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Fuel System (G6BA-GSL 2.7)

GENERAL

GASOLINE ENGINE CONTROL SYSTEM
ENGINE CONTROL MODULE (ECM)

DTC TROUBLESHOOTING PROCEDURES

FUEL DELIVERY SYSTEM
FUEL INJECTOR
FUEL PUMP (FP)
FUEL TANK
SUB FUEL SENDER

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GENERAL

SPECIFICATIONS ECA09D9E

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	65 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	343 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: about 0.5V	
			3000 rpm: about 1.0V	
	Intake Air Temperature Sensor (IATS)	Type	Thermistor type (built in MAFS)	
		Resistance	-40°C(-40°F)	45.3 kΩ
			-10°C(14°F)	9.2 kΩ
			20°C(68°F)	2.5 kΩ
			80°C(176°F)	0.33 kΩ
			130°C(256°F)	0.09 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

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SENSORS	Throttle Position Sensor (TPS)	Type	Variable Resistor Type	
		Resistance	1.6 ~ 2.4 kΩ	
		Output Voltage	C.T	0.25 ~ 0.8V
			W.O.T	4.25 ~ 4.7V
	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℃)
	Intake Manifold Tuning Valve #1 (Surge Tank Side)	Coil Resistance	29.0 ~ 35.0 Ω at 20℃	
	Intake Manifold Tuning Valve #2 (Intake Manifold Side)	Coil Resistance	29.0 ~ 35.0 Ω at 20℃	
	Ignition Coil	Type	Mold Coil type	
		Primary Coil	0.74±10% Ω	
		Secondary Coil	13.3±15% kΩ	

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SEALANTS EDC742B1

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

SERVICE STANDARD

Basic Idle rpm (After warm up)	A/C OFF	700±100 rpm
	A/C ON	750±100 rpm
Ignition Timing(After warm up, at idle)	BTDC 12°±5°	

TIGHTENING TORQUES

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 connector bracket 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
Intake air temperature sensor installation	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
Throttle position sensor installation screws	1.0 ~ 2.5	0.15 ~ 0.25	0.7 ~ 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	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Fuel tank mounting nut	39.2 ~ 54.0	4.0 ~ 5.5	28.9 ~ 39.8

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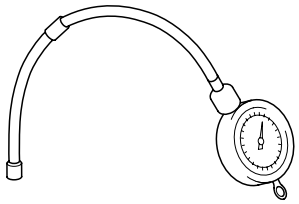
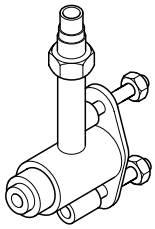
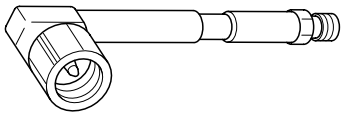
SPECIAL SERVICE TOOLS E2ABBAC7

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)

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BASIC TROUBLESHOOTING EF443BBD

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	Confirmation 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

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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.

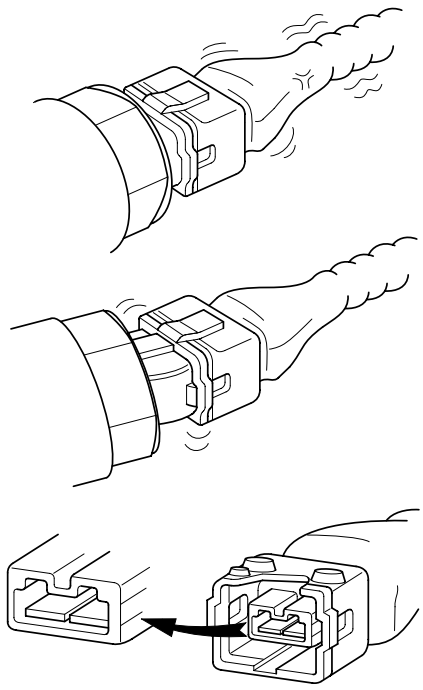
NOTE

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.).

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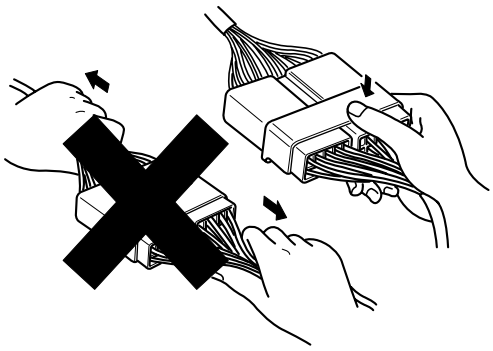
CONNECTOR INSPECTION PROCEDURE

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



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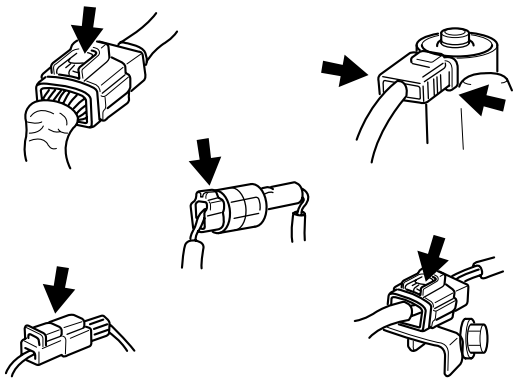
   b. When removing the connector with a lock, press or pull locking lever.



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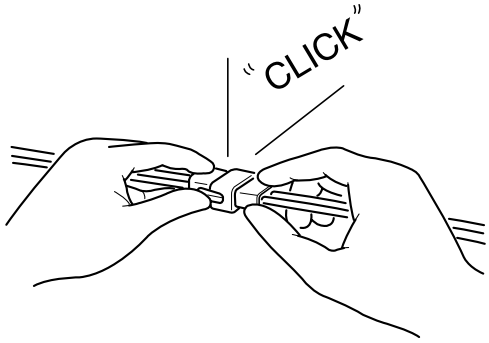
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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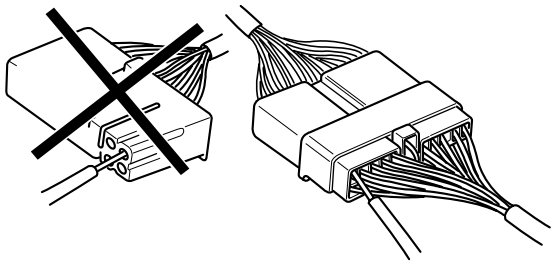
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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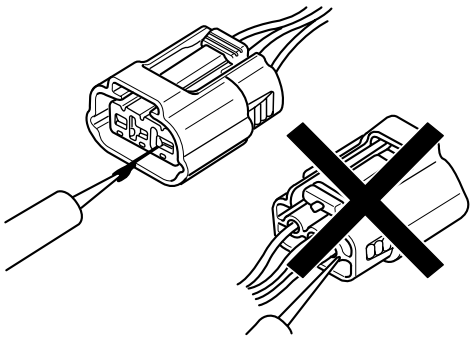
   e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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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.

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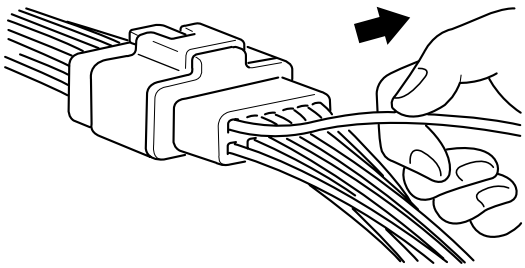
d. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



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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.

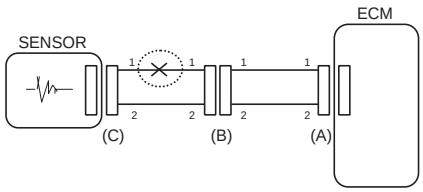
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● 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

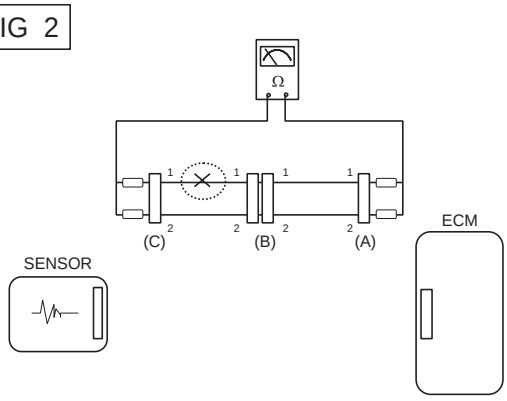
When measuring for resistance, lightly shake the wire harness above and below or from side to side.

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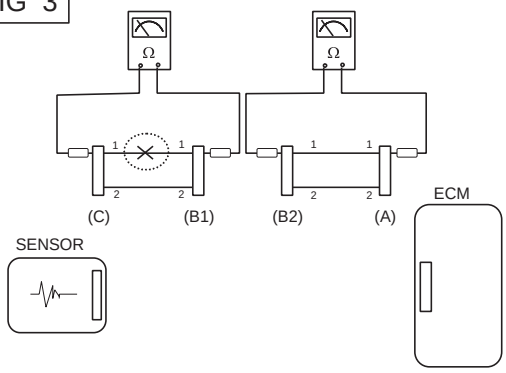
b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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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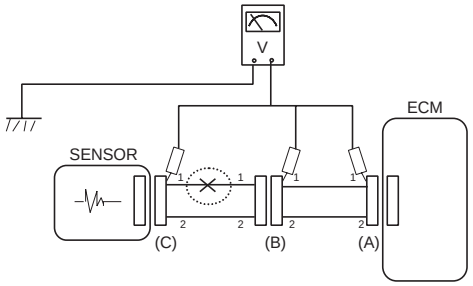
3. Voltage Check Method

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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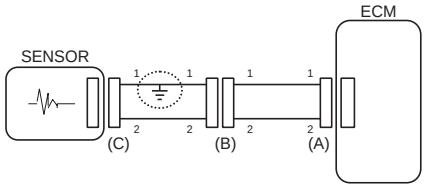
● CHECK SHORT CIRCUIT

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

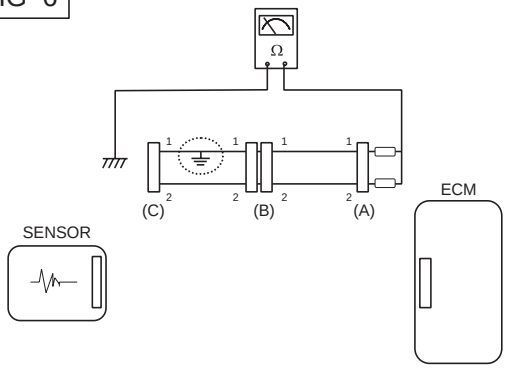
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

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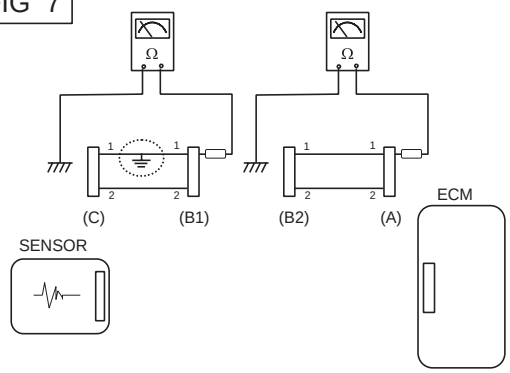
b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

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

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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)

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GASOLINE ENGINE CONTROL SYSTEM

DESCRIPTION ECCD29DE

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]

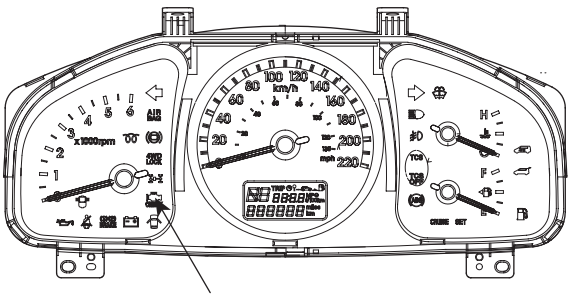
A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start),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



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[NON-EOBD]

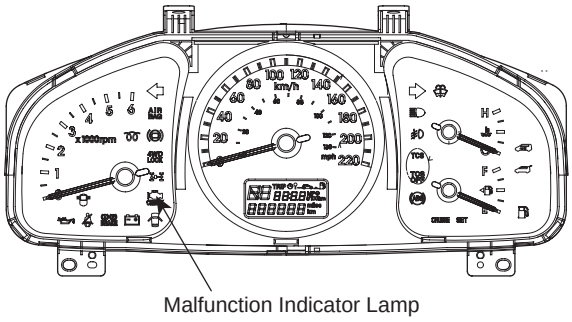
A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start),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



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[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.

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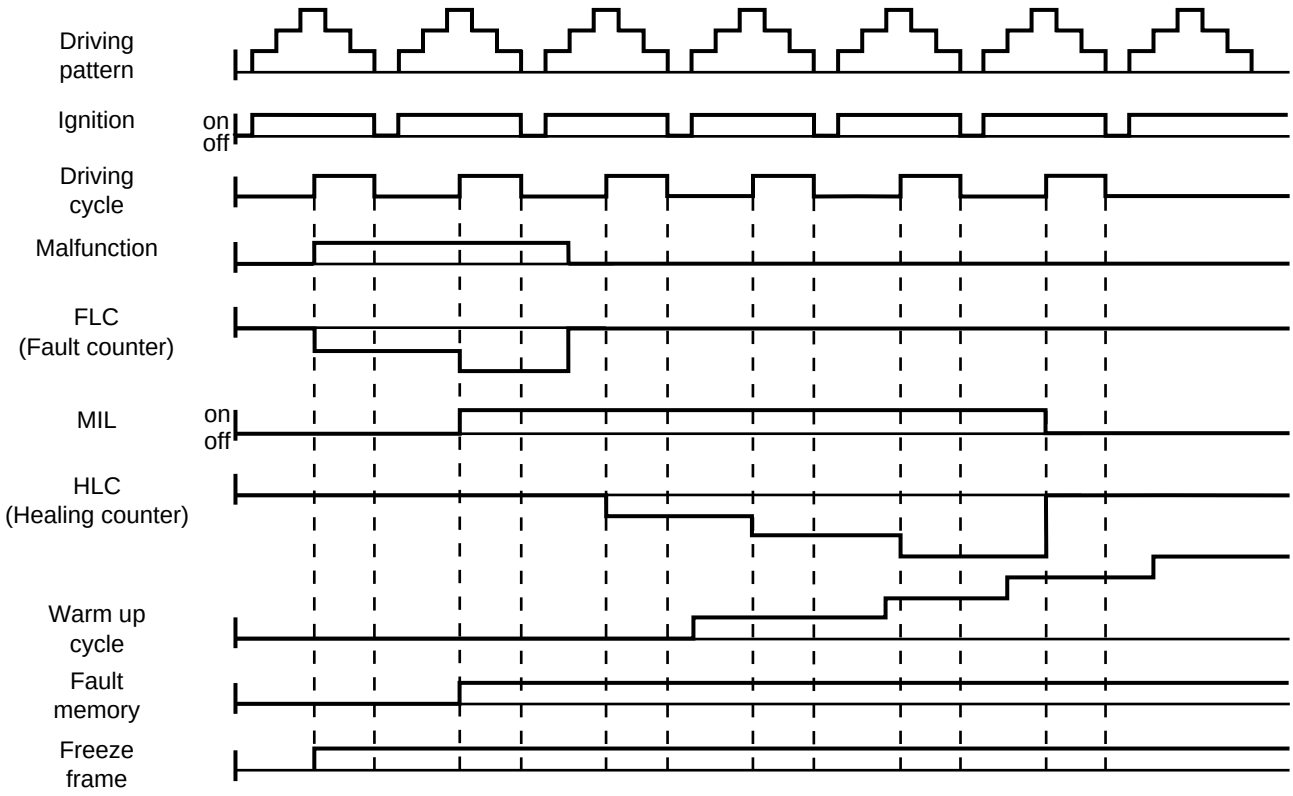
THE RELATION BETWEEN DTC AND DRIVING PATTERN IN EOBD SYSTEM



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.*

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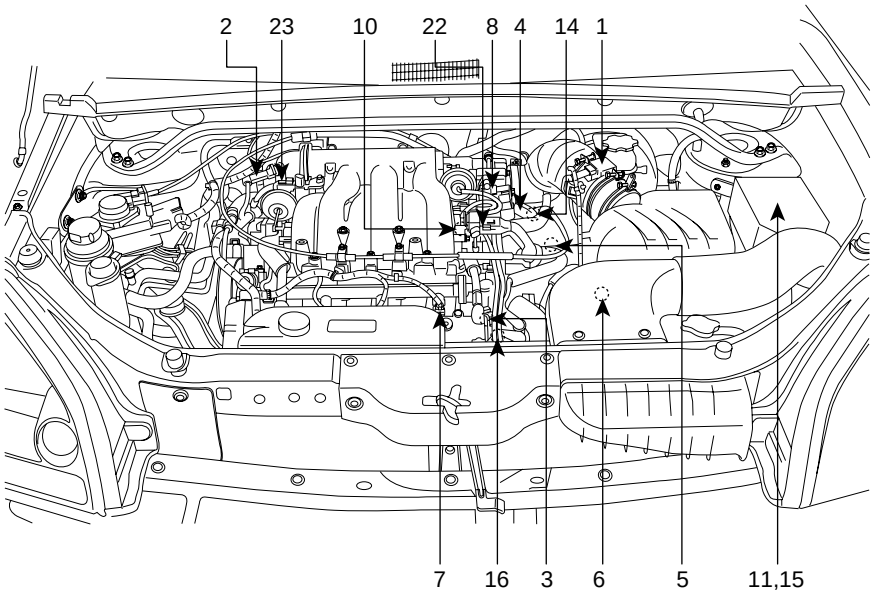
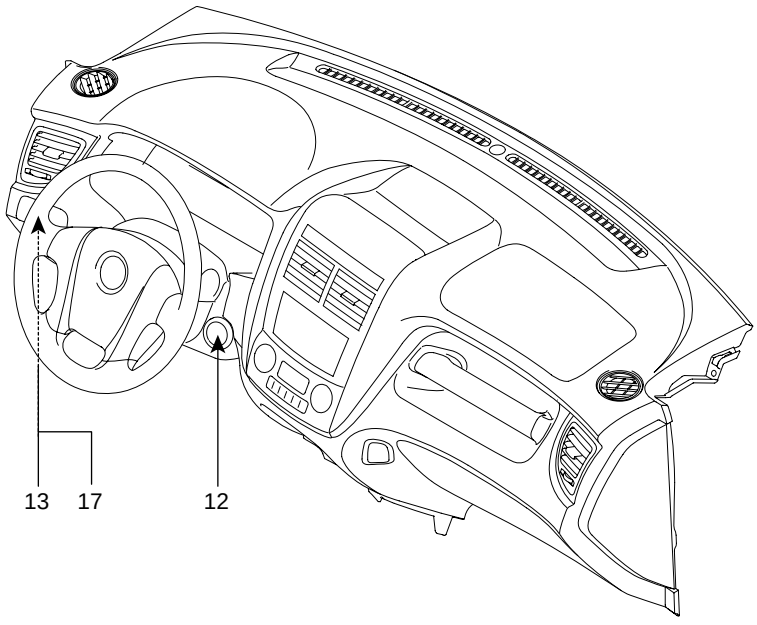
COMPONENTS LOCATION E1FC4AFA





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. Injector
8. Idle Speed Control Actuator (ISCA)
9. Vehicle Speed Sensor (VSS)
10. Knock Sensor
11. Fuel Pump Relay
12. Ignition Switch
13. ECM
14. Purge Control Solenoid Valve (PCSV)
15. Main Relay
16. Ignition Coil
17. DLC (Diagnostic Link Connector)
18. Heated Oxygen Sensor (Bank1, Sensor1)
19. Heated Oxygen seneor (Bank1, Sensor2)
20. Heated Oxygen seneor (Bank2, Sensor1)
21. Heated Oxygen seneor (Bank2, Sensor2)
22. Intake Manifold Tuning Valve #1 (Surge Tank Side)
23. Intake Manifold Tuning Valve #1 (Intake Manifold Side)

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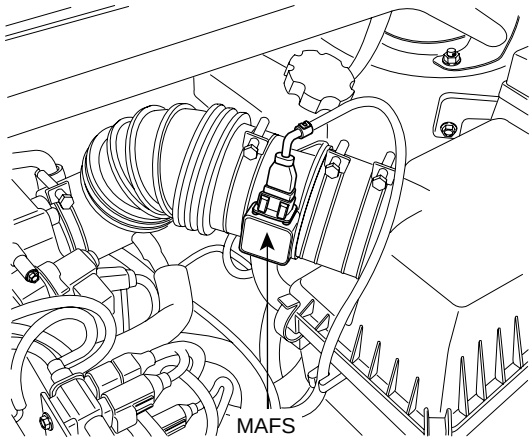
1. Mass Air Flow Sensor (MAFS)



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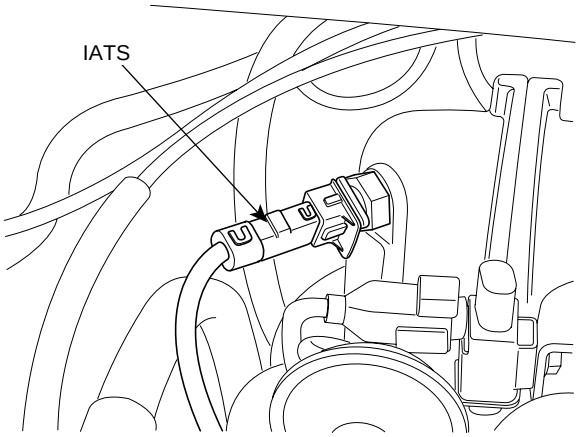
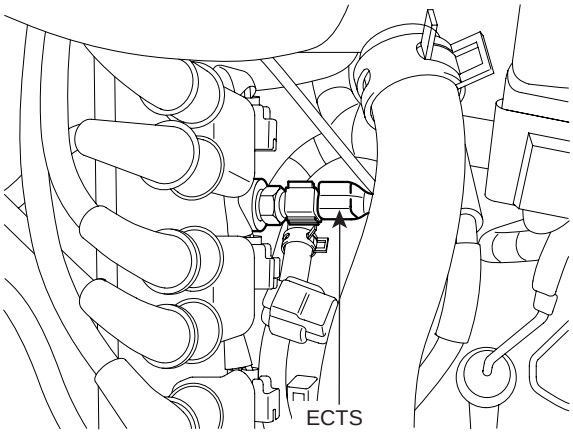
2. Intake Air Temperature Sensor (IATS)



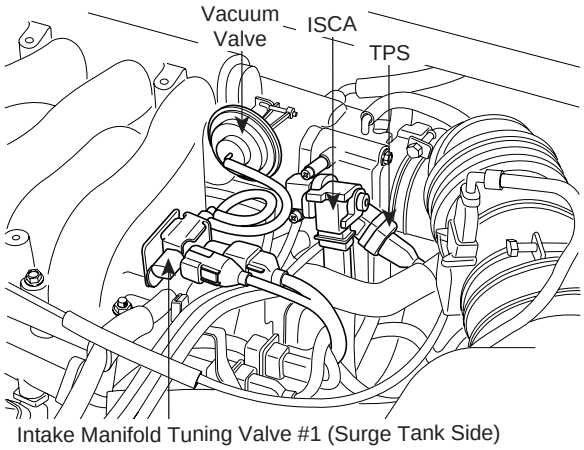
LWIF550A

3. Engine Coolant Temperature Sensor (ECTS)



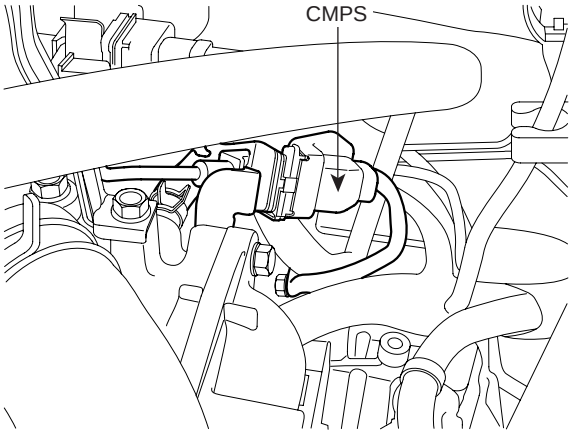
LWIF501G

4. Throttle Position Sensor (TPS)
8. Idle Speed Control Actuator (ISCA)
22. Intake Manifold Tuning Valve #1 (Surge Tank Side)



LWIF502I

5. Camshaft Position Sensor (CMPS)



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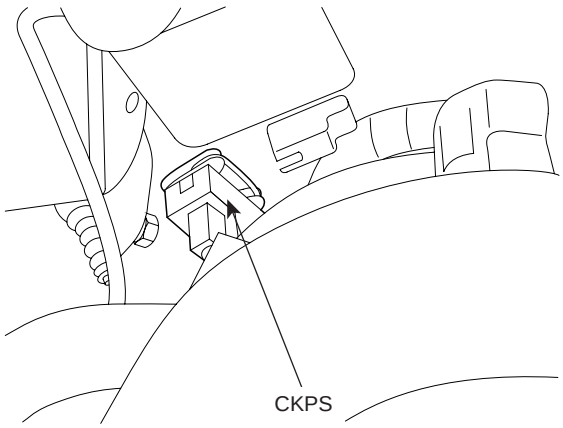
6. Crankshaft Position Sensor (CKPS)



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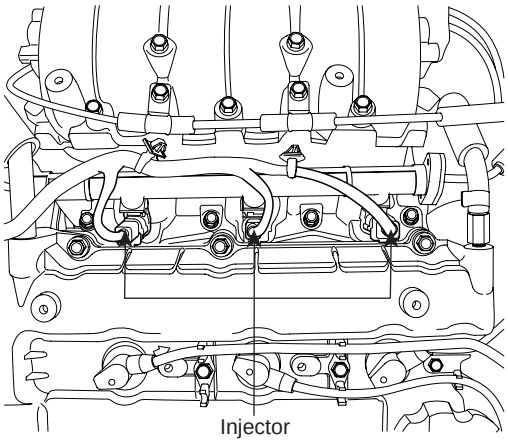
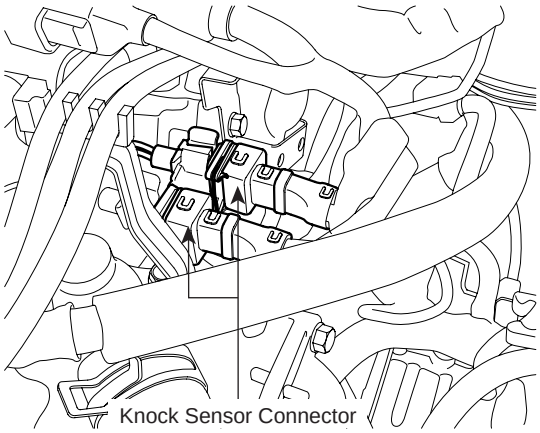
7.Injector



LWIF550F

10. Knock Sensor



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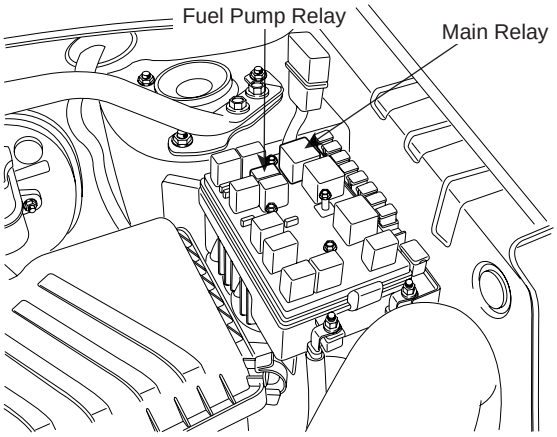
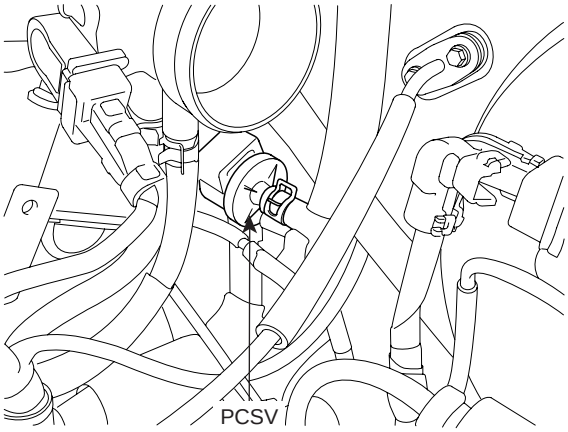
11. Fuel Pump Relay
15. Main Relay



LWIF550H

14. Purge Control Solenoid Valve (PCSV)



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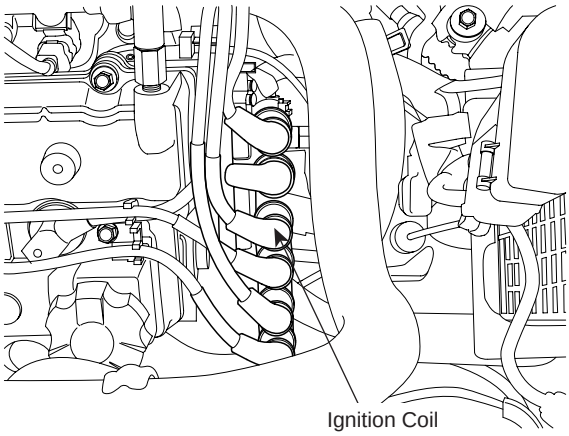
16. Ignition Coil



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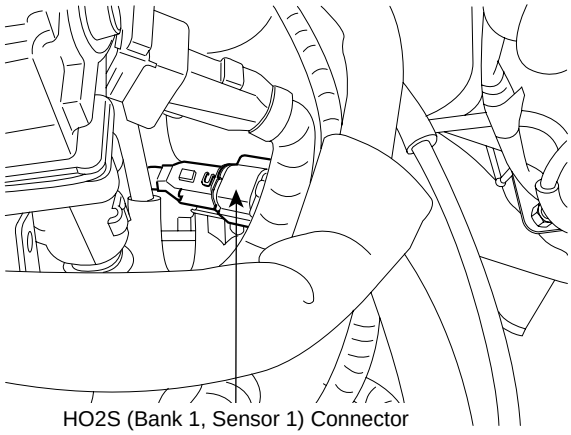
18. Heated Oxygen Sensor (Bank 1, Sensor 1)



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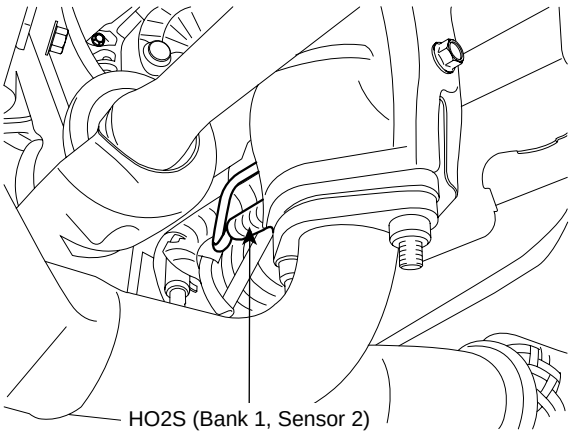
19. Heated Oxygen Sensor (Bank 1, Sensor 2)



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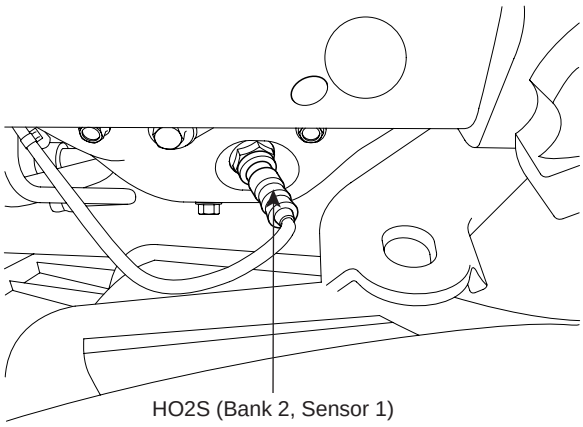
20. Heated Oxygen Sensor (Bank 2, Sensor 1)



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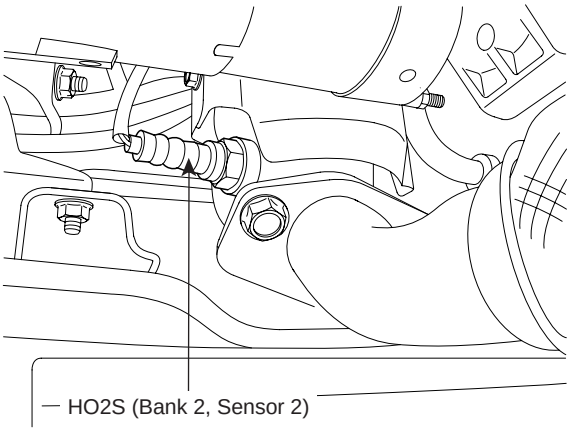
21. Heated Oxygen Sensor (Bank 2, Sensor 2)



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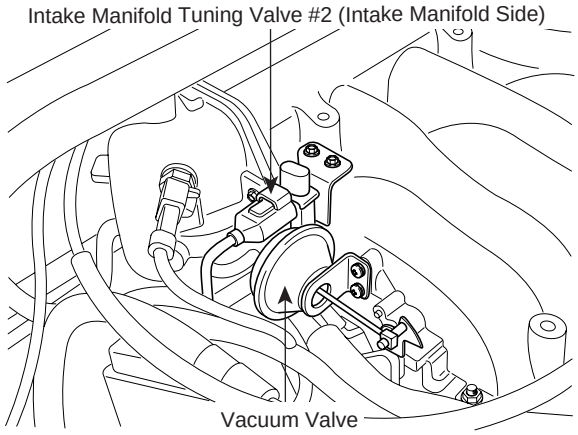
23. Intake Manifold Tuning Valve #2 (Intake Manifold Side)



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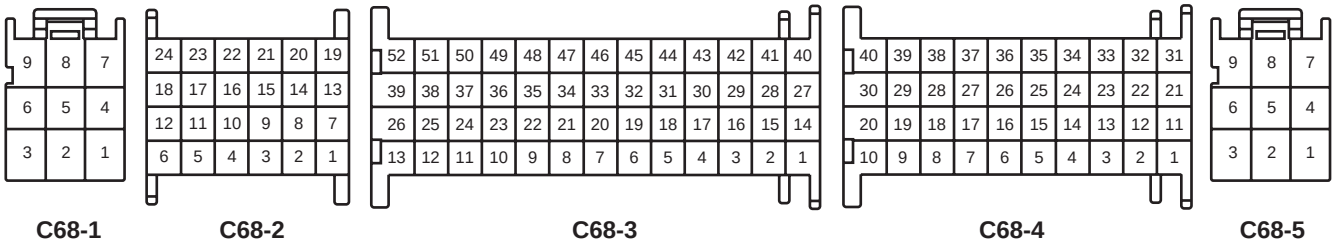
ENGINE CONTROL MODULE (ECM)

ENGINE CONTROL MODULE (ECM) EBA5B36B

1. ECM HARNESS CONNECTOR



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2. ECM TERMINAL FUNCTION

CONNECTOR [C68-1]

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 [C68-2]

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 ONLY
8	Not connected		
9	Not connected		
10	Not connected		
11	Not connected		

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Pin No.	Description	Connected to	Remark
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 ONLY
17	Fuel Consumption signal output	Trip Computer	
18	Heated Oxygen Sensor (B2/S2) signal input	Heated Oxygen Sensor (B2/S2)	EURO-III/IV ONLY
19	Heated Oxygen Sensor (B2/S2) Heater control	Heated Oxygen Sensor (B2/S2)	EURO-III/IV ONLY
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 ONLY
23	Main Relay control output	Main Relay	
24	Heated Oxygen Sensor (B2/S2) ground	Heated Oxygen Sensor (B2/S2)	EURO-III/IV ONLY

CONNECTOR [C68-3]

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		
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)	

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Pin No.	Description	Connected to	Remark
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	Intake Manifold Tuning Valve #1 (Surge Tank Side) control output	Intake Manifold Tuning Valve #1 (Surge Tank Side)	
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	Intake Manifold Tuning Valve #2 (In-mani Side) control output	Intake Manifold Tuning Valve #2 (In-mani Side)]	

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CONNECTOR [C68-4]

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 - CHINA - LEAD
		ABS Control Module	- EURO-III/IV With ABS - JAPAN With ABS
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		

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Pin No.	Description	Connected to	Remark
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
39	Wheel Speed Sensor (WSS) signal input	Wheel Speed Sensor (WSS)	
40	Cooling Fan Relay [High] control output	Cooling Fan Relay	

CONNECTOR [C68-5]

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		

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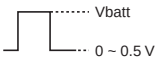
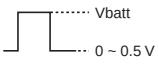
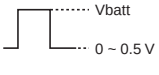
3. ECM TERMINAL INPUT/OUTPUT SIGNAL

CONNECTOR [C68-1]

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 [C68-2]

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				

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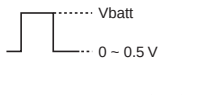
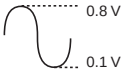
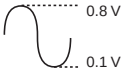
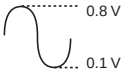
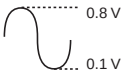
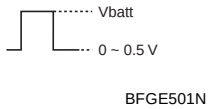
Pin	Description	Type	Vehicle State	Level	Test Result
12	Not connected				
13	Heated Oxygen Sensor (B2/S1) Heater control	PWM	Engine Run	 BFGE501N Freq. : 10Hz	14.24V 400mV 10.0Hz
14	Heated Oxygen Sensor (B1/S1) signal input	Pulse	3000 rpm after warm up	 BFGE501R Freq. : 1.1Hz	0.8V 100mV 1.33Hz
15	Heated 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	0.8V 100mV -Hz
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

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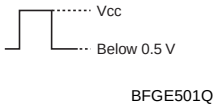
CONNECTOR [C68-3]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Mass Air Flow Sensor signal input	Analog	Idle	0.5V	663mV
			2000 rpm	1.0V	1.54V
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			
			Idle	Idle: 600~900Hz	705.94Hz
			3000 rpm	3000rpm: 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	0.25 ~ 0.8V	304mV
			W.O.T	4.25 ~ 4.7V	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	0°C	4.3V	
			20°C	3.44V	
23	Intake Air Temperature Sensor ground	GND		0~0.5V	3.4mV
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

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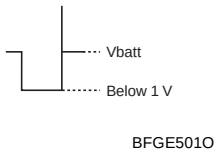
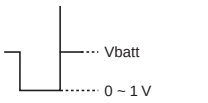
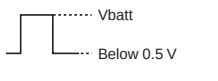
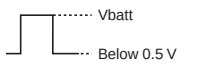
Pin	Description	Type	Vehicle State	Level	Test Result
26	Power Steering Load input	DC	Active	0~0.5V	-26mV
			Inactive	Vbatt	11.55V
27	Not connected				
28	Not connected				
29	Knock Sensor #1 (Cyl. #1, 3, 5) signal input	Fre-quency	Knocking	-0.3 ~ 0.3V	224mV
			Normal	0V	0mV
30	Knock Sensor #1 (Cyl. #1, 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)	IG ON 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 Active (After warm up & racing)	 BFGE501P Freq. : 20Hz	
43	Not connected				
44	Not connected				
45	Intake Manifold Tuning Valve #1 (Surge Tank Side) control output	DC	Active	0~0.5V	200mV
			Inactive	14V	14V
46	Idle Speed Control Actuator PWM output 2 (OPEN)	PWM	Idle	 BFGE501S	High: 15.05V Low: 178mV Freq:100.0Hz
47	Idle Speed Control Actuator PWM output 1 (CLOSE)	PWM	Idle	 BFGE501S	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				

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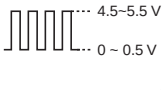
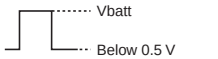
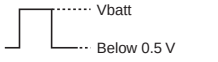
Pin	Description	Type	Vehicle State	Level	Test Result
52	Intake Manifold Tuning Valve #2 (In-mani Side) control output	DC	Active	0~0.5V	200mV
			Inactive	14V	14V

CONNECTOR [C68-4]

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. : 10Hz	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				
17	Engine Speed signal output	Pulse		 BFGE501S	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				

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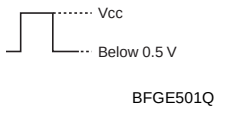
Pin	Description	Type	Vehicle State	Level	Test Result
20	Malfunction Indicating Lamp (MIL) output	DC	MIL ON	0~0.5V	16.4mV
			MIL OFF	Vbatt	13.54V
21	Not connected				
22	Vehicle speed signal input	Pulse	Vehicle Run(80km/h)		High: 5.02V Low: 0.92mV
				From ABS: 250Hz	252Hz
				From VSS: 25Hz	-
23	Air 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	
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

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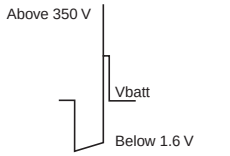
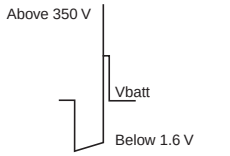
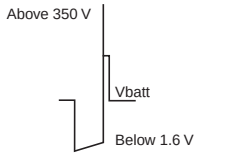
CONNECTOR [C68-5]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Ignition coil #3 (Cyl. #3,6) control output	Pulse	Engine Run	 BFGE501M	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	 BFGE501M	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	 BFGE501M	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				

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ECM PROBLEM INSPECTION PROCEDURE EBBC43FE

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).

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DTC TROUBLESHOOTING PROCEDURES

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC) EBC3D7D2

DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
U0100	Serial Communication Problem with TCU (Timeout)	●	▲	▲	▲	FLB - 40
P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	●	▲		●	FLB - 45
P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	●	▲		●	FLB - 50
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	●			●	FLB - 53
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	●			●	FLB - 58
P0051	HO2S Heater Circuit low (Bank 2 / Sensor 1)	●	▲		●	FLB - 61
P0052	HO2S Heater Circuit high (Bank 2 / Sensor 1)	●	▲		●	FLB - 66
P0057	HO2S Heater Circuit low (Bank 2 / Sensor 2)	●				FLB - 69
P0058	HO2S Heater Circuit high (Bank 2 / Sensor 2)	●				FLB - 75
P0101	Mass or Volume Air Flow Circuit Range/Performance	▲				FLB - 78
P0102	Mass or Volume Air Flow Circuit Low Input	●	▲	▲	●	FLB - 84
P0103	Mass or Volume Air Flow Circuit high Input	●	▲	▲	●	FLB - 89
P0112	Intake Air Temperature Sensor1 Circuit Low Input	●	▲	▲	●	FLB - 93
P0113	Intake Air Temperature Sensor1 Circuit High Input	●	▲	▲	●	FLB - 98
P0116	Engine Coolant Temperature Circuit Range/Performance	●				FLB - 103
P0117	Engine Coolant Temperature Circuit Low Input	●	▲	▲	●	FLB - 108
P0118	Engine Coolant Temperature Circuit High Input	●	▲	▲	●	FLB - 112
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	▲				FLB - 116
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	▲	▲	●	FLB - 121
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	▲	▲	●	FLB - 125
P0130	HO2S Circuit (Bank 1/ Sensor 1)	●	▲		●	FLB - 129
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	▲		●	FLB - 134
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	▲		●	FLB - 137

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DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●				FLB - 140
P0136	HO2S Circuit (Bank 1/ Sensor 2)	●				FLB - 145
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●				FLB - 150
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●				FLB - 152
P0150	HO2S Circuit (Bank 2/ Sensor 1)	●	▲		●	FLB - 155
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●	▲		●	FLB - 160
P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●	▲		●	FLB - 163
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	●				FLB - 166
P0156	HO2S Circuit (Bank 2 / Sensor 2)	●				FLB - 171
P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●				FLB - 176
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●				FLB - 179
P0170	Fuel Trim (Bank 1)	●	▲			FLB - 182
P0171	System Too Lean (Bank 1)	●			●	FLB - 188
P0172	System Too Rich (Bank 1)	●			●	FLB - 194
P0173	Fuel Trim (Bank 2)	●	▲			FLB - 199
P0174	System Too Lean (Bank 2)	●			●	FLB - 205
P0175	System Too Rich (Bank 2)	●			●	FLB - 210
P0230	Fuel Pump Primary Circuit	▲	▲	▲	▲	FLB - 214
P0261	Cylinder 1-Injector Circuit Low	●	▲	▲	●	FLB - 220
P0262	Cylinder 1-Injector Circuit High	●	▲	▲	●	FLB - 225
P0264	Cylinder 2-Injector Circuit Low	●	▲	▲	●	FLB - 220
P0265	Cylinder 2-Injector Circuit High	●	▲	▲	●	FLB - 225
P0267	Cylinder 3-Injector Circuit Low	●	▲	▲	●	FLB - 220
P0268	Cylinder 3-Injector Circuit High	●	▲	▲	●	FLB - 225
P0270	Cylinder 4-Injector Circuit Low	●	▲	▲	●	FLB - 220
P0271	Cylinder 4-Injector Circuit High	●	▲	▲	●	FLB - 225
P0273	Cylinder 5-Injector Circuit Low	●	▲	▲	●	FLB - 220
P0274	Cylinder 5-Injector Circuit High	●	▲	▲	●	FLB - 225
P0276	Cylinder 6-Injector Circuit Low	●	▲	▲	●	FLB - 220
P0277	Cylinder 6-Injector Circuit High	●	▲	▲	●	FLB - 225
P0300	Random/Multiple Cylinder Misfire Detected	●			●	FLB - 229

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DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
P0301	Cylinder 1-Misfire detected	●			●	FLB - 238
P0302	Cylinder 2-Misfire detected	●			●	FLB - 238
P0303	Cylinder 3-Misfire detected	●			●	FLB - 238
P0304	Cylinder 4-Misfire detected	●			●	FLB - 238
P0305	Cylinder 5-Misfire detected	●			●	FLB - 238
P0306	Cylinder 6-Misfire detected	●			●	FLB - 238
P0315	Segment Time Acquisition Incorrect	▲				FLB - 244
P0325	Knock Sensor 1 Circuit	▲	▲	▲	▲	FLB - 248
P0330	Knock Sensor 2 Circuit	▲	▲	▲	▲	FLB - 254
P0335	Crankshaft Position Sensor A Circuit	●	▲	▲	●	FLB - 258
P0340	Camshaft Position Sensor A Circuit Malfunction(Single Sensor)	●	▲	▲	●	FLB - 265
P0350	Ignition Coil Primary / Secondary Circuit	▲	▲	▲		FLB - 271
P0351	Ignition Coil 'A' Primary / Secondary Circuit	▲	▲	▲		FLB - 277
P0352	Ignition Coil 'B' Primary / Secondary Circuit	▲	▲	▲		FLB - 277
P0353	Ignition Coil 'C' Primary / Secondary Circuit	▲	▲	▲		FLB - 277
P0354	Ignition Coil 'D' Primary / Secondary Circuit	▲	▲	▲		FLB - 277
P0355	Ignition Coil 'E' Primary / Secondary Circuit	▲	▲	▲		FLB - 277
P0356	Ignition Coil 'F' Primary / Secondary Circuit	▲	▲	▲		FLB - 277
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●				FLB - 281
P0430	Catalyst System Efficiency below Threshold (Bank 2)	●				FLB - 285
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●			●	FLB - 286
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●			●	FLB - 290
P0501	Vehicle Speed Sensor A Range/Performance	●	▲	▲	▲	FLB - 293
P0506	Idle Air Control System-RPM lower than expected	▲			▲	FLB - 300
P0507	Idle Air Control System-RPM higher than expected	▲			▲	FLB - 304
P0551	Power Steering Pressure Sensor/Switch Circuit Range/Performance	▲	▲	▲		FLB - 307
P0560	System Voltage	▲	▲	▲	▲	FLB - 311
P0605	Internal Control Module Read Only Memory(ROM) Error	▲	▲	▲	▲	FLB - 317

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DTC	DESCRIPTION	MIL				PAGE
		EURO -III/IV	EURO -II	LEADED	JAPAN	
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲				FLB - 319
P0661	Intake manifold tuning valve control circuit low(Bank1)-> Solenoid Type	▲	▲	▲		FLB - 323
P0662	Intake manifold tuning valve control circuit high(Bank1)->Solenoid Type	▲	▲	▲		FLB - 328
P0664	Intake manifold tuning valve control circuit low(Bank2)-> Solenoid Type	▲	▲	▲		FLB - 331
P0665	Intake manifold tuning valve control circuit high(Bank2)-> Solenoid Type	▲	▲	▲		FLB - 336
P0700	TCU Request for MIL On	●			●	FLB - 339
P1505	Idle Charge Actuator Signal Low of Coil #1	●	▲	▲	▲	FLB - 340
P1506	Idle Charge Actuator Signal High of Coil #1	●	▲	▲	▲	FLB - 345
P1507	Idle Charge Actuator Signal Low of Coil #2	●	▲	▲	▲	FLB - 348
P1508	Idle Charge Actuator Signal High of Coil #2	●	▲	▲	▲	FLB - 351

NOTE

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

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DTC U0101 SERIAL COMMUNICATION PROBLEM WITH TCU (TIMEOUT)

GENERAL DESCRIPTION E2C5F408

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.

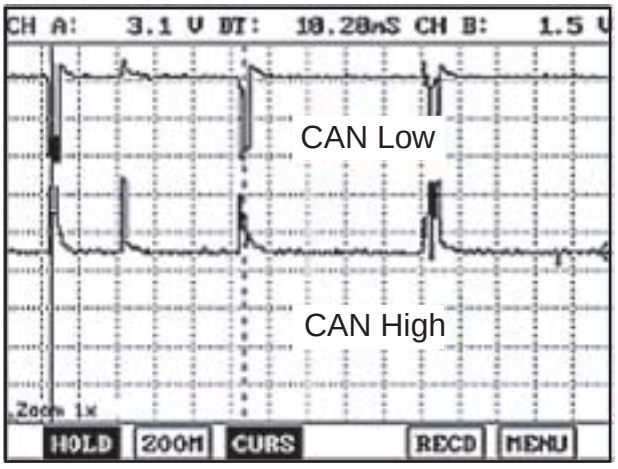
DTC DESCRIPTION E804DD32

The ECM sets DTC U0101 if ECM detects that communication time via CAN exceeds threshold value.

DTC DETECTING CONDITION E8DA2F0A

Item	Detecting Condition	Possible Cause
DTC Strategy	• Missing messages TCU	• Open or short in CAN line • Contact resistance in connectors
Enable Conditions	• Battery voltage ＞10V • Engine speed ＞ Approx. 260 rpm	
Threshold Value	• Time exceeded without message = 0.5 sec.	
Diagnostic Time	• 1 sec.	

SIGNAL WAVEFORM E0214024



Normal wave form with ignition ON

LWIF101Y

MONITOR DTC STATUS E2F64DBB

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

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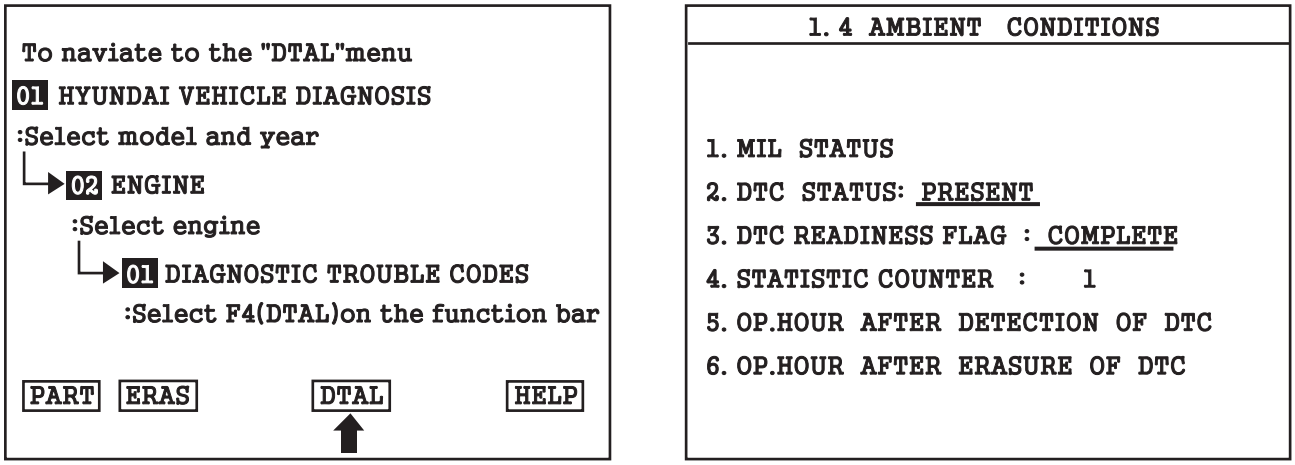
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor(s) and/or the ECM's connector was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION EB4FD1E0

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "CAN High line Inspection" procedure.

CAN HIGH LINE INSPECTION E1E5449E

1. Check for Open in harness

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1) Ignition "OFF".

2) Disconnect ECM and TCM connectors.

3) Measure resistance between terminals 36 of the ECM harness connector and 3 of the TCM harness connector.

Specification : Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

1) Measure resistance between terminal 36 of the ECM harness connector and chassis ground.

Specification : Infinite

2) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in harness.

1) Reconnect the ECM connector.

2) Ignition "ON" & Engine "OFF".

3) Measure voltage between terminal 36 of the ECM harness connector and chassis ground.

Specification : Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "CAN Low Line Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CAN LOW LINE INSPECTION E384E2A7

1. Check for Open in harness.

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1) Ignition "OFF".

2) Disconnect ECM and TCM connectors.

3) Measure resistance between terminals 37 of the ECM harness connector and 4 of the TCM harness connector.

Specification : Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

1) Measure resistance between terminal 37 of the ECM harness connector and chassis ground.

Specification : Infinite

2) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in harness.

1) Reconnect the ECM connector.

2) Ignition "ON" & Engine "OFF".

3) Measure voltage between terminal 37 of the ECM harness connector and chassis ground.

Specification : Approx. 0V

4) Is voltage within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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VERIFICATION OF VEHICLE REPAIR EAEB1708

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

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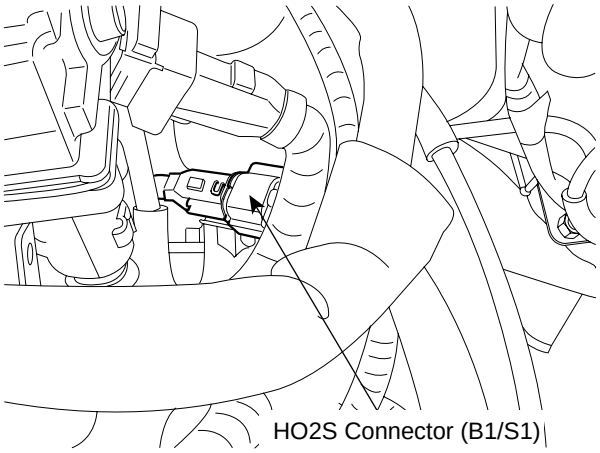
DTC P0031 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 1)

COMPONENT LOCATION E35431DC



LWIF501I

GENERAL DESCRIPTION E4D38E09

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850℃(662 to 1562℉). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION E01B4753

ECM sets DTC P0031 if the ECM detects that the front HO2S heater control circuit is short to ground.

DTC DETECTING CONDITION E6E24180

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check short circuit to ground on front HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage＞10V • 1% ＜Heater power＜99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	

SPECIFICATION EE06D555

HO2S Heater	Normal Parameter
	20℃ (68℉)
Heater Resistance	Approx. 3~4Ω

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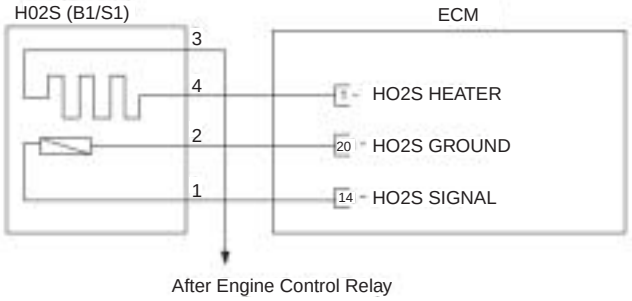
SCHEMATIC DIAGRAM EE9E6E20

[CIRCUIT DIAGRAM]



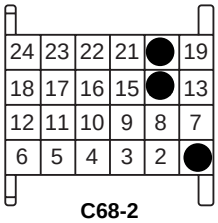
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 14	Signal
2	ECM Terminal 20	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 1	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

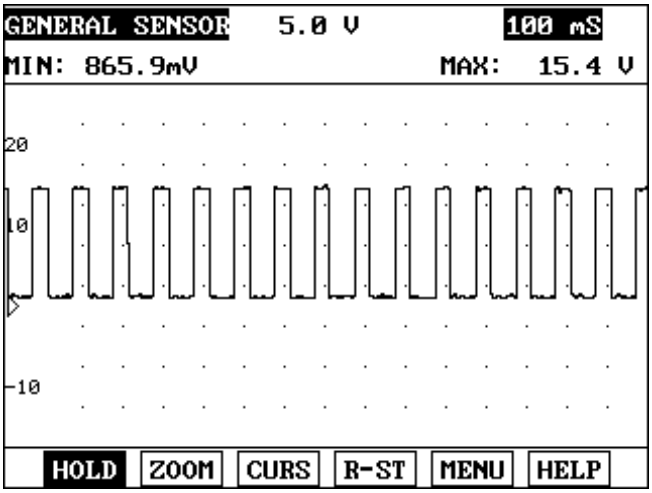


C68-2

ECM side terminal

LWIF001G

SIGNAL WAVEFORM E5D907C2



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the 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 after HO2S heater completes warming-up.

EFKD0004

MONITOR DTC STATUS E20FBDFF

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

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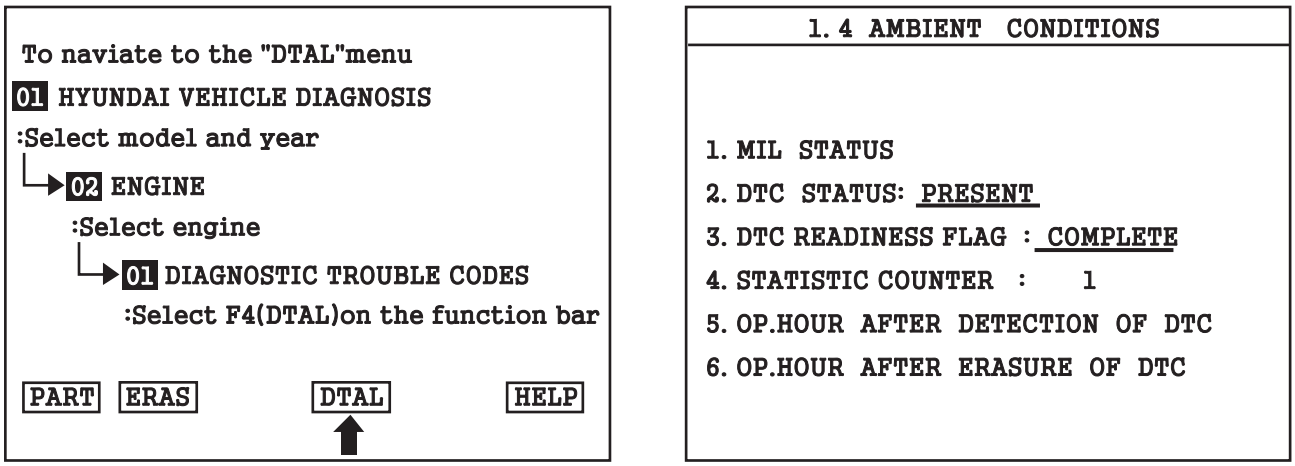
2. Press F4(DTAL) to select DTC information from the DTCs menu.

3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E4D6F919

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

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POWER SUPPLY CIRCUIT INSPECTION E2E59FE5

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check for an open in the power supply circuit between the main relay and the Injector.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E2211FF9

1. Check for open in control harness
   1) Ignition "OFF".
   2) Disconnect ECM connector
   3) Measure resistance between terminals 4 of the HO2S heater harness connector and 1 of the ECM harness connector.

Specification : Approx. 0Ω

   4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit.
   1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : infinite

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2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1A0D741

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20°C(68°F)]

2. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E1F6F479

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

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DTC P0032 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 1)

COMPONENT LOCATION E073818C

Refer to DTC P0031.

GENERAL DESCRIPTION E6AC2AAB

Refer to DTC P0031.

DTC DESCRIPTION EEC83446

ECM sets DTC P0032 if the ECM detects that the front HO2S heater control line is open or short to battery circuit.

DTC DETECTING CONDITION E80F9A19

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check open or short circuit to battery line on front HO2S heater line	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage＞10V • 1%＜Heater power＜99%	
Threshold Value	• Open or short to Battery	
Diagnostic Time	• 20 sec.	
Fail Safe	• Heater open loop control	

SPECIFICATION EC77A490

Refer to DTC P0031.

SCHEMATIC DIAGRAM E6BEE7FF

Refer to DTC P0031.

SIGNAL WAVEFORM EA5C483D

Refer to DTC P0031.

MONITOR DTC STATUS EBE3731A

Refer to DTC P0031.

TERMINAL AND CONNECTOR INSPECTION E52385AD

Refer to DTC P0031.

CONTROL CIRCUIT INSPECTION EAB1EDA2

1. Check for open in control harness

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1) Ignition "OFF".

2) Disconnect HO2S and ECM connectors.

3) Measure resistance between terminals 4 of the HO2S heater harness connector and 1 of the ECM harness connector.

Specification : Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in control circuit.

1) Reconnect the ECM connector.

2) Ignition "ON" & Engine "OFF".

3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDAD2145

1. Ignition "OFF".

2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20°C(68°F)]

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3. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E71ED7A3

Refer to DTC P0031.

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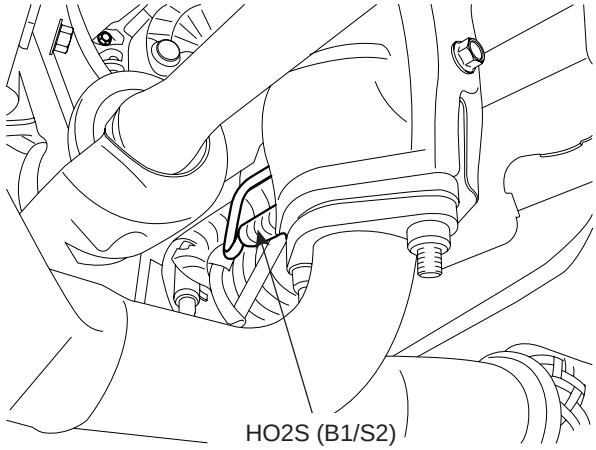
DTC P0037 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 2)

COMPONENT LOCATION E86C0FC9



LWIF501J

GENERAL DESCRIPTION E5676B53

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850℃(662 to 1562℉). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION EA6966A4

ECM sets DTC P0037 if the ECM detects that the rear HO2S heater control line is short to ground.

DTC DETECTING CONDITION ED3914AC

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check short circuit to ground on front HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage＞10V • 1%＜Heater power＜99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec.	
Fail Safe	• Heater open loop control	

SPECIFICATION E05934F9

HO2S Heater	Normal Parameter
	20℃ (68℉)
Heater Resistance	Approx. 3~4Ω

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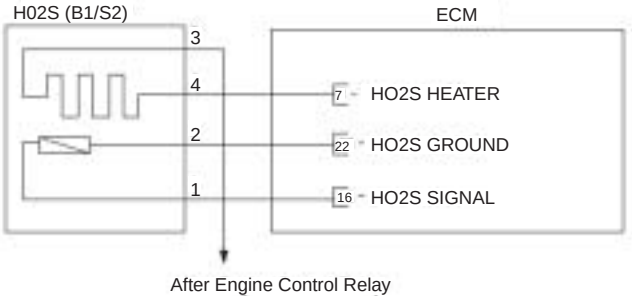
SCHEMATIC DIAGRAM E50713DF

[CIRCUIT DIAGRAM]



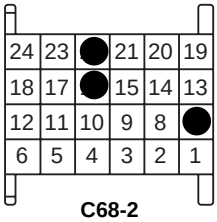
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 16	Signal
2	ECM Terminal 22	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 7	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

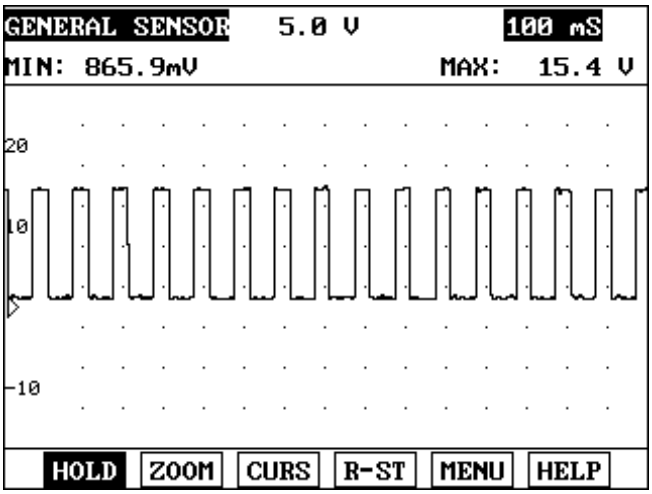


C68-2

ECM side terminal

LWIF001M

SIGNAL WAVEFORM E319F8ED



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the 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 after HO2S heater completes warming-up.

EFKD0004

MONITOR DTC STATUS EB09709B

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

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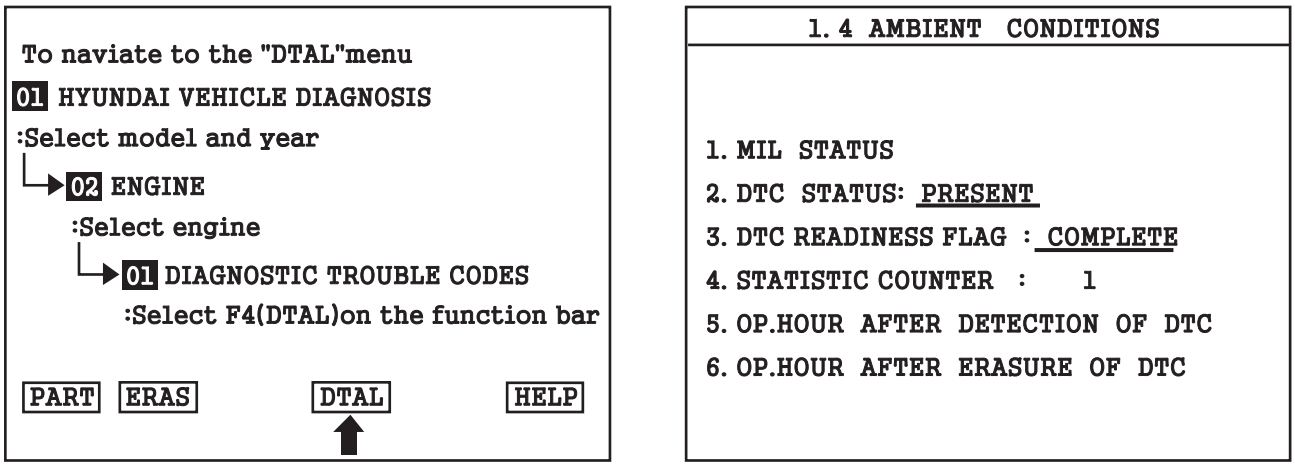
2. Press F4(DTAL) to select DTC information from the DTCs menu.

3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION EDD337EB

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

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POWER SUPPLY CIRCUIT INSPECTION E21D36B7

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check for an open in the power supply circuit between the main relay and the Injector.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EFB72420

1. Check for open in control harness
   1) Ignition "OFF".
   2) Measure resistance between terminals 4 of the HO2S heater harness connector and 7 of the ECM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit.
   1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : infinite

   2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

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NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBFE7D90

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20°C(68°F)]

2. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E76A589A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

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DTC P0038 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 2)

COMPONENT LOCATION EB6E731F

Refer to DTC P0037.

GENERAL DESCRIPTION E0CD3F23

Refer to DTC P0037.

DTC DESCRIPTION E4B38A1B

ECM sets DTC P0038 if the ECM detects that the rear HO2S heater control line is open or short to battery line.

DTC DETECTING CONDITION E37FD6F9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check open or short circuit to battery line on front HO2S heater line	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage＞10V • 1%＜Heater power＜99%	
Threshold Value	• Open or short to Battery	
Diagnostic Time	• 20 sec.	
Fail Safe	• Heater open loop control	

SPECIFICATION EB568F7F

Refer to DTC P0037.

SCHEMATIC DIAGRAM E19D72FC

Refer to DTC P0037.

SIGNAL WAVEFORM E386BB0C

Refer to DTC P0037.

MONITOR DTC STATUS E5CE529E

Refer to DTC P0037.

TERMINAL AND CONNECTOR INSPECTION EA347B23

Refer to DTC P0037.

CONTROL CIRCUIT INSPECTION E8C5F844

1. Check for open in control harness

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1) Ignition "OFF".

2) Disconnect HO2S and ECM connectors.

3) Measure resistance between terminals 4 of the HO2S heater harness connector and 7 of the ECM harness connector.

Specification : Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit.

1) Reconnect the ECM connector.

2) Ignition "ON" & Engine "OFF".

3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6E1D577

1. Ignition "OFF".

2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20°C(68°F)]

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3. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E25631D4

Refer to DTC P0037.

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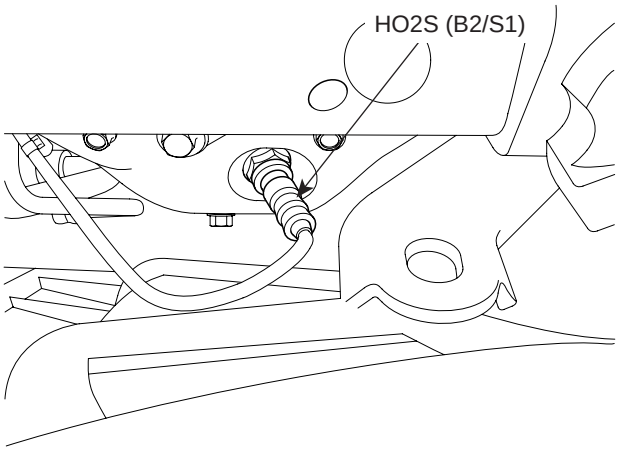
DTC P0051 HO2S HEATER CIRCUIT LOW (BANK 2 / SENSOR 1)

COMPONENT LOCATION E05DD454



LWIF501K

GENERAL DESCRIPTION E996362A

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850℃(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION EE73C3D5

ECM sets DTC P0051 if the ECM detects that the front HO2S heater control line is short to ground.

DTC DETECTING CONDITION EC677893

Item	Detecting condition	Possible Cause
DTC Strategy	• Check short circuit to ground on front HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1% < Heater power < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	

SPECIFICATION E9347695

HO2S Heater	Normal Parameter
	20℃ (68°F)
Heater Resistance	Approx. 3~4Ω

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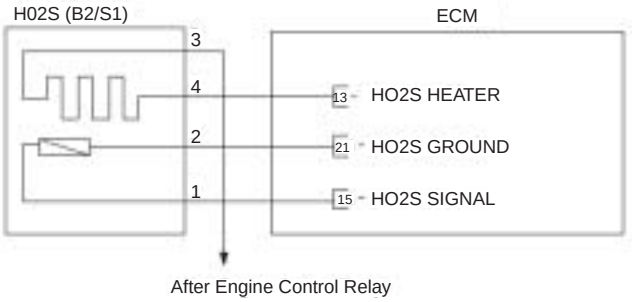
SCHEMATIC DIAGRAM EE4E6C15

[CIRCUIT DIAGRAM]



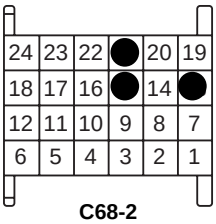
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 15	Signal
2	ECM Terminal 21	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 13	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

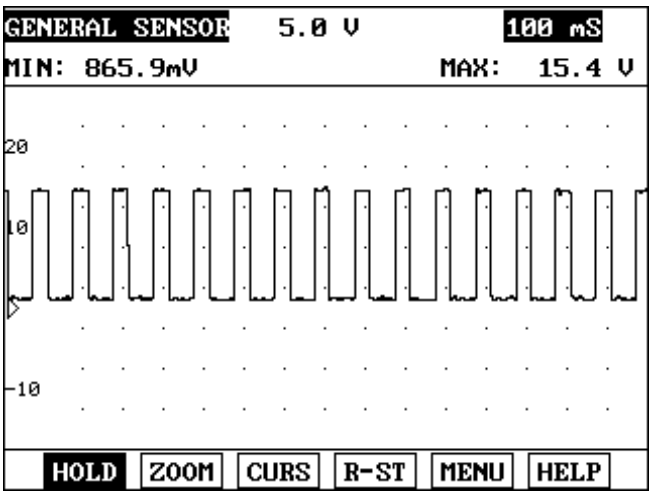


C68-2

ECM side terminal

LWIF001S

SIGNAL WAVEFORM E6218801



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the 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 after HO2S heater completes warming-up.

EFKD0004

MONITOR DTC STATUS E868462A

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

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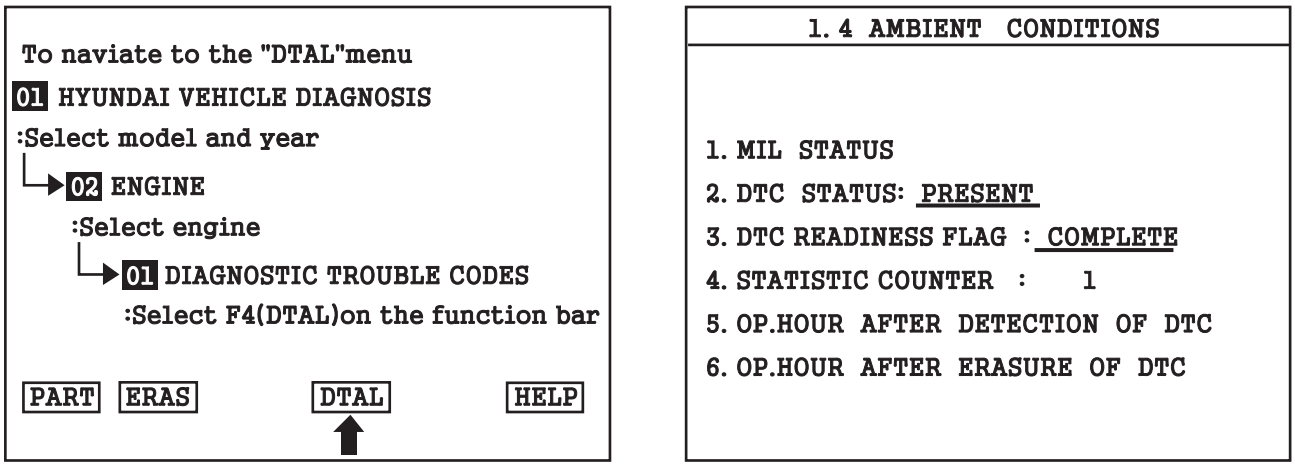
2. Press F4(DTAL) to select DTC information from the DTCs menu.

3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E8671E11

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

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POWER SUPPLY CIRCUIT INSPECTION E597745E

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check for an open in the power supply circuit between the main relay and the HO2S.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E3C5D07B

1. Check for open in control harness.
   1) Ignition "OFF".
   2) Disconnect ECM and HO2S connectors.
   3) Measure resistance between terminals 4 of the HO2S heater harness connector and 13 of the ECM harness connector.

Specification : Approx. 0Ω

   4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit .
   1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : infinite

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2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure .

NO

▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E47F7124

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20℃(68℉)]

2. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC7FC2A0

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0052 HO2S HEATER CIRCUIT HIGH (BANK 2 / SENSOR 1)

COMPONENT LOCATION E3EC48D1

Refer to DTC P0051.

GENERAL DESCRIPTION EF17C3EC

Refer to DTC P0051.

DTC DESCRIPTION E1EC0C61

ECM sets DTC P0052 if the ECM detects that the front HO2S heater control line is open or short to battery line.

DTC DETECTING CONDITION E20CFC53

Item	Detecting condition	Possible Cause
DTC Strategy	• Check open or short circuit to battery line on front HO2S heater line.	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1% < Heater power < 99%	
Threshold Value	• Short to Battery or line break	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	

SPECIFICATION EDE4ADF1

Refer to DTC P0051.

SCHEMATIC DIAGRAM E44577EB

Refer to DTC P0051.

SIGNAL WAVEFORM EC3098A3

Refer to DTC P0051.

MONITOR DTC STATUS E68501D4

Refer to DTC P0051.

TERMINAL AND CONNECTOR INSPECTION EF4BF502

Refer to DTC P0051.

CONTROL CIRCUIT INSPECTION EDD9044F

1. Check for open in control harness.

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1) Ignition "OFF".

2) Disconnect HO2S and ECM connectors.

3) Measure resistance between terminals 4 of the HO2S heater harness connector and 13 of the ECM harness connector.

Specification : Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit

1) Reconnect the ECM connector.

2) Ignition "ON" & Engine "OFF".

3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E87635AD

1. Ignition "OFF".

2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20°C(68°F)]

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3. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAF66ADE

Refer to DTC P0051.

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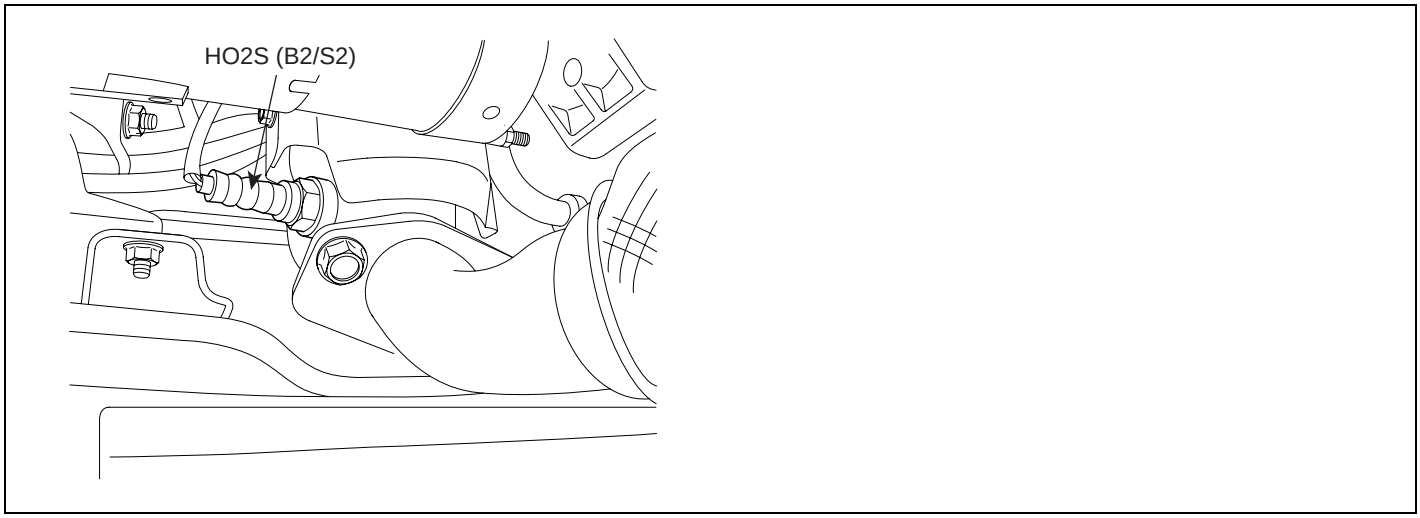
DTC P0057 HO2S HEATER CIRCUIT LOW (BANK 2 / SENSOR 2)

COMPONENT LOCATION E4DF1370



LWIF501L

GENERAL DESCRIPTION E847E169

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850℃(662 to 1562℉). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION EC7FBE05

ECM sets DTC P0057 if the ECM detects that the rear HO2S heater control line is short to ground.

DTC DETECTING CONDITION EC0628B0

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check short circuit to ground on rear HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1% < Heater power < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	

SPECIFICATION E5CFB6B1

HO2S Heater	Normal Parameter
	20℃ (68℉)
Heater Resistance	Approx. 3~4Ω

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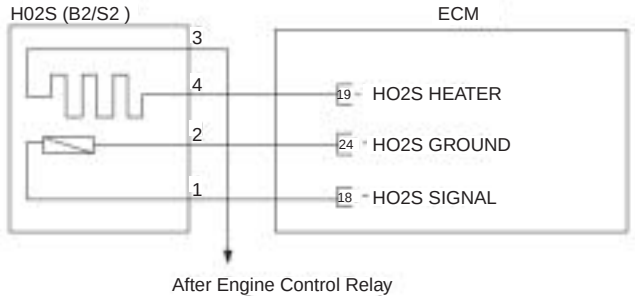
SCHEMATIC DIAGRAM EB6D52BC

[CIRCUIT DIAGRAM]



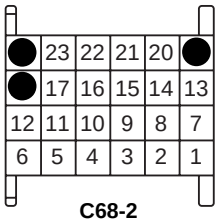
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 18	Signal
2	ECM Terminal 24	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 19	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

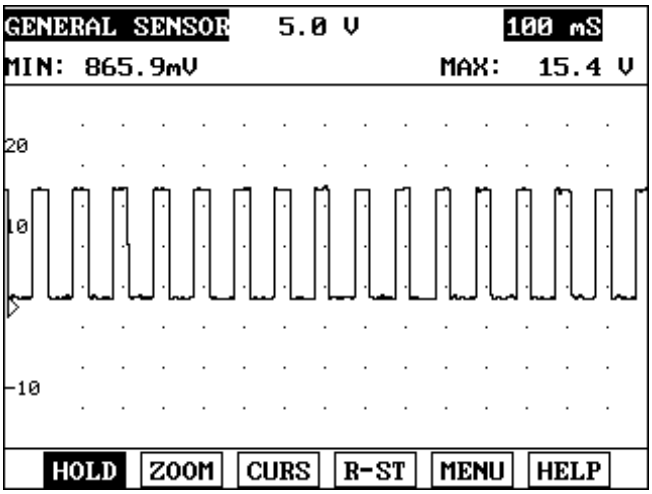


C68-2

ECM side terminal

LWIF001Y

SIGNAL WAVEFORM EFD97B2D



The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the 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 after HO2S heater completes warming-up.

EFKD0004

MONITOR DTC STATUS E19FA534

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

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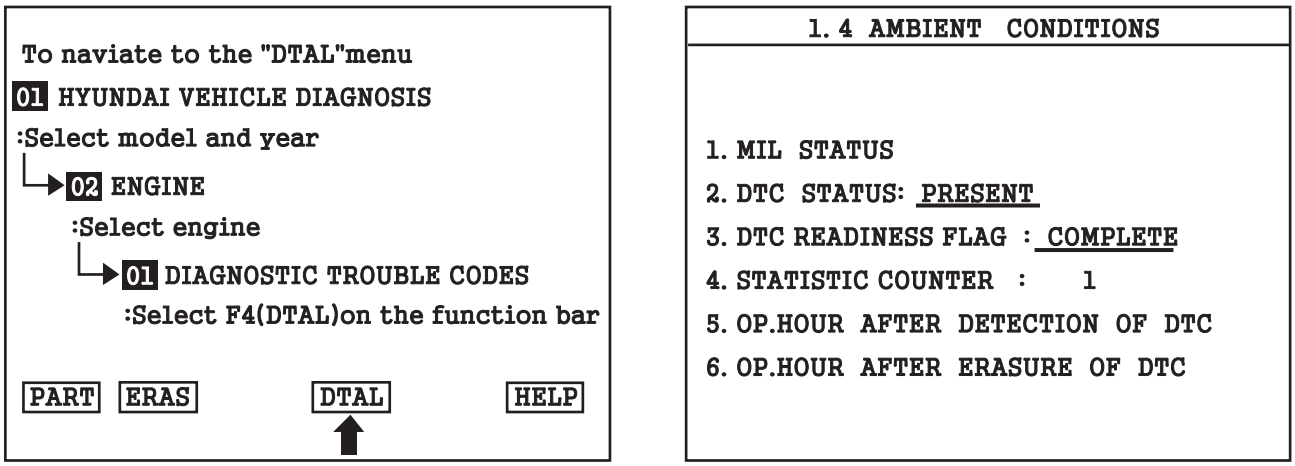
2. Press F4(DTAL) to select DTC information from the DTCs menu.

3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E8D36686

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

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POWER SUPPLY CIRCUIT INSPECTION E1C56B62

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check for an open in the power supply circuit between the main relay and the HO2S.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EA28B940

1. Check for open in control harness.
   1) Ignition "OFF".
   2) Disconnect ECM connector.
   3) Measure resistance between terminals 4 of the HO2S heater harness connector and 19 of the ECM harness connector.

Specification : Approx. 0Ω

   4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit .
   1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : infinite

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https://autolibrary.ir

2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure .

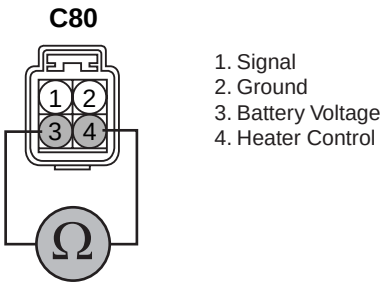
NO

▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E8D205FE

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20℃(68℉)]



1. Signal
2. Ground
3. Battery Voltage
4. Heater Control

LWIF002C

2. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E60115D9

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.

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4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0058 HO2S HEATER CIRCUIT HIGH (BANK 2 / SENSOR 2)

COMPONENT LOCATION E6C8F359

Refer to DTC P0057.

GENERAL DESCRIPTION E7900371

Refer to DTC P0057.

DTC DESCRIPTION E90734B3

ECM sets DTC P0058 if the ECM detects that the rear HO2S heater control line is open or short to battery line.

DTC DETECTING CONDITION E80BAEBE

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check short circuit to ground on rear HO2S heater line	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1% < Heater power < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	

SPECIFICATION E54E7ED1

Refer to DTC P0057.

SCHEMATIC DIAGRAM ED4A5835

Refer to DTC P0057.

SIGNAL WAVEFORM E7F11788

Refer to DTC P0057.

MONITOR DTC STATUS E1F2E956

Refer to DTC P0057.

TERMINAL AND CONNECTOR INSPECTION E8DB0D89

Refer to DTC P0057.

CONTROL CIRCUIT INSPECTION E2C16475

1. Check for open in control harness.
   1) Ignition "OFF".

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2) Disconnect HO2S and ECM connectors.

3) Measure resistance between terminals 4 of the HO2S heater harness connector and 19 of the ECM harness connector.

Specification : Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit

1) Reconnect the ECM connector.

2) Ignition "ON" & Engine "OFF".

3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification : Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ECCAC77C

1. Ignition "OFF".

2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω [at 20°C(68°F)]

3. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

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VERIFICATION OF VEHICLE REPAIR E4108DE7

Refer to DTC P0057.

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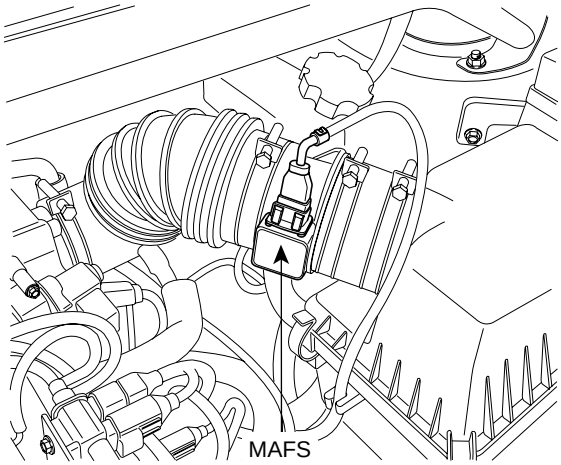
DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E344DED4



LWIF5013

GENERAL DESCRIPTION E7CFB0DC

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.

DTC DESCRIPTION E1178F24

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 modeled Mass Air Flow value is determined by engine speed, throttle angle and ICA valve duty.

DTC DETECTING CONDITION ED291D59

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare calculated MAF with MAF signal	• Dirty air cleaner. • Oil Cap or Dipstick missing or not installed correctly. • Air leak in intake system • Contact resistance in connectors. • Faulty MAFS or TPS
Enable Conditions	• 1500< Engine speed(RPM)< 3500 • 150< Measured Mass Air Flow(mg/stk) <350 • Coolant temperature > 60°C(140°F)	
Threshold Value	• Measured MAF/Calculated MAF <0.5 or >1.3	
Diagnostic Time	• 110 sec.	

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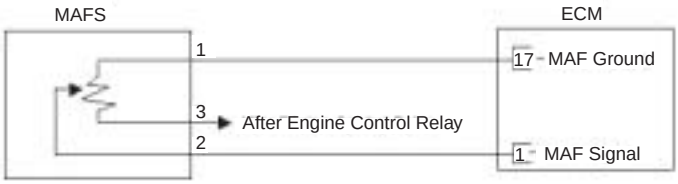
SPECIFICATION E8E60B7E

Test Condition	MAF DATA		TPS DATA	
	Output Voltage (V)	Mass Air Flow (kg/h)	Output Voltage (V)	Resistance (kΩ)
Idle	0.6~1.0	11~20	0.25~0.80	0.71~1.38
Idle & A/C "ON"	1.0~1.3	20~30	-	-
W.O.T	-	-	4.25~4.7	0.2~3.4

SCHEMATIC DIAGRAM E7581D08

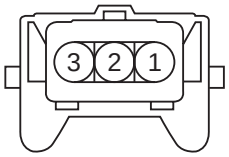
[CIRCUIT DIAGRAM]



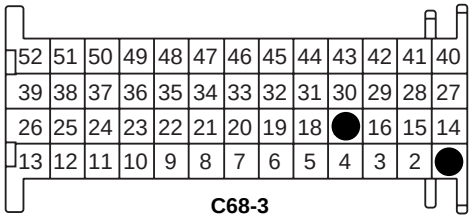
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 17	Ground
2	ECM Terminal 1	Signal
3	Engine Control Relay	Battery Voltage

[HARNESS CONNECTORS]



C53
MAFS Harness side connector



C68-3
ECM side terminal

LWIF002E

SIGNAL WAVEFORM EBD4821C

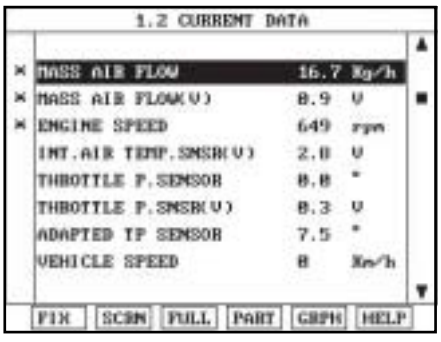


Fig. 1

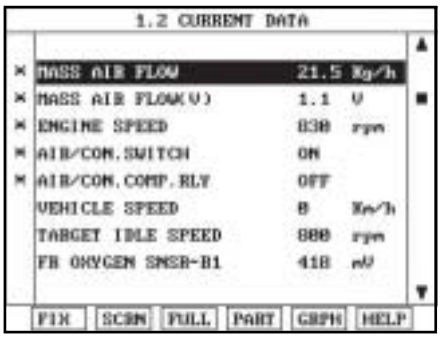


Fig. 2

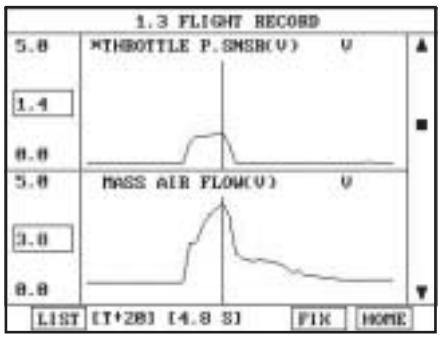


Fig. 3

Fig 1) Normal value with idle after warm up : Approx. 0.7~1.0V
Fig 2) Normal value with idle after warm up and A/C "ON" : Signal increases proportionally with engine load
Fig 3) Normal value with accelerating and decelerating : The MAFS and TPS signals increase at the same time with accelerating and decrease with releasing accelerator pedal

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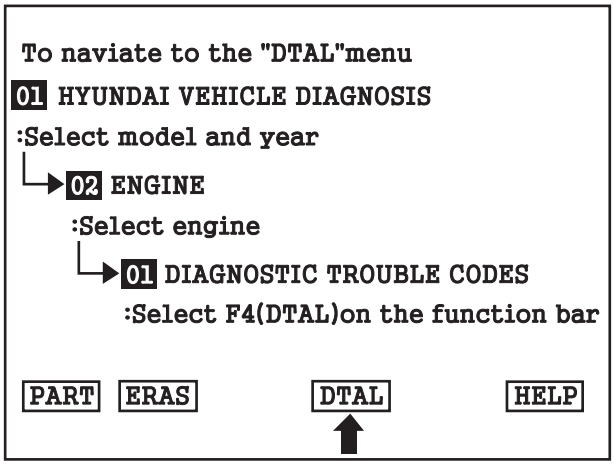
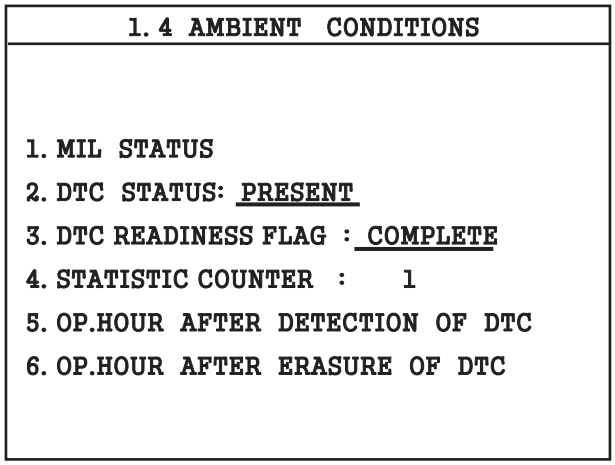
MONITOR DTC STATUS E744F860

NOTE

If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.





LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

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AIR CLEANER INSPECTION

1. Check air cleaner condition. Is air cleaner clogged with dirt?

YES

▶ Replace air cleaner and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Air Leakage Inspection" procedure.

AIR LEAKAGE INSPECTION E23D0398

1. Check intake tube, breather hose and MAFS for source of any air leaks. Are there any cracks in intake tube, MAFS or breather hose.
2. Verify oil cap and dipstick are properly installed and oil cap screwed on completely.
3. Has a problem been found?

YES

▶ Repair or Replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "TPS Inspection" procedure.

TPS INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Connect Scantool and monitor the "THROTTLE P. SENSOR(V)" parameter on the Scantool data list.

Specification : Approx. 0.5V(Closed throttle Valve) / Approx 4.25~4.7V(Wide Open Throttle)

3. Is "THROTTLE P. SENSOR(V)" within specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

▶ Inspect TP sensor and W/harness and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

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TERMINAL AND CONNECTOR INSPECTION E8F6A03F

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "Conponent Inspection" procedure.

COMPONENT INSPECTION E5FB7F5E

1. Engine "ON".
2. Connect Scantool and monitor the "MASS AIR FLOW(V)" parameter on the Scantool data list.
3. Monitor the "MASS AIR FLOW(V)" parameter on the Scantool.

Specification :
Approx. 0.6 ~ 1.0V at idle & No load
Approx. 1.0 ~ 1.3V at idle & A/C "ON"

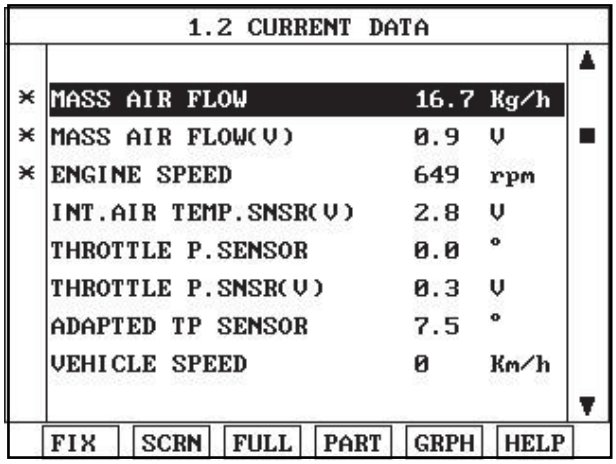

Fig. 1

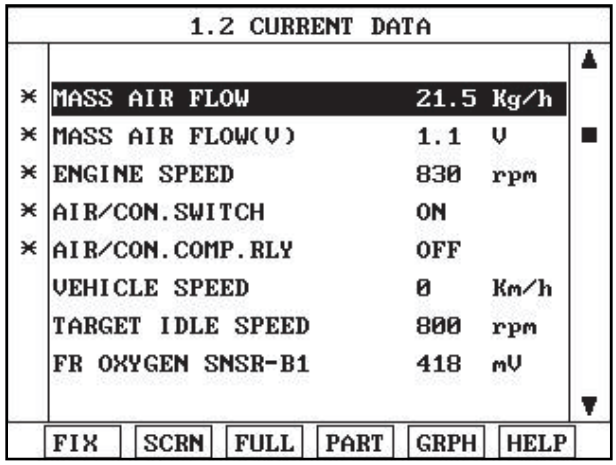

Fig. 2

Fig 1) Test Condition : idle after warm up
Specification : The MAFS is between 0.6~1.0V(11~20kg/h)
Fig 2) Test Condition : idle after warm up & A/C "ON"
Specification : The MAFS increase proportinally with engine load

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4. Is MAF sensor voltage within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Check MAFS for contamination, deterioration, or damage. Substitute with a known-good MAFS and check for proper operation. If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR EB688678

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

COMPONENT LOCATION E89405B0

Refer to DTC P0101.

GENERAL DESCRIPTION E7B3036C

Refer to DTC P0101.

DTC DESCRIPTION E3AA8A2C

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

DTC DETECTING CONDITION E97662C9

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open or short to ground in signal circuit • Open in power supply circuit • Contact resistance in connections. • Faulty MAF sensor
Enable Conditions	• 1500< Engine speed(RPM)< 3500 • 150< Measured Mass Air Flow(mg/stk) <350 • Coolant temperature > 60°C(140°F)	
Threshold Value	• Measured MAF<2kg/h	
Diagnostic Time	• 200 sec.	

SPECIFICATION E194D6A6

Refer to DTC P0101.

SCHEMATIC DIAGRAM E943C131

Refer to DTC P0101.

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SIGNAL WAVEFORM EEF7A3F8

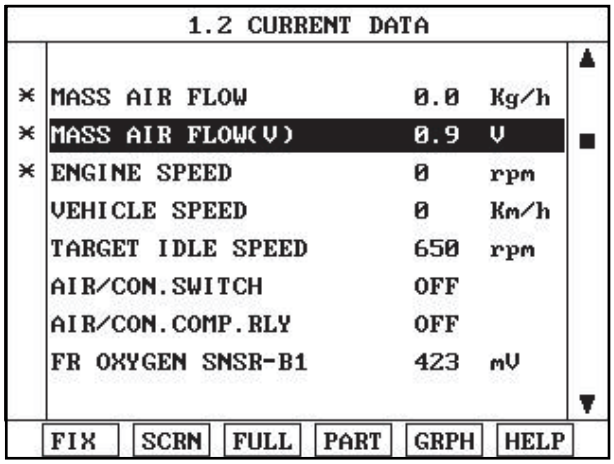


Fig. 1

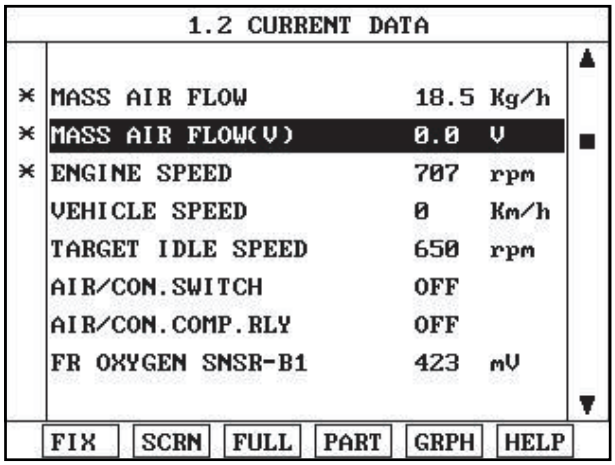


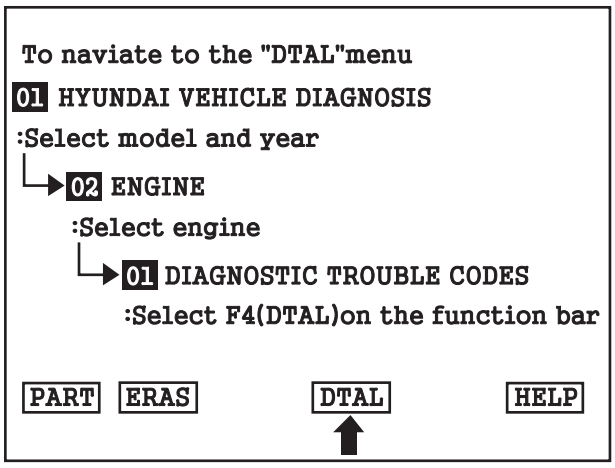
Fig. 2

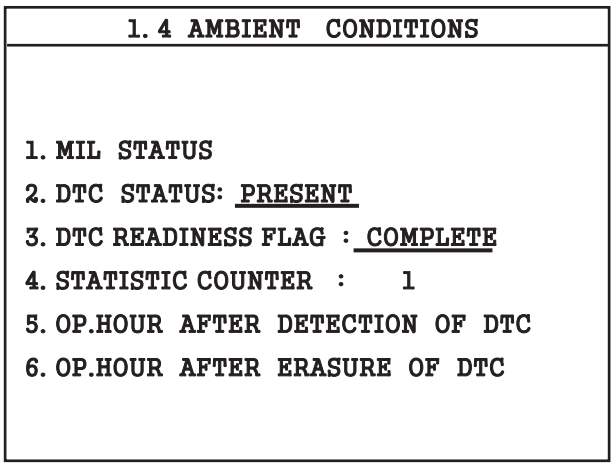
Fig 1) Normal value with ignition ON and engine OFF : Approx. 0.6~1.0V
Fig 2) Open in signal or power supply circuit/Short to ground in signal or power supply circuit : Approx. 0V

LWIF101C

MONITOR DTC STATUS EBEFD3D6

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.





LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

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YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E1F365BE

Refer to DTC P0101.

POWER SUPPLY CIRCUIT INSPECTION EC787F54

1. Ignition "OFF".
2. Disconnect MAF connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the MAF sensor heater harness connector and chassis ground.

Specification : B+

5. Is voltage within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to ground in the power supply circuit between the MAF sensor and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E4384E3A

1. Check for open in signal harness.
   1) Ignition "OFF".
   2) Disconnect ECM connector.
   3) Measure resistance between terminals 2 of the MAF sensor harness connector and 1 of the ECM harness connector.

Specification : Approx. 0Ω

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4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Check for an open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

1) Ignition "OFF".

2) Measure resistance between terminal 2 of the MAF sensor harness connector and chassis ground.

Specification : infinite

3) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA9A3748

1. Engine "ON".
2. Connect Scantool and monitor the "MASS AIR FLOW(V)" parameter on the Scantool data list.
3. Monitor the "MASS AIR FLOW(V)" parameter on the Scantool.

Specification : Approx. 0.6 ~ 1.0V at idle & No load Approx. 1.0 ~ 1.3V at idle & A/C "ON"

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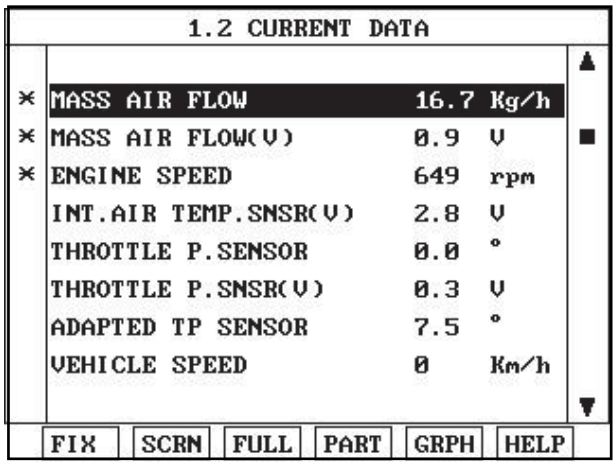

Fig. 1

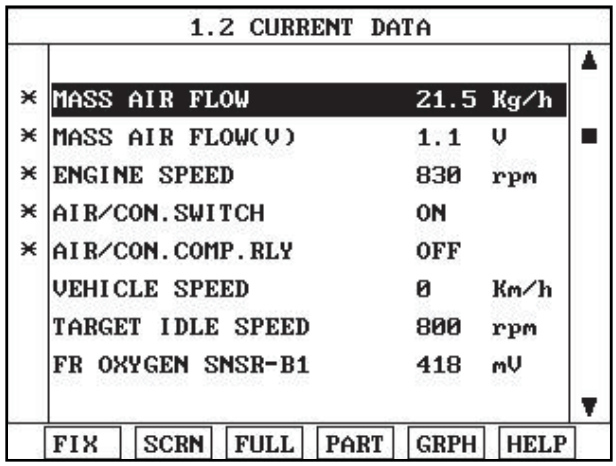

Fig. 2

Fig 1) Test Condition : idle after warm up
Specification : The MAFS is between 0.6~1.0V(11~20kg/h)
Fig 2) Test Condition : idle after warm up & A/C "ON"
Specification : The MAFS increase proportinally with engine load

LWIF101B

4. Is MAF sensor voltage within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check MAFS for contamination, deterioration, or damage. Substitute with a known-good MAFS and check for proper operation. If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EDB836F5

Refer to DTC P0101.

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DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

COMPONENT LOCATION E6C1CA8D

Refer to DTC P0101.

GENERAL DESCRIPTION E6AD83EF

Refer to DTC P0101.

DTC DESCRIPTION E4598F02

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

DTC DETECTING CONDITION E47EF95E

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open in ground harness • Short to battery in signal harness • Contact resistance in connections. • Faulty MAF sensor
Enable Conditions	• 500< Engine speed(RPM)< 3500 • 150< Measured Mass Air Flow(mg/stk) <350 • Coolant temperature > 60℃(140°F)	
Threshold Value	• Measured MAF > 700 kg/h	
Diagnostic Time	• 200 mSec.	

SPECIFICATION E2197041

Refer to DTC P0101.

SCHEMATIC DIAGRAM ECA53AB2

Refer to DTC P0101.

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SIGNAL WAVEFORM EFC4B400

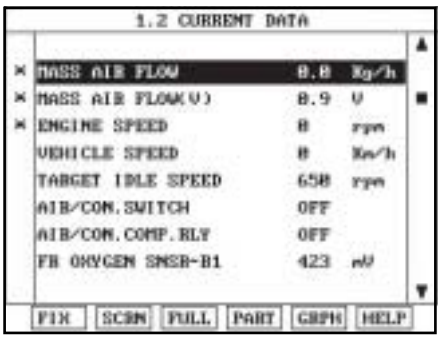

Fig. 1

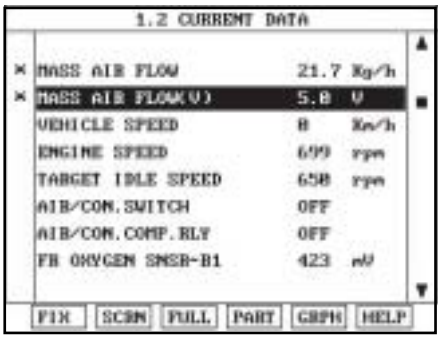

Fig. 2

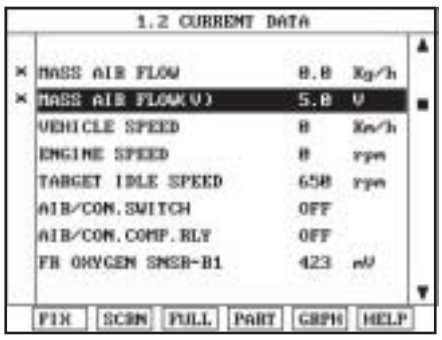

Fig. 3

Fig 1) Normal value with ignition ON and engine OFF : Approx. 0.6~1.0V
Fig 2) Open in ground circuit with ingition ON and engine OFF : Approx 5V
Fig 3) Short to battery in signal circuit with ignition ON and ingine OFF : Approx. 5V

LWIF101D

MONITOR DTC STATUS E0D5220D

Refer to DTC P0102.

TERMINAL AND CONNECTOR INSPECTION EFB63337

Refer to DTC P0101.

GROUND CIRCUIT INSPECTION EEA092EC

1. Ignition "OFF".
2. Disconnect MAF sensor connector.
3. Measure resistance between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to battery in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E07CD48E

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 2 of the MAF sensor harness connector and chassis ground.

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Specification : Approx. 0V

3. Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E69692C1

1. Engine "ON".
2. Connect Scantool and monitor the "MASS AIR FLOW(V)" parameter on the Scantool data list.
3. Monitor the "MASS AIR FLOW(V)" parameter on the Scantool.

Specification :
Approx. 0.6 ~ 1.0V at idle & No load
Approx. 1.0 ~ 1.3V at idle & A/C "ON"

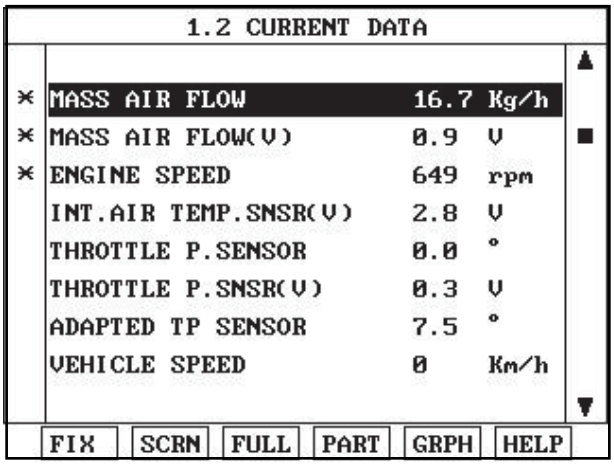

Fig. 1

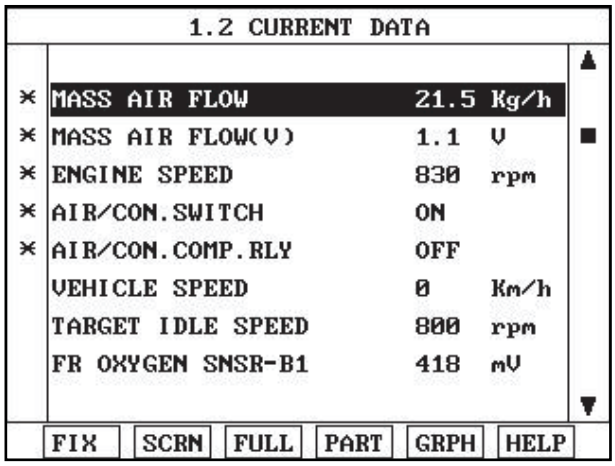

Fig. 2

Fig 1) Test Condition : idle after warm up
Specification : The MAFS is between 0.6~1.0V(11~20kg/h)
Fig 2) Test Condition : idle after warm up & A/C "ON"
Specification : The MAFS increase proportinally with engine load

LWIF101B

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4. Is MAF sensor voltage within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check MAFS for contamination, deterioration, or damage. Substitute with a known-good MAFS and check for proper operation. If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E669A9DD

Refer to DTC P0101.

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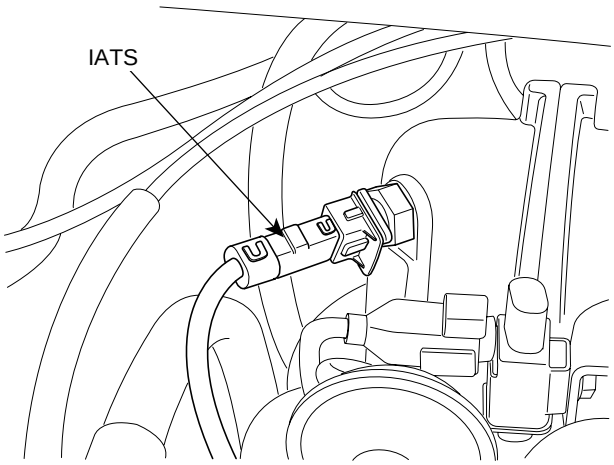
DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

COMPONENT LOCATION E7FC70D8



LWIF501O

GENERAL DESCRIPTION E3986FB9

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). 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 5 V 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 DESCRIPTION E9EC145E

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

DTC DETECTING CONDITION EE5BB071

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Contact resistance in connections. • Faulty IAT sensor
Enable Conditions	• 6< Battery voltage(V) <16 • After 250 seconds from engine start	
Threshold Value	• Measured intake air temperature > 118°C(244°F)	
Diagnostic Time	• 50 sec.	

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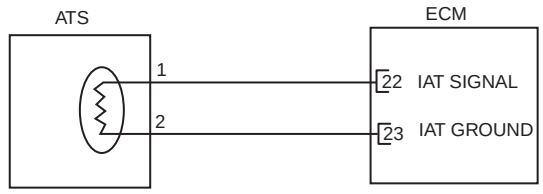
SPECIFICATION E634589F

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(℃)	(°F)		(℃)	(°F)	
-20	-4	14.26~16.02	40	104	1.11~1.19
0	32	5.50~6.05	60	140	0.57~0.60
20	68	2.31~2.59	80	176	0.31~0.32

SCHEMATIC DIAGRAM E6D7D26E

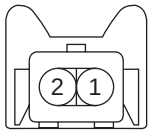
[CIRCUIT DIAGRAM]



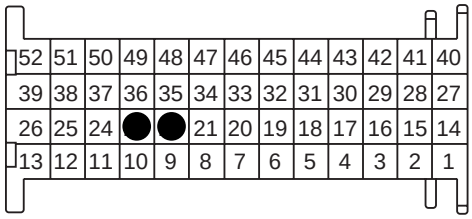
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 22	IAT Signal
2	ECM Terminal 23	IAT Ground

[HARNESS CONNECTORS]



C57
IAT Harness side connector



C68-3
ECM side terminal

LWIF002K

SIGNAL WAVEFORM E88E8709

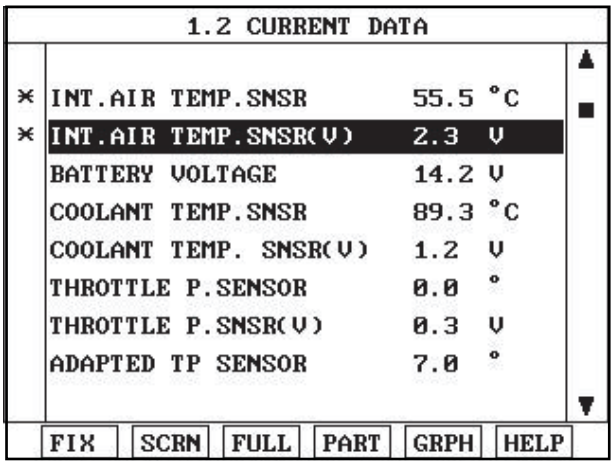


Fig. 1

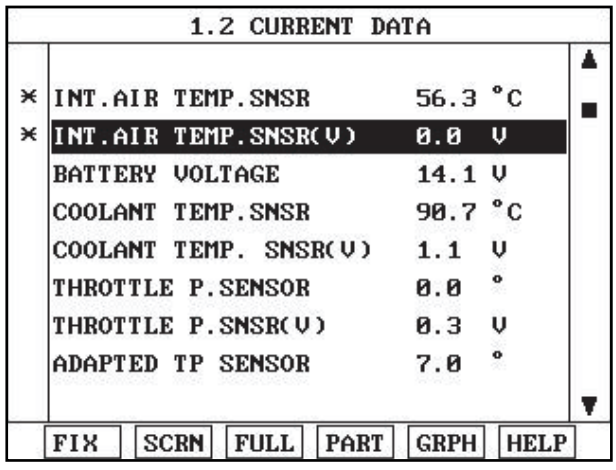


Fig. 2

Fig 1) Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2.3V at 55.5℃(132°F)
Fig 2) Short to ground in signal circuit : Approx. 0V

LWIF101E

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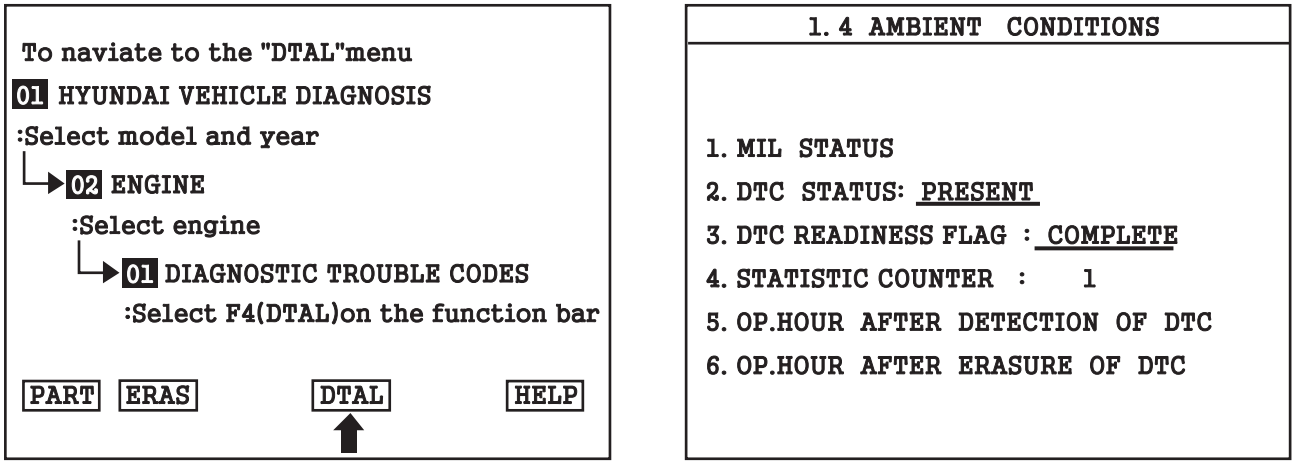
MONITOR DTC STATUS E53EE35E

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA E165D40C

1. Ignition "ON" & Engine "OFF".
2. Disconnect IAT sensor connector.
3. Connect Scantool and monitor the "INT.AIR TEMP. SNSR(V)" parameter on the Scantool data list.

Specification : Approx. 5V

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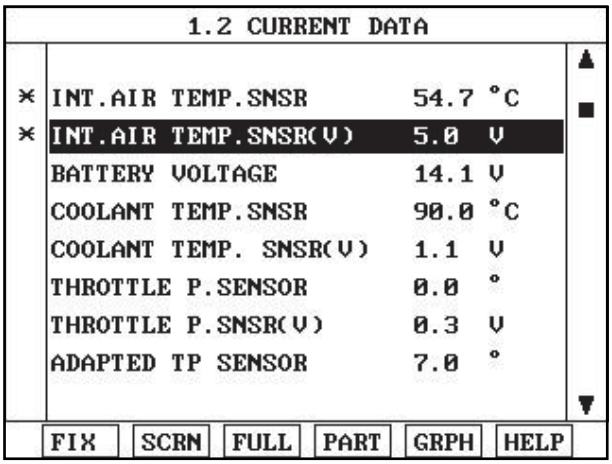

LWIF101F

4. Is displayed IAT data within the specification?

YES

▶ Possibility of sensor malfunction. Go to "Component Inspection" procedure.

NO

▶ Possibility of signal circuit short to ground. Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E1E82F3D

1. Ignition "OFF".
2. Disconnect IAT sensor connector.
3. Measure resistance between terminal 1 of the IAT sensor harness connector and chassis ground.

Specification : Infinite

4. Is resistance within the specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

▶ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E04BD1DF

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

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3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E00736F7

1. Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Temperature	Resistance (kΩ)
-20℃ (-4°F)	Approx. 14.26~16.02
20℃ (68°F)	Approx. 2.31~2.59
80℃ (176°F)	Approx. 0.31~0.32

2. Is IAT sensor data within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check IAT sensor for contamination, deterioration, or damage. Substitute with a known-good IAT sensor and check for proper operation. If the problem is corrected, replace IAT sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5C206B4

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0113 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT HIGH INPUT

COMPONENT LOCATION E8358E59

Refer to DTC P0112.

GENERAL DESCRIPTION EFD05457

Refer to DTC P0112.

DTC DESCRIPTION E6EF3D7E

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

DTC DETECTING CONDITION E1B023E2

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to battery in signal harness • Open in signal or ground circuit • Contact resistance in connections. • Faulty IAT sensor
Enable Conditions	• 6< Battery voltage(V) <16 • After 250 seconds from engine start	
Threshold Value	• Measured intake air temperature > -38℃(-36°F)	
Diagnostic Time	• 50 sec.	

SPECIFICATION E191F033

Refer to DTC P0112.

SCHEMATIC DIAGRAM E730D7D7

Refer to DTC P0112.

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SIGNAL WAVEFORM ED80F076

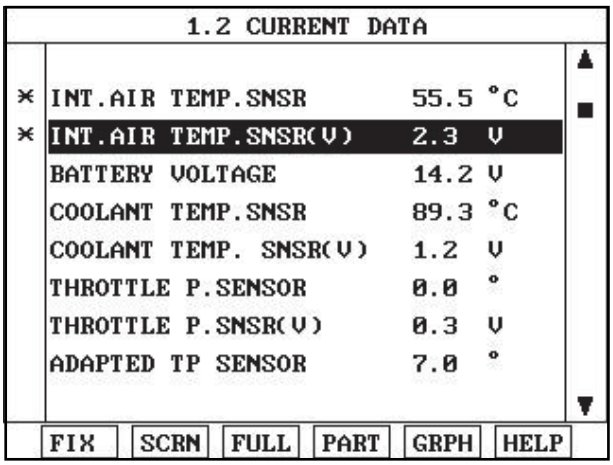


Fig. 1

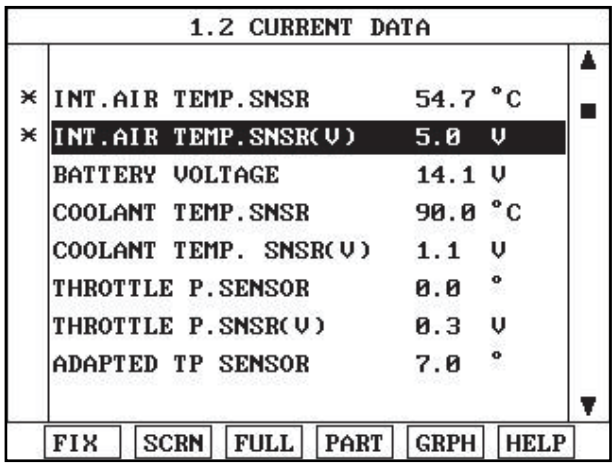


Fig. 2

Fig 1) Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2.3V at 55.5℃(132°F)
Fig 2) Short to battery in signal circuit : Approx. 5V

LWIF101G

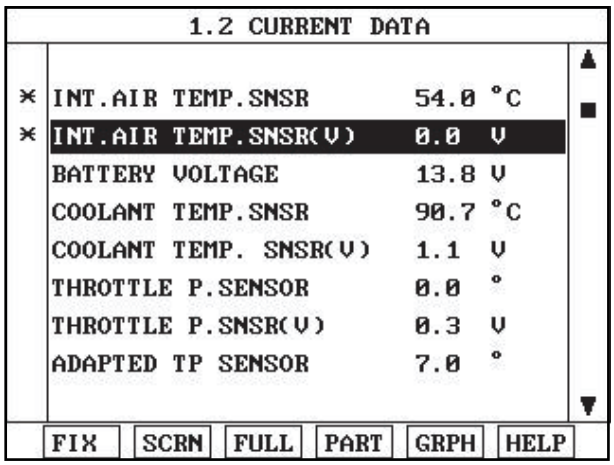
MONITOR DTC STATUS EF028A8B

Refer to DTC P0112.

MONITOR SCANTOOL DATA E5DB1270

1. Ignition "ON" & Engine "OFF".
2. Disconnect IATS sensor connector.
3. Connect Scantool and monitor the "INT.AIR TEMP. SNSR(V)" parameter on the Scantool data list.
4. Jumper the terminals 1 and 2 of the IAT sensor harness connector together.

Specification : Approx. 0v



LWIF101H

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5. Is IAT data within the specification?

YES

▶ Possibility of sensor malfunction. Go to "Component Inspection" procedure.

NO

▶ Go to next step as below.

6. Jumper the terminal 1 of the IAT sensor harness connector to chassis ground.
7. Observe the "IAT SENSOR" parameter on the Scantool.

Specification : Approx. 0V

8. Is IAT data within the specification?

YES

▶ Possibility of open in IAT ground circuit Go to "Ground circuit inspection" procedure.

NO

▶ Possibility of open or short to battery in IAT signal circuit. Go to "Signal Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION E14DB939

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminal 2 of the IATsensor harness connector and 23 of the ECM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Go to "Terminal and Connetor Inspection" procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION EA710560

1. Check for open in signal circuit

   1) Measure resistance between terminals 1 of the IAT sensor harness connector and 22 of the ECM harness connector.

Specification : Approx. 0Ω

   2) Is resistance within the specification?

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YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in signal circuit.

   1) Ignition "ON" & Engine "OFF".

   2) With IATS and ECM connector still disconnected, measure voltage between terminals 1 of the IAT sensor harness connector and 22 of the ECM harness connector.

Specification : Approx. 0V

   3) Is voltage within the specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E90DE97F

Refer to DTC P0112.

COMPONENT INSPECTION E654B604

1. Ignition "OFF"

2. Measure resistance between terminals 1 and 2 of the IAT sensor connector(Component side).

Specification : (at 20℃ (68°F))

Temperature	Resistance (kΩ)
-20℃ (-4°F)	Approx. 14.26~16.02
20℃ (68°F)	Approx. 2.31~2.59
80℃ (176°F)	Approx. 0.31~0.32

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3. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check IAT sensor for contamination, deterioration, or damage. Substitute with a known-good IAT sensor and check for proper operation. If the problem is corrected, replace IAT sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAD89125

Refer to DTC P0112.

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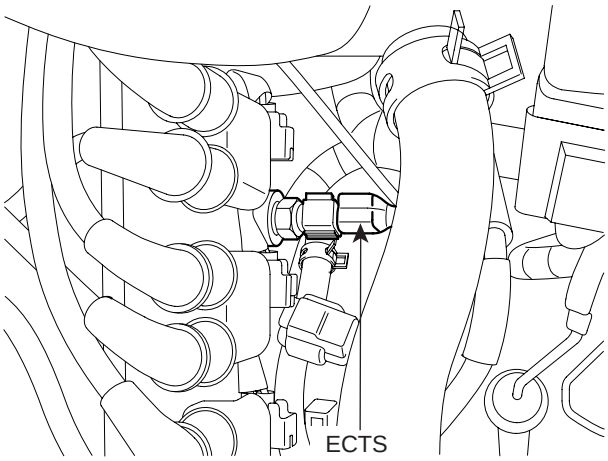
DTC P0116 ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E2B1F85F



LWIF551G

GENERAL DESCRIPTION E8589DDE

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.

DTC DESCRIPTION E07DE3E3

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.

DTC DETECTING CONDITION E6D4E39B

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check coolant temperature signal stuck.	• Contact resistance in connections. • Faulty ECT sensor
Enable Conditions	• Engine coolant ＞20°C (68°F) • After 100~1000 seconds from engine start	
Threshold Value	• TCOmodel increase ＞ Threshold But TCO measuring increase ＜Threshold(Threshold depends on Coolant start temp.)	
Diagnostic Time	• 5 sec.	

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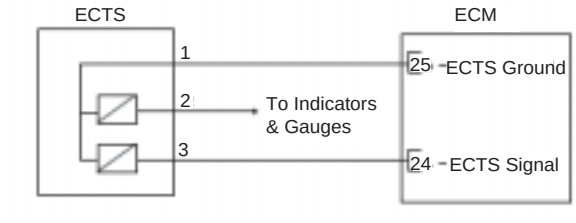
SPECIFICATION E122F3EE

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(°C)	(°F)		(°C)	(°F)	
-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 ED31C450

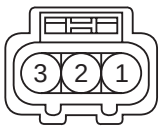
[CIRCUIT DIAGRAM]



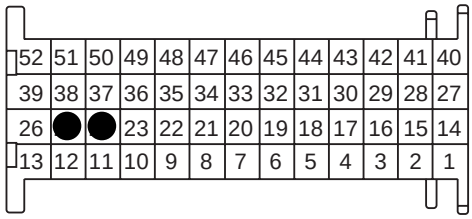
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM terminal 25	ECTS Ground
2	Indicators & Gauges	-
3	ECM terminal 24	ECTS Signal

[HARNESS CONNECTORS]



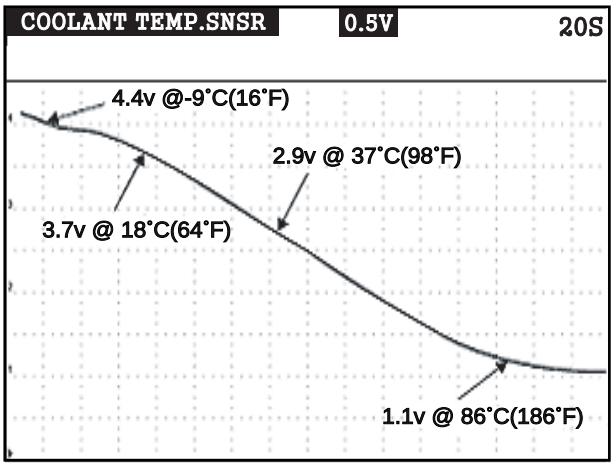
C94
ECTS Harness side connector



C68-3
ECM side terminal

LWIF002Q

SIGNAL WAVEFORM EAEE0A22



Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature

LWIF101I

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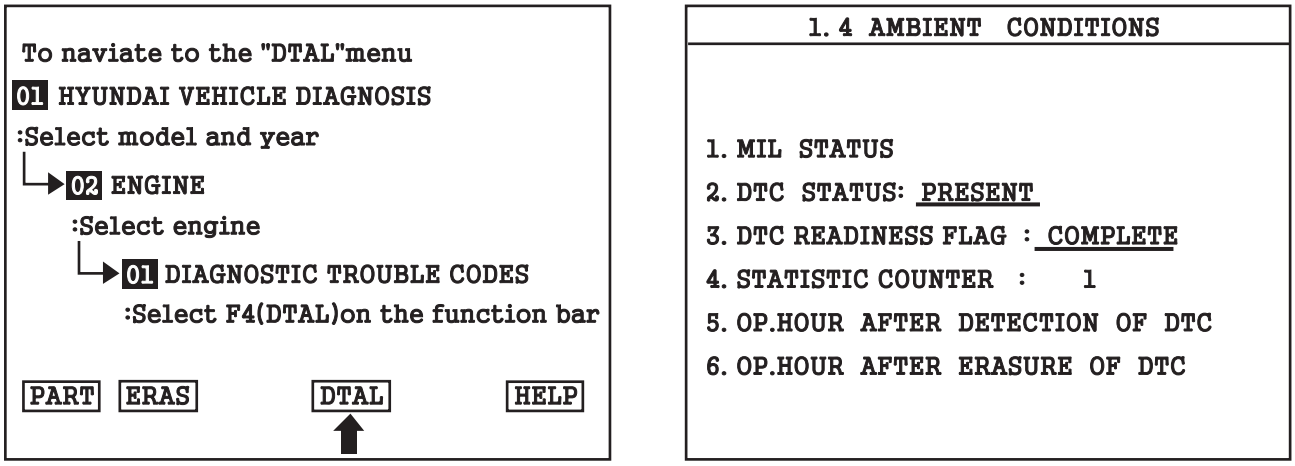
MONITOR DTC STATUS ED71CED5

NOTE

If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

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TERMINAL AND CONNECTOR INSPECTION E355C828

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E18CA4FD

1. Ignition "OFF"
2. Disconnect ECTS connector
3. Measure resistance between terminals 1 and 3 of the ECT sensor connector (Component side)

Specification :

Temperature	Resistance (kΩ)
-20℃ (-4°F)	Approx. 14.13~16.83
20℃ (68°F)	Approx. 2.31~2.59
80℃ (176°F)	Approx. 0.32

4. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check ECT sensor for contamination, deterioration, or damage. Substitute with a known-good ECT sensor and check for proper operation. If the problem is corrected, replace ECT sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE552176

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .

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3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

COMPONENT LOCATION EB099A63

Refer to DTC P0116.

GENERAL DESCRIPTION EFD7AE0C

Refer to DTC P0116.

DTC DESCRIPTION EED2D1C3

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

DTC DETECTING CONDITION E2B7AC1D

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Contact resistance in connections. • Faulty ECT sensor
Enable Conditions	• Engine coolant ＞20℃ (68°F) • After 100~1000 seconds from engine start	
Threshold Value	• Measured coolant temperature ＞ 138℃(280°F).	
Diagnostic Time	• 5 sec.	

SPECIFICATION E997F91E

Refer to DTC P0116.

SCHEMATIC DIAGRAM EAAB8E7F

Refer to DTC P0116.

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SIGNAL WAVEFORM E872149F

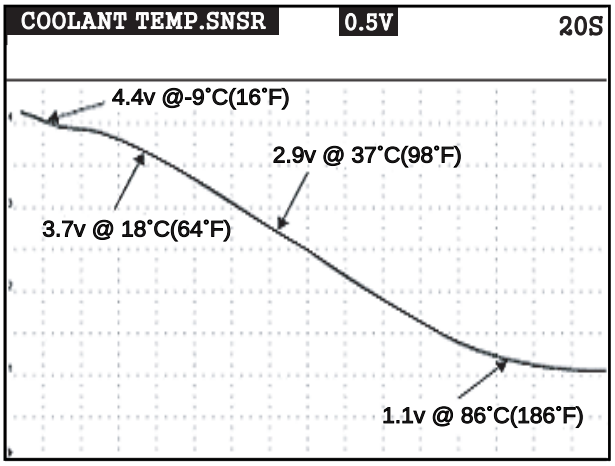


Fig. 1

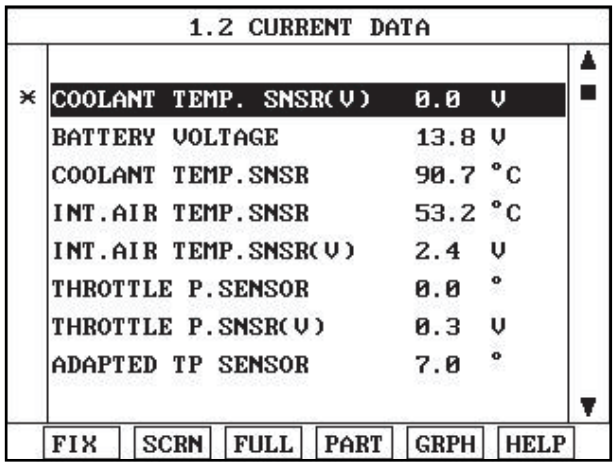


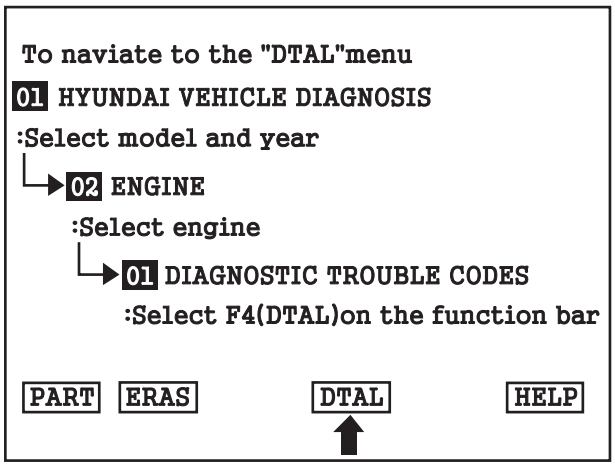
Fig. 2

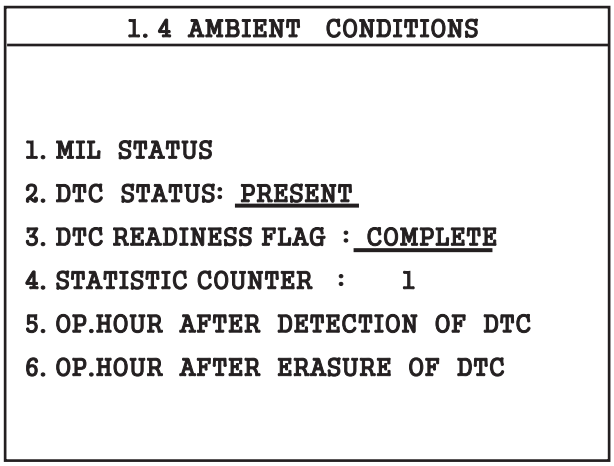
Fig 1) Signal decreases with increasing sensor temperature and increases with decreasign sensor temperature.
Fig 2) Short to ground in signal circuit : Approx. 0V

LWIF101J

MONITOR DTC STATUS E42ACDCC

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.





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5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

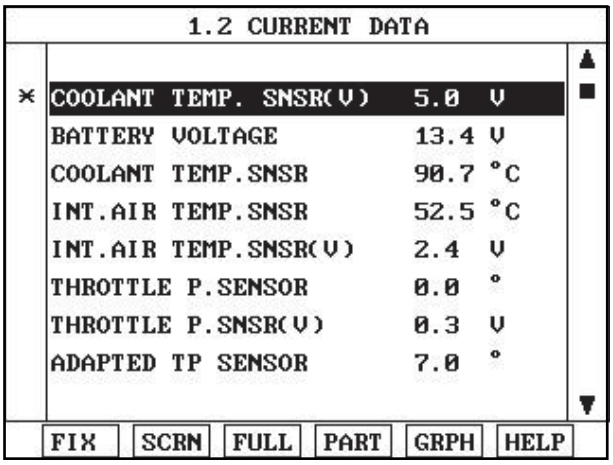
NO

▶ Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA E9B50FD8

1. Ignition "ON" & Engine "OFF".
2. Disconnect ECTS connector.
3. Connect Scantool and monitor the "COOLANT TEMP. SNSR(V)" parameter on the Scantool data list.

Specification : Approx. 5V



LWIF101K

4. Is ECTS parameter within the specification?

YES

▶ Possibility of sensor malfunction. Go to "Component Inspection" procedure.

NO

▶ Possibility of signal circuit short to ground. Go to "Signal Circuit Inspection" procedure.

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SIGNAL CIRCUIT INSPECTION EC971D7C

1. Ignition "OFF".
2. Measure resistance between terminal 3 of the ECT sensor harness connector and chassis ground.

Specification : Infinite

3. Is resistance within the specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

▶ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E18C3C0A

Refer to DTC P0116.

COMPONENT INSPECTION E20687F4

1. Disconnect ECTS connector
2. Measure resistance between terminals 1 and 3 of the ECT sensor connector (Component side)

Specification :

Temperature	Resistance (kΩ)
-20℃ (-4°F)	Approx. 14.13~16.83
20℃ (68°F)	Approx. 2.31~2.59
80℃ (176°F)	Approx. 0.32

3. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check ECTS for contamination, deterioration, or damage. Substitute with a known-good ECTS and check for proper operation. If the problem is corrected, replace ECTS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5B97583

Refer to DTC P0116.

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DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E6085837

Refer to DTC P0116.

GENERAL DESCRIPTION EC9BA308

Refer to DTC P0116.

DTC DESCRIPTION E3064ABB

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

DTC DETECTING CONDITION E110AF1C

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to battery in signal harness • Open in signal or ground circuit • Contact resistance in connections. • Faulty ECT sensor
Enable Conditions	• Engine coolant ＞20℃ (68°F) • After 100~1000 seconds from engine start	
Threshold Value	• Measured coolant temperature ＜ -38℃(-36°F).	
Diagnostic Time	• 5 sec.	

SPECIFICATION E29881DF

Refer to DTC P0116.

SCHEMATIC DIAGRAM E9740367

Refer to DTC P0116.

SIGNAL WAVEFORM E8E648CD

Refer to DTC P0117.

MONITOR DTC STATUS E649FF0B

Refer to DTC P0117.

MONITOR SCANTOOL DATA EC6686FA

1. Ignition "ON" & Engine "OFF"
2. Disconnect ECTS connector
3. Connect Scantool and monitor the "COOLANT TEMP. SNSR(V)" parameter on the Scantool data list.
4. Jumper the terminals 1 and 2 of the ECTS harness connector together.

Specification : Approx. 0V

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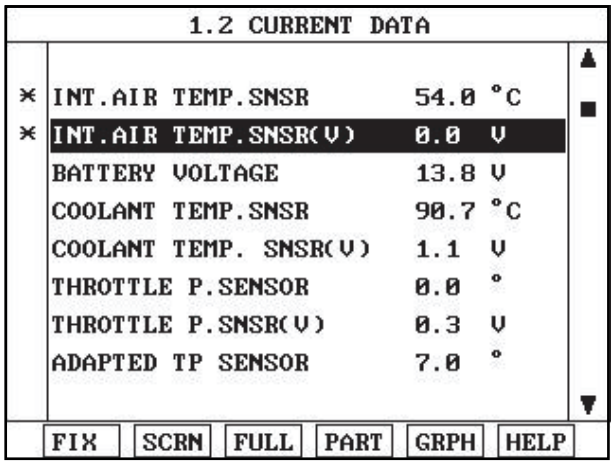

LWIF101H

5. Is ECTS parameter within the specification?

YES

▶ Possibility of sensor malfunction. Go to "Component Inspection" procedure.

NO

▶ Go to next step as below.

6. Jumper the terminal 3 of the ECT sensor harness connector to chassis ground.

7. Observe the "ECT SENSOR" parameter on the Scantool.

Specification : Approx. 0V

8. Is ECT data within the specification?

YES

▶ Possibility of open in ECTS ground circuit. Go to "Ground Circuit Inspection" procedure.

NO

▶ Possibility of open or short to battery in ECTS signal circuit. Go to "Signal Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION E4303EDF

1. Ignition "OFF".

2. Disconnect ECM connector.

3. Measure resistance between terminals 1 of the ECT sensor harness connector and 25 of the ECM harness connector.

Specification : Approx. 0Ω

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4. Is resistance within the specification?

YES

▶ Go to "Terminal and connector Inspection" procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E6B46246

1. Check for open in signal circuit.

   1) Measure resistance between terminals 3 of the ECT sensor harness connector and 24 of the ECM harness connector.

Specification : Approx. 0Ω

   2) Is resistance within the specification?

YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in signal circuit.

   1) Ignition "ON" & Engine "OFF".

   2) Measure voltage between terminals 3 of the ECT sensor harness connector and 24 of the ECM harness connector.

Specification : Approx. 0V

   3) Is voltage within the specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EA8517ED

Refer to DTC P0116.

COMPONENT INSPECTION E8288AE7

1. Ignition "OFF"

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2. Measure resistance between terminals 1 and 3 of the ECT sensor connector (Component side)

Specification :

Temperature	Resistance (kΩ)
-20℃ (-4°F)	Approx. 14.13~16.83
20℃ (68°F)	Approx. 2.31~2.59
80℃ (176°F)	Approx. 0.32

3. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check ECTS for contamination, deterioration, or damage. Substitute with a known-good ECTS and check for proper operation. If the problem is corrected, replace ECTS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6B7B4CF

Refer to DTC P0116.

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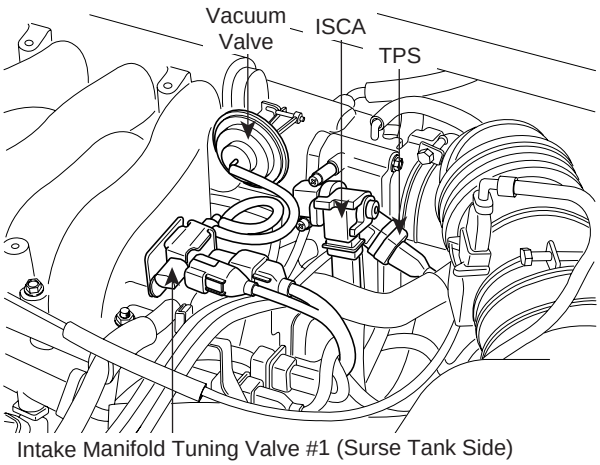
DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E93B8214



LWIF501Y

GENERAL DESCRIPTION E6F46B9A

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 DESCRIPTION E911D75C

The ECM compares the actual measured Mass Air Flow signal with the modeled Mass Air Flow value to detect implausible TPS signal. Because throttle position is one of key parameters in determining the modeled MAF. The modeled Mass Air Flow value is determined by engine speed, throttle angle and ISCA duty. The DTC P0121 is set when the difference between these two value is too high or too low with lambda deviation in same direction for a certain time.

DTC DETECTING CONDITION E76A843F

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare calculated MAF with MAF signa	• Contact resistance in connectors • Faulty TP Sensor(TPS)
Enable Conditions	• 1500< Engine speed(RPM) < 3500 • 150< Measured mass air flow(mg/stk) <350 • Coolant temp. >60℃(140°F)	
Threshold Value	• Measured MAF/Calculated MAF < 0.5 or > 1.3	
Diagnostic Time	• 110 sec.	

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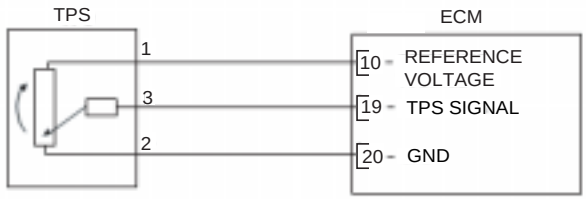
SPECIFICATION E1A6A77F

TPS		Normal parameter	
		C.T (Idle)	W.O.T
Throttle Angle (°)		0~0.5°	Approx. 85°
Signal Voltage (V)		0.25~0.8V	4.25~4.7V
Resistance (kΩ)	Terminal 2 and 3	0.71~1.38 kΩ at all temperature	2.7 kΩ at all temperature
	Terminal 1 and 2	1.6~2.4 kΩ at all throttle position	

SCHEMATIC DIAGRAM EBE1B241

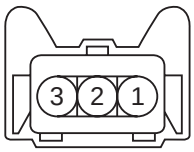
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

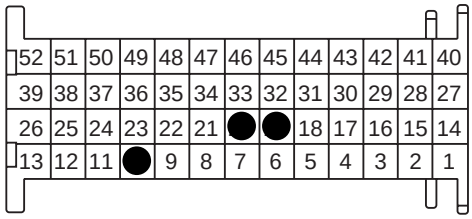
Terminal	Connected to	Function
1	ECM terminal 10	Reference Voltage
2	ECM terminal 20	TPS Ground
3	ECM terminal 19	TPS Signal

[HARNESS CONNECTORS]



C91

TPS Harness side connector



C68-3

ECM side terminal

LWIF002W

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SIGNAL WAVEFORM EBA27AEA

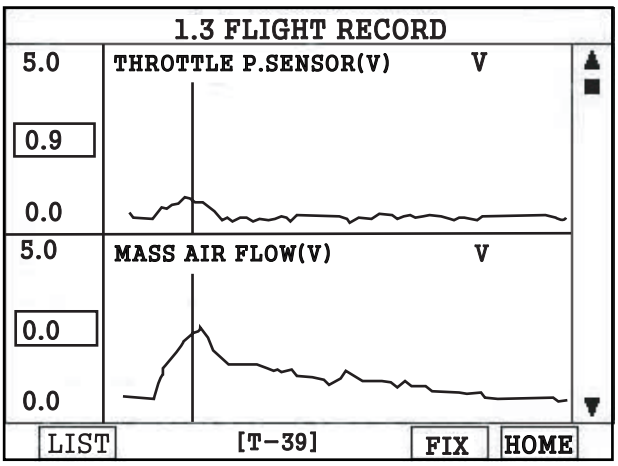


Fig. 1

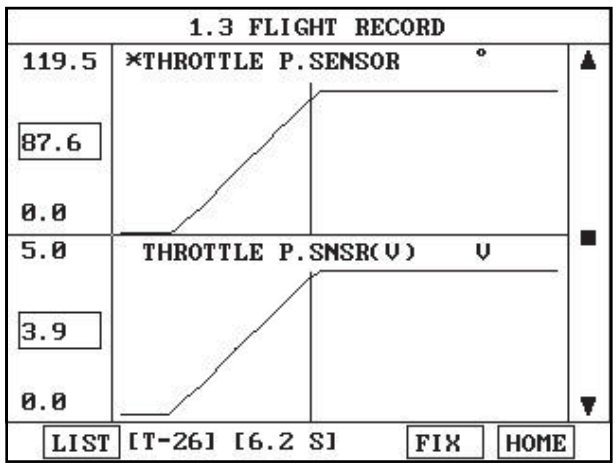


Fig. 2

Fig 1) Normal value with accelerating and decelerating : The MAFS and TPS signals increase at the same time with accelerating and decrease with releasing accelerator pedal
Fig 2) Signal increases proportionally with throttle opening angle

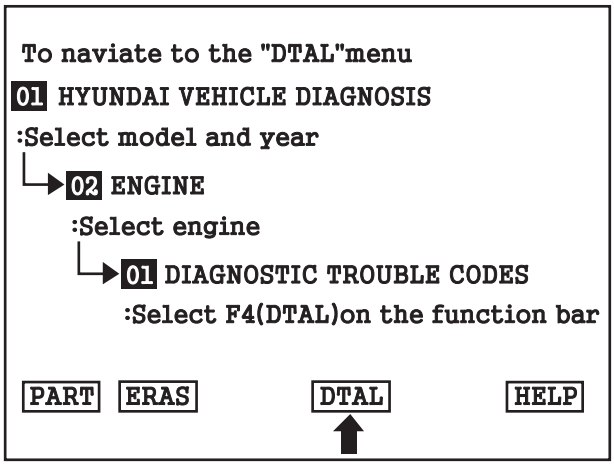
LWIF101M

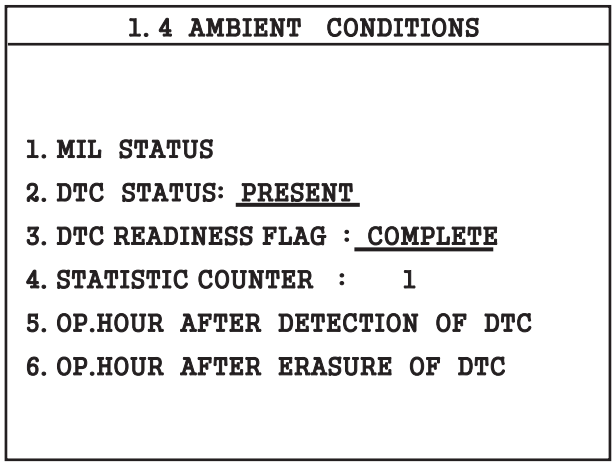
MONITOR DTC STATUS E2438E41

NOTE

If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.





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5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Air Leakage Inspection" procedure.

AIR LEAKAGE INSPECTION EBE46DEE

1. Visually/physically inspect the following items:
   - Vacuum hoses for splits, kinks and improper connections.
   - EVAP system for leakage.
   - PCV hose for proper installation.

2. Was a problem found in any of the above areas?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E0B5B412

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure .

NO

▶ Go to "Component Inspection" procedure.

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COMPONENT INSPECTION EFEA9F52

1. Ignition "OFF".
2. Disconnect TPS connector.
3. Measure resistance between terminals 1 and 2 of the TPS connector(Component side).

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position

4. With still TPS connector disconnected, measure resistance between terminals 2 and 3 of the sensor connector(Component side)
5. Operate the throttle valve slowly from the idle position to the full open position and check the resistance changes smoothly in proportion with the throttle valve opening angle.

Specification : 0.71 ~ 1.38 kΩ at closed throttle valve, 2.7 kΩ at wide open throttle

6. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check TPS for contamination, deterioration, or damage. Substitute with a known-good TPS and check for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E13E9476

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT

COMPONENT LOCATION E18DF49B

Refer to DTC P0121.

GENERAL DESCRIPTION ED82639B

Refer to DTC P0121.

DTC DESCRIPTION E18B0B16

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

DTC DETECTING CONDITION E9D6D24D

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open in power supply harness • Short to ground in power supply or signal harness • Contact resistance in connectors • Faulty TP sensor
Enable Conditions	• 6 ≤ Battery voltage ≤ 16V	
Threshold Value	• Voltage ＜0.14V	
Diagnostic Time	• 1 sec.	

SPECIFICATION E48F092C

Refer to DTC P0121.

SCHEMATIC DIAGRAM E0CDC02F

Refer to DTC P0121.

SIGNAL WAVEFORM E62D4FAE

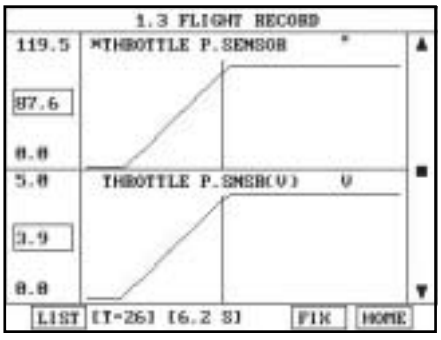

Fig. 1

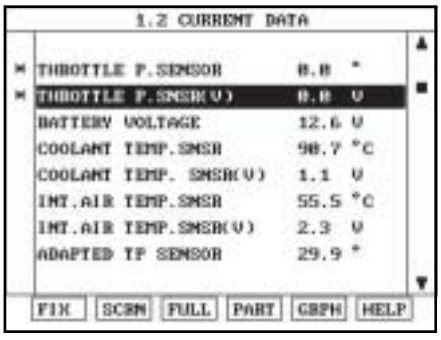

Fig. 2

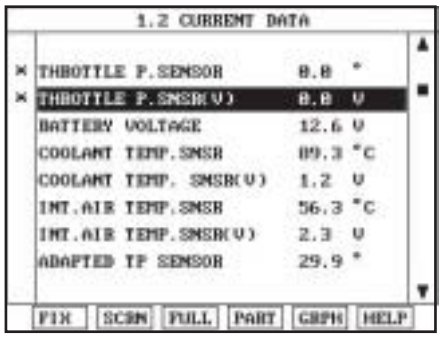

Fig. 3

Fig 1) Signal increases proportionally with throttle opening angle
Fig 2) Short to ground in signal circuit/Open in power supply circuit : Approx. 0V
Fig 3) Short to ground in power supply circuit : Approx. 0V

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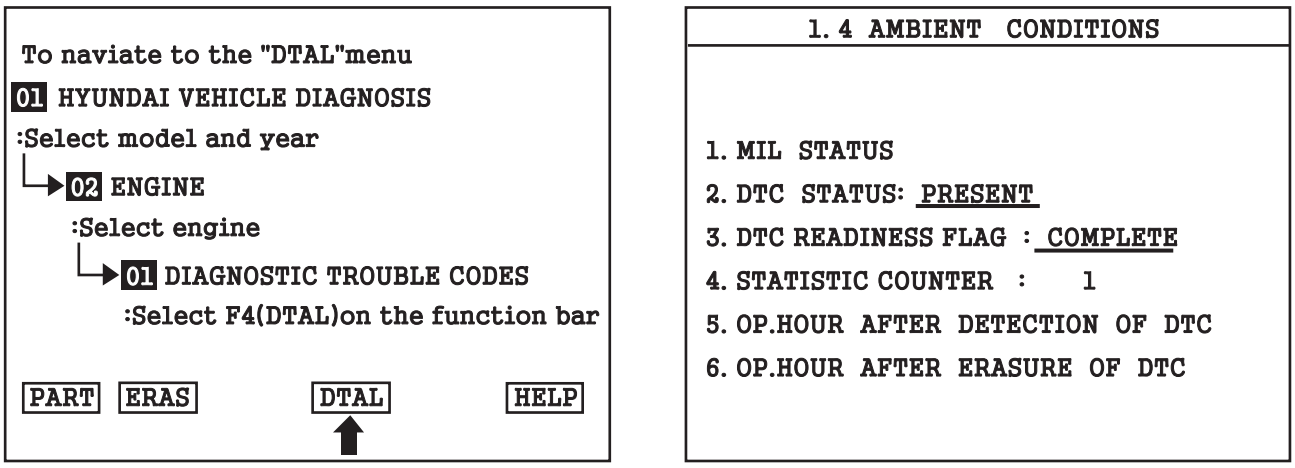
MONITOR DTC STATUS E3B07742

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



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5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E979383B

Refer to DTC P0121.

POWER SUPPLY CIRCUIT INSPECTION EE3A2049

1. Ignition "OFF".
2. Disconnect TPS connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the TPS harness connector and chassis ground.

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Specification : Approx. 5V

5. Is voltage within the specification?

YES

▶ Go to "Signal Circuit inspection" procedure.

NO

▶ Possibility of open or short to ground in 5V reference circuit.
Repair as necessary. Go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EB16C5C8

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. 5V

3. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

NO

Check the short to ground in signal circuit.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0569011

1. Ignition "OFF".
2. Disconnect TPS connector.
3. Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position

4. With still TPS connector disconnected, measure resistance between terminals 2 and 3 of the sensor connector(Component side)
5. Operate the throttle valve slowly from the idle position to the full open position and check the resistance changes smoothly in proportion with the throttle valve opening angle.

Test Condition : Ignition "OFF"
Specification : 0.71 ~ 1.38 kΩ at closed throttle valve, 2.7 kΩ at wide open throttle

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6. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check TPS for contamination, deterioration, or damage. Substitute with a known-good TPS and check for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0838D69

Refer to DTC P0121.

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DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT

COMPONENT LOCATION E6C21403

Refer to DTC P0121.

GENERAL DESCRIPTION E3A0EF44

Refer to DTC P0121.

DTC DESCRIPTION E67B0260

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

DTC DETECTING CONDITION E474C8EF

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open in signal or ground circuit • Short to battery in signal circuit • Contact resistance in connectors • Faulty TP sensor
Enable Conditions	• 6 ≤ Battery voltage(V) ≤ 16	
Threshold Value	• Voltage > 4.86V	
Diagnostic Time	• 1 sec.	

SPECIFICATION E198221A

Refer to DTC P0121.

SCHEMATIC DIAGRAM E89D5C88

Refer to DTC P0121.

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SIGNAL WAVEFORM EF904903

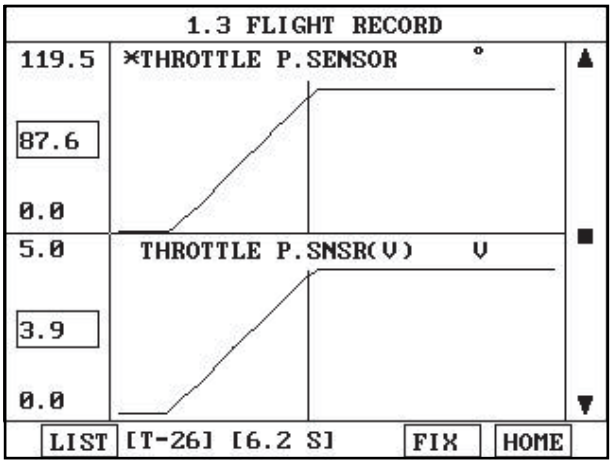


Fig. 1

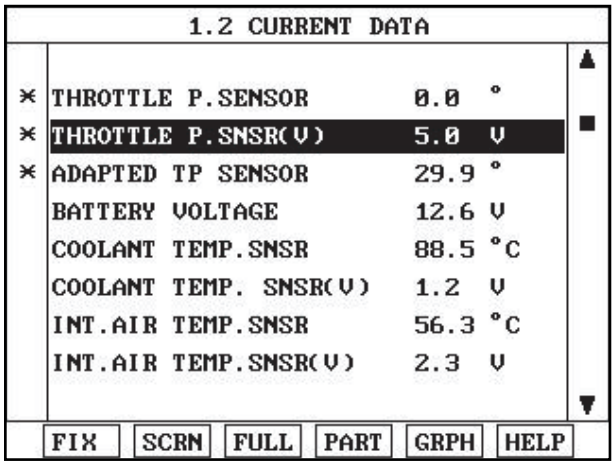


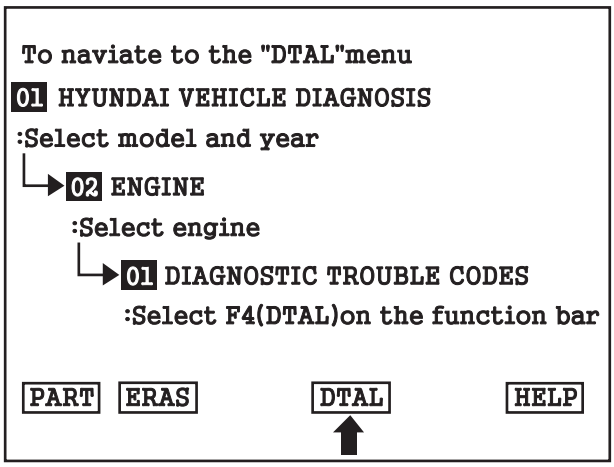
Fig. 2

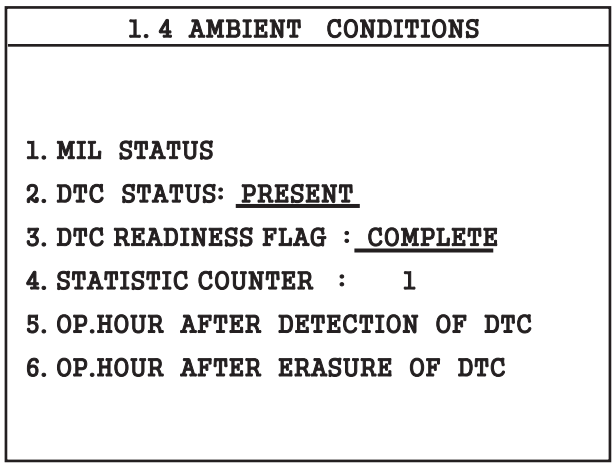
Fig 1) Signal increases proportionally with throttle opening angle
Fig 2) Open in signal or ground circuit : Approx. 5V

LWIF101O

MONITOR DTC STATUS E23CA590

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.





LGIF001X

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5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E72379E5

Refer to DTC P0121.

GROUND CIRCUIT INSPECTION EA0CB82C

1. Ignition "OFF".
2. Disconnect TPS connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : Approx. 0V

5. Is voltage within the specification?

YES

▶ Go to step "Signal Circuit Inspection" procedure.

NO

▶ Check the ground circuit for an open.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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SIGNAL CIRCUIT INSPECTION E1BCB850

1. With sensor connector still disconnected, measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. 5V

2. Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Possibility of open or short to power in signal circuit.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E683D664

1. Ignition "OFF".
2. Disconnect TPS connector.
3. Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position

4. With still TPS connector disconnected, measure resistance between terminals 2 and 3 of the sensor connector(Component side)
5. Operate the throttle valve slowly from the idle position to the full open position and check the resistance changes smoothly in proportion with the throttle valve opening angle.

Specification : 0.71 ~ 1.38 kΩ at closed throttle valve, 2.7 kΩ at wide open throttle

6. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check TPS for contamination, deterioration, or damage. Substitute with a known-good TPS and check for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECF201A6

Refer to DTC P0121.

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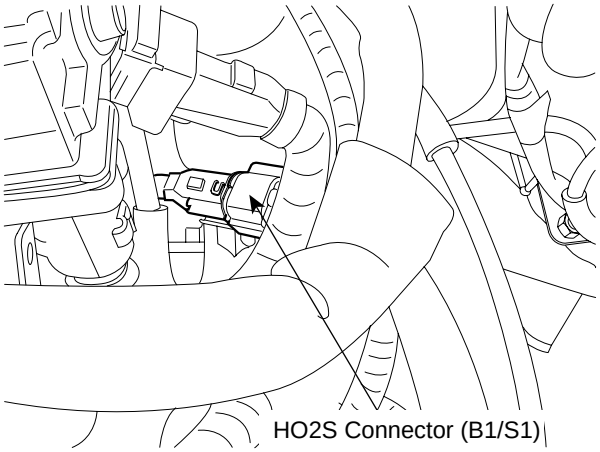
DTC P0130 HO2S CIRCUIT (BANK 1/ SENSOR 1)

COMPONENT LOCATION EE7EF00D



LWIF501I

GENERAL DESCRIPTION E2AEC8EE

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION E1384BA3

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

DTC DETECTING CONDITION E95688D0

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check open circuit on rear HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • Battery voltage ＞10V • Lambda control active	
Threshold Value	• 0.4V ＜ Sensor voltage ＜0.5V	
Diagnostic Time	• 10 Seconds	

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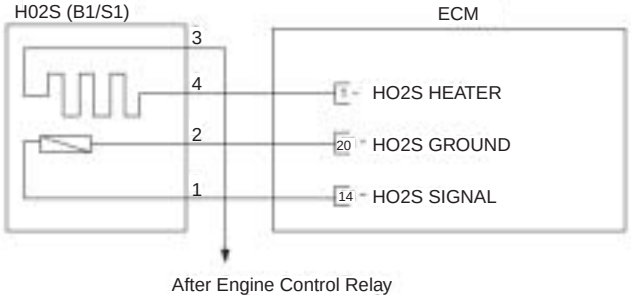
SCHEMATIC DIAGRAM E32098A5

[CIRCUIT DIAGRAM]



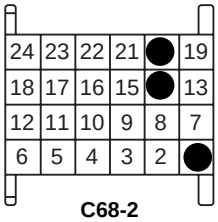
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 14	Signal
2	ECM Terminal 20	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 1	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

ECM side terminal

LWIF001G

SIGNAL WAVEFORM EEECC05A

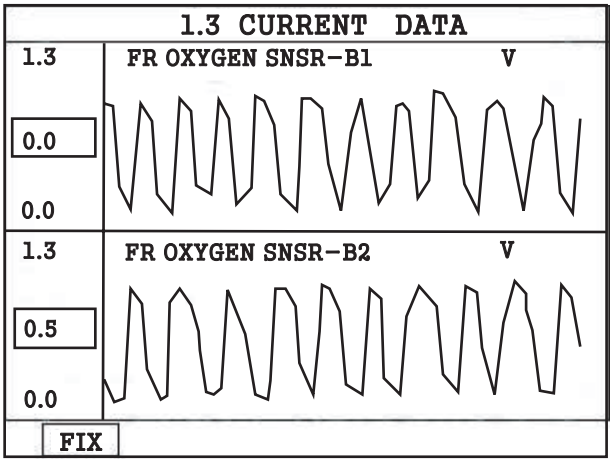


Fig. 1

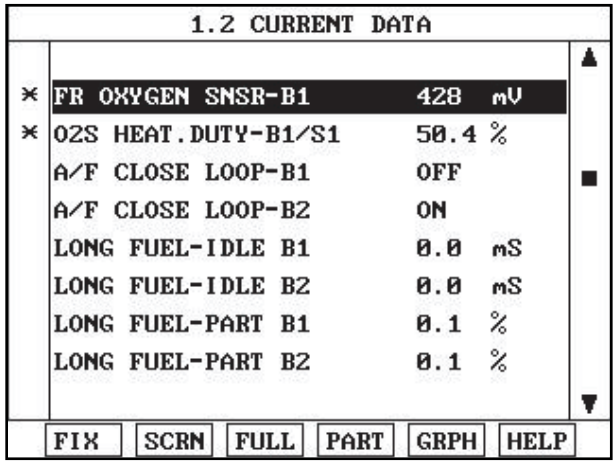


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

LWIF101P

MONITOR DTC STATUS E696CE64

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.

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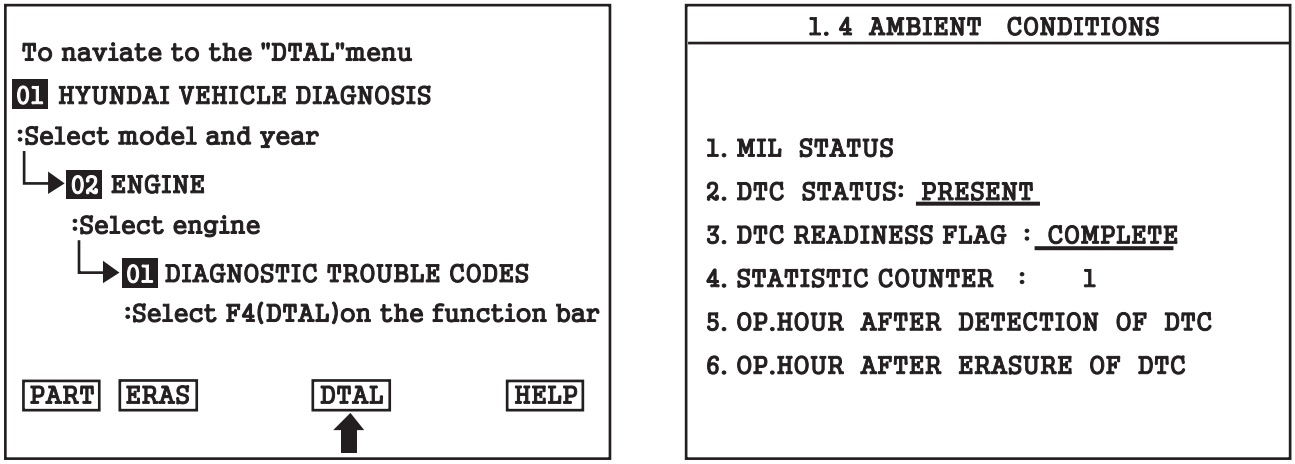
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION E1B67583

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Ground Circuit Inspection" procedure.

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GROUND CIRCUIT INSPECTION E01D3AD1

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminals 2 of the HO2S harness connector and 20 of the ECM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION E1851847

1. Measure resistance between terminals 1 of the HO2S harness connector and 14 of the ECM harness connector.

Specification : Approx. 0Ω

Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED47E2FE

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
     If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

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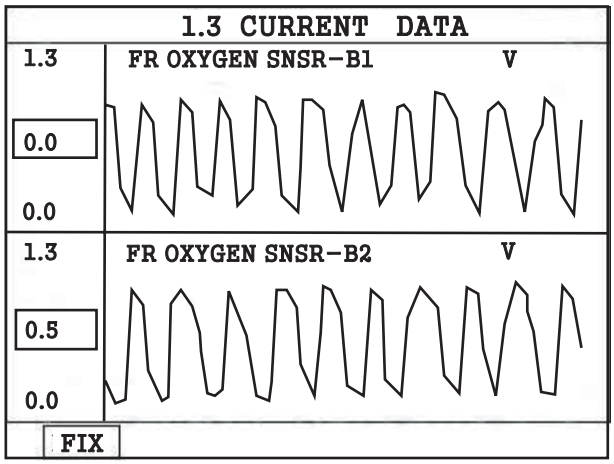

Fig. 1

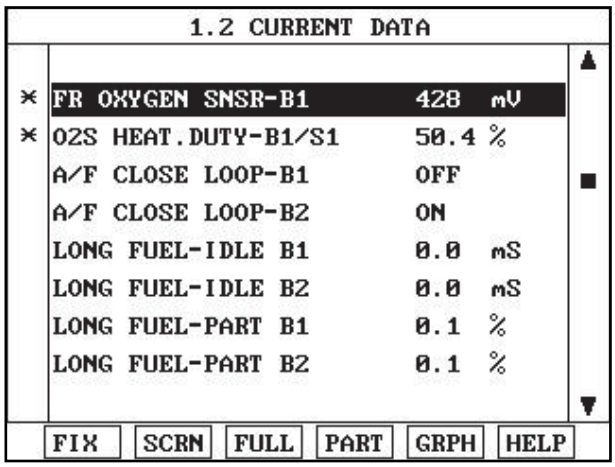

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

LWIF101P

4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9409FE6

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0131 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E457743F

Refer to DTC P0130.

GERNERAL DESCRIPTION E6086E11

Refer to DTC P0130.

DTC DESCRIPTION E7740D9C

The control unit of the linear oxygen sensor built inside the ECM monitors short circuit errors on all front Heated Oxygen Sensor (HO2S) control lines and the ECM sets P0131 with short circuit to ground.

DTC DETECTING CONDITION E8BC1CA3

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＜0.02V and element resistance ＜10Ω	
Diagnostic Time	• 60 sec.	

SCHEMATIC DIGRAM E017BCF2

Refer to DTC P0130.

SIGNAL WAVEFORM EC90FDD1

Refer to DTC P0130.

MONITOR DTC STATUS ED7B2488

Refer to DTC P0130.

TERMINAL & CONNECTOR INSPECTION E6AFDA91

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION E80DEEAD

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Infinite

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4. Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA402B0A

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   - If contamination is evident on the HO2S, replace contaminated sensor and go to next step.

2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

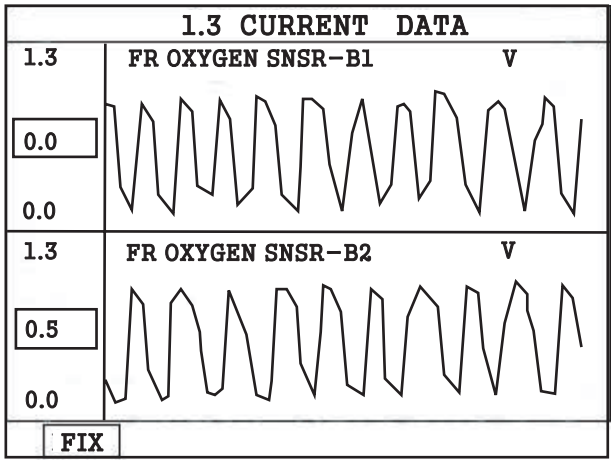

Fig. 1

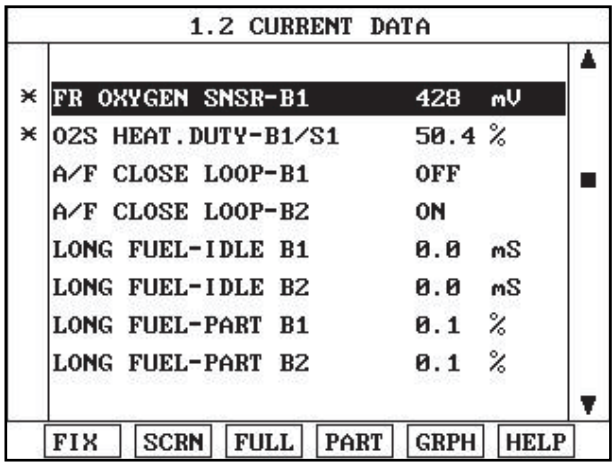

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

LWIF101P

4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

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VERIFICATION OF VEHICLE REPAIR E6C99F3E

Refer to DTC P0130.

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DTC P0132 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION ED7F0A22

Refer to DTC P0130.

GERNERAL DESCRIPTION E27177C8

Refer to DTC P0130.

DTC DESCRIPTION E1397D31

The control unit of the linear oxygen sensor built inside the ECM monitors short circuit errors on all front Heated Oxygen Sensor (HO2S) control lines and the ECM sets P0132 with short circuit to battery.

DTC DETECTING CONDITION EF4A74A2

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage high	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＞1.3V	
Diagnostic Time	• 1 sec.	

SCHEMATIC DAIGRAM E9BEE4D8

Refer to DTC P0130.

SIGNAL WAVEFORM E73879FA

Refer to DTC P0130.

MONITOR DTC STATUS EA4D42A3

Refer to DTC P0130.

TERMINAL & CONNECTOR INSPECTION EFC50E1F

Refer to DTC P0130.

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SIGNAL CIRCUIT INSPECTION E84FDAC2

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Approx. 0V

5. Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF4D23B2

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   - If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

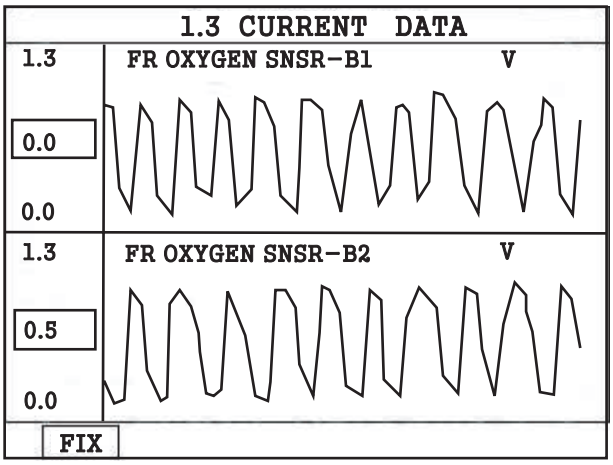

Fig. 1

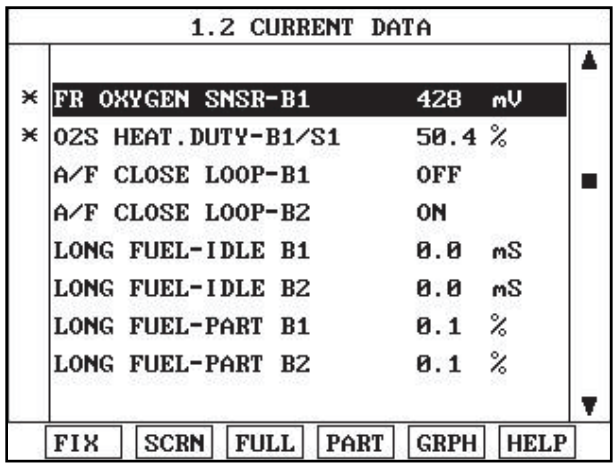

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

LWIF101P

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4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.
If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E53109F7

Refer to DTC P0130.

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DTC P0133 HO2S CIRCUIT SLOW RESPONSE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E97FB58F

Refer to DTC P0130.

GERNERAL DESCRIPTION E791E3F0

Refer to DTC P0130.

DTC DESCRIPTION E6C134AE

The ECM monitors front oxygen sensor amplitude level and compares it to predetermined minimum amplitude value which could increase emission or disturb lambda control by the effect of aging on the oxygen sensor. The ECM sets DTC P0133 when the amplitude of oxygen sensor is equal to or less than minimum amplitude threshold.

DTC DETECTING CONDITION E675545D

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of O2 sensor lean/rich period with calculated period	• Leak in intake or exhaust system • Faulty fuel system. • Front and rear HO2S connections reversed. • Contact resistance in connectors • HO2S contamination
Enable Conditions	• 400℃(752°F)< Catalyst Temp.Model < 600℃(1112°F) • Coolant temp. >70℃(158°F) • 800 <Engine speed(RPM) <2500 • Mass air flow <250 mg/stk • No misfire detected • Not transient condition	
Threshold Value	• Sum of O2 sensor lean/rich period > calculated period	
Diagnostic Time	• 80 lambda controller cycles.	

SCHEMATIC DIAGRAM E75F9087

Refer to DTC P0130.

SIGNAL WAVEFORM E54E01F9

Refer to DTC P0130.

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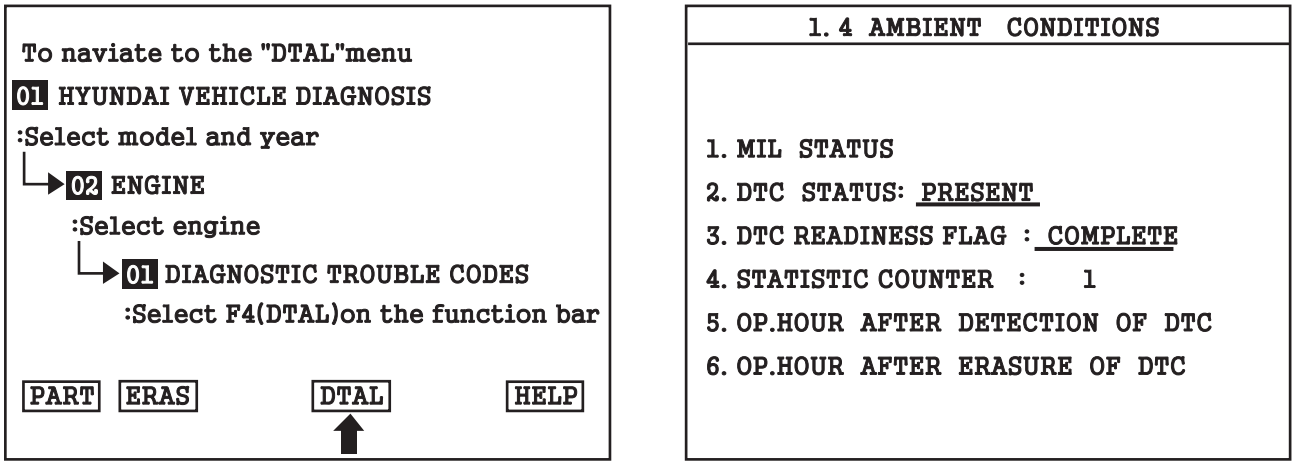
MONITOR DTC STATUS EB0EEF24

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

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VISUAL/PHYSICAL INSPECTION E8761DD2

1. Visually/physically inspect the following items:
   - Ensure that the HO2S is securely installed.
   - Check for corrosion on terminals.
   - Check for terminal tension (at the HO2S and at the ECM).
   - Check for damaged wiring.
   - Check the HO2S ground circuit for a good connection.

2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.

3. Was a problem found in any of the above areas?

   YES

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Air Leakage Inspection" procedure

AIR LEAKAGE INSPECTION EC639FE0

1. Visually/physically inspect the following items:
   - Vacuum hoses for splits, kinks and improper connections.
   - Exhaust system between HO2S and Three way catalyst for air leakage.
   - EVAP system for leakage.
   - PCV hose for proper installation.

2. Was a problem found in any of the above areas?

   YES

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Fuel Pressure Inspection" procedure.

FUEL PRESSURE INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.

2. Install a fuel pressure gage.

3. Inspect fuel pressure with engine idling at normal operating temperature.

Test Condition : Engine "ON" & Vacuum hose disconnected at Idle.
Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

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4. Is the fuel pressure within the specified value?

YES

▶ Go to "Fuel Injector Inspection" procedure as below.

NO

▶ Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

a. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.*

b. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator.*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

c. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

FUEL INJECOTR INSPECTION

1. Ignition "OFF"

2. Check the fuel injectors for clogging or any restrictions.

Specification : No clogging and restriction

3. Is the fuel injector OK?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION E5F58A95

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   - If contamination is evident on the HO2S, replace contaminated sensor and go to next step.

2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

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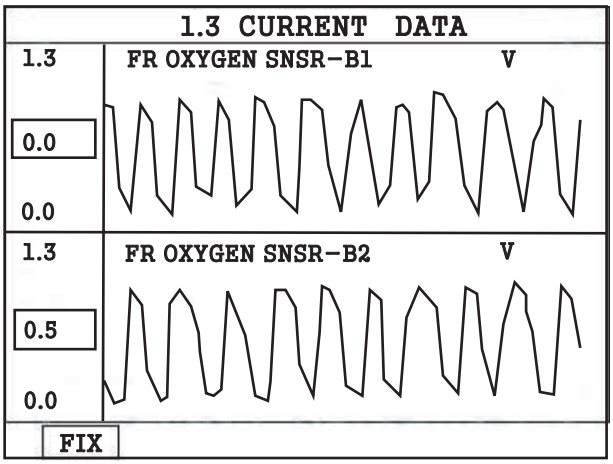

Fig. 1

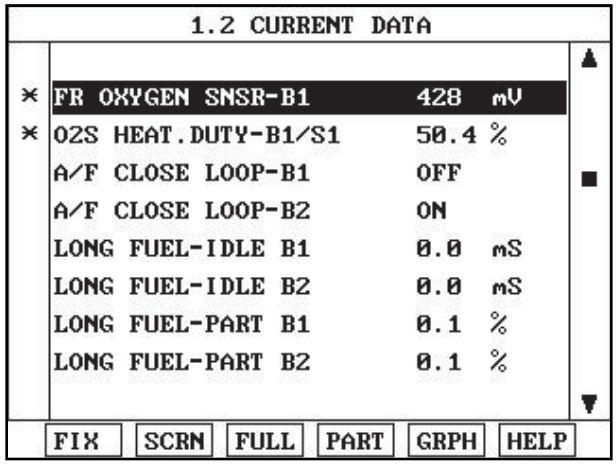

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

LWIF101P

4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.
If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7F55AA3

Refer to DTC P0130.

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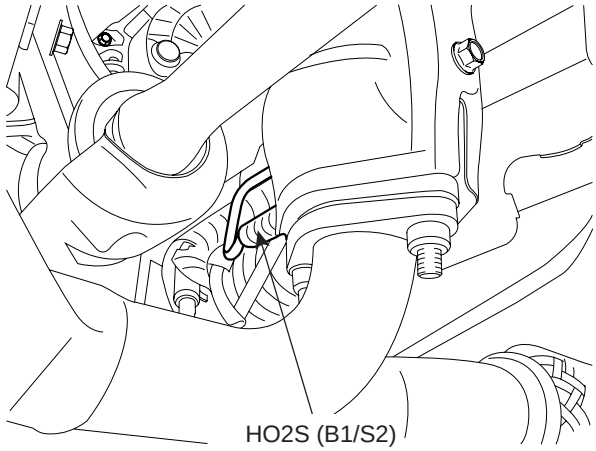
DTC P0136 HO2S CIRCUIT (BANK 1/ SENSOR 2)

COMPONENT LOCATION E3501CE1



LWIF501J

GERNERAL DESCRIPTION EEA59FE2

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 DESCRIPTION E8F511F5

ECM sets DTC P0136 if the ECM detects that the rear HO2S signal circuit is open.

DTC DETECTING CONDITION EE8F9739

ITEM	DETECTING CONDITION	POSSIBL ECAUSE
DTC Strategy	• Check open circuit on rear HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • No relevant failure • 10＜Battery voltage(V) ＜16	
Threshold Value	• Sensor element resistance ＞ 60kΩ	
Diagnostic Time	• 30 sec.	

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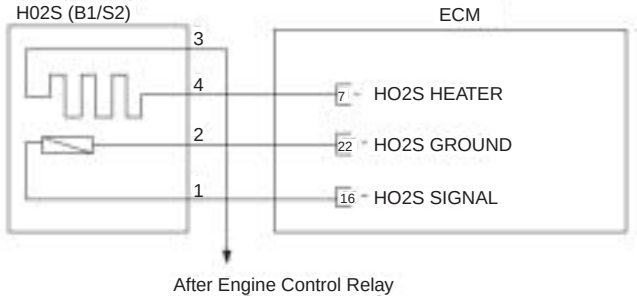
SCHEMATIC DIGRAM E6428D6E

[CIRCUIT DIAGRAM]



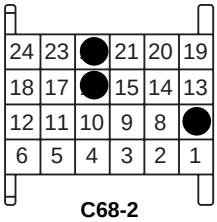
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 16	Signal
2	ECM Terminal 22	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 7	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

ECM side terminal

LWIF001M

SIGNAL WAVEFORM EACE0811

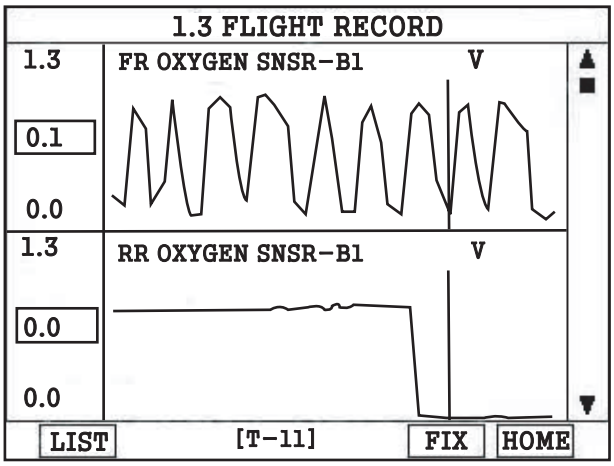


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101Q

MONITOR DTC STATUS E62DCC2D

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

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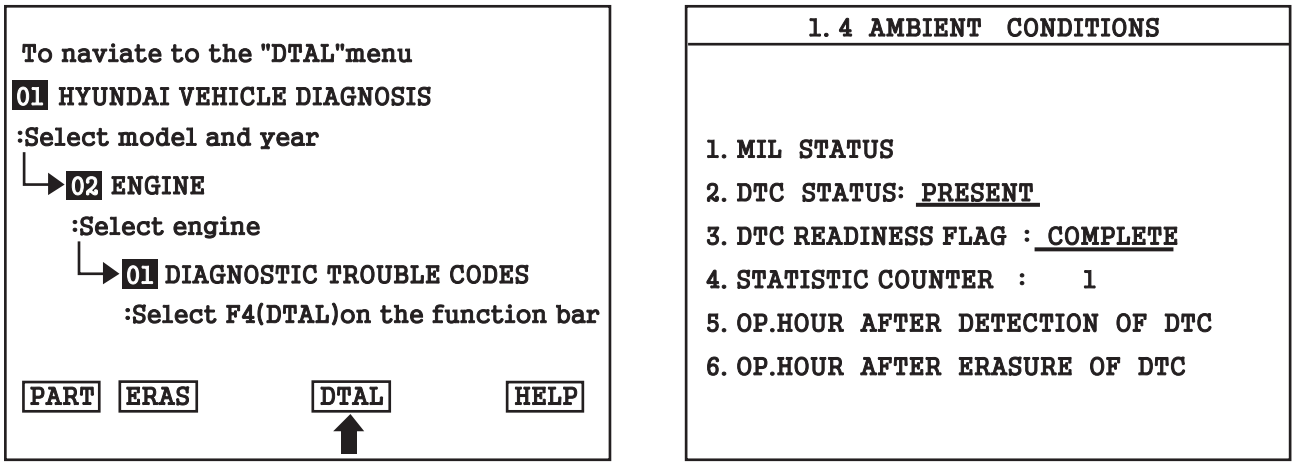
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION EA520B82

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Ground Circuit Inspection" procedure.

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GROUND CIRCUIT INSPECTION E4FB93A2

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminals 2 of the HO2S harness connector and 22 of the ECM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION ED3D752D

1. Measure resistance between terminals 1 of the HO2S harness connector and 16 of the ECM harness connector.

Specification : Approx. 0Ω

Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7126672

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

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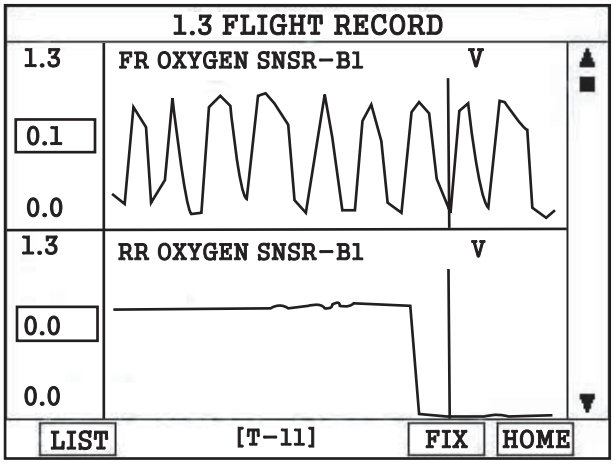

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101Q

3. Is "RR OXYGEN SNSR-B1" sensor data near the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR EB15F885

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0137 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION E0182AA4

Refer to DTC P0136.

GERNERAL DESCRIPTION EEF4BB61

Refer to DTC P0136.

DTC DESCRIPTION EEC986A1

ECM sets DTC P0137 if the ECM detects signal voltage lower than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION E1C6AC85

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＜0.02V and element resistance ＜10Ω	
Diagnostic Time	• 30 sec.	

SCHEMATIC DIAGRAM E6C9D505

Refer to DTC P0136.

SIGNAL WAVEFORM E9CF2FFD

Refer to DTC P0136.

MONITOR DTC STATUS E3762419

Refer to DTC P0136.

TERMINAL & CONNECTOR INSPECTION E1246D43

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E9FC374D

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Infinite

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4. Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E930D178

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Install Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

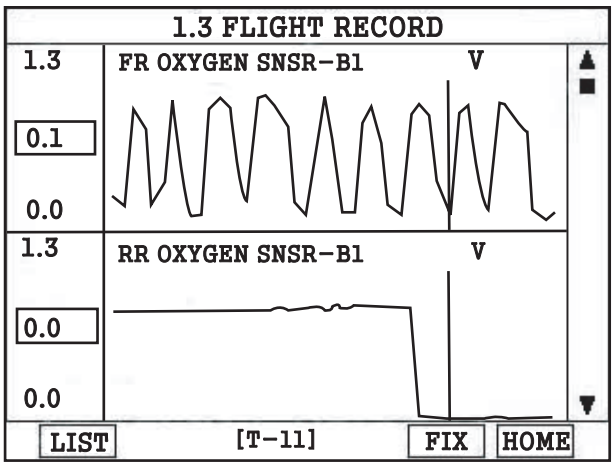

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101Q

3. Is "RR OXYGEN SNSR-B1" sensor data within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E036AD9A

Refer to DTC P0136.

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DTC P0138 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION E8C4190C

Refer to DTC P0136.

GERNERAL DESCRIPTION E3B0B059

Refer to DTC P0136.

DTC DESCRIPTION E715D93B

ECM sets DTC P0138 if the ECM detects signal voltage higher than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION EF853AF1

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage high	• Short to Battery in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＞1.3V	
Diagnostic Time	• 1 sec.	

SCHEMATIC DIGRAM E4F3DF69

Refer to DTC P0136.

SIGNAL WAVEFORM E556A539

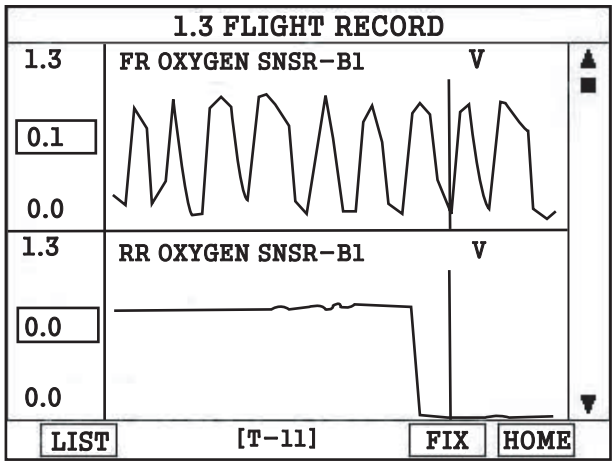

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101Q

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MONITOR DTC STATUS E6A98273

Refer to DTC P0136.

TERMINAL & CONNECTOR INSPECTION E7EB37AE

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E5B22A08

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Approx. 0V

5. Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFD23FB5

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition Specification : Above 0.6V

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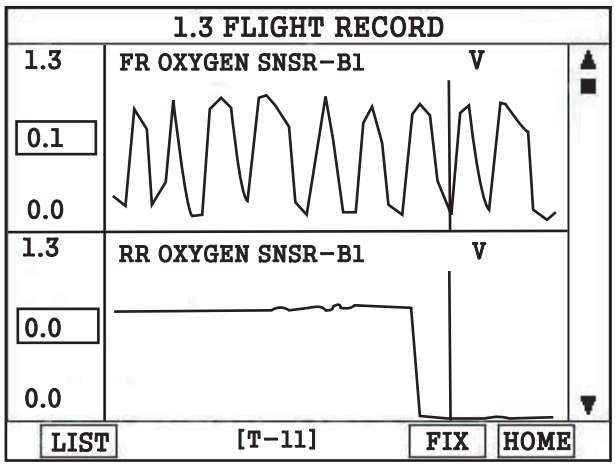

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101Q

3. Is sensor display within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EB244032

Refer to DTC P0136.

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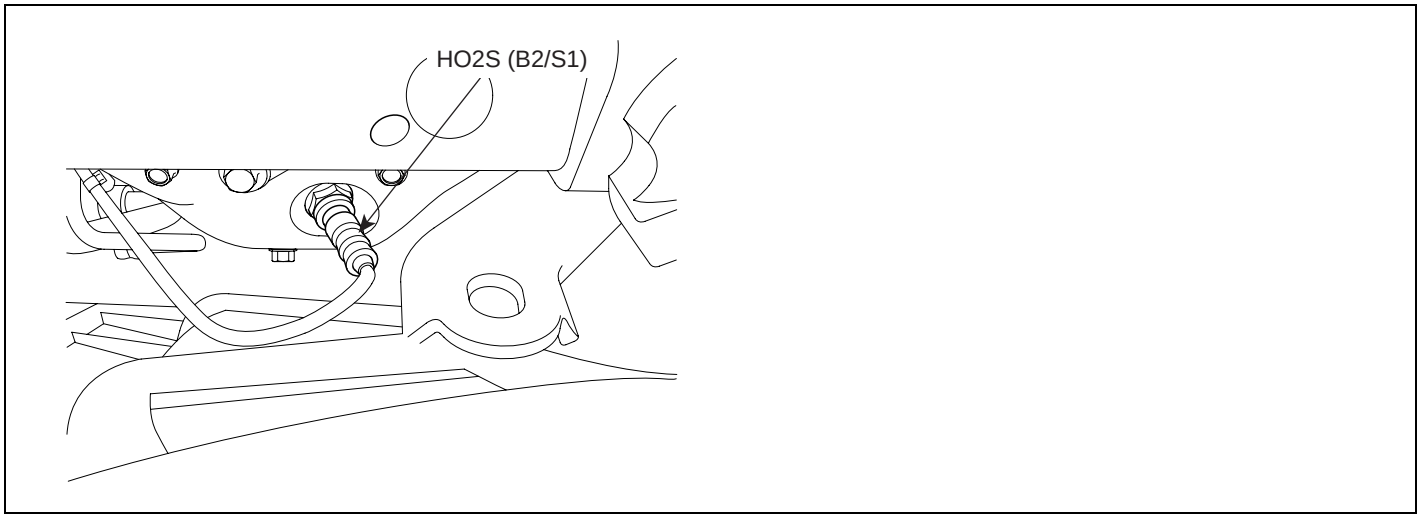
DTC P0150 HO2S CIRCUIT (BANK 2/ SENSOR 1)

COMPONENT LOCATION E6444648



LWIF501K

GENERAL DESCRIPTION E7D2C9C3

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION E1C8A400

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

DTC DETECTING CONDITION EC0142BB

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check open circuit on front HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • Battery voltage ＞10V • Lambda control active	
Threshold Value	• 0.4V ＜ Sensor voltage ＜0.5V	
Diagnostic Time	• 10 Seconds	

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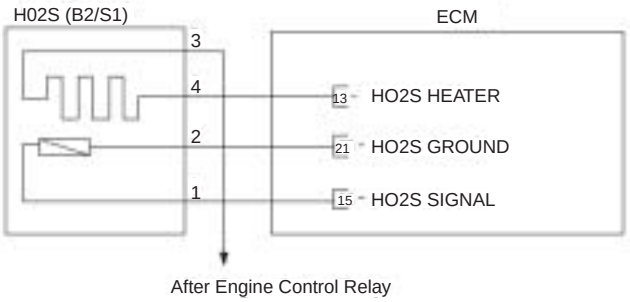
SCHEMATIC DIAGRAM E3AF2AE5

[CIRCUIT DIAGRAM]



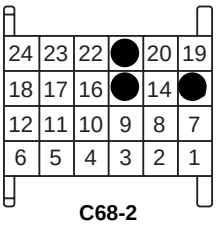
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 15	Signal
2	ECM Terminal 21	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 13	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

ECM side terminal

LWIF001S

SIGNAL WAVEFORM E1137209

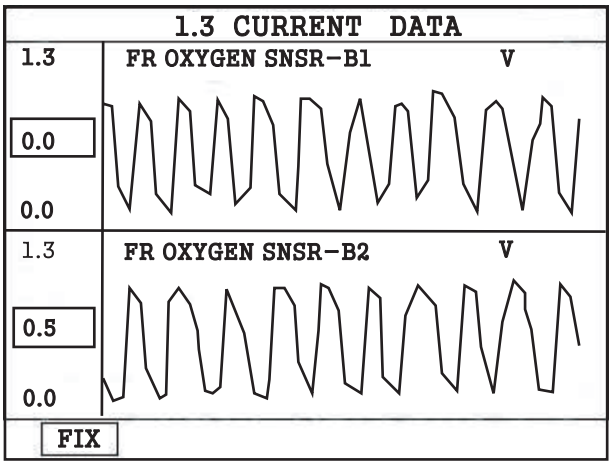


Fig. 1

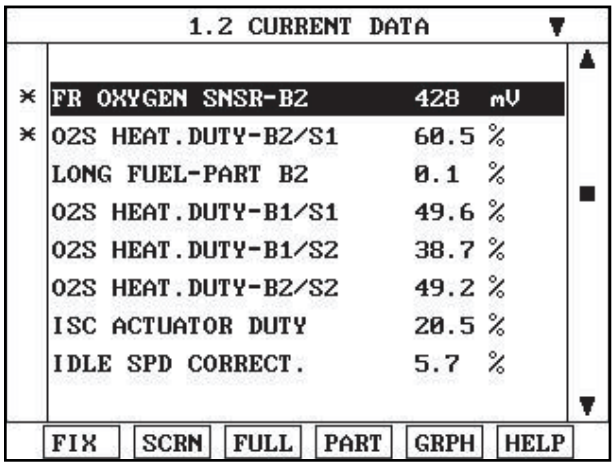


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

LWIF101R

MONITOR DTC STATUS E5400B1D

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.

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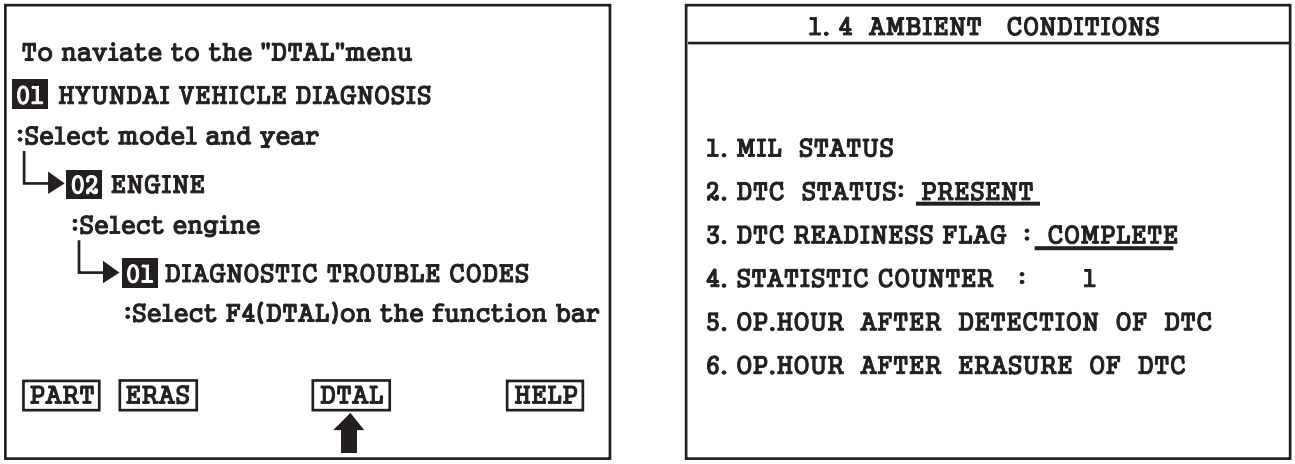
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION E2031E72

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Ground Circuit Inspection" procedure.

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GROUND CIRCUIT INSPECTION E3A091EC

1. Ignition "OFF"
2. Disconnect HO2S and ECM connectors.
3. Measure resistance between terminal 2 of the HO2S harness connector and 21 of the ECM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E59F4D38

1. Measure resistance between terminals 1 of the HO2S harness connector and 15 of the ECM harness connector.

Specification : Approx. 0Ω

2. Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E35FD1C9

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
     If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

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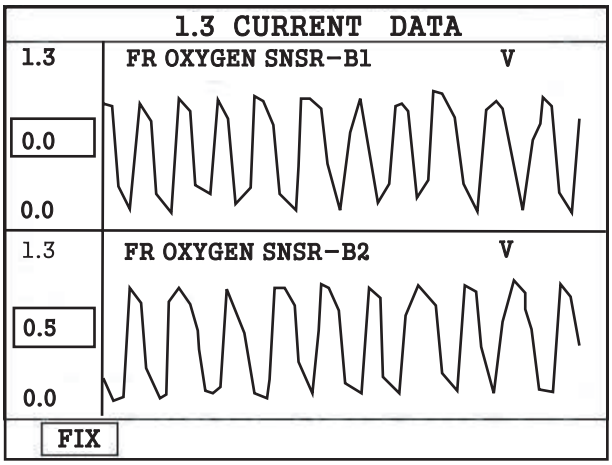

Fig. 1

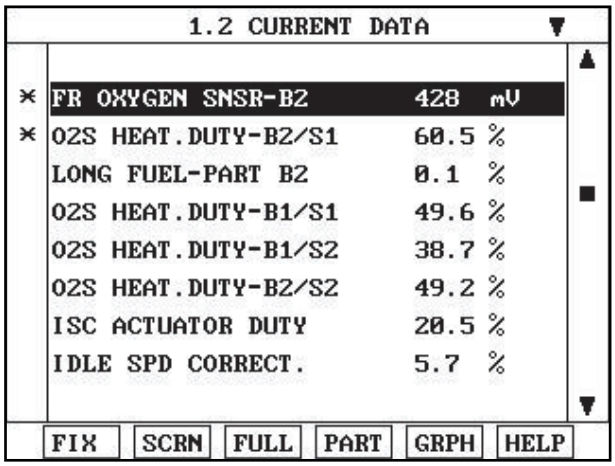

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

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Fig 1) Normal value with idle after warm up : Signal is switching form rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EEC24610

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0151 HO2S CIRCUIT LOW VOLTAGE (BANK 2 / SENSOR 1)

COMPONENT LOCATION EF579046

Refer to DTC P0150.

GERNERAL DESCRIPTION E1FA5EB6

Refer to DTC P0150.

DTC DESCRIPTION E216DCB6

The control unit of the linear oxygen sensor built inside the ECM monitors short circuit error on all front Heated Oxygen Sensor (HO2S) control lines and ECM sets P0151 with short circuit to ground.

DTC DETECTING CONDITION E0109D4D

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＜0.02V and element resistance ＜10Ω	
Diagnostic Time	• 60 sec.	
Fail Safe	• Reset lambda adaptation and fuel trim adaptation. • Front HO2S heater is controlled in open loop control. • EVAP. Emission control function is controlled in minimum operation mode.	

SCHEMATIC DIAGRAM EC28545C

Refer to DTC P0150.

SIGNAL WAVEFORM EF097BC2

Refer to DTC P0150.

MONITOR DTC STATUS E40F60EF

Refer to DTC P0150.

TERMINAL & CONNECTOR INSPECTION ED9F3A1F

Refer to DTC P0150.

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SIGNAL CIRCUIT INSPECTION E32A40C2

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Infinite

4. Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E370E76D

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
     If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

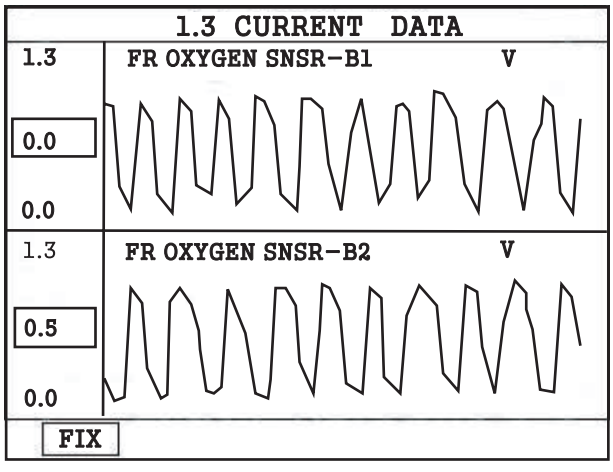

Fig. 1

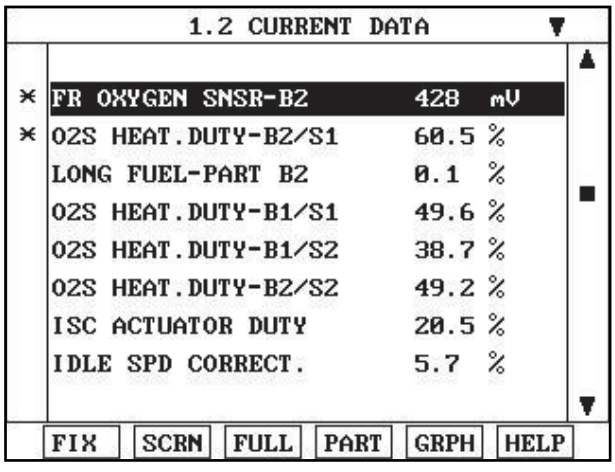

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

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4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC2C62D9

Refer to DTC P0150.

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DTC P0152 HO2S CIRCUIT HIGH VOLTAGE (BANK 2 / SENSOR 1)

COMPONENT LOCATION E8034CB2

Refer to DTC P0150.

GERNERAL DESCRIPTION E33A7466

Refer to DTC P0150.

DTC DESCRIPTION EE76A655

The control unit of the linear oxygen sensor built inside the ECM monitors short circuit error on all front Heated Oxygen Sensor (HO2S) control lines and ECM sets P0152 with short circuit to battery.

DTC DETECTING CONDITION E8A0C8DA

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage high	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＞1.3V	
Diagnostic Time	• 1 sec.	

SCHEMATIC DIAGRAM E370CB09

Refer to DTC P0150.

SIGNAL WAVEFORM EFC57785

Refer to DTC P0150.

MONITOR DTC STATUS E422A58B

Refer to DTC P0150.

TERMINAL & CONNECTOR INSPECTION ECBC2998

Refer to DTC P0150.

SIGNAL CIRCUIT INSPECTION E96CE271

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the HO2S harness connector and chassis ground.

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Specification : Approx. 0V

5. Is voltage within the specification?

YES

▶ Go to "Component Circuit Inspection" procedure.

NO

▶ Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E9677138

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
     If contamination is evident on the HO2S, replace contaminated sensor and go to next step.

2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

3. Connect Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

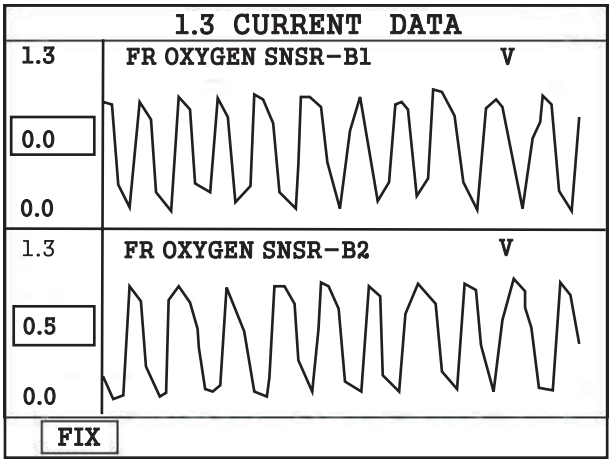

Fig. 1

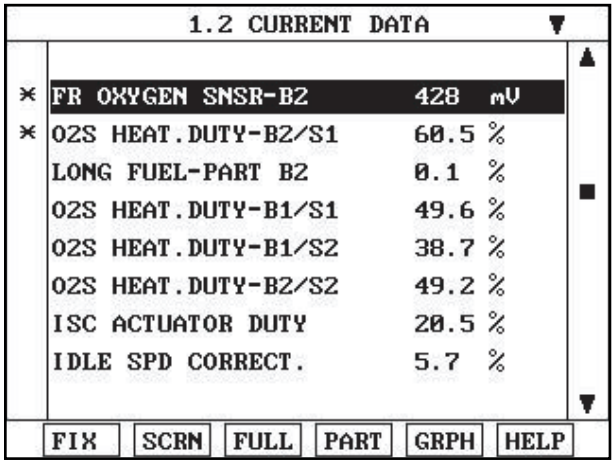

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

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4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7948147

Refer to DTC P0150.

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DTC P0153 HO2S CIRCUIT SLOW RESPONSE (BANK 2 / SENSOR 1)

COMPONENT LOCATION E5992BE2

Refer to DTC P0150.

GERNERAL DESCRIPTION EA8EB67B

Refer to DTC P0150.

DTC DESCRIPTION E36B9292

The ECM monitors front oxygen sensor amplitude level and compares it to predetermined minimum amplitude value which could increase emission or disturb lambda control by the effect of aging on the oxygen sensor. The ECM sets DTC P0153 when the amplitude of oxygen sensor is equal to or less than minimum amplitude threshold.

DTC DETECTING CONDITION EB885726

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of O2 sensor lean/rich period with calculated period	• Leak in intake or exhaust system • Faulty fuel system. • Front and rear HO2S connections reversed. • Contact resistance in connectors • HO2S contamination
Enable Conditions	• 400℃(752°F)< Catalyst Temp.Model < 600℃(1112°F) • Coolant temp. >70℃(158°F) • 800 <Engine speed(RPM) <2500 • Mass air flow <250 mg/stk • No misfire detected • Not transient condition	
Threshold Value	• Sum of O2 sensor lean/rich period > calculated period	
Diagnostic Time	• 80 lambda controller cycles	

SCHEMATIC DIAGRAM E1CF8CA9

Refer to DTC P0150.

SIGNAL WAVEFORM E2B444DB

Refer to DTC P0150.

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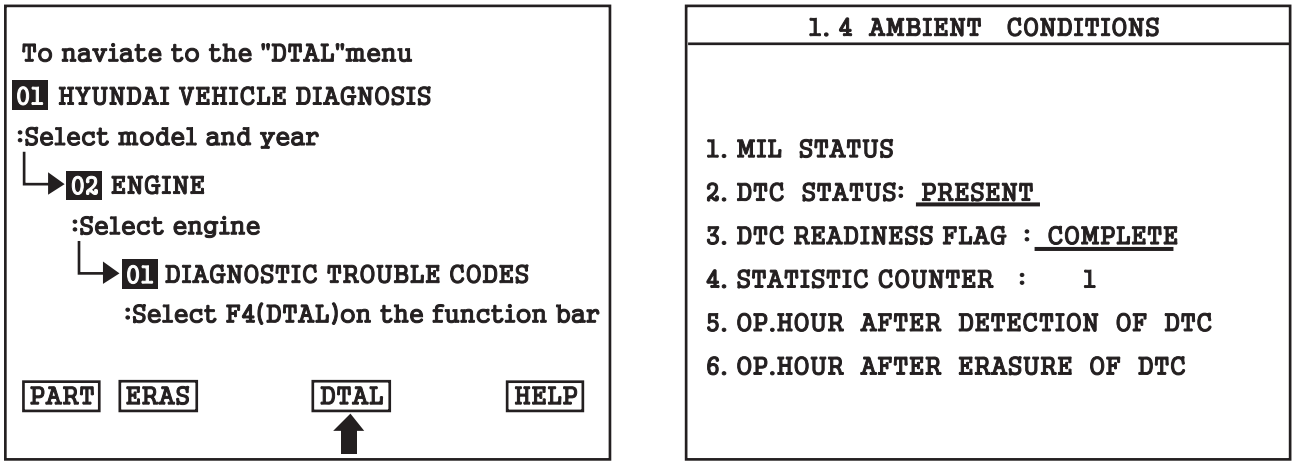
MONITOR DTC STATUS EDE433DD

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



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5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

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VISUAL/PHYSICAL INSPECTION E20D7F3F

1. Visually/physically inspect the following items:
   - Ensure that the HO2S is securely installed.
   - Check for corrosion on terminals.
   - Check for terminal tension (at the HO2S and at the ECM).
   - Check for damaged wiring.
   - Check the HO2S ground circuit for a good connection.

2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.

3. Was a problem found in any of the above areas?

   YES

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Exhaust System Inspection" procedure.

EXHAUST SYSTEM INSPECTION E046CEF3

1. Check the exhaust system for an exhaust leak near the engine.

2. Was an exhaust leak found?

   YES

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Go to "Air Leakage Inspection " procedure.

AIR LEAKAGE INSPECTION EF6A4E80

1. Visually/physically inspect the following items:
   - Vacuum hoses for splits, kinks and improper connections.
   - Exhaust system between HO2S and Three way catalyst for air leakage.
   - EVAP system for leakage.
   - PCV hose for proper installation.

2. Was a problem found in any of the above areas?

   YES

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to "Fuel Pressure Inspection" procedure

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FUEL PRESSURE INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Inspect fuel pressure with engine idling at normal operating temperature.

Test Condition : Engine "ON" & Vacuum hose disconnected at Idle.
Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

4. Is the fuel pressure within the specified value?

YES

▶ Go to "Fuel Injector Inspection" procedure as below.

NO

▶ Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

a. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.*

b. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator.*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

c. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

FUEL INJECOTR INSPECTION

1. Ignition "OFF"
2. Check the fuel injectors for clogging or any restrictions.

Specification : No clogging and restriction

3. Is the fuel injector OK?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

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COMPONENT INSPECTION E33FA91C

1. Visually/physically inspect following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   - If contamination is evident on the HO2S, replace contaminated sensor and go to next step.

2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

3. Install Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Ignition "ON" & Engine "ON"
Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

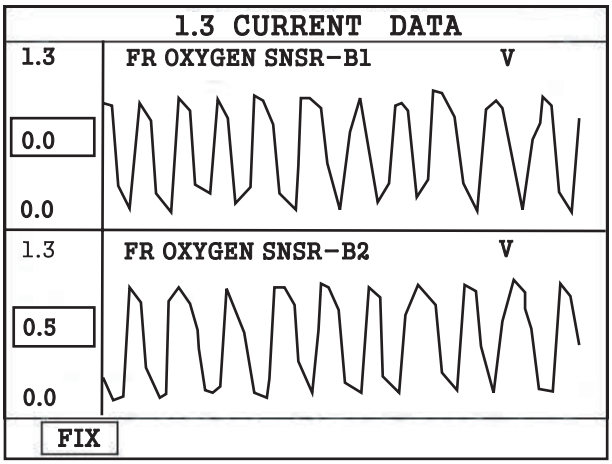

Fig. 1

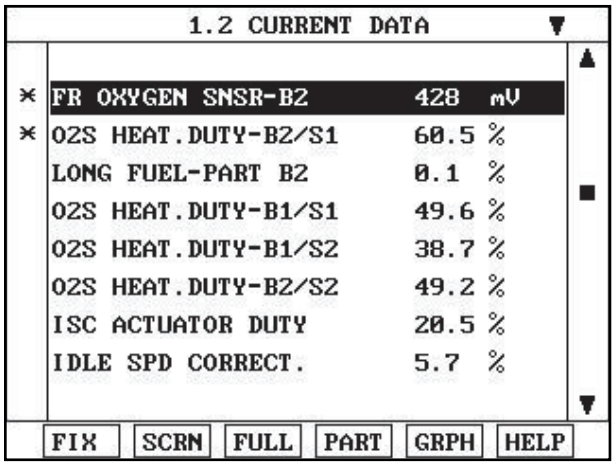

Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

LWIF101R

4. Is sensor switching properly?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.
If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA84660B

Refer to DTC P0150.

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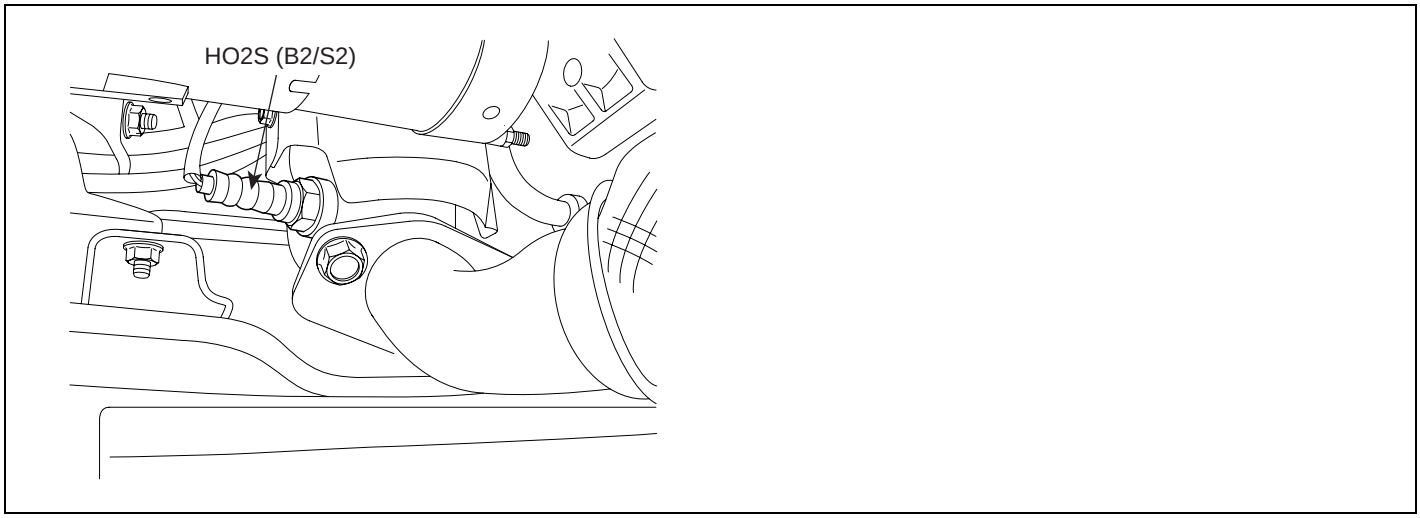
DTC P0156 HO2S CIRCUIT (BANK 2 / SENSOR 2)

COMPONENT LOCATION EA1C6055



LWIF501L

GERNERAL DESCRIPTION EFC0F91F

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 DESCRIPTION E037A853

ECM sets DTC P0136 if the ECM detects that the rear HO2S signal circuit is open.

DTC DETECTING CONDITION E69B7543

ITEM	DETECTING CONDITION	POSSIBL ECAUSE
DTC Strategy	• Check open circuit on rear HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • No relevant failure • Battery voltage > 10V	
Threshold Value	• Sensor element resistance > 60 kΩ	
Diagnostic Time	• 30 sec.	

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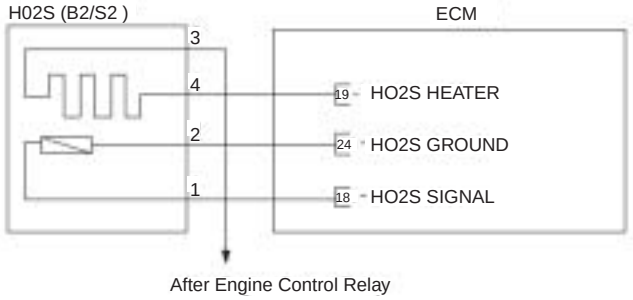
SCHEMATIC DIAGRAM ED348243

[CIRCUIT DIAGRAM]



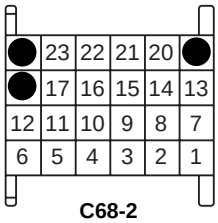
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 18	Signal
2	ECM Terminal 24	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 19	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

ECM side terminal

LWIF001Y

SIGNAL WAVEFORM E0C3014C

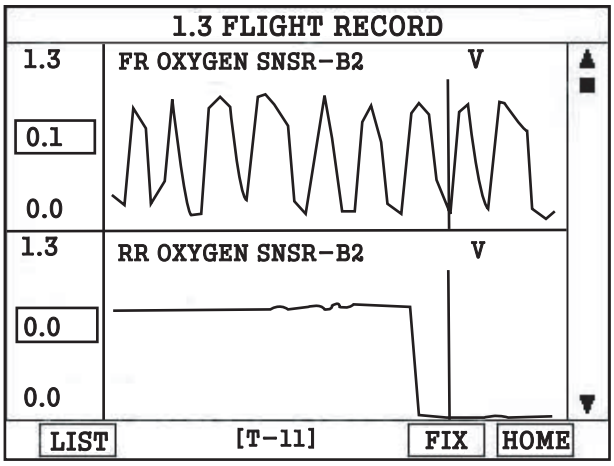


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101S

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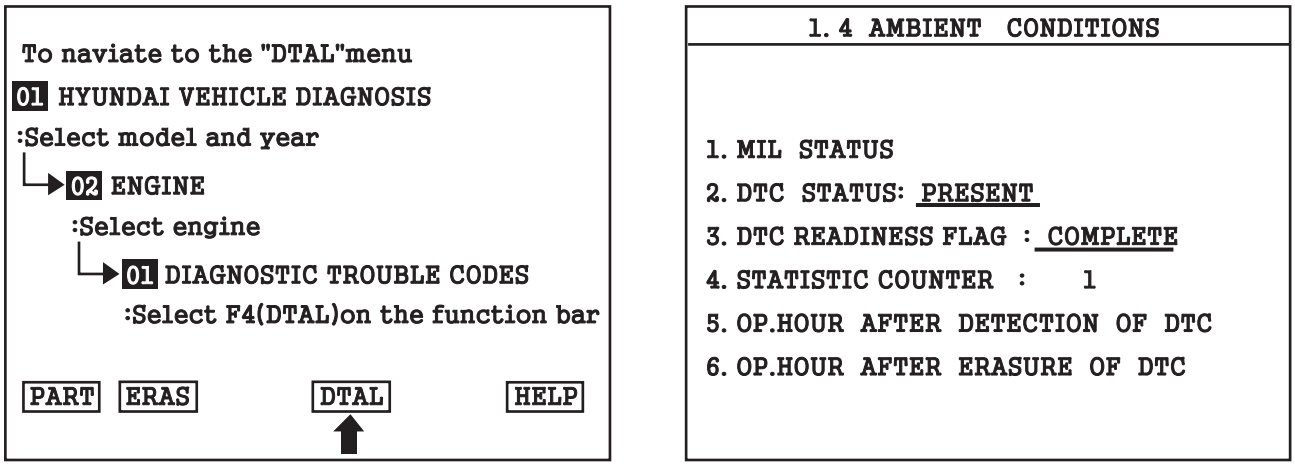
MONITOR DTC STATUS EFFF8D84

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION ED867BD6

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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NO

▶ Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION E20DCD3C

1. Ignition "OFF"
2. Disconnect HO2S and ECM connectors.
3. Measure resistance between terminal 2 of the sensor harness connector and 24 of the ECM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E4289B39

1. Measure resistance between terminals 1 of the HO2S harness connector and 18 of the ECM harness connector.

Specification : Approx. 0Ω

2. Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ECC3115B

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "RR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition.
Specification : Above 0.6V.

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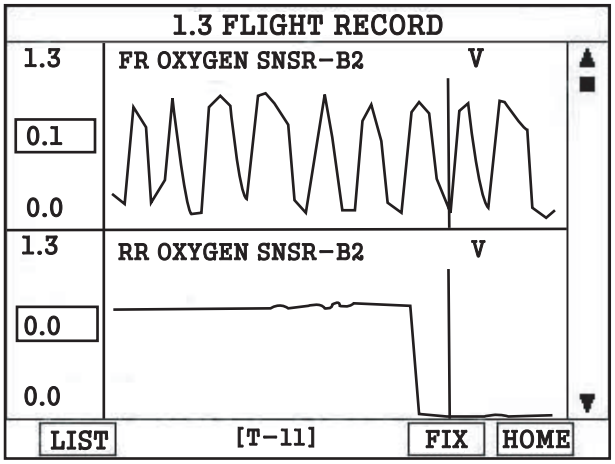

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101S

3. Is sensor data within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E46FAD66

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0157 HO2S CIRCUIT LOW VOLTAGE (BANK 2 / SENSOR 2)

COMPONENT LOCATION EEDE2095

Refer to DTC P0156.

GERNERAL DESCRIPTION E17008CA

Refer to DTC P0156.

DTC DESCRIPTION E2A4AFFE

ECM sets DTC P0157 if the ECM detects signal voltage lower than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION EDA68B70

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor Voltage Low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＜0.02V and element resistance ＜10Ω	
Diagnostic Time	• 30 sec	

SCHEMATIC DIGRAM ED0AF6C0

Refer to DTC P0156.

SIGNAL WAVEFORM ED5D9ED3

Refer to DTC P0156.

MONITOR DTC STATUS EEBA14EF

Refer to DTC P0156.

TERMINAL & CONNECTOR INSECTION E9246064

Refer to DTC P0156.

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SIGNAL CIRCUIT INSPECTION EEFF9FD5

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminal 1 of the sensor harness connector and chassis ground.

Specification : Infinite

4. Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair open or short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E9F43FFA

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Install Scantool and monitor the "RR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition.
Specification : Above 0.6V.

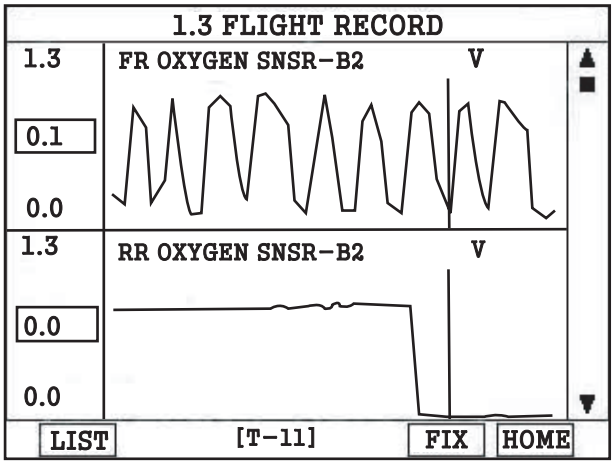

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101S

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3. Is sensor data within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC2F3D9D

Refer to DTC P0156.

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DTC P0158 HO2S CIRCUIT HIGH VOLTAGE (BANK 2 / SENSOR 2)

COMPONENT LOCATION ED7E0A11

Refer to DTC P0156.

GERNERAL DESCRIPTION E49B17D3

Refer to DTC P0156.

DTC DESCRIPTION E98ED171

ECM sets DTC P0158 if the ECM detects signal voltage lower than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION ED1AD69E

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor Voltage High	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage ＞10V	
Threshold Value	• Sensor voltage ＞1.3V	
Diagnostic Time	• 1 sec	

SCHEMATIC DIAGRAM E10A0AAD

Refer to DTC P0156.

SIGNAL WAVEFORM E6E45DD9

Refer to DTC P0156.

MONITOR DTC STATUS E8680B82

Refer to DTC P0156.

TERMINAL & CONNECTOR INSECTION E61B96EB

Refer to DTC P0156.

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SIGNAL CIRCUIT INSPECTION EEDB0A6B

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. 0V

5. Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E8D71BA4

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Install Scantool and monitor the "RR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition.
Specification : Above 0.6V.

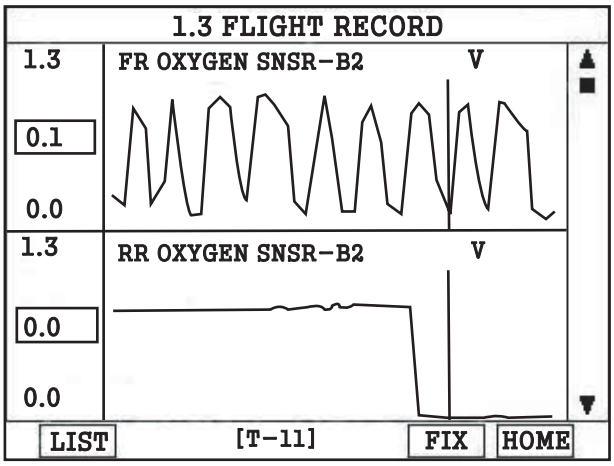

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

LWIF101S

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3. Is sensor data within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E1058290

Refer to DTC P0156.

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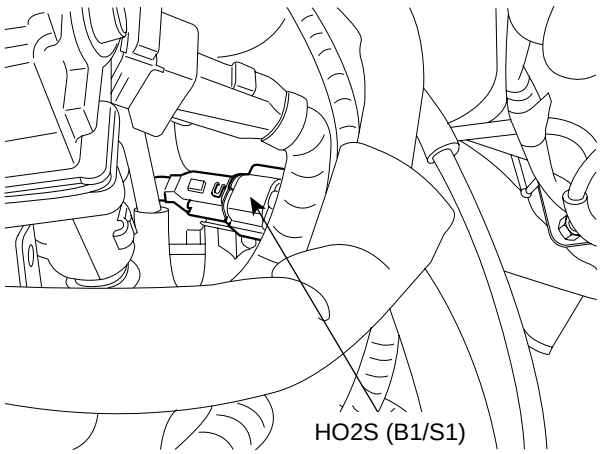
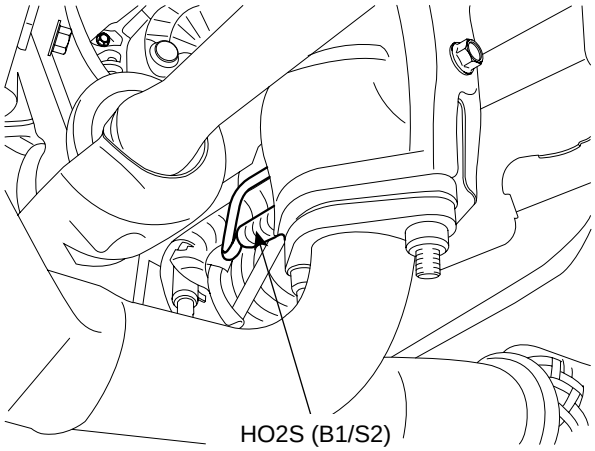
DTC P0170 FUEL TRIM (BANK 1)

COMPONENT LOCATION EBF2E060





LWIF551A

GENERAL DESCRIPTION E4870DE5

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 high concentrations of CO, H2, and HC. Lean mixtures generate the high concentrations of NOx, and free oxygen.

DTC DESCRIPTION E442E6EE

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The ECM sets DTC P0170 if no proportional fuel adaptation occurs for a defined time after the lambda controller has reached its minimum or maximum threshold.

DTC DETECTING CONDITION EECF1DE3

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of lambda controller	• Air leakage or restriction in intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Fuel system • EVAP system • Faulty sensor signals
Enable Conditions	• Canister purge solenoid closed • Coolant temperature＞60°C(140°F)	
Threshold Value	• Lambda controller = +/-32%	
Diagnostic Time	• 2 min	

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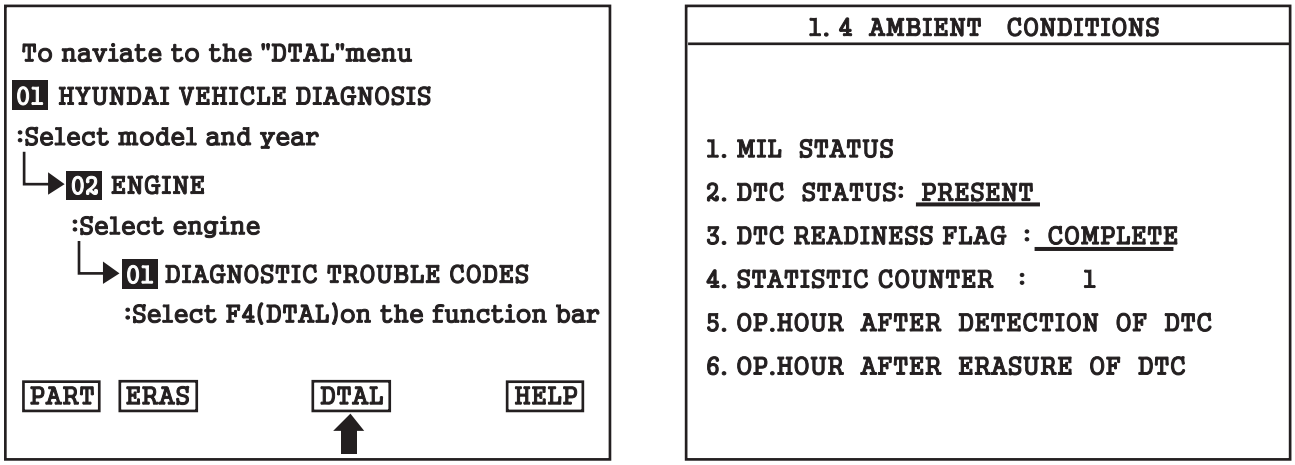
MONITOR DTC STATUS E5C449EA

NOTE

If any codes relating to fuel system, injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Monitor Actuation Test" procedure.

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MONITOR ACTUATION TEST EFB77389

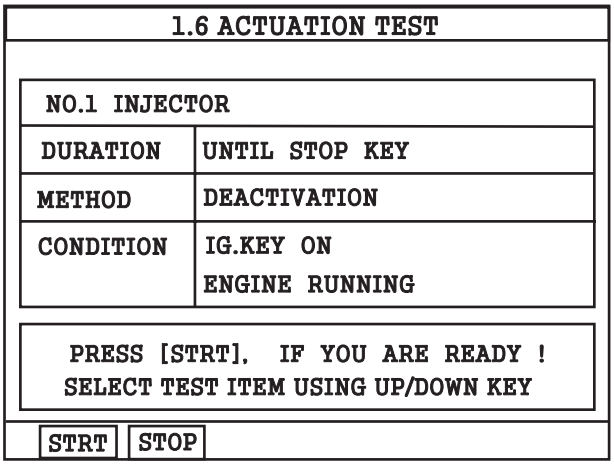
The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

▶ Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

▶ Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

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CHECK INTAKE/EXHAUST SYSTEM FOR RESTRICTION OR LEAKAGE

1. Visually/physically inspect the air leakage in intake/exhaust system as following items.
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket.
   - Gasket between intake manifold and cylinder head.
   - Seals between intake manifold and fuel injectors.
   - Exhaust system between HO2S and Three way catalyst for air leakage.

2. Visually/physically inspect the restriction in intake/exhaust system as following items.
   - Air cleaner filter element for excessive dirt or for any foreign objects.
   - Throttle body inlet for damage or for any foreign objects.
   - Throttle bore, throttle plate and the IAC passages for chocking and for any foreign objects.
   - Restricted exhaust system.

3. Was a problem found in any of the above areas?

   YES

   ▶ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Go to " Check the engine oil contamination " procedure.

CHECK THE ENGINE OIL CONTAMINATION

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature
3. Connect Scantool and note the "SHORT TERM FUEL-B1" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation.
5. Monitor the "SHORT TERM FUEL-B1" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

6. Is the displayed value within the specified value?

   YES

   ▶ Go to "Sensor Contamination Inspection" procedure.

   NO

   ▶ The engine oil is diluted with fuel. Chang the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   - Remove and inspect the HO2S(B1S1) for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal
   - Check MAFS for contamination, deterioration, or damage.
   - If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

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CHECK FOR LEAKAGE IN EVAP SYSTEM

1. Check the EVAP. EM system for possible over.
   1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   3) Does the valve hold vacuum?

      YES

      ▶ Go to "Fuel System Inspection" procedure

      NO

      ▶ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION EB6165C3

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gage.
4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

5. Is fuel pressure within the specification?

   YES

   ▶ Go to "Fuel Injector Inspection" procedure as below

   NO

   ▶ Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

NOTE

A. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging*

B. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

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FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   - Test Condition : Ignition "OFF".
   - Specification : No clogging and restriction.

2. Is the fuel injector OK?

   YES

   ▶ Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EF780884

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

   YES

   ▶ System performing to specification at this time. Clear the DTC.

   NO

   ▶ Go to the applicable troubleshooting procedure.

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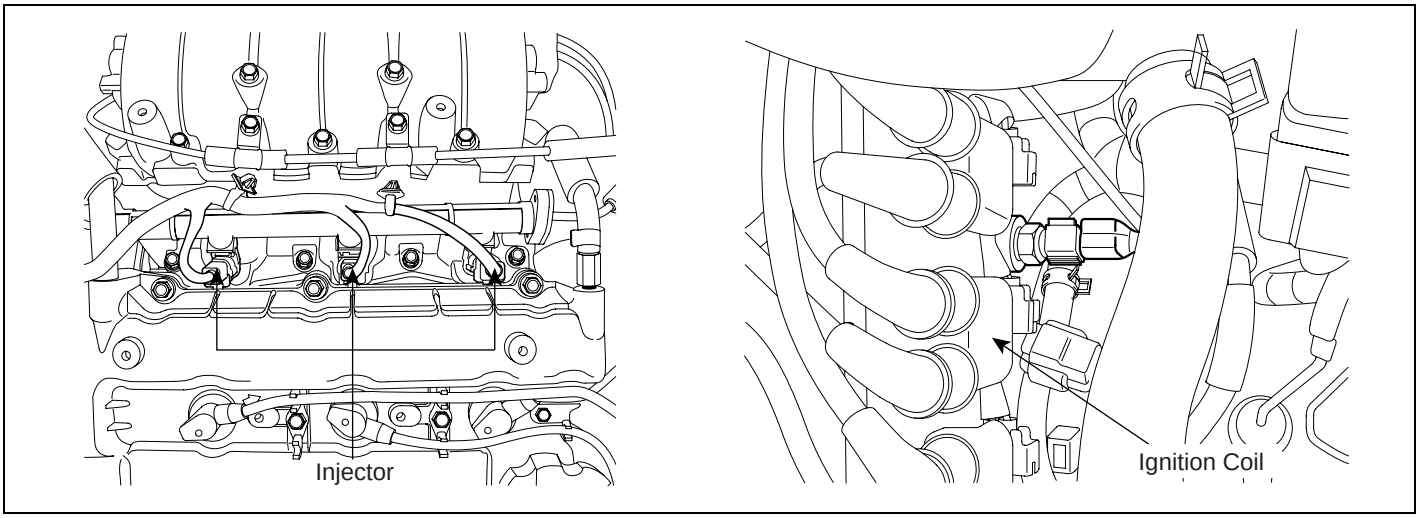
DTC P0171 SYSTEM TOO LEAN (BANK 1)

COMPONENT LOCATION EC3D1EB6



LWIF551B

GENERAL DESCRIPTION E85EEB1F

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 DESCRIPTION EC357F10

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially 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.If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0171 or P0172 respectively depending on the direction of the deviation. P0171 is set with positive deviation and P0172 is set with negative deviation.

DTC DETECTING CONDITION E0FE9512

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of fuel control	• Air leakage • Leaking EVAP system • Low fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading ＞-11% • Estimated altitude ＜ 8000ft • Coolant temp.＞60℃ (140°F) • Fueling adaptation ＞14.5%	
Threshold Value	• Lambda controller +Trim value ＞ 17%(lean A/F ratio) • Lean A/F ratio: 400sec.	
Diagnostic Time	• 900 sec.	

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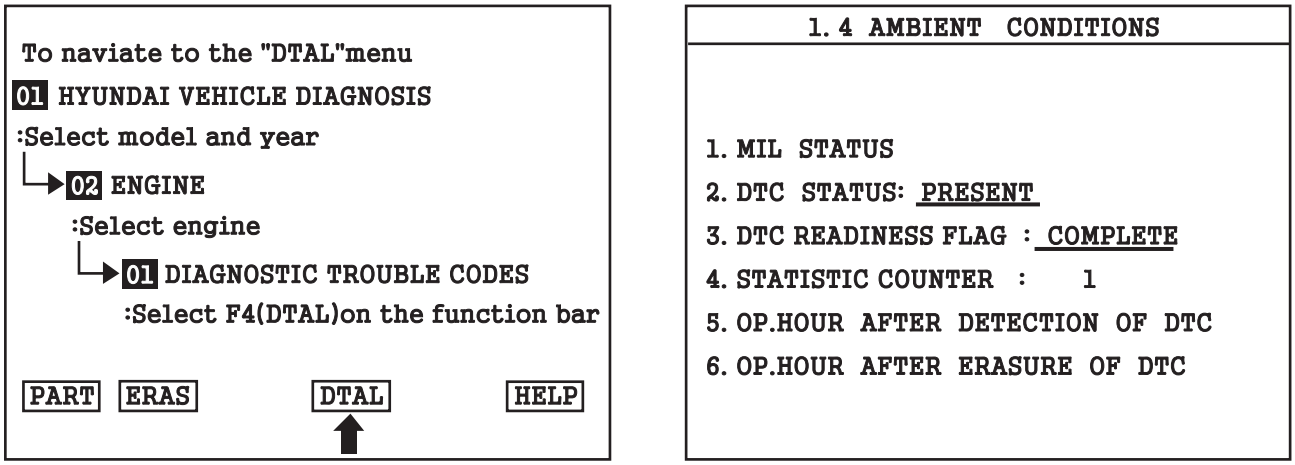
MONITOR DTC STATUS EABA80C5

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Monitor Actuation Test" procedure.

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MONITOR ACTUATION TEST E0DE3ABF

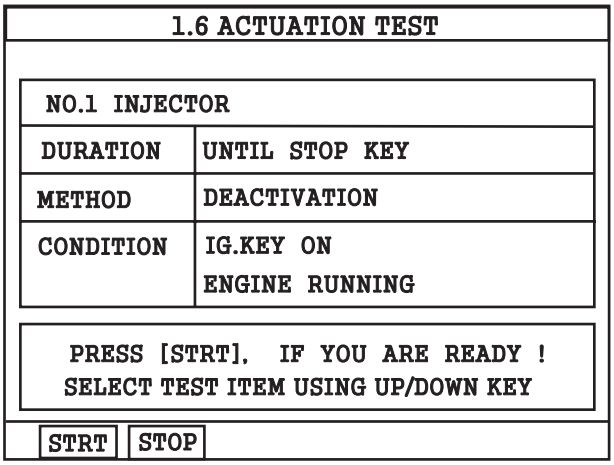
The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

▶ Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

▶ Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

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AIR LEAKAGE INSPECTION E880CECF

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step.
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

2. Check for air leakage in EVAP. Purge control valve.

   1) Remove the manifold side vacuum hose from the EVAP canister purge valve.

   2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.

   3) Does the valve hold vacuum?

   YES

   ▶ Go to "Fuel System Inspection" procedure.

   NO

   ▶ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION E17DEDB5

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.

2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.

3. Install a fuel pressure gauge.

4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

5. Is fuel pressure within the specification?

   YES

   ▶ Go to "Fuel Injector Inspection" procedure as below

   NO

   ▶ Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

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NOTE

A. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging*

B. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

FUEL INJECTOR INSPECTION

1. Check the fuel injector's for clogging or any restrictions.

2. Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   - Test Condition : Ignition "OFF".
   - Specification : No clogging and restriction.

2. Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

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VERIFICATION OF VEHICLE REPAIR EE1EDF9F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0172 SYSTEM TOO RICH (BANK 1)

COMPONENT LOCATION E7428FF8

Refer to DTC P0171.

GENERAL DESCRIPTION E56D6AE1

Refer to DTC P0171.

DTC DESCRIPTION EA87938D

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially 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. If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0171 or P0172 respectively depending on the direction of the deviation. P0171 is set with positive deviation and P0172 is set with negative deviation.

DTC DETECTING CONDITION E6B9671C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of lambda fuel control	• Restricted intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Over purging of the EVAP system • High fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading ＞-11% • Estimated altitude ＜ 8000ft • Coolant temp.＞60℃ (140°F) • Fueling adaptation ＞14.5%	
Threshold Value	• Lambda controller + Trim value ＜-27%(Rich A/F ratio) • Rich A/F ratio: 300sec.	
Diagnostic Time	• 900 sec.	

MONITOR DTC STATUS E68DDA35

Refer to DTC P0171.

MONITOR ACTUATION TEST ED16A91D

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

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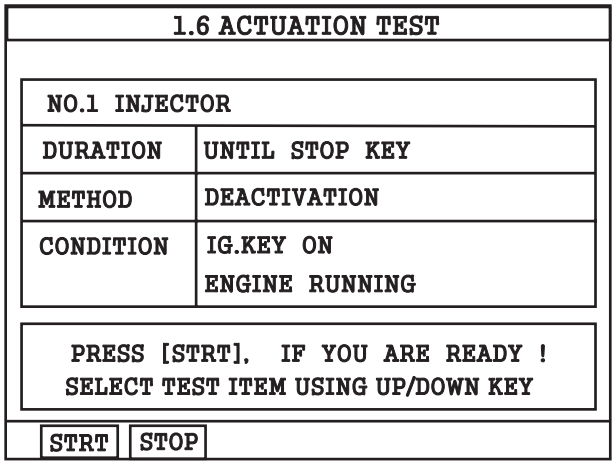
Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

▶ Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

▶ Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

1. Visually/physically inspect the following items:
   - Air cleaner filter element for excessive dirt or for any foreign objects
   - Throttle body inlet for damage or for any foreign objects
   - Throttle bore, throttle plate and the ICA passages for chocking and for any foreign objects
   - Restricted exhaust system

2. Was a problem found in any of the above areas?

YES

▶ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Engine oil contamination Inspection" procedure.

ENGINE OIL CONTAMINATION INSPECTION

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature.
3. Connect Scantool and note the "SHORT TERM FUEL-B1" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation

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5. Monitor the "SHORT TERM FUEL-B1" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

6. Is the displayed value within the specification?

YES

▶ Go to "Sensor Contamination Inspection" procedure.

NO

▶ The engine oil is diluted with fuel. Change the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   - Remove and inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   - Check MAFS for contamination, deterioration, or damage.
   - If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

OVER PURGING OF THE EVAP SYSTEM

1. Check the EVAP. EM system for possible over.
   1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   3) Does the valve hold vacuum?

YES

▶ Go to "Fuel System Inspection" procedure.

NO

▶ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION E13AFBD9

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gage.
4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

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5. Is fuel pressure within the specification?

YES

▶ Go to "Fuel Injector Inspection" procedure as below

NO

▶ Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

NOTE

A. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging*

B. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   - Test Condition : Ignition "OFF".
   - Specification : No clogging and restriction.

2. Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   - Test Condition : Ignition "OFF".
   - Specification : No clogging and restriction.

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2. Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFDC6AD4

Refer to DTC P0171.

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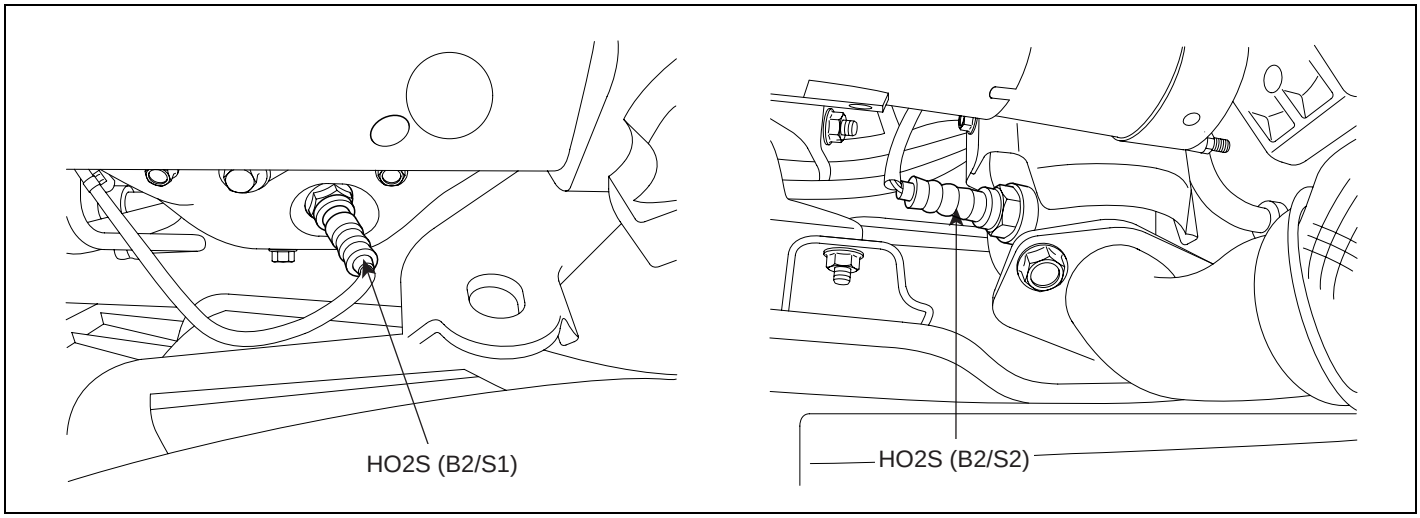
DTC P0173 FUEL TRIM (BANK 2)

COMPONENT LOCATION E91A34E4



LWIF551C

GENERAL DESCRIPTION E6A91019

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 high concentrations of CO, H2, and HC. Lean mixtures generate the high concentrations of NOx, and free oxygen.

DTC DESCRIPTION E9FDEB51

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The ECM sets DTC P0173 if no proportional fuel adaptation occurs for a defined time after the lambda controller has reached its minimum or maximum threshold.

DTC DETECTING CONDITION E0B28BDC

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of lambda controller	• Air leakage or restriction in intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Fuel system • EVAP system • Faulty sensor signals
Enable Conditions	• Canister purge solenoid closed • Coolant temperature > 60°C(140°F)	
Threshold Value	• Lambda controller = +/-32%	
Diagnostic Time	• 2 min	

MONITOR DTC STATUS E1680803

NOTE

If any codes relating to fuel system, injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

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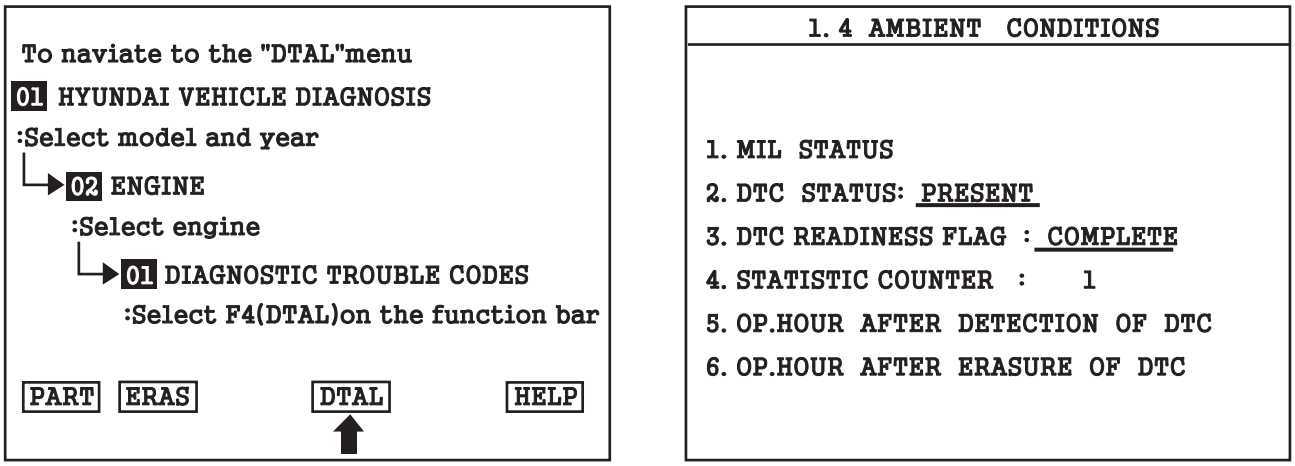
1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST E320F0E4

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.

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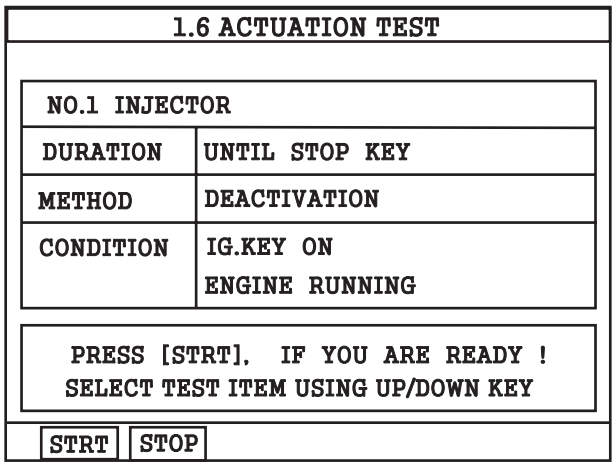
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

▶ Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

▶ Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

CHECK INTAKE/EXHAUST SYSTEM FOR RESTRICTION OR LEAKAGE

1. Visually/physically inspect the air leakage in intake/exhaust system as following items.
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket.
   - Gasket between intake manifold and cylinder head.
   - Seals between intake manifold and fuel injectors.
   - Exhaust system between HO2S and Three way catalyst for air leakage.

2. Visually/physically inspect the restriction in intake/exhaust system as following items.
   - Air cleaner filter element for excessive dirt or for any foreign objects.
   - Throttle body inlet for damage or for any foreign objects.
   - Throttle bore, throttle plate and the IAC passages for chocking and for any foreign objects.
   - Restricted exhaust system.

3. Was a problem found in any of the above areas?

YES

▶ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to " Check the engine oil contamination " procedure.

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CHECK THE ENGINE OIL CONTAMINATION

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature
3. Connect Scantool and note the "SHORT TERM FUEL-B2" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation.
5. Monitor the "SHORT TERM FUEL-B2" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

6. Is the displayed value within the specified value?

YES

▶ Go to "Sensor Contamination Inspection" procedure.

NO

▶ The engine oil is diluted with fuel. Chang the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   - Remove and inspect the HO2S(B1S1) for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   - Check MAFS for contamination, deterioration, or damage.
   - If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

CHECK FOR LEAKAGE IN EVAP SYSTEM

1. Check the EVAP. EM system for possible over.
   1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   3) Does the valve hold vacuum?

YES

▶ Go to "Fuel System Inspection" procedure

NO

▶ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

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FUEL SYSTEM INSPECTION E45ABB50

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gage.
4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 330~350kPa(3.30~3.50 kg/cm², 47~50 psi)

5. Is fuel pressure within the specification?

YES

▶ Go to "Fuel Injector Inspection" procedure as below

NO

▶ Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

NOTE

A. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging*

B. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   - Test Condition : Ignition "OFF".
   - Specification : No clogging and restriction.
2. Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

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VERIFICATION OF VEHICLE REPAIR E24A0406

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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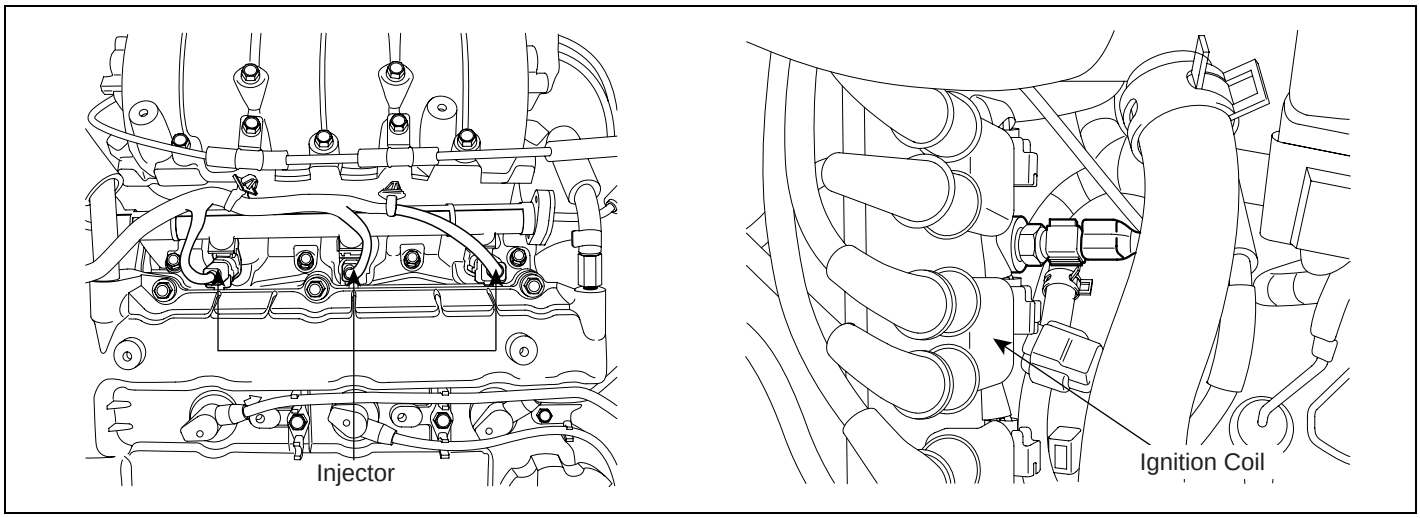
DTC P0174 SYSTEM TOO LEAN (BANK 2)

COMPONENT LOCATION E5007B2C



LWIF551B

GENERAL DESCRIPTION EB199B5F

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 DESCRIPTION E7B09730

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially 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.If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0174 or P0175 respectively depending on the direction of the deviation. P0174 is set with positive deviation and P0172 is set with negative deviation.

DTC DETECTING CONDITION E2FF2290

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring deviation of fuel centrol	• Air leakage • Leaking EVAP system • Low fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading ＞-11% • Estimated altitude ＜ 8000ft • Coolant temp.＞60℃ (140°F) • Fueling adaptation ＞14.5%	
Threshold Value	• Lambda controller + Trim value ＞ 17% (lean A/F ratio)	
Diagnostic Time	• 900 sec	
Fail Safe	• EVAP. Emission control function is controlled in minimum operation mode	

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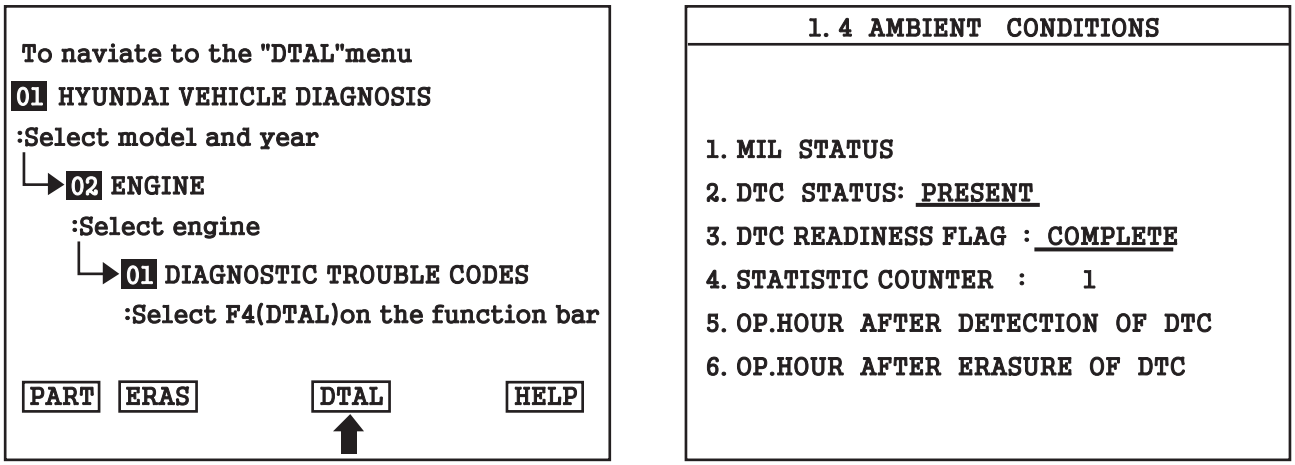
MONITOR DTC STATUS E3040B41

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST E377EF0E

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

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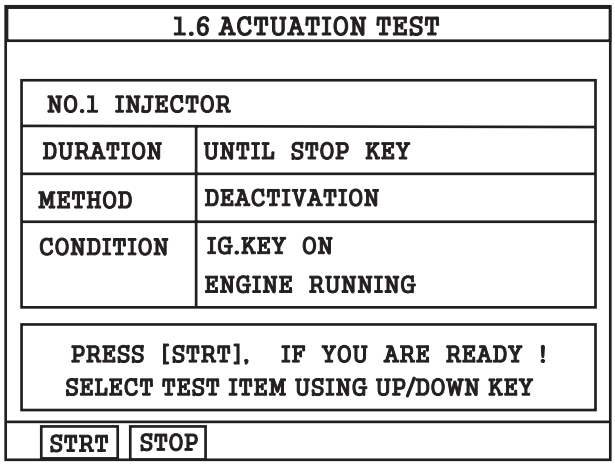
CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

AIR LEAKAGE INSPECTION EDB70BE1

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step.
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage
2. Check for air leakage in EVAP. Purge control valve.
   1) Remove the manifold side vacuum hose from the EVAP canister purge valve.

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2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.

3) Does the valve hold vacuum?

YES

Go to "Fuel System Inspection" procedure.

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION EB27A70F

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gauge.
4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

5. Is fuel pressure within the specification?

YES

Go to "Fuel Injector Inspection" procedure as below

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

A. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.*

B. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator.*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

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FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5C02886

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

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DTC P0175 SYSTEM TOO RICH (BANK 2)

COMPONENT LOCATION EED389BD

Refer to DTC P0174.

GENERAL DESCRIPTION E41C7C0A

Refer to DTC P0174.

DTC DESCRIPTION E15C09AF

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially 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.If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0174 or P0175 respectively depending on the direction of the deviation. P0174 is set with positive deviation and P0175 is set with negative deviation.

DTC DETECTING CONDITION EFD15724

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of fuel control	• Restricted intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Over purging of the EVAP system • High fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading ＞-11% • Estimated altitude ＜ 8000ft • Coolant temp.＞60℃ (140°F) • Fueling adaptation ＞14.5%	
Threshold Value	• Lambda controller +Trim value ＞ -27%(lean A/F ratio) • Rich A/F ratio: 300sec.	
Diagnostic Time	• 900 sec.	

MONITOR DTC STATUS E1A4D4B3

Refer to DTC P0174.

MONITOR ACTUATION TEST E0B3FEA7

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

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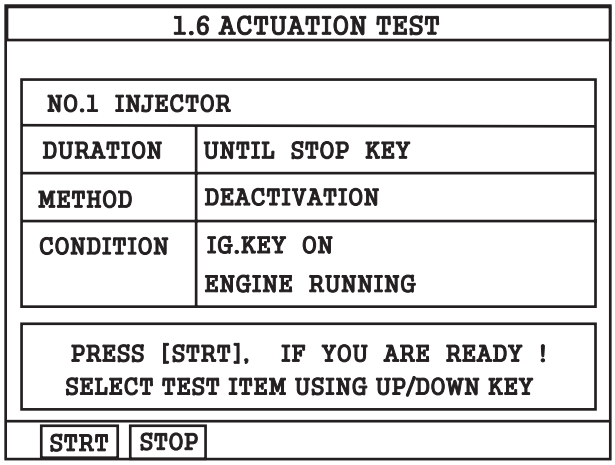
Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

1. Visually/physically inspect the following items:
   - Air cleaner filter element for excessive dirt or for any foreign objects
   - Throttle body inlet for damage or for any foreign objects
   - Throttle bore, throttle plate and the ICA passages for chocking and for any foreign objects
   - Restricted exhaust system

2. Was a problem found in any of the above areas?

YES

Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Engine oil contamination Inspection" procedure.

ENGINE OIL CONTAMINATION INSPECTION

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature.
3. Connect Scantool and note the "LONG FUEL-PART B2" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation.

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5. Monitor the "LONG FUEL-PART B2" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

6. Is the displayed value within the specified value?

YES

Go to "Sensor Contamination Inspection" procedure

NO

The engine oil is diluted with fuel. Chang the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   - Remove and inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   - Check MAFS for contamination, deterioration, or damage.
   - If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

OVER PURGING OF THE EVAP SYSTEM

1. Check the EVAP. EM system for possible over.

   1) Remove the manifold side vacuum hose from the EVAP canister purge valve.

   2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.

   3) Does the valve hold vacuum?

YES

Go to "Fuel System Inspection" procedure.

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION E5C696A8

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.

2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.

3. Install a fuel pressure gage.

4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 330~350kPa(3.30~3.50 kg/㎟, 47~50 psi)

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5. Is fuel pressure within the specification?

YES

Go to "Fuel Injector Inspection" procedure as below.

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

A. Check if fuel line pressure decreases when accelerating quickly
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.*

B. If pressure quickly increases, check pressure regulator.
- *If pressure quickly increases, check pressure regulator*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.

2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. Substitute with a known-good injector and check for proper operation. If the problem is corrected, replace injector and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2704FCE

Refer to DTC P0174.

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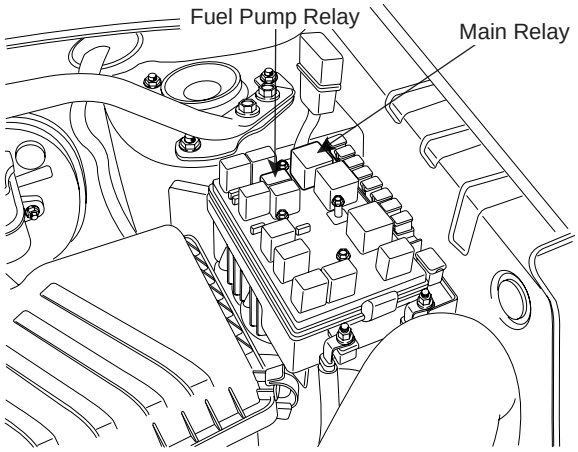
DTC P0230 FUEL PUMP PRIMARY CIRCUIT

COMPONENT LOCATION E1642D27



LWIF501H

GENERAL DESCRIPTION EAB3DD24

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 DESCRIPTION E3F0D341

ECM sets DTC P0230 if the ECM detects the fuel pump relay control circuit is open, shorted to ground or battery.

DTC DETECTING CONDITION EE79AFE2

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check open or short to ground/battery in control circuit	• Open or short in harness • Contact resistance in connectors • Faulty relay
Enable Conditions	• Battery voltage＞10V	
Threshold Value	• Short to ground, line break or short to battery	
Diagnostic Time	• 1.5 sec	

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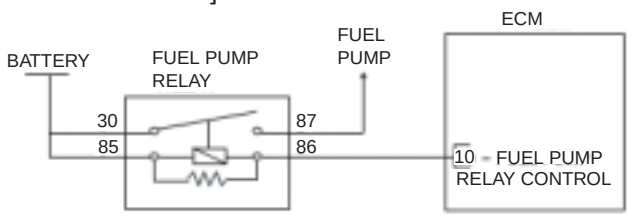
SCHEMATIC DIAGRAM E876C619

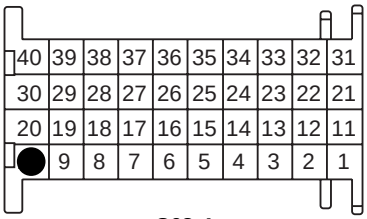
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Voltage
85	Battery	Battery Voltage
86	ECM terminal 10	Fuel Pump Relay Control
87	Fuel Pump	Supply B+

[HARNESS CONNECTORS]



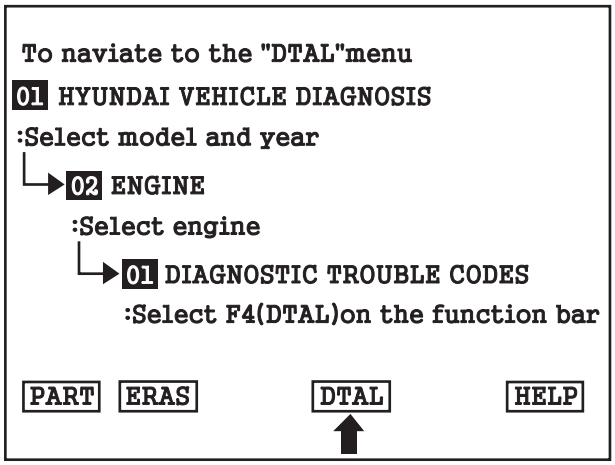
C68-4

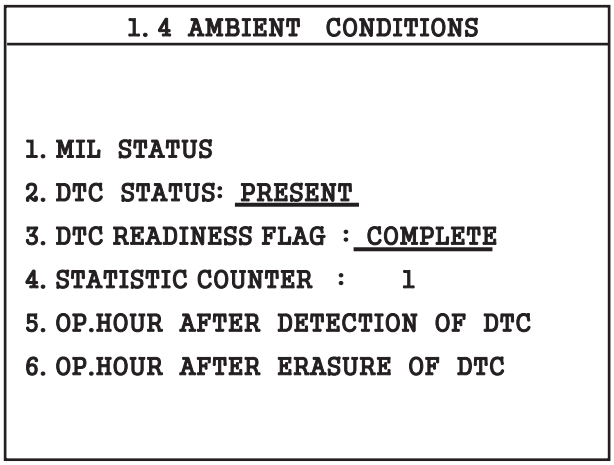
ECM side terminal

LWIF003S

MONITOR DTC STATUS E39552B4

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.





LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

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YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E7E974FA

1. Ignition "OFF".
2. Remove the fuel pump relay.
3. Apply 12V and a ground to 85 and 86 terminals of the fuel pump relay. (Component side)
4. 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.)
5. Does the fuel pump relay operate normally?

YES

▶ Go to next step as below.

NO

▶ Check relay for contamination, deterioration, or damage. Substitute with a known-good relay and check for proper operation. If the problem is corrected, replace relay and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EFAE7C1F

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION EF41AA1D

1. Remove the fuel pump relay.
2. Ignition "ON" & Engine "OFF".
3. Measure the voltage between terminal 30 of the fuel pump relay harness connector and chassis ground.

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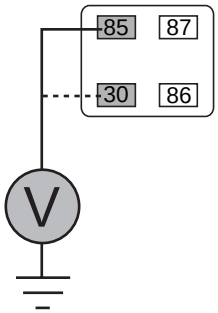
4. Measure the voltage between terminal 85 of the fuel pump relay harness connector and chassis ground.

Specification : Approx. B+



30. Battery Voltage
85. Battery Voltage
86. Fuel Pump Relay Control
87. Supply B+

LGIF004L

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check for an open or short to ground in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

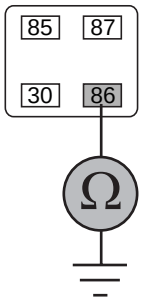
CONTROL CIRCUIT INSPECTION E7DC8F28

1. Check for short to ground in control circuit.

   1) Ignition "OFF" & Relay connector : Disconnected.

   2) Measure resistance between terminal 86 of the relay harness connector and chassis ground.

Specification : Infinite



30. Battery Voltage
85. Battery Voltage
86. Fuel Pump Relay Control
87. Supply B+

LGIF004M

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3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

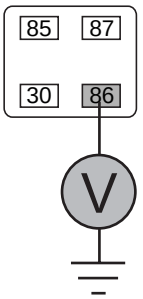
2. Check for short to power in control circuit.

1) Disconnect ECM connector.

2) Ignition "ON" and Engine "OFF".

3) Measure voltage between terminal 86 of the relay harness connector and chassis ground.

Specification : Approx 0V



30. Battery Voltage
85. Battery Voltage
86. Fuel Pump Relay Control
87. Supply B+

LGIF004N

4) Is voltage within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for open in control harness.

1) Measure resistance between terminals 86 of the relay harness connector and 10 of the ECM harness connector.

Specification : Approx 0Ω

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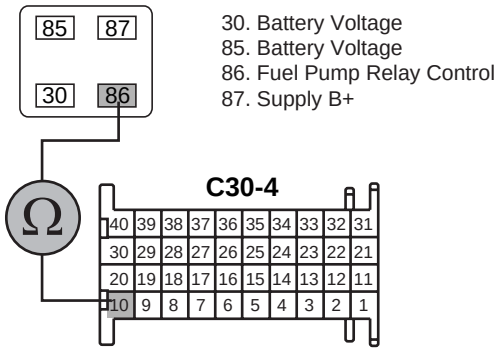

LWIF003W

2) Is resistance within the specification?

YES

▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5FFA7FC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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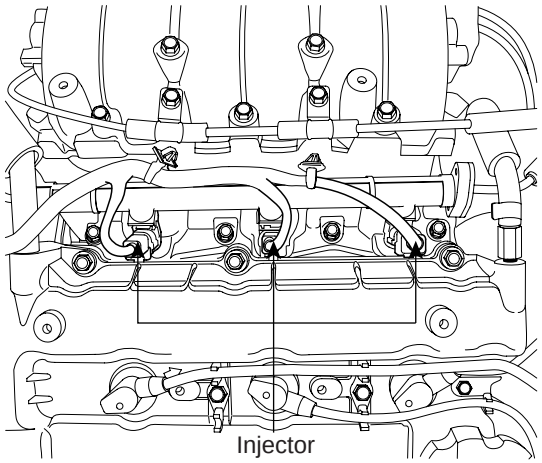
DTC P0261 CYLINDER 1-INJECTOR CIRCUIT LOW
DTC P0264 CYLINDER 2-INJECTOR CIRCUIT LOW
DTC P0267 CYLINDER 3-INJECTOR CIRCUIT LOW
DTC P0270 CYLINDER 4-INJECTOR CIRCUIT LOW
DTC P0273 CYLINDER 5-INJECTOR CIRCUIT LOW
DTC P0276 CYLINDER 6-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E9E553A2



LWIF501R

GENERAL DESCRIPTION E0399A44

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 the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION EF15EF83

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

DTC DETECTING CONDITION E325BF5B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10＜ Battery voltage (V)＜16 • Engine speed (rpm)＞30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec	

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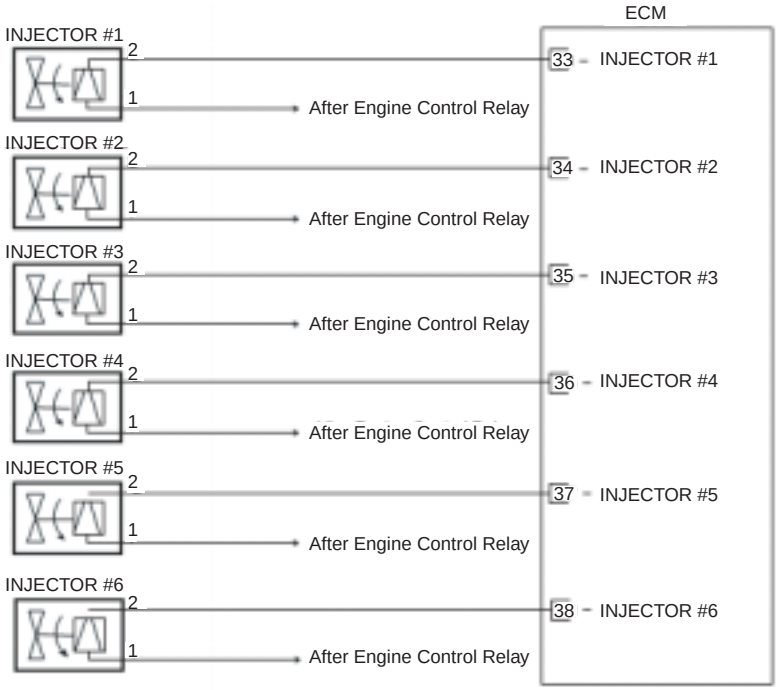
SPECIFICATION EA01396D

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13~16

SCHEMATIC DIAGRAM EAB0E13B

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal 33	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal 34	Injector operation

INJECTOR #3

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal 35	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal 36	Injector operation

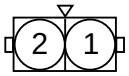
INJECTOR #5

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal 37	Injector operation

INJECTOR #6

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal 38	Injector operation

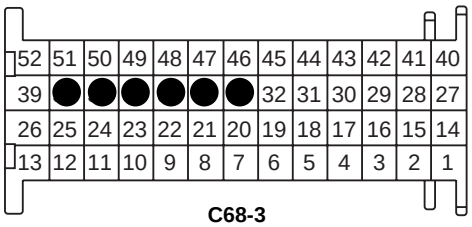
[HARNESS CONNECTORS]



C71-1,3,5

C71-2,4,6

Injector Harness side connector



C68-3

ECM side terminal

LWIF003X

MONITOR DTC STATUS E6EF5869

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.

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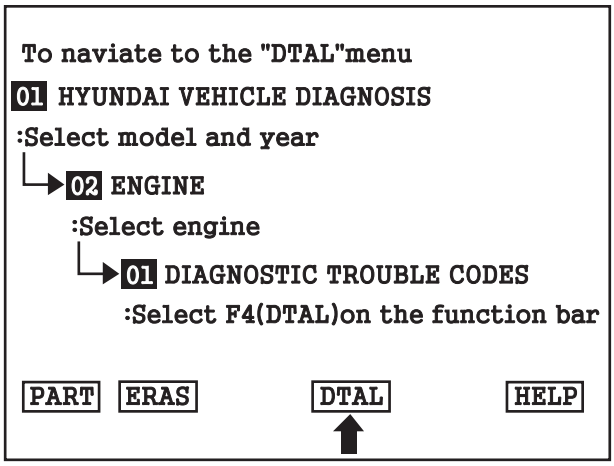

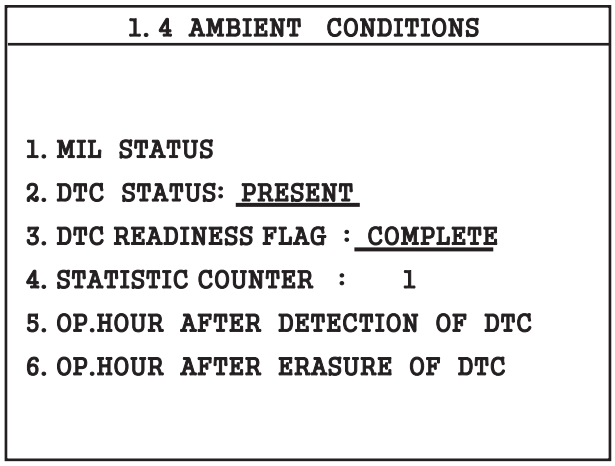

LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION ED036F0E

1. Ignition "OFF".
2. Disconnect injector connector
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

NOTE

P0261: Injector Connector C71-1
P0264: Injector Connector C71-2
P0267: Injector Connector C71-3
P0270: Injector Connector C71-4
P0273: Injector Connector C71-5
P0276: Injector Connector C71-6

Specification : Approx. 13~16Ω at 20°C(68°F)

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4. Is resistance within the specification?

YES

▶ Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

CAUTION

Be careful not to damage wires or components during the test.
Repair as necessary and go to next step as below.

NO

▶ Check Injector for contamination, deterioration, or damage. Substitute with a known-good Injector and check for proper operation. If the problem is corrected, replace Injector and then go to "Verification of Vehicle Repair" procedure

TERMINAL AND CONNECTOR INSPECTION E8DD9E5D

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E7D77191

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

NOTE

P0261: Injector Connector C71-1
P0264: Injector Connector C71-2
P0267: Injector Connector C71-3
P0270: Injector Connector C71-4
P0273: Injector Connector C71-5
P0276: Injector Connector C71-6

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

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NO

▶ Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EEFAE6FB

1. Check for short to ground in control circuit.

   1) Ignition "OFF" & Relay connector : Disconnected.

   2) Measure resistance between terminal 2 of the relay harness connector and chassis ground.

NOTE

P0261: Injector Connector C71-1
P0264: Injector Connector C71-2
P0267: Injector Connector C71-3
P0270: Injector Connector C71-4
P0273: Injector Connector C71-5
P0276: Injector Connector C71-6

Specification : Infinite

2. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE94D7A2

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0262 CYLINDER 1-INJECTOR CIRCUIT HIGH
DTC P0265 CYLINDER 2-INJECTOR CIRCUIT HIGH
DTC P0268 CYLINDER 3-INJECTOR CIRCUIT HIGH
DTC P0271 CYLINDER 4-INJECTOR CIRCUIT HIGH
DTC P0274 CYLINDER 5-INJECTOR CIRCUIT HIGH
DTC P0277 CYLINDER 6-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION EA02F3FC

Refer to DTC P0261.

GENERAL DESCRIPTION E8022B32

Refer to DTC P0261.

DTC DESCRIPTION E30F45D4

ECM sets DTC P0262 if the ECM detects that injector (Cylinder #1) control circuit is shorted to ground.
ECM sets DTC P0265 if the ECM detects that injector (Cylinder #2) control circuit is shorted to ground.
ECM sets DTC P0268 if the ECM detects that injector (Cylinder #3) control circuit is shorted to ground.
ECM sets DTC P0271 if the ECM detects that injector (Cylinder #4) control circuit is shorted to ground.
ECM sets DTC P0274 if the ECM detects that injector (Cylinder #5) control circuit is shorted to ground.
ECM sets DTC P0277 if the ECM detects that injector (Cylinder #6) control circuit is shorted to ground.

DTC DETECTING CONDITION EF75141D

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10＜ Battery voltage (V)＜16 • Engine speed (rpm)＞30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec	

SPECIFICATION EDFB87A4

Refer to DTC P0261.

SCHEMATIC DIAGRAM E6C2C4A6

Refer to DTC P0261.

MONITOR DTC STATUS EF548038

Refer to DTC P0261.

COMPONENT INSPECTION EAE016F7

1. Ignition "OFF".
2. Disconnect injector connector.

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3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

NOTE

P0262: Injector Connector C71-1
P0265: Injector Connector C71-2
P0268: Injector Connector C71-3
P0271: Injector Connector C71-4
P0274: Injector Connector C71-5
P0277: Injector Connector C71-6

Specification : Approx. 13~16Ω at 20°C(68°F)

4. Is resistance within the specification?

YES

▶ Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

CAUTION

Be careful not to damage wires or components during the test.
Repair as necessary and go to next step as below.

NO

▶ Check Injector for contamination, deterioration, or damage. Substitute with a known-good Injector and check for proper operation. If the problem is corrected, replace Injector and then go to "Verification of Vehicle Repair" procedure

TERMINAL AND CONNECTOR INSPECTION EB27CF16

Refer to DTC P0261.

POWER SUPPLY CIRCUIT INSPECTION ECB1D75E

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

NOTE

P0262: Injector Connector C71-1
P0265: Injector Connector C71-2
P0268: Injector Connector C71-3
P0271: Injector Connector C71-4
P0274: Injector Connector C71-5
P0277: Injector Connector C71-6

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

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NO

▶ Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E9C126A5

1. Check for short to battery in control circuit.

   1) Ignition "OFF"

   2) Disconnect injector and ECM connectors.

   3) Ignition "ON" & Engine "OFF".

   4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

   NOTE

   P0262: Injector Connector C71-1
   P0265: Injector Connector C71-2
   P0268: Injector Connector C71-3
   P0271: Injector Connector C71-4
   P0274: Injector Connector C71-5
   P0277: Injector Connector C71-6

Specification : Approx. 0V

   5) Is voltage within the specification?

   YES

   ▶ Go to next step as below.

   NO

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

   1) Ignition "OFF".

   2) Measure resistance between terminals 2 of the injector harness connector and 33 of the ECM harness connector.

   NOTE

   P0262: Injector Connector C71-1
   P0265: Injector Connector C71-2
   P0268: Injector Connector C71-3
   P0271: Injector Connector C71-4
   P0274: Injector Connector C71-5
   P0277: Injector Connector C71-6

Specification : Approx. 0Ω

   3) Is resistance within the specification?

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YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E75EF52B

Refer to DTC P0261.

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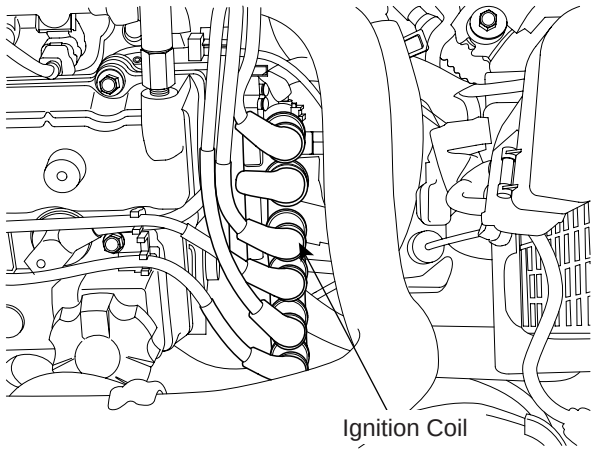
DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

COMPONENT LOCATION EE1605FE



LWIF501P

GENERAL DESCRIPTION E1674C48

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION EE7A48DD

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate. With a more than two cylinder misfire detection, the ECM sets P0300.

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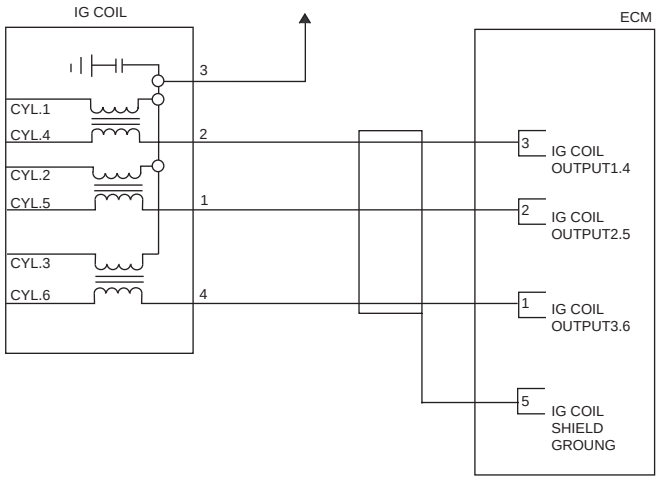
DTC DETECTING CONDITION E72FBEAF

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow ＞Approx. 0 • 550＜ Engine speed(RPM)＜ 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 %within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire＞2% • After first 1000 rev.: Misfire ＞2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	

SCHEMATIC DIAGRAM E68D6F3F

[CIRCUIT DIAGRAM]



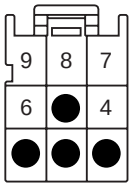
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 2	IG Coll Control (2,5)
2	ECM Terminal 3	IG Coll Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 1	IG Coll Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

LWIF005C

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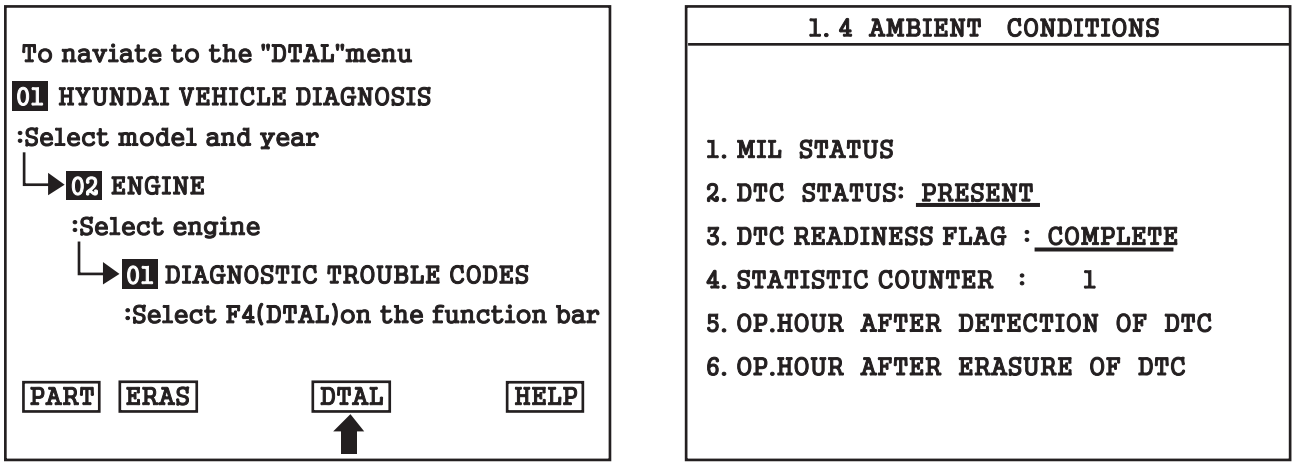
MONITOR DTC STATUS ECDC4D4B

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST E5B00BFA

NOTE

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

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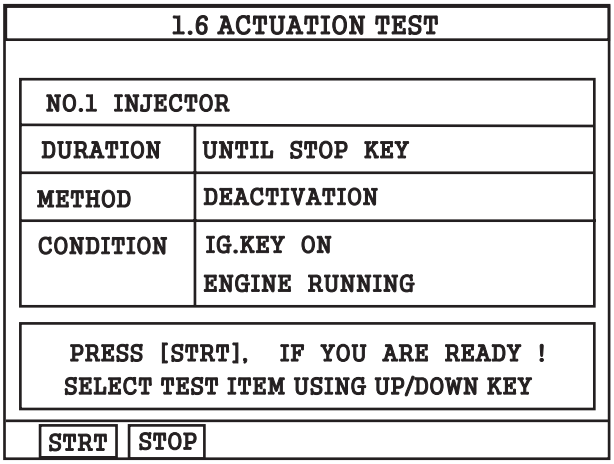
1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

▶ Go to "Timing Inspection" procedure

NO

▶ Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Spark plug cable Inspection" procedure.

NOTE

If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

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SPARK PLUG CABLE INSPECTION

1. Remove suspect cylinder's spark plug cable.

2. Visually/physically inspect the following items:
   - Damage, crack and flashover

3. Measure the resistance of the spark plug cable referring to specification.

Specification :

SPARK PLUG INSPECTION					
N0.1	No.2	No.3	No.4	No.5	No.6
4.39~6.59	2.28~3.43	3.49~5.24	1.9~2.86	3.25~4.87	1.3~1.95

NOTE

Resistance should not be higher than 10,000Ω per foot of cable. If resistance is higher than specification, replace the cable.

4. Is resistance within the specification?

YES

▶ Go to "Spark Plug Inspection " procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SPARK PLUG INSPECTION

1. Remove suspect cylinder's spark plugs.

2. Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks.
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.).
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

3. Was a problem found in any of the above areas?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Fuel Injector Inspection" procedure.

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FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.

Test Condition : Ignition "OFF"
Specification : No clogging and restriction

2. Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem as below:
- Bent push rods
- Leaky or sticky valves or rings
- Excessive valve deposits
- Weak valve spring
- Leaking head gasket

If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
If OK, go to "Ignition Coil Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF"
2. Disconnect ignition coil connector
3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
4. Measure the resistance in each primary coil, referring to specification.(Component side).

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°C)
No.1 & 4 cyl. : terminals 3 & 2
No.2 & 5 cyl. : terminals 3 & 1
No.3 & 6 cyl. : terminals 3 & 4

5. Is resistance within the specification?

YES

▶ Go to "Timing Inspection" procedure.

NO

▶ Test with a new ignition coil and check for proper operation. If problem is corrected, replace ignition coil and go to "Verification of Vehicle Repair" procedure.

TIMING INSPECTION

1. Start engine and let vehicle idle
2. Connect scantool and select "Current Data" mode
3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

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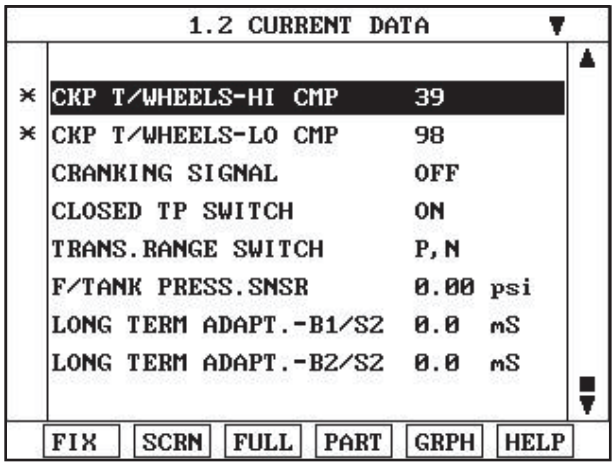
Specification :
"CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth



LWIF101U

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

▶ Go to " Air Leakage Inspection " procedure.

NO

▶ Remove Crankshaft Position Sensor(CKPS) and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

NOTE

- *Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A"*
- *If fail to synchronize CKPS with CMPS, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure.*

AIR LEAKAGE INSPECTION EBF9FDE0

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

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2. Was a problem found in any of the above areas?

YES

▶ Go to "Fuel System Inspection" procedure

NO

▶ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION E6A80879

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

4. Is fuel pressure within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

A. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.*

B. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

VERIFICATION OF VEHICLE REPAIR E206BE86

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

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YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0301 CYLINDER 1-MISFIRE DETECTED
DTC P0302 CYLINDER 2-MISFIRE DETECTED
DTC P0303 CYLINDER 3-MISFIRE DETECTED
DTC P0304 CYLINDER 4-MISFIRE DETECTED
DTC P0305 CYLINDER 5-MISFIRE DETECTED
DTC P0306 CYLINDER 6-MISFIRE DETECTED

COMPONENT LOCATION E36C6481

Refer to DTC P0300.

GENERAL DESCRIPTION E21E5689

Refer to DTC P0300.

DTC DESCRIPTION EE433C09

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate. With a more than two cylinder misfire detection, the ECM sets P0300.

DTC DETECTING CONDITION E09E525C

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow ＞Approx. 0 • 550＜ Engine speed(RPM)＜ 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 %within 200 rev	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case 2)	Threshold Value	• First 1000 rev.: Misfire＞2% • After first 1000 rev.: Misfire ＞2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	

SCHEMATIC DIAGRAM EF5F966B

Refer to DTC P0300.

MONITOR DTC STATUS ED281B83

Refer to DTC P0300.

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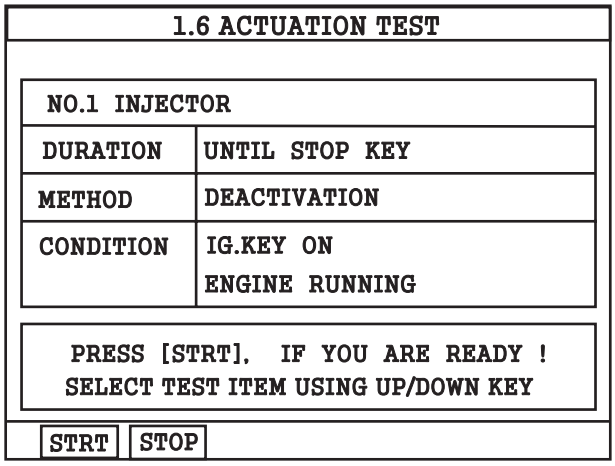
MONITOR ACTUATION TEST EB132FC9

NOTE

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.Caution! Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



LWIF101T

5. Was each cylinder's rpm drop within the same value?

YES

▶ Go to "Timing Inspection" procedure

NO

▶ Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Spark plug cable Inspection" procedure.

NOTE

If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

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SPARK PLUG CABLE INSPECTION

1. Remove suspect cylinder's spark plug cable.
2. Visually/physically inspect the following items:
   - Damage, crack and flashover
3. Measure the resistance of the spark plug cable referring to specification.

Specification :

SPARK PLUG INSPECTION					
N0.1	No.2	No.3	No.4	No.5	No.6
4.39~6.59	2.28~3.43	3.49~5.24	1.9~2.86	3.25~4.87	1.3~1.95

NOTE

Resistance should not be higher than 10,000Ω per foot of cable. If resistance is higher than specification, replace the cable.

4. Is resistance within the specification?

YES

▶ Go to "Spark Plug Inspection " procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SPARK PLUG INSPECTION

1. Remove suspect cylinder's spark plugs.
2. Visually/physically inspect the following items:
   - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks.
   - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.).
   - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.
3. Was a problem found in any of the above areas?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Fuel Injector Inspection" procedure.

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FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.

Test Condition : Ignition "OFF" Specification : No clogging and restriction

2. Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem as below:
- Bent push rods
- Leaky or sticky valves or rings
- Excessive valve deposits
- Weak valve spring
- Leaking head gasket

If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
If OK, go to "Ignition Coil Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF"

2. Disconnect ignition coil connector

3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.

4. [P0301 & P0304] Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side)
   [P0302 & P0305] Measure the resistance between terminals 1 and 3 of the primary ignition coil. (Component side)
   [P0303 & P0306] Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°C)

5. Is resistance within the specification?

YES

▶ Go to "Timing Inspection" procedure.

NO

▶ Test with a new ignition coil and check for proper operation. If problem is corrected, replace ignition coil and go to "Verification of Vehicle Repair" procedure.

TIMING INSPECTION

1. Start engine and let vehicle idle

2. Connect scantool and select "Current Data" mode

3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

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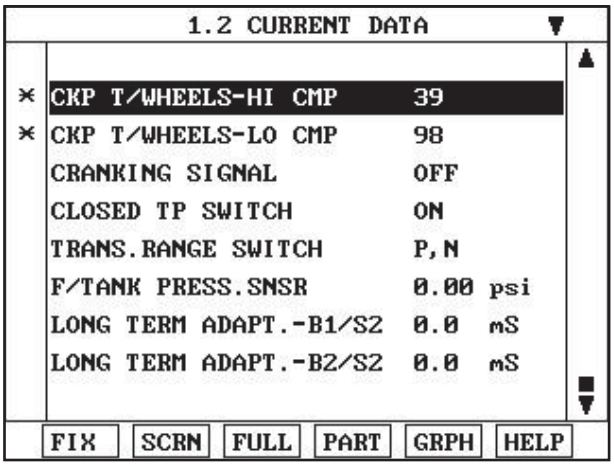
Specification :
"CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth



LWIF101U

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

▶ Go to " Air Leakage Inspection " procedure.

NO

▶ Remove Crankshaft Position Sensor(CKPS) and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

NOTE

- *Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A"*
- *If fail to synchronize CKPS with CMPS, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure.*

AIR LEAKAGE INSPECTION EAFDC4A1

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage

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2. Was a problem found in any of the above areas?

YES

▶ Go to "Fuel System Inspection" procedure

NO

▶ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION ED5746AB

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 330~350kPa(3.30~3.50 kg/㎠, 47~50 psi)

4. Is fuel pressure within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

A. Check if fuel line pressure decreases when accelerating quickly.
- *If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.*

B. If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
- *If pressure quickly increases, check pressure regulator*
- *If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.*

C. If fuel pressure is higher than specification : Is fuel line clogged?
- *If it is not, replace pressure regulator.*
- *If it is, replace it.*

VERIFICATION OF VEHICLE REPAIR EE6FCD3A

Refer to DTC P0300.

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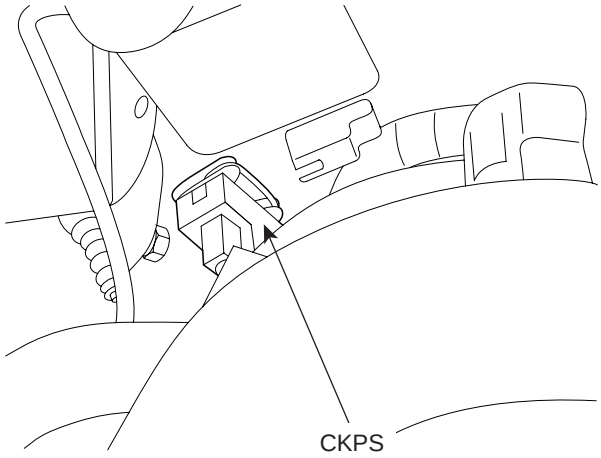
DTC P0315 SEGMENT TIME ACQUISITION INCORRECT

COMPONENT LOCATION EB58E7A3



LWIF5011

GENERAL DESCRIPTION EF3BCE7B

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 DESCRIPTION E32945E5

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 4 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 P0315 if any of segment adaptation value is on the limit.

DTC DETECTING CONDITION EA5C083C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitor segment time adaptation	• Improperly installed target wheel • Contact resistance in connectors
Enable Conditions	• 11 ≤ Battery voltage(V) ≤ 16 • 2,000 < Engine speed < 3,000 • No failure on injector, MAFS, CKPS, CMPS and PCSV	
Threshold Value	• Segment adaptation value = 5/1000	

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SIGNAL WAVEFORM E3FD071E

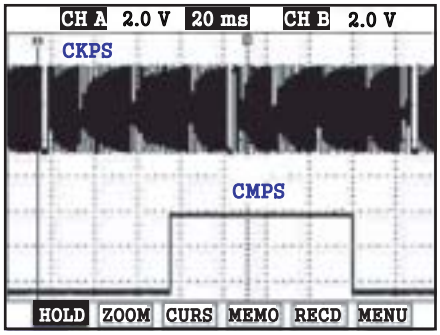


Fig. 1

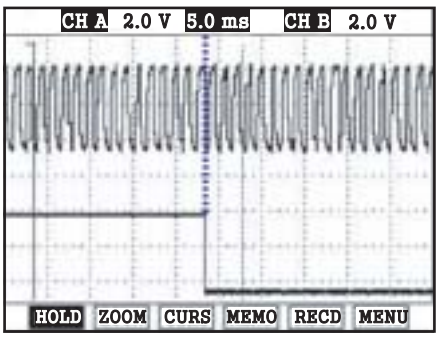


Fig. 2

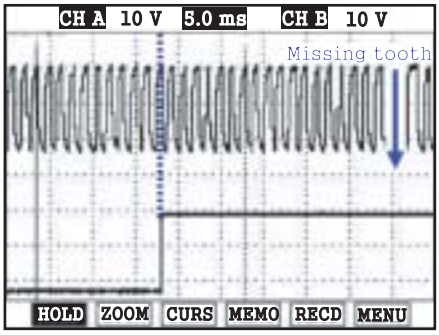


Fig. 3

Fig 1) Normal wave form with idle : The square wave signal should be smooth and without any distortion
Fig 2,3) Normal wave form with engine running : The CMP falling(rising) edge is coincided with 38+/-4 tooth of the CKP from one longer signal(missing tooth)

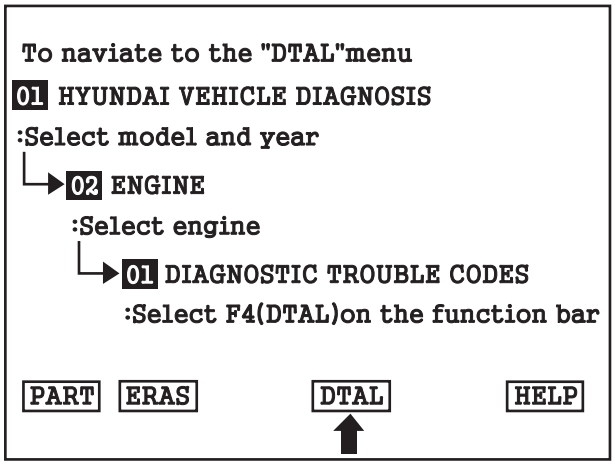
LWIF101V

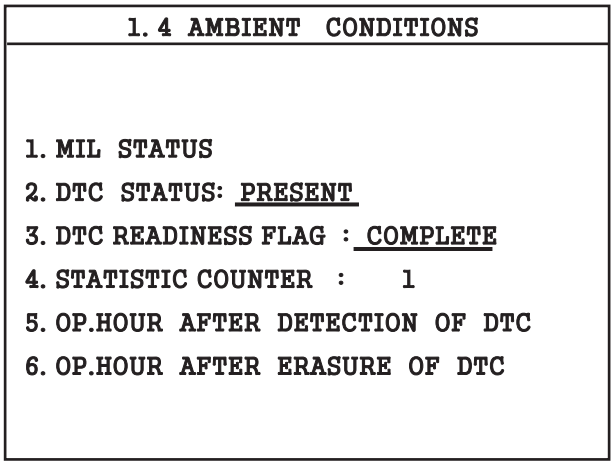
MONITOR DTC STATUS E3F206AA

NOTE

If any codes relating to CKPs are stored, do ALL REPAIRS associated with those codes before proceeding with troubleshooting.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

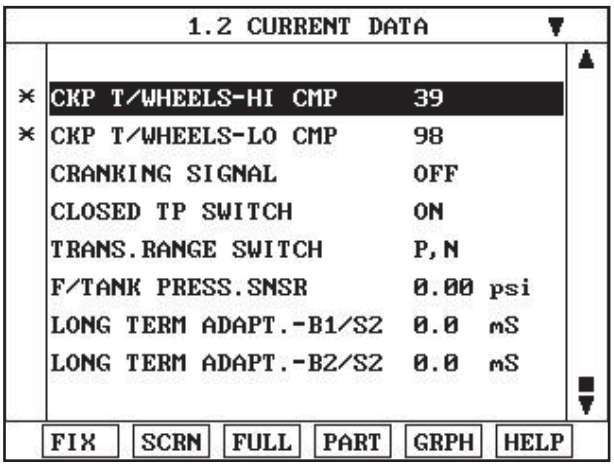
NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EA4C0DF6

1. Start engine and let vehicle idle
2. Connect scantool and select "Current Data" mode.
3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification :
"CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth



LWIF101U

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

▶ Thoroughly check connectors between CKPS and ECM for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

- Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

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NOTE

Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A"

- If failure to synchronize with CMP sensor, readjust timing system and go to next step.

Check CKP sensor for contamination, deterioration, or damage. Substitute with a known-good CKP sensor and check for proper operation. If the problem is corrected, replace CKP sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E50EFE68

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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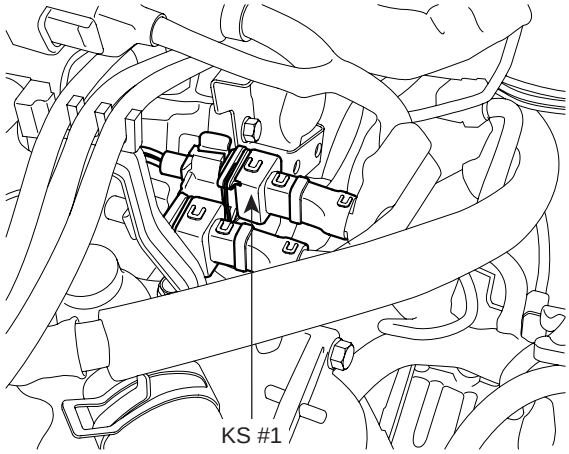
DTC P0325 KNOCK SENSOR 1 CIRCUIT

COMPONENT LOCATION E717502D



LWIF501S

GENERAL DESCRIPTION E154DC23

The knock sensor is attached to the cylinder block and senses engine knocking. The sensor contains a piezoelectric element that converts vibration (or noise) into voltage signal and sends this signal to ECM. With input signals from camshaft position and crankshaft position sensor, ECM can identify which cylinder is knocking. ECM filters vibrations and determines if the vibrations are knocking signal. The Engine Control Module (ECM) uses this signal to suppress knocking by retarding ignition timing. The ECM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the Knock sensor's output voltage falls below minimum threshold. This code indicates an unexpected vibration is being read by the Knock sensor or ECM under normal engine operation.

DTC DESCRIPTION E52EA2D9

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 is set. In case the noise level is higher than the upper threshold or lower than the lower threshold, the DTC P0325 is set too.

DTC DETECTING CONDITION E6A74646

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Open/short in signal or ground circuit • Contact resistance in connectors • Faulty knock sensor
Enable Conditions	• Knock control enabled • Engine speed ＞1800 rpm	
Threshold Value	• Mean value of sensor signal ＜ 0.1V	
Diagnostic Time	• 10*720 crank angle	

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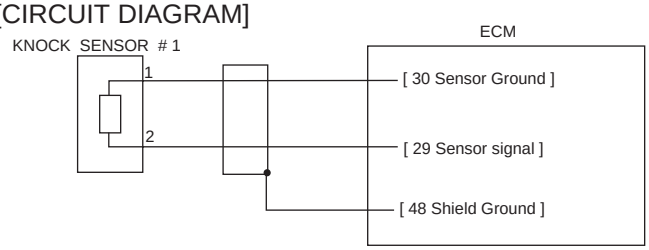
SCHEMATIC DIAGRAM EB38C3E0

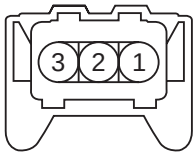
[CIRCUIT DIAGRAM]



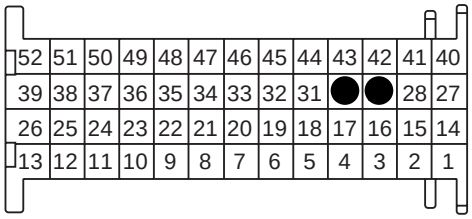
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 30	Sensor Ground
2	ECM Terminal 29	Sensor Signal

[HARNESS CONNECTORS]



C78
Sensor Harness side connector

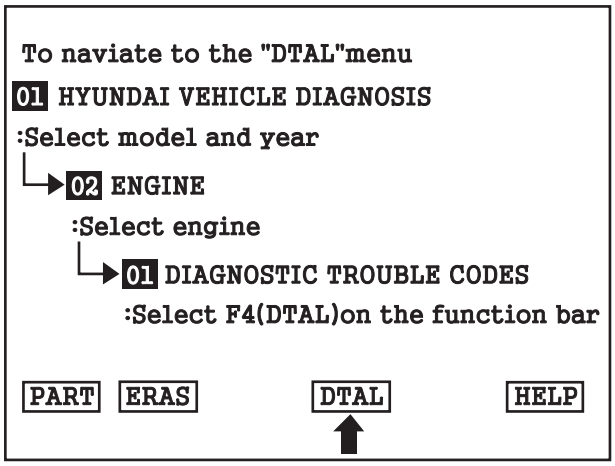


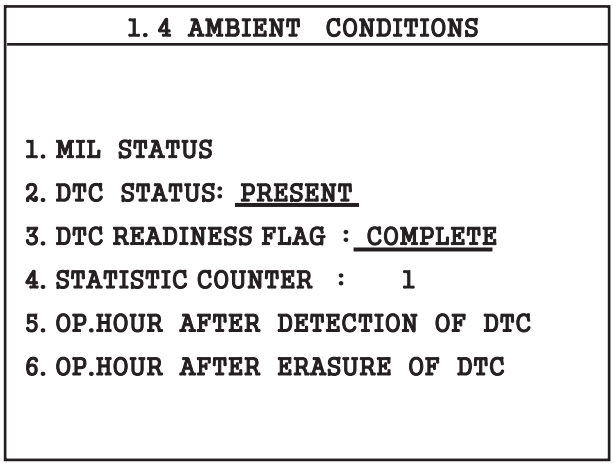
C68-3
ECM side terminal

LWIF005H

MONITOR DTC STATUS E5AB1AFD

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E242D496

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION E02E98A1

1. Ignition "OFF".
2. Disconnect Knock sensor connector.
3. Measure resistance between terminals 1 of the sensor harness connector and 30 of the ECM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open in the ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EF78973B

1. Check for open in signal harness.

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1) Ignition "OFF".

2) Measure resistance between terminals 2 of the sensor harness connector and 29 of the ECM harness connector.

Specification : Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

1) Ignition "OFF"

2) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

Specification : Infinite

3) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.

1) Ignition "OFF"

2) Disconnect ECM connector

3) Ignition "ON" & Engine "OFF"

4) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

Specification : Approx. 0V

5) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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COMPONENT INSPECTION E3C7094D

1. Component resistance inspection.

   1) Ignition "OFF"

   2) Disconnect knock sensor connector

   3) Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Specification : Approx. 5㏁ at 20℃(68°F)

2. Output signal inspection

   1) Remove knock sensor from vehicle and secure (across mounting boss) in a shop vise.

   2) Set up an oscilloscope as follows :
   Channel A (+): terminal 2 (-): terminal 1

   3) Rap on vise with a ball peen hammer while monitoring oscilloscope screen (there should be a spike of less than 1 volt with each hammer strike).

Specification : knock sensor send a voltage spike with hammer strikes

3. Installation torque inspection.

   1) Check the installation torque of the knock sensor.

Specification : Approx. 16 ~ 28N·m(160~250 kg·cm,11.8~18.4 lb·ft)

4. Has a problem been found?

YES

▶ Check knock sensor for contamination, deterioration, or damage. Substitute with a known-good knock sensor and check for proper operation. If the problem is corrected, replace knock sensor and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E55672D8

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

3. Read "DTC Status" parameter.

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4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0330 KNOCK SENSOR 2 CIRCUIT

COMPONENT LOCATION E1B41E89

Refer to DTC P0325.

GENERAL DESCRIPTION ED0DE87D

Refer to DTC P0325.

DTC DESCRIPTION EC0509A2

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 is set. In case the noise level is higher than the upper threshold or lower than the lower threshold, the DTC P0330 is set too.

DTC DETECTING CONDITION E11A043C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Open/short in signal or ground circuit • Contact resistance in connectors • Faulty knock sensor
Enable Conditions	• Knock control enabled • Engine speed ＞1800 rpm	
Threshold Value	• Mean value of sensor signal ＜ 0.1V	
Diagnostic Time	• 10*720 crank angle	

SCHEMATIC DIAGRAM E00E6BCC

Refer to DTC P0325.

MONITOR DTC STATUS E322DEE0

Refer to DTC P0325.

TERMINAL AND CONNECTOR INSPECTION E6168D4E

Refer to DTC P0325.

GROUND CIRCUIT INSPECTION EF6A4C7D

1. Ignition "OFF".
2. Disconnect Knock sensor connector.
3. Measure resistance between terminals 1 of the sensor harness connector and 32 of the ECM harness connector.

Specification : Approx. 0Ω

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4. Is resistance within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open in the ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E25E0C51

1. Check for open in signal harness.
   1) Ignition "OFF".
   2) Measure resistance between terminals 2 of the sensor harness connector and 31 of the ECM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   1) Ignition "OFF"
   2) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

Specification : Infinite

   3) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.
   1) Ignition "OFF"
   2) Disconnect ECM connector
   3) Ignition "ON" & Engine "OFF"
   4) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

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Specification : Approx. 0V

5) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E66F4A08

1. Component resistance inspection.

   1) Ignition "OFF"

   2) Disconnect knock sensor connector

   3) Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Specification : Approx. 5㏁ at 20℃(68°F)

2. Output signal inspection

   1) Remove knock sensor from vehicle and secure (across mounting boss) in a shop vise.

   2) Set up an oscilloscope as follows :
   Channel A (+): terminal 2 (-): terminal 1

   3) Rap on vise with a ball peen hammer while monitoring oscilloscope screen (there should be a spike of less than 1 volt with each hammer strike).

Specification : knock sensor send a voltage spike with hammer strikes

3. Installation torque inspection.

   1) Check the installation torque of the knock sensor.

Specification : Approx. 16 ~ 28N·m(160~250 kg·cm,11.8~18.4 lb·ft)

4. Has a problem been found?

YES

▶ Check knock sensor for contamination, deterioration, or damage. Substitute with a known-good knock sensor and check for proper operation. If the problem is corrected, replace knock sensor and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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VERIFICATION OF VEHICLE REPAIR EE6F1A58

Refer to DTC P0325.

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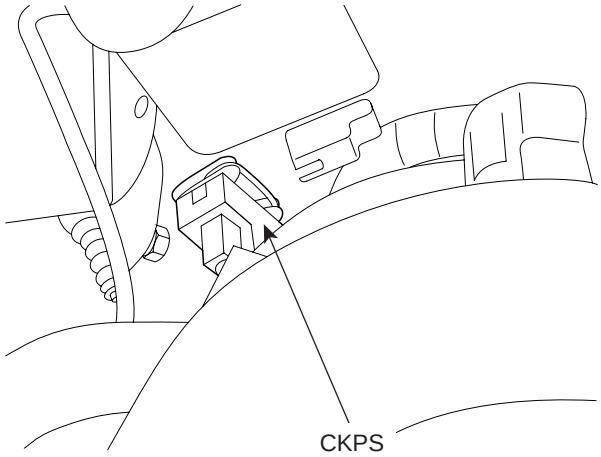
DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION E4A96CF8



LWIF5011

GENERAL DESCRIPTION E6590D3F

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 DESCRIPTION E92FB5C3

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.

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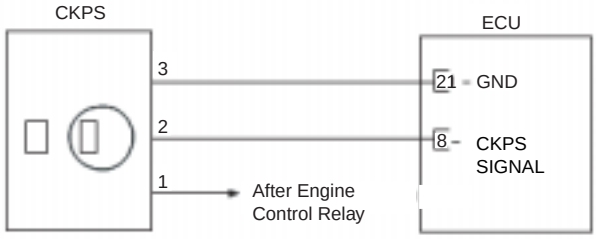
DTC DETECTING CONDITION EECA5C3E

ITEM	DETECTING CONDITION		POSSIBLE CAUSE
DTC Strategy	• Check Crankshaft Signal Switching		• Open or short in signal, ground or power supply circuit • Contact resistance in connectors • Damage to the connecting flange/flywheel • Misadjust crankshaft and camshaft pulley position • Faulty CKP sensor
Case 1	Enable Conditions	• Before Synchronization	
	Threshold Value	• Valid Crankshaft Teeth not yet detected with Camshaft Signal • Can not detect TDC with valid Crankshaft Teeth and Camshaft Signal	
	Diagnosis Time	• 4 revolutions	
Case2	Enable Conditions	• After Synchronization	
	Threshold Value	• Number of Crankshaft Tooth is not correct	
	Diagnosis Time	• 5 revolutions	

SCHEMATIC DIAGRAM E2856CAD

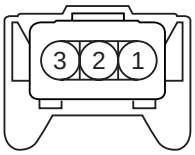
[CIRCUIT DIAGRAM]



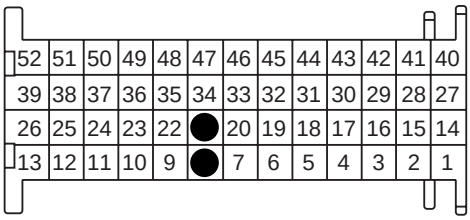
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Engine Control Relay	Battery Voltage
2	ECM Terminal 8	CKPS signal
3	ECM Terminal 21	Sensor ground

[HARNESS CONNECTORS]



C62
CKPS Harness side connector



C68-3
ECM side terminal

LWIF005S

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SINGAL WAVEFORM E4FF5991

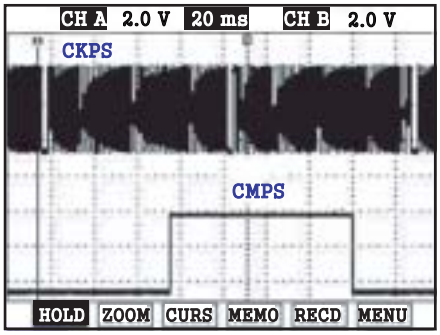


Fig. 1

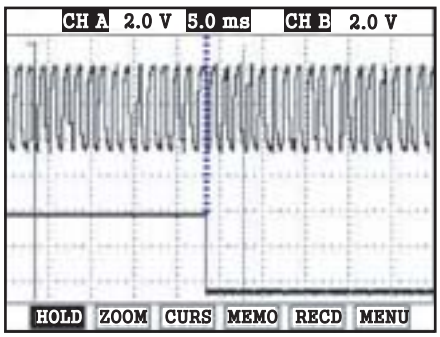


Fig. 2

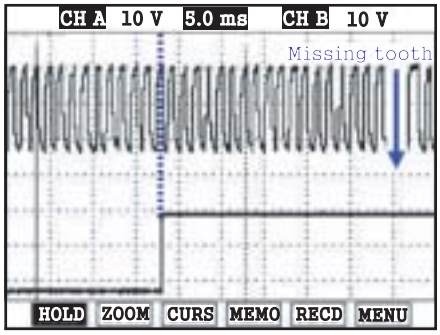


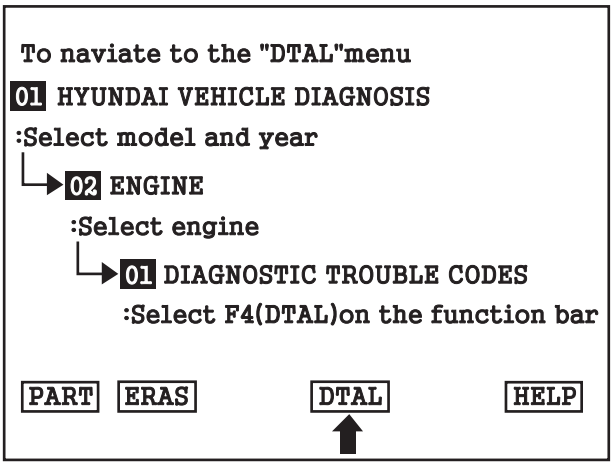
Fig. 3

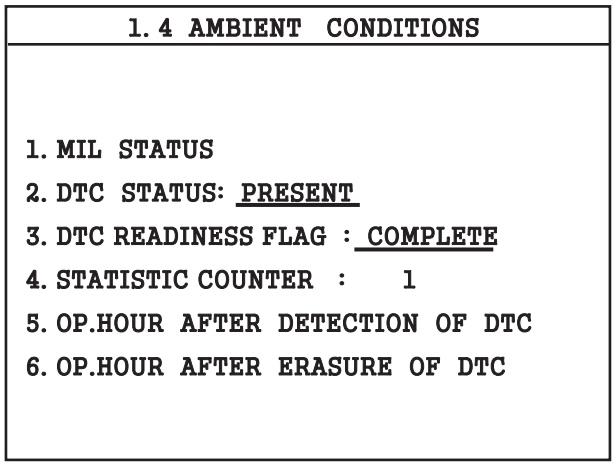
Fig 1) Normal wave form with idle : The square wave signal should be smooth and without any distortion
Fig 2,3) Normal wave form with engine running : The CMP falling(rising) edge is coincided with 38+/-4 tooth of the CKP from one longer signal(missing tooth)

LWIF101V

MONITOR DTC STATUS E00F09D7

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





LGIF001X

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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E1AF42E2

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION EBF5ACC1

1. Ignition "OFF".
2. Disconnect CKP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Ground Circuit Inspection" procedure

NO

▶ Check for a open in the power supply circuit between the main relay and the crankshaft position sensor, Especially check for open or blown 10A sensor fuse refer to "Component Circuit".
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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GROUND CIRCUIT INSPECTION E5145B1A

1. Ignition "OFF".
2. Measure resistance between terminals 3 of the sensor harness connector and chassis ground.

Specification : Approx. 0Ω

3. Is resistance within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open in the ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E50AB1E3

1. Check for open in signal harness.
   1) Ignition "OFF".
   2) Measure resistance between terminals 2 of the sensor harness connector and 8 of the ECM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   1) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

Specification : Infinite

   2) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.
   1) Ignition "ON" & Engine "OFF"

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2) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

Specification : Approx. 0V

3) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure

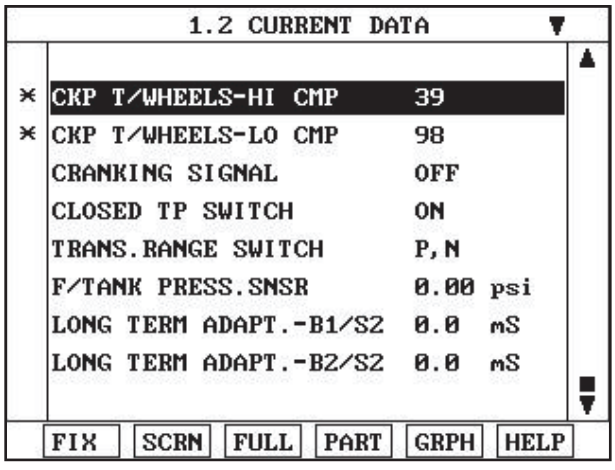
NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E9BBB6D7

1. Start engine and let vehicle idle
2. Connect scantool and select "Current Data" mode
3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification :
"CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth



LWIF101U

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure .

NO

- Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

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NOTE

Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A"

- If fail to synchronize with CMP sensor, readjust timing system and go to next step.

Check CKP sensor for contamination, deterioration, or damage. Substitute with a known-good CKP sensor and check for proper operation. If the problem is corrected, replace CKP sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA82D8F4

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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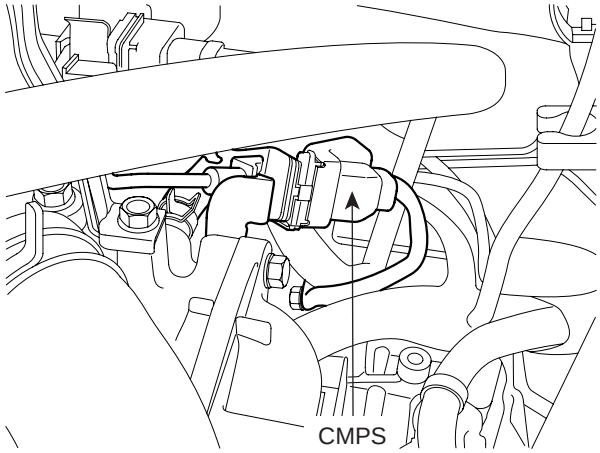
DTC P0340 CAMSHAFT POSITION SENSOR A CIRCUIT MALFUNCTION(SINGLE SENSOR)

COMPONENT LOCATION EFA65F98



LWIF501D

GENERAL DESCRIPTION E12B17E1

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 DESCRIPTION E82CF8D1

The ECM monitors the camshaft sensor signal transition 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.

DTC DETECTING CONDITION E94B5ED8

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check camshaft signal switching	• Open or short in signal, ground or power supply circuit • Contact resistance in connectors • Misadjust crankshaft and camshaft pulley position • Faulty CMP sensor
Enable Conditions	• No Crankshaft Position Sensor signal error	
Threshold Value	• No signal switching	
Diagnostic Time	• 80 revolutions	

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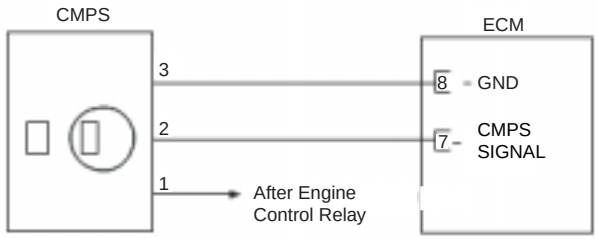
SCHEMATIC DIAGRAM E07F488E

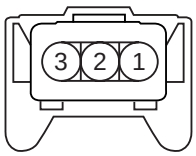
[CIRCUIT DIAGRAM]



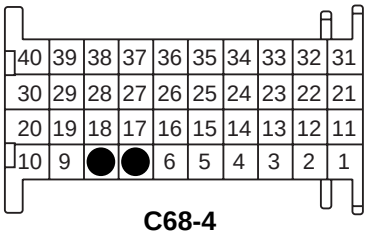
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Engine Control Relay	Battery Voltage
2	ECM Terminal 7	CMPS signal
3	ECM Terminal 8	Sensor ground

[HARNESS CONNECTORS]



C90
CMPS Harness side connector



C68-4
ECM side terminal

LWIF005Y

SINGAL WAVEFORM EFFFACF1

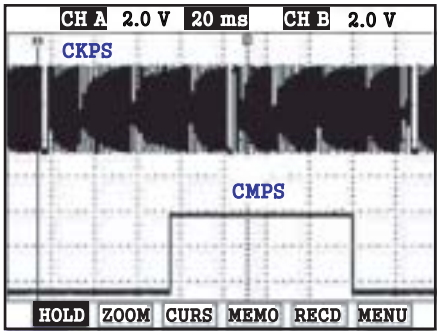


Fig. 1

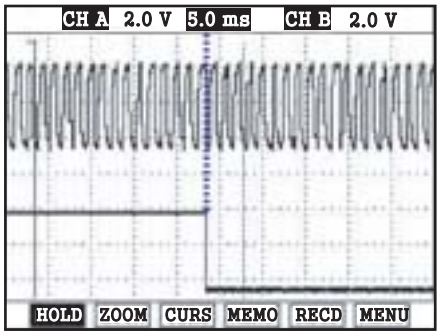


Fig. 2

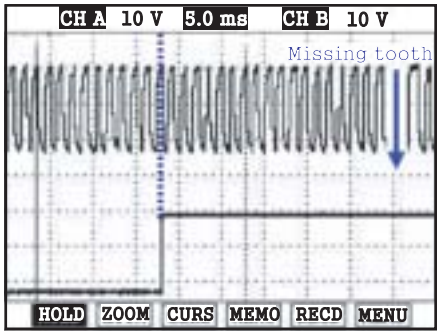


Fig. 3

Fig 1) Normal wave form with idle : The square wave signal should be smooth and without any distortion
Fig 2,3) Normal wave form with engine running : The CMP falling(rising) edge is coincided with 38+/-4 tooth of the CKP from one longer signal(missing tooth)

LWIF101V

MONITOR DTC STATUS E17C3E9A

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.

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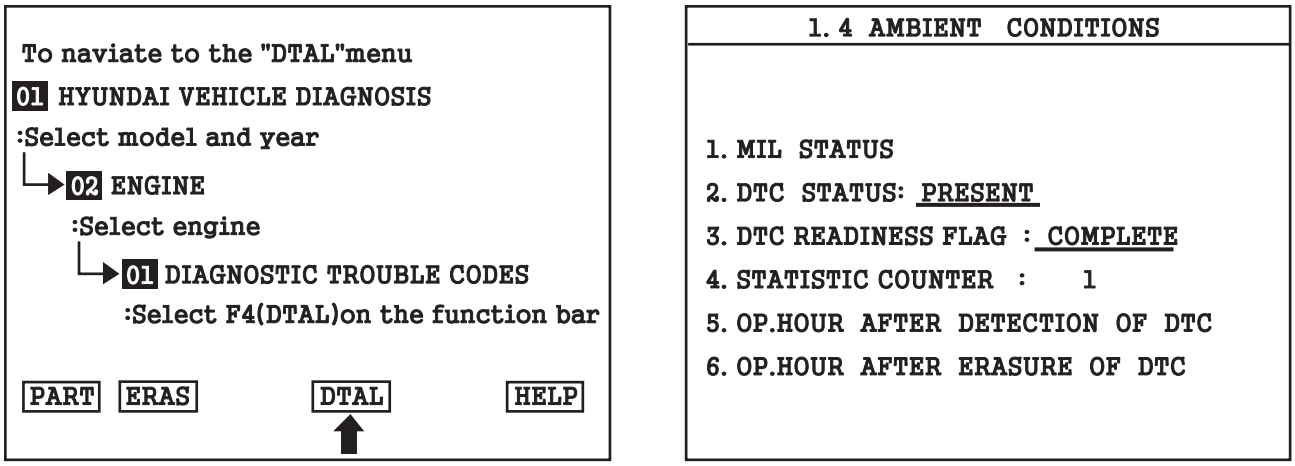

LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION EA5F81F9

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION EA4AD915

1. Ignition "OFF".
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF".

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4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Ground Circuit Inspection" procedure

NO

▶ Check for a open in the power supply circuit between the main relay and the crankshaft position sensor, Especially check for open or blown 10A sensor fuse refer to "Component Circuit".
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E920591B

1. Ignition "OFF".
2. Measure resistance between terminals 3 of the sensor harness connector and chassis ground.

Specification : Approx. 0Ω

3. Is resistance within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to battery in the ground circuit.
Repair as necessary and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION E3150746

1. Check for open in signal harness.
   1) Disconnect ECM connector.
   2) Measure resistance between terminals 2 of the sensor harness connector and 7 of the ECM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

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1) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

Specification : Infinite

2) Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.

1) Ignition "ON" & Engine "OFF"

2) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

Specification : Approx. 0V

3) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ECF5D755

1. Start engine and let vehicle idle
2. Connect scantool and select "Current Data" mode
3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification : "CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth "CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth

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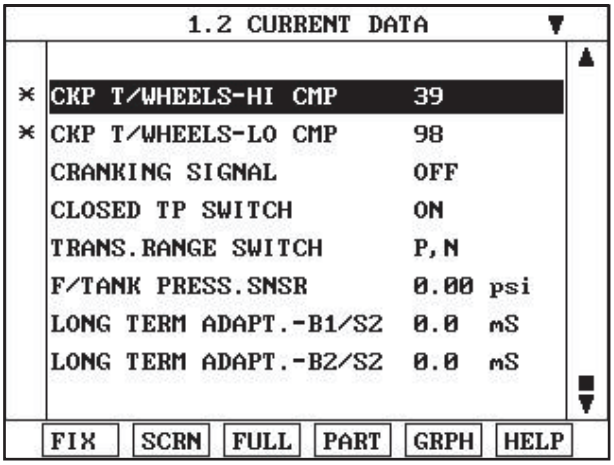

LWIF101U

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure .

NO

- Remove CKP and calculate air gap.
- If fail to synchronize with CMP sensor, readjust timing system and go to next step.

Check CMP sensor for contamination, deterioration, or damage. Substitute with a known-good CMP sensor and check for proper operation. If the problem is corrected, replace CMP sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E25FF424

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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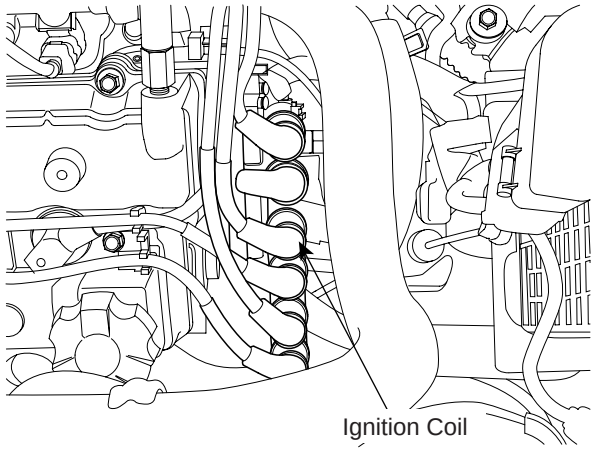
DTC P0350 IGNITION COIL PRIMARY / SECONDARY CIRCUIT

COMPONENT LOCATION E5D83F1D



LWIF501P

GENERAL DESCRIPTION E293A1E4

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 DESCRIPTION E5DD516E

The ECM monitors the peak voltage duration of the ignition primary circuit. If abnormal signal is detected on three cylinders or more, the ECM sets DTC P0350

DTC DETECTING CONDITION EC498A2D

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature ＞75℃(167°F)	
Threshold Value	• Failure on 3 cylinder or more	
Diagnostic Time	• 255 revolutions	

SPECIFICATION EF6FD3D6

Ignition Coil	Normal Parameter at 20℃ (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

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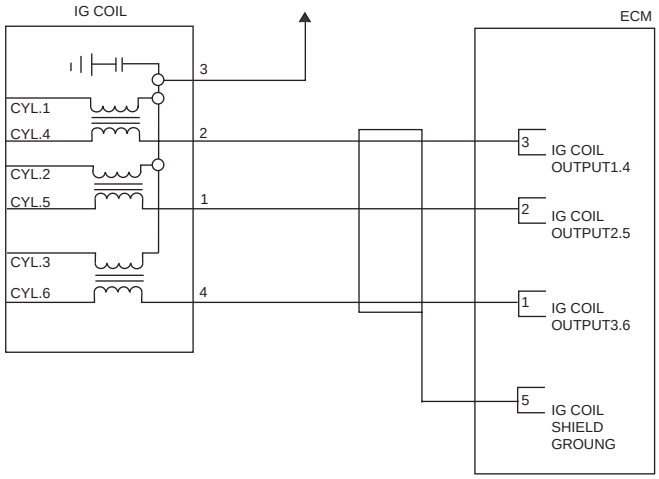
SCHEMATIC DIAGRAM E2F0DB8A

[CIRCUIT DIAGRAM]



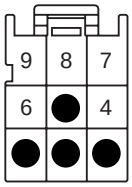
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 2	IG Coll Control (2,5)
2	ECM Terminal 3	IG Coll Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal 1	IG Coll Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

LWIF005C

MONITOR DTC STATUS EB2414E9

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.

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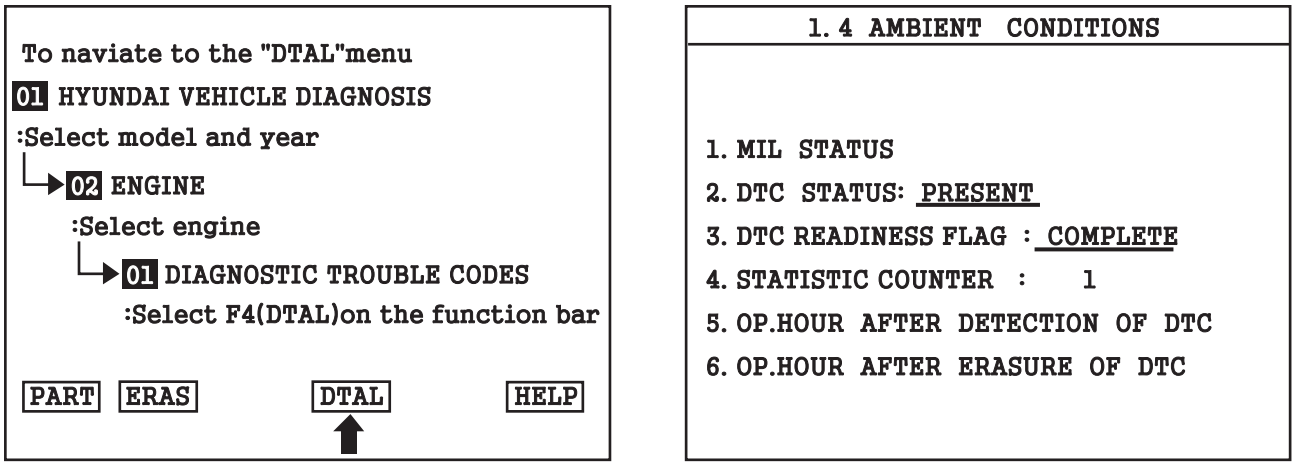

LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION EF539E24

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION ECBF21DB

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".

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4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

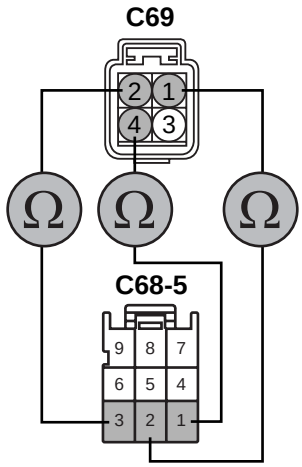
CONTROL CIRCUIT INSPECTION EECA6E7A

1. Check for open in signal harness.

   1) Ignition "OFF".

   2) Measure resistance from each ignition coil control circuit to ECM.

Specification : Approx. 0Ω



1. Coil #2(2&5)
2. Coil #1(1&4)
3. Battery Voltage
4. Coil #3(3&6)

LWIF006F

   3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

   1) Measure resistance from each ignition coil control circuit (4/C14, 1/C14, 2/C14) to chassis ground.

Specification : Infinite

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2) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.

1) Disconnect ECM connector.

2) Ignition "ON" & Engine "OFF".

3) Measure voltage from each ignition coil control circuit (4/C14, 1/C14, 2/C14) to chassis ground.

Specification : Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION E77A81C5

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
4. Measure the resistance in each primary coil, referring to specification.(Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20℃(68°F)
- No.1 & 4 cyl. : terminals 3 & 2
- No.2 & 5 cyl. : terminals 3 & 1
- No.3 & 6 cyl. : terminals 3 & 4

5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal for the No. 3 and No. 6 cylinders, between the high-voltage terminals for the No. 1 and No. 4 cylinders and between the high-voltage terminals for the No.2 and No.5 cylinders.

CAUTION

Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.

Specification : Approx. 12.5 ± 15% (kΩ) at 20℃(68°F)

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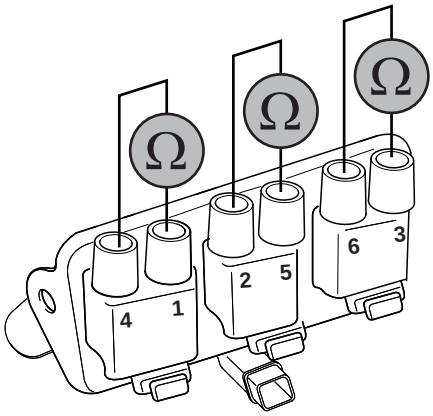

LWIF006I

6. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9B6A8BC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0351 IGNITION COIL 'A' PRIMARY / SECONDARY CIRCUIT
DTC P0352 IGNITION COIL 'B' PRIMARY / SECONDARY CIRCUIT
DTC P0353 IGNITION COIL 'C' PRIMARY / SECONDARY CIRCUIT
DTC P0354 IGNITION COIL 'D' PRIMARY / SECONDARY CIRCUIT
DTC P0355 IGNITION COIL 'E' PRIMARY / SECONDARY CIRCUIT
DTC P0356 IGNITION COIL 'F' PRIMARY / SECONDARY CIRCUIT

COMPONENT LOCATION E8363044

Refer to DTC P0350.

GENERAL DESCRIPTION ED302897

Refer to DTC P0350.

DTC DESCRIPTION E0EC81FF

The ECM monitors the peak voltage duration of the ignition primary circuit. If abnormal signal is detected, the ECM sets DTC P0351 to P0356.

DTC DETECTING CONDITION EAE48002

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature ＞75℃(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration ＜ Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	

SPECIFICATION E0FA4722

Refer to DTC P0350.

SCHEMATIC DIAGRAM E1D17469

Refer to DTC P0350.

MONITOR DTC STATUS E5BB36AC

Refer to DTC P0350.

TERMINAL AND CONNECTOR INSPECTION EDE9255B

Refer to DTC P0350.

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POWER SUPPLY CIRCUIT INSPECTION EA33B832

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EABABF9A

1. Check for open in signal harness.
   1) Ignition "OFF".
   2) [P0301 & P0304] Measure resistance between terminals 2 of the coil harness connector and 3 of the ECM harness connector.
      [P0302 & P0305] Measure resistance between terminals 1 of the coil harness connector and 3 of the ECM harness connector.
      [P0303 & P0306] Measure resistance between terminals 4 of the coil harness connector and 3 of the ECM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   1) [P0301 & P0304] Measure resistance between terminal 2 of the coil harness connector and chassis ground.
      [P0302 & P0305] Measure resistance between terminal 1 of the coil harness connector and chassis ground.
      [P0303 & P0306] Measure resistance between terminal 4 of the coil harness connector and chassis ground.

Specification : Infinite

   2) Is resistance within the specification?

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YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.

   1) Disconnect ECM connector.

   2) Ignition "ON" & Engine "OFF".

   3) [P0301 & P0304] Measure voltage between terminal 2 of the coil harness connector and chassis ground.
      [P0302 & P0305] Measure voltage between terminal 1 of the coil harness connector and chassis ground.
      [P0303 & P0306] Measure voltage between terminal 4 of the coil harness connector and chassis ground.

Specification : Approx. 0V

   4) Is voltage within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION E892A4F8

1. Ignition "OFF".

2. Disconnect ignition coil connector.

3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.

4. [P0301 & P0304] Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side)
   [P0302 & P0305] Measure the resistance between terminals 1 and 3 of the primary ignition coil. (Component side)
   [P0303 & P0306] Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20℃(68°F)

5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal to following diagram.

CAUTION

Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.

Specification : Approx. 13.3 ± 1.9 (kΩ) at 20℃(68°F)

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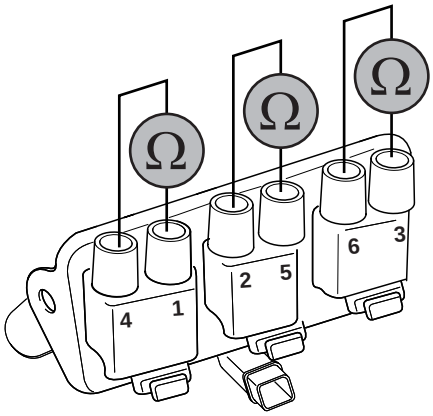

LWIF006I

6. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC0EDF80

Refer to DTC P0350.

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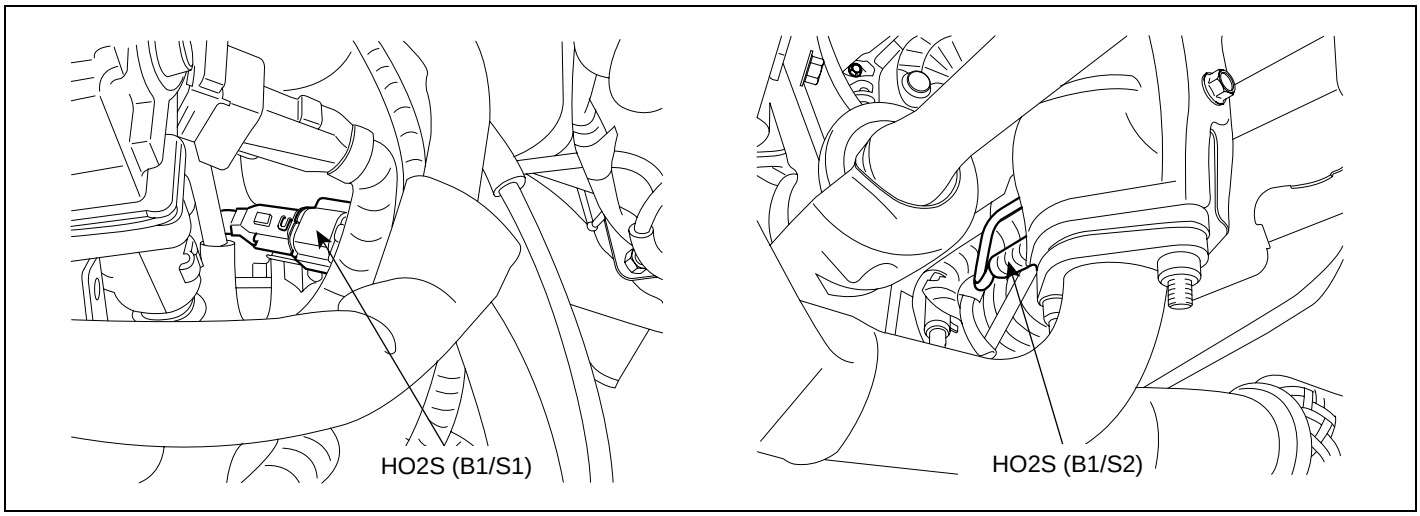
DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

COMPONENT LOCATION E9E59CE4



LWIF551A

GENERAL DESCRIPTION EBF19712

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 DESCRIPTION ED107426

The ECM calculates oscillation size of rear HO2S signal which represents 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 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

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DTC DETECTING CONDITION E3DB2794

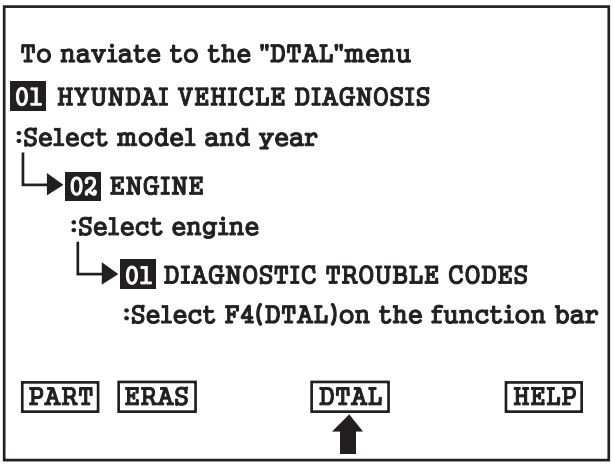
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of the signal ratio of upstream and downstream O2 sensor in a load and speed range	• Exhaust gas leaks • Rear HO2S malfunction • Three way catalyst converter malfunction
Enable Conditions	• 400(752°F)< Catalyst model temperature <600°C(1112°F) • Coolant temperature >70°C(158) • Lambda control within limit • 800rpm< Engine speed < 2500rpm • Air mass flow <250 mg/stk • No misfire is detected • Not transient condition	
Threshold Value	• Averaged malfunction index > 0.7	
Diagnostic Time	• 120 lambda controller cycles	

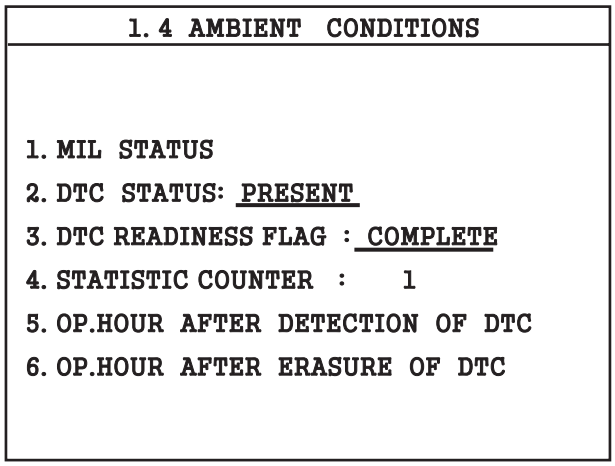
MONITOR DTC STATUS E15193A4

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

EXHAUST SYSTEM INSPECTION E15B421E

1. Visually/physically inspect the rear HO2S for the following conditions:
   - Exhaust system between HO2S and Three way catalyst for air leakage
   - Damage, and for loose or missing hardware.

2. Was a problem found in any of the above areas?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Rear HO2S Inspection " procedure.

REAR HO2S INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   - Ensure that the HO2S is securely installed.(Pigtail and wiring harness not making contact with the exhaust pipe)
   - Check for corrosion on terminals.
   - Check for terminal tension. (at the HO2S and at the ECM)
   - Any road damage.

2. Was a problem found in any of the above areas?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "TWC Inspection " procedure

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TWC INSPECTION

1. Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
   - Severe discoloration caused by excessive temperature.
   - Dents and holes.
   - Internal rattle caused by a damaged catalyst.

2. Also, ensure that the TWC is a proper original equipment manufacturer part.

3. Was a problem found?

   YES

   ▶ Replace TWC and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EF9BC1B7

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

   YES

   ▶ System performing to specification at this time. Clear the DTC

   NO

   ▶ Go to the applicable troubleshooting procedure.

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DTC P0430 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)

COMPONENT LOCATION EBDB6762

Refer to DTC P0420.

GENERAL DESCRIPTION E55C738E

Refer to DTC P0420.

DTC DESCRIPTION E15DE743

The ECM calculates oscillation size of rear HO2S signal which represents 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 P0430 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

DTC DETECTING CONDITION E03D4A00

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of the signal ratio of upstream and downstream O2 sensor in a load and speed range	• Exhaust gas leaks • Rear HO2S malfunction • Three way catalyst converter malfunction
Enable Conditions	• 400(752°F)< Catalyst model temperature <600°C(1112°F) • Coolant temperature >70°C(158) • Lambda control within limit • 800rpm< Engine speed < 2500rpm • Air mass flow <250 mg/stk • No misfire is detected • Not transient condition	
Threshold Value	• Averaged malfunction index > 0.7	
Diagnostic Time	• 120 lambda controller cycles	

MONITOR DTC STATUS EF2810A8

Refer to DTC P0420.

EXHAUST SYSTEM INSPECTION E336F820

Refer to DTC P0420.

VERIFICATION OF VEHICLE REPAIR E3757A10

Refer to DTC P0420.

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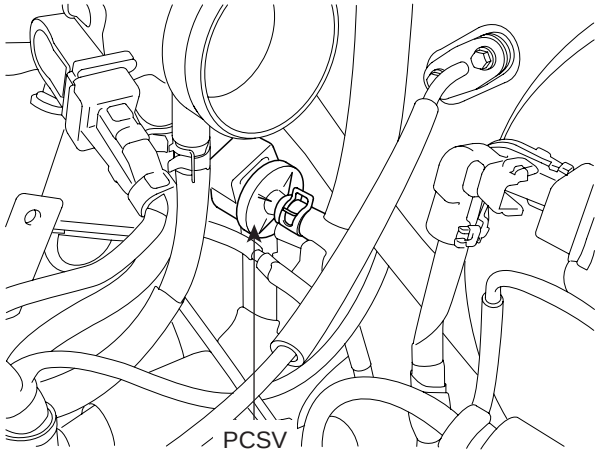
DTC P0444 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT OPEN

COMPONENT LOCATION E3A2E63A



LWIF501W

GENERAL DESCRIPTION E05B5479

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 combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor flow from the canister to the intake manifold.

DTC DESCRIPTION E75500B1

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

DTC DETECTING CONDITION E54297E6

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open in PCSV harness • Contact resistance in connectors • Faulty PCSV
Enable Conditions	• 10V＜ Battery voltage	
Threshold Value	• Open circuit	
Diagnostic Time	• 3 sec.	

SPECIFICATION E77DE1E3

Temperature		PCSV Resistance (Ω)
(℃)	(℉)	
20	68	24.5~27.5

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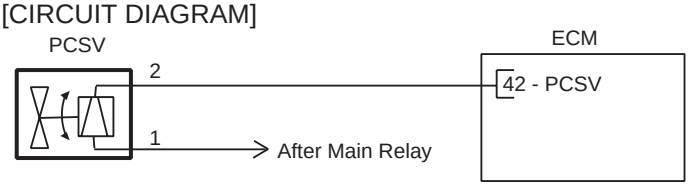
SCHEMATIC DIAGRAM EBDE0FAB

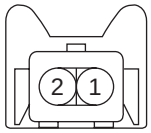
[CIRCUIT DIAGRAM]



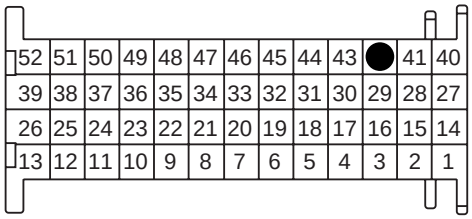
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Engine Control Relay	Battery Voltage
2	ECM Terminal 42	PCSV Operation

[HARNESS CONNECTORS]



C63
PCSV Harness side connector



C68-3
ECM side terminal

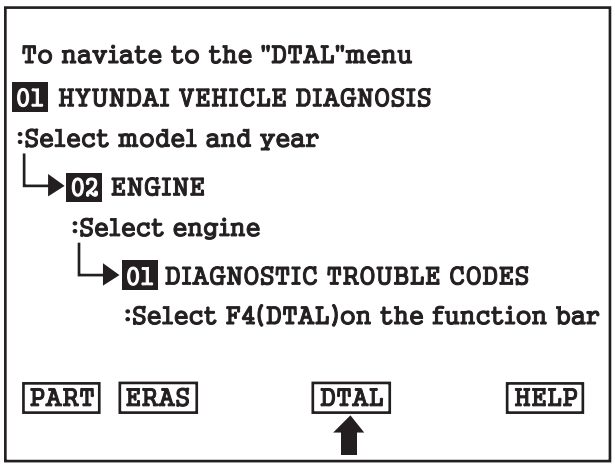
LWIF006V

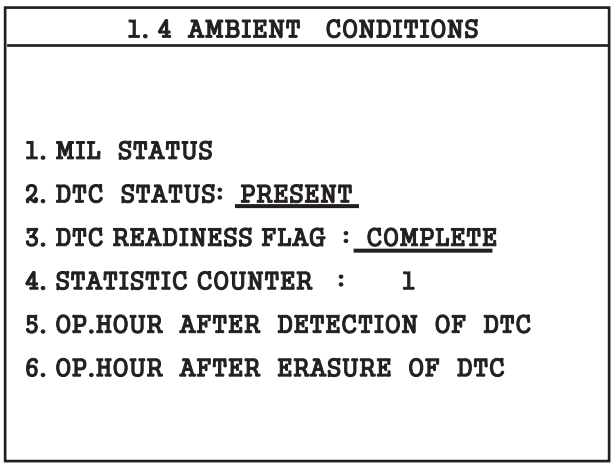
MONITOR DTC STATUS EEE37CA2

NOTE

If any DTCs (or pending codes) are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E3C92F82

1. Ignition "OFF".
2. Disconnect PCSV connector.
3. Measure resistance between terminals 1 and 2 of the PCSV connector(Component side).

Specification : Approx. 24.5~27.5Ω at 20℃(68°F)

4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Check PCSV for contamination, deterioration, or damage. Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E32A3E93

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E9BEB0D1

1. Ignition "ON" & Engine "OFF".

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2. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E23685B2

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9A76E5D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0445 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT SHORTED

COMPONENT LOCATION EACCB0DF

Refer to DTC P0444.

GENERAL DESCRIPTION E9E1F262

Refer to DTC P0444.

DTC DESCRIPTION E0EFE9EA

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

DTC DETECTING CONDITION E4A4B43F

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short in PCSV harness • Contact Resistance in connectors • Faulty PCSV
Enable Conditions	• 10V < Battery voltage	
Threshold Value	• Short to ground or Short to Battery	
Diagnostic Time	• 3 sec.	

SPECIFICATION EF310401

Refer to DTC P0444.

SCHEMATIC DIAGRAM EED94451

Refer to DTC P0444.

MONITOR DTC STATUS EA0514B0

Refer to DTC P0444.

COMPONENT INSPECTION E3460FC9

1. Ignition "OFF".
2. Disconnect PCSV connector.
3. Measure resistance between terminals 1 and 2 of the PCSV connector(Component side).

Specification : Approx. 24.5~27.5Ω at 20°C(68°F)

4. Is resistance within the specification?

YES

▶ Go to next step as below.

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NO

▶ Check PCSV for contamination, deterioration, or damage. Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION ECAD0276

Refer to DTC P0444.

POWER SUPPLY CIRCUIT INSPECTION E1C9499D

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E37CAFBC

1. Check for short to ground in control circuit.
   1) Ignition "OFF".
   2) Disconnect ECM connector.
   3) Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector.

Specification : Approx. 0Ω

   4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in control circuit.
   1) Ignition "ON" & Engine "OFF".
   2) Measure voltage between terminal 2 of the PCSV harness connector and chassis ground.

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Specification : Approx. 0V

3) Is voltage within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E11E67F1

Refer to DTC P0444.

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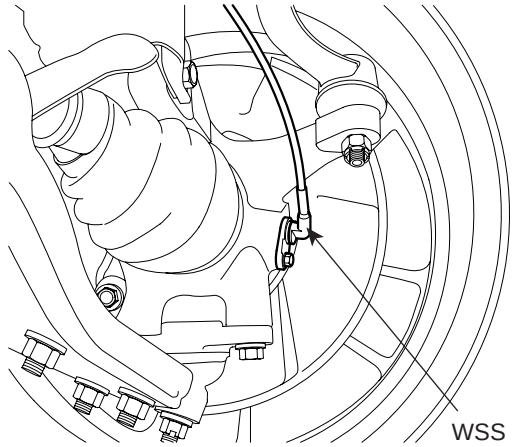
DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

COMPONENT LOCATION E441FA9E



LWIF502B

GENERAL DESCRIPTION E9368446

The Wheel Speed Sensor (WSS) generates a waveform with a frequency proportional 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 if the vehicle is or is not moving. The ECM uses this signal to control the fuel injection, ignition timing, transaxle shift scheduling and torque converter clutch scheduling. The WSS signal is also used to detect rough road conditions.

DTC DESCRIPTION E2178DC0

The ECM evaluates engine speed and mass air flow if there is no vehicle speed signal. This evaluation of both values will detect open circuit or short circuit errors on the 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 the predetermined time.

DTC DETECTING CONDITION EE223676

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check vehicle speed signal	• Open or short in harness • Contact resistance in connectors • Faulty wheel speed sensor
Enable Conditions	• Engine speed ＞2016 rpm • Mass air flow ＞218mg/stk • Coolant temperature ＞ 60°C(140°F) • No fuel shut-off	
Threshold Value	• Vehicle speed = 0 with high engine speed and high load	
Diagnostic Time	• 60 sec. (AT)/40 sec. (MT)	

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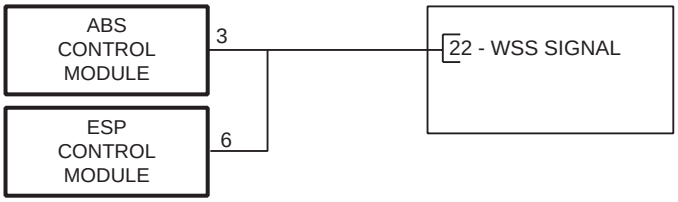
SCHEMATIC DIAGRAM E9AADB3D

[CIRCUIT DIAGRAM]

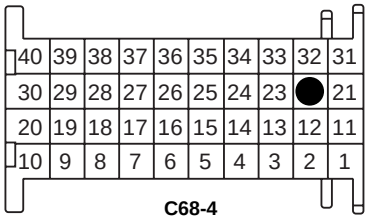
[With ABS / TCS, EPS]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
3	ECM Terminal 22	WSS Signal
6	ECM Terminal 22	WSS Signal

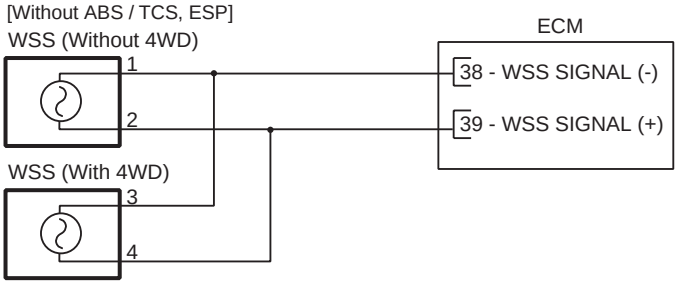
[HARNESS CONNECTORS]



C68-4
ECM side terminal

[CIRCUIT DIAGRAM]

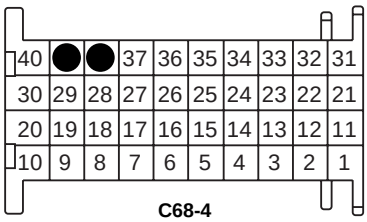
[Without ABS / TCS, ESP]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal 38	WSS Signal (-)
2	ECM Terminal 39	WSS Signal (+)

[HARNESS CONNECTORS]



C68-4
ECM side terminal

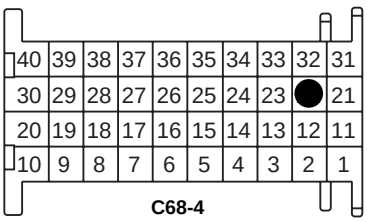
[CIRCUIT DIAGRAM]

[Except Europe]

[CONNECTION INFORMATION]

Terminal	Connected to	Function
3	ECM Terminal 22	VSS Signal

[HARNESS CONNECTORS]



C68-4
ECM side terminal

LWIF007A

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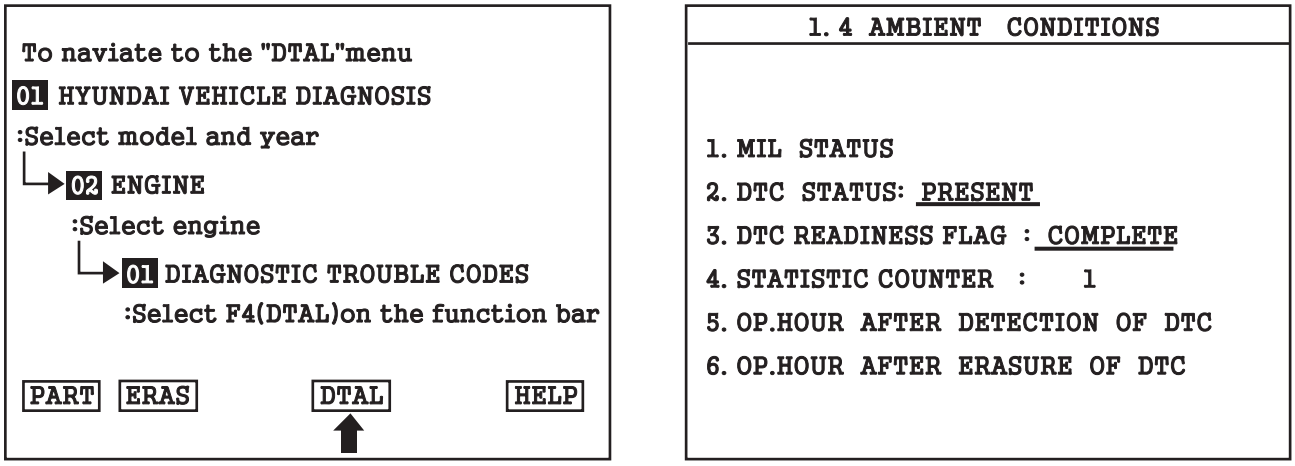
MONITOR DTC STATUS E5995A53

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)".
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History (Not Present) fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent, caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ [With ABS or Except Europe system] Go to "Monitor Scan tool Data" procedure.
[Europe & without ABS system] Go to "Signal Circuit Inspection[Without ABS]" procedure.

MONITOR SCANTOOL DATA EA966A75

1. With vehicle raised on a lift , start the engine and place transaxle in Drive. Let vehicle idle and verify speedometer indicates approx. 10km/h or more(6mph or more) on the instrument cluster.
2. [With ABS] Connect Scantool and select ABS system.
[Except Europe] Connect Scantool and select AUTOMATIC TRANSAXLE system.
3. [With Out]Monitor the "WHEEL SPD SENSOR-FR" parameter on the current data list.
[Except Europe]Monitor the "VEHICLE SPEED" parameter on the current data list.

Specification : 10km/h or more(6mph or more)

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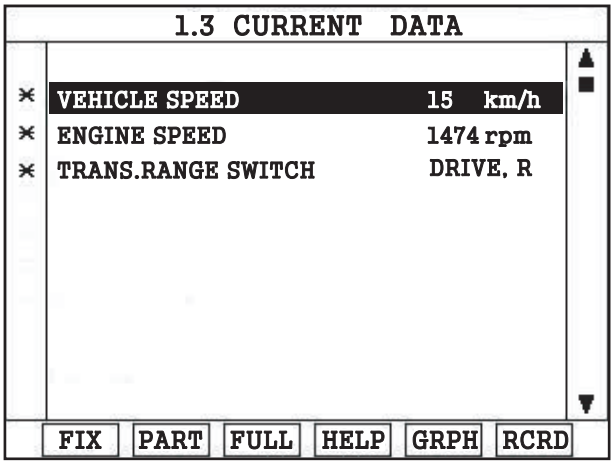

Fig. 1

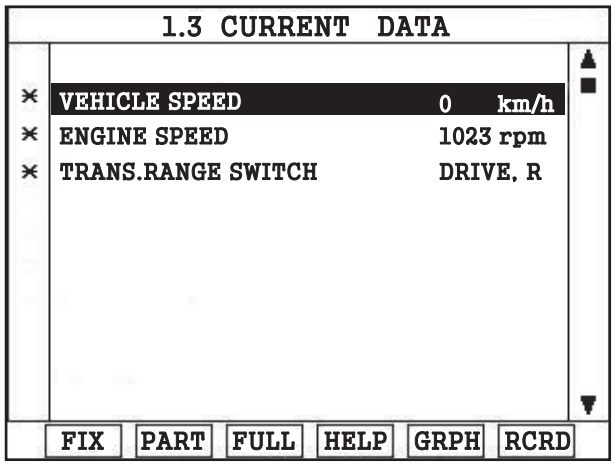

Fig. 2

Fig 1) Normal value with vehicle on lift and transaxle in gear
Fig 2) Open in input circuit with vehicle in motion : Approx. 0km/h

LWIF101W

4. Is value within the specification?

YES

▶[With ABS]Wheel speed sensor is OK. Go to Go to "Signal Circuit Inspection[With ABS]" procedure.
[Except Europe]Vehicle speed sensor is OK. Open or short circuit between VSS and ECM control module.
If problems are found, repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check the following conditions:
[With ABS]
- Open or short circuit between wheel speed sensor(FR) and ABS(or ESP) control module
  If problems are found, repair as necessary and go to "Verification of Vehicle Repair" procedure
  If OK, check wheel speed sensor(FR). Repair as necessary and go to "Verification of Vehicle Repair" procedure

[Except Europe]
- Open or short circuit between VSS and ECM control module.
  If problems are found, repair as necessary and go to "Verification of Vehicle Repair" procedure.
  If OK, check VSS. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EB8A7C9B

[With ABS]

1. Check for open in circuit

   1) Ignition "OFF".

   2) Disconnect ECM and ABS or ESP Control Module connectors.

   3) Measure resistance between terminals 22 of the ECM harness connector and 3 of the ABS Control Module harness connector(W/ABS).
   Measure resistance between terminals 22 of the ECM harness connector and 6 of the ESP Control Module harness connector(W/ESP).

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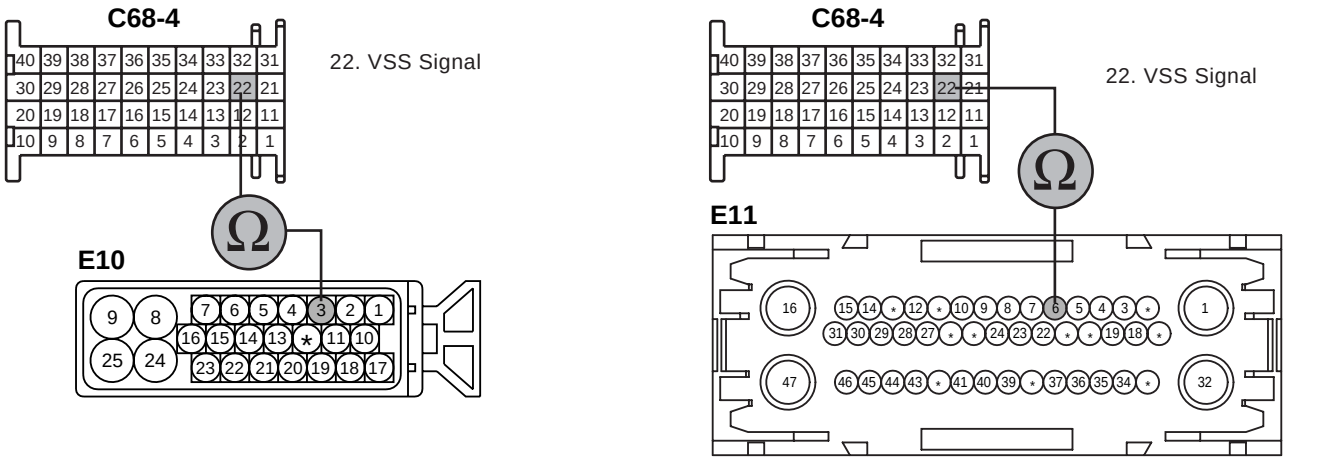
Specification : Approx. 0Ω



LWIF007B

4) Is resistance within the specification?

YES

▶ Go to next step as below

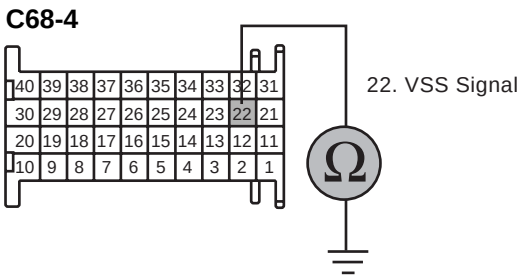
NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in circuit.

1) Measure resistance between terminal 22 of the ECM harness connector and chassis ground

Specification : Infinite



LWIF007C

2) Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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[Europe & without ABS system]

3. Check for open in circuit.

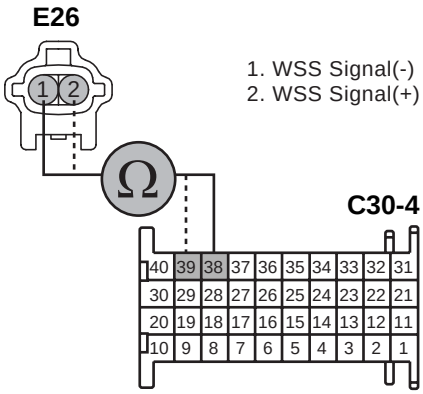
   1) Ignition "OFF".

   2) Disconnect ECM and wheel speed sensor(front right) harness connector.

   3) Measure resistance between wheel speed sensor harness connector and ECM harness connector.

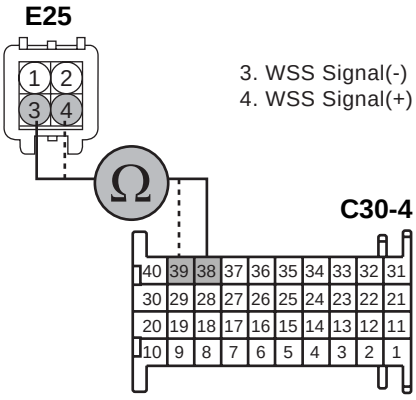
Specification : Approx. 0Ω

[W/O 4WD]
- Terminal 1(sensor) & Terminal 38(ECM)
- Terminal 2(sensor) & Terminal 39(ECM)



LWIF007D

[With 4WD]
- Terminal 3(sensor) & Terminal 38(ECM)
- Terminal 4(sensor) & Terminal 39(ECM)



LWIF007E

   4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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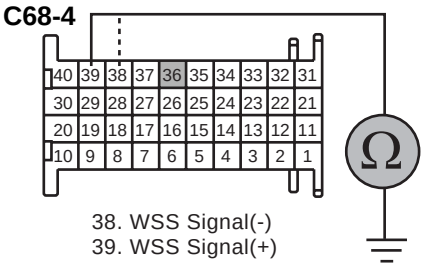
4. Check for short to ground in circuit.

   1) Measure resistance between terminal 38 of the ECM harness connector and chassis ground.

   2) Measure resistance between terminal 39 of the ECM harness connector and chassis ground.

Specification : Infinite



LWIF007F

   3) Is resistance within the specification?

YES

▶ Check wheel speed sensor(FR) as follow:
- Gap between ABS sensor and trigger wheel (Air gap : 0.3~1.1 mm(0.011 ~ 0.043 in))
- Trigger wheel condition
- Sensor resistance : Approx. 1,300~1,900Ω at 20°C(68°F)

Replace wheel speed sensor as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E38759BF

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

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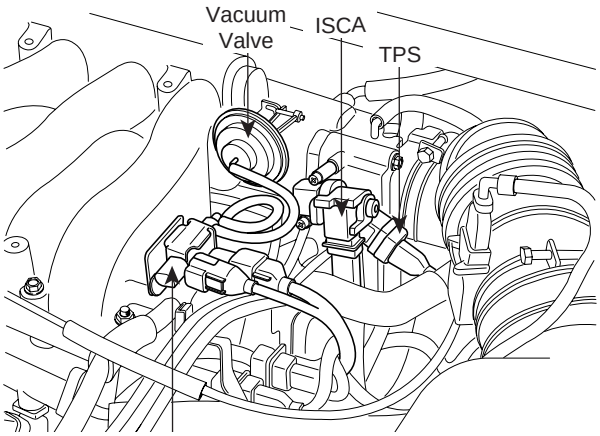
DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

COMPONENT LOCATION EAFC0B8E



Intake Manifold Tuning Valve #1 (Surse Tank Side)

LWIF501Y

GENERAL DESCRIPTION E0F4A272

When the TP sensor's signal indicates closed throttle position and the engine is idling, the ECM adjusts the idle speed control actuator so that the engine runs at the correct idling speed, regardless of coolant temperature, load and etc. When the additional load applied in the engine, the air flow through the idle speed control actuator is increased momentarily to raise the idling speed.

DTC DESCRIPTION E6B30E29

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.

DTC DETECTING CONDITION E5994DF2

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare engine speed and nominal idle speed in idle state	• Restriction in intake or exhaust system • Carbonustment of the accelerator cable • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Vehicle speed =0 • Coolant temperature > 75°C(167°F) • Engine load < 280 mg/stk • Throttle angle:closed • Minimum time after start:15sec. • Canister purge control < 50%	
Threshold Value	• Target idle speed - Engine speed > 100rpm (Engine speed too low)	
Diagnostic Time	• 35 sec.	
Fail Safe	• Evaporative System monitoring is inhibited	

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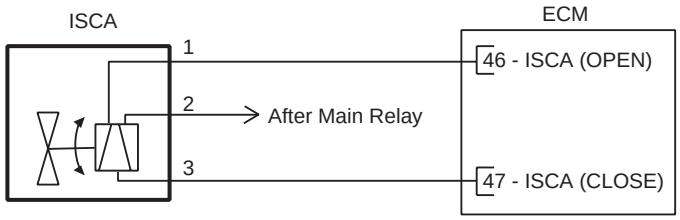
SCHEMATIC DIAGRAM EB937A91

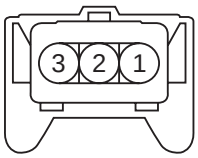
[CIRCUIT DIAGRAM]



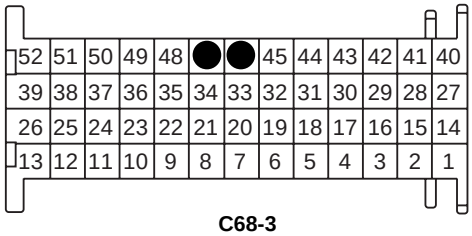
[CONNECTION INFORMATION]

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

[HARNESS CONNECTORS]



C72
ISCA Harness side connector



C68-3
ECM side terminal

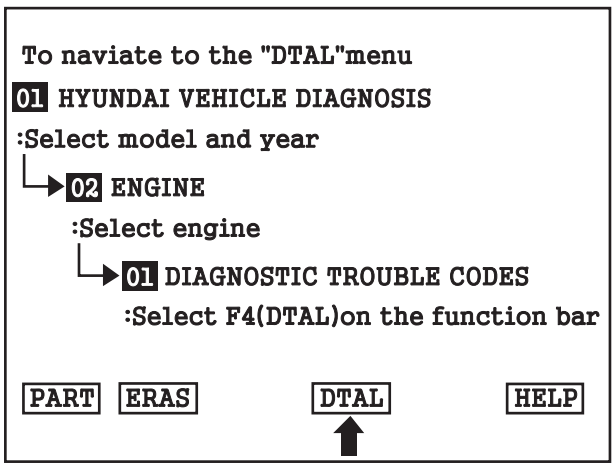
LWIF007G

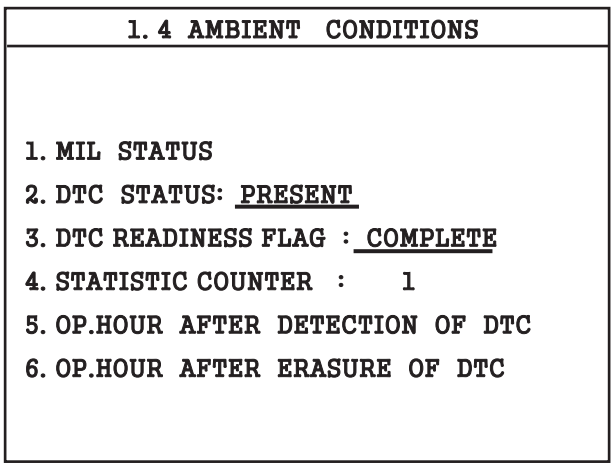
MONITOR DTC STATUS EEA6BEB5

NOTE

If any TPS, MAFS or ISCA Valve circuit codes are present, do ALL REPAIRS associated with them before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





LGIF001X

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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

1. Visually/physically inspect the following items:
   - Air cleaner filter element for excessive dirt or for any foreign objects
   - Throttle body inlet for damage or for any foreign objects
   - Restricted exhaust system

2. Was a problem found in any of the above areas?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION EF7C77D8

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Componment Inspection" procedure.

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COMPONENT INSPECTION E4699564

1. Ignition "OFF"
2. Remove ISCA from Throttle body and Check for throttle bore, throttle plate and the ISCA passages for chocking and for any foreign objects. Repair or clean as necessary
3. Ignition "ON" & Engine "OFF".
4. Connect scan tool and select "IDLE SPEED ACTUATOR" parameter on the "ACTUATION TEST" mode.
5. Activates ISCA by pressing "STAT" key
6. Check the ISCA for clicking sound and visually verifying valve closes and opens

   NOTE

   Repeat numerous times to ensure valve reliability

7. Is ISCA OK?

   YES

   ▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Check ISCA valve for contamination, deterioration, or damage. Substitute with a known-good ISCA valve and check for proper operation. If the problem is corrected, replace ISCA valve and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E803C832

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

   YES

   ▶ System performing to specification at this time. Clear the DTC

   NO

   ▶ Go to the applicable troubleshooting procedure.

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DTC P0507 IDLE AIR CONTROL SYSTEM-RPM HIGHER THAN EXPECTED

COMPONENT LOCATION E58B6B23

Refer to DTC P0506.

GENERAL DESCRIPTION EF938B5E

Refer to DTC P0506.

DTC DESCRIPTION EECD712C

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 lower than the predetermined threshold.

DTC DETECTING CONDITION EB9EF8D9

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare engine speed and nominal idle speed in idle state	• A stuck or binding throttle plate • Misadjustment of the accelerator cable • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Vehicle speed =0 • Coolant temperature > 75°C(167°F) • Engine load < 280 mg/stk • Throttle angle:closed • Minimum time after start:15sec. • Canister purge control < 50%	
Threshold Value	• Engine speed > (target RPM + 200)	
Diagnostic Time	• 35 sec.	

SCHEMATIC DIAGRAM EDC03DBC

Refer to DTC P0506.

MONITOR DTC STATUS E1372776

NOTE

If any TPS, MAFS or ISCA circuit codes are present, do ALL REPAIRS associated with them before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.

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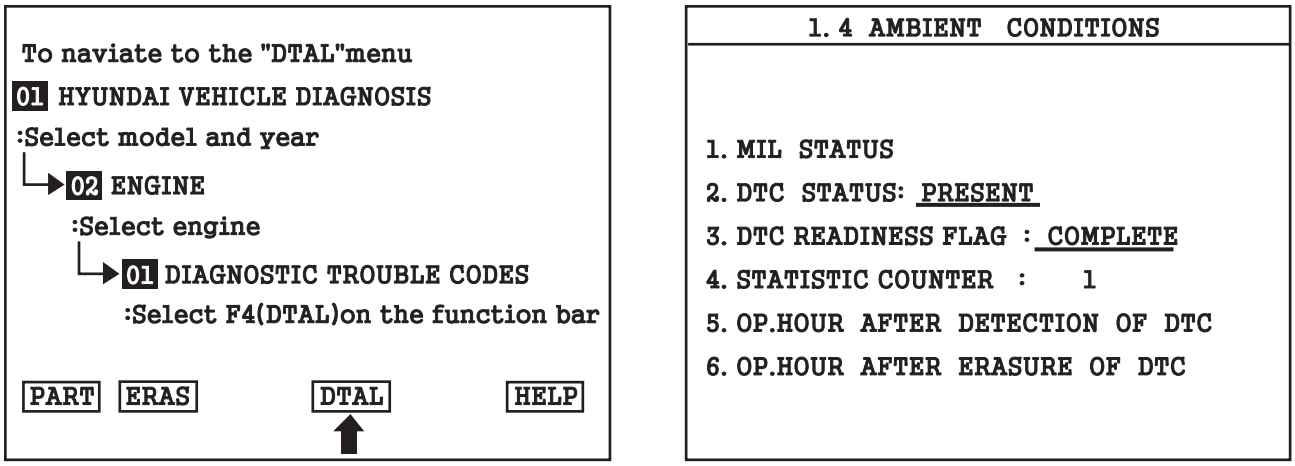

LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Accelerator Cable & Throttle plate Inspection" procedure.

ACCELERATOR CABLE & THROTTLE PLATE INSPECTION

1. Visually/physically inspect the following items. Repair or adjust as necessary and go to next step
   - Check that the Accelerator Cable is not sticking or moving sluggishly.
   - Check Accelerator Cable free play [0.040~0.120 in. (1.0~3.0 mm)].

2. Remove Intake Hose and inspect Throttle Plate for excessive carbon deposits.

3. Is Throttle Plate being held open with excessive carbon deposits?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to next step as below.

AIR LEAKAGE INSPECTION EFD62FD2

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step.
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket.
   - Gasket between intake manifold and cylinder head.

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- Seals between intake manifold and fuel injectors.
- Exhaust system between HO2S and Three way catalyst for air leakage.

2. Check for air leakage in EVAP. Purge control valve

   1) Remove the manifold side vacuum hose from the EVAP canister purge valve.

   2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve

   3) Does the valve hold vacuum?

   YES

   ▶ Go to next step as below.

   NO

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E0480127

Refer to DTC P0506.

COMPONENT INSPECTION EE9F3821

1. Ignition "OFF"
2. Remove ISCA from Throttle body and Check for throttle bore, throttle plate and the ISCA passages for chocking and for any foreign objects. Repair or clean as necessary
3. Ignition "ON" & Engine "OFF".
4. Connect scan tool and select "IDLE SPEED ACTUATOR" parameter on the "ACTUATION TEST" mode.
5. Activates ISCA by pressing "STAT" key
6. Check the ISCA for clicking sound and visually verifying valve closes and opens

   NOTE

   Repeat numerous times to ensure valve reliability

7. Is ISCA OK?

   YES

   ▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   ▶ Check ISCA valve for contamination, deterioration, or damage. Substitute with a known-good ISCA valve and check for proper operation. If the problem is corrected, replace ISCA valve and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E76FD190

Refer to DTC P0506.

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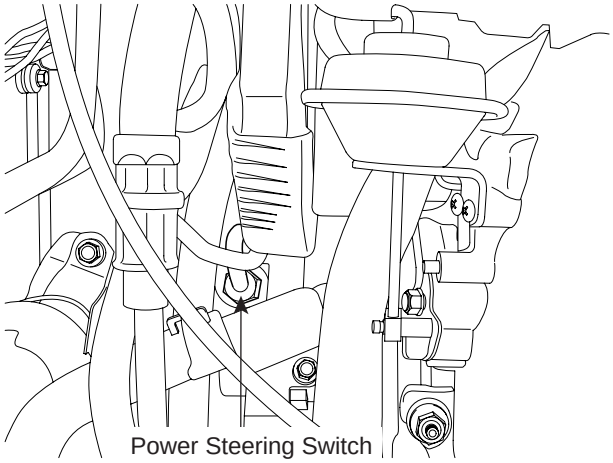
DTC P0551 POWER STEERING PRESSURE SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E6C9515B



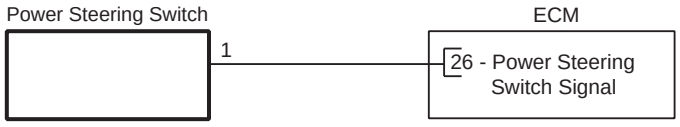
LWIF501X

DTC DETECTING CONDITION E330B9A3

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Power steering switch check	• Open or short circuit • Contact resistance in connectors • Faulty power steering switch
Enable Conditions	• No vehicle speed error • Coolant temperature > 75°C(167°F) • Power steering switch is ON	
Threshold Value	• Power steering is ON with vehicle speed > 100km/h & time > 25.5 sec.	
Diagnostic Time	• 0.1 sec.	

SCHEMATIC DIAGRAM EC875DAC

[CIRCUIT DIAGRAM]

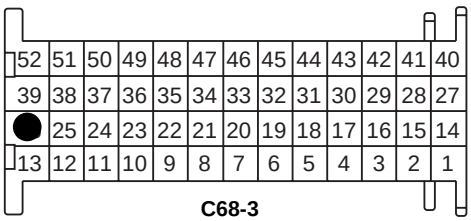


[CONNECTION INFORMATION]

Terminal	Connected to	Function
3	ECM Terminal 26	Power Steering Switch Signal

[HARNESS CONNECTORS]

C86
HO2S Harness side connector



C68-3
ECM side terminal

LWIF007H

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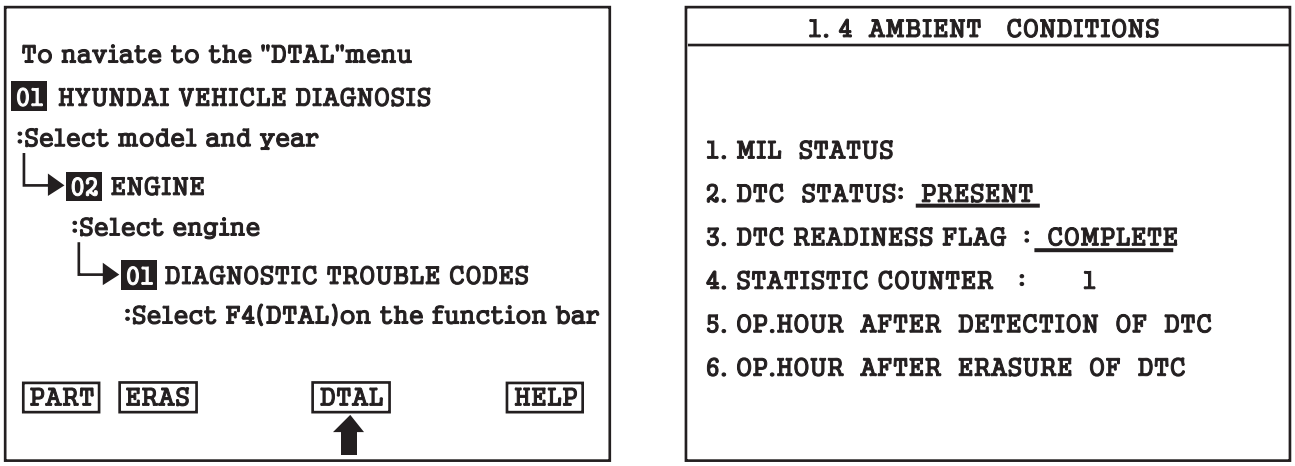
MONITOR DTC STATUS EF14C6FF

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION EAFCB1F8

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

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▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E036A380

1. Ignition "OFF".
2. Disconnect P/S switch connector.
3. Start the engine, and measure voltage between P/S switch harness connector and chassis ground referring to specification.

Specification

Steering Wheel	Voltage
Straight ahead	Approx. B+
Turned	Approx. 0V

4. Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFDA8A39

1. Ignition "OFF".
2. Disconnect P/S switch connector.
3. Check continuity of the switch referring to specification.

Specification

Steering Wheel	Continuity
Straight ahead	No
Turned	Yes

4. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Check P/S switch for contamination, deterioration, or damage. Substitute with a known-good P/S switch and check for proper operation. If the problem is corrected, replace P/S switch and then go to "Verification of Vehicle Repair" procedure

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VERIFICATION OF VEHICLE REPAIR EB1060F7

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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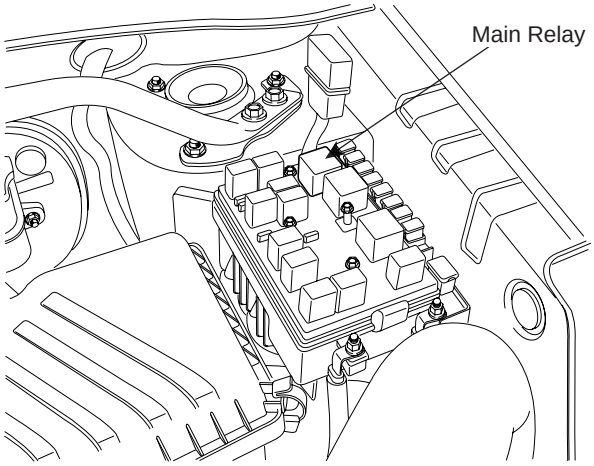
DTC P0560 SYSTEM VOLTAGE

COMPONENT LOCATION E378D8CF



LWIF502Z

GENERAL DESCRIPTION E932C12A

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 DESCRIPTION E33DA649

The ECM measures the voltage from ignition key and from main relay respectively and compares two voltages. This comparison 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 higher than a predetermined threshold after ignition key-off.

DTC DETECTING CONDITION E5561F16

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of battery voltage and voltage after	• Open or short circuit • Contact resistance in connectors
Enable Conditions	• Battery voltage ＞10V • Ignition ON	
Threshold Value	• Voltage after main relay when ON ＜ 6V	
Diagnostic Time	• 0.1 sec.	

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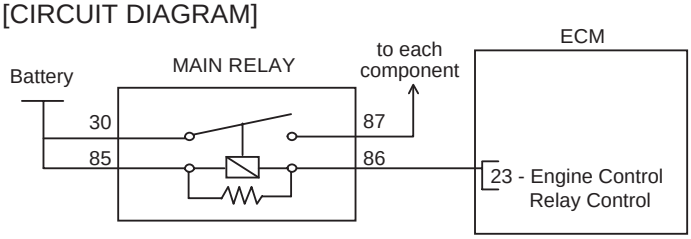
SCHEMATIC DIAGRAM EA5A0865

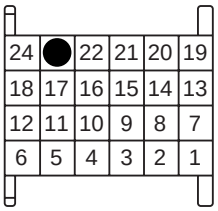
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Supply
85	Battery	Battery Supply
86	ECM Terminal 23	Main Relay Control
87	-	Supply B+

[HARNESS CONNECTORS]



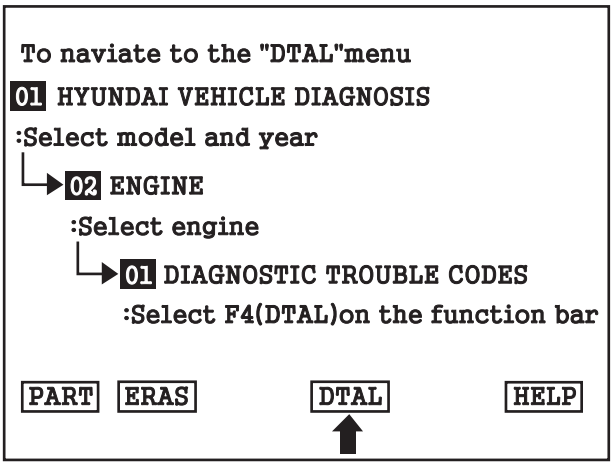
C30-2

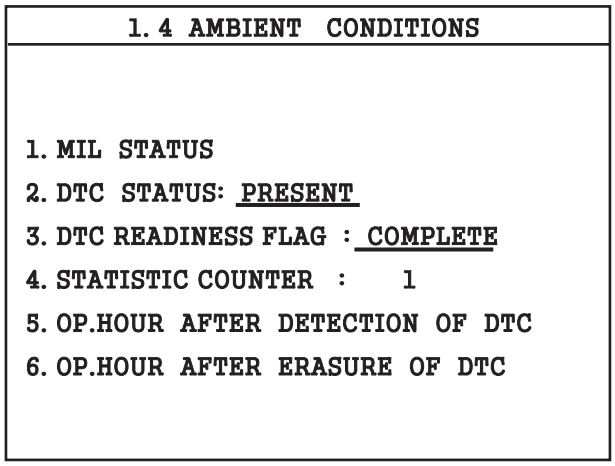
ECM side terminal

LWIF007J

MONITOR DTC STATUS EDBEC349

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

COMPONENT INSPECTION E6AA6F75

1. Ignition "OFF".
2. Remove the main relay.
3. Apply 12V and a ground to 85 and 86 terminals of the main relay.
4. Check if the main relay works well when it is energized. (If the main relay works normally, a clicking sound can be heard.)
5. Does the main relay operate normally?

YES

▶ Go to next step as below.

NO

▶ Replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EFCB09C6

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E09C5F37

1. Remove the main relay.

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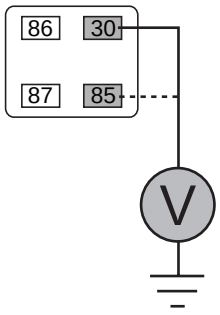
2. Ignition "ON" & Engine "OFF".
3. Measure the voltage between terminal 30 of the main relay harness connector(E07) and chassis ground.
4. Measure the voltage between terminal 85 of the main relay harness connector(E07) and chassis ground.

Specification : Approx. B+



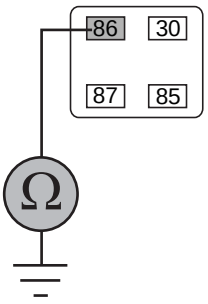
30. Battery Voltage
85. Battery Voltage
86. Main Relay Control
87. Supply B+

LGIF008F

CONTROL CIRCUIT INSPECTION E6BEFF75

1. Check for short to ground in control circuit.
   1) Ignition "OFF".
   2) Disconnect Relay harness connector.
   3) Measure resistance between terminal 86 of the relay harness connector and chassis ground.

Specification : Infinite



30. Battery Voltage
85. Battery Voltage
86. Main Relay Control
87. Supply B+

LGIF008G

   4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit.

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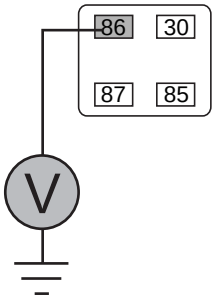
1) Ignition "OFF".

2) Disconnect relay and ECM connectors.

3) Ignition "ON" and Engine "OFF".

4) Measure voltage between terminal 86 of the relay harness connector and chassis ground.

Specification : Approx 0V



30. Battery Voltage
85. Battery Voltage
86. Main Relay Control
87. Supply B+

LGIF008H

5) Is voltage within the specification?

YES

▶ Go to next step as below

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

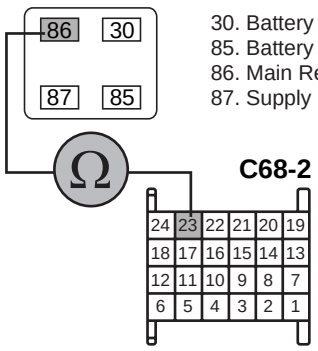
3. Check for open in control harness.

1) Ignition "OFF".

2) Disconnect relay and ECM connectors.

3) Measure resistance between terminals 86 of the relay harness connector and 23 of the ECM harness connector.

Specification : Approx 0Ω



30. Battery Voltage
85. Battery Voltage
86. Main Relay Control
87. Supply B+

LWIF007O

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4) Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EDAB1424

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY(ROM) ERROR

GENERAL DESCRIPTION E65A8308

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 DESCRIPTION EDBF5E52

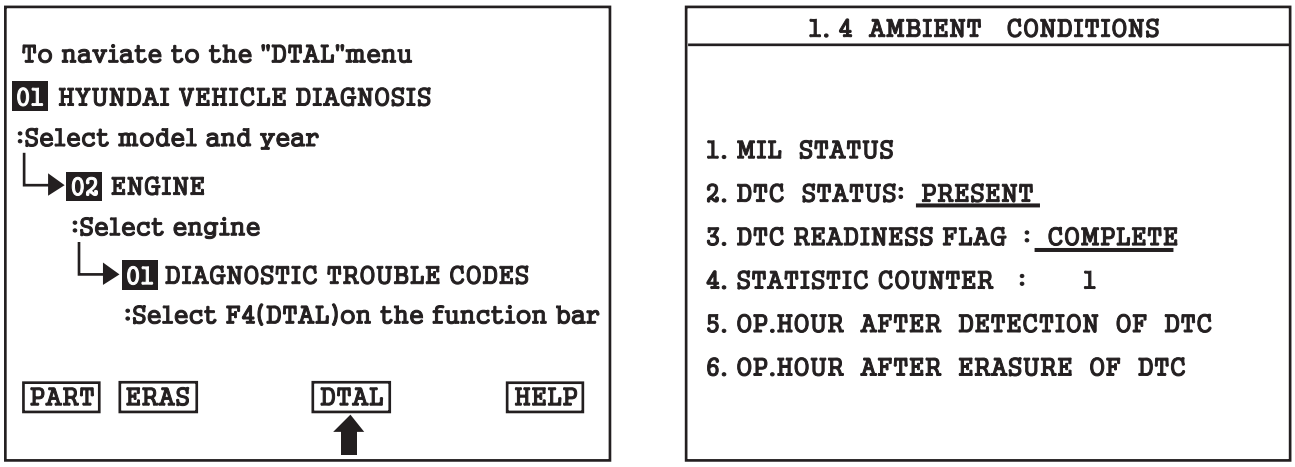
The ECM monitors RAM areas and communication connections between microcontroller and output drivers and sets DTC P0605 if failure is detected.

DTC DETECTING CONDITION E7DA7694

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check RAM Area / Communication connections	• Contact resistance in connectors • Faulty ECM
Enable Conditions	• Ignition ON	
Threshold Value	• Internal check	
Diagnostic Time	• 0.1 sec.	

MONITOR DTC STATUS E5C2B3CB

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



LGIF001X

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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

BACK VOLTAGE INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Turn ignition "ON" and measure voltage between terminal 7 of the ECM harness connector and chassis ground

Specification : Remain stable at battery voltage

4. Are circuits remaining stable at battery voltage?

YES

▶ Test with a new ECM and check for proper operation. If problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ If voltage fluctuates, check circuit Thoroughly for loose, bent or corroded terminals, Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBF5539F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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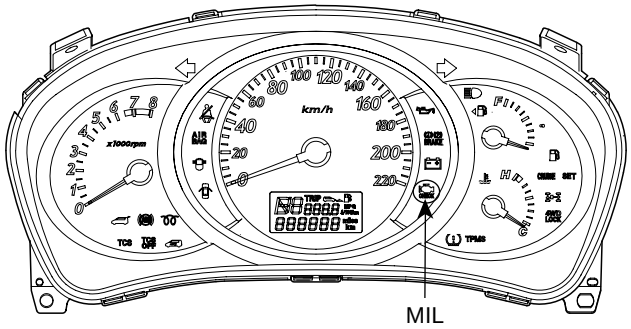
DTC P0650 MALFUNCTION INDICATOR LAMP(MIL) CONTROL CIRCUIT

COMPONENT LOCATION EABC421D



LWIF0650

GENERAL DESCRIPTION EC8F1AE3

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 indicate that the MIL operates normally and goes off after starting.

DTC DESCRIPTION EE957549

ECM sets DTC P0650 if the ECM detects that the MIL control line is open or short circuit to ground or battery line.

DTC DETECTING CONDITION E1FFA085

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open or short between MIL and ECM • Contact resistance in connectors • Burned out MIL bulb
Enable Conditions	• Battery voltage ＞10V	
Threshold Value	• Open, short to ground or battery	
Diagnostic Time	• 20 sec.	

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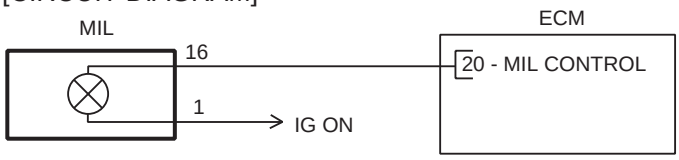
SCHEMATIC DIAGRAM E42AFF87

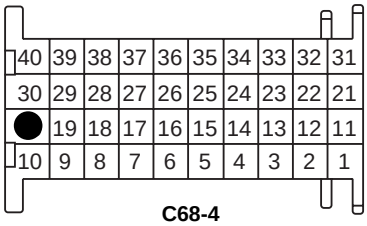
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
16	ECM Terminal 20	MIL Control
1	Ignition Switch	Battery Voltage

[HARNESS CONNECTORS]

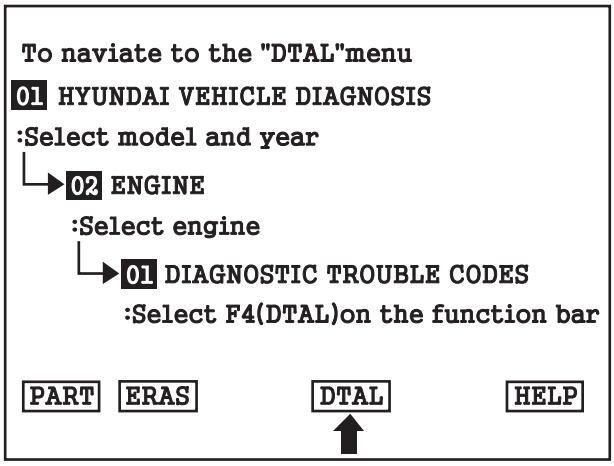


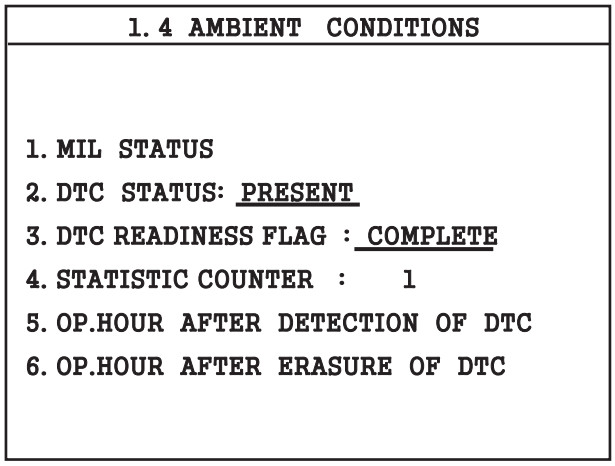
C68-4
ECM side terminal

LWIF007Q

MONITOR DTC STATUS EF856063

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





LGIF001X

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5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

CONTROL CIRCUIT INSPECTION E13DD976

1. Ignition "OFF".
2. Disconnect ECM connector
3. Ignition "ON" & Engine "OFF"
4. Using a suitable wire, jumper the terminal 20 of ECM harness connector to chassis ground.
5. Is MIL bulb illuminated?

YES

▶ Go to next step.

NO

▶ Remove instrument cluster and inspect MIL bulb. If it is burned out, replace bulb. If bulb is okay, locate source of open between bulb and (20/C30-4) or between bulb and Meter Fuse. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

6. Remove wire from ECM harness connector.
7. Does MIL bulb go out?

YES

▶ Thoroughly check for loose, bent, or corroded terminals in MIL circuit (including circuit board). Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check for source of short to GND between bulb and ECM(20/C30-4). Repair as necessary. and go to "Verification of Vehicle Repair" procedure.

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VERIFICATION OF VEHICLE REPAIR E9C47810

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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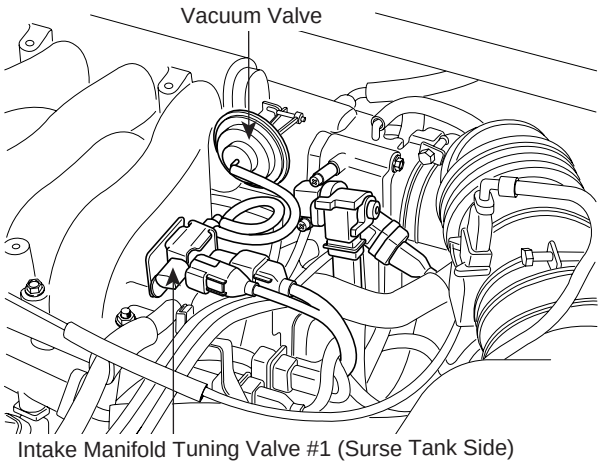
DTC P0661 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT LOW(BANK1)-> SOLENOID TYPE

COMPONENT LOCATION E5772C48



LWIF501Z

GENERAL DESCRIPTION EADF75D9

Intake manifold tuning valve is used to increase torque at lower rpm and increase horsepower at higher rpm. This engine has two intake runners for each cylinder. The primary intake runner is a long, thin tube in which the intake air passes through. This allows a strong stream of air to blast into the cylinder, helping low-end torque. The secondary intake runner is a short, fat tube. This allows a large volume of air to be sucked into the engine, increasing high-end horsepower. At lower rpm range, the engine does not provide enough suction into the cylinders, starving the engine of much needed oxygen. The skinny tube helps blast the air into the cylinder for more oxygen. At higher rpm, the engine has plenty of suction but the intake runner is too small to provide the oxygen it needs. The short, fat tube allows plenty of oxygen to be sucked in. The ECM controls this function utilizing a intake manifold tuning valve. Based on engine RPM, the position of the shutter within the intake manifold is changed, thereby directing intake air through a longer path for low rpm range or a shorter path for high rpm range.

DTC DESCRIPTION E2B12F8E

ECM sets DTC P0661 if the ECM detects that intake manifold tuning valve control circuit is shorted to ground.

DTC DETECTING CONDITION E59FBDBB

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	

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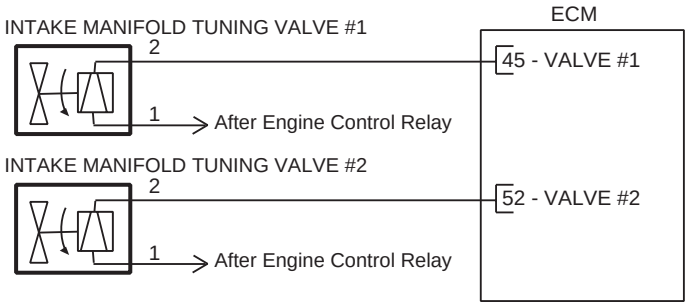
SPECIFICATION E5CB1AD8

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	29~35

SCHEMATIC DIAGRAM EE3691FF

[CIRCUIT DIAGRAM]

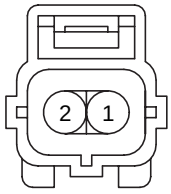


[CONNECTION INFORMATION]

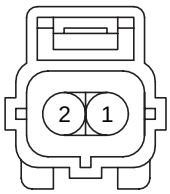
Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal 45	Valve Operation

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal 52	Valve Operation

[HARNESS CONNECTORS]

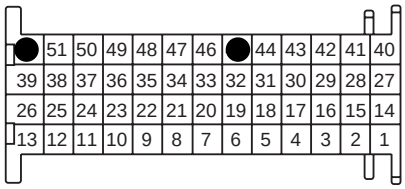


C93



C92

Harness side connector



C68-3

ECM side terminal

LWIF007R

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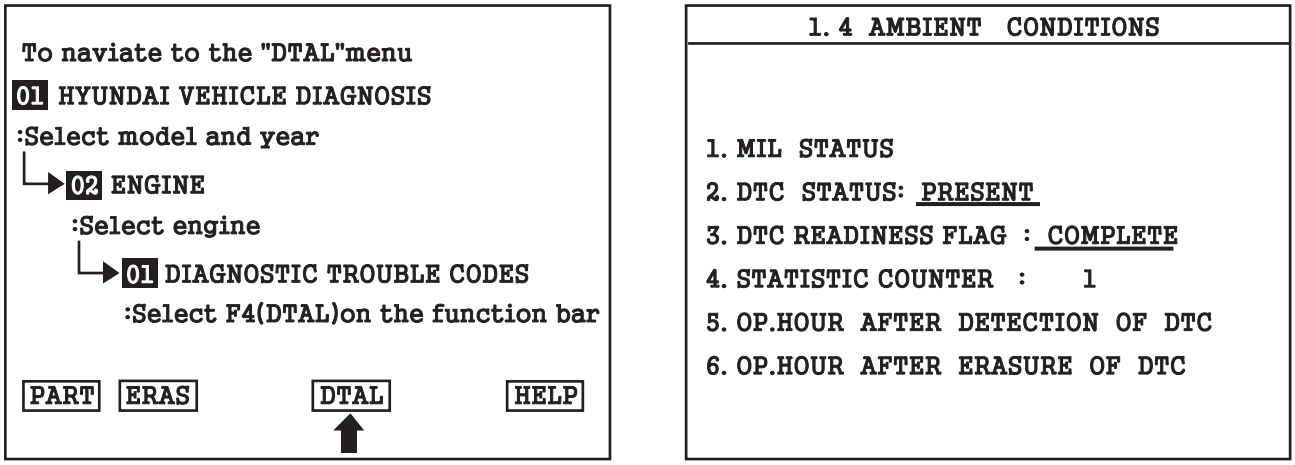
MONITOR DTC STATUS E119692C

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step as below.

COMPONENT INSPECTION EA58C74A

1. Ignition "OFF".
2. Disconnect valve connector.
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

Specification : Approx. 29~35Ω at 20℃(68°F)

4. Is resistance within the specification?

YES

▶ Go to next step as below.

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NO

▶ Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve and then go to "Verification of Vehicle Repair" procedure

TERMINAL AND CONNECTOR INSPECTION E7867DC4

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E42236D6

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection"

NO

▶ Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION E621C536

1. Check for short to ground in control circuit.
   1) Ignition "OFF".
   2) Measure resistance between terminal 2 of the valve harness connector and chassis ground

Specification : Infinite

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2. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure

NO

▶ Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2A71137

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0662 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT HIGH(BANK1)-> SOLENOID TYPE

COMPONENT LOCATION E50E78E9

Refer to DTC P0661.

GENERAL DESCRIPTION E1079A3A

Refer to DTC P0661.

DTC DESCRIPTION EA307CD3

ECM sets DTC P0662 if the ECM detects that intake manifold tuning valve control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION EA1289FD

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec.	

SPECIFICATION ECB36D6E

Refer to DTC P0661.

SCHEMATIC DIAGRAM E5DDCAB7

Refer to DTC P0661.

MONITOR DTC STATUS E8B07AD7

Refer to DTC P0661.

COMPONENT INSPECTION E743620C

1. Ignition "OFF".
2. Disconnect valve connector.
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

Specification : Approx. 29~35Ω at 20℃(68℉)

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4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve and then go to "Verification of Vehicle Repair" procedure

TERMINAL AND CONNECTOR INSPECTION EBABC6C9

Refer to DTC P0661.

POWER SUPPLY CIRCUIT INSPECTION E9D8384F

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection"

NO

▶ Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION EB0CC3D1

1. Check for short to ground in control circuit.
   1) Ignition "OFF".
   2) Disconnect ECM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 2 of the valve harness connector and chassis ground.

Specification : Approx. 0V

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5) Is voltage within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for Open in Control Circuit.

1) Ignition "OFF".

2) Measure resistance between terminals 2 of the valve harness connector and 45 of the ECM harness connector.

Specification : Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E257CCCB

Refer to DTC P0661.

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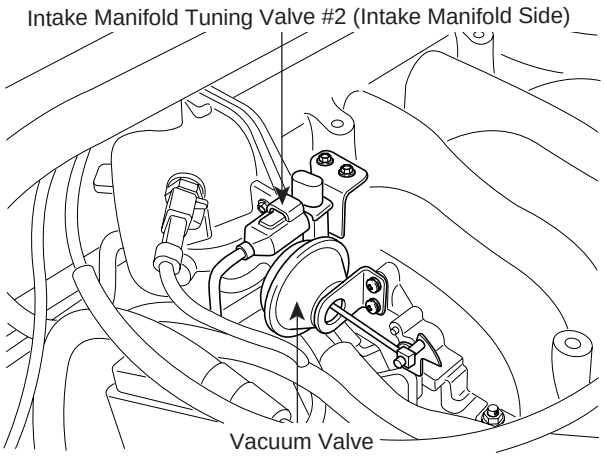
DTC P0664 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT LOW(BANK2)-> SOLENOID TYPE

COMPONENT LOCATION E01706E3



LWIF502A

GENERAL DESCRIPTION EB8EB893

Intake manifold tuning valve is used to increase torque at lower rpm and increase horsepower at higher rpm. This engine has two intake runners for each cylinder. The primary intake runner is a long, thin tube in which the intake air passes through. This allows a strong stream of air to blast into the cylinder, helping low-end torque. The secondary intake runner is a short, fat tube. This allows a large volume of air to be sucked into the engine, increasing high-end horsepower. At lower rpm range, the engine does not provide enough suction into the cylinders, starving the engine of much needed oxygen. The skinny tube helps blast the air into the cylinder for more oxygen. At higher rpm, the engine has plenty of suction but the intake runner is too small to provide the oxygen it needs. The short, fat tube allows plenty of oxygen to be sucked in. The ECM controls this function utilizing a intake manifold tuning valve. Based on engine RPM, the position of the shutter within the intake manifold is changed, thereby directing intake air through a longer path for low rpm range or a shorter path for high rpm range.

DTC DESCRIPTION EA4EBE4F

ECM sets DTC P0664 if the ECM detects that intake manifold tuning valve control circuit is shorted to ground.

DTC DETECTING CONDITION E6CEE4EB

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	

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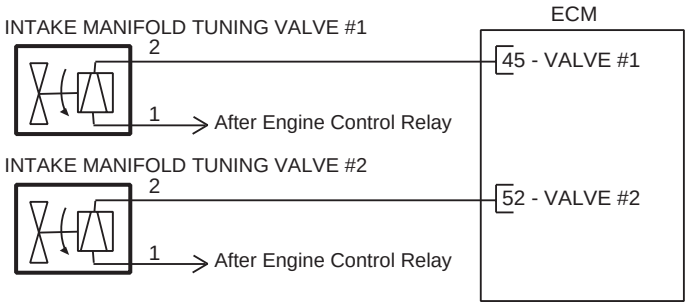
SPECIFICATION E5CFA981

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	29~35

SCHEMATIC DIAGRAM EEA91848

[CIRCUIT DIAGRAM]

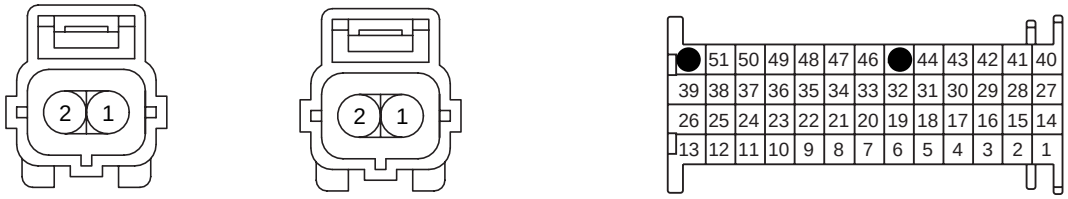


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal 45	Valve Operation

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal 52	Valve Operation

[HARNESS CONNECTORS]



C93 **C92**
Harness side connector

C68-3
ECM side terminal

LWIF007R

MONITOR DTC STATUS E7F787E6

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.

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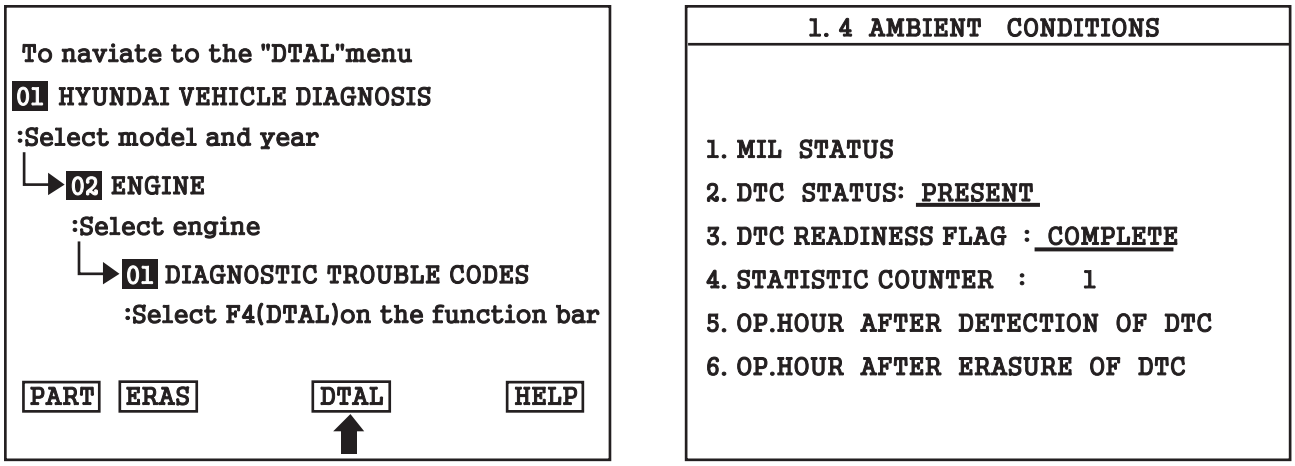

LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EE816187

1. Ignition "OFF".
2. Disconnect valve connector.
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

Specification : Approx. 29~35Ω at 20℃(68°F)

4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve and then go to "Verification of Vehicle Repair" procedure

TERMINAL AND CONNECTOR INSPECTION E2698420

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

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2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E189DAEA

1. Ignition "ON" & Engine "OFF".

2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection"

NO

▶ Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION EB895A29

1. Check for short to ground in control circuit.

   1) Ignition "OFF".

   2) Measure resistance between terminal 2 of the valve harness connector and chassis ground

Specification : Infinite

2. Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure

NO

▶ Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3AD655E

After a repair, it is essential to verify that the fault has been corrected.

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1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P0665 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT HIGH(BANK2)-> SOLENOID TYPE

COMPONENT LOCATION EB7997FE

Refer to DTC P0664.

GENERAL DESCRIPTION E5D4855B

Refer to DTC P0664.

DTC DESCRIPTION E956D47B

ECM sets DTC P0665 if the ECM detects that intake manifold tuning valve control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION ED9C2761

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec.	

SPECIFICATION E0486978

Refer to DTC P0664.

SCHEMATIC DIAGRAM EBC64358

Refer to DTC P0664.

MONITOR DTC STATUS E7B18ADE

Refer to DTC P0664.

COMPONENT INSPECTION E9180417

1. Ignition "OFF".
2. Disconnect valve connector.
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

Specification : Approx. 29~35Ω at 20℃(68°F)

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4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve and then go to "Verification of Vehicle Repair" procedure

TERMINAL AND CONNECTOR INSPECTION ECD7201B

Refer to DTC P0664.

POWER SUPPLY CIRCUIT INSPECTION E696540D

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection"

NO

▶ Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION E1CD0E4C

1. Check for short to ground in control circuit.
   1) Ignition "OFF".
   2) Disconnect ECM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 2 of the valve harness connector and chassis ground.

Specification : Approx. 0V

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5) Is voltage within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for Open in Control Circuit.

1) Ignition "OFF".

2) Measure resistance between terminals 2 of the valve harness connector and 52 of the ECM harness connector.

Specification : Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6C90CB2

Refer to DTC P0664.

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DTC P0700 TCU REQUEST FOR MIL ON

GENERAL DESCRIPTION ED3C2AAC

The TCM can request activation of the MIL lamp Via a communication line to the ECM. This is only a request from TCM to ECM to turn the MIL on. The fault code is stored in the TCM. Select Transaxle system on the Scantool and monitor DTC related automatic transaxle system.
DO ALL REPAIRS associated malfunction with A/T.

DTC DETECTING CONDITION E1C0F937

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Freeze frame request via CAN	• Transaxle system
Enable Conditions	• Battery voltage(V) ＞10V • Engine speed(rpm) ＞256 rpm	
Threshold Value	• MIL is requested by TCM	
Diagnostic Time	• Immediate	

MONITOR DTC STATUS EB3A7D35

1. This is only a request from TCM to ECM to turn the MIL on. The fault code is stored in the TCM. The Freeze Frame Data is stored in the ECM under the P0700 request code. Be sure to retrieve freeze frame data before clearing code P0700 from ECM.

2. Check the transaxle system.

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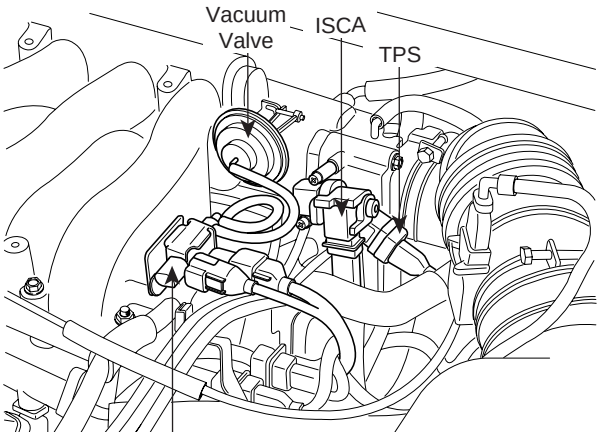
DTC P1505 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #1

COMPONENT LOCATION E89AC780



Intake Manifold Tuning Valve #1 (Surse Tank Side)

LWIF501Y

GENERAL DESCRIPTION EFA407BF

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 vlave is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditons, and also to provide additional air during starting. The ISCA vlave consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensor, 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 DESCRIPTION E19069F6

ECM sets DTC P1505 if the ECM detects that the ISCA(OPEN) control circuit is open or short to ground.

DTC DETECTING CONDITION E80F8A2B

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open or short to ground in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage ＞10V	
Threshold Value	• Open or short to ground	
Diagnostic Time	• 1 sec.	

SPECIFICATION EBD35396

SPECIFICATION	
Opening Coil	Closing Coil
15~16.2Ω	17~18.2 Ω

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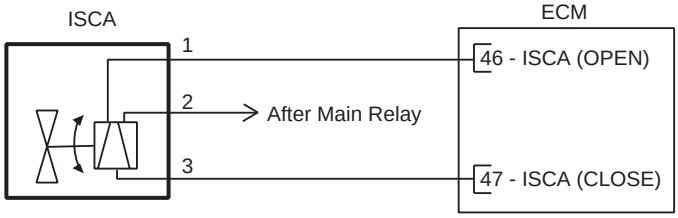
SCHEMATIC DIAGRAM E839EE1A

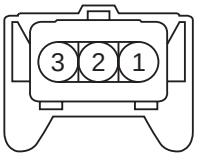
[CIRCUIT DIAGRAM]



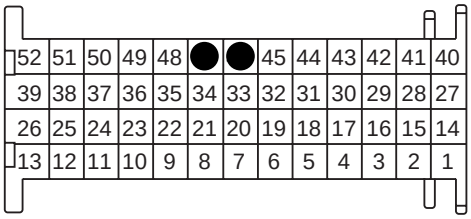
[CONNECTION INFORMATION]

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

[HARNESS CONNECTORS]



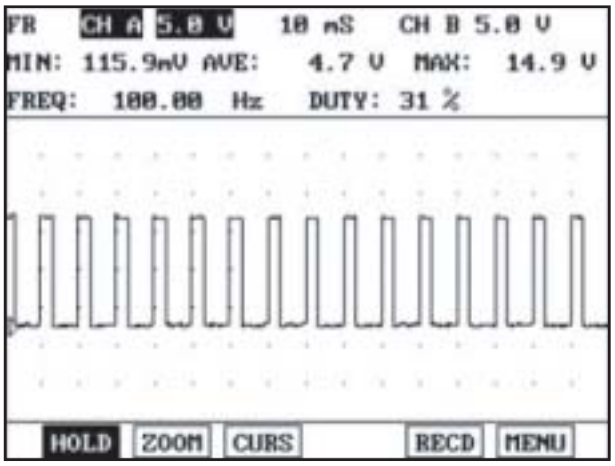
C72
ISCA Harness side connector

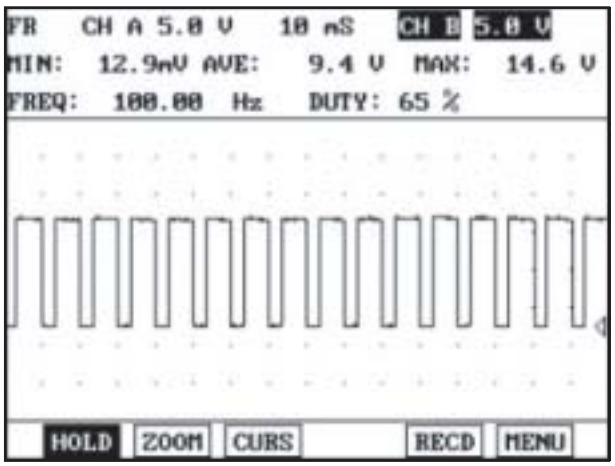


C68-2
ECM side terminal

LWIF008C

SIGNAL WAVEFORM E2E4FCED





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

LWIF101X

MONITOR DTC STATUS E9172B13

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.

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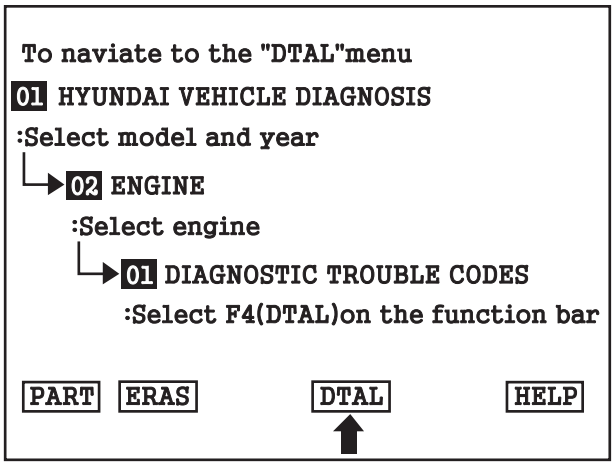

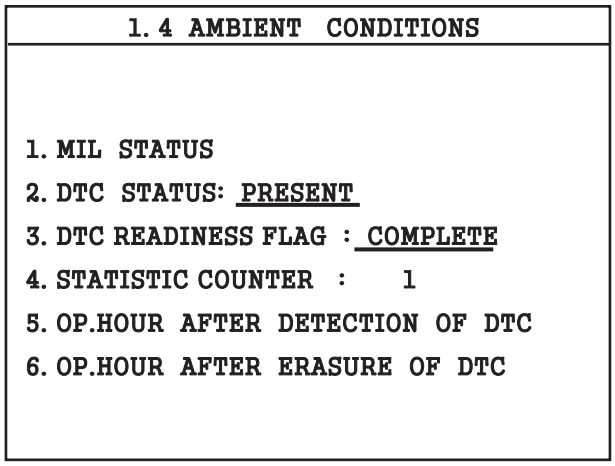

LGIF001X

5. Is parameter displayed "History(Not Present) fault"?
   - History (Not Present) fault : DTC occurred but has been cleared.
   - Present fault : DTC is occurring at present time.

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E7E494C7

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Measure resistance between terminals 1 and 2 of the actuator connector(Component side).

Specification : 15~16.2Ω

4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION ED66F8C0

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

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2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E7587A9D

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the ISCA harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E690B25C

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the ISCA harness connector and chassis ground.

Specification : Approx. 3~4V

3. Is voltage within the specification?

YES

▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to next step as below.

4. Check for open in signal harness

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1) Ignition "OFF".

2) Measure resistance between terminals 1 of the ISCA harness connector and 46 of the ECM harness connector.

Specification : Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

5. Check for short to ground in signal harness.

1) Ignition "OFF".

2) Measure resistance between terminal 1 of the ISCA harness connector and chassis ground.

Specification : Infinite

3) Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E755E060

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

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DTC P1506 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #1

COMPONENT LOCATION EBE45F3E

Refer to DTC P1505.

GENERAL DESCRIPTION ECC3989A

Refer to DTC P1505.

DTC DESCRIPTION E1404107

ECM sets DTC P1506 if the ECM detects that the ISCA(OPEN) control circuit is short to battery.

DTC DETECTING CONDITION EB97B2C6

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short to battery in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage ＞10V	
Threshold Value	• Short to battery	
Diagnostic Time	• 1 sec.	

SPECIFICATION E7B81B2A

Refer to DTC P1505.

SCHEMATIC DIAGRAM E747A127

Refer to DTC P1505.

SIGNAL WAVEFORM E934BE72

Refer to DTC P1505.

MONITOR DTC STATUS E679DCB7

Refer to DTC P1505.

COMPONENT INSPECTION E3B64C5A

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Measure resistance between terminals 1 and 2 of the actuator connector(Component side).

Specification : 15~16.2Ω

4. Is resistance within the specification?

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YES

▶ Go to next step as below.

NO

▶ Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E798C1F1

Refer to DTC P1505.

POWER SUPPLY CIRCUIT INSPECTION EC47E70E

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the ISCA harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E6466026

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the ISCA harness connector and chassis ground.

Specification : Approx. 3~4V

3. Is voltage within the specification?

YES

▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to next step as below.

4. Check for short to power in signal harness

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1) Ignition "OFF".
2) Disconnect ECM connector
3) Ignition "ON"
4) Measure voltage between terminal 1 of the ISCA harness connector and chassis ground

Specification : Approx. 0V

5) Is voltage within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair short in harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAA73F8F

Refer to DTC P1505.

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DTC P1507 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #2

COMPONENT LOCATION E6E42845

Refer to DTC P1505.

GENERAL DESCRIPTION E0FFFA7A

Refer to DTC P1505.

DTC DESCRIPTION EFF1A36B

ECM sets DTC P1507 if the ECM detects that the ISCA(OPEN) control circuit is open or short to ground.

DTC DETECTING CONDITION EDD927F5

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open or short to ground in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage ＞10V	
Threshold Value	• Open or short to ground	
Diagnostic Time	• 1 sec.	

SPECIFICATION EE5C243D

Refer to DTC P1505.

SCHEMATIC DIAGRAM E4EFF66C

Refer to DTC P1505.

SIGNAL WAVEFORM EFE16E09

Refer to DTC P1505.

MONITOR DTC STATUS E37853E3

Refer to DTC P1505.

COMPONENT INSPECTION EFEDDB02

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Measure resistance between terminals 2 and 3 of the actuator connector(Component side).

Specification : 17~18.2Ω

4. Is resistance within the specification?

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YES

▶ Go to next step as below.

NO

▶ Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E3FFE4F1

Refer to DTC P1505.

POWER SUPPLY CIRCUIT INSPECTION E6BA15F8

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the ISCA harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E31B2DDD

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 3 of the ISCA harness connector and chassis ground.

Specification : Approx. 0.5~0.6V

3. Is voltage within the specification?

YES

▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to next step as below.

4. Check for open in signal harness

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1) Ignition "OFF".

2) Measure resistance between terminals 3 of the ISCA harness connector and 47 of the ECM harness connector.

Specification : Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

5. Check for short to ground in signal harness.

1) Ignition "OFF".

2) Measure resistance between terminal 3 of the ISCA harness connector and chassis ground.

Specification : Infinite

3) Is resistance within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E942842D

Refer to DTC P1505.

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DTC P1508 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #2

COMPONENT LOCATION E0377C8F

Refer to DTC P1505.

GENERAL DESCRIPTION E34F8E8E

Refer to DTC P1505.

DTC DESCRIPTION E0153AF9

ECM sets DTC P1508 if the ECM detects that the ISCA(CLOSE) control circuit is short to battery.

DTC DETECTING CONDITION E61522FE

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short to battery in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage ＞10V	
Threshold Value	• Short to battery	
Diagnostic Time	• 1 sec.	

SPECIFICATION E0743525

Refer to DTC P1505.

SCHEMATIC DIAGRAM EDF09F71

Refer to DTC P1505.

SIGNAL WAVEFORM E20E0F8D

Refer to DTC P1505.

MONITOR DTC STATUS EA518165

Refer to DTC P1505.

COMPONENT INSPECTION EE596BF0

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Measure resistance between terminals 2 and 3 of the actuator connector(Component side).

Specification : 17~18.2Ω

4. Is resistance within the specification?

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YES

▶ Go to next step as below.

NO

▶ Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E8655626

Refer to DTC P1505.

POWER SUPPLY CIRCUIT INSPECTION EC509F16

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the ISCA harness connector and chassis ground.

Specification : Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E52330C1

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 3 of the ISCA harness connector and chassis ground.

Specification : Approx. 0.5~0.6V

3. Is voltage within the specification?

YES

▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to next step as below.

4. Check for short to power in signal harness

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1) Ignition "OFF".
2) Disconnect ECM connector
3) Ignition "ON"
4) Measure voltage between terminal 3 of the ISCA harness connector and chassis ground

Specification : Approx. 0V

5) Is voltage within the specification?

YES

▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Repair short in harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EB27589F

Refer to DTC P1505.

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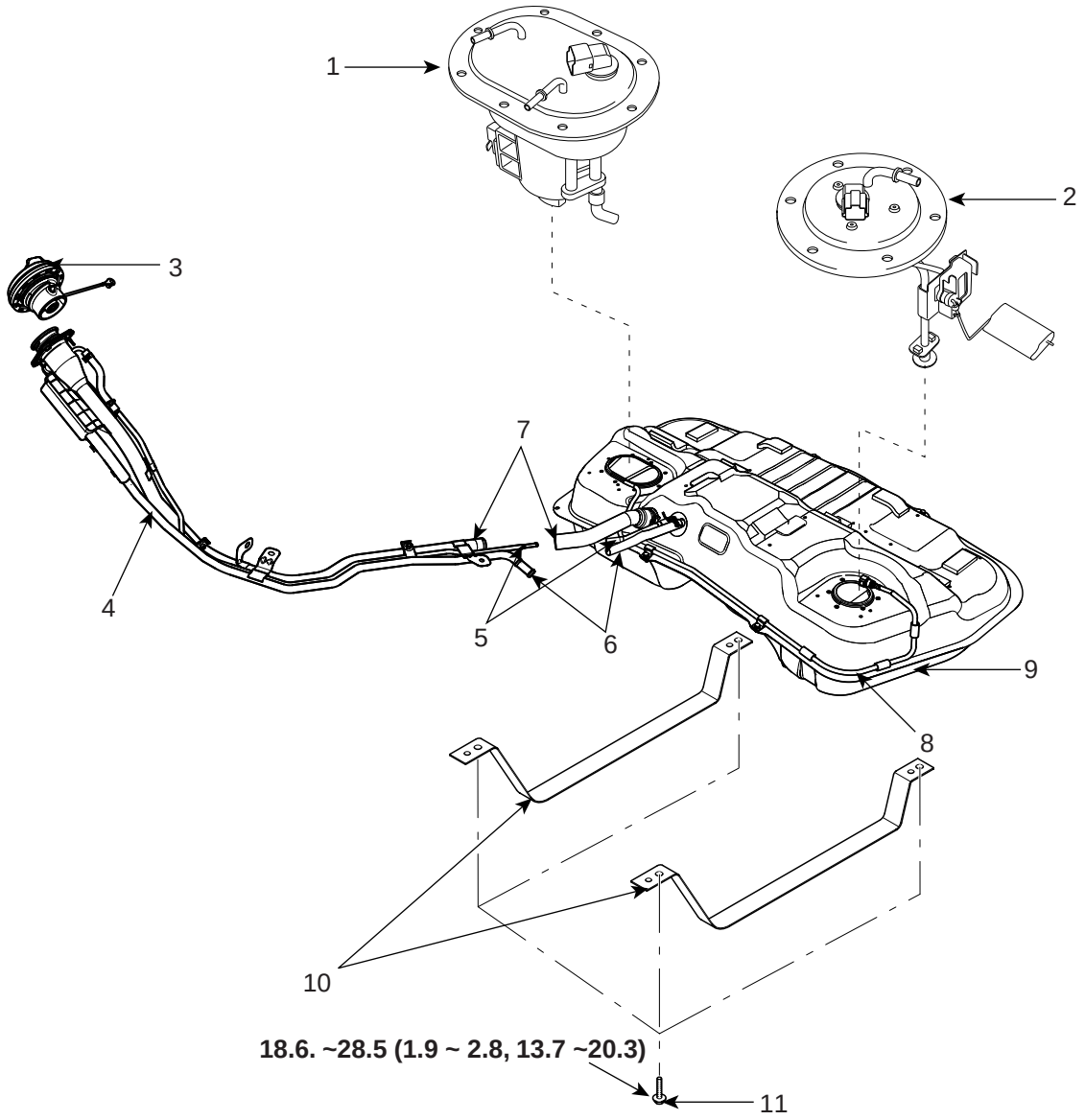
FUEL DELIVERY SYSTEM

COMPONENTS LOCATION EFC9CD35



Tightening Torques: **N·m (kgh·m, lbf·ft)**

1. Fuel Pump Assembly (Including Fuel Filter and Fuel Pressure Regulator)
2. Fuel Sender (Sub)
3. Fuel Filler Cap
4. Fuel Filler Neck assembly
5. Leveling Hose
6. Ventilation Hose
7. Fuel Filler Hose
8. Suction Hose
9. Fuel Tank
10. Fuel Tank Band
11. Mounting Bolts - Fuel Tank Band

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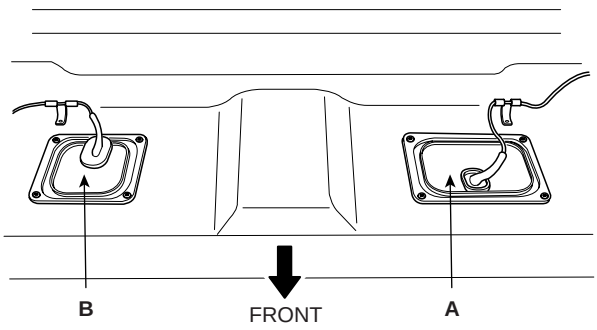
FUEL PRESSURE TEST EEE68EF0

1. PREPARING

1. Remove the rear seat (Refer to ""BD"" group in this WORKSHOP MANUAL).
2. Open the service cover (A) under the rear seat.

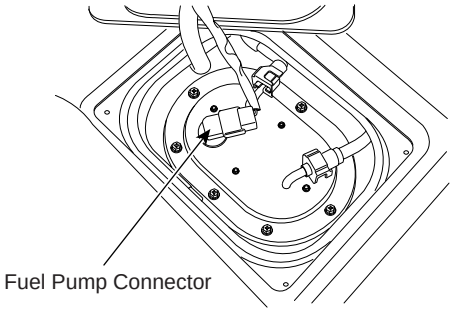


2. RELEASE THE INTERNAL PRESSURE

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.



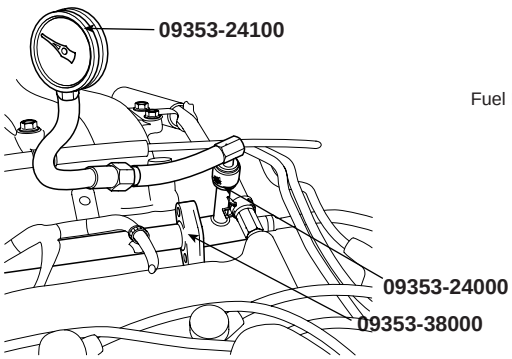
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

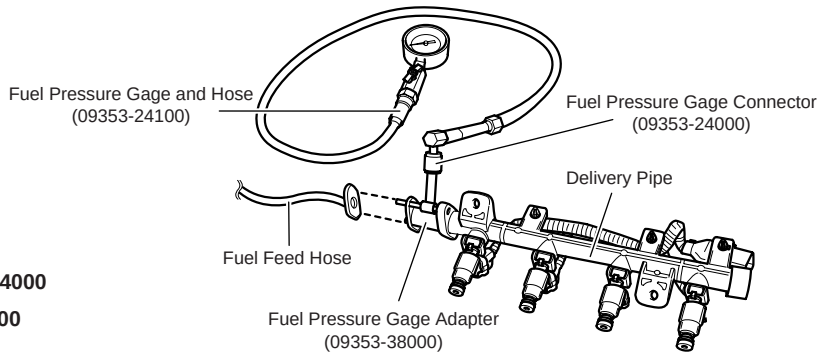
1. Disconnect the fuel feed hose from the delivery pipe.

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).





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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: 343 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

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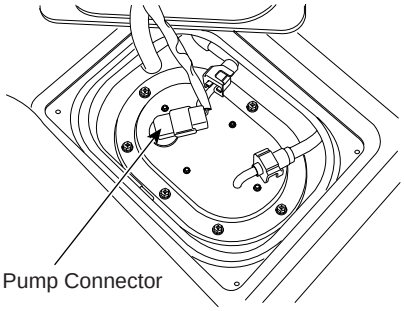
6. RELEASE THE INTERNAL PRESSURE

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.



Fuel Pump Connector

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.

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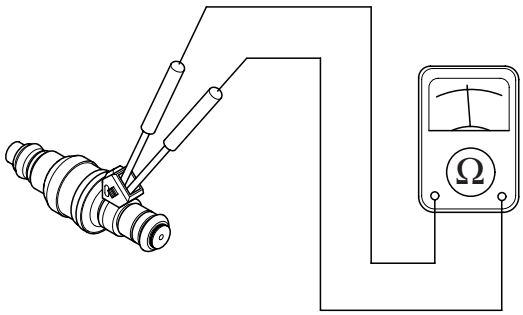
FUEL INJECTOR

INSPECTION E6ABC95B

1. Measure resistance between the terminal 1 and 2 of the injector.

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



LGIF602P

2. If the resistance is not within specification, replace the injector.

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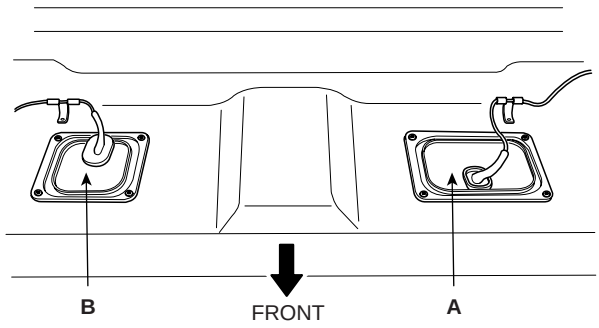
FUEL PUMP (FP)

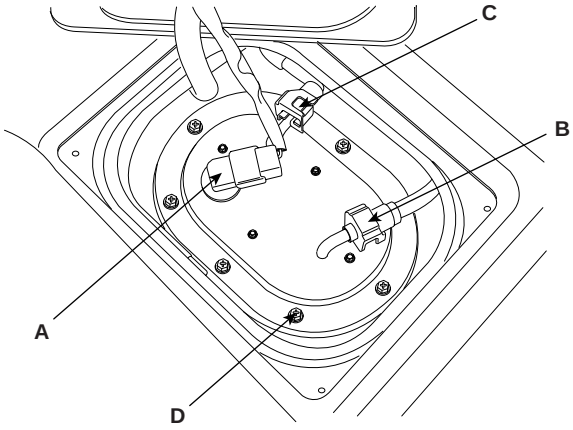
REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) E9A3C9D2

1. Turn ignition switch to " OFF" and disconnect the battery negative (-) terminal.
2. Remove the rear seat (Refer to group " BD" in this Workshop Manual).
3. Remove the service cover (A) under the carpet.



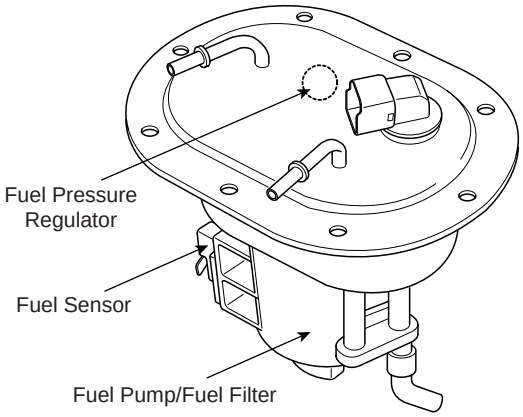
LGIF011L

4. Disconnect the fuel pump wiring connector (A).



LWIF107R

5. Remove the fuel feed hose (B) and suction hose (C).
6. Remove the fuel pump plate mounting bolts (D).
7. Remove the fuel pump assembly.



LGIF007S

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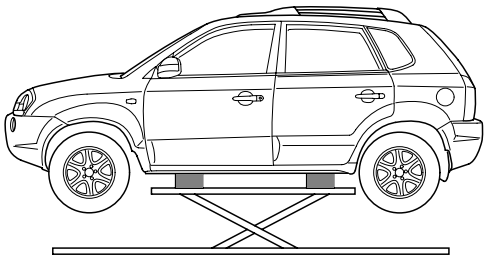
FUEL TANK

REMOVAL EBBC5491

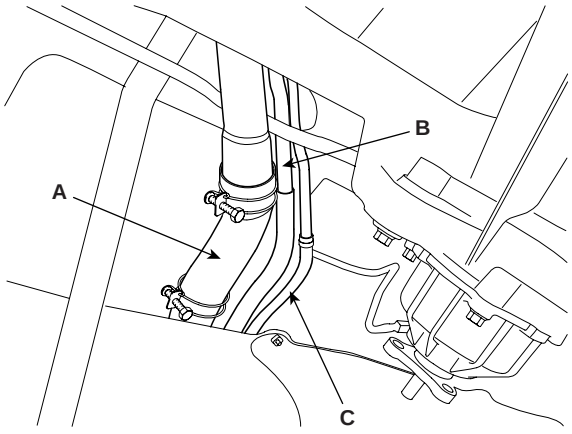
CAUTION

When lifting up or down vehicle, be sure to place blocks between vehicle and lifter to prevent fuel tank from being damaged.



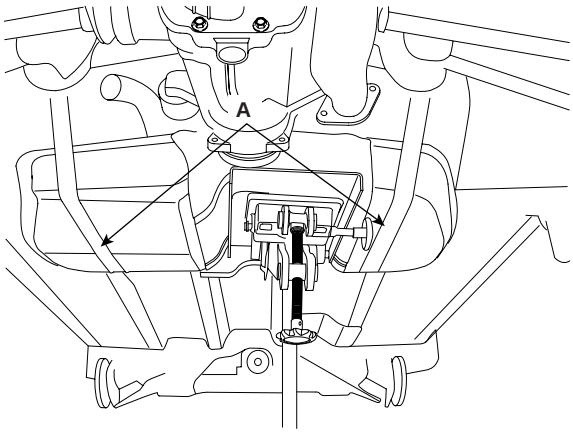
LGIF104V

1. Remove the front and main muffler assembly (Refer to group " EM" in this Workshop Manual).
2. Remove the propeller-shaft (For 4WD only).
3. Disconnect the fuel filler hose (A), fuel leveling hose (B) and ventilation hose (C).



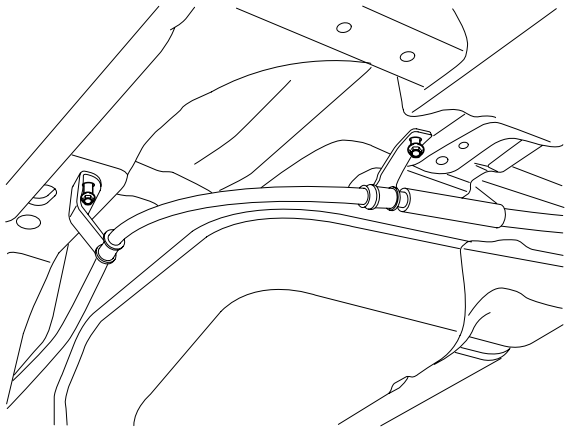
LGIF104G

4. Lift the vehicle and support the fuel tank with a jack, and then remove the two fuel tank band.



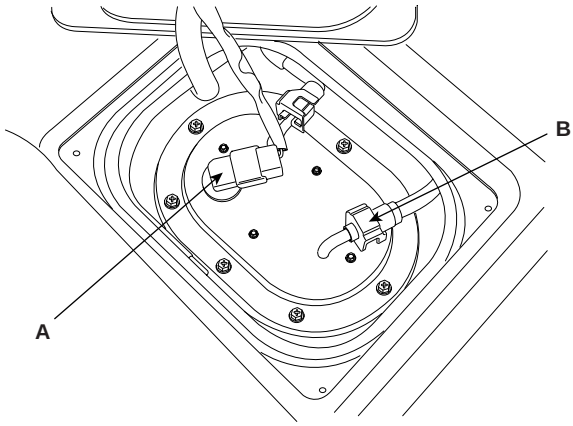
LGIF104H

5. Remove the four parking brake mounting bolts(A).



LGIF004I

6. Down the fuel tank until work space is made, and then disconnect the fuel pump connector (A) and fuel feed hose(B).



LWIF107T

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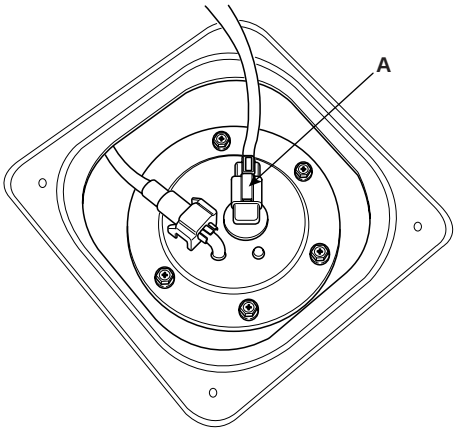
7. Disconnect the sub fuel sender connector (A).



AFIE011K

8. Remove the fuel tank.

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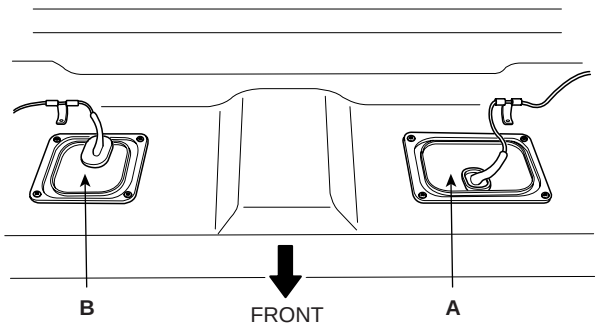
SUB FUEL SENDER

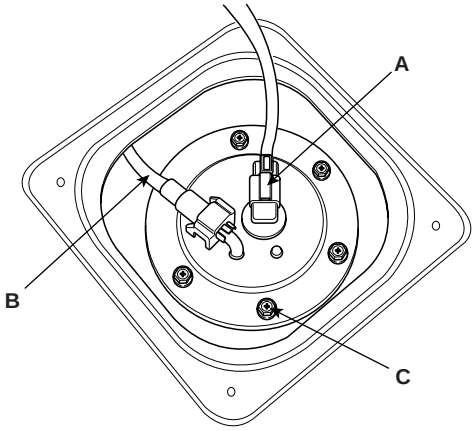
REMOVAL EDB390B7

1. Turn ignition switch to " OFF" and disconnect the battery negative (-) terminal.
2. Remove the rear seat (Refer to group " BD" in this Workshop Manual).
3. Remove the service cover (B) under the carpet.



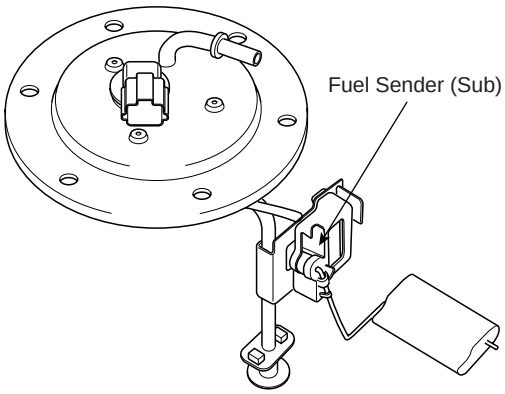
LGIF011L

4. Disconnect the fuel sender (Sub) wiring connector (A).



AFIE011O

5. Disconnect the suction hose (B).
6. Remove the fuel sender (Sub) plate mounting bolt (C).
7. Remove the fuel sender (Sub) assembly.



LGIF011P

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