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SQR484F ENGINE MANAGEMENT SYSTEM

دیجیتال خودرو
مرکز دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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GENERAL INFORMATION

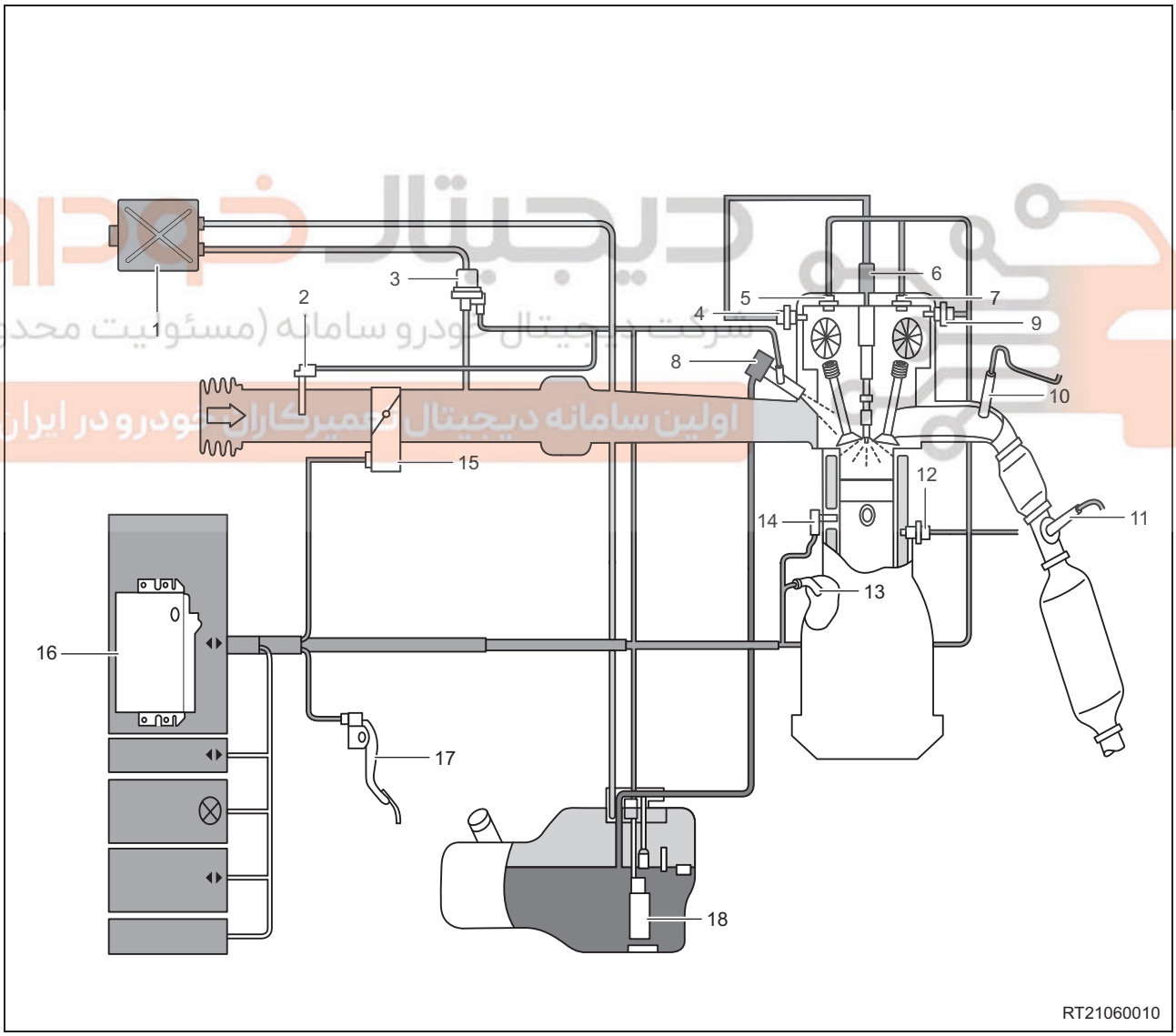
Description

The engine of T21 model adopts UAES engine management system. This system mainly consists engine Control Module (ECM), sensors and actuators, which controls intake air amount, injection volume and ignition timing, etc. when engine is operating.

In 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 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 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



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1 - Canister	2 - Intake Pressure/Temperature Sensor
3 - Canister Solenoid Valve	4 - Intake VVT Control Valve
5 - Camshaft Position Sensor (Intake)	6 - Ignition Coil
7 - Camshaft Position Sensor (Exhaust)	8 - Fuel Injector
9 - Exhaust VVT Control Valve	10 - Upstream Oxygen Sensor
11 - Downstream Oxygen Sensor	12 - Coolant Temperature Sensor
13 - Crankshaft Position Sensor	14 - Knock Sensor
15 - Electronic Throttle	16 - Engine Control Module (ECM)
17 - Electronic Accelerator Pedal	18 - Electric Fuel Pump

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System Function

- Calculate air flow

  ECM calculates air flow by the 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 crankshaft position and engine speed according to the signals from crankshaft position sensor and accurately controls 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. The closed-loop fuel control can accurately regulate the air-fuel ratio of engine, thus effectively controlling emissions. The open-loop fuel control is applied when engine is starting or warming up, or when a oxygen sensor is malfunctioning.

- Ignition control

  The ignition control system of engine adopts packet control.

- Knock control

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

- Emission control

  The 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 air-fuel ratio, thus realizing the optimum conversion efficiency of three-way catalytic converter.

- Three-way catalytic converter protection

  The engine management system has the function to protect three-way catalytic converter. The ECM estimates 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.

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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, the appropriate engine management system operation cannot be guaranteed.
- Only use unleaded gasoline during servicing.
- Please observe normative service and diagnostic flowchart to perform service work.
- Never disassemble the components of engine management system during servicing.
- When holding electronic elements (ECM, sensor, etc.) during servicing, take extra care not to drop them on the ground.
- Set up a consciousness of environmental protection and dispose of the waste effectively that is produced during servicing.

Precautions during servicing

1. Do not causally remove any component or its connector of engine management system from its installation position to prevent damage accidentally, or 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, electric elements may be damaged.
3. When simulating hot operating condition of malfunction and performing other service work that may cause the temperature to rise, never allow ECM temperature to exceed 80°C.
4. As the supplying pressure of fuel system is high (approximately 400 kPa), all the fuel pipes are high pressure resistant pipe. The fuel pressure in fuel lines is still high even when engine is not running. Therefore, be careful not to casually remove the fuel pipe during servicing; when it is necessary to service the fuel system, discharge the pressure in fuel system before removing fuel pipe. The way to discharge pressure is as follows:

   Remove fuel pump relay, start the engine and idle it until the engine stops running by itself. Then attempt to start the engine 2 - 3 times to ensure fuel pressure is discharged completely. The removal of fuel pipe and replacement of fuel filter should be performed in a well-ventilated area by professional service men.
5. Do not energize 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 the time 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 three-way catalytic converter.
8. As idling adjustment is performed by engine management system completely, manual adjustment is not required. The accelerator pedal stopper screw of throttle body has been adjusted at the factory, and the user is not allowed to change its original position.
9. Do not connect battery with its polarity reversed to prevent damage to electronic elements. This system adopts negative ground.
10. Never remove battery cable when engine is running.
11. The positive, negative battery cables and ECM must be removed before performing welding on vehicle.
12. Do not puncture wire outer coat to detect electric signals input and output by components.

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Specifications

Torque Specifications

Description	Torque (N·m)
Coolant Temperature Sensor	11 - 16
Knock Sensor Fixing Bolt	20 ± 5
Engine Speed Sensor Fixing Bolt	8 ± 2
Camshaft Position Sensor Fixing Bolt	8 ± 0.5
VVT Control Valve Fixing Bolt	8 ± 2
Engine Control Module Bracket Fixing Nut	7 ± 1

General Specifications

Items		Parameters
ECM	Working voltage	9 - 16 V
	Working temperature	-40 - 105°C
Oxygen sensor	Working voltage	9 - 16 V
	Working temperature	350°C
	Heater resistance (20°C)	7 - 11 Ω
Knock sensor	Working temperature	-40 - 130°C
	Rated resistance (20°C)	4.9 MΩ ± 20%
	Working voltage	5 V
Engine coolant temperature sensor	Working temperature	-30 - 130°C
	Rated resistance (20°C)	2.5 kΩ ± 5%
	Rated resistance (100°C)	300 - 400 Ω
VVT control valve	Working voltage	9 - 16 V
	Rated resistance (20°C)	8 ± 0.5 Ω
Ignition coil	Working voltage	9 - 16 V
	Rated resistance of primary winding (23 ± 3°C)	0.50 - 0.64 Ω
	Rated resistance of secondary winding (23 ± 3°C)	9.50 - 12.10 kΩ
Fuel injector	Working voltage	6 - 16 V
	Working temperature	-40 - 110°C
	Working injection pressure	300 - 550 kPa
	Rated resistance (20°C)	11 - 16 Ω
Canister solenoid valve	Working voltage	9 - 16 V
	Working temperature	-30 - 120°C
	Rated resistance (20°C)	26 ± 4 Ω

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Items		Parameters
Crankshaft position sensor	Working temperature	-40 - 120°C
	Rated resistance (23°C)	860 Ω ± 20%
	Installation clearance with signal gear	0.2 - 1.8 mm
Intake Pressure/ Temperature Sensor	Working voltage	5 V
	Working temperature	-40 - 130°C
	Rated resistance (20°C)	2.5 kΩ ± 5%
Electronic throttle	Throttle position sensor 1 (Accelerator pedal released)	0.78 V
	Throttle position sensor 1 (Accelerator pedal depressed)	4.29 V
	Throttle position sensor 2 (Accelerator pedal released)	4.22 V
	Throttle position sensor 2 (Accelerator pedal depressed)	0.71 V
Fuel pump	Working voltage	9 - 16 V
	Working temperature	-30 - 70°C
	System pressure	300 - 550 kPa
Spark plug	Spark plug clearance	0.8 - 0.9 mm
Camshaft position sensor	Working voltage	4.5 - 16 V
	Working temperature	-30 - 130°C
	Installation clearance with signal gear	0.2 - 1.8 mm
Electronic accelerator pedal	Electronic accelerator pedal sensor 1 (Accelerator pedal released)	0.72 - 0.74 V
	Electronic accelerator pedal sensor 2 (Accelerator pedal released)	0.36 - 0.37 V
	Electronic accelerator pedal sensor 1 (Accelerator pedal depressed)	3.95 V
	Electronic accelerator pedal sensor 2 (Accelerator pedal depressed)	1.97 V

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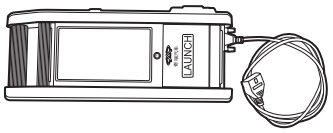
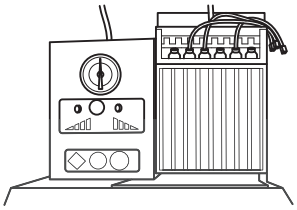
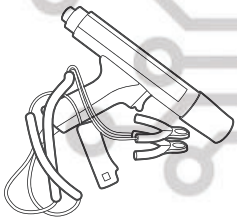
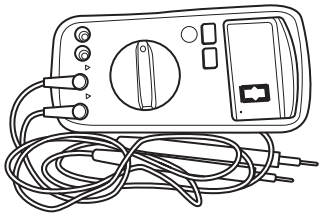
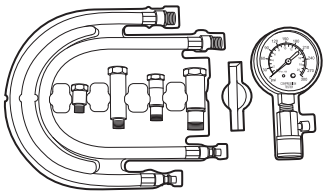
Tools

Special Tool

X-431 3G Diagnostic Tester	 RCH0000001

General Tools

Fuel Injector Cleaning Analyzer	 RCH0000062
Ignition Timing Light	 RCH0000016
Digital Multimeter	 RCH0000002
Cylinder Pressure Gauge	 RCH0000044

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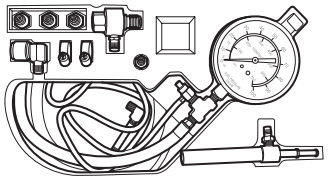
Fuel Pressure Gauge	 RCH0000048
Oscilloscope	 RCH0000061

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ECM Pin Definition

ECM connector 1

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

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ECM connector 2

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

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Circuit Diagram

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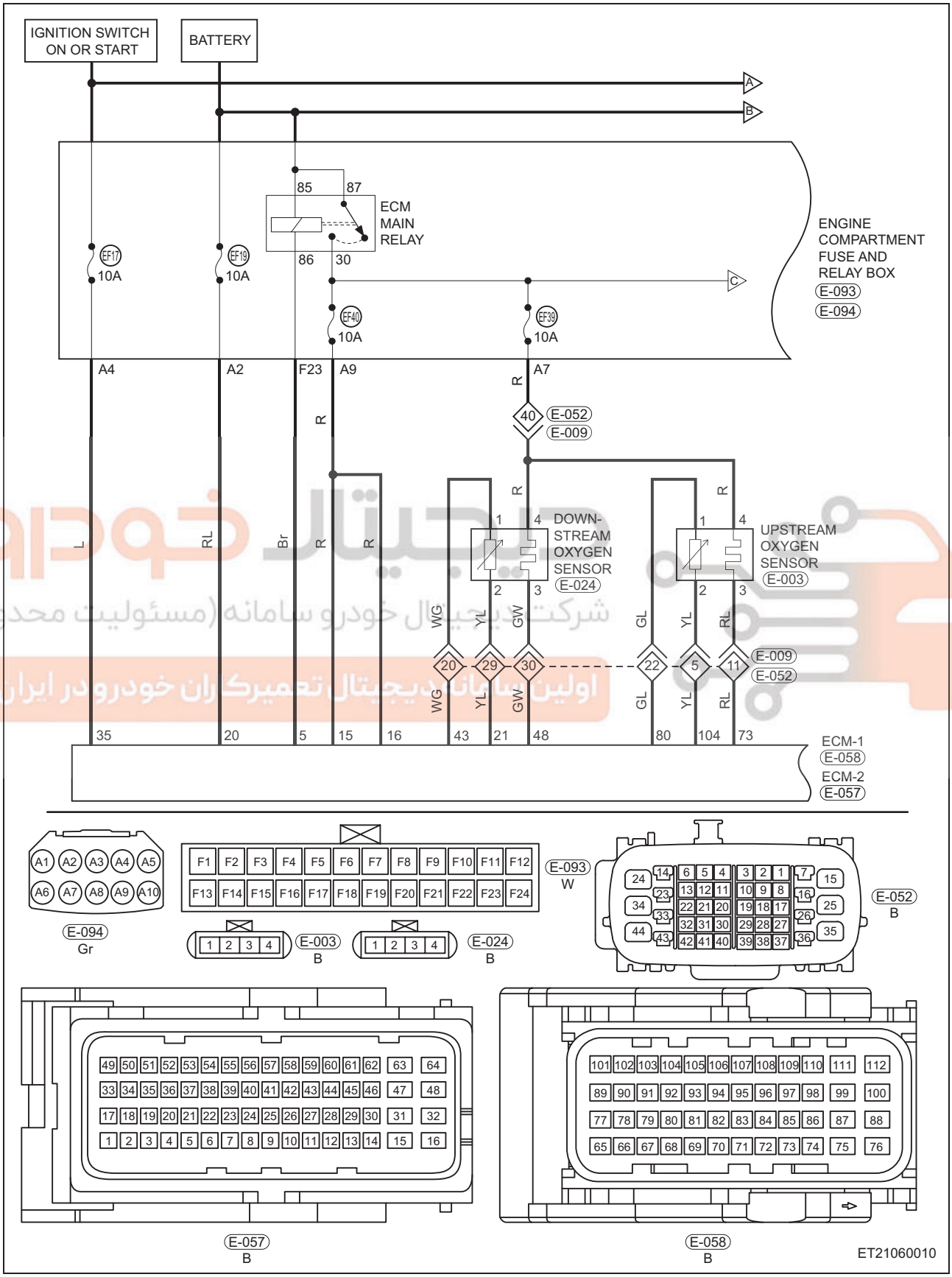

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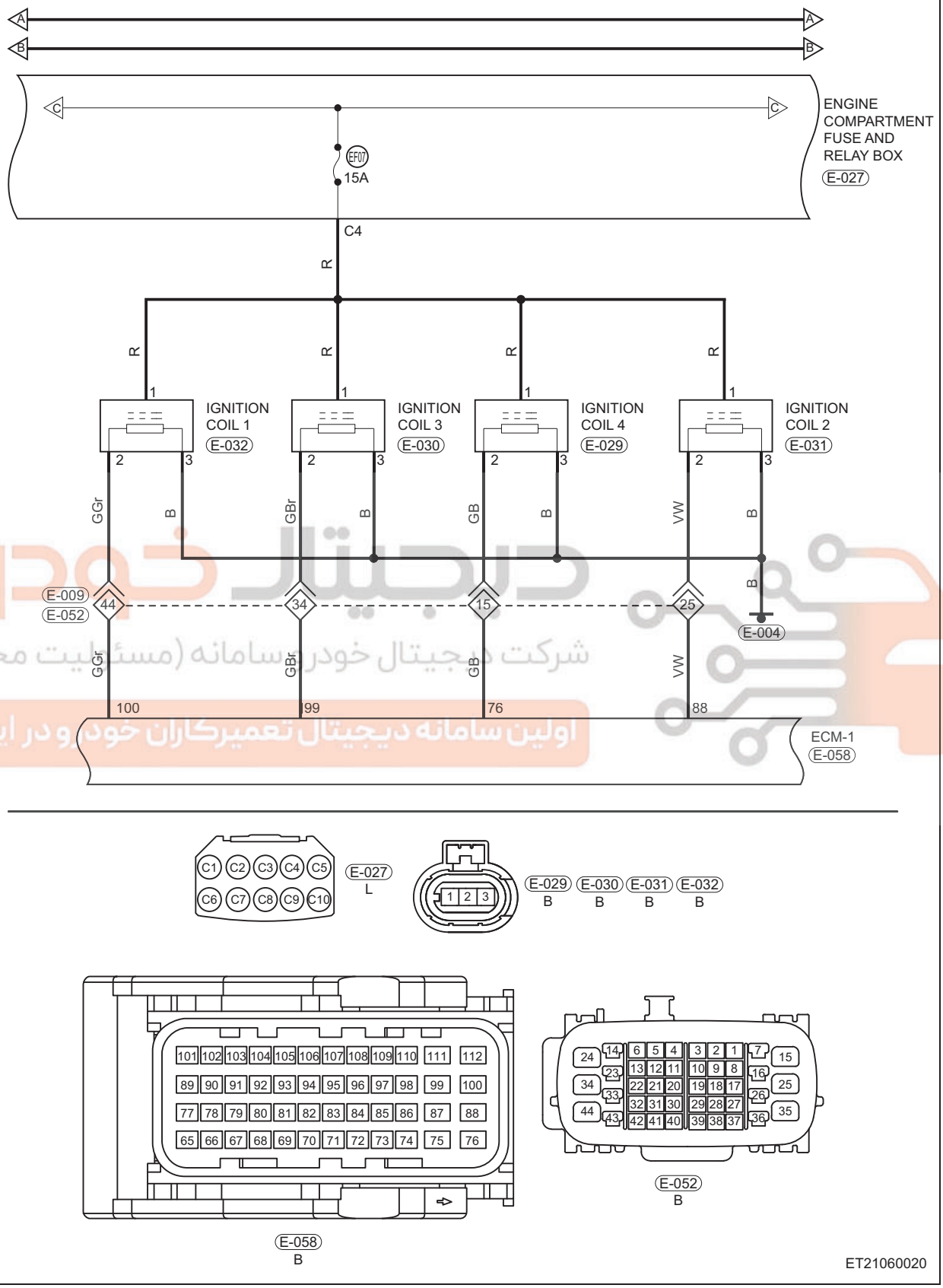

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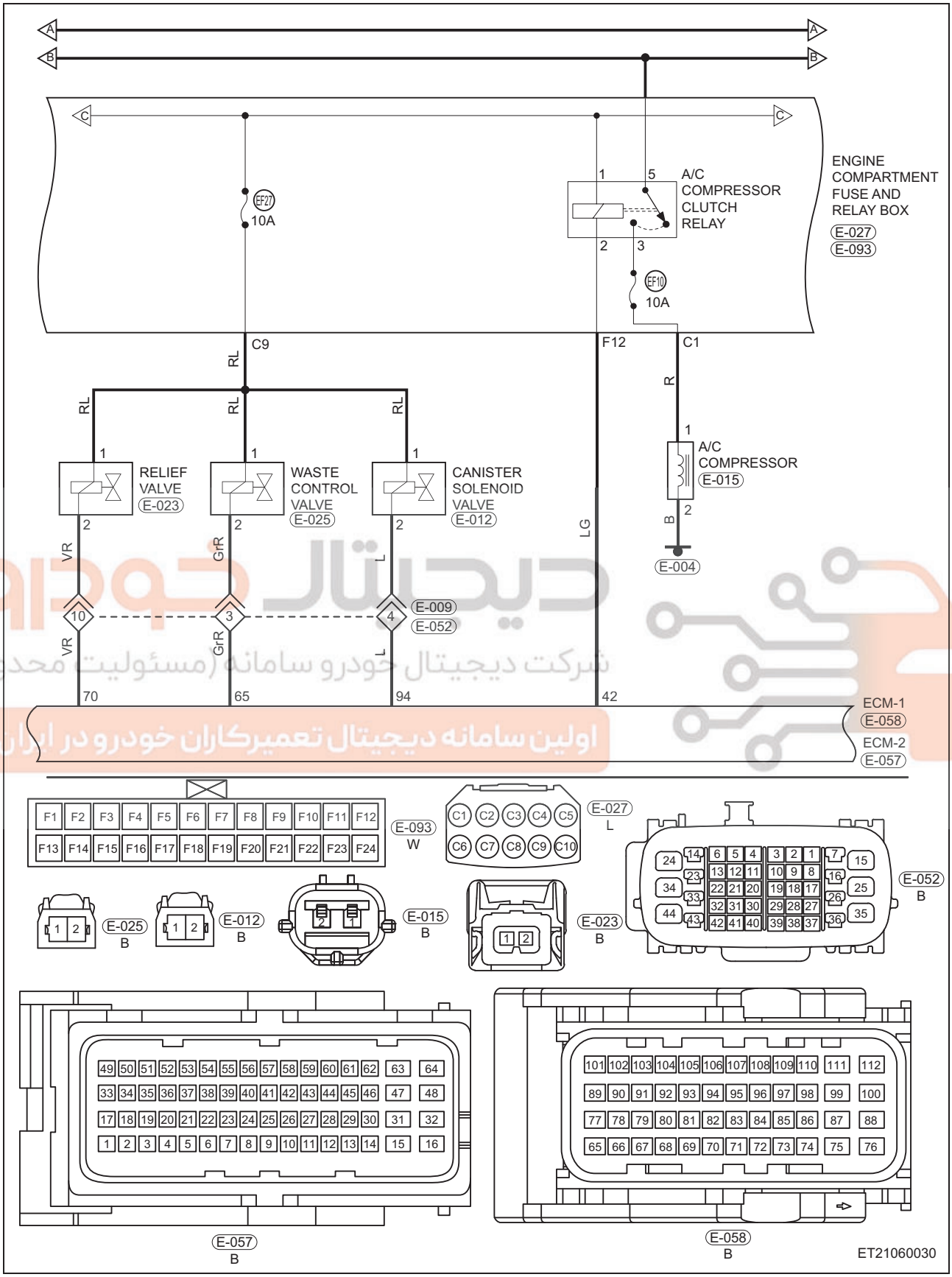

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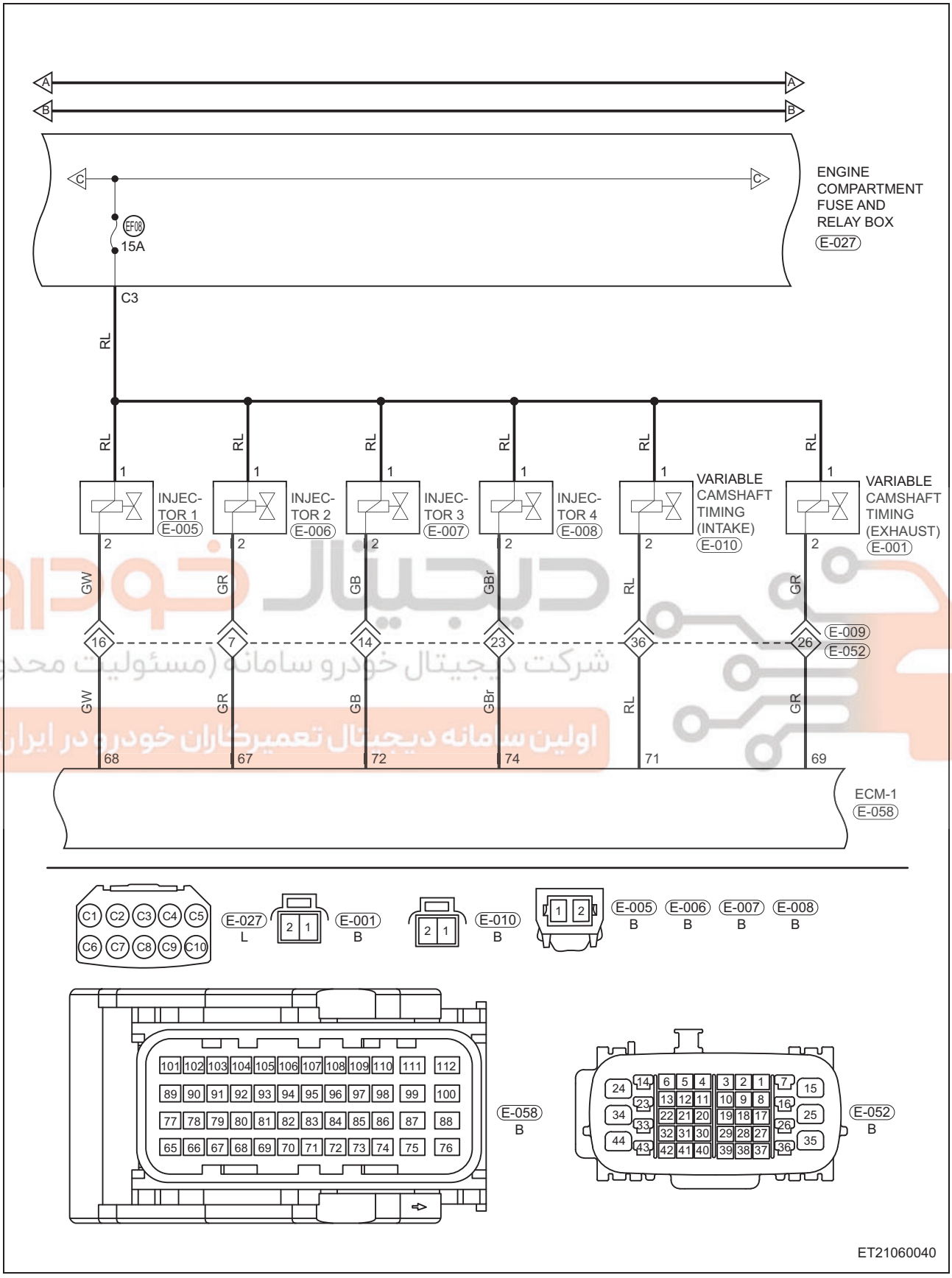

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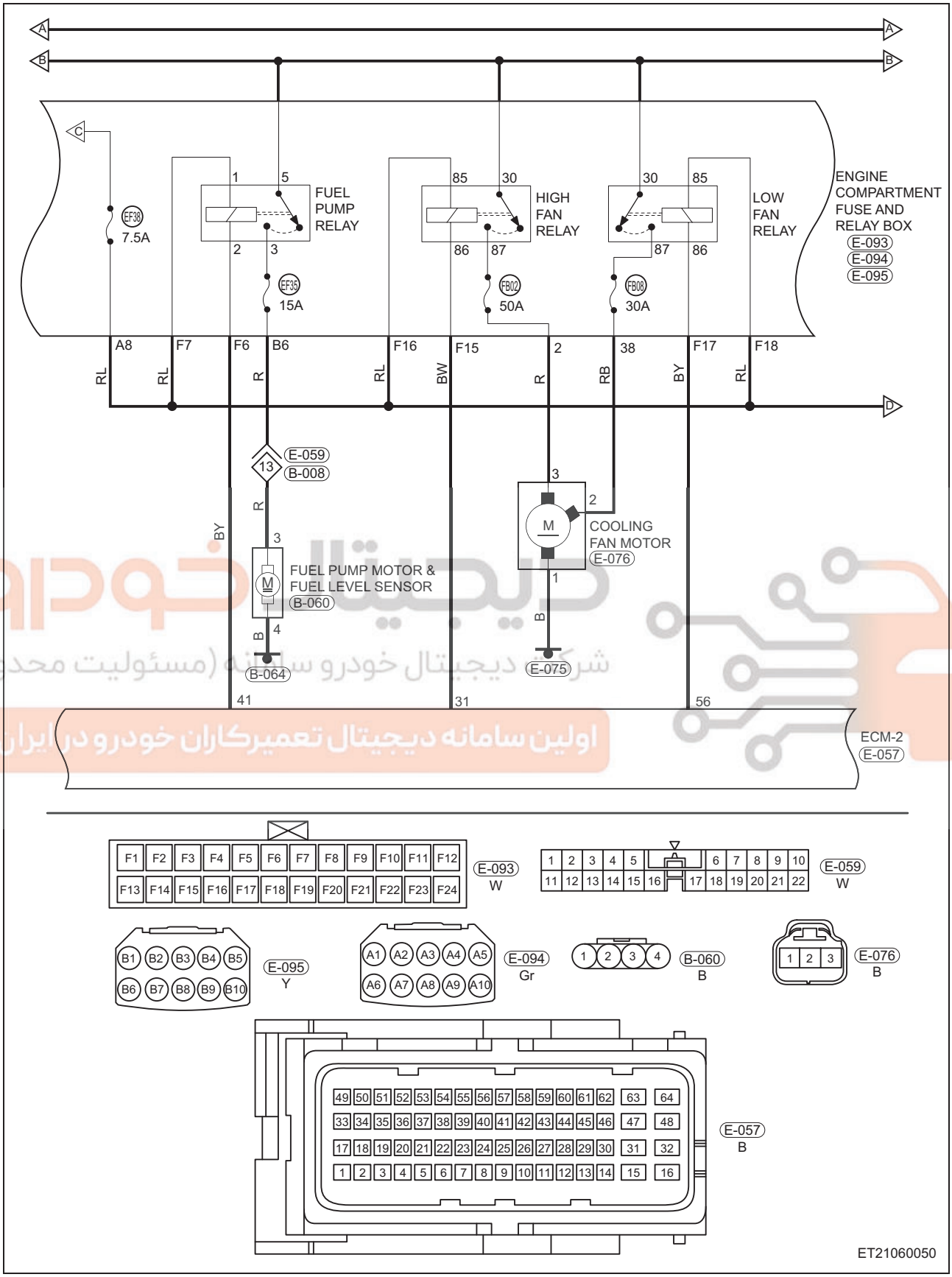

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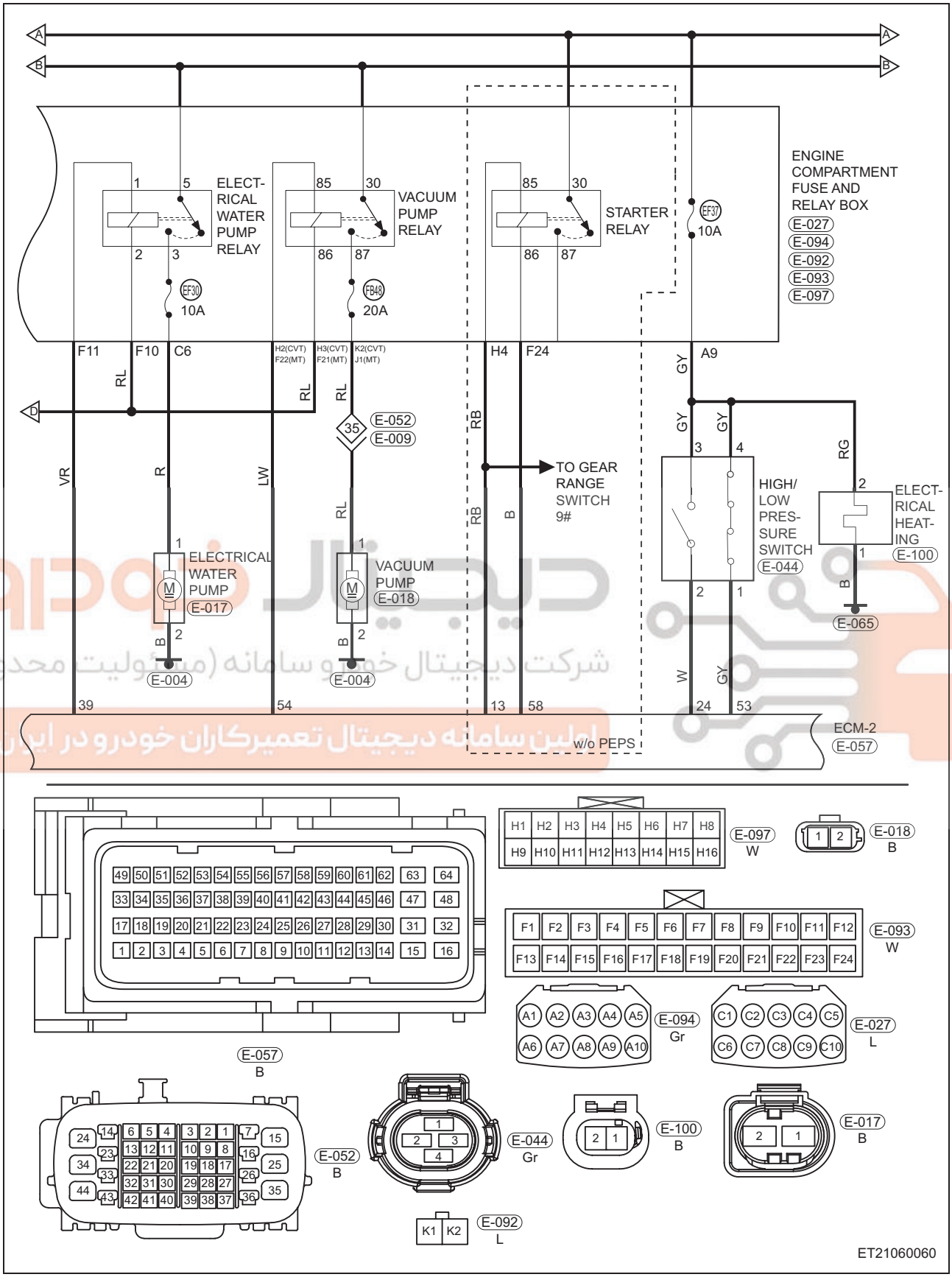

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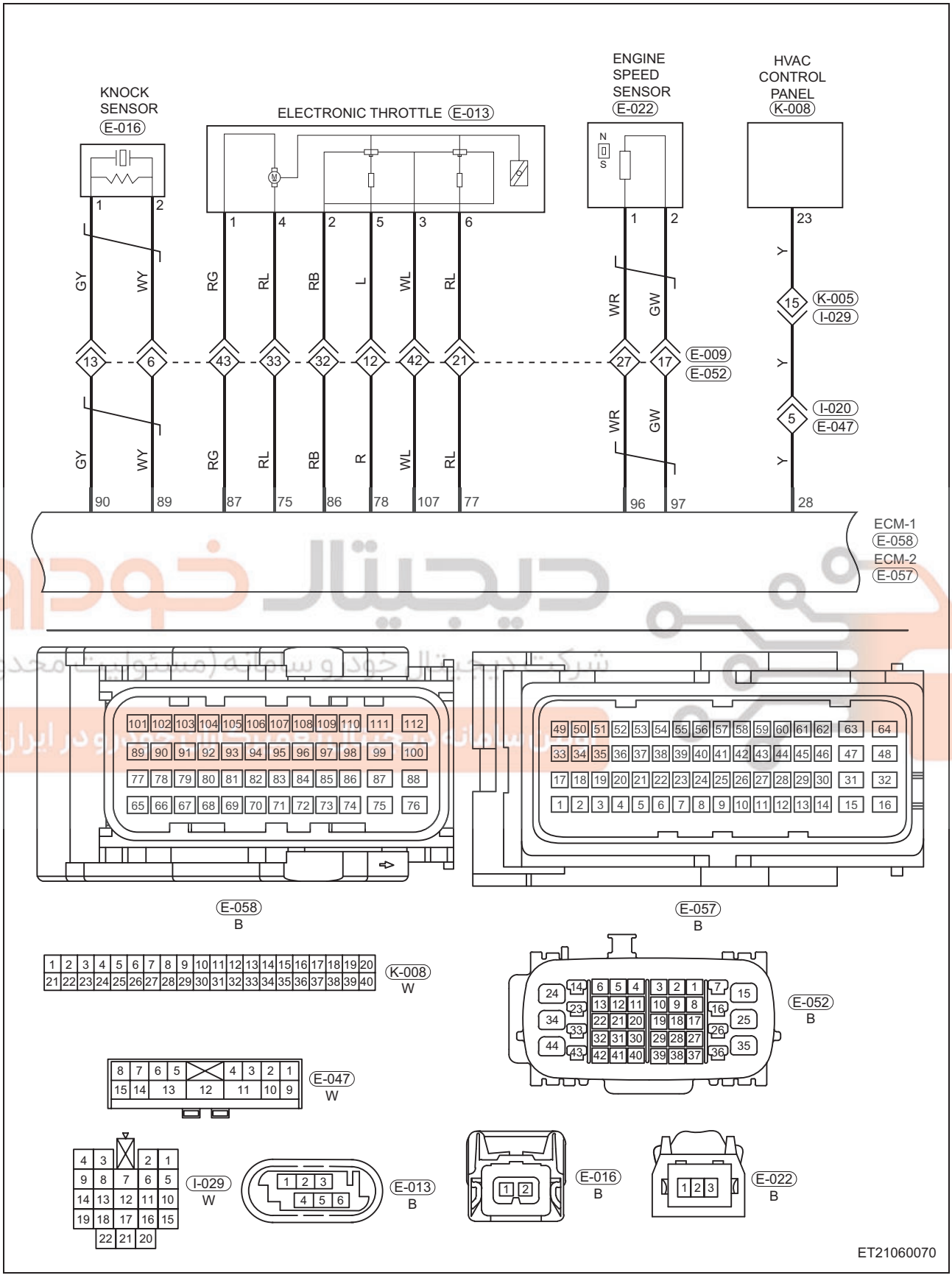

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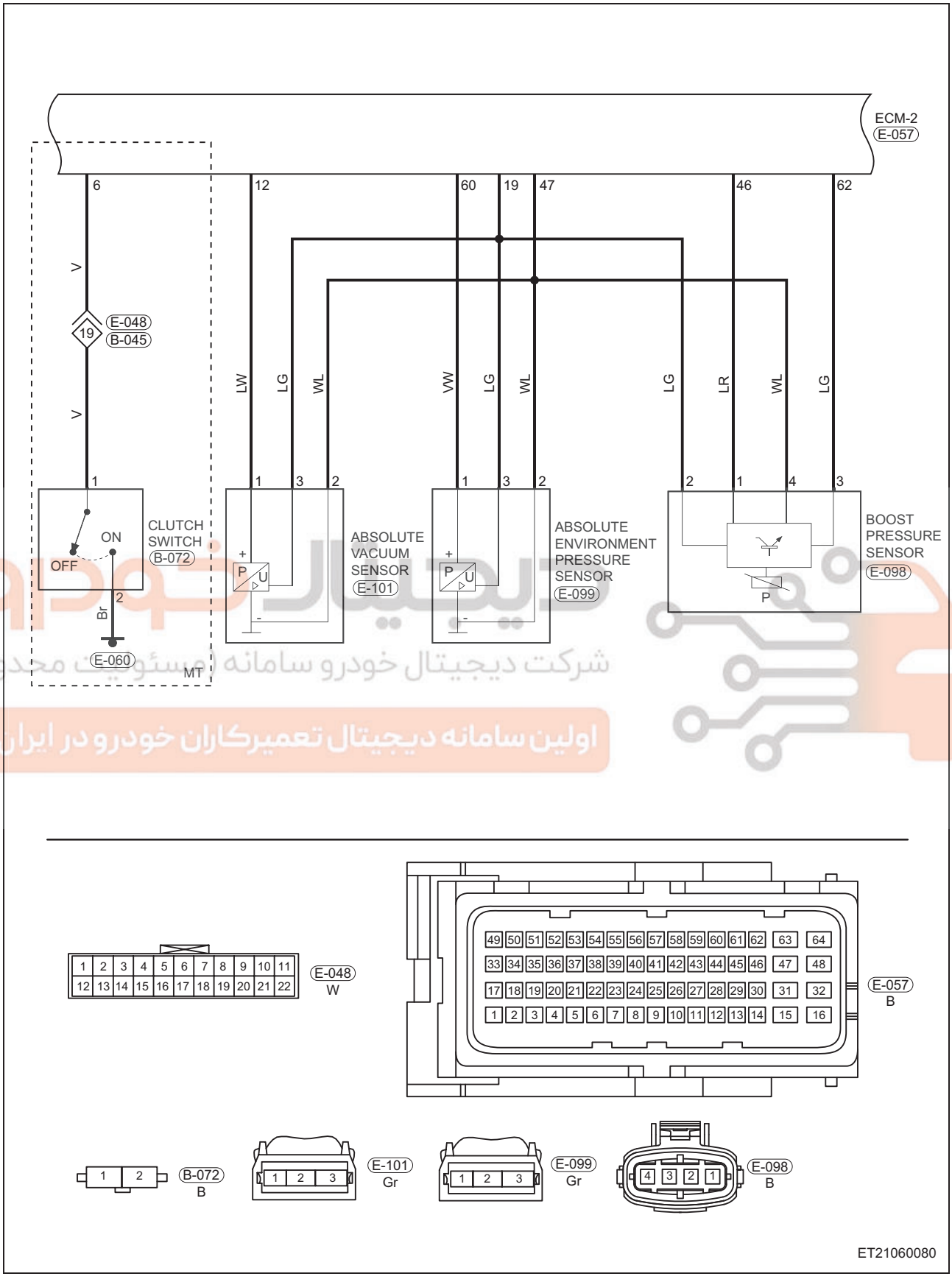

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DIAGNOSIS & TESTING

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 by the 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 the voltage of electronic system.
5. Refer to any Technical Bulletin that may apply to the malfunction.
6. Visually check the related wire harness.
7. Check and clean all Engine Control Module (ECM) grounds related to the current DTC.
8. If multiple trouble codes were set, use circuit diagrams and look for any common ground circuit or power supply circuit applied to the 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 the signal is interrupted in the related circuit.
- If possible, try to duplicate the conditions under which the DTC was set.
- Look for the data that has changed or the DTC to reset during the wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect sensors and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
- Use data recorder and/or oscilloscope to help diagnose intermittent malfunctions.
- Remove the Engine Control Module (ECM) from the malfunctioning vehicle and install it on a new car to perform test. If DTC cannot be cleared, ECM is malfunctioning. If DTC can be cleared, reinstall ECM to the original vehicle.

Ground Inspection

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

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

1. Remove the 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 a good condition.
4. Reinstall the ground bolt or nut securely.
5. Check if add-on accessories interfere with the ground circuit.
6. If several wire harnesses are crimped into one ground terminal, check if they are installed correctly. Make sure all wire harnesses are clean, securely fastened and well contacted without crimping any excessive insulation coat.

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Throttle Self-learning

Perform throttle self-learning in the following conditions:

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

Throttle self-learning conditions:

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

Throttle self-learning procedures:

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

Diagnostic Trouble Code (DTC) Chart

DTC Code	DTC Definition
P000A 00	Camshaft control Slow Response (inlet)
P000B 00	Camshaft control Slow Response (outlet)
P0010 13	Control Circuit of camshaft control valve (inlet)
P0013 13	Control Circuit of camshaft control valve (outlet)
P0012 00	Inlet camshaft not in locking position during start
P0015 00	Outlet camshaft not in locking position during start
P0016 29	Npl error for alignment between camshaft (inlet) and crankshaft
P0018 29	Npl error for alignment between camshaft (outlet) and crankshaft
P0030 13	O2 Sensor Heater Control Circuit Open (upstream of the catalyzer)
P0031 11	O2 Sensor Heater Control Circuit Low (upstream of the catalyzer)
P0032 12	O2 Sensor Heater Control Circuit High (upstream of the catalyzer)
P0036 13	O2 Sensor Heater Control Circuit Open (downstream of the catalyzer)
P0037 11	O2 Sensor Heater Control Circuit Low (downstream of the catalyzer)
P0038 12	O2 Sensor Heater Control Circuit High (downstream of the catalyzer)
P0053 1E	O2 Sensor Heater Resistance too large (upstream of the catalyzer)
P0054 1E	O2 Sensor Heater Resistance too large (downstream of the catalyzer)
P0105 28	Manifolt Absolut Pressure Circuit No Change
P0106 00	Manifold Abs. Pressure Performance Non-plausible
P0107 11	Manifold Abs. Pressure Low Input
P0108 12	Manifold Abs. Pressure High Input
P0111 00	Intake Air Temp. Circ. Performance Non-plausible
P0112 16	Intake Air Temp. Circ. Low Input

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DTC Code	DTC Definition
P0113 17	Intake Air Temp. Circ. High Input
P0116 00	Engine Coolant Temp. Circ. Performance Non-plausible
P0117 16	Engine Coolant Temp. Circ. Low Input
P0118 17	Engine Coolant Temp. Circ. High Input
P0121 29	Throttle Pos. Sensor 1 Circ. Performance Non-plausible
P0122 16	Throttle Pos. Sensor 1 Circ. Low Input
P0123 17	Throttle Pos. Sensor 1 Circ. High Input
P0130 00	O2 Sensor Circ. Malfunction (upstream of the catalyzer)
P0131 16	O2 Sensor Circ. Low Voltage (upstream of the catalyzer)
P0132 17	O2 Sensor Circ. High Voltage (upstream of the catalyzer)
P0133 00	O2 Sensor Circ. Slow Response (upstream of the catalyzer)
P0134 00	O2 Sensor Circ. No Activity Detected (upstream of the catalyzer)
P0136 00	O2 Sensor Circ. Malfunction (downstream of the catalyzer)
P0137 16	O2 Sensor Circ. Low Voltage (downstream of the catalyzer)
P0138 17	O2 Sensor Circ. High Voltage (downstream of the catalyzer)
P0140 00	O2 Sensor Circ. No Activity Detected (downstream of the catalyzer)
P0201 13	Cylinder 1 - Injector Circuit error
P0271 12	Cylinder 4 - Injector Circuit High
P0300 21	Random/Multiple Cylinder Misfire Detected (over emission limit)
P0301 21	Cylinder 1 Misfire Detected (over emission limit)
P0302 21	Cylinder 2 Misfire Detected (over emission limit)
P0303 21	Cylinder 3 Misfire Detected (over emission limit)
P0304 21	Cylinder 4 Misfire Detected (over emission limit)
P0322 00	EPM - Crankshaft signal fault
P0327 00	Knock Sensor 1 Circuit Low
P0328 00	Knock Sensor 1 Circuit High
P0341 00	EPM - Camshaft signal fault
P0346 00	EPM - Camshaft 2 signal fault
P0420 00	Catalyst conversion insufficient
P0444 13	Evaporativ Emiss. System Purge Control Valve Circuit Open
P0458 16	Evaporative Emission System Purge Control Valve Circuit Low
P0459 17	Evaporative Emission System Purge Control Valve Circuit High
P0480 13	Cooling Fan 1 Control Circuit error
P0481 13	Cooling Fan 2 Control Circuit error
P0560 00	Non-plausible error of battery voltage
P0562 16	System Voltage Low
P0563 17	System Voltage High

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DTC Code	DTC Definition
P0604 43	Internal contr. module RAM error
P0605 43	Internal contr. module ROM error
P0606 00	Safety monitoring fuel cutoff error
P0627 13	Fuel Pump Control Circuit Open
P0628 11	Fuel Pump Control Circuit Low
P0629 12	Fuel Pump Control Circuit High
P0645 13	AC clutch relais circuit open
P0646 11	A/C Clutch Relay Control Circuit Low
P0647 12	A/C Clutch Relay Control Circuit High
P0688 91	Power Relay Sense Circuit Non-plausible error
P0688 92	Power Relay Sense Circuit Signal error
P0691 11	Fan 1 Control Circuit Low
P2195 00	O2 Sensor Signal Stuck Lean (upstream of the catalyzer)
P2196 00	O2 Sensor Signal Stuck Rich (upstream of the catalyzer)
P2270 00	O2 Sensor Signal Stuck Lean (downstream of the catalyzer)
P2271 00	O2 Sensor Signal Stuck Rich (downstream of the catalyzer)
U0101 87	Lost Communication with TCM
U0129 87	Lost Communication With Brake System Control Module
U0140 87	Lost Communication with Body Control Module (BCM)
U0293 87	Lost Communication with HCU
P1106 00	Throttle position deviation error
P1111 00	Return spring check max error
P1619 00	ECM not programed (virgin state)
U0140 00	Lost Communication With Body Control Module (Immo)

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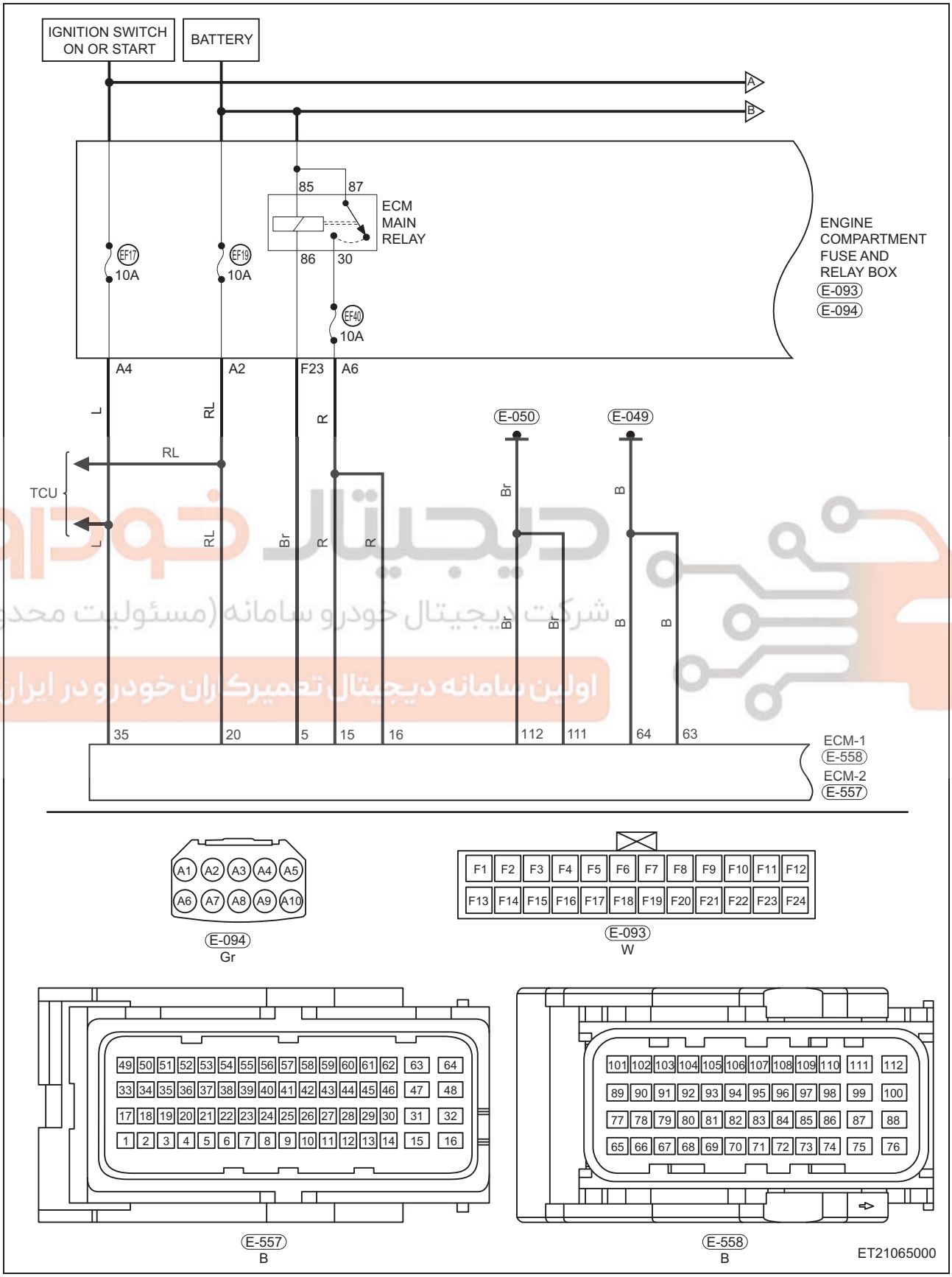
ECM Power Supply Circuit & Ground Circuit Testing

Power Supply Circuit (Page 1 of 1)



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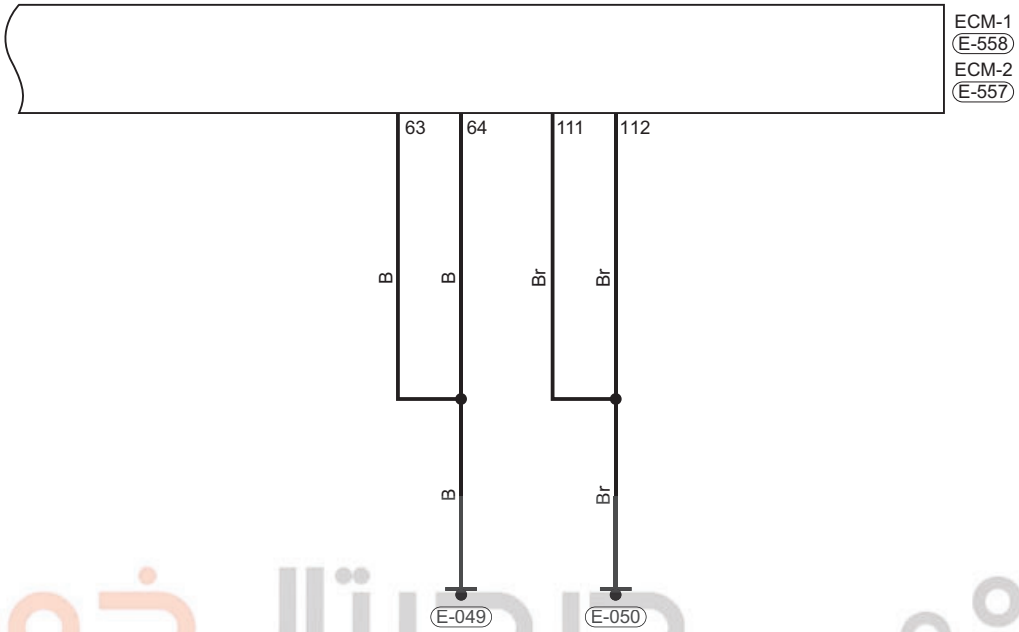
Ground Circuit (Page 1 of 1)



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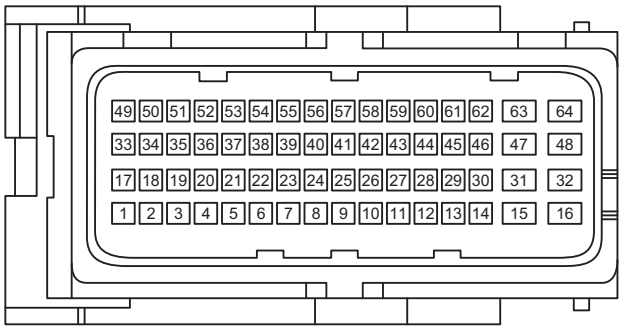
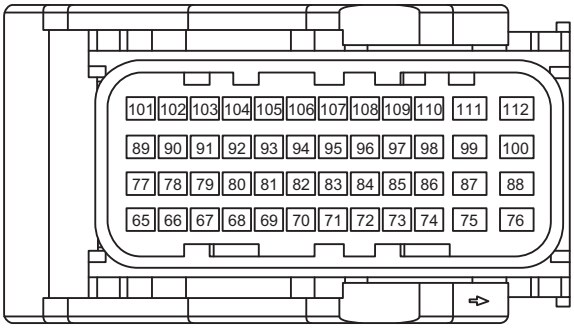


E-557
B



E-558
B

ET21065001

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Confirmation Procedure

Before performing the following procedures, confirm that battery voltage is higher than 12 V.

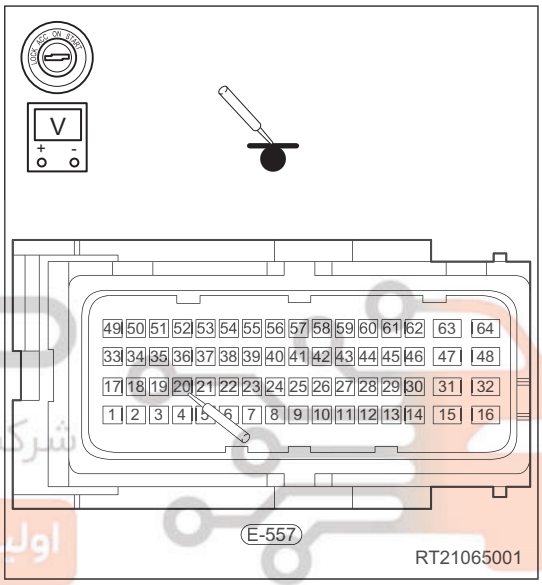
- Turn ignition switch off.
- Connect X-431 3G diagnostic tester (the latest version) to Data Link Connector (DLC).
- Turn ignition switch ON.
- Using diagnostic tester, select Read Datastream.
- If the datastream is not detected, the malfunction indicated by the datastream is current. Go to the diagnosis procedure - Step 1.
- If the datastream is detected, the malfunction indicated by the datastream is intermittent (See page 06-20).

Diagnosis Procedure

1	Check ECM power supply circuit

a. Turn ignition switch off.
b. Disconnect ECM connector E-557.
c. Check voltage between terminals of ECM connector E-557 and body ground.

Multimeter Connection	Condition	Specified Condition
E-557 (20) - Body Ground	Always	11 to 14 V



OK → Go to step 4

NG

2	Check ECM fuse

a. Unplug ECM fuse EF19 (10A) from engine compartment fuse and relay box.
b. Check resistance of fuse.

Standard resistance: less than 1 Ω

NG → Replace ECM fuse

OK

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

a. Disconnect engine compartment fuse and relay box connector E-094.

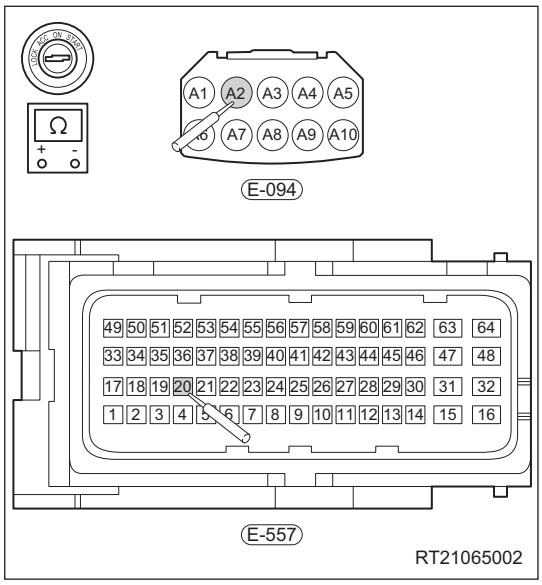
b. Check wire harness between connector terminals on wire harness side.

Check for Open

Multimeter Connection	Specified Condition
E-557 (20) - E-094 (A2)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (20) or E-094 (A2) - Body ground	No continuity
E-557 (20) or E-094 (A2) - Battery positive	No continuity



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

OK →

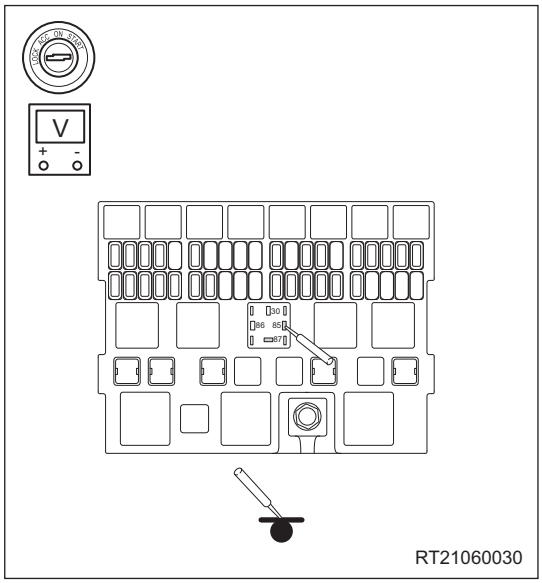
Repair or replace engine compartment fuse and relay box or wire harness (engine compartment fuse and relay box - battery)

4	Check main relay circuit voltage

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

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

Multimeter Connection	Condition	Specified Condition
Main relay terminals 85 and 87 (engine compartment fuse and relay box side) - Body ground	Always	11 to 14 V



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

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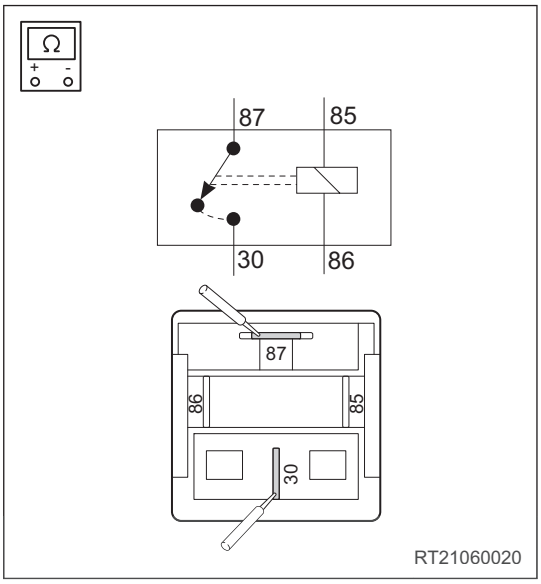
OK

5	Check main relay and fuse EF40

a. Check if fuse EF40 is normal.

b. Check for continuity between terminals of main relay.

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



NG → Replace 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.

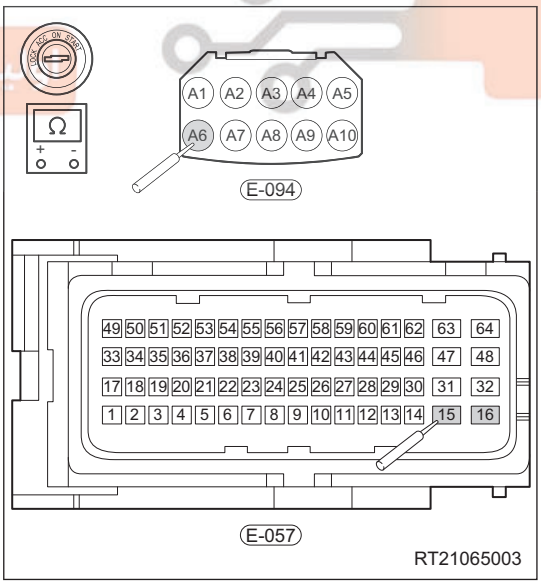
b. Disconnect engine compartment fuse and relay box connector E-093.

Check for Open

Multimeter Connection	Specified Condition
E-557 (15, 16) - E-094 (A6)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (15, 16) or E-094 (A6) - Body ground	No continuity
E-557 (15, 16) or E-094 (A6) - Battery positive	No continuity



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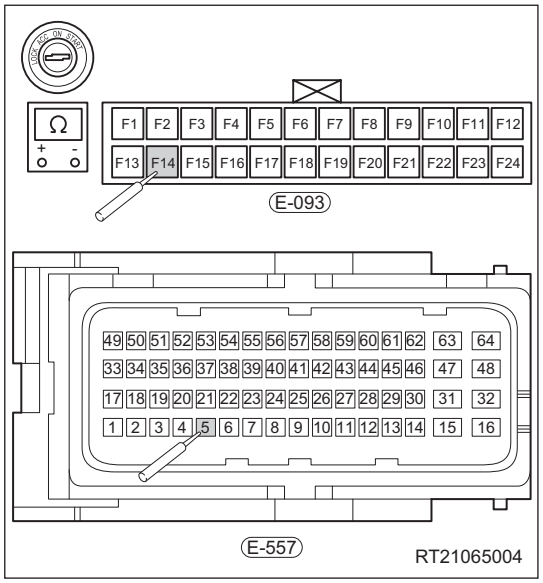
Check for Open

Multimeter Connection	Specified Condition
E-557 (5) - E-093 (F14)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (5) or E-093 (F14) - Body ground	No continuity
E-557 (5) or E-093 (F14) - Battery positive	No continuity

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



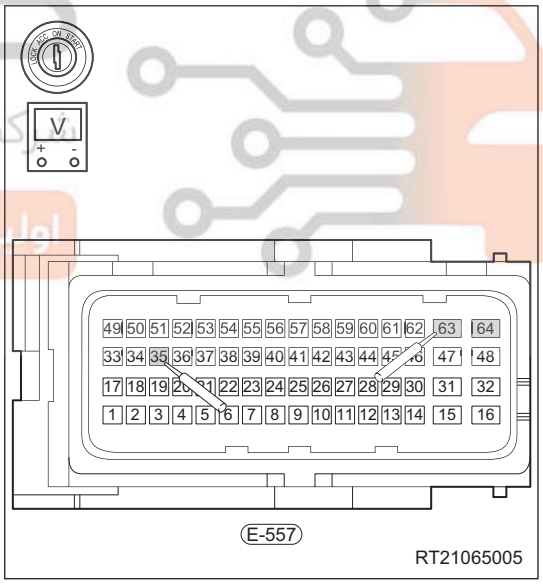
OK

7	Check ECM power supply circuit (ignition switch voltage)

a. Connect fuse and relay box connector E-094.
b. Turn ignition switch to ON.
c. Check voltage between terminals of ECM connector.

Multimeter Connection	Condition	Specified Condition
E-557 (35) - E-557 (63, 64)	Ignition switch ON	11 to 14 V

OK → **Replace ECM**



NG

8	Check ECM fuse

a. Unplug ECM fuse EF17 (10A) from engine compartment fuse and relay box.
b. Check resistance of fuse.
Standard resistance: less than 1 Ω

NG → **Replace ECM fuse**

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OK

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

a. Disconnect engine compartment fuse and relay box connector E-094.

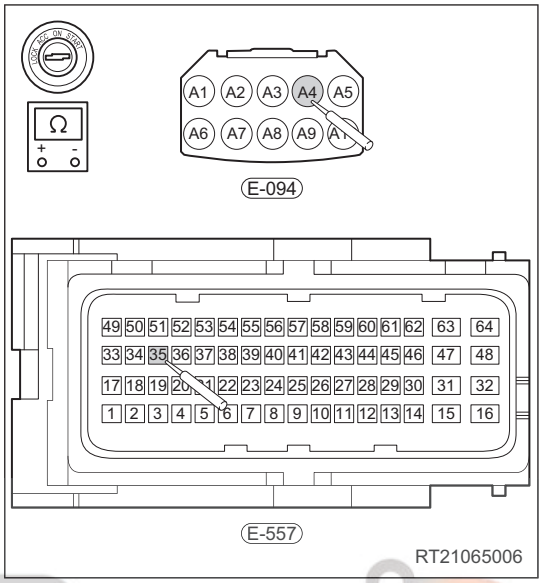
b. Check wire harness between connector terminals on wire harness side.

Check for Open

Multimeter Connection	Specified Condition
E-557 (35) - E-094 (A4)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (35) or E-094 (A4) - Body ground	No continuity
E-557 (35) or E-094 (A4) - Battery positive	No continuity



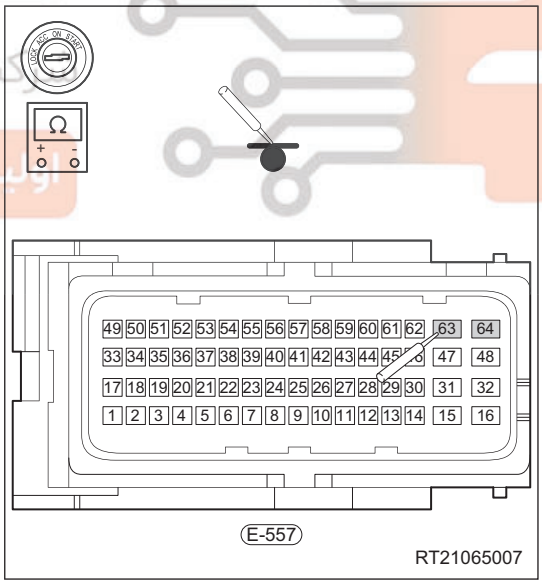
c. Disconnect ECM ground point E-049 and E-050.

d. Check ECM ground point (See page 06-20).

e. Check ECM ground wire harness.

Check for Open

Multimeter Connection	Specified Condition
E-557 (63, 64) - E-049	Continuity
E-558 (47, 48) - E-050	Continuity



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

OK

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10	Check ignition switch assembly (See page 24-14)

NG → Replace ignition switch assembly

OK →

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

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DTC	P0030 13	O2 Sensor Heater Control Circuit Open (upstream of the catalyzer)
DTC	P0031 11	O2 Sensor Heater Control Circuit Low (upstream of the catalyzer)
DTC	P0032 12	O2 Sensor Heater Control Circuit High (upstream of the catalyzer)
DTC	P0053 1E	O2 Sensor Heater Resistance too large (upstream of the catalyzer)

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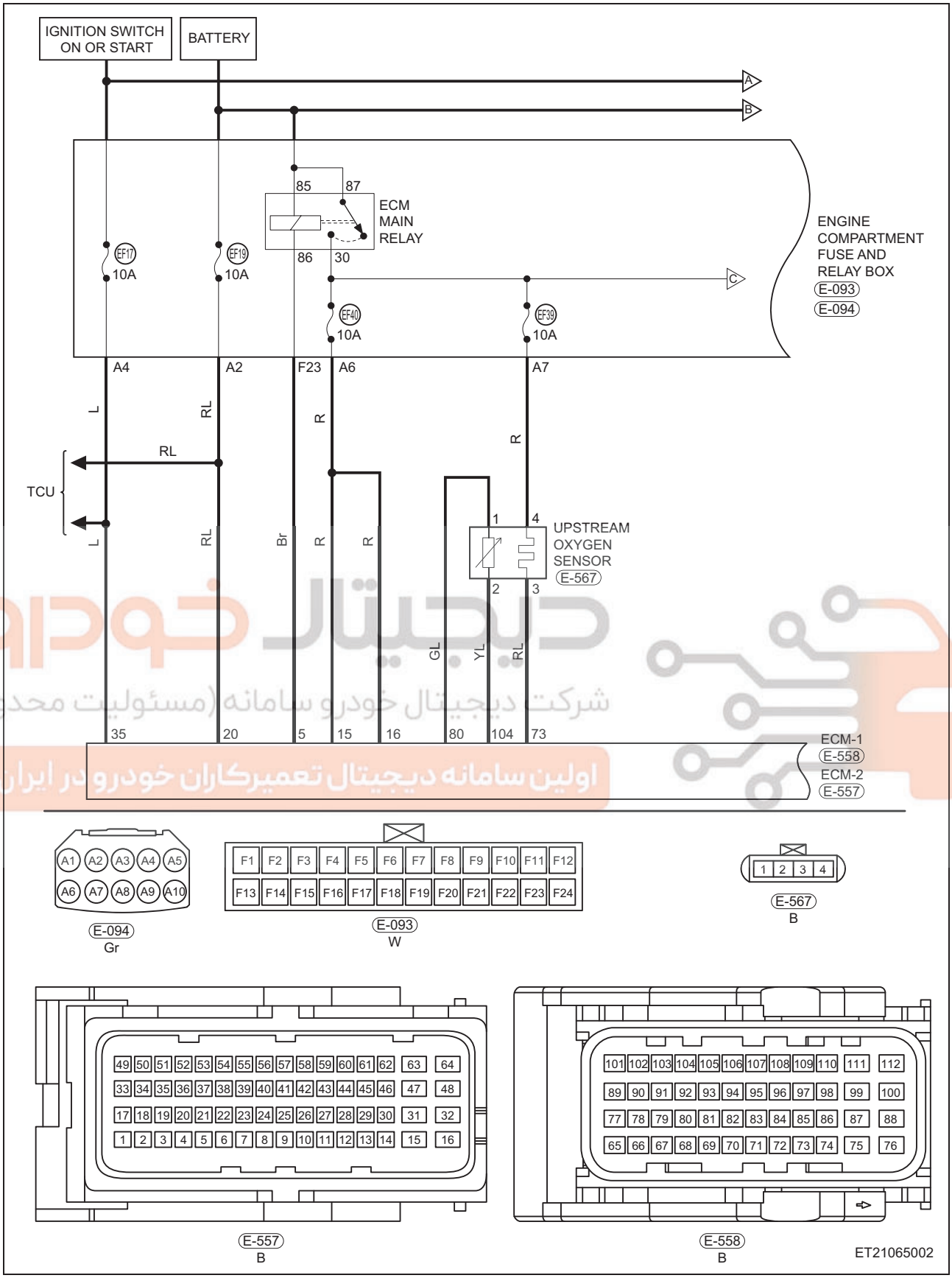

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0030 13	O2 Sensor Heater Control Circuit Open (upstream of the catalyzer)	Ignition switch ON Engine running	• Upstream oxygen sensor • Wire harness or connector • Fuse • ECM
P0031 11	O2 Sensor Heater Control Circuit Low (upstream of the catalyzer)		
P0032 12	O2 Sensor Heater Control Circuit High (upstream of the catalyzer)		
P0053 1E	O2 Sensor Heater Resistance too large (upstream of the catalyzer)		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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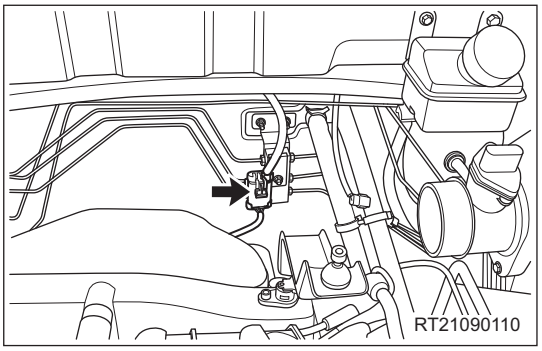
2	Check upstream oxygen sensor connector

a. Disconnect upstream oxygen sensor connector E-567.
b. Check upstream oxygen sensor connector.



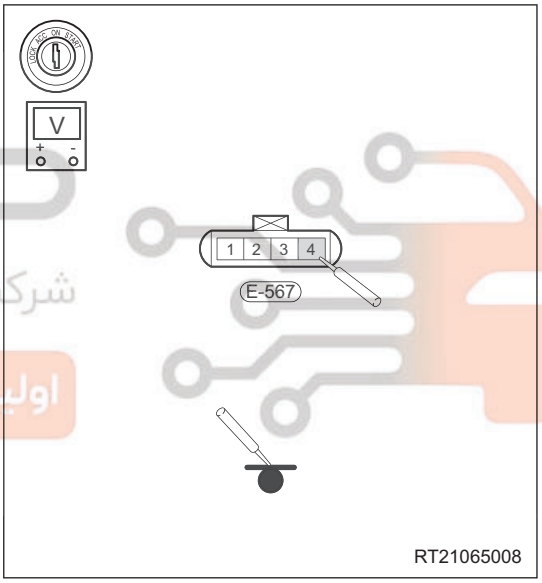
NG → Repair or replace connector

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-567 and body ground.

Multimeter Connection	Condition	Specified Condition
E-567 (4) - Body ground	Ignition switch ON	11 to 14 V



OK → Go to step 5

NG

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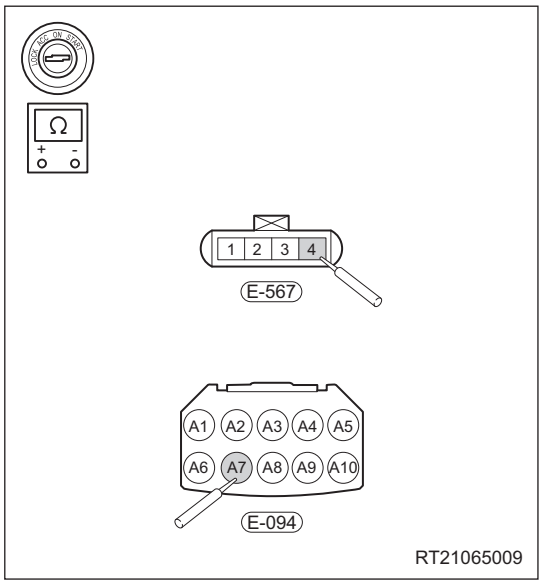
4	Check upstream oxygen sensor power supply circuit

a. Turn ignition switch to LOCK.
b. Check fuse EF39 and main relay.
c. Disconnect engine compartment fuse and relay box connector E-094.
d. Check wire harness between upstream oxygen sensor connector terminals and engine compartment fuse and relay box connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-567 (4) - E-094 (A7)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-567 (4) or E-094 (A7) - Body ground	Always	No continuity
E-567 (4) or E-094 (A7) - Battery positive	Always	No continuity

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

OK →

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5	Check upstream oxygen sensor heater control circuit

a. Disconnect ECM connector E-558.

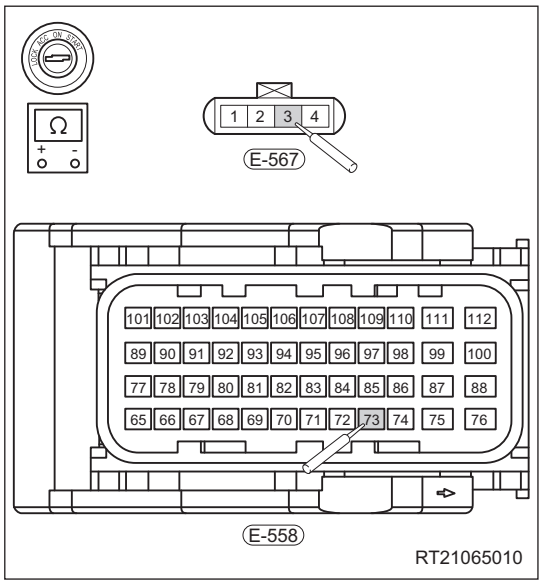
b. Check wire harness between upstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-567 (3) - E-558 (73)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-567 (3) or E-558 (73) - Body ground	Always	No continuity
E-567 (3) or E-558 (73) - Battery positive	Always	No continuity



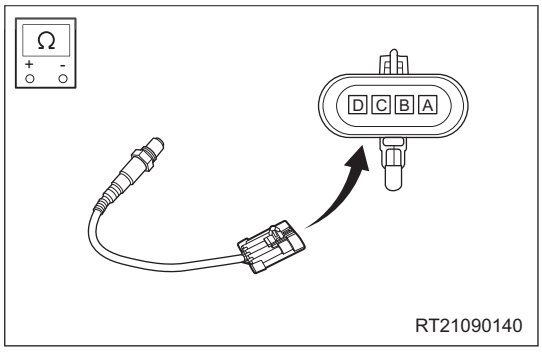
NG → **Repair or replace wire harness or connector (upstream oxygen sensor - ECM)**

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 B	Always	No continuity
Terminal A - Terminal C		
Terminal A - Terminal D		
Terminal B - Terminal C		
Terminal B - Terminal D		



NG → **Replace upstream oxygen sensor**

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OK

7	Check for DTCs

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

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

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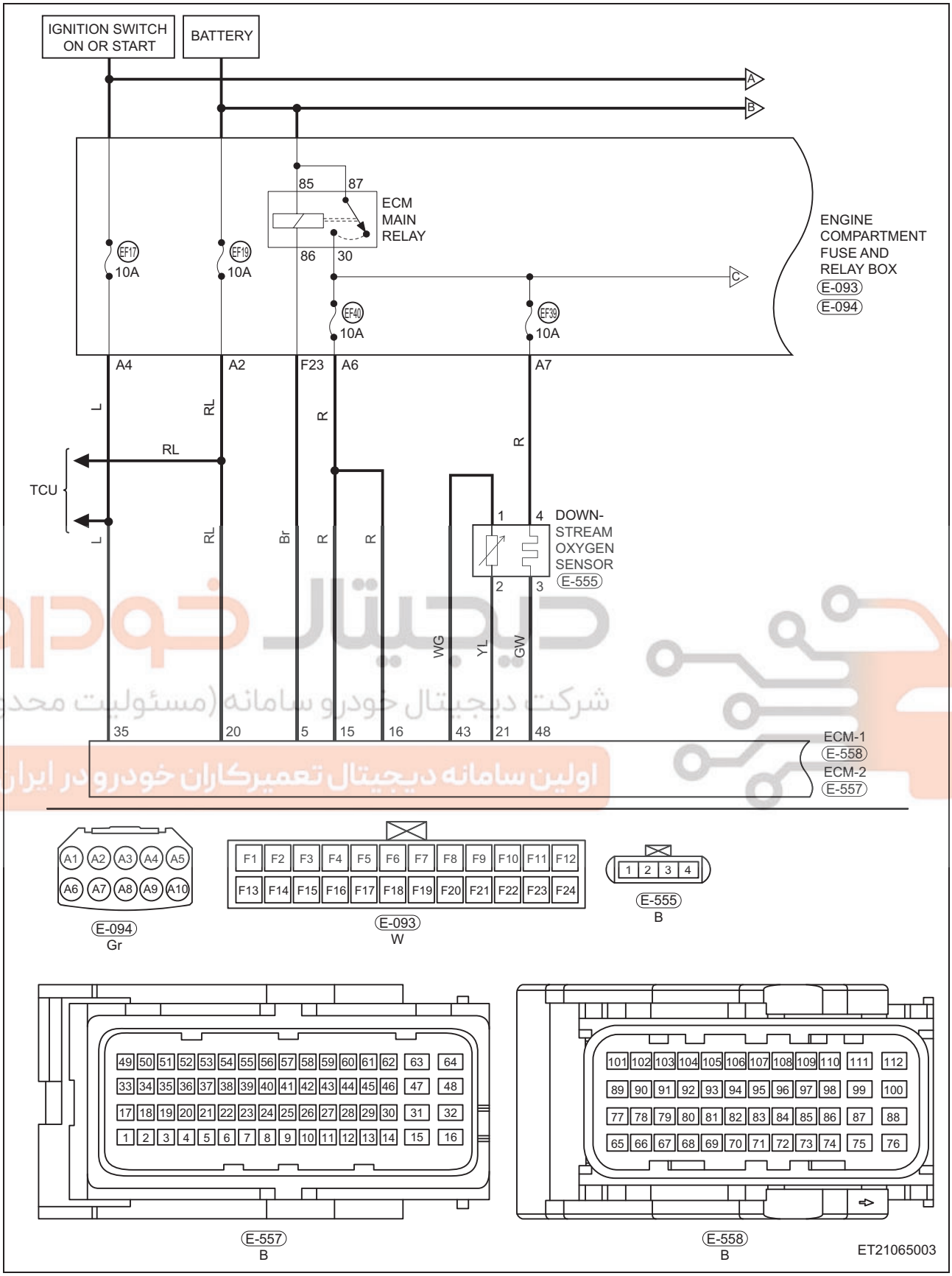

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0036 13	O2 Sensor Heater Control Circuit Open (downstream of the catalyzer)	Ignition switch ON Engine running	• Downstream oxygen sensor • Wire harness or connector • Fuse • ECM
P0037 11	O2 Sensor Heater Control Circuit Low (downstream of the catalyzer)		
P0038 12	O2 Sensor Heater Control Circuit High (downstream of the catalyzer)		
P0054 1E	O2 Sensor Heater Resistance too large (downstream of the catalyzer)		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK →

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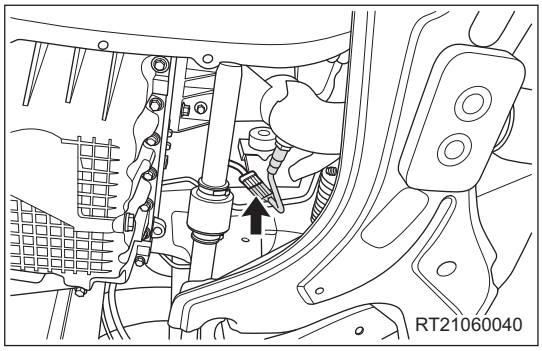
2	Check downstream oxygen sensor connector

a. Disconnect downstream oxygen sensor connector.

b. Check downstream oxygen sensor connector.

NG → **Repair or replace connector**



OK

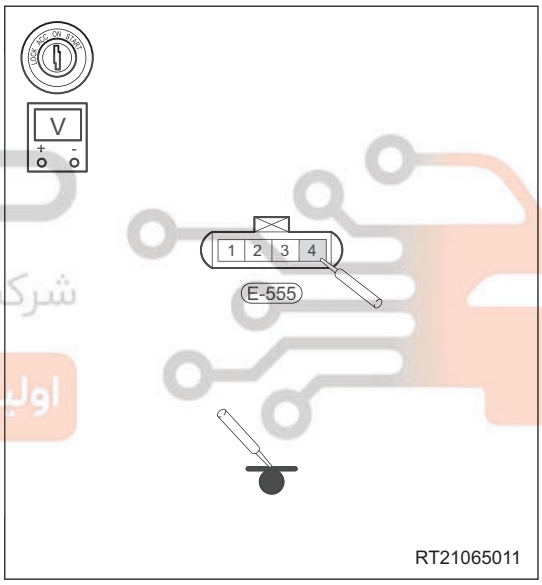
3	Check downstream oxygen sensor heater power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between terminal 4 of downstream oxygen sensor connector E-555 and body ground.

Multimeter Connection	Condition	Specified Condition
E-555 (4) - Body ground	Ignition switch ON	11 to 14 V

OK → **Go to step 5**



NG

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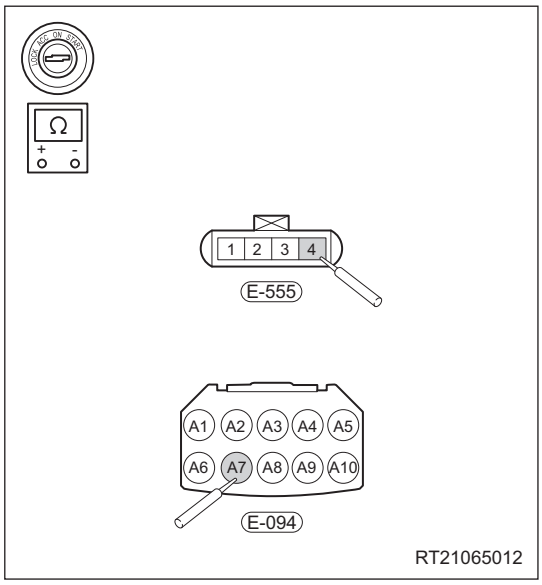
4	Check downstream oxygen sensor power supply circuit

a. Turn ignition switch to LOCK.
b. Check fuse EF39 and main relay.
c. Disconnect engine compartment fuse and relay box connector E-094.
d. Check wire harness between downstream oxygen sensor connector terminals and engine compartment fuse and relay box connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-555 (4) - E-094 (A7)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-555 (4) or E-076 (A7) - Body ground	Always	No continuity
E-555 (4) or E-094 (A7) - Battery positive	Always	No continuity

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

OK

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5	Check downstream oxygen sensor heater control circuit

a. Disconnect ECM connector E-557.

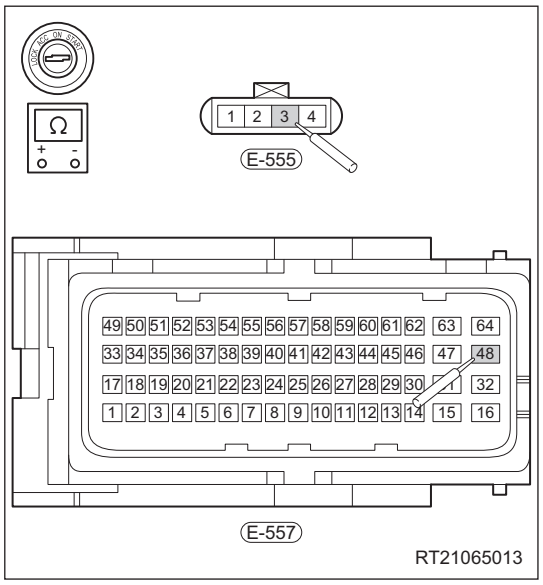
b. Check wire harness between downstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-555 (3) - E-557 (48)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-555 (3) or E-557 (48) - Body ground	Always	No continuity
E-555 (3) or E-557 (48) - Battery positive	Always	No continuity



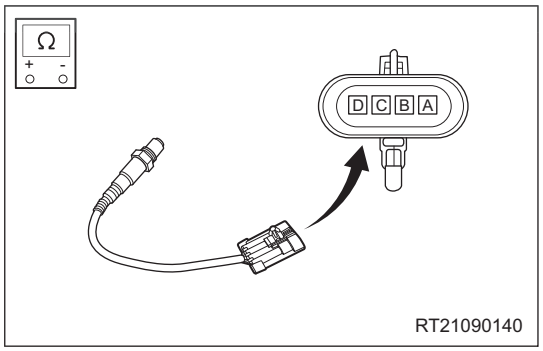
NG → **Repair or replace wire harness or connector (downstream oxygen sensor - ECM)**

OK →

6	Check downstream oxygen sensor heater

a. Measure resistance of downstream oxygen sensor.

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



NG → **Replace downstream oxygen sensor**

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OK

7	Check for DTCs

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

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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DTC	P0105 28	Manifolt Absolut Pressure Circuit No Change
DTC	P0106 00	Manifold Abs. Pressure Performance Non-plausible
DTC	P0107 11	Manifold Abs. Pressure Low Input
DTC	P0108 12	Manifold Abs. Pressure High Input

دیجیتال خودرو
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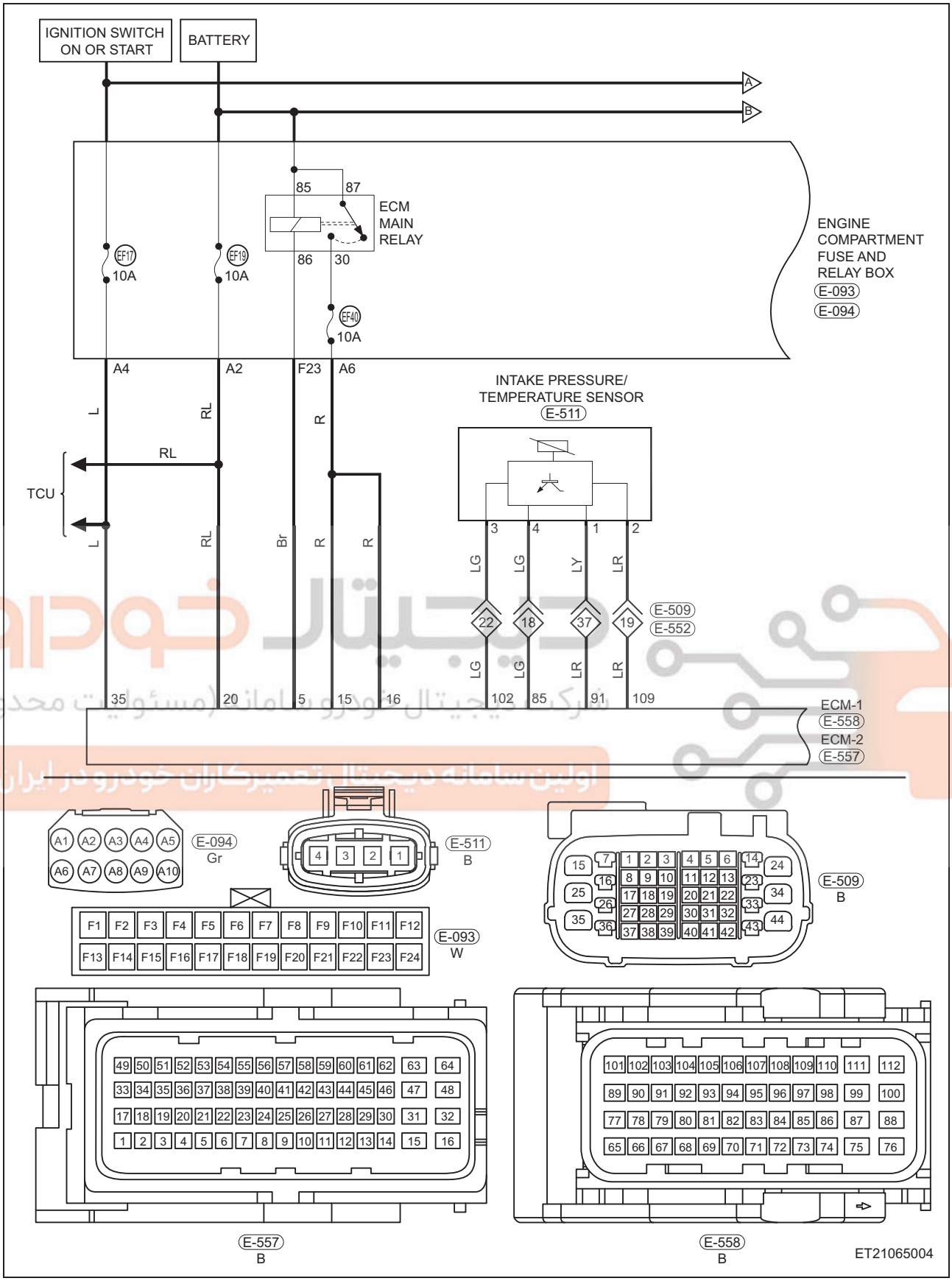

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0105 28	Manifolt Absolut Pressure Circuit No Change	Ignition switch ON Engine running	• Intake Pressure/Temperature Sensor • Wire harness or connector • ECM
P0106 00	Manifold Abs. Pressure Performance Non-plausible		
P0107 11	Manifold Abs. Pressure Low Input		
P0108 12	Manifold Abs. Pressure High Input		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیر خودرو در ایران

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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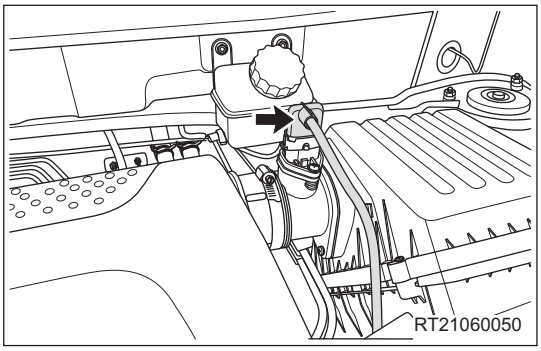
2	Check Intake Pressure/Temperature Sensor connector

a. Disconnect Intake Pressure/Temperature Sensor connector E-511.

b. Check Intake Pressure/Temperature Sensor connector.



NG → **Repair or replace connector**

OK

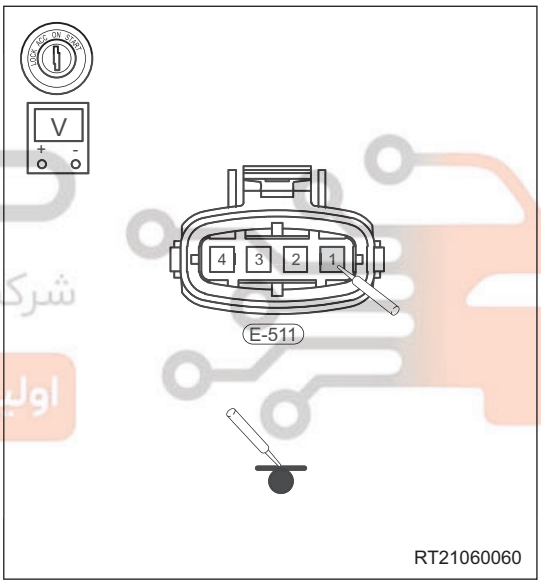
3	Check Intake Pressure/Temperature Sensor signal voltage

a. Connect air flow meter connector E-511.

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

c. Using multimeter, measure voltage between connector E-511 terminal 1 and body ground.

Multimeter Connection	Condition	Specified Condition
E-511 (1) - Body ground	Idle	Voltage is about 1.3 V (value changes with model)
	Rapidly depress accelerator pedal	Instantaneous voltage is about 4 V (value changes with model)



OK → **Go to step 8**

NG

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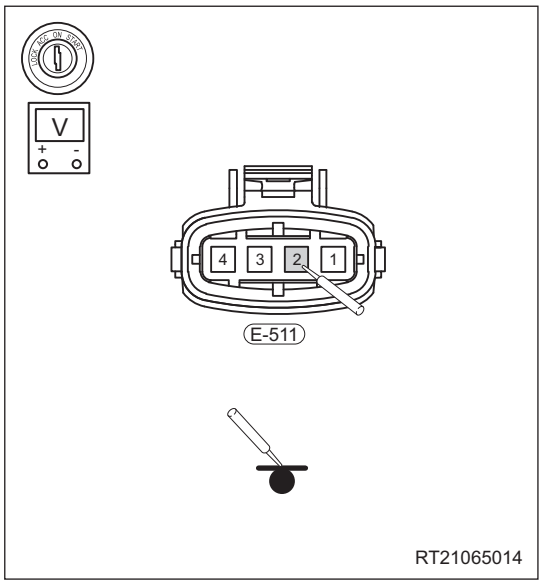
4	Check Intake Pressure/Temperature Sensor power supply voltage

a. Disconnect Intake Pressure/Temperature Sensor connector E-511.

b. Check voltage between Intake Pressure/Temperature Sensor connector terminals and body ground.

Multimeter Connection	Condition	Specified Condition
E-511 (2) - Body ground	Ignition switch ON	5 V



OK → **Go to step 6**

NG

5	Check Intake Pressure/Temperature Sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect ECM connector E-558 and engine compartment fuse and relay box connector E-558.

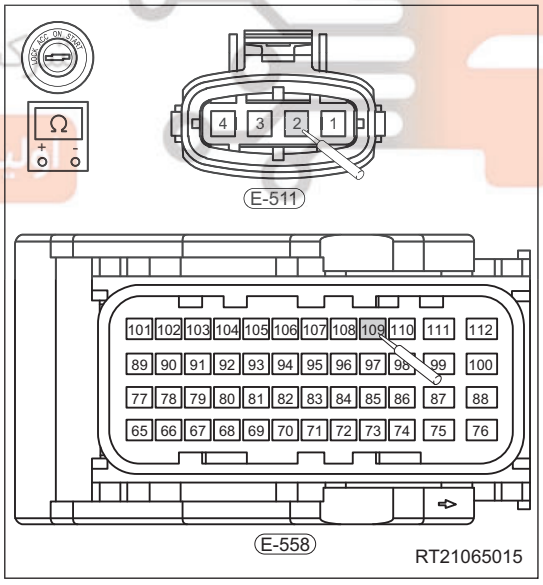
c. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-511 (2) - E-558 (109)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-511 (2) or E-558 (109) - Body ground	Always	No continuity
E-511 (2) or E-558 (109) - Battery positive	Always	No continuity



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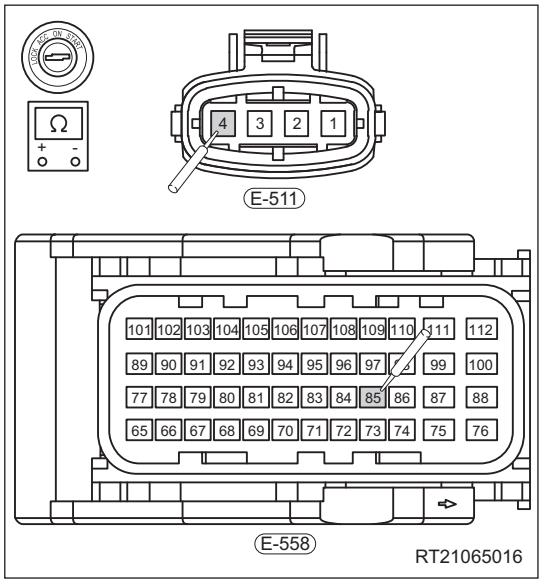
Check for Open

Multimeter Connection	Condition	Specified Condition
E-551 (4) - E-558 (85)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-551 (4) or E-558 (85) - Body ground	Always	No continuity
E-551 (4) or E-558 (85) - Battery positive	Always	No continuity



NG → **Replace wire harness or connector (Intake Pressure/Temperature Sensor - ECM or engine compartment fuse and relay box)**

OK →

6 Check Intake Pressure/Temperature Sensor signal circuit

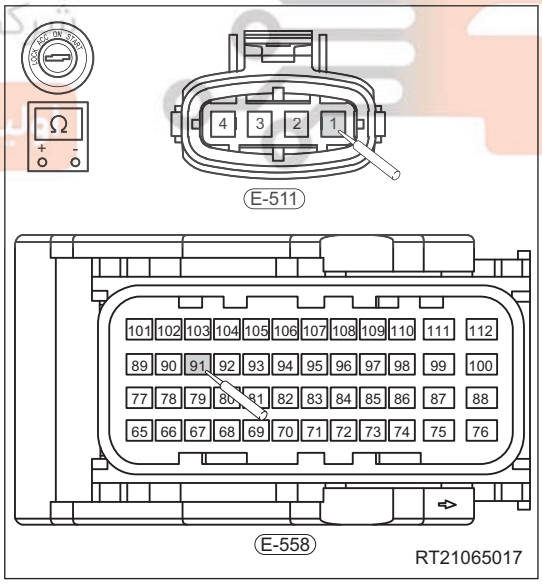
a. Check wire harness between Intake Pressure/Temperature Sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-551 (1) - E-558 (91)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-551 (1) or E-558 (91) - Body ground	Always	No continuity
E-551 (1) or E-558 (91) - Battery positive	Always	No continuity



NG → **Repair or replace wire harness or connector (Intake Pressure/Temperature Sensor - ECM)**

OK →

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7	Check Intake Pressure/Temperature Sensor

a. Remove Intake Pressure/Temperature Sensor.
b. Check Intake Pressure/Temperature Sensor for debris and damage.

NG → **Clean or replace Intake Pressure/ Temperature Sensor, and go to next step**

OK

8	Check for DTCs

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

NG → **Replace ECM**

OK

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

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

دیجیتال خودرو
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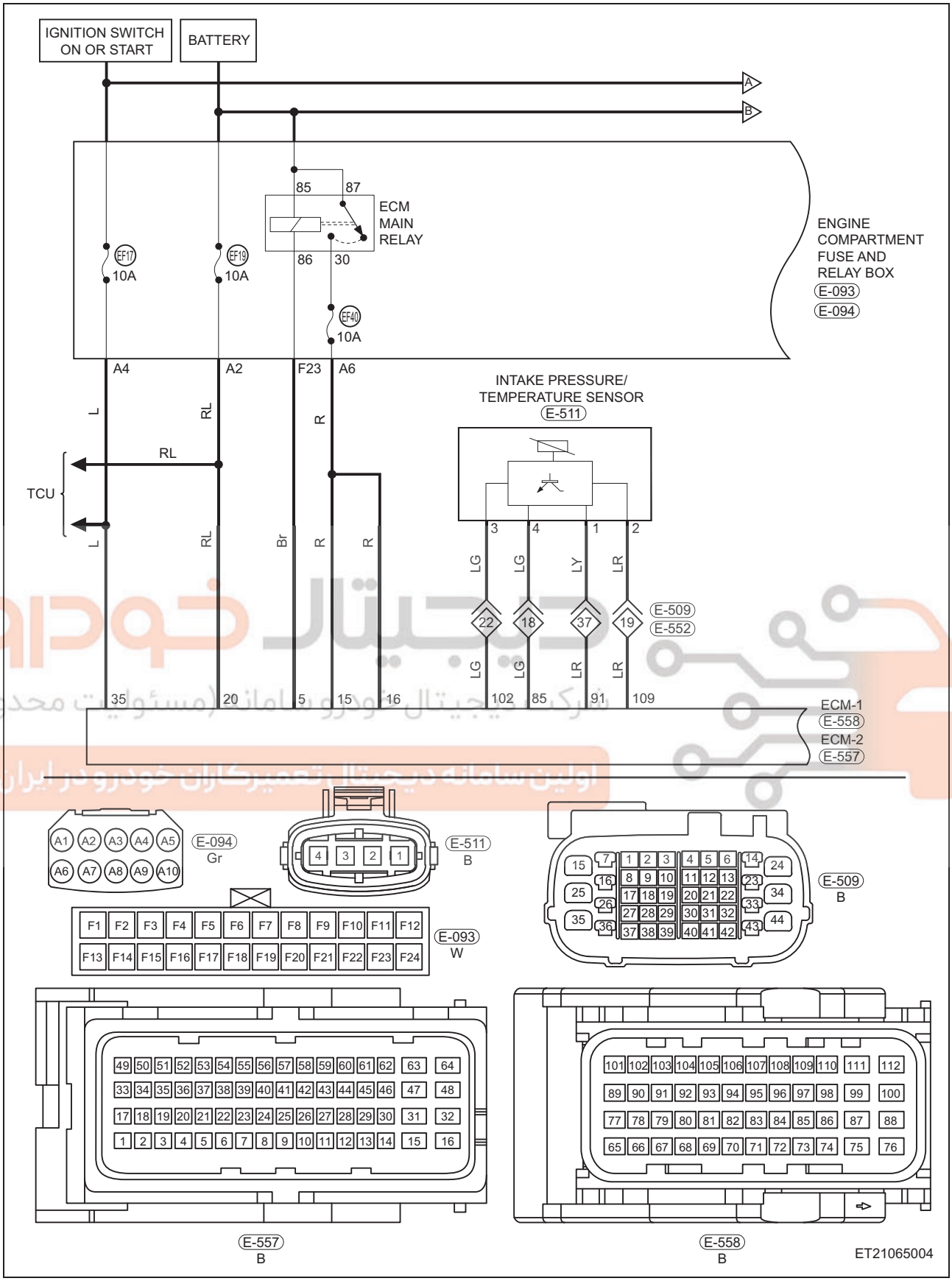

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0111 00	Intake Air Temp. Circ. Performance Non-plausible	Ignition switch ON Engine running	• Intake Pressure/Temperature Sensor • Wire harness or connector • ECM
P0112 16	Intake Air Temp. Circ. Low Input		
P0113 17	Intake Air Temp. Circ. High Input		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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2	Check air flow meter connector

a. Disconnect Intake Pressure/Temperature Sensor connector E-551.
b. Check Intake Pressure/Temperature Sensor connector.

NG → Repair or replace connector

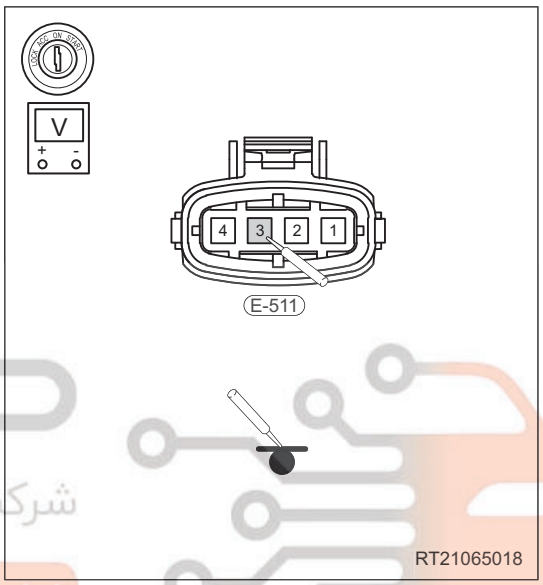
OK

3	Check intake temperature sensor voltage

a. Disconnect Intake Pressure/Temperature Sensor connector E-017.
b. Turn ignition switch to ON.
c. Check voltage between connector terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-551 (3) - Body ground	Ignition switch ON	5 V

OK → Go to step 6



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4	Check intake temperature sensor signal circuit

a. Turn ignition switch to LOCK.

b. Disconnect ECM connector E-035.

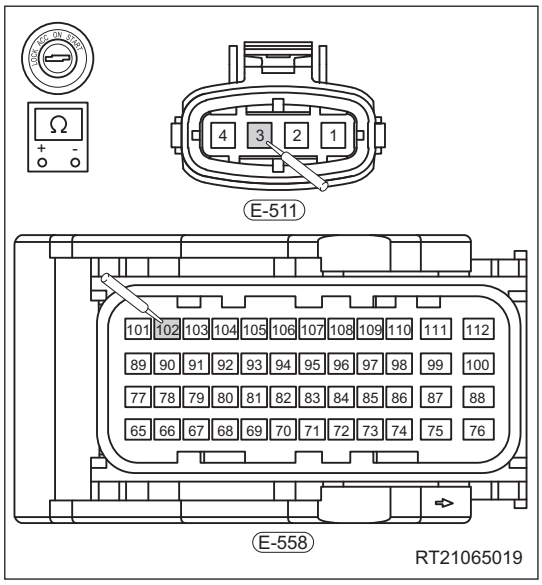
c. Check wire harness between Intake Pressure/Temperature Sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-551 (3) - E-558 (102)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-551 (3) or E-558 (102) - Body ground	Always	No continuity
E-551 (3) or E-558 (102) - Battery positive	Always	No continuity



NG → **Replace wire harness or connector (Intake Pressure/Temperature Sensor - ECM)**

OK

5	Check intake pressure sensor ground circuit

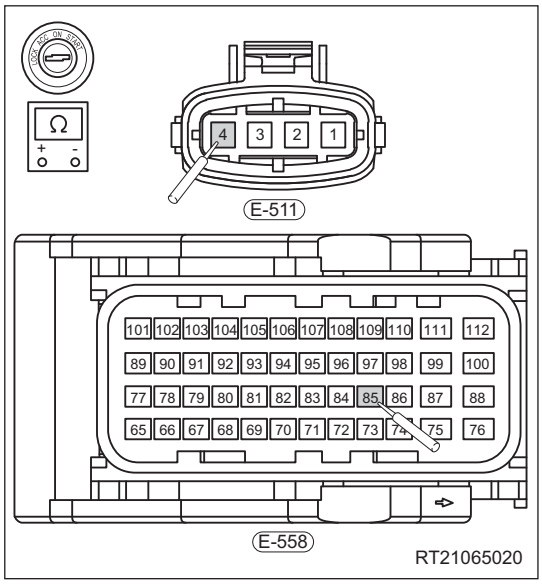
a. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-551 (4) - E-558 (85)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-551 (4) or E-558 (85) - Body ground	Always	No continuity
E-551 (4) or E-558 (85) - Battery positive	Always	No continuity



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NG → **Repair or replace wire harness or connector (Intake Pressure/Temperature Sensor - ECM)**

OK ↓

Replace Intake Pressure/Temperature Sensor, and go to step 7

6	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0111 00, P0112 16, P0113 17 still exists.

NG → **Replace ECM**

OK ↓

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

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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DTC	P0116 00	Engine Coolant Temp. Circ. Performance Non-plausible

DTC	P0117 16	Engine Coolant Temp. Circ. Low Input

DTC	P0118 17	Engine Coolant Temp. Circ. High Input

دیجیتال خودرو
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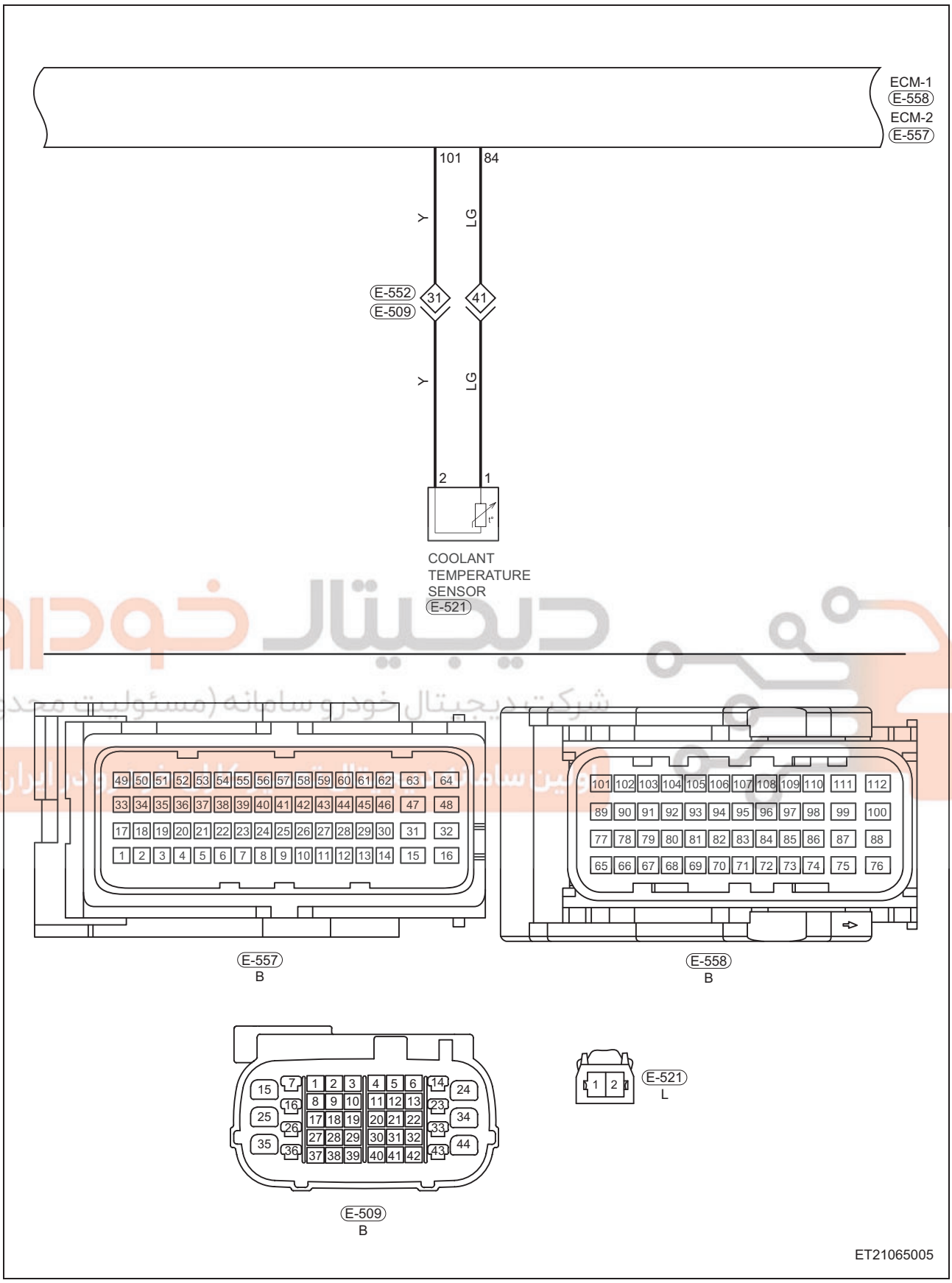

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0116 00	Engine Coolant Temp. Circ. Performance Non-plausible	Ignition switch ON Engine running	• Engine coolant temperature sensor • Wire harness or connector • ECM
P0117 16	Engine Coolant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

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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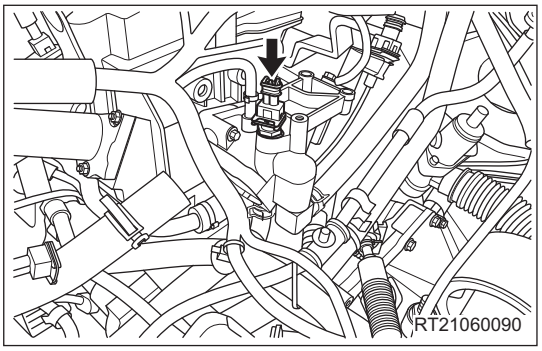
2	Check engine coolant temperature sensor connector

a. Disconnect engine coolant temperature sensor connector E-521.

b. Check engine coolant temperature sensor connector.



NG → **Repair or replace connector**

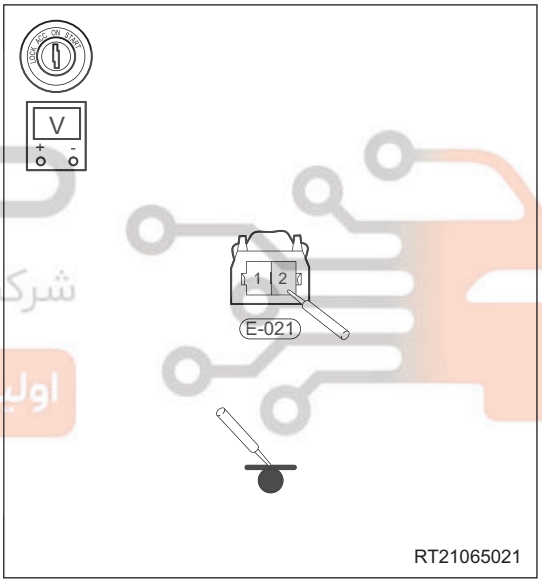
OK

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-521 (2) - Body ground	Ignition switch ON	5 V



OK → **Go to step 5**

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4	Check engine coolant temperature sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect ECM connector E-035.

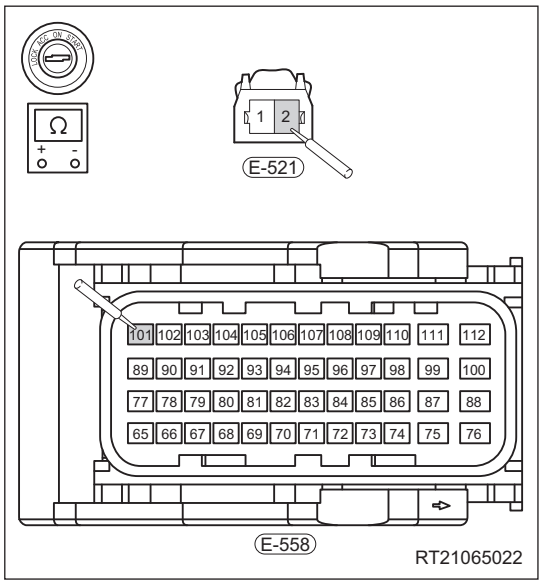
c. Check wire harness between engine coolant temperature sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-521 (2) - E-558 (101)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-521 (2) or E-558 (101) - Body ground	Always	No continuity
E-521 (2) or E-558 (101) - Battery positive	Always	No continuity



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

OK

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5	Check engine coolant temperature sensor ground circuit

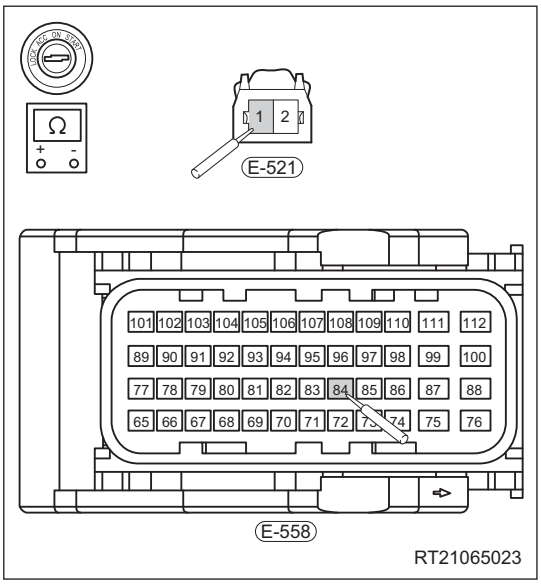
a. Check wire harness between engine coolant temperature sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-521 (1) - E-558 (84)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-521 (1) or E-558 (84) - Body ground	Always	No continuity
E-521 (1) or E-558 (84) - Battery positive	Always	No continuity



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

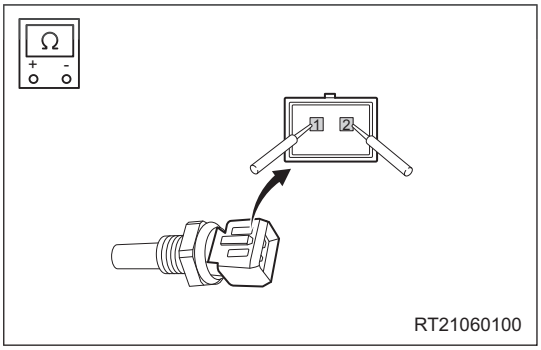
OK

6	Check engine coolant temperature sensor

a. Remove engine coolant temperature sensor.

b. Check resistance of engine coolant temperature sensor.

Multimeter Connection	Specified Condition
1 - 2	Resistance is 2.5 kΩ ± 5% (20°C), 300 - 400 Ω in boiled water (value changes with boiled water temperature)



NG → **Replace engine coolant temperature sensor**

OK

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7	Check for DTCs

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

NG → **Replace ECM**

OK →

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

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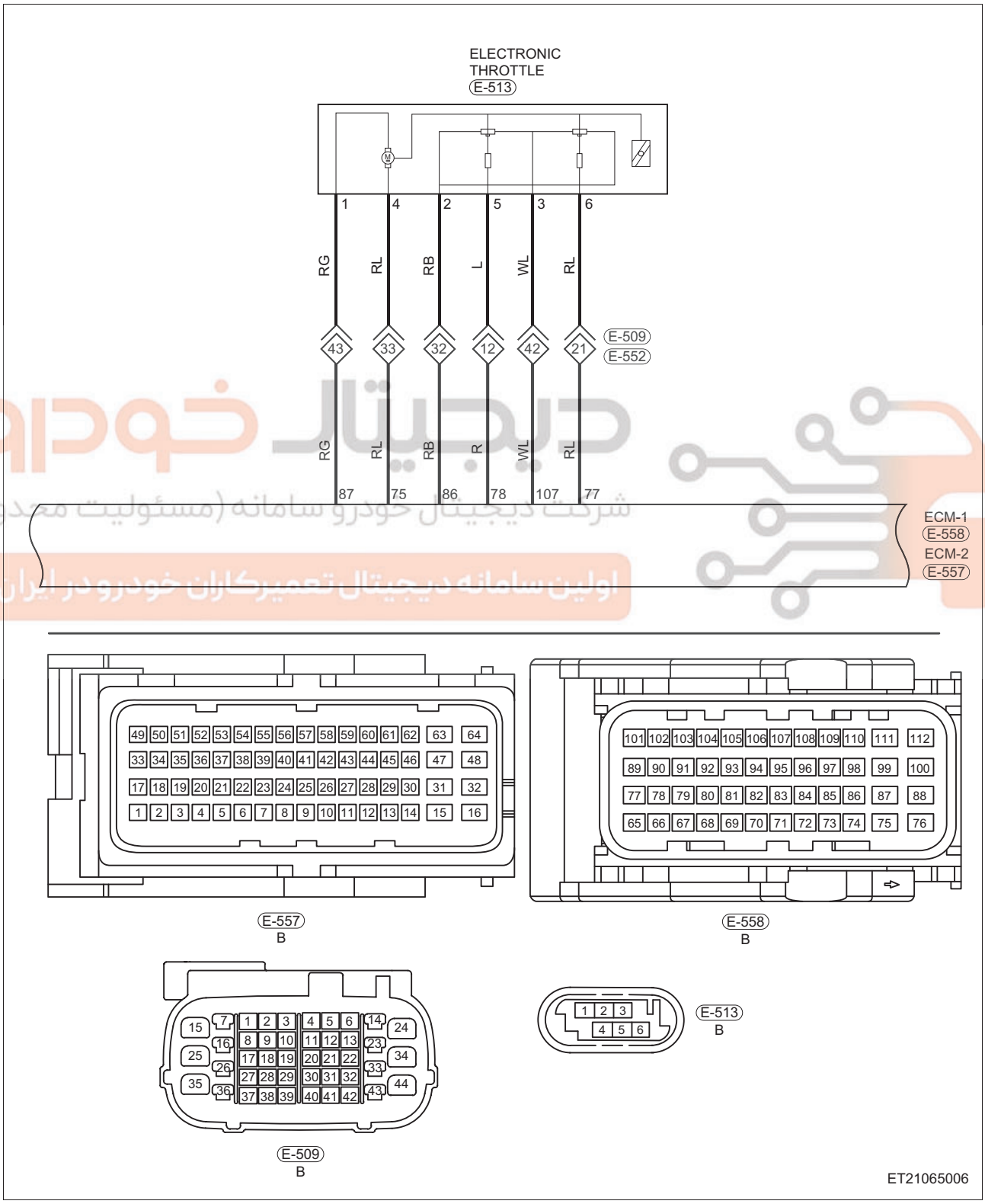
DTC	P0121 29	Throttle Pos.Sensor 1 Circ. Performance Non-plausible

DTC	P0122 16	Throttle Pos.Sensor 1 Circ. Low Input

DTC	P0123 17	Throttle Pos.Sensor 1 Circ. High Input



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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0121 29	Throttle Pos.Sensor 1 Circ. Performance Non-plausible	Ignition switch ON Engine running	• Throttle position sensor 1 • Wire harness or connector • ECM
P0122 16	Throttle Pos.Sensor 1 Circ. Low Input		
P0123 17	Throttle Pos.Sensor 1 Circ. High Input		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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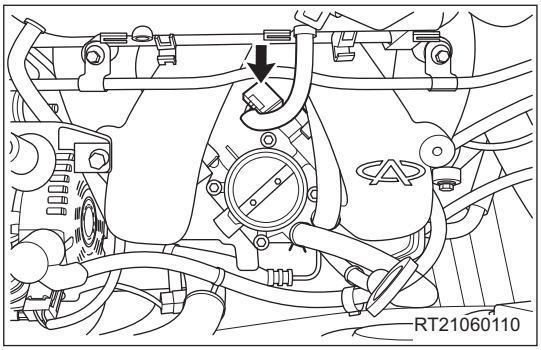
2	Check electronic throttle connector

a. Disconnect electronic throttle connector E-513.
b. Check electronic throttle connector.



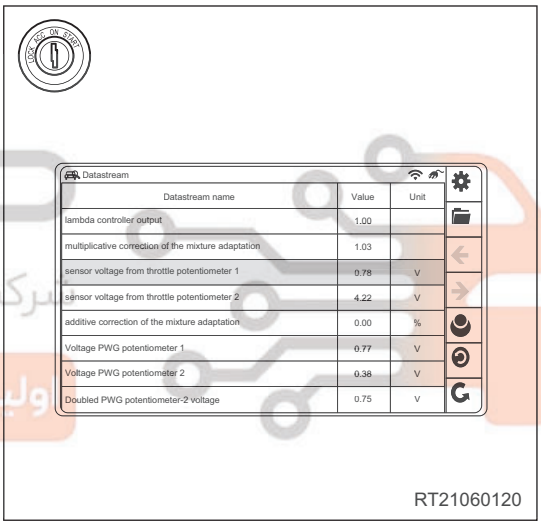
NG → Repair or replace connector

OK

3	Check throttle position sensor 1 signal voltage

a. Connect throttle position sensor connector E-513.
b. Turn ignition switch to ON.
c. Using diagnostic tester, check throttle position sensor 1 signal voltage.

Condition	Standard Value (V)
Accelerator pedal released	0.78
Accelerator pedal depressed	4.29



OK → Go to step 8

NG

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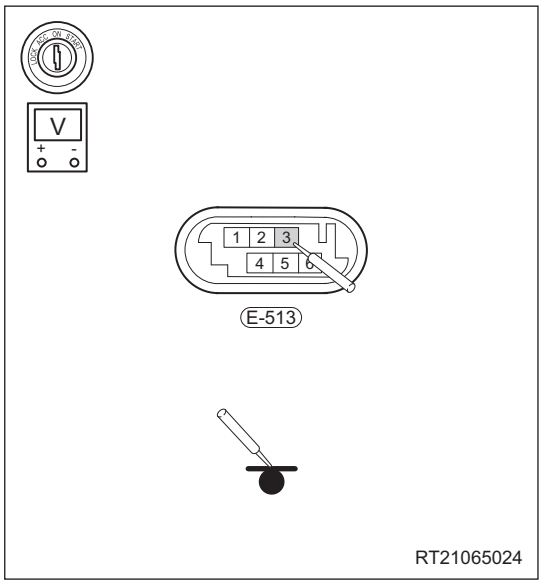
4	Check throttle position sensor power supply voltage

a. Turn ignition switch to LOCK.
b. Disconnect electronic throttle connector E-513.
c. Turn ignition switch to ON and check voltage between electronic throttle connector terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-513 (3) - Body ground	Ignition switch ON	5 V



OK → **Go to step 6**

NG

5	Check throttle position sensor power supply circuit

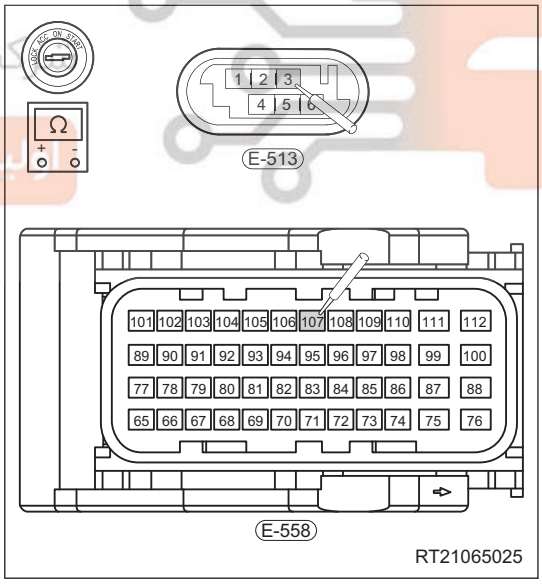
a. Turn ignition switch to LOCK.
b. Disconnect ECM connector E-558.
c. Check wire harness between electronic throttle connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-513 (3) - E-558 (107)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-513 (3) or E-558 (107) - Body ground	Always	No continuity
E-513 (3) or E-558 (107) - Battery positive		



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

OK

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6	Check throttle position sensor 1 signal circuit and ground circuit

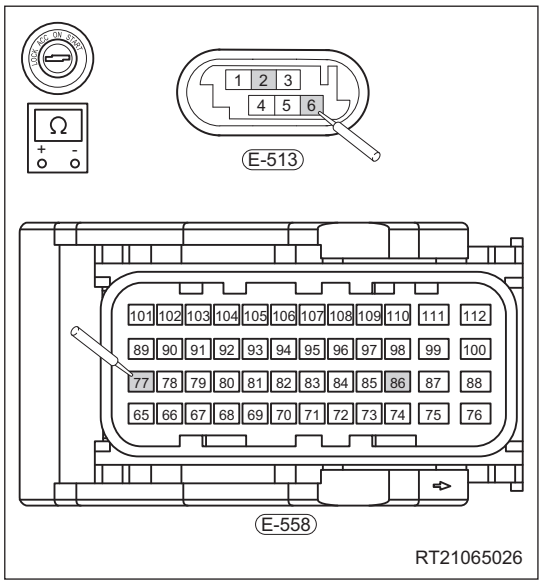
a. Check wire harness between electronic throttle connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-513 (6) - E-558 (77)	Always	Continuity
E-513 (2) - E-558 (86)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-513 (6) or E-558 (77) - Body ground	Always	No continuity
E-513 (6) or E-558 (77) - Battery positive		
E-513 (2) or E-558 (86) - Body ground		
E-513 (2) or E-558 (86) - Battery positive		



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

OK

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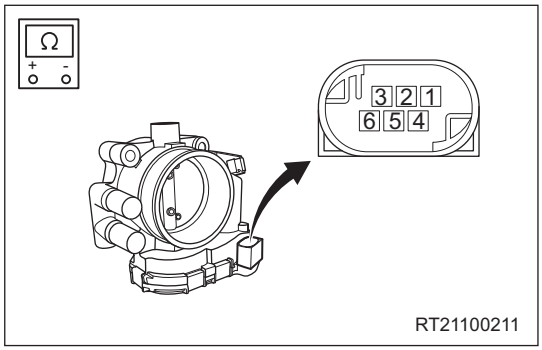
7	Check electronic throttle

a. Check electronic throttle for carbon deposits and foreign matter accumulation inside.
b. Check if throttle valve body is stuck.
c. Check resistance of electronic throttle.



Multimeter Connection	Condition	Specified Condition
Terminal 3 - Terminal 2	At normal temperature	1.067 kΩ
Terminal 6 - Terminal 2	Throttle valve is rotated	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

8	Check for DTCs

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

NG → **Replace ECM**

OK

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

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

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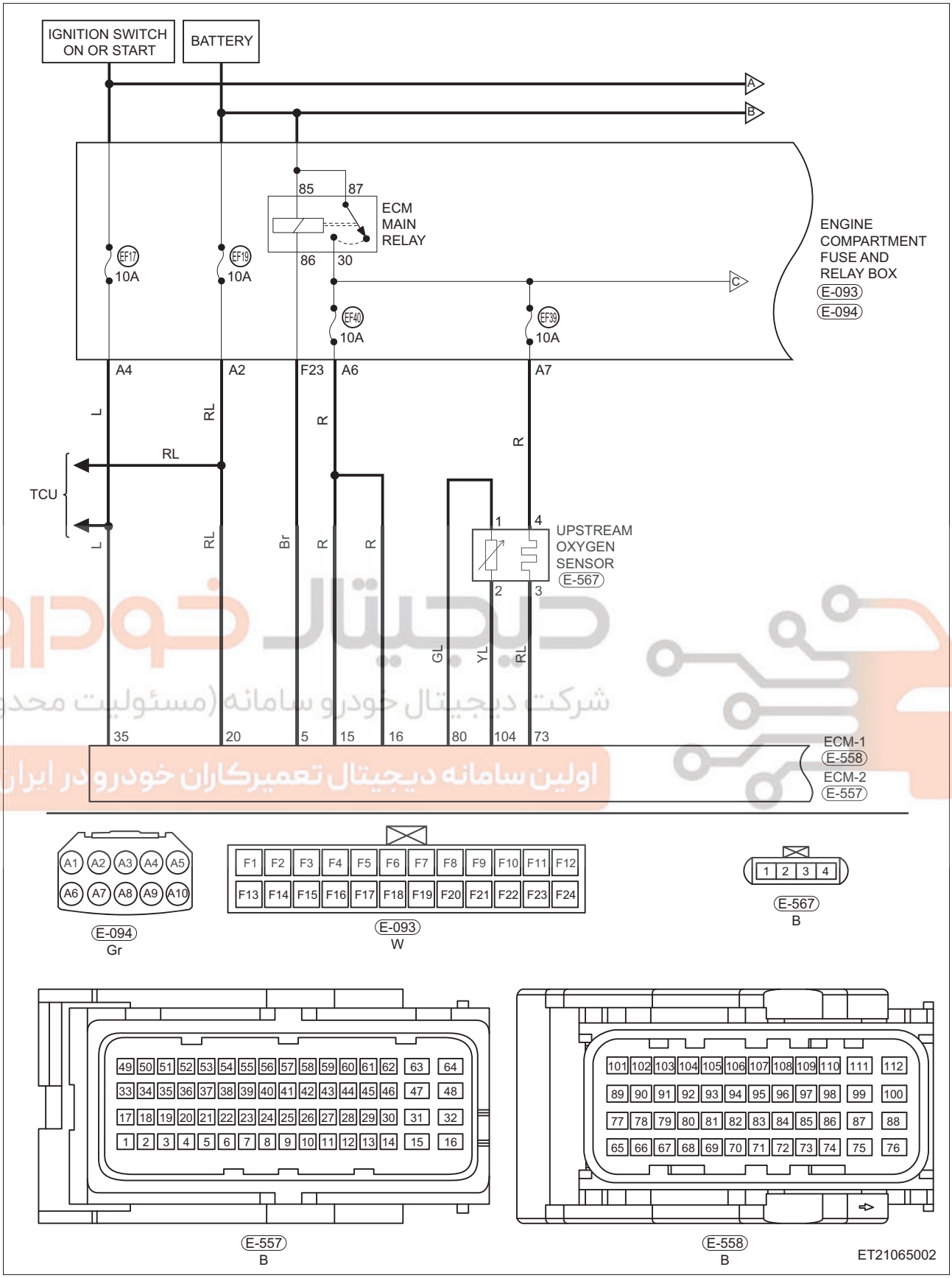

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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0130 00	O2 Sensor Circ. Malfunction (upstream of the catalyzer)	Ignition switch ON Engine running	• Upstream oxygen sensor • Wire harness or connector • ECM
P0131 16	O2 Sensor Circ. Low Voltage (upstream of the catalyzer)		
P0132 17	O2 Sensor Circ. High Voltage (upstream of the catalyzer)		
P0133 00	O2 Sensor Circ. Slow Response (upstream of the catalyzer)		
P0134 00	O2 Sensor Circ. No Activity Detected (upstream of the catalyzer)		
P2195 00	O2 Sensor Signal Stuck Lean (upstream of the catalyzer)		
P2196 00	O2 Sensor Signal Stuck Rich (upstream of the catalyzer)		

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DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

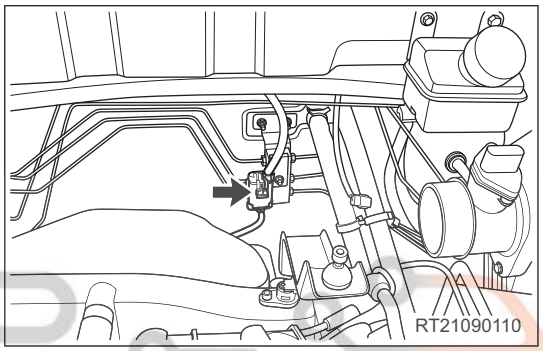
NG → **Repair or replace ground wire harness or ground point**

OK ↓

2	Check upstream oxygen sensor connector

a. Disconnect upstream oxygen sensor connector E-567.

b. Check upstream oxygen sensor connector.



NG → **Repair or replace connector**

OK ↓

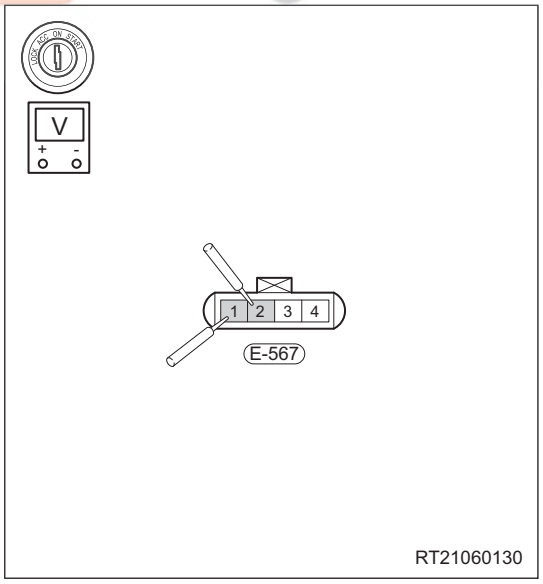
3	Check upstream oxygen sensor signal

a. Connect upstream oxygen sensor connector E-567.

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

c. Using multimeter, measure voltage between terminals 2 and 1 of connector E-567.

Multimeter Connection	Condition	Specified Condition
E-567 (2) - E-567 (1)	Engine running	Fluctuates fast between 0.1 and 0.9 V (when operating temperature is 350°C)



OK → **Go to step 7**

NG ↓

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4	Check upstream oxygen sensor signal circuit

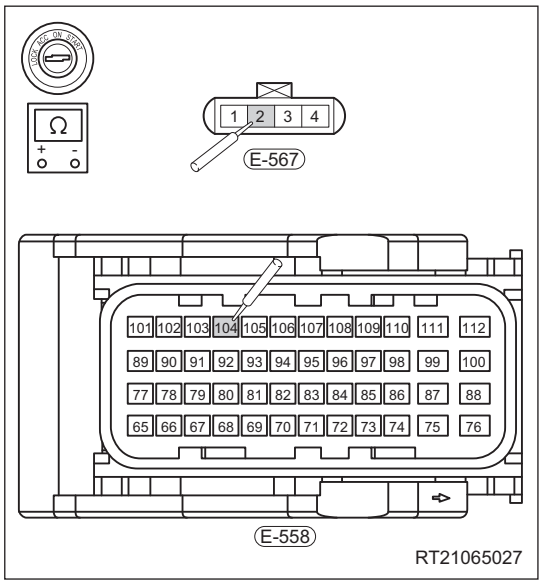
a. Turn ignition switch to LOCK.
b. Disconnect ECM connector E-558.
c. Disconnect upstream oxygen sensor connector E-567.
d. Check wire harness between upstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-567 (2) - E-558 (104)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-567 (2) or E-558 (104) - Body ground	Always	No continuity
E-567 (2) or E-558 (104) - Battery positive		



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

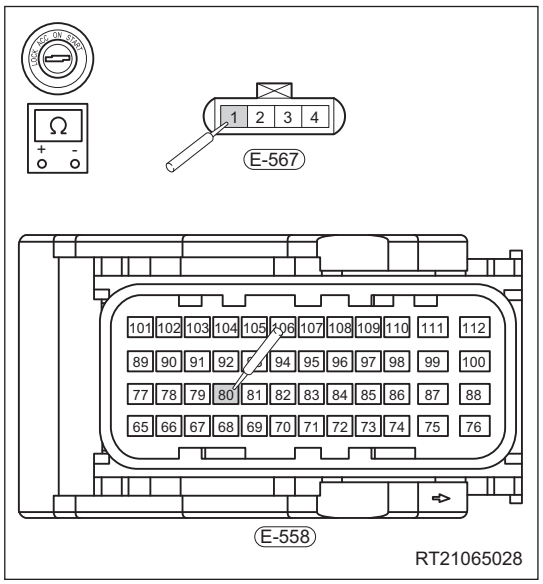
OK →

5	Check upstream oxygen sensor ground circuit

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

Check for Open

Multimeter Connection	Condition	Specified Condition
E-567 (1) - E-558 (16)	Always	Continuity



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Check for Short

Multimeter Connection	Condition	Specified Condition
E-567 (1) or E-558 (16) - Body ground	Always	No continuity
E-567 (1) or E-558 (16) - Battery positive		

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

OK

6	Check upstream oxygen sensor

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

NG → **Replace upstream oxygen sensor**

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OK

7	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0130 00, P0131 16, P0132 17, P0133 00, P0134 00, P2195 00 or P2196 00 still exists.

NG → **Replace ECM**

OK

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

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

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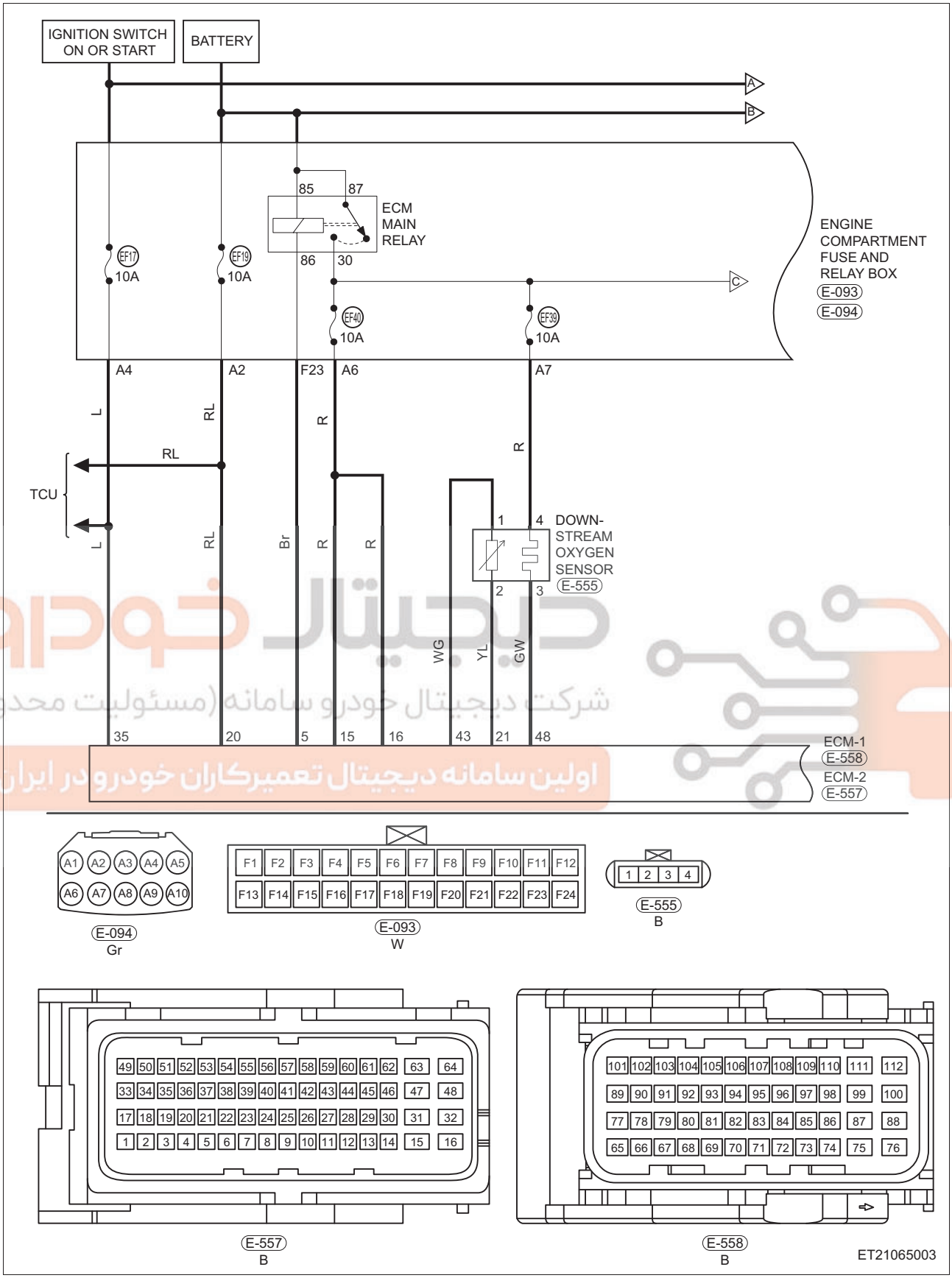

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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0136 00	O2 Sensor Circ. Malfunction (downstream of the catalyzer)	Ignition switch ON Engine running	• Downstream oxygen sensor • Wire harness or connector • ECM
P0137 16	O2 Sensor Circ. Low Voltage (downstream of the catalyzer)		
P0138 17	O2 Sensor Circ. High Voltage (downstream of the catalyzer)		
P0140 00	O2 Sensor Circ. No Activity Detected (downstream of the catalyzer)		
P2270 00	O2 Sensor Signal Stuck Lean (downstream of the catalyzer)		
P2271 00	O2 Sensor Signal Stuck Rich (downstream of the catalyzer)		

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DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	Check ECM ground point

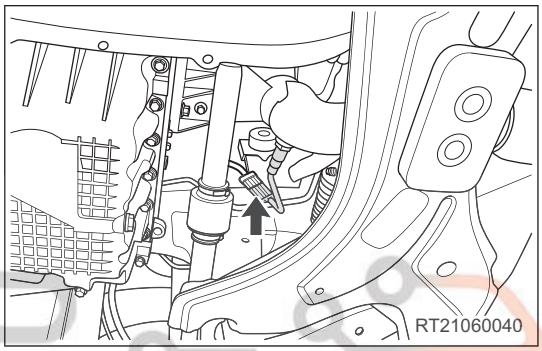
a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

2	Check downstream oxygen sensor connector

a. Disconnect downstream oxygen sensor connector.
b. Check downstream oxygen sensor connector.



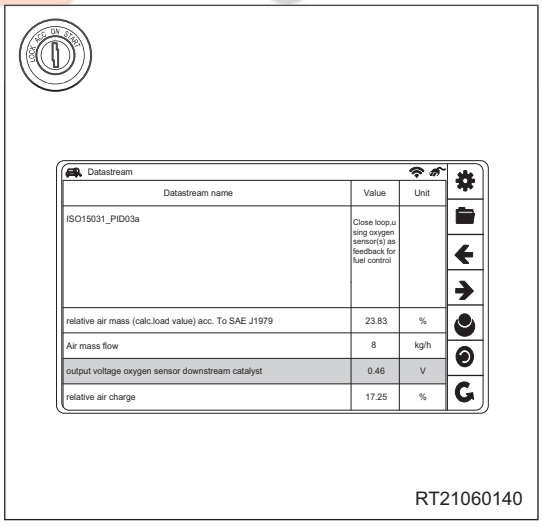
NG → **Repair or replace connector**

OK

3	Check downstream oxygen sensor signal

a. Connect downstream oxygen sensor connector E-555.
b. Turn ignition switch to ON, start the engine and idle it for about 3 minutes.
c. Using diagnostic tester, measure downstream oxygen sensor signal voltage, or using multimeter, measure voltage between terminals 2 and 1 of connector E-555.

Multimeter Connection	Condition	Specified Condition
E-555 (2) - E-555 (1)	Engine running	Fluctuates slightly at about 0.45 V



OK → **Go to step 7**

NG

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4	Check downstream oxygen sensor signal circuit

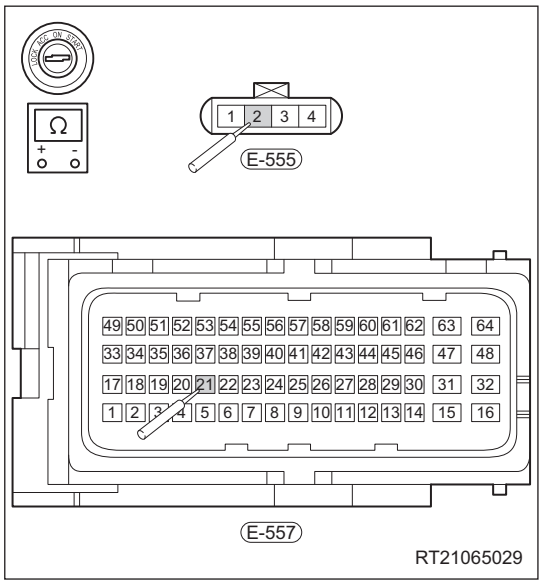
a. Turn ignition switch to LOCK.
b. Disconnect ECM connector E-557.
c. Disconnect downstream oxygen sensor connector E-555.
d. Check wire harness between downstream oxygen sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-555 (2) - E-557 (21)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-555 (2) or E-557 (21) - Body ground	Always	No continuity
E-555 (2) or E-557 (21) - Battery positive		



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

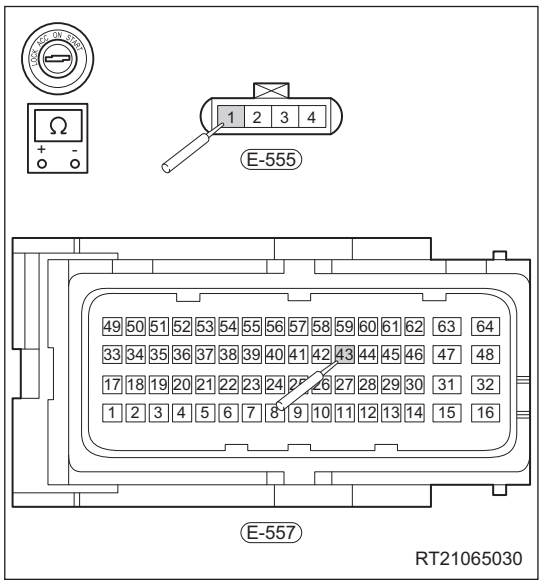
OK

5	Check downstream oxygen sensor ground circuit

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

Check for Open

Multimeter Connection	Condition	Specified Condition
E-555 (1) - E-557 (43)	Always	Continuity



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Check for Short

Multimeter Connection	Condition	Specified Condition
E-555 (1) or E-557 (43) - Body ground	Always	No continuity
E-555 (1) or E-557 (43) - Battery positive		

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

OK

6	Check downstream oxygen sensor

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

NG → **Replace downstream oxygen sensor**

OK

7	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0136 00, P0137 16, P0138 17, P0140 00, P2270 00, P2271 00 still exists.

NG → **Replace ECM**

OK

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

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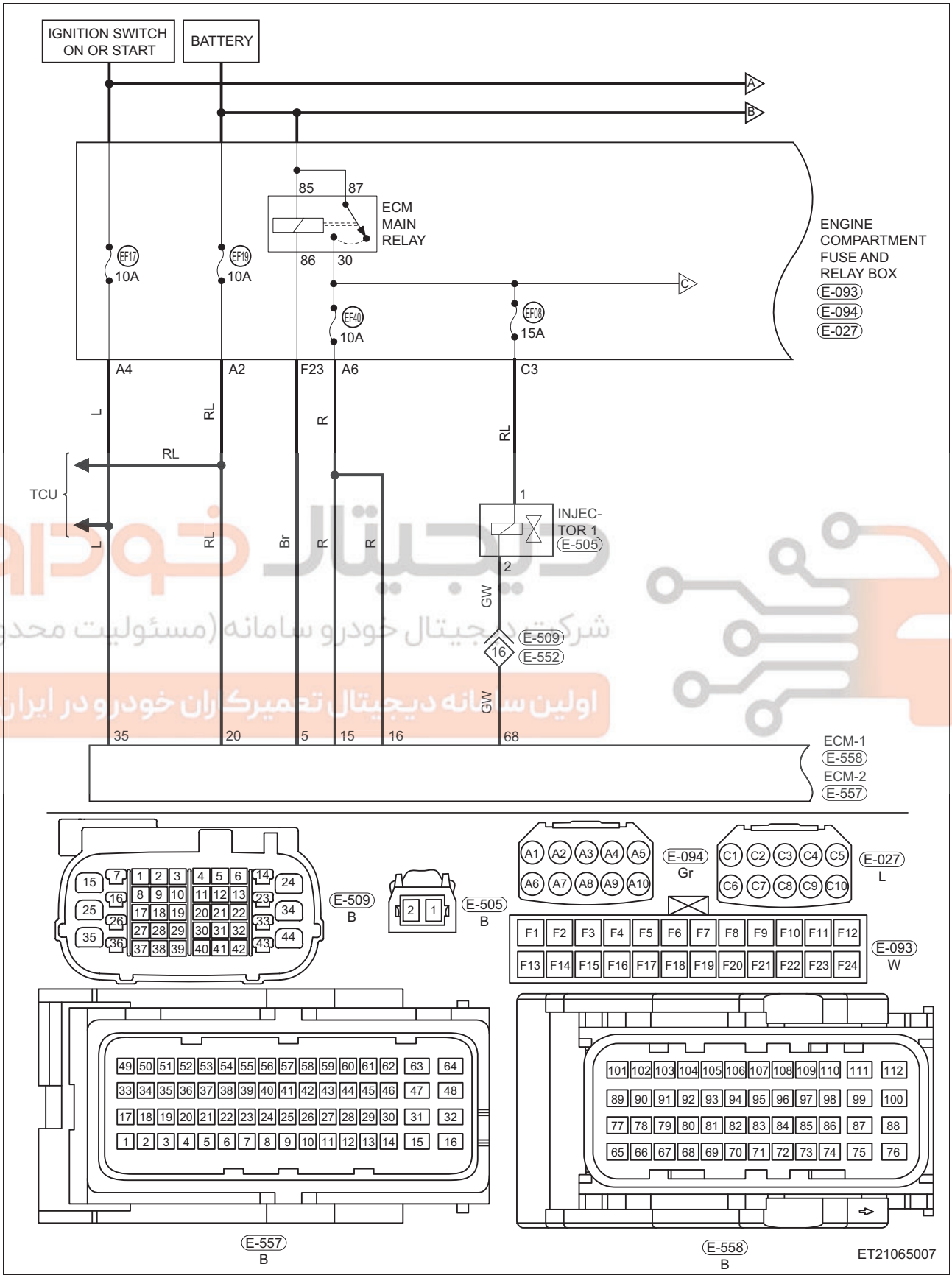
DTC	P0201 13	Cylinder 1 - Injector Circuit error



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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0201 13	Cylinder 1 - Injector Circuit error	Engine running	• Injector of cylinder 1 • Wire harness or connector • ECM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

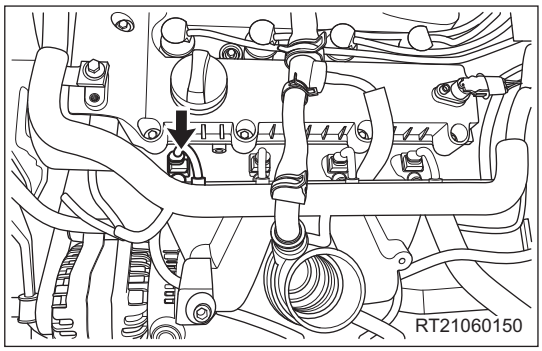
NG → **Repair or replace ground wire harness or ground point**

OK

2	**Check injector connector of cylinder 1**

a. Disconnect injector connector E-505 of cylinder 1.
b. Check injector connector.

NG → **Repair or replace connector**



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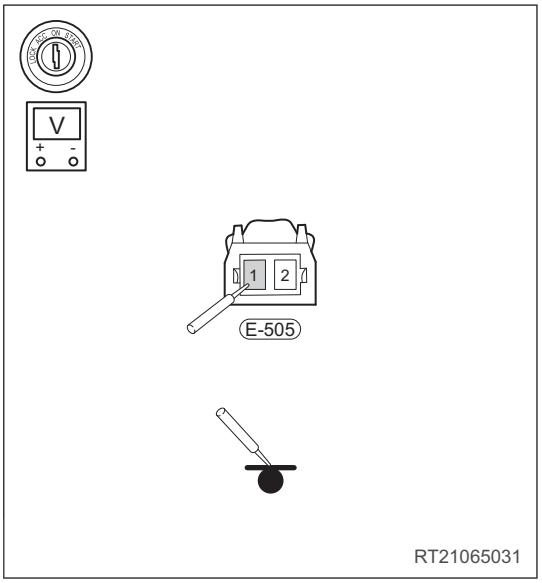
OK

3	Check injector power supply voltage of cylinder 1

a. Disconnect injector connector E-505 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-505 (1) - Body ground	Ignition switch ON	11 to 14 V



OK → Go to step 5

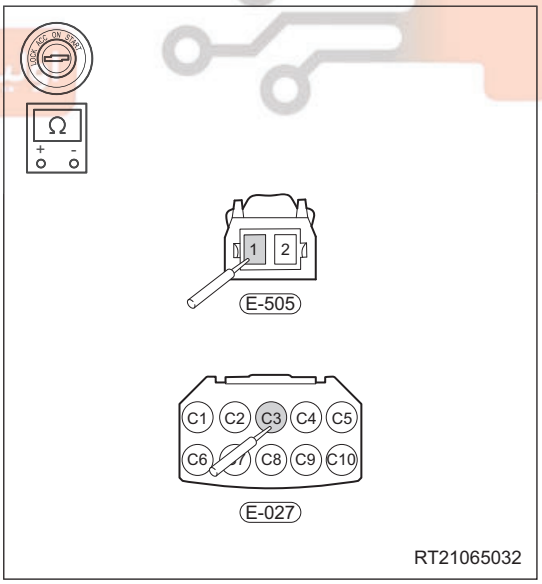
NG

4	Check injector power supply circuit of cylinder 1

a. Turn ignition switch to LOCK.
b. Check fuse EF08 and main relay.
c. Disconnect engine compartment fuse and relay box connector E-027.
d. Check wire harness between injector connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-505 (1) - E-027 (C3)	Always	Continuity



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Check for Short

Multimeter Connection	Condition	Specified Condition
E-505 (1) or E-027 (C3) - Body ground	Always	No continuity
E-505 (1) or E-027 (C3) - Battery positive		

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

OK →

5	Check injector control circuit of cylinder 1

a. Disconnect ECM connector E-558.

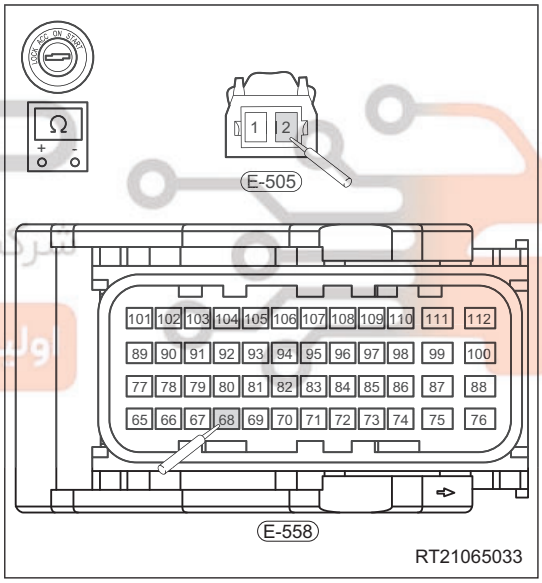
b. Check wire harness between injector connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-505 (2) - E-558 (68)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-505 (2) or E-558 (68) - Body ground	Always	No continuity
E-505 (2) or E-558 (68) - Battery positive		



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

OK →

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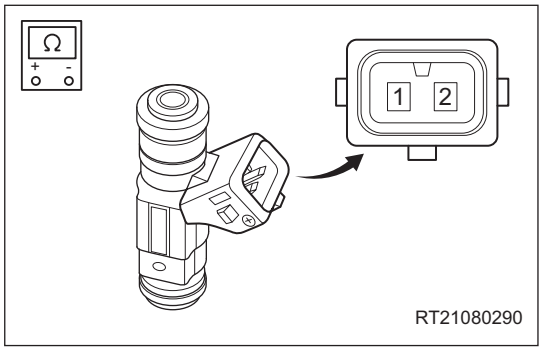
6	Check injector of cylinder 1

a. Check resistance of injector of cylinder 1.

Multimeter Connection	Specified Condition
1 - 2	12 Ω (at 20°C)



NG → Replace injector of cylinder 1

OK

7	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0201 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.

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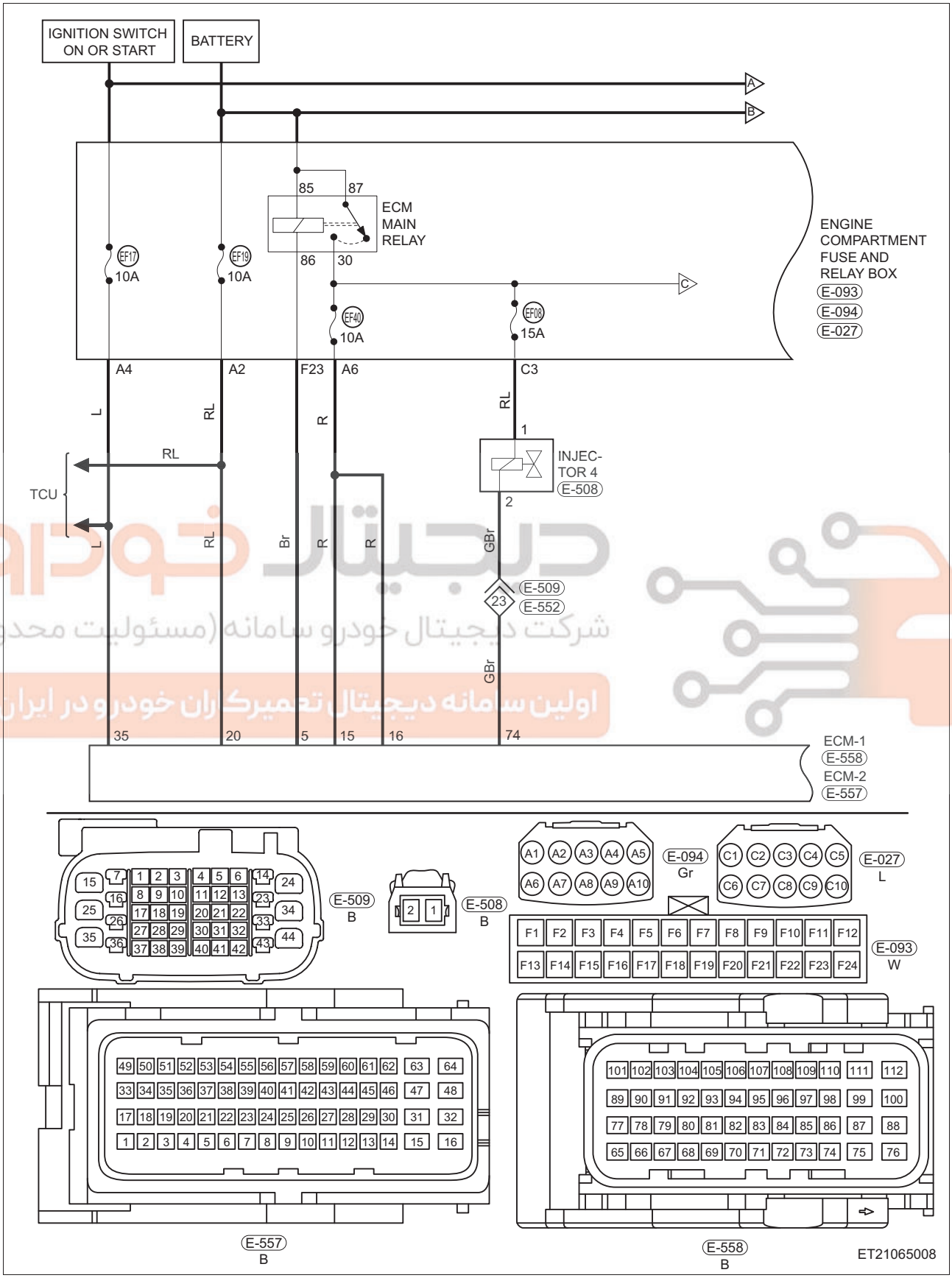
DTC	P0271 12	Cylinder 4 - Injector Circuit High



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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0271 12	Cylinder 4 - Injector Circuit High	Engine running	• Injector of cylinder 4 • Wire harness or connector • ECM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

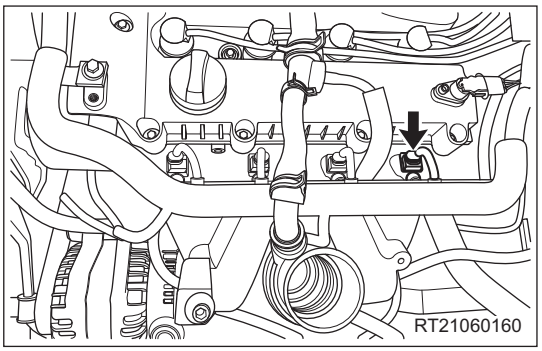
NG → **Repair or replace ground wire harness or ground point**

OK →

2	**Check injector connector of cylinder 4**

a. Disconnect injector connector E-508 of cylinder 4.
b. Check injector connector.

NG → **Repair or replace connector**



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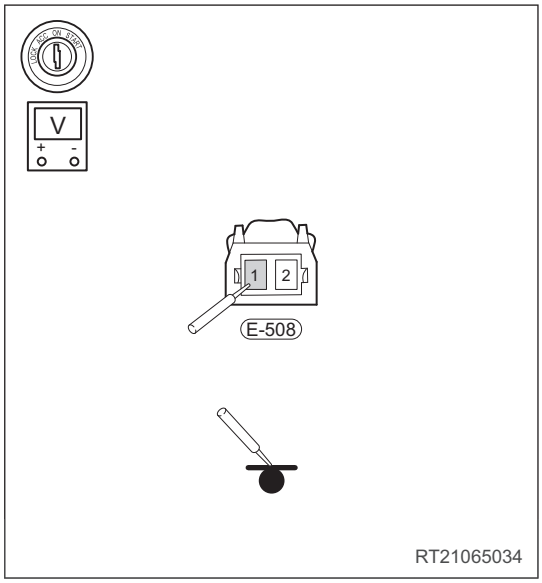
OK

3	Check injector power supply voltage of cylinder 4

a. Disconnect injector connector E-508 of cylinder 4.
b. Turn ignition switch to ON.
c. Check voltage between injector connector terminal of cylinder 4 and body ground.

Multimeter Connection	Condition	Specified Condition
E-508 (1) - Body ground	Ignition switch ON	11 to 14 V

OK → Go to step 5



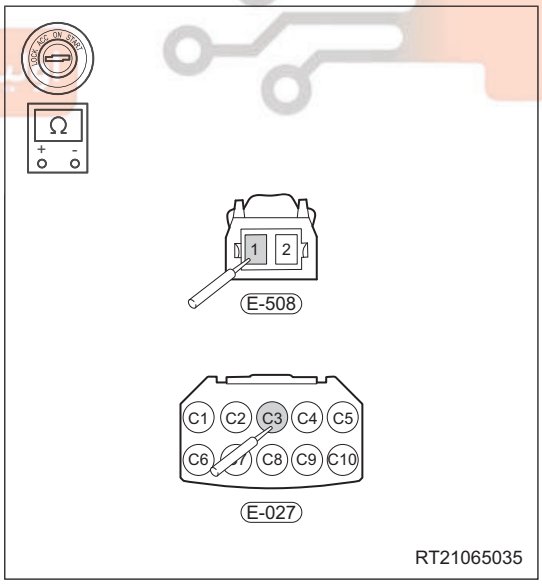
NG

4	Check injector power supply circuit of cylinder 4

a. Turn ignition switch to LOCK.
b. Check fuse EF08 and main relay.
c. Disconnect engine compartment fuse and relay box connector E-027.
d. Check wire harness between injector connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-508 (1) - E-027 (C3)	Always	Continuity



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Check for Short

Multimeter Connection	Condition	Specified Condition
E-508 (1) or E-027 (C3) - Body ground	Always	No continuity
E-508 (1) or E-027 (C3) - Battery positive		

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

OK →

5	Check injector control circuit of cylinder 4

a. Disconnect ECM connector E-558.

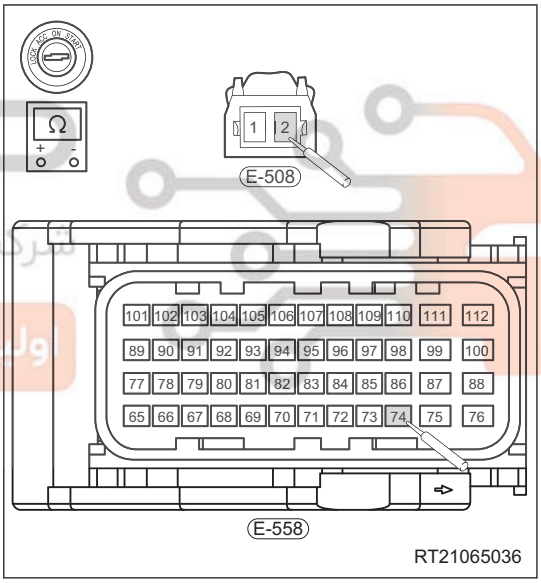
b. Check wire harness between injector connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-508 (2) - E-558 (74)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-508 (2) or E-558 (74) - Body ground	Always	No continuity
E-508 (2) or E-558 (74) - Battery positive		



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

OK →

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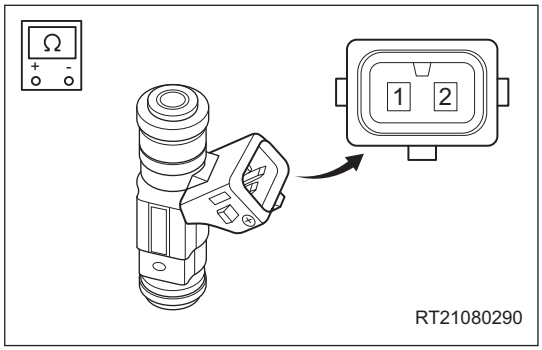
6	Check injector of cylinder 4

a. Check resistance of injector of cylinder 4.

Multimeter Connection	Specified Condition
1 - 2	12 Ω (at 20°C)



NG → Replace injector of cylinder 4

OK

7	Check for DTCs

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

NG → Replace ECM

OK

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

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DTC	P1102 00	Throttle limphome position self learning error
DTC	P1102 29	Throttle lower mechanic stop re-learning error
DTC	P1103 00	Throttle lower mechanic stop first learning error
DTC	P1106 00	Throttle position deviation error
DTC	P1106 21	Throttle PID adjustment min error
DTC	P1106 22	Throttle PID adjustment max error
DTC	P1111 00	Return spring check max error
DTC	P2106 92	Throttle power stage Non-plausible error
DTC	P2106 12	Throttle power stage max error
DTC	P2106 13	Throttle power stage Signal error
DTC	P2106 19	Load monitoring error

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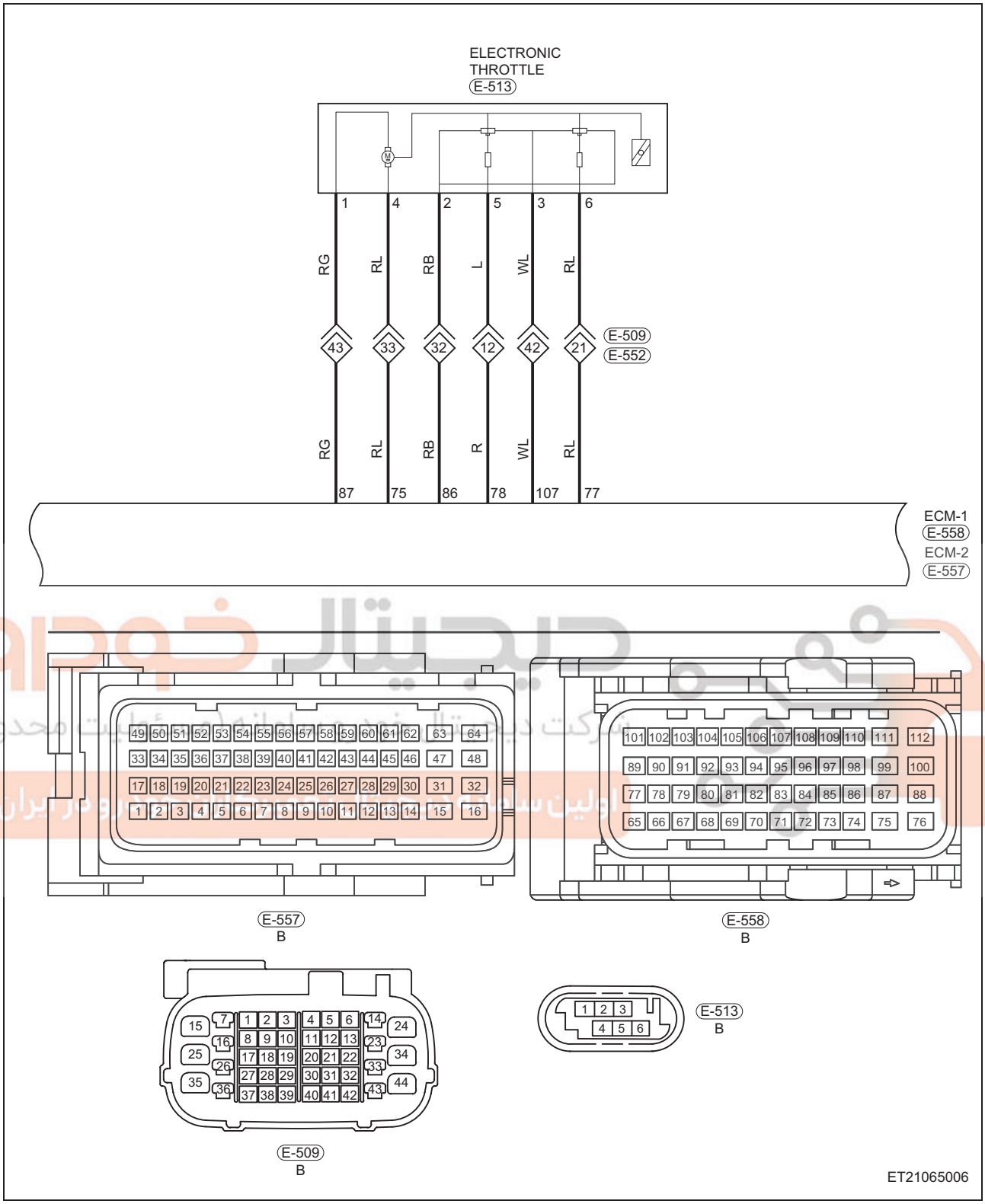

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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P1102 00	Throttle limphome position self learning error	Ignition switch ON	• Electronic throttle • Wire harness or connector • ECM
P1102 29	Throttle lower mechanic stop re-learning error		
P1103 00	Throttle lower mechanic stop first learning error		
P1106 00	Throttle position deviation error		
P1106 21	Throttle PID adjustment min error		
P1106 22	Throttle PID adjustment max error		
P1111 00	Return spring check max error		
P2106 92	Throttle power stage Non-plausible error		
P2106 12	Throttle power stage max error		
P2106 13	Throttle power stage Signal error		
P2106 19	Load monitoring error		

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DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	Check ECM ground point

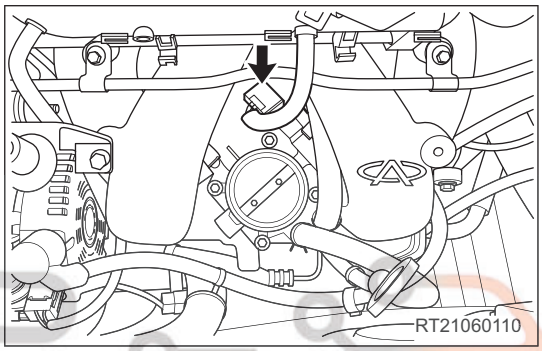
a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

2	Check electronic throttle connector

a. Disconnect electronic throttle connector E-513.
b. Check electronic throttle connector.

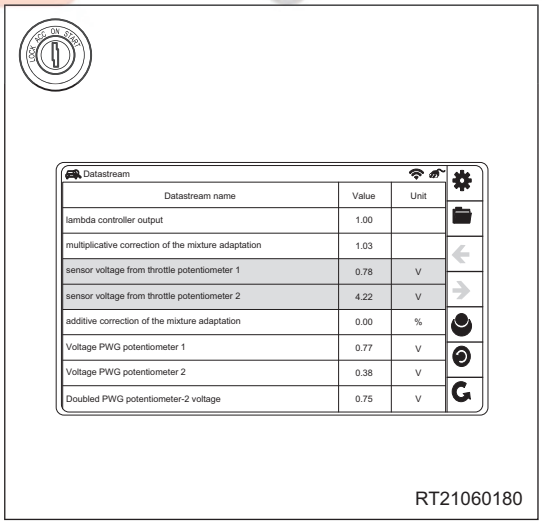


NG → **Repair or replace connector**

OK

3	Check throttle position sensor signal voltage

a. Connect electronic throttle connector E-513.
b. Turn ignition switch to ON.
c. Using diagnostic tester, check throttle position sensor signal voltage.



Item	Condition	Standard Value (V)
Throttle position sensor 1	Accelerator pedal released	0.78
	Accelerator pedal depressed	4.29
Throttle position sensor 2	Accelerator pedal released	4.22
	Accelerator pedal depressed	0.71

OK → **Go to step 7**

NG

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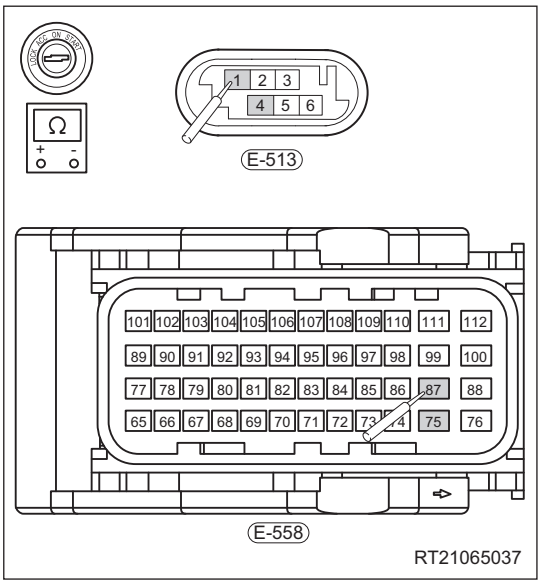
4	Check electronic throttle actuator circuit

a. Turn ignition switch to LOCK.
b. Disconnect electronic throttle connector E-513.
c. Disconnect ECM connector E-558.
d. Check wire harness between connector terminals.



Check for Open

Multimeter Connection	Condition	Specified Condition
E-558 (87) - E-513 (1)	Always	Continuity
E-558 (75) - E-513 (4)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-558 (87) or E-513 (1) - Body ground	Always	No continuity
E-558 (87) or E-513 (1) - Battery positive	Always	No continuity
E-558 (75) or E-513 (4) - Body ground	Always	No continuity
E-558 (75) or E-513 (4) - Battery positive	Always	No continuity

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

OK →

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5	Check throttle position sensor circuit

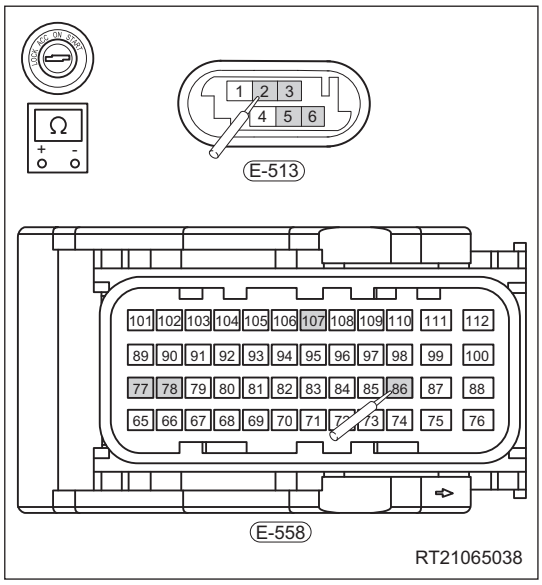
a. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-558 (86) - E-513 (2)	Always	Continuity
E-558 (78) - E-513 (5)	Always	Continuity
E-558 (107) - E-513 (3)	Always	Continuity
E-558 (77) - E-513 (6)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-558 (86, 78, 107, 77) or E-513 (2, 5, 3, 6) - Body ground	Always	No continuity
E-558 (86, 78, 107, 77) or E-513 (2, 5, 3, 6) - Battery positive	Always	No continuity



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

OK

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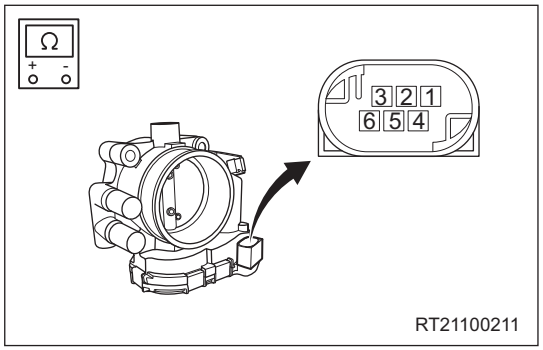
6	Check electronic throttle

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

b. Check if throttle valve body is stuck.

c. Check resistance of electronic throttle.



Multimeter Connection	Condition	Specified Condition
Terminal 3 - Terminal 2	At normal temperature	1.067 kΩ
Terminal 6 - Terminal 2	Throttle valve is rotated	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

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

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P1102 00, P1102 29, P1103 00, P1106 00, P1106 21, P1106 22, P1111 00, P2106 92, P2106 12, P2106 13, P2106 19 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.

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DTC	P0300 21	Random/Multiple Cylinder Misfire Detected
DTC	P0301 21	Cyl.1 Misfire Detected
DTC	P0302 21	Cyl.2 Misfire Detected
DTC	P0303 21	Cyl.3 Misfire Detected
DTC	P0304 21	Cyl.4 Misfire Detected

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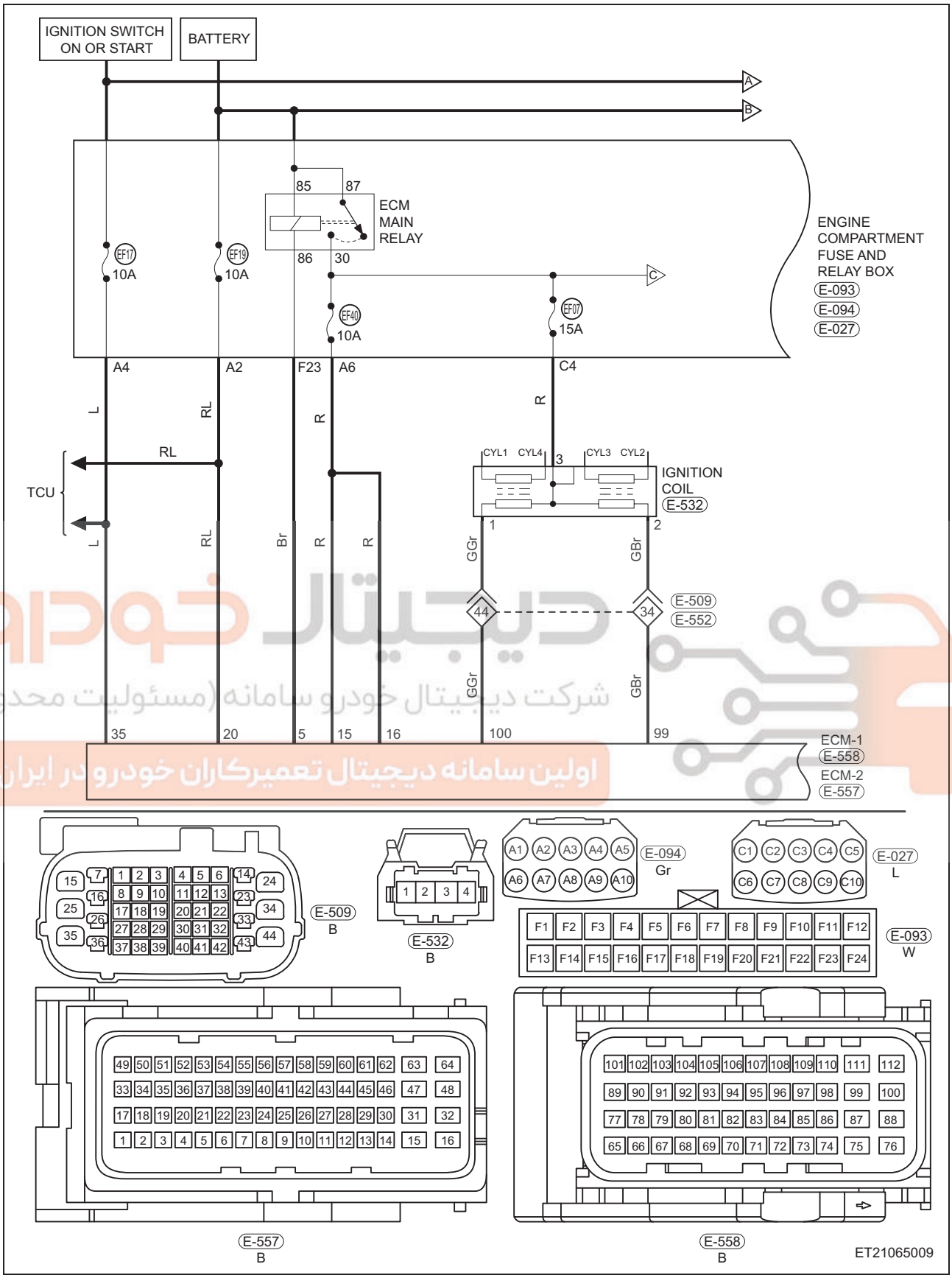

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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0300 21	Random/Multiple Cylinder Misfire Detected	Engine running	• Ignition coil • Spark plug • Wire harness or connector • ECM
P0301 21	Cyl.1 Misfire Detected		
P0302 21	Cyl.2 Misfire Detected		
P0303 21	Cyl.3 Misfire Detected		
P0304 21	Cyl.4 Misfire Detected		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK →

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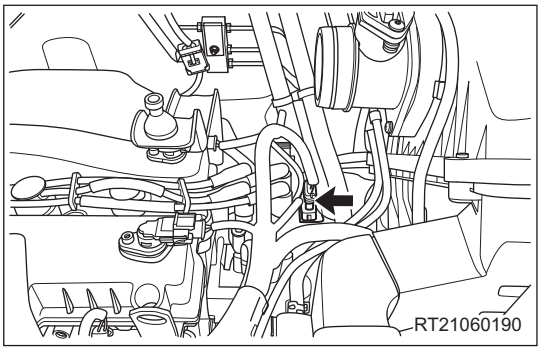
2	Check ignition coil connector

a. Turn ignition switch to LOCK.
b. Disconnect ignition coil connector E-532.
c. Check ignition coil connector.

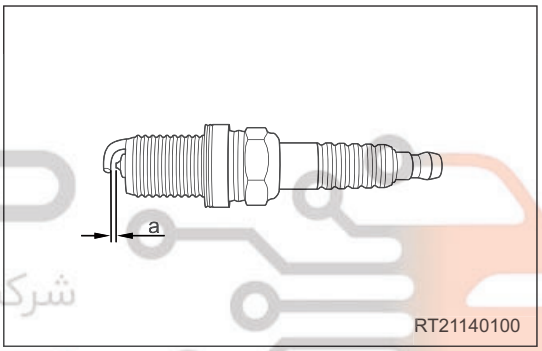


NG → Repair or replace connector

OK

3	Check spark plug of misfiring cylinder

a. Remove the spark plug of misfiring cylinder.
b. Check spark plug for burns, cracks or deposits.
c. Check spark plug gap.
OK: 0.8 - 0.9 mm



NG → Clean or replace spark plug

OK

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4	Check spark

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

NG → Go to step 6

OK

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5	Check compression of misfiring cylinder

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

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

OK →

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

6	Check spark of misfiring cylinder with a normally functioning spark plug

a. Replace the spark plug with a normally functioning one.

b. Perform spark test.

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

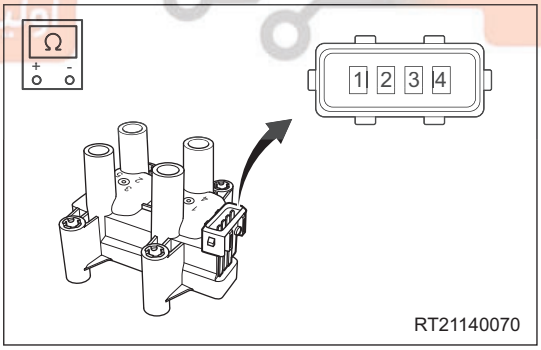
OK → **Replace spark plug**

NG →

7	Check ignition coil

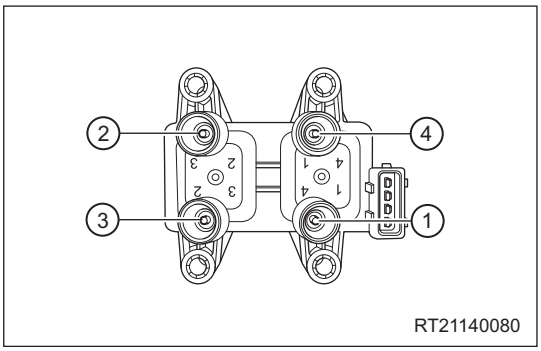
a. Check resistance of primary winding of ignition coil.

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



b. Check resistance of secondary winding of ignition coil.

Multimeter Connection	Condition	Specification (kΩ)
Post 1 - Post 4	Normal temperature	9.5 - 12.1
Post 2 - Post 3	Normal temperature	9.5 - 12.1



NG → **Replace ignition coil**

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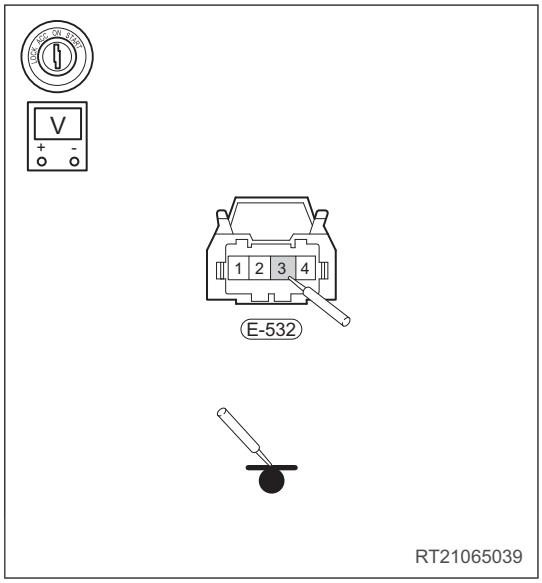
OK

8	Check ignition coil power supply voltage

a. Turn ignition switch to ON.

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

Multimeter Connection	Condition	Specified Condition
E-532 (3) - Body ground	Ignition switch ON	11 to 14 V



OK → Go to step 10

NG

9	Check ignition coil power supply circuit

a. Turn ignition switch to LOCK.

b. Check fuse EF07 and main relay.

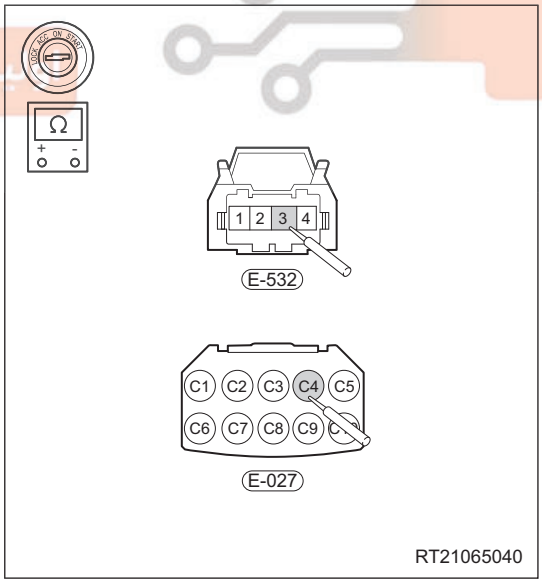
c. Check wire harness between ignition coil connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-532 (3) - E-027 (C4)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-532 (3) or E-027 (C4) - Body ground	Always	No continuity
E-532 (3) or E-027 (C4) - Battery positive	Always	No continuity



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

OK

10 Check ignition coil control circuit

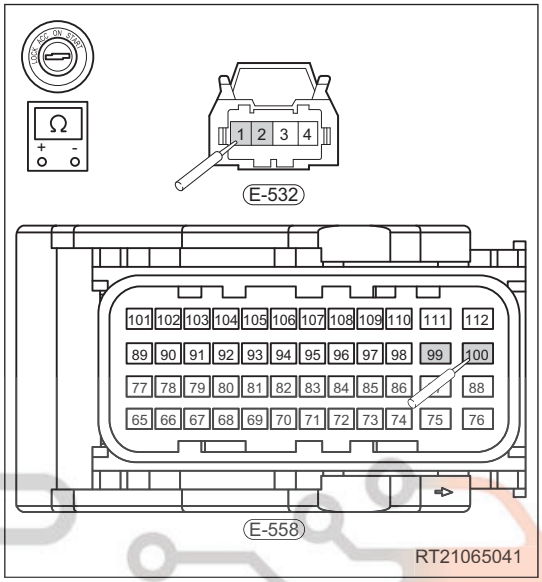
a. Turn ignition switch to LOCK.
b. Disconnect ECM connector E-558.
c. Check wire harness between ignition coil connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-532 (1) - E-558 (100)	Always	Continuity
E-532 (2) - E-558 (99)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-532 (1) or E-558 (100) - Body ground	Always	No continuity
E-532 (1) or E-558 (100) - Battery positive	Always	No continuity
E-532 (2) or E-558 (99) - Body ground	Always	No continuity
E-532 (2) or E-558 (99) - Battery positive	Always	No continuity



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

OK

11 Check for DTCs

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

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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.

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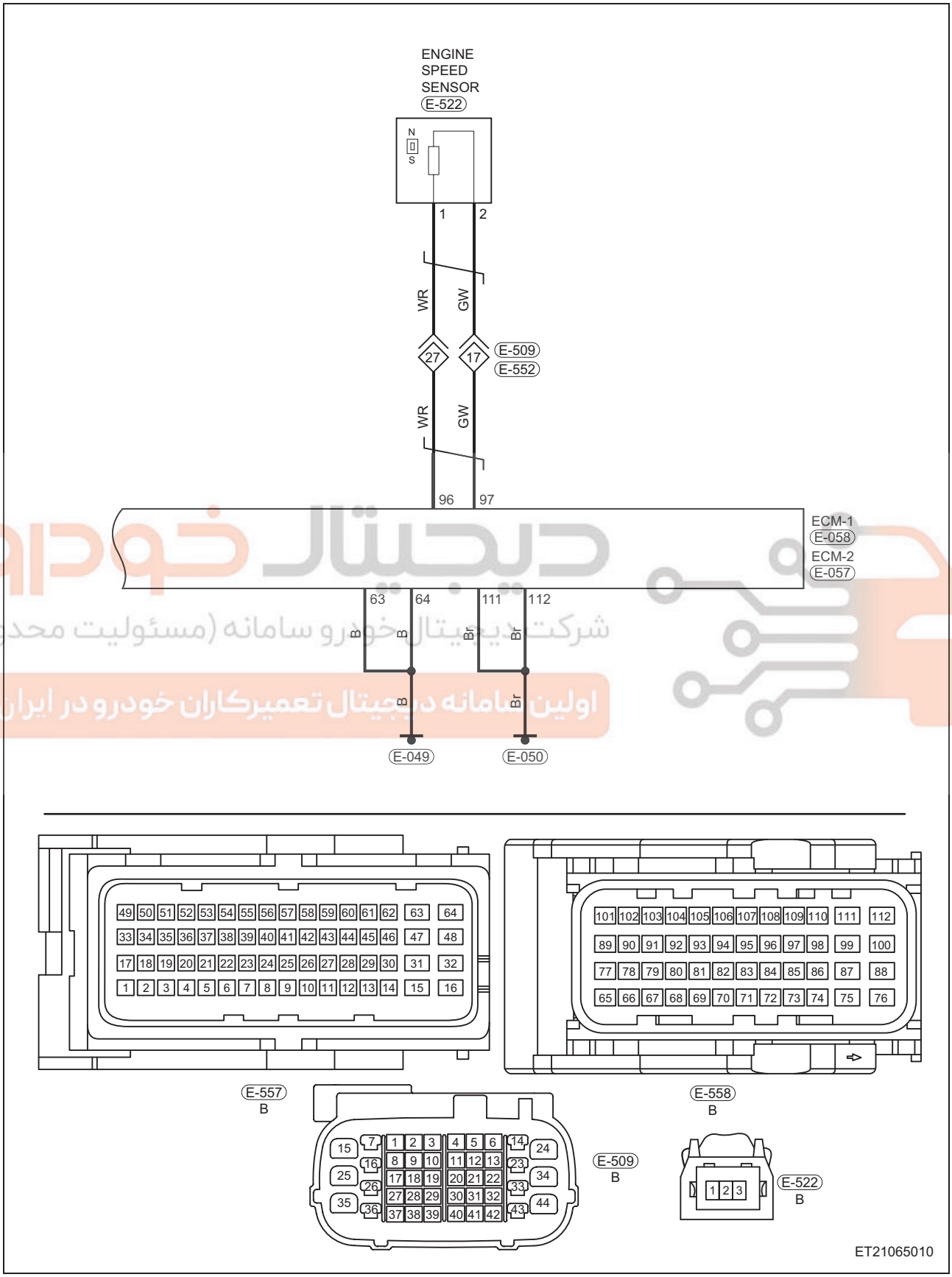
DTC	P0322 00	EPM - Crankshaft signal fault



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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0322 00	EPM - Crankshaft signal fault	Engine running	• Engine speed sensor • Flywheel gear ring • Wire harness or connector • ECM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK →

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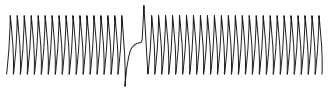
2	Check engine speed sensor signal waveform

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

	Normal Waveform of Engine Speed Senor Signal
Oscilloscope	 RT21060200

OK → Go to step 9

NG

3	Check engine speed sensor connector

a. Turn ignition switch to LOCK.
b. Disconnect engine speed sensor connector E-522.
c. Check engine speed sensor connector.

NG → Repair or replace engine speed sensor connector

OK

4	Check installation of engine speed sensor

a. Remove 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

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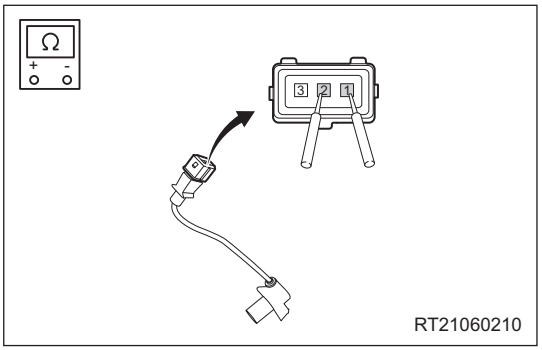
5	Check resistance of engine speed sensor

a. Check resistance between engine speed sensor terminals 1 and 2.

Normal resistance: 860 Ω ± 20% (at normal temperature)



NG → **Replace engine speed sensor**

OK

6	Check engine speed sensor circuit

a. Disconnect ECM connector E-558.

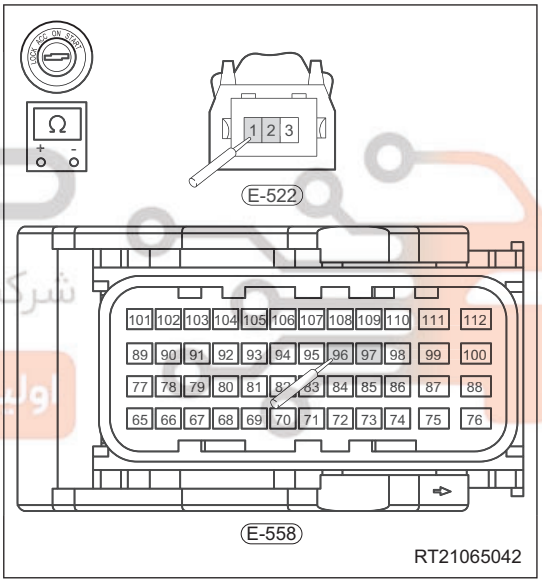
b. Check wire harness between engine speed sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-522 (1) - E-558 (96)	Always	Continuity
E-522 (2) - E-558 (97)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-522 (1) or E-558 (96) - Body ground	Always	No continuity
E-522 (1) or E-558 (96) - Battery positive		
E-522 (2) or E-558 (97) - Body ground		
E-522 (2) or E-558 (97) - Battery positive		



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

OK

7	Install a normal engine speed sensor and observe signal waveform

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

OK → **Replace engine speed sensor**

NG

8	Check flywheel gear ring

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

NG → **Clear off debris and clean flywheel gear ring. Replace flywheel if necessary (See page 07-42)**

OK

9	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0322 00 still exists.

NG → **Replace ECM**

OK

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

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DTC	P0327 00	Knock Sensor 1 Circuit Low

DTC	P0328 00	Knock Sensor 1 Circuit High

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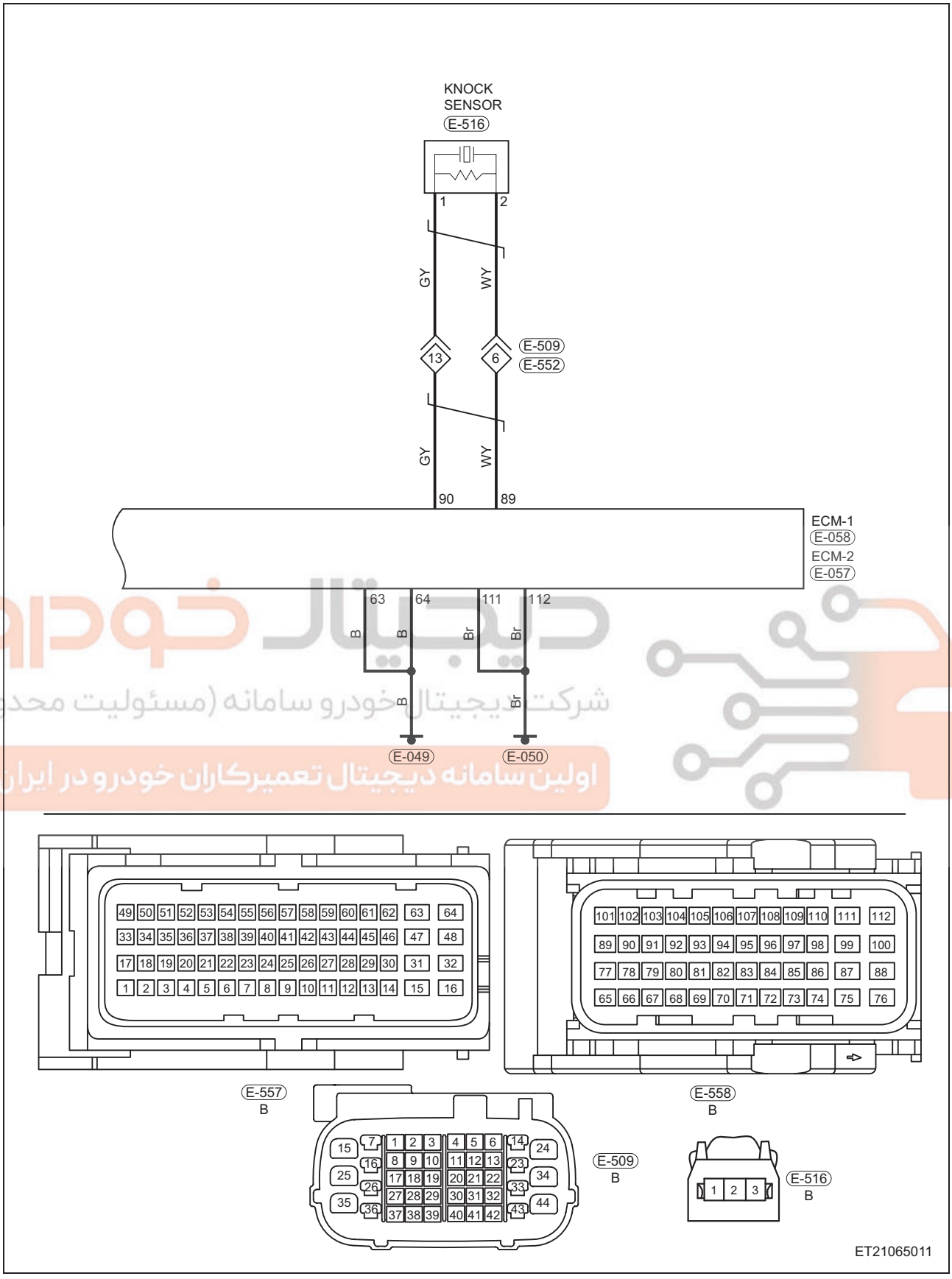

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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0327 00	Knock Sensor 1 Circuit Low	Engine running	• Knock sensor • Wire harness or connector • ECM
P0328 00	Knock Sensor 1 Circuit High		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

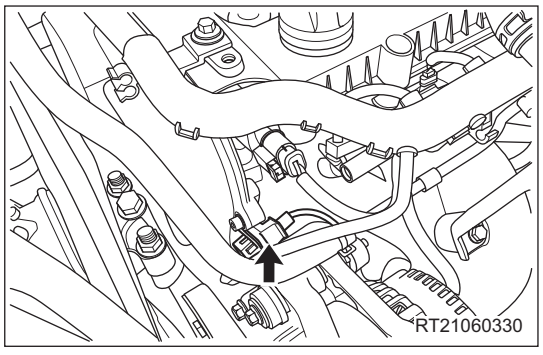
OK

2	Check knock sensor connector

a. Disconnect knock sensor connector E-516.

b. Check knock sensor connector.

NG → **Repair or replace connector**



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OK

3	Check installation of knock sensor

a. Remove knock sensor.

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

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

OK

4	Check resistance of knock sensor

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

OK: 4.9 ± 20% MΩ (at normal temperature)

NG → **Replace knock sensor**

OK

5	Check knock sensor signal circuit

a. Disconnect ECM wire harness connector E-558.

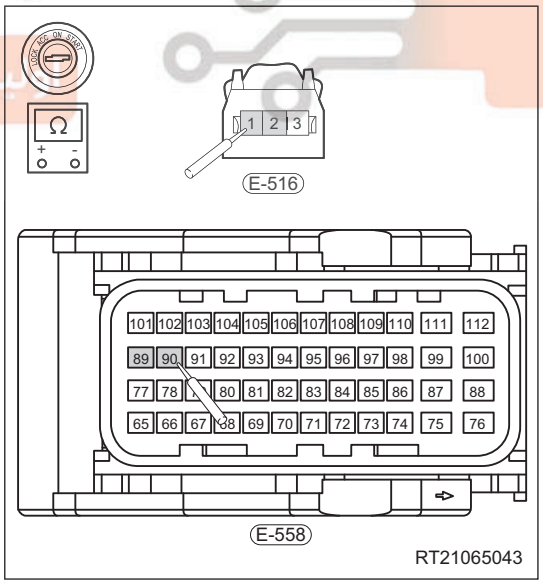
b. Check wire harness between terminals of connector E-558 and connector E-516.

Check for Open

Multimeter Connection	Specified Condition
E-558 (90) - E-516 (1)	Continuity
E-558 (89) - E-516 (2)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-558 (90) or E-516 (1) - Body ground	No continuity
E-558 (90) or E-516 (1) - Battery positive	No continuity
E-558 (89) or E-516 (2) - Body ground	No continuity
E-558 (89) or E-516 (2) - Battery positive	No continuity



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

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OK

6	Check knock sensor signal

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

NG → Replace knock sensor

OK

7	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0327 00 or P0328 00 still exists.

NG → Replace ECM

OK

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

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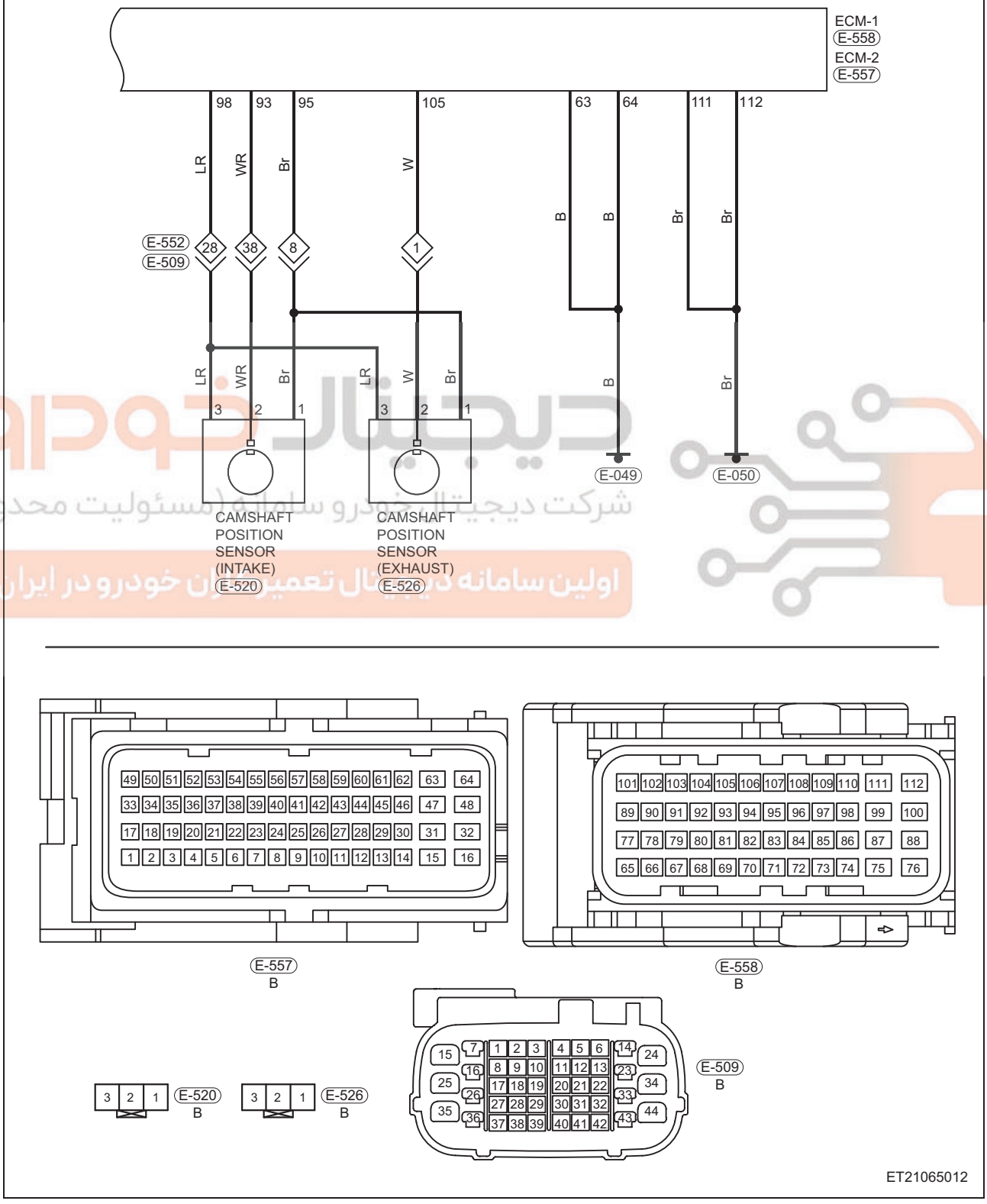
DTC	P0341 00	EPM - Camshaft signal fault

DTC	P0346 00	EPM - Camshaft2 signal fault



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DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0341 00	EPM - Camshaft signal fault	Engine running	• Camshaft position sensor (intake) • Camshaft position sensor (exhaust) • Camshaft • Wire harness or connector • ECM
P0346 00	EPM - Camshaft2 signal fault		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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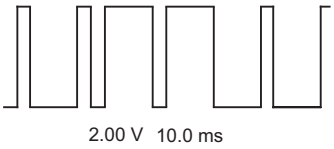
2	Check camshaft position sensor signal waveform

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

	Normal Waveform
Oscilloscope	

OK → Go to step 10

NG

3	Check camshaft position sensor connector

a. Turn ignition switch to LOCK.
b. Disconnect camshaft position sensor connectors E-520 and E-526.
c. Check camshaft position sensor connector.

NG → Repair or replace camshaft position sensor connector

OK

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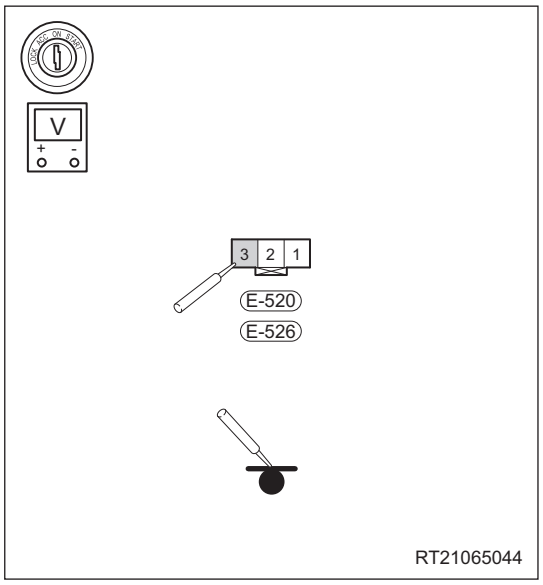
4	Check camshaft position sensor power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between terminal 3 of camshaft position sensor connector E-520 or E-526 and body ground.

Multimeter Connection	Condition	Specified Condition
E-520 (3) or E-526 (3) - Body ground	Ignition switch ON	5 V



OK → **Go to step 6**

NG

5	Check camshaft position sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect ECM connector E-558.

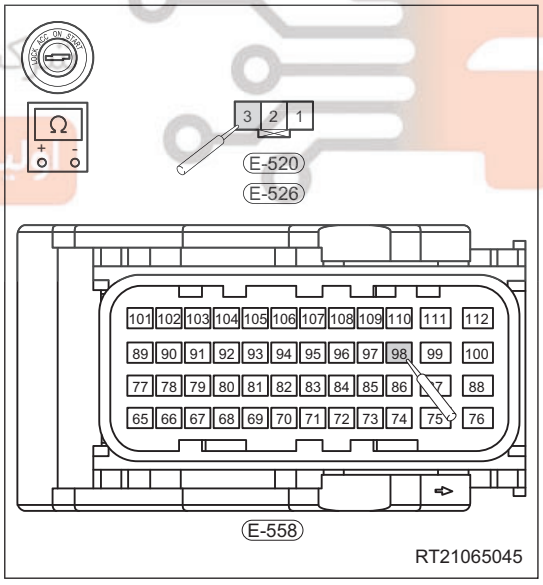
c. Check wire harness between camshaft position sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-520 (3) - E-558 (98)	Always	Continuity
E-526 (3) - E-558 (98)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-520 (3), E-526 (3) or E-558 (98) - Body ground	Always	No continuity
E-520 (3), E-526 (3) or E-558 (98) - Battery positive	Always	No continuity



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

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OK

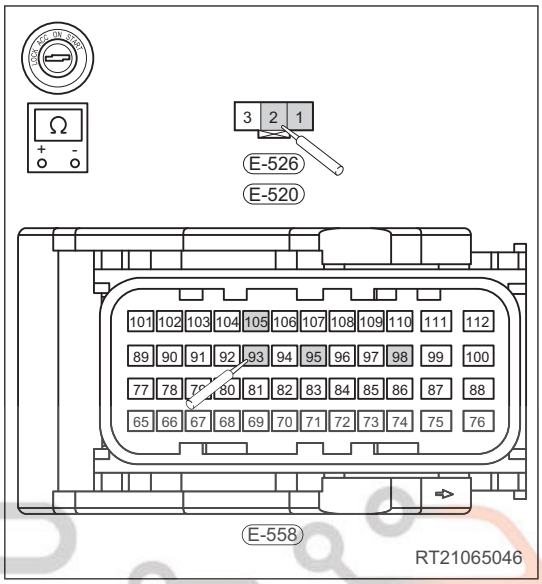
Replace ECM

6 Check camshaft position sensor signal circuit and ground circuit

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

Check for Open

Multimeter Connection	Condition	Specified Condition
E-520 (2) - E-558 (93)	Always	Continuity
E-526 (2) - E-558 (105)		
E-020 (1), E-526 (1) - E-558 (95)		



Check for Short

Multimeter Connection	Condition	Specified Condition
E-520 (2) or E-558 (93) - Body ground	Always	No continuity
E-520 (2) or E-558 (93) - Battery positive		
E-526 (2) or E-558 (105) - Body ground		
E-526 (2) or E-558 (105) - Battery positive		
E-520 (1), E-526 (1) or E-558 (98) - Body ground		
E-520 (1), E-526 (1) or E-558 (98) - Battery positive		

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

OK

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7	Check installation of camshaft position sensor

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

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

OK ↓

8	Check camshaft gear ring

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

NG → **Clear off debris and clean camshaft gear ring or replace camshaft**

OK ↓

9	Install a normal camshaft position sensor and observe signal waveform

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

OK → **Replace camshaft position sensor**

NG ↓

10	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0341 00 or P0346 00 still exists.

NG → **Replace ECM**

OK ↓

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

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DTC	P0420 00	Catalyst System, Bank1 Efficiency Below Threshold

DTC Code	DTC Definitions	DTC Detection Conditions	Possible Cause
P0420 00	Catalyst System, Bank1 Efficiency Below Threshold	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 the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

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 the 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 for other DTCs first**

A

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2	Read datastream

a. Read datastream using diagnostic tester.
b. Check datastream below.

Item	OK (Idling)	If it is NG, proceed to
Upstream Oxygen Sensor Voltage	Quickly fluctuates between 0.1 to 0.9 V	A
Downstream Oxygen Sensor Voltage	Fluctuates slightly at about 0.45 V	B
Average Injection Pulse Width	1.5 - 2.9 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 the 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

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5	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0420 00 still exists.

NG → Replace ECM

OK →

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

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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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DTC	P0444 13	Evaporative Emiss. System Purge Control Valve Circ. Open

DTC	P0458 16	Evaporative Emission System Purge Control Valve Circuit Low

DTC	P0459 17	Evaporative Emission System Purge Control Valve Circuit High

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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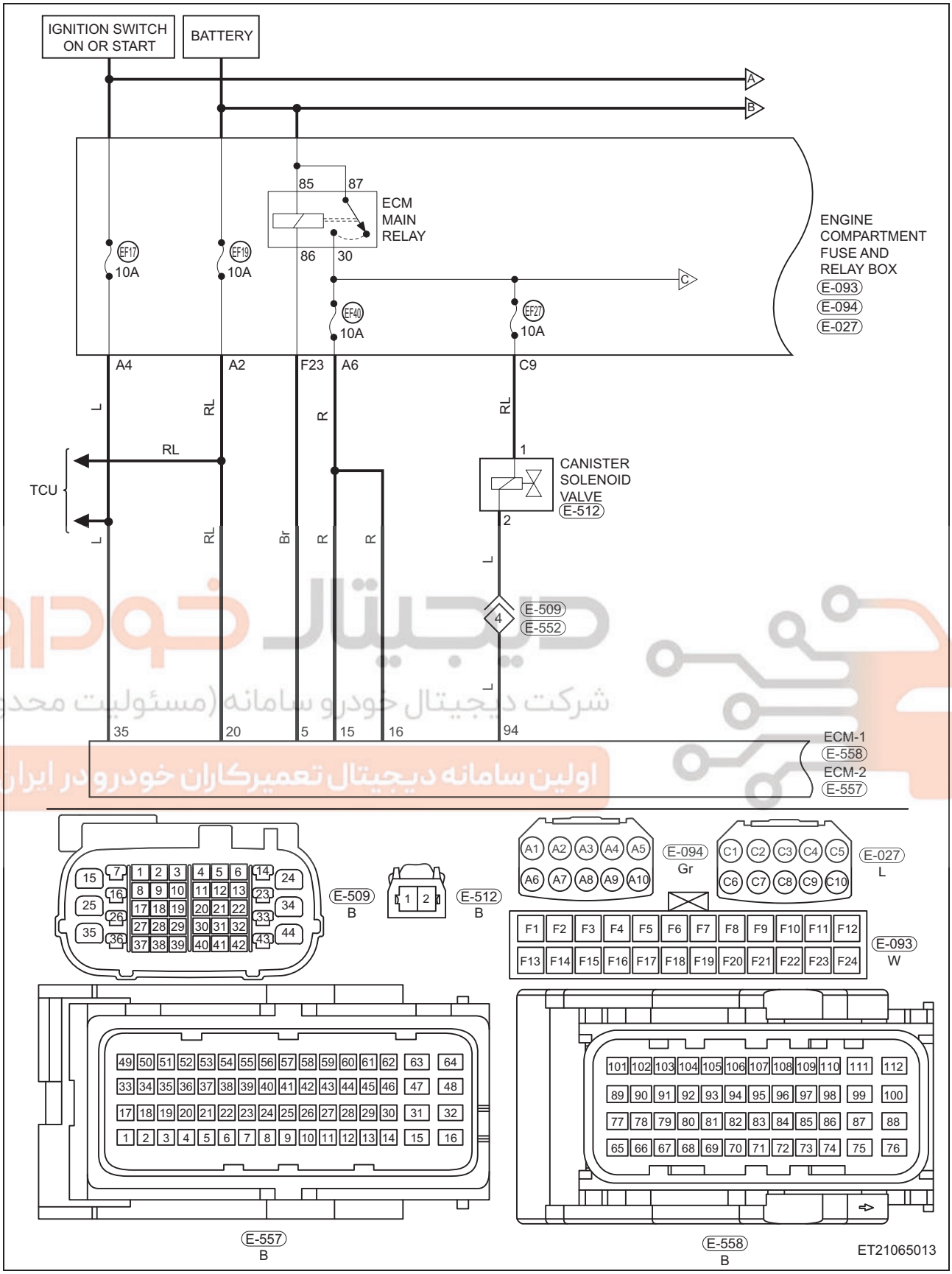

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0444 13	Evaporative Emiss. System Purge Control Valve Circ. Open	Engine running	• Canister solenoid valve • Wire harness or connector • ECM
P0458 16	Evaporative Emission System Purge Control Valve Circuit Low		
P0459 17	Evaporative Emission System Purge Control Valve Circuit High		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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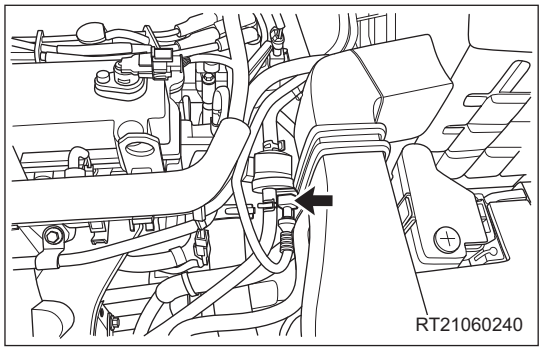
2	Check canister solenoid valve connector

a. Disconnect canister solenoid valve connector E-512.
b. Check canister solenoid valve connector.



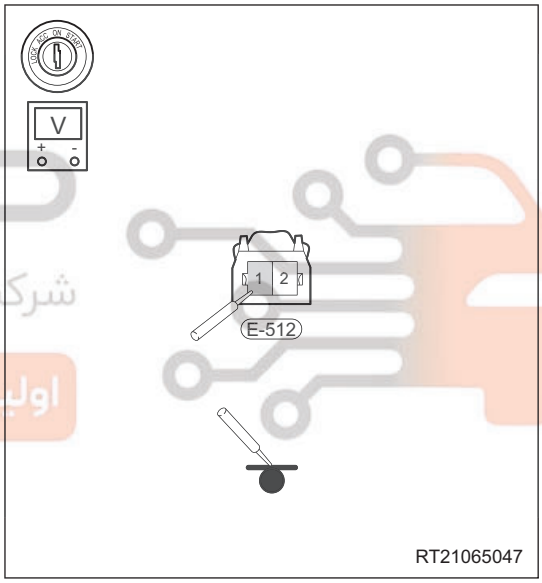
NG → Repair or replace connector

OK

3	Check canister solenoid valve power supply voltage

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

Multimeter Connection	Condition	Specified Condition
E-512 (1) - Body ground	Ignition switch ON	11 to 14 V



OK → Go to step 5

NG

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4	Check canister solenoid valve power supply circuit

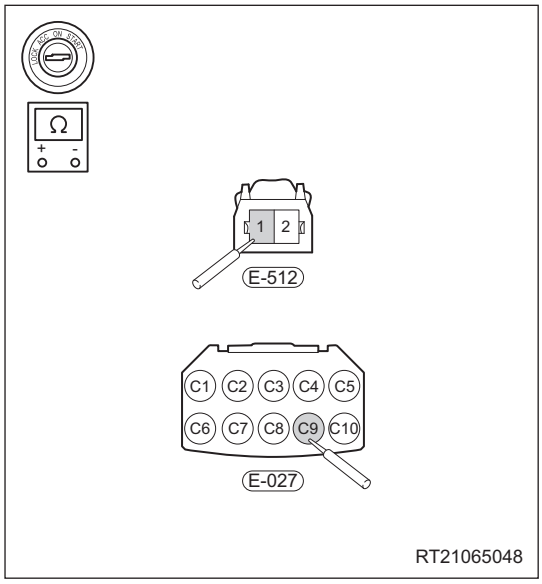
a. Turn ignition switch to LOCK.
b. Check fuse EF27 and main relay.
c. Disconnect engine compartment fuse and relay box connector E-027.
d. Check wire harness between canister solenoid valve connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-512 (1) - E-027 (C9)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-512 (1) or E-027 (C9) - Body ground	Always	No continuity
E-512 (1) or E-027 (C9) - Battery positive	Always	No continuity



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

OK

دیجیتال خودرو
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5	Check canister solenoid valve control circuit

a. Disconnect ECM connector E-558.

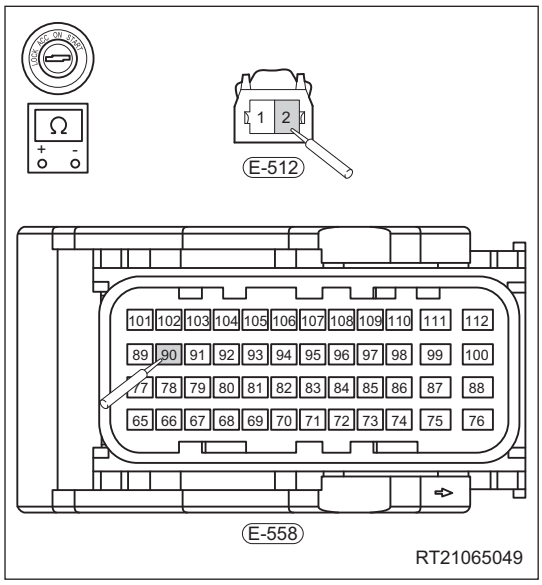
b. Check wire harness between canister solenoid valve connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-512 (2) - E-558 (90)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-512 (2) or E-558 (90) - Body ground	Always	No continuity
E-512 (2) or E-558 (90) - Battery positive		



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

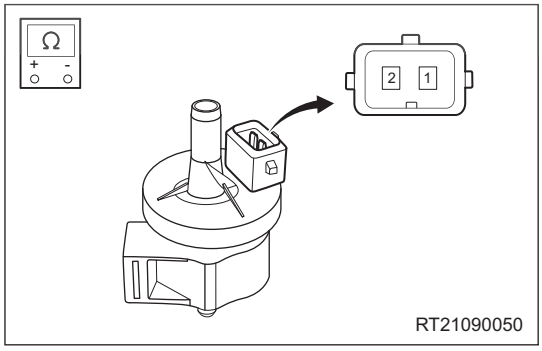
OK

6	Check canister solenoid valve

a. Check resistance of canister solenoid valve.

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

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



NG → **Replace canister solenoid valve**

OK

7	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0444 00, P0458 00 or P0459 00 still exists.

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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.

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DTC	P0480 13	Cooling Fan 1 Control Circuit error

DTC	P0481 13	Cooling Fan 2 Control Circuit error

DTC	P0691 11	Cooling Fan 1 Control Circuit Low

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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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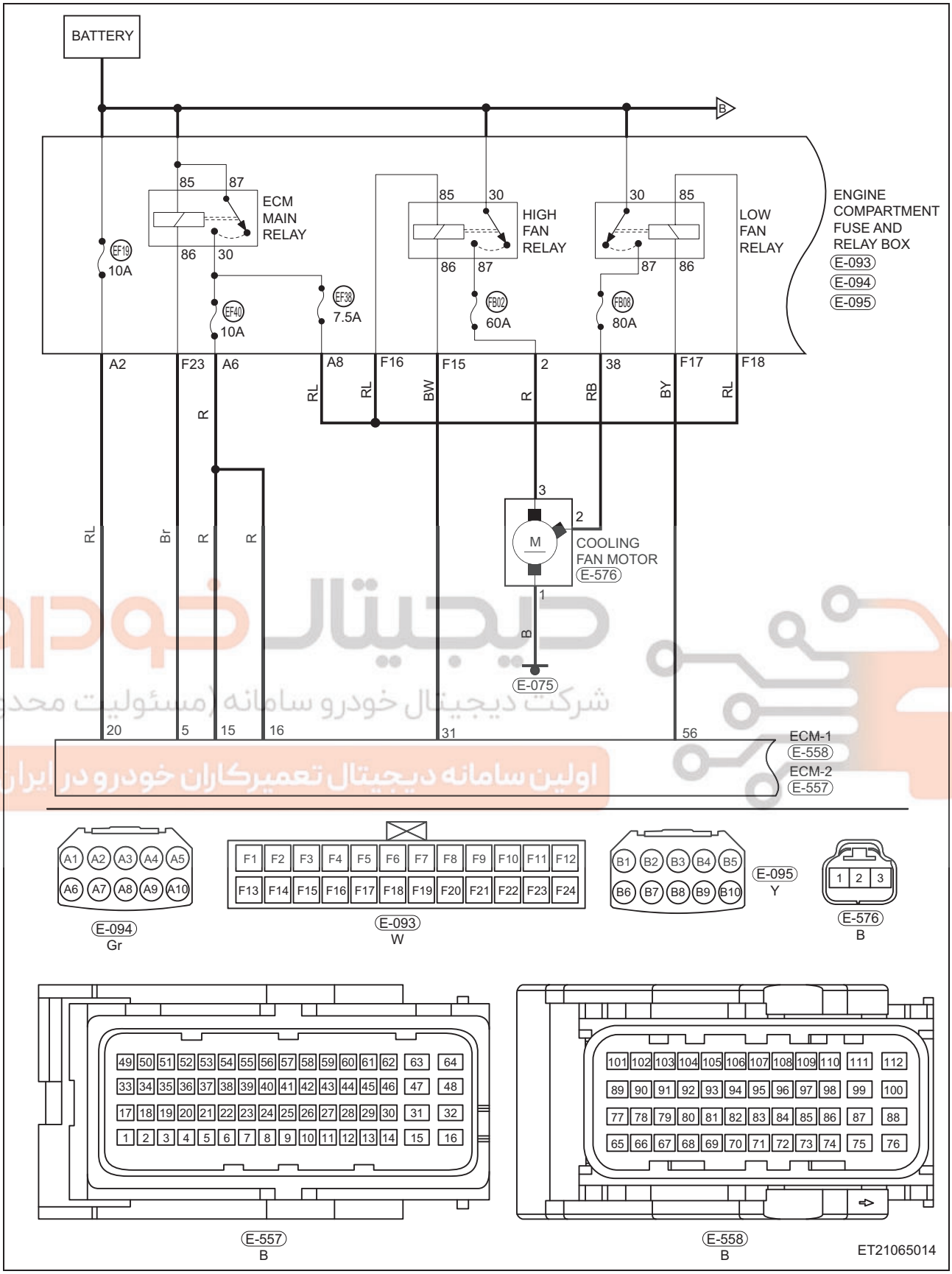

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0480 13	Cooling Fan 1 Control Circuit error	Ignition switch ON	• Cooling fan relay • Cooling fan controller • Fuse • Wire harness or connector • ECM
P0481 13	Cooling Fan 2 Control Circuit error		
P0691 11	Cooling Fan 1 Control Circuit Low		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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2	Check cooling fan controller connector

a. Disconnect cooling fan controller connector E-576.
b. Check cooling fan controller connector.

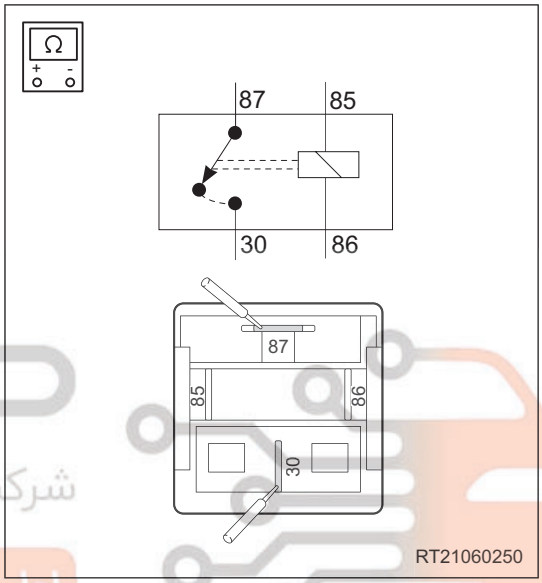
NG → Repair or replace connector

OK

3	Check cooling fan fuse and relay

a. Unplug cooling fan fuse and relay from engine compartment fuse and relay box.
b. Check if fuse is normal.
c. Check cooling fan relay.

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



NG → Replace fuse or relay

OK

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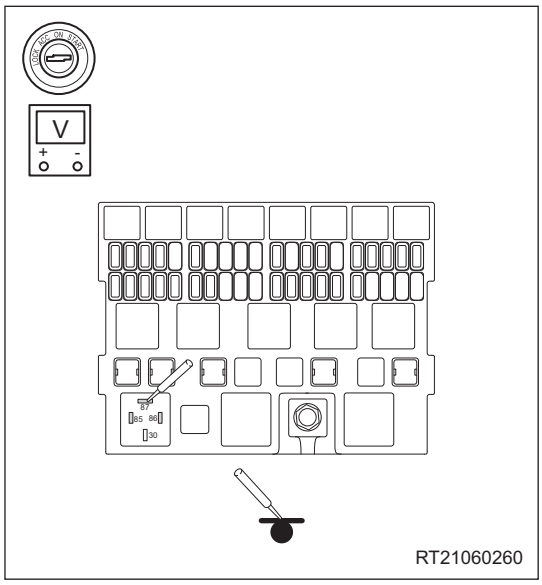
4	Check cooling fan relay circuit voltage

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

Multimeter Connection	Condition	Specified Condition
Terminal 87 - Body ground	Always	11 to 14 V
Terminal 85 - Body ground	Ignition switch ON	11 to 14 V
Terminal 86 - Body ground	Always	0 V



NG → **Check engine compartment fuse and relay box, repair or replace wire harness or connector (fan relay - battery)**

OK →

5	Check wire harness and connector

a. Disconnect fuse and relay box connector E-093.

b. Disconnect ECM connector E-557.

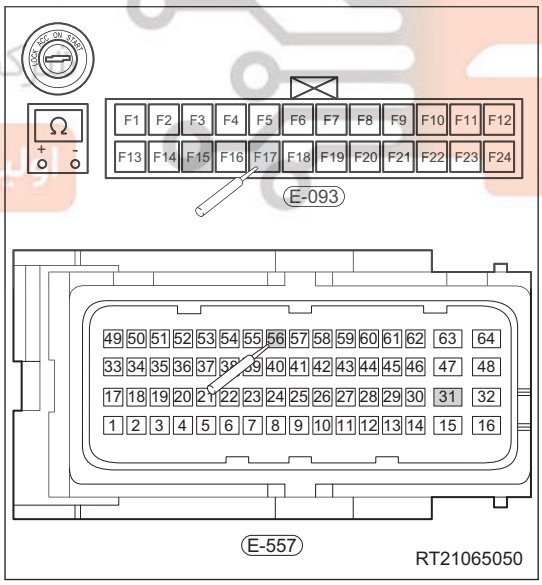
c. Check wire harness between fan controller connector and ECM connector, engine compartment fuse and relay box connector and body ground.

Check for Open

Multimeter Connection	Specified Condition
E-557 (56) - E-093 (F17)	Continuity
E-557 (31) - E-093 (F15)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (56), E-093 (F17), E-557 (31), E-093 (F15) - Body ground	No continuity
E-557 (56), E-093 (F17), E-557 (31), E-093 (F15) - Battery positive	No continuity



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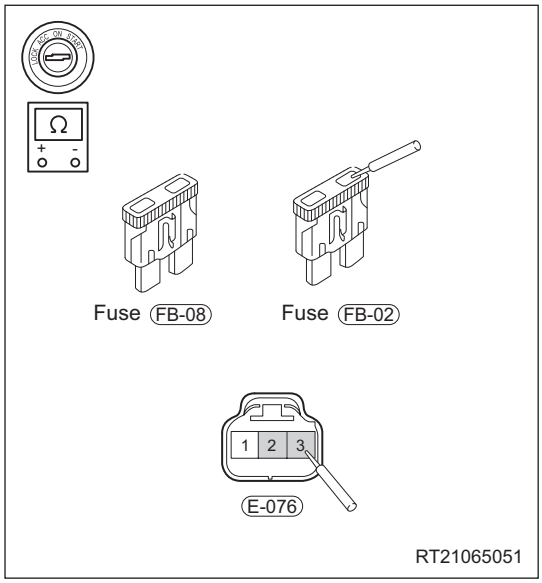
Check for Open

Multimeter Connection	Specified Condition
E-576 (2) - FB08	Continuity
E-576 (3) - FB02	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-576 (2/3) - Body ground	No continuity
E-576 (2/3) - Battery positive	No continuity



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

OK → **Replace cooling fan controller, and go to step 6**

6	Check for DTCs

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

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DTC	P0560 00	Non-plausible error of battery voltage

DTC	P0562 16	System Voltage Low

DTC	P0563 17	System Voltage High

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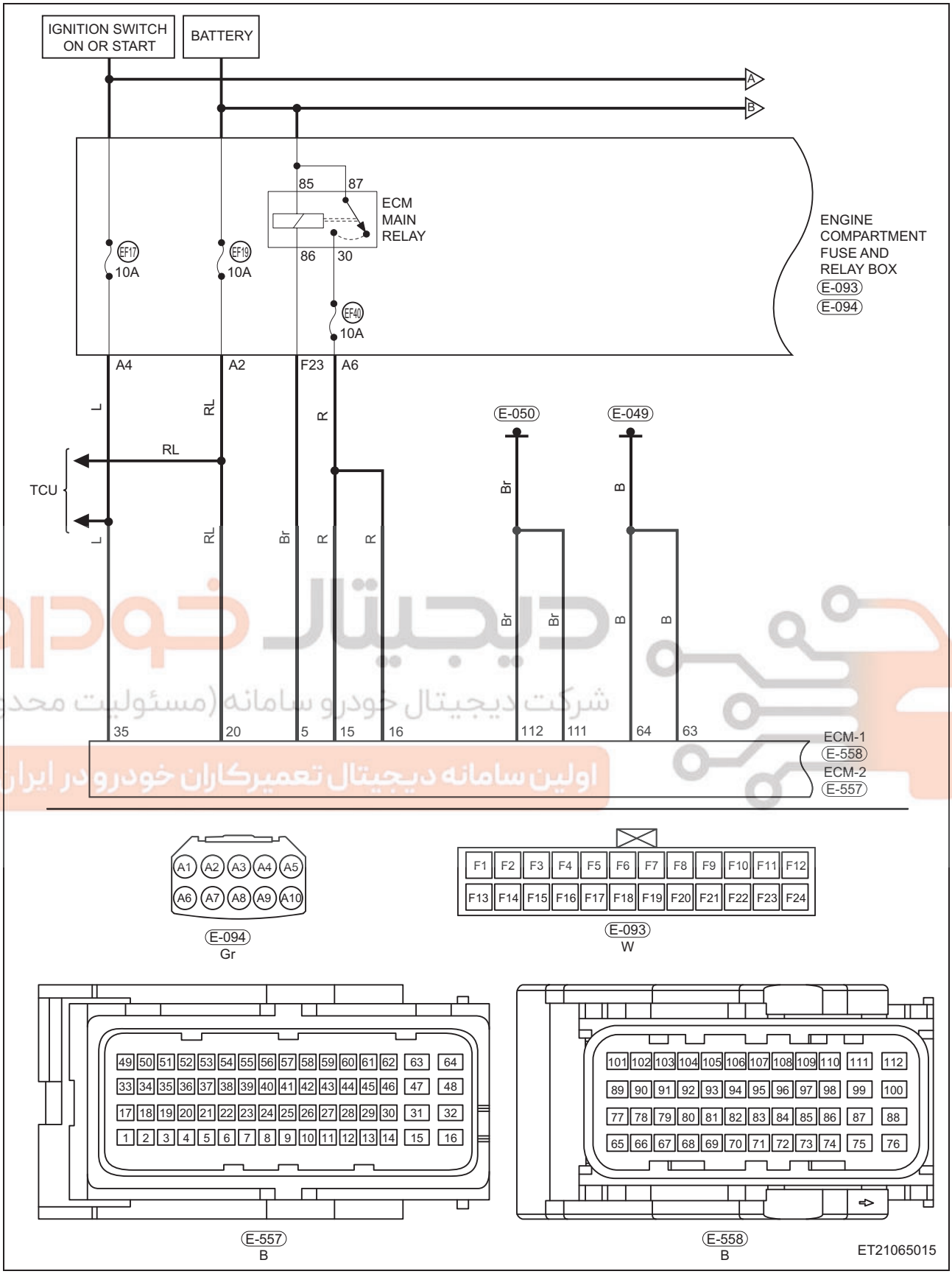

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0560 00	System Voltage Malfunction	Ignition switch ON	• Fuse • Wire harness or connector • Battery • Battery terminal • ECM
P0562 16	System Voltage Low		
P0563 17	System Voltage High		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (سهامی خاص)
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Diagnosis Procedure

1	Check battery

a. Check if battery voltage is normal.

NG → Recharge or replace battery

OK ↓

2	Check battery terminals

a. Check if battery terminals are loose or corroded.

NG → Tighten or replace battery terminals

OK ↓

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3	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK ↓

4	Check ECM connector

a. Disconnect ECM connector E-557 and E-558.

b. Check ECM connector.

NG → **Repair or replace ECM connector**

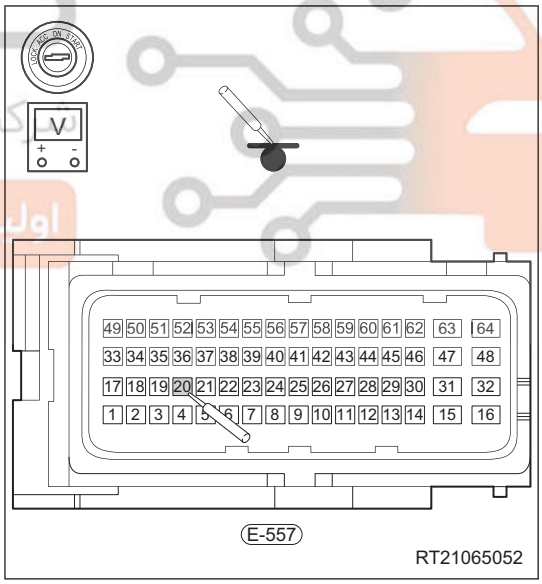
OK ↓

5	Check ECM power supply voltage (battery voltage)

a. Measure voltage between ECM connector E-557 terminal and body ground.

Multimeter Connection	Condition	Specified Condition
E-557 (20) - Body ground	Always	11 to 14 V

OK → **Go to step 8**



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6	Check ECM fuse

a. Unplug ECM fuse EF19 (10 A) from engine compartment fuse and relay box.

b. Check resistance of fuse EF19.

Standard resistance: less than 1 Ω

NG → **Replace ECM fuse**

OK

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

a. Disconnect engine compartment fuse and relay box connector E-094.

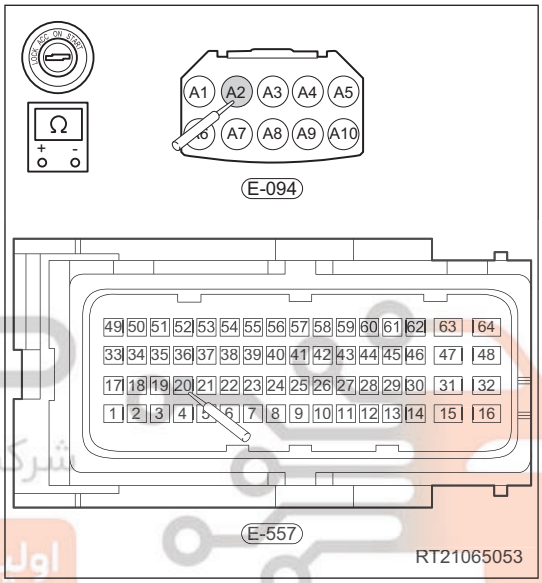
b. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Specified Condition
E-557 (20) - E-094 (A2)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (20) or E-094 (A2) - Body ground	No continuity
E-557 (20) or E-094 (A2) - 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)

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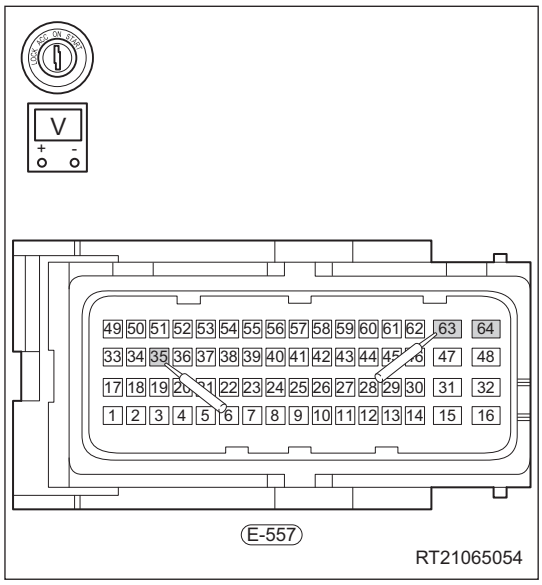
8	Check ECM power supply voltage (ignition switch voltage)

a. Connect engine compartment fuse and relay box connector E-094.

b. Turn ignition switch to ON.

c. Check voltage between terminals of ECM connector E-557.

Multimeter Connection	Condition	Specified Condition
E-557 (35) - E-558 (63) or E-557 (64)	Ignition switch ON	11 to 14 V



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OK → Go to step 12

NG

9	Check ECM fuse

a. Unplug fuse EF17 (10 A) from engine compartment fuse and relay box.

b. Check resistance of fuse EF17.

Standard resistance: less than 1 Ω

NG → Replace fuse

OK

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

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a. Disconnect engine compartment fuse and relay box connector E-094.

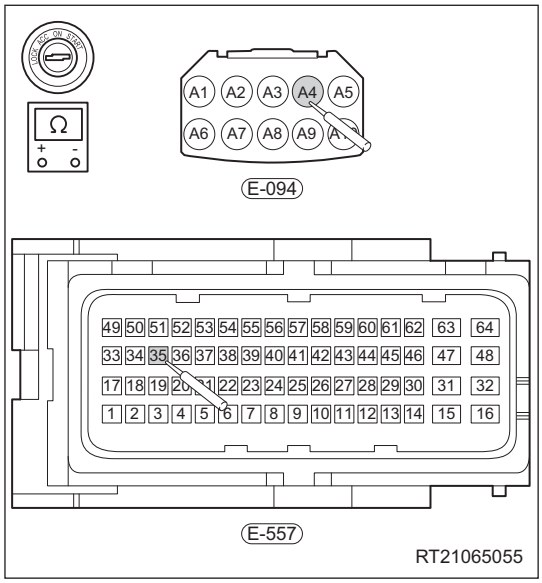
b. Check wire harness between ECM connector terminals and engine compartment fuse and relay box connector terminals.

Check for Open

Multimeter Connection	Specified Condition
E-557 (35) - E-094 (A4)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (35) or E-094 (A4) - Body ground	No continuity
E-557 (35) or E-094 (A4) - Battery positive	No continuity



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

OK

11	Check ignition switch assembly (See page 24-14)

NG → **Replace ignition switch assembly**

OK

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

12	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

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

NG → **Replace ECM**

OK

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

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DTC	P0627 13	Fuel Pump Control Circuit/Open

DTC	P0628 11	Fuel Pump Control Circuit Low

DTC	P0629 12	Fuel Pump Control Circuit High

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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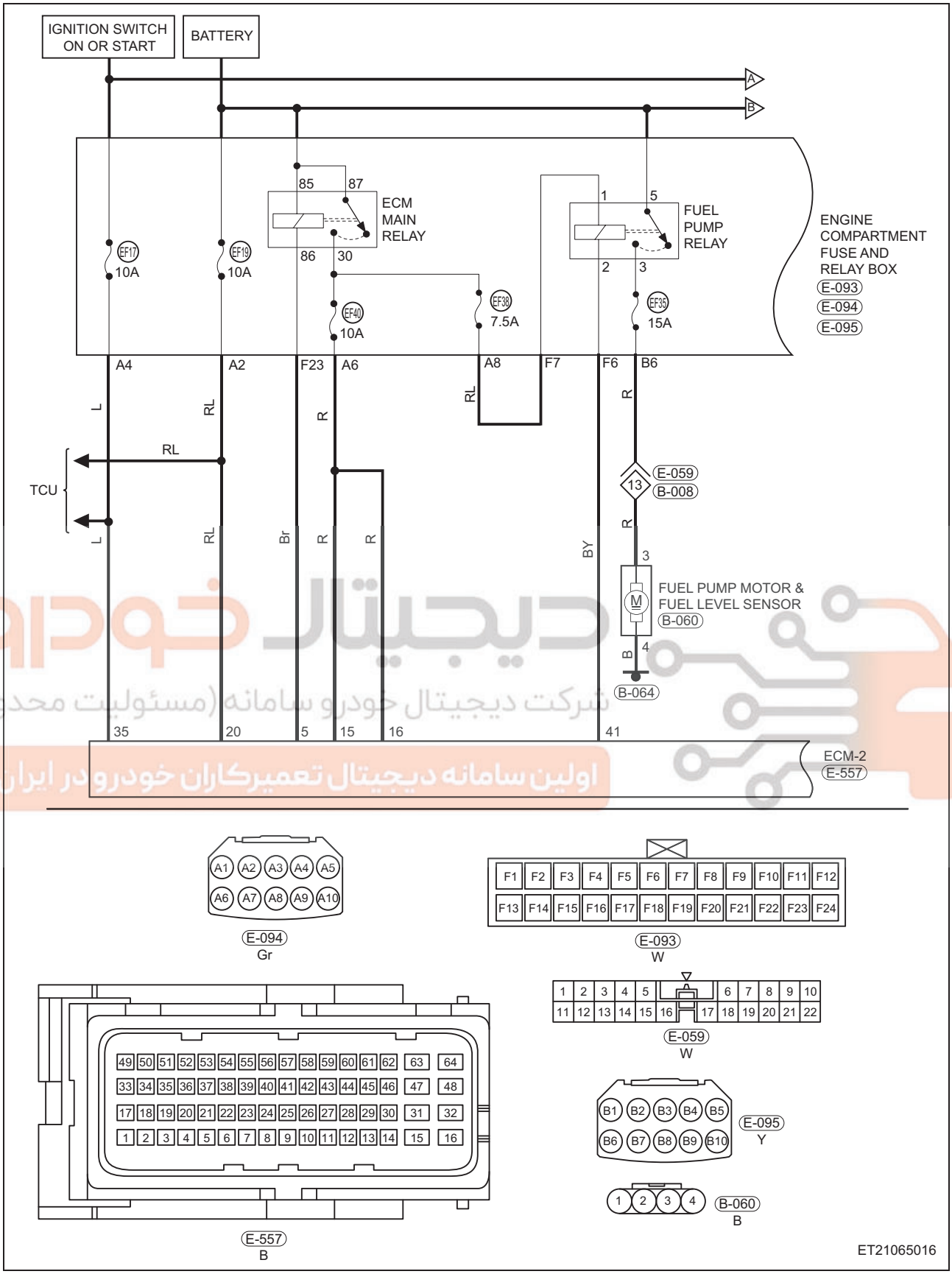

E-094
Gr

E-093
W

E-059
W

E-557
B

E-095
Y

B-060
B

ET21065016

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0627 13	Fuel Pump Control Circuit/Open	Ignition switch ON Engine running	• Fuel pump relay • Wire harness or connector • ECM • Engine compartment fuse and relay box
P0628 11	Fuel Pump Control Circuit Low		
P0629 12	Fuel Pump Control Circuit High		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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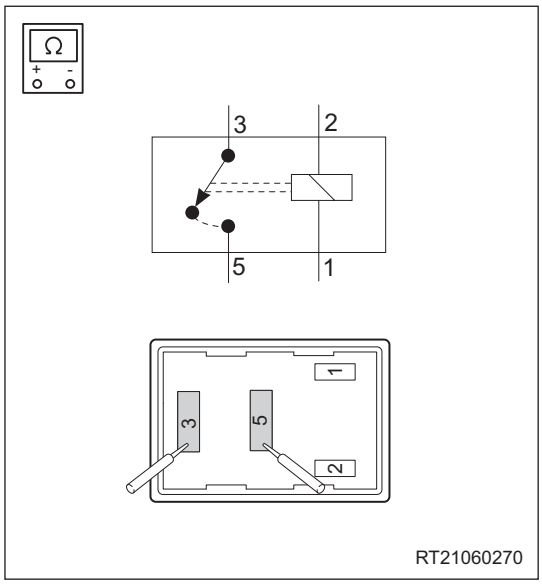
2	Check fuel pump relay

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

b. Check fuel pump relay terminals.

Multimeter Connection	Specified Condition
3 - 5	No continuity
3 - 5	Continuity (when battery voltage is applied between terminals 1 and 2)



NG → **Replace fuel pump relay**

OK

3	Check fuel pump relay control circuit

a. Disconnect engine compartment fuse and relay box connector E-093.

b. Disconnect ECM connector E-557.

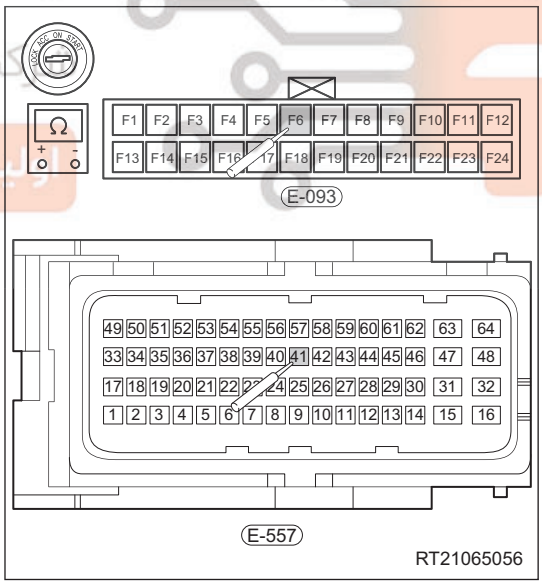
c. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Specified Condition
E-557 (41) - E-093 (F6)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (41) or E-093 (F6) - Body ground	No continuity
E-557 (41) or E-093 (F6) - Battery positive	No continuity



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

OK

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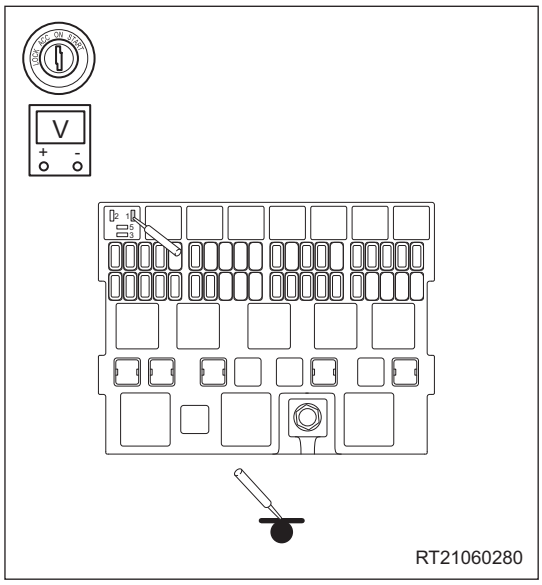
4	Check fuel pump relay terminal voltage

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

Multimeter Connection	Condition	Specified Condition
Fuel pump relay terminal 1 (engine compartment fuse and relay box side) - Body ground	Ignition switch ON	11 to 14 V



OK → Go to step 6

NG

5	Check main relay and fuse EF38

NG → Replace main relay or fuse

OK

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

6	Check for DTCs

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

NG → Replace ECM

OK

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

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

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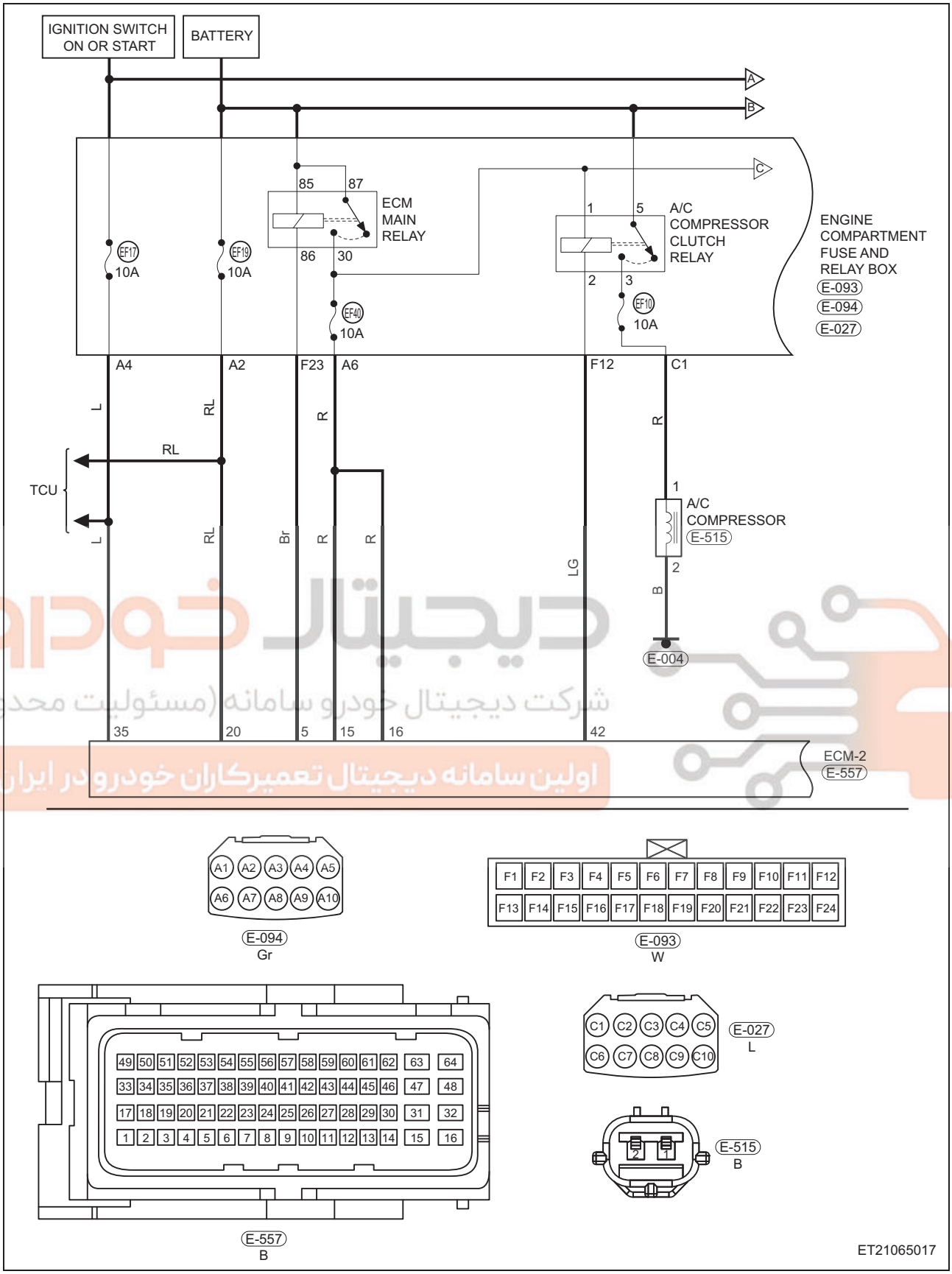

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0645 13	A/C Clutch Relay Circuit	Ignition switch ON Engine running	• A/C compressor relay • Wire harness or connector • ECM
P0646 11	A/C Clutch Relay Control Circuit Low		
P0647 12	A/C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

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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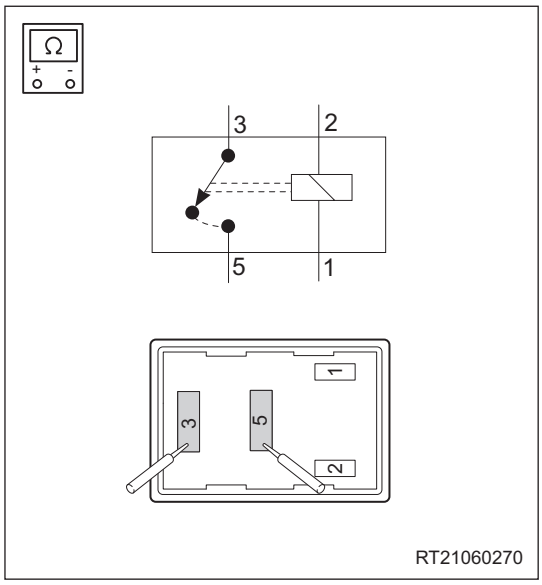
2	Check A/C compressor relay

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

b. Check A/C compressor relay terminals.

Multimeter Connection	Specified Condition
3 - 5	No continuity
3 - 5	Continuity (when battery voltage is applied between terminals 1 and 2)



NG → Replace A/C compressor relay

OK →

3	Check A/C compressor relay control circuit

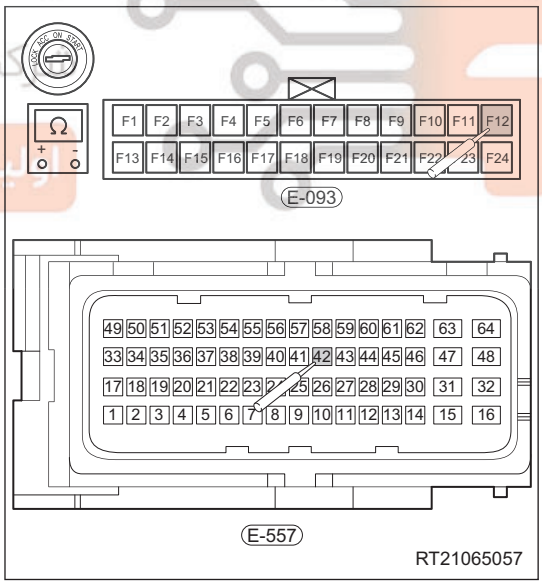
a. Disconnect engine compartment fuse and relay box connector E-093.

b. Disconnect ECM connector E-557.

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

Check for Open

Multimeter Connection	Condition	Specified Condition
E-557 (42) - E-094 (F12)	Always	Continuity



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Check for Short

Multimeter Connection	Condition	Specified Condition
E-557 (42) or E-094 (F12) - Body ground	Always	No continuity
E-557 (42) or E-094 (F12) - Battery positive	Always	No continuity

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

OK

4	Check for DTCs

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

NG → **Replace ECM**

OK

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

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DTC	P0688 91	Power Relay Sense Circuit Non-plausible error

DTC	P0688 92	Power Relay Sense Circuit Signal error

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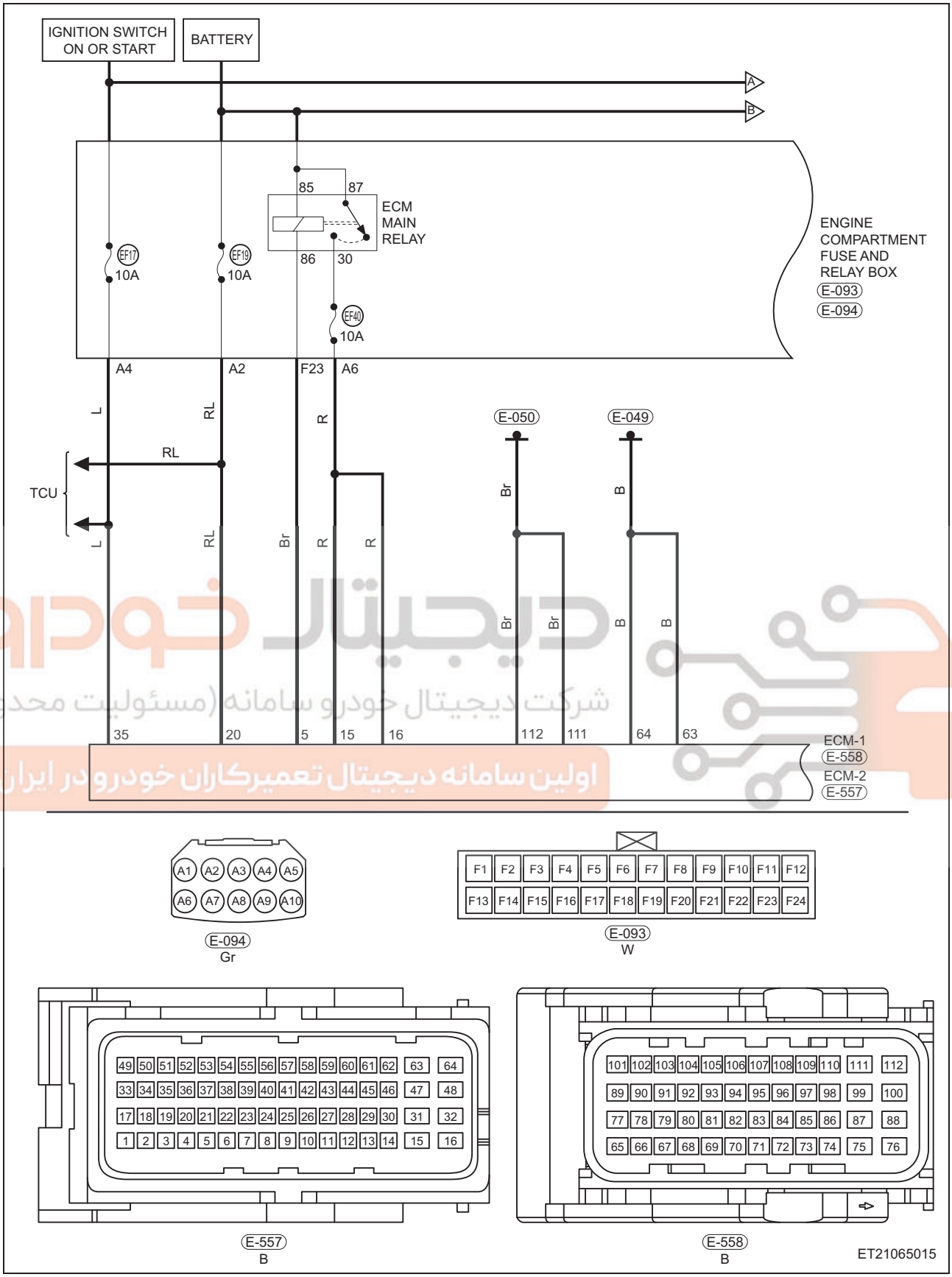

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0688 91	Power Relay Sense Circuit Non-plausible error	Ignition switch ON	• Main Relay • Wire harness or connector • ECM
P0688 92	Power Relay Sense Circuit Signal error		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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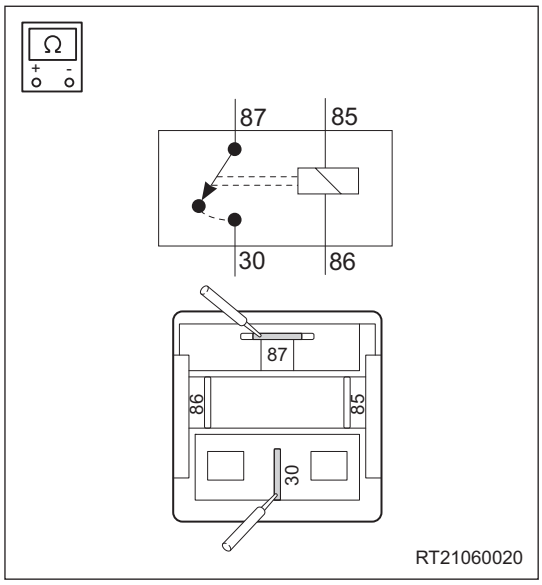
2	Check main relay and fuse

a. Unplug main relay and fuse EF40 from engine compartment fuse and relay box.

b. Check if fuse EF40 is normal.

c. Check for continuity between terminals of main relay.

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



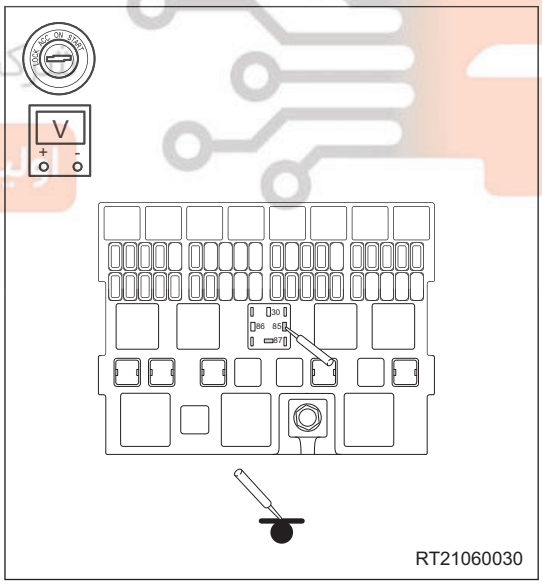
NG → **Replace main relay**

OK

3	Check main relay circuit voltage

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

Multimeter Connection	Condition	Specified Condition
Main relay terminals 87 and 85 (engine compartment fuse and relay box side) - Body ground	Always	11 to 14 V



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

OK

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

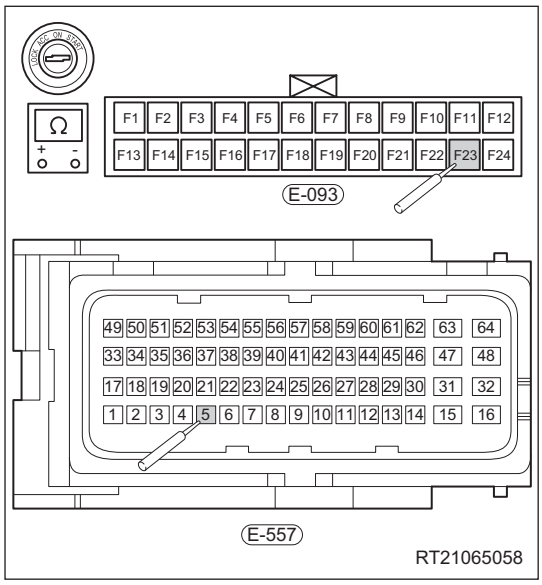
a. Disconnect fuse and relay box connectors E-069 and E-094.
b. Disconnect ECM connector E-557.
c. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Specified Condition
E-557 (5) - E-093 (F23)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (5) or E-093 (F23) - Body ground	No continuity
E-557 (5) or E-094 (F23) - Battery positive	No continuity

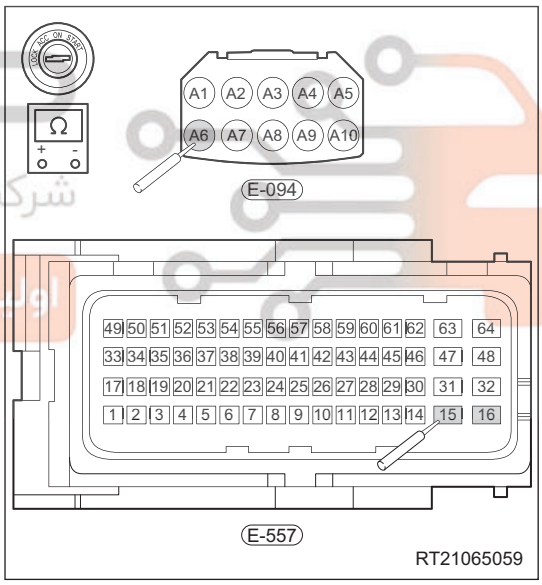


Check for Open

Multimeter Connection	Specified Condition
E-557 (15) - E-094 (A6)	Continuity
E-557 (16) - E-076 (A6)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (15, 16) or E-094 (A6) - Body ground	No continuity
E-557 (15, 16) or E-094 (A6) - Battery positive	No continuity



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

OK

5	Check for DTCs

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

NG → **Replace ECM**

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OK

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

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DTC	P0604 43	Internal contr.module RAM error

DTC	P0605 43	Internal contr.module ROM error

DTC	P0606 00	Safety monitoring fuel cutoff error

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0604 43	Internal contr.module RAM error	Ignition switch ON	• Wire harness or connector • ECM
P0605 43	Internal contr.module ROM error		
P0606 00	Safety monitoring fuel cutoff error		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK ↓

2	Check ECM connector

a. Disconnect ECM connector E-557 and E-558.

b. Check if connector is normal.

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NG → Repair or replace connector

OK

Replace ECM

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DTC	P1619 00	ECM Not Programmed (Virgin State)

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P1619 00	ECM Not Programmed (Virgin State)	Ignition switch ON	• Wire harness or connector • ECM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK ↓

2	Check ECM connector

a. Disconnect ECM connector E-557 and E-558.

b. Check if connector is normal.

NG → **Repair or replace connector**

OK ↓

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3	**Use X-431 3G diagnostic tester to match ECM (See page 67-3), and check for DTCs**

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P1619 00 still exists.

NG → **Replace ECM**

OK

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

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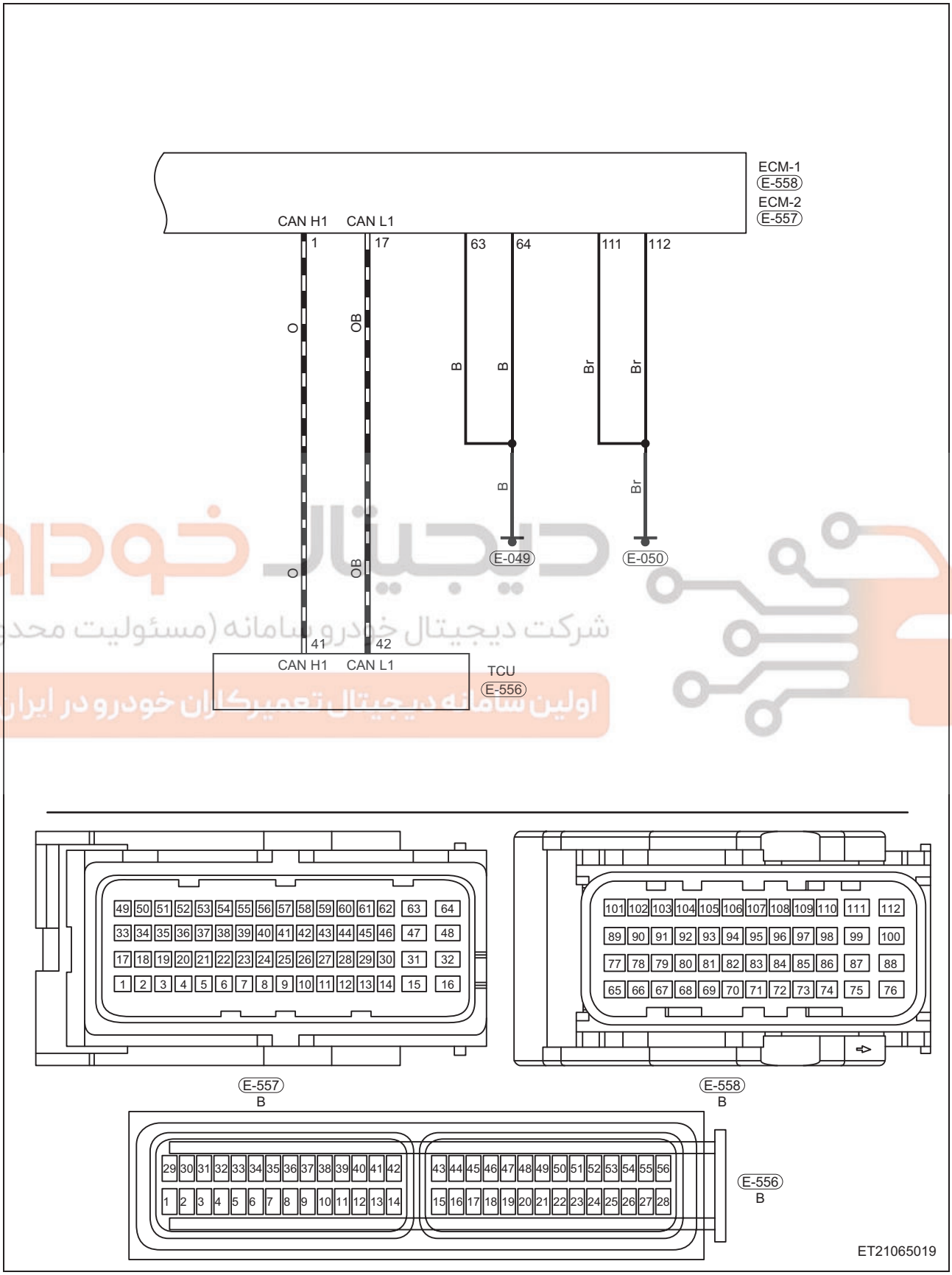
DTC	U0101 87	Lost Communication With TCM (CVT only)



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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
U0101 87	Lost Communication With TCM (CVT only)	Ignition switch ON Engine running	• CAN line or connector • ECM • TCM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK ↓

2	**Check ECM connector and TCM connector**

a. Disconnect ECM connector E-557.
b. Disconnect TCU connector E-556.
c. Check if connectors are normal.

NG → **Repair or replace connector**

OK ↓

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3	Check CAN line

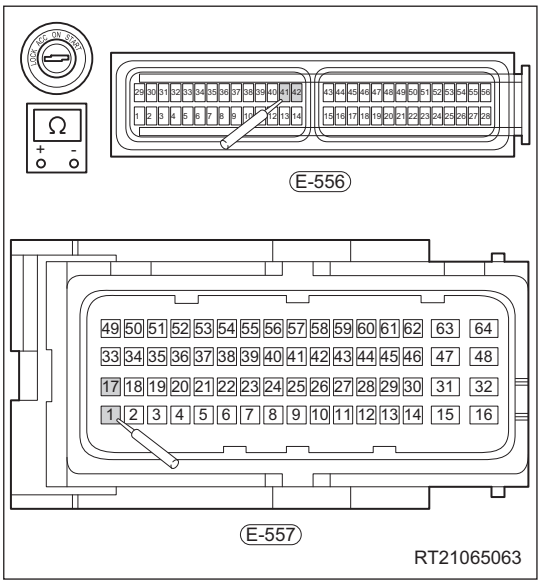
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
E-557 (1) - E-556 (41)	Continuity
E-557 (17) - E-556 (42)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (1) or E-556 (41) - Body ground	No continuity
E-557 (1) or E-556 (41) - Battery positive	No continuity
E-557 (17) or E-556 (42) - Body ground	No continuity
E-557 (17) or E-556 (42)- Battery positive	No continuity



NG → **Repair or replace CAN line**

OK

4	Replace ECM, and check for DTCs

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

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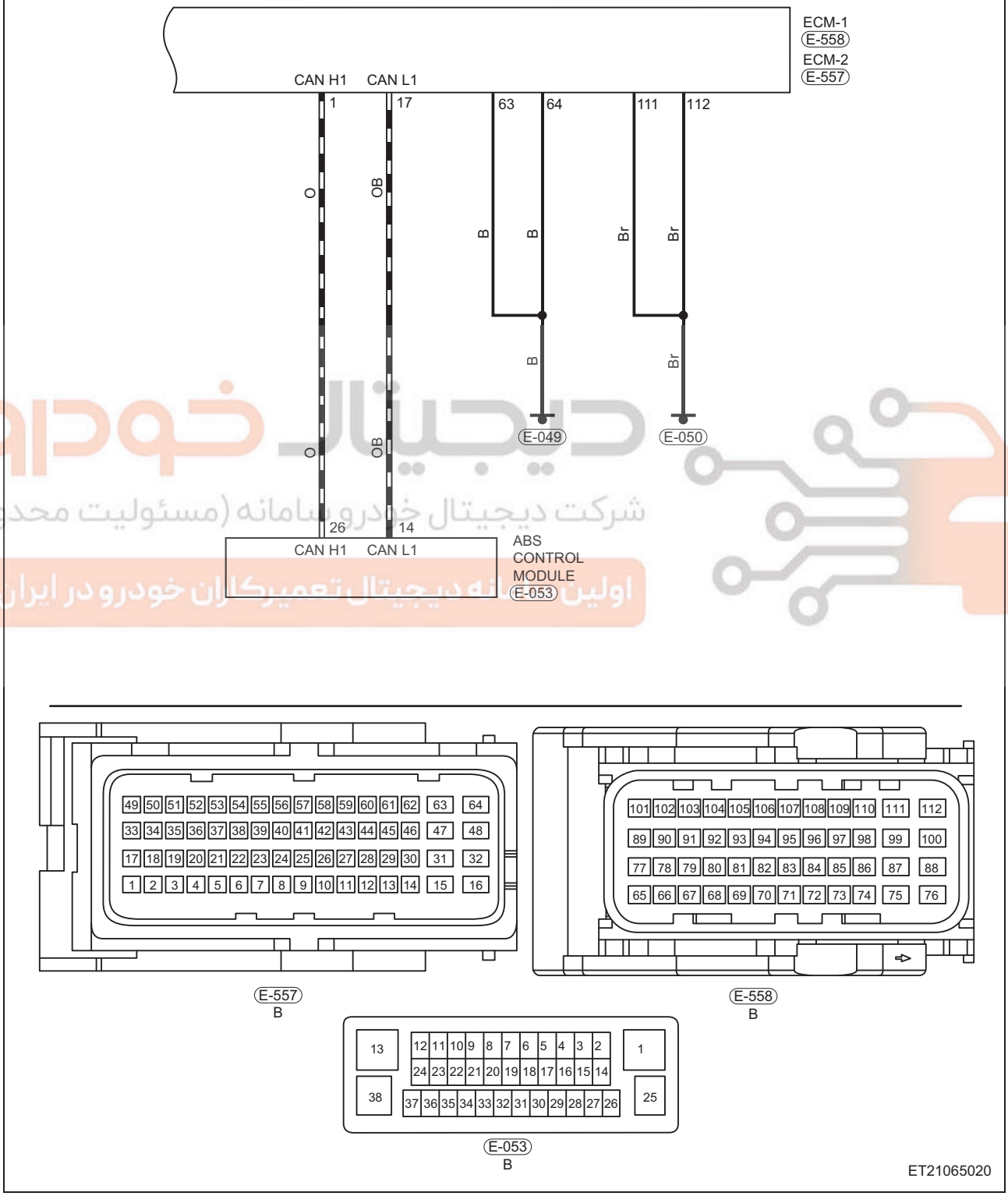
DTC	U0129 87	Lost Communication With Brake System Control Module



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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
U0129 87	Lost Communication With Brake System Control Module	Ignition switch ON Engine running	• CAN line or connector • ECM • ABS

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

2	**Check ECM connector and ABS connector**

a. Disconnect ECM connector E-050.
b. Disconnect ABS connector E-053.
c. Check if connectors are normal.

NG → **Repair or replace connector**

OK

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3	Check CAN line

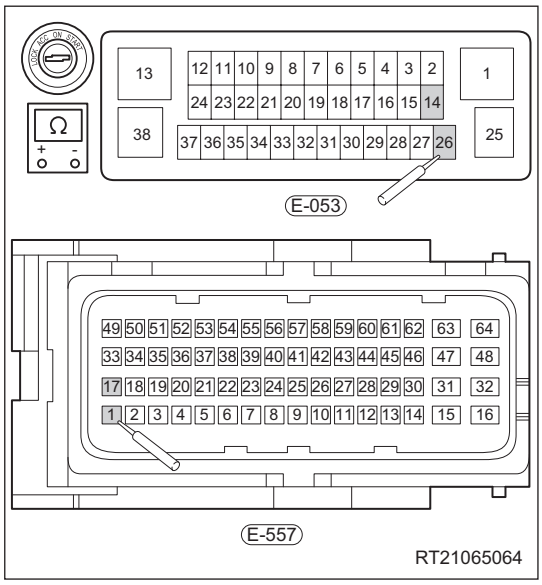
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
E-557 (1) - E-053 (26)	Continuity
E-557 (17) - E-053 (14)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (1) or E-053 (26) - Body ground	No continuity
E-557 (1) or E-053 (26) - Battery positive	No continuity
E-557 (17) or E-053 (14) - Body ground	No continuity
E-557 (17) or E-053 (14) - Battery positive	No continuity



NG → **Repair or replace CAN line**

OK

4	Replace ECM, and check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC U0129 87 still exists.

NG → **Replace ABS control module**

OK

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

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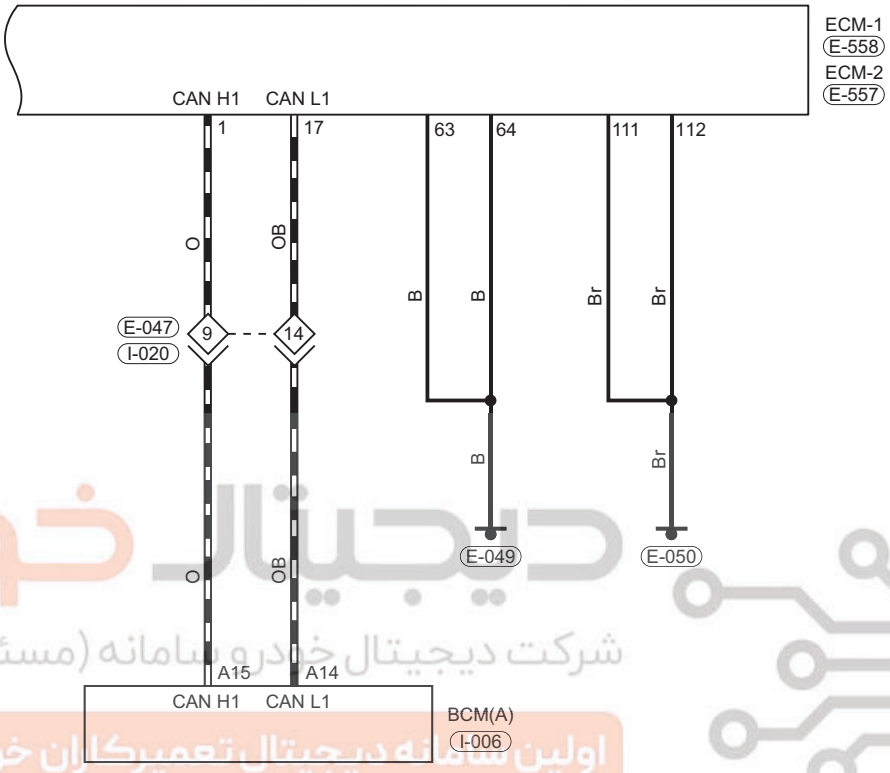
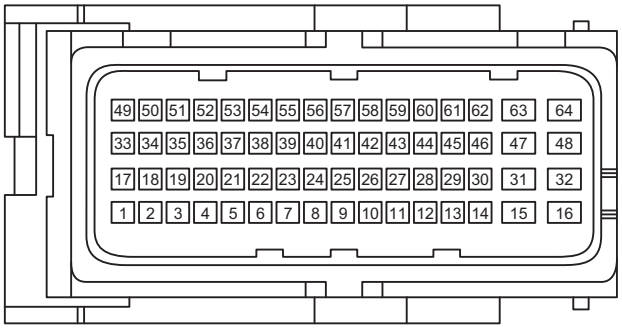
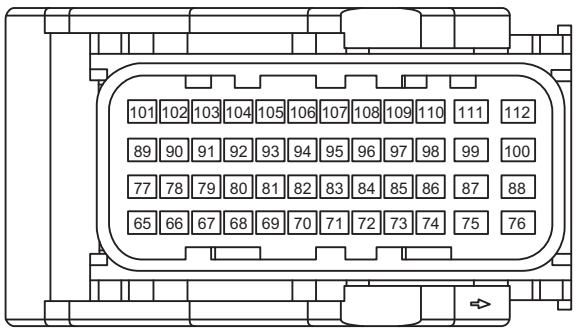
DTC	U0140 87	Lost Communication with Body Control Module (BCM)

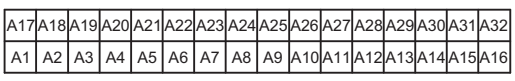




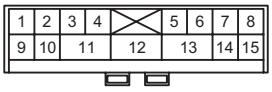
E-557
B



E-558
B



I-006
L



E-020
W

ET21065021

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
U0140 87	Lost Communication with Body Control Module (BCM)	Ignition switch ON Engine running	• CAN line or connector • ECM • BCM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK ↓

2	**Check ECM connector and BCM connector**

a. Disconnect ECM connector E-557.
b. Disconnect BCM connector I-006.
c. Check if connectors are normal.

NG → **Repair or replace connectors**

OK ↓

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3	Check CAN line

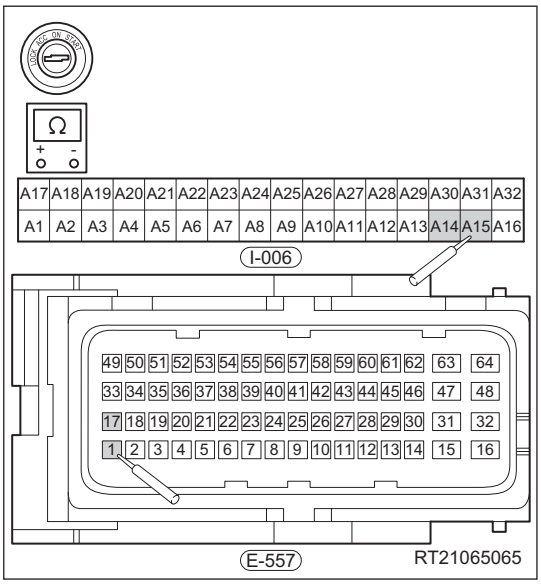
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
E-557 (1) - I-006 (A15)	Continuity
E-557 (17) - I-006 (A14)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (1) or I-006 (A15) - Body ground	No continuity
E-557 (1) or I-006 (A15) - Battery positive	No continuity
E-557 (17) or I-006 (A14) - Body ground	No continuity
E-557 (17) or I-006 (A14) - Battery positive	No continuity



NG → **Repair or replace CAN line**

OK

4	Replace ECM, and check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC U0140 87 still exists.

NG → **Replace BCM**

OK

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

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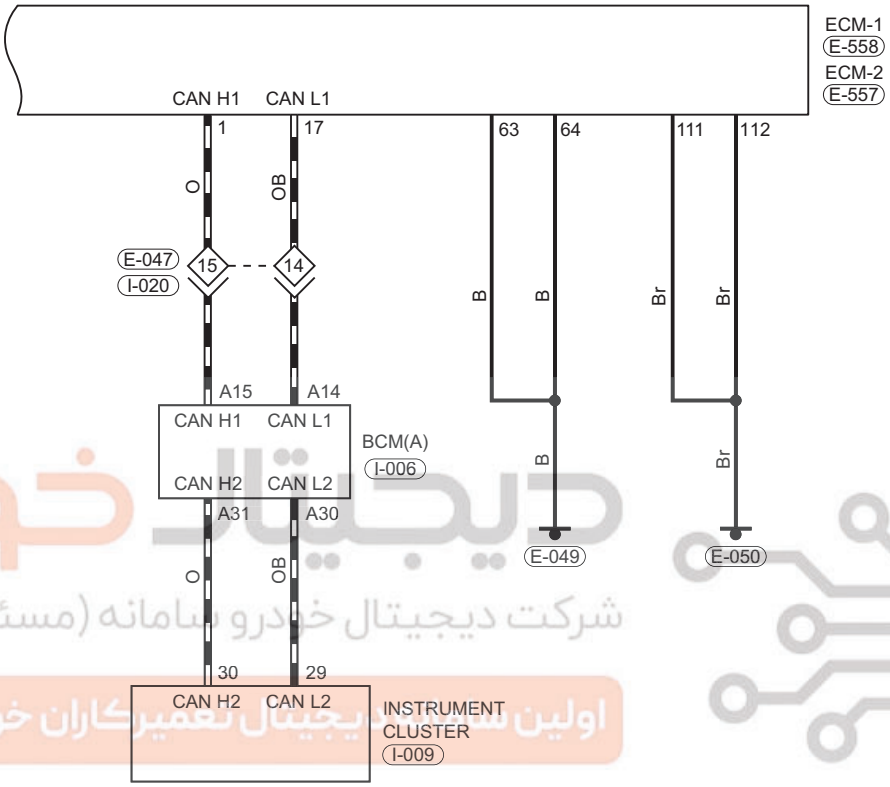
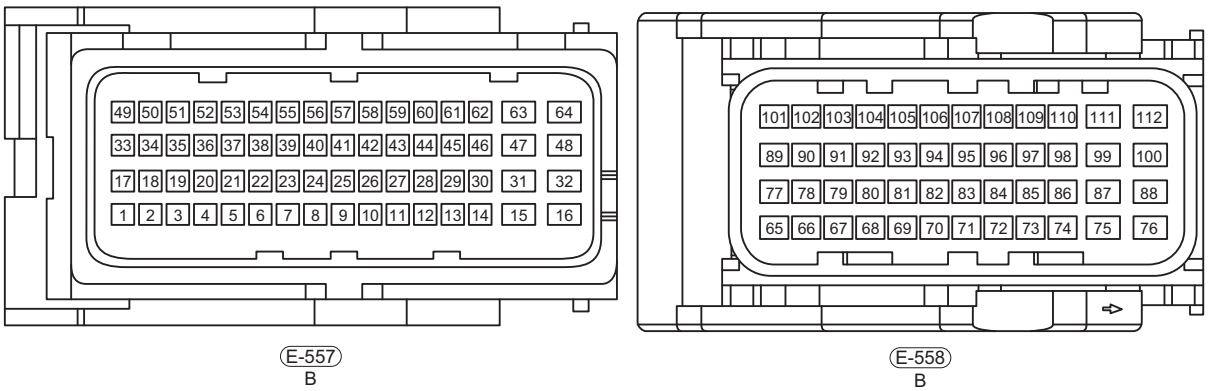
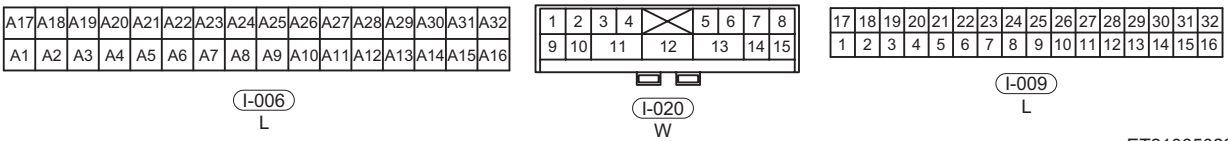
DTC	U0155 87	Lost Communication With Instrument Panel Cluster (IPC) Control Module







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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
U0155 87	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Ignition switch ON Engine running	• CAN line or connector • ECM • ICM • BCM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK ↓

2	Check ECM connector, instrument cluster connector and BCM connector

a. Disconnect ECM connector E-557.
b. Disconnect instrument cluster connector I-009.
c. Disconnect BCM connector I-006.
d. Check if connectors are normal.

NG → **Repair or replace connectors**

OK ↓

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3	Check CAN line (ECM - BCM)

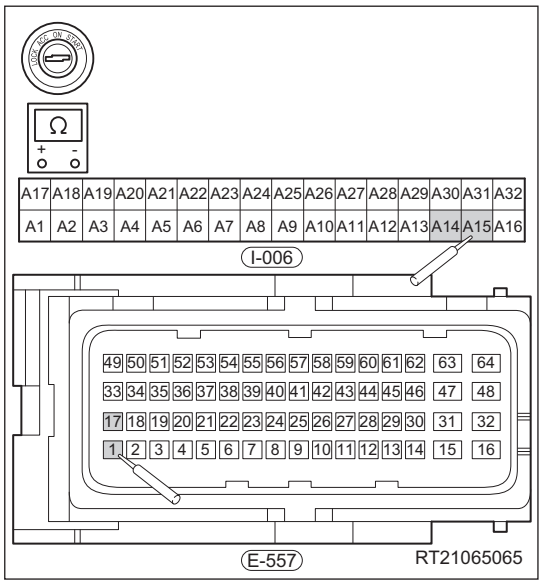
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
E-557 (1) - I-006 (A15)	Continuity
E-557 (17) - I-006 (A14)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (1) or I-006 (A15) - Body ground	No continuity
E-557 (1) or I-006 (A15) - Battery positive	No continuity
E-557 (17) or I-006 (A14) - Body ground	No continuity
E-557 (17) or I-006 (A14) - Battery positive	No continuity



NG → **Repair or replace CAN line**

OK

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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4	Check CAN line (BCM - ICM)

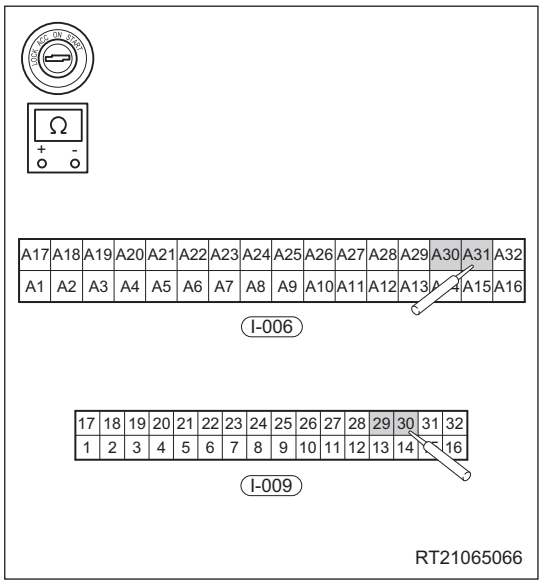
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
I-009 (30) - I-005 (A31)	Continuity
I-009 (29) - I-005 (A30)	Continuity

Check for Short

Multimeter Connection	Specified Condition
I-009 (30) or I-006 (A31) - Body ground	No continuity
I-009 (30) or I-006 (A31) - Battery positive	No continuity
I-009 (29) or I-006 (A30) - Body ground	No continuity
I-009 (29) or I-006 (A30) - Battery positive	No continuity



NG → **Repair or replace CAN line**

OK

5	Replace ECM, and check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC U0155 87 still exists.

NG → **Check or replace BCM and ICM**

OK

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

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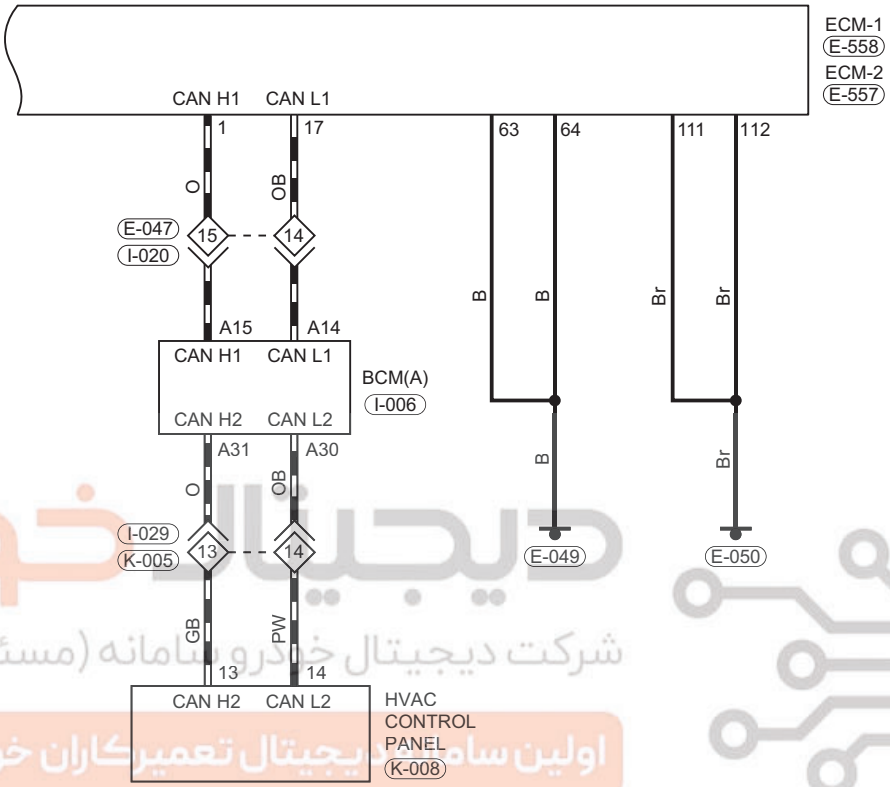
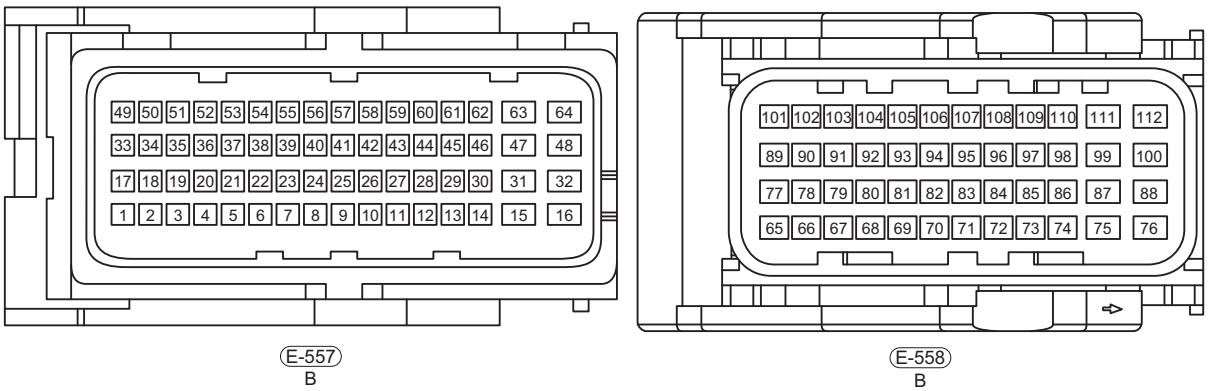
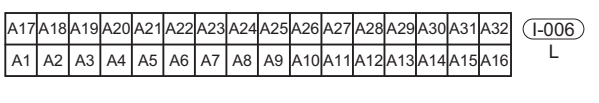
DTC	U0164 87	Lost Communication with HCU



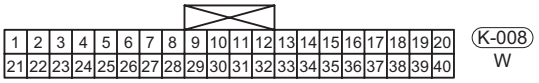


E-557
B

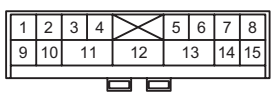
E-558
B



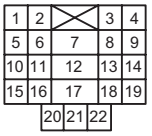
I-006
L



K-008
W



I-020
W



I-029
W

ET21065023

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
U0164 87	Lost Communication with HCU	Ignition switch ON Engine running	• CAN line or connector • ECM • CLM (A/C control module) • BCM

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK ↓

2	Check ECM connector, A/C control panel connector and BCM connector

a. Disconnect ECM connector E-557.
b. Disconnect A/C control panel connector K-008.
c. Disconnect BCM connector I-006.
d. Check if connectors are normal.

NG → **Repair or replace connectors**

OK ↓

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3	Check CAN line (ECM - BCM)

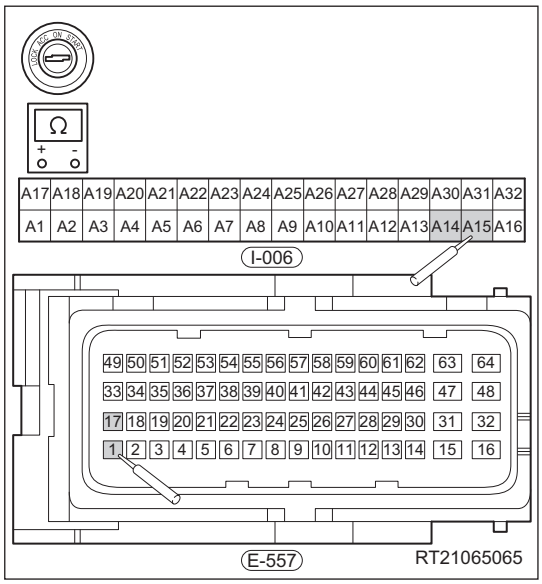
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
E-557 (1) - I-006 (A15)	Continuity
E-557 (17) - I-006 (A14)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (1) or I-006 (A15) - Body ground	No continuity
E-557 (1) or I-006 (A15) - Battery positive	No continuity
E-557 (17) or I-006 (A14) - Body ground	No continuity
E-557 (17) or I-006 (A14) - Battery positive	No continuity



NG → **Repair or replace CAN line**

OK

دیجیتال خودرو
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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4	Check CAN line (BCM - A/C control panel)

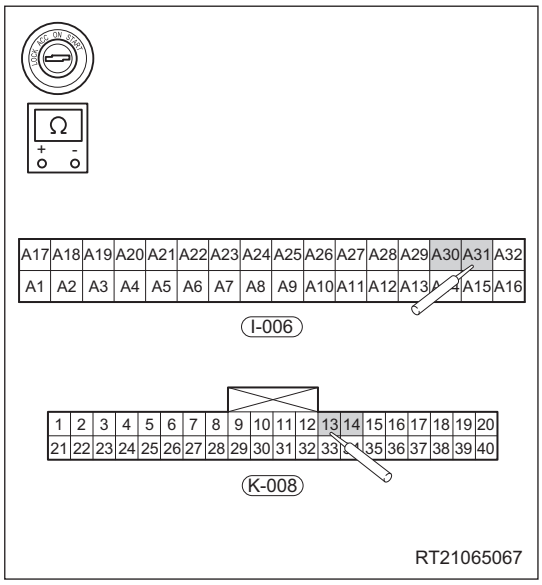
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
K-008 (13) - I-006 (A31)	Continuity
K-008 (14) - I-006 (A30)	Continuity

Check for Short

Multimeter Connection	Specified Condition
K-008 (13) or I-006 (A31) - Body ground	No continuity
K-008 (13) or I-006 (A31) - Battery positive	No continuity
K-008 (14) or I-006 (A30) - Body ground	No continuity
K-008 (14) or I-006 (A30) - Battery positive	No continuity



NG → **Repair or replace CAN line**

OK

5	Replace ECM, and check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC U0164 87 still exists.

NG → **Check or replace BCM and A/C control panel**

OK

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

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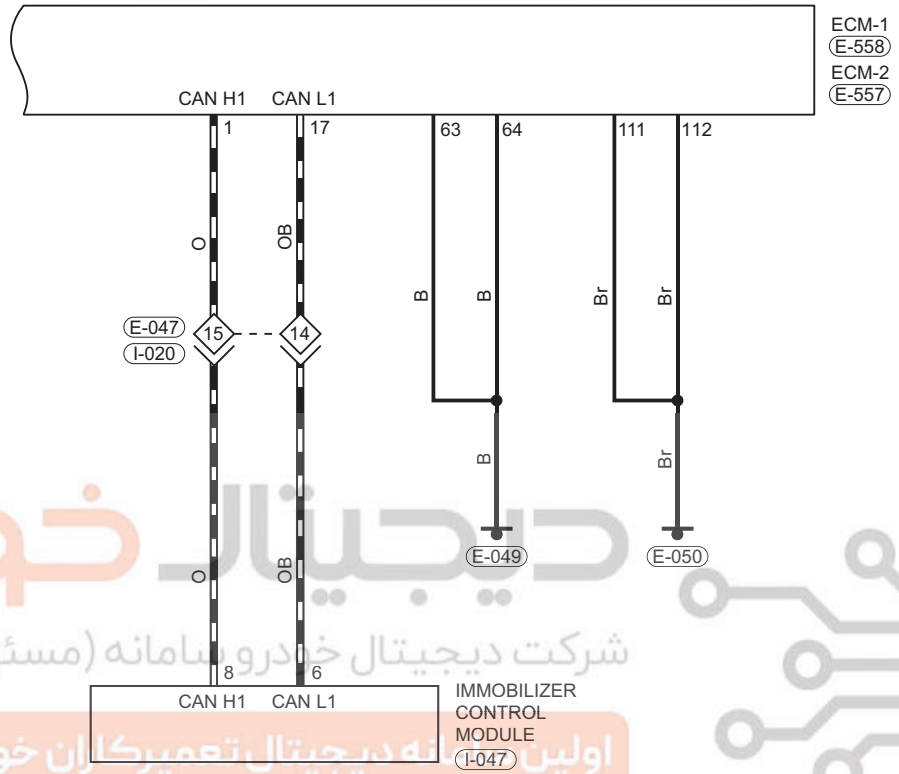
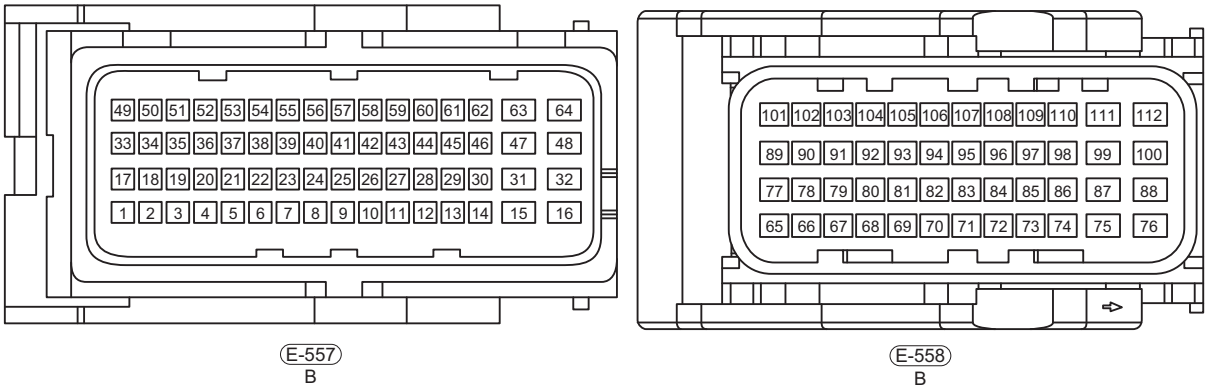
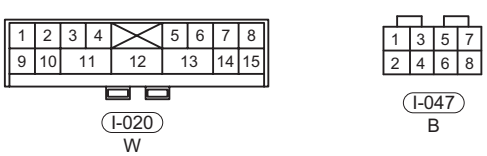
DTC	U0140 00	Lost Communication With Body Control Module (IMMO)







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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
U0140 00	Lost Communication With Body Control Module (Immo)	Ignition switch ON	• CAN line or connector • ECM • Engine immobilizer module

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

2	**Check ECM connector and engine immobilizer module connector**

a. Disconnect ECM connector E-557.
b. Disconnect engine immobilizer module connector I-047.
c. Check if connectors are normal.

NG → **Repair or replace connectors**

OK

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3	Check CAN line (ECM - engine immobilizer module)

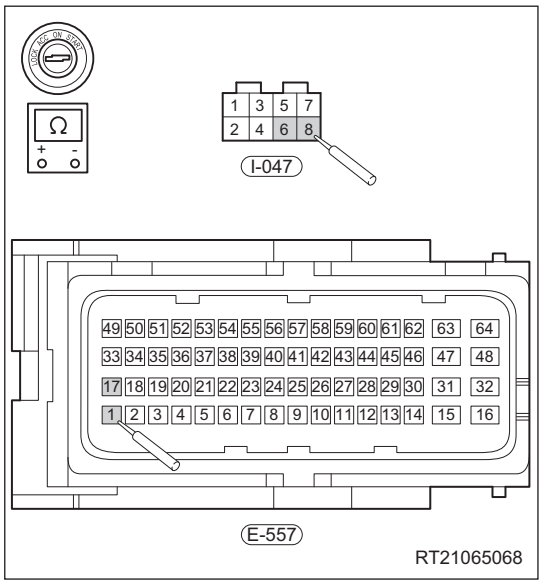
a. Check CAN line.

Check for Open

Multimeter Connection	Specified Condition
E-557 (1) - I-047 (8)	Continuity
E-557 (17) - I-047 (6)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-557 (1) or I-047 (8) - Body ground	No continuity
E-557 (1) or I-047 (8) - Battery positive	No continuity
E-557 (17) or I-047 (6) - Body ground	No continuity
E-557 (17) or I-047 (6) - Battery positive	No continuity



NG → Repair or replace CAN line

OK ↓

4	Replace ECM, and check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC U0140 00 still exists.

NG → Replace engine immobilizer module

OK ↓

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

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DTC	P000A 00	Camshaft control Slow Response (inlet)

DTC	P000B 00	Camshaft control Slow Response (outlet)

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P000A 00	Camshaft control Slow Response (inlet)	Ignition switch ON Engine running	• Camshaft phaser • VVT control valve • Wire harness or connector • ECM
P000B 00	Camshaft control Slow Response (outlet)		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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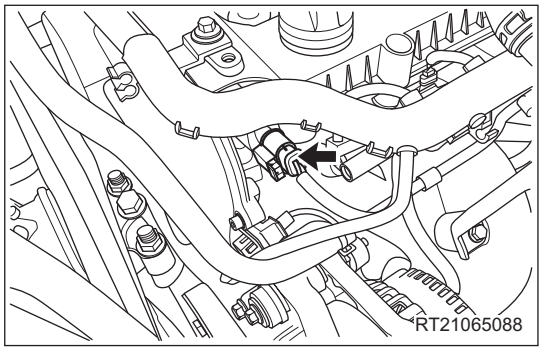
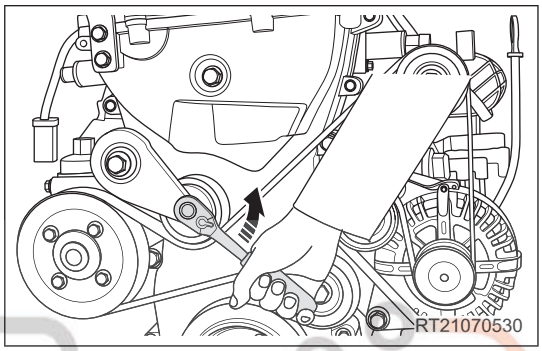
2	Check VVT control valve connector

a. Disconnect intake VVT control valve connector E-510.



b. Disconnect exhaust VVT control valve connector E-501.

c. Check VVT control valve connectors.



NG → **Repair or replace connector**

OK

3	Check intake/exhaust camshaft phaser

a. Check if intake/exhaust camshaft phaser is blocked or stuck.

NG → **Replace intake/exhaust camshaft phaser**

OK

4	Check intake/exhaust VVT control valve

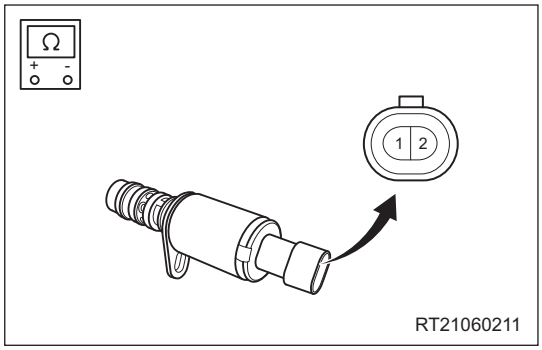
a. Turn ignition switch to LOCK.

b. Remove intake/exhaust VVT control valves.

c. Check intake/exhaust VVT control valves.

Multimeter Connection	Specified Condition
Terminal 1 - Terminal 2	8 Ω

d. When battery voltage is applied between terminals 1 and 2, control valve should move quickly.



NG → **Replace intake/exhaust VVT control valve**

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OK

5	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P000A 00 or P000B 00 still exists.

NG → Replace ECM

OK

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

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DTC	P0010 13	Control Circuit of camshaft control valve (inlet)

DTC	P0013 13	Control Circuit of camshaft control valve (outlet)

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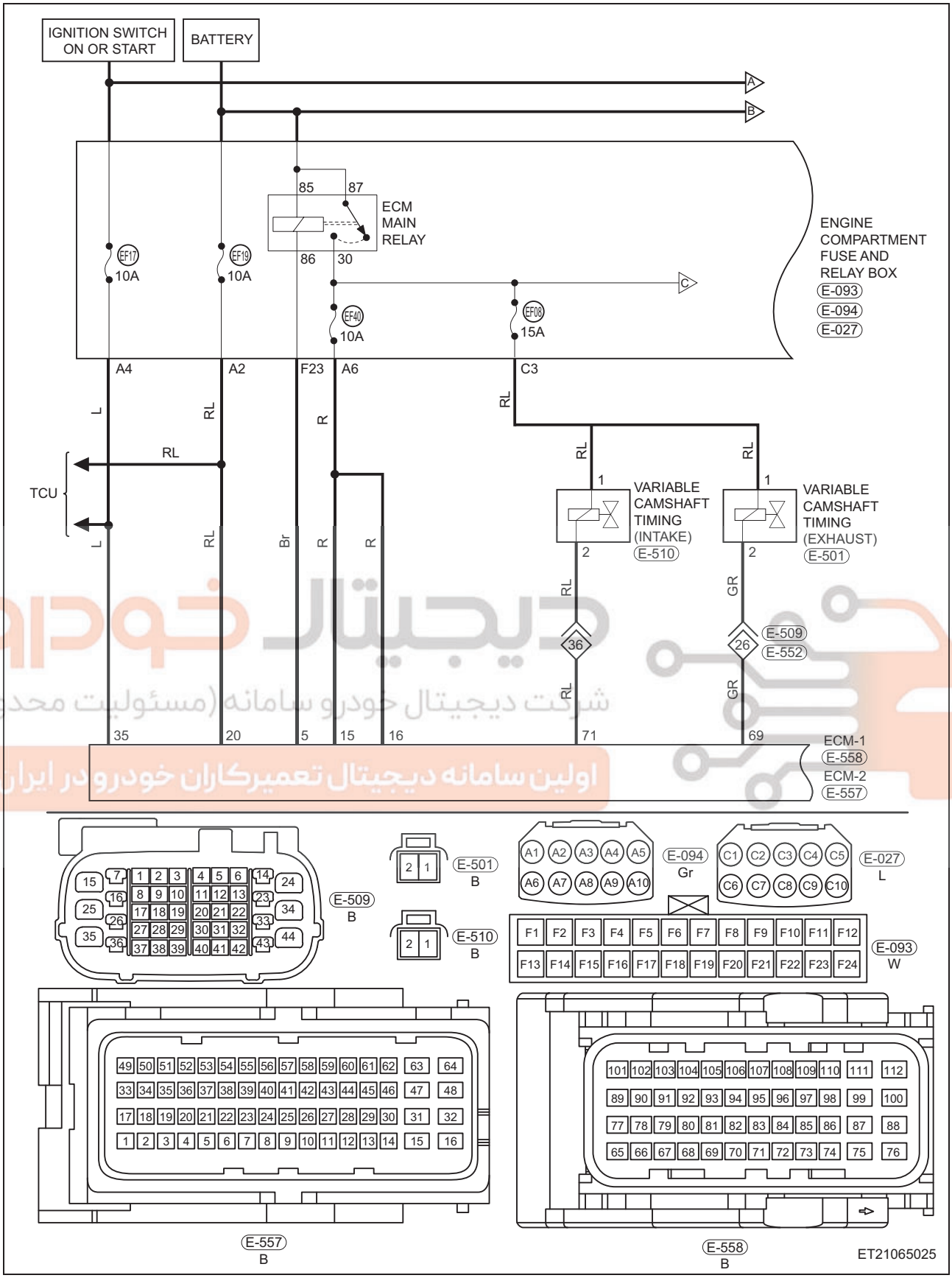

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0010 13	Control Circuit of camshaft control valve (inlet)	Ignition switch ON Engine running	• VVT control valve • Wire harness or connector • ECM
P0013 13	Control Circuit of camshaft control valve (outlet)		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

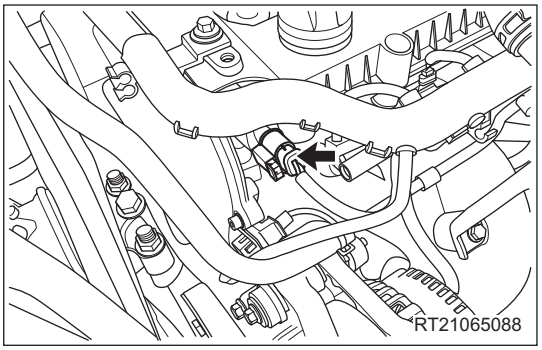
b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

2	**Check VVT control valve connector**

a. Disconnect intake VVT control valve connector E-510.



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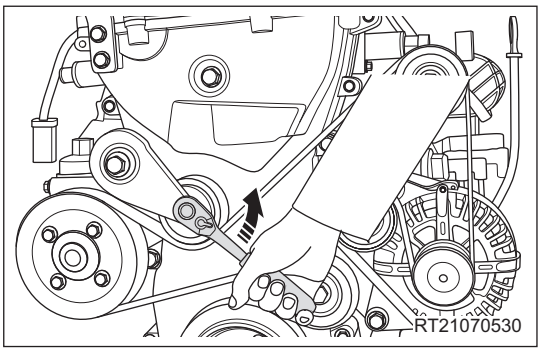
b. Disconnect exhaust VVT control valve connector E-501.
c. Check VVT control valve connectors.



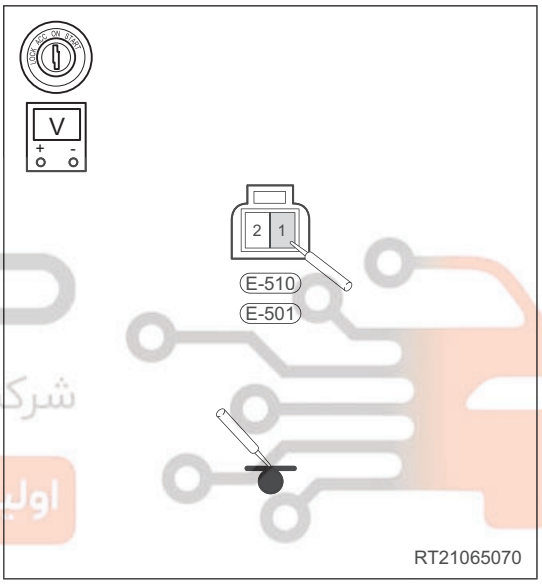
NG → **Repair or replace connector**

OK

3 Check VVT control valve power supply voltage

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

Multimeter Connection	Condition	Specified Condition
E-510 (1) - Body ground	Ignition switch ON	11 to 14 V
E-501 (1) - Body ground		



OK → **Go to step 5**

NG

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4	Check VVT control valve power supply circuit and fuse EF08

a. Turn ignition switch to LOCK.

b. Check if fuse EF08 is normal.

c. Disconnect engine compartment fuse and relay box connector E-027.

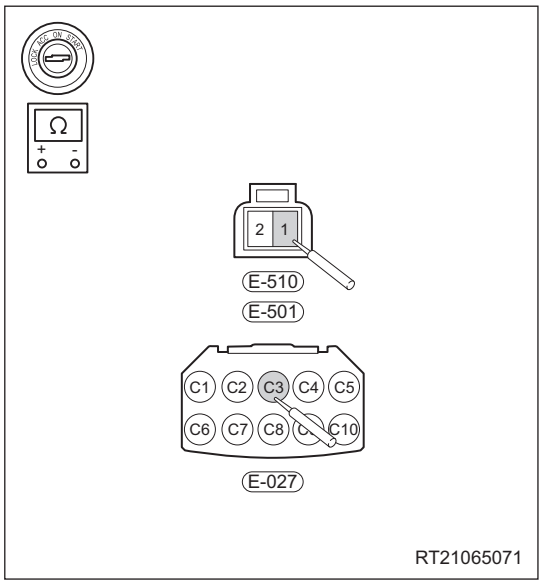
d. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-510 (1) - E-027 (C3)	Always	Continuity
E-501 (1) - E-027 (C3)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-510 (1), E-501 (1) or E-027 (C3) - Body ground	Always	No continuity
E-510 (1), E-501 (1) or E-027 (C3) - Battery positive	Always	No continuity



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

OK

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5	Check VVT control valve control circuit

a. Disconnect ECM connector E-558.

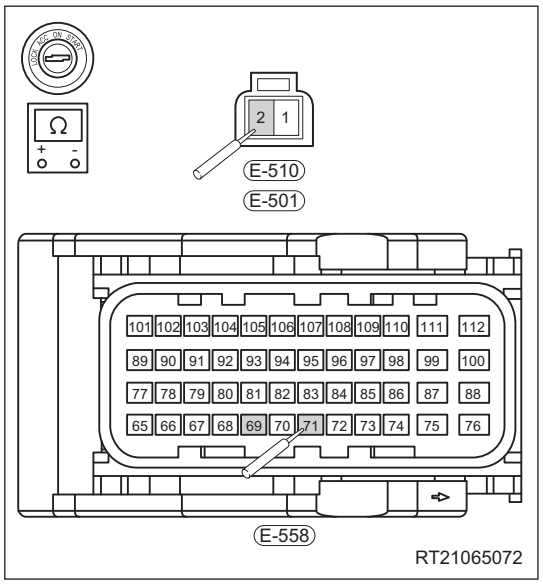
b. Check wire harness between connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-510 (2) - E-558 (71)	Always	Continuity
E-501 (2) - E-558 (69)		

Check for Short

Multimeter Connection	Condition	Specified Condition
E-510 (2) or E-558 (71) - Body ground	Always	No continuity
E-510 (2) or E-558 (71) - Battery positive	Always	No continuity
E-501 (2) or E-558 (69) - Body ground	Always	No continuity
E-501 (2) or E-558 (69) - Battery positive	Always	No continuity



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

OK

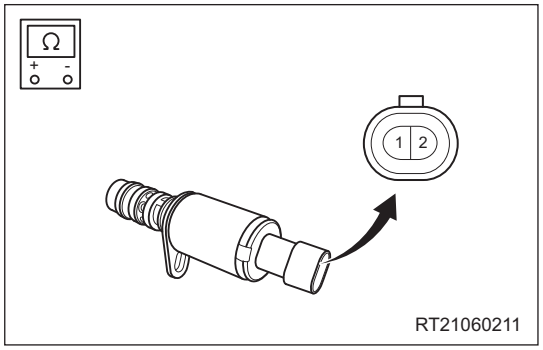
6	Check intake/exhaust VVT control valve

a. Remove intake/exhaust VVT control valves.

b. Check intake/exhaust VVT control valves.

Multimeter Connection	Specified Condition
Terminal 1 - Terminal 2	8 Ω

c. When battery voltage is applied between terminals 1 and 2, control valve should move quickly.



NG → **Replace intake/exhaust VVT control valve**

OK

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7	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0010 13 or P0013 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.

دیجیتال خودرو
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DTC	P0012 00	Inlet camshaft not in locking position during start

DTC	P0015 00	Outlet camshaft not in locking position during start

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0012 00	Inlet camshaft not in locking position during start	Ignition switch ON Engine running	• Camshaft phaser • Wire harness or connector • ECM
P0015 00	Outlet camshaft not in locking position during start		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Start the engine and warm it up to normal operating temperature, and then select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	Check ECM ground point

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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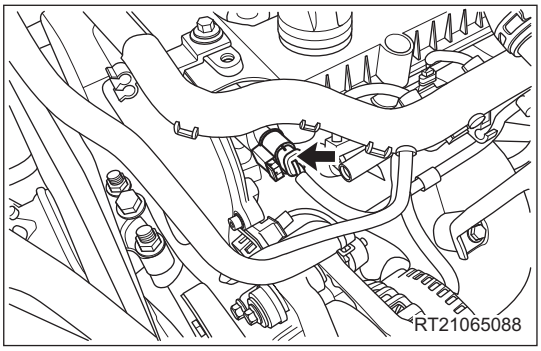
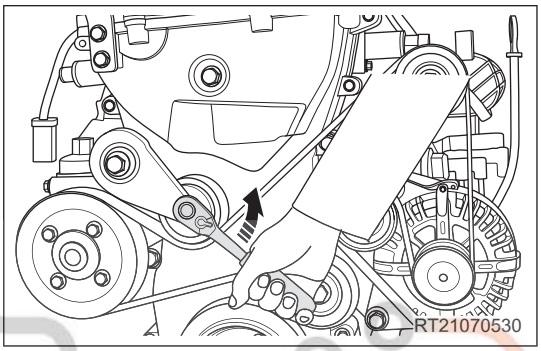
2	Check VVT control valve connector

a. Disconnect intake VVT control valve connector E-510.



b. Disconnect exhaust VVT control valve connector E-501.

c. Check VVT control valve connectors.



NG → **Repair or replace connector**

OK

3	Check intake/exhaust camshaft phaser

a. Check if intake/exhaust camshaft phaser is blocked or stuck.

NG → **Replace intake/exhaust camshaft phaser**

OK

4	Check for DTCs

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

b. Refer to "DTC Confirmation Procedure".

c. Check if DTC P0012 00 or P0015 00 still exists.

NG → **Replace ECM**

OK

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

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DTC	P0016 29	Npl error for alignment between camshaft (inlet) and crankshaft

DTC	P0018 29	Npl error for alignment between camshaft (outlet) and crankshaft

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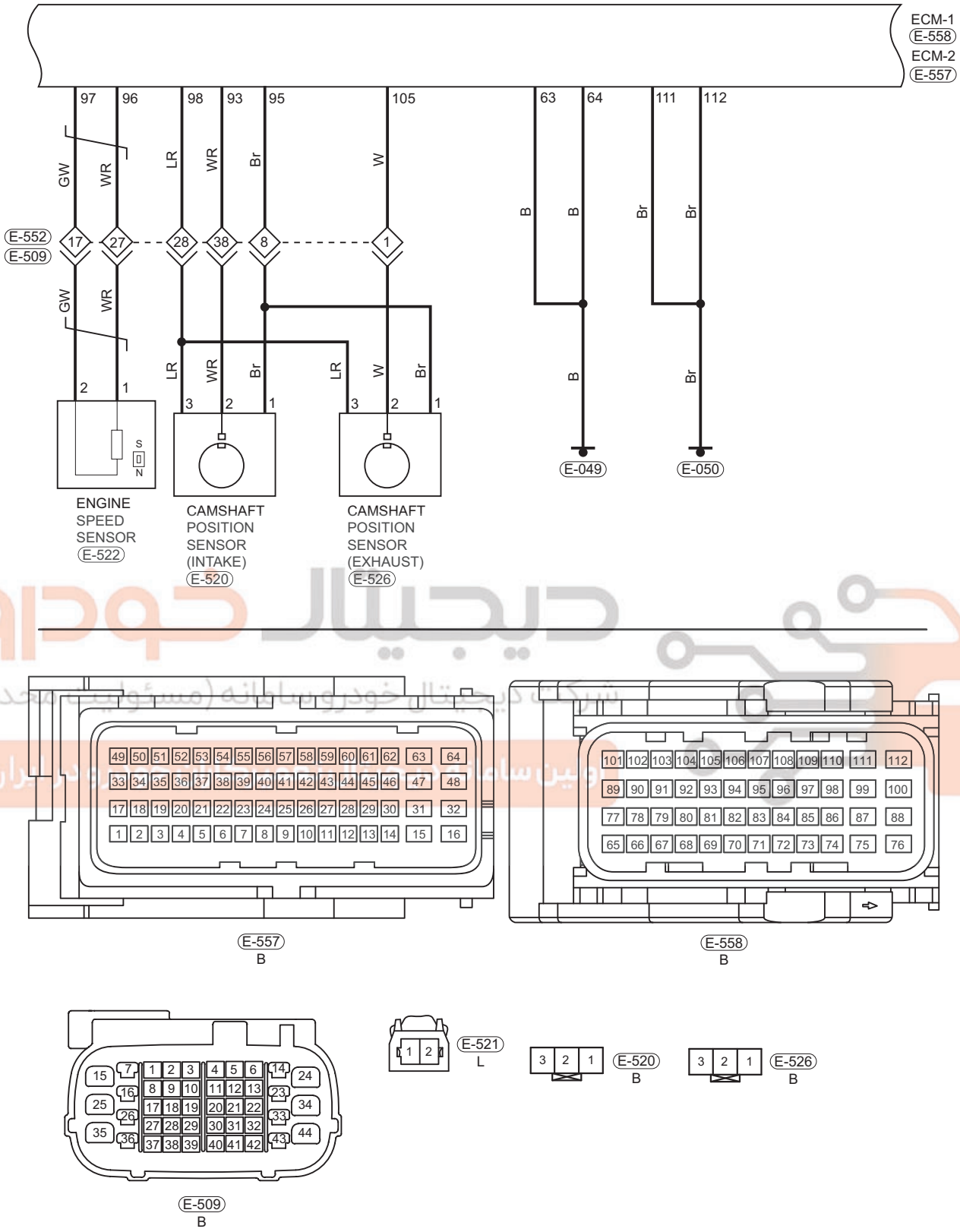

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DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P0016 29	Npl error for alignment between camshaft (inlet) and crankshaft	Ignition switch ON Engine running	• Camshaft position sensor • Crankshaft position sensor • Wire harness or connector • Flywheel gear ring • Camshaft gear ring • ECM
P0018 29	Npl error for alignment between camshaft (outlet) and crankshaft		

DTC Confirmation Procedure

Confirm that battery voltage is over 12 V before performing the 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.
- Use X-431 3G diagnostic tester to record and clear the DTCs stored in the ECM.
- Select Read Code.
- If the DTC is detected, the malfunction indicated by the DTC is current. Go to the diagnosis procedure - Step 1.
- If DTC is not detected, the malfunction indicated by the DTC is intermittent (See page 06-20).

CAUTION

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

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Diagnosis Procedure

1	**Check ECM ground point**

a. Turn ignition switch to LOCK.

b. Check ECM grounds E-049 and E-050 (See page 06-20).

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

OK

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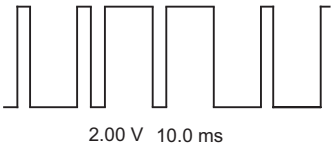
2	Check camshaft position sensor signal waveform

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

	Normal Waveform
Oscilloscope	 RT21060230

OK → Go to step 8

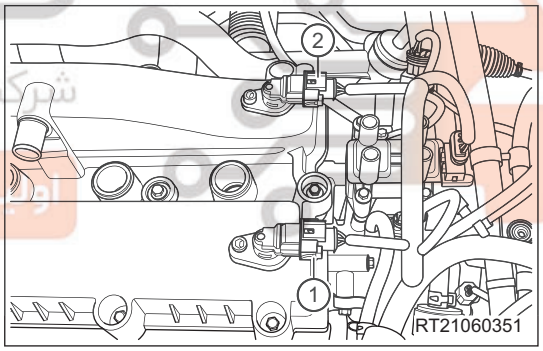
NG

3	Check camshaft position sensor connector

a. Disconnect intake camshaft position sensor connector E-520 (1).

b. Disconnect exhaust camshaft position sensor connector E-526 (2).

c. Check camshaft position sensor connectors.



NG → Repair or replace connector

OK

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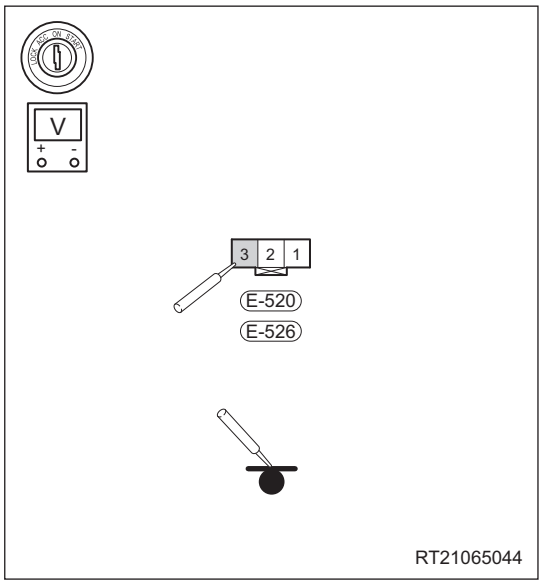
4	Check camshaft position sensor power supply voltage

a. Turn ignition switch to ON.

b. Check voltage between terminal 3 of camshaft position sensor connector E-520 or E-526 and body ground.

Multimeter Connection	Condition	Specified Condition
E-520 (3) or E-526 (3) - Body ground	Ignition switch ON	5 V



OK → **Go to step 6**

NG

5	Check camshaft position sensor power supply circuit

a. Turn ignition switch to LOCK.

b. Disconnect ECM connector E-558.

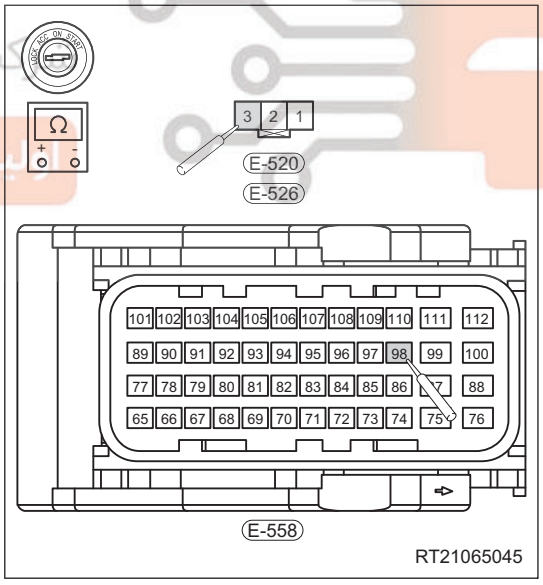
c. Check wire harness between camshaft position sensor connector terminals and ECM connector terminals.

Check for Open

Multimeter Connection	Condition	Specified Condition
E-520 (3) - E-558 (98)	Always	Continuity
E-526 (3) - E-558 (98)	Always	Continuity

Check for Short

Multimeter Connection	Condition	Specified Condition
E-520 (3), E-015 (3) or E-558 (98) - Body ground	Always	No continuity
E-520 (3), E-015 (3) or E-558 (98) - Battery positive	Always	No continuity



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

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OK

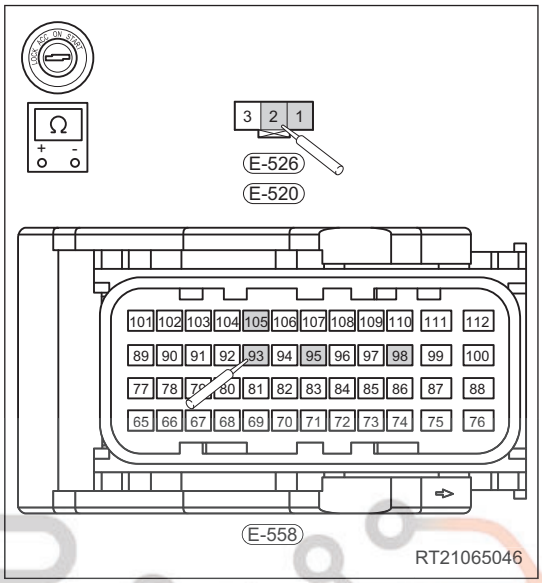
Replace ECM

6	Check camshaft position sensor signal circuit and ground circuit

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

Check for Open

Multimeter Connection	Condition	Specified Condition
E-520 (2) - E-558 (93)	Always	Continuity
E-526 (2) - E-558 (105)		
E-520 (1), E-526 (1) - E-558 (95)		



Check for Short

Multimeter Connection	Condition	Specified Condition
E-520 (2) or E-558 (93) - Body ground	Always	No continuity
E-520 (2) or E-558 (93) - Battery positive		
E-526 (2) or E-558 (105) - Body ground		
E-526 (2) or E-558 (105) - Battery positive		
E-520 (1), E-526 (1) or E-558 (105) - Body ground		
E-520 (1), E-526 (1) or E-558 (105) - Battery positive		

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

OK

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7	Check camshaft position sensor

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

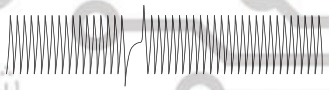
NG → **Clean installation area or replace camshaft position sensor**

OK ↓

Replace ECM

8	Check engine speed sensor signal waveform

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

	Normal Waveform of Engine Speed Senor Signal
Oscilloscope	 RT21060200

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OK → **Go to step 15**

NG ↓

9	Check engine speed sensor connector

a. Turn ignition switch to LOCK.
b. Disconnect engine speed sensor connector E-522.
c. Check engine speed sensor connector.

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

OK ↓

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10	Check installation of engine speed sensor

a. Remove engine speed sensor.

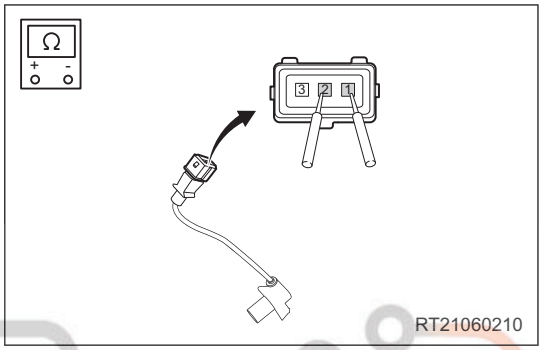
b. Check and clean engine speed sensor and installation area, and check for damage, foreign matter or excessive movement, etc. that cause signal incorrectness.

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

OK

11	Check resistance of engine speed sensor

a. Check resistance between engine speed sensor terminals 1 and 2.
Normal resistance: 860 Ω ± 20% (at normal temperature)



NG → **Replace engine speed sensor**

OK

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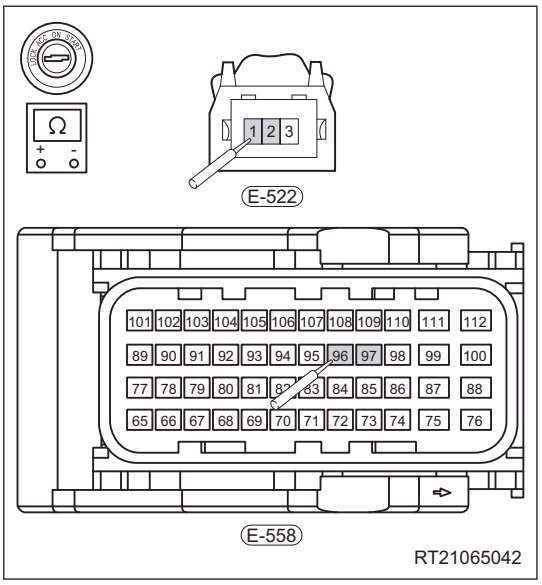
12	Check engine speed sensor circuit

a. Disconnect ECM connector E-558.

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

Check for Open

Multimeter Connection	Condition	Specified Condition
E-522 (1) - E-558 (96)	Always	Continuity
E-522 (2) - E-558 (97)		



Check for Short

Multimeter Connection	Condition	Specified Condition
E-522 (1) or E-558 (96) - Body ground	Always	No continuity
E-522 (1) or E-558 (96) - Battery positive		
E-522 (2) or E-558 (97) - Body ground		
E-522 (2) or E-558 (97) - Battery positive		

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

OK

13	Check crankshaft and flywheel gear ring

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

NG → **Clear off debris and clean flywheel gear ring. Replace flywheel if necessary (See page 07-42).**

OK

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14	Check engine timing

a. Check for timing deviation.

NG → Correct engine timing

OK

15	Check for DTCs

a. Use X-431 3G diagnostic tester to read the ECM DTC.
b. Refer to "DTC Confirmation Procedure".
c. Check if DTC P0016 29 or P0018 29 still exists.

NG → Replace ECM

OK

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

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Engine Problem Symptom Diagnosis

Perform primary inspection first before performing malfunction diagnosis procedures:

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

Then, perform appearance inspection:

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

HINT:

If above conditions exist, repair the trouble areas first. Otherwise, it will affect the repair work for the 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 the 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 the trouble can be eliminated, the trouble area is in ECM; if the trouble symptom still exists, reuse the original ECM, repeat the procedures, and perform service again.

Problem Symptoms Table

Symptom	Suspected Area	See page
Engine does not crank or cranks slowly while starting	Battery	06-213
	Starter motor	
	Wire harness or ignition switch	
	Engine mechanical	
Engine cranks normally but cannot startsuccessfully while starting	No fuel in tank	06-215
	Fuel pump	
	Engine speed sensor	
	Ignition coil	
	Engine mechanical	
Difficult to start with hot engine	Water in fuel	06-217
	Fuel pump	
	Coolant temperature sensor	
	Fuel pressure regulator	
	Ignition coil	

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Symptom	Suspected Area	See page
Difficult to start with cold engine	Water in fuel	06-219
	Fuel pump	
	Coolant temperature sensor	
	Injector	
	Ignition coil	
	Throttle	
	Engine mechanical	
Engine speed is normal, but it is difficult to start at anytime	Water in fuel	06-221
	Fuel pump	
	Coolant temperature sensor	
	Injector	
	Ignition coil	
	Throttle	
	Intake pipe	
	Ignition timing	
	Spark plug	
	Engine mechanical	
Engine starts normally, but idles roughly at anytime	Water in fuel	06-224
	Injector	
	Spark plug	
	Throttle	
	Intake pipe	
	Ignition timing	
	Engine mechanical	
Engine starts normally, but idles roughly during warming up	Water in fuel	06-226
	Coolant temperature sensor	
	Spark plug	
	Throttle	
	Intake pipe	
	Engine mechanical	
Engine starts normally, but idles roughly after warming up	Water in fuel	06-228
	Coolant temperature sensor	
	Spark plug	
	Throttle body	
	Intake pipe	
	Engine mechanical	

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Symptom	Suspected Area	See page
Engine starts normally, but idles roughly or stalls with part load (for example, A/C is ON)	Air conditioning system	06-230
	Injector	
Engine starts normally, but idle speed is too high	Throttle	06-232
	Vacuum pipe	
	Coolant temperature sensor	
	Ignition timing	
Low engine speed or stalls when accelerating	Water in fuel	06-234
	Air flow meter and throttle position sensor	
	Spark plug	
	Throttle	
	Intake pipe	
	Injector	
	Ignition timing	
	Exhaust pipe	
Slow response when accelerating	Water in fuel	06-237
	Air flow meter and throttle position sensor	
	Spark plug	
	Throttle inlet pipe	
	Injector	
	Ignition timing	
	Exhaust pipe	
Lack of power and poor performance when accelerating	Water in fuel	06-240
	Air flow meter and throttle position sensor	
	Spark plug	
	Ignition coil	
	Throttle	
	Intake pipe	
	Injector	
	Ignition timing	
	Exhaust pipe	

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Engine does not crank or cranks slowly while starting

Diagnosis Procedure

1	Check voltage between two battery posts when engine starts

OK: Voltage is 8 to 12 V.

NG → Replace battery

OK

2	Check voltage of positive post of starter motor

a. The ignition switch remains in START position and check voltage of positive post of starter motor.
OK: Voltage is 8 to 12 V.

NG → Repair or replace wire harness

OK

3	Check operation of starter motor

a. Remove 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

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OK

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Engine cranks normally but cannot start successfully while starting

Diagnosis Procedure

1	Check fuel pressure

a. Using a fuel pressure gauge, check fuel pressure (See page 10-11).

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 the engine and select Read Datastream.
b. Observe if any speed signal is output.

NG → **Check and repair crankshaft position sensor wire harness**

OK ↓

3	Check spark

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

OK: Spark is generated.

NG → **Check and repair ignition system**

OK ↓

4	Check pressure of cylinder

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

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

OK ↓

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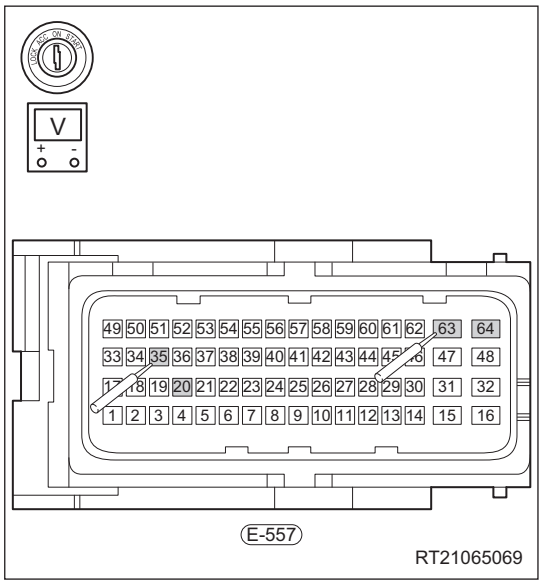
5	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK →

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Difficult to start with hot engine

Diagnosis Procedure

1	**Check fuel pressure**

a. Using a fuel pressure gauge, check fuel pressure (See page 10-11).

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 the engine, and check if spark is generated.

OK: Spark is generated.

NG → **Check and repair ignition system**

OK ↓

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

OK → **Check and repair wire harness or replace sensor**

NG ↓

4	**Check fuel pressure regulator**

NG → **Replace fuel pressure regulator**

OK ↓

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5	Check fuel condition

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

NG → Replace fuel

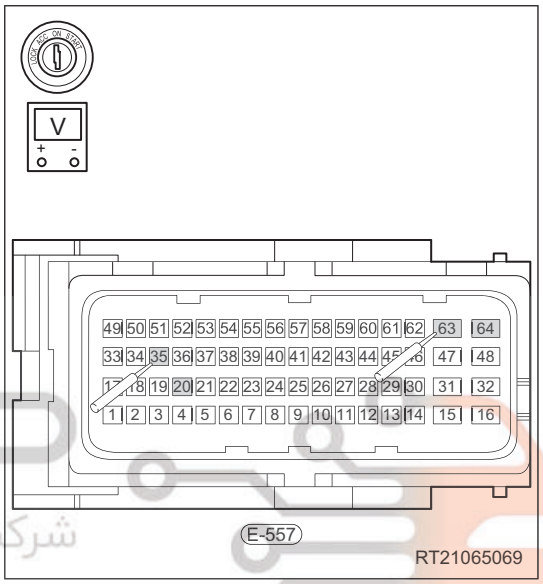
OK

6	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



NG → Repair or replace related wire harness

OK

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Difficult to start with cold engine

Diagnosis Procedure

1	Check fuel pressure

a. Using a fuel pressure gauge, check fuel pressure (See page 10-11).

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 the engine, and check if spark is generated.

OK: Spark is generated.

NG → Check and repair ignition system

OK ↓

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

OK → Check and repair wire harness or replace sensor

NG ↓

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

OK → Clean throttle

NG ↓

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5	Check injector for leakage or blockage

NG → Clean or replace injector

OK ↓

6	Check fuel condition

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

NG → Replace fuel

OK ↓

7	Check pressure of cylinder

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

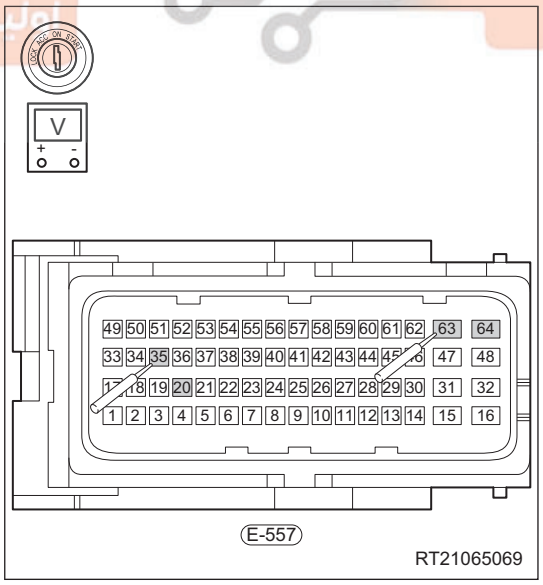
NG → Check engine to confirm cause of low compression

OK ↓

8	Check ECM power supply and ground

a. Disconnect ECM connector E-557.
b. Turn ignition switch to ON and check ECM connector terminals.

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



NG → Repair or replace related wire harness

OK ↓

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

Diagnosis Procedure

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

NG → Check and repair intake system

OK ↓

2	Check fuel pressure

a. Using a fuel pressure gauge, check fuel pressure (See page 10-11).

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 the type and gap are as specified.

NG → Replace spark plug

OK ↓

4	Check spark

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

OK: Spark is generated.

NG → Check and repair ignition system

OK ↓

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

OK → Check and repair wire harness or replace sensor

NG

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

OK → Clean throttle

NG

7	Check injector for leakage or blockage

NG → Clean or replace injector

OK

8	Check fuel condition

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

NG → Replace fuel

OK

9	Check pressure of cylinder

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

NG → Check engine to confirm cause of low compression

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

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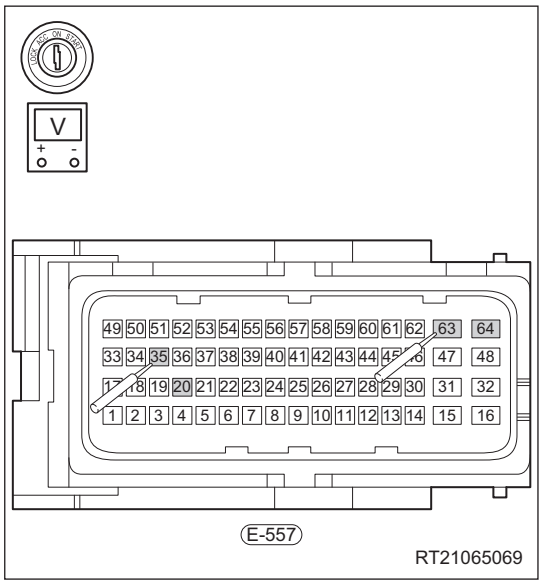
11	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK

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Engine starts normally, but idles roughly at anytime

Diagnosis Procedure

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

NG → Check and repair intake system

OK ↓

2	Check if throttle is stuck

NG → Repair or replace throttle

OK ↓

3	Check spark plug

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

NG → Replace spark plug

OK ↓

4	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

5	Check injector for leakage or blockage

NG → Clean or replace injector

OK ↓

6	Check fuel condition

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

NG → Replace fuel

OK ↓

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7	Check pressure of cylinder

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

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

OK

8	Check engine ignition sequence and ignition timing

a. Check if engine ignition sequence and ignition timing are as specified.

NG → **Check and repair ignition timing**

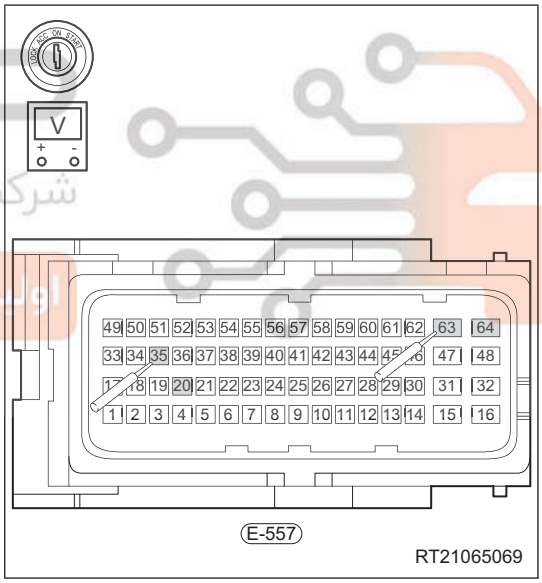
OK

9	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK

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Engine starts normally, but idles roughly during warming up

Diagnosis Procedure

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

NG → Check and repair intake system

OK ↓

2	Check spark plug

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

NG → Replace spark plug

OK ↓

3	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

4	Unplug coolant temperature sensor connector, start engine and observe if engine idles normally during warming up

OK → Check and repair wire harness or replace sensor

NG ↓

5	Check injector for leakage or blockage

NG → Clean or replace injector

OK ↓

6	Check fuel condition

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

NG → Replace fuel

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OK

7	Check pressure of cylinder

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

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

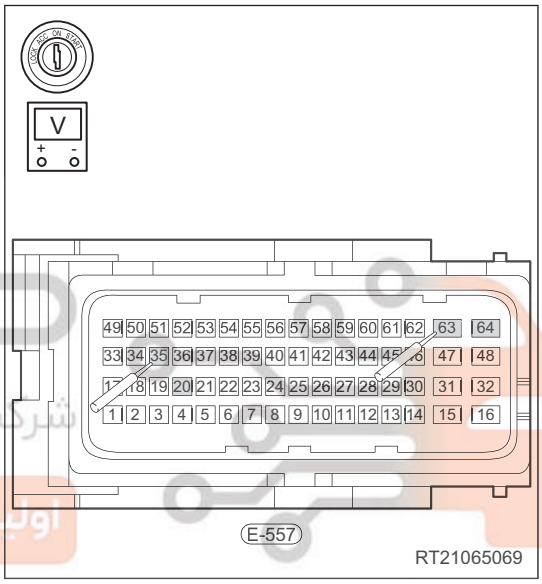
OK

8	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK

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Engine starts normally, but idles roughly after warming up

Diagnosis Procedure

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

NG → Check and repair intake system

OK ↓

2	Check spark plug

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

NG → Replace spark plug

OK ↓

3	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

4	Unplug coolant temperature sensor connector, start engine and observe if engine idles normally during warming up

OK → Check and repair wire harness or replace sensor

NG ↓

5	Check injector for leakage or blockage

NG → Clean or replace injector

OK ↓

6	Check fuel condition

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

NG → Replace fuel

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OK

7	Check pressure of cylinder

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

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

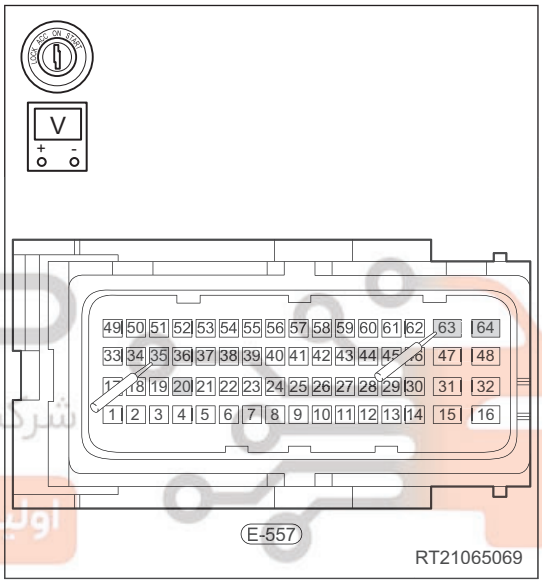
OK

8	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK

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

Diagnosis Procedure

1	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

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

OK → Go to step 4

NG ↓

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

NG → Check and repair A/C system

OK ↓

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

NG → Check and repair A/C system

OK ↓

5	Check injector for leakage or blockage

NG → Clean or replace injector

OK ↓

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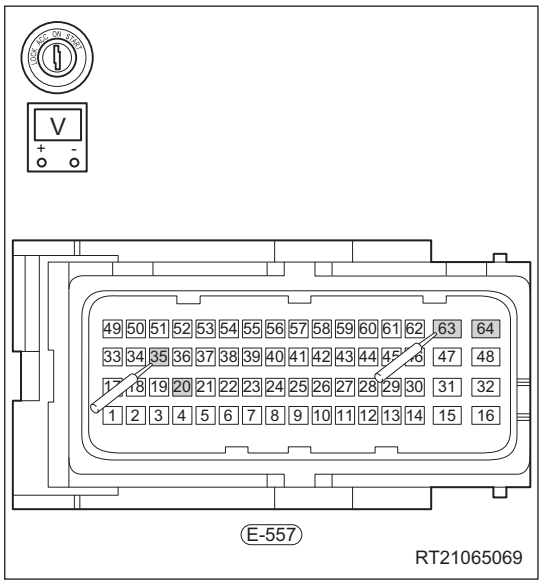
6	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK

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Engine starts normally, but idle speed is too high

Diagnosis Procedure

1	Check if accelerator pedal is stuck

NG → Adjust or replace accelerator pedal

OK ↓

2	Check intake system and connected vacuum pipe for air leakage

NG → Check and repair intake system

OK ↓

3	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

4	Disconnect coolant temperature sensor connector, start engine and observe if engine idles normally at this time

OK → Check and repair wire harness or replace sensor

NG ↓

5	Check engine ignition timing

a. Check if engine ignition timing is as specified.

NG → Check and repair ignition timing

OK ↓

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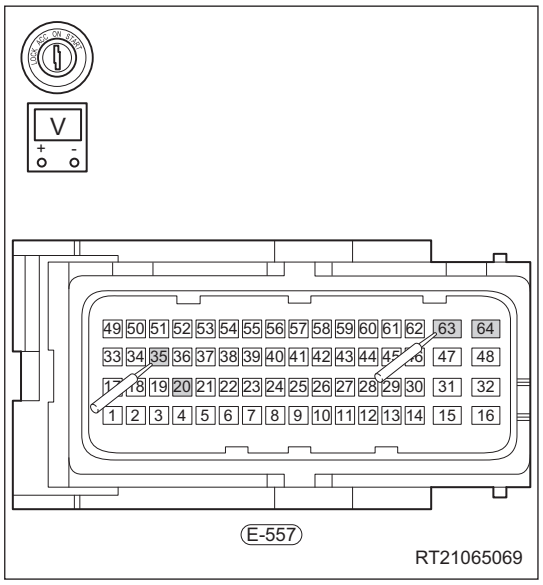
6	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK

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Low engine speed or stalls when accelerating

Diagnosis Procedure

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

NG → Check and repair intake system

OK ↓

2	Check fuel pressure

a. Using a fuel pressure gauge, check fuel pressure (See page 10-11).

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 the type and gap are as specified.

NG → Replace spark plug

OK ↓

4	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

5	Check air flow meter and throttle position sensor and wire harness

NG → Check and repair wire harness or replace sensor

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OK

6	Check injector for leakage or blockage

NG → Clean or replace injector

OK

7	Check fuel condition

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

NG → Replace fuel

OK

8	Check engine ignition sequence and ignition timing

a. Check if engine ignition sequence and ignition timing are as specified.

NG → Check and repair ignition timing

OK

9	Check exhaust system

a. Check exhaust system for leakage or blockage.

NG → Repair or replace related exhaust system components

OK

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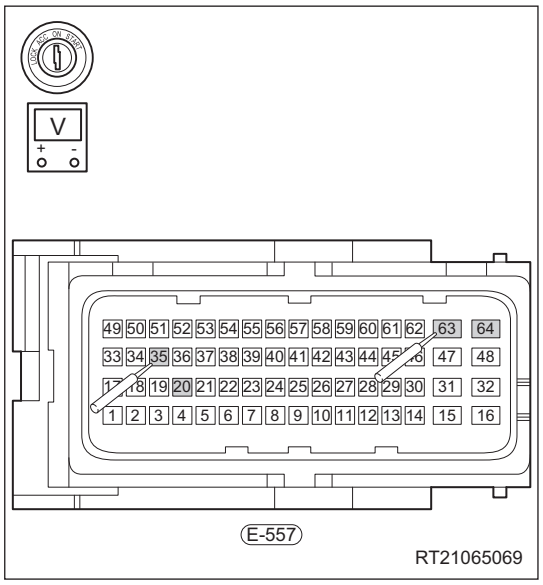
10	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK →

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Slow response when accelerating

Diagnosis Procedure

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

NG → Check and repair intake system

OK ↓

2	Check fuel pressure

a. Using a fuel pressure gauge, check fuel pressure (See page 10-11).

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 the type and gap are as specified.

NG → Replace spark plug

OK ↓

4	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

5	Check air flow meter and throttle position sensor and wire harness

NG → Check and repair wire harness or replace sensor

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OK

6	Check injector for leakage or blockage

NG → Clean or replace injector

OK

7	Check fuel condition

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

NG → Replace fuel

OK

8	Check engine ignition sequence and ignition timing

a. Check if engine ignition sequence and ignition timing are as specified.

NG → Check and repair ignition timing

OK

9	Check exhaust system

a. Check exhaust system for leakage or blockage.

NG → Repair or replace related exhaust system components

OK

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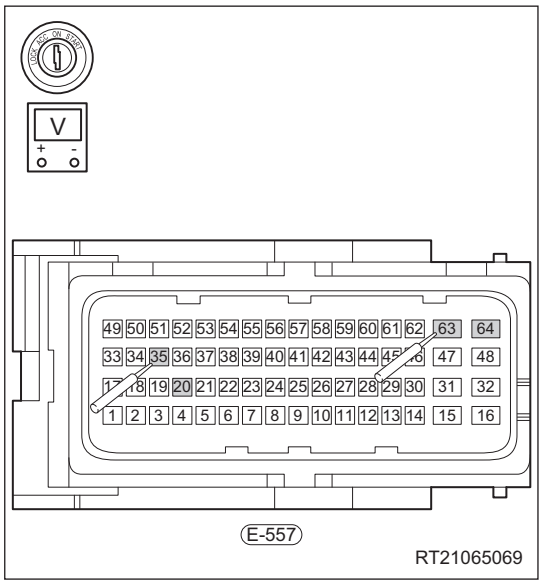
10	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



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

OK

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Lack of power and poor performance when accelerating

Diagnosis Procedure

1	Check if malfunctions that clutch slipping, low tire inflation pressure, brake dragging, incorrect tire size, and incorrect four-wheel alignment are present

NG → Check and repair malfunctioning component

OK ↓

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

NG → Check and repair intake system

OK ↓

3	Check fuel pressure

a. Using a fuel pressure gauge, check fuel pressure (See page 10-11).

Standard Fuel Pressure

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

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NG → Repair or replace fuel system

OK ↓

4	Check spark plug

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

NG → Replace spark plug

OK ↓

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5	Check spark

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

OK: Spark is generated.

NG → Check and repair ignition system

OK ↓

6	Check throttle for carbon deposits

NG → Clean throttle

OK ↓

7	Check air flow meter and throttle position sensor and wire harness

NG → Check and repair wire harness or replace sensor

OK ↓

8	Check injector for leakage or blockage

NG → Clean or replace injector

OK ↓

9	Check fuel condition

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

NG → Replace fuel

OK ↓

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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

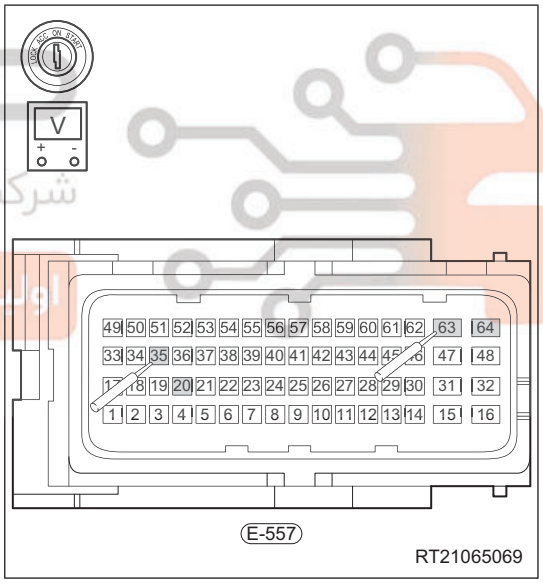
OK

12	Check ECM power supply and ground

a. Disconnect ECM connector E-557.

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

Multimeter Connection	Condition	Specified Condition
E-557 (35, 20) - E-557 (63 or 64)	Ignition switch ON	11 to 14 V



NG → Repair or replace related wire harness

OK

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ON-VEHICLE SERVICE

Intake/Exhaust VVT Control Valve

Description

There are two VVT control valves, which are located on intake side and exhaust side respectively.

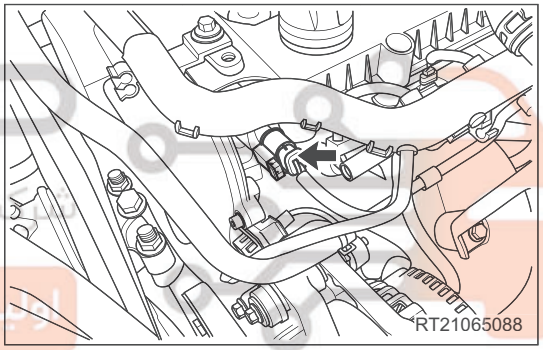
Operation

ECM controls the VVT control valve depending on the engine condition, changes the flowing direction of oil in the phasers to advance or retard intake/exhaust camshaft, thus changing the timing of intake valve and exhaust valve.

Removal

Use the same procedures of removal for exhaust VVT control valve and intake VVT control valve. The procedures listed below are for the intake VVT control valve.

1. Turn off all electrical equipment and ignition switch.
2. Disconnect negative battery cable.
3. Remove engine trim cover.
4. Remove intake VVT control valve.
   a. Disconnect intake VVT control valve connector.



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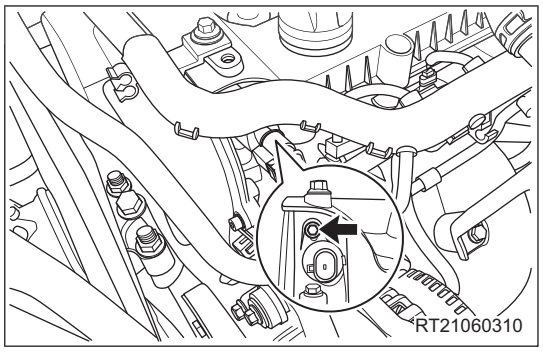
   b. Remove intake VVT control valve fixing bolt and intake VVT control valve.
   (Tightening torque: 8 ± 2 N·m)



Installation

Installation is in the reverse order of removal.

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Coolant Temperature Sensor

Description

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

Operation

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

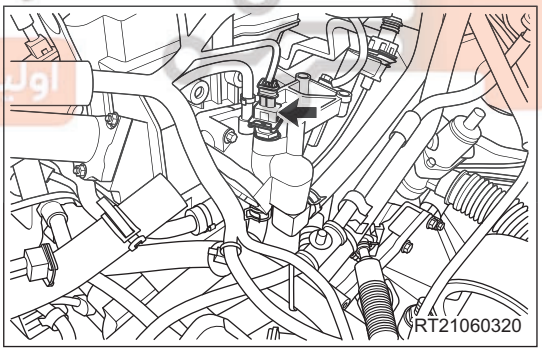
Removal

1. Turn off all electrical equipment and ignition switch.
2. Disconnect negative battery cable.
3. Drain coolant (See page 18-13).

⚠ WARNING

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

4. Remove engine trim cover.
5. Remove coolant temperature sensor.
   a. Disconnect coolant temperature sensor connector and remove coolant temperature sensor. (Tightening torque: 11 - 16 N·m)



⚠ WARNING

- Remove the coolant temperature sensor when engine cools down to avoid scalding injury.

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Installation

Installation is in the reverse order of removal.

CAUTION

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

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Knock Sensor

Description

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

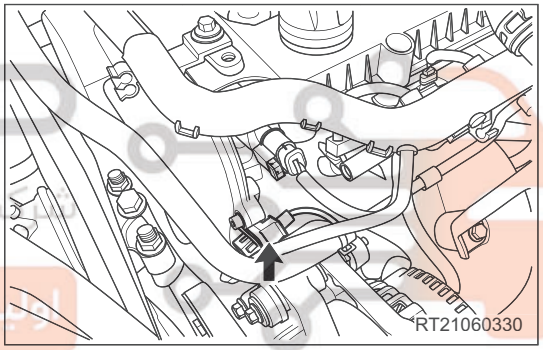
Operation

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

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

Removal

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



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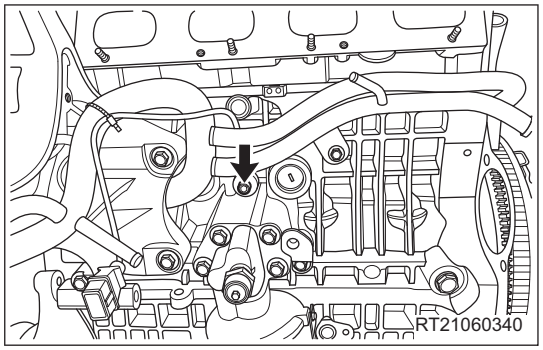
   b. Remove intake manifold assembly (See page 14-23).
   c. Remove knock sensor fixing bolt and knock sensor. (Tightening torque: 20 ± 5 N·m)



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Installation

Installation is in the reverse order of removal.

CAUTION

- Never allow any kinds of gasket and washer between sensor and engine block. Only the metal part of sensor can contact with the engine block directly.
- DO NOT apply lubricant, grease or seal gum when installing 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.

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Oxygen Sensor

Description

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

Operation

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

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

Upstream Oxygen Sensor

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

Downstream Oxygen Sensor

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

Removal & Installation - Upstream Oxygen Sensor

(See page 16-10)

Removal & Installation - Downstream Oxygen Sensor

(See page 16-11)

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Camshaft Position Sensor

Description

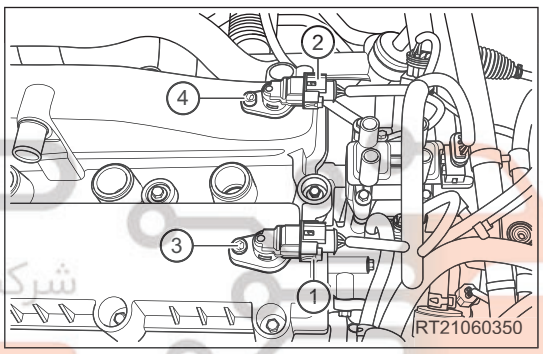
This vehicle is equipped with an intake camshaft position sensor and an exhaust camshaft position sensor, which are installed on cylinder head cover.

Operation

The camshaft position sensor is a Hall type sensor and a sensor plate is installed on camshaft. When the sensor plate is in high teeth, the applicable circuit output is low; when the sensor plate is in missing teeth, the applicable circuit output is high. As a result, the crankshaft phase information is provided to 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 ignition switch.
2. Disconnect negative battery cable.
3. Remove engine trim cover.
4. Remove camshaft position sensor.
   a. Disconnect intake camshaft position sensor connector (1) and exhaust camshaft position sensor connector (2).
   b. Remove intake camshaft position sensor fixing bolt (3) and exhaust camshaft position sensor fixing bolt (4). (Tightening torque: 8 ± 0.5 N·m)



   c. Remove intake camshaft position sensor and exhaust camshaft position sensor.

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Installation

Installation is in the reverse order of removal.

CAUTION

- The sensor should be pressed into mounting hole. Never use tools (such as a hammer) to strike the sensor into mounting hole forcibly.

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Engine Speed Sensor

Description

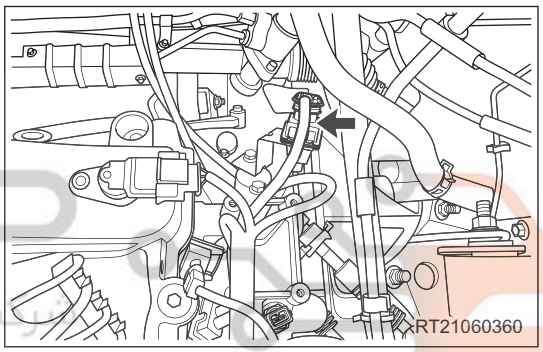
The engine speed sensor is installed on clutch case, against flywheel teeth. It is used to detect the speed and position of crankshaft.

Operation

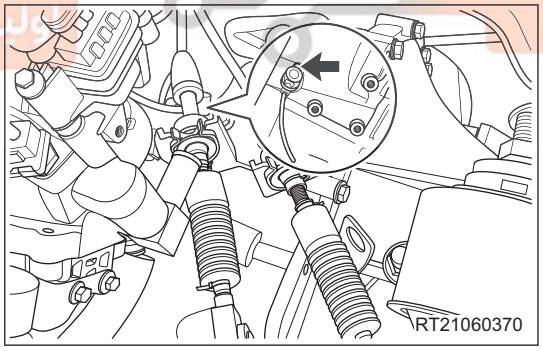
The engine speed sensor operates by using magnetoelectric effect. When crankshaft rotates, it drives flywheel to rotate. The flywheel teeth will cut the magnetic line of sensor, and change of magnetic flux causes both ends of sensor coil to generate output voltage with a certain frequency that is sent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

Removal

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



   b. Remove engine speed sensor fixing bolt and engine speed sensor.
   (Tightening torque: 8 ± 2 N·m)



Installation

Installation is in the reverse order of removal.

CAUTION

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

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Intake Pressure/Temperature Sensor

Description

Intake pressure/temperature sensor integrates with intake manifold absolute pressure sensor and intake temperature sensor.

Operation

Intake manifold absolute pressure sensing element consists of a piece of silicon chip, which will deform mechanically as intake manifold absolute pressure changes. 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 silicon chip.

Intake temperature sensor is a negative temperature coefficient thermistor, whose resistance changes with intake temperature. This sensor converts temperature signal into voltage value and sends it to Engine Control Module (ECM), thus monitoring the change of intake temperature.

Removal & Installation

(See page 14-12)

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Ignition Coil

Description

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

Operation

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

Removal & Installation

(See page 06-252)

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Electric Fuel Pump

Description

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

Operation

The battery supplies power to 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, the fuel pump stops running automatically. The maximum pressure at electric fuel pump outlet is adjusted by pressure regulator to keep the whole fuel system pressure at 400 kPa.

Removal & Installation

(See page 06-253)

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Fuel Injector

Description

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

Operation

The 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 gravity and friction force, the needle begins to rise up and injector starts to inject fuel. The pressure of return spring forces the needle to close again when injection pulse stops.

Removal & Installation

(See page 10-26)

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Electronic Throttle Assembly

Description

The electronic throttle assembly is located on intake manifold assembly.

Operation

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

The electronic throttle assembly consists of four parts: drive module, train module, executive module and feedback module, and all components are integrated into the same throttle valve housing.

Removal & Installation

(See page 14-19)

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Canister Solenoid Valve

Description

The canister solenoid valve opens when power is on, and closes when power is off.

Operation

The canister solenoid valve consists of solenoid coil, magnet armature, valve, etc. The air volume through canister solenoid valve depends on electric pulse duty ratio that outputs from Engine Control Module (ECM) and pressure difference between canister inlet and outlet. When there is no electric pulse, the canister solenoid valve closes.

Removal & Installation

(See page 12-7)

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Engine Control Module (ECM)

Description

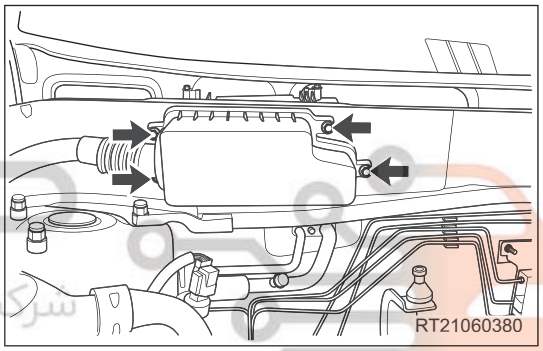
The Engine Control Module (ECM), mounted on the lower right side of engine compartment rain gutter front end panel assembly, can be removed only as a unit for replacement.

Operation

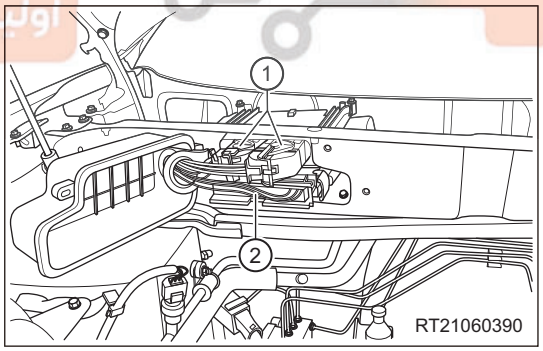
The Engine Control Module (ECM) is a pre-programmed microprocessor digital computer, which is used to adjust ignition timing, air-fuel ratio, emission control, speed control, A/C compressor and idle speed etc. The Engine Control Module (ECM) enables the program to suit ever-changing operation conditions.

Removal

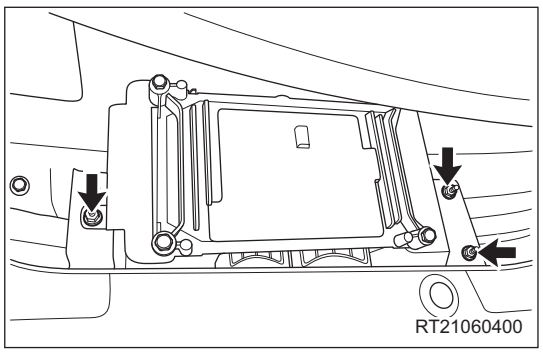
1. Turn off all electrical equipment and ignition switch.
2. Disconnect negative battery cable.
3. Remove front wiper arm assembly (See page 49-23).
4. Remove front windshield lower garnish assembly (See page 62-39).
5. Remove Engine Control Module (ECM).
   a. Remove ECM connector protection cover bolts.



   b. For MT model, disconnect 2 ECM connectors (1).
   For CVT model, disconnect 2 ECM connector (1) and TCU connector (2).



   c. Remove ECM bracket fixing nuts (arrow).
   (Tightening torque: 7 ± 1 N·m)



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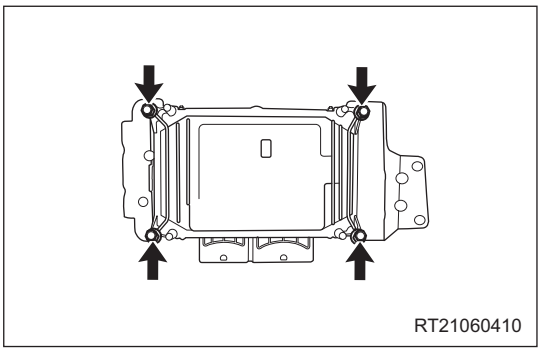
d. Remove the Engine Control Module (ECM) from bracket.



Installation

Installation is in the reverse order of removal.

CAUTION

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

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