Fuel System (G6BA-GSL 2.7)

GENERAL

SPECIFICATIONS EDC64FCA

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	55 L
Fuel Retrun System	Type	Returnless
Fuel Filter	Type	High pressure type (built in Fuel Pump Assembly)
Fuel Pressure Regulator	Type	Built in fuel pump assembly
	Regulated Fuel Pressure	350 kpa (3.5 kg/cm2, 49.8 psi)
Fuel Pump	Type	Electrical, in-tank type

ENGINE MANAGEMENT SYSTEM

SENSORS	Mass Air Flow Sensor (MAFS)	Type	Hot film type	
		Output Voltage	Idle: 0.6 ~ 1.0 V	
			2000 rpm: 1.3 ~ 1.5 V 3000 rpm: 1.7 ~ 1.9 V	
	Intake Air Temperature Sensor (IATS)	Type	Thermistor type (built in MAFS)	
		Resistance	-20°C(-4°F)	11.72 ~ 19.54 kΩ
			0°C(32°F)	4.75 ~ 7.11 kΩ
			20°C(68°F)	2.22 ~ 2.82 kΩ
			40°C(104°F)	1.06 ~ 1.31 kΩ
			60°C(140°F)	0.55 ~ 0.66 kΩ
			80°C(176°F)	0.30 ~ 0.36 kΩ
	Engine Coolant Temperature Sensor (ECTS)	Type	Thermistor type	
		Resistance	-40°C(-40°F)	48.14 kΩ
			-20°C(-4°F)	14.13 ~ 16.83 kΩ
			0°C(32°F)	5.79 kΩ
			20°C(68°F)	2.31 ~ 2.59 kΩ
			40°C(104°F)	1.15 kΩ
			60°C(140°F)	0.59 kΩ
			80°C(176°F)	0.32 kΩ

SENSOR	Throttle Position Sensor (TPS)	Type	Variable Resistor Type	
		Resistance	1.6 ~ 2.4 kΩ	
		Output Voltage	C.T	0.2 ~ 0.8 V
			W.O.T	4.3 ~ 4.8 V
	Heated Oxygen Sensor (HO2S)	Type	Zirconia Sensor (including Heater)	
		Output Voltage	0 ~ 1V	
		Heater Resistance	3.0 ~ 4.0Ω at 23±5℃	
	Knock Sensor	Type	Piezo-electric type	
		Capacitance	0.8 ~1.6 nF	
	Camshaft Position Sensor (CMPS)	Type	Hall Effect Sensor	
		Output Voltage	0 ~ 5.0V	
	Crankshaft Position Sensor (CKPS)	Type	Hall Effect Sensor	
		Output Voltage	0 ~ 5.0V	
ACTUATORS	Injector	Type	Electromagnetic Type	
		Number	6	
		Coil Resistance	13.8 ~ 15.2 Ω at 20℃	
	Purge Control Solenoid Valve (PCSV)	Type	Duty Control Type	
		Coil Resistance	24.5 ~ 27.5 Ω at 20℃	
	Idle Speed Control Actuator (ISCA)	Type	Double Coil Type	
		Coil Resistance	CLOSE	17.0 ~ 18.2 Ω (at 20℃)
			OPEN	14.9 ~ 16.1 Ω (at 20℃)
	Ignition Coil	Type	Mold Coil type	
		Primary Coil	0.74±10% Ω	
		Secondary Coil	13.3±15% kΩ	

SEALANTS E319AF6A

Engine Coolant Temperature Sensor (ECTS) assemby	LOCTITE 962T or equivalent

SERVICE STANDARD

Basic Idle rpm (After warm up)	A/C OFF	N, P (or Neutral)	700±100 rpm
		D	700±100 rpm
	A/C ON	N,P (or Neutral)	870±100 rpm
		D	700±100 rpm
Ignition Timing(After warm up, at idle)	BTDC 12°±5°		

TIGHTENING TORQUES E5FDCEF7

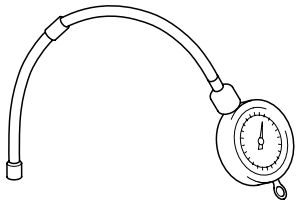
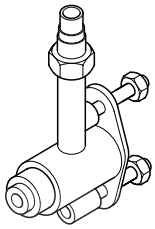
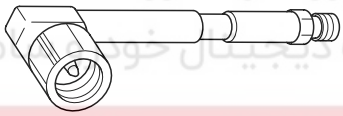
ENGINE CONTROL SYSTEM

Items	N·m	kgf·m	lbf·ft
ECM bracket installation bolt/nut	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Mass air flow sensor clamp installation	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6
Crankshaft position sensor installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Crankshaft position sensor connector bracket installation bolt	19.6 ~ 21.6	2.0 ~ 2.2	14.5 ~ 15.9
Crankshaft position sensor wheel installation screw	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
Knock sensor installation bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Knock sensor connector bracket installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Engine coolant temperature sensor installation	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Heated Oxygen Sensor (Bank 1, Sensor 1)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Heated Oxygen Sensor (Bank 1, Sensor 2)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Heated Oxygen Sensor (Bank 2, Sensor 1)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Heated Oxygen Sensor (Bank 2, Sensor 2)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Camshaft position sensor installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Oil pressure switch installation	14.7 ~ 21.6	1.5 ~ 2.2	10.9 ~ 15.9
Throttle position sensor installation screws	1.5 ~ 2.5	0.15 ~ 0.25	1.1 ~ 1.8
Idle speed control actuator installation bolts	5.9 ~ 7.8	0.6 ~ 0.8	4.3 ~ 5.8

FUEL DELIVERY SYSTEM

Items	N·m	kgf·m	lbf·ft
Delivery pipe installation bolts	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.9
Throttle body installation bolt/nut	14.7 ~ 19.6	1.5 ~ 2.0	10.9 ~ 14.5
Accelerator pedal installation bolt	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~11.6

SPECIAL SERVICE TOOLS E4BD844F

Tool (Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge	 EFDA003A	Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter	 BF1A025D	Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector	 EFDA003C	Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)

BASIC TROUBLESHOOTING E9DB66BC

BASIC TROUBLESHOOTING GUIDE

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**

- Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**

- Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC).
- Record the DTC and freeze frame data.

NOTE

To erase DTC and freeze frame data, refer to Step 5.

4	**Confirm the Inspection Procedure for the System or Part**

- Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**

WARNING

NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".

6	**Inspect Vehicle Visually**

- Go to Step 11, if you recognize the problem.

7	**Recreate (Simulate) Symptoms the DTC**

- Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
- If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	**Confirm Symptoms of Problem**

- If DTC(s) is/are not displayed, go to Step 9.
- If DTC(s) is/are displayed, go to Step 11.

9	**Recreate (Simulate) Symptom**

- Try to recreate or simulate the condition of the malfunction as described by the customer.

10	**Check the DTC**

- If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.
- If DTC(s) occur(s), go to Step 11.

11	**Perform troubleshooting procedure for DTC**

12	**Adjust or repair the vehicle**

13	**Confirm test**

14	**END**

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CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

(I) VIN:
(II) Production Date:
(III) Odometer Reading: (km)

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other_____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High: _____ rpm, Low: _____rpm) ☐ Other _____
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other _____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other _____

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other _____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other _____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (____ min) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other _____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)	☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

BASIC INSPECTION PROCEDURE

MEASURING CONDITION OF ELECTRONIC PARTS' RESISTANCE

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20℃, 68°F), unless there is any notice.

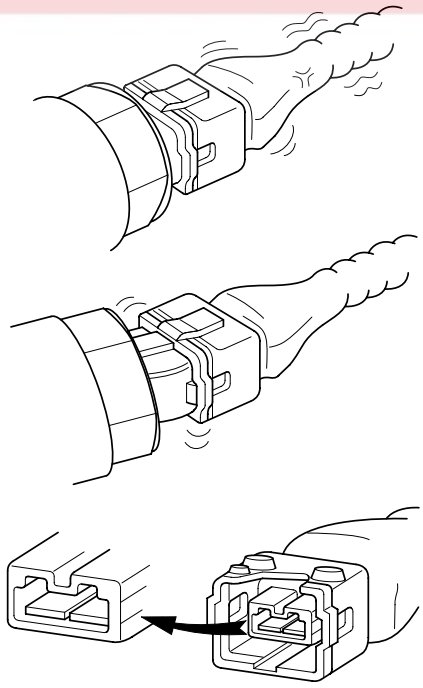
NOTE

The measured resistance in except for ambient temperature (20℃, 68°F) is reference value.

INTERMITTENT PROBLEM INSPECTION PROCEDURE

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, technician should thoroughly make out a "CUSTOMER PROBLEM ANALYSIS SHEET" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



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3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● SIMULATING VIBRATION

a. Sensors and Actuators
: Slightly vibrate sensors, actuators or relays with finger.

WARNING

Strong vibration may break sensors, actuators or relays

b. Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● SIMULATING HEAT

a. Heat components suspected of causing the malfunction with a hair dryer or other heat sourre.

WARNING

- **DO NOT heat components to the point where they may be damaged.**
- **DO NOT heat the ECM directly.**

● SIMULATING WATER SPRINKLING

a. Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

WARNING

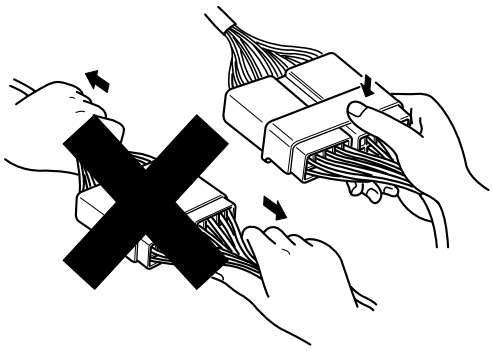
DO NOT sprinkle water directly into the engine compartment or electronic components.

● SIMULATING ELECTRICAL LOAD

a. Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, etc.).

CONNECTOR INSPECTION PROCEDURE

1. Handling of Connector
   a. Never pull on the wiring harness when disconnecting connectors.



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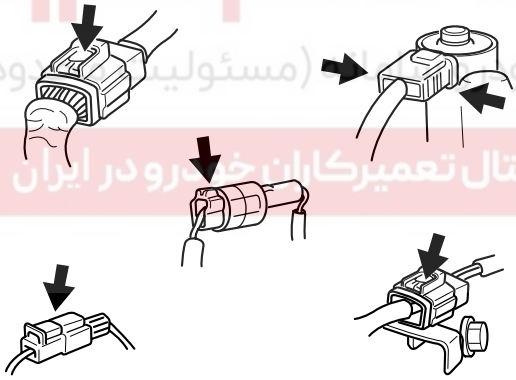
   b. When removing the connector with a lock, press or pull locking lever.



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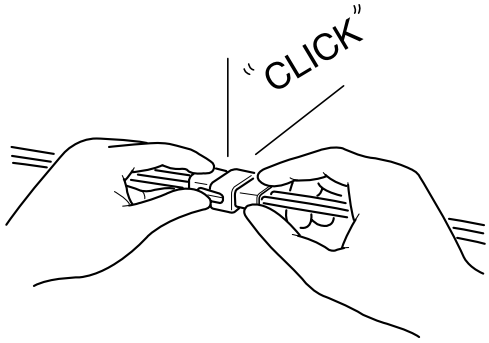
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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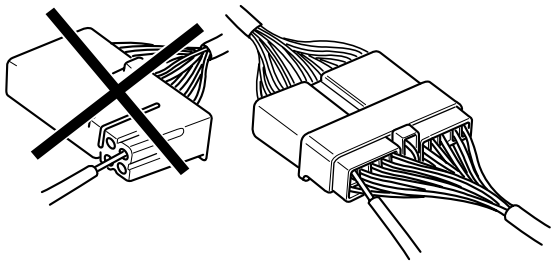
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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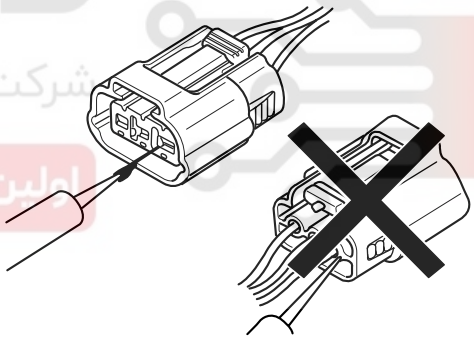
   e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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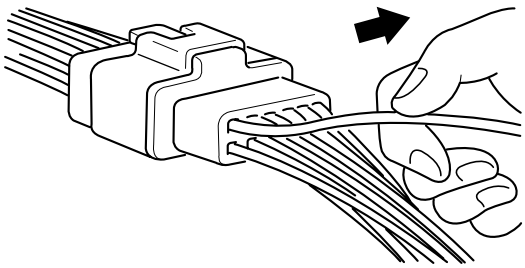
NOTE

- *Use a fine wire to prevent damage to the terminal.*
- *Do not damage the terminal when inserting the tester lead.*

2. Checking Point for Connector
   a. While the connector is connected:
   Hold the connector, check connecting condition and locking efficiency.
   b. When the connector is disconnected:
   Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness. Visually check for rust, contamination, deformation and bend.
   c. Check terminal tightening condition:
   Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

d. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



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3. Repair Method of Connector Terminal
   a. Clean the contact points using air gun and/or shop rag.

NOTE

Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

   b. In case of abnormal contact pressure, replace the female terminal.

WIRE HARNESS INSPECTION PROCEDURE

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.

2. Check whether the wire harness is twisted, pulled or loosened.

3. Check whether the temperature of the wire harness is abnormally high.

4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.

5. Check the connection between the wire harness and any installed part.

6. If the covering of wire harness is damaged; secure, repair or replace the harness.

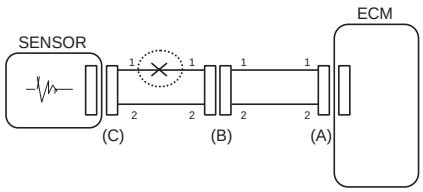
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● CHECK OPEN CIRCUIT

1. Procedures for Open Circuit
   - Continuity Check
   - Voltage Check

If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



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2. Continuity Check Method

NOTE

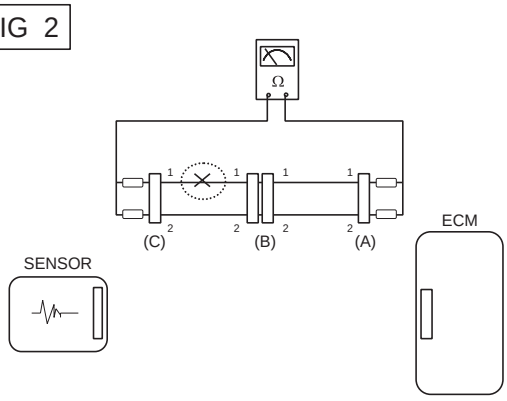
When measuring for resistance, lightly shake the wire harness above and below or from side to side.

Specification (Resistance)
1Ω or less → Normal Circuit
1MΩ or Higher → Open Circuit

   a. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

      In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2



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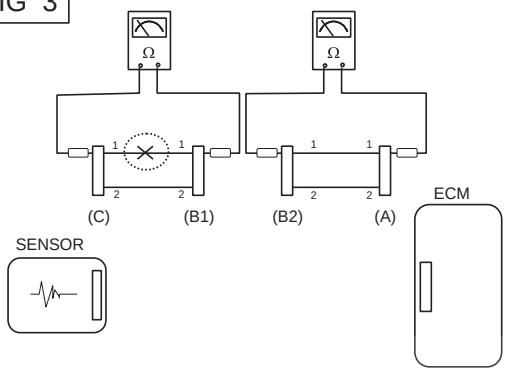
b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 3



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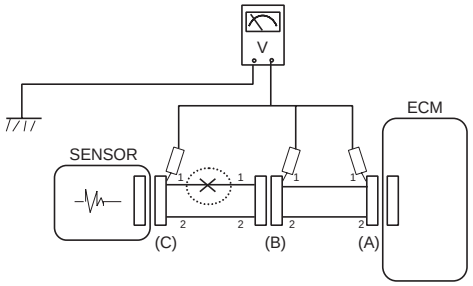
3. Voltage Check Method

a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

FIG 4



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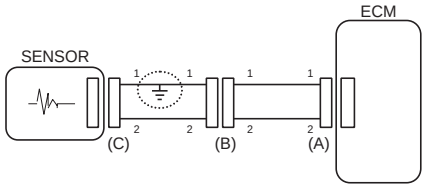
● CHECK SHORT CIRCUIT

4. Test Method for Short to Ground Circuit
   - Continuity Check with Chassis Ground

If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing below Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



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5. Continuity Check Method (with Chassis Ground)

NOTE

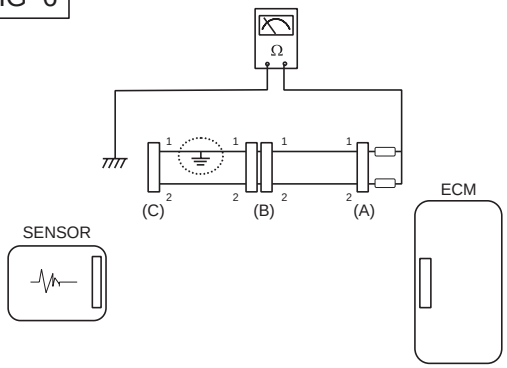
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

a. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].

The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the folowing step.

FIG 6



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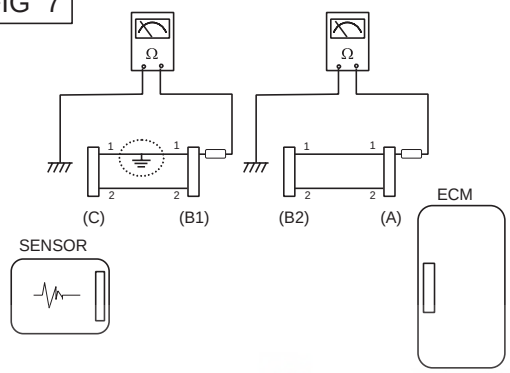
b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 7



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SYMPTOM TROUBLESHOOTING GUIDE CHART

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp ON)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the ISCA and ISCA circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the ISCA and ISCA circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Poor fuel economy	1. Check customer's driving habits • Is A/C on full time or the defroster mode on? • Are tires at correct pressure? • Is excessively heavy load being carried? • Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECT sensor and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refueling (Overflow during refueling)	1. Inspect the fuel filler hose/pipe • Pinched, kinked or blocked? • Filler hose is torn 2. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 3. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

GASOLINE ENGINE CONTROL SYSTEM

DESCRIPTION E30FF0DE

If the Gasoline Engine Control system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may be encountered.

1. Engine is hard to start or does not start at all.
2. Unstable idle.
3. Poor driveability

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the Gasoline Engine Control system components with the HI-SCAN (Pro).

NOTE

- *Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.*
- *Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the ECM.*
- *The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.*
- *When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.*
- *When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.*

MALFUNCTION INDICATOR LAMP (MIL)

[EOBD]

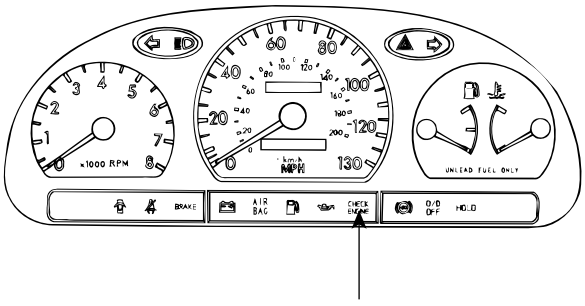
A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL.

- Catalyst
- Fuel system
- Mass Air Flow Sensor (MAFS)
- Intake Air Temperature Sensor (IATS)
- Engine Coolant Temperature Sensor (ECTS)
- Throttle Position Sensor (TPS)
- Upstream Oxygen Sensor
- Upstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Injector
- Misfire
- Crankshaft Position Sensor (CKPS)
- Camshaft Position Sensor (CMPS)
- Evaporative Emission Control System
- Vehicle Speed Sensor (VSS)
- Idle Speed Control Actuator (ISCA)
- Power Supply
- ECM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.



Malfunction indicator lamp

EFDA015A

[NON-EOBD]

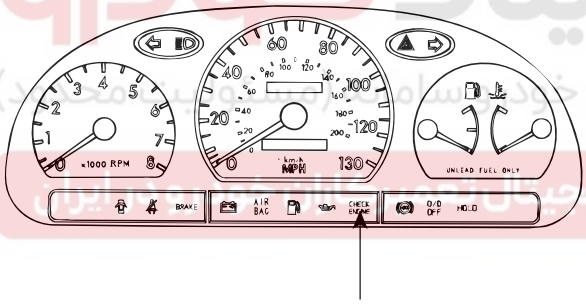
A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)
- Mass Air Flow sensor (MAFS)
- Throttle position sensor (TPS)
- Engine coolant temperature sensor (ECTS)
- Idle speed control actuator (ISCA)
- Injectors
- ECM

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.



EFDA015A

[INSPECTION]

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.

2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

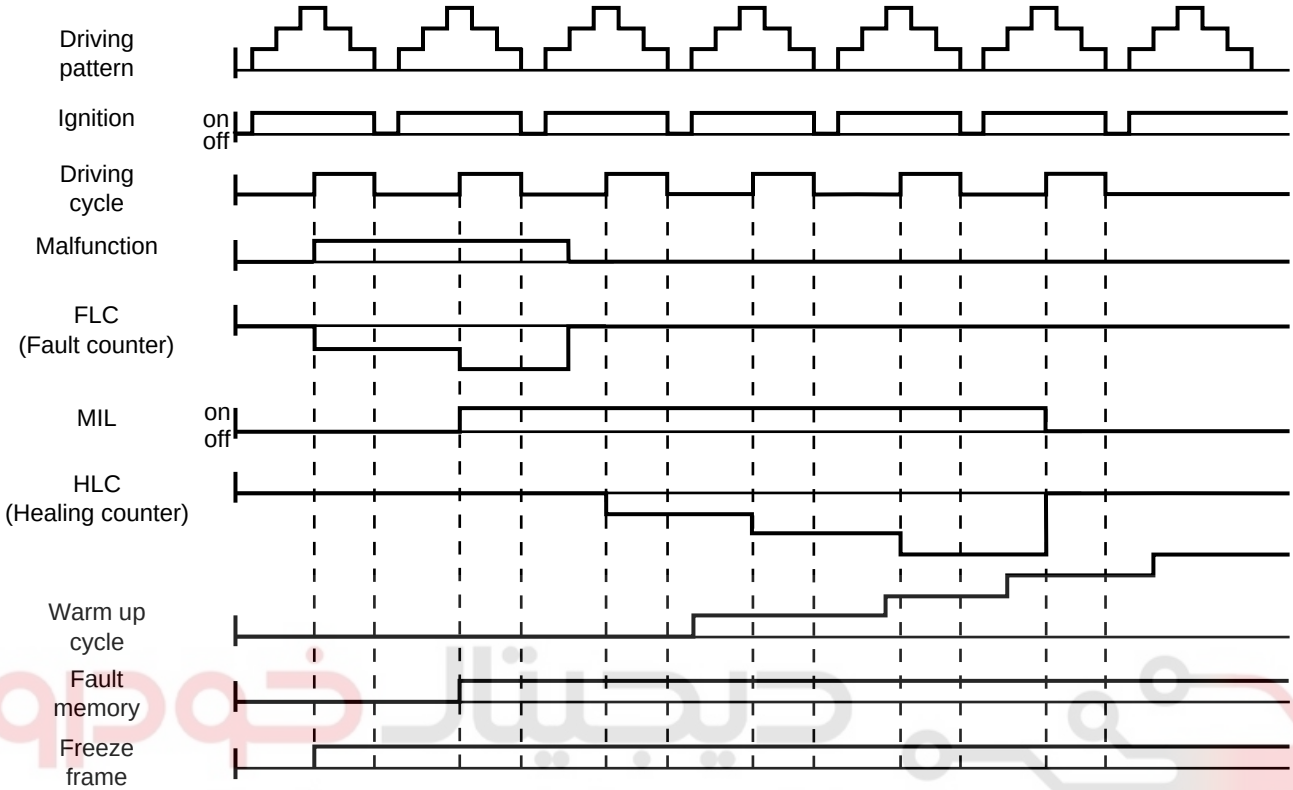
SELF-DIAGNOSIS

The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN (Pro). Diagnostic Trouble Codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or ECM connector is disconnected, or by the HI-SCAN (Pro).

NOTE

If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

THE RELATION BETWEEN DTC AND DRIVING PATTERN IN EOBD SYSTEM



LGIF601Q

1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.

2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.

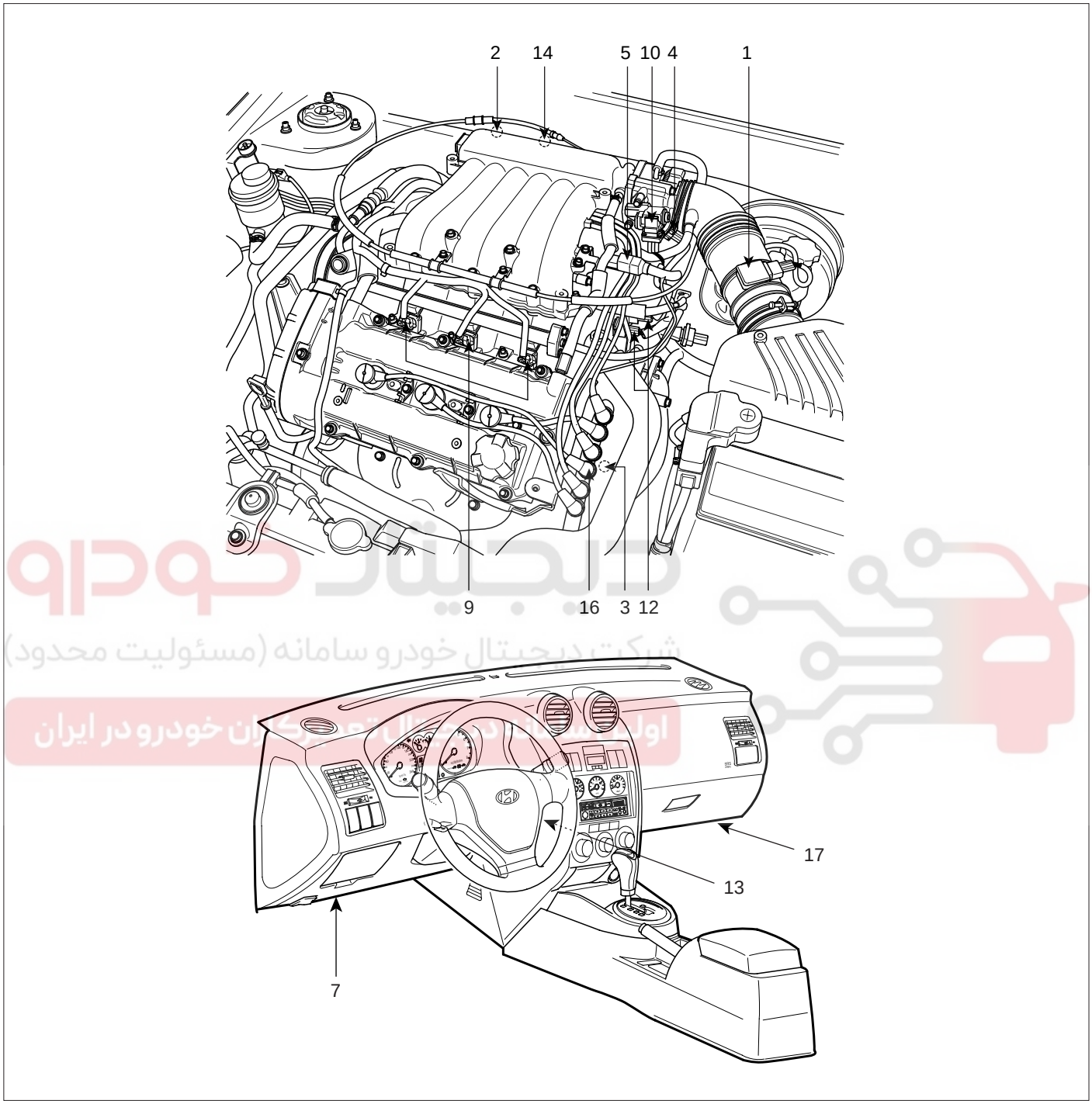
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
   If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.

4. A Diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

NOTE

- *A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degress Fahrenheit.*
- *A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.*

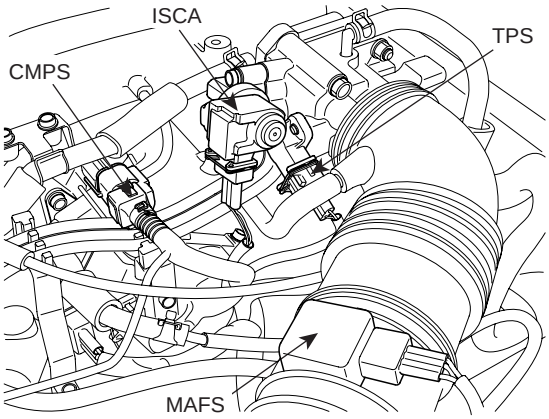
COMPONENTS LOCATION E9FF7BCC



1. Mass Air Flow Sensor (MAFS)
2. Intake Air Temperature Sensor (IATS)
3. Engine Coolant Temperature Sensor (ECTS)
4. Throttle Position Sensor (TPS)
5. Camshaft Position Sensor (CMPS)
6. Crankshaft Position Sensor (CKPS)
7. Diagnostic Link Connector (DLC)
8. Fuel Pump Relay
9. Injector
10. Idle Speed Control Actuator (ISCA)
11. Vehicle Speed Sensor (VSS)
12. Knock Sensor
13. Ignition Switch
14. Purge Control Solenoid Valve (PCSV)
15. Main Relay
16. Ignition Coil
17. ECM
18. Heated Oxygen Sensor (Bank1, Sensor1)
19. Heated Oxygen seneor (Bank1, Sensor2)
20. Heated Oxygen seneor (Bank2, Sensor1)
21. Heated Oxygen seneor (Bank2, Sensor2)

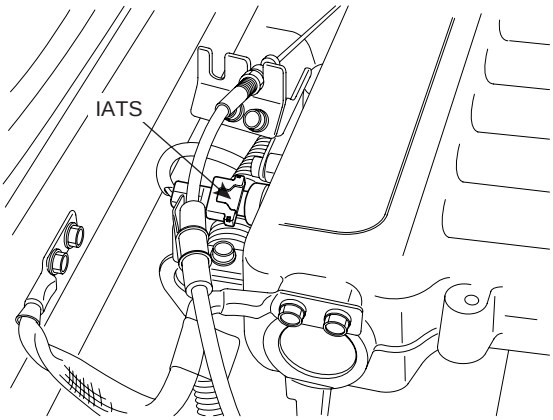
EZOF600R

[1] Mass Air Flow Sensor (MAFS)
[4] Throttle Position Sensor (TPS)
[5] Camshaft Position Sensor (CMPS)
[10] Idle Speed Control Actuator (ISCA)



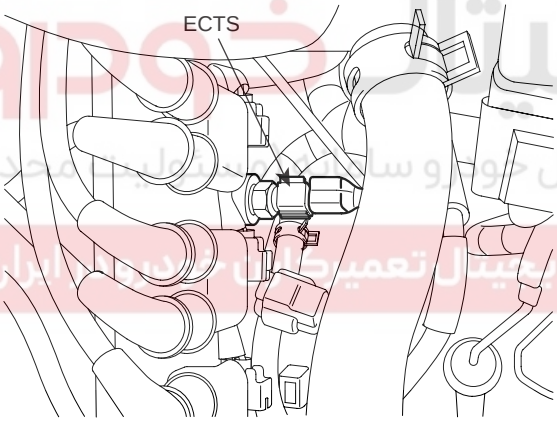
EGOF007B

[2] Intake Air Temperature Sensor (IATS)



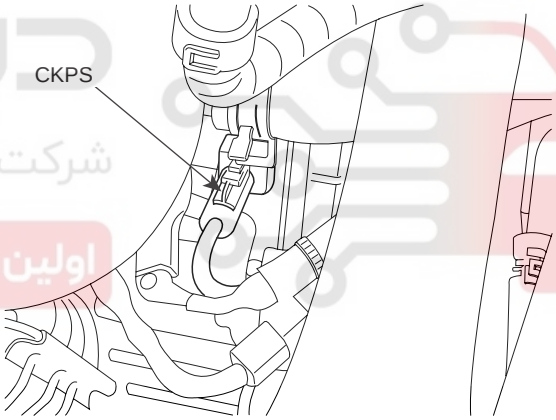
EGOF007D

[3] Engine Coolant Temperature Sensor (ECTS)



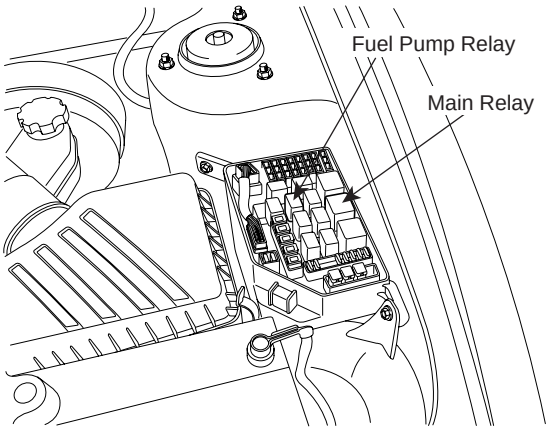
EGOF501Q

[6] Crankshaft Position Sensor (CKPS)



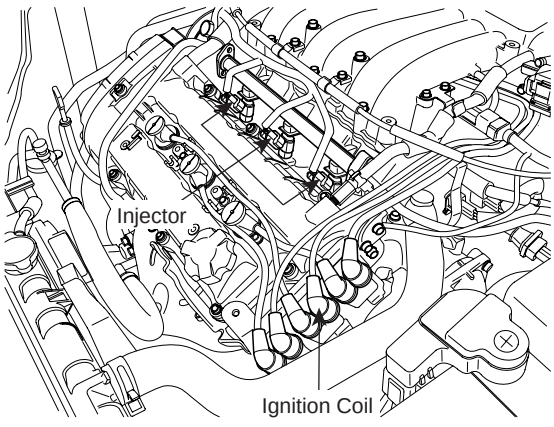
EGOF550V

[8] Fuel Pump Relay
[15] Main Relay



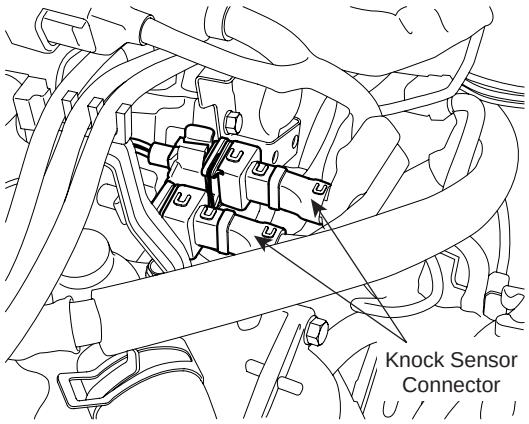
EZOF007J

[9] Injector
[16] Ignition Coil



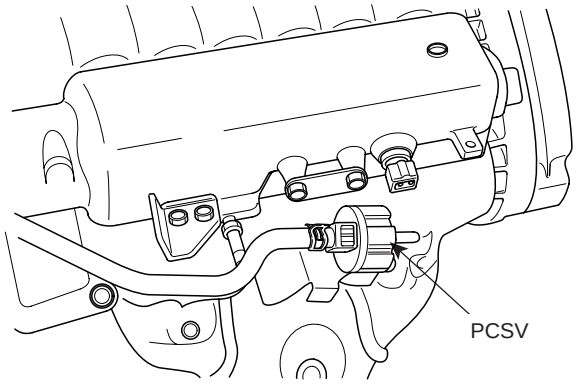
EZOF301J

[12] Knock Sensor



EZOF550G

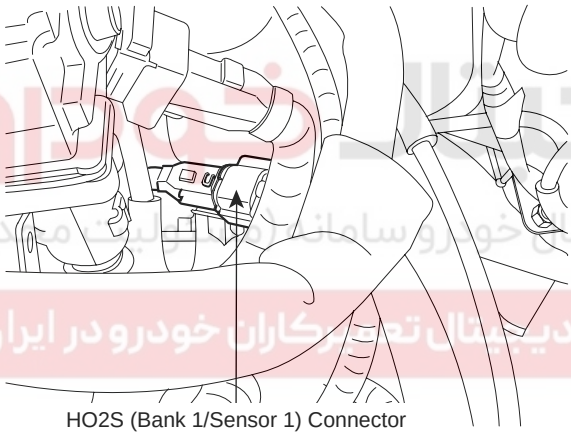
[14] Purge Control Solenoid Valve (PCSV)



EGOF007I

[18] Heated Oxygen Sensor (Bank 1, Sensor 1)

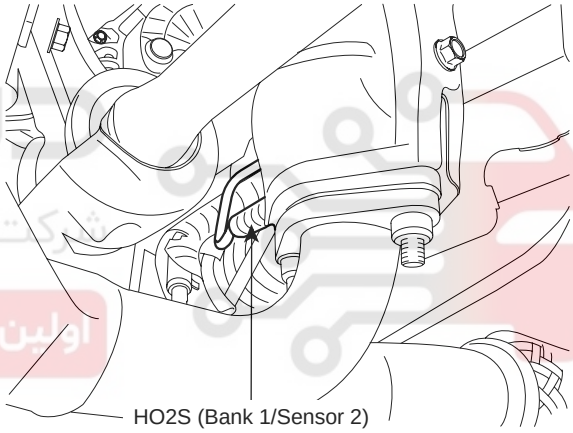
[EURO-III/IV & JAPAN]



EZOF550N

[19] Heated Oxygen Sensor (Bank 1, Sensor 2)

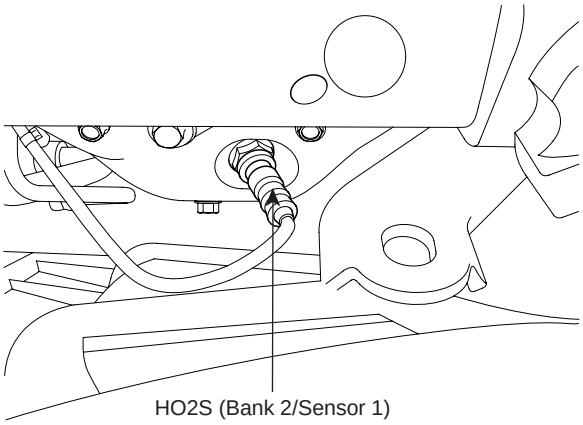
[EURO-III/IV & JAPAN]



EZOF550O

[20] Heated Oxygen Sensor (Bank 2, Sensor 1)

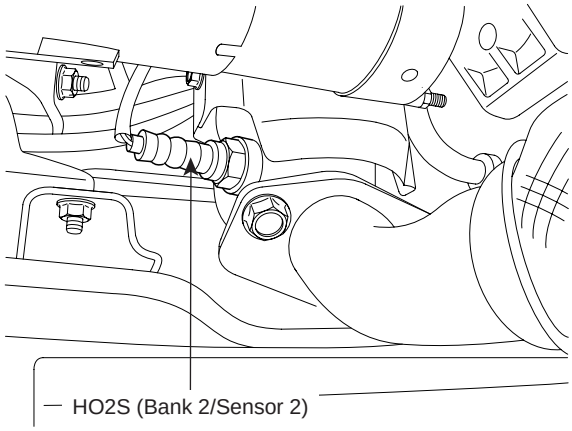
[EURO-III/IV & JAPAN]



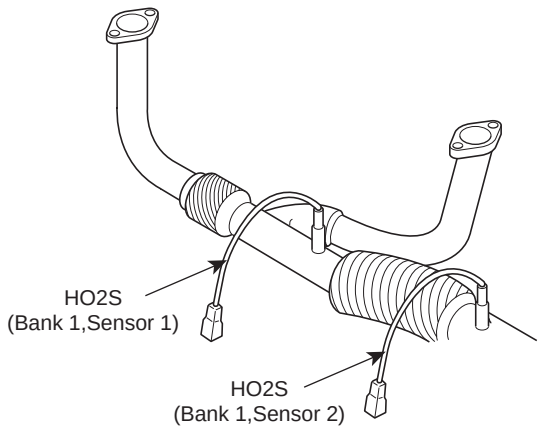
EZOF550P

[21] Heated Oxygen Sensor (Bank 2, Sensor 2)

[EURO-III/IV & JAPAN]



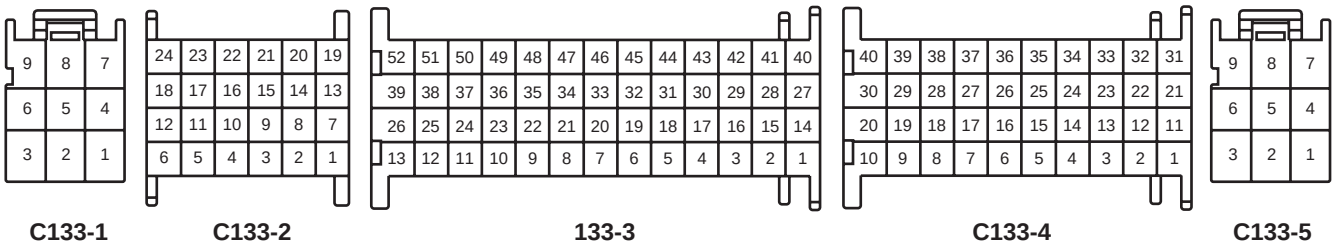
EZOF550Q

[18] Heated Oxygen Sensor (Bank 1, Sensor 1) [19] Heated Oxygen Sensor (Bank 1, Sensor 2)	
[EURO-II]  EZOF015B	

ENGINE CONTROL MODULE (ECM)

ENGINE CONTROL MODULE (ECM) EBB1FBF9

1. ECM HARNESS CONNECTOR



EZOF132A

2. ECM TERMINAL FUNCTION

CONNECTOR [C133-1]

Pin No.	Description	Connected to	Remark
1	Ignition switch signal input	Ignition Switch	
2	Not connected		
3	Diagnostic Data Line (k-Line)	Data Link Connector (DLC)	
4	ECM ground	Chassis ground	
5	Power stage ground	Chassis ground	
6	Power stage ground	Chassis ground	
7	Battery voltage supply	Battery	
8	Battery Voltage Supply after Main Relay	Main Relay	
9	Battery Voltage Supply after Main Relay	Main Relay	

CONNECTOR [C133-2]

Pin No.	Description	Connected to	Remark
1	Heated Oxygen Sensor Heater (B1/S1) control	Heated Oxygen Sensor (B1/S1)	Except for LEAD
2	Not connected		
3	Not connected		
4	Not connected		
5	Not connected		
6	Not connected		
7	Heated Oxygen Sensor (B1/S2) Heater control	Heated Oxygen Sensor (B1/S2)	- EURO-III/IV - JAPAN
8	Not connected		

Pin No.	Description	Connected to	Remark
9	Not connected		
10	Not connected		
11	Not connected		
12	Not connected		
13	Heated Oxygen Sensor (B2/S1) Heater control	Heated Oxygen Sensor (B2/S1)	Except for LEAD
14	Heated Oxygen Sensor (B1/S1) signal input	Heated Oxygen Sensor (B1/S1)	Except for LEAD
15	Heated Oxygen Sensor (B2/S1) signal input	Heated Oxygen Sensor (B2/S1)	Except for LEAD
16	Heated Oxygen Sensor (B1/S2) signal input	Heated Oxygen Sensor (B1/S2)	- EURO-III/IV - JAPAN
17	Fuel Consumption signal output	Trip Computer	
18	Heated Oxygen Sensor (B2/S2) signal input	Heated Oxygen Sensor (B2/S2)	- EURO-III/IV - JAPAN
19	Heated Oxygen Sensor (B2/S2) Heater control	Heated Oxygen Sensor (B2/S2)	- EURO-III/IV - JAPAN
20	Heated Oxygen Sensor (B1/S1) ground	Heated Oxygen Sensor (B1/S1)	Except for LEAD
21	Heated Oxygen Sensor (B2/S1) ground	Heated Oxygen Sensor (B2/S1)	Except for LEAD
22	Heated Oxygen Sensor (B1/S2) ground	Heated Oxygen Sensor (B1/S2)	- EURO-III/IV - JAPAN
23	Main Relay control output	Main Relay	
24	Heated Oxygen Sensor (B2/S2) ground	Heated Oxygen Sensor (B2/S2)	- EURO-III/IV - JAPAN

CONNECTOR [C133-3]

Pin No.	Description	Connected to	Remark
1	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)	
2	Not connected		
3	Not connected		
4	Not connected		
5	Not connected		
6	Not connected		
7	Not connected		
8	Crankshaft Position Sensor signal input	Crankshaft Position Sensor (CKPS)	
9	Not connected		
10	Throttle Position Sensor supply	Throttle Position Sensor (TPS)	
11	Not connected		
12	Not connected		

Pin No.	Description	Connected to	Remark
13	Not connected		
14	Not connected		
15	Not connected		
16	Not connected		
17	Mass Air Flow Sensor ground	Mass Air Flow Sensor (MAFS)	
18	Not connected		
19	Throttle Position Sensor signal input	Throttle Position Sensor (TPS)	
20	Throttle Position Sensor ground	Throttle Position Sensor (TPS)	
21	Crankshaft Position Sensor ground	Crankshaft Position Sensor (CKPS)	
22	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)	
23	Intake Air Temperature Sensor ground	Intake Air Temperature Sensor (IATS)	
24	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)	
25	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor (ECTS)	
26	Power Steering Load input	Power Steering Switch	
27	Not connected		
28	Not connected		
29	Knock Sensor #1 (Cyl. #1, 3, 5) signal input	Knock Sensor (KS) #1	
30	Knock Sensor #1 (Cyl. #1, 3, 5) ground	Knock Sensor (KS) #1	
31	Knock Sensor #2 (Cyl. #2, 4, 6) signal input	Knock Sensor (KS) #2	
32	Knock Sensor #2 (Cyl. #2, 4, 6) signal input	Knock Sensor (KS) #2	
33	Injector (Cyl. 1) control output	Injector (Cyl. 1)	
34	Injector (Cyl. 2) control output	Injector (Cyl. 2)	
35	Injector (Cyl. 3) control output	Injector (Cyl. 3)	
36	Injector (Cyl. 4) control output	Injector (Cyl. 4)	
37	Injector (Cyl. 5) control output	Injector (Cyl. 5)	
38	Injector (Cyl. 6) control output	Injector (Cyl. 6)	
39	Not connected		
40	Not connected		
41	Not connected		
42	Purge Control Solenoid Valve PWM output	Purge Control Solenoid Valve (PCSV)	
43	Not connected		
44	Not connected		
45	Not connected		

Pin No.	Description	Connected to	Remark
46	Idle Speed Control Actuator PWM output 2 (OPEN)	Idle Speed Control Actuator (ISCA)	
47	Idle Speed Control Actuator PWM output 1 (CLOSE)	Idle Speed Control Actuator (ISCA)	
48	Knock Sensor Shield	Knock Sensor (KS)	
49	Not connected		
50	Not connected		
51	Not connected		
52	Not connected		

CONNECTOR [C133-4]

Pin No.	Description	Connected to	Remark
1	Not connected		
2	Not connected		
3	Not connected		
4	Not connected		
5	Not connected		
6	Not connected		
7	Camshaft Position Sensor signal input	Camshaft Position Sensor (CMPS)	
8	Camshaft Position Sensor ground	Camshaft Position Sensor (CMPS)	
9	Not connected		
10	Fuel Pump Relay control output	Fuel Pump Relay	
11	Not connected		
12	Not connected		
13	Throttle Position PWM output	Other control modules	
14	Not connected		
15	Not connected		
16	Not connected		
17	Engine Speed signal output	Tachometer	
18	Cooling Fan Relay [Low] control output	Cooling Fan Relay	
19	Not connected		
20	Malfunction Indicating Lamp (MIL) output	Malfunction Indicating Lamp (MIL)	
21	Not connected		
22	Vehicle speed signal input	Vehicle Speed Sensor (VSS)	- EURO-II - LEAD
		ABS Control Module	- EURO-III/IV With ABS - JAPAN With ABS

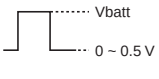
Pin No.	Description	Connected to	Remark
23	Air conditioner switch [Low/High] signal input	Triple Switch	
24	Air conditioner switch signal input	Air Conditioner Switch	
25	Air conditioner switch [Middle] signal input	Triple Switch	
26	Not connected		
27	Not connected		
28	Not connected		
29	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay	
30	Not connected		
31	Not connected		
32	Not connected		
33	Not connected		
34	Not connected		
35	Not connected		
36	CAN [HIGH]	Other control modules (TCM, ABS, etc.)	
37	CAN [LOW]	Other control modules (TCM, ABS, etc.)	
38	Wheel Speed Sensor (WSS) ground	Wheel Speed Sensor (WSS)	- EURO-III/IV without ABS - JAPAN Without ABS
39	Wheel Speed Sensor (WSS) signal input	Wheel Speed Sensor (WSS)	
40	Cooling Fan Relay [High] control output	Cooling Fan Relay	

CONNECTOR [C133-5]

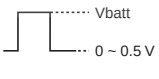
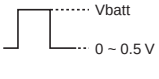
Pin No.	Description	Connected to	Remark
1	Ignition coil #3 (Cyl. #3,6) control output	Ignition coil #3 (Cyl. #3,6)	
2	Ignition coil #2 (Cyl. #2,5) control output	Ignition coil #2 (Cyl. #2,5)	
3	Ignition coil #1 (Cyl. #1,4) control output	Ignition coil #1 (Cyl. #1,4)	
4	Not connected		
5	Ignition Coil shield	Ignition Coil and Chassis ground	
6	Not connected		
7	Not connected		
8	Not connected		
9	Not connected		

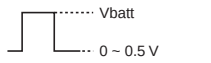
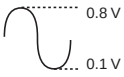
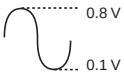
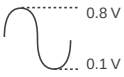
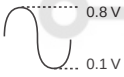
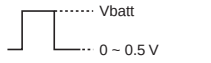
3. ECM TERMINAL INPUT/OUTPUT SIGNAL

CONNECTOR [C133-1]

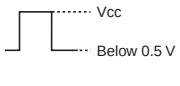
Pin	Description	Type	Vehicle State	Level	Test Result
1	Ignition switch signal input	DC	IG ON	Vbatt	14.19V
			IG OFF	0~0.5V	0mV
2	Not connected				
3	Diagnostic Data Line (k-Line)	Pulse	When communicating	 BFGE501N	High: 13.69V Low: 307mV Speed:10.365kbps
4	ECM ground	Static Signal	Always	0~0.5V	
5	Power stage ground	Static Signal	Always	0~0.5V	
6	Power stage ground	Static Signal	Always	0~0.5V	
7	Battery voltage supply	DC	Always	Vbatt	13.37V
8	Battery Voltage Supply after Main Relay	DC	IG ON	Vbatt	14.15V
			IG OFF	0~0.5V	0mV
9	Battery Voltage Supply after Main Relay	DC	IG ON	Vbatt	14.17V
			IG OFF	0~0.5V	0V

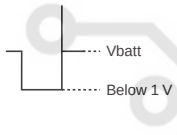
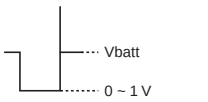
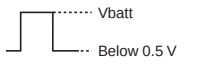
CONNECTOR [C133-2]

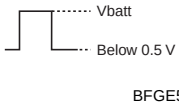
Pin	Description	Type	Vehicle State	Level	Test Result
1	Heated Oxygen Sensor Heater (B1/S1) control	PWM	Engine Run	 BFGE501N Freq. : 10Hz	14.24V 400mV 10.0Hz
2	Not connected				
3	Not connected				
4	Not connected				
5	Not connected				
6	Not connected				
7	Heated Oxygen Sensor (B1/S2) Heater control	PWM	Engine Run	 BFGE501N Freq. : 10Hz	14.19V 400mV 10.0Hz
8	Not connected				
9	Not connected				
10	Not connected				
11	Not connected				

Pin	Description	Type	Vehicle State	Level	Test Result
12	Not connected				
13	Heated Oxygen Sensor (B2/S1) Heater control	PWM	Engine Run	 BFGE501N Freq. : 10Hz	14.24V 400mV 10.0Hz
14	Heated Oxygen Sensor (B1/S1) signal input	Pulse	3000 rpm after warm up	 BFGE501R Freq. : 1.1Hz	0.8V 100mV 1.33Hz
15	Heated Oxygen Sensor (B2/S1) signal input	Pulse	3000 rpm after warm up	 BFGE501R Freq. : 1.1Hz	0.8V 100mV 1.09Hz
16	Heated Oxygen Sensor (B1/S2) signal input	Pulse	Racing	 BFGE501R Freq. : 1.1Hz	0.8V 100mV -Hz
17	Fuel Consumption signal output				
18	Heated Oxygen Sensor (B2/S2) signal input	Pulse	Racing	 BFGE501R Freq. : 1.1Hz	
19	Heated Oxygen Sensor (B2/S2) Heater control	PWM	Engine Run	 BFGE501N Freq. : 10Hz	14.01V 400mV 10.0Hz
20	Heated Oxygen Sensor (B1/S1) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V
21	Heated Oxygen Sensor (B2/S1) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V
22	Heated Oxygen Sensor (B1/S2) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V
23	Main Relay control output	DC	IG ON	0~1V	903mV
			IG OFF	Vbatt	13.47V
24	Heated Oxygen Sensor (B2/S2) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V

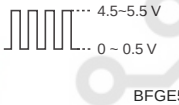
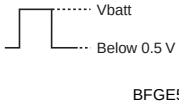
CONNECTOR [C133-3]

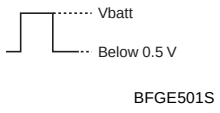
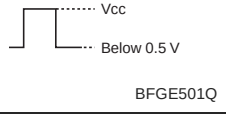
Pin	Description	Type	Vehicle State	Level	Test Result
1	Mass Air Flow Sensor signal input	Analog	Idle	0.6~1.0V	663mV
			2000 rpm	1.3~1.5V	1.54V
			3000 rpm	1.7~1.9V	
2	Not connected				
3	Not connected				
4	Not connected				
5	Not connected				
6	Not connected				
7	Not connected				
8	Crankshaft Position Sensor signal input	Pulse		 BFGE501Q	
			Idle	600~900Hz	705.94Hz
			3000 rpm	2.7~3.3kHz	3,028Hz
9	Not connected				
10	Throttle Position Sensor supply	DC	After IG ON	Vcc	5.02V
11	Not connected				
12	Not connected				
13	Not connected				
14	Not connected				
15	Not connected				
16	Not connected				
17	Mass Air Flow Sensor ground	GND		0~0.5V	6.1mV
18	Not connected				
19	Throttle Position Sensor signal input	Analog	Idle	0.2~0.8V	304mV
			W.O.T	4.3~4.8V	4.16V
20	Throttle Position Sensor ground	GND		0~0.5V	5.2mV
21	Crankshaft Position Sensor ground	GND		0~0.5V	5.2mV
22	Intake Air Temperature Sensor signal input	Analog	-20°C (-4°F)	4.27~4.54 V	
			0°C (32°F)	3.54~3.9 V	
			20°C (68°F)	2.63~2.93 V	
			40°C (104°F)	1.73~1.98 V	
			60°C (140°F)	1.08~1.25 V	
			80°C (176°F)	0.65~0.76 V	
23	Intake Air Temperature Sensor ground	GND		0~0.5V	3.4mV

Pin	Description	Type	Vehicle State	Level	Test Result
24	Engine Coolant Temperature Sensor signal input	Analog	COLD(20°C)	3.44V	
			WARM(80°C)	1.25V	
25	Engine Coolant Temperature Sensor ground	GND		0~0.5V	4.7mV
26	Power Steering Load input	DC	Active	0~0.5V	-26mV
			Inactive	Vbatt	11.55V
27	Not connected				
28	Not connected				
29	Knock Sensor #1 (Cyl. #1, 3, 5) signal input	Fre-quency	Knocking	-0.3 ~ 0.3V	224mV
			Normal	0V	0mV
30	Knock Sensor #1 (Cyl. #1, 3, 5) ground				
31	Knock Sensor #2 (Cyl. #2, 4, 6) signal input	Fre-quency	Knocking	-0.3 ~ 0.3V	247mV
			Normal	0V	0mV
32	Knock Sensor #2 (Cyl. #2, 4, 6) ground				
33	Injector (Cyl. 1) control output	DC(PWM)	3000rpm	 BFGE501O (20 ~ 30Hz)	High: 14.01V Low: 185mV Idle: 5.86Hz 3000rpm: 25.04Hz
34	Injector (Cyl. 2) control output				
35	Injector (Cyl. 3) control output				
36	Injector (Cyl. 4) control output				
37	Injector (Cyl. 5) control output				
38	Injector (Cyl. 6) control output				
39	Not connected				
40	Not connected				
41	Not connected				
42	Purge Control Solenoid Valve PWM output	Pulse PWM	Inactive	Vbatt	
			Active (After warm up & racing)	 BFGE501P Freq. : 20Hz	
43	Not connected				
44	Not connected				
45	Not connected				
46	Idle Speed Control Actuator PWM output 2 (OPEN)	PWM	Idle	 BFGE501S Freq : 100Hz	High: 15.05V Low: 178mV Freq:100.0Hz

Pin	Description	Type	Vehicle State	Level	Test Result
47	Idle Speed Control Actuator PWM output 1 (CLOSE)	PWM	Idle	 BFGE501S Freq : 100Hz	High: 14.82V Low: 151mV Freq:100.0Hz
48	Knock Sensor Shield	GND		0~0.5V	
49	Not connected				
50	Not connected				
51	Not connected				
52	Not connected				

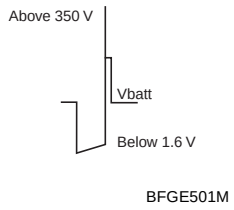
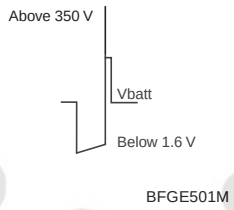
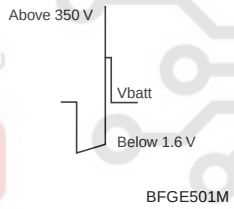
CONNECTOR [C133-4]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Not connected				
2	Not connected				
3	Not connected				
4	Not connected				
5	Not connected				
6	Not connected				
7	Camshaft Position Sensor signal input	Fre-quency		 BFGE501T	High: 5.02V Low: 529mV
			Idle	5.25~7.25Hz	Idle: 5.84Hz
			3000rpm	20~30Hz	3000rpm: 25.14Hz
8	Camshaft Position Sensor ground	GND		0~0.5V	
9	Not connected				
10	Fuel Pump Relay control output	DC	IG ON	Vbatt	13.08V
			Idle	0~0.5V	93mV
11	Not connected				
12	Not connected				
13	Throttle Position PWM output	Pulse		 BFGE501S Freq. : 100Hz	High: 12.72V Low: 88mV Freq:100.0Hz
			C.T	5% DUTY	C.T:4.92%
			W.O.T	91% DUTY	WOT:90.92%
14	Not connected				
15	Not connected				
16	Not connected				

Pin	Description	Type	Vehicle State	Level	Test Result
17	Engine Speed signal output	Pulse			High: 10.35V Low: 13.6mV
			Idle	40Hz	Idle: 35.25Hz
			3000 rpm	150Hz	3000rpm: 151.25Hz
18	Cooling Fan Relay [Low] control output	DC	FAN ON	0~0.5V	497mV
			FAN OFF	Vbatt	13.95V
19	Not connected				
20	Malfunction Indicating Lamp (MIL) output	DC	MIL ON	0~0.5V	16.4mV
			MIL OFF	Vbatt	13.54V
21	Not connected				
22	Vehicle speed signal input	Pulse	Vehicle Run(80km/h)		High: 5.02V Low: 0.92mV
				From ABS: 250Hz	252Hz
				From VSS: 25Hz	-
23	Air conditioner switch [Low/High] signal input	DC	S/W OFF	0~0.5V	0.02V
			S/W ON	Vbatt	12.22V
24	Air conditioner switch signal input	DC	S/W OFF	0~0.5V	0mV
			S/W ON	Vbatt	12.45V
25	Air conditioner switch [Middle] signal input	DC	S/W OFF	0~0.5V	0mV
			S/W ON	Vbatt	12.22V
26	Not connected				
27	Not connected				
28	Not connected				
29	Air Conditioner Compressor Relay control output	DC	Relay ON	0~0.5V	118mV
			Relay OFF	Vbatt	13.7V
30	Not connected				
31	Not connected				
32	Not connected				
33	Not connected				
34	Not connected				
35	Not connected				
36	CAN [HIGH]	DC (256kbps)	Recessive	2.0~3.0V	2.51V
			Dominant	2.75~4.5V	3.56V
37	CAN [LOW]	DC (256kbps)	Recessive	2.0~3.0V	2.52V
			Dominant	0.5~2.25V	1.51V
38	Wheel Speed Sensor (WSS) ground	GND		0V	

Pin	Description	Type	Vehicle State	Level	Test Result
39	Wheel Speed Sensor (WSS) signal input		Run Vehicle		
40	Cooling Fan Relay [High] control output	DC	Relay ON	0V	543mV
			Relay OFF	Vbatt	13.98V

CONNECTOR [C133-5]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Ignition coil #3 (Cyl. #3,6) control output	Pulse	Engine Run		High: 14.03V Low: 0.78V~1.13V Peak Voltage: 348V Idle: 11.70Hz 3000rpm: 50.22Hz
2	Ignition coil #2 (Cyl. #2,5) control output	Pulse	Engine Run		High: 13.98V Low: 0.77V~1.13V Peak Voltage: 352V Idle: 11.79Hz 3000rpm: 50.54Hz
3	Ignition coil #1 (Cyl. #1,4) control output	Pulse	Engine Run		High: 14.07V Low: 0.77V~1.09V Peak Voltage: 352V Idle: 11.88Hz 3000rpm: 49.82Hz
4	Not connected				
5	Ignition Coil shield	GND		0V	-0.2mV
6	Not connected				
7	Not connected				
8	Not connected				
9	Not connected				

ECM PROBLEM INSPECTION PROCEDURE EEBCCAD5

1. TEST ECM GROUND CIRCUIT: Measure resistance between ECM and chassis ground using the backside of ECM harness connector as ECM side check point. If the problem is found, repair it.

Specification (Resistance): 1Ω or less

2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact contact pressure. If the problem is found, repair it.

3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the ECM.

4. RE-TEST THE ORIGINAL ECM : Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

DTC TROUBLESHOOTING PROCEDURES

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC) ECA1FF81

DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	●	▲		●	FLB - 40
P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	●	▲		●	FLB - 44
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	●	▲		●	FLB - 47
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	●	▲		●	FLB - 51
P0051	HO2S Heater Circuit low (Bank 2 / Sensor 1)	●			●	FLB - 54
P0052	HO2S Heater Circuit high (Bank 2 / Sensor 1)	●			●	FLB - 58
P0057	HO2S Heater Circuit low (Bank 2 / Sensor 2)	●			●	FLB - 61
P0058	HO2S Heater Circuit high (Bank 2 / Sensor 2)	●			●	FLB - 65
P0101	Mass or Volume Air Flow Circuit Range/Performance	▲				FLB - 68
P0102	Mass or Volume Air Flow Circuit Low Input	●	▲	▲	●	FLB - 73
P0103	Mass or Volume Air Flow Circuit high Input	●	▲	▲	●	FLB - 76
P0112	Intake Air Temperature Circuit Low Input	●	▲	▲	●	FLB - 79
P0113	Intake Air Temperature Circuit High Input	●	▲	▲	●	FLB - 83
P0116	Engine Coolant Temperature Circuit Range/Performance	●				FLB - 86
P0117	Engine Coolant Temperature Circuit Low Input	●	▲	▲	●	FLB - 90
P0118	Engine Coolant Temperature Circuit High Input	●	▲	▲	●	FLB - 93
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	▲				FLB - 96
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	▲	▲	●	FLB - 100
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	▲	▲	●	FLB - 103
P0130	HO2S Circuit (Bank 1/ Sensor 1)	●	▲		●	FLB - 106
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	▲		●	FLB - 109
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	▲		●	FLB - 111
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●				FLB - 113
P0136	HO2S Circuit (Bank 1/ Sensor 2)	●	▲		●	FLB - 115

DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●	▲		●	FLB - 118
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●	▲		●	FLB - 120
P0150	HO2S Circuit (Bank 2/ Sensor 1)	●			●	FLB - 122
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●			●	FLB - 125
P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●			●	FLB - 127
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	●				FLB - 129
P0156	HO2S Circuit (Bank 2 / Sensor 2)	●			●	FLB - 131
P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●			●	FLB - 134
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●			●	FLB - 136
P0171	System Too Lean (Bank 1)	●			●	FLB - 138
P0172	System Too Rich (Bank 1)	●			●	FLB - 142
P0174	System Too Lean (Bank 2)	●			●	FLB - 138
P0175	System Too Rich (Bank 2)	●			●	FLB - 142
P0230	Fuel Pump Primary Circuit	▲	▲	▲	▲	FLB - 145
P0261	Cylinder 1-Injector Circuit Low	●	▲	▲	●	FLB - 149
P0262	Cylinder 1-Injector Circuit High	●	▲	▲	●	FLB - 154
P0264	Cylinder 2-Injector Circuit Low	●	▲	▲	●	FLB - 149
P0265	Cylinder 2-Injector Circuit High	●	▲	▲	●	FLB - 154
P0267	Cylinder 3-Injector Circuit Low	●	▲	▲	●	FLB - 149
P0268	Cylinder 3-Injector Circuit High	●	▲	▲	●	FLB - 154
P0270	Cylinder 4-Injector Circuit Low	●	▲	▲	●	FLB - 149
P0271	Cylinder 4-Injector Circuit High	●	▲	▲	●	FLB - 154
P0273	Cylinder 5-Injector Circuit Low	●	▲	▲	●	FLB - 149
P0274	Cylinder 5-Injector Circuit High	●	▲	▲	●	FLB - 154
P0276	Cylinder 6-Injector Circuit Low	●	▲	▲	●	FLB - 149
P0277	Cylinder 6-Injector Circuit High	●	▲	▲	●	FLB - 154
P0300	Random/Multiple Cylinder Misfire Detected	●			●	FLB - 157
P0301	Cylinder 1-Misfire detected	●			●	FLB - 157
P0302	Cylinder 2-Misfire detected	●			●	FLB - 157
P0303	Cylinder 3-Misfire detected	●			●	FLB - 157
P0304	Cylinder 4-Misfire detected	●			●	FLB - 157
P0305	Cylinder 5-Misfire detected	●			●	FLB - 157

DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
P0306	Cylinder 6-Misfire detected	●			●	FLB - 157
P0325	Knock Sensor 1 Circuit	▲	▲	▲	▲	FLB - 163
P0330	Knock Sensor 2 Circuit	▲	▲	▲	▲	FLB - 163
P0335	Crankshaft Position Sensor A Circuit	●	▲	▲	●	FLB - 168
P0340	Camshaft Position Sensor A Circuit Malfunction(Single Sensor)	●	▲	▲	●	FLB - 174
P0350	Ignition Coil Primary / Secondary Circuit	▲	▲	▲		FLB - 179
P0351	Ignition Coil 'A' Primary / Secondary Circuit	▲	▲	▲		FLB - 179
P0352	Ignition Coil 'B' Primary / Secondary Circuit	▲	▲	▲		FLB - 179
P0353	Ignition Coil 'C' Primary / Secondary Circuit	▲	▲	▲		FLB - 179
P0354	Ignition Coil 'D' Primary / Secondary Circuit	▲	▲	▲		FLB - 179
P0355	Ignition Coil 'E' Primary / Secondary Circuit	▲	▲	▲		FLB - 179
P0356	Ignition Coil 'F' Primary / Secondary Circuit	▲	▲	▲		FLB - 179
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●				FLB - 185
P0430	Catalyst System Efficiency below Threshold (Bank 2)	●				FLB - 185
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●			●	FLB - 188
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●			●	FLB - 192
P0501	Vehicle Speed Sensor A Range/Performance	●	▲	▲	▲	FLB - 195
P0506	Idle Air Control System-RPM lower than expected	▲			▲	FLB - 203
P0507	Idle Air Control System-RPM higher than expected	▲			▲	FLB - 208
P0551	Power Steering Pressure Sensor/Switch Circuit Range/Performance	▲	▲	▲		FLB - 212
P0560	System Voltage	▲	▲	▲	▲	FLB - 215
P0605	Internal Control Module Read Only Memory(ROM) Error	▲	▲	▲	▲	FLB - 219
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲				FLB - 220
P1166	HO2S System - Lambda Controller at the Limit (Bank 1)	●	▲			FLB - 223
P1167	HO2S System - Lambda Controller at the Limit (Bank 2)	●				FLB - 223
P1372	Segment Time Acquisition Incorrect	▲				FLB - 226
P1505	Idle Charge Actuator Signal Low of Coil #1	●	▲	▲	▲	FLB - 228

DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
P1506	Idle Charge Actuator Signal High of Coil #1	●	▲	▲	▲	FLB - 233
P1507	Idle Charge Actuator Signal Low of Coil #2	●	▲	▲	▲	FLB - 236
P1508	Idle Charge Actuator Signal High of Coil #2	●	▲	▲	▲	FLB - 239
P1529	TCM Request for MIL ON/Freeze Frame To ECM via CAN	●			●	FLB - 242
P1602	CAN Communication BUS with TCM (Timeout)	●	▲	▲	▲	FLB - 243
P1642	Non-Immobilizer-EMS connected to an Immobilizer	▲	▲	▲		-

NOTE

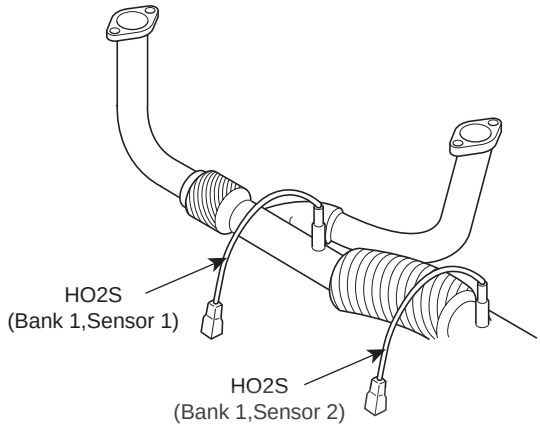
●: *MIL ON & FAULT CODE MEMORY*
▲: *MIL OFF & FAULT CODE MEMORY*

TROUBLESHOOTING FOR DTC ED5C4FA2

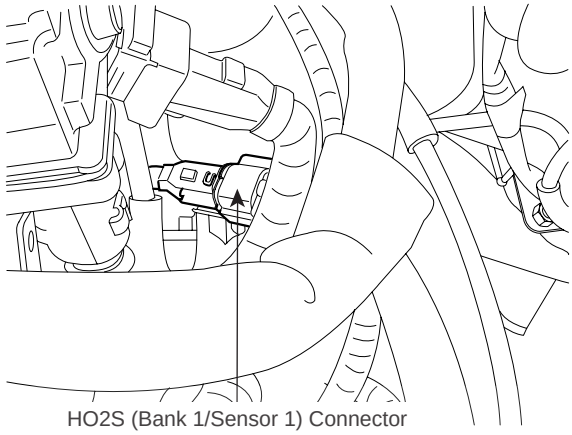
DTC	P0031	HO2S Heater Circuit Low (Bank 1 / Sensor 1)

COMPONENT LOCATION

[EURO-II]



[EURO-III/IV & JAPAN]



EZOF505E

DESCRIPTION

In order to control the emission of the CO, HC and NOx components of the exhaust gas, a heated oxygen sensor (HO2S), mounted on the front side and rear side of the catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. So the HO2S contains a heater element to reduce warm-up time and ensure proper performance during all driving conditions, which allows for closed loop fuel control or catalyst monitoring immediately upon engine start-up. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0031 if the ECM detects that the HO2S(B1/S1) heater control line is short to ground or broken.

2. Conditions for Setting the DTC

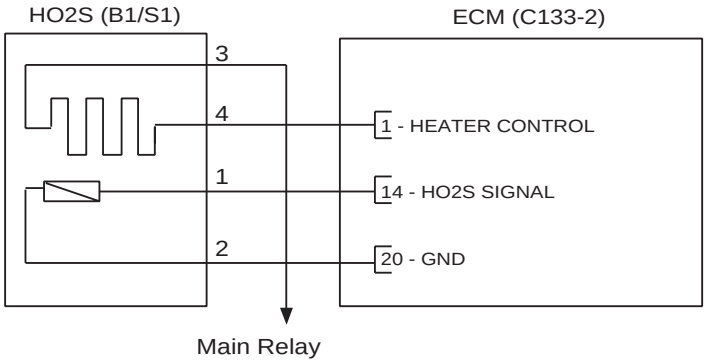
DTC	Detecting Condition & Limp Home	Possible Cause
P0031	Detecting Condition • DTC Strategy - Driver Stage Check • Enable condition - Battery Voltage > 10V - 1% < HO2S heater duty < 99%	• Open or short to ground in HO2S(B1/S1) heater circuit • HO2S(B1/S1) heater • ECM

SPECIFICATION

- HO2S Heater Resistance : 3.0~4.0 Ω at 23±5°C

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

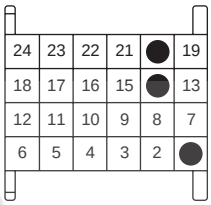


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-2 (14)	HO2S(B1/S1) Signal
2	ECM C133-2 (20)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (1)	HO2S Heater (B1/S1)

[HARNESS CONNECTORS]

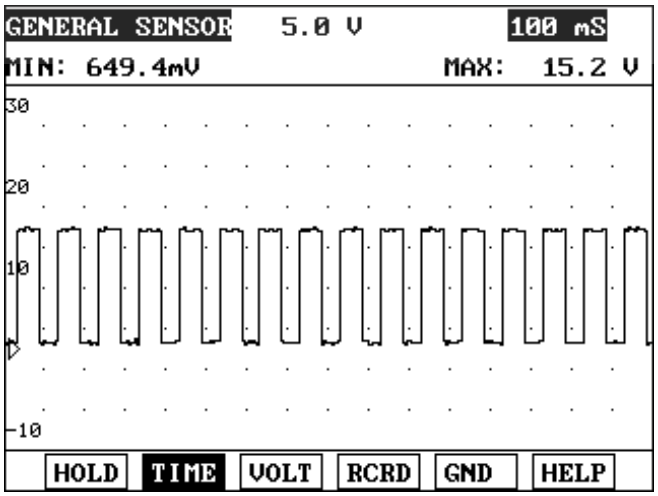
C145 (EURO-III/IV & JAPAN)
C116 (EURO-II)
HO2S (B1/S2)

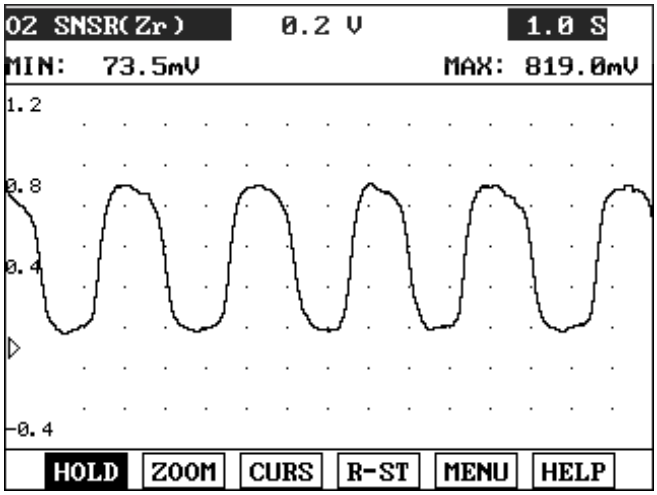


C133-2
ECM

EZOF401D

SIGNAL WAVE FORM





The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains a heater element to reduce its warming-up time and to ensure its performance during all driving conditions. The HO2S heater should be always ON after cold engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The left illustration is the signal waveform of HO2S Heater and the right is the one of HO2 sensor.

EZOF0002

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

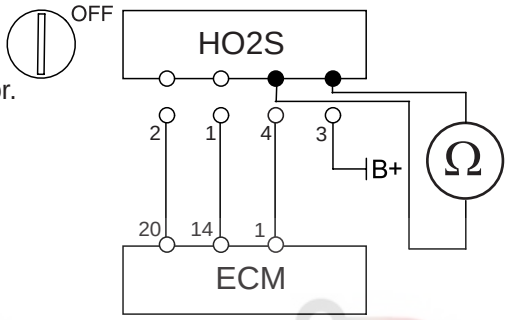
Does scan tool display DTC P0031?

Yes

No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3 and 4 of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**



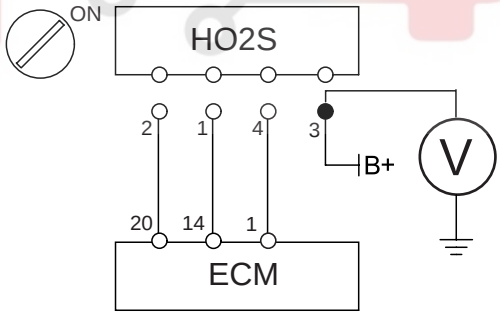
Is resistance within specification?

Yes

No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



Is voltage within specification?

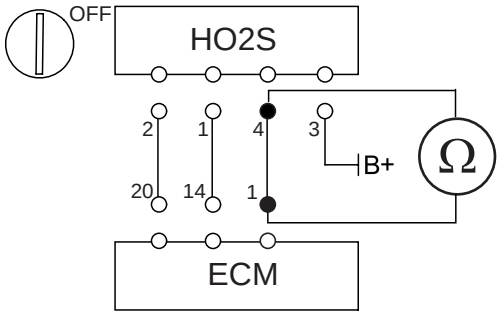
Yes

No	Repair open or short to chassis ground in harness.

EZOF601F

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and 1 of the ECM harness connector(C133-2).
   - **Specification (Resistance): below 1Ω**

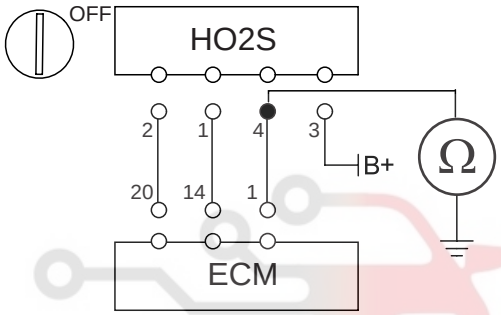


Does the resistance indicate continuity?

Yes	No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601G

TROUBLESHOOTING FOR DTC EEAF7DAC

DTC	P0032	HO2S Heater Circuit High (Bank 1 / Sensor 1)

DESCRIPTION

Refer to DTC P0031

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0032 if the ECM detects that the HO2S (B1/S1) heater control line is short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0032	Detecting Condition • DTC Strategy - Driver stage Check • Enable condition - Battery Voltage > 10V - 1 % < HO2S heater duty < 99 %	• Short to battery line in HO2S (B1/S1) heater circuit • HO2S (B1/S1) heater • ECM

SPECIFICATION

Refer to DTC P0031

SCHEMATIC DIAGRAM

Refer to DTC P0031

SIGNAL WAVE FORM

Refer to DTC P0031

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

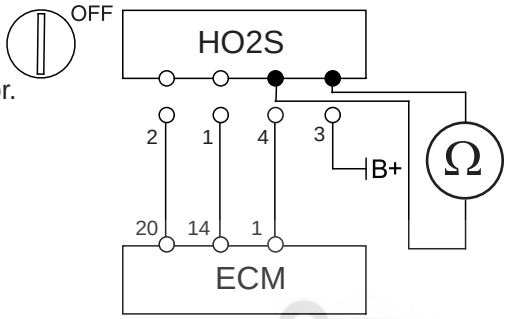
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

Does scan tool display DTC P0032?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3 and 4 of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**

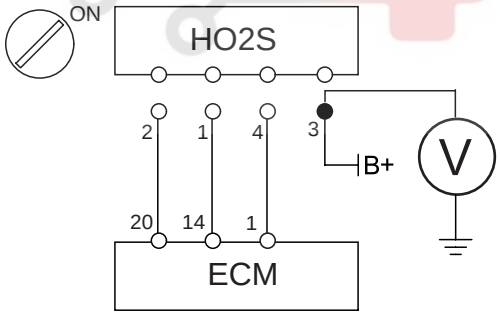


Is resistance within specification?

Yes	
No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



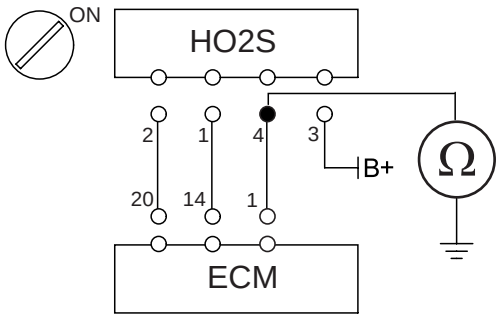
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF601H

4. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is viltage within specification?

Yes	
No	Repair short to power in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

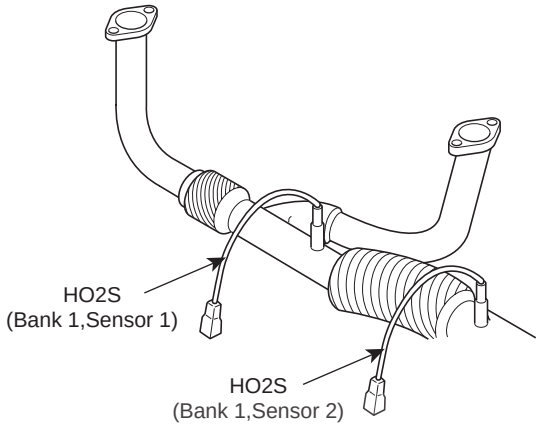
EZOF601I

TROUBLESHOOTING FOR DTC EFBCECEE

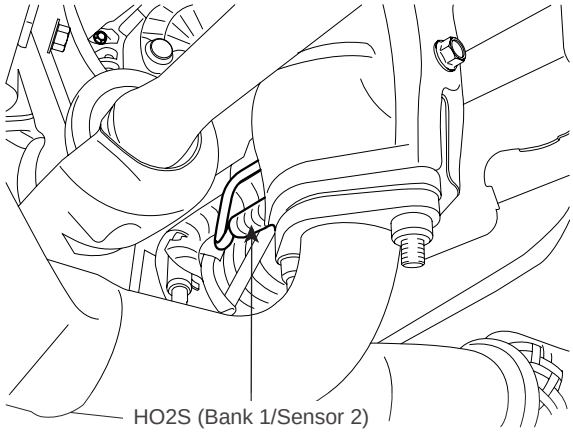
DTC	P0037	HO2S Heater Circuit Low (Bank 1 / Sensor 2)

COMPONENT LOCATION

[EURO-II]



[EURO-III/IV & JAPAN]



EZOF5050

DESCRIPTION

In order to control the emission of the CO, HC and NOx components of the exhaust gas, a heated oxygen sensor (HO2S), mounted on the front side and rear side of the catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. So the HO2S contains a heater element to reduce warm-up time and ensure proper performance during all driving conditions, which allows for closed loop fuel control or catalyst monitoring immediately upon engine start-up. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0037 if the ECM detects that the HO2S(B1/S2) heater control line is short to ground or broken.

2. Conditions for Setting the DTC

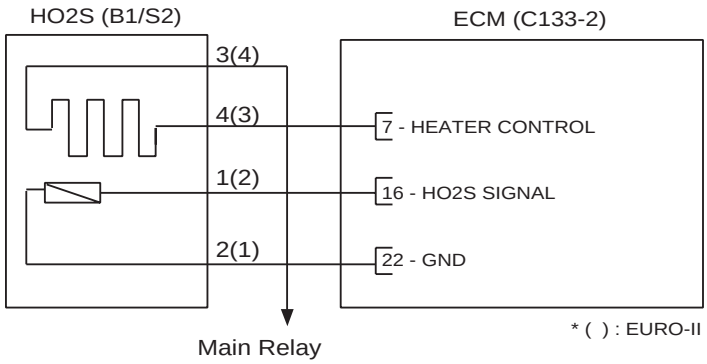
DTC	Detecting Condition & Limp Home	Possible Cause
P0037	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery Voltage > 10V - 1% < HO2S heater duty < 99%	• Open or short to ground in HO2S (B1/S2) • HO2S (B1/S2) heater • ECM

SPECIFICATION

- HO2S Heater Resistance : 3.0~4.0 Ω at 23±5°C

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

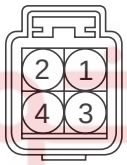
EURO-III/IV (C147)

Terminal	Connected to	Function
1	ECM C133-2 (16)	HO2S(B1/S2) Signal
2	ECM C133-2 (22)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (7)	HO2S Heater (B1/S2)

EURO-II (C122)

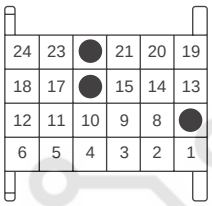
Terminal	Connected to	Function
1	ECM C133-2 (22)	Ground
2	ECM C133-2 (16)	HO2S(B1/S2) Signal
3	ECM C133-2 (17)	HO2S Heater (B1/S2)
4	Main Relay	Battery Voltage

[HARNESS CONNECTORS]



C147 (EURO-III/IV)
HO2S (B1/S2)

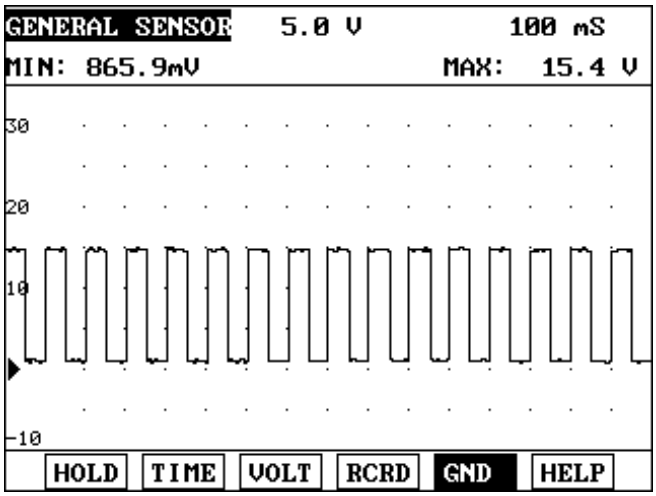
C122 (EURO-II)



C133-2
ECM

EZOF4010

SIGNAL WAVE FORM



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains a heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle.

EFOE0014

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

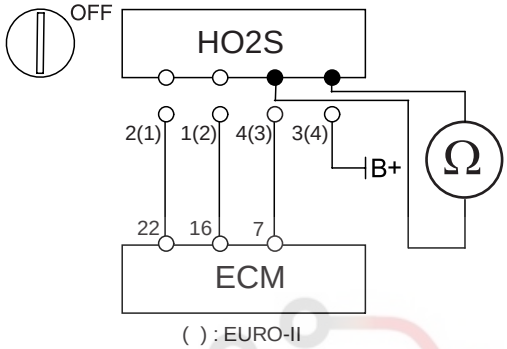
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

Does scan tool display DTC P0037?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3(4) and 4(3) of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**

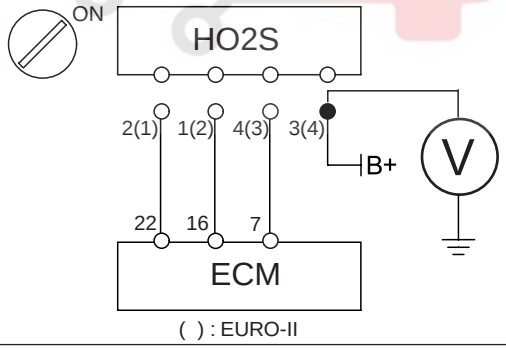


Is resistance within specification?

Yes	
No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3(4) of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



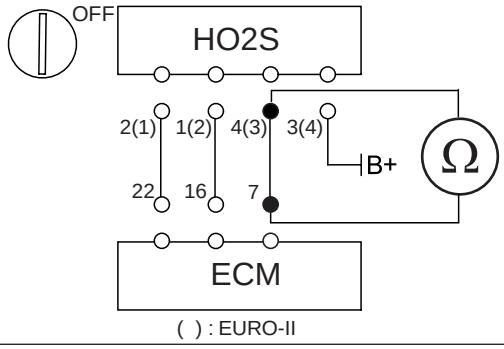
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF601K

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4(3) of the HO2S harness connector and 7 of the ECM harness connector (C133-2).
   - **Specification (Resistance): below 1Ω**

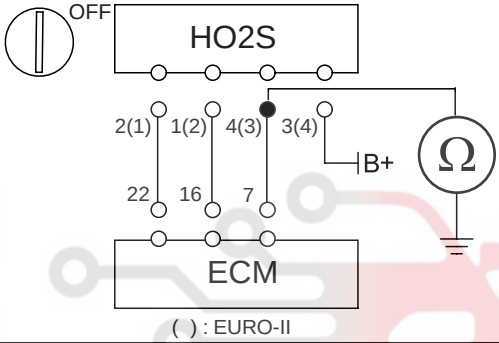


Does the resistance indicate continuity?

Yes		
	No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4(3) of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes		
	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601L

TROUBLESHOOTING FOR DTC E6A8679F

DTC	P0038	HO2S Heater Circuit High (Bank 1 / Sensor 2)

DESCRIPTION

Refer to DTC P0037

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0038 if the ECM detects that the HO2S (B1/S2) heater control line is short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0038	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery Voltage > 10V - 1 % < HO2S heater duty < 99 %	• Short to battery line in HO2S (B1/S2) heater circuit • HO2S (B1/S2) heater • ECM

SPECIFICATION

Refer to DTC P0037

SCHEMATIC DIAGRAM

Refer to DTC P0037

SIGNAL WAVE FORM

Refer to DTC P0037

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

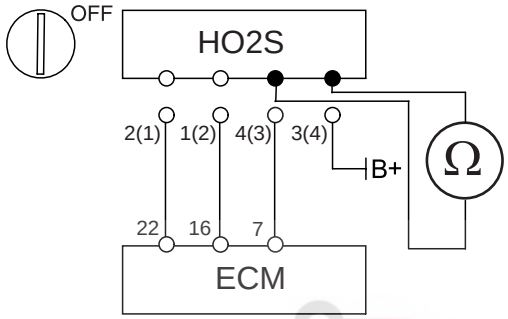
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

Does scan tool display DTC P0038?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3(4) and 4(3) of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**

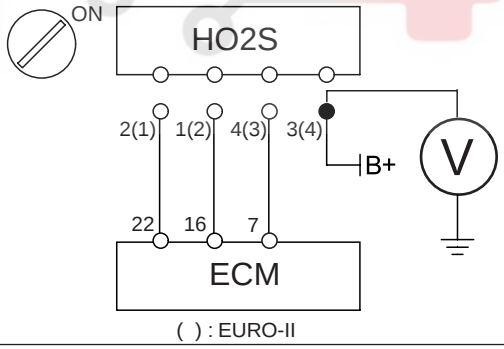


Is resistance within specification?

Yes	
No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3(4) of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



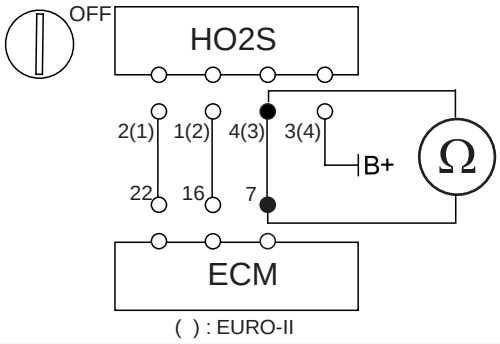
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF601M

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4(3) of the HO2S harness connector and 7 of the ECM harness connector (C133-2).
   - **Specification (Resistance): below 1Ω**

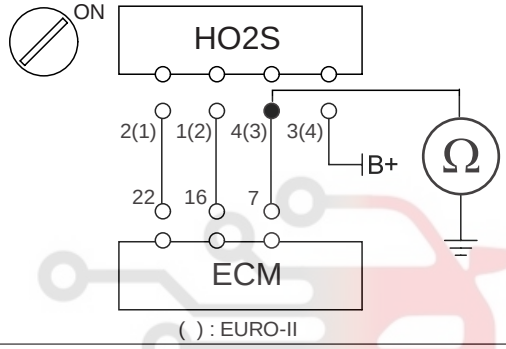


Does the resistance indicate continuity?

Yes		
	No	Repair open in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4(3) of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is viltage within specification?

Yes		
	No	Repair short to power in harness.

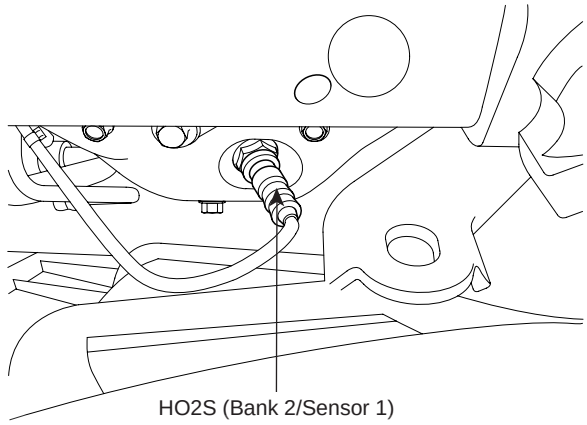
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601N

TROUBLESHOOTING FOR DTC E78A4CA8

DTC	P0051	HO2S Heater Circuit Low (Bank 2 / Sensor 1)

COMPONENT LOCATION



EZOF6030

DESCRIPTION

In order to control the emission of the CO, HC and NOx components of the exhaust gas, a heated oxygen sensor (HO2S), mounted on the front side and rear side of the catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. So the HO2S contains a heater element to reduce warm-up time and ensure proper performance during all driving conditions, which allows for closed loop fuel control or catalyst monitoring immediately upon engine start-up. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0051 if the ECM detects that the HO2S(B2/S1) heater control line is short to ground or broken.

2. Conditions for Setting the DTC

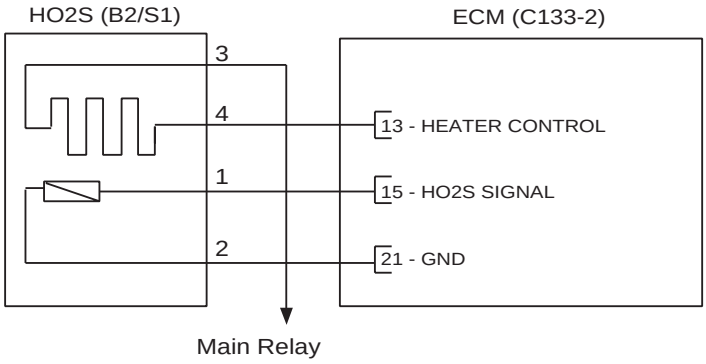
DTC	Detecting Condition & Limp Home	Possible Cause
P0051	Detecting Condition • DTC Strategy - Driver Stage Check • Enable condition - Battery Voltage > 10V - 1% < HO2S heater duty < 99%	• Open or short to ground in HO2S(B2/S1) heater circuit • HO2S(B2/S1) heater • ECM

SPECIFICATION

- HO2S Heater Resistance : 3.0~4.0 Ω at 23±5°C

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



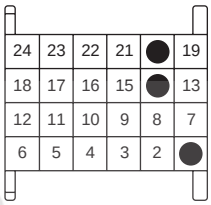
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-2 (14)	HO2S(B2/S1) Signal
2	ECM C133-2 (20)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (1)	HO2S Heater (B2/S1)

[HARNESS CONNECTORS]

C146

HO2S (B2/S2)

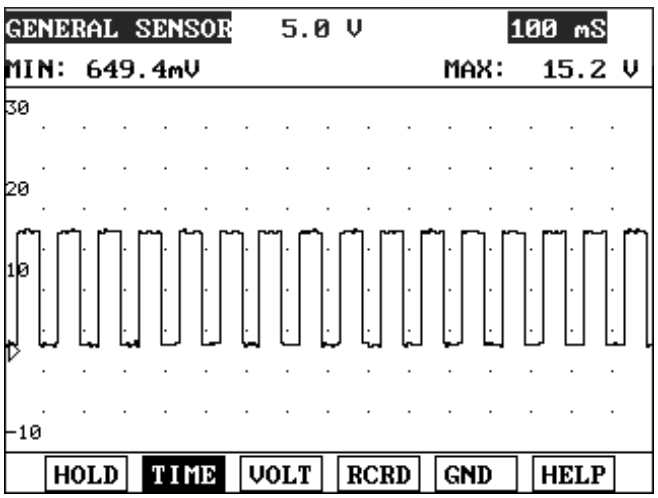


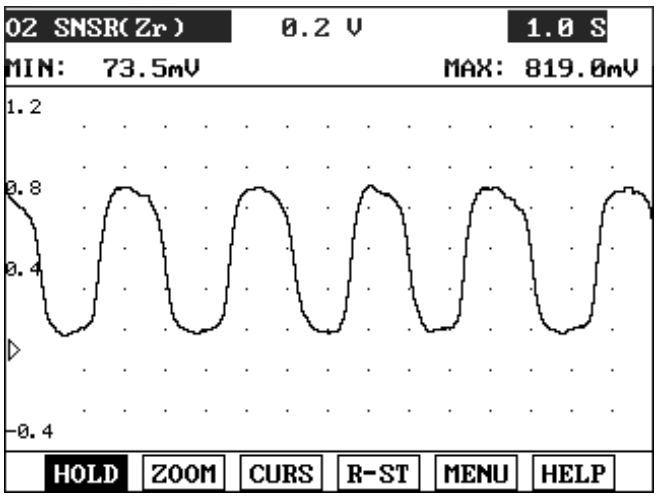
C133-2

ECM

EZOF4411

SIGNAL WAVE FORM





The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains a heater element to reduce its warming-up time and to ensure its performance during all driving conditions. The HO2S heater should be always ON after cold engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The left illustration is the signal waveform of HO2S Heater and the right is the one of HO2 sensor.

EZOF0002

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

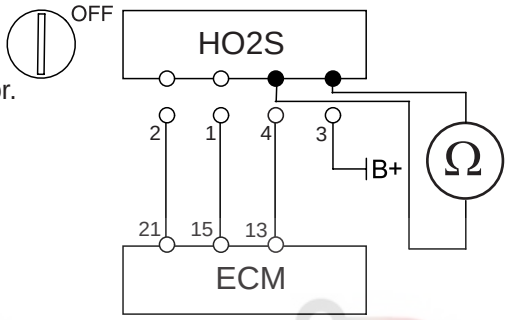
Does scan tool display DTC P0051?

Yes

No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3 and 4 of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**



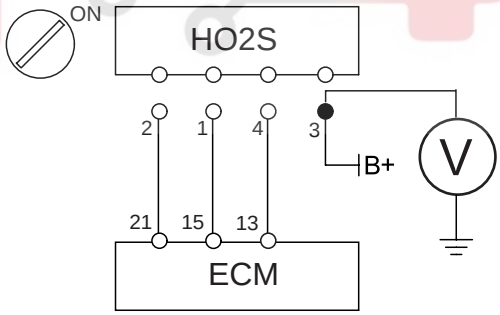
Is resistance within specification?

Yes

No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



Is voltage within specification?

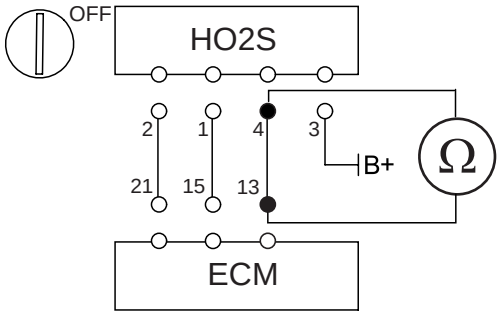
Yes

No	Repair open or short to chassis ground in harness.

EZOF6031

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and 13 of the ECM harness connector(C133-2).
   - **Specification (Resistance): below 1Ω**

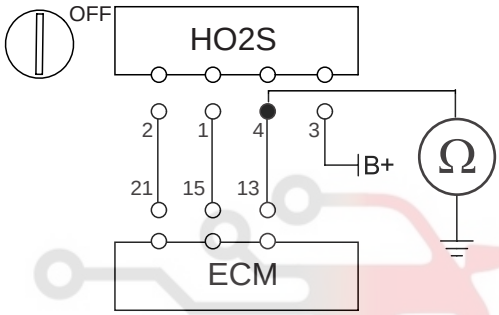


Does the resistance indicate continuity?

Yes	No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6032

TROUBLESHOOTING FOR DTC EEF05CE3

DTC	P0052	HO2S Heater Circuit High (Bank 2 / Sensor 1)

DESCRIPTION

Refer to DTC P0051

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0052 if the ECM detects that the HO2S (B2/S1) heater control line is short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0052	Detecting Condition • DTC Strategy - Driver stage Check • Enable condition - Battery Voltage > 10V - 1 % < HO2S heater duty < 99 %	• Short to battery line in HO2S (B2/S1) heater circuit • HO2S (B2/S1) heater • ECM

SPECIFICATION

Refer to DTC P0051

SCHEMATIC DIAGRAM

Refer to DTC P0051

SIGNAL WAVE FORM

Refer to DTC P0051

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

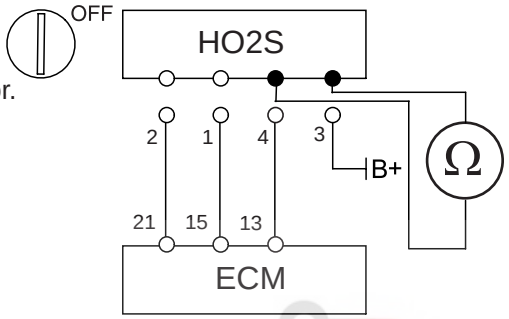
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

Does scan tool display DTC P0052?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3 and 4 of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**

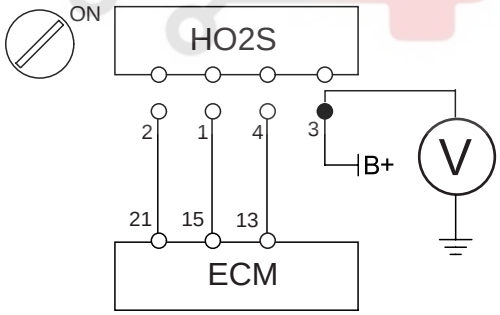


Is resistance within specification?

Yes	
No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



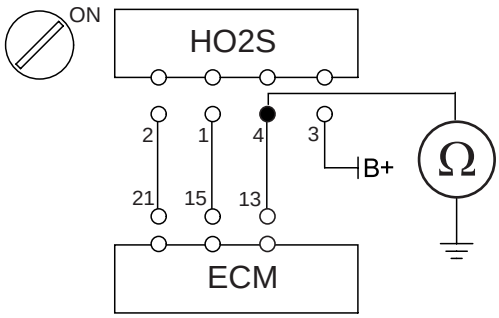
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF6033

4. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is viltage within specification?

Yes	No	Repair short to power in harness.

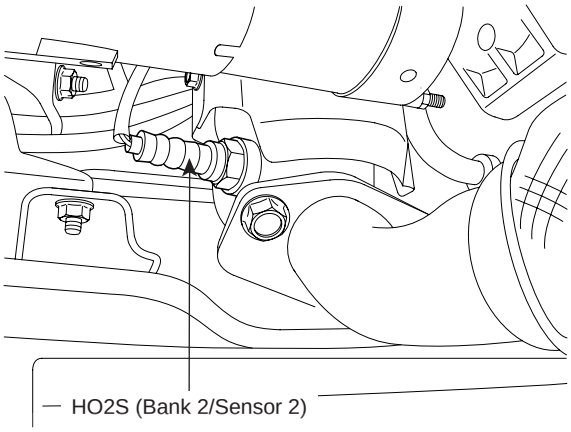
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6034

TROUBLESHOOTING FOR DTC E48A3153

DTC	P0057	HO2S Heater Circuit Low (Bank 2 / Sensor 2)

COMPONENT LOCATION



EZOF6035

DESCRIPTION

In order to control the emission of the CO, HC and NOx components of the exhaust gas, a heated oxygen sensor (HO2S), mounted on the front side and rear side of the catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. So the HO2S contains a heater element to reduce warm-up time and ensure proper performance during all driving conditions, which allows for closed loop fuel control or catalyst monitoring immediately upon engine start-up. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0057 if the ECM detects that the HO2S(B2/S2) heater control line is short to ground or broken.

2. Conditions for Setting the DTC

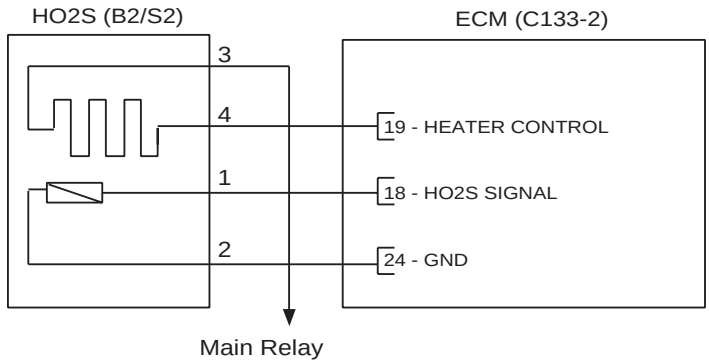
DTC	Detecting Condition & Limp Home	Possible Cause
P0057	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery Voltage > 10V - 1% < HO2S heater duty < 99%	• Open or short to ground in HO2S (B2/S2) • HO2S (B2/S2) heater • ECM

SPECIFICATION

- HO2S Heater Resistance : 3.0~4.0 Ω at 23±5°C

SCHEMATIC DIAGRAM

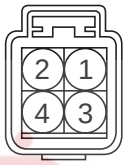
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

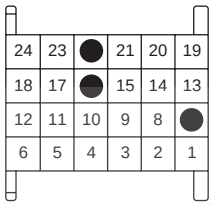
Terminal	Connected to	Function
1	ECM C133-2 (18)	HO2S(B2/S2) Signal
2	ECM C133-2 (24)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (19)	HO2S Heater (B2/S2)

[HARNESS CONNECTORS]



C148

HO2S (B2/S2)

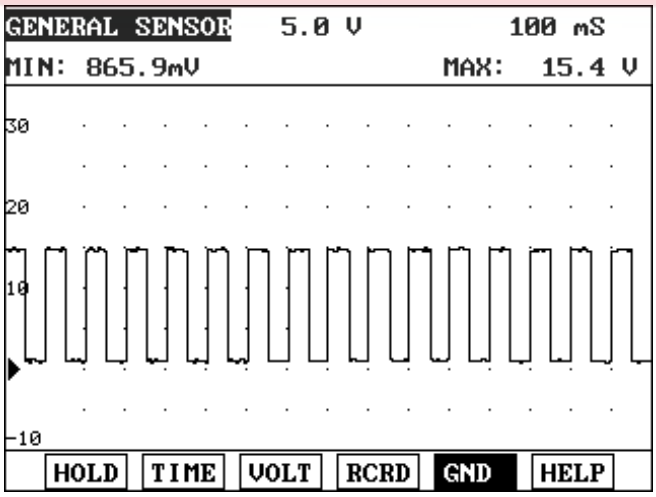


C133-2

ECM

EZOF4410

SIGNAL WAVE FORM



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains a heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle.

EFOE0014

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

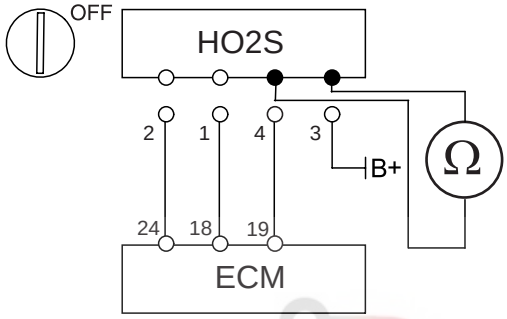
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

Does scan tool display DTC P0057?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3 and 4 of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**

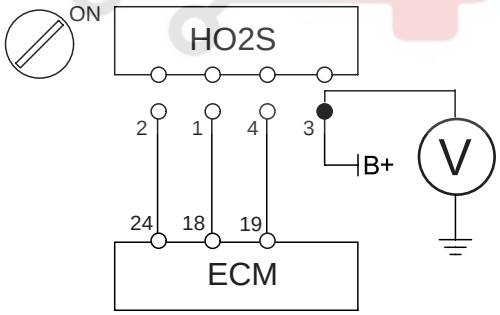


Is resistance within specification?

Yes	
No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



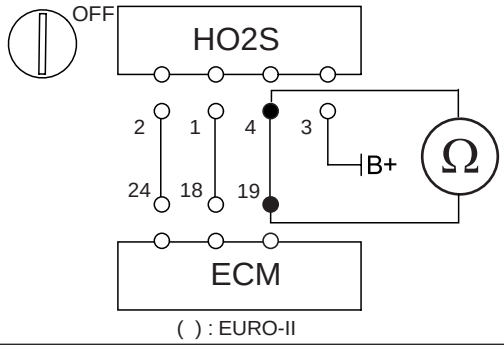
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF6036

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and 19 of the ECM harness connector (C133-2).
   - **Specification (Resistance): below 1Ω**

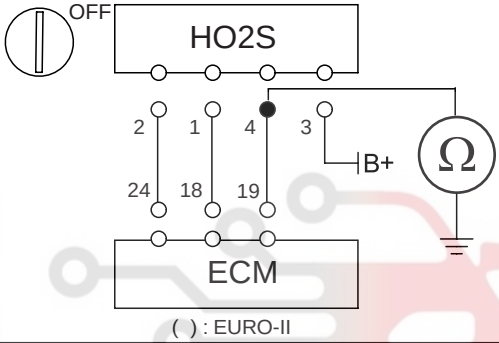


Does the resistance indicate continuity?

Yes	No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6037

TROUBLESHOOTING FOR DTC E45EB5D5

DTC	P0058	HO2S Heater Circuit High (Bank 2 / Sensor 2)

DESCRIPTION

Refer to DTC P0057

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0058 if the ECM detects that the HO2S (B2/S2) heater control line is short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0058	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery Voltage > 10V - 1 % < HO2S heater duty < 99 %	• Short to battery line in HO2S (B2/S2) heater circuit • HO2S (B2/S2) heater • ECM

SPECIFICATION

Refer to DTC P0057

SCHEMATIC DIAGRAM

Refer to DTC P0057

SIGNAL WAVE FORM

Refer to DTC P0057

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

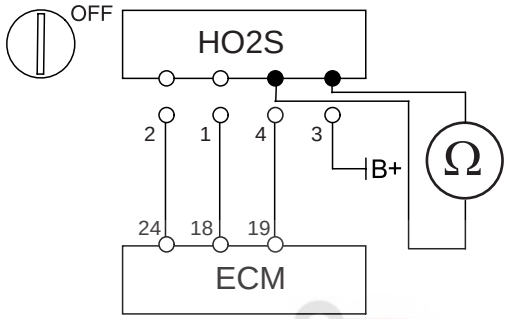
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and warm up the vehicle until the cooling operates.

Does scan tool display DTC P0058?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HEATER RESISTANCE

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Measure resistance between terminals 3 and 4 of the HO2S connector.
   - **Specification (HO2S resistance): 3.0 ~ 4.0 Ω at 23 ± 5°C**

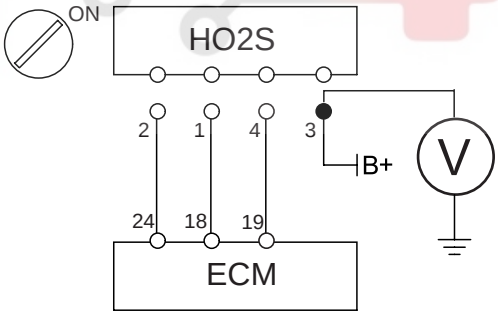


Is resistance within specification?

Yes	
No	Replace HO2S.

3. CHECK POWER TO HO2S HEATER

1. Turn ignition switch to OFF position and disconnect HO2S connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



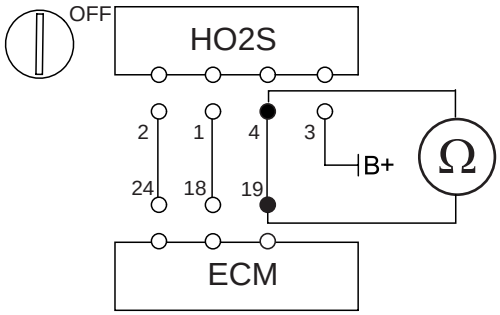
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF6038

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and 19 of the ECM harness connector (C133-2).
   - **Specification (Resistance): below 1Ω**



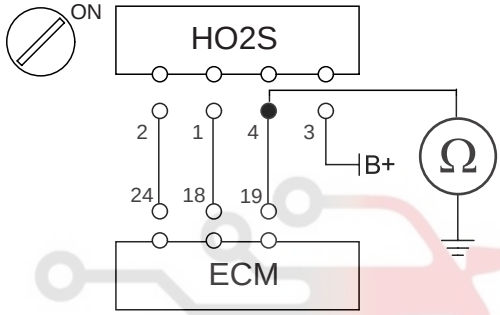
Does the resistance indicate continuity?

Yes

No	Repair open in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 4 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is viltage within specification?

Yes

No	Repair short to power in harness.

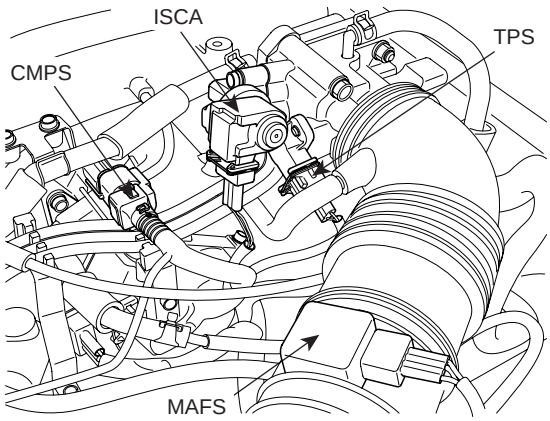
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

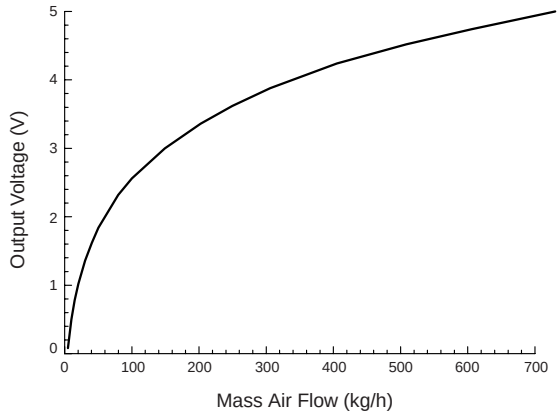
EZOF6039

TROUBLESHOOTING FOR DTC EEEABE6B

DTC	P0101	Mass or Volume Air Flow Circuit Range/Performance

COMPONENT LOCATION

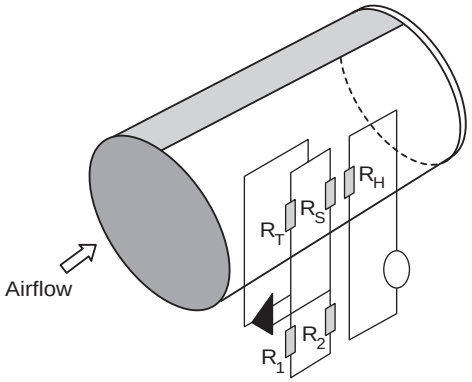




EZOF505G

DESCRIPTION

The Mass Air Flow Sensor (MAFS) is located between the air cleaner assembly and the throttle body. The MAFS uses a hot film type sensing element to measure the mass of intake air entering the engine. This hot film type air flow sensor consists of a hot film sensor, housing and metering ducts. Mass air flow rate is measured by detection of heat transfer from a hot film probe. The change in air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air. A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle. The mass of intake air should increase at acceleration and be stable during constant engine speed. The ECM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.



BFGE505H

DTC DETECTING CONDITION

1. DTC Description

The ECM compares the actual measured Mass Air Flow signal to the modeled Mass Air Flow value and sets the DTC P0101 when the difference between these two value is too high or too low with lambda deviation in opposite direction. The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails. The modeled Mass Air Flow value is determined by engine speed, throttle angle and ISCA duty.

2. Conditions for Setting the DTC

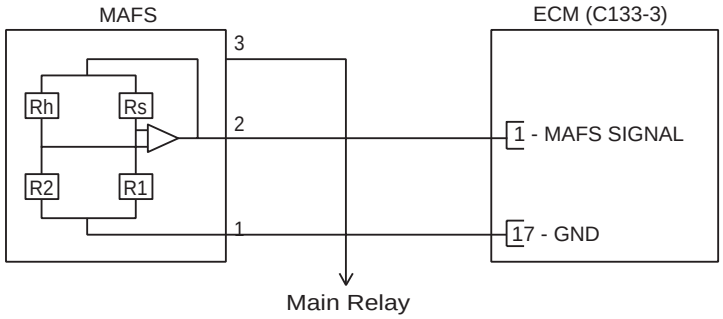
DTC	Detecting Condition & Limp Home	Possible Cause
P0101	Detecting Condition • DTC Strategy - Compare calculated MAF with MAFS signal • Enable condition - 1,500 < Engine speed < 3,500 rpm - 150 < Measured mass air flow < 350 mg/stroke - Engine coolant temperature > 60°C(140°F) • Threshold Value - (Measured MAF) / (Calculated MAF) > 1.3 or < 0.5 - and lambda controller limit for 110 seconds	• MAFS • TPS • Air cleaner • ECM

SPECIFICATION

Test Condition	MAFS DATA	
	Output Voltage (V)	Mass Air Flow (kg/h)
Idle	0.6 ~ 1.0	11.66 ~ 15.38
2000 rpm	1.3 ~ 1.5	28.41 ~ 35.58
3000 rpm	1.7 ~ 1.9	43.84 ~ 53.38

SCHEMATIC DIAGRAM

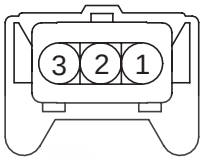
[CIRCUIT DIAGRAM]



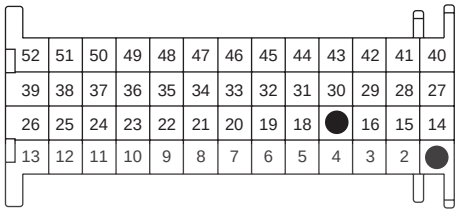
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-3 (17)	Ground
2	ECM C133-3 (1)	MAFS Signal
3	Main Relay	Battery Voltage

[HARNESS CONNECTORS]



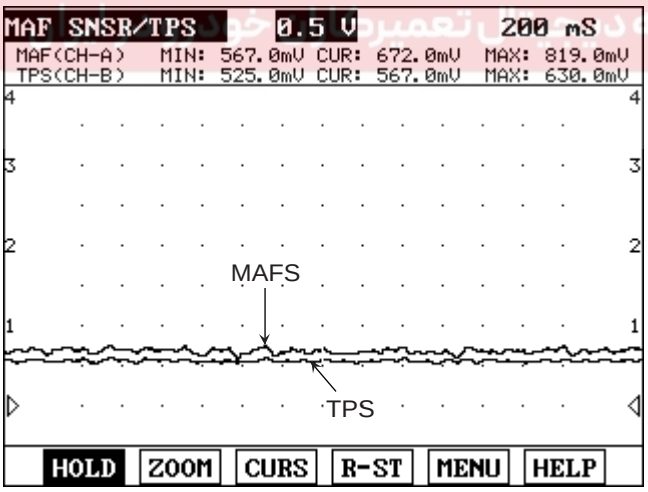
C125
MAFS

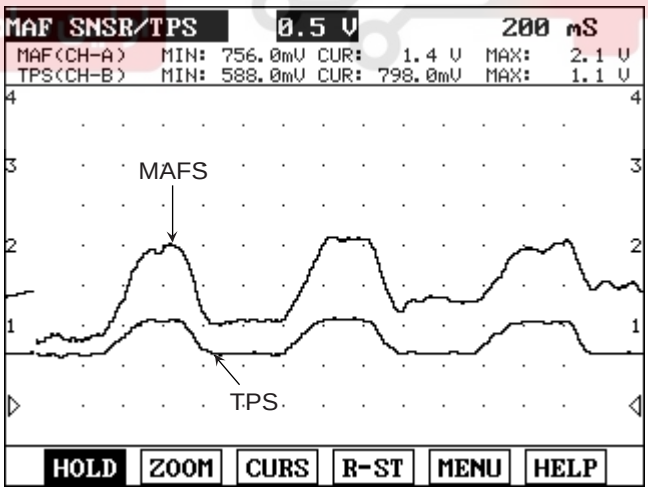


C133-3
ECM

EZOF401H

SIGNAL WAVE FORM





As much as possible, MAFS signal should be compared with the TPS signal. And check whether MAFS and TPS signals are increased at the same time when accelerating. During acceleration, the MAFS output voltage increases; during deceleration, the MAFS output voltage decreases. The left illustration is signal waveform at idle and the right illustration during acceleration and deceleration.

EZOF6042

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO MAFS/TPS

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition switch to ON position and monitor other DTCs.

Is any DTC relating to MAFS or TPS set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. PROBLEM VERIFICATION

1. Warm up engine to normal operating temperature.
2. Using Hi-Scan (Pro), monitor MAFS signals while changing throttle position.
   - **Specification (MAFS signal voltage):**
     0.6 ~ 1.0 V at idle
     1.3 ~ 1.5 V at 2000 rpm
     1.7 ~ 1.9 V at 3000 rpm

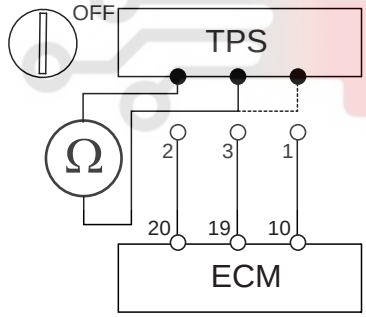
Does signal change normally according to TPS signal?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

3. CHECK TPS RESISTANCE

1. Turn ignition switch to OFF and disconnect TPS connector.
2. Measure resistance between the terminals 3 and 2 of TPS connector.
   - **Specification (TPS resistance)**
     0.71 ~ 1.38 kΩ at idle position
     2.2 ~ 3.4 kΩ at W.O.T
3. Measure resistance between the terminals 2 and 3 of TPS connector.
   - **Specification (TPS resistance): 1.6 ~ 2.4 kΩ at all throttle position**



Is resistance within specification?

Yes

No	Replace TPS.

4. CHECK MAFS, TPS, AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

EZOF601R

Yes	No	Repair or replace it.

5. CHECK AIR CLEANER

1. Check air cleaner for dirt, blockage, or damage.

Is air cleaner good?

Yes	No	Clean or replace it.

6. CHECK INTAKE SYSTEM FOR LEAKAGE

1. Check entire air intake system for leaks or blockages such as:
   - Throttle body
   - PCV valve
   - Intake manifold
   - Gasket between intake manifold and surge tank
   - Seals between intake manifold and fuel injectors
   - Seal between surge tank and PCV pipe

Is entire air intake system good?

Yes	No	Repair or replace it.

7. CHECK MAFS SIGNAL AGAIN

1. Reconnect the ECM and MAFS connectors.
2. Connect a Hi-Scan (Pro) to the data link connector.
3. Start the engine and monitor the MAFS signals.
   - **Specification (MAFS signal voltage):**
     0.6 ~ 1.0 V at idle
     1.3 ~ 1.5 V at 2000 rpm
     1.7 ~ 1.9 V at 3000 rpm

Is signal within specification?

Yes	No	Replace MAFS.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601S

TROUBLESHOOTING FOR DTC EA5BE623

DTC	P0102	Mass Air Flow Circuit Low Input

DESCRIPTION

Refer to DTC P0101

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0102 if the ECM detects signal voltage lower than the possible range of a properly operating MAF sensor.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0102	Detecting Condition • DTC Strategy - Voltage range check • Threshold Value - Mass air flow < 6 kg/h for 200 msec	• Open or short to ground in MAFS circuit • MAFS • ECM

SPECIFICATION

Refer to DTC P0101

SCHEMATIC DIAGRAM

Refer to DTC P0101

SIGNAL WAVE FORM

Refer to DTC P0101

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start the engine and monitor the MAFS signals.
   - **Specification (MAFS signal voltage):**
     0.6 ~ 1.0 V at idle
     1.3 ~ 1.5 V at 2000 rpm
     1.7 ~ 1.9 V at 3000 rpm

Is signal within specification?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK MAFS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

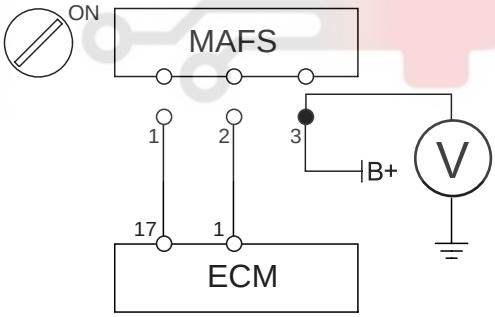
Are both connectors good?

Yes

No	Repair or replace it.

3. CHECK POWER TO MAFS

1. Turn ignition switch to OFF position and disconnect MAFS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the MAFS harness connector and chassis ground.
   - **Specification : approximately B+**



Is voltage within specification?

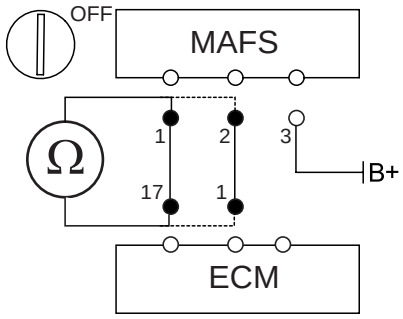
Yes

No	Repair open or short to chassis ground in harness.

EZOF6010

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect MAFS and ECM connector.
2. Measure resistance between terminal 2 of the MAFS harness connector and 1 of the ECM harness connector (C133-3).
3. Measure resistance between terminal 1 of the MAFS harness connector and 17 of the ECM harness connector (C133-3).
   - **Specification (Resistance) : below 1Ω**



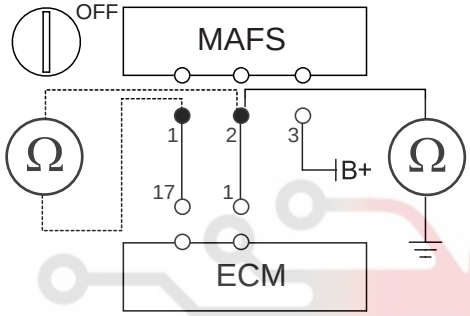
Does resistance indicate continuity?

Yes

No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect MAFS and ECM connector.
2. Measure resistance between terminal 2 of the MAFS harness connector and chassis ground.
3. Measure resistance between terminals 2 and 1 of the MAFS harness connector.
   - **Specification (Resistance) : infinite**



Does the resistance indicate open?

Yes

No	Repair short or short to chassis ground in harness.

6. CHECK MAFS SIGNAL

1. Connect the ECM and MAFS connectors.
2. Connect a Hi-Scan (Pro) to the data link connector.
3. Start the engine and monitor the MAFS signals.
   - **Specification (MAFS signal voltage):**
     0.6 ~ 1.0 V at idle
     1.3 ~ 1.5 V at 2000 rpm
     1.7 ~ 1.9 V at 3000 rpm

Is signal within specification?

Yes

No	Replace MAFS.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601U

TROUBLESHOOTING FOR DTC E7D8AFC8

DTC	P0103	Mass Air Flow Circuit High Input

DESCRIPTION

Refer to DTC P0101

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0103 if the ECM detects signal voltage higher than the possible range of a properly operating MAF sensor.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0103	Detecting Condition • DTC Strategy - Voltage range check • Threshold Value - Mass air flow > 700 kg/h for 200 msec	• Short to battery line in MAFS circuit • MAFS • ECM

SPECIFICATION

Refer to DTC P0101

SCHEMATIC DIAGRAM

Refer to DTC P0101

SIGNAL WAVE FORM

Refer to DTC P0101

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start the engine and monitor the MAFS signals.
   - **Specification (MAFS signal voltage):**
     0.6 ~ 1.0 V at idle
     1.3 ~ 1.5 V at 2000 rpm
     1.7 ~ 1.9 V at 3000 rpm

Is signal within specification?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK MAFS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

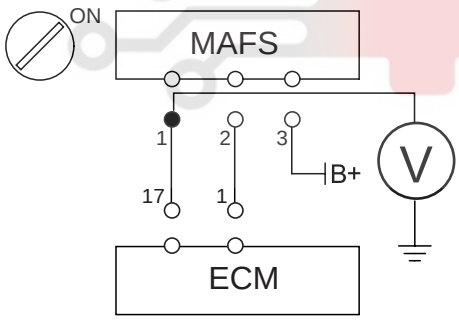
Are both connectors good?

Yes

No	Repair or replace it.

3. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position and disconnect MAFS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 2 of the MAFS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5 V**



Is voltage within specification?

Yes

No	Repair short to power in harness.

EZOF6011

4. CHECK MAFS SIGNAL

1. Reconnect the ECM and MAFS connectors.
2. Connect a Hi-Scan (Pro) to the data link connector.
3. Start the engine and monitor the MAFS signals.
   - **Specification (MAFS signal voltage):**
     0.6 ~ 1.0 V at idle
     1.3 ~ 1.5 V at 2000 rpm
     1.7 ~ 1.9 V at 3000 rpm

Is signal within specification?

Yes	No	Replace MAFS.

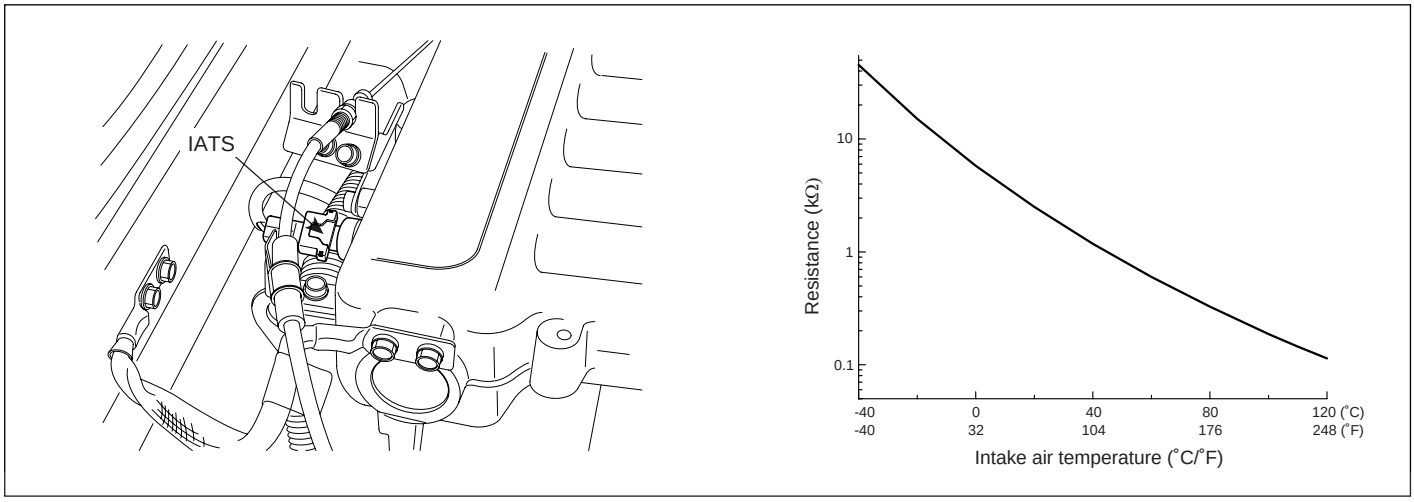
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601W

TROUBLESHOOTING FOR DTC E7DD7384

DTC	P0112	Intake Air Temperature Circuit Low Input

COMPONENT LOCATION



EZOF505I

DESCRIPTION

The Intake Air Temperature Sensor (IATS) is installed on surge tank. The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0112 if the ECM detects signal voltage lower than the possible range of a properly operating IATS.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0111	Detecting Condition • DTC Strategy - Voltage range check • Threshold Value - Intake air Temperature > 117.75°C (243.95°F) for 50 seconds	• Short to ground in IATS circuit • IATS • ECM

SPECIFICATION

Temperature		IATS Resistance(kΩ)	Temperature		IATS Resistance(kΩ)
(℃)	(°F)		(℃)	(°F)	
-20	-4	11.72~19.54	40	104	1.06~1.31
0	32	4.75~7.11	60	140	0.55~0.66
20	68	2.22~2.82	80	176	0.30~0.36

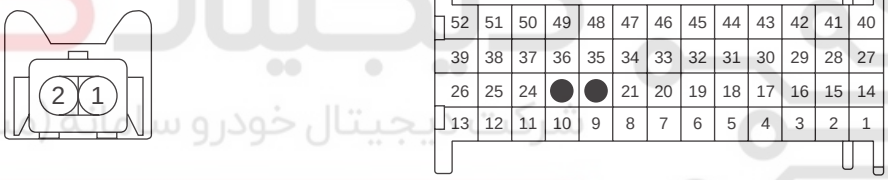
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-3 (22)	IATS Signal
2	ECM C133-3 (23)	Ground

[HARNESS CONNECTORS]

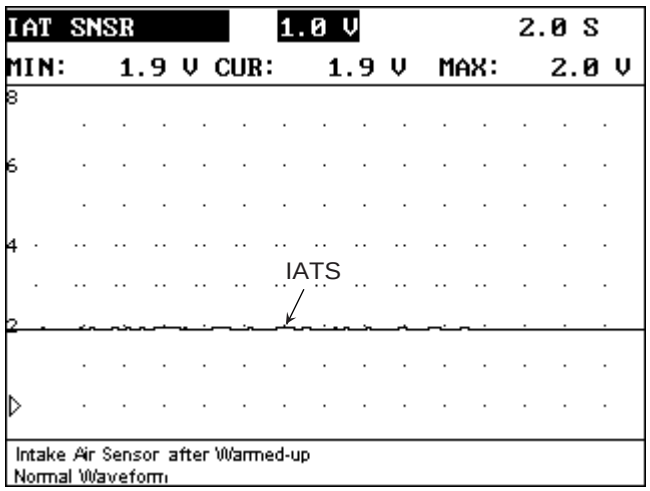


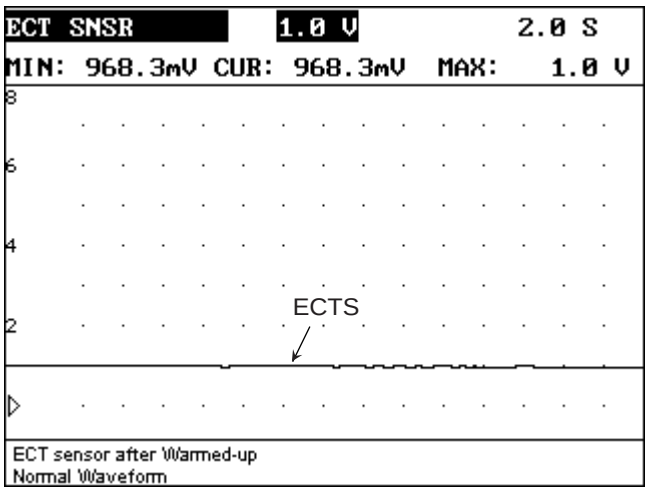
C127
IATS

C133-3
ECM

EZOF401T

SIGNAL WAVE FORM





IATS and ECTS signals should be smooth and continuous without any sudden changes. When the engine is cold, IATS and ECTS signals should look similar, depending on the ambient air temperature. After warmed-up the IATS signal should not have changed significantly while ECTS signal should have dropped. This indicates the normal increase of the engine coolant temperature is larger than the normal increase of the intake air temperature as the engine warms up.

EZOF6043

INSPECTION PROCEDURE

1. CHECK IATS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

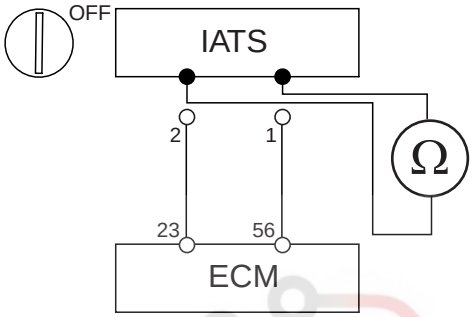
Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK IATS RESISTANCE

1. Turn ignition switch to OFF position and disconnect IATS connector.
2. Measure resistance between terminals 1 and 2 of the IATS connector.
   - **Specification (IATS resistance):**

Temperature (°C)	Temperature (°F)	Resistance (Ω)	Temperature (°C)	Temperature (°F)	Resistance (Ω)
-20	-4	11.72 ~ 19.54	40	104	1.06 ~ 1.31
0	32	4.75 ~ 7.11	60	140	0.55 ~ 0.66
20	68	2.22 ~ 2.82	80	176	0.30 ~ 0.36

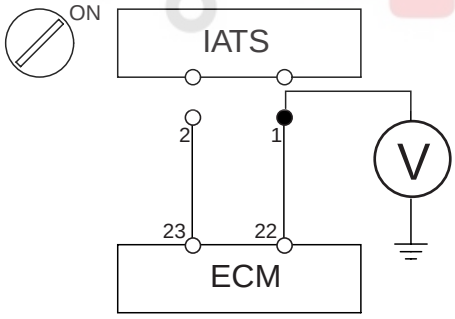


Is resistance within specification?

Yes	
No	Replace IATS.

3. CHECK REFERENCE VOLTAGE TO IATS

1. Turn ignition switch to OFF position and disconnect IATS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the IATS harness connector and chassis ground.
   - **Specification (Voltage): approximately 5V**



Is voltage within specification?

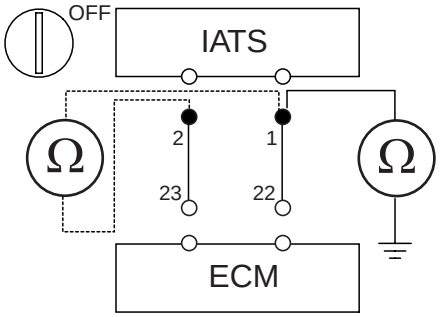
Yes	
No	Repair open or short to chassis ground in harness.

EZOF6012

4. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect IATS and ECM connector.
2. Measure resistance between terminal 1 of the IATS harness connector and chassis ground.
3. Measure resistance between terminal 1 and 2 of the IATS harness connector.
   - **Specification (Resistance): infinite**

Does each resistance indicate open?



Yes		
	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601Y

TROUBLESHOOTING FOR DTC ED124B40

DTC	P0113	Intake Air Temperature Sensor Circuit High Input

DESCRIPTION

Refer to DTC P0112

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0113 if the ECM detects signal voltage higher than the possible range of a properly operating IATS.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0113	Detecting Condition • DTC Strategy - Voltage range check • Enable condition - Time after engine start > 300sec • Threshold Value - Intake air temperature < - 38.25°C (-36.85°C) for 50 seconds	• Open or short to battery line in IATS circuit • IATS • ECM

SPECIFICATION

Refer to DTC P0112

SCHEMATIC DIAGRAM

Refer to DTC P0112

SIGNAL WAVE FORM

Refer to DTC P0112

INSPECTION PROCEDURE

1. CHECK IATS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

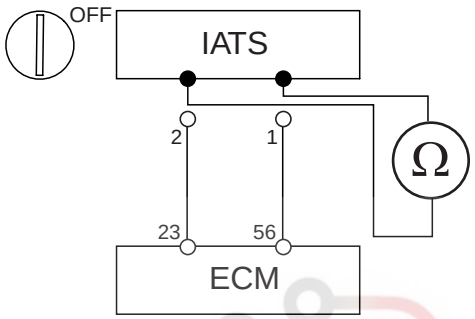
Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK IATS RESISTANCE

1. Turn ignition switch to OFF position and disconnect IATS connector.
2. Measure resistance between terminals 1 and 2 of the IATS connector.
   - **Specification (IATS resistance):**

Temperature (°C)	Temperature (°F)	Resistance (Ω)	Temperature (°C)	Temperature (°F)	Resistance (Ω)
-20	-4	11.72 ~ 19.54	40	104	1.06 ~ 1.31
0	32	4.75 ~ 7.11	60	140	0.55 ~ 0.66
20	68	2.22 ~ 2.82	80	176	0.30 ~ 0.36

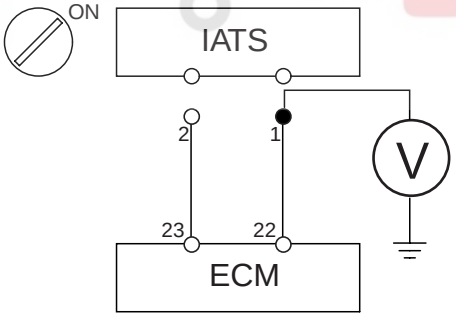


Is resistance within specification?

Yes	
No	Replace IATS.

3. CHECK REFERENCE VOLTAGE TO IATS

1. Turn ignition switch to OFF position and disconnect IATS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the IATS harness connector and chassis ground.
   - **Specification (Voltage): approximately 5V**



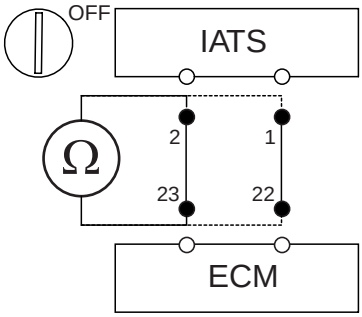
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF6012

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect IATS and ECM connector.
2. Measure resistance between terminal 1 of the IATS harness connector and 22 of the ECM harness connector (C133-3).
3. Measure resistance between terminal 2 of the IATS harness connector and 23 of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**

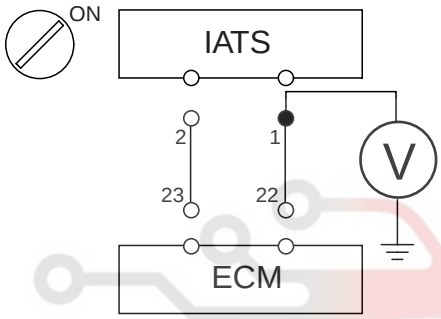


Does the resistance indicate continuity?

Yes	No	Repair open in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position and disconnect IATS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the IATS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	No	Repair short to power in harness.

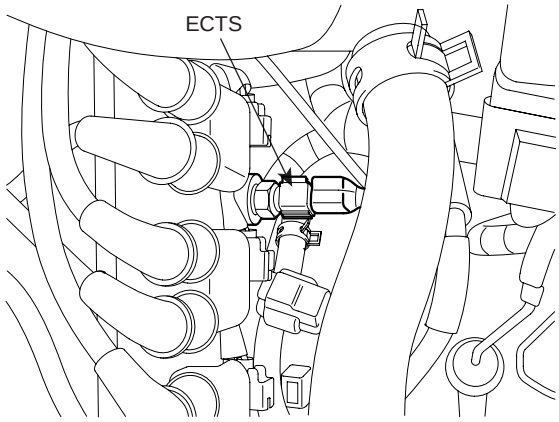
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF601Z

TROUBLESHOOTING FOR DTC E65AADCF

DTC	P0116	Engine Coolant Temperature Circuit Range/Performance

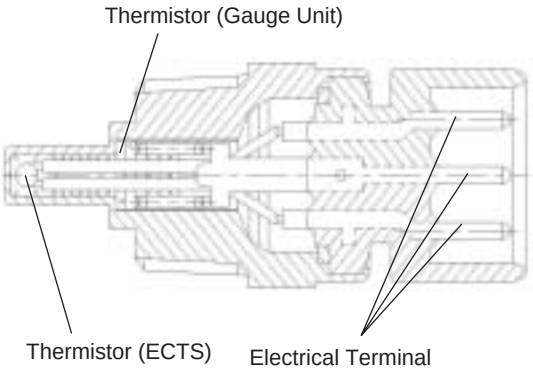
COMPONENT LOCATION



EZOF505J

DESCRIPTION

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



BFGE505K

DTC DETECTING CONDITION

1. DTC Description

The purpose of this diagnosis is to detect a stuck coolant temperature signal. The diagnostic function checks whether after a variation of the calculated coolant temperature also a variation of the measured coolant temperature is detected. ECM sets DTC P0116 when the variation of measured engine coolant temperature from engine start is smaller than threshold while variation of calculated coolant temperature by ECM is greater than threshold. If this error code is set in the next driving cycle again, ECM illuminates the MIL. The diagnosis is performed only once per driving cycle.

2. Conditions for Setting the DTC

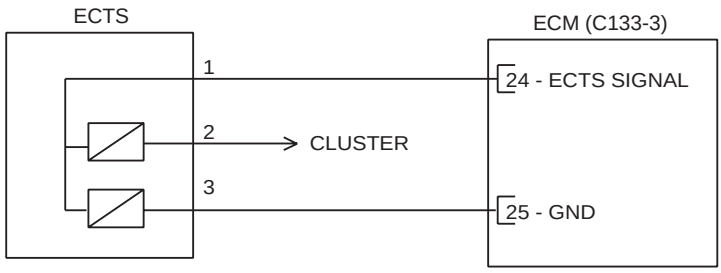
DTC	Detecting Condition & Limp Home	Possible Cause
P0116	Detecting Condition • DTC Strategy - Signal stuck • Threshold Value - The calculated ECT is higher than the threshlod value but the measured ECT is lower than the threshlod value for 5 seconds. (The threshold value deands on the ECT at start.)	• ECTS • ECM

SPECIFICATION

Temperature		ECTS Resistance(kΩ)	Temperature		ECTS Resistance(kΩ)
(℃)	(℉)		(℃)	(℉)	
-20	-4	14.13 ~ 16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31 ~ 2.59	80	176	0.32

SCHEMATIC DIAGRAM

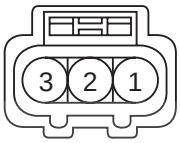
[CIRCUIT DIAGRAM]



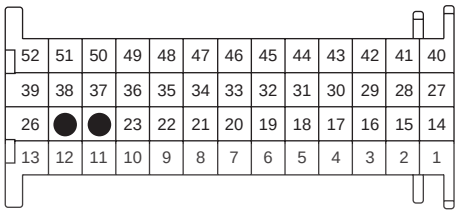
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-3 (24)	ECTS Signal
2	Cluster	-
3	ECM C133-3 (25)	Ground

[HARNESS CONNECTORS]



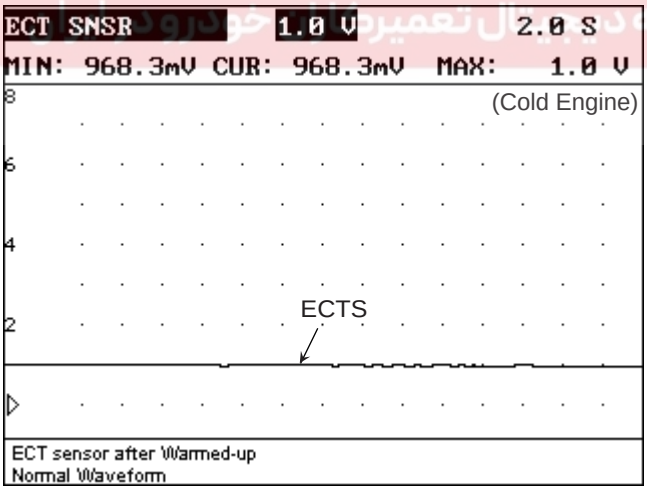
C111
ECTS

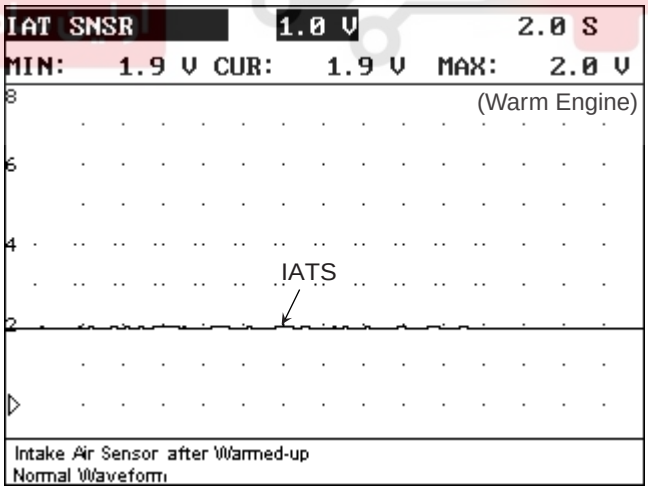


C133-3
ECM

EZOF401L

SIGNAL WAVE FORM





ECTS and IATS signals should be smooth and continuous without any sudden changes. When the engine is cold, ECTS and IATS signals should look similar, depending on the ambient air temperature. After warmed-up the IATS signal should not have changed significantly while ECTS signal should have dropped. This indicates the normal increase of the engine coolant temperature is larger than the normal increase of the intake air temperature as the engine warms up.

EZOF6044

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO ECTS

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition switch to ON position and monitor other DTCs.

Is any DTC relating to ECTS set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK ECTS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

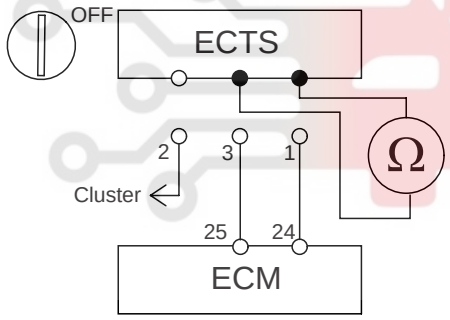
Yes

No	Repair or replace it.

3. CHECK ECTS RESISTANCE

1. Turn ignition switch to OFF and disconnect ECTS connector.
2. Measure resistance between the terminals 1 and 3 of ECTS connector.
   - **Specification (ECTS resistance):**

Temperature (°C)	Temperature (°F)	ECTS Resistance (kΩ)	Temperature (°C)	Temperature (°F)	ECTS Resistance (kΩ)
-20	-4	14.13 ~ 16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31 ~ 2.59	80	176	0.32



Is resistance within specification?

Yes

No	Replace ECTS.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF602A

TROUBLESHOOTING FOR DTC ED35B6BF

DTC	P0117	Engine Coolant Temperature Circuit Low

DESCRIPTION

Refer to DTC P0116

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0117 if the ECM detects signal voltage lower than the possible range of a properly operating ECTS.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0117	Detecting Condition • DTC Strategy - Voltage range check • Threshold Value - Engine coolant temperature > 138°C(280.4°F) for 5 seconds	• Short to ground in ECTS circuit • ECTS • ECM

SPECIFICATION

Refer to DTC P0116

SCHEMATIC DIAGRAM

Refer to DTC P0116

SIGNAL WAVE FORM

Refer to DTC P0116

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start the engine and monitor the ECTS signals while warming up engine to normal operating temperature.

Scanned temperature on the Hi-Scan (Pro) should be close to actual engine coolant temperature, shouldn't it?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK ECTS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

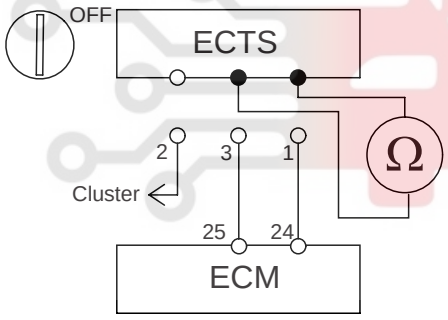
Yes

No	Repair or replace it.

3. CHECK ECTS RESISTANCE

1. Turn ignition switch to OFF and disconnect ECTS connector.
2. Measure resistance between the terminals 1 and 3 of ECTS connector.
   - **Specification (ECTS resistance):**

Temperature (°C)	Temperature (°F)	ECTS Resistance (kΩ)	Temperature (°C)	Temperature (°F)	ECTS Resistance (kΩ)
-20	-4	14.13 ~ 16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31 ~ 2.59	80	176	0.32



Is resistance within specification?

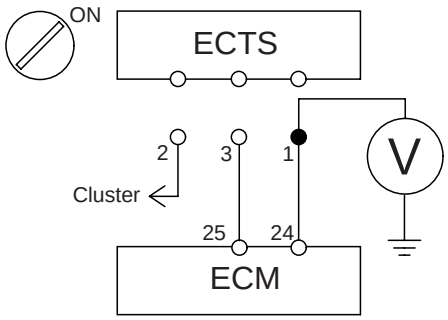
Yes

No	Replace ECTS.

EZOF602B

4. CHECK REFERENCE VOLTAGE TO ECTS

1. Turn ignition switch to OFF position and disconnect ECTS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the ECTS harness connector and chassis ground.
   - **Specification (Voltage): approximately 5V**

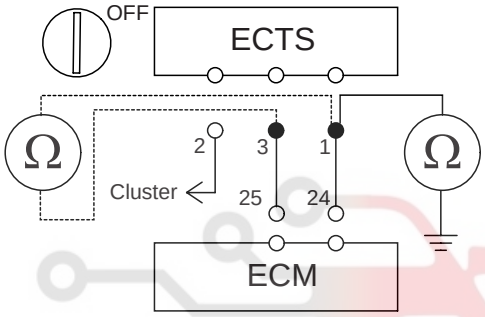


Is voltage within specification?

Yes		
	No	Repair open or short to chassis ground in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect ECTS and ECM connectors.
2. Measure resistance between terminal 1 of the ECTS harness connector and chassis ground.
3. Measure resistance between terminal 1 and 3 of the ECTS harness connector.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes		
	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF602C

TROUBLESHOOTING FOR DTC E74CA4FF

DTC	P0118	Engine Coolant Temperature Sensor Circuit High

DESCRIPTION

Refer to DTC P0116

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0118 if the ECM detects signal voltage higher than the possible range of a properly operating ECTS.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0118	Detecting Condition • DTC Strategy - Voltage range check • Enable condition a) When intake air temperature < 30°C (86°F) - Time after start > 60 seconds b) When in take air temperature > 30°C (86°F) - Immediately after start • Threshold Value - Engine coolant temperature < -38°C (-36.4°F) for 5 seconds	• Open or short to battery line in ECTS circuit • ECTS • ECM

SPECIFICATION

Refer to DTC P0116

SCHEMATIC DIAGRAM

Refer to DTC P0116

SIGNAL WAVE FORM

Refer to DTC P0116

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start the engine and monitor the ECTS signals while warming up engine to normal operating temperature.

Scanned temperature on the Hi-Scan (Pro) should be close to actual engine coolant temperature, shouldn't it?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK ECTS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

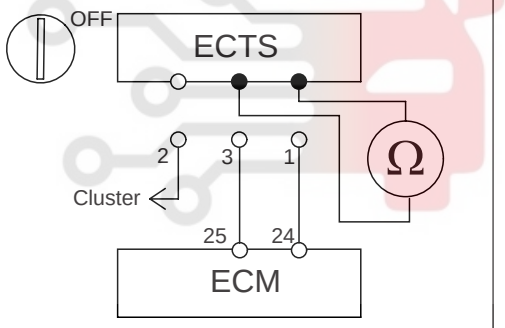
Yes

No	Repair or replace it.

3. CHECK ECTS RESISTANCE

1. Turn ignition switch to OFF and disconnect ECTS connector.
2. Measure resistance between the terminals 1 and 3 of ECTS connector.
   - **Specification (ECTS resistance):**

Temperature (°C)	Temperature (°F)	ECTS Resistance (kΩ)	Temperature (°C)	Temperature (°F)	ECTS Resistance (kΩ)
-20	-4	14.13 ~ 16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31 ~ 2.59	80	176	0.32



Is resistance within specification?

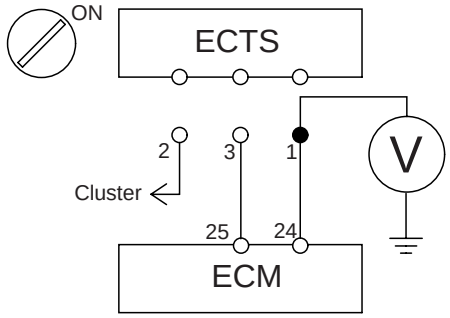
Yes

No	Replace ECTS.

EZOF602B

4. CHECK REFERENCE VOLTAGE TO ECTS

1. Turn ignition switch to OFF position and disconnect ECTS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the ECTS harness connector and chassis ground.
   - **Specification (Voltage): approximately 5V**

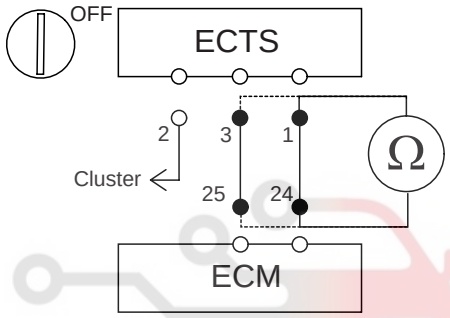


Is voltage within specification?

Yes		
	No	Repair open or short to chassis ground in harness.

5. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect ECTS and ECM connector.
2. Measure resistance between terminal 1 of the ECTS harness connector and 24 of the ECM harness connector (C133-3).
3. Measure resistance between terminal 3 of the ECTS harness connector and 25 of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**

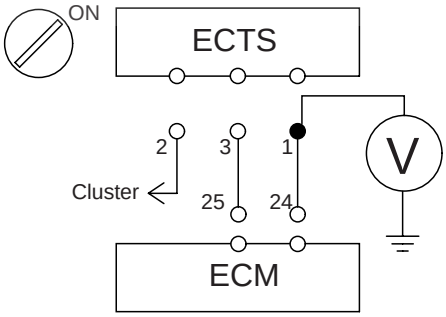


Does the resistance indicate continuity?

Yes		
	No	Repair open in harness.

6. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect ECTS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the ECTS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes		
	No	Repair short to power in harness.

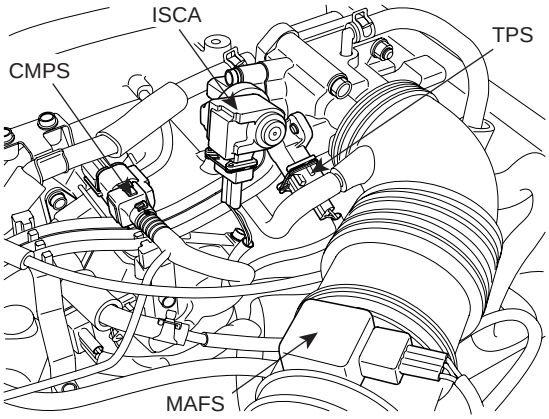
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

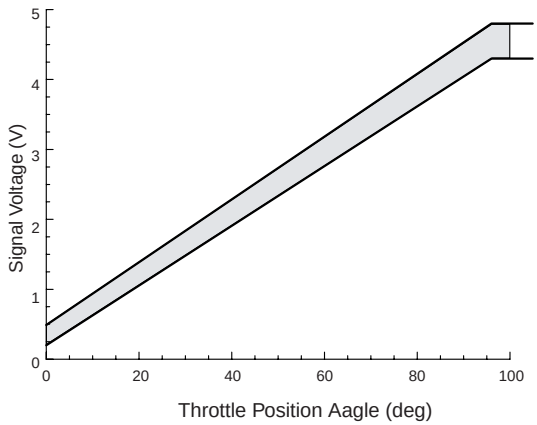
EZOF602D

TROUBLESHOOTING FOR DTC E3406292

DTC	P0121	Throttle Position Sensor Circuit Range / Performance Problem

COMPONENT LOCATION





EZOF505M

DESCRIPTION

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) whose characteristic is the resistance changing according to the throttle angle. During acceleration, the TPS resistance between the reference 5V and the signal terminal decreases and output voltage increases; during deceleration, the TPS resistance increases and TPS output voltage decreases. The ECM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The TPS output voltage will vary from 0.2~0.8V at closed throttle to 4.3~4.8V at wide-open throttle. The ECM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The ECM uses the Mass Air Flow Sensor (MAFS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC DETECTING CONDITION

1. DTC Description

The ECM compares the actual measured Mass Air Flow signal with the modeled Mass Air Flow value to detect implausibile TPS signal. Because throttle position is one of key parameters in determining the modeled Mass Air Flow value.
The DTC P0121 is set when the difference between these two value is too high or too low with lambda deviation in same dirrection for a certain time.
The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.
The modeled Mass Air Flow value is determined by engine speed, throttle angle and ISCA duty.

2. Conditions for Setting the DTC

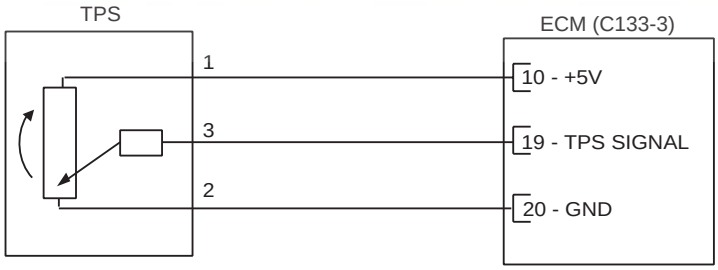
DTC	Detecting Condition & Limp Home	Possible Cause
P0121	Detecting Condition • DTC Strategy - Compare calculated MAF with MAFS signal • Enable condition - 1,500 < Engine speed < 3,500 rpm - 150 < Meqsured mass air flow < 350mg/stroke - Engine coolant temperature > 60°C(140°F) • Threshold Value - (Measured MAF) / (Calculated MAF) > 1.3 of < 0.5	• TPS • Intake system • ECM

SPECIFICATION

TPS		Normal Parameter	
		C.T (Idle)	W.O.T
Throttle Angle (°)		0 ~ 0.5 °	90°~100°
Signal Voltage (V)		0.2 ~ 0.8 V	4.3 ~ 4.8 V
Resistance (kΩ)	Terminal 1 and 2	0.71 ~ 1.38 kΩ at all temperature	2.2~3.4 kΩ at all temperature
	Terminal 2 and 3	1.6 ~ 2.4 kΩ at all throttle position	

SCHEMATIC DIAGRAM

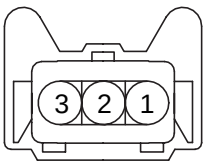
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

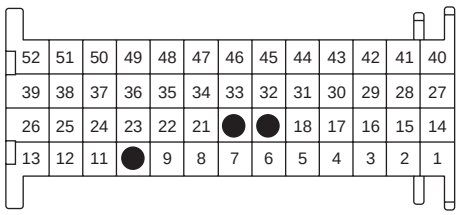
Terminal	Connected to	Function
1	ECM C133-3 (10)	Reference Voltage
2	ECM C133-3 (20)	Ground
3	ECM C133-3 (19)	MAFS Signal

[HARNESS CONNECTORS]



C112

TPS

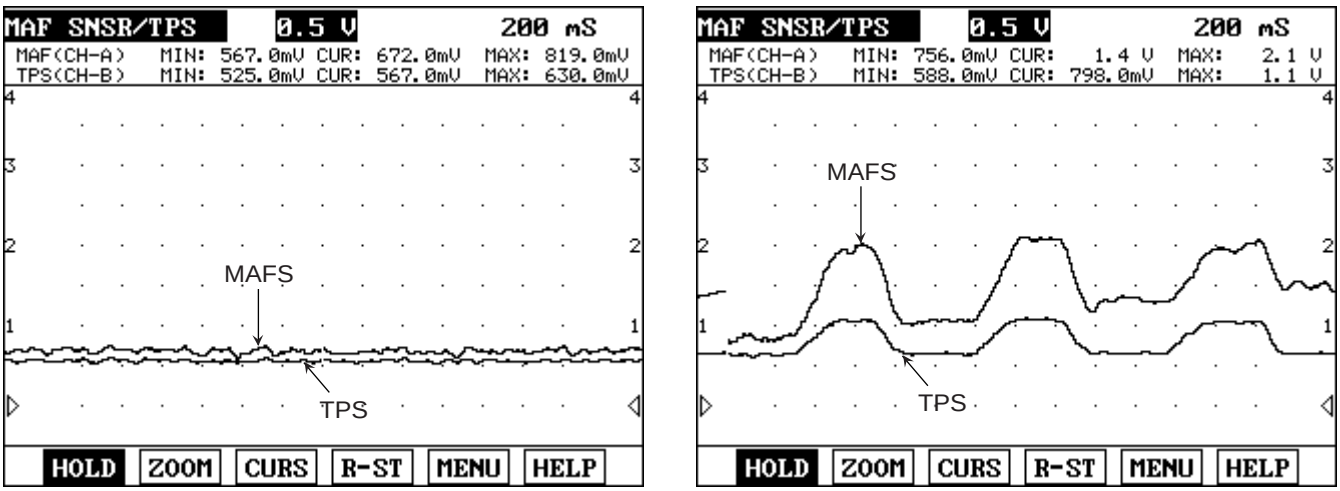


C133-3

ECM

EZOF401N

SIGNAL WAVE FORM



During acceleration, the TPS output voltage increases; during deceleration, the TPS output voltage decreases. As much as possible, TPS signal should be compared with the MAFS signal. And check whether TPS and MAFS signals are increased at the same time when accelerated.

EZOF6045

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO TPS

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition to ON position and monitor other DTCs.

Is any DTC relating to TPS set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK INTAKE SYSTEM

1. Inspect the intake system for the following items:
   - Air leakage
   - Connection of each components

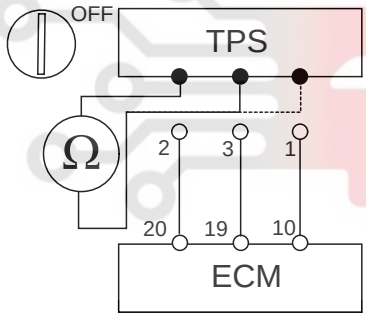
Are the items okay?

Yes

No	Repair or replace it.

3. CHECK TPS RESISTANCE

1. Turn ignition switch to OFF and disconnect TPS connector.
2. Measure resistance between the terminal 3 and 2 of TPS connector.
3. Measure resistance between the terminal 2 and 1 of TPS connector.
   - **Specification (TPS resistance at any temperature):**
     - **Terminal 1 and 2: 0.71 ~ 1.38 kΩ at Closed Throttle**
       2.2 ~ 3.4 kΩ at Wide Open Throttle
     - **Terminal 2 and 3: 1.6 ~ 2.4 kΩ at all throttle position**



Is each resistance within specification?

Yes

No	Replace TPS.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF602E

TROUBLESHOOTING FOR DTC EF417C60

DTC	P0122	Throttle Position Sensor Circuit Low Input

DESCRIPTION

Refer to DTC P0121

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0122 if the ECM detects signal voltage lower than the possible range of a properly operating TPS.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0122	Detecting Condition • DTC Strategy - Voltage range check • Threshold Value - TPS signal < 0.14V for 1 second	• Short to ground in TPS circuit • TPS • ECM

SPECIFICATION

Refer to DTC P0121

SCHEMATIC DIAGRAM

Refer to DTC P0121

SIGNAL WAVE FORM

Refer to DTC P0121

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Turn ignition switch to ON position.
2. Using a Hi-Scan (Pro), monitor the TPS signals while slowly opening the throttle.
   - **Specification (TPS signal):**
     0.2 ~ 0.8 V at Closed Throttle
     4.3 ~ 4.8 V at Wide Open Throttle
   - **Refer to CHARACTERISTIC CURVE in P0121 about any other throttle angle.**

Is signal within specification and consistent with the normal curve?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK TPS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

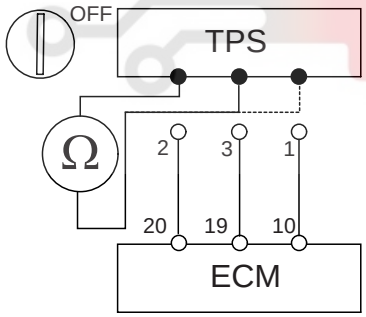
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK TPS RESISTANCE

1. Turn ignition switch to OFF and disconnect TPS connector.
2. Measure resistance between the terminal 3 and 2 of TPS connector.
3. Measure resistance between the terminal 2 and 1 of TPS connector.
   - **Specification (TPS resistance at any temperature):**
     - **Terminal 1 and 2: 0.71 ~ 1.38 kΩ at Closed Throttle**
       2.2 ~ 3.4 kΩ at Wide Open Throttle
     - **Terminal 2 and 3: 1.6 ~ 2.4 kΩ at all throttle position**



Is each resistance within specification?

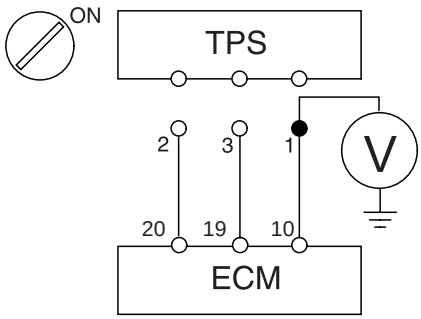
Yes

No	Replace TPS.

EZOF602F

4. CHECK REFERENCE VOLTAGE TO TPS

1. Turn ignition switch to OFF position and disconnect TPS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the TPS harness connector and chassis ground.
   - **Specification (Voltage): approximately 5V**

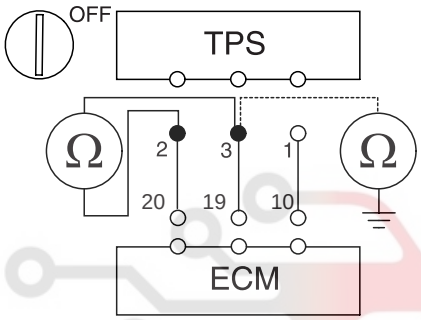


Is voltage within specification?

Yes		
	No	Repair open or short to chassis ground in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect TPS and ECM connectors.
2. Measure resistance between terminal 3 and 2 of the TPS harness connector.
3. Measure resistance between terminal 3 of the TPS harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does each resistance indicate open?

Yes		
	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF602G

TROUBLESHOOTING FOR DTC E3E7B98B

DTC	P0123	Throttle Position Sensor Circuit High Input

DESCRIPTION

Refer to DTC P0121

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0123 if the ECM detects signal voltage higher than the possible range of a properly operating TPS.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0123	Detecting Condition • DTC Strategy - Voltage range check • Threshold Value - TPS signal > 4.86V for 1 seconds	• Open or short to battery line in TPS circuit • TPS • ECM

SPECIFICATION

Refer to DTC P0121

SCHEMATIC DIAGRAM

Refer to DTC P0121

SIGNAL WAVE FORM

Refer to DTC P0121

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Turn ignition switch to ON position.
2. Using a Hi-Scan (Pro), monitor the TPS signals while slowly opening the throttle.
   - **Specification (TPS signal):**
     0.2 ~ 0.8 V at Closed Throttle
     4.3 ~ 4.8 V at Wide Open Throttle
   - **Refer to CHARACTERISTIC CURVE in P0121 about any other throttle angle.**

Is signal within specification and consistent with the normal curve?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK TPS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

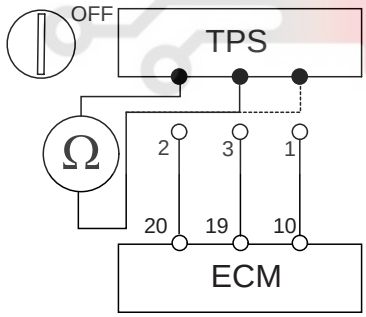
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK TPS RESISTANCE

1. Turn ignition switch to OFF and disconnect TPS connector.
2. Measure resistance between the terminal 3 and 2 of TPS connector.
3. Measure resistance between the terminal 2 and 1 of TPS connector.
   - **Specification (TPS resistance at any temperature):**
     - **Terminal 1 and 2: 0.71 ~ 1.38 kΩ at Closed Throttle**
       2.2 ~ 3.4 kΩ at Wide Open Throttle
     - **Terminal 2 and 3: 1.6 ~ 2.4 kΩ at all throttle position**



Is each resistance within specification?

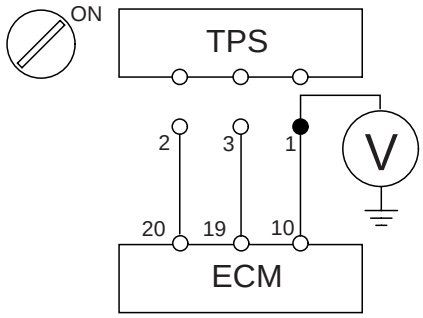
Yes

No	Replace TPS.

EZOF602F

4. CHECK REFERENCE VOLTAGE TO TPS

1. Turn ignition switch to OFF position and disconnect TPS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the TPS harness connector and chassis ground.
   - **Specification (Voltage): approximately 5V**

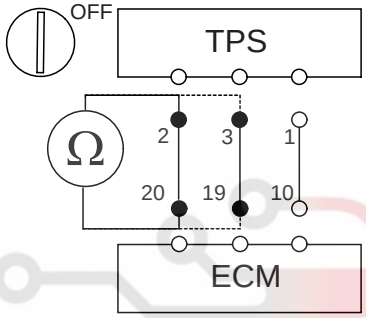


Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

5. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect TPS and ECM connector.
2. Measure resistance between terminal 2 of the TPS harness connector and 20 of the ECM harness connector (C133-3).
3. Measure resistance between terminal 3 of the TPS harness connector and 19 of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**

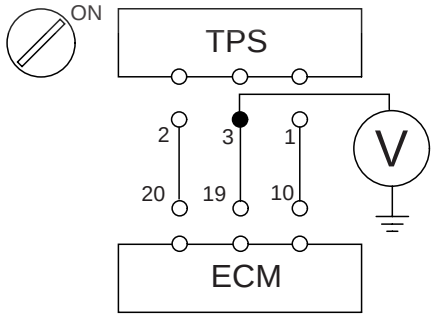


Does each resistance indicate continuity?

Yes	
No	Repair open in harness.

6. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect TPS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the TPS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	
No	Repair short to power in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

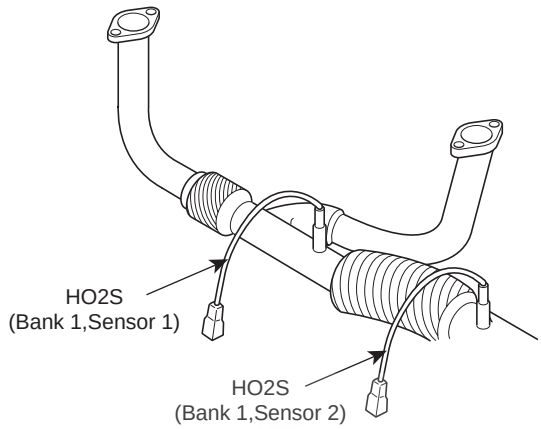
EZOF602H

TROUBLESHOOTING FOR DTC EA75A8A0

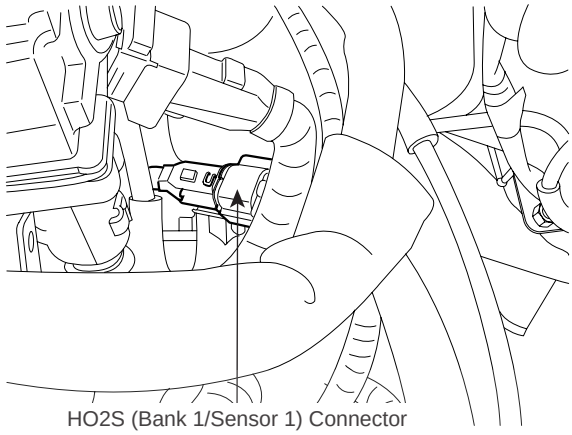
DTC	P0130	HO2S Circuit Low Voltage (Bank 1/Sensor 1)

COMPONENT LOCATION

[EURO-II]



[EURO-III/IV & JAPAN]



EZOF505E

DESCRIPTION

The heated oxygen sensor is mounted on the front side of Catalytic Converter (warm-up catalytic converter) or in the front exhaust pipe, which detects the oxygen concentration in the exhaust gas. The heated oxygen sensor (HO2S) produces a voltage that varies between 0V and 1V. When the air/fuel ratio is lean, the oxygen concentration in the exhaust gas increases and the front HO2S outputs a low voltage (approximately 0 ~ 0.1V). When the air/fuel ratio is rich, the oxygen concentration in the exhaust gas decreases and the front HO2S outputs a high voltage (approximately 0.8 ~ 1V). The ECM constantly monitors the HO2S and increases or decreases the fuel injection duration by using the HO2S signal, which is called closed-loop fuel control operation.

DTC DETECTING CONDITION

1. DTC Description

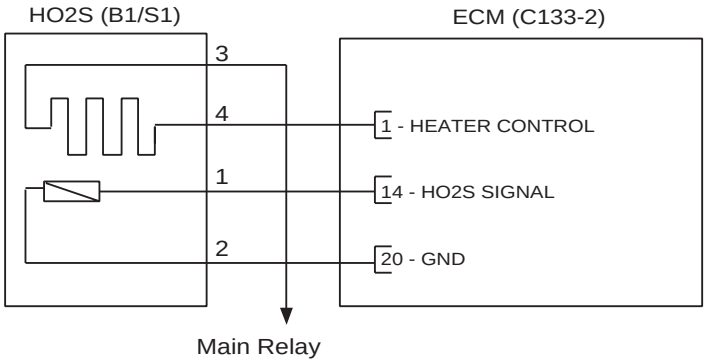
ECM sets DTC P0130 if the ECM detects that the front HO2S signal line is open.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0130	Detecting Condition • DTC Strategy - Check open circuit on HO2S (B1/S1) • Enable condition - Sensor pre-heating and full heating phases finished - Lambda control active - No relevant failure - Battery voltage > 10V • Threshold Value - 0.37 < HO2S signal < 0.49V for 1 seconds	• Open in HO2S(B1/S1) circuit • HO2S (B1/S1) • ECM

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

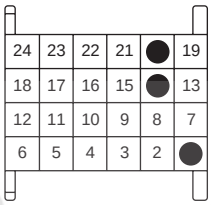


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-2 (14)	HO2S(B1/S1) Signal
2	ECM C133-2 (20)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (1)	HO2S Heater (B1/S1)

[HARNESS CONNECTORS]

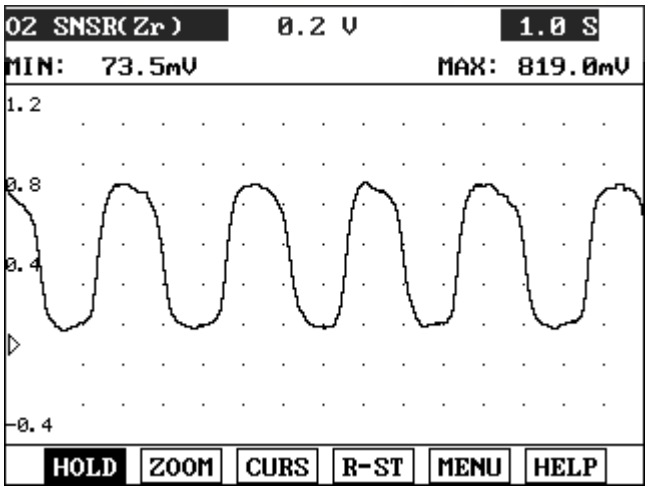
C145 (EURO-III/IV & JAPAN)
C116 (EURO-II)
HO2S (B1/S2)



C133-2
ECM

EZOF401D

SIGNAL WAVE FORM



If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O2 sensor service data in the Hi-Scan (Pro) will display values 200mV or lower. When you suddenly press on the accelerator pedal down, the voltage will reach 0.6 ~ 1.0 V. When you let the engine idle again, the voltage will fluctuate between 200 mV or lower and 0.6 ~ 1.0 V. In this case, the O2sensor can be determined as good.

EFAE0098

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Warm up engine to normal operating temperature and monitor HO2S signal.

Does the HO2S signal switch from lean to rich or from rich to lean ?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HO2S AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

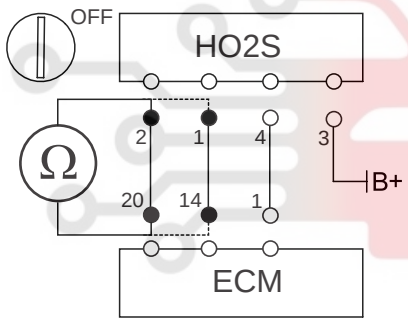
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 2 of the HO2S harness connector and terminal 20 of the ECM harness connector (C133-2).
3. Measure resistance between terminal 1 of the HO2S harness connector and terminal 14 of the ECM harness connector (C133-2).
   - **Specification (HO2S resistance): below 1Ω**



Does each resistance indicate continuity?

Yes

No	Repair open in harness.

4. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Do the front HO2S signals fluctuate between 0V and 1V?

Yes

No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF602R

TROUBLESHOOTING FOR DTC EA134453

DTC	P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)

DESCRIPTION

Refer to DTC P0130

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0131 if the ECM detects signal voltage lower than the possible range of a properly operating HO2S (B1/S1).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0131	Detecting Condition • DTC Strategy - Sensor voltage low • Enable condition - Sensor pre-heating and full heating phases finished - Battery voltage > 10V • Threshold Value - HO2S signal < 0.02V for 2 seconds	• Short to ground in HO2S (B1/S1) circuit • Front HO2S (B1/S1) • ECM

SPECIFICATION

Refer to DTC P0130

SCHEMATIC DIAGRAM

Refer to DTC P0130

SIGNAL WAVE FORM

Refer to DTC P0130

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Warm up engine to normal operating temperature and monitor HO2S signal.

Does the HO2S signal switch from lean to rich or from rich to lean ?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HO2S AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

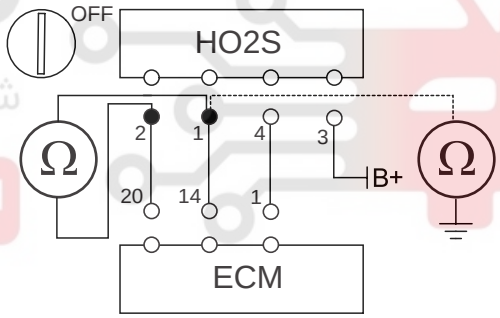
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 1 and 2 of the HO2S harness connector.
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does each resistance indicate open?

Yes

No	Repair short in harness or short to chassis ground.

4. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes

No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF602S

TROUBLESHOOTING FOR DTC E6B5DA73

DTC	P0132	HO2S Circuit High Input (Bank 1 / Sensor 1)

DESCRIPTION

Refer to DTC P0130

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0132 if the ECM detects signal voltage higher than the possible range of a properly operating HO2S (B1/S1).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0132	Detecting Condition • DTC Strategy - Sensor voltage high • Enable condition - Sensor pre-heating and full heating phases finished - Battery voltage > 10V • Threshold Value - HO2S signal > 1.3V for 2 seconds	• Short to battery line in HO2S (B1/S1) circuit • HO2S (B1/S1) • ECM

SPECIFICATION

Refer to DTC P0130

SCHEMATIC DIAGRAM

Refer to DTC P0130

SIGNAL WAVE FORM

Refer to DTC P0130

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Warm up engine to normal operating temperature and monitor HO2S signal.

Does the HO2S signal switch from lean to rich or from rich to lean ?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HO2S AND ECM CONNECTORS

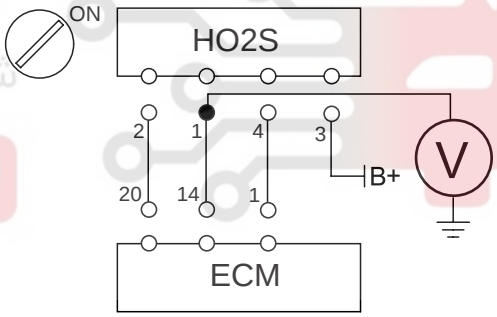
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

3. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	
No	Repair short to power in harness.

4. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	
No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF602T

TROUBLESHOOTING FOR DTC E134FDE3

DTC	P0133	HO2S Circuit Slow Response (Bank 1/ Sensor 1)

DESCRIPTION

Refer to DTC P0130

DTC DETECTING CONDITION

1. DTC Description

DTC P0133 is set when the switching time is bigger than the limit value.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0133	Detecting Condition • DTC Strategy - Comparison of HO2S lean/rich period with calculated period • Enable condition - Catalyst temperature (Model) : 340~600°C(644~1,112°F) - Engine coolant temperature > 70°C(158°F) - 800 < Engine speed < 2500 rpm • Threshold Value - Sum of HO2S Lean/Rich period > Calculated limit for 80 lambda controller cycles	• Open or short in HO2S (B1/S1) heater circuit • HO2S (B1/S1) • Intake system • Improper fuel pressure • ECM

SCHEMATIC DIAGRAM

Refer to DTC P0130

SIGNAL WAVE FORM

Refer to DTC P0130

INSPECTION PROCEDURE

1. CHECK OTHER DTC

1. Connect Hi-Scan (Pro) to data link connector.
2. Turn ignition switch to ON and monitor other DTCs.

Are any other DTCs also set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK FRONT HO2S

1. Check the front HO2S for the following items:
   - HO2S error
   - Open or short in HO2S circuit
   - **Refer to "DTC P0131 and P0132 (O2 Sensor Circuit High/Low Input)" for a detailed inspection procedure.**

Is the front HO2S okay?

Yes

No	Replace it.

3. CHECK INTAKE SYSTEM FOR VACUUM LEAKGE

1. Visually check intake system for vacuum leakage.

Is any leakage present?

Yes

No	Repair it.

4. CHECK FUEL LINE PRESSURE

1. Reduce the fuel pressure to install the fuel pressure gauge.
2. After installing tightly the fuel pressure gauge to fuel delivery pipe, start the engine and let it idle.
3. Check fuel line pressure.
   - **Refer to " FUEL PRESSURE TEST " of FUEL DELIVERY SYSTEM for more information.**

Is fuel line pressure normal?

Yes

No	Repair it.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

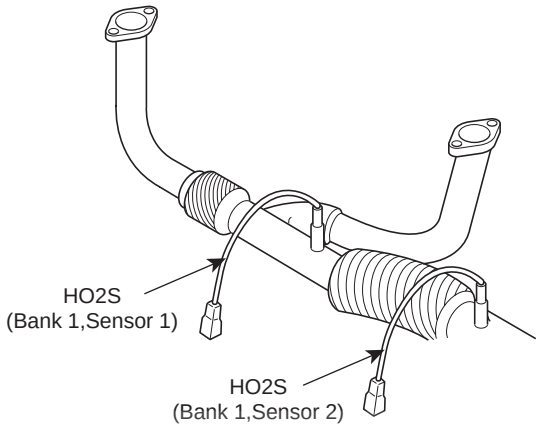
LGGE0050

TROUBLESHOOTING FOR DTC EA4C3E1C

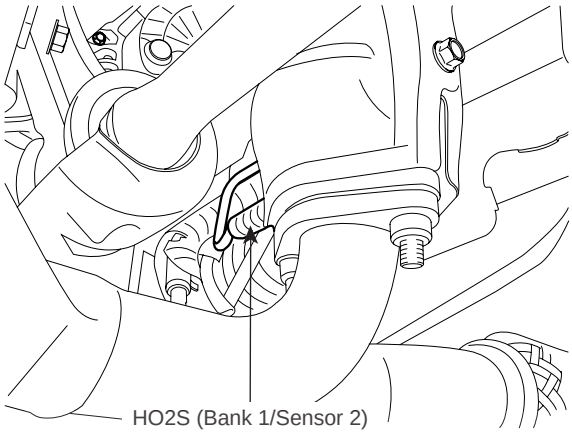
DTC	P0136	HO2S Circuit (Bank 1 / Sensor 2)

COMPONENT LOCATION

[EURO-II]



[EURO-III/IV & JAPAN]



EZOF5050

DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which detects the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DETECTING CONDITION

1. DTC Description

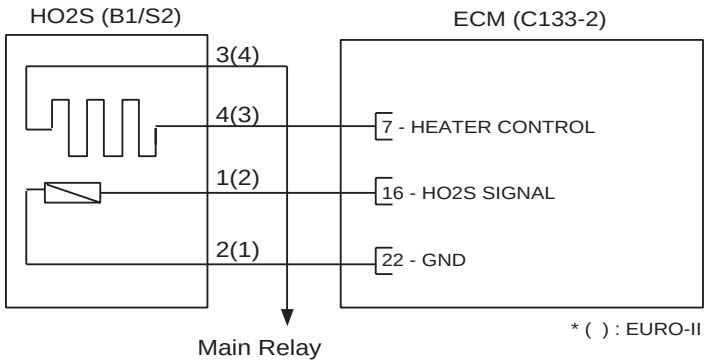
ECM sets DTC P0136 if the ECM detects that the HO2S (B1/S2) signal line is open.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0136	Detecting Condition • DTC Strategy - Check open circuit on rear HO2S • Enable condition - Sensor pre-heating and full heating phases finished - No relevant failure - 10 < Battery voltage < 16V • Threshold Value - 0.37 < HO2S signal < 0.49V for 2 seconds	• Open in HO2S (B1/S2) circuit • HO2S (B1/S2) • ECM

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

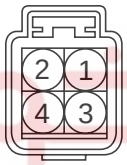
EURO-III/IV (C147)

Terminal	Connected to	Function
1	ECM C133-2 (16)	HO2S(B1/S2) Signal
2	ECM C133-2 (22)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (7)	HO2S Heater (B1/S2)

EURO-II (C122)

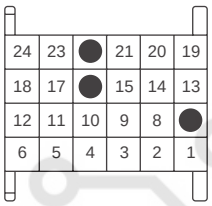
Terminal	Connected to	Function
1	ECM C133-2 (22)	Ground
2	ECM C133-2 (16)	HO2S(B1/S2) Signal
3	ECM C133-2 (17)	HO2S Heater (B1/S2)
4	Main Relay	Battery Voltage

[HARNESS CONNECTORS]



C147 (EURO-III/IV)
HO2S (B1/S2)

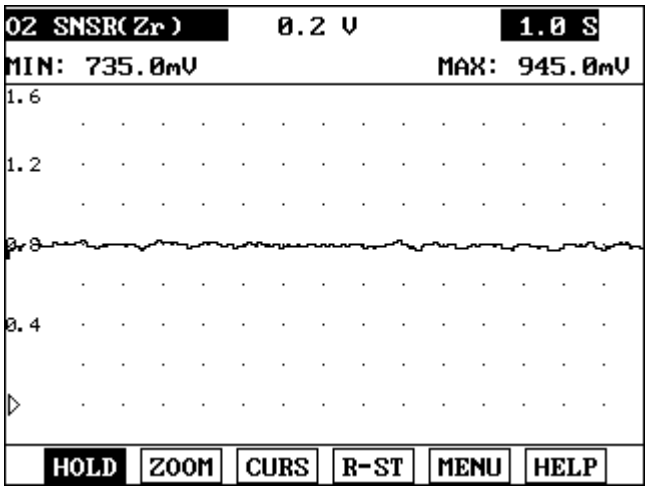
C122 (EURO-II)



C133-2
ECM

EZOF4010

SIGNAL WAVE FORM



The amplitude of signal output of rear HO2S has small value compared to front HO2S because rear HO2S detects emission gas purified by catalytic converter. This illustration is the normal signal waveform of rear HO2S at idle.

EFAE0113

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

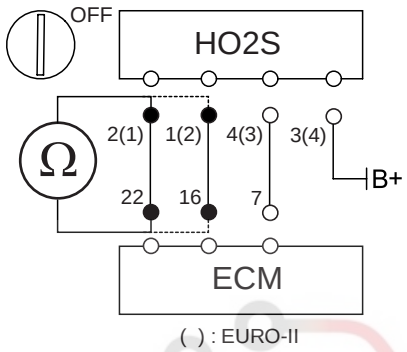
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and hold the engine at 3000 rpm with no load (in P or N) until the cooling fan comes on.

Does scan tool display DTC P0136?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 2(1) of the HO2S harness connector and terminal 22 of the ECM harness connector (C133-2).
3. Measure resistance between terminal 1(2) of the HO2S harness connector and terminal 16 of the ECM harness connector(C133-2).
   - **Specification (HO2S resistance): below 1Ω**



( ) : EURO-II

Does each resistance indicate continuity?

Yes	
No	Repair open in harness.

3. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.

NOTE

- *0.0V at Fuel-Cut state after racing with no load*
- *0.1 ~ 0.8V at idle.*

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	
No	Rep-lace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6020

TROUBLESHOOTING FOR DTC ED5BBF78

DTC	P0137	O2 Sensor Circuit Low Input (Bank1, Sensor2)

DESCRIPTION

Refer to DTC P0136

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0137 if the ECM detects signal voltage lower than the possible range of a properly operating HO2S (B1/S2).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0137	Detecting Condition • DTC Strategy - Sensor voltate low • Enable condition - Sensor pre-heating and full heating phases finished - Battery voltage ＞ 10V • Threshold Value - HO2S signal ＜ 0.02V for 2 seconds	• Short to ground in HO2S (B1/S2) circuit • HO2S (B1/S2) • ECM

SPECIFICATION

Refer to DTC P0136

SCHEMATIC DIAGRAM

Refer to DTC P0136

SIGNAL WAVE FORM

Refer to DTC P0136

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

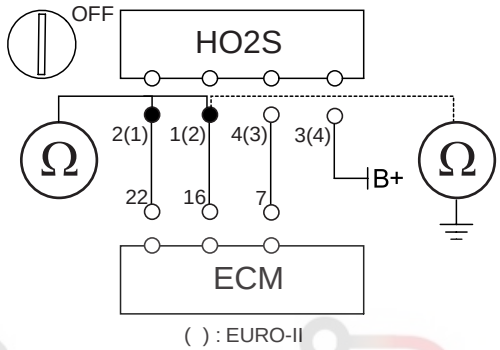
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and wait 1 minute.

Does scan tool display DTC P0137?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 2(1) and 1(2) of the HO2S harness connector.
3. Measure resistance between terminal 1(2) of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does each resistance indicate open?

Yes	
No	Repair short in harness or short to chassis ground.

3. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.

NOTE

- *0.0V when signal line is short to chassis ground*

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	
No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6021

TROUBLESHOOTING FOR DTC EFF9712D

DTC	P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)

DESCRIPTION

Refer to DTC P0136

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0138 if the ECM detects signal voltage higher than the possible range of a properly operating HO2S (B1/S2).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0138	Detecting Condition • DTC Strategy - Sensor voltage high • Enable condition - Sensor pre-heating and fullheating phases finished - Battery voltage ＞10V • Threshold Value - HO2S signal ＞ 1.3V for 2 seconds	• Short to battery line in HO2S (B1/S2) circuit • HO2S (B1/S2) • ECM

SPECIFICATION

Refer to DTC P0136

SCHEMATIC DIAGRAM

Refer to DTC P0136

SIGNAL WAVE FORM

Refer to DTC P0136

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

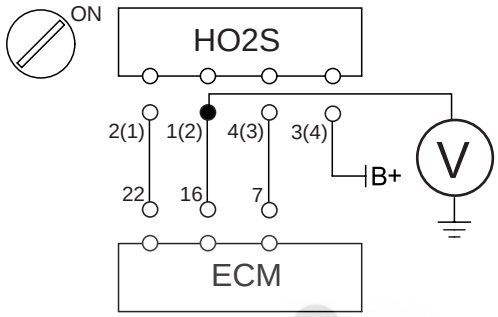
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and wait 1 minute.

Does scan tool display DTC P0138?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1(2) of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	
No	Repair short to power in harness.

3. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.

NOTE

- *1.3V when signal line is short to battery line.*

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	
No	Replace HO2S.

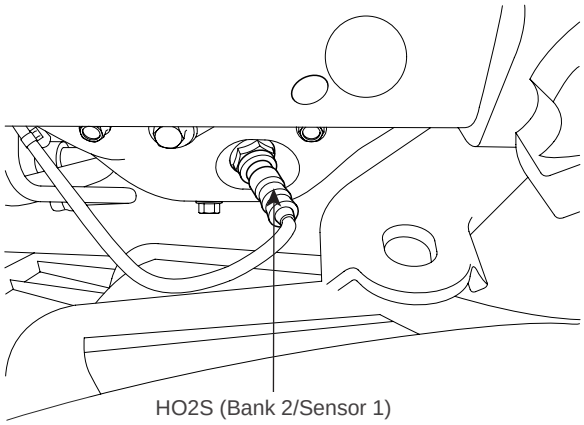
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6022

TROUBLESHOOTING FOR DTC EB2FDE9E

DTC	P0150	HO2S Circuit Low Voltage (Bank 2/Sensor 1)

COMPONENT LOCATION



EZOF6030

DESCRIPTION

The heated oxygen sensor is mounted on the front side of Catalytic Converter (warm-up catalytic converter) or in the front exhaust pipe, which detects the oxygen concentration in the exhaust gas. The heated oxygen sensor (HO2S) produces a voltage that varies between 0V and 1V. When the air/fuel ratio is lean, the oxygen concentration in the exhaust gas increases and the front HO2S outputs a low voltage (approximately 0 ~ 0.1V). When the air/fuel ratio is rich, the oxygen concentration in the exhaust gas decreases and the front HO2S outputs a high voltage (approximately 0.8 ~ 1V). The ECM constantly monitors the HO2S and increases or decreases the fuel injection duration by using the HO2S signal, which is called closed-loop fuel control operation.

DTC DETECTING CONDITION

1. DTC Description

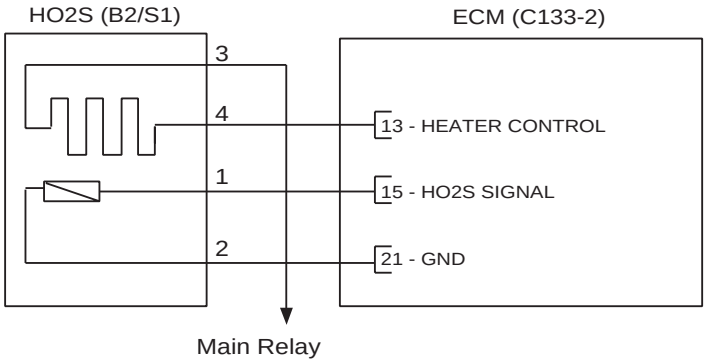
ECM sets DTC P0150 if the ECM detects that the front HO2S signal line is open.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0150	Detecting Condition • DTC Strategy - Check open circuit on HO2S (B2/S1) • Enable condition - Sensor pre-heating and full heating phases finished - Lambda control active - No relevant failure - Battery voltage > 10V • Threshold Value - 0.37 < HO2S signal < 0.49V for 1 seconds	• Open in HO2S(B2/S1) circuit • HO2S (B2/S1) • ECM

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



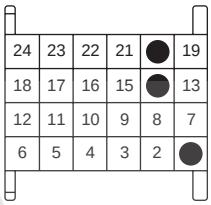
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-2 (14)	HO2S(B2/S1) Signal
2	ECM C133-2 (20)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (1)	HO2S Heater (B2/S1)

[HARNESS CONNECTORS]

C146

HO2S (B2/S2)

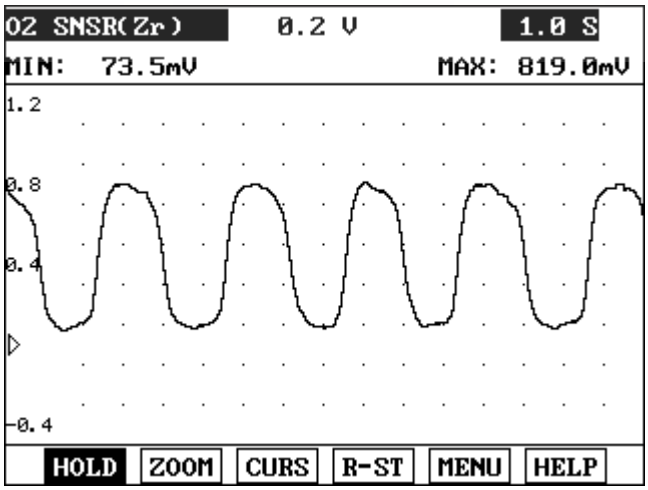


C133-2

ECM

EZOF4411

SIGNAL WAVE FORM



If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O2 sensor service data in the Hi-Scan (Pro) will display values 200mV or lower. When you suddenly press on the accelerator pedal down, the voltage will reach 0.6 ~ 1.0 V. When you let the engine idle again, the voltage will fluctuate between 200 mV or lower and 0.6 ~ 1.0 V. In this case, the O2sensor can be determined as good.

EFAE0098

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Warm up engine to normal operating temperature and monitor HO2S signal.

Does the HO2S signal switch from lean to rich or from rich to lean ?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HO2S AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

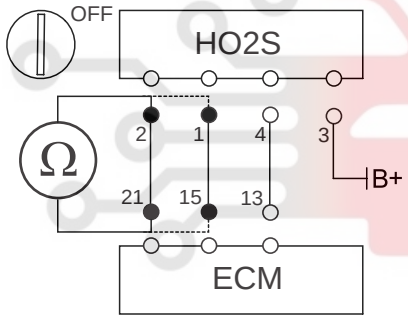
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 2 of the HO2S harness connector and terminal 21 of the ECM harness connector (C133-2).
3. Measure resistance between terminal 1 of the HO2S harness connector and terminal 15 of the ECM harness connector (C133-2).
   - **Specification (HO2S resistance): below 1Ω**



Does each resistance indicate continuity?

Yes

No	Repair open in harness.

4. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Do the front HO2S signals fluctuate between 0V and 1V?

Yes

No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6046

TROUBLESHOOTING FOR DTC E8EA6FD8

DTC	P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)

DESCRIPTION

Refer to DTC P0150

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0151 if the ECM detects signal voltage lower than the possible range of a properly operating HO2S (B2/S1).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0151	Detecting Condition • DTC Strategy - Sensor voltage low • Enable condition - Sensor pre-heating and full heating phases finished - Battery voltage > 10V • Threshold Value - HO2S signal < 0.02V for 2 seconds	• Short to ground in HO2S (B2/S1) circuit • Front HO2S (B2/S1) • ECM

SPECIFICATION

Refer to DTC P0150

SCHEMATIC DIAGRAM

Refer to DTC P0150

SIGNAL WAVE FORM

Refer to DTC P0150

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Warm up engine to normal operating temperature and monitor HO2S signal.

Does the HO2S signal switch from lean to rich or from rich to lean ?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HO2S AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

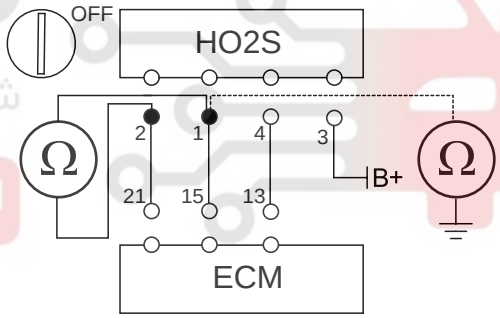
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 1 and 2 of the HO2S harness connector.
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does each resistance indicate open?

Yes

No	Repair short in harness or short to chassis ground.

4. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes

No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6047

TROUBLESHOOTING FOR DTC E3E204AF

DTC	P0152	HO2S Circuit High Input (Bank 2 / Sensor 1)

DESCRIPTION

Refer to DTC P0150

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0152 if the ECM detects signal voltage higher than the possible range of a properly operating HO2S (B2/S1).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0152	Detecting Condition • DTC Strategy - Sensor voltage high • Enable condition - Sensor pre-heating and full heating phases finished - Battery voltage > 10V • Threshold Value - HO2S signal > 1.3V for 2 seconds	• Short to battery line in HO2S (B2/S1) circuit • HO2S (B2/S1) • ECM

SPECIFICATION

Refer to DTC P0150

SCHEMATIC DIAGRAM

Refer to DTC P0150

SIGNAL WAVE FORM

Refer to DTC P0150

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Warm up engine to normal operating temperature and monitor HO2S signal.

Does the HO2S signal switch from lean to rich or from rich to lean ?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK HO2S AND ECM CONNECTORS

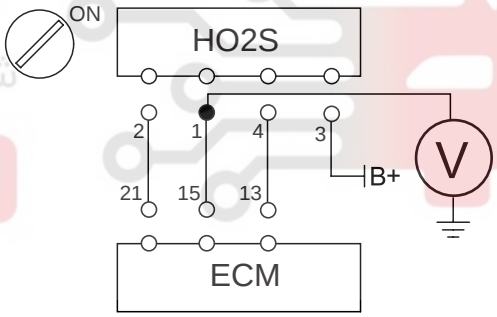
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

3. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	
No	Repair short to power in harness.

4. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	
No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6048

TROUBLESHOOTING FOR DTC E1E21C4C

DTC	P0153	HO2S Circuit Slow Response (Bank 2/ Sensor 1)

DESCRIPTION

Refer to DTC P0150

DTC DETECTING CONDITION

1. DTC Description

DTC P0153 is set when the switching time is bigger than the limit value.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0153	Detecting Condition • DTC Strategy - Comparison of HO2S lean/rich period with calculated period • Enable condition - Catalyst temperature (Model) : 340~600°C(644~1,112°F) - Engine coolant temperature > 70°C(158°F) - 800 < Engine speed < 2500 rpm • Threshold Value - Sum of HO2S Lean/Rich period > Calculated limit for 80 lambda controller cycles	• Open or short in HO2S (B2/S1) heater circuit • HO2S (B2/S1) • Intake system • Improper fuel pressure • ECM

SCHEMATIC DIAGRAM

Refer to DTC P0150

SIGNAL WAVE FORM

Refer to DTC P0150

INSPECTION PROCEDURE

1. CHECK OTHER DTC

1. Connect Hi-Scan (Pro) to data link connector.
2. Turn ignition switch to ON and monitor other DTCs.

Are any other DTCs also set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK FRONT HO2S

1. Check the front HO2S for the following items:

   • HO2S error
   • Open or short in HO2S circuit

   • Refer to "DTC P0151 and P0152 (O2 Sensor Circuit High/Low Input)" for a detailed inspection procedure.

Is the front HO2S okay?

Yes

No	Replace it.

3. CHECK INTAKE SYSTEM FOR VACUUM LEAKGE

1. Visually check intake system for vacuum leakage.

Is any leakage present?

Yes

No	Repair it.

4. CHECK FUEL LINE PRESSURE

1. Reduce the fuel pressure to install the fuel pressure gauge.
2. After installing tightly the fuel pressure gauge to fuel delivery pipe, start the engine and let it idle.
3. Check fuel line pressure.

   • Refer to " FUEL PRESSURE TEST " of FUEL DELIVERY SYSTEM for more information.

Is fuel line pressure normal?

Yes

No	Repair it.

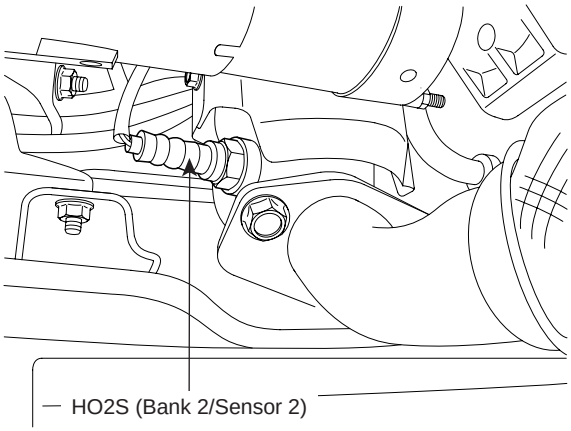
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6049

TROUBLESHOOTING FOR DTC EBA239FB

DTC	P0156	HO2S Circuit (Bank 2 / Sensor 2)

COMPONENT LOCATION



EZOF6035

DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which detects the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DETECTING CONDITION

1. DTC Description

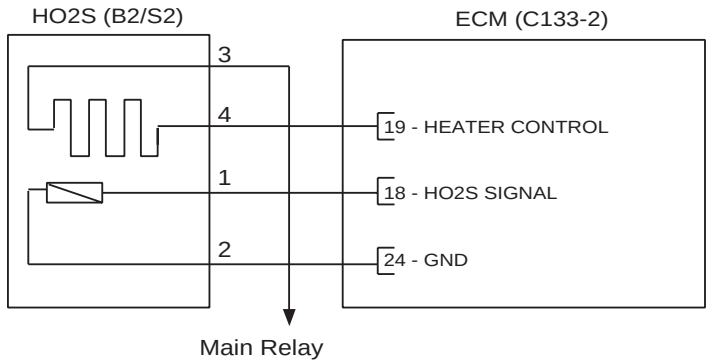
ECM sets DTC P0156 if the ECM detects that the HO2S (B2/S2) signal line is open.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0156	Detecting Condition • DTC Strategy - Check open circuit on rear HO2S • Enable condition - Sensor pre-heating and full heating phases finished - No relevant failure - 10 < Battery voltage < 16V • Threshold Value - 0.37 < HO2S signal < 0.49V for 2 seconds	• Open in HO2S (B2/S2) circuit • HO2S (B2/S2) • ECM

SCHEMATIC DIAGRAM

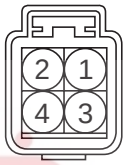
[CIRCUIT DIAGRAM]



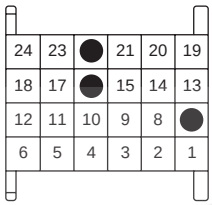
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-2 (18)	HO2S(B2/S2) Signal
2	ECM C133-2 (24)	Ground
3	Main Relay	Battery Voltage
4	ECM C133-2 (19)	HO2S Heater (B2/S2)

[HARNESS CONNECTORS]



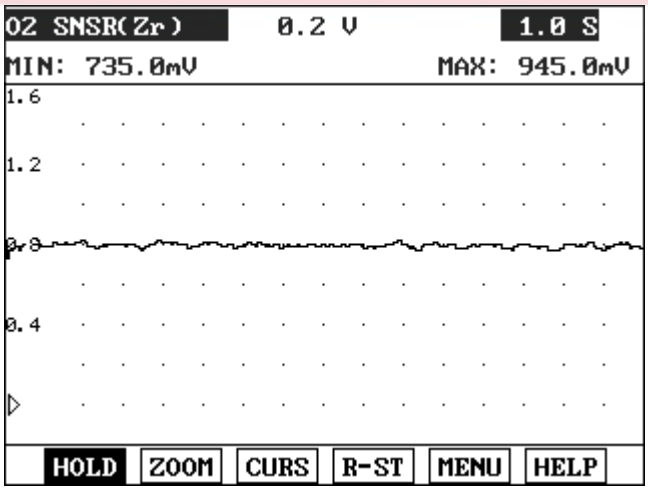
C148
HO2S (B2/S2)



C133-2
ECM

EZOF4410

SIGNAL WAVE FORM



The amplitude of signal output of rear HO2S has small value compared to front HO2S because rear HO2S detects emission gas purified by catalytic converter. This illustration is the normal signal waveform of rear HO2S at idle.

EFAE0113

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

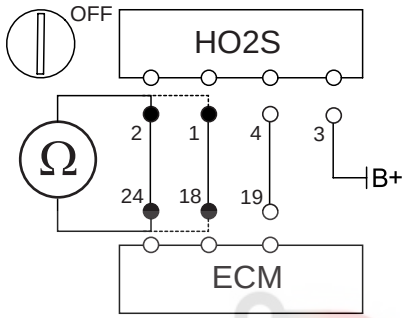
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and hold the engine at 3000 rpm with no load (in P or N) until the cooling fan comes on.

Does scan tool display DTC P0156?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 2 of the HO2S harness connector and terminal 24 of the ECM harness connector (C133-2).
3. Measure resistance between terminal 1 of the HO2S harness connector and terminal 18 of the ECM harness connector(C133-2).
   - **Specification (HO2S resistance): below 1Ω**



Does each resistance indicate continuity?

Yes	
No	Repair open in harness.

3. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.

NOTE

- *0.0V at Fuel-Cut state after racing with no load*
- *0.1 ~ 0.8V at idle.*

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	
No	Rep-lace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6050

TROUBLESHOOTING FOR DTC E2AB58EC

DTC	P0157	O2 Sensor Circuit Low Input (Bank2, Sensor2)

DESCRIPTION

Refer to DTC P0156

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0137 if the ECM detects signal voltage lower than the possible range of a properly operating HO2S (B2/S2).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0157	Detecting Condition • DTC Strategy - Sensor voltate low • Enable condition - Sensor pre-heating and full heating phases finished - Battery voltage ＞ 10V • Threshold Value - HO2S signal ＜ 0.02V for 2 seconds	• Short to ground in HO2S (B2/S2) circuit • HO2S (B2/S2) • ECM

SPECIFICATION

Refer to DTC P0156

SCHEMATIC DIAGRAM

Refer to DTC P0156

SIGNAL WAVE FORM

Refer to DTC P0156

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

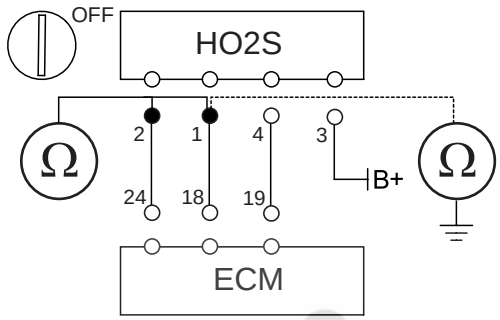
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and wait 1 minute.

Does scan tool display DTC P0157?

Yes	No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connector.
2. Measure resistance between terminal 2 and 1 of the HO2S harness connector.
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does each resistance indicate open?

Yes	No	Repair short in harness or short to chassis ground.

3. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.

NOTE

- *0.0V when signal line is short to chassis ground*

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6051

TROUBLESHOOTING FOR DTC E45C4773

DTC	P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)

DESCRIPTION

Refer to DTC P0156

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0158 if the ECM detects signal voltage higher than the possible range of a properly operating HO2S (B2/S2).

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0158	Detecting Condition • DTC Strategy - Sensor voltage high • Enable condition - Sensor pre-heating and fullheating phases finished - Battery voltage ＞10V • Threshold Value - HO2S signal ＞ 1.3V for 2 seconds	• Short to battery line in HO2S (B2/S2) circuit • HO2S (B2/S2) • ECM

SPECIFICATION

Refer to DTC P0156

SCHEMATIC DIAGRAM

Refer to DTC P0156

SIGNAL WAVE FORM

Refer to DTC P0156

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

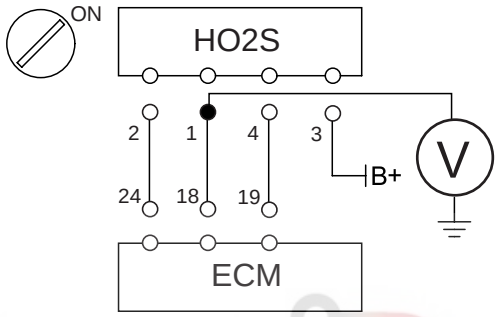
1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start engine and wait 1 minute.

Does scan tool display DTC P0158?

Yes	
No	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect HO2S and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the HO2S harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	
No	Repair short to power in harness.

3. CHECK HO2S SIGNAL WAVEFORM

1. Reconnect the HO2S and ECM connectors.
2. Warm up the engine to normal operating temperature.
3. Using a Hi-Scan (Pro), monitor the HO2S signal waveform.

NOTE

- *1.3V when signal line is short to battery line.*

Do the rear HO2S signals fluctuate between 0V and 1V?

Yes	
No	Replace HO2S.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6052

TROUBLESHOOTING FOR DTC EED927DC

DTC	P0171 P0174	System Too Lean (Bank 1) System Too Lean (Bank 2)

DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DETECTING CONDITION

1. DTC Description

Breaking the lambda adaptation and lambda controller limits for a long time, which may have been caused by failures in the fuel or intake system will involve emission rise and therefore shall be diagnosed by fuel system monitoring. The lambda controller deviation including adaptive terms are used for fuel system monitoring. The time counter is increased if lambda controller exceeds the threshold and the ECM sets DTC P0171/P0174 or P0172/P0175 respectively depending on direction of lambda controller deviation. P0171/P0174 is set with positive deviation and P0172/P0175 is set with negative deviation.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0171 P0174	Detecting Condition • DTC Strategy - Monitoring deviation of fueling control • Enable condition - Estimated canister loading ＞-11% - Estimated altitude ＜ 2,440m(8,000ft) - Engine coolant temperature ＞ 60°C(140°F) - Fueling adaptation ＞ 23% • Threshold Value - (Lambda controller + Trim) ＞ 2.2% (Lean A/F ratio) for 800 seconds [Lean A/F ratio : 300 sec]	• PCSV • Intake system • Exhaust system • Fuel delivery system • Ignition system • MAFS • Front HO2S • TPS • ECM

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO INJECTOR, HO2S, ECTS, OR MAFS

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition to ON position and monitor other DTCs.

Are DTCs relating to injector, HO2S, ECTS, or MAFS also set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK FUEL/SEALS/GASKETS FOR CONTAMINATION AND/OR LEAK

1. Visually/physically inspect the following items :
   - Throttle body gasket
   - Gasket between intake manifold and surge tank
   - Seals between intake manifold and fuel injectors
   - Seals between surge tank and PCV valves
   - Crankcase ventilation valve and/or system for leaks
   - Contaminated fuel

Are all items okay?

Yes

No	Repair or replace it.

3. CHECK AIR CLEANER/MAFS/EXHAUST SYSTEM

1. Visually/physically inspect the following items :
   - Air cleaner element for being restricted.
   - Inspect Mass Air Flow Sensor (MAFS)
   - Check for exhaust gas leakage

Are all items okay?

Yes

No	Repair or replace it.

4. CHECK CONNECTIONS

1. Check vacuum hoses for splits and proper connections.
   (Especially PCSV, ISCA hose, throttle body, intake manifold, and brake booster).

Are all connections okay?

Yes

No	Repair or replace it.

EZOF602X

5. CHECK VACUUM AT PCSV

1. Disconnect PCSV connector and EVAP. hose (PCSV side) between PCSV and canister.
2. Start engine and check vacuum at PCSV at idle.

NOTE

In 40 seconds after starting the engine (the engine is already warmed up), PCSV operates. So this test must be terminated for 40 seconds.

Is vacuum present?

No

Yes	PCSV circuit failure. Repair according to DTC P0444 and P0445 repair procedures.

6. CHECK FUEL LINE PRESSURE

1. Reconnect the ignition coils and spark plug connectors.
2. Release the fuel pressure and attach the fuel pressure gauge.
3. Start the engine and warm it up to operating temperature.
4. Check fuel line pressure at idle.
   - **Refer to "FUEL PREESURE TEST" in FUEL DELIVERY SYSTEM.**

Is fuel line pressure correct with ignition switch ON?

Yes

No	Check fuel delivery system. (Refer to "FUEL PREESURE TEST" in FUEL DELIVERY SYSTEM)

7. CHECK INJECTOR FOR NORMAL OPERATION

1. Start engine and check engine RPM decrease when disconnecting each injector connector in sequence.
2. Measure the decreasing engine RPM of all cylinders.

Is there any cylinder with no change in RPM or only a small change in RPM?

No

Yes	Repair or replace it.

8. CHECK INJECTOR FOR NORMAL OPERATION

1. Remove spark plugs and inspect spark plug tips.
2. Check abnormal color of spark plug tips compared to other cylinders.

Is any spark plug with abnormal color compared to others?

No

Yes	Check engine for mechanical failure. If it is okay, replace spark plugs.

EZOF602Y

9. CHECK ECM INPUT SIGNALS

1. Check for ECM input signal from MAFS, HO2S, TPS and other input signals.

Are input signals within specification?

Yes	No	Replace all failed parts.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6023

TROUBLESHOOTING FOR DTC ECD8D02E

DTC	P0172 P0175	System Too Rich (Bank 1) System Too Rich (Bank 2)

DESCRIPTION

Refer to DTC P0171/P0174

DTC DETECTING CONDITION

1. DTC Description

Breaking the lambda adaptation and lambda controller limits for a long time, which may have been caused by failures in the fuel or intake system will involve emission rise and therefore shall be diagnosed by fuel system monitoring. The lambda controller deviation including adaptive terms are used for fuel system monitoring. The time counter is increased if lambda controller exceeds the threshold and the ECM sets DTC P0171/P0174 or P0172/P0175 respectively depending on direction of lambda controller deviation. P0171/P0174 is set with positive deviation and P0172/P0175 is set with negative deviation.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0172 P0175	Detecting Condition • DTC Strategy - Monitoring deviation of fueling control • Enable condition - Estimated canister loading > -11% - Estimated altitude < 2,440m(8,000ft) - Engine coolant temperature > 60°C(140°F) - Fueling adaptation > 23% • Threshold Value - (Lambda controller + Trim) < -27% (Rich A/F ratio) for 800 seconds [Rich A/F ratio : 400 sec]	• PCSV • Intake system • Exhaust system • Fuel delivery system • MAFS • Front HO2S • TPS • ECM

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO INJECTOR, HO2S, ECTS, OR MAFS

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition switch to ON position and monitor other DTCs.

Are DTCs relating to injector, HO2S, ECTS, or MAFS also set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK AIR CLEANER/MAFS

1. Visually/physically inspect the following items :
   - **Air cleaner element for restrictions.**
   - **MAFS for proper installation and foreign objects**

Are all items okay?

Yes

No	Repair or replace it.

3. CHECK FUEL LINE PRESSURE

1. Reconnect the ignition coils and spark plug connectors.
2. Release the fuel pressure and attach the fuel pressure gauge to the service port on the fuel rail.
3. Start the engine and warm it up to operating temperature.
4. Check fuel line pressure at idle.
   - **Refer to "FUEL PREESURE TEST" in FUEL DELIVERY SYSTEM.**

Is fuel line pressure correct with ignition switch ON?

Yes

No	Check fuel delivery system. (Refer to "FUEL PREESURE TEST" in FUEL DELIVERY SYSTEM)

4. CHECK INJECTOR FOR NORMAL OPERATION

1. Start engine and check engine RPM decrease when disconnecting each injector connector in sequence.
2. Measure the decreasing engine RPM of all cylinders.

Is there any cylinder with no change in RPM or only a small change in RPM?

No

Yes	Repair or replace it.

BFGE602Z

5. CHECK ECM INPUT SIGNALS

1. Check for ECM input signal from MAFS, HO2S, TPS and other input signals.

Are input signals within specification?

Yes	No	Replace all failed parts.

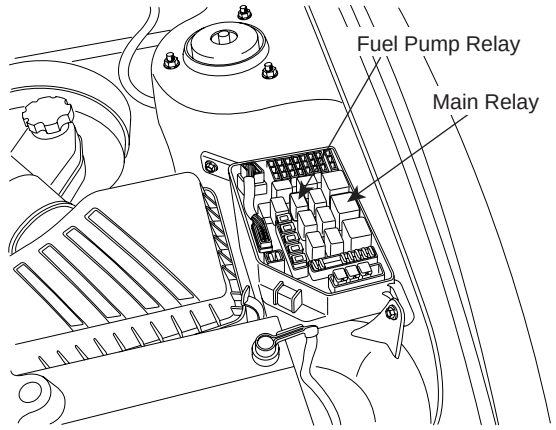
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

BFGE603A

TROUBLESHOOTING FOR DTC EC924D46

DTC	P0230	Fuel Pump Circuit Malfunction

COMPONET LOCATION



EZOF6053

DESCRIPTION

The ECM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The ECM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the ECM energizes the fuel pump relay, which sends power to the fuel pump.

DTC DETECTING CONDITION

1. DTC Description

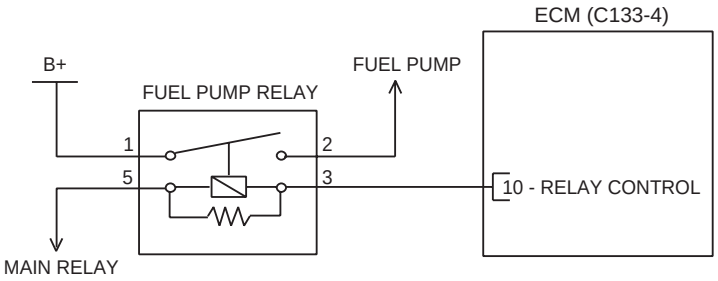
ECM sets DTC P0230 if the ECM detects that fuel pump relay control line is open or short to ground or battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0230	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery Voltage > 10V • Threshold Value - Fuel pump relay control line is open or short to ground for 1.5 seconds	• Open or short in fuel pump relay circuit • Fuel pump relay • ECM

SPECIFICATION

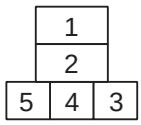
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

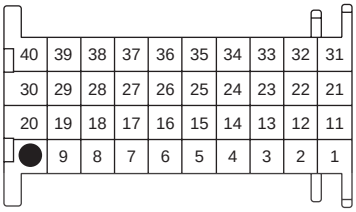
Terminal	Connected to	Function
1	Battery	Battery Voltage
2	Fuel Pump	Fuel Pump Power Supply
3	ECM C133-4 (10)	Fuel Pump Relay Control
5	Main Relay	Battery Voltage

[HARNESS CONNECTORS]



E49

FUEL PUMP RELAY



C133-4

ECM

EZOF401U

INSPECTION PROCEDURE

1. CHECK FUEL PUMP RELAY AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK FUEL PUMP RELAY

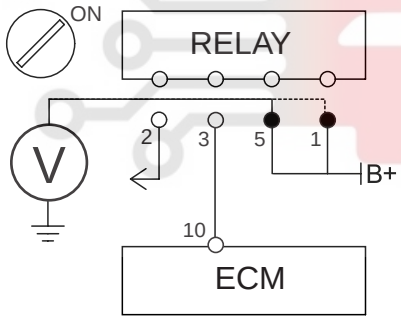
1. Remove the fuel pump relay.
2. Apply power to the fuel pump relay terminal 5 and ground terminal 3.
3. Check if the fuel pump relay works well when it is energized.
   (If the fuel pump relay works normally, a clicking sound can be heard.)

Does the fuel pump relay operate normally?

Yes	
No	Replace fuel pump relay.

3. CHECK POWER TO FUEL PUMP RELAY

1. Remove the fuel pump relay.
2. Turn ignition switch to ON position.
3. Measure the voltage between terminal 5 of the fuel pump relay harness connector and chassis ground.
4. Measure the voltage between terminal 1 of the fuel pump relay harness connector and chassis ground.
   - **Specification : approximately B+**



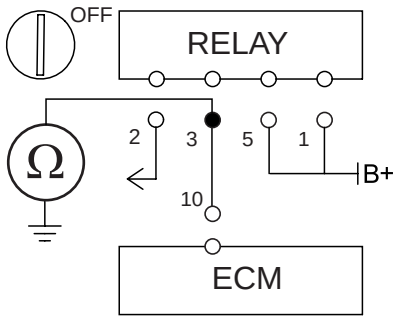
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF603F

4. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect fuel pump relay and ECM connectors.
2. Measure resistance between terminal 3 of the fuel pump relay harness connector and chassis ground.
   - **Specification (Resistance): infinite**

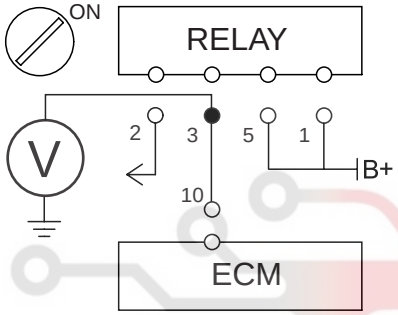


Does the resistance indicate open?

Yes		
	No	Repair short or short to chassis ground in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect fuel pump relay and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the fuel pump relay harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**

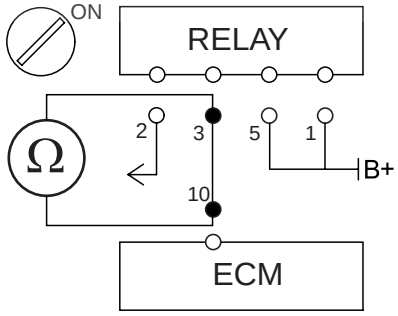


Is voltage within specification?

Yes		
	No	Repair short to power in harness.

6. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect fuel pump relay and ECM connectors.
2. Measure resistance between terminal 3 of the injector harness connector and terminal 10 of ECM harness connector (C133-4).
   - **Specification (Resistance): below 1Ω**



Does resistance indicate continuity?

Yes		
	No	Repair open in harness.

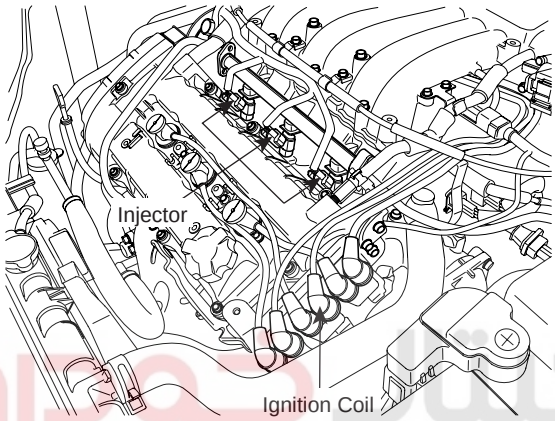
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603G

TROUBLESHOOTING FOR DTC EF99CD44

DTC	P0261	Cylinder 1 - Injector Circuit Low Input
	P0264	Cylinder 2 - Injector Circuit Low Input
	P0267	Cylinder 3 - Injector Circuit Low Input
	P0270	Cylinder 4 - Injector Circuit Low Input
	P0273	Cylinder 5 - Injector Circuit Low Input
	P0276	Cylinder 6 - Injector Circuit Low Input

COMPONENT LOCATION



EZOF505R

DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0261, P0264, P0267, P0270, P0273 or P0276 respectively if the ECM detects that injector (Cylinder #1, 2, 3, 4, 5 or 6) control line is short to ground.

2. Conditions for Setting the DTC

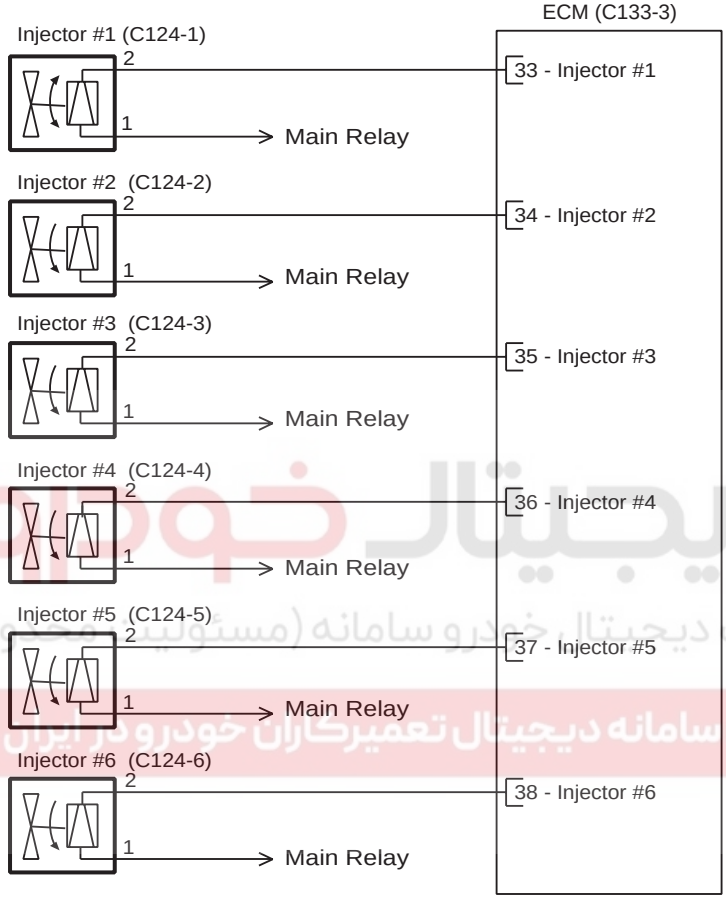
DTC	Detecting Condition & Limp Home	Possible Cause
P0261 P0264 P0267 P0270 P0273 P0276	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Engine speed > 30 rpm - Battery voltage > 10V • Threshold Value - Injector control line is short to ground for 1.5 seconds	• Short to ground in injector circuit • Injector • ECM

SPECIFICATION

- Injector Resistance : 13.8~15.2Ω at 20°C(68°F)

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1 (C124-1)

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (33)	Injector Operation

Injector #2 (C124-2)

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (34)	Injector Operation

Injector #3 (C124-3)

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (35)	Injector Operation

Injector #4 (C124-4)

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (36)	Injector Operation

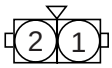
Injector #5 (C124-5)

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (37)	Injector Operation

Injector #6 (C124-6)

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (38)	Injector Operation

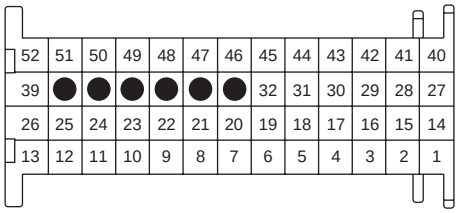
[HARNESS CONNECTORS]



C124-1,3,5

C124-2,4,6

INJECTOR

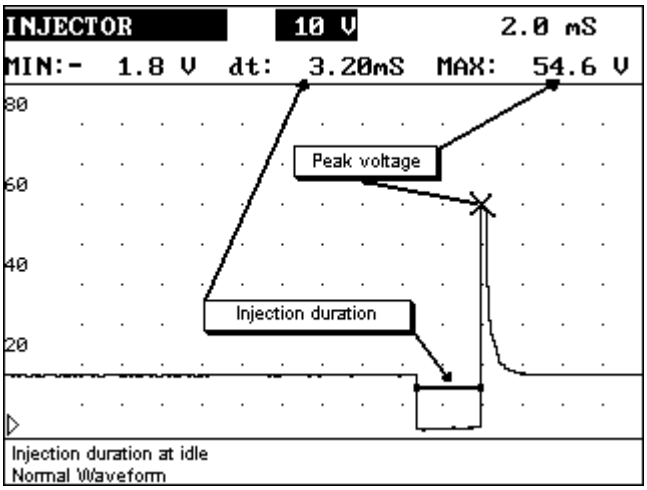


C133-3

ECM

EZOF401V

SIGNAL WAVE FROM



When the ECM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.Peak voltage and injection duration (injector opening time) is equal to the individual cylinder without acceleration.

EFAE0182

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-scan (Pro) to the data link connector.
2. Start the engine.
3. Using the Hi-Scan (Pro), monitor the signal waveform of the injector.

Is the signal waveform normal?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK INJECTOR AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

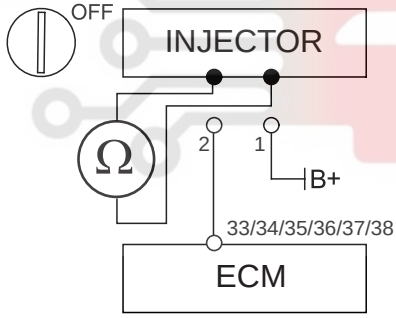
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK INJECTOR RESISTANCE

1. Turn ignition switch to OFF and disconnect injector connector.
2. Measure resistance between the terminal 1 and 2 of injector connector.
   - **Specification (injector resistance): 13.8 ~ 15.2 Ω at 20°C (68°F)**



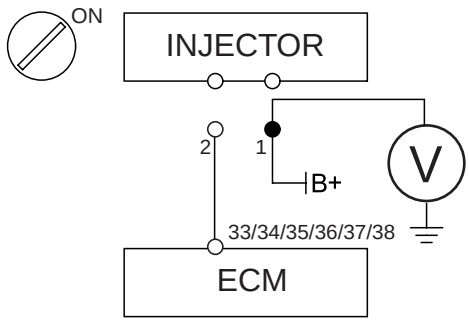
Is resistance within specification?

Yes

No	Replace Injector.

4. CHECK POWER TO INJECTOR

1. Turn ignition switch to OFF position and disconnect injector connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the injector harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



Is voltage within specification?

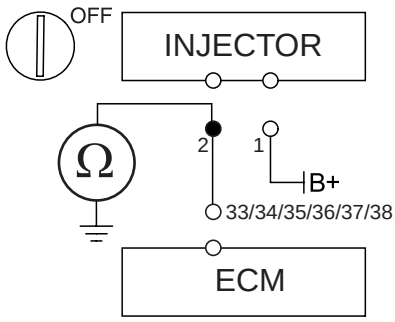
EZOF603H

Yes

No	Repair open or short to chassis ground in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect injector and ECM connectors.
2. Measure resistance between terminal 2 of the injector harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes

No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603I

TROUBLESHOOTING FOR DTC EE27EEAA

DTC	P0262	Cylinder 1 - Injector Circuit High Input
	P0265	Cylinder 2 - Injector Circuit High Input
	P0268	Cylinder 3 - Injector Circuit High Input
	P0271	Cylinder 4 - Injector Circuit High Input
	P0274	Cylinder 5 - Injector Circuit High Input
	P0277	Cylinder 6 - Injector Circuit High Input

DESCRIPTION

Refer to DTC P0261

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0262, P0265, P0268, P0271, P0274 or P0277 respectively if the ECM detects that injector (Cylinder #1, 2, 3, 4, 5 or 6) control line is open or short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0262 P0265 P0268 P0271 P0274 P0277	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Engine speed > 30 rpm - Battery voltage > 10V • Threshold Value - Injector control line is open or short to battery line for 1.5 seconds	• Open or short to battery line in injector circuit • Injector • ECM

SPECIFICATION

Refer to DTC P0261

SCHEMATIC DIAGRAM

Refer to DTC P0261

SIGNAL WAVE FORM

Refer to DTC P0261

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-scan (Pro) to the data link connector.
2. Start the engine.
3. Using the Hi-Scan (Pro), monitor the signal waveform of the injector.

Is the signal waveform normal?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK INJECTOR AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

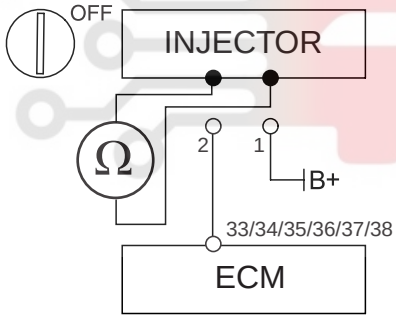
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK INJECTOR RESISTANCE

1. Turn ignition switch to OFF and disconnect injector connector.
2. Measure resistance between the terminal 1 and 2 of injector connector.
   - **Specification (injector resistance): 13.8 ~ 15.2 Ω at 20°C (68°F)**



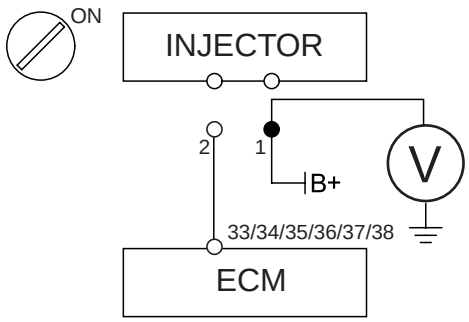
Is resistance within specification?

Yes

No	Replace Injector.

4. CHECK POWER TO INJECTOR

1. Turn ignition switch to OFF position and disconnect injector connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the injector harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



Is voltage within specification?

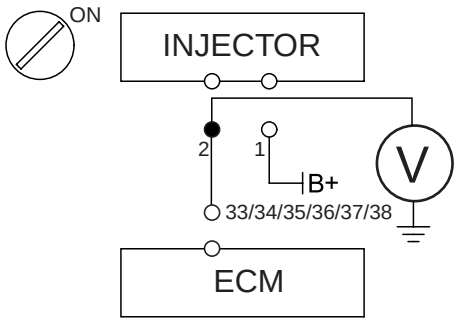
EZOF603H

Yes

No	Repair open or short to chassis ground in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect injector and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 2 of the injector harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



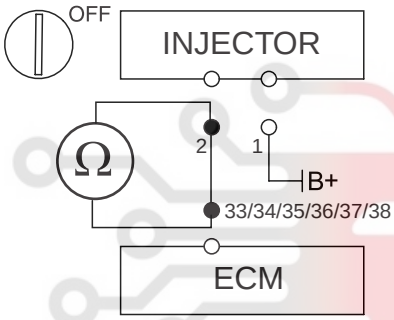
Is voltage within specification?

Yes

No	Repair short to power in harness.

6. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect injector and ECM connectors.
2. Measure resistance between terminal 2 of the injector harness connector and terminal 33, 34, 35, 36, 37 or 38 (for cylinder #1, 2, 3, 4, 5 or 6 respectively) of ECM harness connector.
   - **Specification (Resistance): below 1Ω**



Does resistance indicate continuity?

Yes

No	Repair open in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603J

TROUBLESHOOTING FOR DTC E8446E6D

DTC	P0300	Random/Mutiple Cylinder Misfire Detected
	P0301	Cylinder 1 - Misfire Detected
	P0302	Cylinder 2 - Misfire Detected
	P0303	Cylinder 3 - Misfire Detected
	P0304	Cylinder 4 - Misfire Detected
	P0305	Cylinder 5 - Misfire Detected
	P0306	Cylinder 6 - Misfire Detected

DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DETECTING CONDITION

1. DTC Description

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM identify the cylinder(s) that has(have) misfired and calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as misfiring rate exceed the limit which result in damage to the catalyst or increase emissions. The ECM stores individual DTC for the cylinder which has more than 10% of total misfire rate. With more than two cylinders misfire detection, the ECM sets P0300.
If the misfire rate is not extremely high, the MIL will be illuminated in the next driving cycle that diagnostic runs and fails.
With extremely high misfire rate which has a danger of burning up the catalyst, the MIL blinks immediately.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0300	Detecting Condition • DTC Strategy - Calculation of engine roughness • Threshold Value - Misfire detected on 2 or more cylinders	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Compression pressure • Valve clearance and timing • PCV hose • PCV hose connection • CKPS • ECM
P0301 P0302 P0303 P0304 P0305 P0306	Detecting Condition (I) • DTC Strategy - Calculation of engine roughness • Enable Condition - Catalyst temperature > 1,050°C(1,922°F) - Mass air flow > zero load - 500 < Engine speed < 6,500 rpm - Intake air mass gradient > threshold value calculated by MAF gradient - Throttle angle gradient > threshold value calculated by TP gradient - Time after start = 0 sec • Threshold Value - 6 < Misfire rate < 17% within 200 revolutions during 200 or 3*200 revolutions	
	Detecting Condition (II) • DTC Strategy - Calculation of engine roughness • Enable Condition - A/CON compressor is not switched in between ON and OFF - Fuel cut-off not active - No rough load • Threshold Value - Misfire rate > 2.3% during first 1,000 revolutions during 1,000 revolutions or - Misfire rate > 2.3% after first 1,000 revolutions during 4*1,000 revolutions	

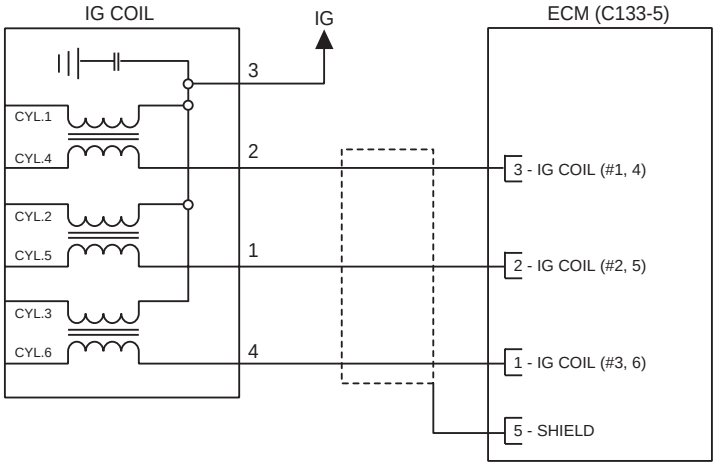
SPECIFICATION

Temperature		Ignition Coil Resistance	
(°C)	(°F)	Primary Coil (Ω)	Secondary Coil (kΩ)
20	68	0.74±10%Ω	13.3±15%kΩ

Item	Specification
Spark Plug Air Gap	1.0~1.1 mm (0.039~0.043 in)

SCHEMATIC DIAGRAM

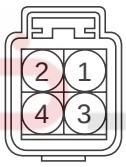
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

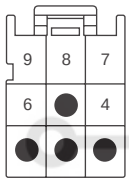
Terminal	Connected to	Function
1	ECM C133-5 (2)	IG COIL (#2, 5)
2	ECM C133-5 (3)	IG COIL (#1, 4)
3	IG	Power
4	ECM C133-5 (1)	IG COIL (#3, 6)

[HARNESS CONNECTORS]



C118

IGNITION COIL



C133-5

ECM

EZOF403A

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO INJECTOR/CKPS/MAFS/TPS

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition to ON position and monitor other DTCs.

Is any DTC relating to injectors, CKPS, MAFS or TPS set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK INTAKE SYSTEM FOR VACUUM LEAK AND PCV VALVE

1. Check intake system for any split, disconnected, worn, or perforated vacuum hoses.
2. Check Positive Crankcase Ventilation (PCV) valve for proper operation and for leak.

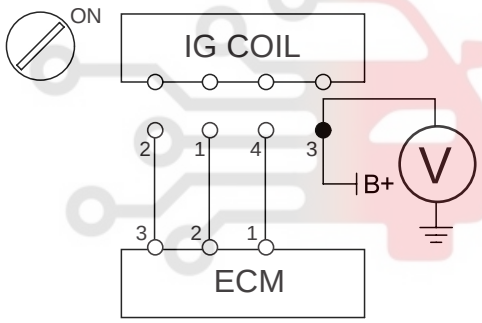
Are vacuum hoses and PCV valve okay?

Yes

No	Replace faulty vacuum hoses or PCV valve.

3. CHECK POWER TO IGNITION COIL

1. Turn ignition switch to OFF position and disconnect ignition coil connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the ignition coil harness connector and chassis ground.
   - **Specification: approximately B+**



Is resistance within specification?

Yes

No	Repair open or short to chassis ground in harness.

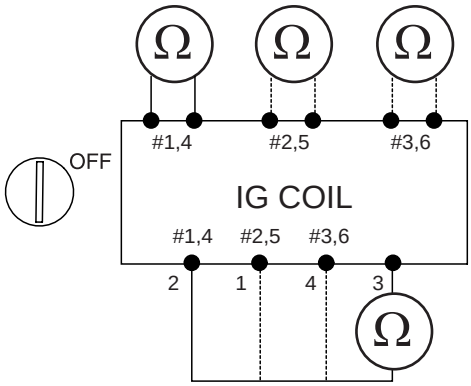
EZOF603K

4. CHECK IGNITION COILS AND SPARK PLUG WIRES

1. Turn ignition switch to OFF position and disconnect the ignition coil connector.
2. Measure resistance of the primary coils and the secondary iginition coils.

NOTE

P0300 : Ignition Coil No.1 through No.6
P0301 : Ignition Coil No.1
P0302 : Ignition Coil No.2
P0303 : Ignition Coil No.3
P0304 : Ignition Coil No.4
P0305 : Ignition Coil No.5
P0306 : Ignition Coil No.6



- **Specification (Resistance):**

Temperature		IgnitionCoil Resistance	
(°C)	(°F)	Primary Coil (Ω)	Secondary Coil (kΩ)
20	68	0.74 ± 10% Ω	13.3 ± 15% kΩ

3. Disconnect plug wires and check spark plug wires for cracks, corroded terminal, or carbon tracking.

Are ignition coils and spark plug wires okay?

Yes	No	Repair or replace it.

5. CHECK SPARK PLUG FOR PROPER OPERATION

1. Remove the spark plug.
2. Visually check the spark plug for carbon tracking, foreign materials (oil or fuel), damage, or cracking.
3. Measure the spark plug gap and check the spark plug for proper operation.
   - **Specification (Air Gap): 1.0~1.1 mm (0.039~0.043 in)**

Is spark plug okay?

Yes	No	Repair or replace it.

6. CHECK CKPS, TONE-WHEEL AND AIR GAP

1. Turn ignition switch to OFF position.
2. Disconnect the CKPS connector.
3. Visually check the tone-wheel for damaged teeth, foreign materials and improper installation and measure the air gap between the CKPS and the rotor.
   - **Specification (Air Gap): 0.3~1.7 mm (0.012~0.067 in)**

Are CKPS and tone-wheel okay?

EZOF603L

Yes	No	Repair or replace it.

7. CHECK COMPRESSION

1. Do a compression test (no more than 10% between highest and lowest cylinder).
   - **Refer to "EM" group.**

Is compression okay?

Yes	No	Repair or replace it.

8. CHECK FUEL LINE PRESSURE

1. Reconnect the ignition coils and spark plug connectors.
2. Release the fuel pressure and attach the fuel pressure gage to the delivery pipe.
   - **To release the fuel presure, refer to "FUEL DELIVERY SYSTEM" section.**
3. Start the engine and warm it up to normal operating temperature.
4. Check fuel line pressure at idle.
   - **Specification (Fuel Pressure): 350 kpa (3.5 kg/cm², 49.8 psi)**

Is fuel line pressure within specification?

Yes	No	Check fuel delivery system. (Refer to "FUEL DELIVERY SYSTEM" section)

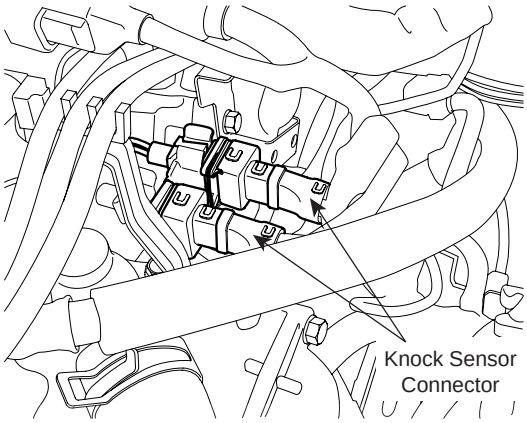
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6054

TROUBLESHOOTING FOR DTC EDB2DA27

DTC	P0325 P0330	Knock Sensor 1 Circuit Knock Sensor 2 Circuit

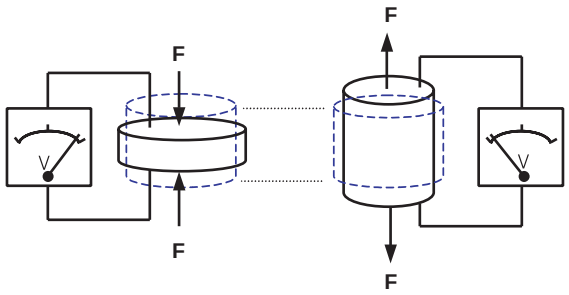
COMPONENT LOCATION



EZOF505B

DESCRIPTION

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. The knock sensor (KS) is attached to the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. The knock sensor (KS) detects vibration upon increase and decrease in engine RPM and generates a voltage based on this vibration. The ECM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to suppress it. This DTC is set when the frequency goes outside a calibrated level.



BFGE505A

DTC DETECTING CONDITION

1. DTC Description

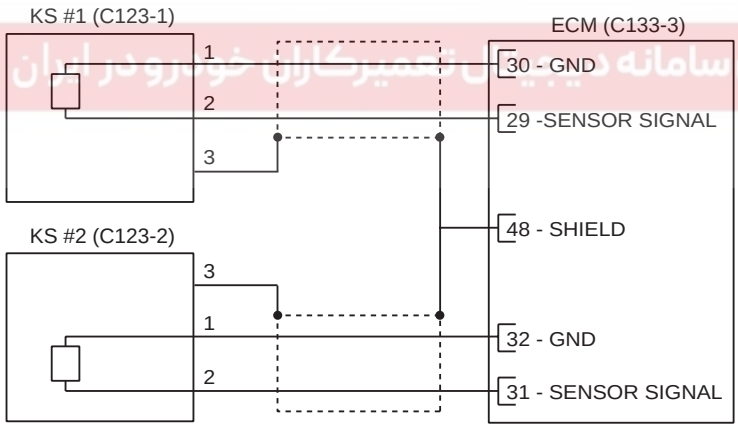
The ECM monitors the range of the analog input signal from knock sensor to check sensor failure that is short circuit or open circuit.
If the difference between knock signal and noise level is smaller than the threshold during defined time period, the DTC P0325 or P0330 are set. In case the noise level is higher than the uppper threshold or lower than the lower threshold, the DTC P0325 or P0330 are set too. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0325 P0330	Detecting Condition • DTC Strategy - Voltage range check • Enable condition - Engine speed > 1,800 rpm - Knock control enabled • Threshold Value - Mean Value of sensor signal < 0.1V during 10*720°CA	• Open or Short in knock sensor circuit • Knock sensor • ECM

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

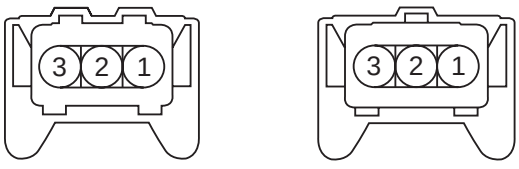
KNOCK SENSOR #1 (C123-1)

Terminal	Connected to	Function
1	ECM C133-3 (30)	Ground
2	ECM C133-3 (29)	Knock Sensor Signal
3	ECM C133-3 (48)	Knock Sensor Shield

KNOCK SENSOR #2 (C123-2)

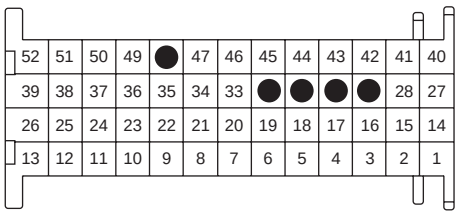
Terminal	Connected to	Function
1	ECM C133-3 (32)	Ground
2	ECM C133-3 (31)	Knock Sensor Signal
3	ECM C133-3 (48)	Knock Sensor Shield

[HARNESS CONNECTORS]



C123-1 C123-2

KNOCK SENSOR

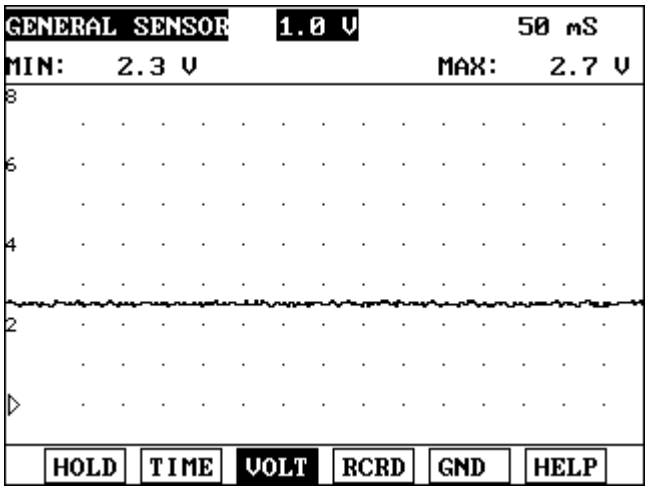


C133-3

ECM

EZOF402C

SIGNAL WAVE FORM



The knock sensor is installed at the cylinder block to sense a vibration successfully when engine operates. The waveform shown is the knock sensor signal's characteristic and indicates that the knocking doesn't take place. The knocking signal generally appears that a noise generates more than other sensors.

EFAE0228

INSPECTION PROCEDURE

1. CHECK KNOCK SENSOR AND ECM CONNECTORS

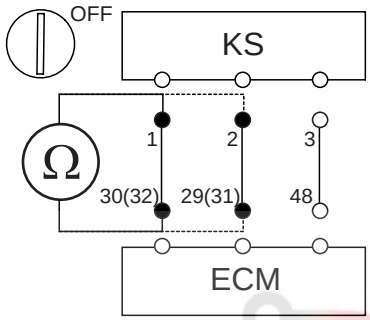
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	No	Repair or replace it.

2. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect KS and ECM connector.
2. Measure resistance between terminal 1 of the KS harness connector and 30(32) of the ECM harness connector (C133-3).
3. Measure resistance between terminal 2 of the KS harness connector and 29(31) of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**



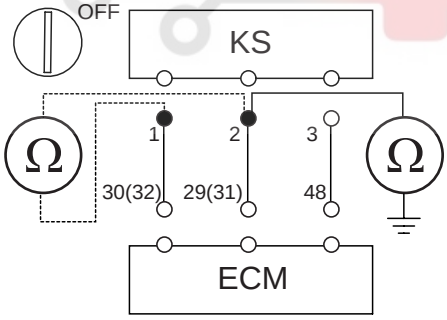
( ) : Knock Sensor #2

Does each resistance indicate continuity?

Yes	No	Repair open in harness.

3. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect KS and ECM connector.
2. Measure resistance between terminal 2 of the KS harness connector and chassis ground.
3. Measure resistance between terminal 1 and 2 of the KS harness connector.
   - **Specification (Resistance): infinite**



( ) : Knock Sensor #2

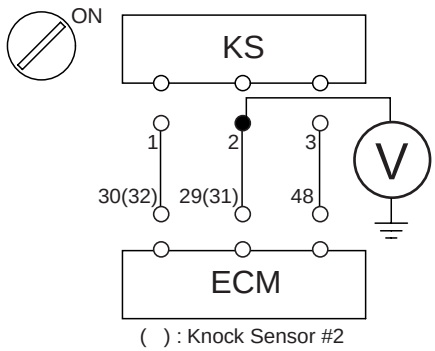
Does each resistance indicate open?

Yes	No	Repair short or short to chassis ground in harness.

EZOF603N

4. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect KS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 2 of the KS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	
No	Repair short to power in harness.

5. CHECK KNOCK SENSOR SIGNAL

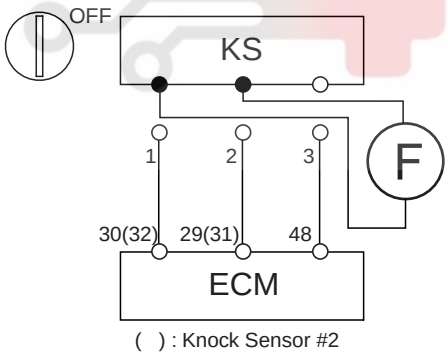
1. Reconnect the ECM and KS connectors.
2. Connect a Hi-Scan (Pro) to the knock sensor.
3. Start the engine and monitor the KS signal at idle.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Is KS signal normal?

Yes	
No	Replace KS.

6. CHECK KNOCK SENSOR

1. Turn ignition switch to OFF position and disconnect KS connectors.
2. Measure capacitance between terminal 1 and 2 of the KS connector.
   - **Specification (capacitance): 0.8 ~ 1.6 nF (800 ~ 1,600 pF)**



Is the measured capacitance within specification?

Yes	
No	Replace KS.

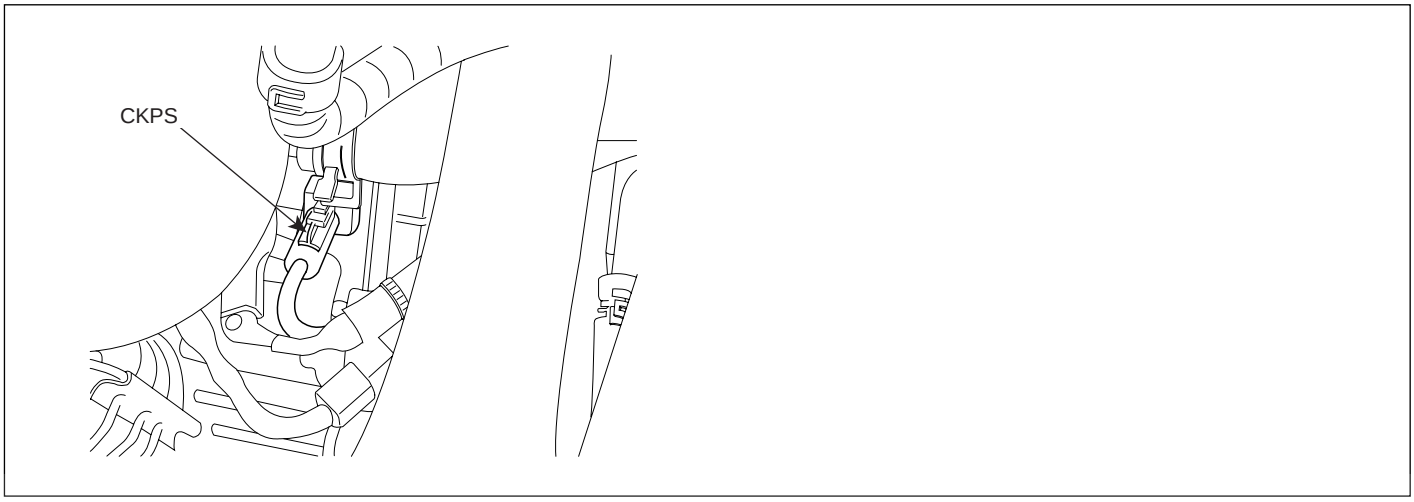
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603O

TROUBLESHOOTING FOR DTC EAF6EA2D

DTC	P0335	Crankshaft Position Sensor A Circuit Malfunction

COMPONENT LOCATION



EZOF505W

DESCRIPTION

The Crankshaft Position Sensor (CKPS) is a hall effect type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 58 slots in the target wheel where one is longer than the others. When the slot in the wheel aligns with the sensor, the sensor voltage outputs low. When the metal (tooth) in the wheel aligns with the sensor, the sensor voltage outputs high. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The ECM calculates engine RPM by using the sensor's signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the ECM identifies which cylinder is at top dead center.

DTC DETECTING CONDITION

1. DTC Description

The ECM sets DTC P0335 when the number of crankshaft teeth during one revolution is incorrect or crankshaft signal is missing while camshaft signal is detected. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0335	Detecting Condition (I) • DTC Strategy - Check cranksnaft signal switching • Enable condition - Before camshaft signal synchronization • Threshold Value - Valid crankshaft teeth is not yet detected with camshaft signal or - TDC cannot be detected with valid crankshaft teeth and camshaft signal during 4 revolutions	• Open or short to groumd or battery voltage line in CKPS Circuit • Poor connection of CKPS connector • Air gap out of specification • CKPS interfered with electrical noise at cranking • CKPS • ECM
	Detecting condition (II) • DTC Strategy - Check crankshaft signal switching • Engble Condition - After camshaft signal synchronization • Threshold Value - Number of crankshaft teeth is not correct during 5 revolutions	

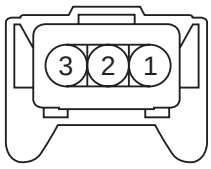
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

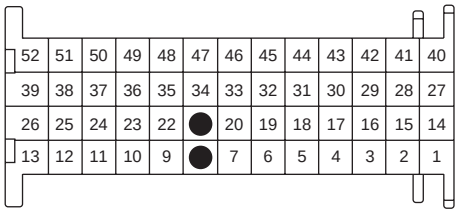
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (8)	CKPS Signal
3	ECM C133-3 (21)	Ground

[HARNESS CONNECTORS]



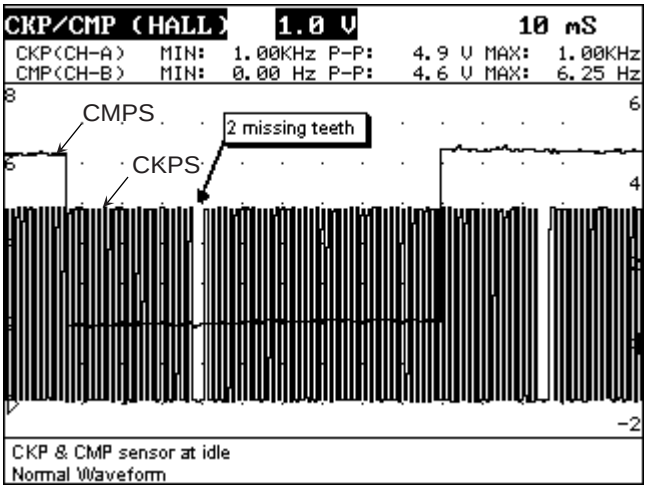
C113
CKPS

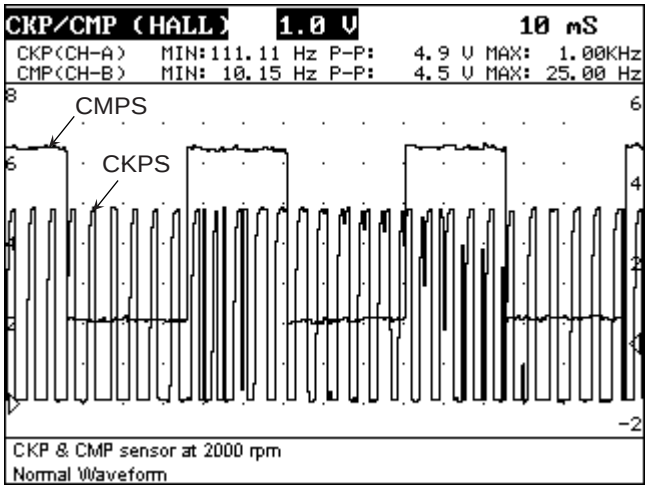


C133-3
ECM

EZOF402E

SIGNAL WAVE FORM





The given data is the normal waveform of the Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS). The ECM controls the injection timing and the ignition timing by using these signals. The CKPS signal is used to detect the piston's position and the CMPS signal is used to detect the Top Dead Center of each cylinder.

EZOF6055

INSPECTION PROCEDURE

1. CHECK CKPS AND ECM CONNECTORS

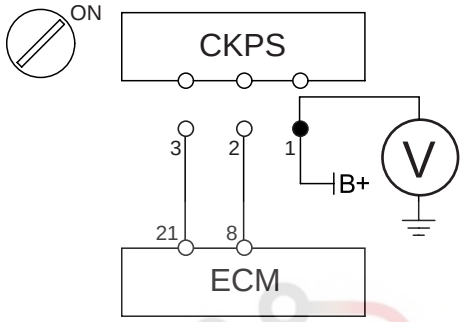
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK POWER TO CKPS

1. Turn ignition switch to OFF position, and then disconnect CKPS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the CKPS harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**

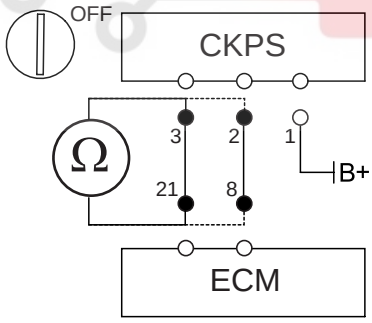


Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

3. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect CKPS and ECM connector.
2. Measure resistance between terminal 3 of the CKPS harness connector and 21 of the ECM harness connector (C133-3).
3. Measure resistance between terminal 2 of the CKPS harness connector and 8 of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**



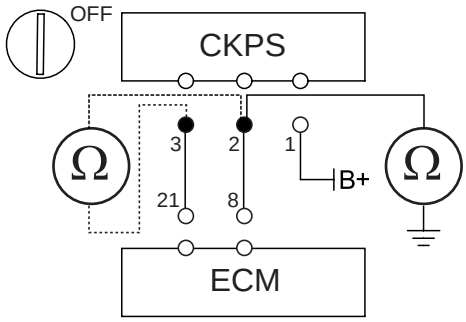
Does each resistance indicate continuity?

Yes	
No	Repair open in harness.

EZOF603P

4. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect CKPS and ECM connector.
2. Measure resistance between terminal 2 of the CKPS harness connector and chassis ground.
3. Measure resistance between terminal 3 and 2 of the CKPS harness connector.
   - **Specification (Resistance): infinite**

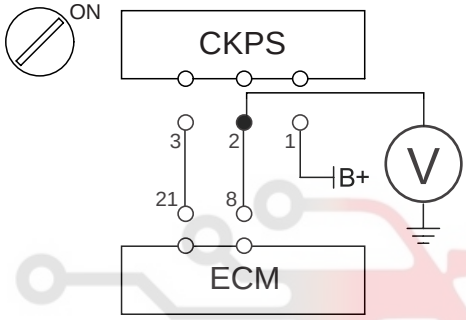


Does each resistance indicate open?

Yes		
	No	Repair short or short to chassis ground in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect CKPS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 2 of the CKPS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes		
	No	Repair short to power in harness.

6. CHECK CKPS SIGNAL

1. Reconnect the ECM and CKPS connectors.
2. Connect a Hi-Scan (Pro) to the CKPS.
3. Start the engine and monitor the CKPS signal at normal operating temperature.
   - **Refer to "SIGNAL WAVEFORM" for more information.**

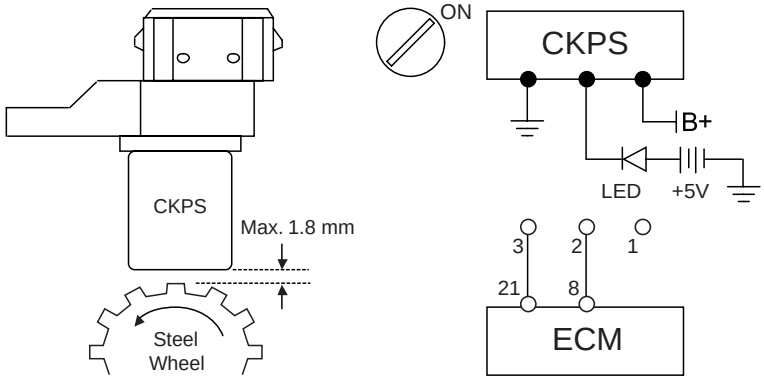
Is CKPS signal normal?

Yes		
	No	Replace CKPS.

EZOF603Q

7. CHECK CKPS

1. Turn ignition switch to OFF position and then disconnect CKPS connector.
2. Remove the CKPS from the engine.
3. Turn ignition switch to ON position.
4. Apply battery voltage to the terminal 1 and ground terminal 3 of CKPS as shown in the figure.
5. Install a LED between +5V power and CKPS terminal 2, and then set a steel wheel (or anything made of steel; hammer, wrench, bolt and nut etc.) at the CKPS's tip.
6. Rotate the steel wheel slowly and check if the LED flashes light.
   - **If the LED blinks, the CKPS works normally.**



Does flash the LED when rotating the steel wheel?

Yes	
No	Replace CKPS.

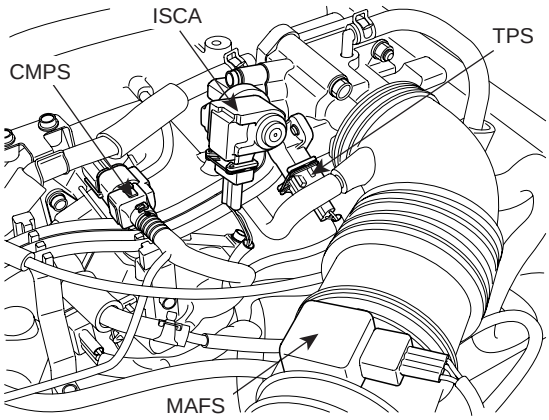
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603R

TROUBLESHOOTING FOR DTC E3AAB9CB

DTC	P0340	Camshaft Position Sensor Circuit Malfunction

COMPONENT LOCATION



EZOF505Y

DESCRIPTION

The Camshaft Position Sensor (CMPS) is a sensor that detects the compression TDC of the NO. 1 cylinder. The CMPS consists of a hall type sensor and a target on the end of the intake camshaft. When the target triggers the sensor, the sensor voltage is 5V. If not, the sensor voltage is 0V. These CMPS signal is sent to the ECM and the ECM uses the CMPS signal for synchronizing the firing of sequential fuel injectors.

DTC DETECTING CONDITION

1. DTC Description

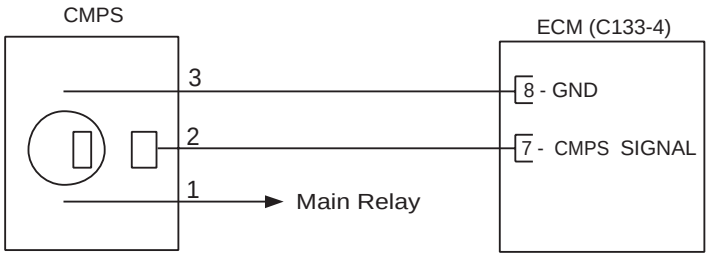
The ECM monitors the camshaft sensor signal tranisiton position which must change only once per crankshaft revolution. If no camshaft signal is detected while crankshaft signal is detected, the ECM sets DTC P0340.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0340	Detecting Condition • DTC Strategy - Check camshaft signal switching • Enable condition - No failure on CKPS • Threshold Value - No camshaft signal switching detected or - Rising and falling camshaft edge is not within defined window (-8~+8 teeth)during 80 revolutions	• Short to ground • Open or short to ground or battery voltage line in CMPS circuit • Poor connection of CMPS connector • CMPS • ECM

SCHEMATIC DIAGRAM

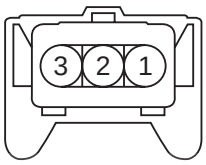
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

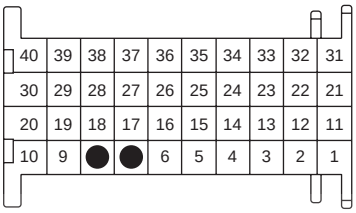
Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-4 (7)	CMPS Signal
3	ECM C133-4 (8)	Ground

[HARNESS CONNECTORS]



C114

CMPS

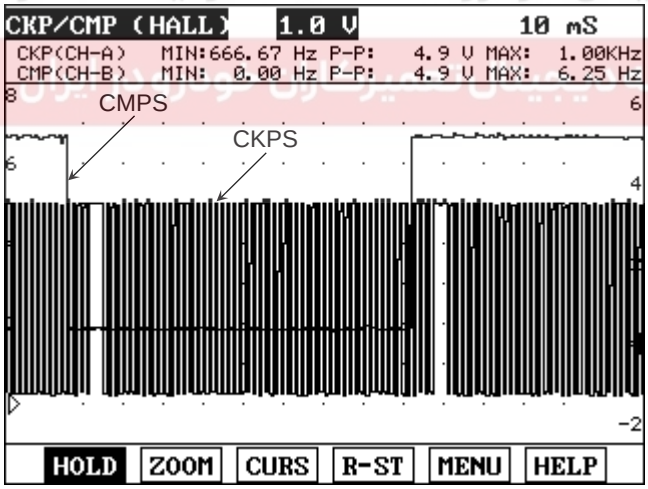


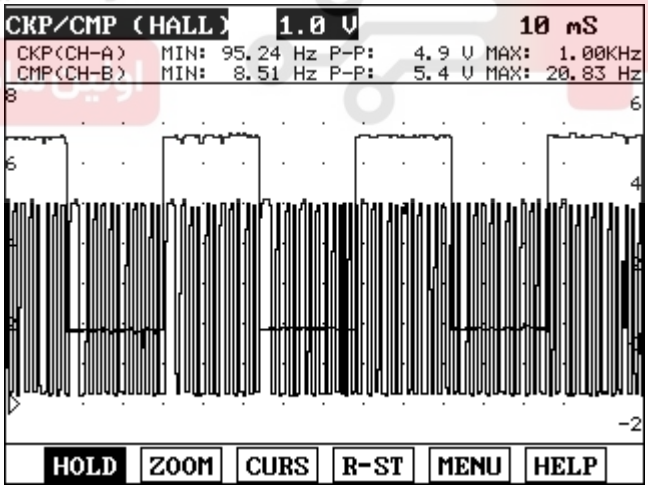
C133-4

ECM

EZOF402G

SIGNAL WAVE FORM





The given data is the normal waveform of the Crankshaft Position Sensor (CKPS) and Camshaft Position Sensor (CMPS). The ECM controls the injection timing and the ignition timing by using these signals. The CKPS signal is used to detect the piston's position and the CMPS signal is used to detect the Top Dead Center of each cylinder.

LGGE402H

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Start the engine and monitor the CMPS signal at normal operating temperature without electrical loads.

Is signal continuously fluctuating between 0V and 5V?

No

Yes	Problem is intermittent or was repaired and ECM memory was not cleared. Refer to "INTERMITTENT PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

2. CHECK CMPS AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

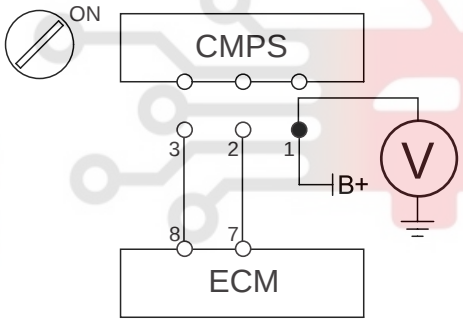
Are all connectors good?

Yes

No	Repair or replace it.

3. CHECK POWER TO CMPS

1. Turn ignition switch to OFF position, and then disconnect CMPS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the CMPS harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



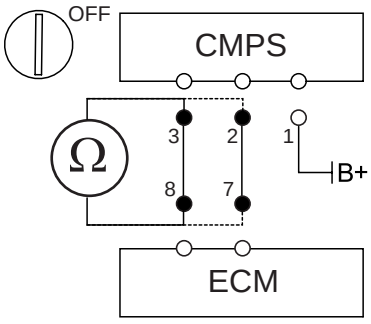
Is voltage within specification?

Yes

No	Repair open or short to chassis ground in harness.

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect CMPS and ECM connector.
2. Measure resistance between terminal 3 of the CMPS harness connector and 8 of the ECM harness connector (C133-4).
3. Measure resistance between terminal 2 of the CMPS harness connector and 7 of the ECM harness connector (C133-4).
   - **Specification (Resistance): below 1Ω**



Does each resistance indicate continuity?

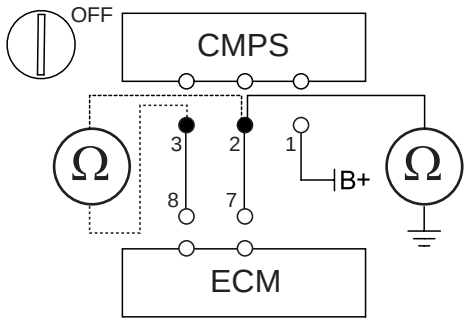
EZOF603S

Yes

No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect CMPS and ECM connector.
2. Measure resistance between terminal 2 of the CMPS harness connector and chassis ground.
3. Measure resistance between terminal 3 and 2 of the CMPS harness connector.
   - **Specification (Resistance): infinite**



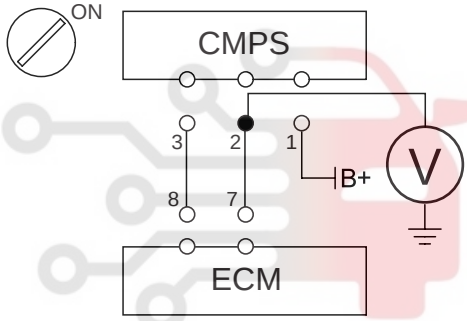
Does each resistance indicate open?

Yes

No	Repair short or short to chassis ground in harness.

6. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect CMPS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 2 of the CMPS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

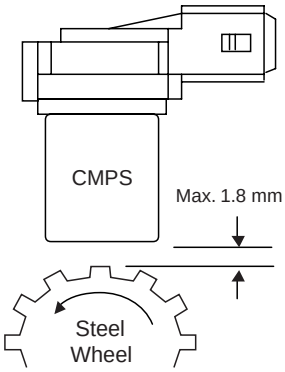
Yes

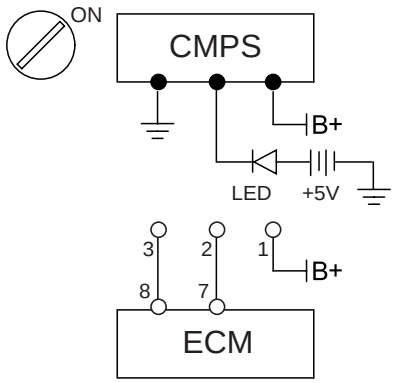
No	Repair short to power in harness.

EZOF603T

7. CHECK CMPS

1. Turn ignition switch to OFF position and then disconnect CMPS connector.
2. Remove the CMPS from the engine.
3. Turn ignition switch to ON position.
4. Apply battery voltage to the terminal 1 and ground terminal 3 of CMPS as shown in the figure.
5. Install a LED between +5V power and CMPS terminal 2, and then set a steel wheel (or anything made of steel; hammer, wrench, bolt and nut etc.) at the CMPS's tip.
6. Rotate the steel wheel slowly and check if the LED flashes light.
   - **If the LED blinks, the CMPS works normally.**





Does flash the LED when rotating the steel wheel?

Yes	No	Replace CMPS.

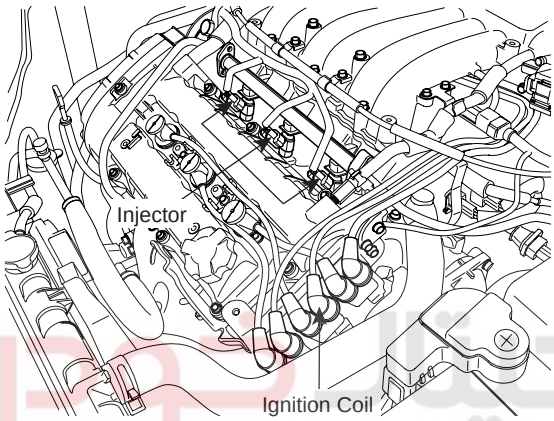
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603U

TROUBLESHOOTING FOR DTC EFF82B4F

DTC	P0350	Ignition Coil Primary/Secondary Circuit
	P0351	Ignition Coil 'A' Primary/Secondary Circuit
	P0352	Ignition Coil 'B' Primary/Secondary Circuit
	P0353	Ignition Coil 'C' Primary/Secondary Circuit
	P0354	Ignition Coil 'D' Primary/Secondary Circuit
	P0355	Ignition Coil 'E' Primary/Secondary Circuit
	P0356	Ignition Coil 'F' Primary/Secondary Circuit

COMPONENT LOCATION



EZOF6056

DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for energizing the primary ignition coils. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DETECTING CONDITION

1. DTC Description

The ECM monitors the peak voltage duration of the ignition primary circuit. If abnormal signal is detected on a cylinder (P0351 ot P0356) or more than three cylinders (P0350), the ECM sets above DTC.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0350	Detecting Condition • DTC Strategy - Monitoring ignition coil primary voltage • Threshold Value - Failure on three or more cylinders	• Open or short in ignition coil circuit • Ignition system • ECM
P0351 P0352 P0353 P0354 P0355 P0356	Detecting Condition (I) • DTC Strategy - Monitoring ignition coil primary voltage • Enable Condition - Engine coolant temperature > 75°C(167°F) - No cylinder shut-off active - 5 subsequent working cycles after shut-off are passed - No failure present on camshaft • Threshold Value - No ignition spark - Ignition coil primary over voltage duration (depending on engine speed and mass air flow) too short - Over voltage duration of each ignition output overlapping below 4,500 rpm	

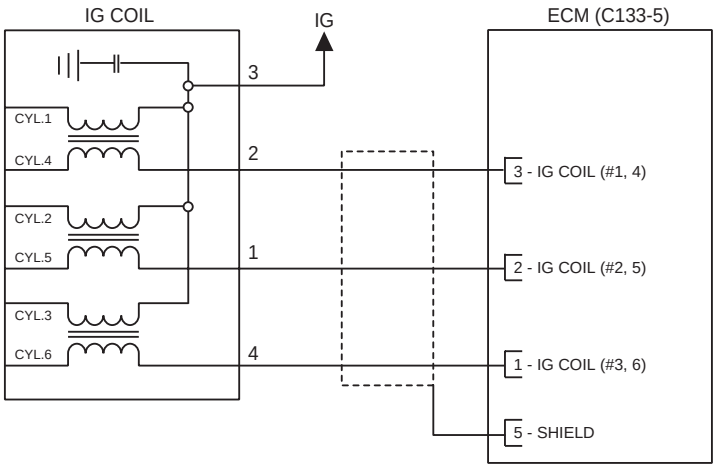
SPECIFICATION

Temperature		Ignition Coil Resistance	
(°C)	(°F)	Primary Coil (Ω)	Secondary Coil (kΩ)
20	68	0.74±10%Ω	13.3±15%kΩ

Item	Specification
Spark Plug Air Gap	1.0~1.1 mm (0.039~0.043 in)

SCHEMATIC DIAGRAM

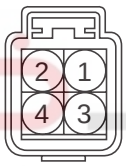
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

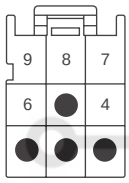
Terminal	Connected to	Function
1	ECM C133-5 (2)	IG COIL (#2, 5)
2	ECM C133-5 (3)	IG COIL (#1, 4)
3	IG	Power
4	ECM C133-5 (1)	IG COIL (#3, 6)

[HARNESS CONNECTORS]



C118

IGNITION COIL

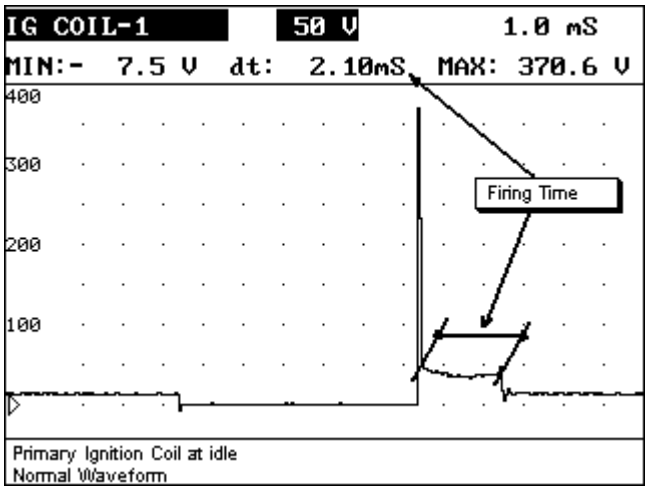


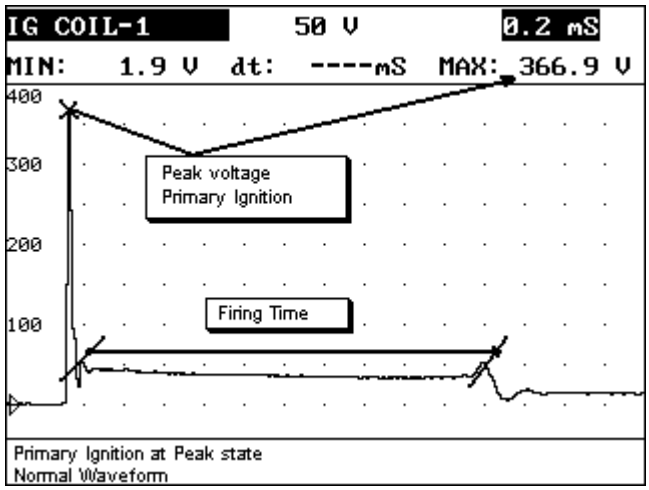
C133-5

ECM

EZOF403A

SINGAL WAVEFORM





The ignition power transistor, controlled by the ECM, provides a switching circuit to ground for energizing the primary ignition coil. When the primary ignition coil is energized and de-energized, the secondary coil produces a high voltage through the attached spark plug.

EFAE0253

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO MISFIRE

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition to ON position and monitor other DTCs.

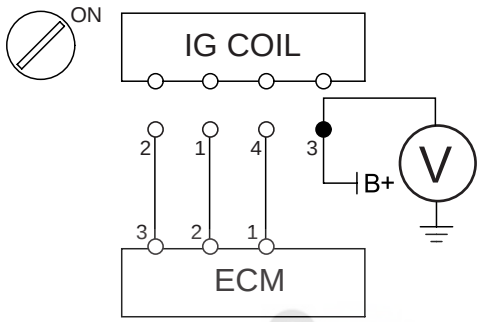
Is any DTC relating to misfire set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK POWER TO IGNITION COIL

1. Turn ignition switch to OFF position and disconnect ignition coil connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the ignition coil harness connector and chassis ground.
   - **Specification: approximately B+**



Is resistance within specification?

Yes

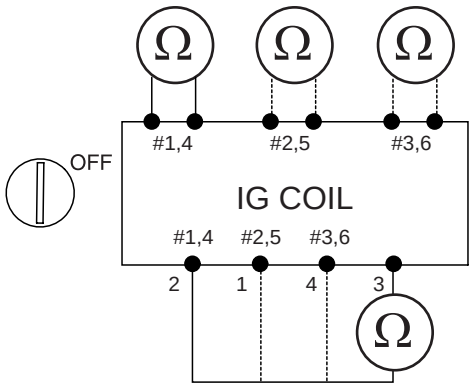
No	Repair open or short to chassis ground in harness.

3. CHECK IGNITION COILS AND SPARK PLUG WIRES

1. Turn ignition switch to OFF position and disconnect the ignition coil connector.
2. Measure resistance of the primary coils and the secondary iginition coils.

NOTE

P0350 : Ignition Coil No.1 through No.6
P0351 : Ignition Coil No.1
P0352 : Ignition Coil No.2
P0353 : Ignition Coil No.3
P0354 : Ignition Coil No.4
P0355 : Ignition Coil No.5
P0356 : Ignition Coil No.6



- **Specification (Resistance):**

Temperature		IgnitionCoil Resistance	
(°C)	(°F)	Primary Coil (Ω)	Secondary Coil (kΩ)
20	68	0.74 ± 10% Ω	13.3 ± 15% kΩ

3. Disconnect plug wires and check spark plug wires for cracks, corroded terminal, or carbon tracking.

Are ignition coils and spark plug wires okay?

EZOF6057

4. CHECK SPARK PLUG FOR PROPER OPERATION

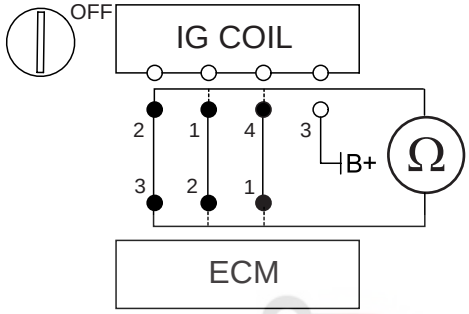
1. Remove the spark plug.
2. Visually check the spark plug for carbon tracking, foreign materials (oil or fuel), damage, or cracking.
3. Measure the spark plug gap and check the spark plug for proper operation.
   - **Specification (Air Gap): 1.0~1.1 mm (0.039~0.043 in)**

Is spark plug okay?

Yes	
No	Repair or replace it.

5. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF and disconnect ECM connector.
2. [P0351 & P0354] Measure resistance between terminals 2 of ignition coil harness connector and 3 of ECM harness connector (C133-5).
3. [P0352 & P0355] Measure resistance between terminals 2 of ignition coil harness connector and 2 of ECM harness connector (C133-5).
4. [P0353 & P0356] Measure resistance between terminals 2 of ignition coil harness connector and 1 of ECM harness connector (C133-5).
   - **Specification : below 1Ω**

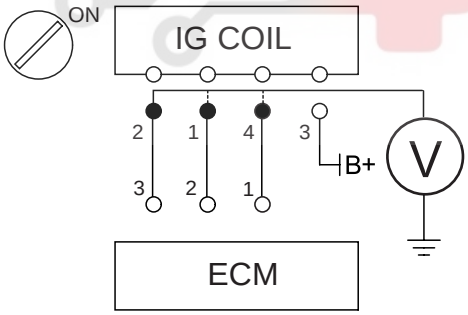


Does each resistance indicate open?

no	
Yes	Repair open in harness.

6. CHECK FOR SHORT TO POWER HARNESS

1. Turn ignition switch to ON.
2. [P0351 & P0354] Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.
3. [P0352 & P0355] Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.
4. [P0353 & P0356] Measure voltage between terminal 4 of ignition coil harness connector and chassis ground.
   - **Specification : below 0.5V**



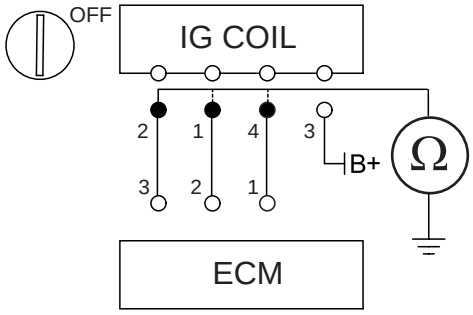
Is voltage within specificaion?

Yes	
No	Repair short to power in harness.

EZOF6058

7. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF.
2. [P0351 & P0354] Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.
3. [P0352 & P0355] Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.
4. [P0353 & P0356] Measure voltage between terminal 4 of ignition coil harness connector and chassis ground.
   - **Specification : infinite**



Does each resistance indicate open?

Yes	No	Repair short to chassis ground in harness.

8. CHECK FIRST AND SECOND IGNITION SIGNAL PATTERNS

1. Reconnect ignition coil and ECM connectors.
2. Start engine and monitor ignition coil signal pattern.

Is signal pattern normal?

Yes	No	Repair or replace it.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6059

TROUBLESHOOTING FOR DTC E931E3FC

DTC	P0420 P0430	Catalyst System Efficiency Below Threshold (Bank 1) Catalyst System Efficiency Below Threshold (Bank 2)

DESCRIPTION

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO2S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front. The output voltage of the rear HO2S copies the voltage of the front HO2S.To monitor the system, the lean-to-rich switches of the front HO2S to the rear HO2S is counted. The ratio of rear switches to front switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer rear switches than front switches, that is, a ratio closer to zero.

DTC DETECTING CONDITION

1. DTC Description

The ECM calculates oscillation size of rear HO2S signal which respresents catalyst conversion properties. This oscillation size will determine if catalyst conversion is low due to aging or poisoning from leaded fuel or misfiring. The ECM sets P0420(Bank 1) or P0430(Bank 2) if the average of caculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0420 P0430	Detecting Condition • DTC Strategy - Based on oxgen storage capability • Enable condition - Catalyst temperature: 340~600 °C(644~1,112°F) - Engine coolant temperature > 70°C (158°F) - Engine speed: 800~2500 rpm - Air mass flow < 250mg/stroke - Lambda control within its limit - No misfire detected - Not transient condition • Threshoold Value - The signal ratio of front HO2S and rear HO2S in a load and speed range > 0.7 during 171 lambda controller cycles Limp-Home Function • None	• Air leakage • HO2S • Fuel delivery system • Injector • Catalytic converter • ECM

INSPECTION PROCEDURE

1. CHECK DTC RELEAVANT TO HO2S/FUEL TRIM/MISFIRE

1. Connect Hi-Scan (Pro) to data link connector.
2. Turn ignition switch to ON and monitor any other DTCs relating to HO2S, fuel trim, or misfire.

Are any other DTCs also set?

No

Yes	Do all repairs associated with those codes before going to next step.

2. CHECK AIR LEAKAGE

1. Check air leakage in exhaust system.

Is there any air leakage in exhasut system?

No

Yes	Repair or replace it.

3. CHECK CATALYST CONVERTER AND HO2S FOR CONDITIONS

1. Thoroughly check catalyst and HO2S for contamination, deterioration or damage.

Is Catalyst converter or HO2S contaminated, deteriorated or damaged?

No

Yes	Repair or replace it.

4. CHECK HO2S

1. Check front and rear HO2S for normal operation.
   - **Refer to "DTC P0130 ~ P0160" for a detailed procedure.**

Is front and rear HO2S normal?

Yes

No	Repair it.

5. CHECK INJECTOR FOR NORMAL OPERATION

1. Start engine and check RPM decrease when disconnecting each injector connector in sequence.
2. Measure the decreasing engine RPM of all cylinders.

Is there any cylinder with no change in RPM or only a small RPM change?

EZOF0273

No

Yes	Repair or replace the injector of failed cylinder.

6. CHECK FUEL LINE PRESSURE

1. Reconnect the ignition coils and spark plug connectors.
2. Release the fuel pressure and attach the fuel pressure gage to the delivery pipe.
   - **To release the fuel presure, refer to "FUEL DELIVERY SYSTEM" section.**
3. Start the engine and warm it up to normal operating temperature.
4. Check fuel line pressure at idle.
   - **Specification (Fuel Pressure): 350 kpa (3.5 kg/cm², 49.8 psi)**

Is fuel line pressure within specification?

Yes

No	Check fuel delivery system. (Refer to "FUEL DELIVERY SYSTEM" section)

7. CHECK SIGNAL PATTERN OF FRONT AND REAR HO2S

1. Start engine and warm it up to normal operating temperature.
2. Using Hi-Scan (Pro), monitor both front HO2S and rear HO2S signals.

Do both signals of front and rear HO2S switch lean to rich or rich to lean similarly?

No

Yes	Replace manifold catalytic convertr.

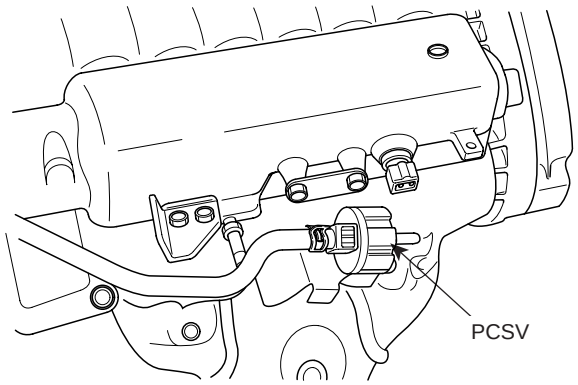
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

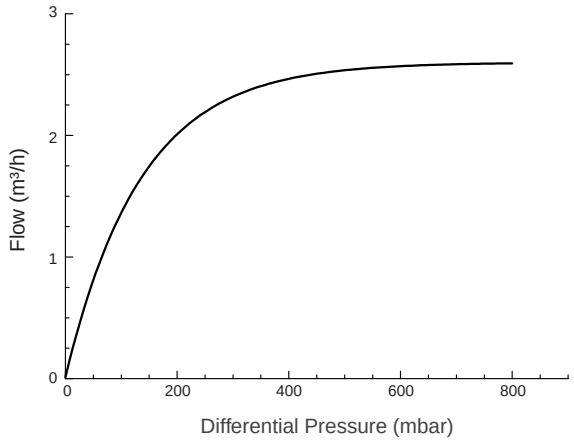
EZOF0274

TROUBLESHOOTING FOR DTC EAEFEFBF

DTC	P0444	Evap. Emission Control System-Purge Control Valve Circuit Open

COMPINENT LOCATION





EZOF505Z

DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustlon. This valve is actuated by the purge control signal from the ECM and controls fuel vapor from the canister to the intake manifold.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0444 if the ECM detects that the PCSV control line is open.

2. Conditions for Setting the DTC

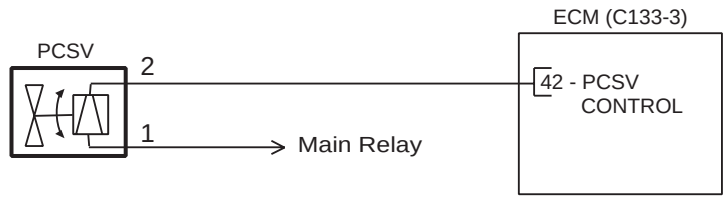
DTC	Detecting Condition & Limp Home	Possible Cause
P0444	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery voltage ＞ 10V • Threshold Value - PCSV control line is open for 3 seconds	• Open in PCSV circuit • PCSV • ECM

SPECIFICATION

- PCSV Resistance : 24.5~27.5Ω at 20°C(68°F)

SCHEMATIC DIAGRAM

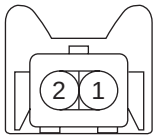
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

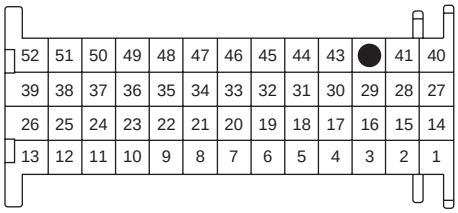
Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C133-3 (42)	PCSV Operation

[HARNESS CONNECTORS]



C121

PCSV

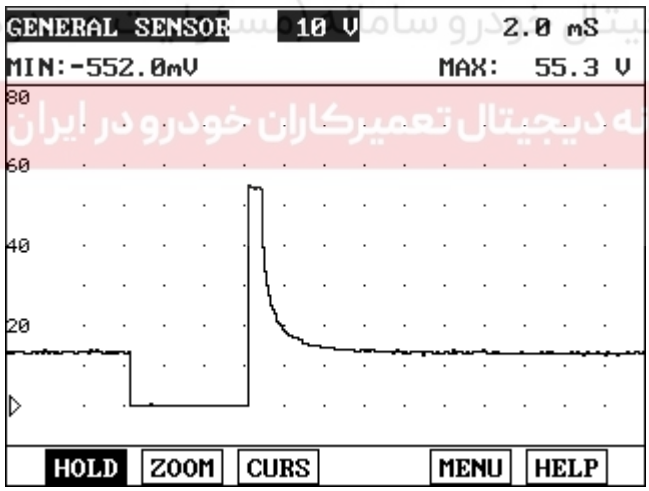


C133-3

ECM

EZOF402I

SIGNAL WAVE FROM



In normal operation, the PCSV opens and closes, depending on throttle angle and intake manifold vacuum. When it opens, fuel vapor is flushed from the canister and drawn into the intake manifold. To avoid a vacuum build-up in the canister, the canister close valve is normally held open to allow fresh air to replace the vapors drawn into the intake manifold.The given data is the signal waveform when PCSV operates normally. Note that the PCSV will not operate until the engine has reached normal operating temperature.

EZOF0293

INSPECTION PROCEDURE

1. CHECK PCSV AND ECM CONNECTORS

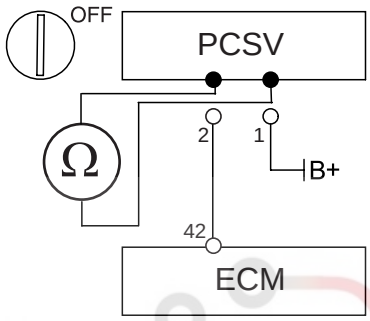
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK PCSV RESISTANCE

1. Turn ignition switch to OFF and disconnect PCSV connector.
2. Measure resistance between the terminal 1 and 2 of PCSV connector.
   - **Specification (PCSV resistance): 24.5 ~ 27.5 Ω at 20˚C (68˚F)**

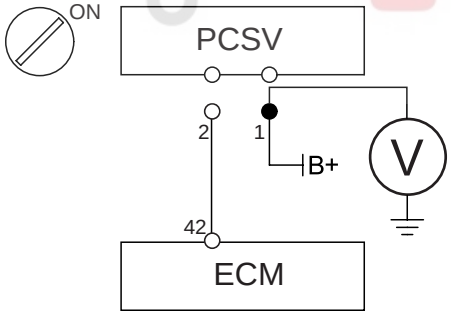


Is resistance within specification?

Yes	
No	Replace PCSV.

3. CHECK POWER TO PCSV

1. Turn ignition switch to OFF position and disconnect PCSV connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



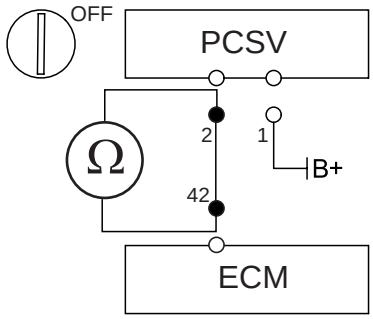
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF603X

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect PCSV and ECM connector.
2. Measure resistance between terminal 2 of the PCSV harness connector and 42 of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**



Does each resistance indicate continuity?

Yes	No	Repair open in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603Y

TROUBLESHOOTING FOR DTC ED2BD228

DTC	P0445	Evap. Emission Control System-Purge Control Valve Circuit Shorted

DESCRIPTION

Refer to DTC P0444

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P0445 if the ECM detects that the PCSV control line is short to ground or short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0445	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery voltage ＞ 10V • Threshold Value - PCSV control line is short to ground or battery line for 3 seconds	• Short to ground or short to battery line in PCSV circuit • PCSV • ECM

SPECIFICATION

Refer to DTC P0444

SCHEMATIC DIAGRAM

Refer to DTC P0444

SIGNAL WAVE FORM

Refer to DTC P0444

INSPECTION PROCEDURE

1. CHECK PCSV AND ECM CONNECTORS

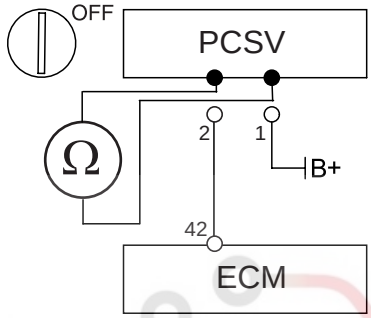
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK PCSV RESISTANCE

1. Turn ignition switch to OFF and disconnect PCSV connector.
2. Measure resistance between the terminal 1 and 2 of PCSV connector.
   - **Specification (PCSV resistance): 24.5 ~ 27.5 Ω at 20°C (68°F)**

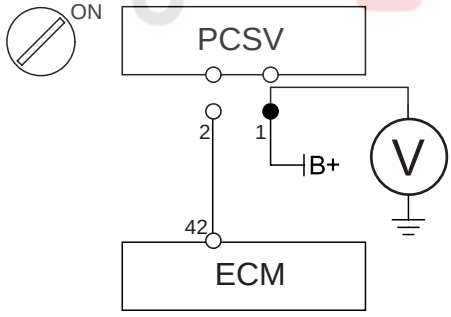


Is resistance within specification?

Yes	
No	Replace PCSV.

3. CHECK POWER TO PCSV

1. Turn ignition switch to OFF position and disconnect PCSV connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



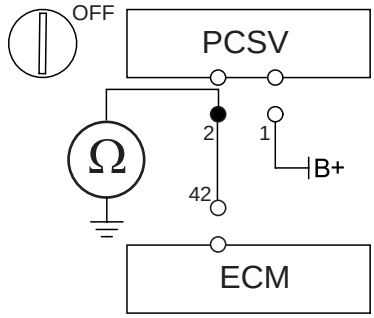
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF603X

4. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect PCSV and ECM connectors.
2. Measure resistance between terminal 2 of the PCSV harness connector and chassis ground.
   - **Specification (Resistance): infinite**

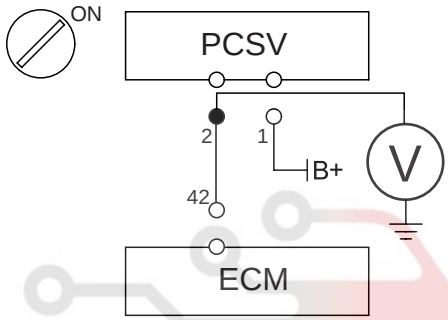


Does the resistance indicate open?

Yes	No	Repair short or short to chassis ground in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect PCSV and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 2 of the PCSV harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	No	Repair short to power in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF603Z

TROUBLESHOOTING FOR DTC EF0ED60D

DTC	P0501	Vehicle Speed Sensor A Range/ Performance [EURO-III/IV & JAPAN]

DESCRIPTION

The Wheel Speed Sensor (WSS) generates a waveform with a frequency according to the speed of the vehicle. The signal generated by the WSS informs the ECM not only if the vehicle speed is low or high but also is stopped the vehicle or not. The ECM uses this signal to control the fuel injection, ignition timing, transmission/transaxle shift scheduling and torque converter clutch scheduling. Also the WSS signal is used to detect rough road driving condition.

DTC DETECTING CONDITION

1. DTC Description

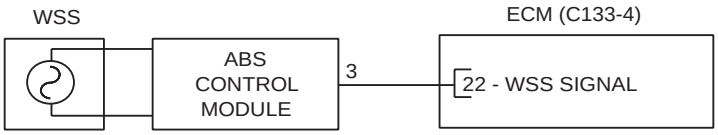
The ECM evaluates engine speed and mass air flow if there is no vehicle speed signal. This evaluation of both value will detect open circuit or short circuit error on wheel speed sensor. The ECM sets DTC P0501 if there is no vehicle speed signal from wheel speed sensor while both engine speed and mass air flow are higher than predetermined threshold during predetermined time.
If the same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0501	Detecting Condition • DTC Strategy - Check vehicle speed signal • Enable condition - Engine coolant temperature > 60°C (140°F) - Engine speed > 2,016 rpm - Mass air flow > 218 mg/stroke - No fuel cut-off • Threshoold Value - Vehick speed = 0 with high engine speed and high load for 40 sec(M/T) or 60 sec(A/T)	• Open or short in WSS circuit • WSS • ABS control module • ECM

SCHEMATIC DIAGRAM (I) - WITH ABS

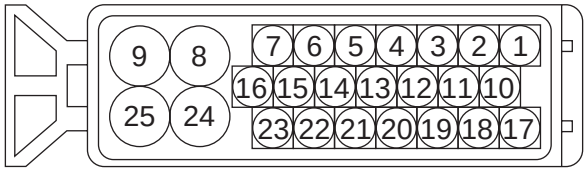
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

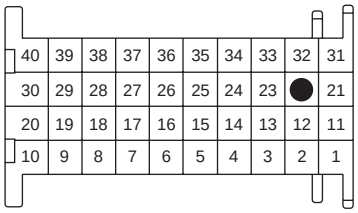
Terminal	Connected to	Function
3	ECM C133-4 (22)	WSS signal

[HARNESS CONNECTORS]



E37

ABS CONTROL MODULE



C133-4

ECM

EZOF402N

SCHEMATIC DIAGRAM (II) - WITHOUT ABS

[CIRCUIT DIAGRAM]

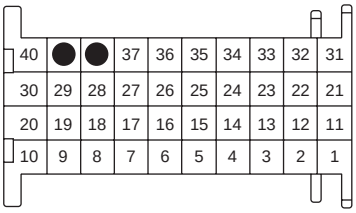
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-4 (38)	WSS signal (-)
2	ECM C133-4 (39)	WSS signal (+)

[HARNESS CONNECTORS]

E39

WSS



C133-4

ECM

EZOF402M

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO FRONT RIGHT WSS OF ABS (OR WSS)

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn the ignition switch ON and monitor any other DTCs relating to front right WSS of ABS (or WSS).

Is DTC relating to front right wheel speed sensor of ABS (or WSS)?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK ABS CONTROl MODULE (OR WSS) AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

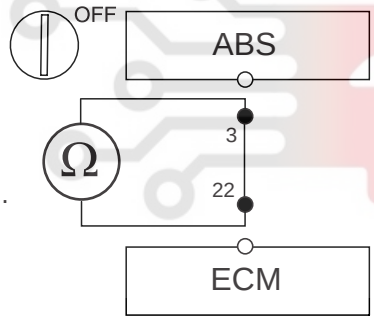
Yes

No	Repair or replace it.

3. CHECK FOR OPEN IN HARNESS

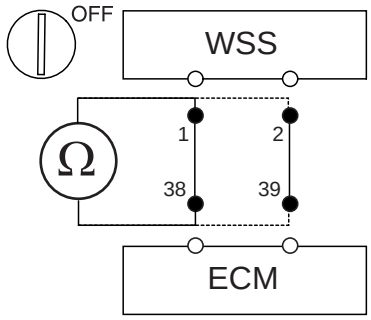
[WITH ABS]

1. Turn ignition switch to OFF position, and then disconnect ABS control module and ECM connector.
2. Measure resistance between terminal 3 of the ABS control module harness connector(E37) and 22 of the ECM harness connector (C133-4).
   - **Specification (Resistance) : below 1Ω**



[WITHOUT ABS]

1. Turn ignition switch to OFF position, and then disconnect WSS and ECM connector.
2. Measure resistance between terminal 1 of the WSS harness connector and 38 of the ECM harness connector (C133-4).
3. Measure resistance between terminal 2 of the WSS harness connector and 39 of the ECM harness connector (C133-4).
   - **Specification (Resistance) : below 1Ω**



Does each resistance indicate continuity?

Yes

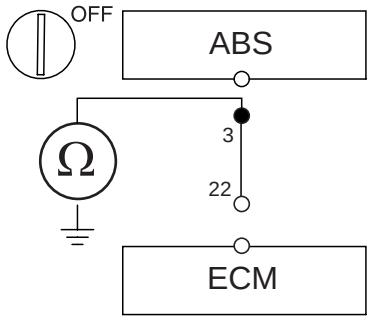
No	Repair open in harness.

EZOF604R

4. CHECK FOR SHORT TO GROUND IN HARNESS

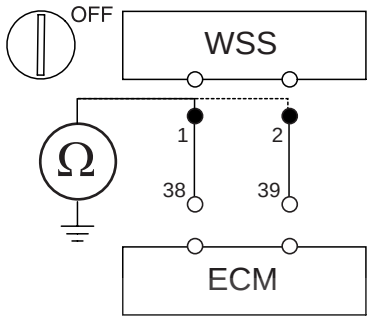
[WITH ABS]

1. Turn ignition switch to OFF position, and then disconnect ABS control module and ECM connector.
2. Measure resistance between terminal 3 of the ABS control module harness connector and chassis ground.
   - **Specification (Resistance) : infinite**



[WITHOUT ABS]

1. Turn ignition switch to OFF position, and then disconnect WSS and ECM connector.
2. Measure resistance between terminal 1 of the WSS harness connector and chassis ground.
3. Measure resistance between terminal 2 of the WSS harness connector and chassis ground.
   - **Specification (Resistance) : infinite**



Does each resistance indicate open?

Yes	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF604S

TROUBLESHOOTING FOR DTC

DTC	P0501	Vehicle Speed Sensor A Range/ Performance [EURO-II & LEAD]

DESCRIPTION

The vehicle Speed Sensor (VSS) generates a waveform with a frequency according to the speed of the vehicle. The signal generated by the VSS informs the ECM not only if the vehicle speed is low or high but also is stopped the vehicle or not. The ECM uses this signal to control the fuel injection, ignition timing, transmission/transaxle shift scheduling and torque converter clutch scheduling. Also the WSS signal is used to detect rough road driving condition.

DTC DETECTING CONDITION

1. DTC Description

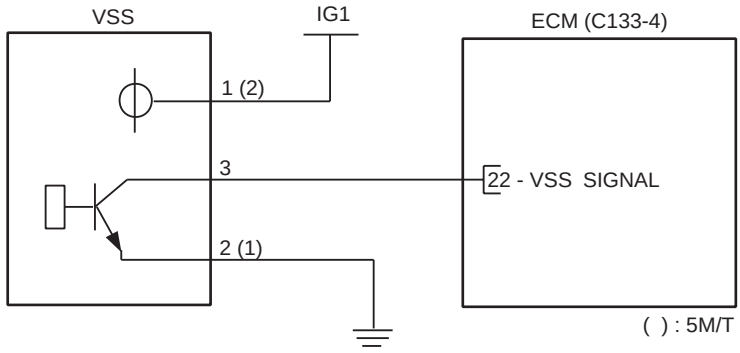
The ECM evaluates engine speed and mass air flow if there is no vehicle speed signal. This evaluation of both value will detect open circuit or short circuit error on vehicle speed sensor. The ECM sets DTC P0501 if there is no vehicle speed signal from vehicle speed sensor while both engine speed and mass air flow are higher than predetermined threshold during predetermined time

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0501	Detecting Condition • DTC Strategy - Check vehicle speed signal • Enable condition - Engine coolant temperature > 60°C (140°F) - Engine speed > 2,016 rpm - Mass air flow > 218 mg/stroke - No fuel cut-off • Threshoold Value - Vehick speed = 0 with high engine speed and high load for 40 sec(M/T) or 60 sec(A/T)	• Open or short in VSS circuit • VSS • ABS control module • ECM

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

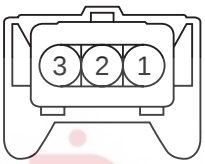
A/T, 6M/T (C109)

Terminal	Connected to	Function
1	IG	Battery Voltage
2	Chassis Ground	Ground
3	ECM C133-4 (22)	VSS Signal

5M/T (C110)

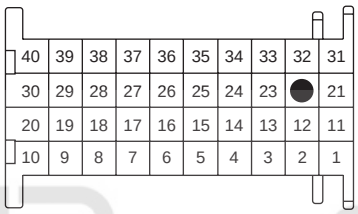
Terminal	Connected to	Function
1	Chassis Ground	Ground
2	IG	Battery Voltage
3	ECM C133-4 (22)	VSS Signal

[HARNESS CONNECTORS]



C109 (A/T, 6M/T)
C110 (5M/T)

VSS



C133-4

ECM

EZOF402S

INSPECTION PROCEDURE

1. CHECK VSS AND ECM CONNECTORS

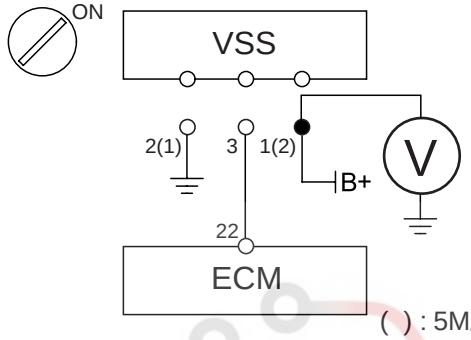
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	No	Repair or replace it.

2. CHECK POWER TO VSS

1. Turn ignition switch to OFF position, and then disconnect CMPS connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1(2) of the VSS harness connector and chassis ground.
   - **Specification (Voltage): approximately B+**



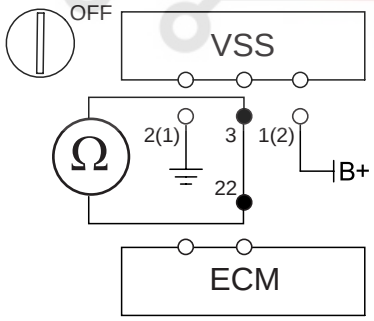
( ) : 5M/T

Is voltage within specification?

Yes	No	Repair open or short to chassis ground in harness.

3. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect VSS and ECM connector.
2. Measure resistance between terminal 3 of the VSS harness connector and 22 of the ECM harness connector (C133-4).
   - **Specification (Resistance): below 1Ω**



( ) : 5M/T

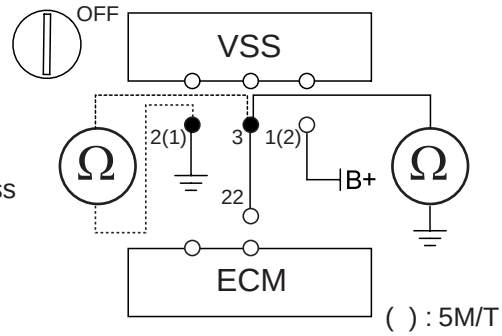
Does each resistance indicate continuity?

Yes	No	Repair open in harness.

EZOF001E

4. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect VSS and ECM connector.
2. Measure resistance between terminal 3 of the VSS harness connector and chassis ground.
3. Measure resistance between terminal 3 and 2(1) of the VSS harness connector.
   - **Specification (Resistance): infinite**

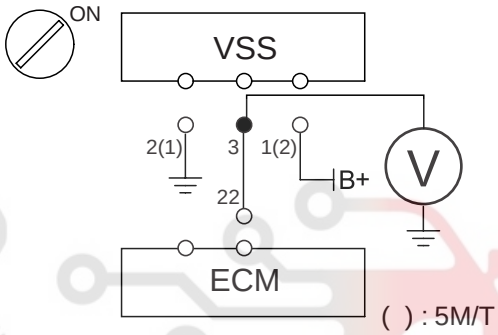


Does each resistance indicate open?

Yes	No	Repair short or short to chassis ground in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect VSS and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the VSS harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	No	Repair short to power in harness.

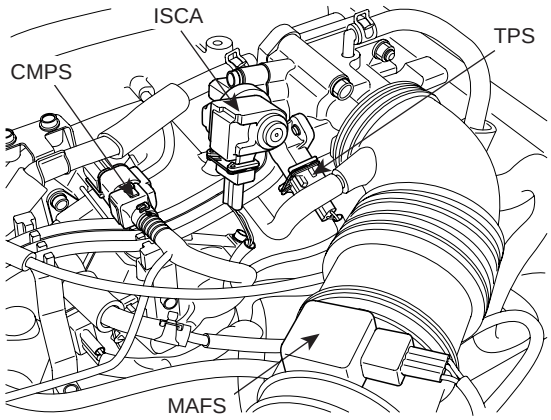
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF001F

TROUBLESHOOTING FOR DTC EAFF213C

DTC	P0506	Idle Air Control System - rpm Lower Than Expected

COMPONENT LOCATION



EZOF505Y

DESCRIPTION

The Idle Speed Control Actuator (ISCA) is installed on the intake manifold and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle valve is closed. The function of the ISCA is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting. The ISCA consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by pass airflow into the engine.

DTC DETECTING CONDITION

1. DTC Description

The ECM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the idle speed valve opening is stable.
The ECM sets DTC P0506 if the difference to the target idle engine speed is lower than the predetermined threshold. If the same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0506	Detecting Condition • DTC Strategy - Monitoring of unplausible idle speed • Enable condition - Minimum time after start = 15 seconds - Canister purge control < 50% - Throttle is fully closed (Idle state) - Vehicle speed: 0 kph - Engine coolant temperature > 75 ℃ (167 °F) - Engine load < 280 mg/stroke • Threshold Value - Target idle speed-Engine speed > 100rpm (Engine speed too low) for 25 seconds	• ISCA • TPS • Intake hose • Carbon fouled throttle plate • Accelerator cable adjusted improperly • ECM

SPECIFICATION

TPS

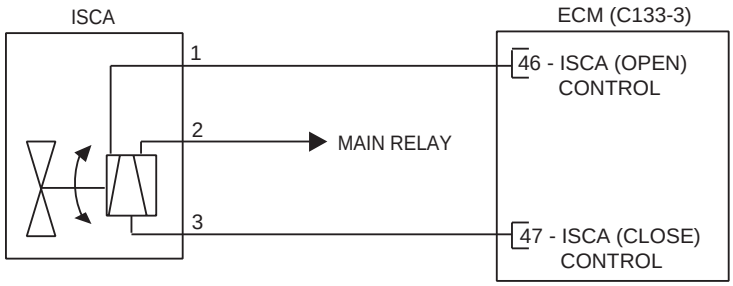
Throttle Position	Output Voltage
C.T (IDLE)	0.2 ~ 0.8 V
W.O.T	4.3 ~ 4.8 V

ISCA

Temperature		ISCA Coil #1 (OPEN) Resistance(Ω)	ISCA Coil #2 (CLOSE) Resistance(Ω)
(°C)	(°F)		
20	68	14.9 ~ 16.1	17.0 ~ 18.2

SCHEMATIC DIAGRAM

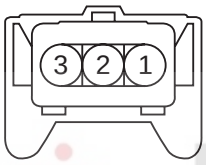
[CIRCUIT DIAGRAM]



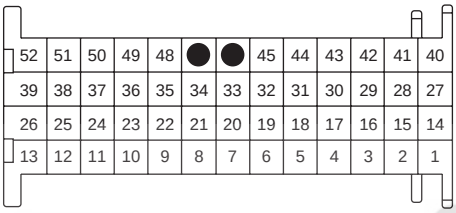
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-3 (46)	ISCA (OPEN) Control
2	Main Relay	Battery Voltage
3	ECM C133-3 (47)	ISCA (CLOSE) Control

[HARNESS CONNECTORS]



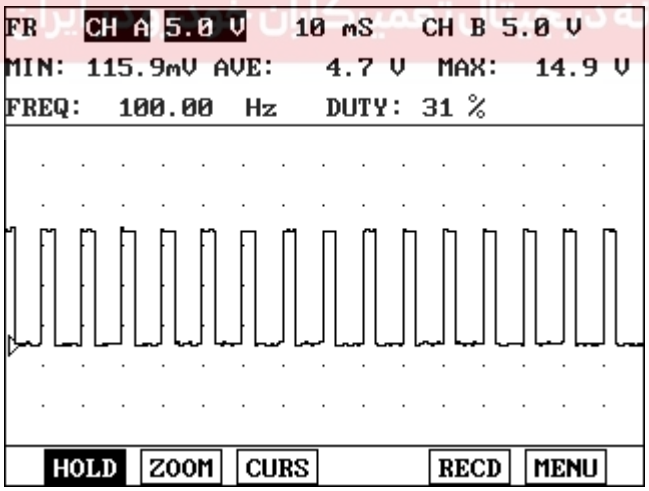
C126
ISCA

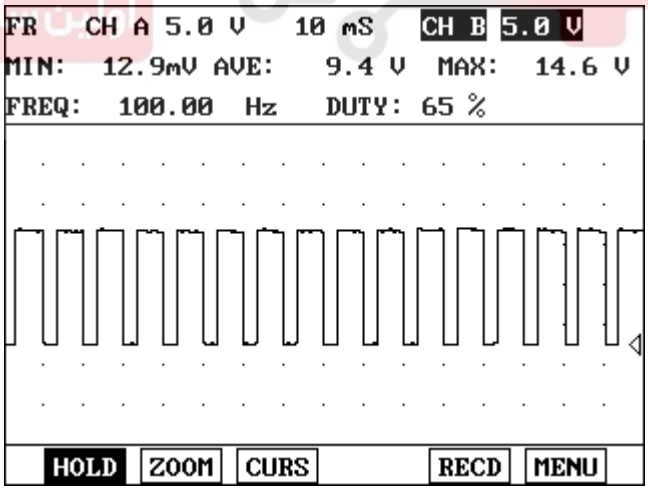


C133-3
ECM

EZOF402O

SIGNAL WAVE FORM





The above waveforms are the voltage signals generated when ISCA operates. This ISCA type is duty type and the time ratio opened determines duty amount. The left side is the waveform of ISCA Opening coil at idle. The right side is the waveform of ISCA Closing coil at idle.

EFAE0352

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO TPS, MAFS, INJECTOR, PCSV, OR ISCA

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition switch to ON position and monitor any other DTCs.

Are any other DTC relating to TPS, MAFS, injector, PCSV, or ISCA also set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK FREE PLAY OF ACCELERATOR CABLE

1. Turn ignition switch to OFF position.
2. Check the free play of the accelerator cable.
   - **Specifications: 1.0~2.0 mm (0.0039~0.0079 in)**

Is free play within specification?

Yes

No	Adjust cable.

3. CHECK TPS SIGNAL

1. Turn ignition switch to ON position.
2. Using the Hi-Scan (Pro), monitor the TPS signals while slowly opening the throttle.
   - **Specification (Voltage):**
     0.2 ~ 0.8 V at C.T (IDLE)
     4.3 ~ 4.8 V at W.O.T

Is signal within specification?

Yes

No	Replace the TPS.

4. VISUALLY CHECK ISCA FOR CONNECTOR CONDITION

1. Turn ignition switch to OFF position and disconnect the ISCA connector.
2. Thoroughly check the ISCA for loose, bent, corroded, contaminated, deteriorated or damaged connectors.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Is any problem present?

Yes

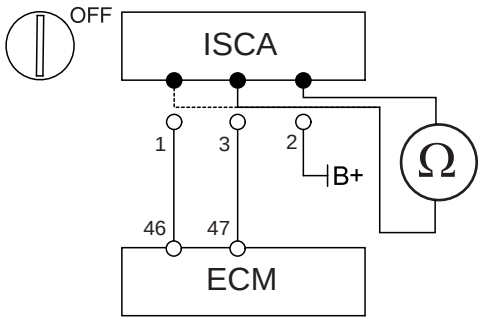
No	Repair or replace it.

BFGE604T

5. CHECK ISCA RESISTANCE

1. Turn ignition switch to OFF position and then disconnect ISCA connector.
2. Measure resistance between terminals 2 and 3 of the ISCA closing coil.
3. Measure resistance between terminals 1 and 2 of the ISCA opening coil.
   - **Specification (ISCA resistance):**

Temperature (°C)	Temperature (°F)	ISCA Coil #1 (OPEN) Resistance (Ω)	ISCA Coil #2 (CLOSE) Resistance (Ω)
20	68	14.9 ~ 16.1	17.0 ~ 18.2



Is each resistance within specification?

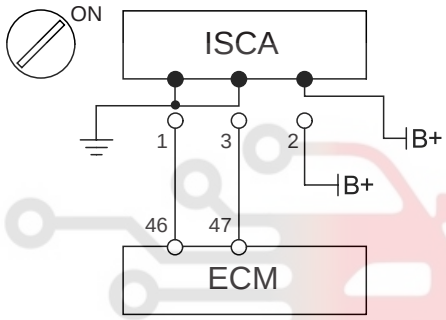
Yes	
No	Replace ISCA.

6. CHECK ISCA FOR NORMAL OPERATION

1. Remove ISCA from throttle body and check for blockage and sticking.
2. Connect terminal 2 of the ISCA connector to a 12V power supply. One at a time, momentarily ground terminal 1 of the opening coil and terminal 3 of the closing coil while verifying that the valve closes when the closing coil is grounded and that the valve opens when opening coil is grounded.
3. Repeat several times to ensure reliability.

NOTE

While ISCA is removed, inspect the throttle body for obstructions in the idle circuit ports. Repair or replace it.



Is ISCA working properly?

Yes	
No	Replace ISCA.

7. CHECK INTAKE HOSE AND THROTTLE PLATE FOR BLOCKAGE

1. Visually check the intake hose and throttle plate for blockage or carbon deposits.

Is the passage of the intake hose or the throttle plate blocked?

Yes	
No	Clean or replace it.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF604U

TROUBLESHOOTING FOR DTC E7027B5F

DTC	P0507	Idle Air Control System - rpm Higher Than Expected

DESCRIPTION

Refer to DTC P0506

DTC DETECTING CONDITION

1. DTC Description

The ECM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the idle speed valve opening is stable.
The ECM sets DTC P0507 if the difference to the target idle engine speed is higher than the predetermined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0507	Detecting Condition • DTC Strategy - Monitoring of unplausible idle speed • Enable condition - Minimum time after start = 15 seconds - Canister purge control < 50% - Throttle is fully closed (Idle state) - Vehicle speed: 0 kph - Engine coolant temperature > 75 °C (167 °F) - Engine load < 280 mg/stroke • Threshold Value - Engine speed-Target idle speed > 200rpm (Engine speed too high) for 25 seconds	• ISCA • TPS • Air leakage intake system • Vacuum hose and PCV • PCSV • Accelerator cable adjusted improperly • ECM

SPECIFICATION

Refer to DTC P0506

SCHEMATIC DIAGRAM

Refer to DTC P0506

SIGNAL WAVE FORM

Refer to DTC P0506

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO TPS, MAFS, INJECTOR, PCSV, OR ISCA

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition switch to ON position and monitor any other DTCs.

Are any other DTC relating to TPS, MAFS, injector, PCSV, or ISCA also set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK FREE PLAY OF ACCELERATOR CABLE

1. Turn ignition switch to OFF position.
2. Check the free play of the accelerator cable.
   - **Specifications: 1.0~2.0 mm (0.0039~0.0079 in)**

Is free play within specification?

Yes

No	Adjust cable.

3. CHECK TPS SIGNAL

1. Turn ignition switch to ON position.
2. Using the Hi-Scan (Pro), monitor the TPS signals while slowly opening the throttle.
   - **Specification (Voltage):**
     0.2 ~ 0.8 V at C.T (IDLE)
     4.3 ~ 4.8 V at W.O.T

Is signal within specification?

Yes

No	Replace the TPS.

4. VISUALLY CHECK ISCA FOR CONNECTOR CONDITION

1. Turn ignition switch to OFF position and disconnect the ISCA connector.
2. Thoroughly check the ISCA for loose, bent, corroded, contaminated, deteriorated or damaged connectors.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Is any problem present?

Yes

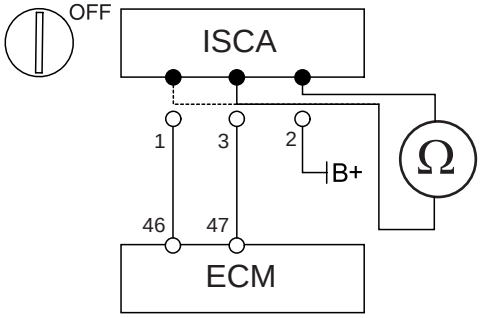
No	Repair or replace it.

BFGE604T

5. CHECK ISCA RESISTANCE

1. Turn ignition switch to OFF position and then disconnect ISCA connector.
2. Measure resistance between terminals 2 and 3 of the ISCA closing coil.
3. Measure resistance between terminals 1 and 2 of the ISCA opening coil.
   - **Specification (ISCA resistance):**

Temperature (°C)	Temperature (°F)	ISCA Coil #1 (OPEN) Resistance (Ω)	ISCA Coil #2 (CLOSE) Resistance (Ω)
20	68	14.9 ~ 16.1	17.0 ~ 18.2



Is each resistance within specification?

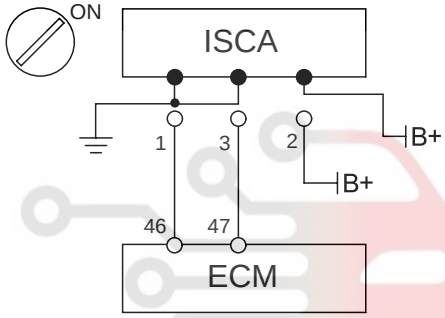
Yes	
No	Replace ISCA.

6. CHECK ISCA FOR NORMAL OPERATION

1. Remove ISCA from throttle body and check for blockage and sticking.
2. Connect terminal 2 of the ISCA connector to a 12V power supply. One at a time, momentarily ground terminal 3 of the opening coil and terminal 1 of the closing coil while verifying that the valve closes when the closing coil is grounded and that the valve opens when opening coil is grounded.
3. Repeat several times to ensure reliability.

NOTE

While ISCA is removed, inspect the throttle body for obstructions in the idle circuit ports. Repair or replace it.



Is ISCA working properly?

Yes	
No	Replace ISCA.

7. CHECK VACUUM HOSE AND PCV

1. Visually check for any split, disconnected or perforated vacuum hose.
2. Also, check PCV valve for proper operation.

Are vacuum hose and PCV okay?

EZOF604W

Yes

No	Repair or replace it.

8. CHECK PCSV FOR NORMAL OPERATION

1. Turn ignition switch to OFF position and disconnect the hose leading from the PCSV to the intake manifold at PCSV.
2. Draw a vacuum at the nipple and verify that the PCSV holds vacuum.
3. Turn ignition switch to ON position and ground the PCSV connector terminal 2 (should hear a faint "click" from PCSV).
4. The Vacuum should bleed off.
5. Repeat this procedure 4 or 5 times to ensure PCSV reliability.

Is PCSV working properly?

Yes

No	Repair or replace it.

9. CHECK GASKETS, SEALS, AND VALVE FOR CRACKS OR LEAKS

1. Visually inspect the following items:
   - Gasket between the intake manifold and the surge tank
   - Gasket between the intake manifold and the cylinder head
   - Seals between the intake manifold and the fuel injectors
   - Seals between the surge tank and the PCV valves
   - Crankcase ventilation valve and/or system for leaks

Are the above items okay?

Yes

No	Repair or replace it.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

BFGE604X

TROUBLESHOOTING FOR DTC E7E36BC9

DTC	P0551	Power Steering Pressure Sensor/Switch Circuit Range/Performance

DESCRIPTION

The power steering system increases steering performance and improves steering feel and power-saving effectiveness. The power steering switch senses the power steering load into low/high voltage. Then the ECM controls the idle speed control motor by using this input signal.

DTC DETECTING CONDITION

DTC	Detecting Condition & Limp Home	Possible Cause
P0506	Detecting Condition • DTC Strategy - Power steering switch check • Enable condition - Engine coolant temperature > 75°C (167°F) - No vehicle speed error - Power steering switch ON • Threshold Value - Power steering is ON with high vehicle speed (> 100 km/h) for more than 25.5 secibds	• Open or short in power steering switch circuit • Power steering switch • • ECM

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

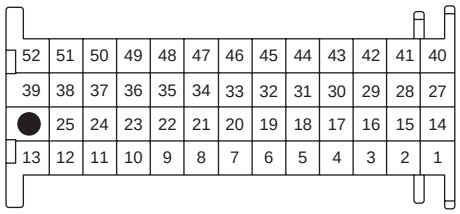
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C133-3 (26)	P/S S/W SIGNAL

[HARNESS CONNECTORS]

C144

POWER STEERING SWITCH



C133-3

ECM

EZOF403I

INSPECTION PROCEDURE

1. CHECK POWER STEERING SWITCH AND ECM CONNECTORS

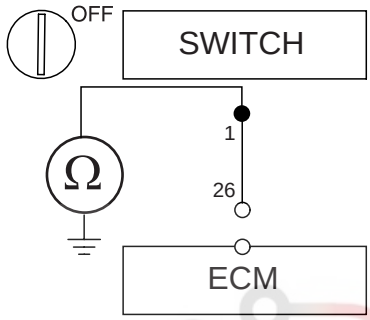
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect power steering switch and ECM connectors.
2. Measure resistance between terminal 1 of the power steering switch harness connector and chassis ground.
   - **Specification (Resistance): infinite**

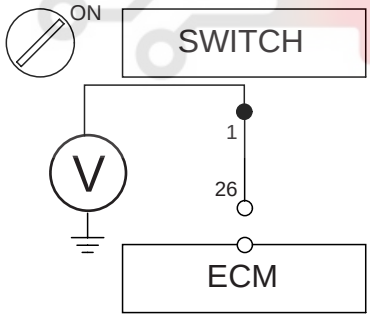


Does the resistance indicate open?

Yes	
No	Repair short or short to chassis ground in harness.

3. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect main relay and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the power steering switch harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



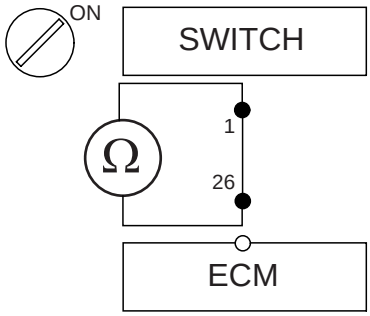
Is voltage within specification?

Yes	
No	Repair short to power in harness.

EZOF604Y

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect main relay and ECM connectors.
2. Measure resistance between terminal 1 of the power steering switch harness connector and terminal 26 of ECM harness connector (C133-3).
   - **Specification (Resistance): below** Ω



Does resistance indicate continuity?

Yes		
	No	Repair open in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF604Z

TROUBLESHOOTING FOR DTC EC43E401

DTC	P0560	System Voltage

DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DETECTING CONDITION

1. DTC Description

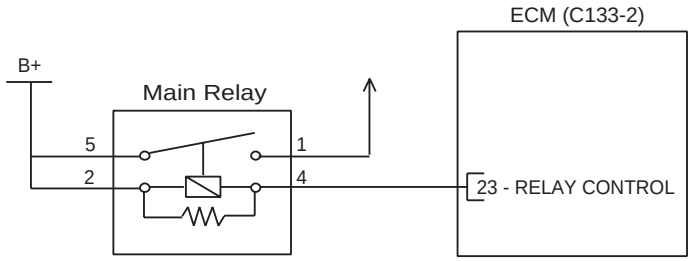
The ECM measures the voltage from ignition key and from main relay repectively and compares two voltages. This comparision will watch if the Main Relay has switched and remains on after ignition Key-On and if it has switched off after the ignition Key-Off. The ECM sets DTC P0560 if the voltage after Main Relay is lower than a predetermined threshold after ignition key-on or higer than a perdetermined threshold after ignition key-off.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0560	Detecting Condition • DTC Strategy - Comparison battery voltage with voltage after main relay • Enable condition - Battery voltage ＞ 10V - IG ON • Threshold Value - Voltage after main relay ＜ 6V for 1.5 seconds	• Open or short in main relay circuit • Main relay • ECM

SCHEMATIC DIAGRAM

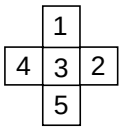
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

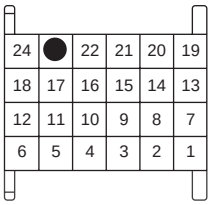
Terminal	Connected to	Function
1	-	Power Supply
2	Battery	Battery Voltage
3	-	-
4	ECM C133-2 (23)	Main Relay Control
5	Battery	Battery Voltage

[HARNESS CONNECTORS]



E42

MAIN RELAY



C133-2

ECM

EZOF402Q

INSPECTION PROCEDURE

1. CHECK MAIN RELAY AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK MAIN RELAY

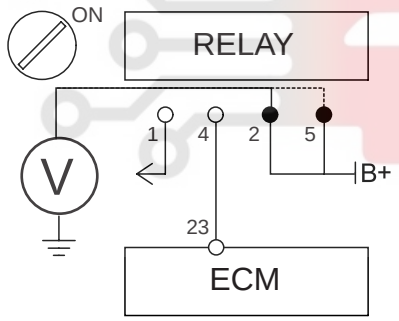
1. Remove the main relay.
2. Apply power to the main relay terminal 2 and ground terminal 4.
3. Check if the main relay works well when it is energized.
   (If the main relay works normally, a clicking sound can be heard.)

Does the main relay operate normally?

Yes	
No	Replace main relay.

3. CHECK POWER TO MAIN RELAY

1. Remove the main relay.
2. Turn ignition switch to ON position.
3. Measure the voltage between terminal 2 of the main relay harness connector and chassis ground.
4. Measure the voltage between terminal 5 of the main relay harness connector and chassis ground.
   - **Specification : approximately B+**

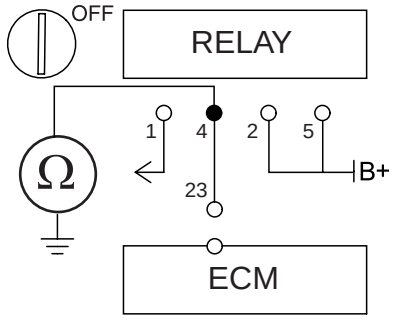


Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

4. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect main relay and ECM connectors.
2. Measure resistance between terminal 4 of the main relay harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

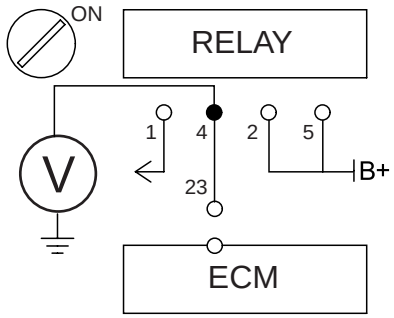
EZOF6040

Yes

No	Repair short or short to chassis ground in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect main relay and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 4 of the main relay harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



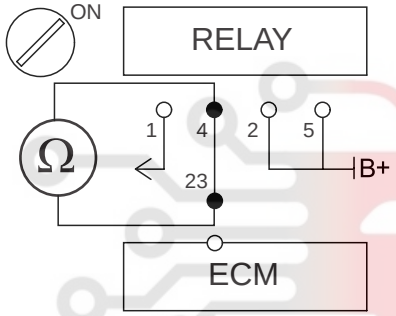
Is voltage within specification?

Yes

No	Repair short to power in harness.

6. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect main relay and ECM connectors.
2. Measure resistance between terminal 4 of the main relay harness connector and terminal 23 of ECM harness connector (C133-2).
   - **Specification (Resistance): below Ω**



Does resistance indicate continuity?

Yes

No	Repair open in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6041

TROUBLESHOOTING FOR DTC EEC9A03E

DTC	P0605	Internal Control Module Read Only Memory (ROM) Error

DESCRIPTION

A malfunction is detected by using a checksum technique for verifying data. The digital data is composed of zeros and ones. A checksum is the total of all ones in a string of data. By comparing the checksum value with a stored value, a malfunction can be detected.

DTC DETECTING CONDITION

1. DTC Description

The ECM monitors RAM areas and communication connections between microcontroller and output drivers and sets DTC P0605 if failure is detected.
If same error code is set in the next driving cycle, the ECM will illuminate the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0605	Detecting Condition • DTC Strategy - ECM ROM error • Enable condition - IG ON • Threshold Value - Internal check (for 100 msec)	• ECM internal fault • ECM hardware or software error

INSPECTION PROCEDURE

1. CHECK ECM SOFTWARE VERSION

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition to ON position.
3. Check ECM software version.

Is the version newest one?

Yes	No	Upgrade the ECM software.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

BFGE605B

TROUBLESHOOTING FOR DTC E6658A31

DTC	P0650	Malfunction Indicator Lamp (MIL) Control Circuit Malfunction

DESCRIPTION

The Malfunction Indicator Lamp (MIL), which is located in the instrument cluster, comes on to notify the driver that there may be a problem with the vehicle and that service is needed. Immediately after the ignition switch turns on, the malfunction indicator lamp is lit for 5 seconds to indicate that the MIL operates normally.

DTC DETECTING CONDITION

1. DTC Description

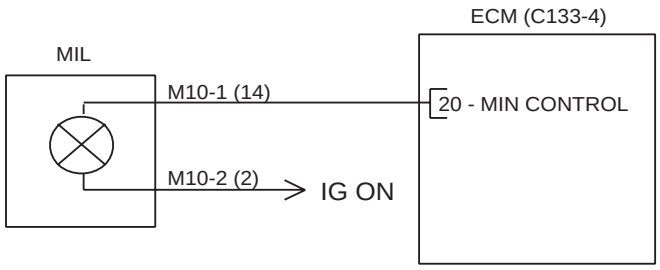
ECM sets DTC P0650 if the ECM detects that the MIL control line is open or short circuit to ground or battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P0650	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery voltage > 10V • Threshold Value - MIL control line is open or shor to ground or battery line for 20 seconds	• Open circuit in MIL circuit • Short to ground or battery line in MIL circuit • MIL • ECM

SCHEMATIC DIAGRAM

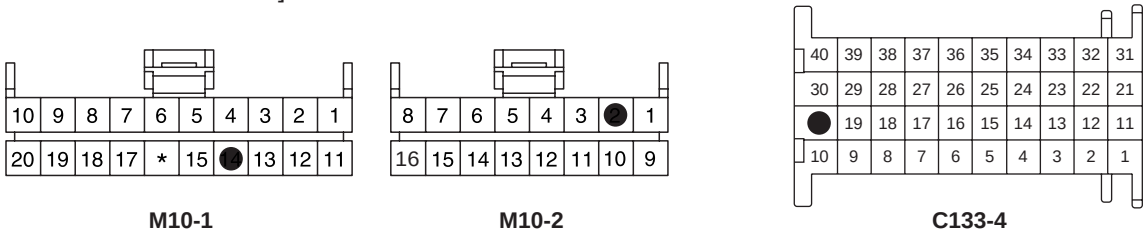
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
M10-1 (14)	ECM C133-4 (20)	MIL Control
M10-2 (2)	Ignition Switch	Battery Voltage

[HARNESS CONNECTORS]



M10-1 M10-2 C133-4

CLUSTER ECM

EZOF402R

INSPECTION PROCEDURE

1. PROBLEM VERIFICATION

1. Start the engine.
2. Check that the MIL illuminates for several seconds and then goes out.

Does the MIL illuminate for several seconds and then go out?

Yes	No	Upgrade the ECM software.

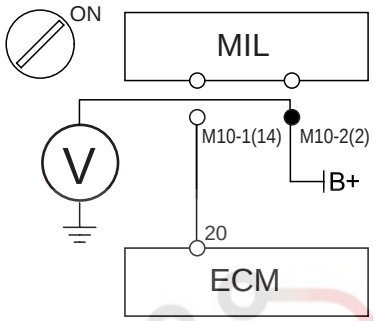
2. CHECK POWER TO MIL

1. Turn ignition switch to OFF position and disconnect MIL connector.

NOTE

MIL connector is a part of instrument panel connector.

2. Turn ignition switch to ON position.
3. Measure voltage between terminal 2 of the MIL harness connector and chassis ground (M10-2).
   - **Specification (Voltage): approximately B+**

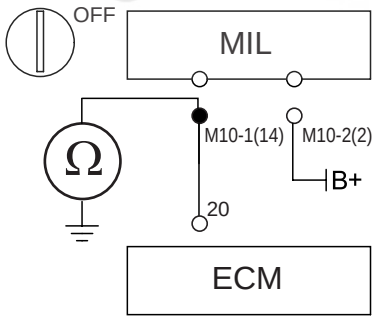


Is voltage within specification?

Yes	No	Repair open or short to chassis ground in harness.

3. CHECK FOR SHORT IN HARNESS TO GROUND

1. Turn ignition switch to OFF position, and then disconnect MIL and ECM connector.
2. Measure resistance between terminal 14 of MIL harness connector (M10-1) and chassis ground.
   - **Specifications: infinite**



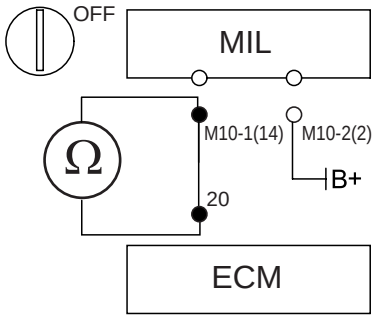
Does resistance indicate open?

Yes	No	Repair short to chassis ground in harness.

EZOF605C

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect MIL and ECM connector.
2. Measure resistance between terminals 14 of MIL harness connector (M10-1) and 20 of ECM harness connector (C133-2).
   - **Specifications: below 1Ω**



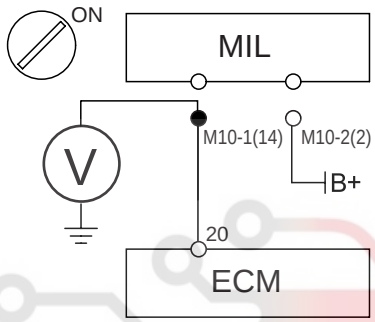
Does resistance indicate continuity?

Yes		
	No	Repair open in harness.

5. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect MIL and ECM connector.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 14 of MIL harness connector (M10-1) and chassis ground.

- **Specification: below 0.5V**



Is voltage within specification?

Yes		
	No	Repair short to power in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF605D

TROUBLESHOOTING FOR DTC EB13E3AA

DTC	P1166 P1167	HO2S System-Lambda Controller at the Limit (Bank 1) HO2S System-Lambda Controller at the Limit (Bank 2)

DESCRIPTION

The Lambda closed-loop control system is included in the engine's control system. The control system regulates the lambda upstream with the HO2S signal. Rich mixtures generate the high concentrations of CO, H2, and HC. Lean mixtures generate the high concentrations of NOx, and free oxygen.

DTC DETECTING CONDITION

1. DTC Description

If the lambda controller reaches to the maximum or minimum threshold, then no more feedback control is possible and emission will be increased. The ECM sets DTC P1166(Bank 1) or P1167(Bank 2) if no proportional fuel adaptation occurs for a defined time after the lambda controller reached to minimum or maximum threshold.
If the same error code is set in the next driving cycle, the ECM illuminates the MIL.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1166 P1167	Detecting Condition • DTC Strategy - Monitoring deviation of lambda controller • Enable condition - PCSV closed - Engine coolant temperatue > 60°C(140°F) • Threshold Value - Lambda controller on max. (+32%) or min. limit (-32%) for 2 minutes	• PCSV • Air leakage • Fuel pressure • Injector • Front HO2S • ECM

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO HO2S, FUEL SYSTEM, EVAP. SYSTEM, OR IGNITION SYSTEM

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn the ignition switch ON and monitor any other DTCs relating to CKPS.

Are DTC relating to HO2S, fuel system, EVAP. System, or ignition system set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK AIR LEAKAGE AND CONNECTIONS TO DYNAMIC CHAMBER

1. Check for air leakage and bad connections to the engine dynamic chamber (especially PCV, PCSV, ISCA, throttle body, intake manifold, brake booster, and oil filler cap).
   - **Refer to "EC" group.**

Are all connections okay?

Yes

No	Repair or replace it.

3. CHECK PCSV

1. Disconnect the PCSV connector and the EVAP hose (PCSV side) between the PCSV and the canister.
2. Check vacuum at the PCSV.
   - **Refer to "EC" group.**

Is PCSV normal?

Yes

No	Replace it.

4. CHECK FUEL LINE PRESSURE

1. Release the fuel pressure and attach the fuel pressure gage to the delivery pipe.
   - **To release the fuel presure, refer to "FUEL DELIVERY SYSTEM" section.**
2. Start the engine and warm it up to normal operating temperature.
3. Check fuel line pressure at idle.
   - **Specification (Fuel Pressure): 350 kpa (3.5 kg/cm², 49.8 psi)**

Is fuel line pressure within specification?

Yes

No	Check fuel delivery system. (Refer to "FUEL DELIVERY SYSTEM" section)

EZOF605E

5. CHECK INJECTOR FOR NORMAL OPERATION

1. Start the engine and check the engine RPM decrease when disconnecting each injector connector in sequence.
2. Measure the decreasing engine RPM of all cylinders.

Is there any cylinder with no change in RPM or only a small RPM change?

No	Yes	Repair or replace it.

6. CHECK FRONT HO2S

1. Temporarily install a good HO2S and check for proper operation.

Is problem corrected?

No	Yes	Replace it.

7. CHECK ECM INPUT SIGNALS RELATING TO MAFS, TPS, AND ECTS

1. Check for ECM input signals from the MAFS, TPS, and ECTS.

Are input signals normal?

Yes	No	Replace all failed parts.

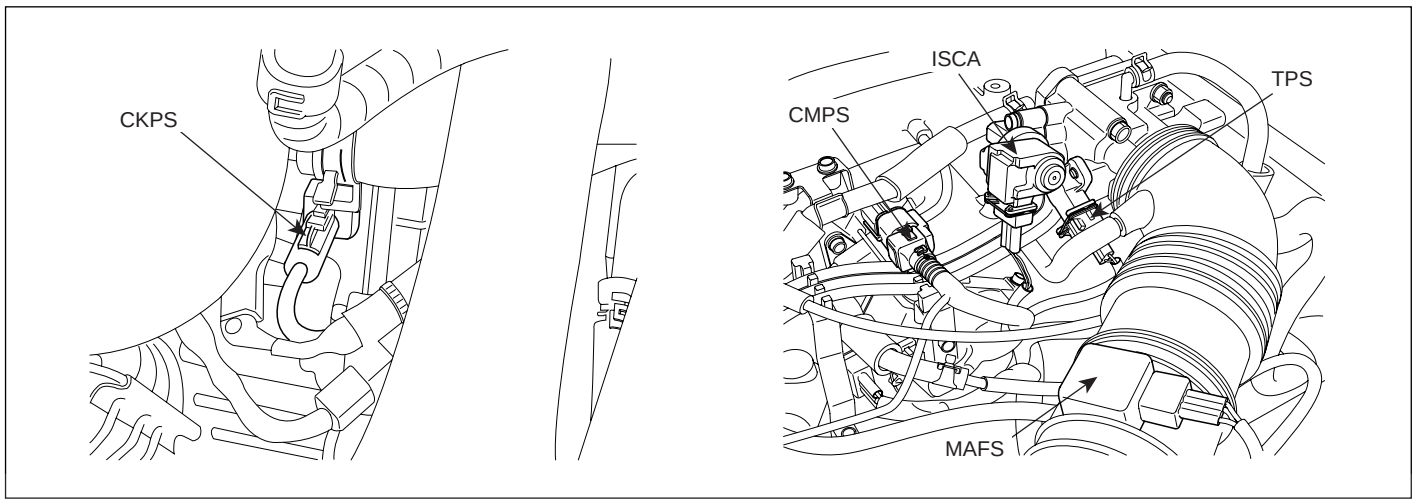
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

BFGE605F

TROUBLESHOOTING FOR DTC E873E6AA

DTC	P1372	Segment Time Acquisition Incorrect

COMPONENT LOCATION



EZOF6025

DESCRIPTION

A misfire induces a decrease in the engine speed and causes a variation in the segment period. Therefore, misfiring detection is based on the observation of this variation of the segment period.

DTC DETECTING CONDITION

1. DTC Description

Because of the tolerance in mechanical machining and assembling process of the target wheel, the duration of each segment are not always same but differ from segment to segment on the same engine. And this irregular segment duration can disturb misfiring detection which is based on the difference of engine rotational speed between the firing and the misfiring cylinder. The ECM compares segment duration of 6 cylinders during fuel cut-off and deceleration period. With this comparison ECM perform segment adaptation to adapt the difference of each segment duration. The ECM sets DTC P1372 if any of segment adaptation value is on the limit.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1372	Detecting Condition • DTC Strategy - Monitor segment time adaptation • Threshold Value - Segment adaptation value is at the limit (= 5/1000)	• Installation of CKPS • Improperly installed target wheel • ECM

INSPECTION PROCEDURE

1. CHECK DTC RELATING TO CKPS

1. Connect Hi-Scan(Pro) to data link connector.
2. Turn ignition switch to ON and monitor DTCs relating to CKPS

Are DTCs relating to CKPS also set?

No

Yes	Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK INSTALLATION OF CKPS AND SENSOR WHEEL

1. Turn ignition switch to OFF and disconnect CKPS connector.
2. Check sensor wheel for damaged teeth, crack, improper installation and measure the clearance between CKPS and sensor wheel with a depth gauge.
3. Check CKPS for loose, bent, corroded, contaminated, deteriorated or damaged connector.
   - **Refer to "Engine Mechanical System".**

Are CKPS and sensor wheel okey?

Yes

No	Repair or replace it.

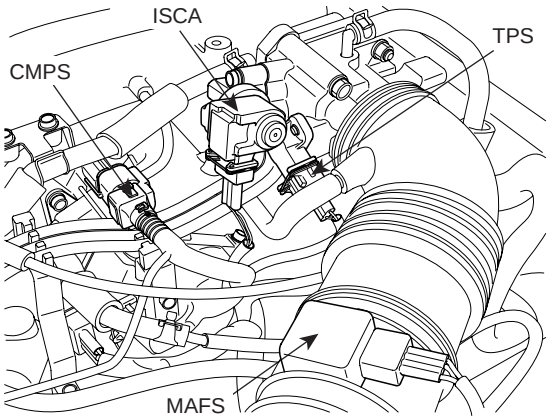
Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6026

TROUBLESHOOTING FOR DTC E6D569E7

DTC	P1505	Idle Charge Actuator Signal Low of Coil #1

COMPONENT LOCATION



EZOF505Y

DESCRIPTION

The Idle Speed Control Actuator (ISCA) is installed on the intake manifold and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle valve is closed. The function of the ISCA is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting. The ISCA consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by pass airflow into the engine.

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P1505 if the ECM detects that the ISCA (OPEN) control line is open or short to ground.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1505	Detecting Condition • DTC Strategy - Criver stage check (Coil #1) • Enable condition - Battery voltage > 10V • Threshold Value - ISCA(Coil #1) control line is open or short to ground for 1second	• Open or short to ground in ISCA circuit • ISCA • ECM

SPECIFICATION

TPS

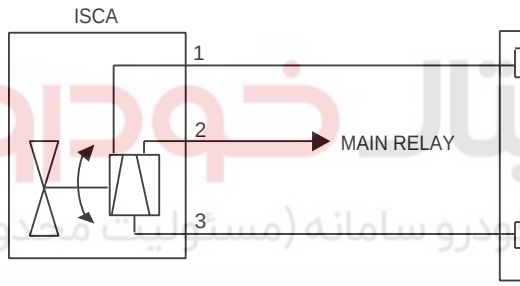
Throttle Position	Output Voltage
C.T (IDLE)	0.2 ~ 0.8 V
W.O.T	4.3 ~ 4.8 V

ISCA

Temperature		ISCA Coil #1 (OPEN) Resistance(Ω)	ISCA Coil #2 (CLOSE) Resistance(Ω)
(°C)	(°F)		
20	68	14.9 ~ 16.1	17.0 ~ 18.2

SCHEMATIC DIAGRAM

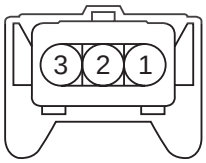
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

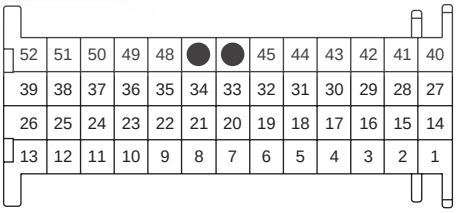
Terminal	Connected to	Function
1	ECM C133-3 (46)	ISCA (OPEN) Control
2	Main Relay	Battery Voltage
3	ECM C133-3 (47)	ISCA (CLOSE) Control

[HARNESS CONNECTORS]



C126

ISCA

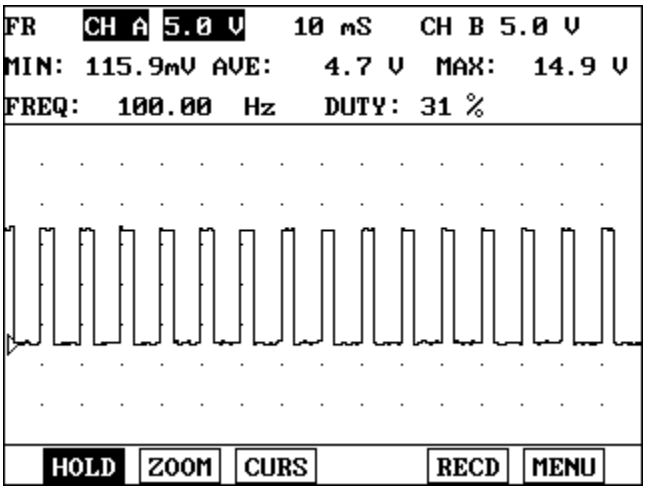


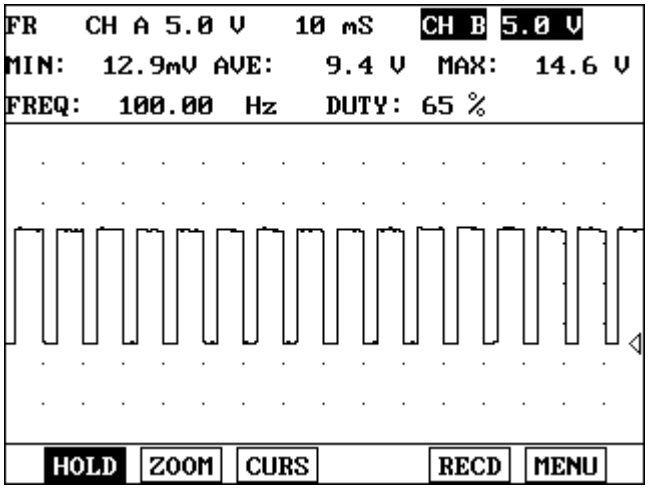
C133-3

ECM

EZOF402O

SIGNAL WAVE FORM





The above waveforms are the voltage signals generated when ISCA operates. This ISCA type is duty type and the time ratio opened determines duty amount. The left side is the waveform of ISCA Opening coil at idle. The right side is the waveform of ISCA Closing coil at idle.

EFAE0352

INSPECTION PROCEDURE

1. CHECK ISCA AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

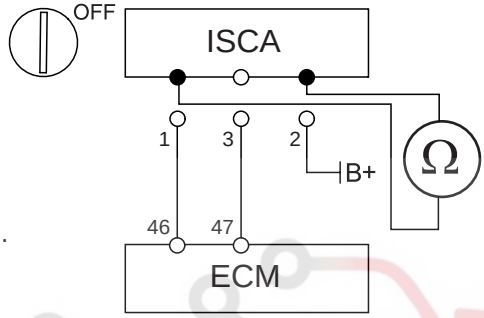
Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK ISCA RESISTANCE

1. Turn ignition switch to OFF position and then disconnect ISCA connector.
2. Measure resistance between terminals 2 and 1 of the ISCA opening coil.
   - **Specification (ISCA resistance):**

Temperature (°C)	Temperature (°F)	ISCA Coil #1 (OPEN) Resistance (Ω)	ISCA Coil #2 (CLOSE) Resistance (Ω)
20	68	14.9 ~ 16.1	17.0 ~ 18.2



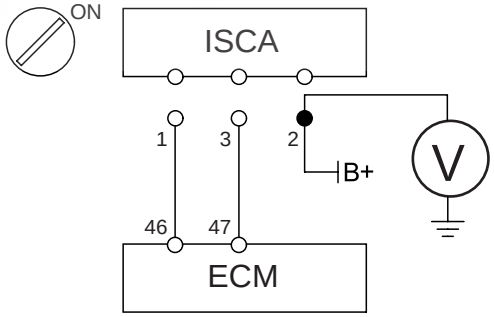
3. Inspect the signal waveform of the ISCA closing coil using a Hi-Scan (Pro).
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Is the resistance within specification?

Yes	
No	Replace ISCA.

3. CHECK POWER TO ISCA

1. Turn ignition switch to OFF position and disconnect ISCA connector.
2. Turn ignition switch to ON position.
3. Measure the voltage between terminal 2 of the ISCA harness connector and chassis ground.
   - **Specification: approximately B+**



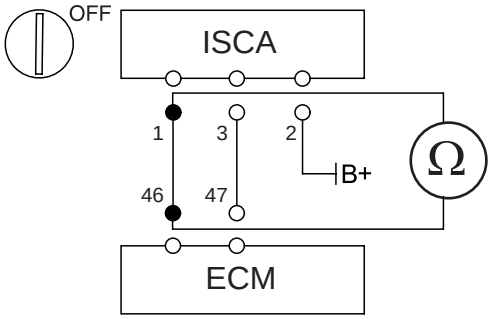
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF605K

4. CHECK FOR OPEN IN HARNESSS

1. Turn ignition to OFF position, and then disconnect ISCA and ECM connector.
2. Measure resistance between terminal 1 of the ISCA harness connector and 46 of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**

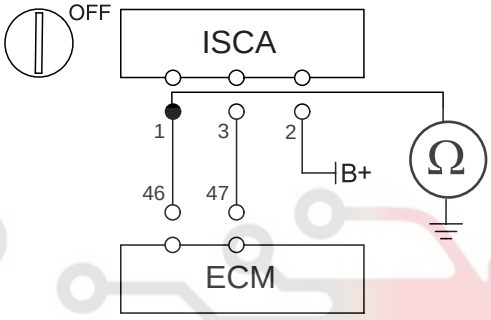


Does the resistance indicate continuity?

Yes		
	No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect ISCA and ECM connector.
2. Measure resistance between terminal 1 of the ISCA harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes		
	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF605L

TROUBLESHOOTING FOR DTC E660EF86

DTC	P1506	Idle Charge Actuator Signal High of Coil #1

DESCRIPTION

Refer to DTC P1505

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P1506 if the ECM detects that the ISCA (OPEN) control line is short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1506	Detecting Condition • DTC Strategy - Driver stage check (Coil #1) • Enable condition - Battery voltage ＞ 10V • Threshold Value - ISCA (Coil #1) control line is short to battey line for 1 second	• Short to battery line in ISCA circuit • ISCA • ECM

SPECIFICATION

Refer to DTC P1505

SCHEMATIC DIAGRAM

Refer to DTC P1505

SIGNAL WAVE FORM

Refer to DTC P1505

INSPECTION PROCEDURE

1. CHECK ISCA AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

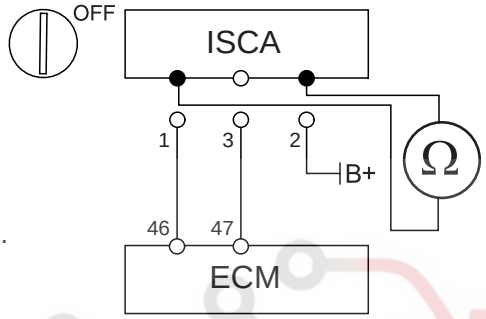
Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK ISCA RESISTANCE

1. Turn ignition switch to OFF position and then disconnect ISCA connector.
2. Measure resistance between terminals 2 and 1 of the ISCA opening coil.
   - **Specification (ISCA resistance):**

Temperature		ISCA Coil #1 (OPEN) Resistance (Ω)	ISCA Coil #2 (CLOSE) Resistance (Ω)
(°C)	(°F)		
20	68	14.9 ~ 16.1	17.0 ~ 18.2



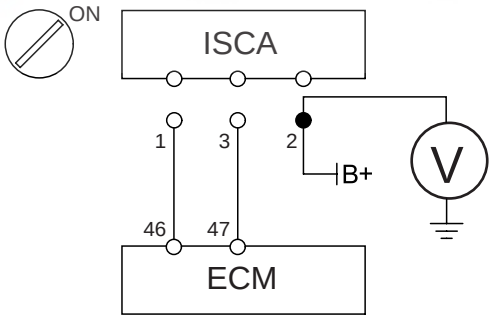
3. Inspect the signal waveform of the ISCA closing coil using a Hi-Scan (Pro).
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Is the resistance within specification?

Yes	
No	Replace ISCA.

3. CHECK POWER TO ISCA

1. Turn ignition switch to OFF position and disconnect ISCA connector.
2. Turn ignition switch to ON position.
3. Measure the voltage between terminal 2 of the ISCA harness connector and chassis ground.
   - **Specification: approximately B+**



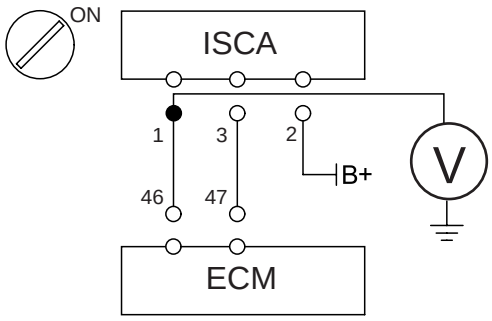
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF605K

4. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position and disconnect ISCA and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 1 of the ISCA harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes		
	No	Repair short to power in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF605M

TROUBLESHOOTING FOR DTC E33FC549

DTC	P1507	Idle Charge Actuator Signal Low of Coil #2

DESCRIPTION

Refer to DTC P1505

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P1507 if the ECM detects that the ISCA (CLOSE) control line is open or short to ground.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1507	Detecting Condition • DTC Strategy - Driver stage check (Coil #2) • Enable condition - Battery voltage ＞ 10V • Threshold Value - ISCA (Coil #2) control line is open or short to ground for 1 second	• Open or short to ground in ISCA circuit • ISCA • ECM

SPECIFICATION

Refer to DTC P1505

SCHEMATIC DIAGRAM

Refer to DTC P1505

SIGNAL WAVE FORM

Refer to DTC P1505

INSPECTION PROCEDURE

1. CHECK ISCA AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

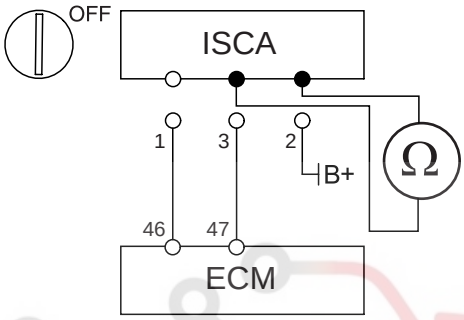
Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK ISCA RESISTANCE

1. Turn ignition switch to OFF position and then disconnect ISCA connector.
2. Measure resistance between terminals 3 and 2 of the ISCA closing coil.
   - **Specification (ISCA resistance):**

Temperature		ISCA Coil #1 (OPEN) Resistance (Ω)	ISCA Coil #2 (CLOSE) Resistance (Ω)
(°C)	(°F)		
20	68	14.9 ~ 16.1	17.0 ~ 18.2



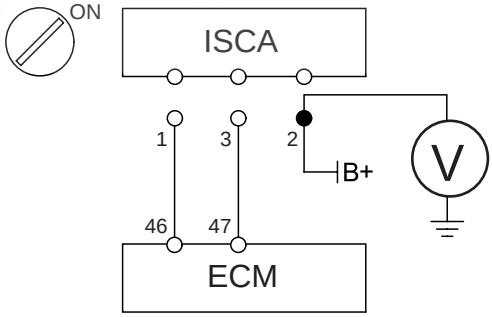
3. Inspect the signal waveform of the ISCA closing coil using a Hi-Scan (Pro).
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Is the resistance within specification?

Yes	
No	Replace ISCA.

3. CHECK POWER TO ISCA

1. Turn ignition switch to OFF position and disconnect ISCA connector.
2. Turn ignition switch to ON position.
3. Measure the voltage between terminal 2 of the ISCA harness connector and chassis ground.
   - **Specification: approximately B+**



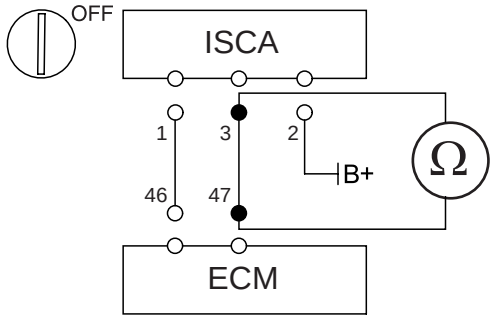
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF605H

4. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect ISCA and ECM connector.
2. Measure resistance between terminal 3 of the ISCA harness connector and 47 of the ECM harness connector (C133-3).
   - **Specification (Resistance): below 1Ω**

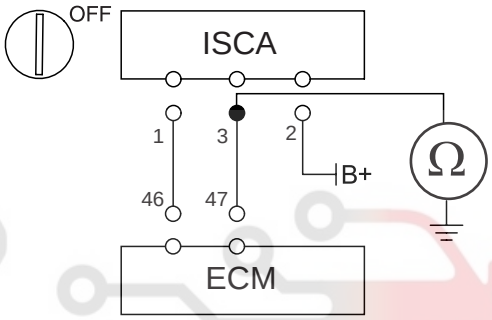


Does the resistance indicate continuity?

Yes		
	No	Repair open in harness.

5. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect ISCA and ECM connector.
2. Measure resistance between terminal 3 of the ISCA harness connector and chassis ground.
   - **Specification (Resistance): infinite**



Does the resistance indicate open?

Yes		
	No	Repair short or short to chassis ground in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF605I

TROUBLESHOOTING FOR DTC E7CE7AB2

DTC	P1508	Idle Charge Actuator Signal High of Coil #2

DESCRIPTION

Refer to DTC P1505

DTC DETECTING CONDITION

1. DTC Description

ECM sets DTC P1508 if the ECM detects that the ISCA (CLOSE) control line is short to battery line.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1508	Detecting Condition • DTC Strategy - Driver stage check • Enable condition - Battery voltage ＞ 10V • Threshold Value - ISCA (Coil #2) control line is short to battery line for 1 second	• Short to battery line in ISCA circuit • ISCA • ECM

SPECIFICATION

Refer to DTC P1505

SCHEMATIC DIAGRAM

Refer to DTC P1505

SIGNAL WAVE FORM

Refer to DTC P1505

INSPECTION PROCEDURE

1. CHECK ISCA AND ECM CONNECTORS

1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to "CONNECTOR INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.**

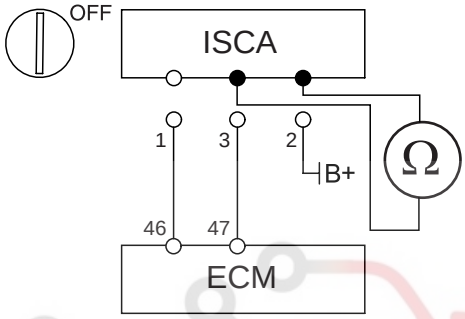
Are all connectors good?

Yes	
No	Repair or replace it.

2. CHECK ISCA RESISTANCE

1. Turn ignition switch to OFF position and then disconnect ISCA connector.
2. Measure resistance between terminals 3 and 2 of the ISCA closing coil.
   - **Specification (ISCA resistance):**

Temperature (°C)	Temperature (°F)	ISCA Coil #1 (OPEN) Resistance (Ω)	ISCA Coil #2 (CLOSE) Resistance (Ω)
20	68	14.9 ~ 16.1	17.0 ~ 18.2



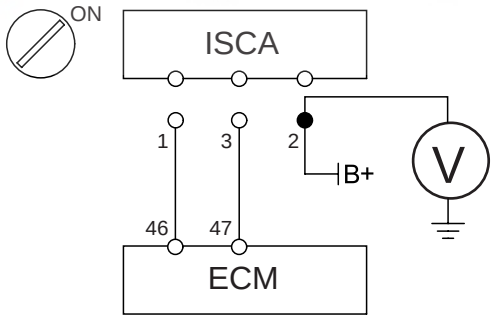
3. Inspect the signal waveform of the ISCA closing coil using a Hi-Scan (Pro).
   - **Refer to "SIGNAL WAVEFORM" for more information.**

Is the resistance within specification?

Yes	
No	Replace ISCA.

3. CHECK POWER TO ISCA

1. Turn ignition switch to OFF position and disconnect ISCA connector.
2. Turn ignition switch to ON position.
3. Measure the voltage between terminal 2 of the ISCA harness connector and chassis ground.
   - **Specification: approximately B+**



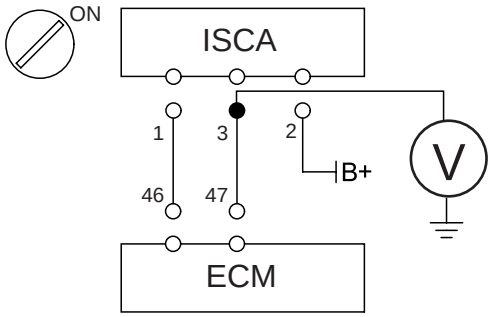
Is voltage within specification?

Yes	
No	Repair open or short to chassis ground in harness.

EZOF605H

4. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position and disconnect ISCA and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 3 of the ISCA harness connector and chassis ground.
   - **Specification (Voltage): below 0.5V**



Is voltage within specification?

Yes	No	Repair short to power in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF605J

TROUBLESHOOTING FOR DTC ECC3DFFB

DTC	P1529	TCM Request for MIL ON / Freeze frame to ECM via CAN

DESCRIPTION

A communication line exists between the Engine Control Module (ECM) and the Transaxle Control Module (TCM). The sole purpose of this communication line is for the TCM to notify the ECM to activate the Malfunction Indicator Lamp (MIL) when a serious transaxle failure has occurred.

DTC DETECTING CONDITION

1. DTC Description

The ECM illuminates the MIL and sets DTC P1529 if TCM requests "MIL ON" via CAN.
This error code determines diagnostic failure at TCM side.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1529	Detecting Condition • DTC Strategy - MIL ON request from TCM • Enable condition - None • Threshold Value - MIL is requested by TCM	• Transaxle system

INSPECTION PROCEDURE

- This is only a request from the TCM to turn the MIL ON. The fault code is stored in the TCM. The freeze frame data is stored in the ECM under the P1529 request code. Be sure to retrieve the freeze frame data before clearing code P1529 from the ECM.
- Check the transaxle system.

TROUBLESHOOTING FOR DTC E347D9F1

DTC	P1602	CAN Communication BUS with TCM (Timeout)

DESCRIPTION

A communication line exists between the Engine Control Module(ECM) and the Transaxle Control Module(TCM). The communication is through a Control Area Network(CAN). Without CAN communication, an independent pin and wiring is needed to receive a sensor information from a ECM. The more information to be communicated, the more wirings is required. In case of CAN communication type, all the information need to be communicated among control modules such as ECM and TCM use CAN lines.

DTC DETECTING CONDITION

1. DTC Description
The ECM sets DTC P1602 if the message from the TCM is missed.

2. Conditions for Setting the DTC

DTC	Detecting Condition & Limp Home	Possible Cause
P1602	Detecting Condition • DTC Strategy - Missing messages from TCM • Enable condition - Battery voltage > 10V - Engine speed > 256 rpm • Threshoold Value - Time(0.5 sec) exceeded without message for 1 second	• Open or short in CAN communication line • ECM

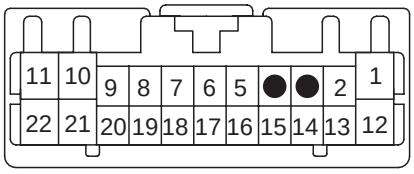
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

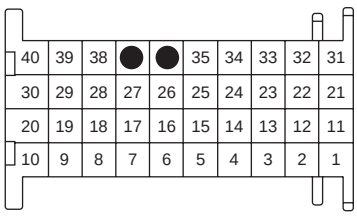
[CONNECTION INFORMATION]

Terminal	Connected to	Function
3	ECM C133-4 (36)	CAN LOW
4	ECM C133-4 (37)	CAN HIGH

[HARNESS CONNECTORS]



C136-3
IATS



C133-4
ECM

EZOF6027

INSPECTION PROCEDURE

1. CHECK TCM AND ECM CONNECTORS

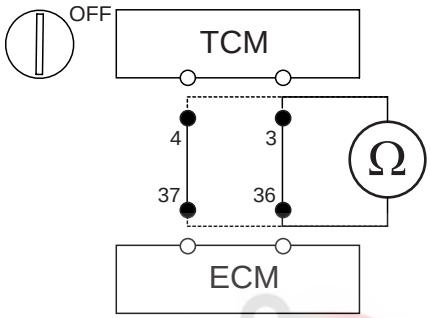
1. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
   - **Refer to ""CONNECTOR INSPECTION PROCEDURE"" in BASIC INSPECTION PROCEDURE."**

Are all connectors good?

Yes	No	Replace TCM.

2. CHECK FOR OPEN IN HARNESS

1. Turn ignition to OFF position, and then disconnect TCM and ECM connector.
2. Measure resistance between terminal 4 of the TCM harness connector (C136-3) and 37 of the ECM harness connector (C133-4).
3. Measure resistance between terminal 3 of the TCM harness connector (C136-3) and 36 of the ECM harness connector (C133-4).
   - **Specification (Resistance): below 1Ω**

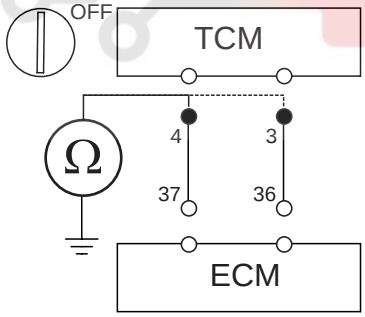


Does each resistance indicate continuity?

Yes	No	Repair open in harness.

3. CHECK FOR SHORT TO GROUND IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect TCM and ECM connectors.
2. Measure resistance between terminal 4 of the TCM harness connector (C136-3) and chassis ground.
3. Measure resistance between terminal 3 of the TCM harness connector (C136-3) and chassis ground.
   - **Specification (Resistance): infinite"**



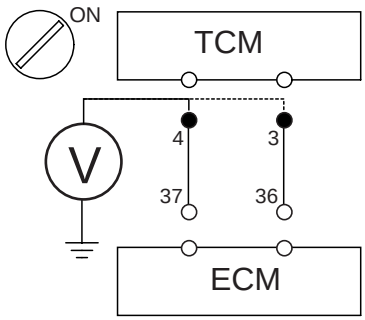
Does each resistance indicate open?

Yes	No	Repair short in harness or short to chassis ground.

EZOF6028

4. CHECK FOR SHORT TO POWER IN HARNESS

1. Turn ignition switch to OFF position, and then disconnect TCM and ECM connectors.
2. Turn ignition switch to ON position.
3. Measure voltage between terminal 4 of the TCM harness connector (C136-3) and chassis ground.
4. Measure voltage between terminal 3 of the TCM harness connector (C136-3) and chassis ground.
   - **Specification (Voltage): below 0.5V"**



Is voltage within specification?

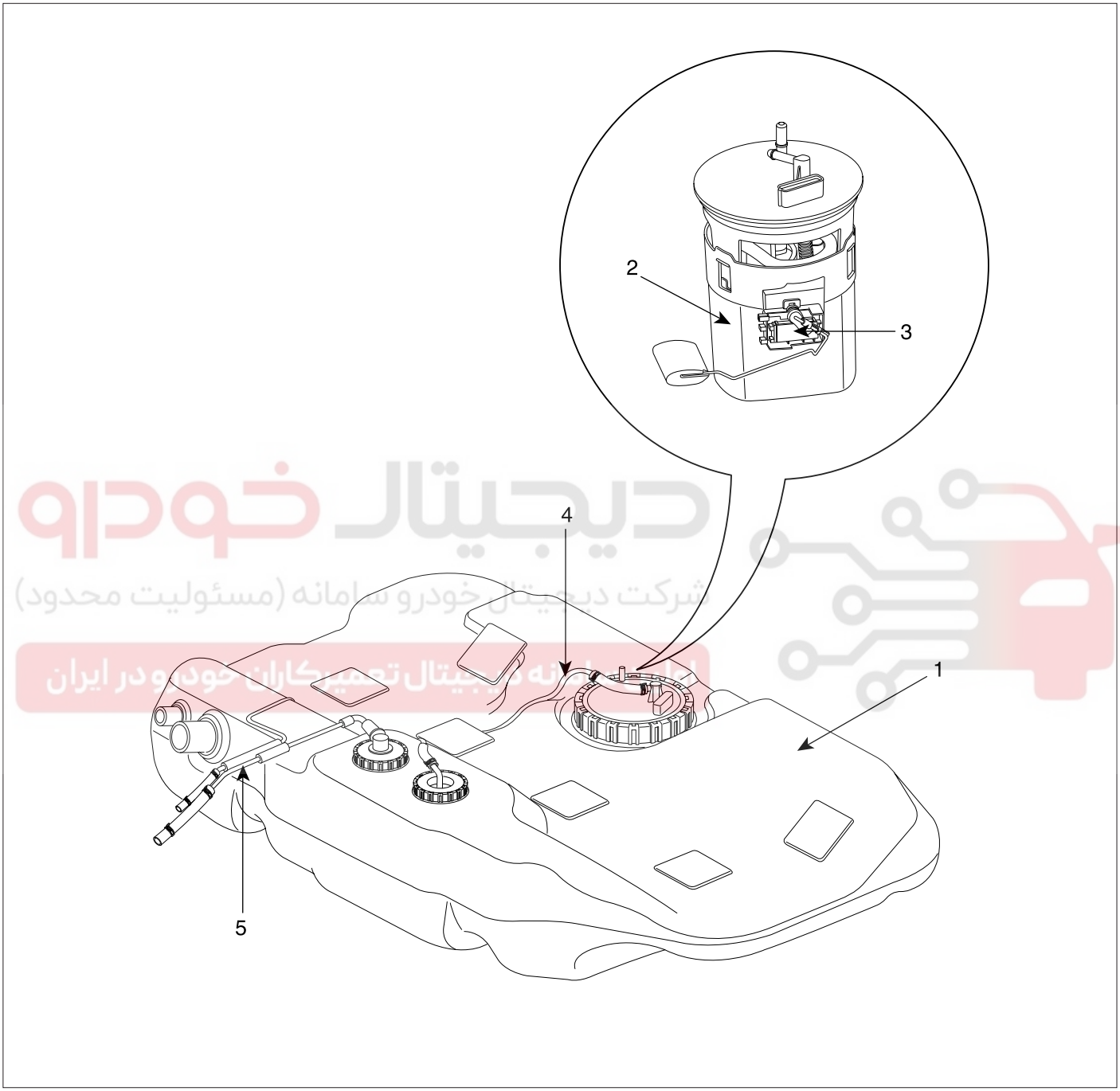
Yes		
	No	Repair short to power in harness.

Proceed with "ECM PROBLEM INSPECTION PROCEDURE" in BASIC INSPECTION PROCEDURE.

EZOF6029

FUEL DELIVERY SYSTEM

COMPONENTS LOCATION ED65A2C7



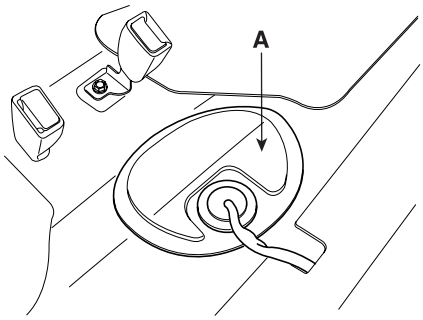
1. Fuel Tank
2. Fuel Pump (Including Fuel Filter and Fuel Pressure Regulator)
3. Fuel Sender
4. Hose - Suction
5. Hose - Canister

EWOF008B

FUEL PRESSURE TEST EECECC8E

1. PREPARING

1. Remove the rear seat cushion (Refer to ""BD"" group in this SHOP MANUAL).
2. Open the service cover (A) under the rear seat cushion.

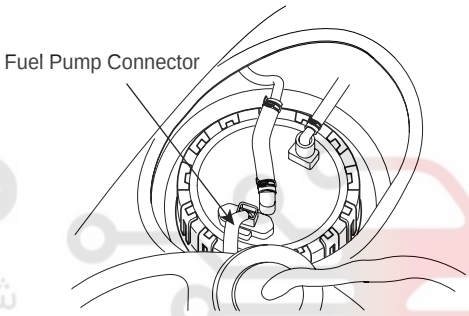


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector.
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



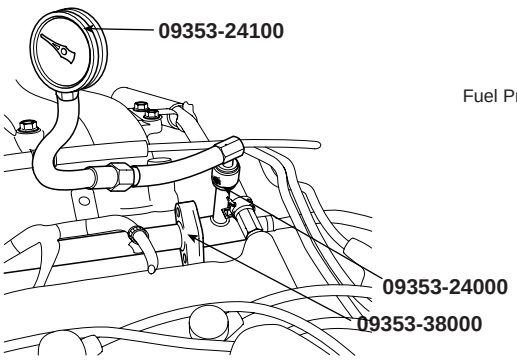
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

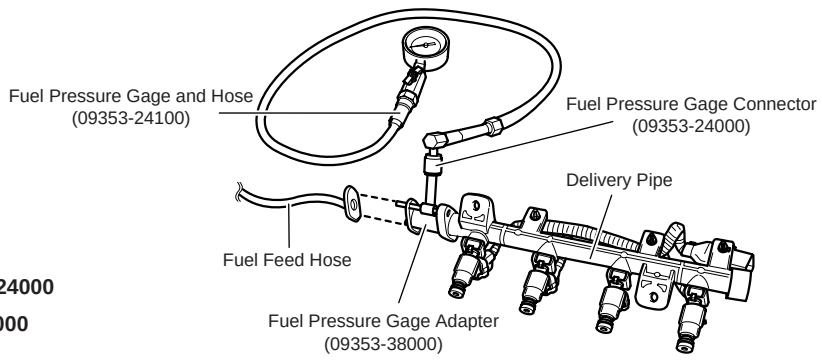
1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gage Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gage Connector (09353-24000) to the Fuel Pressure Gage Adapter (09353-38000).
4. Connect the Fuel Pressure Gage and Hose (09353-24100) to Fuel Pressure Gage Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gage Adapter (09353-38000).





EZOF008I

4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESURE TEST

1. Diconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 350 kpa (3.5 kg/㎠, 49.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gage reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gage reading drops and perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

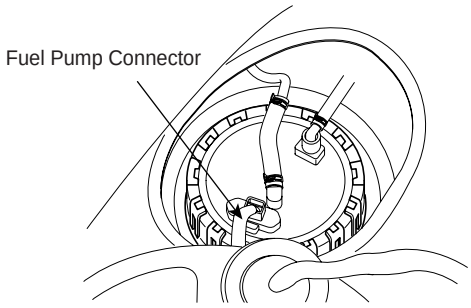
EWOF008Z

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector.
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

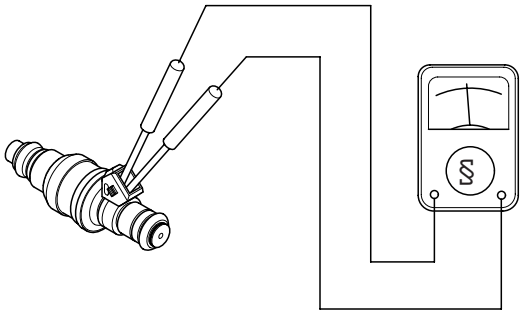
1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

EWOF008K

FUEL INJECTOR

INSPECTION E6C3CF1D

1. Measure resistance between the terminal 1 and 2 of the injector.



BFGE502Q

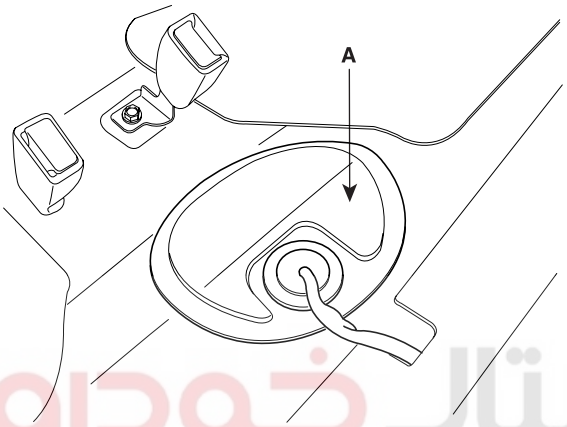
Specification (Resistance): 13.8 ~ 15.2Ω at 20°C (68°F)

2. If the resistance is not within specification, replace the injector.

FUEL PUMP (FP)

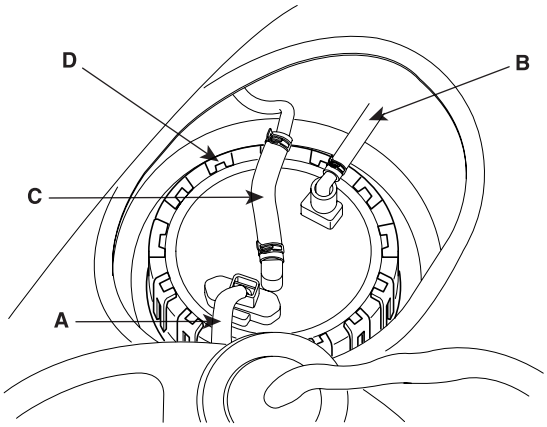
REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) E2AC6DE7

1. Remove the rear seat cushion (Refer to "BD" group in this SHOP MANUAL).
2. Open the service cover (A) under the rear seat cushion.



EWOF008C

3. Release the internal pressure of the fuel lines and hoses as following:
   a. Disconnect the fuel pump assembly harness connector (A).
   b. Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, turn the ignition switch to OFF position.
   c. Disconnect the negative (-) terminal from the battery.



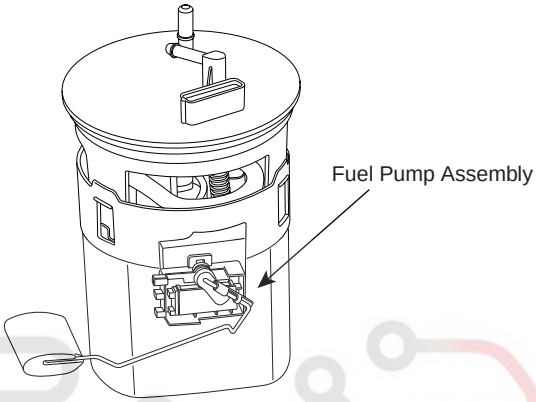
EWOF008D

4. Disconnect the fuel feed line (B) and the suction hose(C).

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line

5. Unfasten the fuel pump cap (D) counterclockwise.
6. Remove the fuel pump assembly.

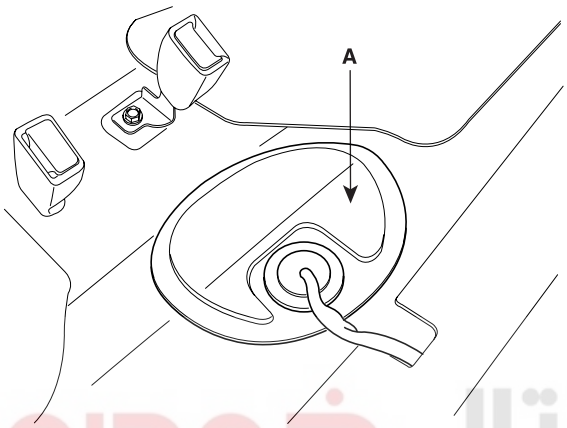


EWOF008E

FUEL TANK

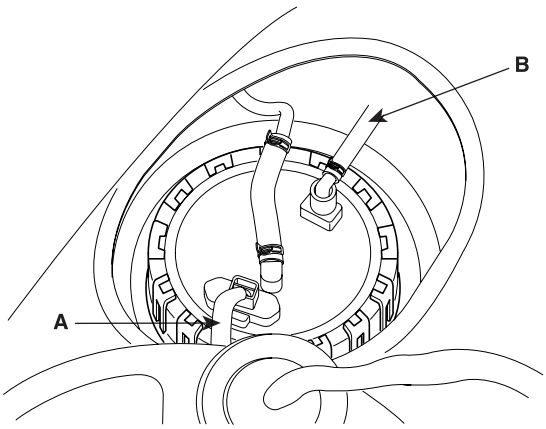
REMOVAL E8956AD8

1. Remove the rear seat cushion (Refer to " BD" group in this SHOP MANUAL).
2. Open the service cover (A) under the rear seat cushion.



EWOF008C

3. Release the internal pressure of the fuel lines and hoses as following:
   a. Disconnect the fuel pump assembly harness connector (A).
   b. Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, turn the ignition switch to OFF position.
   c. Disconnect the negative (-) terminal from the battery.



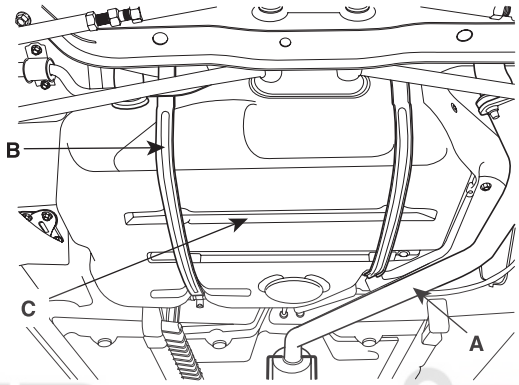
EWOF008F

4. Disconnect the fuel feed line (B).

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line

5. Lift the vehicle.
6. Remove the muffler (A) (Refer to "EM" group in this SHOP MANUAL).



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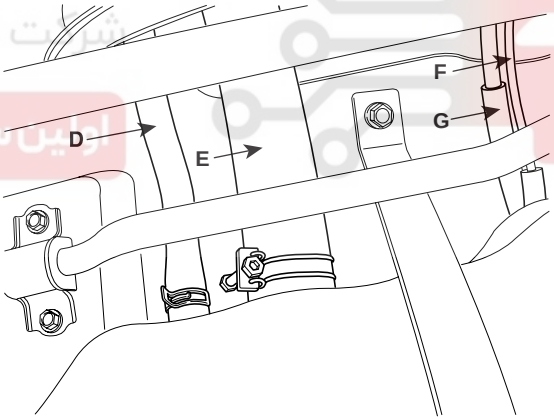

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7. Disconnect the leveling hose (D), the fuel filler hose (E) and the vaccum hoses (F,G)

NOTE

When disconnecting the vaccum hose (D), also release the connection point in front of the fuel tank.

8. Support the fuel tank with lifter.
9. Remove the fuel tank band (B) and remove the fuel tank (C).