Fuel System

GENERAL

GASOLINE ENGINE CONTROL SYSTEM
- ENGINE CONTROL MODULE (ECM)

DTC TROUBLESHOOTING PROCEDURES

FUEL DELIVERY SYSTEM
- FUEL LINE AND VAPOR LINE
- INJECTOR
- FUEL TANK
- FUEL PUMP (FP)

GENERAL

SPECIFICATIONS EAC6D3D9

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	58 L
Fuel Retrun System	Type	Returnless
Fuel Filter	Type	High pressure type (built in Fuel Pump Assembly)
Fuel Pressure Regulator	Type	Built in fuel pump assembly
	Regulated Fuel Pressure	350 kpa (3.5 kg/cm2, 49.8 psi)
Fuel Pump	Type	Electrical, in-tank type

INPUT SENSORS

MASS AIR FLOW SENSOR (MAFS)

▶ Type: Hot film type
▶ Specification

Test Condition	MAFS Output Voltage	Mass Air Flow
Idle	0.6 ~ 1.0 V	11.66 ~ 19.85 kg/h
3000 rpm	1.7 ~2.0 V	43.84 ~58.79 kg/h

THROTTLE POSITION SENSOR (TPS)

▶ Type: Variable resistor type
▶ Specification

Test Condition	Signal Voltage	Throttle Angle
C.T	0.2 ~ 0.8 V	0 ~ 0.5°
W.O.T	4.3 ~ 4.8 V	86°

Test Condition	Resistance (Terminal 1 and 2)	Resistance (Terminal 2 and 3)
C.T	0.71 ~ 1.38 kΩ at all temperature	1.6 ~ 2.4 kΩ at all throttle position
W.O.T	2.7 kΩ at all temperature	

HEATED OXYGEN SENSOR (HO2S)

▶ Type: Zirconia Sensor

▶ Specificiation
- Output Voltage: 0 ~ 1 V

Temperature	Heater Resistance	
	Front HO2S	Rear HO2S
20 (68)°C (°F)	9.2Ω	9.2Ω
100 (212)°C (°F)	10.7Ω	10.7Ω
200 (392)°C (°F)	13.1Ω	13.1Ω
300 (572)°C (°F)	14.6Ω	14.6Ω
400 (752)°C (°F)	17.7Ω	17.7Ω
500 (932)°C (°F)	19.2Ω	19.2Ω
600 (1112)°C (°F)	20.7Ω	20.7Ω
700 (1292)°C (°F)	22.5Ω	22.5Ω

INTAKE AIR TEMPERATURE SENSOR (IATS)

▶ Type: Thermistor type (built in MAFS)
▶ Specificiation

Temperature	Sensor Resistance
-20 (-4) °C (°F)	14.26 ~ 16.02 kΩ
0 (32) °C (°F)	5.50 ~ 6.05 kΩ
20 (68) °C (°F)	2.35 ~ 2.54 kΩ
40 (104) °C (°F)	1.11 ~ 1.19 kΩ
60 (140) °C (°F)	0.57 ~ 0.60 kΩ
80 (176) °C (°F)	0.31 ~ 0.32 kΩ

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

▶ Type: Thermistor type
▶ Specificiation

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

CVVT OIL TEMPERATURE SENSOR (OTS)

▶ Type: Thermistor type
▶ Specificiation

Temperature	Sensor Resistance
-20 (-4) °C (°F)	16.52 kΩ
0 (32) °C (°F)	6.00 kΩ
20 (68) °C (°F)	2.45 kΩ
40 (104) °C (°F)	1.11 kΩ
60 (140) °C (°F)	0.54 kΩ
80 (176) °C (°F)	0.29 kΩ

KNOCK SENSOR

▶ Type: Piezoelectric type

VEHICLE (WHEEL) SPEED SENSOR

▶ Type: Inductive type

CAMSHAFT POSITION SENSOR (CMPS)

▶ Type: Hall Effect Sensor
▶ Output Voltage (V): 0~5

CRANKSHAFT POSITION SENSOR (CKPS)

▶ Type: Hall Effect Sensor
▶ Output Voltage (V): 0~5

OUTPUT ACTUATORS

IDLE SPEED CONTROL ACTUATOR (ISCA)

▶ Type: Double coil type
▶ Control Frequency: 100Hz
▶ Specificiation

ISCA (I)

Temperature	ISCA Resistance	
	Coil #1 (CLOSE)	Coil #2 (OPEN)
-20 (-4) °C (°F)	12.1 ~ 13.7Ω	9.2 ~ 10.8Ω
0 (32) °C (°F)	13.4 ~ 15.0Ω	10.2 ~ 11.8Ω
20 (68) °C (°F)	14.5 ~ 16.1Ω	11.1 ~ 12.7Ω
40 (104) °C (°F)	15.7 ~ 17.3Ω	12.0 ~ 13.6Ω
60 (140) °C (°F)	16.9 ~ 18.5Ω	12.9 ~ 14.5Ω
80 (176) °C (°F)	18.0 ~ 19.6Ω	13.8 ~ 15.4Ω

CVVT OIL CONTROL VALVE (OCV) [WITH CVVT]

▶ Specificiation

Temperature	OCV Resistance
0 (32) °C (°F)	6.2 ~ 7.4Ω
20 (68) °C (°F)	6.8 ~ 8.0Ω
40 (104) °C (°F)	7.4 ~ 8.6Ω
60 (140) °C (°F)	8.0 ~ 9.2Ω
80 (176) °C (°F)	8.6 ~ 9.8Ω

INJECTOR

▶ Type: Electromagnetic type
▶ Number: 4
▶ Specificiation

Temperature	Injector Resistance
-20 (-4) °C (°F)	12.2 ~ 12.3Ω
0 (32) °C (°F)	13.3 ~ 13.5Ω
20 (68) °C (°F)	14.4 ~ 14.6Ω
40 (104) °C (°F)	15.5 ~ 15.7Ω
60 (140) °C (°F)	16.6 ~ 16.8Ω
80 (176) °C (°F)	17.7 ~ 17.9Ω

PURGE CONTROL SOLENOID VALVE (PCSV)

▶ Type: Duty Control type
▶ Specificiation

Temperature	PCSV Resistance
-20 (-4) °C (°F)	20 ~ 24Ω
0 (32) °C (°F)	22 ~ 26Ω
20 (68) °C (°F)	24 ~ 28Ω
40 (104) °C (°F)	25 ~ 29Ω
60 (140) °C (°F)	27 ~ 31Ω
80 (176) °C (°F)	29 ~ 33Ω

IGNITION COIL

▶ Specificiation

Temperature	Ignition Coil Resistance	
	Primary Coil	Secondary Coil
-20 (-4) °C (°F)	0.5Ω	7.7kΩ
0 (32) °C (°F)	0.54Ω	8.4kΩ
20 (68) °C (°F)	0.58Ω	9.1kΩ
40 (104) °C (°F)	0.62Ω	9.8kΩ
60 (140) °C (°F)	0.66Ω	10.5kΩ
80 (176) °C (°F)	0.71Ω	11.2kΩ

SERVICE STANDARD

Basic Idle rpm (After warm up)	A/C OFF	700±100 rpm
	A/C ON	850±100 rpm
Ignition Timing(After warm up, at idle)	BTDC 8°±5°	

SEALANTS

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

TIGHTENING TORQUES

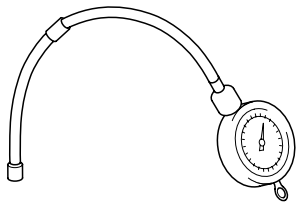
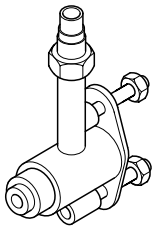
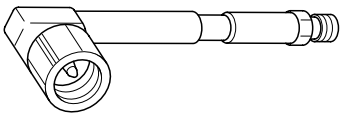
ENGINE CONTROL SYSTEM

Items	N·m	kg·m	lb·ft
ECU Bracket	4 ~ 6	0.4 ~ 0.6	2.9 ~ 4.3
Heated Oxygen Sensor (HO2S, Sensor 1)	50 ~ 60	5.0 ~ 6.0	36.2 ~ 43.4
Heated Oxygen Sensor (HO2S, Sensor 2)	50 ~ 60	5.0 ~ 6.0	36.2 ~ 43.4
Knock Sensor	17 ~ 27	1.7 ~ 2.7	12.3 ~ 19.5
Oil Temperature Sensor (OTS)	20 ~ 40	2.0 ~ 4.0	14.5 ~ 28.9
Crankshaft Position Sensor (CKPS)	4 ~ 6	0.4 ~ 0.6	2.9 ~ 4.3
Camshaft Position Sensor (CMPS)	4 ~ 6	0.4 ~ 0.6	2.9 ~ 4.3
Engine Coolant Temperature Sensor (ECTS)	15 ~ 20	1.5 ~ 2.0	10.8 ~ 14.5
Throttle Position Sensor (TPS)	1.5 ~ 2.5	0.15 ~ 0.25	1.1 ~ 1.8
Manifold Absolute Pressure Sensor (MAPS)	4 ~ 6	0.4 ~ 0.6	2.9 ~ 4.3

FUEL DELIVERY SYSTEM

Items	**N·m**	**kg·m**	**lb·ft**
Fuel tank band installation bolt	40 ~ 55	4.0 ~ 5.5	28.9 ~ 39.8
High pressure hose to delivery pipe	25 ~ 34	2.5 ~ 3.4	18.1 ~ 24.6
Delivery pipe installation	10 ~ 13	1.0 ~ 1.3	7.2 ~ 9.4

SPECIAL SERVICE TOOLS ED4EAA6C

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

BASIC TROUBLESHOOTING EF071F71

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

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 BASIC INSPECTION in INTERMITTENT PROBLEM 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

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

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

2. SYMPTOMS

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

3. ENVIRONMENT

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

4. MIL/DTC

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

BASIC INSPECTION PROCEDURE

MEASURING CONDITION OF ELECTRONIC PARTS' RESISTANCE

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

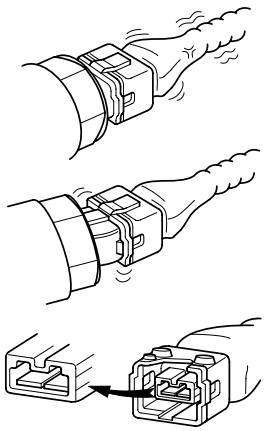
NOTE

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

INTERMITTENT PROBLEM INSPECTION PROCEDURE

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

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



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

● SIMULATING VIBRATION

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

WARNING

Strong vibration may break sensors, actuators or relays

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

● SIMULATING HEAT

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

WARNING

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

● SIMULATING WATER SPRINKLING

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

WARNING

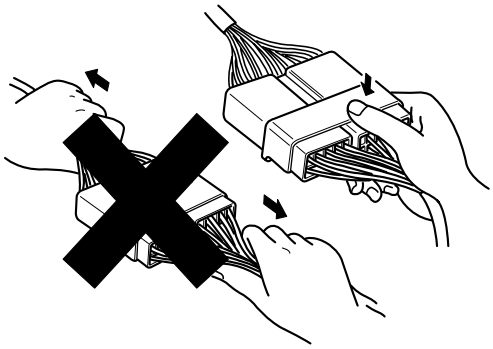
DO NOT sprinkle water directly into the engine compartment or electronic components.

● SIMULATING ELECTRICAL LOAD

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

CONNECTOR INSPECTION PROCEDURE

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



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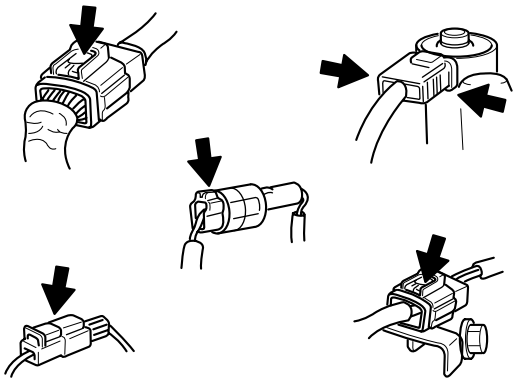
   b. When removing the connector with a lock, press or pull locking lever.



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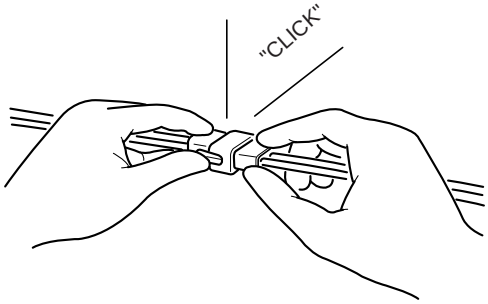
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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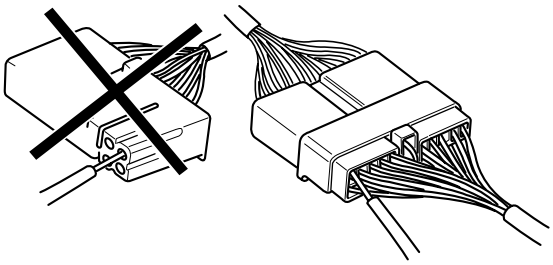
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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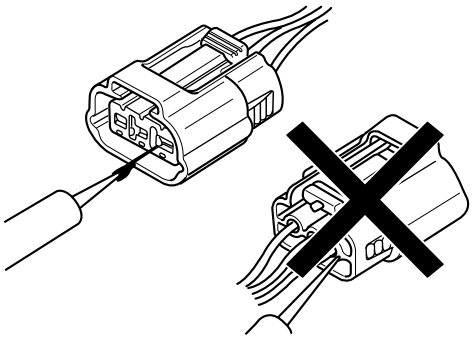
e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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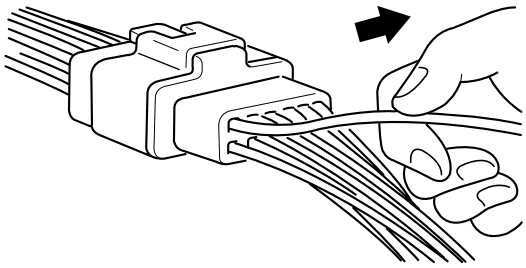
NOTE

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

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



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

NOTE

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

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

WIRE HARNESS INSPECTION PROCEDURE

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

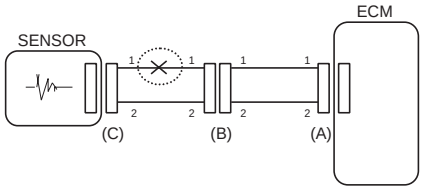
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● CHECK OPEN CIRCUIT

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

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

FIG. 1



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2. Continuity Check Method

   NOTE

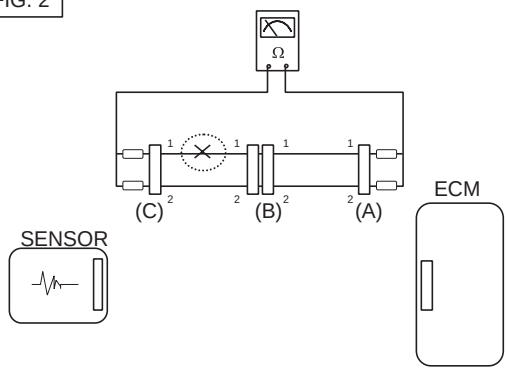
   When measuring for resistance, lightly shake the wire harness above and below or from side to side.

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

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

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

FIG. 2



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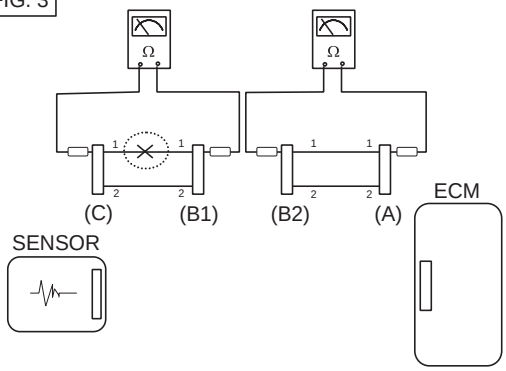
b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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

FIG. 3



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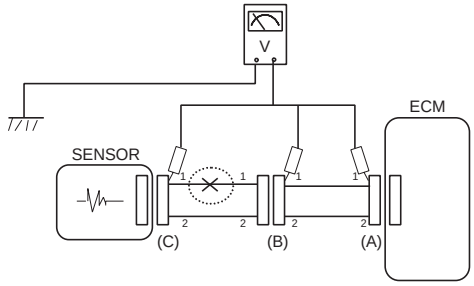
3. Voltage Check Method
   a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

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

FIG. 4



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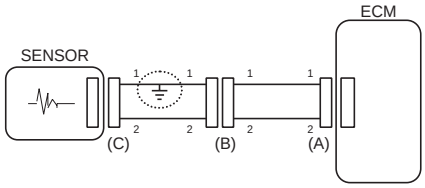
● CHECK SHORT CIRCUIT

1. 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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2. Continuity Check Method (with Chassis Ground)

NOTE

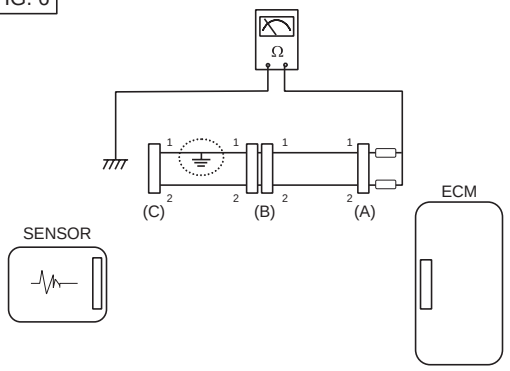
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

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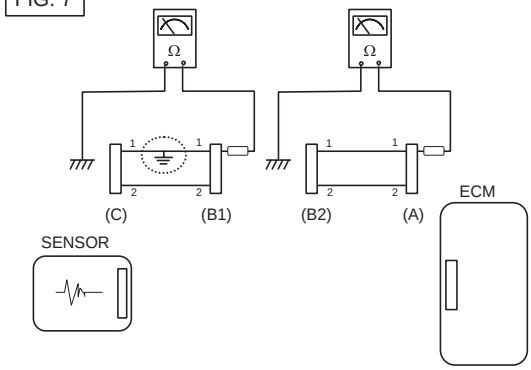
b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

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



EGQE600N

SYMPTOM TROUBLESHOOTING GUIDE CHART

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

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

GASOLINE ENGINE CONTROL SYSTEM

ENGINE CONTROL MODULE (ECM)

DESCRIPTION E5FAF6EE

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]

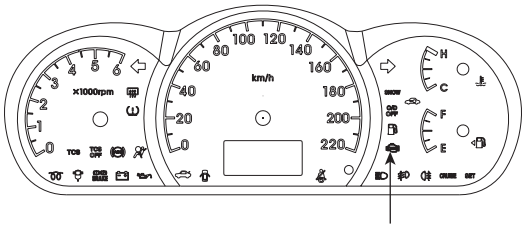
A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start),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

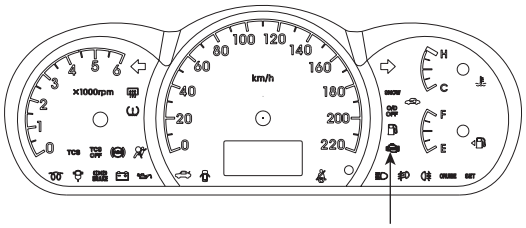
A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start),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



EGQE601P

[INSPECTION]

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

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

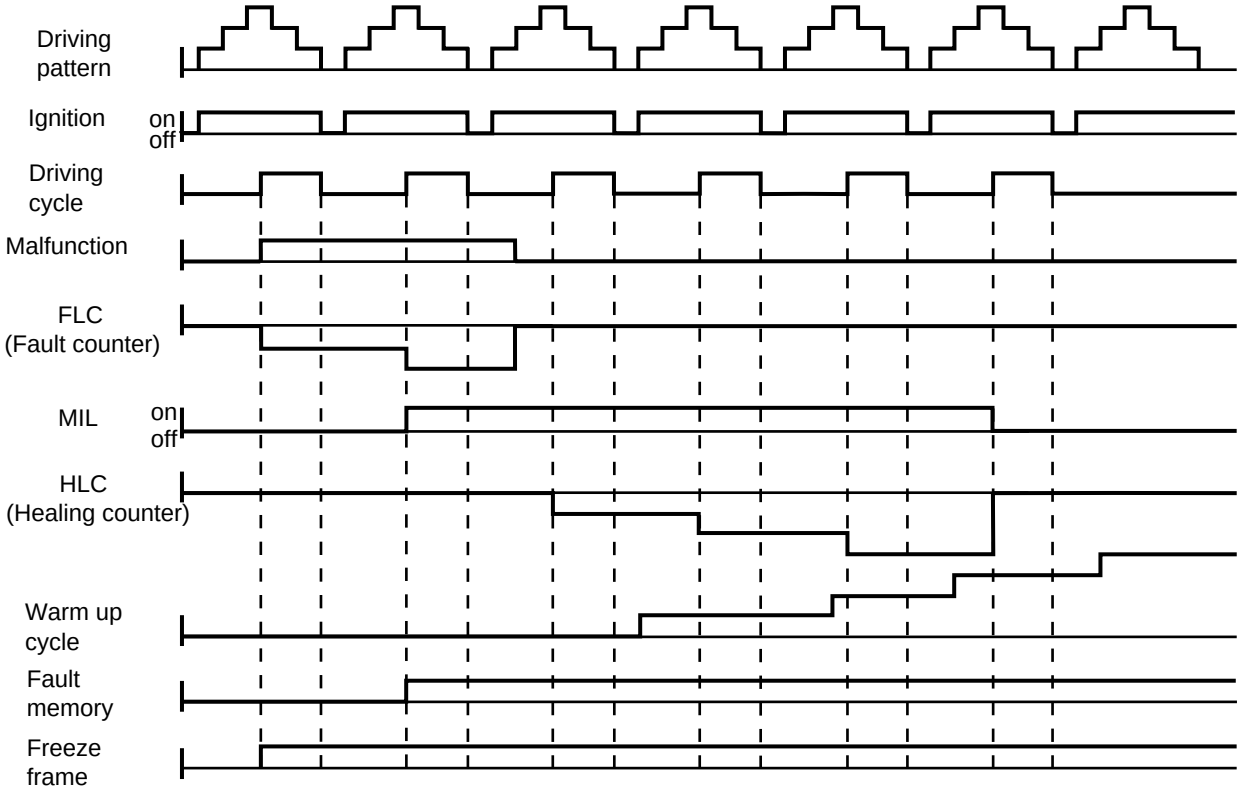
SELF-DIAGNOSIS

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

NOTE

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

THE RELATION BETWEEN DTC AND DRIVING PATTERN IN EOBD SYSTEM



EGQE601Q

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

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

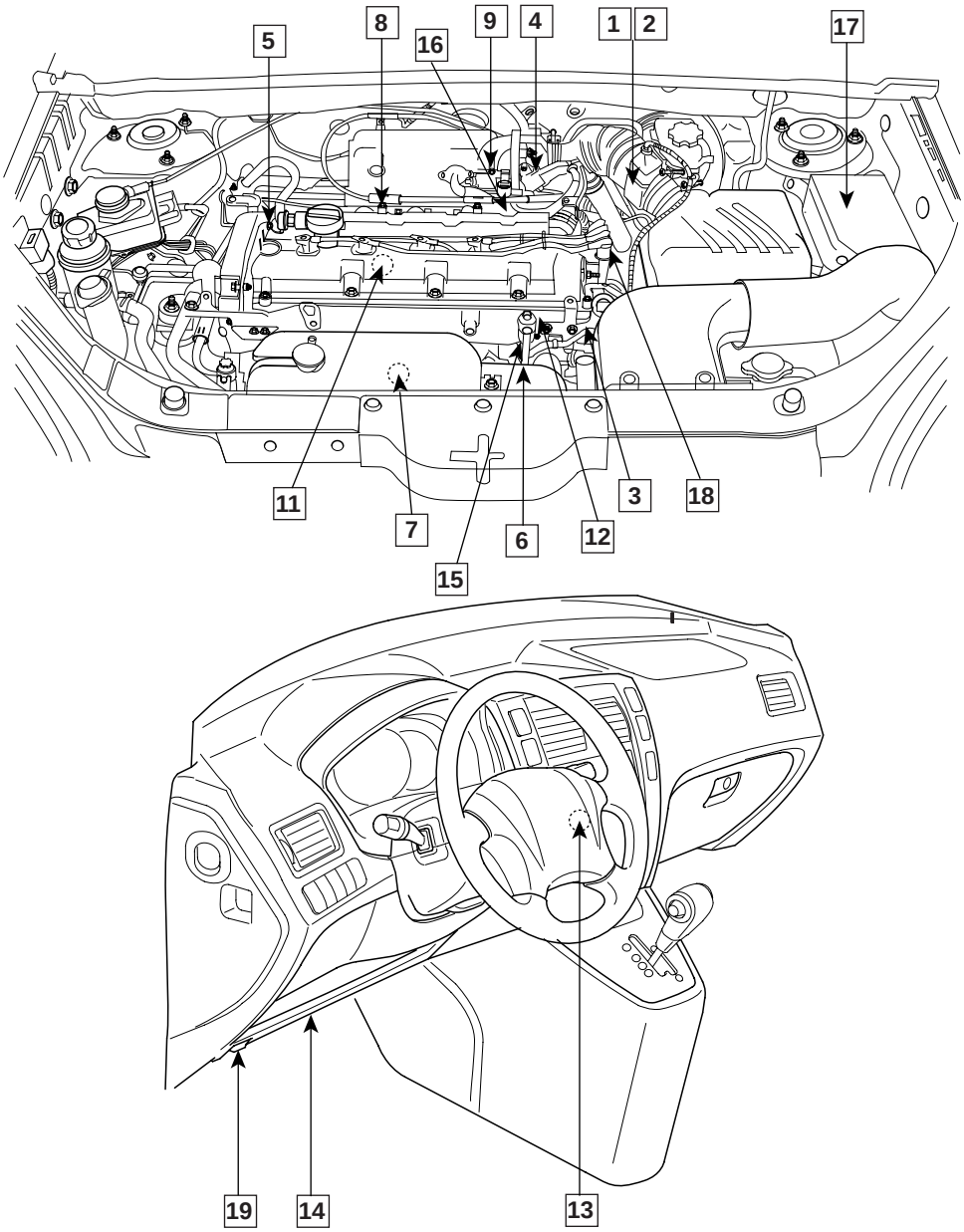
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
   If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately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

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

NOTE

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

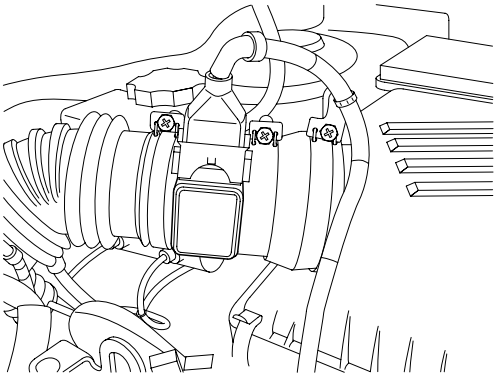
COMPONENTS LOCATION E9AC348E



1. Mass Air Flow Sensor (MAFS) [With CVVT]
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. Heated Oxygen Sensor (HO2S, Sensor 1)
8. Injector
9. Idle Speed Control Actuator (ISCA)
10. Vehicle Speed Sensor (VSS)
11. Knock Sensor
12. CVVT Oil Control Valve (OCV) [With CVVT]
13. Ignition Switch
14. ECM
15. CVVT Oil Temperature Sensor (OTS) [With CVVT]
16. Purge Control Solenoid Valve (PCSV)
17. Main Relay
18. Ignition Coil
19. DLC (Diagnostic Link Connector)
20. Heated Oxygen Sensor (HO2S, Sensor 2)

EGQE601R

1. Mass Air Flow Sensor (MAFS) [With CVVT]
2. Intake Air Temperature Sensor (IATS)



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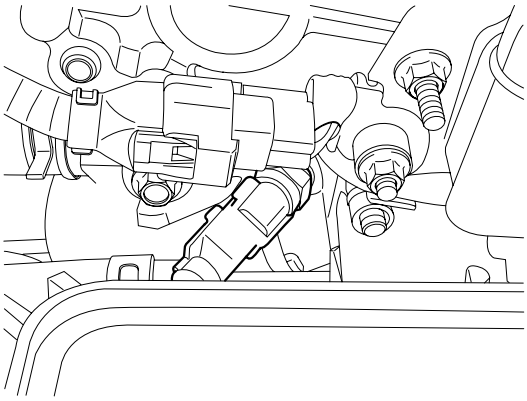
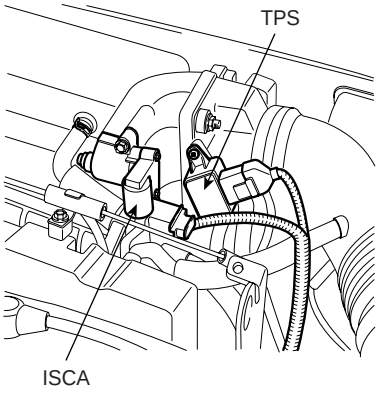
3. Engine Coolant Temperature Sensor (ECTS)



EGQE550S

4. Throttle Position Sensor (TPS)
9. Idle Speed Control Actuator (ISCA)



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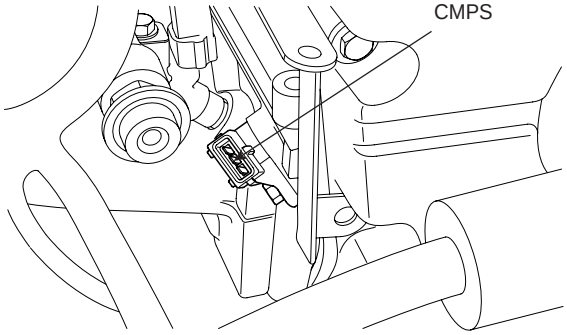
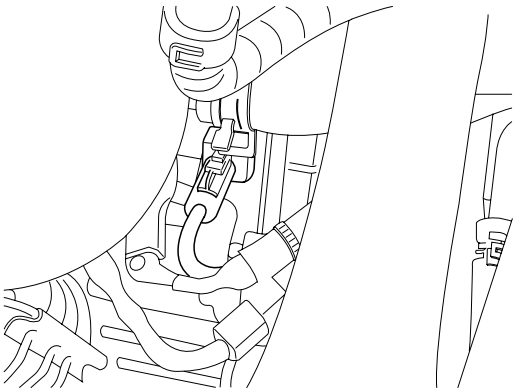
5. Camshaft Position Sensor (CMPS)



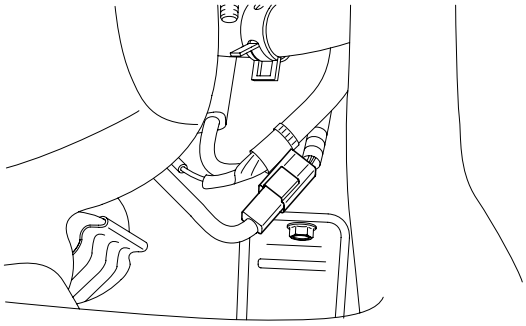
EGQE550U

6. Crankshaft Position Sensor (CKPS)



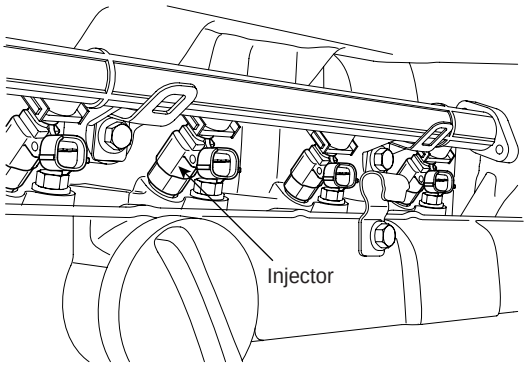
EGQE550V

7. Heated Oxygen Sensor (HO2S, Sensor 1)



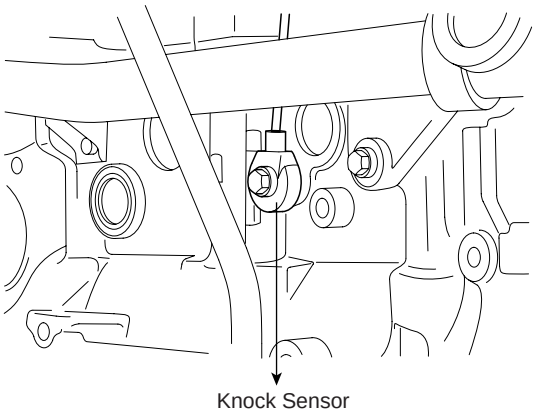
EGQE550W

8. Injector



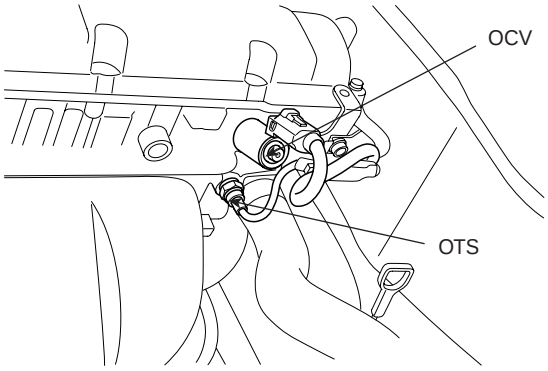
EGQE550X

11. Knock Sensor



EGQE550Y

12. CVVT Oil Control Valve (OCV) [With CVVT]
15. CVVT Oil Temperature Sensor (OTS) [With CVVT]



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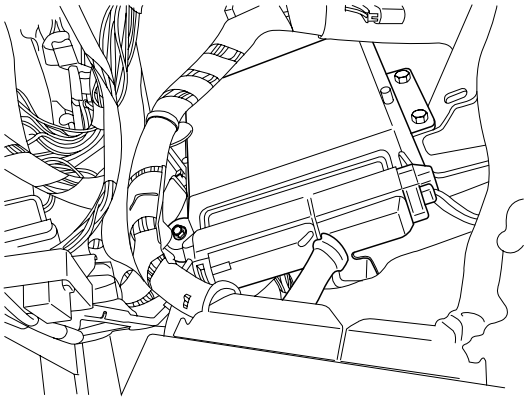
14. ECM



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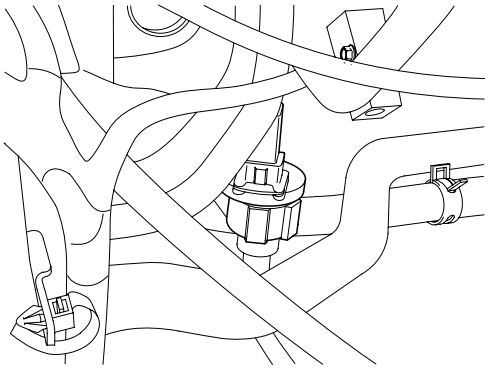
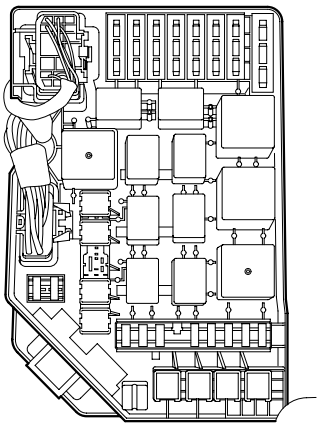
16. Purge Control Solenoid Valve (PCSV)

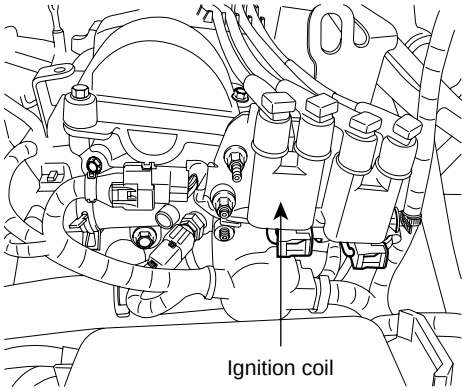
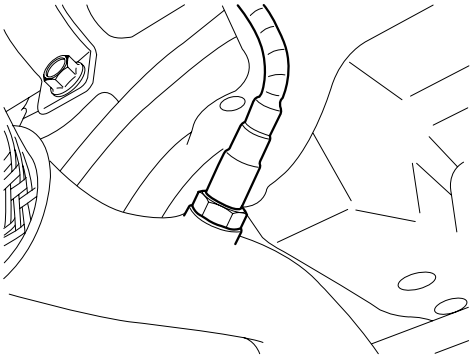


EGQE551B

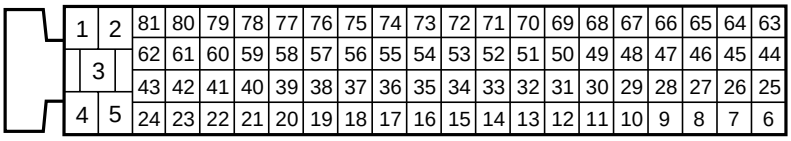
17. Main Relay



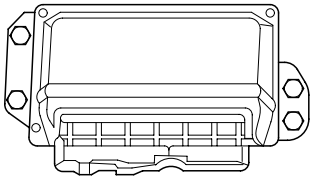
EGQE551D

18. Ignition Coil	20. Heated Oxygen Sensor (HO2S, Sensor 2)
 EGQE551C	 EGQE551E

1. ECM HARNESS CONNECTOR ECB5E1FB



ECM Harness Side Connector



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2. ECM TERMINAL FUNCTION

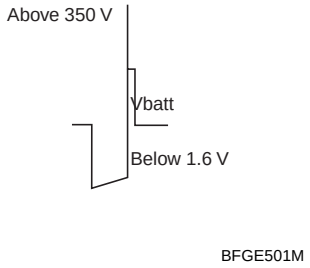
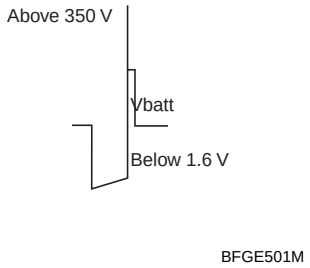
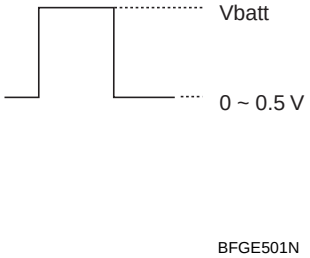
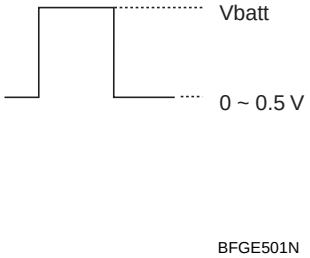
Pin No.	Description	Connected to	Remark
1	ECM ground	Chassis ground	
2	Power stage ground	Chassis ground	
3	Direct battery voltage supply	Battery	
4	Ignition coil output 1,4	Ignition Coil #1, 4	
5	Ignition coil output 2,3	Ignition Coil #2, 3	
6	CAN LOW	Other control modules (TCM, ABS, etc.)	
7	CAN HIGH	Other control modules (TCM, ABS, etc.)	
8	HO2S Heater (B1/S1)	HO2S (B1/S1)	Except for LEADED
9	HO2S Heater (B1/S2)	HO2S (B1/S2)	EOBD ONLY
10	Knock Sensor Input	Knock Sensor	
11	CVVT Oil Control Valve output	CVVT Oil Control Valve	
12	Not connected	-	
13	Not connected	-	
14	Battery Voltage Supply after Main Relay	Main Relay	
15	Not connected	-	
16	Not connected	-	
17	Wheel Speed Sensor (-)	Wheel Speed Sensor	
18	Wheel Speed Sensor (+)	Wheel Speed Sensor	
19	Not connected	-	
20	Not connected	-	
21	Battery Voltage Supply after Main Relay	Main Relay	
22	Battery Voltage Supply after Ignition Key	Ignition Key	
23	Injector output (cyl. 4)	Injector (cyl. 4)	
24	Injector output (cyl. 1)	Injector (cyl. 1)	
25	Spare Sensor supply	Sensors	
26	Purge Control Solenoid Valve (PCSV) PWM output	Purge Control Solenoid Valve (PCSV)	

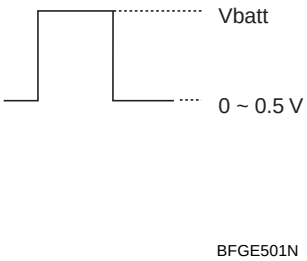
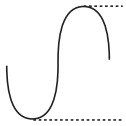
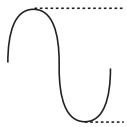
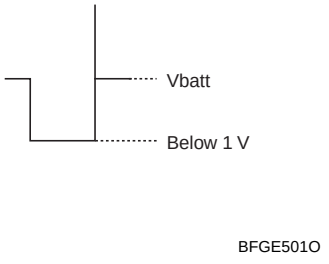
Pin No.	Description	Connected to	Remark
27	Crankshaft Position Sensor ground	Crankshaft Position Sensor	
28	Not connected	-	
29	Crankshaft Position Sensor input	Crankshaft Position Sensor	
30	Camshaft Position Sensor ground	Camshaft Position Sensor	
31	Engine Coolant Temperature Sensor input	Engine Coolant Temperature Sensor	
32	Throttle Position Sensor input	Throttle Position Sensor	
33	Not connected	-	
34	Not connected	-	
35	Not connected	-	
36	Not connected	-	
37	HO2S (B1/S2) ground	HO2S (B1/S2)	
38	Throttle Position Sensor ground	Throttle Position Sensor	
39	Vehicle Speed Sensor input	Vehicle Speed Sensor	Without ABS
	Wheel Speed Sensor input	Wheel Speed Sensor	With ABS
40	Not connected	-	
41	Not connected	-	
42	HO2S (B1/S2) input	HO2S (B1/S2)	EOBD ONLY
43	HO2S (B1/S1) input	HO2S (B1/S1)	Except for LEADED
44	MAFS, IATS supply	MAFS, IATS	
45	Throttle Position Sensor supply	Throttle Position Sensor	
46	Spare Sensor supply 2	Sensors	
47	Immobilizer Data Line	Immobilizer	With Immobilizer
48	MAFS, IATS ground	MAFS, IATS	
49	Not connected	-	
50	Air Conditioner Compressor Switch input	Triple Switch	
51	Air Conditioner Pressure switch input	Triple Switch	
52	Oil Temperature Sensor input	Oil Temperature Sensor	
53	Not connected	-	
54	Knock Sensor ground	Knock Sensor	
55	Ignition shield ground	Ignition Coil	
56	Intake Air Temperature Sensor input	MAFS, IATS	
57	Not connected	-	
58	Air Conditioner Request Switch input	Air Conditioner Request Switch	
59	HO2S (B1/S1) ground	HO2S (B1/S1)	Except for LEADED
60	Mass Air Flow Sensor signal input	MAFS	
61	Injector output (cyl.3)	Injector (cyl.3)	

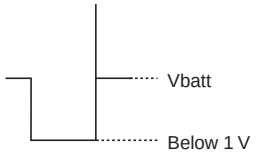
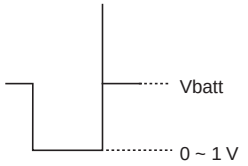
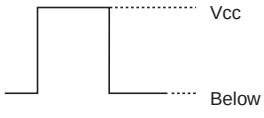
Pin No.	Description	Connected to	Remark
62	Injector output (cyl.2)	Injector (cyl.2)	
63	Not connected	-	
64	Cooling Fan Relay - High control output	Cooling Fan Relay	
65	Cooling Fan Relay - Low control output	Cooling Fan Relay	
66	Engine Speed signal output	Tachometer	
67	Main Relay control output	Main Relay	
68	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay	
69	Electric Fuel Pump Relay control output	Electric Fuel Pump Relay	
70	Malfunction Indicating Lamp (MIL) output	Malfunction Indicating Lamp (MIL)	
71	Immobilizer ground	Immobilizer	With Immobilizer
72	Camshaft Position Sensor input	Camshaft Position Sensor	
73	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor	
74	Throttle Position PWM output		
75	Fuel Consumption signal output	Trip Computer	
76	Oil Temperature Sensor ground	Oil Temperature Sensor	
77	Diagnostic Data Line (k-Line)	Data Link Conector (DLC)	
78	Idle Speed Control Actuator PWM output 2 (CLOSE)	Idle Speed Control Actuator	
79	Not connected	-	
80	Idle Speed Control Actuator PWM output 1 (OPEN)	Idle Speed Control Actuator	
81	Immobilizer Lamp output	Immobilizer	With Immobilizer

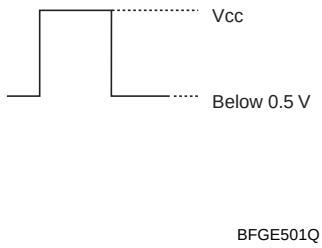
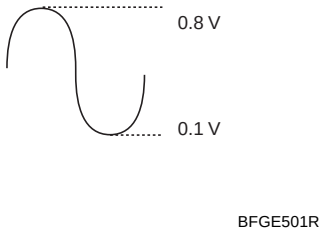
3. ECM TERMINAL INPUT/OUTPUT SIGNAL

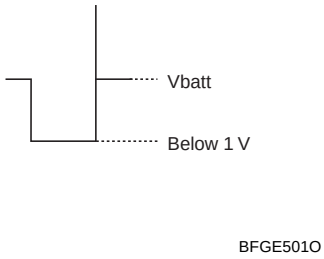
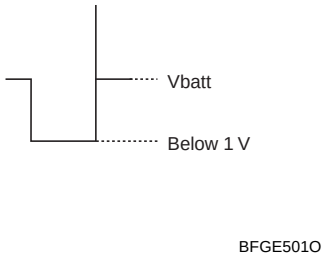
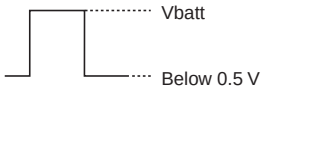
Pin No.	**Description**	**Input, Output Value**		**Vehicle State**	**Test Result**
		Type	Range		
1	ECM ground	Static Signal	0 ~ 0.5V	Always	0.3V
2	Power stage ground	Static Signal	0 ~ 0.5V	Always	0.3V
3	Direct battery voltage supply	Static Signal	Vbatt	Others	12.5 V (Vbatt Level)
				Running	13.7 V (Vbatt Level)

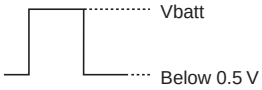
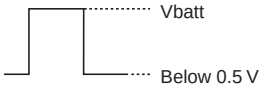
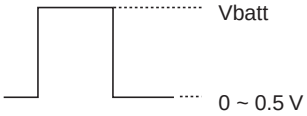
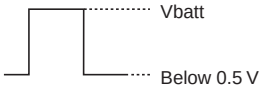
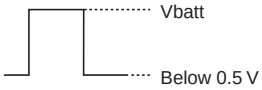
Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
4	Ignition coil output 1,4	Pulse		Engine run	High: 14.03V Low: 0.78~1.13V Peak voltage: 348V Idle : 17.2Hz
5	Ignition coil output 2,3	Pulse		Engine run	High: 14.03V Low: 0.78~1.13V Peak voltage: 348V Idle : 17.2Hz
6	CAN LOW	DC (PWM)	2.0 ~ 3.0V	Recessive	
			0.5 ~ 2.25V	Dominant	
7	CAN HIGH	DC (PWM)	2.0 ~ 3.0V	Recessive	
			2.75~4.5V	Dominant	
8	HO2S Heater (B1/S1)	PWM		Engine run	High: 14.01V Low: 0.4V Frequency:10Hz
9	HO2S Heater (B1/S2)	PWM		Engine run	High: 14.01V Low: 0.4V Frequency:10Hz
10	Knock Sensor Input	Frequency	-0.5 ~ 0.7V	Knocking	0.3V
			0V	Normal	0V

Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
11	CVVT Oil Control Valve output	PWM		Engine run	High: 14.01V Low: 0.4V Frequency: 300Hz
12	Not connected				
13	Not connected				
14	Battery Voltage Supply after Main Relay	DC	Vbatt	IG ON	12.7V
			0 ~ 0.5V	IG OFF	0.3V
15	Not connected				
16	Not connected				
17	Wheel Speed Sensor(-)	Sensor signal	Approximately 50rpm: 37Hz, 236mV (Peak to Peak) 100rpm: 76Hz, 376mV (Peak to Peak) 1000rpm: 769Hz, 1.64V (Peak to Peak)	Vehicle run	
18	Wheel Speed Sensor(+)	Sensor signal	Approximately 50rpm: 37Hz, 236mV (Peak to Peak) 100rpm: 76Hz, 376mV (Peak to Peak) 1000rpm: 769Hz, 1.64V (Peak to Peak)	Vehicle run	
19	Not connected				
20	Not connected				
21	Battery Voltage Supply after Main Relay	Static Signal	Vbatt	IG ON	12.7V
			0 ~ 0.5V	IG OFF	0.3V
22	Battery Voltage Supply after Ignition Key	Static Signal	Vbatt	IG ON	12.7V
			0 ~ 0.5V	IG OFF	0.3V
23	Injector output (cyl. 4)	Frequency		Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V

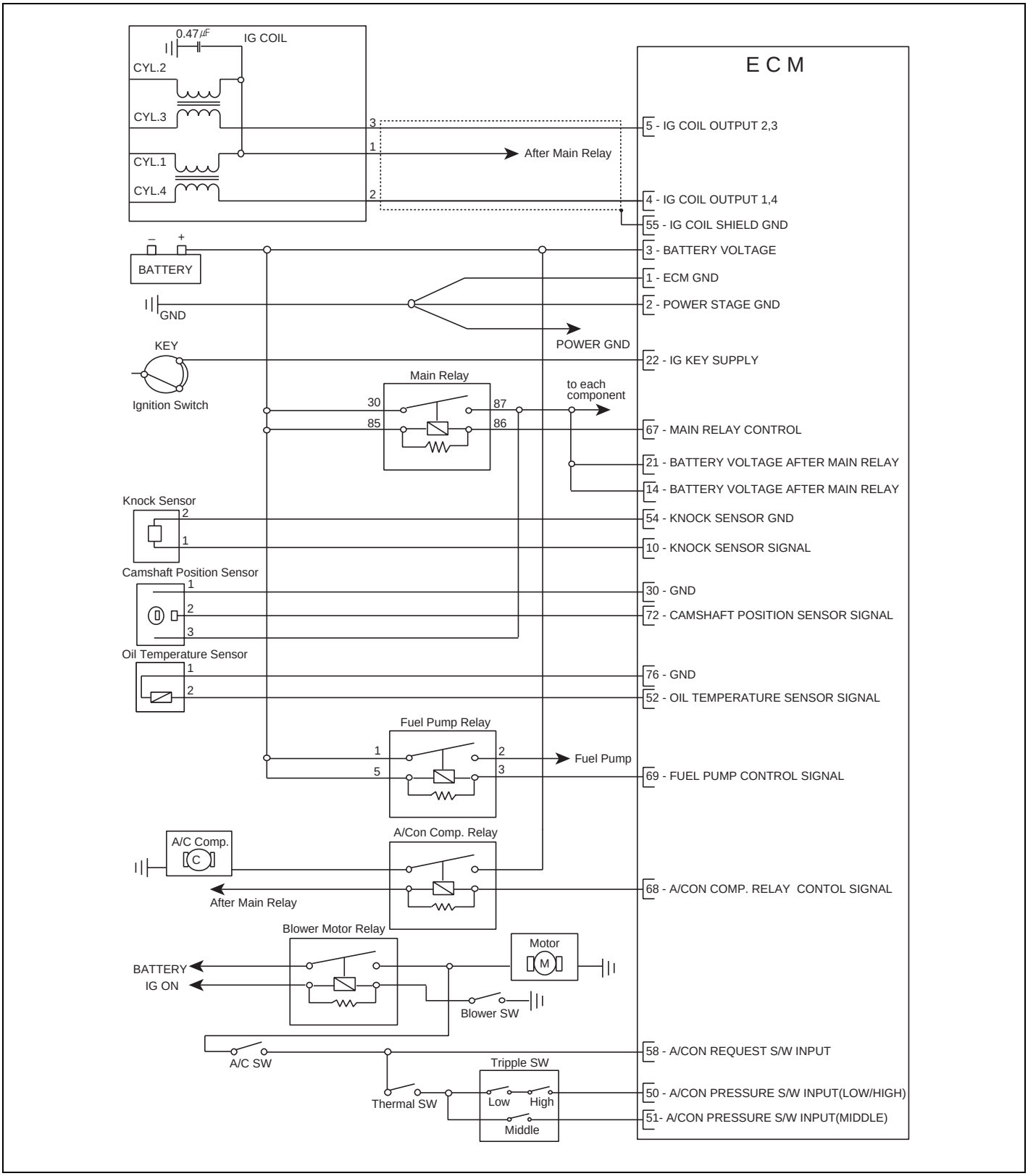
Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
24	Injector output (cyl. 1)	Frequency	 BFGE501O	Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V
25	Spare Sensor supply	Static Signal	Vcc	IG ON	5V
			0 ~ 0.5V	IG OFF	0.3V
26	Purge Control Solenoid Valve (PCSV) PWM output	PWM Pulse	 BFGE501P	Inactive Active (after warm up & racing)	High: 14.01V Low: 0.3V Frequency: 20Hz
27	Crankshaft Position Sensor ground	Static Signal	0 ~ 0.5V	Always	0.2 V
28	Not connected				
29	Crankshaft Position Sensor input	Frequency	 BFGE501Q	Idle: 740Hz	5V
				3000rpm: 3126Hz	0.3V
30	Camshaft Position Sensor ground	Static Signal		Always	
31	Engine Coolant Temperature Sensor input	Analog	-40 ℃ ~ 145 ℃ 4.9V ~ 0.322V	80℃ [176°F]	1.25V
32	Throttle Position Sensor input	Analog	0.25 ~ 0.8V	Idle	0.3V
			4.15 ~ 4.7V	W.O.T	4.16V
33	Not connected				
34	Not connected				
35	Not connected				
36	Not connected				
37	HO2S (B1/S2) ground	Static Signal	0 ~ 0.5V	Always	0.3V
38	Throttle Position Sensor ground	Static Signal	0 ~ 0.5V	Always	0.3V

Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
39	Vehicle Speed Sensor input	Pulse		Vehicle run	High : 5V Low : 0.9V
40	Not connected				
41	Not connected				
42	HO2S (B1/S2) input	Analog Pulse		3000rpm After warm up	0.8V 0.1V Frequency: 1.1Hz
43	HO2S (B1/S1) input	Analog Pulse	RICH : 0.6 ~ 1.0 V	Engine run	0.746 V
			LEAN : Max. 0.4 V		0.081 V
44	Not connected				
45	Throttle Position Sensor supply	Static Signal	5V	IG ON	4.9V
			0 ~ 0.5V	IG OFF	0.4V
46	Spare Sensor supply 2	Static Signal	5V	IG ON	5V
			0 ~ 0.5V	IG OFF	0.3V
47	Immobilizer Data Line	Pulse	High : Min. 8.5 V Low : Max. 3.5 V	When communicating after IG ON.	11.625 V 0.187 V
48	MAFS, IATS ground	Static Signal	0 ~ 0.5V	Always	0.4 V
49	Not connected				
50	Air Conditioner Compressor Switch input	DC	Vbatt	SW ON	13V
			0 ~ 0.5V	SW OFF	0.3V
51	Air Conditioner Pressure switch input	DC	Vbatt	SW ON	12.9V
			0 ~ 0.5V	SW OFF	0.4V
52	Oil Temperature Sensor input	Analog	-40 ℃ ~ 130 ℃ 4.9V ~ 0.4V	84℃ [183.2 °F]	1.29V
53	Not connected				
54	Knock Sensor ground	Static Signal	0 ~ 0.5V	Always	0.3V
55	Ignition shield ground	Static Signal	0 ~ 0.5V	Always	0.3V

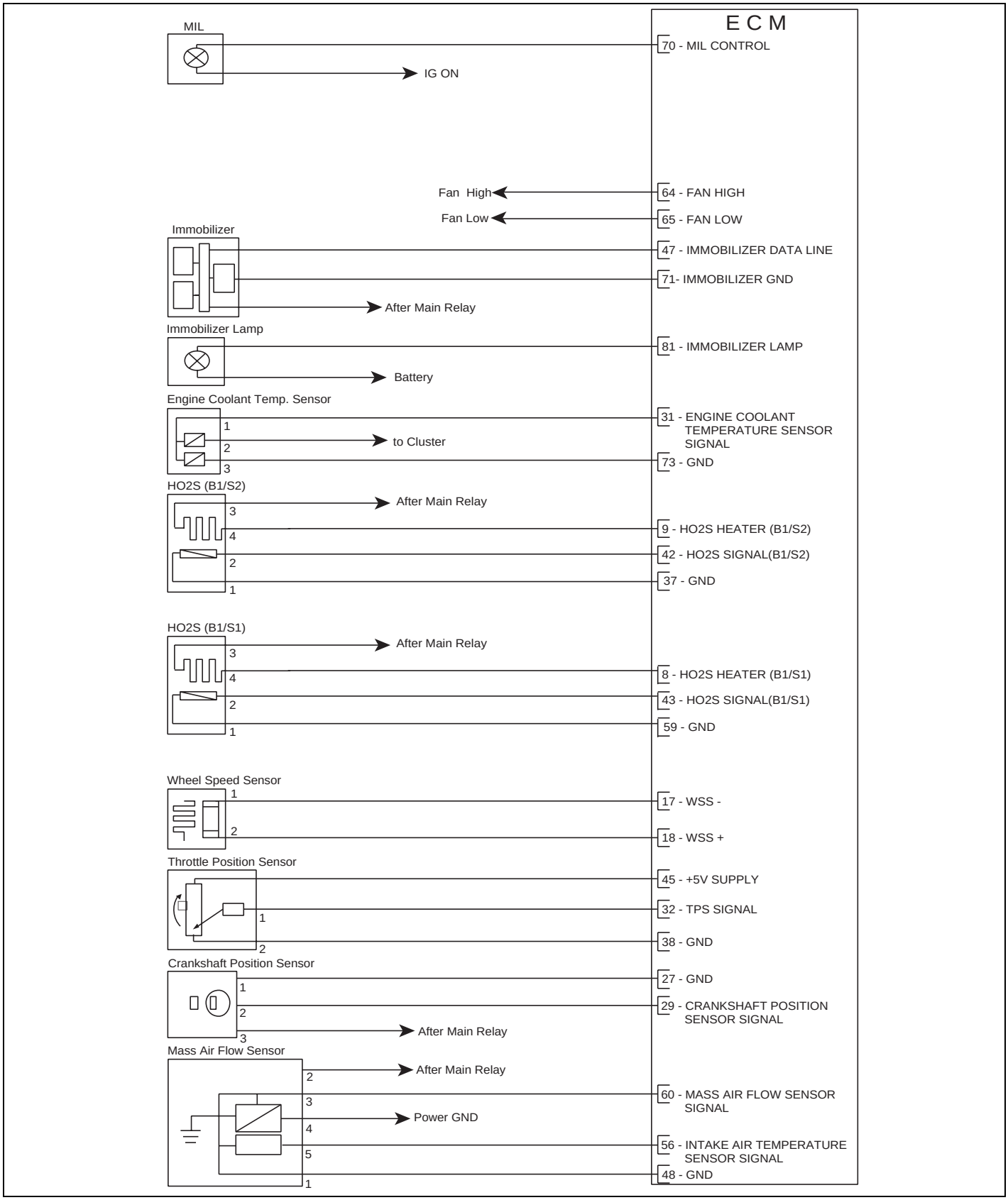
Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
56	Intake Air Temperature Sensor input	Analog	-40 ℃ ~ 266 ℃ 4.9V ~ 0.34 V	Idle	3.26 V (33℃ [91.4 °F])
57	Not connected				
58	Air Conditioner Request Switch input	DC	Vbatt	SW ON	12.9V
			0 ~ 0.5 V	SW OFF	0.4V
59	HO2S (B1/S1) ground	DC	Max. 50 mV	Idle	2.5 mV
60	Mass Air Flow Sensor signal input	Analog	0 ~ 2.0 V	Idle	1.0V
			1.0 ~ 4.5 V	3000 rpm	2.3V
61	Injector output (cyl.3)	Frequency		Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V
62	Injector output (cyl.2)	Frequency		Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V
63	Not connected				
64	Cooling Fan Relay - High control output	DC	Vbatt	SW OFF	12.9V
				SW ON	0.4V
65	Cooling Fan Relay - Low control output	DC	Vbatt	SW OFF	13V
				SW ON	0.5V
66	Engine Speed signal output	Frequency		Engine run	High: 10.5V Low: 0.4V Idle: 24.7Hz 3000 rpm: 104.6Hz
67	Main Relay control output	DC	0 ~ 1V	IG ON	0.9V
			Vbatt	IG OFF	13.5V
68	Air Conditioner Compressor Relay control output	DC	0 ~ 0.5V	A/C ON	0.2V
			Vbatt	A/C OFF	12.5V
69	Fuel Pump Relay control output	DC	Vbatt	IG ON	13.08V
			0 ~ 0.5V	Idle	0.3V
70	Malfunction Indicator Lamp (MIL) output	DC	0 ~ 0.5V	IG ON	0.4V
			Vbatt	Vbatt	13.6V

Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
71	Immobilizer ground	Static Signal	0 ~ 0.5V	Always	0.4V
72	Camshaft Position Sensor input	Frequency	BFGE501T	Idle: 6.3 Hz 3000 rpm: 25 Hz	High: 5V Low: 0.6V
73	Engine Coolant Temperature Sensor ground	Static Signal	0 ~ 0.5V	Always	0.4V
74	Throttle Position PWM output	PWM	 BFGE501S	Engine run	High: 12.75V Low: 0.5V Frequency: 100Hz C.T: 5% duty W.O.T : 90% duty
75	Fuel Consumption signal output	PWM	 BFGE501S	Engine run	High: 12.75V Low: 0.5V Frequency: 100Hz
76	Oil Temperature Sensor ground	Static Signal	0 ~ 0.5V	Always	0.4V
77	Diagnosis line (k-line)	Pulse	 BFGE501N	IG ON	High: 14V Low: 0.5V
78	Idle Speed Control Actuator PWM output2	PWM	 BFGE501S	Idle	High : 15V Low : 0.3V Frequency: 250Hz
79	Not connected				
80	Idle Speed Control Actuator PWM output1	PWM	 BFGE501S	Idle	High : 15V Low : 0.3V Frequency: 250Hz
81	Immobilizer Lamp output	DC	0 ~ 0.5V	IG ON	0.4V
			Vbatt	Cranking	13.6V

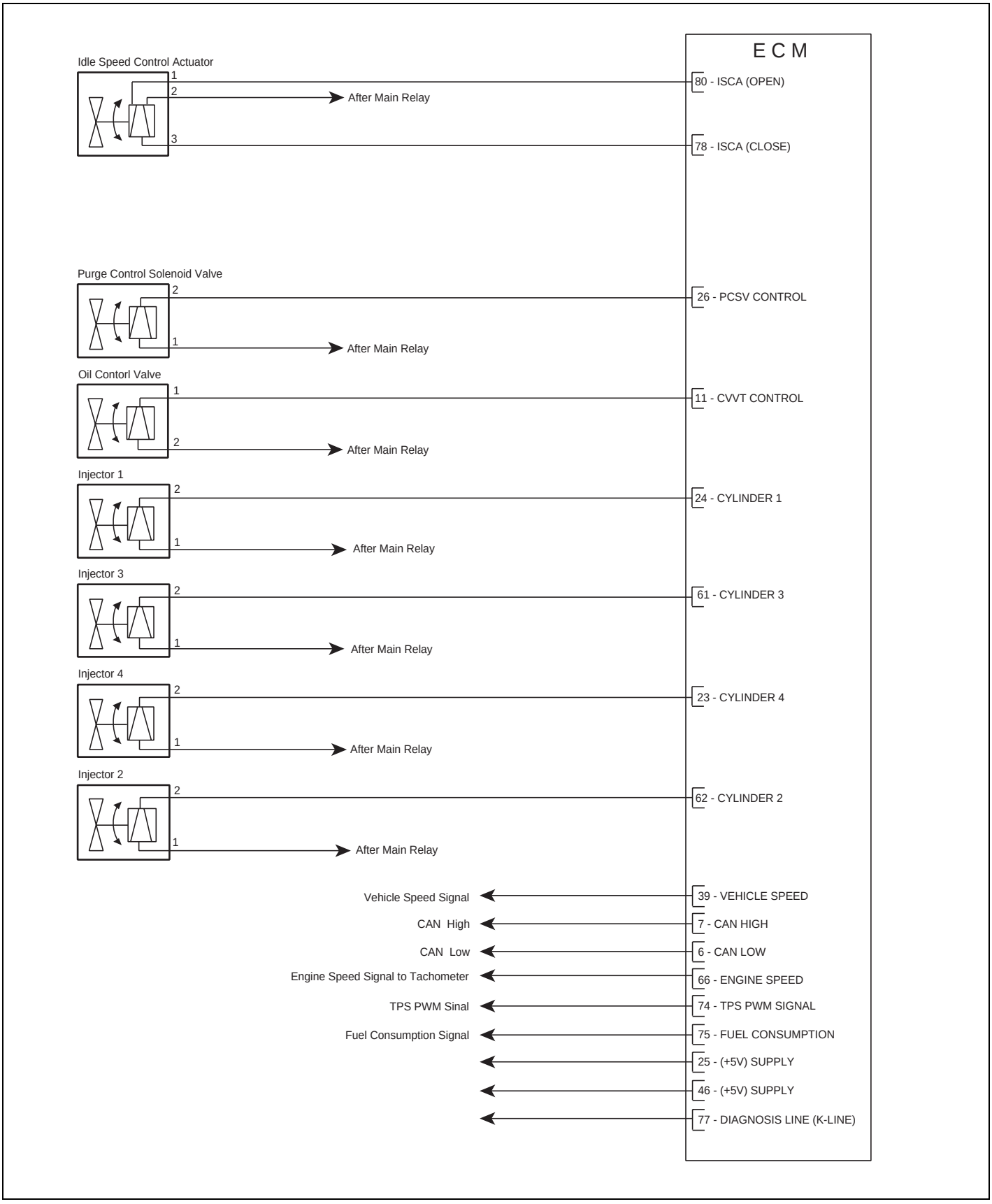
CIRCUIT DIAGRAM E0B25FA2



EGQE401J


E C M
MIL
IG ON
70 - MIL CONTROL
Fan High
Fan Low
64 - FAN HIGH
65 - FAN LOW
Immobilizer
47 - IMMOBILIZER DATA LINE
71- IMMOBILIZER GND
After Main Relay
Immobilizer Lamp
81 - IMMOBILIZER LAMP
Battery
Engine Coolant Temp. Sensor
1
2
3
to Cluster
31 - ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
73 - GND
HO2S (B1/S2)
After Main Relay
9 - HO2S HEATER (B1/S2)
42 - HO2S SIGNAL(B1/S2)
37 - GND
HO2S (B1/S1)
After Main Relay
8 - HO2S HEATER (B1/S1)
43 - HO2S SIGNAL(B1/S1)
59 - GND
Wheel Speed Sensor
17 - WSS -
18 - WSS +
Throttle Position Sensor
45 - +5V SUPPLY
32 - TPS SIGNAL
38 - GND
Crankshaft Position Sensor
27 - GND
29 - CRANKSHAFT POSITION SENSOR SIGNAL
After Main Relay
Mass Air Flow Sensor
After Main Relay
Power GND
60 - MASS AIR FLOW SENSOR SIGNAL
56 - INTAKE AIR TEMPERATURE SENSOR SIGNAL
48 - GND

EGQE401K

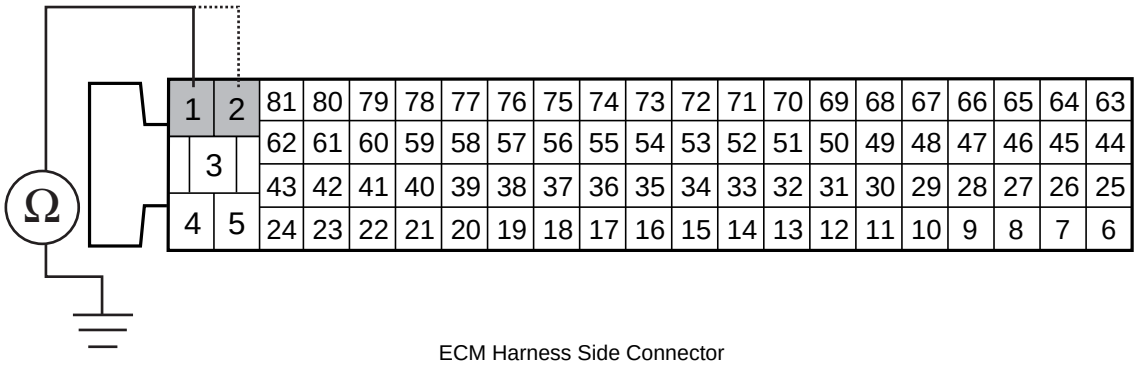

E C M
Idle Speed Control Actuator
1
2
3
After Main Relay
80 - ISCA (OPEN)
78 - ISCA (CLOSE)
Purge Control Solenoid Valve
2
1
After Main Relay
26 - PCSV CONTROL
Oil Contorl Valve
1
2
After Main Relay
11 - CVVT CONTROL
Injector 1
2
1
After Main Relay
24 - CYLINDER 1
Injector 3
2
1
After Main Relay
61 - CYLINDER 3
Injector 4
2
1
After Main Relay
23 - CYLINDER 4
Injector 2
2
1
After Main Relay
62 - CYLINDER 2
Vehicle Speed Signal
39 - VEHICLE SPEED
CAN High
7 - CAN HIGH
CAN Low
6 - CAN LOW
Engine Speed Signal to Tachometer
66 - ENGINE SPEED
TPS PWM Sinal
74 - TPS PWM SIGNAL
Fuel Consumption Signal
75 - FUEL CONSUMPTION
25 - (+5V) SUPPLY
46 - (+5V) SUPPLY
77 - DIAGNOSIS LINE (K-LINE)

EGQE401L

ECM PROBLEM INSPECTION PROCEDURE

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)
Between terminal 1 of C230-1 connector and chassis ground : 1Ω or less
Between terminal 2 of C230-1 connector and chassis ground : 1Ω or less



ECM Harness Side Connector

EFUE521

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

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

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

DTC TROUBLESHOOTING PROCEDURES

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES(DTC) E4DB765B

P-Code	Description	MIL		
		EURO-II	EURO-III	LEADED
P0011	Camshaft Position-Timing Over-Advanced or System Performance(Bank 1)	▲	●	▲
P0016	Crankshaft Position-Camshaft Position Correlation(Bank 1)	▲	●	▲
P0030	O2 Sensor Heater - Heater Control Circuit (Bank 1 / Sensor 1)	▲	●	-
P0031	O2 Sensor Heater Circuit low (Bank 1 / Sensor 1)	▲	●	-
P0032	O2 Sensor Heater Circuit high (Bank 1 / Sensor 1)	▲	●	-
P0036	O2 Sensor Heater - Heater Control Circuit (Bank 1 / Sensor 2)	-	●	-
P0037	O2 Sensor Heater Circuit low (Bank 1 / Sensor 2)	-	●	-
P0038	O2 Sensor Heater Circuit high (Bank 1 / Sensor 2)	-	●	-
P0076	Intake Valve Control Solenoid Circuit Low (Bank1)	▲	●	▲
P0077	Intake Valve Control Solenoid Circuit High (Bank1)	▲	●	▲
P0101	Mass or Volume Air Flow Circuit Range / Performance Problem	●	●	●
P0102	Mass or Volume Air Flow Circuit Low Input	●	●	●
P0103	Mass or Volume Air Flow Circuit high Input	●	●	●
P0112	Intake Air Temperature Circuit Low Input	▲	●	▲
P0113	Intake Air Temperature Circuit High Input	▲	●	▲
P0116	Engine Coolant Temperature Circuit Range / Performance	●	●	●
P0117	Engine Coolant Temperature Circuit Low Input	●	●	●
P0118	Engine Coolant Temperature Circuit High Input	●	●	●
P0121	Throttle / Pedal Position Circuit Range/Performance Problem	●	●	●
P0122	Throttle / Pedal Position Circuit Low Input	●	●	●
P0123	Throttle / Pedal Position Circuit High Input	●	●	●
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	-	●	-
P0130	O2 Sensor Circuit(Bank 1/ Sensor 1)	▲	●	-
P0131	O2 Sensor Circuit Low Input(Bank 1 / Sensor 1)	▲	●	-
P0132	O2 Sensor Circuit High Input(Bank 1 / Sensor 1)	▲	●	-
P0133	O2 Sensor Circuit Slow Response (Bank 1 / Sensor 1)	▲	●	-
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 / Sensor 1)	▲	●	-

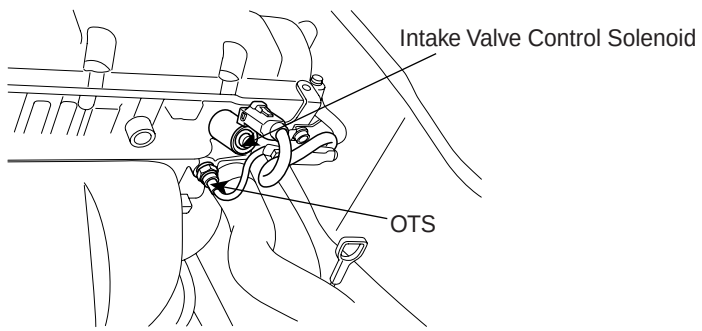
P0136	O2 Sensor Circuit Malfunction(Bank 1 / Sensor 2)	-	●	-
P0137	O2 Sensor Circuit Low Input (Bank 1 / Sensor 2)	-	●	-
P0138	O2 Sensor Circuit High Input (Bank 1 / Sensor 2)	-	●	-
P0139	O2 Sensor Circuit Slow Response (Bank 1 / Sensor 2)	-	●	-
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 / Sensor 2)	-	●	-
P0171	Fuel Trim Malfunction - System Too Lean (Bank 1)	-	●	-
P0172	Fuel Trim Malfunction - System Too Rich (Bank 1)	-	●	-
P0196	Engine Oil Temp. Sensor Range / Performance	▲	●	▲
P0197	Engine Oil Temp. Sensor Low Input	▲	●	▲
P0198	Engine Oil Temp. Sensor High Input	▲	●	▲
P0230	Fuel Pump Circuit Malfunction	▲	▲	▲
P0261	Cylinder 1 - Injector Circuit Low	●	●	●
P0262	Cylinder 1 - Injector Circuit High	●	●	●
P0264	Cylinder 2 - Injector Circuit Low	●	●	●
P0265	Cylinder 2 - Injector Circuit High	●	●	●
P0267	Cylinder 3 - Injector Circuit Low	●	●	●
P0268	Cylinder 3 - Injector Circuit High	●	●	●
P0270	Cylinder 4 - Injector Circuit Low	●	●	●
P0271	Cylinder 4 - Injector Circuit High	●	●	●
P0300	Multiple Cylinder Misfire Detected	-	●	-
P0301	Cylinder 1 - Misfire detected	-	●	-
P0302	Cylinder 2 - Misfire detected	-	●	-
P0303	Cylinder 3 - Misfire detected	-	●	-
P0304	Cylinder 4 - Misfire detected	-	●	-
P0325	Knock Sensor 1 Circuit Malfunction	▲	▲	▲
P0335	Crankshaft Position Sensor A Circuit	▲	●	▲
P0340	Camshaft Position Sensor Circuit Malfunction (Bank1 or Single Sensor)	▲	●	▲
P0420	Catalyst System Efficiency below Threshold (Bank 1)	-	●	-
P0444	Evap. Emission Ctrl. System - Purge Ctrl. Valve Circuit Open	-	●	-
P0445	Evap. Emission Ctrl. System - Purge Ctrl. Valve Circuit Shorted	-	●	-
P0501	Vehicle Speed Sensor Range / Performance	▲	●	▲
P0506	Idle Control System - RPM lower than expected	▲	▲	▲
P0507	Idle Control System - RPM higher than expected	▲	▲	▲
P0560	System Voltage Malfunction	▲	▲	▲

P0562	System Voltage Low	▲	●	▲
P0563	System Voltage High	▲	●	▲
P0600	Serial Communication Link Malfunction	▲	●	▲
P0605	Internal Control Module Read Only Memory(ROM) Error	▲	▲	▲
P0650	Malfunction Indicator Lamp(MIL) Control Circuit Malfunction	-	▲	-
P0170	O2 Sensor System - Lambda Controller at the Limit (Bank 1)	-	●	-
P0315	Segment Time Acquisition Incorrect	-	▲	-
P1505	Idle Charge Actuator Signal Low of Coil #1	●	●	●
P1506	Idle Charge Actuator Signal High of Coil #1	●	●	●
P1507	Idle Charge Actuator Signal Low of Coil #2	●	●	●
P1508	Idle Charge Actuator Signal High of Coil #2	●	●	●
P0700	TCU Request for MIL On / Freeze Frame to ECU via CAN	▲	●	▲
P1602	Serial Communication Problem with TCU (Timeout)	▲	●	▲

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

DTC P0011 "A" CAMSHAFT POSITION-TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

COMPONENT LOCATION EF8DA46B



EGQE603M

GENERAL DESCRIPTION ECF661DE

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the exhaust camshaft. There is no variation in valve timing of the exhaust cam because the exhaust camshaft is driven by the timing belt. The timing of the intake cam is varied by the relative operation the CVVT vane to the housing. This system helps the engine decrease exhaust gases and increase engine power and fuel economy by changing the valve open/close timing of the intake camshaft.

DTC DESCRIPTION E9FCBFE7

The deviation of the camshaft position from the target point is evaluated during stable driving condition. The PCM accumulats this deviation for a certain period and sets DTC P0011 when the accumulated deviation is too high. The target camshaft position is predetermineded value depending on engine speed and throttle angle in the PCM.

DTC DETECTING CONDITION EE6E1D8C

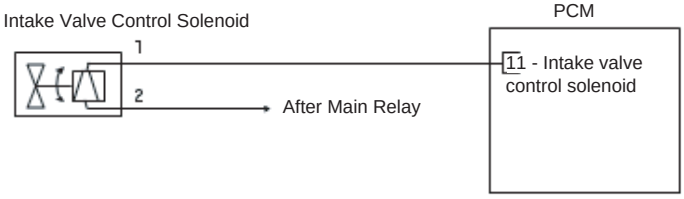
Item	Detecting Condition	Possible Cause
DTC Strategy	● Monitor deviation between camshaft position setpoint and actual value	● Oil leakage ● Faulty Oil pump ● Faulty Intake valve control solenoid
Enable Conditions	● No relevant failure ● 11V < Battery voltage < 16V ● CVVT control : enabled ● Holding position adaptation not active ● Camshaft setpoint moved more than 5 times for this Driving Cycle ● Camshaft target position is stable with less than 1.125°CRK moving ● 600rpm < Engine speed < 5000rpm ● 20℃(68°F) < Engine oil temperature < 100℃(212°F)	
Threshold Value	● Integral of Camshaft position setpoint - Camshaft position actual value > 150°CRK/sec.	
Diagnostic Time	● Approx. 38~300 seconds depending on CAM deviation	
Fail-Safe	● CVVT control is disabled	

SPECIFICATION E091CCFB

Intake valve control solenoid	Normal Parameter
Insulation Resistance (Ω)	above 50 MΩ

Temp.(℃)	Temp.(°F)	Resistance(Ω)	Temp.(℃)	Temp.(°F)	Resistance(Ω)
0	32	6.2 ~ 7.4	60	140	8.0 ~ 9.2
10	50	6.5 ~ 7.7	70	158	8.3 ~ 9.5
20	68	6.8 ~ 8.0	80	176	8.6 ~ 9.8
30	86	7.1 ~ 8.3	90	194	8.9 ~ 10.1
40	104	7.4 ~ 8.6	100	212	9.0 ~ 10.4
50	122	7.7 ~ 8.9			

SCHEMATIC DIAGRAM E5010A97

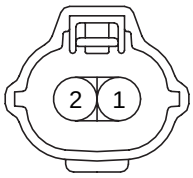


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 11	Control
2	Main Relay	Battery Voltage

[CONNECTOR]

IVCS Harness side connector



C166

PCM side terminal

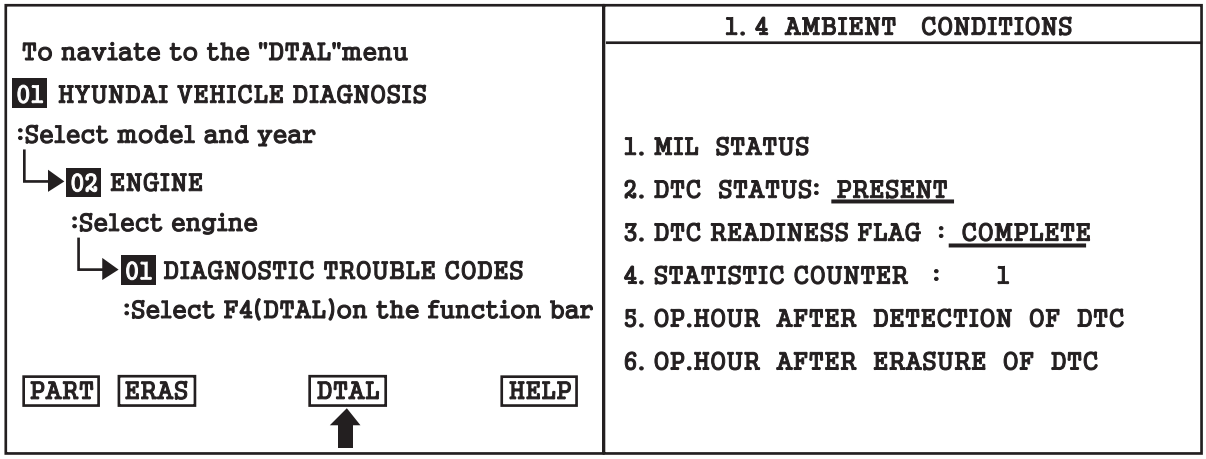
6	7	8	9	10	●	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B00111

MONITOR DTC STATUS EB0F780E

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



B00112

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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

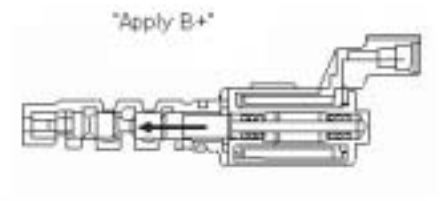
NO

▶ Go to "Component Inspection" procedure

COMPONENT INSPECTION ECC58DA1

VISUALLY CHECK INTAKE VALVE CONTROL SOLENOLD

1. Ignition "OFF".
2. Remove the intake valve control solenoid from the engine.
3. Visually check the Spool Column of intake valve control solenoid for contamination.
4. Connect 12V and a ground to 2 and 1 of the solenoid(Component side). Verify that spool column move to left as shown in the figure.
5. Disconnect 12V and verify that spool column move to original condition.



B00113

6. Has a problem been found?

YES

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

NO

▶ Go to next step as below

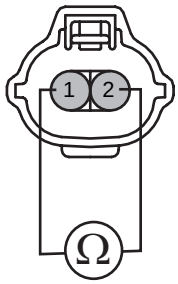
CHECK INTAKE VALVE CONTROL SOLENOID RESISTANCE

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Resistance(Ω)	Temp.(℃)	Temp.(℉)	Resistance(Ω)
0	32	6.2 ~ 7.4	60	140	8.0 ~ 9.2
10	50	6.5 ~ 7.7	70	158	8.3 ~ 9.5
20	68	6.8 ~ 8.0	80	176	8.6 ~ 9.8
30	86	7.1 ~ 8.3	90	194	8.9 ~ 10.1
40	104	7.4 ~ 8.6	100	212	9.0 ~ 10.4
50	122	7.7 ~ 8.9			

<C166>



1. Intake Valve Control
2. Battery Voltage

B00114

4. Is resistance within the specification?

YES

▶ Go to next step as below

NO

▶ Replace the intake valve control solenoid and go to "Verification of Vehicle Repair" procedure

CHECK THE SUSPECTED AREA

1. Check the following items
   - Intake valve control solenoid filter for sticking or contamination
   - Engine oil and it's level
   - Engine oil filter

2. Is there any problem?

YES

▶ Repair or replace the intake valve control solenoid and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION EFEFB4A0

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

▶ Check for poor connection between PCM 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 EC8AEAB4

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.

DTC P0016 CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION (BANK 1 SENSOR A)

GENERAL DESCRIPTION E1E348CE

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the exhaust camshaft. There is no variation in valve timing of the exhaust cam because the exhaust camshaft is driven by the timing belt. The timing of the intake cam is varied by the relative operation the CVVT vane to the housing. This system helps the engine decrease exhaust gases and increase engine power and fuel economy by changing the valve open / close timing of the intake camshaft.

DTC DESCRIPTION EDA7E64D

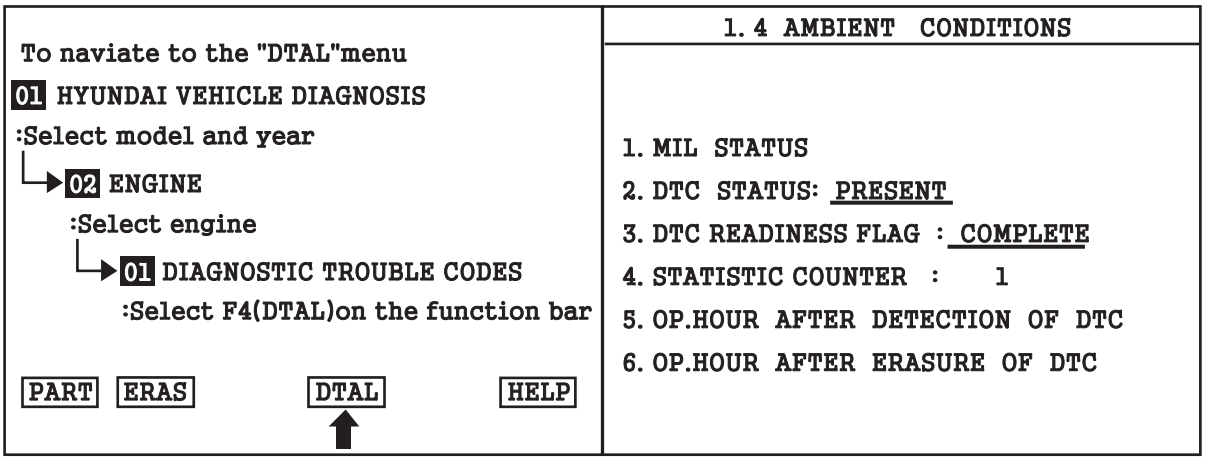
This diagnosis checks the camshaft position plausibility whether the expected range plus some margin is not violated that might be caused by a wrong engine repair, or a chain/belt misalignment. DTC P0016 is set when actual camshaft position is too much retarded or advanced than full retard position or full advance position. To continue the adjustment in such case could lead to a damage of the engine by hitting the valves with the piston.

DTC DETECTING CONDITION EAB723D1

Item	Detecting Condition	Possible Cause
DTC Strategy	● Monitor Camshaft position in the full retard condition or during CVVT control	● Abnormal installation of camshaft ● Abnormal installation of crankshaft ● Abnormal installation of tone wheel
Enable Conditions	● No failure on oil control valve ● Battery voltage > 11V ● CVVT control state ="Ready" or "Adaptation" or "Enable"	
Threshold Value	● Actual measured camshaft position in full retard position ("Ready" or "Adaptation") is out of 105 ~ 145 °CRK ● Camshaft position in "Enable" condition is out of 70 °CRK ~ 140 °CRK	
Diagnostic Time	● 8 Sec.	

MONITOR DTC STATUS EBE7B1DF

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



B00112

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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E96BA965

1. Timing Inspection

   1) Set up an oscilloscope as follows :
      Channel A (+): terminal 2 of the CKPS, (-): ground
      Channel B (+): terminal 2 of the CMPS, (-): ground

   2) Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.

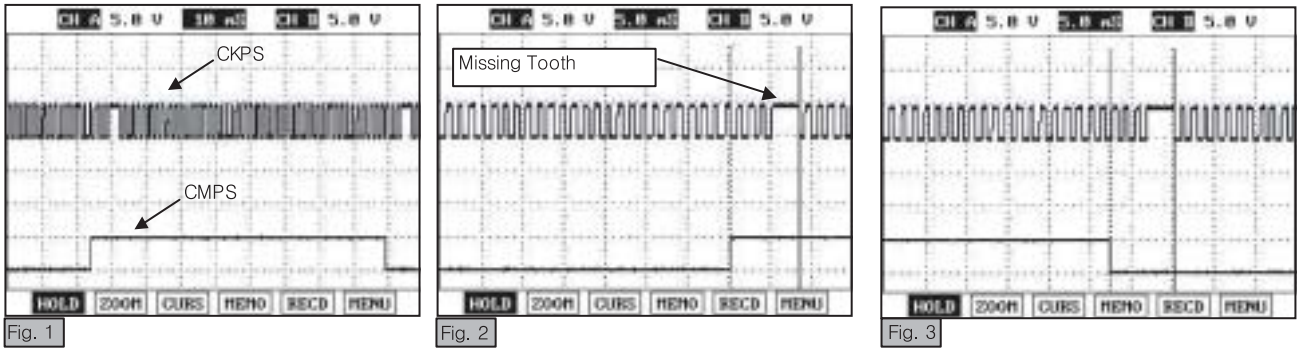


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B00161

3) Is the signal waveform normal?

YES

▶ Check for poor connection between PCM 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 the following items.
- Alignment of the timing belt
- Alignment of the camshaft timing chain

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

VERIFICATION OF VEHICLE REPAIR EC8DCE63

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

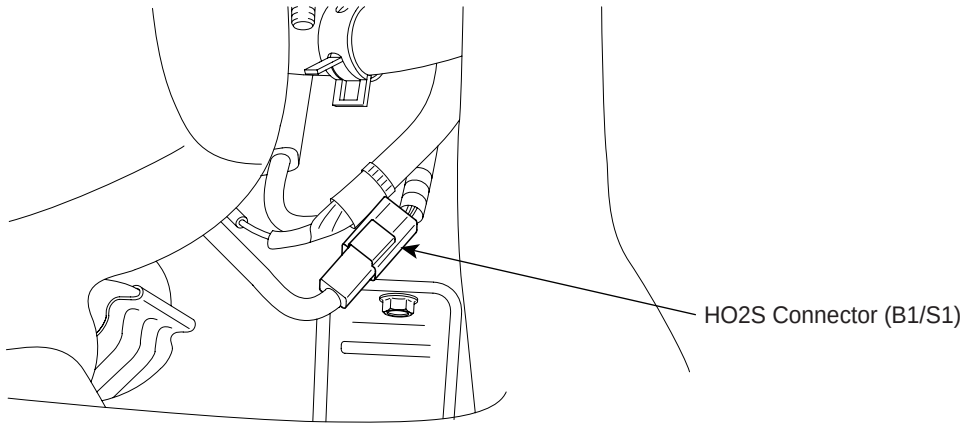
▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 / SENSOR 1)

COMPONENT LOCATION EC19C14E



EGQE501N

GENERAL DESCRIPTION E8436F5E

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The PCM 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 E3DCB6D1

The PCM determines if a front HO2S heater fault has occurred and sets DTC P0030 if the front HO2S heater control driver inside the PCM fails, if HO2S is not operational (after an elapse of predetermined time) since engine start, or when the front HO2S tip temperature is out of normal working range.

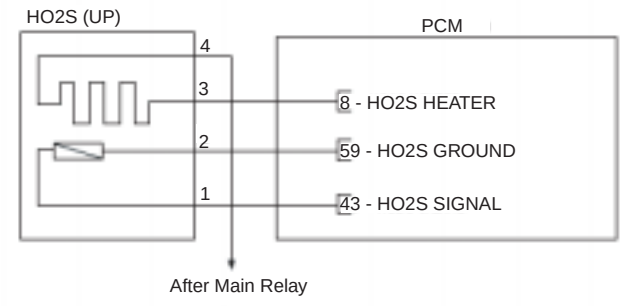
DTC DETECTING CONDITION E9DA9CDB

Item	Detecting Condition	Possible Cause
DTC Strategy	● Evaluate O2 sensor element temperature via measuring element resistance	● Related fuse blown or missing ● Heater control circuit open or short ● Power supply circuit open or short ● Contact resistance in connectors ● Faulty HO2S
Enable Conditions	● Sensor preheating and full heating phases finished ● Time after start elapsed:240 sec. ● 11V＜Battery voltage＜16V ● 1%＜Heater power＜99% ● Exhaust gas temp. model＜650°C (1,202°F)	
Threshold Value	● O2 sensor Element Resistance ＞2100 Ohm	
Diagnostic Time	● 5 min.	
Fail-Safe	● EVAP. emission control function is controlled in minimum operation mode	

SPECIFICATION EB9E0BE5

Temp.(℃)	Temp.(°F)	Front HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(°F)	Front HO2S Heater Resistance(Ω)
20	68	9.2	400	752	17.7
100	212	10.7	500	932	19.2
200	392	13.1	600	1,112	20.7
300	572	14.6	700	1,292	22.5

SCHEMATIC DIAGRAM E62A3FE4



[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 43	Signal
2	PCM Terminal 59	Ground
3	PCM Terminal 8	Heater Control
4	Main Relay	Battery Voltage

[CONNECTOR]

HO2S Harness side connector

C127

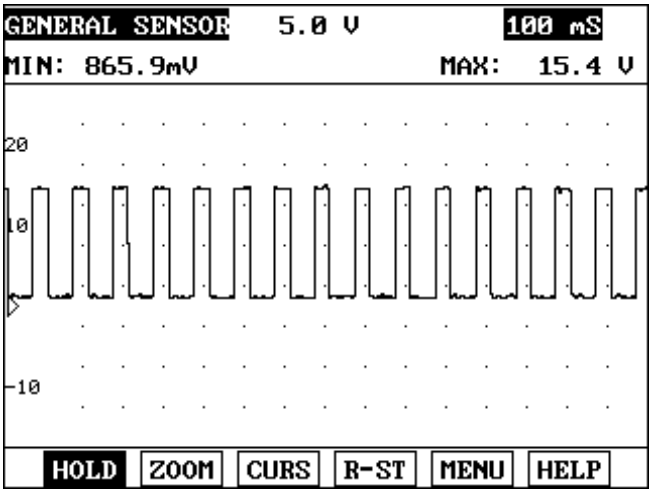
PCM side terminal

6	7	●	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	●	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	●	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B00307

SIGNAL WAVEFORM E1318E78

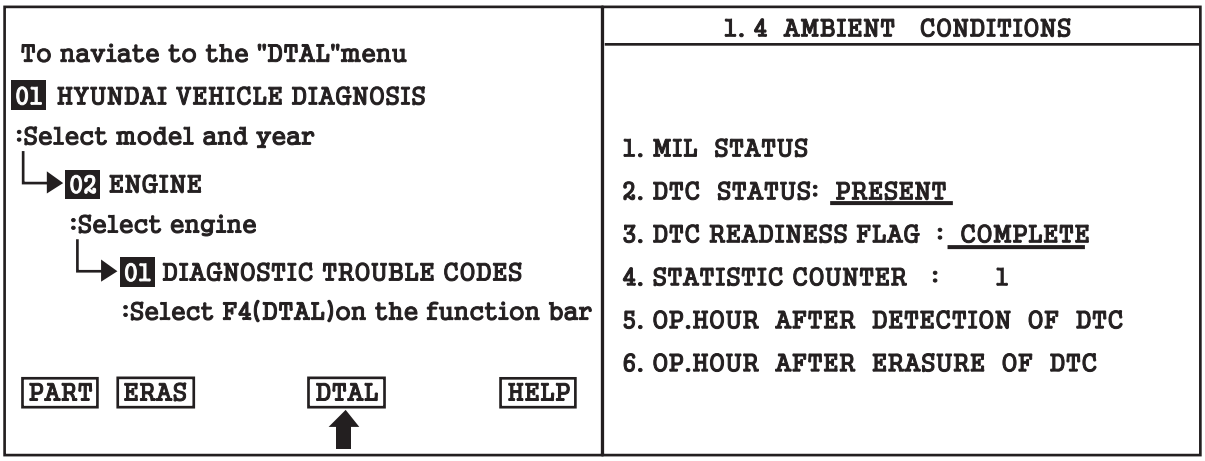


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element 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 EE38548F

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



B00112

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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION E4ABC1FD

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 EFC6790C

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

Specification :	Approx. B+

5. Is voltage display near the specified value?

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 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EC4626AF

1. Check for open in control harness.

   1) Ignition "OFF".

   2) Disconnect PCM connector

   3) Measure resistance between terminals 3 of the HO2S heater harness connector and 8 of the PCM 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 3 of the HO2S heater 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 control circuit.

   1) Reconnect the PCM connector.

   2) Ignition "ON" & Engine "OFF"

   3) Measure voltage between terminal 3 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

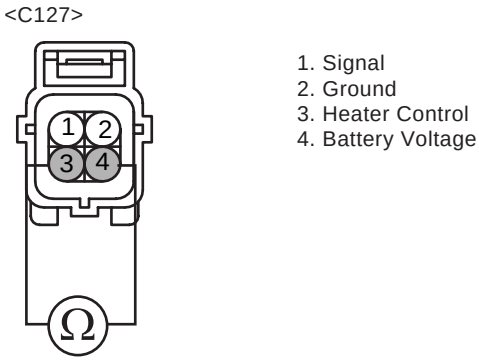
   ▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION E9CC9CA9

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Front HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(℉)	Front HO2S Heater Resistance(Ω)
20	68	9.2	400	752	17.7
100	212	10.7	500	932	19.2
200	392	13.1	600	1,112	20.7
300	572	14.6	700	1,292	22.5



B00306

2. Is HO2S heater resistance display near the specified value?

YES

▶ Check for poor connection between PCM 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 E281111B

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.

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

COMPONENT LOCATION E42B18D2

Refer to DTC P0030.

GENERAL DESCRIPTION E019ED6B

Refer to DTC P0030.

DTC DESCRIPTION E7F36BE9

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

DTC DETECTING CONDITION EBBE00E8

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	● 10 sec.	
Fail-Safe	● Heater open loop control	

SPECIFICATION EECE5E8B

Temp.(℃)	Temp.(°F)	Front HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(°F)	Front HO2S Heater Resistance(Ω)
20	68	9.2	400	752	17.7
100	212	10.7	500	932	19.2
200	392	13.1	600	1,112	20.7
300	572	14.6	700	1,292	22.5

SCHEMATIC DIAGRAM EBB52593

Refer to DTC P0030.

SIGNAL WAVEFORM E67B32FD

Refer to DTC P0030.

MONITOR DTC STATUS EA05E00D

Refer to DTC P0030.

TERMINAL AND CONNECTOR INSPECTION EDA5B8A0

Refer to DTC P0030.

POWER SUPPLY CIRCUIT INSPECTION E1ABFDB0

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

Specification : Approx. B+

5. Is voltage display near the specified value?

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 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EFF77B27

1. Check for open in control harness.
   1) Ignition "OFF".
   2) Disconnect PCM connector
   3) Measure resistance between terminals 3 of the HO2S heater harness connector and 8 of the PCM 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 3 of the HO2S heater harness connector and chassis ground.

Specification : infinite

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 E2A0AA35

Refer to DTC P0030.

VERIFICATION OF VEHICLE REPAIR E7216E30

Refer to DTC P0030.

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

COMPONENT LOCATION E3ACEFC3

Refer to DTC P0030.

GENERAL DESCRIPTION EAF7DD5A

Refer to DTC P0030.

DTC DESCRIPTION E4A1FBDF

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

DTC DETECTING CONDITION E921CA6C

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 harnesss ● Contact resistance in connectors ● Faulty HO2S
Enable Conditions	● Battery voltage＞10V ● 1%＜Heater power＜99%	
Threshold Value	● Open or short to Battery	
Diagnostic Time	● 10 sec.	
Fail-Safe	● Heater open loop control	

SPECIFICATION ED2FA874

Temp.(℃)	Temp.(℉)	Front HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(℉)	Front HO2S Heater Resistance(Ω)
20	68	9.2	400	752	17.7
100	212	10.7	500	932	19.2
200	392	13.1	600	1,112	20.7
300	572	14.6	700	1,292	22.5

SCHEMATIC DIAGRAM EFEDBDE7

Refer to DTC P0030.

SIGNAL WAVEFORM EE26B2FF

Refer to DTC P0030.

MONITOR DTC STATUS EBC7F094

Refer to DTC P0030.

TERMINAL AND CONNECTOR INSPECTION ECA788FB

Refer to DTC P0030.

CONTROL CIRCUIT INSPECTION E17AE508

1. Check for open in control harness.
   1) Ignition "OFF".
   2) Disconnect HO2S and PCM connectors
   3) Measure resistance between terminals 3 of the HO2S heater harness connector and 8 of the PCM 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 PCM connector.
   2) Ignition "ON" & Engine "OFF"
   3) Measure voltage between terminal 3 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 ED0C0B17

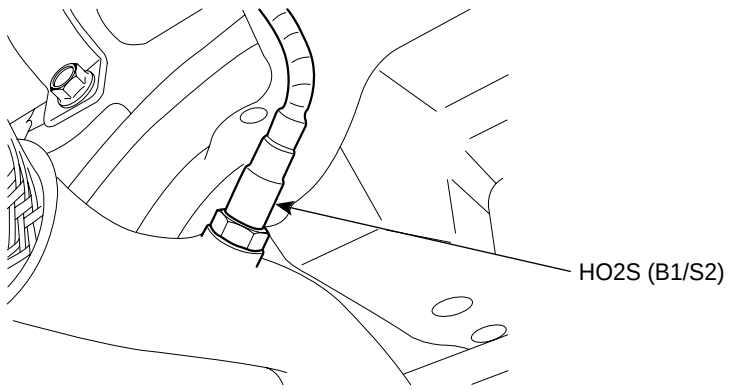
Refer to DTC P0030.

VERIFICATION OF VEHICLE REPAIR EA1DDABB

Refer to DTC P0030.

DTC P0036 HO2S HEATER CONTROL CIRCUIT (BANK 1 / SENSOR 2)

COMPONENT LOCATION EC557F7B



EGQE501M

GENERAL DESCRIPTION E03FD5EF

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The PCM 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 E83CAD65

The PCM determines when a rear HO2S heater fault occurs and sets DTC P0036 if measured rear HO2S resistance is lower than the predetermined threshold.

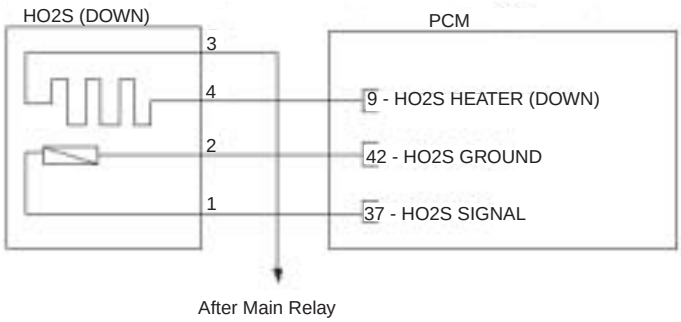
DTC DETECTING CONDITION E3CCD3E9

Item	Detecting Condition	Possible Cause
DTC Strategy	● Evaluate O2 sensor element temperature via measuring element resistance	● Related fuse blown or missing ● Heater control circuit open or short ● Power supply circuit open or short ● Contact resistance in connectors ● Faulty HO2S
Enable Conditions	● Sensor preheating and full heating phases finished ● Time after start elapsed:240 sec. ● 11V＜Battery voltage＜16V ● 1%＜Heater power＜99% ● Exhaust gas temp. model＜650°C (1,202°F)	
Threshold Value	● O2 sensor Element Resistance ＞1100 Ohm	
Diagnostic Time	● 5 min.	
Fail-Safe	● EVAP. emission control function is controlled in minimum operation mode	

SPECIFICATION E941BAEA

Temp.(℃)	Temp.(°F)	Rear HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(°F)	Rear HO2S Heater Resistance(Ω)
20	68	9.2	500	932	19.2
100	212	10.7	600	1,112	20.7
200	392	13.1	700	1,292	22.5
300	572	14.6	800	1,472	25.1
400	752	17.7	900	1,652	26.5

SCHEMATIC DIAGRAM EBF8CFF3

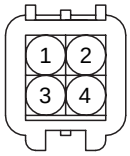


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 37	Ground
2	PCM Terminal 42	HO2S Signal
3	Main Relay	Battery Voltage
4	PCM Terminal 9	HO2S Heater(DOWN)

[CONNECTOR]

HO2S Harness side connector



C125

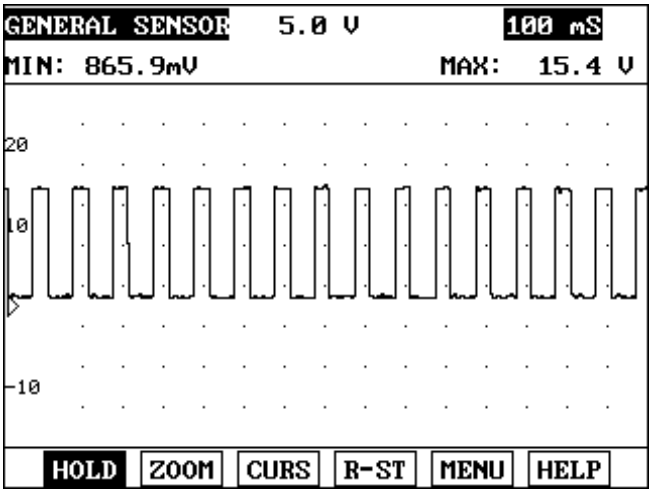
PCM side terminal

6	7	8	●	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	●	38	39	*	*	●	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B00361

SIGNAL WAVEFORM EACFC5F5

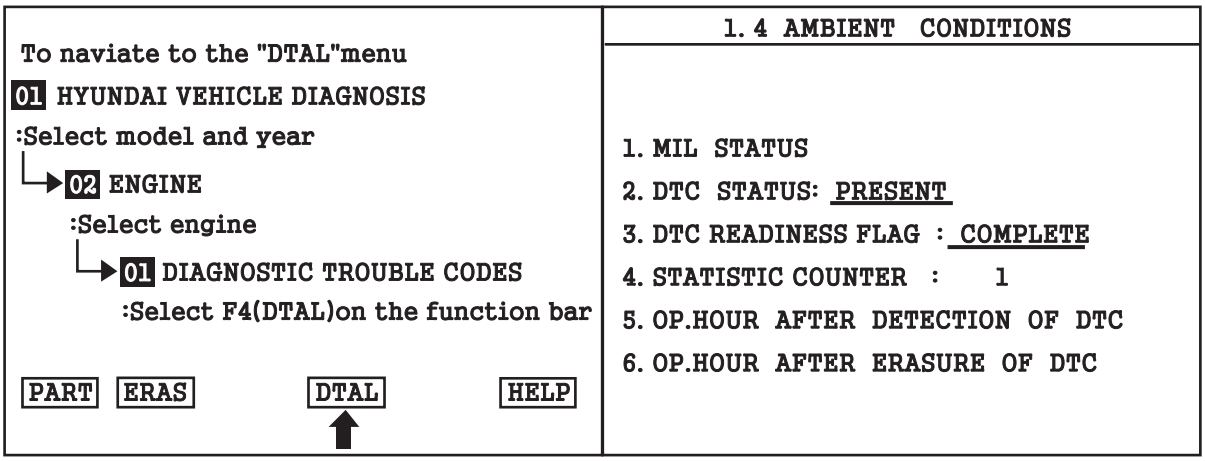


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element 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 E65F9200

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



B00112

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 PCM's connector or was repaired and PCM 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 E82F9007

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 E593E8AC

1. Ignition "OFF".
2. Disconnect HO2S sensor connecto.
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 HO2S
Especially check for "10A Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EF27A51B

1. Check for open in control harness.

   1) Ignition "OFF".

   2) Disconnect PCM connector

   3) Measure resistance between terminals 4 of the HO2S heater harness connector and 9 of the PCM 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

   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 control circuit.

   1) Reconnect the PCM 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

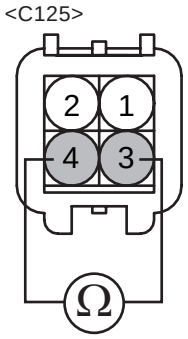
COMPONENT INSPECTION ECC7D3BE

1. Ignition "OFF".

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Rear HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(℉)	Rear HO2S Heater Resistance(Ω)
20	68	9.2	500	932	19.2
100	212	10.7	600	1,112	20.7
200	392	13.1	700	1,292	22.5
300	572	14.6	800	1,472	25.1
400	752	17.7	900	1,652	26.5



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

B00366

3. Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 EACDCAB8

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.

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

COMPONENT LOCATION E4D2EEFD

Refer to DTC P0036.

GENERAL DESCRIPTION EFE5A5FC

Refer to DTC P0036.

DTC DESCRIPTION EC9DDB98

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

DTC DETECTING CONDITION E0FCB009

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	● 10 sec.	
Fail-Safe	● Heater open loop control	

SPECIFICATION E33ACFA2

Temp.(℃)	Temp.(°F)	Rear HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(°F)	Rear HO2S Heater Resistance(Ω)
20	68	9.2	500	932	19.2
100	212	10.7	600	1,112	20.7
200	392	13.1	700	1,292	22.5
300	572	14.6	800	1,472	25.1
400	752	17.7	900	1,652	26.5

SCHEMATIC DIAGRAM E76C7611

Refer to DTC P0036.

SIGNAL WAVEFORM E2E4B3B6

Refer to DTC P0036.

MONITOR DTC STATUS E8E19ABD

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION ED4DFE33

Refer to DTC P0036.

POWER SUPPLY CIRCUIT INSPECTION EFEF1D41

1. Ignition "OFF".
2. Disconnect HO2S sensor connecto.
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 HO2S
Especially check for "10A Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E489EB5E

1. Check for open in control harness.
   1) Ignition "OFF".
   2) Disconnect the PCM connector
   3) Measure resistance between terminals 4 of the HO2S heater harness connector and 9 of the PCM 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

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 EA764057

Refer to DTC P0036.

VERIFICATION OF VEHICLE REPAIR E3B35FDA

Refer to DTC P0036.

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

COMPONENT LOCATION ED754112

Refer to DTC P0036.

GENERAL DESCRIPTION EC3E4E24

Refer to DTC P0036.

DTC DESCRIPTION EFCE9DB9

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

DTC DETECTING CONDITION EAAEFC3E

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	● 10 sec.	
Fail-Safe	● Heater open loop control	

SPECIFICATION E8E18ACB

Temp.(℃)	Temp.(℉)	Rear HO2S Heater Resistance(Ω)	Temp.(℃)	Temp.(℉)	Rear HO2S Heater Resistance(Ω)
20	68	9.2	500	932	19.2
100	212	10.7	600	1,112	20.7
200	392	13.1	700	1,292	22.5
300	572	14.6	800	1,472	25.1
400	752	17.7	900	1,652	26.5

SCHEMATIC DIAGRAM EBA4AFCB

Refer to DTC P0036.

SIGNAL WAVEFORM EE256D5E

Refer to DTC P0036.

MONITOR DTC STATUS E31BC367

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION EEDFDAEA

Refer to DTC P0036.

CONTROL CIRCUIT INSPECTION E4205E7B

1. Check for open in control harness.
   1) Ignition "OFF".
   2) Disconnect HO2S and PCM connectors.
   3) Measure resistance between terminals 4 of the HO2S heater harness connector and 9 of the PCM 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) Reconnect the PCM 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 resistance within the specification?

      YES

      ▶ Go to "Component Inspection" procedure

      NO

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

COMPONENT INSPECTION E9CA05EE

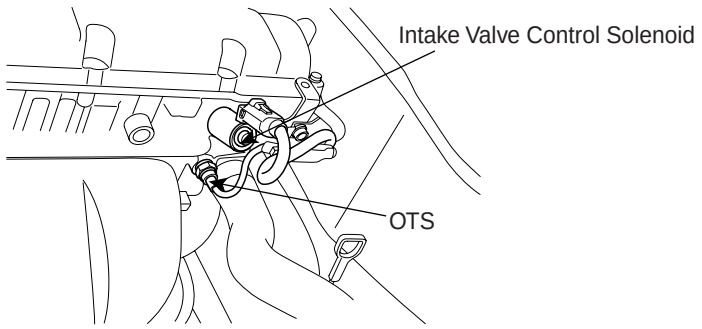
Refer to DTC P0036.

VERIFICATION OF VEHICLE REPAIR E1F0A3F4

Refer to DTC P0036.

DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

COMPONENT LOCATION EE1769A8



EGQE603M

GENERAL DESCRIPTION EB2826A2

The CVVT (Continuously Variable Valve Timing) system built on the camshaft helps the engine decrease the exhaust gas and increase engine power and fuel economy by changing the valve open/close timing of the intake camshaft continuously. The intake valve control solenoid, the main control part of the CVVT, changes the direction of the oil path through the CVVT by the duty control of the PCM and changes the open and close timing of the intake and exhaust valves.

DTC DESCRIPTION EF2D8CBC

PCM sets DTC P0076 if the PCM detects that the intake valve control solenoid control circuit is short to ground.

DTC DETECTING CONDITION E1EB0226

Item	Detecting Condition	Possible Cause
DTC Strategy	● Electrical check	● Short to ground in control circuit ● Contact resistance in connectors ● Faulty Intake Valve Control Solenoid
Enable Conditions	● 100mS after ignition key ON ● 10 < Battery voltage <16	
Threshold Value	● Short to ground	
Diagnostic Time	● 2 seconds.	
Fail-Safe	● No intake valve control solenoid activity	

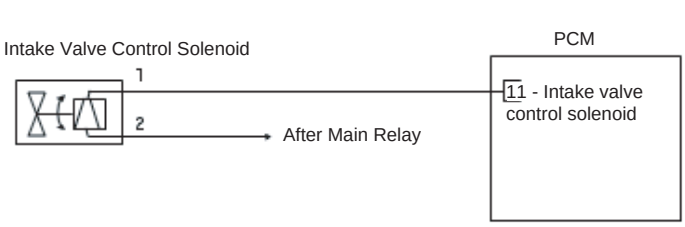
SPECIFICATION EDFDCF25

Intake valve control solenoid	Normal Parameter
Insulation Resistance (Ω)	above 50 MΩ

Temp.(℃)	Temp.(℉)	Resistance(Ω)	Temp.(℃)	Temp.(℉)	Resistance(Ω)
0	32	6.2 ~ 7.4	60	140	8.0 ~ 9.2

10	50	6.5 ~ 7.7	70	158	8.3 ~ 9.5
20	68	6.8 ~ 8.0	80	176	8.6 ~ 9.8
30	86	7.1 ~ 8.3	90	194	8.9 ~ 10.1
40	104	7.4 ~ 8.6	100	212	9.2 ~ 10.4
50	122	7.7 ~ 8.9			

SCHEMATIC DIAGRAM EA0DFECA

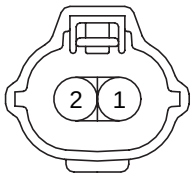


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 11	Control
2	Main Relay	Battery Voltage

[CONNECTOR]

IVCS Harness side connector



C166

PCM side terminal

6	7	8	9	10	●	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B00761

SIGNAL WAVEFORM E603DCC0

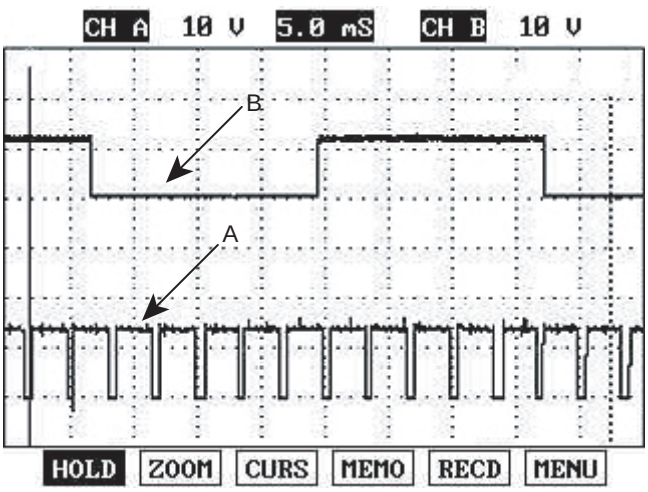


Fig.1: Idle

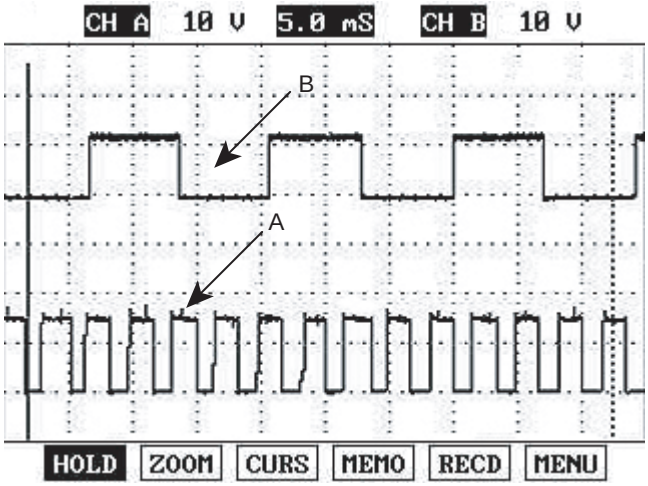


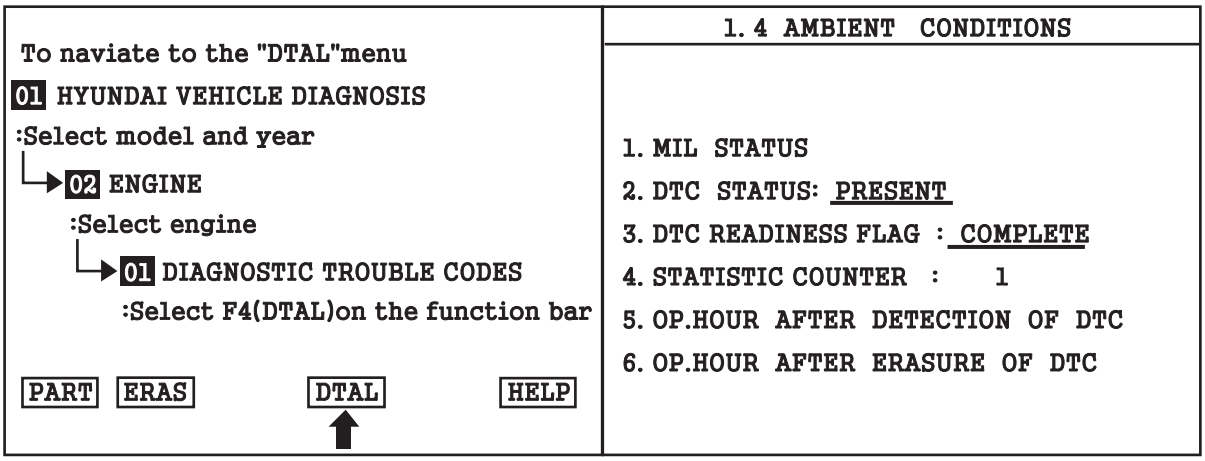
Fig.2 : 2000 rpm

A : Intake valve control solenoid, B : Engine speed
The intake valve control solenoid is operated by the duty control of the PCM.
Duty ratio of the Intake valve control solenoid increases with engine speed & load

B00762

MONITOR DTC STATUS E9C0EBCC

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



B00112

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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure

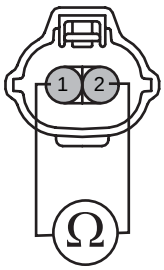
COMPONENT INSPECTION E80AE9DD

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Resistance(Ω)	Temp.(℃)	Temp.(℉)	Resistance(Ω)
0	32	6.2 ~ 7.4	60	140	8.0 ~ 9.2
10	50	6.5 ~ 7.7	70	158	8.3 ~ 9.5
20	68	6.8 ~ 8.0	80	176	8.6 ~ 9.8
30	86	7.1 ~ 8.3	90	194	8.9 ~ 10.1
40	104	7.4 ~ 8.6	100	212	9.2 ~ 10.4
50	122	7.7 ~ 8.9			

<C166>



1. Intake Valve Control
2. Battery Voltage

B00763

4. Is resistance within specification?

YES

▶ Go to next step as below.

NO

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

POWER SUPPLY CIRCUIT INSPECTION E3B1266A

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between terminal 2 of the intake valve control solenoid harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

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

CONTROL CIRCUIT INSPECTION E5FA2468

1. Measure resistance between terminal 1 of the intake valve control solenoid harness connector and chassis ground.

Specification : Infinite

2. Is resistance within specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

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

TERMINAL AND CONNECTOR INSPECTION EB65A1E4

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

▶ Check for poor connection between PCM 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 E6F9C973

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.

DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

COMPONENT LOCATION EAB79249

Refer to DTC P0076

GENERAL DESCRIPTION E5D02958

Refer to DTC P0076.

DTC DESCRIPTION E07A77D3

PCM sets DTC P0077 if the PCM detects that the OCV control circuit is open or short to battery.

DTC DETECTING CONDITION ED6E4CEC

Item	Detecting Condition	Possible Cause
DTC Strategy	● Electrical check	● Open or short to battery in control circuit ● Contact resistance in connectors ● Faulty Intake Valve Control Solenoid
Enable Conditions	● 100mS after ignition key ON ● 10 < Battery voltage <16	
Threshold Value	● Open or short to battery	
Diagnostic Time	● 2 seconds.	

SPECIFICATION E3C2BB70

Intake valve control solenoid	Normal Parameter
Insulation Resistance (Ω)	above 50 MΩ

Temp.(℃)	Temp.(℉)	Resistance(Ω)	Temp.(℃)	Temp.(℉)	Resistance(Ω)
0	32	6.2 ~ 7.4	60	140	8.0 ~ 9.2
10	50	6.5 ~ 7.7	70	158	8.3 ~ 9.5
20	68	6.8 ~ 8.0	80	176	8.6 ~ 9.8
30	86	7.1 ~ 8.3	90	194	8.9 ~ 10.1
40	104	7.4 ~ 8.6	100	212	9.2 ~ 10.4
50	122	7.7 ~ 8.9			

SCHEMATIC DIAGRAM EE7D69E9

Refer to DTC P0076.

SIGNAL WAVEFORM EBFD1E83

Refer to DTC P0076.

MONITOR DTC STATUS EFE3849C

Refer to DTC P0076.

COMPONENT INSPECTION E12A02FE

Refer to DTC P0076.

CONTROL CIRCUIT INSPECTION EFBC4B83

1. Ignition "OFF".
2. Disconnect intake valve control solenoid and PCM connectors.
3. Ignition "ON".
4. Measure voltage between terminals 1 of the intake valve control solenoid connector and chassis ground.

Specification : Below 0.5V

5. Is voltage within specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

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

TERMINAL AND CONNECTOR INSPECTION EC3D99F8

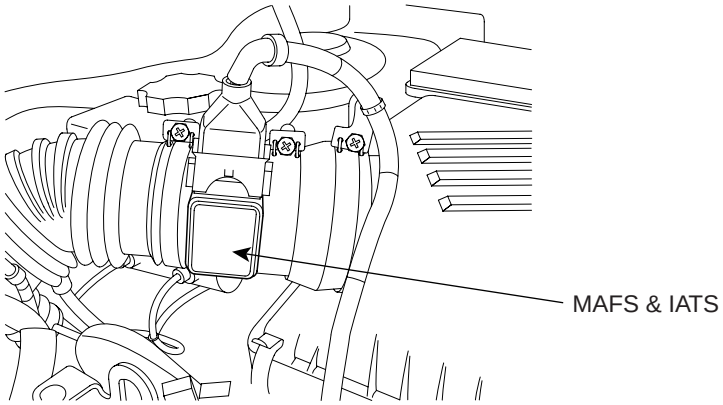
Refer to DTC P0076.

VERIFICATION OF VEHICLE REPAIR E0326EFF

Refer to DTC P0076.

DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EE0DDCA5



EGQE501T

GENERAL DESCRIPTION E13A82A4

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 PCM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION E6CA391F

The PCM 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 PCM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.
The modeled Mass Air Flow value is determined by engine speed, throttle angle and ICA duty.

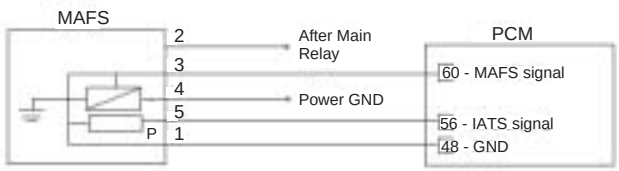
DTC DETECTING CONDITION E8AAB726

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	● No relevant failure ● 11 ≤ Battery voltage ≤ 16V ● Lambda control active	
Threshold Value	● Calculated MAF - Measured MAF > 300 mg/rev	
Diagnostic Time	● 200 revolutions.	

SPECIFICATION ED8414BB

Test Comdition	MAF(V)	MAF(kg/h)	TPS(V)	TPS(kΩ)
Idle	0.6 ~ 1.0	11.66 ~ 19.85	0.2 ~ 0.8	0.71 ~ 1.38
3000 rpm	1.7 ~ 2.0	43.84 ~ 58.79	-	-
W.O.T	-	-	4.3 ~ 4.8	0.2 ~ 3.4

SCHEMATIC DIAGRAM EF18D23A

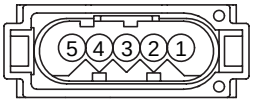


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 48	Sensor ground
2	Main Relay	Battery Voltage
3	PCM Terminal 60	MAFS signal
4	Power ground	Ground
5	PCM Terminal 56	IATS signal

[CONNECTOR]

MAFS Harness side connector



C113

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	●	*	50	51	52	*	54	55	●	*	58	59	●	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B01011

SIGNAL WAVEFORM E42809CD

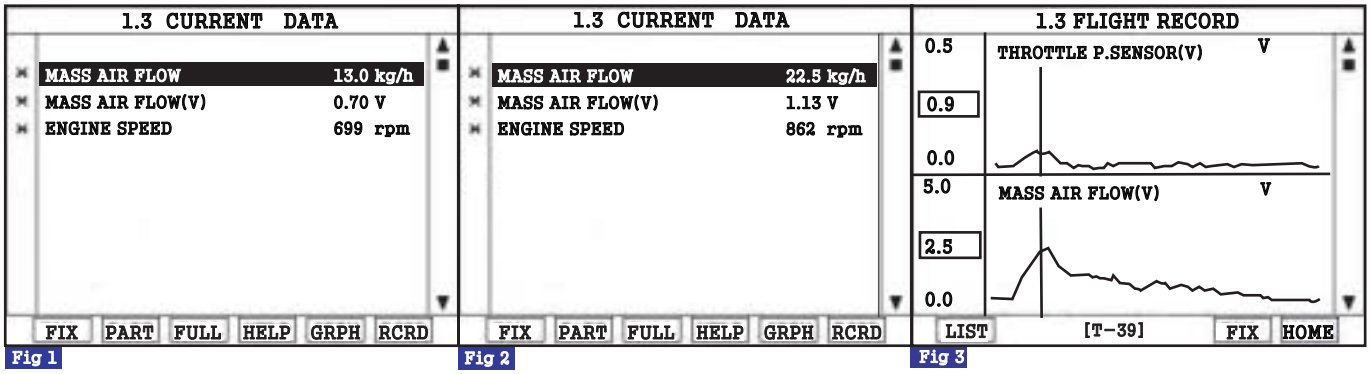


Fig 1 Fig 2 Fig 3

Fig 1) Normal value with idle after warm up : Approx. 0.6~1.0V
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

B01012

MONITOR DTC STATUS EA2DEEC6

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
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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

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 E3EBF459

1. Check 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 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. Install Scantool and monitor the "THROTTLE P.SENSOR(V)" parameter on the Scantool data list.

Specification : Approx. 0.25~0.80V(Closed throttle Valve) Approx 4.0~4.4V(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

TERMINAL AND CONNECTOR INSPECTION EBB3F16B

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 EE4C4FE6

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

Specification : Approx. 0.6 ~ 1.0V at idle & No load

3. Is MAF sensor voltage near the specified value?

YES

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

VERIFICATION OF VEHICLE REPAIR EF03CE7C

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.

DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

COMPONENT LOCATION ED8E2CE0

Refer to DTC P0101.

GENERAL DESCRIPTION E00BD2F9

Refer to DTC P0101.

DTC DESCRIPTION E5B2A99C

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

DTC DETECTING CONDITION E1A9EE0C

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	● 11 ≤ Battery voltage ≤ 16V ● Engine speed > Approx. 540 rpm	
Threshold Value	● Measured MAF < 2 kg/h	
Diagnostic Time	● 10 revolutions.	

SPECIFICATION EC66F40E

Test Comdition	MAF(V)	MAF(kg/h)	TPS(V)	TPS(kΩ)
Idle	0.6 ~ 1.0	11.66 ~ 19.85	0.2 ~ 0.8	0.71 ~ 1.38
3000 rpm	1.7 ~ 2.0	43.84 ~ 58.79	-	-
W.O.T	-	-	4.3 ~ 4.8	0.2 ~ 3.4

SCHEMATIC DIAGRAM E8F9220D

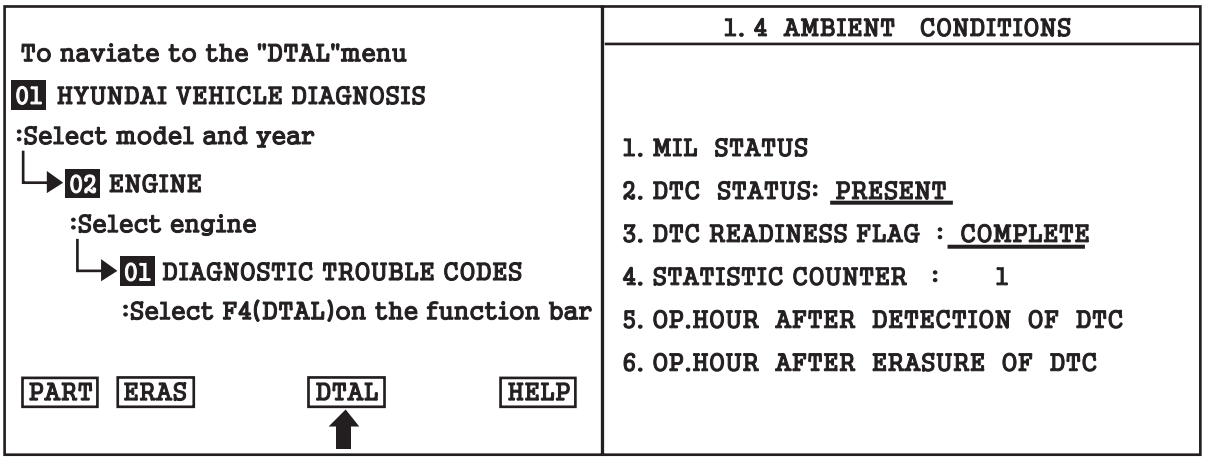
Refer to DTC P0101.

SIGNAL WAVEFORM E30AE0AA

Refer to DTC P0101.

MONITOR DTC STATUS EF9E4EB1

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



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E6E1CC3E

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 EAA572CE

1. Ignition "OFF".

2. Disconnect MAF sensor connector.

3. Ignition "ON" & Engine "OFF"

4. Measure voltage between terminal 2 of the sensor 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 MAF sensor and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EDADBF41

1. Check for open in signal harness.

   1) Ignition "OFF".

   2) Disconnect PCM connector.

   3) Measure resistance between terminals 3 of sensor harness connector and 60 of the PCM harness connector.

Specification : Approx. 0Ω

   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) Measure resistance between terminal 3 of sensor harness connector and chassis ground.

Specification : Infinite

   2) Is resistance within the specification?

   YES

   ▶ Go to "Component Inspection" procedure.

   NO

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

COMPONENT INSPECTION E1AB965B

Refer to DTC P0101.

VERIFICATION OF VEHICLE REPAIR E45F0CD5

Refer to DTC P0101.

DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

COMPONENT LOCATION E32AEDB0

Refer to DTC P0101.

GENERAL DESCRIPTION E1FB8B32

Refer to DTC P0101.

DTC DESCRIPTION E69B39C7

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

DTC DETECTING CONDITION E85BCECC

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	● 10 ≤ Battery voltage ≤ 16V ● Engine speed > Approx. 540 rpm	
Threshold Value	● Measured MAF > 650 kg/h	
Diagnostic Time	● 10 revolutions.	

SPECIFICATION EDC62C5A

Test Comdition	MAF(V)	MAF(kg/h)	TPS(V)	TPS(kΩ)
Idle	0.6 ~ 1.0	11.66 ~ 19.85	0.2 ~ 0.8	0.71 ~ 1.38
3000 rpm	1.7 ~ 2.0	43.84 ~ 58.79	-	-
W.O.T	-	-	4.3 ~ 4.8	0.2 ~ 3.4

SCHEMATIC DIAGRAM E0D9DB6A

Refer to DTC P0101.

SIGNAL WAVEFORM E570AF6D

Refer to DTC P0101.

MONITOR DTC STATUS EAEEE775

Refer to DTC P0101.

TERMINAL AND CONNECTOR INSPECTION EC1CFCEF

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 EB75F1FA

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 EEF5499D

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

2. Measure voltage between terminal 3 of sensor harness connector and chassis ground.

Specification : Approx. 0V

3. Is MAF sensor 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 EB2DDAE9

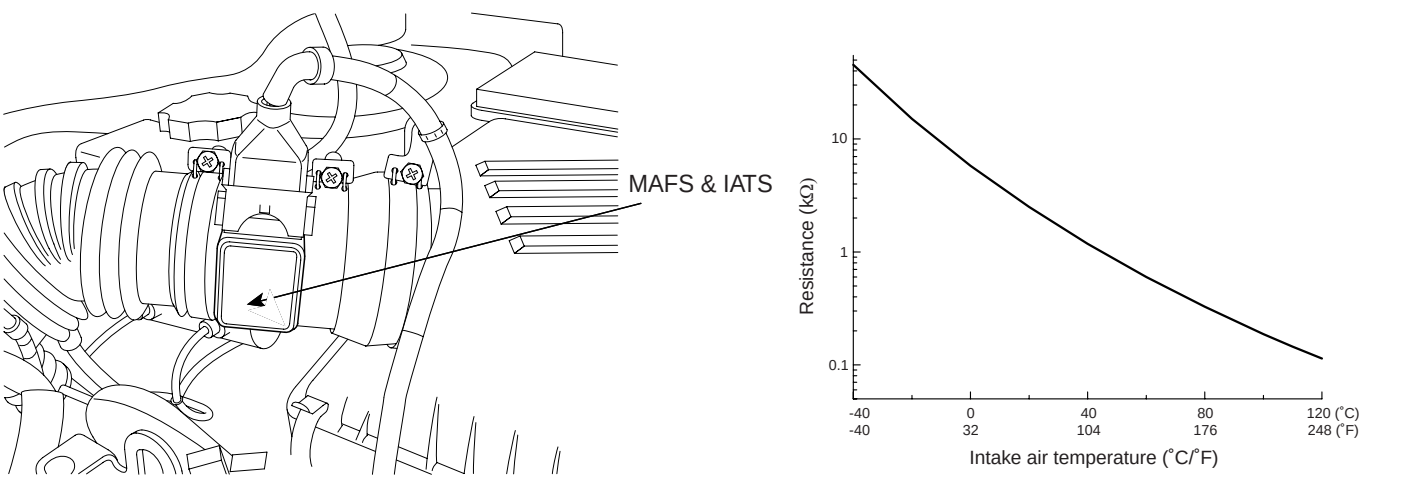
Refer to DTC P0101.

VERIFICATION OF VEHICLE REPAIR E0A04E8D

Refer to DTC P0101.

DTC P0111 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EEAD0B7D



EGQE590B

GENERAL DESCTIPTION E4AB7985

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 PCM is supplied to the IATS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM corrects basic fuel injection duration and ignition timing.

DTC DESCRIPTION EA87D7FB

The purpose of this diagnosis is to detect a stuck intake air temperature signal. The diagnostic function checks whether after a variation of the calculated intake air temperature also a variation of the measured intake air temperature is detected.PCM sets DTC P0111 when the variation of measured intake air temperature from engine start is smaller than threshold while variation of calculated intake air temperature by PCM is greater than threshold.

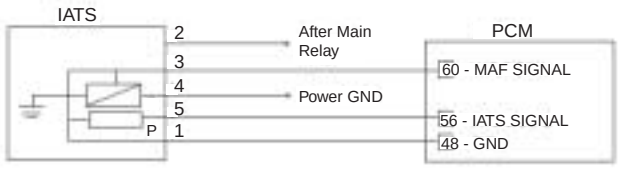
DTC DETECTING CONDITION E5119C9A

Item	Detecting Condition	Possible Cause
DTC Strategy	● Check intake air temperature signal stuck.	● Contact resistance in connections. ● Faulty IAT sensor
Enable Conditions	● Time after engine start > 300sec. ● Coolant temp. > 76℃(169°F) ● Coolant temp. increasing after start > 40℃(104°F) ● Vehicle speed < 5km/h(3 mph) ● No relevant failure	
Threshold value	● Difference between intake air temp. at stat and minimum air temp. < 1.5℃(34.7°F) and difference between maximum air temp. and intake air temp. at stat and <1.5℃(34.7°F)	
Diagonostic Time	● 5 sec.	

SPECIFICATION E02AC2A5

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-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	2.35 ~ 2.54	80	176	0.31 ~ 0.32

SCHEMATIC DIAGRAM E281C0AB

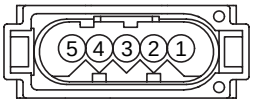


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 48	Sensor ground
2	Main Relay	Battery Voltage
3	PCM Terminal 60	MAFS signal
4	Power ground	Ground
5	PCM Terminal 56	IATS signal

[CONNECTOR]

IATS Harness side connector



C113

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	●	*	50	51	52	*	54	55	●	*	58	59	●	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B01112

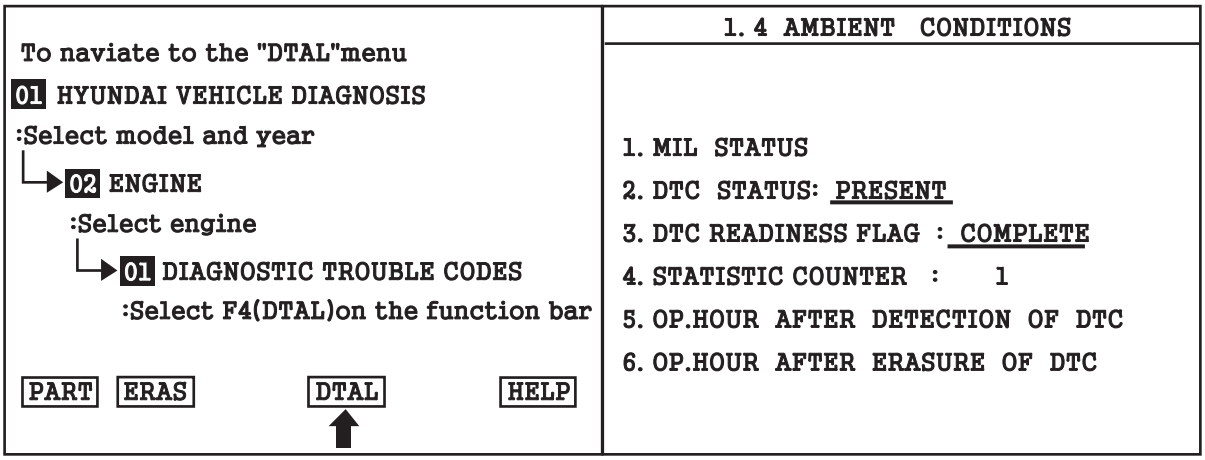
MONITOR DTC STATUS EFDD2E19

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



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION E3FF6D18

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

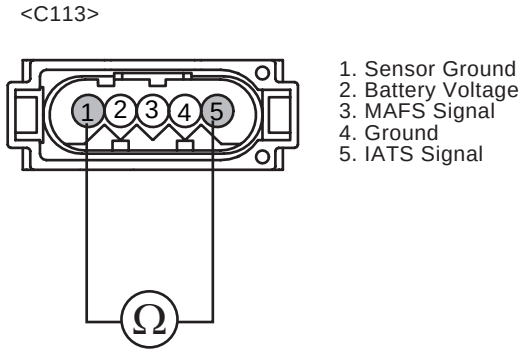
▶ Go to "Component Inspection" procedure .

COMPONENT INSPECTION E8091B23

1. Ignition "OFF"
2. Disconnect IATS connector.
3. Measure resistance between terminals 1 and 5 of the sensor connector(Component side).

SPECIFICATION

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-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	2.35 ~ 2.54	80	176	0.31 ~ 0.32



B01111

4. Is resistance within the specification?

YES

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

VERIFICATION OF VEHICLE REPAIR EC9E893C

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.

DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

COMPONENT LOCATION E22B25BF

Refer to DTC P0111.

GENERAL DESCTIPTION E8199BC9

Refer to DTC P0111.

DTC DESCRIPTION EBDD104B

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

DTC DETECTING CONDITION EFBE17DC

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 < 16V ● After 60 seconds from engine start	
Threshold value	● Measured intake air temperature > 142℃(287°F)	
Diagonostic Time	● 5 seconds.	

SPECIFICATION ECCE6C5F

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-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	2.35 ~ 2.54	80	176	0.31 ~ 0.32

SCHEMATIC DIAGRAM EE9ED26E

Refer to DTC P0111.

SIGNAL WAVEFORM E37A59E3

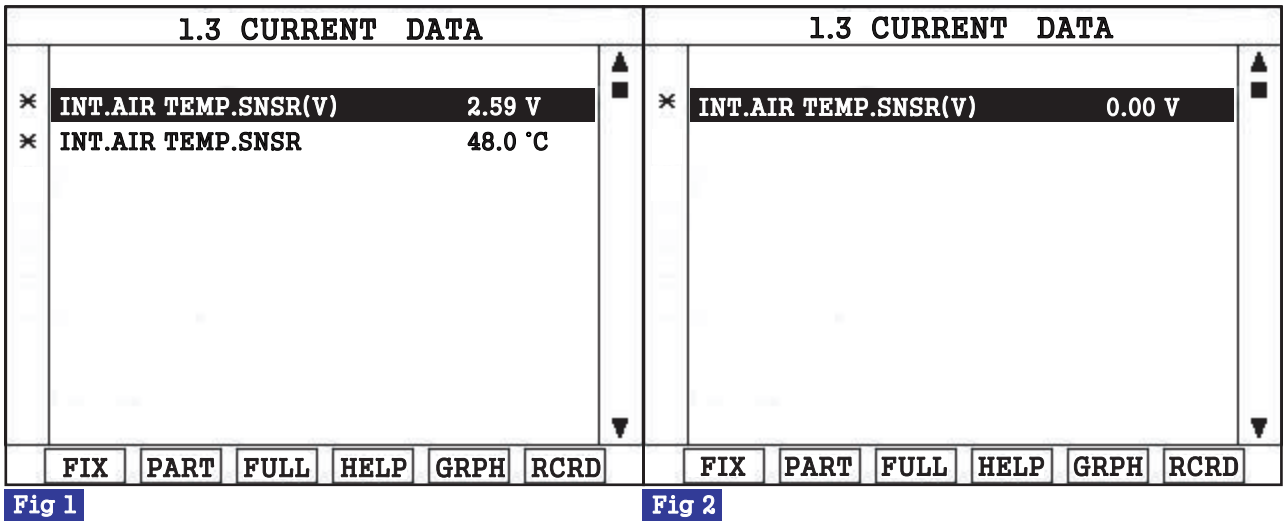
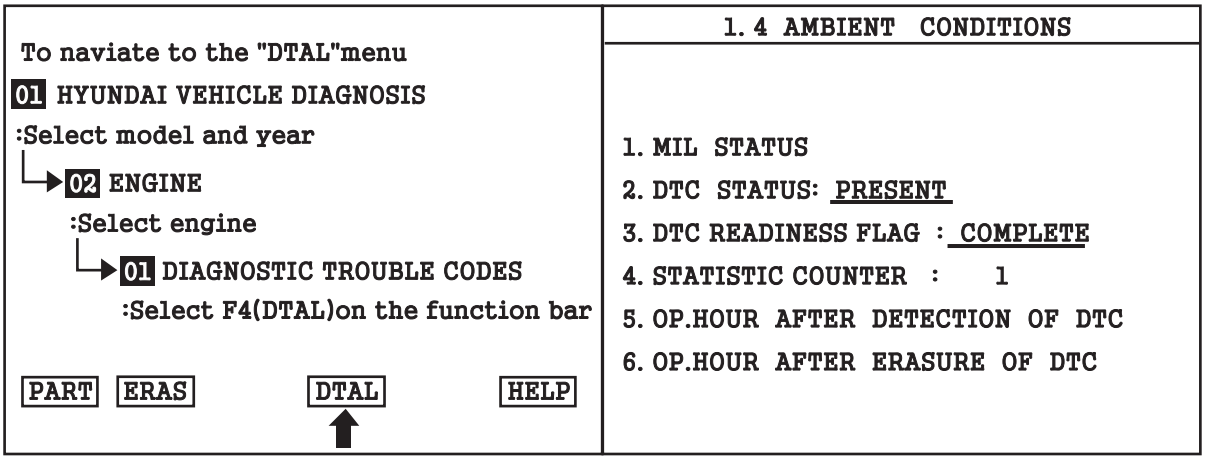


Fig 1) Signal decteases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2.59V at 48℃(118°F)
Fig 2) Short to ground in signal circuit : Approx. 0V

B00121

MONITOR DTC STATUS EE04F7E2

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



B00112

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 PCM's connector, which was repaired but PCM 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.

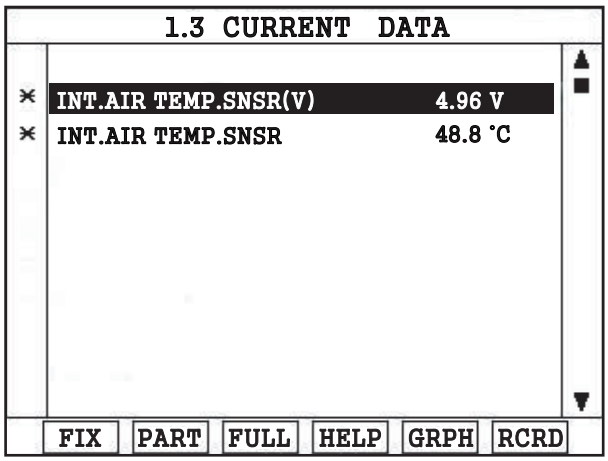
NO

▶ Go to "Monitor Scantool Data" procedure

MONITOR SCANTOOL DATA EBA535E6

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



B01121

4. Is displayed IAT data near the specified value.?

YES

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

NO

▶ Possibility of signal circuit short to ground. Go to next step as below.

SIGNAL CIRCUIT INSPECTION E9ABABFE

1. Ignition "OFF".
2. Disconnect IATS connector.
3. Measure resistance between terminal 5 of the sensor harness connector and chassis ground.

Specification : Infinite

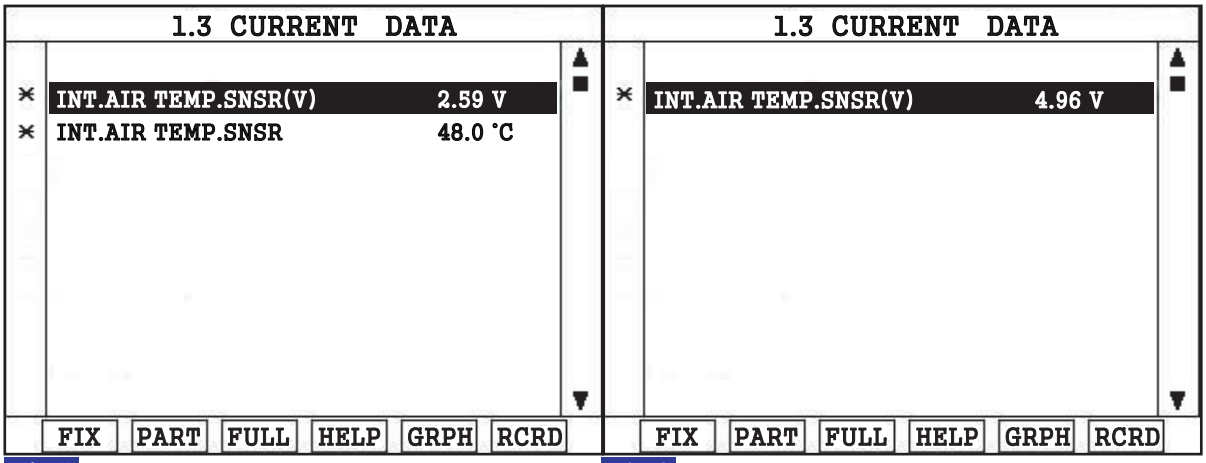


Fig 1 Fig 2

Fig 1) Signal decteases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2.59V at 48℃(118°F)
Fig 2) Short to ground in signal circuit : Approx. 0V

B01122

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 & CONNECTOR INSPECTION E259B09A

Refer to DTC P0111.

COMPONENT INSPECTION E6FBDE99

Refer to DTC P0111.

VERIFICATION OF VEHICLE REPAIR E19CA5AC

Refer to DTC P0111.

DTC P0113 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT HIGH INPUT

COMPONENT LOCATION E492DCEB

Refer to DTC P0111.

GENERAL DESCRIPTION E6625B89

Refer to DTC P0111.

DTC DESCRIPTION EB3DCAFD

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

DTC DETECTING CONDITION E76F77FD

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 < 16V ● After 60 seconds from engine start	
Threshold Value	● Measured intake air temperature < -46℃(-51°F).	
Diagnostic Time	● 5 seconds	
Fail-Safe	● No failure detected on ECTS · The limp home value of IATS depends on engine coolant temperature. ● Failure detected on ECTS · PCM controls with mapping data.	

SPECIFICATION E2EA2D0F

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-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	2.35 ~ 2.54	80	176	0.31 ~ 0.32

SCHEMATIC DIAGRAM EFE79210

Refer to DTC P0111.

SIGNAL WAVEFORM EA140013

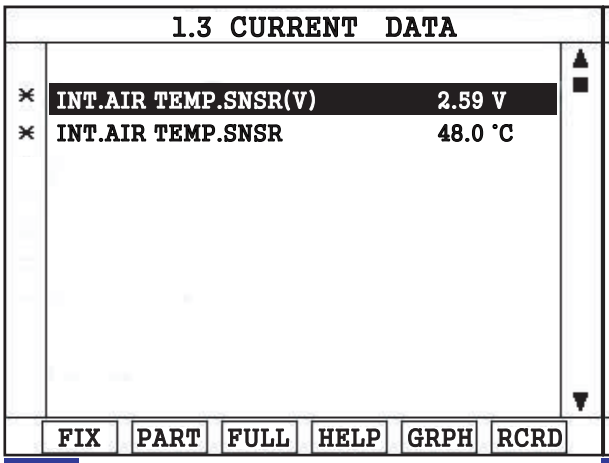


Fig 1

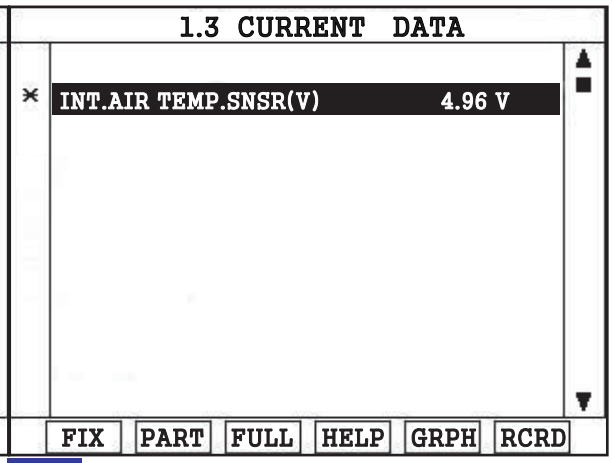


Fig 2

Fig 1) Signal decteases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2.59V at 48℃(118˚F)
Fig 2) Short to ground in signal circuit : Approx. 0V

B01122

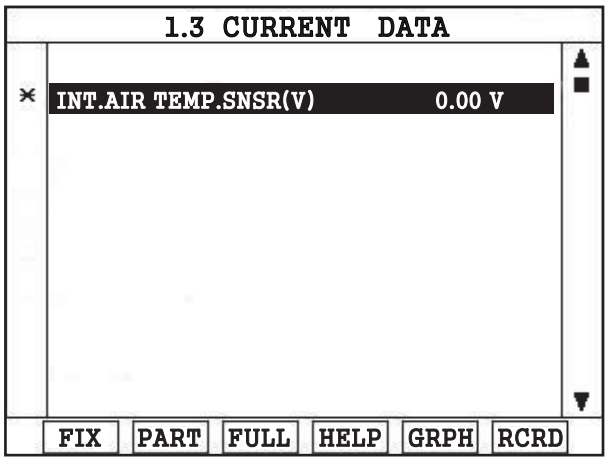
MONITOR DTC STATUS EFED1E2D

Refer to DTC P0111.

MONITOR SCANTOOL DATA EC8DDCB0

1. Ignition "ON" & Engine "OFF".
2. Disconnect IATS connector.
3. Connect Scantool and monitor the "INT.AIR TEMP. SNSR(V)" parameter on the Scantool data list.
4. Jumper the terminals 1 and 5 of the sensor harness connector together.

Specification : Approx. 0V



B01132

5. Is IAT data near the specified value.?

YES

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

NO

▶ Go to next step as below.

6. Jumper the terminal 5 of the IATS harness connector to chassis ground.
7. Read "INT.AIR TEMP. SNSR(V)" parameter on the Scantool.

Specification : Approx. 0V

8. Is displayed IAT data near the specified value.?

YES

▶ Possibility of open in IATS 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 ED5DDBCE

1. Ignition "OFF".
2. Disconnect PCM connector.
3. Measure resistance between terminals 1 of the sensor harness connector and 48 of the PCM harness connector.

Specification : Approx. 0Ω

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 E3B94A44

1. Check for open in signal circuit.
   1) Measure resistance between terminals 5 of the sensor harness connector and 56 of the PCM 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) With IATS and PCM connector still disconnected, measure voltage between terminals 5 of sensor harness connector and 56 of the PCM 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 & CONNECTOR INSPECTION E7D38EC3

Refer to DTC P0111.

COMPONENT INSPECTION E2633D5E

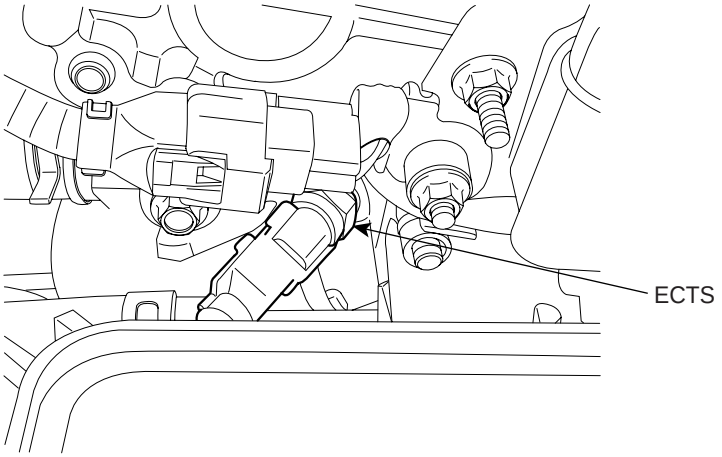
Refer to DTC P0111.

VERIFICATION OF VEHICLE REPAIR E8DA026F

Refer to DTC P0111.

DTC P0116 ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EAE7C8BD



EGQE501F

GENERAL DESCTIPTION E75A263B

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 PCM is supplied to the ECTS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM 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 EDD5E6B7

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.PCM 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 PCM is greater than threshold.

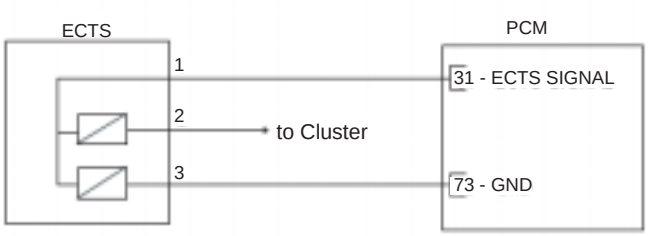
DTC DETECTING CONDITION EA7D1C22

Item	Detecting Condition	Possible Cause
DTC Strategy	● Check coolant temperature signal stuck.	● Contact resistance in connections. ● Faulty ECT sensor
Enable Conditions	● No ECTS failure ● 6 < Battery voltage < 16V	
Threshold value	● TCOmodel increase > Threshold But TCOmeas increase < Threshold (Threshold depends on Coolant start temp.	
Diagonostic Time	● 10~30 minutes	

SPECIFICATION E66C813B

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

SCHEMATIC DIAGRAM EFAA09C6

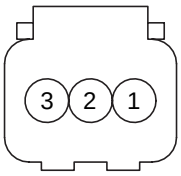


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 31	ECTS signal
2	Cluster	-
3	PCM Terminal 73	Sensor ground

[CONNECTOR]

ECTS Harness side connector



C104

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	●	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	●	*	75	76	77	78	*	80	81	2	1

C130-1

B01161

SIGNAL WAVEFORM E3CCC644

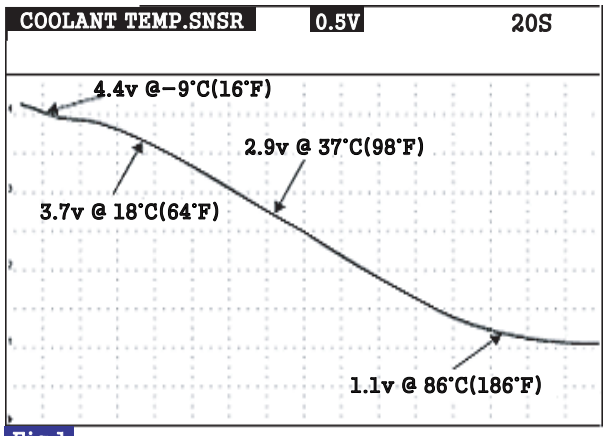


Fig 1

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

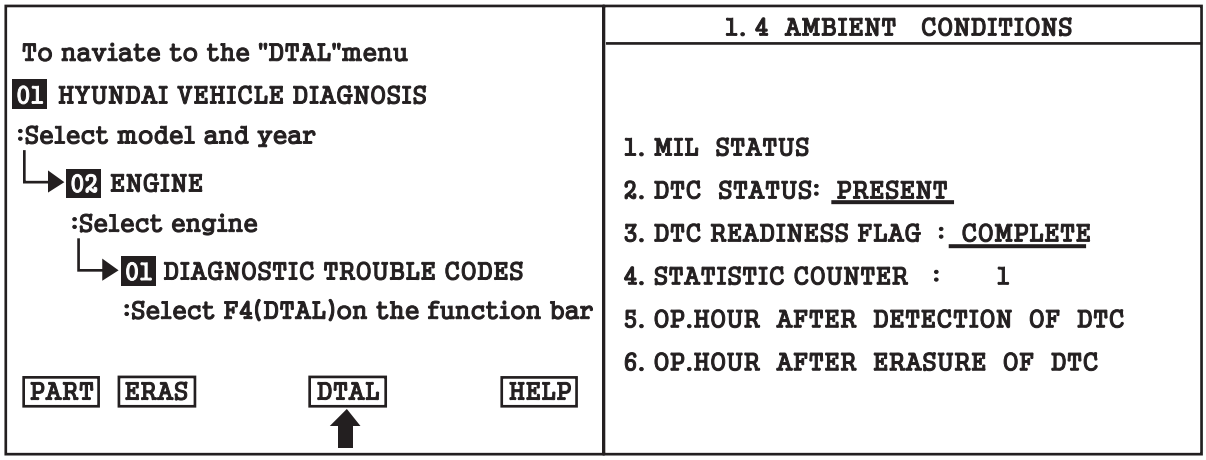
A01161

MONITOR DTC STATUS E854F4CF

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



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION E4C1DAD0

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

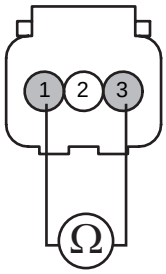
COMPONENT INSPECTION EE98E96C

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

SPECIFICATION

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	13.13~16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31~2.59	80	176	0.32

<C104>



1. ECTS Signal
2. To Cluster
3. Sensor Ground

B01162

4. Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 ED5FED7D

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.

DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

COMPONENT LOCATION E931AC5D

Refer to DTC P0116.

GENERAL DESCRIPTION ED3E7156

Refer to DTC P0116.

DTC DESCRIPTION E8E59FDF

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

DTC DETECTING CONDITION EBA8B6EE

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	● 6 < Battery voltage < 16V ● After 60 seconds from engine start in case of short circuit to B+ or open circuit	
Threshold value	● Measured coolant temperature > 138℃(280°F).	
Diagonostic Time	● 5 sec.	
Fall Safe	● The limp-home value of ECTS depends on intake air temperature.	

SPECIFICATION EE1F7CE2

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

SCHEMATIC DIAGRAM EC1641EC

Refer to DTC P0116.

SIGNAL WAVEFORM E0803889

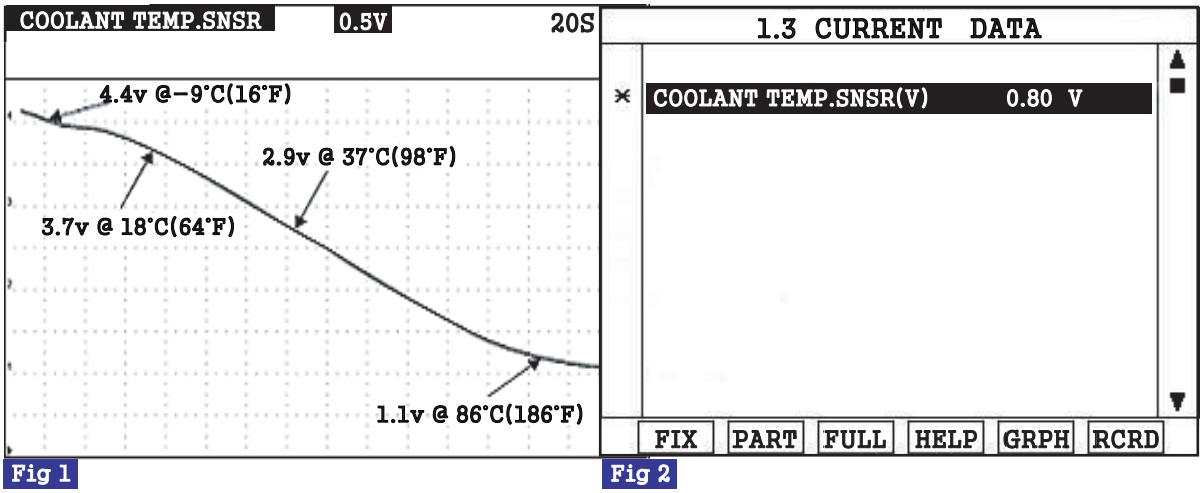
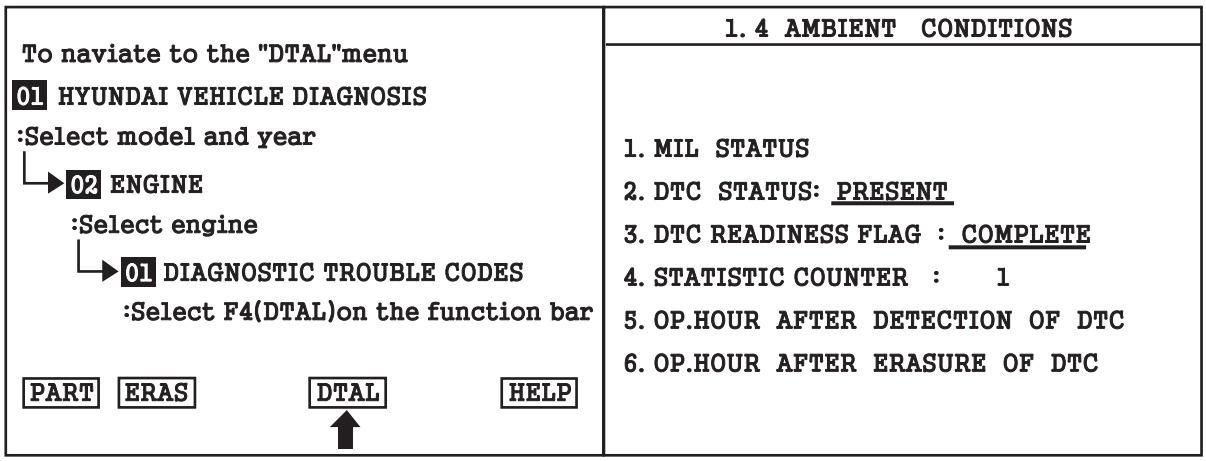


Fig 1) Signal decreases with increasing sensor temperature and increases with decreasign sensor temperature.
Fig 2) Short to ground in signal circuit : Approx. 0V

B01171

MONITOR DTC STATUS E41C6D98

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.



B00112

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 PCM's connector, which was repaired but PCM 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.

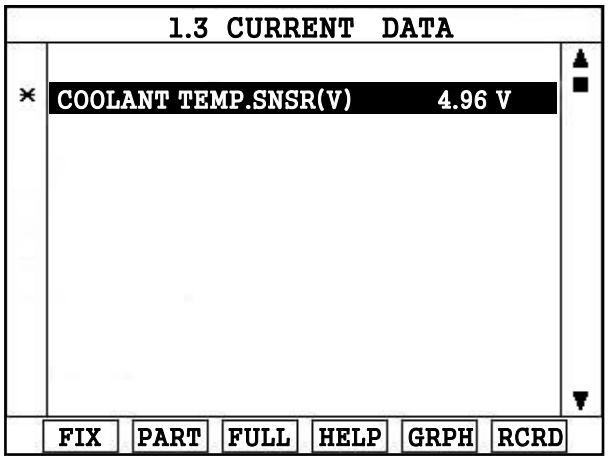
NO

▶ Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA E9BC1CA3

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



B01172

4. Is ECTS parameter near the specified value?

YES

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

NO

Possibility of signal circuit short to ground. Go to next step as below.

SIGNAL CIRCUIT INSPECTION E5B18AAC

1. Ignition "OFF".
2. Measure resistance between terminal 1 of the 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 & CONNECTOR INSPECTION EF6F9FAE

Refer to DTC P0116.

COMPONENT INSPECTION E292BEBD

Refer to DTC P0116.

VERIFICATION OF VEHICLE REPAIR E802FC2A

Refer to DTC P0116.

DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION EFADFC78

Refer to DTC P0116.

GENERAL DESCRIPTION E4F3DA8F

Refer to DTC P0116.

DTC DESCRIPTION EEC9EFFB

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

DTC DETECTING CONDITION E5FAE6F4

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	● 6 < Battery voltage < 16V ● After 110 seconds from engine start in case of short circuit to B+ or open circuit	
Threshold value	● Measured coolant temperature < -46℃(-51°F).	
Diagonostic Time	● 5 sec.	
Fall Safe	● The limp-home value of ECTS depends on intake air temperature.	

SPECIFICATION E01AC30F

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

SCHEMATIC DIAGRAM E27A31A6

Refer to DTC P0116.

SIGNAL WAVEFORM EFD5B81B

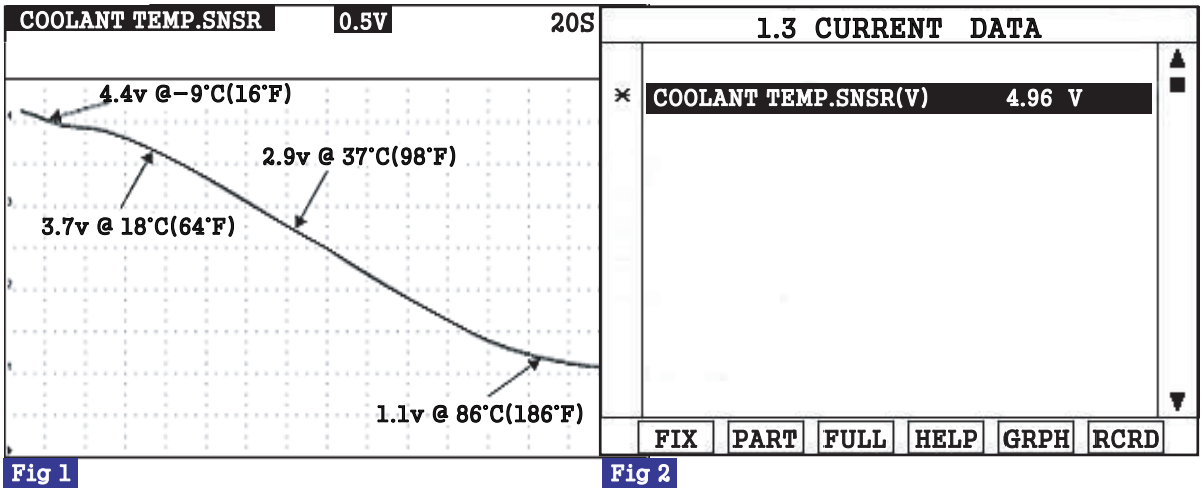
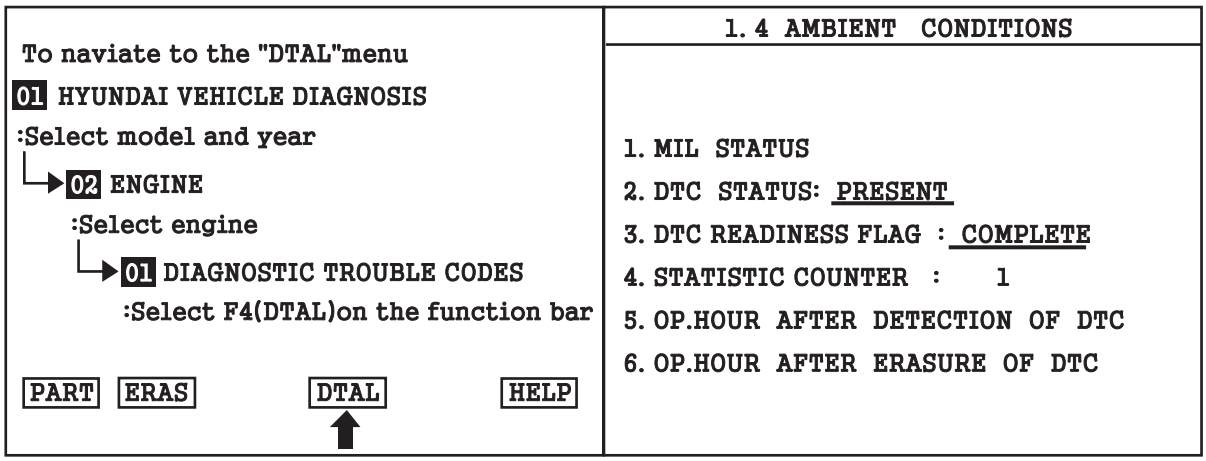


Fig 1) Signal decreases with increasing sensor temperature and increases with decreasign sensor temperature.
Fig 2) Open in signal or ground circuit : Approx. 5V

B01184

MONITOR DTC STATUS EC88561B

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 Read "DTC Status" parameter.
4. Read "DTC Status" parameter.



B00112

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 PCM's connector, which was repaired but PCM 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.

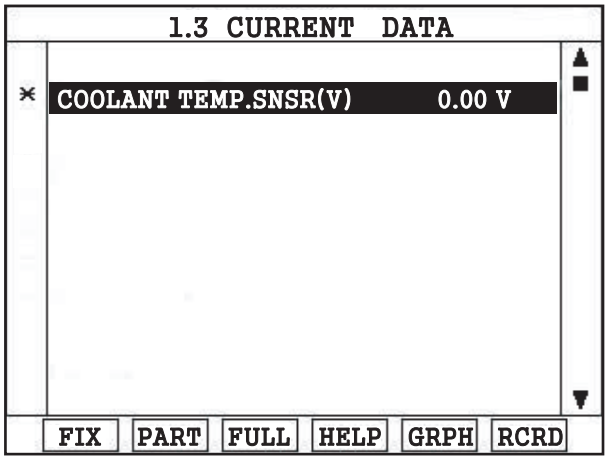
NO

▶ Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA EFF9A4B6

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 3 of the sensor harness connector together.

Specification : Approx. 0V



B01186

5. Is ECTS parameter near the specified value?

YES

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

NO

Possibility of signal circuit short to ground. Go to "W/Harness Inspection" procedure.

6. Jumper the terminal 1 of the sensor harness connector to chassis ground.
7. Read the "COOLANT TEMP. SNSR(V)" parameter on the Scantool.

Specification : Approx. 0V

8. Is displayed ECT data near the specified value.?

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 EDFD7AB7

1. Ignition "OFF".
2. Disconnect PCM connector.
3. Measure resistance between terminals 3 of the sensor harness connector and 73 of the PCM harness connector.

Specification : Approx. 0Ω

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 E83C8930

1. Check for open in signal circuit.
   1) Measure resistance between terminals 1 of the sensor harness connector and 31 of the PCM 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 1 of the sensor harness connector and 31 of the PCM 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 & CONNECTOR INSPECTION EDC729BD

Refer to DTC P0116.

COMPONENT INSPECTION EA4E8EBA

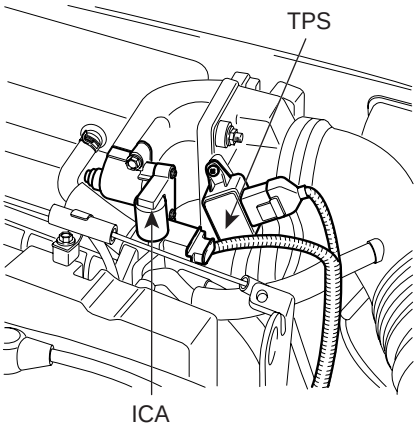
Refer to DTC P0116.

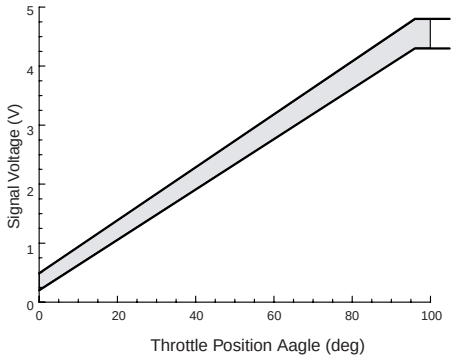
VERIFICATION OF VEHICLE REPAIR EE4D44C1

Refer to DTC P0116.

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

COMPONENT LOCATION E923F9AA





EGQE502D

GENERAL DESCTIPTION E4334D0D

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 PCM 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 PCM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The PCM uses the Mass Air Flow Sensor (MAFS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC DESCRIPTION E6F34C12

The PCM 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.

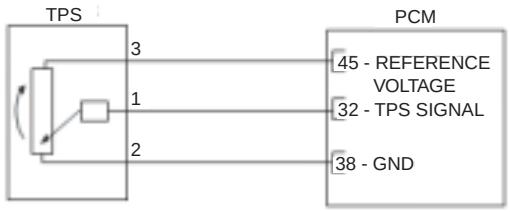
DTC DETECTING CONDITION ECEEBAB8

Item	Detecting Condition	Possible Cause
DTC Strategy	● Compare calculated MAF with MAF signal	● Contact resistance in connectors ● Faulty TP Sensor(TPS)
Enable Conditions	● No relevant failure ● 11 ≤ Battery voltage ≤ 16 ● Lambda control active	
Threshold value	● Calculated MAF-Measured MAF > 300 mg/rev	
Diagonostic Time	● 200 revolutions	
Fall Safe	● Throttle position is determined by engine speed and MAF. ● EVAP. emission control function is controlled in minimum operation mode	

SPECIFICATION E7AA69B7

TPS		Fully Closed	Fully Open
Throttle Angle (°)		0~0.5°	86°
Signal Voltage (V)		0.2~0.8V	4.3~4.8V
Resistance(kΩ)	Terminal 1 and 2	0.71 ~ 1.38kΩ at all temperature	2.7kΩ at all temperature
	Terminal 2 and 3	1.6 ~ 2.4 kΩ at all throttle position	

SCHEMATIC DIAGRAM E31BA6B2

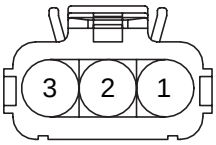


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 32	TPS signal
2	PCM Terminal 38	Sensor ground
3	PCM Terminal 45	Reference Voltage

[CONNECTOR]

TPS Harness side connector



C159

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	●	*	*	*	*	37	●	39	*	*	42	43	3	
*	●	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B01211

SIGNAL WAVEFORM EF09FCCB

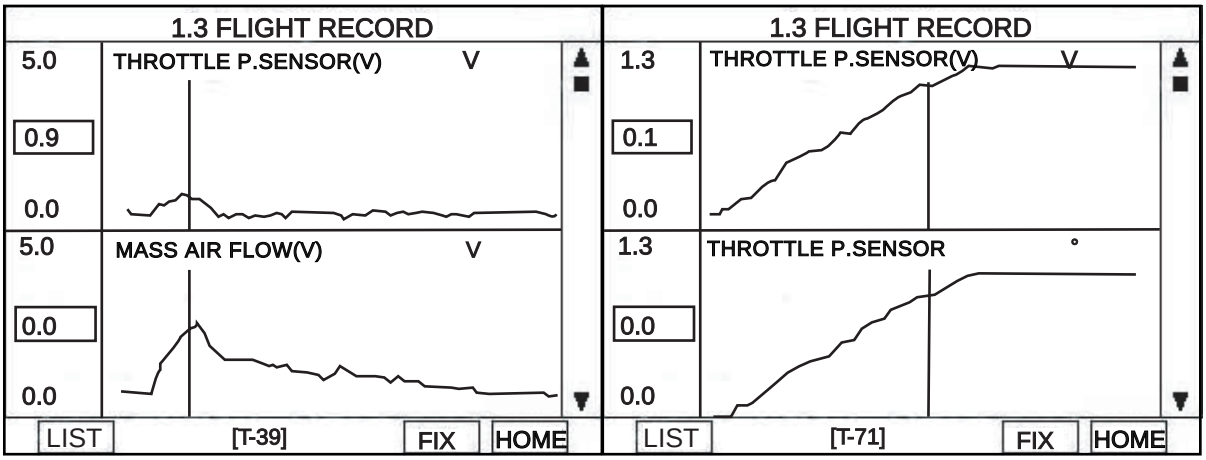


Fig 1) Normal value with accelerating and decelerating : The MAFS and TPS signals increase at the same time with accelerating and decrease with releasing accelerator pedal
Fig 2) Signal increases proportionally with throttle opening angle

B01212

MONITOR DTC STATUS EBD5A146

NOTE

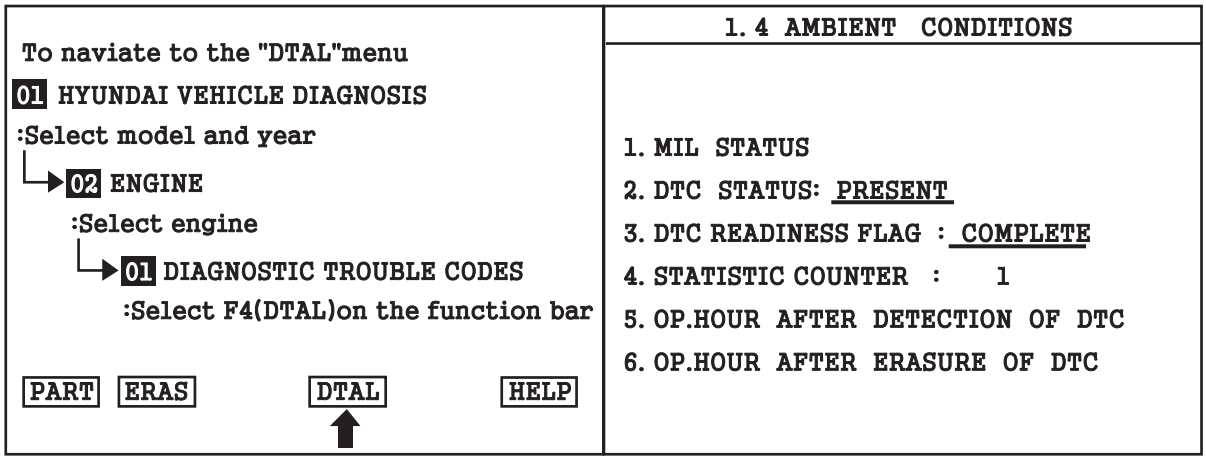
If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to "Air Leakage Inspection" procedure.

AIR LEAKAGE INSPECTION ED893945

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 & CONNECTOR INSPECTION EAF987DF

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.

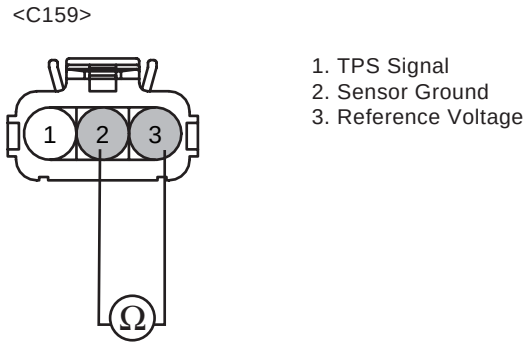
COMPONENT INSPECTION EEFE5C60

1. Ignition "OFF" .

2. Disconnect TPS connector.

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

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

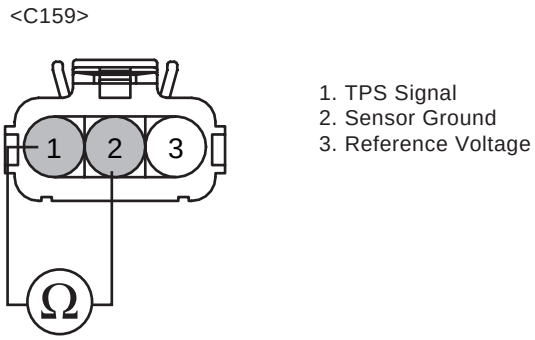


B01213

4. With still TPS connector disconnected, measure resistance between terminals 1 and 2 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 ~ 1.38kΩ at closed throttle valve, 2.7kΩ at wide open throttle



B01214

6. Is resistance within the specification?

YES

Check for poor connection between PCM 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 E461CAEE

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.

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

COMPONENT LOCATION E1408072

Refer to DTC P0121.

GENERAL DESCTIPTION E6DAB7F6

Refer to DTC P0121.

DTC DESCRIPTION EB4F0DFE

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

DTC DETECTING CONDITION EDFD139A

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	
Diagonostic Time	● 1 sec.	
Fall Safe	● Throttle position is determined by function of engine speed, mass air flow and idle duty.	

SPECIFICATION EBD6B0A2

TPS		Fully Closed	Fully Open
Throttle Angle (°)		0~0.5°	86°
Signal Voltage (V)		0.2~0.8V	4.3~4.8V
Resistance(kΩ)	Terminal 1 and 2	0.71 ~ 1.38kΩ at all temperature	2.7kΩ at all temperature
	Terminal 2 and 3	1.6 ~ 2.4 kΩ at all throttle position	

SCHEMATIC DIAGRAM EF6DEE1E

Refer to DTC P0121.

SIGNAL WAVEFORM EA267D14

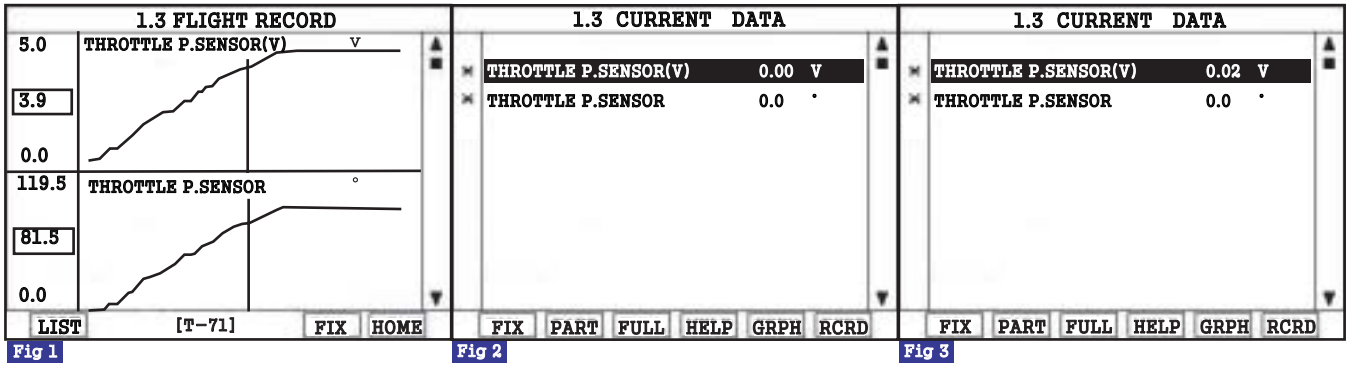
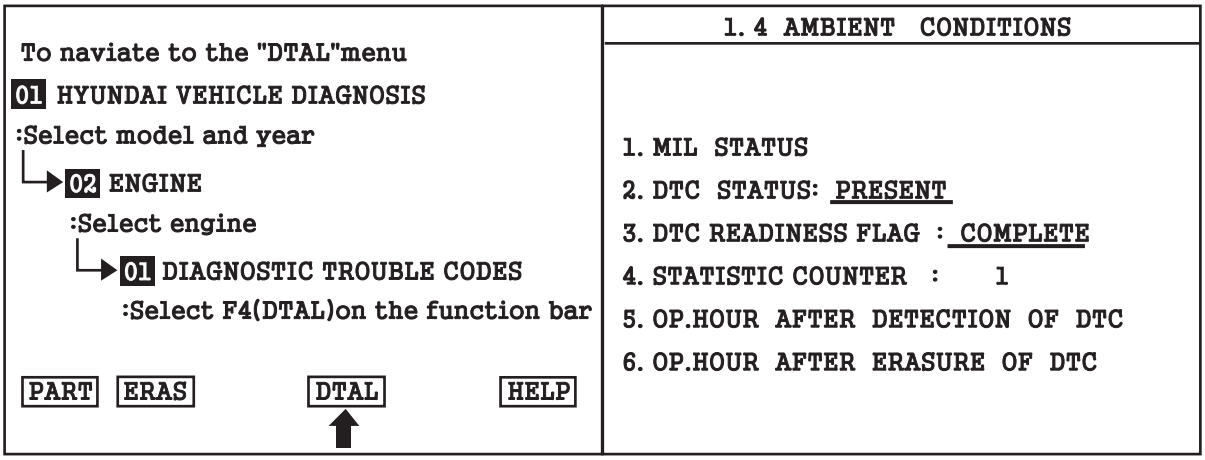


Fig 1) signal increases proportionally with throttle opening angle
Fig 2) Short to ground in signal circuit/Open in power supply circuit : Approx. 0V
Fig 3) Short to ground in power supply circuit : Approx. 0V

B01221

MONITOR DTC STATUS E70AD2BA

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION E13C90BA

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 Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION EDC447C4

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

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 and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E2CB1DC5

1. Ignition "ON"
2. Measure voltage between terminal 1 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 ED882348

Refer to DTC P0121.

VERIFICATION OF VEHICLE REPAIR E912D057

Refer to DTC P0121.

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

COMPONENT LOCATION E29A051D

Refer to DTC P0121.

GENERAL DESCTIPTION ED3E2BB9

Refer to DTC P0121.

DTC DESCRIPTION EC972AB1

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

DTC DETECTING CONDITION EFA8E736

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 ≤ 16V	
Threshold value	● Voltage > 4.86 V	
Diagonostic Time	● 1 sec.	
Fall Safe	● Throttle position value is determined by function of engine speed, mass air flow and idle duty.	

SPECIFICATION EAE875C3

TPS		Fully Closed	Fully Open
Throttle Angle (°)		0~0.5°	86°
Signal Voltage (V)		0.2~0.8V	4.3~4.8V
Resistance(kΩ)	Terminal 1 and 2	0.71 ~ 1.38kΩ at all temperature	2.7kΩ at all temperature
	Terminal 2 and 3	1.6 ~ 2.4 kΩ at all throttle position	

SCHEMATIC DIAGRAM E75B625A

Refer to DTC P0121.

SIGNAL WAVEFORM EBED9A5F

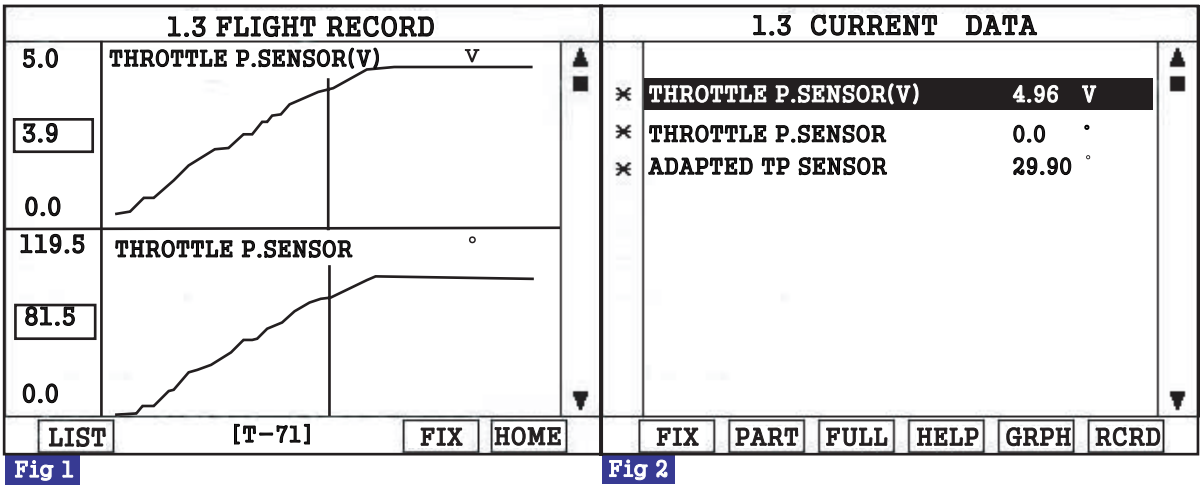


Fig 1) Signal increases proportionally with throttle opening angle
Fig 2) Open in signal or ground circuit : Approx. 5V

B01231

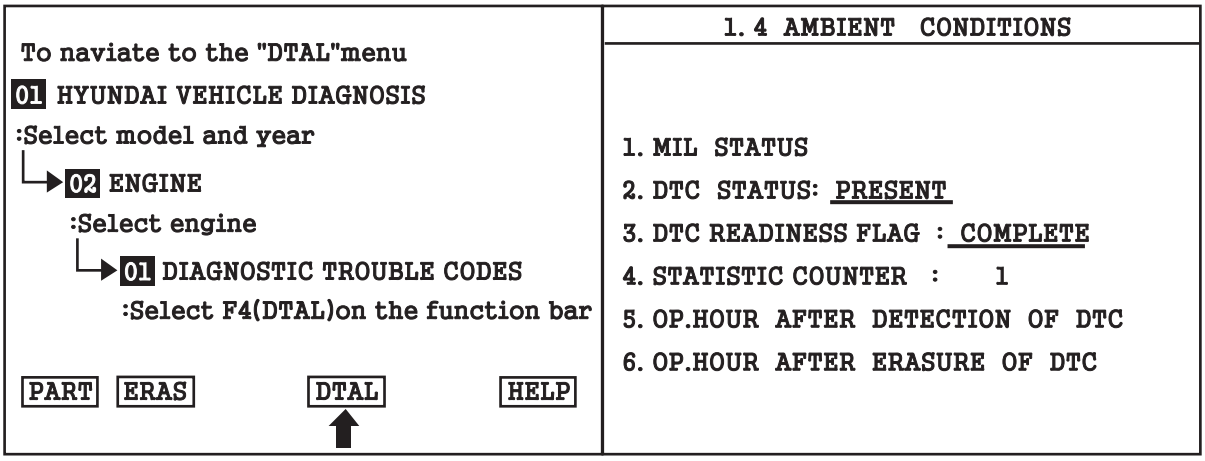
MONITOR DTC STATUS EE9D4EDC

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL & CONNECTOR INSPECTION E28315E4

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 E5B03BE7

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.

SIGNAL CIRCUIT INSPECTION E9D3DAED

1. With connector still disconnected, measure voltage between terminal 1 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 EFC520DE

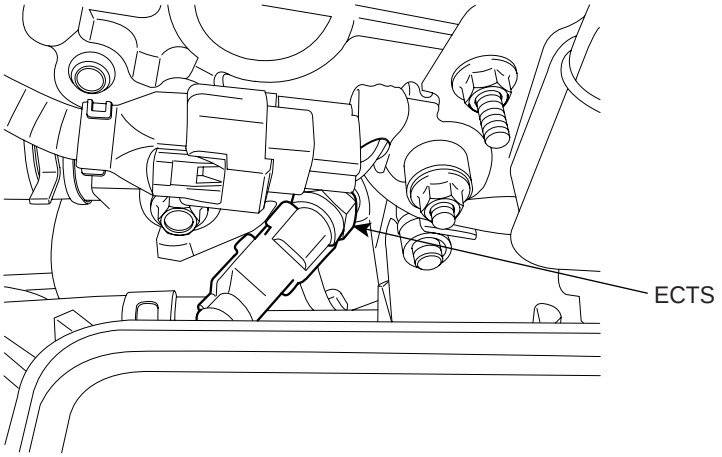
Refer to DTC P0121.

VERIFICATION OF VEHICLE REPAIR E4C29EE8

Refer to DTC P0121.

DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

COMPONENT LOCATION EBAD8D8D



EGQE501F

GENERAL DESCTIPTION E6C01B8C

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the PCM for engine control and as an enabling criteria for related diagnostics. The air flow coming into the engine is accumulated and used to determine if the engine has been driven within conditions that would allow the engine coolant to heat up normally to the thermostat regulating temperature. If the coolant temperature does not reach regulating temperature of the thermostat, diagnostics that use engine coolant temperature as enabling criteria, may not run when expected.This DTC will set when there has been excessive time to reach a minimum coolant temperature required for closed loop fuel control.

DTC DESCRIPTION E1506A9F

The purpose of this diagnosis is to monitor the minimum coolant temperature that enables lambda closed loop control after start. Minimum coolant temperature to run lambda control must be reached before the threshold time predetermined according to intake air temperature at start. If the lambda control is not active because of low engine coolant temperature within predetermined minimum time after start, the PCM sets DTC P0125.

DTC DETECTING CONDITION EE5E3709

Item	Detecting Condition	Possible Cause
DTC Strategy	● Check time to closed loop control start with coolant temperature model.	● Contact resistance in connectors. ● Faulty cooling system. ● Faulty thermostat. ● Faulty ECT sensor.
Enable Conditions	● Minimum time after engine start versus intake air temperature at start : 1) 2minutes for intake air temp. ＞ 10℃(50°F) 2) 5minutes for -7℃(19°F) ＜ Intake air temp. ＜ 10℃(50°F) ● 6 ＜ Battery voltage(V) ＜16	
Threshold value	● Measured coolant temperature ＜ 5°C(41°F) When modeled coolant temperature ＞ 5℃(41°F)	
Diagonostic Time	● Immediate.	
Fall Safe	● Calculated engine coolant temperature is used for engine control. ● Cooling/Condenser fan is active with MAX speed. ● EVAP. emission control function is controlled in minimum operation mode.	

SPECIFICATION EAF44DA2

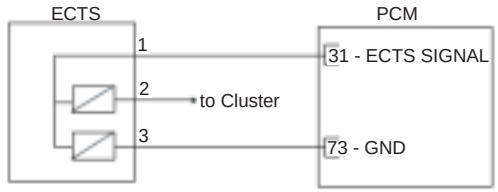
[ECTS]

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

[THERMOSTAT]

Thermostat	Normal Parameter
Valve Opening Temp.	80~84°C(176~183°F)
Valve Closing Temp.	77°C(170.6°F)
Full Open Lift	Above 10mm at 95°C(203°F)

SCHEMATIC DIAGRAM ECBEE3A1

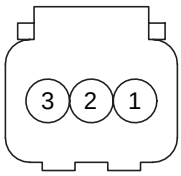


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 31	ECTS signal
2	Cluster	-
3	PCM Terminal 73	Sensor ground

[CONNECTOR]

ECTS Harness side connector



C104

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	●	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	●	*	75	76	77	78	*	80	81	2	1

C130-1

B01251

SIGNAL WAVEFORM EFCF3A15

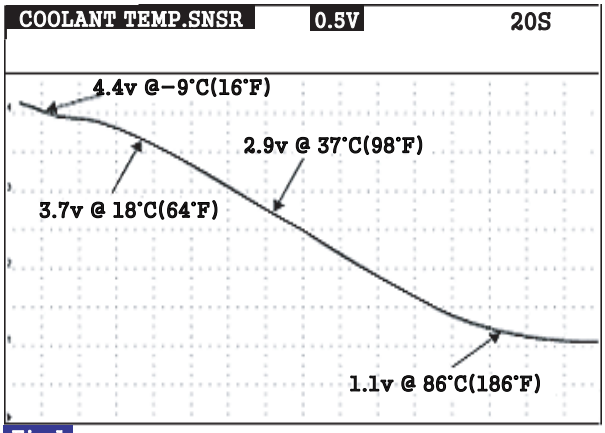


Fig 1

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

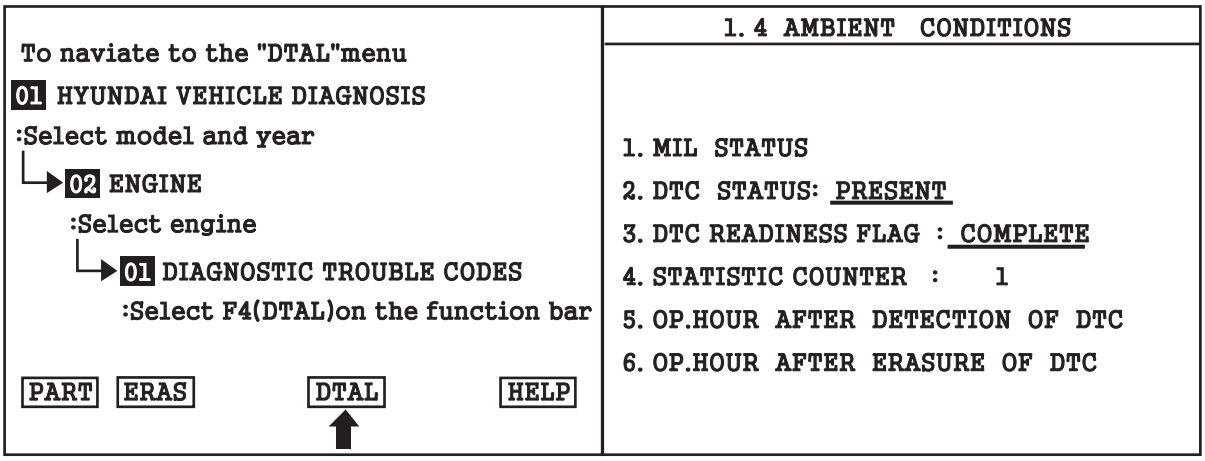
A01161

MONITOR DTC STATUS EDB5A82D

NOTE

If any codes relating to ECTs are stored, do ALL REPAIRS associated with those codes before proceeding with this 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.



B00112

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 PCM's connector or was repaired and PCM 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 "Cooling System Inspection" procedure.

COOLING SYSTEM INSPECTION

1. Check cooling system coolant level and fill if low.

2. Check for a proper cooling system operation. Especially check that cooling and condenser fan working normally.

3. Remove the thermostat and check the following items:
   - Stuck or damaged
   - Verify the temperature at which the valve begins to open.
     Valve opening temperature : 80~84°C(176~183.2°F)
     Valve opening temperature : 95°C(203°F)

4. is a problem found?

YES

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

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION E20F9532

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 E63CBB31

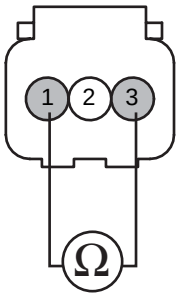
1. Ignition "OFF" .
2. Disconnect ECTS connector.
3. Measure resistance between terminals 1 and 3 of the sensor connector(Component side).

SPECIFICATION

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

4. Is resistance within the specification?

<C104>



1. ECTS Signal
2. To Cluster
3. Sensor Ground

B01253

YES

▶ Check for poor connection between PCM 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 E1CC7ACD

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

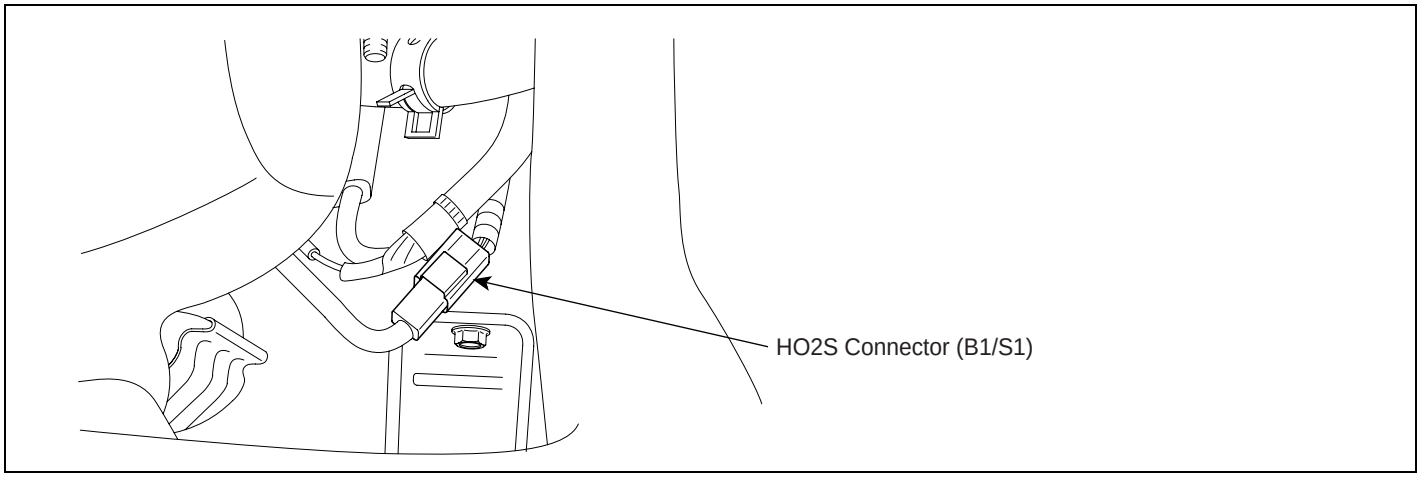
▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0130 HO2S CIRCUIT (BANK 1/ SENSOR 1)

COMPONENT LOCATION E6E00E1F



EGQE501N

GENERAL DESCRIPTION E0A435BF

The HO2S is used to supply the PCM 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 (PCM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the PCM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The PCM 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.

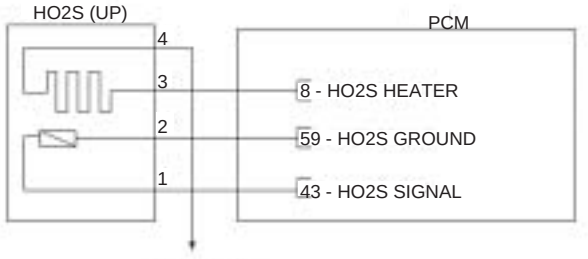
DTC DESCRIPTION ED248B23

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

DTC DETECTING CONDITION EE84EA2A

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		● Voltage range check	● 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 ● Modelled exhausr gas temp, > 600°C(1112°F) ● Lambda control active ● No relevant failure ● Battery voltage >10V	
Case1)	Threshold Value	● Lambda control not active within the defined time	
Case2)		● 0,49V > Down HO2S > 0,37V and sensor element resistance > 60 KΩ	
Case1)	Diagnostic Time	● 30~100 sec. depending on start temp.	
Case2)		● 10 sec.	

SCHEMATIC DIAGRAM ECDF6EC7



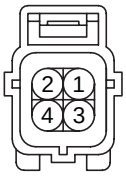
After Main Relay

[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 43	Signal
2	PCM Terminal 59	Ground
3	PCM Terminal 8	Heater Control
4	Main Relay	Battery Voltage

[CONNECTOR]

HO2S Harness side connector



C127

PCM side terminal

6	7	●	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	●	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	●	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B01301

SIGNAL WAVEFORM E89BA5C6

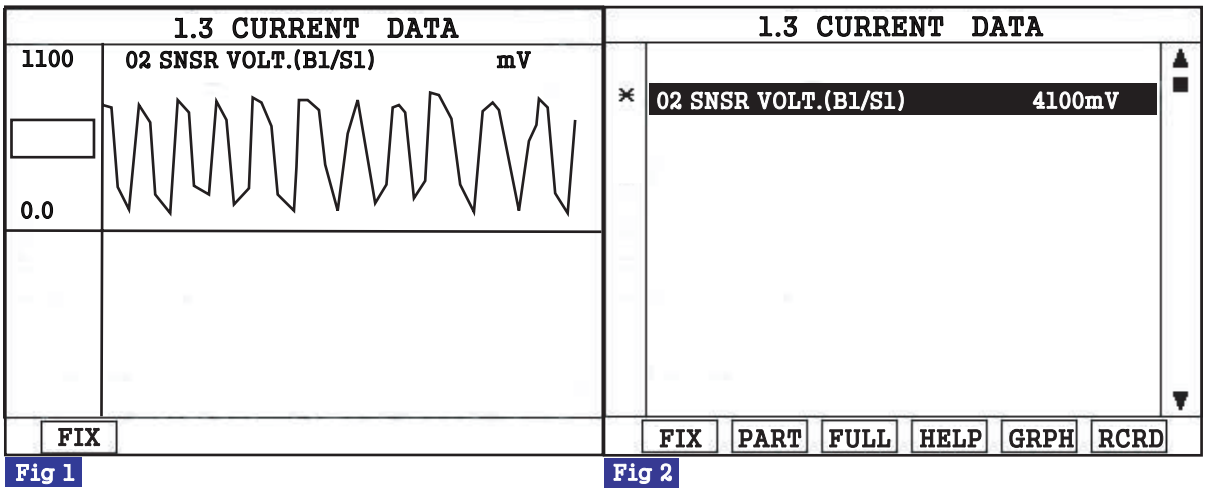
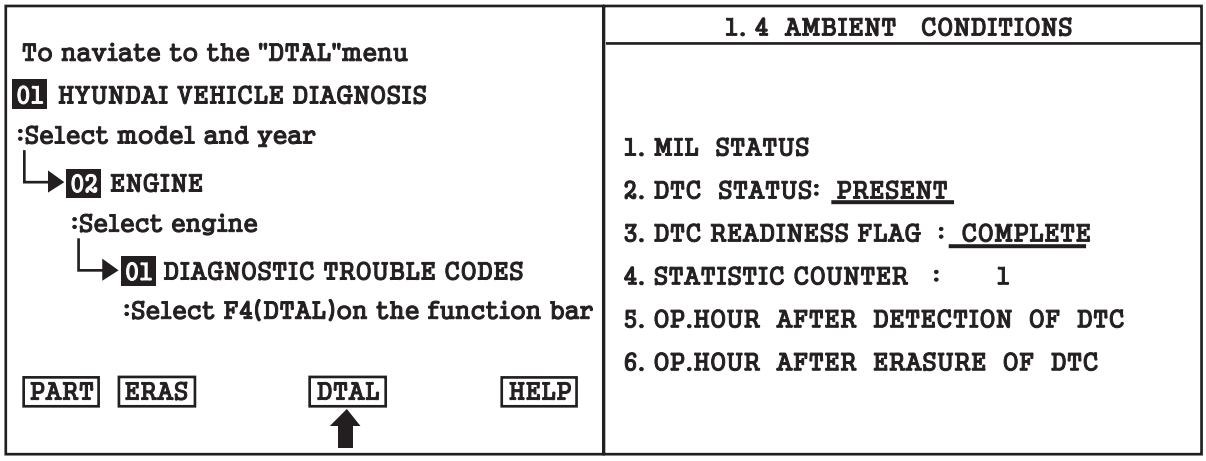


Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

B01302

MONITOR DTC STATUS E3AB53C0

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.



B00112

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 E9F9BADA

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 EB46C86C

1. Ignition "OFF".
2. Disconnect HO2S and PCM connectors.
3. Measure resistance between terminals 2 of the sensor harness connector and 59 of the PCM 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 EA0ECD76

1. Measure resistance between terminals 1 of the HO2S harness connector and 43 of the PCM 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 ED189BEA

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 "O2 SNSR VOLT. (B1/S1)" 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).

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 EE7EFA78

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.

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

COMPONENT LOCATION EED786DF

Refer to DTC P0130.

GENERAL DESCRIPTION EDC8C6D0

Refer to DTC P0130.

DTC DESCRIPTION EBCD1CDA

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

DTC DETECTING CONDITION E9A9AA7E

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	● Voltage Range check	● Short to ground in signal harness. ● Contact resistance in connectors. ● Faulty Heated O2 Sensor(HO2S).
Enable Conditions	● Lambda regulation on Maximum Limit(50%) ● Canister Purge valve closed ● Battery voltage > 10V ● No relevant failure	
Threshold Value	● Sensor voltage < 0,02 V and resistance < 30 Ω	
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 E3C33FEE

Refer to DTC P0130.

SIGNAL WAVEFORM E853FD8A

Refer to DTC P0130.

MONITOR DTC STATUS E44A5382

Refer to DTC P0130.

TERMINAL & CONNECTOR INSPECTION EEFE7AFD

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 "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E1BA08FC

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 E7BB56A8

Refer to DTC P0130.

VERIFICATION OF VEHICLE REPAIR EBB923AF

Refer to DTC P0130.

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

COMPONENT LOCATION EE4DEA66

Refer to DTC P0130.

GENERAL DESCRIPTION EBEF0FE5

Refer to DTC P0130.

DTC DESCRIPTION E6805D79

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

DTC DETECTING CONDITION EB77238A

ITEM	DETECTING 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 ● 10V ≤ Battery voltage ≤16V	
Threshold Value	● Sensor voltage > 1.3V	
Diagnostic Time	● 1 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 E9DAA0F6

Refer to DTC P0130.

SIGNAL WAVEFORM EC8548A5

Refer to DTC P0130.

MONITOR DTC STATUS EFF5F50A

Refer to DTC P0130.

TERMINAL & CONNECTOR INSPECTION EADDF3A7

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by in terference 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 "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EE39701C

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

COMPONENT INSPECTION E26BAF2B

Refer to DTC P0130.

VERIFICATION OF VEHICLE REPAIR E7EC66BE

Refer to DTC P0130.

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

COMPONENT LOCATION E9BF7E34

Refer to DTC P0130.

GENERAL DESCRIPTION EDB634CC

Refer to DTC P0130.

DTC DESCRIPTION E3FAB151

The PCM 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 PCM sets DTC P0133 when the amplitude of oxygen sensor is equal to or less than minimum amplitude threshold.

DTC DETECTING CONDITION EEBC6F50

ITEM	DETECTING 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 contaminatio
Enable Conditions	● Coolant temp. > 74°C(165°F) ● 400°C(752°F) < Catalyst temp. model < 900°C(1652°F) ● 5km/h(3MPH) < Vehicle speed < 180km/h(112MPH) ● Engine speed < 3400rpm ● 200 < Engine load(mg/rev.) < 700 ● 11V < Battery voltage ● Stable driving condition. ● Lambda regulation active. ● Canister Purge Valve not in CLOSE state.	
Threshold Value	● Average Ratio between measured and maximum allowed frequency during.100 Lambda regulation cycles > 1	
Diagnostic Time	● 100 lambda controller cycles.	
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 EB3C1EDC

Refer to DTC P0130.

SIGNAL WAVEFORM E8318CE5

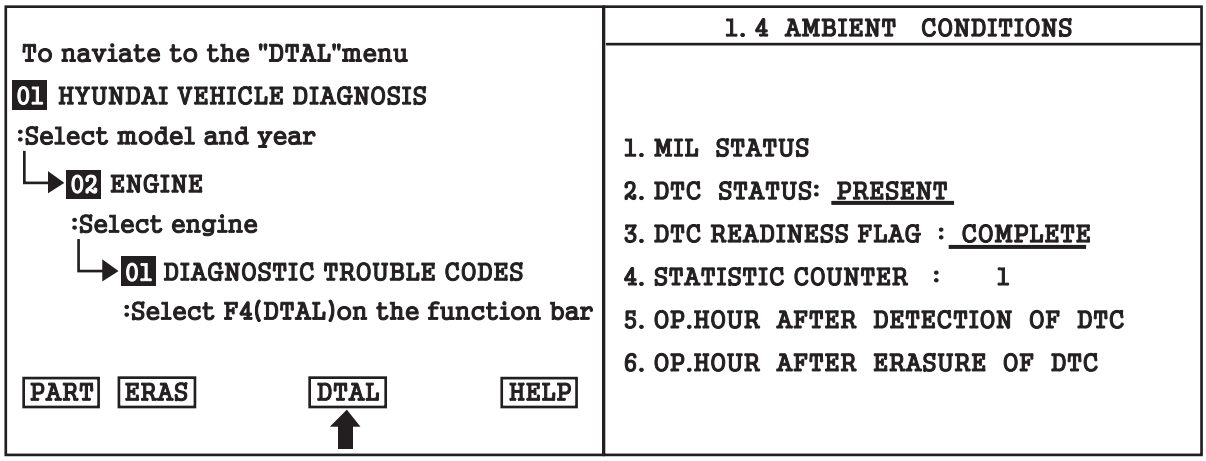
Refer to DTC P0130.

MONITOR DTC STATUS E1E89B7F

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.



B00112

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.

VISUAL / PHYSICAL INSPECTION E5A2BFEE

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 PCM).
   - 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 E0B27E82

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 : Ignition "ON" & Engine "ON" & Vacuum hose disconnected at Idle
Specification : 250~350kPa(2.50~3.50 kg/㎠, 36~50 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 INJECTOR 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 E6AAC492

Refer to DTC P0130.

VERIFICATION OF VEHICLE REPAIR EC8431A9

Refer to DTC P0130.

DTC P0134 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 1)

COMPONENT LOCATION E10FF7F8

Refer to DTC P0130.

GENERAL DESCRIPTION EE9EECFF

Refer to DTC P0130.

DTC DESCRIPTION EACCE291

Due to possible oxygen sensor defects (e.g. reference air poisoning) or faults in the injection system (e.g. leaking fuel injector), the rear oxygen sensor may not provide the expected lean or rich signal level during fuel cut-off or full load condition. Hence, the oxygen sensor signal is checked for plausibility during this engine operating states.

DTC DETECTING CONDITION EFA4F903

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
Case1)	DTC Strategy	● Signal plausibility during fuel cut off	● Related fuse blown or missing ● Contact resistance in connectors ● HO2S contamination
	Enable Conditions	● Sensor preheating and full heating phases finished ● Fuel Cut Off active ● Integrated Mass Air Flow > 16g ● Battery voltage > 10V	
	Threshold Value	● Voltage with fuel cut off > 0.1V	
	Diagnostic Time	● 5 Sec.	
Case2)	DTC Strategy	● Signal stroke plausibility	
	Enable Conditions	● Sensor preheating and full heating phases finished ● Signal stroke valid (5 P-jump after Lambda regulation activation) ● Lambda controller is not on the limit ● Lean / rich cycle time < 2.5 sec. ● Battery voltage > 10V	
	Threshold Value	● Sensor voltage < 0.25V	
	Diagnostic Time	● 2 min.	

SCHEMATIC DIAGRAM ECACCEA8

Refer to DTC P0130.

SIGNAL WAVEFORM EDE43C15

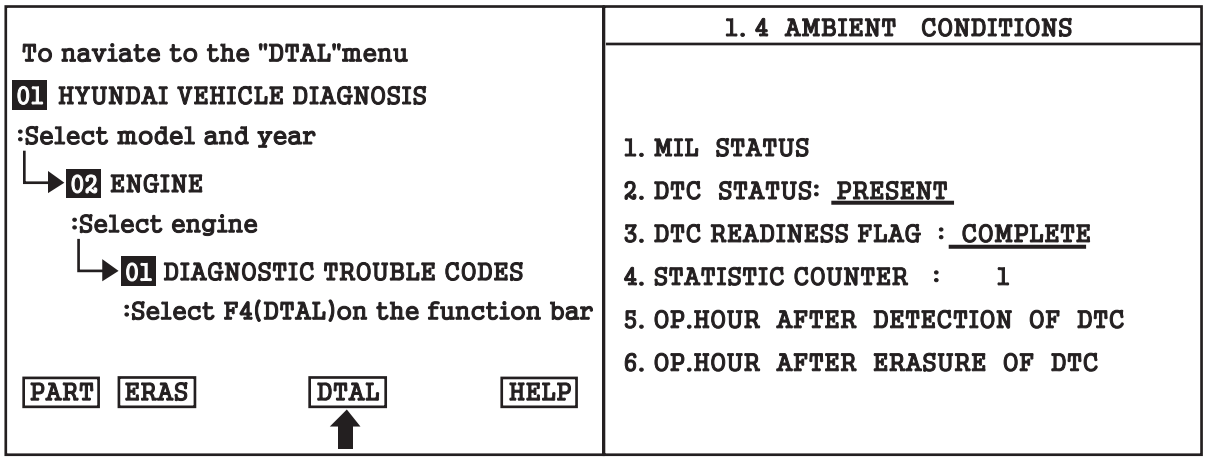
Refer to DTC P0130.

MONITOR DTC STATUS E25FB1BB

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.



B00112

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 E68B59BA

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 "HO2S Fuse Inspection" procedure

HO2S FUSE INSPECTION

1. Ignition "OFF" & Engine "OFF"
2. Verify "10A Sensor fuse" is installed and not blown.
3. If OK, go to "Component Inspection" procedure.
   If NG, replace fuse and repair any shorts as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1F2A73D

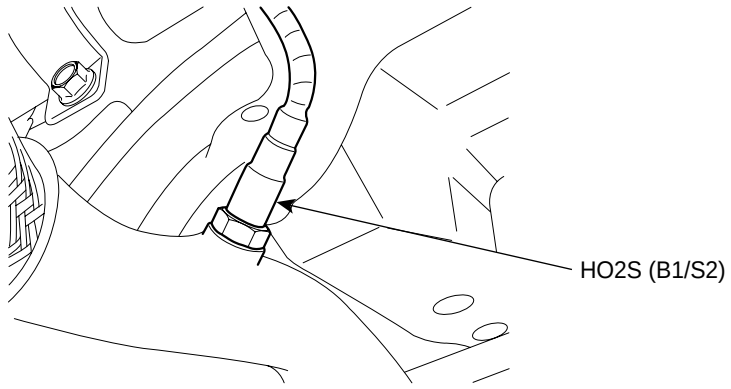
Refer to DTC P0130.

VERIFICATION OF VEHICLE REPAIR E7807C46

Refer to DTC P0130.

DTC P0136 HO2S CIRCUIT (BANK 1/ SENSOR 2)

COMPONENT LOCATION E7C39ECE



EGQE501M

GENERAL DESCRIPTION ED0404C8

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.

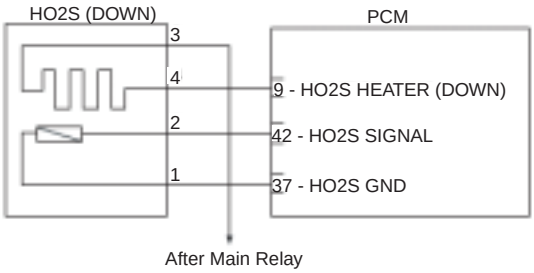
DTC DESCRIPTION EAA4525C

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

DTC DETECTING CONDITION EBE4D0D0

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 ● No relevant failure ● 10V＜Battery voltage ＜16V	
Threshold Value	● 0.37 ＜ Downstream O2 Sensor voltage ＜ 0.49V & sensor element resistance ＞ 60kΩ	
Diagnostic Time	● 30 sec.	

SCHEMATIC DIAGRAM E95F376E

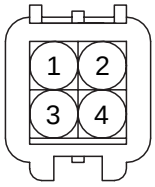


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 37	Ground
2	PCM Terminal 42	HO2S Signal
3	Main Relay	Battery Voltage
4	PCM Terminal 9	HO2S Heater (DOWN)

[CONNECTOR]

HO2S Harness side connector



C125

PCM side terminal

6	7	8	●	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	●	38	39	*	*	●	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B01361

SIGNAL WAVEFORM E4FBEC6D

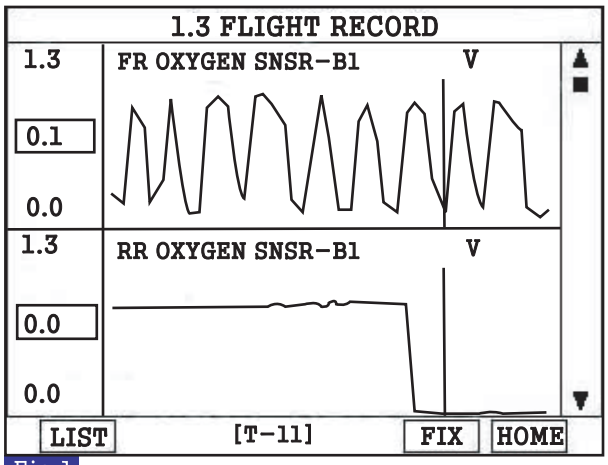


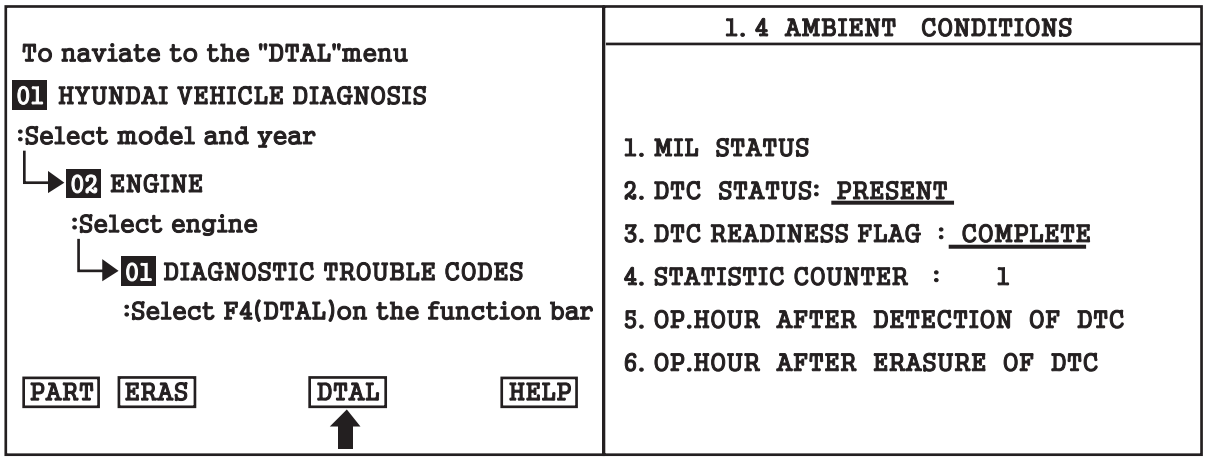
Fig 1

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

A01361

MONITOR DTC STATUS E99B22E0

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.



B00112

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 E580FFE1

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 EEC6AE84

1. Ignition "OFF"

2. Disconnect HO2S connector.

3. Measure resistance between terminals 1 of the sensor harness connector and 37 of the PCM 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 E2D03DF3

1. Measure resistance between terminals 2 of the sensor harness connector and 42 of the PCM 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 E770FB98

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "O2 SNSR VOLT.(B1/S2)" parameter on the Scantool data list.

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

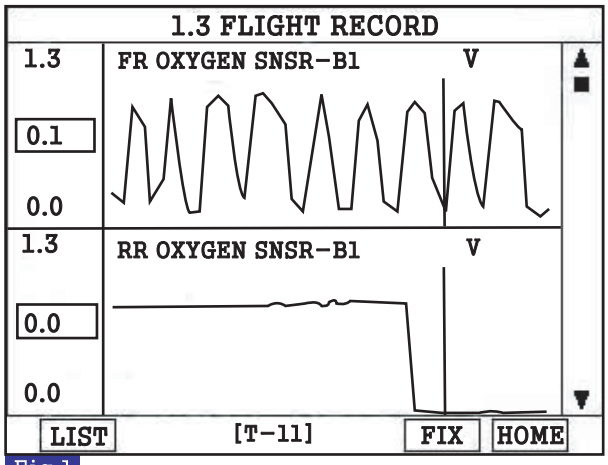


Fig 1

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

A01361

3. Is sensor data near the specified value?

YES

▶ Check for poor connection between PCM 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 ECEED00F

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.

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

COMPONENT LOCATION EDE6098E

Refer to DTC P0136.

GENERAL DESCRIPTION E91327F0

Refer to DTC P0136.

DTC DESCRIPTION EEBE6E7D

PCM sets DTC P0137 if the PCM detects that the rear HO2S signal circuit is open.

DTC DETECTING CONDITION EB38BD71

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	●Check short circuit to ground on rear HO2S	● Short to ground in signal harness ● Contact resistance in connectors ● Faulty Heated O2 Sensor(HO2S)
Enable Condition	● Catalyst temperature model > 400°C(752°F) ● No relevant failure ● 10 < Battery voltage < 16 ● Closed loop mode ● Lambda controller is not on the limit ● Catalyst purge after fuel cut off is not active	
Threshold Value	● Downstream O2 Sensor voltage < 0.02V & sensor element resistance < 30Ω	
Diagnostic Time	● 20 sec.	

SCHEMATIC DIAGRAM EE25828A

Refer to DTC P0136.

SIGNAL WAVEFORM E1E20AF4

Refer to DTC P0136.

MONITOR DTC STATUS E93C07A6

Refer to DTC P0136.

TERMINAL & CONNECTOR INSPECTION E4C3D401

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 "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E6AC52AF

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminal 2 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 in the ground circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC87401D

Refer to DTC P0136.

VERIFICATION OF VEHICLE REPAIR E7117E2C

Refer to DTC P0136.

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

COMPONENT LOCATION E780EB14

Refer to DTC P0136.

GENERAL DESCRIPTION ECEC6FBA

Refer to DTC P0136.

DTC DESCRIPTION EFFFF7BA

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

DTC DETECTING CONDITION ECAFCD3C

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	●Check short circuit to battery on rear HO2S	● Short to Battery in signal harness ● Contact resistance in connectors ● Faulty Heated O2 Sensor(HO2S)
Enable Condition	● 10 < Battery voltage < 16V	
Threshold Value	● Sensor voltage >1.3V	
Diagnostic Time	● 1 sec.	

SCHEMATIC DIAGRAM EFA6A235

Refer to DTC P0136.

SIGNAL WAVEFORM E242B0C8

Refer to DTC P0136.

MONITOR DTC STATUS EE766747

Refer to DTC P0136.

TERMINAL & CONNECTOR INSPECTION EBF6A5D2

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 "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EE8C8BDB

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Ignition "ON"
4. Measure resistance 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 open in the ground circuit and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION ECD8EF79

Refer to DTC P0136.

VERIFICATION OF VEHICLE REPAIR E9F1AE77

Refer to DTC P0136.

DTC P0139 HO2S CIRCUIT SLOW RESPONSE (BANK 1 / SENSOR 2)

COMPONENT LOCATION EB0E1AEA

Refer to DTC P0136.

GENERAL DESCRIPTION E53AC7EA

Refer to DTC P0136.

DTC DESCRIPTION E1CBADED

The PCM monitors rich-lean switching time of rear heated oxygen sensor (HO2S) after fuel cut-off to validate dynamic behavior of rear heated oxygen sensor (HO2S). After detection of fuel cut-off engine operating state, the PCM measures rich-lean switching time of the rear heated oxygen sensor (HO2S) signal and compares it to the predetermined limit value. DTC P0139 is set when the switching time is bigger than the limit value.

DTC DETECTING CONDITION EAB30C1E

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	● Slow response(Switching time check at entry in fuel cut off)	● Leak in intake or exhaust system ● Faulty fuel system. ● Front and rear HO2S connections reversed. ● Contact resistance in connectors ● HO2S contamination
Enable Condition	● Coolant temp ＞74°C(165°F) ● Closed loop mode ● 5km/h(3mph) ＜ Vehicle speed ＜ 180km/h(112mph) ● Sensor preheating and full phase finished ● Catalyst temp.model ＞350°C(662°C) ● No relevant failure ● 11 ＜ Battery voltage ＜ 16 ● Downstream O2 sensor signal at entry in fuel cut off ＞ 0.55V	
Threshold Value	● Average ratio(between measured and maximum allowed switching time at entry in fuel cut-off) ＞ 1	
Diagnostic Time	● 5 fuel cut-off phases	

SCHEMATIC DIAGRAM EE9EFAB3

Refer to DTC P0136.

SIGNAL WAVEFORM E22A28B2

Refer to DTC P0136.

MONITOR DTC STATUS E7C1E63E

NOTE

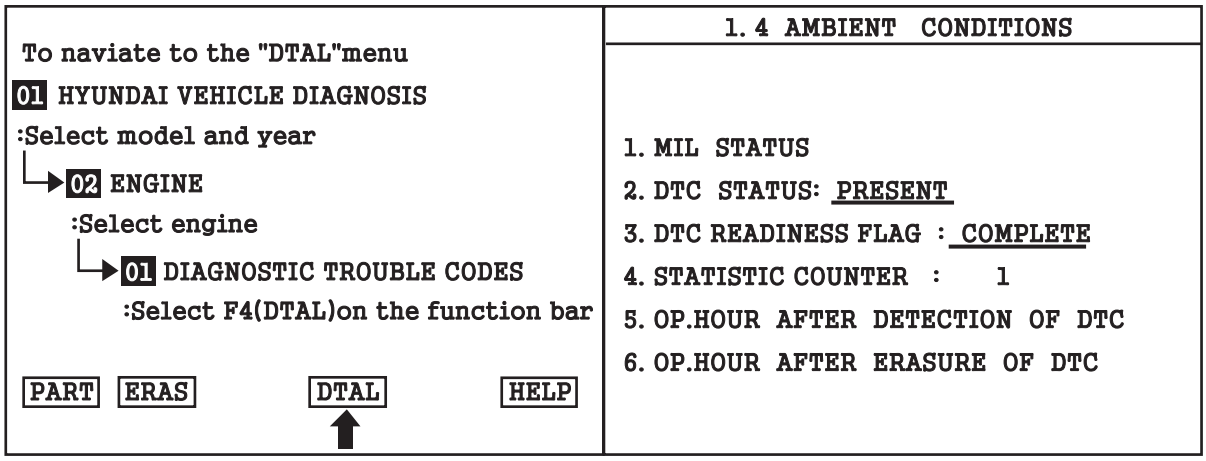
If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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.

VISUAL / PHYSICAL INSPECTION E338CC47

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 PCM)
   - 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 EDE5D1CA

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 E0A9885F

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 : Ignition "ON" & Engine "ON" & Vacuum hose disconnected at Idle Specification : 250~350kPa(2.50~3.50 kg/㎠, 36~50 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 INJECTOR 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 E51F36D4

Refer to DTC P0136.

VERIFICATION OF VEHICLE REPAIR EA1E0CE4

Refer to DTC P0136.

DTC P0140 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 2)

COMPONENT LOCATION E1DF1393

Refer to DTC P0136.

GENERAL DESCRIPTION E8C2A0AA

Refer to DTC P0136.

DTC DESCRIPTION EBD638AF

Due to possible oxygen sensor defects (e.g. reference air poisoning) or faults in the injection system (e.g. leaking fuel injector), the rear oxygen sensor may not provide the expected lean or rich signal level during fuel cut-off or full load condition. Hence, the oxygen sensor signal is checked for plausibility during this engine operating states.
There are 2 cases which DTC P0140 sets.
(I) Signal monitoring during fuel cut-off: The PCM monitors rear O2 sensor signal level during fuel cut-off which normally shows near 0V and sets DTC P0140 when signal level is too high.
(II) Signal monitoring after fuel cut-off: The PCM monitors rear O2 sensor signal level for a certain time after leaving fuel cut-off and sets DTC P0140 when signal variation during checked period is too small.

DTC DETECTING CONDITION EE768613

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
Case1)	DTC Strategy	● Signal plausibility during fuel cut off	● Related fuse blown or missing ● Contact resistance in connectors ● HO2S contamination
	Enable Conditions	● Sensor preheating and full heating phases finished ● In fuel cut off phase ● Integrated mass air flow > 20g ● No relevant failure ● 10V < Battery voltage <16V	
	Threshold Value	● Voltage with fuel cut off > 0.1V	
	Diagnostic Time	● 5 seconds	
Case2)	DTC Strategy	● Signal plausibility after fuel cut off	
	Enable Conditions	● Integrated engine load in fuel cut off > 12g ● Integrated engine load after fuel cut off > 40g ● Coolant temperature > 74°C(165°F) ● In Closed loop mode ● Catalyst temperature > 350°C(662°F) ● No relevant failure ● 11V < Battery voltage < 16V	
	Threshold Value	● Sensor signal increase < 10mV	
	Diagnostic Time	● 5 after fuel cut off phase	

SCHEMATIC DIAGRAM EF36E3AA

Refer to DTC P0136.

SIGNAL WAVEFORM E0917C0C

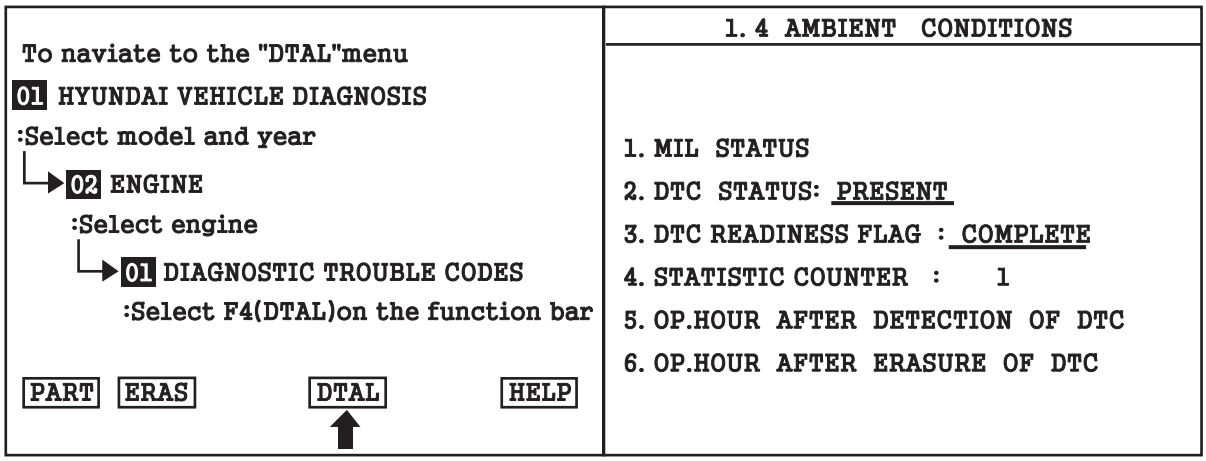
Refer to DTC P0136.

MONITOR DTC STATUS EC251AAC

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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 EFBD6F1E

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 "HO2S Fuse Inspection" procedure.

HO2S FUSE INSPECTION

1. Ignition "OFF" & Engine "OFF".

2. Verify "10A Sensor fuse" is installed and not blown.

3. If OK, go to "Component Inspection" procedure.
   If NG, replace fuse and repair any shorts as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5B23628

1. Visually/physically inspect following items:
   - Ensure that the sensor is securely installed
   - Check for corrosion on terminals
   - Check for damaged wiring
   - Repair as necessary 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 "O2 SNSR VOLT.(B1/S2)" parameter on the Scantool data list.

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

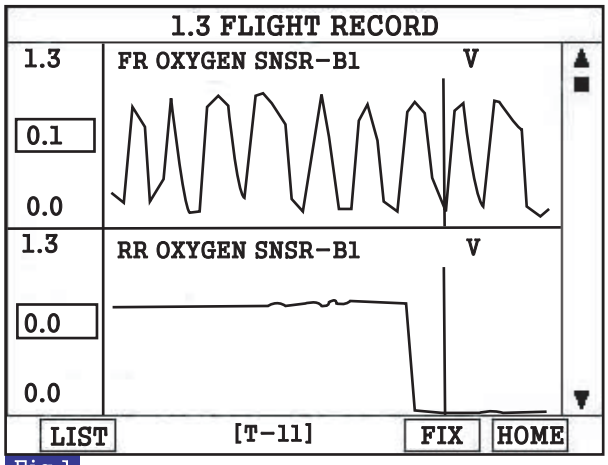


Fig 1

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

A01361

4. Is sensor data near the specified value?

YES

▶ Check for poor connection between PCM 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

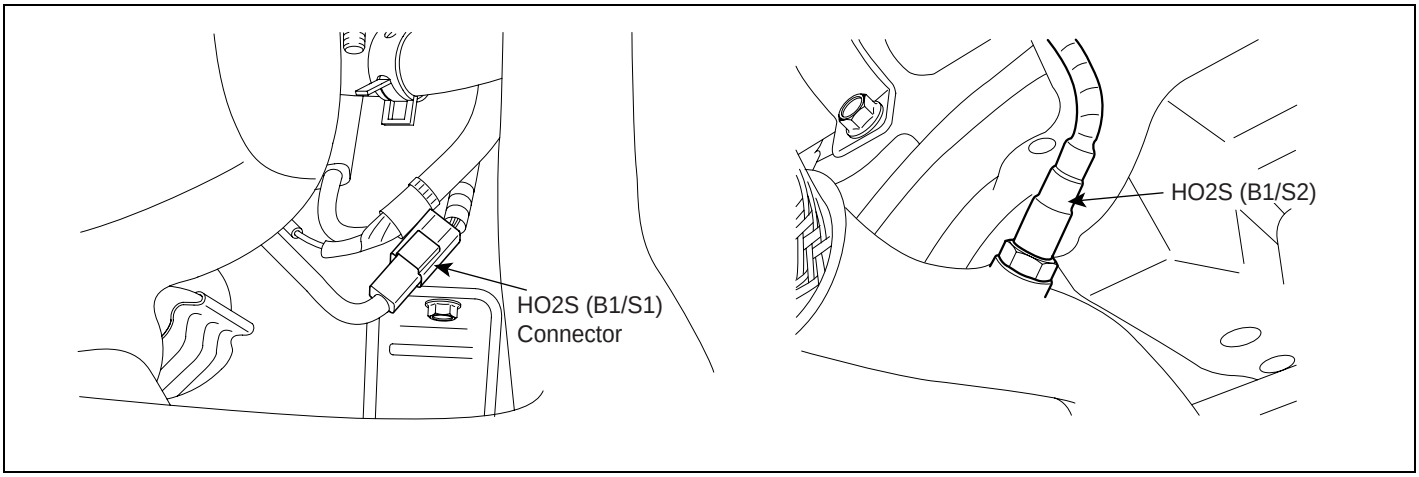
▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E87F4CB1

Refer to DTC P0136.

DTC P0170 FUEL TRIM (BANK 1)

COMPONENT LOCATION E0CFE38D



EGQE603N

GENERAL DESCRIPTION ECEB0A8C

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM 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 PCM 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 PCM 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 EF8C59F9

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The PCM 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 E5E12DFF

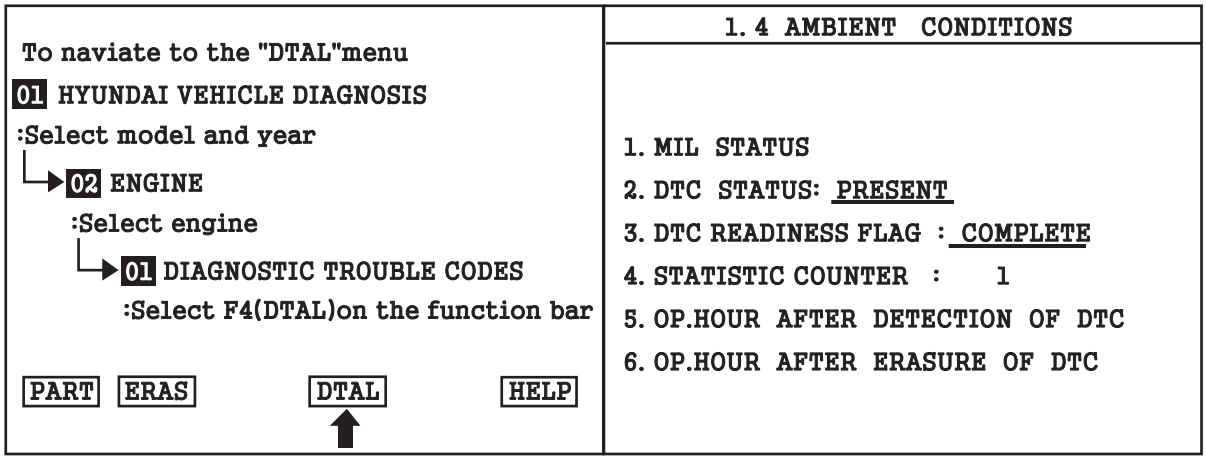
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	● Monitoring deviation of lambda controller	● Air leakage or restriction in intake or exhaust system ● Dirty engine oil or oil level too high ● Front HO2S or MAFS contamination ● Fuel system ● EVAP system ● Faulty sensor signals
Enable Condition	● Lambda control active ● Coolant temperature＞70℃(158°F) ● No relevant failure ● 10＜ Battery voltage＜16	
Threshold Value	● Lambda controller= -30%/+50%	
Diagnostic Time	● 40 seconds	

MONITOR DTC STATUS EF274C02

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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.

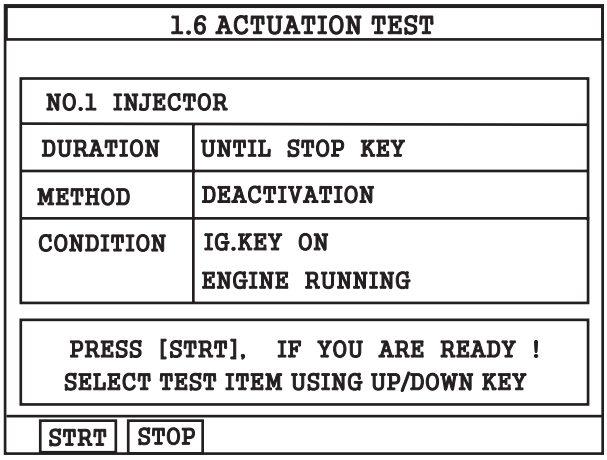
MONITOR ACTUATION TEST E68F41A5

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. Install 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.



B00172

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 cylinders.

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.

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.

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 E1FF9819

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 : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

5. Is 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 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 E3DFF62E

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 condition.
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.

DTC P0171 SYSTEM TOO LEAN (BANK 1)

COMPONENT LOCATION E31BD1CE

Refer to DTC P0170.

GENERAL DESCRIPTION E9003FD7

Refer to DTC P0170.

DTC DESCRIPTION ED8CBD6C

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 PCM 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 PCM 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 EA1ED3EB

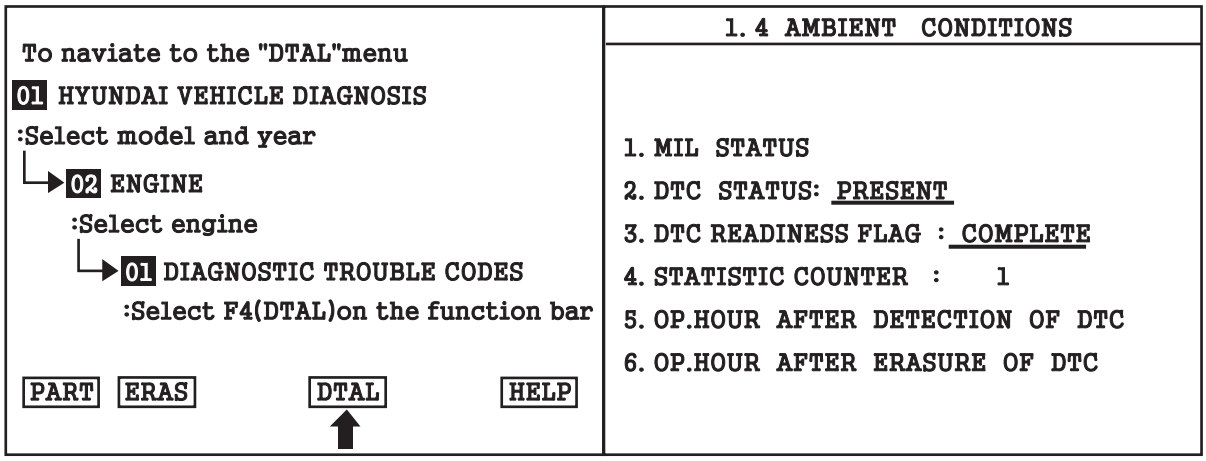
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	● Monitoring deviation of fuel control	● Air leakage ● Leaking EVAP system ● Low fuel pressure ● Faulty sensor signals
Enable Condition	● No relevant failure ● Estimated canister loading < 1 ● Lambda control active ● Estimated fuel dilution in oil limited is in rich side	
Threshold Value	● Lambda controller+Trim value > 36% ● The above condition is met for more than 60 sec. within 180 sec.	
Diagnostic Time	● 60 seconds	
Fail Safe	● EVAP. Emission control function is controlled in minimum operation mode.	

MONITOR DTC STATUS E5BEAA77

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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 E7FE097D

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. Install 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.

1.6 ACTUATION TEST	
NO.1 INJECTOR	
DURATION	UNTIL STOP KEY
METHOD	DEACTIVATION
CONDITION	IG.KEY ON ENGINE RUNNING

PRESS [STRT], IF YOU ARE READY !
SELECT TEST ITEM USING UP/DOWN KEY

STRT STOP

B00172

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

YES

▶ Go to "Air Leakage Inspection" 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 cylinders.

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.

AIR LEAKAGE INSPECTION E462F6F1

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 EF9524F0

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 : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

5. Is 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 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 EC0671F5

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 condition.
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.

DTC P0172 SYSTEM TOO RICH (BANK 1)

COMPONENT LOCATION ECB65111

Refer to DTC P0170.

GENERAL DESCRIPTION E66279AC

Refer to DTC P0170.

DTC DESCRIPTION ECBC7D2E

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 PCM 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 PCM 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 EF3CBCBB

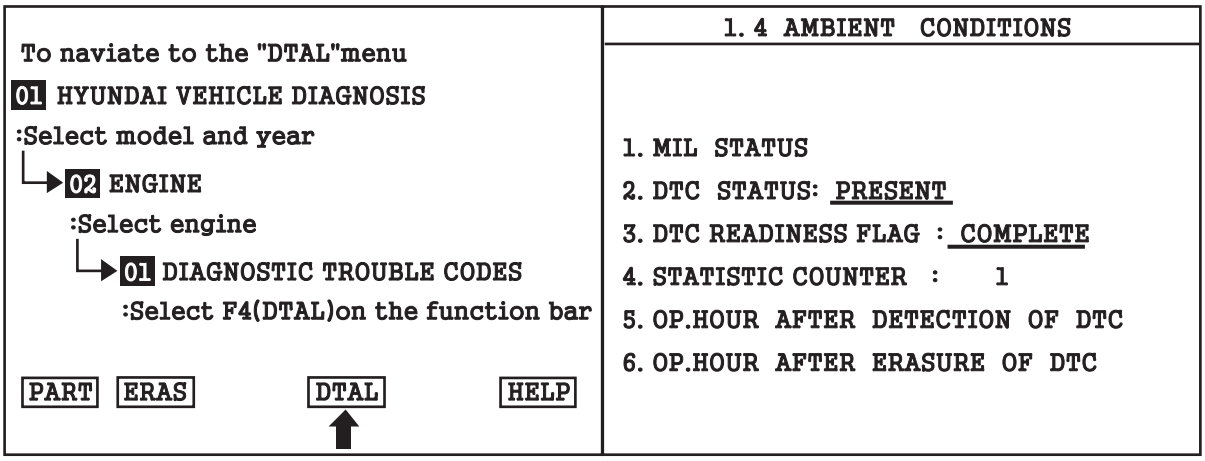
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	● Monitoring deviation of lambda controller	● Restricted intake or exhaust system ● Dirty engine oil or oil level too high ● Front HO2S or MAFS contamination ● Over purging of the EVAP system ● High fuel pressure ● Faulty sensor signals
Enable Condition	● No relevant failure ● Estimated canister loading < 1 ● Lambda control active ● Estimated fuel dilution in oil limited is in rich side	
Threshold Value	● Lambda controller+Trim value > 36% ● The above condition is met for more than 60 sec. within 180	
Diagnostic Time	● 60 seconds	
Fail Safe	● EVAP. Emission control function is controlled in minimum operation mode	

MONITOR DTC STATUS EB0C2BCF

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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 EFE8AF45

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. Install 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.

1.6 ACTUATION TEST	
NO.1 INJECTOR	
DURATION	UNTIL STOP KEY
METHOD	DEACTIVATION
CONDITION	IG.KEY ON ENGINE RUNNING

PRESS [STRT], IF YOU ARE READY !
SELECT TEST ITEM USING UP/DOWN KEY

STRT STOP

B00172

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

YES

▶ Go to " Check for restricted intake or exhause system" 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 cylinders.

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.

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 IAC 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. Install Scantool and note the "S/TERM FUEL TRIM(B1)" parameter on the Scantool data list.

4. Disconnect and plug the positive crankcase ventilation

5. Monitor the "S/TERM FUEL TRIM(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.

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 E3A14E44

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 : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

5. Is 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 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 E8B29C59

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 condition.

3. Read "DTC Status" parameter.

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

YES

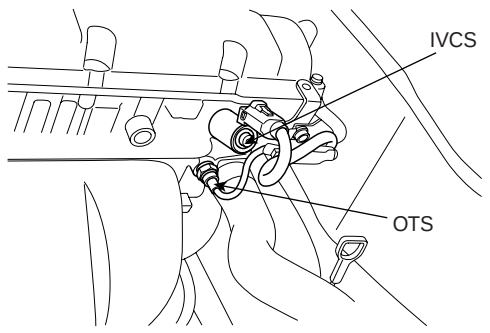
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0196 ENGINE OIL TEMP. SENSOR RANGE / PERFORMANCE

COMPONENT LOCATION E2D04625



EGQE601V

GENERAL DESCRIPTION E77A94BA

The fluid of the CVVT is the engine oil and its density changes according to the engine oil temperature. At this time the Oil Temperature Sensor (OTS) helps compensation against the temperature differences. The Oil Temperature Sensor measures the engine oil temperature before the engine oil comes into the Oil-flow Control Valve (OCV).According to the measured temperature, the Engine Control Module (PCM) compensates the oil-flow control valve operation time.

DTC DESCRIPTION EC6E6ACA

The purpose of this diagnosis is to detect a stuck oil temperature signal or unplausibly low ,high signal. For the stuck signal detection, the PCM checks whether after a variation of the calculated oil temperature also a variation of the measured oil temperature is detected and sets DTC P0196 if the variation of the measured oil temperature is lower than the threshold.For the unplausibly high, low signal detection, the PCM compares measured engine oil temperature with calculated oil temperature or coolant temperature and sets DTC P0196 when one of following conditions is met.

1. Measured oil temperture is unplausibly low when calculated oil temperature is high.

2. Measured oil temperature is unplausibly high when coolant is low without any relevant failure.

DTC DETECTING CONDITION EEAC794C

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
Case1)	DTC Strategy	● Signal stuck	● Contact resistance in connectors ● Faulty OTS
	Enable Conditions	● Engine coolant temperature at start < 40°C(104°F) ● No relevant failure ● 6 < Battery voltage < 16	
	Threshold Value	● Calculated oil temperature increase > threshold but measured oil temperature increase < threshold(Threshold depends on Coolant temperature at start)	
	Diagnostic Time	●10~30 minutes depending on coolant temperature at start and drive pattern	
Case2)	DTC Strategy	● Signal plausibility	
	Enable Conditions	● No relevant failure ● 6 < Battery voltage < 16	
	Threshold Value	● Coolant temperature at start < 40°C(104°F) & calculated oil temperature > 70°C(158°F) & measured oil temperature < 20°C(68°F) ● Coolant temperature < 70°C(158°F) & measured oil temperature > 100°C(212°F)	
	Diagnostic Time	● 15 seconds	

SPECIFICATION EACEAE4B

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	16.52	40	104	1.11
0	32	6.00	60	140	0.54
20	68	2.45	80	176	0.29

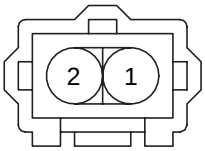
SCHEMATIC DIAGRAM E6586C5E

[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 76	Sensor Ground
2	PCM Terminal 52	OTS signal

[CONNECTOR]

OTS Harness side connector



C112

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	●	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	●	77	78	*	80	81	2	1

C130-1

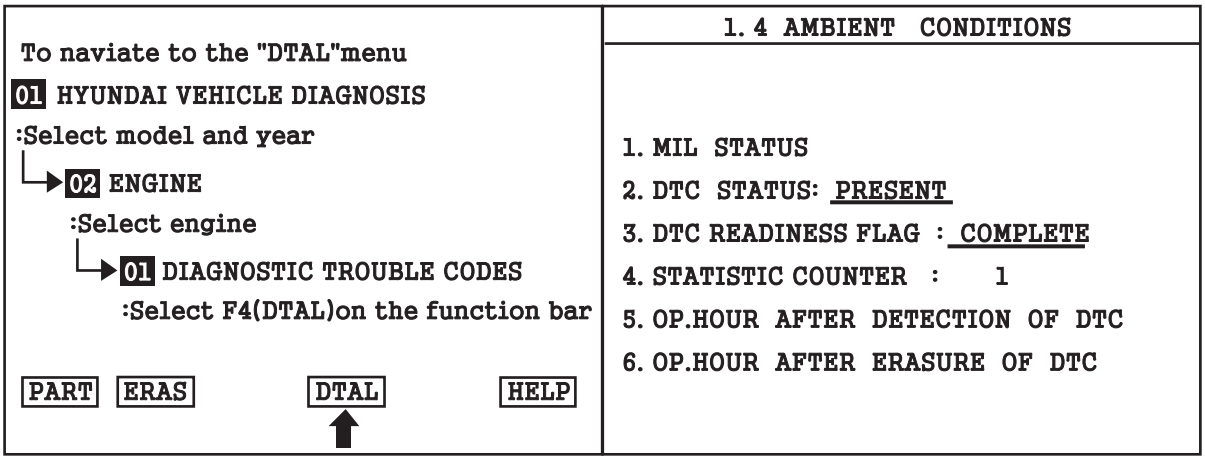
B01961

MONITOR DTC STATUS EBC5BB67

NOTE

If any codes relating to OTS 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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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 E92F19EC

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

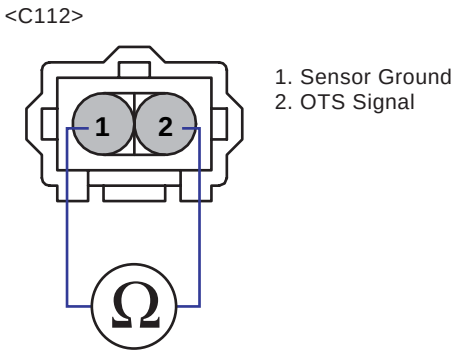
▶ Go to "Component Inspection" procedure

COMPONENT INSPECTION EB5356EB

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

SPECIFICATION

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	16.52	40	104	1.11
0	32	6.00	60	140	0.54
20	68	2.45	80	176	0.29



4. Is sensor switching properly?

YES

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

VERIFICATION OF VEHICLE REPAIR E2C8BDAF

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.

DTC P0197 ENGINE OIL TEMP. SENSOR LOW INPUT

COMPONENT LOCATION EB25451D

Refer to DTC P0196.

GENERAL DESCRIPTION ED85C312

Refer to DTC P0196.

DTC DESCRIPTION E2DF30B8

PCM sets DTC P0197 if the PCM detects signal voltage lower than the possible range of a properly operating OTS.

DTC DETECTING CONDITION EDFBEE27

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	● Voltage range check	● Short circuit to ground ● Contact resistance in connectors ● Faulty OTS
Enable Condition	● Engine coolant temperature < 100°C(212°F)	
Threshold Value	● Oil temperature > 154°C(309°F)	
Diagnostic Time	● 5 seconds	

SPECIFICATION EAAB15C2

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	16.52	40	104	1.11
0	32	6.00	60	140	0.54
20	68	2.45	80	176	0.29

SCHEMATIC DIAGRAM E7F08BCB

Refer to DTC P0196.

SIGNAL WAVEFORM E0470A46

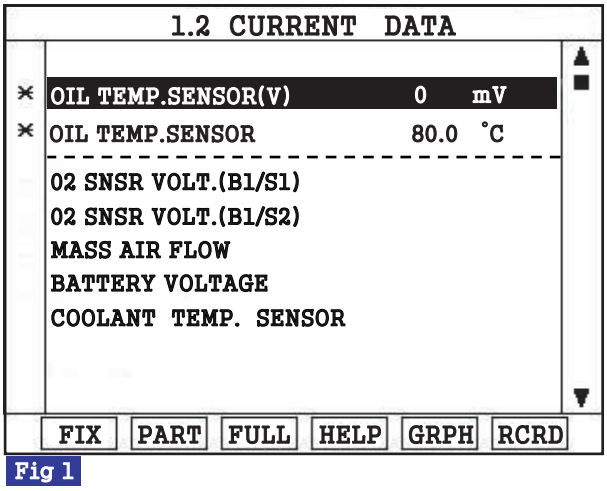
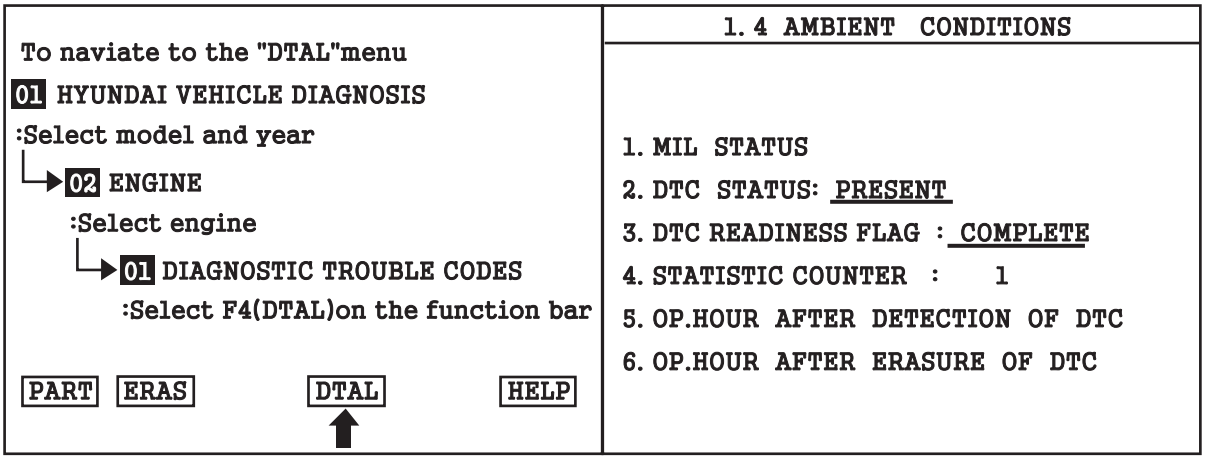


Fig. 1) Short to ground in signal circuit: Approx. 0V

B01971

MONITOR DTC STATUS E80E0758

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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 E31855D2

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

Specification :	Approx. 5V

4. Is OTS parameter near the specified value.?

YES

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

NO

▶ Possibility of signal circuit short to ground. Go to next step as below.

SIGNAL CIRCUIT INSPECTION E57FD360

1. Ignition "OFF"
2. Disconnect OTS connector.
3. Measure resistance between terminal 2 of the 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 EBD240ED

Refer to DTC P0196.

COMPONENT INSPECTION EEF6E7ED

Refer to DTC P0196.

VERIFICATION OF VEHICLE REPAIR EB9DB58A

Refer to DTC P0196.

DTC P0198 ENGINE OIL TEMP. SENSOR HIGH INPUT

COMPONENT LOCATION EC760304

Refer to DTC P0196.

GENERAL DESCRIPTION E23E101D

Refer to DTC P0196.

DTC DESCRIPTION E7CEDEB0

PCM sets DTC P0198 if the PCM detects signal voltage higher than the possible range of a properly operating OTS.

DTC DETECTING CONDITION E9AED52E

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	● Voltage range check	● Open or short circuit to battery ● Contact resistance in connectors ● Faulty OTS
Enable Condition	● 5 minutes after engine start if coolant temperature ＜-10°C(14°F)	
Threshold Value	● Oil temperature ＜ -36°C(-33°F)	
Diagnostic Time	● 5 seconds	

SPECIFICATION E6F142B4

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	16.52	40	104	1.11
0	32	6.00	60	140	0.54
20	68	2.45	80	176	0.29

SCHEMATIC DIAGRAM EAA580C3

Refer to DTC P0196.

SIGNAL WAVEFORM ED25384E

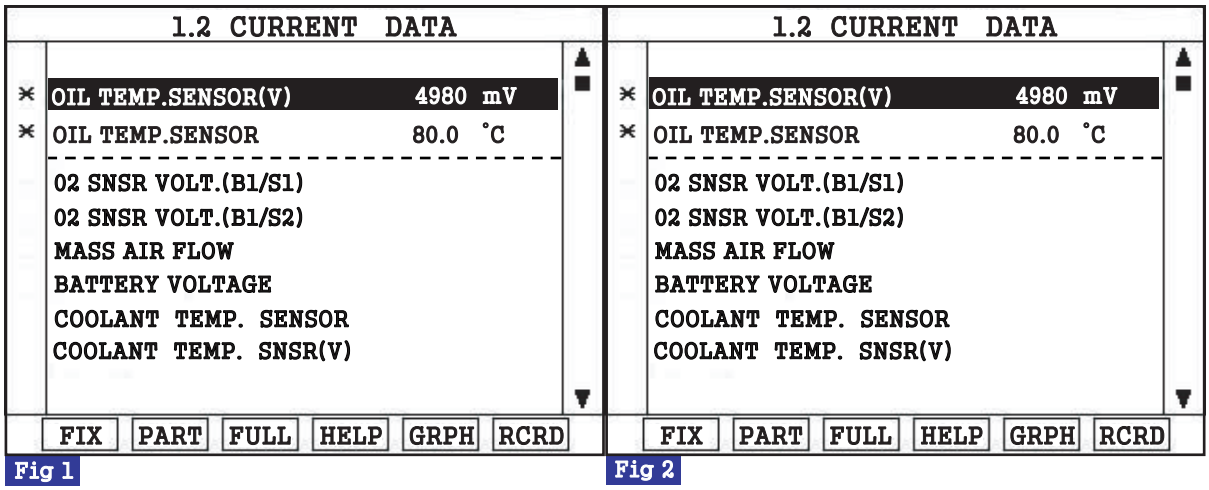


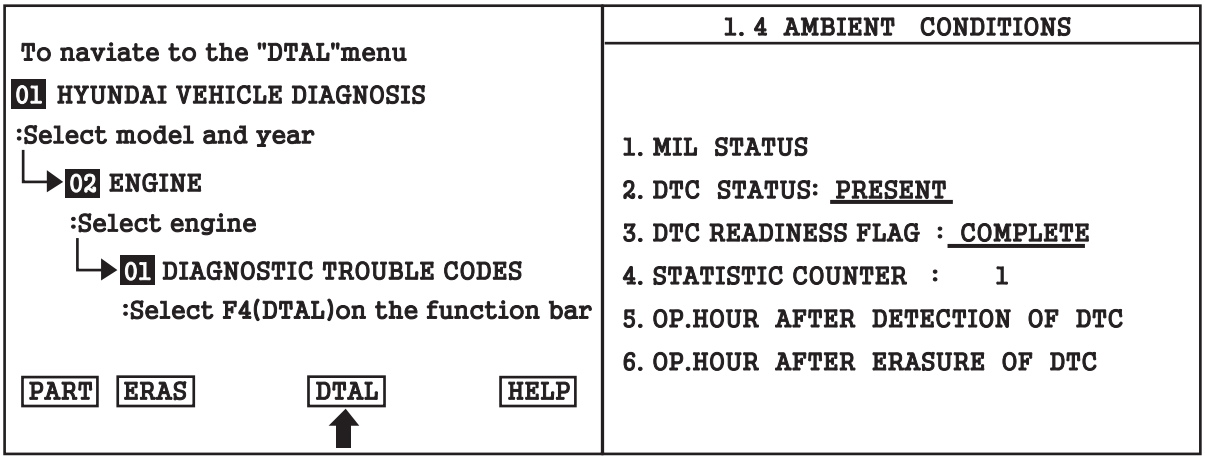
Fig. 1) Open in signal circuit : Approx. 5V

Fig. 2) Open in ground circuit : Approx. 5V

B01981

MONITOR DTC STATUS EA1B0D4F

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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 E4DF135B

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

Specification :	Approx. 0V

5. Is OTS parameter near the specified value.?

YES

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

NO

▶ Go to next step as below.

6. Jumper the terminal 2 of the OTS harness connector to chassis ground.
7. Observe the "OIL TEMP. SENSOR" parameter on the Scantool.

Specification :	Approx. 0V

YES

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

NO

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

GROUND CIRCUIT INSPECTION EFFBCA5A

1. Ignition "OFF"
2. Disconnect PCM connector.
3. Measure resistance between terminals 1 of the OTS harness connector and 76 of the PCM harness connector.

Specification :	Approx. 0Ω

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.

SIGNAL CIRCUIT INSPECTION ECACA8DD

1. Check for open in signal circuit.

   1) Ignition "OFF"

   2) Measure resistance between terminals 2 of the OTS harness connector and 52 of the PCM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within 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) Disconnected PCM connector.

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

   3) Measure voltage between terminals 2 of the OTS harness connector and 52 of the PCM harness connector.

Specification : Approx. 0V

   4) Is voltage within specification?

   YES

   ▶ Go to "Terminal and Connector Inspection" procedure.

   NO

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

TERMINAL AND CONNECTOR INSPECTION E9F0EDE6

Refer to DTC P0196.

COMPONENT INSPECTION EE7D5B8B

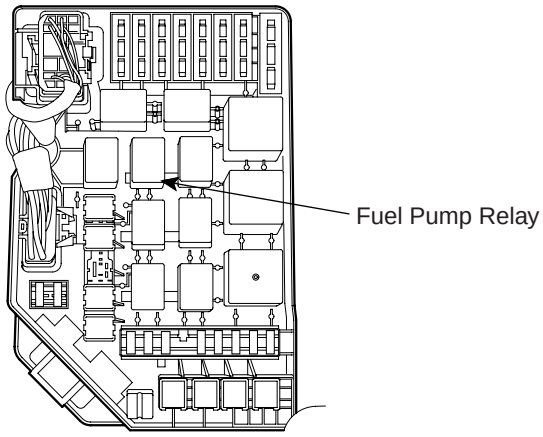
Refer to DTC P0196.

VERIFICATION OF VEHICLE REPAIR E00FF0FA

Refer to DTC P0196.

DTC P0230 FUEL PUMP PRIMARY CIRCUIT

COMPONENT LOCATION EBDC05EE



EGQE501H

GENERAL DESCRIPTION E4112B7A

The PCM 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 PCM monitors the control circuit between the fuel pump relay and the PCM. When the ignition switch is turned ON, the PCM energizes the fuel pump relay, which sends power to the fuel pump.

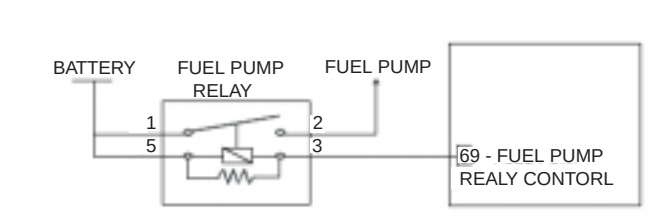
DTC DESCRIPTION EF3CDAFF

PCM sets DTC P0230 if the PCM detects the fuel pump relay control circuit is open, short to ground or battery.

DTC DETECTING CONDITION ECDDAF9C

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 fuel pump relay
Enable Condition	● 10V < Battery voltage < 16V	
Threshold Value	● Open, short to battery or short to ground	
Diagnostic Time	● 3 seconds	

SCHEMATIC DIAGRAM EC1CFFEB

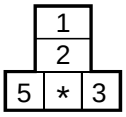


[Connection Information]

Terminal	Connected to	Function
1	Battery	Battery Voltage
5	Battery	Battery Voltage
3	PCM Terminal 69	Fuel Pump Relay Control
2	-	Supply B+

[CONNECTOR]

Fuel Pump Relay Harness side connector



E14

PCM side terminal

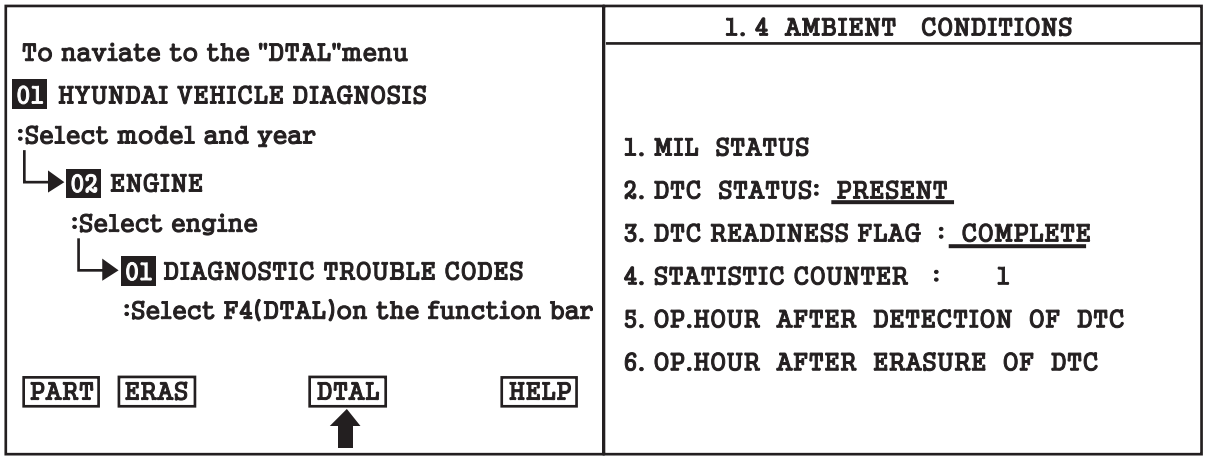
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	●	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B02301

MONITOR DTC STATUS E0977D88

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.



B00112

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

NOTE

A. History (Not Present) fault : DTC occurred but has been cleared.
B. 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 "Component Inspection" procedure.

COMPONENT INSPECTION E421AB97

1. Ignition "OFF" & Engine "OFF"
2. Remove the fuel pump relay.
3. Apply 12V and a ground to 5 and 3 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 E9CA5AF2

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

POWER SUPPLY CIRCUIT INSPECTION E5BF27AB

1. Remove the fuel pump relay.
2. Ignition "ON" & Engine "OFF".
3. Measure the voltage between terminal 5 of the fuel pump relay harness connector and chassis ground.

4. Measure the voltage between terminal 1 of the fuel pump relay harness connector and chassis ground.

Specification : Approx. B+

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.

CONTORL CIRCUIT INSPECTION EF7D4DAD

1. Check for short to ground in control circuit

   1) Ignition "OFF" & Relay connector : Disconnected.

   2) Measure resistance between terminal 3 of the relay 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.

2. Check for short to power in control circuit

   1) Disconnect PCM connector

   2) Ignition "ON" & Engine "OFF"

   3) Measure voltage between terminal 3 of the relay 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.

3. Check for open in control harness

1) Measure resistance between terminals 3 of the relay harness connector and 69 of the PCM harness connector.

Specification : Approx 0Ω

2) Is resistance within the specification?

YES

▶ Thoroughly Check for poor connection between PCM 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 E30FE3AC

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

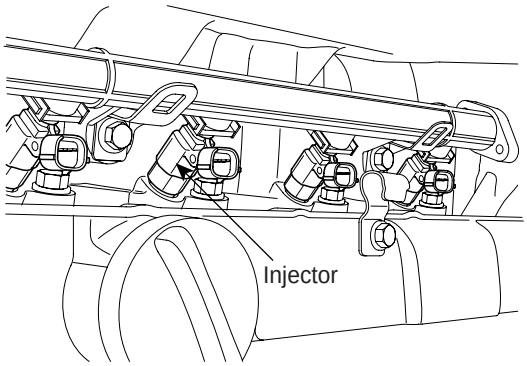
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0261 CYLINDER 1-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EAD92CEA



EGQE603L

GENERAL DESCRIPTION EBBF2B77

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION E9A3AFF3

PCM sets DTC P0261 if the PCM detects that injector (Cylinder #1) control circuit is shorted to ground.

DTC DETECTING CONDITION ECC746F2

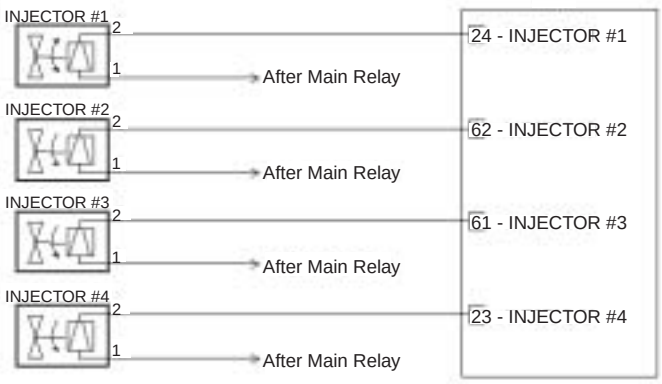
Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver Stage Check	● Open in power supply harness ● Short to ground in control harness ● Contact resistance in connectors ● Faulty injector
Enable Conditions	● 10 < Battery voltage(V) <16 ● Engine speed(rpm) >30	
Threshold Value	● Short to ground	
Diagnostic Time	● 1.5 sec.	

SPECIFICATION EF4EFC97

Temp.(℃)	Temp.(°F)	Resistance (Ω)	Temp.(℃)	Temp.(°F)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9

20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM E44CD10E



[Connection Information]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 24	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 62	Injector operation

INJECTOR #3

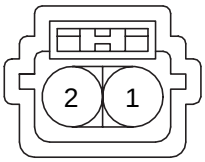
Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 61	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 23	Injector operation

[CONNECTOR]

INJECTOR Harness side connector



C137-1

PCM side terminal

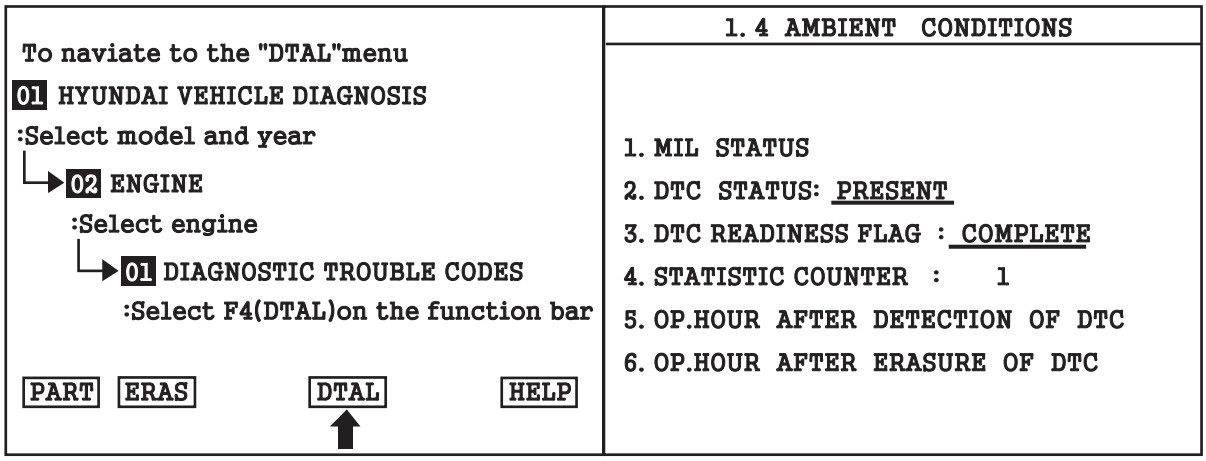
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	●	●	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	●	●		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B02611

MONITOR DTC STATUS E7FAE911

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.



B00112

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

NOTE

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

YES

▶ Fault is intermittent, caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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

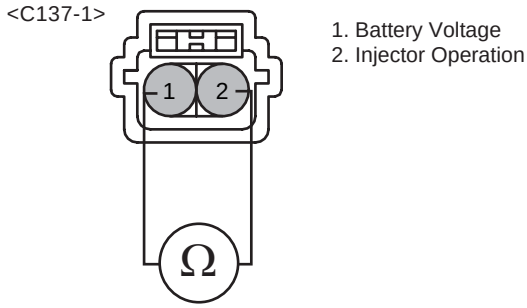
▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E642FD23

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1



B02614

4. Is resistance within the specification?

YES

▶ 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 E1DBCCB8

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 procedure.

NO

▶ Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E3B23BBD

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 EA9EBF3B

1. Check for short to ground in control circuit.

   1) Ignition "OFF".

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

Specification :	Infinite

2. Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 E42A5DCA

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.

DTC P0262 CYLINDER 1-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E61CCF2B

Refer to DTC P0261.

GENERAL DESCRIPTION E2BD9636

Refer to DTC P0261.

DTC DESCRIPTION E8B2EC3E

PCM sets DTC P0262 if the PCM detects that injector (Cylinder #1) control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION EA6FEBC0

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 EFBFF9D2

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM EC4A3657

Refer to DTC P0261.

MONITOR DTC STATUS ED0AC4DC

Refer to DTC P0261.

COMPONENT INSPECTION E3E4216A

Refer to DTC P0261.

TERMINAL AND CONNECTOR INSPECTION EEA8D979

Refer to DTC P0261.

POWER SUPPLY CIRCUIT INSPECTION EBB8A6EC

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 EFADECF5

1. Check for short to battery in control circuit.
   1) Ignition "OFF".
   2) Disconnect PCM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

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. Check for Open in Control Circuit.
   1) Ignition "OFF".
   2) Measure resistance between terminals 2 of the injector harness connector and 24 of the PCM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 E16BF29E

Refer to DTC P0261.

DTC P0264 CYLINDER 2-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E8F479ED

Refer to DTC P0261.

GENERAL DESCRIPTION E305BE8A

Refer to DTC P0261.

DTC DESCRIPTION E99B9480

PCM sets DTC P0264 if the PCM detects that injector (Cylinder #2) control circuit is shorted to ground.

DTC DETECTING CONDITION EBCF0BF4

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.	

SPECIFICATION E6EBC993

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM E18B97A7

Refer to DTC P0261.

MONITOR DTC STATUS E7E06CAE

Refer to DTC P0261.

COMPONENT INSPECTION E45C5A24

Refer to DTC P0261.

TERMINAL AND CONNECTOR INSPECTION EF8E8F23

Refer to DTC P0261.

POWER SUPPLY CIRCUIT INSPECTION ECF83DBE

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 E9CB65DE

1. Check for short to ground in control circuit.
   1) Ignition "OFF".
   2) Measure resistance between terminal 2 of the injector harness connector and chassis ground.

Specification : Infinite

2. Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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

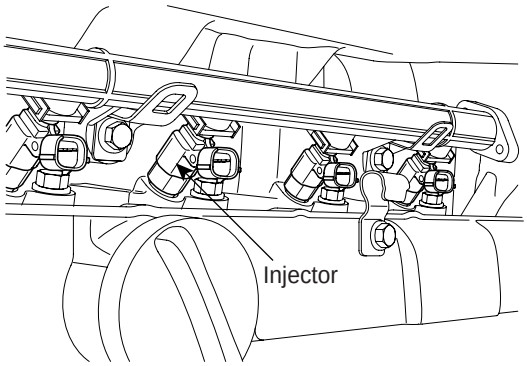
▶ Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE17C273

Refer to DTC P0261.

DTC P0265 CYLINDER 2-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION EC2FB54A



EGQE603L

GENERAL DESCRIPTION EEEDCBC4

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION EAFF70D3

PCM sets DTC P0265 if the PCM detects that injector (Cylinder #2) control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION E5AFBE6E

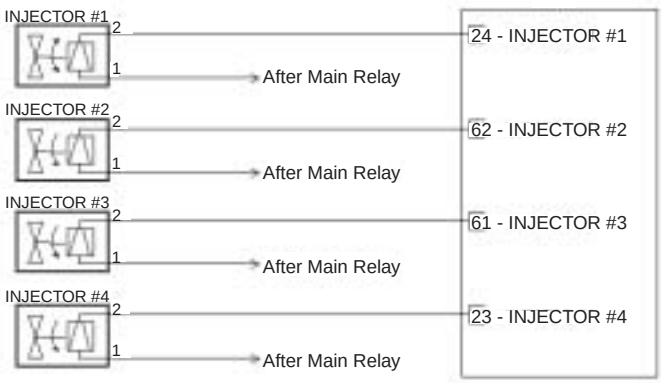
Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver Stage Check	● Open or short to battery in control harness. ● Contact resistance in connectors ● Faulty injector
Enable Conditions	● 10 ≤ Battery voltage(V) ≤ 16 ● Engine speed(rpm) > 30	
Threshold Value	● Open or short to battery	
Diagnostic Time	● 1.5 sec.	

SPECIFICATION EBA6F568

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9

20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM E443A37A



[Connection Information]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 24	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 62	Injector operation

INJECTOR #3

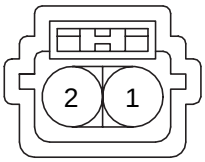
Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 61	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 23	Injector operation

[CONNECTOR]

INJECTOR Harness side connector



C137-2

PCM side terminal

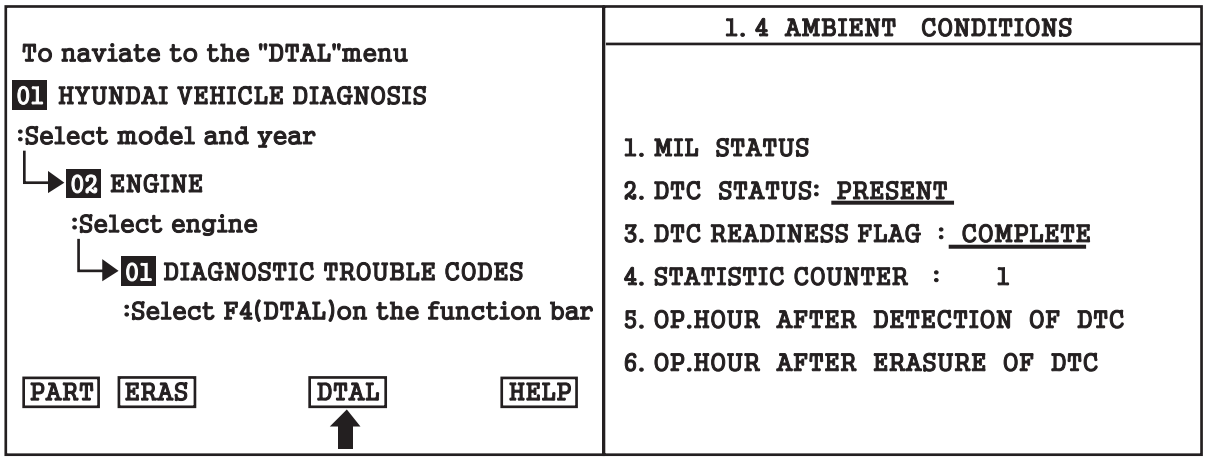
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	●	●	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	●	●		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B02644

MONITOR DTC STATUS EB0CBA8C

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.



B00112

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

NOTE

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

YES

▶ Fault is intermittent, caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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

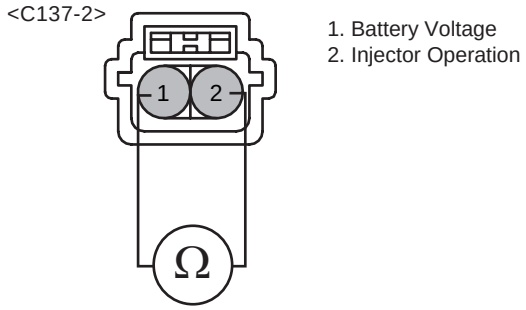
▶ Go to "Component Inspection" procedure

COMPONENT INSPECTION EE1CEEFF

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1



B02641

4. Is resistance within the specification?

YES

▶ 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 EA8C6DF5

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 EED8DB92

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 E1F28AA1

1. Check for short to battery in control circuit.

   1) Ignition "OFF".

   2) Disconnect PCM connector.

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

   4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

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. Check for Open in Control Circuit.

   1) Ignition "OFF".

   2) Measure resistance between terminals 2 of the injector harness connector and 62 of the PCM harness connector

Specification : Approx. 0Ω

   3) Is resistance within the specification?

   YES

   ▶ Check for poor connection between PCM 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 E692CE15

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

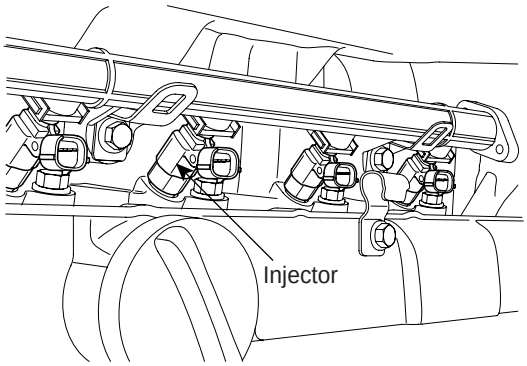
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0267 CYLINDER 3-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E6122EBB



EGQE603L

GENERAL DESCRIPTION EFD93DBD

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION E3F26CCC

PCM sets DTC P0267 if the PCM detects that injector (Cylinder #3) control circuit is shorted to ground.

DTC DETECTING CONDITION E8932A4F

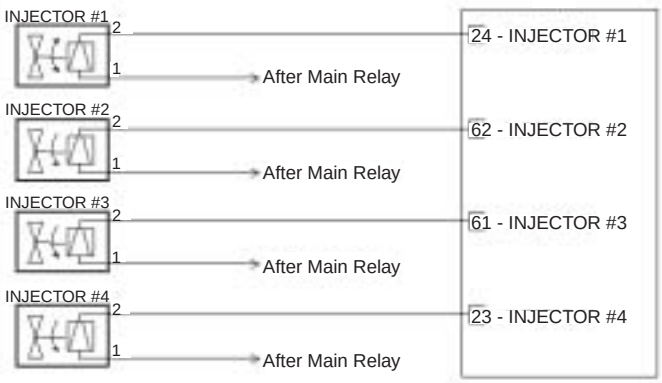
Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver Stage Check	● Open in power supply harness ● Short to ground in control harness ● Contact resistance in connectors ● Faulty injector
Enable Conditions	● 10 ≤ Battery voltage(V) ≤ 16 ● Engine speed(rpm) > 30	
Threshold Value	● Short to ground	
Diagnostic Time	● 1.5 sec.	

SPECIFICATION E49A8849

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9

20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM EB74E5DD



[Connection Information]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 24	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 62	Injector operation

INJECTOR #3

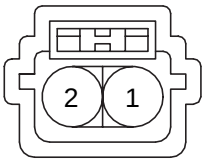
Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 61	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 23	Injector operation

[CONNECTOR]

INJECTOR Harness side connector



C137-3

PCM side terminal

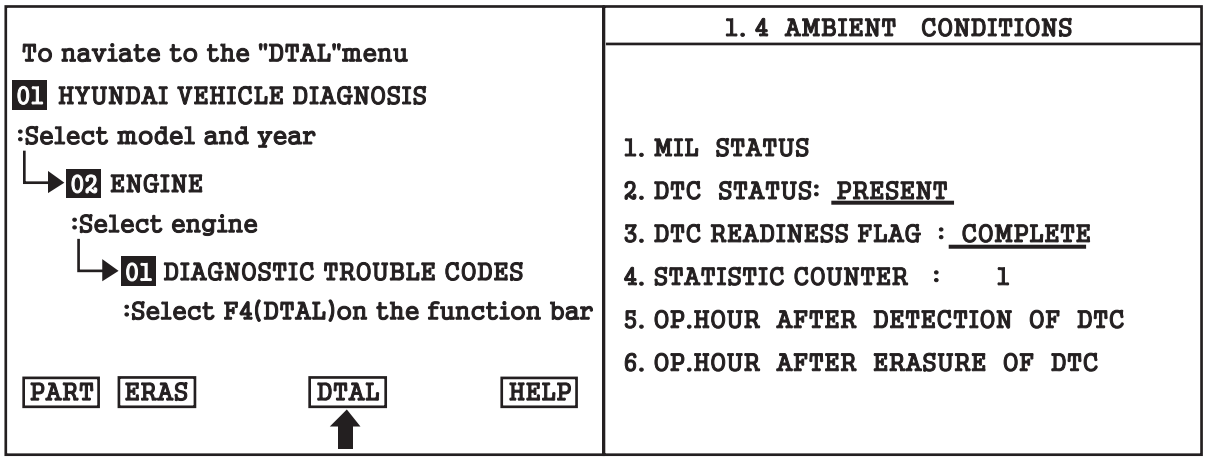
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	●	●	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	●	●		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B02674

MONITOR DTC STATUS ED98036C

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.



B00112

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

NOTE

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

YES

▶ Fault is intermittent, caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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

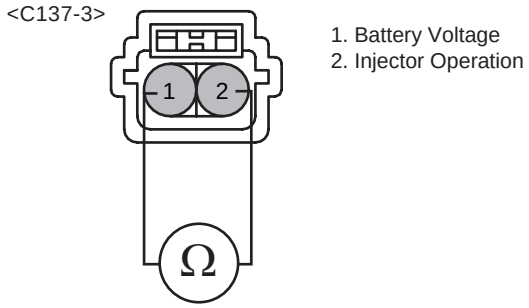
▶ Go to "Component Inspection" procedure

COMPONENT INSPECTION EAA860E9

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1



B02671

4. Is resistance within the specification?

YES

▶ 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 EEAD3EEA

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 E95B4583

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 ECEDEB82

1. Check for short to ground in control circuit.

   1) Ignition "OFF".

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

Specification : Infinite

   3) Is resistance within the specification?

   YES

   ▶ Check for poor connection between PCM 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 EF9E2A97

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.

DTC P0268 CYLINDER 3-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E584FE9E

Refer to DTC P0267.

GENERAL DESCRIPTION EBDE85AC

Refer to DTC P0267.

DTC DESCRIPTION E69B12AB

PCM sets DTC P0268 if the PCM detects that injector (Cylinder #3) control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION E1A2701E

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 E7F93E28

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM EA46553A

Refer to DTC P0267.

MONITOR DTC STATUS E479F33A

Refer to DTC P0267.

COMPONENT INSPECTION E9EAC0C4

Refer to DTC P0267.

TERMINAL AND CONNECTOR INSPECTION ED7EAECD

Refer to DTC P0267.

POWER SUPPLY CIRCUIT INSPECTION E8BCB5D8

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 EEE5B2D0

1. Check for short to battery in control circuit.
   1) Ignition "OFF".
   2) Disconnect PCM connector.
   3) Ignition "ON" & Engine "OFF"
   4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

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. Check for Open in Control Circuit.
   1) Ignition "OFF".
   2) Measure resistance between terminals 2 of the injector harness connector and 61 of the PCM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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

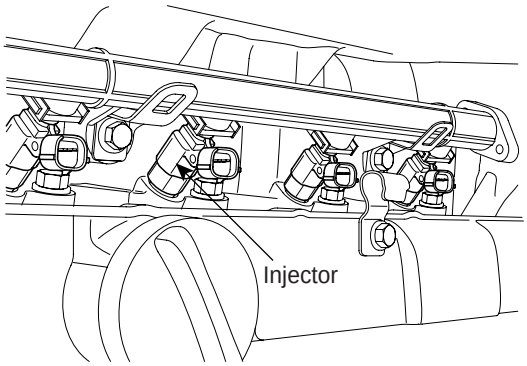
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EB9D7A65

Refer to DTC P0267.

DTC P0270 CYLINDER 4-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E37BD831



EGQE603L

GENERAL DESCRIPTION EE0D8D4A

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION EB1D3345

PCM sets DTC P0270 if the PCM detects that injector (Cylinder #4) control circuit is shorted to ground.

DTC DETECTING CONDITION E8130A5D

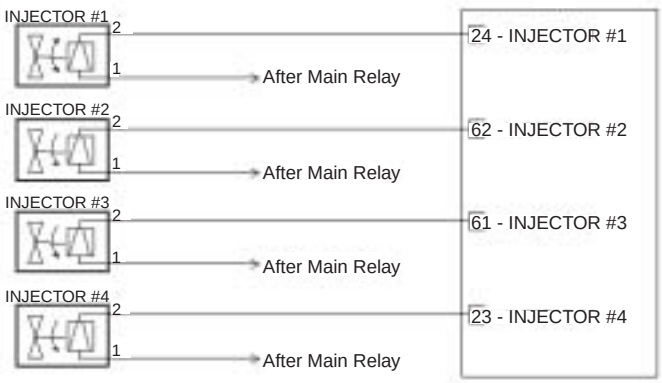
Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver Stage Check	● Open in power supply harness ● Short to ground in control harness ● Contact resistance in connectors ● Faulty injector
Enable Conditions	● 10 ≤ Battery voltage(V) ≤16 ● Engine speed(rpm) ＞30	
Threshold Value	● Short to ground	
Diagnostic Time	● 1.5 sec.	

SPECIFICATION EDFEFED1

Temp.(℃)	Temp.(°F)	Resistance (Ω)	Temp.(℃)	Temp.(°F)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9

20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM E9BA25E0



[Connection Information]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 24	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 62	Injector operation

INJECTOR #3

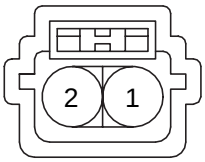
Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 61	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	PCM Terminal 23	Injector operation

[CONNECTOR]

INJECTOR Harness side connector



C137-1

PCM side terminal

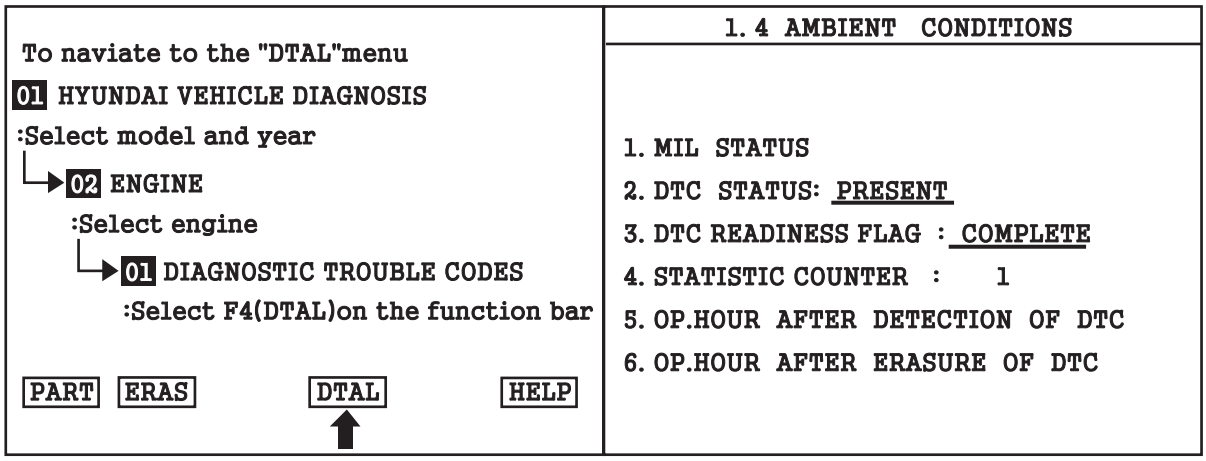
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	●	●	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	●	●		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B02611

MONITOR DTC STATUS E4BAE375

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.



B00112

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

NOTE

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

YES

▶ Fault is intermittent, caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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

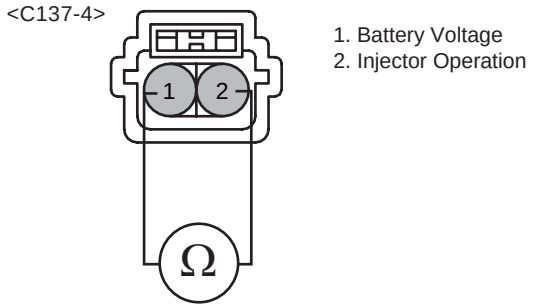
▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EAB84A8D

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1



B02701

4. Is resistance within the specification?

YES

▶ 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 EC75588F

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 EE98F59E

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 EBA943FB

1. Check for short to ground in control circuit.

   1) Ignition "OFF".

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

Specification : Infinite

   3) Is resistance within the specification?

   YES

   ▶ Check for poor connection between PCM 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 EFAD1AA3

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.

DTC P0271 CYLINDER 4-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E87C9A91

Refer to DTC P0270.

GENERAL DESCRIPTION EB0EBF99

Refer to DTC P0270.

DTC DESCRIPTION EE18ED04

PCM sets DTC P0271 if the PCM detects that injector (Cylinder #4) control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION EC05C31D

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 E7D2DABF

Temp.(℃)	Temp.(℉)	Resistance (Ω)	Temp.(℃)	Temp.(℉)	Resistance (Ω)
-20	-4	12.2 ~ 12.3	40	104	15.5 ~ 15.7
-10	14	12.9 ~ 13.1	50	122	16.1 ~ 16.3
0	32	13.3 ~ 13.5	60	140	16.6 ~ 16.8
10	50	13.9 ~ 14.0	80	176	17.7 ~ 17.9
20	68	14.4 ~ 14.6	100	212	18.8 ~ 19.0
30	86	15.0 ~ 15.2	120	248	19.9 ~ 20.1

SCHEMATIC DIAGRAM EAE69FB7

Refer to DTC P0270.

MONITOR DTC STATUS ED9ECD2B

Refer to DTC P0270.

COMPONENT INSPECTION E2FC13C2

Refer to DTC P0270.

TERMINAL AND CONNECTOR INSPECTION EF68A04F

Refer to DTC P0270.

POWER SUPPLY CIRCUIT INSPECTION E391CF5E

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the injector 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 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 E8ABF5DB

1. Check for short to battery in control circuit.
   1) Ignition "OFF".
   2) Disconnect PCM connector.
   3) Ignition "ON" & Engine "OFF".
   4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

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. Check for Open in Control Circuit.
   1) Ignition "OFF".
   2) Measure resistance between terminals 2 of the injector harness connector and 23 of the PCM harness connector.

Specification : Approx. 0Ω

   3) Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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

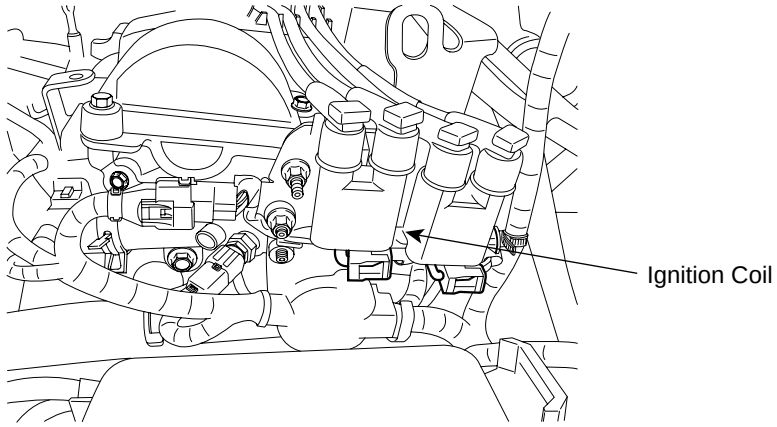
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECFFDBD3

Refer to DTC P0270.

DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

COMPONENT LOCATION E3703CC8



EGQE501Q

GENERAL DESCRIPTION EDAE4AC1

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The PCM 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 PCM 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 PCM 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 PCM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION ECEF58DC

The PCM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the PCM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0304) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The PCM 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 PCM sets P0300.

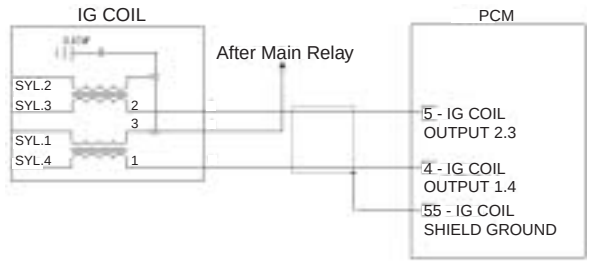
DTC DETECTING CONDITION EF8F0558

Item	Detecting Condition	Possible Cause
DTC Strategy	● Calculation of engine roughness	● Faulty spark plugs, high-tension 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	● 78＜ Mass air flow(mg/stroke)＜ 356 ● 540＜ Engine speed(RPM)＜ 6500 ● Coolant temperature ＞20°C if Start temperature＜ -7°C ● 11V＜ Battery voltage＜ 16V ● Throttle Angle gradient is in predetermined range ● No injector shut off ● No rough road	
Threshold Value	● Misfire detected on 2 or more cylinders	

SPECIFICATION EA5FA36D

Temp.(℃)	Temp.(°F)	Ignition primary coil (Ω)	Ignition secondary coil (kΩ)
-20	-4	0.5	7.7
0	32	0.54	8.4
20	68	0.58	9.1
40	104	0.62	9.8
60	140	0.66	10.5
80	176	0.71	11.2
100	212	0.75	11.9

SCHEMATIC DIAGRAM EBA7BB9C

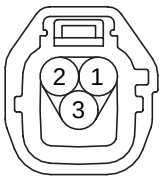


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 4	IG Coil control (1,4)
2	PCM Terminal 5	IG Coil control (2,3)
3	Main Relay	Battery voltage

[CONNECTOR]

IG Coil Harness side connector



C114

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	●	●
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	●	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

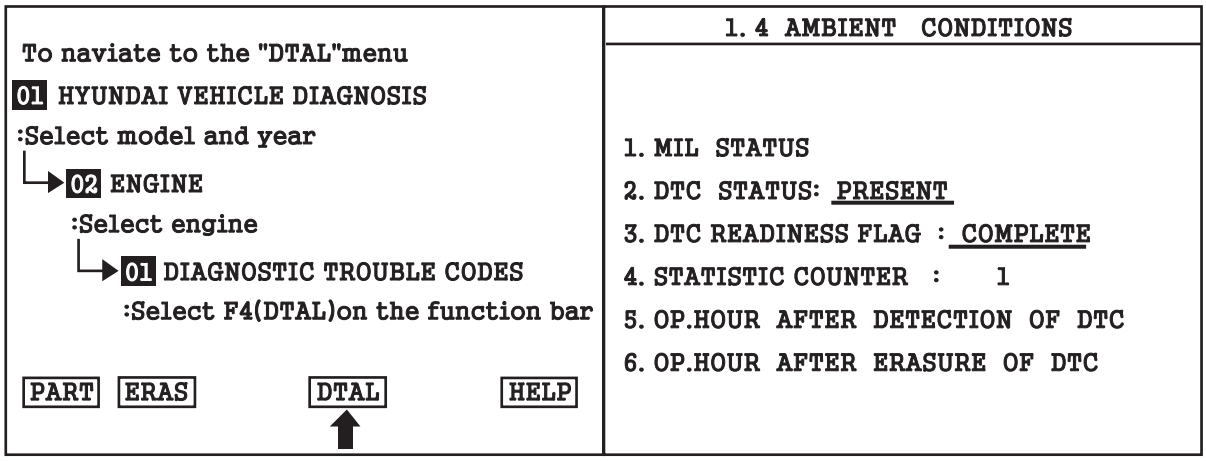
B03001

MONITOR DTC STATUS E6C05F0B

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.



B00112

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 PCM's connector or was repaired and PCM 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 E141AE17

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. Install 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.

1.6 ACTUATION TEST	
NO.1 INJECTOR	
DURATION	UNTIL STOP KEY
METHOD	DEACTIVATION
CONDITION	IG.KEY ON ENGINE RUNNING

PRESS [STRT], IF YOU ARE READY !
SELECT TEST ITEM USING UP/DOWN KEY

STRT STOP

B00172

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.

SPARK PLUG CABLE INSPECTION

1. Remove suspect cylinder's spark plug cable.

2. Visually/physically inspect the following items:
   - Damage, cracks and flashover.

3. Measure the resistance of the spark plug cable referring to specification.

Specification : 5.6kΩ /m ±20%

NOTE

Resistance should not be higher than 10,000Ω per foot of cable. If resistance is higher than specification, replace the cable.

4. Is the displayed value within the specified value?

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.

FUEL INJECTOR INSPECTION

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

Test Condition : Ignition "OFF".
Specification : No clogging and restriction.

Is the fuel injector OK?

YES

▶ Visually/physically inspect the engine mechanical problem as below:
- 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. Ignition coil connector : Disconnect.

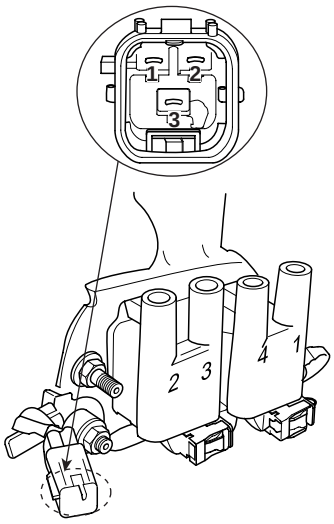
3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.

4. Measure the primary coil resistance between terminals 1,3 and 2,3.

SPECIFICATION :

Temp.(℃)	Temp.(℉)	Ignition primary coil (Ω)
-20	-4	0.5

0	32	0.54
20	68	0.58
40	104	0.62
60	140	0.66
80	176	0.71
100	212	0.75



EBKD002H

Is resistance within the specified value?

YES

▶ Go to "Timing Inspection" procedure.

NO

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

TIMING INSPECTION

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.

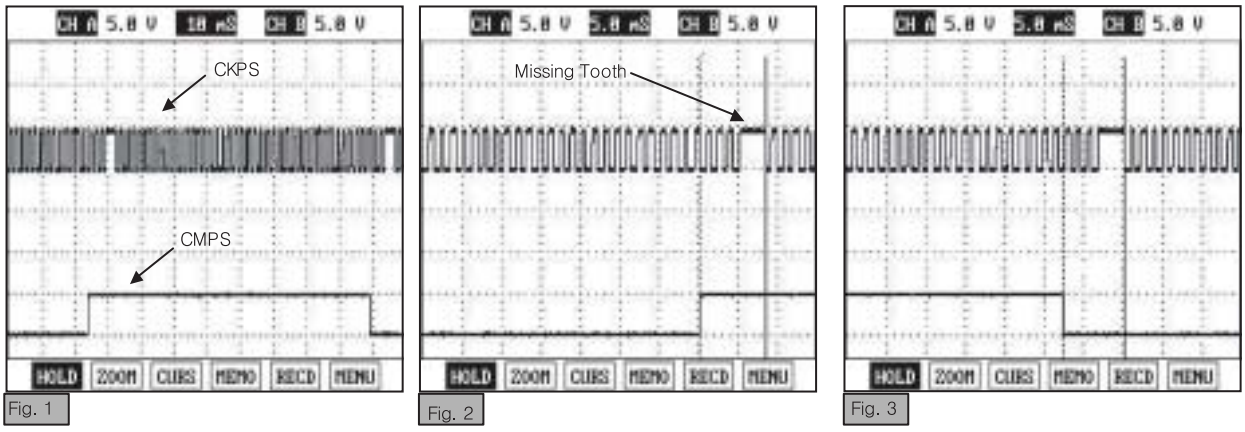


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

3. Is the signal waveform normal?

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 E7CF7417

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. 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 EA8D8BB0

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 : Ignition "ON" & Engine "ON" at Idle Specification : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

4. Is fuel pressure within the specified value?

YES

▶ Check for poor connection between PCM 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 E41F19B9

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

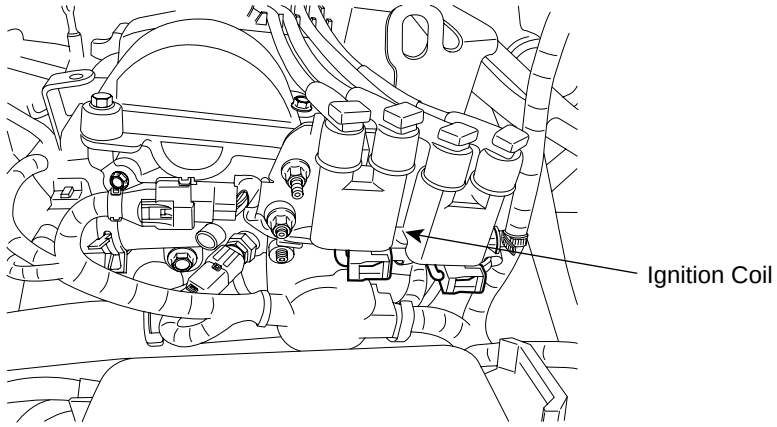
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0301 CYLINDER 1-MISFIRE DETECTED

COMPONENT LOCATION E98B32D4



EGQE501Q

GENERAL DESCRIPTION E4F389DF

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The PCM 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 PCM 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 PCM 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 PCM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION E0805EEF

The PCM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the PCM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0304) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The PCM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

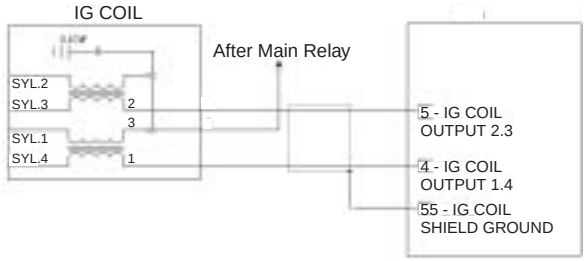
DTC DETECTING CONDITION EEDCCC8D

Item		Detecting Condition	Possible Cause
DTC Strategy		● Calculation of engine roughness	● Faulty spark plugs, high-tension 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		● 150＜ Mass air flow(mg/rev.)＜ 710 ● 512＜ Engine speed(RPM)＜ 6500 ● Coolant temperature ＞20°C if Start temperature＜ -7°C ● 11V＜ Battery voltage＜ 16V ● Throttle Angle gradient is in predetermined range ● No injector shut off ● No rough road	
Case1)	Threshold Value	● Misfire= 12~54% within 200 rev.	
	Diagnosis Time	● 200 revolution or 3*200 revolution.	
Case2)	Threshold Value	● Misfire ＞1.2% within 1000 revolutions.	
	Diagnosis Time	● 1000 revolution or 4*1000 revolution	

SPECIFICATION EAF87B8D

Temp.(°C)	Temp.(°F)	Ignition primary coil (Ω)	Ignition secondary coil (kΩ)
-20	-4	0.5	7.7
0	32	0.54	8.4
20	68	0.58	9.1
40	104	0.62	9.8
60	140	0.66	10.5
80	176	0.71	11.2
100	212	0.75	11.9

SCHEMATIC DIAGRAM E6083FFF

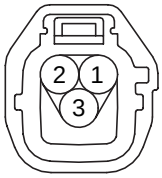


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 4	IG Coil control (1,4)
2	PCM Terminal 5	IG Coil control (2,3)
3	Main Relay	Battery voltage

[CONNECTOR]

IG Coil Harness side connector



C114

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	●	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	●	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

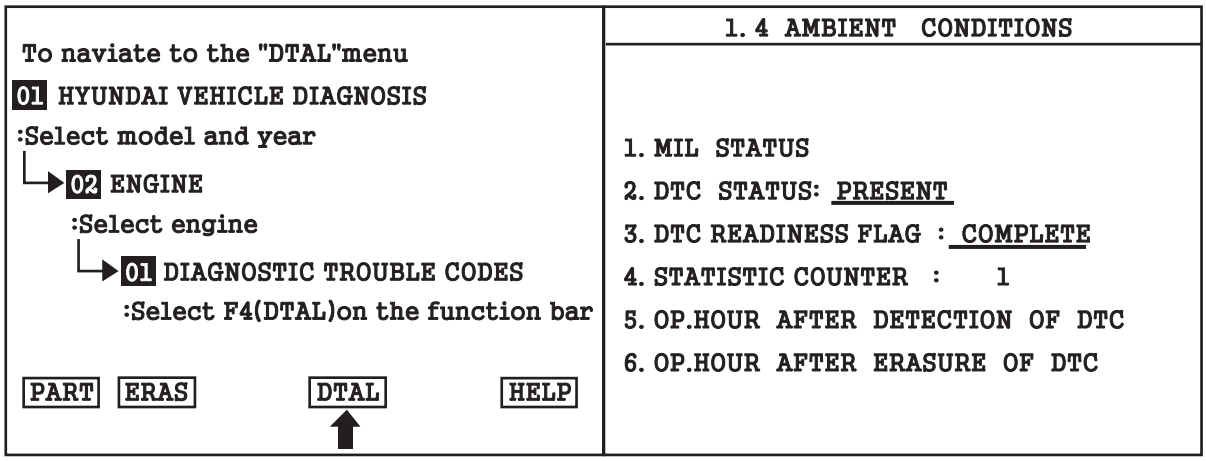
B03011

MONITOR DTC STATUS EB9D96A0

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.



B00112

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 PCM's connector or was repaired and PCM 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

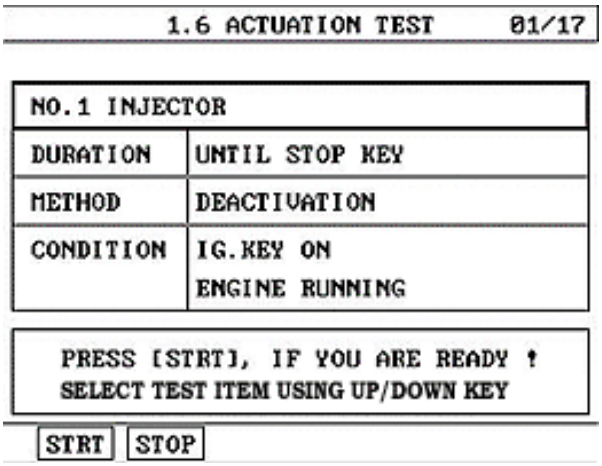
MONITOR ACTUATOR TEST E5C21CAC

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. Install 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.



B03012

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.

SPARK PLUG CABLE INSPECTION

1. Remove suspect cylinder's spark plug cable.

2. Visually/physically inspect the following items:
   - Damage, cracks and flashover.

3. Measure the resistance of the spark plug cable referring to specification.

Specification : 5.6kΩ /m ±20%

NOTE

Resistance should not be higher than 10,000Ω per foot of cable. If resistance is higher than specification, replace the cable.

4. Is the displayed value within the specified value?

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.

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:
- 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".

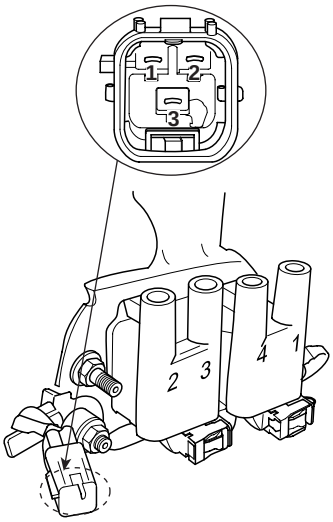
2. Ignition coil connector : Disconnect.

3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.

4. Measure the primary coil resistance between terminals 1 and 3.

SPECIFICATION :

Temp.(℃)	Temp.(℉)	Ignition primary coil (Ω)
-20	-4	0.5
0	32	0.54
20	68	0.58
40	104	0.62
60	140	0.66
80	176	0.71
100	212	0.75



EBKD002H

5. Is resistance within the specified value?

YES

▶ Go to "Timing Inspection" procedure.

NO

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

TIMING INSPECTION

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.

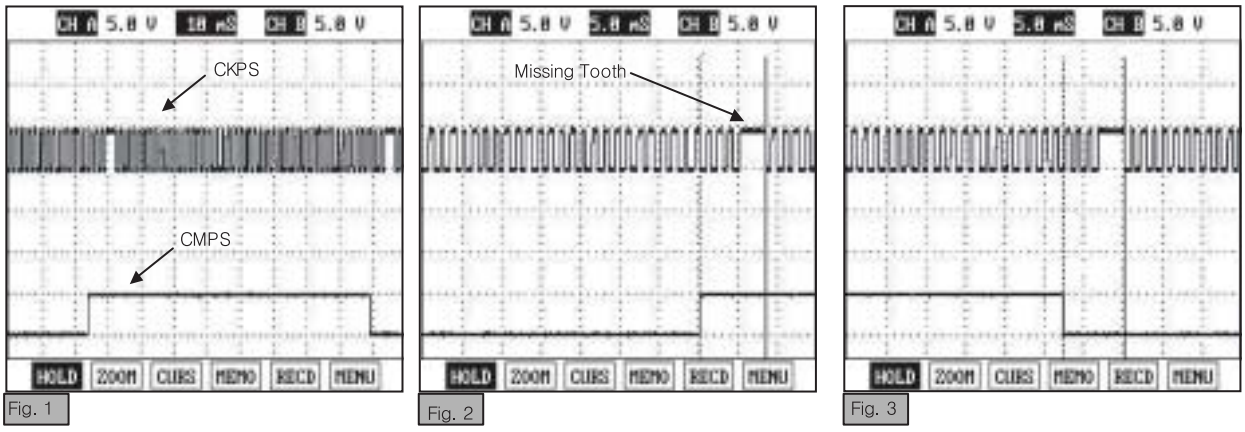


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

3. Is the signal waveform normal?

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 EF7DC2AB

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. 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 ECFE9F17

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 : Ignition "ON" & Engine "ON" at Idle Specification : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

4. Is fuel pressure within the specified value?

YES

▶ Check for poor connection between PCM 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

1. 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.*

2. 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.*

3. 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 EAE4E72E

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.

DTC P0302 CYLINDER 2-MISFIRE DETECTED

COMPONENT LOCATION E04247A5

Refer to DTC P0301.

GENERAL DESCRIPTION EC75E4B4

Refer to DTC P0301.

DTC DESCRIPTION EFF6B2BF

The PCM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the PCM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0304) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The PCM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

DTC DETECTING CONDITION E58CAFB9

Item		Detecting Condition	Possible Cause
DTC Strategy		● Calculation of engine roughness	● Faulty spark plugs, high-tension 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		● 150＜ Mass air flow(mg/rev.)＜ 710 ● 512＜ Engine speed(RPM)＜ 6500 ● Coolant temperature ＞20°C if Start temperature＜ -7°C ● 11V＜ Battery voltage＜ 16V ● Throttle Angle gradient is in predetermined range ● No injector shut off ● No rough road	
Case1)	Threshold Value	● Misfire= 12~54% within 200 rev.	
	Diagnosis Time	● 200 revolution or 3*200 revolution.	
Case2)	Threshold Value	● Misfire ＞1.2% within 1000 revolutions.	
	Diagnosis Time	● 1000 revolution or 4*1000 revolution	

SPECIFICATION E8BAA73B

Temp.(°C)	Temp.(°F)	Ignition primary coil (Ω)	Ignition secondary coil (kΩ)
-20	-4	0.5	7.7
0	32	0.54	8.4
20	68	0.58	9.1
40	104	0.62	9.8
60	140	0.66	10.5
80	176	0.71	11.2
100	212	0.75	11.9

SCHEMATIC DIAGRAM EBDC4D4A

Refer to DTC P0301.

MONITOR DTC STATUS EE6CF2C6

NOTE

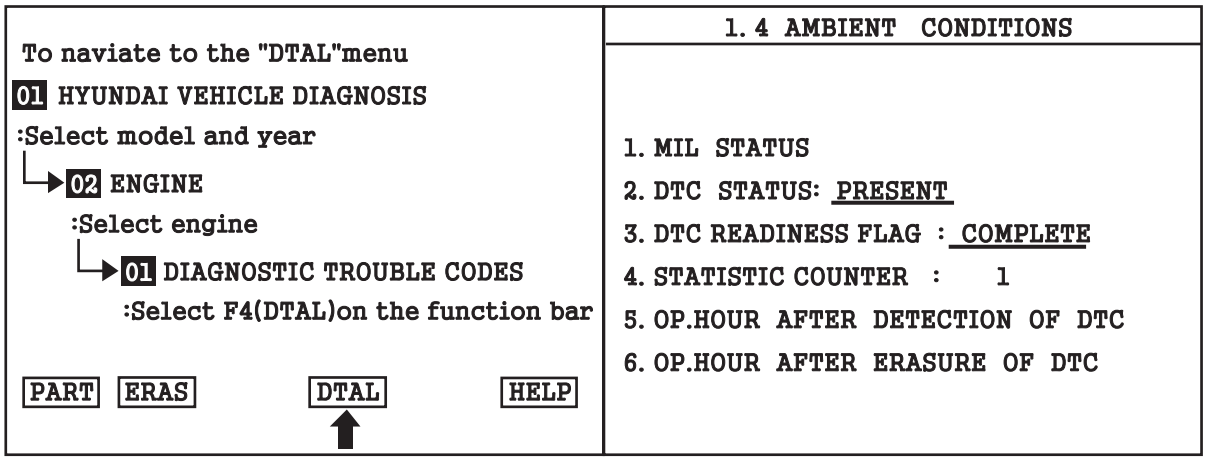
If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

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.



B00112

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 PCM's connector or was repaired and PCM 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.

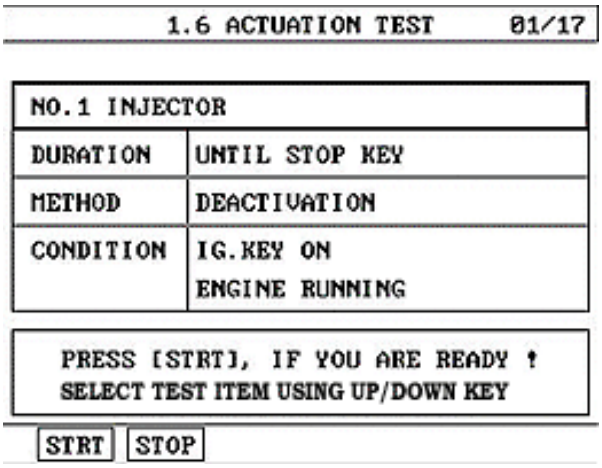
MONITOR ACTUATOR TEST E3616AD6

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. Install 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.



B03012

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.

SPARK PLUG CABLE INSPECTION

1. Remove suspect cylinder's spark plug cable.
2. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
3. Measure the resistance of the spark plug cable referring to specification.

Specification : 5.6kΩ /m ±20%

NOTE

Resistance should not be higher than 10,000Ω per foot of cable. If resistance is higher than specification, replace the cable.

4. Is the displayed value within the specified value?

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.

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:
- 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

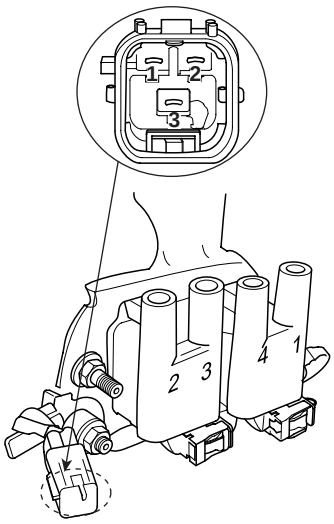
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Ignition coil connector : Disconnect.
3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
4. Measure the primary coil resistance between terminals 2 and 3.

SPECIFICATION :

Temp.(°C)	Temp.(°F)	Ignition primary coil (Ω)
-20	-4	0.5
0	32	0.54
20	68	0.58
40	104	0.62
60	140	0.66
80	176	0.71
100	212	0.75



EBKD002H

5. Is resistance within the specified value?

YES

▶ Go to "Timing Inspection" procedure.

NO

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

TIMING INSPECTION

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.

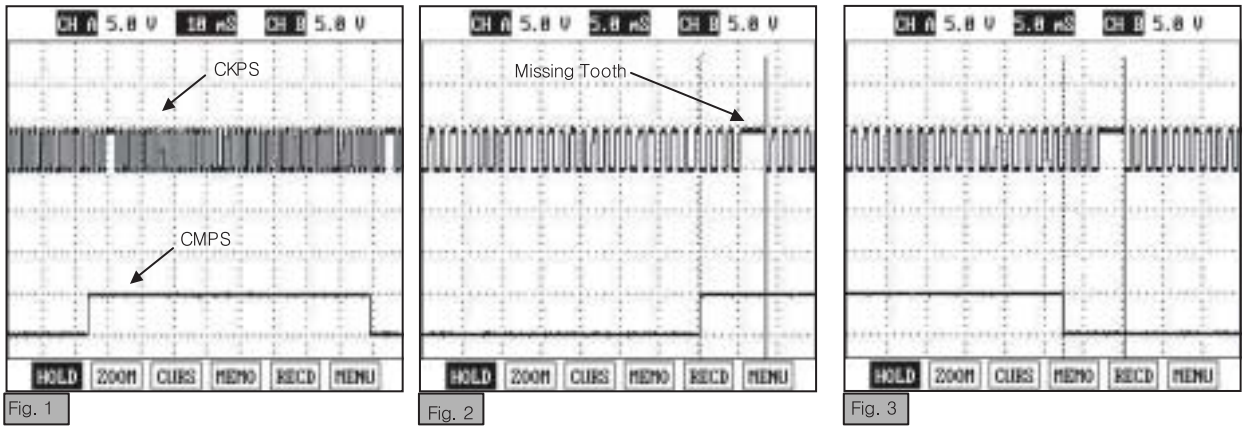


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

3. Is the signal waveform normal?

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 EA3DDED3

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. 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 E56F84E2

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 : Ignition "ON" & Engine "ON" at Idle. Specification : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

4. Is fuel pressure within the specified value?

   YES

   ▶ Check for poor connection between PCM 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

   1. 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.*

   2. 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.*

   3. 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 E0EFC276

Refer to DTC P0301.

DTC P0303 CYLINDER 3-MISFIRE DETECTED

COMPONENT LOCATION E890FA71

Refer to DTC P0301.

GENERAL DESCRIPTION EB142880

Refer to DTC P0301.

DTC DESCRIPTION EEBC8DF5

The PCM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the PCM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0304) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The PCM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

DTC DETECTING CONDITION E3B2439D

Item		Detecting Condition	Possible Cause
DTC Strategy		● Calculation of engine roughness	● Faulty spark plugs, high-tension 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		● 150＜ Mass air flow(mg/rev.)＜ 710 ● 512＜ Engine speed(RPM)＜ 6500 ● Coolant temperature ＞20°C if Start temperature＜ -7°C ● 11V＜ Battery voltage＜ 16V ● Throttle Angle gradient is in predetermined range ● No injector shut off ● No rough road	
Case1)	Threshold Value	● Misfire= 12~54% within 200 rev.	
	Diagnosis Time	● 200 revolution or 3*200 revolution.	
Case2)	Threshold Value	● Misfire ＞1.2% within 1000 revolutions.	
	Diagnosis Time	● 1000 revolution or 4*1000 revolution.	

SPECIFICATION E67F6AF8

Temp.(°C)	Temp.(°F)	Ignition primary coil (Ω)	Ignition secondary coil (kΩ)
-20	-4	0.5	7.7
0	32	0.54	8.4
20	68	0.58	9.1
40	104	0.62	9.8
60	140	0.66	10.5
80	176	0.71	11.2
100	212	0.75	11.9

SCHEMATIC DIAGRAM E09BF8A7

Refer to DTC P0301.

MONITOR DTC STATUS ED12461B

NOTE

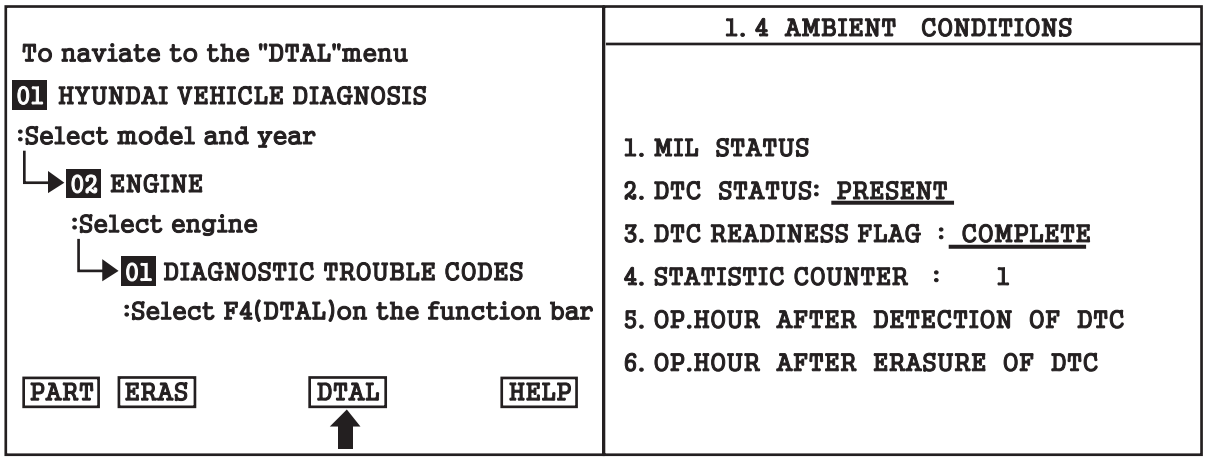
If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

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.



B00112

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 PCM's connector or was repaired and PCM 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.

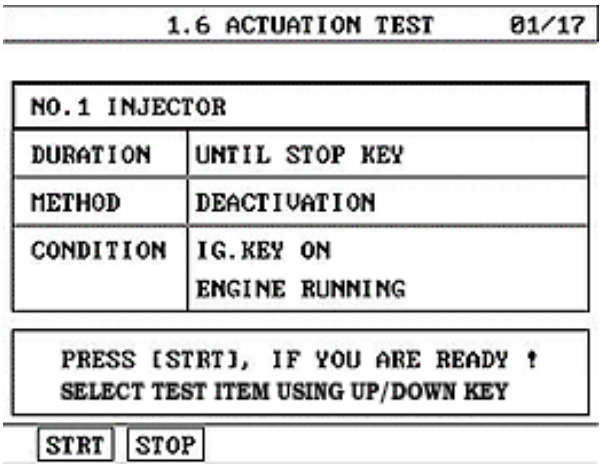
MONITOR ACTUATION TEST E10ABC12

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. Install 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.



B03012

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.

SPARK PLUG CABLE INSPECTION

1. Remove suspect cylinder's spark plug cable.
2. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
3. Measure the resistance of the spark plug cable referring to specification.

Specification : 5.6kΩ /m ±20%

NOTE

Resistance should not be higher than 10,000Ω per foot of cable. If resistance is higher than specification, replace the cable.

4. Is the displayed value within the specified value?

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.

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:
- 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

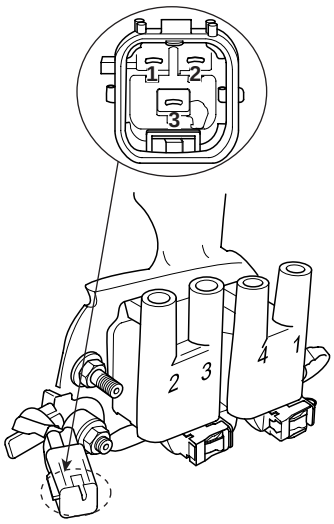
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Ignition coil connector : Disconnect.
3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
4. Measure the primary coil resistance between terminals 2 and 3.

SPECIFICATION :

Temp.(°C)	Temp.(°F)	Ignition primary coil (Ω)
-20	-4	0.5
0	32	0.54
20	68	0.58
40	104	0.62
60	140	0.66
80	176	0.71
100	212	0.75



EBKD002H

5. Is resistance within the specified value?

YES

▶ Go to "Timing Inspection" procedure.

NO

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

TIMING INSPECTION

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.

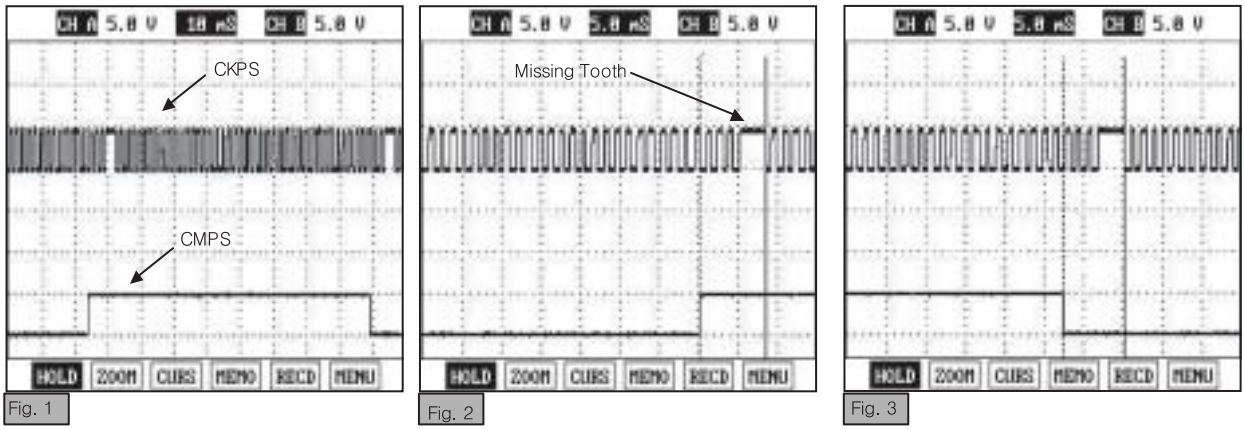


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

3. Is the signal waveform normal?

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 ECD6B12D

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. 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 E3A73F3E

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 : Ignition "ON" & Engine "ON" at Idle. Specification : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

4. Is fuel pressure within the specified value?

   YES

   ▶ Check for poor connection between PCM 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 E8B88DCB

Refer to DTC P0301.

DTC P0304 CYLINDER 4-MISFIRE DETECTED

COMPONENT LOCATION ED3CDAB1

Refer to DTC P0301.

GENERAL DESCRIPTION EA6E88B0

Refer to DTC P0301.

DTC DESCRIPTION E5EE3D35

The PCM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the PCM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0304) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The PCM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

DTC DETECTING CONDITION EA65034D

Item		Detecting Condition	Possible Cause
DTC Strategy		● Calculation of engine roughness	● Faulty spark plugs, high-tension 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		● 150＜ Mass air flow(mg/rev.)＜ 710 ● 512＜ Engine speed(RPM)＜ 6500 ● Coolant temperature ＞20°C if Start temperature＜ -7°C ● 11V＜ Battery voltage＜ 16V ● Throttle Angle gradient is in predetermined range ● No injector shut off ● No rough road	
Case1)	Threshold Value	● Misfire= 12~54% within 200 rev.	
	Diagnosis Time	● 200 revolution or 3*200 revolution.	
Case2)	Threshold Value	● Misfire ＞1.2% within 1000 revolutions.	
	Diagnosis Time	● 1000 revolution or 4*1000 revolution.	

SPECIFICATION E8CFF0D2

Temp.(°C)	Temp.(°F)	Ignition primary coil (Ω)	Ignition secondary coil (kΩ)
-20	-4	0.5	7.7
0	32	0.54	8.4
20	68	0.58	9.1
40	104	0.62	9.8
60	140	0.66	10.5
80	176	0.71	11.2
100	212	0.75	11.9

SCHEMATIC DIAGRAM EBEB2F51

Refer to DTC P0301.

MONITOR DTC STATUS EE8BE6D6

NOTE

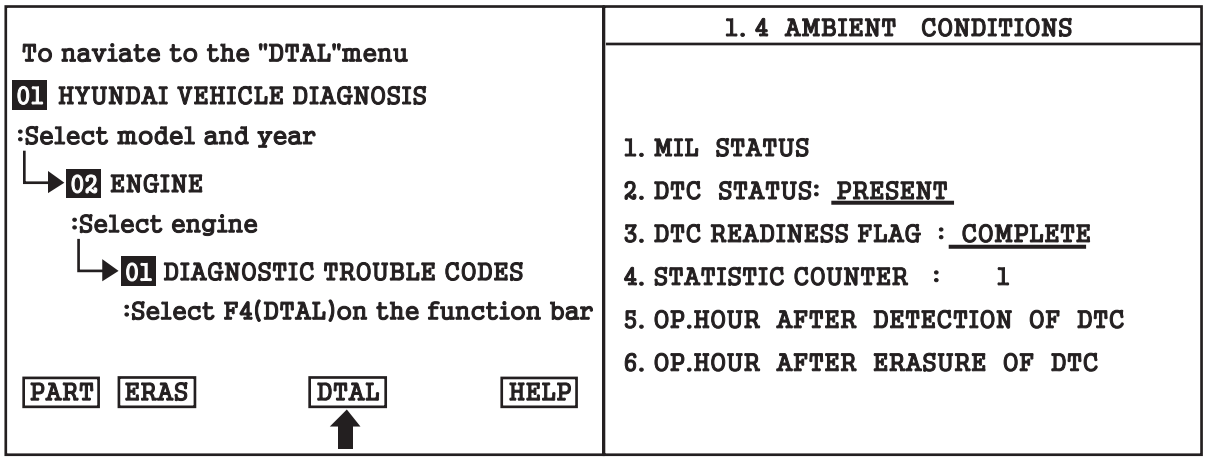
If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

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.



B00112

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 PCM's connector or was repaired and PCM 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.

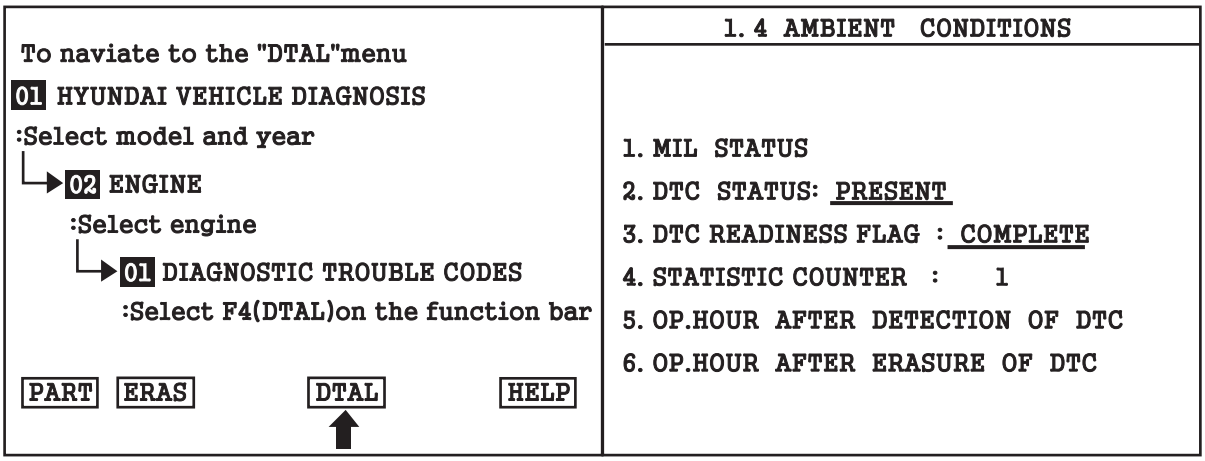
MONITOR ACTUATION TEST E3E04CED

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. Install 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.



B00112

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.

SPARK PLUG CABLE INSPECTION

1. Remove suspect cylinder's spark plug cable.
2. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
3. Measure the resistance of the spark plug cable referring to specification.

Specification : 5.6kΩ /m ±20%

NOTE

Resistance should not be higher than 10,000Ω per foot of cable. If resistance is higher than specification, replace the cable.

4. Is the displayed value within the specified value?

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.

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:
- 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

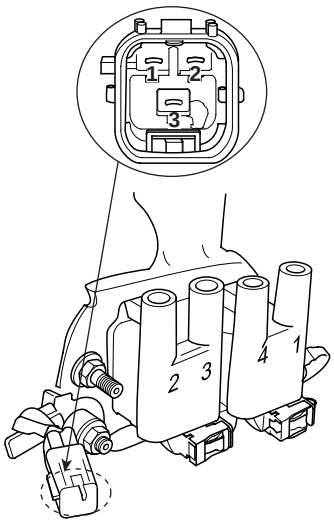
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Ignition coil connector : Disconnect.
3. Visually/physically inspect the following items:
   - Damage, cracks and flashover.
4. Measure the primary coil resistance between terminals 1 and 3.

SPECIFICATION :

Temp.(°C)	Temp.(°F)	Ignition primary coil (Ω)
-20	-4	0.5
0	32	0.54
20	68	0.58
40	104	0.62
60	140	0.66
80	176	0.71
100	212	0.75



EBKD002H

5. Is resistance within the specified value?

YES

▶ Go to "Timing Inspection" procedure.

NO

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

TIMING INSPECTION

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.

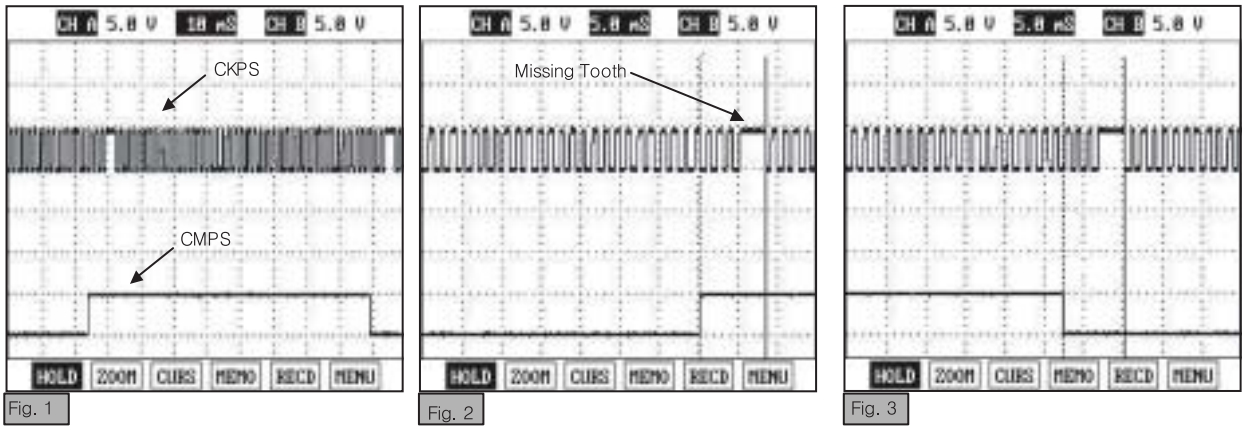


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

3. Is the signal waveform normal?

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 ED276A7F

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. 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 E0509F7F

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 : Ignition "ON" & Engine "ON" at Idle. Specification : 250~350kPa(2.50~3.50 kg/㎠, 36~50 psi)

4. Is fuel pressure within the specified value?

   YES

   ▶ Check for poor connection between PCM 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.*

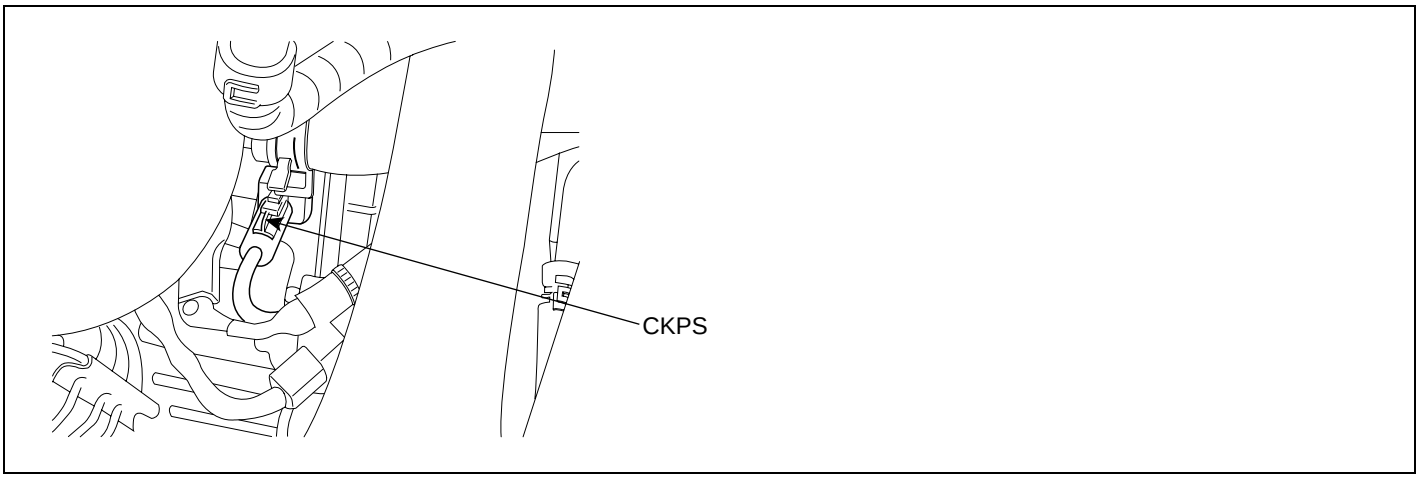
   C. If fuel pressure is higher than specification : Is fuel line clogged?
   - *If it is not, replace pressure regulator.*
   - *If it is, replace it.*

VERIFICATION OF VEHICLE REPAIR E5D14D8C

Refer to DTC P0301.

DTC P0315 SEGMENT TIME ACQUISITION INCORRECT

COMPONENT LOCATION E7BA5ACC



EGQE501B

GENERAL DESCRIPTION E24A0848

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 E40AA6CD

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 PCM compares segment duration of 4 cylinders during fuel cut-off and deceleration period. With this comparison PCM perform segment adaptation to adapt the difference of each segment duration.
The PCM sets DTC P0315 if any of segment adaptation value is on the limit.

DTC DETECTING CONDITION EAE48C52

Item	Detecting Condition	Possible Cause
DTC Strategy	● Monitor segment time adaptation	● Improperly installed target wheel ● Contact resistance in connectors
Enable Conditions	● Engine speed is between 2000 and 3000 rpm after finishing segment time adaptation ● No relevant failure	
Threshold Value	● Segment adaptation value = 5/1000	
Diagnostic Time		

MONITOR DTC STATUS E5A8BA61

NOTE

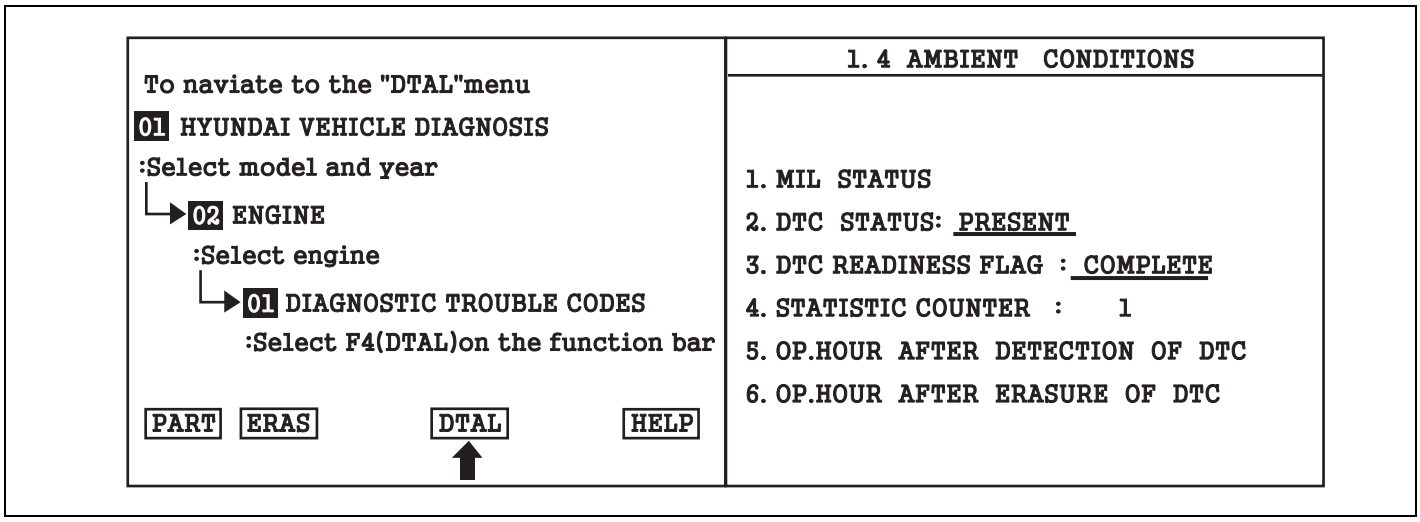
If any codes relating to CKPs are stored, do ALL REPAIRS associated with those codes before proceeding with troubleshooting.

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E0B87FED

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.

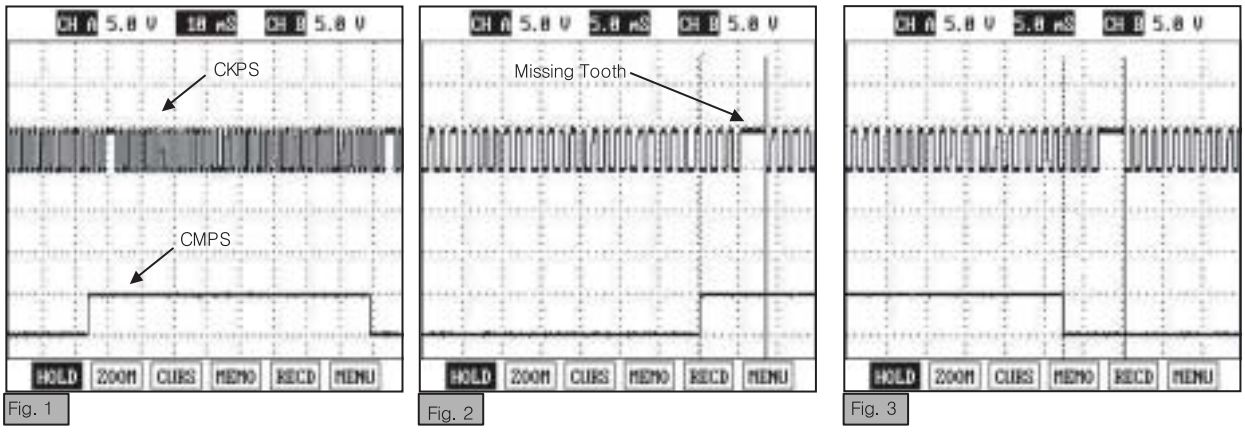


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

3. Is the signal waveform normal?

YES

▶ Go to " Verification of Vehicle Repair " 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.

VERIFICATION OF VEHICLE REPAIR EDBDC6EE

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

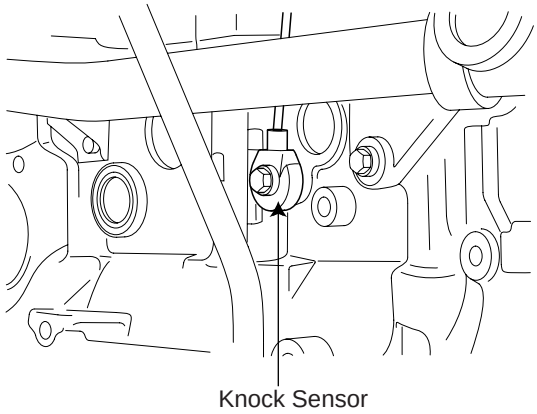
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0325 KNOCK SENSOR 1 CIRCUIT

COMPONENT LOCATION EAC383BC



EGQE601O

GENERAL DESCRIPTION EDD6B1CB

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 PCM. With input signals from camshaft position and crankshaft position sensor, PCM can identify which cylinder is knocking. PCM filters vibrations and determines if the vibrations are knocking signal. The Engine Control Module (PCM) uses this signal to suppress knocking by retarding ignition timing. The PCM 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 PCM under normal engine operation.

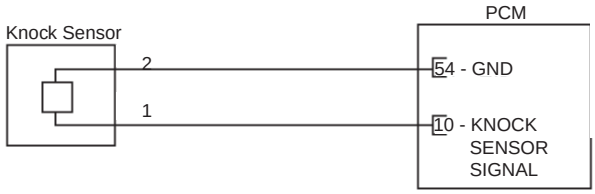
DTC DESCRIPTION EA7768CE

The PCM 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 ED7CCDC7

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	● Engine speed ＞2700 rpm ● Engine load ＞440mg/rev. ● No relevant failure	
Threshold Value	● Difference between sensor signal and noise level ＜ 0.06V	
Diagnostic Time	● 10 seconds	

SCHEMATIC DIAGRAM E9BAD45A

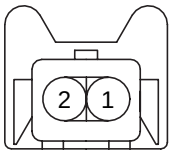


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 10	Sensor Signal
2	PCM Terminal 54	Sensor Ground

[CONNECTOR]

KNOCK SENSOR Harness side connector



C119

PCM side terminal

6	7	8	9	●	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	●	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B03251

MONITOR DTC STATUS E7725A6B

NOTE

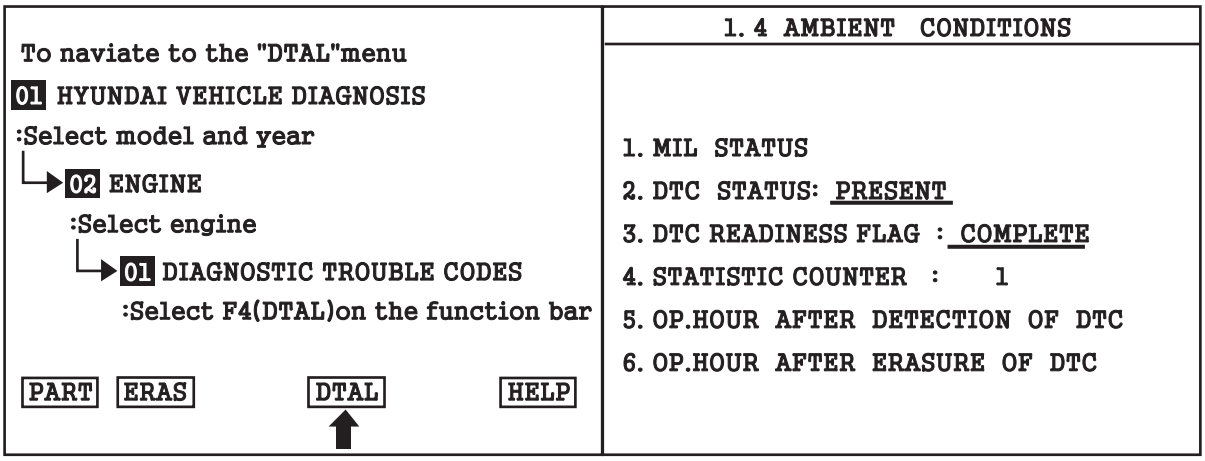
If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to "W/Harness Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E2FB0FEE

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 E4D2AD7D

1. Ignition "OFF".

2. Disconnect Knock sensor and PCM connectors.

3. Measure resistance between terminals 2 of the sensor harness connector and 54 of the PCM 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 EA2D9CE1

1. Check for open in signal harness.

   1) Measure resistance between terminals 1 of sensor harness connector and 10 of the PCM 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 ground in signal harness.

   1) Measure resistance between terminal 1 of 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 terminals 1 of 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 E55AB1F0

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. 5MΩ 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 1 (-): terminal 2.

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 sensor and check for proper operation. If the problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Check for poor connection between PCM 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 E0E0E895

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

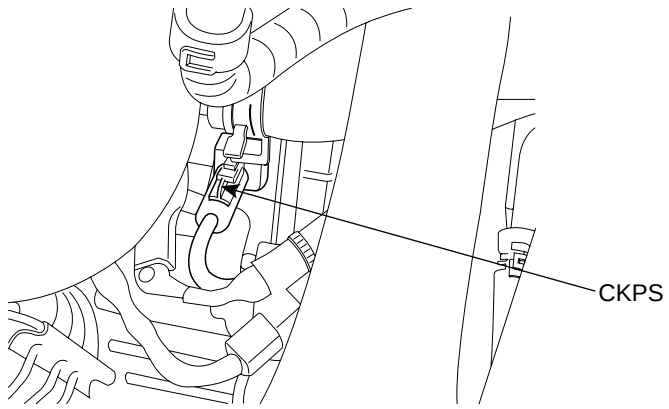
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION ECB4ECFD



EGQE501B

GENERAL DESCRIPTION EF4CBB9F

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 PCM 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 PCM identifies which cylinder is at top dead center.

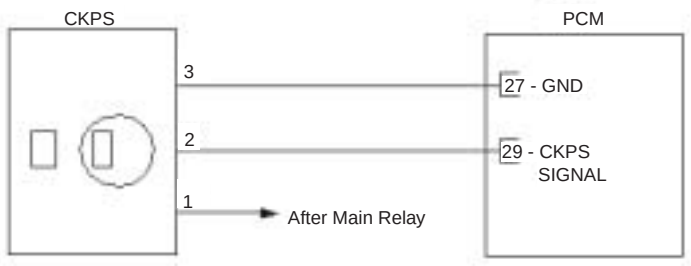
DTC DESCRIPTION ECA7503F

The PCM sets DTC P0335 when the number of crankshaft teeth during one revolution is incorrect or crankshaft signal is missing while camshaft signal is detected.

DTC DETECTING CONDITION EF8FAEA3

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
Enable Conditions		● Camshaft position sensor signal is valid ● 6V＜ Battery voltage ＜ 16V	
Case 1	Threshold Value	● No Crankshaft Teeth detected after 4 Camshaft signal transitions ● Crankshaft teeth detected but synchronization is not successful	
	Diagnosis Time	● 2 revolutions	
Case2	Threshold Value	● Number of Crankshaft Teeth is not correct	
	Diagnosis Time	● 2.5 revolutions	

SCHEMATIC DIAGRAM E20B45A2

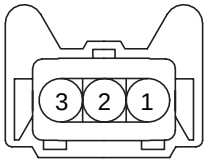


[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	PCM Terminal 29	CKPS signal
3	PCM Terminal 27	Sensor ground

[CONNECTOR]

CKPS Harness side connector



C101

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	●	*	●	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B03351

SINGAL WAVEFORM E7B2F2B7

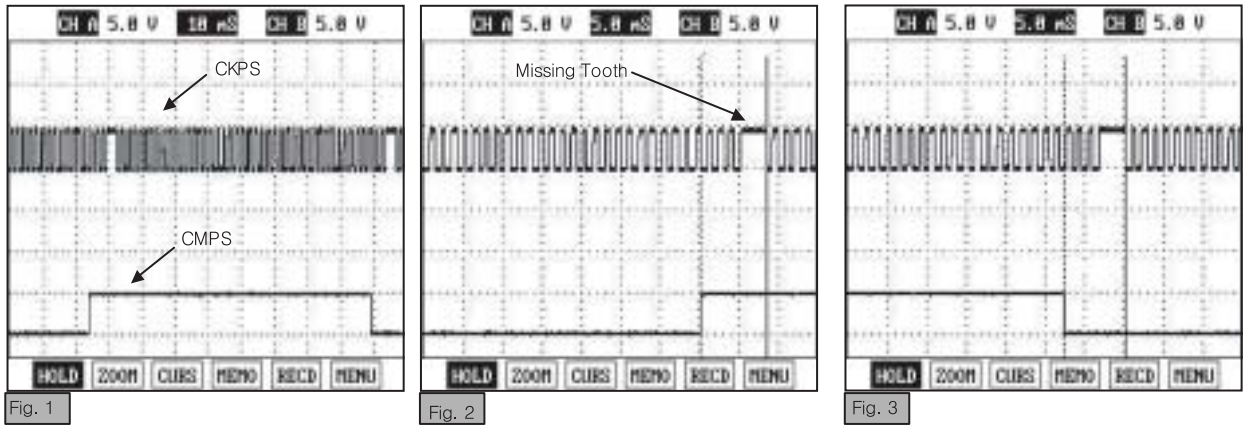


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

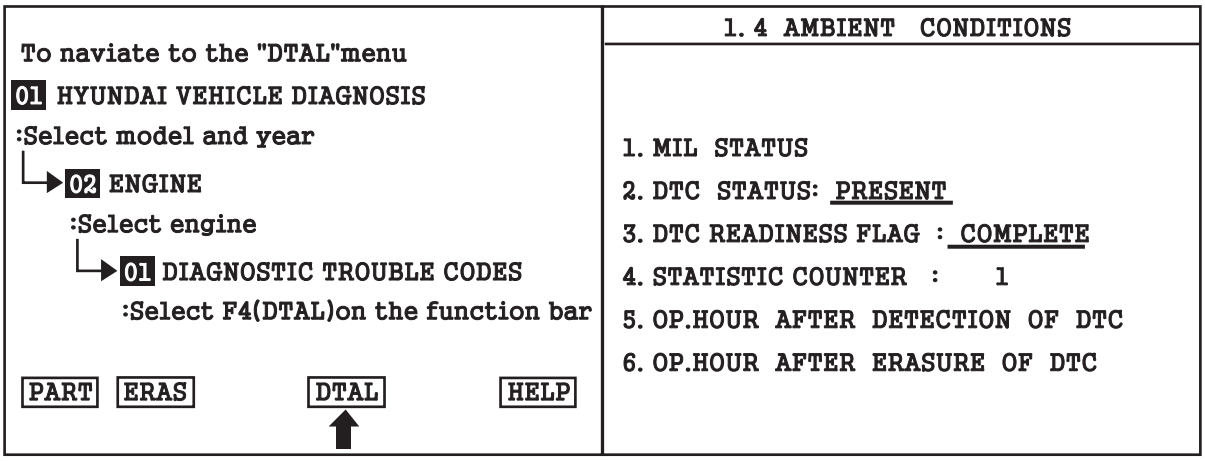
MONITOR DTC STATUS E3A960BE

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION EAFCDE34

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 ECBEFC43

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 CKPS.
Especially check for open or blown 10A sensor fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EF38CBC7

1. Ignition "OFF".

2. Measure resistance between terminal 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 ED25A9DF

1. Check for open in signal harness.

   1) Disconnect PCM connector.

   2) Measure resistance between terminals 2 of sensor harness connector and 29 of the PCM 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 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 E8E2BEDA

1. Reconnect the CKPS and PCM connectors.

2. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

3. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing.

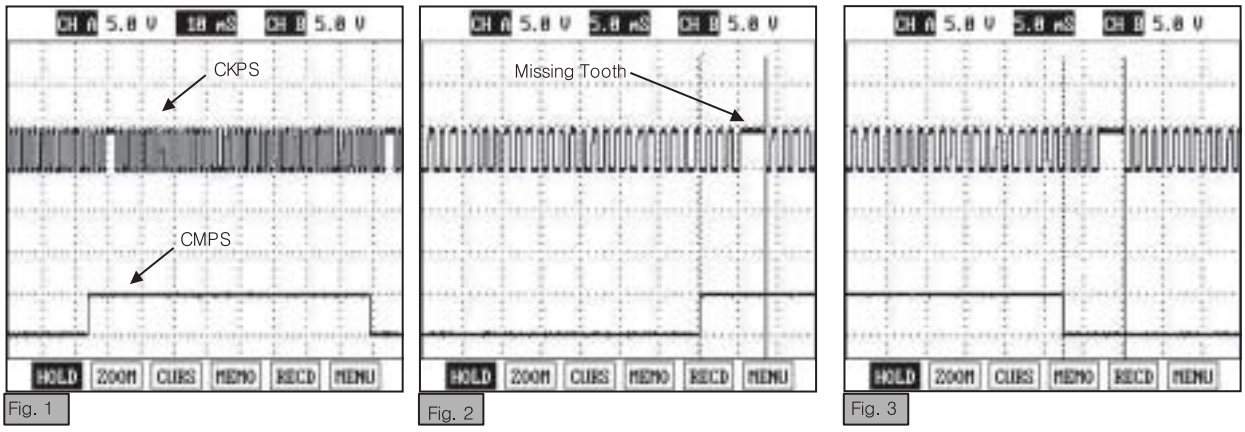


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

4. Is the signal waveform normal?

YES

▶ Check for poor connection between PCM 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

▶ Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

NOTE

Air gap [0.3~1.8 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 CKPS for contamination, deterioration, or damage. Substitute with a known-good CKPS and check for proper operation. If the problem is corrected, replace CKPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBA55DDA

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

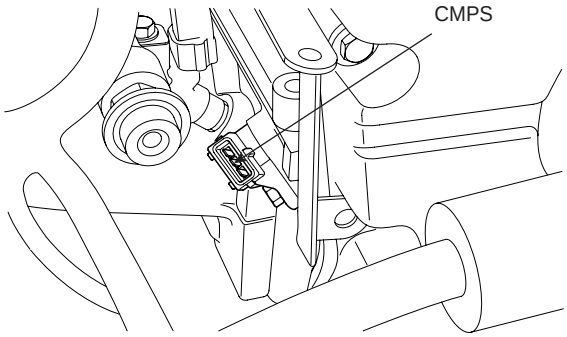
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0340 CAMSHAFT POSITION SENSOR A CIRCUIT MALFUNCTION(SINGLE SENSOR)

COMPONENT LOCATION E0F8FCC0



EGQE590A

GENERAL DESCRIPTION EA8946BA

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 PCM and the PCM uses the CMPS signal for synchronizing the firing of sequential fuel injectors.

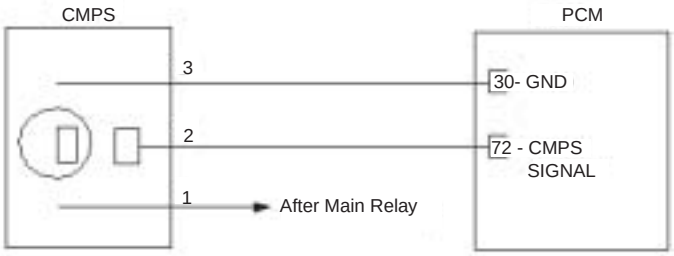
DTC DESCRIPTION EACC3BFD

The PCM 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 PCM sets DTC P0340.

DTC DETECTING CONDITION EDADDD60

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 ● 6V＜Battery voltage＜16V	
Threshold Value	● No signal switching ●Rising/falling camshaft edge not within defined window : -5 ~ +5 teeth	
Diagnostic Time	● 40 revolutions	

SCHEMATIC DIAGRAM EBF3B36A

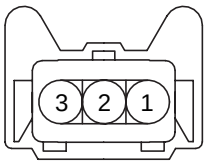


[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	PCM Terminal 72	CMPS signal
3	PCM Terminal 30	Sensor ground

[CONNECTOR]

CMPS Harness side connector



C101

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	●	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	●	73	*	75	76	77	78	*	80	81	2	1

C130-1

B03407

SIGNAL WAVEFORM E540CAE3

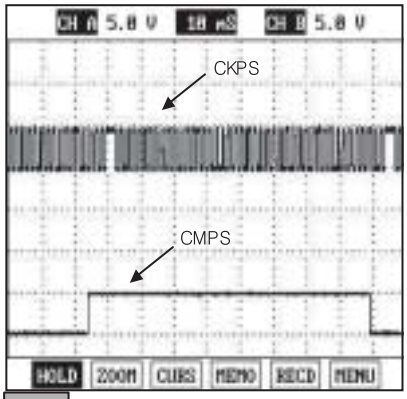


Fig. 1

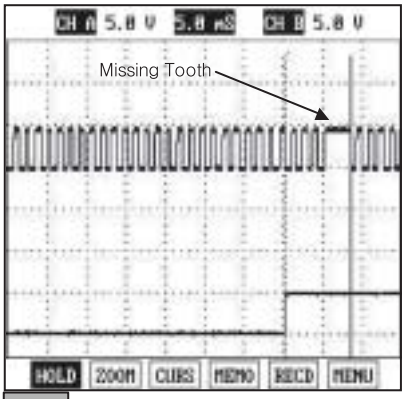


Fig. 2

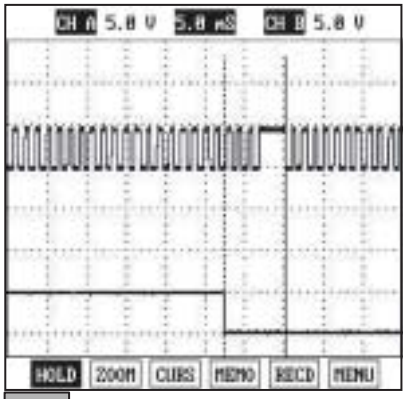


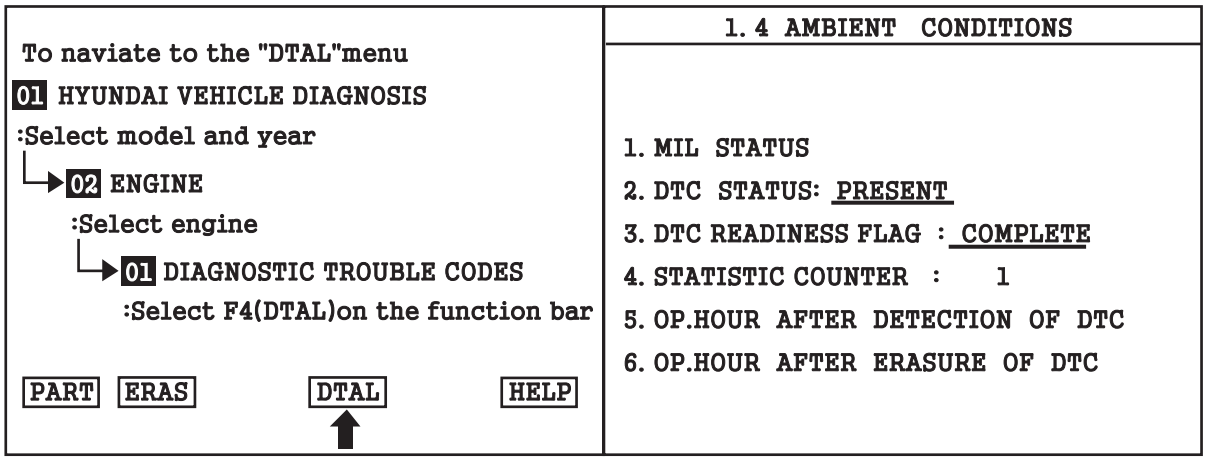
Fig. 3

Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

MONITOR DTC STATUS E3AACFE6

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.



B00112

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 PCM's connector or was repaired and PCM 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 E81B9580

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 E07B9CF8

1. Ignition "OFF".

2. Disconnect CMP 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 CMPS.
Especially check for open or blown 10A sensor fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EED5EA9C

1. Ignition "OFF".

2. Measure resistance between terminal 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 E189AF0C

1. Check for open in signal harness.

   1) Disconnect PCM connector.

   2) Measure resistance between terminals 2 of sensor harness connector and 72 of the PCM 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 battery 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 E6F9EDAE

1. Reconnect the CMPS and PCM connectors.

2. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS, (-): ground
   Channel B (+): terminal 2 of the CMPS, (-): ground

3. Start the engine and check for signal waveform whether synchronize with CKPS or not and tooth is missing.

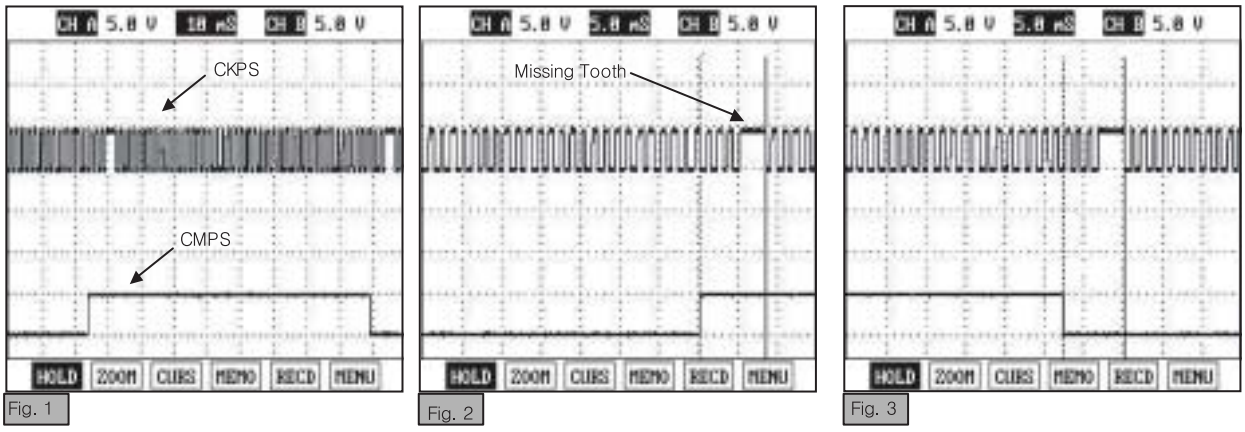


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

B03352

4. Is the signal waveform normal?

YES

▶ Check for poor connection between PCM 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

▶ Remove CMP and calculate air gap[1.8mm(0.07in)]. Readjust and repair as necessary and go to "Verification of Vehicle Repair" procedure. If OK, check CMPS for contamination, deterioration, or damage. Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBFEC3B8

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

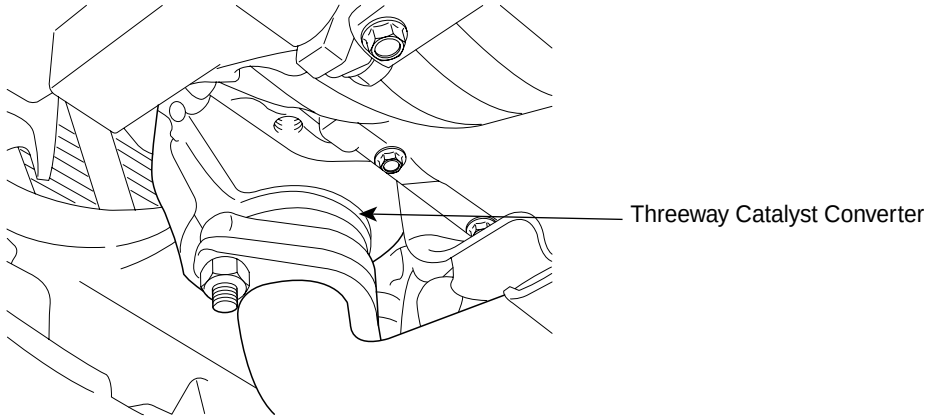
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

COMPONENT LOCATION EF62DCEF



EGQE501A

GENERAL DESCRIPTION EC9DFBFF

The PCM 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 EFAECF9C

The PCM 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 PCM sets P0420 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

DTC DETECTING CONDITION ECF4A694

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 ● Faulty rear HO2S ● Faulty three way catalyst converter
Enable Conditions	● Coolant temperature > 74°C(165°F) ● 400°C(752°F) ≤ Catalyst temp. model ≤ 900°C(1652°F) ● 5km/h(3MPH) < Vehicle speed < 180km/h(112MPH) ● 200 < Mass air flow(mg/rev.) < 700 ● Engine speed < 3400rpm ● 11V < Battery voltage < 16 ● Lambda regulation active ● Canister purge valve not in CLOSE state ● Catalyst purge after fuel cut-off finished ● No relevant failure	
Threshold Value	● Averaged malfunction index > threshold value	
Diagnostic Time	● 110 lambda controller cycles	

MONITOR DTC STATUS E1EE93AA

NOTE

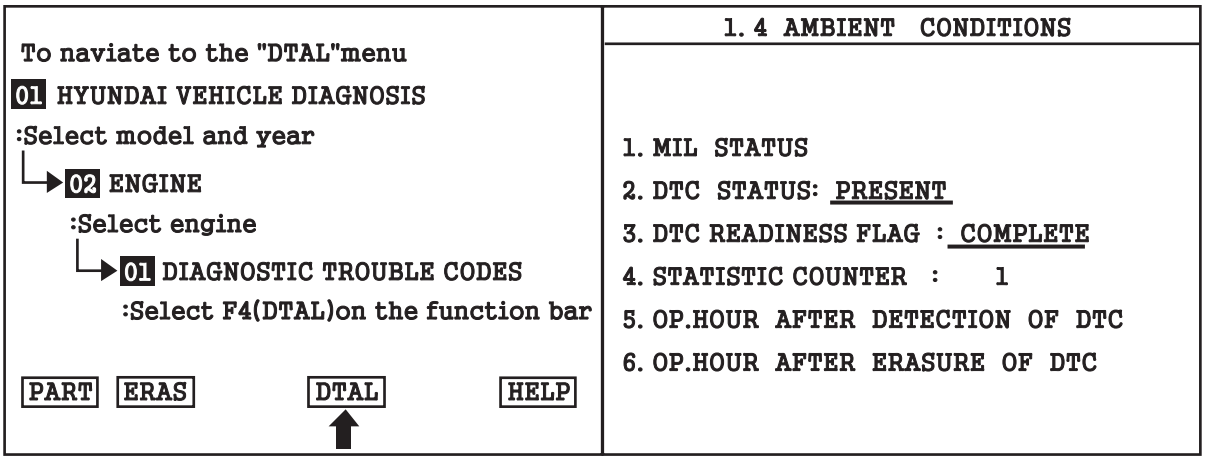
If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

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.



B00112

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 PCM's connector or was repaired and PCM 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 "Exhaust System Inspection" procedure.

EXHAUST SYSTEM INSPECTION E5ABBA1F

1. Visually/physically inspect 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 PCM)
   - 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.

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 Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E01BE8B4

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

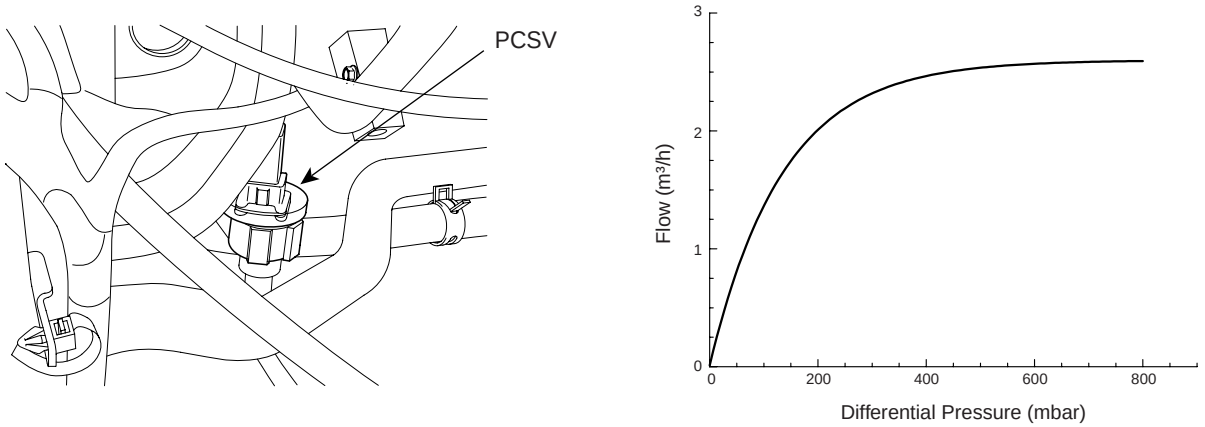
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0444 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT OPEN

COMPONENT LOCATION EF0C4FAD



EGQE502E

GENERAL DESCRIPTION E67EDADB

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 PCM 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 PCM and controls fuel vapor flow from the canister to the intake manifold.

DTC DESCRIPTION E0F8BCFB

PCM sets DTC P0444 if the PCM detects that the PCSV control circuit is open.

DTC DETECTING CONDITION E17CDCFF

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(V) < 16 ● 2% < Canister purge duty < 98%	
Threshold Value	● Open circuit	
Diagnostic Time	● 3 sec.	

SPECIFICATION E4174A29

Temp.(℃)	Temp.(℉)	PCSV Resistance(Ω)	Temp.(℃)	Temp.(℉)	PCSV Resistance(Ω)
-20	-4	20 ~ 24	40	104	25 ~ 29
0	32	22 ~ 26	60	140	27 ~ 31
20	68	24 ~ 28	80	176	29 ~ 33

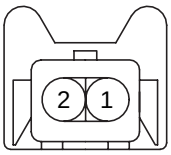
SCHEMATIC DIAGRAM ED5D9DCF

[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	PCM Terminal 26	PCSV operation

[CONNECTOR]

PCSV Harness side connector



C106

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	●	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

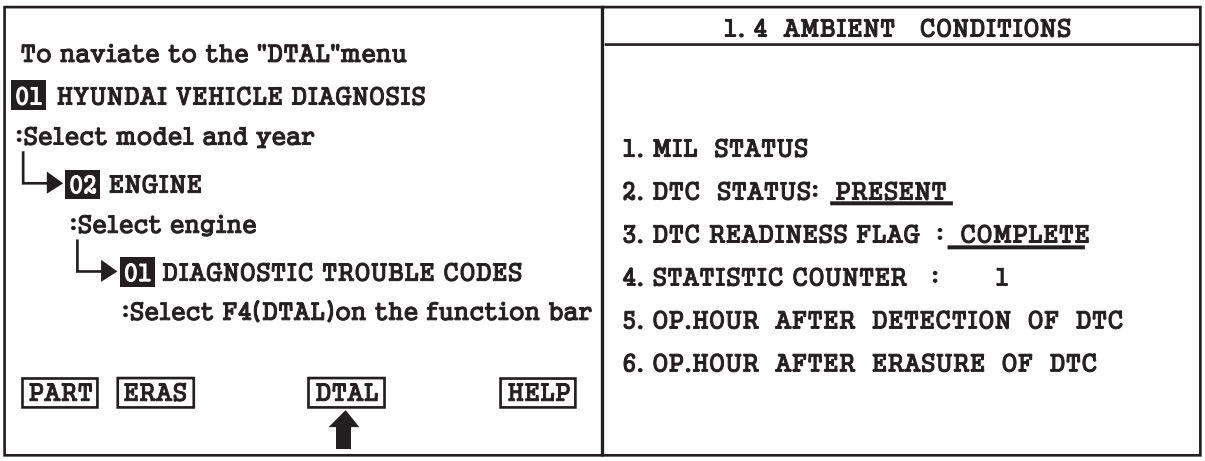
B04441

MONITOR DTC STATUS E98F34CF

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.



B00112

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 PCM's connector or was repaired and PCM 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

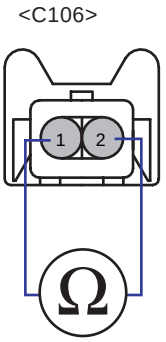
▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E4FF8A43

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℉)

Temp.(℃)	Temp.(℉)	PCSV Resistance(Ω)	Temp.(℃)	Temp.(℉)	PCSV Resistance(Ω)
-20	-4	20 ~ 24	40	104	25 ~ 29
0	32	22 ~ 26	60	140	27 ~ 31
20	68	24 ~ 28	80	176	29 ~ 33



1. Battery Voltage
2. PCSV Operation

B04442

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 EAF65853

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 EBC366D6

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 EED7F465

1. Ignition "OFF".
2. Disconnect PCM connector.
3. Measure resistance between terminals 2 of the PCSV harness connector and 26 of the PCM harness connector.

Specification :	Approx. 0Ω

4. Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 EB77D1E0

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.

DTC P0445 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT SHORTED

COMPONENT LOCATION EAE3E8DF

Refer to DTC P0444.

GENERAL DESCRIPTION E3C5FDFF

Refer to DTC P0444.

DTC DESCRIPTION EE441CD1

PCM sets DTC P0445 if the PCM detects that the PCSV control circuit is shorted to ground or shorted to battery voltage.

DTC DETECTING CONDITION ECDCEB7D

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(V) < 16 ● 2% < Canister purge duty < 98%	
Threshold Value	● Short to ground or Short to Battery	
Diagnostic Time	● 3 sec.	

SPECIFICATION E9DB3986

Temp.(℃)	Temp.(℉)	PCSV Resistance(Ω)	Temp.(℃)	Temp.(℉)	PCSV Resistance(Ω)
-20	-4	20 ~ 24	40	104	25 ~ 29
0	32	22 ~ 26	60	140	27 ~ 31
20	68	24 ~ 28	80	176	29 ~ 33

SCHEMATIC DIAGRAM E20F5EFF

Refer to DTC P0444.

MONITOR DTC STATUS E4C0ED79

Refer to DTC P0444.

COMPONENT INSPECTION E940BCE3

Refer to DTC P0444.

TERMINAL AND CONNECTOR INSPECTION E1001B8A

Refer to DTC P0444.

POWER SUPPLY CIRCUIT INSPECTION EF8CAFFE

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 E21F36FD

1. Check for short to ground in control circuit.
   1) Ignition "OFF".
   2) Disconnect PCM connector.
   3) Measure resistance between terminals 2 of the PCSV harness connector and 26 of the PCM 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.

Specification : Approx. 0V

   3) Is voltage within the specification?

YES

▶ Check for poor connection between PCM 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

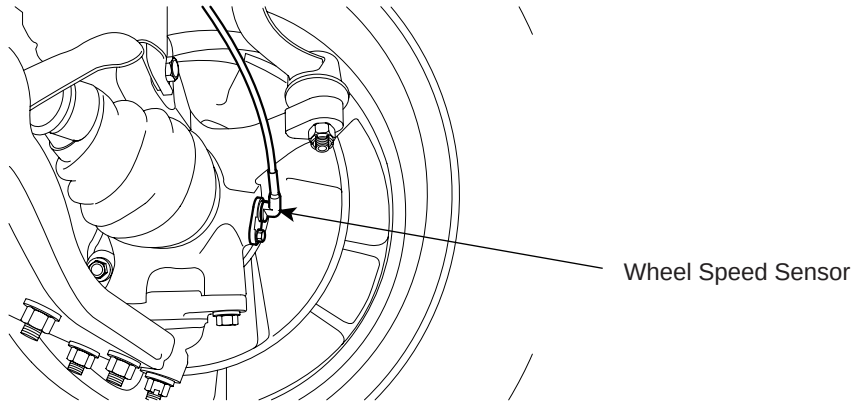
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7BFFC0A

Refer to DTC P0444.

DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

COMPONENT LOCATION E609DDBC



EGQE502B

GERNERAL DESCRIPTION EFD6DC27

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 PCM not only if the vehicle speed is low or high but also if the vehicle is or is not moving. The PCM 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.

DTP DESCRIPTION E4899A36

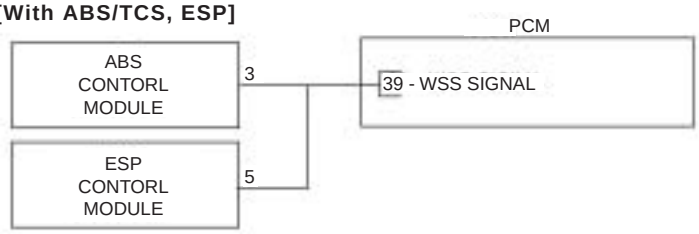
The PCM evaluates engine speed and mass air flow if there is no vehicle speed signal. This evaluation of both values will detect open circuit or short circuit errors on the wheel speed sensor. The PCM sets DTC P0501 if there is no vehicle speed signal from wheel speed sensor while both engine speed and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

DTP DETDCING CONDITION E9F0CF4A

ITEM		DETECING CONDITION	POSSIBLE CAUSE
Case1)	DTC Strategy	● Plausibility check	● Open or short in harness ● Contact resistance in connectors ● Faulty wheel speed sensor
	Enable Conditions	● Engine speed ＞2100 rpm ● Engine load ＞250 mg/rev. ● Coolant temperature ＞ 60℃(140°F) ● 10V＜ Battery voltage ＜16V ● No fuel shut-off	
	Threshold Value	● Vehicle speed=0 with high engine speed and engine load	
	Diagnostic Time	● 60 seconds	
Case2)	DTC Strategy	● Electrical check	
	Enable Conditions	● Vehicle speed ＞ 0 ● 10V＜ Battery voltage ＜16V	
	Threshold Value	● PCM detects abnormal input voltage of the signal circuit	
	Diagnostic Time	● 10 seconds	

SCHEMATIC DIGRAM EDFE164B

[With ABS/TCS, ESP]



[Connection Information]

Terminal	Connected to	Function
3	PCM Terminal 39	WSS signal
5	PCM Terminal 39	WSS signal

[CONNECTOR]

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	●	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

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[Without ABS/TCS, ESP]

[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 17	WSS signal (-)
2	PCM Terminal 18	WSS signal (+)

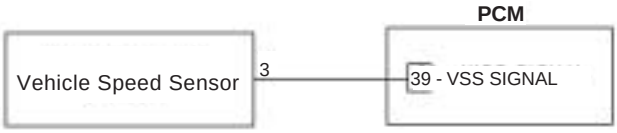
[CONNECTOR]

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	●	●	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

[SCHEMATIC DIAGRAM (II) - Except Europe]



[Connection Information]

Terminal	Connected to	Function
3	PCM Terminal 39	VSS signal

[CONNECTOR]

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	●	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

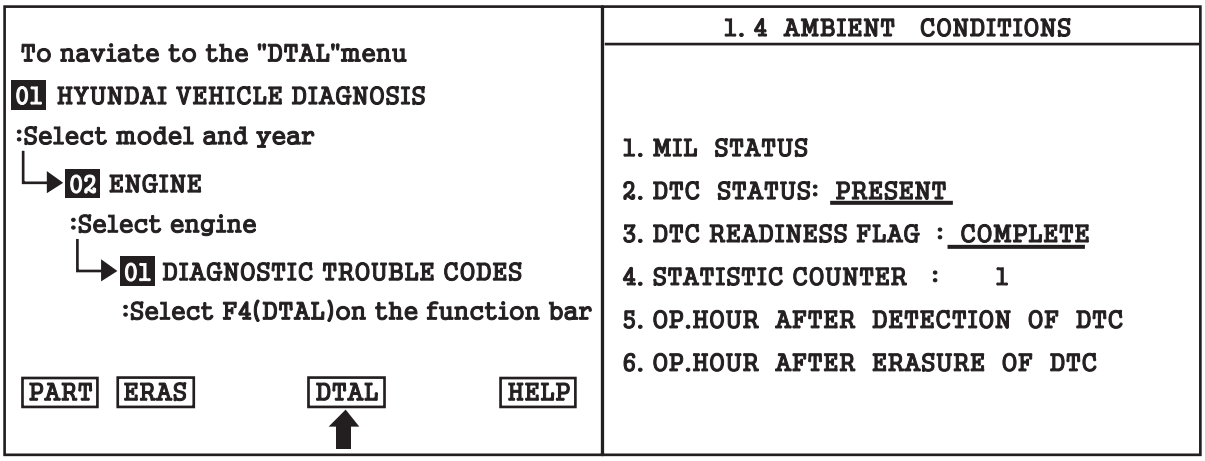
MONITOR DTC STATUS E261A3DE

1. Connect 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.



B00112

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 PCM's connector or was repaired and PCM 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

▶ [Europe & with ABS] Go to "Monitor Scan tool Data" procedure.
▶ [Europe & without ABS system] Go to "Signal Circuit Inspection[Without ABS]" procedure.
▶ [Except Europe] Open or short circuit between VSS and PCM 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.

MONITOR SCAN TOOL DATA ED9531DE

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. Conect Scantool and select ABS system.

3. Monitor the "WHEEL SPD SENSOR-FR" parameter on the current data list.

Specification : 10km/h or more(6mph or more)

4. Is value within the specification?

YES

▶ Wheel speed sensor is OK. Go to "Signal Circuit Inspection[With ABS]" procedure.

NO

▶ Check for 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) 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. 1,300~1,500Ω at 20℃(68℉)
▶ Replace wheel speed sensor as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EA05F86B

[WITH ABS]

1. Check for open in circuit.

   1) Ignition "OFF".

   2) Disconnect PCM and ABS or ESP Control Module connectors.

   3) Measure resistance between terminals 39 of the PCM harness connector and 3 of the ABS Control Module harness connector(W/ABS)
   Measure resistance between terminals 39 of the PCM harness connector and 5 of the ESP Control Module harness connector(W/ESP)

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 circuit.

   1) Measure resistance between terminal 39 of the PCM harness connector and chassis ground.

Specification : Infinite

   2) Is resistance within the specification?

   YES

   ▶ Check for poor connection between PCM 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.

[EUROPE & WITHOUT ABS SYSTEM]

1. Check for open in circuit.

   1) Ignition "OFF".

   2) Disconnect PCM and wheel speed sensor(front right) harness connector.

   3) Measure resistance between wheel speed sensor harness connector and PCM harness connector.

Specification : Approx. 0Ω

[W/O 4WD]
- Terminal 1(sensor) & Terminal 17(PCM)
- Terminal 2(sensor) & Terminal 18(PCM)

[WITH 4WD]
- Terminal 3(sensor) & Terminal 17(PCM)
- Terminal 4(sensor) & Terminal 18(PCM)

   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 17 of the PCM harness connector and chassis ground.

   2) Measure resistance between terminal 18 of the PCM harness connector and chassis ground.

Specification : Infinite

   3) Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 EE9BDD72

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

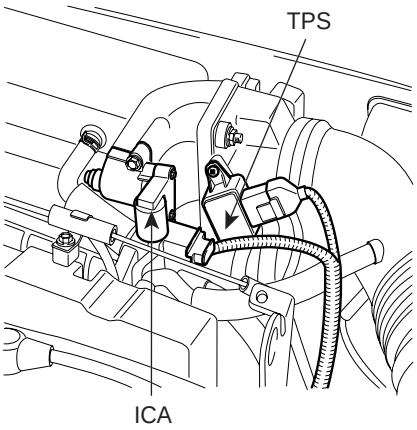
▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

COMPONENT LOCATION EE67C60D



EGQE602V

GENERAL DESCRIPTION ECEDE685

When the TP sensor's signal indicates closed throttle position and the engine is idling, the PCM 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 E7A9AC94

The PCM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the idle speed valve opening is stable. The PCM sets DTC P0506 if the difference to the target idle engine speed is lower than the predetermined threshold.

DTC DETECTING CONDITION E2B9DB99

Item	Detecting Condition	Possible Cause
DTC Strategy	● Monitor deviation between target idle speed and actual engine speed	● Restriction in intake or exhaust system. ● Carbonustment of the accelerator cable. ● Contact resistance in connectors. ● Faulty ISC valve.
Enable Conditions	● Vehicle speed=0 ● Coolant temperature ＞74°C(165°F) ● Throttle angle: closed ● 20seconds after engine start. ● Engine load ＜1000mg/rev. ● 10V＜ Battery voltage ＜16 ● No relevant failure	
Threshold Value	● Target idle speed-Engine speed > 100rpm (Engine speed too low)	
Diagnostic Time	● 16 seconds.	

SPECIFICATION EFBEB90F

TPS

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

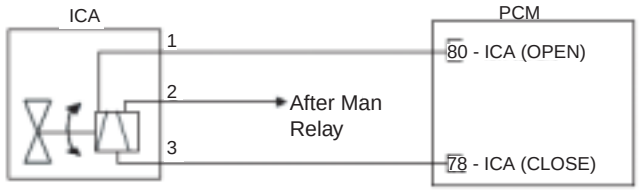
ICA COIL #1 (OPEN)

Temp.(℃)	Temp.(°F)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(°F)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5
10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0
20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3

ICA COIL #2 (CLOSE)

Temp.(℃)	Temp.(°F)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(°F)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0
20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8

SCHEMATIC DIAGRAM E59016A6

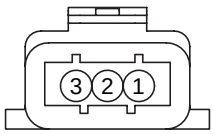


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 80	ICA (OPEN)
2	Main Relay	Battery voltage
3	PCM Terminal 78	ICA (CLOSE)

[CONNECTOR]

ICA Harness side connector



C115

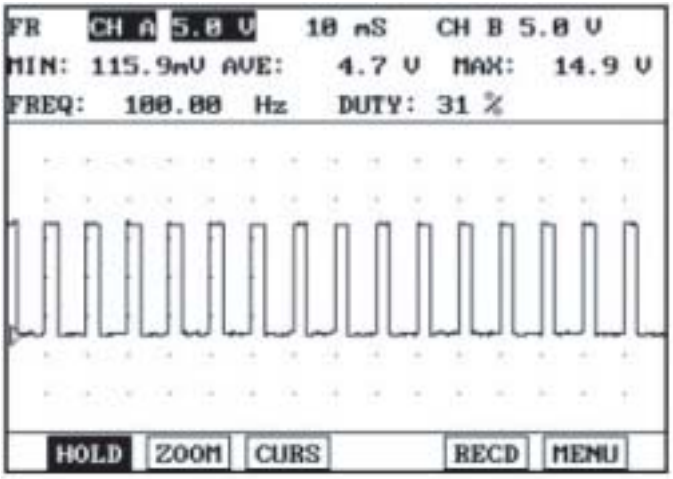
PCM side terminal

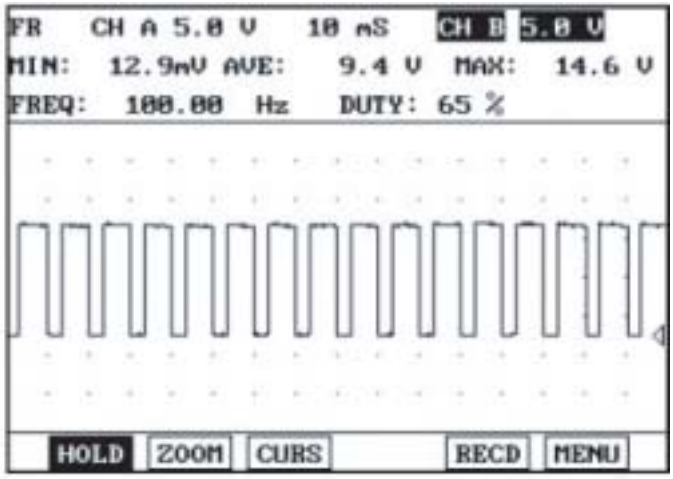
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	●	*	●	81	2	1

C130-1

B05061

SIGNAL WAVEFORM EF24C4B5





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

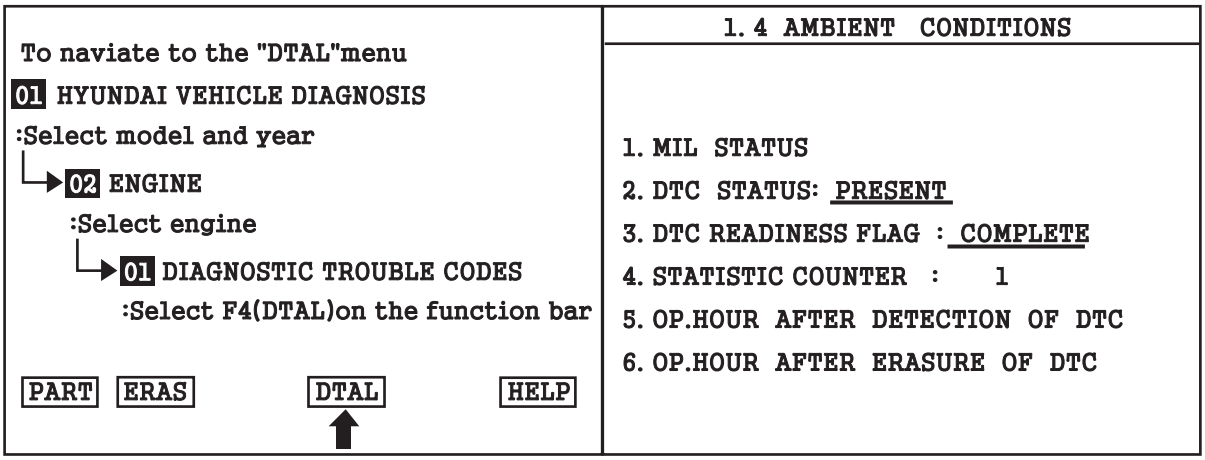
B05062

MONITOR DTC STATUS EC34F129

NOTE

If any TPS, MAFS or ICA 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



B00112

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 PCM's connector or was repaired and PCM 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 "Check for restricted intake or exhaust system" procedure.

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 E02BDF3A

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 next step as below.

COMPONENT INSPECTION E3EFE63C

1. Ignition "ON".

2. Remove ICA Valve from Throttle body. Check for throttle bore, throttle plate and the ICA passages for chocking and for any foreign objects. Repair or clean as necessary.

3. Install the ICA valve.

4. Ignition "ON" & Engine "OFF".
5. Install scan tool and select "IDLE SPEED ACTUATOR" parameter on the "Actuation Test" mode.
6. Activates ICA valve by pressing "STAT" key.
7. Check the ICA valve for clicking sound and visually verifying valve closes and opens.

   NOTE

   Repeat numerous times to ensure valve reliability.

8. Is ICA Valve OK?

   YES

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

VERIFICATION OF VEHICLE REPAIR E8AB1C4B

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.

DTC P0507 IDLE AIR CONTROL SYSTEM-RPM HIGHER THAN EXPECTED

COMPONENT LOCATION EF7CBFEA

Refer to DTC P0506.

GENERAL DESCRIPTION E5C90D87

Refer to DTC P0506.

DTC DESCRIPTION E972CC96

The PCM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the idle speed valve opening is stable. The PCM sets DTC P0507 if the difference to the target idle engine speed is higher than the predetermined threshold.

DTC DETECTING CONDITION ECFB9A9A

Item	Detecting Condition	Possible Cause
DTC Strategy	● Monitor deviation between target idle speed and actual engine speed	● A stuck or binding throttle plate. ● Maladjustment of the accelerator cable. ● Contact resistance in connectors. ● Faulty ISC valve.
Enable Conditions	● Vehicle speed=0 ● Coolant temperature ＞74℃(165°F) ● Throttle angle: closed ● 20seconds after engine start. ● Engine load ＜1000mg/rev. ● 10V＜ Battery voltage ＜16V ● No relevant failure	
Threshold Value	● Engine speed > (target RPM + 200)	
Diagnostic Time	● 16 seconds.	

SPECIFICATION E0EAD801

TPS

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

ICA COIL #1 (OPEN)

Temp.(℃)	Temp.(°F)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(°F)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5
10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0

20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3

ICA COIL #2 (CLOSE)

Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0
20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8

SCHEMATIC DIAGRAM EC2EEEAC

Refer to DTC P0506.

SIGNAL WAVEFORM E75AA4AC

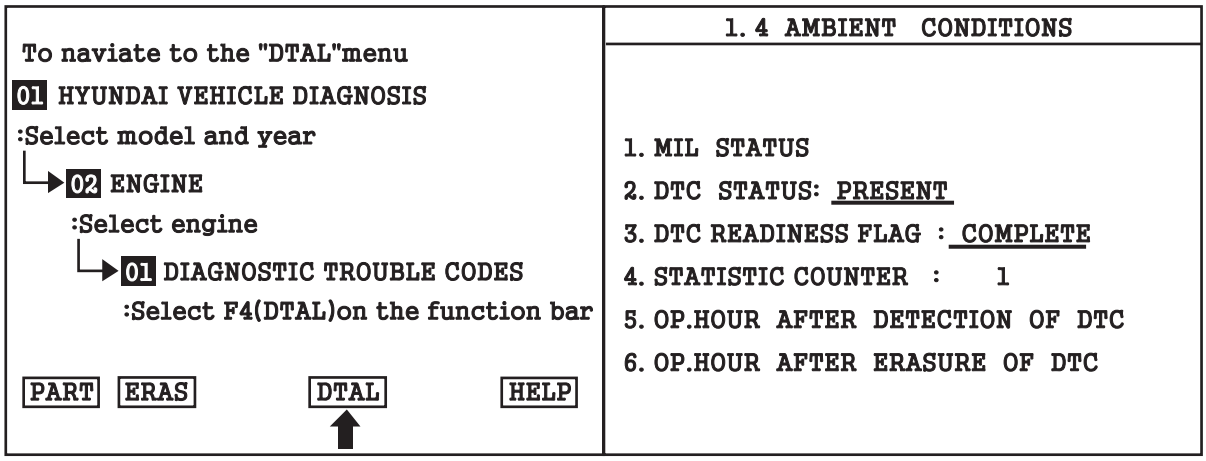
Refer to DTC P0506.

MONITOR DTC STATUS E2E1DB28

NOTE

If any TPS, MAFS or ICA 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



B00112

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 PCM's connector or was repaired and PCM 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 "Air Leakage Inspection" procedure.

AIR LEAKAGE INSPECTION E868B928

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 next step as below.

   NO

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

TERMINAL AND CONNECTOR INSPECTION E6CB1635

Refer to DTC P0506.

COMPONENT INSPECTION EAEDCC44

1. Ignition "OFF".

2. Remove ICA Valve from Throttle body. Check for throttle bore, throttle plate and the ICA passages for chocking and for any foreign objects. Repair or clean as necessary.

3. Install the ICA valve.

4. Ignition "ON" & Engine "OFF".

5. Install scan tool and select "IDLE SPEED ACTUATOR" parameter on the "Actuation Test" mode.

6. Activates ICA valve by pressing "STAT" key.

7. Check the ICA valve for clicking sound and visually verifying valve closes and opens.

   NOTE

   Repeat numerous times to ensure valve reliability.

8. Is ICA Valve OK?

   YES

   ▶ Check for poor connection between PCM 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

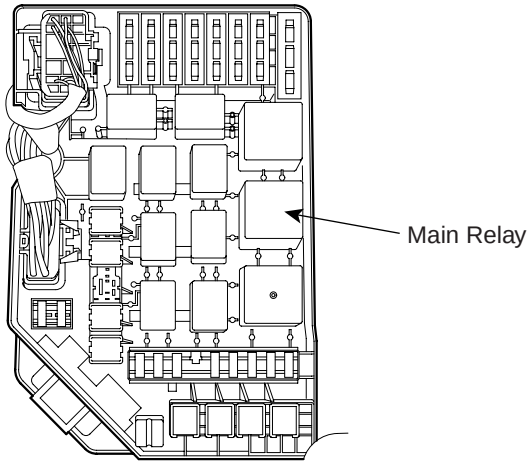
   ▶ Check ICA for contamination, deterioration, or damage. Substitute with a known-good ICA and check for proper operation. If the problem is corrected, replace ICA and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED86AAC8

Refer to DTC P0506.

DTC P0560 SYSTEM VOLTAGE

COMPONENT LOCATION E4AF616F



EGQE502F

GENERAL DESCRIPTION EE5D8FEB

The PCM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The PCM monitors battery voltage and the voltage after the main relay.

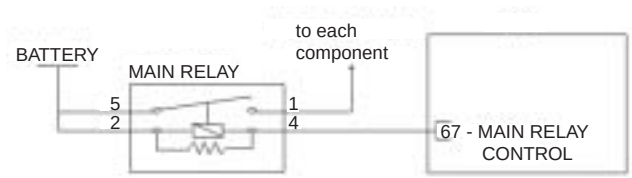
DTC DESCRIPTION E18FA7EA

The PCM 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 PCM 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 E6FA6C7D

Item		Detecting Condition	Possible Cause
DTC Strategy		● Comparison of battery voltage and voltage after main relay	● Open or short circuit ● Contact resistance in connectors
Case 1)	Enable Conditions	● Battery voltage ＞10V ● Ignition ON	
	Threshold Value	● Voltage after main relay when ON ＜ 6V	
	Diagnosis Time	● 180 mSec.	
Case 2)	Enable Conditions	● Ignition OFF	
	Threshold Value	● Voltage after main relay when ON ＞ 6V	
	Diagnosis Time	● 180 mSec.	

SCHEMATIC DIAGRAM EBF7C1F6

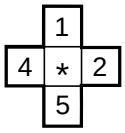


[Connection Information]

Terminal	Connected to	Function
1	-	Supply B+
2	Battery	Battery Voltage
4	PCM terminal 67	Main Relay Control
5	Battery	Battery Voltage

[CONNECTOR]

Relay Harness side connector



E07

PCM side terminal

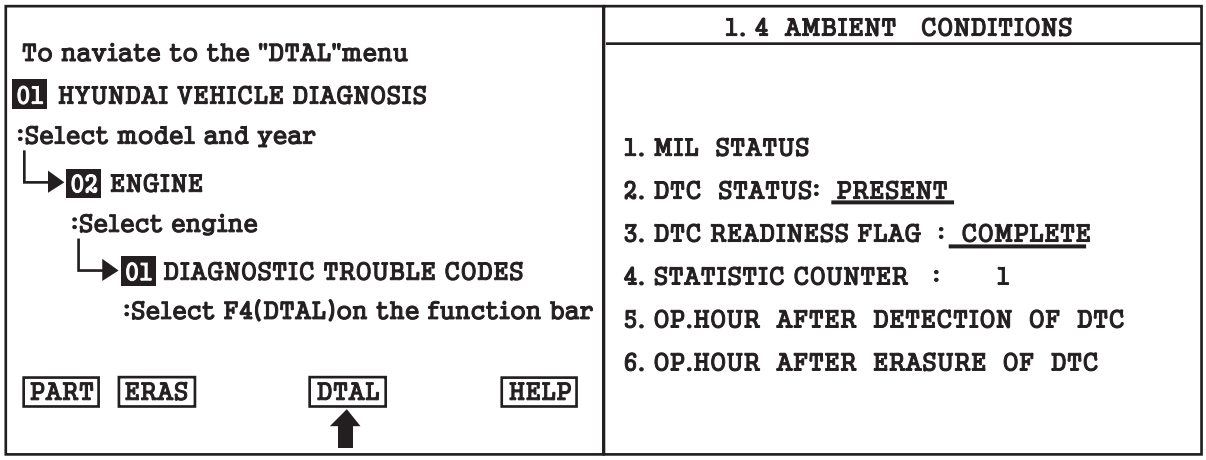
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	●	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B05601

MONITOR DTC STATUS E9EA299B

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION ECFDDE9B

1. Ignition "OFF".
2. Remove the main relay.
3. Apply 12V and a ground to 2 and 4 terminals of the main relay(Components side).
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

▶ 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 EF050CAE

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 E402EAA7

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

3. Measure the voltage between terminal 5 of the main relay harness connector and chassis ground.

Specification : Approx. B+

4. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection"

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 E7C9FF10

1. Check for short to ground in control circuit.

   1) Ignition "OFF".

   2) Measure resistance between terminal 4 of the relay 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.

2. Check for short to power in control circuit.

   1) Disconnect PCM connectors.

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

   3) Measure voltage between terminal 4 of the relay 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.

3. Check for open in control harness.

1) Measure resistance between terminals 4 of the relay harness connector and 67 of the ECM harness connector.

Specification : Approx 0Ω

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.

VERIFICATION OF VEHICLE REPAIR E173BEB9

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.

DTC P0562 SYSTEM VOLTAGE LOW

COMPONENT LOCATION EECDA2B9

Refer to DTC P0560.

GENERAL DESCRIPTION EA8BAA2B

Refer to DTC P0560.

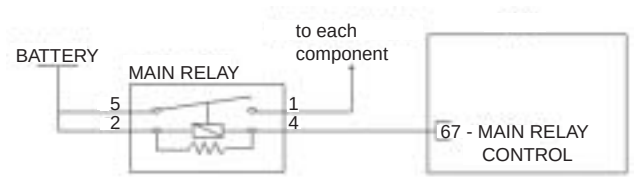
DTC DESCRIPTION ED1D4EBB

The sets DTC P0562 if the PCM detects system voltage lower than the possible range of battery voltage.

DTC DETECTING CONDITION EA2DFD36

Item	Detecting Condition	Possible Cause
DTC Strategy	● Check system voltage	● Contact resistance in connectors. ● Faulty charging system.
Enable Conditions	● No main relay failure ● Vehicle speed > 10km/h(6mph)	
Threshold Value	● Voltage after main relay when ON < 10V	
Diagnostic Time	● 30 sec.	

SCHEMATIC DIAGRAM ED136247

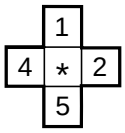


[Connection Information]

Terminal	Connected to	Function
1	-	Supply B+
2	Battery	Battery Voltage
4	PCM terminal 67	Main Relay Control
5	Battery	Battery Voltage

[CONNECTOR]

Relay Harness side connector



E07

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	●	68	69	70	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

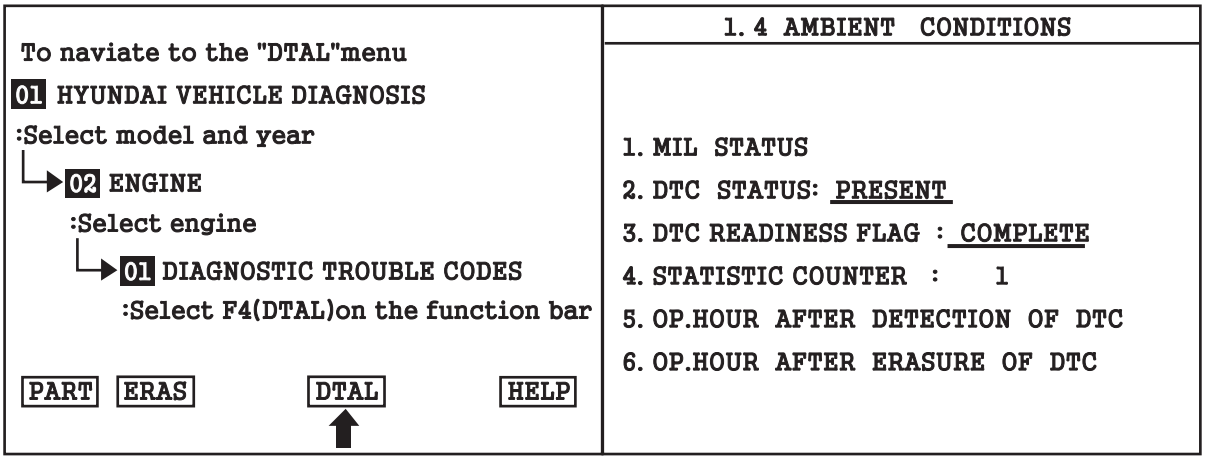
B05601

MONITOR DTC STATUS E3FED0D3

NOTE

If any codes relating to system voltage(P0560) is 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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E7BA8ED2

Refer to DTC P0560.

CHARGING SYSTEM INSPECTION E2BBC567

1. Check battery condition and Generator output.

2. Are battery conditions and Generator output both okay?

YES

▶ Check for poor connection between PCM 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 E8B8ABEE

Refer to DTC P0560.

DTC P0563 SYSTEM VOLTAGE HIGH

COMPONENT LOCATION EFEDC4D7

Refer to DTC P0560.

GENERAL DESCRIPTION E7C06CFB

Refer to DTC P0560.

DTC DESCRIPTION E9A25A5D

PCM sets DTC P0563 if the PCM detects system voltage higher than the possible range of battery voltage.

DTC DETECTING CONDITION EC907AF4

Item	Detecting Condition	Possible Cause
DTC Strategy	● Check system voltage	● Contact resistance in connectors ● Faulty charging system
Enable Conditions	● No main relay failure ● Vehicle speed > 10km/h(6mph)	
Threshold Value	● Voltage after main relay when ON > 16V	
Diagnostic Time	● 30 sec.	

SCHEMATIC DIAGRAM E90FA45C

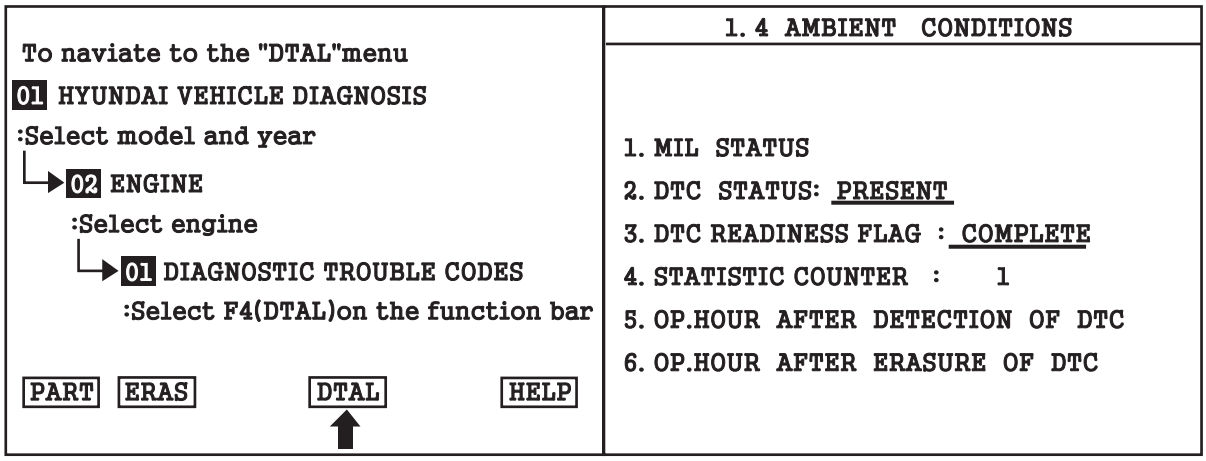
Refer to DTC P0560.

MONITOR DTC STATUS E16812D2

NOTE

If any codes relating to system voltage(P0560) is 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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION E8CBF96F

Refer to DTC P0560.

CHARGING SYSTEM INSPECTION EBED3E7E

1. Check battery condition and Generator output.

2. Are battery conditions and Generator output both okay?

YES

▶ Check for poor connection between PCM 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 EE87ECEB

Refer to DTC P0560.

DTC P0600 CAN COMMUNICATION BUS

GENERAL DESCRIPTION ECE45BF2

A communication line exists between the Engine Control Module(PCM) 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 PCM. 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 PCM and ABS control module use CAN lines.

DTC DESCRIPTION E6216FF5

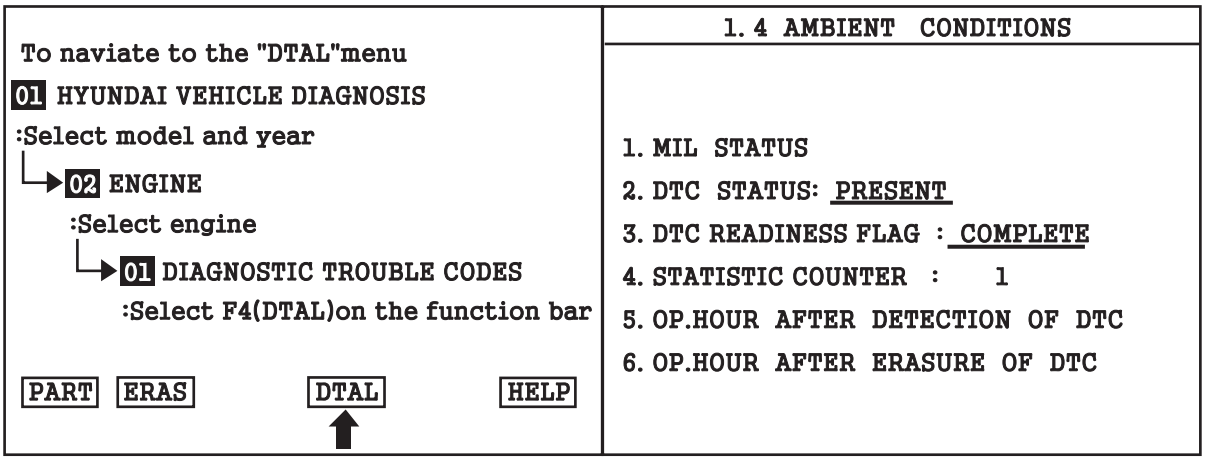
The PCM determines CAN commuication error and sets DTC P0600 if communication with other engine control devices (e.g. ABS) via CAN is impossible or PCM detects that communication time via CAN exceeds threshold value.

DTC DETECTING CONDITION E48BE6AE

Item		Detecting Condition	Possible Cause
Case1	DTC Strategy	● CAN message transfer incorrect	● Open or short in CAN line ● Contact resistance in connectors ● Faulty PCM
	Enable Conditions	● Battery voltage ＞10V ● Engine speed ＞ Approx. 30 rpm	
	Threshold Value	● CAN message is incorrect	
	Diagnostic Time	● 20 wrong messages	
Case2	DTC Strategy	● No message from control module	
	Enable Conditions	● Battery voltage ＞10V ● Engine speed ＞ Approx. 30 rpm	
	Threshold Value	● Time exceeded without message = 1 sec.	
	Diagnostic Time	● 1 sec.	

MONITOR DTC STATUS E9F2B402

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.



B00112

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 PCM's connector was repaired and PCM 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 E1DB220A

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

1. Check for Open in harness.
   [With ABS]

   1) Ignition "OFF".

2) Measure resistance between terminals 7 of the PCM harness connectors and 11 of the ABS control module harness connector.

Specification : Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Go to "Check for short to ground in harness" procedure.

NO

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

[Without ABS]

4) Measure resistance between terminals 7 of the PCM harness connectors and 2 of the vertical resistor.

Specification : Approx. 0Ω

5) Is resistance within the specification?

YES

▶ Go to "Check for short to ground in harness" procedure.

NO

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

2. Check for short to ground in harness.

1) Measure resistance between terminals 7 of the PCM harness connectors 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) Ignition "ON" & Engine "OFF".

2) Measure resistance between terminals 7 of the PCM harness connectors and chassis ground

Specification : Approx. 0V

3) 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

1. Check for Open in harness.
   [With ABS]

   1) Measure resistance between terminals 6 of the PCM harness connectors and 10 of the ABS control module harness connector.

Specification : Approx. 0Ω

   2) Is resistance within the specification?

   YES

   ▶ Go to "Check for short to ground in harness" procedure.

   NO

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

   [Without ABS]

   3) Measure resistance between terminals 6 of the PCM harness connectors and 1 of the vertical resistor.

Specification : Approx. 0Ω

   4) Is resistance within the specification?

   YES

   ▶ Go to "Check for short to ground in harness" procedure.

   NO

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

2. Check for short to ground in harness.

   1) Measure resistance between terminals 6 of the PCM harness connectors 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) Ignition "ON" & Engine "OFF".

   2) Measure resistance between terminals 6 of the PCM harness connectors and chassis ground.

Specification : Approx. 0V

   3) Is voltage within the specification?

YES

▶ Using a scan tool, check PCM software version and upgrade as necessary. If version is the newest one, go to "Verification of Vehicle Repair" procedure.

NO

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

VERIFICATION OF VEHICLE REPAIR EFB6A9B6

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

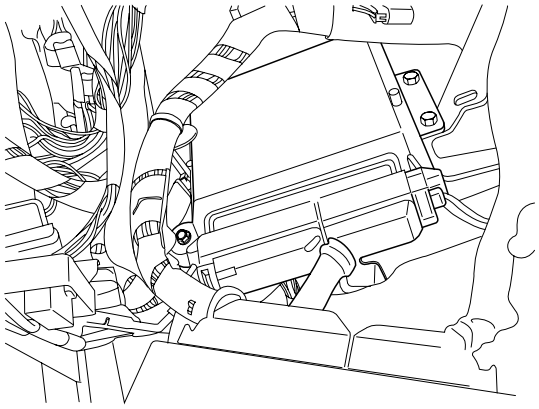
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY(ROM) ERROR

COMPONENT LOCATION EF40B4F7



EGQE501E

GENERAL DESCRIPTION E4FE8BE0

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 E0A90DFC

The PCM monitors RAM areas and communication connections between microcontroller and output drivers and sets DTC P0605 if failure is detected.

DTC DETECTING CONDITION E6AE72F5

Item	Detecting Condition	Possible Cause
DTC Strategy	● Check RAM Area / Communication connections	● Contact resistance in connectors ● Faulty PCM
Enable Conditions	● Ignition ON	
Threshold Value	● Internal check	
Diagnostic Time	● 0.1 second	

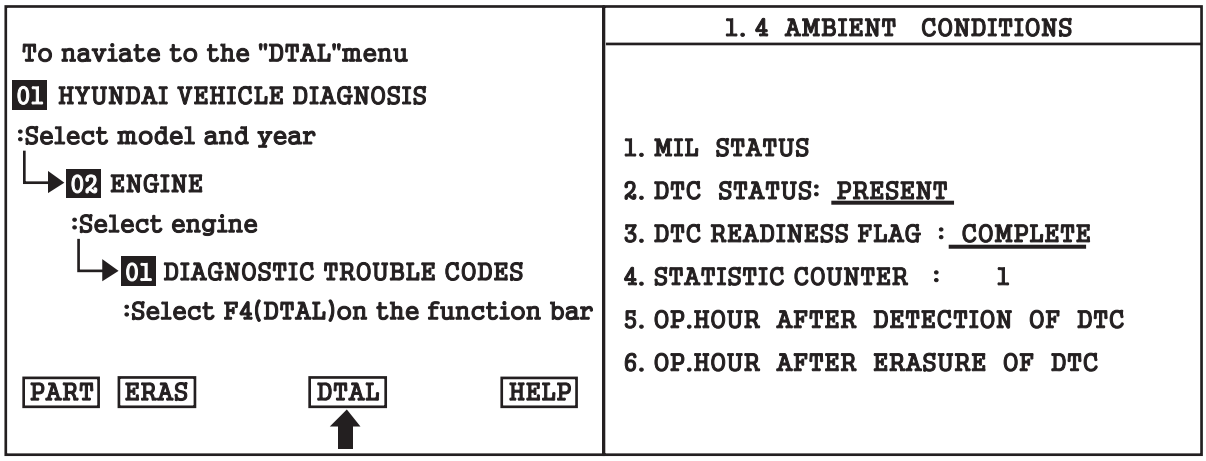
MONITOR DTC STATUS EF5C9AFE

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to "Back Up Voltage Inspection " procedure.

BACK UP VOLTAGE INSPECTION

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

Specification : Remain stable at battery voltage

5. Are circuits remaining stable at battery voltage?

YES

▶ Using a scan tool, check PCM software version and upgrade as necessary. If version is the newest one, go to "Verification of Vehicle Repair" procedure.

NO

▶ If voltage fluctuates, check circuit for loose, bent or corroded terminals, Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EEA497AA

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

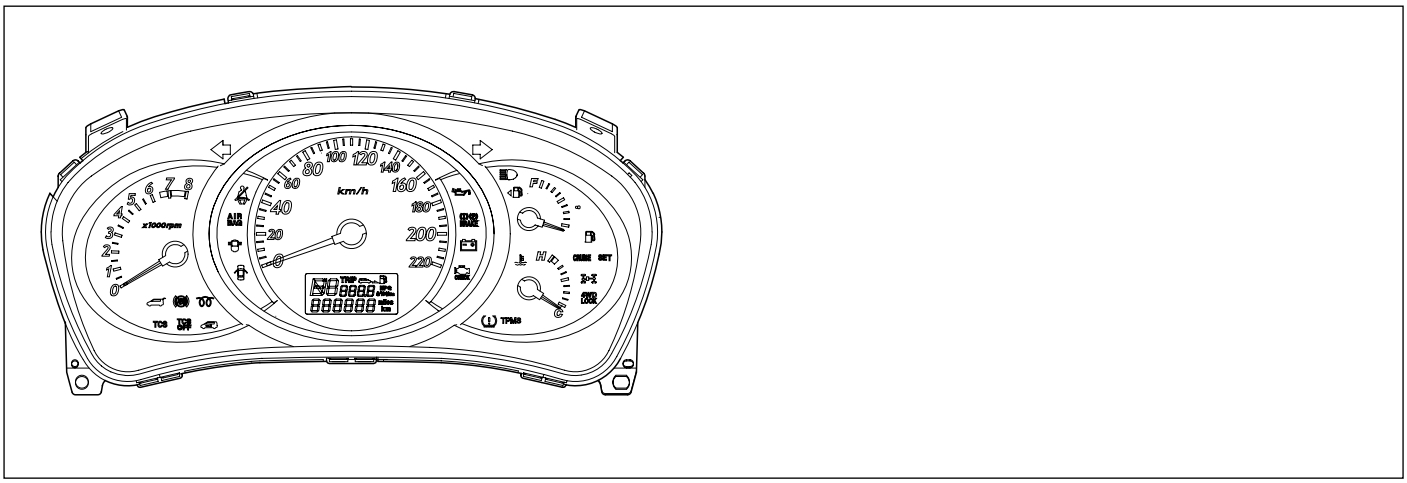
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0650 MALFUNCTION INDICATOR LAMP(MIL) CONTROL CIRCUIT

COMPONENT LOCATION EE29E0CA



P06501

GENERAL DESCRIPTION EDAD6AAD

The Malfunction Indicator Lamp (MIL), which is located in the instrument cluster, comes on to notify the driver that there may be a problem with the vehicle and that service is needed. Immediately after the ignition switch turns on, the malfunction indicator lamp is lit to indicate that the MIL operates normally and goes off after starting.

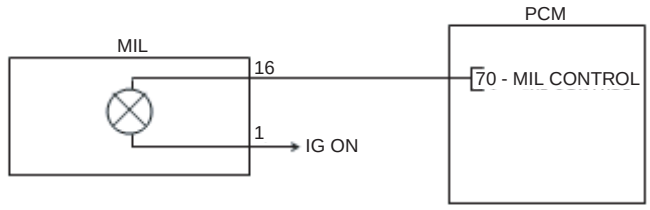
DTC DESCRIPTION EEECC6F7

PCM sets DTC P0650 if the PCM detects that the MIL control line is open or short circuit to ground or battery line.

DTC DETECTING CONDITION EAE4F5A7

Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver stage check	● Open or short between MIL and PCM ● Contact resistance in connectors ● Burned out MIL bulb
Enable Conditions	● Ignit10 < Battery voltage < 16	
Threshold Value	● Open, short to ground or battery	
Diagnostic Time	● 10 sec.	

SCHEMATIC DIAGRAM E6E16BAE



[Connection Information]

Terminal	Connected to	Function
16	PCM Terminal 70	MIL
1	Ignition Switch	Battery Voltage

[NOTE]
MIL connector is a part of instrument panel connector. For more information about terminal A,B, refer to "BODY ELCTRICAL SYSTEM" group.

[CONNECTOR]

PCM side terminal

6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	●	71	72	73	*	75	76	77	78	*	80	81	2	1

C130-1

B06501

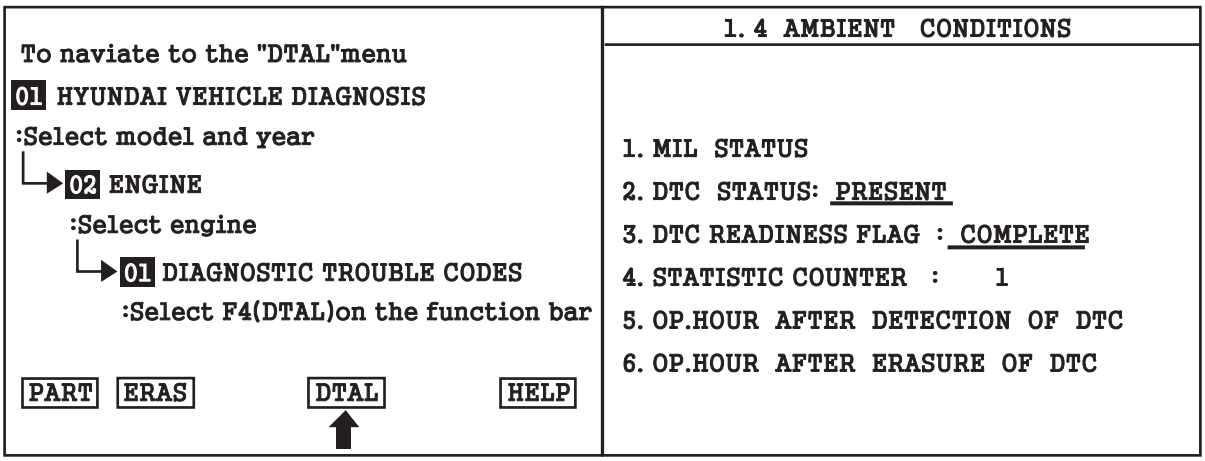
MONITOR DTC STATUS EB4DDA24

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 .



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to next step as below.

CONTROL CIRCUIT INSPECTION E7EFF7B3

1. Ignition "OFF".
2. Disconnect PCM connector.
3. Ignition "ON" & Engine "OFF".
4. Using a suitable wire, jumper the terminal 70 of the PCM 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 Meter Fuse. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

6. Remove wire from PCM harness connector.
7. Does MIL bulb go out?

YES

▶ Check for poor connection between PCM 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 for source of short to GND between bulb and PCM. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E289C538

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.

DTC P0700 TCU REQUEST FOR MIL ON

GENERAL DESCRIPTIONT E8BE130E

The TCM can request activation of the MIL lamp via a communication line to the PCM. This is only a request from TCM to PCM 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 ECB403E5

Item	Detecting Condition	Possible Cause
DTC Strategy	● Freeze frame request via CAN	● Transaxle system
Enable Conditions	● Battery voltage > 10V ● Engine speed > 256 rpm	
Threshold Value	● MIL is requested by TCM	
Diagnostic Time	● Immediate	

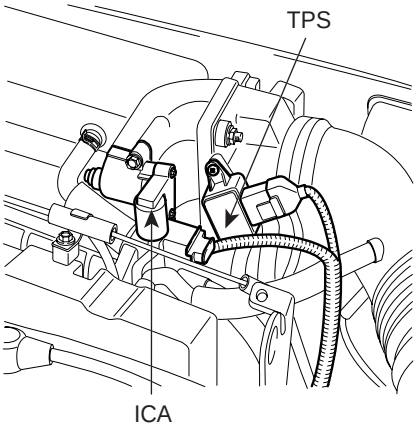
MONITOR DTC STATUS EB8D0A87

1. This is only a request from TCM to PCM to turn the MIL on. The fault code is stored in the TCM. The Freeze Frame Data is stored in the PCM under the P0700 request code. Be sure to retrieve freeze frame data before clearing code P0700 from PCM.

2. Check the transaxle system.

DTC P1505 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #1

COMPONENT LOCATION EBD5C3FF



EGQE602V

GENERAL DESCRIPTION E7D18186

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

DTC DESCRIPTION EE0BA6F9

PCM sets DTC P1505 if the PCM detects that the ICAV(OPEN) control circuit is open or short to ground.

DTC DETECTING CONDITION EA637A1C

Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver stage check	● Open or short to ground in harness ● Contact resistance in connectors ● Faulty ICA valve
Enable Conditions	● 10V < Battery voltage < 16V ● 20% < ICA duty < 80%	
Threshold Value	● Open or short to ground	
Diagnostic Time	● 1 sec.	

SPECIFICATION EDEC2E1F

ICA COIL #1 (OPEN)

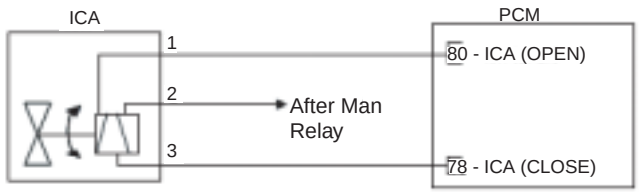
Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5

10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0
20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3

ICA COIL #2 (CLOSE)

Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0
20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8

SCHEMATIC DIAGRAM E17A9529

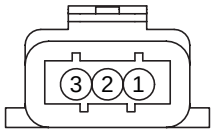


[Connection Information]

Terminal	Connected to	Function
1	PCM Terminal 80	ICA (OPEN)
2	Main Relay	Battery voltage
3	PCM Terminal 78	ICA (CLOSE)

[CONNECTOR]

ICA Harness side connector



C115

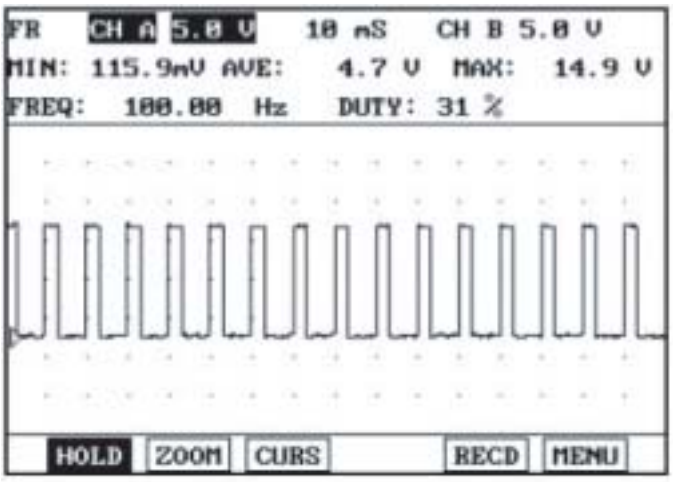
PCM side terminal

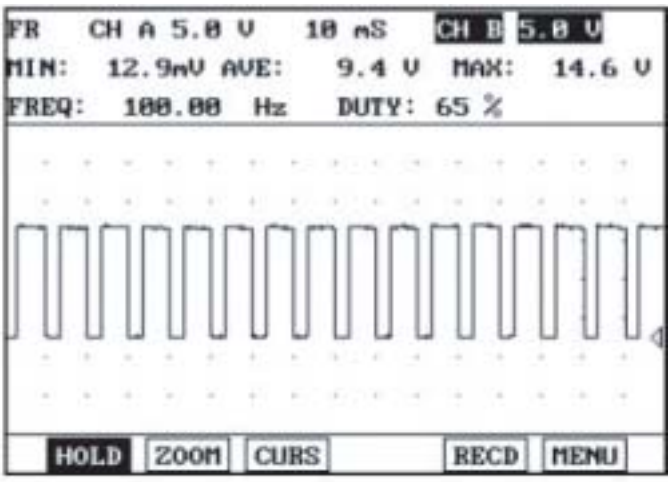
6	7	8	9	10	11	*	*	14	*	*	17	18	*	*	21	22	23	24	5	4
*	26	27	*	29	30	31	32	*	*	*	*	37	38	39	*	*	42	43	3	
*	45	*	47	48	*	50	51	52	*	54	55	56	*	58	59	60	61	62		
*	64	65	66	67	68	69	70	71	72	73	*	75	76	77	●	*	●	81	2	1

C130-1

B05061

SIGNAL WAVEFORM E4BE1BBB



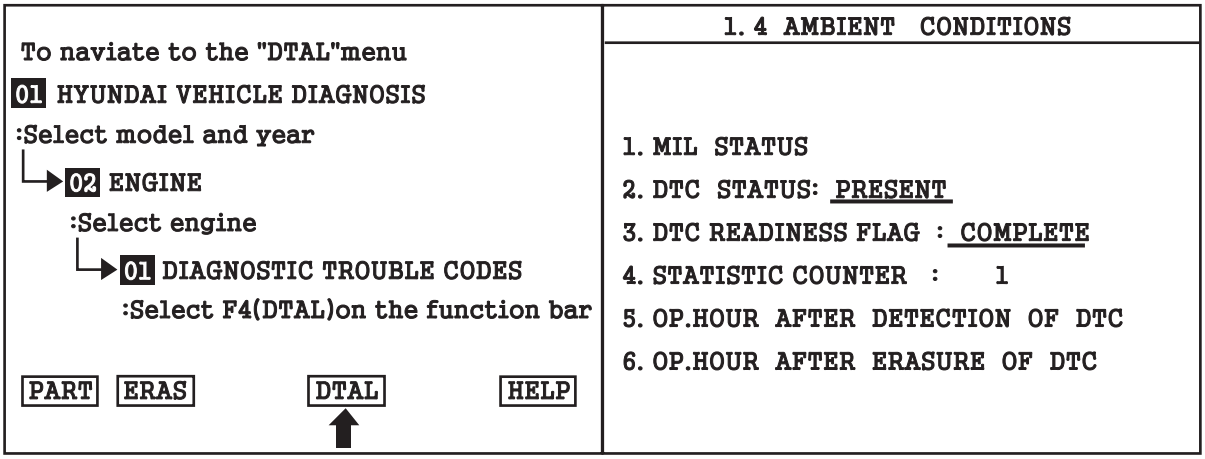


The above waveforms are the voltage signals generated when the ICA operates. This ICA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ICA Opening coil during idle.
The right side is the waveform of the ICA Closing coil during idle.

B05062

MONITOR DTC STATUS E2EF1ACD

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.



B00112

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 PCM's connector, which was repaired but PCM 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

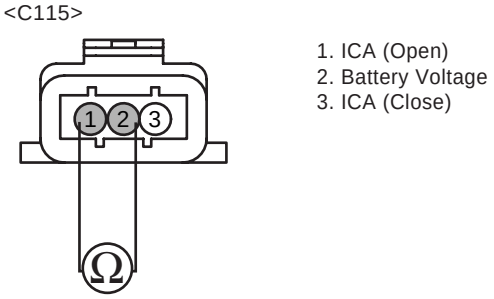
▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E79FE74F

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5
10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0
20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3



B15055

4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

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

TERMINAL AND CONNECTOR INSPECTION E959D5CE

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 ED3C5253

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

2. Measure voltage between terminal 2 of the valve harness connector and chassis ground.

Specification :	Approx. B+

3. 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 ICA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EA56FA62

1. Check for open in signal harness.

   1) Ignition "OFF".

   2) Disconnect PCM connector.

   3) Measure resistance between terminals 1 of the valve harness connector and 80 of the PCM 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 signal harness.

   1) Measure resistance between terminal 1 of valve harness connector and chassis ground.

Specification : Infinite

   2) Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 E5E73EE7

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.

DTC P1506 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #1

COMPONENT LOCATION E81FBA2F

Refer to DTC P1505.

GENERAL DESCRIPTION EABBB993

Refer to DTC P1505.

DTC DESCRIPTION E00E9D05

PCM sets DTC P1506 if the PCM detects that the ICAV(OPEN) control circuit is short to battery.

DTC DETECTING CONDITION EDACAB4D

Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver stage check	● Open or short to ground in harness ● Contact resistance in connectors ● Faulty ICA valve
Enable Conditions	● 10V < Battery voltage < 16V ● 20% < ICA duty < 80%	
Threshold Value	● Open or short to ground	
Diagnostic Time	● 1 sec.	

SPECIFICATION EAB4DAC0

ICA COIL #1 (OPEN)

Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5
10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0
20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3

ICA COIL #2 (CLOSE)

Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0
20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8

SCHEMATIC DIAGRAM EB9C6FDE

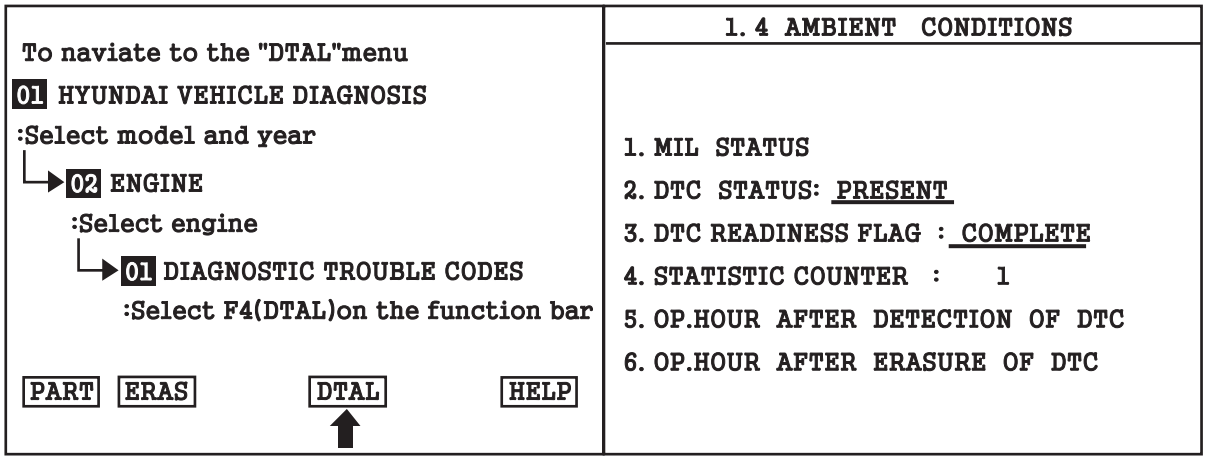
Refer to DTC P1505.

SIGNAL WAVEFORM E969CD63

Refer to DTC P1505.

MONITOR DTC STATUS EC928C62

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.



B00112

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 PCM's connector, which was repaired but PCM 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

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EFABCA77

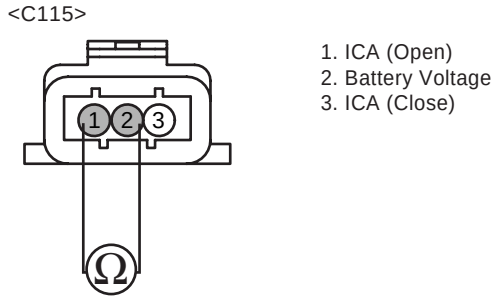
1. Ignition "OFF".

2. Disconnect ICA valve connector.

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5
10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0
20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3



B15055

4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

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

TERMINAL AND CONNECTOR INSPECTION E4AAA88E

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 EE4EBDFA

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

Specification : Approx. B+

3. 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 ICA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E5A7B3F3

1. Ignition "OFF".
2. Disconnect PCM connector.
3. Ignition "ON".
4. Measure voltage between terminal 1 of valve harness connector and chassis ground.

Specification : Approx. 0Ω

5. Is voltage within the specification?

YES

▶ Check for poor connection between PCM 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 E01FE00E

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.

DTC P1507 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #2

COMPONENT LOCATION E887A24F

Refer to DTC P1505.

GENERAL DESCRIPTION EAB3B0CB

Refer to DTC P1505.

DTC DESCRIPTION E5D758DA

PCM sets DTC P1507 if the PCM detects that the ICAV(CLOSE) control line is open or short to ground.

DTC DETECTING CONDITION E06E05DD

Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver stage check	● Open or short to ground in harness. ● Contact resistance in connectors. ● Faulty ICA valve.
Enable Conditions	● 10V＜ Battery voltage ＜16 ● 20%＜ ICA duty ＜80%	
Threshold Value	● Open or short to ground	
Diagnostic Time	● 1 sec.	

SPECIFICATION EEDD7BE6

ICA COIL #1 (OPEN)

Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5
10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0
20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3

ICA COIL #2 (CLOSE)

Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0
20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8

SCHEMATIC DIAGRAM E339DA7B

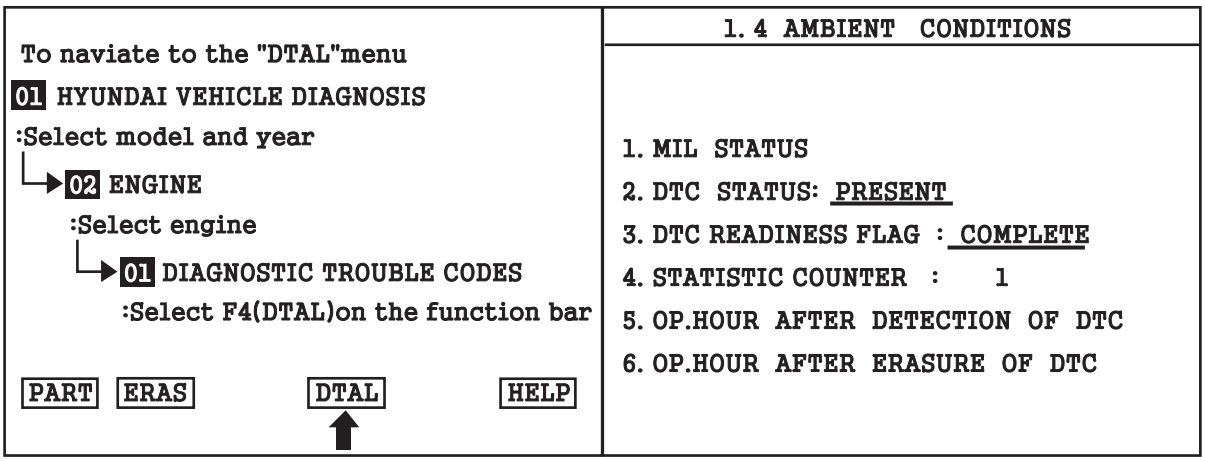
Refer to DTC P1505.

SIGNAL WAVEFORM EE629E8A

Refer to DTC P1505.

MONITOR DTC STATUS EBECCDF6

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



B00112

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 PCM's connector or was repaired and PCM 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 ECC3CB8C

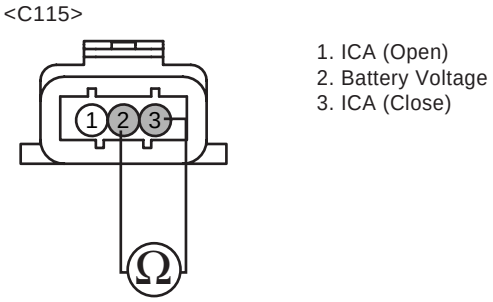
1. Ignition "OFF".

2. Disconnect ICA valve connector.

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

SPECIFICATION

Temp.(℃)	Temp.(°F)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(°F)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0
20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8



B15071

4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

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

TERMINAL AND CONNECTOR INSPECTION E2BE2AF9

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 E6CA67A8

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

Specification : Approx. B+

3. 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 ICA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E1511513

1. Check for open in signal harness.
   1) Ignition "OFF".
   2) Disconnect PCM connector.
   3) Measure resistance between terminals 3 of the valve harness connector and 78 of the PCM 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 signal harness.
   1) Measure resistance between terminal 3 of valve harness connector and chassis ground.

Specification : Infinite

   2) Is resistance within the specification?

YES

▶ Check for poor connection between PCM 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 E0B99DF0

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.

DTC P1508 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #2

COMPONENT LOCATION E5194E96

Refer to DTC P1505.

GENERAL DESCRIPTION EB16A50E

Refer to DTC P1505.

DTC DESCRIPTION EDD3B3A9

PCM sets DTC P1508 if the PCM detects that the ICAV(CLOSE) control circuit is short to battery.

DTC DETECTING CONDITION EFF6D0A8

Item	Detecting Condition	Possible Cause
DTC Strategy	● Driver stage check	● Short to battery in harness ● Contact resistance in connectors ● Faulty ICA valve
Enable Conditions	● 10< Battery voltage <16V ● 20%< ICA duty <80%	
Threshold Value	● Short to battery	
Diagnostic Time	● 1 sec.	
Fail-Safe	● PCM controls idle speed with predetermined value	

SPECIFICATION EC9EA8AC

ICA COIL #1 (OPEN)

Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #1 (OPEN)(Ω)
-20	-4	9.2 ~ 10.8	40	104	12.0 ~ 13.6
-10	14	9.7 ~ 11.3	50	122	12.4 ~ 14.0
0	32	10.2 ~ 11.8	60	140	12.9 ~ 14.5
10	50	10.6 ~ 12.2	70	158	13.4 ~ 15.0
20	68	11.1 ~ 12.7	80	176	13.8 ~ 15.4
30	86	11.5 ~ 13.1	100	212	14.7 ~ 16.3

ICA COIL #2 (CLOSE)

Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0

20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8

SCHEMATIC DIAGRAM EA9CEDBC

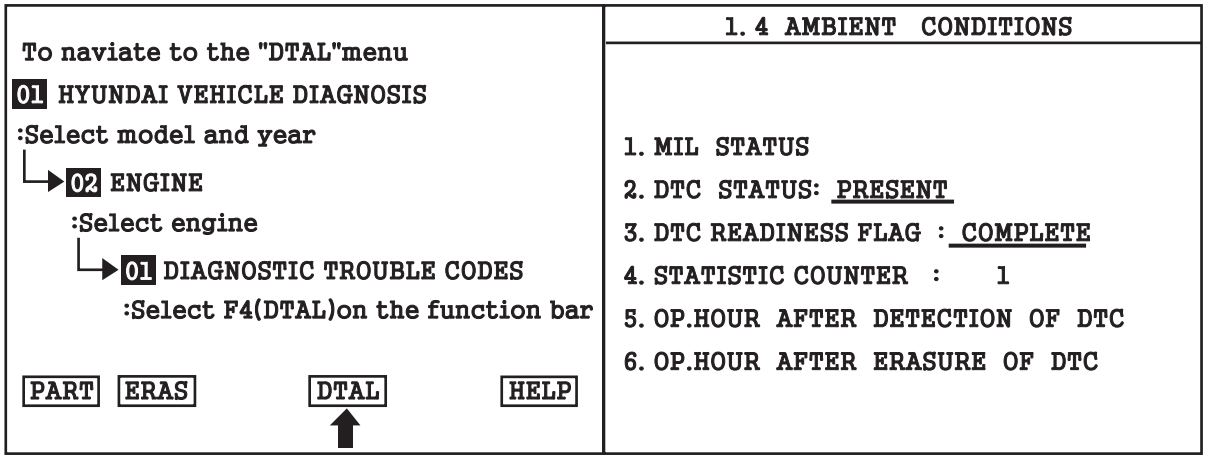
Refer to DTC P1505.

SIGNAL WAVEFORM E7686B3A

Refer to DTC P1505.

MONITOR DTC STATUS E192FA3F

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



B00112

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 PCM's connector was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

NO

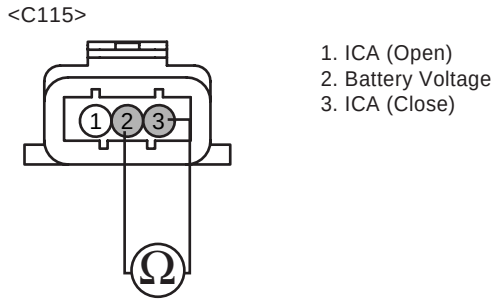
▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EDABDECC

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

SPECIFICATION

Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)	Temp.(℃)	Temp.(℉)	ICA Coil #2 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7	40	104	15.7 ~ 17.3
-10	14	12.8 ~ 14.4	50	122	16.3 ~ 17.9
0	32	13.4 ~ 15.0	60	140	16.9 ~ 18.5
10	50	14.0 ~ 15.6	70	158	17.4 ~ 19.0
20	68	14.5 ~ 16.1	80	176	18.0 ~ 19.6
30	86	15.1 ~ 16.7	100	212	19.2 ~ 20.8



B15071

4. Is resistance within the specification?

YES

▶ Go to next step as below.

NO

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

TERMINAL AND CONNECTOR INSPECTION E2AFB5D4

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 ED4DCBDE

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

Specification :	Approx. B+

3. 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 ICA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E9EA60DE

1. Ignition "OFF".
2. Disconnect PCM connector.
3. Ignition "ON".
4. Measure voltage between terminal 3 of valve harness connector and chassis ground.

Specification :	Approx. 0V

5. Is voltage within the specification?

YES

▶ Check for poor connection between PCM 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 E480BE61

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

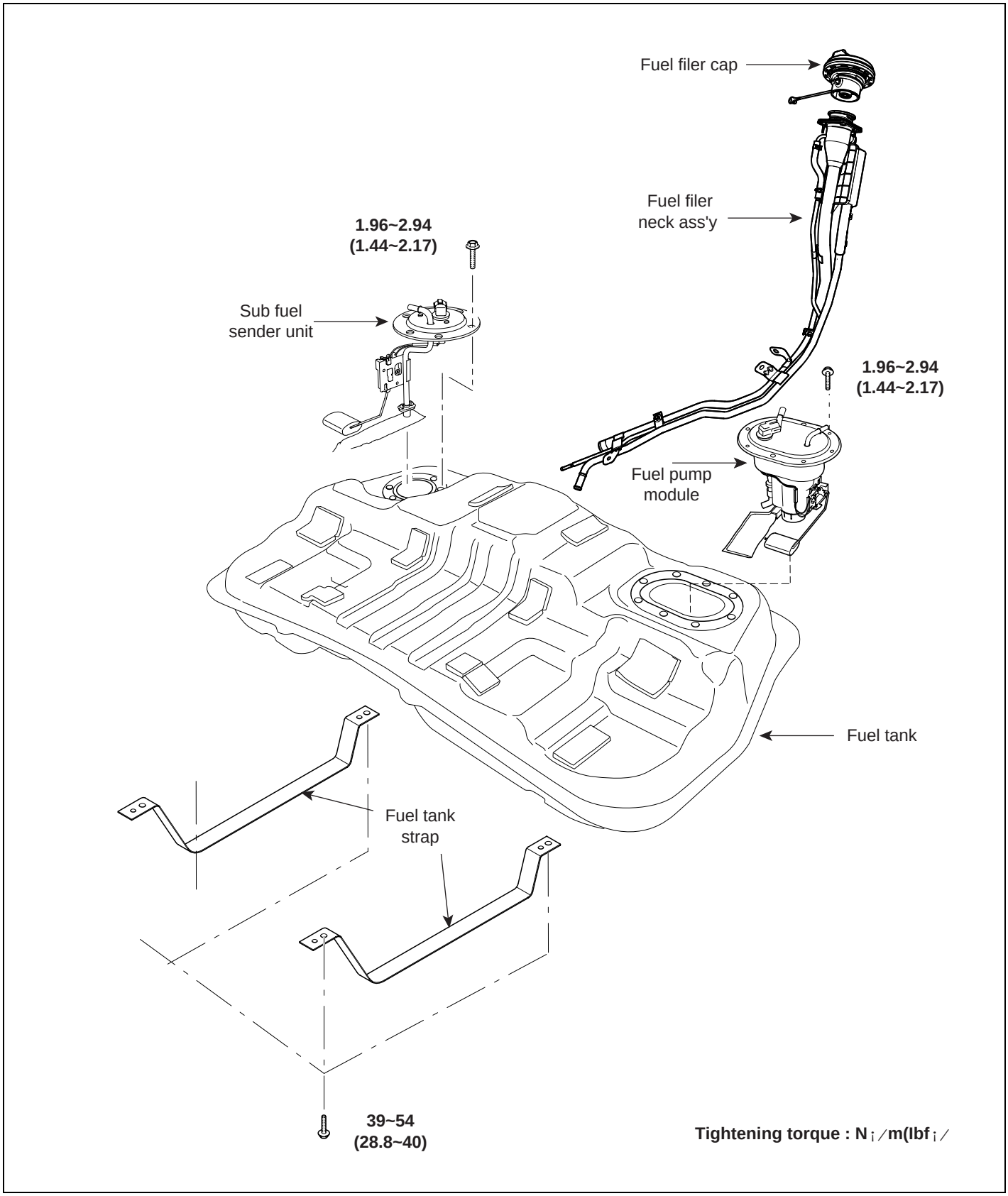
▶ System performing to specification at this time. Clear the DTC

NO

▶ Go to the applicable troubleshooting procedure.

FUEL DELIVERY SYSTEM

COMPONENTS E330E7C9



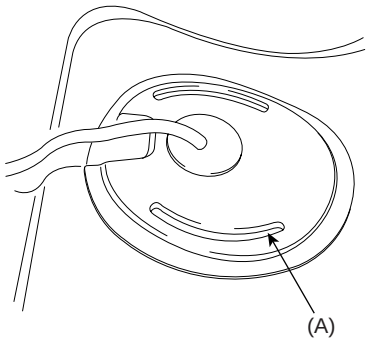
EGQE004F

FUEL LINE AND VAPOR LINE

FUEL PRESSURE TEST EB2AEC1E

1. PREPARING

1. Remove the rear seat cushion (Refer to ""BD"" group in this WORKSHOP MANUAL).
2. Open the service cover (A) under the rear seat cushion.

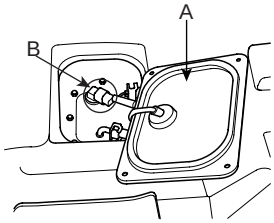


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(B).
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.



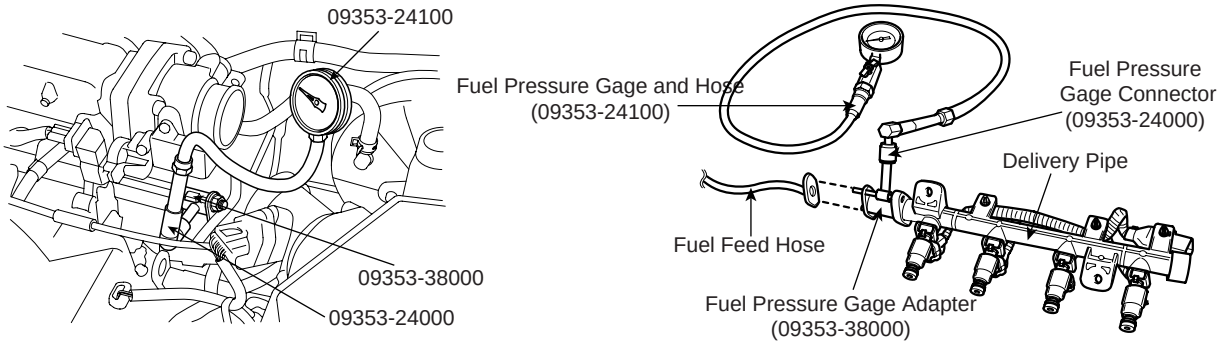
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

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).



4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESURE TEST

1. Diconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 350 kpa (3.5 kg/㎠, 49.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

6. 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

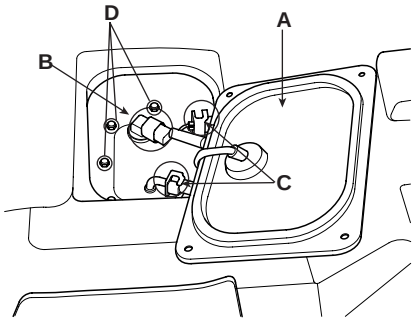
EGQE602O

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(B).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

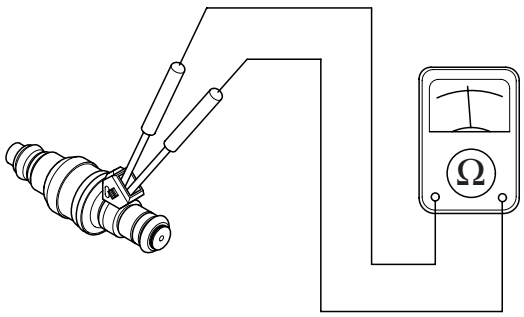
1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

EGQE602N

INJECTOR

INSPECTION E730BAB2

1. Measure resistance between the terminal 1 and 2 of the injector.



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SPECIFICATION (RESISTANCE):

Temperature		Resistance (Ω)
(°C)	(°F)	
-20	-4	12.2 ~ 12.3
0	32	13.3 ~ 13.5
20	68	14.4 ~ 14.6
40	104	15.5 ~ 15.7
60	140	16.6 ~ 16.8
80	176	17.7 ~ 17.9
100	212	18.8 ~ 19.0
120	248	19.9 ~ 20.1

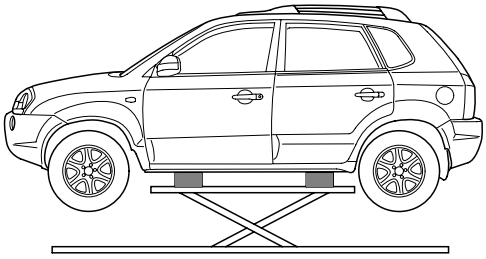
2. If the resistance is not within specification, replace the injector.

FUEL TANK

REMOVAL E9FA2F2F

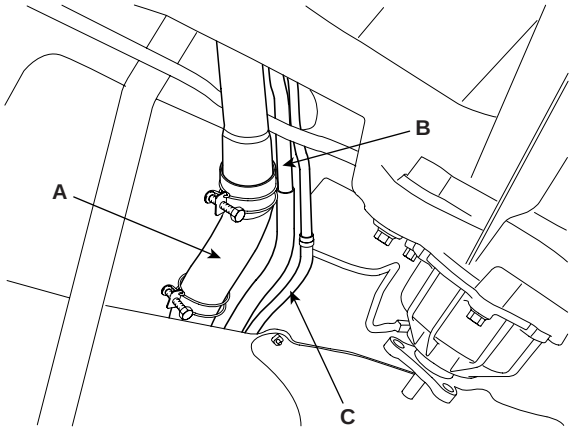
CAUTION

When lifting up or down vehicle, be sure to place blocks between vehicle and lifter to prevent fuel tank from being damaged.



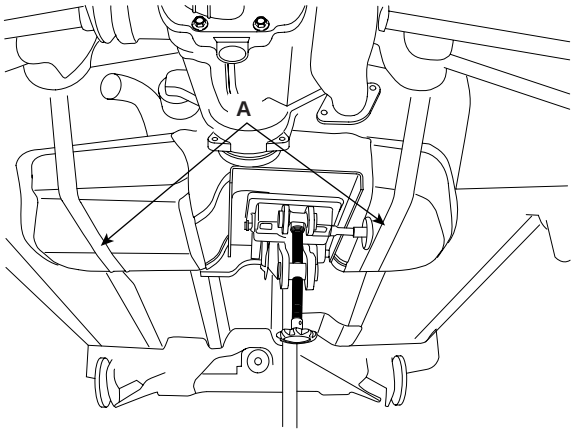
KFQE004V

1. Remove front muffler and main muffler assemblys.
2. Remove profellershaft assembly(4WD only).
3. Remove fuel tank under cover.
4. Remove clamp(3EA) for fuel filler hose(A), leveling hose(B) and ventilation(C).



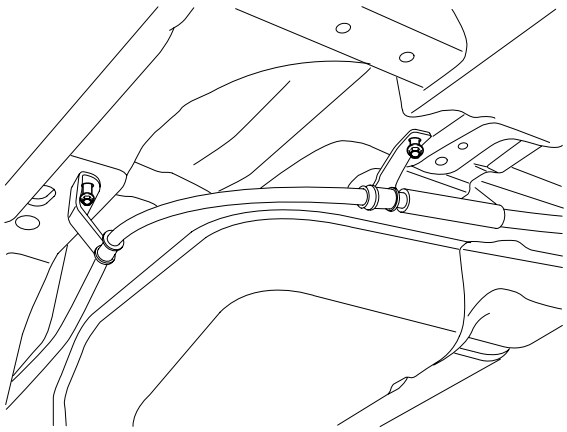
KFQE004G

5. Support fuel tank with jack and remove fuel tank straps(2EA).



KFQE004H

6. Unfastem parking brake cable mounting bolts(2EA) in each right adn left sides.



KFQE004I

7. Lifting down fuel tank slowly, remove fuel pump wiring connector, and then main fuel hose and return fuel hose connected to fuel tank.

8. Disconnect fuel sender wiring connector.

9. Remove fuel tank.

INSTALLATION E6E4ADB5

1. Installation is in reverse order of remaval.

DISASSEMBLY EAA843C4

1. Remove the suction hose between fuel pump module and sub fuel sender unit.

2. Unscrew fuel pump module mounting bolts and sub fuel sender unit mounting bolts.

3. When lifting up fuel pump module and sub fuel sender, be careful not to do damage to the sender.

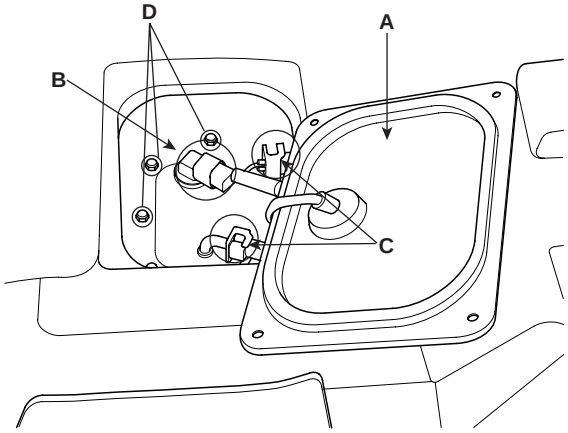
REASSEMBLY ED1F9A4F

1. Assembly is in reverse order of disassembly.

FUEL PUMP (FP)

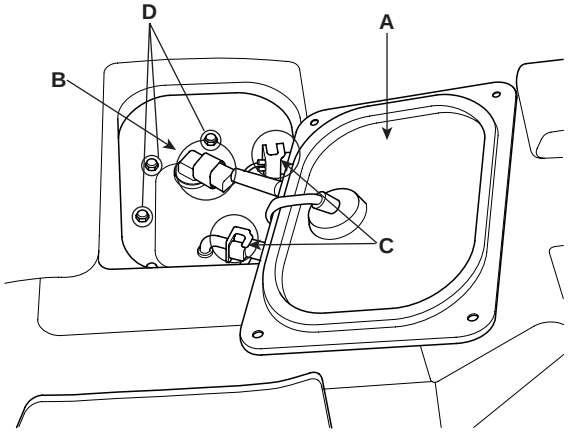
DISASSEMBLY EA15685A

1. Trun ignition key off and disconnect battery(-) cable.
2. Remove the second seat.
3. Remove the capet covering service cover for fuel pump and service cover(A).



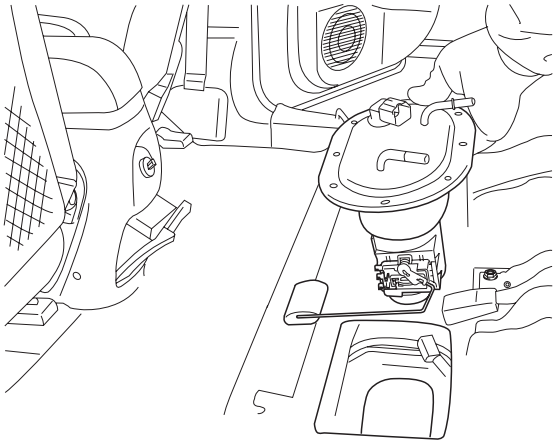
KFQE004D

4. Disconnect the fuel pump wiring connector(B).
5. Spread out service towel around fuel hoses(C) and disconnect fuel hoses(C).
6. Unscrew fuel pump plate mounting bolts(D).



KFQE004D

7. Remove the fuel pump module.



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