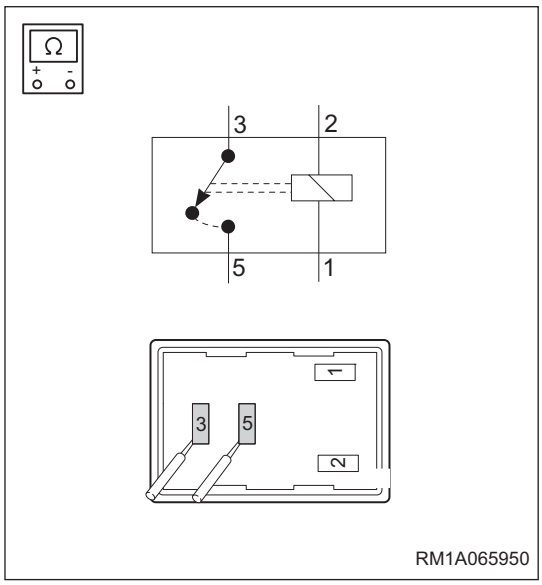
**OK**

| 2 | Check fuel pump relay |
|---|---|

a. Unplug fuel pump relay from engine compartment fuse and relay box.

b. Check the fuel pump relay terminals.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 3 - Terminal 5 | Always | No continuity |
| Terminal 3 - Terminal 5 | Continuity (When battery voltage is applied between terminal 1 and terminal 2) | Continuity |




NG → Replace fuel pump relay

OK

| 3 | Check fuel pump relay control circuit |
|---|---|

a. Disconnect the engine compartment fuse and relay box connector B-008.

b. Disconnect the ECM connector B-011.

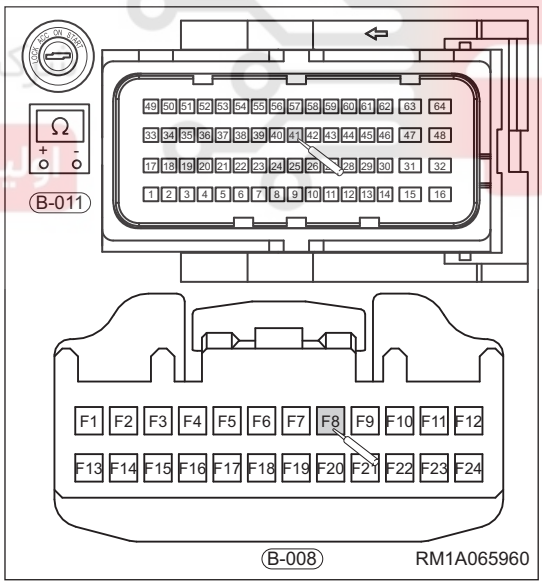
c. Check wire harness between ECM connector terminal and engine compartment fuse and relay box connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-008 (F8) - B-011 (41) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-008 (F8) or B-011 (41) - Body ground | Always | No continuity |
| B-008 (F8) or B-011 (41) - Battery positive | Always | No continuity |



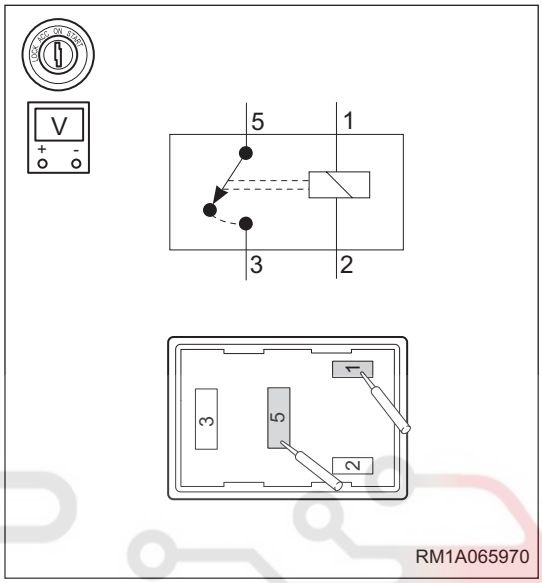
NG → **Repair or replace wire harness or connector (ECM- engine compartment fuse and relay box)**

OK

| 4 | Check fuel pump relay power supply circuit |
|---|---|

a. Turn ignition switch to ON.
b. Disconnect the fuel pump relay.
c. Check voltage between terminals 1 and 5 of fuel pump relay and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Fuel pump relay (1, 5) - Body ground | Always | 12 to 14 V |




NG → **Replace engine compartment fuse and relay box**

OK

| 5 | Check for DTCs |
|---|---|

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

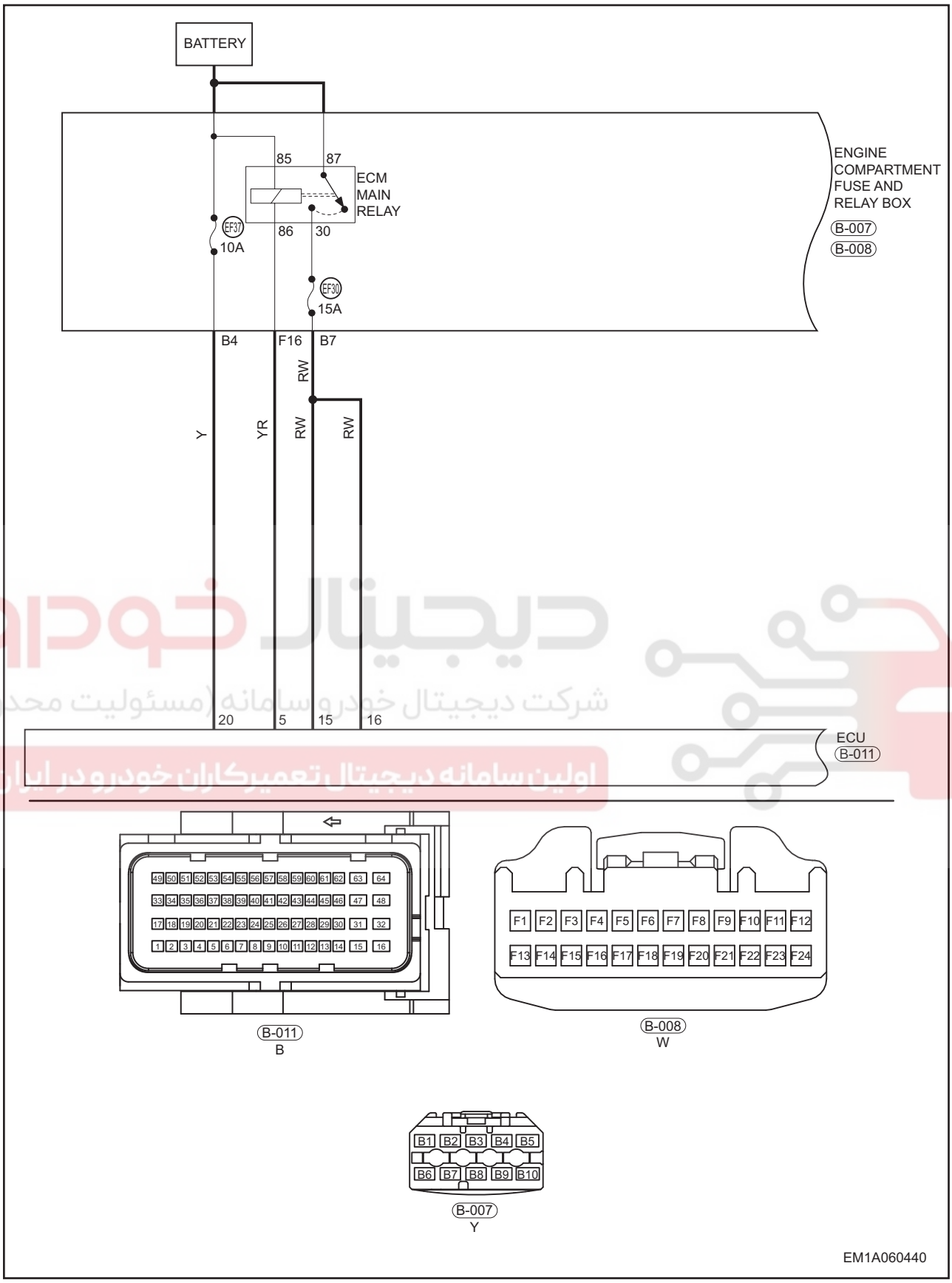
NG → **Replace ECM**

OK

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

| | | |
|---|---|---|
| DTC | P0688 91 | Power Relay Sense Circuit Non-plausible Error |

| | | |
|---|---|---|
| DTC | P0688 92 | Power Relay Sense Circuit Signal Error |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0688 91 | Power Relay Sense Circuit Non-plausible Error | Ignition switch ON Engine running | • Main relay<br>• Wire harness or connector<br>• Battery<br>• ECM |
| P0688 92 | Power Relay Sense Circuit Signal Error | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point B-017 (See page 06-23).

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

OK →

| 2 | Check main relay |
|---|---|

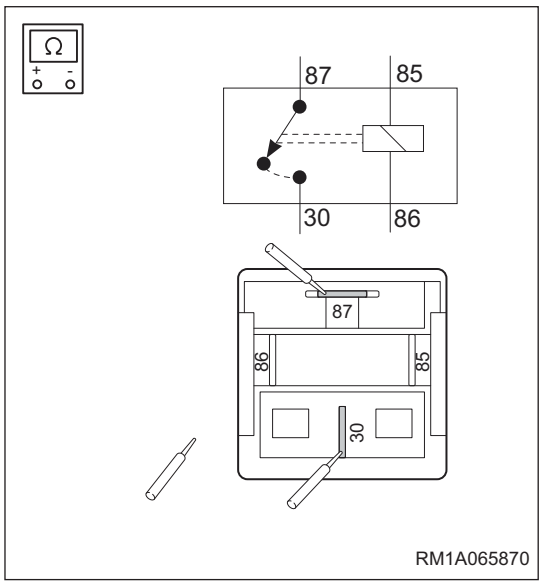
a. Unplug main relay and fuse EF29 (15A) from engine compartment fuse and relay box.

b. Check resistance of fuse.

**Standard resistance: less than 1 Ω**

c. Check terminals of main relay.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 87 - Terminal 30 | Always | No continuity |
| Terminal 87 - Terminal 30 | Continuity (When battery voltage is applied between terminal 85 and terminal 86) | Continuity |




NG → **Replace main relay and fuse**

OK

| 3 | Check main relay circuit |
|---|---|

a. Disconnect engine compartment fuse and relay box connectors B-007 and B-008.

b. Disconnect the ECM connector B-011.

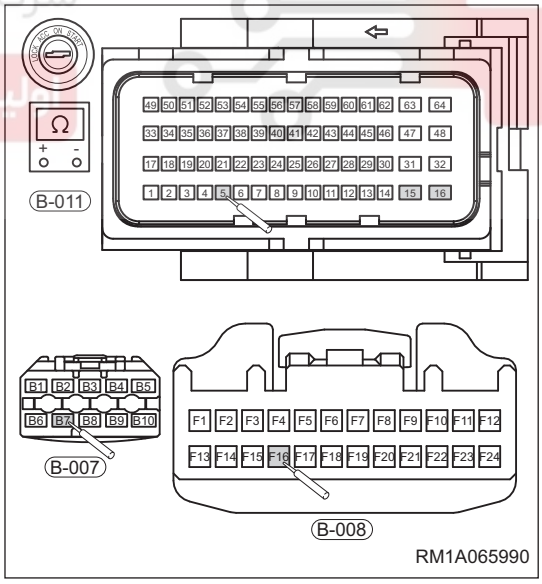
c. Check wire harness between ECM connector terminal and engine compartment fuse and relay box connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-008 (F16) - B-011 (5) | Always | Continuity |
| B-007 (B7) - B-011 (15, 16) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-008 (F16), B-007 (B7) or B-011 (5, 15, 16) - Body ground | Always | No continuity |



| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-008 (F16), B-007 (B7) or B-011 (5, 15, 16) - Battery positive | Always | No continuity |

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

OK

| 4 | Check main relay power supply circuit |
|---|---|

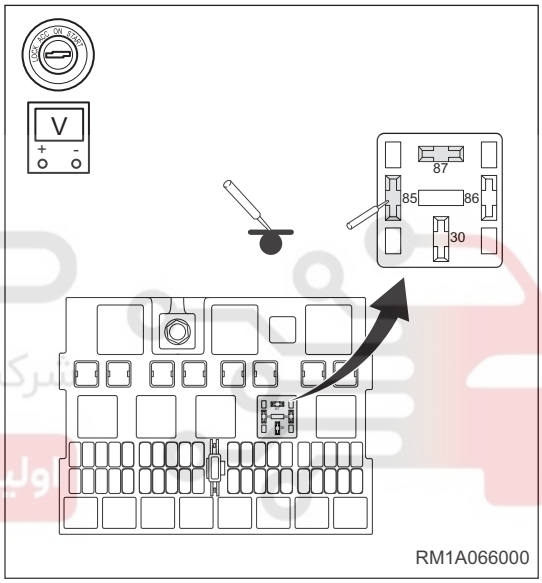
a. Turn ignition switch to ON.

b. Disconnect the main relay.

c. Check voltage between terminals 2 and 3 of main relay and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Main relay (85, 87) - Body ground | Always | 12 to 14 V |

NG → **Replace engine compartment fuse and relay box**




OK

| 5 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

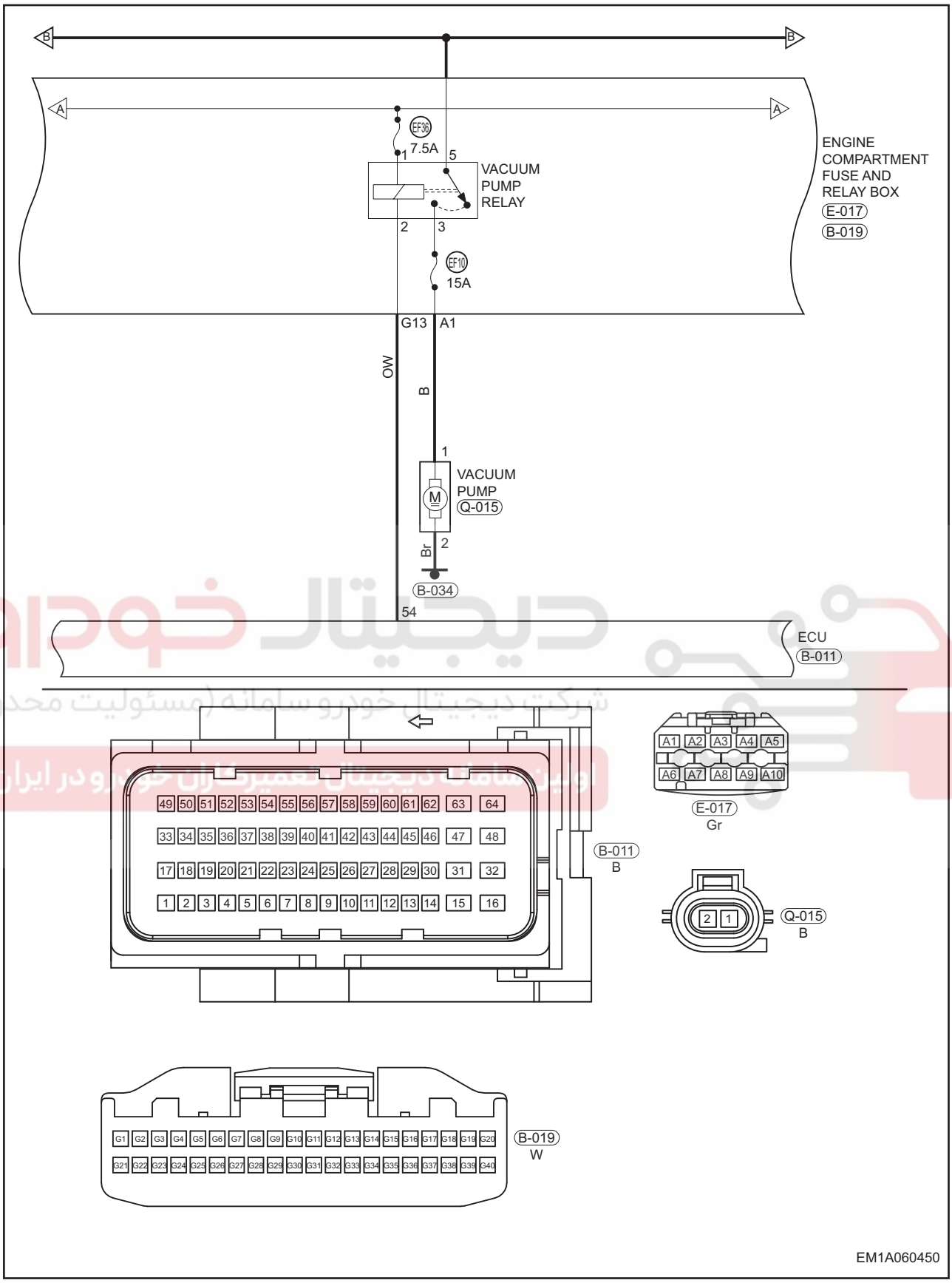
c. Check if DTC P0688 91 or P0688 92 still exists.

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 | P1130 00 | Diagnosis of Brake Booster Pump Malfunction |
| DTC | P1131 17 | Diagnosis of Brake Booster Pump Control Circuit High |
| DTC | P1132 16 | Diagnosis of Brake Booster Pump Control Circuit Low |
| DTC | P1133 13 | Diagnosis of Brake Booster Pump Control Circ. Open |
| DTC | P1427 12 | Diagnosis of Brake Booster Pump Control Circ. High |
| DTC | P1428 11 | Diagnosis of Brake Booster Pump Control Circ. Low |
| DTC | P1429 13 | Diagnosis of Brake Booster Pump Control Circ. Open |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P1130 00 | Diagnosis of Brake Booster Pump Malfunction | Ignition switch ON Engine running | • Brake vacuum booster pump relay<br>• Wire harness or connector<br>• Battery<br>• ECM |
| P1131 17 | Diagnosis of Brake Booster Pump Control Circuit High | | |
| P1132 16 | Diagnosis of Brake Booster Pump Control Circuit Low | | |
| P1133 13 | Diagnosis of Brake Booster Pump Control Circ. Open | | |
| P1427 12 | Diagnosis of Brake Booster Pump Control Circ. High | | |
| P1428 11 | Diagnosis of Brake Booster Pump Control Circ. Low | | |
| P1429 13 | Diagnosis of Brake Booster Pump Control Circ. Open | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point B-017 (See page 06-23).

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

OK

| 2 | Check brake vacuum booster pump relay |
|---|---|

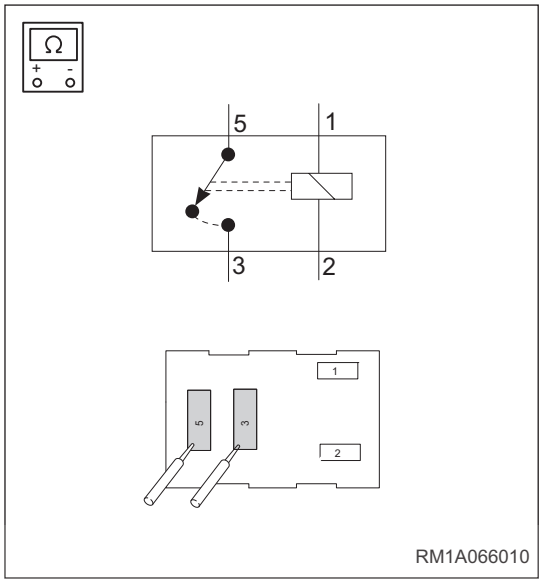
a. Unplug brake vacuum booster pump relay and fuse EF10 (15A) from engine compartment fuse and relay box.

b. Check resistance of fuse.

**Standard resistance: less than 1 Ω**

c. Check terminals of brake vacuum booster pump relay.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 3 - Terminal 5 | Always | No continuity |
| Terminal 3 - Terminal 5 | Continuity (When battery voltage is applied between terminal 1 and terminal 2) | Continuity |



RM1A066010

NG → **Replace brake vacuum booster pump relay and fuse**

OK

| 3 | Check brake vacuum booster pump relay control circuit |
|---|---|

a. Disconnect the engine compartment fuse and relay box connector B-019.

b. Disconnect the ECM connector B-011.

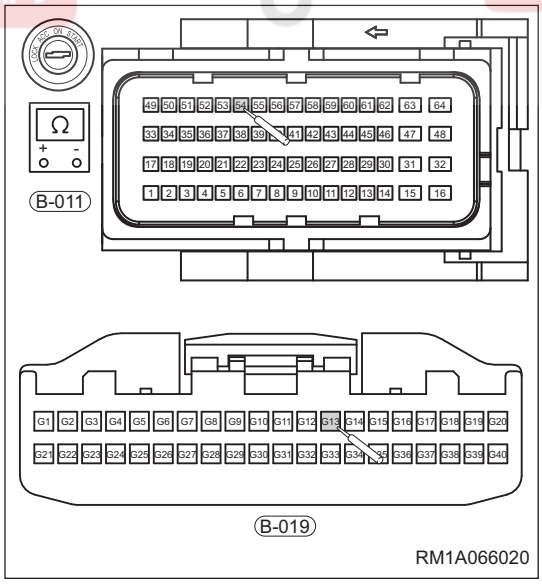
c. Check wire harness between ECM connector terminal and engine compartment fuse and relay box connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-019 (G13) - B-011 (54) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-019 (G13) or B-011 (54) - Body ground | Always | No continuity |



RM1A066020

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-019 (G13) or B-011 (54) - Battery positive | Always | No continuity |

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

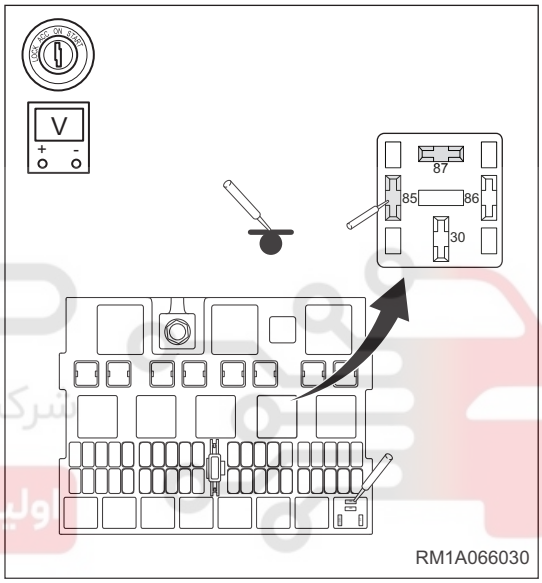
OK

| 4 | Check brake vacuum booster pump relay power supply circuit |
|---|---|

a. Turn ignition switch to ON.

b. Disconnect the brake vacuum booster pump relay.

c. Check voltage between terminals 86, 30 of brake vacuum booster pump relay and body ground.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Brake vacuum booster pump relay (1, 2) - Body ground | Always | 12 to 14 V |

NG → **Replace engine compartment fuse and relay box**

OK

| 5 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

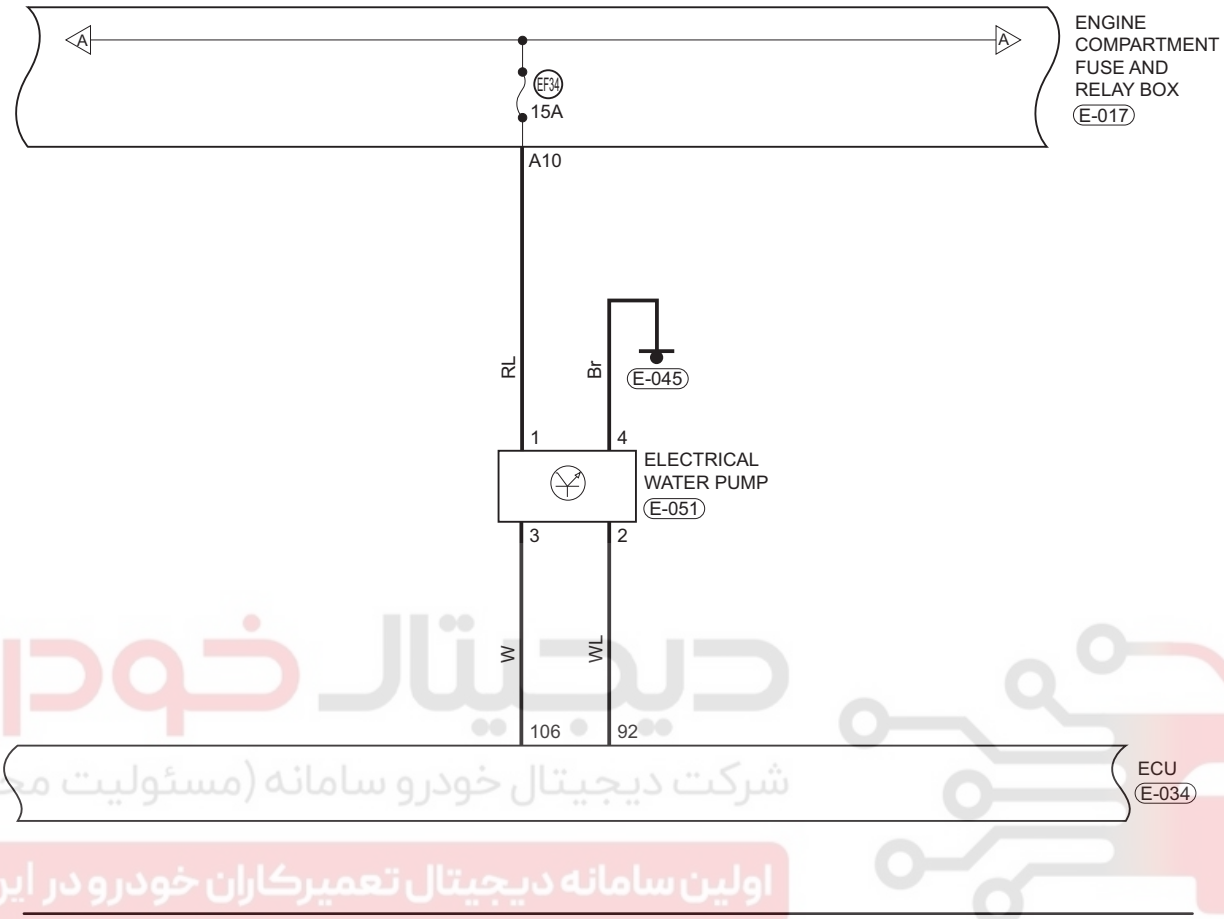
c. Check if DTC P1130 00, P1131 17, P1132 16, P1133 13, P1427 12, P1428 11 or P1429 13 still exists.

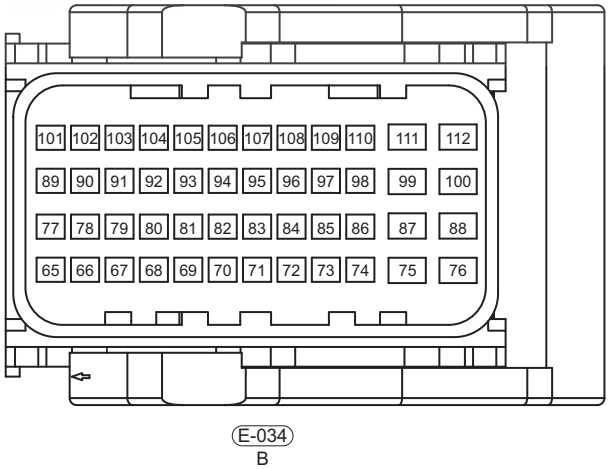
NG → **Replace ECM**

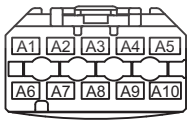
OK

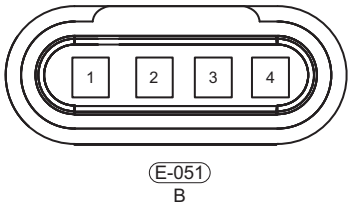
**System is operating normally. Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.**

| | | |
|---|---|---|
| DTC | P023A 00 | Charge Air Cooler Coolant Pump Control Circuit |
| DTC | P023B 00 | Charge Air Cooler Coolant Pump Control Circuit Low |
| DTC | P023C 00 | Charge Air Cooler Coolant Pump Control Circuit High |
| DTC | P1700 00 | Charge Air Cooler Coolant Pump Dry Run |
| DTC | P1703 00 | Charge Air Cooler Coolant Pump Over Voltage |
| DTC | P1704 00 | Charge Air Cooler Coolant Pump Over Current |
| DTC | P1705 00 | Charge Air Cooler Coolant Pump Over Temperature |
| DTC | P1706 00 | Charge Air Cooler Coolant Pump Stall |
| DTC | P1707 00 | Charge Air Cooler Coolant Pump Under Voltage |
| DTC | P1708 00 | Charge Air Cooler Coolant Pump Feedback Signal Error Circ.High |
| DTC | P1709 00 | Charge Air Cooler Coolant Pump Feedback Signal Error Circ.Low |




EM1A060460

| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P023A 00 | Charge Air Cooler Coolant Pump Control Circuit | Ignition switch ON<br>Engine running | • Electric water pump<br>• Wire harness or connector<br>• Battery<br>• ECM |
| P023B 00 | Charge Air Cooler Coolant Pump Control Circuit Low | | |
| P023C 00 | Charge Air Cooler Coolant Pump Control Circuit High | | |
| P1700 00 | Charge Air Cooler Coolant Pump Dry Run | | |
| P1703 00 | Charge Air Cooler Coolant Pump Over Voltage | | |
| P1704 00 | Charge Air Cooler Coolant Pump Over Current | | |
| P1705 00 | Charge Air Cooler Coolant Pump Over Temperature | | |
| P1706 00 | Charge Air Cooler Coolant Pump Stall | | |
| P1707 00 | Charge Air Cooler Coolant Pump Under Voltage | | |
| P1708 00 | Charge Air Cooler Coolant Pump Feedback Signal Error Circ. High | | |
| P1709 00 | Charge Air Cooler Coolant Pump Feedback Signal Error Circ. Low | | |

### DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

OK

| 2 | Check electric water pump connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the electric water pump connector E-051.

c. Check the electric water pump connector.

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

OK

| 3 | Check electric water pump power supply |
|---|---|

a. Turn ignition switch to OFF.

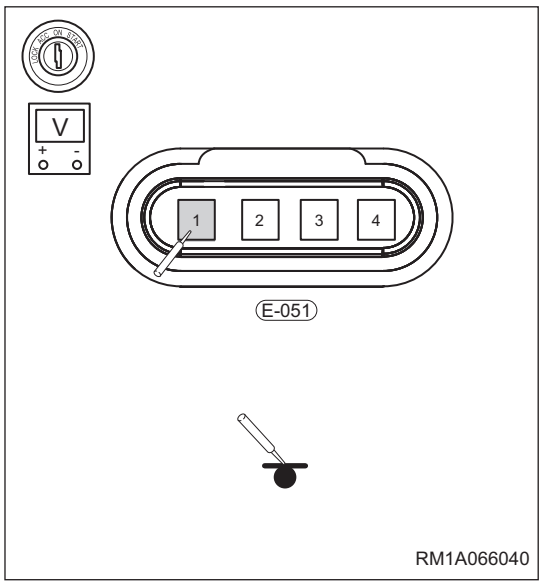
b. Unplug the electric water pump connector E-051.

c. Turn ignition switch to ON.

d. Check voltage between electric water pump connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-051 (1) - Body ground | Always | 12 to 14 V |

NG → **Go to step 6**



OK

| 4 | Check electric water pump fuse |
|---|---|

a. Unplug fuse EF034 (15A) from engine compartment fuse and relay box.

b. Check resistance of fuse.

**Standard resistance: less than 1 Ω**

NG → **Replace fuse**

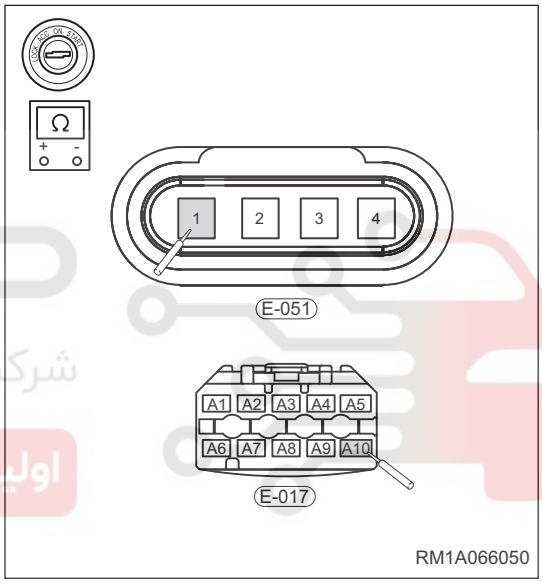
OK

| 5 | Check electric water pump power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the engine compartment fuse and relay box connector E-017.

c. Check wire harness between electric water pump connector terminal and engine compartment fuse and relay box connector terminal.




**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-051 (1) - E-017 (A10) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-051 (1) or E-017 (A10) - Body ground | Always | No continuity |
| E-051 (1) or E-017 (A10) - Battery positive | | |

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

OK

| 6 | Check electric water pump ground circuit |
|---|---|

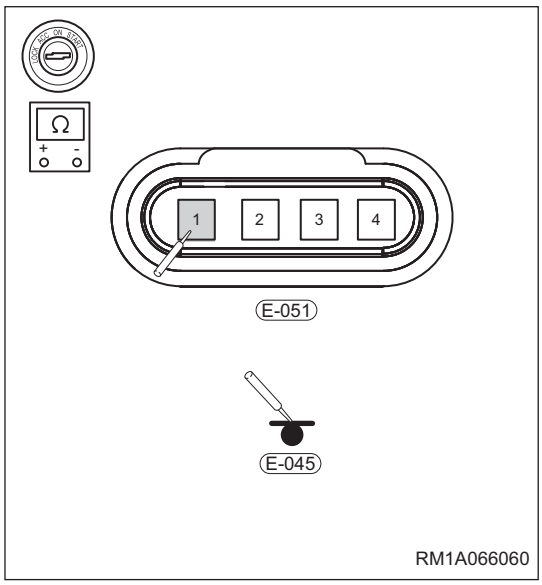
a. Check wire harness between electric water pump connector terminal and ground point.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-051 (4) - E-045 | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-051 (4) - Power supply | Always | No continuity |




**NG** → **Repair or replace wire harness or connector (electric water pump - ground point E-045)**

**OK**

| 7 | Check electric water pump relay control circuit |
|---|---|

a. Disconnect the electric water pump connector E-051.

b. Disconnect the ECM connector E-034.

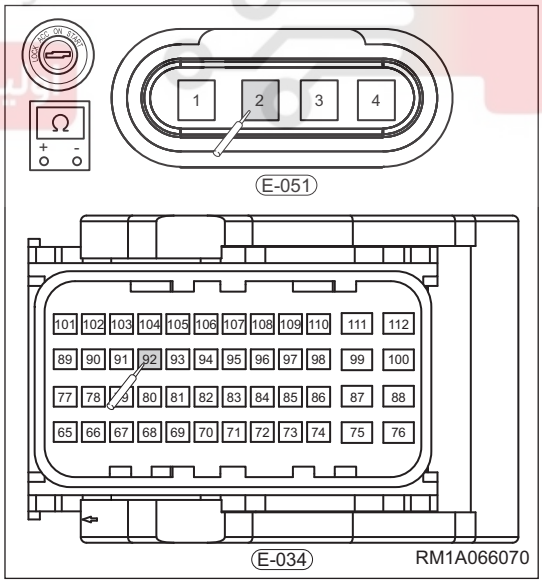
c. Check wire harness between ECM connector terminal and electric water pump connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (92) - E-051 (2) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (92) or E-051 (2) - Body ground | Always | No continuity |
| E-034 (92) or E-051 (2) - Battery positive | Always | No continuity |




**NG** → **Repair or replace wire harness or connector (ECM- electric water pump)**

OK

| 8 | Check electric water pump signal feedback circuit |
|---|---|

a. Disconnect the electric water pump connector E-051.

b. Disconnect the ECM connector E-034.

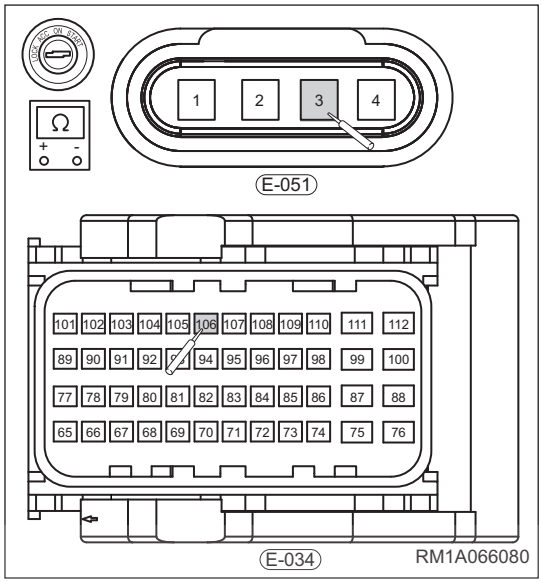
c. Check wire harness between ECM connector terminal and electric water pump connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (106) - E-051 (3) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-034 (106) or E-051 (3) - Body ground | Always | No continuity |
| E-034 (106) or E-051 (3) - Battery positive | Always | No continuity |




NG → **Repair or replace wire harness or connector (ECM- electric water pump)**

OK

**Replace electric water pump**

| 9 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P023A 00, P023B 00, P023C 00, P1700 00, P1703 00, P1704 00, P1705 00, P1706 00, P1707 00, P1708 00 or P1709 00 still exists.

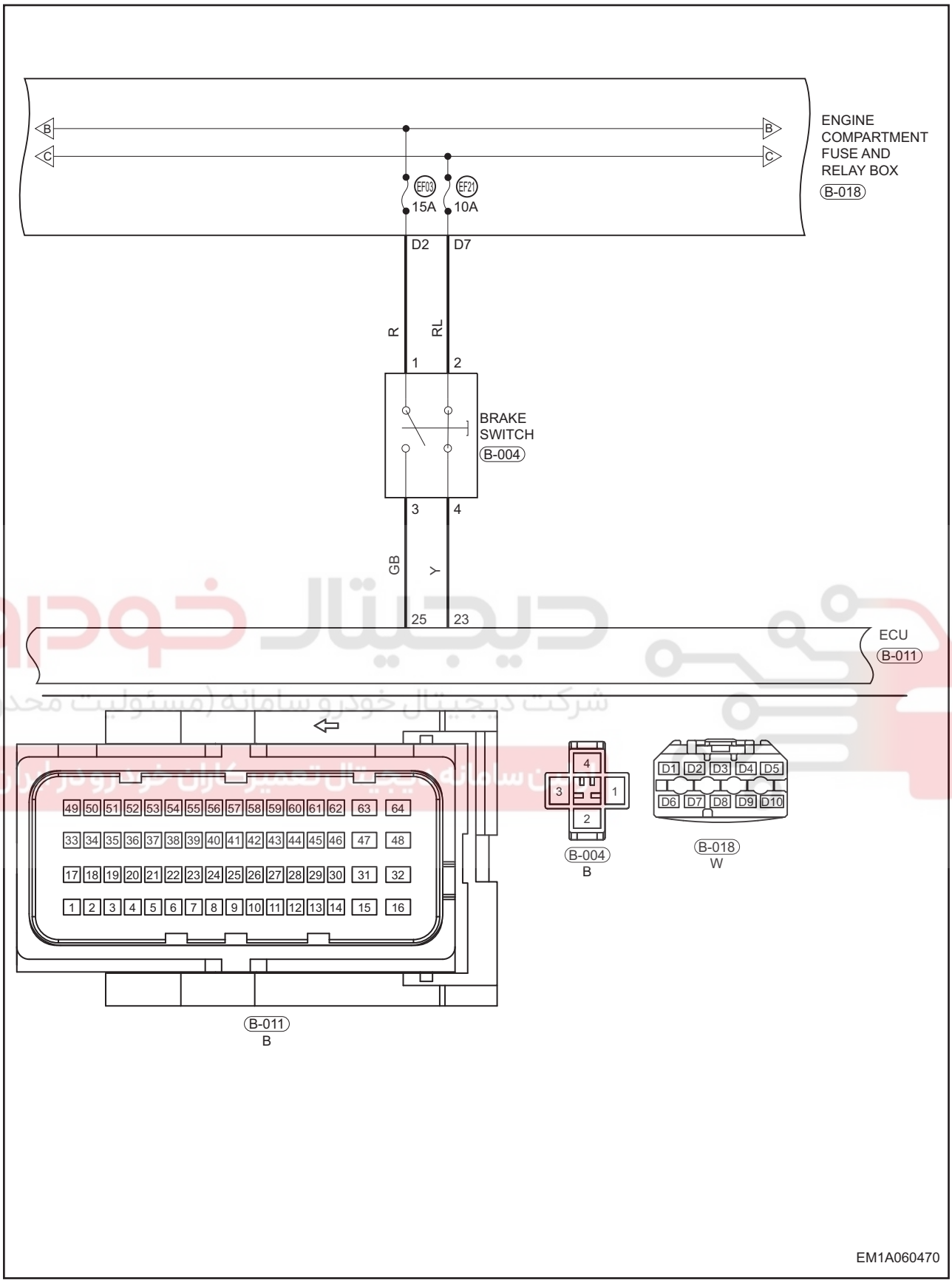
NG → **Replace ECM**

OK

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

| | | |
|---|---|---|
| DTC | P0571 29 | Brake Signal Synchronization Error |

| | | |
|---|---|---|
| DTC | P0571 1C | Brake Light Signal Circuit Error |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0571 29 | Brake Signal Synchronization Error | Ignition switch ON | • Fuse<br>• Brake switch<br>• Wire harness or connector<br>• ECM |
| P0571 1C | Brake Light Signal Circuit Error | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point B-017 (See page 06-23).

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

OK

| | |
|---|---|
| 2 | **Check fuse** |

a. Remove fuses EF21 (10A) and EF03 (15A) from engine compartment fuse and relay box.

b. Check if fuses EF21 and EF03 are normal and measure the resistance.

**Standard resistance: less than 1 Ω**

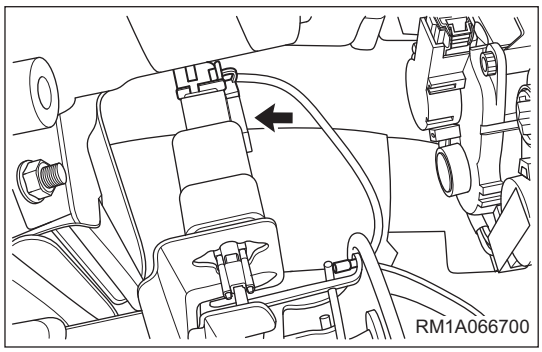
NG → **Replace fuse**

OK

| 3 | Check brake light switch connector |
|---|---|

a. Disconnect the brake light switch connector B-004 (arrow).

b. Check the brake light switch connector.



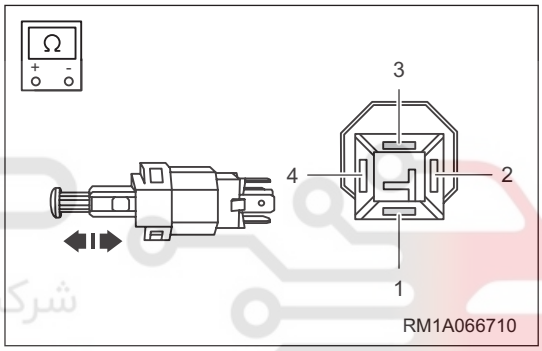

NG → Repair or replace connector

OK

| 4 | Check brake light switch |
|---|---|

a. Remove the brake light switch.

b. Check the brake light switch.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 1 - Terminal 3 | Brake pedal depressed (switch pin released) | Continuity |
| Terminal 4 - Terminal 2 | | No continuity |
| Terminal 1 - Terminal 3 | Brake pedal released (switch pin pushed) | No continuity |
| Terminal 4 - Terminal 2 | | Continuity |

NG → Replace brake light switch

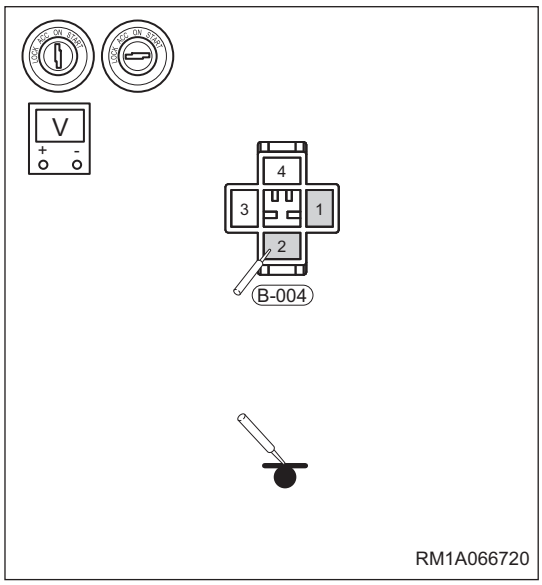
OK

| 5 | Check brake light switch power supply voltage |
|---|---|

a. Turn ignition switch to OFF and check voltage between terminal 1 of brake light switch connector and body ground.

b. Turn ignition switch to ON and check voltage between terminal 2 of brake light switch connector and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-004 (1) - Body ground | Ignition switch OFF | 11 to 14 V |
| B-004 (2) - Body ground | Ignition switch ON | 11 to 14 V |




**NG** → **Go to step 7**

**OK**

| 6 | Check brake light switch power supply circuit |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect brake light switch connector and engine compartment fuse and relay box connector.

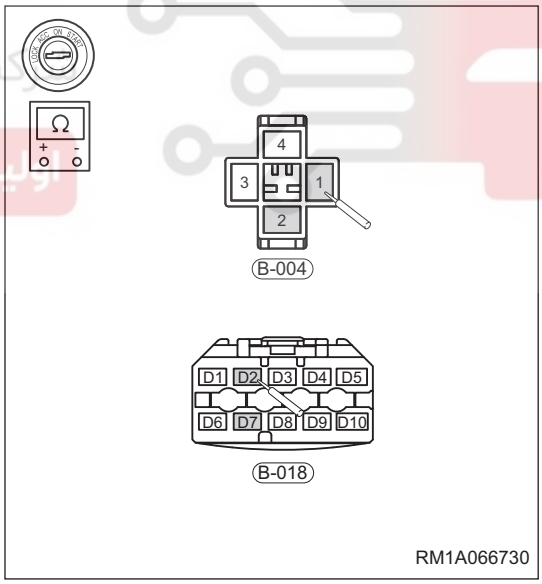
c. Check wire harness between brake light switch connector terminal and engine compartment fuse and relay box connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-004 (1) - B-018 (D2) | Always | Continuity |
| B-004 (2) - B-018 (D7) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-004 (1, 2) or B-018 (D2, D7) - Body ground | Always | No continuity |
| B-004 (1, 2) or B-018 (D2, D7) - Battery positive | | |



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

OK

## 7 Check circuit between brake light switch and ECU

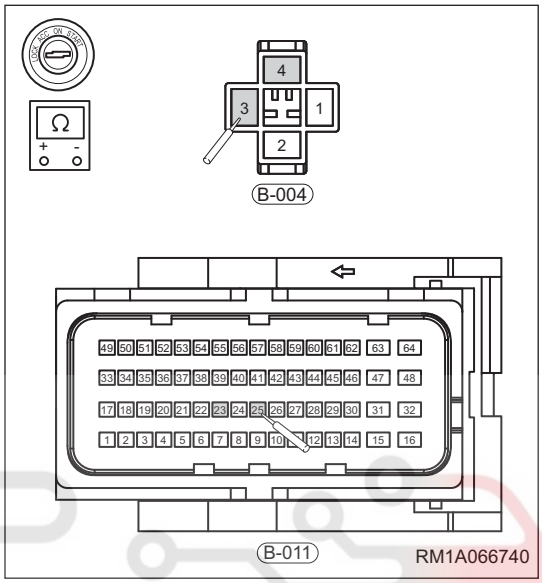
a. Turn ignition switch to OFF.

b. Disconnect brake light switch connector and ECM connector.

c. Check wire harness between brake light switch connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-004 (3) - B-011 (25) | Always | Continuity |
| B-004 (4) - B-011 (23) | | |




**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-004 (3, 4) or B-011 (23, 25) - Body ground | Always | No continuity |
| B-004 (3, 4) or B-011 (23, 25) - Battery positive | | |

NG → **Repair or replace wire harness or connector (brake light switch - ECM)**

OK

## 8 Check for DTCs

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

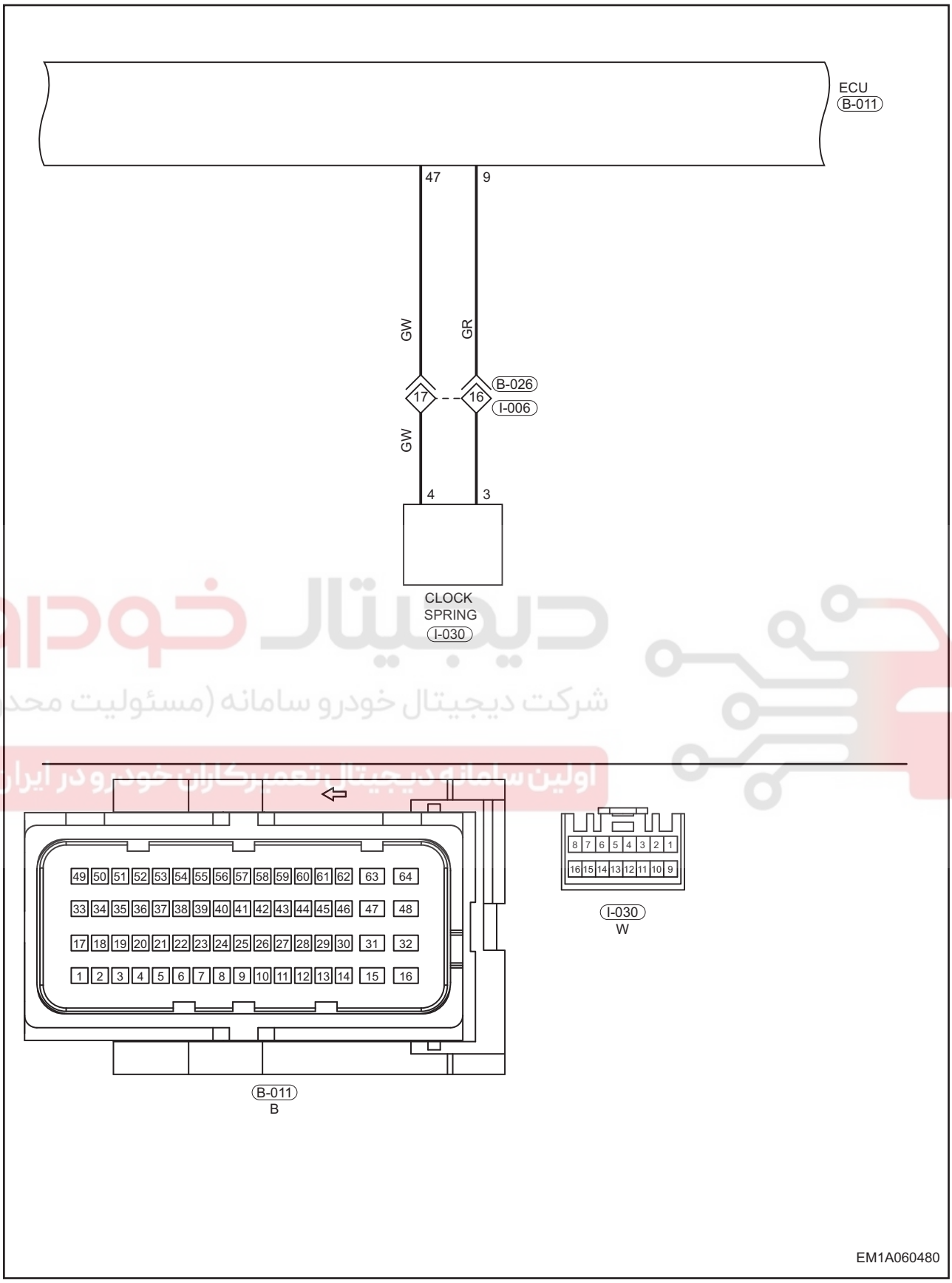
c. Check if DTC P0571 29 or P0571 1C still exists.

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 | P0568 1C | Cruise Control Set Signal Non-plausible |
| DTC | P0568 86 | Cruise Control Set Signal Stuck |
| DTC | P0568 81 | Cruise Control Set Signal Error |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0568 1C | Cruise Control Set Signal Non-plausible | Ignition switch ON | • Cruise switch<br>• Wire harness or connector<br>• ECM |
| P0568 86 | Cruise Control Set Signal Stuck | | |
| P0568 81 | Cruise Control Set Signal Error | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

OK ↓

| | |
|---|---|
| 2 | **Check cruise switch connector** |

a. Disconnect the cruise switch connector I-030 (arrow).

b. Check the cruise switch connector.

NG → **Repair or replace connector**

OK ↓

| 3 | Check cruise switch |
|---|---|

a. Remove the cruise switch.

b. Check the cruise switch (See page 35-8).

NG → **Replace cruise switch**

OK

| 4 | Check circuit between cruise switch and ECU |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect cruise switch connector and ECM connector.

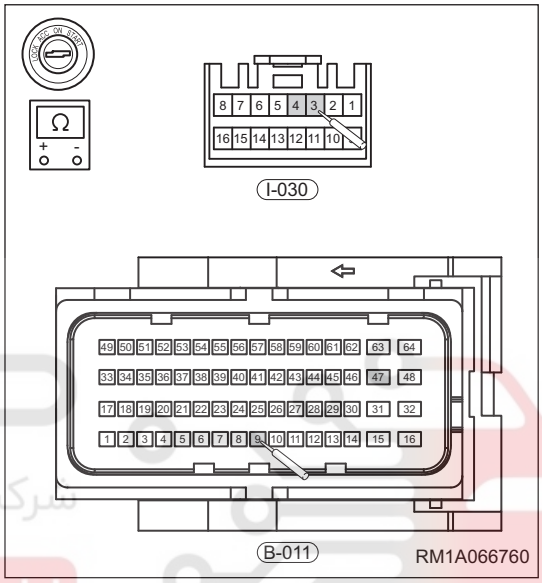
c. Check wire harness between cruise switch connector terminal and ECM connector terminal.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| I-030 (3) - B-011 (9) | Always | Continuity |
| I-030 (4) - B-011 (47) | | |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| I-030 (3, 4) or B-011 (9, 47) - Body ground | Always | No continuity |
| I-030 (3, 4) or B-011 (9, 47) - Battery positive | | |




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

OK

| 5 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0568 1C, P0568 86 or P0568 81 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 | P0601 00 | Safety Monitoring Function Error (ECU EEPROM Error) |
|---|---|---|

| DTC | P0604 43 | Internal Contr. Module RAM Error |
|---|---|---|

| DTC | P0605 43 | Internal Contr. Module ROM Error |
|---|---|---|

| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0601 00 | Safety Monitoring Function Error (ECU EEPROM Error) | Ignition switch ON | • Wire harness or connector<br>• ECM |
| P0604 43 | Internal Contr. Module RAM Error | | |
| P0605 43 | Internal Contr. Module ROM Error | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| 1 | Check ECM ground point |
|---|---|

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

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

OK ↓

| 2 | Check ECM connector |
|---|---|

a. Disconnect the ECM connectors E-034 and B-011.

b. Check if connectors are normal.

NG → **Repair or replace connector**

OK

| 3 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

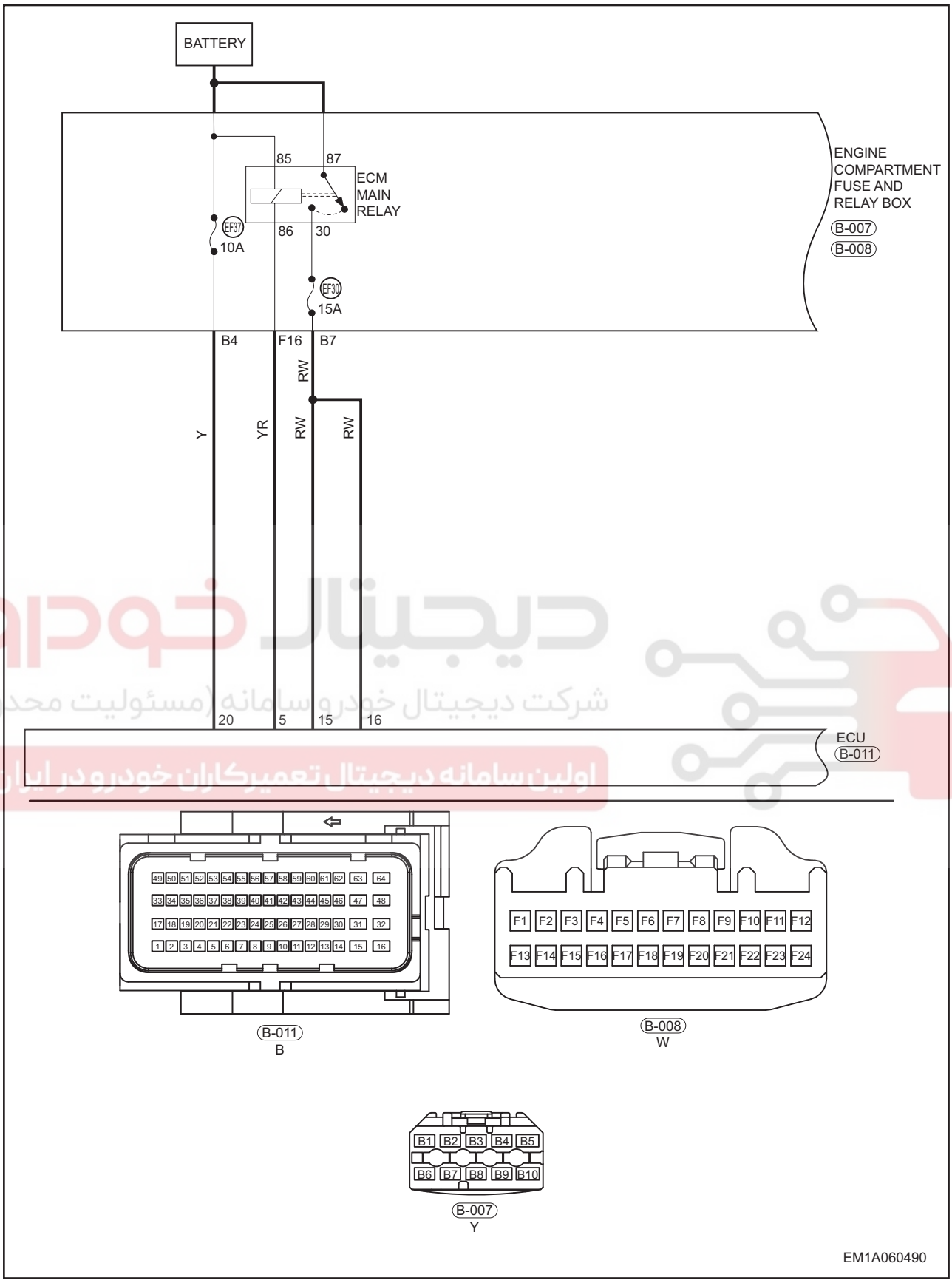
c. Check if DTC P0601 00, P0604 43 or P0605 43 still exists.

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 | P1614 00 | Immo Transferred Transponder Response was Corrupted |
| DTC | P1615 00 | ECM Status Unknown |
| DTC | P1616 00 | Authentication Not OK |
| DTC | P1617 00 | No Response from SIM During Challenge Period |
| DTC | P1618 00 | Fail to Write EOL Confidtional Data into EEProm |
| DTC | P1619 00 | ECM Not Programed (Virgin State) |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P1614 00 | Immo Transferred Transponder Response was Corrupted | Ignition switch ON | • Anti-theft module<br>• ECM<br>• Wire harness or connector |
| P1615 00 | ECM Status Unknown | | |
| P1616 00 | Authentication Not OK | | |
| P1617 00 | No Response from SIM During Challenge Period | | |
| P1618 00 | Fail to Write EOL Confidtional Data into EEProm | | |
| P1619 00 | ECM Not Programed (Virgin State) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

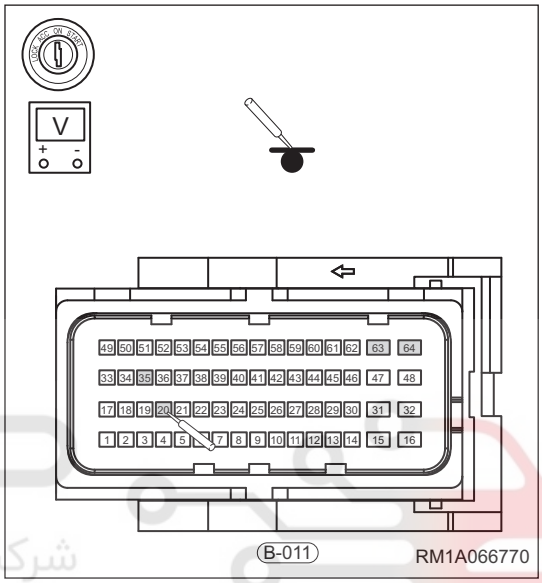
- When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

## Diagnosis Procedure

| 1 | Check ECM power supply and ground |
|---|---|

a. Check ECM power supply and ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (20, 35) - Body ground | Ignition switch ON | 11 to 14 V |
| B-011 (63, 64) - Body ground | | 0 V |




NG → Repair or replace connector

OK

| 2 | Rematch anti-theft system |
|---|---|

a. Turn ignition switch to OFF.

b. Check if information in anti-theft module can be read.

NG → Replace anti-theft module with a new one and perform match

OK

| 3 | Read SK code in ECM |
|---|---|

NG → Reprogram ECM

OK

| | |
|---|---|
| 4 | Check if SK codes in ECM and anti-theft module are the same |

NG → Reprogram ECM after resetting

OK ↓

| | |
|---|---|
| 5 | Check if SK codes in ECM and anti-theft module are the same again |

NG → Replace and reprogram ECM

OK ↓

| | |
|---|---|
| 6 | Use X-431 3G diagnostic tester to match ECM (See page 33-6), and check for DTCs again |

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

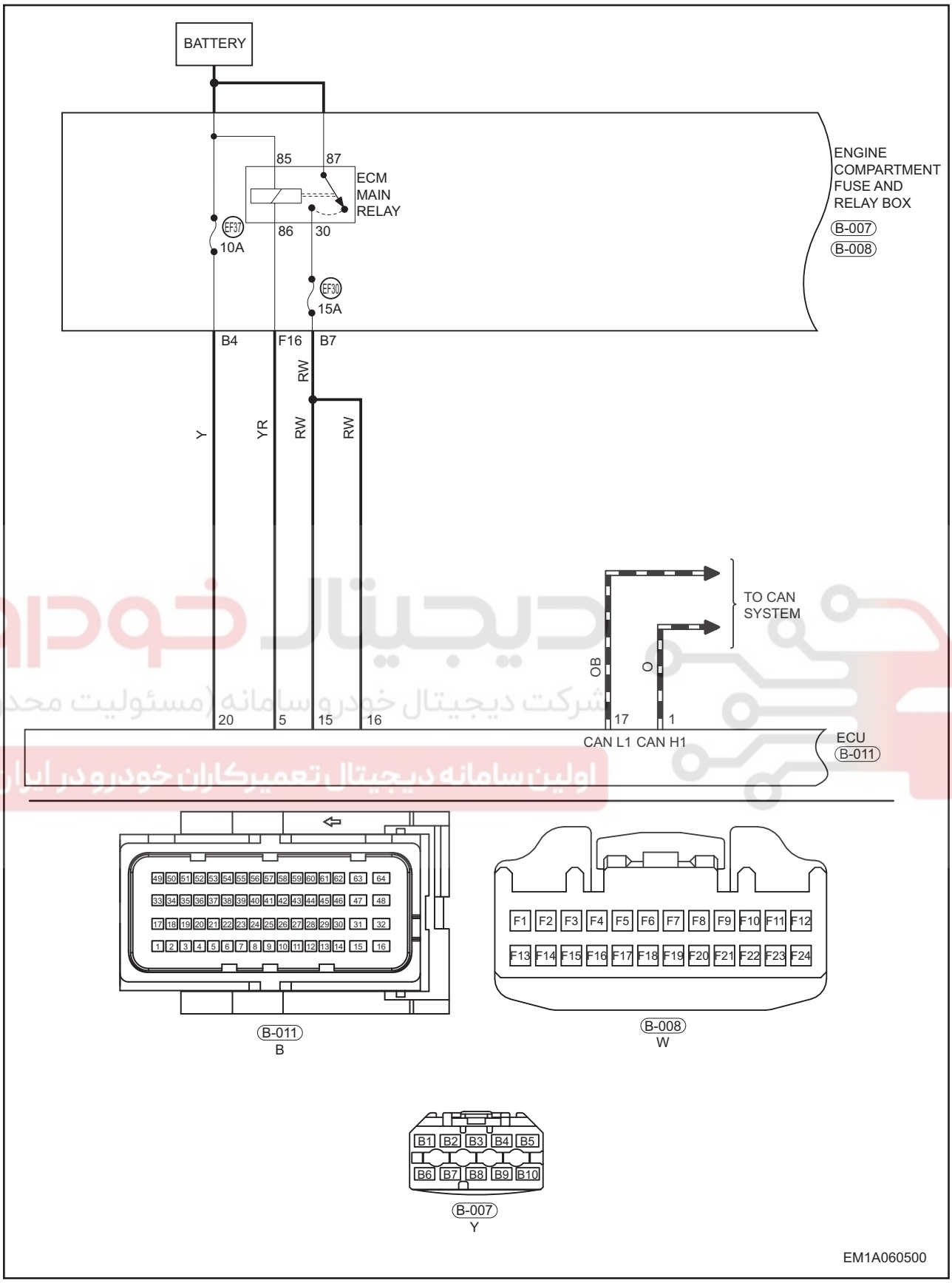
c. Check if DTC P1614 00, P1615 00, P1616 00, P1617 00, P1618 00 or P1619 00 still exists.

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 | U0001 88 | Error Busoff on CAN-bus |
| DTC | U0101 87 | Lost Communication with TCM |
| DTC | U0129 87 | Lost Communication with Brake System Control Module |
| DTC | U0140 00 | Lost Communication with Body Control Module (Immo) |
| DTC | U0214 87 | Lost Communication with Passive Entry Passive Start (PEPS) |
| DTC | U0140 87 | Lost Communication with Body Control Module (BCM) |
| DTC | U0155 87 | Lost Communication with Instrument Panel Cluster (IPC) Control Module |
| DTC | U0121 87 | Lost Communication with ABS |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| U0001 88 | Error Busoff on CAN-bus | Ignition switch ON Engine running | • CAN line or connector<br>• Shielded wire<br>• TCU, ABC, BCM, PEPS, SAM, IPC, HCU, CCU, ECM |
| U0101 87 | Lost Communication with TCM | | |
| U0129 87 | Lost Communication with Brake System Control Module | | |
| U0121 87 | Lost Communication with ABS | | |
| U0140 00 | Lost Communication with Body Control Module (Immo) | | |
| U0140 87 | Lost Communication with Body Control Module (BCM) | | |
| U0155 87 | Lost Communication with Instrument Panel Cluster (IPC) Control Module | | |
| U0214 87 | Lost Communication with Passive Entry Passive Start (PEPS) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Turn ignition switch to OFF.

b. Check the ECM ground point E-037 (See page 06-23).

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

OK

| 2 | Check CAN bus connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ECM connector B-011.

c. Check if connector is normal.

NG → **Repair or replace connector**

OK

| 3 | Check CAN line |
|---|---|

a. Turn ignition switch to OFF and disconnect negative battery cable.

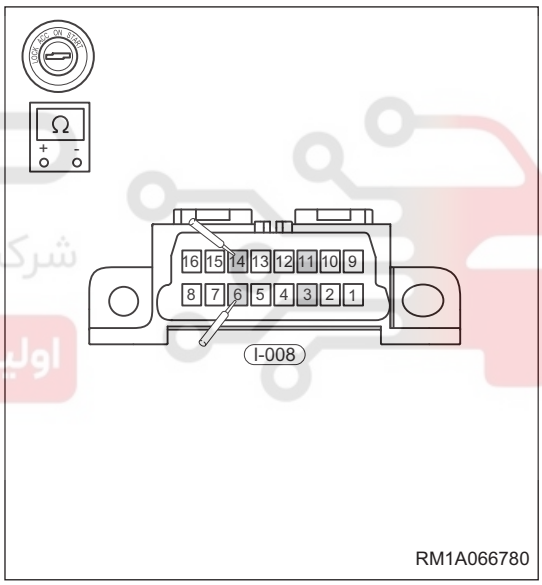
b. Use a multimeter to measure data link connector I-008.

**Resistance Inspection**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| I-008 (6) - I-008 (14) | Always | 60 Ω |
| I-008 (3) - I-008 (11) | Always | 60 Ω |

**Voltage Inspection**

Connect negative battery cable, turn ignition switch to ON and measure voltage between CAN line connector terminal and body ground.




| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| I-008 (3) or I-008 (6) - Body ground | Always | 2.6 V |
| I-008 (11) or I-008 (14) - Battery positive | Always | 2.4 V |

NG → **Repair or replace CAN line**

OK

| 4 | Check connections between TCU, ABC, BCM,PEPS, IPC modules and CAN |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the TCU, ABC, BCM, PEPS and IPC connectors.

c. Check if connectors are normal.

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

OK ↓

| 5 | Check TCU, ABC, BCM, PEPS and IPC modules |
|---|---|

a. Turn ignition switch to ON.

b. Use X-431 3G diagnostic tester to diagnose if each module operates normally.

NG → **Replace corresponding faulty module**

OK ↓

| 6 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

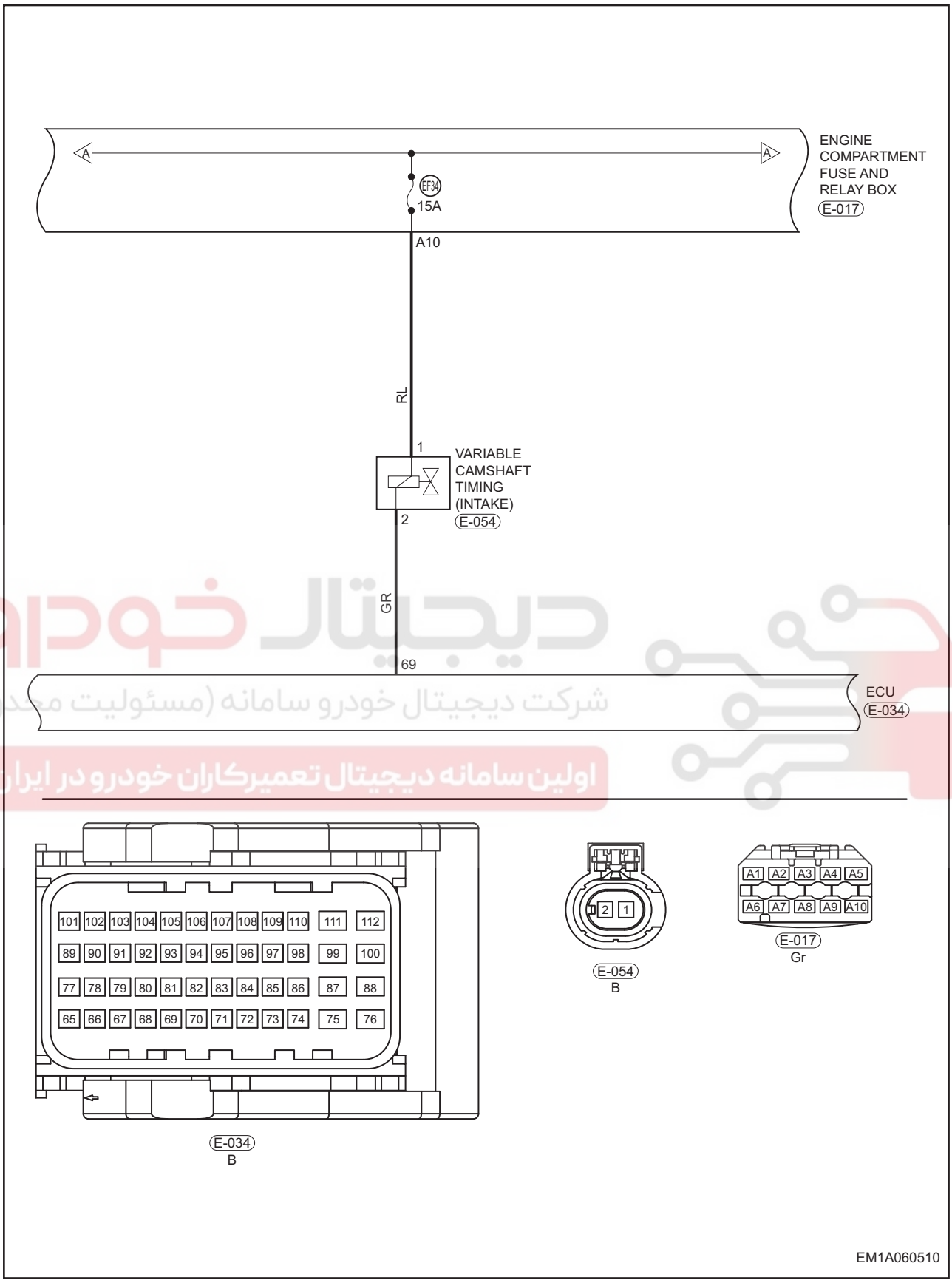
c. Check if DTC U0001 88, U0101 87, U0104 87, U0129 87, U0121 87, U0140 00, U0140 87 or U0155 87 still exists.

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 | P000A 00 | Camshaft Control Slow Response (Inlet) |
| DTC | P000A 77 | Camshaft Control Target Error (Inlet) |
| DTC | P0010 13 | Control Circuit of Camshaft Control Valve (Inlet) |
| DTC | P2088 11 | Control Circuit Low of Camshaft Control Valve (Inlet) |
| DTC | P2089 12 | Control Circuit High of Camshaft Control Valve (Inlet) |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P000A 00 | Camshaft Control Slow Response (Inlet) | Ignition switch ON<br>Engine running | • VVT control valve<br>• Wire harness or connector<br>• ECM |
| P000A 77 | Camshaft Control Target Error (Inlet) | | |
| P0010 13 | Control Circuit of Camshaft Control Valve (Inlet) | | |
| P2088 11 | Control Circuit Low of Camshaft Control Valve (Inlet) | | |
| P2089 12 | Control Circuit High of Camshaft Control Valve (Inlet) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| **1** | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

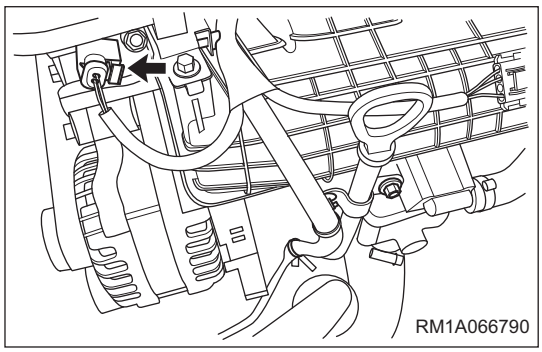
**OK**

| 2 | Check intake VVT control valve connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the intake VVT control valve connector E-054 (arrow).

c. Check the intake VVT control valve connector.




NG → **Repair or replace connector**

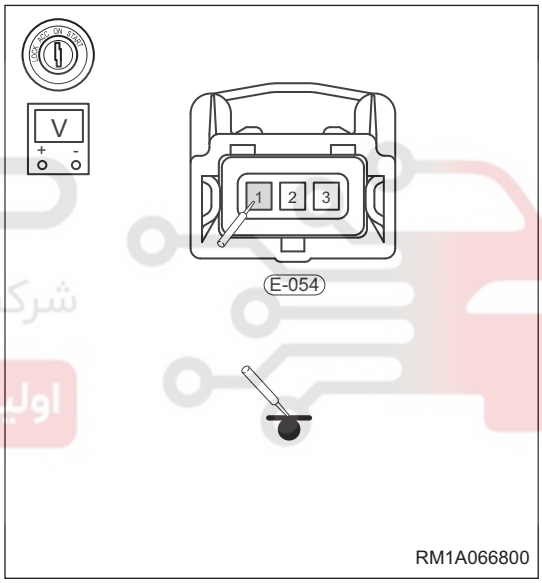
OK

| 3 | Check intake VVT control valve power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (1) - Body ground | Ignition switch ON | 11 to 14 V |




NG → **Go to step 5**

OK

| 4 | Check intake VVT control valve power supply circuit and fuse EF20 (15A) |
|---|---|

a. Turn ignition switch to OFF.

b. Check if fuse EF34 (15A) is normal.

c. Disconnect the engine compartment fuse and relay box connector E-017.

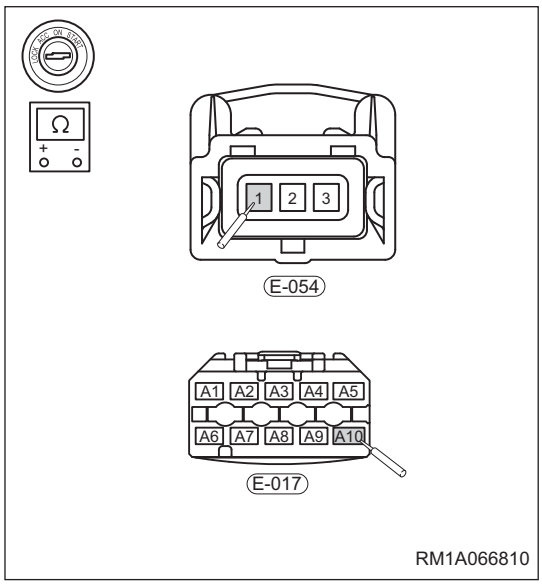
d. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (1) - E-017 (A10) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (1) or E-017 (A10) - Body ground | Always | No continuity |
| E-054 (1) or E-017 (A10) - Battery positive | | |




NG → **Repair or replace wire harness or connector (intake VVT control valve - engine compartment fuse and relay box)**

OK →

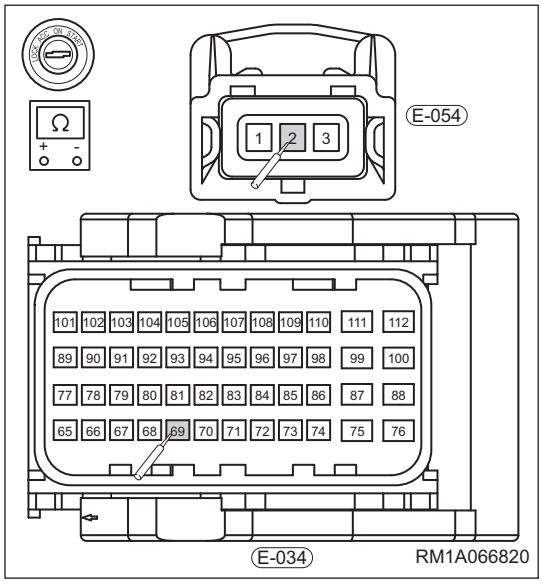
| 5 | Check intake VVT control valve control circuit |
|---|---|

a. Disconnect the ECM connector E-034.

b. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (2) - E-034 (69) | Always | Continuity |



**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-054 (2) or E-034 (69) - Body ground | Always | No continuity |
| E-054 (2) or E-034 (69) - Battery positive | | |

NG → **Repair or replace wire harness or connector (intake VVT control valve - ECM)**

OK

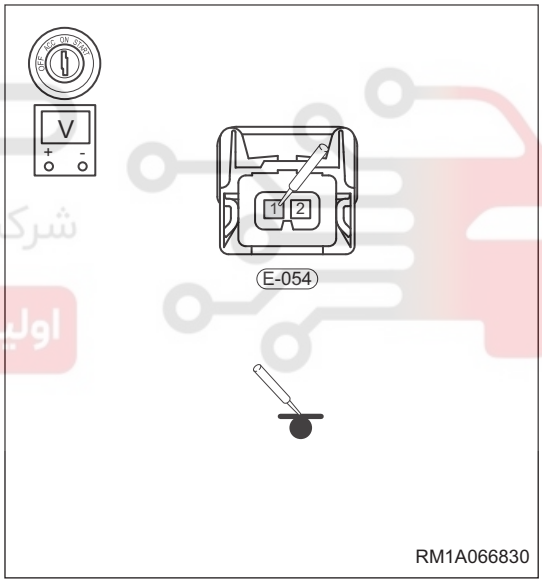
## 6 Check intake VVT control valve

a. Remove the intake VVT control valve.

b. Check the intake VVT control valve.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 1 - Terminal 2 | Always | 8 Ω |

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




NG → **Replace intake VVT control valve**

OK

## 7 Check for DTCs

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

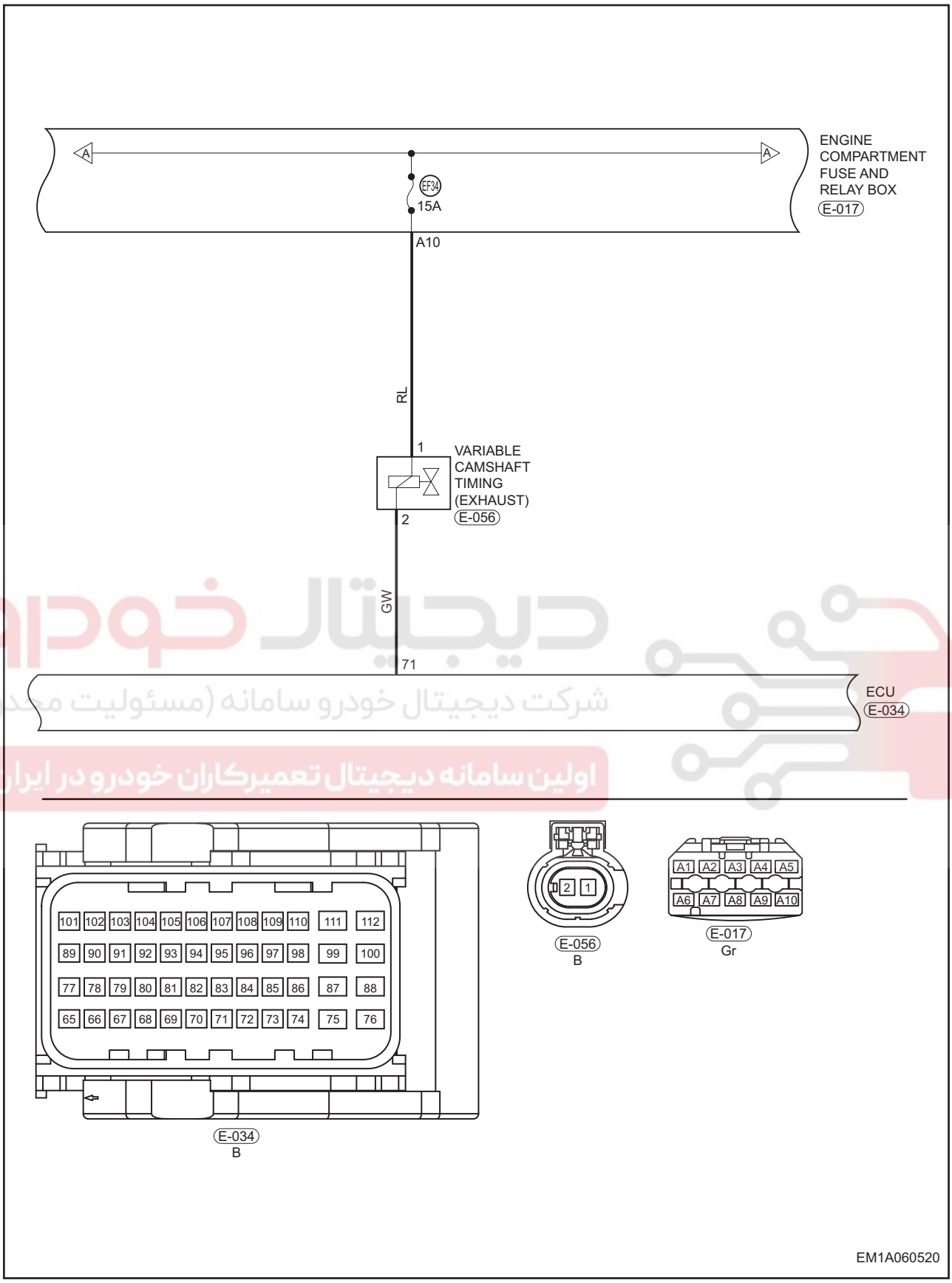
c. Check if DTC P000A 00, P000A 77, P0010 13, P2088 11 or P2089 12 still exists.

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 | P000B 00 | Camshaft Control Slow Response (Outlet) |
| DTC | P000B 77 | Camshaft Control Target Error (Outlet) |
| DTC | P0013 13 | Control Circuit of Camshaft Control Valve (Outlet) |
| DTC | P0015 00 | Outlet Camshaft not in Locking Position During Start |
| DTC | P2090 11 | Control Circuit Low of Camshaft Control Valve (Outlet) |
| DTC | P2091 12 | Control Circuit High of Camshaft Control Valve (Outlet) |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P000B 00 | Camshaft Control Slow Response (Outlet) | Ignition switch ON<br>Engine running | • VVT control valve<br>• Wire harness or connector<br>• ECM |
| P000B 77 | Camshaft Control Target Error (Outlet) | | |
| P0013 13 | Control Circuit of Camshaft Control Valve (Outlet) | | |
| P0015 00 | Outlet Camshaft not in Locking Position During Start | | |
| P2090 11 | Control Circuit Low of Camshaft Control Valve (Outlet) | | |
| P2091 12 | Control Circuit High of Camshaft Control Valve (Outlet) | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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

## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

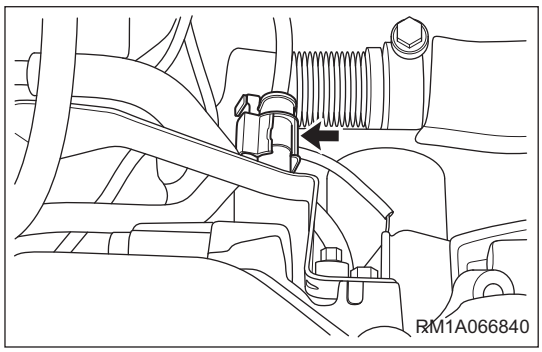
OK →

| 2 | Check exhaust VVT control valve connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the exhaust VVT control valve connector E-056 (arrow).

c. Check the exhaust VVT control valve connector.




NG → **Repair or replace connector**

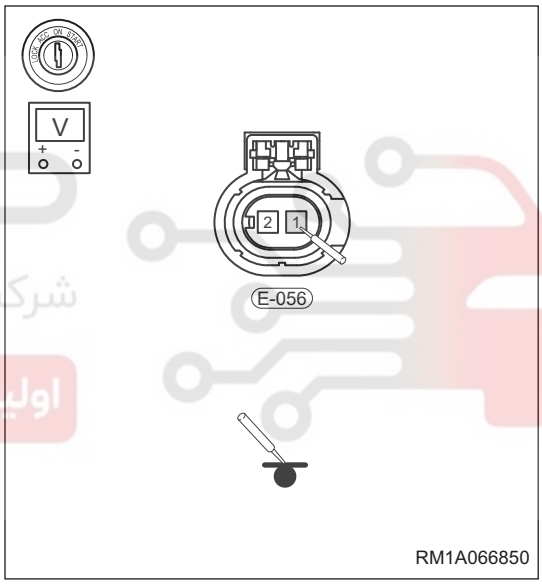
OK

| 3 | Check exhaust VVT control valve power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-056 (1) - Body ground | Ignition switch ON | 11 to 14 V |




OK → **Go to step 5**

NG

| 4 | Check exhaust VVT control valve power supply circuit and fuse EF04 (15A) |
|---|---|

a. Turn ignition switch to OFF.

b. Check if fuse EF34 (15A) is normal.

c. Disconnect the engine compartment fuse and relay box connector E-017.

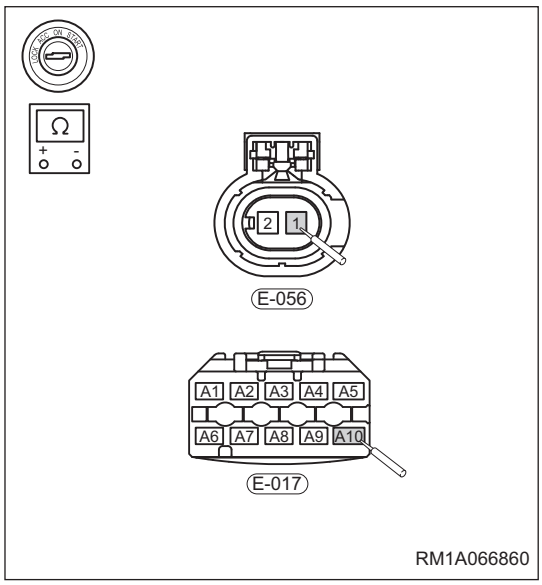
d. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-056 (1) - E-017 (A10) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-056 (1) or E-017 (A10) - Body ground | Always | No continuity |
| E-056 (1) or E-017 (A10) - Battery positive | | |




NG → **Repair or replace wire harness or connector (exhaust VVT control valve - engine compartment fuse and relay box)**

OK

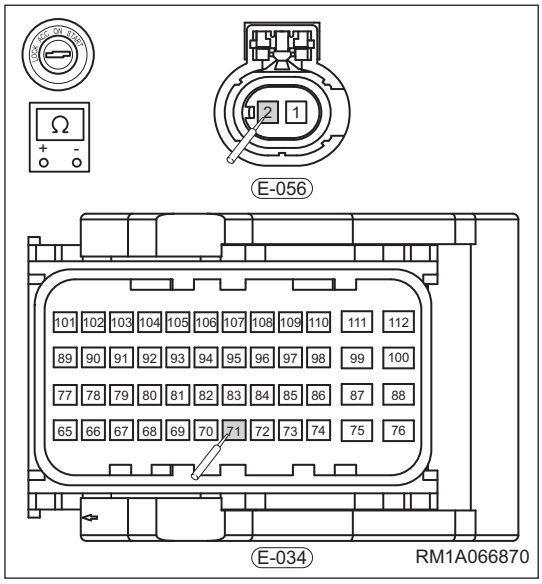
| 5 | Check exhaust VVT control valve control circuit |
|---|---|

a. Disconnect the ECM connector E-034.

b. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-056 (2) - E-034 (71) | Always | Continuity |



**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-056 (2) or E-034 (71) - Body ground | Always | No continuity |
| E-056 (2) or E-034 (71) - Battery positive | | |

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

OK

| 6 | Check exhaust VVT control valve |
|---|---|

a. Remove the exhaust VVT control valve.

b. Check the exhaust VVT control valve.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 1 - Terminal 2 | Always | 8 Ω |

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

NG → **Replace exhaust VVT control valve**

OK

| 7 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

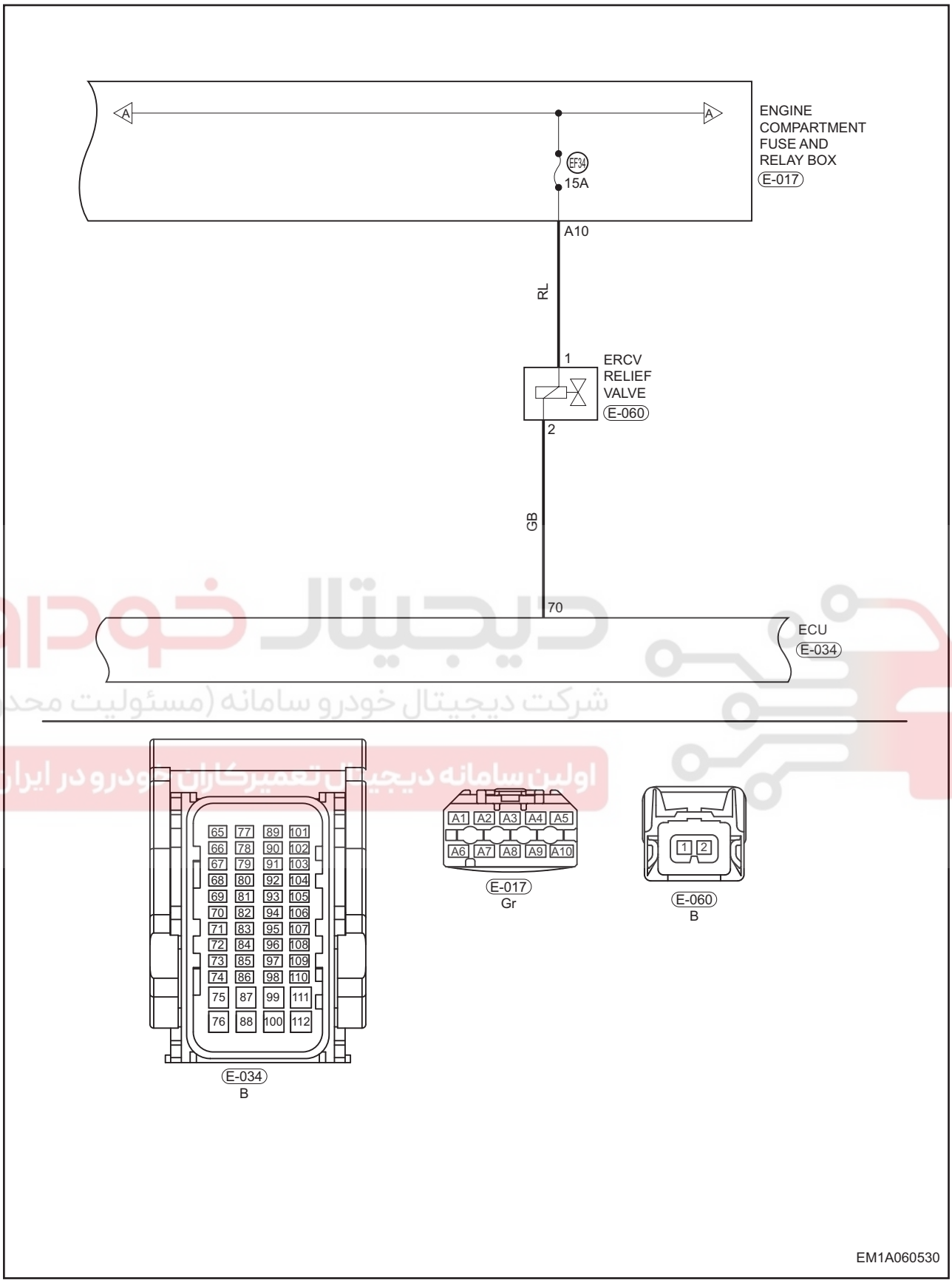
c. Check if DTC P000B 00, P000B 77, P0013 13, P0015 00, P2090 11 or P2091 12 still exists.

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 | P0033 13 | Dump Valve Control Circuit Open |
| DTC | P0034 11 | Dump Valve Control Circuit Low |
| DTC | P0035 12 | Dump Valve Control Circuit High |
| DTC | P2261 00 | Dump Valve - Mechanical Error |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0033 13 | Dump Valve Control Circuit Open | Ignition switch ON Engine running | • ERCV relief valve<br>• Wire harness or connector<br>• ECM |
| P0034 11 | Dump Valve Control Circuit Low | | |
| P0035 12 | Dump Valve Control Circuit High | | |
| P2261 00 | Dump Valve - Mechanical Error | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

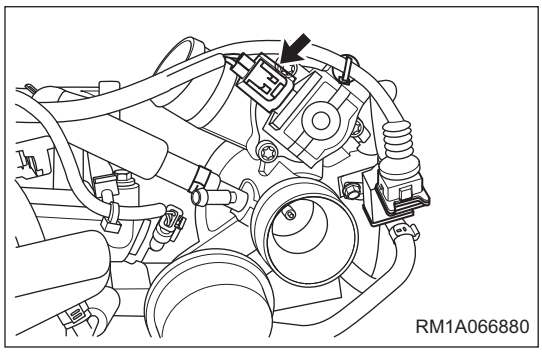
OK →

| 2 | Check ERCV relief valve connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the ERCV relief valve connector E-060 (arrow).

c. Check the ERCV relief valve connector.




NG → **Repair or replace connector**

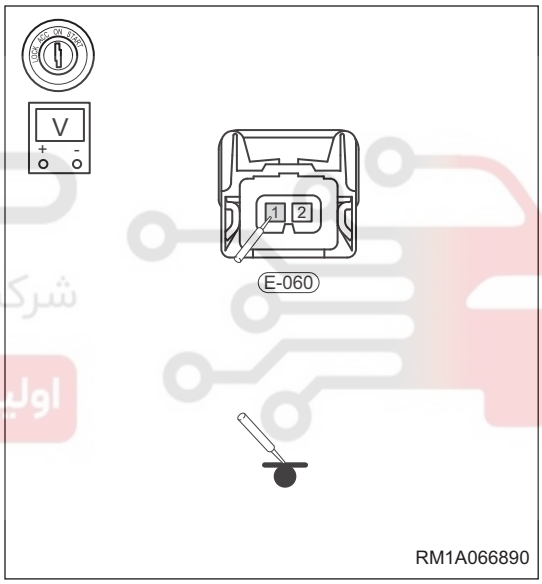
OK

| 3 | Check ERCV relief valve power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-060 (1) - Body ground | Ignition switch ON | 11 to 14 V |




OK → **Go to step 5**

NG

| 4 | Check ERCV relief valve power supply circuit and fuse EF34 (15A) |
|---|---|

a. Turn ignition switch to OFF.

b. Check if fuse EF34 (15A) is normal.

c. Disconnect the engine compartment fuse and relay box connector E-017.

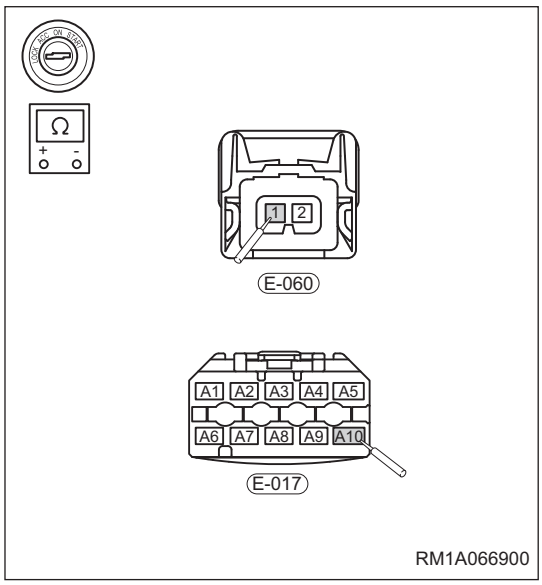
d. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-060 (1) - E-017 (A10) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-060 (1) or E-017 (A10) - Body ground | Always | No continuity |
| E-060 (1) or E-017 (A10) - Battery positive | | |




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

OK

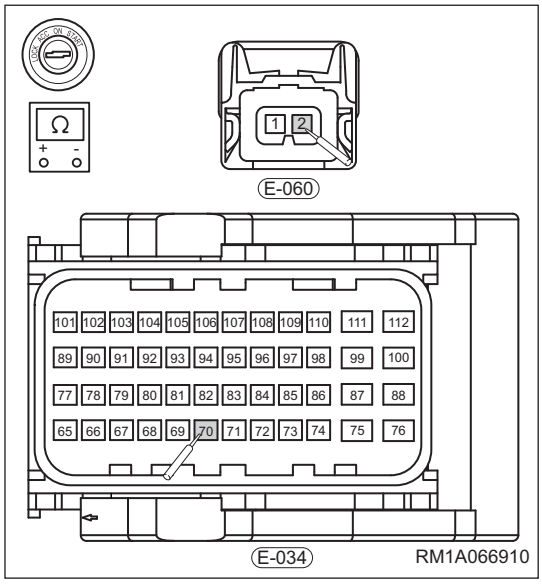
| 5 | Check ERCV relief valve control circuit |
|---|---|

a. Disconnect the ECM connector E-034.

b. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-060 (2) - E-034 (70) | Always | Continuity |



**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-060 (2) or E-034 (70) - Body ground | Always | No continuity |
| E-060 (2) or E-034 (70) - Battery positive | | |

NG → **Repair or replace wire harness or connector (ERCV relief valve - ECM)**

OK

| 6 | Check ERCV relief valve |
|---|---|

a. Remove the ERCV relief valve.

b. Check the ERCV relief valve.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 1 - Terminal 2 | Always | 13 Ω |

c. When battery voltage is applied between terminals 1 and 2, ERCV relief valve should move quickly.

NG → **Replace ERCV relief valve**

OK

| 7 | Check for DTCs |
|---|---|

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

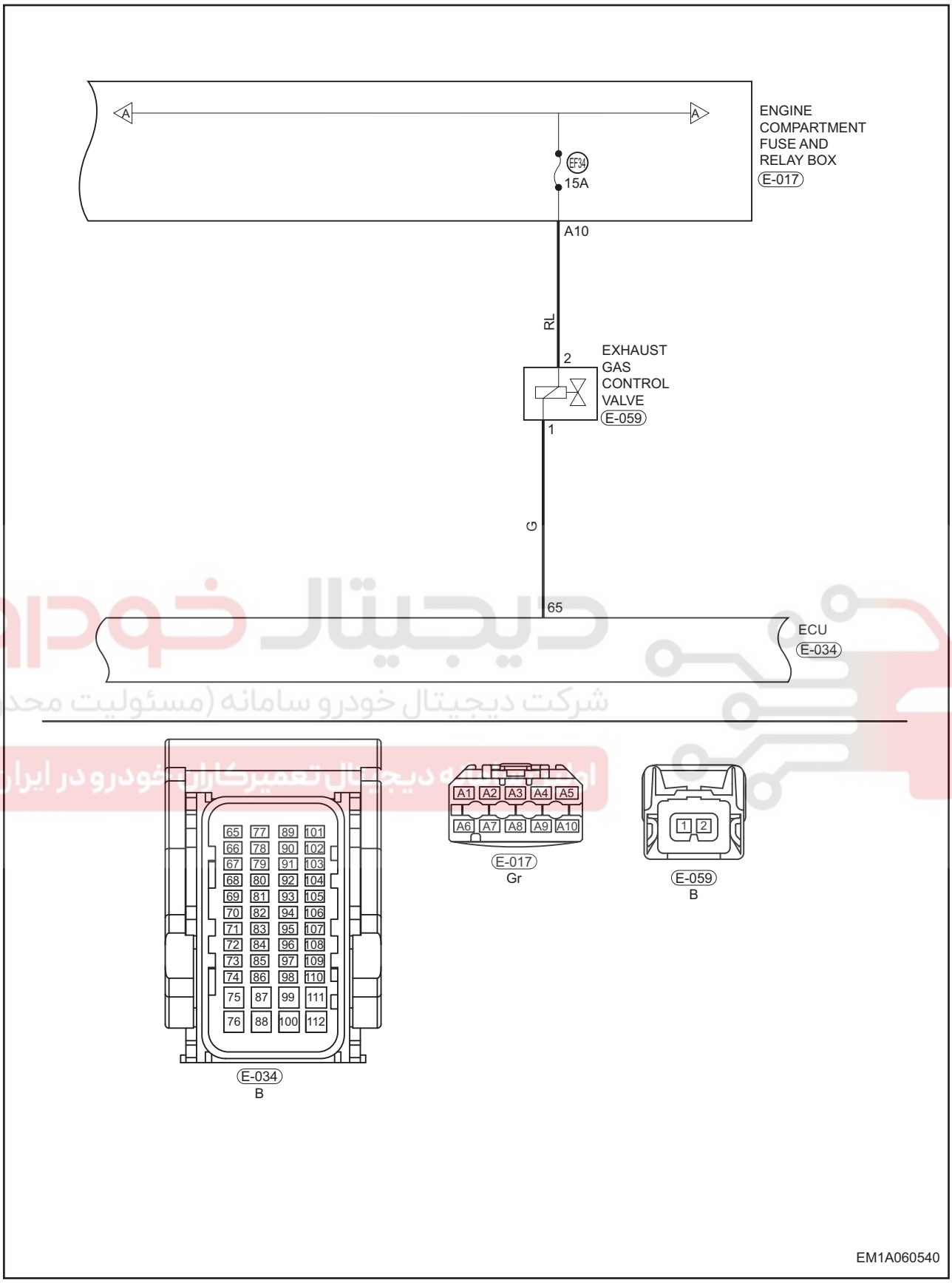
c. Check if DTC P0033 13, P0034 11, P0035 12 or P2261 00 still exists.

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 | P0234 00 | Turbu/Super Charger Overboost Condition |
| DTC | P0243 13 | Turbo/Super Charger Wastegate Solonoid Open |
| DTC | P0245 11 | Turbo/Super Charger Wasteg. Solonoid Low |
| DTC | P0246 12 | Turbo/Sup. Charger Wasteg. Solonoid High |



| DTC | DTC Definition | DTC Detection Condition | Possible Cause |
|---|---|---|---|
| P0234 00 | Turbu/Super Charger Overboost Condition | Ignition switch ON Engine running | • Exhaust gas control valve<br>• Wire harness or connector<br>• ECM |
| P0243 13 | Turbo/Super Charger Wastegate Solonoid Open | | |
| P0245 11 | Turbo/Super Charger Wasteg. Solonoid Low | | |
| P0246 12 | Turbo/Sup. Charger Wasteg. Solonoid High | | |

## DTC Confirmation Procedure

Confirm that battery voltage is between 11 V and 14 V before performing following procedures.

- Turn ignition switch to OFF.
- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC).
- Turn ignition switch to ON.
- Using X-431 3G diagnostic tester, record and clear DTCs stored in ECM.
- Start engine and warm it up to normal operating temperature, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 06-23).

**CAUTION**

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



## Diagnosis Procedure

| | |
|---|---|
| 1 | **Check ECM ground point** |

a. Check if battery voltage is normal.

b. Check the ECM ground point E-037 (See page 06-23).

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

OK

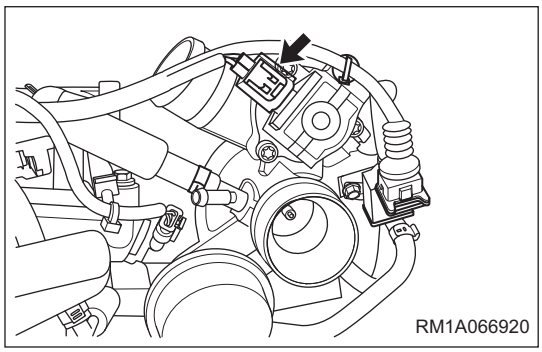
| 2 | Check exhaust gas control valve connector |
|---|---|

a. Turn ignition switch to OFF.

b. Disconnect the exhaust gas control valve connector E-059 (arrow).

c. Check the exhaust gas control valve connector.

NG → **Repair or replace connector**


RM1A066920

OK

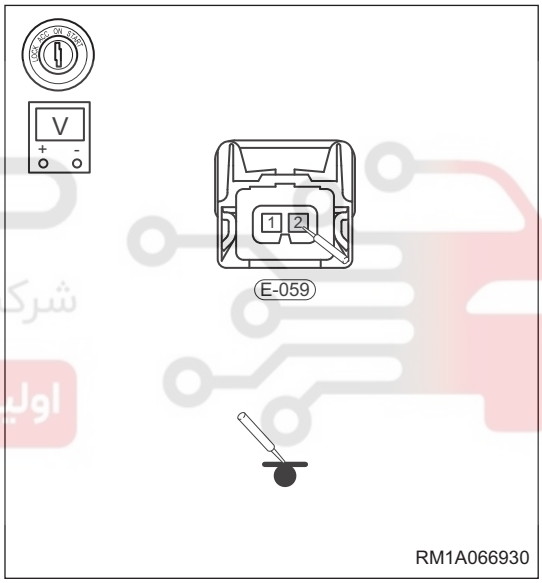
| 3 | Check exhaust gas control valve power supply voltage |
|---|---|

a. Turn ignition switch to ON.

b. Check voltage between connector terminal and body ground.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-059 (2) - Body ground | Ignition switch ON | 11 to 14 V |

NG → **Go to step 5**



RM1A066930

OK

| 4 | Check exhaust gas control valve power supply circuit and fuse EF34 (15A) |
|---|---|

a. Turn ignition switch to OFF.

b. Check if fuse EF34 (15A) is normal.

c. Disconnect the engine compartment fuse and relay box connector E-017.

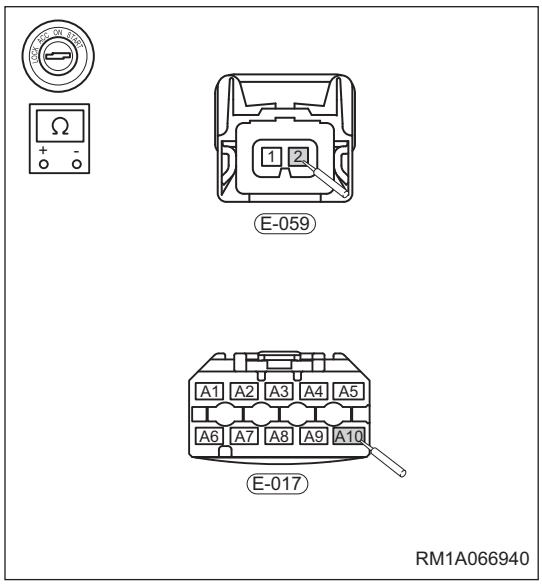
d. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-059 (2) - E-017 (A10) | Always | Continuity |

**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-059 (2) or E-055 (A10) - Body ground | Always | No continuity |
| E-059 (2) or E-055 (A10) - Battery positive | | |




NG → **Repair or replace wire harness or connector (exhaust gas control valve - engine compartment fuse and relay box)**

OK

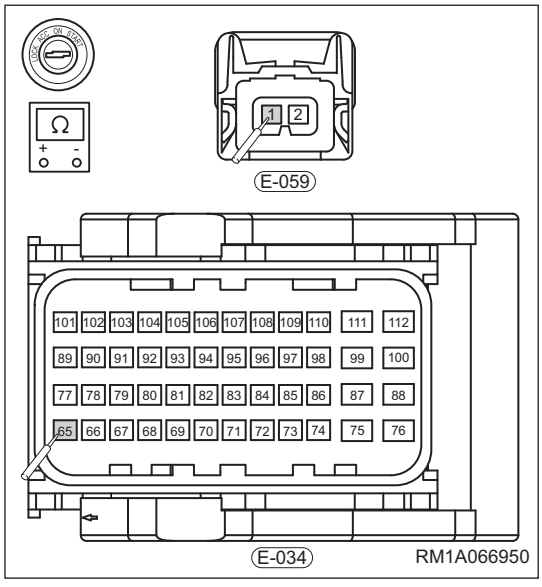
| 5 | Check exhaust gas control valve control circuit |
|---|---|

a. Disconnect the ECM connector E-034.

b. Check wire harness between connector terminals.

**Check for Open**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-059 (1) - E-034 (65) | Always | Continuity |



**Check for Short**

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| E-059 (1) or E-034 (65) - Body ground | Always | No continuity |
| E-059 (1) or E-034 (65) - Battery positive | | |

NG → **Repair or replace wire harness or connector (exhaust gas control valve - ECM)**

OK

| 6 | Check exhaust gas control valve |
|---|---|

a. Remove the exhaust gas control valve.

b. Check the exhaust gas control valve.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| Terminal 1 - Terminal 2 | Always | 23 Ω |

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

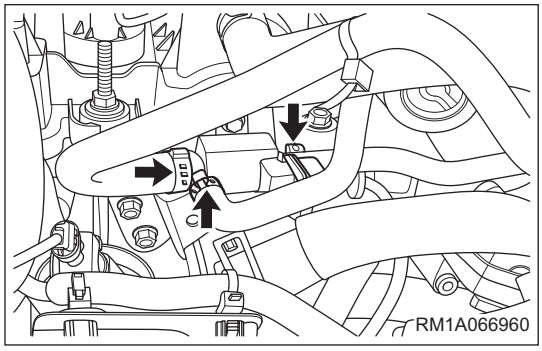
NG → **Replace exhaust gas control valve**

OK

| 7 | Check exhaust gas control valve line |
|---|---|

a. Check exhaust gas control valve line for blockage, air leakage, crush or damage.

NG → **Reinstall or replace exhaust gas control valve line**




OK

| | |
|---|---|
| 8 | **Check for DTCs** |

a. Using X-431 3G diagnostic tester, read ECM DTCs.

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0234 00, P0243 13, P0245 11 or P0246 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.**

# Engine Problem Symptom Diagnosis

Perform primary inspection first before performing malfunction diagnosis procedures:

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

Then, perform appearance inspection:

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

**HINT:**

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

## Diagnostic Help

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

## Problem Symptoms Table

| Symptom | Suspected Area | See page |
|---|---|---|
| Engine does not crank or cranks slowly while starting | Battery<br>Starter motor<br>Wire harness or ignition switch<br>Starter relay<br>ECM, TCM<br>Gear switch (CVT)<br>Engine mechanical | 06-257 |
| Engine cranks normally but cannot start successfully while starting | No fuel in tank<br>Fuel pump<br>Fuel injector<br>Engine speed sensor<br>Ignition coil<br>Engine immobilizer<br>ECM<br>Engine mechanical | 06-259 |

| Symptom | Suspected Area | See page |
|---|---|---|
| Difficult to start with hot engine | Water in fuel<br>Fuel pump<br>Coolant temperature sensor<br>Engine speed sensor<br>Ignition coil<br>Camshaft position sensor<br>Fuel injector<br>Engine mechanical | 06-261 |
| Engine starts normally, but idles roughly or stalls with partial load (for example, A/C is ON) | A/C system<br>Fuel injector | 06-273 |
| Engine starts normally, but idle speed is too high | Throttle<br>Vacuum pipe<br>Coolant temperature sensor<br>Ignition timing | 06-274 |
| Engine speed is too low or engine stalls when accelerating | Water in fuel<br>Intake pressure/temperature sensor<br>Intake pipe<br>Exhaust pipe<br>Ignition timing<br>Throttle position sensor<br>Fuel injector<br>Spark plug | 06-275 |
| Slow response when accelerating | Water in fuel<br>Intake pressure/temperature sensor<br>Intake pipe<br>Exhaust pipe<br>Ignition timing<br>Throttle position sensor<br>Fuel injector<br>Spark plug | 06-277 |

## Engine does not crank or cranks slowly while starting

| | |
|---|---|
| 1 | Check voltage between two posts of battery when engine starts |

- OK: Voltage is between 11.5 and 12.5 V

NG → Replace battery

OK →

| | |
|---|---|
| 2 | Check voltage of starter motor positive post |

a. With ignition switch in START position, check voltage of starter motor positive post.

- OK: Voltage is between 11.5 and 12.5 V

NG → Repair or replace starter relay, wire harness or ECM

OK →

| | |
|---|---|
| 3 | Check operation of starter |

a. Remove the starter.

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

NG → Repair or replace starter

OK →

| | |
|---|---|
| 4 | Check engine lubricant and gear oil |

a. If malfunction only occurs in winter, check if starter resistance is too strong due to improper engine lubricant and gear oil selection.

NG → Replace lubricant with appropriate number

OK →

| | |
|---|---|
| 5 | Check engine internal mechanical resistance |

a. Check if engine internal mechanical resistance is too strong, causing starter not to run or run slowly.

NG → Check and repair engine internal resistance malfunction

OK

Go to Diagnostic Help

## Engine cranks normally but cannot start successfully while starting

| | |
|---|---|
| 1 | **Check fuel pressure** |

a. Using a fuel pressure gauge, check the fuel pressure (See page 08-11).

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 diagnostic tester, start 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 ignition system** |

a. Remove ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start 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 compression of misfiring cylinder (See page 07-20).

NG → **Check engine to confirm cause of low compression**

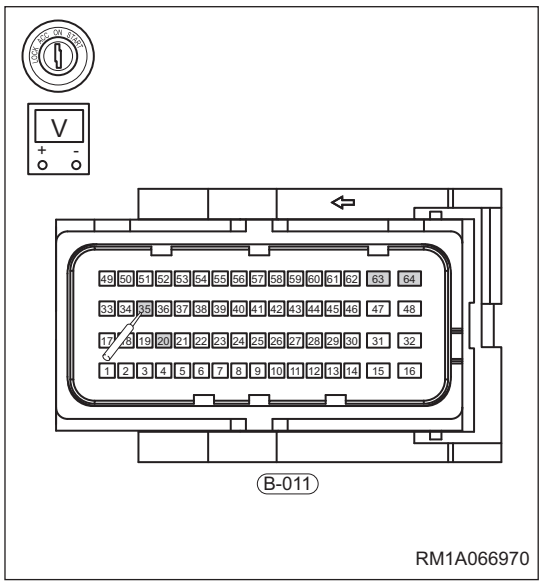
OK ↓

| 5 | Check ECM power supply and ground |
|---|---|

a. Disconnect the ECM connector B-011.

b. Turn ignition switch to ON and check ECM connector terminals.

| Multimeter Connection | Condition | Specified Condition |
|---|---|---|
| B-011 (35, 20) | Ignition switch ON | 11 to 14 V |
| B-011 (63, 64) | | 0 V |




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

OK

**Go to Diagnostic Help**

## Difficult to start with hot engine

| | |
|---|---|
| 1 | **Check fuel pressure** |

a. Using a fuel pressure gauge, check the fuel pressure (See page 08-11).

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 ignition system** |

a. Remove ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start 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 circuit or replace sensor**

OK ↓

| | |
|---|---|
| 4 | **Check pressure of cylinder** |

a. Measure compression of misfiring cylinder (See page 07-20).

NG → **Check engine to confirm cause of low compression**

OK ↓

| | |
|---|---|
| 5 | **Check fuel condition** |

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

NG → Replace fuel

OK

Go to Diagnostic Help

## Difficult to start with cold engine

| | |
|---|---|
| 1 | **Check fuel pressure** |

a. Using a fuel pressure gauge, check the fuel pressure (See page 08-11).

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 ignition system** |

a. Remove ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start 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 circuit or replace sensor**

OK ↓

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

NG → **Clean or replace throttle valve**

OK ↓

| | |
|---|---|
| 5 | **Check injector for leakage or blockage** |

NG → **Clean or replace injector**

OK

| | |
|---|---|
| 6 | Check fuel condition |

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

NG → Replace fuel

OK

| | |
|---|---|
| 7 | Check pressure of cylinder |

a. Measure compression of misfiring cylinder (See page 07-20).

NG → Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

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

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

NG → Check and repair intake system

OK ↓

| | |
|---|---|
| 2 | Check fuel pressure |

a. Using a fuel pressure gauge, check the fuel pressure (See page 08-11).

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 plug |

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

NG → Replace spark plug

OK ↓

| | |
|---|---|
| 4 | Check ignition system |

a. Remove ignition coil and spark plug of one cylinder, and ground the spark plug housing. Start 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 |

NG → Check and repair circuit or replace sensor

OK

| | |
|---|---|
| 6 | Depress accelerator pedal slightly, and observe if it is easy to start |

NG → Clean throttle

OK

| | |
|---|---|
| 7 | Check injector for leakage or blockage |

NG → Clean or replace injector

OK

| | |
|---|---|
| 8 | Check fuel condition |

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

NG → Replace fuel

OK

| | |
|---|---|
| 9 | Check pressure of cylinder |

a. Measure compression of misfiring cylinder (See page 07-20).

NG → Check engine to confirm cause of low compression

| | |
|---|---|
| 10 | Check engine ignition sequence and ignition timing |

a. Check if engine ignition sequence and ignition timing are as specified.

NG → Check and repair ignition timing

OK

Go to Diagnostic Help

## Engine starts normally, but idles roughly at anytime

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

NG → Check and repair intake system

OK

| | |
|---|---|
| 2 | Check if throttle is stuck |

NG → Repair or replace throttle

OK

| | |
|---|---|
| 3 | Check spark plug |

a. Check spark plug of each cylinder, and observe if 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 trouble occurs just after fuel is filled.

NG → Replace fuel

OK

| | |
|---|---|
| 7 | **Check pressure of cylinder** |

a. Measure compression of misfiring cylinder (See page 07-20).

NG → **Check engine to confirm cause of low compression**

OK ↓

| | |
|---|---|
| 8 | **Check engine ignition sequence and ignition timing** |

a. Check if engine ignition sequence and ignition timing are as specified.

NG → **Check and repair ignition timing**

OK ↓

**Go to Diagnostic Help**

## Engine starts normally, but idles roughly during warming up

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

NG → Check and repair intake system

OK ↓

| | |
|---|---|
| 2 | Check spark plug |

a. Check spark plug of each cylinder, and observe if 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 |

NG → Check and repair circuit or replace sensor

OK ↓

| | |
|---|---|
| 5 | Check injector for leakage or blockage |

NG → Clean or replace injector

OK ↓

| | |
|---|---|
| 6 | Check fuel condition |

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

NG → Replace fuel

OK ↓

| | |
|---|---|
| 7 | **Check pressure of cylinder** |

a. Measure compression of misfiring cylinder (See page 07-20).

NG → **Check engine to confirm cause of low compression**

OK →

**Go to Diagnostic Help**

## Engine starts normally, but idles roughly after warming up

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

NG → Check and repair intake system

OK ↓

| | |
|---|---|
| 2 | Check spark plug |

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

NG → Replace spark plug

OK ↓

| | |
|---|---|
| 3 | Unplug coolant temperature sensor connector, start engine and observe if engine idles normally during warming up |

NG → Check and repair circuit or replace sensor

OK ↓

| | |
|---|---|
| 4 | Check injector for leakage or blockage |

NG → Clean or replace injector

OK ↓

| | |
|---|---|
| 5 | Check fuel condition |

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

NG → Replace fuel

OK ↓

| | |
|---|---|
| 6 | Check pressure of cylinder |

a. Measure compression of misfiring cylinder (See page 07-20).

NG → Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

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

| | |
|---|---|
| 1 | Check throttle for carbon deposits |

NG → Clean throttle

OK ↓

| | |
|---|---|
| 2 | Observe if engine output increases when A/Cis turned on. In other words, observe changes of ignition advance angle, injection pulse width and intake air volume using diagnostic tester |

NG → Go to step 5

OK ↓

| | |
|---|---|
| 3 | Check if A/C compressor pump resistance increases |

NG → Check and repair or replace A/C system

OK ↓

| | |
|---|---|
| 4 | Observe if engine speed increases when A/Cis turned on |

NG → Replace ECM

OK ↓

| | |
|---|---|
| 5 | Check injector for leakage or blockage |

NG → Clean or replace injector

OK ↓

Go to Diagnostic Help

## Engine starts normally, but idle speed is too high

| | |
|---|---|
| 1 | Check if accelerator pedal is stuck |

NG → Adjust or replace accelerator pedal

OK ↓

| | |
|---|---|
| 2 | Check intake system and connected vacuum pipe for air leakage |

NG → Check and repair intake system

OK ↓

| | |
|---|---|
| 3 | Check throttle for carbon deposits |

NG → Clean or replace throttle valve

OK ↓

| | |
|---|---|
| 4 | Disconnect coolant temperature sensor connector, start engine and observe if engine idle is normal |

NG → Check and repair circuit or replace sensor

OK ↓

| | |
|---|---|
| 5 | Check engine ignition timing |

NG → Check and repair ignition timing

OK ↓

Go to Diagnostic Help

## Engine speed is too low or engine stalls when accelerating

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

NG → Check and repair intake system

OK ↓

| | |
|---|---|
| 2 | Check fuel pressure |

a. Using a fuel pressure gauge, check the fuel pressure (See page 08-11).

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 plug |

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

NG → Replace spark plug

OK ↓

| | |
|---|---|
| 4 | Check throttle for carbon deposits |

NG → Clean throttle

OK ↓

| | |
|---|---|
| 5 | Check intake pressure/temperature sensor, throttle position sensor and circuit |

NG → Check and repair circuit or replace sensor

OK ↓

| | |
|---|---|
| 6 | Check injector for leakage or blockage |

NG → Clean or replace injector

OK

| | |
|---|---|
| 7 | Check fuel condition |

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

NG → Replace fuel

OK

| | |
|---|---|
| 8 | Check engine ignition sequence and ignition timing |

a. Check if engine ignition sequence and ignition timing are as specified.

NG → Check and repair ignition timing

OK

| | |
|---|---|
| 9 | Check exhaust system |

a. Check exhaust system for leakage or blockage.

NG → Repair or replace related exhaust system components

OK

Go to Diagnostic Help

## Slow response when accelerating

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

NG → Check and repair intake system

OK ↓

| | |
|---|---|
| 2 | Check fuel pressure |

a. Using a fuel pressure gauge, check the fuel pressure (See page 08-11).

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 plug |

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

NG → Replace spark plug

OK ↓

| | |
|---|---|
| 4 | Check throttle for carbon deposits |

NG → Clean throttle

OK ↓

| | |
|---|---|
| 5 | Check intake pressure/temperature sensor, throttle position sensor and circuit |

NG → Check and repair circuit or replace sensor

OK ↓

| | |
|---|---|
| 6 | Check injector for leakage or blockage |

NG → Clean or replace injector

OK

| | |
|---|---|
| 7 | Check fuel condition |

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

NG → Replace fuel

OK

| | |
|---|---|
| 8 | Check engine ignition sequence and ignition timing |

a. Check if engine ignition sequence and ignition timing are as specified.

NG → Check and repair ignition timing

OK

| | |
|---|---|
| 9 | Check exhaust system |

a. Check exhaust system for leakage or blockage.

NG → Repair or replace related exhaust system components

OK

Go to Diagnostic Help

## Lack of power and poor performance when accelerating

| | |
|---|---|
| 1 | Check if malfunctions that clutch slipping, low tire inflation pressure, brake dragging, incorrect tire size, and incorrect four-wheel alignment are present |

NG → Check and repair faulty components

OK ↓

| | |
|---|---|
| 2 | Check air filter for blockage, and intake pipe for air leakage |

NG → Check and repair intake system

OK ↓

| | |
|---|---|
| 3 | Check fuel pressure |

a. Using a fuel pressure gauge, check the fuel pressure (See page 08-11).

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 plug |

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

NG → Replace spark plug

OK ↓

| | |
|---|---|
| 5 | Check ignition system |

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

- OK: Spark is generated

NG → Check and repair ignition system

OK

| | |
|---|---|
| 6 | Check throttle for carbon deposits |

NG → Clean throttle

OK

| | |
|---|---|
| 7 | Check intake pressure/temperature sensor, throttle position sensor and circuit |

NG → Check and repair circuit or replace sensor

OK

| | |
|---|---|
| 8 | Check injector for leakage or blockage |

NG → Clean or replace injector

OK

| | |
|---|---|
| 9 | Check fuel condition |

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

NG → Replace fuel

OK

| | |
|---|---|
| 10 | Check engine ignition sequence and ignition timing |

a. Check if engine ignition sequence and ignition timing are as specified.

NG → Check and repair ignition timing

OK

| | |
|---|---|
| 11 | Check exhaust system |

a. Check exhaust system for leakage or blockage.

NG → Repair or replace related exhaust system components

OK

Go to Diagnostic Help

# ON-VEHICLE SERVICE

## VVT Control Valve

### Description

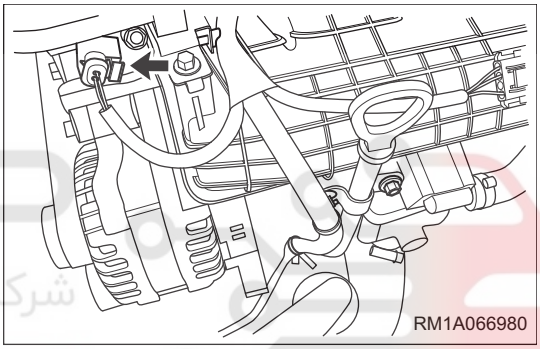
There are two VVT control valves, which are located on front end of intake and exhaust camshafts.

### Operation

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

### Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the VVT control valve (take intake VVT as an example).
   a. Disconnect intake VVT control valve connector (arrow), and then remove intake VVT control valve fixing bolt (1).
      (Tightening torque: 8 ± 2 N·m)




### Installation

Installation is in the reverse order of removal.

# Coolant Temperature Sensor

## Description

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

## Operation

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

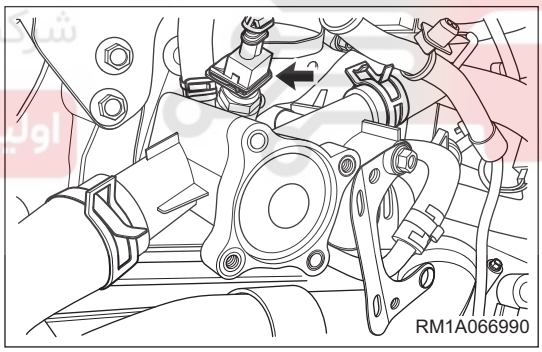
## Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.

**⚠ WARNING**

- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system overheats. The overheated engine coolant and steam with high-pressure may flow out and cause serious personal injury.

3. Remove the engine trim cover.
4. Disconnect coolant temperature sensor connector and remove coolant temperature sensor (arrow).
   (Tightening torque: 14 ± 1 N·m)




## Installation

Installation is in the reverse order of removal.

**CAUTION**

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

# Knock Sensor

## Description

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

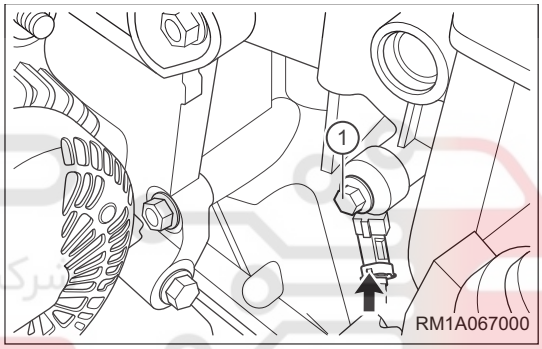
## Operation

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 sensor. Due to pressure generated by vibration of mass block, the piezoelectric ceramic generates a voltage at both electrode faces, and converts the vibration signal to an AC voltage signal to output it. As intensity of vibration increases, knock sensor output voltage increases accordingly.

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

## Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Disconnect knock sensor connector (arrow) and remove knock sensor fixing bolt (1).
   (Tightening torque: 20 ± 5 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 engine block directly.
- DO NOT apply lubricant, grease or seal gum when installing knock sensor. Keep engine block clean and dry, and never allow any foreign matter (such as oil) on the installation area of knock sensor.
- Never tap knock sensor when installing it.

# Oxygen Sensor

## Description

Oxygen sensors consist of upstream oxygen sensor and downstream oxygen sensor. Oxygen sensors continually monitor the oxygen concentration in exhaust gas.

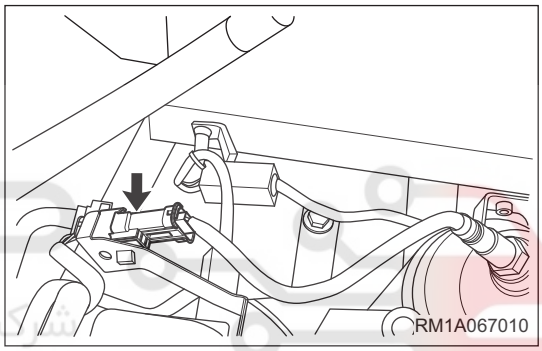
## Operation

Oxygen sensors monitor oxygen content and convert it into voltage. The sensor generates low voltage when oxygen content is high, and high voltage when oxygen content is low. Therefore, sensor acts as controlling injection volume by closed-loop.

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

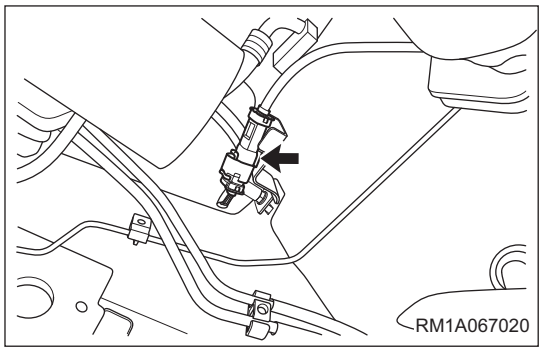
## Upstream Oxygen Sensor

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




## Downstream Oxygen Sensor

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




## Removal & Installation - Upstream Oxygen Sensor

(See page 09-13).

## Removal & Installation - Downstream Oxygen Sensor

(See page 09-15).

# Camshaft Position Sensor

## Description

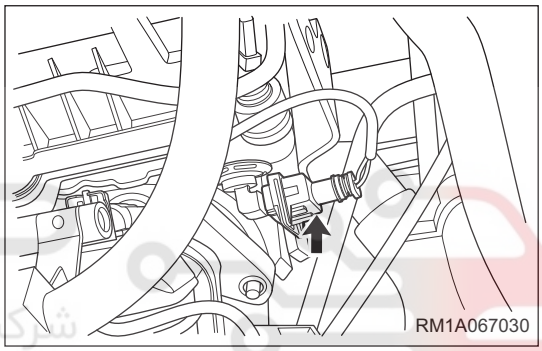
Camshaft position sensor is installed on cylinder head behind camshaft.

## Operation

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

## Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the camshaft position sensor (take intake side as an example).
   a. Disconnect camshaft position sensor connector (arrow), and then remove camshaft position sensor fixing bolt.
      (Tightening torque: 8 ± 1 N·m)




## Installation

Installation is in the reverse order of removal.

**CAUTION**

- Sensor should be pressed into mounting hole. Never use tools (such as a hammer) to strike sensor into mounting hole forcibly.

# Engine Speed Sensor

## Description

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

## Operation

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

## Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Remove the engine speed sensor.
   a. Disconnect engine speed sensor connector, and remove engine speed sensor fixing bolt.
   (Tightening torque: 8 ± 2 N·m)

## Installation

Installation is in the reverse order of removal.

**CAUTION**

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

# Boost Pressure/Temperature Sensor

## Description

Boost pressure/temperature sensor integrates with the boost pressure sensor and intake temperature sensor, which is installed on the boost intercooler.

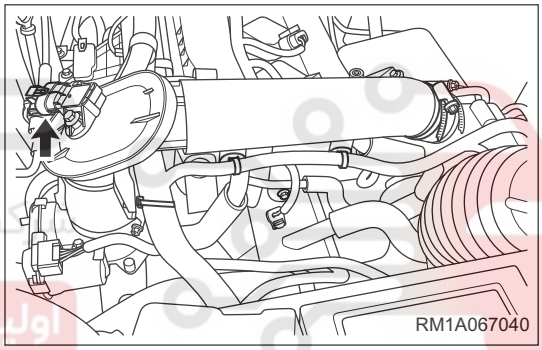
## Operation

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

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

## Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the engine trim cover.
4. Disconnect the boost pressure/temperature sensor connector (arrow).




5. Remove boost pressure/temperature sensor fixing bolt, and remove boost pressure/temperature sensor. (Tightening torque: 6 ± 1 N·m)

## Installation

Installation is in the reverse order of removal.

**CAUTION**

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

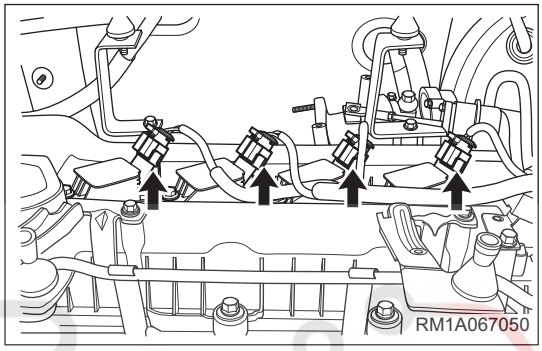
# Ignition Coil

## Description

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

## Operation

Ignition coil consists of primary winding, secondary winding, iron core and housing etc. The primary and secondary windings form an induced circuit. An instant induced voltage generated by turning primary circuit switch on and off, and an instant high voltage generated by secondary circuit will cause spark plugs to discharge, thus igniting the combustible air-fuel mixture. Primary winding will recharge when its ground channel is engaged through an Engine Control Module (ECM) signal. Once 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.




## Removal & Installation

(See page 14-8).

# Electronic Accelerator Pedal Sensor

## Description

Accelerator pedal is installed to cowl of the body, and accelerator pedal sensor is located inside the accelerator pedal.

## Operation

Accelerator pedal sensor outputs the electrical signal which varies linearly depending on the pedal travel to ECM, in order to detect position of the accelerator pedal.

ECM adjusts opening angle of the electronic throttle according to this signal and other information to meet the intake requirements under different operating conditions.

## Removal & Installation

(See page 10-33).

# Electric Fuel Pump

## Description

Electric fuel pump consists of DC motor, vane pump and end cover (integrated with check valve, pressure regulator and anti-electromagnetic interference element) etc. 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

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

## Removal & Installation

(See page 08-15).

# Fuel Injector

## Description

Fuel injector is located on the cylinder head near to one end of intake valve, and nozzle end is located directly above the intake port.

## Operation

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

## Removal & Installation

(See page 08-26).

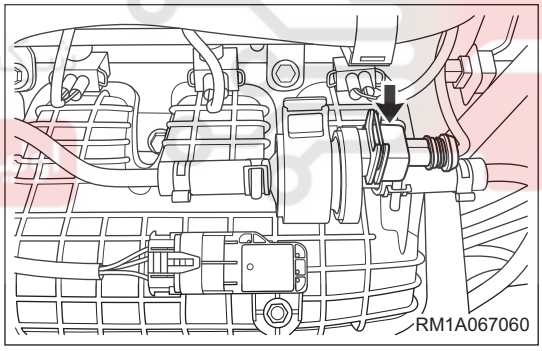
# Canister Solenoid Valve

## Description

Canister solenoid valve opens when power is on, and closes when power is off.

## Operation

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




## Removal & Installation

(See page 09-9).

# Engine Control Module (ECM)

## Description

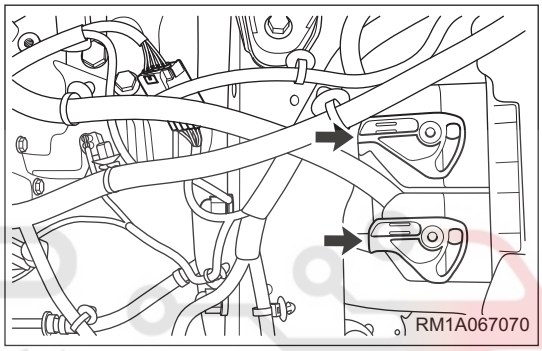
Engine Control Module (ECM), mounted on the left side rail wheel housing assembly in engine compartment, can be removed only as a unit for replacement.

## Operation

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

## Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the Engine Control Module (ECM).
   a. Remove 4 ECM fixing bolts.
   b. Disconnect ECM connectors (arrow), and remove ECM.
      (Tightening torque: 7 ± 1 N·m)




## Installation

Installation is in the reverse order of removal.

**CAUTION**

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

- MEMO -