SQRD4G15B ENGINE MANAGEMENT SYSTEM

GENERAL INFORMATION

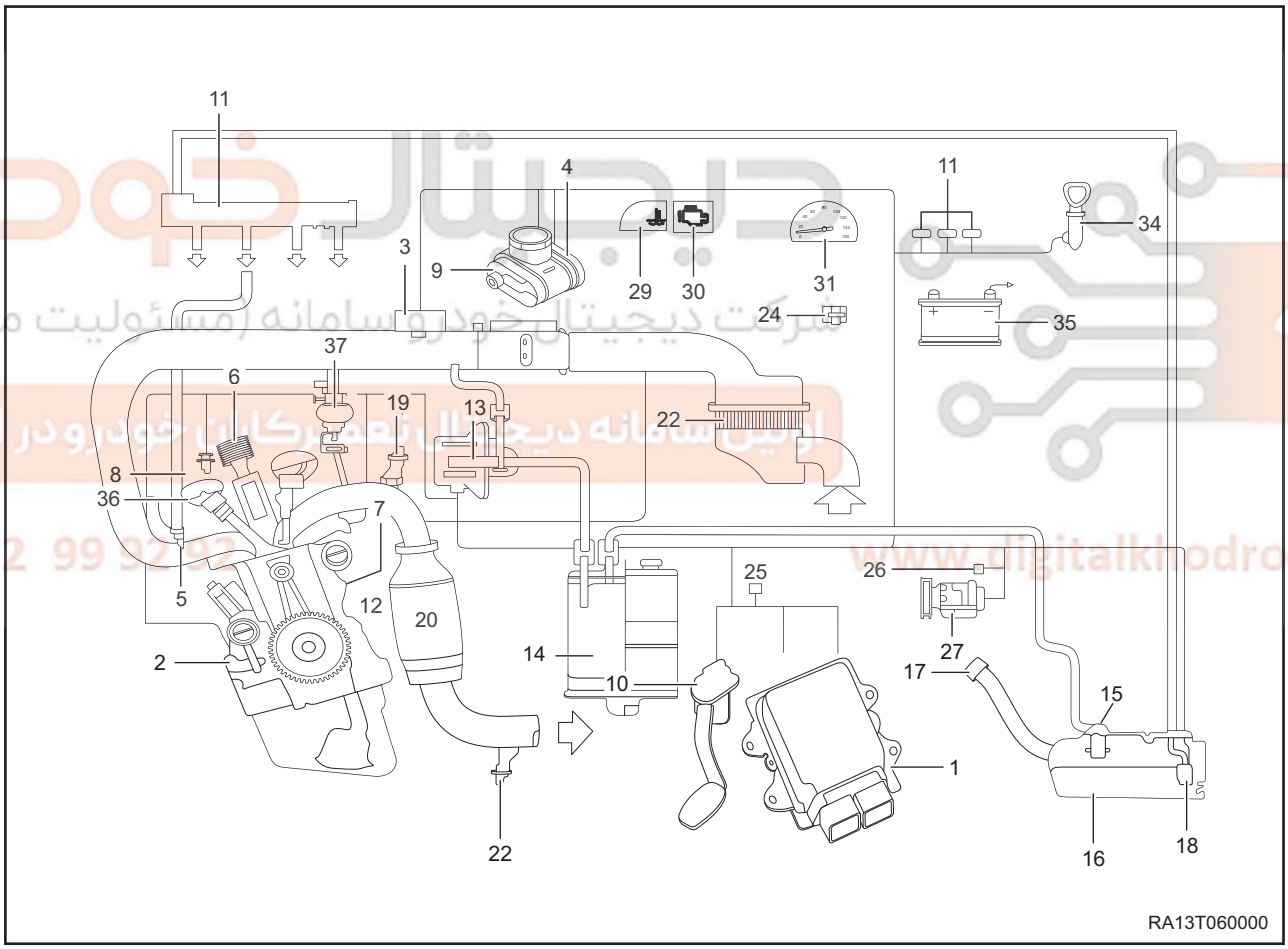
Description

Engine of A13T model adopts Marelli 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 and recall "Limp Home" function. When detecting that fault has been eliminated, it will return to use normal value.

Basic Components of Engine Management System



1 - Engine Control Unit	2 - Speed Sensor
3 - Intake Pressure/Temperature Sensor	4 - Electronic Throttle Body
5 - Injector	6 - Ignition Coil
7 - Coolant Temperature Sensor	8 - Camshaft Position Sensor
9 - Throttle Position Sensor	10 - Electronic Accelerator Pedal
11 - Oil Rail	12 - Knock Sensor
13 - Canister Solenoid Valve	14 - Canister
15 - Fuel Tank Cap	16 - Fuel Tank
17 - Fuel Seal Cover	18 - Fuel Pump
19 - Upstream Oxygen Sensor	20 - Precatalytic Converter
21 - Downstream Oxygen Sensor	22 - Air Filter
23 - EGR Valve	24 - OBD Diagnostic Interface
25 - Brake Switch	26 - A/C Compressor Relay
27 - A/C Compressor	28 - Battery
29 - Instrument Cluster Fuel Level Indictor	30 - Warning Light
31 - Engine Tachometer	32 - Fuse
33 - VVT Driver	34 - Ignition Switch

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 No.1 cylinder 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 group 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 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 ECM temperature 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

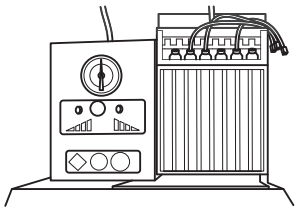
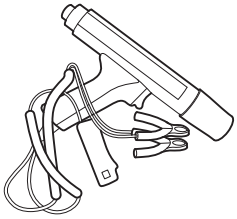
Description	Torque (N·m)
Coolant Temperature Sensor	14 ± 1
Intake Pressure/Temperature Sensor Fixing Bolt	6 ± 1
Knock Sensor Fixing Bolt	20 ± 5
Engine Speed Sensor Fixing Bolt	8 ± 2
Camshaft Position Sensor Fixing Bolt	8 ± 1
VVT Control Valve Fixing Bolt	8 ± 2
ECM Fixing Bolt	7 ± 1

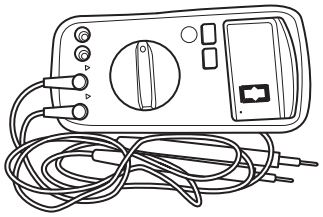
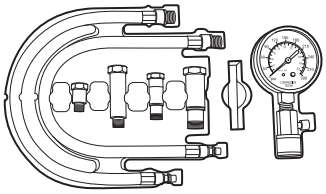
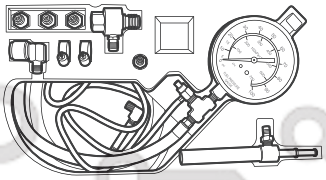
Tools

Special Tool

X-431 3G Diagnostic Tester	 RCH0000001

General Tools

X-431 3G 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 A

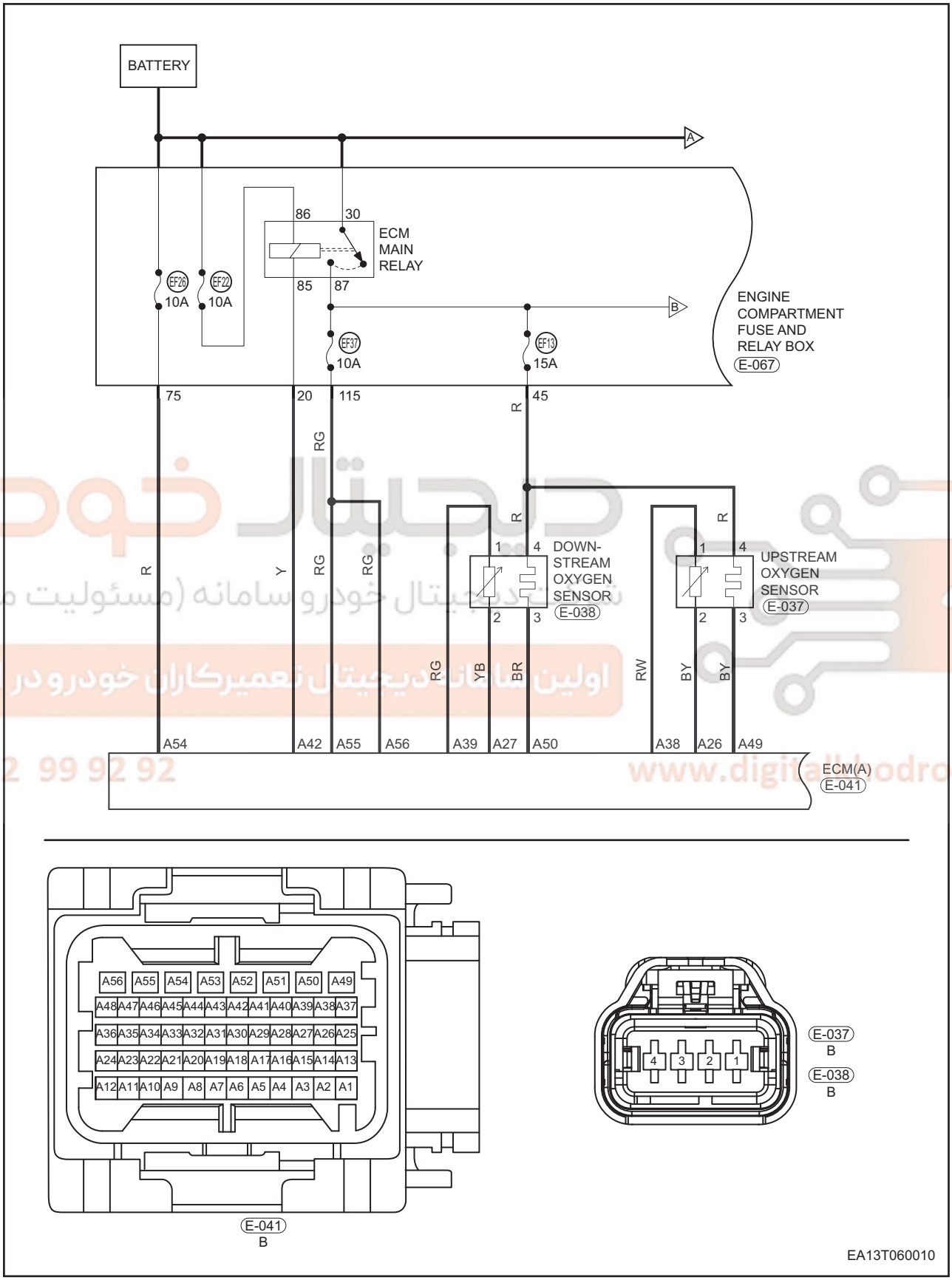
Terminal No.	Definition	Terminal No.	Definition
A1	Electronic Accelerator Pedal 2 Sensor	A29	Cruise Switch Ground
A2	-	A30	Electronic Accelerator Pedal 2 Power
A3	Cruise Switch Signal	A31	-
A4	A/C Middle Pressure Switch	A32	-
A5	Brake Switch 2	A33	-
A6	A/C Switch	A34	Thermostat
A7	Starter Relay Control	A35	-
A8	-	A36	-
A9	-	A37	-
A10	-	A38	Sensor Ground
A11	CAN1-H	A39	Sensor Ground
A12	-	A40	Electronic Accelerator Pedal 1 Ground
A13	Electronic Accelerator Pedal 1 Sensor	A41	-
A14	-	A42	Main Relay Coil
A15	-	A43	Low-speed Fan
A16	Clutch Pedal Switch	A44	A/C Compressor Relay
A17	Brake Switch 1	A45	Fuel Pump Relay
A18	-	A46	High-speed Fan
A19	-	A47	-
A20	-	A48	-
A21	Ground	A49	Upstream Oxygen Sensor Heating
A22	Ignition Switch (ON)	A50	Downstream Oxygen Sensor Heating
A23	CAN1-L	A51	-
A24	-	A52	Ground 1
A25	Ignition Switch (Start)	A53	Ground 2
A26	Upstream Oxygen Sensor	A54	Battery Power Supply
A27	Downstream Oxygen Sensor	A55	Noncontinuous Power Supply
A28	Electronic Accelerator Pedal 2 Ground	A56	Noncontinuous Power Supply

ECM Connector B

Terminal No.	Definition	Terminal No.	Definition
B1	-	B29	EGR Sensor Power
B2	-	B30	Throttle Position Sensor (+)
B3	Power Steering Pump	B31	Throttle Position Sensor (-)
B4	Coolant Temperature Sensor Ground	B32	EGR Sensor Ground
B5	Knock Sensor (+)	B33	Sensor Ground
B6	Throttle Position Sensor 2	B34	-
B7	Intake Temperature Sensor Signal	B35	Injector 3
B8	EGR Sensor Signal	B36	Injector 1
B9	-	B37	-
B10	-	B38	Variable Camshaft Timing
B11	-	B39	Ignition Coil Drive
B12	Engine Speed Sensor	B40	Engine Speed Sensor (+)
B13	Camshaft Position Sensor	B41	Camshaft Position Sensor (+)
B14	-	B42	-
B15	A/C High/Low Pressure Switch	B43	-
B16	Camshaft Position Sensor (-)	B44	-
B17	Knock Sensor (-)	B45	-
B18	Throttle Position Sensor 1	B46	-
B19	Intake Pressure Sensor Signal	B47	Injector 4
B20	-	B48	Injector 2
B21	Coolant Temperature Sensor Signal	B49	-
B22	-	B50	Alternator
B23	-	B51	Throttle Actuator (-)
B24	Engine Speed Sensor (-)	B52	Throttle Actuator (+)
B25	-	B53	Ignition Coil 4
B26	EGR Valve Control	B54	Ignition Coil 3
B27	-	B55	Ignition Coil 2
B28	Intake Pressure Sensor Power	B56	Ignition Coil 1

Circuit Diagram

Engine Management System (Page 1 of 9)



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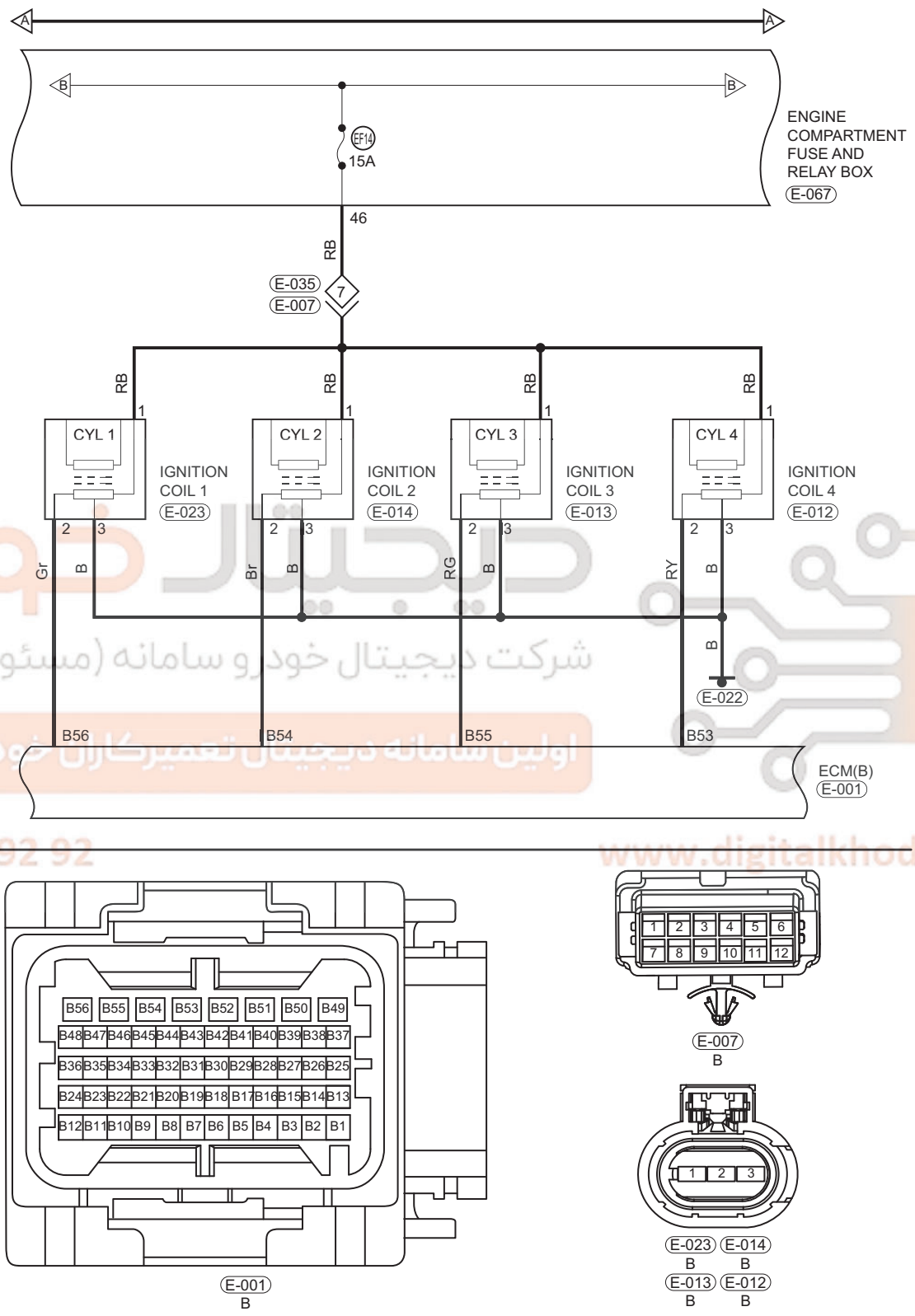

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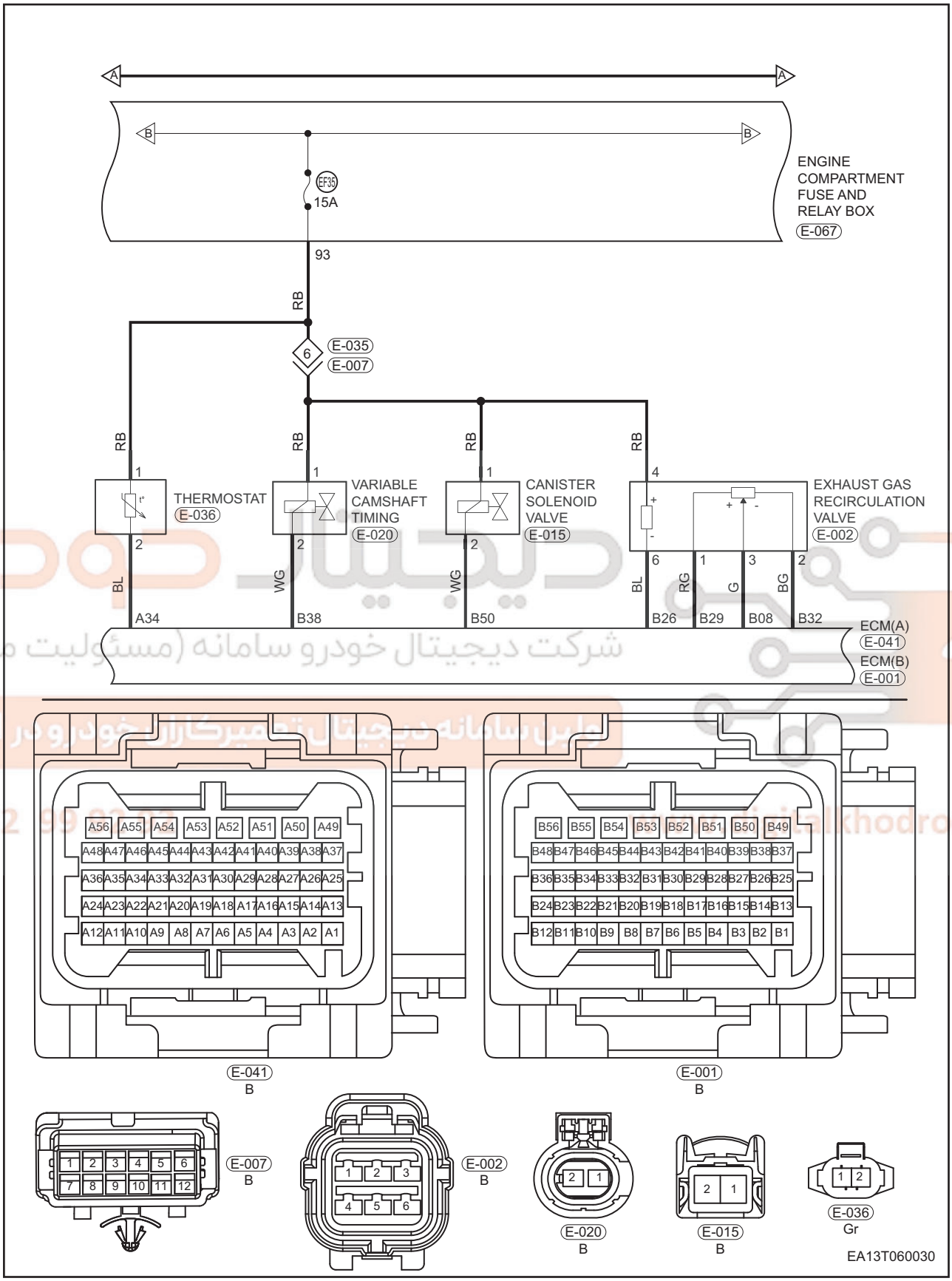

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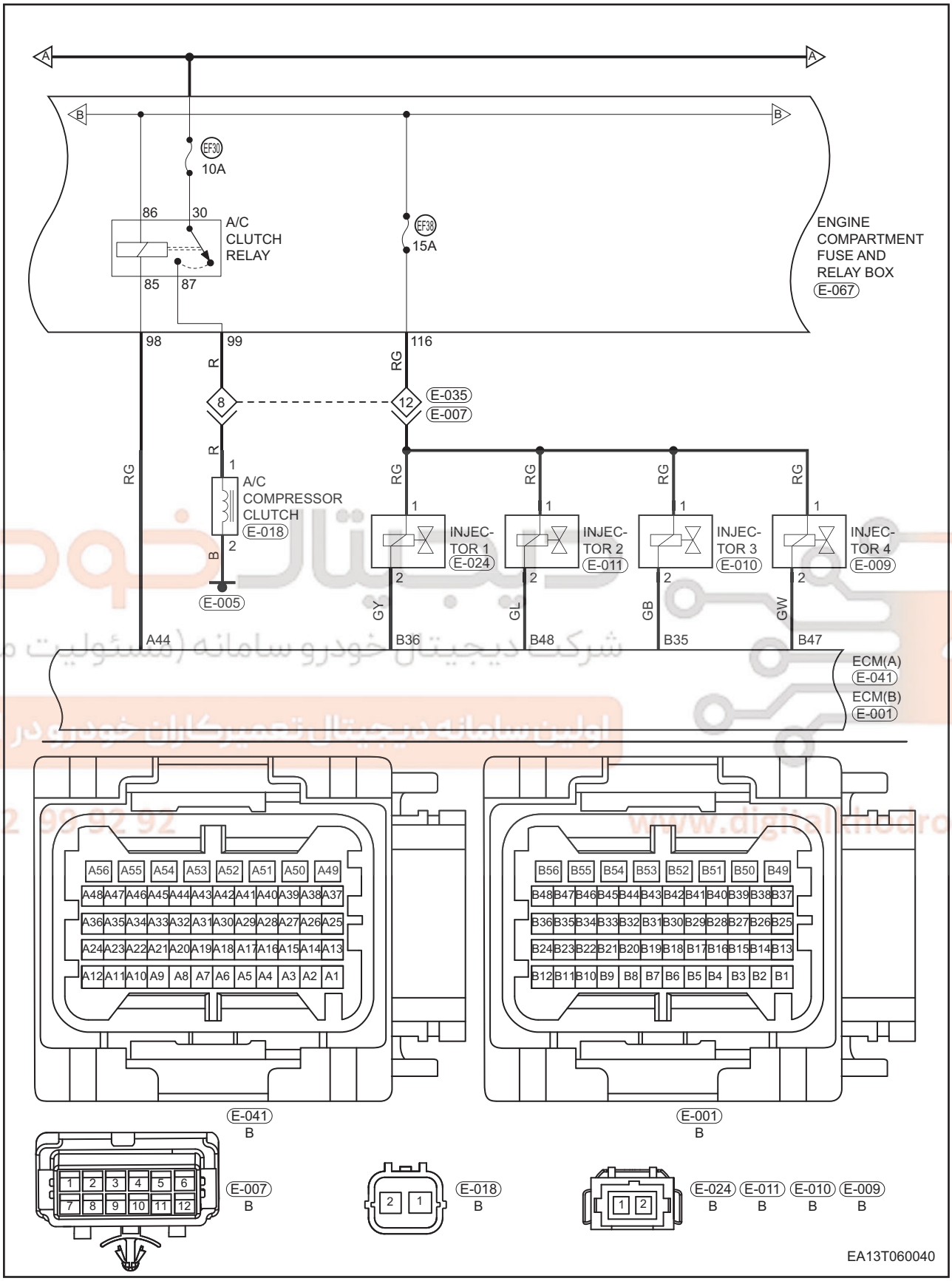

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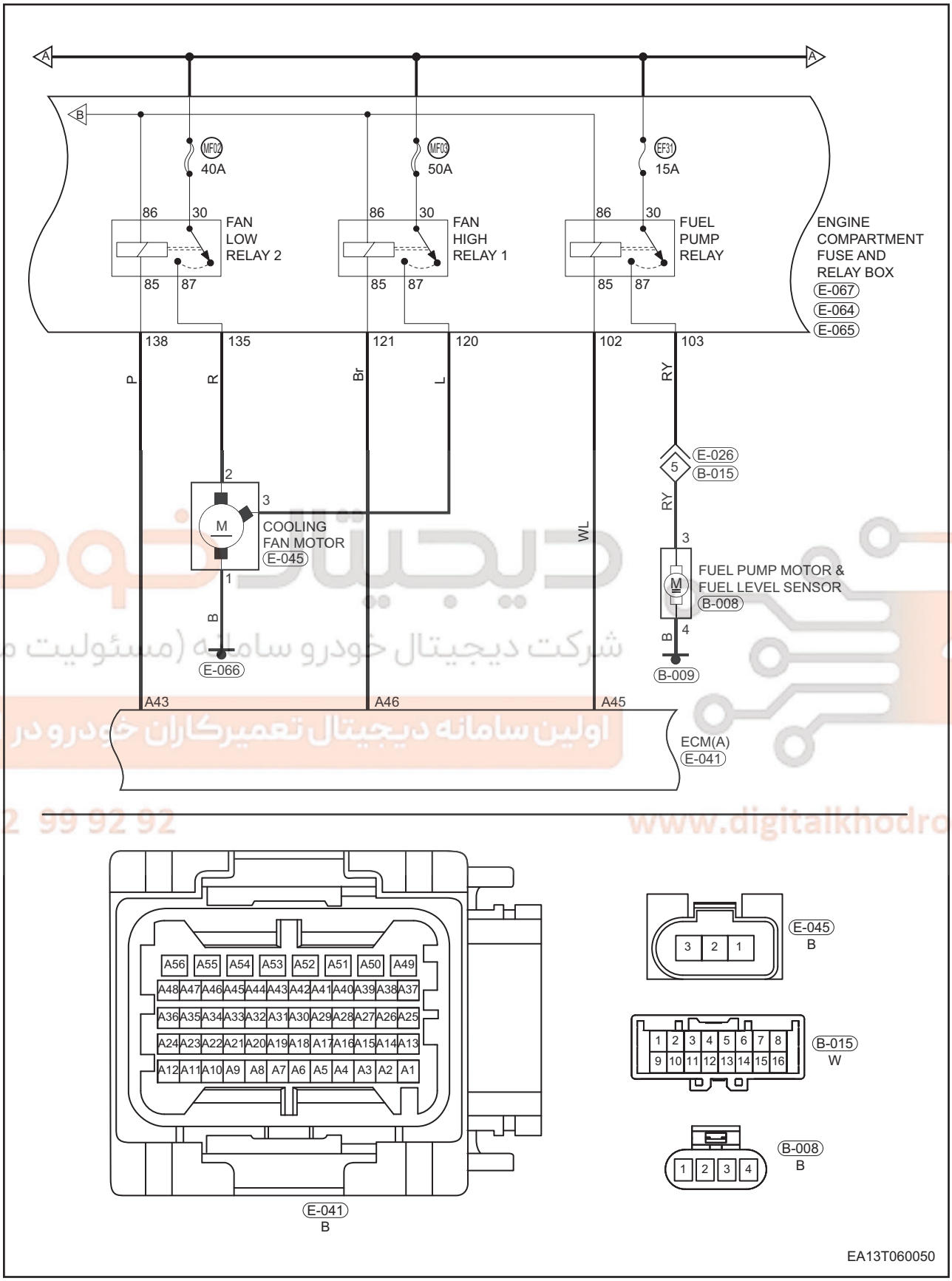

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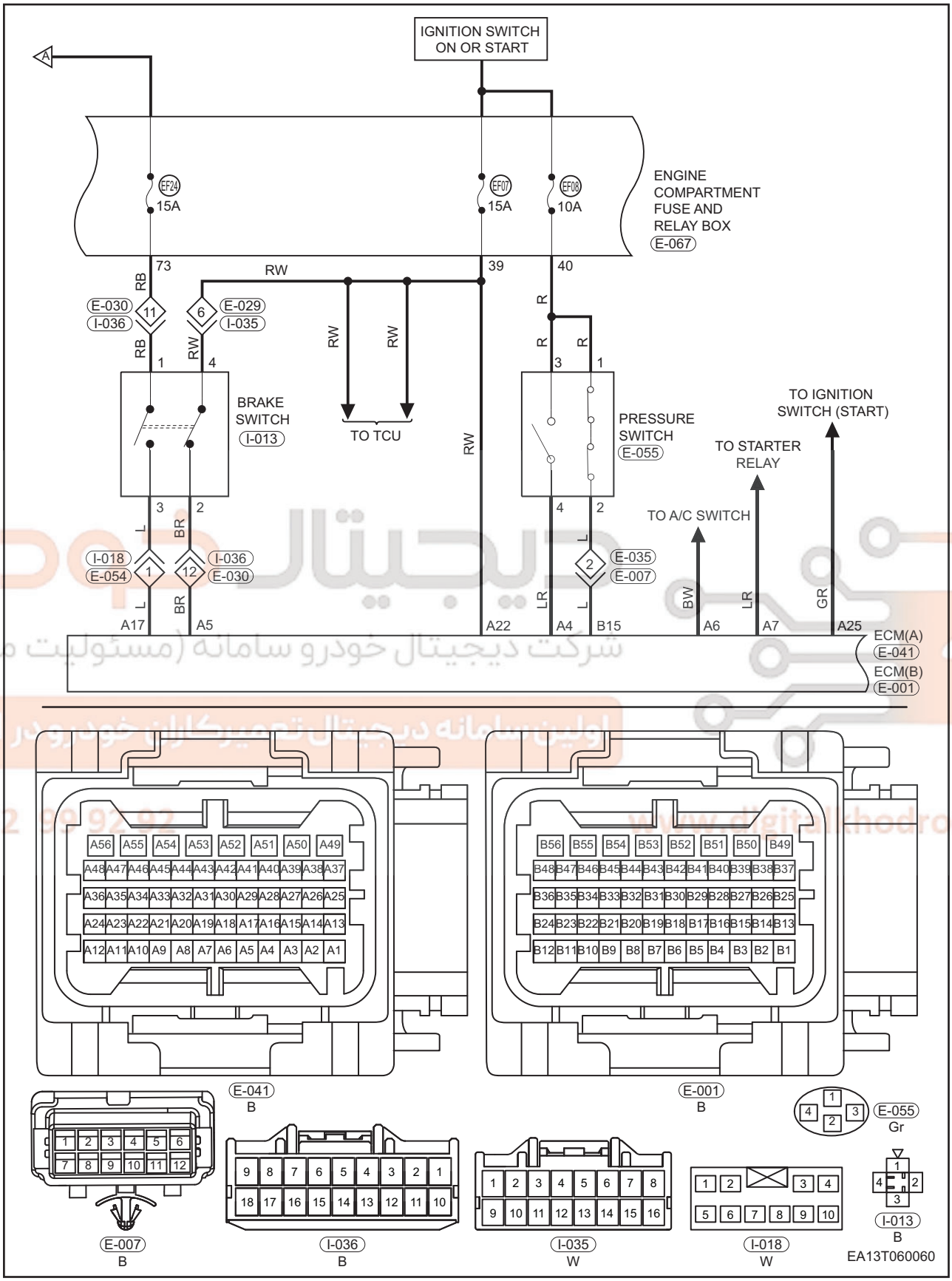

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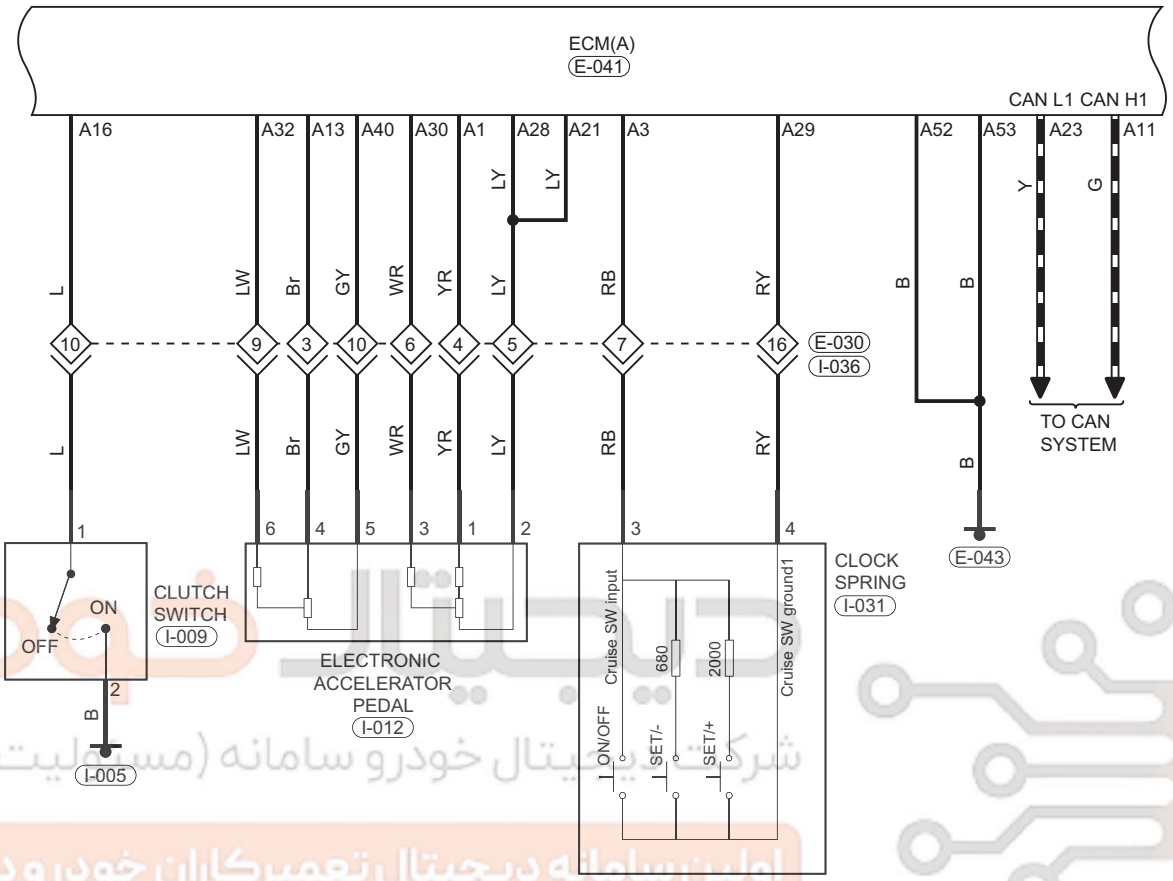

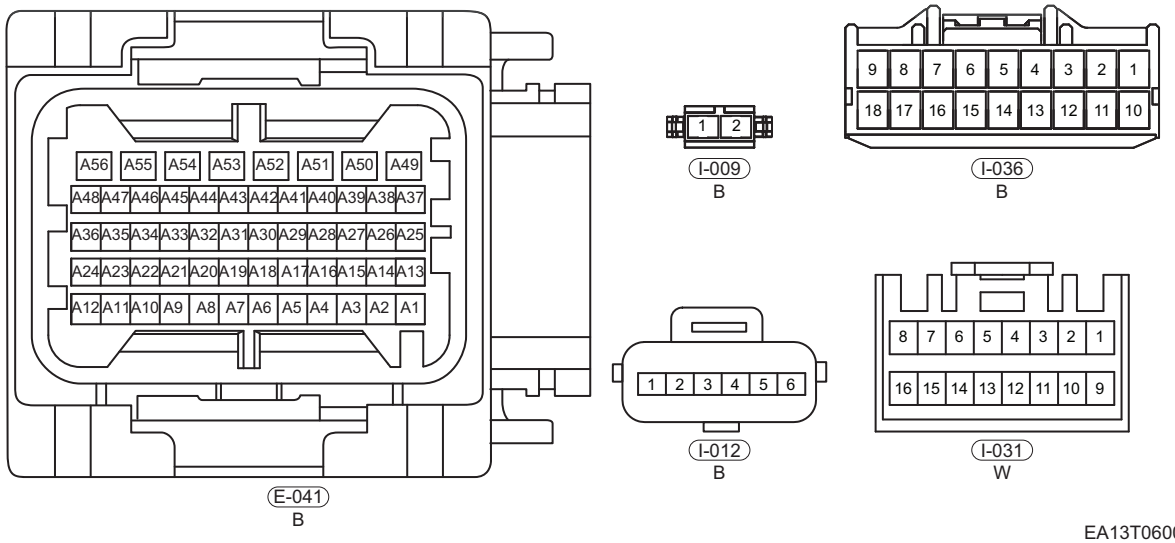

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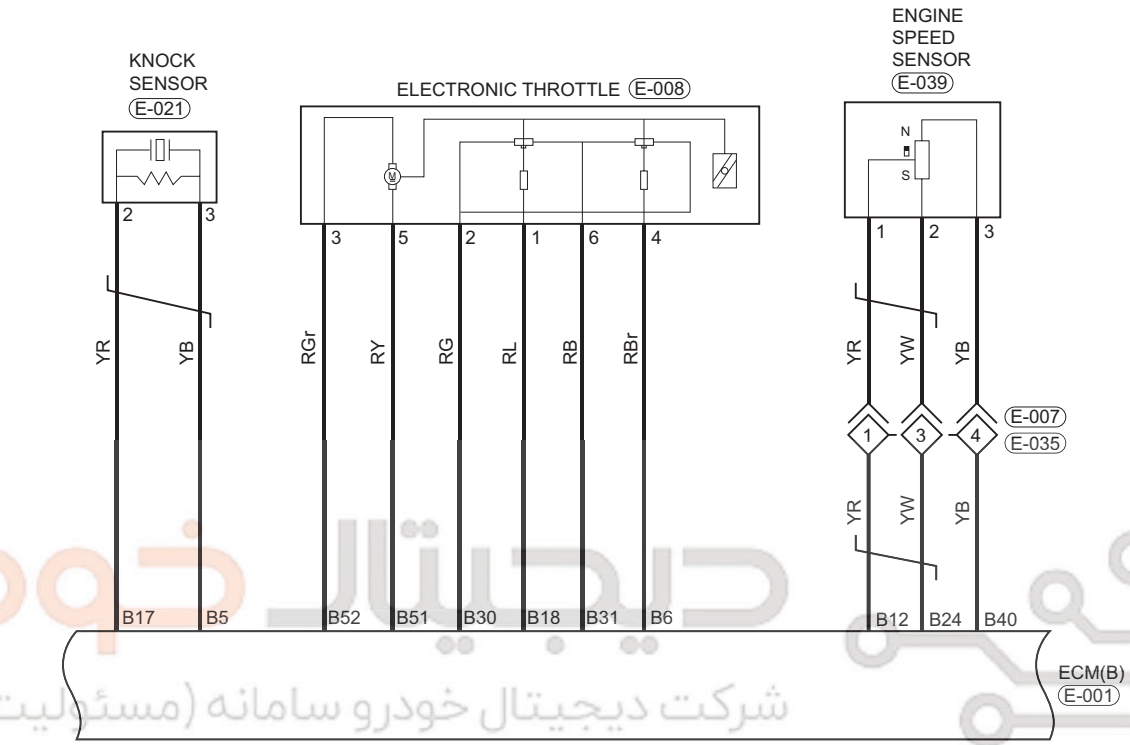

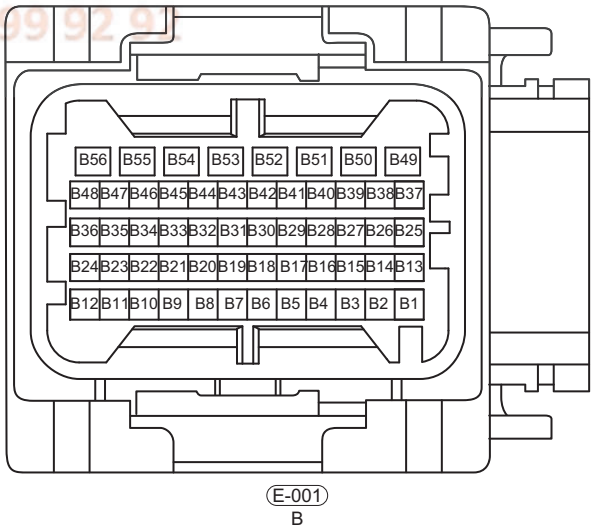

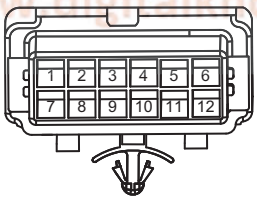

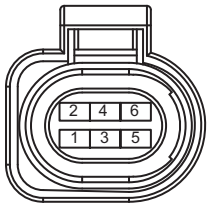

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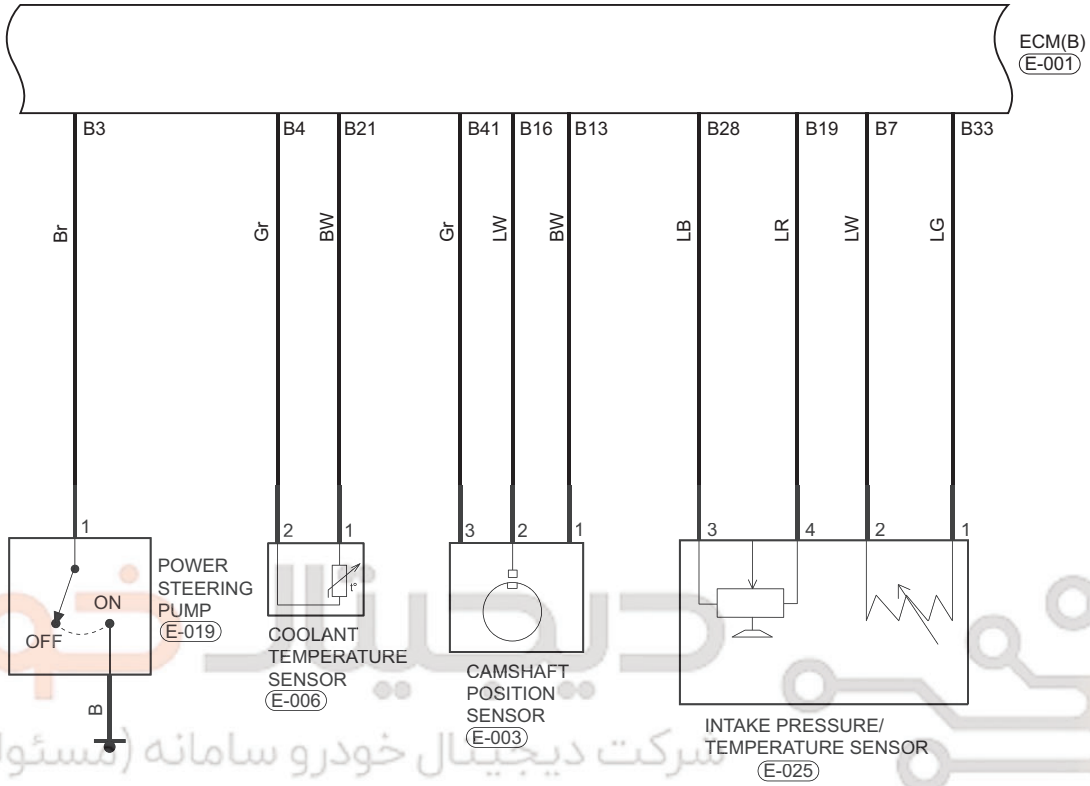
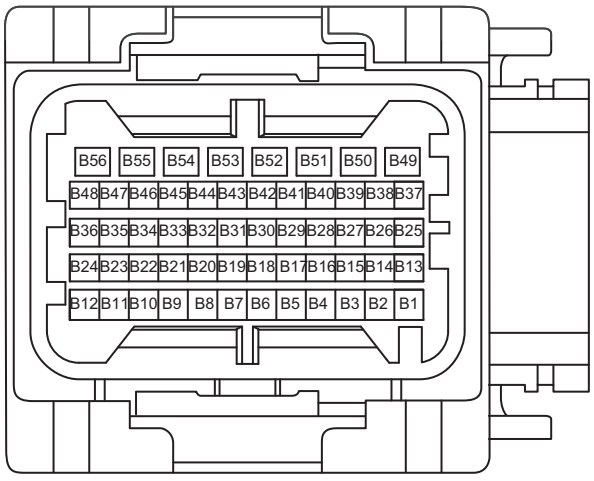
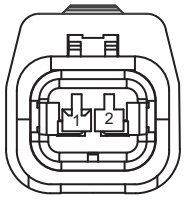




E-001
B



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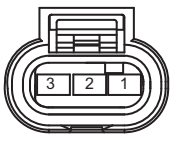

E-003
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E-019
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E-025
B

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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, the 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 the 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, refer to circuit diagrams to 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 harnesses and connectors and observe if related circuit signal is interrupted.
- If possible, try to duplicate the conditions under which DTC was set.
- Look for data that has changed or DTC to reset during wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect sensors and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
- Use data recorder and/or oscilloscope to help diagnose intermittent malfunctions.
- Remove the Engine Control Module (ECM) from malfunctioning vehicle and install it to a new vehicle to perform a test. If DTC cannot be cleared, ECM is malfunctioning. If DTC can be cleared, reinstall 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 if they are installed correctly. 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:

- 100.5°C > coolant temperature > 80°C
- Engine speed not more than 250 rpm
- Vehicle speed = 0 km/h
- Battery voltage 9 V ~ 15.2 V

Throttle self-learning procedures:

Start engine for 3 times to finish self-learning. Then start vehicle and observe if it operates normally.

Flywheel 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.

Flywheel self-learning conditions:

- 100.5°C > coolant temperature > 80°C
- Vehicle speed = 0 km/h
- Battery voltage 9 V ~ 15.2 V

Flywheel self-learning procedure:

Depress accelerator pedal continuously and rapidly to 4500 rpm for 3 times.

Operations for Replacing New ECM

1. Engine immobilizer match (if equipped).
2. Clutch switch position learning for MT model (unlearning starter not opearte).
   Method: Fully depress clutch pedal, then release it, which can allow ECM receive a complete clutch switch signal.
3. Brake switch position learning for AT model (unlearning starter not opearte).
   Method: Fully depress brake pedal, then release it, which can allow ECU receive a complete brake switch signal.
4. Throttle self-learning.
5. Flywheel self-learning.

Diagnostic Trouble Code (DTC) Chart

P0009-62	VVT Parking Position Signal Compare Failure
P0010-11	VVT Driver Circuit Short to Ground
P0010-12	VVT Driver Circuit Short to Battery
P0010-13	VVT Driver Circuit Open
P0010-14	VVT Driver Circuit Short to Ground or Open
P0011-61	VVT Error Position Signal Calculation Failure
P0012-65	EVELVVT - Variator Speed Diagnosis Signal Has Too Few Transitions/Events
P0012-66	EVELVVT - Variator Speed Diagnosis Signal Has Too Many Transitions/Events
P0016-76	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A
P0053-1E	Upstream Lambda Sonde Resistor (Functional Test) Circuit Resistance Out of Range
P0054-1E	Downstream Lambda Sonde Resistor (Functional Test) Circuit Resistance Out of Range
P0101-62	Air Intake Manifold Signal Compare Failure
P0105-12	Intake Manifold Pressure Sensor (Electric) Circuit Short to Battery
P0105-14	Intake Manifold Pressure Sensor (Electric) Circuit Short to Ground or Open
P0106-26	Air Pressure Sensor (Functional) Signal Rate of Change Below Threshold
P0106-27	Air Pressure Sensor (Functional) Signal Rate of Change Above Threshold
P0110-11	Air Temperature Sensor Circuit Short to Ground
P0110-15	Air Temperature Sensor Circuit Short to Battery or Open
P0110-3A	Air Temperature Sensor Signal Has Too Many Pulses
P0111-62	Air Temperature Sensor (Functional) Signal Compare Failure
P0115-11	Water temperature sensor Circuit Short to Ground
P0115-15	Water Temperature Sensor Circuit Short to Battery or Open
P0115-3A	Water Temperature Sensor Signal Has Too Many Pulses
P0116-62	Water Temperature Sensor (Functional) Signal Compare Failure
P0120-12	Pedal Ootentiometer 1 Circuit Short to Battery
P0120-14	Pedal Potentiometer 1 Circuit Short to Ground or Open
P0121-12	Throttle Potentiometer 1 Circuit Short to Battery
P0121-14	Throttle Potentiometer 1 Circuit Short to Ground or Open
P0130-24	Functional Test Lambda Sensor 1 Signal Stuck High
P0132-12	Electric Test Lambda Sensor 1 Circuit Short to Battery
P0133-62	First Probe Diagnosis Signal Compare Failure
P0135-12	Lambda Sensor1 Heater Driver Circuit Short to Battery
P0135-14	Lambda Sensor1 Heater Driver Circuit Short to Ground or Open
P0136-23	Functional Test Lambda Sensor 2 Signal Stuck Low
P0136-24	Functional Test Lambda Sensor 2 Signal Stuck High

P0139-62	DO2V Signal Compare Failure
P0141-12	Lambda Sensor2 Heater Driver Circuit Short to Battery
P0141-14	Lambda Sensor2 Heater Driver Circuit Short to Ground or Open
P0170-25	Frequency Diagnosis Signal Shape/Waveform Failure
P0171-62	DFSL - Lean Diagnosis Signal Compare Failure
P0171-64	DFSL - Lean Diagnosis Signal Plausibility Failure
P0171-67	DFSL - Lean Diagnosis Signal Incorrect After Event
P0172-62	Rich Diagnosis Signal Compare Failure
P0172-64	Rich Diagnosis Signal Plausibility Failure
P0172-67	Rich Diagnosis Signal Incorrect After Event
P0201-11	Injector 1 Driver Circuit Short to Ground
P0201-12	Injector 1 Driver Circuit Short to Battery
P0201-13	Injector 1 Driver Circuit Open
P0202-11	Injector 2 Driver Circuit Short to Ground
P0202-12	Injector 2 Driver Circuit Short to Battery
P0202-13	Injector 2 Driver Circuit Open
P0203-11	Injector 3 Driver Circuit Short to Ground
P0203-12	Injector 3 Driver Circuit Short to Battery
P0203-13	Injector 3 Driver Circuit Open
P0204-11	Injector 4 Driver Circuit Short to Ground
P0204-12	Injector 4 Driver Circuit Short to Battery
P0204-13	Injector 4 Driver Circuit Open
P0219-68	OSP-Engine Over Speed Event Information
P0220-12	Pedal Ootentiometer 2 Circuit Short to Battery
P0220-14	Pedal Potentiometer 2 Circuit Short to Ground or Open
P0230-11	Relay High Side Circuit Short to Ground
P0230-15	Relay High Side Circuit Short to Battery or Open
P0230-12	Relay High Side Circuit Short to Battery
P0230-13	Relay High Side Circuit Open
P023D-26	AIRC-Aircomponent Signal Rate of Change Below Threshold
P023D-27	AIRC-Aircomponent Signal Rate of Change Above Threshold
P0300-92	DM10 - 1000 Turn Misfire Diagnosis Performance or Incorrect Operation
P0300-98	DM20 - 200 Turn Misfire Diagnosis Component or System Over Temperature
P0301-92	DM11 - 1000 Turn Misfire Diagnosis Performance or Incorrect Operation
P0301-98	DM21 - 200 Turn Misfire Diagnosis Component or System Over Temperature
P0302-92	DM12 - 1000 Turn Misfire Diagnosis Performance or Incorrect Operation
P0302-98	DM22 - 200 Turn Misfire Diagnosis Component or System Over Temperature
P0303-92	DM13 - 1000 Turn Misfire Diagnosis Performance or Incorrect Operation

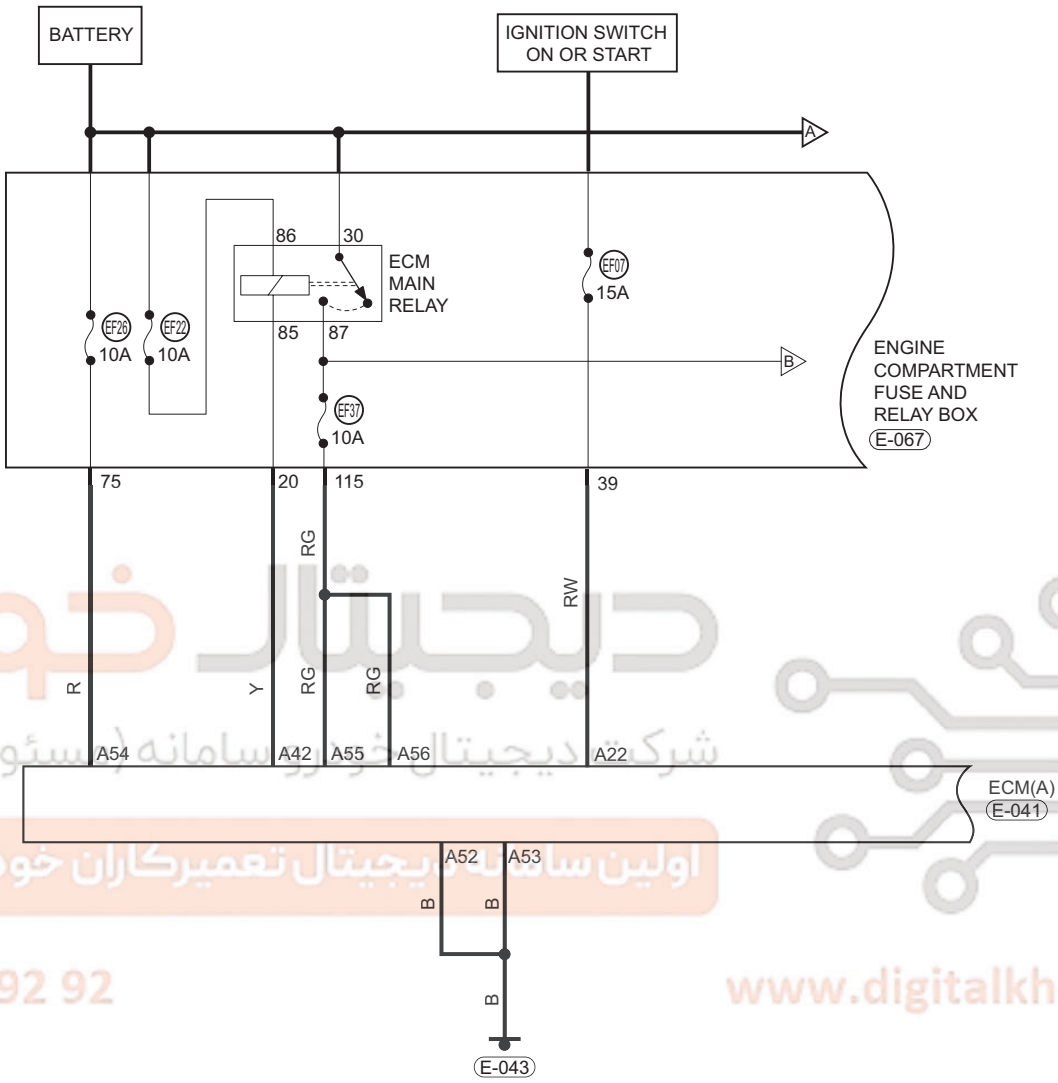
P0303-98	DM23 - 200 Turn Misfire Diagnosis Component or System Over Temperature
P0304-92	DM14 - 1000 Turn Misfire Diagnosis Performance or Incorrect Operation
P0304-98	DM24 - 200 Turn Misfire Diagnosis Component or System Over Temperature
P0325-12	Knock Sensor (Engine-Run) Circuit Short to Battery
P0335-62	Engine Speed Sensor Signal Compare Failure
P0340-11	Cam-shaft Sensor Circuit Short to Ground
P0340-15	Cam-shaft Sensor Circuit Short to Battery or Open
P0340-62	Cam-shaft Sensor Signal Compare Failure
P0351-12	Ignition 1 Driver Circuit Short to Battery
P0351-14	Ignition 1 Driver Circuit Short to Ground or Open
P0352-12	Ignition 2 Driver Circuit Short to Battery
P0352-14	Ignition 2 Driver Circuit Short to Ground or Open
P0353-12	Ignition 3 Driver Circuit Short to Battery
P0353-14	Ignition 3 Driver Circuit Short to Ground or Open
P0354-12	Ignition 4 Driver Circuit Short to Battery
P0354-14	Ignition 4 Driver Circuit Short to Ground or Open
P0403-11	EGR Control Circuit Short to Ground
P0403-12	EGR Control Circuit Short to Battery
P0403-13	EGR Control Circuit Open
P0403-61	EGR Control Circuit Signal Calculation Failure
P0409-12	EGR Sensor Circuit Short to Battery
P0409-14	EGR Sensor Circuit Short to Ground or Open
P0420-62	Catalizer Diagnosis Signal Compare Failure
P0441-72	DNPG Actuator Stuck Open
P0443-11	Canister Purge Driver Circuit Short to Ground
P0443-12	Canister Purge Driver Circuit Short to Battery
P0443-13	Canister Purge Driver Circuit Open
P0480-11	Cooling Fan Driver 1 (Low) Circuit Short to Ground
P0480-12	Cooling Fan Driver 1 (Low) Circuit Short to Battery
P0480-13	Cooling Fan Driver 1 (Low) Circuit Open
P0481-11	Cooling Fan Driver 2 (High) Circuit Short to Ground
P0481-12	Cooling Fan Driver 2 (High) Circuit Short to Battery
P0481-13	Cooling Fan Driver 2 (High) Circuit Open
P0500-64	VEV-Vehicle Speed Sensor Signal Plausibility Failure
P0500-68	VEV-Vehicle Speed Sensor Event Information
P0504-13	Brake Signal Circuit Open
P0504-62	Brake Signal Compare Failure
P0504-67	Brake Signal Incorrect After Event

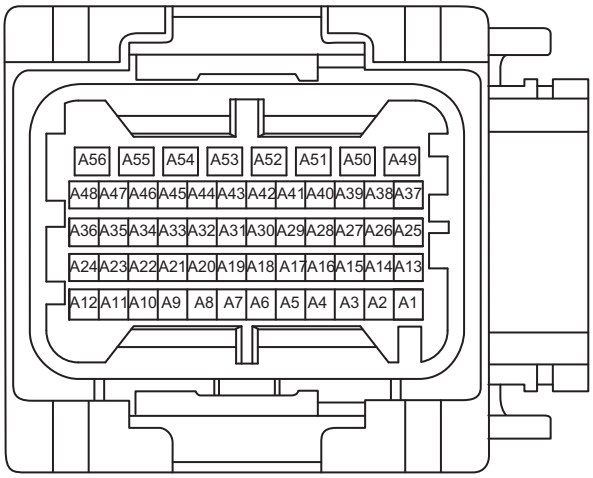
P0504-86	Brake Signal Invalid
P0560-16	ECU Power Supply Circuit Voltage Below Threshold
P0560-17	ECU Power Supply Circuit Voltage Above Threshold
P0576-62	CCANOM-Cruise Control Disabled for High Deceleration Signal Compare Failure
P0579-62	CRCAN-Cruise Control Disabled for High Acceleration Signal Compare Failure
P0601-44	EEPROM Memory Data Memory Failure
P0604-62	RAM Memory Signal Compare Failure
P0605-41	ROM (EPROM) Memory General Checksum Failure
P0605-49	ROM (EPROM) Memory Internal Electronic Failure
P0606-47	E.C.U. (Microprocessor) Watchdog/Safety uC Failure
P0606-92	E.C.U. (Microprocessor) Performance or Incorrect Operation
P060B-49	A/D Converter Internal Electronic Failure
P060C-62	SAFSE-Stop Engine for Safety Signal Compare Failure
P0615-11	Starter Relay Circuit Short to Ground
P0615-15	Starter Relay Circuit Short to Battery or Open
P0638-11	DC Motor Command Circuit Short to Ground
P0638-12	DC Motor Command Circuit Short to Battery
P0638-13	DC Motor Command Circuit Open
P0638-61	DC Motor Command Signal Calculation Failure
P0641-49	SSPLY - Sensor Supply 1 Internal Electronic Failure
P0645-11	Air Conditioner 1 (Relay I/O) Circuit Short to Ground
P0645-12	Air Conditioner 1 (Relay I/O) Circuit Short to Battery
P0645-13	Air Conditioner 1 (Relay I/O) Circuit Open
P0651-49	SSPLY - Sensor Supply 2 Internal Electronic Failure
P0657-16	Main Relay Circuit Voltage Below Threshold
P0657-17	Main Relay Circuit Voltage Above Threshold
P0685-11	Fuel Pump Relay Driver Circuit Short to Ground
P0685-12	Fuel Pump Relay Driver Circuit Short to Battery
P0685-13	Fuel Pump Relay Driver Circuit Open
P0697-49	Sensor Supply 3 Internal Electronic Failure
P0700-62	Engine Stop Request by Selespeed Signal Compare Failure
P0704-23	Clutch Switch Signal Stuck Low
P0704-24	Clutch Switch Signal Stuck High
P1300-55	Flywheel Self Learning Not Configured
P1430-11	A/C Defrost Temperature Diagnosis Circuit Short to Ground
P1430-15	A/C Defrost Temperature Diagnosis Circuit Short to Battery or Open
P1430-3A	A/C Defrost Temperature Diagnosis Signal Has Too Many Pulses
P1600-11	Thermostat Circuit Short to Ground

P1600-12	Thermostat Circuit Short to Battery
P1600-13	Thermostat Circuit Open
P1601-23	CC_BUTTON Cruise Control Button Signal Stuck Low
P1610-51	Immo Secret Key and Security Code Not Programmed Not Programmed
P1614-86	Immo Transferred Transponder Authentication is Failed Signal Invalid
P1616-81	IMMO Authentication Fail Invalid Serial Data Received
P1617-87	IMMO Authentication Message not Received Missing Message
P1618-87	Fail to Write EOL Immobilizer Data into EEProm Missing Message
P1619-51	ECM Not Programmed (Virgin State) Not Programmed
P1666-54	EGR Selflearning Mechanical Fault Missing Calibration
P1652-12	Knock Sensor; Key on Diagnosis Circuit Short to Battery
P1652-11	Knock Sensor; Key on Diagnosis Circuit Short to Ground
P1652-49	Knock Sensor; Key on Diagnosis Internal Electronic Failure
P1652-64	Knock Sensor; Key on Diagnosis Signal Plausibility Failure
P1653-62	Pedal Potentiometer Congruence Signal Compare Failure
P1654-62	Throttle Potentiometer Congruence Signal Compare Failure
P1655-94	Self Learning Throttle bat Unexpected Operation
P1656-94	Self Learning Throttle slc Unexpected Operation
P1657-77	Self Learning Throttle lhp Commanded Position not Reachable
P1658-77	Self Learning Throttle trc Commanded Position not Reachable
P1659-92	Self Learning Throttle mtc Performance or Incorrect Operation
P1660-77	Self Learning Throttle tro Commanded Position not Reachable
P1661-61	Throttle Control Error Position Signal Calculation Failure
P1663-62	Low Air Manifold Pressure (Functional) Signal Compare Failure
P1667-16	Puntual ECS Fdbk Current Fault Circuit Voltage Below Threshold
P1667-17	Puntual ECS Fdbk Current Fault Circuit Voltage Above Threshold
P2227-62	Plausibility MAP at Key On Signal Compare Failure
P2244-92	O2 Sensor Reference Voltage Performance (Bank 1 Sensor 1) Performance or Incorrect Operation
P2299-62	Gas & Brake Pedal Coherence Signal Compare Failure

ECM Power Supply Circuit & Ground Circuit Testing

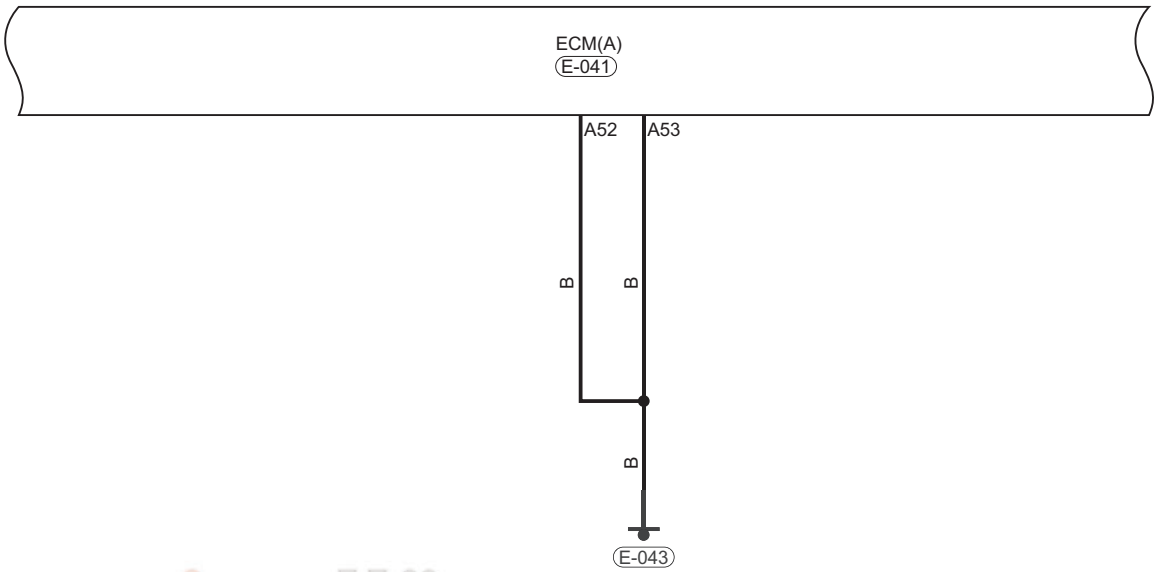
Power Supply Circuit

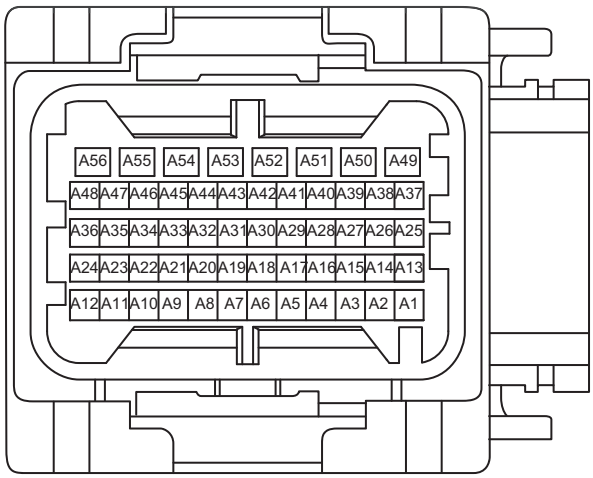




EA13T060100

Ground Circuit





EA13T060110

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

Diagnosis Procedure

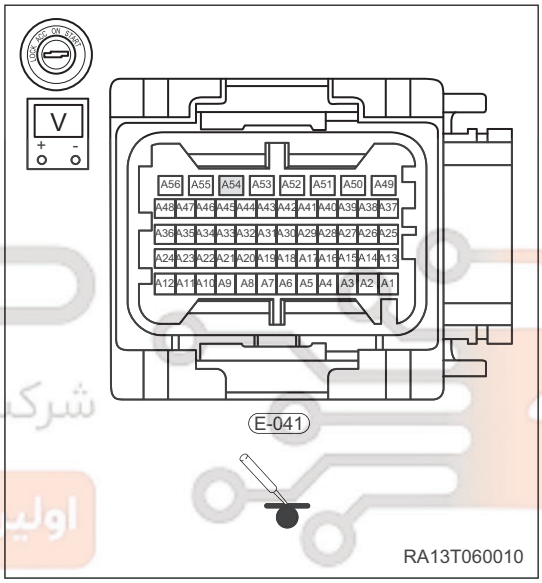
1	Check ECM power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-041.

c. Check voltage between terminal of ECM connector E-041 and body ground.

Multimeter Connection	Condition	Specified Condition
E-041 (A54) - Body ground	Always	11 to 14 V



OK → **Go to step 4**

NG

2	Check ECM fuse

a. Unplug ECM fuse EF26 (10A) 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 E-067.

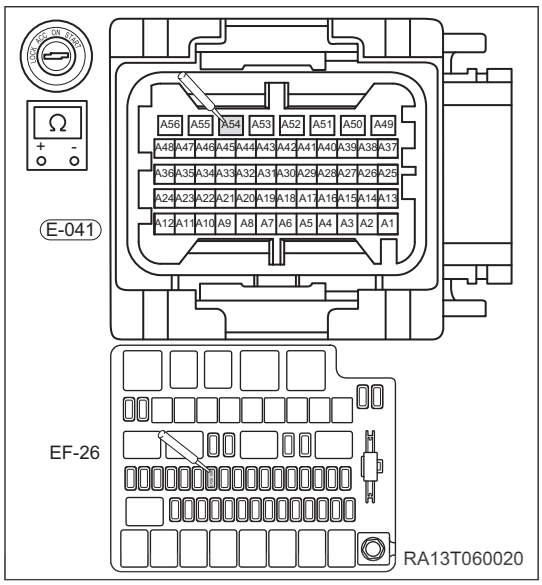
b. Check wire harness between connector terminals on wire harness side.

Check for Open

Multimeter Connection	Specified Condition
E-041 (A54) - E-067 (75)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-041 (A54) or E-067 (75) - Body ground	No continuity
E-041 (A54) or E-067 (75) - Battery positive	No continuity



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

OK

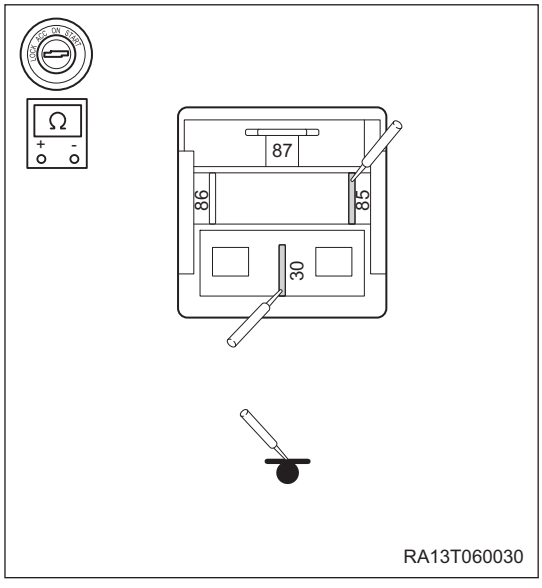
Repair or replace engine compartment fuse and relay box or wire harness (engine compartment fuse and relay box - battery)

4	Check main relay circuit voltage

a. Remove 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 30 (engine compartment fuse and relay box side) - Body ground	Always	11 to 14 V



NG → **Repair or replace wire harness or connector (mainrelay - battery)**

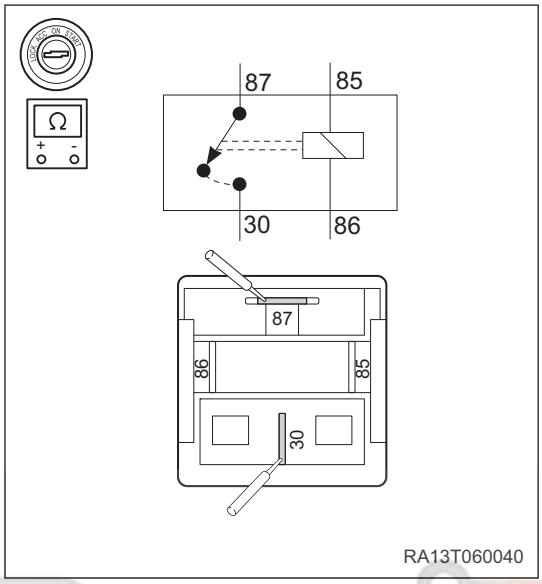
OK

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 30 - Terminal 87	No continuity
Terminal 30 - Terminal 87	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. Check wire harness between connector terminals.

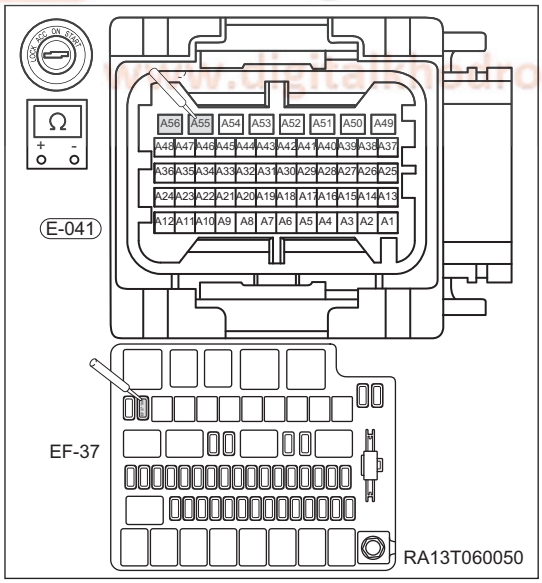
b. Disconnect the engine compartment fuse and relay box connector E-067.

Check for Open

Multimeter Connection	Specified Condition
E-041 (A55,A56) - E-067 (115)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-041 (A55,A56) or E-067 (115) - Body ground	No continuity
E-041 (A55,A56) or E-067 (115) - Battery positive	No continuity



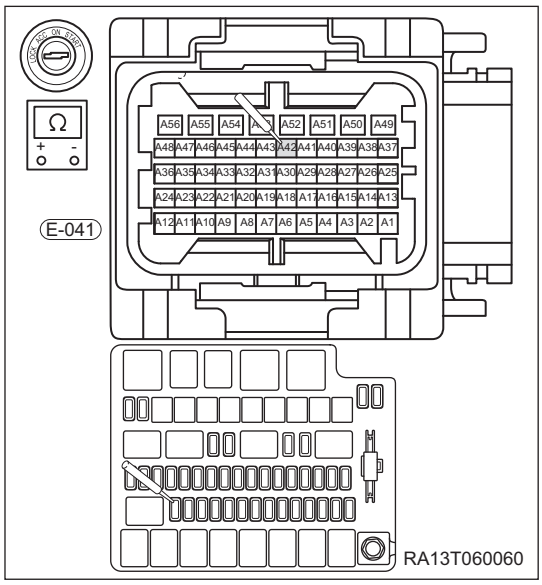
Check for Open

Multimeter Connection	Specified Condition
E-041 (A42) - E-067 (20)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-041 (A42) or E-067 (20) - Body ground	No continuity
E-041 (A42) or E-067 (20) - Battery positive	No continuity

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



OK

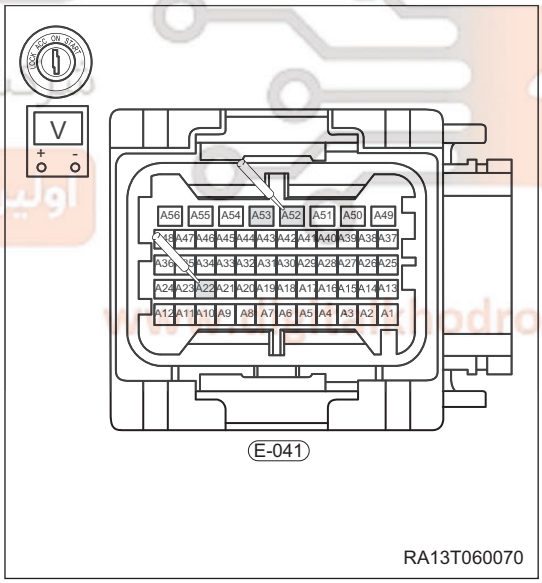
7 Check ECM power supply circuit (ignition switch voltage)

a. Turn ignition switch to ON.

b. Check voltage between terminals of ECM connector.

Multimeter Connection	Condition	Specified Condition
E-041 (A22) - E-041 (A52,A53)	Ignition switch ON	11 to 14 V

OK → **Replace ECM**



NG

8 Check ECM fuse

a. Unplug fuse FE07(15A) 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 engine compartment fuse and relay box connector E-067.

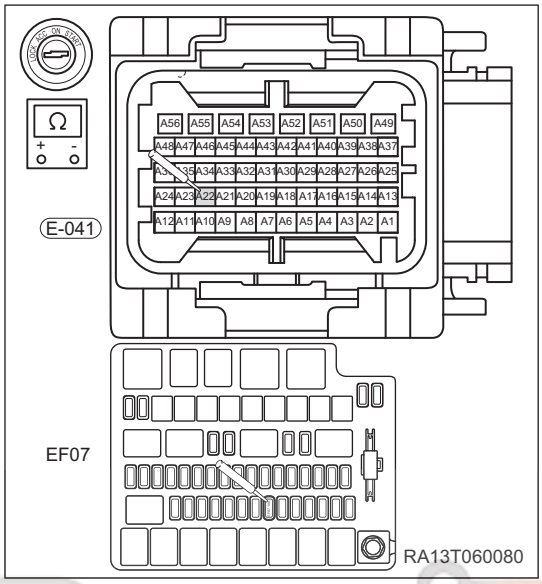
b. Check wire harness between connector terminals on wire harness side.

Check for Open

Multimeter Connection	Specified Condition
E-041 (A22) - E-067 (39)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-041 (A22) or E-067 (39) - Body ground	No continuity
E-041 (A22) or E-067 (39) - Battery positive	No continuity



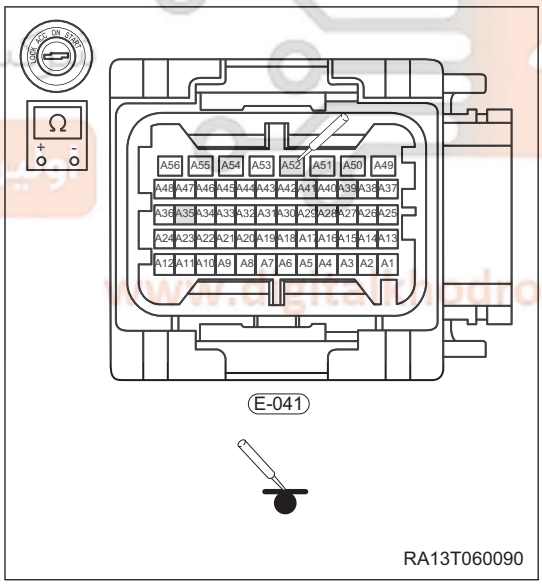
c. Disconnect the ground point E-043.

d. Check the ECM ground point (See page 06-19).

e. Check the ECM ground wire harness.

Check for Open

Multimeter Connection	Specified Condition
E-041 (A52, A35) - E-043	Continuity



NG	Repair or replace wire harness or connector

OK

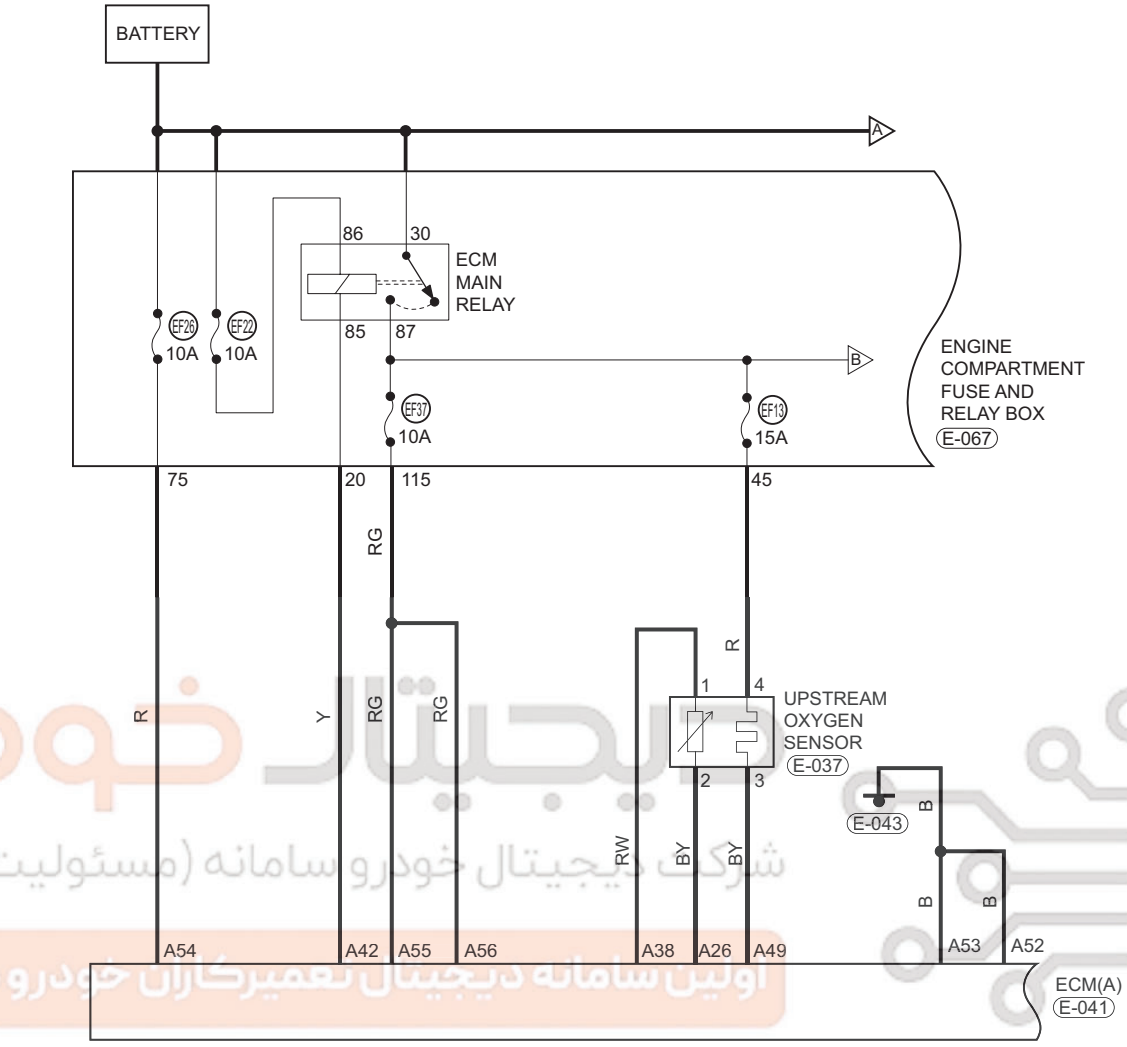
10	Check the ignition switch assembly (See page 15-12).

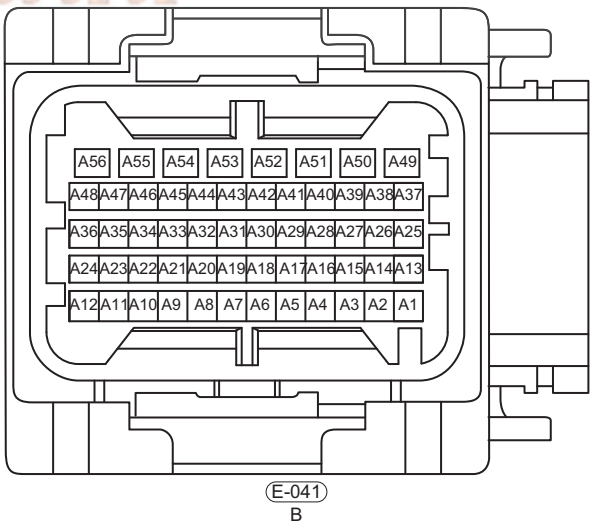
NG	Replace ignition switch assembly

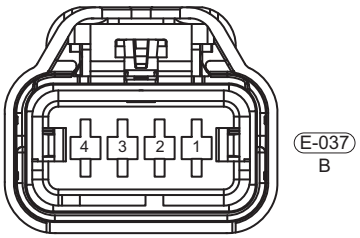
OK

Repair or replace engine compartment fuse and relay box or wire harness

DTC	P0135-12	Lambda Sensor1 Heater Driver Circuit Short to Battery
DTC	P0135-14	Lambda Sensor1 Heater Driver Circuit Short to Ground or Open
DTC	P0132-12	Electric Test Lambda Sensor 1 Circuit Short to Battery
DTC	P0053-1E	Upstream Lambda Sonde Resistor (Functional Test) Circuit Resistance Out of Range







EA13T060160

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0135-12	Lambda Sensor1 Heater Driver Circuit Short to Battery	Ignition switch ON Engine running	• Upstream oxygen sensor • Wire harness or connector • Fuse • ECM
P0135-14	Lambda Sensor1 Heater Driver Circuit Short to Ground or Open		
P0132-12	Electric Test Lambda Sensor 1 Circuit Short to Battery		
P0053-1E	Upstream Lambda Sonde Resistor (Functional Test) Circuit Resistance Out of Range		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

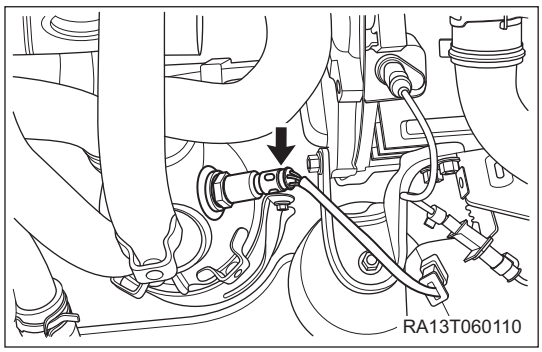
NG → **Repair or replace ground wire harness or ground point**

OK →

2	Check upstream oxygen sensor connector

a. Disconnect the upstream oxygen sensor connector E-037.

b. Check the upstream oxygen sensor connector.



NG → **Repair or replace connector**

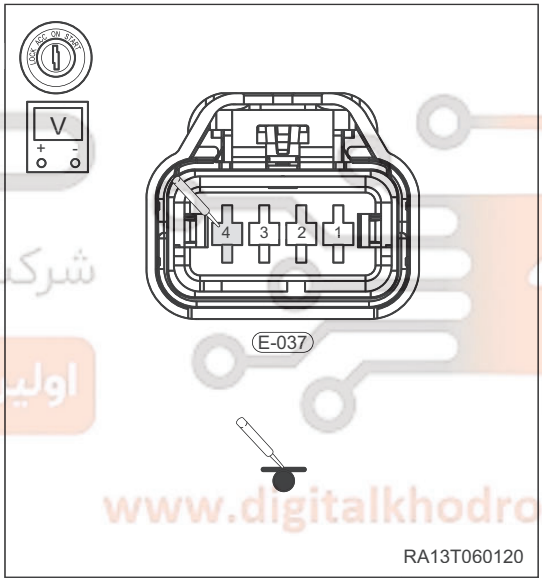
OK

3	Check upstream oxygen sensor heater power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between terminal 4 of upstream oxygen sensor connector E-037 and body ground.

Multimeter Connection	Condition	Specified Condition
E-037 (4) - Body ground	Ignition switch ON	11 - 14 V



OK → **Go to step 5**

NG

4	Check upstream oxygen sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Check fuse EF13 and main relay.

c. Disconnect the engine compartment fuse and relay box connector E-067.

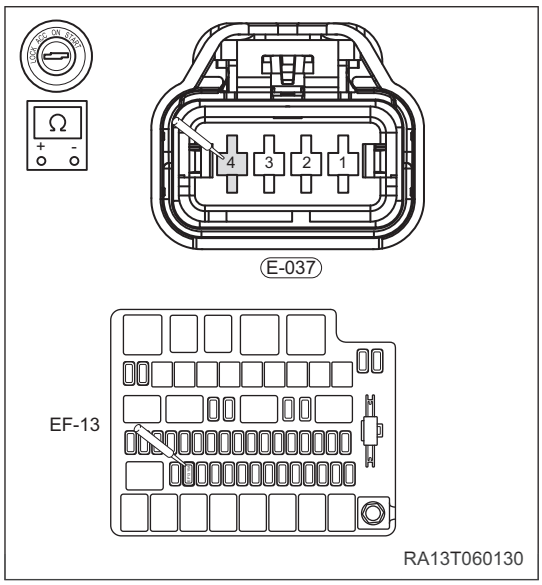
d. Check wire harness between upstream oxygen sensor connector terminal and engine compartment fuse and relay box connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-037 (4) - E-067 (45)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-037 (4) or E-067 (45) - Body ground	Always	No continuity
E-037 (4) or E-067 (45) - 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-041.

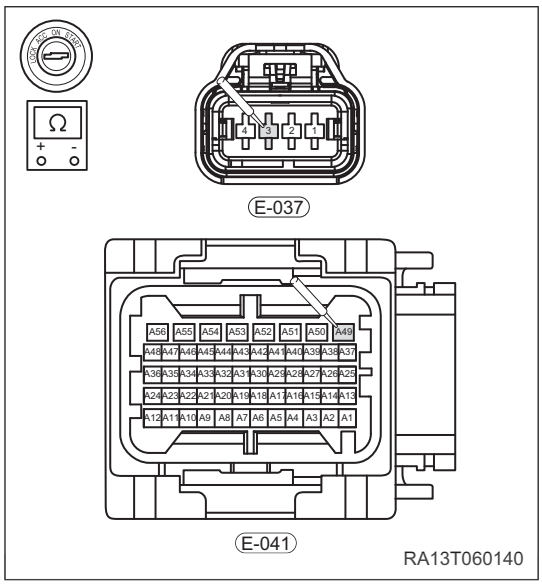
b. Check wire harness between upstream oxygen sensor connector terminal and ECM connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-037 (3) - E-041 (A49)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-037 (3) or E-041 (A49) - Body ground	Always	No continuity
E-037 (3) or E-041 (A49) - Battery positive	Always	No continuity



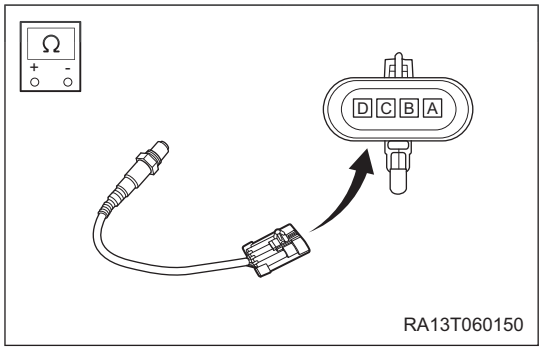
NG → **Repair or replace wire harness or connector (upstream oxygen sensor - ECM)**

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 - 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 for DTCs

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

b. Refer to "DTC Confirmation Procedure".

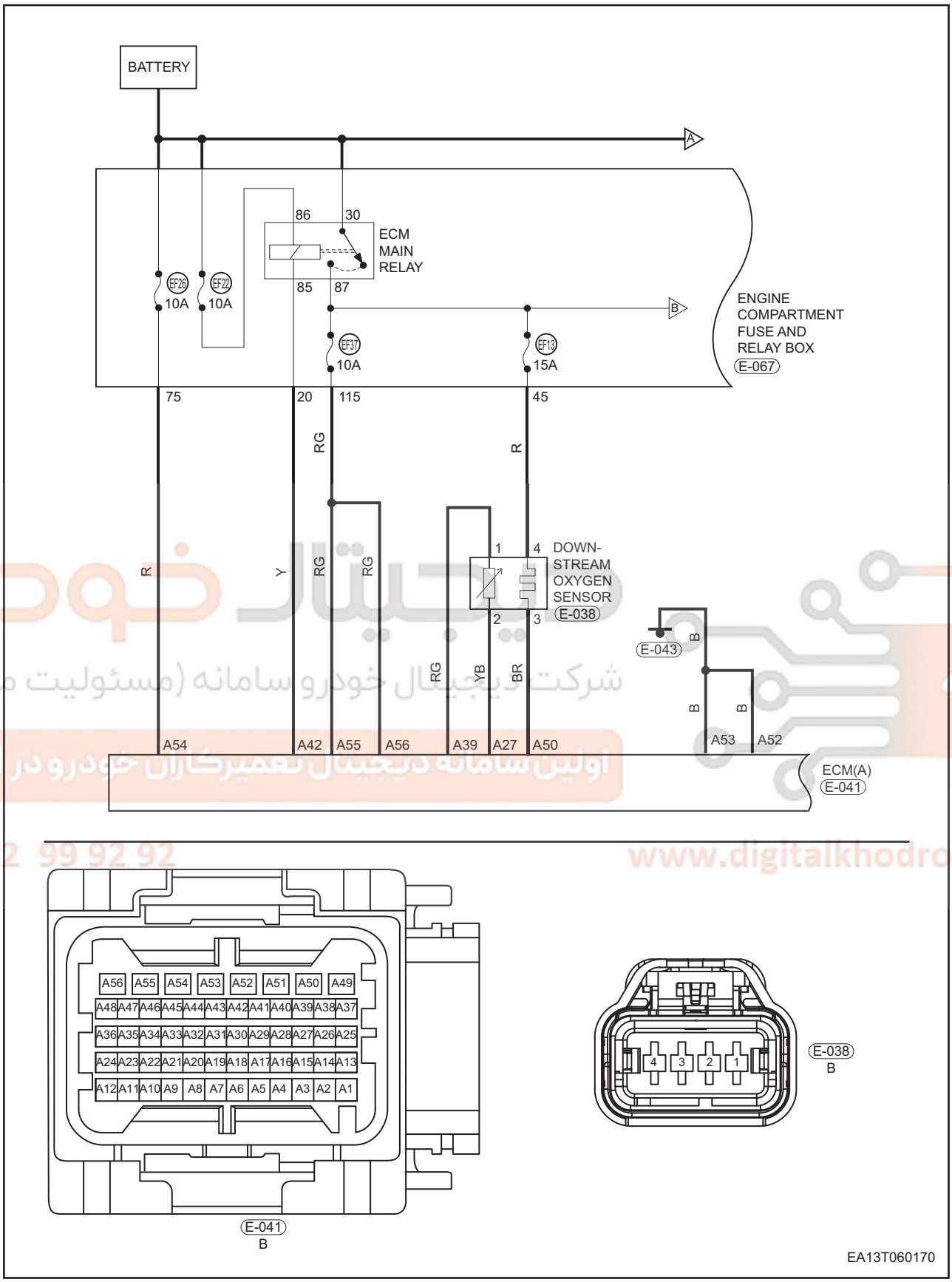
c. Check if DTC P0135-14, P0135-12, P0132-12 or P0053-1E still exists.

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	P0138-12	Electric Test Lambda sensor 2 Circuit Short to Battery
DTC	P0141-12	Lambda Sensor2 Heater Driver Circuit Short to Battery
DTC	P0141-14	Lambda Sensor2 Heater Driver Circuit Short to Ground or Open
DTC	P0054-1E	Downstream Lambda Sonde Resistor (Functional Test) Circuit Resistance Out of Range



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0138-12	Electric Test Lambda sensor 2 Circuit Short to Battery	Ignition switch ON Engine running	• Downstream oxygen sensor • Wire harness or connector • Fuse • ECM
P0141-12	Lambda Sensor2 Heater Driver Circuit Short to Battery		
P0141-14	Lambda Sensor2 Heater Driver Circuit Short to Ground or Open		
P0054-1E	Downstream Lambda Sonde Resistor (Functional Test) Circuit Resistance Out of Range		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

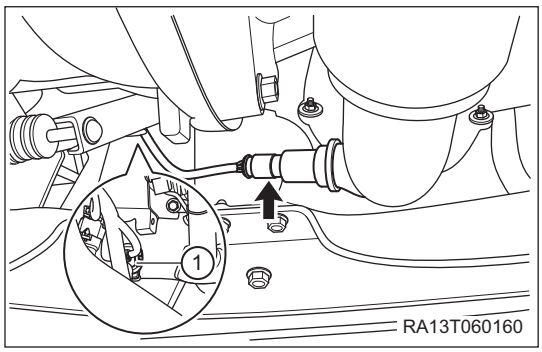
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check downstream oxygen sensor connector

a. Disconnect the downstream oxygen sensor connector.

b. Check the downstream oxygen sensor connector.



NG → Repair or replace connector

OK

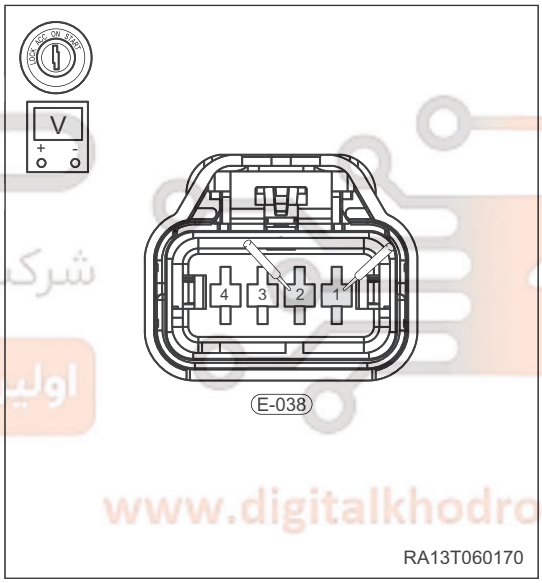
3	Check downstream oxygen sensor signal

a. Connect the downstream oxygen sensor connector E-038.

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 2 and 1 of connector E-038.

Multimeter Connection	Condition	Specified Condition
E-038 (2) - E-038 (1)	Engine running	Fluctuates slightly at about 0.45 V



OK → Go to step 8

NG

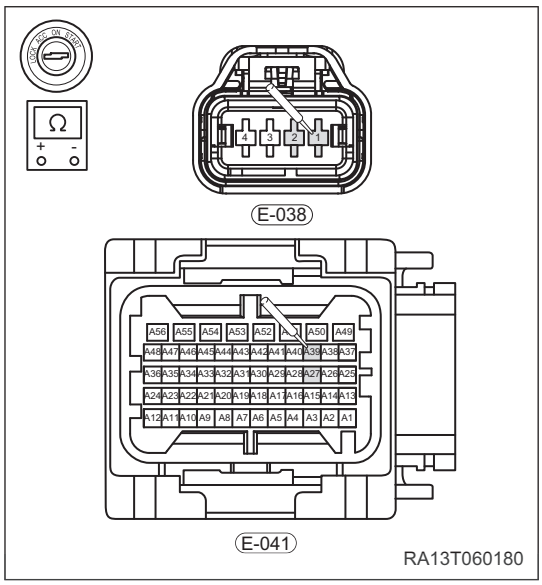
4	Check downstream oxygen sensor signal circuit

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

b. Turn ignition switch to LOCK.

c. Disconnect the ECM connector E-041.

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-038 (1) - E-041 (A39)	Always	Continuity
E-038 (2) - E-041 (A27)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-038 (1,2) or E-041 (A39,A27) - Body ground	Always	No continuity
E-038 (1,2) or E-041 (A39,A27) - Battery positive	Always	No continuity

OK → **Go to step 8**

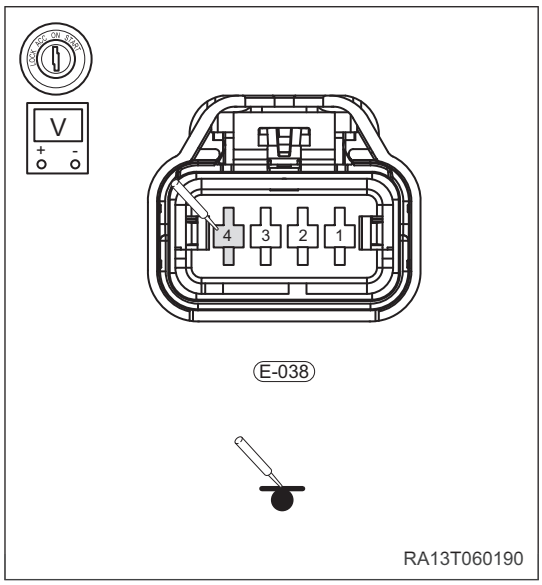
NG

5	Check downstream oxygen sensor heater power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between terminal 4 of downstream oxygen sensor connector E-062 and body ground.

Multimeter Connection	Condition	Specified Condition
E-038 (4) - Body ground	Ignition switch ON	11 - 14 V



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

OK

6	Check downstream oxygen sensor heater control circuit

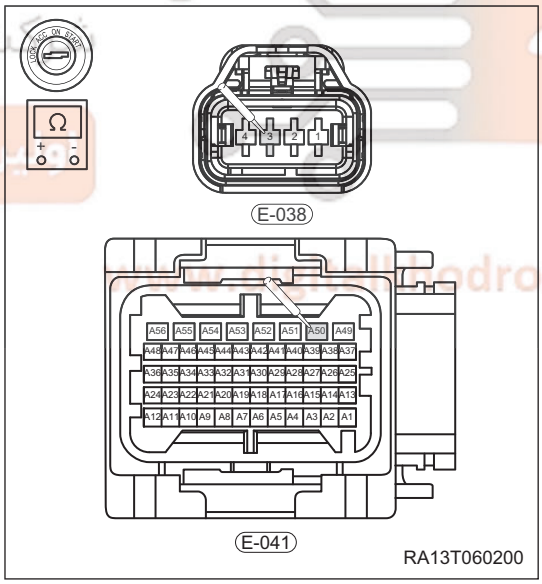
a. Check wire harness between downstream oxygen sensor connector terminal and ECM connector terminal.

b. **Check for Open**

Multimeter Connection	Condition	Specified Condition
E-038 (3) - E-041 (A50)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-038 (3) or E-041 (A50) - Body ground	Always	No continuity
E-038 (3) or E-041 (A50) - Battery positive	Always	No continuity



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

OK

7	Visually 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 ↓

8	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

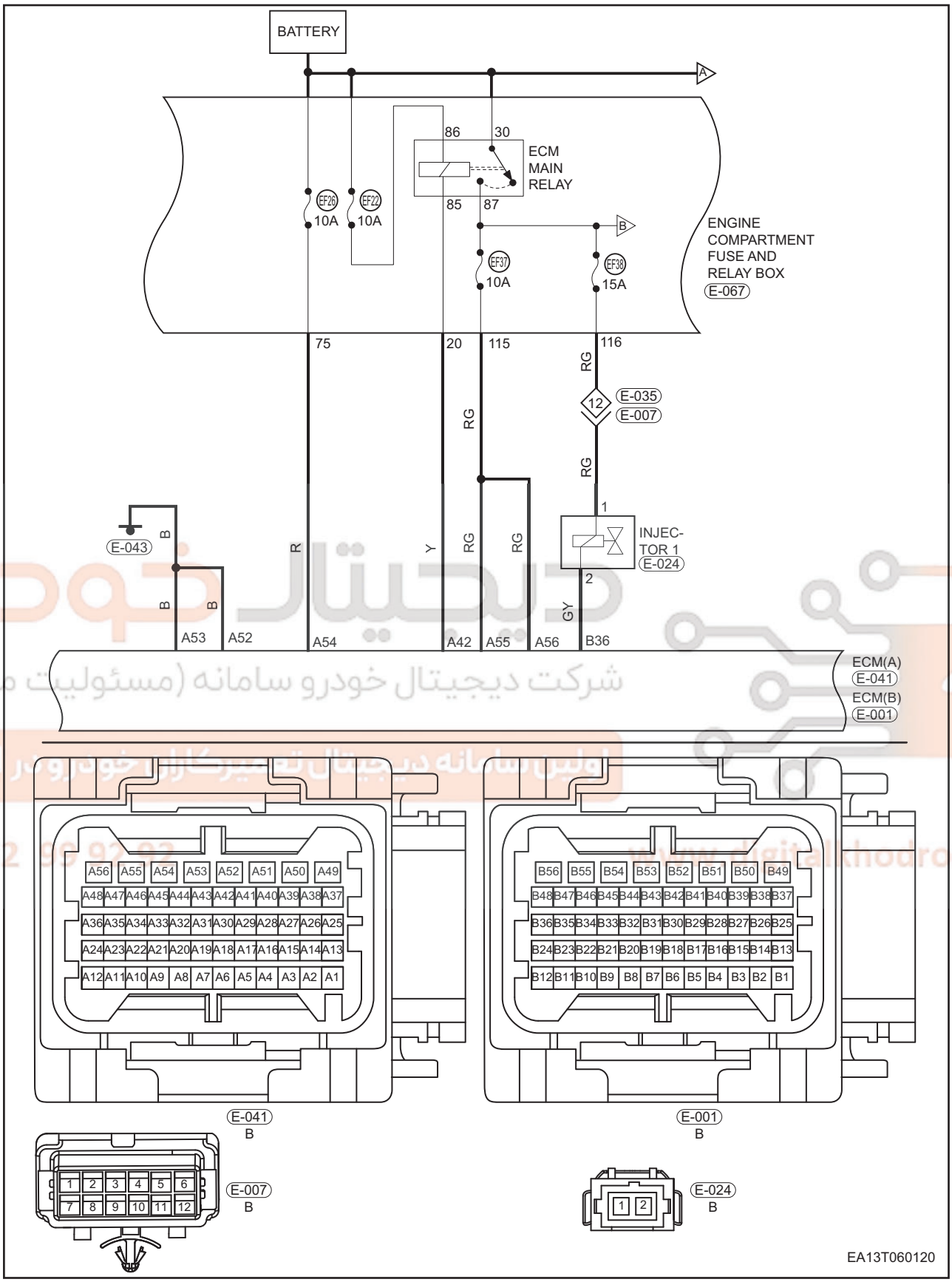
c. Check if DTC P0138-12, P0141-12, P0141-14 or P0054-1E still exists.

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	P0201-11	Injector 1 Driver Circuit Short to Ground
DTC	P0201-12	Injector 1 Driver Circuit Short to Battery
DTC	P0201-13	Injector 1 Driver Circuit Open



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0201-11	Injector 1 Driver Circuit Short to Ground	Ignition switch ON Engine running	• Fuel injector • Wire harness or connector • ECM
P0201-12	Injector 1 Driver Circuit Short to Battery		
P0201-13	Injector 1 Driver Circuit Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

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

OK

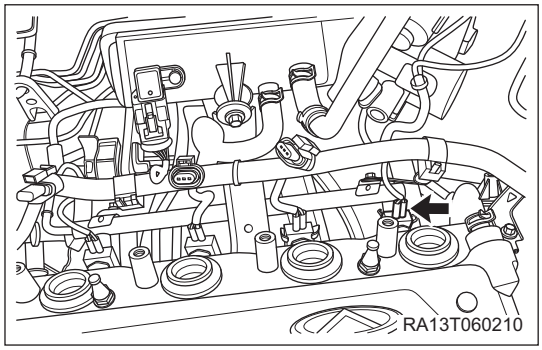
2	Check injector connector of cylinder 1

a. Disconnect injector connector E-024 of cylinder 1.

b. Turn ignition switch to ON.

c. Check voltage between injector connector terminal of cylinder 1 and body ground.

NG → **Repair or replace connector**



OK

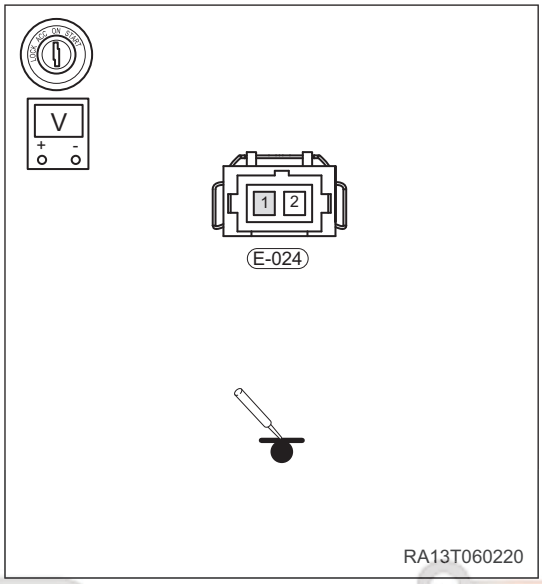
3	Check injector power supply voltage of cylinder1

a. Disconnect injector connector E-002 of cylinder 1.

b. Turn ignition switch to ON.

c. Check voltage between injector connector terminal of cylinder 1 and body ground.

Multimeter Connection	Condition	Specified Condition
E-024 (1) - Body ground	Ignition switch ON	11 - 14 V



OK → Go to step 5

NG

4	Check injector power supply circuit of cylinder1

a. Turn ignition switch to LOCK.

b. Check fuse EF38 and main relay.

c. Disconnect the engine compartment fuse and relay box connector E-067.

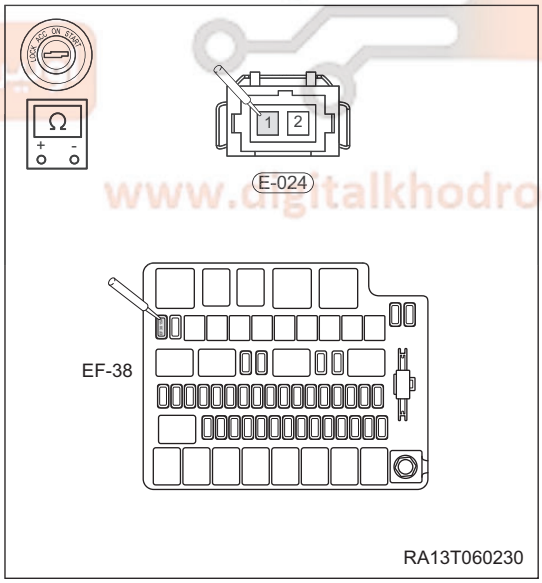
d. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-024 (1) - E-067 (116)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-024 (1) or E-067 (116) - Body ground	Always	No continuity
E-024 (1) or E-067 (116) - 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 of cylinder1

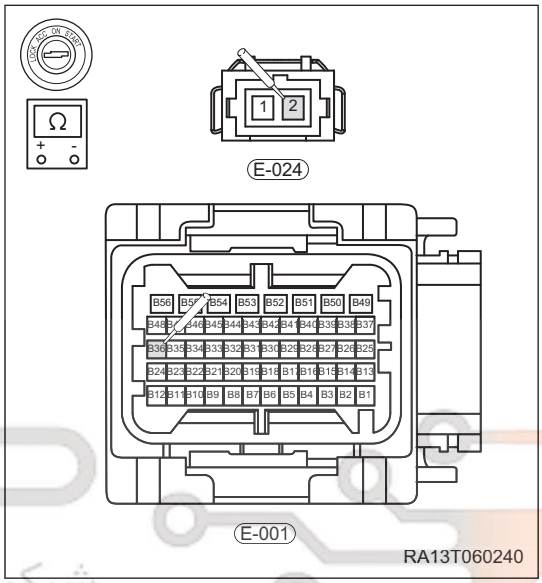
a. Disconnect the ECM connector E-001.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-024 (2) - E-001 (B36)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-024 (2) or E-001 (B36) - Body ground	Always	No continuity
E-024 (2) or E-001 (B36) - Body ground	Always	No continuity



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

OK

6	Check injector

a. Check resistance of injector.

NG → **Replace injector**

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

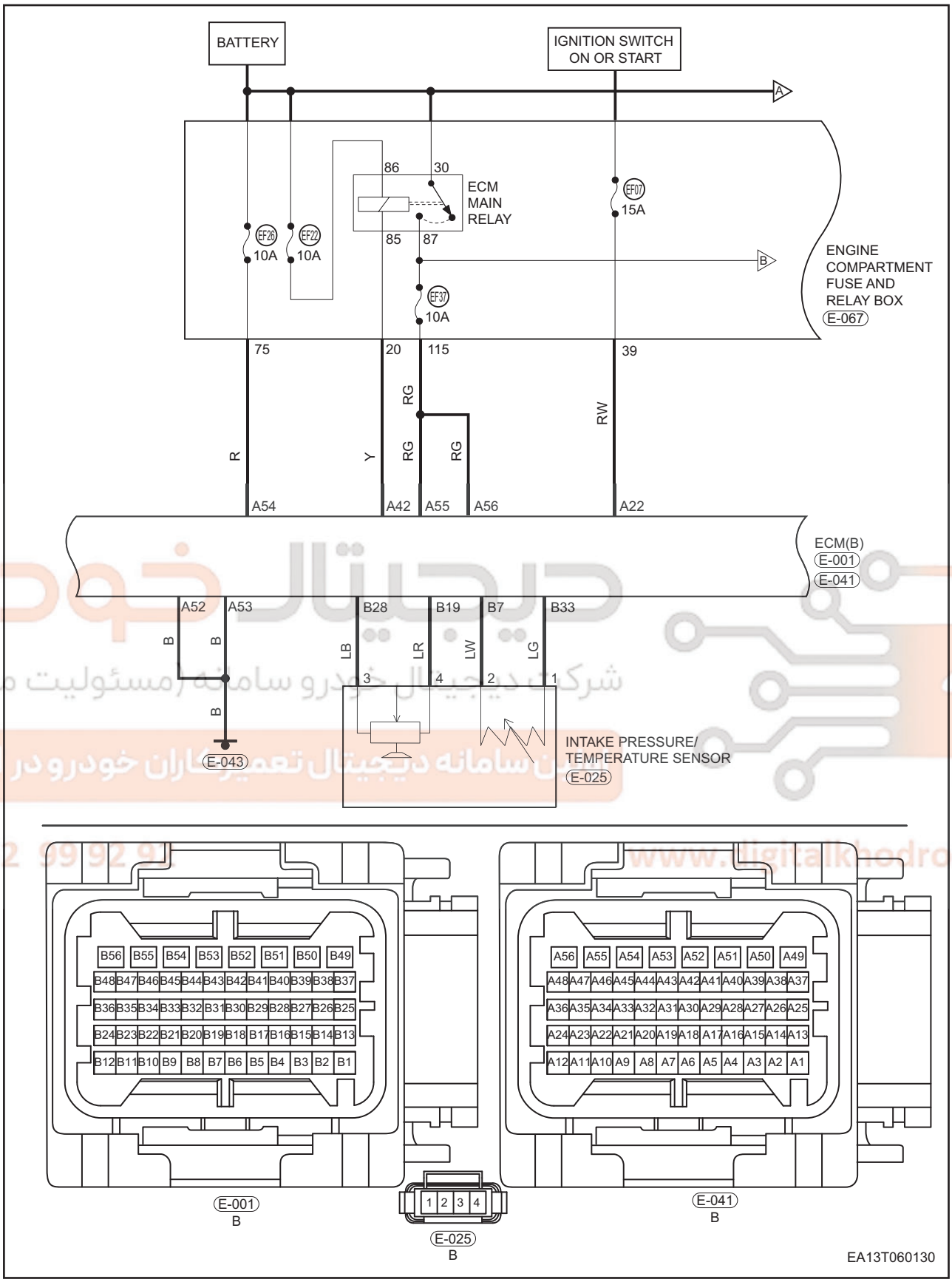
c. Check if DTC P0201-11, P0201-12 or P0201-13 still exist.

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	P0105-12	Intake Manifold Pressure Sensor (Electric) Circuit Shortto Battery
DTC	P0105-14	Intake Manifold Pressure Sensor (Electric) Circuit Shortto Ground or Open
DTC	P0106-26	Air Pressure Sensor (Functional) Signal Rate of Change BelowThreshold
DTC	P0106-27	Air Pressure Sensor (Functional) Signal Rate of Change AboveThreshold
DTC	P0101-62	Air Intake Manifold Signal Compare Failure
DTC	P1663-62	Low Air Manifold Pressure (Functional) Signal Compare Failure



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0105-12	Intake Manifold Pressure Sensor (Electric) Circuit Short to Battery	Ignition switch ON Engine running	• Intake pressure sensor • Wire harness or connector • ECM
P0105-14	Intake Manifold Pressure Sensor (Electric) Circuit Short to Ground or Open		
P0106-26	Air Pressure Sensor (Functional) Signal Rate of Change Below Threshold		
P0106-27	Air Pressure Sensor (Functional) Signal Rate of Change Above Threshold		
P1663-62	Low Air Manifold Pressure (Functional) Signal Compare Failure		
P0101-62	Air Intake Manifold Signal Compare Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

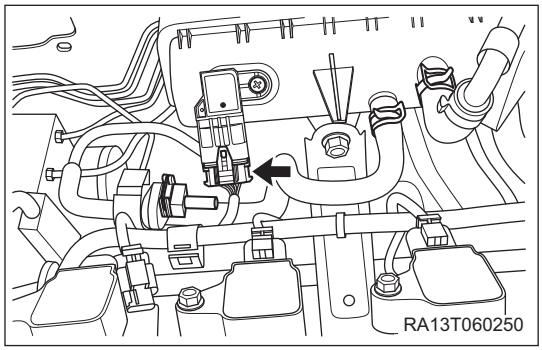
NG → **Repair or replace ground wire harness or ground point**

OK

2 Check intake pressure/temperature sensor connector

a. Disconnect the intake pressure/temperature sensor connector E-025.

b. Check the intake pressure/temperature sensor connector.



NG → **Repair or replace connector**

OK

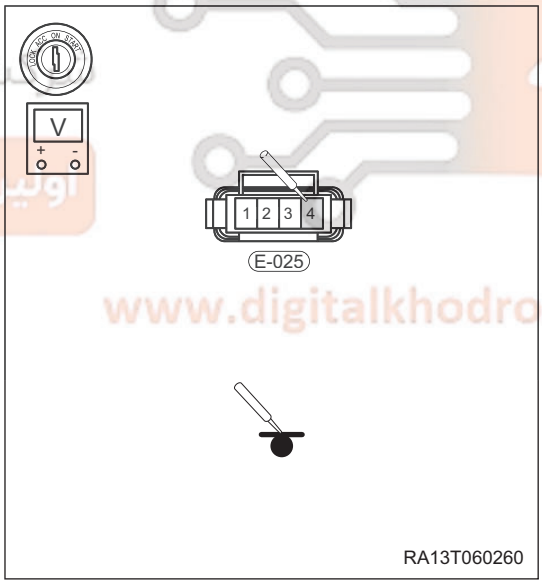
3 Check intake pressure sensor signal voltage

a. Connect the intake pressure/temperature sensor connector E-025.

b. Turn ignition switch to ON and start engine.

c. Using a multimeter, measure voltage between terminal 4 of connector E-025 and body ground.

Multimeter Connection	Condition	Specified Condition
E-025 (4) - Body ground	Idle	Voltage is about 1.3 V (value changes with model)
	Rapidly depress accelerator pedal	Maximum instantaneous voltage is about 4 V (value changes with model)



OK → **Go to step 8**

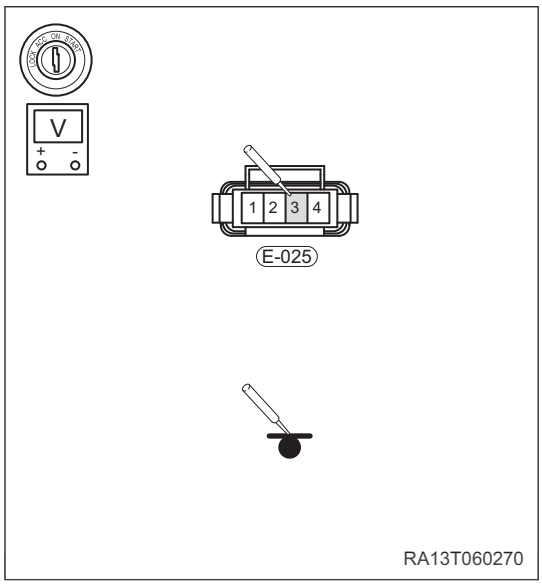
NG

4	Check intake pressure sensor power supply voltage

a. Disconnect the intake pressure/temperature sensor connector E-025.

b. Check voltage between connector terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-025 (3) - Body ground	Ignition switch ON	5 V



OK → **Go to step 6**

NG

5	Check intake pressure sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-001.

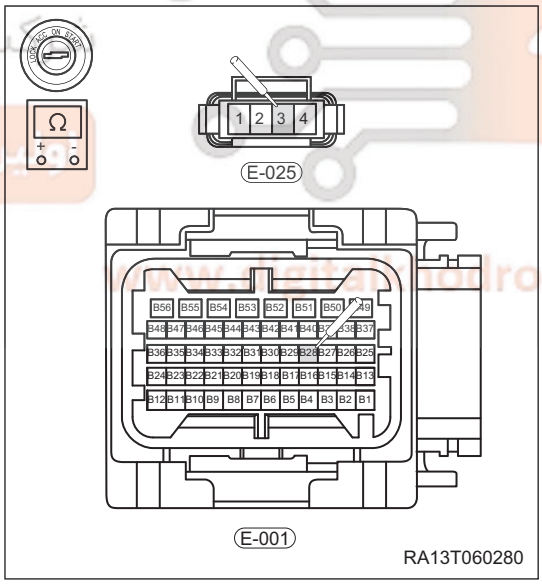
c. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-025 (3) - E-001 (B28)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-025 (3) or E-001 (B28) - Body ground	Always	No continuity
E-025 (3) or E-001 (B28) - Battery positive	Always	No continuity



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

OK

6	Check intake pressure sensor signal circuit

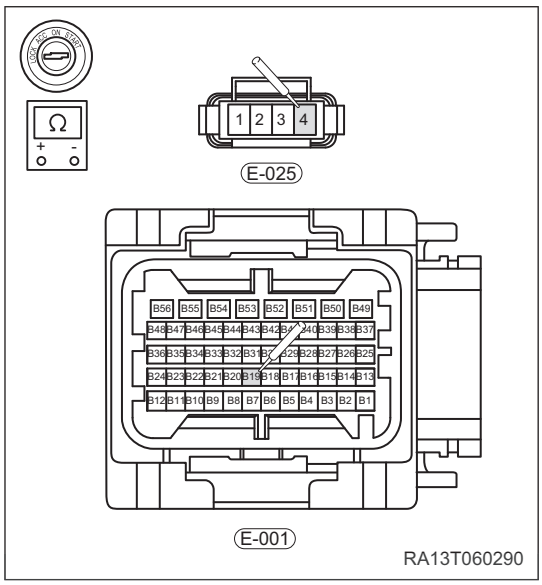
a. Check wire harness between intake pressure/temperature sensor connector terminal and ECM connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-025 (4) - E-001 (B19)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-025 (4) or E-001 (B19) - Body ground	Always	No continuity
E-025 (4) or E-001 (B19) - Battery positive	Always	No continuity



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

OK

7	Check intake pressure sensor

a. Remove the intake pressure/temperature sensor.

b. Check sensor connection part for debris or damage.

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

OK

8	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

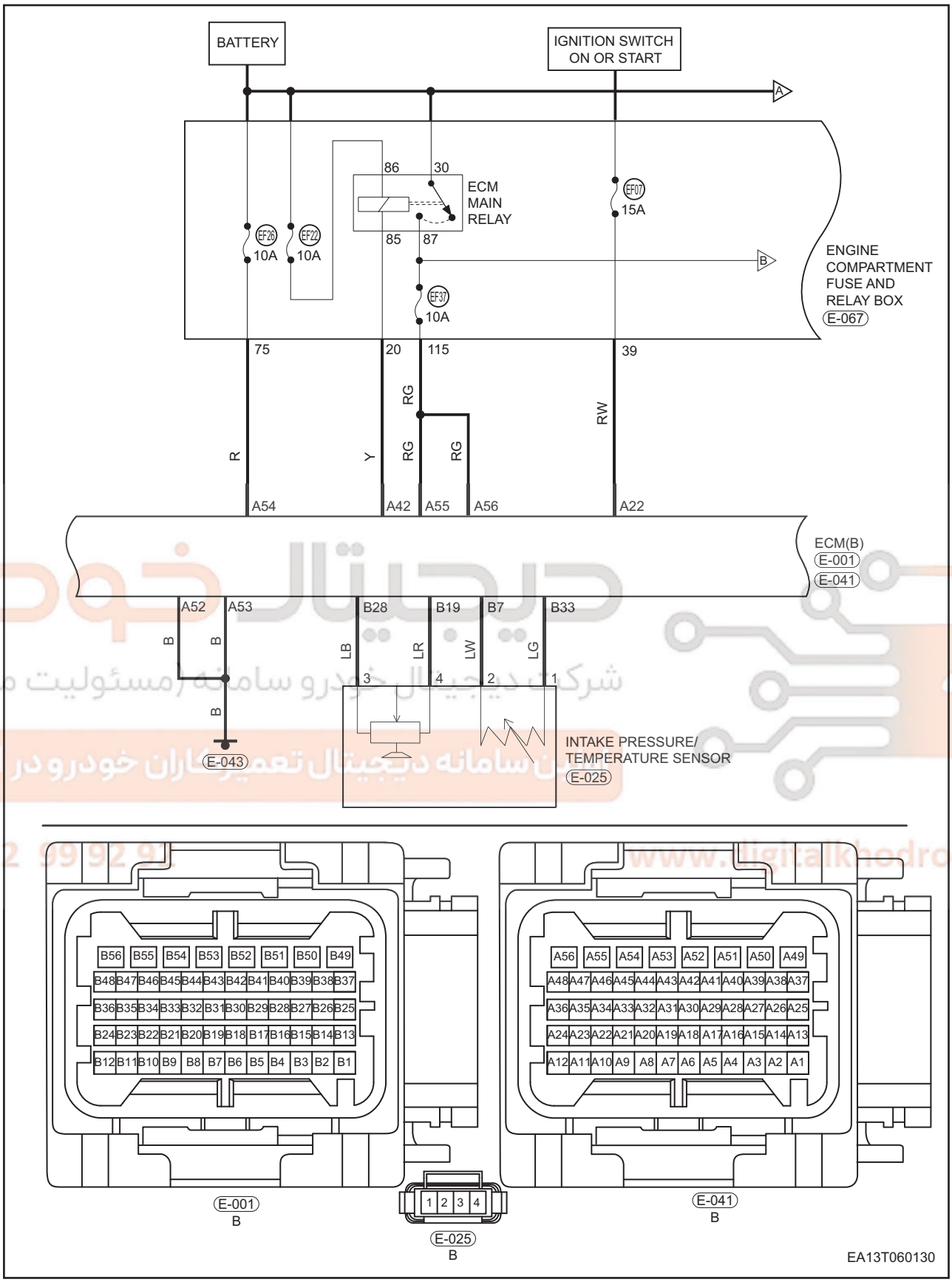
c. Check if DTC P0101-62, P0105-12, P0105-14, P1663-62, P0106-26 or P0106-27 still exists.

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	P0110-11	Air Temperature Sensor Circuit Short to Ground
DTC	P0110-15	Air Temperature Sensor Circuit Short to Battery or Open
DTC	P0110-3A	Air Temperature Sensor Signal Has Too Many Pulses
DTC	P0111-62	Air Temperature Sensor (Functional) Signal Compare Failure



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0110-11	Air Temperature Sensor Circuit Short to Ground	Ignition switch ON Engine running	• Intake temperature sensor • Wire harness or connector • ECM
P0110-15	Air Temperature Sensor Circuit Short to Battery or Open		
P0110-3A	Air Temperature Sensor Signal Has Too Many Pulses		
P0111-62	Air Temperature Sensor (Functional) Signal Compare Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

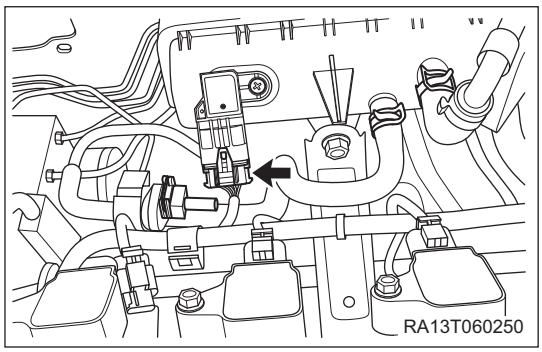
NG → **Repair or replace ground wire harness or ground point**

OK →

2	Check intake pressure/temperature sensor connector

a. Disconnect the intake pressure/temperature sensor connector E-025.

b. Check the intake pressure/temperature sensor connector.



NG → **Repair or replace connector**

OK

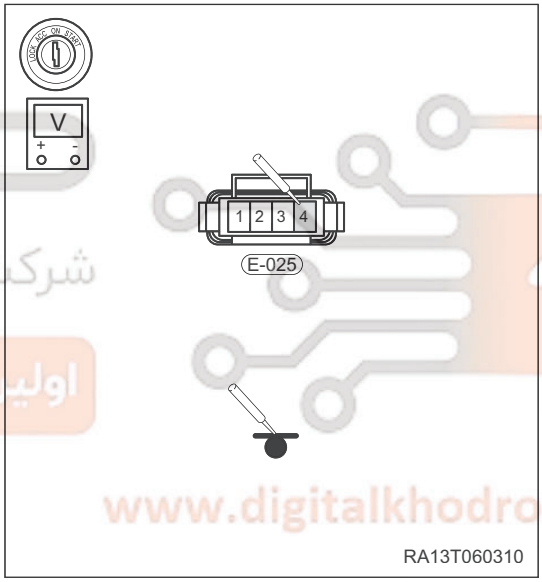
3	Check intake temperature sensor signal voltage

a. Connect the intake pressure/temperature sensor connector E-025.

b. Turn ignition switch to ON and start engine.

c. Using a multimeter, measure voltage between terminal 4 of connector E-025 and body ground.

Multimeter Connection	Condition	Specified Condition
E-025 (4) - Body ground	Ignition switch ON	5 V



OK → **Go to step 5**

NG

4	Check intake temperature sensor signal circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-018.

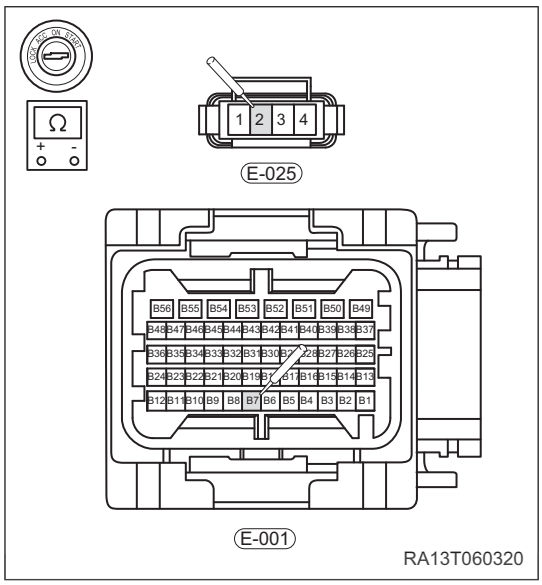
c. Check wire harness between connector terminal and ECM connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-025 (2) - E-001 (B7)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-025 (2) or E-001 (B7) - Body ground	Always	No continuity
E-025 (2) or E-001 (B7) - Battery positive	Always	No continuity



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

OK

5	Check intake temperature sensor ground circuit

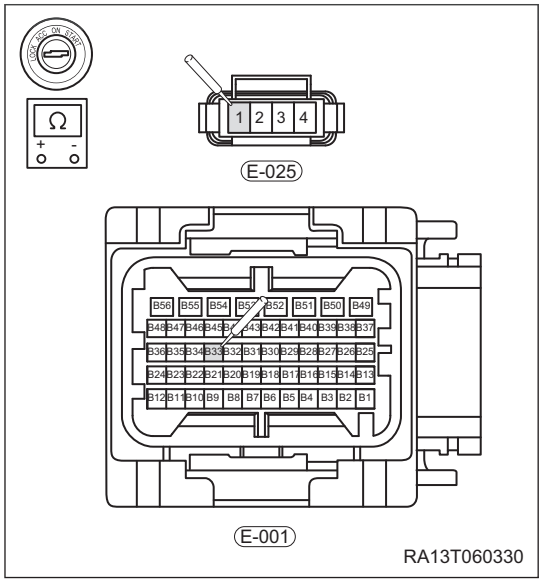
a. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-025 (1) - E-001 (B33)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-025 (1) or E-001 (B33) - Body ground	Always	No continuity
E-025 (1) or E-001 (B33) - Battery positive	Always	No continuity



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

OK

6	Check intake temperature sensor

a. Remove the intake pressure/temperature sensor.

b. Check resistance of intake temperature sensor.

Check for Open

Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 2	Always	2.5 kΩ ± 5% (20°C)

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

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

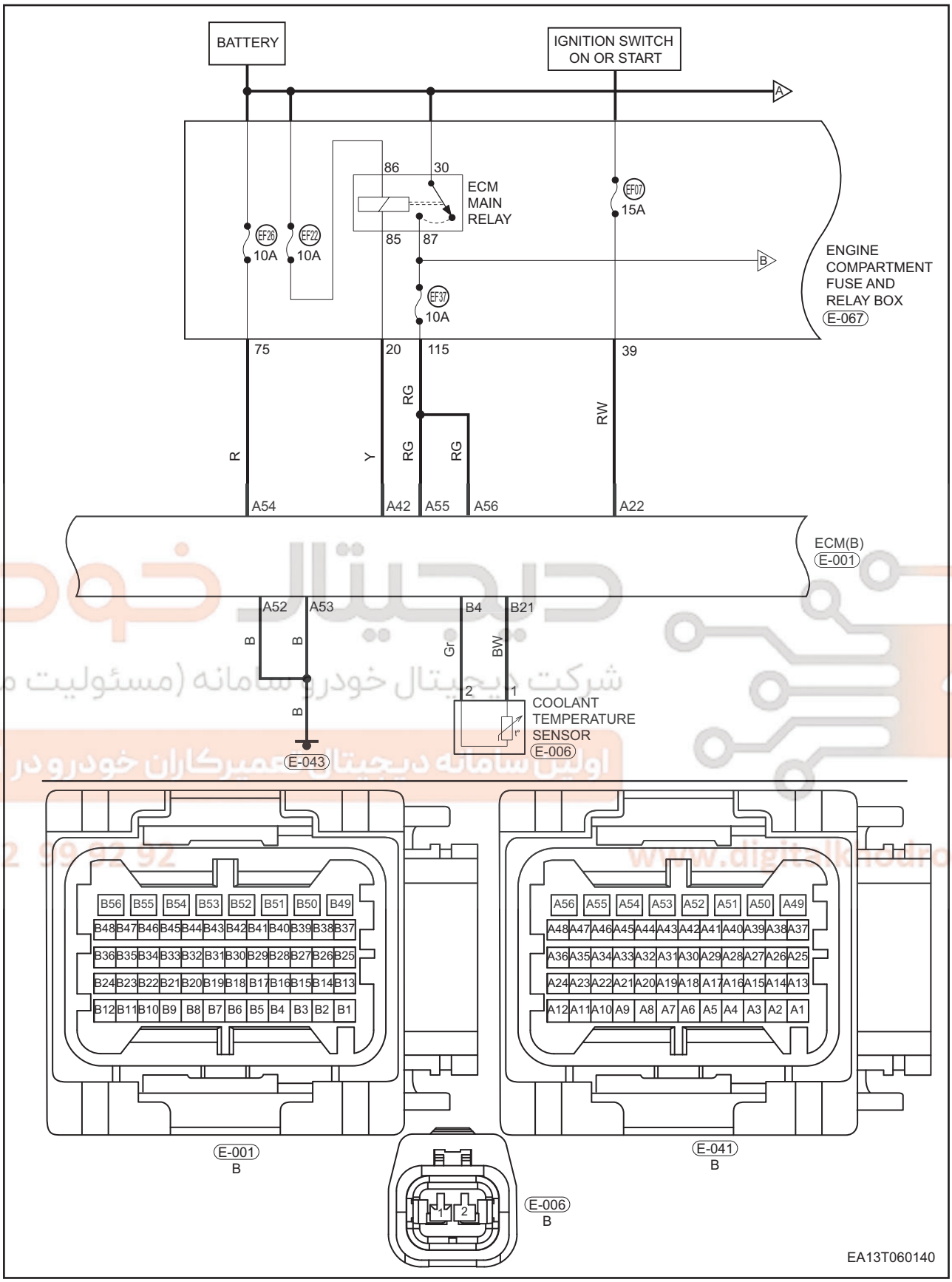
c. Check if DTC P0110-11, P0110-15, P0110-3A or P0111-62 exists.

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	P0115-11	Water temperature sensor Circuit Short to Ground
DTC	P0115-15	Water Temperature Sensor Circuit Short to Battery or Open
DTC	P0115-3A	Water Temperature Sensor Signal Has Too Many Pulses
DTC	P0116-62	Water Temperature Sensor (Functional) Signal Compare Failure



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0115-11	Water temperature sensor Circuit Short to Ground	Ignition switch ON Engine running	• Engine coolant temperature sensor • Wire harness or connector • ECM
P0115-15	Water Temperature Sensor Circuit Short to Battery or Open		
P0115-3A	Water Temperature Sensor Signal Has Too Many Pulses		
P0116-62	Water Temperature Sensor (Functional) Signal Compare Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

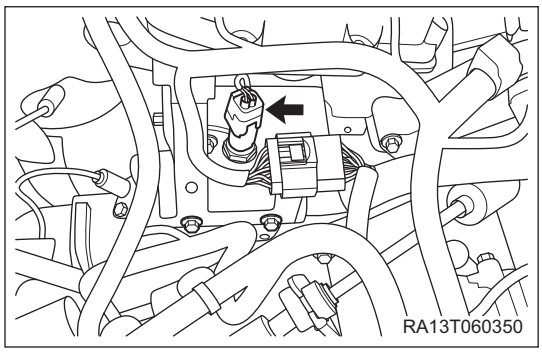
NG → **Repair or replace ground wire harness or ground point**

OK →

2	Check engine coolant temperature sensor connector

a. Disconnect the engine coolant temperature sensor connector E-006.

b. Check engine coolant temperature sensor connector



NG → Repair or replace connector

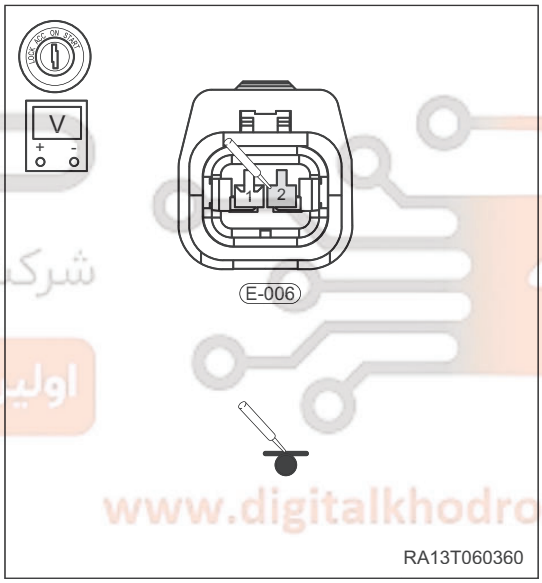
OK

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-006 (2) - Body ground	Ignition switch ON	5 V



OK → Go to step 5

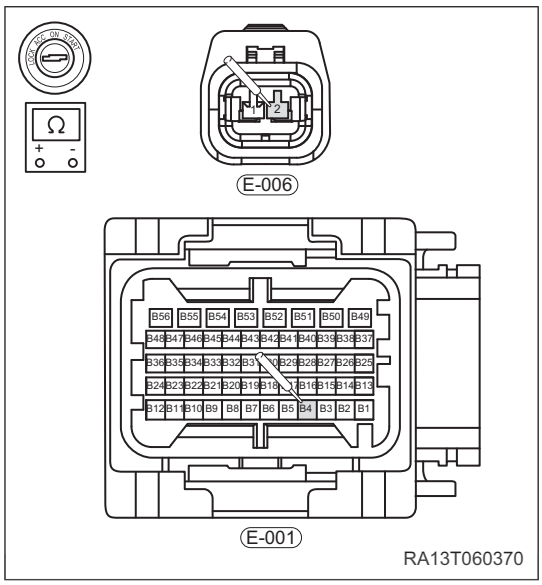
NG

4	Check engine coolant temperature sensor power supply circuit

a. Disconnect the engine coolant temperature sensor connector E-025.

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-006 (2) - E-001 (B4)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-006 (2) or E-001 (B4) - Body ground	Always	No continuity
E-006 (2) or E-001 (B4) - 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

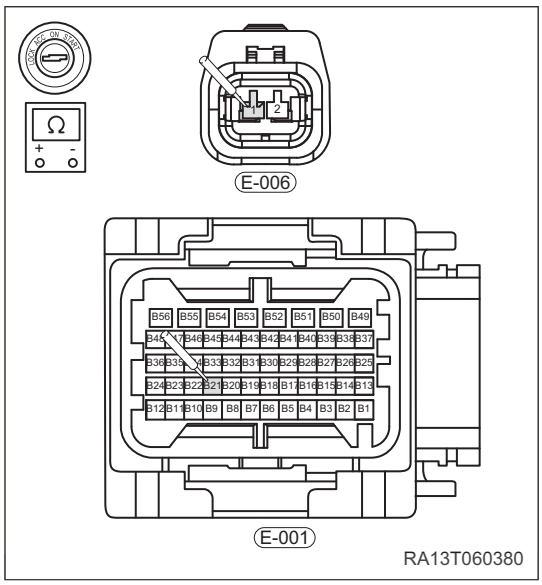
a. Check wire harness between engine coolant temperature sensor connector terminal and ECM connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-006 (1) - E-001 (B21)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-006 (1) or E-001 (B21) - Body ground	Always	No continuity
E-006 (1) or E-001 (B21) - Battery positive	Always	No continuity



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

OK

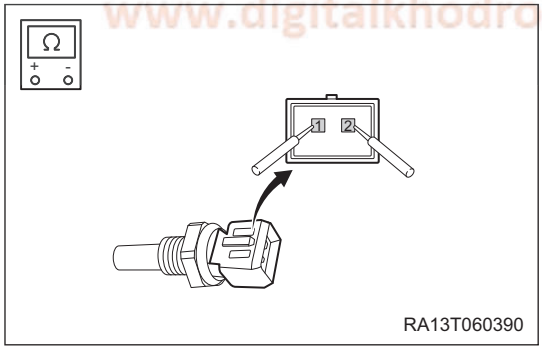
6	Check engine coolant temperature sensor

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 Resistance is 2.5 kΩ ± 5% at normal temperature (20°C) and 300 - 400 Ω in boiled water (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 DTC.

b. Refer to "DTC Confirmation Procedure".

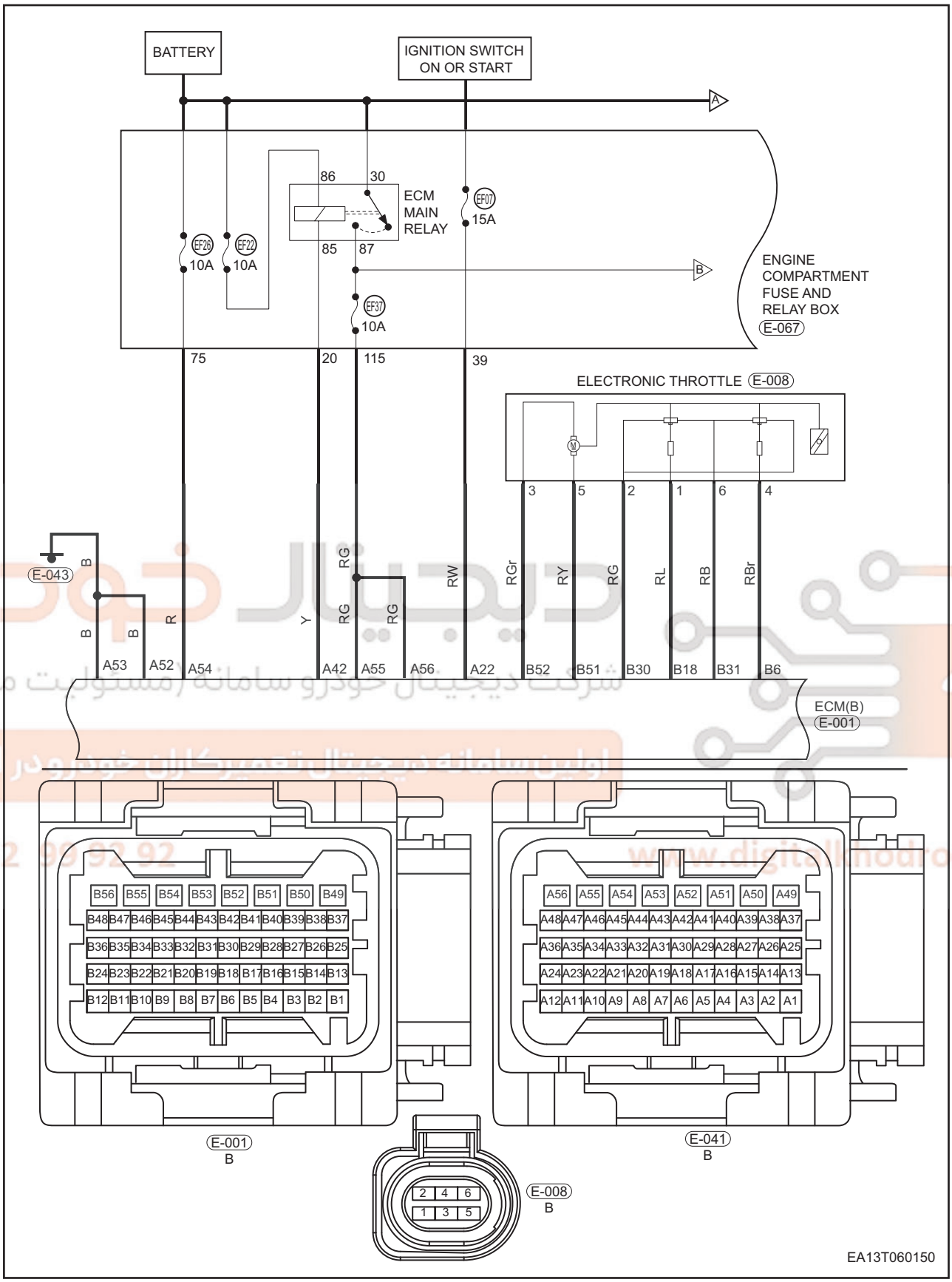
c. Check if DTC P0115-11, P0115-15, P0115-3A or P0116-62 still exists.

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	P0121-12	Throttle Potentiometer 1 Circuit Short to Battery
DTC	P0121-14	Pedal Potentiometer 1 Circuit Short to Ground or Open
DTC	P0221-12	Throttle Potentiometer 2 Circuit Short to Battery
DTC	P0221-14	Pedal Potentiometer 2 Circuit Short to Ground or Open



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0121-12	Throttle Potentiometer 1 Circuit Short to Battery	Ignition switch ON Engine running	• Throttle position sensor 1 • Throttle position sensor 2 • Wire harness or connector • ECM
P0121-14	Pedal Potentiometer 1 Circuit Short to Ground or Open		
P0221-12	Throttle Potentiometer 2 Circuit Short to Battery		
P0221-14	Pedal Potentiometer 2 Circuit Short to Ground or Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

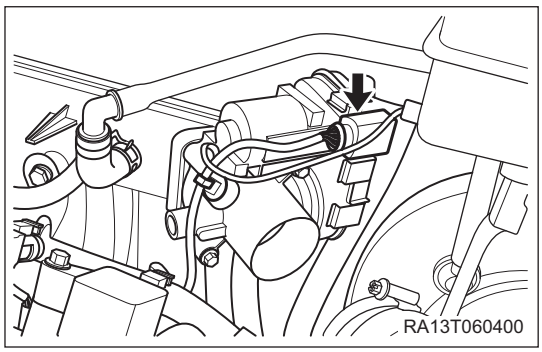
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check electronic throttle connector

a. Disconnect the electronic throttle connector E-008.

b. Check the electronic throttle connector.



NG → Repair or replace connector

OK

3	Check throttle position sensor 1 signal voltage

a. Turn ignition switch to ON.

b. Connect the electronic throttle connector E-008.

c. Using diagnostic tester, check signal voltage of throttle position sensor 1.

Multimeter Connection	Condition	Specified Condition
Accelerator pedal released	Ignition switch ON	0.78 V
Accelerator pedal depressed		4.22 V

OK → Go to step 8

NG

4	Check throttle position sensor power supply voltage

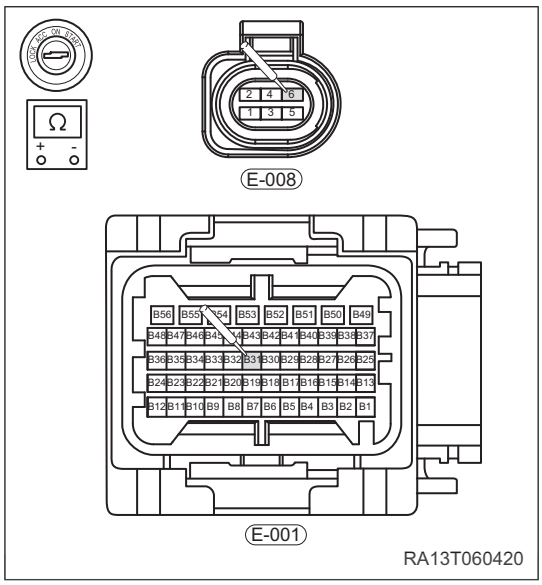
a. Turn ignition switch to LOCK.

b. Disconnect the electronic throttle connector E-008.

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

Voltage Inspection

Multimeter Connection	Condition	Specified Condition
E-008 (6) - Body ground	Ignition switch ON	5 V



OK → **Go to step 6**

NG

5	Check throttle position sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-001.

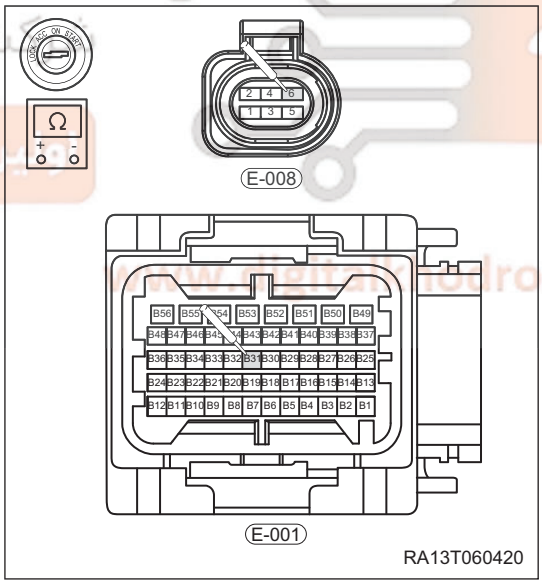
c. Check wire harness between electronic throttle connector terminal and ECM connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-008 (6) - E-001 (B31)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-008 (6) or E-001 (B31) - Body ground	Always	No continuity
E-008 (6) or E-001 (B31) - Battery positive	Always	No continuity

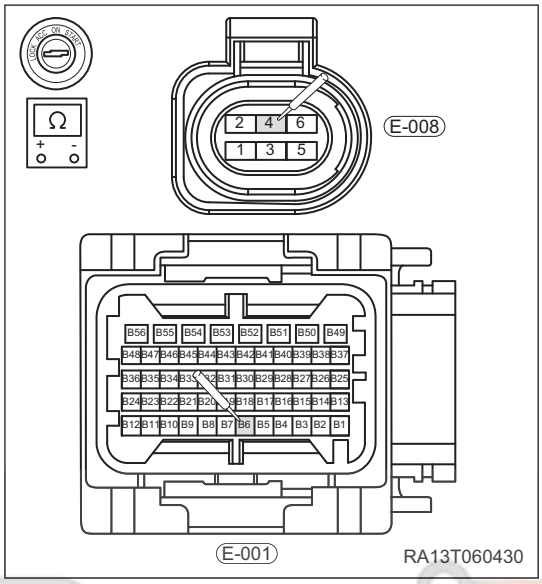


NG → **Replace wire harness or connector (electronic throttle - ECM)**

OK

6	Check throttle position sensor 1 signal circuit and ground circuit

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-008 (4) - E-001 (B6)	Always	Continuity
E-008 (2) - E-001 (B30)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-008 (4), E-018 (B6), E-008 (2) or E-001 (B30) - Body ground	Always	No continuity
E-008 (4), E-018 (B6), E-008 (2) or E-001 (B30) - Battery positive	Always	No continuity

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

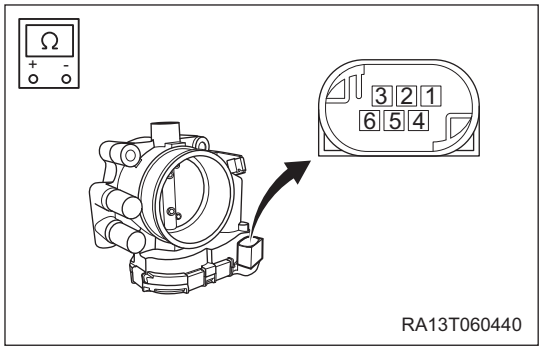
OK

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 3 - Terminal 2	Normal temperature	1.067 kΩ

Multimeter Connection	Condition	Specified Condition
Terminal 6 - Terminal 2	Throttle turned	Resistance increases as throttle valve opens
Terminal 6 - Terminal 3	Throttle turned	Resistance decreases as throttle valve opens

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 DTC.

b. Refer to "DTC Confirmation Procedure".

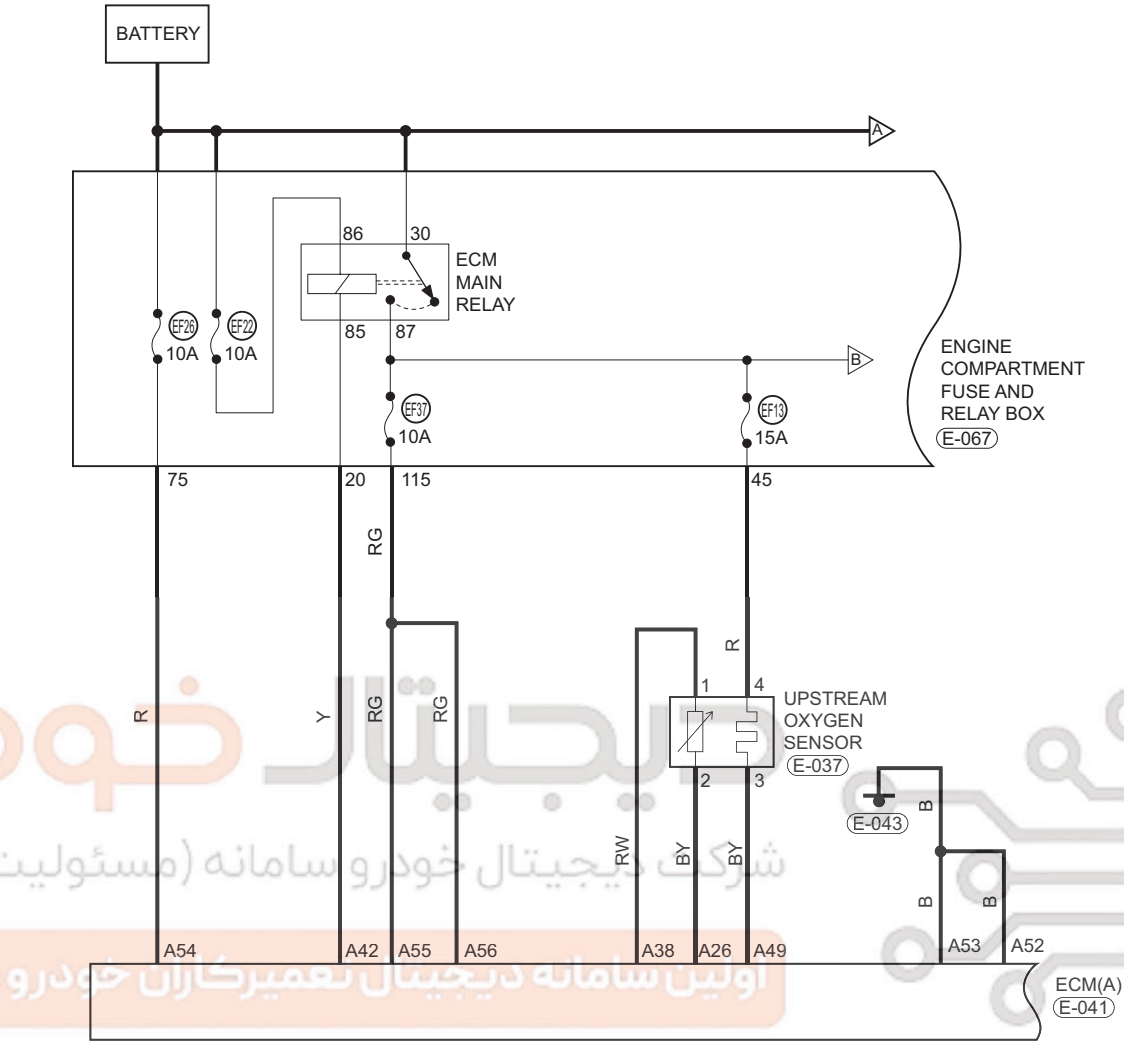
c. Check if DTC P0120-12, P0120-14, P0121-12 or P0121-14 still exists.

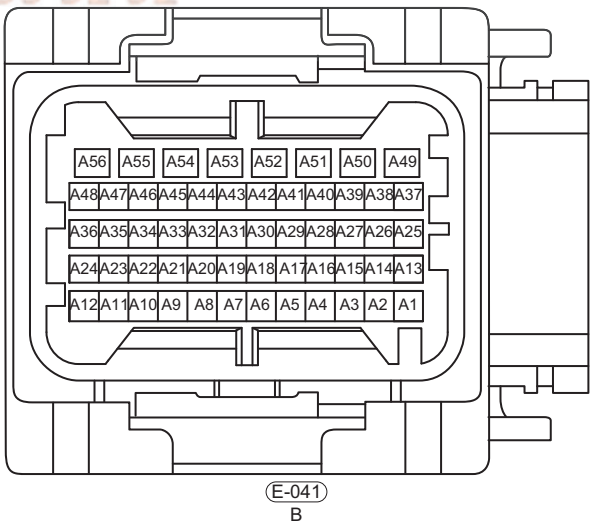
NG → **Replace ECM**

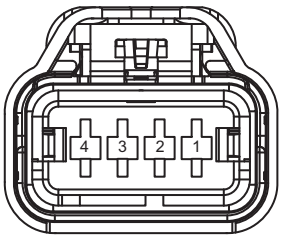
OK ↓

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

DTC	P0130-23	Functional Test Lambda Sensor 1 Signal Stuck Low
DTC	P0130-24	Functional Test Lambda Sensor 1 Signal Stuck High
DTC	P0133-62	First Probe Diagnosis Signal Compare Failure







EA13T060160

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0130-23	Functional Test Lambda Sensor 1 Signal Stuck Low	Ignition switch ON Engine running	• Upstream oxygen sensor • Wire harness or connector • ECM
P0130-24	Functional Test Lambda Sensor 1 Signal Stuck High		
P0133-62	First Probe Diagnosis Signal Compare Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

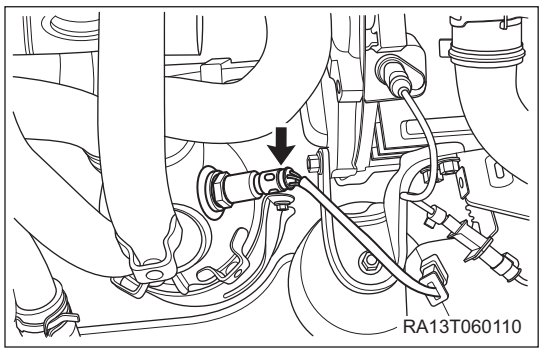
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check upstream oxygen sensor connector

a. Disconnect the upstream oxygen sensor connector E-037.

b. Check the upstream oxygen sensor connector.



NG → Repair or replace connector

OK

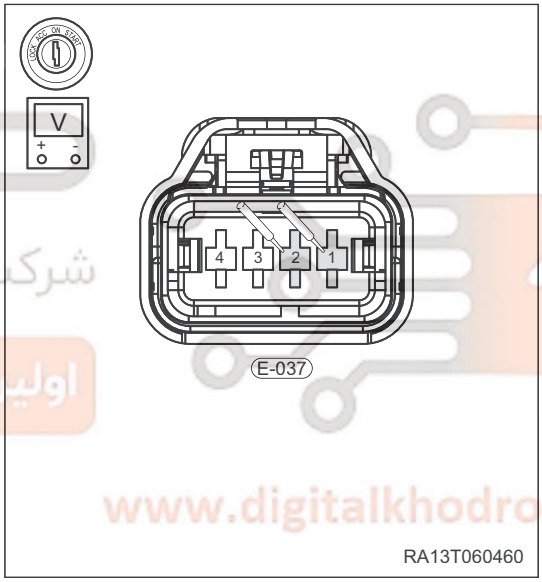
3	Check upstream oxygen sensor signal

a. Connect the upstream oxygen sensor connector E-037.

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

c. Using a multimeter, measure voltage between terminals 2 and 1 of connector E-037.

Multimeter Connection	Condition	Specified Condition
E-037 (2) - E-037 (1)	Engine running	Fluctuates fast between 0.1 and 0.9 V (when operating temperature is 350°C)



OK → Go to step 8

NG

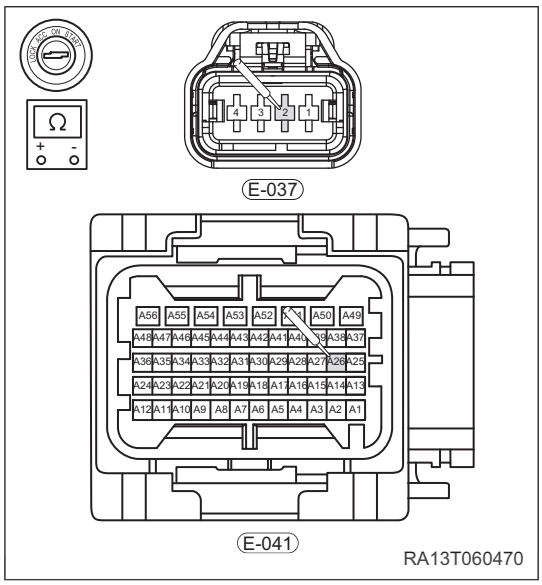
4	Check upstream oxygen sensor signal circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-001.

c. Disconnect the upstream oxygen sensor connector E-037.

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-037 (2) - E-041 (A26)	Always	Continuity

Check for Short

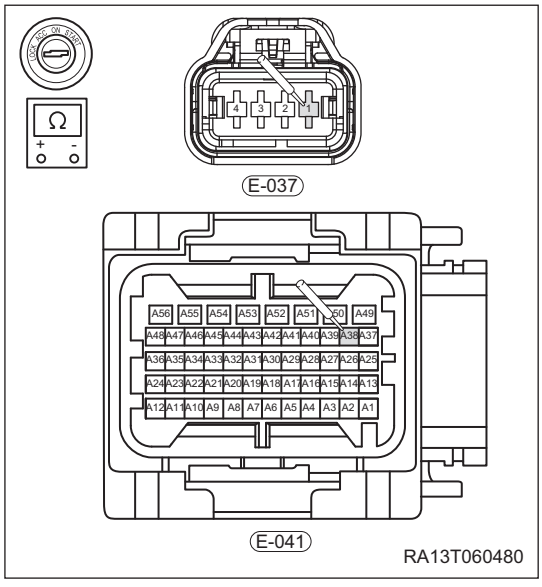
Multimeter Connection	Condition	Specified Condition
E-037 (2) or E-041 (A26) - Body ground	Always	No continuity
E-037 (2) or E-041 (A26) - Battery positive	Always	No continuity

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

OK

5	Check upstream oxygen sensor ground circuit

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-037 (1) - E-041 (A38)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-037 (1) or E-041 (A38) - Body ground	Always	No continuity

Multimeter Connection	Condition	Specified Condition
E-037 (1) or E-041 (A38) - Battery positive	Always	No continuity

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

OK ↓

6	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 ↓

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

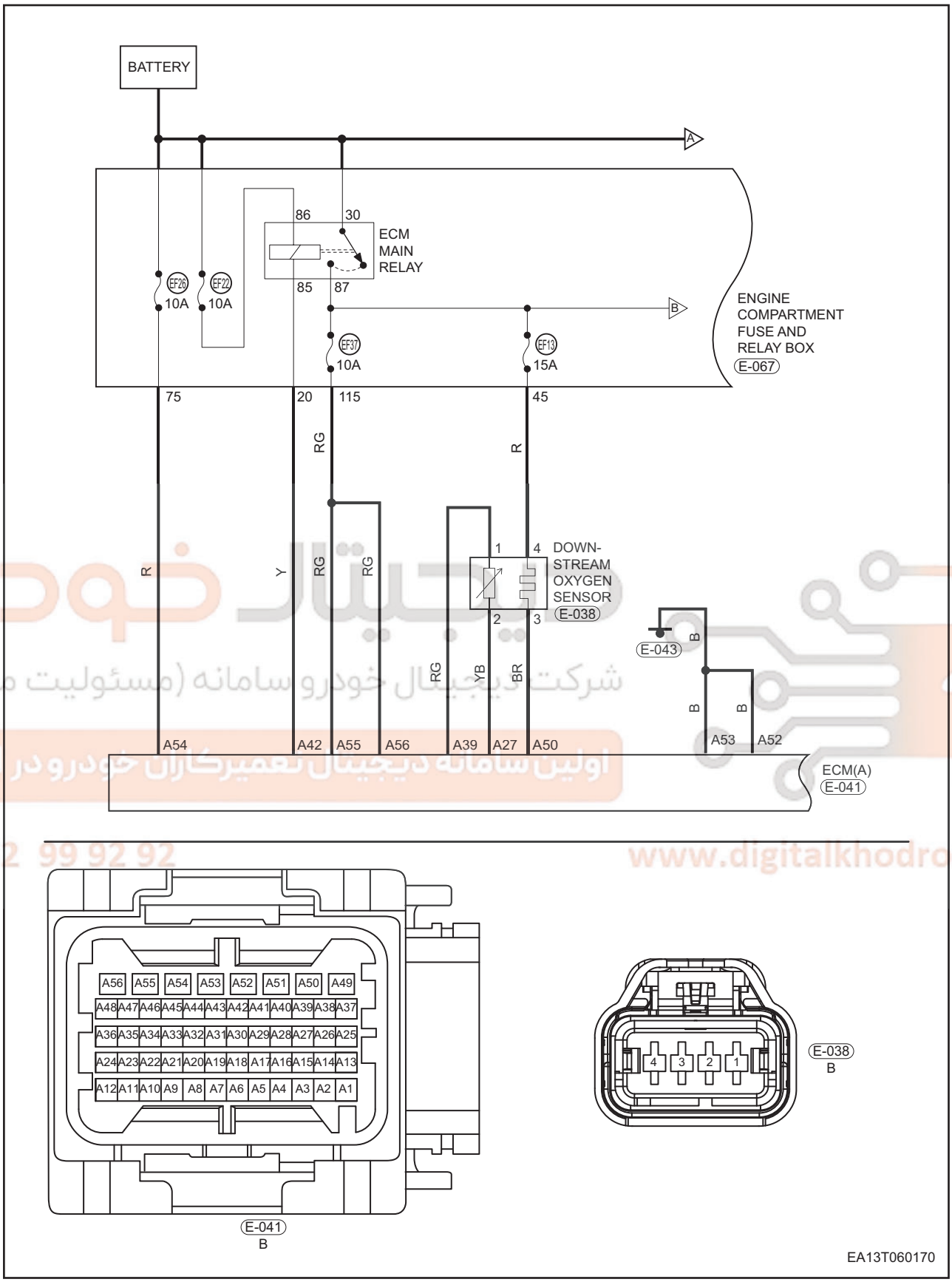
c. Check if DTC P0130-23, P0130-24 or P0133-62 still exists.

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	P0136-23	Functional Test Lambda Sensor 2 Signal Stuck Low
DTC	P0136-24	Functional Test Lambda Sensor 2 Signal Stuck High
DTC	P0139-62	DO2V Signal Compare Failure



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0136-23	Functional Test Lambda Sensor 2 Signal Stuck Low	Ignition switch ON Engine running	• Downstream oxygen sensor • Wire harness or connector • ECM
P0136-24	Functional Test Lambda Sensor 2 Signal Stuck High		
P0139-62	DO2V Signal Compare Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

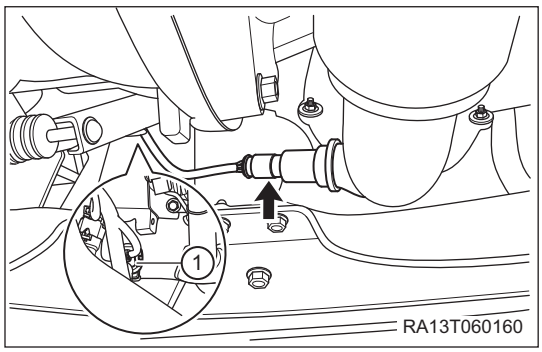
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check downstream oxygen sensor connector

a. Disconnect the downstream oxygen sensor connector E-038.

b. Check the downstream oxygen sensor connector.



NG → Repair or replace connector

OK

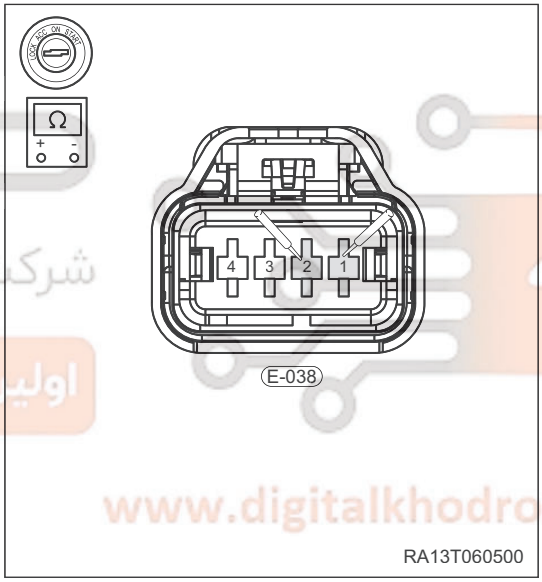
3	Check downstream oxygen sensor signal

a. Connect the downstream oxygen sensor connector E-038.

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 2 and 1 of connector E-062.

Multimeter Connection	Condition	Specified Condition
E-038 (2) - E-038 (1)	Engine running	Fluctuates slightly at about 0.45 V



OK → Go to step 8

NG

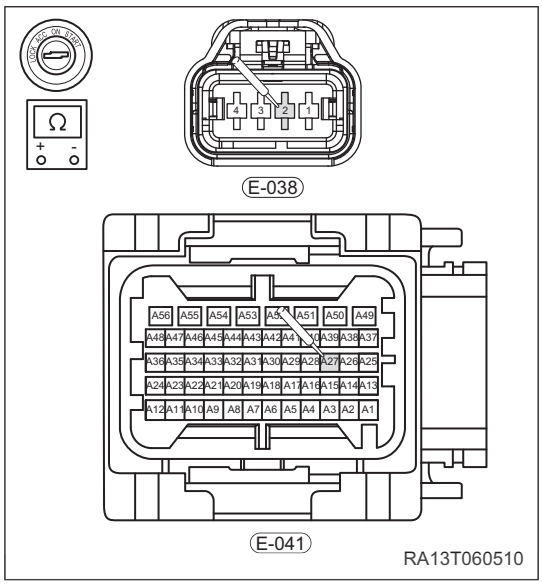
4	Check downstream oxygen sensor signal circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-041.

c. Disconnect the downstream oxygen sensor connector E-038.

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-038 (2) - E-041 (A27)	Always	Continuity

Check for Short

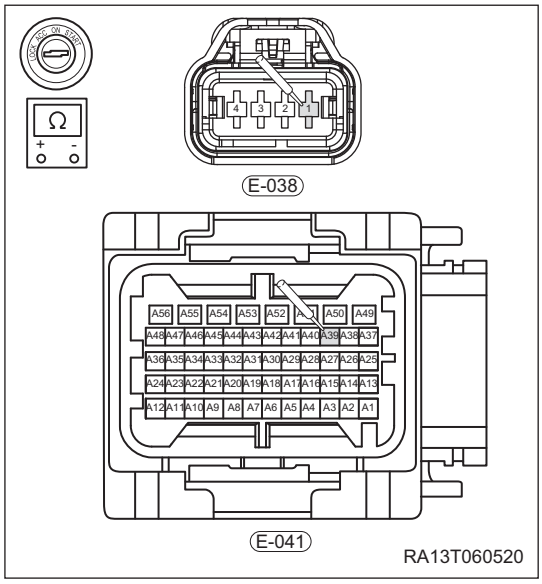
Multimeter Connection	Condition	Specified Condition
E-038 (2) or E-041 (A27) - Body ground	Always	No continuity
E-038 (2) or E-041 (A27) - Battery positive	Always	No continuity

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

OK

5	Check downstream oxygen sensor ground circuit

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-038 (1) - E-041 (A39)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-038 (1) or E-041 (A39) - Body ground	Always	No continuity

Multimeter Connection	Condition	Specified Condition
E-038 (1) or E-041 (A39) - Battery positive	Always	No continuity

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

OK ↓

6	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 ↓

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

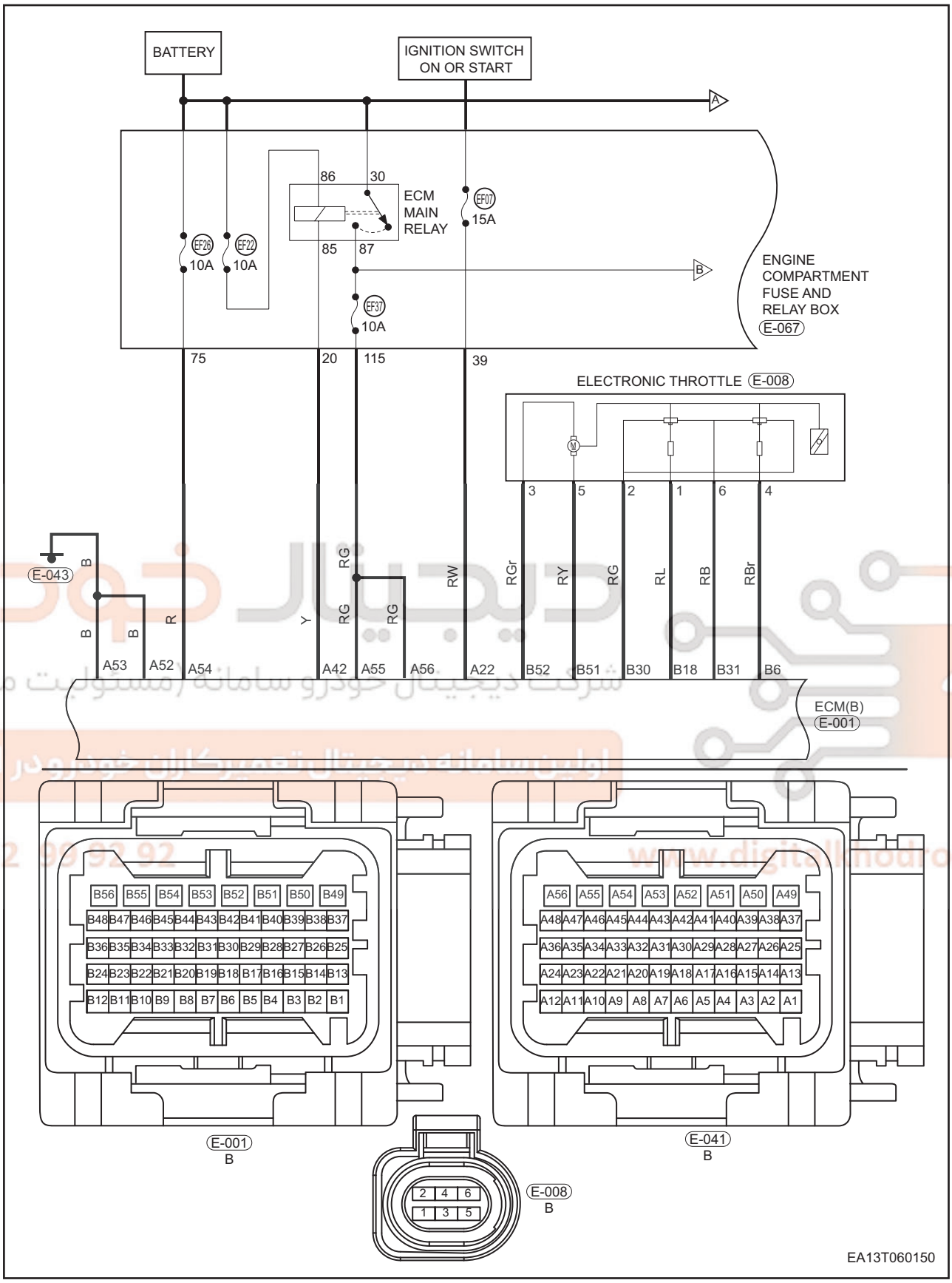
c. Check if DTC P0136-23, P0136-24 or P0139-62 still exists.

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	P1654-62	Throttle Potentiometer Congruence Signal Compare Failure
DTC	P1655-94	Self Learning Throttle bat Unexpected Operation
DTC	P1656-94	Self Learning Throttle slc Unexpected Operation
DTC	P1657-77	Self Learning Throttle lhp Commanded Position not Reachable
DTC	P1658-77	Self Learning Throttle trc Commanded Position not Reachable
DTC	P1659-92	Self Learning Throttle mtc Performance or Incorrect Operation
DTC	P1660-77	Self Learning Throttle tro Commanded Position not Reachable



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P1654-62	Throttle Potentiometer Congruence Signal Compare Failure	Ignition switch ON Engine running	• Unsuccessful throttle self-learning • Insufficient battery voltage • Throttle mechanical malfunction • Wire harness or connector • ECM
P1655-94	Self Learning Throttle bat Unexpected Operation		
P1656-94	Self Learning Throttle slc Unexpected Operation		
P1657-77	Self Learning Throttle lhp Commanded Position not Reachable		
P1658-77	Self Learning Throttle trc Commanded Position not Reachable		
P1659-92	Self Learning Throttle mtc Performance or Incorrect Operation		
P1660-77	Self Learning Throttle tro Commanded Position not Reachable		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

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

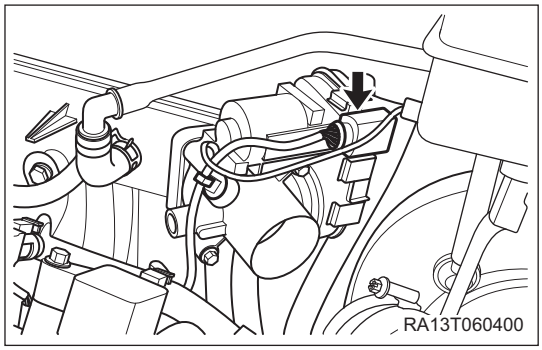
OK

2	Check electronic throttle connector

a. Disconnect the electronic throttle connector E-008.

b. Check electronic throttle connector

NG → **Repair or replace connector**



OK

3	Perform electronic throttle self-learning procedures

a. Connect the electronic throttle connector E-008.

b. Perform the electronic throttle self-learning procedures (See page 06-20).

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

d. Check if DTC P1654-62, P1655-94, P1656-94, P1657-77, P1658-77, P1659-92 or P1660-77 still exists.

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

NG

4	Check battery voltage

a. Check the battery voltage (See page 16-6).

NG → **Detect or replace battery**

OK

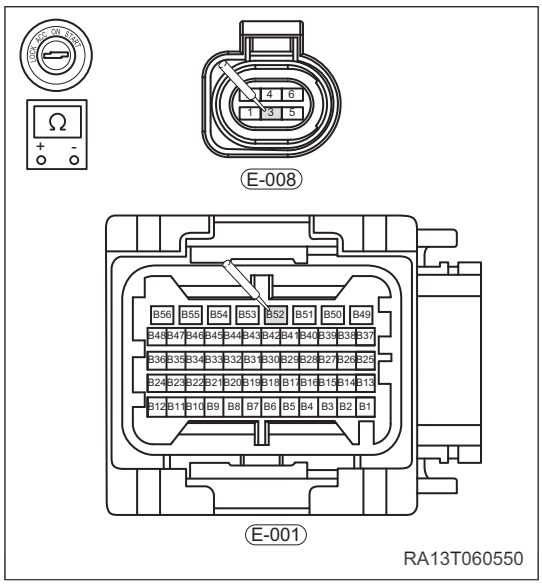
5	Check electronic throttle actuator circuit

a. Turn ignition switch to LOCK.

b. Disconnect the electronic throttle connector E-008.

c. Disconnect the ECM connector E-001.

d. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-001 (B52) - E-008 (3)	Always	Continuity
E-001 (B51) - E-008 (5)	Always	Continuity

Check for Short

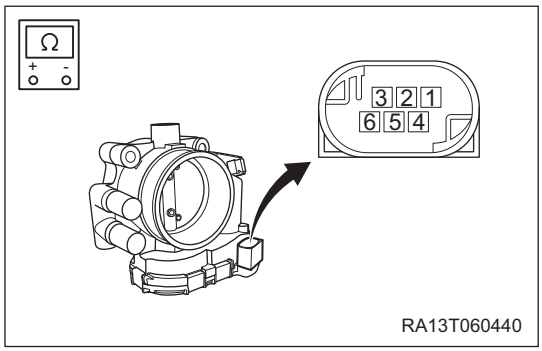
Multimeter Connection	Condition	Specified Condition
E-001 (B52), E-008 (3), E-001 (B51) or E-008 (5) - Body ground	Always	No continuity
E-001 (B52), E-008 (3), E-001 (B51) or E-008 (5) - Battery positive	Always	No continuity

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

OK

6	Check electronic throttle

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



Check for Short

Multimeter Connection	Condition	Specified Condition
Terminal 3 - Terminal 2	Throttle turned	1.067 kΩ
Terminal 6 - Terminal 2		Resistance increases as throttle valve opens
Terminal 6 - Terminal 3		Resistance decreases as throttle valve opens
Terminal 5 - Terminal 2		Resistance decreases as throttle valve opens
Terminal 5 - Terminal 3		Resistance increases as throttle valve opens

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

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

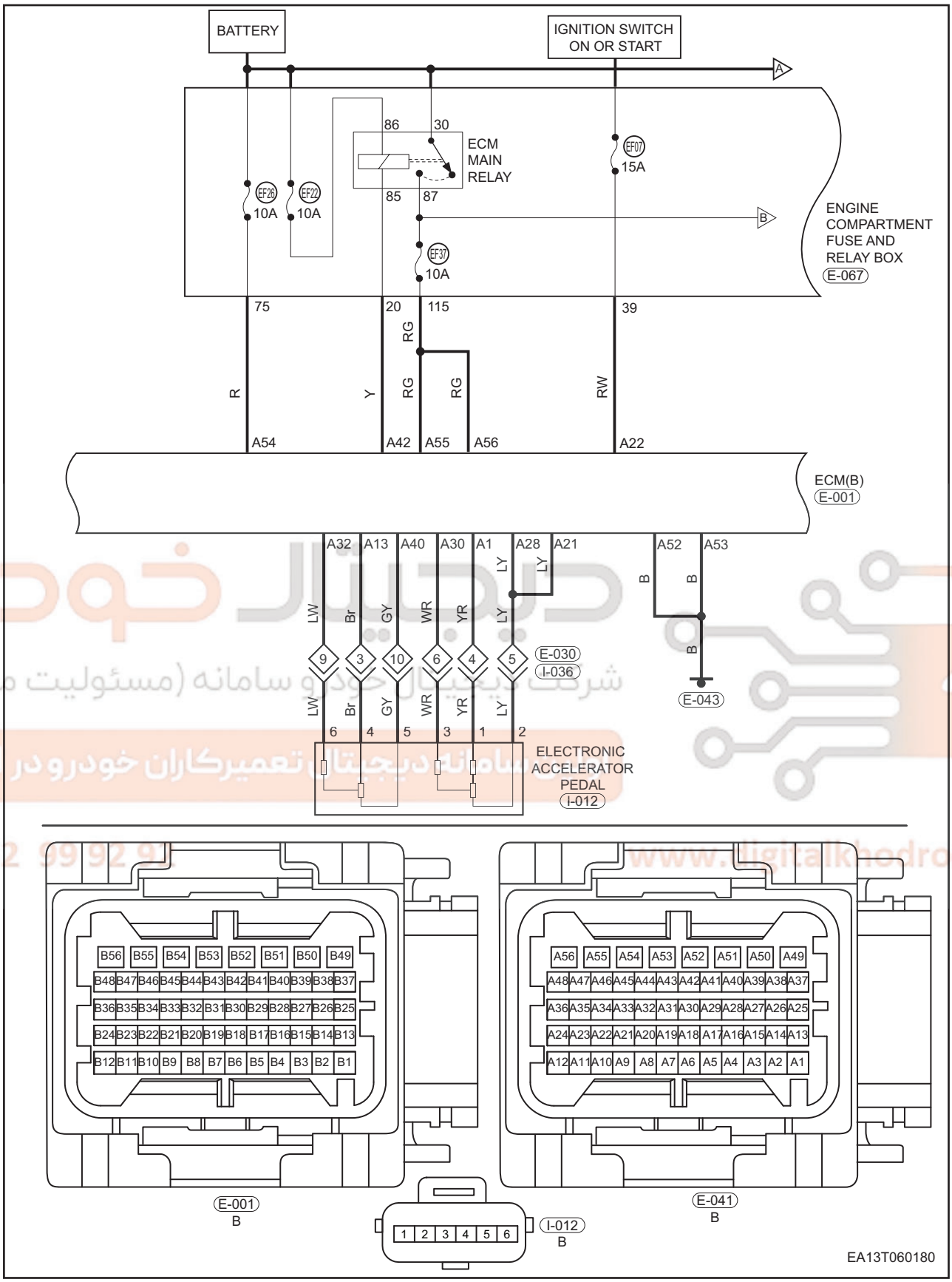
c. Check if DTC P1654-62, P1655-94, P1656-94, P1657-77, P1658-77, P1659-92 or P1660-77 still exists.

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	P0120-12	Pedal Ootentiometer 1 Circuit Short to Battery
DTC	P0120-14	Pedal Potentiometer 1 Circuit Short to Ground or Open
DTC	P0220-12	Pedal Ootentiometer 2 Circuit Short to Battery
DTC	P0220-14	Pedal Potentiometer 2 Circuit Short to Ground or Open



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0120-12	Pedal Ootentiometer 1 Circuit Short to Battery	Ignition switch ON Engine running	• Accelerator pedal position sensor 1 • Wire harness or connector • ECM
P0120-14	Pedal Potentiometer 1 Circuit Short to Ground or Open		
P0220-12	Pedal Ootentiometer 2 Circuit Short to Battery		
P0220-14	Pedal Potentiometer 2 Circuit Short to Ground or Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

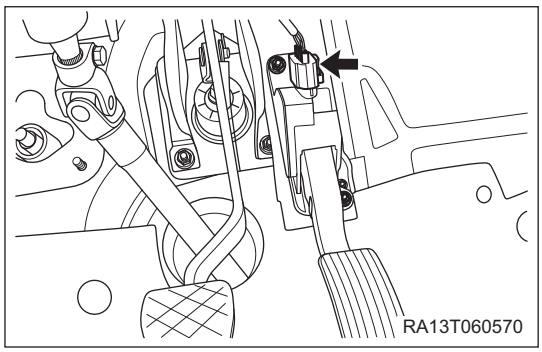
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check electronic accelerator pedal connector

a. Disconnect the electronic accelerator pedal connector I-012 (arrow).

b. Check the electronic accelerator pedal connector.



NG → **Repair or replace connector**

OK

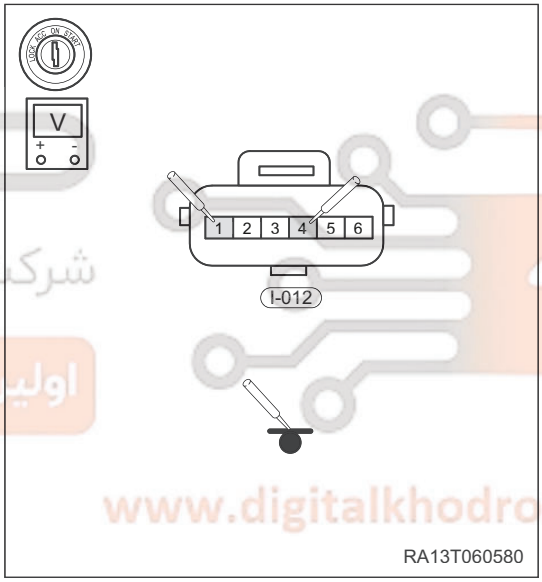
3	Check electronic accelerator pedal voltage

a. Turn ignition switch to ON.

b. Connect the electronic accelerator pedal connector I-012.

c. Using diagnostic tester, check signal voltage of electronic accelerator pedal.

Multimeter Connection	Condition	Specified Condition
I-012 (1,4) - Body ground	Ignition switch ON	5 V
I-012 (2,5) - Body ground		0 V



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

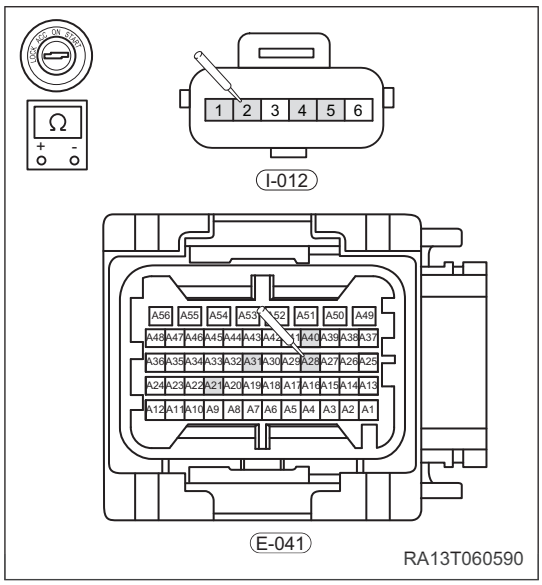
OK

4	Check electronic accelerator pedal circuit

a. Turn ignition switch to LOCK.

b. Disconnect electronic accelerator pedal connector I-012.

c. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
I-012 (2) - E-041 (A28)	Always	Continuity
I-012 (1) - E-041 (A21)		
I-012 (5) - E-041 (A40)		
I-012 (4) - E-041 (A31)		

Check for Short

Multimeter Connection	Condition	Specified Condition
I-012 (1, 2, 4, 5) or E-041 (A13, A21, A28, A40) - Battery positive	Always	No continuity
I-012 (1, 2, 4, 5) or E-041 (A13, A21, A28, A40) - Battery positive		

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

OK

5	Check electronic accelerator pedal sensor circuit

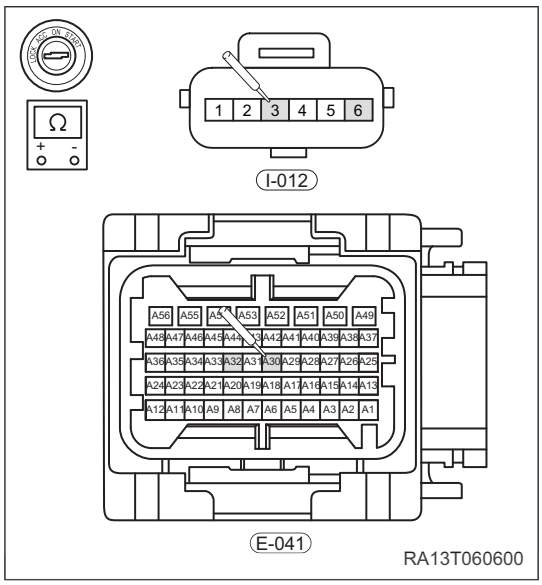
a. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
I-012 (3) - E-041 (A30)	Always	Continuity
I-012 (6) - E-041 (A32)		

Check for Short

Multimeter Connection	Condition	Specified Condition
I-012 (3, 6) or E-041 (A30,32) - Body ground	Always	No continuity
I-012 (3, 6) or E-041 (A30, 32) - Battery positive		



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

OK

6	Replace electronic throttle pedal and check DTC again

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

b. Refer to "DTC Confirmation Procedure".

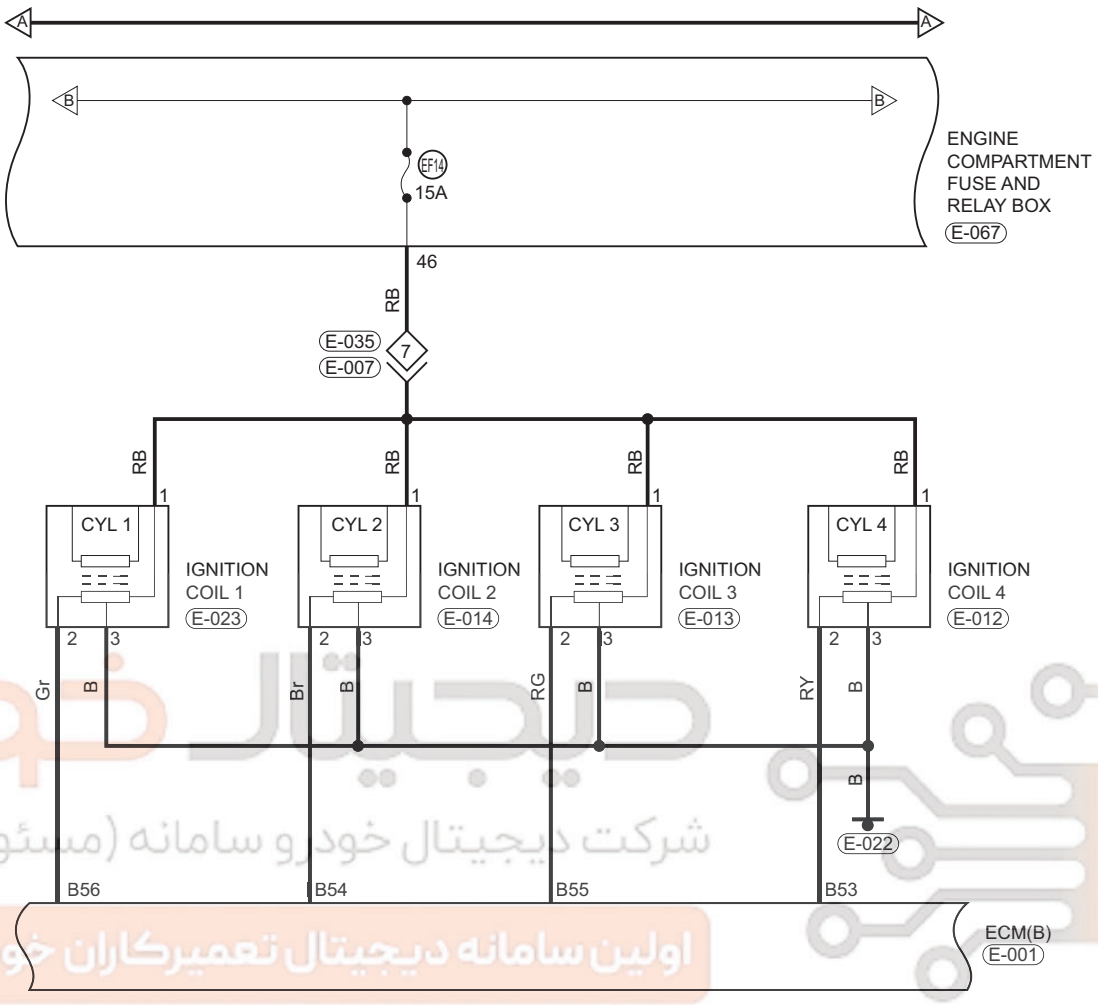
c. Check if DTC P0120-12, P0120-14, P0220-12 or P0220-14 still exists.

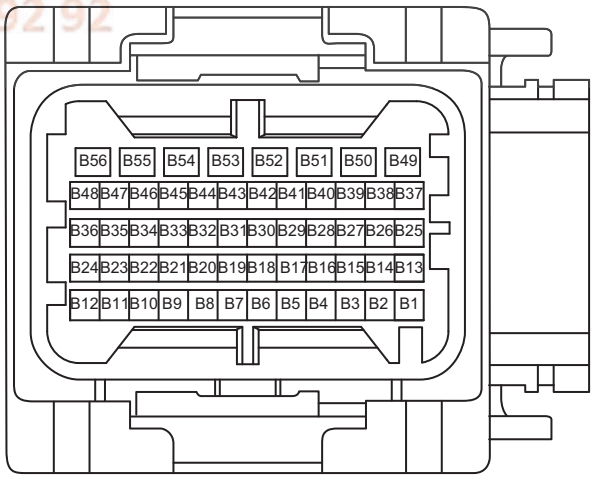
NG → **Replace ECM**

OK

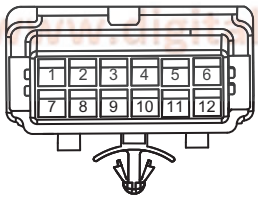
System is operating normally. Reassemble vehicle and perform a road test to confirm that malfunction reported by customer has been repaired.

DTC	P0351-12	Ignition 1 Driver Circuit Short to Battery
DTC	P0351-14	Ignition 1 Driver Circuit Short to Ground or Open

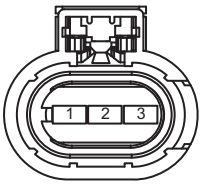




E-001
B



E-007
B



E-023 E-014
B B
E-013 E-012
B B

EA13T060190

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0351-12	Ignition 1 Driver Circuit Short to Battery	Ignition switch ON Engine running	• Ignition coil 1 • Wire harness or connector • ECM
P0351-14	Ignition 1 Driver Circuit Short to Ground or Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

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

OK

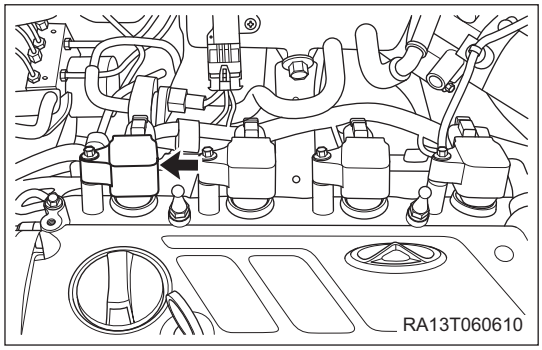
2	Check ignition coil connector

a. Turn ignition switch to LOCK.

b. Disconnect the ignition coil 1 connector E-023 (arrow).

c. Check the ignition coil connector.

NG → **Repair or replace connector**



OK

3	Check compression of misfiring cylinder

a. Measure compression of misfiring cylinder (See page 07-16).

NG → **Check engine to confirm cause of low compression**

OK

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

06

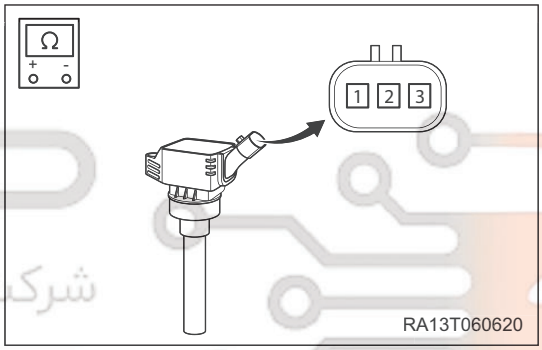
4	Check ignition coil

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

b. Inspect resistance of ignition coil secondary winding.

Primary Ignition Coil Inspection

Multimeter Connection	Condition	Specified Condition (KΩ)
Posts of high-voltage cable	Normal temperature (25°C ± 5°C)	9.68 - 12.32



NG → **Check engine to confirm cause of low compression**

OK

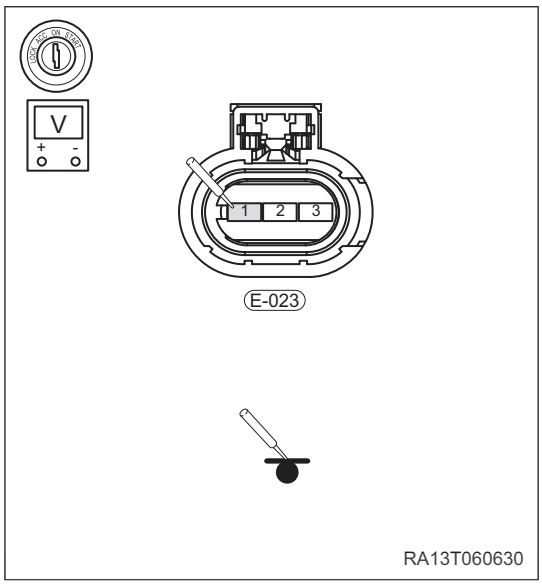
5	Check ignition coil power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between ignition coil connector terminal and body ground.

c. Using diagnostic tester, check signal voltage of ignition coil.

Multimeter Connection	Condition	Specified Condition
E-023 (1) - Body ground	Ignition switch ON	11 - 14 V



OK → **Go to step 7**

NG

6	Check ignition coil power supply circuit

a. Turn ignition switch to LOCK.

b. Check fuse EF14 and main relay.

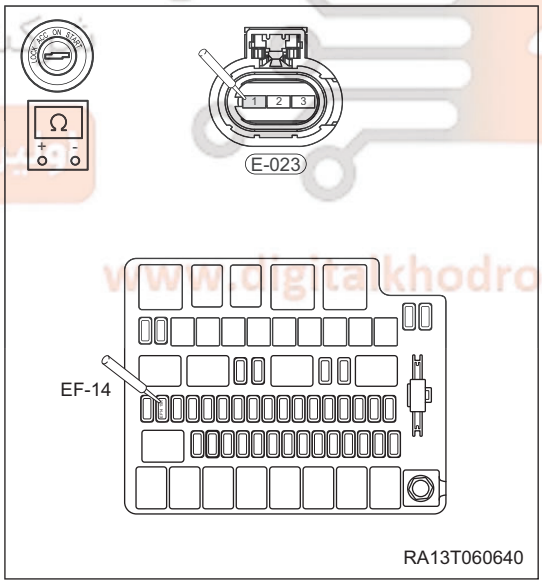
c. Check wire harness between ignition coil connector terminal and engine compartment fuse and relay box connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-023 (1) - E-067 (46)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-023 (1) or E-067 (46) - Body ground	Always	No continuity
E-023 (1) or E-067 (46) - Battery positive		



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

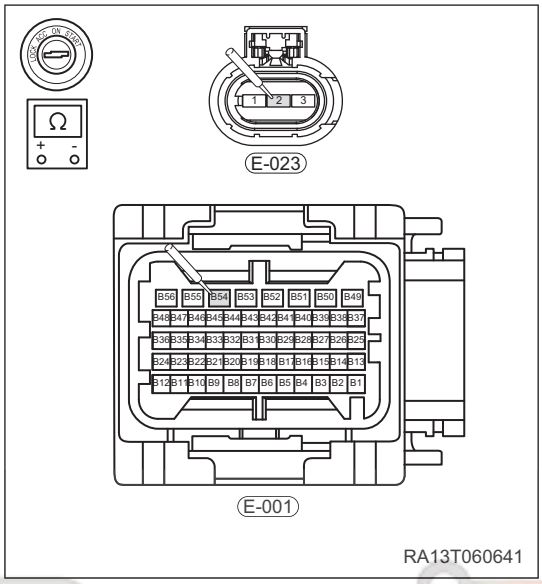
OK

7	Check ignition coil control circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-001.

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-023 (2) - E-001 (B54)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-023 (2) or E-001 (B54) - Body ground	Always	No continuity
E-023 (2) or E-001 (B54) - Battery positive		

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

OK

8	Replace ignition coil 1 and check DTC again

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

b. Refer to "DTC Confirmation Procedure".

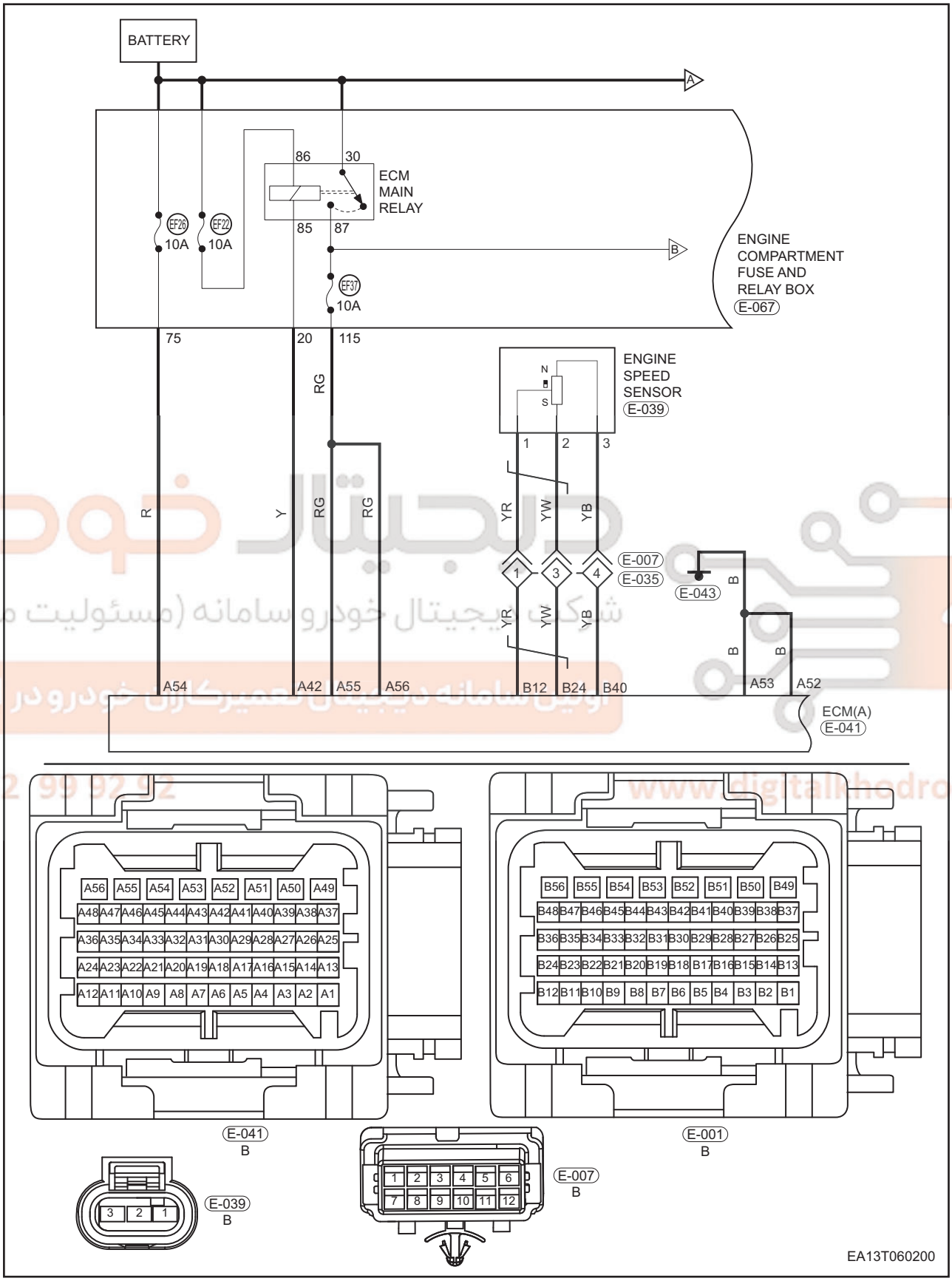
c. Check if DTC P0351-12 or P0351-14 still exists.

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	P0335-62	Engine Speed Sensor Signal Compare Failure



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0335-62	Engine Speed Sensor Signal Compare Failure	Ignition switch ON Engine running	• Speed sensor • Wire harness or connector • ECM

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.
b. Check ECM ground point E-043 (See page 06-19).

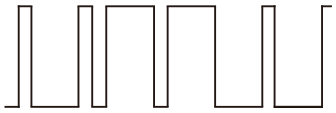
NG → **Repair or replace ground wire harness or ground point**

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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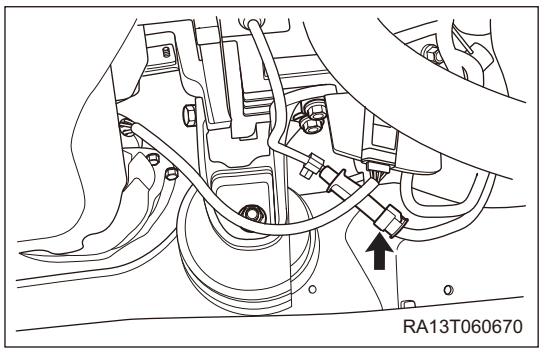
NG

3	Check engine speed sensor connector

a. Turn ignition switch to LOCK.

b. Disconnect the engine speed sensor connector E-039.

c. Check the engine speed sensor connector.


RA13T060670

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.

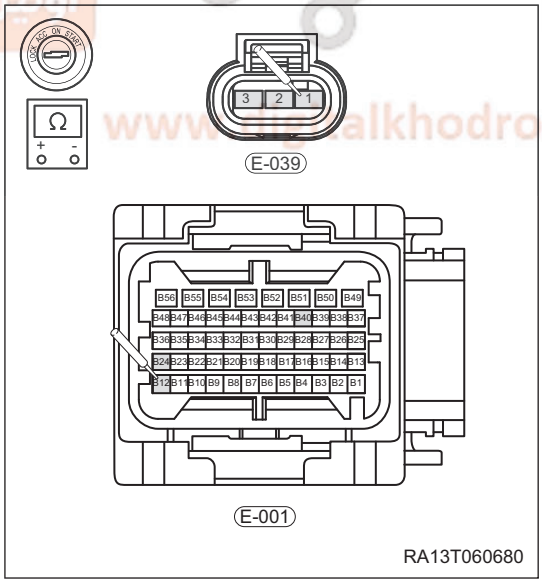
NG → **Clean or replace engine speed sensor**

OK

5	Check engine speed sensor circuit

a. Disconnect the ECM connector E-001.

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



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Check for Open

Multimeter Connection	Condition	Specified Condition
E-039 (1) - E-001 (B12)	Always	Continuity
E-039 (2) - E-001 (B24)	Always	Continuity
E-039 (3) - E-001 (B40)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-039 (1,2,3) or E-001 (B12,B40,B24) - Body ground	Always	No continuity

Multimeter Connection	Condition	Specified Condition
E-039 (1,2,3) or E-001 (B12,B40,B24) - Battery positive	Always	No continuity

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

OK ↓

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

06

6 **Check spark of misfiring cylinder with an normally functioning spark plug**

a. Install a normal engine speed sensor and observe signal waveform.

b. Connect the engine speed sensor connector.

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

OK → **Replace engine speed sensor**

NG ↓

7 **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 ↓

8 **Check for DTCs**

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

b. Refer to "DTC Confirmation Procedure".

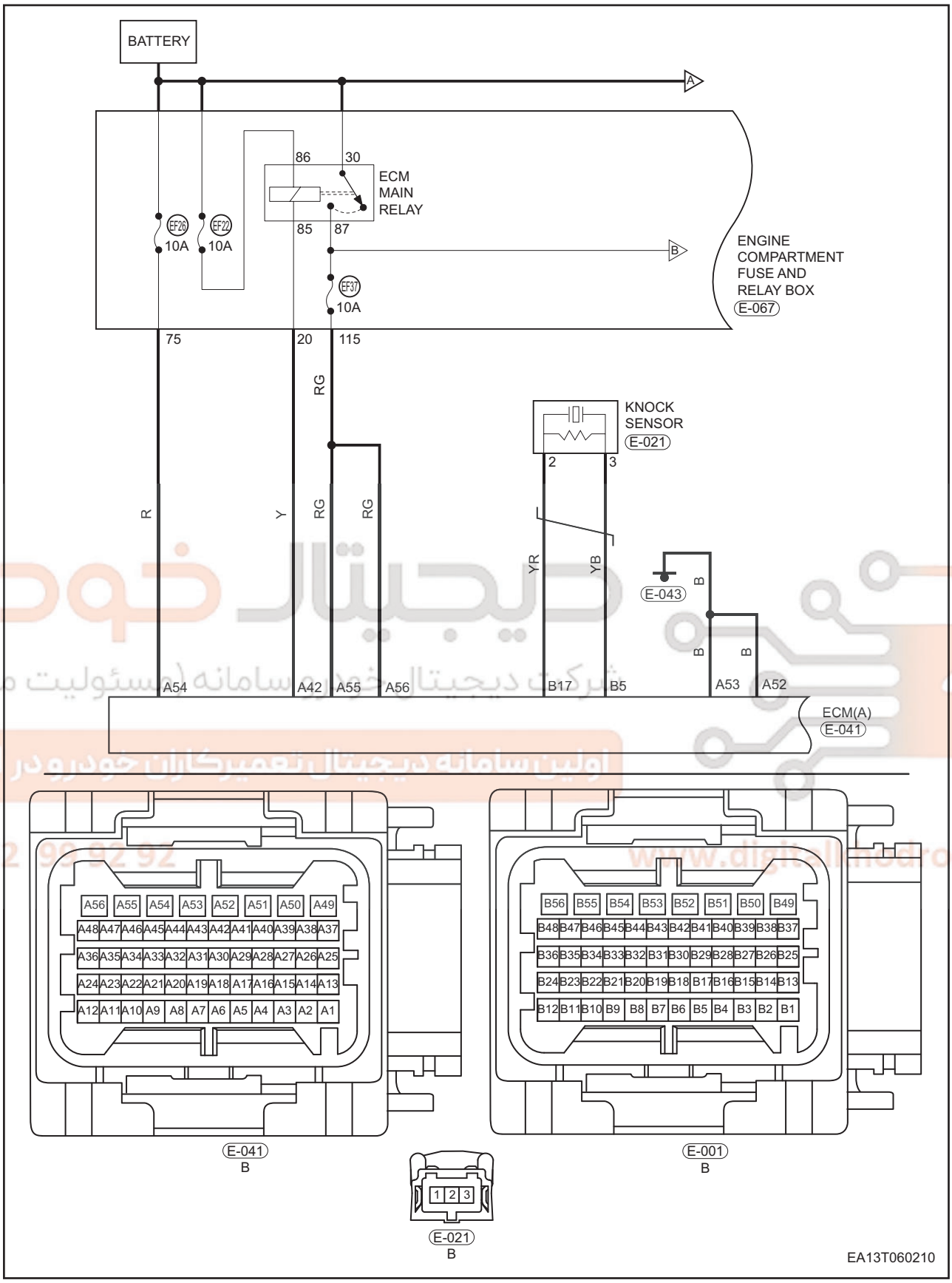
c. Check if DTC P0335-62 still exists.

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	P0325-12	Knock Sensor (Engine-Run) Circuit Short to Battery
DTC	P1652-12	Knock Sensor; Key on Diagnosis Circuit Short to Battery
DTC	P1652-11	Knock Sensor; Key on Diagnosis Circuit Short to Ground
DTC	P1652-49	Knock Sensor; Key on Diagnosis Internal Electronic Failure
DTC	P1652-64	Knock Sensor; Key on Diagnosis Signal Plausibility Failure



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0325-12	Engine Speed Sensor Signal Compare Failure	Ignition switch ON Engine running	• Knock sensor • Wire harness or connector • ECM
P1652-12	Knock Sensor; Key on Diagnosis Circuit Short to Battery	Ignition switch LOCK	
P1652-11	Knock Sensor; Key on Diagnosis Circuit Short to Ground		
P1652-49	Knock Sensor; Key on Diagnosis Internal Electronic Failure		
P1652-64	Knock Sensor; Key on Diagnosis Signal Plausibility Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

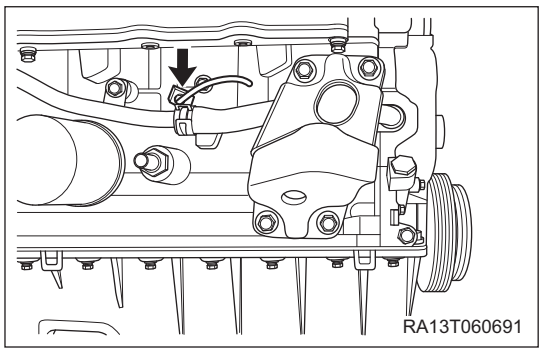
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check knock sensor connector

a. Disconnect the knock sensor connector E-021.

b. Check the knock sensor connector.



3	Check knock sensor signal circuit

a. Disconnect the ECM wire harness connector E-001.

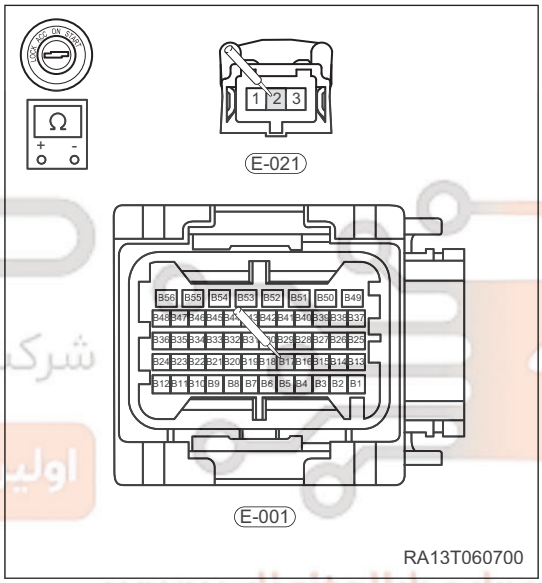
b. Check wire harness between terminals of connector E-001 and connector E-021.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-001 (B17) - E-021 (2)	Always	Continuity
E-001 (B5) - E-021 (3)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-001 (B17,B5) or E-021 (2,3) - Body ground	Always	No continuity
E-001 (B17,B5) or E-021 (2,3) - Battery positive	Always	No continuity



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: Above 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 DTC.

b. Refer to "DTC Confirmation Procedure".

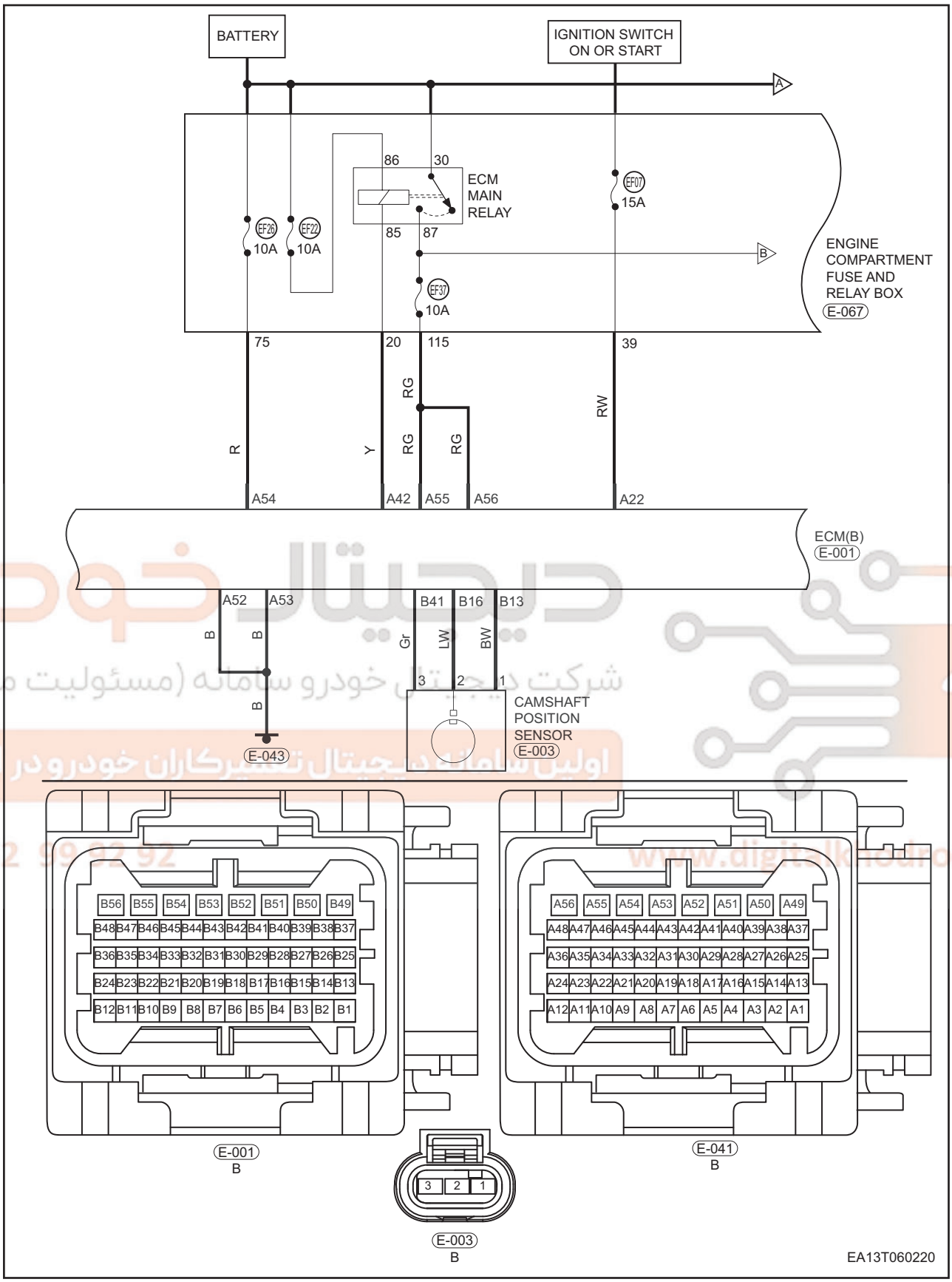
c. Check if DTC P0325-12, P1652-12, P1652-11, P1652-49 or P1652-64 still exists.

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	P0340-11	Cam-shaft Sensor Circuit Short to Ground
DTC	P0340-15	Cam-shaft Sensor Circuit Short to Battery or Open
DTC	P0340-62	Cam-shaft Sensor Signal Compare Failure
DTC	P0016-76	Wrong Assembly Camshaft Wrong Mounting Position



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0340-11	Cam-shaft Sensor Circuit Short to Ground	Ignition switch ON Engine running	• Camshaft position sensor • Incorrect installation position of camshaft position sensor • Engine mechanical malfunction • Wire harness or connector • ECM
P0340-15	Cam-shaft Sensor Circuit Short to Battery or Open		
P0340-62	Cam-shaft Sensor Signal Compare Failure		
P0016-76	Wrong Assembly Camshaft Wrong Mounting Position		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

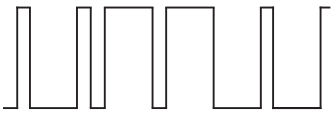
b. Check ECM ground point E-043 (See page 06-19).

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

OK →

2	Check camshaft position sensor signal waveform

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

	Normal Waveform
Oscilloscope	 RA13T060710

OK → **Go to step 10**

NG

3	Check camshaft position sensor connector

a. Turn ignition switch to LOCK.

b. Disconnect the camshaft position sensor connector E-003.

c. Check the camshaft position sensor connector.

NG → **Repair or replace camshaft position sensor connector**

OK

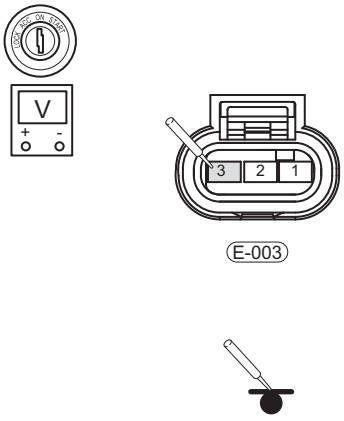
4	Check camshaft position sensor power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between terminal 3 of camshaft position sensor connector E-003 and body ground.

Multimeter Connection	Condition	Specified Condition
E-003 (3) - Body ground	Ignition switch ON	5 V

OK → **Go to step 6**



RA13T060720

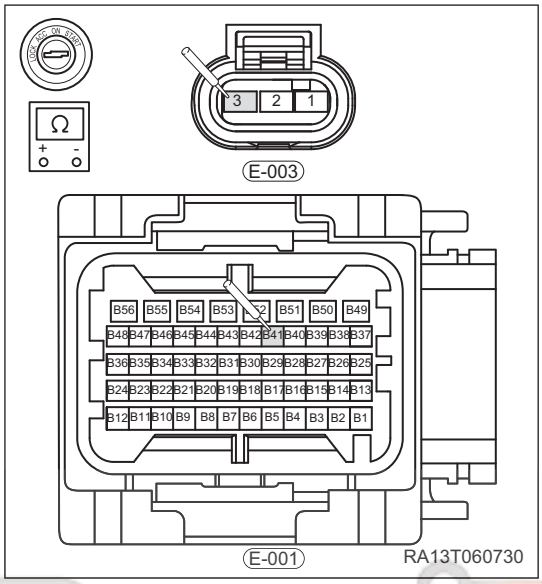
NG

5	Check camshaft position sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-001.

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-003 (3) - E-001(B41)	Always	Continuity
E-003 (3) - E-001(B41)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-003 (3) or E-001 (B41) - Body ground	Always	No continuity
E-003 (3) or E-01(B41) - Battery positive	Always	No continuity

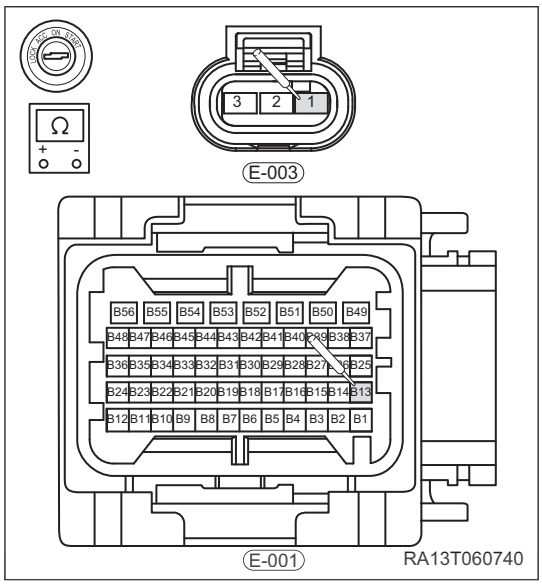
NG → Repair or replace wire harness or connector (camshaft position sensor - ECM)

OK

Replace ECM

6	Check camshaft position sensor signal circuit and ground circuit

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-001 (1) - E-003 (B13)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-001 (1) or E-003 (B13) - Body ground	Always	No continuity
E-001 (1) or E-003 (B13) - Battery positive	Always	No continuity

06

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

OK

7	Check installation of camshaft position sensor

a. Remove the camshaft position sensor.

b. Check and clean 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 camshaft position sensor**

OK

8	Check camshaft ring gear

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

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

OK

9	Install a normal camshaft position sensor and observe signal waveform

a. Install a normal camshaft position sensor.

b. Connect the camshaft position sensor connector.

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

OK → Replace camshaft position sensor

NG

10	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0340-11, P0340-15, P0340-62 or P0016-76 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	P0420-62	Catalizer Diagnosis Signal Compare Failure

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0420-62	Catalizer Diagnosis Signal Compare Failure	Ignition switch ON Engine running	• Three-way catalytic converter • Leakage in exhaust system • Upstream oxygen sensor • Downstream oxygen sensor • ECM

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

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
DTC P0420-00	A
DTC P0420-00 and other DTCs	B

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

A

2	Read datastream

a. Using diagnostic tester, select Read Datastream.

b. Check datastreams below.

Item	OK (Idling)	If it is NG, proceed to
Upstream Oxygen Sensor Voltage	Quickly fluctuates between 0.1 and 0.9 V	A

Item	OK (Idling)	If it is 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 DTC.

b. Refer to "DTC Confirmation Procedure".

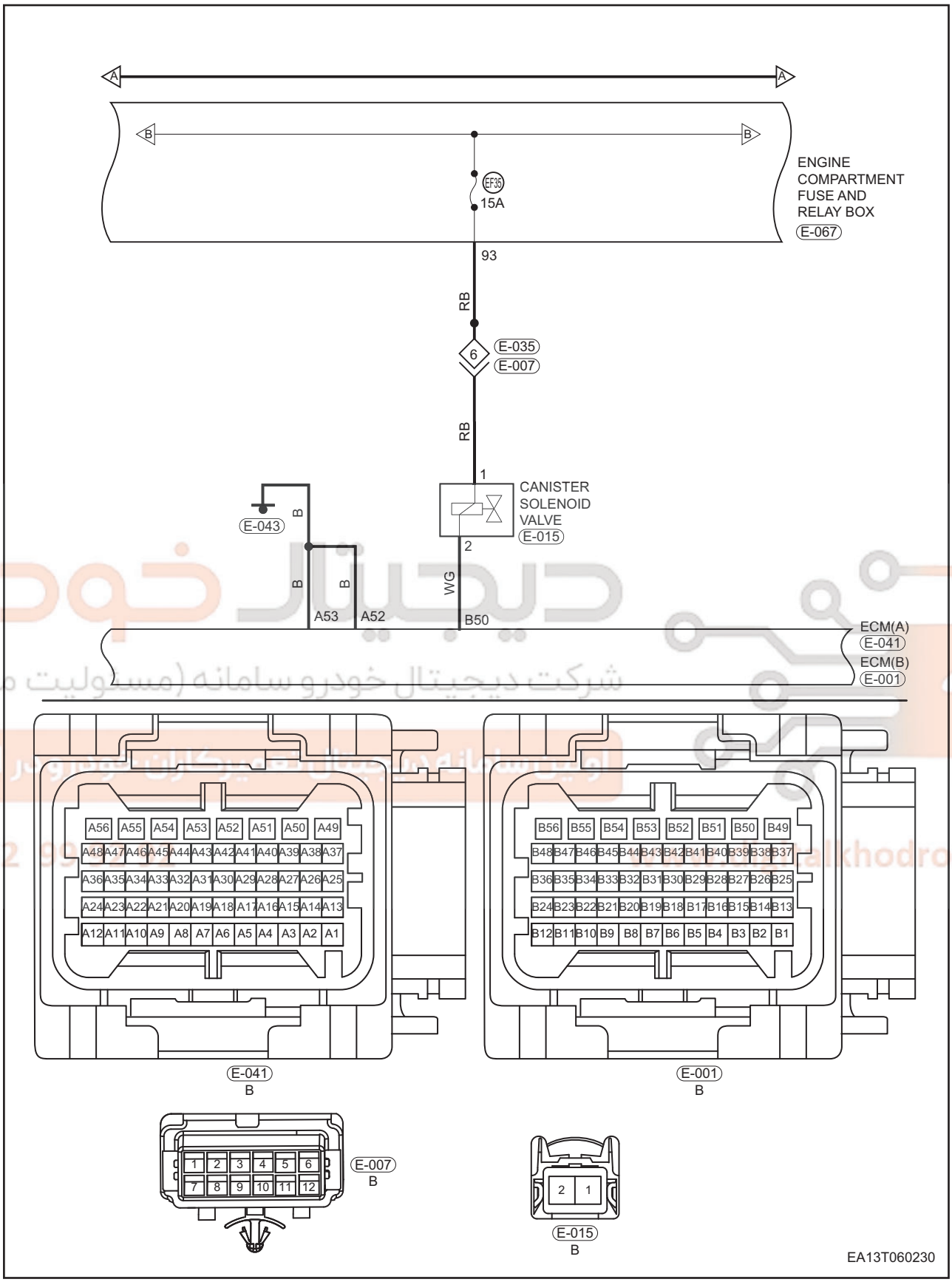
c. Check if DTC P0420-62 still exists.

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	P0443-11	Canister Purge Driver Circuit Short to Ground
DTC	P0443-12	Canister Purge Driver Circuit Short to Battery
DTC	P0443-13	Canister Purge Driver Circuit Open



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0443-11	Canister Purge Driver Circuit Short to Ground	Ignition switch ON Engine running	• Canister solenoid valve • Wire harness or connector • ECM
P0443-12	Canister Purge Driver Circuit Short to Battery		
P0443-13	Canister Purge Driver Circuit Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

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

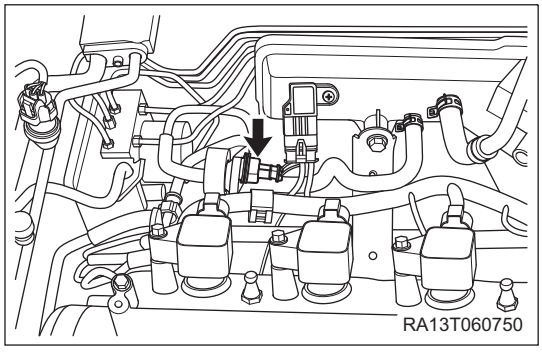
OK

2	Check canister solenoid valve connector

a. Disconnect the canister solenoid valve connector E-015 (arrow).

b. 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.

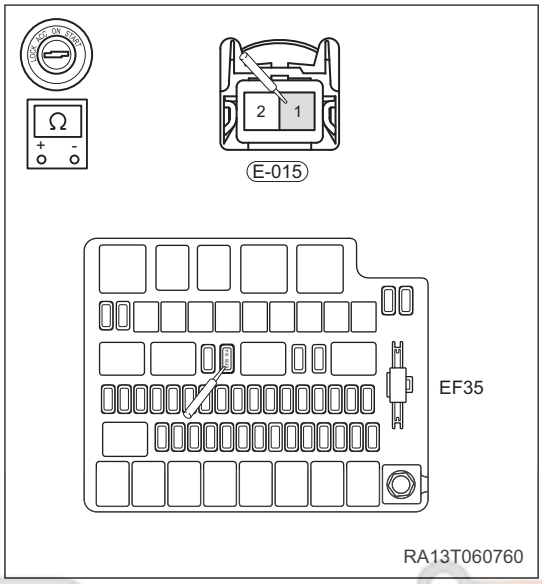
b. Check voltage between canister solenoid valve connector terminals and body ground.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-015 (1) - E-067 (93)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-015 (1) or E-067 (93) - Body ground	Always	No continuity
E-015 (1) or E-067 (93) - Battery positive		



OK → **Go to step 5**

NG

4	Check canister solenoid valve power supply circuit

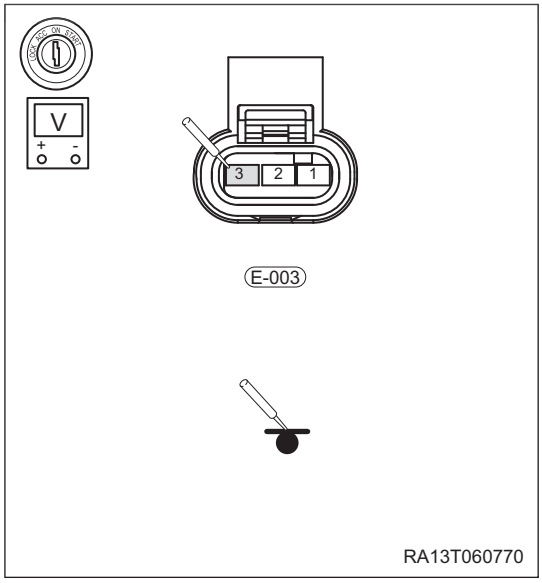
a. Turn ignition switch to LOCK.

b. Check fuse EF35 and main relay.

c. Disconnect the engine compartment fuse and relay box connector E-067.

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

Multimeter Connection	Condition	Specified Condition
E-003 (3) - Body ground	Ignition switch ON	5 V



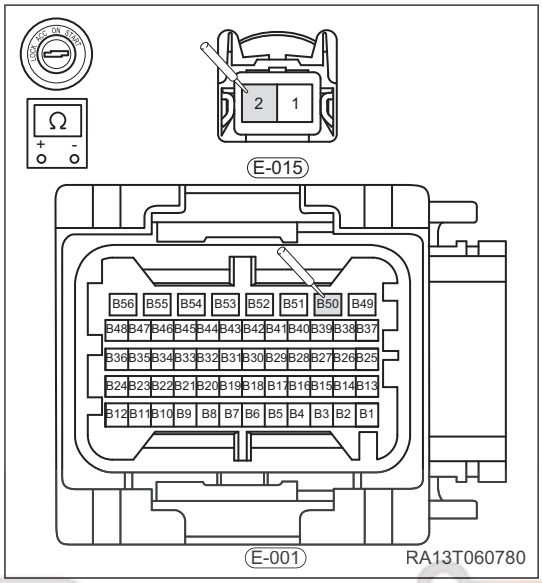
OK → **Repair or replace wire harness or connector (canister solenoid valve - engine compartment fuse and relay box)**

NG

5	Check canister solenoid valve control circuit

a. Disconnect the ECM connector E-067.

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



Check for Open

Multimeter Connection	Condition	Specified Condition
E-015 (2) - E-001 (B50)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-015 (2) or E-001 (B50) - Body ground	Always	No continuity
E-015 (2) or E-001 (B50) - 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 (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 DTC.

b. Refer to "DTC Confirmation Procedure".

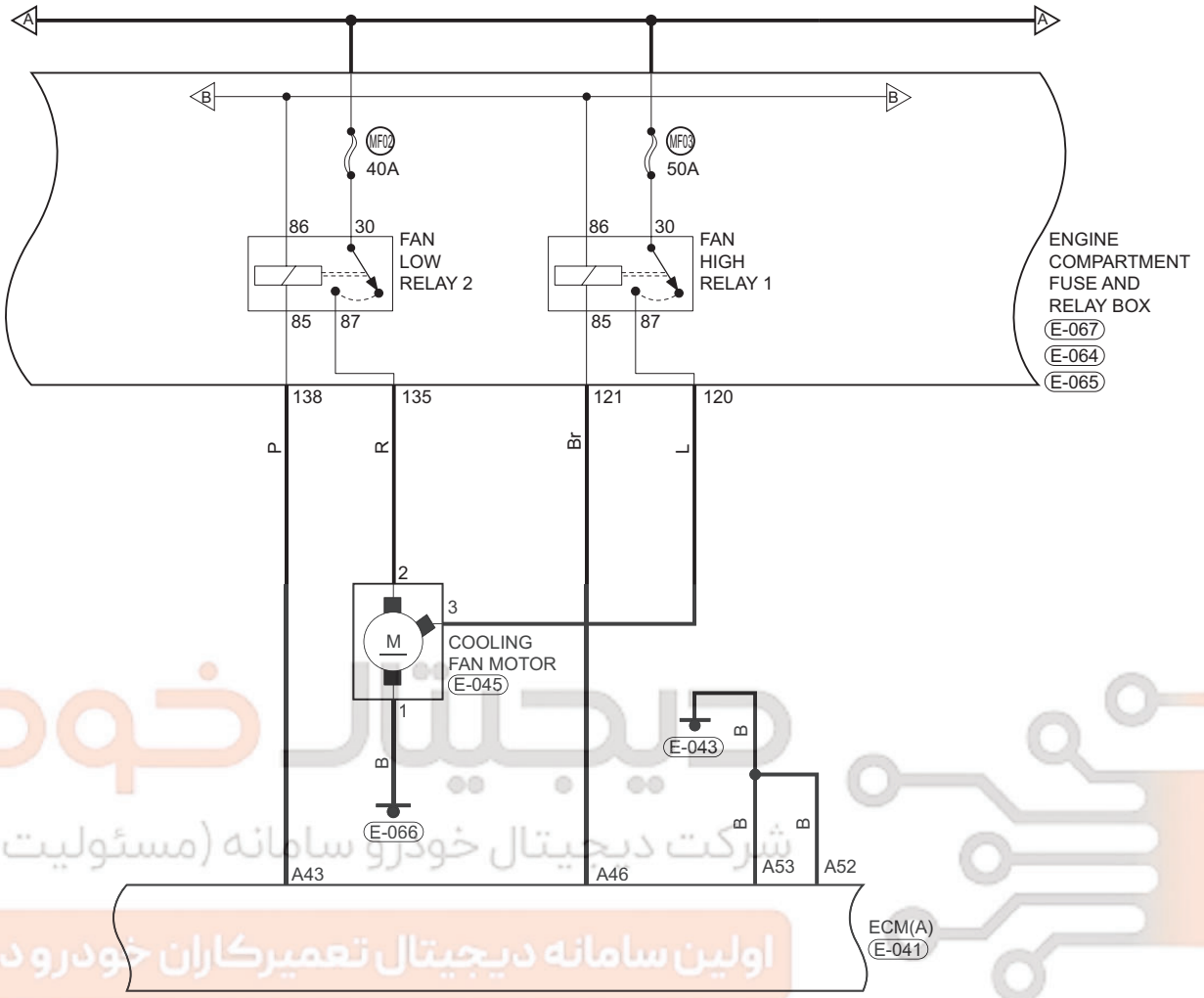
c. Check if DTC P0443-11, P0443-12 or P0443-13 still exists.

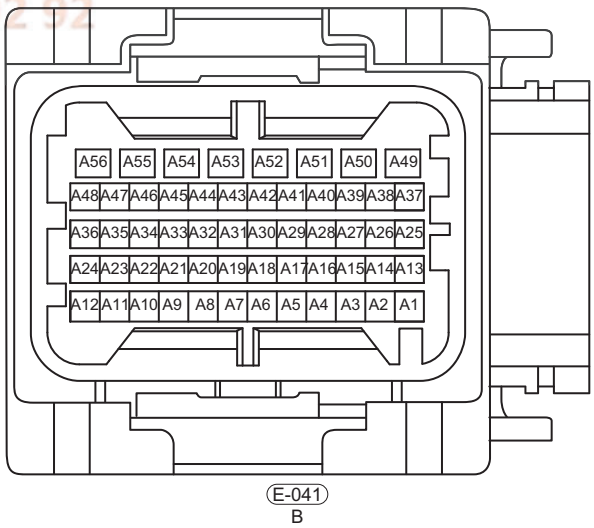
NG → Replace ECM

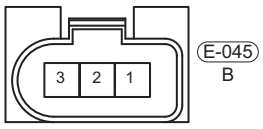
OK

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

DTC	P0481-13	Cooling Fan Driver 2 (High) Circuit Open
DTC	P0480-13	Cooling Fan Driver 1 (Low) Circuit Open
DTC	P0480-11	Cooling Fan Driver 1 (Low) Circuit Short to Ground
DTC	P0480-12	Cooling Fan Driver 1 (Low) Circuit Short to Battery
DTC	P0481-11	Cooling Fan Driver 2 (High) Circuit Short to Ground
DTC	P0481-12	Cooling Fan Driver 2 (High) Circuit Short to Battery







EA13T060240

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0481-13	Cooling Fan Driver 2 (High) Circuit Open	Ignition switch ON Engine running	• Wire harness or connector • Cooling fan control module (relay) • ECM
P0480-13	Cooling Fan Driver 1 (Low) Circuit Open		
P0480-11	Cooling Fan Driver 1 (Low) Circuit Short to Ground		
P0480-12	Cooling Fan Driver 1 (Low) Circuit Short to Battery		
P0481-11	Cooling Fan Driver 2 (High) Circuit Short to Ground		
P0481-12	Cooling Fan Driver 2 (High) Circuit Short to Battery		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM ground point E-043 (See page 06-19).

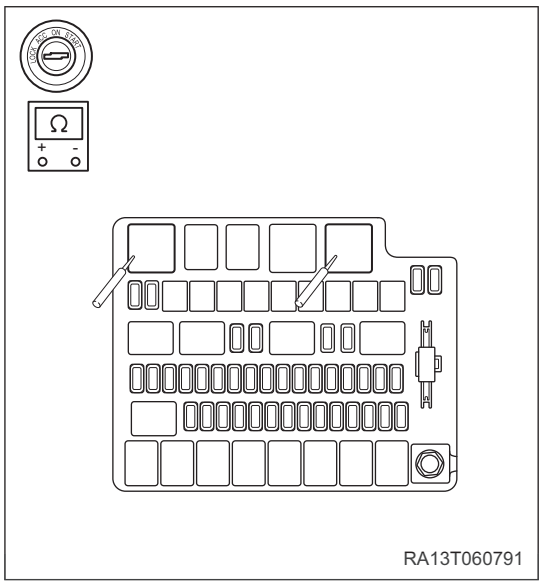
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check cooling fan control relay

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

b. Check the cooling fan relays.



RA13T060791

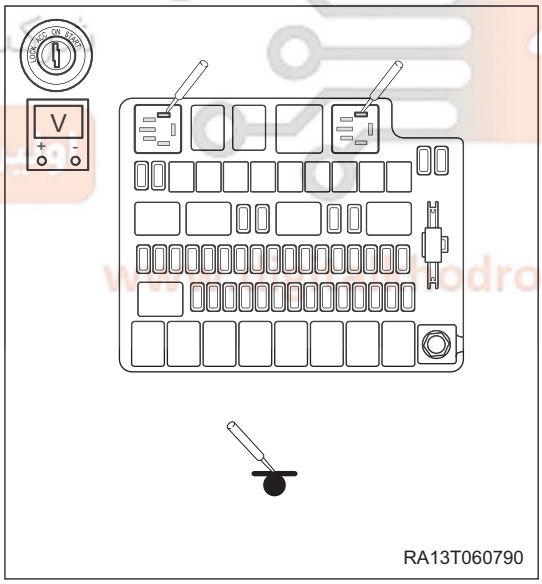
NG → **Repair or replace relay**

OK

3	Check cooling fan control relay circuit voltage

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

Multimeter Connection	Condition	Specified Condition
E-067 (138, 121) - Body ground	Ignition switch ON	11 to 14 V



RA13T060790

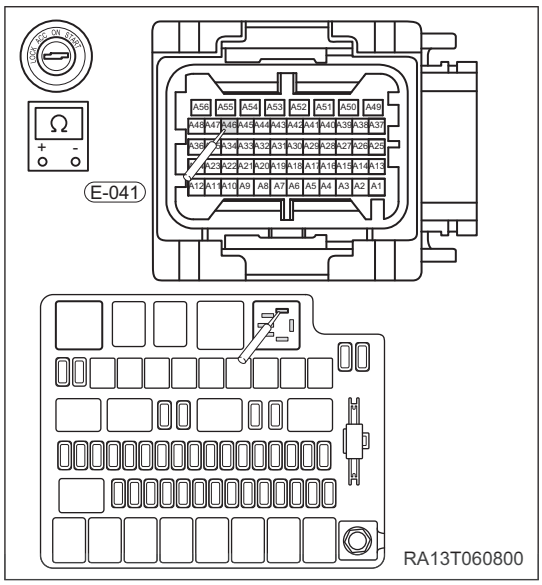
NG → **Check engine compartment fuse and relay box, repairor replace wire harness or connector**

OK

4	Check cooling fan high speed control circuit

a. Disconnect the ECM connector E-041.

b. Check wire harness between fan control module connector and ECM (2) connector.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-041 (A46) - E-067 (121)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-041 (A46) or E-067 (121) - Body ground	Always	No continuity
E-041 (A46) or E-067 (121) - Battery positive	Always	No continuity

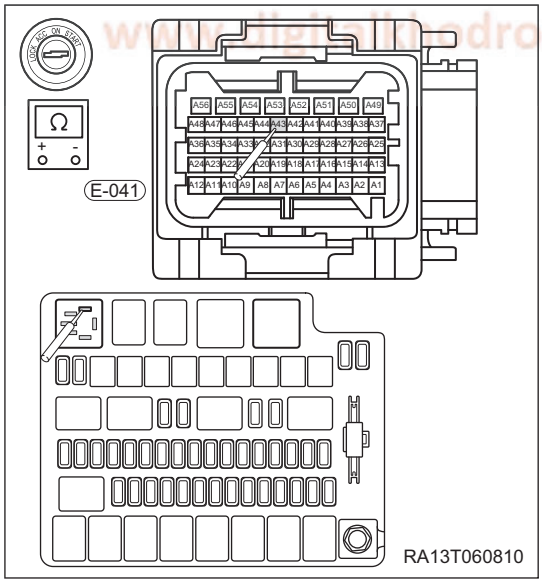
NG → **Repair or replace wire harness**

OK

5	Check cooling fan low speed control circuit

a. Disconnect the ECM connector E-041.

b. Check wire harness between fan control module connector and ECM (2) connector.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-041 (A43) - E-067 (138)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-041 (A43) or E-067 (138) - Body ground	Always	No continuity
E-041 (A43) or E-067 (138) - Battery positive	Always	No continuity

NG → Repair or replace wire harness

OK

6	Check cooling fan high speed power supply circuit

a. Disconnect the fan control module connector E-045.

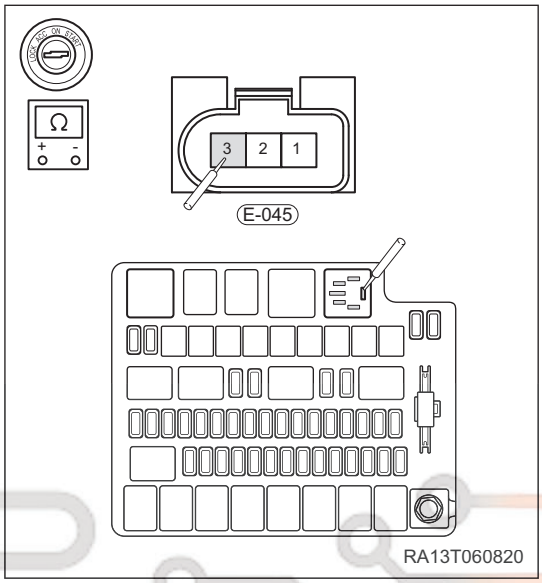
b. Check wire harness between fan control module connector E-045 and engine compartment fuse and relay box connector.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-045 (3) - E-067 (120)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-045 (3) or E-067 (120) - Body ground	Always	No continuity
E-045 (3) or E-067 (120) - Battery positive		



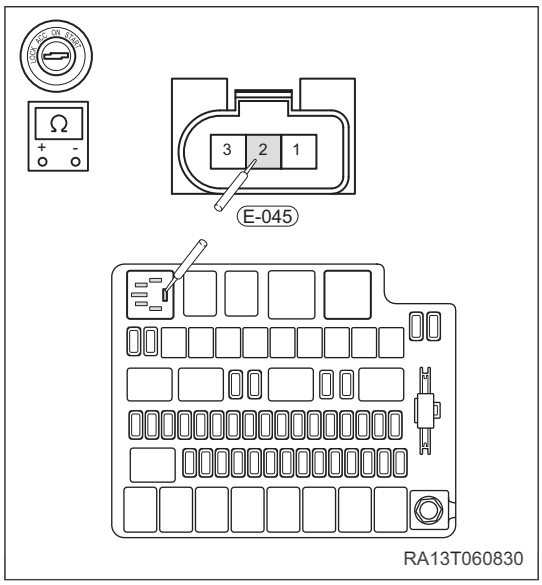
NG → Repair or replace wire harness

OK

7	Check cooling fan low speed power supply circuit

a. Disconnect the fan control module connector E-045.

b. Check wire harness between fan control module connector E-045 and engine compartment fuse and relay box connector.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-045 (2) - E-067 (135)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-045 (2) or E-067 (135) - Body ground	Always	No continuity
E-045 (2) or E-067 (135) - Battery positive		

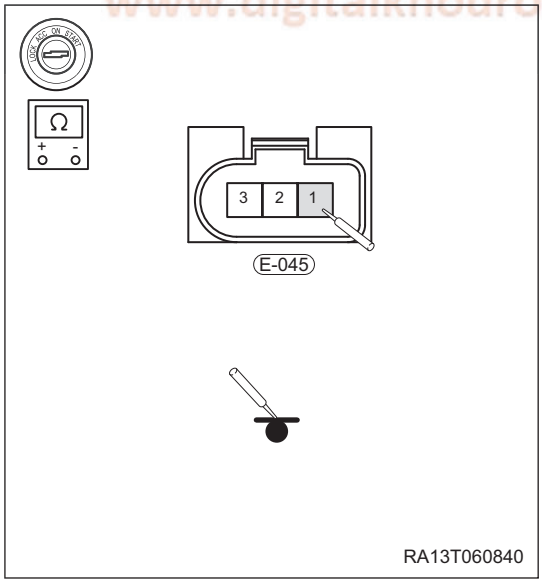
NG → Repair or replace wire harness

OK

8	Check cooling fan ground circuit

a. Disconnect the fan control module connector E-045.

b. Check wire harness between fan control module connector E-045 and engine compartment fuse and relay box connector.



Ground Inspection

Multimeter Connection	Condition	Specified Condition
E-045 (1) - Body ground	Always	Continuity

NG → Repair or replace wire harness

OK

9	Replace fan control module, and check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

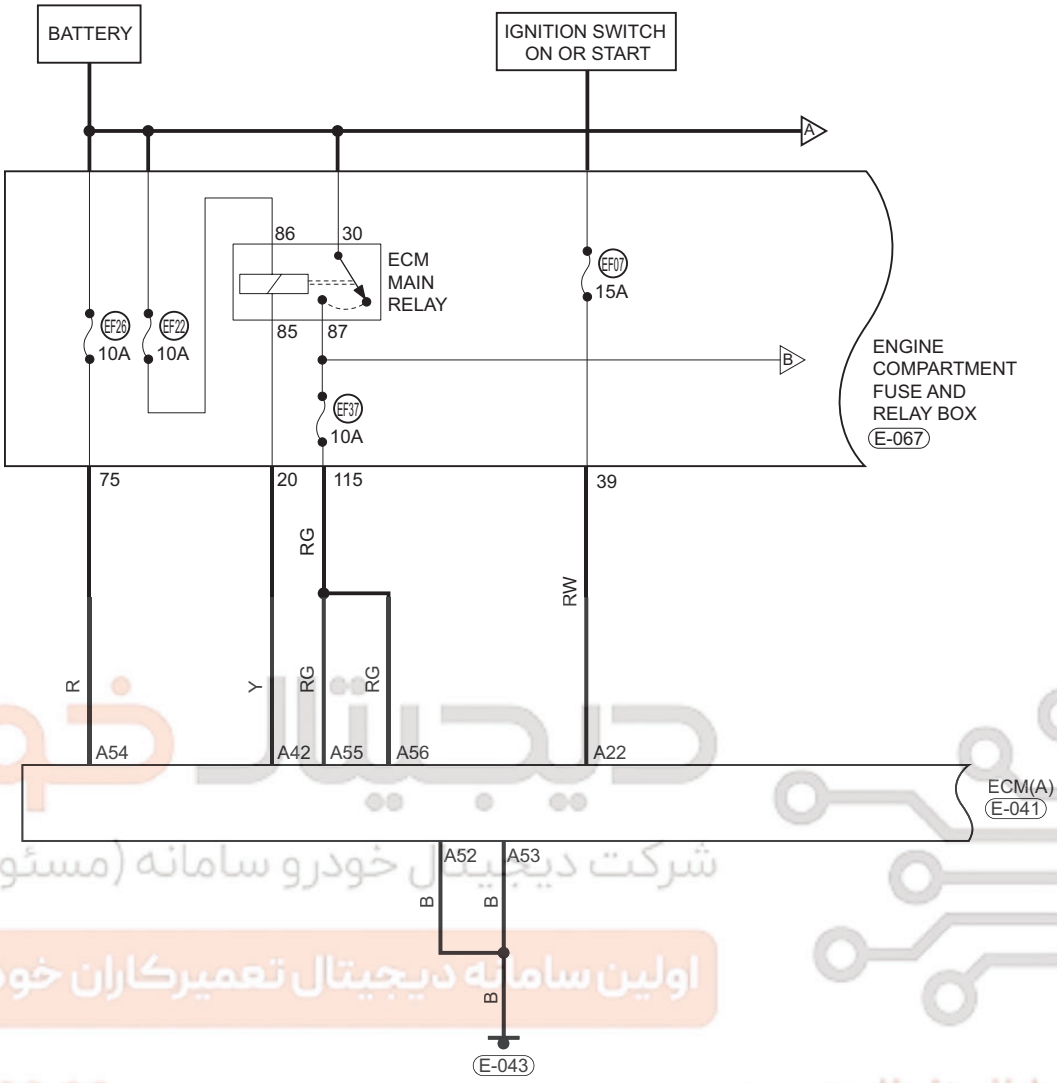
c. Check if DTC P0480-13, P0481-13, P0480-11, P0480-12, P0481-11 or P0481-12 still exists.

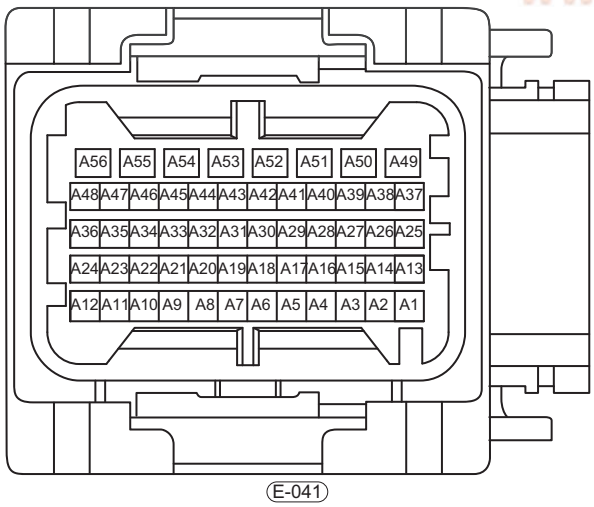
NG → **Replace ECM**

OK

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

DTC	P0560-16	ECU Power Supply Circuit Voltage Below Threshold
DTC	P0560-17	ECU Power Supply Circuit Voltage Above Threshold





EA13T060100

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0560-16	ECU Power Supply Circuit Voltage Below Threshold	Ignition switch ON Engine running	• Fuse • Wire harness or connector • Battery • Battery terminal • ECM
P0560-17	ECU Power Supply Circuit Voltage Above Threshold		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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 terminals are loose or corroded.

NG → Tighten or replace battery terminal

OK

3	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check the ECM ground point E-043 (See page 06-19).

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

OK

4	Check ECM connector

a. Disconnect the ECM connector E-041.

b. Check the ECM connector.

NG → **Repair or replace ECM connector**

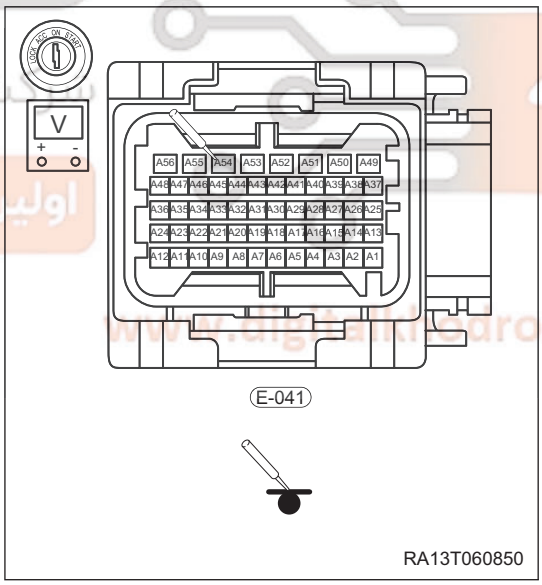
OK

5	Check ECM power supply voltage (battery voltage)

a. Check voltage between terminal of ECM connector E-041 and body ground.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-041 (A54) - Body ground	Always	11 to 14 V



OK → **Go to step 8**

NG

6	Check ECM fuse

a. Unplug ECM fuse EF26(10A) from engine compartment fuse and relay box.

b. Check resistance of fuse EF26.

Standard resistance: less than 1 Ω

NG → **Replace ECM fuse**

OK

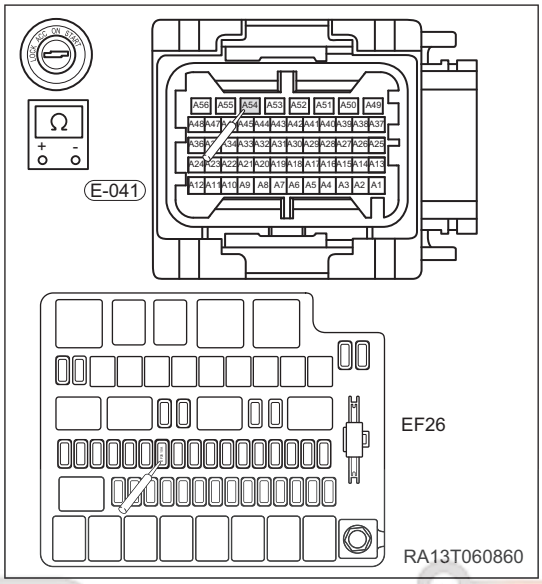
7	Check wire harness and connector (ECM - engine compartment fuse and relay box)

Check for Open

Multimeter Connection	Condition	Specified Condition
E-041 (A54) - E-067 (75)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-041 (A54) or E-067 (75) - Body ground	Always	No continuity
E-041 (A54) or E-067 (75) - Battery positive		



NG → Repair or replace wire harness or connector

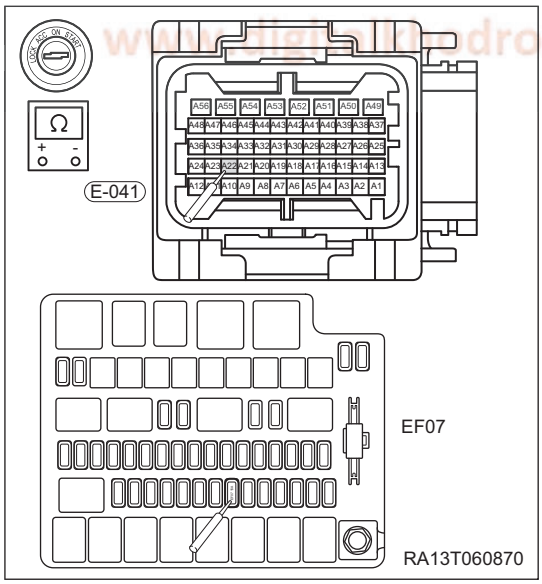
OK

8	Check ECM power supply voltage (ignition switch voltage)

a. Turn ignition switch to ON.

b. Check voltage between terminals of ECM connector E-041.

Multimeter Connection	Condition	Specified Condition
E-041 (A22) - E-067 (39)	Ignition switch ON	11 to 14 V



OK → Go to step 12

NG

9	Check ECM fuse

a. Unplug fuse EF07(10A) from instrument panel fuse and relay box.

b. Check fuse EF07(10A) on instrument panel fuse and relay box.

Standard resistance: less than 1 Ω

NG → **Replace fuse**

OK ↓

10	Check the ignition switch assembly (See page 15-12).

NG → **Replace ignition switch assembly**

OK ↓

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

11	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

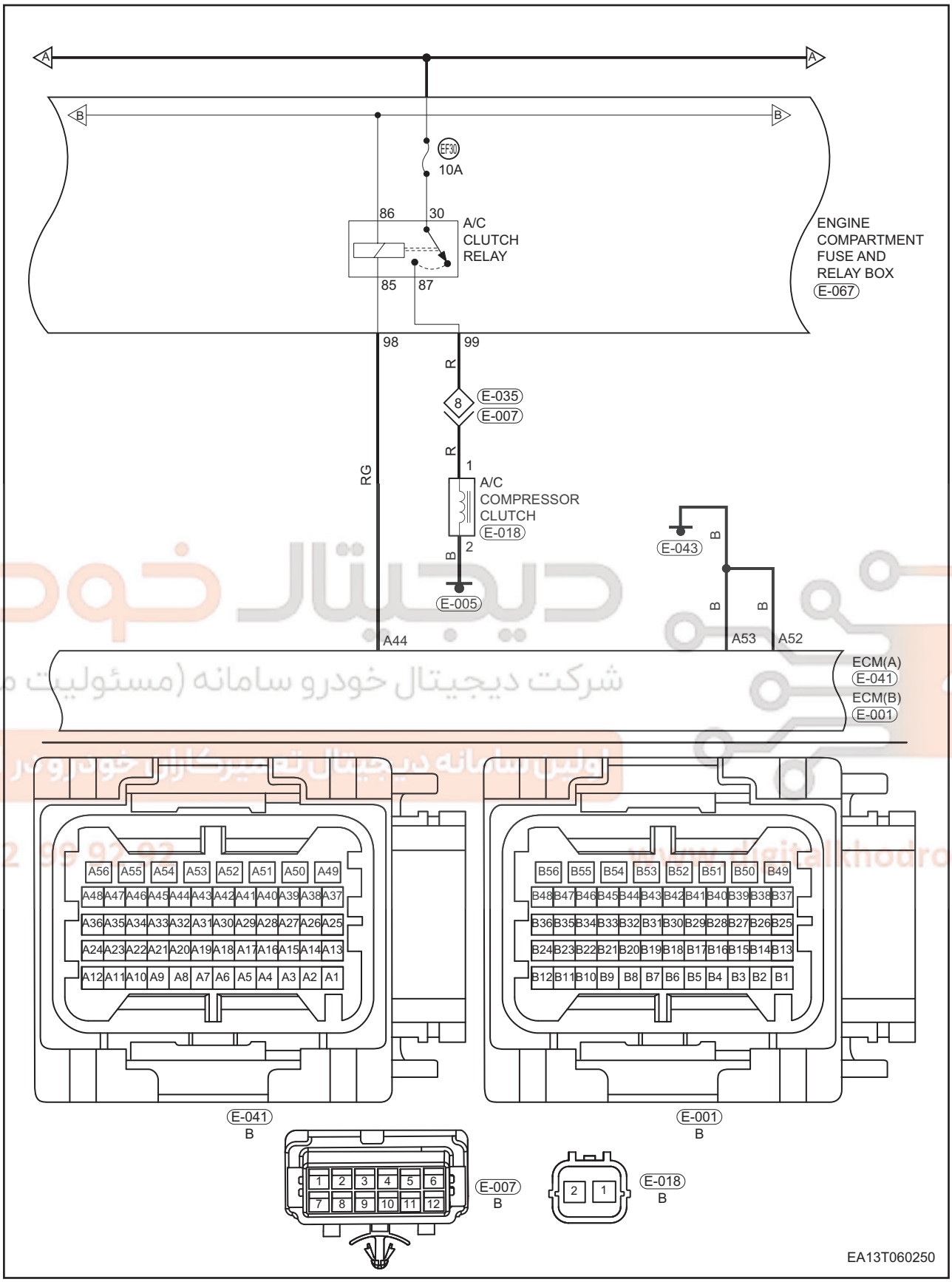
c. Check if DTC P0560-16 or P0560-17 still exists.

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	P0645-13	Air Conditioner 1 (Relay I/O) Circuit Open
DTC	P0645-11	Air Conditioner 1 (Relay I/O) Circuit Short to Ground
DTC	P0645-12	Air Conditioner 1 (Relay I/O) Circuit Short to Battery



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0627-13	ECU Power Supply Circuit Voltage Below Threshold	Ignition switch ON Engine running	• A/C compressor relay • Wire harness or connector • Battery • ECM
P0645-11	Air Conditioner 1 (Relay I/O) Circuit Short to Ground		
P0645-12	Air Conditioner 1 (Relay I/O) Circuit Short to Battery		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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-043 (See page 06-19).

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

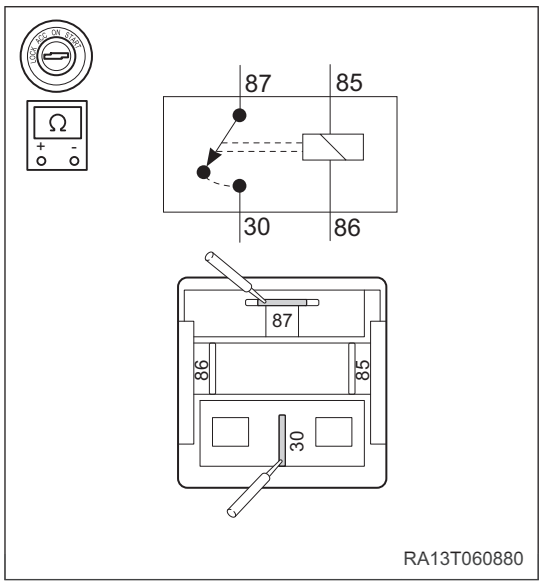
OK

2	Check A/C compressor relay

a. Unplug A/C compressor relay connector terminal from engine compartment fuse and relay box.

b. Check the A/C compressor relay terminal.

Multimeter Connection	Condition	Specified Condition
Terminal 30 - Terminal 87	Always	No continuity
Terminal 30 - Terminal 87	Always	Continuity (Battery voltage is applied between terminals 1 and 2)



NG → **Replace A/C compressor relay**

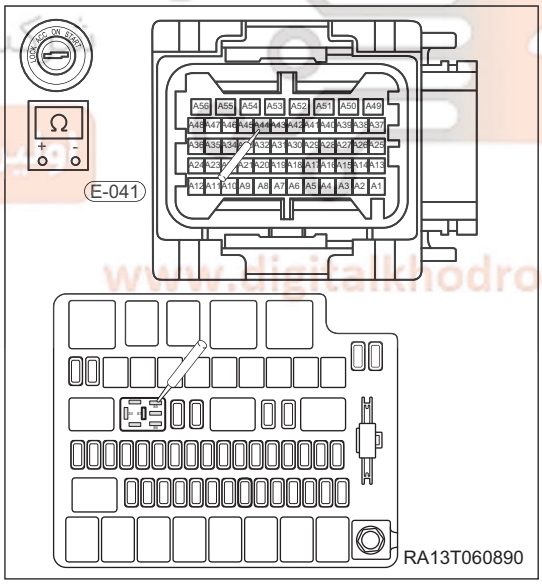
OK

3	Check A/C compressor relay control circuit

a. Disconnect the engine compartment fuse and relay box connector E-067.

b. Disconnect the ECM connector E-041.

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
E-067 (98) - B-041 (A44)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-067 (98) or B-041 (A44) - Body ground	Always	No continuity
E-067 (98) or B-041 (A44) - Battery positive	Always	No continuity

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

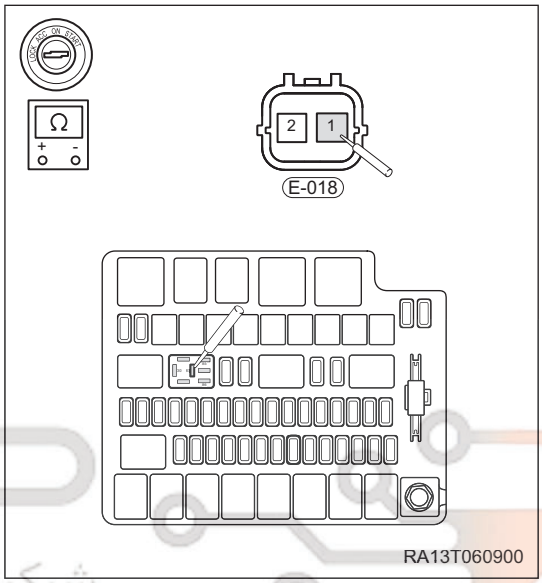
OK

4	Check A/C compressor relay power supply circuit

a. Disconnect the engine compartment fuse and relay box connector E-067.

b. Disconnect the A/C compressor relay connector E-018.

c. Check wire harness between engine compartment fuse and relay box connector E-067 and A/C compressor relay connector E-018.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-067 (99) - E-018 (1)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-067 (99) or E-018 (1) - Body ground	Always	No continuity
E-067 (99) or E-018 (1) - Battery positive	Always	No continuity

NG → **Replace wire harness between engine compartment fuse and relay box connector and A/C compressor relay connector.**

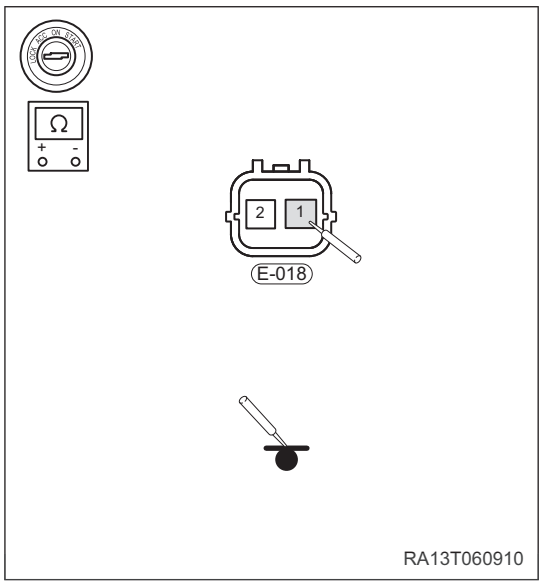
OK

5	Check A/C compressor ground wire harness

a. Turn ignition switch to LOCK.

b. Check voltage between A/C compressor wire harness and body ground.

Multimeter Connection	Condition	Specified Condition
E-018 (2) - Body ground	Ignition switch LOCK	0 V



NG → **Go to step 6**

OK

6	Check main relay

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

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

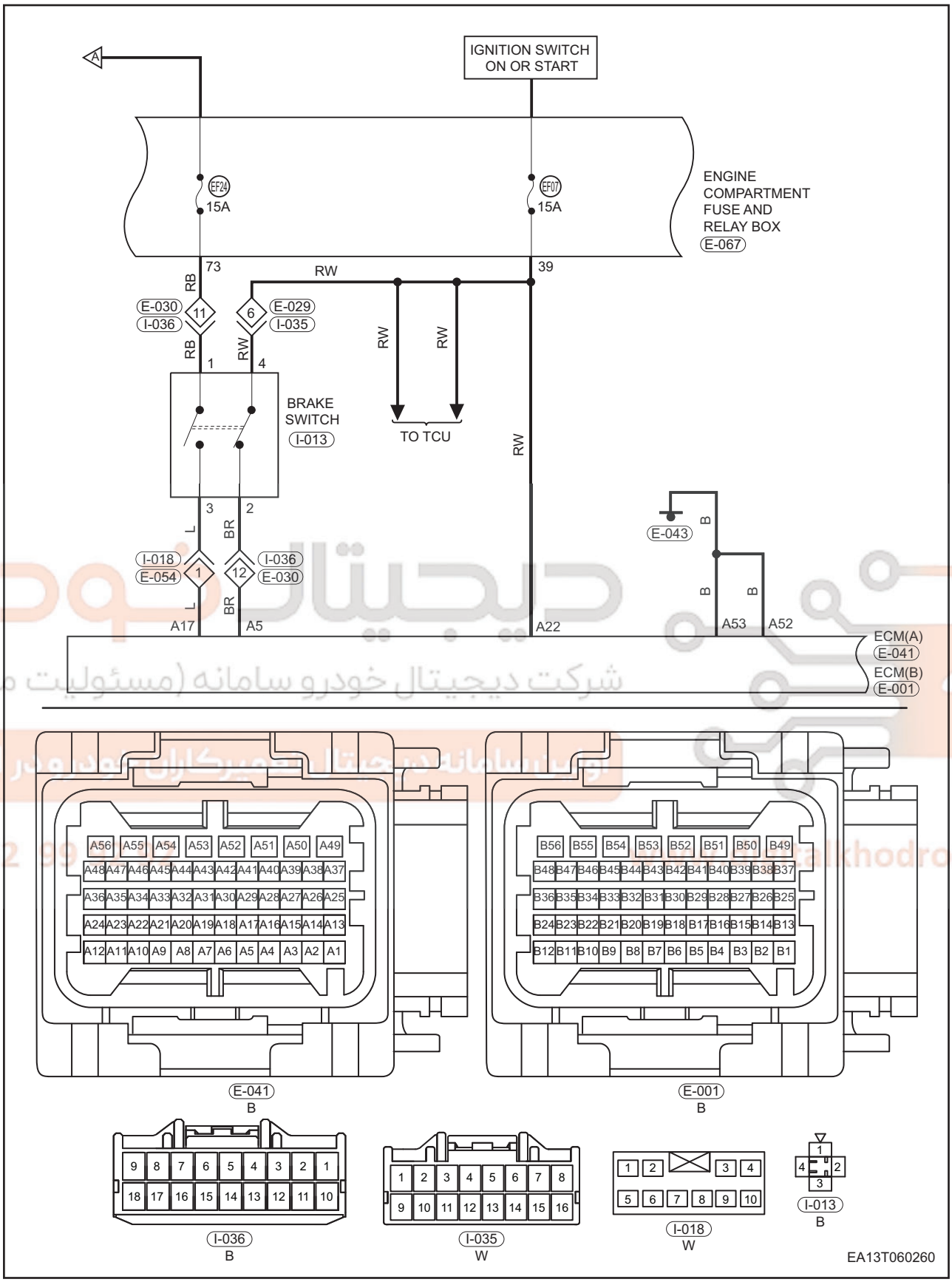
c. Check if DTC P0645-13, P0646-11 or P0647-12 still exists.

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	P0504-13	Brake Signal Circuit Open
DTC	P0504-62	Brake Signal Compare Failure
DTC	P0504-67	Brake Signal Incorrect After Event
DTC	P0504-86	Brake Signal Invalid



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0504-13	Brake Signal Circuit Open	Ignition switch ON	• Fuse • Brake switch • Wire harness or connector • ECM
P0504-62	Brake Signal Compare Failure		
P0504-67	Brake Signal Incorrect After Event		
P0504-86	Brake Signal Invalid		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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-043 (See page 06-19).

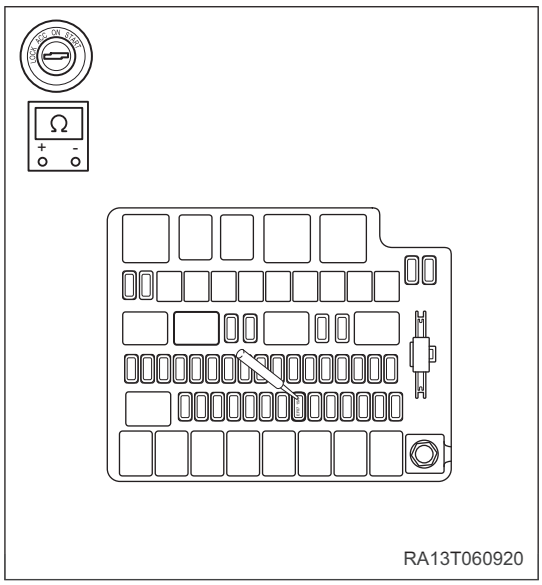
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check fuse

a. Remove fuses EF07, EF24 from engine compartment fuse and relay box.

b. Check if fuses EF07, EF24 are normal.



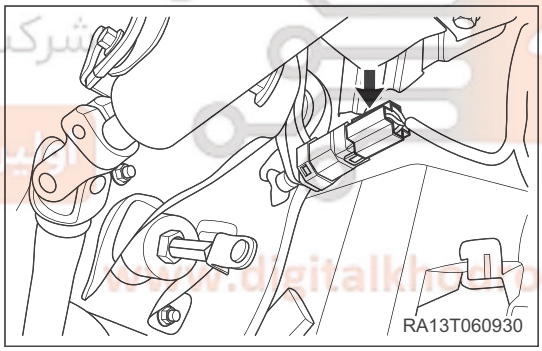
NG → Replace fuse

OK

3	Check brake switch power supply circuit

a. Disconnect the brake switch connector I-013 (arrow).

b. Check the brake switch connector.



NG → Repair or replace connector

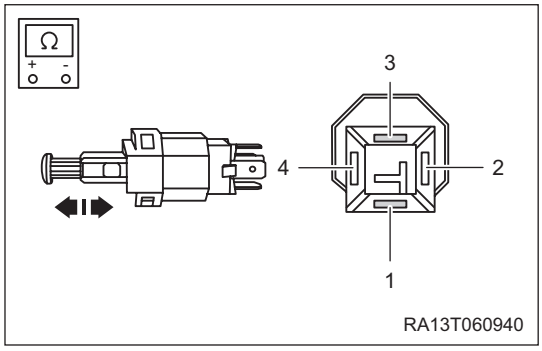
OK

4	Check brake switch

a. Remove the brake switch.

b. Check the brake switch.

Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 3	Brake pedal depressed (switch pin released)	Continuity
Terminal 4 - Terminal 2		No continuity



Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 3	Brake pedal released (switch pin pushed)	No continuity
Terminal 4 - Terminal 2		Continuity

NG → **Replace brake switch**

OK

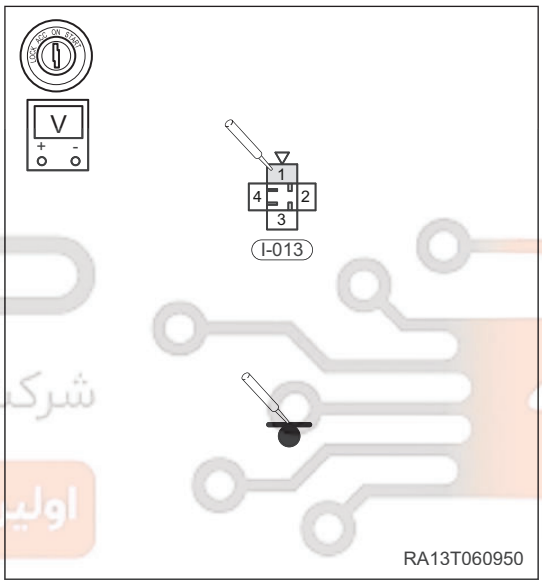
5	Check brake switch power supply voltage

a. Turn ignition switch to LOCK and check voltage between terminal 1 of brake switch connector and body ground.

b. Turn ignition switch to ON and check voltage between terminal 4 of brake switch connector and body ground.

Multimeter Connection	Condition	Specified Condition
I-013 (1) - Body ground	Ignition switch ON	11 - 14 V
I-013 (4) - Body ground		11 - 14 V

OK → **Go to step 6**



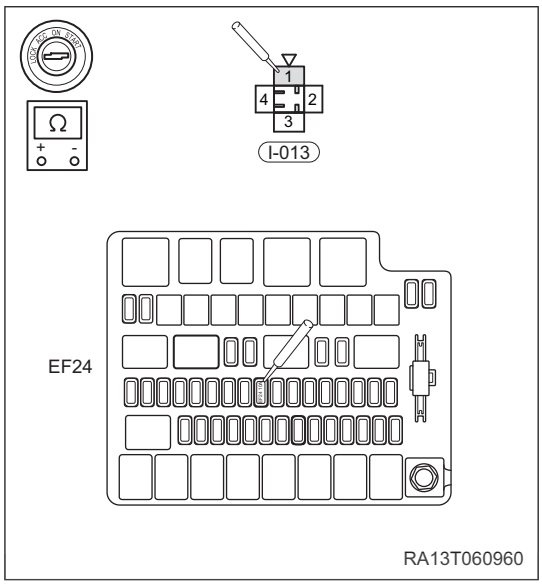
NG

6	Check brake switch power supply circuit

a. Check the fuses EF24 and EF07.

b. Disconnect the engine compartment fuse and relay box connector E-067.

c. Check wire harness between brake switch connector terminals and engine compartment fuse and relay box connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
I-013 (1) - E-067 (73)	Always	Continuity
I-013 (4) - E-067 (39)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
I-013 (1) or E-067 (73) - Body ground	Always	No continuity
I-013 (1) or E-067 (73) - Battery positive	Always	No continuity
I-013 (4) or E-067 (39) - Battery positive	Always	No continuity
I-013 (4) or E-067 (39) - Battery positive	Always	No continuity

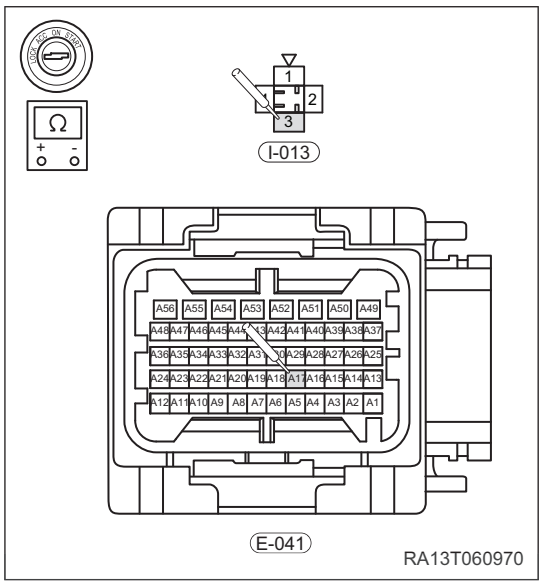
NG → **Replace fues, repair or replace wire harness orconnector (brake switch - engine compartment fuse and relay box)**

OK

7	Check brake switch control circuit

a. Disconnect the ECM connector E-041.

b. Check wire harness between brake switch connector terminals and ECM connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
I-013 (3) - E-041 (A17)	Always	Continuity
I-013 (2) - E-041 (A5)		

Check for Short

Multimeter Connection	Condition	Specified Condition
I-013 (3) or E-041 (A17) - Body ground	Always	No continuity
I-013 (3) or E-041 (A17) - Battery positive		
I-013 (2) or E-041 (A5) - Battery positive		
I-013 (2) or E-041 (A5) - Battery positive		

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

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 P0504-13, P0504-62, P0504-67 or P0504-86 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	P0604-62	RAM Memory Signal Compare Failure

DTC	P0605-41	ROM (EPROM) Memory General Checksum Failure

DTC	P0605-49	ROM (EPROM) Memory Internal Electronic Failure

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0604-62	RAM Memory Signal Compare Failure	Ignition switch ON	• Wire harness or connector • ECM
P0605-41	ROM (EPROM) Memory General Checksum Failure		
P0605-49	ROM (EPROM) Memory Internal Electronic Failure		
P0601-44	EEPROM Memory Data Memory Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check the ECM ground point E-043 (See page 06-19).

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

OK

2	Check ECM connector

a. Disconnect the ECM connectors E-001 and E-041.

b. Check if connectors are normal.

NG → Repair or replace connector

OK

Replace ECM

3	Use X-431 3G diagnostic tester to match ECM, and check for DTCs again

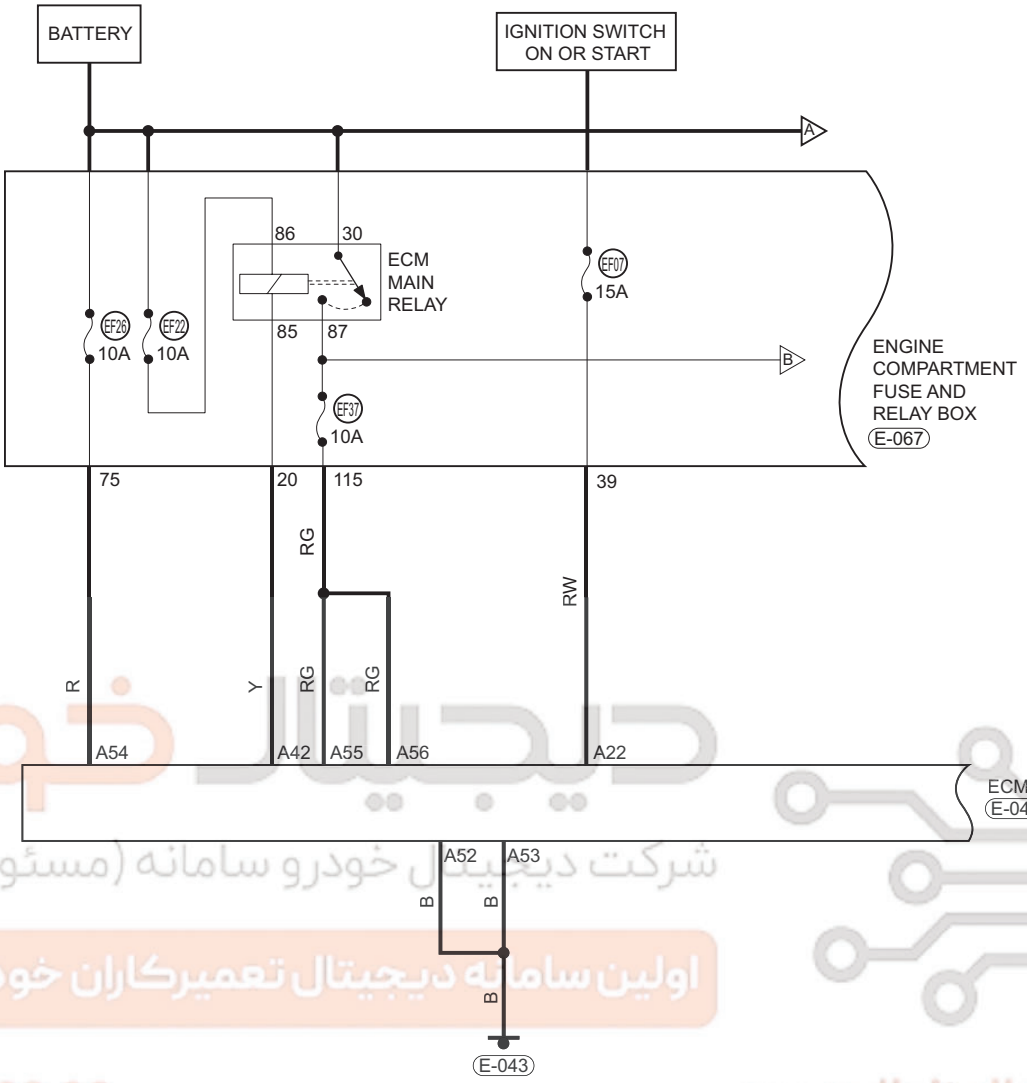
a. Using X-431 3G diagnostic tester, read ECM DTC.

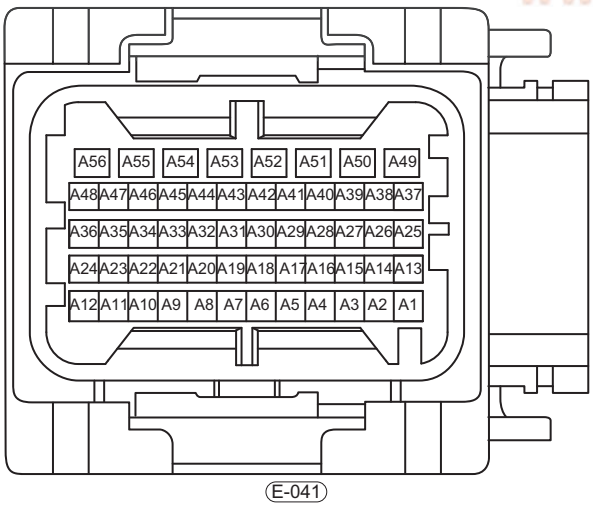
b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0601-44, P0604-62, P0605-41 or P0605-49 still exists.

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

DTC	P1610-51	Immo Secret Key and Security Code Not Programmed Not Programmed
DTC	P1616-81	IMMO Authentication Fail Invalid Serial Data Received
DTC	P1617-87	IMMO Authentication Message not Received Missing Message
DTC	P1618-87	Fail to Write EOL Immobilizer Data into EEProm Missing Message
DTC	P1614-86	Immo Transferred Transponder Authentication is Failed SignalInvalid





EA13T060100

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P1610-51	Immo Secret Key and Security Code Not Programmed Not Programmed	Ignition switch ON	• Anti-theft module • ECM • Wire harness or connector
P1616-81	IMMO Authentication Fail Invalid Serial Data Received		
P1617-87	IMMO Authentication Message not Received Missing Message		
P1618-87	Fail to Write EOL Immobilizer Data into EEProm Missing Message		
P1614-86	Immo Transferred Transponder Authentication is Failed Signal Invalid		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Rematch anti-theft system

a. Turn ignition switch to LOCK.

b. Check if information in anti-theft module can be read.

NG → **Replace a new anti-theft module and match it.**

OK

2	Read SK code in ECM

NG → Program ECM again

OK

3	Check if SK codes in ECM and anti-theft module are the same.

NG → Program ECM again after returning ECM

OK

4	Check if SK codes in ECM and anti-theft module are the same again.

NG → Replace ECM and program it again

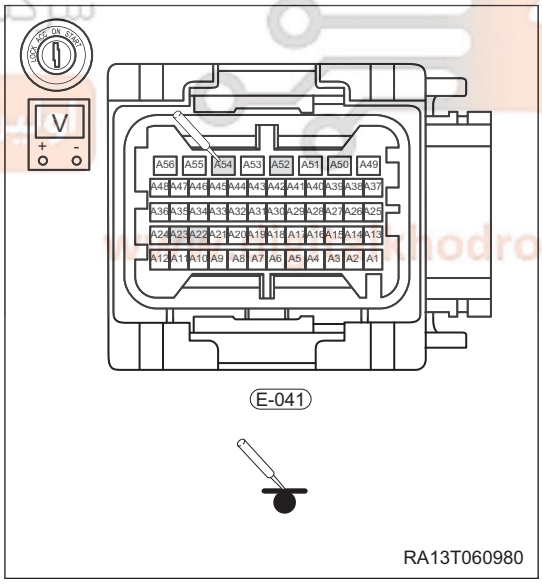
OK

5	Check ECM power supply and ground

a. Check ECM power supply and ground

Multimeter Connection	Condition	Specified Condition
E-041 (A54, A22) - Body ground	Ignition switch ON	11 to 14 V
E-041 (A52, A53) - Body ground		0 V

NG → Repair or replace connector



OK

6	Use X-431 3G diagnostic tester to match ECM, and check for DTCs again

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

b. Refer to "DTC Confirmation Procedure".

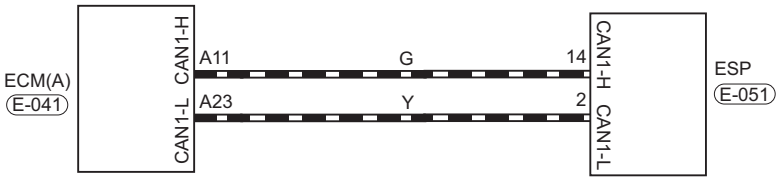
c. Check if DTC P1610-51, P1614-86, P1616-81, P1617-87 or P1618-87 still exists.

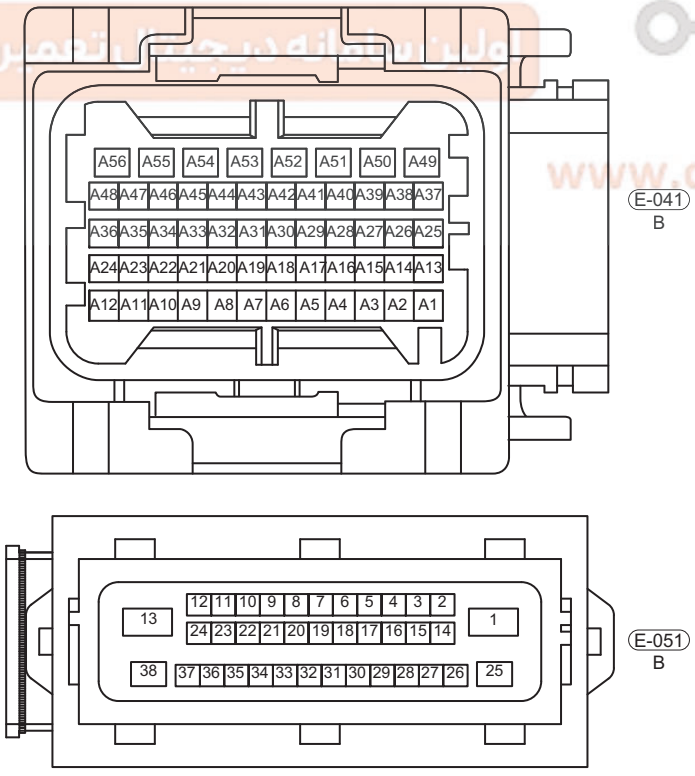
NG → **Replace ECM**

OK →

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

DTC	U0129-87	Lost Communication with BSM





EA13T060280

DTC	DTC Definition	DTC Detection Condition	Possible Cause
U0129-87	Lost Communication with BSM	Ignition switch ON Engine running	• CAN line or connector • ESP (ABS) • ECM

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check the ECM ground point E-043 (See page 06-19).

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

OK ↓

Replace ECM

2	Check ECM connector and ESP (ABS) connector.

a. Disconnect the ECM connector E-041.

b. Disconnect the ESP (ABS) connector B-061.

c. Check if connectors are normal.

NG → **Repair or replace connector**

OK ↓

3	Check CAN line

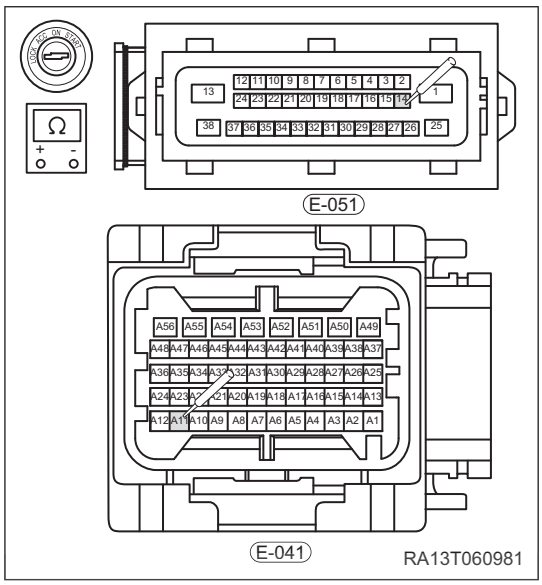
a. Check the CAN line.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-041 (A11) - B-051 (14)	Always	Continuity
E-041 (A23) - B-061 (2)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-041 (A11) or B-051 (14) - Body ground	Always	No continuity
E-041 (A11) or B-051 (14) - Battery positive	Always	No continuity
E-041 (A23) or B-061 (2) - Body ground	Always	No continuity
E-041 (A23) or B-061 (2) - Battery positive	Always	No continuity



NG → **Repair or replace CAN line**

OK

4	Replace ECM, and check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

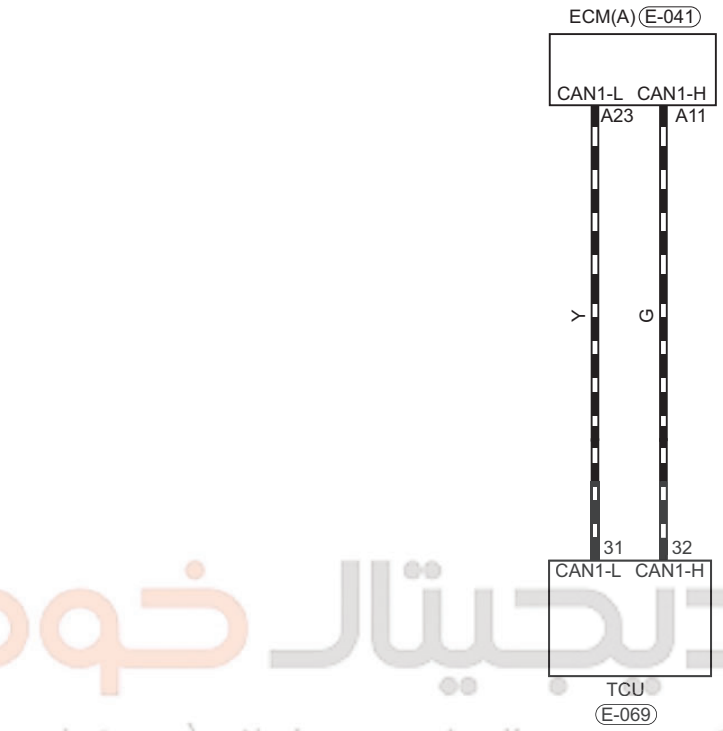
c. Check if DTC U0129-87 still exists.

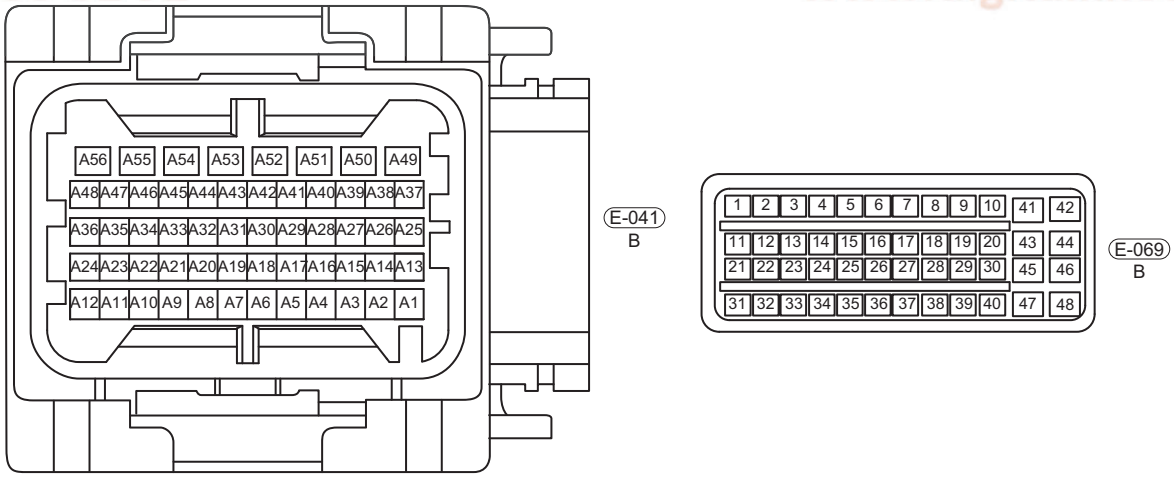
NG → **Replace ESP (ABS)**

OK

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

DTC	U0101-87	Lost Communication with TCU





EA13T060270

DTC	DTC Definition	DTC Detection Condition	Possible Cause
U0101-87	Lost Communication with TCU	Ignition switch ON Engine running	• CAN line or connector • TCU • ECM

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check the ECM ground point E-043 (See page 06-19).

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

OK

2	Check ECM connector and TCU connector.

a. Disconnect the ECM connector E-041.

b. Disconnect the TCU connector E-069.

c. Check if connectors are normal.

NG → **Repair or replace connector**

OK

3	Check CAN line

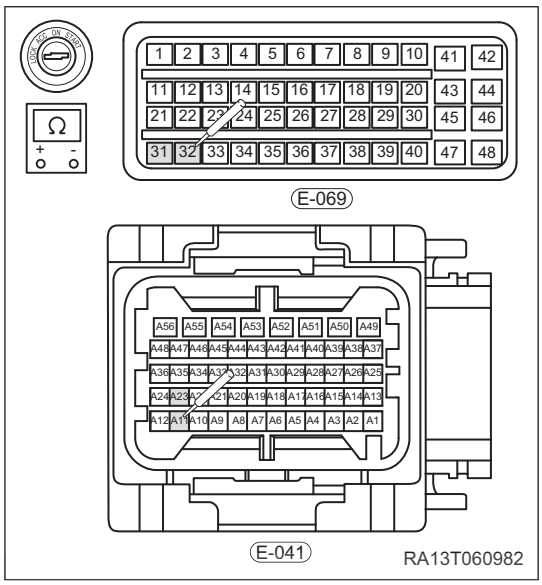
a. Check the CAN line.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-041 (A11) - E-069 (32)	Always	Continuity
E-041 (A23) - E-069 (31)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-041 (A11) or E-069 (32) - Body ground	Always	No continuity
E-041 (A11) or E-069 (32) - Battery positive	Always	No continuity
E-041 (A23) or E-069 (31) - Body ground	Always	No continuity
E-041 (A23) or E-069 (31) - Battery positive	Always	No continuity



NG → **Repair or replace CAN line**

OK

4	Replace ECM, and check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

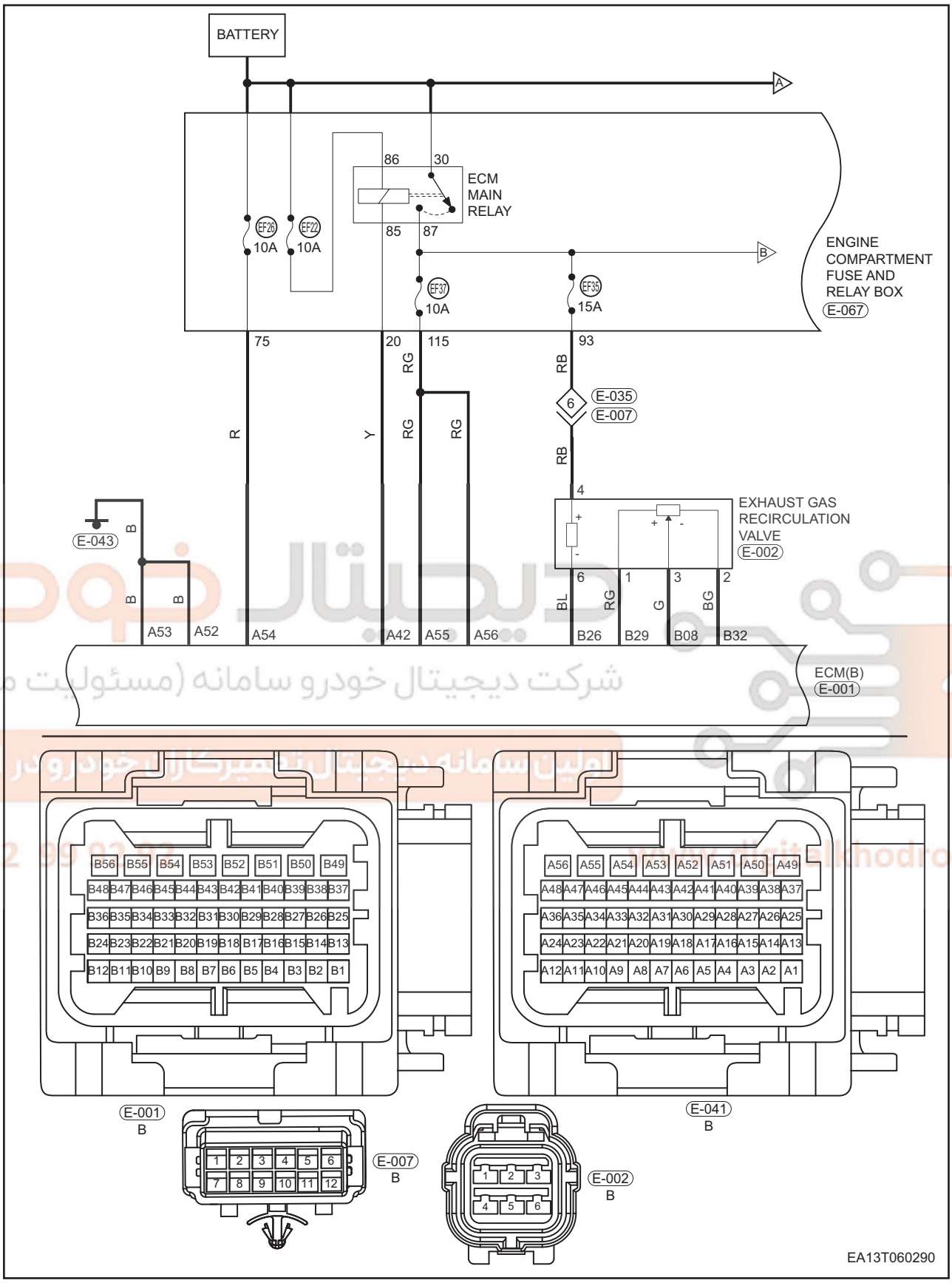
c. Check if DTC U0101-87 still exists.

NG → **Replace TCU**

OK

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

DTC	P0403-11	EGR Control Circuit Short to Ground
DTC	P0403-12	EGR Control Circuit Short to Battery
DTC	P0403-13	EGR Control Circuit Open
DTC	P0403-61	EGR Control Circuit Signal Calculation Failure



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0403-11	EGR Control Circuit Short to Ground	Ignition switch ON Engine running	• EGR valve • Wire harness or connector • ECM
P0403-12	EGR Control Circuit Short to Battery		
P0403-13	EGR Control Circuit Open		
P0403-61	EGR Control Circuit Signal Calculation Failure		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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-043 (See page 06-19).

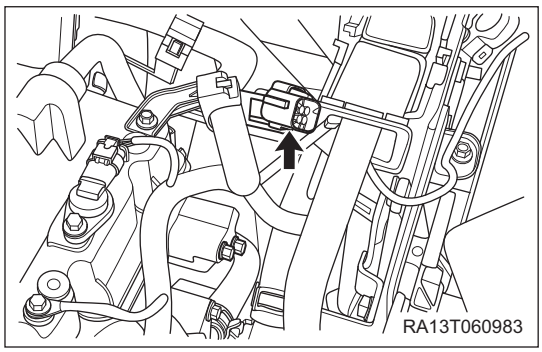
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check EGR valve connector

a. Disconnect the EGR valve connector E-002 (arrow).

b. Check the EGR valve connector.



NG → **Repair or replace connector**

OK

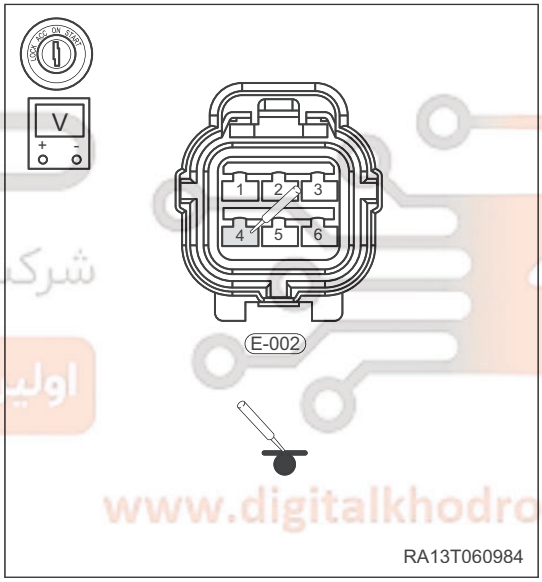
3	Check EGR valve drive motor power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between connector terminal and body ground.

c. Check wire harness between connector terminals.

Multimeter Connection	Condition	Specified Condition
E-002 (4) - Body ground	Ignition switch ON	11 - 14 V



OK → **Go to step 5**

NG

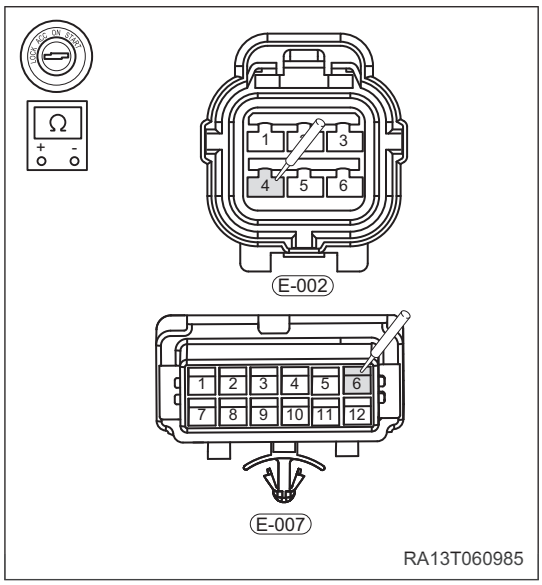
4	Check EGR valve drive motor power supply circuit and fuse EF35

a. Turn ignition switch to LOCK.

b. Check if fuse EF35 is normal.

c. Disconnect the engine compartment fuse and relay box connector E-067.

d. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-002 (4) - E-007 (6)	Always	Continuity
E-035 (6) - E-067 (93)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-002 (4), E-007 (6), E-035 (6) or E-067 (93) - Body ground	Always	No continuity
E-002 (4), E-007 (6), E-035 (6) or E-067 (93) - Battery positive		

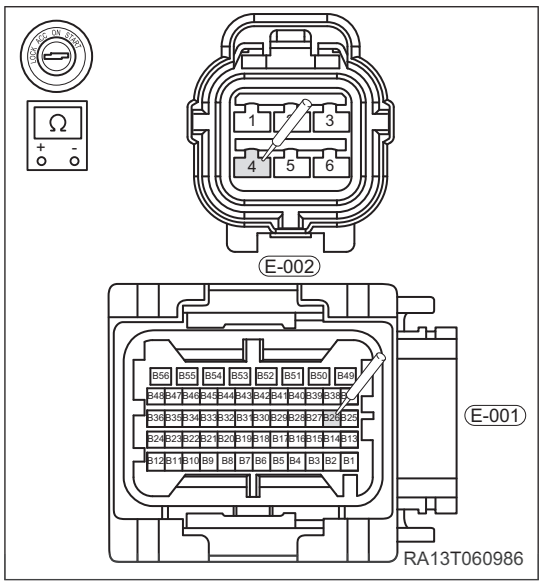
NG → **Repair or replace wire harness or connector (EGR valve - engine compartment fuse and relay box)**

OK →

5	Check EGR valve drive motor control circuit

a. Disconnect the ECM connector E-001.

b. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-002 (4) - E-001 (B26)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-002 (4) or E-001 (B26) - Body ground	Always	No continuity
E-002 (4) or E-001 (B26) - Battery positive		

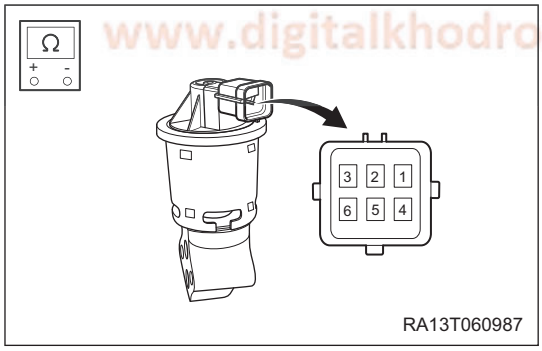
NG → **Repair or replace wire harness or connector (EGR valve - ECM)**

OK

6	Check EGR valve drive motor control circuit

a. Remove the EGR valve.

b. Check the EGR valve drive motor.



Multimeter Connection	Condition	Specified Condition
Terminal 4 - Terminal 6	Always	8 Ω

c. When battery voltage is applied between terminals 4 and 6, control valve should move quickly.

NG → **Replace EGR valve**

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

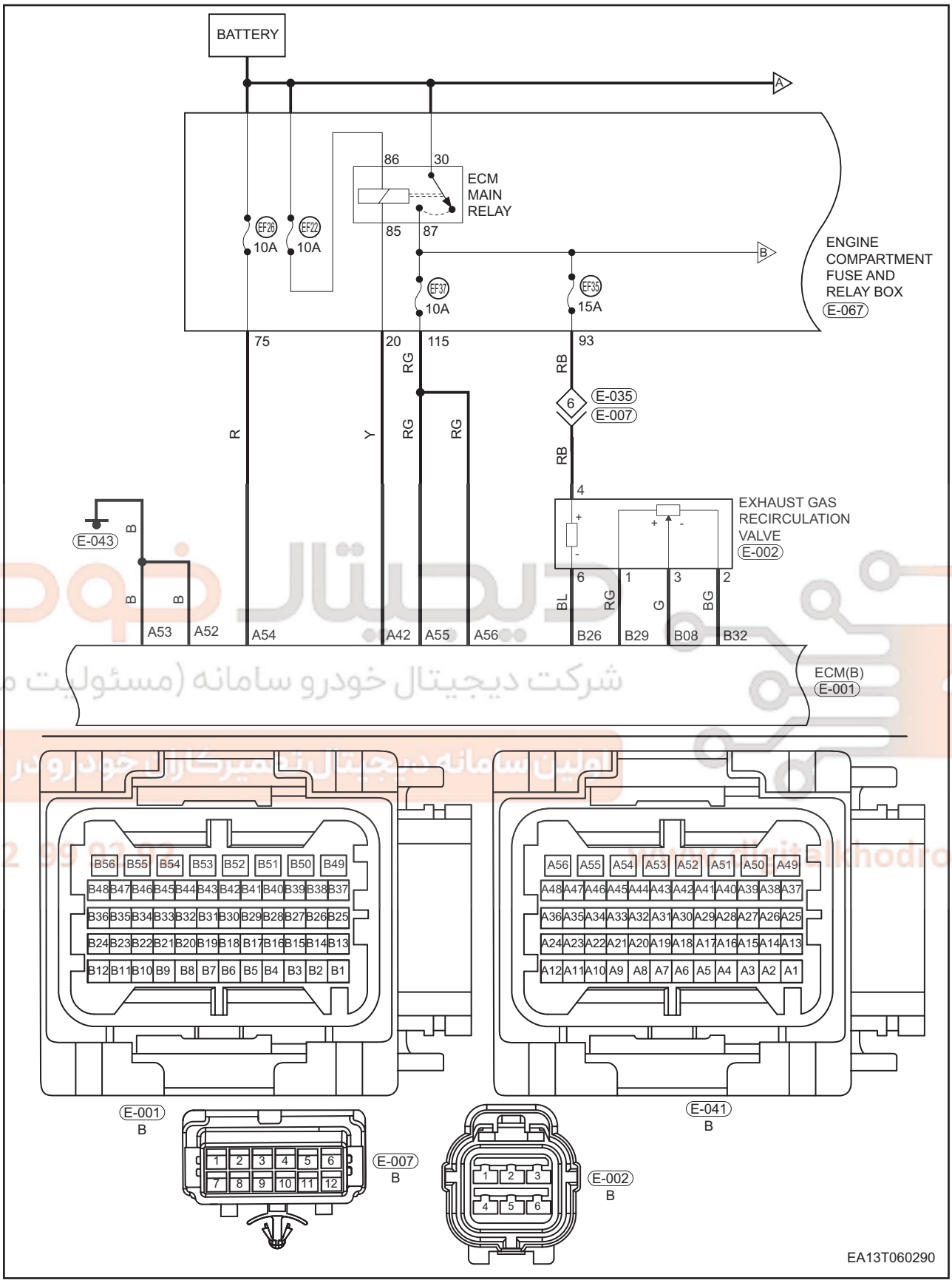
c. Check if DTC P0403-11, P0403-12, P0403-13 or P0403-61 still exists.

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	P0409-12	EGR Sensor Circuit Short to Battery
DTC	P0409-14	EGR Sensor Circuit Short to Ground or Open



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0409-12	EGR Sensor Circuit Short to Battery	Ignition switch ON Engine running	• EGR valve • Wire harness or connector • ECM
P0409-14	EGR Sensor Circuit Short to Ground or Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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-043 (See page 06-19).

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

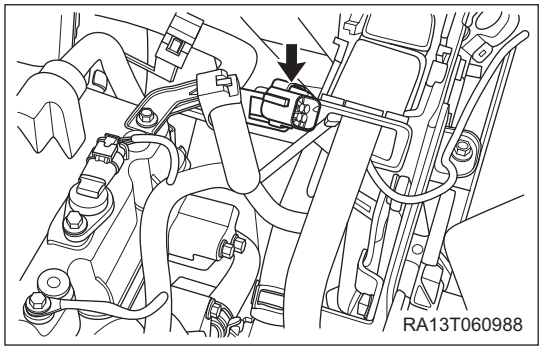
OK

2	Check EGR valve connector

a. Disconnect the EGR valve connector E-002 (arrow).

b. Check the EGR valve connector.

NG → **Repair or replace connector**



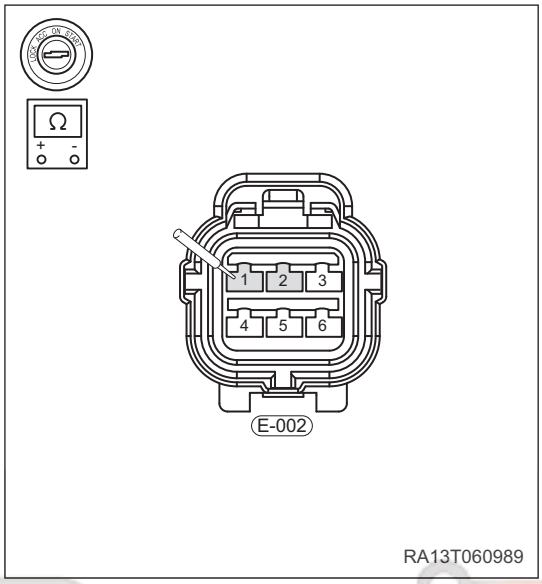
OK

3	Check EGR valve sensor power supply

a. Turn ignition switch to ON.

b. Check voltage between sensor connector terminals.

Multimeter Connection	Condition	Specified Condition
E-002 (1) - E-002 (2)	Ignition switch ON	5 V



OK → Go to step 5

NG

4	Check EGR valve sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-001.

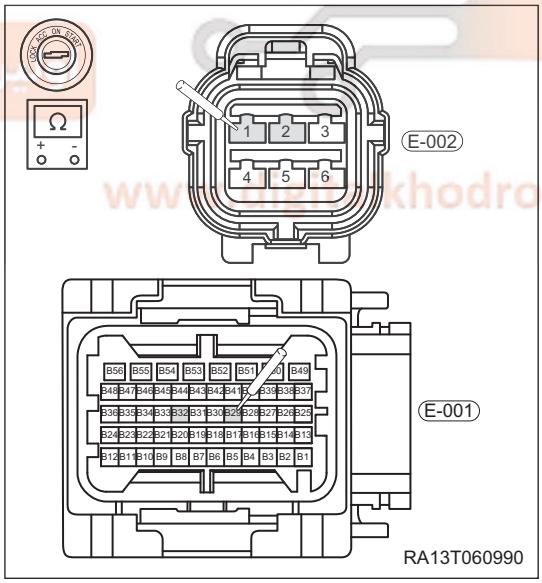
c. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-002 (1) - E-001 (B29)	Always	Continuity
E-002 (2) - E-001 (B32)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-002 (1), E-001 (B29), E-002 (2) or E-001 (B32) - Body ground	Always	No continuity
E-002 (1), E-001 (B29), E-002 (2) or E-001 (B32) - Battery positive		



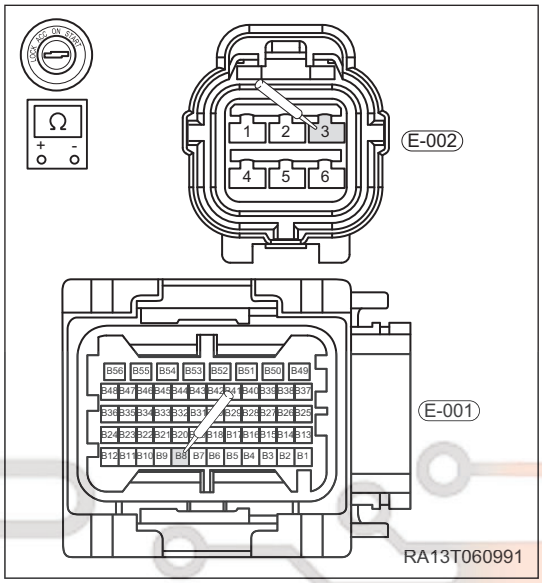
NG → **Repair or replace wire harness or connector (EGR valve - ECM)**

OK

5	Check EGR valve sensor signal circuit

a. Disconnect the ECM connector E-001.

b. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-002 (3) - E-001 (B08)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-002 (3) or E-001 (B08) - Body ground	Always	No continuity
E-002 (3) or E-001 (B08) - Battery positive		

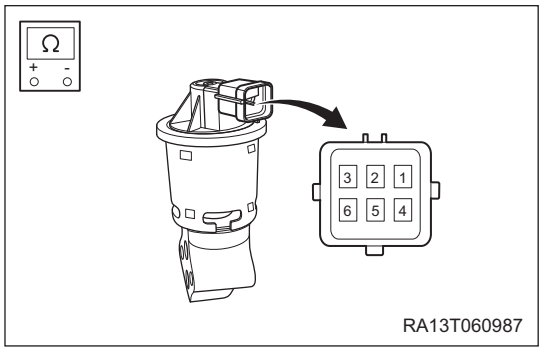
NG → **Repair or replace wire harness or connector (EGR valve - ECM)**

OK

6	Check the EGR valve sensor.

a. Remove the EGR valve.

b. Check the EGR valve drive motor.



Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 2	Always	2340 Ω ~ 3380 Ω

c. Apply battery voltage to terminals 4 and 6, so that EGR valve can move; check if resistance between terminals 1 and 3, and between terminals 2 and 3 changes equally in reverse direction.

NG → **Replace EGR valve**

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 P0409-12 or P0409-14 still exists.

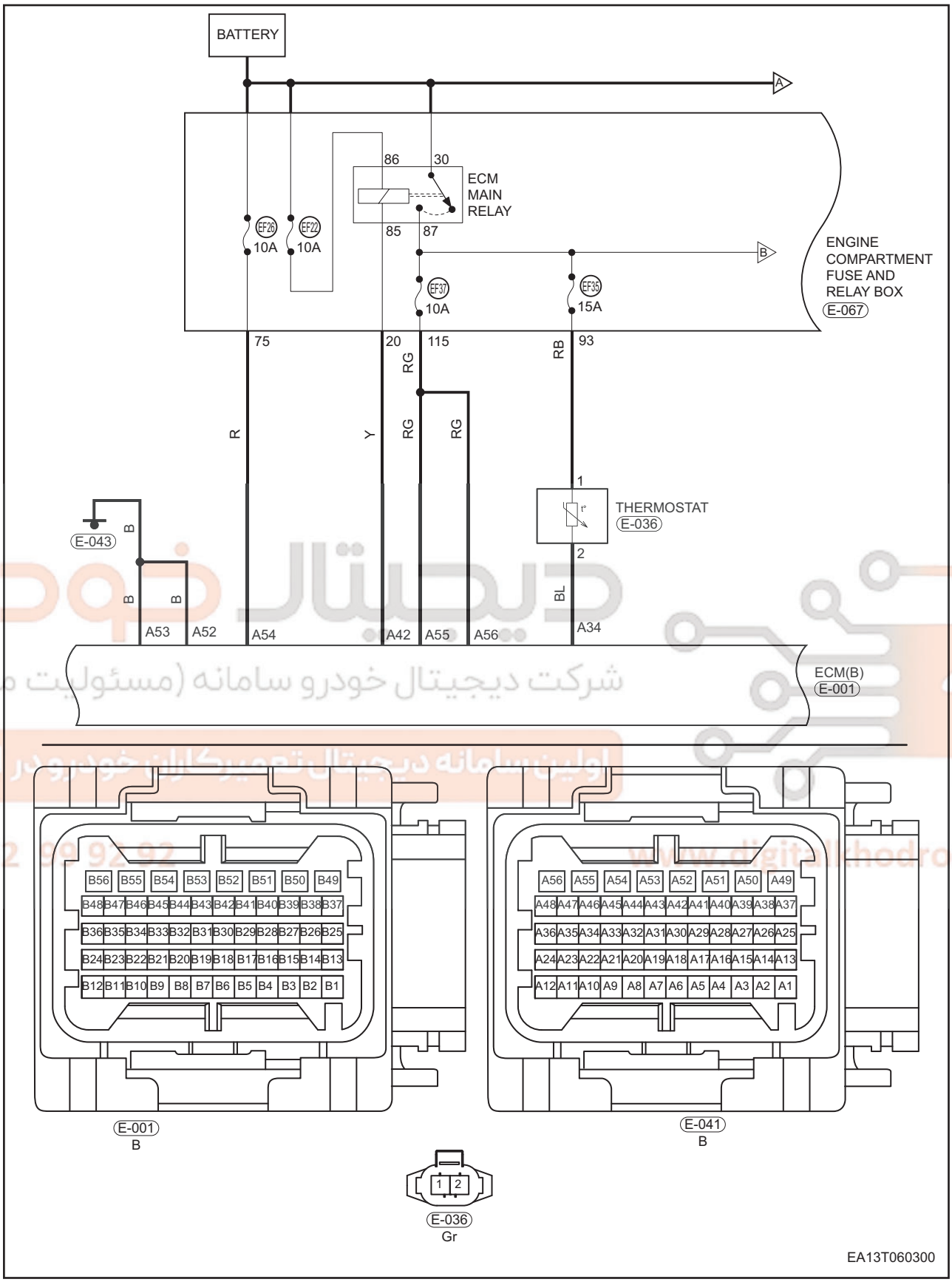
NG → Replace ECM

OK

06

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

DTC	P1600-11	Thermostat Circuit Short to Ground
DTC	P1600-12	Thermostat Circuit Short to Battery
DTC	P1600-13	Thermostat Circuit Open



EA13T060300

DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0409-12	EGR Sensor Circuit Short to Battery	Ignition switch ON Engine running	• Electronic thermostat • Wire harness or connector • ECM
P0409-14	EGR Sensor Circuit Short to Ground or Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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-043 (See page 06-19).

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

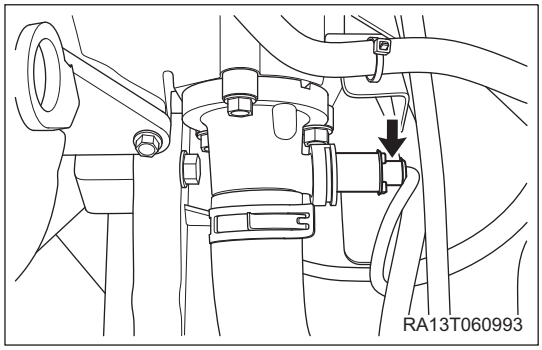
OK

2	Check electronic thermostat connector

a. Disconnect the electronic thermostat connector E-036 (arrow).

b. Check the electronic thermostat connector.

NG → **Repair or replace connector**



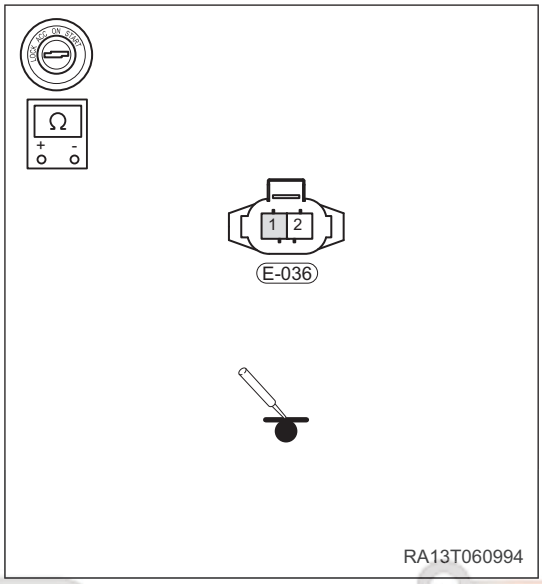
OK

3	Check electronic thermostat power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between connector terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-036 (1) - Body ground	Ignition switch ON	11 - 14 V



OK → Go to step 5

NG

4	Check electronic thermostat power supply circuit and fuse EF35

a. Turn ignition switch to LOCK.

b. Check if fuse EF35 is normal.

c. Disconnect the engine compartment fuse and relay box connector E-067.

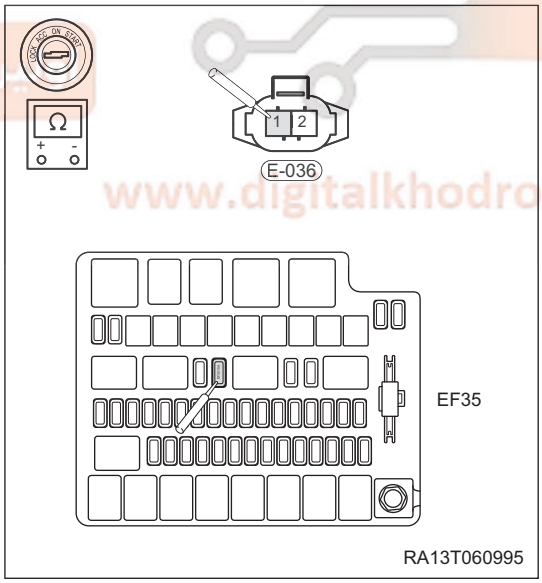
d. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-036 (1) - E-067 (93)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-036 (1) or E-067 (93) - Body ground	Always	No continuity
E-036 (1) or E-067 (93) - Battery positive		



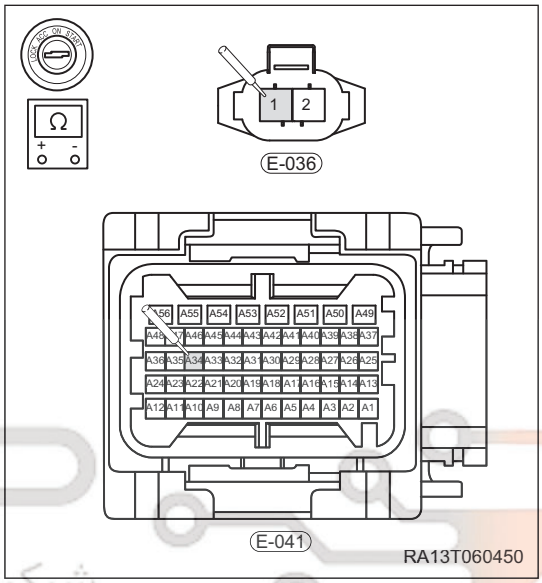
NG → **Repair or replace wire harness or connector (electronic thermostat - engine compartment fuse and relay box)**

OK

5	Check electronic thermostat control circuit

a. Disconnect the ECM connector E-041.

b. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-036 (2) - E-041 (A34)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-036 (2) or E-041 (A34) - Body ground	Always	No continuity
E-036 (2) or E-041 (A34) - Battery positive		

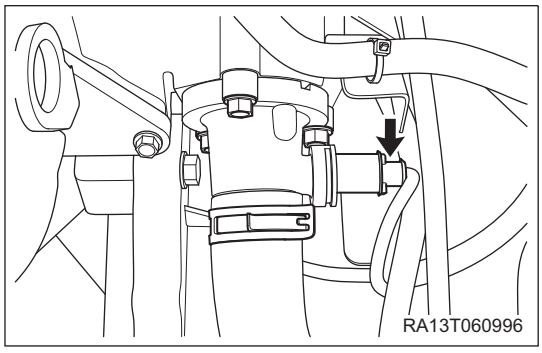
NG → **Repair or replace wire harness or connector (electronic thermostat - ECM)**

OK

6	Check electronic thermostat

a. Remove the electronic thermostat.

b. Check resistance of electronic thermostat.



Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 2	Always	15 Ω

c. Heat thermostat in water to 100°C, then apply battery voltage to terminals 1 and 2 of thermostat, observe if opening travel is 8 mm.

CAUTION

Energizing time cannot be above 60 seconds ever time.

NG → **Replace electronic thermostat**

OK ↓

7	**Check for DTCs**

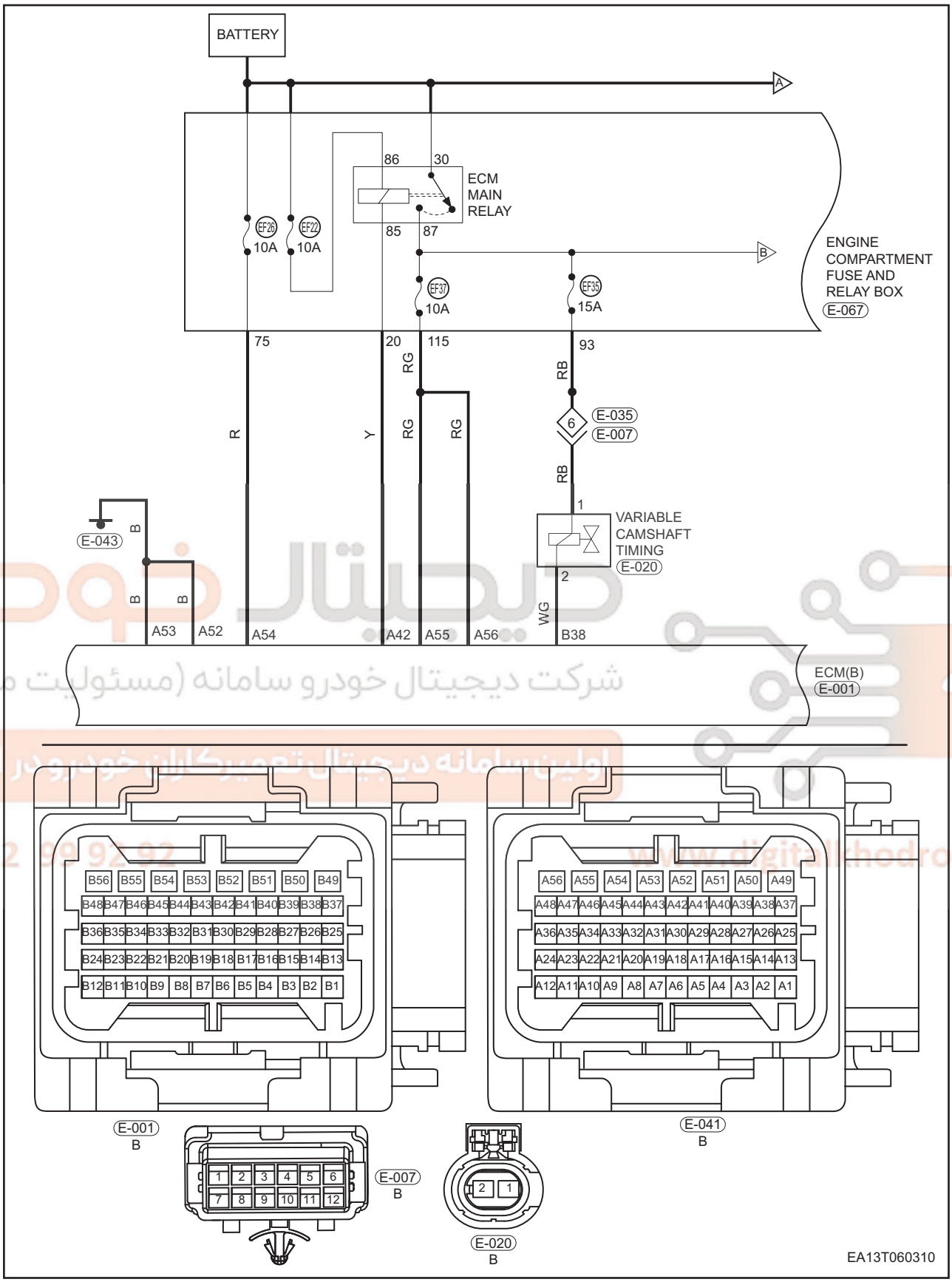
a. Using X-431 3G diagnostic tester, read ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P1600-11, P1600-12 or P1600-13 still exists.

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	P0010-11	VVT Driver Circuit Short to Ground
DTC	P0010-12	VVT Driver Circuit Short to Battery
DTC	P0010-13	VVT Driver Circuit Open
DTC	P0010-14	VVT Driver Circuit Short to Ground or Open



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0010-11	VVT Driver Circuit Short to Ground	Ignition switch ON Engine running	• VVT control valve • Wire harness or connector • ECM
P0010-12	VVT Driver Circuit Short to Battery		
P0010-13	VVT Driver Circuit Open		
P0010-14	VVT Driver Circuit Short to Ground or Open		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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-043 (See page 06-19).

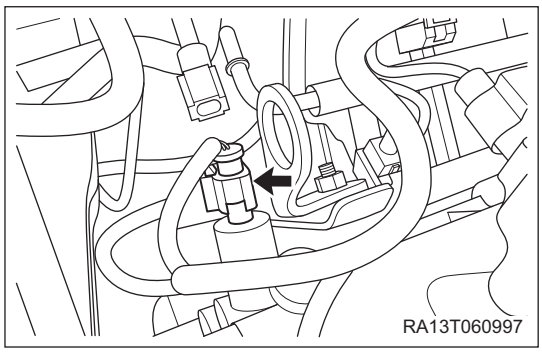
NG → **Repair or replace ground wire harness or ground point**

OK

2	Check VVT control valve

a. Disconnect the VVT control valve connector E-020 (arrow).

b. Check the VVT control valve connector.



NG → **Repair or replace connector**

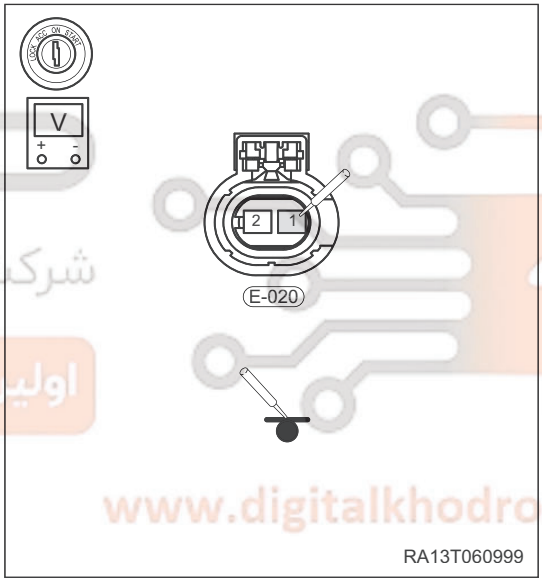
OK

3	Check 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-020 (1) - Body ground	Ignition switch ON	11 - 14 V



OK → **Go to step 5**

NG

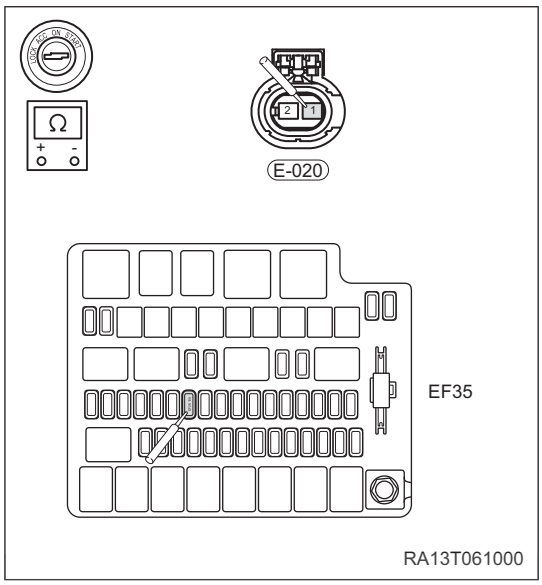
4	Check VVT control valve power supply circuit and fuse EF35

a. Turn ignition switch to LOCK.

b. Check if fuse EF35 is normal.

c. Disconnect the engine compartment fuse and relay box connector E-067.

d. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-020 (1) - E-067 (75)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-036 (1) or E-067 (93) - Body ground	Always	No continuity
E-036 (1) or E-067 (93) - Battery positive		

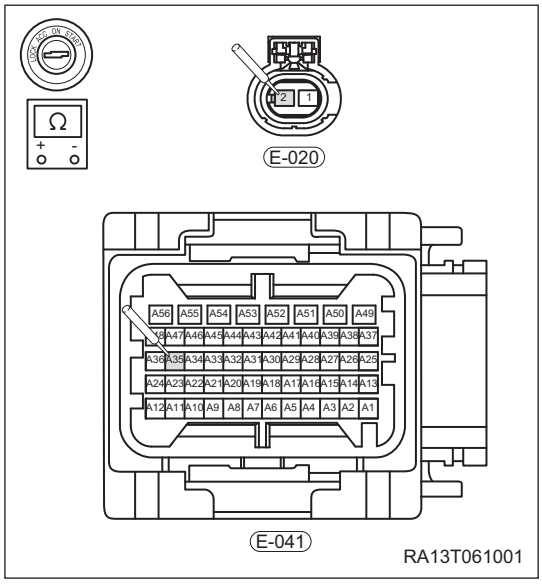
NG → **Repair or replace wire harness or connector (VVT control valve - engine compartment fuse and relay box)**

OK

5	Check VVT control valve control circuit

a. Disconnect the ECM connector E-041.

b. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-020 (2) - E-041 (B35)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-020 (2) or E-041 (B35) - Body ground	Always	No continuity
E-020 (2) or E-041 (B35) - Battery positive		

NG → **Repair or replace wire harness or connector (VVT control valve - ECM)**

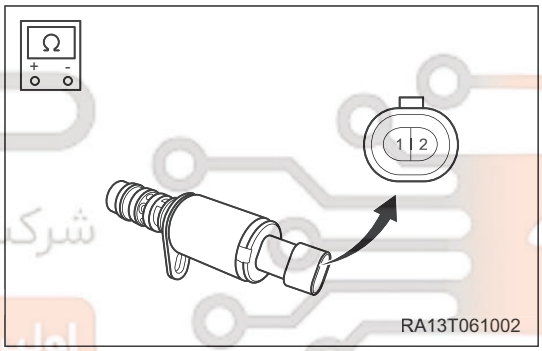
OK

6	Check VVT control valve

a. Remove the VVT control valve.

b. Check the 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 VVT control valve**

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

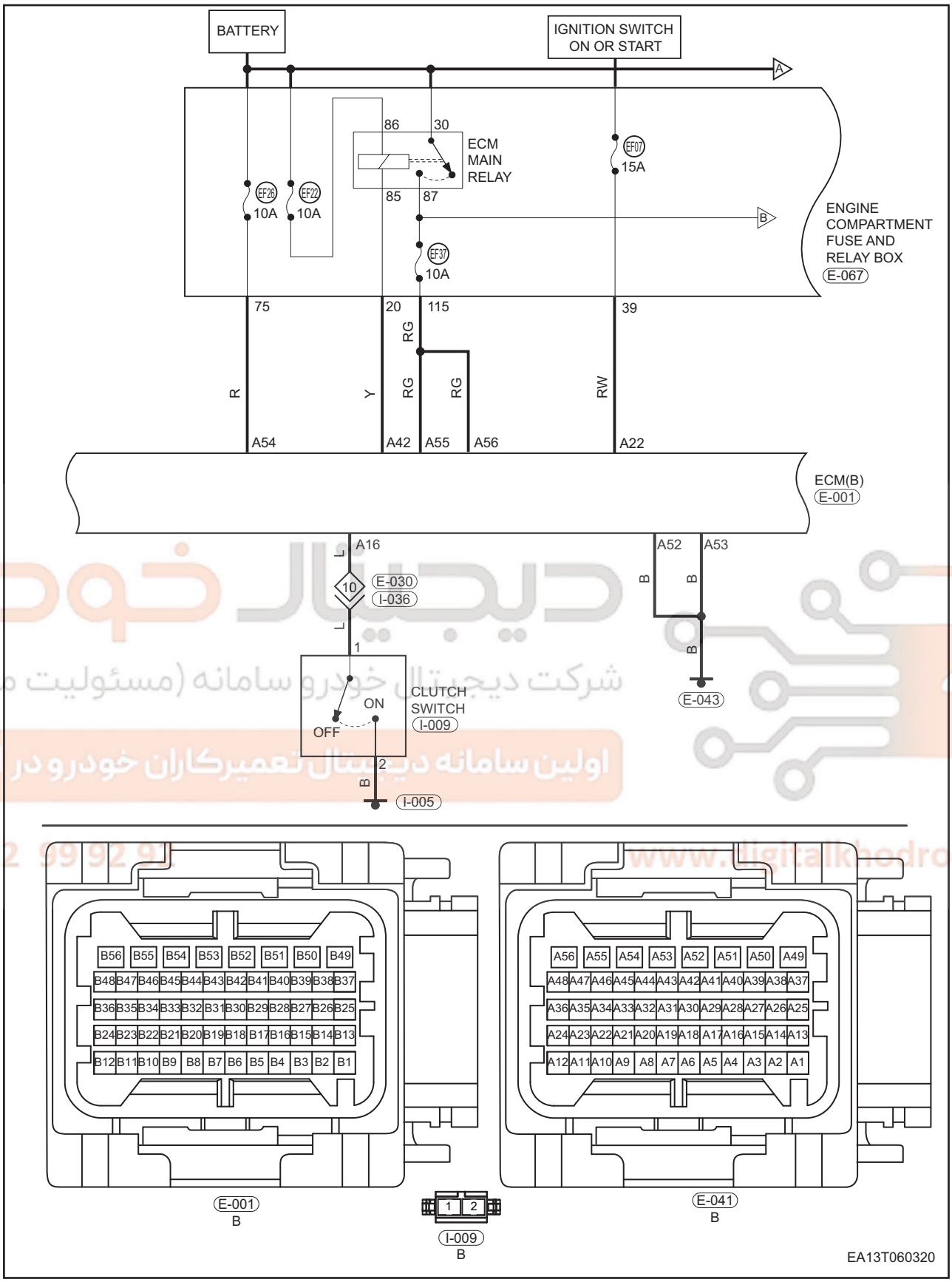
c. Check if DTC P0010-11, P0010-12, P0010-13 or P0010-14 still exists.

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	P0704-23	Clutch Switch Signal Stuck Low
DTC	P0704-24	Clutch Switch Signal Stuck High



DTC	DTC Definition	DTC Detection Condition	Possible Cause
P0704-23	Clutch Switch Signal Stuck Low	Ignition switch ON Engine running	• Clutch switch • Wire harness or connector • ECM
P0010-12	Clutch Switch Signal Stuck High		

DTC Confirmation Procedure

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

- Turn ignition switch to LOCK.
- 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 06-19).

CAUTION

- When performing circuit diagnosis and test, always refer to 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-043 (See page 06-19).

NG → Repair or replace ground wire harness or ground point

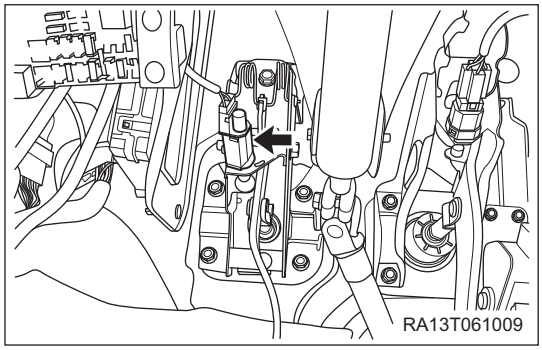
OK

2	Check clutch switch connector

a. Disconnect the clutch switch connector I-009 (arrow).

b. Check the clutch switch connector.

NG → Repair or replace connector



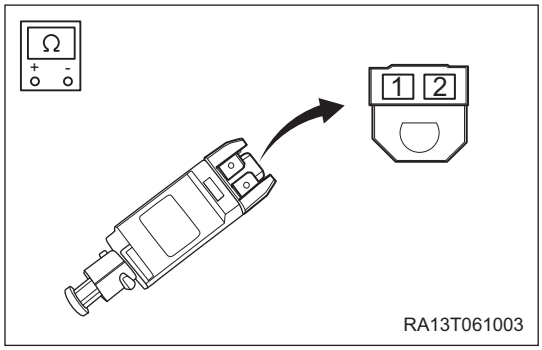
OK

3	Check clutch switch

a. Remove the clutch switch.

b. Check the clutch switch.

Multimeter Connection	Condition	Specified Condition
Terminal 1 - Terminal 2	ON (not pushed)	Continuity
	OFF (pushed)	No continuity



NG → Replace clutch switch

OK

4	Check clutch switch circuit

a. Turn ignition switch to LOCK.

b. Disconnect the ECM connector E-041.

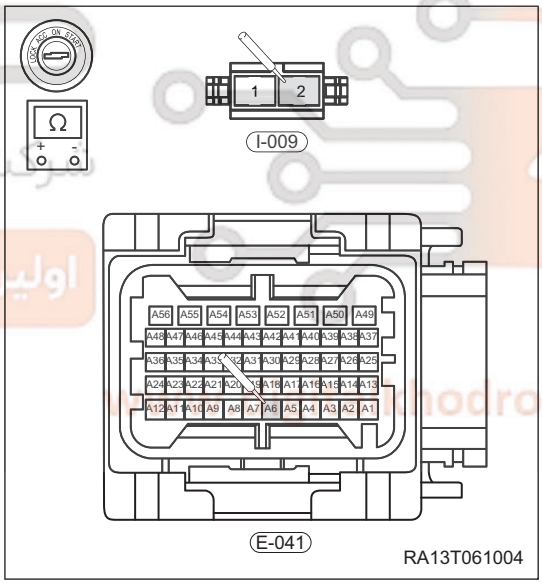
c. Check wire harness between clutch switch connector terminal and ECM connector terminal.

Check for Open

Multimeter Connection	Condition	Specified Condition
I-009 (2) - E-041 (A6)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
I-009 (2) or E-041 (A6) - Body ground	Always	No continuity
I-009 (2) or E-041 (A6) - Battery positive		



NG → Repair or replace wire harness or connector (clutch switch - ECM)

OK

5	Check clutch switch ground circuit

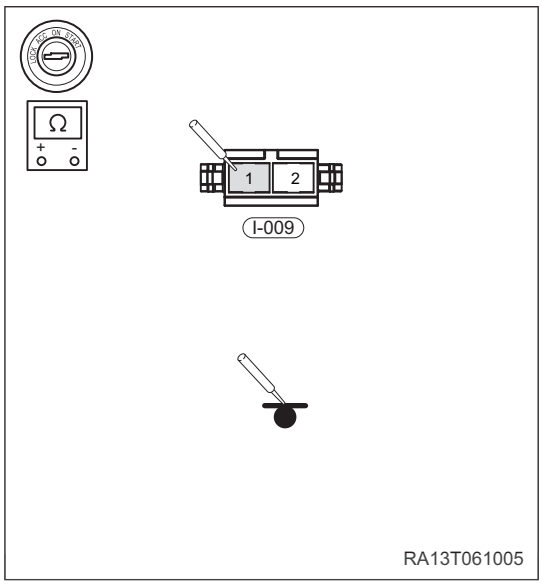
a. Check the ground point I-005.

b. Check wire harness between clutch switch connector terminal and body ground.

Check for Open

Multimeter Connection	Condition	Specified Condition
I-009 (1) - Body ground	Always	Continuity

NG → **Repair or replace wire harness or connector (clutch switch - body ground)**



OK

6	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0704-23 or P0704-24 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

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 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 or connected correctly;
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, there may be ECM problem; if trouble symptom still exists, reuse original ECM, repeat procedures, and perform the service again.

Problem Symptoms Table

Symptom	Suspected Area	See page
Engine does not crank or cranks slowly while starting	Battery Starter motor Wire harness or ignition switch Starter relay ECM, TCM Gear switch (AT) Engine mechanical	06-19
Engine cranks normally but cannot start successfully while starting	No fuel in tank Fuel pump Fuel injector Engine speed sensor Ignition coil Engine immobilizer ECM Engine mechanical	06-19

Symptom	Suspected Area	See page
Difficult to start with hot engine	Water in fuel Fuel pump Coolant temperature sensor Engine speed sensor Ignition coil Camshaft position sensor Fuel injector Engine mechanical	06-19
Engine starts normally, but idles roughly or stalls with part load (for example, A/C is ON)	A/C system Fuel injector	06-19
Engine starts normally, but idle speed is too high	Throttle valve Vacuum pipe Coolant temperature sensor Ignition timing	06-19
Low engine speed or stalls when accelerating	Water in fuel Intake pressure/temperature sensor Intake pipe Exhaust pipe Ignition timing Throttle position sensor Fuel injector Spark plug	06-19
Slow response when accelerating	Water in fuel Intake pressure/temperature sensor Intake pipe Exhaust pipe Ignition timing Throttle position sensor Fuel injector Spark plug	06-19

Engine does not crank or cranks slowly while starting

1	Check voltage between two battery posts when engine starts

OK: Voltage is 11.5 - 12.5 V

NG → **Replace battery**

OK ↓

2	Check voltage of starter motor positive post

a. Ignition switch remains in START position and check voltage of starter motor positive post.

OK: Voltage is 11.5 - 12.5 V

NG → **Repair or replace starter relay, wire harnessor ECM**

OK ↓

3	Check operation of starter motor

a. Remove the starter motor.

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

NG → **Repair or replace starter**

OK ↓

4	Check engine lubricant and gear oil

a. If malfunction only occurs in winter, check if starter motor resistance is too strong because of improper engine lubricant and gear oil selection.

NG → **Replace lubricant with appropriate number**

OK ↓

5	Check engine internal mechanical resistance

a. Check if engine internal mechanical resistance is too strong, causing starter motor not to run or run slowly.

NG → **Check and repair engine internal resistance malfunction**

OK

Go to Diagnostic Help

Engine cranks normally but cannot start successfully while starting

1	**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 engine speed sensor wire harness**

OK ↓

3	**Check spark plug**

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

OK: Spark is generated

NG → **Check and repair ignition system**

OK ↓

4	**Check pressure of cylinder**

a. Measure compression of misfiring cylinder (See page 07-16).

NG → **Check engine to confirm cause of low compression**

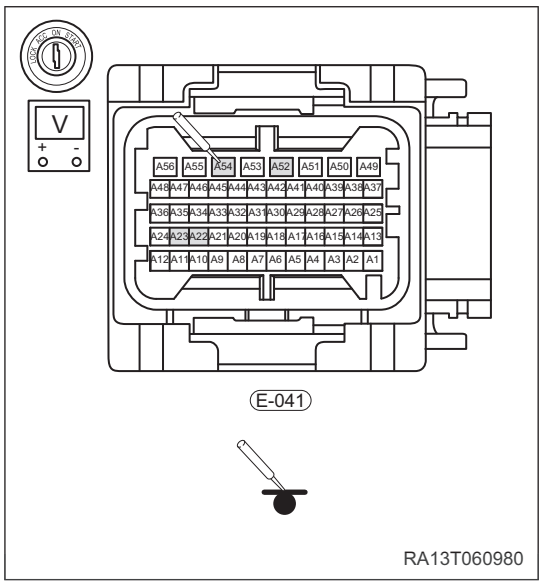
OK ↓

5	Check ECM power supply and ground

a. Disconnect the ECM connector E-041.

b. Turn ignition switch to ON and check ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
E-041 (A54, A22)	Ignition switch ON	11 to 14 V
E-041 (A52, A53)		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 spark**

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

OK: Spark is generated

NG → **Check and repair ignition system**

OK ↓

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

OK → **Check and repair circuit or replace sensor**

NG ↓

4	**Clamp fuel pump return pipe, measure fuel pressure and observe if fuel pressure rises**

NG → **Replace fuel pump assembly**

OK ↓

5	**Check ECM power supply and ground**

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 spark**

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

OK: Spark is generated

NG → **Check and repair ignition system**

OK

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

OK → **Check and repair circuit or replace sensor**

NG

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

NG → **Clean 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 07-16).

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 → **Spark Plug Replacement**

OK

4	**Check spark**

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

OK: Spark is generated

NG → **Check and repair ignition system**

OK

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

OK → Check and repair circuit or replace sensor

NG

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

NG → Clean throttle valve

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

a. Measure compression of misfiring cylinder (See page 07-16).

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 sticking

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 → Spark Plug Replacement

OK ↓

4	Check throttle for carbon deposits

NG → Clean 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 07-16).

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 → Spark Plug Replacement

OK ↓

3	Check throttle for carbon deposits

NG → Clean throttle valve

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 07-16).

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 → Spark Plug Replacement

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 07-16).

NG → Check engine to confirm cause of low compression

OK

Go to Diagnostic Help

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

1	Check throttle for carbon deposits

NG → Clean throttle valve

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

OK → Go to step 4

NG ↓

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

NG → Check and repair A/C system

OK ↓

4	Connect ECM adapter, and disconnect cableof ECM corresponding terminal. Check if wire harness side is HIGH-levelsignal with A/C ON

NG → Check and repair A/C system

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

OK → Check and repair intake system

NG

3	Check throttle for carbon deposits

NG → Clean throttle valve

OK

4	Disconnect coolant temperature sensor connector, start engine and observe if engine idling is normal

NG → Check and repair circuit or replace sensor

OK

5	Check engine ignition timing

NG → Check and repair ignition timing

OK

Go to Diagnostic Help

Low engine speed or stalls when accelerating

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

NG → Check and repair intake system

OK ↓

2	Check fuel pressure

a. 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 → Spark Plug Replacement

OK ↓

4	Check throttle for carbon deposits

NG → Clean throttle valve

OK ↓

5	Check intake pressure/temperature sensor, throttle position sensor and circuit

OK → Check and repair circuit or replace sensor

NG ↓

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 → Spark Plug Replacement

OK ↓

4	Check throttle for carbon deposits

NG → Clean throttle valve

OK ↓

5	Check intake pressure/temperature sensor, throttle position sensor and circuit

OK → Check and repair circuit or replace sensor

NG ↓

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 malfunctioning 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 → **Spark Plug Replacement**

OK

5	**Check spark**

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

OK: Spark is generated

NG → **Check and repair ignition system**

OK

6	Check throttle for carbon deposits

NG → Clean throttle valve

OK

7	Check intake pressure/temperature sensor, throttle position sensor and circuit

OK → Check and repair circuit or replace sensor

NG

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

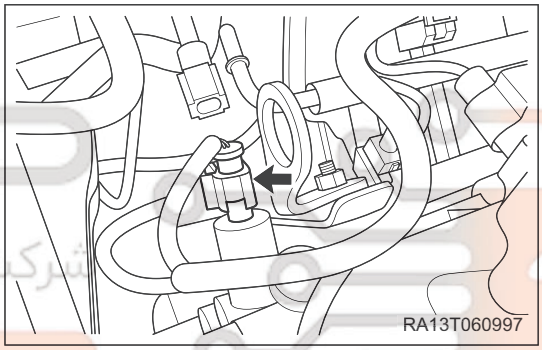
There is a VVT control valve, which is located on front end of cylinder head.

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 timings 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.
   a. Disconnect VVT control valve connector (arrow), and then remove 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.

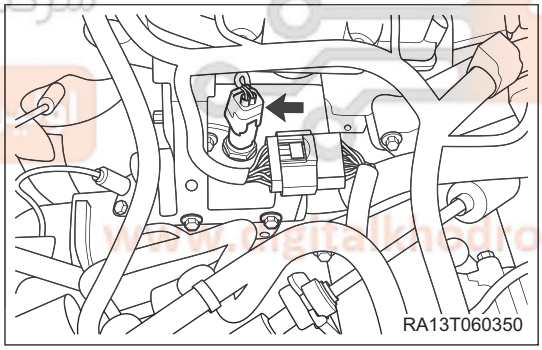
Removal

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.
   (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.

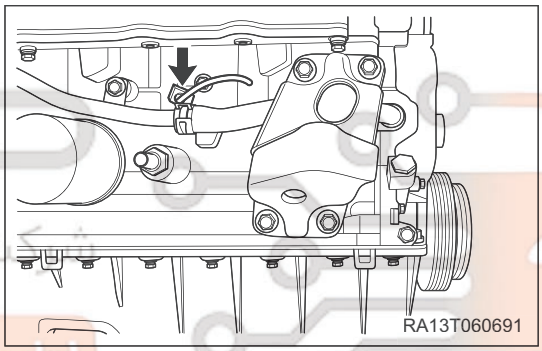
Operation

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 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 coolant temperature sensor connector and remove coolant temperature sensor.
   (Tightening torque: 14 ± 1 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.

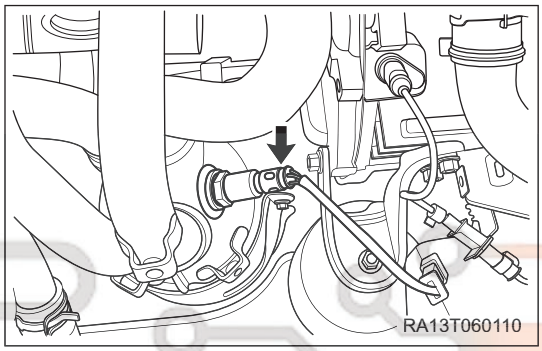
Operation

Oxygen sensors monitor oxygen content and convert it into voltage. 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.

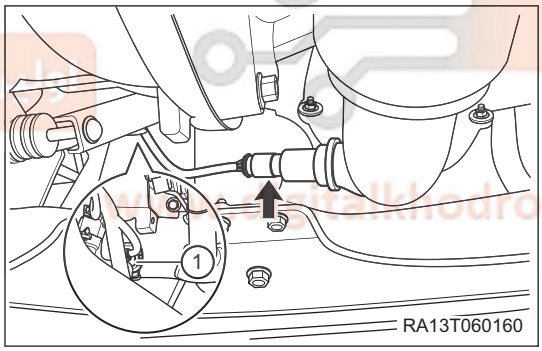
Upstream Oxygen Sensor

Input signal from heated upstream oxygen sensor is used to inform 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 sensor begins to match upstream sensor signal except for a slight delay. By comparing signal from heated upstream oxygen sensor to signal from downstream sensor, Engine Control Module (ECM) calculates 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

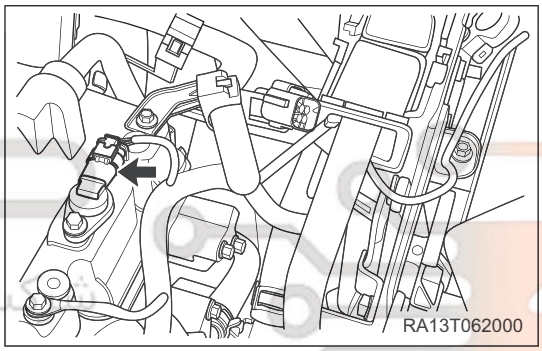
Camshaft position sensor is installed on cylinder head cover.

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.
   a. Disconnect camshaft position sensor connector (arrow), then remove camshaft position sensor fixing bolt (1).
   (Tightening torque: 8 ± 1 N·m)


RA13T062000

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

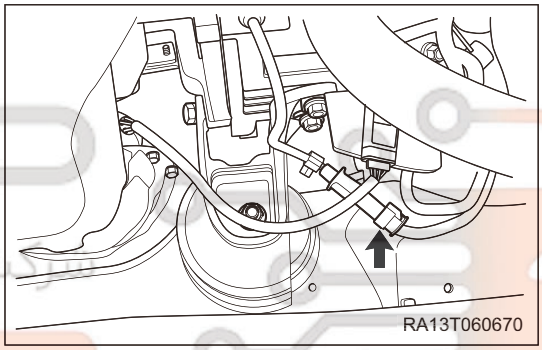
Engine speed sensor is installed on clutch case, against flywheel teeth. It is used to detect the speed and position of crankshaft.

Operation

Engine speed sensor is a Hall type sensor. When crankshaft rotates, it drives flywheel to rotate. Flywheel teeth will cut the magnetic line of sensor, and change of magnetic flux causes sensor output signal voltage change, which is sent to Engine Control Module (ECM). And 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 (arrow), and remove engine speed sensor fixing bolt (1).
   (Tightening torque: 8 ± 2 N·m)



Installation

Installation is in the reverse order of removal.

CAUTION

- Press in crankshaft position sensor rather than tap when installing it.

Intake Pressure/Temperature Sensor

Description

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

Operation

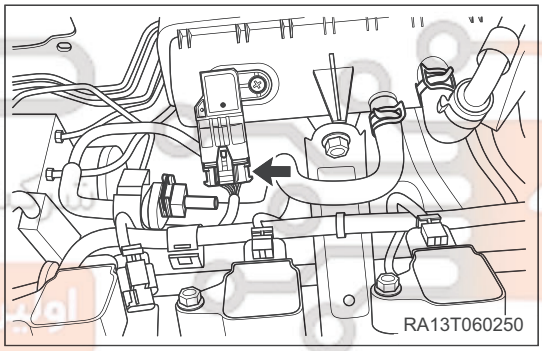
Intake manifold absolute pressure sensing element consists of a piece of silicon chip, which will deform mechanically as the intake manifold absolute pressure changes. The piezoresistor in sensor will also deform, thus changing the resistance. Voltage signal linearly related to the pressure is generated 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 of 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 intake pressure/temperature sensor connector (arrow).



5. Remove the intake pressure/temperature sensor fixing bolt.
   (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.

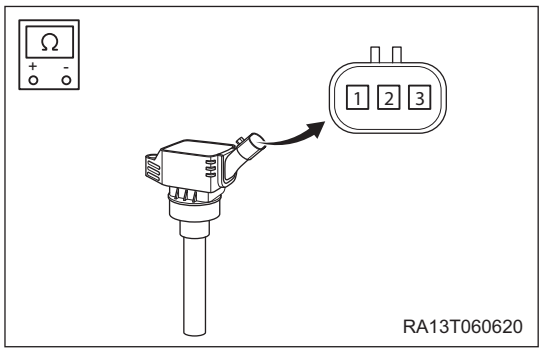
Ignition Coil

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. 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 line is on through an Engine Control Module (ECM) signal. Once Engine Control Module (ECM) cuts off control signal to primary winding circuit, it will stop charging and a high voltage will be induced in secondary winding.



Removal & Installation

(See page 14-8)

Electronic Accelerator Pedal Sensor

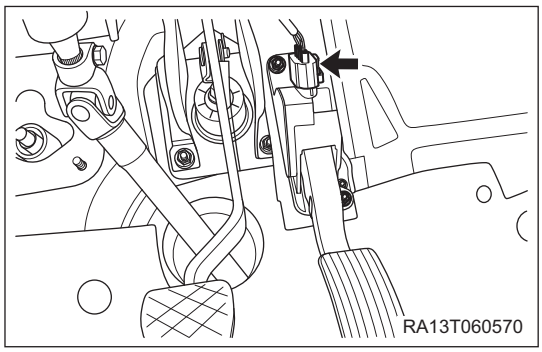
Description

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 10-17)

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 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. 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 08-14)

Fuel Injector

Description

Fuel injector is located on the cylinder head near to 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, the needle valve begins to rise up and the injector starts to inject fuel. Pressure of return spring forces the needle valve to close again when injection pulse stops.

Removal & Installation

(See page 08-22)

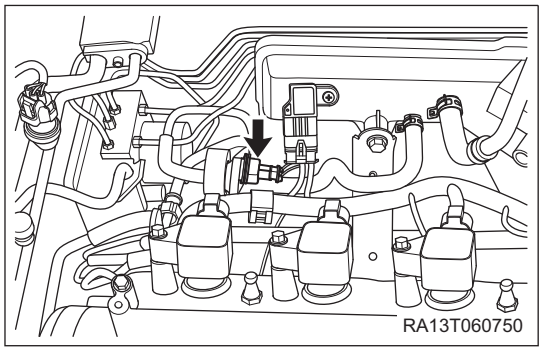
Canister Solenoid Valve

Description

Electric throttle assembly is located on the intake manifold assembly.

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 09-10)

Engine Control Module (ECM)

Description

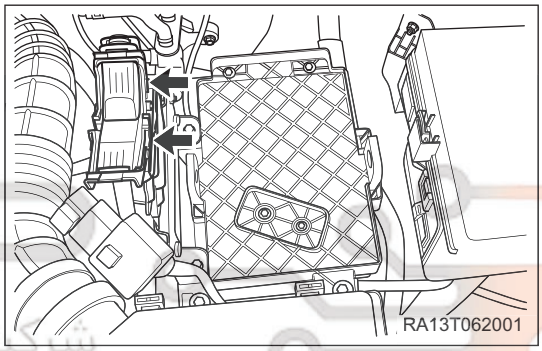
Engine Control Module (ECM), mounted on the battery bracket in engine compartment, can be removed only as a unit for replacement.

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. Disconnect the ECM connector (arrow).
   b. Remove 4 ECM fixing bolts, and take off 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.